CUDA MATH API

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API Reference Manual

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1.1. Mathematical Functions

CUDA mathematical functions are always available in device code. Some functions are also available in host code as indicated.

Note that floating-point functions are overloaded for different argument types. For example, the log() function has the following prototypes:

```
↱ double log(double x);
       float log(float x);
       float logf(float x);
```

1.2. Single Precision Mathematical Functions

This section describes single precision mathematical functions.

__host____device__ float acosf (float x)

Calculate the arc cosine of the input argument.

Returns

Result will be in radians, in the interval [0, π] for x inside [-1, +1].

- acosf(1) returns +0.
- acosf(x) returns NaN for x outside [-1, +1].

Description

Calculate the principal value of the arc cosine of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float acoshf (float x)

Calculate the nonnegative arc hyperbolic cosine of the input argument.

Returns

Result will be in the interval [0, $+\infty$].

- acoshf(1) returns 0.
- acoshf(x) returns NaN for x in the interval [$-\infty$, 1).

Description

Calculate the nonnegative arc hyperbolic cosine of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float asinf (float x)

Calculate the arc sine of the input argument.

Returns

Result will be in radians, in the interval [- $\pi/2$, + $\pi/2$] for x inside [-1, +1].

- asinf(0) returns +0.
- asinf(x) returns NaN for x outside [-1, +1].

Description

Calculate the principal value of the arc sine of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float asinhf (float x)

Calculate the arc hyperbolic sine of the input argument.

Returns

- asinhf(0) returns 1.

Description

Calculate the arc hyperbolic sine of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float atan2f (float y, float x)

Calculate the arc tangent of the ratio of first and second input arguments.

Returns

Result will be in radians, in the interval [- π , + π].

- atan2f(0, 1) returns +0.

Description

Calculate the principal value of the arc tangent of the ratio of first and second input arguments `y` / `x`. The quadrant of the result is determined by the signs of inputs `y` and `x`.

> For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float atanf (float x)

Calculate the arc tangent of the input argument.

Returns

Result will be in radians, in the interval [- $\pi/2$, + $\pi/2$].

- atanf(0) returns +0.

Description

Calculate the principal value of the arc tangent of the input argument `x`.

> For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float atanhf (float x)

Calculate the arc hyperbolic tangent of the input argument.

Returns

- atanhf(± 0) returns ± 0.
- atanhf(± 1) returns $\pm \infty$.
- atanhf(`x`) returns NaN for `x` outside interval [-1, 1].

Description

Calculate the arc hyperbolic tangent of the input argument `x`.

> For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float cbrtf (float x)

Calculate the cube root of the input argument.

Returns

Returns $x^{1/3}$.

- cbrtf(± 0) returns ± 0.
- cbrtf($\pm \infty$) returns $\pm \infty$.

Description

Calculate the cube root of `x`, $x^{1/3}$.

> For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float ceilf (float x)

Calculate ceiling of the input argument.

Returns

Returns $\lceil x \rceil$ expressed as a floating-point number.

- ceilf(± 0) returns ± 0.
- ceilf($\pm \infty$) returns $\pm \infty$.

Description

Compute the smallest integer value not less than `x`.

__host____device__ float copysignf (float x, float y)

Create value with given magnitude, copying sign of second value.

Returns

Returns a value with the magnitude of `x` and the sign of `y`.

Description

Create a floating-point value with the magnitude `x` and the sign of `y`.

__host____device__ float cosf (float x)

Calculate the cosine of the input argument.

Returns

- cosf(0) returns 1.
- cosf($\pm\infty$) returns NaN.

Description

Calculate the cosine of the input argument x (measured in radians).

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
- This function is affected by the `--use_fast_math` compiler flag. See the CUDA C Programming Guide, Appendix D.2, Table 8 for a complete list of functions affected.

__host____device__ float coshf (float x)

Calculate the hyperbolic cosine of the input argument.

Returns

- coshf(0) returns 1.
- coshf($\pm\infty$) returns NaN.

Description

Calculate the hyperbolic cosine of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float cospif (float x)

Calculate the cosine of the input argument $\times\pi$.

Returns

- cospif(± 0) returns 1.
- cospif($\pm\infty$) returns NaN.

Description

Calculate the cosine of `x` $\times \pi$ (measured in radians), where `x` is the input argument.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float cyl_bessel_i0f (float x)

Calculate the value of the regular modified cylindrical Bessel function of order 0 for the input argument.

Returns

Returns the value of the regular modified cylindrical Bessel function of order 0.

Description

Calculate the value of the regular modified cylindrical Bessel function of order 0 for the input argument `x`, $I_0(x)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float cyl_bessel_i1f (float x)

Calculate the value of the regular modified cylindrical Bessel function of order 1 for the input argument.

Returns

Returns the value of the regular modified cylindrical Bessel function of order 1.

Description

Calculate the value of the regular modified cylindrical Bessel function of order 1 for the input argument `x`, $I_1(x)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host_____device__ float erfcf (float x)

Calculate the complementary error function of the input argument.

Returns

- erfcf($-\infty$) returns 2.
- erfcf($+\infty$) returns +0.

Description

Calculate the complementary error function of the input argument `x`, 1 - erf(`x`).

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host_____device__ float erfcinvf (float y)

Calculate the inverse complementary error function of the input argument.

Returns

- erfcinvf(0) returns $+\infty$.
- erfcinvf(2) returns $-\infty$.

Description

Calculate the inverse complementary error function of the input argument `y`, for `y` in the interval [0, 2]. The inverse complementary error function find the value `x` that satisfies the equation `y` = erfc(`x`), for $0 \le y \le 2$, and $-\infty \le x \le \infty$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host_____device__ float erfcxf (float x)

Calculate the scaled complementary error function of the input argument.

Returns

- erfcxf($-\infty$) returns $+\infty$
- erfcxf($+\infty$) returns +0
- erfcxf(`x`) returns $+\infty$ if the correctly calculated value is outside the single floating point range.

Description

Calculate the scaled complementary error function of the input argument x, $e^{x^2} \cdot \mathrm{erfc}(x)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float erff (float x)

Calculate the error function of the input argument.

Returns

- erff(± 0) returns ± 0.
- erff($\pm \infty$) returns ± 1.

Description

Calculate the value of the error function for the input argument x, $\frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float erfinvf (float y)

Calculate the inverse error function of the input argument.

Returns

- erfinvf(1) returns $+\infty$.
- erfinvf(-1) returns $-\infty$.

Description

Calculate the inverse error function of the input argument y, for y in the interval [-1, 1]. The inverse error function finds the value x that satisfies the equation y = erf(x), for $-1 \le y \le 1$, and $-\infty \le x \le \infty$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float exp10f (float x)

Calculate the base 10 exponential of the input argument.

Returns

Returns 10^x.

Description

Calculate the base 10 exponential of the input argument `x`.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
- This function is affected by the `--use_fast_math` compiler flag. See the CUDA C Programming Guide, Appendix D.2, Table 8 for a complete list of functions affected.

__host____device__ float exp2f (float x)

Calculate the base 2 exponential of the input argument.

Returns

Returns 2^x.

Description

Calculate the base 2 exponential of the input argument `x`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float expf (float x)

Calculate the base e exponential of the input argument.

Returns

Returns e^x.

Description

Calculate the base e exponential of the input argument `x`, e^x.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
- This function is affected by the `--use_fast_math` compiler flag. See the CUDA C Programming Guide, Appendix D.2, Table 8 for a complete list of functions affected.

__host____device__ float expm1f (float x)

Calculate the base *e* exponential of the input argument, minus 1.

Returns

Returns $e^x - 1$.

Description

Calculate the base *e* exponential of the input argument `x`, minus 1.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float fabsf (float x)

Calculate the absolute value of its argument.

Returns

Returns the absolute value of its argument.

- fabs($\pm\infty$) returns $+\infty$.
- fabs(± 0) returns 0.

Description

Calculate the absolute value of the input argument `x`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float fdimf (float x, float y)

Compute the positive difference between `x` and `y`.

Returns

Returns the positive difference between `x` and `y`.

- fdimf(`x`, `y`) returns `x` - `y` if `x` > `y`.
- fdimf(`x`, `y`) returns +0 if `x` ≤ `y`.

Description

Compute the positive difference between `x` and `y`. The positive difference is `x` - `y` when `x` > `y` and +0 otherwise.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__DEVICE_FUNCTIONS_DECL__ float fdividef (float x, float y)

Divide two floating point values.

Returns

Returns `x` / `y`.

Description

Compute `x` divided by `y`. If `--use_fast_math` is specified, use __fdividef() for higher performance, otherwise use normal division.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
- This function is affected by the `--use_fast_math` compiler flag. See the CUDA C Programming Guide, Appendix D.2, Table 8 for a complete list of functions affected.

__host____device__ float floorf (float x)

Calculate the largest integer less than or equal to `x`.

Returns

Returns $log_e(1+x)$ expressed as a floating-point number.

- floorf($\pm\infty$) returns $\pm\infty$.
- floorf(± 0) returns ± 0.

Description

Calculate the largest integer value which is less than or equal to `x`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float fmaf (float x, float y, float z)

Compute $x \times y + z$ as a single operation.

Returns

Returns the rounded value of $x \times y + z$ as a single operation.

- fmaf($\pm\infty$, ± 0 , `z`) returns NaN.
- fmaf(± 0 , $\pm\infty$, `z`) returns NaN.
- fmaf(`x`, `y`, $-\infty$) returns NaN if $x \times y$ is an exact $+\infty$.
- fmaf(`x`, `y`, $+\infty$) returns NaN if $x \times y$ is an exact $-\infty$.

Description

Compute the value of $x \times y + z$ as a single ternary operation. After computing the value to infinite precision, the value is rounded once.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float fmaxf (float x, float y)

Determine the maximum numeric value of the arguments.

Returns

Returns the maximum numeric values of the arguments `x` and `y`.

- If both arguments are NaN, returns NaN.
- If one argument is NaN, returns the numeric argument.

Description

Determines the maximum numeric value of the arguments `x` and `y`. Treats NaN arguments as missing data. If one argument is a NaN and the other is legitimate numeric value, the numeric value is chosen.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float fminf (float x, float y)

Determine the minimum numeric value of the arguments.

Returns

Returns the minimum numeric values of the arguments `x` and `y`.

- If both arguments are NaN, returns NaN.
- If one argument is NaN, returns the numeric argument.

Description

Determines the minimum numeric value of the arguments `x` and `y`. Treats NaN arguments as missing data. If one argument is a NaN and the other is legitimate numeric value, the numeric value is chosen.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float fmodf (float x, float y)

Calculate the floating-point remainder of `x` / `y`.

Returns

- Returns the floating point remainder of `x` / `y`.
- fmodf(± 0 , `y`) returns ± 0 if `y` is not zero.
- fmodf(`x`, `y`) returns NaN and raised an invalid floating point exception if `x` is $\pm\infty$ or `y` is zero.
- fmodf(`x`, `y`) returns zero if `y` is zero or the result would overflow.
- fmodf(`x`, $\pm\infty$) returns `x` if `x` is finite.
- fmodf(`x`, 0) returns NaN.

Description

Calculate the floating-point remainder of `x` / `y`. The absolute value of the computed value is always less than `y's` absolute value and will have the same sign as `x`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float frexpf (float x, int *nptr)

Extract mantissa and exponent of a floating-point value.

Returns

Returns the fractional component `m`.

- frexp(0, `nptr`) returns 0 for the fractional component and zero for the integer component.
- frexp(± 0 , `nptr`) returns ± 0 and stores zero in the location pointed to by `nptr`.
- frexp($\pm\infty$, `nptr`) returns $\pm\infty$ and stores an unspecified value in the location to which `nptr` points.
- frexp(NaN, `y`) returns a NaN and stores an unspecified value in the location to which `nptr` points.

Description

Decomposes the floating-point value `x` into a component `m` for the normalized fraction element and another term `n` for the exponent. The absolute value of `m` will be greater than or equal to 0.5 and less than 1.0 or it will be equal to 0; $x = m \cdot 2^n$. The integer exponent `n` will be stored in the location to which `nptr` points.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float __CRTDECL hypotf (float x, float y)

Calculate the square root of the sum of squares of two arguments.

Returns

Returns the length of the hypotenuse $\sqrt{x^2 + y^2}$. If the correct value would overflow, returns $+\infty$. If the correct value would underflow, returns 0.

Description

Calculates the length of the hypotenuse of a right triangle whose two sides have lengths `x` and `y` without undue overflow or underflow.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ int ilogbf (float x)

Compute the unbiased integer exponent of the argument.

Returns

- If successful, returns the unbiased exponent of the argument.
- ilogbf(0) returns `INT_MIN`.
- ilogbf(NaN) returns NaN.
- ilogbf(`x`) returns `INT_MAX` if `x` is ∞ or the correct value is greater than `INT_MAX`.
- ilogbf(`x`) return `INT_MIN` if the correct value is less than `INT_MIN`.

Description

Calculates the unbiased integer exponent of the input argument `x`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ __RETURN_TYPE isfinite (float a)

Determine whether argument is finite.

Returns

- With Visual Studio 2013 host compiler: __RETURN_TYPE is 'bool'. Returns true if and only if `a` is a finite value.
- With other host compilers: __RETURN_TYPE is 'int'. Returns a nonzero value if and only if `a` is a finite value.

Description

Determine whether the floating-point value `a` is a finite value (zero, subnormal, or normal and not infinity or NaN).

__host____device__ __RETURN_TYPE isinf (float a)

Determine whether argument is infinite.

Returns

- With Visual Studio 2013 host compiler: __RETURN_TYPE is 'bool'. Returns true if and only if `a` is a infinite value.
- With other host compilers: __RETURN_TYPE is 'int'. Returns a nonzero value if and only if `a` is a infinite value.

Description

Determine whether the floating-point value `a` is an infinite value (positive or negative).

__host____device__ __RETURN_TYPE isnan (float a)

Determine whether argument is a NaN.

Returns

- With Visual Studio 2013 host compiler: __RETURN_TYPE is 'bool'. Returns true if and only if `a` is a NaN value.
- With other host compilers: __RETURN_TYPE is 'int'. Returns a nonzero value if and only if `a` is a NaN value.

Description

Determine whether the floating-point value `a` is a NaN.

__host____device__ float j0f (float x)

Calculate the value of the Bessel function of the first kind of order 0 for the input argument.

Returns

Returns the value of the Bessel function of the first kind of order 0.

- j0f($\pm\infty$) returns +0.
- j0f(NaN) returns NaN.

Description

Calculate the value of the Bessel function of the first kind of order 0 for the input argument x, $J_0(x)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float j1f (float x)

Calculate the value of the Bessel function of the first kind of order 1 for the input argument.

Returns

Returns the value of the Bessel function of the first kind of order 1.

- j1f(± 0) returns ± 0.
- j1f($\pm\infty$) returns +0.
- j1f(NaN) returns NaN.

Description

Calculate the value of the Bessel function of the first kind of order 1 for the input argument x, $J_1(x)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float jnf (int n, float x)

Calculate the value of the Bessel function of the first kind of order n for the input argument.

Returns

Returns the value of the Bessel function of the first kind of order `n`.

- jnf(`n`, NaN) returns NaN.
- jnf(`n`, `x`) returns NaN for `n` < 0.
- jnf(`n`, $+\infty$) returns +0.

Description

Calculate the value of the Bessel function of the first kind of order `n` for the input argument `x`, $J_n(x)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float ldexpf (float x, int exp)

Calculate the value of $x \cdot 2^{exp}$.

Returns

- ldexpf(`x`) returns $\pm\infty$ if the correctly calculated value is outside the single floating point range.

Description

Calculate the value of $x \cdot 2^{exp}$ of the input arguments `x` and `exp`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float lgammaf (float x)

Calculate the natural logarithm of the absolute value of the gamma function of the input argument.

Returns

- lgammaf(1) returns +0.

- lgammaf(2) returns +0.
- lgammaf(x) returns $\pm\infty$ if the correctly calculated value is outside the single floating point range.
- lgammaf(x) returns $+\infty$ if x $\leq$ 0.
- lgammaf($-\infty$) returns $-\infty$.
- lgammaf($+\infty$) returns $+\infty$.

Description

Calculate the natural logarithm of the absolute value of the gamma function of the input argument x, namely the value of $log_e \left| \int_0^\infty e^{-t} t^{x-1} dt \right|$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ long long int llrintf (float x)

Round input to nearest integer value.

Returns

Returns rounded integer value.

Description

Round x to the nearest integer value, with halfway cases rounded towards zero. If the result is outside the range of the return type, the result is undefined.

__host____device__ long long int llroundf (float x)

Round to nearest integer value.

Returns

Returns rounded integer value.

Description

Round x to the nearest integer value, with halfway cases rounded away from zero. If the result is outside the range of the return type, the result is undefined.

This function may be slower than alternate rounding methods. See llrintf().

__host____device__ float log10f (float x)

Calculate the base 10 logarithm of the input argument.

Returns

- log10f(± 0) returns $-\infty$.
- log10f(1) returns +0.
- log10f(x) returns NaN for x < 0.
- log10f($+\infty$) returns $+\infty$.

Description

Calculate the base 10 logarithm of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float log1pf (float x)

Calculate the value of $log_e(1+x)$.

Returns

- log1pf(± 0) returns $-\infty$.
- log1pf(-1) returns +0.
- log1pf(x) returns NaN for x < -1.
- log1pf($+\infty$) returns $+\infty$.

Description

Calculate the value of $log_e(1+x)$ of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float log2f (float x)

Calculate the base 2 logarithm of the input argument.

Returns

- log2f(± 0) returns $-\infty$.
- log2f(1) returns +0.

- log2f(x) returns NaN for $x < 0$.
- log2f($+\infty$) returns $+\infty$.

Description

Calculate the base 2 logarithm of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float logbf (float x)

Calculate the floating point representation of the exponent of the input argument.

Returns

- logbf ± 0 returns $-\infty$
- logbf $+\infty$ returns $+\infty$

Description

Calculate the floating point representation of the exponent of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float logf (float x)

Calculate the natural logarithm of the input argument.

Returns

- logf(± 0) returns $-\infty$.
- logf(1) returns +0.
- logf(x) returns NaN for $x < 0$.
- logf($+\infty$) returns $+\infty$.

Description

Calculate the natural logarithm of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ long int lrintf (float x)

Round input to nearest integer value.

Returns

Returns rounded integer value.

Description

Round `x` to the nearest integer value, with halfway cases rounded towards zero. If the result is outside the range of the return type, the result is undefined.

__host____device__ long int lroundf (float x)

Round to nearest integer value.

Returns

Returns rounded integer value.

Description

Round `x` to the nearest integer value, with halfway cases rounded away from zero. If the result is outside the range of the return type, the result is undefined.

This function may be slower than alternate rounding methods. See lrintf().

__host____device__ float modff (float x, float *iptr)

Break down the input argument into fractional and integral parts.

Returns

- modff($\pm x$, `iptr`) returns a result with the same sign as `x`.
- modff($\pm\infty$, `iptr`) returns ± 0 and stores $\pm\infty$ in the object pointed to by `iptr`.
- modff(NaN, `iptr`) stores a NaN in the object pointed to by `iptr` and returns a NaN.

Description

Break down the argument `x` into fractional and integral parts. The integral part is stored in the argument `iptr`. Fractional and integral parts are given the same sign as the argument `x`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float nanf (const char *tagp)

Returns "Not a Number" value.

Returns

- nanf(`tagp`) returns NaN.

Description

Return a representation of a quiet NaN. Argument `tagp` selects one of the possible representations.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float nearbyintf (float x)

Round the input argument to the nearest integer.

Returns

- nearbyintf(± 0) returns ± 0.
- nearbyintf($\pm \infty$) returns $\pm \infty$.

Description

Round argument `x` to an integer value in single precision floating-point format.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float nextafterf (float x, float y)

Return next representable single-precision floating-point value afer argument.

Returns

- nextafterf($\pm \infty$, `y`) returns $\pm \infty$.

Description

Calculate the next representable single-precision floating-point value following x in the direction of y. For example, if y is greater than x, nextafterf() returns the smallest representable number greater than x

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float norm3df (float a, float b, float c)

Calculate the square root of the sum of squares of three coordinates of the argument.

Returns

Returns the length of the 3D $\sqrt{p.x^2 + p.y^2 + p.z^2}$. If the correct value would overflow, returns $+\infty$. If the correct value would underflow, returns 0.

Description

Calculates the length of three dimensional vector p in euclidean space without undue overflow or underflow.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float norm4df (float a, float b, float c, float d)

Calculate the square root of the sum of squares of four coordinates of the argument.

Returns

Returns the length of the 4D vector $\sqrt{p.x^2 + p.y^2 + p.z^2 + p.t^2}$. If the correct value would overflow, returns $+\infty$. If the correct value would underflow, returns 0.

Description

Calculates the length of four dimensional vector p in euclidean space without undue overflow or underflow.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float normcdff (float y)

Calculate the standard normal cumulative distribution function.

Returns

- normcdff($+\infty$) returns 1
- normcdff($-\infty$) returns +0

Description

Calculate the cumulative distribution function of the standard normal distribution for input argument y, $\Phi(y)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float normcdfinvf (float y)

Calculate the inverse of the standard normal cumulative distribution function.

Returns

- normcdfinvf(0) returns $-\infty$.
- normcdfinvf(1) returns $+\infty$.
- normcdfinvf(x) returns NaN if x is not in the interval [0,1].

Description

Calculate the inverse of the standard normal cumulative distribution function for input argument y, $\Phi^{-1}(y)$. The function is defined for input values in the interval (0, 1).

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float powf (float x, float y)

Calculate the value of first argument to the power of second argument.

Returns

- powf(± 0 , y) returns $\pm\infty$ for y an integer less than 0.
- powf(± 0 , y) returns ± 0 for y an odd integer greater than 0.
- powf(± 0 , y) returns +0 for y > 0 and not and odd integer.
- powf(-1, $\pm\infty$) returns 1.
- powf(+1, y) returns 1 for any y, even a NaN.
- powf(x, ± 0) returns 1 for any x, even a NaN.
- powf(x, y) returns a NaN for finite x < 0 and finite non-integer y.
- powf(x, $-\infty$) returns $+\infty$ for $|x| < 1$.
- powf(x, $-\infty$) returns +0 for $|x| > 1$.
- powf(x, $+\infty$) returns +0 for $|x| < 1$.
- powf(x, $+\infty$) returns $+\infty$ for $|x| > 1$.
- powf($-\infty$, y) returns -0 for y an odd integer less than 0.
- powf($-\infty$, y) returns +0 for y < 0 and not an odd integer.
- powf($-\infty$, y) returns $-\infty$ for y an odd integer greater than 0.
- powf($-\infty$, y) returns $+\infty$ for y > 0 and not an odd integer.
- powf($+\infty$, y) returns +0 for y < 0.
- powf($+\infty$, y) returns $+\infty$ for y > 0.

Description

Calculate the value of x to the power of y.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float rcbrtf (float x)

Calculate reciprocal cube root function.

Returns

- rcbrt(± 0) returns $\pm\infty$.
- rcbrt($\pm\infty$) returns ± 0.

Description

Calculate reciprocal cube root function of x

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float remainderf (float x, float y)

Compute single-precision floating-point remainder.

Returns

- remainderf(x, 0) returns NaN.
- remainderf($\pm\infty$, y) returns NaN.
- remainderf(x, $\pm\infty$) returns x for finite x.

Description

Compute single-precision floating-point remainder r of dividing x by y for nonzero y. Thus $r = x - ny$. The value n is the integer value nearest $\frac{x}{y}$. In the case when $|n - \frac{x}{y}| = \frac{1}{2}$, the even n value is chosen.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float remquof (float x, float y, int *quo)

Compute single-precision floating-point remainder and part of quotient.

Returns

Returns the remainder.

- remquof(x, 0, quo) returns NaN.
- remquof($\pm\infty$, y, quo) returns NaN.
- remquof(x, $\pm\infty$, quo) returns x.

Description

Compute a double-precision floating-point remainder in the same way as the remainderf() function. Argument quo returns part of quotient upon division of x by y. Value quo has the same sign as $\frac{x}{y}$ and may not be the exact quotient but agrees with the exact quotient in the low order 3 bits.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float rhypotf (float x, float y)

Calculate one over the square root of the sum of squares of two arguments.

Returns

Returns one over the length of the hypotenuse $\frac{1}{\sqrt{x^2+y^2}}$. If the square root would overflow, returns 0. If the square root would underflow, returns $+\infty$.

Description

Calculates one over the length of the hypotenuse of a right triangle whose two sides have lengths `x` and `y` without undue overflow or underflow.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float rintf (float x)

Round input to nearest integer value in floating-point.

Returns

Returns rounded integer value.

Description

Round `x` to the nearest integer value in floating-point format, with halfway cases rounded towards zero.

__host____device__ float rnorm3df (float a, float b, float c)

Calculate one over the square root of the sum of squares of three coordinates of the argument.

Returns

Returns one over the length of the 3D vector $\frac{1}{\sqrt{p.x^2+p.y^2+p.z^2}}$. If the square root would overflow, returns 0. If the square root would underflow, returns $+\infty$.

Description

Calculates one over the length of three dimension vector `p` in euclidean space without undue overflow or underflow.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float roundf (float x)

Round to nearest integer value in floating-point.

Returns

Returns rounded integer value.

Description

Round `x` to the nearest integer value in floating-point format, with halfway cases rounded away from zero.

This function may be slower than alternate rounding methods. See rintf().

__host____device__ float rsqrtf (float x)

Calculate the reciprocal of the square root of the input argument.

Returns

Returns $1/\sqrt{x}$.

- rsqrtf($+\infty$) returns +0.

- rsqrtf(± 0) returns $\pm\infty$.
- rsqrtf(x) returns NaN if x is less than 0.

Description

Calculate the reciprocal of the nonnegative square root of x, $1/\sqrt{x}$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float scalblnf (float x, long int n)

Scale floating-point input by integer power of two.

Returns

Returns x * 2^n.

- scalblnf(± 0 , n) returns ± 0.
- scalblnf(x, 0) returns x.
- scalblnf($\pm\infty$, n) returns $\pm\infty$.

Description

Scale x by 2^n by efficient manipulation of the floating-point exponent.

__host____device__ float scalbnf (float x, int n)

Scale floating-point input by integer power of two.

Returns

Returns x * 2^n.

- scalbnf(± 0 , n) returns ± 0.
- scalbnf(x, 0) returns x.
- scalbnf($\pm\infty$, n) returns $\pm\infty$.

Description

Scale x by 2^n by efficient manipulation of the floating-point exponent.

__host____device__ __RETURN_TYPE signbit (float a)

Return the sign bit of the input.

Returns

Reports the sign bit of all values including infinities, zeros, and NaNs.

- With Visual Studio 2013 host compiler: __RETURN_TYPE is 'bool'. Returns true if and only if `a` is negative.
- With other host compilers: __RETURN_TYPE is 'int'. Returns a nonzero value if and only if `a` is negative.

Description

Determine whether the floating-point value `a` is negative.

__host____device__ void sincosf (float x, float *sptr, float *cptr)

Calculate the sine and cosine of the first input argument.

Returns

- none

Description

Calculate the sine and cosine of the first input argument `x` (measured in radians). The results for sine and cosine are written into the second argument, `sptr`, and, respectively, third argument, `cptr`.

See also:

sinf() and cosf().

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
- This function is affected by the `--use_fast_math` compiler flag. See the CUDA C Programming Guide, Appendix D.2, Table 8 for a complete list of functions affected.

__host____device__ void sincospif (float x, float *sptr, float *cptr)

Calculate the sine and cosine of the first input argument $\times \pi$.

Returns

- none

Description

Calculate the sine and cosine of the first input argument, `x` (measured in radians), $\times \pi$. The results for sine and cosine are written into the second argument, `sptr`, and, respectively, third argument, `cptr`.

See also:

sinpif() and cospif().

> For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float sinf (float x)

Calculate the sine of the input argument.

Returns

- sinf(± 0) returns ± 0.
- sinf($\pm \infty$) returns NaN.

Description

Calculate the sine of the input argument `x` (measured in radians).

> - For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
> - This function is affected by the `--use_fast_math` compiler flag. See the CUDA C Programming Guide, Appendix D.2, Table 8 for a complete list of functions affected.

__host____device__ float sinhf (float x)

Calculate the hyperbolic sine of the input argument.

Returns

- sinhf(± 0) returns ± 0.
- sinhf($\pm \infty$) returns NaN.

Description

Calculate the hyperbolic sine of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float sinpif (float x)

Calculate the sine of the input argument $\times \pi$.

Returns

- sinpif(± 0) returns ± 0.
- sinpif($\pm \infty$) returns NaN.

Description

Calculate the sine of x $\times \pi$ (measured in radians), where x is the input argument.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float sqrtf (float x)

Calculate the square root of the input argument.

Returns

Returns $\sqrt{x}$.

- sqrtf(± 0) returns ± 0.
- sqrtf($+\infty$) returns $+\infty$.
- sqrtf(x) returns NaN if x is less than 0.

Description

Calculate the nonnegative square root of `x`, $\sqrt{x}$.

> For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float tanf (float x)

Calculate the tangent of the input argument.

Returns

- tanf(± 0) returns ± 0.
- tanf($\pm \infty$) returns NaN.

Description

Calculate the tangent of the input argument `x` (measured in radians).

> - For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
> - This function is affected by the `--use_fast_math` compiler flag. See the CUDA C Programming Guide, Appendix D.2, Table 8 for a complete list of functions affected.

__host____device__ float tanhf (float x)

Calculate the hyperbolic tangent of the input argument.

Returns

- tanhf(± 0) returns ± 0.

Description

Calculate the hyperbolic tangent of the input argument `x`.

> For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float tgammaf (float x)

Calculate the gamma function of the input argument.

Returns

- tgammaf(± 0) returns $\pm \infty$.
- tgammaf(2) returns +0.
- tgammaf(x) returns $\pm \infty$ if the correctly calculated value is outside the single floating point range.
- tgammaf(x) returns NaN if $x < 0$.
- tgammaf($-\infty$) returns NaN.
- tgammaf($+\infty$) returns $+\infty$.

Description

Calculate the gamma function of the input argument x, namely the value of $\int_0^\infty e^{-t} t^{x-1} dt$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float truncf (float x)

Truncate input argument to the integral part.

Returns

Returns truncated integer value.

Description

Round x to the nearest integer value that does not exceed x in magnitude.

__host____device__ float y0f (float x)

Calculate the value of the Bessel function of the second kind of order 0 for the input argument.

Returns

Returns the value of the Bessel function of the second kind of order 0.

- y0f(0) returns $-\infty$.
- y0f(x) returns NaN for $x < 0$.
- y0f($+\infty$) returns +0.

- y0f(NaN) returns NaN.

Description

Calculate the value of the Bessel function of the second kind of order 0 for the input argument `x`, $Y_0(x)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float y1f (float x)

Calculate the value of the Bessel function of the second kind of order 1 for the input argument.

Returns

Returns the value of the Bessel function of the second kind of order 1.

- y1f(0) returns $-\infty$.
- y1f(`x`) returns NaN for `x` < 0.
- y1f($+\infty$) returns +0.
- y1f(NaN) returns NaN.

Description

Calculate the value of the Bessel function of the second kind of order 1 for the input argument `x`, $Y_1(x)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ float ynf (int n, float x)

Calculate the value of the Bessel function of the second kind of order n for the input argument.

Returns

Returns the value of the Bessel function of the second kind of order `n`.

- ynf(`n`, `x`) returns NaN for `n` < 0.
- ynf(`n`, 0) returns $-\infty$.
- ynf(`n`, `x`) returns NaN for `x` < 0.
- ynf(`n`, $+\infty$) returns +0.

- ynf(n, NaN) returns NaN.

Description

Calculate the value of the Bessel function of the second kind of order n for the input argument x, $Y_n(x)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

1.3. Double Precision Mathematical Functions

This section describes double precision mathematical functions.

__host____device__ double acos (double x)

Calculate the arc cosine of the input argument.

Returns

Result will be in radians, in the interval [0, π] for x inside [-1, +1].

- acos(1) returns +0.
- acos(x) returns NaN for x outside [-1, +1].

Description

Calculate the principal value of the arc cosine of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double acosh (double x)

Calculate the nonnegative arc hyperbolic cosine of the input argument.

Returns

Result will be in the interval [0, $+\infty$].

- acosh(1) returns 0.
- acosh(x) returns NaN for x in the interval [$-\infty$, 1).

Description

Calculate the nonnegative arc hyperbolic cosine of the input argument `x`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double asin (double x)

Calculate the arc sine of the input argument.

Returns

Result will be in radians, in the interval [- π /2, + π /2] for `x` inside [-1, +1].

- asin(0) returns +0.
- asin(`x`) returns NaN for `x` outside [-1, +1].

Description

Calculate the principal value of the arc sine of the input argument `x`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double asinh (double x)

Calculate the arc hyperbolic sine of the input argument.

Returns

- asinh(0) returns 1.

Description

Calculate the arc hyperbolic sine of the input argument `x`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double atan (double x)

Calculate the arc tangent of the input argument.

Returns

Result will be in radians, in the interval [- π /2, + π /2].

- atan(0) returns +0.

Description

Calculate the principal value of the arc tangent of the input argument `x`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double atan2 (double y, double x)

Calculate the arc tangent of the ratio of first and second input arguments.

Returns

Result will be in radians, in the interval [- π /, + π].

- atan2(0, 1) returns +0.

Description

Calculate the principal value of the arc tangent of the ratio of first and second input arguments `y` / `x`. The quadrant of the result is determined by the signs of inputs `y` and `x`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double atanh (double x)

Calculate the arc hyperbolic tangent of the input argument.

Returns

- atanh(± 0) returns ± 0.
- atanh(± 1) returns $\pm \infty$.
- atanh(`x`) returns NaN for `x` outside interval [-1, 1].

Description

Calculate the arc hyperbolic tangent of the input argument `x`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double cbrt (double x)

Calculate the cube root of the input argument.

Returns

Returns $x^{1/3}$.

- cbrt(± 0) returns ± 0.
- cbrt($\pm \infty$) returns $\pm \infty$.

Description

Calculate the cube root of `x`, $x^{1/3}$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double ceil (double x)

Calculate ceiling of the input argument.

Returns

Returns $\lceil x \rceil$ expressed as a floating-point number.

- ceil(± 0) returns ± 0.
- ceil($\pm \infty$) returns $\pm \infty$.

Description

Compute the smallest integer value not less than `x`.

__host____device__ double copysign (double x, double y)

Create value with given magnitude, copying sign of second value.

Returns

Returns a value with the magnitude of `x` and the sign of `y`.

Description

Create a floating-point value with the magnitude `x` and the sign of `y`.

__host____device__ double cos (double x)

Calculate the cosine of the input argument.

Returns

- cos(± 0) returns 1.
- cos($\pm\infty$) returns NaN.

Description

Calculate the cosine of the input argument `x` (measured in radians).

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double cosh (double x)

Calculate the hyperbolic cosine of the input argument.

Returns

- cosh(0) returns 1.
- cosh($\pm\infty$) returns $+\infty$.

Description

Calculate the hyperbolic cosine of the input argument `x`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double cospi (double x)

Calculate the cosine of the input argument $\times \pi$.

Returns

- cospi(± 0) returns 1.
- cospi($\pm \infty$) returns NaN.

Description

Calculate the cosine of x $\times \pi$ (measured in radians), where x is the input argument.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double cyl_bessel_i0 (double x)

Calculate the value of the regular modified cylindrical Bessel function of order 0 for the input argument.

Returns

Returns the value of the regular modified cylindrical Bessel function of order 0.

Description

Calculate the value of the regular modified cylindrical Bessel function of order 0 for the input argument x, $I_0(x)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double cyl_bessel_i1 (double x)

Calculate the value of the regular modified cylindrical Bessel function of order 1 for the input argument.

Returns

Returns the value of the regular modified cylindrical Bessel function of order 1.

Description

Calculate the value of the regular modified cylindrical Bessel function of order 1 for the input argument x, $I_1(x)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double erf (double x)

Calculate the error function of the input argument.

Returns

- erf(± 0) returns ± 0.
- erf($\pm \infty$) returns ± 1.

Description

Calculate the value of the error function for the input argument x, $\frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double erfc (double x)

Calculate the complementary error function of the input argument.

Returns

- erfc($-\infty$) returns 2.
- erfc($+\infty$) returns +0.

Description

Calculate the complementary error function of the input argument x, 1 - erf(x).

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double erfcinv (double y)

Calculate the inverse complementary error function of the input argument.

Returns

- erfcinv(0) returns $+\infty$.
- erfcinv(2) returns $-\infty$.

Description

Calculate the inverse complementary error function of the input argument `y`, for `y` in the interval [0, 2]. The inverse complementary error function find the value `x` that satisfies the equation `y` = erfc(`x`), for $0 \le y \le 2$, and $-\infty \le x \le \infty$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double erfcx (double x)

Calculate the scaled complementary error function of the input argument.

Returns

- erfcx($-\infty$) returns $+\infty$
- erfcx($+\infty$) returns +0
- erfcx(`x`) returns $+\infty$ if the correctly calculated value is outside the double floating point range.

Description

Calculate the scaled complementary error function of the input argument `x`, $e^{x^2} \cdot \mathrm{erfc}(x)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double erfinv (double y)

Calculate the inverse error function of the input argument.

Returns

- erfinv(1) returns $+\infty$.
- erfinv(-1) returns $-\infty$.

Description

Calculate the inverse error function of the input argument `y`, for `y` in the interval [-1, 1]. The inverse error function finds the value `x` that satisfies the equation `y` = erf(`x`), for $-1 \le y \le 1$, and $-\infty \le x \le \infty$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double exp (double x)

Calculate the base e exponential of the input argument.

Returns

Returns e^x.

Description

Calculate the base e exponential of the input argument `x`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double exp10 (double x)

Calculate the base 10 exponential of the input argument.

Returns

Returns 10^x.

Description

Calculate the base 10 exponential of the input argument `x`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double exp2 (double x)

Calculate the base 2 exponential of the input argument.

Returns

Returns 2^x.

Description

Calculate the base 2 exponential of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double expm1 (double x)

Calculate the base e exponential of the input argument, minus 1.

Returns

Returns $e^x - 1$.

Description

Calculate the base e exponential of the input argument x, minus 1.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double fabs (double x)

Calculate the absolute value of the input argument.

Returns

Returns the absolute value of the input argument.

- fabs($\pm\infty$) returns $+\infty$.
- fabs(± 0) returns 0.

Description

Calculate the absolute value of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double fdim (double x, double y)

Compute the positive difference between x and y.

Returns

Returns the positive difference between x and y.

- fdim(x, y) returns x - y if x > y.
- fdim(x, y) returns +0 if x $\leq$ y.

Description

Compute the positive difference between x and y. The positive difference is x - y when x > y and +0 otherwise.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__host____device__ double floor (double x)

Calculate the largest integer less than or equal to x.

Returns

Returns $log_e(1+x)$ expressed as a floating-point number.

- floor($\pm\infty$) returns $\pm\infty$.
- floor(± 0) returns ± 0.

Description

Calculates the largest integer value which is less than or equal to x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double fma (double x, double y, double z)

Compute $x \times y + z$ as a single operation.

Returns

Returns the rounded value of $x \times y + z$ as a single operation.

- fma($\pm\infty$, ± 0 , z) returns NaN.
- fma(± 0 , $\pm\infty$, z) returns NaN.
- fma(x, y, $-\infty$) returns NaN if $x \times y$ is an exact $+\infty$.
- fma(x, y, $+\infty$) returns NaN if $x \times y$ is an exact $-\infty$.

Description

Compute the value of $x \times y + z$ as a single ternary operation. After computing the value to infinite precision, the value is rounded once.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double fmax (double, double)

Determine the maximum numeric value of the arguments.

Returns

Returns the maximum numeric values of the arguments x and y.

- If both arguments are NaN, returns NaN.
- If one argument is NaN, returns the numeric argument.

Description

Determines the maximum numeric value of the arguments x and y. Treats NaN arguments as missing data. If one argument is a NaN and the other is legitimate numeric value, the numeric value is chosen.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double fmin (double x, double y)

Determine the minimum numeric value of the arguments.

Returns

Returns the minimum numeric values of the arguments `x` and `y`.

- If both arguments are NaN, returns NaN.
- If one argument is NaN, returns the numeric argument.

Description

Determines the minimum numeric value of the arguments `x` and `y`. Treats NaN arguments as missing data. If one argument is a NaN and the other is legitimate numeric value, the numeric value is chosen.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double fmod (double x, double y)

Calculate the floating-point remainder of `x` / `y`.

Returns

- Returns the floating point remainder of `x` / `y`.
- fmod(± 0 , `y`) returns ± 0 if `y` is not zero.
- fmod(`x`, `y`) returns NaN and raised an invalid floating point exception if `x` is $\pm\infty$ or `y` is zero.
- fmod(`x`, `y`) returns zero if `y` is zero or the result would overflow.
- fmod(`x`, $\pm\infty$) returns `x` if `x` is finite.
- fmod(`x`, 0) returns NaN.

Description

Calculate the floating-point remainder of `x` / `y`. The absolute value of the computed value is always less than `y's` absolute value and will have the same sign as `x`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double frexp (double x, int *nptr)

Extract mantissa and exponent of a floating-point value.

Returns

Returns the fractional component m.

- frexp(0, nptr) returns 0 for the fractional component and zero for the integer component.
- frexp(± 0 , nptr) returns ± 0 and stores zero in the location pointed to by nptr.
- frexp($\pm\infty$, nptr) returns $\pm\infty$ and stores an unspecified value in the location to which nptr points.
- frexp(NaN, y) returns a NaN and stores an unspecified value in the location to which nptr points.

Description

Decompose the floating-point value x into a component m for the normalized fraction element and another term n for the exponent. The absolute value of m will be greater than or equal to 0.5 and less than 1.0 or it will be equal to 0; $x = m \cdot 2^n$. The integer exponent n will be stored in the location to which nptr points.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double __CRTDECL hypot (double x, double y)

Calculate the square root of the sum of squares of two arguments.

Returns

Returns the length of the hypotenuse $\sqrt{x^2 + y^2}$. If the correct value would overflow, returns $+\infty$. If the correct value would underflow, returns 0.

Description

Calculate the length of the hypotenuse of a right triangle whose two sides have lengths x and y without undue overflow or underflow.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ int ilogb (double x)

Compute the unbiased integer exponent of the argument.

Returns

- If successful, returns the unbiased exponent of the argument.
- ilogb(0) returns `INT_MIN`.
- ilogb(NaN) returns NaN.
- ilogb(`x`) returns `INT_MAX` if `x` is ∞ or the correct value is greater than `INT_MAX`.
- ilogb(`x`) return `INT_MIN` if the correct value is less than `INT_MIN`.

Description

Calculates the unbiased integer exponent of the input argument `x`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ __RETURN_TYPE isfinite (double a)

Determine whether argument is finite.

Returns

- With Visual Studio 2013 host compiler: __RETURN_TYPE is 'bool'. Returns true if and only if `a` is a finite value.
- With other host compilers: __RETURN_TYPE is 'int'. Returns a nonzero value if and only if `a` is a finite value.

Description

Determine whether the floating-point value `a` is a finite value (zero, subnormal, or normal and not infinity or NaN).

__host____device__ __RETURN_TYPE isinf (double a)

Determine whether argument is infinite.

Returns

- With Visual Studio 2013 host compiler: Returns true if and only if `a` is a infinite value.
- With other host compilers: Returns a nonzero value if and only if `a` is a infinite value.

Description

Determine whether the floating-point value `a` is an infinite value (positive or negative).

__host____device__ __RETURN_TYPE isnan (double a)

Determine whether argument is a NaN.

Returns

- With Visual Studio 2013 host compiler: __RETURN_TYPE is 'bool'. Returns true if and only if `a` is a NaN value.
- With other host compilers: __RETURN_TYPE is 'int'. Returns a nonzero value if and only if `a` is a NaN value.

Description

Determine whether the floating-point value `a` is a NaN.

__host____device__ double j0 (double x)

Calculate the value of the Bessel function of the first kind of order 0 for the input argument.

Returns

Returns the value of the Bessel function of the first kind of order 0.

- j0($\pm\infty$) returns +0.
- j0(NaN) returns NaN.

Description

Calculate the value of the Bessel function of the first kind of order 0 for the input argument `x`, $J_0(x)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double j1 (double x)

Calculate the value of the Bessel function of the first kind of order 1 for the input argument.

Returns

Returns the value of the Bessel function of the first kind of order 1.

- j1(± 0) returns ± 0.
- j1($\pm\infty$) returns +0.
- j1(NaN) returns NaN.

Description

Calculate the value of the Bessel function of the first kind of order 1 for the input argument `x`, $J_1(x)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double jn (int n, double x)

Calculate the value of the Bessel function of the first kind of order n for the input argument.

Returns

Returns the value of the Bessel function of the first kind of order `n`.

- jn(`n`, NaN) returns NaN.
- jn(`n`, `x`) returns NaN for `n` < 0.
- jn(`n`, $+\infty$) returns +0.

Description

Calculate the value of the Bessel function of the first kind of order `n` for the input argument `x`, $J_n(x)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double ldexp (double x, int exp)

Calculate the value of $x \cdot 2^{exp}$.

Returns

- ldexp(`x`) returns $\pm\infty$ if the correctly calculated value is outside the double floating point range.

Description

Calculate the value of $x \cdot 2^{exp}$ of the input arguments `x` and `exp`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double lgamma (double x)

Calculate the natural logarithm of the absolute value of the gamma function of the input argument.

Returns

- lgamma(1) returns +0.
- lgamma(2) returns +0.
- lgamma(x) returns $\pm\infty$ if the correctly calculated value is outside the double floating point range.
- lgamma(x) returns $+\infty$ if x $\leq$ 0.
- lgamma($-\infty$) returns $-\infty$.
- lgamma($+\infty$) returns $+\infty$.

Description

Calculate the natural logarithm of the absolute value of the gamma function of the input argument x, namely the value of $\log_e\left|\int_0^\infty e^{-t}t^{x-1}dt\right|$

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ long long int llrint (double x)

Round input to nearest integer value.

Returns

Returns rounded integer value.

Description

Round x to the nearest integer value, with halfway cases rounded towards zero. If the result is outside the range of the return type, the result is undefined.

__host____device__ long long int llround (double x)

Round to nearest integer value.

Returns

Returns rounded integer value.

Description

Round x to the nearest integer value, with halfway cases rounded away from zero. If the result is outside the range of the return type, the result is undefined.

This function may be slower than alternate rounding methods. See llrint().

__host____device__ double log (double x)

Calculate the base e logarithm of the input argument.

Returns

- log(± 0) returns $-\infty$.
- log(1) returns +0.
- log(x) returns NaN for x < 0.
- log($+\infty$) returns $+\infty$

Description

Calculate the base e logarithm of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double log10 (double x)

Calculate the base 10 logarithm of the input argument.

Returns

- log10(± 0) returns $-\infty$.
- log10(1) returns +0.
- log10(x) returns NaN for x < 0.
- log10($+\infty$) returns $+\infty$.

Description

Calculate the base 10 logarithm of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double log1p (double x)

Calculate the value of $log_e(1+x)$.

Returns

- log1p(± 0) returns $-\infty$.
- log1p(-1) returns +0.
- log1p(x) returns NaN for x < -1.
- log1p($+\infty$) returns $+\infty$.

Description

Calculate the value of $log_e(1+x)$ of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double log2 (double x)

Calculate the base 2 logarithm of the input argument.

Returns

- log2(± 0) returns $-\infty$.
- log2(1) returns +0.
- log2(x) returns NaN for x < 0.
- log2($+\infty$) returns $+\infty$.

Description

Calculate the base 2 logarithm of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double logb (double x)

Calculate the floating point representation of the exponent of the input argument.

Returns

- logb ± 0 returns $-\infty$
- logb $\pm\infty$ returns $+\infty$

Description

Calculate the floating point representation of the exponent of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ long int lrint (double x)

Round input to nearest integer value.

Returns

Returns rounded integer value.

Description

Round x to the nearest integer value, with halfway cases rounded towards zero. If the result is outside the range of the return type, the result is undefined.

__host____device__ long int lround (double x)

Round to nearest integer value.

Returns

Returns rounded integer value.

Description

Round x to the nearest integer value, with halfway cases rounded away from zero. If the result is outside the range of the return type, the result is undefined.

This function may be slower than alternate rounding methods. See lrint().

__host____device__ double modf (double x, double *iptr)

Break down the input argument into fractional and integral parts.

Returns

- modf($\pm x$, `iptr`) returns a result with the same sign as `x`.
- modf($\pm\infty$, `iptr`) returns ± 0 and stores $\pm\infty$ in the object pointed to by `iptr`.
- modf(NaN, `iptr`) stores a NaN in the object pointed to by `iptr` and returns a NaN.

Description

Break down the argument `x` into fractional and integral parts. The integral part is stored in the argument `iptr`. Fractional and integral parts are given the same sign as the argument `x`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double nan (const char *tagp)

Returns "Not a Number" value.

Returns

- nan(`tagp`) returns NaN.

Description

Return a representation of a quiet NaN. Argument `tagp` selects one of the possible representations.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double nearbyint (double x)

Round the input argument to the nearest integer.

Returns

- nearbyint(± 0) returns ± 0.
- nearbyint($\pm\infty$) returns $\pm\infty$.

Description

Round argument x to an integer value in double precision floating-point format.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double nextafter (double x, double y)

Return next representable double-precision floating-point value after argument.

Returns

- nextafter($\pm\infty$, y) returns $\pm\infty$.

Description

Calculate the next representable double-precision floating-point value following x in the direction of y. For example, if y is greater than x, nextafter() returns the smallest representable number greater than x

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double norm3d (double a, double b, double c)

Calculate the square root of the sum of squares of three coordinates of the argument.

Returns

Returns the length of 3D vector $\sqrt{p.x^2+p.y^2+p.z^2}$. If the correct value would overflow, returns $+\infty$. If the correct value would underflow, returns 0.

Description

Calculate the length of three dimensional vector p in euclidean space without undue overflow or underflow.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double norm4d (double a, double b, double c, double d)

Calculate the square root of the sum of squares of four coordinates of the argument.

Returns

Returns the length of 4D vector $\sqrt{p.x^2 + p.y^2 + p.z^2 + p.t^2}$. If the correct value would overflow, returns $+\infty$. If the correct value would underflow, returns 0.

Description

Calculate the length of four dimensional vector p in euclidean space without undue overflow or underflow.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double normcdf (double y)

Calculate the standard normal cumulative distribution function.

Returns

- normcdf($+\infty$) returns 1
- normcdf($-\infty$) returns +0

Description

Calculate the cumulative distribution function of the standard normal distribution for input argument y, $\Phi(y)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double normcdfinv (double y)

Calculate the inverse of the standard normal cumulative distribution function.

Returns

- normcdfinv(0) returns $-\infty$.
- normcdfinv(1) returns $+\infty$.
- normcdfinv(x) returns NaN if x is not in the interval [0,1].

Description

Calculate the inverse of the standard normal cumulative distribution function for input argument `y`, $\Phi^{-1}(y)$. The function is defined for input values in the interval (0, 1).

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double pow (double x, double y)

Calculate the value of first argument to the power of second argument.

Returns

- pow(± 0 , y) returns $\pm \infty$ for y an integer less than 0.
- pow(± 0 , y) returns ± 0 for y an odd integer greater than 0.
- pow(± 0 , y) returns +0 for y > 0 and not and odd integer.
- pow(-1, $\pm \infty$) returns 1.
- pow(+1, y) returns 1 for any y, even a NaN.
- pow(x, ± 0) returns 1 for any x, even a NaN.
- pow(x, y) returns a NaN for finite x < 0 and finite non-integer y.
- pow(x, $-\infty$) returns $+\infty$ for $|x| < 1$.
- pow(x, $-\infty$) returns +0 for $|x| > 1$.
- pow(x, $+\infty$) returns +0 for $|x| < 1$.
- pow(x, $+\infty$) returns $+\infty$ for $|x| > 1$.
- pow($-\infty$, y) returns -0 for y an odd integer less than 0.
- pow($-\infty$, y) returns +0 for y < 0 and not an odd integer.
- pow($-\infty$, y) returns $-\infty$ for y an odd integer greater than 0.
- pow($-\infty$, y) returns $+\infty$ for y > 0 and not an odd integer.
- pow($+\infty$, y) returns +0 for y < 0.
- pow($+\infty$, y) returns $+\infty$ for y > 0.

Description

Calculate the value of `x` to the power of `y`

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double rcbrt (double x)

Calculate reciprocal cube root function.

Returns

- rcbrt(± 0) returns $\pm\infty$.
- rcbrt($\pm\infty$) returns ± 0.

Description

Calculate reciprocal cube root function of `x`

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double remainder (double x, double y)

Compute double-precision floating-point remainder.

Returns

- remainder(`x`, 0) returns NaN.
- remainder($\pm\infty$, `y`) returns NaN.
- remainder(`x`, $\pm\infty$) returns `x` for finite `x`.

Description

Compute double-precision floating-point remainder `r` of dividing `x` by `y` for nonzero `y`. Thus $r = x - ny$. The value `n` is the integer value nearest $\frac{x}{y}$. In the case when $|n - \frac{x}{y}| = \frac{1}{2}$, the even `n` value is chosen.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double remquo (double x, double y, int *quo)

Compute double-precision floating-point remainder and part of quotient.

Returns

Returns the remainder.

- remquo(x, 0, quo) returns NaN.
- remquo($\pm\infty$, y, quo) returns NaN.
- remquo(x, $\pm\infty$, quo) returns x.

Description

Compute a double-precision floating-point remainder in the same way as the remainder() function. Argument quo returns part of quotient upon division of x by y. Value quo has the same sign as $\frac{x}{y}$ and may not be the exact quotient but agrees with the exact quotient in the low order 3 bits.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double rhypot (double x, double y)

Calculate one over the square root of the sum of squares of two arguments.

Returns

Returns one over the length of the hypotenuse $\frac{1}{\sqrt{x^2+y^2}}$. If the square root would overflow, returns 0. If the square root would underflow, returns $+\infty$.

Description

Calculate one over the length of the hypotenuse of a right triangle whose two sides have lengths x and y without undue overflow or underflow.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double rint (double x)

Round to nearest integer value in floating-point.

Returns

Returns rounded integer value.

Description

Round x to the nearest integer value in floating-point format, with halfway cases rounded to the nearest even integer value.

__host____device__ double rnorm3d (double a, double b, double c)

Calculate one over the square root of the sum of squares of three coordinates of the argument.

Returns

Returns one over the length of the 3D vetor $\frac{1}{\sqrt{p.x^2+p.y^2+p.z^2}}$. If the square root would overflow, returns 0. If the square root would underflow, returns $+\infty$.

Description

Calculate one over the length of three dimensional vector p in euclidean space undue overflow or underflow.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double round (double x)

Round to nearest integer value in floating-point.

Returns

Returns rounded integer value.

Description

Round x to the nearest integer value in floating-point format, with halfway cases rounded away from zero.

This function may be slower than alternate rounding methods. See rint().

__host____device__ double rsqrt (double x)

Calculate the reciprocal of the square root of the input argument.

Returns

Returns $1/\sqrt{x}$.

- rsqrt($+\infty$) returns +0.
- rsqrt(± 0) returns $\pm\infty$.
- rsqrt(x) returns NaN if x is less than 0.

Description

Calculate the reciprocal of the nonnegative square root of x, $1/\sqrt{x}$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double scalbln (double x, long int n)

Scale floating-point input by integer power of two.

Returns

Returns x * 2^n.

- scalbln(± 0 , n) returns ± 0.
- scalbln(x, 0) returns x.
- scalbln($\pm\infty$, n) returns $\pm\infty$.

Description

Scale x by 2^n by efficient manipulation of the floating-point exponent.

__host____device__ double scalbn (double x, int n)

Scale floating-point input by integer power of two.

Returns

Returns `x` * 2^n.

- scalbn(± 0 , `n`) returns ± 0.
- scalbn(`x`, 0) returns `x`.
- scalbn($\pm \infty$, `n`) returns $\pm \infty$.

Description

Scale `x` by 2^n by efficient manipulation of the floating-point exponent.

__host____device__ __RETURN_TYPE signbit (double a)

Return the sign bit of the input.

Returns

Reports the sign bit of all values including infinities, zeros, and NaNs.

- With Visual Studio 2013 host compiler: __RETURN_TYPE is 'bool'. Returns true if and only if `a` is negative.
- With other host compilers: __RETURN_TYPE is 'int'. Returns a nonzero value if and only if `a` is negative.

Description

Determine whether the floating-point value `a` is negative.

__host____device__ double sin (double x)

Calculate the sine of the input argument.

Returns

- sin(± 0) returns ± 0.
- sin($\pm \infty$) returns NaN.

Description

Calculate the sine of the input argument `x` (measured in radians).

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ void sincos (double x, double *sptr, double *cptr)

Calculate the sine and cosine of the first input argument.

Returns

- none

Description

Calculate the sine and cosine of the first input argument `x` (measured in radians). The results for sine and cosine are written into the second argument, `sptr`, and, respectively, third argument, `cptr`.

See also:

sin() and cos().

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ void sincospi (double x, double *sptr, double *cptr)

Calculate the sine and cosine of the first input argument $\times \pi$.

Returns

- none

Description

Calculate the sine and cosine of the first input argument, `x` (measured in radians), $\times \pi$. The results for sine and cosine are written into the second argument, `sptr`, and, respectively, third argument, `cptr`.

See also:

sinpi() and cospi().

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double sinh (double x)

Calculate the hyperbolic sine of the input argument.

Returns

- sinh(± 0) returns ± 0.

Description

Calculate the hyperbolic sine of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double sinpi (double x)

Calculate the sine of the input argument $\times \pi$.

Returns

- sinpi(± 0) returns ± 0.
- sinpi($\pm \infty$) returns NaN.

Description

Calculate the sine of x $\times \pi$ (measured in radians), where x is the input argument.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double sqrt (double x)

Calculate the square root of the input argument.

Returns

Returns $\sqrt{x}$.

- sqrt(± 0) returns ± 0.

- sqrt($+\infty$) returns $+\infty$.
- sqrt(x) returns NaN if x is less than 0.

Description

Calculate the nonnegative square root of x, $\sqrt{x}$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double tan (double x)

Calculate the tangent of the input argument.

Returns

- tan(± 0) returns ± 0.
- tan($\pm\infty$) returns NaN.

Description

Calculate the tangent of the input argument x (measured in radians).

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double tanh (double x)

Calculate the hyperbolic tangent of the input argument.

Returns

- tanh(± 0) returns ± 0.

Description

Calculate the hyperbolic tangent of the input argument x.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double tgamma (double x)

Calculate the gamma function of the input argument.

Returns

- tgamma(± 0) returns $\pm\infty$.
- tgamma(2) returns +0.
- tgamma(x) returns $\pm\infty$ if the correctly calculated value is outside the double floating point range.
- tgamma(x) returns NaN if $x < 0$.
- tgamma($-\infty$) returns NaN.
- tgamma($+\infty$) returns $+\infty$.

Description

Calculate the gamma function of the input argument x, namely the value of $\int_0^\infty e^{-t}t^{x-1}dt$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double trunc (double x)

Truncate input argument to the integral part.

Returns

Returns truncated integer value.

Description

Round x to the nearest integer value that does not exceed x in magnitude.

__host____device__ double y0 (double x)

Calculate the value of the Bessel function of the second kind of order 0 for the input argument.

Returns

Returns the value of the Bessel function of the second kind of order 0.

- y0(0) returns $-\infty$.
- y0(x) returns NaN for $x < 0$.
- y0($+\infty$) returns +0.

- y0(NaN) returns NaN.

Description

Calculate the value of the Bessel function of the second kind of order 0 for the input argument `x`, $Y_0(x)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double y1 (double x)

Calculate the value of the Bessel function of the second kind of order 1 for the input argument.

Returns

Returns the value of the Bessel function of the second kind of order 1.

- y1(0) returns $-\infty$.
- y1(`x`) returns NaN for `x` < 0.
- y1($+\infty$) returns +0.
- y1(NaN) returns NaN.

Description

Calculate the value of the Bessel function of the second kind of order 1 for the input argument `x`, $Y_1(x)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

__host____device__ double yn (int n, double x)

Calculate the value of the Bessel function of the second kind of order n for the input argument.

Returns

Returns the value of the Bessel function of the second kind of order `n`.

- yn(`n`, `x`) returns NaN for `n` < 0.
- yn(`n`, 0) returns $-\infty$.
- yn(`n`, `x`) returns NaN for `x` < 0.
- yn(`n`, $+\infty$) returns +0.

- yn(n, NaN) returns NaN.

Description

Calculate the value of the Bessel function of the second kind of order n for the input argument x, $Y_n(x)$.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.

1.4. Single Precision Intrinsics

This section describes single precision intrinsic functions that are only supported in device code.

__DEVICE_FUNCTIONS_DECL__ float __cosf (float x)

Calculate the fast approximate cosine of the input argument.

Returns

Returns the approximate cosine of x.

Description

Calculate the fast approximate cosine of the input argument x, measured in radians.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.2, Table 9.
- Input and output in the denormal range is flushed to sign preserving 0.0.

__DEVICE_FUNCTIONS_DECL__ float __exp10f (float x)

Calculate the fast approximate base 10 exponential of the input argument.

Returns

Returns an approximation to 10^x.

Description

Calculate the fast approximate base 10 exponential of the input argument x, 10^x.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.2, Table 9.
- Most input and output values around denormal range are flushed to sign preserving 0.0.

__DEVICE_FUNCTIONS_DECL__ float __expf (float x)

Calculate the fast approximate base e exponential of the input argument.

Returns

Returns an approximation to e^x.

Description

Calculate the fast approximate base e exponential of the input argument `x`, e^x.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.2, Table 9.
- Most input and output values around denormal range are flushed to sign preserving 0.0.

__DEVICE_FUNCTIONS_DECL__ float __fadd_rd (float x, float y)

Add two floating point values in round-down mode.

Returns

Returns `x` + `y`.

Description

Compute the sum of `x` and `y` in round-down (to negative infinity) mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
- This operation will never be merged into a single multiply-add instruction.

__DEVICE_FUNCTIONS_DECL__ float __fadd_rn (float x, float y)

Add two floating point values in round-to-nearest-even mode.

Returns

Returns `x` + `y`.

Description

Compute the sum of `x` and `y` in round-to-nearest-even rounding mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
- This operation will never be merged into a single multiply-add instruction.

__DEVICE_FUNCTIONS_DECL__ float __fadd_ru (float x, float y)

Add two floating point values in round-up mode.

Returns

Returns `x` + `y`.

Description

Compute the sum of `x` and `y` in round-up (to positive infinity) mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
- This operation will never be merged into a single multiply-add instruction.

__DEVICE_FUNCTIONS_DECL__ float __fadd_rz (float x, float y)

Add two floating point values in round-towards-zero mode.

Returns

Returns `x` + `y`.

Description

Compute the sum of x and y in round-towards-zero mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
- This operation will never be merged into a single multiply-add instruction.

__DEVICE_FUNCTIONS_DECL__ float __fdiv_rd (float x, float y)

Divide two floating point values in round-down mode.

Returns

Returns x / y.

Description

Divide two floating point values x by y in round-down (to negative infinity) mode.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__DEVICE_FUNCTIONS_DECL__ float __fdiv_rn (float x, float y)

Divide two floating point values in round-to-nearest-even mode.

Returns

Returns x / y.

Description

Divide two floating point values x by y in round-to-nearest-even mode.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__DEVICE_FUNCTIONS_DECL__ float __fdiv_ru (float x, float y)

Divide two floating point values in round-up mode.

Returns

Returns x / y.

Description

Divide two floating point values x by y in round-up (to positive infinity) mode.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__DEVICE_FUNCTIONS_DECL__ float __fdiv_rz (float x, float y)

Divide two floating point values in round-towards-zero mode.

Returns

Returns x / y.

Description

Divide two floating point values x by y in round-towards-zero mode.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__DEVICE_FUNCTIONS_DECL__ float __fdividef (float x, float y)

Calculate the fast approximate division of the input arguments.

Returns

Returns x / y.

- __fdividef(∞ , y) returns NaN for $2^{126} < y < 2^{128}$.
- __fdividef(x, y) returns 0 for $2^{126} < y < 2^{128}$ and $x \neq \infty$.

Description

Calculate the fast approximate division of `x` by `y`.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.2, Table 9.

__DEVICE_FUNCTIONS_DECL__ float __fmaf_rd (float x, float y, float z)

Compute $x \times y + z$ as a single operation, in round-down mode.

Returns

Returns the rounded value of $x \times y + z$ as a single operation.

- fmaf($\pm\infty$, ± 0 , `z`) returns NaN.
- fmaf(± 0 , $\pm\infty$, `z`) returns NaN.
- fmaf(`x`, `y`, $-\infty$) returns NaN if $x \times y$ is an exact $+\infty$.
- fmaf(`x`, `y`, $+\infty$) returns NaN if $x \times y$ is an exact $-\infty$.

Description

Computes the value of $x \times y + z$ as a single ternary operation, rounding the result once in round-down (to negative infinity) mode.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__DEVICE_FUNCTIONS_DECL__ float __fmaf_rn (float x, float y, float z)

Compute $x \times y + z$ as a single operation, in round-to-nearest-even mode.

Returns

Returns the rounded value of $x \times y + z$ as a single operation.

- fmaf($\pm\infty$, ± 0 , `z`) returns NaN.
- fmaf(± 0 , $\pm\infty$, `z`) returns NaN.
- fmaf(`x`, `y`, $-\infty$) returns NaN if $x \times y$ is an exact $+\infty$.
- fmaf(`x`, `y`, $+\infty$) returns NaN if $x \times y$ is an exact $-\infty$.

Description

Computes the value of $x \times y + z$ as a single ternary operation, rounding the result once in round-to-nearest-even mode.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__DEVICE_FUNCTIONS_DECL__ float __fmaf_ru (float x, float y, float z)

Compute $x \times y + z$ as a single operation, in round-up mode.

Returns

Returns the rounded value of $x \times y + z$ as a single operation.

- fmaf($\pm\infty$, ± 0 , z) returns NaN.
- fmaf(± 0 , $\pm\infty$, z) returns NaN.
- fmaf(x, y, $-\infty$) returns NaN if $x \times y$ is an exact $+\infty$.
- fmaf(x, y, $+\infty$) returns NaN if $x \times y$ is an exact $-\infty$.

Description

Computes the value of $x \times y + z$ as a single ternary operation, rounding the result once in round-up (to positive infinity) mode.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__DEVICE_FUNCTIONS_DECL__ float __fmaf_rz (float x, float y, float z)

Compute $x \times y + z$ as a single operation, in round-towards-zero mode.

Returns

Returns the rounded value of $x \times y + z$ as a single operation.

- fmaf($\pm\infty$, ± 0 , z) returns NaN.
- fmaf(± 0 , $\pm\infty$, z) returns NaN.
- fmaf(x, y, $-\infty$) returns NaN if $x \times y$ is an exact $+\infty$.
- fmaf(x, y, $+\infty$) returns NaN if $x \times y$ is an exact $-\infty$.

Description

Computes the value of $x \times y + z$ as a single ternary operation, rounding the result once in round-towards-zero mode.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__DEVICE_FUNCTIONS_DECL__ float __fmul_rd (float x, float y)

Multiply two floating point values in round-down mode.

Returns

Returns `x` * `y`.

Description

Compute the product of `x` and `y` in round-down (to negative infinity) mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
- This operation will never be merged into a single multiply-add instruction.

__DEVICE_FUNCTIONS_DECL__ float __fmul_rn (float x, float y)

Multiply two floating point values in round-to-nearest-even mode.

Returns

Returns `x` * `y`.

Description

Compute the product of `x` and `y` in round-to-nearest-even mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
- This operation will never be merged into a single multiply-add instruction.

__DEVICE_FUNCTIONS_DECL__ float __fmul_ru (float x, float y)

Multiply two floating point values in round-up mode.

Returns

Returns `x` * `y`.

Description

Compute the product of `x` and `y` in round-up (to positive infinity) mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
- This operation will never be merged into a single multiply-add instruction.

__DEVICE_FUNCTIONS_DECL__ float __fmul_rz (float x, float y)

Multiply two floating point values in round-towards-zero mode.

Returns

Returns `x` * `y`.

Description

Compute the product of `x` and `y` in round-towards-zero mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
- This operation will never be merged into a single multiply-add instruction.

__DEVICE_FUNCTIONS_DECL__ float __frcp_rd (float x)

Compute $\frac{1}{x}$ in round-down mode.

Returns

Returns $\frac{1}{x}$.

Description

Compute the reciprocal of x in round-down (to negative infinity) mode.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__DEVICE_FUNCTIONS_DECL__ float __frcp_rn (float x)

Compute $\frac{1}{x}$ in round-to-nearest-even mode.

Returns

Returns $\frac{1}{x}$.

Description

Compute the reciprocal of x in round-to-nearest-even mode.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__DEVICE_FUNCTIONS_DECL__ float __frcp_ru (float x)

Compute $\frac{1}{x}$ in round-up mode.

Returns

Returns $\frac{1}{x}$.

Description

Compute the reciprocal of x in round-up (to positive infinity) mode.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__DEVICE_FUNCTIONS_DECL__ float __frcp_rz (float x)

Compute $\frac{1}{x}$ in round-towards-zero mode.

Returns

Returns $\frac{1}{x}$.

Description

Compute the reciprocal of x in round-towards-zero mode.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__DEVICE_FUNCTIONS_DECL__ float __frsqrt_rn (float x)

Compute $1/\sqrt{x}$ in round-to-nearest-even mode.

Returns

Returns $1/\sqrt{x}$.

Description

Compute the reciprocal square root of x in round-to-nearest-even mode.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__DEVICE_FUNCTIONS_DECL__ float __fsqrt_rd (float x)

Compute $\sqrt{x}$ in round-down mode.

Returns

Returns $\sqrt{x}$.

Description

Compute the square root of x in round-down (to negative infinity) mode.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__DEVICE_FUNCTIONS_DECL__ float __fsqrt_rn (float x)

Compute $\sqrt{x}$ in round-to-nearest-even mode.

Returns

Returns $\sqrt{x}$.

Description

Compute the square root of x in round-to-nearest-even mode.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__DEVICE_FUNCTIONS_DECL__ float __fsqrt_ru (float x)

Compute $\sqrt{x}$ in round-up mode.

Returns

Returns $\sqrt{x}$.

Description

Compute the square root of x in round-up (to positive infinity) mode.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__DEVICE_FUNCTIONS_DECL__ float __fsqrt_rz (float x)

Compute $\sqrt{x}$ in round-towards-zero mode.

Returns

Returns $\sqrt{x}$.

Description

Compute the square root of `x` in round-towards-zero mode.

For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.

__DEVICE_FUNCTIONS_DECL__ float __fsub_rd (float x, float y)

Subtract two floating point values in round-down mode.

Returns

Returns `x` - `y`.

Description

Compute the difference of `x` and `y` in round-down (to negative infinity) mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
- This operation will never be merged into a single multiply-add instruction.

__DEVICE_FUNCTIONS_DECL__ float __fsub_rn (float x, float y)

Subtract two floating point values in round-to-nearest-even mode.

Returns

Returns `x` - `y`.

Description

Compute the difference of `x` and `y` in round-to-nearest-even rounding mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
- This operation will never be merged into a single multiply-add instruction.

__DEVICE_FUNCTIONS_DECL__ float __fsub_ru (float x, float y)

Subtract two floating point values in round-up mode.

Returns

Returns `x` - `y`.

Description

Compute the difference of `x` and `y` in round-up (to positive infinity) mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
- This operation will never be merged into a single multiply-add instruction.

__DEVICE_FUNCTIONS_DECL__ float __fsub_rz (float x, float y)

Subtract two floating point values in round-towards-zero mode.

Returns

Returns `x` - `y`.

Description

Compute the difference of `x` and `y` in round-towards-zero mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 6.
- This operation will never be merged into a single multiply-add instruction.

__DEVICE_FUNCTIONS_DECL__ float __log10f (float x)

Calculate the fast approximate base 10 logarithm of the input argument.

Returns

Returns an approximation to $\log_{10}(x)$.

Description

Calculate the fast approximate base 10 logarithm of the input argument `x`.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.2, Table 9.
- Most input and output values around denormal range are flushed to sign preserving 0.0.

__DEVICE_FUNCTIONS_DECL__ float __log2f (float x)

Calculate the fast approximate base 2 logarithm of the input argument.

Returns

Returns an approximation to $\log_2(x)$.

Description

Calculate the fast approximate base 2 logarithm of the input argument `x`.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.2, Table 9.
- Input and output in the denormal range is flushed to sign preserving 0.0.

__DEVICE_FUNCTIONS_DECL__ float __logf (float x)

Calculate the fast approximate base e logarithm of the input argument.

Returns

Returns an approximation to $\log_e(x)$.

Description

Calculate the fast approximate base e logarithm of the input argument `x`.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.2, Table 9.
- Most input and output values around denormal range are flushed to sign preserving 0.0.

__DEVICE_FUNCTIONS_DECL__ float __powf (float x, float y)

Calculate the fast approximate of x^y.

Returns

Returns an approximation to x^y.

Description

Calculate the fast approximate of x, the first input argument, raised to the power of y, the second input argument, x^y.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.2, Table 9.
- Most input and output values around denormal range are flushed to sign preserving 0.0.

__DEVICE_FUNCTIONS_DECL__ float __saturatef (float x)

Clamp the input argument to [+0.0, 1.0].

Returns

- __saturatef(x) returns 0 if $x < 0$.
- __saturatef(x) returns 1 if $x > 1$.
- __saturatef(x) returns x if $0 \leq x \leq 1$.
- __saturatef(NaN) returns 0.

Description

Clamp the input argument x to be within the interval [+0.0, 1.0].

__DEVICE_FUNCTIONS_DECL__ void __sincosf (float x, float *sptr, float *cptr)

Calculate the fast approximate of sine and cosine of the first input argument.

Returns

- none

Description

Calculate the fast approximate of sine and cosine of the first input argument `x` (measured in radians). The results for sine and cosine are written into the second argument, `sptr`, and, respectively, third argument, `cptr`.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.2, Table 9.
- Denorm input/output is flushed to sign preserving 0.0.

__DEVICE_FUNCTIONS_DECL__ float __sinf (float x)

Calculate the fast approximate sine of the input argument.

Returns

Returns the approximate sine of `x`.

Description

Calculate the fast approximate sine of the input argument `x`, measured in radians.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.2, Table 9.
- Input and output in the denormal range is flushed to sign preserving 0.0.

__DEVICE_FUNCTIONS_DECL__ float __tanf (float x)

Calculate the fast approximate tangent of the input argument.

Returns

Returns the approximate tangent of `x`.

Description

Calculate the fast approximate tangent of the input argument `x`, measured in radians.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.2, Table 9.
- The result is computed as the fast divide of __sinf() by __cosf(). Denormal input and output are flushed to sign-preserving 0.0 at each step of the computation.

1.5. Double Precision Intrinsics

This section describes double precision intrinsic functions that are only supported in device code.

__device__ double __ddiv_rd (double x, double y)

Divide two floating point values in round-down mode.

Returns

Returns `x` / `y`.

Description

Divides two floating point values `x` by `y` in round-down (to negative infinity) mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.
- Requires compute capability >= 2.0.

__device__ double __ddiv_rn (double x, double y)

Divide two floating point values in round-to-nearest-even mode.

Returns

Returns `x` / `y`.

Description

Divides two floating point values `x` by `y` in round-to-nearest-even mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.
- Requires compute capability >= 2.0.

__device__ double __ddiv_ru (double x, double y)

Divide two floating point values in round-up mode.

Returns

Returns `x` / `y`.

Description

Divides two floating point values `x` by `y` in round-up (to positive infinity) mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.
- Requires compute capability >= 2.0.

__device__ double __ddiv_rz (double x, double y)

Divide two floating point values in round-towards-zero mode.

Returns

Returns `x` / `y`.

Description

Divides two floating point values `x` by `y` in round-towards-zero mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.
- Requires compute capability >= 2.0.

__device__ double __drcp_rd (double x)

Compute $\frac{1}{x}$ in round-down mode.

Returns

Returns $\frac{1}{x}$.

Description

Compute the reciprocal of `x` in round-down (to negative infinity) mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.
- Requires compute capability >= 2.0.

__device__ double __drcp_rn (double x)

Compute $\frac{1}{x}$ in round-to-nearest-even mode.

Returns

Returns $\frac{1}{x}$.

Description

Compute the reciprocal of x in round-to-nearest-even mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.
- Requires compute capability >= 2.0.

__device__ double __drcp_ru (double x)

Compute $\frac{1}{x}$ in round-up mode.

Returns

Returns $\frac{1}{x}$.

Description

Compute the reciprocal of x in round-up (to positive infinity) mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.
- Requires compute capability >= 2.0.

__device__ double __drcp_rz (double x)

Compute $\frac{1}{x}$ in round-towards-zero mode.

Returns

Returns $\frac{1}{x}$.

Description

Compute the reciprocal of x in round-towards-zero mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.
- Requires compute capability >= 2.0.

__device__ double __dsqrt_rd (double x)

Compute $\sqrt{x}$ in round-down mode.

Returns

Returns $\sqrt{x}$.

Description

Compute the square root of x in round-down (to negative infinity) mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.
- Requires compute capability >= 2.0.

__device__ double __dsqrt_rn (double x)

Compute $\sqrt{x}$ in round-to-nearest-even mode.

Returns

Returns $\sqrt{x}$.

Description

Compute the square root of x in round-to-nearest-even mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.
- Requires compute capability >= 2.0.

__device__ double __dsqrt_ru (double x)

Compute $\sqrt{x}$ in round-up mode.

Returns

Returns $\sqrt{x}$.

Description

Compute the square root of x in round-up (to positive infinity) mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.
- Requires compute capability >= 2.0.

__device__ double __dsqrt_rz (double x)

Compute $\sqrt{x}$ in round-towards-zero mode.

Returns

Returns $\sqrt{x}$.

Description

Compute the square root of x in round-towards-zero mode.

- For accuracy information for this function see the CUDA C Programming Guide, Appendix D.1, Table 7.
- Requires compute capability >= 2.0.

1.6. Integer Intrinsics

This section describes integer intrinsic functions that are only supported in device code.

__DEVICE_FUNCTIONS_DECL__ unsigned int __brev (unsigned int x)

Reverse the bit order of a 32 bit unsigned integer.

Returns

Returns the bit-reversed value of `x`. i.e. bit N of the return value corresponds to bit 31-N of `x`.

Description

Reverses the bit order of the 32 bit unsigned integer `x`.

__DEVICE_FUNCTIONS_DECL__ unsigned long long int __brevll (unsigned long long int x)

Reverse the bit order of a 64 bit unsigned integer.

Returns

Returns the bit-reversed value of `x`. i.e. bit N of the return value corresponds to bit 63-N of `x`.

Description

Reverses the bit order of the 64 bit unsigned integer `x`.

__DEVICE_FUNCTIONS_DECL__ unsigned int __byte_perm (unsigned int x, unsigned int y, unsigned int s)

Return selected bytes from two 32 bit unsigned integers.

Returns

The returned value r is computed to be: `result[n] := input[selector[n]]` where `result[n]` is the nth byte of r.

Description

byte_perm(x,y,s) returns a 32-bit integer consisting of four bytes from eight input bytes provided in the two input integers `x` and `y`, as specified by a selector, `s`.

The input bytes are indexed as follows: input[0] = x<7:0> input[1] = x<15:8> input[2] = x<23:16> input[3] = x<31:24> input[4] = y<7:0> input[5] = y<15:8> input[6] = y<23:16> input[7] = y<31:24> The selector indices are as follows (the upper 16-bits of the selector are not used): selector[0] = s<2:0> selector[1] = s<6:4> selector[2] = s<10:8> selector[3] = s<14:12>

__DEVICE_FUNCTIONS_DECL__ int __clz (int x)

Return the number of consecutive high-order zero bits in a 32 bit integer.

Returns

Returns a value between 0 and 32 inclusive representing the number of zero bits.

Description

Count the number of consecutive leading zero bits, starting at the most significant bit (bit 31) of `x`.

__DEVICE_FUNCTIONS_DECL__ int __clzll (long long int x)

Count the number of consecutive high-order zero bits in a 64 bit integer.

Returns

Returns a value between 0 and 64 inclusive representing the number of zero bits.

Description

Count the number of consecutive leading zero bits, starting at the most significant bit (bit 63) of `x`.

__DEVICE_FUNCTIONS_DECL__ int __ffs (int x)

Find the position of the least significant bit set to 1 in a 32 bit integer.

Returns

Returns a value between 0 and 32 inclusive representing the position of the first bit set.

- __ffs(0) returns 0.

Description

Find the position of the first (least significant) bit set to 1 in `x`, where the least significant bit position is 1.

__DEVICE_FUNCTIONS_DECL__ int __ffsll (long long int x)

Find the position of the least significant bit set to 1 in a 64 bit integer.

Returns

Returns a value between 0 and 64 inclusive representing the position of the first bit set.

- __ffsll(0) returns 0.

Description

Find the position of the first (least significant) bit set to 1 in `x`, where the least significant bit position is 1.

__DEVICE_FUNCTIONS_DECL__ int __hadd (int, int)

Compute average of signed input arguments, avoiding overflow in the intermediate sum.

Returns

Returns a signed integer value representing the signed average value of the two inputs.

Description

Compute average of signed input arguments `x` and `y` as (`x` + `y`) >> 1, avoiding overflow in the intermediate sum.

__DEVICE_FUNCTIONS_DECL__ int __mul24 (int x, int y)

Calculate the least significant 32 bits of the product of the least significant 24 bits of two integers.

Returns

Returns the least significant 32 bits of the product `x` * `y`.

Description

Calculate the least significant 32 bits of the product of the least significant 24 bits of `x` and `y`. The high order 8 bits of `x` and `y` are ignored.

__DEVICE_FUNCTIONS_DECL__ long long int __mul64hi (long long int x, long long int y)

Calculate the most significant 64 bits of the product of the two 64 bit integers.

Returns

Returns the most significant 64 bits of the product `x` * `y`.

Description

Calculate the most significant 64 bits of the 128-bit product `x` * `y`, where `x` and `y` are 64-bit integers.

__DEVICE_FUNCTIONS_DECL__ int __mulhi (int x, int y)

Calculate the most significant 32 bits of the product of the two 32 bit integers.

Returns

Returns the most significant 32 bits of the product `x` * `y`.

Description

Calculate the most significant 32 bits of the 64-bit product `x` * `y`, where `x` and `y` are 32-bit integers.

__DEVICE_FUNCTIONS_DECL__ int __popc (unsigned int x)

Count the number of bits that are set to 1 in a 32 bit integer.

Returns

Returns a value between 0 and 32 inclusive representing the number of set bits.

Description

Count the number of bits that are set to 1 in `x`.

__DEVICE_FUNCTIONS_DECL__ int __popcll (unsigned long long int x)

Count the number of bits that are set to 1 in a 64 bit integer.

Returns

Returns a value between 0 and 64 inclusive representing the number of set bits.

Description

Count the number of bits that are set to 1 in `x`.

__DEVICE_FUNCTIONS_DECL__ int __rhadd (int, int)

Compute rounded average of signed input arguments, avoiding overflow in the intermediate sum.

Returns

Returns a signed integer value representing the signed rounded average value of the two inputs.

Description

Compute average of signed input arguments `x` and `y` as (`x` + `y` + 1) >> 1, avoiding overflow in the intermediate sum.

__DEVICE_FUNCTIONS_DECL__ unsigned int __sad (int x, int y, unsigned int z)

Calculate $|x - y| + z$, the sum of absolute difference.

Returns

Returns $|x - y| + z$.

Description

Calculate $|x - y| + z$, the 32-bit sum of the third argument `z` plus and the absolute value of the difference between the first argument, `x`, and second argument, `y`.

Inputs `x` and `y` are signed 32-bit integers, input `z` is a 32-bit unsigned integer.

__DEVICE_FUNCTIONS_DECL__ unsigned int __uhadd (unsigned int, unsigned int)

Compute average of unsigned input arguments, avoiding overflow in the intermediate sum.

Returns

Returns an unsigned integer value representing the unsigned average value of the two inputs.

Description

Compute average of unsigned input arguments `x` and `y` as (`x` + `y`) >> 1, avoiding overflow in the intermediate sum.

__DEVICE_FUNCTIONS_DECL__ unsigned int __umul24 (unsigned int x, unsigned int y)

Calculate the least significant 32 bits of the product of the least significant 24 bits of two unsigned integers.

Returns

Returns the least significant 32 bits of the product `x` * `y`.

Description

Calculate the least significant 32 bits of the product of the least significant 24 bits of `x` and `y`. The high order 8 bits of `x` and `y` are ignored.

__DEVICE_FUNCTIONS_DECL__ unsigned long long int __umul64hi (unsigned long long int x, unsigned long long int y)

Calculate the most significant 64 bits of the product of the two 64 unsigned bit integers.

Returns

Returns the most significant 64 bits of the product `x` * `y`.

Description

Calculate the most significant 64 bits of the 128-bit product `x` * `y`, where `x` and `y` are 64-bit unsigned integers.

__DEVICE_FUNCTIONS_DECL__ unsigned int __umulhi (unsigned int x, unsigned int y)

Calculate the most significant 32 bits of the product of the two 32 bit unsigned integers.

Returns

Returns the most significant 32 bits of the product `x` * `y`.

Description

Calculate the most significant 32 bits of the 64-bit product `x` * `y`, where `x` and `y` are 32-bit unsigned integers.

__DEVICE_FUNCTIONS_DECL__ unsigned int __urhadd (unsigned int, unsigned int)

Compute rounded average of unsigned input arguments, avoiding overflow in the intermediate sum.

Returns

Returns an unsigned integer value representing the unsigned rounded average value of the two inputs.

Description

Compute average of unsigned input arguments `x` and `y` as (`x` + `y` + 1) >> 1, avoiding overflow in the intermediate sum.

__DEVICE_FUNCTIONS_DECL__ unsigned int __usad (unsigned int x, unsigned int y, unsigned int z)

Calculate $|x - y| + z$, the sum of absolute difference.

Returns

Returns $|x - y| + z$.

Description

Calculate $|x - y| + z$, the 32-bit sum of the third argument `z` plus and the absolute value of the difference between the first argument, `x`, and second argument, `y`.

Inputs `x`, `y`, and `z` are unsigned 32-bit integers.

1.7. Type Casting Intrinsics

This section describes type casting intrinsic functions that are only supported in device code.

__DEVICE_FUNCTIONS_DECL__ int __double2int_rz (double)

Convert a double to a signed int in round-towards-zero mode.

Returns

Returns converted value.

Description

Convert the double-precision floating point value x to a signed integer value in round-towards-zero mode.

__DEVICE_FUNCTIONS_DECL__ long long int __double2ll_rz (double)

Convert a double to a signed 64-bit int in round-towards-zero mode.

Returns

Returns converted value.

Description

Convert the double-precision floating point value x to a signed 64-bit integer value in round-towards-zero mode.

__DEVICE_FUNCTIONS_DECL__ unsigned int __double2uint_rz (double)

Convert a double to an unsigned int in round-towards-zero mode.

Returns

Returns converted value.

Description

Convert the double-precision floating point value x to an unsigned integer value in round-towards-zero mode.

__DEVICE_FUNCTIONS_DECL__ unsigned long long int __double2ull_rz (double)

Convert a double to an unsigned 64-bit int in round-towards-zero mode.

Returns

Returns converted value.

Description

Convert the double-precision floating point value `x` to an unsigned 64-bit integer value in round-towards-zero mode.

__DEVICE_FUNCTIONS_DECL__ unsigned short __float2half_rn (float x)

Convert a single-precision float to a half-precision float in round-to-nearest-even mode.

Returns

Returns converted value.

Description

Convert the single-precision float value `x` to a half-precision floating point value represented in `unsigned short` format, in round-to-nearest-even mode.

__DEVICE_FUNCTIONS_DECL__ int __float2int_rd (float x)

Convert a float to a signed integer in round-down mode.

Returns

Returns converted value.

Description

Convert the single-precision floating point value `x` to a signed integer in round-down (to negative infinity) mode.

__DEVICE_FUNCTIONS_DECL__ int __float2int_rn (float x)

Convert a float to a signed integer in round-to-nearest-even mode.

Returns

Returns converted value.

Description

Convert the single-precision floating point value x to a signed integer in round-to-nearest-even mode.

__DEVICE_FUNCTIONS_DECL__ int __float2int_ru (float)

Convert a float to a signed integer in round-up mode.

Returns

Returns converted value.

Description

Convert the single-precision floating point value x to a signed integer in round-up (to positive infinity) mode.

__DEVICE_FUNCTIONS_DECL__ int __float2int_rz (float x)

Convert a float to a signed integer in round-towards-zero mode.

Returns

Returns converted value.

Description

Convert the single-precision floating point value x to a signed integer in round-towards-zero mode.

__DEVICE_FUNCTIONS_DECL__ long long int __float2ll_rd (float x)

Convert a float to a signed 64-bit integer in round-down mode.

Returns

Returns converted value.

Description

Convert the single-precision floating point value x to a signed 64-bit integer in round-down (to negative infinity) mode.

__DEVICE_FUNCTIONS_DECL__ long long int __float2ll_rn (float x)

Convert a float to a signed 64-bit integer in round-to-nearest-even mode.

Returns

Returns converted value.

Description

Convert the single-precision floating point value x to a signed 64-bit integer in round-to-nearest-even mode.

__DEVICE_FUNCTIONS_DECL__ long long int __float2ll_ru (float x)

Convert a float to a signed 64-bit integer in round-up mode.

Returns

Returns converted value.

Description

Convert the single-precision floating point value x to a signed 64-bit integer in round-up (to positive infinity) mode.

__DEVICE_FUNCTIONS_DECL__ long long int __float2ll_rz (float x)

Convert a float to a signed 64-bit integer in round-towards-zero mode.

Returns

Returns converted value.

Description

Convert the single-precision floating point value x to a signed 64-bit integer in round-towards-zero mode.

__DEVICE_FUNCTIONS_DECL__ unsigned int __float2uint_rd (float x)

Convert a float to an unsigned integer in round-down mode.

Returns

Returns converted value.

Description

Convert the single-precision floating point value x to an unsigned integer in round-down (to negative infinity) mode.

__DEVICE_FUNCTIONS_DECL__ unsigned int __float2uint_rn (float x)

Convert a float to an unsigned integer in round-to-nearest-even mode.

Returns

Returns converted value.

Description

Convert the single-precision floating point value x to an unsigned integer in round-to-nearest-even mode.

__DEVICE_FUNCTIONS_DECL__ unsigned int __float2uint_ru (float x)

Convert a float to an unsigned integer in round-up mode.

Returns

Returns converted value.

Description

Convert the single-precision floating point value x to an unsigned integer in round-up (to positive infinity) mode.

__DEVICE_FUNCTIONS_DECL__ unsigned int __float2uint_rz (float x)

Convert a float to an unsigned integer in round-towards-zero mode.

Returns

Returns converted value.

Description

Convert the single-precision floating point value x to an unsigned integer in round-towards-zero mode.

__DEVICE_FUNCTIONS_DECL__ unsigned long long int __float2ull_rd (float x)

Convert a float to an unsigned 64-bit integer in round-down mode.

Returns

Returns converted value.

Description

Convert the single-precision floating point value x to an unsigned 64-bit integer in round-down (to negative infinity) mode.

__DEVICE_FUNCTIONS_DECL__ unsigned long long int __float2ull_rn (float x)

Convert a float to an unsigned 64-bit integer in round-to-nearest-even mode.

Returns

Returns converted value.

Description

Convert the single-precision floating point value x to an unsigned 64-bit integer in round-to-nearest-even mode.

__DEVICE_FUNCTIONS_DECL__ unsigned long long int __float2ull_ru (float x)

Convert a float to an unsigned 64-bit integer in round-up mode.

Returns

Returns converted value.

Description

Convert the single-precision floating point value x to an unsigned 64-bit integer in round-up (to positive infinity) mode.

__DEVICE_FUNCTIONS_DECL__ unsigned long long int __float2ull_rz (float x)

Convert a float to an unsigned 64-bit integer in round-towards-zero mode.

Returns

Returns converted value.

Description

Convert the single-precision floating point value x to an unsigned 64-bit integer in round-towards_zero mode.

__DEVICE_FUNCTIONS_DECL__ int __float_as_int (float x)

Reinterpret bits in a float as a signed integer.

Returns

Returns reinterpreted value.

Description

Reinterpret the bits in the single-precision floating point value `x` as a signed integer.

__DEVICE_FUNCTIONS_DECL__ float __half2float (unsigned short x)

Convert a half-precision float to a single-precision float in round-to-nearest-even mode.

Returns

Returns converted value.

Description

Convert the half-precision floating point value `x` represented in `unsigned short` format to a single-precision floating point value.

__DEVICE_FUNCTIONS_DECL__ float __int2float_rd (int x)

Convert a signed integer to a float in round-down mode.

Returns

Returns converted value.

Description

Convert the signed integer value `x` to a single-precision floating point value in round-down (to negative infinity) mode.

__DEVICE_FUNCTIONS_DECL__ float __int2float_rn (int x)

Convert a signed integer to a float in round-to-nearest-even mode.

Returns

Returns converted value.

Description

Convert the signed integer value x to a single-precision floating point value in round-to-nearest-even mode.

__DEVICE_FUNCTIONS_DECL__ float __int2float_ru (int x)

Convert a signed integer to a float in round-up mode.

Returns

Returns converted value.

Description

Convert the signed integer value x to a single-precision floating point value in round-up (to positive infinity) mode.

__DEVICE_FUNCTIONS_DECL__ float __int2float_rz (int x)

Convert a signed integer to a float in round-towards-zero mode.

Returns

Returns converted value.

Description

Convert the signed integer value x to a single-precision floating point value in round-towards-zero mode.

__DEVICE_FUNCTIONS_DECL__ float __int_as_float (int x)

Reinterpret bits in an integer as a float.

Returns

Returns reinterpreted value.

Description

Reinterpret the bits in the signed integer value `x` as a single-precision floating point value.

__DEVICE_FUNCTIONS_DECL__ float __ll2float_rd (long long int x)

Convert a signed integer to a float in round-down mode.

Returns

Returns converted value.

Description

Convert the signed integer value `x` to a single-precision floating point value in round-down (to negative infinity) mode.

__DEVICE_FUNCTIONS_DECL__ float __ll2float_rn (long long int x)

Convert a signed 64-bit integer to a float in round-to-nearest-even mode.

Returns

Returns converted value.

Description

Convert the signed 64-bit integer value `x` to a single-precision floating point value in round-to-nearest-even mode.

__DEVICE_FUNCTIONS_DECL__ float __ll2float_ru (long long int x)

Convert a signed integer to a float in round-up mode.

Returns

Returns converted value.

Description

Convert the signed integer value x to a single-precision floating point value in round-up (to positive infinity) mode.

__DEVICE_FUNCTIONS_DECL__ float __ll2float_rz (long long int x)

Convert a signed integer to a float in round-towards-zero mode.

Returns

Returns converted value.

Description

Convert the signed integer value x to a single-precision floating point value in round-towards-zero mode.

__DEVICE_FUNCTIONS_DECL__ float __uint2float_rd (unsigned int x)

Convert an unsigned integer to a float in round-down mode.

Returns

Returns converted value.

Description

Convert the unsigned integer value x to a single-precision floating point value in round-down (to negative infinity) mode.

__DEVICE_FUNCTIONS_DECL__ float __uint2float_rn (unsigned int x)

Convert an unsigned integer to a float in round-to-nearest-even mode.

Returns

Returns converted value.

Description

Convert the unsigned integer value `x` to a single-precision floating point value in round-to-nearest-even mode.

__DEVICE_FUNCTIONS_DECL__ float __uint2float_ru (unsigned int x)

Convert an unsigned integer to a float in round-up mode.

Returns

Returns converted value.

Description

Convert the unsigned integer value `x` to a single-precision floating point value in round-up (to positive infinity) mode.

__DEVICE_FUNCTIONS_DECL__ float __uint2float_rz (unsigned int x)

Convert an unsigned integer to a float in round-towards-zero mode.

Returns

Returns converted value.

Description

Convert the unsigned integer value `x` to a single-precision floating point value in round-towards-zero mode.

__DEVICE_FUNCTIONS_DECL__ float __ull2float_rd (unsigned long long int x)

Convert an unsigned integer to a float in round-down mode.

Returns

Returns converted value.

Description

Convert the unsigned integer value `x` to a single-precision floating point value in round-down (to negative infinity) mode.

__DEVICE_FUNCTIONS_DECL__ float __ull2float_rn (unsigned long long int x)

Convert an unsigned integer to a float in round-to-nearest-even mode.

Returns

Returns converted value.

Description

Convert the unsigned integer value `x` to a single-precision floating point value in round-to-nearest-even mode.

__DEVICE_FUNCTIONS_DECL__ float __ull2float_ru (unsigned long long int x)

Convert an unsigned integer to a float in round-up mode.

Returns

Returns converted value.

Description

Convert the unsigned integer value `x` to a single-precision floating point value in round-up (to positive infinity) mode.

__DEVICE_FUNCTIONS_DECL__ float __ull2float_rz (unsigned long long int x)

Convert an unsigned integer to a float in round-towards-zero mode.

Returns

Returns converted value.

Description

Convert the unsigned integer value x to a single-precision floating point value in round-towards-zero mode.

1.8. SIMD Intrinsics

This section describes SIMD intrinsic functions that are only supported in device code.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vabs2 (unsigned int a)

Computes per-halfword absolute value.

Returns

Returns computed value.

Description

Splits 4 bytes of argument into 2 parts, each consisting of 2 bytes, then computes absolute value for each of parts. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vabs4 (unsigned int a)

Computes per-byte absolute value.

Returns

Returns computed value.

Description

Splits argument by bytes. Computes absolute value of each byte. Result is stored as unsigned int.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vabsdiffs2 (unsigned int a, unsigned int b)

Computes per-halfword sum of absolute difference of signed integer.

Returns

Returns computed value.

Description

Splits 4 bytes of each into 2 parts, each consisting of 2 bytes. For corresponding parts function computes absolute difference. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vabsdiffs4 (unsigned int a, unsigned int b)

Computes per-byte absolute difference of signed integer.

Returns

Returns computed value.

Description

Splits 4 bytes of each into 4 parts, each consisting of 1 byte. For corresponding parts function computes absolute difference. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vabsdiffu2 (unsigned int a, unsigned int b)

Performs per-halfword absolute difference of unsigned integer computation: |a - b|.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts function computes absolute difference. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vabsdiffu4 (unsigned int a, unsigned int b)

Computes per-byte absolute difference of unsigned integer.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts function computes absolute difference. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vabsss2 (unsigned int a)

Computes per-halfword absolute value with signed saturation.

Returns

Returns computed value.

Description

Splits 4 bytes of argument into 2 parts, each consisting of 2 bytes, then computes absolute value with signed saturation for each of parts. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vabsss4 (unsigned int a)

Computes per-byte absolute value with signed saturation.

Returns

Returns computed value.

Description

Splits 4 bytes of argument into 4 parts, each consisting of 1 byte, then computes absolute value with signed saturation for each of parts. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vadd2 (unsigned int a, unsigned int b)

Performs per-halfword (un)signed addition, with wrap-around: a + b.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes, then performs unsigned addition on corresponding parts. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vadd4 (unsigned int a, unsigned int b)

Performs per-byte (un)signed addition.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte, then performs unsigned addition on corresponding parts. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vaddss2 (unsigned int a, unsigned int b)

Performs per-halfword addition with signed saturation.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes, then performs addition with signed saturation on corresponding parts. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vaddss4 (unsigned int a, unsigned int b)

Performs per-byte addition with signed saturation.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte, then performs addition with signed saturation on corresponding parts. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vaddus2 (unsigned int a, unsigned int b)

Performs per-halfword addition with unsigned saturation.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes, then performs addition with unsigned saturation on corresponding parts.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vaddus4 (unsigned int a, unsigned int b)

Performs per-byte addition with unsigned saturation.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte, then performs addition with unsigned saturation on corresponding parts.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vavgs2 (unsigned int a, unsigned int b)

Performs per-halfword signed rounded average computation.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. then computes signed rounded avarege of corresponding parts. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vavgs4 (unsigned int a, unsigned int b)

Computes per-byte signed rounder average.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. then computes signed rounded avarege of corresponding parts. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vavgu2 (unsigned int a, unsigned int b)

Performs per-halfword unsigned rounded average computation.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. then computes unsigned rounded avarege of corresponding parts. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vavgu4 (unsigned int a, unsigned int b)

Performs per-byte unsigned rounded average.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. then computes unsigned rounded avarege of corresponding parts. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmpeq2 (unsigned int a, unsigned int b)

Performs per-halfword (un)signed comparison.

Returns

Returns 0xffff computed value.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts result is ffff if they are equal, and 0000 otherwise. For example __vcmpeq2(0x1234aba5, 0x1234aba6) returns 0xffff0000.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmpeq4 (unsigned int a, unsigned int b)

Performs per-byte (un)signed comparison.

Returns

Returns 0xff if a = b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts result is ff if they are equal, and 00 otherwise. For example __vcmpeq4(0x1234aba5, 0x1234aba6) returns 0xffffff00.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmpges2 (unsigned int a, unsigned int b)

Performs per-halfword signed comparison: a >= b ? 0xffff : 0.

Returns

Returns 0xffff if a >= b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts result is ffff if 'a' part >= 'b' part, and 0000 otherwise. For example __vcmpges2(0x1234aba5, 0x1234aba6) returns 0xffff0000.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmpges4 (unsigned int a, unsigned int b)

Performs per-byte signed comparison.

Returns

Returns 0xff if a >= b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts result is ff if 'a' part >= 'b' part, and 00 otherwise. For example __vcmpges4(0x1234aba5, 0x1234aba6) returns 0xffffff00.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmpgeu2 (unsigned int a, unsigned int b)

Performs per-halfword unsigned comparison: a >= b ? 0xffff : 0.

Returns

Returns 0xffff if a >= b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts result is ffff if 'a' part >= 'b' part, and 0000 otherwise. For example __vcmpgeu2(0x1234aba5, 0x1234aba6) returns 0xffff0000.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmpgeu4 (unsigned int a, unsigned int b)

Performs per-byte unsigned comparison.

Returns

Returns 0xff if a = b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts result is ff if 'a' part >= 'b' part, and 00 otherwise. For example __vcmpgeu4(0x1234aba5, 0x1234aba6) returns 0xffffff00.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmpgts2 (unsigned int a, unsigned int b)

Performs per-halfword signed comparison: a > b ? 0xffff : 0.

Returns

Returns 0xffff if a > b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts result is ffff if 'a' part > 'b' part, and 0000 otherwise. For example __vcmpgts2(0x1234aba5, 0x1234aba6) returns 0x00000000.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmpgts4 (unsigned int a, unsigned int b)

Performs per-byte signed comparison.

Returns

Returns 0xff if a > b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts result is ff if 'a' part > 'b' part, and 00 otherwise. For example __vcmpgts4(0x1234aba5, 0x1234aba6) returns 0x00000000.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmpgtu2 (unsigned int a, unsigned int b)

Performs per-halfword unsigned comparison: a > b ? 0xffff : 0.

Returns

Returns 0xffff if a > b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts result is ffff if 'a' part > 'b' part, and 0000 otherwise. For example __vcmpgtu2(0x1234aba5, 0x1234aba6) returns 0x00000000.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmpgtu4 (unsigned int a, unsigned int b)

Performs per-byte unsigned comparison.

Returns

Returns 0xff if a > b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts result is ff if 'a' part > 'b' part, and 00 otherwise. For example __vcmpgtu4(0x1234aba5, 0x1234aba6) returns 0x00000000.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmples2 (unsigned int a, unsigned int b)

Performs per-halfword signed comparison: a <= b ? 0xffff : 0.

Returns

Returns 0xffff if a <= b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts result is ffff if 'a' part <= 'b' part, and 0000 otherwise. For example __vcmples2(0x1234aba5, 0x1234aba6) returns 0xffffffff.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmples4 (unsigned int a, unsigned int b)

Performs per-byte signed comparison.

Returns

Returns 0xff if a <= b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts result is ff if 'a' part <= 'b' part, and 00 otherwise. For example __vcmples4(0x1234aba5, 0x1234aba6) returns 0xffffffff.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmpleu2 (unsigned int a, unsigned int b)

Performs per-halfword unsigned comparison: a <= b ? 0xffff : 0.

Returns

Returns 0xffff if a <= b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts result is ffff if 'a' part <= 'b' part, and 0000 otherwise. For example __vcmpleu2(0x1234aba5, 0x1234aba6) returns 0xffffffff.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmpleu4 (unsigned int a, unsigned int b)

Performs per-byte unsigned comparison.

Returns

Returns 0xff if a <= b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts result is ff if 'a' part <= 'b' part, and 00 otherwise. For example __vcmpleu4(0x1234aba5, 0x1234aba6) returns 0xffffffff.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmplts2 (unsigned int a, unsigned int b)

Performs per-halfword signed comparison: a < b ? 0xffff : 0.

Returns

Returns 0xffff if a < b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts result is ffff if 'a' part < 'b' part, and 0000 otherwise. For example __vcmplts2(0x1234aba5, 0x1234aba6) returns 0x0000ffff.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmplts4 (unsigned int a, unsigned int b)

Performs per-byte signed comparison.

Returns

Returns 0xff if a < b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts result is ff if 'a' part < 'b' part, and 00 otherwise. For example __vcmplts4(0x1234aba5, 0x1234aba6) returns 0x000000ff.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmpltu2 (unsigned int a, unsigned int b)

Performs per-halfword unsigned comparison: a < b ? 0xffff : 0.

Returns

Returns 0xffff if a < b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts result is ffff if 'a' part < 'b' part, and 0000 otherwise. For example __vcmpltu2(0x1234aba5, 0x1234aba6) returns 0x0000ffff.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmpltu4 (unsigned int a, unsigned int b)

Performs per-byte unsigned comparison.

Returns

Returns 0xff if a < b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts result is ff if 'a' part < 'b' part, and 00 otherwise. For example __vcmpltu4(0x1234aba5, 0x1234aba6) returns 0x000000ff.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmpne2 (unsigned int a, unsigned int b)

Performs per-halfword (un)signed comparison: a != b ? 0xffff : 0.

Returns

Returns 0xffff if a != b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts result is ffff if 'a' part != 'b' part, and 0000 otherwise. For example __vcmplts2(0x1234aba5, 0x1234aba6) returns 0x0000ffff.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vcmpne4 (unsigned int a, unsigned int b)

Performs per-byte (un)signed comparison.

Returns

Returns 0xff if a != b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts result is ff if 'a' part != 'b' part, and 00 otherwise. For example __vcmplts4(0x1234aba5, 0x1234aba6) returns 0x000000ff.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vhaddu2 (unsigned int a, unsigned int b)

Performs per-halfword unsigned average computation.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. then computes unsigned avarege of corresponding parts. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vhaddu4 (unsigned int a, unsigned int b)

Computes per-byte unsigned average.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. then computes unsigned avarege of corresponding parts. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vmaxs2 (unsigned int a, unsigned int b)

Performs per-halfword signed maximum computation.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts function computes signed maximum. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vmaxs4 (unsigned int a, unsigned int b)

Computes per-byte signed maximum.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts function computes signed maximum. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vmaxu2 (unsigned int a, unsigned int b)

Performs per-halfword unsigned maximum computation.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts function computes unsigned maximum. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vmaxu4 (unsigned int a, unsigned int b)

Computes per-byte unsigned maximum.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts function computes unsigned maximum. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vmins2 (unsigned int a, unsigned int b)

Performs per-halfword signed minimum computation.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts function computes signed minimum. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vmins4 (unsigned int a, unsigned int b)

Computes per-byte signed minimum.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts function computes signed minimum. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vminu2 (unsigned int a, unsigned int b)

Performs per-halfword unsigned minimum computation.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts function computes unsigned minimum. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vminu4 (unsigned int a, unsigned int b)

Computes per-byte unsigned minimum.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts function computes unsigned minimum. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vneg2 (unsigned int a)

Computes per-halfword negation.

Returns

Returns computed value.

Description

Splits 4 bytes of argument into 2 parts, each consisting of 2 bytes. For each part function computes negation. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vneg4 (unsigned int a)

Performs per-byte negation.

Returns

Returns computed value.

Description

Splits 4 bytes of argument into 4 parts, each consisting of 1 byte. For each part function computes negation. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vnegss2 (unsigned int a)

Computes per-halfword negation with signed saturation.

Returns

Returns computed value.

Description

Splits 4 bytes of argument into 2 parts, each consisting of 2 bytes. For each part function computes negation. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vnegss4 (unsigned int a)

Performs per-byte negation with signed saturation.

Returns

Returns computed value.

Description

Splits 4 bytes of argument into 4 parts, each consisting of 1 byte. For each part function computes negation. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsads2 (unsigned int a, unsigned int b)

Performs per-halfword sum of absolute difference of signed.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts functions computes absolute difference and sum it up. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsads4 (unsigned int a, unsigned int b)

Computes per-byte sum of abs difference of signed.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts functions computes absolute difference and sum it up. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsadu2 (unsigned int a, unsigned int b)

Computes per-halfword sum of abs diff of unsigned.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts function computes absolute differences, and returns sum of those differences.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsadu4 (unsigned int a, unsigned int b)

Computes per-byte sum af abs difference of unsigned.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts function computes absolute differences, and returns sum of those differences.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vseteq2 (unsigned int a, unsigned int b)

Performs per-halfword (un)signed comparison.

Returns

Returns 1 if a = b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts function performs comparison 'a' part == 'b' part. If both equalities are satisfiad, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vseteq4 (unsigned int a, unsigned int b)

Performs per-byte (un)signed comparison.

Returns

Returns 1 if a = b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts function performs comparison 'a' part == 'b' part. If both equalities are satisfiad, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsetges2 (unsigned int a, unsigned int b)

Performs per-halfword signed comparison.

Returns

Returns 1 if a >= b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts function performs comparison 'a' part >= 'b' part. If both inequalities are satisfied, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsetges4 (unsigned int a, unsigned int b)

Performs per-byte signed comparison.

Returns

Returns 1 if a >= b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts function performs comparison 'a' part >= 'b' part. If both inequalities are satisfied, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsetgeu2 (unsigned int a, unsigned int b)

Performs per-halfword unsigned minimum unsigned comparison.

Returns

Returns 1 if a >= b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts function performs comparison 'a' part >= 'b' part. If both inequalities are satisfied, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsetgeu4 (unsigned int a, unsigned int b)

Performs per-byte unsigned comparison.

Returns

Returns 1 if a >= b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts function performs comparison 'a' part >= 'b' part. If both inequalities are satisfied, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsetgts2 (unsigned int a, unsigned int b)

Performs per-halfword signed comparison.

Returns

Returns 1 if a > b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts function performs comparison 'a' part > 'b' part. If both inequalities are satisfied, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsetgts4 (unsigned int a, unsigned int b)

Performs per-byte signed comparison.

Returns

Returns 1 if a > b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts function performs comparison 'a' part > 'b' part. If both inequalities are satisfied, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsetgtu2 (unsigned int a, unsigned int b)

Performs per-halfword unsigned comparison.

Returns

Returns 1 if a > b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts function performs comparison 'a' part > 'b' part. If both inequalities are satisfied, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsetgtu4 (unsigned int a, unsigned int b)

Performs per-byte unsigned comparison.

Returns

Returns 1 if a > b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts function performs comparison 'a' part > 'b' part. If both inequalities are satisfied, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsetles2 (unsigned int a, unsigned int b)

Performs per-halfword unsigned minimum computation.

Returns

Returns 1 if a <= b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts function performs comparison 'a' part <= 'b' part. If both inequalities are satisfied, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsetles4 (unsigned int a, unsigned int b)

Performs per-byte signed comparison.

Returns

Returns 1 if a <= b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts function performs comparison 'a' part <= 'b' part. If both inequalities are satisfied, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsetleu2 (unsigned int a, unsigned int b)

Performs per-halfword signed comparison.

Returns

Returns 1 if a <= b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts function performs comparison 'a' part <= 'b' part. If both inequalities are satisfied, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsetleu4 (unsigned int a, unsigned int b)

Performs per-byte unsigned comparison.

Returns

Returns 1 if a <= b, else returns 0.

Description

Splits 4 bytes of each argument into 4 part, each consisting of 1 byte. For corresponding parts function performs comparison 'a' part <= 'b' part. If both inequalities are satisfied, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsetlts2 (unsigned int a, unsigned int b)

Performs per-halfword signed comparison.

Returns

Returns 1 if a < b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts function performs comparison 'a' part <= 'b' part. If both inequalities are satisfied, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsetlts4 (unsigned int a, unsigned int b)

Performs per-byte signed comparison.

Returns

Returns 1 if a < b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts function performs comparison 'a' part <= 'b' part. If both inequalities are satisfied, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsetltu2 (unsigned int a, unsigned int b)

Performs per-halfword unsigned comparison.

Returns

Returns 1 if a < b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts function performs comparison 'a' part <= 'b' part. If both inequalities are satisfied, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsetltu4 (unsigned int a, unsigned int b)

Performs per-byte unsigned comparison.

Returns

Returns 1 if a < b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts function performs comparison 'a' part <= 'b' part. If both inequalities are satisfied, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsetne2 (unsigned int a, unsigned int b)

Performs per-halfword (un)signed comparison.

Returns

Returns 1 if a != b, else returns 0.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts function performs comparison 'a' part != 'b' part. If both conditions are satisfied, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsetne4 (unsigned int a, unsigned int b)

Performs per-byte (un)signed comparison.

Returns

Returns 1 if a != b, else returns 0.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts function performs comparison 'a' part != 'b' part. If both conditions are satisfied, function returns 1.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsub2 (unsigned int a, unsigned int b)

Performs per-halfword (un)signed substraction, with wrap-around.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts functions performs substraction. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsub4 (unsigned int a, unsigned int b)

Performs per-byte substraction.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts functions performs substraction. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsubss2 (unsigned int a, unsigned int b)

Performs per-halfword (un)signed substraction, with signed saturation.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts functions performs substraction with signed saturation. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsubss4 (unsigned int a, unsigned int b)

Performs per-byte substraction with signed saturation.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts functions performs substraction with signed saturation. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsubus2 (unsigned int a, unsigned int b)

Performs per-halfword substraction with unsigned saturation.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 2 parts, each consisting of 2 bytes. For corresponding parts functions performs substraction with unsigned saturation. Result is stored as unsigned int and returned.

__DEVICE_FUNCTIONS_DECL__ unsigned int __vsubus4 (unsigned int a, unsigned int b)

Performs per-byte substraction with unsigned saturation.

Returns

Returns computed value.

Description

Splits 4 bytes of each argument into 4 parts, each consisting of 1 byte. For corresponding parts functions performs substraction with unsigned saturation. Result is stored as unsigned int and returned.

1.9. Half Precision Intrinsics

This section describes half precision intrinsic functions that are only supported in device code.

Half Arithmetic Functions

Half2 Arithmetic Functions

Half Comparison Functions

Half2 Comparison Functions

Half Precision Conversion And Data Movement

1.9.1. Half Arithmetic Functions

Half Precision Intrinsics

__CUDA_FP16_DECL__ __half __hadd (const __half a, const __half b)

Performs `half` addition in round-to-nearest mode.

Returns

Returns the `half` result of adding `a` and `b`.

Description

Performs `half` addition of inputs `a` and `b`, in round-to-nearest mode.

__CUDA_FP16_DECL__ __half __hadd_sat (const __half a, const __half b)

Performs `half` addition in round-to-nearest mode, with saturation to [0.0, 1.0].

Returns

Returns the `half` result of adding `a` and `b` with saturation.

Description

Performs `half` add of inputs `a` and `b`, in round-to-nearest mode, and clamps the result to range [0.0, 1.0]. NaN results are flushed to +0.0.

__CUDA_FP16_DECL__ __half __hfma (const __half a, const __half b, const __half c)

Performs `half` fused multiply-add in round-to-nearest mode.

Returns

Returns the `half` result of the fused multiply-add operation on `a`, `b`, and `c`.

Description

Performs `half` multiply on inputs `a` and `b`, then performs a `half` add of the result with `c`, rounding the result once in round-to-nearest mode.

__CUDA_FP16_DECL__ __half __hfma_sat (const __half a, const __half b, const __half c)

Performs `half` fused multiply-add in round-to-nearest mode, with saturation to [0.0, 1.0].

Returns

Returns the `half` result of the fused multiply-add operation on `a`, `b`, and `c` with saturation.

Description

Performs `half` multiply on inputs `a` and `b`, then performs a `half` add of the result with `c`, rounding the result once in round-to-nearest mode, and clamps the result to range [0.0, 1.0]. NaN results are flushed to +0.0.

__CUDA_FP16_DECL__ __half __hmul (const __half a, const __half b)

Performs `half` multiplication in round-to-nearest mode.

Returns

Returns the `half` result of multiplying `a` and `b`.

Description

Performs `half` multiplication of inputs `a` and `b`, in round-to-nearest mode.

__CUDA_FP16_DECL__ __half __hmul_sat (const __half a, const __half b)

Performs `half` multiplication in round-to-nearest mode, with saturation to [0.0, 1.0].

Returns

Returns the `half` result of multiplying `a` and `b` with saturation.

Description

Performs `half` multiplication of inputs `a` and `b`, in round-to-nearest mode, and clamps the result to range [0.0, 1.0]. NaN results are flushed to +0.0.

__CUDA_FP16_DECL__ __half __hneg (const __half a)

Negates input `half` number and returns the result.

Returns

Returns negated `half` input `a`.

Description

Negates input `half` number and returns the result.

__CUDA_FP16_DECL__ __half __hsub (const __half a, const __half b)

Performs `half` subtraction in round-to-nearest mode.

Returns

Returns the `half` result of subtraction `b` from `a`.

Description

Subtracts `half` input `b` from input `a` in round-to-nearest mode.

__CUDA_FP16_DECL__ __half __hsub_sat (const __half a, const __half b)

Performs `half` subtraction in round-to-nearest mode, with saturation to [0.0, 1.0].

Returns

Returns the `half` result of subtraction `b` from `a` with saturation.

Description

Subtracts `half` input `b` from input `a` in round-to-nearest mode, and clamps the result to range [0.0, 1.0]. NaN results are flushed to +0.0.

1.9.2. Half2 Arithmetic Functions

Half Precision Intrinsics

__CUDA_FP16_DECL__ __half2 __hadd2 (const __half2 a, const __half2 b)

Performs `half2` vector addition in round-to-nearest mode.

Returns

Returns the `half2` vector result of adding vectors `a` and `b`.

Description

Performs `half2` vector add of inputs `a` and `b`, in round-to-nearest mode.

__CUDA_FP16_DECL__ __half2 __hadd2_sat (const __half2 a, const __half2 b)

Performs `half2` vector addition in round-to-nearest mode, with saturation to [0.0, 1.0].

Returns

Returns the `half2` vector result of adding vectors `a` and `b` with saturation.

Description

Performs `half2` vector add of inputs `a` and `b`, in round-to-nearest mode, and clamps the results to range [0.0, 1.0]. NaN results are flushed to +0.0.

__CUDA_FP16_DECL__ __half2 __hfma2 (const __half2 a, const __half2 b, const __half2 c)

Performs `half2` vector fused multiply-add in round-to-nearest mode.

Returns

Returns the `half2` vector result of the fused multiply-add operation on vectors `a`, `b`, and `c`.

Description

Performs `half2` vector multiply on inputs `a` and `b`, then performs a `half2` vector add of the result with `c`, rounding the result once in round-to-nearest mode.

__CUDA_FP16_DECL__ __half2 __hfma2_sat (const __half2 a, const __half2 b, const __half2 c)

Performs `half2` vector fused multiply-add in round-to-nearest mode, with saturation to [0.0, 1.0].

Returns

Returns the `half2` vector result of the fused multiply-add operation on vectors `a`, `b`, and `c` with saturation.

Description

Performs `half2` vector multiply on inputs `a` and `b`, then performs a `half2` vector add of the result with `c`, rounding the result once in round-to-nearest mode, and clamps the results to range [0.0, 1.0]. NaN results are flushed to +0.0.

__CUDA_FP16_DECL__ __half2 __hmul2 (const __half2 a, const __half2 b)

Performs `half2` vector multiplication in round-to-nearest mode.

Returns

Returns the `half2` vector result of multiplying vectors `a` and `b`.

Description

Performs `half2` vector multiplication of inputs `a` and `b`, in round-to-nearest mode.

__CUDA_FP16_DECL__ __half2 __hmul2_sat (const __half2 a, const __half2 b)

Performs `half2` vector multiplication in round-to-nearest mode, with saturation to [0.0, 1.0].

Returns

Returns the `half2` vector result of multiplying vectors `a` and `b` with saturation.

Description

Performs `half2` vector multiplication of inputs `a` and `b`, in round-to-nearest mode, and clamps the results to range [0.0, 1.0]. NaN results are flushed to +0.0.

__CUDA_FP16_DECL__ __half2 __hneg2 (const __half2 a)

Negates both halves of the input `half2` number and returns the result.

Returns

Returns `half2` number with both halves negated.

Description

Negates both halves of the input `half2` number `a` and returns the result.

__CUDA_FP16_DECL__ __half2 __hsub2 (const __half2 a, const __half2 b)

Performs `half2` vector subtraction in round-to-nearest mode.

Returns

Returns the `half2` vector result of subtraction vector `b` from `a`.

Description

Subtracts `half2` input vector `b` from input vector `a` in round-to-nearest mode.

__CUDA_FP16_DECL__ __half2 __hsub2_sat (const __half2 a, const __half2 b)

Performs `half2` vector subtraction in round-to-nearest mode, with saturation to [0.0, 1.0].

Returns

Returns the `half2` vector result of subtraction vector `b` from `a` with saturation.

Description

Subtracts `half2` input vector `b` from input vector `a` in round-to-nearest mode, and clamps the results to range [0.0, 1.0]. NaN results are flushed to +0.0.

1.9.3. Half Comparison Functions

Half Precision Intrinsics

__CUDA_FP16_DECL__ bool __heq (const __half a, const __half b)

Performs `half` if-equal comparison.

Returns

Returns boolean result of if-equal comparison of `a` and `b`.

Description

Performs `half` if-equal comparison of inputs `a` and `b`. NaN inputs generate false results.

__CUDA_FP16_DECL__ bool __hequ (const __half a, const __half b)

Performs `half` unordered if-equal comparison.

Returns

Returns boolean result of unordered if-equal comparison of `a` and `b`.

Description

Performs `half` if-equal comparison of inputs `a` and `b`. NaN inputs generate true results.

__CUDA_FP16_DECL__ bool __hge (const __half a, const __half b)

Performs `half` greater-equal comparison.

Returns

Returns boolean result of greater-equal comparison of `a` and `b`.

Description

Performs `half` greater-equal comparison of inputs `a` and `b`. NaN inputs generate false results.

__CUDA_FP16_DECL__ bool __hgeu (const __half a, const __half b)

Performs `half` unordered greater-equal comparison.

Returns

Returns boolean result of unordered greater-equal comparison of `a` and `b`.

Description

Performs `half` greater-equal comparison of inputs `a` and `b`. NaN inputs generate true results.

__CUDA_FP16_DECL__ bool __hgt (const __half a, const __half b)

Performs `half` greater-than comparison.

Returns

Returns boolean result of greater-than comparison of `a` and `b`.

Description

Performs `half` greater-than comparison of inputs `a` and `b`. NaN inputs generate false results.

__CUDA_FP16_DECL__ bool __hgtu (const __half a, const __half b)

Performs `half` unordered greater-than comparison.

Returns

Returns boolean result of unordered greater-than comparison of `a` and `b`.

Description

Performs `half` greater-than comparison of inputs `a` and `b`. NaN inputs generate true results.

__CUDA_FP16_DECL__ int __hisinf (const __half a)

Checks if the input `half` number is infinite.

Returns

Returns -1 iff `a` is equal to negative infinity, 1 iff `a` is equal to positive infinity and 0 otherwise.

Description

Checks if the input `half` number `a` is infinite.

__CUDA_FP16_DECL__ bool __hisnan (const __half a)

Determine whether `half` argument is a NaN.

Returns

Returns boolean true iff argument is a NaN, boolean false otherwise.

Description

Determine whether `half` value `a` is a NaN.

__CUDA_FP16_DECL__ bool __hle (const __half a, const __half b)

Performs `half` less-equal comparison.

Returns

Returns boolean result of less-equal comparison of `a` and `b`.

Description

Performs `half` less-equal comparison of inputs `a` and `b`. NaN inputs generate false results.

__CUDA_FP16_DECL__ bool __hleu (const __half a, const __half b)

Performs `half` unordered less-equal comparison.

Returns

Returns boolean result of unordered less-equal comparison of `a` and `b`.

Description

Performs `half` less-equal comparison of inputs `a` and `b`. NaN inputs generate true results.

__CUDA_FP16_DECL__ bool __hlt (const __half a, const __half b)

Performs `half` less-than comparison.

Returns

Returns boolean result of less-than comparison of `a` and `b`.

Description

Performs `half` less-than comparison of inputs `a` and `b`. NaN inputs generate false results.

__CUDA_FP16_DECL__ bool __hltu (const __half a, const __half b)

Performs `half` unordered less-than comparison.

Returns

Returns boolean result of unordered less-than comparison of `a` and `b`.

Description

Performs `half` less-than comparison of inputs `a` and `b`. NaN inputs generate true results.

__CUDA_FP16_DECL__ bool __hne (const __half a, const __half b)

Performs `half` not-equal comparison.

Returns

Returns boolean result of not-equal comparison of `a` and `b`.

Description

Performs `half` not-equal comparison of inputs `a` and `b`. NaN inputs generate false results.

__CUDA_FP16_DECL__ bool __hneu (const __half a, const __half b)

Performs `half` unordered not-equal comparison.

Returns

Returns boolean result of unordered not-equal comparison of `a` and `b`.

Description

Performs `half` not-equal comparison of inputs `a` and `b`. NaN inputs generate true results.

1.9.4. Half2 Comparison Functions

Half Precision Intrinsics

__CUDA_FP16_DECL__ bool __hbeq2 (const __half2 a, const __half2 b)

Performs `half2` vector if-equal comparison, and returns boolean true iff both `half` results are true, boolean false otherwise.

Returns

Returns boolean true if both `half` results of if-equal comparison of vectors `a` and `b` are true, boolean false otherwise.

Description

Performs `half2` vector if-equal comparison of inputs `a` and `b`. The bool result is set to true only if both `half` if-equal comparisons evaluate to true, or false otherwise. NaN inputs generate false results.

__CUDA_FP16_DECL__ bool __hbequ2 (const __half2 a, const __half2 b)

Performs `half2` vector unordered if-equal comparison, and returns boolean true iff both `half` results are true, boolean false otherwise.

Returns

Returns boolean true if both `half` results of unordered if-equal comparison of vectors `a` and `b` are true, boolean false otherwise.

Description

Performs `half2` vector if-equal comparison of inputs `a` and `b`. The bool result is set to true only if both `half` if-equal comparisons evaluate to true, or false otherwise. NaN inputs generate true results.

__CUDA_FP16_DECL__ bool __hbge2 (const __half2 a, const __half2 b)

Performs `half2` vector greater-equal comparison, and returns boolean true iff both `half` results are true, boolean false otherwise.

Returns

Returns boolean true if both `half` results of greater-equal comparison of vectors `a` and `b` are true, boolean false otherwise.

Description

Performs `half2` vector greater-equal comparison of inputs `a` and `b`. The bool result is set to true only if both `half` greater-equal comparisons evaluate to true, or false otherwise. NaN inputs generate false results.

__CUDA_FP16_DECL__ bool __hbgeu2 (const __half2 a, const __half2 b)

Performs `half2` vector unordered greater-equal comparison, and returns boolean true iff both `half` results are true, boolean false otherwise.

Returns

Returns boolean true if both `half` results of unordered greater-equal comparison of vectors `a` and `b` are true, boolean false otherwise.

Description

Performs `half2` vector greater-equal comparison of inputs `a` and `b`. The bool result is set to true only if both `half` greater-equal comparisons evaluate to true, or false otherwise. NaN inputs generate true results.

__CUDA_FP16_DECL__ bool __hbgt2 (const __half2 a, const __half2 b)

Performs `half2` vector greater-than comparison, and returns boolean true iff both `half` results are true, boolean false otherwise.

Returns

Returns boolean true if both `half` results of greater-than comparison of vectors `a` and `b` are true, boolean false otherwise.

Description

Performs `half2` vector greater-than comparison of inputs `a` and `b`. The bool result is set to true only if both `half` greater-than comparisons evaluate to true, or false otherwise. NaN inputs generate false results.

__CUDA_FP16_DECL__ bool __hbgtu2 (const __half2 a, const __half2 b)

Performs `half2` vector unordered greater-than comparison, and returns boolean true iff both `half` results are true, boolean false otherwise.

Returns

Returns boolean true if both `half` results of unordered greater-than comparison of vectors `a` and `b` are true, boolean false otherwise.

Description

Performs `half2` vector greater-than comparison of inputs `a` and `b`. The bool result is set to true only if both `half` greater-than comparisons evaluate to true, or false otherwise. NaN inputs generate true results.

__CUDA_FP16_DECL__ bool __hble2 (const __half2 a, const __half2 b)

Performs `half2` vector less-equal comparison, and returns boolean true iff both `half` results are true, boolean false otherwise.

Returns

Returns boolean true if both `half` results of less-equal comparison of vectors `a` and `b` are true, boolean false otherwise.

Description

Performs `half2` vector less-equal comparison of inputs `a` and `b`. The bool result is set to true only if both `half` less-equal comparisons evaluate to true, or false otherwise. NaN inputs generate false results.

__CUDA_FP16_DECL__ bool __hbleu2 (const __half2 a, const __half2 b)

Performs `half2` vector unordered less-equal comparison, and returns boolean true iff both `half` results are true, boolean false otherwise.

Returns

Returns boolean true if both `half` results of unordered less-equal comparison of vectors `a` and `b` are true, boolean false otherwise.

Description

Performs `half2` vector less-equal comparison of inputs `a` and `b`. The bool result is set to true only if both `half` less-equal comparisons evaluate to true, or false otherwise. NaN inputs generate true results.

__CUDA_FP16_DECL__ bool __hblt2 (const __half2 a, const __half2 b)

Performs `half2` vector less-than comparison, and returns boolean true iff both `half` results are true, boolean false otherwise.

Returns

Returns boolean true if both `half` results of less-than comparison of vectors `a` and `b` are true, boolean false otherwise.

Description

Performs `half2` vector less-than comparison of inputs `a` and `b`. The bool result is set to true only if both `half` less-than comparisons evaluate to true, or false otherwise. NaN inputs generate false results.

__CUDA_FP16_DECL__ bool __hbltu2 (const __half2 a, const __half2 b)

Performs `half2` vector unordered less-than comparison, and returns boolean true iff both `half` results are true, boolean false otherwise.

Returns

Returns boolean true if both `half` results of unordered less-than comparison of vectors `a` and `b` are true, boolean false otherwise.

Description

Performs `half2` vector less-than comparison of inputs `a` and `b`. The bool result is set to true only if both `half` less-than comparisons evaluate to true, or false otherwise. NaN inputs generate true results.

__CUDA_FP16_DECL__ bool __hbne2 (const __half2 a, const __half2 b)

Performs `half2` vector not-equal comparison, and returns boolean true iff both `half` results are true, boolean false otherwise.

Returns

Returns boolean true if both `half` results of not-equal comparison of vectors `a` and `b` are true, boolean false otherwise.

Description

Performs `half2` vector not-equal comparison of inputs `a` and `b`. The bool result is set to true only if both `half` not-equal comparisons evaluate to true, or false otherwise. NaN inputs generate false results.

__CUDA_FP16_DECL__ bool __hbneu2 (const __half2 a, const __half2 b)

Performs `half2` vector unordered not-equal comparison, and returns boolean true iff both `half` results are true, boolean false otherwise.

Returns

Returns boolean true if both `half` results of unordered not-equal comparison of vectors `a` and `b` are true, boolean false otherwise.

Description

Performs `half2` vector not-equal comparison of inputs `a` and `b`. The bool result is set to true only if both `half` not-equal comparisons evaluate to true, or false otherwise. NaN inputs generate true results.

__CUDA_FP16_DECL__ __half2 __heq2 (const __half2 a, const __half2 b)

Performs half2 vector if-equal comparison.

Returns

Returns the `half2` vector result of if-equal comparison of vectors `a` and `b`.

Description

Performs `half2` vector if-equal comparison of inputs `a` and `b`. The corresponding `half` results are set to 1.0 for true, or 0.0 for false. NaN inputs generate false results.

__CUDA_FP16_DECL__ __half2 __hequ2 (const __half2 a, const __half2 b)

Performs `half2` vector unordered if-equal comparison.

Returns

Returns the `half2` vector result of unordered if-equal comparison of vectors `a` and `b`.

Description

Performs `half2` vector if-equal comparison of inputs `a` and `b`. The corresponding `half` results are set to 1.0 for true, or 0.0 for false. NaN inputs generate true results.

__CUDA_FP16_DECL__ __half2 __hge2 (const __half2 a, const __half2 b)

Performs `half2` vector greater-equal comparison.

Returns

Returns the `half2` vector result of greater-equal comparison of vectors `a` and `b`.

Description

Performs `half2` vector greater-equal comparison of inputs `a` and `b`. The corresponding `half` results are set to 1.0 for true, or 0.0 for false. NaN inputs generate false results.

__CUDA_FP16_DECL__ __half2 __hgeu2 (const __half2 a, const __half2 b)

Performs `half2` vector unordered greater-equal comparison.

Returns

Returns the `half2` vector result of unordered greater-equal comparison of vectors `a` and `b`.

Description

Performs `half2` vector greater-equal comparison of inputs `a` and `b`. The corresponding `half` results are set to 1.0 for true, or 0.0 for false. NaN inputs generate true results.

__CUDA_FP16_DECL__ __half2 __hgt2 (const __half2 a, const __half2 b)

Performs `half2` vector greater-than comparison.

Returns

Returns the half2 vector result of greater-than comparison of vectors `a` and `b`.

Description

Performs `half2` vector greater-than comparison of inputs `a` and `b`. The corresponding `half` results are set to 1.0 for true, or 0.0 for false. NaN inputs generate false results.

__CUDA_FP16_DECL__ __half2 __hgtu2 (const __half2 a, const __half2 b)

Performs `half2` vector unordered greater-than comparison.

Returns

Returns the `half2` vector result of unordered greater-than comparison of vectors `a` and `b`.

Description

Performs `half2` vector greater-than comparison of inputs `a` and `b`. The corresponding `half` results are set to 1.0 for true, or 0.0 for false. NaN inputs generate true results.

__CUDA_FP16_DECL__ __half2 __hisnan2 (const __half2 a)

Determine whether `half2` argument is a NaN.

Returns

Returns `half2` which has the corresponding `half` results set to 1.0 for true, or 0.0 for false.

Description

Determine whether each half of input `half2` number `a` is a NaN.

__CUDA_FP16_DECL__ __half2 __hle2 (const __half2 a, const __half2 b)

Performs `half2` vector less-equal comparison.

Returns

Returns the `half2` vector result of less-equal comparison of vectors `a` and `b`.

Description

Performs `half2` vector less-equal comparison of inputs `a` and `b`. The corresponding `half` results are set to 1.0 for true, or 0.0 for false. NaN inputs generate false results.

__CUDA_FP16_DECL__ __half2 __hleu2 (const __half2 a, const __half2 b)

Performs `half2` vector unordered less-equal comparison.

Returns

Returns the `half2` vector result of unordered less-equal comparison of vectors `a` and `b`.

Description

Performs `half2` vector less-equal comparison of inputs `a` and `b`. The corresponding `half` results are set to 1.0 for true, or 0.0 for false. NaN inputs generate true results.

__CUDA_FP16_DECL__ __half2 __hlt2 (const __half2 a, const __half2 b)

Performs `half2` vector less-than comparison.

Returns

Returns the `half2` vector result of less-than comparison of vectors `a` and `b`.

Description

Performs `half2` vector less-than comparison of inputs `a` and `b`. The corresponding `half` results are set to 1.0 for true, or 0.0 for false. NaN inputs generate false results.

__CUDA_FP16_DECL__ __half2 __hltu2 (const __half2 a, const __half2 b)

Performs `half2` vector unordered less-than comparison.

Returns

Returns the `half2` vector result of unordered less-than comparison of vectors `a` and `b`.

Description

Performs `half2` vector less-than comparison of inputs `a` and `b`. The corresponding `half` results are set to 1.0 for true, or 0.0 for false. NaN inputs generate true results.

__CUDA_FP16_DECL__ __half2 __hne2 (const __half2 a, const __half2 b)

Performs `half2` vector not-equal comparison.

Returns

Returns the `half2` vector result of not-equal comparison of vectors `a` and `b`.

Description

Performs `half2` vector not-equal comparison of inputs `a` and `b`. The corresponding `half` results are set to 1.0 for true, or 0.0 for false. NaN inputs generate false results.

__CUDA_FP16_DECL__ __half2 __hneu2 (const __half2 a, const __half2 b)

Performs `half2` vector unordered not-equal comparison.

Returns

Returns the `half2` vector result of unordered not-equal comparison of vectors `a` and `b`.

Description

Performs `half2` vector not-equal comparison of inputs `a` and `b`. The corresponding `half` results are set to 1.0 for true, or 0.0 for false. NaN inputs generate true results.

1.9.5. Half Precision Conversion And Data Movement

Half Precision Intrinsics

__CUDA_FP16_DECL__ __half2 __float22half2_rn (const float2 a)

Converts both components of float2 number to half precision in round-to-nearest mode and returns `half2` with converted values.

Returns

Returns `half2` which has corresponding halves equal to the converted float2 components.

Description

Converts both components of float2 to half precision in round-to-nearest mode and combines the results into one `half2` number. Low 16 bits of the return value correspond to `a.x` and high 16 bits of the return value correspond to `a.y`.

__CUDA_FP16_DECL__ __half2 __float2half2_rn (const float a)

Converts input to half precision in round-to-nearest mode and populates both halves of `half2` with converted value.

Returns

Returns `half2` with both halves equal to the converted half precision number.

Description

Converts input `a` to half precision in round-to-nearest mode and populates both halves of `half2` with converted value.

__CUDA_FP16_DECL__ __half2 __floats2half2_rn (const float a, const float b)

Converts both input floats to half precision in round-to-nearest mode and returns `half2` with converted values.

Returns

Returns `half2` which has corresponding halves equal to the converted input floats.

Description

Converts both input floats to half precision in round-to-nearest mode and combines the results into one `half2` number. Low 16 bits of the return value correspond to the input `a`, high 16 bits correspond to the input `b`.

__CUDA_FP16_DECL__ float2 __half22float2 (const __half2 a)

Converts both halves of `half2` to float2 and returns the result.

Returns

Returns converted float2.

Description

Converts both halves of `half2` input `a` to float2 and returns the result.

__CUDA_FP16_DECL__ __half2 __half2half2 (const __half a)

Returns `half2` with both halves equal to the input value.

Returns

Returns `half2` with both halves equal to the input `a`.

Description

Returns `half2` number with both halves equal to the input `a` `half` number.

__CUDA_FP16_DECL__ __half2 __halves2half2 (const __half a, const __half b)

Combines two `half` numbers into one `half2` number.

Returns

Returns `half2` number which has one half equal to `a` and the other to `b`.

Description

Combines two input `half` number `a` and `b` into one `half2` number. Input `a` is stored in low 16 bits of the return value, input `b` is stored in high 16 bits of the return value.

__CUDA_FP16_DECL__ float __high2float (const __half2 a)

Converts high 16 bits of `half2` to float and returns the result.

Returns

Returns high 16 bits of `a` converted to float.

Description

Converts high 16 bits of `half2` input `a` to 32 bit floating point number and returns the result.

__CUDA_FP16_DECL__ __half __high2half (const __half2 a)

Returns high 16 bits of `half2` input.

Returns

Returns `half` which contains high 16 bits of the input.

Description

Returns high 16 bits of `half2` input `a`.

__CUDA_FP16_DECL__ __half2 __high2half2 (const __half2 a)

Extracts high 16 bits from `half2` input.

Returns

Returns `half2` with both halves equal to high 16 bits from the input.

Description

Extracts high 16 bits from `half2` input `a` and returns a new `half2` number which has both halves equal to the extracted bits.

__CUDA_FP16_DECL__ __half2 __highs2half2 (const __half2 a, const __half2 b)

Extracts high 16 bits from each of the two `half2` inputs and combines into one `half2` number.

Returns

Returns `half2` which contains high 16 bits from `a` and `b`.

Description

Extracts high 16 bits from each of the two `half2` inputs and combines into one `half2` number. High 16 bits from input `a` is stored in low 16 bits of the return value, high 16 bits from input `b` is stored in high 16 bits of the return value.

__CUDA_FP16_DECL__ float __low2float (const __half2 a)

Converts low 16 bits of `half2` to float and returns the result.

Returns

Returns low 16 bits of `a` converted to float.

Description

Converts low 16 bits of `half2` input `a` to 32 bit floating point number and returns the result.

__CUDA_FP16_DECL__ __half __low2half (const __half2 a)

Returns low 16 bits of `half2` input.

Returns

Returns `half` which contains low 16 bits of the input.

Description

Returns low 16 bits of `half2` input `a`.

__CUDA_FP16_DECL__ __half2 __low2half2 (const __half2 a)

Extracts low 16 bits from `half2` input.

Returns

Returns `half2` with both halves equal to low 16 bits from the input.

Description

Extracts low 16 bits from `half2` input `a` and returns a new `half2` number which has both halves equal to the extracted bits.

__CUDA_FP16_DECL__ __half2 __lowhigh2highlow (const __half2 a)

Swaps both halves of the `half2` input.

Returns

Returns `half2` with halves swapped.

Description

Swaps both halves of the `half2` input and returns a new `half2` number with swapped halves.

__CUDA_FP16_DECL__ __half2 __lows2half2 (const __half2 a, const __half2 b)

Extracts low 16 bits from each of the two `half2` inputs and combines into one `half2` number.

Returns

Returns `half2` which contains low 16 bits from `a` and `b`.

Description

Extracts low 16 bits from each of the two `half2` inputs and combines into one `half2` number. Low 16 bits from input `a` is stored in low 16 bits of the return value, low 16 bits from input `b` is stored in high 16 bits of the return value.