

# Module std::uq64\_64

Defines an unsigned, fixed-point numeric type with a 64-bit integer part and a 64-bit fractional part. The notation [uq64\\_64](#) and [UQ64\\_64](#) is based on [Q notation](#). q indicates it a fixed-point number. The u prefix indicates it is unsigned. The 64\_64 suffix indicates the number of bits, where the first number indicates the number of bits in the integer part, and the second the number of bits in the fractional part--in this case 64 bits for each.

A fixed-point numeric type with 64 integer bits and 64 fractional bits, represented by an underlying 128 bit value. This is a binary representation, so decimal values may not be exactly representable, but it provides more than 19 decimal digits of precision both before and after the decimal point (38 digits total).

The total number of bits in the fixed-point number. Used in macro invocations.

The number of fractional bits in the fixed-point number. Used in macro invocations.

Create a fixed-point value from a quotient specified by its numerator and denominator. [from\\_quotient](#) and [from\\_int](#) should be preferred over using [from\\_raw](#). Unless the denominator is a power of two, fractions can not be represented accurately, so be careful about rounding errors. Aborts if the denominator is zero. Aborts if the input is non-zero but so small that it will be represented as zero, e.g. smaller than  $2^{-64}$ . Aborts if the input is too large, e.g. larger than or equal to  $2^{64}$ .

Create a fixed-point value from an integer. [from\\_int](#) and [from\\_quotient](#) should be preferred over using [from\\_raw](#).

Add two fixed-point numbers,  $a + b$ . Aborts if the sum overflows.

Subtract two fixed-point numbers,  $a - b$ . Aborts if  $a < b$ .

Multiply two fixed-point numbers, truncating any fractional part of the product. Aborts if the product overflows.

Divide two fixed-point numbers, truncating any fractional part of the quotient. Aborts if the divisor is zero. Aborts if the quotient overflows.

Convert a fixed-point number to an integer, truncating any fractional part.

Multiply a [u128](#) integer by a fixed-point number, truncating any fractional part of the product. Aborts if the product overflows.

Divide a [u128](#) integer by a fixed-point number, truncating any fractional part of the quotient. Aborts if the divisor is zero. Aborts if the quotient overflows.

Less than or equal to. Returns true if and only if  $a \leq b$ .

Less than. Returns true if and only if  $a < b$ .

Greater than or equal to. Returns true if and only if  $a \geq b$ .

Greater than. Returns true if and only if  $a > b$ .

Accessor for the raw u128 value. Can be paired with [from\\_raw](#) to perform less common operations on the raw values directly.

Accessor for the raw u128 value. Can be paired with [to\\_raw](#) to perform less common operations on the raw values directly.

## Struct

A fixed-point numeric type with 64 integer bits and 64 fractional bits, represented by an underlying 128 bit value. This is a binary representation, so decimal values may not be exactly representable, but it provides more than 19 decimal digits of precision both before and after the decimal point (38 digits total).

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The total number of bits in the fixed-point number. Used in macro invocations.

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The number of fractional bits in the fixed-point number. Used in macro invocations.

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Create a fixed-point value from a quotient specified by its numerator and denominator. [from\\_quotient](#) and [from\\_int](#) should be preferred over using [from\\_raw](#). Unless the denominator is a power of two, fractions can not be represented accurately, so be careful about rounding errors. Aborts if the denominator is zero. Aborts if the input is non-zero but so small that it will be represented as zero, e.g. smaller than  $2^{\{-64\}}$ . Aborts if the input is too large, e.g. larger than or equal to  $2^{64}$ .

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Create a fixed-point value from an integer. [from\\_int](#) and [from\\_quotient](#) should be preferred over using [from\\_raw](#).

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Add two fixed-point numbers,  $a + b$ . Aborts if the sum overflows.

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Subtract two fixed-point numbers,  $a - b$ . Aborts if  $a < b$ .

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Multiply two fixed-point numbers, truncating any fractional part of the product. Aborts if the product overflows.

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Divide two fixed-point numbers, truncating any fractional part of the quotient. Aborts if the divisor is zero. Aborts if the quotient overflows.

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Convert a fixed-point number to an integer, truncating any fractional part.

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Multiply a [u128](#) integer by a fixed-point number, truncating any fractional part of the product. Aborts if the product overflows.

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Divide a [u128](#) integer by a fixed-point number, truncating any fractional part of the quotient. Aborts if the divisor is zero. Aborts if the quotient overflows.

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Less than or equal to. Returns true if and only if  $a \leq a$ .

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Less than. Returns true if and only if  $a < b$ .

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Greater than or equal to. Returns true if and only if  $a \geq b$ .

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Greater than. Returns true if and only if  $a > b$ .

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Accessor for the raw u128 value. Can be paired with [from\\_raw](#) to perform less common operations on the raw values directly.

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Accessor for the raw u128 value. Can be paired with [to\\_raw](#) to perform less common operations on the raw values directly.

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## Constants

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The total number of bits in the fixed-point number. Used in macro invocations.

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Create a fixed-point value from an integer. [from\\_int](#) and [from\\_quotient](#) should be preferred over using [from\\_raw](#).

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Add two fixed-point numbers,  $a + b$ . Aborts if the sum overflows.

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Subtract two fixed-point numbers,  $a - b$ . Aborts if  $a < b$ .

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Multiply two fixed-point numbers, truncating any fractional part of the product. Aborts if the product overflows.

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Divide two fixed-point numbers, truncating any fractional part of the quotient. Aborts if the divisor is zero. Aborts if the quotient overflows.

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Convert a fixed-point number to an integer, truncating any fractional part.

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Less than or equal to. Returns true if and only if  $a \leq a$ .

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Less than. Returns true if and only if  $a < b$ .

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Greater than or equal to. Returns true if and only if  $a \geq b$ .

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## Function

Create a fixed-point value from a quotient specified by its numerator and denominator. [from\\_quotient](#) and [from\\_int](#) should be preferred over using [from\\_raw](#) . Unless the denominator is a power of two, fractions can not be represented accurately, so be careful about rounding errors. Aborts if the denominator is zero. Aborts if the input is non-zero but so small that it will be represented as zero, e.g. smaller than  $2^{\{-64\}}$  . Aborts if the input is too large, e.g. larger than or equal to  $2^{64}$  .

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Create a fixed-point value from an integer. [from\\_int](#) and [from\\_quotient](#) should be preferred over using [from\\_raw](#) .

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Divide two fixed-point numbers, truncating any fractional part of the quotient. Aborts if the divisor is zero. Aborts if the quotient overflows.

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Convert a fixed-point number to an integer, truncating any fractional part.

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Accessor for the raw u128 value. Can be paired with [from\\_raw](#) to perform less common operations on the raw values directly.

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Accessor for the raw u128 value. Can be paired with [to\\_raw](#) to perform less common operations on the raw values directly.

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## Function

Create a fixed-point value from an integer. [from\\_int](#) and [from\\_quotient](#) should be preferred over using [from\\_raw](#) .

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Add two fixed-point numbers,  $a + b$ . Aborts if the sum overflows.

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Subtract two fixed-point numbers,  $a - b$ . Aborts if  $a < b$ .

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Multiply two fixed-point numbers, truncating any fractional part of the product. Aborts if the product overflows.

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Divide two fixed-point numbers, truncating any fractional part of the quotient. Aborts if the divisor is zero. Aborts if the quotient overflows.

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Convert a fixed-point number to an integer, truncating any fractional part.

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## Function

Add two fixed-point numbers,  $a + b$ . Aborts if the sum overflows.

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Subtract two fixed-point numbers,  $a - b$ . Aborts if  $a < b$ .

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Multiply two fixed-point numbers, truncating any fractional part of the product. Aborts if the product overflows.

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Divide two fixed-point numbers, truncating any fractional part of the quotient. Aborts if the divisor is zero. Aborts if the quotient overflows.

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Convert a fixed-point number to an integer, truncating any fractional part.

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Multiply a [u128](#) integer by a fixed-point number, truncating any fractional part of the product. Aborts if the product overflows.

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Divide a [u128](#) integer by a fixed-point number, truncating any fractional part of the quotient. Aborts if the divisor is zero. Aborts if the quotient overflows.

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Less than or equal to. Returns true if and only if  $a \leq b$ .

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Less than. Returns true if and only if  $a < b$ .

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Greater than or equal to. Returns true if and only if  $a \geq b$ .

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Greater than. Returns true if and only if  $a > b$ .

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Accessor for the raw u128 value. Can be paired with [to\\_raw](#) to perform less common operations on the raw values directly.

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## Function

Subtract two fixed-point numbers,  $a - b$ . Aborts if  $a < b$ .

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Multiply two fixed-point numbers, truncating any fractional part of the product. Aborts if the product overflows.

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Divide two fixed-point numbers, truncating any fractional part of the quotient. Aborts if the divisor is zero. Aborts if the quotient overflows.

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Convert a fixed-point number to an integer, truncating any fractional part.

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Multiply a [u128](#) integer by a fixed-point number, truncating any fractional part of the product. Aborts if the product overflows.

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Divide a [u128](#) integer by a fixed-point number, truncating any fractional part of the quotient. Aborts if the divisor is zero. Aborts if the quotient overflows.

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Less than or equal to. Returns true if and only if  $a \leq b$ .

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Less than. Returns true if and only if  $a < b$ .

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Greater than or equal to. Returns true if and only if  $a \geq b$ .

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Greater than. Returns true if and only if  $a > b$ .

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Accessor for the raw u128 value. Can be paired with [from\\_raw](#) to perform less common operations on the raw values directly.

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Accessor for the raw u128 value. Can be paired with [to\\_raw](#) to perform less common operations on the raw values directly.

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## Function

Multiply two fixed-point numbers, truncating any fractional part of the product. Aborts if the product overflows.

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Divide two fixed-point numbers, truncating any fractional part of the quotient. Aborts if the divisor is zero. Aborts if the quotient overflows.

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Convert a fixed-point number to an integer, truncating any fractional part.

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Multiply a [u128](#) integer by a fixed-point number, truncating any fractional part of the product. Aborts if the product overflows.

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Divide a [u128](#) integer by a fixed-point number, truncating any fractional part of the quotient. Aborts if the divisor is zero. Aborts if the quotient overflows.



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Less than or equal to. Returns true if and only if  $a \leq b$ .

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Greater than. Returns true if and only if  $a > b$ .

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Accessor for the raw u128 value. Can be paired with [from\\_raw](#) to perform less common operations on the raw values directly.

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Accessor for the raw u128 value. Can be paired with [to\\_raw](#) to perform less common operations on the raw values directly.

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## Function

Divide two fixed-point numbers, truncating any fractional part of the quotient. Aborts if the divisor is zero. Aborts if the quotient overflows.

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Convert a fixed-point number to an integer, truncating any fractional part.

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Multiply a [u128](#) integer by a fixed-point number, truncating any fractional part of the product. Aborts if the product overflows.

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Divide a [u128](#) integer by a fixed-point number, truncating any fractional part of the quotient. Aborts if the divisor is zero. Aborts if the quotient overflows.

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Accessor for the raw u128 value. Can be paired with [from\\_raw](#) to perform less common operations on the raw values directly.

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Accessor for the raw u128 value. Can be paired with [to\\_raw](#) to perform less common operations on the raw values directly.

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## Function

Convert a fixed-point number to an integer, truncating any fractional part.

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Multiply a [u128](#) integer by a fixed-point number, truncating any fractional part of the product. Aborts if the product overflows.

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Divide a [u128](#) integer by a fixed-point number, truncating any fractional part of the quotient. Aborts if the divisor is zero. Aborts if the quotient overflows.

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## Function

Multiply a [u128](#) integer by a fixed-point number, truncating any fractional part of the product. Aborts if the product overflows.

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Divide a [u128](#) integer by a fixed-point number, truncating any fractional part of the quotient. Aborts if the divisor is zero. Aborts if the quotient overflows.

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Less than or equal to. Returns true if and only if  $a \leq b$ .

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'''

Greater than or equal to. Returns true if and only if  $a \geq b$ .

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Greater than. Returns true if and only if  $a > b$ .

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'''

Accessor for the raw u128 value. Can be paired with [from\\_raw](#) to perform less common operations on the raw values directly.

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'''bash

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Accessor for the raw u128 value. Can be paired with [to\\_raw](#) to perform less common operations on the raw values directly.

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## Function

Divide a [u128](#) integer by a fixed-point number, truncating any fractional part of the quotient. Aborts if the divisor is zero. Aborts if the quotient overflows.

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Less than or equal to. Returns true if and only if  $a \leq b$ .

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Less than. Returns true if and only if  $a < b$ .

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Greater than or equal to. Returns true if and only if  $a \geq b$ .

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Greater than. Returns true if and only if  $a > b$ .

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