TDE

API Reference

Issue **07**

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About This Document

Purpose

This document describes the application programming interfaces (APIs), data structures, and instances of the two-dimensional engine (TDE).

Related Versions

The following table lists the product versions related to this document.

Product Name	Version
Hi3536	V100
Hi3521A	V100
Hi3520D	V300
Hi3531A	V100
Hi3531D	V100
Hi3521D	V100
Hi3536C	V100
Hi3536D	V100
Hi3520D	V400

Intended Audience

This document is intended for:

- Technical support engineers
- Board development engineers

Change History

Changes between document issues are cumulative. Therefore, the latest document issue contains all changes made in previous issues.

Issue 07 (2018-01-17)

This issue is the seventh official release, which incorporates the following changes:

Section 1.2.2 is modified.

In section 2.2, the descriptions in the **Note** field of HI_TDE2_QuickCopy to HI_TDE2_QuickDeflicker are modified. The descriptions in the **Note** field of HI_TDE2_Bitblit to HI_TDE2_BitmapMaskBlend are modified.

In section 3.2, the description in the **Note** field of TDE2_COLOR_FMT_E is modified.

Issue 06 (2017-12-13)

This issue is the sixth official release, which incorporates the following changes:

In section 2.2, the Note fields of the following APIs are modified: HI_TDE2_QuickCopy, HI_TDE2_QuickFill, HI_TDE2_QuickResize, HI_TDE2_QuickDeflicker, HI_TDE2_PatternFill, HI_TDE2_MbBlit, HI_TDE2_SolidDraw, HI_TDE2_BitmapMaskRop, and HI_TDE2_BitmapMaskBlend.

In section 3.2, the Note field of TDE2_COLOR_FMT_E is modified.

Issue 05 (2017-11-20)

This issue is the fifth official release, which incorporates the following changes:

Section 1.2.2 is updated.

Issue 04 (2017-09-08)

This issue is the fourth official release, which incorporates the following changes:

The description of the Hi3536D V100 is added.

Issue 03 (2017-04-10)

This issue is the third official release, which incorporates the following changes:

The description of the Hi3536C V100 is added.

Chapter 4 Error Codes

In this chapter, table 4-1 is updated.

Issue 02 (2016-05-25)

This issue is the second official release, which incorporates the following changes:

Chapter 1 Overview

In section 1.2.2, the description of **g_u32TdeTmpBuf** is modified.

Chapter 2 API Reference

In section 2.2, the descriptions in the **Note** fields of HI_TDE2_QuickResize, HI_TDE2_QuickDeflicker, and HI_TDE2_Bitblit are modified. The descriptions of HI_TDE2_BeginJob and HI_TDE2_WaitForDone are modified

Issue 01 (2015-12-17)

This issue is the first official release, which incorporates the following changes:

Chapter 1 Overview

In section 1.2.2, the description of **g_bEnableAlphaFilter** is added.

Chapter 2 API Reference

In section 2.2, the descriptions in the **Note** fields of HI_TDE2_BitmapMaskRop and HI_TDE2_BitmapMaskBlend are modified.

Issue 00B03 (2015-07-29)

This issue is the third draft release, which incorporates the following changes:

The contents related to the Hi3531A are added.

Issue 00B02 (2015-03-30)

This issue is the second draft release, which incorporates the following changes:

The contents related to the Hi3521A and Hi3520D V300 are added.

Issue 00B01 (2015-01-14)

This issue is the first draft release.

Contents

Figures

Tables

1 Overview

1.1 Description

The two-dimensional engine (TDE) provides rapid graphics drawing functions through hardware when the on-screen display (OSD) function and graphical user interface (GUI) are used. Such functions contain rapid bitmap transfer, rapid color filling, rapid anti-flicker transfer, rapid bitmap scaling, point drawing, horizontal/vertical line drawing, bitmap format conversion, bitmap alpha blending, bitmap Boolean operation by bits, and colorkey.

1.2 Loading Drivers

1.2.1 Commands

To load drivers, run **insmod** hi35xx**_tde.ko g_u32TdeTmpBuf=*XXX***. *XXX* indicates the value of **g_u32TdeTmpBuf** and can be configured.

1.2.2 Parameters

g_pszTdeMmzName

g_pszTdeMmzName determines the media memory zone (MMZ) from which the internal memory used by the TDE is allocated. This parameter is a string. If a driver is loaded, the MMZ is defined. If this parameter is not set, the memory used by the TDE is allocated from an anonymous MMZ by default.

g_u32TdeTmpBuf

A temporary buffer is required when HI_TDE2_MbBlit is being called. **g_u32TdeTmpBuf** specifies the size of the temporary buffer. The default value of **g_u32TdeTmpBuf** is 1658880 bytes, and the value can be changed based on services. **g_u32TdeTmpBuf** must be configured when HI_TDE2_BitmapMaskRop and HI_TDE2_BitmapMaskBlend are called.

The value of **g_u32TdeTmpBuf** is calculated as follows:

g_u32TdeTmpBuf = Bitmap width x Bitmap height x 4. For example, if the size of the source bitmap processed by HI_TDE2_MbBlit is 720 x 576, **g_u32TdeTmpBuf** is 1658880 (720 x 576 x 4).

g_bEnableAlphaFilter

The Alpha filter is disabled by default when the HI_TDE2_QuickResize interface is used. You can set g_bEnableAlphaFilter to 1 when loading the .ko files to enable this filter.

g_bResizeFilter

When HI_TDE2_QuickResize is running, if filtering is required during internal calculation, filtering is performed. If the pixels of an image are insufficient, the effect of resize filtering is poor. Set this parameter to 0, so that no filtering is performed internally. If you set this parameter to 1, filtering is enabled and is performed as required.

1.3 Reference Field Description

1.3.1 API Reference Fields

This document describes the application programming interfaces (APIs) by using nine reference fields, as shown in Table 1-1.

Table 1-1 Description of API reference fields

Reference Field	Description
Purpose	Describes the major function of an API.
Syntax	Lists the required header files and the API prototype declaration when an API is called.
Parameter	Describes the parameters and attributes of an API.
Description	Describes the working process of an API.
Return Value	Lists the possible return values and their definitions of an API.
Requirement	Lists the header files of an API and the library files to be linked when the API is complied.
Note	Describes the precautions when an API is called.
Example	Lists the example of calling an API.
See Also	Lists the related APIs.

1.3.2 Data Structure Reference Fields

This document describes the data structures by using five reference fields, as shown in Table 1-2.

Table 1-2 Descriptions of data structure reference fields

Reference Field	Description
Description	Describes the major function of a data structure.

Reference Field	Description
Syntax	Lists the definition statement of a data structure.
Member	Lists the members of a data structure and the definition of each member.
Note	Lists the precautions when a data structure is used.
See Also	Lists the related data structures and interfaces.

2 API Reference

2.1 API Description

The API reference of the TDE describes the operations related to 2D acceleration.

This module provides the following APIs:

- HI_TDE2_Open: Starts the TDE device.
- HI_TDE2_Close: Closes the TDE device.
- HI_TDE2_BeginJob: Creates a TDE job.
- HI_TDE2_EndJob: To submit the created TDE job.
- HI_TDE2_WaitAllDone: Waits for the completion of all TDE jobs.
- HI_TDE2_Reset: Resets the TDE.
- HI_TDE2_QuickCopy: Adds a rapid copy operation to a TDE job.
- HI_TDE2_QuickFill: Adds a rapid filling operation to a TDE job.
- HI_TDE2_QuickResize: Adds a raster bitmap scaling operation to a TDE job.
- HI_TDE2_QuickDeflicker: Adds a raster bitmap anti-flicker operation to a TDE job.
- HI_TDE2_GetDeflickerLevel: Obtains the anti-flicker level.
- HI_TDE2_SetDeflickerLevel: Sets the anti-flicker level.
- HI_TDE2_GetAlphaThresholdValue: Obtains the alpha judgment threshold.
- HI_TDE2_SetAlphaThresholdValue: Sets the alpha judgment threshold.
- HI_TDE2_GetAlphaThresholdState: Queries whether the alpha judgment function is enabled.
- HI_TDE2_SetAlphaThresholdState: Enables or disables alpha judgment.
- HI_TDE2_EnableRegionDeflicker: Enable or disables the regional anti-flicker function.
- HI_TDE2_Bitblit: Adds a transfer operation with additional functions performed on the raster bitmap to a TDE job.
- HI_TDE2_PatternFill: Fills a pattern.
- HI_TDE2_MbBlit: Adds a transfer operation with additional functions performed on the macroblock bitmap to a TDE job.
- HI_TDE2_SolidDraw: Adds a filling operation with additional functions performed on the raster bitmap to a TDE job.
- HI_TDE2_BitmapMaskRop: Adds a mask raster operation (ROP) operation performed on the raster bitmap to a TDE job.

- HI_TDE2_BitmapMaskBlend: Adds a mask blending operation performed on the raster bitmap to a TDE job.
- HI_TDE2_CancelJob: Cancels a specific TDE job.
- HI_TDE2_WaitForDone: Waits for the completion of a specific TDE job.
- HI_TDE2_MultiBlending: Adds a transfer operation with additional functions performed on multiple graphics layers to a TDE job.

2.2 Function Reference

HI_TDE2_Open

[Purpose]

To start the TDE device.

[Syntax]

```
HI_S32 HI_TDE2_Open(HI_VOID);
```

[Description]

This API is used to start the TDE device.

[Parameter]

None

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_SUCCESS	Success
HI_ERR_TDE_DEV_OPEN_FAILED	The TDE device fails to be started.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

- Call this API to start the TDE device before performing operations on the TDE device.

- This API can be called repeatedly to start the TDE device.

[Example]

```
/*Declaration*/
HI_S32 s32Ret = 0;

/*Start the TDE device*/
s32Ret = HI_TDE2_Open();
if (HI_SUCCESS != s32Ret)
{
    return -1;
}

/*Close the TDE device*/
HI_TDE2_Close();
```

HI_TDE2_Close

[Purpose]

To stop the TDE device.

[Syntax]

```
HI_VOID HI_TDE2_Close(HI_VOID);
```

[Description]

This API is used to stop the TDE device.

[Parameter]

None

[Return Value]

None

[Error Code]

None

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

The times of calling HI_TDE2_Open and HI_TDE2_Close must be the same.

[Example]

None

HI_TDE2_BeginJob

[Purpose]

To create a TDE job.

[Syntax]

```
TDE_HANDLE HI_TDE2_BeginJob(HI_VOID);
```

[Description]

This API is used to create a TDE job. The TDE manages TDE commands as TDE jobs. A TDE job consists of a set of TDE commands. That is, a job may contain one or more TDE operations. Each TDE command corresponds to a TDE operation. After creating a TDE job and adding TDE operations, you can call HI_TDE2_EndJob to submit the TDE job. The TDE commands in a job are executed in sequence.

[Parameter]

None

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_ERR_TDE_INVALID_HANDLE	The job handle is invalid.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

- Ensure that the TDE device is started before calling this API.
- Ensure that a valid job handle is obtained by checking the return value.
- The number of jobs that can be buffered is determined by the size of the TDE memory. When the memory is insufficient, the memory fails to be allocated to the jobs. It is recommended that the maximum number of jobs be less than or equal to 200.
- HI_TDE2_EndJob must be called if HI_TDE2_BeginJob is called; otherwise, the memory is leaked.

[Example]

```
/* declaration */
    HI_S32  s32Ret;
    TDE_HANDLE s32Handle;

    /* create a TDE job */
    s32Handle = HI_TDE2_BeginJob();
    if(HI_ERR_TDE_INVALID_HANDLE == s32Handle
|| HI_ERR_TDE_DEV_NOT_OPEN == s32Handle)
    {
        return -1;
    }

    /* submit the job */
    s32Ret = HI_TDE2_EndJob(s32Handle, HI_FALSE, HI_TRUE, 20);
    if(HI_SUCCESS != s32Ret)
    {
        return -1;
}
```

HI_TDE2_EndJob

[Purpose]

To submit the created TDE job.

[Syntax]

```
HI_S32 HI_TDE2_EndJob(TDE_HANDLE s32Handle, HI_BOOL bSync, HI_BOOL bBlock,
HI_U32 u32TimeOut);
```

[Description]

This API is used to submit a TDE job. You can specify whether the API is called in block mode or non-block mode. If it is in block mode, you can set the timeout period.

- Block

  When the API is called, the API is not returned at once until one of the following conditions is met:

  - All commands of the TDE job are executed.
  - Waiting times out.
  - The waiting is interrupted.
- Non-block

  After the API is called, the API is returned at once no matter whether the commands of the TDE job are executed.

You can set a maximum waiting period in block mode. If the waiting times out but the commands of the TDE job are not executed, the API is returned. The commands, however, are executed later.

[Parameter]

Parameter	Description	Input/Output
s32Handle	TDE job handle	Input
bSync	Reserved parameter, not used currently	Input
bBlock	Block flag HI_TRUE: block HI_FALSE: non-block	Input
u32TimeOut	Timeout period. unit: ms	Input

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_SUCCESS	The job is submitted successfully. • Block job: All TDE commands of the job are executed. • Non-block job: All TDE commands of the job are submitted successfully.
HI_ERR_TDE_INVALID_HANDLE	The job handle is invalid.
HI_ERR_TDE_JOB_TIMEOUT	Waiting times out.
HI_ERR_TDE_INTERRUPT	The waiting is interrupted.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

- Before calling this API, call HI_TDE2_Open to start the TDE device and call HI_TDE2_BeginJob to obtain a valid job handle.
- If you use the block mode, when HI_TDE2_EndJob is returned due to timeout or interruption, note that the operation continues till it is complete even though the API related to the TDE operation is returned in advance.

- After a job is submitted, its handle becomes invalid, and the error code HI_ERR_TDE_INVALID_HANDLE is returned if you submit this job again.

[Example]

None

HI_TDE2_WaitAllDone

[Purpose]

To wait for the completion of all TDE jobs.

[Syntax]

```
HI_S32  HI_TDE2_WaitAllDone(HI_VOID);
```

[Description]

This API is used to wait for the completion of all TDE jobs.

[Parameter]

None

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	Fail to call the API because the TDE device is not started.
HI_ERR_TDE_UNSUPPORTED_OPERATION	The operation is not supported.

[Requirement]

- Header file: hi_tde_api.h
- LLibrary file: libtde.a

[Note]

As a block interface, this API is blocked until all TDE jobs are complete.

[Example]

None

HI_TDE2_Reset

[Purpose]

To reset the TDE.

[Syntax]

```
HI_S32 HI_TDE2_Reset(HI_VOID);
```

[Description]

This API is called to reset the TDE.

[Parameter]

None

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	Fail to call the API because the TDE device is not started.

[Requirement]

- Header file: hi_tde_api.h
- LLibrary file: libtde.a

[Note]

This API is used to reset software and hardware if a timeout error occurs due to the inconsistency between the software and hardware during standby wakeup.

[Example]

None

HI_TDE2_QuickCopy

[Purpose]

To add a rapid copy operation to a TDE job.

[Syntax]

```
HI_S32 HI_TDE2_QuickCopy(TDE_HANDLE s32Handle,
```

```
                                TDE2_SURFACE_S *pstSrc,
                                TDE2_RECT_S *pstSrcRect,
                                TDE2_SURFACE_S *pstDst,
                                TDE2_RECT_S *pstDstRect);
```

[Description]

This API is used to copy the specified area pstSrcRect in the bitmap pstSrc to the memory pstDst with the output area pstDstRect.

The bitmap, operation area, and the relationships between them are described as follows:

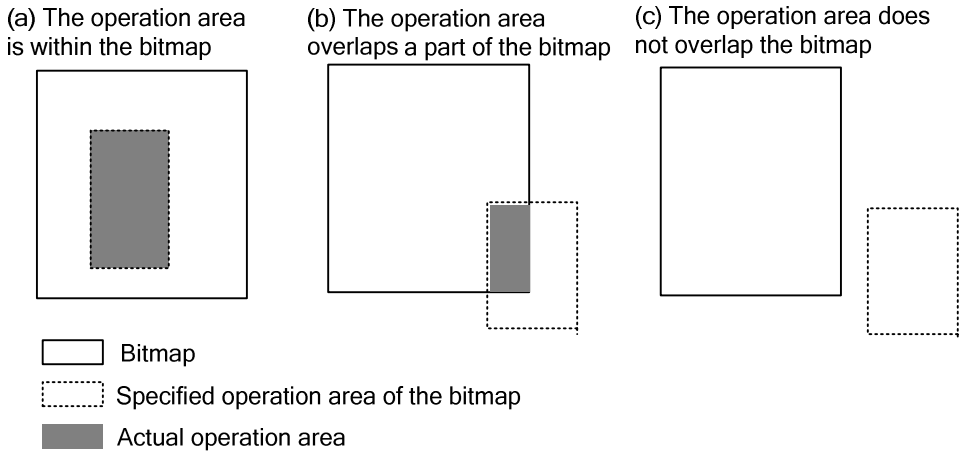
- The basic bitmap information is described by TDE2_SURFACE_S, including the pixel width, pixel height, stride between lines, color format, and physical address of the bitmap.
- The rectangle range of the bitmap relating to an operation, that is, operation area, is described by TDE2_RECT_S. The information contains the start position and rectangle size.
- Figure 2-1 shows the relationships between bitmaps and operation areas.

  By specifying the operation area, you can specify a part of the bitmap or the entire bitmap for an operation.
  - If you want to specify the entire bitmap, the start point of the operation area must be (0, 0) and the width and height must be the same as those of the bitmap.
  - If you want to specify a part of the bitmap, specify the size of the operation area. As shown in part (a) of Figure 2-1, the specified area is the valid operation area. Note: If the specified operation area overlaps a part of the bitmap (as shown in part (b) of Figure 2-1), the specified operation area is clipped automatically. Therefore, the valid operation area is the gray overlapped part.
  - If the specified operation area does not overlap the bitmap (as shown in part (c) of Figure 2-1), the configuration is incorrect and the error code HI_ERR_TDE_INVALID_PARA is returned.

NOTE

The valid operation area refers to the overlapped part of the specified operation area and the bitmap.

Figure 2-1 Relationships between bitmaps and operation areas



[Parameter]

Parameter	Description	Input/Output
s32Handle	TDE job handle	Input
pstSrc	Source bitmap	Input
pstSrcRect	Operation area in the source bitmap	Input
pstDst	Target bitmap	Input
pstDstRect	Operation area in the target bitmap	Input

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_ERR_TDE_NULL_PTR	The pointer of the input parameter is null.
HI_ERR_TDE_INVALID_HANDLE	The job handle is invalid.
HI_ERR_TDE_INVALID_PARA	The input parameter is invalid.
HI_ERR_TDE_NO_MEM	The memory fails to be allocated.
HI_ERR_TDE_UNSUPPORTED_OPERATION	The operation is not supported.
HI_FAILURE	A system error or an unknown error occurs.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

- The following bitmap formats are supported:

Source Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, TDE2_COLOR_FMT_RABG8888, TDE2_COLOR_FMT_CLUT1, TDE2_COLOR_FMT_CLUT2, TDE2_COLOR_FMT_CLUT4, TDE2_COLOR_FMT_CLUT8, TDE2_COLOR_FMT_ACLUT44, TDE2_COLOR_FMT_ACLUT88, TDE2_COLOR_FMT_A1, TDE2_COLOR_FMT_A8, TDE2_COLOR_FMT_YCbCr888, TDE2_COLOR_FMT_AYCbCr8888, TDE2_COLOR_FMT_YCbCr422, TDE2_COLOR_FMT_Byte, and TDE2_COLOR_FMT_halfword
Target Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, TDE2_COLOR_FMT_RABG8888, TDE2_COLOR_FMT_CLUT1, TDE2_COLOR_FMT_CLUT2, TDE2_COLOR_FMT_CLUT4, TDE2_COLOR_FMT_CLUT8, TDE2_COLOR_FMT_ACLUT44, TDE2_COLOR_FMT_ACLUT88, TDE2_COLOR_FMT_A1, TDE2_COLOR_FMT_A8, TDE2_COLOR_FMT_YCbCr888, TDE2_COLOR_FMT_AYCbCr8888, TDE2_COLOR_FMT_YCbCr422, TDE2_COLOR_FMT_Byte, and TDE2_COLOR_FMT_halfword

- The function of HI_TDE2_QuickCopy is implemented by using DMA transfer; therefore, HI_TDE2_QuickCopy is superior to HI_TDE2_Bitblit in the transfer function.
- The rapid copy operation does not support format conversion; therefore, ensure that the format of the source bitmap is the same as that of the target bitmap.
- The rapid copy operation does not support the scaling function. If the operation area size of the source bitmap is different from that of the target bitmap, the minimum common operation area in the two bitmaps is copied and transferred.
- Ensure that the specified operation area and the specified bitmap have a common area; otherwise, an error is returned. This requirement is applicable to other APIs.
- If the pixel format of a bitmap is greater than or equal to a byte, the base address and stride of the bitmap format must be aligned based on the pixel format. If the pixel format

of a bitmap is smaller than a byte, the base address and stride of the bitmap must be aligned based on byte. This requirement is applicable to other APIs.

- If the pixel format of a bitmap is smaller than a byte, the horizontal start point and width of the bitmap must be aligned based on pixel.
- The horizontal start point and width of the YCbCr422 bitmap must be even numbers. This requirement is applicable to other APIs.

[Example]

None

HI_TDE2_QuickFill

[Purpose]

To add a rapid filling operation to a TDE job.

[Syntax]

```
HI_S32 HI_TDE2_QuickFill(TDE_HANDLE s32Handle, TDE2_SURFACE_S *pstDst,
                         TDE2_RECT_S *pstDstRect, HI_U32 u32FillData);
```

[Description]

This API is used to fill u32FillData to the memory with the destination address pstDst and the output area pstDstRect, achieving the color filling function.

[Parameter]

Parameter	Description	Input/Output
s32Handle	TDE job handle	Input
pstDst	Target bitmap	Input
pstDstRect	Operation area in the target bitmap	Input
u32FillData	Fill data	Input

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_ERR_TDE_NULL_PTR	The pointer of the input parameter is null.

Error Code	Description
HI_ERR_TDE_INVALID_HANDLE	The job handle is invalid.
HI_ERR_TDE_INVALID_PARA	The input parameter is invalid.
HI_ERR_TDE_NO_MEM	The memory fails to be allocated.
HI_ERR_TDE_UNSUPPORTED_OPERATION	The operation is not supported.
HI_FAILURE	A system error or an unknown error occurs.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

- The following target bitmap formats are supported:

  TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, and TDE2_COLOR_FMT_RABG8888
- After this API is called, u32FillData is filled in the specified area in the bitmap directly. If you want to fill blue in a specified bitmap, specify a fill value corresponding to the blue color according to the bitmap format.
- If the bitmap format is ARGB1555 and the fill color is blue, set u32FillData to 0x801F (the alpha bit is 1).

[Example]

None

HI_TDE2_QuickResize

[Purpose]

To add a raster bitmap scaling operation to a TDE job.

[Syntax]

```
HI_S32 HI_TDE2_QuickResize(TDE_HANDLE s32Handle,
                           TDE2_SURFACE_S *pstSrc,
                           TDE2_RECT_S *pstSrcRect,
```

```
                                    TDE2_SURFACE_S *pstDst,
                                    TDE2_RECT_S *pstDstRect);
```

[Description]

This API is used to scale down the specified area pstSrcRect in the bitmap pstSrc to the size of pstDstRect and copy the result to the memory pstDst with the output area pstDstRect at the same time.

[Parameter]

Parameter	Description	Input/Output
s32Handle	TDE job handle	Input
pstSrc	Source bitmap	Input
pstSrcRect	Operation area in the source bitmap	Input
pstDst	Target bitmap	Input
pstDstRect	Operation area in the target bitmap	Input

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_ERR_TDE_NULL_PTR	The pointer of the input parameter is null.
HI_ERR_TDE_INVALID_HANDLE	The job handle is invalid.
HI_ERR_TDE_INVALID_PARA	The input parameter is invalid.
HI_ERR_TDE_NO_MEM	The memory fails to be allocated.
HI_ERR_TDE_MINIFICATION	The multiple of down scaling exceeds the threshold **255**.
HI_ERR_TDE_NOT_ALIGNED	The position, width, height, or stride of the picture is not aligned as required.
HI_ERR_TDE_UNSUPPORTED_OPERATION	The operation is not supported.
HI_FAILURE	A system error or an unknown error occurs.

[Requirement]

- Header file: hi_tde_api.h
- Library file: hitde.a

[Note]

- The following bitmap formats are supported:

Source Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, and TDE2_COLOR_FMT_RABG8888
Target Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, and TDE2_COLOR_FMT_RABG8888

- The maximum down-scaling multiple must be less than **255**, and the up-scaling result cannot exceed the maximum resolution supported.
- You can scale the bitmap that serves as both source and target bitmaps. If the memory of the source bitmap overlaps that of the target bitmap, the bitmaps cannot be scaled.

[Example]

None

HI_TDE2_QuickDeflicker

[Purpose]

To add an anti-flicker operation to a TDE job.

[Syntax]

```
HI_S32 HI_TDE2_QuickDeflicker(TDE_HANDLE s32Handle,
                              TDE2_SURFACE_S *pstSrc,
                              TDE2_RECT_S *pstSrcRect,
                              TDE2_SURFACE_S *pstDst,
                              TDE2_RECT_S *pstDstRect);
```

[Description]

This API is used to perform the anti-flicker operation on the specified area pstSrcRect in the bitmap pstSrc and copy the result to the memory pstDst with the output area pstDstRect at the same time.

[Parameter]

Parameter	Description	Input/Output
s32Handle	TDE job handle	Input
pstSrc	Source bitmap	Input
pstSrcRect	Operation area in the source bitmap	Input
pstDst	Target bitmap	Input
pstDstRect	Operation area in the target bitmap	Input

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_ERR_TDE_NULL_PTR	The pointer of the input parameter is null.
HI_ERR_TDE_INVALID_HANDLE	The job handle is invalid.
HI_ERR_TDE_INVALID_PARA	The input parameter is invalid.
HI_ERR_TDE_NO_MEM	The memory fails to be allocated.
HI_ERR_TDE_NOT_ALIGNED	The position, width, height, or stride of the picture is not aligned as required.
HI_ERR_TDE_UNSUPPORTED_OPERATION	The operation is not supported.

Error Code	Description
HI_ERR_TDE_MINIFICATION	The multiple of down scaling exceeds the limitation (the maximum value is 255).
HI_FAILURE	A system error or an unknown error occurs.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

- The following bitmap formats are supported:

Source Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, and TDE2_COLOR_FMT_RABG8888
Target Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, and TDE2_COLOR_FMT_RABG8888

- The anti-flicker operation supports vertical filtering only.
- The source bitmap and the target bitmapt of the anti-flicker operation must be the same bitmap, but the operation regions cannot be overlapped.
- If the sizes of the specified input area and the output area are different, it is scaled down.
- If the formats of the source bitmap and target bitmap are different, a format is converted.

[Example]

None

HI_TDE2_GetDeflickerLevel

[Purpose]

To obtain the anti-flicker level.

[Syntax]

```
HI_S32 HI_TDE2_GetDeflickerLevel(TDE_DEFLICKER_LEVEL_E *pDeflickerLevel);
```

[Description]

This API is used to obtain the anti-flicker level.

[Parameter]

Parameter	Description	Input/Output
pDeflickerLevel	Pointer to the enumeration of anti-flicker levels	Output

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_ERR_TDE_NULL_PTR	The pointer of the input parameter is null.
HI_ERR_TDE_INVALID_PARA	The input parameter is invalid.
HI_ERR_TDE_NO_MEM	The memory fails to be allocated.
HI_FAILURE	A system error or an unknown error occurs.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

None

[Example]

None

HI_TDE2_SetDeflickerLevel

[Purpose]

To set the anti-flicker level.

[Syntax]

```
HI_S32 HI_TDE2_SetDeflickerLevel(TDE_DEFLICKER_LEVEL_E enDeflickerLevel);
```

[Description]

This API is used to set the anti-flicker level.

[Parameter]

Parameter	Description	Input/Output
enDeflickerLevel	Enumeration of anti-flicker levels	Input

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_ERR_TDE_INVALID_PARA	The input parameter is invalid.
HI_ERR_TDE_NO_MEM	The memory fails to be allocated.
HI_FAILURE	A system error or an unknown error occurs.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

None

[Example]

None

HI_TDE2_GetAlphaThresholdValue

[Purpose]

To obtain the alpha judgment threshold.

[Syntax]

```
HI_S32 HI_TDE2_GetAlphaThresholdValue(HI_U8 *pu8ThresholdValue);
```

[Description]

This API is used to obtain the alpha judgment threshold and is applicable when the result picture is in ARGB1555 format. If the alpha operation result of the foreground bitmap and background bitmap is less than the threshold, the alpha bit of the result pixel is 0; if the alpha operation result is greater than or less than the threshold, the alpha bit is 1.

[Parameter]

Parameter	Description	Input/Output
pu8ThresholdValue	Pointer to the alpha judgment threshold	Output

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_ERR_TDE_NULL_PTR	The pointer of the input parameter is null.
HI_FAILURE	A system error or an unknown error occurs.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

None

[Example]

None

HI_TDE2_SetAlphaThresholdValue

[Purpose]

To set the alpha judgment threshold.

[Syntax]

```
HI_S32 HI_TDE2_SetAlphaThresholdValue(HI_U8 u8ThresholdValue);
```

[Description]

This API is used to set the alpha judgment threshold. When a bitblit operation is performed on the foreground and background bitmaps, an intermediate bitmap in ARGB888 format is generated regardless of the formats of the foreground and background bitmaps. If the target picture is in ARGB1555 format and the alpha operation result of the foreground bitmap and background bitmap is less than the threshold, the alpha bit of the result pixel is 0; if the target picture is in ARGB1555 format and the alpha operation result is greater than or less than the threshold, the alpha bit is 1.

[Parameter]

Parameter	Description	Input/Output
u8ThresholdValue	Alpha judgment threshold	Input

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_ERR_TDE_INVALID_PARA	The input parameter is invalid.
HI_FAILURE	A system error or an unknown error occurs.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

None

[Example]

None

HI_TDE2_GetAlphaThresholdState

[Purpose]

To query whether the alpha judgment function is enabled.

[Syntax]

```
HI_TDE2_GetAlphaThresholdState(HI_BOOL * p_bEnAlphaThreshold);
```

[Parameter]

Parameter	Description	Input/Output
p_bEnAlphaThreshold	Pointer to the status of the alpha judgment function	Output

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_ERR_TDE_NULL_PTR	The pointer of the input parameter is null.
HI_FAILURE	A system error or an unknown error occurs.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

None

[Example]

None

HI_TDE2_SetAlphaThresholdState

[Purpose]

To enable or disable alpha judgment. When alpha judgment is enabled, the alpha judgment threshold is the user-defined value; when alpha judgment is disabled, the threshold is 0xFF.

[Syntax]

```
HI_TDE2_SetAlphaThresholdState(HI_BOOL bEnAlphaThreshold);
```

[Description]

This API is used to enable or disable alpha judgment.

[Parameter]

Parameter	Description	Input/Output
bEnAlphaThreshold	Status of the alpha judgment function • True: The alpha judgment function is enabled. • False: The alpha judgment function is disabled.	Input

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_FAILURE	A system error or an unknown error occurs.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

None

[Example]

None

HI_TDE2_EnableRegionDeflicker

[Purpose]

To enable or disable the regional anti-flicker function.

[Syntax]

```
HI_S32 HI_TDE2_EnableRegionDeflicker(HI_BOOL bRegionDeflicker);
```

[Description]

This API is used to enable or disable the regional anti-flicker function.

[Parameter]

Parameter	Description	Input/Output
bRegionDeflicker	Regional anti-flicker enable flag • True: enabled • False: disabled	Input

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_ERR_TDE_NO_MEM	The memory fails to be allocated.
HI_FAILURE	A system error or an unknown error occurs.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

If anti-flicker is performed on a specific region by calling HI_TDE2_QuickDeflicker or HI_TDE2_Bitblit when regional anti-flicker is disabled, the values of the pixels around the region are not referenced. If regional anti-flicker is enabled, the values of the pixels around the region are referenced. Therefore, the anti-flicker results for region edges when anti-flicker is enabled are different from those when the regional anti-flicker is disabled. If anti-flicker is performed on an entire picture, the results obtained when anti-flicker is enabled are the same as those obtained when anti-flicker is disabled.

[Example]

None

HI_TDE2_Bitblit

[Purpose]

To add a transfer operation with additional functions performed on the raster bitmap to a TDE job.

[Syntax]

```
HI_S32 HI_TDE2_Bitblit(TDE_HANDLE s32Handle,
                       TDE2_SURFACE_S *pstBackGround,
                       TDE2_RECT_S *pstBackGroundRect,
                       TDE2_SURFACE_S *pstForeGround,
                       TDE2_RECT_S *pstForeGroundRect,
                       TDE2_SURFACE_S *pstDst,
                       TDE2_RECT_S *pstDstRect,
                       TDE2_OPT_S *pstOpt);
```

[Description]

This API is used to perform operations on the specified area (pstForeGroundRect) of the foreground bitmap (pstForeGround) and the specified area (pstBackGroundRect) of the background bitmap (pstBackGround), and then copy the obtained bitmap to the specified area (pstDstRect) of the target bitmap (pstDst). The size of the specified area (pstBackGroundRect) of the background bitmap (pstBackGround) must be the same as the size of the specified area (pstDstRect) of the target bitmap (pstDst).

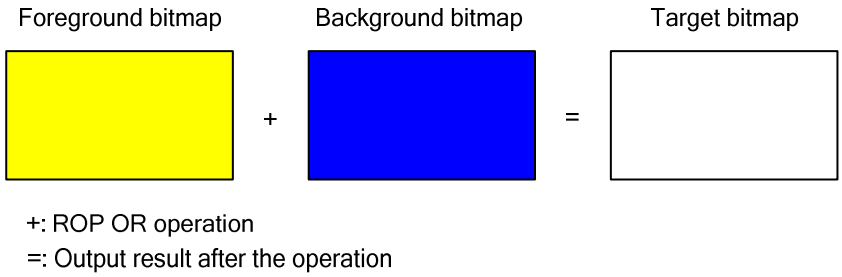
TDE2_OPT_S stores the configurations of the TDE operation function. For example, whether to perform the ROP operation and run the ROP command code; whether to specify the colorkey and set the value of the colorkey; whether to clip an area and specify the area to be clipped; whether to scale; whether to perform anti-flicker; whether to mirror; and whether to perform alpha blending. These operations can be simultaneously enabled.

The concepts related to the configuration items of TDE2_OPT_S are described as follows:

- Bitwise boolean operation, that is, ROP

  The ROP operation refers to the bitwise boolean operation (including bitwise AND and bitwise OR) that is performed on the RGB components and alpha components of the foreground bitmap and the background bitmap. After the operation, results are output. See Figure 2-2.

Figure 2-2 Transfer operation during the ROP operation (src1: R, G, B = 0xFF, 0xFF, 0; src2: R, G, B = 0, 0, 0xFF)



- Alpha blending

  Alpha blending refers to the weight sum of the pixels of the foreground bitmap and the background bitmap based on the alpha value of the foreground bitmap. In this way, a

bitmap with blended alpha value is obtained and the two bitmaps are blended with certain transparency. The alpha value of the output bitmap depends on the configured alpha blending command. For details, see the description of TDE2_BLENDCMD_E. There are two blending modes:

NOTE

The global alpha must be blended in either of modes.

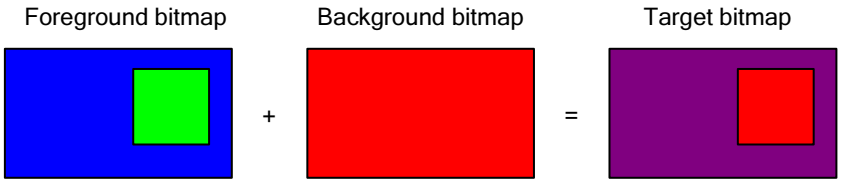
- If the data of the foreground or background bitmap is premultiplied by alpha, select the foreground or background premultiplied alpha blending mode.
- If the data of the foreground or background bitmap is not premultiplied, select the foreground or background non-premultiplied alpha blending mode.

- Colorkey operation

  The colorkey operation refers to that the pixels within the colorkey range are excluded from the TDE operations. You need to set the filtering conditions for each component based on the pixel format in colorkey settings. If all components of a color meet the filtering conditions, the color is a colorkey. There are two colorkey operation modes:

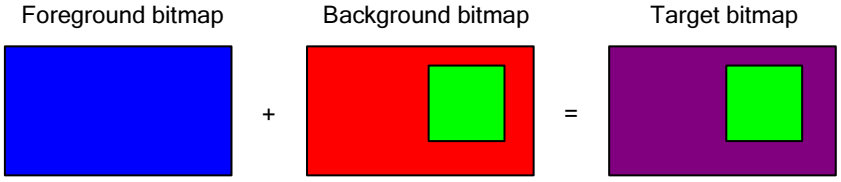
  - Performing the colorkey operation on the foreground bitmap: In this mode, the colorkey of the foreground bitmap is excluded from the colorkey operation and the background bitmap is retained. That is, the corresponding area in the background bitmap is copied to the output bitmap, as shown in Figure 2-3.
  - Performing the colorkey operation on the background bitmap: In this mode, the colorkey area in the background bitmap is copied to the output bitmap and the other areas are the operation results, as shown in Figure 2-4.

Figure 2-3 Transfer operation during the colorkey operation performed on the foreground bitmap



+: Perform colorkey operation on the foreground bitmap and alpha operation
=: Output result after the operation

Figure 2-4 Transfer operation during the colorkey operation performed on the background bitmap



+: Perform colorkey operation on the foreground bitmap and alpha operation
=: Output result after the operation

- Scaling operation

When the sizes of the operation areas of the foreground bitmap and the target bitmap are different, perform one of the following two operations:

- If the bResize parameter of TDE2_OPT_S is set to TRUE, scale the Operation area in the foreground bitmap to the size of the operation area in the target bitmap and then perform other operations on the obtained foreground bitmap and the Background bitmap
- If the bResize parameter of TDE2_OPT_S is set to FALSE, the Operation area in the foreground bitmap is not scaled. Instead, the minimum area between the operation areas (pstForeGroundRect, pstBackGroundRect, and pstDstRect) of the foreground bitmap, background bitmap, and target bitmap is selected and served as the actual operation area in the three bitmaps.

- Anti-flicker operation

  The anti-flicker operation refers to that anti-flicker is performed on the Operation area in the foreground bitmap and then other operations such as alpha blending operation are performed on the foreground bitmap and the background bitmap. You can determine whether to perform the anti-flicker operation by configuring the bDeflicker parameter of TDE2_OPT_S.

- Mirror function

  The mirror function refers to that the output result is reversed horizontally and/or vertically. You can specify the mirror type by configuring the enMirror parameter of TDE2_OPT_S. The mirror types are as follows:

  - Horizontal mirror: Symmetrically copy the output result in the horizontal direction.
  - Vertical mirror: Symmetrically copy the output result in the vertical direction.
  - Horizontal and vertical mirror: Symmetrically copy the output result in both horizontal and vertical directions.

- Color extension or correction function

  The color extension function refers to that the color with low precision is extended to the true color through the palette (also called CLUT). For example, if a CLUT8 bitmap has only 256 colors, you can construct a proper CLUT and then set the pu8ClutPhyAdd attribute of the bitmap surface to the start address of the CLUT. Then the TDE can implement the extension from CLUT8 to the true color ARGB by retrieving the CLUT.

  To implement color extension, you need to configure the following items:

  - CLUT start address pu8ClutPhyAddr of the bitmap surface. The memory in this address must be continuous.
  - bYCbCrClut item of the bitmap surface. This item specifies whether the CLUT is in the RGB space or YC space.
  - bClutReload item of TDE2_OPT_S. This item specifies whether the hardware needs to reload the CLUT. The CLUT reload flag needs to be marked when the color is extended from the CLUT to the RGB/AYCbCr for the first time.

- Clip function for the output picture

  - Generally, the pictures processed by the TDE are output to the specified area in the target bitmap. Through the clip function, only the specified part of the picture is output to the target bitmap. That is, the output picture is clipped and then output. The TDE supports the following two clip modes:
  - Intra-area clip: In this mode, the TDE operation result is the updated area within the clipped area. As shown in Figure 2-5, the clipped area overlaps the operation area in the target bitmap. Through the intra-area clip function, only the updated gray area is the TDE operation result and the other part of the destination operation area remains.

- Intra-area clip: The TDE operation result is the updated area outside of the clipped area. As shown in Figure 2-6, the clipped area overlaps the operation area in the target bitmap. Through the extra-area clip function, only the updated gray area is the TDE operation result and the part within the clipped area remains.

Figure 2-5 Intra-area clip

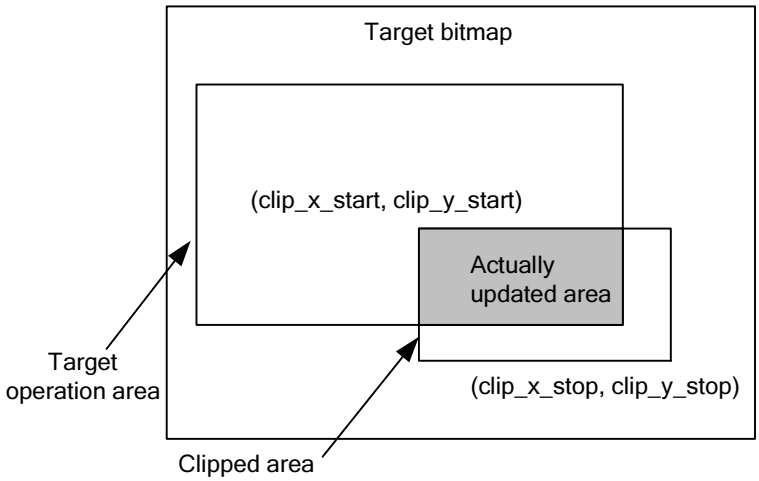
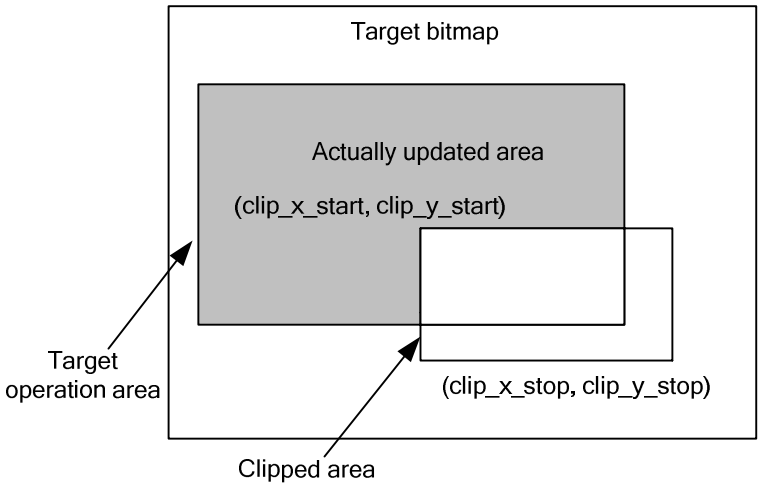


Figure 2-6 Extra-area clip



- Output source of the alpha

  There are four output sources:

  - From the operation result
  - From the foreground bitmap
  - From the background bitmap
  - From the global alpha

NOTE

You need to select the source of operation result for the alpha blending operation.

- Single-source or dual-source graphics operation

  The single-source operation refers to that only one bitmap source is specified. For example, when only the background and target bitmaps are specified, the foreground bitmap is null. In this case, you can perform the following operations on the background bitmap:

  - Bitmap transfer
  - Bitmap format conversion
  - Bitmap scaling
  - Bitmap anti-flicker
  - Bitmap color extension or correction
  - Bitmap output result clipping

  The dual-source operation refers to that two bitmap (background bitmap and foreground bitmap) sources are specified, and then the operation result of the two bitmaps are output to the specified area in the target bitmap. Here, the background bitmap can be the same as the target bitmap. The description of the operation is as follows: operate the foreground bitmap and the background bitmap and output the result to the background bitmap. The double-source operations are as follows:

  - ROP between the foreground bitmap and the background bitmap
  - Alpha blending operation between the foreground bitmap and the background bitmap
  - Colorkey operation
  - After performing the scaling or anti-flicker operation on the specified area in the foreground bitmap, perform the alpha blending operation between the obtained foreground bitmap and the Background bitmap

[Parameter]

Parameter	Description	Input/Output
s32Handle	TDE job handle	Input
pstBackGround	Background bitmap	Input
pstBackGroundRect	Operation area in the background bitmap	Input
pstForeGround	Foreground bitmap	Input
pstForeGroundRect	Operation area in the foreground bitmap	Input
pstDst	Target bitmap	Input
pstDstRect	Operation area in the target bitmap	Input
pstOpt	Operation parameter settings	Input

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_ERR_TDE_NULL_PTR	The pointer of the input parameter is null.
HI_ERR_TDE_INVALID_HANDLE	The job handle is invalid.
HI_ERR_TDE_INVALID_PARA	The input parameter is invalid.
HI_ERR_TDE_NO_MEM	The memory fails to be allocated.
HI_ERR_TDE_NOT_ALIGNED	The position, width, height, or stride of the picture is not aligned as required.
HI_ERR_TDE_MINIFICATION	The multiple of down scaling exceeds the limitation (the maximum value is 255).
HI_ERR_TDE_UNSUPPORTED_OPERATION	The operation is not supported.
HI_ERR_TDE_CLIP_AREA	The operation area does not overlap the clipped area.
HI_FAILURE	A system error or an unknown error occurs.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

- The following bitmap formats are supported:

Background Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, TDE2_COLOR_FMT_RABG8888, TDE2_COLOR_FMT_CLUT1, TDE2_COLOR_FMT_CLUT2, TDE2_COLOR_FMT_CLUT4, TDE2_COLOR_FMT_CLUT8, TDE2_COLOR_FMT_ACLUT44, TDE2_COLOR_FMT_ACLUT88, TDE2_COLOR_FMT_A1, TDE2_COLOR_FMT_A8, TDE2_COLOR_FMT_YCbCr888, TDE2_COLOR_FMT_AYCbCr8888, TDE2_COLOR_FMT_YCbCr422, TDE2_COLOR_FMT_Byte, TDE2_COLOR_FMT_halfword, TDE2_COLOR_FMT_JPG_YCbCr400MBP, TDE2_COLOR_FMT_JPG_YCbCr422MBHP, TDE2_COLOR_FMT_JPG_YCbCr422MBVP, TDE2_COLOR_FMT_MP1_YCbCr420MBP, TDE2_COLOR_FMT_MP2_YCbCr420MBP, TDE2_COLOR_FMT_MP2_YCbCr420MBI, TDE2_COLOR_FMT_JPG_YCbCr420MBP, and TDE2_COLOR_FMT_JPG_YCbCr444MBP
Foreground Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, TDE2_COLOR_FMT_RABG8888, TDE2_COLOR_FMT_CLUT1, TDE2_COLOR_FMT_CLUT2, TDE2_COLOR_FMT_CLUT4, TDE2_COLOR_FMT_CLUT8, TDE2_COLOR_FMT_ACLUT44, TDE2_COLOR_FMT_ACLUT88, TDE2_COLOR_FMT_A1, TDE2_COLOR_FMT_A8, TDE2_COLOR_FMT_YCbCr888, TDE2_COLOR_FMT_AYCbCr8888, TDE2_COLOR_FMT_YCbCr422, TDE2_COLOR_FMT_Byte, TDE2_COLOR_FMT_halfword, TDE2_COLOR_FMT_JPG_YCbCr400MBP, TDE2_COLOR_FMT_JPG_YCbCr422MBHP, TDE2_COLOR_FMT_JPG_YCbCr422MBVP, TDE2_COLOR_FMT_MP1_YCbCr420MBP, TDE2_COLOR_FMT_MP2_YCbCr420MBP, TDE2_COLOR_FMT_MP2_YCbCr420MBI, TDE2_COLOR_FMT_JPG_YCbCr420MBP, and TDE2_COLOR_FMT_JPG_YCbCr444MBP

Target Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, TDE2_COLOR_FMT_RABG8888, TDE2_COLOR_FMT_CLUT1, TDE2_COLOR_FMT_CLUT2, TDE2_COLOR_FMT_CLUT4, TDE2_COLOR_FMT_CLUT8, TDE2_COLOR_FMT_ACLUT44, TDE2_COLOR_FMT_ACLUT88, TDE2_COLOR_FMT_A1, TDE2_COLOR_FMT_A8, TDE2_COLOR_FMT_YCbCr888, TDE2_COLOR_FMT_AYCbCr8888, TDE2_COLOR_FMT_YCbCr422, TDE2_COLOR_FMT_Byte, and TDE2_COLOR_FMT_halfword

- When the output is in a CLUT format, the input must also in the same CLUT format, and only the copy operation is supported. The two source bitmaps for the dual-source operation cannot be in CLUT formats at the same time.
- The foreground and target bitmaps must be in A1, A8, byte or halfword format for the single-source operation when the operation item is null. The foreground and target bitmaps in this case must be in the same format.
- The background and foreground bitmaps cannot be in any of the following macroblock formats at the same time:
  - TDE2_COLOR_FMT_JPG_YCbCr400MBP
  - TDE2_COLOR_FMT_JPG_YCbCr422MBHP
  - TDE2_COLOR_FMT_JPG_YCbCr422MBVP
  - TDE2_COLOR_FMT_MP1_YCbCr420MBP
  - TDE2_COLOR_FMT_MP2_YCbCr420MBP
  - TDE2_COLOR_FMT_MP2_YCbCr420MBI
  - TDE2_COLOR_FMT_JPG_YCbCr420MBP
  - TDE2_COLOR_FMT_JPG_YCbCr444MBP

  You are advised to call HI_TDE2_MbBlit to process a macroblock bitmap.
- Before calling this API, call HI_TDE2_Open to start the TDE device and call HI_TDE2_BeginJob to obtain a valid job handle.
- The color space of the target bitmap must be the same as that of the background bitmap. The color space of the foreground bitmap can be different from that of the background or target bitmap; if so, the color space is converted.
- When the size of the foreground bitmap is different from that of the target bitmap, if you enable the scaling function, the bitmap is scaled based on the preset area; otherwise, the clip and transfer operations are performed based on the minimum value of the minimum common area.
- The global alpha, Alplh0, and Alpha1 range from 0 to 255.
- The background bitmap and the target bitmap can be the same.

- If you need only the single-source transfer operation (for example, performing the ROP and reverse operations on the source bitmap only), you can set null pointers for the foreground, background, pstForeGroundRect, and pstBackGroundRect. The foreground or background describes the bitmap and pstForeGroundRect or pstBackGroundRect describes the operation area.
- When the mirror function is enabled, the scaling function is disabled.
- For an inter-area clip operation, the clipped area must overlap the operation area; otherwise, an error code is returned. For an intra-area clip operation, the operation area cannot be completely overlaid with the clipped area; otherwise, an error code is returned. That is, the actually updated area cannot be blank.
- The CLUT reload flag needs to be marked when the color is extended from the CLUT to the RGB/AYCbCr for the first time.
- During the ROP operation, you can specify the color component and alpha component for the ROP operation by configuring the members enRopCode_Color and enRopCode_Alpha of TDE2_OPT_S respectively. For the ROP type, S1 indicates the background bitmap pstBackGround and S2 indicates the foreground bitmap pstForeGround.
- This MPI cannot be used to overlay the graphics and videos.

[Example]

None

HI_TDE2_PatternFill

[Purpose]

To fill a pattern.

[Syntax]

```
HI_S32 HI_TDE2_PatternFill(TDE_HANDLE s32Handle,
                           TDE2_SURFACE_S *pstBackGround,
                           TDE2_RECT_S *pstBackGroundRect,
                           TDE2_SURFACE_S *pstForeGround,
                           TDE2_RECT_S *pstForeGroundRect,
                           TDE2_SURFACE_S *pstDst,
                           TDE2_RECT_S *pstDstRect,
                           TDE2_PATTERN_FILL_OPT_S *pstOpt);
```

[Description]

When the specified area pstForeGroundRect of the foreground bitmap pstForeGround is tiled onto the specified area pstBackGroundRect of the background bitmap pstBackGround, the operations including colorkey, ROP, clipping, color extension, and bitmap format conversion can be implemented. The operation result is transferred to the specified area pstDstRect of the target bitmap pstDst. When the background bitmap is filled with the foreground bitmap, the specified area in the foreground bitmap is scaled and the foreground bitmap is tiled onto the entire specified area in the background bitmap. If the specified area in the foreground bitmap is larger than that in the background bitmap, the specified area in the foreground bitmap is automatically clipped.

- In single-source operation mode, the background bitmap and its specified area or the foreground bitmap and its specified area can be set to null. In this case, the foreground

bitmap or background bitmap can be tiled onto the specified area in the target bitmap. During the tile process, you can convert the bitmap format, extend or correct the bitmap color, or clip the output bitmap.

- In dual-source operation mode, when the specified area in the background bitmap is filled with the specified area in the foreground bitmap, an operation is performed on the two bitmaps, and the operation result is output to the specified area in the target bitmap. The double-source operations are as follows:
  - ROP between the foreground bitmap and the background bitmap
  - Alpha blending between the foreground bitmap and the background bitmap
  - Colorkey operation

[Parameter]

Parameter	Description	Input/Output
s32Handle	TDE job handle	Input
pstBackGround	Background bitmap	Input
pstBackGroundRect	Operation area in the background bitmap	Input
pstForeGround	Foreground bitmap	Input
pstForeGroundRect	Operation area in the foreground bitmap	Input
pstDst	Target bitmap	Input
pstDstRect	Operation area in the target bitmap	Input
pstOpt	Operation parameter settings	Input

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_ERR_TDE_NULL_PTR	The pointer of the input parameter is null.
HI_ERR_TDE_INVALID_HANDLE	The job handle is invalid.
HI_ERR_TDE_INVALID_PARA	The input parameter is invalid.
HI_ERR_TDE_NO_MEM	The memory fails to be allocated.
HI_ERR_TDE_NOT_ALIGNED	The position, width, height, or stride of the picture is not aligned as required.
HI_ERR_TDE_UNSUPPORTED_OPERATION	The operation is not supported.
HI_ERR_TDE_CLIP_AREA	The operation area does not overlap the clipped area.
HI_FAILURE	A system error or an unknown error occurs.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

- The following bitmap formats are supported:

Background Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, TDE2_COLOR_FMT_RABG8888, TDE2_COLOR_FMT_CLUT1, TDE2_COLOR_FMT_CLUT2, TDE2_COLOR_FMT_CLUT4, TDE2_COLOR_FMT_CLUT8, TDE2_COLOR_FMT_ACLUT44, TDE2_COLOR_FMT_ACLUT88, TDE2_COLOR_FMT_YCbCr888, TDE2_COLOR_FMT_AYCbCr8888, and TDE2_COLOR_FMT_YCbCr422
Foreground Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, TDE2_COLOR_FMT_RABG8888, TDE2_COLOR_FMT_CLUT1, TDE2_COLOR_FMT_CLUT2, TDE2_COLOR_FMT_CLUT4, TDE2_COLOR_FMT_CLUT8, TDE2_COLOR_FMT_ACLUT44, TDE2_COLOR_FMT_ACLUT88, TDE2_COLOR_FMT_YCbCr888, TDE2_COLOR_FMT_AYCbCr8888, and TDE2_COLOR_FMT_YCbCr422
Target Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, TDE2_COLOR_FMT_RABG8888, TDE2_COLOR_FMT_CLUT1, TDE2_COLOR_FMT_CLUT2, TDE2_COLOR_FMT_CLUT4, TDE2_COLOR_FMT_CLUT8, TDE2_COLOR_FMT_ACLUT44, TDE2_COLOR_FMT_ACLUT88, TDE2_COLOR_FMT_YCbCr888, TDE2_COLOR_FMT_AYCbCr8888, and

	TDE2_COLOR_FMT_YCbCr422

- Before calling this API, call HI_TDE2_Open to start the TDE device and call HI_TDE2_BeginJob to obtain a valid job handle.
- When the background bitmap is null:
  - The specified area in the foreground bitmap is clipped if the specified area in the foreground bitmap is larger than the specified area in the target bitmap.
  - The width and height of the foreground bitmap must be even numbers unless the width and height are 1. There is no such requirement when the background bitmap is not null.
- If the following conditions are met, the size of the specified area in the background bitmap must be the same as that of the specified area in the target bitmap
  - The width and height of the specified area in the background bitmap are less than or equal to the maximum width and height of the Background bitmap
  - The width and height of the specified area in the target bitmap are less than or equal to the maximum width and height of the target bitmap
- If the width or height of the specified area in the target bitmap is greater than the maximum width or height of the target bitmap, the specified area is automatically clipped.
- If the width or height of the foreground bitmap is greater than the maximum width or height of the foreground bitmap or the width or height of the background bitmap is greater than the maximum width or height of the background bitmap, the foreground bitmap or background bitmap is not clipped and the format filling fails.
- If the specified area in the foreground bitmap is larger than the specified area in the target bitmap, the specified area in the foreground bitmap is automatically clipped.
- If the pixel format of the background bitmap is CLUT, the pixel format of the target bitmap must be CLUT. If the pixel format of the background bitmap is not CLUT, the pixel format of the target bitmap cannot be CLUT.
- That is, if the background bitmap is in another pixel format, the target bitmap can be in a pixel format other than CLUT. In addition, the color spaces of the background and target bitmaps can be different.
- If both the foreground bitmap and background bitmap are not null, the operations including scaling, anti-flicker, and mirror are unavailable when the specified area in the background bitmap is filled with the specified area in the Foreground bitmap Other operations are the same as those performed on the two bitmaps during the Bitblit process.
- When you clip an area, note that the clipped area must overlap the operation area; otherwise, an error occurs.
- The CLUT reload flag needs to be marked when the color is extended from CLUT to RGB/AYCbCr for the first time.
- During the ROP operation, you can specify the color component and alpha component for the ROP operation by configuring the members enRopCode_Color and enRopCode_Alpha of TDE2_OPT_S respectively. For the ROP type, S1 indicates the background bitmap pstBackGround and S2 indicates the foreground bitmap pstForeGround.
- Scaling is not supported for this operation.

[Example]

None

HI_TDE2_MbBlit

[Purpose]

To add a transfer operation with additional functions performed on the macroblock bitmap to a TDE job. That is, the luminance macroblock data and the chrominance macroblock data are combined into raster data. During the combination, the scaling, anti-flicker, and clip operations can be performed concurrently.

[Syntax]

```
HI_S32 HI_TDE2_MbBlit(TDE_HANDLE s32Handle,
                      TDE2_MB_S *pstMB, TDE2_RECT_S *pstMbRect,
                      TDE2_SURFACE_S *pstDst, TDE2_RECT_S*pstDstRect,
                      TDE2_MBOPT_S *pstMbOpt);
```

[Description]

The luminance data and chrominance data of the specified area on the macroblock surface are combined into raster data and then output to the specified area on the destination surface. During the combination, the scaling function can be performed and the scaling mode is specified by the parameter enResize of pstMbOp. If scaling is not specified, the combined macroblock data is directly output to the destination surface and the excessive area is clipped. If the clip function is enabled, the clip and copy operations are performed. The anti-flicker function is also supported during the combination.

[Parameter]

Parameter	Description	Input/Output
s32Handle	TDE job handle	Input
pstMB	Surface of the macroblock	Input
pstMbRect	Operation area in the macroblock	Input
pstDst	Target bitmap	Input
pstDstRect	Operation area in the target bitmap	Input
pstMbOpt	Attributes of the macroblock operation	Input

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_ERR_TDE_NULL_PTR	The pointer of the input parameter is null.
HI_ERR_TDE_INVALID_HANDLE	The job handle is invalid.
HI_ERR_TDE_INVALID_PARA	The input parameter is invalid.
HI_ERR_TDE_NO_MEM	The memory fails to be allocated.
HI_ERR_TDE_MINIFICATION	The multiple of down scaling exceeds the limitation (the maximum value is 255).
HI_ERR_TDE_UNSUPPORTED_OPERATION	The operation is not supported.
HI_ERR_TDE_CLIP_AREA	The operation area does not overlap the clipped area.
HI_FAILURE	A system error or an unknown error occurs.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

- The following bitmap formats are supported:

Background Bitmap Format	TDE2_MB_COLOR_FMT_JPG_YCbCr400MBP, TDE2_MB_COLOR_FMT_JPG_YCbCr422MBHP, TDE2_MB_COLOR_FMT_JPG_YCbCr422MBVP, TDE2_MB_COLOR_FMT_MP1_YCbCr420MBP, TDE2_MB_COLOR_FMT_MP2_YCbCr420MBP, TDE2_MB_COLOR_FMT_MP2_YCbCr420MBI, TDE2_MB_COLOR_FMT_JPG_YCbCr420MBP, and TDE2_MB_COLOR_FMT_JPG_YCbCr444MBP
Target Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, TDE2_COLOR_FMT_RABG8888, TDE2_COLOR_FMT_YCbCr888, TDE2_COLOR_FMT_AYCbCr8888, and TDE2_COLOR_FMT_YCbCr422

- Before calling this API, call HI_TDE2_Open to start the TDE device and call HI_TDE2_BeginJob to obtain a valid job handle.
- For an YCbCr422 macroblock, if horizontal sampling is performed, the horizontal coordinate of the start point of the operation area must be an even number. This is no such restriction if vertical sampling is performed.

[Example]

None

HI_TDE2_SolidDraw

[Purpose]

To add a filling operation with additional functions performed on the raster bitmap to a TDE job. The functions of drawing a point, drawing a line, filling a color block, and filling a memory on the surface can be implemented.

[Syntax]

```
HI_S32 HI_TDE2_SolidDraw(TDE_HANDLE s32Handle,
                         TDE2_SURFACE_S *pstForeGround,
                         TDE2_RECT_S *pstForeGroundRect,
                         TDE2_SURFACE_S *pstDst,
                         TDE2_RECT_S *pstDstRect,
                         TDE2_FILLCOLOR_S *pstFillColor,
                         TDE2_OPT_S *pstOpt);
```

[Description]

This API is used to operate the operation area of the foreground surface and the fill color and then output the result to the operation area of the destination surface. The operation can be alpha blending or ROP operation, during which the clip operation is supported.

[Parameter]

Parameter	Description	Input/Output
s32Handle	TDE job handle	Input
pstForeGround	Foreground bitmap	Input
pstForeGroundRect	Operation area in the foreground bitmap	Input
pstDst	Target bitmap	Input
pstDstRect	Operation area in the target bitmap	Input
pstFillColor	Fill color	Input
pstOpt	Operation attributes	Input

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_ERR_TDE_NULL_PTR	The pointer of the input parameter is null.
HI_ERR_TDE_INVALID_HANDLE	The job handle is invalid.
HI_ERR_TDE_INVALID_PARA	The input parameter is invalid.
HI_ERR_TDE_NO_MEM	The memory fails to be allocated.
HI_ERR_TDE_NOT_ALIGNED	The position, width, height, or stride of the picture is not aligned as required.
HI_ERR_TDE_MINIFICATION	The multiple of down scaling exceeds the limitation (the maximum value is 255).
HI_ERR_TDE_UNSUPPORTED_OPERATION	The operation is not supported.

Error Code	Description
HI_ERR_TDE_CLIP_AREA	The operation area does not overlap the clipped area.
HI_FAILURE	A system error or an unknown error occurs.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

- The following bitmap formats are supported:

Background Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, TDE2_COLOR_FMT_RABG8888, TDE2_COLOR_FMT_YCbCr888, TDE2_COLOR_FMT_AYCbCr8888, and TDE2_COLOR_FMT_YCbCr422
Target Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, TDE2_COLOR_FMT_RABG8888, TDE2_COLOR_FMT_YCbCr888, TDE2_COLOR_FMT_AYCbCr8888, and TDE2_COLOR_FMT_YCbCr422

- Before calling this API, call HI_TDE2_Open to start the TDE device and call HI_TDE2_BeginJob to obtain a valid job handle.
- When the foreground bitmap and the parameter pstOpt are null, the single color fill function can be implemented by calling HI_TDE2_SolidDraw. In this case, the functions

of HI_TDE2_SolidDraw and HI_TDE2_QuickFill are the same. HI_TDE2_SolidDraw is called as follows:

```
HI_TDE2_SolidDraw(s32Handle,NULL,NULL,pstDst,pstDstRect,
pstFillColor,NULL);
```

- When the foreground bitmap is not null (pstOpt cannot be null in this case), HI_TDE2_SolidDraw can be used to perform scaling and anti-flicker operations on the specified area in the foreground bitmap, perform alpha blending or ROP operation on the same specified area and the fill color, and then output the result to the specified area in the target bitmap. HI_TDE2_SolidDraw is called as follows:

  ```
  HI_TDE2_SolidDraw(s32Handle, pstForeGround, pstForeGroundRect,
  pstDst, pstDstRect, pstFillColor, pstOpt);
  ```

  You can perform alpha blending on the filling color and a specified bitmap as well as the ROP, colorkey, output result mirroring, or clipping operation.

  - When the ROP operation is specified, the operated object S1 indicates the fill color and S2 indicates the Foreground bitmap
  - When the colorkey operation is specified, only the foreground bitmap supports this operation.
- To draw a rectangle, a vertical line, or a horizontal line by calling HI_TDE2_SolidDraw, you can set the width and height of the filled rectangle. For example, drawing a vertical line is to draw a rectangle with the width of one pixel.

[Example]

None

HI_TDE2_BitmapMaskRop

[Purpose]

To add a mask ROP operation performed on the raster bitmap to a TDE job. That is, the ROP operation is performed on the foreground bitmap and the background bitmap based on the Mask bitmap

[Syntax]

```
HI_S32 HI_TDE2_BitmapMaskRop(TDE_HANDLE s32Handle,
                             TDE2_SURFACE_S *pstBackGround,
                             TDE2_RECT_S *pstBackGroundRect,
                             TDE2_SURFACE_S *pstForeGround,
                             TDE2_RECT_S *pstForeGroundRect,
                             TDE2_SURFACE_S *pstMask,
                             TDE2_RECT_S *pstMaskRect,
                             TDE2_SURFACE_S *pstDst,
                             TDE2_RECT_S *pstDstRect,
                             TDE2_ROP_CODE_E enRopCode_Color,
                             TDE2_ROP_CODE_E enRopCode_Alpha);
```

[Description]

The mask bitmap must be an A1 bitmap. In a mask bitmap, the output value of the part indicated by the value 0 is the pixel value of the background bitmap, whereas the output value

of the part indicated by the value 1 is the result obtained after performing the ROP operation on the foreground bitmap and Background bitmap

The differences between the mask ROP operation and a common ROP operation are as follows:

- During a common ROP operation, the ROP operation is performed on all pixel points in the operation areas of the two pictures. That is, the ROP operation cannot be performed on only a part of the operation area (the background cannot be kept).
- A mask ROP operation is implemented through the construction of a proper Mask bitmap Part of the output picture is the ROP result of the foreground bitmap and background bitmap and part of the output picture is the background bitmap. In other words, the ROP result of the foreground bitmap and background bitmap is clipped. After constructing a mask bitmap, you can clip the picture in a random shape.

[Parameter]

Parameter	Description	Input/Output
s32Handle	TDE job handle	Input
pstBackGround	Background bitmap	Input
pstBackGroundRect	Operation area in the background bitmap	Input
pstForeGround	Foreground bitmap	Input
pstForeGroundRect	Operation area in the foreground bitmap	Input
pstMask	Mask bitmap	Input
pstMaskRect	Operation area in the mask bitmap	Input
pstDst	Target bitmap	Input
pstDstRect	Operation area in the target bitmap	Input
enRopCode_Color	ROP operation code of the color component	Input
enRopCode_Alpha	ROP operation code of the alpha component	Input

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.

Error Code	Description
HI_ERR_TDE_NULL_PTR	The pointer of the input parameter is null.
HI_ERR_TDE_INVALID_HANDLE	The job handle is invalid.
HI_ERR_TDE_INVALID_PARA	The input parameter is invalid.
HI_ERR_TDE_NO_MEM	The memory fails to be allocated.
HI_FAILURE	A system error or an unknown error occurs.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

- The following bitmap formats are supported:

Background Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, TDE2_COLOR_FMT_RABG8888, TDE2_COLOR_FMT_YCbCr888, TDE2_COLOR_FMT_AYCbCr8888, and TDE2_COLOR_FMT_YCbCr422
Foreground Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, TDE2_COLOR_FMT_RABG8888, TDE2_COLOR_FMT_CLUT1, TDE2_COLOR_FMT_CLUT2, TDE2_COLOR_FMT_CLUT4, TDE2_COLOR_FMT_CLUT8, TDE2_COLOR_FMT_ACLUT44, TDE2_COLOR_FMT_ACLUT88, TDE2_COLOR_FMT_YCbCr888, TDE2_COLOR_FMT_AYCbCr8888, and TDE2_COLOR_FMT_YCbCr422
Target Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, TDE2_COLOR_FMT_RABG8888, TDE2_COLOR_FMT_YCbCr888, TDE2_COLOR_FMT_AYCbCr8888, and TDE2_COLOR_FMT_YCbCr422

- Before calling this API, call HI_TDE2_Open to start the TDE device and call HI_TDE2_BeginJob to obtain a valid job handle.

- When you obtain the valid operation areas between the foreground bitmap, background bitmap, mask bitmap, or target bitmap and their corresponding operation areas, the size of the four valid operation areas must be the same.
- The mask bitmap must be an A1 bitmap.
- The target bitmap and the background bitmap must be in the same color space.
- For details about other restrictions, see HI_TDE2_Bitblit.
- The API requires a temporary buffer. When **the .ko driver** is loaded, the value of **g_u32TdeTmpBuf** must be set to the size of the foreground bitmap. For example, for the picture in ARGB8888 foreground format with the 720 x 576 resolution, **g_u32TdeTmpBuf** needs to be set to **1658880** (720 x 576 x 4).

NOTE

The valid operation area refers to the overlapped part of the specified operation area and the bitmap.

[Example]

None

HI_TDE2_BitmapMaskBlend

[Purpose]

To add a mask blending operation performed on the raster bitmap to a TDE job. That is, the blending operation is performed on the foreground bitmap and the background bitmap with the mask bitmap based on the Mask bitmap

[Syntax]

```
HI_S32 HI_TDE2_BitmapMaskBlend(TDE_HANDLE s32Handle,
                               TDE2_SURFACE_S *pstBackGround,
                               TDE2_RECT_S *pstBackGroundRect,
                               TDE2_SURFACE_S *pstForeGround,
                               TDE2_RECT_S *pstForeGroundRect,
                               TDE2_SURFACE_S *pstMask,
                               TDE2_RECT_S *pstMaskRect,
                               TDE2_SURFACE_S *pstDst,
                               TDE2_RECT_S *pstDstRect,
                               HI_U8 u8Alpha,
                               TDE2_ALUCMD_E enBlendMode);
```

[Description]

The mask bitmap must be an A1 bitmap. In a mask bitmap, the output value of the part indicated by the value 0 is the pixel value of the background bitmap, whereas the output value of the part indicated by the value 1 is the result obtained after performing the blending operation on the foreground bitmap and Background bitmap

The differences between the mask blending operation and a common blending operation are as follows:

- During a common blending operation, the blending operation is performed on all pixel points in the operation areas of the two pictures. That is, the blending operation cannot be performed on only a part of the operation area (the background cannot be kept).

- A mask blending operation is implemented through the construction of a proper Mask bitmap Part of the output picture is the blending result of the foreground bitmap and background bitmap and part of the output picture is the background bitmap. In other words, the blending result of the foreground bitmap and background bitmap is clipped. After constructing a mask bitmap, you can clip the picture in a random shape.

[Parameter]

Parameter	Description	Input/Output
s32Handle	TDE job handle	Input
pstBackGround	Background bitmap	Input
pstBackGroundRect	Operation area in the background bitmap	Input
pstForeGround	Foreground bitmap	Input
pstForeGroundRect	Operation area in the foreground bitmap	Input
pstMask	Mask bitmap	Input
pstMaskRect	Operation area in the mask bitmap	Input
pstDst	Target bitmap	Input
pstDstRect	Operation area in the target bitmap	Input
u8Alpha	Global alpha value during alpha blending	Input
enBlendMode	Alpha blending mode	Input

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_ERR_TDE_NULL_PTR	The pointer of the input parameter is null.
HI_ERR_TDE_INVALID_HANDLE	The job handle is invalid.
HI_ERR_TDE_INVALID_PARA	The input parameter is invalid.
HI_ERR_TDE_NO_MEM	The memory fails to be allocated.
HI_FAILURE	A system error or an unknown error occurs.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

- The following bitmap formats are supported:

Background Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, TDE2_COLOR_FMT_RABG8888, TDE2_COLOR_FMT_YCbCr888, TDE2_COLOR_FMT_AYCbCr8888, TDE2_COLOR_FMT_YCbCr422
Foreground Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, TDE2_COLOR_FMT_RABG8888, TDE2_COLOR_FMT_CLUT1, TDE2_COLOR_FMT_CLUT2, TDE2_COLOR_FMT_CLUT4, TDE2_COLOR_FMT_CLUT8, TDE2_COLOR_FMT_ACLUT44, TDE2_COLOR_FMT_ACLUT88, TDE2_COLOR_FMT_YCbCr888, TDE2_COLOR_FMT_AYCbCr8888, TDE2_COLOR_FMT_YCbCr422
Target Bitmap Format	TDE2_COLOR_FMT_RGB444, TDE2_COLOR_FMT_BGR444, TDE2_COLOR_FMT_RGB555, TDE2_COLOR_FMT_BGR555, TDE2_COLOR_FMT_RGB565, TDE2_COLOR_FMT_BGR565, TDE2_COLOR_FMT_RGB888, TDE2_COLOR_FMT_BGR888, TDE2_COLOR_FMT_ARGB4444, TDE2_COLOR_FMT_ABGR4444, TDE2_COLOR_FMT_RGBA4444, TDE2_COLOR_FMT_BGRA4444, TDE2_COLOR_FMT_ARGB1555, TDE2_COLOR_FMT_ABGR1555, TDE2_COLOR_FMT_RGBA1555, TDE2_COLOR_FMT_BGRA1555, TDE2_COLOR_FMT_ARGB8565, TDE2_COLOR_FMT_ABGR8565, TDE2_COLOR_FMT_RGBA8565, TDE2_COLOR_FMT_BGRA8565, TDE2_COLOR_FMT_ARGB8888, TDE2_COLOR_FMT_ABGR8888, TDE2_COLOR_FMT_RGBA8888, TDE2_COLOR_FMT_BGRA8888, TDE2_COLOR_FMT_RABG8888, TDE2_COLOR_FMT_YCbCr888, TDE2_COLOR_FMT_AYCbCr8888, TDE2_COLOR_FMT_YCbCr422

- Before calling this API, call HI_TDE2_Open to start the TDE and call HI_TDE2_BeginJob to obtain a valid job handle.
- The target and background bitmaps must be in the same color space.

- The Hi35xx supports the premultiplied mode. If the foreground bitmap is the premultiplied data, select the premultiplied mode for alpha blending; if not, select the non-premultiplied mode.
- The parameter enBlendMode cannot be set to TDE2_ALUCMD_ROP.
- When you obtain the valid operation areas between the foreground bitmap, background bitmap, mask bitmap, or target bitmap and their corresponding operation areas, the size of the four valid operation areas must be the same.
- The mask bitmap must be an A1 or A8 bitmap.
- For details about other restrictions, see HI_TDE2_Bitblit.
- The API requires a temporary buffer. When **the .ko driver** is loaded, the value of **g_u32TdeTmpBuf** must be set to the size of the foreground bitmap. For example, for the picture in ARGB8888 foreground format with the 720 x 576 resolution, **g_u32TdeTmpBuf** needs to be set to **1658880** (720 x 576 x 4).

[Example]

None

HI_TDE2_CancelJob

[Purpose]

To cancel a TDE job and the added operations.

[Syntax]

```
HI_S32 HI_TDE2_CancelJob(TDE_HANDLE s32Handle);
```

[Description]

When you add an operation to a TDE job, if errors such as invalid operation parameter occur and the program needs to be quit, you can call this API to cancel the TDE job and all operations.

[Parameter]

Parameter	Description	Input/Output
s32Handle	TDE job handle	Input

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_FAILURE	The specified job has been submitted and cannot be canceled.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

- Before calling this API, call HI_TDE2_Open to start the TDE device and call HI_TDE2_BeginJob to obtain a valid job handle.
- A submitted job cannot be canceled.
- A job becomes invalid after it is canceled. Therefore, no operation can be added to the job and the job cannot be submitted.
- If an error occurs when you add an operation (such as operation A) to a TDE job, you can process such problem by using either of the following methods:
  - Ignore operation A and add other operations to the TDE job, and then submit the job. If the job is run successfully, all operations that are successfully added are finished, and operation A is not performed because it fails to be added.
  - Cancel the job. Then all successfully added operations of the TDE job are canceled.

[Example]

```
/* declaration */
    HI_S32  s32Ret;
    TDE_HANDLE s32Handle;
    TDE2_SURFACE_S stSrc;
    TDE2_SURFACE_S stDst;
    TDE2_OPT_S stOpt = {0};

    /* create a TDE job */
    s32Handle = HI_API_TDE_BeginJob();
    if(HI_ERR_TDE_INVALID_HANDLE == s32Handle)
    {
        return -1;
    }

    /* add several commands to job successfully*/
...

    /* prepare arguments of bitblit command */

    /* if fail to add one more bitblt command to the job, cancel the job*/
```

```
s32Ret = HI_API_TDE_BitBlt(s32Handle, &stSrc, &stDst, &stOpt);
if(HI_SUCCESS != s32Ret)
{
    printf("add bitlit command failed!\n");
   HI_TDE2_CancleJob(s32Handle);
   return -1;
}
```

HI_TDE2_WaitForDone

[Purpose]

To wait for the completion of a specific TDE job.

[Syntax]

```
HI_S32 HI_TDE2_WaitForDone(TDE_HANDLE s32Handle);
```

[Description]

When you submit a TDE job in non-block mode, you can call this API to wait the completion of the job. This API is called in block mode.

After the TDE performs a non-block operation on a display buffer, the software performs operations on the display buffer. In this case, this MPI is called. This may result in the risk of performing operations on the same display buffer concurrently by the TDE and software. At this time, you can call this API to ensure that the TDE job is complete, and then perform operations by using software.

[Parameter]

Parameter	Description	Input/Output
s32Handle	TDE job handle	Input

[Return Value]

Return Value	Description
0	The specified TDE job is complete.
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
HI_ERR_TDE_INVALID_HANDLE	The job handle is invalid.

HI_ERR_TDE_QUERY_TIMEOUT	The specific job is not complete due to timeout.
HI_ERR_TDE_UNSUPPORTED_OPERATION	The operation is not supported.

[Requirement]

- Header file: hi_tde_api.h
- Library file: libtde.a

[Note]

- As a block interface, this API is used to block the job of waiting for the completion of a specified job.
- It is prohibited to wait for an unsubmitted job; otherwise, the error code HI_ERR_TDE_INVALID_HANDLE is returned.

[Example]

None

HI_TDE2_MultiBlending

[Purpose]

To add a transfer operation with additional functions performed on multiple graphics layers to a TDE job.

[Syntax]

```
HI_S32 HI_TDE2_MultiBlending(TDE_HANDLE s32Handle, TDE_SURFACE_LIST_S
*pstSurfaceList);
```

[Description]

This API is used to perform HI_TDE2_Bitblit operations on multiple graphics layers.

[Parameter]

Parameter	Description	Input/Output
s32Handle	TDE job handle	Input
pstSurfaceList	Attributes of multi-layer graphics	Input

[Return Value]

Return Value	Description
0	Success
Other values	Failure. Its value is an error code. For details, see chapter 4 "Error Codes."

[Error Code]

Error Code	Description
HI_ERR_TDE_DEV_NOT_OPEN	Fail to call the API because the TDE device is not started.
HI_ERR_TDE_NULL_PTR	The pointer of the input parameter is null.
HI_ERR_TDE_INVALID_HANDLE	The job handle is invalid.
HI_ERR_TDE_INVALID_PARA	The parameter value is invalid.
HI_ERR_TDE_NO_MEM	An operation fails to be added due to insufficient memory.
HI_ERR_TDE_MINIFICATION	The minification is too large.
HI_ERR_TDE_NOT_ALIGNED	The start address of the CLUT is not 4-byte-aligned.
HI_ERR_TDE_UNSUPPORTED_OPERATION	The operation is not supported.
HI_ERR_TDE_CLIP_AREA	The operation area does not overlap the clipped area, and no displayed information is updated.
HI_FAILURE	A system error or an unknown error occurs.

[Requirement]

- Header file: hi_tde_api.h
- LLibrary file: libtde.a

[Note]

See the **Note** field of HI_TDE2_Bitblit.

[Example]

None

3 Data Structures

3.1 Mapping Table

This chapter describes the data structures related to APIs, as shown in Table 3-1.

Table 3-1 TDE data structures

Data Structure	Description
TDE_HANDLE	Defines the TDE job handle
TDE_FUNC_CB	Defines the TDE callback function.
TDE2_COLOR_FMT_E	Defines the raster pixel format supported by the TDE.
TDE2_RECT_S	Defines the attributes of the operation area.
TDE2_ALUCMD_E	Defines the TDE logical operation type.
TDE2_ROP_CODE_E	Defines the ROP type supported by the TDE.
TDE2_COLORKEY_MODE_E	Defines the colorkey mode.
TDE2_COLORKEY_COMP_S	Defines the colorkey attributes of each color component.
TDE2_COLORKEY_U	Defines the attributes of the colorkey.
TDE2_CLIPMODE_E	Defines the clip mode.
TDE2_OUTALPHA_FROM_E	Defines the type of the alpha output source.
TDE2_DEFLICKER_MODE_E	Defines the configuration of the anti-flicker processing channel.
TDE_DEFLICKER_LEVEL_E	Defines the anti-flicker level.
TDE_COMPOSOR_S	Defines multi-layer graphics information.
TDE_SURFACE_LIST_S	Defines the multi-layer surface.
TDE2_BLEND_MODE_E	Defines the user-defined alpha blending mode.

Data Structure	Description
TDE2_BLENDCMD_E	Defines the alpha blending command.
TDE2_BLEND_OPT_S	Defines the alpha blending operation.
TDE2_PATTERN_FILL_OPT_S	Defines pattern filling information.
TDE2_FILTER_MODE_E	Defines the picture filtering mode.
TDE2_FILLCOLOR_S	Defines the attributes of the image fill colors.
TDE2_MIRROR_E	Defines the mirror attributes of a picture.
TDE2_SURFACE_S	Defines the surface of a bitmap.
TDE2_OPT_S	Defines the attributes of a TDE operation.
TDE2_MB_COLOR_FMT_E	Defines the macroblock format supported by the TDE.
TDE2_MB_S	Defines the basic attributes of a macroblock bitmap.
TDE2_MBRESIZE_E	Defines the calling mode of the macroblock format.
TDE2_MBOPT_S	Defines the attributes of the macroblock surface operation.
TDE2_CSC_OPT_S	Defines CSC options.

3.2 Data Structures

TDE_HANDLE

[Description]

Defines the TDE job handle

[Syntax]

```
typedef HI_S32 TDE_HANDLE;
```

[Member]

None

[Note]

None

[See Also]

None

TDE_FUNC_CB

[Description]

Defines the TDE callback function.

[Syntax]

```
typedef HI_VOID (* TDE_FUNC_CB) (HI_VOID *pParaml, HI_VOID *pParamr);
```

[Member]

Member	Description
pParaml	User-defined parameter
pParamr	User-defined parameter

[Note]

None

[See Also]

None

TDE2_COLOR_FMT_E

[Description]

Defines the pixel format supported by the TDE.

[Syntax]

```
typedef enum hiTDE2_COLOR_FMT_E
{
    TDE2_COLOR_FMT_RGB444 = 0,
    TDE2_COLOR_FMT_BGR444,
    TDE2_COLOR_FMT_RGB555,
    TDE2_COLOR_FMT_BGR555,
    TDE2_COLOR_FMT_RGB565,
    TDE2_COLOR_FMT_BGR565,
    TDE2_COLOR_FMT_RGB888,
    TDE2_COLOR_FMT_BGR888,
    TDE2_COLOR_FMT_ARGB4444,
    TDE2_COLOR_FMT_ABGR4444,
    TDE2_COLOR_FMT_RGBA4444,
    TDE2_COLOR_FMT_BGRA4444,
    TDE2_COLOR_FMT_ARGB1555,
    TDE2_COLOR_FMT_ABGR1555,
    TDE2_COLOR_FMT_RGBA1555,
    TDE2_COLOR_FMT_BGRA1555,
```

```
    TDE2_COLOR_FMT_ARGB8565,
    TDE2_COLOR_FMT_ABGR8565,
    TDE2_COLOR_FMT_RGBA8565,
    TDE2_COLOR_FMT_BGRA8565,
    TDE2_COLOR_FMT_ARGB8888,
    TDE2_COLOR_FMT_ABGR8888,
    TDE2_COLOR_FMT_RGBA8888,
    TDE2_COLOR_FMT_BGRA8888,
    TDE2_COLOR_FMT_RABG8888,
    TDE2_COLOR_FMT_CLUT1,
    TDE2_COLOR_FMT_CLUT2,
    TDE2_COLOR_FMT_CLUT4,
    TDE2_COLOR_FMT_CLUT8,
    TDE2_COLOR_FMT_ACLUT44,
    TDE2_COLOR_FMT_ACLUT88,
    TDE2_COLOR_FMT_A1,
    TDE2_COLOR_FMT_A8,
    TDE2_COLOR_FMT_YCbCr888,
    TDE2_COLOR_FMT_AYCbCr8888,
    TDE2_COLOR_FMT_YCbCr422,
    TDE2_COLOR_FMT_byte,
    TDE2_COLOR_FMT_halfword,
    TDE2_COLOR_FMT_JPG_YCbCr400MBP,
    TDE2_COLOR_FMT_JPG_YCbCr422MBHP,
    TDE2_COLOR_FMT_JPG_YCbCr422MBVP,
    TDE2_COLOR_FMT_MP1_YCbCr420MBP,
    TDE2_COLOR_FMT_MP2_YCbCr420MBP,
    TDE2_COLOR_FMT_MP2_YCbCr420MBI,
    TDE2_COLOR_FMT_JPG_YCbCr420MBP,
    TDE2_COLOR_FMT_JPG_YCbCr444MBP,
    TDE2_COLOR_FMT_BUTT
} TDE2_COLOR_FMT_E;
```

[Member]

Member	Description
TDE2_COLOR_FMT_RGB444	RGB444 format
TDE2_COLOR_FMT_BGR444	BGR444
TDE2_COLOR_FMT_RGB555	RGB555 format
TDE2_COLOR_FMT_BGR555	BGR555
TDE2_COLOR_FMT_RGB565	RGB565 format
TDE2_COLOR_FMT_BGR565	BGR565

Member	Description
TDE2_COLOR_FMT_RGB888	RGB888 format
TDE2_COLOR_FMT_BGR888	BGR888
TDE2_COLOR_FMT_ARGB4444	ARGB4444 format
TDE2_COLOR_FMT_ABGR4444	ABGR4444
TDE2_COLOR_FMT_RGBA4444	RGBA4444
TDE2_COLOR_FMT_BGRA4444	BGRA4444
TDE2_COLOR_FMT_ARGB1555	ARGB1555 format
TDE2_COLOR_FMT_ABGR1555	ABGR1555
TDE2_COLOR_FMT_RGBA1555	RGBA1555
TDE2_COLOR_FMT_BGRA1555	BGRA1555
TDE2_COLOR_FMT_ARGB8565	ARGB8565 format
TDE2_COLOR_FMT_ABGR8565	ABGR8565
TDE2_COLOR_FMT_RGBA8565	RGBA8565
TDE2_COLOR_FMT_BGRA8565	BGRA8565
TDE2_COLOR_FMT_ARGB8888	ARGB8888 format
TDE2_COLOR_FMT_ABGR8888	ABGR8888
TDE2_COLOR_FMT_RGBA8888	RGBA8888
TDE2_COLOR_FMT_BGRA8888	BGRA8888
TDE2_COLOR_FMT_RABG8888	RABG8888
TDE2_COLOR_FMT_CLUT1	CLUT1 format
TDE2_COLOR_FMT_CLUT2	CLUT2
TDE2_COLOR_FMT_CLUT4	CLUT4 format
TDE2_COLOR_FMT_CLUT8	CLUT8 format
TDE2_COLOR_FMT_ACLUT44	ACLUT44 format
TDE2_COLOR_FMT_ACLUT88	ACLUT88 format
TDE2_COLOR_FMT_A1	A1 format
TDE2_COLOR_FMT_A8	A8 format
TDE2_COLOR_FMT_YCbCr888	YCbCr888 format
TDE2_COLOR_FMT_AYCbCr8888	AYCbCr8888 format
TDE2_COLOR_FMT_YCbCr422	YCbCr422 format
TDE2_COLOR_FMT_byte	Byte format

Member	Description
TDE2_COLOR_FMT_halfword	Halfword format
TDE2_COLOR_FMT_JPG_YCbCr400MBP	YCbCr400MBP
TDE2_COLOR_FMT_JPG_YCbCr422MBHP	YCbCr422MBHP
TDE2_COLOR_FMT_JPG_YCbCr422MBVP	YCbCr422MBVP
TDE2_COLOR_FMT_MP1_YCbCr420MBP	YCbCr420MBP
TDE2_COLOR_FMT_MP2_YCbCr420MBP	YCbCr420MBP
TDE2_COLOR_FMT_MP2_YCbCr420MBI	YCbCr420MBI
TDE2_COLOR_FMT_JPG_YCbCr420MBP	YCbCr420MBP
TDE2_COLOR_FMT_JPG_YCbCr444MBP	YCbCr444MBP
TDE_COLOR_FMT_BUTT	Invalid

[Note]

- The target format cannot be TDE2_COLOR_FMT_YCbCr400MBP, TDE2_COLOR_FMT_YCbCr422MBHP, TDE2_COLOR_FMT_YCbCr422MBVP, TDE2_COLOR_FMT_YCbCr420MBP, TDE2_COLOR_FMT_YCbCr420MBI, and TDE2_COLOR_FMT_YCbCr444MBP.
- TDE2_COLOR_FMT_A1, TDE2_COLOR_FMT_A8, and TDE2_COLOR_FMT_byte support only DMA transfer and cannot be transformed into other formats.
- When the output is in a CLUT format, the input must also in the same CLUT format, and only the copy operation is supported. The two source bitmaps for the dual-source operation cannot be in CLUT formats at the same time.

[See Also]

None

TDE2_RECT_S

[Description]

Defines the attributes of the operation area of the TDE.

[Syntax]

```
typedef struct hiTDE2_RECT_S
{
    HI_S32 s32Xpos;
    HI_S32 s32Ypos;
    HI_U32 u32Width;
    HI_U32 u32Height;
} TDE2_RECT_S;
```

[Member]

Member	Description
s32Xpos	Start horizontal coordinate of the operation area (in pixel) Valid range: [0, bitmap width)
s32Ypos	Start vertical coordinate of the operation area (in pixel) Valid range: [0, bitmap height)
u32Width	Width of the operation area (in pixel) Valid range: (0, 0xFFF]
u32Height	Height of the operation area (in pixel) Valid range: (0, 0xFFF]

[Note]

- For the details about the relationships between bitmaps and operation areas, see Figure 2-1.
- If an operation area overlaps a bitmap, the overlapped area is served as the actual operation area; if an operation area does not overlap a bitmap, an error code is returned.

[See Also]

None

TDE2_ALUCMD_E

[Description]

Defines the attributes of the logical operation types.

[Syntax]

```
typedef enum hiTDE2_ALUCMD_E
{
    TDE2_ALUCMD_NONE = 0,
    TDE2_ALUCMD_BLEND,
    TDE2_ALUCMD_ROP,
    TDE2_ALUCMD_COLORIZE,
    TDE2_ALUCMD_BUTT
} TDE2_ALUCMD_E;
```

[Member]

Member	Description
TDE2_ALUCMD_NONE	No logical operation
TDE2_ALUCMD_BLEND	Alpha blending type
TDE2_ALUCMD_ROP	Boolean operation type
TDE2_ALUCMD_COLORIZE	Colorize operation

Member	Description
TDE2_ALUCMD_BUTT	Invalid

[Note]

- To perform the alpha blending operation on two bitmaps, select TDE2_ALUCMD_BLEND; to perform the colorize operation, select TDE2_ALUCMD_COLORIZE.
- If TDE2_ALUCMD_ROP is selected, the boolean logical operation is performed. You can specify the members enRopCode_Color and enRopCode_Alpha of TDE2_OPT_S to specify the ROP types of the color component and the alpha component.

[See Also]

None

TDE2_ROP_CODE_E

[Description]

Defines the ROP type supported by the TDE.

[Syntax]

```
typedef enum hiTDE2_ROP_CODE_E
{
    TDE2_ROP_BLACK = 0,         /*Blackness*/
    TDE2_ROP_NOTMERGEPEN,      /*~(S2+S1)*/
    TDE2_ROP_MASKNOTPEN,        /*~S2&S1*/
    TDE2_ROP_NOTCOPYPEN,        /* ~S2*/
    TDE2_ROP_MASKPENNOT,        /* S2&~S1 */
    TDE2_ROP_NOT,               /* ~S1 */
    TDE2_ROP_XORPEN,            /* S2^S1 */
    TDE2_ROP_NOTMASKPEN,        /* ~(S2&S1) */
    TDE2_ROP_MASKPEN,           /* S2&S1 */
    TDE2_ROP_NOTXORPEN,         /* ~(S2^S1) */
    TDE2_ROP_NOP,               /* S1 */
    TDE2_ROP_MERGENOTPEN,       /* ~S2+S1 */
    TDE2_ROP_COPYPEN,           /* S2 */
    TDE2_ROP_MERGEPENNOT,       /* S2+~S1 */
    TDE2_ROP_MERGEPEN,          /* S2+S1 */
    TDE2_ROP_WHITE,             /* Whiteness */
    TDE2_ROP_BUTT
} TDE2_ROP_CODE_E;
```

[Member]

Member	Description
TDE2_ROP_BLACK	Blackness
TDE2_ROP_NOTMERGEPEN	~(S2+S1)
TDE2_ROP_MASKNOTPEN	~S2&S1
TDE2_ROP_NOTCOPYPEN	~S2
TDE2_ROP_MASKPENNOT	S2&~S1
TDE2_ROP_NOT	~S1
TDE2_ROP_XORPEN	S2^S1
TDE2_ROP_NOTMASKPEN	~(S2&S1)
TDE2_ROP_MASKPEN	S2&S1
TDE2_ROP_NOTXORPEN	~(S2^S1)
TDE2_ROP_NOP	S1
TDE2_ROP_MERGENOTPEN	~S2+S1
TDE2_ROP_COPYPE	S2
TDE2_ROP_MERGEPENNOT	S2+~S1
TDE2_ROP_MERGEPEN	S2+S1
TDE2_ROP_WHITE	Whiteness
TDE_ROP_BUTT	Invalid

NOTE

S1 indicates bitmap 1 and S2 indicates bitmap 2.

[Note]

The bitmaps indicated by S1 and S2 vary according to operations. For details, see the description of each API. If the operation type for two bitmaps is set to TDE2_ALUCMD_ROP, different ROP operations can be specified for the color space and alpha. Assume that the foreground bitmap and background bitmap are in ARGB8888 format, the pixel value of the foreground bitmap is foreground, the pixel value of the background bitmap is background, the pixel value after operation is pixel, the ROP operation for alpha is whiteness, and the ROP operation for the color space is blackness. Then the pixel values after operation are as follows:

- pixel.alpha = 0xff
- pixel.r = pixel.g = pixel.b = 0x00

where **pixel.alpha**, **pixel.r**, **pixel.g**, and **pixel.b** indicate the bitmap components after operation.

[See Also]

None

TDE2_COLORKEY_MODE_E

[Description]

Defines the attributes of the colorkey mode of the TDE.

[Syntax]

```
typedef enum hiTDE2_COLORKEY_MODE_E
{
    TDE2_COLORKEY_MODE_NONE = 0,
    TDE2_COLORKEY_MODE_FOREGROUND,
    TDE2_COLORKEY_MODE_BACKGROUND,
    TDE2_COLORKEY_MODE_BUTT
} TDE2_COLORKEY_MODE_E;
```

[Member]

Member	Description
TDE2_COLORKEY_MODE_NONE	Do not perform the colorkey operation.
TDE2_COLORKEY_MODE_FOREGROUND	Perform the colorkey operation on the Foreground bitmap
TDE2_COLORKEY_MODE_BACKGROUND	Perform the colorkey operation on the Background bitmap
TDE2_COLORKEY_MODE_BUTT	Invalid

[Note]

When performing the colorkey operation on the foreground bitmap, the TDE performs this operation before the CLUT for color extension and performs this operation after the CLUT for color correction.

[See Also]

None

TDE2_COLORKEY_COMP_S

[Description]

Defines the colorkey attributes of each color component.

[Syntax]

```
typedef struct hiTDE2_COLORKEY_COMP_S
{
    HI_U8 u8CompMin;          /*Minimum colorkey of a component.*/
    HI_U8 u8CompMax;          /*Maximum colorkey of a component.*/
    HI_U8 bCompOut;           /*The colorkey of a component is within or out
of the range.*/
```

```
    HI_U8 bCompIgnore;      /*Whether to ignore a component.*/
    HI_U8 u8CompMask;        /**<Component mask*/
    HI_U8 u8Reserved;
    HI_U8 u8Reserved1;
    HI_U8 u8Reserved2;
} TDE2_COLORKEY_COMP_S;
```

[Member]

Member	Description
u8CompMin	Minimum colorkey of a component
u8CompMax	Maximum colorkey of a component
bCompOut	The colorkey of a component is within or out of the range.
bCompIgnore	Whether to ignore a component
u8CompMask	Component mask
u8Reserved–u8Reserved2	Reserved

[Note]

- The member **bCompIgnore** specifies whether to ignore a component during colorkey comparison and considers that the component always meets the colorkey requirements.
  - If **bCompIgnore** is set to **TRUE**, a component is ignored during colorkey comparison and it is considered that the component always meets the colorkey requirements.
  - If **bCompIgnore** is set to **FALSE**, the TDE checks whether the component meets the colorkey requirements based on the [minimum colorkey, maximum colorkey] and the value of **bCompOut**.
- The member **u8CompMask** determines the valid bits of components. That is, components and **u8CompMask** are involved in operations. If **u8CompMask** is **0**, the component value is **0**; if **u8CompMask** is **0xFF**, the component value is that of the current pixel. The same rule applies to other values.

[See Also]

None

TDE2_COLORKEY_U

[Description]

Defines the attributes of the colorkey.

[Syntax]

```
typedef union hiTDE2_COLORKEY_U
{
```

```
    struct
    {
        TDE2_COLORKEY_COMP_S stAlpha;
        TDE2_COLORKEY_COMP_S stRed;
        TDE2_COLORKEY_COMP_S stGreen;
        TDE2_COLORKEY_COMP_S stBlue;
    } struCkARGB;
    struct
    {
        TDE2_COLORKEY_COMP_S stAlpha;
        TDE2_COLORKEY_COMP_S stY;
        TDE2_COLORKEY_COMP_S stCb;
        TDE2_COLORKEY_COMP_S stCr;
    } struCkYCbCr;
    struct
    {
        TDE2_COLORKEY_COMP_S stAlpha;
        TDE2_COLORKEY_COMP_S stClut;
    } struCkClut;
} TDE2_COLORKEY_U;
```

[Member]

The member struCkARGB indicates the colorkey attributes of each component when the bitmap is in the ARGB format.

Member	Description
stAlpha	Colorkey attributes of the alpha component
stRed	Colorkey attributes of the R component
stGreen	Colorkey attributes of the G component
stBlue	Colorkey attributes of the B component

The member struCkYCbCr indicates the colorkey attributes of each component when the bitmap is in the AYCbCr format.

Member	Description
stAlpha	Colorkey attributes of the alpha component
stY	Colorkey attributes of the Y component
stCb	Colorkey attributes of the Cb component
stCr	Colorkey attributes of the Cr component

The member **struCkClut** indicates the colorkey attributes of each component when the bitmap is in the CLUT format.

Member	Description
stAlpha	Colorkey attributes of the alpha component
stClut	Colorkey attributes of the CLUT component

The member TDE2_COLORKEY_U indicates the colorkey attributes of each component.

Member	Description
struCkARGB	Colorkey attributes when the bitmap is in the ARGB format
struCkYCbCr	Colorkey attributes when the bitmap is in the AYCbCr format
struCkClut	Colorkey attributes when the bitmap is in the CLUT format

[Note]

Regardless of the format of the current bitmap, the maximum and minimum values of the color space must be in ARGB8888 format.

[See Also]

None

TDE2_CLIPMODE_E

[Description]

Defines the clip mode.

[Syntax]

```
typedef enum hiTDE2_CLIPMODE_E
{
    TDE2_CLIPMODE_NONE = 0,
    TDE2_CLIPMODE_INSIDE,
    TDE2_CLIPMODE_OUTSIDE,
    TDE2_CLIPMODE_BUTT
} TDE2_CLIPMODE_E;
```

[Member]

Member	Description
TDE2_CLIPMODE_NONE	No clip for the output result
TDE2_CLIPMODE_INSIDE	Intra-area clip mode
TDE2_CLIPMODE_OUTSIDE	Extra-area clip mode

Member	Description
TDE2_CLIPMODE_BUTT	Invalid

[Note]

None

[See Also]

None

TDE2_OUTALPHA_FROM_E

[Description]

Defines the type of the alpha output source.

[Syntax]

```
typedef enum hiTDE2_OUTALPHA_FROM_E
{
    TDE2_OUTALPHA_FROM_NORM = 0,
    TDE2_OUTALPHA_FROM_BACKGROUND,
    TDE2_OUTALPHA_FROM_FOREGROUND,
    TDE2_OUTALPHA_FROM_GLOBALALPHA,
    TDE2_OUTALPHA_FROM_BUTT
} TDE2_OUTALPHA_FROM_E;
```

[Member]

Member	Description
TDE2_OUTALPHA_FROM_NORM	The alpha value of the output picture is derived from the result of the alpha blending or anti-flicker operation.
TDE2_OUTALPHA_FROM_BACKGROUND	The alpha value of the output picture is derived from the Background bitmap
TDE2_OUTALPHA_FROM_FOREGROUND	The alpha value of the output picture is derived from the Foreground bitmap
TDE2_OUTALPHA_FROM_GLOBALALPHA	The alpha value of the output picture is derived from the global alpha value.

[Note]

None

[See Also]

None

TDE2_DEFLICKER_MODE_E

[Description]

Defines the configuration of the anti-flicker processing channel.

[Syntax]

```
typedef enum hiTDE2_DEFLICKER_MODE_E
{
    TDE2_DEFLICKER_MODE_NONE = 0,
    TDE2_DEFLICKER_MODE_RGB,
    TDE2_DEFLICKER_MODE_BOTH,
    TDE2_DEFLICKER_MODE_BUTT
}TDE2_DEFLICKER_MODE_E;
```

[Member]

Member	Description
TDE2_DEFLICKER_MODE_NONE	No anti-flicker
TDE2_DEFLICKER_MODE_RGB	Anti-flicker on RGB component
TDE2_DEFLICKER_MODE_BOTH	Anti-flicker on alpha component
TDE2_DEFLICKER_MODE_BUTT	Invalid

[Note]

None

[See Also]

None

TDE_DEFLICKER_LEVEL_E

[Description]

Defines the anti-flicker level.

[Syntax]

```
typedef enum hiTDE_DEFLICKER_LEVEL_E
{
    TDE_DEFLICKER_AUTO = 0,
    TDE_DEFLICKER_LOW,
    TDE_DEFLICKER_MIDDLE,
    TDE_DEFLICKER_HIGH,
```

```
    TDE_DEFLICKER_BUTT
}TDE_DEFLICKER_LEVEL_E;
```

[Member]

Member	Description
TDE_DEFLICKER_AUTO	Adaptation. The anti-flicker coefficient is selected by the TDE.
TDE_DEFLICKER_LOW	Low-level anti-flicker
TDE_DEFLICKER_MIDDLE	Medium-level anti-flicker
TDE_DEFLICKER_HIGH	Intermediate-level anti-flicker
TDE_DEFLICKER_BUTT	Invalid

[Note]

None

[See Also]

None

TDE_COMPOSOR_S

[Description]

Defines multi-layer graphics information.

[Syntax]

```
typedef struct hiTDE_COMPOSOR_S
{
    TDE2_SURFACE_S stSrcSurface;
    TDE2_RECT_S stInRect;
    TDE2_RECT_S stOutRect;
    TDE2_OPT_S stOpt;
    HI_S32 s32HorizonOffset;
    HI_S32 s32VerticalOffset;
} TDE_COMPOSOR_S;
```

[Member]

Member	Description
stSrcSurface	Structure of the user-defined bitmap information
stInRect	Operation area of the input source
stOutRect	Operation area of the output source
stOpt	Operation option

Member	Description
s32HorizonOffset	Horizontal offset
s32VerticalOffset	Vertical offset

[Note]

None

[See Also]

None

TDE_SURFACE_LIST_S

[Description]

Defines the multi-layer surface.

[Syntax]

```
typedef struct hiTDE_SURFACE_LIST_S
{
    HI_U32 u32SurfaceNum;
    TDE2_SURFACE_S *pDstSurface;
    TDE_COMPOSOR_S *pstComposor;
}TDE_SURFACE_LIST_S;
[Member]
```

Member	Description
u32SurfaceNum	Number of graphics layers
pDstSurface	Target surface
pstComposor	Multi-layer operation surface

[Note]

None

[See Also]

None

TDE2_BLEND_MODE_E

[Description]

Defines the user-defined alpha blending mode.

[Syntax]

```
typedef enum hiTDE2_BLEND_MODE_E
```

```
{
    TDE2_BLEND_ZERO = 0x0,
    TDE2_BLEND_ONE,
    TDE2_BLEND_SRC2COLOR,
    TDE2_BLEND_INVSRC2COLOR,
    TDE2_BLEND_SRC2ALPHA,
    TDE2_BLEND_INVSRC2ALPHA,
    TDE2_BLEND_SRC1COLOR,
    TDE2_BLEND_INVSRC1COLOR,
    TDE2_BLEND_SRC1ALPHA,
    TDE2_BLEND_INVSRC1ALPHA,
    TDE2_BLEND_SRC2ALPHASAT,
    TDE2_BLEND_BUTT
}TDE2_BLEND_MODE_E;
```

[Member]

Pixel = (Foreground x fs + Background x fd)

where

- fs: foreground blend coefficient
- fd: destination blend coefficient
- Pixel: pixel value after operation
- Foreground: pixel value of the foreground bitmap
- Background: pixel value of the background bitmap
- sa: foreground alpha
- da: background alpha
- sc: foreground color
- dc: background color
- fs and fd: pixel coefficients of the source bitmap and target bitmap respectively. Each member indicates a coefficient.

Member	Description
TDE2_BLEND_ZERO	0
TDE2_BLEND_ONE	1
TDE2_BLEND_SRC2COLOR	sc
TDE2_BLEND INVSRC2COLOR	1 – sc
TDE2_BLEND SRC2ALPHA	sa
TDE2_BLEND INVSRC2ALPHA	1 – sa

Member	Description
TDE2_BLEND SRC1COLOR	dc
TDE2_BLEND INVSRC1COLOR	1 – dc
TDE2_BLEND SRC1ALPHA	da
TDE2_BLEND INVSRC1ALPHA	1-da
TDE2_BLEND SRC2ALPHASAT	min(1 – da, sa) + 1
TDE2_BLEND_BUTT	Invalid

[Note]

When alpha blending is performed on the foreground bitmap and background bitmap, the blending mode of the Src1 channel and Src2 channel can be independently set. Currently, eleven blending modes are supported. When TDE2_BLENDCMD_E is set to TDE2_BLENDCMD_CONFIG, you can select the blending mode by setting TDE2_BLEND_MODE_E.

[See Also]

None

TDE2_BLENDCMD_E

[Description]

Defines the alpha blending command. This command is used to calculate the pixel value after alpha blending.

[Syntax]

```
typedef  enum  hiTDE2_BLENDCMD_E
{
    TDE2_BLENDCMD_NONE = 0x0,
    TDE2_BLENDCMD_CLEAR,
    TDE2_BLENDCMD_SRC,
    TDE2_BLENDCMD_SRCOVER,
    TDE2_BLENDCMD_DSTOVER,
     TDE2_BLENDCMD_SRCIN,
     TDE2_BLENDCMD_DSTIN,
    TDE2_BLENDCMD_SRCOUT,
    TDE2_BLENDCMD_DSTOUT,
    TDE2_BLENDCMD_SRCATOP,
    TDE2_BLENDCMD_DSTATOP,
```

```
    TDE2_BLENDCMD_ADD,
    TDE2_BLENDCMD_XOR,
    TDE2_BLENDCMD_DST,
    TDE2_BLENDCMD_CONFIG,
    TDE2_BLENDCMD_BUTT
}TDE2_BLENDCMD_E
```

[Member]

Pixel = (Foreground x fs + Background x fd)

where,

- fs: foreground blend coefficient
- fd: destination blend coefficient
- Pixel: pixel value after operation
- Foreground: pixel value of the foreground bitmap
- Background: pixel value of the background bitmap
- sa: foreground alpha
- da: background alpha

Member	Description
TDE2_BLENDCMD_NONE	fs is valued at sa and fd is valued at (1.0 – sa).
TDE2_BLENDCMD_CLEAR	Both fs and fd are valued at 0.0.
TDE2_BLENDCMD_SRC	fs is valued at 1.0 and fd is valued at 0.0.
TDE2_BLENDCMD_SRCOVER	fs is valued at 1.0 and fd is valued at (1.0 – sa).
TDE2_BLENDCMD_DSTOVER	fs is valued at (1.0 – da) and fd is valued at 1.0.
TDE2_BLENDCMD_SRCIN	fs is valued at da and fd is valued at 0.0.
TDE2_BLENDCMD_DSTIN	fs is valued at 0.0 and fd is valued at sa.
TDE2_BLENDCMD_SRCOUT	fs is valued at (1.0 – da) and fd is valued at 0.0.
TDE2_BLENDCMD_DSTOUT	fs is valued at 0.0 and fd is valued at (1.0 – sa).
TDE2_BLENDCMD_SRCATOP	fs is valued at da and fd is valued at (1.0 – sa).
TDE2_BLENDCMD_DSTATOP	fs is valued at (1.0 – da) and fd is valued at sa.
TDE2_BLENDCMD_ADD	Both fs and fd are valued at 1.0.
TDE2_BLENDCMD_XOR	fs is valued at (1.0 – da) and fd is valued at (1.0 – sa).
TDE2_BLENDCMD_DST	fs is valued at 0.0 and fd is valued at 1.0.
TDE2_BLENDCMD_CONFIG	User-defined configuration
TDE2_BLENDCMD_BUTT	Invalid

[Note]

None

[See Also]

None

TDE2_BLEND_OPT_S

[Description]

Defines the alpha blending operation.

[Syntax]

```
typedef struct hiTDE2_BLEND_OPT_S
{
    HI_BOOL  bGlobalAlphaEnable;
    HI_BOOL  bPixelAlphaEnable;
    HI_BOOL bSrc1AlphaPremulti;
    HI_BOOL bSrc2AlphaPremulti;
    TDE2_BLENDCMD_E eBlendCmd;
    TDE2_BLEND_MODE_E eSrc1BlendMode;
    TDE2_BLEND_MODE_E eSrc2BlendMode;
}TDE2_BLEND_OPT_S;
```

[Member]

Member	Description
bGlobalAlphaEnable	Global alpha enable
bPixelAlphaEnable	Pixel alpha enable
bSrc1AlphaPremulti	Src1 alpha premultiply enable
bSrc2AlphaPremulti	Src2 alpha premultiply enable
eBlendCmd	Alpha blending command
eSrc1BlendMode	Src1 blending mode select. It is valid when eBlendCmd is set to TDE2_BLENDCMD_CONFIG.
eSrc2BlendMode	Src2 blending mode select. It is valid when eBlendCmd is set to TDE2_BLENDCMD_CONFIG.

[Note]

None

[See Also]

None

TDE2_PATTERN_FILL_OPT_S

[Description]

Defines the pattern filling information.

[Syntax]

```
typedef struct hiTDE2_PATTERN_FILL_OPT_S
{
    TDE2_ALUCMD_E enAluCmd;
    TDE2_ROP_CODE_E enRopCode_Color;
    TDE2_ROP_CODE_E enRopCode_Alpha;
    TDE2_COLORKEY_MODE_E enColorKeyMode;
    TDE2_COLORKEY_U unColorKeyValue;
    TDE2_CLIPMODE_E enClipMode;
    TDE2_RECT_S stClipRect;
    HI_BOOL bClutReload;
    HI_U8 u8GlobalAlpha;
    TDE2_OUTALPHA_FROM_E enOutAlphaFrom;
    HI_U32 u32Colorize;
    TDE2_BLEND_OPT_S stBlendOpt;
    TDE2_CSC_OPT_S stCscOpt;
}TDE2_PATTERN_FILL_OPT_S;
```

[Member]

Member	Description
enAluCmd	Logical operation type
enRopCode_Color	ROP type of the color space
enRopCode_Alpha	ROP type of the alpha
enColorKeyMode	Colorkey mode
unColorKeyValue	Colorkey value
enClipMode	Clip mode
stClipRect	Clipped area
bClutReload	Whether to reload the CLUT
u8GlobalAlpha	Global alpha
enOutAlphaFrom	Alpha output source
u32Colorize	Colorize value

Member	Description
stBlendOpt	Blending option
stCscOpt	CSC parameter option

[Note]

None

[See Also]

None

TDE2_FILTER_MODE_E

[Description]

Defines the picture filtering mode.

[Syntax]

```
typedef enum hiTDE2_FILTER_MODE_E
{
    TDE2_FILTER_MODE_COLOR = 0,
    TDE2_FILTER_MODE_ALPHA,
    TDE2_FILTER_MODE_BOTH,
    TDE2_FILTER_MODE_NONE,
    TDE2_FILTER_MODE_BUTT
} TDE2_FILTER_MODE_E;
```

[Member]

Member	Description
TDE2_FILTER_MODE_COLOR	Filter the color.
TDE2_FILTER_MODE_ALPHA	Filter the alpha channel.
TDE2_FILTER_MODE_BOTH	Filter the color and alpha channel concurrently.
TDE2_FILTER_MODE_NONE	No filtering
TDE2_FILTER_MODE_BUTT	Invalid

[Note]

The picture scaling or anti-flicker operation is a filtering operation. Therefore, you need to specify the filtering mode before performing the scaling or/and anti-flicker operations.

[See Also]

None

TDE2_FILLCOLOR_S

[Description]

Defines the attributes of the picture fill colors.

[Syntax]

```
typedef struct hiTDE2_FILLCOLOR_S
{
    TDE2_COLOR_FMT_E enColorFmt;
    HI_U32           u32FillColor;
} TDE2_FILLCOLOR_S;
```

[Member]

Member	Description
enColorFmt	Format of the fill color
u32FillColor	Fill value

[Note]

The fill value must match the format of the fill color. For example, if you want to fill blue in a bitmap, you can specify the format of the fill color to ARGB15555 and set the fill value to 0x801F (the alpha bit is 1).

[See Also]

None

TDE2_MIRROR_E

[Description]

Defines the mirror attributes of a picture.

[Syntax]

```
typedef enum hiTDE2_MIRROR_E
{
    TDE2_MIRROR_NONE = 0,
    TDE2_MIRROR_HORIZONTAL,
    TDE2_MIRROR_VERTICAL,
    TDE2_MIRROR_BOTH,
    TDE2_MIRROR_BUTT
} TDE2_MIRROR_E
```

[Member]

Member	Description
TDE2_MIRROR_NONE	Do not perform the mirror operation on the output picture.
TDE2_MIRROR_HORIZONTAL	Perform the horizontal mirror operation on the output picture.
TDE2_MIRROR_VERTICAL	Perform the vertical mirror operation on the output picture.
TDE2_MIRROR_BOTH	Perform the horizontal and vertical mirror operations on the output picture concurrently.
TDE2_MIRROR_BUTT	Invalid

[Note]

None

[See Also]

None

TDE2_SURFACE_S

[Description]

Defines the surface of a bitmap.

[Syntax]

```
typedef struct hiTDE2_SURFACE_S
{
    HI_U32 u32PhyAddr;
    TDE2_COLOR_FMT_E enColorFmt;
    HI_U32 u32Height;
    HI_U32 u32Width;
    HI_U32 u32Stride;
    HI_U8* pu8ClutPhyAddr;
    HI_BOOL bYCbCrClut;
    HI_BOOL bAlphaMax255;
    HI_BOOL bAlphaExt1555;
    HI_U8 u8Alpha0;
    HI_U8 u8Alpha1;
    HI_U32 u32CbCrPhyAddr;
    HI_U32 u32CbCrStride;
} TDE2_SURFACE_S;
```

[Member]

Member	Description
u32PhyAddr	Start address of a bitmap
enColorFmt	Bitmap format
u16Height	Bitmap height
u16Width	Bitmap width
u16Stride	Bitmap stride
pu8ClutPhyAddr	Start address of the CLUT, for color extension or color correction
bYCbCrClut	Whether the CLUT is in the YCbCr space
bAlphaMax255	The maximum alpha value of a bitmap is 255 or 128.
bAlphaExt1555	Whether to enable the alpha extension of an ARGB1555 bitmap The parameter is valid if the bitmap is in the ARGB1555 format.
u8Alpha0	Alpha0 value Value range: [0, 255] The parameter is valid if the bitmap is in the ARGB1555 format and bAlphaExt1555 is set to TRUE. When the format is ARGB1555, if the most significant bit (MSB) of the pixel is 0, the alpha0 value is selected as the alpha value for alpha blending.
u8Alpha1	Alpha1 value Value range: [0, 255] The parameter is valid if the bitmap is in the ARGB1555 format and bAlphaExt1555 is set to TRUE. When the format is ARGB1555, if the MSB of the pixel is 1, the alpha1 value is selected as the alpha value for alpha blending.
u32CbCrPhyAddr	CbCr component address
u32CbCrStride	CbCr component stride

[Note]

- If the pixel format of a bitmap is greater than or equal to a byte, the start address and stride of the bitmap format must be aligned based on the pixel format. If the pixel format of a bitmap is smaller than a byte, the start address and stride of the bitmap must be aligned based on byte.
- If the pixel format of a bitmap is smaller than a byte, the horizontal start point and width of the bitmap must be aligned based on pixel.
- The horizontal start point and width of a YCbCr422 bitmap must be even numbers.
- The extension from the CLUT to the true color ARGB is implemented by retrieving the CLUT. Therefore, for the color extension function (for example, extend a CLUT1 bitmap to an ARGB8888 bitmap) or the color correction function, you need to configure the start address pu8ClutPhyAddr of the CLUT and ensure that the memory corresponding to the start address is physically continuous.

[See Also]

None

TDE2_OPT_S

[Description]

Defines the attributes of a TDE operation.

[Syntax]

```
typedef struct hiTDE2_OPT_S
{
    TDE2_ALUCMD_E enAluCmd;                 /*Logical operation type*/
    TDE2_ROP_CODE_E enRopCode_Color;        /*ROP type of the color space*/
    TDE2_ROP_CODE_E enRopCode_Alpha;        /*ROP type of the alpha*/
    TDE2_COLORKEY_MODE_E enColorKeyMode;    /*Colorkey mode*/
    TDE2_COLORKEY_U unColorKeyValue;        /*Colorkey value*/
    TDE2_CLIPMODE_E enClipMode;             /*Intra-area clip or extra-area
clip*/
    TDE2_RECT_S stClipRect;                 /*Definition of the clipped
area*/
    HI_BOOL bDeflicker;                     /*Whether to perform
anti-flicker*/
    TDE2_DEFLICKER_MODE_E enDeflickerMode;  /**<Anti-flicker mode*/
    TDE2_FILTER_MODE_E enFilterMode;        /*Filtering mode for scaling or
anti-flicker*/
    TDE2_MIRROR_E enMirror;                 /*Mirror type*/
    HI_BOOL bClutReload;                    /*Whether to reload the CLUT*/
    HI_U8   u8GlobalAlpha;                  /*Global alpha value*/
    TDE2_OUTALPHA_FROM_E enOutAlphaFrom;    /*Alpha output source*/
    HI_U32 u32Colorize;                  /**<Colorize value*/
    TDE2_BLEND_OPT_S stBlendOpt;
    TDE2_CSC_OPT_S stCscOpt;
} TDE2_OPT_S
```

[Member]

Member	Description
enAluCmd	Logical operation type
enRopCode_Color	ROP type of the color space
enRopCode_Alpha	ROP type of the alpha
enColorKeyMode	Colorkey mode
unColorKeyValue	Colorkey value

Member	Description
enClipMode	Intra-area clip or extra-area clip
stClipRect	Definition of the clipped area
bDeflicker	Whether to perform anti-flicker
bResize	Whether to scale
enFilterMode	Filtering mode for scaling or anti-flicker
enMirror	Mirror type
bClutReload	Whether to reload the CLUT
u8GlobalAlpha	Global alpha value Value range: [0, 255]
enOutAlphaFrom	Alpha output source
u32Colorize	Colorize value
stBlendOpt	Alpha blending operation option
stCscOpt	CSC parameter option

[Note]

None

[See Also]

None

TDE2_MB_COLOR_FMT_E

[Description]

Defines the macroblock format supported by the TDE.

[Syntax]

```
typedef enum hiTDE2_MB_COLOR_FMT_E
{
    TDE2_MB_COLOR_FMT_JPG_YCbCr400MBP = 0,
    TDE2_MB_COLOR_FMT_JPG_YCbCr422MBHP,
    TDE2_MB_COLOR_FMT_JPG_YCbCr422MBVP,
    TDE2_MB_COLOR_FMT_MP1_YCbCr420MBP,
    TDE2_MB_COLOR_FMT_MP2_YCbCr420MBP,
    TDE2_MB_COLOR_FMT_MP2_YCbCr420MBI,
    TDE2_MB_COLOR_FMT_JPG_YCbCr420MBP,
    TDE2_MB_COLOR_FMT_JPG_YCbCr444MBP,
    TDE2_MB_COLOR_FMT_BUTT
} TDE2_MB_COLOR_FMT_E;
```

[Member]

Member	Description
TDE2_MB_COLOR_FMT_JPG_YCbCr400MBP	Macroblock 400 in the JPEG encoding format
TDE2_MB_COLOR_FMT_JPG_YCbCr422MBHP	Macroblock 422 in the JPEG encoding format (half of the horizontal sampling)
TDE2_MB_COLOR_FMT_JPG_YCbCr422MBVP	Macroblock 422 in the JPEG encoding format (half of the vertical sampling)
TDE2_MB_COLOR_FMT_MP1_YCbCr420MBP	Macroblock 420 in the MPEG-1 encoding format
TDE2_MB_COLOR_FMT_MP2_YCbCr420MBP	Macroblock 420 in the MPEG-2 encoding format
TDE2_MB_COLOR_FMT_MP2_YCbCr420MBI	Macroblock 420 in the MPEG-2 encoding format (interlaced)
TDE2_MB_COLOR_FMT_JPG_YCbCr420MBP	Macroblock 420 in the JPEG encoding format
TDE2_MB_COLOR_FMT_JPG_YCbCr444MBP	Macroblock 444 in the JPEG encoding format

[Note]

None

[See Also]

None

TDE2_MB_S

[Description]

Defines the surface of the macroblock. This data structure describes the basic information about the picture in macroblock format.

[Syntax]

```
typedef struct hiTDE2_MB_S
{
    TDE2_MB_COLOR_FMT_E enMbFmt;
    HI_U32              u32YPhyAddr;
    HI_U32              u32YWidth;
    HI_U32              u32YHeight;
    HI_U32              u32YStride;
    HI_U32              u32CbCrPhyAddr;
    HI_U32              u32CbCrStride;
} TDE2_MB_S;
```

[Member]

Member	Description
enMbFmt	Format of a macroblock
u32YPhyAddr	Start physical address of a luminance block
u32YWidth	Width of a luminance block
u32YHeight	Height of a luminance block
u32YStride	Stride between adjacent lines of a luminance block
u32CbCrPhyAddr	Start physical address of a chrominance block
u32CbCrStride	Stride between adjacent lines of a chrominance block

[Note]

None

[See Also]

None

TDE2_MBRESIZE_E

[Description]

Defines the scaling mode of the macroblock format.

[Syntax]

```
typedef enum hiTDE2_MBRESIZE_E
{
    TDE2_MBRESIZE_NONE = 0,
    TDE2_MBRESIZE_QUALITY_LOW,
    TDE2_MBRESIZE_QUALITY_MIDDLE,
    TDE2_MBRESIZE_QUALITY_HIGH,
    TDE2_MBRESIZE_BUTT
} TDE2_MBRESIZE_E;
```

[Member]

Member	Description
TDE2_MBRESIZE_NONE	No scaling
TDE2_MBRESIZE_QUALITY_LOW	Low-quality scaling mode of the macroblock surface
TDE2_MBRESIZE_QUALITY_MIDDLE	Medium-quality scaling mode of the macroblock surface

TDE2_MBRESIZE_QUALITY_HIGH	High-quality scaling mode of the macroblock surface

[Note]

None

[See Also]

None

TDE2_MBOPT_S

[Description]

Defines the attributes of the macroblock surface operation.

[Syntax]

```
typedef struct hiTDE2_MBOPT_S
{
    TDE2_CLIPMODE_E enClipMode;
    TDE2_RECT_SstClipRect;
    HI_BOOL bDeflicker;
    TDE2_MBRESIZE_E enResize;
    HI_BOOL bSetOutAlpha;
    HI_U8   u8OutAlpha;
} TDE2_MBOPT_S;
```

[Member]

Member	Description
enClipMode	Clip mode: intra-area clip or extra-area clip
stClipRect	Definition of the clipped area
bDeflicker	Whether to perform anti-flicker
enResize	Macroblock scaling mode: no scaling, high-quality scaling, medium-quality scaling, or high-quality scaling.
bSetOutAlpha	Whether the alpha value of the output result bitmap is specified by users If the alpha value is not set, the maximum alpha value is output by default.
u8OutAlpha	Alpha value of the output result bitmap specified by users

[Note]

None

[See Also]

None

TDE2_CSC_OPT_S

[Description]

Defines CSC options.

[Syntax]

```
typedef struct hiTDE2_CSC_OPT_S
{
    HI_BOOL bICSCUserEnable;        /**User-defined ICSC parameter enable*/
    HI_BOOL bICSCParamReload;   /**User-defined ICSC parameter reload
enable*/
    HI_BOOL bOCSCUserEnable;        /**User-defined OCSC parameter enable*/
    HI_BOOL bOCSCParamReload;   /**User-defined OCSC parameter reload
enable*/
    HI_U32 u32ICSCParamAddr;        /**ICSC parameter address. The address
must be 128-bit aligned.*/
    HI_U32 u32OCSCParamAddr;    /**OCSC parameter address. The address must
be 128-bit aligned.*/
}TDE2_CSC_OPT_S;
```

[Member]

Member	Description
bICSCUserEnable	User-defined ICSC parameter enable
bICSCParamReload	User-defined ICSC parameter reload enable
bOCSCUserEnabl	User-defined OCSC parameter enable
bOCSCParamReload	User-defined OCSC parameter reload enable
u32ICSCParamAddr	ICSC parameter address. The address must be 128-bit aligned.
u32OCSCParamAddr	OCSC parameter address. The address must be 128-bit aligned.

[Note]

None

[See Also]

None

4 Error Codes

Table 4-1 describes the error codes of TDE APIs.

Table 4-1 Error codes of TDE APIs

Error Code	Macro Definition	Description
0xA0648001.	HI_ERR_TDE_DEV_NOT_OPEN	The TDE device is not started.
0xA0648002	HI_ERR_TDE_DEV_OPEN_FAILED	The TDE device fails to be started.
0xA0648003	HI_ERR_TDE_NULL_PTR	The pointer of the input parameter is null.
0xA0648004	HI_ERR_TDE_NO_MEM	The memory fails to be allocated.
0xA0648005	HI_ERR_TDE_INVALID_HANDLE	The job handle is invalid.
0xA0648006	HI_ERR_TDE_INVALID_PARA	The input parameter is invalid.
0xA0648007	HI_ERR_TDE_NOT_ALIGNED	The position, width, height, or stride of the picture is not aligned as required.
0xA0648008	HI_ERR_TDE_MINIFICATION	The multiple of down scaling exceeds the limitation (the maximum value is 255).
0xA0648009	HI_ERR_TDE_CLIP_AREA	The operation area does not overlap the clipped area.
0xA064800A	HI_ERR_TDE_JOB_TIMEOUT	Waiting times out.
0xA064800B	HI_ERR_TDE_UNSUPPORTED_OPERATION	The operation is not supported.
0xA064800C	HI_ERR_TDE_QUERY_TIMEOUT	The specific job is not complete due to timeout.

Error Code	Macro Definition	Description
0xA064800D	HI_ERR_TDE_INTERRUPT	Waiting for job completion is interrupted.

5 Instances

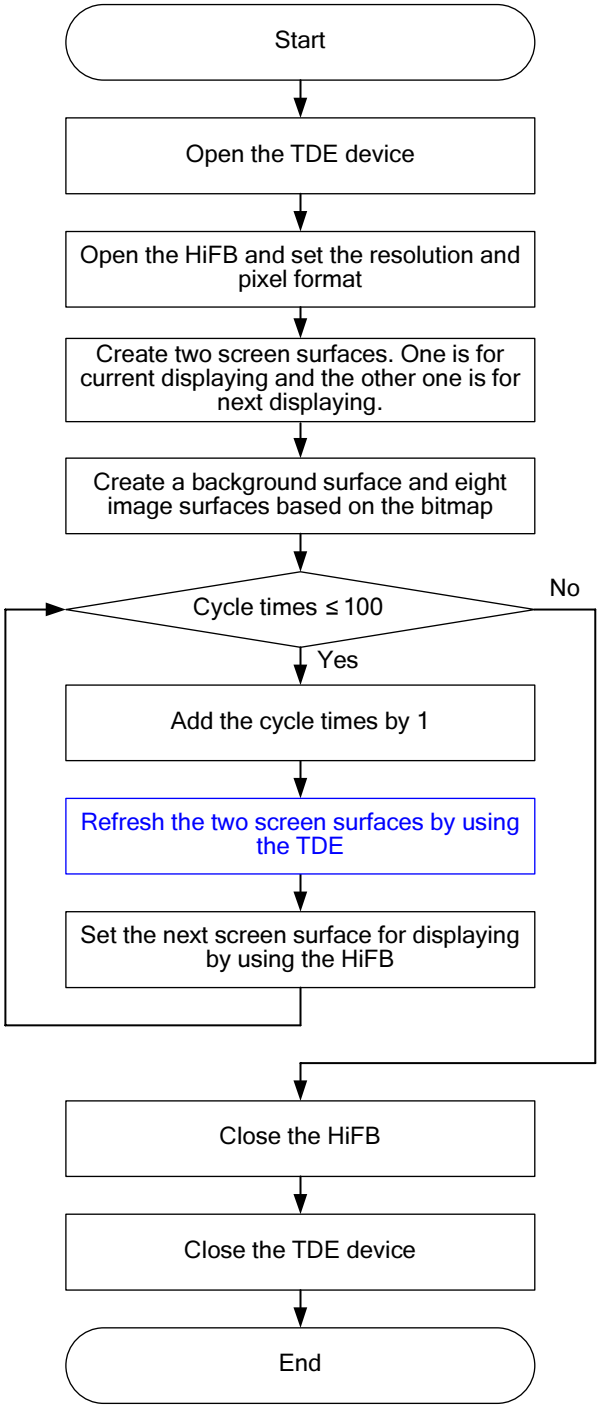
5.1 Software Process

NOTE

This section describes how to implement picture animation rotation by using the bitblt and color space. Ensure that the TDE and HiSilicon frame buffer (HiFB) drivers are loaded and the video output device works properly before enabling the TDE. In this instance, you need to allocate at least 1658880 bytes for the display buffer of graphics layer 0. For details about how to load the HiFB, see the *HiFB Development Guide*.

Figure 5-1 shows the software process.

Figure 5-1 Software process (main process)

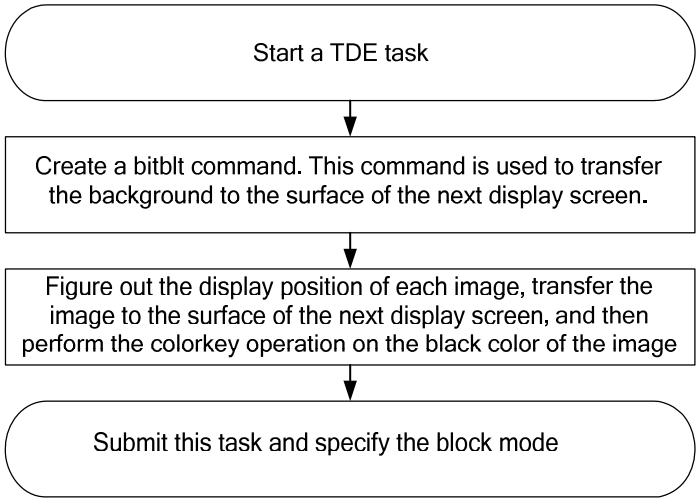


NOTE

For details about how to refresh the two screen surfaces by using the TDE, see Figure 5-2.

Figure 5-2 shows how to refresh the two screen surfaces by using the TDE.

Figure 5-2 Refreshing the two screen surfaces by using the TDE



5.2 Reference Codes

For details about the codes, see the **tde/sample_tde.c** in the **sample** folder of the SDK.