



# **ISP MPI Differences Between the Hi3516A/Hi3516D and the Hi3518**

**Issue**            **01**

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## **HiSilicon Technologies Co., Ltd.**

Address: Huawei Industrial Base  
Bantian, Longgang  
Shenzhen 518129  
People's Republic of China

Website: <http://www.hisilicon.com>

Email: [support@hisilicon.com](mailto:support@hisilicon.com)



# About This Document

## Purpose

This document is intended for engineers using HiISP for development, and provides solutions and help to implement fast Hi3518-to-Hi3516A/Hi3516D development.

## Related Versions

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

Product Name	Version
Hi3516A	V100
Hi3516D	V100



## Intended Audience

This document is intended for:




- Technical support engineers
- Software development engineers

## Symbol Conventions

The symbols that may be found in this document are defined as follows:

Symbol	Description
 <b>DANGER</b>	Alerts you to a high risk hazard that could, if not avoided, result in serious injury or death.
 <b>WARNING</b>	Alerts you to a medium or low risk hazard that could, if not avoided, result in moderate or minor injury.



Symbol	Description
 <b>CAUTION</b>	Alerts you to a potentially hazardous situation that could, if not avoided, result in equipment damage, data loss, performance deterioration, or unanticipated results.
 <b>TIP</b>	Provides a tip that may help you solve a problem or save time.
 <b>NOTE</b>	Provides additional information to emphasize or supplement important points in the main text.

## Change History

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

### Issue 01 (2014-12-20)

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

The contents related to the Hi3516D are added.

### Issue 00B02 (2014-09-14)

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

#### **Chapter 2** System Control

The item HI\_MPI\_ISP\_MemInit is added.

#### **Chapter 3** AE

The item ISP\_AE\_PARAM\_S is added.

#### **Chapter 4** AWB

The item ISP\_AWB\_PARAM\_S is added.

### Issue 00B01 (2014-07-25)

This issue is the first draft release.



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# 1 Overview

To help Hi3518 series engineers fast transition to Hi3516A/Hi3516D development, this document describes the ISP MPI differences between the Hi3518 series and the Hi3516A/Hi3516D.



## NOTE

- Unless otherwise specified, this document applies to the Hi3516A and Hi3516D.
- This document is also applicable to the Hi3516C, which belongs to the Hi3518 series.

Since changes of many MPIs are common, a general change description is provided:

1. For future expansion of supported ISP devices, the ISP device number **IspDev** is added for Hi3516A MPIs. **IspDev** has a fixed value of **0**.
2. Compared with the Hi3518, the Hi3516A supports a larger maximum value for ISO. As a result, the array size of parameters associated with ISO is increased from 8 to 16.
3. For functional modules supporting both manual and auto modes, the Hi3516A reorganizes their data structures: The operation type (ISP\_OP\_TYPE\_E) is used to select the manual or auto mode, and manual and auto attributes use independent variables. For a set interface, only manual attributes can be set if the operation type is manual; only auto attributes can be set if the operation type is auto. For a get interface, a get operation always obtains both the manual and auto attributes.
4. If an interface involves both calibration and correction, it will be divided into calibration and correction MPIs.



# 2 System Control

Item	Hi3518	Hi3516A
MPI	-	HI_MPI_ISP_MemInit
	HI_MPI_ISP_SetImageAttr	HI_MPI_ISP_SetPubAttr
	HI_MPI_ISP_SetInputTiming	
	HI_MPI_ISP_GetImageAttr	HI_MPI_ISP_GetPubAttr
	HI_MPI_ISP_GetInputTiming	
	HI_MPI_ISP_FreezeFmw	HI_MPI_ISP_SetFMWState
	-	HI_MPI_ISP_GetFMWState
	HI_MPI_ISP_SetWdrAttr	HI_MPI_ISP_SetWDRMode
	HI_MPI_ISP_SetWdrAttr	HI_MPI_ISP_GetWDRMode
Data structure	ISP_IMAGE_ATTR_S	ISP_PUB_ATTR_S
	ISP_INPUT_TIMING_S	
	-	ISP_FMW_STATE_E
	ISP_WDR_ATTR_S	ISP_WDR_MODE_S
	-	ISP_MODULE_CTRL_U
	ISP_SENSOR_REGISTER_S	ISP_SENSOR_REGISTER_S

Change description:

- Compared with the Hi3518, the Hi3516A needs to call HI\_MPI\_ISP\_MemInit to initialize the ISP external registers after the system starts, call HI\_MPI\_ISP\_SetWDRMode to set the wide dynamic range (WDR) mode, call HI\_MPI\_ISP\_SetPubAttr to set attributes such as the width, height, as well as frame rate, and then call HI\_MPI\_ISP\_Init to initialize the ISP.
- Compared with the Hi3518, the Hi3516A uses HI\_MPI\_ISP\_SetPubAttr to set interface parameters, deletes the redundant parameter **enWndMode**, and incorporates configuration of picture width and height in the picture attributes and cropping window.



3. Compared with the Hi3518, the Hi3516A uses the floating-point variable **f32FrameRate** to indicate the frame rate, and supports integral or non-integral frame rates (also need to be supported by the sensor).
4. Compared with the Hi3518, the Hi3516A supports query of firmware status.
5. Compared with the Hi3518, the Hi3516A uses the data structure `ISP_MODULE_CTRL_U` to control the functional module.
6. Compared with the Hi3518, the Hi3516A adds `pfn_cmos_get_wdr_attr` and `pfn_cmos_get_sns_reg_info` to the data structure `ISP_SENSOR_REGISTER_S`, supporting 2-to-1 WDR mode and resolution switching.





# 3 AE

Item	Hi3518	Hi3516A
MPI	HI_MPI_ISP_SetExposureType	HI_MPI_ISP_SetExposureAttr
	HI_MPI_ISP_SetAEAttr	
	HI_MPI_ISP_SetAEAttrEx	
	HI_MPI_ISP_SetMEAttr	
	HI_MPI_ISP_SetMEAttrEx	
	HI_MPI_ISP_SetAntiFlickerAttr	
	HI_MPI_ISP_SetAEDelayAttr	
	HI_MPI_ISP_GetExposureType	HI_MPI_ISP_GetExposureAttr
	HI_MPI_ISP_GetAEAttr	
	HI_MPI_ISP_GetAEAttrEx	
	HI_MPI_ISP_GetMEAttr	
	HI_MPI_ISP_GetMEAttrEx	
	HI_MPI_ISP_GetAntiFlickerAttr	
	HI_MPI_ISP_GetAEDelayAttr	
	HI_MPI_ISP_QueryInnerStateInfo	HI_MPI_ISP_QueryExposureInfo
	HI_MPI_ISP_QueryInnerStateInfoEx	
	HI_MPI_ISP_SetAIAAttr	HI_MPI_ISP_SetAICalibrate
	-	HI_MPI_ISP_SetIrisAttr
	HI_MPI_ISP_GetAIAAttr	HI_MPI_ISP_GetAICalibrate
	-	HI_MPI_ISP_GetIrisAttr
	HI_MPI_ISP_SetIrisType	HI_MPI_ISP_SetIrisAttr
	HI_MPI_ISP_SetMIAAttr	



Item	Hi3518	Hi3516A
	HI_MPI_ISP_GetIrisTyp	HI_MPI_ISP_GetIrisAttr
	HI_MPI_ISP_GetMIAttr	
	HI_MPI_ISP_SetExpStaInfo	<i>HI_MPI_ISP_SetStatisticsConfig</i>
	HI_MPI_ISP_GetExpStaInfo	<i>HI_MPI_ISP_GetStatisticsConfig</i>
		<i>HI_MPI_ISP_GetStatistics</i>
	HI_MPI_ISP_SetSlowFrameRate	<i>HI_MPI_ISP_SetPubAttr</i>
	HI_MPI_ISP_GetSlowFrameRate	<i>HI_MPI_ISP_GetPubAttr</i>
Data structure	ISP_OP_TYPE_E	ISP_EXPOSURE_ATTR_S
	ISP_AE_ATTR_S	
	ISP_AE_ATTR_EX_S	
	ISP_ANTIFLICKER_S	
	ISP_AE_DELAY_S	
	ISP_ME_ATTR_S	
	ISP_ME_ATTR_EX_S	
	ISP_INNER_STATE_INFO_S	ISP_EXP_INFO_S
	ISP_INNER_STATE_INFO_EX_S	
	ISP_AI_ATTR_S	ISP_AI_CALIBRATE_S
		ISP_IRIS_ATTR_S
	ISP_MI_ATTR_S	ISP_IRIS_ATTR_S
	ISP_EXP_STA_INFO_S	<i>ISP_STATISTICS_CFG_S</i>
		<i>ISP_STATISTICS_S</i>
	ISP_AE_PARAM_S	ISP_AE_PARAM_S

Change description:

1. Compared with the Hi3518, the Hi3516A adds an ISP device number for each MPI, facilitating future expansion of supported ISP devices.
2. Compared with the Hi3518, the Hi3516A uses one MPI to set and get the exposure type, manual exposure attributes, and auto exposure attributes, and removes the redundant MPIs.
3. Compared with the Hi3518, the Hi3516A changes the unit of exposure time from line to microsecond ( $\mu$ s). Absolute time is set to dodge exposure line differences between different sensors.
4. Compared with the Hi3518, the Hi3516A unifies the gain precision to 10 bits, and supports setting of the minimum digital ISP gain and minimum system gain.



5. Compared with the Hi3518, the Hi3516A uses one MPI to query the internal exposure status.
6. Compared with the Hi3518, the Hi3516A separates automatic iris (AI) correction and AI attribute setting, allowing for higher MPI functionality independence.
7. Compared with the Hi3518, the Hi3516A uses one MPI to set and get the iris type, manual iris (MI) attributes, and AI attributes, and removes the redundant MPIs.
8. Compared with the Hi3518, the Hi3516A uses ISP-related MPIs (italicized interfaces in the preceding table) to set and get automatic exposure (AE) statistics, and supports configuration of statistics location, and query of the newly added global average values and zone-based average values.
9. Compared with the Hi3518, the Hi3516A deletes the interface for manual frame rate reduction. Relevant functions can be implemented by modifying the target frame rate of `HI_MPI_ISP_SetPubAttr`.
10. Compared with the Hi3518, the Hi3516A adds the **u8WDRMode** variable to `ISP_AE_PARAM_S` to support the WDR boot mode.



# 4 AWB

Item	Hi3518	Hi3516A
MPI	HI_MPI_ISP_SetWBType	HI_MPI_ISP_SetWBAttr
	HI_MPI_ISP_SetAWBAttr	
	HI_MPI_ISP_SetAWBAlgType	
	HI_MPI_ISP_SetMWBAAttr	
	HI_MPI_ISP_GetWBType	HI_MPI_ISP_GetWBAttr
	HI_MPI_ISP_GetAWBAttr	
	HI_MPI_ISP_GetAWBAlgType	
	HI_MPI_ISP_GetMWBAAttr	
	HI_MPI_ISP_SetAdvAWBAttr	HI_MPI_ISP_SetAWBAttrEx
	HI_MPI_ISP_SetLightSource	
	HI_MPI_ISP_GetAdvAWBAttr	HI_MPI_ISP_GetAWBAttrEx
	HI_MPI_ISP_GetLightSource	
	HI_MPI_ISP_SetColorTone	HI_MPI_ISP_SetColorToneAttr
	HI_MPI_ISP_GetColorTone	HI_MPI_ISP_GetColorToneAttr
	HI_MPI_ISP_SetCCM	HI_MPI_ISP_SetCCMAAttr
	HI_MPI_ISP_GetCCM	HI_MPI_ISP_GetCCMAAttr
	HI_MPI_ISP_SetSaturation	HI_MPI_ISP_SetSaturationAttr
	HI_MPI_ISP_SetSaturationAttr	
	HI_MPI_ISP_GetSaturationAttr	HI_MPI_ISP_GetSaturationAttr
	HI_MPI_ISP_GetColorTemp	HI_MPI_ISP_QueryWBInfo
	HI_MPI_ISP_GetSaturation	
	HI_MPI_ISP_SetColorTemp	Deleted



Item	Hi3518	Hi3516A
	HI_MPI_ISP_SetWBStaInfo	HI_MPI_ISP_SetStatisticsConfig
	HI_MPI_ISP_GetWBStaInfo	HI_MPI_ISP_SetStatisticsConfig HI_MPI_ISP_GetStatistics
Data structure	ISP_AWB_CALIBRATION_S	ISP_AWB_ATTR_S
	ISP_AWB_ATTR_S	
	ISP_MWB_ATTR_S	ISP_MWB_ATTR_S
	ISP_AWB_IN_OUT_ATTR_S	ISP_AWB_IN_OUT_ATTR_S
	ISP_AWB_CT_LIMIT_ATTR_S	ISP_AWB_CT_LIMIT_ATTR_S
	ISP_ADV_AWB_ATTR_S	ISP_AWB_ATTR_EX_S
	ISP_AWB_LIGHTSOURCE_INFO_S	ISP_AWB_EXTRA_LIGHTSOURCE_INFO_S
	ISP_AWB_ADD_LIGHTSOURCE_S	
	ISP_WB_ZONE_STA_INFO_S	ISP_WB_STATISTICS_S
	ISP_WB_STA_INFO_S	ISP_WB_STATISTICS_CFG_S
	ISP_COLORMATRIX_S	ISP_COLORMATRIX_ATTR_S
	ISP_COLORTONE_S	ISP_COLOR_TONE_ATTR_S
	ISP_SATURATION_ATTR_S	ISP_SATURATION_ATTR_S
	ISP_AWB_PARAM_S	ISP_AWB_PARAM_S

Change description:

1. Compared with the Hi3518, the Hi3516A adds an ISP device number for each MPI, facilitating future expansion of supported ISP devices.
2. Compared with the Hi3518, the Hi3516A uses one MPI to set and get the WB enable status, attributes, and basic parameters, and removes the redundant MPIs.
3. Compared with the Hi3518, the Hi3516A uses one MPI to set and get the extended WB parameters, and removes the redundant MPIs.
4. Compared with the Hi3518, the Hi3516A supports manual CCM setting.
5. Compared with the Hi3518, the Hi3516A extends the length of the saturation array from 8 to 16.
6. Compared with the Hi3518, the Hi3516A uses one MPI to query the WB-calculated environmental color temperature, current effective CCM, and saturation value.
7. Compared with the Hi3518, the Hi3516A uses ISP-related MPIs to set the get AWB statistics. The Hi3516A supports two groups of AWB statistics. One group of AWB statistics is consistent with that of the Hi3518 and collected in the RGB region (after AWB & demosaic). The global and zone-based (17 x 15) G/R, G/B, and white point quantity are output. Another group of AWB statistics is newly added and collected in the



Bayer region (after 2D denoising and before AWB). The global and zone-based (17 x 15) average R, G, B tri-component values and white point quantity are output.

8. Compared with the Hi3518, the Hi3516A adds the **u8WDRMode** variable to ISP\_AWB\_PARAM\_S to support the WDR boot mode.



# 5 IMP

## Sharpen

Item	Hi3518	Hi3516A
Member	bManualEnable	enOpType
	u8StrengthTarget	stManual. u8SharpenD
	u8StrengthUdTarget	stManual. u8SharpenUd
	-	stManual.u8SharpenRGB
	u8StrengthMin	Deleted
	u8SharpenAltD[8]	stAuto. au8SharpenD[ISP_AUTO_STENGTH_NUM]
	u8SharpenAltUd[8]	stAuto.au8SharpenUd[ISP_AUTO_STENGTH_NUM]
	-	stAuto. au8SharpenRGB [ISP_AUTO_STENGTH_NUM]

Change description:

1. The Hi3516A reorganizes the data structure ISP\_SHARPEN\_ATTR\_S by separating manual and auto attributes, and changes names of relevant variables.
2. The Hi3516A adds variables u8SharpenRGB and au8SharpenRGB to the data structure ISP\_SHARPEN\_ATTR\_S for adjusting the strength of the sharpen module, which is added to the ISP pipeline behind the gamma module.
3. The Hi3516A deletes the redundant variable u8StrengthMin from the data structure ISP\_SHARPEN\_ATTR\_S.
4. The Hi3516A extends the array size of automatic sharpening from 8 to 16.



## Gamma

Item	Hi3518	Hi3516A
MPI	HI_MPI_ISP_SetGammaAttr	HI_MPI_ISP_SetGammaAttr
	HI_MPI_ISP_SetGammaTable	
	HI_MPI_ISP_GetGammaAttr	HI_MPI_ISP_GetGammaAttr
	HI_MPI_ISP_GetGammaTable	
Data structure	ISP_GAMMA_ATTR_S	ISP_GAMMA_ATTR_S
	ISP_GAMMA_TABLE_S	
Member	enGammaCurve	enCurveType
	u16Gamma[GAMMA_NODE_NUMBE R]	u16Table[GAMMA_NODE_NUM]

Change description:

1. The Hi3516A combines the gamma attribute MPI and gamma table MPI into one MPI.
2. The Hi3516A data structure ISP\_GAMMA\_ATTR\_S contains all gamma attributes, and the gamma FE table is removed.
3. Naming is further standardized for variables enCurveType and u16Table of the Hi3516A.
4. ISP\_GAMMA\_CURVE\_1\_6 and other values are removed from variable enCurveType of the Hi3516A.

## DRC

Item	Hi3518	Hi3516A
Member	bDRCEnable	bEnable
	bDRCManualEnable	enOpType
	u32StrengthTarget	stManual.u32Strength
		stAuto.u32Strength

Change description:

The Hi3516A reorganizes the data structure ISP\_DRC\_ATTR\_S by separating manual and auto attributes, and changes names of relevant variables.

## Lens Shading Correction

Item	Hi3518	Hi3516A
MPI	HI_MPI_ISP_SetShadingAttr	HI_MPI_ISP_SetShadingAttr
	HI_MPI_ISP_SetShadingTable	





Item	Hi3518	Hi3516A
	HI_MPI_ISP_GetShadingAttr	HI_MPI_ISP_GetShadingAttr
	HI_MPI_ISP_GetShadingTable	
Data structure	ISP_SHADING_ATTR_S	ISP_SHADING_ATTR_S
	ISP_SHADINGTAB_S	
Member	u16ShadingCenterR_X	astRadialShading[0]. stCenter. s32X
	u16ShadingCenterR_Y	astRadialShading[0]. stCenter. s32Y
	u16ShadingCenterG_X	astRadialShading[1]. stCenter. s32X
	u16ShadingCenterG_Y	astRadialShading[1]. stCenter. s32Y
	u16ShadingCenterB_X	astRadialShading[2]. stCenter. s32X
	u16ShadingCenterB_Y	astRadialShading[3]. stCenter. s32Y
	u16ShadingTable_R	astRadialShading[0]. u32Table
	u16ShadingTable_G	astRadialShading[1]. u32Table
	u16ShadingTable_B	astRadialShading[2]. u32Table
	u16ShadingOffCenter_R	astRadialShading[0]. u16OffCenter
	u16ShadingOffCenter_G	astRadialShading[1]. u16OffCenter
	u16ShadingOffCenter_B	astRadialShading[2]. u16OffCenter
	u16ShadingTableNodeNumber	u16TableNodeNum

Change description:

1. The Hi3516A combines the shading attribute MPI and shading table MPI into one MPI.
2. The Hi3516A data structure ISP\_SHADING\_ATTR\_S contains all shading attributes.
3. RGB components in Hi3516A variables use the array format.
4. Coordinates in Hi3516A variables use the data structure stCenter, ensuring better consistency with the SDK codes.
5. Shading is removed from Hi3516A variables.

## Defect Pixel

Item	Hi3518	Hi3516A
MPI	HI_MPI_ISP_SetDefectPixelAttr	HI_MPI_ISP_SetDPCalibrate
		HI_MPI_ISP_SetDPAttr
	HI_MPI_ISP_GetDefectPixelAttr	HI_MPI_ISP_GetDPCalibrate
		HI_MPI_ISP_GetDPAttr
Data	ISP_DP_ATTR_S	ISP_DP_STATIC_CALIBRATE_S



Item	Hi3518	Hi3516A
structure		ISP_DP_ATTR_S

Change description:

1. The Hi3516A separates the static defect pixel calibration and static/dynamic defect pixel attribute into two MPIs.
2. The Hi3516A data structure ISP\_DP\_ATTR\_S is divided into two data structures: ISP\_DP\_STATIC\_CALIBRATE\_S and ISP\_DP\_ATTR\_S.
3. The maximum number of defect pixels supported by defect pixel correction of the Hi3516A is increased from 1024 to 4096 (including bright and dark pixels).
4. The Hi3516A supports correction of both bright and dark pixels.

## Crosstalk Removal

Item	Hi3518	Hi3516A
Data structure	ISP_CR_ATTR_S	ISP_CR_ATTR_S

Change description:

The Hi3516A extends the array size of automatic crosstalk removal from 8 to 16.

## 2D Noise Reduction

Item	Hi3518	Hi3516A
MPI	HI_MPI_ISP_SetDenoiseAttr	HI_MPI_ISP_SetNRAttr
	HI_MPI_ISP_SetDenoiseAttr	HI_MPI_ISP_GetNRAttr
Data structure	ISP_DENOISE_ATTR_S	ISP_NR_ATTR_S
	bManualEnable	enOpType
	u8ThreshTarget	stManual. u8Thresh
	u8ThreshMax	Deleted
	u8SnrThresh[8]	stAuto. au8Thresh[ISP_AUTO_STENGTH_NUM]

Change description:

1. The Hi3516A reorganizes the data structure ISP\_NR\_ATTR\_S by separating manual and auto attributes, and changes names of relevant variables.
2. The Hi3516A deletes the redundant variable u8ThreshMax from the data structure ISP\_NR\_ATTR\_S.
3. The Hi3516A extends the array size of automatic noise reduction from 8 to 16.



## DIS

Change description:

None

## DeFog

Item	Hi3518	Hi3516A
MPI	HI_MPI_ISP_SetAntiFogAttr	HI_MPI_ISP_SetDeFogAttr
	HI_MPI_ISP_GetAntiFogAttr	HI_MPI_ISP_GetDeFogAttr
Data structure	ISP_ANTIFOG_S	ISP_DEFOG_ATTR_S

Change description:

1. The Hi3516A changes AntiFog to DeFog.
2. Hi3516A defog supports auto and manual modes, and relevant data structure members are added.
3. Hi3516A defog supports partial defogging, and adds variables u8HorizonBlock and u8VerticalBlock to describe the number of horizontal blocks and the number of vertical blocks.

## Anti-False Color

Change description:

None

## Demosaic

Item	Hi3518	Hi3516A
Data structure	ISP_DEMOSAIC_ATTR_S	ISP_DEMOSAIC_ATTR_S

Change description:

1. The Hi3516A extends the gain-associated array size in the data structure ISP\_DEMOSAIC\_ATTR\_S from 8 to 16.
2. The name of member u8DemosaicConfig in the data structure ISP\_DEMOSAIC\_ATTR\_S is changed to enCfgType.



## Black Level

Change description:

None

## Anti-FPN

Change description:

A new module is added to eliminate the FPN.

## ACM

Change description:

A new module is added to adjust preferred colors by tuning luminance, hue, and saturation within the certain zone, such as fine-tuning of green, blue, and skin color.

## WDR

Item	Hi3518	Hi3516A
MPI	HI_MPI_ISP_SetWdrAttr	HI_MPI_ISP_SetWDRMode
	HI_MPI_ISP_GetWdrAttr	HI_MPI_ISP_GetWDRMode
	HI_MPI_ISP_SetGammaFETable	HI_MPI_ISP_SetGammaFEAttr
	HI_MPI_ISP_GetGammaFETable	HI_MPI_ISP_GetGammaFEAttr
	-	HI_MPI_ISP_SetFSWDRAttr
	-	HI_MPI_ISP_GetFSWDRAttr
Data structure	ISP_WDR_ATTR_S	ISP_WDR_MODE_S
	ISP_GAMMA_TABLE_S	ISP_GAMMAFE_ATTR_S

Change description:

1. Besides the sensor WDR mode, the Hi3516A supports the multi-frame combination WDR mode.
2. The Hi3516A changes HI\_MPI\_ISP\_SetWdrAttr to HI\_MPI\_ISP\_SetWDRMode, indicating that this interface is only used for WDR mode switching.
3. In addition to dynamic WDR mode switching, the Hi3516A supports start in WDR mode (that is, WDR mode is enabled after a start; however, this function is not supported at present).
4. The Hi3516A data structure ISP\_GAMMAFE\_ATTR\_S is isolated from the gamma data structure.
5. The Hi3516A adds FSWDRAttr for adjusting image quality in the multi-frame combination WDR mode.



# 6 Statistics

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Change description:

New interfaces are added to facilitate debugging.