

TC358743XBG

本资料是为了参考的目的由原始文档翻译而来。
使用本资料时，请务必确认原始文档关联的最新
信息，并遵守其相关指示。

原本：“TC358743XBG” 2015-12-18

翻译日: 2016-04

CMOS 硅单片数字集成电路

TC358743XBG

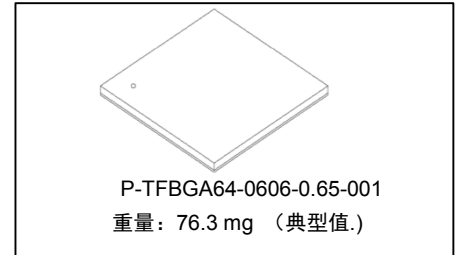
移动外围设备

概述

HDMI®-RX ~ MIPI®CSI-2-TX 是将 HDMI 输入流转换为 MIPI CSI-2 TX 的设备。

当前和下一代应用处理器以及基带芯片在设计上没有视频输入端口，用于摄像机输入的 CSI-2 除外。智能手机处理器正在使用几个需要视频输入的应用程序

TC358743XBG 接收 HDMI 输入并转换成像是摄像机输入的 CSI-2。



特征

● HDMI-RX 接口

- ◇ HDMI 1.4
 - 视频格式支持 (高达 1080P @60fps)
 - RGB, YCbCr444: 24-bpp @60fps
 - YCbCr422 24-bpp @60fps
 - 音频支持
 - 内部音频 PLL 跟踪 ACR 包传输的 N/CTS 值。
 - 3D 支持
 - 支持 HDCP
 - DDC 支持
 - EDID 支持
 - 版本 A, 修订版 1 (2000-02-09)
 - 前 128 个字节 (EDID 1.3 构架)
 - 首个 E-EDID 扩展: 128 字节 CEA 扩展, 版本 3 (CEA-861-D 指定)。
 - 内置 1K 字节 SRAM (EDID_SRAM)
 - 最大 HDMI 时钟速度: 165MHz
- ◇ 不支持音频回路和 HDMI 以太网通道

● CSI-2 TX 接口

- ◇ 兼容 MIPI CSI-2 (版本 1.01 修订版 00.04 - 2009.04.02)
- ◇ 每个数据通道支持高达 1 Gbps 的传输速率
 - 可通过 MIPI CSI-2 传输视频、音频和 InfoFrame 数据
- ◇ 最多支持 4 个数据通道

● I²C 从接口

- ◇ 支持正常模式(100 kHz)和快速模式(400 kHz)
- ◇ 支持超快模式 (2MHz)
- ◇ 配置所有 TC358743XBG 内部寄存器

● 音频输出接口

I2S 或 TDM 音频接口可用 (引脚多路复用)

I2S 音频接口

- ◇ 立体声数据单数据通道
 - ◇ 仅支持主时钟模式
 - ◇ 支持 16、18、20 或 24 位数据 (取决于 HDMI 输入流)
 - ◇ 通过 MSB 第一支持左-右对齐
 - ◇ 仅支持 32 位宽的时隙
 - ◇ 输出音频过采样时钟 (256fs)
- TDM (时分多路复用) 音频接口
- ◇ 固定到 8 通道(取决于 HDMI 输入流)
 - ◇ 仅支持 32 位宽的时隙
 - ◇ 仅支持主时钟模式
 - ◇ 支持 16、18、20 或 24 位 PCM 音频数据字(取决于 HDMI 输入流)
 - ◇ 输出音频过采样时钟 (256fs)

● 红外 (IR)

- ◇ 支持 NEC 红外协议。

● 系统

- ◇ 内部核心有两个电源域 (VDDC1 和 VDDC2)
 - VDDC1 常开电源域
 - VDDC2 可在深度睡眠模式下关闭

● 电源输入

- ◇ 核心和 MIPI D-PHY: 1.2V
- ◇ I/O: 1.8V – 3.3V
- ◇ HDMI: 3.3V
- ◇ APLL: 3.3V/2.5V

● 典型操作期间的功耗

- ◇ 720P: 0.48 W
- ◇ 1080P @30fps: 0.48 W
- ◇ 1080P @60fps: 0.54 W

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1. MIPI D-PHY, "MIPI_D-PHY_specification_v01-00-00, May 14, 2009"
2. MIPI CSI-2, "MIPI Alliance Standard for Camera Serial Interface 2 (CSI-2) Version 1.01 Revision Nov 2010"
3. VESA Mobile Display Digital Interface Standard (Version 1.2, Type II)
4. I²C bus specification, version 2.1, January 2000, Philips Semiconducto

译文

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TC358743XBG 接收 HDMI 输入并转换成表面上看起来像是摄像机输入的 CSI-2。

TC358743XBG 系统概览方框图如下所示。

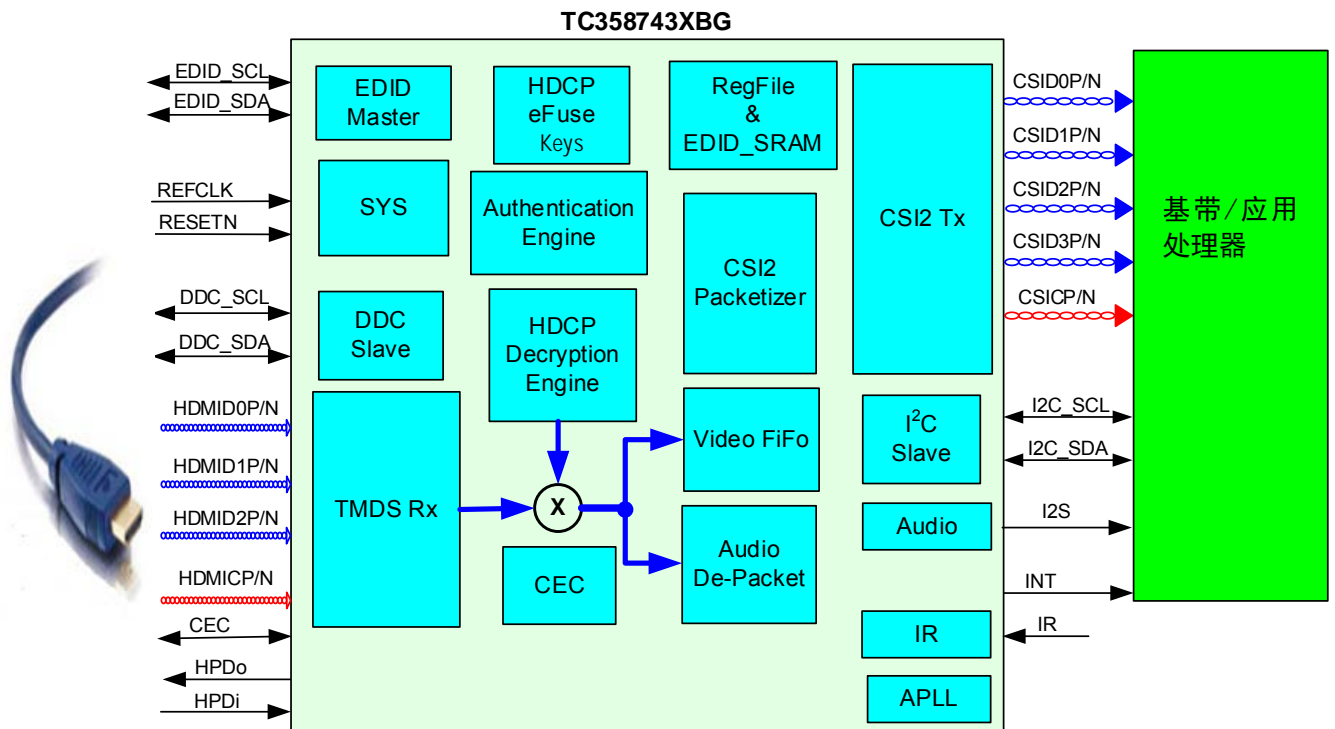


图 1.1 TC358743XBG 系统概览

2. 特征

以下是 TC358743XBG 支持的主要特征。

- HDMI-RX 接口

- ◇ HDMI 1.4

- 视频格式支持 (高达 1080P @60fps)
 - RGB, YCbCr444: 24-bpp @60fps
 - YCbCr422 24-bpp @60fps
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- EDID 支持
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 - 嵌入式 1K 字节 SRAM (EDID_SRAM)
- 最大 HDMI 时钟速度: 165MHz

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- ◇ 仅支持 32 位宽的时隙
- ◇ 输出音频过采样时钟 (256fs)

TDM（时分多路复用）音频接口

- ◇ 固定到 8 通道(取决于 HDMI 输入流)
- ◇ 仅支持 32 位宽的时隙
- ◇ 仅支持主时钟模式
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- ◇ 内部核心有两个电源域 (VDDC1 和 VDDC2)
 - VDDC1 常开电源域
 - VDDC2 可在深度睡眠模式下关闭

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- ◇ I/O: 1.8V – 3.3V
- ◇ HDMI: 3.3V
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- ◇ 1080P @30fps: 0.48 W
- ◇ 1080P @60fps: 0.54 W

表 2.1 TC358743XBG 典型操作期间的功耗

		VDDC1	VDDC2	VDDIO1	VDDIO2	VDDMIPI	AVDD33	AVDD12	AVDD25	总功率	单位
		1.2	1.2	3.3	1.8	1.2	3.3	1.2	2.5		
720P @60 帧	电流(A)	0.0472	0	0.0009	0.0178	0.0879	0.0656	0.0128	480.47	mW	
	功率(W)	0.05664	0	0.0017	0.0214	0.2901	0.0787	0.032			
1080P @60 帧	电流(A)	0.0766	0	0.0009	0.0228	0.0881	0.0829	0.0128	543.19	mW	
	功率(W)	0.09192	0	0.0017	0.0274	0.2907	0.0995	0.032			
Sleep 0x0002 = 0x0001	电流(μA)	0.91	0.002	0.0430	0.0490	32.3700	0.3200	0.2	108.94	μW	
	功率(μW)	1.092	0.0066	0.0774	0.0588	106.8210	0.3840	0.5			

注:

- 注意防静电。本产品防静电能力欠佳。请小心处理。
- TC358743XBG 不进行 YCbCr ↔ YUV 转换。在本文件中，它们可互换使用。
- TC358743XBG 提供有或无 HDCP 密钥。通过下面显示的封装标记进行识别。
 - 图 2.1 显示 HDCP 密钥被刻录到封装上。
 - 图 2.2 显示 HDCP 密钥没有被包括，请忽略与 HDCP 功能性相关的所有寄存器。



图 2.1 带HDCP密钥的封装标记，HAL添加到批次码



图 2.2 不带HDCP密钥的封装标记，HNL添加到批次码

3. 外部引脚

TC358743XB 用于 BGA64 引脚封装。下表显示 TC358743XBG 及其功能信号。

表 3.1 TC358743XBG 功能信号列表

组别	引脚名称	I/O	Init (O)	类型	功能	电源电压	注释
系统: 复位& 时钟 (4)	RESETN	I	-	Sch	系统复位输入, 低态有效	VDDIO2	1.8V -3.3V
	REFCLK	I	-	N	参考时钟输入 (27/26MHz 或 42MHz)	VDDIO2	1.8V -3.3V
	TEST	I	-	N	TEST 模式选择 0:正常模式 1:试验模式	VDDIO2	1.8V -3.3V
	INT	O	L	N	中断输出信号 - 高态有效 (电平)	VDDIO2	1.8V -3.3V
CSI-2 TX (10)	CSICP		H	MIPI-PHY	MIPI-CSI-2 时钟有效	VDD_MIPI	1.2V
	CSICN		H	MIPI-PHY	MIPI-CSI-2 时钟无效	VDD_MIPI	1.2V
	CSID0P		H	MIPI-PHY	MIPI-CSI-2 Data 0 有效	VDD_MIPI	1.2V
	CSID0N		H	MIPI-PHY	MIPI-CSI-2 Data 0 无效	VDD_MIPI	1.2V
	CSID1P		H	MIPI-PHY	MIPI-CSI-2 Data 1 有效	VDD_MIPI	1.2V
	CSID1N		H	MIPI-PHY	MIPI-CSI-2 Data 1 无效	VDD_MIPI	1.2V
	CSID2P		H	MIPI-PHY	MIPI-CSI-2 Data 2 有效	VDD_MIPI	1.2V
	CSID2N		H	MIPI-PHY	MIPI-CSI-2 Data 2 无效	VDD_MIPI	1.2V
	CSID3P		H	MIPI-PHY	MIPI-CSI-2 Data 3 有效	VDD_MIPI	1.2V
CSID3N		H	MIPI-PHY	MIPI-CSI-2 Data 3 无效	VDD_MIPI	1.2V	
HDMI-RX (8)	HDMICP		-	HDMI-PHY	HDMI 时钟通道有效	AVDD33	3.3V
	HDMICN		-	HDMI-PHY	HDMI 时钟通道无效	AVDD33	3.3V
	HDMID0P		-	HDMI-PHY	HDMI Data 0 通道有效	AVDD33	3.3V
	HDMID0N		-	HDMI-PHY	HDMI Data 0 通道无效	AVDD33	3.3V
	HDMID1P		-	HDMI-PHY	HDMI Data 1 通道有效	AVDD33	3.3V
	HDMID1N		-	HDMI-PHY	HDMI Data 1 通道无效	AVDD33	3.3V
	HDMID2P		-	HDMI-PHY	HDMI Data 2 通道有效	AVDD33	3.3V
HDMID2N		-	HDMI-PHY	HDMI Data 2 通道无效	AVDD33	3.3V	
DDC (2)	DDC_SCL	IO	-	N(注 2)	DDC 从时钟	VDDIO1	3.3V ^(注 1)
	DDC_SDA	IO	-	N ^(注 2)	DDC 从数据	VDDIO1	3.3V(注 1)
EDID (2)	EDID_SCL	IO	-	N(注 2)	EDID 主时钟	VDDIO2	1.8V -3.3V
	EDID_SDA	IO	-	N(注 2)	EDID 主数据	VDDIO2	1.8V -3.3V
CEC	CEC	IO	-	N(注 2)	CEC 信号	VDDIO1	3.3V
HPD (2)	HPDI	I	-	N	热插拔检测输入	VDDIO1	3.3V(注 1)
	HPDO	O	L	N	热插拔检测输出	VDDIO1	3.3V
音频 (4)	A_SCK	O	L	N	I2S/TDM 位时钟信号	VDDIO2	1.8V -3.3V
	A_WFS	O	L	N	I2S 字时钟或 TDM 帧同步信号	VDDIO2	1.8V -3.3V
	A_SD	O	L	N	I2S/TDM 数据信号	VDDIO2	1.8V -3.3V
	A_OSCK	O	L	N	音频过采样时钟	VDDIO2	1.8V -3.3V
IR	IR	I	-	Sch	红外信号	VDDIO2	1.8V -3.3V
I2C (2)	I2C_SCL	IO	-	N(注 2)	I ² C 串口时钟	VDDIO2	1.8V -3.3V
	I2C_SDA	IO	-	N(注 2)	I ² C 串口数据	VDDIO2	1.8V -3.3V
APLL (4)	BIASDA	O	L	-	BIAS 信号 不使用时, 通过 0.1 μF 连接至 AVSS	-	-
	DAOUT	O	H	-	音频 PLL 时钟参考输出时钟 不使用时请保持打开	-	-
	PCKIN	I	-	-	音频 PLL 参考输入时钟 不使用时, 通过 0.1 μF 连接至 AVSS	-	-
	PFIL	O	L	-	音频 PLL 低通滤波器信号 不使用时, 通过 0.1 μF 连接至 AVSS	-	-
电源 (12)	VDDC1, VDDC2	-	-	-	内部核心 VDD (3)	-	1.2V
	VDDIO1	-	-	-	VDDIO1 IO 电源(1)	-	3.3V
	VDDIO2	-	-	-	VDDIO2 IO 电源(1)	-	1.8V-3.3V
	VDD_MIPI	-	-	-	MIPI CSI-2 VDD(2)	-	1.2V

组别	引脚名称	I/O	Init (O)	类型	功能	电源电压	注释
	AVDD12	-	-	-	HDMI Phy 1.2 V 电源(2)	-	1.2V
	AVDD33	-	-	-	HDMI Phy 3.3 V 电源(2)	-	3.3V
	AVDD25	-	-	-	APLL 2.5 V 电源(1)	-	2.5V
接地 (10)	VSS	-	-	-	接地	-	-
Misc (2)	REXT	-	-	-	外部参考电阻器, 请通过 2 kΩ 电阻器连接至 AVDD33 (± 1%)	-	-
	VPGM	-	-	-	eFuse 程序电源, 请连接到地面	-	-

总共 64 个引脚

注 1: 这些 IO 都能耐受 5V 电压。

注 2: 通过 Schmitt 触发脉冲输入双向 IO。

缓冲器类型缩写:

- N: 正常 IO
- N_{PD}: 正常 IO, 内部下拉弱
- N_{PU}: 正常 IO, 内部上拉弱
- FS-SOD: 故障安全伪漏极开路输出, Schmitt 输入
- FS: 故障安全 IO
- Sch: Schmitt 输入缓冲器
- MIPI-PHY: CSI-2 前端模拟 IO
- HDMI-PHY: HDMI 前端模拟 IO

3.1. TC358743XBG BGA64 引脚数汇总

表 3.2 BGA64引脚数汇总

组名	引脚数
系统	4
CSI-2 TX	10
HDMI-RX	8
DDC	2
EDID	2
CEC	1
HPD	2
音频	4
IR	1
I2C	2
APLL	4
电源	12
接地	10
其他	2
总计	64

3.2. 引脚布置

A1 REXT	A2 VSS	A3 VPGM	A4 BIASDA	A5 DAOUT	A6 PFIL	A7 CSID3N	A8 CSID3P
B1 AVDD33	B2 AVDD12	B3 INT	B4 IR	B5 AVDD25	B6 PCKIN	B7 CSID2N	B8 CSID2P
C1 HDMICP	C2 HDMICN	C3 VDDC2	C4 VSS	C5 VSS	C6 VDD_MIPI	C7 CSICN	C8 CSICP
D1 HDMID0P	D2 HDMID0N	D3 AVDD12	D4 VSS	D5 VSS	D6 VSS	D7 CSID1N	D8 CSID1P
E1 HDMID1P	E2 HDMID1N	E3 VSS	E4 VSS	E5 TEST	E6 VSS	E7 CSID0N	E8 CSID0P
F1 HDMID2P	F2 HDMID2N	F3 AVDD33	F4 VDDIO1	F5 VDDC2	F6 VDD_MIPI	F7 A_SCK	F8 A_SD
G1 CEC	G2 VDDC1	G3 DDC_SDA	G4 I2C_SDA	G5 RESETN	G6 EDID_SDA	G7 A_WFS	G8 A_OSCK
H1 HPDO	H2 HPDI	H3 DDC_SCL	H4 I2C_SCL	H5 REFCLK	H6 EDID_SCL	H7 VDDIO2	H8 VSS

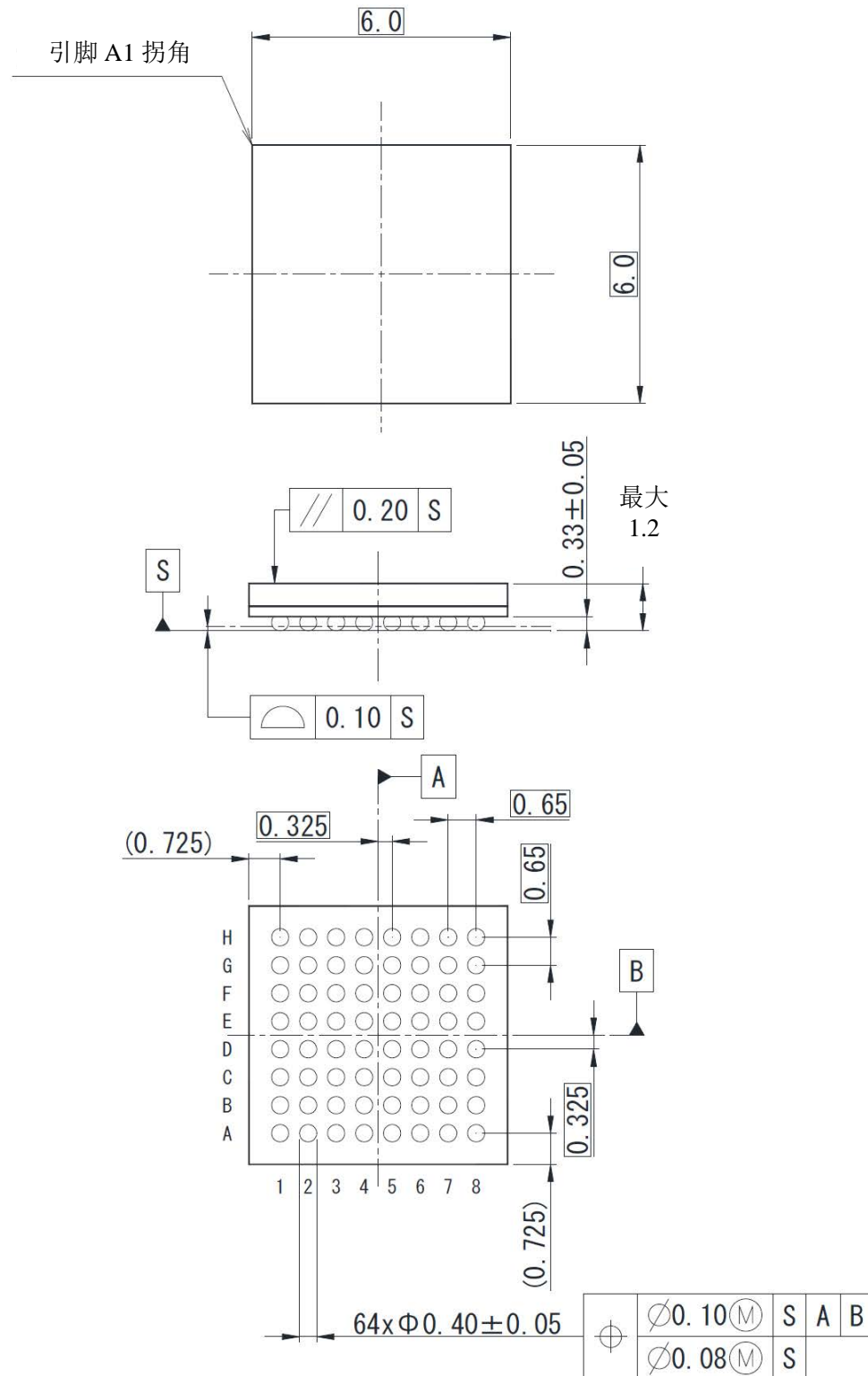
图 3.1 TC358743XBG64-引脚布置(顶视图)

4. 封装

TC358743XBG 封装图如下。

P-TFBGA64-0606-0.65-001

(单位: mm)



重量: 76.3 mg (典型值)

图 4.1 TC358743XBG封装(64 引脚)

表 4.1 机械尺寸

尺寸	最小值	典型值	最大值
焊球间距	-	0.65 mm	-
封装尺寸	-	6.0 × 6.0 mm ²	-
封装高度	-	-	1.2 mm

5. 电气特性

5.1. 最大绝对额定值

VSS= 0V 基准

参数	符号	额定值	单位
电源电压 (1.8V - 数字 IO)	VDDIO	-0.3 ~ +3.9	V
电源电压 (1.2V - 数字核心)	VDDC	-0.3 ~ +1.8	V
电源电压 (1.2V - MIPI CSI PHY)	VDD_MIPI	-0.3 ~ +1.8	V
电源电压 (3.3V - HDMIRX Phy)	AVDD33	-0.3 ~ +3.9	V
电源电压 (1.2V - HDMIRX Phy)	AVDD12	-0.3 ~ +1.8	V
电源电压 (2.5V - APLL)	AVDD25	-0.3 ~ +2.75	v
输入电压 (CSI IO)	V _{IN_CSI}	-0.3 ~ VDD_MIPI+0.3	V
输出电压 (CSI IO)	V _{OUT_CSI}	-0.3 ~ VDD_MIPI+0.3	V
输入电压 (数字 IO)	V _{IN_IO}	-0.3 ~ VDDIO+0.3	V
输出电压 (数字 IO)	V _{OUT_IO}	-0.3 ~ VDDIO+0.3	V
输出电压 (APLL)	V _{OUT_APLL}	-0.3 ~ AVDD25+0.3	V
结温	T _j	125	°C
存放温度	T _{stg}	-40 ~ +125	°C

5.2. 操作条件

VSS= 0V 基准

参数	符号	最小值	典型值	最大值	单位
电源电压(1.8/3.3V - 数字 IO)	VDDIO2	1.65	1.8	3.6	V
电源电压(3.3V - HDMI 数字 IO)	VDDIO1	3.0	3.3	3.6	V
电源电压(1.2V - 数字核心)	VDDC	1.1	1.2	1.3	V
电源电压(1.2V - MIPI CSI PHY)	VDD_MIPI	1.1	1.2	1.3	V
电源电压(2.5V - APLL)	AVDD25	2.25	2.5	2.75	V
工作温度 (环境温度, 施加电压)	T _a	-30	25	70	°C
电源噪声电压	VSN	-	-	0.1	V _{pp}
电源电压(3.3V - HDMIRX PHY)	AVDD33	3.135	3.3	3.465	V
AVDD33 电源噪声电压	VSN33	-	-	0.08	V _{pp}
电源电压(1.2V - HDMIRX PHY)	AVDD12	1.15	1.2	1.25	V
AVDD12 电源噪声电压	VSN12	-	-	0.04	V _{pp}

5.3. 直流电气规格

参数	符号	最小值	典型值	最大值	单位
输入电压, 高电平输入 ^{注1}	V_{IH}	$0.7 \times V_{DDIO}$	-	V_{DDIO}	V
输入电压, 低电平输入 ^{注1}	V_{IL}	0	-	$0.3 \times V_{DDIO}$	V
输入电压高电平 CMOS Schmitt 触发器 ^{注1,2}	V_{IHS}	$0.7 \times V_{DDIO}$	-	V_{DDIO}	V
输入电压低电平 CMOS Schmitt 触发器 ^{注1,2}	V_{ILS}	0	-	$0.3 \times V_{DDIO}$	V
输出电压高电平 ^{注1,注2}	V_{OH}	$0.8 \times V_{DDIO}$	-	V_{DDIO}	V
输出电压低电平 ^{注1,注2}	V_{OL}	0	-	$0.2 \times V_{DDIO}$	V
输入泄漏电流, 高电平 (条件: $V_{IN} = +V_{DDIO}$, $V_{DDIO} = 3.6V$)	I_{ILH1} ^(注4)	-10	-	10	μA
输入泄漏电流, 低电平 (条件: $V_{IN} = 0V$, $V_{DDIO} = 3.6V$)	I_{ILL1} ^(注5)	-10	-	10	μA

注 1: 各个电源在建议操作条件下工作。

注 2: 针对各 IO 缓冲器单独规定电流输出值。输出电压随输出电流值变化。

注 4: “正常”引脚或“上拉 IO”引脚向 V_{in} (输入电压) 施加 V_{DDIO} 电源电压

注 5: “正常”引脚向 V_{in} (输入电压) 施加 V_{SS} (0V)

6. 修订记录

表 6.1 修订记录

修订版本	日期	修订说明
修订版 0.582	2014-05-16	最新发布
修订版 0.621	2015-12-18	在外部引脚上 Init(O) DAOUT 引脚排印错误

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