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## FSA3000 — 双端口、高速、MHL™ 开关

### 产品特性

- 低导通电容：2.7 pF/4.1 pF MHL/USB（典型值）
- 低功耗：30  $\mu$ A（最大值）
- MHL 数据速率：4.92 Gbps ( $f_{3dB} = 2.46$  GHz)
- 10-引脚 MicroPak™ 封装
- 所有 USB 和 MHL 端口上的过压容差 (OVT) 高达 5.25 V，无外部组件

### 应用

- 手机和数码相机

### 说明

#### FSA3000

是一款双向、低功率、双端口、高速USB2.0视频数据开关，支持移动高清链路 (MHL) 规格版本 2.0。FSA3000 配置为双刀双掷 (DPDT) 数据开关，专门针对 USB2.0 和 MHL 数据源进行了优化。

FSA3000 的开关 I/O 引脚上有电路，使得器件能够在  $V_{cc}$  电源断开 ( $V_{cc}=0$ ) 的应用中承受过压状况。

FSA3000最大限度地降低了电流消耗，即使在施加于控制引脚的电压低于电源电压的情况下也是如此 ( $V_{cc}$ )。该特性特别适合手机等移动应用，可直接连接基带处理器的通用 I/O。

其他应用包括便携式手机、数码相机和笔记本电脑中共享的开关和连接器。

### 订购信息

器件型号	顶标	工作温度范围	封装
FSA3000L10X	LK	-40 至 +85° C	10-引脚, MicroPak™ 1.6 x 2.1 mm JEDEC M0255B
FSA3000L10X_f131	LK		10-引脚, MicroPak™ 1.6 x 2.1 mm JEDEC M0255B, Package Rotated 90° in Tape and Reel

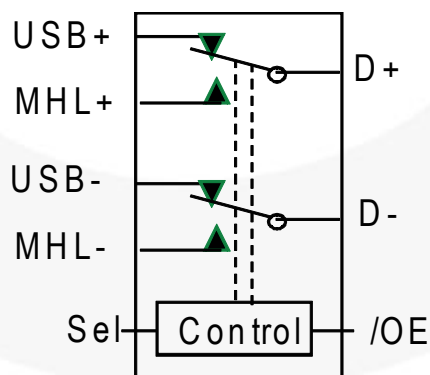


图 1. 模拟符号

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## 数据开关选择真值表

SEL <sup>(1)</sup>	/OE <sup>(1)</sup>	功能
X	高	USB 和 MHL 路径均为高阻抗
低	低	D+/D- 连接到 USB+/USB-
高	低	D+/D- 连接到 MHL+/MHL-

## 注意:

1. 严禁悬空或断连控制输入。

## 引脚布局

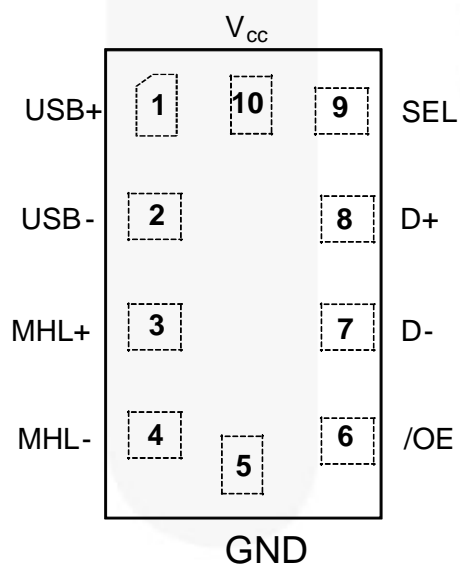


图 2. 引脚分配 (俯视图)

## 引脚说明

引脚号	名称	说明
1	USB1+	USB 差分数据 (正)
2	USB1-	USB 差分数据 (负)
3	MHL+	MHL 差分数据 (正)
4	MHL-	MHL 差分数据 (负)
5	GND	接地
6	/OE	输出使能 (低电平有效)
7	D-	数据开关输出 (负)
8	D+	数据开关输出 (正)
9	SEL	数据开关选择
10	V <sub>CC</sub>	电源

## 绝对最大额定值

应力超过绝对最大额定值，可能会损坏设备。

在超出推荐的工作条件的情况下，该器件可能无法正常运行或操作，且不建议让器件在这些条件下长期工作。此外，过度暴露在高于推荐的工作条件下，会影响器件的可靠性。绝对最大额定值仅是额定应力值。

符号	参数		最小值	最大值	单位
$V_{CC}$	电源电压		-0.5	5.5	V
$V_{CNTRL}$	DC 输入电压 (SEL, /OE) <sup>(2)</sup>		-0.5	$V_{CC}$	V
$V_{SW}$	直流开关 I/O 电压 <sup>(2,3)</sup>		-0.50	5.25	V
$I_{IK}$	直流输入二极管电流		-50		mA
$I_{OUT}$	直流输出电流			100	mA
$T_{STG}$	存储温度		-65	+150	°C
MSL	潮湿敏感度 (JEDEC J-STD-020A)			1	
ESD	人体模型, JEDEC: JESD22-A114	全部引脚		3.5	kV
	IEC 61000-4-2, 4 级, 用于 D+/D- 和 $V_{CC}$ 引脚 <sup>(4)</sup>	接触式		8	
	IEC 61000-4-2, 4 级, 用于 D+/D- 和 $V_{CC}$ 引脚 <sup>(4)</sup>	空气放电		15	
	充电器件模式, JESD22-C101			2	

### 说明:

- 当测量输入与输出二极管电流额定值时，该输入与输出可能超出负额定值。
- $V_{SW}$  指模拟数据开关路径 (USB 和 MHL)。
- 在使用 TVS 二极管的系统环境中进行测试。

## 推荐工作条件

推荐的操作条件表定义了器件的真实工作条件。指定推荐的工作条件，以确保设备的最佳性能达到数据表中的规格。飞兆半导体建议不要超过推荐工作条件，也不能按照绝对最大额定值进行设计。

符号	参数		最小值	最大值	单位
$V_{CC}$	电源电压		2.7	4.3	V
$t_{RAMP(VCC)}$	电源转换速率		100	1000	$\mu s/V$
$V_{CNTRL}$	控制输入电压 (SEL, /OE) <sup>(5)</sup>		0	4.3	V
$\Theta_{JA}$	热阻			313	°C/W
$V_{SW(USB)}$	开关输入/输出电压 (USB 开关路径)		-0.5	3.6	V
$V_{SW(MHL)}$	开关输入/输出电压 (MHL 开关路径)		1.65	3.45	V
$T_A$	工作温度		-40	+85	°C

### 注意:

- 控制输入必须保持高电平或低电平，不允许悬空。

## 直流电气特性

若无其他说明，所有典型值都在  $T_A=25^\circ\text{C}$  下测得。

符号	参数	条件	$V_{CC}$ (V)	$T_A = -40^\circ\text{C}$ 至 $+85^\circ\text{C}$			单位
				最小值	典型值	最大值	
$V_{IK}$	箝位二极管电压	$I_{IN} = -18\text{ mA}$	2.7			-1.2	V
$V_{IH}$	控制输入高电平	SEL, /OE	2.7 至 4.3	1.25			V
$V_{IL}$	控制输入低电平	SEL, /OE	2.7 至 4.3			0.6	V
$I_{IN}$	控制输入漏电	$V_{SW}=0$ 至 3.6 V, $V_{CTRL}=0$ 至 $V_{CC}$	4.3	-500		500	nA
$I_{OZ(MHL)}$	开放 MHLn 数据路径关断状态漏电	$V_{SW}=1.65 \leq \text{MHL} \leq 3.45\text{ V}$	4.3	-500		500	nA
$I_{OZ(USB)}$	开放 USBn 数据路径关断状态漏电	$V_{SW}=0 \leq \text{USB} \leq 3.6\text{ V}$	4.3	-500		500	nA
$I_{CL(MHL)}$	封闭 MHLn 数据路径导通状态漏电 <sup>(6)</sup>	$V_{SW}=1.65 \leq \text{MHL} \leq 3.45\text{ V}$	4.3	-500		500	nA
$I_{CL(USB)}$	封闭 USBn 数据路径导通状态漏电 <sup>(6)</sup>	$V_{SW}=0 \leq \text{USB} \leq 3.6\text{ V}$	4.3	-500		500	nA
$I_{OFF}$	关机漏电 (全部输入/输出端口)	$V_{SW}=0\text{ V}$ 或 3.6 V, 图 4	0	-500		500	nA
$R_{ON(USB)}$	HS 开关导通电阻 (USB 至 Dn 路径)	$V_{SW}=0.4\text{ V}$ , $I_{ON}=-8\text{ mA}$	2.7		3.5	4.8	$\Omega$
$R_{ON(MHL)}$	HS 开关导通电阻 (MHL 至 Dn 路径)	$V_{SW}=V_{CC}-1050\text{ mV}$ , $I_{ON}=-8\text{ mA}$ 图3	2.7		4.7	6.0	$\Omega$
$\Delta R_{ON(MHL)}$	$R_{ON}$ 在 MHL 正负极之间的差异	$V_{SW}=V_{CC}-1050\text{ mV}$ , $I_{ON}=-8\text{ mA}$ , 图 3	2.7		0.03		$\Omega$
$\Delta R_{ON(USB)}$	$R_{ON}$ 在 USB 正负极之间的差异	$V_{SW}=0.4\text{ V}$ , $I_{ON}=-8\text{ mA}$	2.7		0.18		$\Omega$
$R_{ONF(MHL)}$	$R_{ON}$ MHL 路径平坦度	$V_{SW}=1.65$ 至 3.45 V, $I_{ON}=-8\text{ mA}$	2.7		0.9		$\Omega$
$I_{CC}$	静态电源电流	$V_{/OE}=0$ , $V_{SEL}=0$ 或 $V_{CC}$ , $I_{OUT}=0$	4.3			30	$\mu\text{A}$
$I_{CCZ}$	静态电源电流 (高阻抗)	$V_{SEL}=X$ , $V_{/OE}=V_{CC}$ , $I_{OUT}=0$	4.3			1	$\mu\text{A}$
$I_{COT}$	静态电源电流增量	$V_{SEL}=X$ , $V_{/OE}=1.65\text{ V}$	4.3		5	10	$\mu\text{A}$

## 注意:

6. 对于该项测试，使用相应的悬空开关引脚将数据开关闭合。

## 交流电气特性

若无其他说明, 所有典型值都在  $V_{CC}=3.3\text{ V}$ ,  $T_A=25^\circ\text{ C}$  下测得。

符号	参数	条件	$V_{CC}$ (V)	$T_A = -40^\circ\text{C}$ 至 $+85^\circ\text{C}$			单位
				最小值	典型值	最大值	
$t_{ON}$	MHL 导通时间, SE L 至输出	$R_L=50\ \Omega$ , $C_L=5\ \text{pF}$ , $V_{SW(USB)}=0.8\ \text{V}$ , $V_{SW(MHL)}=3.3\ \text{V}$ 图 5, 图 6	2.7 至 3.6 V		350	600	ns
$t_{OFF}$	MHL 导通时间, SE L 至输出	$R_L=50\ \Omega$ , $C_L=5\ \text{pF}$ , $V_{SW(USB)}=0.8\ \text{V}$ , $V_{SW(MHL)}=3.3\ \text{V}$ 图 5, 图 6	2.7 至 3.6 V		125	300	ns
$t_{ZHM, ZLM}$	MHL 启用时间, /OE 至输出	$R_L=50\ \Omega$ , $C_L=5\ \text{pF}$ , $V_{SW(MHL)}=3.3\ \text{V}$ 图 5 图 6	2.7 至 3.6 V		60	150	$\mu\text{s}$
$t_{ZHU, ZLU}$	USB 启用时间, /OE 至输出	$R_L=50\ \Omega$ , $C_L=5\ \text{pF}$ , $V_{SW(USB)}=0.8\ \text{V}$ 图 5 图 6	2.7 至 3.6 V		100	300	ns
$t_{LZM, HZM}$	MHL 禁用时间, /OE 至输出	$R_L=50\ \Omega$ , $C_L=5\ \text{pF}$ , $V_{SW(MHL)}=3.3\ \text{V}$ 图 5 图 6	2.7 至 3.6 V		35	100	ns
$t_{LZU, HZU}$	USB 禁用时间, /OE 至输出	$R_L=50\ \Omega$ , $C_L=5\ \text{pF}$ , $V_{SW(USB)}=0.8\ \text{V}$ 图 5 图 6	2.7 至 3.6 V		35	100	ns
$t_{PD}$	传输延迟 <sup>(7)</sup>	$C_L=5\ \text{pF}$ , $R_L=50\ \Omega$ , 图 5, 图 7	2.7 至 3.6 V		0.25		ns
$t_{BBM}$	先开后合 <sup>(7)</sup>	$R_L=50\ \Omega$ , $C_L=5\ \text{pF}$ , $V_{ID}=V_{MHL}=3.3\ \text{V}$ , $V_{USB}=0.8\ \text{V}$ 图 9	2.7 至 3.6 V	2		13	ns
$O_{IRR(MHL)}$	关断隔离 <sup>(7)</sup>	$V_S=1\ \text{V}_{pk-pk}$ , $R_L=50\ \Omega$ , $f=240\ \text{MHz}$ 图 11	2.7 至 3.6 V		-55		dB
$O_{IRR(USB)}$		$V_S=400\ \text{mV}_{pk-pk}$ , $R_L=50\ \Omega$ , $f=240\ \text{MHz}$ , 图 11	2.7 至 3.6 V		-45		dB
$Xtalk_{MHL}$	非相邻通道 <sup>(7)</sup> 串扰	$V_S=1\ \text{V}_{pk-pk}$ , $R=50\ \Omega$ , $f=240\ \text{MHz}$ , 图 12	2.7 至 3.6 V		-47		dB
$Xtalk_{USB}$		$V_S=400\ \text{mV}_{pk-pk}$ , $R_L=50\ \Omega$ , $f=240\ \text{MHz}$ , 图 12	2.7 至 3.6 V		-45		dB
BW (插入损耗)	差分 -3db 带宽 <sup>(7)</sup>	$V_{IN}=1\ \text{V}_{pk-pk}$ , MHL 路径, $R_L=50\ \Omega$ , $C_L=0\ \text{Pf}$ , 图 10, 图 15	2.7 至 3.6 V		2.46		GHz
		$V_{IN}=400\ \text{mV}_{pk-pk}$ , USB 路径, $R_L=50\ \Omega$ , $C_L=0\ \text{pF}$ , 图 10, 图 16			1.22		

## 注意:

7. 由产品特性保证。

## USB 高速交流电气特性

若无其他说明，所有典型值都在  $V_{CC}=3.3\text{ V}$ ， $T_A=25^\circ\text{ C}$  下测得。

符号	参数	条件	$V_{CC}$ (V)	典型值	单位
$t_{SK(P)}$	在相同输出下，反向转换的时滞 <sup>(8)</sup>	$C_L=5\text{ pF}$ ， $R_L=50\ \Omega$ ，图 8	3.0 至 3.6	6	ps
$t_J$	总抖动 <sup>(8)</sup>	$R_L=50\ \Omega$ ， $C_L=5\text{ pf}$ ， $t_R=t_F=500\text{ ps}$ (10–90%) (480 Mbps, PN7 时)	3.0 至 3.6	15	ps

### 注意：

8. 由产品特性保证。

## MHL 交流电气特性

若无其他说明，所有典型值都在  $V_{CC}=3.3\text{ V}$ ， $T_A=25^\circ\text{ C}$  下测得。

符号	参数	条件	$V_{CC}$ (V)	典型值	单位
$t_{SK(P)}$	在相同输出下，反向转换的时滞 <sup>(9)</sup>	$R_{PU}=50\ \Omega$ 至 $V_{CC}$ ， $C_L=0\text{ pF}$	3.0 至 3.6	6	ps
$t_J$	总抖动 <sup>(9)</sup>	$f=2.25\text{ Gbps}$ ，PN7， $R_{PU}=50\ \Omega$ 至 $V_{CC}$ ， $C_L=0\text{ pF}$	3.0 至 3.6	15	ps

### 注意：

9. 由产品特性保证。

## 电容值

若无其他说明，所有典型值都在  $V_{CC}=3.3\text{ V}$ ， $T_A=25^\circ\text{ C}$  下测得。

符号	参数	条件	典型值	最大值	单位
$C_{IN}$	控制引脚输入电容 <sup>(10)</sup>	$V_{CC}=0\text{ V}$ ， $f=1\text{ MHz}$	2.1		pF
$C_{ON(USB)}$	USB 路径导通电容 <sup>(10)</sup>	$V_{CC}=3.3\text{ V}$ ， $f=240\text{ MHz}$ ，图 14	4.1	5.0	pF
$C_{OFF(USB)}$	USB 路径关断电容 <sup>(10)</sup>	$V_{CC}=3.3\text{ V}$ ， $f=240\text{ MHz}$ ，图 13	2.8	3.2	pF
$C_{ON(MHL)}$	MHL 路径导通电容 <sup>(10)</sup>	$V_{CC}=3.3\text{ V}$ ， $f=240\text{ MHz}$ ，图 14	2.7	3.0	pF
$C_{OFF(MHL)}$	MHL 路径关断电容 <sup>(10)</sup>	$V_{CC}=3.3\text{ V}$ ， $f=240\text{ MHz}$ ，图 13	1.1	1.5	pF

### 注意：

10. 由产品特性保证，未经生产测试。

### 测试框图

**注意:**

11. HSD 指 USB 或 MHL 路径上的高速数据。

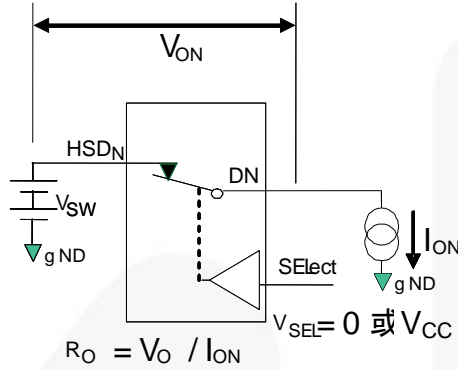


图 3. 导通电阻

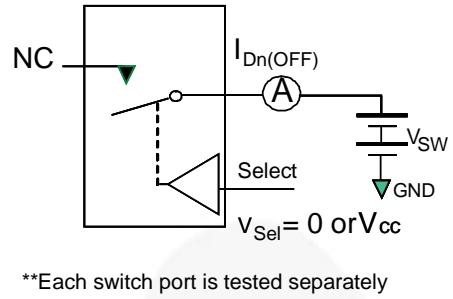
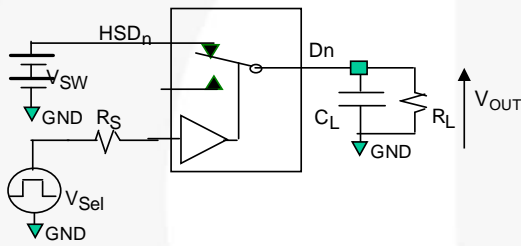


图 4. 关断漏电



$R_L$ ,  $R_S$  and  $C_L$  are function of application environment (see AC Tables for specific values)  
 $C_L$  includes test fixture and stray capacitance

图 5. 交流测试电路负载

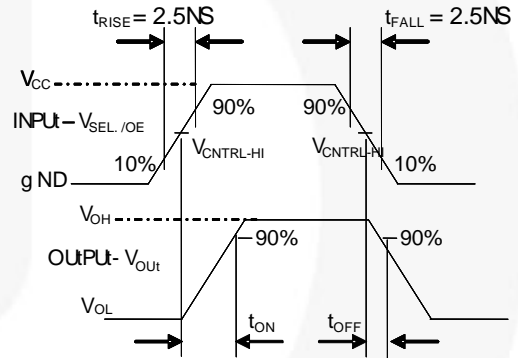


图 6. 开通/关断波形

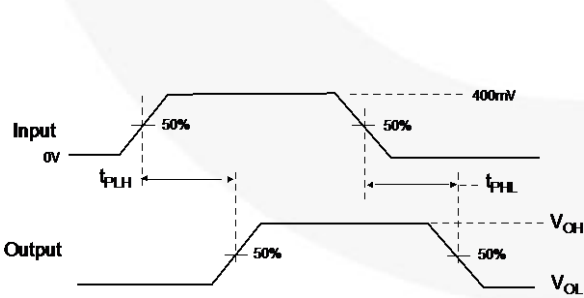


图 7. 传输延迟 ( $t_{r}t_f = 500$  ps)

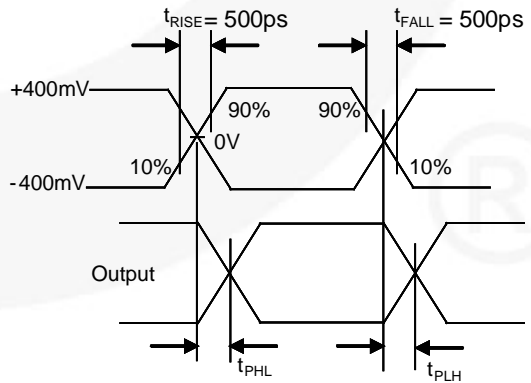
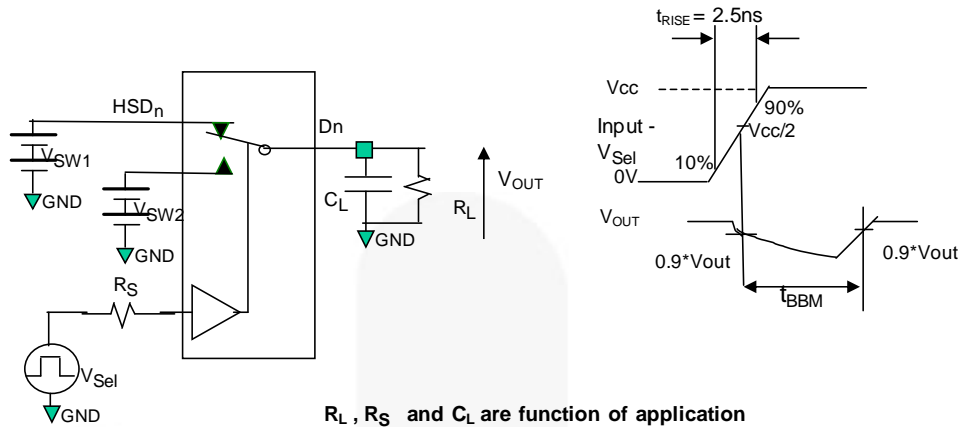


图 8. 内部成对时滞测试  $t_{sk(0)}$

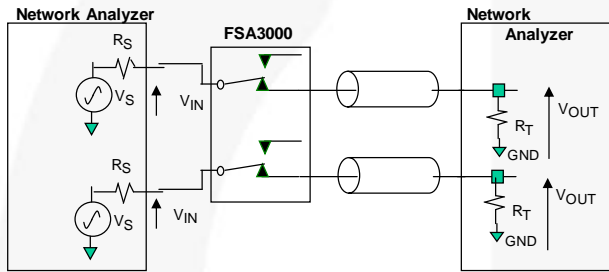


测试框图 (续)



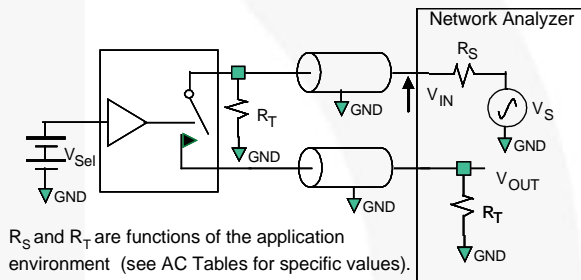
$R_L$ ,  $R_S$  and  $C_L$  are function of application environment (see AC Tables for specific values)  
 $C_L$  includes test fixture and stray capacitance

图 9. 先开后合间隔时序



$V_S$ ,  $R_S$  and  $R_T$  are function of application environment (see AC/DC Tables for values)

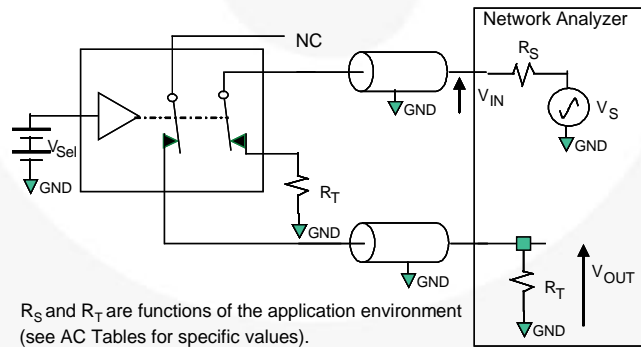
图 10. 插入损耗



$R_S$  and  $R_T$  are functions of the application environment (see AC Tables for specific values).

Off isolation =  $20 \text{ Log} (V_{OUT} / V_{IN})$

图 11. 通道的关断隔离



$R_S$  and  $R_T$  are functions of the application environment (see AC Tables for specific values).

Crosstalk =  $20 \text{ Log} (V_{OUT} / V_{IN})$

图 12. 非相邻通道间串扰

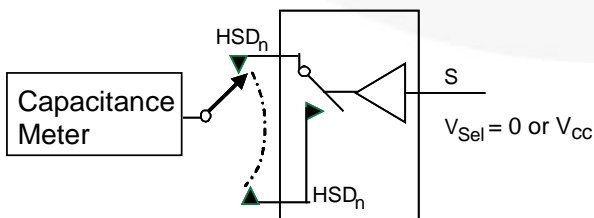


图 13. 通道关断电容

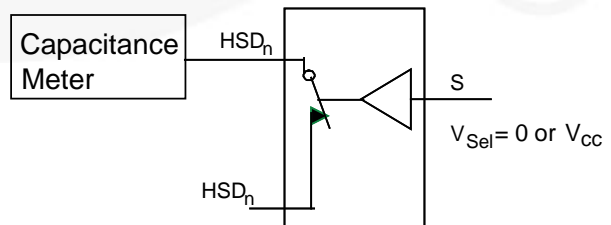


图 14. 通道导通电容

## 插入损耗

### FSA3000

在移动数字视频应用中的主要优点之一就是接收信号的插入损耗低，因为该插入损耗通过了开关。这就使收到的眼图信号劣化程度降至最低。测量高数据速率信道质量的方法之一就是使用平衡端口和四端口差分 S 参数分析法，尤其是 SDD21。

带宽测量使用 S 参数 SDD21 方法。图 15 显示 MHL 路径的带宽 (GHz)，图 16 显示 USB 路径的带宽曲线。

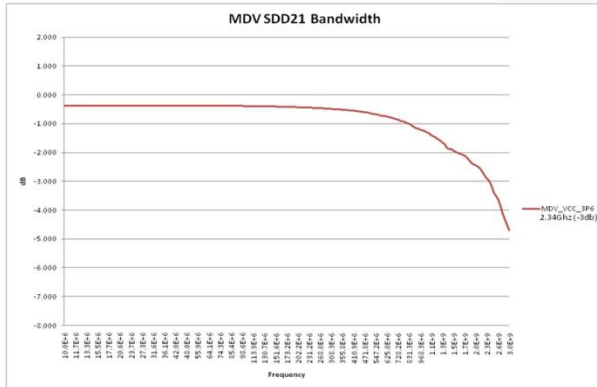


图 15. MHL (MDV) 路径 SDD21 插入损耗曲线

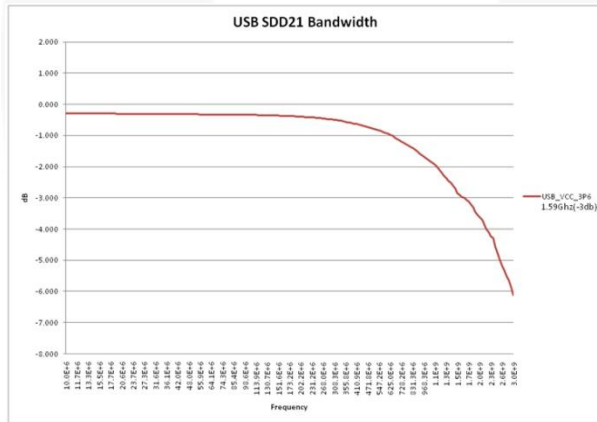


图 16. USB 路径 SDD21 插入损耗曲线

## 典型应用

图 17 显示一个利用 FSA3000 进行 MHL 路径开关的典型移动应用。FSA3157 在 MHL 路径 CBUS 和 USB 端口 ID 引脚需要切换的场景中用于实现 OTG 双角色设备。用于 MHL\_SEL 且阻值为 3M 电阻器为可选器件，确保 USB 开关路径上电后被选择为默认路径。

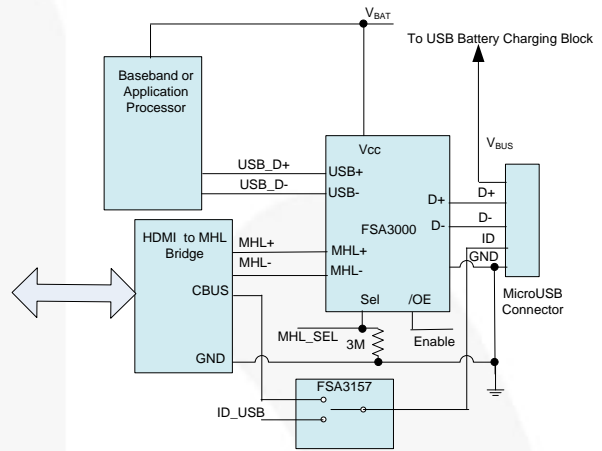


图 17. 典型移动 MHL 应用

# Packing Specifications

## MicroPak 1.6x2.1 F131, Packing Drawing

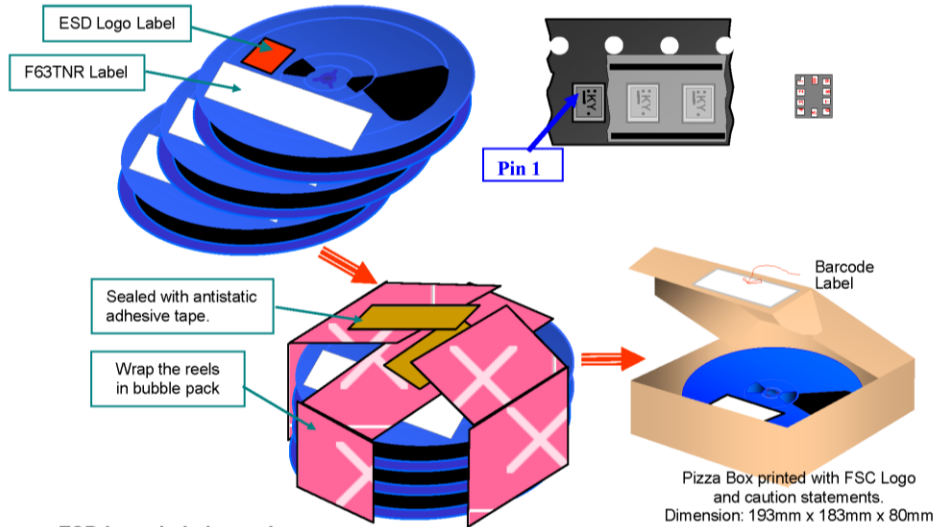


### Packing Description:

MicroPak 1.6x2.1 F131 products are classified under Moisture Sensitive Level 1.

The carrier tape is made from dissipative polystyrene or polycarbonate resin. The cover tape is a multilayer film primarily composed of polyester film, adhesive layer, heat activated sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 5000 units per 178 mm diameter reel. Up to three reels are packed in each intermediate box. The reels is made of polystyrene plastic (anti-static coated or intrinsic).

These full reels are individually barcode labeled and placed inside a pizza box made of recyclable corrugated brown paper with a Fairchild logo printing. Up to 3 reels could be packed in the pizza box. And these pizza boxes are placed inside a barcode labeled shipping box which comes in different sizes depending on the number of parts shipped.



### ESD Logo Label sample



### F63TNR Label sample

LOT: PMH01008888	QTY: 5000
FSID: FSA831L10X	SPEC: F131
D/C1: P1136AA QTY1:	SPEC REV: 2 <sup>nd</sup> Level Interconnect
D/C2: QTY2:	Green Component
	1. Category G4
	2. Maximum safe temperature 260 deg C
	3. MSL 1
	FAIRCHILD SEMICONDUCTOR (F63TNR)8.0

### Tape Leader and Trailer Configuration

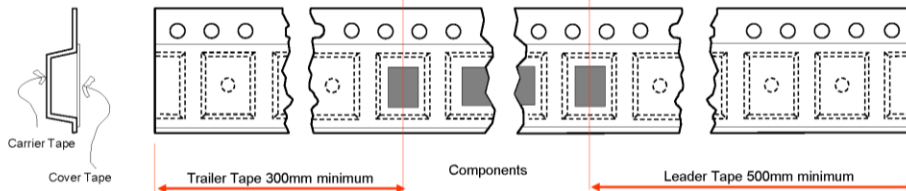
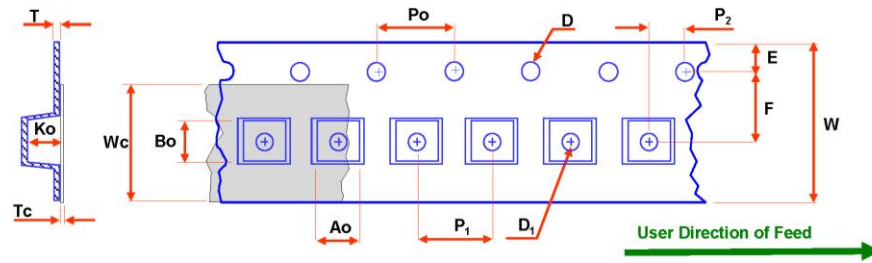


图 18. MicroPak™ 1.6 x 2.1 mm, Packing Drawing, Page 1

## Packing Specifications (Continued)

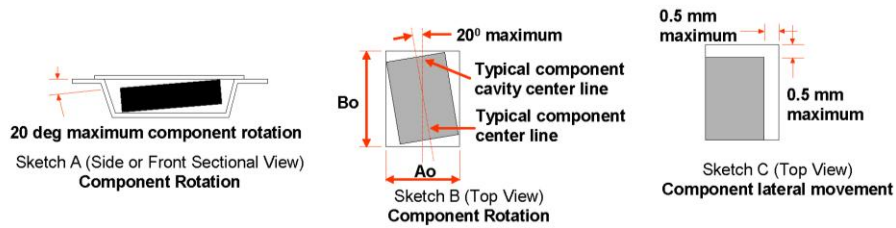
### Embossed Tape Dimension



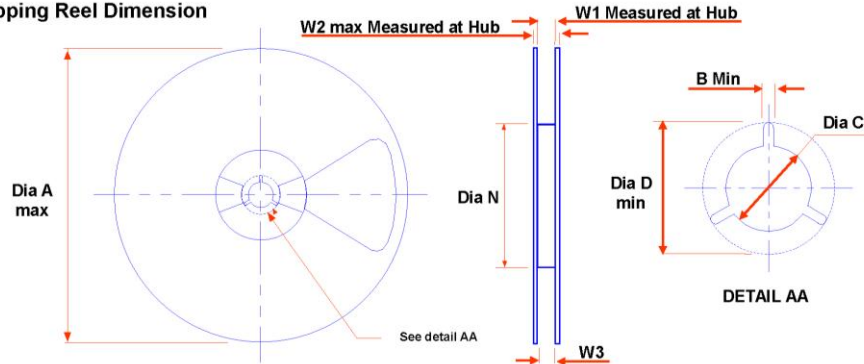
Dimensions are in millimeters

Package	Ao	Bo	D	D <sub>1</sub>	E	F	Ko	P <sub>1</sub>	Po	P <sub>2</sub>	T	Tc	W	Wc
	+/-0.05	+/-0.05	+/-0.10	min.	+/-0.1	+/-0.1	+/-0.05	TYP	TYP	+/-0.05	TYP	+/-0.005	+/-0.3	TYP
MAC10A	1.83	2.34	1.5	0.5	1.75	3.5	0.65	4	4	2.0	0.254	0.06	8	5.3

Notes: Ao, Bo, and Ko dimensions are determined with respect to the EIA /Jedec RS-481 rotational and lateral movement requirements (see sketches A, B, and C).



### Shipping Reel Dimension

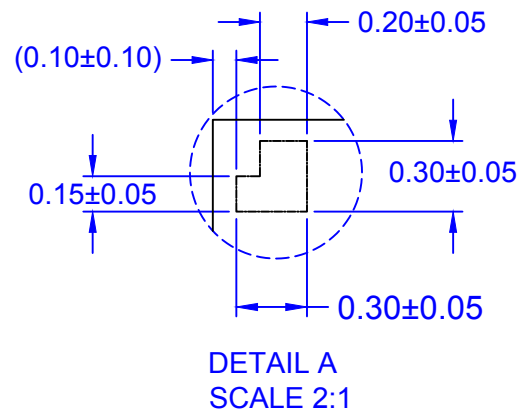
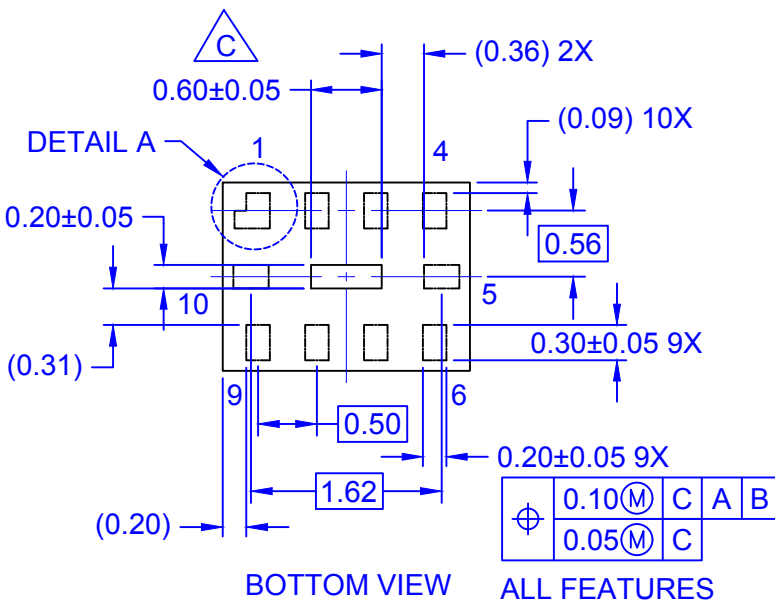
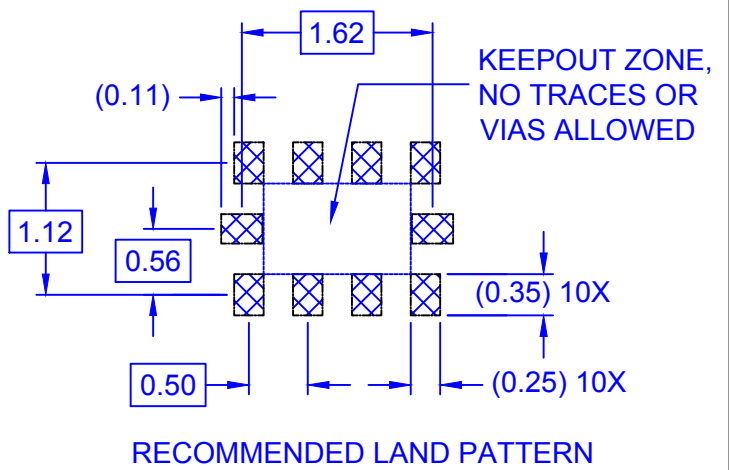
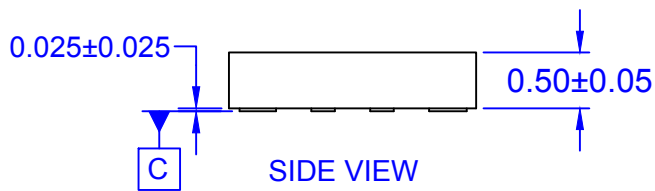
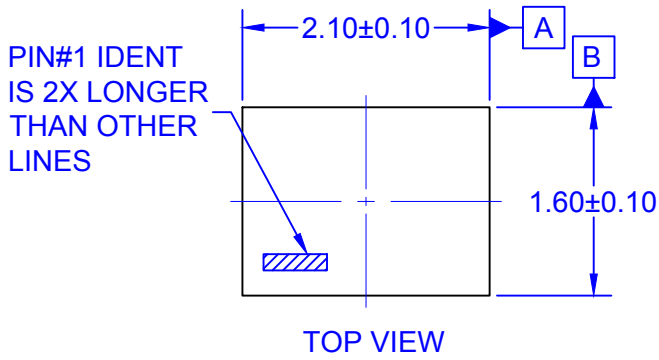


Dimensions are in millimeters

Tape Width	Dia A max	Dim B min	Dia C +5/-2	Dia D min	Dim N min	Dim W1 +2/-0	Dim W2 max	Dim W3 (LSL - USL)
8	178	1.5	13	20.2	55	8.4	14.4	7.9-10.4

APPROVALS	DATE						
DESIGN							
DRG. CHG.							
ENGR. CHG.							
		MicroPak 1.6x2.1 F131 Packing Configuration					
SCALE	1:1	SIZE	N/A	DRAWING NUMBER	PKG - MAC10A-F131	REV	1
DO NOT SCALE DRAWING				SHEET 1 of 1			

图 19. MicroPak™ 1.6 x 2.1 mm, Packing Drawing, Page 2



NOTES:

- A. PACKAGE CONFORMS TO JEDEC REGISTRATION MO-255, VARIATION UABD.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. PRESENCE OF CENTER PAD IS PACKAGE SUPPLIER DEPENDENT. IF PRESENT IT IS NOT INTENDED TO BE SOLDERED AND HAS A BLACK OXIDE FINISH.
- D. DRAWING FILENAME: MKT-MAC10ArevG.
- E. DIMENSIONS WITHIN ( ) ARE UNCONTROLLED.

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