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FSUSB30

低功率、双端口、高速 USB2.0(480Mbps) 开关

特性

- 低导通电容: 3.7pF (典型值)
- 低导通电阻: 6.5W (典型值)
- 低功耗: 1μA (最大值)
 - 最大 I_{CCT} 超过扩展控制电压范围 ($V_{IN} = 2.6V$, $V_{CC} = 4.3V$)
- 宽 -3dB 带宽, >720MHz
- 8kV 静电放电保护
- 当 $V_{CC} = 0V$; D+/D- 引脚可耐受的电压达到 5.5V 时, 会提供断电保护
- 封装:
 - 10 引脚 MicroPak™ (1.6 x 2.1mm)
 - 10 引脚 MSOP
 - 10 引脚 UMLP (1.4 x 1.8mm)

应用

- 手机、个人数字处理 (PDA)、数码相机和笔记本 LCD 显示器、电视机和机顶盒

相关应用说明

- AN-6022 使用 FSUSB30/FSUSB31, 以符合 USB 2.0 故障条件要求

说明

FSUSB30 是一款低功率、2 端口、高速 USB 2.0 开关。该器件配置为双刀双掷 (DPDT) 开关, 专为在两个高速 (480Mbps) 源或高速和全速 (12Mbps) 源之间切换进行了优化。FSUSB30 符合 USB2.0 的要求, 并且具有 3.7pF 的极低导通电容 (C_{ON})。此器件的宽带宽 (720MHz) 超过了通过三次谐波所需的带宽, 这使得信号的边沿和相位失真降到最小。出色的通道间串扰性能可实现最小的干扰。

FSUSB30 在 D+ / D- 引脚上包含了特殊的电路, 在断电时可使器件承受过压条件。同时, 当应用于 S 引脚的控制电压小于电源电压 (V_{CC}) 时, 该器件可以最大限度地降低功耗。此特性对超便携式应用 (例如手机) 尤为重要, 可支持基带处理器通用 I/O 的直接接口。其他应用包括便携式手机、PDA、数码相机、打印机和笔记本电脑中共享的开关和连接器。

订购信息

订货号	封装编号	产品代码记号	封装说明
FSUSB30L10X	MAC010A	FJ	10 引脚 MicroPak, 1.6 x 2.1mm
FSUSB30MUX	MUA10A	FSUSB30	10 引脚模塑小外形封装 (MSOP), JEDEC MO-187, 3.0mm 宽
FSUSB30UMX	MLP010A	GJ	10 引脚方形超薄 MLP (UMLP) 1.4 x 1.8mm

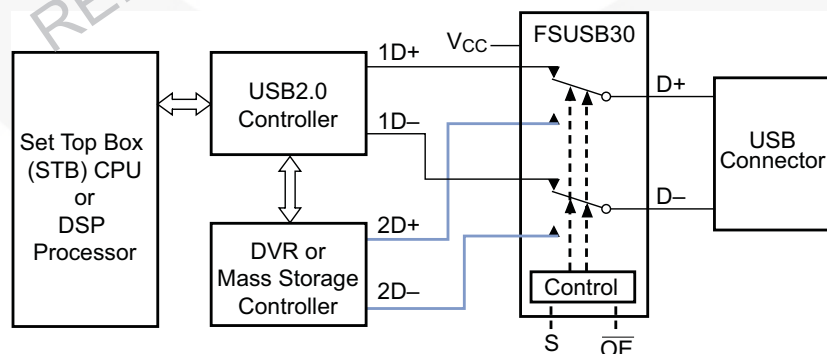
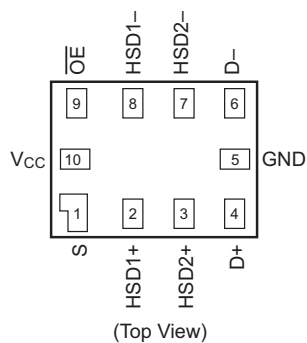


图 1. 典型应用

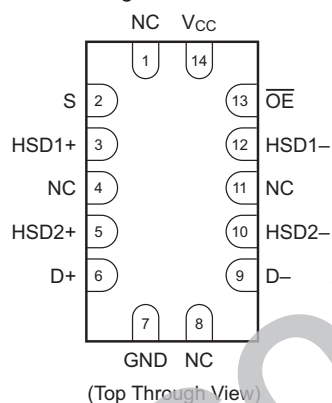
MicroPak™ 是飞兆半导体公司的商标。

连接图

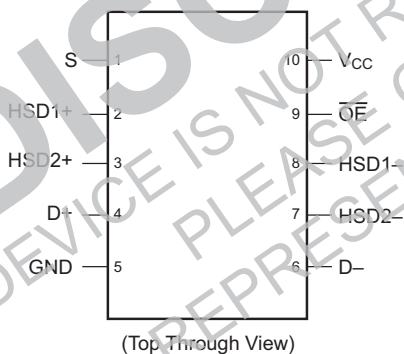
Pad Assignments for MicroPak



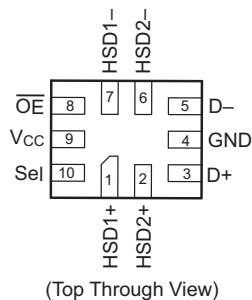
Pad Assignments for DQFN



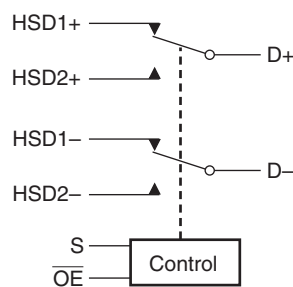
Pin Assignment for MSOP



Pad Assignments for μMLP



模拟符号



引脚描述

引脚名	说明
$\overline{OE}$	总线开关使能
S	选择输入
D+, D-, HSDn+, HSDn-	数据端口
NC	未连接

真值表

S	$\overline{OE}$	功能
X	高	未连接
低	低	D+, D- = HSD1 _n
高	低	D+, D- = HSD2 _n

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		最低	最大值	单位
V_{CC}	电源电压		-0.5	+5.5	V
V_{CNTRL}	DC 输入电压 ⁽¹⁾		-0.5	V_{CC}	V
V_{SW}	直流开关 I/O 电压 ⁽¹⁾	HSDnX	0.5	V_{CC}	V
		D+,D- 考虑到 $V_{CC} > 0$	0.5	V_{CC}	V
		D+,D- 考虑到 $V_{CC} = 0$	-0.50	V_{CC}	V
I_{IK}	直流输入二极管电流		-50		mA
I_{OUT}	直流输出电流			50	mA
T_{STG}	存储温度		-65	+150	°C
ESD	人体模型	全部引脚		8	kV
		输入 / 输出至地		8	kV

注意：

1. 当观测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。

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	最低	最大值	单位
V_{CC}	电源电压	3.0	4.3	V
V_{IN}	控制输入电压	0	V_{CC}	V
V_{SW}	开关输入电压	0	V_{CC}	V
T_A	工作温度	-40	+85	°C
Θ_{JA}	热阻，10 MicroPak		250	°C/W

注意：

2. 控制输入必须保持高电平或低电平，不允许浮动。

直流电气特性

若无其他说明，所有典型值都在 25°C 下测得。

符号	参数	工作条件	V _{CC} (V)	T _A = -40°C 至 +85°C			单位
				最小值	典型值	最大值	
V _{IK}	箝位二极管电压	I _{IN} = -18mA	3.0			-1.2	V
V _{IH}	输入电压高电平		3.0 至 3.6	1.3			V
			4.3	1.7			V
V _{IL}	输入电压低电平		3.0 至 3.6			0.5	V
			4.3			0.7	V
I _{IN}	控制脚输入漏电流	V _{SW} = 0.0V 至 V _{CC}	4.3	-1.0		1.0	μA
I _{OZ}	关断漏电流	0 ≤ D _n , HSD1 _n , HSD2 _n ≤ V _{CC}	4.3	-2.0		2.0	μA
I _{OFF}	电源关断漏电流 (D+, D-)	V _{SW} = 0V 至 4.3V, V _{CC} = 0V	0	-2.0		2.0	μA
R _{ON}	开关导通电阻 (3)	V _{SW} = 0.4V, I _{ON} = -8mA	3.0		6.5	10.0	Ω
		V _{SW} = 0V, I _O = 30mA, 25°C	3.6			7.0	Ω
ΔR _{ON}	Delta R _{ON} ⁽⁴⁾	V _{SW} = 0.4V, I _{ON} = -8mA	3.0		0.35		Ω
R _{ON} 平坦度	R _{ON} 平坦度 ⁽³⁾	V _{SW} = 0.0V - 1.0V, I _{ON} = -8mA	3.0		2.0		Ω
I _{CC}	静态电源电流	V _{CNTRL} = 0.0V 或 V _{CC} , I _{OUT} = 0	4.3			1.0	μA
I _{CCT}	每个控制电压的 I _{CC} 电流增量	V _{CNTRL} (控制输入) = 2.6V	4.3			10.0	μA

说明：

3. 在通过开关的指定电流下，由 D_n, HSD1_n 和 HSD2_n 引脚之间的电压降测得。
导通电阻决定于这两个端口上的电压降。
4. 由产品特性保证。

交流电气特性若无其他说明，所有典型值都在 25°C，V_{CC}=3.3V 时测得。

符号	参数	工作条件	V _{CC} (V)	T _A = -40°C 至 +85°C			单位	图位
				最小值	典型值	最大值		
t _{ON}	导通时间 S, OE 至 Output	HD1 _n , HD2 _n = 0.8V, R _L = 50Ω, C _L = 5pF	3.0 至 3.6		13	30	ns	图 9
t _{OFF}	关断时间 S, OE 至 Output	HD1 _n , HD2 _n = 0.8V, R _L = 50Ω, C _L = 5pF	3.0 至 3.6		12	25	ns	图 9
t _{PD}	传输延迟 ⁽⁴⁾	R _L = 50Ω, C _L = 5pF	3.3		0.25		ns	图 7 图 8
t _{BBM}	先开后合	R _L = 50Ω, C _L = 5pF, V _{IN} = 0.8V	3.0 至 3.6	2.0		6.5	ns	图 10
O _{IRR}	关断隔离 (非相邻)	f = 240MHz, R _T = 50Ω	3.0 至 3.6		-30		dB	图 13
Xtalk	非相邻通道串扰	R _T = 50Ω, f = 240MHz	3.0 至 3.6		-45		dB	图 14
BW	-3dB 带宽	R _T = 50Ω, C _L = 0pF	3.0 至 3.6		720		MHz	图 12
		R _T = 50Ω, C _L = 5pF			550			

高速 USB 相关的交流电气特性

符号	参数	工作条件	V_{CC} (V)	$T_A = -40^{\circ}\text{C}$ 至 $+85^{\circ}\text{C}$			单位	图位
				最小值	典型值	最大值		
$t_{SK(O)}$	通道间相位差 (5)	$R_L = 50\Omega$, $C_L = 5\text{pF}$	3.0 至 3.6		50		ps	图 7 图 11
$t_{SK(P)}$	在相同输出下, 反向转换的时滞 (5)	$R_L = 50\Omega$, $C_L = 5\text{pF}$	3.0 至 3.6		20		ps	图 7 图 11
t_J	总抖动 (5)	$R_L = 50\Omega$, $C_L = 5\text{pF}$, 480 Mbps 时, $t_R = t_F = 500\text{ps}$ (PRBS = $2^{15} - 1$)	3.0 至 3.6		200		ps	

注意:

5. 由产品特性保证。

电容值

符号	参数	工作条件	$T_A = -40^{\circ}\text{C}$ 至 $+85^{\circ}\text{C}$			单位	图位
			最小值	典型值	最大值		
C_{IN}	控制引脚输入电容	$V_{CC} = 0\text{V}$		1.5		pF	图 16
C_{ON}	D1 _n , D2 _n , Dn 导通电容	$V_{CC} = 3.3$, $\overline{OE} = 0\text{V}$		3.7		pF	图 15
C_{OFF}	D1 _n , D2 _n 关断电容	V_{CC} 和 $\overline{OE} = 3.3$		2.5		pF	图 16

典型特性

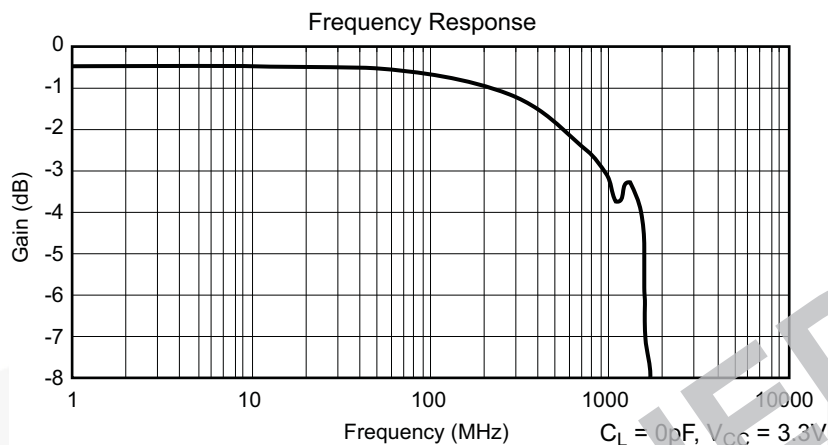


图 2. 增益 vs. 频率

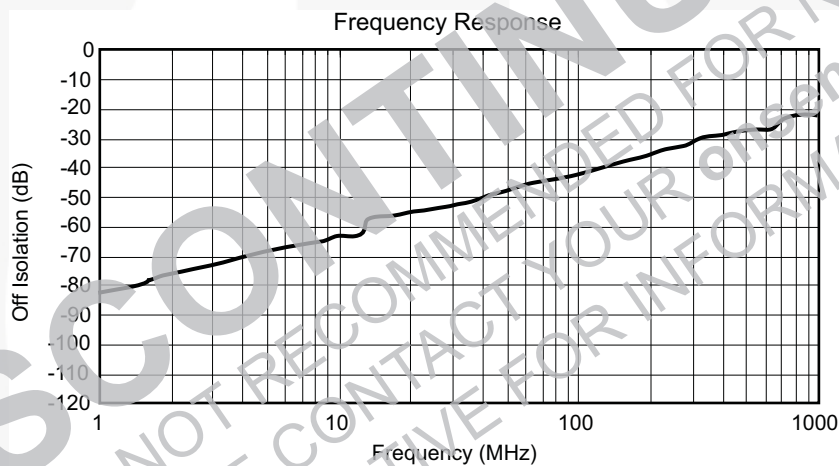


图 3. 关断隔离

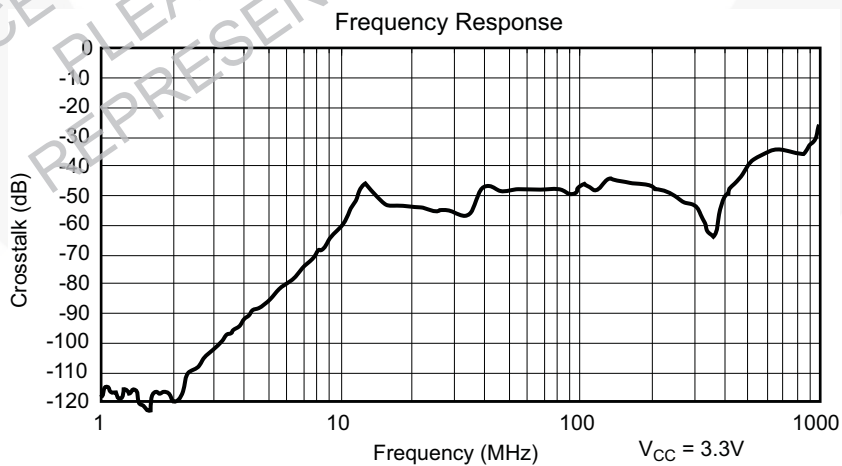


图 4. 串扰

测试框图

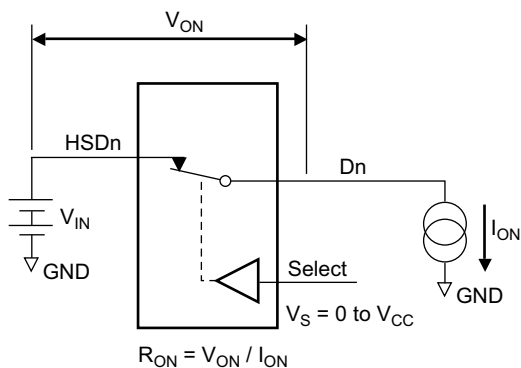


图 5. 导通电阻

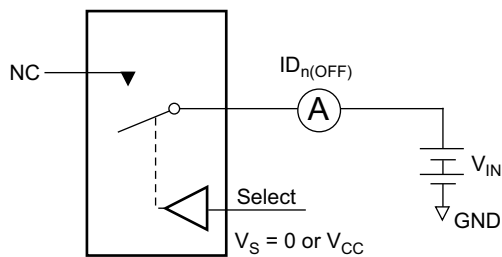


图 6. 关断漏电流

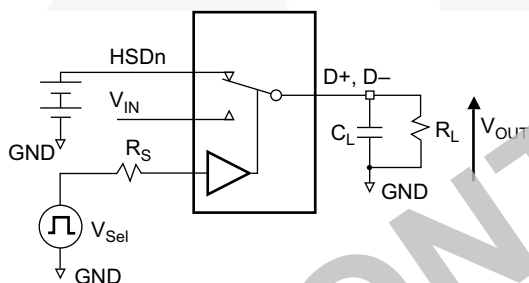


图 7. 交流测试电路负载

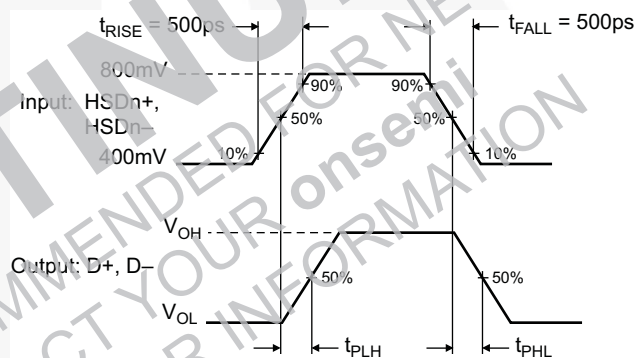


图 8. 开关传输延迟波形

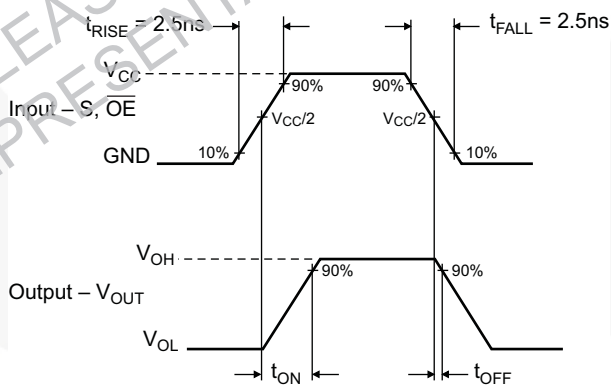
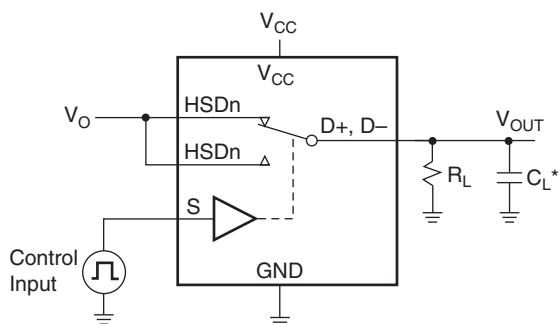


图 9. 开通 / 关断波形



* C_L includes test fixture and stray capacitance.

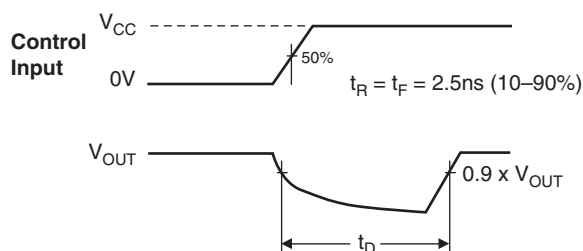


图 10. “先开后合”(t_{BBM})

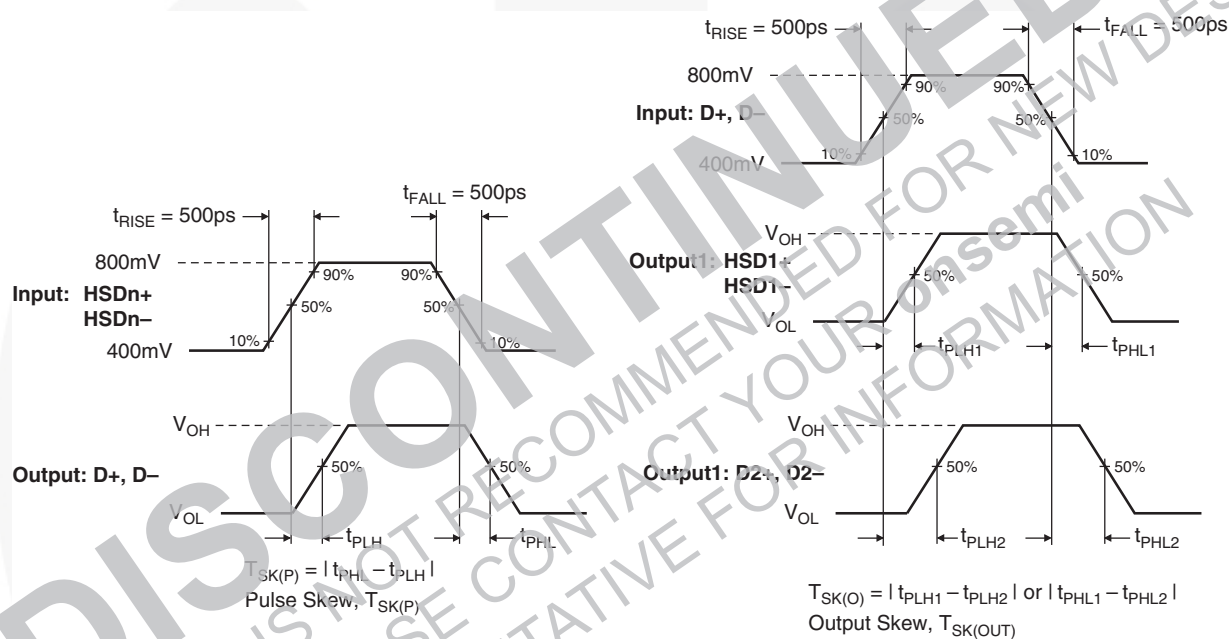
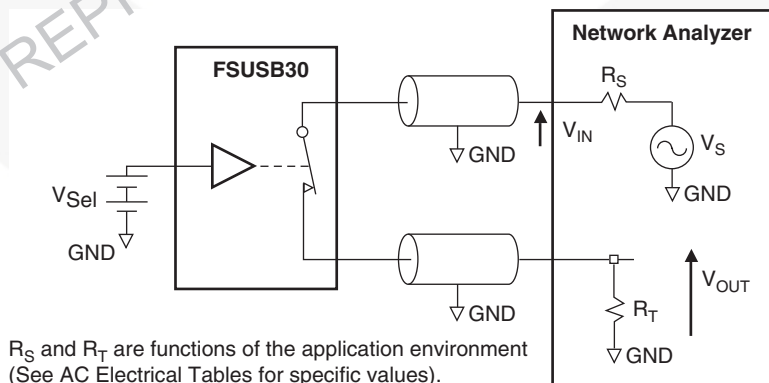


图 11. 开关时滞测试



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

图 12. 带宽

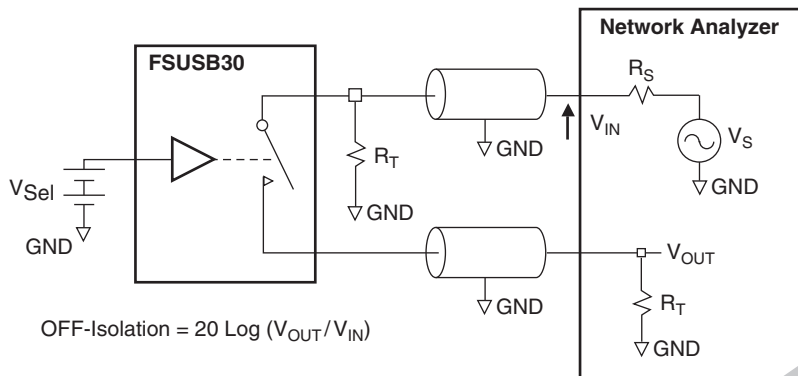


图 13. 通道的关断隔离

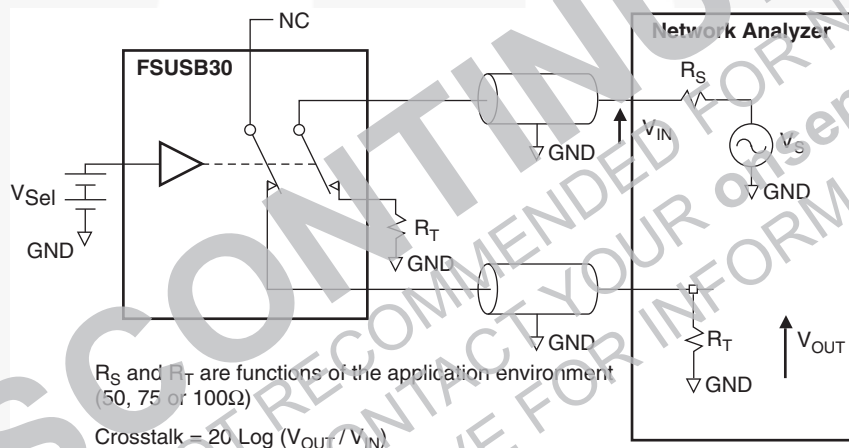


图 14. 非相邻通道间串扰

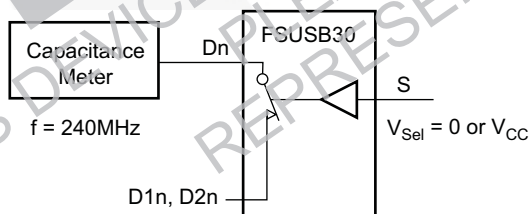


图 15. 通道导通电容

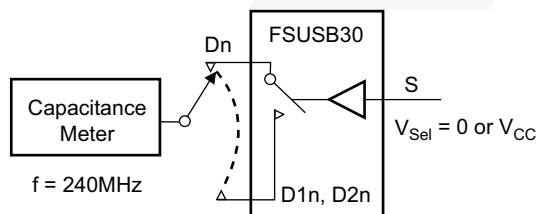


图 16. 通道关断电容

应用指南：符合 USB 2.0 Vbus 短路要求

在 USB 2.0 规范的第 7.1.1 节，说明了 USB 设备必须能够耐受关闭或开启 USB 设备时 Vbus 与 D+ 或 D- 的短路。FSUSB30 配置可有效满足这两项要求。

断电保护

对于 Vbus 短路，开关需要能够耐受这种情况至少 24 小时。FSUSB30 具有专门设计的电路，可以防止关闭电源和过压条件下的意外信号泄漏，并且保证系统可靠性。这种保护也被增加到普通引脚 (D+, D-)。

上电保护

USB 2.0 规范还说明，USB 设备应该能够耐受传输数据时出现的 Vbus 短路。为了提供针对这种情况的防护，飞兆建议在开关 VCC 引脚和电源电压轨之间加入一个 100W 串行电阻。在出现过压时，这种更改操作可以限制流回 V_{CC} 轨道的电流，从而将电流保持在安全工作范围内。在这种应用中，开关将完整的 5.25V 输入信号通过选择的输出口发送出去，同时维持未被选择的引脚上的关断隔离。

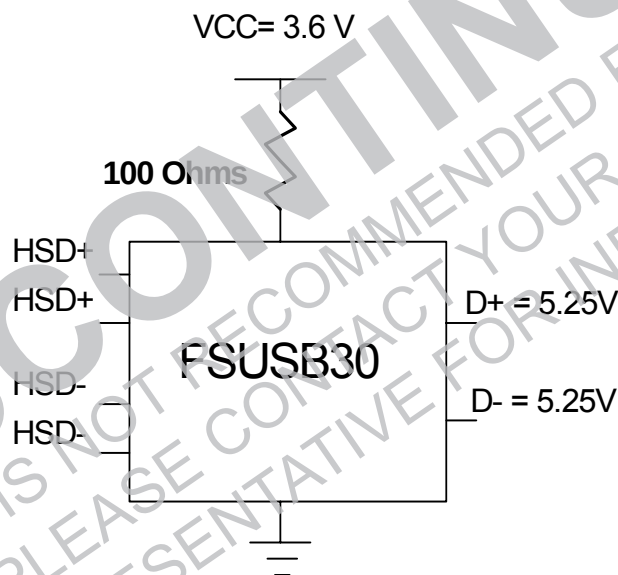


Figure 17. Adding 100Ω resistor in series with the V_{CC} supply allows the FSUSB30 to withstand a Vbus short when powered up

For more information, see Applications Note AN-6022 *Using the FSUSB30 to Comply with USB 2.0 Fault Condition Requirements* at www.fairchildsemi.com

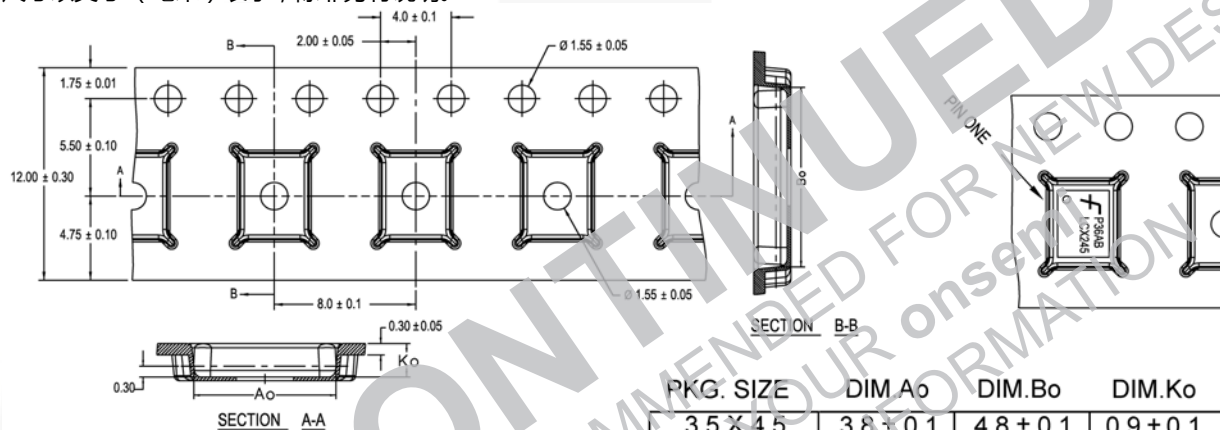
卷带和卷盘规格

DQFN 的卷带形式

封装指示符	带第 节	位腔	腔状态	盖带状态
BQX	空白段 (始点终点)	125 (典型值)	空	密封
	载体	2500/3000	装满	密封
	空白片尾 (插孔末端)	75 (典型值)	空	密封

卷带尺寸

尺寸以英寸 (毫米) 表示, 除非另有说明。



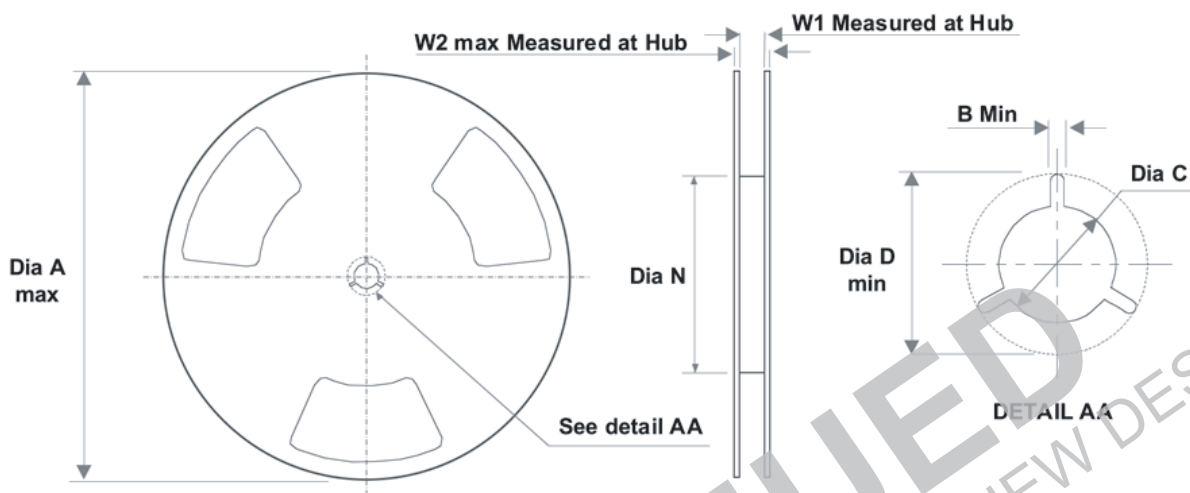
DIMENSIONS ARE IN MILLIMETERS

NOTES: unless otherwise specified

1. Cumulative pitch for feeding holes and cavities (chip pockets) not to exceed 0.008[0.20] over 10 pitch span.
2. Smallest allowable bending radius.
3. Thru hole inside cavity is centered within cavity.
4. Tolerance is $\pm 0.002[0.05]$ for these dimensions on all 12mm tapes.
5. A_o and B_o measured on a plane 0.120[0.30] above the bottom of the pocket.
6. K_o measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
7. Pocket position relative to sprocket hole measured as true position of pocket. Not pocket hole.
8. Controlling dimension is millimeter. Dimension in inches rounded.

DQFN 的卷带尺寸

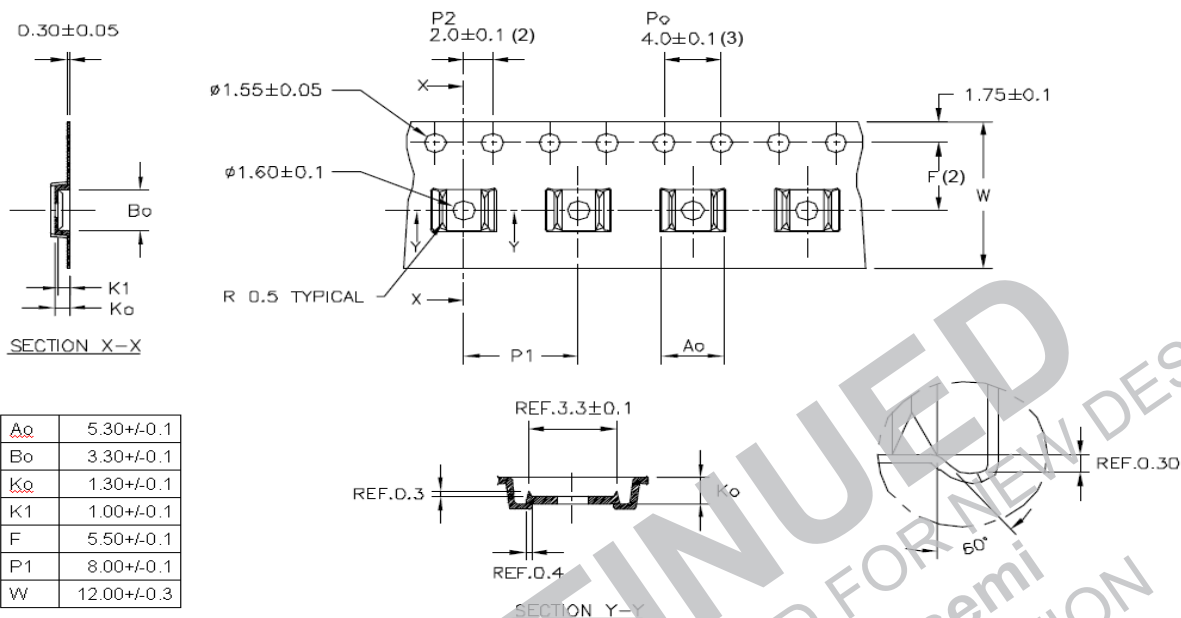
尺寸以英寸（毫米）表示，除非另有说明。



卷带大小	A	B	C	D	N	W1	W2
(12mm)	13.0 (330)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	7.008 (178)	0.488 (12.4)	0.724 (18.4)

MSOP 的卷带尺寸

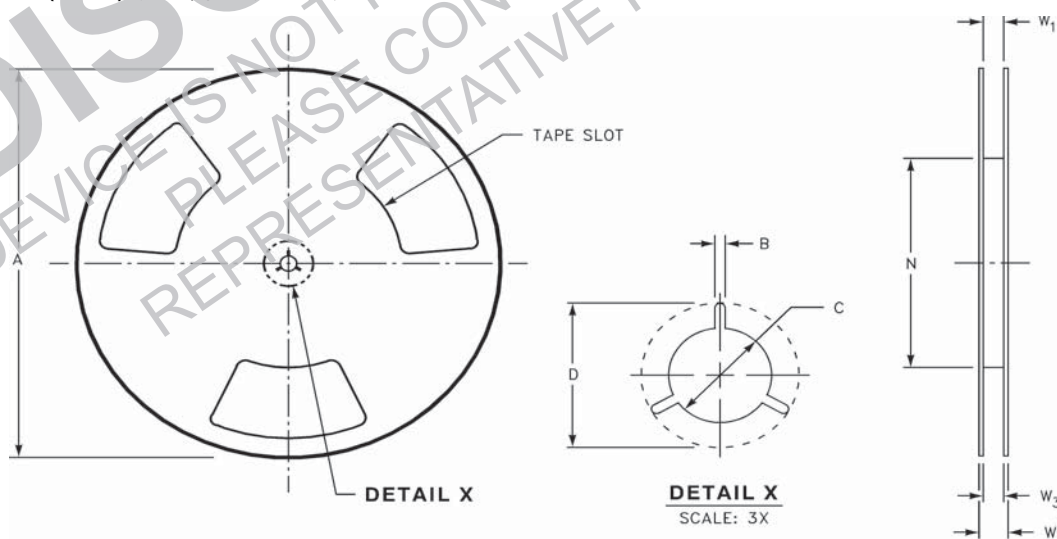
尺寸以英寸（毫米）表示，除非另有说明。

**Notes:**

1. All dimensions are in millimeters.
2. Measured from centerline of sprocket hole to centerline of pocket.
3. Cumulative tolerance of ten sprocket holes is ± 0.20 mm.
4. Other material available.

MSOP 的卷带尺寸

尺寸以英寸（毫米）表示，除非另有说明。



卷带大小	A	B	C	D	N	W1	W2	W3
(12mm)	13 (330)	0.059 (1.5)	0.512 (13)	0.795 (20.2)	7.008 (178)	0.448 (12.4)	0.724 (18.4)	0.468-0.606 (11.9 -15.4)

物理尺寸测试

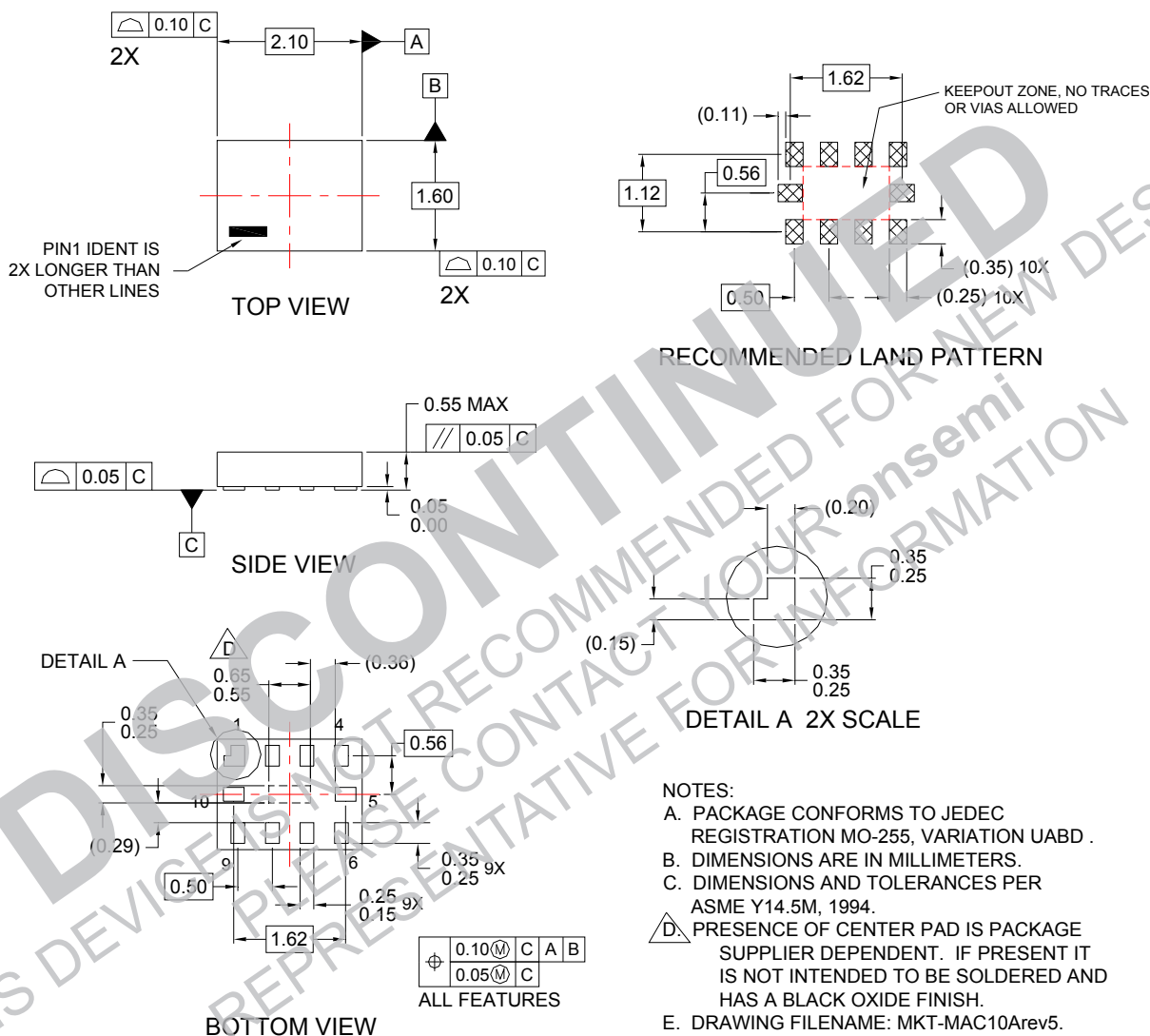


图 17. 10 引脚 MicroPak , 1.6 x 2.1mm

要了解卷带和卷盘规格，请访问飞兆半导体的网站：http://www.fairchildsemi.com/products/logic/pdf/micropak_tr.pdf.

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物理尺寸测试

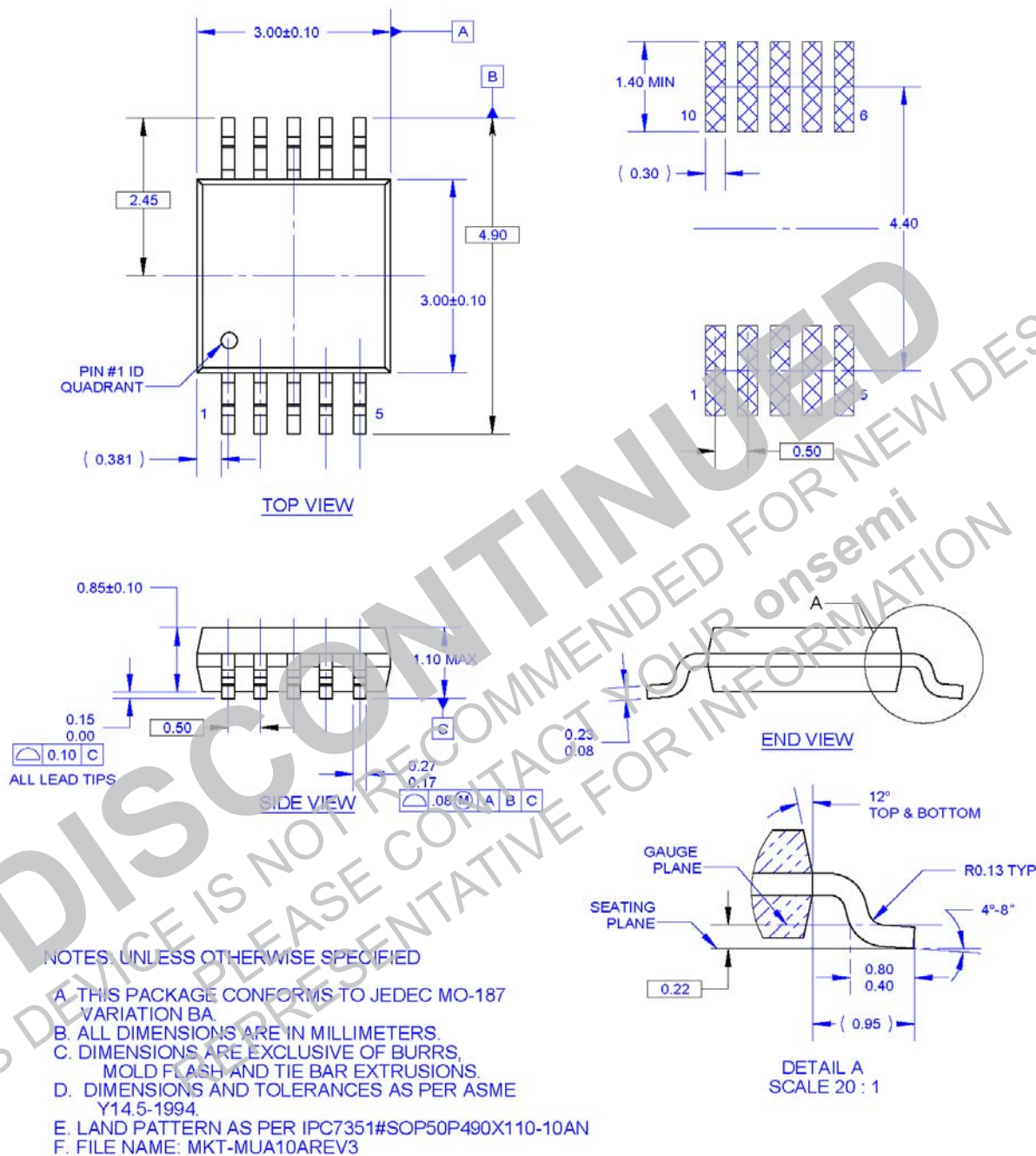


图 18. 10 引脚模塑小外形封装 (MSOP), JEDEC MO-187, 3.0mm 宽

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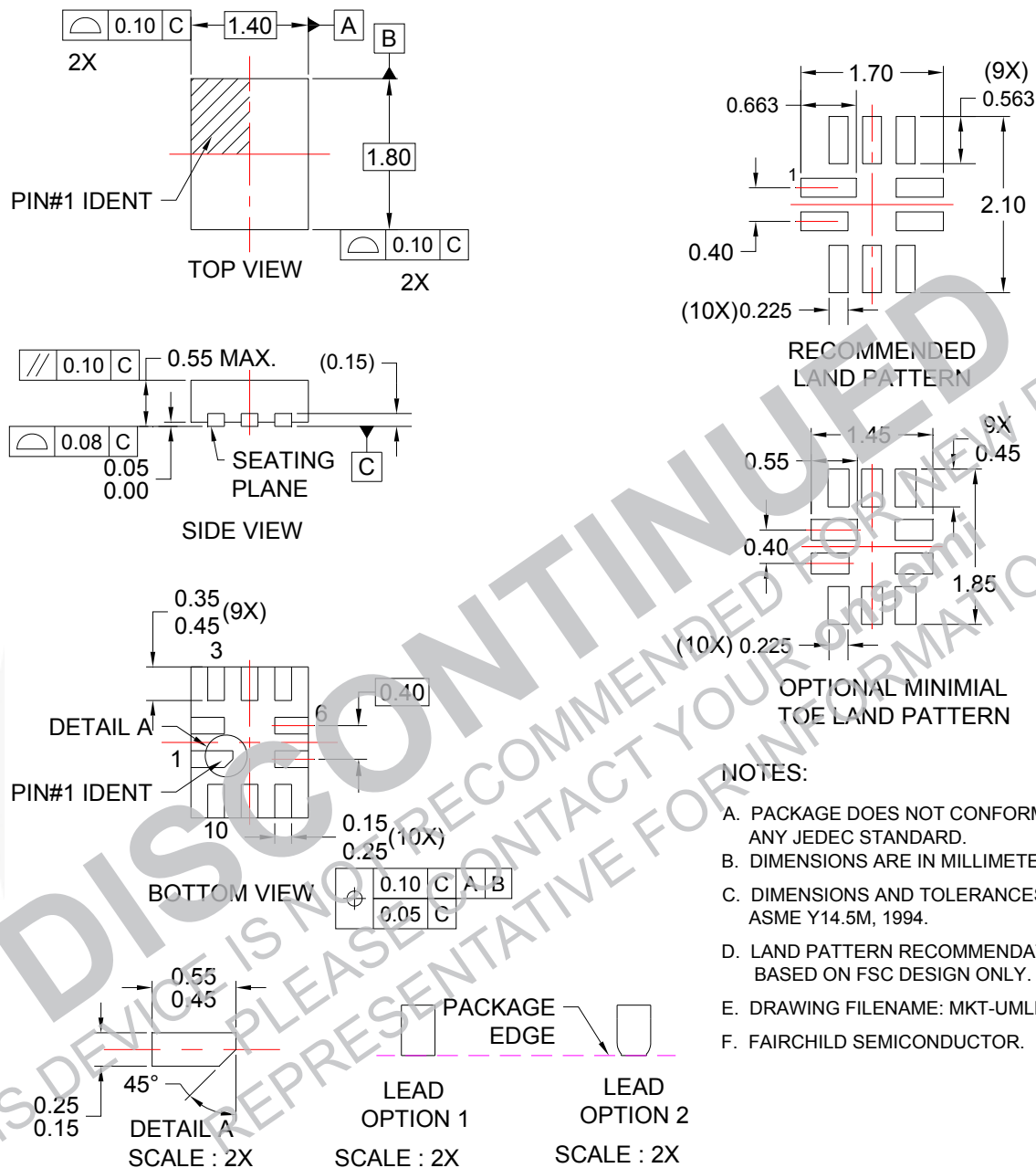


图 19.10 引脚，方形，超薄膜塑无铅封装 (UMLP)，1.4 x 1.8mm

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