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FSA644 — 2:1 MIPI D-PHY (1.5Gbps) 4 数据通道开关

产品特性

| | |
|----------------------|--|
| 开关类型 | SPDT (10x) |
| 信号类型 | MIPI, D-PHY |
| V _{CC} | 1.65 至 4.5 V |
| 输入信号 | 0 至 V _{CC} |
| R _{ON} | 6 Ω (典型值) HS MIPI 8 Ω (典型值) LP MIPI |
| ΔR _{ON} | 0.6 Ω (典型值) HS 和 LP MIPI |
| R _{ON_FLAT} | 0.3 Ω (典型值) |
| I _{CCZ} | 0.5 μA (最大值) |
| I _{CC} | 32 μA (最大值) |
| O _{IRR} | -40dB (典型值) |
| X _{TALK} | -25dB (典型值) |
| 带宽 | 1100MHz (最小值) |
| 通道间相位差 | 6 ps (典型值) |
| C _{ON} | 5.2 pF |
| 工作温度 | -40 至 +85° C |
| 封装 | 36 焊点, WLCSP |
| 顶标 | M7 |
| 订购信息 | FSA644UCX |
| 顶标 | KM |
| 订购信息 | FSA644BUCX |

说明

FSA644 是一款 4 数据通道，移动产业处理器接口 (MIPI)，D-PHY 开关。该器件为单刀双掷 (SPDT) 开关，专门针对两个高速或低功耗 MIPI 信号源之间的切换进行了优化。FSA644 特别为 MIPI 规格设计，可与 CSI 或 DSI 模块连接。

适用范围

- 手机，智能电话
- 显示屏

相关资源

- FSA644 演示板

典型应用

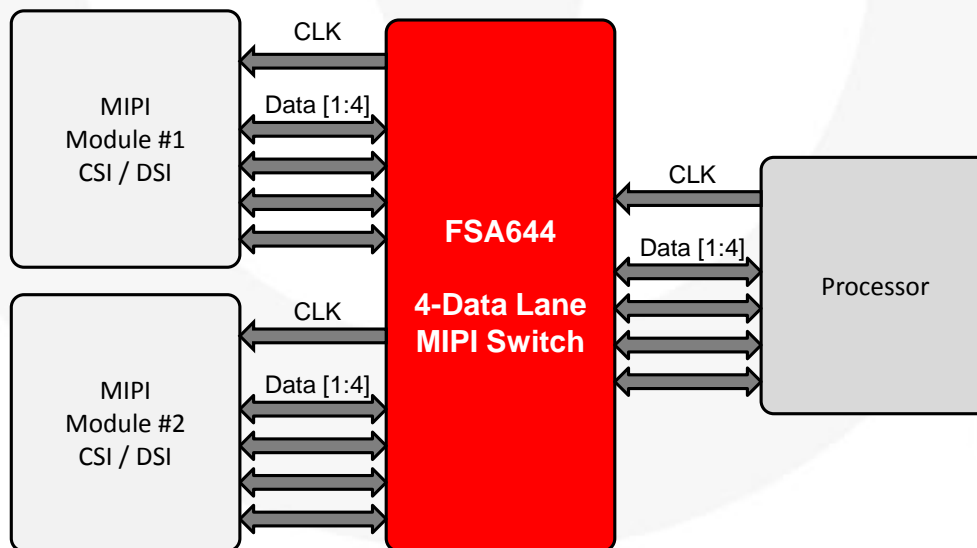


图1. 移动电话示例

引脚描述

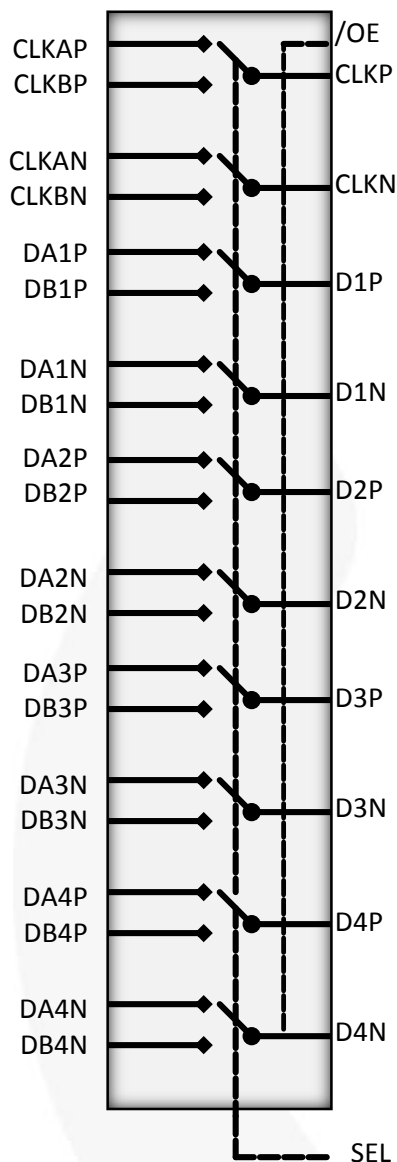


图2. 模拟符号

| 引脚名 | 说明 | | |
|---------------------|-----------|-------|---|
| CLK _{P/N} | 公共时钟路径 | | |
| D1 _{P/N} | 公共数据路径 1 | | |
| D2 _{P/N} | 公共数据路径 2 | | |
| D3 _{P/N} | 公共数据路径 3 | | |
| D4 _{P/N} | 公共数据路径 4 | | |
| CLKA _{P/N} | A 侧时钟路径 | | |
| DA1 _{P/N} | A 侧数据路径 1 | | |
| DA2 _{P/N} | A 侧数据路径 2 | | |
| DA3 _{P/N} | A 侧数据路径 3 | | |
| DA4 _{P/N} | A 侧数据路径 4 | | |
| CLKB _{P/N} | B 侧时钟路径 | | |
| DB1 _{P/N} | B 侧数据路径 1 | | |
| DB2 _{P/N} | B 侧数据路径 2 | | |
| DB3 _{P/N} | B 侧数据路径 3 | | |
| DB4 _{P/N} | B 侧数据路径 4 | | |
| SEL | 控制引脚 | SEL=0 | CLKP=CLKAP, CLKN=CLKAN, Dn (P/N)=DAn (P/N) |
| | | SEL=1 | CLKP=CLKBP, CLKN=CLKBN, Dn (P/N)=DBn (P/N) |
| /OE | 输出使能 | | |
| V _{CC} | 电源 | | |
| GND | 接地 | | |
| NC | 未连接 | | |

引脚说明

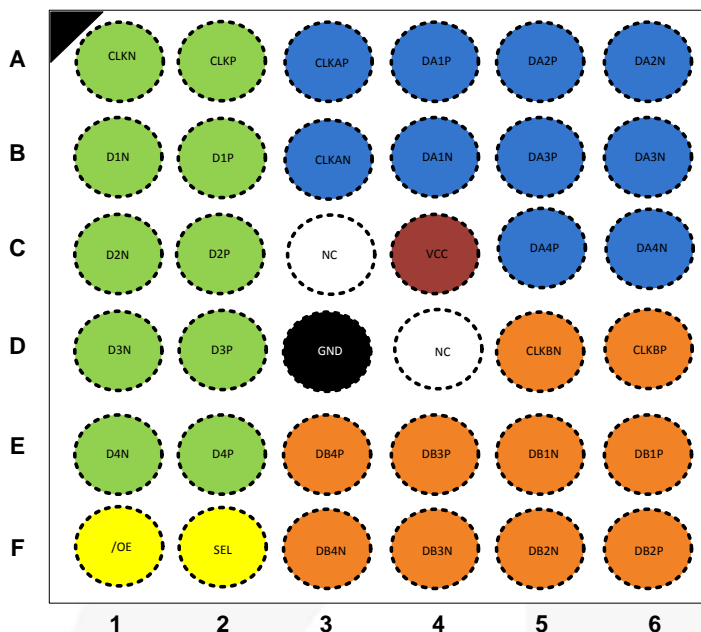


图3. 顶视图

表1. 焊点与引脚对应关系

| 焊点 | 引脚名 |
|----|-------------------|
| A1 | CLK _N |
| A2 | CLK _P |
| A3 | CLKA _P |
| A4 | DA1 _P |
| A5 | DA2 _P |
| A6 | DA2 _N |
| B1 | D1 _N |
| B2 | D1 _P |
| B3 | CLKA _N |
| B4 | DA1 _N |
| B5 | DA3 _P |
| B6 | DA3 _N |
| C1 | D2 _N |
| C2 | D2 _P |
| C3 | NC |
| C4 | V _{CC} |
| C5 | DA4 _P |
| C6 | DA4 _N |
| D1 | D3 _N |
| D2 | D3 _P |
| D3 | GND |
| D4 | NC |
| D5 | CLKB _N |
| D6 | CLKB _P |
| E1 | D4 _N |
| E2 | D4 _P |
| E3 | DB4 _P |
| E4 | DB3 _P |
| E5 | DB1 _N |
| E6 | DB1 _P |
| F1 | /OE |
| F2 | SEL |
| F3 | DB4 _N |
| F4 | DB3 _N |
| F5 | DB2 _N |
| F6 | DB2 _P |

真值表

| SEL | /OE | 功能 |
|-----|-----|--|
| 低 | 低 | $CLK_P=CLKA_P$, $CLK_N=CLKA_N$, $D_n(P/N)=DA_n(P/N)$ |
| 高 | 低 | $CLK_P=CLKB_P$, $CLK_N=CLKB_N$, $D_n(P/N)=DB_n(P/N)$ |
| X | 高 | $DA_n(P/N)$, $DB_n(P/N)$ 数据端口高阻抗 |

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。

在推荐的工作条件之上，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 | -0.50 | +5.25 | V | |
| V_{CNTRL} | 直流输入电压 (/OE) ⁽¹⁾ | -0.5 | V_{CC} | V | |
| V_{SW} | 直流开关输入/输出电压 ⁽¹⁾ | -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 | | 50 | mA | |
| T_{STG} | 存储温度 | -65 | +150 | °C | |
| ESD | 人体模式, JEDEC: JESD22-A114 | 全部引脚 | | 3.5 | kV |
| | | 输入/输出至地 | | 3.5 | |
| | | 电源至地 | | 8.0 | |
| | 充电器件模式, JEDEC: JESD22-C101 | | | 1.5 | |
| | IEC 61000-4-2 系统 | 接触式 | | 8.0 | |
| 空气式 | | | 15.0 | | |

注意:

1. 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。

推荐工作条件

推荐的操作条件定义了真实器件的工作条件。

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 | 1.65 | 4.50 | V | |
| V_{CNTRL} | 控制输入电压 (S, /OE) ⁽²⁾ | 0 | V_{CC} | V | |
| V_{SW} | 开关输入/输出电压 (CLK_N , CLK_A , $CLKB_N$, D_n , DA_n , DB_n) | HS 模式 | 0.1 | 0.3 | V |
| | | LP 模式 | 0 | 1.2 | |
| T_A | 工作温度 | -40 | +85 | °C | |

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 $T_A=25^\circ\text{C}$ 下测得。

| 符号 | 参数 | 工作条件 | 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 | $I_{IN}=-18\text{ mA}$ | 2.8 | | | -1.2 | V |
| V _{IH} | 输入电压高电平 | | 1.65 至 4.5 | 1.0 | | | V |
| V _{IL} | 输入电压低电平 | | 1.65 至 4.5 | | | 0.4 | V |
| I _{IN} | 控制输入漏电 (SEL, /OE) | $V_{SW}=0$ 至 V_{CC} | 1.65 至 4.5 | -100 | | 100 | nA |
| I _{NO(OFF)} , I _{NC(OFF)} | 端口 CLKAn, DAn, CLKBn, DBn 关断漏电流 | CLKn, Dn=0.3 V; $V_{CC}=0.3$ V; CLKAn, DAn, 或 CLKBn; DBn= $V_{CC}-0.3$ V, 0.3 V, 或浮置; /OE=0 V | 1.65 至 4.5 | -100 | | 100 | nA |
| I _{A(ON)} | 公共端口 (CLKn, Dn) 导通漏电流 | CLKn, Dn = 0.3 V; $V_{CC}=0.3$ V; CLKAn, DAn, 或 CLKBn; DBn= $V_{CC}-0.3$ V, 0.3 V, 或浮置; /OE=0 V | 1.65 至 4.5 | -100 | | 100 | nA |
| I _{OFF} | 电源断开泄漏电流 | CLKn, Dn, 或 CLKAn; DAn 或 CLKBn, DBn; $V_{IN}=0$ V 至 4.5 V; $V_{CC}=0$ V | 0 | -100 | | 100 | nA |
| I _{OZ} | 关断漏电流 | $0 \leq$ CLKn, Dn, CLKAn, CLKBn, DAn, DBn \leq 3.6 V, /OE=高电平 | 4.5 | -100 | | 100 | nA |
| R _{ON_MIPI_HS} | HS MIPI 应用开关导通电阻 ⁽³⁾ | $I_{ON}=-10\text{ mA}$, /OE=0 V, SEL= V_{CC} 或 0V, CLK _{A, B} , DBn 或 DAN=0.1, 0.2, 0.3 | 1.8 | | 7 | 12 | Ω |
| | | | 2.5 | | 6 | 9 | |
| | | | 3.6 | | 6 | 9 | |
| | | | 4.5 | | 6 | 9 | |
| R _{ON_MIPI_LP} | LP MIPI 应用开关导通电阻 ⁽³⁾ | $I_{ON}=-10\text{ mA}$, /OE=0 V, SEL= V_{CC} 或 0V, CLK _{A, B} , DBn 或 DAN=0, 0.6, 1.2 V | 1.8 | | 6.7 | 12.0 | Ω |
| | | | 2.5 | | 6.4 | 9.0 | |
| | | | 3.6 | | 6.2 | 9.0 | |
| | | | 4.5 | | 6.0 | 9.0 | |
| ΔR _{ON_MIPI_HS} | HS MIPI 通道间导通电阻匹配 ⁽⁴⁾ | $I_{ON}=-10\text{ mA}$, /OE=0 V, SEL= V_{CC} 或 0V, CLK _{A, B} , DBn 或 DAN=0.1, 0.2, 0.3 | 1.8 | | 0.8 | | Ω |
| | | | 2.5 | | 0.6 | | |
| | | | 3.6 | | 0.5 | | |
| | | | 4.5 | | 0.5 | | |
| ΔR _{ON_MIPI_LP} | LP MIPI 通道间导通电阻匹配 ⁽⁴⁾ | $I_{ON}=-10\text{ mA}$, /OE=0 V, SEL= V_{CC} 或 0 V, CLK _{A, B} , DBn 或 DAN= 0.0, 0.6, 1.2 V | 1.8 | | 0.8 | | Ω |
| | | | 2.5 | | 0.6 | | |
| | | | 3.6 | | 0.5 | | |
| | | | 4.5 | | 0.5 | | |
| R _{ON_FLAT_MIPI_HS} | HS MIPI 信号导通电阻平坦度 ⁽⁴⁾ | $I_{ON}=-10\text{ mA}$, /OE=0 V, SEL= V_{CC} 或 0 V, CLK _{A, B} , DBn 或 DAN=0.1, 0.2, 0.3 | 1.8 | | 1.5 | | Ω |
| | | | 2.5 | | 0.5 | | |
| | | | 3.6 | | 0.3 | | |
| | | | 4.5 | | 0.2 | | |

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 | 工作条件 | 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 | |
| $R_{ON_FLAT_MIPI_LP}$ | LP MIPI 信号导通电阻平坦度 ⁽⁴⁾ | $I_{ON}=-10\text{ mA}$, $/OE=0\text{ V}$, $SEL=V_{CC}$ 或 0 V , CLK_{A, B, DB_n} 或 $DAn=0.0, 0.6, 1.2\text{ V}$ | 1.8 | | 35 | | Ω |
| | | | 2.5 | | 2 | | |
| | | | 3.6 | | 1 | | |
| | | | 4.5 | | 0.5 | | |
| I_{CCZ} | Hi-Z静态电源电流 | $V_{IN}=0$ 或 V_{CC} , $I_{OUT}=0$ | 4.5 | | | 0.5 | μA |
| I_{CC} | 静态电源电流 | $V_{IN}=0$ 或 V_{CC} , $I_{OUT}=0$ | 2.5 至 4.5 | | | 32 | μA |
| | | | 1.8 | | | 22 | |
| I_{CCT} | 每个控制电压和 V_{CC} 的 I_{CC} 电流增量 | $V_{SEL}/OE=1.65\text{ V}$ | 4.5 | | | 4 | μA |
| | | | 2.5 | | | 0.1 | |

说明:

- 在指定通过电流下，由 A 和 B 引脚之间的电压降测得。导通电阻决定于这两个端口(A 或 B 端口)上的电压降。
- 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 $V_{CC}=3.3\text{V}$, $T_A=25^\circ\text{C}$ 下测得。

| 符号 | 参数 | 工作条件 | 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_{INIT} | 初始化时间 V_{CC} 至输出 ⁽⁵⁾ | $R_L=50\ \Omega$, $C_L=5\text{ pF}$, $V_{SW}=1.2\text{ V}$ | 2.5 至 4.5 | | | 100 | μs |
| | | | 1.8 | | | 150 | |
| t_{EN} | 启用开启时间, $/OE$ 至输出 | $R_L=50\ \Omega$, $C_L=5\text{ pF}$, $V_{SW}=1.2\text{ V}$ | 2.5 至 4.5 | | 120 | 200 | nS |
| | | | 1.8 | | 250 | 500 | |
| t_{DIS} | 禁用关断时间, $/OE$ 至输出 | $R_L=50\ \Omega$, $C_L=5\text{ pF}$, $V_{SW}=1.2\text{ V}$ | 2.5 至 4.5 | | 25 | 50 | ns |
| | | | 1.8 | | 50 | 90 | |
| t_{ON} | 开启时间, SEL 至输出 | $R_L=50\ \Omega$, $C_L=5\text{ pF}$, $V_{SW}=1.2\text{ V}$ | 2.5 至 4.5 | | 50 | 100 | ns |
| | | | 1.8 | | 75 | 125 | |
| t_{OFF} | 关断时间 SEL 至输出 | $R_L=50\ \Omega$, $C_L=5\text{ pF}$, $V_{SW}=1.2\text{ V}$ | 2.5 至 4.5 | | 50 | 200 | ns |
| | | | 1.8 | | 200 | 325 | |
| t_{BBM} | “先开后合”时间 | $R_L=50\ \Omega$, $C_L=5\text{ pF}$, $V_{SW}=1.2\text{ V}$ | | 10 | 50 | ns | |
| OIRR | MIPI 关断隔离 ⁽⁵⁾ | $R_L=50\ \Omega$, $f=750\text{ MHz}$, $/OE=V_{CC}$ $V_{SW}=-1\text{ dBm}$ (200 mV _{PP}) | 1.65 至 4.5 | | -18 | | dB |
| X_{TALK} | MIPI 串扰 ⁽⁵⁾ | $R_L=50\ \Omega$, $f=750\text{ MHz}$, $V_{SW}=-1\text{ dBm}$ (200 mV _{PP}) | 1.65 至 4.5 | | -25 | | dB |
| BW | -3db 带宽 ⁽⁵⁾ | $R_L=50\ \Omega$, $C_L=0\text{ pF}$ | 3.0 | 1100 | 1600 | | MHz |
| S _{DD21} | 差分数据传输速率 | 互操作数据传输速率 | 3.0 | | 1.5 | | Gbps |

注意:

- 由产品特性保证。

高速相关的交流电气特性

| 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 | |
| t _{SK(O)} | 通道间单端相位差 ⁽⁶⁾ | TDR 方法 (V _{SW} =0.2 V _{PP} , C _L =C _{ON}) | 3.3 | | 6 | 20 | ps |
| t _{SK(P)} | 在相同输出下, 反向转换的时滞 ⁽⁶⁾ | TDR 方法 (V _{SW} =0.2 V _{PP} , C _L =C _{ON}) | 3.3 | | 6 | 20 | ps |

注意:

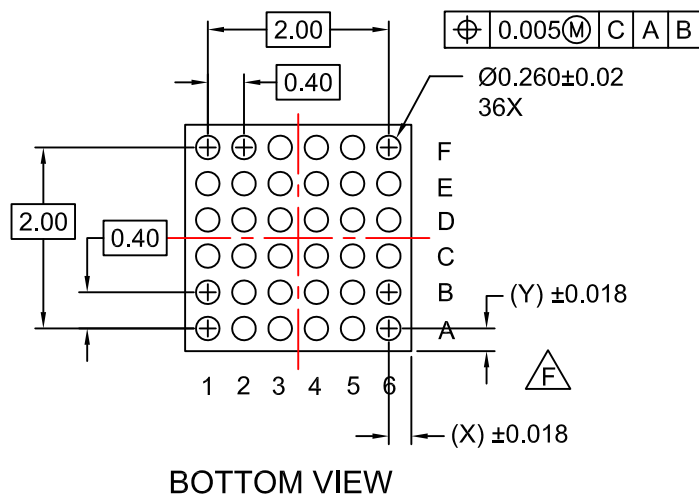
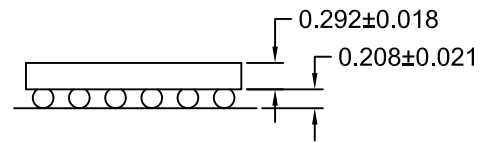
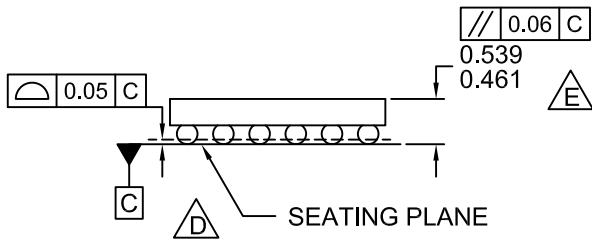
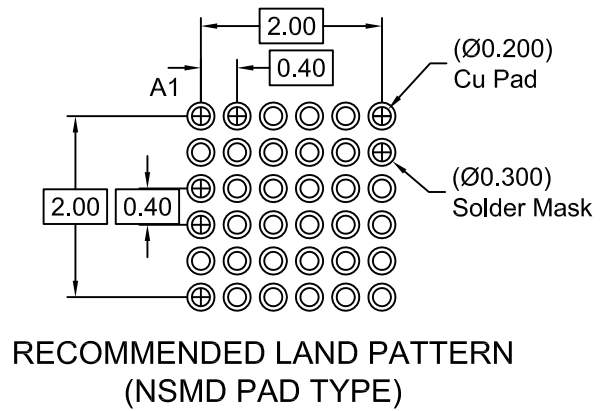
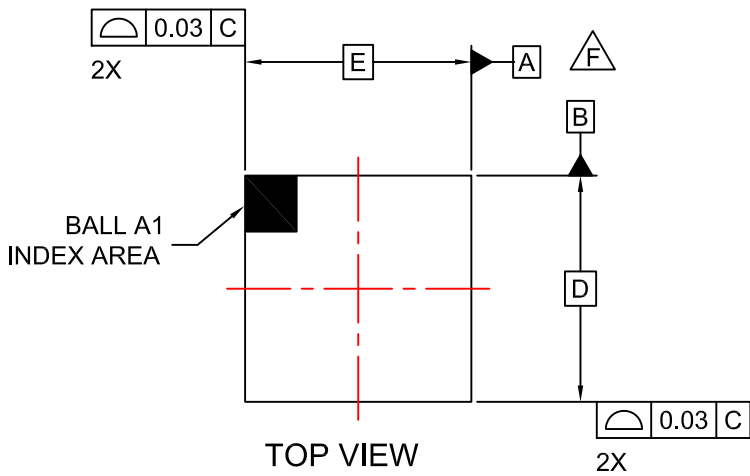
6. 由产品特性保证。

电容值

| 符号 | 参数 | 工作条件 | T _A =- 40°C 至 +85°C | | | 单位 |
|------------------|----------|--|--------------------------------|-----|-----|----|
| | | | 最小值 | 典型值 | 最大值 | |
| C _{IN} | 控制引脚输入电容 | V _{cc} =0 V, f=1 MHz | | 2.1 | | pF |
| C _{ON} | 输出导通电容 | V _{cc} =3.3 V, /OE=0 V, f=1 MHz | | 5. | | |
| C _{OFF} | 输出关断电容 | V _{cc} 且 /OE=3.3 V, f=1 MHz | | 2.0 | | |

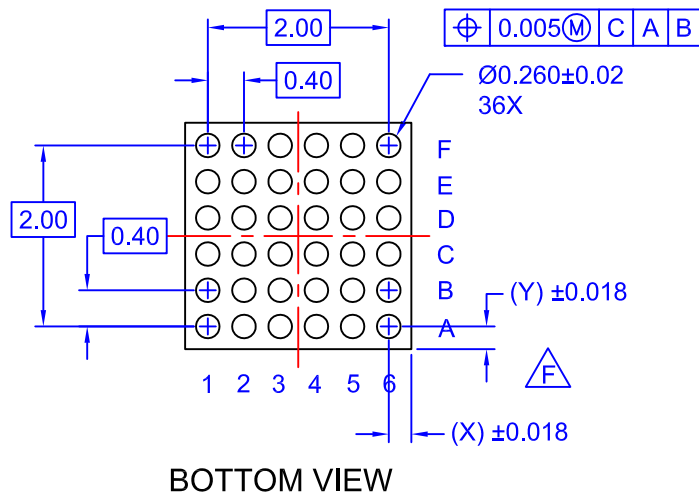
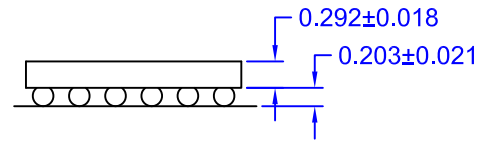
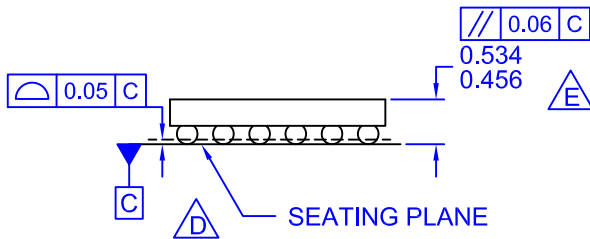
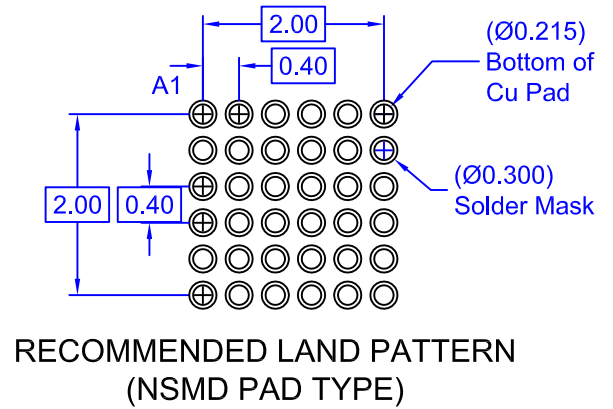
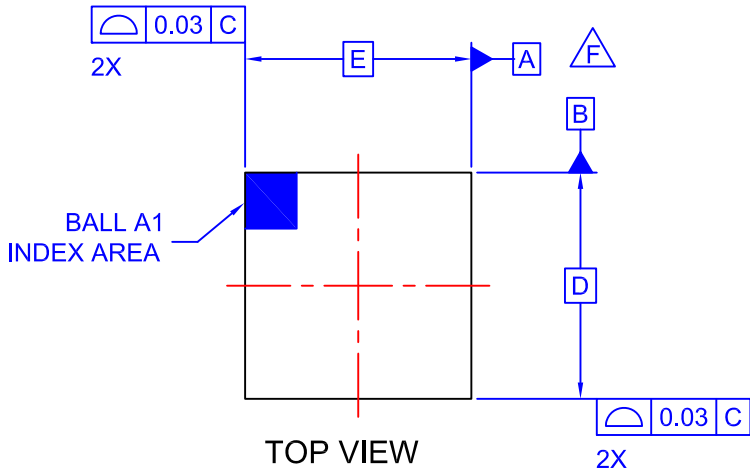
订购信息

| 器件型号 | 顶标 | 封装 | D | E | X | Y |
|------------|----|---|----------|----------|----------|----------|
| FSA644UCX | M7 | 36 焊点, WLCSP, 非 JEDEC, 2.4 毫米×2.4 毫米, 0.4 毫米毫米 | 2.36 毫米 | 2.36 毫米 | 0.18毫米 | 0.18毫米 |
| FSA644BUGX | KM | 36-Ball WLCSP, Non-JEDEC 2.415 毫米× 2.415 毫米, 0.4 毫米毫米 | 2.415 毫米 | 2.415 毫米 | 0.208 毫米 | 0.208 毫米 |



NOTES

- A. NO JEDEC REGISTRATION APPLIES.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCE PER ASMEY14.5M, 1994.
- D. DATUM C IS DEFINED BY THE SPHERICAL CROWNS OF THE BALLS.
- E. PACKAGE NOMINAL HEIGHT IS 500 ± 39 MICRONS (461-539 MICRONS).
- F. FOR DIMENSIONS D, E, X, AND Y SEE PRODUCT DATASHEET.
- G. DRAWING FILNAME: MKT-UC036AArev1.



NOTES

- A. NO JEDEC REGISTRATION APPLIES.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCE PER ASMEY14.5M, 2009.
- D. DATUM C IS DEFINED BY THE SPHERICAL CROWNS OF THE BALLS.
- E. PACKAGE NOMINAL HEIGHT IS 495 ± 39 MICRONS (456-534 MICRONS).
- F. FOR DIMENSIONS D, E, X, AND Y SEE PRODUCT DATASHEET.
- G. DRAWING FILNAME: MKT-UC036AB REV1.



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