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FPF1504 / FPF1504L 先进负载管理开关

特性

- 1.0至3.6V的输入电压工作范围
- 典型RDS(ON) :
 - 15 mΩ (VIN=3.3 V时)
 - 20 mΩ (VIN=1.8 V时)
 - VIN=1.0V时为40mΩ
- 转换速率控制
- 输出放电功能
- 小于1 μA的低静态电流 (VON=VIN)
- 静电放电保护: 4000 V HBM, 2000 V CDM
- 兼容GPIO/CMOS的使能电路
- 高电平有效版本和低电平有效版本

应用

- 移动设备和智能手机
- 便携式媒体设备
- 数码相机
- 高级笔记本电脑、超便携移动个人电脑和移动互联网设备
- 便携式医疗设备
- 全球定位系统和导航设备

说明

FPF1504/FPF1504L是IntelliMAX™系列的低RDS P沟道MOSFET负载开关。

集成的压摆率控制可防止过量浪涌电流干扰电源应用中通用的电容负载的电源电压轨。

此外, FPF1504/FPF1504L具有输出放电功能。

输入电压的工作范围为1.0V到3.6V, 可满足当今移动设备的供电要求。

开关控制是通过能够直接连接嵌入式处理器中的低压CMOS控制信号和GPIO的逻辑输入 (ON引脚) 来实现的。

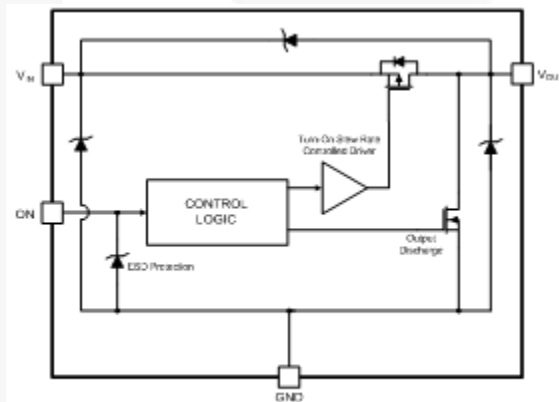


图 1. 框图

订购信息

器件型号	顶标	1.8VIN 的开关 (典型值)	输入 缓冲	输出 放电	ON引脚 动作	封装
FPF1504UCX	G4	20 mΩ	CMOS	是	高电平有效	4引脚, WLCSP, 0.5 mm引脚间距
FPF1504BUCX	G4	20 mΩ	CMOS	是	高电平有效	4引脚, WLCSP封装, 背部层压, 0.5 mm引脚间距
FPF1504LUCX	GZ	20 mΩ	CMOS	是	低电平有效	4引脚, WLCSP, 0.5 mm引脚间距
FPF1504LBUCX	G4	20 mΩ	CMOS	是	低电平有效	4引脚, WLCSP封装, 背部层压, 0.5 mm引脚间距

应用框图

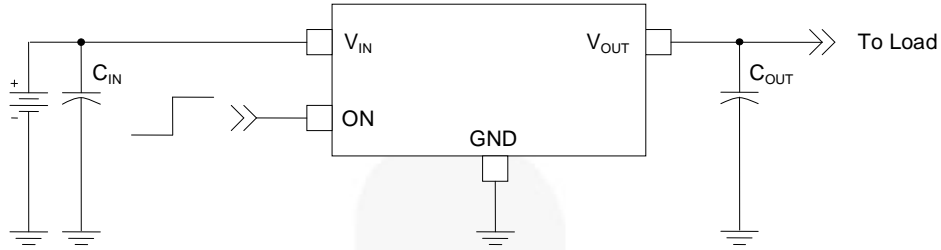


图 2. 典型应用

说明:

1. $C_{IN}=1\mu\text{F}$, X5R, 0603, 例如 Murata GRM185R60J105KE26.
2. $C_{OUT}=1\mu\text{F}$, X5R, 0805, 例如 Murata GRM216R61A105KA01.

引脚布局

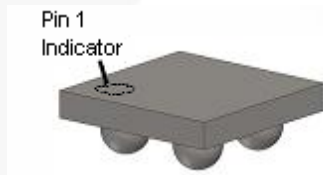


图 3. 1 x 1 毫米 WLGSP 封装, 凸块向下

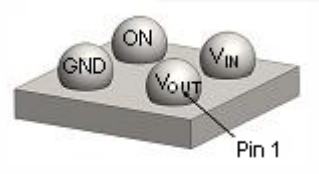


图 4. 1 x 1 毫米 WLGSP 封装, 凸块向上

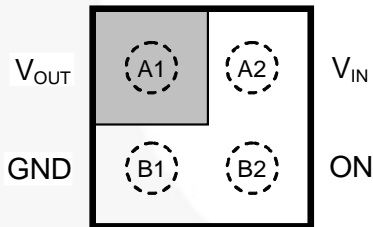


图 5. 引脚分配 (顶视图/俯视图)

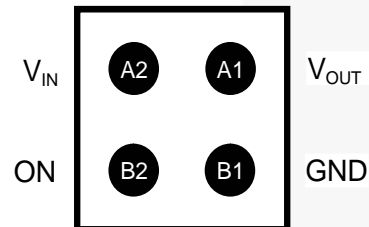


图 6. 引脚布局 (底视图)

引脚说明

引脚号	名称	说明
A1	V_{OUT}	开关输出
A2	V_{IN}	电源输入; 电源开关的输入
B1	GND	接地
B2	ON	导通/关断控制

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_{IN}	V_{IN} 、 V_{OUT} 、 V_{ON} 到 GND	-0.3	4.0	V	
I_{SW}	连续开关电流最大值		1.5	A	
P_D	功耗 ($T_A=25^\circ\text{C}$)		1.0	W	
T_{STG}	存储结温	-65	+150	$^\circ\text{C}$	
T_A	工作温度范围	-40	+85	$^\circ\text{C}$	
Θ_{JA}	结至环境热阻	1S2P, 1 热阻通过		95	$^\circ\text{C/W}$
		1S2P, 无热阻通过		187	
ESD	静电放电能力	人体模型, JESD22-A114	4		kV
		充电器件模式, JESD22-C101	2		

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_{IN}	电源电压	1.0	3.6	V
T_A	工作环境温度	-40	+85	$^\circ\text{C}$

电气特性

 除非另有说明, $V_{IN}=1.0$ 至 $3.6V$, $T_A=-40$ 至 $+85^\circ C$; $V_{IN}=3.3V$, $T_A=25^\circ C$ 时为典型值。

符号	参数		工作条件	最小值	典型值	最大值	单位
基本工作							
V_{IN}	电源电压			1.0		3.6	V
$I_{Q(OFF)}$	关断电源电流	FPF1504	$V_{ON}=\text{接地}, V_{OUT}=\text{开路}$		0.25		
		FPF1504L	$V_{ON}=V_{IN}, V_{OUT}=\text{开路}$		0.3		
$I_{SD(OFF)}$	关断开关电流	FPF1504	$V_{ON}=\text{GND}, V_{OUT}=\text{GND}$		0.25		μA
		FPF1504L	$V_{ON}=V_{IN}, V_{OUT}=\text{GND}$		0.3		
I_Q	静态电流	FPF1504	$I_{OUT}=0 \text{ mA}, V_{IN}=3.6 \text{ V}, V_{ON}=V_{IN}$		0.08		
			$I_{OUT}=0 \text{ mA}, V_{ON}=V_{IH(ON)}$		0.75		
		FPF1504L	$I_{OUT}=0 \text{ mA}, V_{IN}=3.6 \text{ V}, V_{ON}=\text{GND}$		0.08		
			$I_{OUT}=0 \text{ mA}, V_{ON}=V_{IL(MAX)}$		0.95		
R_{ON}	导通电阻	$V_{IN}=3.3 \text{ V}, I_{OUT}=200 \text{ mA}, T_A=25^\circ C$			15	30	$m\Omega$
		$V_{IN}=1.8 \text{ V}, I_{OUT}=200 \text{ mA}, T_A=25^\circ C$			20	40	
		$V_{IN}=1.5 \text{ V}, I_{OUT}=200 \text{ mA}, T_A=25^\circ C$			30		
		$V_{IN}=1.0 \text{ V}, I_{OUT}=200 \text{ mA}, T_A=25^\circ C$			40	80	
		$V_{IN}=1.8 \text{ V}, I_{OUT}=200 \text{ mA}, T_A=85^\circ C^{(3)}$			35	50	
R_{PD}	输出放电下拉电阻		$V_{ON}=0 \text{ V or } V_{IN}, I_{OUT}=-20 \text{ mA}$		65	95	Ω
V_{IH}	导通输入逻辑高电压	FPF1504		0.8			V
V_{IL}	导通输入逻辑低电压	FPF1504				0.3	
I_{ON}	导通输入漏电流		$V_{ON}=V_{IN} \text{ or } \text{GND}$			1	μA
动态特性							
t_{DON}	导通延迟 ⁽⁴⁾	FPF1504			80		μs
t_R	V_{OUT} 上升时间 ⁽⁴⁾	FPF1504	$R_L=10 \Omega, C_L=0.1 \mu F, V_{IN}=3.3 \text{ V}, T_A=25^\circ C$		130		
t_{ON}	导通时间 ⁽⁴⁾	FPF1504			210		
t_{DON}	导通延迟 ⁽⁴⁾	FPF1504			70	100	μs
		FPF1504L			95		
t_R	V_{OUT} 上升时间 ⁽⁴⁾	FPF1504	$R_L=500 \Omega, C_L=0.1 \mu F, V_{IN}=3.3 \text{ V}, T_A=25^\circ C$		110	150	
		FPF1504L			115		
t_{ON}	导通时间 ⁽⁴⁾	FPF1504			180	250	
		FPF1504L			210		

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电气特性 (续)

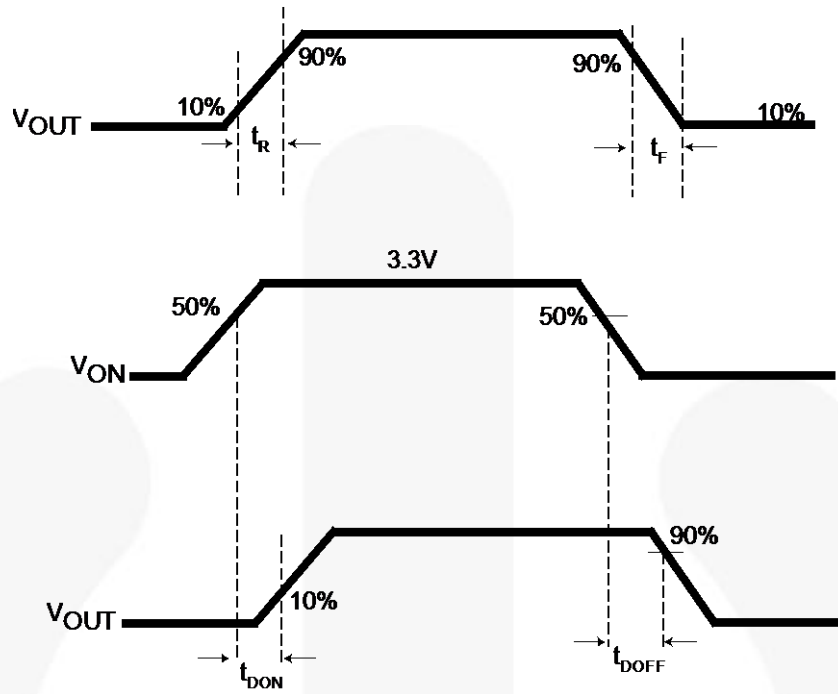
 除非另有说明, $V_{IN}=1.0$ 至 $3.6V$, $T_A=-40$ 至 $+85^\circ C$; $V_{IN}=3.3V$, $T_A=25^\circ C$ 时为典型值。

符号	参数	工作条件	最小值	典型值	最大值	单位
动态特性 (接上页)						
t_{DOFF}	关断延迟 ⁽⁴⁾	FPF1504		25	30	μs
t_F	V_{OUT} 下降时间 ⁽⁴⁾	FPF1504	$R_L=10 \Omega$, $C_L=0.1 \mu F$, $V_{IN}=3.3 V$, $T_A=25^\circ C$	2		
t_{OFF}	关断时间 ⁽⁴⁾	FPF1504		27		
t_{DOFF}	关断延迟 ⁽⁴⁾	FPF1504 FPF1504L		25 2		μs
t_F	V_{OUT} 下降时间 ⁽⁴⁾	FPF1504 FPF1504L	$R_L=500 \Omega$, $C_L=0.1 \mu F$, $V_{IN}=3.3 V$, $T_A=25^\circ C$	12 14		
t_{OFF}	关断时间 ⁽⁴⁾	FPF1504 FPF1504L		37 16		

说明:

- 该参数通过设计和特性得到保证, 无需生产测试。
- $t_{DON}/t_{DOFF}/t_R/t_F$ 在 中进行定义图 7。
- 断开时, 输出放电路径开启。

时序图 - FPF1504



说明:

- 6. $t_{ON} = t_r + t_{DON}$.
- 7. $t_{OFF} = t_f + t_{DOFF}$.

图 7. FPF1504时序图

FPF1504的典型性能特征

仅适用于高电平有效版本。

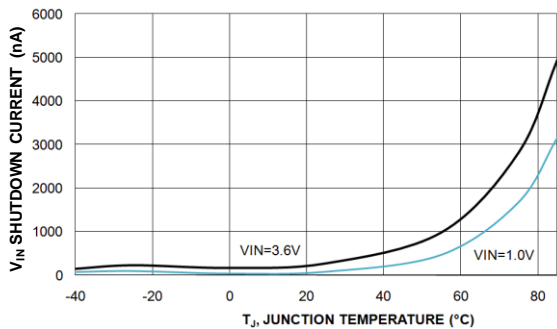


图 8. 关断电流与温度的关系

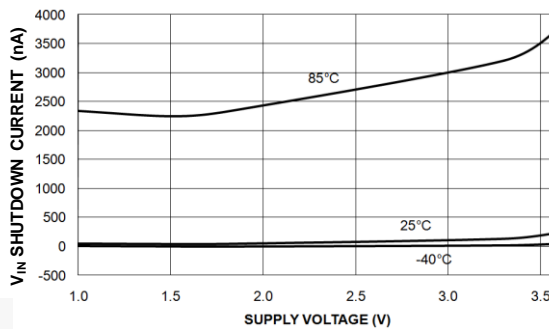


图 9. 关断电流与电源电压的关系

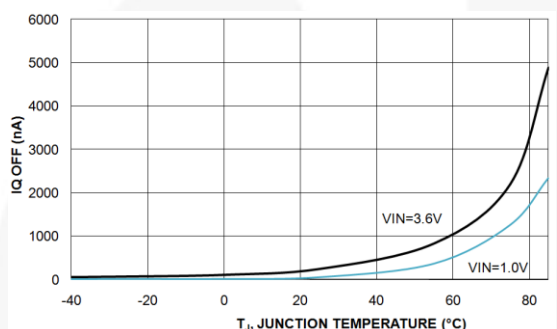


图 10. 关断电源电流与温度的关系

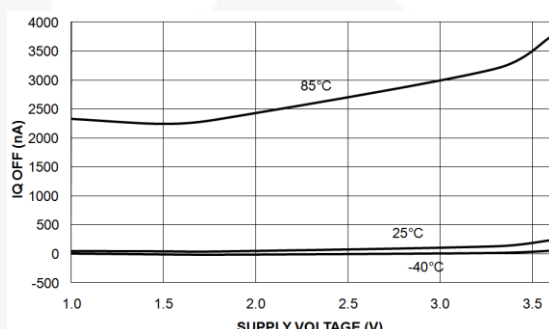


图 11. 关断电源电流与电源电压的关系

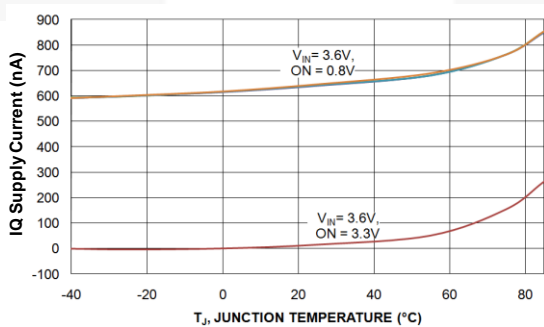


图 12. 静态电流与温度的关系

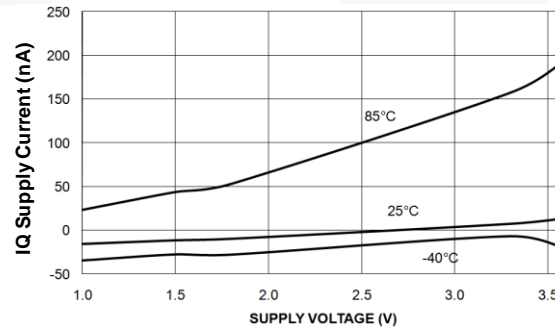


图 13. 静态电流与电源电压的关系 (V_{ON}=V_{IN})

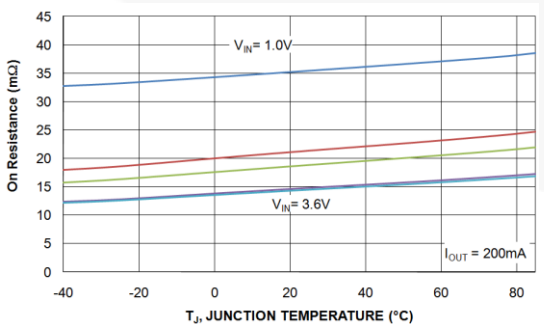


图 14. R_{ON}与温度的关系

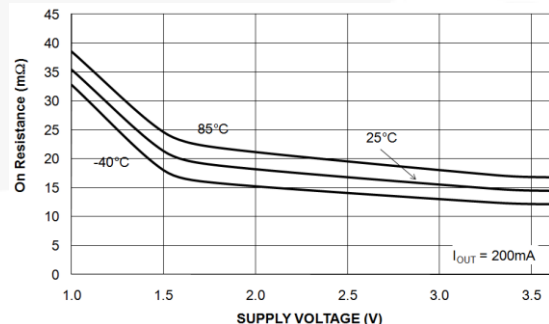


图 15. R_{ON}与电源电压的关系

FPF1504的典型性能特征

仅适用于高电平有效版本。

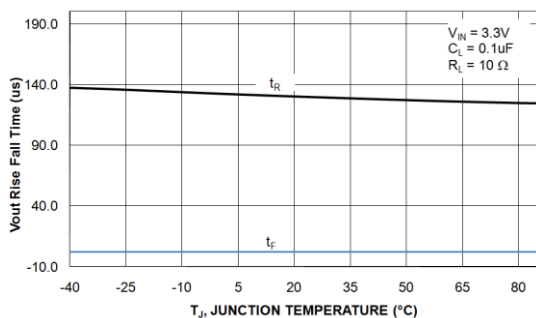


图 16. V_{out} 上升/下降时间与温度的关系 ($R_L=10\Omega$)

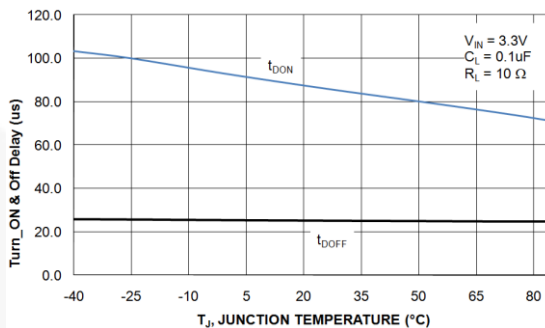


图 17. V_{out} 导通/关闭延迟与温度的关系 ($R_L=10\Omega$)

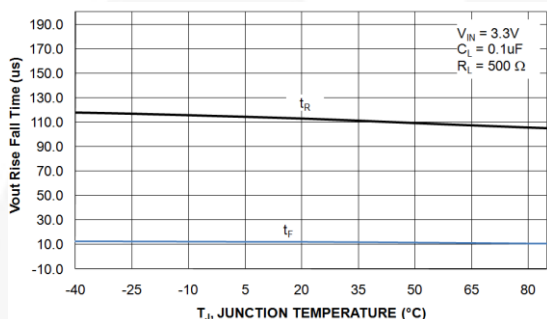


图 18. V_{out} 上升/下降时间与温度的关系 ($R_L=500\Omega$)

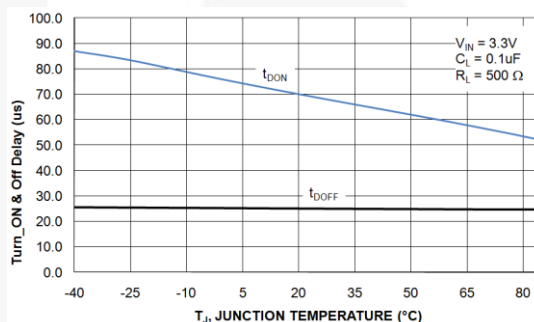


图 19. V_{out} 导通/关闭延迟与温度的关系 ($R_L=500\Omega$)

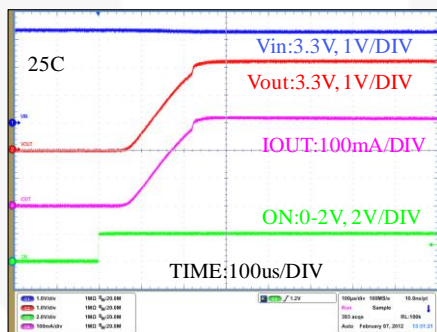


图 20. 导通响应
($V_{in}=3.3\text{ V}$, $C_{out}=0.1\ \mu\text{F}$, $R_L=10\ \Omega$)

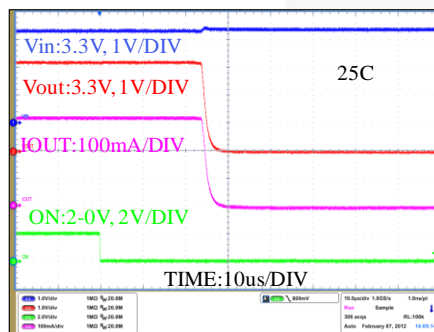


图 21. 关断响应
($V_{in}=3.3\text{ V}$, $C_{out}=0.1\ \mu\text{F}$, $R_L=10\ \Omega$)

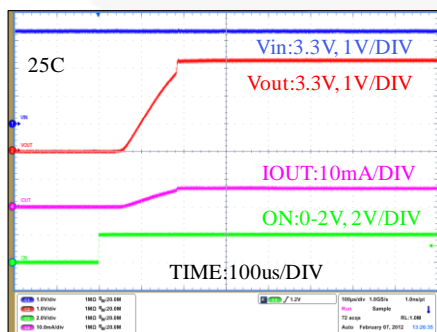


图 22. 导通响应
($V_{in}=3.3\text{ V}$, $C_{out}=0.1\ \mu\text{F}$, $R_L=500\ \Omega$)

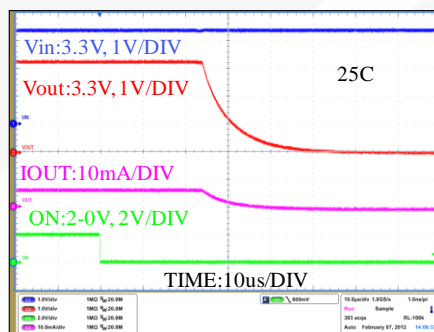


图 23. 关断响应
($V_{in}=3.3\text{ V}$, $C_{out}=0.1\ \mu\text{F}$, $R_L=500\ \Omega$)

应用信息

输入电容

IntelliMAX™ 开关无需输入电容。

为了降低设备的浪涌电流，建议靠近 VIN 引脚放置一个 0.1μF 的电容 C_{IN}。

使用更大的 C_{IN} 可进一步降低开关导通至更大的电容负载时造成的电压跌落。

同一等式也适用于带下拉输出电阻的设备，则 R_L 由并联下拉电阻和外部输出电阻级联所替代，如下所示：

$$t_F = \frac{R_L \times R_{PD}}{R_L + R_{PD}} \times C_L \times 2.2 \quad (2)$$

其中，t_F 为 90% 至 10% 的下降时间，R_L 为输出负载，R_{PD} 为输出下拉电阻（65 Ω 典型值 L），C_L 为输出电容。

输出电容

IntelliMAX™ 开关无需输出电容亦可工作。如果断开时应用电路板寄生电感使得 V_{OUT} 低于 GND，必须在 V_{OUT} 和 GND 引脚之间放置一个 0.1μF 电容 C_{OUT}。

下降时间

设备输出下降时间可以根据如下所示外部元件 RC 常数计算出来。

$$t_F = R_L \times C_L \times 2.2 \quad (1)$$

其中，下降时间 t_F 为 90% 至 10%，R_L 为输出负载，C_L 为输出电容。

建议焊盘模式和布局

为获得最佳热性能和最低电感与寄生影响，建议输入、输出线路短路，电容尽可能靠近设备。以下建议布局，可使设备实现最佳性能。

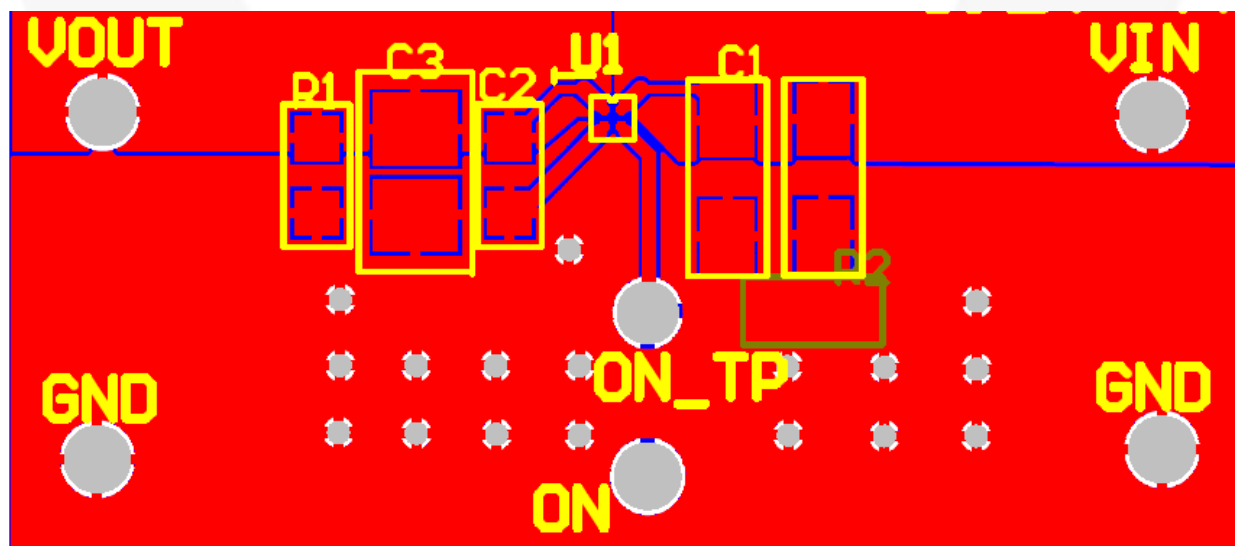


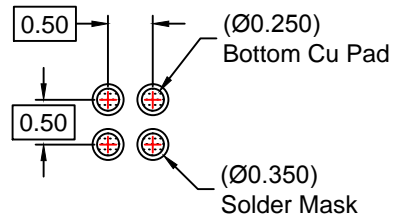
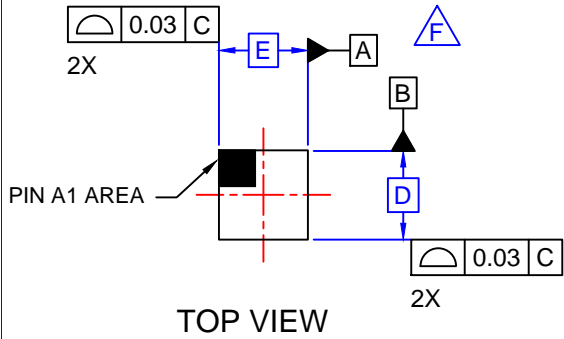
图 24. 建议焊盘模式和布局

以下信息适用到下一个页面上的WL -CSP封装尺寸：

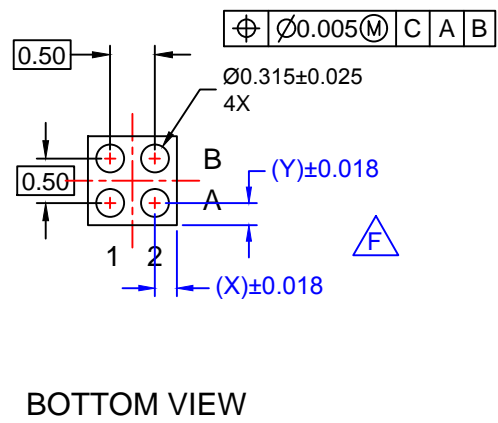
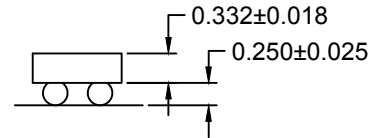
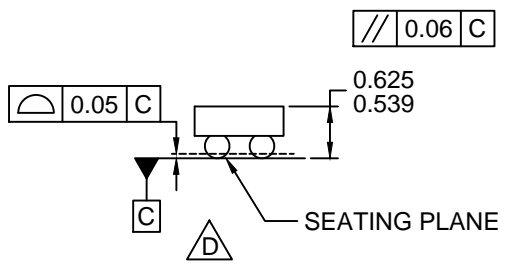
产品规格尺寸

产品	D	E	X	Y
FPF1504UCX	960 μm \pm 30 μm	960 μm \pm 30 μm	0.230 mm	0.230 mm
FPF1504BUCX				
FPF1504LUCX				
FPF1504LUCX				





RECOMMENDED LAND PATTERN
(NSMD PAD TYPE)



NOTES:

- A. NO JEDEC REGISTRATION APPLIES.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
- D. DATUM C IS DEFINED BY THE SPHERICAL CROWNS OF THE BALLS.
- E. PACKAGE NOMINAL HEIGHT IS 582 MICRONS ±43 MICRONS (539-625 MICRONS).
- F. FOR DIMENSIONS D, E, X, AND Y SEE PRODUCT DATASHEET.
- G. DRAWING FILENAME: MKT-UC004ABrev3.



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