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2014年2月



FOD3184 — 3A 输出电流，高速 MOSFET/IGBT 栅极驱动光耦合器

FOD3184 3A 输出电流，高速 MOSFET/IGBT 栅极驱动光耦合器

特性

- 具有 50 kV/ μ s（典型值）共模抑制特点的高抗噪能力
@ $V_{CM} = 2,000V$
- 保证工作温度范围为 $-40^{\circ}C$ 至 $+100^{\circ}C$
- 中等功率 MOSFET/IGBT 的 3A 峰值输出电流
- 快速开关速度
 - 210 ns（最大值）传播延迟
 - 65 ns max 脉宽失真度
- 快速输出上升 / 下降时间
 - 提供较低的动态功耗
- 250 kHz 最大开关速度
- 宽 V_{DD} 工作范围 15 V 至 30 V
- 使用输出级的 P 沟道 MOSFET 可使输出电压摆幅接近供电轨（轨到轨输出）
- 带滞回的欠压锁定保护 (UVLO) - 优化用于驱动 IGBT
- 安全和法规认证
 - UL1577, 5,000 VAC_{RMS}, 1 分钟。
 - DIN EN/IEC 60747-5-2, 1,414 峰值工作绝缘电压
 - 最小爬电距离为 8.0 mm
 - 最小绝缘厚度为 8 mm 至 16 mm
(选项 TV 或 TSV)
 - 最小绝缘厚度为 0.5 mm

应用

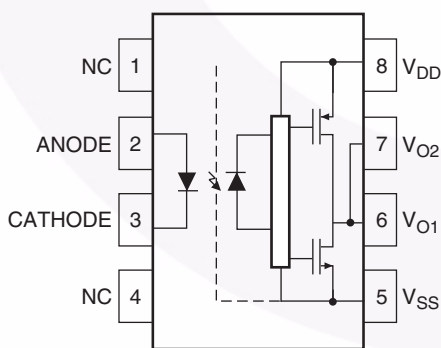
- 等离子显示屏
- 高性能 DC/DC 转换器
- 高性能开关模式电源
- 高性能不间断电源
- 隔离功率 MOSFET/IGBT 栅极驱动

说明

FOD3184 是具有 3A 输出电流，高速 MOSFET/IGBT 栅极驱动光耦。它由铝砷化镓 (AlGaAs) 发光二极管组成，该二极管与具有 PMOS 和 NMOS 输出功率晶体管集成电路功率级的 CMOS 感测器进行光耦合。非常适用于等离子显示屏 (PDPs)，电动机用逆变器控制，以及高性能 DC/DC 转换器中采用的高频功率驱动 MOSFETS/IGBT。

该器件封装在 8 引脚双列直插式外壳内，兼容 $260^{\circ}C$ 回流焊接工艺，符合无铅焊接的规定。

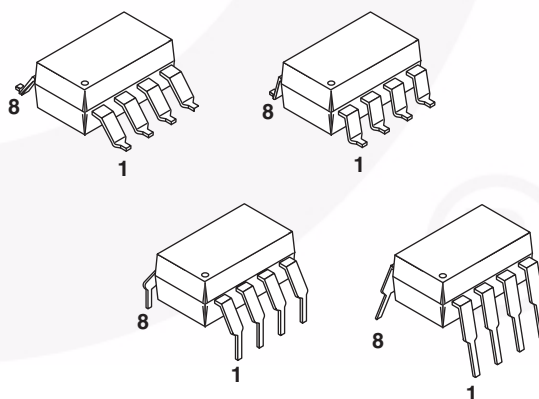
功能框图



注意:

0.1 μ F 旁路电容必须连接在引脚 5 和 8 之间。

封装外形



真值表

LED	$V_{DD}-V_{SS}$ “正向”（导通）	$V_{DD}-V_{SS}$ “负向”（关断）	V_O
关	0V 至 30 V	0V 至 30 V	低
导通	0V 至 11.5 V	0V 至 10 V	低
导通	11.5 V 至 13.5 V	10 V 至 12 V	转换
导通	13.5 V 至 30 V	12 V 至 30 V	高

引脚定义

引脚号	名称	说明
1	NC	未连接
2	阳极	LED 阳极
3	阴极	LED 阴极
4	NC	未连接
5	V_{SS}	负极电源电压
6	V_{O2}	输出电压 2（内部连接至 V_{O1} ）
7	V_{O1}	输出电压 1
8	V_{DD}	正向电源电压

安全性和绝缘标准

根据 DIN EN/IEC 60747-5-2。此光电耦合器仅适用于安全极限数据之内的“安全电气绝缘”。通过保护性电路确保各项安全标准达标。

符号	参数	最小值	典型值	最大值	单位
	安装标准符合 DIN VDE 0110/1.89 表 1				
	对于额定市电电压 < 150 Vrms		I-IV		
	对于额定市电电压 < 300 Vrms		I-IV		
	对于额定市电电压 < 450 Vrms		I-III		
	对于额定市电电压 < 600 Vrms		I-III		
	对于额定市电电压 < 1000 Vrms (选项 T、TS)		I-III		
	气候分类		40/100/21		
	污染等级 (DIN VDE 0110/1.89)		2		
CTI	相比漏电起痕指数	175			
V_{PR}	输入至输出测试电压，方法 b， $V_{IORM} \times 1.875 = V_{PR}$ ，100% 生产测试测试 $t_m = 1$ 秒，局部放电 < 5pC	2651			
	输入至输出测试电压，方法 a， $V_{IORM} \times 1.5 = V_{PR}$ ，类型和样品测试， $t_m = 60$ s，局部放电 < 5 pC	2121			
V_{IORM}	最大工作绝缘电压	1,414			V_{peak}
V_{IOTM}	最高允许过电压	6000			V_{peak}
	外部爬电距离	8			mm
	外部绝缘间隙	7.4			mm
	外部绝缘间隙 (对于选项 T 或 TS - 0.4" 引线间距)	10.16			mm
	绝缘厚度	0.5			mm
$T_{外壳}$	安全极限值 – 发生故障时允许的最大值 壳体温度	150			°C
$I_{S,INPUT}$	输入电流	25			mA
$P_{S,OUTPUT}$	输出功率	250			mW
R_{IO}	T_S , $V_{IO} = 500$ V 时的绝缘阻抗	10^9			Ω

绝对最大额定值（除非另有规定， $T_A = 25^\circ\text{C}$ ）

应力超过绝对最大额定值，可能会损坏器件。在超出推荐的工作条件和应力的情况下，该器件可能无法正常工作，所以不建议让器件在这些条件下工作。此外，过度暴露在高于推荐的工作条件的应力下，会影响器件的可靠性。绝对最大额定值仅是应力规格值。

符号	参数	数值	单位
T_{STG}	存储温度	-40 至 +125	$^\circ\text{C}$
T_{OPR}	工作温度	-40 至 +100	$^\circ\text{C}$
T_{J}	结温	-40 至 +125	$^\circ\text{C}$
T_{SOL}	引脚焊接温度 – 波峰焊 (请参阅回流焊温度曲线，第 22 页)	260 for 10 sec.	$^\circ\text{C}$
$I_{\text{F(AVG)}}$	平均输入电流 ⁽¹⁾	25	mA
$I_{\text{F(tr, tf)}}$	LED 电流上升 / 下降最小斜率	250	ns
V_{R}	反向输入电压	5	V
$I_{\text{OH(PEAK)}}$	“高”峰值输出电流 ⁽²⁾	3	A
$I_{\text{OL(PEAK)}}$	“低”峰值输出电流 ⁽²⁾	3	A
$V_{\text{DD}} - V_{\text{SS}}$	电源电压	-0.5 至 35	V
$V_{\text{O(PEAK)}}$	输出电压	0 至 V_{DD}	V
P_{O}	输出功率 ⁽³⁾	250	mW
P_{D}	总功耗 ⁽³⁾	295	mW

推荐工作条件

推荐的操作条件表明了器件的真实工作条件。指定推荐的工作条件，以确保器件的最佳性能达到数据表中的规格。飞兆不建议超出额定或依照绝对最大额定值进行设计。

符号	参数	数值	单位
$V_{\text{DD}} - V_{\text{SS}}$	电源	15 至 30	V
$I_{\text{F(ON)}}$	输入电流 (ON)	10 至 16	mA
$V_{\text{F(OFF)}}$	输入电压 (OFF)	-3.0 至 0.8	V

光电特性 (DC)应用于所有推荐的条件；除非另有规定，典型值测量条件为 $V_{DD} = 30\text{ V}$ ， $V_{SS} = 0\text{ V}$ ， $T_A = 25^\circ\text{C}$ 。

符号	参数	测试条件	最小值	典型值	最大值	单位
I_{OH}	高电平输出电流	$V_{OH} = (V_{DD} - V_{SS} - 1\text{ V})$		-0.9	-0.5	A
		$V_{OH} = (V_{DD} - V_{SS} - 6\text{ V})$			-2.5	
I_{OL}	低电平输出电流	$V_{OL} = (V_{DD} - V_{SS} + 1\text{ V})$	0.5	1		A
		$V_{OL} = (V_{DD} - V_{SS} + 6\text{ V})$	2.5			
V_{OH}	高级输出电压 ⁽⁴⁾⁽⁵⁾	$I_O = -100\text{ mA}$, $I_F = 10\text{ mA}$	$V_{DD} - 0.5$			V
		$I_O = -2.5\text{ A}$, $I_F = 10\text{ mA}$	$V_{DD} - 7$			
V_{OL}	低电平输出电压 ⁽⁴⁾⁽⁵⁾	$I_O = 100\text{ mA}$, $I_F = 0\text{ mA}$			$V_{SS} + 0.5$	V
		$I_O = 2.5\text{ A}$, $I_F = 0\text{ mA}$			$V_{SS} + 7$	
I_{DDH}	高电平电源电流	输出开路, $I_F = 10$ 至 16 mA		2.6	3.5	mA
I_{DDL}	低电平电源电流	输出开, $V_F = -3.0$ 至 0.8 V		2.5	3.5	mA
I_{FLH}	阈值输入电流 低电平至高电平	$I_O = 0\text{ mA}$, $V_O > 5\text{ V}$		3.0	7.5	mA
V_{FHL}	阈值输入电压 高电平至低电平	$I_O = 0\text{ mA}$, $V_O < 5\text{ V}$	0.8			V
V_F	输入正向电压	$I_F = 10\text{ mA}$	1.1	1.43	1.8	V
$\Delta V_F / T_A$	正向电压温度系数	$I_F = 10\text{ mA}$		-1.5		mV/°C
V_{UVLO+}	欠压锁定阈值	$V_O > 5\text{ V}$, $I_F = 10\text{ mA}$	11.5	13.0	13.5	V
V_{UVLO-}		$V_O < 5\text{ V}$, $I_F = 10\text{ mA}$	10.0	11.5	12.0	V
$UVLO_{HYST}$	UVLO 滞回			1.5		V
BV_R	反向击穿输入电压	$I_R = 10\text{ }\mu\text{A}$	5			V
C_{IN}	输入电容	$f = 1\text{ MHz}$, $V_F = 0\text{ V}$		25		pF

开关特性

应用于所有推荐的条件；除非另有规定，典型值测量条件为 $V_{DD} = 30\text{ V}$ ， $V_{SS} = 0\text{ V}$ ， $T_A = 25^\circ\text{C}$ 。

符号	参数	测试条件	最小值	典型值 *	最大值	单位
t_{PLH}	传播延迟时间到高输出电平 ⁽⁶⁾	$I_F = 10\text{ mA}$, $R_g = 10\ \Omega$, $f = 250\text{ kHz}$, 占空比 = 50%, $C_g = 10\text{ nF}$	50	120	210	ns
t_{PHL}	传播延迟时间到低输出电平 ⁽⁶⁾		50	145	210	ns
P_{WD}	脉宽失真度 ⁽⁷⁾			35	65	ns
P_{DD} ($t_{PHL} - t_{PLH}$)	任何两个部件 ⁽⁸⁾ 之间的传播延迟差			-90		90
t_r	上升时间	$C_L = 10\text{ nF}$, $R_g = 10\ \Omega$		38		ns
t_f	下降时间			24		ns
$t_{UVLO\ ON}$	UVLO 导通延迟			2.0		μs
$t_{UVLO\ OFF}$	UVLO 关断延迟			0.3		μs
$ CM_H $	输出高电平共模瞬态抑制性 ⁽⁹⁾⁽¹⁰⁾	$T_A = +25^\circ\text{C}$, $I_f = 10\text{ mA}$ 至 16 mA , $V_{CM} = 2\text{ kV}$, $V_{DD} = 30\text{ V}$	35	50		$\text{kV}/\mu\text{s}$
$ CM_L $	输出低电平共模瞬态抑制性 ⁽⁹⁾⁽¹¹⁾	$T_A = +25^\circ\text{C}$, $V_f = 0\text{ V}$, $V_{CM} = 2\text{ kV}$, $V_{DD} = 30\text{ V}$	35	50		$\text{kV}/\mu\text{s}$

* $T_A = 25^\circ\text{C}$ 时的典型值

绝缘特性

符号	参数	测试条件	最小值	典型值 *	最大值	单位
V_{ISO}	耐受绝缘电压 ⁽¹²⁾⁽¹³⁾	$T_A = 25^\circ\text{C}$, R.H. < 50%, $t = 1$ 分钟, $I_{I-O} \leq 10\ \mu\text{A}$	5000			V_{rms}
R_{I-O}	电阻（输入至输出） ⁽¹³⁾	$V_{I-O} = 500\text{ V}$		10^{11}		Ω
C_{I-O}	电容（输入至输出）	频率 = 1 MHz		1		pF

* $T_A = 25^\circ\text{C}$ 时的典型值

注意：

1. 空气温度超过 +79°C 时，线性降额的速度为 0.37 mA/°C。
2. 最大脉冲宽度 = 10 μ s。
3. 空气温度超过 +79°C 时，线性降额的速度为 5.73 mA/°C。
4. 在该测试中， V_{OH} 采用 dc 负载电流 100 mA 测得。驱动电容负载时，随着 I_{OH} 接近零安培， V_{OH} 将接近 V_{DD} 。
5. 最大脉宽 = 1 ms，最大占空比 = 20%。
6. t_{PHL} 传播延迟的测量是从 50% 的输入脉冲下降沿至 50% 的 V_O 信号下降沿。 t_{PLH} 传播延迟的测量是从 50% 的输入脉冲上升沿至 50% 的 V_O 信号上升沿。
7. 对于任何给定器件，PWD 定义为 $|t_{PHL} - t_{PLH}|$ 。
8. 在相同工作条件下（具有相同负载），任何两个 FOD3184 部件间 t_{PHL} 和 t_{PLH} 间的差异。
9. 引脚 1 和 4 需要连接至 LED 公共端。
10. 高电平状态下的共模瞬变抑制是共模脉冲 V_{CM} 的最大容许 dV_{CM}/dt ，从而确保输出将保持高电平状态（例如， $V_O > 15$ V）。
11. 低电平状态下的共模瞬变抑制是共模脉冲 V_{CM} 的最大容许 dV_{CM}/dt ，从而确保输出将保持低电平状态（例如， $V_O < 1.0$ V）。
12. 根据 UL 1577，每个光电耦合器都通过应用绝缘测试电压 > 1 秒钟的 6000 Vrms、60 Hz（泄露检测电流限制 $I_{L-O} < 10$ μ A）得到验证。
13. 器件属于两极器件：输入端引脚短接，输出端引脚短接。

典型性能曲线

Fig. 1 Output High Voltage Drop vs. Output High Current

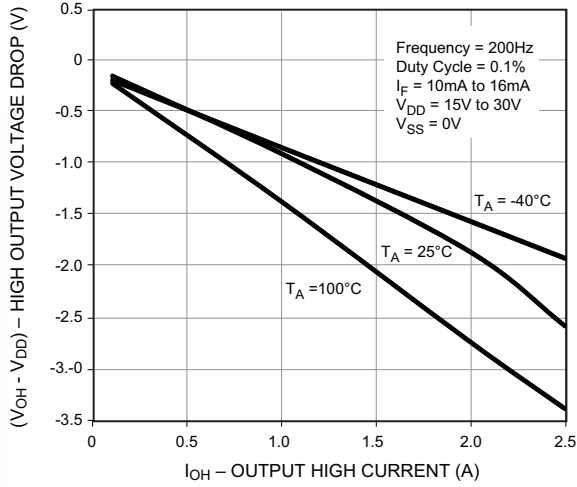


Fig. 2 Output High Voltage Drop vs. Ambient Temperature

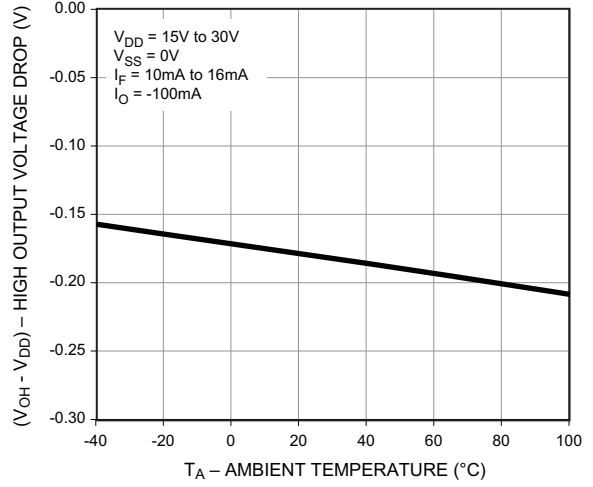


Fig. 3 Output High Current vs. Ambient Temperature

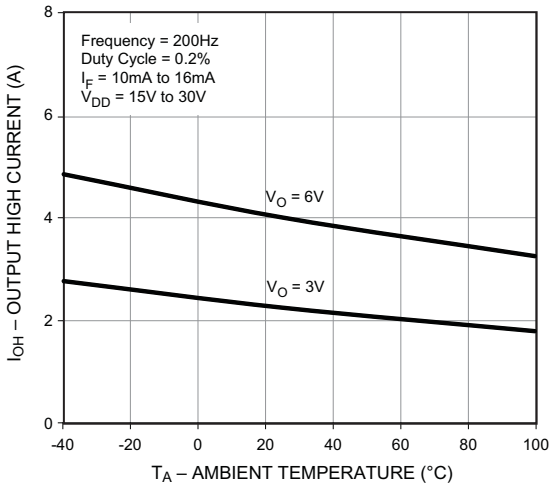


Fig. 4 Output High Current vs. Ambient Temperature

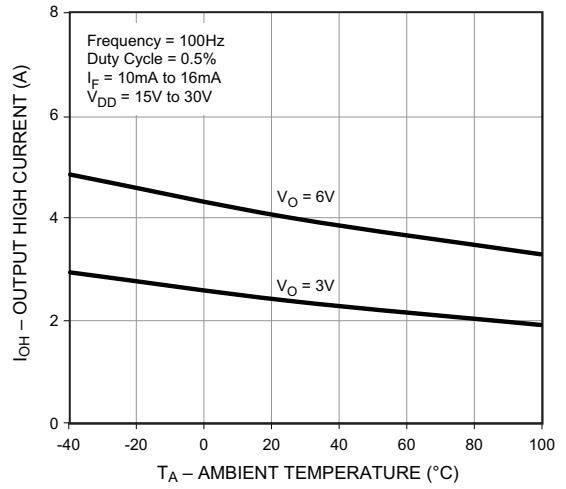


Fig. 5 Output Low Voltage vs. Output High Current

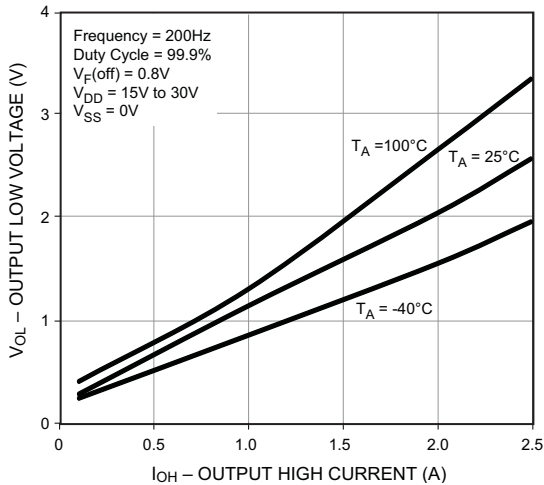
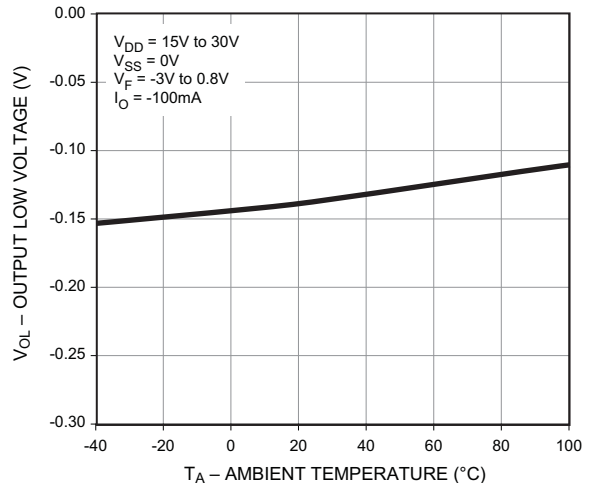


Fig. 6 Output Low Voltage vs. Ambient Temperature



典型性能曲线 (续)

Fig. 7 Output Low Current vs. Ambient Temperature

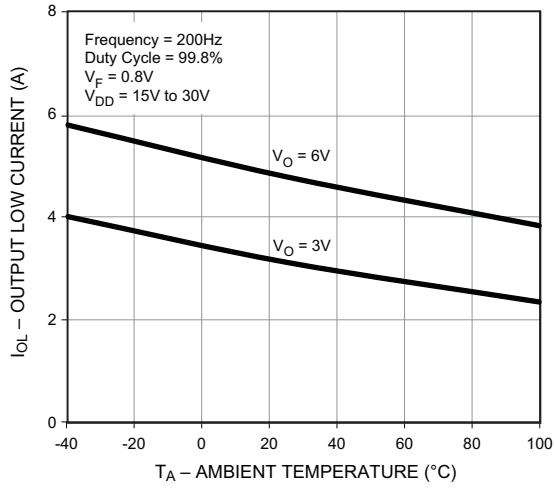


Fig. 8 Output Low Current vs. Ambient Temperature

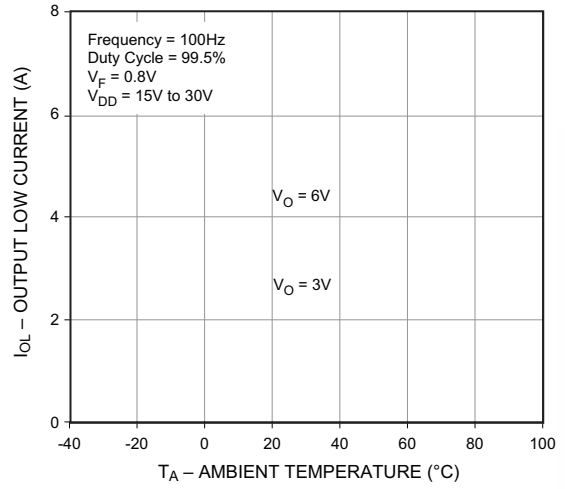


Fig. 9 Supply Current vs. Ambient Temperature

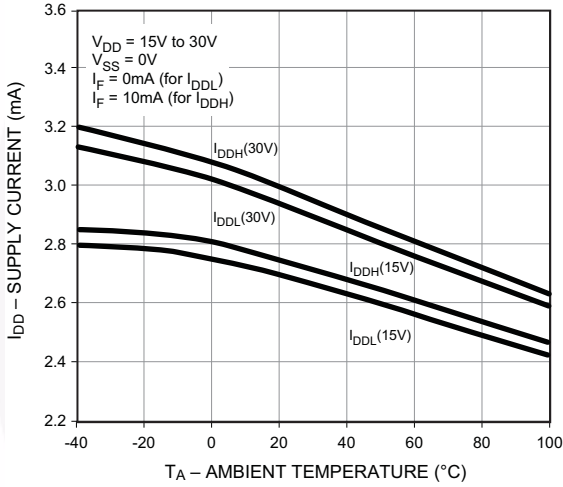


Fig. 10 Supply Current vs. Supply Voltage

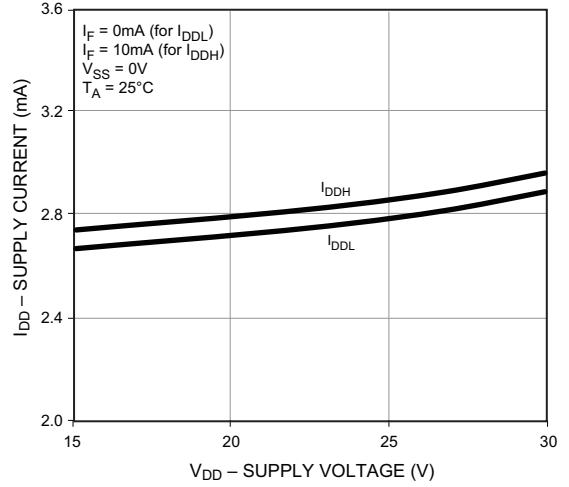


Fig. 11 Low-to-High Input Current Threshold vs. Ambient Temperature

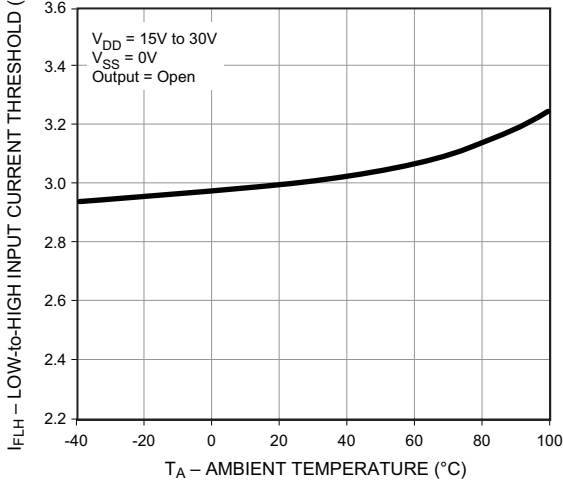
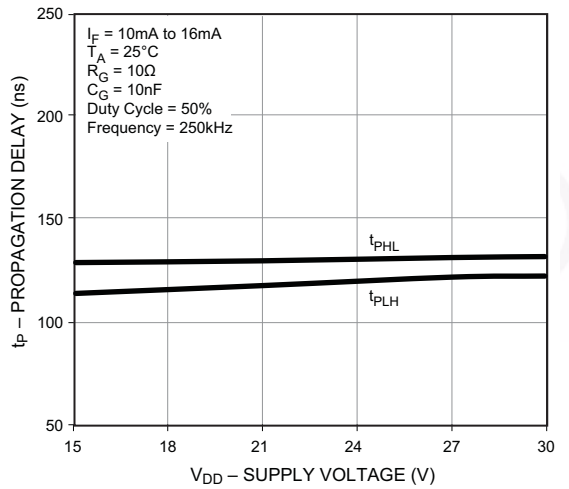


Fig. 12 Propagation Delay vs. Supply Voltage



典型性能曲线 (续)

Fig. 13 Propagation Delay vs. LED Forward Current

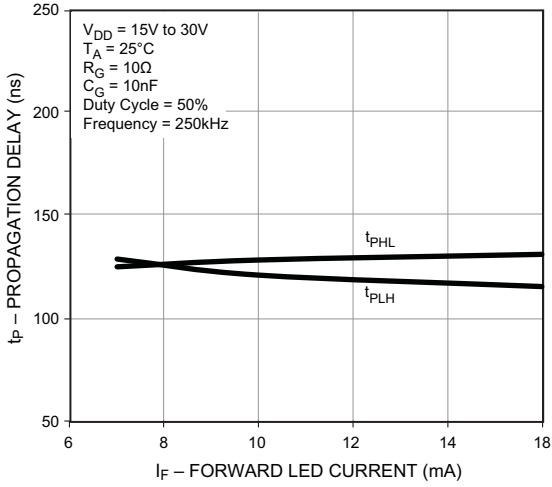


Fig. 14 Propagation Delay vs. Ambient Temperature

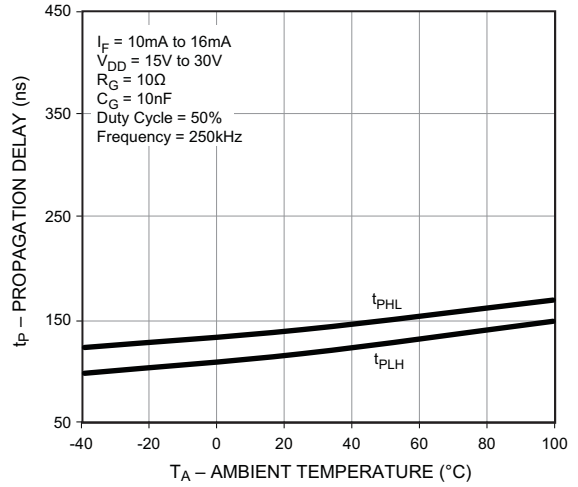


Fig. 15 Propagation Delay vs. Series Load Resistance

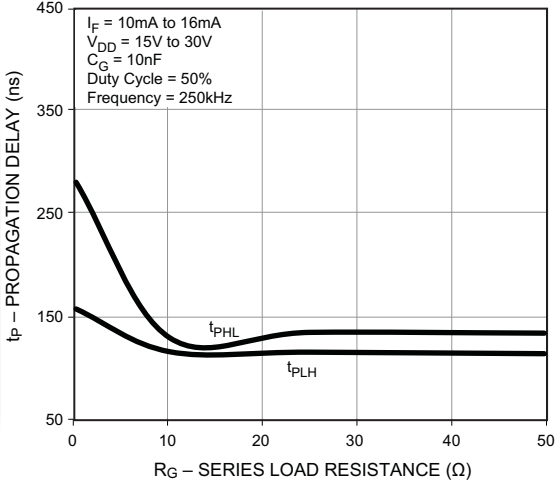


Fig. 16 Propagation Delay vs. Series Load Capacitance

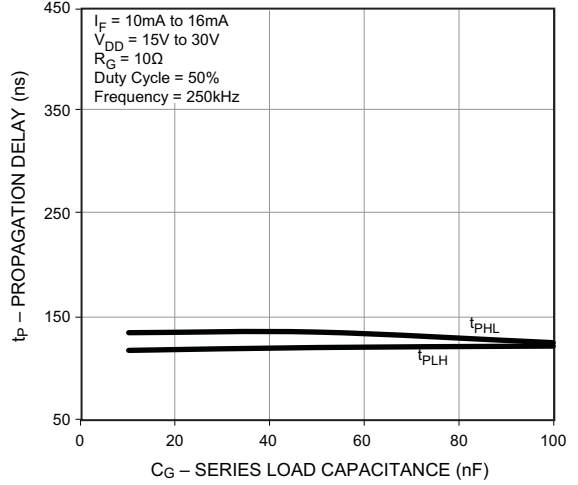


Fig. 17 Transfer Characteristics

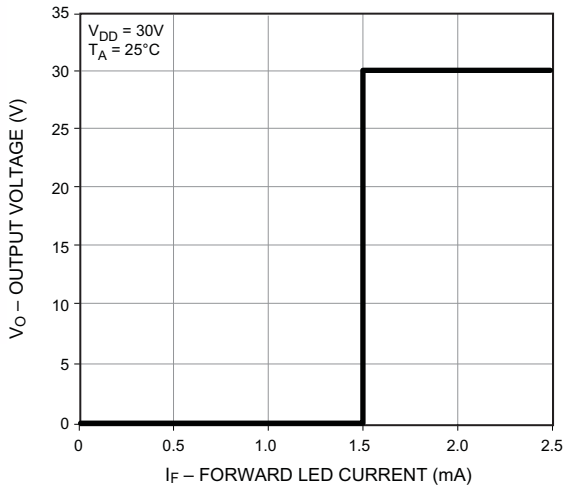
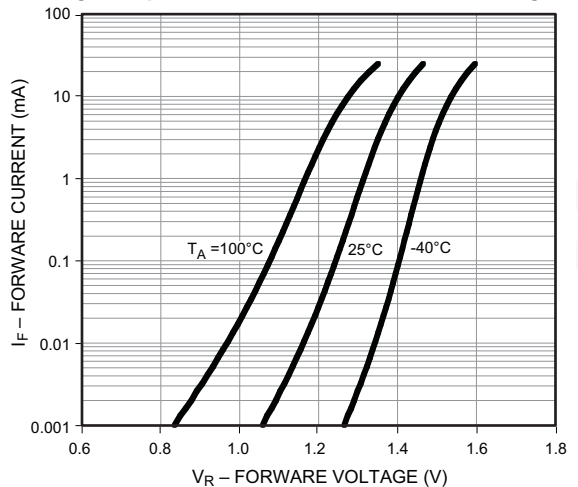
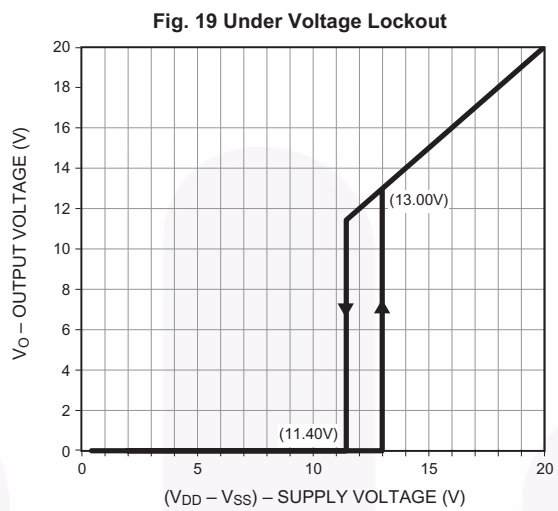


Fig. 18 Input Forward Current vs. Forward Voltage



典型性能曲线 (续)



测试电路

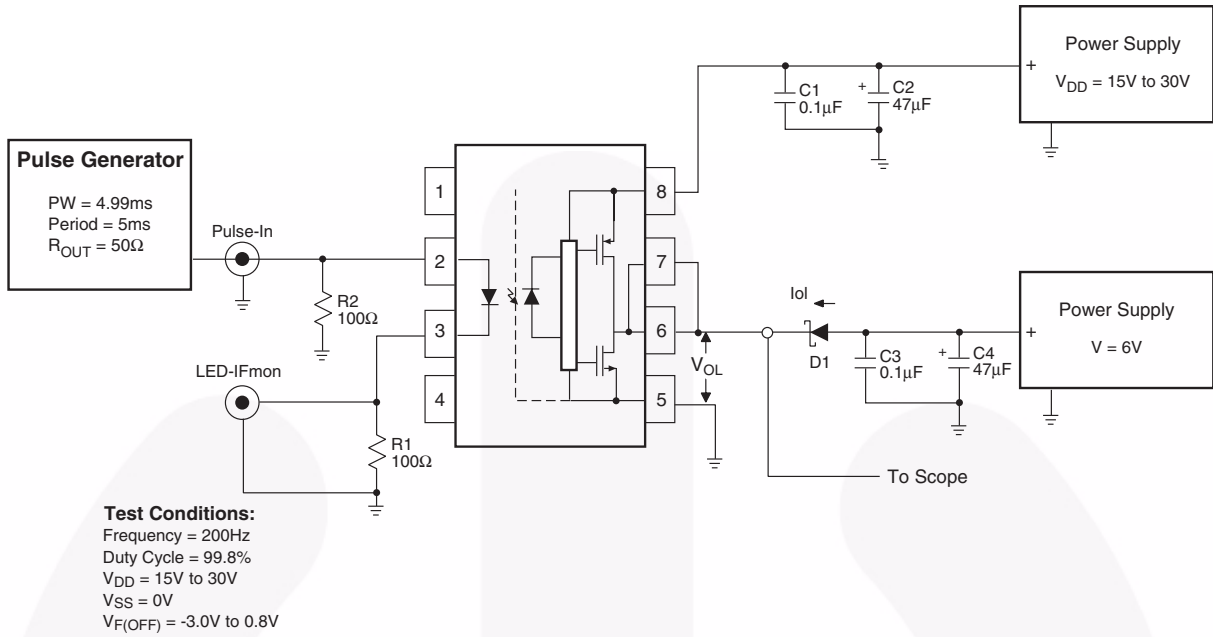


图 20. I_{OL} 测试电路

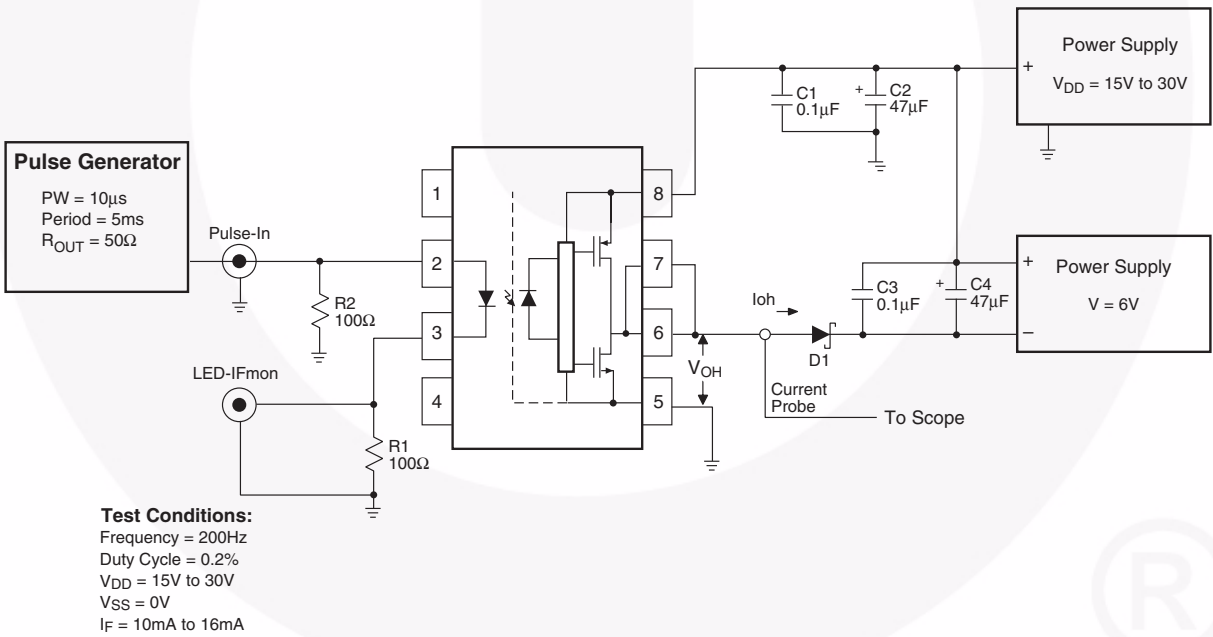


图 21. I_{OH} 测试电路

测试电路 (续)

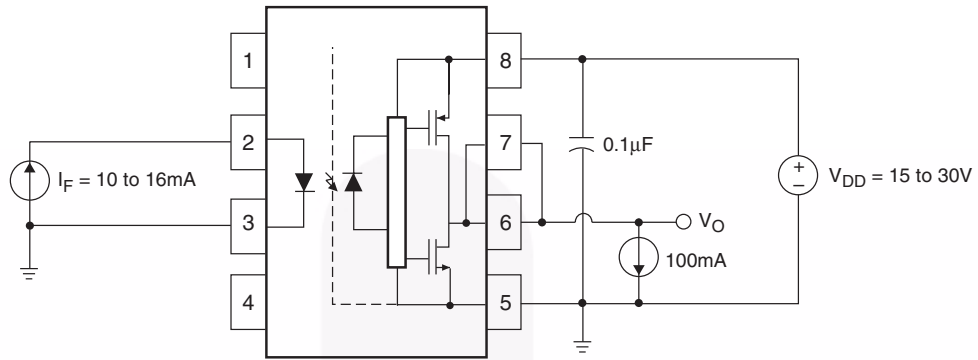


图 22. V_{OH} 测试电路

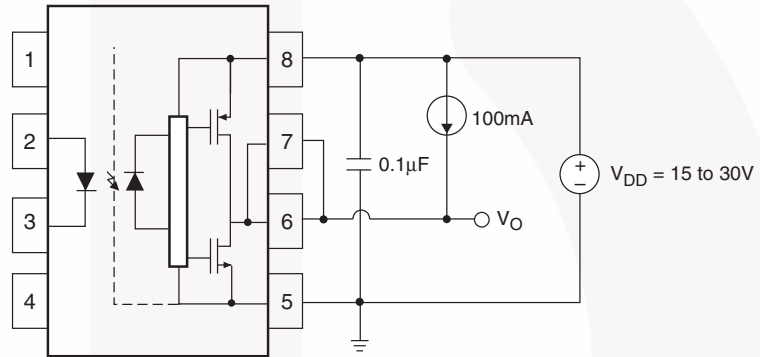


图 23. V_{OL} 测试电路

测试电路 (续)

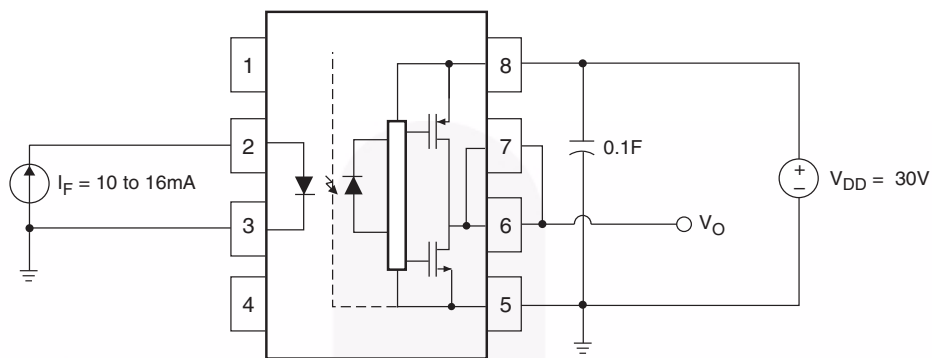


图 24. I_{DDH} 测试电路

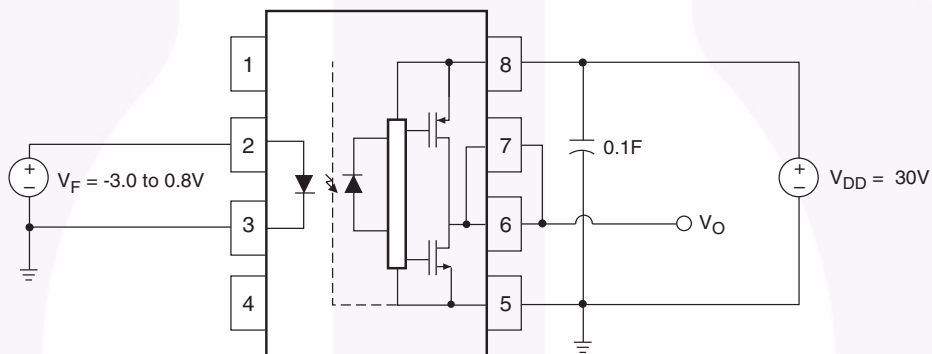


图 25. I_{DDL} 测试电路

测试电路 (续)

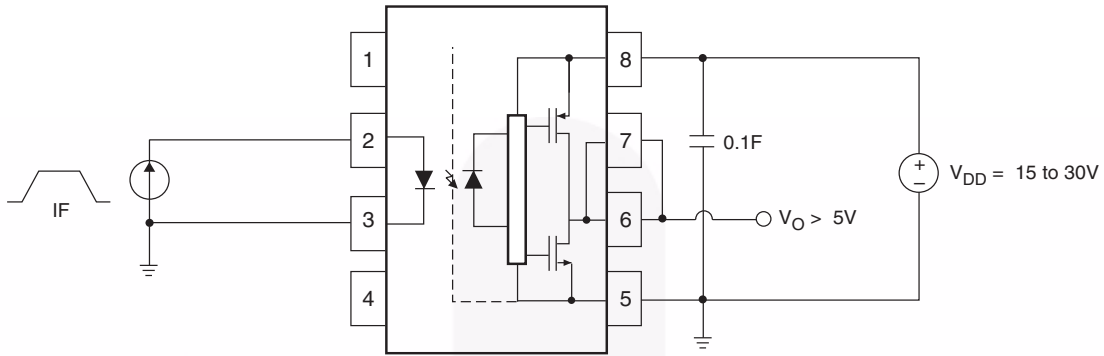


图 26. I_{FLH} 测试电路

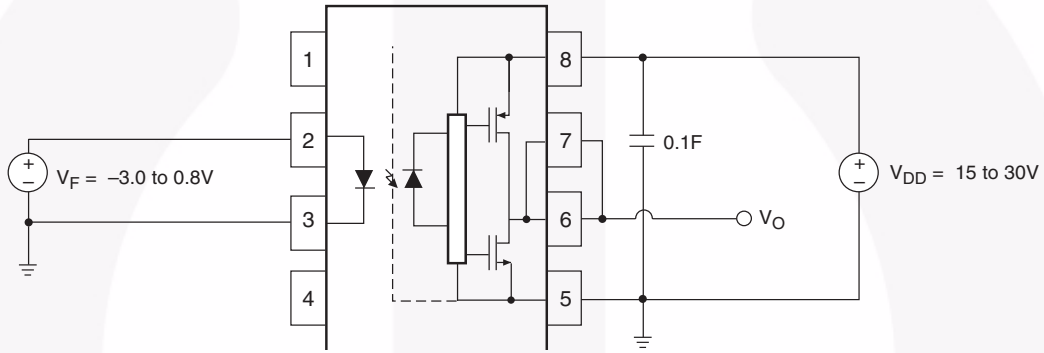


图 27. I_{FHL} 测试电路

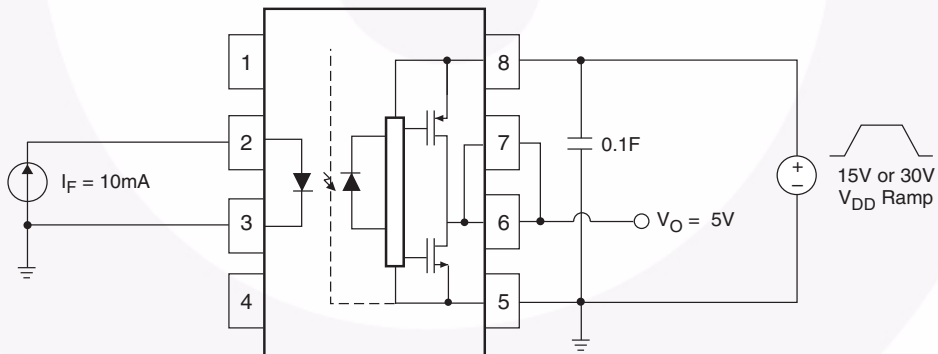


图 28. UVLO 测试电路

测试电路 (续)

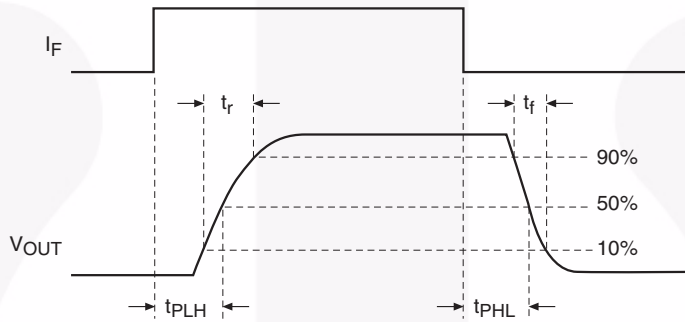
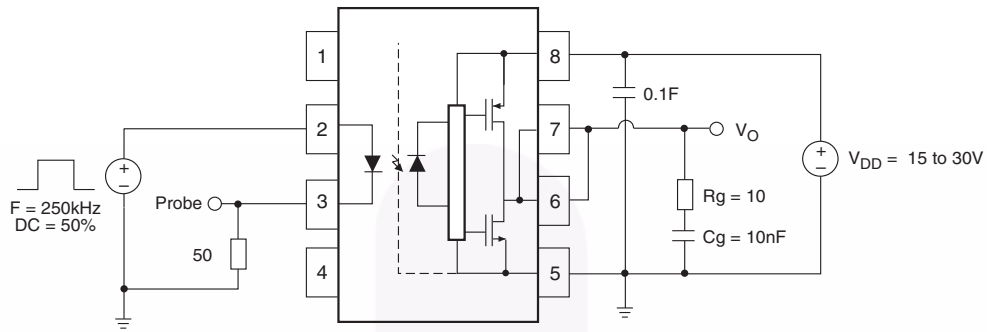


图 29. t_{PHL} 、 t_{PLH} 、 t_r 和 t_f 测试电路和波形

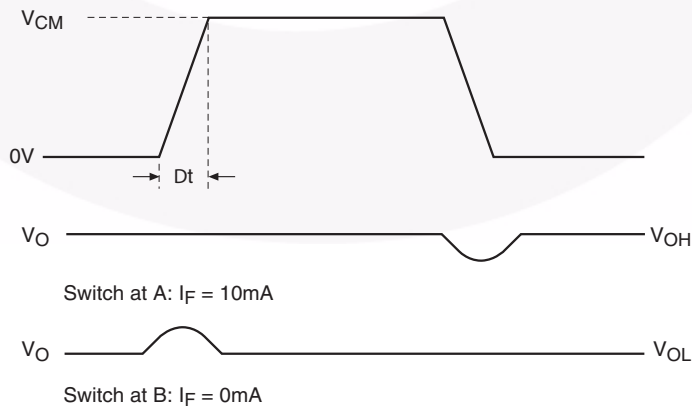
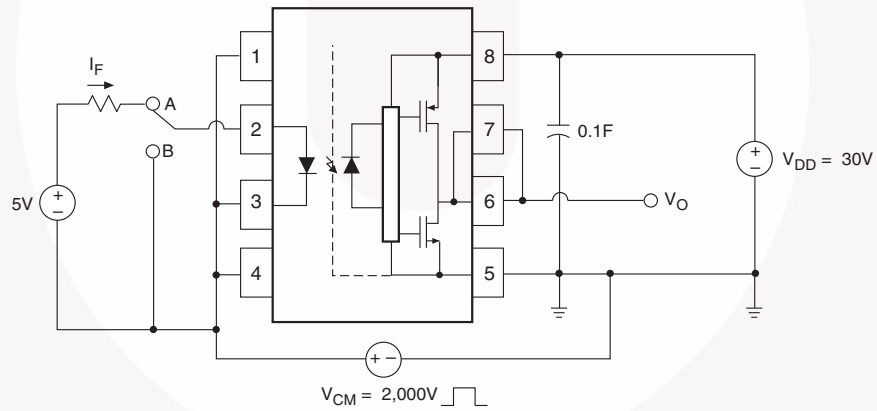
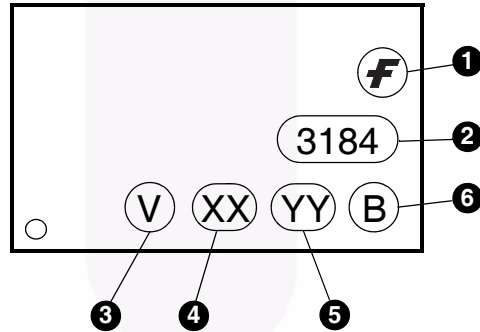


图 30. CMR 测试电路与波形

订购信息

器件编号	封装	包装方法
FOD3184	DIP 8 引脚	管装 (每管 50 个)
FOD3184S	SMT 8 引脚 (弯曲引线)	管装 (每管 50 个)
FOD3184SD	SMT 8 引脚 (弯曲引线)	编卷带包装 (每卷 1000 单位)
FOD3184V	DIP 8 引脚、DIN EN/IEC 60747-5-2 选项	管装 (每管 50 个)
FOD3184SV	SMT 8 引脚 (弯曲引线)、DIN EN/IEC 60747-5-2 选项	管装 (每管 50 个)
FOD3184SDV	SMT 8 引脚 (弯曲引线)、DIN EN/IEC 60747-5-2 选项	编卷带包装 (每卷 1000 单位)
FOD3184TV	DIP 8 引脚、0.4" 引线间距、DIN EN/IEC 60747-5-2 选项	管装 (每管 50 个)
FOD3184TSV	SMT 8 引脚、0.4" 引线间距、DIN EN/IEC 60747-5-2 选项	管装 (每管 50 个)
FOD3184TSR2V	SMT 8 引脚、0.4" 引线间距、DIN EN/IEC 60747-5-2 选项	卷带和卷盘 (每卷 700 装)

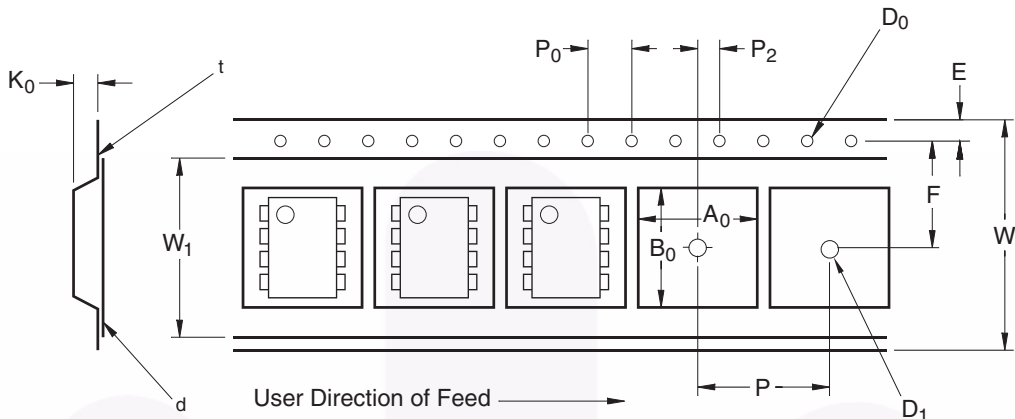
标识信息



定义

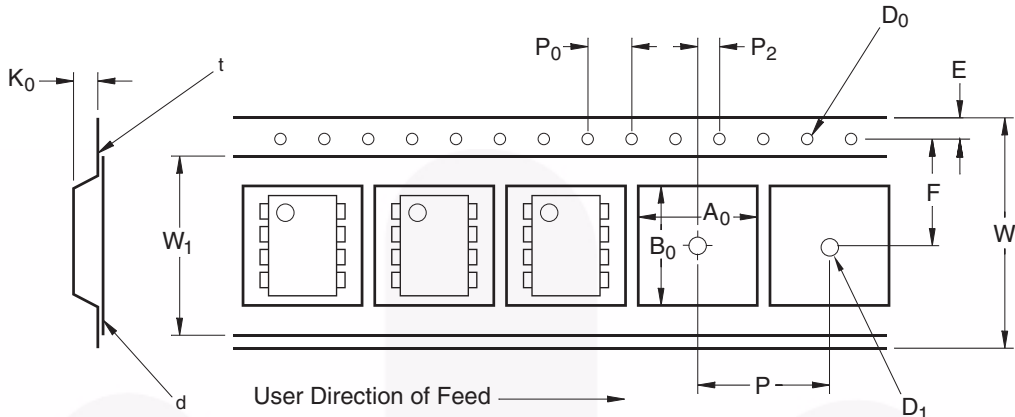
1	飞兆徽标
2	器件号
3	VDE 标记 (注: 仅订购 DIN EN/IEC 60747-5-2 选项的器件才显示 - 见订单条目表)
4	两位数年份代码, 如“11”
5	两位数, 代表工作周从“01”到“53”
6	装配封装码

承载带规格 - 选项 S



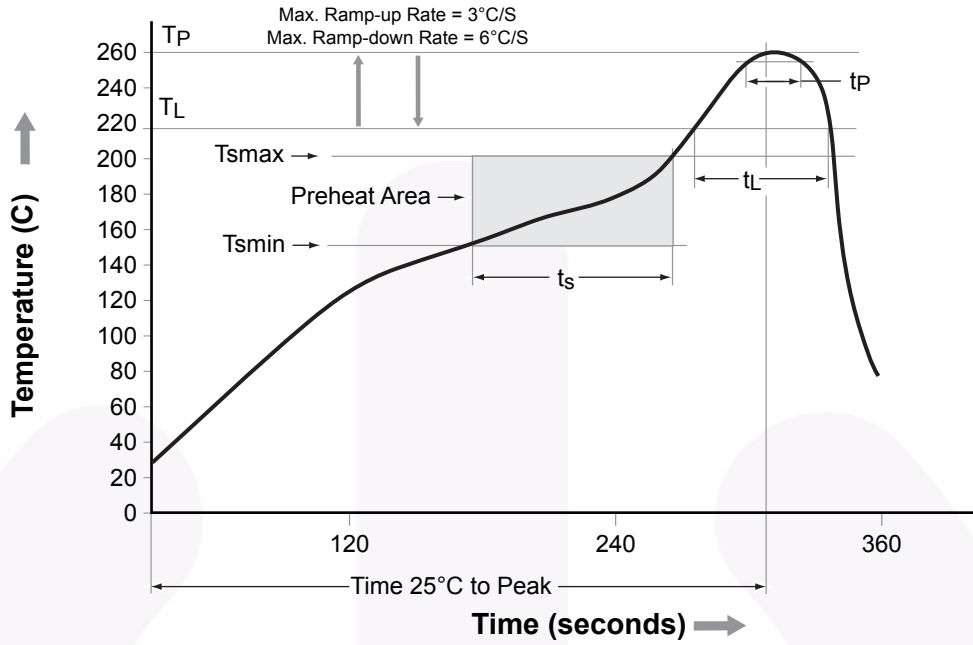
符号	说明	单位 mm
W	带宽	16.0 ± 0.3
t	带厚	0.30 ± 0.05
P ₀	孔距	4.0 ± 0.1
D ₀	孔径	1.55 ± 0.05
E	孔位置	1.75 ± 0.10
F	Pocket 位置	7.5 ± 0.1
P ₂		2.0 ± 0.1
P	Pocket 间距	12.0 ± 0.1
A ₀	Pocket 尺寸	10.30 ± 0.20
B ₀		10.30 ± 0.20
K ₀		4.90 ± 0.20
W ₁	覆带宽	13.2 ± 0.2
D	覆带厚	0.1 (最大值)
	组件旋转或斜度最大值	10°
R	最小弯曲半径	30

承载带规格 - 选项 TS

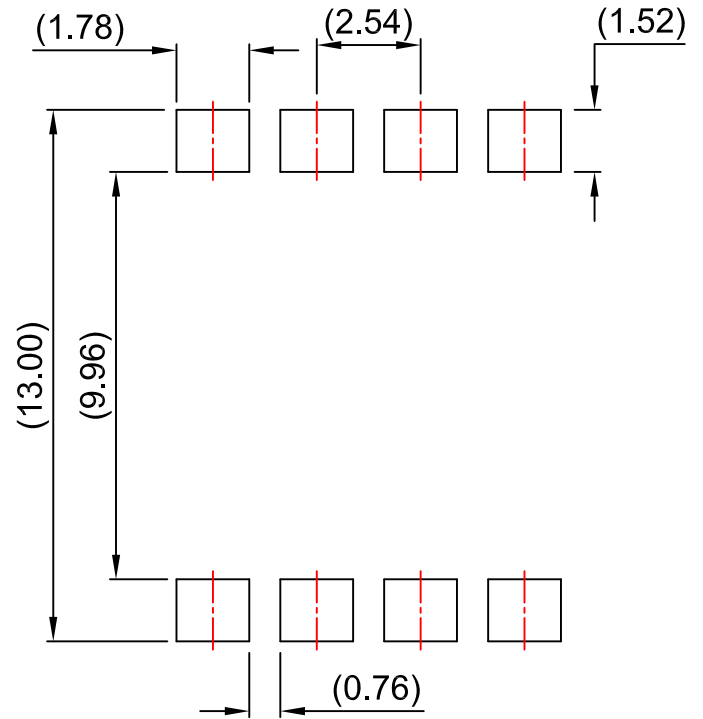


符号	说明	单位 mm
W	带宽	24.0 ± 0.3
t	带厚	0.40 ± 0.1
P ₀	孔距	4.0 ± 0.1
D ₀	孔径	1.55 ± 0.05
E	孔位置	1.75 ± 0.10
F	Pocket 位置	11.5 ± 0.1
P ₂		2.0 ± 0.1
P	Pocket 间距	16.0 ± 0.1
A ₀	Pocket 尺寸	12.80 ± 0.1
B ₀		10.35 ± 0.1
K ₀		5.7 ± 0.1
W ₁	覆带宽	21.0 ± 0.1
D	覆带厚	0.1 (最大值)
	组件旋转或斜度最大值	10°
R	最小弯曲半径	30

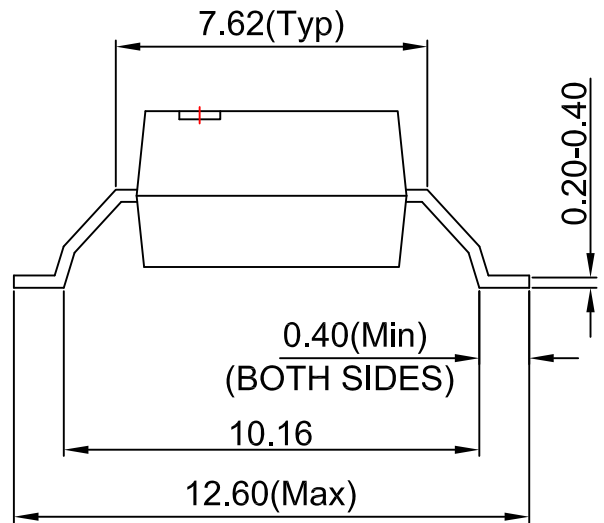
回流焊数据



特征	无铅装配数据
最低温度 (T _{smin})	150°C
最高温度 (T _{smax})	200°C
时间 (t _s) 从 (T _{smin} 至 T _{smax})	60 至 120 秒
斜升率 (t _L to t _p)	最高 3°C/ 秒
液态温度 (T _L)	217°C
保持在 (t _L) 以上的时间 (t _L)	60 至 150 秒
体封装温度峰值	260°C +0°C / -5°C
时间 (t _p), 260°C 的 5°C 内	30 秒
斜降率 (T _p to T _L)	最高 6°C/ 秒
25°C 至峰值温度的时间	最多 8 分钟



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PIN 1

15.0° (MAX)

10.16 (TYP)

0.20-0.40



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