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FAN7383

半桥栅极驱动 IC

特性

- 浮动通道专为高达 +600V 的自举运行而设计
- 两个通道的源 / 灌电流驱动能力典型值为 350mA/650mA
- 将容许负 V_S 摆幅扩展至 -9.8V, 用于 $V_{DD}=V_{BS}=15V$ 时的信号传播
- 高侧输出 IN 信号同相
- 两个通道均内置欠压锁定 (UVLO) 功能
- 内置共模 dv/dt 噪声消除电路
- 典型内部 330ns 最小死区时间
- 可编程导通延迟时间控制 (死区时间)

应用

- SMPS
- 电机驱动变频器
- 荧光灯镇流器
- HID 镇流器

说明

FAN7383 是一款半桥、栅极驱动 IC, 带关断和可编程死区时间控制功能, 能驱动 MOSFET 和 IGBT, 工作电压高达 +600V。

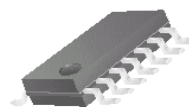
飞兆的高压工艺和共模噪声消除技术可使高侧驱动器在高 dv/dt 噪声环境下稳定运行。

先进的电平转换电路使高端栅极驱动器运行偏置电压高达 $V_S = -9.8V$ (典型值), 当 $V_{BS}=15V$ 时。

当 V_{DD} 和 V_{BS} 小于指定阈值电压时, 两个通道的欠压锁定 (UVLO) 电路可防止发生故障。

输出驱动器的源电流 / 灌电流典型值分别为 350mA/650mA, 适用于各种各样的半桥和全桥逆变器。

14-SOP



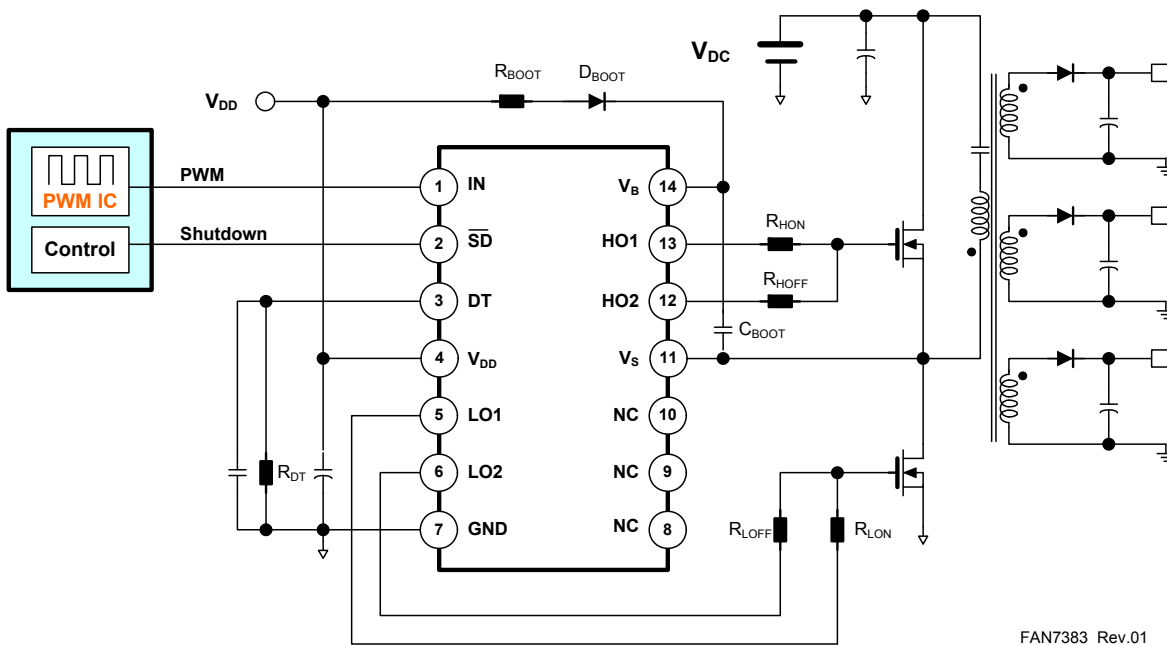
订购信息

器件编号	封装	无铅	工作温度范围	包装方法
FAN7383M ⁽¹⁾	14-SOP	是	-40°C ~ 125°C	塑料管
FAN7383MX ⁽¹⁾				卷带和卷盘

注:

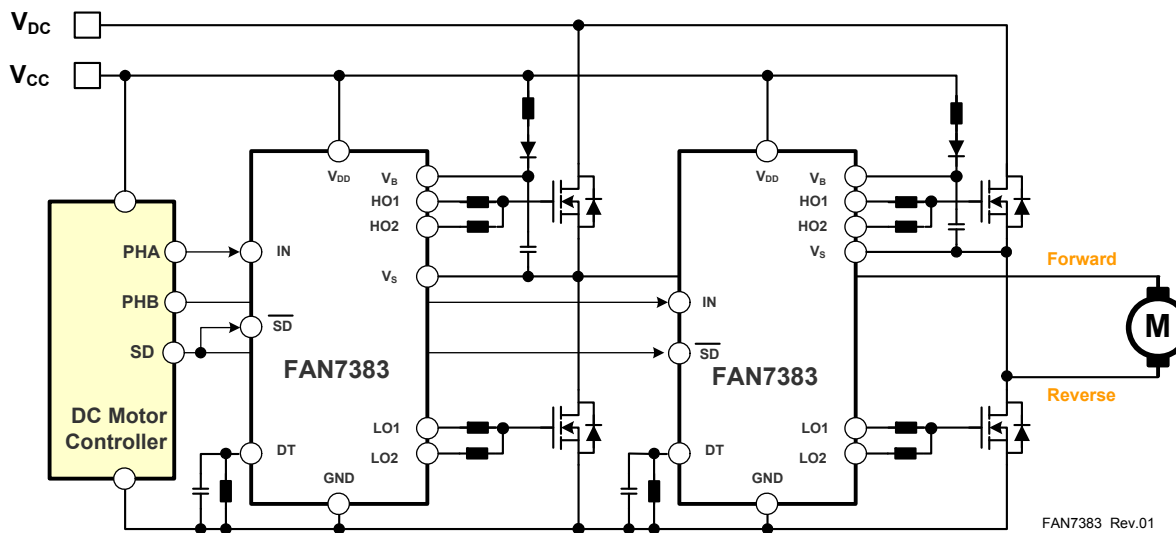
1. 这些器件通过了 JESD22A-111 波峰焊测试。

典型应用电路



FAN7383 Rev.01

图 1. 半桥开关电源应用电路



FAN7383 Rev.01

图 2. 全桥直流电机驱动器应用电路

内部框图

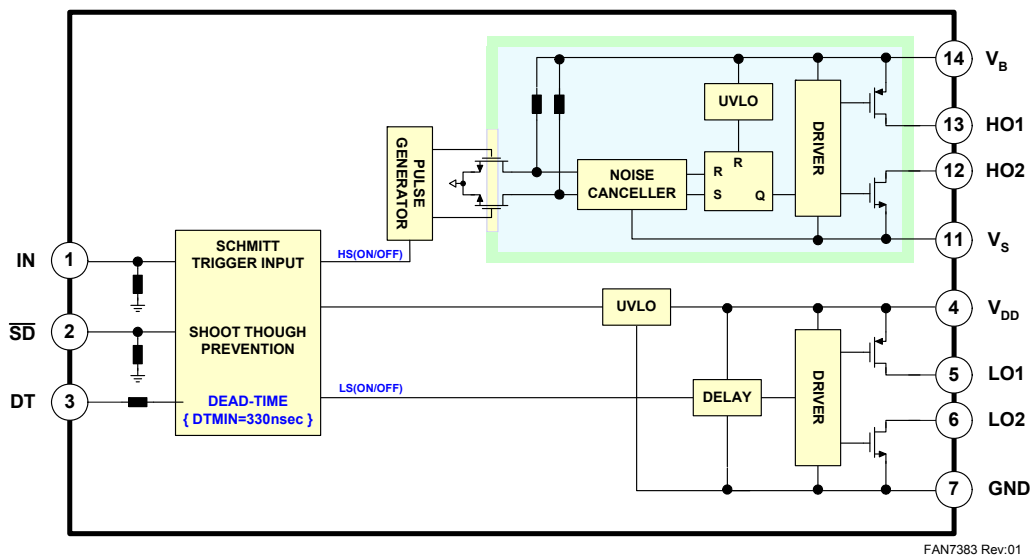


图 3. FAN7383 功能框图

引脚布局

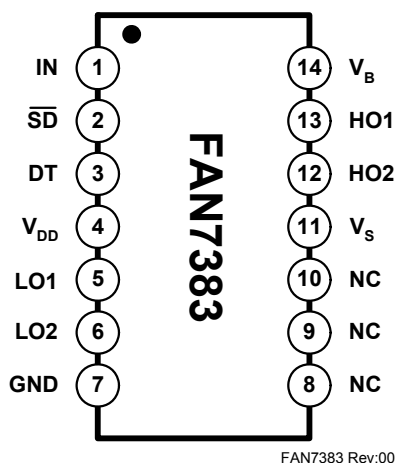


图 4. 引脚配置（俯视图）

引脚定义

引脚号	名称	说明
1	IN	栅极驱动器逻辑输入
2	\overline{SD}	关断逻辑输入（低电平有效）
3	DT	通过外接电阻实现可编程死区时间控制
4	V_{DD}	低侧电源电压
5	LO1	低侧驱动器源电流输出
6	LO2	低侧驱动器灌电流输出
7	GND	接地
8	N.C.	未连接
9	N.C.	未连接
10	N.C.	未连接
11	V_S	高侧浮动电源返回
12	HO2	高侧端驱动器灌电流输出
13	HO1	高侧驱动器源电流输出
14	V_B	高侧浮动电源

绝对最大额定值

应力超过绝对最大额定值，可能会损坏器件。在超出推荐的工作条件的情况下，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长期工作。此外，长期工作在高压推荐的工作条件下工作，会影响器件的可靠性。绝对最大额定值仅是应力规格值。除非另有说明， $T_A = 25^\circ\text{C}$ 。

符号	参数	最小值	最大值	单位
V_S	高侧偏置电压	V_B-25	$V_B+0.3$	V
V_B	高侧浮动电源电压	-0.3	625	V
V_{HO}	高侧浮动输出电压 HO1、HO2	$V_S-0.3$	$V_B+0.3$	V
V_{DD}	低侧和逻辑固定电源电压	-0.3	25	V
V_{LO}	低侧输出电压 LO1、LO2	-0.3	$V_{DD}+0.3$	V
V_{IN}	逻辑输入电压 (IN)	-0.3	$V_{DD}+0.3$	V
$V_{\overline{SD}}$	关断逻辑输入电压	-0.3	$V_{DD}+0.3$	V
V_{DT}	死区时间控制电压	-0.3	5.0	V
GND	逻辑地	$V_{DD}-25$	$V_{DD}+0.3$	V
d V_S /dt	允许的偏置电压变化速率		50	V/ns
$P_D^{(2)(3)(4)}$	功耗		1.0	W
θ_{JA}	结至环境热阻		110	$^\circ\text{C}/\text{W}$
T_J	结温		150	$^\circ\text{C}$
T_{STG}	存储温度		150	$^\circ\text{C}$

注意：

2. 安装在 76.2 x 114.3 x 1.6mm PCB 上时。(FR-4 玻璃环氧树脂材料)。

3. 请参考：

JESD51-2: 集成电路热测试方法环境条件 - 自然对流

JESD51-3: 含铅表面贴装封装的低有效导热系数测试板

4. 在任何情况下，都不要超过 P_D 。

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	条件	最小值	最大值	单位
V_B	高侧浮动电源电压		V_S+15	V_S+20	V
V_S	高侧浮动电源偏置电压		$6-V_{DD}$	600	V
V_{DD}	低侧电源电压		15	20	V
V_{HO}	高侧 (HO) 输出电压		V_S	V_B	V
V_{LO}	低侧 (LO) 输出电压		GND	V_{DD}	V
V_{IN}	逻辑输入电压 (IN)		GND	V_{DD}	V
T_A	环境温度		-40	125	$^\circ\text{C}$

电气特性

除非另有说明, V_{BIAS} (V_{DD} , V_{BS}) = 15.0V, $R_{DT} = GND$, $T_A = 25^\circ C$ 。 V_{IN} 和 I_{IN} 参数以 GND 为参考点。 V_O 和 I_O 参数以 V_S 和 GND 为参考点, 并适用于相应的输出 HO 和 LO。

符号	参数	条件	最小值	典型值	最大值	单位
电源电流部分						
I_{QBS}	V_{BS} 静态电源电流	$V_{IN}=0V$ 或 $5V$		35	90	μA
I_{QDD}	V_{DD} 静态电源电流	$V_{IN}=0V$ 或 $5V$, $R_{DT}=0\Omega$		650	900	
$I_{SD}^{(5)}$	关闭模式下的 V_{DD} 电源电流	$\overline{SD}=GND$		650	900	
I_{PBS}	V_{BS} 工作电源电流	$f_{IN}=20kHz$ (均方根值)		400	700	
I_{PDD}	V_{DD} 工作电源电流	$f_{IN}=20kHz$ (均方根值) $R_{DT}=0\Omega$		950	1200	
I_{LK}	偏置电源的漏电流	$V_B=V_S=600V$			10	
电源部分						
V_{DDUV+} V_{BSUV+}	V_{DD} 和 V_{BS} 电源欠压正向阈值		10.7	11.6	12.5	V
V_{DDUV-} V_{BSUV-}	V_{DD} 和 V_{BS} 电源欠压负向阈值		10.0	10.8	11.6	
V_{DDUVH} V_{BSUVH}	V_{DD} 和 V_{BS} 电源欠压锁定迟回电压回差			0.8		
栅极驱动器输出部分						
V_{OH}	高电平输出电压, $V_{BIAS}-V_O$	$I_O=20mA$			1.0	V
V_{OL}	低电平输出电压, V_O				0.6	V
I_{O+}	输出高电平短路脉冲电流	$V_O=0V$, $V_{IN}=5V$ with $PW<10\mu s$	250	350		mA
I_{O-}	输出低电平短路脉冲电流	$V_O=15V$, $V_{IN}=0V$ with $PW<10\mu s$	500	650		mA
V_S	IN 信号传播到 HO 时允许的 V_S 引脚负电压			-9.8	-7.0	V
逻辑输入部分 (输入和关断)						
V_{IH}	逻辑 "1" 输入电压		2.9			V
V_{IL}	逻辑 "0" 输入电压				1.2	V
I_{IN+}	逻辑 "1" 输入偏置电流	$V_{IN}=5V$		50	100	μA
I_{IN-}	逻辑 "0" 输入偏置电流	$V_{IN}=0V$			2.0	μA
$\overline{SD+}$	关断 "1" 输入电压				1.2	V
$\overline{SD-}$	关断 "0" 输入电压		2.9			V
R_{PD}	输入下拉电阻			100		K Ω

注:

5. 该参数由设计保证。

动态电气特性

除非另有说明, $V_{BIAS} (V_{DD}, V_{BS}) = 15.0V$, $V_S = GND$, $C_L = 1000pF$, $R_{DT} = GND$, $T_A = 25^\circ C$ 。

符号	参数	工作条件	最小值	典型值	最大值	单位
t_{ON}	导通传播延时	$V_S = 0V$		500	670	ns
t_{OFF}	关断传播延时	$V_S = 0V$ 或 $600V^{(5)}$		170	250	
t_R	导通上升时间			50	100	
t_F	关断下降时间			30	80	
$t_{SD}^{(5)}$	关闭传播延迟			100	180	
DT1, DT2	LO 关断至 HO 开启以及 HO 关断至 LO 开启的死区时间	$R_{DT} = 0\Omega$	250	330	420	ns
		$R_{DT} = 200K\Omega$	1.20	1.68	2.30	μs
DMT	死区时间匹配	$R_{DT} = 0\Omega$		0	60	ns
		$R_{DT} = 200K\Omega$		0	150	

注:

5. 这些参数由设计保证。

典型特性

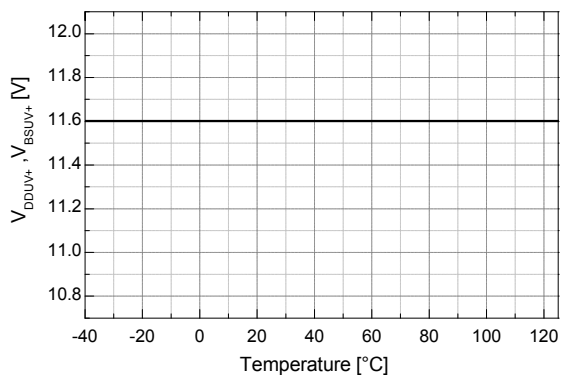


图 5. V_{DD}/V_{BS} UVLO (+) 与温度的关系

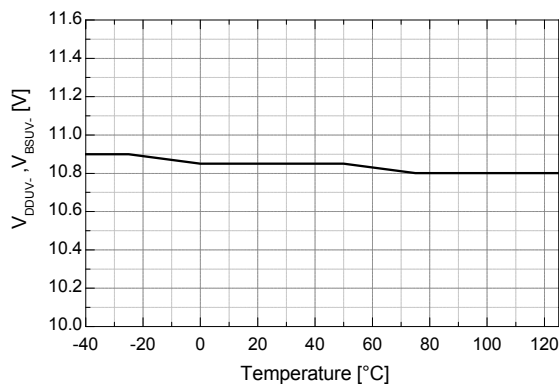


图 6. V_{DD}/V_{BS} UVLO (-) 与温度的关系

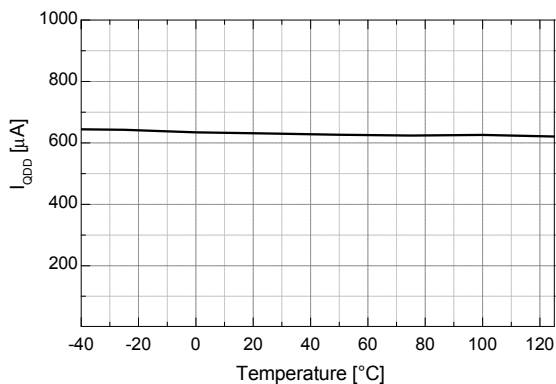


图 7. V_{DD} 静态电流与温度的关系

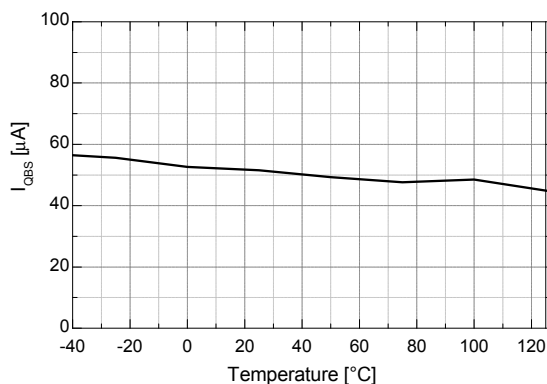


图 8. V_{BS} 静态电流与温度的关系

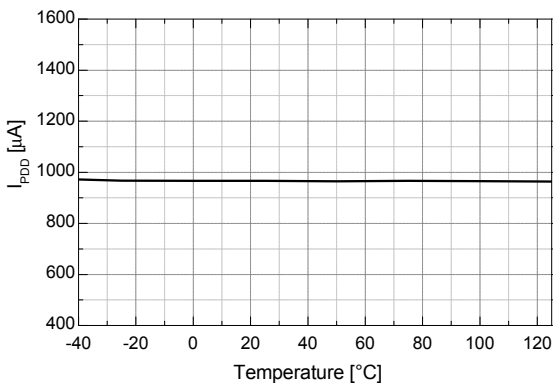


图 9. V_{DD} 工作电流与温度的关系

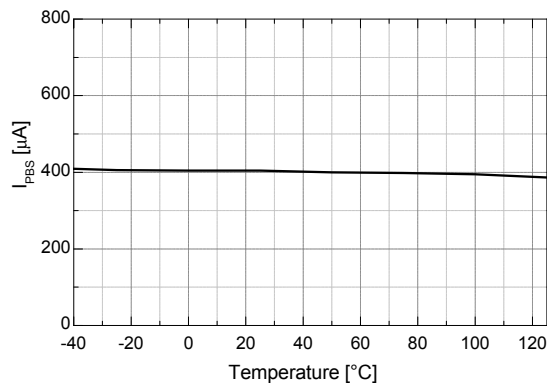


图 10. V_{BS} 工作电流与温度的关系

典型特性 (续)

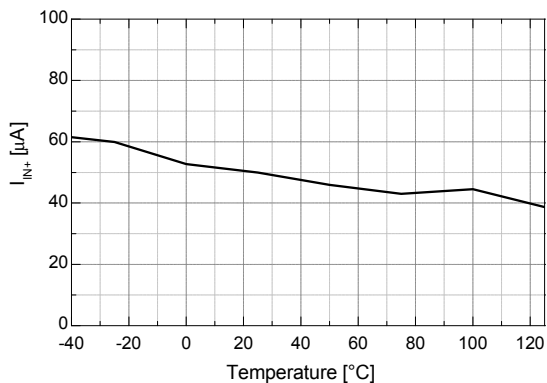


图 11. 逻辑输入电流与温度的关系

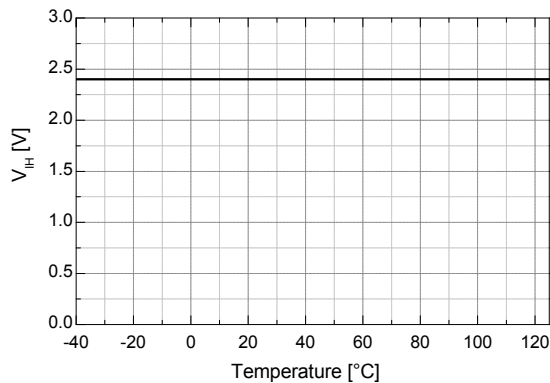


图 12. 逻辑输入高压与温度的关系

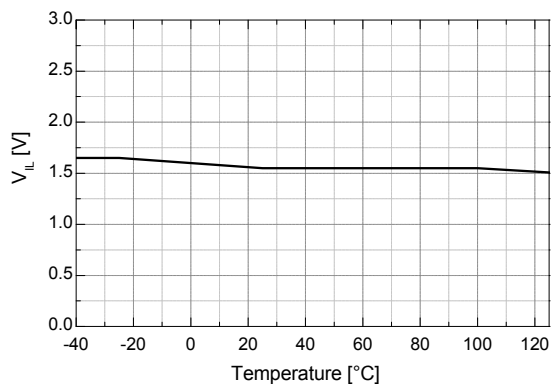


图 13. 逻辑输入低压与温度的关系

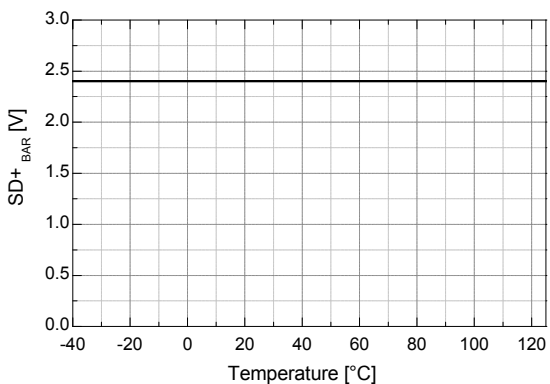


图 14. \overline{SD} 正阈值与温度的关系

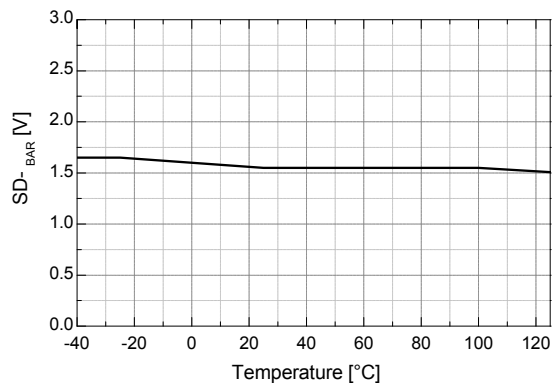


图 15. \overline{SD} 负阈值与温度的关系

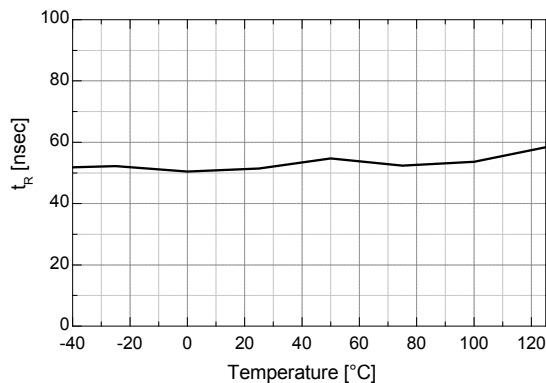


图 16. 上升时间与温度的关系

典型特性 (续)

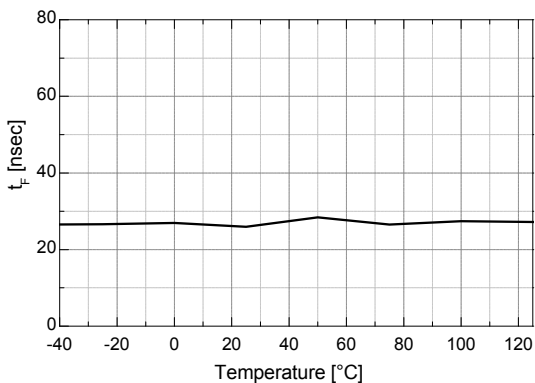


图 17. 下降时间与温度的关系

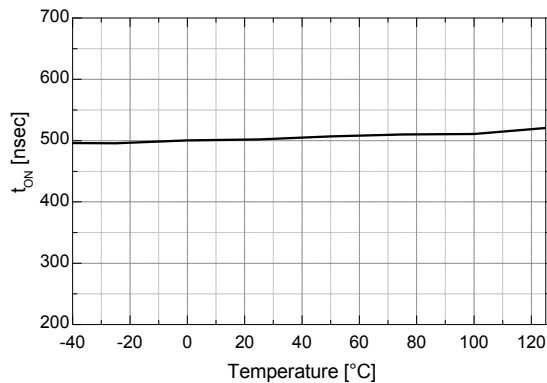


图 18. 导通延迟时间与温度的关系

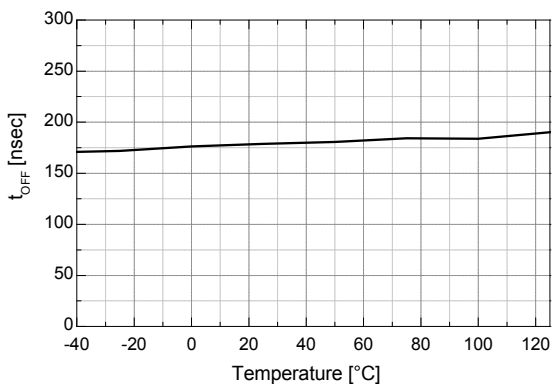


图 19. 关断下降时间与温度的关系

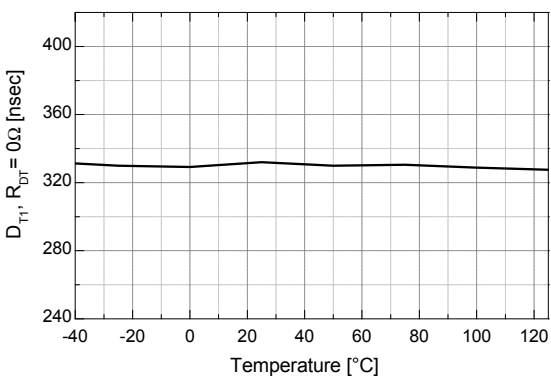


图 20. 死区时间 (R_{DT}=0kW) 与温度的关系

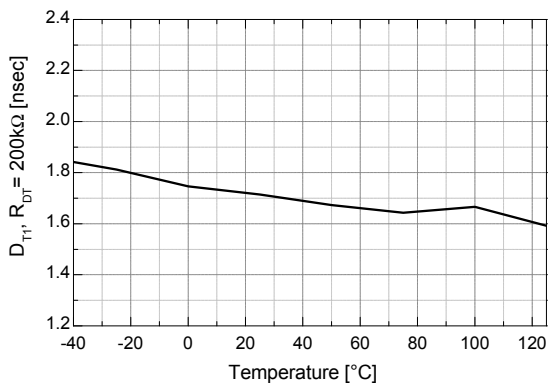


图 21. 死区时间 (R_{DT}=200kW) 与温度的关系

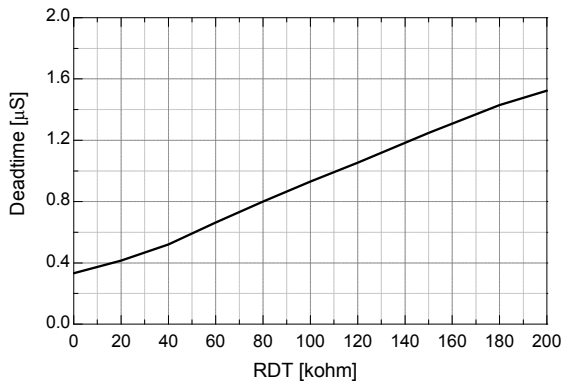
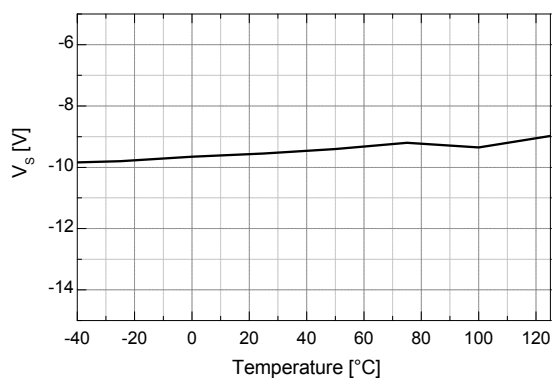


图 22. R_{DT} 与死区时间的关系

典型特性 (续)

图 23. 信号传播至高侧允许的 V_{GS} 负电压与温度的关系

开关时间定义

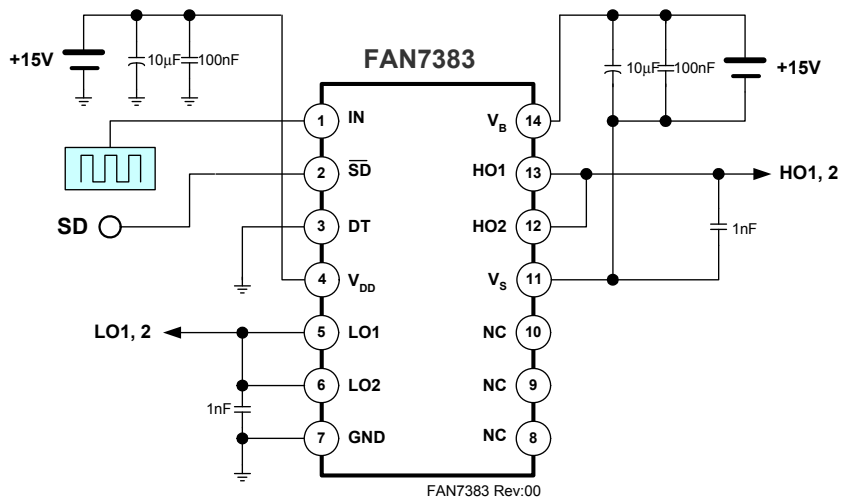


图 24. 开关时间测试电路

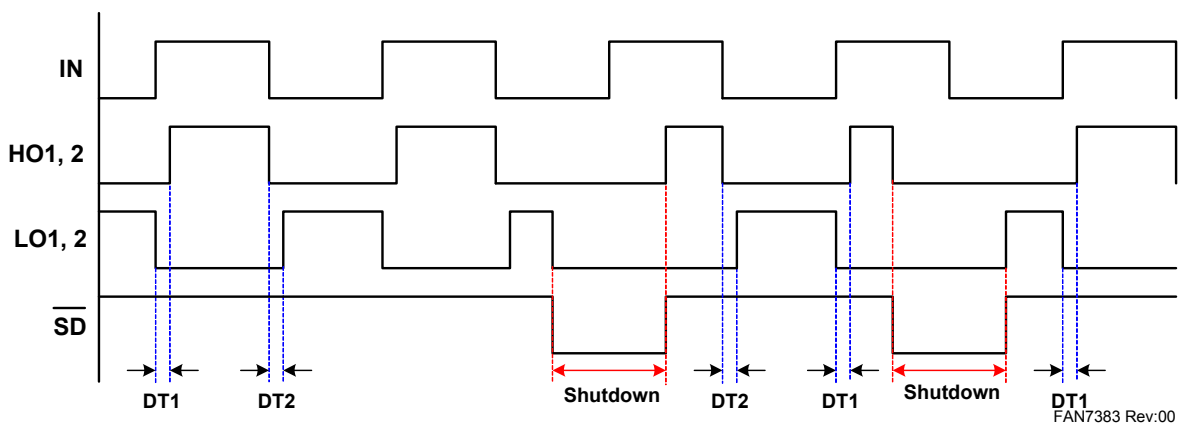


图 25. 输入 / 输出波形

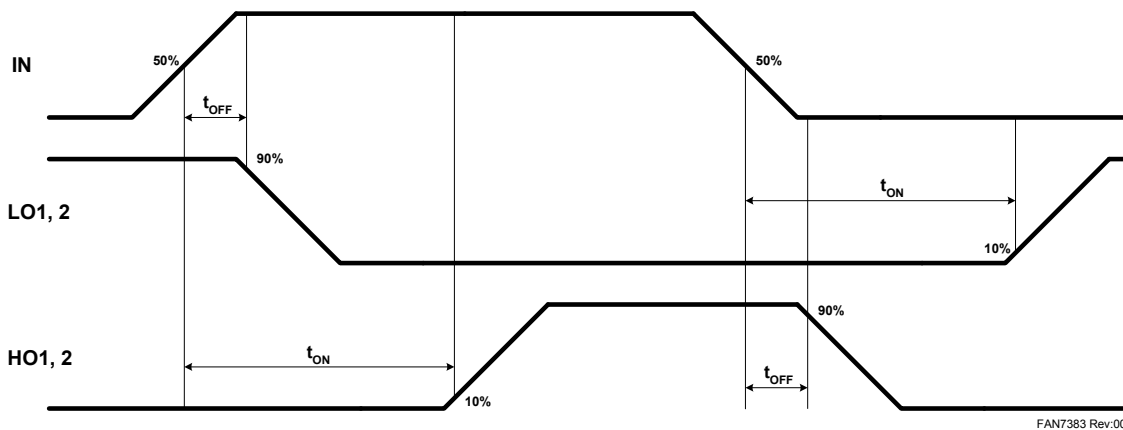
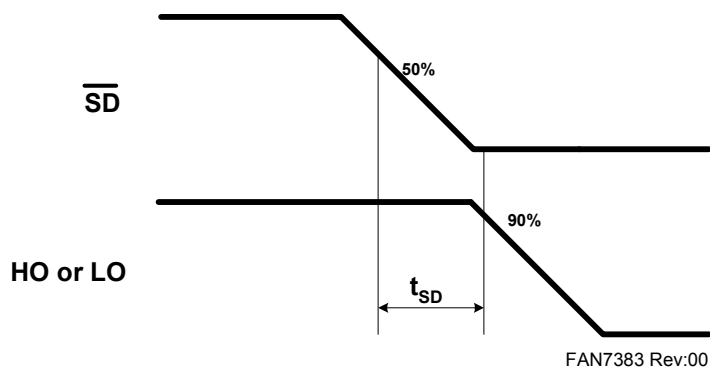
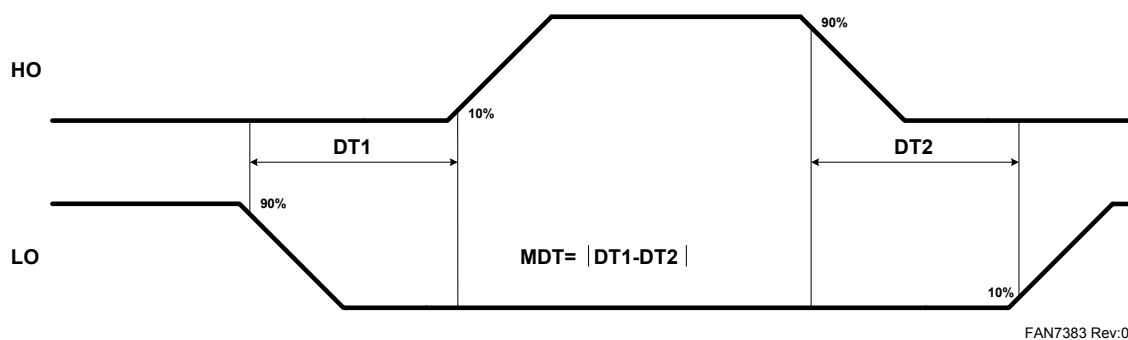


图 26. 开关时间波形定义



FAN7383 Rev:00

图 27. 关闭波形定义



FAN7383 Rev:00

图 28. 死区时间波形定义

典型应用信息

1. 正常工作考虑因素

FAN7383 是一款单 PWM 输入半桥栅极驱动 IC，集成可编程死区时间和关断功能。

死区时间可通过 DT 引脚上的电阻 (R_{DT}) 设置。宽可编程死区时间范围可为一系列开关器件 (MOSFET 或 IGBT) 和应用提供优化驱动信号时序的灵活性。

导通时间延迟电路 (死区时间) 可支持 0W 至 200kW 的电阻值，且死区时间与 R_{DT} 电阻值成比例。

DT 引脚接地可将 FAN7383 设置为以最小死区时间驱动所有两路输出。

如果在正常工作时， \overline{SD} 引脚电压下降到 1.2V 以下，则 IC 进入关闭模式。

2. 欠压锁定 (UVLO)

FAN7383 集成欠压锁定 (UVLO) 保护电路，当 V_{DD} 或 V_{BS} 低于额定阈值电压时保护高侧和低侧通道免受损害。UVLO 电路独立监控电源电压 (V_{DD}) 和自举电容电压 (V_{BS})。

3. 布局考虑因素

若要获得最佳的高侧和低侧栅极驱动器性能，则进行印刷电路板 (PCB) 布局设计时必须详加考察。

3.1 电源电容

如果输出级能够以大电流快速导通开关器件，那么电源电容必须尽可能靠近器件引脚放置 (V_{DD} 和 GND 用于接地电源， V_B 和 V_S 用于浮动电源)，这样可以最大程度减少寄生电感和电阻。

3.2 栅极驱动环路

电流环路的表现类似于天线，会接收和发送噪声。若要减少噪声耦合 / 发射并改善电源开关的导通和关断性能，必须尽可能缩短栅极驱动环路。

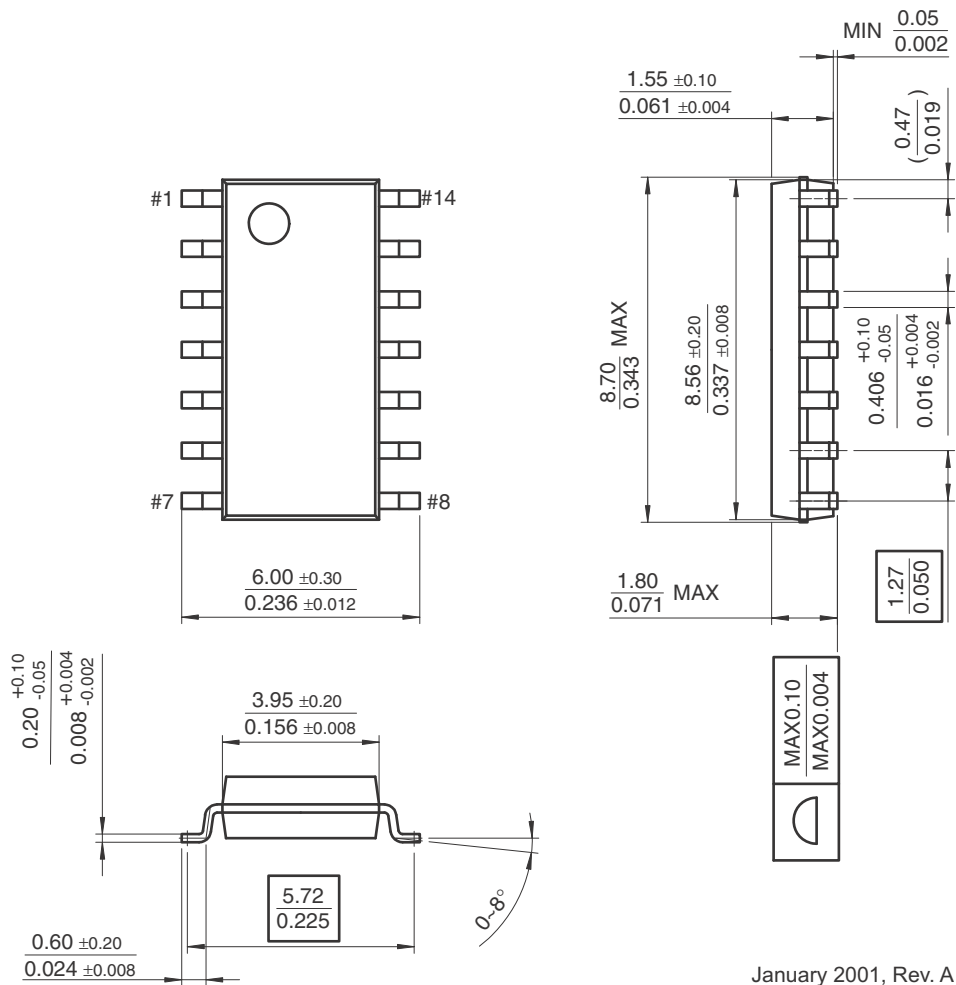
3.3 接地层

接地层一定不能位于高压浮动端下面或附近，以便最大程度减少噪声耦合。

封装尺寸

14-SOP

除非另有说明，否则尺寸单位为毫米。




January 2001, Rev. A

图 29.14 引脚小尺寸封装 (SOP)



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