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FAIRCHILD

2015 年 1 月

FAN8831
配备升压 DC-DC 转换器的正弦波压电致动器驱动器

特性

升压 DC-DC 转换器

- 最高可达 36 V 的集成式升压功率开关
- 宽工作电压范围：2.7 至 5.5 V
- 可调节升压输出电压
- 可调节升压限流
- 零电流检测器 (ZCD)
- 内部软启动
- 内置保护电路
  - 过压保护 (OVP)
  - 热关断 (TSD)

压电致动器驱动器

- 集成式全桥开关 (V_{DS}=75 V)
- 数字实现的正弦调制器

封装信息

- 小型 4.0 mm × 4.0 mm MLP

应用

- Piezo 致动器

描述

FAN8831 是一款单芯片压电致动器驱动器，由升压 DC-DC 转换器组成，集成了 36 V 升压开关和全桥输出级该器件能够在 120 V 峰峰值时从单节 3 V 锂电池双向驱动 Piezo 升压 DC-DC 转换器以临界导通模式 (CRM) 运行，经优化可在耦合电感配置下工作，以提供超出 60 V 的输出电压。同时提供过压保护、过流保护和热关断功能 当升压 DC-DC 转换器输出电压达到正常电平（带滞后）时，内部就绪电路用于使能全桥栅极驱动器。

升压使用外部电阻设置，并且升压限流可在 OCP 引脚上通过外部电阻编程。

输出 H 桥具有四个集成式 75 V P 和 N 沟道，可实现压电器致动器的正弦波驱动。

订购信息

器件编号	工作温度范围	封装	包装方法
FAN8831MPX	-40°C 至 +125°C	24 引脚，MLP	卷带和卷盘

应用框图

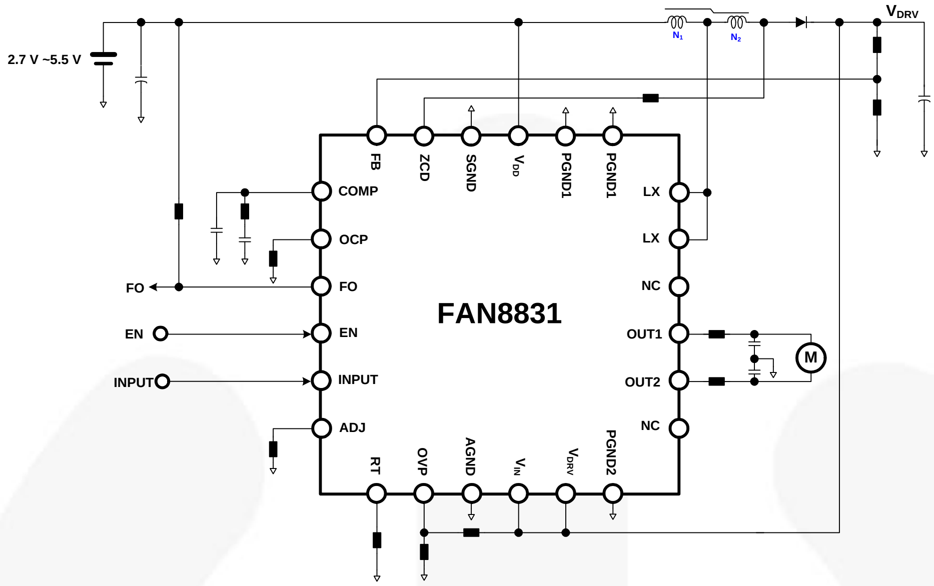


图 1. 压电器致动器驱动器的典型应用电路

内部框图

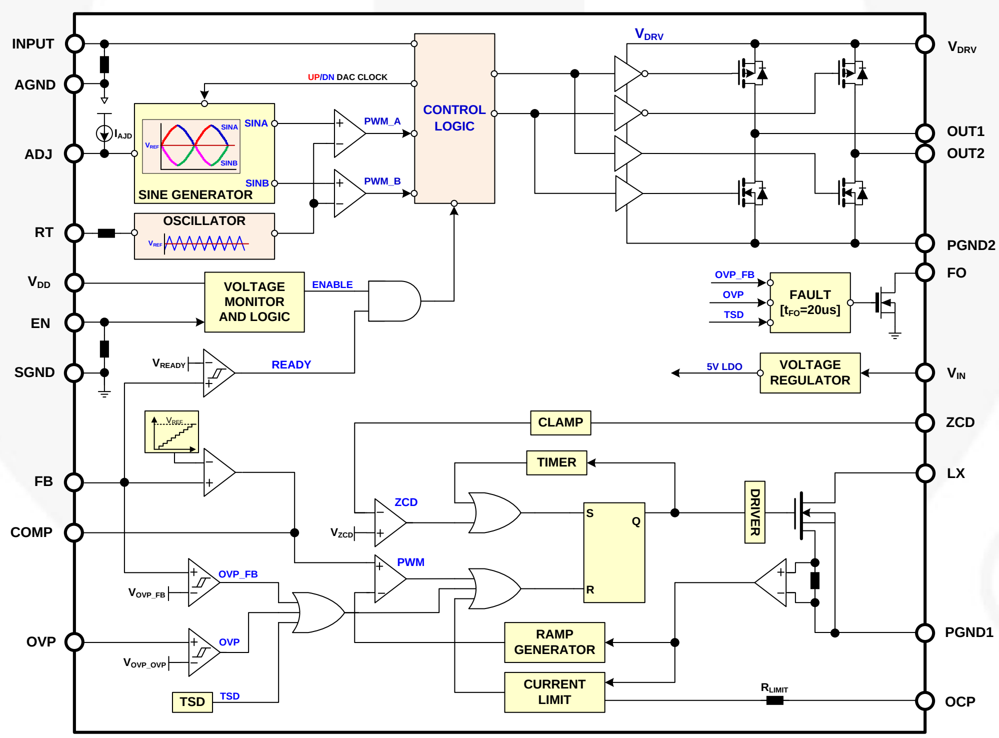


图 2. 功能框图

引脚配置

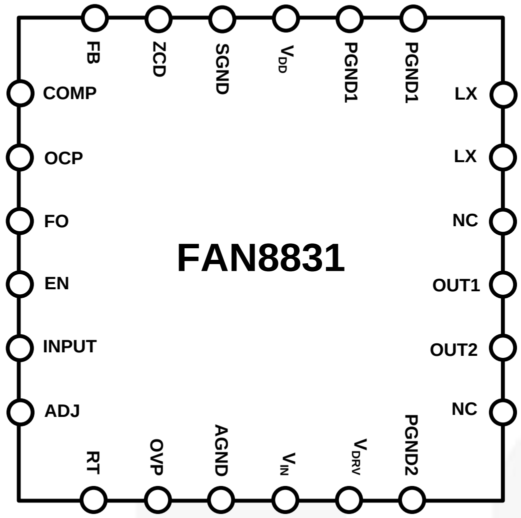


图 3. 引脚分配

引脚定义

引脚号	名称	描述
1,2	PGND1	电源地 1 连接升压开关源。
3	V_{DD}	升压 DC-DC 转换器的电源。
4	SGND	信号地 升压 DC-DC 转换器电路的信号地。
5	ZCD	零电流检测的输入。
6	FB	升压 DC-DC 转换器输出电压反馈输入。
7	COMP	跨导误差放大器输出。
8	OCP	设置升压 DC-DC 转换器限流。
9	FO	故障输出。
10	EN	使引脚能够开关整个系统（有源低关断模式）。
11	输入	正弦波形的逻辑输入。
12	ADJ	输出电压调节控制引脚连接内部电流源以便使用外部电阻改变输出电压连接小型电容 (1 nF)。
13	RT	振荡器频率控制引脚。
14	OVP	升压 DC-DC 转换器的电压感测输入，用于过压保护。
15	AGND	模拟地全桥驱动器电路信号地。
16	V_{IN}	5 V LDO 电源。
17	V_{DRV}	全桥驱动器电源。
18	PGND2	电源地 2 全桥驱动器电源地。
19	NC	未连接。
20	OUT2	全桥驱动器的输出 2。
21	OUT1	全桥驱动器的输出 1。
22	NC	未连接。
23, 24	L_X	开关节点该引脚连接电感。

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，长期在高于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。

符号	参数		最小值	最大值。	单位
V_{DRV}	每个 MOSFET 的直流母线输入电压漏极-源极电压			75	V
V_{DD}	用于 DC-DC 转换器的 DC 电源电压		-0.3	5.5	V
$V_{IN,DCDC}$	EN，输入，FB 和 COMP 至 SGND		-0.3	V_{DD} +0.3	V
V_{IN}	用于 LDO 的 DC 电源电压		-0.3	75	V
V_{LX}	LX至PGND		-0.3	36	V
P_D	功耗(2)	1S0P 带散热孔(3)		0.98	W
		1S2P 带散热孔(4)		2.9	
θ_{JA}	结到空气热阻(2)	1S0P 带散热孔(3)		127	°C/W
		1S2P 带散热孔(4)		43	
T_A	工作环境温度范围		-40	125	°C
T_J	工作结温		-55	150	°C
T_{STG}	存储温度范围		-55	150	°C
ESD	静电放电能力	人体放电模型，JESD22-A114		2	KV
		元件充电模型，JESD22-C101		500	V

注意：
1. 所有电压值，差分电压除外，均参照 SGND、AGND 和 PGND 引脚。
2. JEDEC 标准：JESD51-2, JESD51-3. 安装在 76.2×114.3×1.6 mm PCB 上（FR-4 环氧玻璃材料）。
3. 1S0P 带散热孔：一个信号层带零功率平面及散热孔。
4. 1S2P 带散热孔：一个信号层带双功率平面及散热孔。

推荐工作条件

推荐的操作条件表明确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 Fairchild 不建议超出推荐的工作条件，或按照绝对最大额定值进行设计。

符号	参数	最小值	典型值	最大值。	单位
V_{DRV}	全桥驱动器的电源电压	30		60	V
V_{LX}	升压开关电压	10		30	V
V_{DD}	DC-DC 转换器的工作电压	2.7	3.0	3.3	V
V_{IN}	稳压器的工作电压	10		60	V
R_{OCP}	限流控制电阻	7.0		150	kΩ

电气特性

V_{DD}=3.0 V，V_{IN}=15.0 V，V_{DRV}=60 V，R_T=70 KΩ 并且 T_A=-40°C 至 +125°C 除非另有说明，典型值 T_A=25°C。

符号	参数	工作条件	最小值	典型值	最大值	单位
电源部分						
$I_{Q,DD}$	静态电流，用于 V_{DD} (5)	V_{EN}=V_{COMP}=V_{DD}, V_{FB}=1.0 V 器件未开关		700	1200	μA
$I_{Q,IN}$	静态电流，用于 V_{IN}			300	500	μA
$I_{Q,DRV}$	静态电流，用于 V_{DRV}			200	300	μA
$I_{SD,DD}$	关断电流，用于 V_{DD}	V_{EN}=0 V, V_{DD}=V_{IN}=V_{DRV} =3 V			1	μA
$I_{SD,IN}$	关断电流，用于 V_{IN}				1	μA
$I_{SD,DRV}$	关断电流，用于 V_{DRV}			5	10	μA
$V_{DDSTART}$	启动阈值电压		2.6	2.7	2.8	V
$V_{DDUVHYS}$	V_{DD} UVLO 滞后电压		0.1	0.2	0.3	V
误差放大器部分						
V_{FB}	反馈参考电压	T_A=25°C	0.99	1.0	1.01	V
I_{FB}	FB 引脚偏压电流	V_{FB}=0 V ~ 2 V			1	μA
ΔV_{FB1}	反馈电压线路调节(6)	2.7 V < V_{DD} < 5 V		0.5	1.5	%/V
G_m	跨导	T_A=25°C		800		μmho
零电流检测部分						
V_{ZCD}	输入电压阈值(7)		1.65	1.83	2.00	V
V_{CLAMPH}	输入高电平箝位电压	I_{DET}=2.3 mA	3.0	3.5	4.0	V
V_{CLAMPL}	输入低电平箝位电压	I_{DET}= -2.3 mA	-0.30	0.12	0.50	V
$I_{ZCD,SR}$	源极电流性能				-2.3	mA
$I_{ZCD,SK}$	漏极电流性能				2.3	mA
$t_{ZCD,D}$	从 ZCD 到输入导通的延时(7)			50	200	ns
最大导通时间部分						
$t_{ON,MAX}$	最大导通时间		15	25	35	μs
重启/最大开关频率限制部分						
t_{RST}	重启定时器		15	25	35	μs
f_{MAX}	最大开关频率(7)			900	1000	KHz
软启动定时器部分						
t_{SS}	内部软启动		16	28	40	ms
限流比较器部分						
I_{OCP}	OCP 触发电流	R_{OCP}=3.3 KΩ, V_{DD}=3.3 V	1.85	2.00	2.15	A
		R_{OCP}=22 KΩ, V_{DD}=3.3 V	0.9	1.0	1.1	A
t_{CS_BLANK}	比较器前沿消隐时间(7)		80	130	180	ns

注意：

5. 这是激活但未开关时消耗的 VDD 电流不包括栅极驱动电流
6. 根据以下方法计算线路调节： $\frac{\Delta V_{OUT}}{\Delta V_{IN}} \times \frac{1}{V_{OUT}}$
7. 该参数由设计保证；生产过程中不做测试。

电气特性

V_{DD}=3.0 V，V_{IN}=15.0 V，V_{DRV}=60 V，R_T=70 KΩ 并且 T_A=-40°C 至 +125°C 除非另有说明，典型值 T_A=25°C。

符号	参数	工作条件	最小值	典型值	最大值	单位
升压开关部分						
R_{DSON}	N 沟道导通电阻	V_{DD}=3.3 V，T_A=25°C		0.2	0.5	Ω
I_{LK_LX}	LX 泄漏电流	V_{LX}=36 V			1.0	µA
振荡器部分						
f_{OSC}	工作频率	R_T=58 KΩ	40	50	60	KHz
		R_T=121 KΩ	20	25	30	KHz
逻辑（EN和输入）部分						
V_{INPUT+}	输入逻辑高阈值电压		1.34			V
V_{INPUT-}	输入逻辑低阈值电压				0.5	V
I_{INPUT-}	输入低电流，用于输入和 EN	V_{EN}=0 V			1	µA
I_{INPUT+}	输入高电流，用于输入和 EN	V_{EN}=V_{DD}	8	12	16	µA
R_{INPUT}	输入逻辑下拉电阻	V_{EN}= V_{INPUT}=3 V		250	375	K Ω
f_{INPUT}	输入逻辑工作频率(8)		20		1000	Hz
全桥开关部分						
$R_{DS,ONP}$	输出上端导通电阻	T_A=25°C		3.0	5.0	Ω
$R_{DS,ONN}$	输出下端导通电阻	T_A=25°C		3.0	5.0	Ω
输出控制部分						
$V_{ADJ,MAX}$	模拟输出控制最大电压值(8)	V_{DRV}=目标 100%		1.0		V
$V_{ADJ,MIN}$	模拟输出控制最小电压值(8)			0.1		V
I_{ADJ+}	内部电流源极，用于 ADJ 引脚	T_A=25°C	9	10	11	µA
保护（就绪、OVP 和 TSD）						
V_{READY}	输出就绪阈值电压		0.75	0.80	0.85	V
HY_{READY}	输出就绪滞后			0.2		V
V_{OVP_FB}	OVP 阈值电压，在 FB 引脚		1.05	1.10	1.15	V
HY_{OVP_FB}	OVP 滞后电压，在 FB 引脚			0.1		V
V_{OVP_OVP}	OVP 阈值电压，在 OVP 引脚		1.10	1.15	1.20	V
HY_{OVP_OVP}	OVP 滞后电压，在 OVP 引脚			0.15		V
T_{SD}	热关闭温度(8)			150		°C
T_{HYS}	TSD的滞后温度(8)			50		°C
T_{FO}	故障输出持续时间			20	30	µs
V_{FOL}	故障输出低电压	R_{PU}=50 KΩ, V_{PU}=3 V		0.1	0.4	V

注：

8. 此参数尽管得到设计保证，但未经过生产测试。

典型性能特征

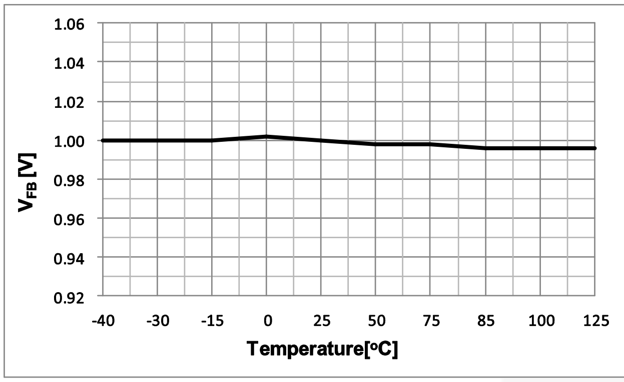


图 4. 参考电压与温度

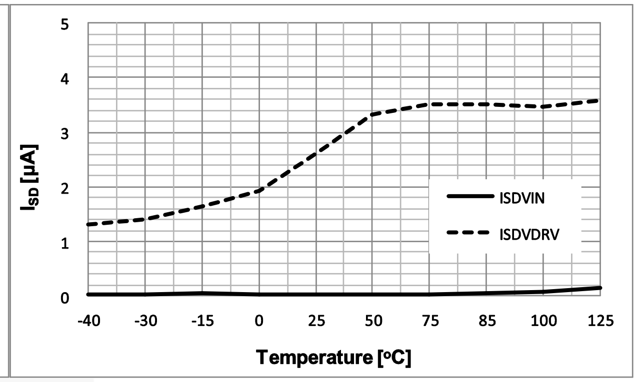


图 5. 关断电流（用 V_{DRV} 和 V_{IN} ）与温度

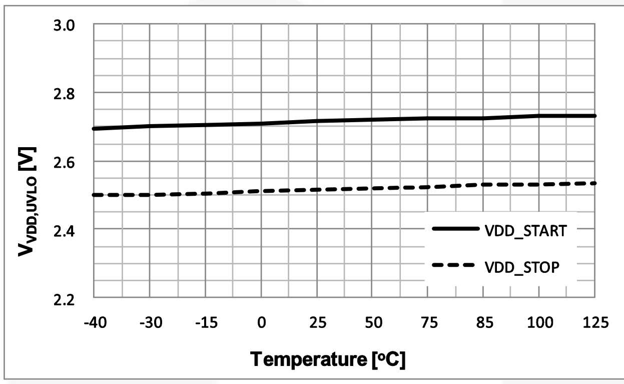


图 6. V_{DD} UVLO 与温度

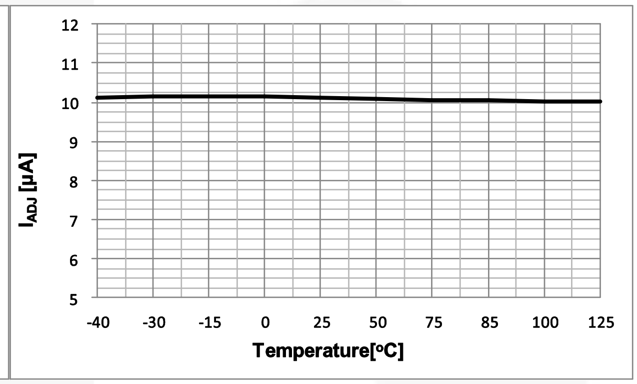


图 7. ADJ 电流与温度

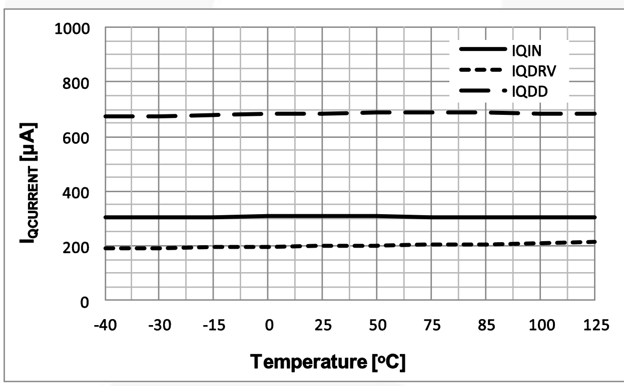


图 8. 静态电流（用于 V_{DD}、V_{DRV} 和 V_{IN}）与温度

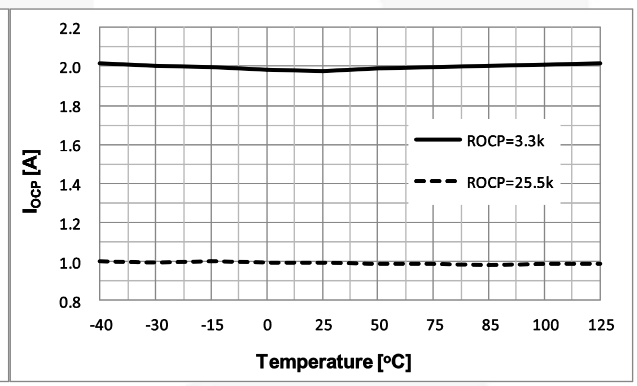


图 9. OCP 电流与温度

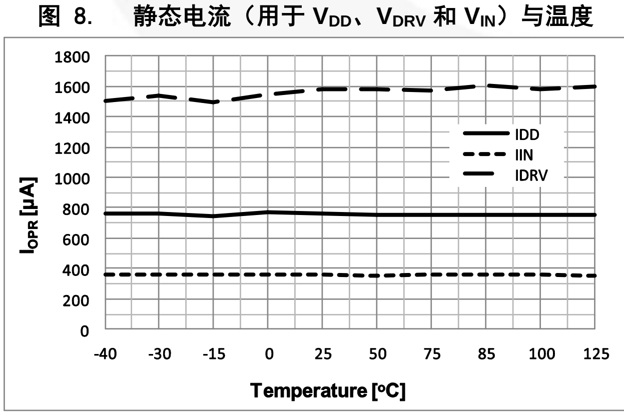


图 10. 工作电流（用于 V_{DD}、V_{DRV} 和 V_{IN}）与温度

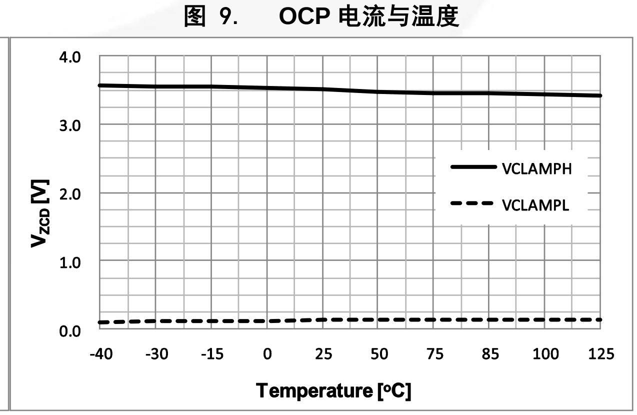


图 11. ZDC 箝位电压与温度

典型性能特征

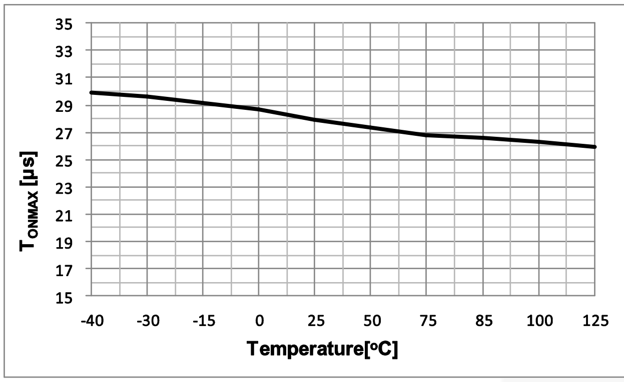


图 12. 最大导通时间与温度

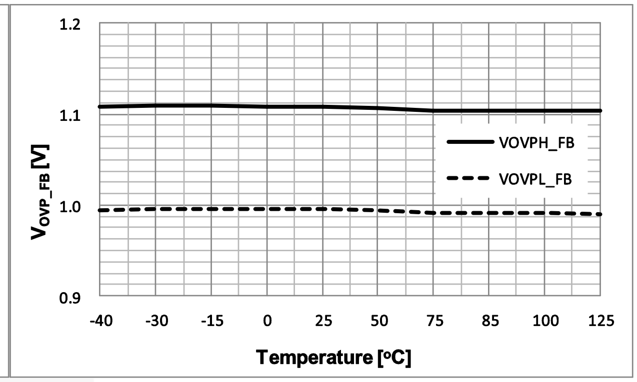


图 13. 首次 OVP (FB) 与温度

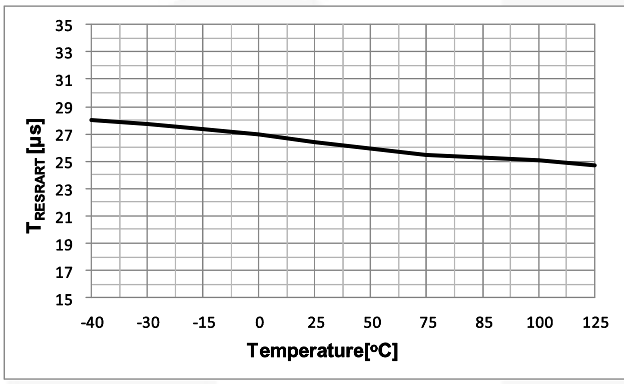


图 14. 重启时间与温度

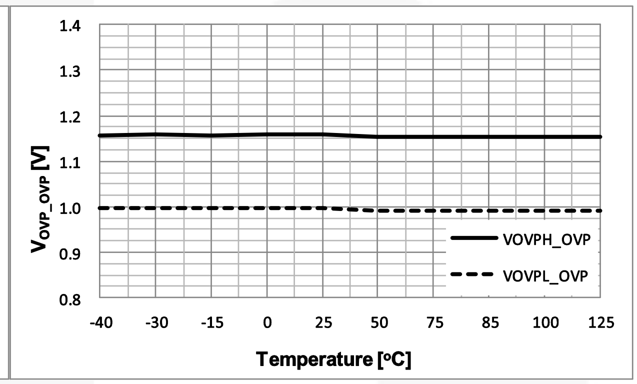


图 15. 第二次 (OVP) 与温度

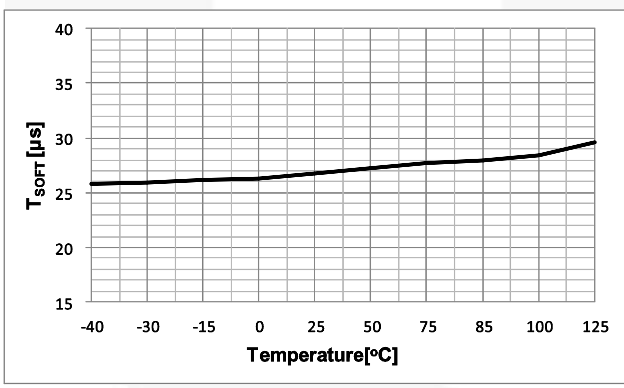


图 16. 软启动时间与温度

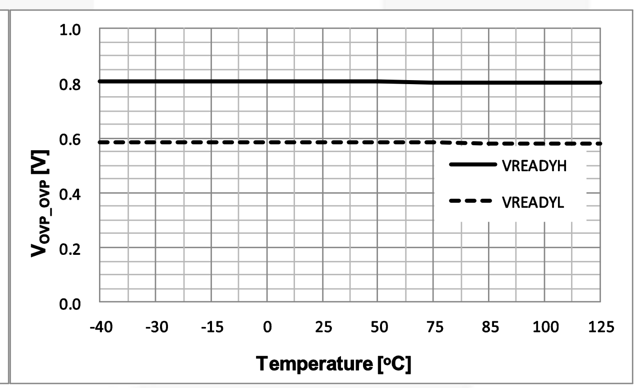


图 17. 就绪电压与温度

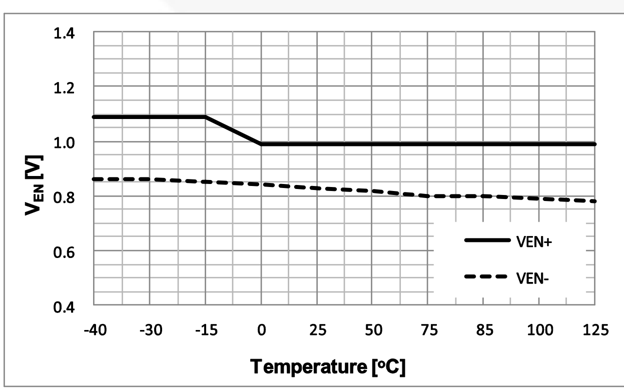


图 18. 使能 (EN) 阈值电压与温度

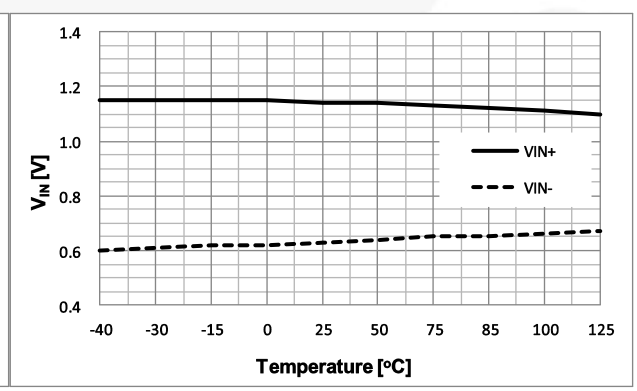


图 19. 输入 (INPUT) 阈值电压与温度

典型性能特征

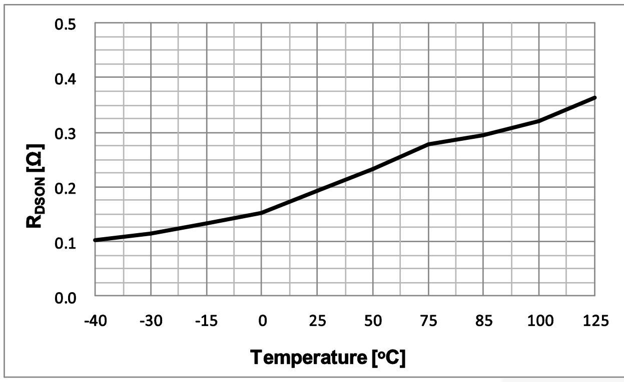


图 20. 升压开关 R_{DSON} 与温度

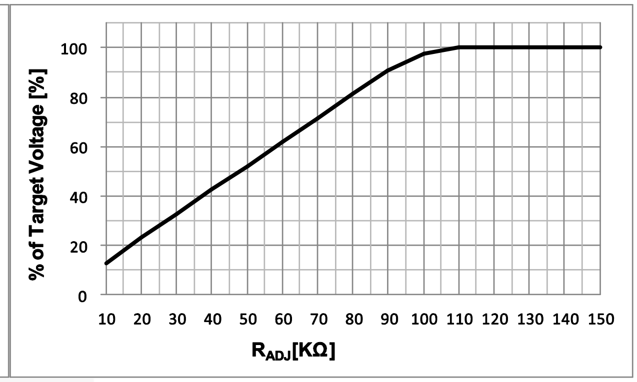


图 21. % 的正弦波幅度与 R_{ADJ}

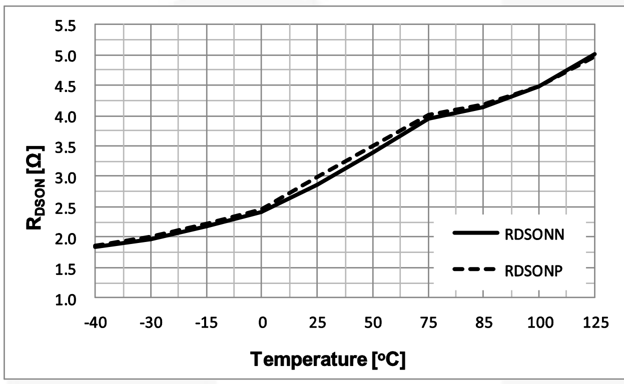


图 22. 全桥开关 R_{DSON} 与温度

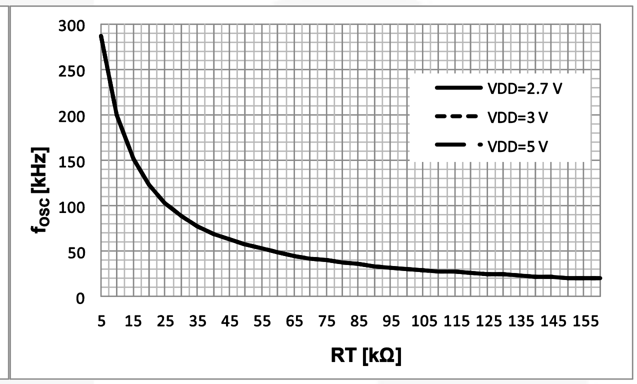


图 23. f_{OSC} 与 RT

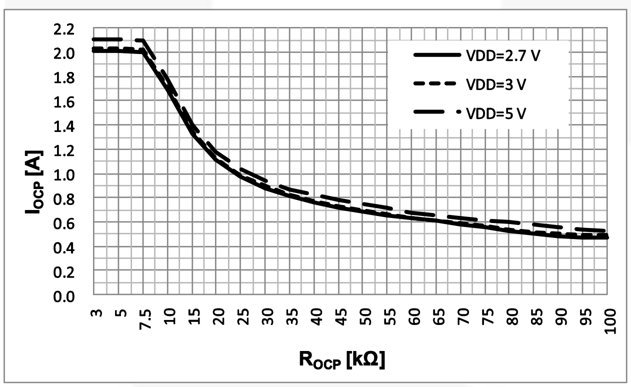
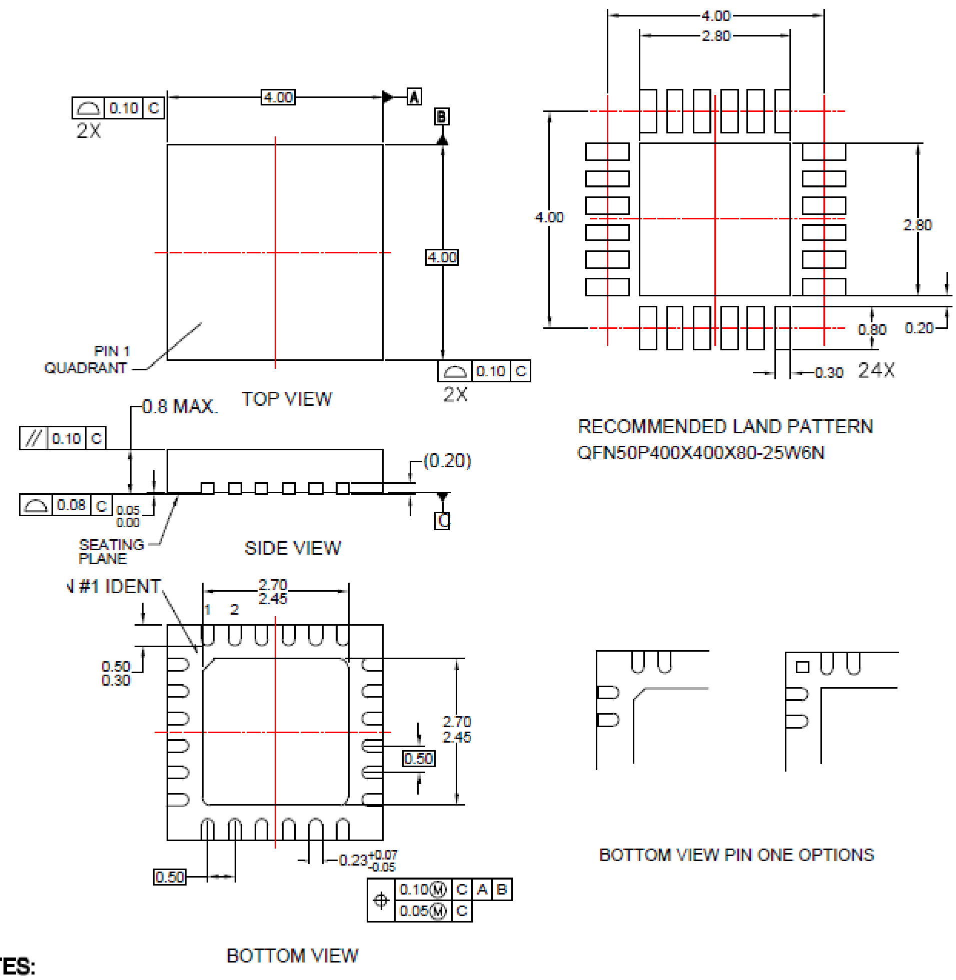


图 24. I_{OCP} 与 R_{OCP}

物理尺寸



NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-220, VARIATION WGGD-6

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

D. LANDPATTERN DIMS ARE REFERENCE ONLY

MLP24Erev2

图 25. 24 引脚模塑无铅封装

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