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August 2010

FAN5343
6-LED系列集成肖特基二极管和单线数字接口的升压 LED 驱动器

产品特性

- 异步升压变换器
  - V_{OUT} 可达 24V
- 内置肖特基二极管
- 输出功率可达500mW
- 输入电压范围：2.7V－5.5V
- 单线数控接口，可设置LED亮度等级
  - 32级线性调整
- 固定开关频率：1.2MHz
- 软启动
- 输入欠压锁定(UVLO)
- 输出过压保护 (OVP)
- 短路检测
- 热关闭保护（）TSD
- 小型 6引脚 2.0 x 2.0 x 0.55mm U型封装MLP

适用范围

- 移动电话
- 移动互联网设备
- 便携式媒体播放器
- PDA、DSC、MP3 播放器

说明

FAN5343 为异步恒流LED驱动器，可以向6个串联的LED提供最高可达500mW的功率。优化设计更适用于小型装置，1.2MHz的固定开关频率从而允许使用较小的芯片电感和电容。

FAN5343采用单线数控接口，可通过数字脉冲对LED的亮度进行32级线性调整。

安全方面，器件整合了过压、过流、短路检测和热关断保护功能。此外，若电池电压过低将触发输入欠压闭锁保护。

FAN5343实现了超小型封装，2mm x 2mm x 0.55mm 6引脚U型封装符合环保和 RoHS的要求。

订购信息

器件型号	温度范围	封装	包装
FAN5343UMPX	-40 至 +85°C	6-引脚超薄模塑无铅封装(UMLP)	卷带

典型应用图

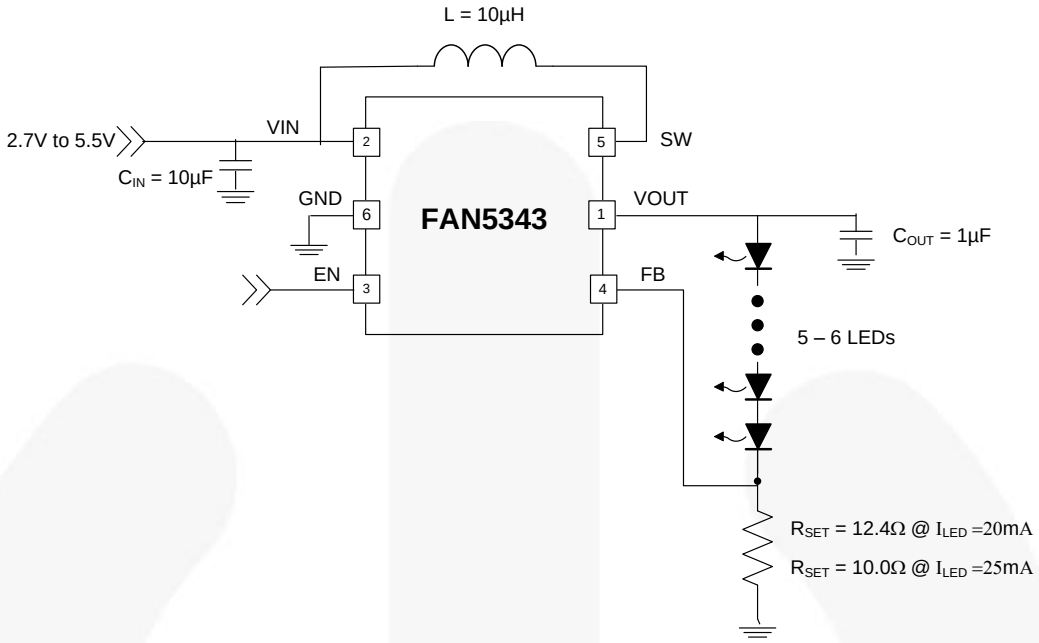


Figure 1. 典型应用

框图

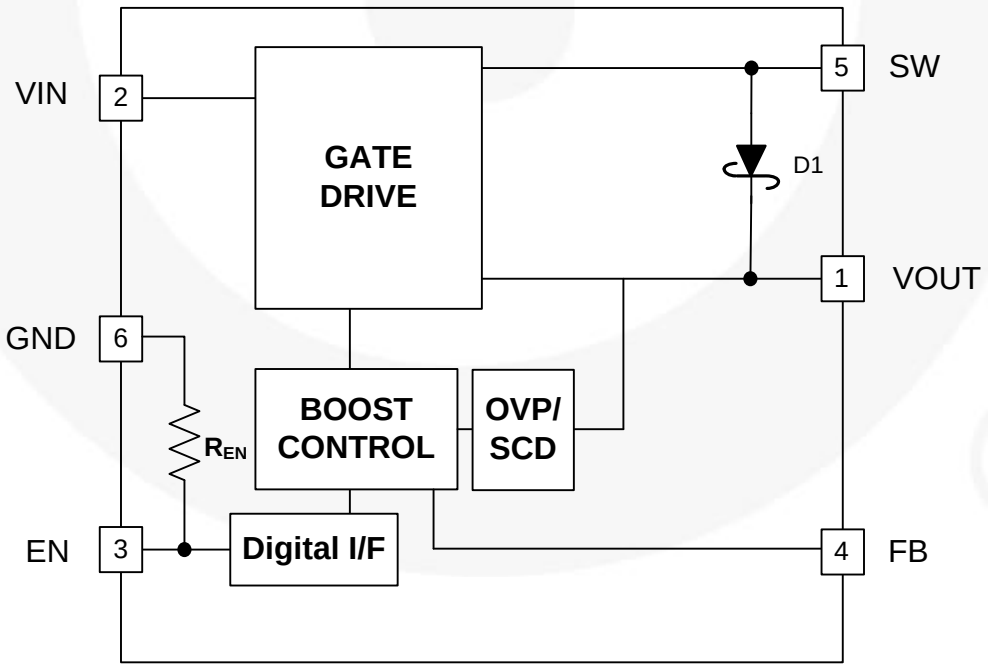


Figure 2. 框图

引脚布局

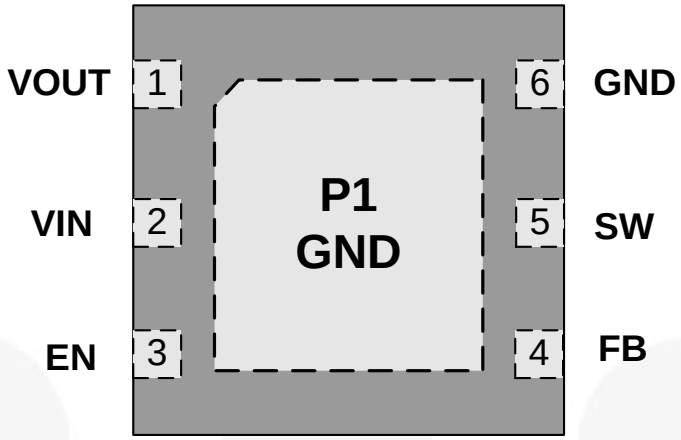


Figure 3. UMLP6封装(顶视图)

引脚说明

引脚号	名称	说明
1	VOUT	**升压输出电压**。升压稳压器的输出。LED连接到该引脚。连接 C_{OUT}接地。
2	VIN	**输入电压**。连接电源并接地去耦合。CIN
3	EN	**启用亮度控制**。采用数字脉冲驱动该引脚可编制亮度等级。
4	FB	**电压反馈**。升压稳压器可将该引脚的电压调至0.25V，以控制LED的串行电流。将该引脚连接GND和LED串阴极之间的电流设置电阻（R_{SET}）。
5	SW	**开关节点**。电感L1在VIN和SW引脚之间。
6	GND	**接地**。直接限制于GND。

绝对最大额定值

如果应力超过绝对最大额定值，器件就会毁损。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_{IN}	VIN引脚上的电压		–0.3	6.0	V
V_{FB}、V_{EN}	FB与EN引脚电压		–0.3	V_{IN} + 0.3	V
V_{SW}	SW引脚上的电压		–0.3	25	V
V_{OUT}	VOUT引脚上的电压		–0.3	25	V
ESD	静电放电防护等级	人体模型满足 JESD22-A114	3.3		kV
		充电器件模型 JESD22-C101	2.0		
T_J	结温		–40	+150	°C
T_{STG}	存储温度		–65	+150	°C
T_L	引线焊接温度，10秒			+260	°C

推荐工作条件

推荐的操作条件表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	工作条件	最小值	最大值	单位
V_{IN}	V_{IN} 电源电压		2.7	5.5	V
V_{OUT}	V_{OUT} 电压(1)		6.2	24.0	V
I_{OUT}	V_{OUT}负载电流	500mW 最大输出功率	5	25	mA
T_A	环境温度		–40	+85	°C
T_J	结温		–40	+125	°C

说明：

1. 应用必须确保最大和最小占空比在20-85%之间，方可满足指定范围。

热性能

结-环境之间热阻与具体应用和电路板布局有关。该数据由2s2p四层板测得，符合JESD51-JEDEC标准。特别注意的是，不要超过给定环境温度T_A时的结温 $T_{J(max)}$。

符号	参数	典型值	单位
θ_{JA}	结-环境之间热阻	70	°C/W

电气规格

V_{IN} = 2.7V 至 5.5V, T_A = -40°C至 +85°C，除非另有说明。典型值测量条件为 T_A = 25°C 且 V_{IN} = 3.6V。

符号	参数	工作条件	最小值	典型值	最大值	单位
电源						
I_{SD}	停机电源电流	EN = GND, V_{IN} = 3.6V		0.30	0.75	µA
V_{UVLO}	欠压闭锁阈值	V_{IN} 升	2.10	2.35	2.60	V
		V_{IN} 降	1.90	2.15	2.40	V
V_{UVHYST}	欠压锁定滞环宽度			250		mV
EN:启用引脚						
V_{IH}	输入电压高电平		1.2			V
V_{IL}	输入电压低电平				0.4	V
R_{EN}	EN 下拉电阻		200	300	400	kΩ
t_{LO}	EN 低电平 调光时间	V_{IN} = 3.6V; *参见图14*	0.5		300.0	µs
t_{HI}	压差延时	V_{IN} = 3.6V; *参见图14*	0.5			µs
T_{SD}	EN 低电平，关断脉冲宽度	V_{IN} = 3.6V；自 EN 的下降沿	1			ms
反馈和参考						
V_{FB}	反馈电压	I_{LED} = 20mA 自 -40°C 至 +85°C, 2.7V ≤ V_{IN} ≤ 5.5V	237	250	263	mV
I_{FB}	反馈输入电流	V_{FB} = 250mV		0.1	1.0	µA
电源输出						
$R_{DS(ON)\_Q1}$	升压开关接通电阻	V_{IN} = 3.6V, I_{SW} = 100mA		600		mΩ
		V_{IN} = 2.7V, I_{SW} = 100mA		650		
$I_{SW(OFF)}$	SW 节点漏电流(2)	EN = 0, V_{IN} = V_{SW} = V_{OUT} = 5.5V, V_{LED} = 0		0.1	2.0	µA
I_{LIM-PK}	升压开关峰值电流限值	V_{IN} = 3.6V		750		mA
振荡器						
f_{SW}	升压稳压器开关频率		1.0	1.2	1.4	MHz
输出和保护						
V_{OVP}	升压输出过压保护 (OVP)		22.5	24.5		V
	OVP 滞环			1.0		
V_{TLSC}	V_{OUT} 短路检测阈值	V_{OUT} 降		V_{IN} – 1.4		V
V_{THSC}	V_{OUT} 短路检测阈值	V_{OUT} 升		V_{IN} – 1.2		V
D_{MAX}	最大升压占空比(3,4)		85			%
D_{MIN}	最小升压占空比(3,4)				20	%
T_{TSD}	热关闭			150		°C
T_{HYS}	热关闭滞环宽度			35		°C

说明:

2. SW 漏电流包括包括 两个内部开关的漏电流；SW 至 GND 与 SW 至 VOUT。
3. 未经产品测试；由设计保证
4. 应用必须确保最大和最小占空比在20-85%之间，方可满足指定范围。

典型特性

V_{IN} = 3.6V, T_A = 25°C, I_{LED} = 25mA, L = 10µH, C_{OUT} = 1.0µF

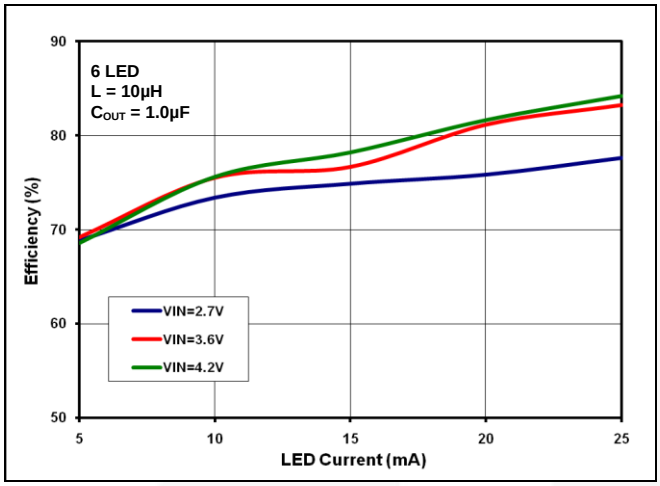


Figure 4. 6 LED：效率 vs LED 电流 vs. 输入电压

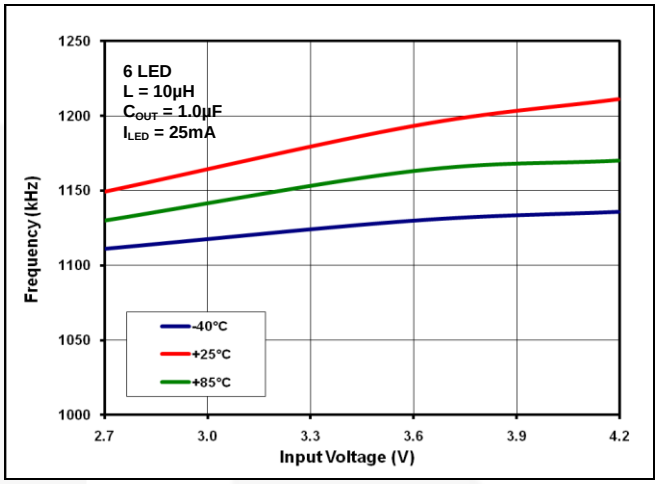


Figure 5. 频率 vs.输入电压vs.温度

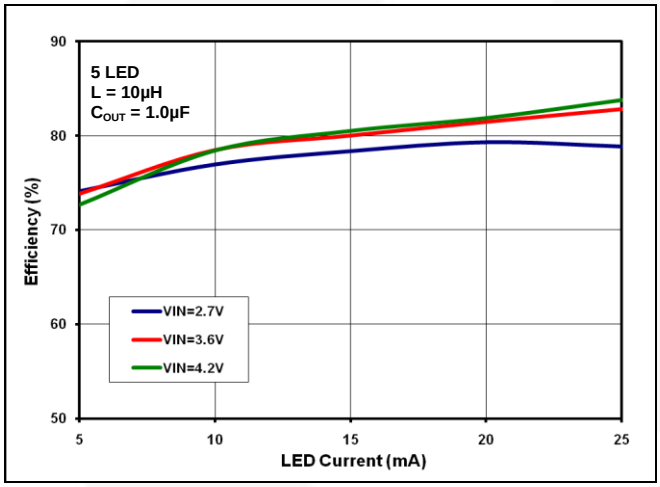


Figure 6. 5 LED：效率 vs LED 电流 vs. 输入电压

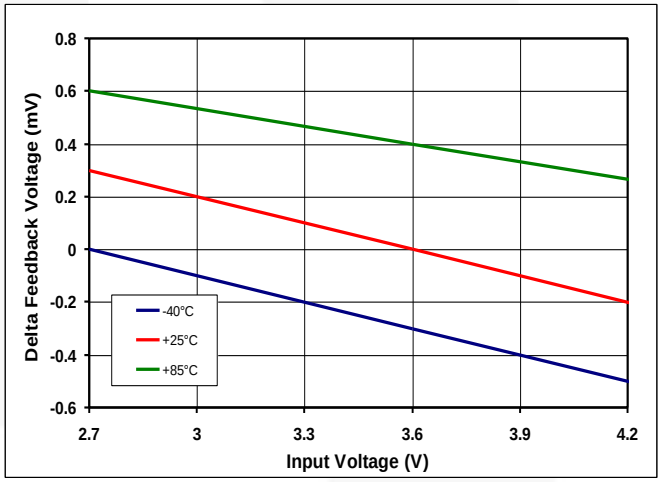


Figure 7. V_{FB}输入电压过压和温度的变量，6 LED，L=10µH 且 C_{OUT}=1.0µF

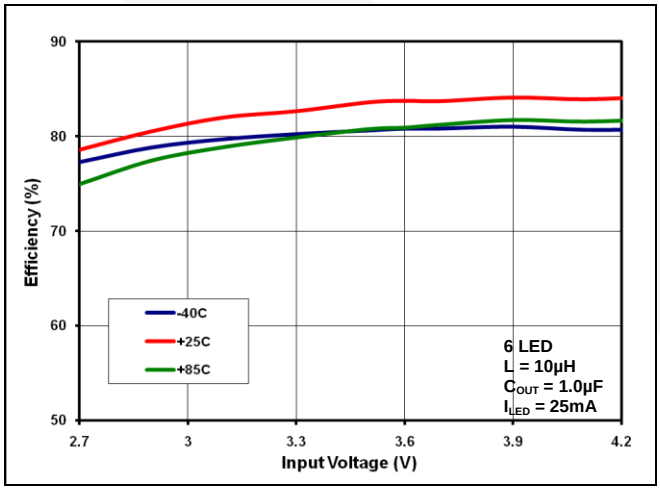


Figure 8. 效率 vs.输入电压vs.温度

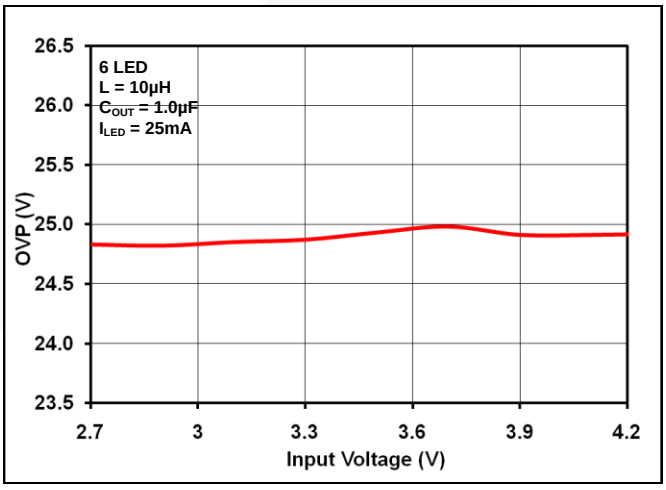


Figure 9. 过压保护 vs. 输入电压

典型特性

V_{IN} = 3.6V, T_A = 25°C, I_{LED} = 25mA, L = 10µH, C_{OUT} = 1.0µF

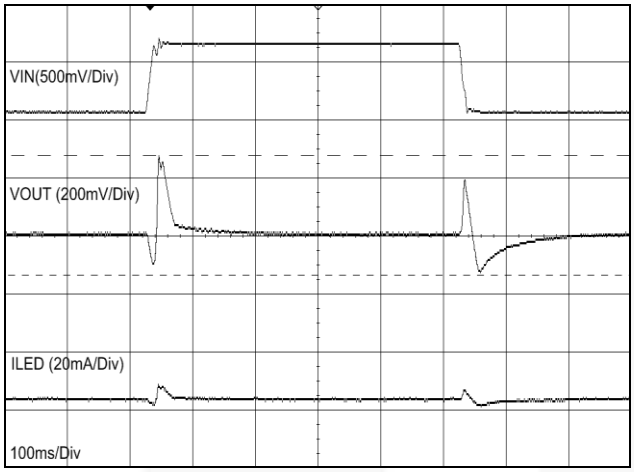


Figure 10. 6 LED 的线性瞬态响应

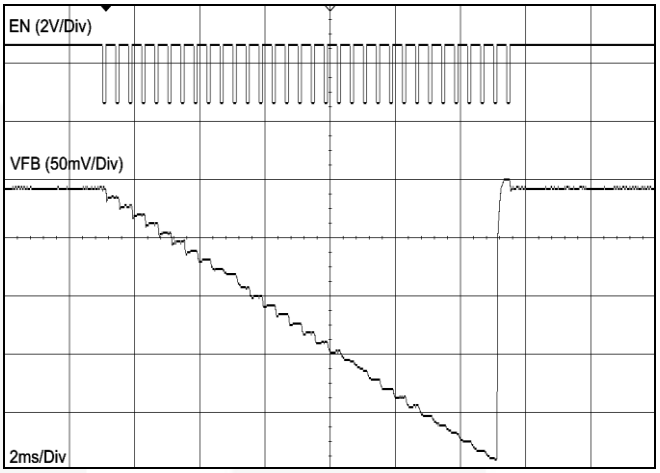


Figure 11. FAN5343 的调光操作

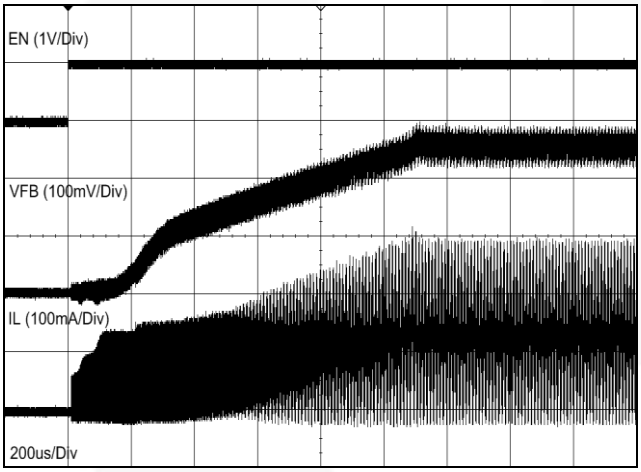


Figure 12. 6 LED 的开关电压，电感电流的启动波形，V_{FB}，以及 EN

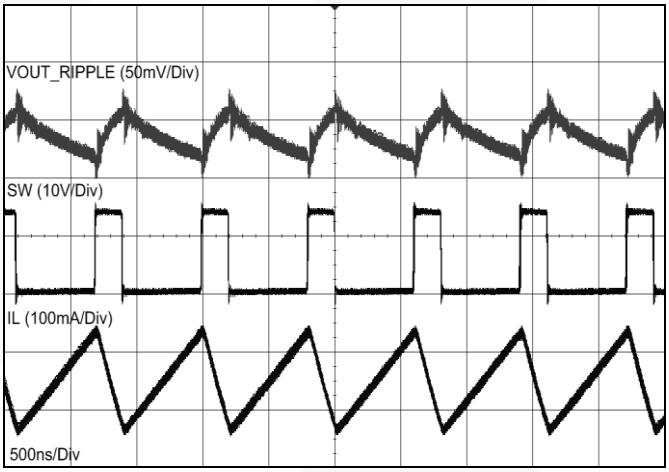


Figure 13. 6 LED 的 V_{OUT}，开关电压，电感电流的稳态波形

功能说明

概述

FAN5343 是一款电感电流模式升压的串联 LED 驱动器，通过保持R_{SET}电阻 0.25V 的电压实现LED电流的调节。LED 串的电流（I_{LED}）的计算公式为：

$$I_{LED} = \frac{0.25}{R_{SET}} \quad (1)$$

电压 V_{OUT} 取决于每个LED上正向电压之和，再加上保持为250mV的R_{SET}上的压降。

UVLO 和软启动

若 EN 低电平超过 1ms,芯片在 EN 升高时将进行一次 “冷启动” 软起动周期，前提是V_{IN} 高于 UVLO 阈值。

数字接口

FAN5343采用单线数控接口，可通过数字脉冲对LED的亮度进行32级线性调整。采用单线解决方案，FAN5343就不再需要系统处理器持续提供信号来驱动LED。

数字调光控制

FAN5343 开始以最高亮度等级驱动LED。启动后，控制逻辑可接受编程脉冲通过施加在 EN 引脚的正端来逐步降低。图14 显示了FAN5343 的数字脉冲的调光控制。

过流和短路检测

升压模式工作期间，采用逐周期峰值电流限值~750mA，以保护开关元件和检测元件免受损坏。

过压/开路保护

若 LED 串采用开路，FB 保持为 0V，且输出电压在没有过压保护（OVP）电路的情况下持续升高。当 V_{OUT} 超过24.5V 时，FAN5343 的 OVP电路将禁用升压稳压器，并持续到V_{OUT}降至22.5V以下方可启用。

热关闭

晶圆温度超过150°C时，发生复位并保持，直至晶圆冷却至125°C；此时允许电路开始软起动序列。

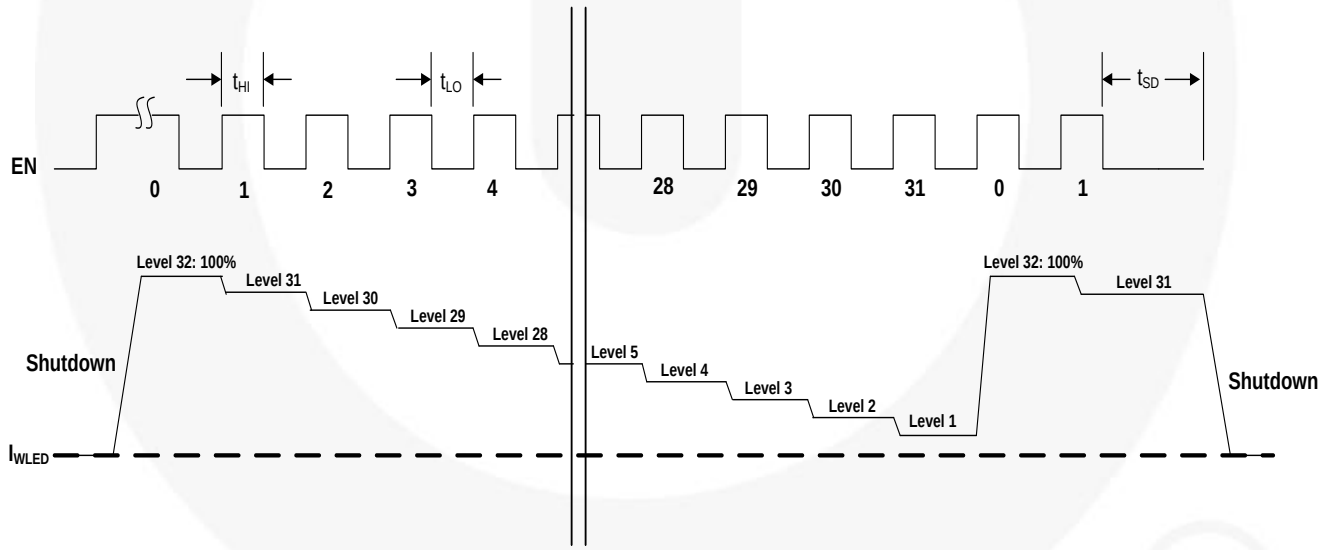


Figure 14. 数字脉冲调光控制图

应用信息

电感和输出电容的选择

Table 1. 建议使用的外部器件

LED 编号	L	器件型号	生产厂商	Min. C_{OUT}	器件型号	生产厂商
5, 6	10.0µH	LQH43MN100K03	Murata	1.00µF	UMK212BJ105KG	Taiyo Yuden
		NLCV32T-100K-PFR	TDK			
		VLF3010AT-100MR49-1	TDK			

推荐的器件和PCB布局

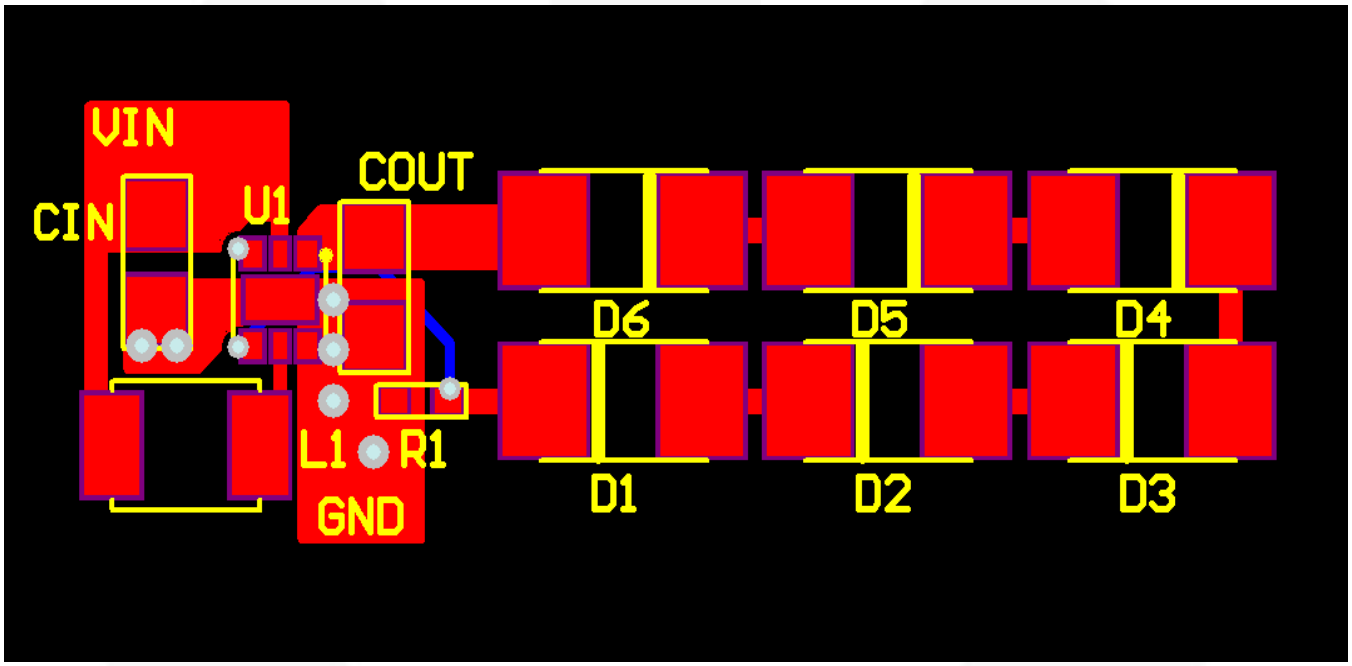


Figure 15. 推荐的器件布局

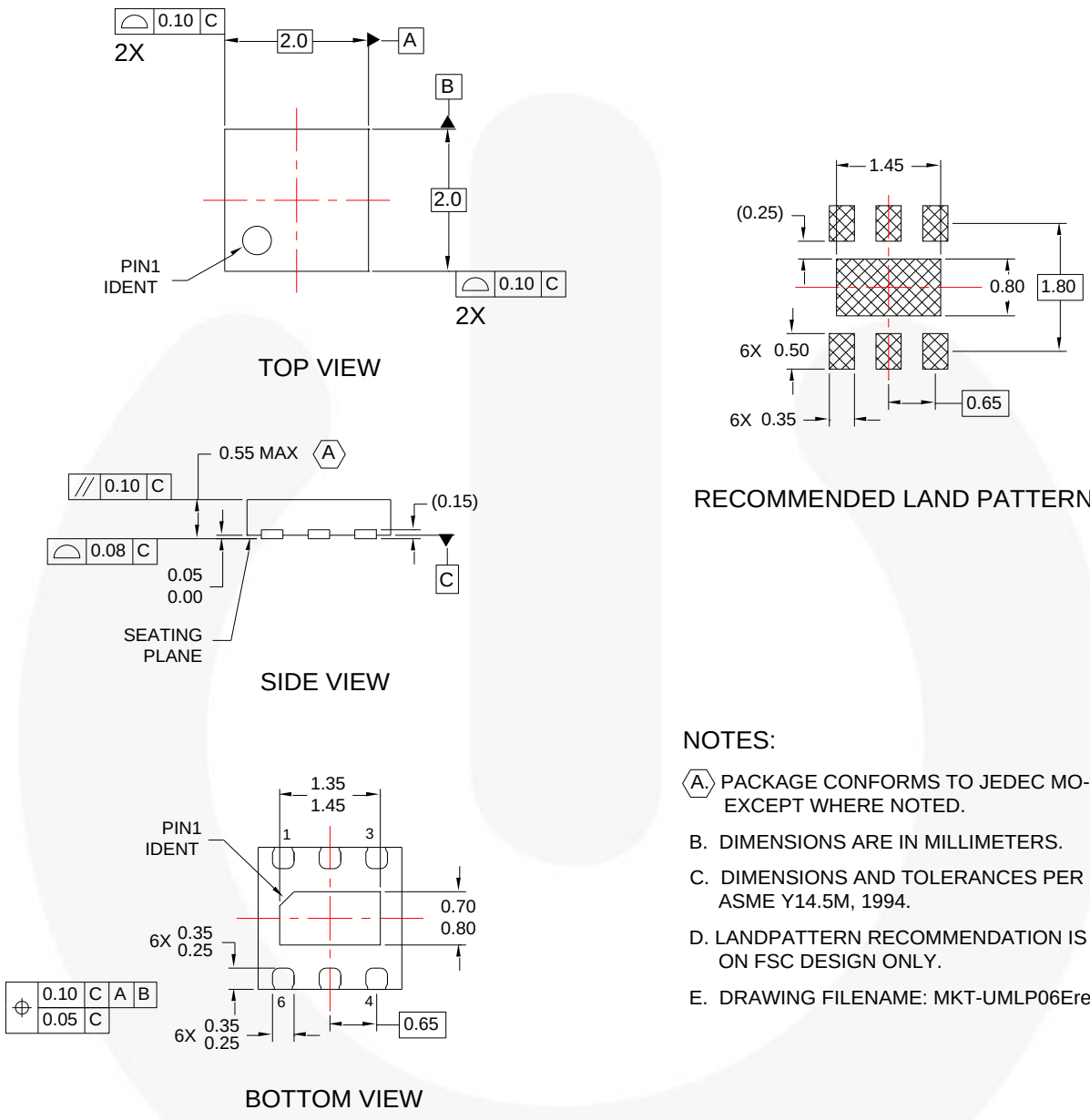
输入电容

在典型应用中，输入和输出电容应尽量靠近芯片，实现正常功能无需其他电容。但是，在测试环境中，若FAN5343通过较长的电缆供电，需要附加的输入电容（10µF）来保证功能稳定。这个电容应靠近电源线与 FAN5343评估板的连接处放置。

PCB推荐布局

- 电感应连接至 VIN，必要时可通过其他层。
- 反馈引脚可返回连接至IC下一层。

物理尺寸



NOTES:

A. PACKAGE CONFORMS TO JEDEC MO-229 EXCEPT WHERE NOTED.

B. DIMENSIONS ARE IN MILLIMETERS.

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

D. LANDPATTERN RECOMMENDATION IS BASED ON FSC DESIGN ONLY.

E. DRAWING FILENAME: MKT-UMLP06Erev2.

Figure 16. 6-引脚超薄模塑无铅封装(U)MLP

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OPTOPLANAR®
PowerTrench®
PowerXS™
Programmable Active Droop™
QFET®
QS™
Quiet Series™
RapidConfigure™
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SuperSOT™-8
SupreMOS®
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