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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

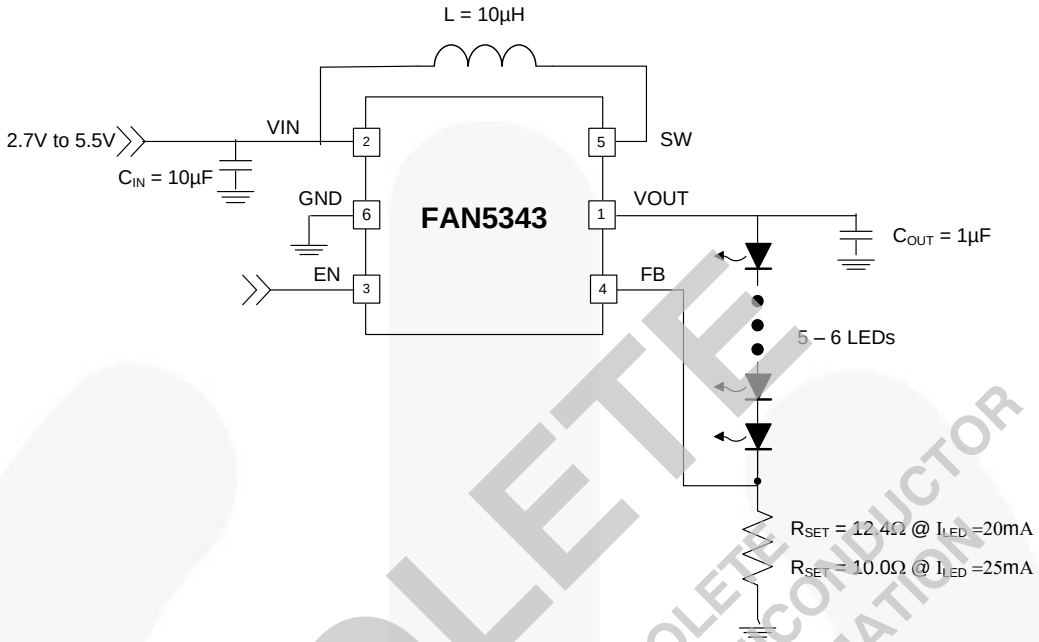

Figure 1. 典型应用

框图

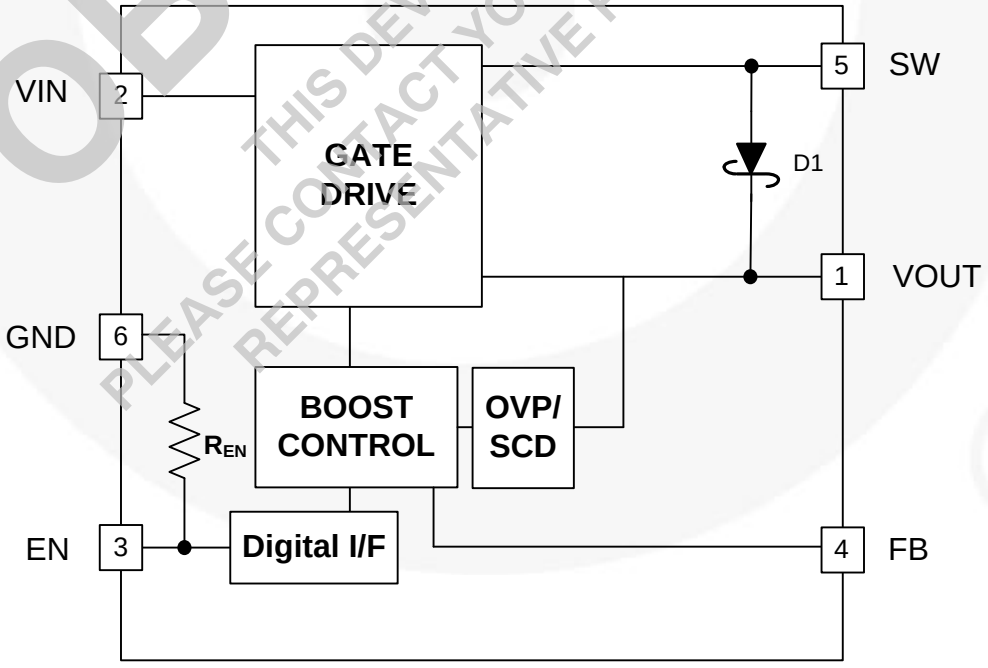

Figure 2. 框图

引脚布局

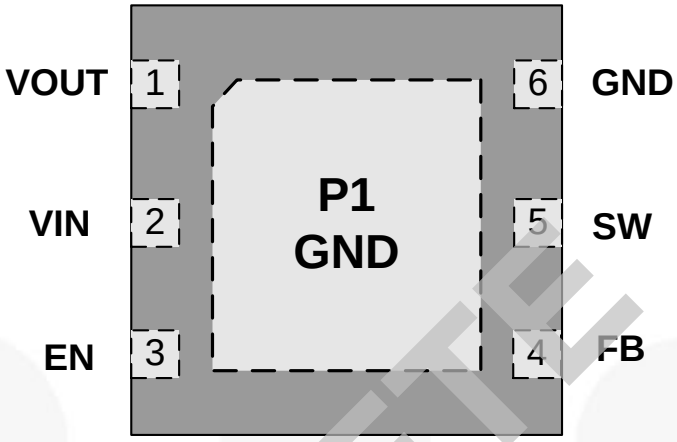

Figure 3. UMLP6封装(顶视图)

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

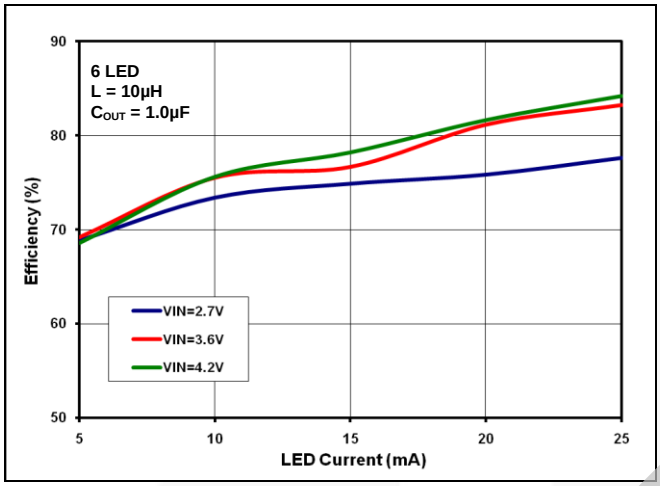

Figure 4. 6 LED：效率 vs LED 电流 vs. 输入电压

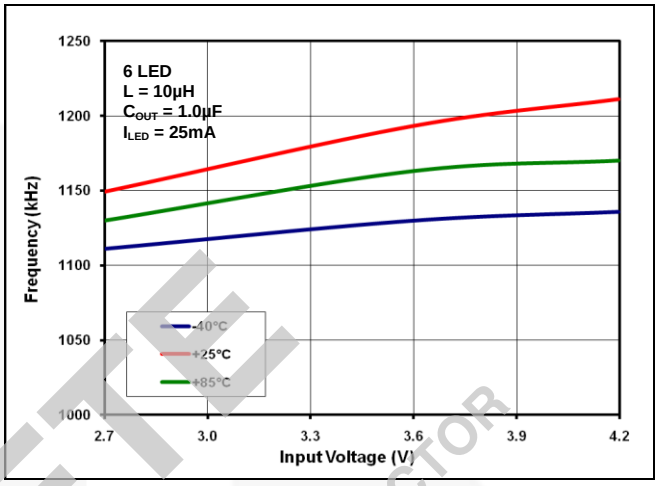

Figure 5. 频率 vs.输入电压vs.温度

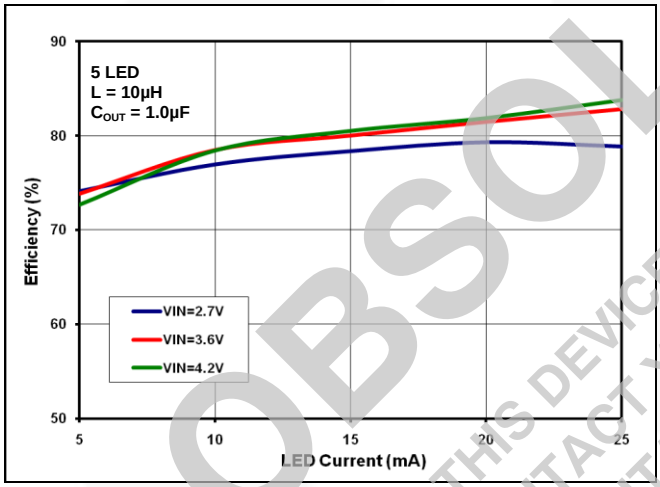

Figure 6. 5 LED：效率 vs LED 电流 vs. 输入电压

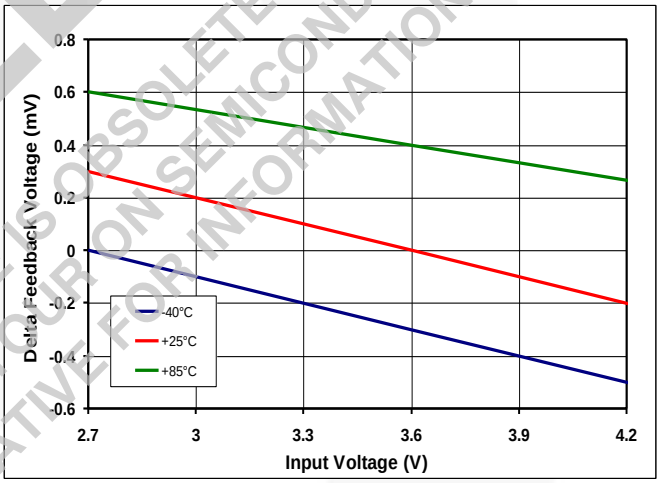

Figure 7. V_{FB}输入电压过压和温度的变量，6 LED，L=10µH 且 C_{OUT}=1.0µF

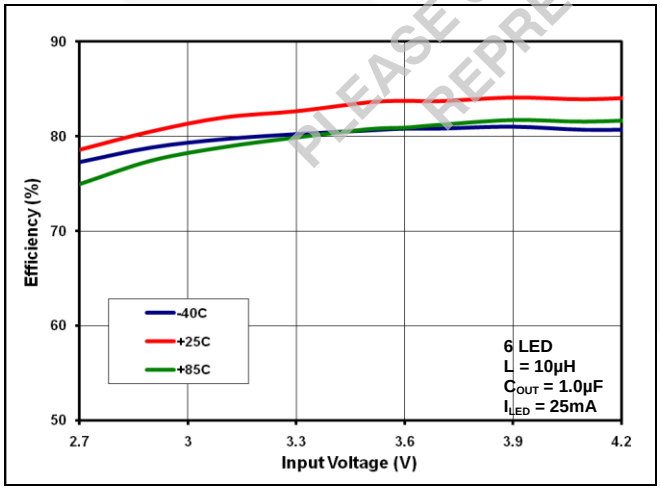

Figure 8. 效率 vs.输入电压vs.温度

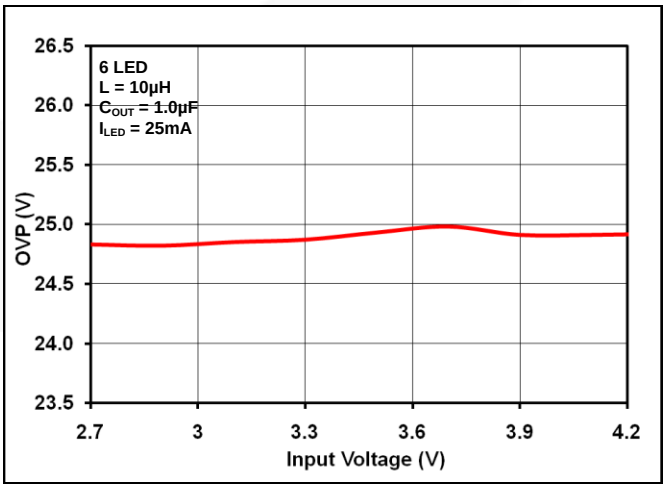

Figure 9. 过压保护 vs. 输入电压

典型特性

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

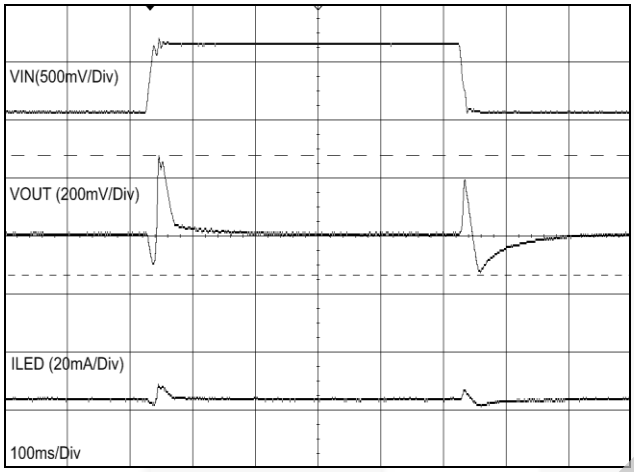

Figure 10. 6 LED 的线性瞬态响应

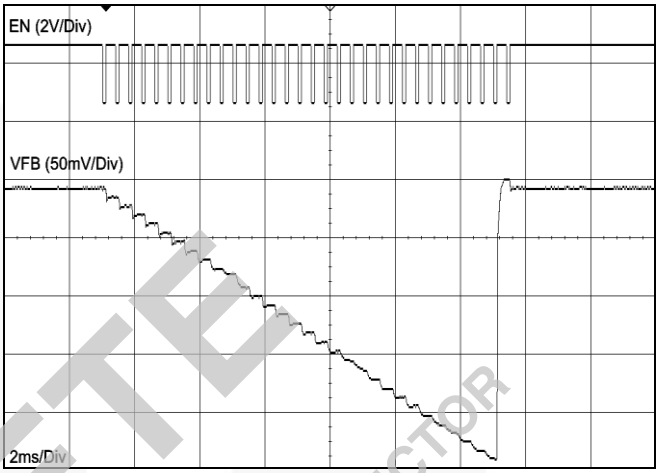

Figure 11. FAN5343 的调光操作

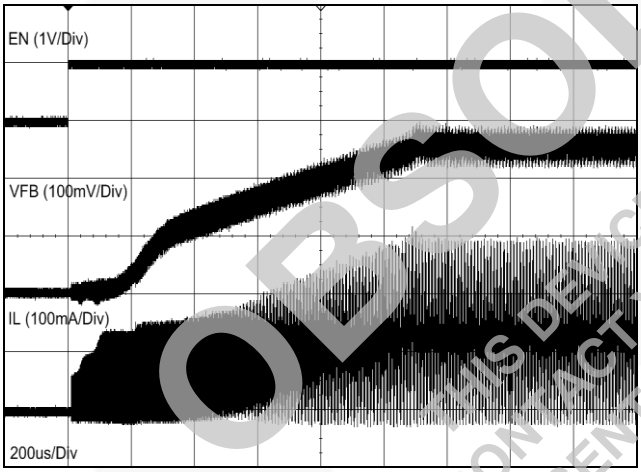

Figure 12. 6 LED 的开关电压，电感电流的启动波形，V_{FB}，以及 EN

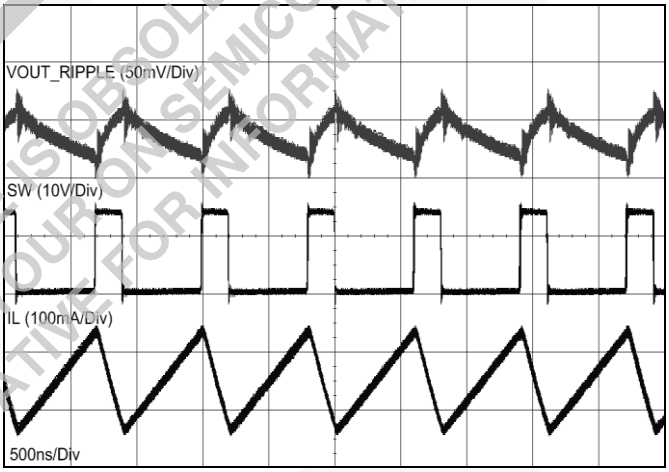

Figure 13. 6 LED 的 V_{OUT}，开关电压，电感电流的稳态波形

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。

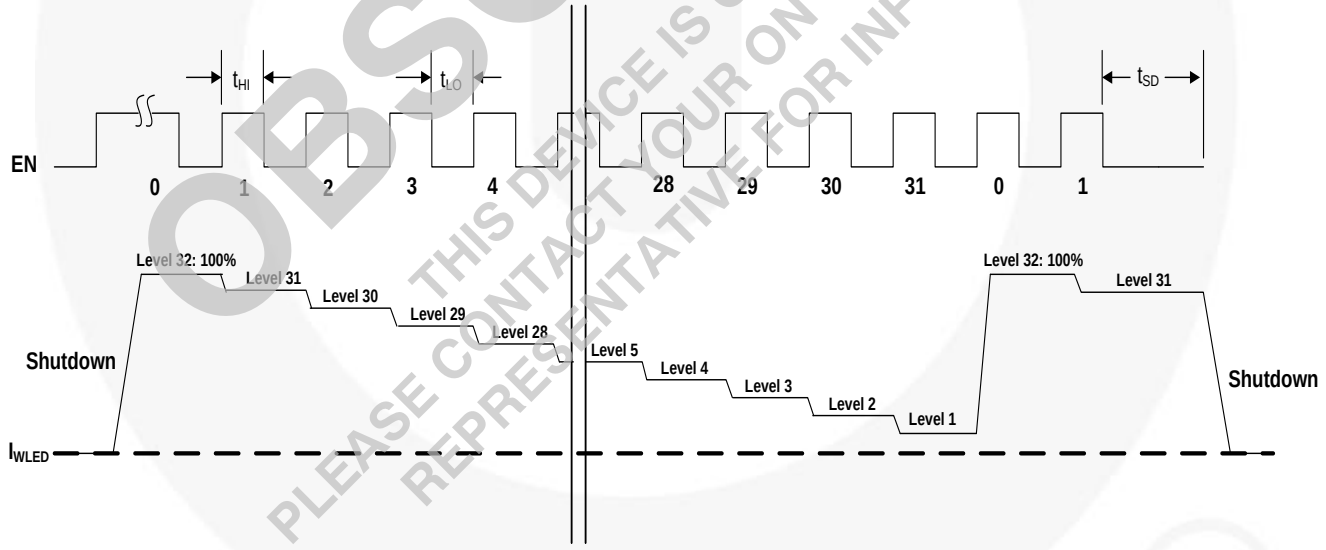

Figure 14. 数字脉冲调光控制图

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

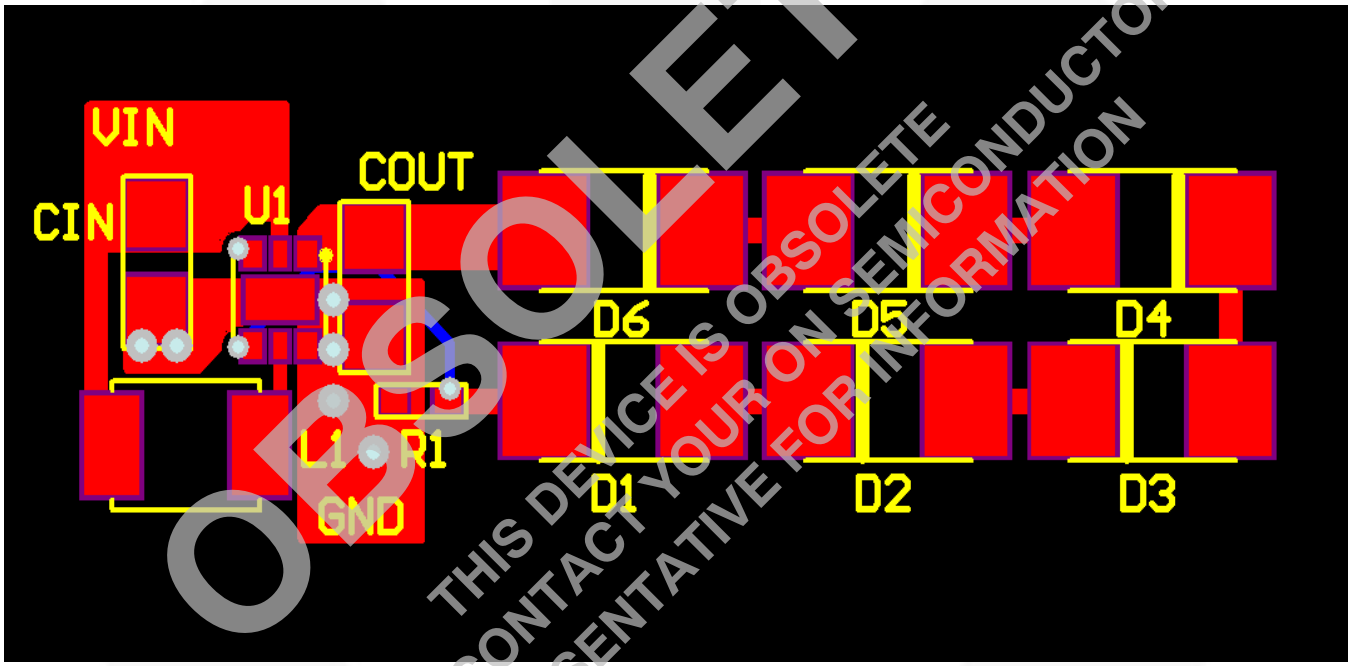

Figure 15. 推荐的器件布局

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

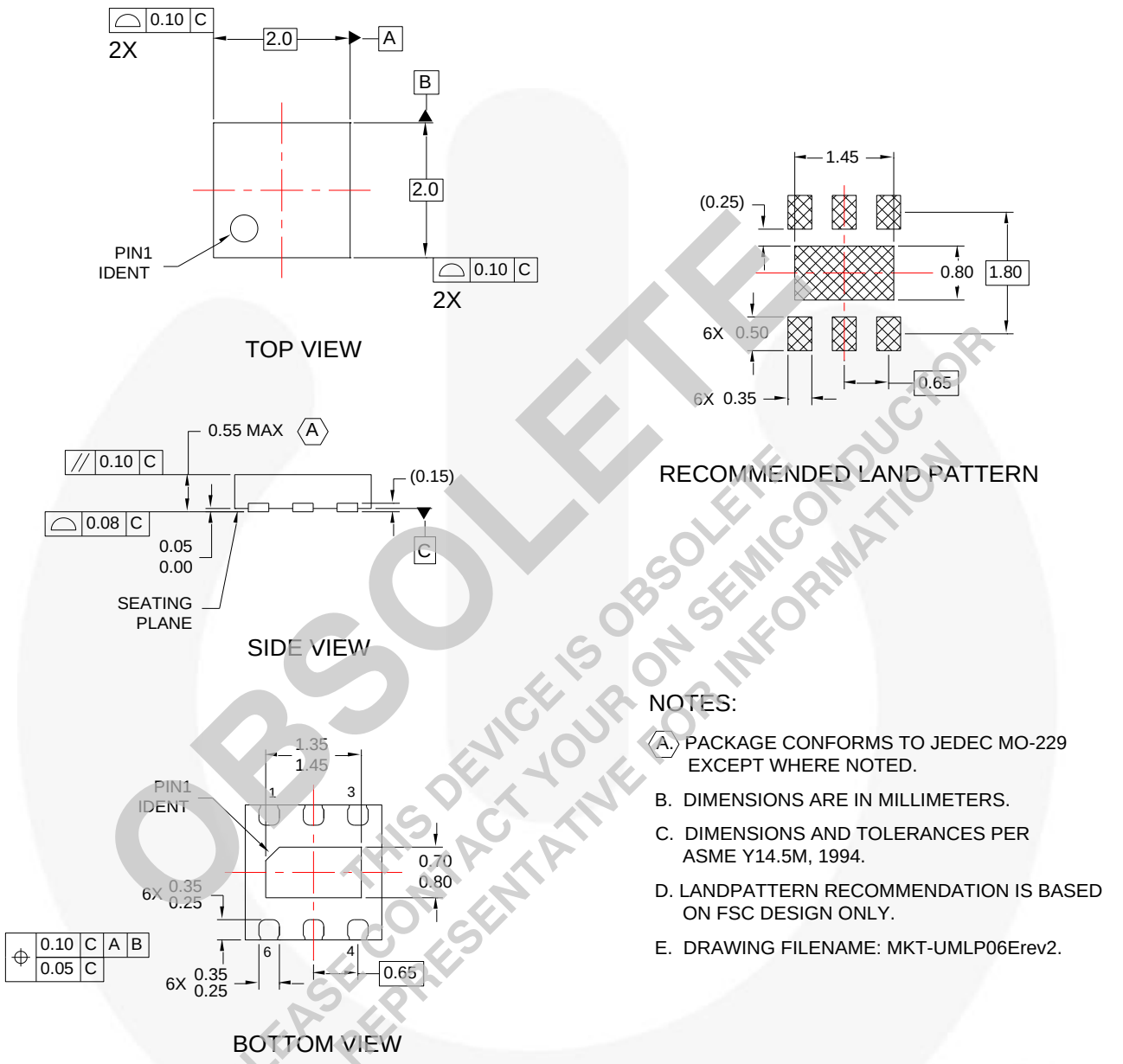

Figure 16. 6-引脚超薄模塑无铅封装(U)MLP

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As used herein:

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PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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