CSD18531Q5A 60V N 通道 NexFET™ 功率 MOSFET

1 特性

- 超低 Q_g 和 Q_{gd}
- 低热阻
- 雪崩额定值
- 逻辑电平
- 无铅引脚镀层
- 符合 RoHS 标准
- 无卤素
- SON 5mm × 6mm 塑料封装

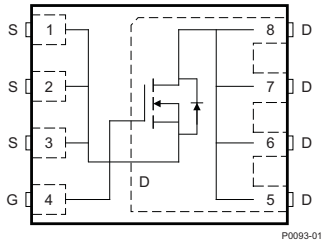
2 应用

- 直流 - 直流转换
- 次级侧同步整流
- 电池电机控制

3 说明

此 60V、3.5mΩ、5mm × 6mm NexFET™功率 MOSFET 旨在最大限度地减小电源转换应用中的 损耗。

顶视图



产品概要

T_A = 25°C		典型值	单位
V_{DS}	漏源电压	60	V

产品概要 (接下页)

T_A = 25°C		典型值		单位
Q_g	栅极电荷总量 (10V)	36		nC
Q_{gd}	栅极电荷（栅极到漏极）	5.9		nC
$R_{DS(on)}$	漏源导通电阻	V_{GS} = 4.5V	4.4	mΩ
		V_{GS} = 10V	3.5	
$V_{GS(th)}$	阈值电压	1.8		V

器件信息(1)

器件	数量	包装介质	封装	运输
CSD18531Q5A	2500	13 英寸卷带	SON 5.00mm × 6.00mm 塑料封装	卷带封装
CSD18531Q5AT	250	7 英寸卷带		

(1) 如需了解所有可用封装，请参阅产品说明书末尾的可订购产品附录。

绝对最大额定值

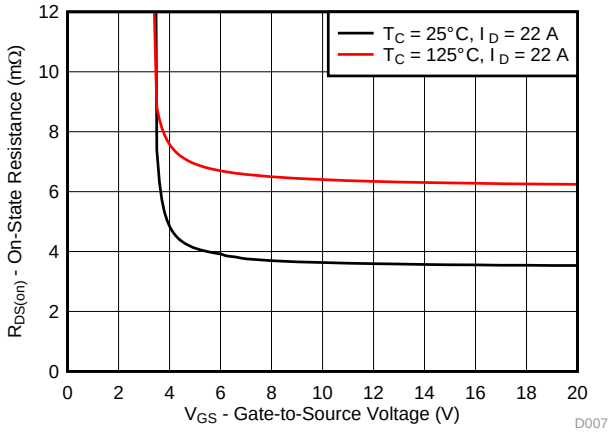
T_A = 25°C		值	单位
V_{DS}	漏源电压	60	V
V_{GS}	栅源电压	±20	V
I_D	持续漏极电流（受封装限制）	100	A
	持续漏极电流（受芯片限制），T_C = 25°C 时测得	134	
	持续漏极电流(1)	19	
I_{DM}	脉冲漏极电流(2)	400	A
P_D	功率耗散(1)	3.8	W
	功率耗散，T_C = 25°C 时测得	156	
T_J	运行结温范围	-55 至 175	°C
T_{stg}	存储温度	-55 至 175	°C
E_{AS}	雪崩能量，单一脉冲 I_D = 67A，L = 0.1mH，R_G = 25Ω	224	mJ

(1) $R_{\theta JA}$ = 40°C/W，这是在一块厚度为 0.06 英寸环氧树脂 (FR4) 印刷电路板 (PCB) 上的 1 英寸^2，2 盎司铜焊盘上测得的典型值。

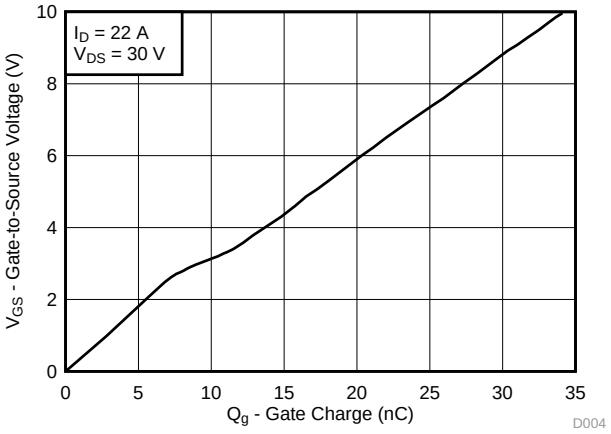
(2) 最大 $R_{\theta JC}$ = 1°C/W，脉冲持续时间 ≤ 100µs，占空比 ≤ 1%。

An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

$R_{DS(on)}$ 与 V_{GS} 对比



栅极电荷



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目录

4 修订历史记录

注：之前版本的页码可能与当前版本有所不同。

Changes from Revision F (October 2016) to Revision G — **Page**

- 已更改 温度范围：从 150°C 至 175°C ... 1
- 已更改 使用 175°C 数据更改了 I_{DM}，将 370A 更改为 400A ... 1
- 已更改 使用 175°C 数据更改了 P_D，将 3.1W 更改为 3.8W ... 1
- Changed Figure 6 to extend to 175°C ... 6
- Changed Figure 8 to extend to 175°C ... 7
- Changed Figure 10 using 175°C data ... 7
- Changed Figure 12 to extend to 175°C ... 7

Changes from Revision E (August 2015) to Revision F — **Page**

- 已更改 125°C $R_{DS(on)}$ 与 V_{GS} 对比 曲线，以反映典型部件特性 ... 2
- Changed the 125°C curve in Figure 7 to reflect typical part characterization ... 6
- 已添加 *Receiving Notification of Documentation Updates* 部分添加到*器件和文档支持*部分 ... 9

Changes from Revision D (May 2015) to Revision E — **Page**

- 将说明部分的器件尺寸 单位 从 m 更正为 mm。 ... 1
- 将封装类型更正为 SON。 ... 1

Changes from Revision C (March 2015) to Revision D — **Page**

- 添加了 *社区资源*。 ... 9

Changes from Revision B (October 2012) to Revision C — **Page**

- 在标题中添加了部件编号。 ... 1
- 已更改 Q_g 值至 36nC（10V 条件下测量）。 ... 1
- 在订购信息中添加了 7 英寸卷带。 ... 1
- 将最大脉冲电流增加至 370A。 ... 1
- 针对外壳温度保持在 25°C 时的最大功率耗散添加了一行内容。 ... 1
- 更新了脉冲电流条件。 ... 1
- Updated Figure 1 to show $Z_{\theta JC}$ curves. ... 6
- Updated Figure 10 ... 7

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- Updated Figure 12. 7

Changes from Revision A (June 2012) to Revision B **Page**

- Changed the Transconductance TYP value From: 177 S To: 128 S. 5
- Changed the Turn On and Turn Off Delay Time, Rise and Fall Time Test. Conditions From: I_{DS} = 22 A, R_G = 2 Ω To: I_{DS} = 22 A, R_G = 0 Ω. 5
- Changed the Q_{rr} Reverse Recovery Charge TYP value From: 68 nC To: 100 nC. 5

Changes from Original (June 2012) to Revision A **Page**

- 已添加 T_A = 25°C 至产品概要表 1
- 已添加 T_A = 25°C 至产品概要表 1

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5 Specifications

5.1 Electrical Characteristics

T_A = 25°C (unless otherwise stated)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
STATIC CHARACTERISTICS						
BV_{DSS}	Drain-to-source voltage	V_{GS} = 0 V, I_D = 250 μA	60			V
I_{DSS}	Drain-to-source leakage current	V_{GS} = 0 V, V_{DS} = 48 V			1	μA
I_{GSS}	Gate-to-source leakage current	V_{DS} = 0 V, V_{GS} = 20 V			100	nA
$V_{GS(th)}$	Gate-to-source threshold voltage	V_{DS} = V_{GS}, I_D = 250 μA	1.5	1.8	2.3	V
$R_{DS(on)}$	Drain-to-source on-resistance	V_{GS} = 4.5 V, I_D = 22 A		4.4	5.8	mΩ
		V_{GS} = 10 V, I_D = 22 A		3.5	4.6	
g_{fs}	Transconductance	V_{DS} = 30 V, I_D = 22 A		128		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input capacitance	V_{GS} = 0 V, V_{DS} = 30 V, f = 1 MHz		3200	3840	pF
C_{oss}	Output capacitance			380	456	pF
C_{rss}	Reverse transfer capacitance			11	14	pF
R_G	Series gate resistance			1.2	2.4	Ω
Q_g	Gate charge total (4.5 V)	V_{DS} = 30 V, I_D = 22 A		18	22	nC
Q_g	Gate charge total (10 V)			36	43	nC
Q_{gd}	Gate charge gate-to-drain			5.9		nC
Q_{gs}	Gate charge gate-to-source			6.9		nC
$Q_{g(th)}$	Gate charge at V_{th}			5.2		nC
Q_{oss}	Output charge	V_{DS} = 30 V, V_{GS} = 0 V		32		nC
$t_{d(on)}$	Turnon delay time	V_{DS} = 30 V, V_{GS} = 10 V, I_{DS} = 22 A, R_G = 0 Ω		4.4		ns
t_r	Rise time			7.8		ns
$t_{d(off)}$	Turnoff delay time			20		ns
t_f	Fall time			2.7		ns
DIODE CHARACTERISTICS						
V_{SD}	Diode forward voltage	I_{SD} = 22 A, V_{GS} = 0 V		0.8	1	V
Q_{rr}	Reverse recovery charge	V_{DS}= 30 V, I_F = 22 A, di/dt = 300 A/μs		100		nC
t_{rr}	Reverse recovery time			40		ns

5.2 Thermal Information

T_A = 25°C (unless otherwise stated)

THERMAL METRIC		MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction-to-case thermal resistance(1)			1.0	°C/W
$R_{\theta JA}$	Junction-to-ambient thermal resistance(1)(2)			50	°C/W

(1) $R_{\theta JC}$ is determined with the device mounted on a 1-in^2 (6.45-cm^2), 2-oz (0.071-mm) thick Cu pad on a 1.5-in × 1.5-in (3.81-cm × 3.81-cm), 0.06-in (1.52-mm) thick FR4 PCB. $R_{\theta JC}$ is specified by design, whereas $R_{\theta JA}$ is determined by the user's board design.
(2) Device mounted on FR4 material with 1-in^2 (6.45-cm^2), 2-oz (0.071-mm) thick Cu.

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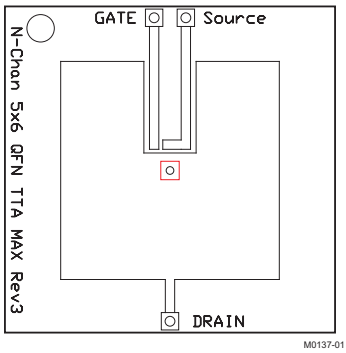
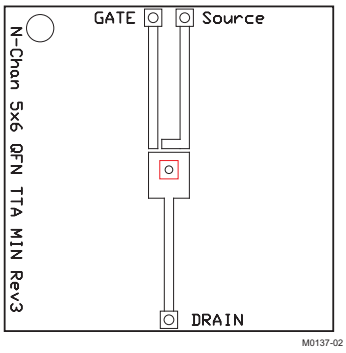


Max $R_{\theta JA}$ = 50°C/W when mounted on 1 in^2 (6.45 cm^2) of 2-oz (0.071-mm) thick Cu.



Max $R_{\theta JA}$ = 125°C/W when mounted on a minimum pad area of 2-oz (0.071-mm) thick Cu.

5.3 Typical MOSFET Characteristics

T_A = 25°C (unless otherwise stated)

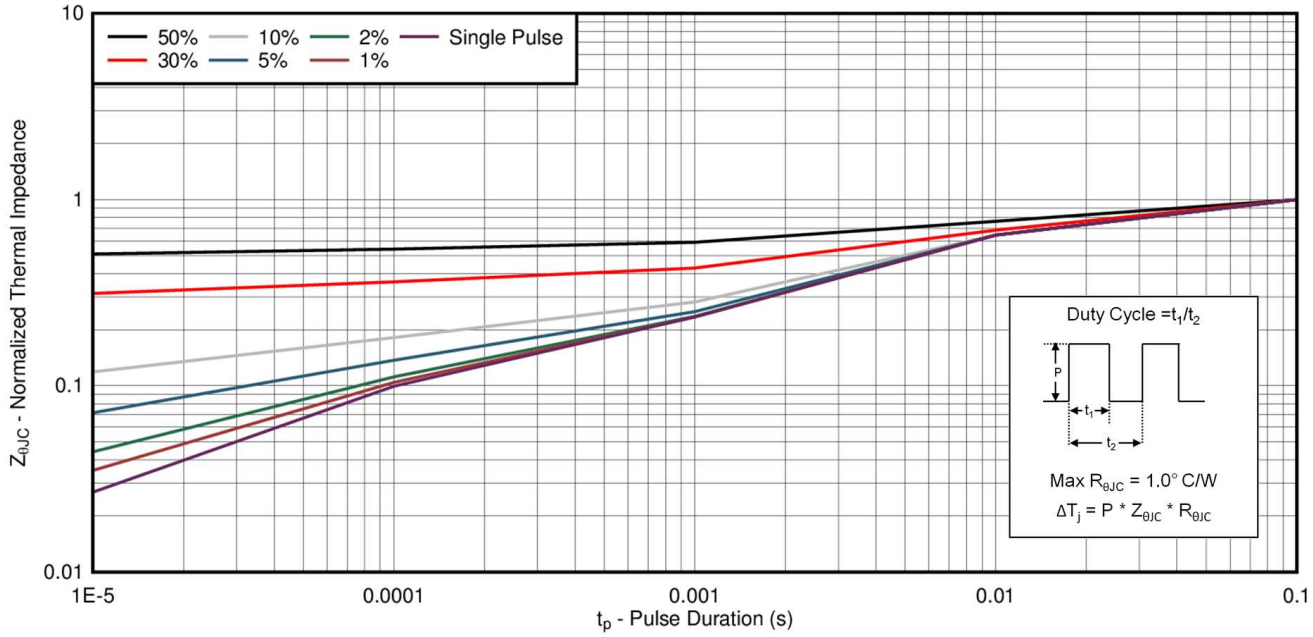


Figure 1. Transient Thermal Impedance

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Typical MOSFET Characteristics (continued)

T_A = 25°C (unless otherwise stated)

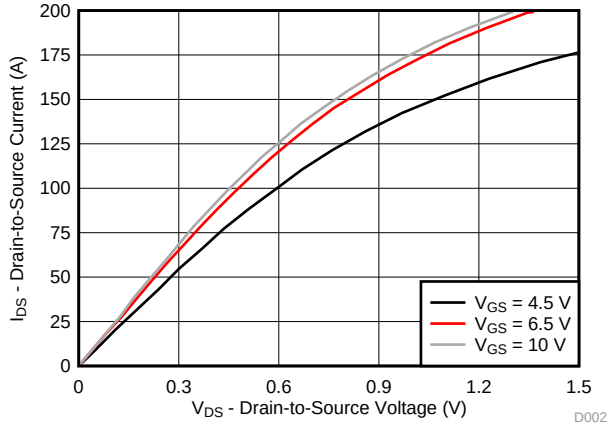

Figure 2. Saturation Characteristics

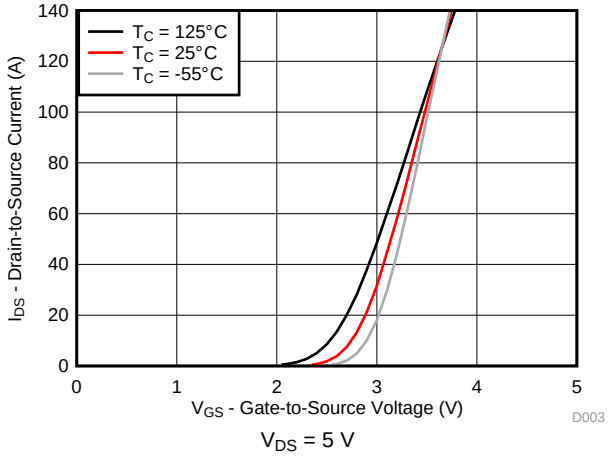

Figure 3. Transfer Characteristics

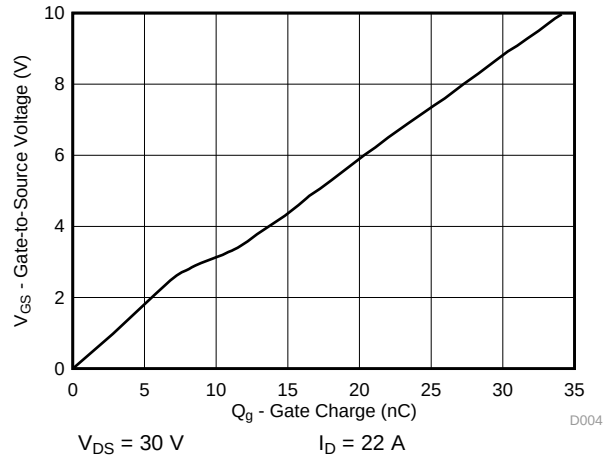

Figure 4. Gate Charge

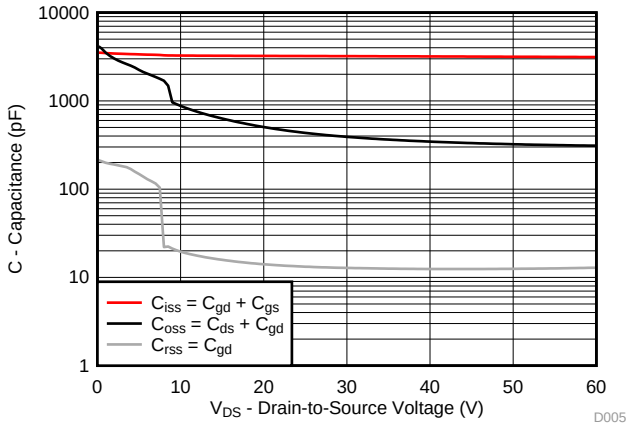

Figure 5. Capacitance

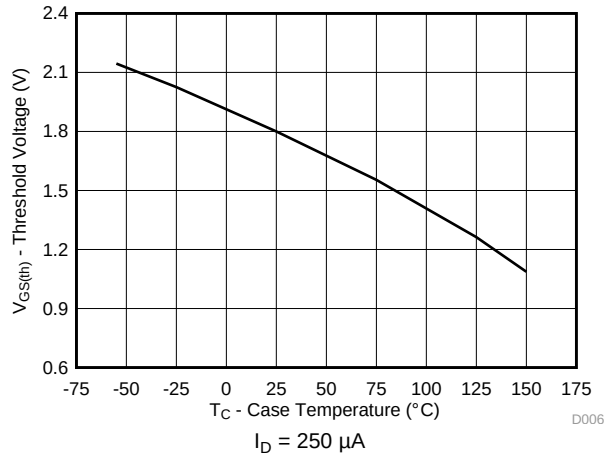

Figure 6. Threshold Voltage vs Temperature

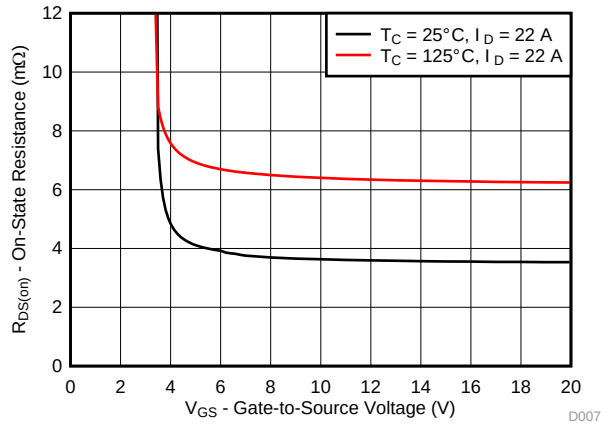

Figure 7. On-State Resistance vs Gate-to-Source Voltage

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Typical MOSFET Characteristics (continued)

T_A = 25°C (unless otherwise stated)

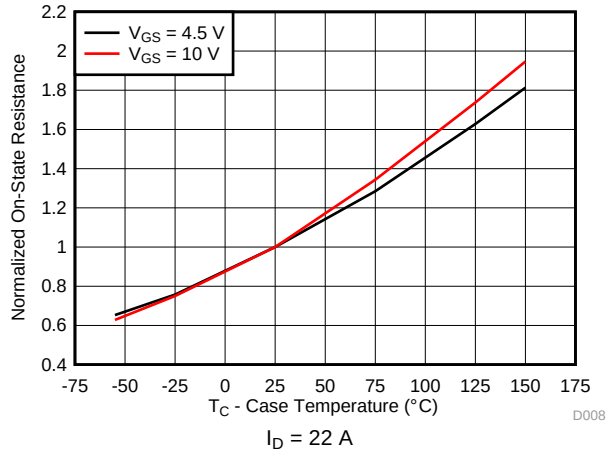

Figure 8. Normalized On-State Resistance vs Temperature

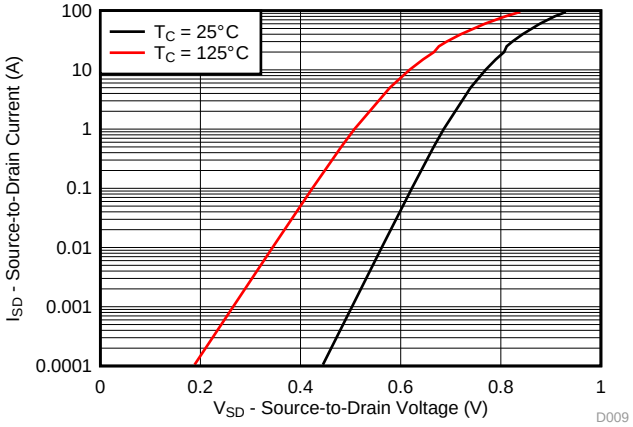

Figure 9. Typical Diode Forward Voltage

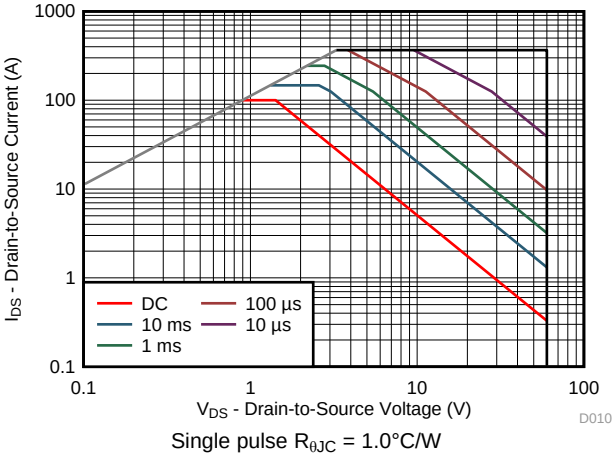

Figure 10. Maximum Safe Operating Area

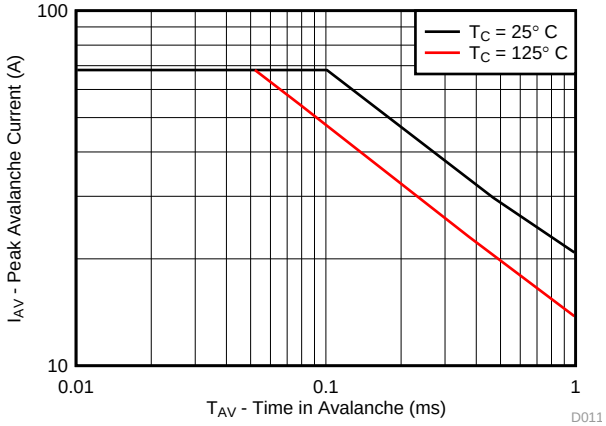

Figure 11. Single Pulse Unclamped Inductive Switching

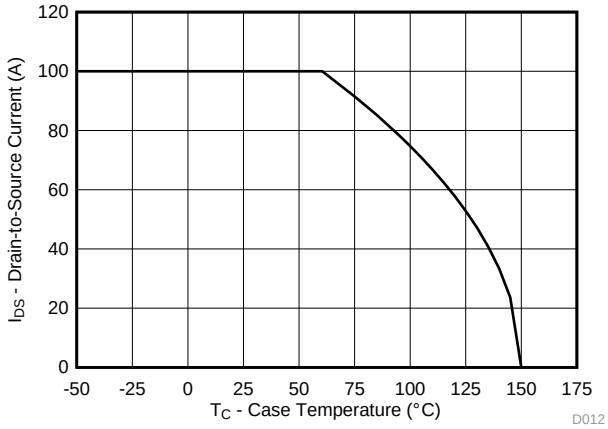

Figure 12. Maximum Drain Current vs Temperature

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6 器件和文档支持

6.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

6.2 社区资源

下列链接提供到 TI 社区资源的连接。链接的内容由各个分销商“按照原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的 《使用条款》。

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设计支持 ***TI 参考设计支持*** 可帮助您快速查找有帮助的 E2E 论坛、设计支持工具以及技术支持的联系信息。

6.3 商标

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6.4 静电放电警告

这些装置包含有限的内置 ESD 保护。 存储或装卸时，应将导线一起截短或将装置放置于导电泡棉中，以防止 MOS 门极遭受静电损伤。

6.5 Glossary

SLYZ022 — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

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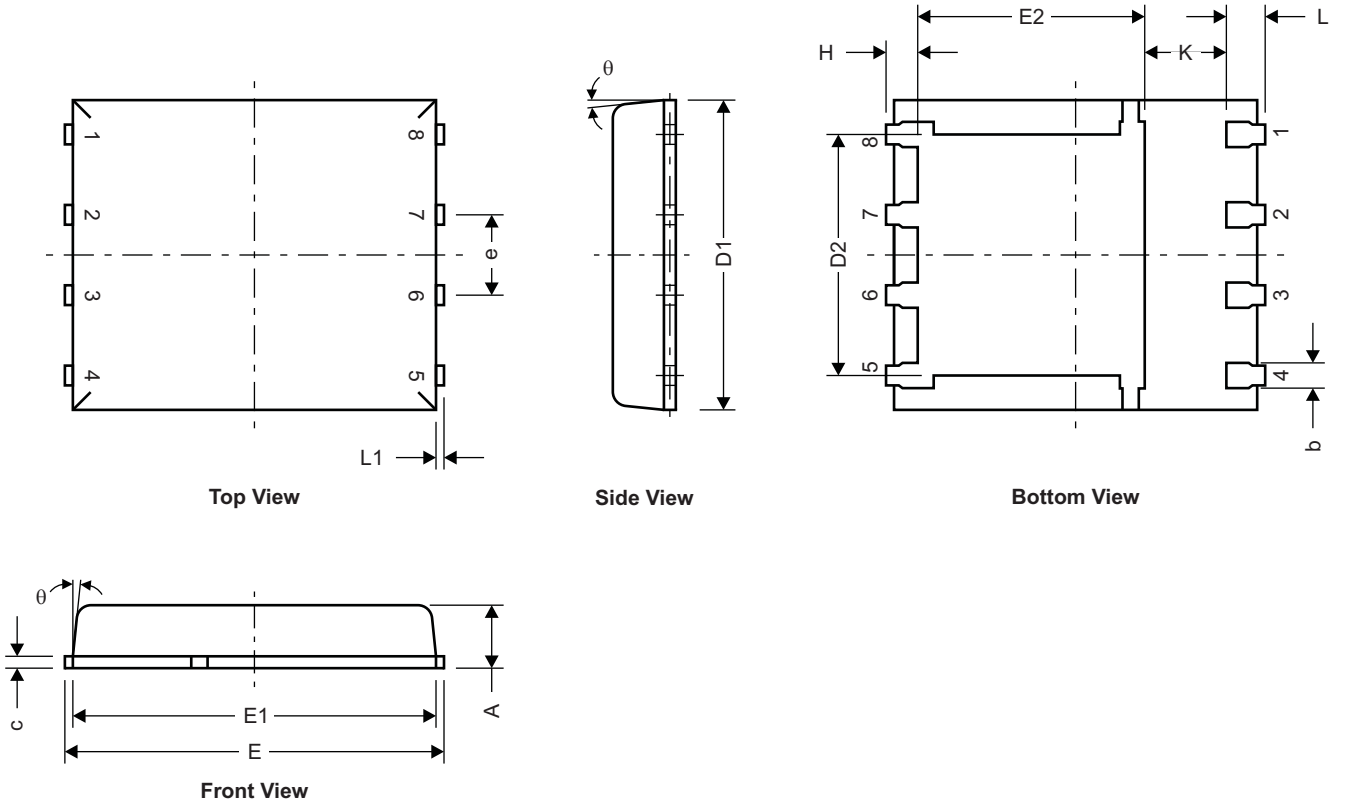
7 机械、封装和可订购信息

以下页面包含机械、封装和可订购信息。这些信息是指定器件的最新可用数据。数据如有变更，恕不另行通知和修订此文档。如欲获取此数据表的浏览器版本，请参阅左侧的导航。

7.1 Q5A 封装尺寸



M0135-01

DIM	毫米		
	最小值	标称值	最大值
A	0.90	1.00	1.10
b	0.33	0.41	0.51
c	0.20	0.25	0.34
D1	4.80	4.90	5.00
D2	3.61	3.81	4.02
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	3.38	3.58	3.78
e	1.17	1.27	1.37
H	0.41	0.56	0.71
K	1.10	—	—
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
θ	0°	—	12°

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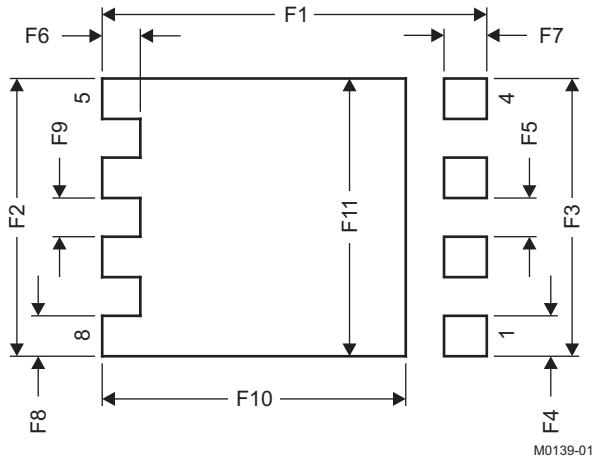
7.2 建议印刷电路板 (PCB) 布局

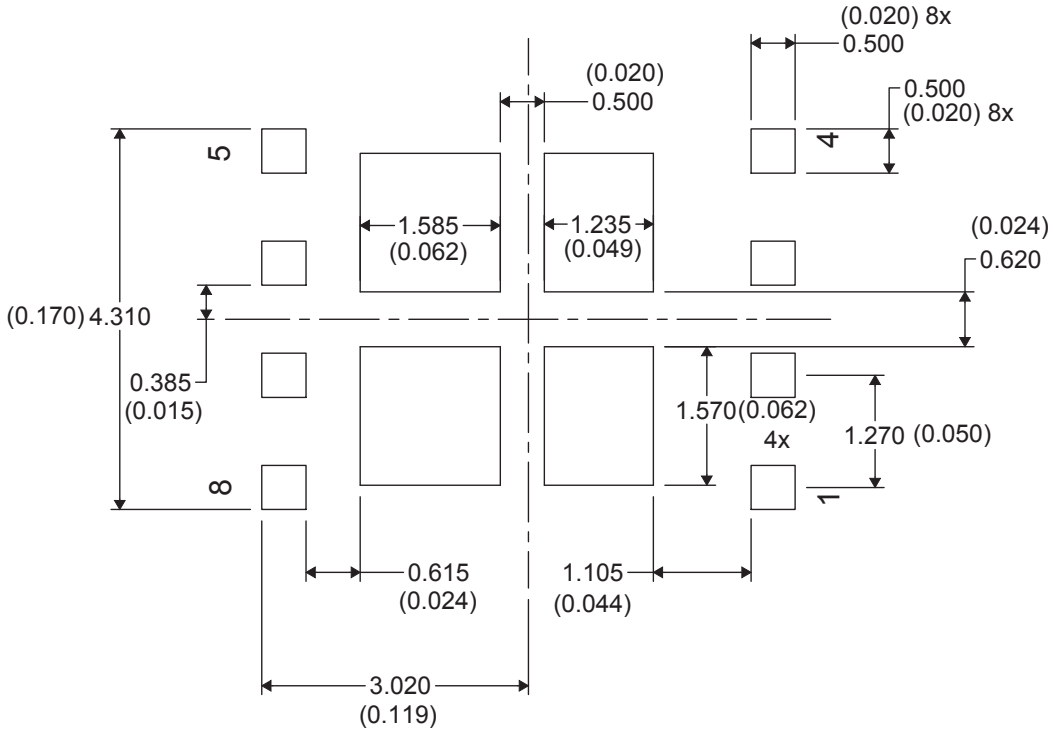


建议印刷电路板 (PCB) 布局 (接下页)

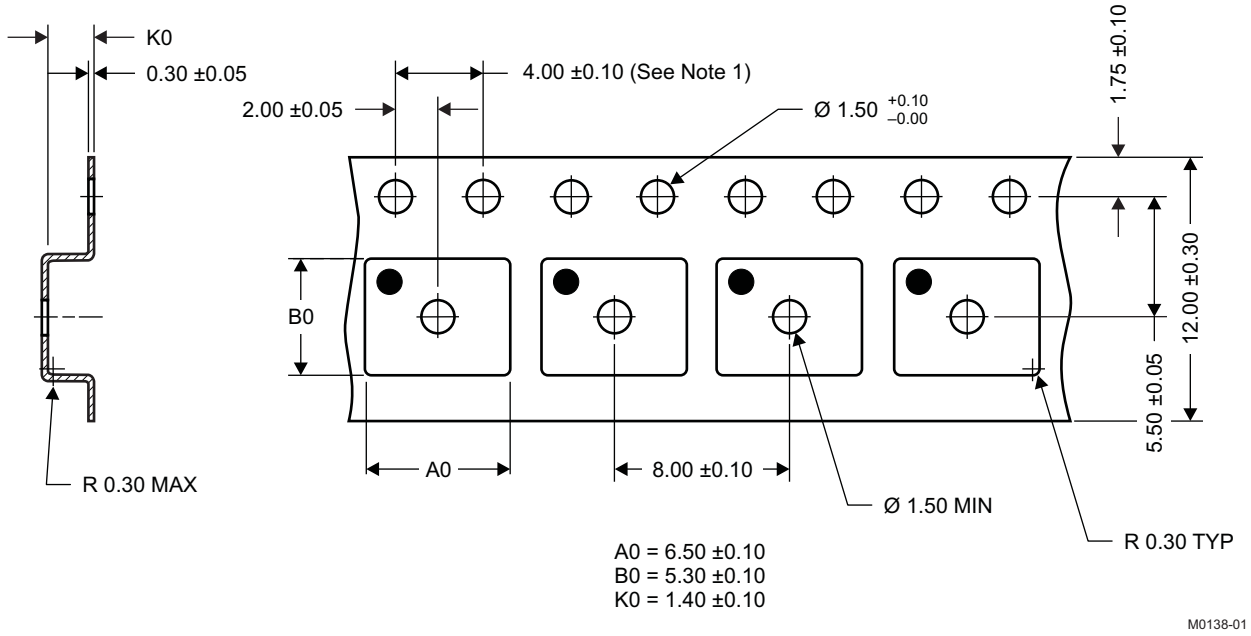
DIM	毫米		英寸	
	最小值	最大值	最小值	最大值
F1	6.205	6.305	0.244	0.248
F2	4.46	4.56	0.176	0.18
F3	4.46	4.56	0.176	0.18
F4	0.65	0.7	0.026	0.028
F5	0.62	0.67	0.024	0.026
F6	0.63	0.68	0.025	0.027
F7	0.7	0.8	0.028	0.031
F8	0.65	0.7	0.026	0.028
F9	0.62	0.67	0.024	0.026
F10	4.9	5	0.193	0.197
F11	4.46	4.56	0.176	0.18

如需了解针对 PCB 设计的建议电路布局，请参阅*《通过 PCB 布局技巧来减少振铃》*(SLPA005)。

7.3 建议模板开口



7.4 Q5A 卷带信息



注：

1. 10 链轮孔距累积容差为 ±0.2。
2. 每 100mm 长度的翘曲不能超过 1mm，在 250mm 长度上不累积。
3. 材料：黑色抗静电聚苯乙烯。
4. 全部尺寸为 mm（除非另外注明）。
5. 高于孔眼底部 0.3mm 的平面上测量得到 A0 和 B0 值.

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PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
CSD18531Q5A	ACTIVE	VSONP	DQJ	8	2500	RoHS-Exempt & Green	SN	Level-1-260C-UNLIM	-55 to 150	CSD18531	Samples
CSD18531Q5AT	ACTIVE	VSONP	DQJ	8	250	RoHS-Exempt & Green	SN	Level-1-260C-UNLIM	-55 to 150	CSD18531	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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