



# CSD16556Q5B 25V N 沟道 NexFET™ 功率金属氧化物半导体场效应晶体管 (MOSFET)

## 1 特性

- 超低电阻
- 超低  $Q_g$  和  $Q_{gd}$
- 低热阻
- 雪崩级
- 无铅引脚镀层
- 符合 RoHS 标准
- 无卤素
- 小外形尺寸无引线 (SON) 5mm x 6mm 塑料封装

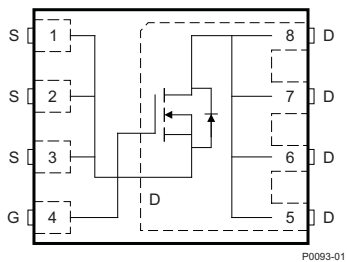
## 2 应用范围

- 网络互联、电信和计算系统中的负载点同步降压
- 已针对同步场效应晶体管 (FET) 应用进行优化

## 3 说明

这款 25V、0.9mΩ、5mm × 6mm SON NexFET™ 功率 MOSFET 设计用于大大降低同步整流和其它功率转换应用中的损耗。

顶视图

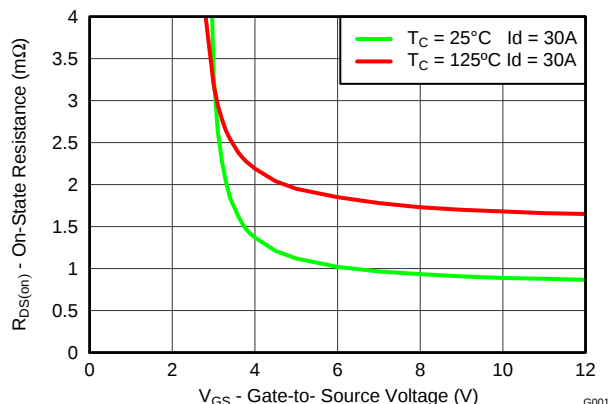


P0093-01

产品概要

| $T_A = 25^\circ\text{C}$ |      | 典型值 | 单位 |
|--------------------------|------|-----|----|
| $V_{DS}$                 | 漏源电压 | 25  | V  |

$R_{DS(on)}$  与  $V_{GS}$  间的关系



产品概要 (接下页)

| $T_A = 25^\circ\text{C}$ |               | 典型值                    |     | 单位 |
|--------------------------|---------------|------------------------|-----|----|
| $Q_g$                    | 栅极电荷总量 (4.5V) | 36                     |     | nC |
| $Q_{gd}$                 | 栅极电荷 (栅极到漏极)  | 12                     |     | nC |
| $R_{DS(on)}$             | 漏源导通电阻        | $V_{GS} = 4.5\text{V}$ | 1.2 | mΩ |
|                          |               | $V_{GS} = 10\text{V}$  | 0.9 | mΩ |
| $V_{GS(th)}$             | 阈值电压          | 1.4                    |     | V  |

订购信息<sup>(1)</sup>

| 器件           | 介质      | 数量   | 封装                 | 出货   |
|--------------|---------|------|--------------------|------|
| CSD16556Q5B  | 13 英寸卷带 | 2500 | SON 5mm x 6mm 塑料封装 | 卷带封装 |
| CSD16556Q5BT | 7 英寸卷带  | 250  |                    |      |

(1) 要了解所有可用封装, 请见数据表末尾的可订购产品附录。

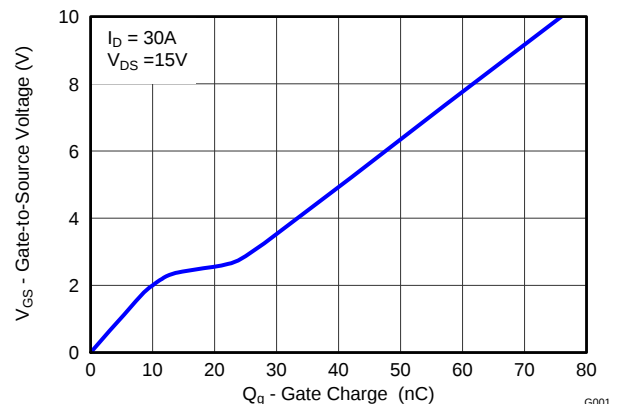
绝对最大额定值

| $T_A = 25^\circ\text{C}$ |                                                                           | 值         | 单位 |
|--------------------------|---------------------------------------------------------------------------|-----------|----|
| $V_{DS}$                 | 漏源电压                                                                      | 25        | 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), $T_C = 25^\circ\text{C}$ 时测得                              | 263       |    |
|                          | 持续漏极电流 <sup>(1)</sup>                                                     | 40        |    |
| $I_{DM}$                 | 脉冲漏极电流 <sup>(2)</sup>                                                     | 400       | A  |
| $P_D$                    | 功率耗散 <sup>(1)</sup>                                                       | 3.2       | W  |
|                          | 功率耗散, $T_C = 25^\circ\text{C}$                                            | 191       |    |
| $T_J$ ,<br>$T_{stg}$     | 运行结温和<br>储存温度范围                                                           | -55 至 150 | °C |
| $E_{AS}$                 | 雪崩能量, 单一脉冲<br>$I_D = 103\text{A}$ , $L = 0.1\text{mH}$ , $R_G = 25\Omega$ | 530       | mJ |

(1)  $R_{\theta JA} = 40^\circ\text{C/W}$ , 这是在一块厚度为 0.06 英寸 (1.52mm) 的 FR4 印刷电路板 (PCB) 上的一英寸<sup>2</sup> (6.45cm<sup>2</sup>), 2 盎司 (厚度 0.071mm) 的铜过渡垫片上测得的典型值。

(2) 最大  $R_{\theta JC} = 1.3^\circ\text{C/W}$ , 脉冲持续时间  $\leq 100\mu\text{s}$ , 占空比  $\leq 1\%$

栅极电荷



## 目录

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## 4 修订历史记录

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| <b>Changes from Revision B (January 2013) to Revision C</b>                    | <b>Page</b> |
|--------------------------------------------------------------------------------|-------------|
| • 已将器件编号添加至标题 .....                                                            | 1           |
| • 已在订购信息中添加“7 英寸卷带” .....                                                      | 1           |
| • 已将最大脉冲电流增加至 400A .....                                                       | 1           |
| • 已添加外壳温度保持在 25°C 时的最大功耗一行 .....                                               | 1           |
| • 已更新脉冲电流条件 .....                                                              | 1           |
| • Updated <a href="#">Figure 1</a> to a normalized $R_{\theta JC}$ curve ..... | 4           |
| • Updated the SOA in <a href="#">Figure 10</a> .....                           | 6           |
| • 已更新机械制图和尺寸表 .....                                                            | 8           |

| <b>Changes from Revision A (December 2012) to Revision B</b>              | <b>Page</b> |
|---------------------------------------------------------------------------|-------------|
| • Changed $g_{fs}$ , Transconductance TYP value From: 2 S To: 191 S ..... | 3           |

| <b>Changes from Original (November 2012) to Revision A</b> | <b>Page</b> |
|------------------------------------------------------------|-------------|
| • 已将器件状态从“产品预览”更改为“量产数据” .....                             | 1           |

## 5 Specifications

### 5.1 Electrical Characteristics

(T<sub>A</sub> = 25°C unless otherwise stated)

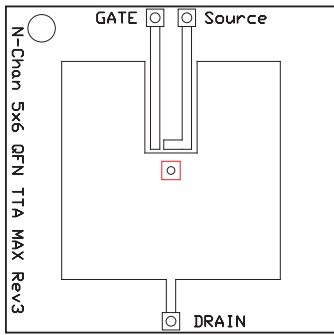
| PARAMETER               |                                  | TEST CONDITIONS                                                                                  | MIN | TYP  | MAX  | UNIT |
|-------------------------|----------------------------------|--------------------------------------------------------------------------------------------------|-----|------|------|------|
| STATIC CHARACTERISTICS  |                                  |                                                                                                  |     |      |      |      |
| BV <sub>DSS</sub>       | Drain-to-Source Voltage          | V <sub>GS</sub> = 0 V, I <sub>DS</sub> = 250 μA                                                  | 25  |      |      | V    |
| I <sub>DSS</sub>        | Drain-to-Source Leakage Current  | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 24 V                                                    |     |      | 1    | μA   |
| I <sub>GSS</sub>        | Gate-to-Source Leakage Current   | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = 20 V                                                    |     |      | 100  | nA   |
| V <sub>GS(th)</sub>     | Gate-to-Source Threshold Voltage | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>DS</sub> = 250 μA                                     | 1.2 | 1.4  | 1.7  | V    |
| R <sub>DS(on)</sub>     | Drain-to-Source On-Resistance    | V <sub>GS</sub> = 4.5 V, I <sub>DS</sub> = 30 A                                                  |     | 1.2  | 1.5  | mΩ   |
|                         |                                  | V <sub>GS</sub> = 10 V, I <sub>DS</sub> = 30 A                                                   |     | 0.9  | 1.07 | mΩ   |
| g <sub>fs</sub>         | Transconductance                 | V <sub>DS</sub> = 15 V, I <sub>DS</sub> = 30 A                                                   |     | 191  |      | S    |
| DYNAMIC CHARACTERISTICS |                                  |                                                                                                  |     |      |      |      |
| C <sub>iSS</sub>        | Input Capacitance                | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 15 V,<br>f = 1MHz                                       |     | 4750 | 6180 | pF   |
| C <sub>oSS</sub>        | Output Capacitance               |                                                                                                  |     | 2270 | 2950 | pF   |
| C <sub>rSS</sub>        | Reverse Transfer Capacitance     |                                                                                                  |     | 220  | 280  | pF   |
| R <sub>G</sub>          | Series Gate Resistance           |                                                                                                  |     | 0.7  | 1.4  | Ω    |
| Q <sub>g</sub>          | Gate Charge Total (4.5 V)        | V <sub>DS</sub> = 15 V, I <sub>DS</sub> = 30 A                                                   |     | 36   | 47   | nC   |
| Q <sub>gd</sub>         | Gate Charge Gate-to-Drain        |                                                                                                  |     | 12   |      | nC   |
| Q <sub>gs</sub>         | Gate Charge Gate-to-Source       |                                                                                                  |     | 11   |      | nC   |
| Q <sub>g(th)</sub>      | Gate Charge at V <sub>th</sub>   |                                                                                                  |     | 7    |      | nC   |
| Q <sub>oSS</sub>        | Output Charge                    | V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V                                                    |     | 45   |      | nC   |
| t <sub>d(on)</sub>      | Turn On Delay Time               | V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 4.5 V,<br>I <sub>DS</sub> = 30 A, R <sub>G</sub> = 2 Ω |     | 17   |      | ns   |
| t <sub>r</sub>          | Rise Time                        |                                                                                                  |     | 34   |      | ns   |
| t <sub>d(off)</sub>     | Turn Off Delay Time              |                                                                                                  |     | 25   |      | ns   |
| t <sub>f</sub>          | Fall Time                        |                                                                                                  |     | 13   |      | ns   |
| DIODE CHARACTERISTICS   |                                  |                                                                                                  |     |      |      |      |
| V <sub>SD</sub>         | Diode Forward Voltage            | I <sub>SD</sub> = 30 A, V <sub>GS</sub> = 0 V                                                    |     | 0.8  | 1    | V    |
| Q <sub>rr</sub>         | Reverse Recovery Charge          | V <sub>DD</sub> = 15 V, I <sub>F</sub> = 30 A, di/dt = 300 A/μs                                  |     | 84   |      | nC   |
| t <sub>rr</sub>         | Reverse Recovery Time            |                                                                                                  |     | 41   |      | ns   |

### 5.2 Thermal Information

(T<sub>A</sub> = 25°C unless otherwise stated)

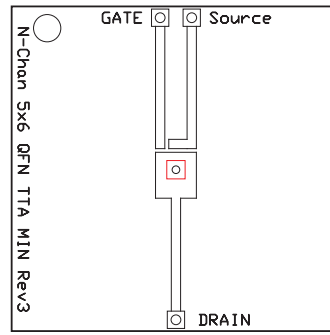
| THERMAL METRIC   |                                                          | MIN | TYP | MAX | UNIT |
|------------------|----------------------------------------------------------|-----|-----|-----|------|
| R <sub>θJC</sub> | Junction-to-Case Thermal Resistance <sup>(1)</sup>       |     |     | 1.3 | °C/W |
| R <sub>θJA</sub> | Junction-to-Ambient Thermal Resistance <sup>(1)(2)</sup> |     |     | 50  |      |

- (1) R<sub>θJC</sub> is determined with the device mounted on a 1-inch<sup>2</sup> (6.45-cm<sup>2</sup>), 2-oz. (0.071-mm thick) Cu pad on a 1.5-inches × 1.5-inches (3.81-cm × 3.81-cm), 0.06-inch (1.52-mm) thick FR4 PCB. R<sub>θJC</sub> is specified by design, whereas R<sub>θJA</sub> is determined by the user's board design.
- (2) Device mounted on FR4 material with 1-inch<sup>2</sup> (6.45-cm<sup>2</sup>), 2-oz. (0.071-mm thick) Cu.



M0137-01

Max  $R_{\theta JA} = 50^{\circ}\text{C/W}$   
when mounted on  
1 inch<sup>2</sup> (6.45 cm<sup>2</sup>) of  
2-oz. (0.071-mm thick)  
Cu.

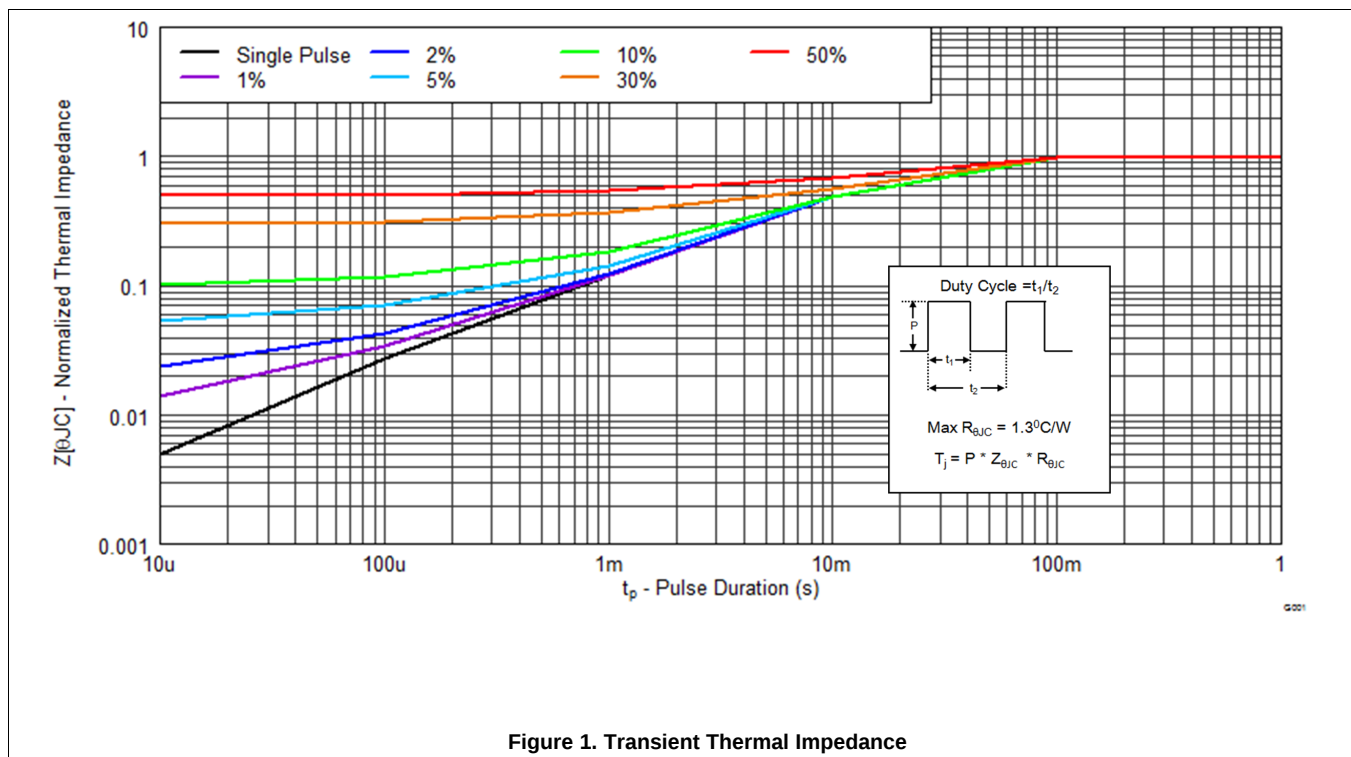


M0137-02

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

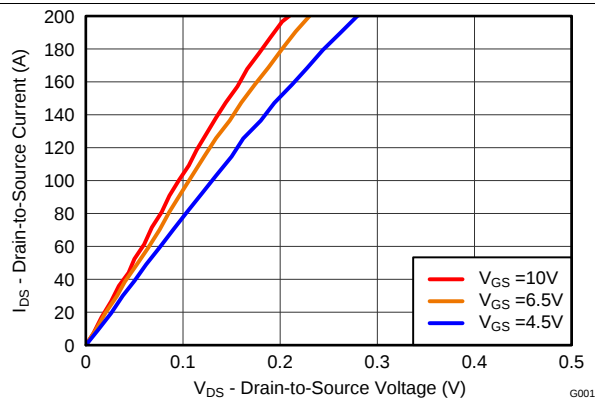
### 5.3 Typical MOSFET Characteristics

( $T_A = 25^{\circ}\text{C}$  unless otherwise stated)

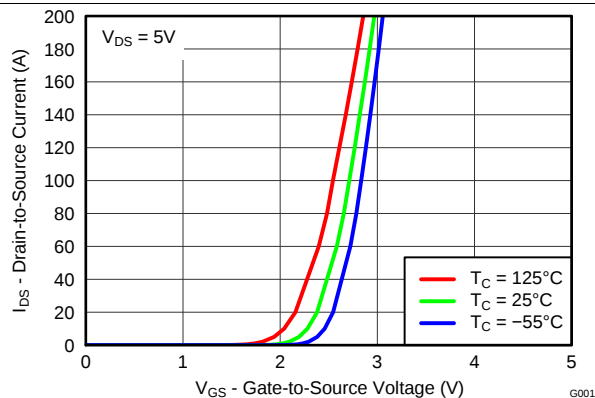


## Typical MOSFET Characteristics (continued)

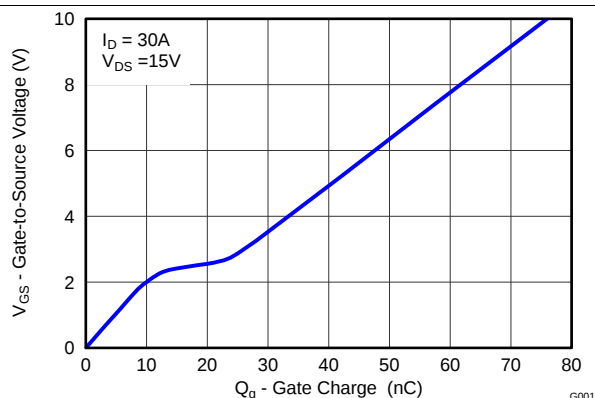
( $T_A = 25^\circ\text{C}$  unless otherwise stated)



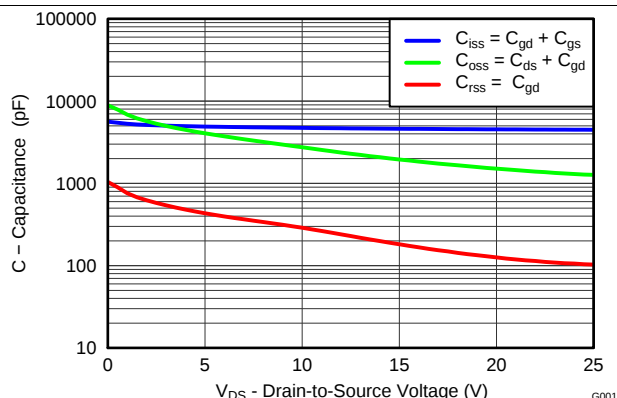
**Figure 2. Saturation Characteristics**



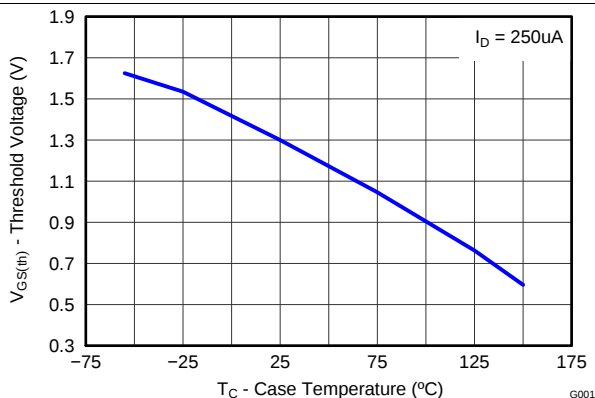
**Figure 3. Transfer Characteristics**



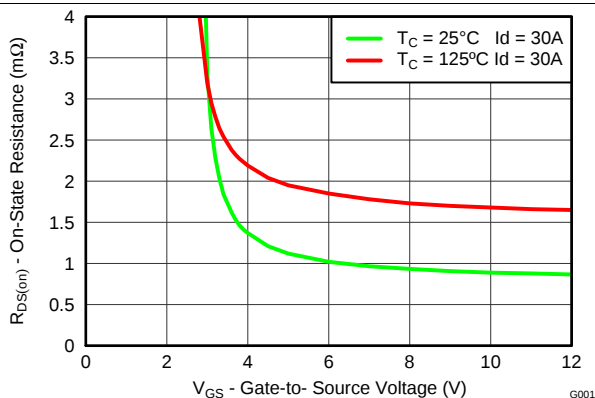
**Figure 4. Gate Charge**



**Figure 5. Capacitance**



**Figure 6. Threshold Voltage vs Temperature**



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

## Typical MOSFET Characteristics (continued)

( $T_A = 25^\circ\text{C}$  unless otherwise stated)

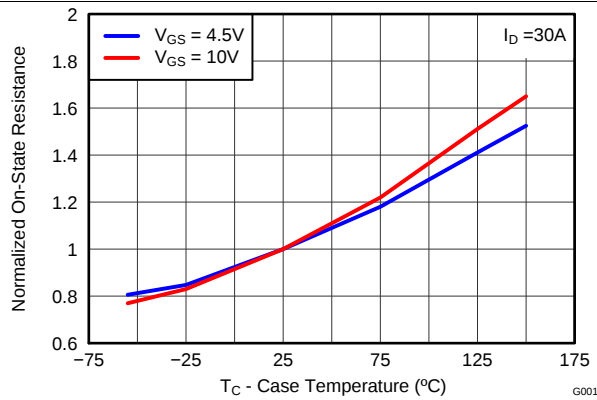


Figure 8. Normalized On-State Resistance vs Temperature

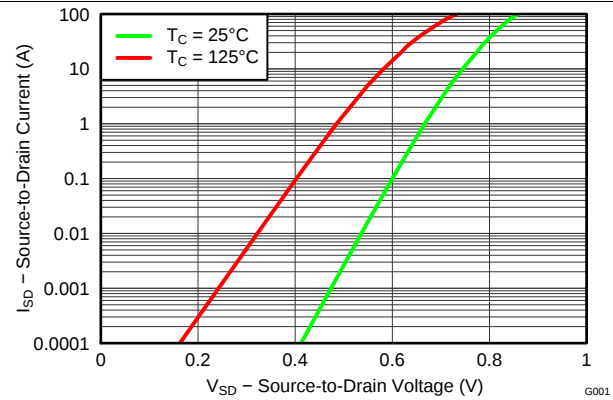


Figure 9. Typical Diode Forward Voltage

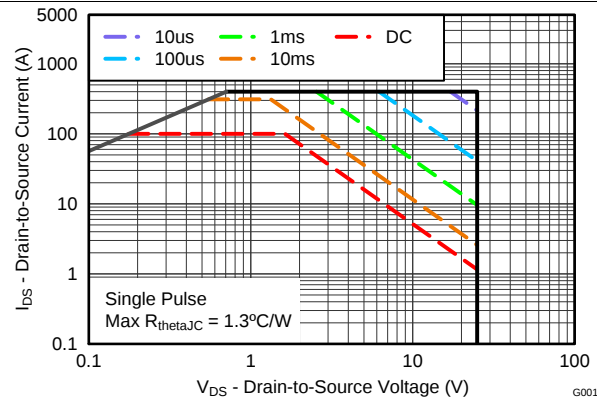


Figure 10. Maximum Safe Operating Area (SOA)

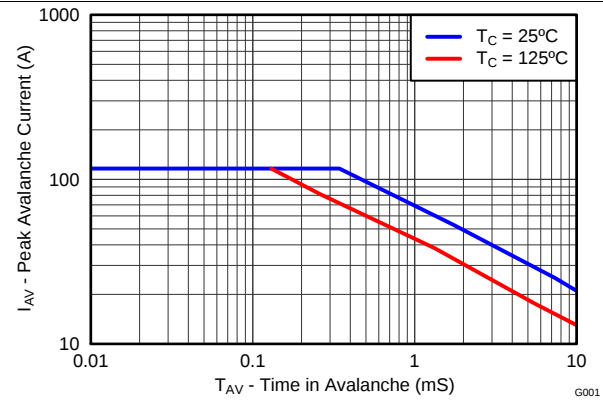


Figure 11. Single Pulse Unclamped Inductive Switching

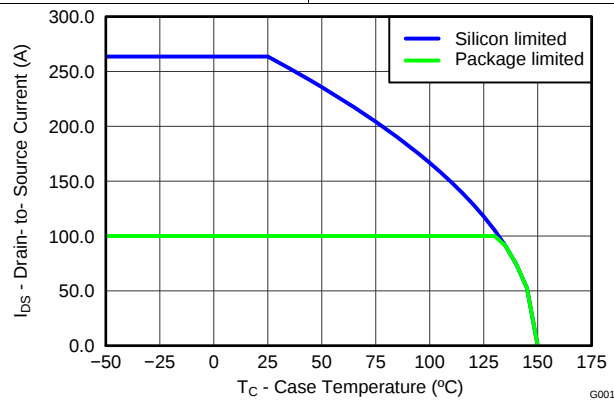


Figure 12. Maximum Drain Current vs Temperature

## 6 器件和文档支持

### 6.1 商标

NexFET is a trademark of Texas Instruments.

All other trademarks are the property of their respective owners.

### 6.2 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。

### 6.3 术语表

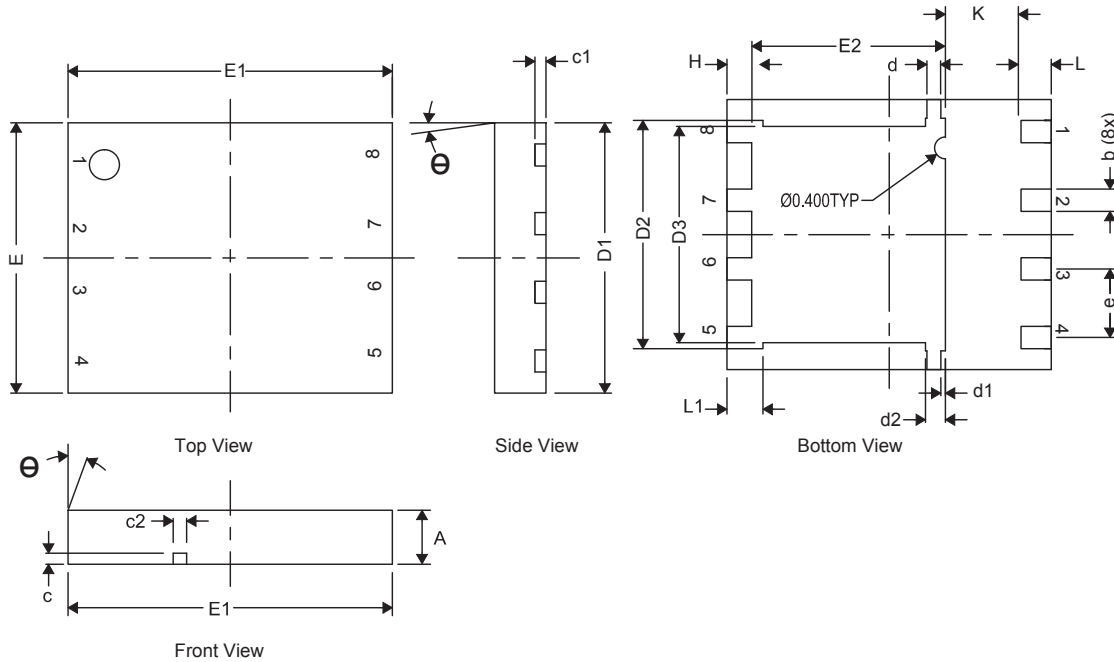
[SLYZ022](#) — TI 术语表。

这份术语表列出并解释术语、首字母缩略词和定义。

## 7 机械、封装和可订购信息

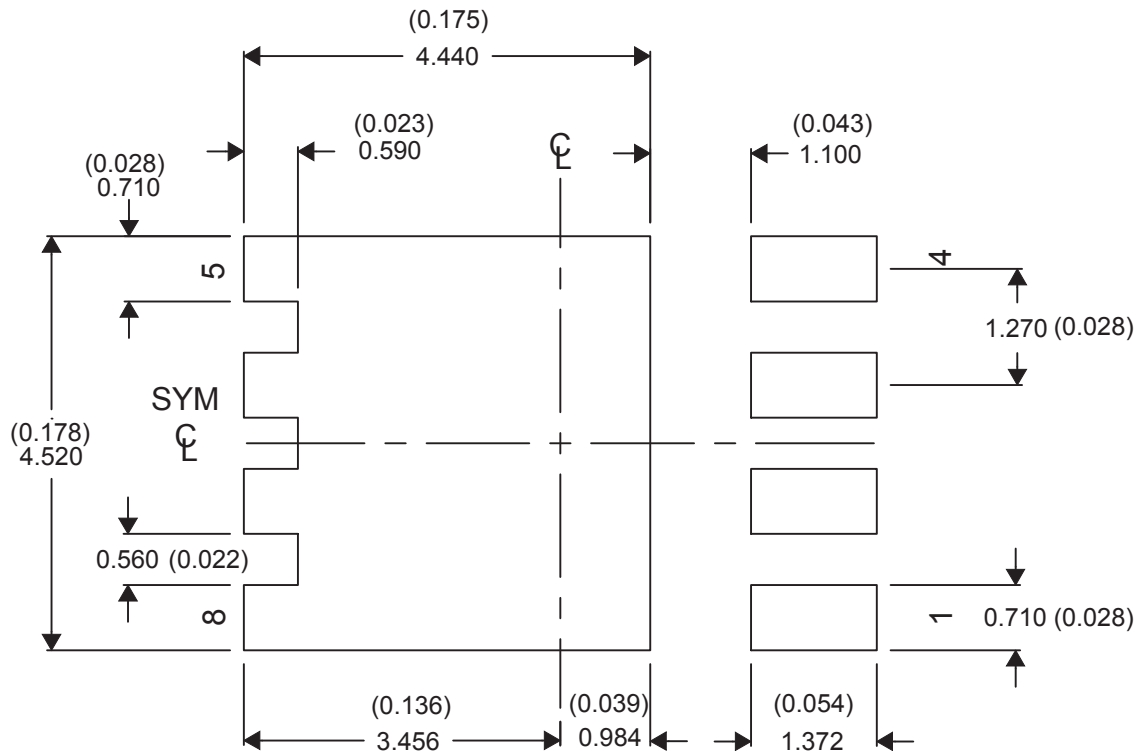
以下页中包括机械、封装和可订购信息。 这些信息是针对指定器件可提供的最新数据。 这些数据会在无通知且不对本文档进行修订的情况下发生改变。 要获得这份数据表的浏览器版本，请查阅左侧的导航栏。

### 7.1 Q5B 封装尺寸



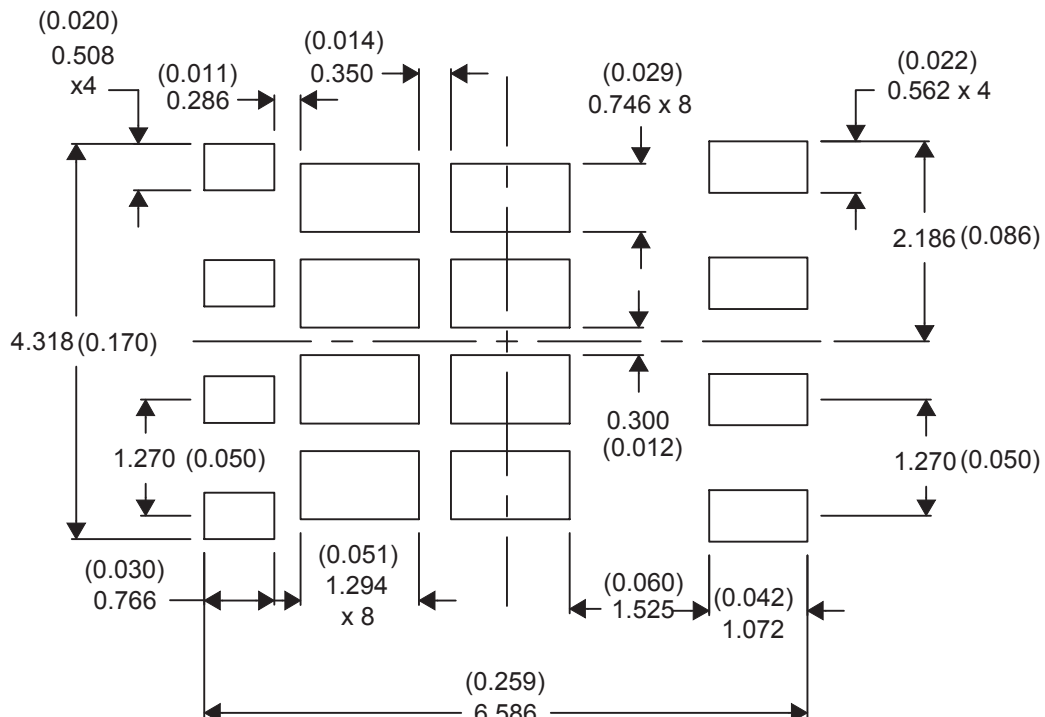
| DIM | 毫米        |       |       |
|-----|-----------|-------|-------|
|     | 最小值       | 标称值   | 最大值   |
| A   | 0.80      | 1.00  | 1.05  |
| b   | 0.36      | 0.41  | 0.46  |
| c   | 0.15      | 0.20  | 0.25  |
| c1  | 0.15      | 0.20  | 0.25  |
| c2  | 0.20      | 0.25  | 0.30  |
| D1  | 4.90      | 5.00  | 5.10  |
| D2  | 4.12      | 4.22  | 4.32  |
| D3  | 3.90      | 4.00  | 4.10  |
| d   | 0.20      | 0.25  | 0.30  |
| d1  | 0.085 典型值 |       |       |
| d2  | 0.319     | 0.369 | 0.419 |
| E   | 4.90      | 5.00  | 5.10  |
| E1  | 5.90      | 6.00  | 6.10  |
| E2  | 3.48      | 3.58  | 3.68  |
| e   | 1.27 典型值  |       |       |
| H   | 0.36      | 0.46  | 0.56  |
| L   | 0.46      | 0.56  | 0.66  |
| L1  | 0.57      | 0.67  | 0.77  |
| θ   | 0°        | —     | —     |
| K   | 1.40 典型值  |       |       |

## 7.2 建议 PCB 布局

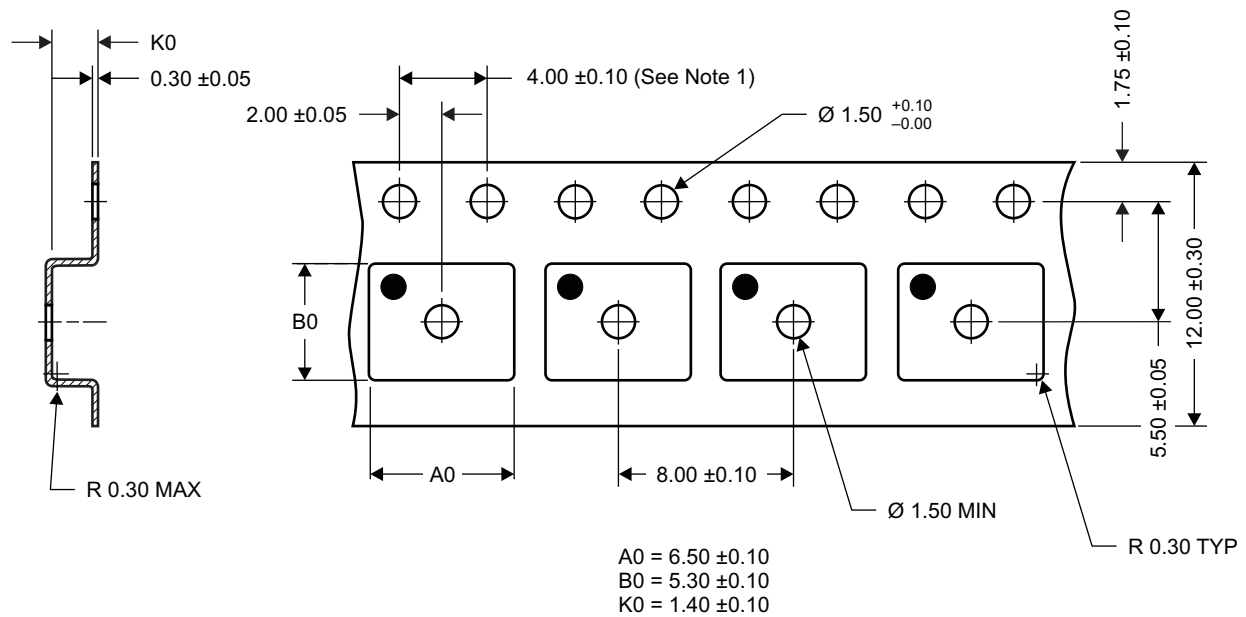


要获得与印刷电路板 (PCB) 设计相关的建议电路布局布线, 请参见《应用说明》[SLPA005](#) - 通过 PCB 布局布线技巧来减少振铃。

## 7.3 建议模板布局



## 7.4 Q5B 卷带信息



M0138-01

### 注释:

- 10 个链齿孔的累积容差为  $\pm 0.2$
- 每 100mm 长度的翘曲不能超过 1mm，在 250mm 长度上不累积
- 材料：黑色抗静电聚苯乙烯
- 全部尺寸单位为 mm（除非另外注明）。
- 高于孔眼底部 0.3mm 的平面上测量得到 A0 和 B0 值。

## PACKAGING INFORMATION

| Orderable part number       | Status<br>(1) | Material type<br>(2) | Package   Pins      | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|-----------------------------|---------------|----------------------|---------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| <a href="#">CSD16556Q5B</a> | Active        | Production           | VSON-CLIP (DNK)   8 | 2500   LARGE T&R      | ROHS Exempt | SN                                   | Level-1-260C-UNLIM                | -55 to 150   | CSD16556            |
| CSD16556Q5B.B               | Active        | Production           | VSON-CLIP (DNK)   8 | 2500   LARGE T&R      | ROHS Exempt | SN                                   | Level-1-260C-UNLIM                | -55 to 150   | CSD16556            |

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts 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.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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