



CSD18501Q5A 40V N 通道 NexFET™ 功率金属氧化物半导体场效应晶体管 (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
- 小外形尺寸无引线 (SON) 5mm x 6mm 塑料封装

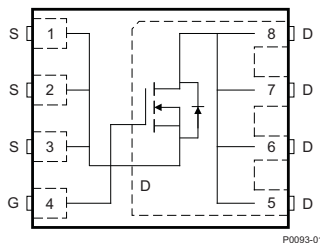
2 应用范围

- 直流 - 直流转换
- 次级侧同步整流
- 电池电机控制

3 说明

这款 40V, 2.5mΩ, SON 5mm × 6mm NexFET™ 功率 MOSFET 被设计成在功率转换应用中最大限度地降低功率损耗。

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	40		V
Q_g	栅极电荷总量 (4.5V)	20		nC
Q_{gd}	栅极电荷 (栅极到漏极)	5.9		nC
$R_{DS(on)}$	漏源导通电阻	$V_{GS} = 4.5\text{V}$	3.3	mΩ
		$V_{GS} = 10\text{V}$	2.5	mΩ
$V_{GS(th)}$	阈值电压	1.8		V

订购信息⁽¹⁾

器件	数量	介质	封装	出货
CSD18501Q5A	2500	13 英寸卷带	SON 5mm × 6mm 塑料封装	卷带封装
CSD18501Q5AT	250	7 英寸卷带		

(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。

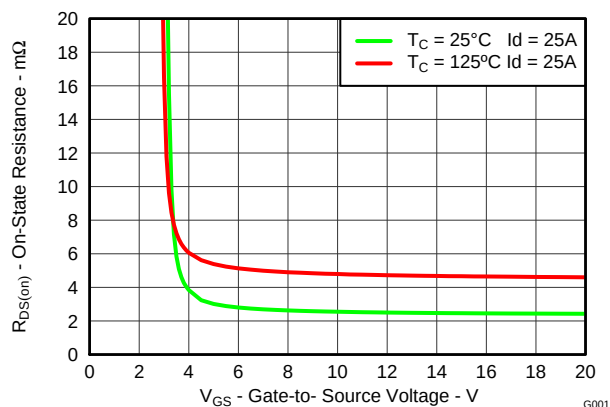
最大绝对额定值

$T_A = 25^\circ\text{C}$		值	单位
V_{DS}	漏源电压	40	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	161	
	持续漏极电流 ⁽¹⁾	22	
I_{DM}	脉冲漏极电流 ⁽²⁾	400	A
P_D	功率耗散 ⁽¹⁾	3.1	W
	功耗, $T_C = 25^\circ\text{C}$	150	
T_J , T_{stg}	运行结温和 储存温度范围	-55 至 150	°C
E_{AS}	雪崩能量, 单一脉冲 $I_D=68\text{A}$, $L=0.1\text{mH}$, $R_G=25\Omega$	231	mJ

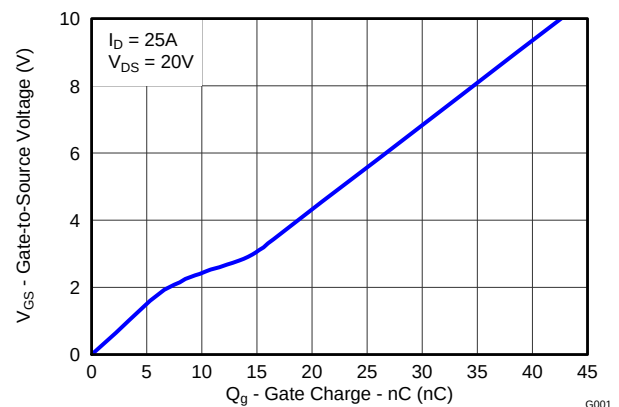
(1) $R_{\theta JA} = 40^\circ\text{C/W}$, 这是在一个厚度 0.06 英寸环氧树脂 (FR4) 印刷电路板 (PCB) 上的 1 英寸², 2 盎司 的铜过渡垫片上测得的典型值。

(2) 最大 $R_{\theta JC} = 1.0^\circ\text{C/W}$, 脉冲持续时间 $\leq 100\mu\text{s}$, 占空比 $\leq 1\%$

$R_{DS(on)}$ 与 V_{GS} 间的关系



栅极电荷



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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.

Changes from Revision B (October 2012) to Revision C	Page
• 已添加器件编号至标题.....	1
• 在订购信息表中添加了 7 英寸卷带.....	1
• 已将受芯片限制的持续漏极电流增加至 161A.....	1
• 已将脉冲漏极电流增加至 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 Figure 1 to a normalized $R_{\theta JC}$ curve.....	4
• Updated the SOA in Figure 9.....	6
• 已添加建议模板开口.....	9

Changes from Revision A (June 2012) to Revision B	Page
• Changed the Transconductance TYP value From: 142 S To: 118 S.....	3
• Changed the Turn On and Turn Off Delay Time, Rise and Fall Time Test Conditions From: $I_{DS} = 25\text{ A}$, $R_G = 2\ \Omega$ To: $I_{DS} = 25\text{ A}$, $R_G = 0\ \Omega$	3
• Changed the Q_{rr} Reverse Recovery Charge TYP value From: 21 nC To: 70 nC.....	3

Changes from Original (June 2012) to Revision A	Page
• 已添加“ $T_A = 25^\circ\text{C}$ ”至产品概要表.....	1

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	40			V
I _{DSS}	Drain-to-Source Leakage Current	V _{GS} = 0 V, V _{DS} = 32 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	1.4	1.8	2.3	V
R _{DS(on)}	Drain-to-Source On-Resistance	V _{GS} = 4.5 V, I _D = 25 A	3.3		4.3	mΩ
		V _{GS} = 10 V, I _D = 25 A	2.5		3.2	mΩ
g _{fs}	Transconductance	V _{DS} = 20 V, I _D = 25 A	118			S
DYNAMIC CHARACTERISTICS						
C _{iss}	Input Capacitance	V _{GS} = 0 V, V _{DS} = 20 V, f = 1 MHz	3200		3840	pF
C _{oss}	Output Capacitance		725		870	pF
C _{rss}	Reverse Transfer Capacitance		18		23	pF
R _G	Series Gate Resistance		1.2	2.4		Ω
Q _g	Gate Charge Total (4.5 V)	V _{DS} = 20 V, I _D = 25 A	20	24		nC
Q _g	Gate Charge Total (10 V)		42	50		
Q _{gd}	Gate Charge Gate-to-Drain		5.9			nC
Q _{gs}	Gate Charge Gate-to-Source		8.1			nC
Q _{g(th)}	Gate Charge at V _{th}		5.7			nC
Q _{oss}	Output Charge		V _{DS} = 20 V, V _{GS} = 0 V	48		
t _{d(on)}	Turn On Delay Time	V _{DS} = 20 V, V _{GS} = 10 V, I _{DS} = 25 A, R _G = 0	4.7			ns
t _r	Rise Time		10			ns
t _{d(off)}	Turn Off Delay Time		20			ns
t _f	Fall Time		3.4			ns
DIODE CHARACTERISTICS						
V _{SD}	Diode Forward Voltage	I _{DS} = 25 A, V _{GS} = 0 V	0.8	1		V
Q _{rr}	Reverse Recovery Charge	V _{DS} = 20 V, I _F = 25 A, di/dt = 300 A/μs	70			nC
t _{rr}	Reverse Recovery Time		40			ns

5.2 Thermal Information

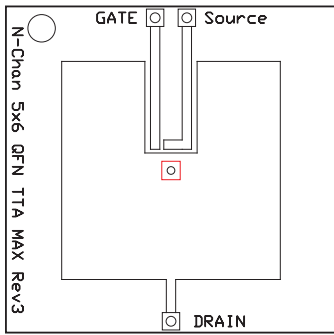
(T_A = 25°C unless otherwise stated)

THERMAL METRIC		MIN	TYP	MAX	UNIT
R _{θJC}	Junction-to-Case Thermal Resistance ⁽¹⁾			1.0	°C/W
R _{θJA}	Junction-to-Ambient Thermal Resistance ⁽¹⁾⁽²⁾			50	

- (1) R_{θJC} is determined with the device mounted on a 1-inch² (6.45-cm²), 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_{θJC} is specified by design, whereas R_{θJA} is determined by the user's board design.
- (2) Device mounted on FR4 material with 1-inch² (6.45-cm²), 2-oz. (0.071-mm thick) Cu.

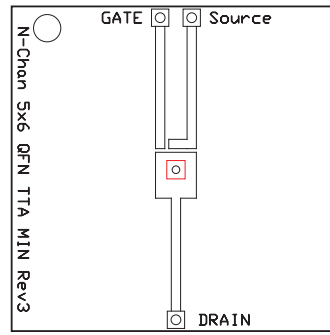
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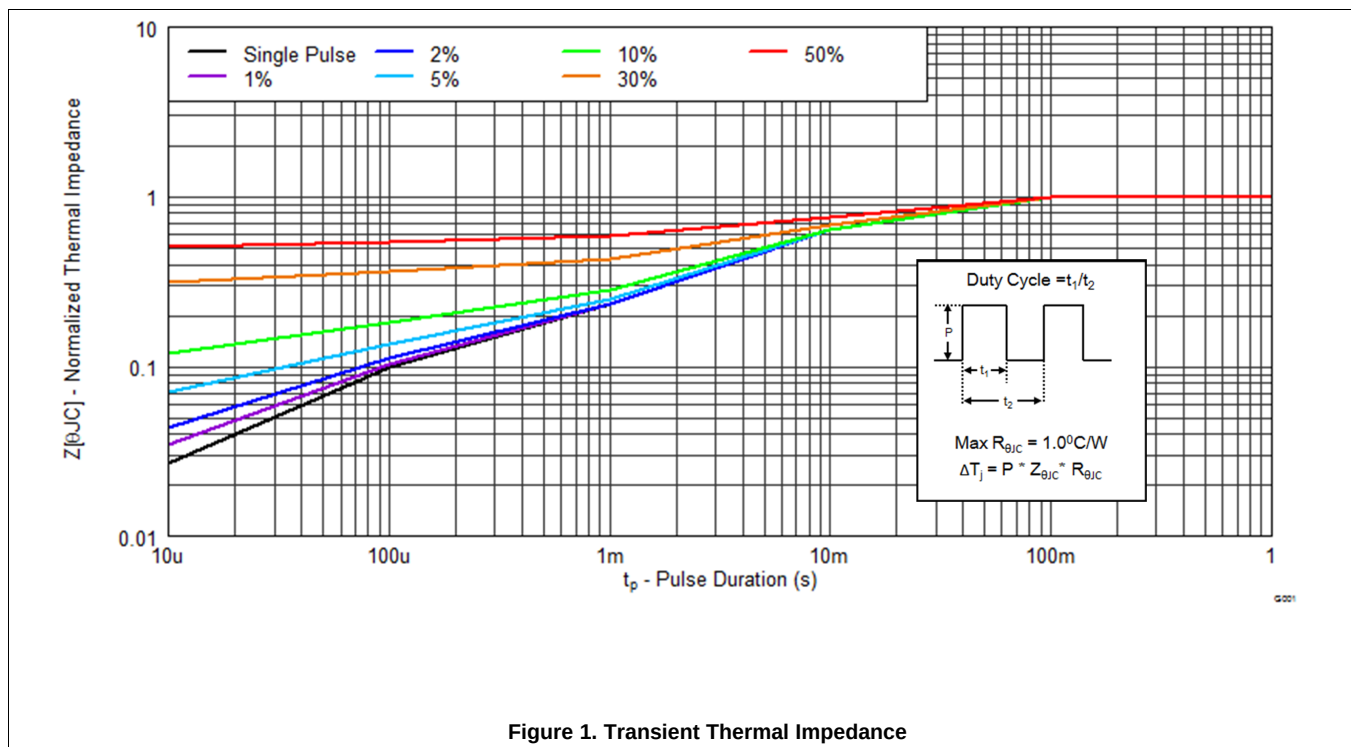
Max $R_{\theta JA} = 50^{\circ}\text{C/W}$
 when mounted on
 1 inch² (6.45-cm²) of
 2-oz. (0.071-mm thick)
 Cu.



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)

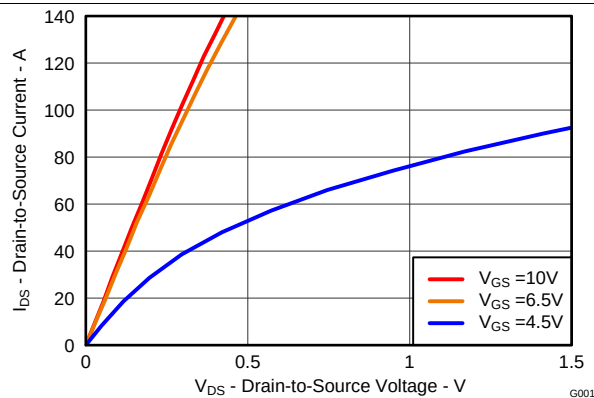


Figure 2. Saturation Characteristics

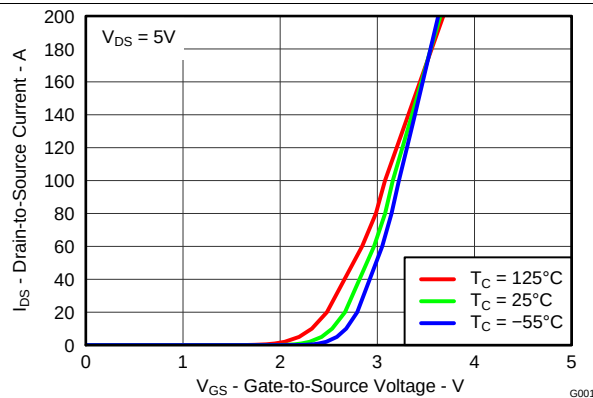


Figure 3. Transfer Characteristics

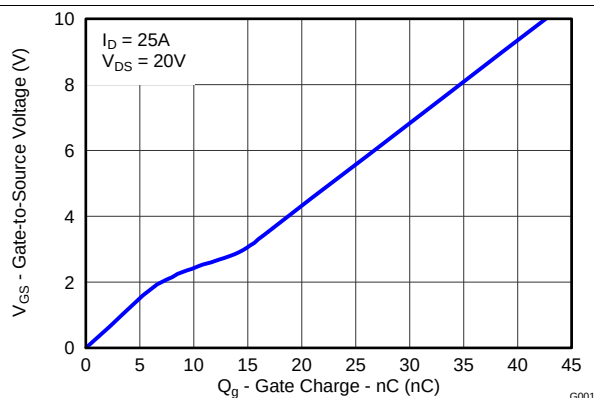


Figure 4. Gate Charge

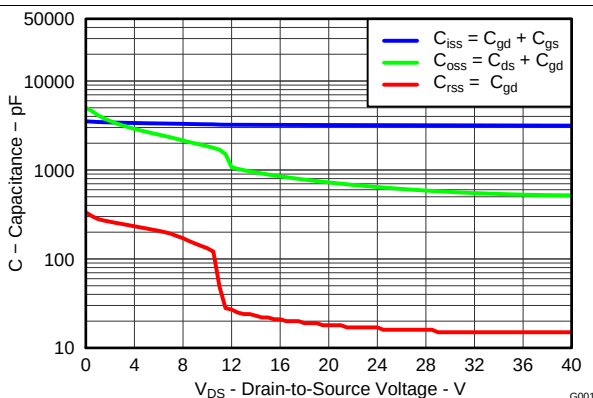


Figure 5. Capacitance

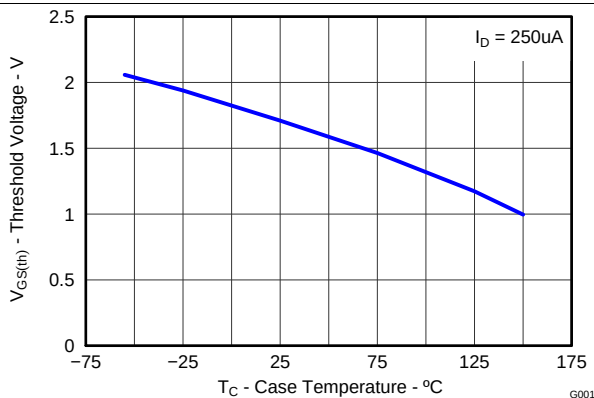


Figure 6. Threshold Voltage vs Temperature

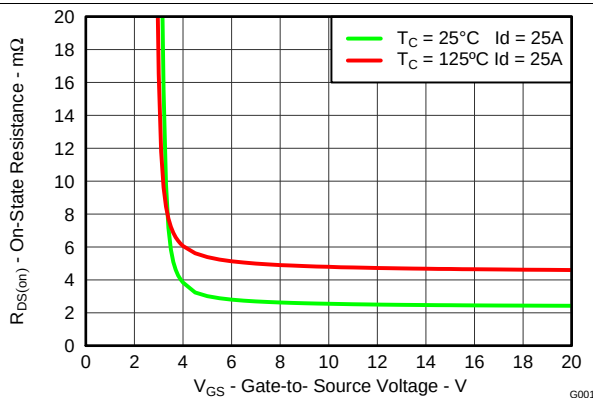


Figure 7. On-State Resistance vs Gate-to-Source Voltage

Typical MOSFET Characteristics (continued)

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

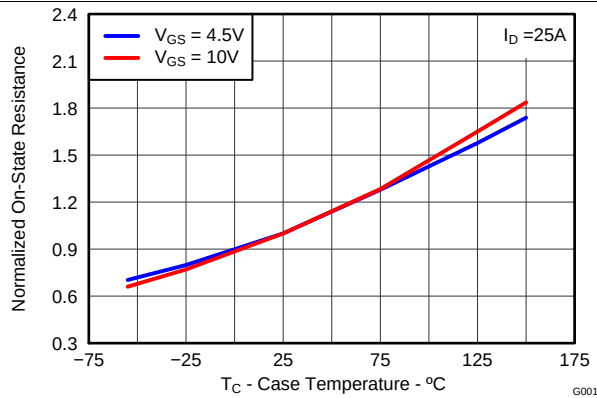


Figure 8. Normalized On-State Resistance vs Temperature

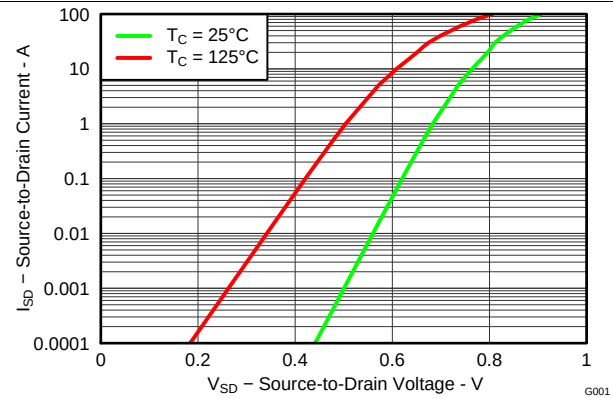


Figure 9. Typical Diode Forward Voltage

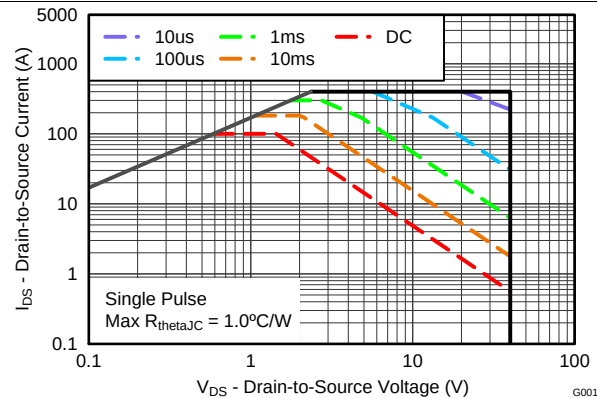


Figure 10. Maximum Safe Operating Area

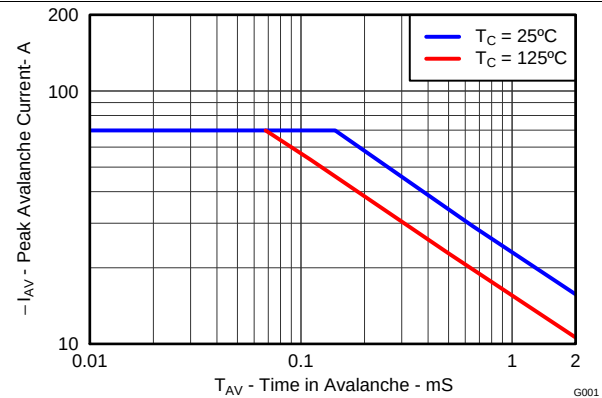


Figure 11. Single Pulse Unclamped Inductive Switching

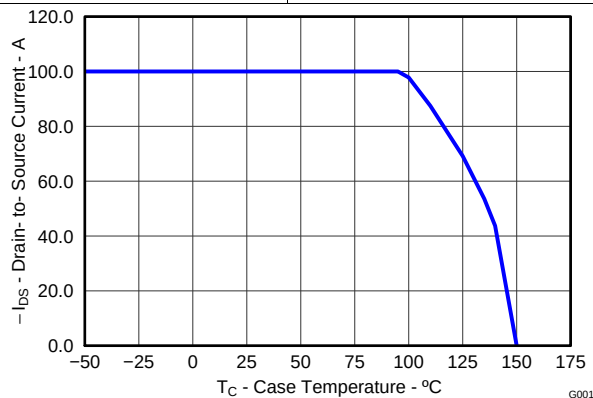


Figure 12. Maximum Drain Current vs Temperature

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

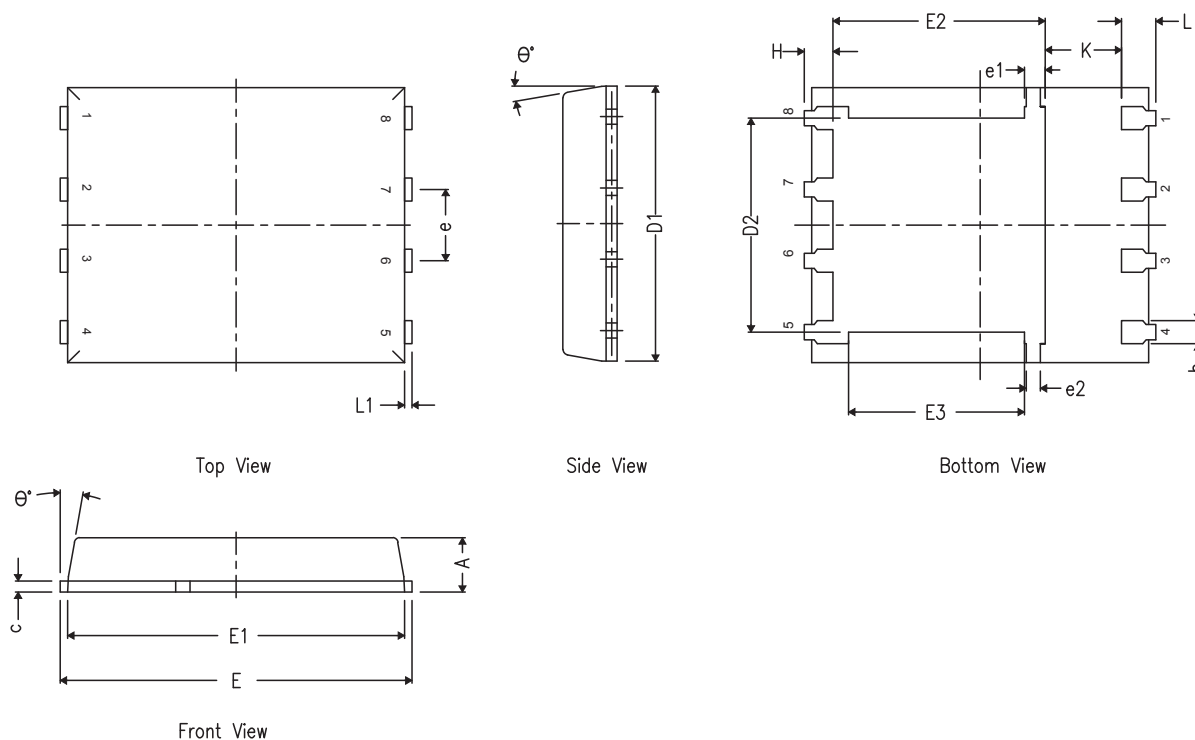
[SLYZ022](#) — *TI* 术语表。

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。 欲获得该数据表的浏览器版本，请查阅左侧的导航栏。

7.1 Q5A 封装尺寸



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
E3	3.03	3.13	3.23
e	1.17	1.27	1.37
e1	0.27	0.37	0.47
e2	0.15	0.25	0.35
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°

PACKAGING INFORMATION

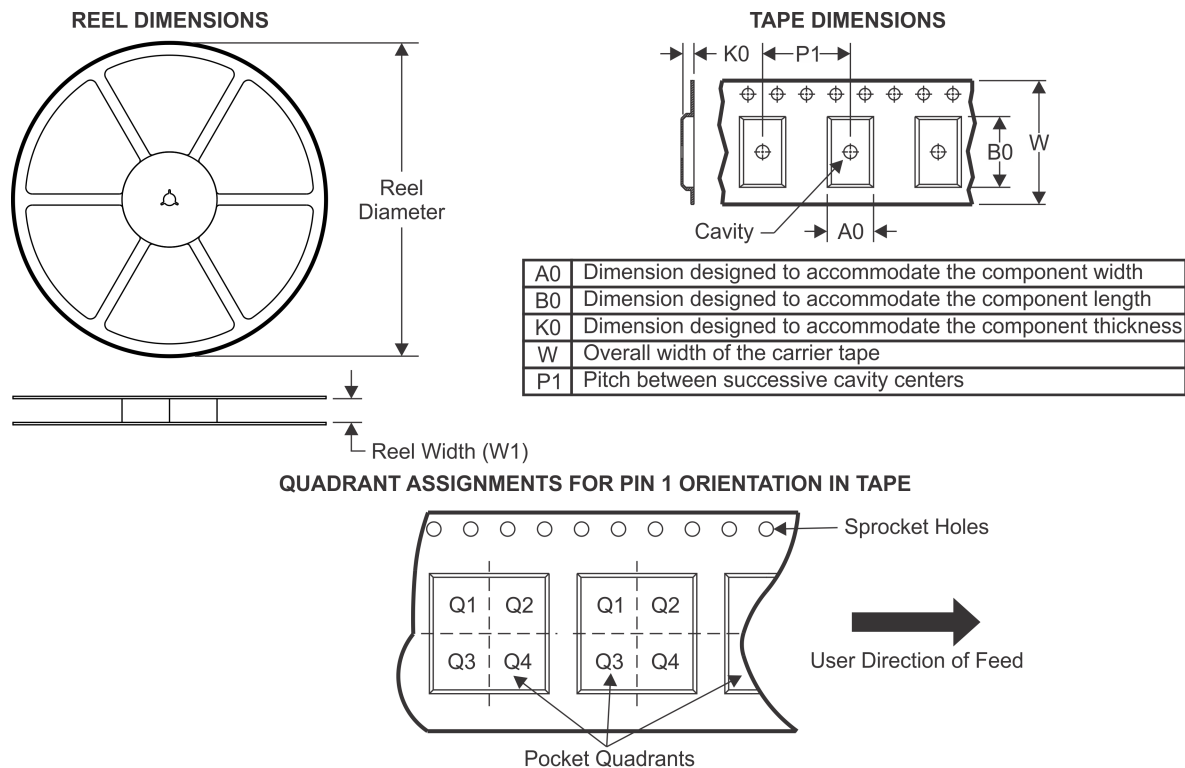
Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
CSD18501Q5A	Active	Production	VSONP (DQJ) 8	2500 LARGE T&R	ROHS Exempt	SN	Level-1-260C-UNLIM	-55 to 150	CSD18501
CSD18501Q5A.B	Active	Production	VSONP (DQJ) 8	2500 LARGE T&R	ROHS Exempt	SN	Level-1-260C-UNLIM	-55 to 150	CSD18501

- ⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).
- ⁽²⁾ **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.
- ⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.
- ⁽⁴⁾ **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.
- ⁽⁵⁾ **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.
- ⁽⁶⁾ **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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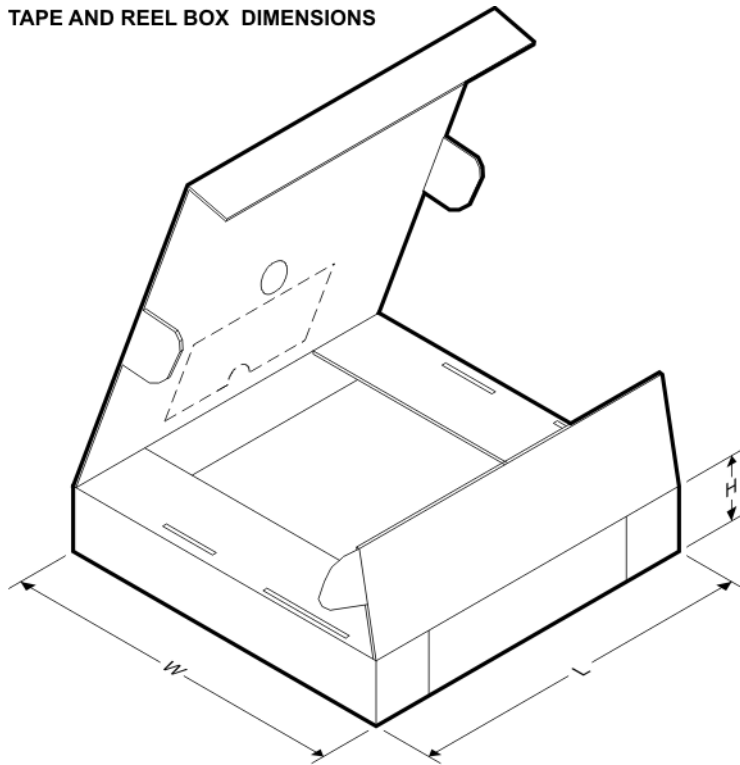
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TAPE AND REEL INFORMATION


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
CSD18501Q5A	VSONP	DQJ	8	2500	330.0	12.4	6.3	5.3	1.2	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CSD18501Q5A	VSONP	DQJ	8	2500	340.0	340.0	38.0



VSONP - 1.1 mm max height

[illegible]

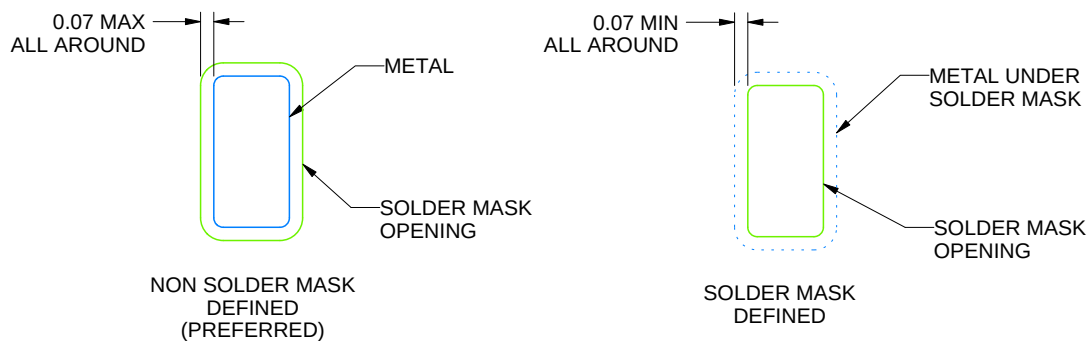
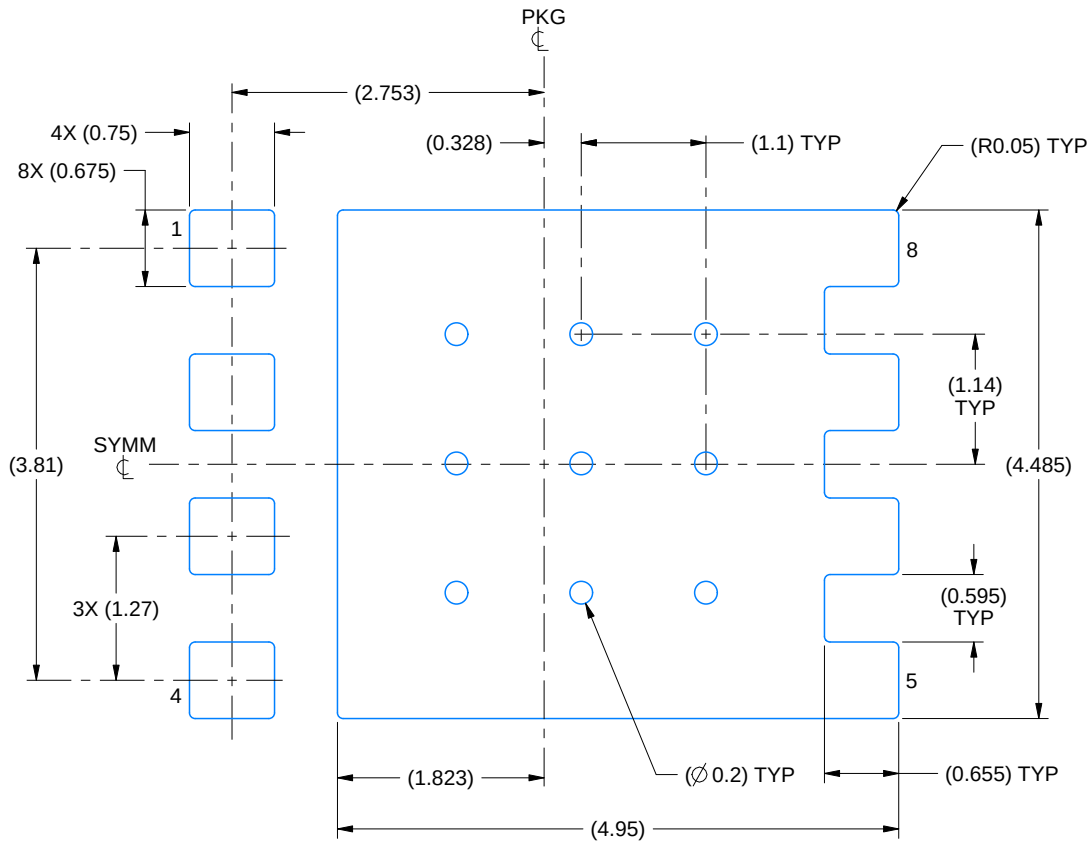
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.
4. Metalized features are supplier options and may not be on the package.
5. These dimensions do not include mold flash protrusions or gate burrs.
6. These dimensions include interterminal flash or protrusion. Interterminal flash or protrusion shall not exceed 0.25 mm per side.

EXAMPLE BOARD LAYOUT

DQJ0008A

VSONP - 1.1 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER MASK DETAILS

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NOTES: (continued)

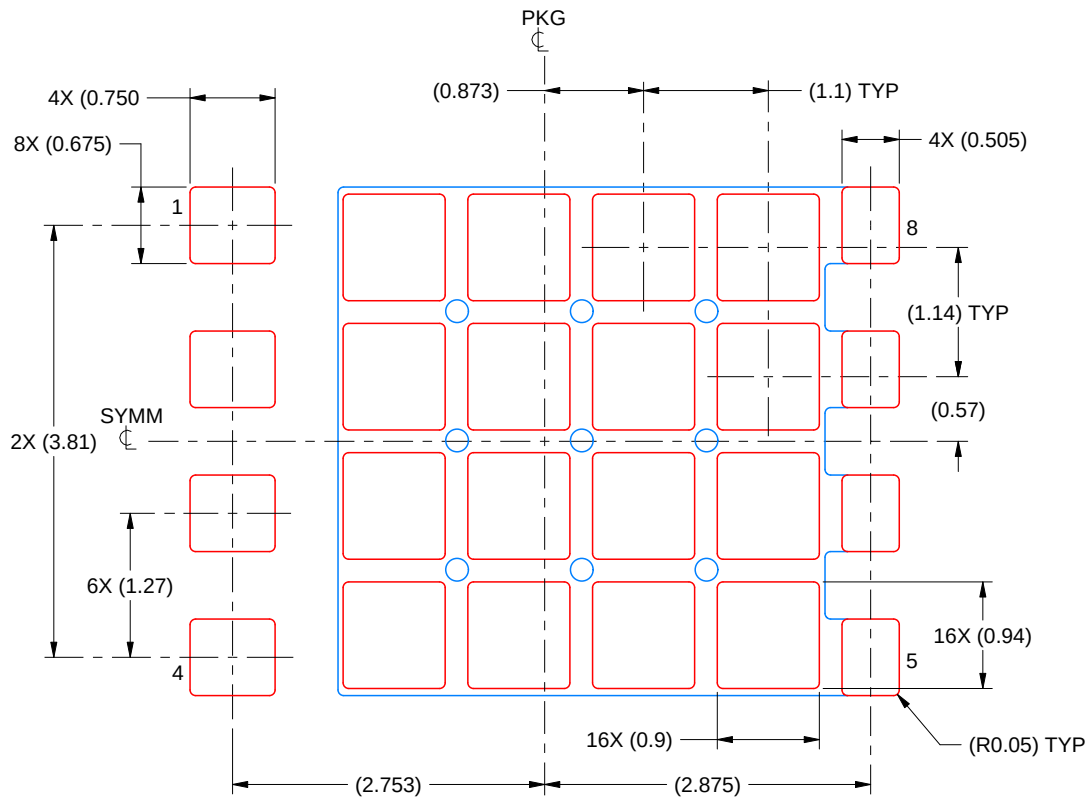
7. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/sluea271).
8. Vias are optional depending on application, refer to device data sheet. If some or all are implemented, recommended via locations are shown.

EXAMPLE STENCIL DESIGN

DQJ0008A

VSONP - 1.1 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD:
70% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
SCALE: 15X

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NOTES: (continued)

9. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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