

CSD95372BQ5M 同步降压 NexFET™ 智能功率级

1 特性

- 60A 持续运行电流能力
- 电流 30A 时，系统效率达到 93.4%
- 电流 30A 时，2.8W 低功率损耗
- 高频运行（高达 1.25MHz）
- 支持强制连续传导模式 (FCCM) 的二极管仿真模式
- 温度补偿双向电流感测
- 模拟温度输出（0°C 时 600mV）
- 故障监控
 - 高端短路、过流和过热保护
- 输入电压高达 14.5V
- 与 3.3 和 5V 脉宽调制 (PWM) 信号兼容
- 三态 PWM 输入
- 集成型自举二极管
- 针对击穿保护的经优化死区时间
- 高密度小外形尺寸无引线 (SON) 5mm x 6mm 封装
- 超低电感封装
- 系统已优化的印刷电路板 (PCB) 封装
- 双冷却封装
- 符合 RoHS 绿色环保标准-无铅端子镀层
- 无卤素

2 应用范围

- 多相位同步降压转换器
 - 高频应用
 - 高电流、低占空比应用
- 负载点 (POL) 直流 - 直流转换器
- 内存和图形卡
- 台式机和服务器 VR11.x / VR12.x V 内核和存储器同步转换器

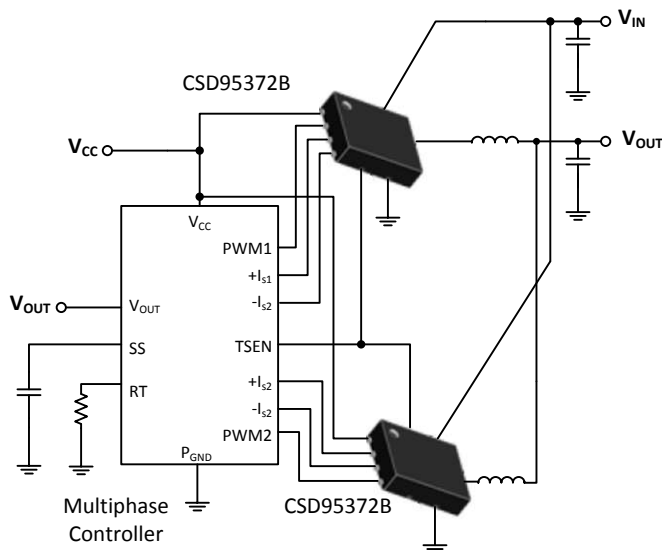
3 说明

CSD95372BQ5M NexFET™ 功率级的设计针对高功率、高密度同步降压转换器中的使用进行了高度优化。这个产品集成了驱动器集成电路 (IC) 和功率金属氧化物半导体场效应晶体管 (MOSFET) 来完善功率级开关功能。这个组合在小型 5mm x 6mm 外形尺寸封装中提供高电流、高效和高速开关功能。它还集成了准确电流感测和温度感测功能，以简化系统设计并提高准确度。此外，已经 PCB 封装进行了优化以帮助减少设计时间并简化总体系统设计的完成。

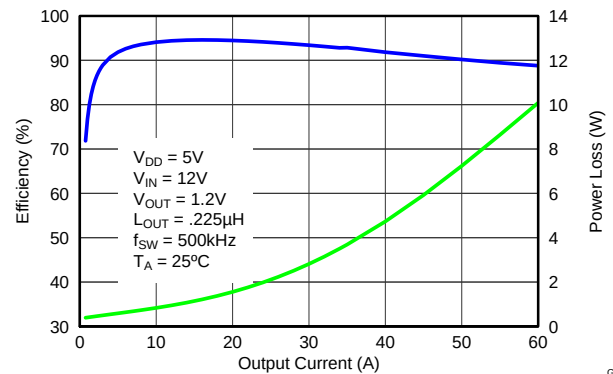
器件信息

器件	介质	数量	封装	出货
CSD95372BQ5M	13 英寸卷带	2500	SON 5mm x 6mm 封装	卷带封装
CSD95372BQ5MT	7 英寸卷带	250		

应用图表



典型功率级效率与功率损耗



G001



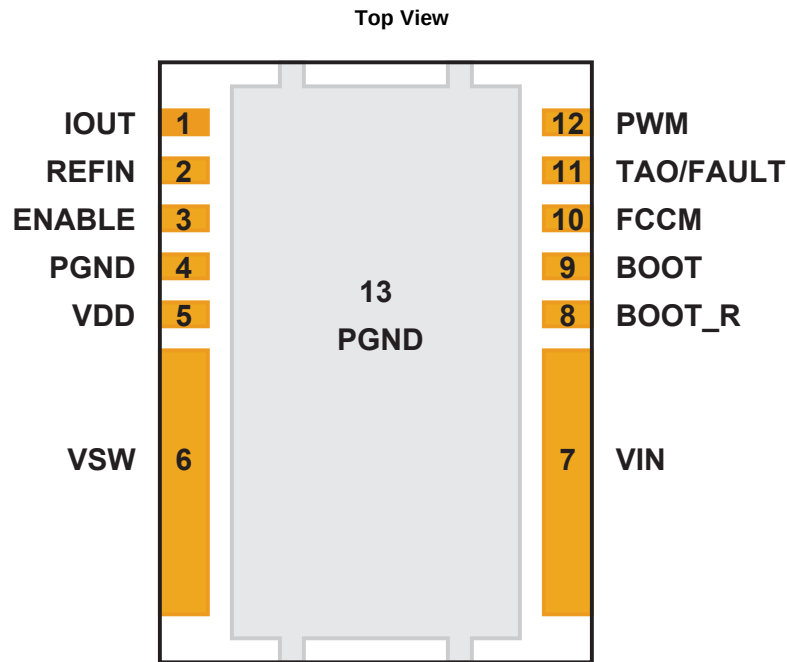
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4 修订历史记录

日期	修订版本	注释
2014 年 3 月	*	最初发布版本。

5 Terminal Configuration and Functions



Terminal Functions

TERMINAL		DESCRIPTION
NAME	NUMBER	
BOOT	9	Bootstrap capacitor connection. Connect a minimum of 0.1- μ F 16-V X7R ceramic capacitor from BOOT to BOOT_R pins. The bootstrap capacitor provides the charge to turn on the control FET. The bootstrap diode is integrated.
BOOT_R	8	Return path for HS gate driver, connected to V _{SW} internally.
ENABLE	3	Enables device operation. If ENABLE = logic HIGH, turns on device. If ENABLE = logic LOW, the device is turned off and both MOSFET gates are actively pulled low. An internal 100k Ω pull down resistor will pull the ENABLE pin LOW if left floating.
FCCM	10	This pin enables the Diode Emulation function. When this pin is held LOW, Diode Emulation Mode is enabled for sync FET. When FCCM is HIGH, the device is operated in Forced Continuous Conduction Mode. An internal 5- μ A current source will pull the FCCM pin to 3.3 V if left floating.
IOUT	1	Output of current sensing amplifier. V(IOUT) – V(REFIN) is proportional to the phase current.
P _{GND}	4	Power ground, connected directly to terminal 13.
P _{GND}	13	Power ground
PWM	12	Pulse width modulated 3-state input from external controller. Logic LOW sets control FET gate low and sync FET gate high. Logic HIGH sets control FET gate high and sync FET gate low. Open or High Z sets both MOSFET gates low if greater than the 3-state shutdown hold-off time (t _{3HT}).
REFIN	2	External reference voltage input for current sensing amplifier
TAO/ FAULT	11	Temperature Analog Output. Reports a voltage proportional to the die temperature. An ORing diode is integrated in the IC. When used in multiphase application, a single wire can be used to connect the TAO pins of all the IC's. Only the highest temperature will be reported. TAO will be pulled up to 3 V if thermal shutdown occurs. TAO should be bypassed to P _{GND} with a 1nF 16V X6R ceramic capacitor.
V _{DD}	5	Supply voltage to gate driver and internal circuitry
V _{IN}	7	Input voltage pin. Connect input capacitors close to this pin.
V _{SW}	6	Phase node connecting the HS MOSFET source and LS MOSFET drain – pin connection to the output inductor.

6 Specifications

6.1 Absolute Maximum Ratings

$T_A = 25^\circ\text{C}$ (unless otherwise noted)⁽¹⁾

PARAMETER	MIN	MAX	UNIT
V_{IN} to P_{GND}	-0.3	25	V
V_{IN} to V_{SW}	-0.3	25	V
V_{IN} to V_{SW} (10 ns)	-7	27	V
V_{SW} to P_{GND}	-0.3	20	V
V_{SW} to P_{GND} (10 ns)	-7	23	V
V_{DD} to P_{GND}	-0.3	7	V
ENABLE, PWM, FCCM, TAO, IOUT, REFIN to P_{GND}	-0.3	$V_{DD} + 0.3\text{ V}$	V
BOOT to BOOT_R ⁽²⁾	-0.3	$V_{DD} + 0.3\text{ V}$	V
P_D , Power Dissipation		12	W
T_J , Operating Junction	-55	150	$^\circ\text{C}$

(1) Stresses beyond those listed under *absolute maximum ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) Should not exceed 7 V

6.2 Handling Ratings

PARAMETER	MIN	MAX	UNIT
T_{stg} Storage Temperature Range	-55	150	$^\circ\text{C}$
ESD Rating	Human Body Model (HBM)		2000
	Charged Device Model (CDM)		500

6.3 Recommended Operating Conditions

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

PARAMETER	CONDITIONS	MIN	MAX	UNIT
V_{DD} , Gate Drive Voltage		4.5	5.5	V
V_{IN} , Input Supply Voltage			14.5	V
V_{OUT} , Output Voltage			5.5	V
I_{OUT} , Continuous Output Current	$V_{IN} = 12\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{OUT} = 1.2\text{ V}$, $f_{SW} = 500\text{ kHz}$, $L_{OUT} = 0.225\text{ }\mu\text{H}$ ⁽¹⁾		60	A
I_{OUT-PK} , Peak Output Current ⁽²⁾			90	A
f_{SW} , Switching Frequency	$C_{BST} = 0.1\text{ }\mu\text{F}$ (min)		1250	kHz
On Time Duty Cycle	$f_{SW} = 1\text{ MHz}$		85	%
Minimum PWM On Time		40		ns
Operating Temperature		-40	125	$^\circ\text{C}$

(1) Measurement made with six 10- μF (TDK C3216X5R1C106KT or equivalent) ceramic capacitors placed across V_{IN} to P_{GND} pins.

(2) System conditions as defined in Note 1. Peak Output Current is applied for $t_p = 50\text{ }\mu\text{s}$.

6.4 Thermal Information

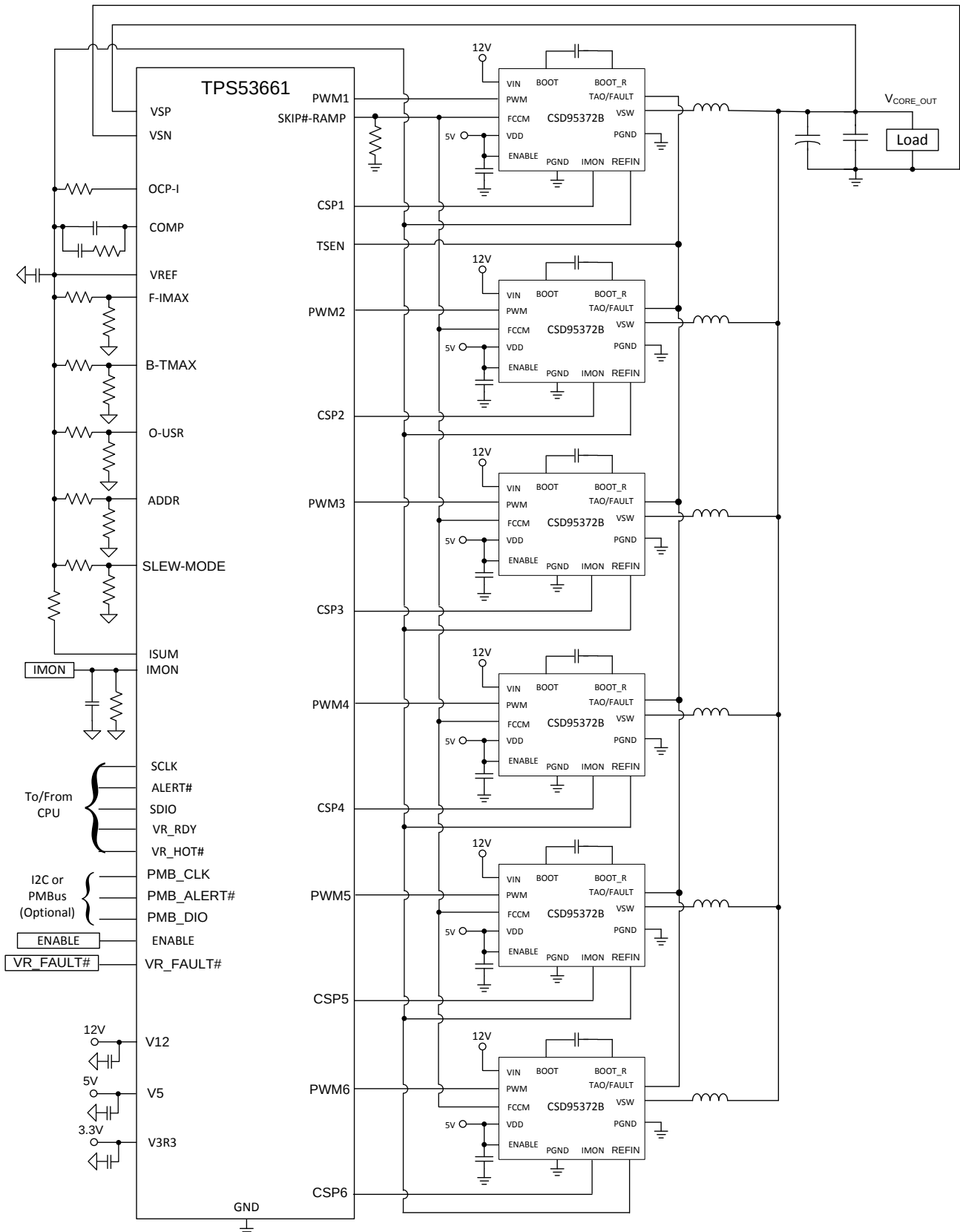
$T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER	MIN	TYP	MAX	UNIT
$R_{\theta JC}$ Thermal Resistance, Junction-to-Case (Top of package) ⁽¹⁾			15	$^\circ\text{C/W}$
$R_{\theta JB}$ Thermal Resistance, Junction-to-Board ⁽²⁾			1.5	

(1) $R_{\theta JC}$ is determined with the device mounted on a 1-inch² (6.45 -cm²), 2-oz (.071-mm thick) Cu pad on a 1.5-inch x 1.5-inch, 0.06-inch (1.52-mm) thick FR4 board.

(2) $R_{\theta JB}$ value based on hottest board temperature within 1 mm of the package.

7 Application Schematic



8 器件和文档支持

8.1 Trademarks

NexFET is a trademark of Texas Instruments.

8.2 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

8.3 Glossary

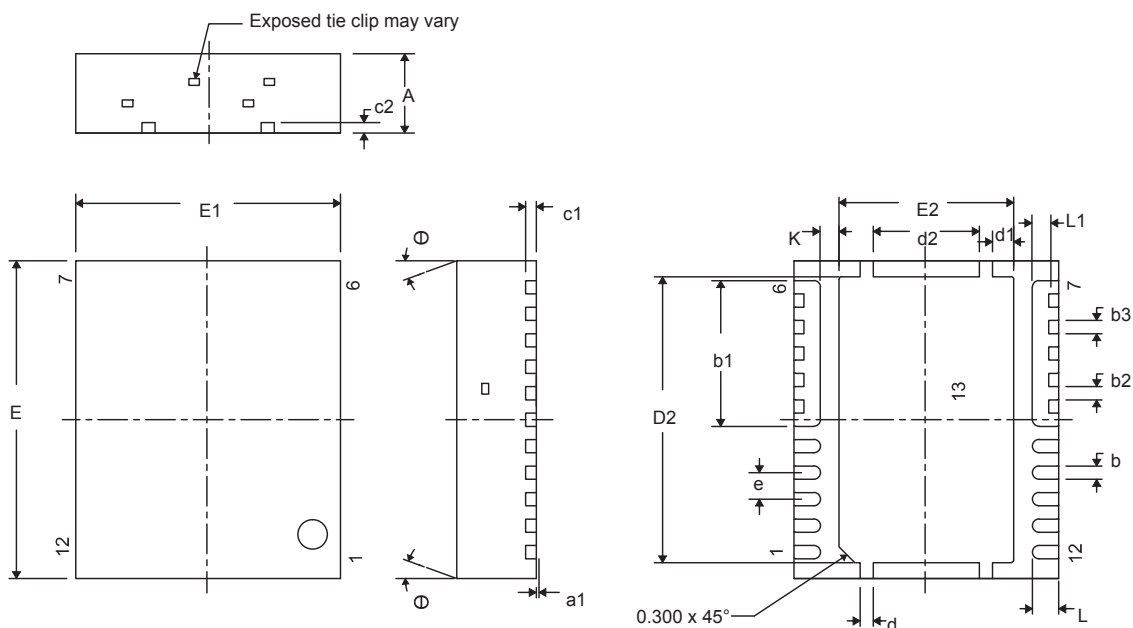
[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms and definitions.

9 机械封装和可订购信息

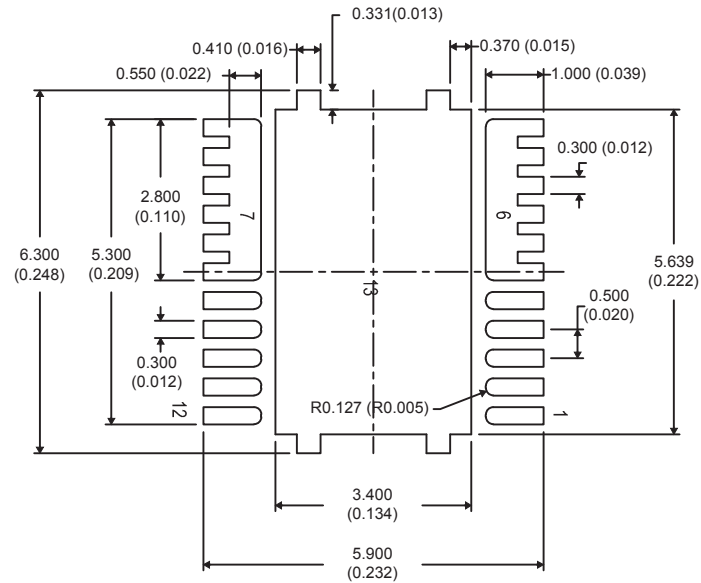
以下页中包括机械封装和可订购信息。 这些信息是针对指定器件可提供的最新数据。 这些数据会在无通知且不对本文档进行修订的情况下发生改变。 要获得这份数据表的浏览器版本，请查阅左侧的导航栏。

9.1 机械制图



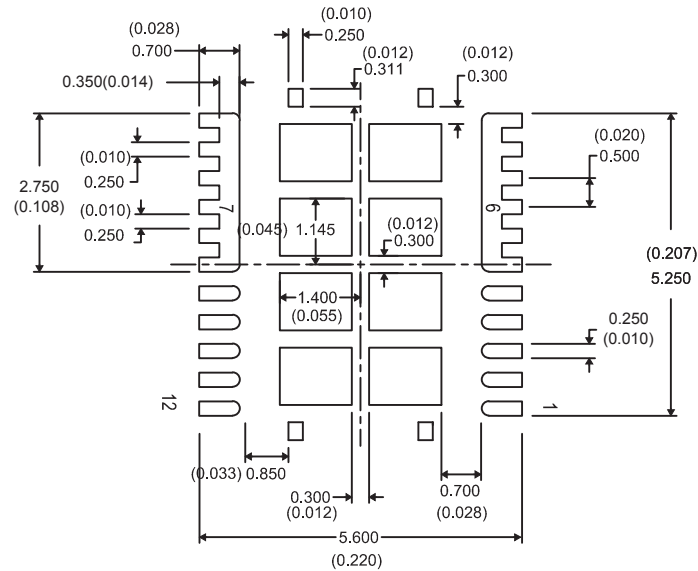
DIM	毫米			英寸		
	最小值	标称值	最大值	最小值	标称值	最大值
A	1.400	1.450	1.500	0.057	0.059	0.061
a1	0.000	0.000	0.050	0.000	0.000	0.002
b	0.200	0.250	0.320	0.008	0.010	0.013
b1	2.750 典型值			0.108 典型值		
b2	0.200	0.250	0.320	0.008	0.010	0.013
b3	0.250 典型值			0.010 典型值		
c1	0.150	0.200	0.250	0.006	0.008	0.010
c2	0.200	0.250	0.300	0.008	0.010	0.012
D2	5.300	5.400	5.500	0.209	0.213	0.217
d	0.200	0.250	0.300	0.008	0.010	0.012
d1	0.350	0.400	0.450	0.014	0.016	0.018
d2	1.900	2.000	2.100	0.075	0.079	0.083
E	5.900	6.000	6.100	0.232	0.236	0.240
E1	4.900	5.000	5.100	0.193	0.197	0.201
E2	3.200	3.300	3.400	0.126	0.130	0.134
e	0.500 典型值			0.020 典型值		
K	0.350 典型值			0.014 典型值		
L	0.400	0.500	0.600	0.016	0.020	0.024
L1	0.210	0.310	0.410	0.008	0.012	0.016
θ	0.00	—	—	0.00	—	—

9.2 建议印刷电路板 (PCB) 焊盘图案



1. 尺寸单位为 mm（英寸）。

9.3 建议模板开口



1. 尺寸单位为 mm（英寸）。
2. 模板厚度 100μm

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)
CSD95372BQ5M	Active	Production	LSON-CLIP (DQP) 12	2500 LARGE T&R	ROHS Exempt	NIPDAU	Level-2-260C-1 YEAR	-55 to 150	95372BM
CSD95372BQ5M.A	Active	Production	LSON-CLIP (DQP) 12	2500 LARGE T&R	ROHS Exempt	NIPDAU	Level-2-260C-1 YEAR	-55 to 150	95372BM
CSD95372BQ5M.B	Active	Production	LSON-CLIP (DQP) 12	2500 LARGE T&R	-	Call TI	Call TI	-55 to 150	
CSD95372BQ5MG4	Active	Production	LSON-CLIP (DQP) 12	2500 LARGE T&R	ROHS Exempt	NIPDAU	Level-2-260C-1 YEAR	-55 to 150	95372BM
CSD95372BQ5MG4.A	Active	Production	LSON-CLIP (DQP) 12	2500 LARGE T&R	ROHS Exempt	NIPDAU	Level-2-260C-1 YEAR	-55 to 150	95372BM
CSD95372BQ5MG4.B	Active	Production	LSON-CLIP (DQP) 12	2500 LARGE T&R	-	Call TI	Call TI	-55 to 150	
CSD95372BQ5MT	Active	Production	LSON-CLIP (DQP) 12	250 SMALL T&R	ROHS Exempt	NIPDAU SN	Level-2-260C-1 YEAR	-55 to 150	95372BM
CSD95372BQ5MT.A	Active	Production	LSON-CLIP (DQP) 12	250 SMALL T&R	ROHS Exempt	NIPDAU	Level-2-260C-1 YEAR	-55 to 150	95372BM
CSD95372BQ5MT.B	Active	Production	LSON-CLIP (DQP) 12	250 SMALL T&R	-	Call TI	Call TI	-55 to 150	

⁽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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