具有 ±15kV ESD 保护功能的 MAX3232 3V 至 5.5V 多通道 RS-232 线路驱动器和接收器

1 特性

- RS-232 总线终端 ESD 保护大于 ±15kV 人体放电模型 (HBM)
- 符合或超出 TIA/EIA-232-F 和 ITU V.28 标准的要求
- 由 3V 至 5.5V V_{CC} 电源供电
- 速率高达 250kbit/s
- 两个驱动器和两个接收器
- 低电源电流：300 µA（典型值）
- 外部电容器：4 × 0.1 µF
- 接受 5V 逻辑输入及 3.3V 电源
- 备选高速端子兼容器件 (1Mbit/s)
  - SN65C3232（–40°C 至 85°C）
  - SN75C3232（0°C 至 70°C）

2 应用

- 工业 PC
- 有线网络
- 数据中心和企业级联网
- 电池供电型系统
- PDA
- 笔记本电脑
- 便携式计算机
- 掌上电脑
- 手持设备

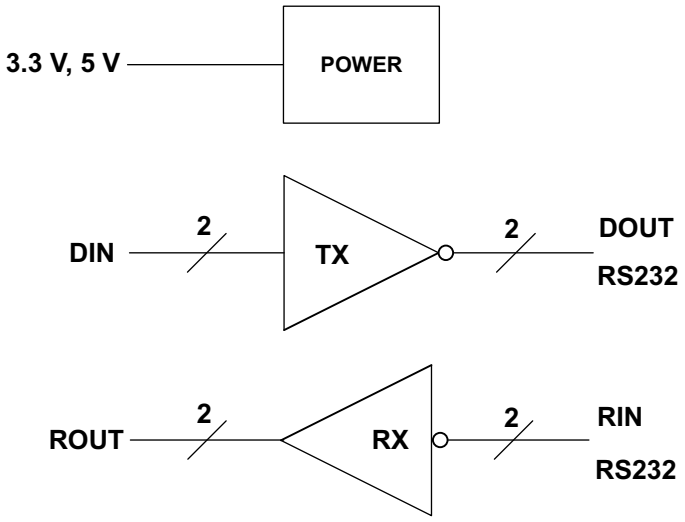
3 说明

MAX3232 器件由两个线路驱动器、两个线路接收器和一个双路电荷泵电路组成，具有端子间（串行端口连接端子，包括 GND）±15kV ESD 保护。该器件符合 TIA/EIA-232-F 的要求，并在异步通信控制器与串行端口连接器之间提供电气接口。电荷泵和四个小型外部电容器支持由 3V 至 5.5V 单电源供电。该器件以高达 250kbit/s 的数据信号传输速率运行，驱动器输出压摆率最高为 30V/µs。

器件信息

器件型号	封装(1)	封装尺寸
MAX3232	SOIC (D) (16)	9.90mm × 3.91mm
	SSOP (DB) (16)	6.20mm × 5.30mm
	SOIC (DW) (16)	10.30mm × 7.50mm
	TSSOP (PW) (16)	5.00mm × 4.40mm

(1) 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。



简化版原理图

本文档旨在为方便起见，提供有关 TI 产品中文版本的信息，以确认产品的概要。有关适用的官方英文版本的最新信息，请访问 www.ti.com，其内容始终优先。TI 不保证翻译的准确性和有效性。在实际设计之前，请务必参考最新版本的英文版本。

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4 Revision History

注：以前版本的页码可能与当前版本的页码不同

Changes from Revision N (June 2017) to Revision O (June 2021) — **Page**

- 添加了*应用*：工业 PC、有线网络、数据中心和企业级计算 1
- Changed the thermal parameter values for D, DB and PW packages in the *Thermal Information* table 5

Changes from Revision M (April 2017) to Revision N (June 2017) — **Page**

- Changed the *Thermal Information* table 5

Changes from Revision L (March 2017) to Revision M (April 2017) — **Page**

- Changed From: "±" To: "to" in the V_{CC} column of 表 9-1 12

Changes from Revision K (January 2015) to Revision L (March 2017) — **Page**

- Changed pin 16 (V_{CC}) in 图 9-1 11

Changes from Revision J (January 2014) to Revision K (January 2015) — **Page**

- 添加了*应用*、*器件信息* 表、*引脚功能* 表、*ESD 等级* 表、*热性能信息* 表、*典型特性*、*特性说明* 部分、*器件功能模式*、*应用和实施* 部分、*电源相关建议* 部分、*布局* 部分、*器件和文档支持* 部分以及*机械、封装和可订购信息* 部分 1

Changes from Revision I (January 2004) to Revision J (January 2014) — **Page**

- 将文档更新为新的 TI 数据表格式 - 无规格变化 1
- 删除了*订购信息* 表 1

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5 Pin Configuration and Functions

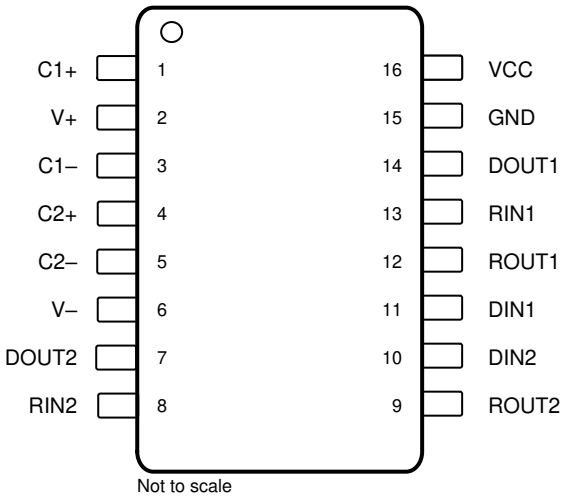


图 5-1. D, DB, DW, or PW Package, 16-Pin SOIC, SSOP, or TSSOP, Top View

表 5-1. Pin Functions

PIN		TYPE	DESCRIPTION
NAME	NO.		
C1+	1	—	Positive lead of C1 capacitor
V+	2	O	Positive charge pump output for storage capacitor only
C1 –	3	—	Negative lead of C1 capacitor
C2+	4	—	Positive lead of C2 capacitor
C2 –	5	—	Negative lead of C2 capacitor
V –	6	O	Negative charge pump output for storage capacitor only
DOUT2	7	O	RS232 line data output (to remote RS232 system)
DOUT1	14	O	RS232 line data output (to remote RS232 system)
RIN2	8	I	RS232 line data input (from remote RS232 system)
RIN1	13	I	RS232 line data input (from remote RS232 system)
ROUT2	9	O	Logic data output (to UART)
ROUT1	12	O	Logic data output (to UART)
DIN2	10	I	Logic data input (from UART)
DIN1	11	I	Logic data input (from UART)
GND	15	—	Ground
V_{CC}	16	—	Supply Voltage, Connect to external 3 V to 5.5 V power supply

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6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

			MIN	MAX	UNIT
V_{CC}	Supply voltage range(2)		–0.3	6	V
V+	Positive output supply voltage range(2)		–0.3	7	V
V–	Negative output supply voltage range(2)		–7	0.3	V
V+ – V–	Supply voltage difference(2)			13	V
V_I	Input voltage range	Drivers	–0.3	6	V
		Receivers	–25	25	
V_O	Output voltage range	Drivers	–13.2	13.2	V
		Receivers	–0.3	V_{CC} + 0.3	
T_J	Operating virtual junction temperature			150	°C
T_{stg}	Storage temperature range		–65	150	°C

(1) Operation outside the *Absolute Maximum Ratings* may cause permanent device damage. *Absolute Maximum Ratings* do not imply functional operation of the device at these or any other conditions beyond those listed under *Recommended Operating Conditions*. If used outside the *Recommended Operating Conditions* but within the *Absolute Maximum Ratings*, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime.
(2) All voltages are with respect to network GND.

6.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 RIN , DOUT, and GND pins (1)	15000	V
		Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 All other pins(1)	3000	
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins(2)	1000	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions

(see 图 9-1)(1)

				MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage		V_{CC} = 3.3 V	3	3.3	3.6	V
			V_{CC} = 5 V	4.5	5	5.5	
V_{IH}	Driver high-level input voltage	DIN	V_{CC} = 3.3 V	2			V
			V_{CC} = 5 V	2.4			
V_{IL}	Driver low-level input voltage	DIN				0.8	V
V_I	Driver input voltage	DIN		0		5.5	V
	Receiver input voltage	RIN		–25		25	
T_A	Operating free-air temperature		MAX3232C	0		70	°C
			MAX3232I	–40		85	

(1) Test conditions are C1 – C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2 – C4 = 0.33 μF at V_{CC} = 5 V ± 0.5 V.

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6.4 Thermal Information

THERMAL METRIC[1]		MAX3232				UNIT
		SOIC (D)	SSOP (DB)	SOIC (DW)	TSSOP (PW)	
		16 PINS				
$R_{\theta JA}$	Junction-to-ambient thermal resistance	85.9	103.1	66.6	108.2	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	43.1	49.2	32.4	39.0	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	44.5	54.8	31.9	54.4	°C/W
ψ_{JT}	Junction-to-top characterization parameter	10.1	12	8.4	3.3	°C/W
ψ_{JB}	Junction-to-board characterization parameter	44.1	54.1	31.5	53.8	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	n/a	n/a	n/a	n/a	°C/W

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report.

6.5 Electrical Characteristics — Device

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)[2] (see 图 9-1)

PARAMETER		TEST CONDITIONS		MIN	TYP[1]	MAX	UNIT
I_{CC}	Supply current	No load,	V_{CC} = 3.3 V to 5 V		0.3	1	mA

(1) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.
(2) Test conditions are C1 – C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2 – C4 = 0.33 μF at V_{CC} = 5 V ± 0.5 V.

6.6 Electrical Characteristics — Driver

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)[3] (see 图 9-1)

PARAMETER		TEST CONDITIONS		MIN	TYP[1]	MAX	UNIT
V_{OH}	High-level output voltage	D_{OUT} at R_L = 3 kΩ to GND,	D_{IN} = GND	5	5.4		V
V_{OL}	Low-level output voltage	D_{OUT} at R_L = 3 kΩ to GND,	D_{IN} = V_{CC}	–5	–5.4		V
I_{IH}	High-level input current	V_I = V_{CC}			±0.01	±1	μA
I_{IL}	Low-level input current	V_I at GND			±0.01	±1	μA
I_{OS} [2]	Short-circuit output current	V_{CC} = 3.6 V	V_O = 0 V		±35	±60	mA
		V_{CC} = 5.5 V	V_O = 0 V				
r_O	Output resistance	V_{CC}, V+, and V – = 0 V	V_O = ±2 V	300	10M		Ω

(1) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.
(2) Short-circuit durations should be controlled to prevent exceeding the device absolute power dissipation ratings, and not more than one output should be shorted at a time.
(3) Test conditions are C1 – C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2 – C4 = 0.33 μF at V_{CC} = 5 V ± 0.5

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6.7 Electrical Characteristics — Receiver

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)(2) (see 图 9-1)

PARAMETER		TEST CONDITIONS	MIN	TYP(1)	MAX	UNIT
V_{OH}	High-level output voltage	I_{OH} = – 1 mA	V_{CC} – 0.6	V_{CC} – 0.1		V
V_{OL}	Low-level output voltage	I_{OL} = 1.6 mA			0.4	V
V_{IT+}	Positive-going input threshold voltage	V_{CC} = 3.3 V		1.5	2.4	V
		V_{CC} = 5 V		1.8	2.4	
V_{IT-}	Negative-going input threshold voltage	V_{CC} = 3.3 V	0.6	1.2		V
		V_{CC} = 5 V	0.8	1.5		
V_{hys}	Input hysteresis (V_{IT+} – V_{IT-})			0.3		V
r_I	Input resistance	V_I = ±3 V to ±25 V	3	5	7	kΩ

(1) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.
(2) Test conditions are C1 – C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2 – C4 = 0.33 μF at V_{CC} = 5 V ± 0.5 V.

6.8 Switching Characteristics

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)(3) (see 图 9-1)

PARAMETER		TEST CONDITIONS		MIN	TYP(1)	MAX	UNIT
	Maximum data rate	R_L = 3 kΩ, One D_{OUT} switching,	C_L = 1000 pF See 图 7-1	150	250		kbit/s
$t_{sk(p)}$	Driver Pulse skew(2)	R_L = 3 kΩ to 7 kΩ,	C_L = 150 to 2500 pF See 图 7-2		300		ns
SR(tr)	Slew rate, transition region (see 图 7-1)	R_L = 3 kΩ to 7 kΩ, V_{CC} = 5 V	C_L = 150 to 1000 pF	6		30	V/μs
			C_L = 150 to 2500 pF	4		30	
$t_{PLH®)}$	Propagation delay time, low- to high-level output	C_L = 150 pF			300		ns
$t_{PHL®)}$	Propagation delay time, high- to low-level output				300		
$t_{sk(p)}$	Receiver Pulse skew(3)				300		

(1) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.
(2) Pulse skew is defined as $|t_{PLH} - t_{PHL}|$ of each channel of the same device.
(3) Test conditions are C1 – C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2 – C4 = 0.33 μF at V_{CC} = 5 V ± 0.5 V.

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6.9 Typical Characteristics

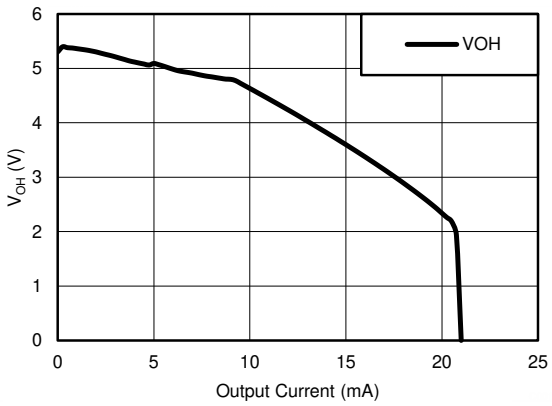


图 6-1. DOUT V_{OH} vs Load Current, Both Drivers Loaded

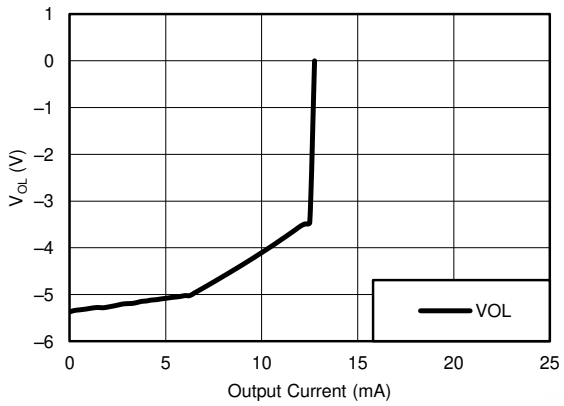
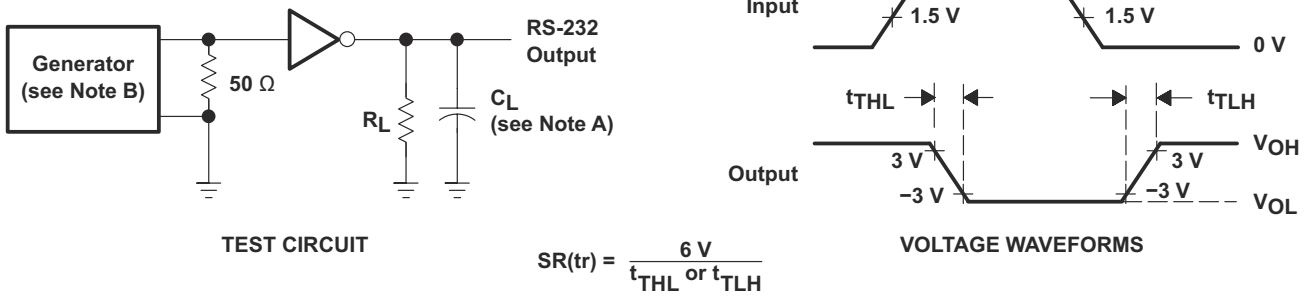


图 6-2. DOUT V_{OL} vs Load Current, Both Drivers Loaded

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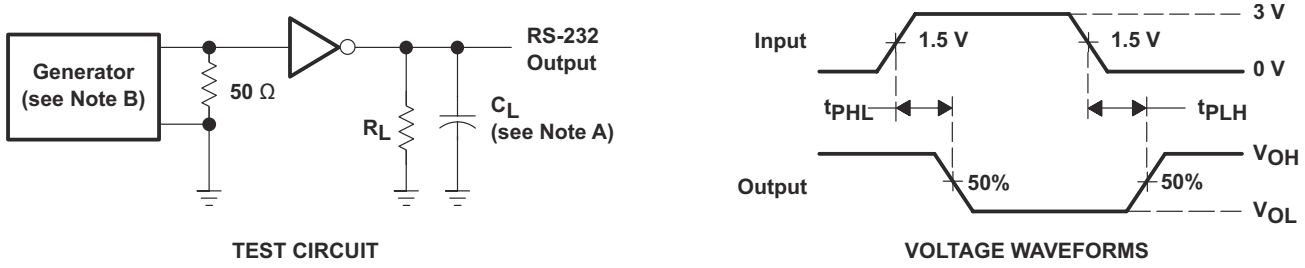
7 Parameter Measurement Information



A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: PRR = 250 kbit/s, Z_O = 50 Ω, 50% duty cycle, $t_r \leqslant 10$ ns, $t_f \leqslant 10$ ns.

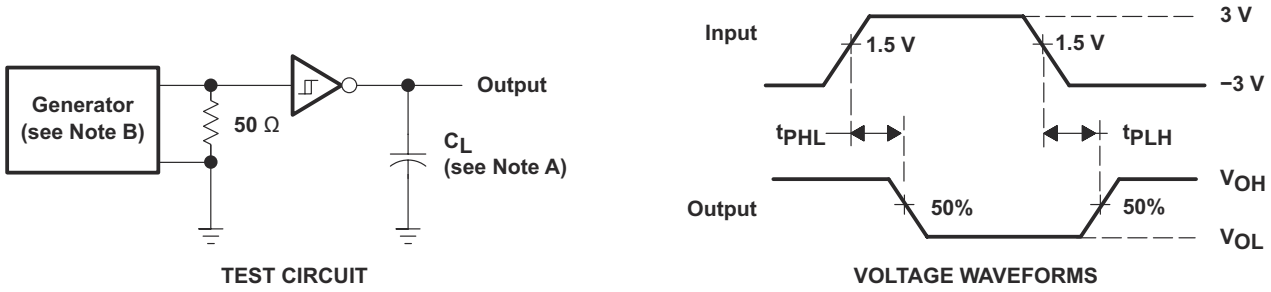
图 7-1. Driver Slew Rate



A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: PRR = 250 kbit/s, Z_O = 50 Ω, 50% duty cycle, $t_r \leqslant 10$ ns, $t_f \leqslant 10$ ns.

图 7-2. Driver Pulse Skew



A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: Z_O = 50 Ω, 50% duty cycle, $t_r \leqslant 10$ ns, $t_f \leqslant 10$ ns.

图 7-3. Receiver Propagation Delay Times

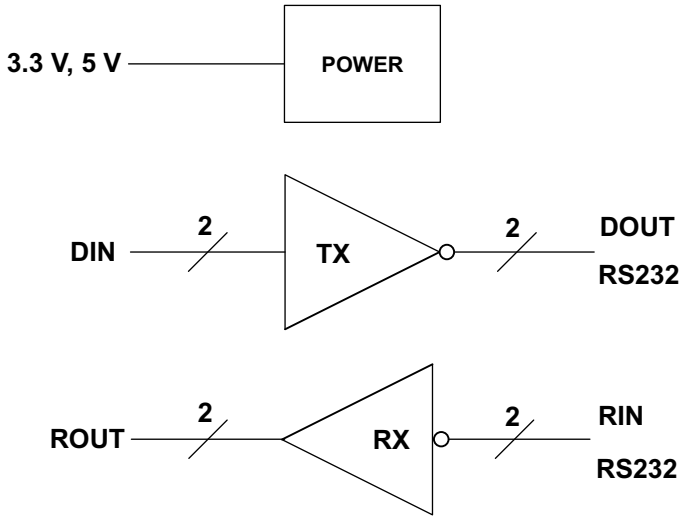
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8 Detailed Description

8.1 Overview

The MAX3232 device consists of two line drivers, two line receivers, and a dual charge-pump circuit with ±15-kV ESD protection terminal to terminal (serial-port connection terminals, including GND). The device meets the requirements of TIA/EIA-232-F and provides the electrical interface between an asynchronous communication controller and the serial-port connector. The charge pump and four small external capacitors allow operation from a single 3-V to 5.5-V supply. The device operates at data signaling rates up to 250 kbit/s and a maximum of 30-V/ μ s driver output slew rate. Outputs are protected against shorts to ground.

8.2 Functional Block Diagram



8.3 Feature Description

8.3.1 Power

The power block increases, inverts, and regulates voltage at V+ and V- pins using a charge pump that requires four external capacitors.

8.3.2 RS232 Driver

Two drivers interface standard logic level to RS232 levels. Both DIN inputs must be valid high or low.

8.3.3 RS232 Receiver

Two receivers interface RS232 levels to standard logic levels. An open input will result in a high output on ROUT. Each RIN input includes an internal standard RS232 load.

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8.4 Device Functional Modes

表 8-1. Each Driver[1]

INPUT DIN	OUTPUT DOUT
L	H
H	L

(1) H = high level, L = low level

表 8-2. Each Receiver[1]

INPUT RIN	OUTPUT ROUT
L	H
H	L
Open	H

(1) H = high level, L = low level, Open = input disconnected or connected driver off

8.4.1 V_{CC} powered by 3 V to 5.5 V

The device will be in normal operation.

8.4.2 V_{CC} unpowered, V_{CC} = 0 V

When MAX3232 is unpowered, it can be safely connected to an active remote RS232 device.

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9 Application and Implementation

Note

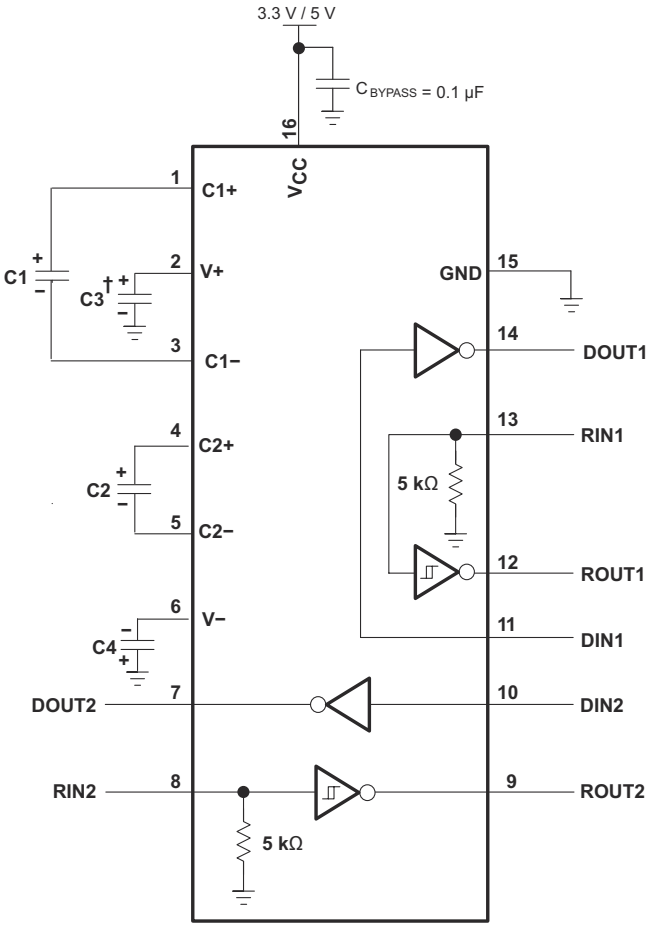
Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

9.1 Application Information

For proper operation, add capacitors as shown in 图 9-1.

9.2 Standard Application

ROUT and DIN connect to UART or general purpose logic lines. RIN and DOUT lines connect to a RS232 connector or cable.



† C3 can be connected to V_{CC} or GND.

A. Resistor values shown are nominal.

B. Nonpolarized ceramic capacitors are acceptable. If polarized tantalum or electrolytic capacitors are used, they should be connected as shown.

图 9-1. Typical Operating Circuit and Capacitor Values

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9.2.1 Design Requirements

- Recommended V_{CC} is 3.3 V or 5 V. 3 V to 5.5 V is also possible
- Maximum recommended bit rate is 250 kbit/s.

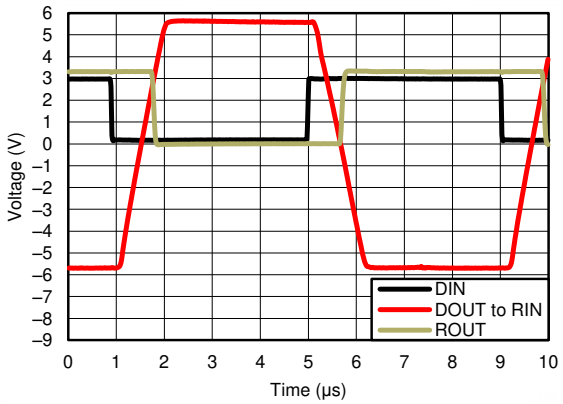
表 9-1. V_{CC} vs Capacitor Values

V_{CC}	C1	C2, C3, C4
3.3 V ± 0.3 V	0.1 µF	0.1 µF
5 V ± 0.5 V	0.047 µF	0.33 µF
3 V to 5.5 V	0.1 µF	0.47 µF

9.2.2 Detailed Design Procedure

- All DIN, $\overline{\text{FORCEOFF}}$ and FORCEON inputs must be connected to valid low or high logic levels.
- Select capacitor values based on VCC level for best performance.

9.2.3 Application Curves



V_{CC} = 3.3 V

图 9-2. 250 kbit/s Driver to Receiver Loopback Timing Waveform

10 Power Supply Recommendations

V_{CC} should be between 3 V and 5.5 V. Charge pump capacitors should be chosen using table in 图 9-1.

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11 Layout

11.1 Layout Guidelines

Keep the external capacitor traces short. This is more important on C1 and C2 nodes that have the fastest rise and fall times.

11.2 Layout Example

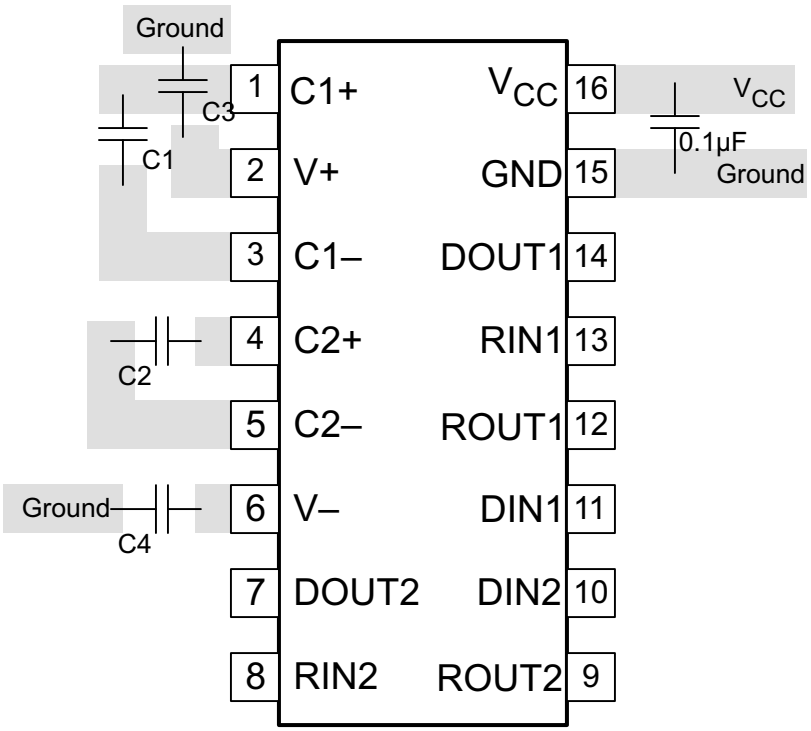


图 11-1. Layout Diagram

12 Device and Documentation Support

12.1 接收文档更新通知

要接收文档更新通知，请导航至 ti.com 上的器件产品文件夹。点击 *订阅更新* 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

12.2 支持资源

TI E2E™ 中文支持论坛是工程师的重要参考资料，可直接从专家处获得快速、经过验证的解答和设计帮助。搜索现有解答或提出自己的问题，获得所需的快速设计帮助。

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所有商标均为其各自所有者的财产。

12.4 静电放电警告

静电放电 (ESD) 会损坏这个集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

12.5 术语表

TI 术语表　　本术语表列出并解释了术语、首字母缩略词和定义。

13 Mechanical, Packaging, and Orderable Information

The following pages include mechanical packaging and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser based versions of this data sheet, refer to the left hand navigation.

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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
MAX3232CD	NRND	SOIC	D	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MAX3232C	
MAX3232CDB	NRND	SSOP	DB	16	80	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	
MAX3232CDBE4	NRND	SSOP	DB	16	80	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	
MAX3232CDBG4	NRND	SSOP	DB	16	80	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	
MAX3232CDBR	ACTIVE	SSOP	DB	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	Samples
MAX3232CDBRE4	ACTIVE	SSOP	DB	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	Samples
MAX3232CDE4	NRND	SOIC	D	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MAX3232C	
MAX3232CDG4	NRND	SOIC	D	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MAX3232C	
MAX3232CDR	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples
MAX3232CDRE4	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples
MAX3232CDRG4	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples
MAX3232CDW	ACTIVE	SOIC	DW	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples
MAX3232CDWG4	ACTIVE	SOIC	DW	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples
MAX3232CDWR	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples
MAX3232CDWRE4	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples
MAX3232CDWRG4	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples
MAX3232CPW	NRND	TSSOP	PW	16	90	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	
MAX3232CPWE4	NRND	TSSOP	PW	16	90	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	
MAX3232CPWG4	NRND	TSSOP	PW	16	90	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	
MAX3232CPWR	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	MA3232C	Samples
MAX3232CPWRE4	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	Samples
MAX3232CPWRG4	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	Samples
MAX3232ID	LIFEBUY	SOIC	D	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	MAX3232I	

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
MAX3232IDB	NRND	SSOP	DB	16	80	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3232I	
MAX3232IDBE4	NRND	SSOP	DB	16	80	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3232I	
MAX3232IDBR	ACTIVE	SSOP	DB	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3232I	Samples
MAX3232IDBRE4	ACTIVE	SSOP	DB	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3232I	Samples
MAX3232IDE4	ACTIVE	SOIC	D	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	MAX3232I	Samples
MAX3232IDG4	LIFEBUY	SOIC	D	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	MAX3232I	
MAX3232IDR	LIFEBUY	SOIC	D	16	2500	RoHS & Green	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	MAX3232I	
MAX3232IDRE4	LIFEBUY	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	MAX3232I	
MAX3232IDRG4	LIFEBUY	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	MAX3232I	
MAX3232IDW	ACTIVE	SOIC	DW	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	MAX3232I	Samples
MAX3232IDWR	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	MAX3232I	Samples
MAX3232IDWRE4	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	MAX3232I	Samples
MAX3232IDWRG4	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	MAX3232I	Samples
MAX3232IPW	NRND	TSSOP	PW	16	90	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3232I	
MAX3232IPWR	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	MB3232I	Samples
MAX3232IPWRE4	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3232I	Samples
MAX3232IPWRG4	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3232I	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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OTHER QUALIFIED VERSIONS OF MAX3232 :

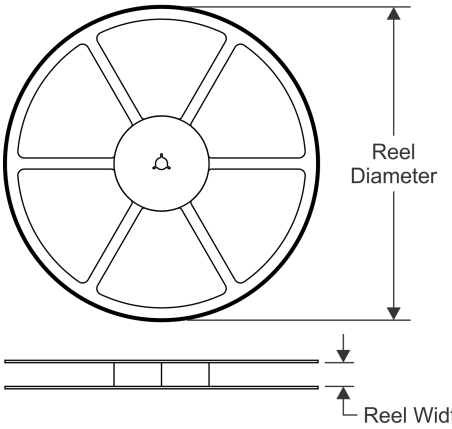
- Enhanced Product : MAX3232-EP

NOTE: Qualified Version Definitions:

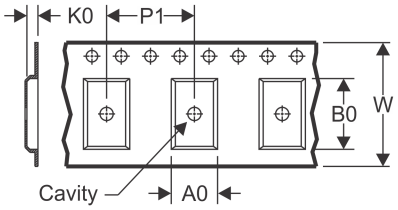
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

TAPE AND REEL INFORMATION

REEL DIMENSIONS

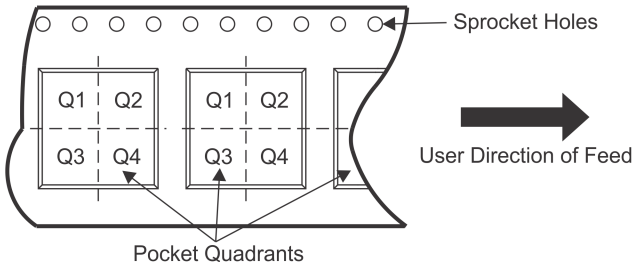


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

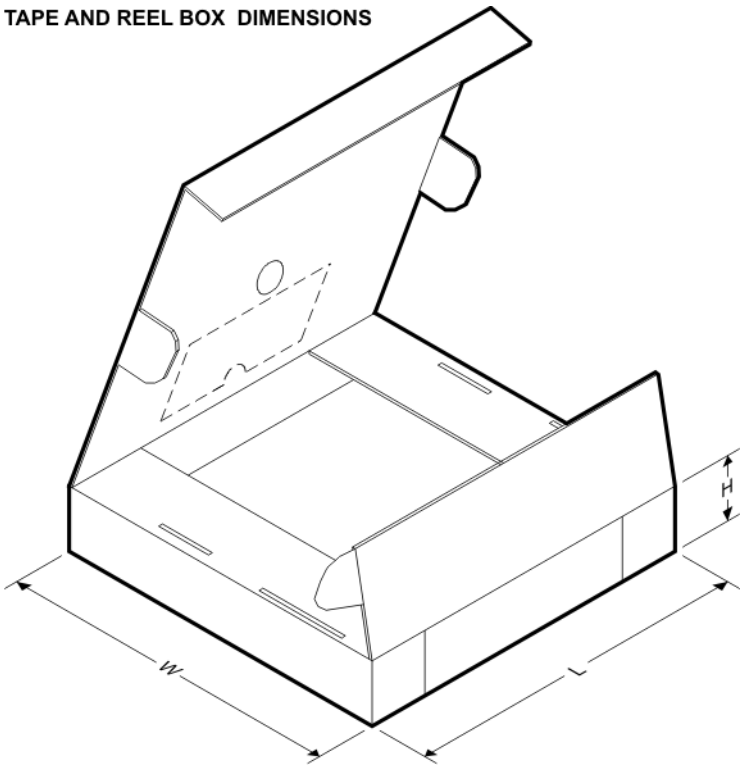


*All dimensions are nominal

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
MAX3232CDBR	SSOP	DB	16	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
MAX3232CDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
MAX3232CDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
MAX3232CDRG4	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
MAX3232CDWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
MAX3232CDWRG4	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
MAX3232CPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
MAX3232CPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
MAX3232CPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
MAX3232CPWRG4	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
MAX3232CPWRG4	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
MAX3232IDBR	SSOP	DB	16	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
MAX3232IDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
MAX3232IDRG4	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
MAX3232IDWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
MAX3232IDWRG4	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
MAX3232IPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
MAX3232IPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

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
MAX3232IPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
MAX3232IPWRG4	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
MAX3232IPWRG4	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS

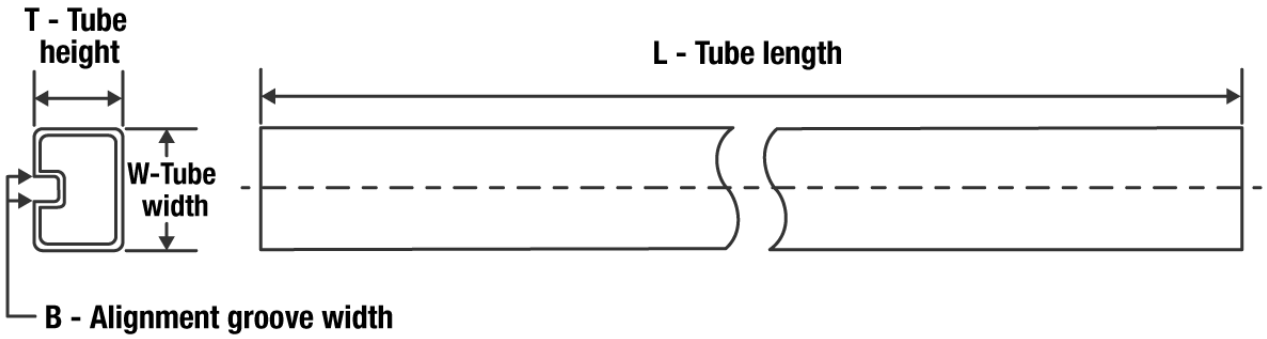


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
MAX3232CDBR	SSOP	DB	16	2000	853.0	449.0	35.0
MAX3232CDR	SOIC	D	16	2500	853.0	449.0	35.0
MAX3232CDR	SOIC	D	16	2500	340.5	336.1	32.0
MAX3232CDRG4	SOIC	D	16	2500	340.5	336.1	32.0
MAX3232CDWR	SOIC	DW	16	2000	350.0	350.0	43.0
MAX3232CDWRG4	SOIC	DW	16	2000	350.0	350.0	43.0
MAX3232CPWR	TSSOP	PW	16	2000	853.0	449.0	35.0
MAX3232CPWR	TSSOP	PW	16	2000	364.0	364.0	27.0
MAX3232CPWR	TSSOP	PW	16	2000	853.0	449.0	35.0
MAX3232CPWRG4	TSSOP	PW	16	2000	853.0	449.0	35.0
MAX3232CPWRG4	TSSOP	PW	16	2000	853.0	449.0	35.0
MAX3232IDBR	SSOP	DB	16	2000	853.0	449.0	35.0
MAX3232IDR	SOIC	D	16	2500	340.5	336.1	32.0
MAX3232IDRG4	SOIC	D	16	2500	340.5	336.1	32.0

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
MAX3232IDWR	SOIC	DW	16	2000	350.0	350.0	43.0
MAX3232IDWRG4	SOIC	DW	16	2000	350.0	350.0	43.0
MAX3232IPWR	TSSOP	PW	16	2000	364.0	364.0	27.0
MAX3232IPWR	TSSOP	PW	16	2000	853.0	449.0	35.0
MAX3232IPWR	TSSOP	PW	16	2000	853.0	449.0	35.0
MAX3232IPWRG4	TSSOP	PW	16	2000	853.0	449.0	35.0
MAX3232IPWRG4	TSSOP	PW	16	2000	853.0	449.0	35.0

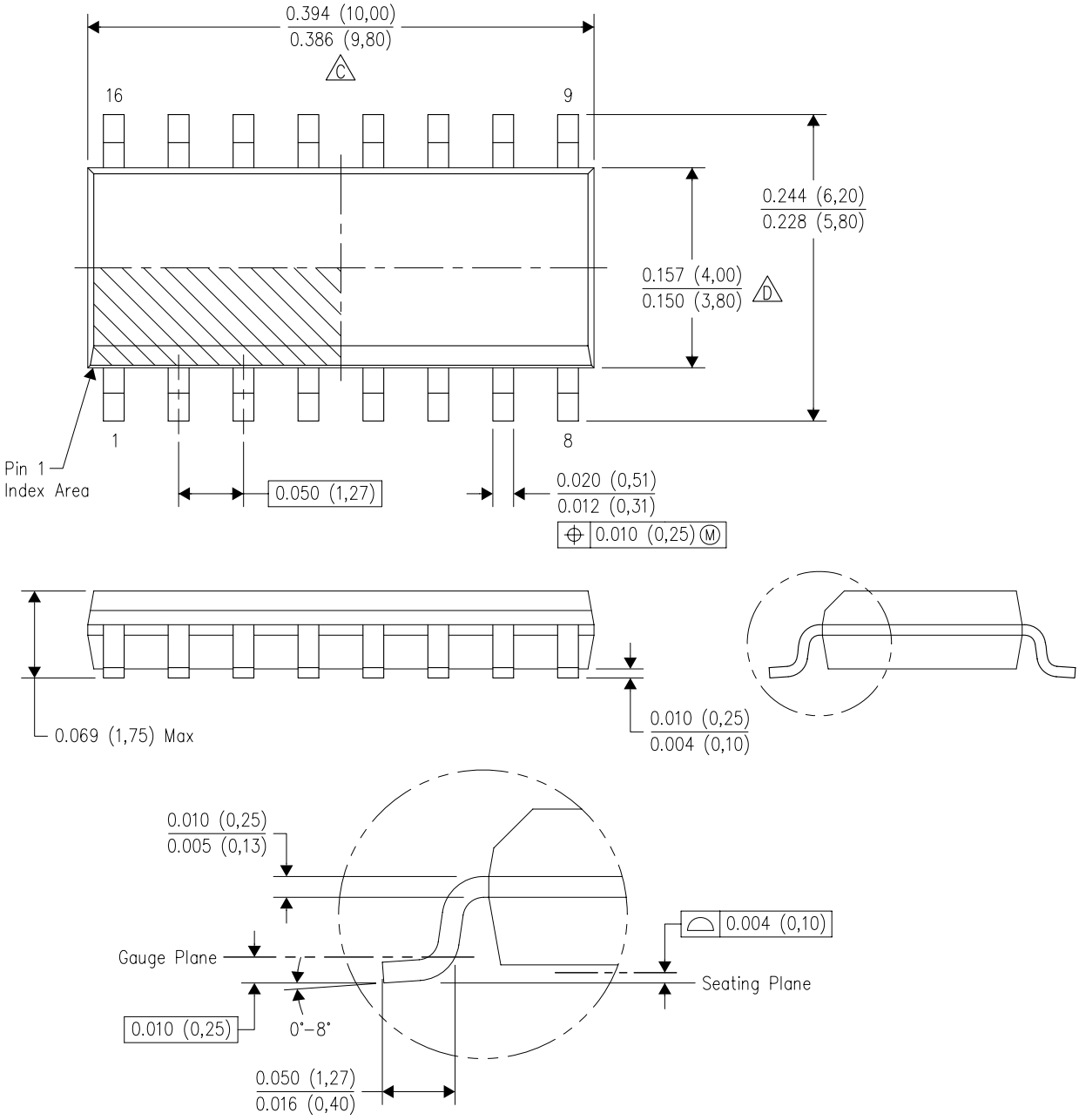
TUBE



*All dimensions are nominal

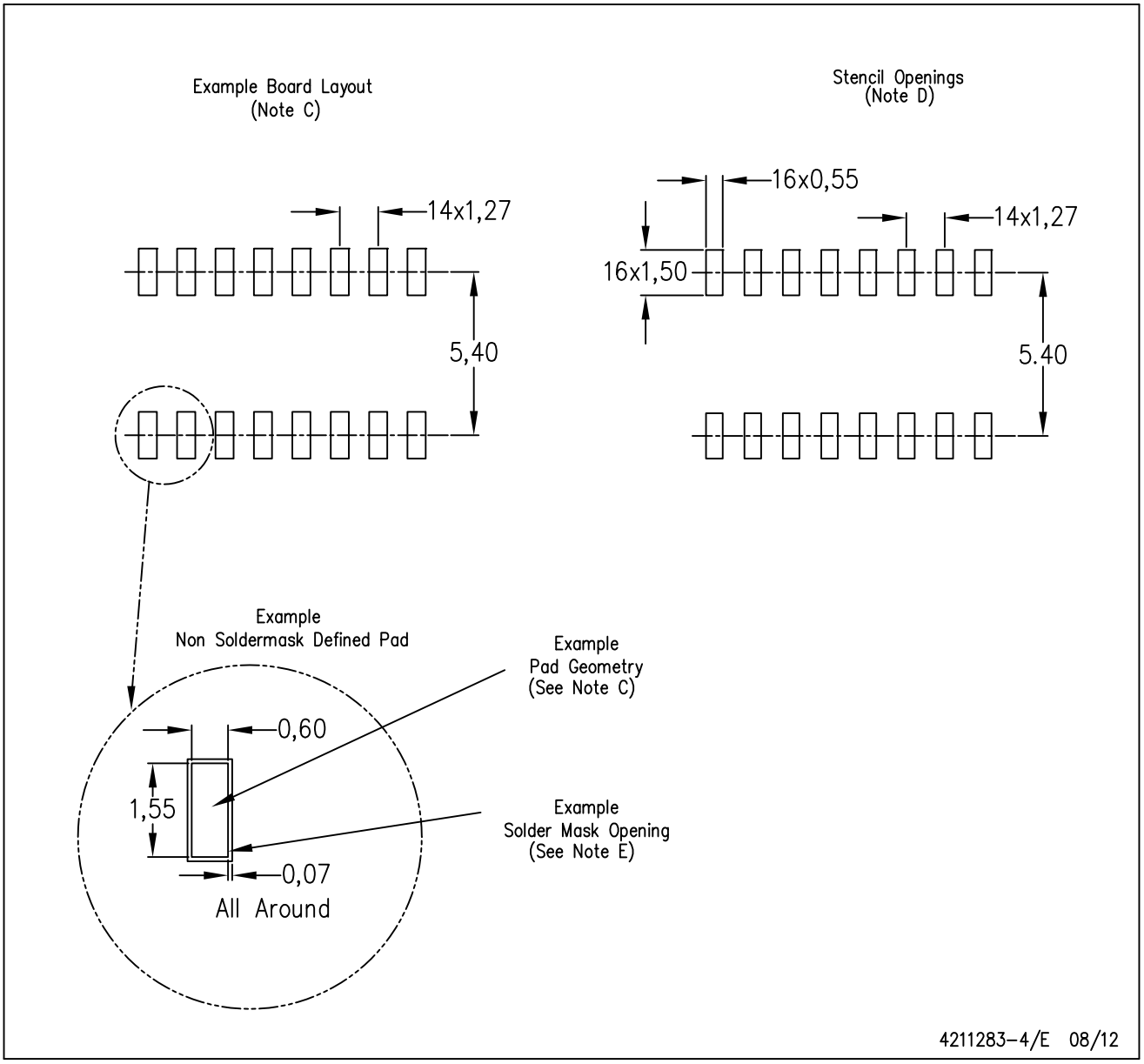
Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
MAX3232CD	D	SOIC	16	40	507	8	3940	4.32
MAX3232CDB	DB	SSOP	16	80	530	10.5	4000	4.1
MAX3232CDBE4	DB	SSOP	16	80	530	10.5	4000	4.1
MAX3232CDBG4	DB	SSOP	16	80	530	10.5	4000	4.1
MAX3232CDE4	D	SOIC	16	40	507	8	3940	4.32
MAX3232CDG4	D	SOIC	16	40	507	8	3940	4.32
MAX3232CDW	DW	SOIC	16	40	506.98	12.7	4826	6.6
MAX3232CDWG4	DW	SOIC	16	40	506.98	12.7	4826	6.6
MAX3232CPW	PW	TSSOP	16	90	530	10.2	3600	3.5
MAX3232CPWE4	PW	TSSOP	16	90	530	10.2	3600	3.5
MAX3232CPWG4	PW	TSSOP	16	90	530	10.2	3600	3.5
MAX3232ID	D	SOIC	16	40	507	8	3940	4.32
MAX3232IDB	DB	SSOP	16	80	530	10.5	4000	4.1
MAX3232IDBE4	DB	SSOP	16	80	530	10.5	4000	4.1
MAX3232IDE4	D	SOIC	16	40	507	8	3940	4.32
MAX3232IDG4	D	SOIC	16	40	507	8	3940	4.32
MAX3232IDW	DW	SOIC	16	40	506.98	12.7	4826	6.6
MAX3232IPW	PW	TSSOP	16	90	530	10.2	3600	3.5

D (R–PDSO–G16) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
E. Reference JEDEC MS–012 variation AC.

D (R–PDSO–G16) PLASTIC SMALL OUTLINE



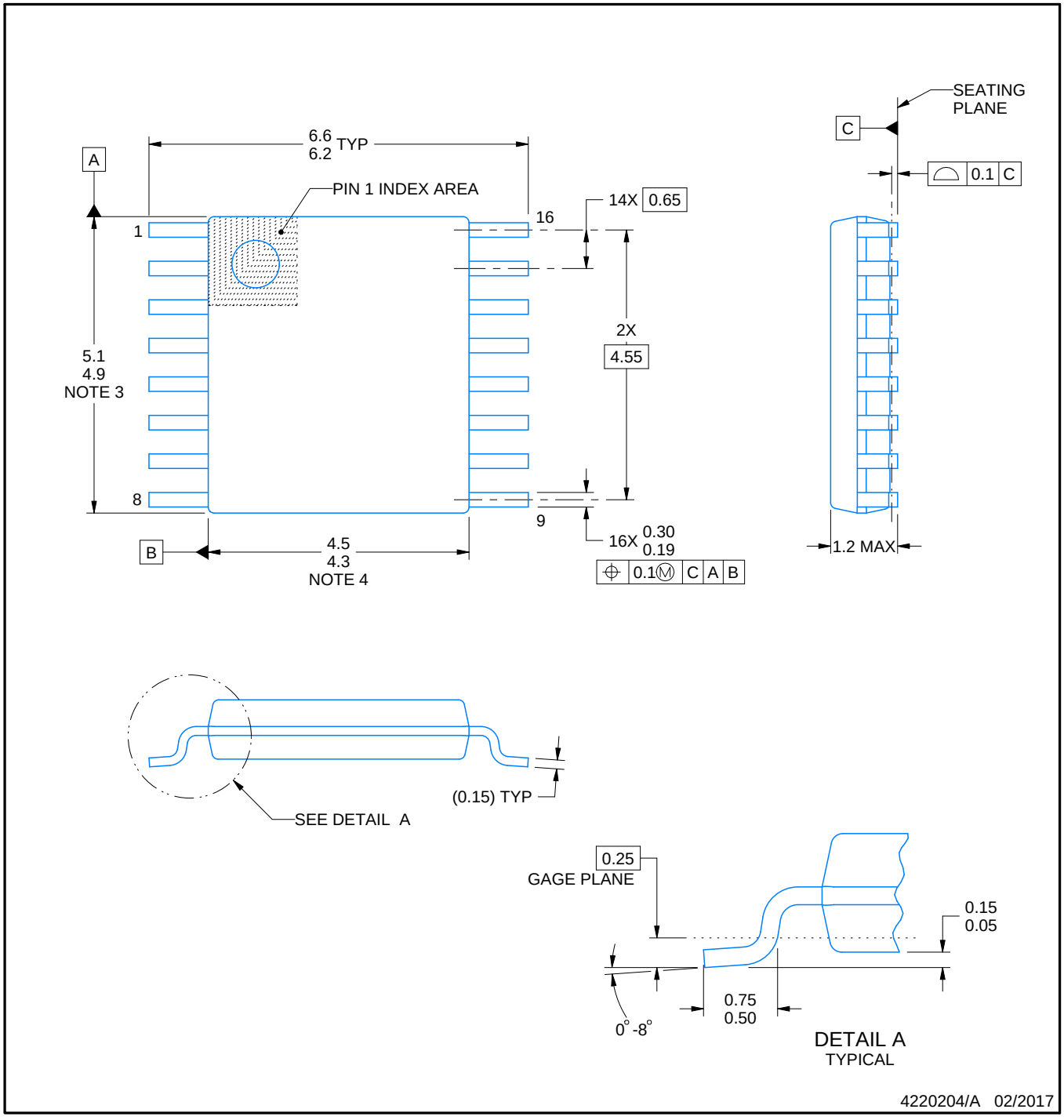
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC–7525 for other stencil recommendations.
E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PACKAGE OUTLINE

PW0016A

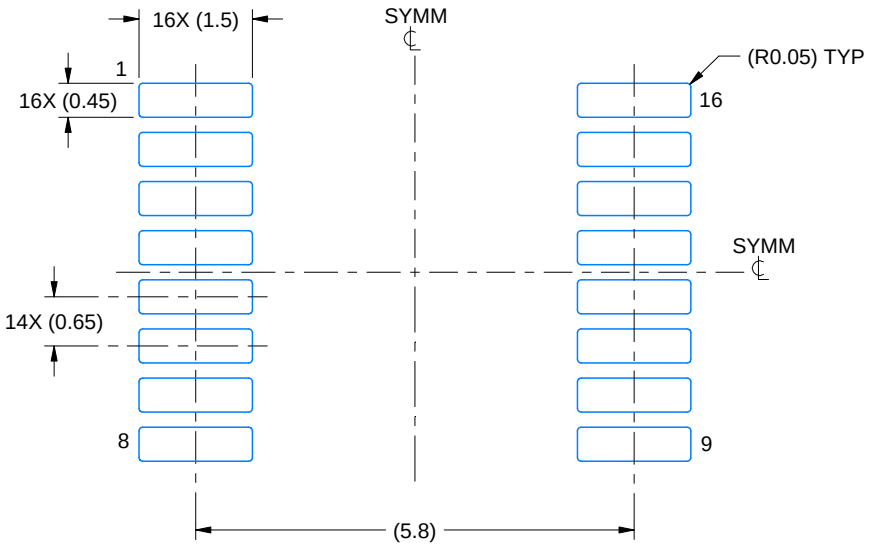
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

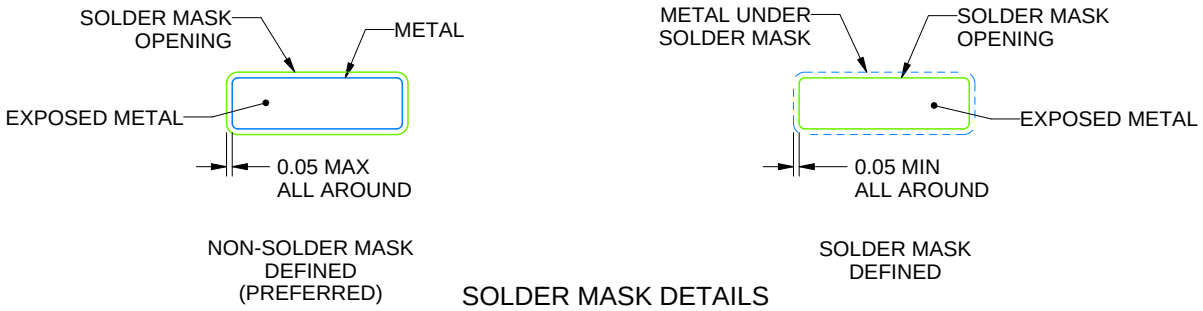


NOTES:

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. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

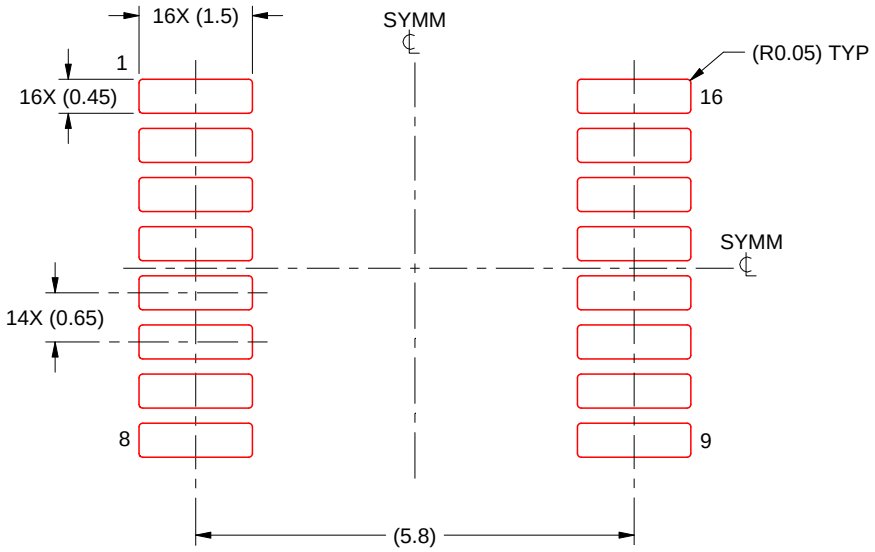


SOLDER MASK DETAILS

4220204/A 02/2017

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220204/A 02/2017

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

GENERIC PACKAGE VIEW

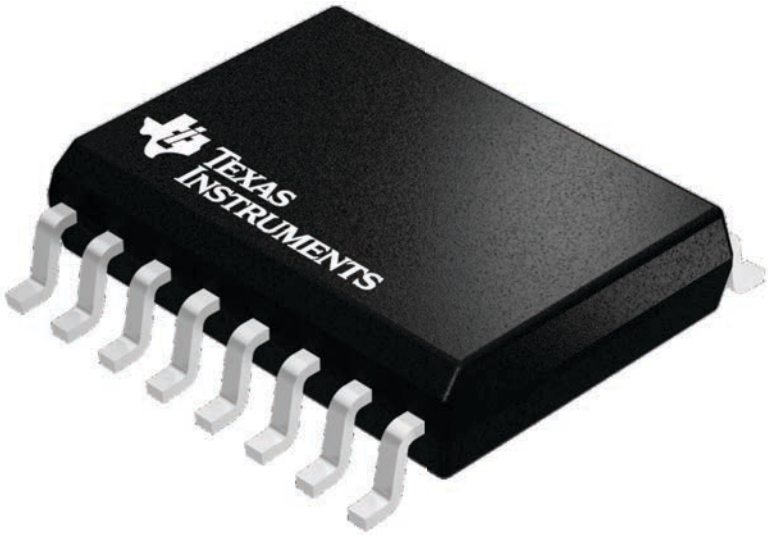
DW 16

SOIC - 2.65 mm max height

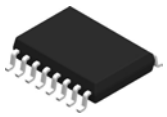
7.5 x 10.3, 1.27 mm pitch

SMALL OUTLINE INTEGRATED CIRCUIT

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



4224780/A

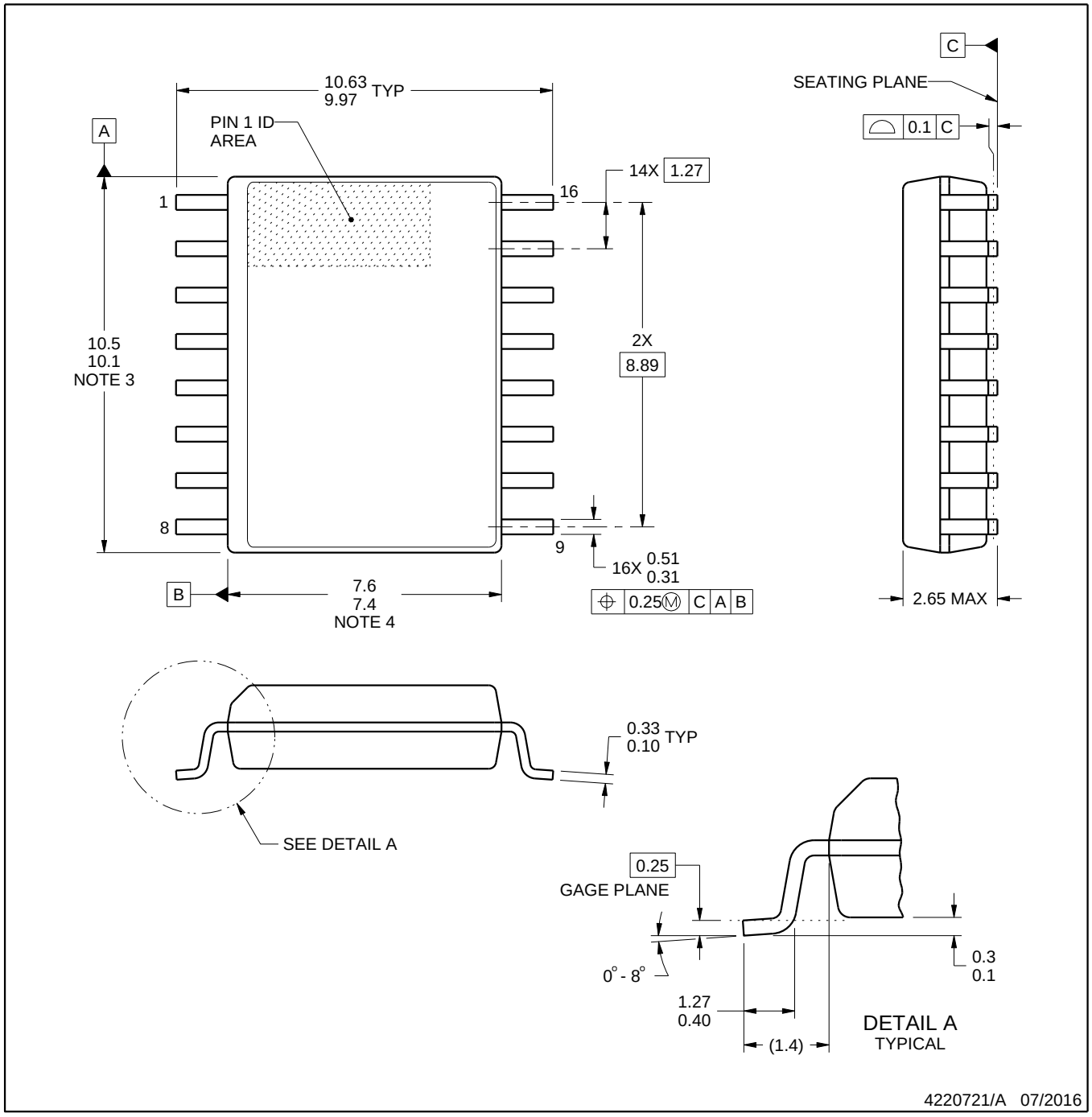


PACKAGE OUTLINE

DW0016A

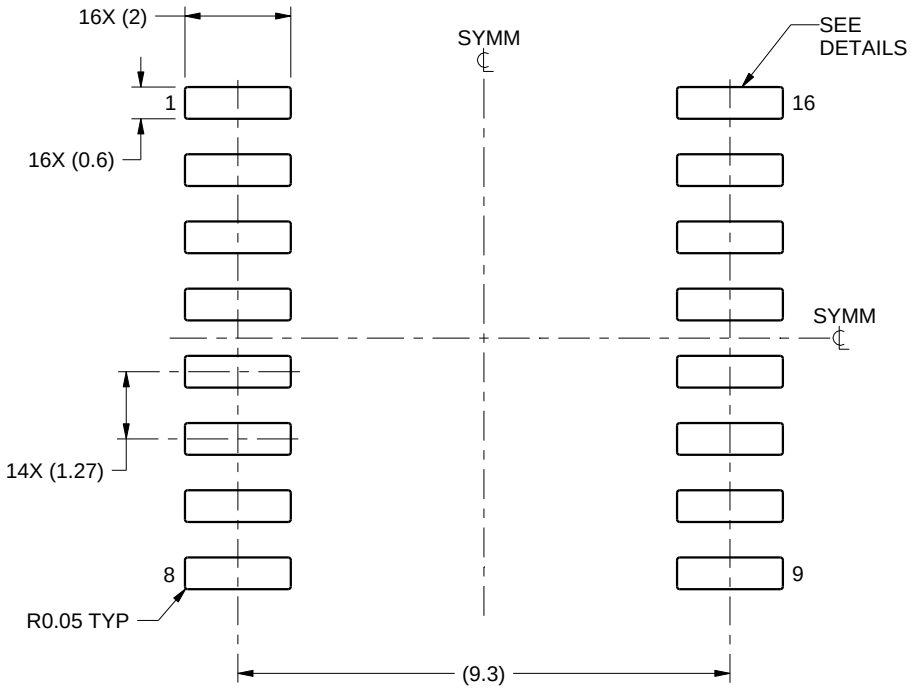
SOIC - 2.65 mm max height

SOIC

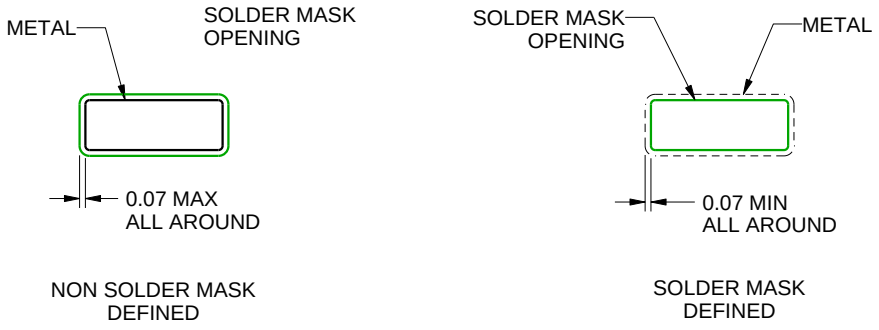


NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.
5. Reference JEDEC registration MS-013.



LAND PATTERN EXAMPLE
SCALE:7X

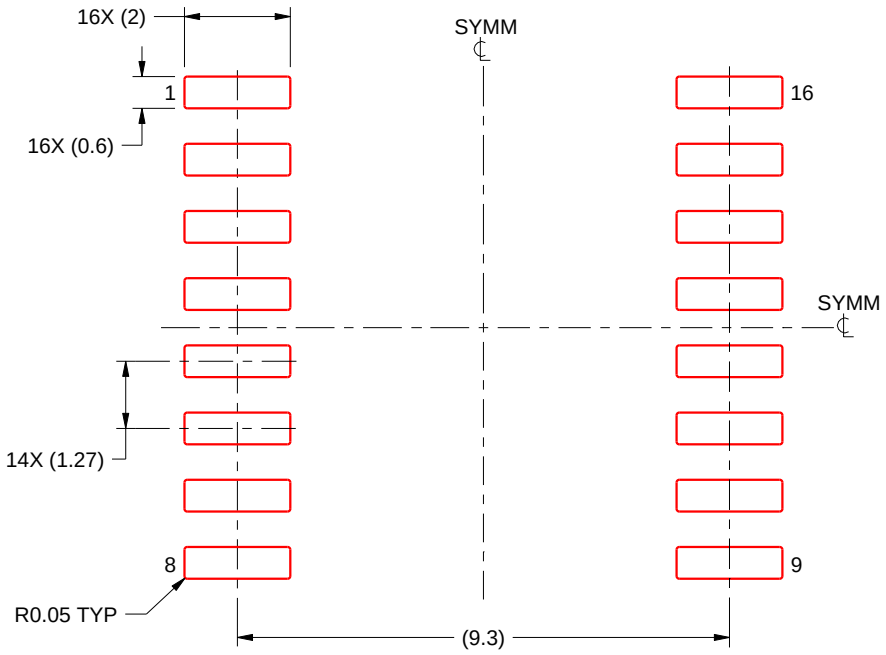


SOLDER MASK DETAILS

4220721/A 07/2016

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:7X

4220721/A 07/2016

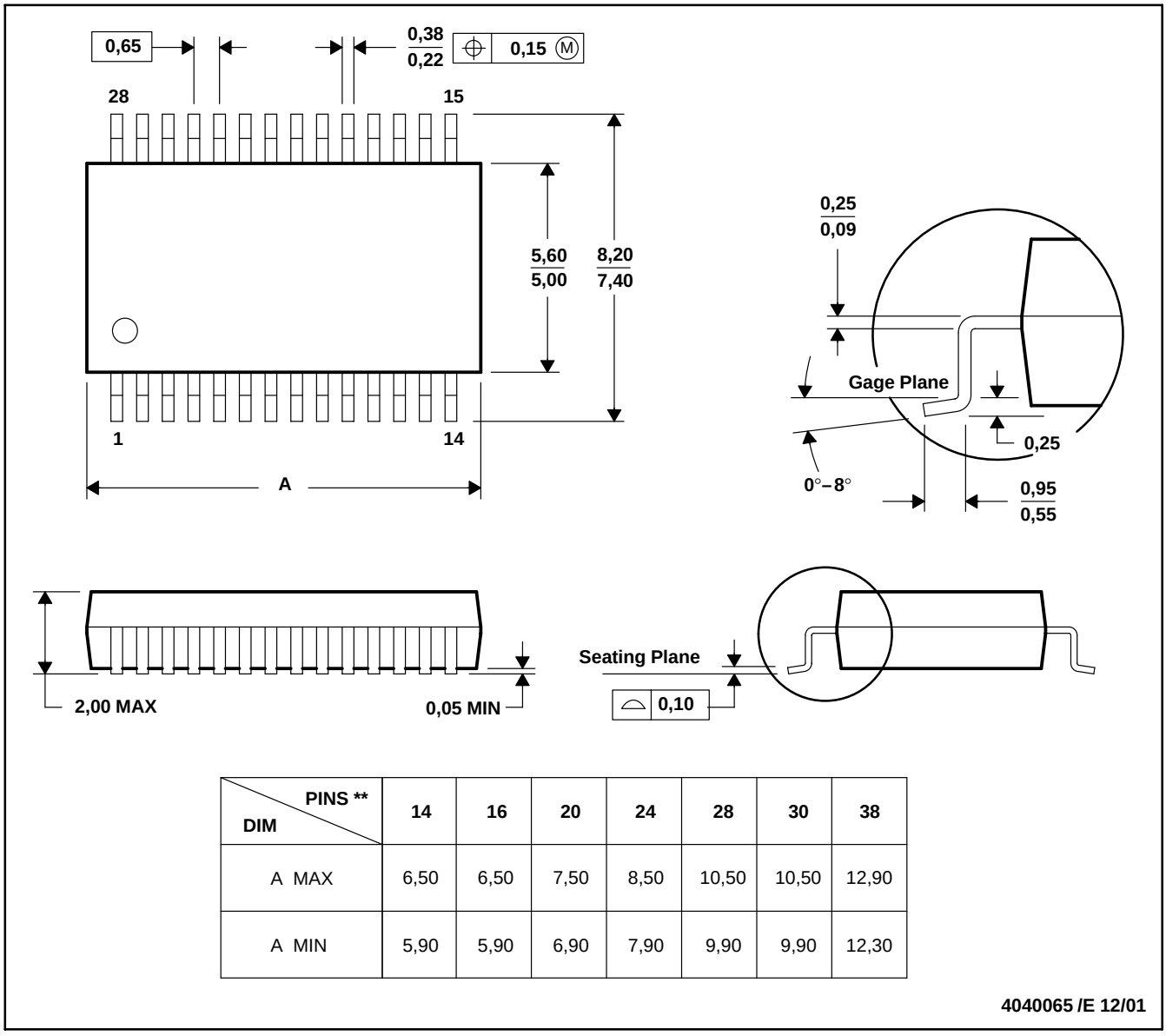
NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

MSSO002E – JANUARY 1995 – REVISED DECEMBER 2001

DB (R-PDSO-G)** **PLASTIC SMALL-OUTLINE**

28 PINS SHOWN



DIM \ PINS **	14	16	20	24	28	30	38
A MAX	6,50	6,50	7,50	8,50	10,50	10,50	12,90
A MIN	5,90	5,90	6,90	7,90	9,90	9,90	12,30

4040065 /E 12/01

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
D. Falls within JEDEC MO-150

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