AM26LS31 四路差分线路驱动器

1 特性

- 符合或超出 ANSI TIA/EIA-422-B 和 ITU 的要求
- 由 5V 单电源供电运行
- TTL 兼容
- 互补输出
- 在断电情况下具有高输出阻抗
- 互补输出使能输入
- 提供已通过 MIL-PRF-38535 认证的选项 (M)：所有参数均经过测试，除非另有说明。对于所有其他产品，生产流程不一定包含对所有参数的测试。

2 应用

- 电机编码器
- 现场变送器：压力传感器和温度传感器
- 军用和航空电子成像
- 采用 Modbus 的温度传感器或控制器

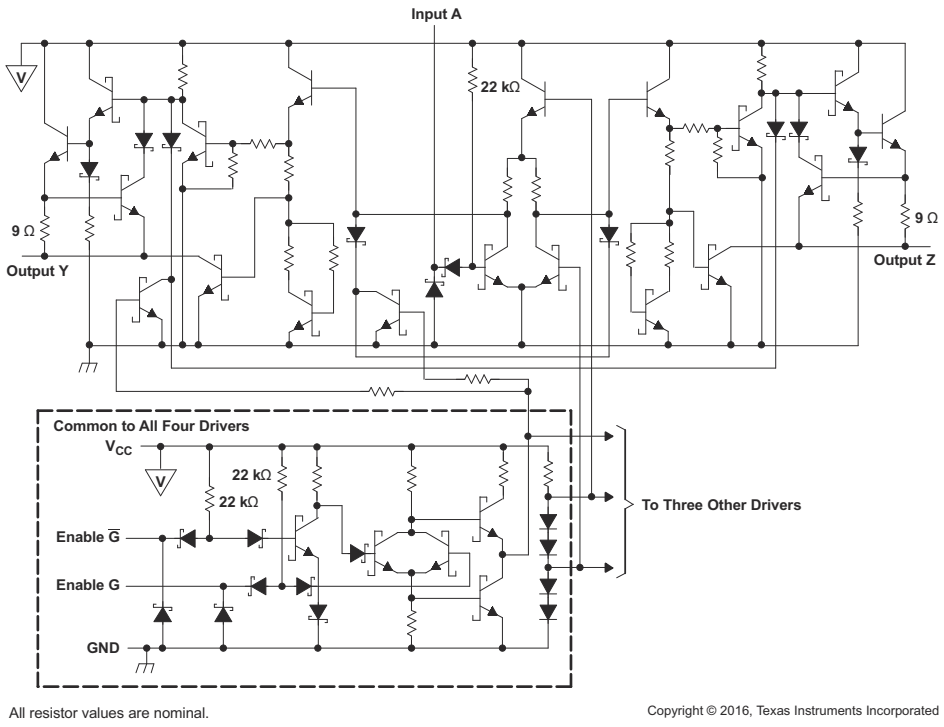
3 说明

AM26LS31CN-E 系列器件是四路互补输出线路驱动器，可满足 ANSI TIA/EIA-422-B 和 ITU（原 CCITT）建议 V.11 的要求。三态输出可提供用于驱动双绞线或平行线传输线路等平衡线路的高电流，并在断电情况下处于高阻抗状态。四个驱动器均具有使能功能，该功能提供了两种可选输入：高电平有效使能和低电平有效使能（G、$\overline{G}$）输入。低功耗肖特基电路可在不牺牲速度的情况下降低功耗。

封装信息

器件型号	封装(1)	封装尺寸(2)
AM26LS31MFK	LCCC (20)	8.89mm × 8.89mm
AM26LS31MJ	CDIP (16)	19.6mm × 6.92mm
AM26LS31MW	CFP (16)	10.3mm × 6.73mm
AM26LS31CD	SOIC (16)	9.9mm × 3.91mm
AM26LS31CDB	SSOP (16)	6.2mm × 5.3mm
AM26LS31CN-E	PDIP (16)	19.3mm × 6.35mm
AM26LS31xNS	SO (16)	10.3mm × 5.3mm

(1) 有关更多信息，请参阅节 11。
(2) 封装尺寸（长 × 宽）为标称值，并包括引脚（如适用）。



原理图（每个驱动器）

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4 Pin Configuration and Functions

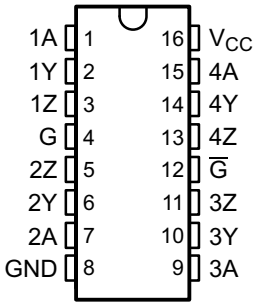

图 4-1. D (SOIC), DB (SSOP), N (PDIP) , NS (SO), J (CDIP), or W (CFP) Packages (Top View)

表 4-1. Pin Functions

PIN		I/O	DESCRIPTION
NAME	NO.		
1A	1	I	Logic Data Input to RS422 Driver number 1
1Y	2	O	RS-422 Data Line (Driver 1)
1Z	3	O	RS-422 Data Line (Driver 1)
G	4	I	Driver Enable (active high)
$\overline{G}$	12	I	Driver Enable (active Low)
2A	7	I	Logic Data Input to RS422 Driver number 2
2Y	6	O	RS-422 Data Line (Driver 2)
2Z	5	O	RS-422 Data Line (Driver 2)
3A	9	I	Logic Data Input to RS422 Driver number 3
3Y	10	O	RS-422 Data Line (Driver 3)
3Z	11	O	RS-422 Data Line (Driver 3)
4A	15	I	Logic Data Input to RS422 Driver number 4
4Y	14	O	RS-422 Data Line (Driver 4)
4Z	13	O	RS-422 Data Line (Driver 4)
VCC	16	–	Power Input. Connect to 5V Power Source.
GND	8	–	Device Ground Pin

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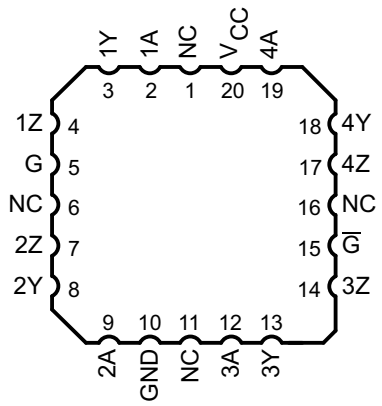

图 4-2. FK (LCCC) 20-Pin Package (Top View)

表 4-2. Pin Functions

PIN		I/O	DESCRIPTION
NAME	NO.		
1A	1	I	Logic Data Input to RS422 Driver number 1
1Y	2	O	RS-422 Data Line (Driver 1)
1Z	3	O	RS-422 Data Line (Driver 1)
G	4	I	Driver Enable (active high)
$\overline{G}$	12	I	Driver Enable (active Low)
2A	7	I	Logic Data Input to RS422 Driver number 2
2Y	6	O	RS-422 Data Line (Driver 2)
2Z	5	O	RS-422 Data Line (Driver 2)
3A	9	I	Logic Data Input to RS422 Driver number 3
3Y	10	O	RS-422 Data Line (Driver 3)
3Z	11	O	RS-422 Data Line (Driver 3)
4A	15	I	Logic Data Input to RS422 Driver number 4
4Y	14	O	RS-422 Data Line (Driver 4)
4Z	13	O	RS-422 Data Line (Driver 4)
VCC	8	I	Power Input. Connect to 5V Power Source.
GND	16	I	Device Ground Pin

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5 Specifications

5.1 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
V_{CC}	Supply voltage(2)			7	V
V_I	Input voltage			7	V
	Output off-state voltage			5.5	V
	Lead temperature 1,6 mm (1/16 in) from case for 10 s			260	°C
	Lead temperature 1,6 mm (1/16 in) from case for 60 s	J package		300	°C
T_{stg}	Storage temperature		–65	150	°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 under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) All voltage values, except differential output voltage V_{OD}, are with respect to network GND.

5.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1)	±2000	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101(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.

5.3 Recommended Operating Conditions

			MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage	AM26LS31C	4.75	5	5.25	V
		AM26LS31M	4.5	5	5.5	
V_{IH}	High-level input voltage		2			V
V_{IL}	Low-level input voltage				0.8	V
I_{OH}	High-level output current				–20	mA
I_{OL}	Low-level output current				20	mA
T_A	Operating free-air temperature	AM26LS31C	0		70	°C
		AM26LS31I	–40		85	
		AM26LS31M	–55		125	

5.4 Thermal Information

THERMAL METRIC(1)		AM26LS31x				UNIT
		D (SOIC)	DB (SSOP)	N (PDIP)	NS (SO)	
		16 PINS	16 PINS	16 PINS	16 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance(2)	84.6	82	60.6	88.5	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	43.5	–	48.1	46.2	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	43.2	–	40.6	50.7	°C/W
ψ_{JT}	Junction-to-top characterization parameter	10.4	–	27.5	13.5	°C/W
ψ_{JB}	Junction-to-board characterization parameter	42.8	–	40.3	50.3	°C/W

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report.
(2) The package thermal impedance is calculated in accordance with JESD 51-7.

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5.5 Electrical Characteristics

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

PARAMETER		TEST CONDITIONS		MIN	TYP(2)	MAX	UNIT
V_{IK}	Input clamp voltage	V_{CC} = MIN, I_I = –18mA				–1.5	V
V_{OH}	High-level output voltage	V_{CC} = MIN, I_{OH} = –20mA		2.5			V
V_{OL}	Low-level output voltage	V_{CC} = MIN, I_{OL} = 20mA				0.5	V
I_{OZ}	Off-state (high-impedance-state) output current	V_{CC} = MIN,	V_O = 0.5V			–20	μA
			V_O = 2.5V			20	
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 7V				0.1	mA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.7V				20	μA
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.4V				–0.36	mA
I_{OS}	Short-circuit output current(3)	V_{CC} = MAX		–30		–150	mA
I_{CC}	Supply current	V_{CC} = MAX, all outputs disabled			32	80	mA

(1) For C-suffix devices, V_{CC} min = 4.75V and V_{CC} max = 5.25V. For M-suffix devices, V_{CC} min = 4.5V and V_{CC} max = 5.5V.
(2) All typical values are at V_{CC} = 5V and T_A = 25°C.
(3) Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.

5.6 Switching Characteristics – AM26LS31

T_A = 25°C, V_{CC} = 5V (see 图 6-1)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low- to high-level output	C_L = 30pF, S1 and S2 open			14	20	ns
t_{PHL}	Propagation delay time, high- to low-level output				14	20	
t_{PZH}	Output enable time to high level	C_L = 30pF	R_L = 75Ω		25	40	ns
t_{PZL}	Output enable time to low level		R_L = 180Ω		37	45	
t_{PHZ}	Output disable time from high level	C_L = 10pF, S1 and S2 closed			21	30	ns
t_{PLZ}	Output disable time from low level				23	35	
t_{SKEW}	Output-to-output skew	C_L = 30pF, S1 and S2 open			1	6	ns

5.7 Switching Characteristics – AM26LS31M

T_A = 25°C, V_{CC} = 5V (see 图 6-1)

PARAMETER		TEST CONDITIONS		MIN	MAX	UNIT
t_{PLH}	Propagation delay time, low- to high-level output	C_L = 30pF, S1 and S2 open			30	ns
t_{PHL}	Propagation delay time, high- to low-level output				30	
t_{PZH}	Output enable time to high level	C_L = 30pF	R_L = 75Ω		60	ns
t_{PZL}	Output enable time to low level		R_L = 180Ω		68	
t_{PHZ}	Output disable time from high level	C_L = 10pF, S1 and S2 closed			45	ns
t_{PLZ}	Output disable time from low level				53	
t_{SKEW}	Output-to-output skew	C_L = 30pF, S1 and S2 open			9	ns

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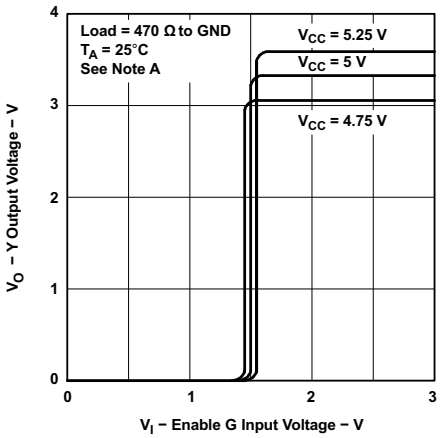
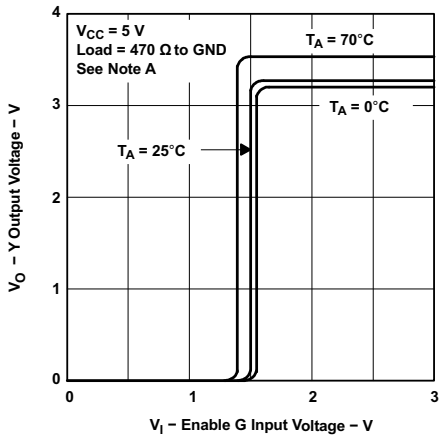
5.8 Typical Characteristics



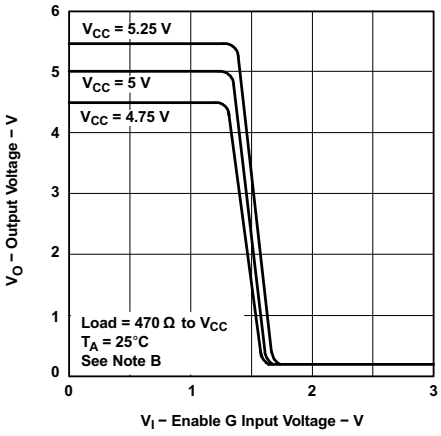
A. The A input is connected to V_{CC} during testing of the Y outputs and to ground during testing of the Z outputs.

图 5-1. Output Voltage vs Enable G Input Voltage



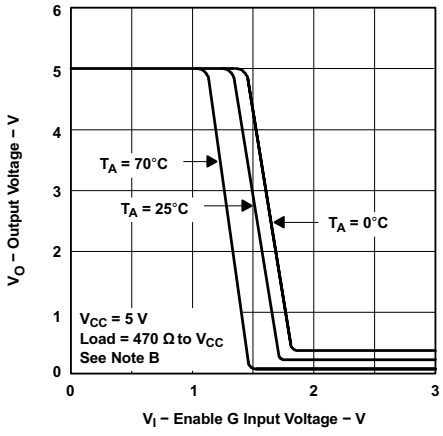
A. The A input is connected to V_{CC} during testing of the Y outputs and to ground during testing of the Z outputs.

图 5-2. Output Voltage vs Enable G Input Voltage



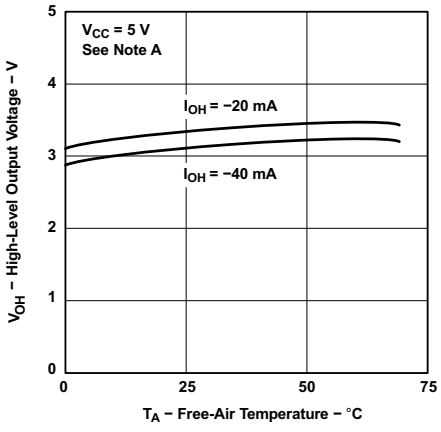
B. The A input is connected to ground during testing of the Y outputs and to V_{CC} during testing of the Z outputs.

图 5-3. Output Voltage vs Enable G Input Voltage



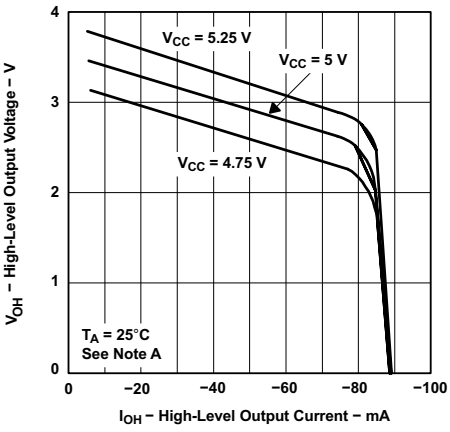
B. The A input is connected to ground during testing of the Y outputs and to V_{CC} during testing of the Z outputs.

图 5-4. Output Voltage vs Enable G Input Voltage



A. The A input is connected to V_{CC} during testing of the Y outputs and to ground during testing of the Z outputs.

图 5-5. High-Level Output Voltage vs Free-Air Temperature



A. The A input is connected to V_{CC} during testing of the Y outputs and to ground during testing of the Z outputs.

图 5-6. High-Level Output Voltage vs High-Level Output Current

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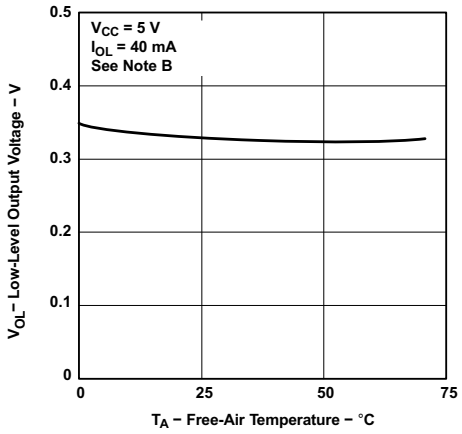
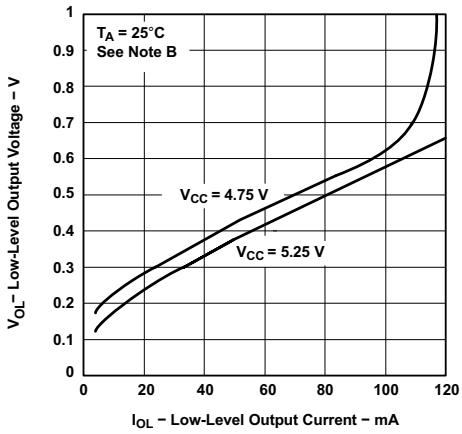
5.8 Typical Characteristics (continued)



B. The A input is connected to ground during testing of the Y outputs and to V_{CC} during testing of the Z outputs.

图 5-7. Low-Level Output Voltage vs Free-Air Temperature



B. The A input is connected to ground during testing of the Y outputs and to V_{CC} during testing of the Z outputs.

图 5-8. Low-Level Output Voltage vs Low-Level Output Current

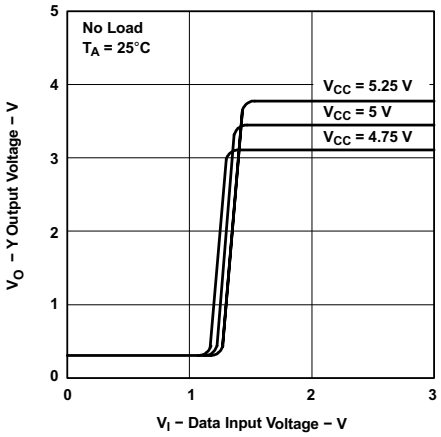


图 5-9. Y Output Voltage vs Data Input Voltage

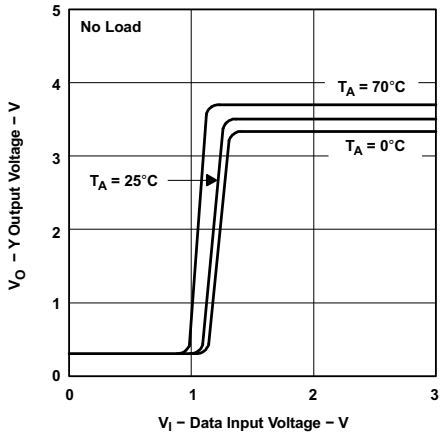


图 5-10. Y Output Voltage vs Data Input Voltage

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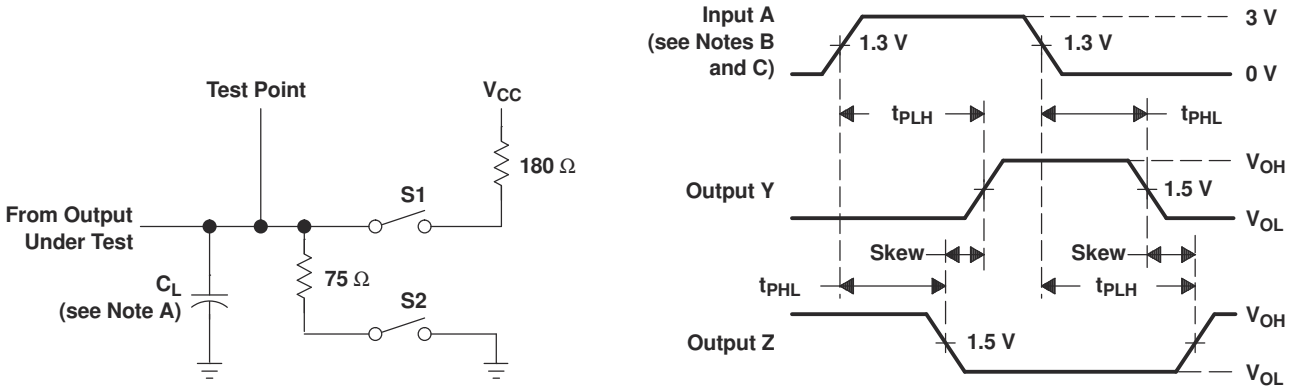
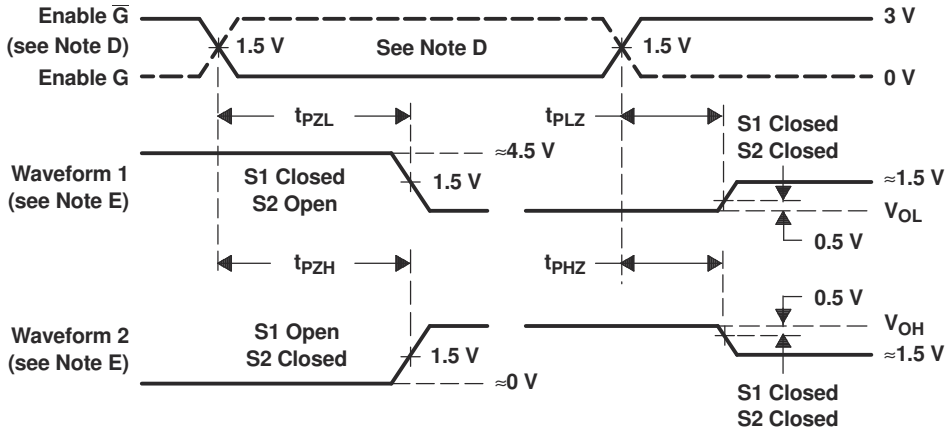
6 Parameter Measurement Information



PROPAGATION DELAY TIMES AND SKEW

TEST CIRCUIT



ENABLE AND DISABLE TIME WAVEFORMS

NOTES: A. C_L includes probe and jig capacitance.
B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O ≈ 50 Ω, t_r ≤ 15 ns, t_f ≤ 6 ns.
C. When measuring propagation delay times and skew, switches S1 and S2 are open.
D. Each enable is tested separately.
E. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.

图 6-1. Test Circuit and Voltage Waveforms

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7 Detailed Description

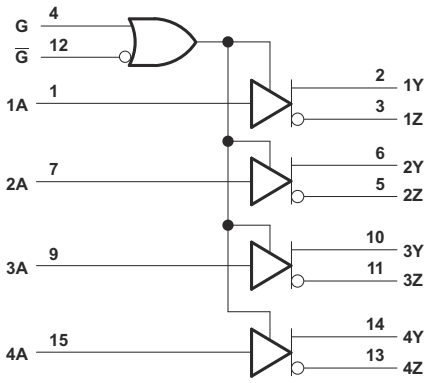
7.1 Overview

The AM26LS31x CN-E differential bus transmitter is a monolithic integrated circuit designed for unidirectional data communication on transmission lines. It is designed for balanced transmission lines and meets ANSI Standard EIA/TIA-422-B and ITU Recommendation V.11.

The AM26LS31x CN-E has a four 3-state differential line drivers that operate from a single 5V power supply. The driver also integrates active-high and active-low enables for precise device control.

The driver is designed to handle loads of a minimum of ±30mA of sink or source current. The driver features positive- and negative-current limiting for protection from line fault conditions.

7.2 Functional Block Diagram



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7.3 Feature Description

7.3.1 Complementary Output-Enable Inputs

The AM26LS31x can be configured using the G and $\overline{G}$ logic inputs to control transmitter outputs. Setting either G to a logic HIGH or $\overline{G}$ to an logic LOW enables the transmitter outputs. If G is set to logic LOW and $\overline{G}$ is set to logic HIGH, the transmitter outputs are disabled. See 表 7-1 for a complete truth table.

7.3.2 High Output Impedance in Power-Off Conditions

When the AM26LS31x transmitter outputs are disabled using G and $\overline{G}$, the outputs are set to a high impedance state.

7.3.3 Complementary Outputs

The AM26LS31x is the driver half of a pair of devices, with the AM26LS32 being the complementary receiver. TI recommends using these devices together for optimal performance, but any RS-422 compliant receive must ensure proper RS-422 communication and logic level translation.

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7.4 Device Functional Modes

表 7-1 lists the functional modes of the AM26LS31CN-E.

表 7-1. Function Table(1)
(Each Driver)

INPUT A	ENABLES G	ENABLES $\overline{G}$	OUTPUTS Y	OUTPUTS Z
H	H	X	H	L
L	H	X	L	H
H	X	L	H	L
L	X	L	L	H
X	L	H	Z	Z

(1) H = high level, L = low level,
X = irrelevant,
Z = high impedance (off)

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8 Application and Implementation

备注

以下应用部分中的信息不属于 TI 器件规格的范围，TI 不担保其准确性和完整性。TI 的客 户应负责确定器件是否适用于其应用。客户应验证并测试其设计，以确保系统功能。

8.1 Application Information

When designing a system that uses drivers, receivers, and transceivers that comply with RS-422 or RS-485, proper cable termination is essential for highly reliable applications with reduced reflections in the transmission line. Because RS-422 allows only one driver on the bus, if termination is used, it is placed only at the end of the cable near the last receiver. In general, RS-485 requires termination at both ends of the cable. Factors to consider when determining the type of termination usually are performance requirements of the application and the ever-present factor, cost. The different types of termination techniques discussed are unterminated lines, parallel termination, AC termination, and multipoint termination. Laboratory waveforms for each termination technique (except multipoint termination) illustrate the usefulness and robustness of RS-422 (and, indirectly, RS-485). Similar results can be obtained if 485-compliant devices and termination techniques are used. For laboratory experiments, 100 feet of 100 Ω, 24-AWG, twisted-pair cable (Bertek) was used. A single driver and receiver, TI AM26LS31CN-E and AM26LS32C, respectively, were tested at room temperature with a 5V supply voltage. Two plots per termination technique are shown. In each plot, the top waveform is the driver input and the bottom waveform is the receiver output. To show voltage waveforms related to transmission-line reflections, the first plot shows output waveforms from the driver at the start of the cable; the second plot shows input waveforms to the receiver at the far end of the cable.

8.2 Typical Application

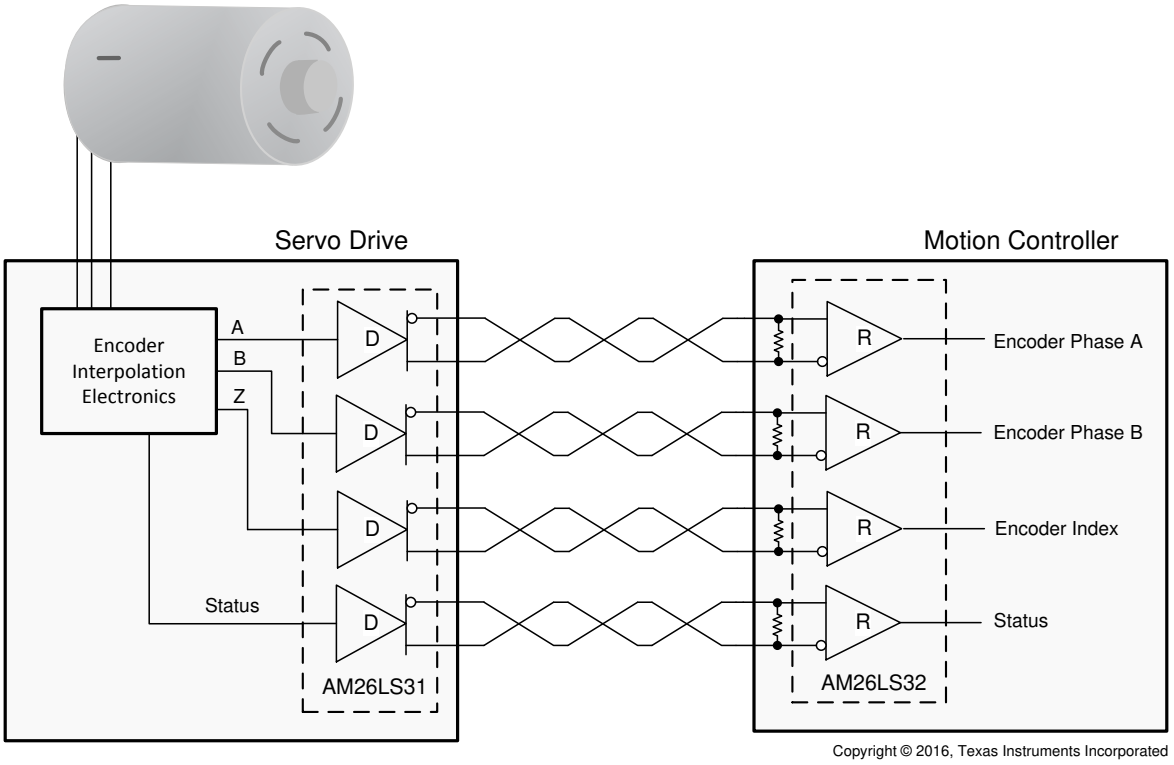

图 8-1. Encoder Application

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8.2.1 Design Requirements

This example requires the following:

- 5V power source
- RS-485 bus operating at 10Mbps or less
- Connector that makes sure the correct polarity for port pins

8.2.2 Detailed Design Procedure

Place the device close to bus connector to keep traces (stub) short to prevent adding reflections to the bus line.

If desired, add external fail-safe biasing to ensure 200mV on the A-B port, if the drive is in high impedance state (see *Failsafe in RS-485 data buses*).

8.2.3 Application Curve

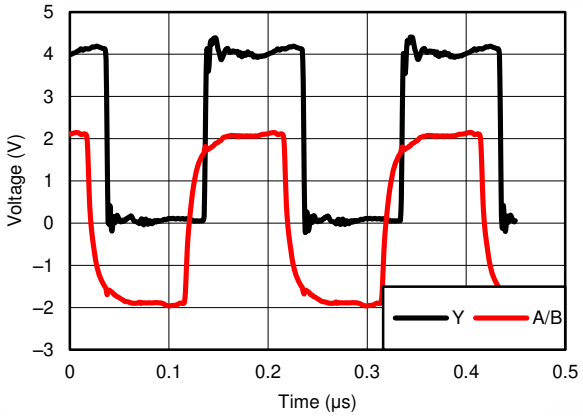

图 8-2. Differential 120-Ω Terminated Output Waveforms (Cat 5E Cable)

8.3 Power Supply Recommendations

Place a 0.1 µF bypass capacitors close to the power-supply pins to reduce errors coupling in from noisy or high impedance power supplies.

8.4 Layout

8.4.1 Layout Guidelines

For best operational performance of the device, use good PCB layout practices, including:

- Noise can often propagate into analog circuitry through the power supply of the circuit. Bypass capacitors are used to reduce the coupled noise by providing low impedance power sources local to the analog circuitry.
  - Connect low-ESR, 0.1 µF ceramic bypass capacitors between each supply pin and ground, placed as close to the device as possible. A single bypass capacitor from V+ to ground is applicable for single-supply applications.
- Separate grounding for analog and digital portions of circuitry is one of the simplest and most-effective methods of noise suppression. One or more layers on multilayer PCBs are usually devoted to ground planes. A ground plane helps distribute heat and reduces EMI noise pickup. Make sure to physically separate digital and analog grounds, paying attention to the flow of the ground current.
- To reduce parasitic coupling, run the input traces as far away from the supply or output traces as possible. If it is not possible to keep them separate, it is much better to cross the sensitive trace perpendicular as opposed to in parallel with the noisy trace.
- Place the external components as close to the device as possible. Keeping RF and RG close to the inverting input minimizes parasitic capacitance.
- Keep the length of input traces as short as possible. Always remember that the input traces are the most sensitive part of the circuit.

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8.4.2 Layout Example

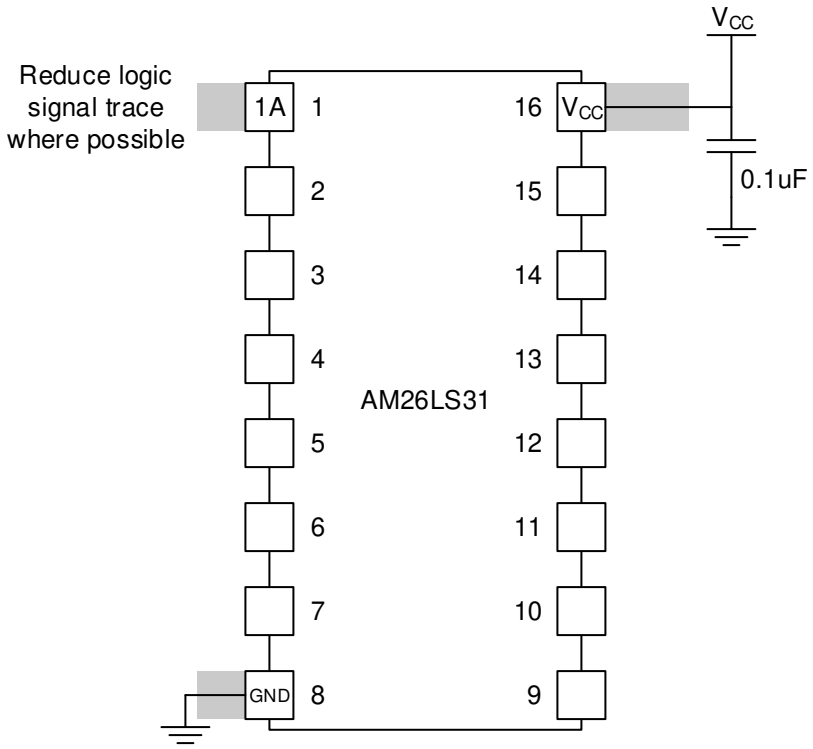

图 8-3. Layout Recommendation

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9 Device and Documentation Support

9.1 Documentation Support

9.1.1 Related Documentation

For related documentation, see the following:

Failsafe in RS-485 data buses (SLYT080)

9.2 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*通知* 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。

9.3 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。

链接的内容由各个贡献者“按原样”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。

9.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.
所有商标均为其各自所有者的财产。

9.5 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。

9.6 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。

10 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 L (October 2018) to Revision M (March 2024)	Page
• 将“器件信息”表更改为*封装信息* 表	1
• Changed the *Thermal Information* table	5

Changes from Revision K (July 2016) to Revision L (October 2018)	Page
• Changed VCC pin number From: 8 To: 16 in the *Pin Functions* table	3
• Changed GND pin number From: 16 To: 8 in the *Pin Functions* table	3

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

- 添加了*应用*部分、*器件信息*表、*ESD 等级*表、*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
- Split up *Switching Characteristics* table into two tables specified for each part 6

Changes from Revision I (February 2006) 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
- 更新了“特性” 1

11 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
5962-7802301M2A	ACTIVE	LCCC	FK	20	55	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-7802301M2A AM26LS31 MFKB	Samples
5962-7802301MEA	ACTIVE	CDIP	J	16	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-7802301MEA AM26LS31MJB	Samples
5962-7802301MFA	ACTIVE	CFP	W	16	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-7802301MFA AM26LS31MWB	Samples
5962-7802301Q2A	ACTIVE	LCCC	FK	20	55	Non-RoHS & Green	SNPB	N / A for Pkg Type		5962-7802301Q2A AM26LS31M	Samples
AM26LS31CD	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI	0 to 70	AM26LS31C	
AM26LS31CDBR	ACTIVE	SSOP	DB	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	SA31C	Samples
AM26LS31CDR	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	AM26LS31C	Samples
AM26LS31CDRG4	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI	0 to 70	AM26LS31C	
AM26LS31CN	ACTIVE	PDIP	N	16	25	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	AM26LS31CN	Samples
AM26LS31CNSR	ACTIVE	SOP	NS	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	26LS31	Samples
AM26LS31INSR	ACTIVE	SOP	NS	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	26LS31	Samples
AM26LS31MFKB	ACTIVE	LCCC	FK	20	55	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-7802301M2A AM26LS31 MFKB	Samples
AM26LS31MJB	ACTIVE	CDIP	J	16	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-7802301MEA AM26LS31MJB	Samples
AM26LS31MWB	ACTIVE	CFP	W	16	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-7802301MFA AM26LS31MWB	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.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF AM26LS31, AM26LS31M :

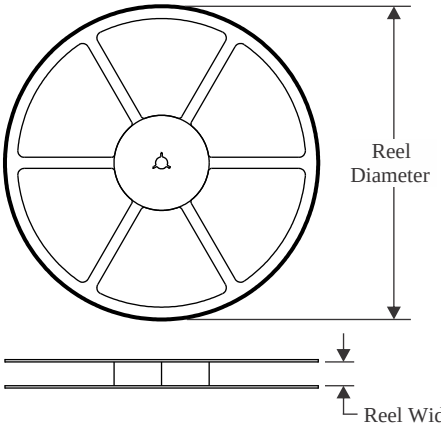
- Catalog : AM26LS31
- Military : AM26LS31M

NOTE: Qualified Version Definitions:

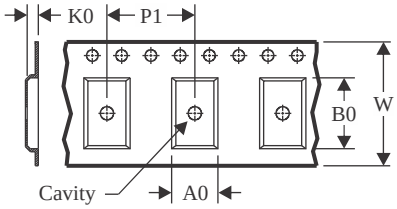
- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION

REEL DIMENSIONS

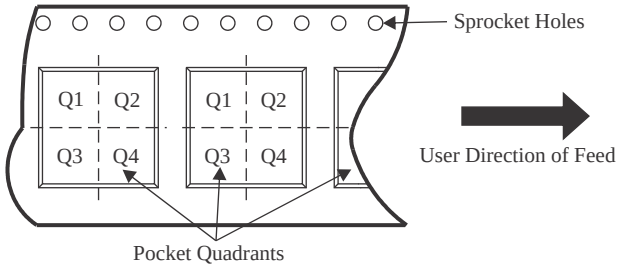


TAPE DIMENSIONS



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

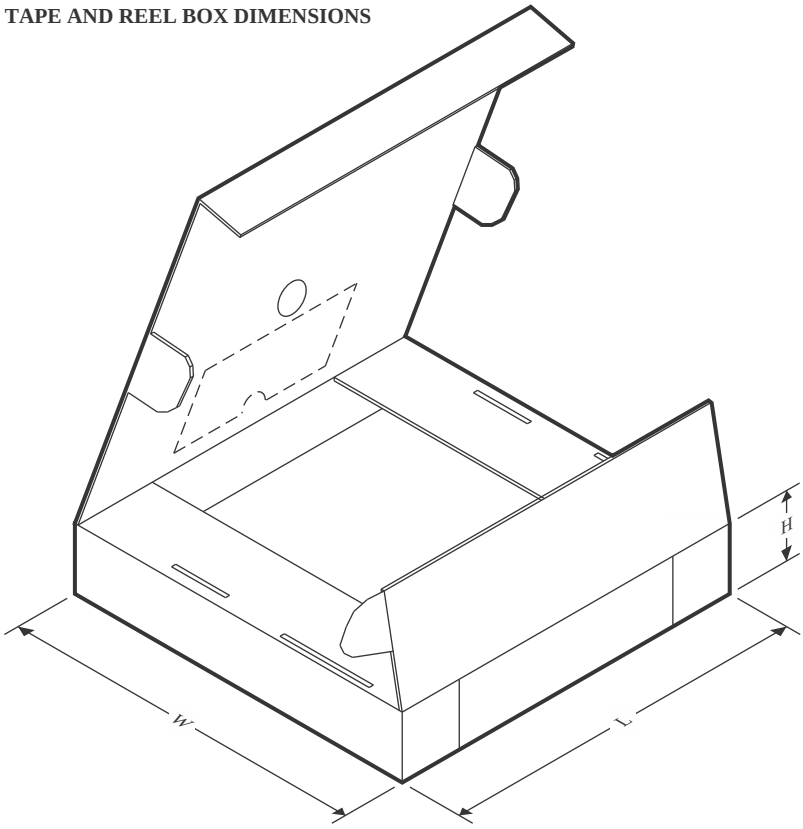
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
AM26LS31CDBR	SSOP	DB	16	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
AM26LS31CDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
AM26LS31CDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
AM26LS31CNSR	SOP	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
AM26LS31CNSR	SOP	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
AM26LS31INSR	SOP	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1

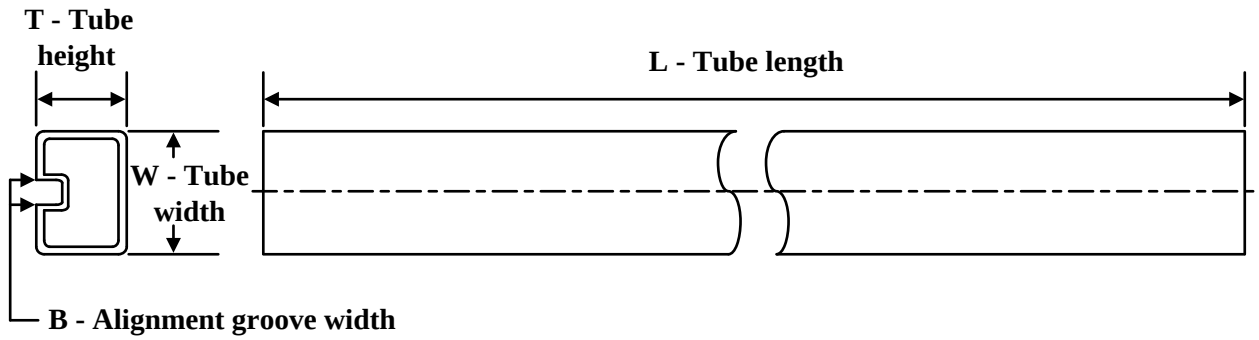
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
AM26LS31CDBR	SSOP	DB	16	2000	356.0	356.0	35.0
AM26LS31CDR	SOIC	D	16	2500	340.5	336.1	32.0
AM26LS31CDR	SOIC	D	16	2500	353.0	353.0	32.0
AM26LS31CNSR	SOP	NS	16	2000	353.0	353.0	32.0
AM26LS31CNSR	SOP	NS	16	2000	367.0	367.0	38.0
AM26LS31INSR	SOP	NS	16	2000	356.0	356.0	35.0

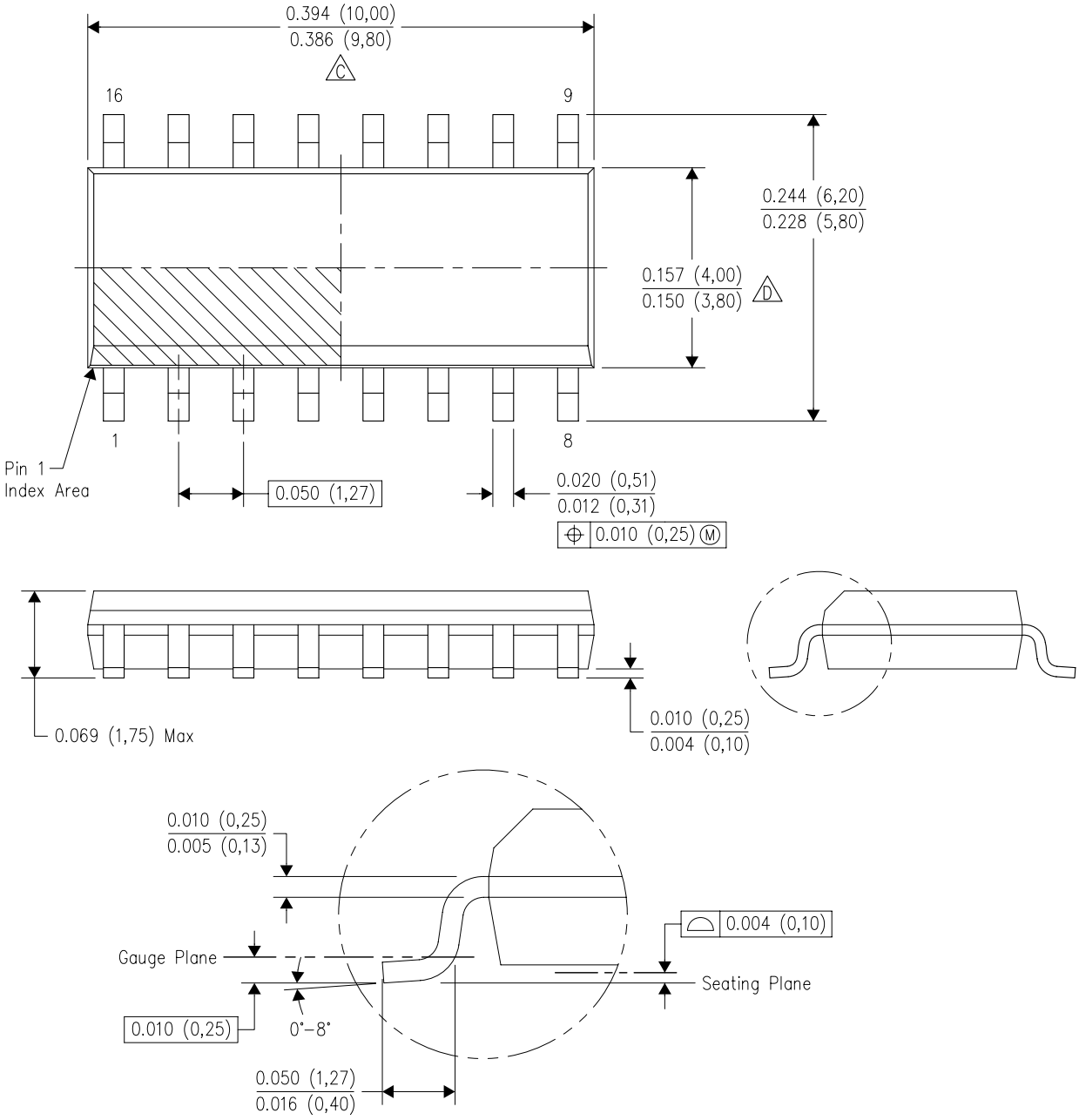
TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
5962-7802301M2A	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-7802301MFA	W	CFP	16	25	506.98	26.16	6220	NA
5962-7802301Q2A	FK	LCCC	20	55	506.98	12.06	2030	NA
AM26LS31CN	N	PDIP	16	25	506	13.97	11230	4.32
AM26LS31MFKB	FK	LCCC	20	55	506.98	12.06	2030	NA
AM26LS31MWB	W	CFP	16	25	506.98	26.16	6220	NA

D (R–PDSO–G16) PLASTIC SMALL OUTLINE



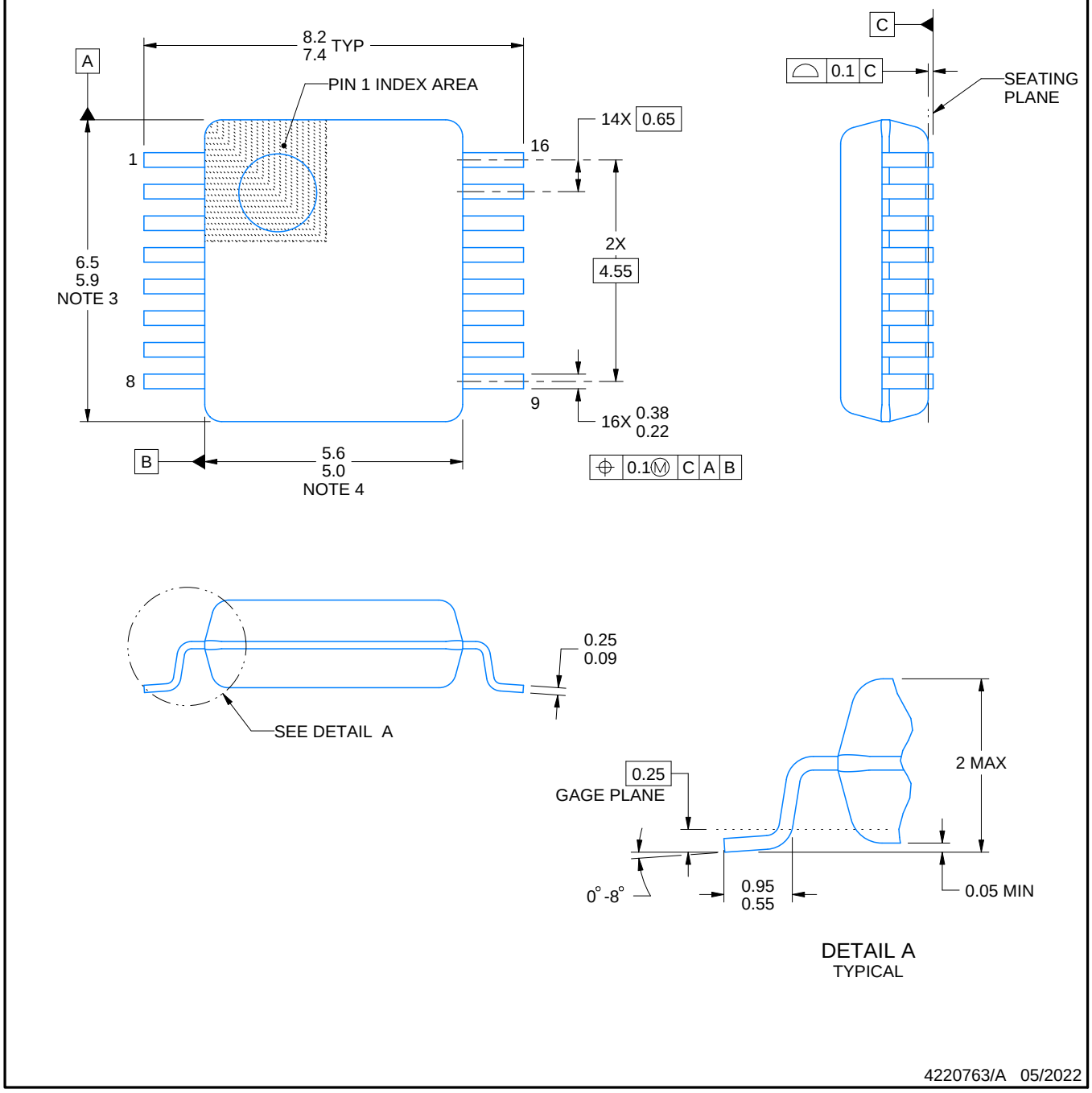
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
D. Body width does not include interlead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

PACKAGE OUTLINE

DB0016A

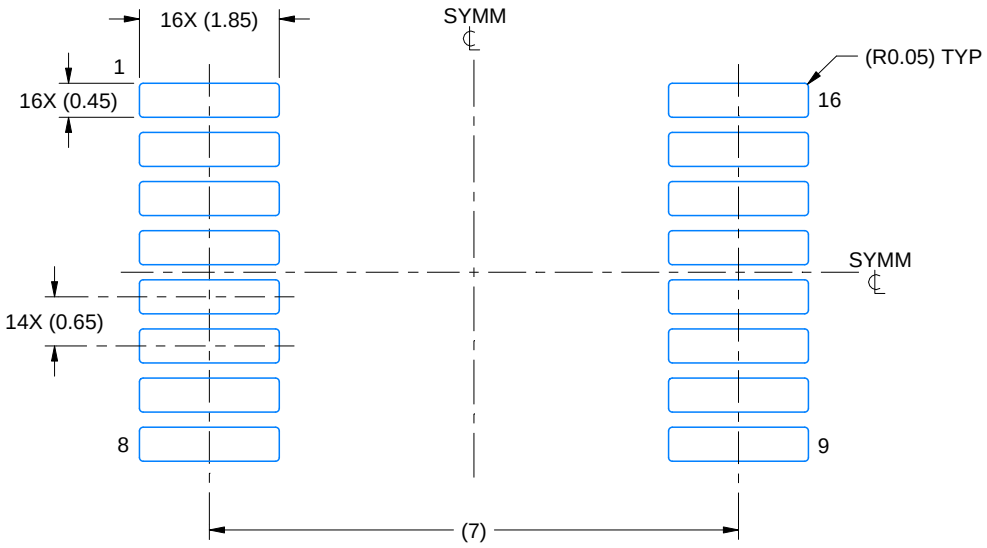
SSOP - 2 mm max height

SMALL OUTLINE PACKAGE

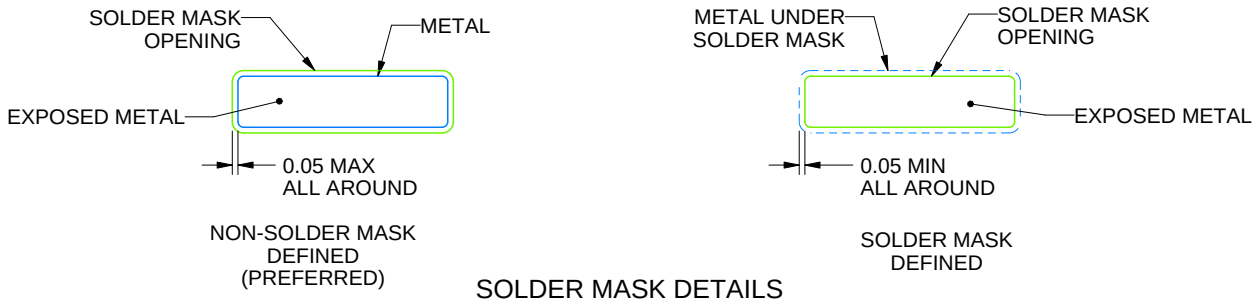


NOTES:

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. Reference JEDEC registration MO-150.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

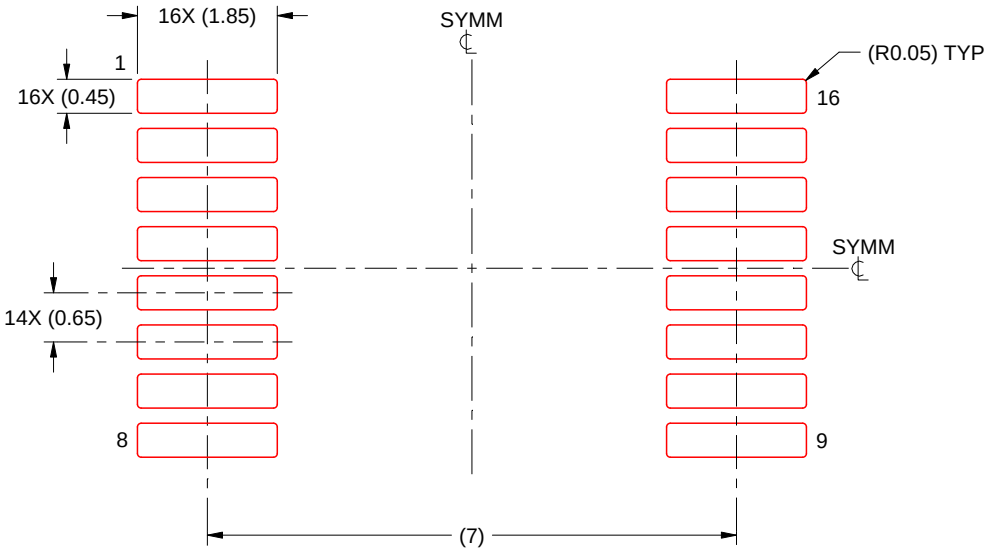


SOLDER MASK DETAILS

4220763/A 05/2022

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. 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

4220763/A 05/2022

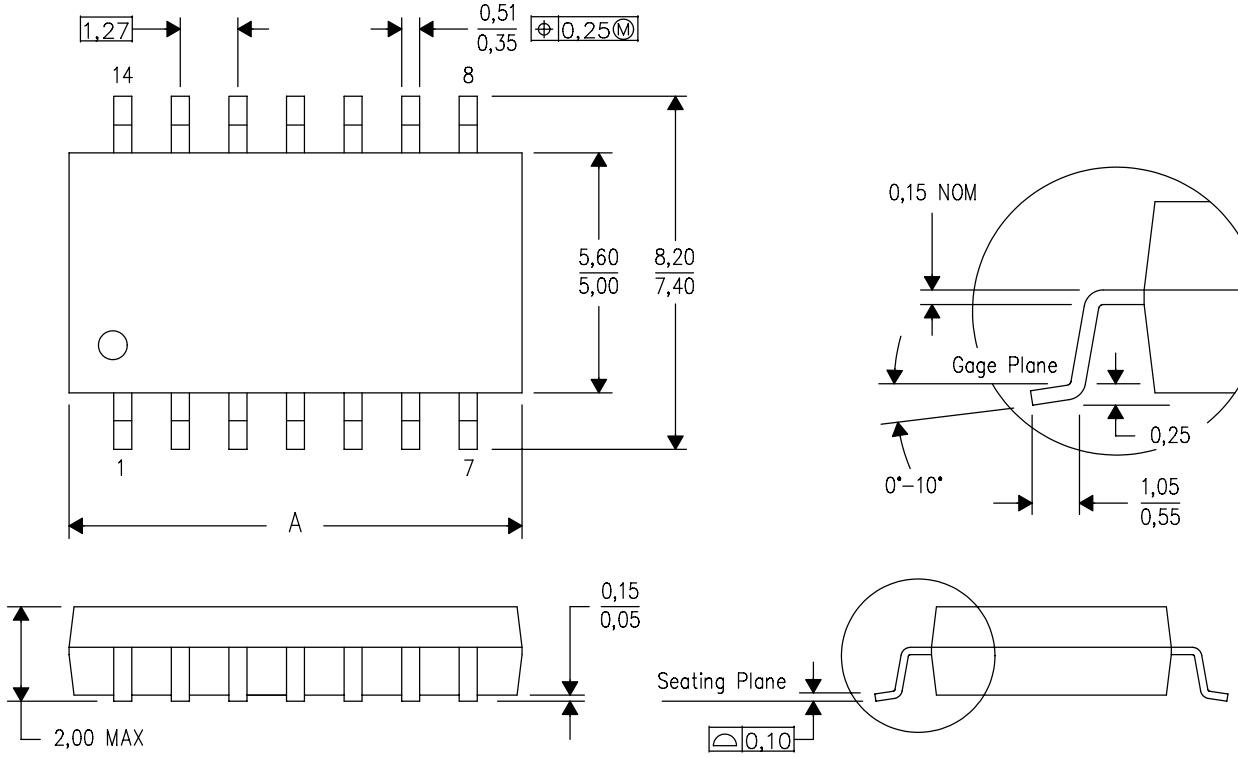
NOTES: (continued)

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

MECHANICAL DATA

NS (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14-PINS SHOWN

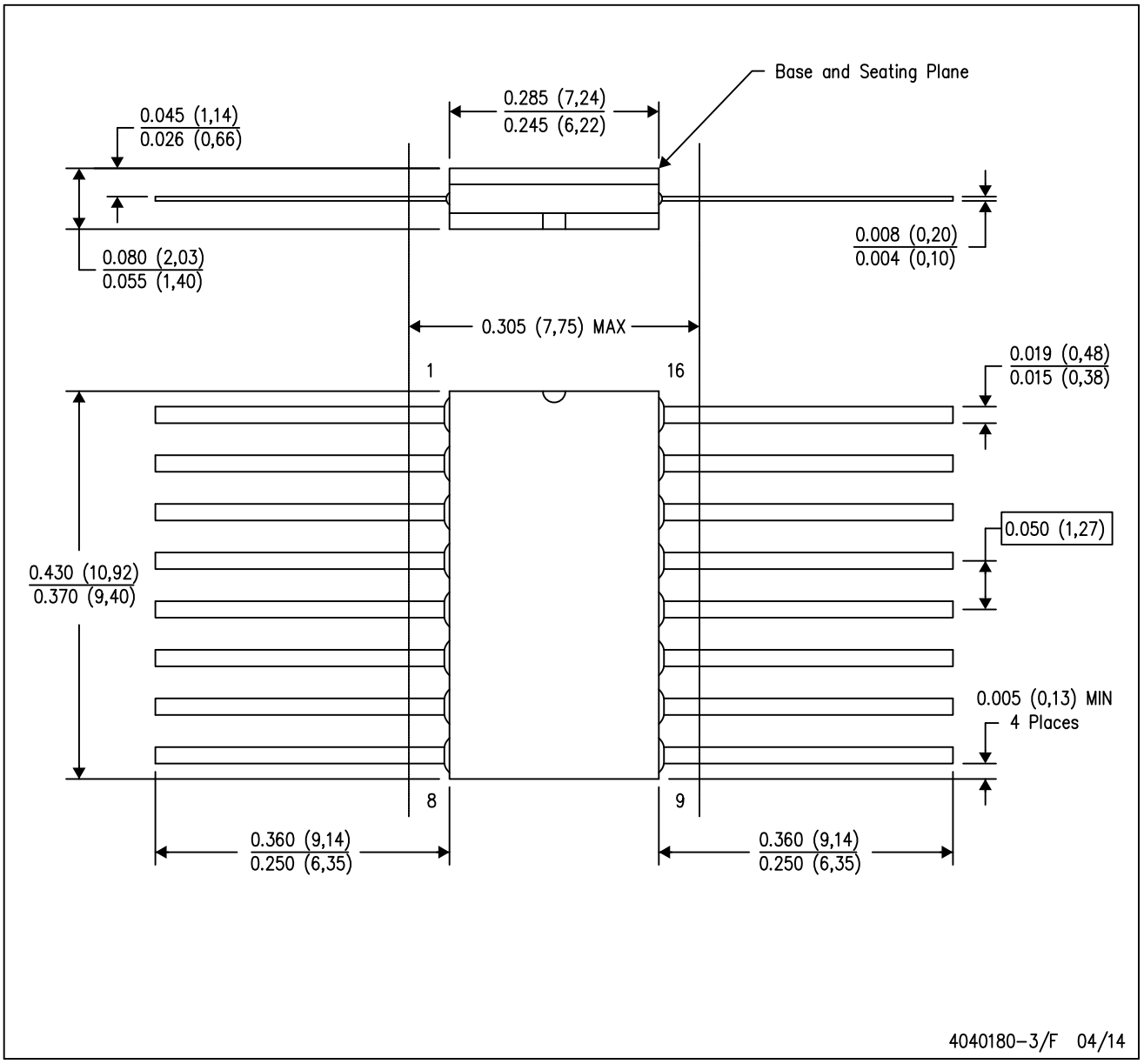


DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

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.

W (R–GDFP–F16) CERAMIC DUAL FLATPACK



NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only.
E. Falls within MIL STD 1835 GDFP2–F16

GENERIC PACKAGE VIEW

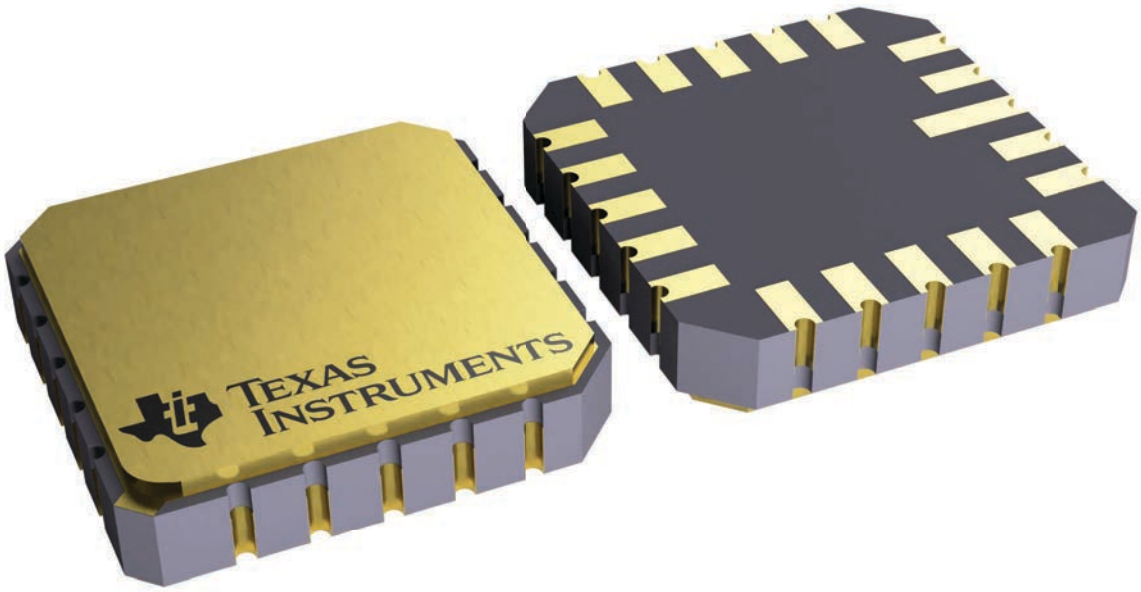
FK 20

LCCC - 2.03 mm max height

8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

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

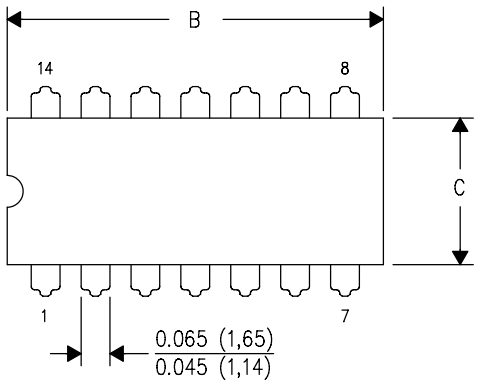


4229370VA\

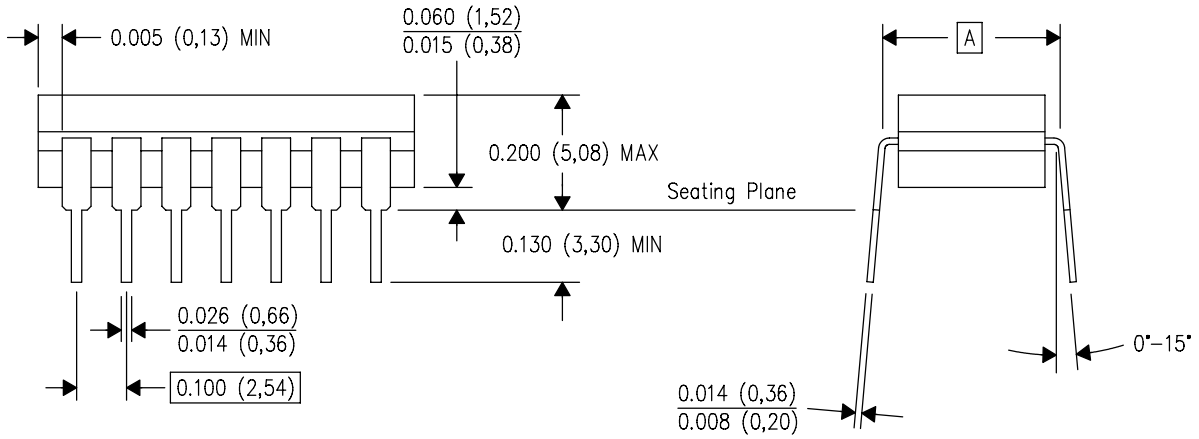
J (R–GDIP–T**)

14 LEADS SHOWN

CERAMIC DUAL IN–LINE PACKAGE



DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



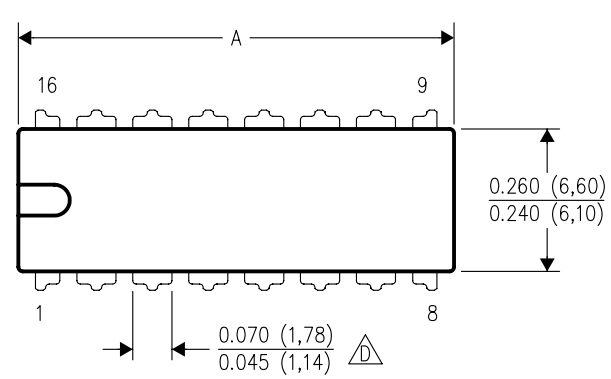
4040083/F 03/03

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
E. Falls within MIL STD 1835 GDIP1–T14, GDIP1–T16, GDIP1–T18 and GDIP1–T20.

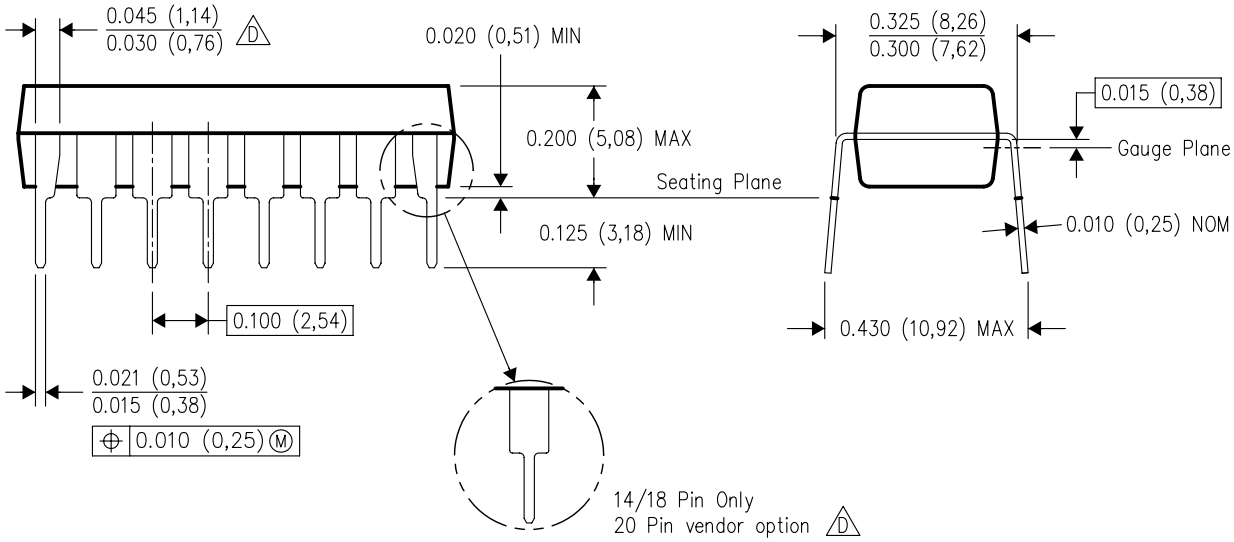
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN

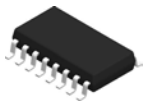


DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS–001 VARIATION (C)	AA	BB	AC	AD



4040049/E 12/2002

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001, except 18 and 20 pin minimum body length (Dim A).
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

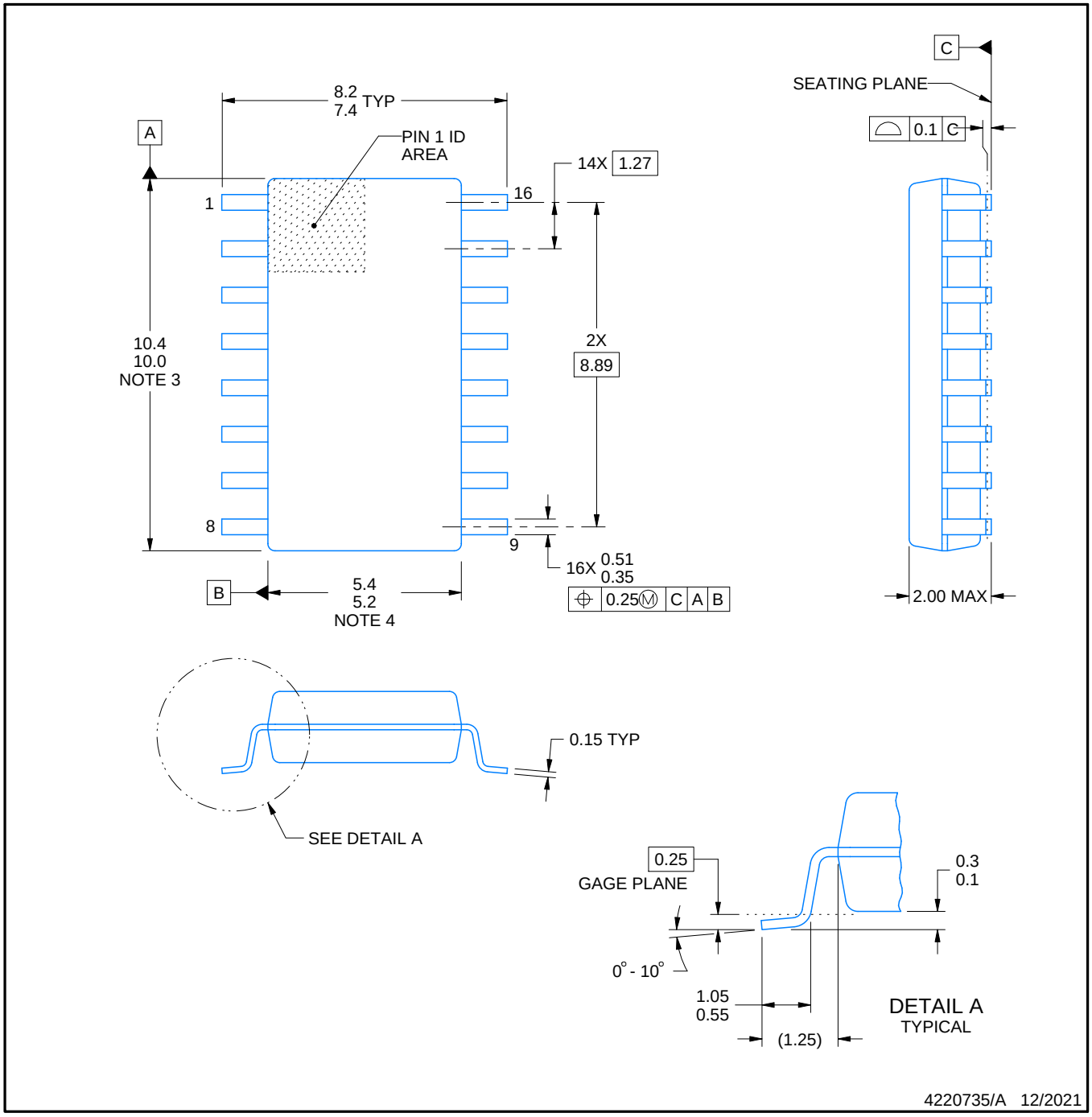


PACKAGE OUTLINE

NS0016A

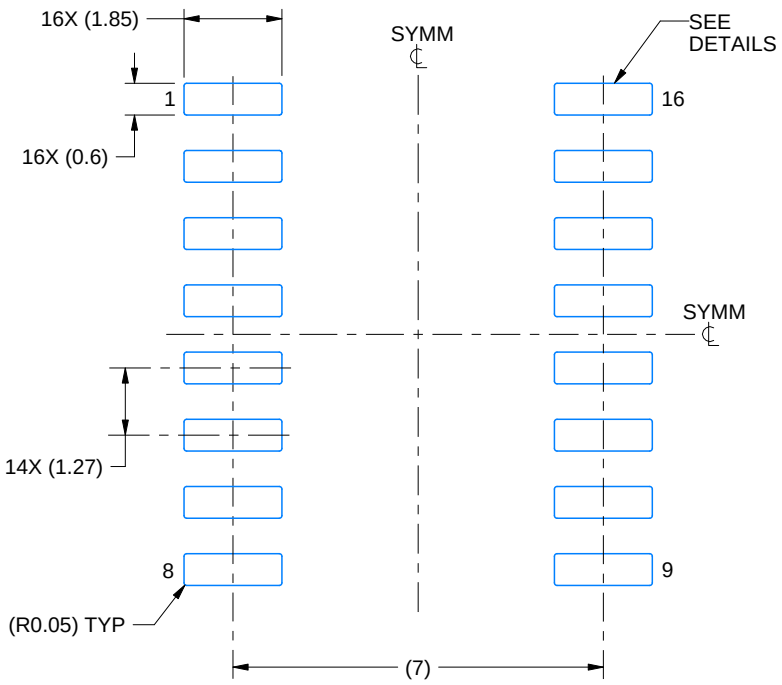
SOP - 2.00 mm max height

SOP

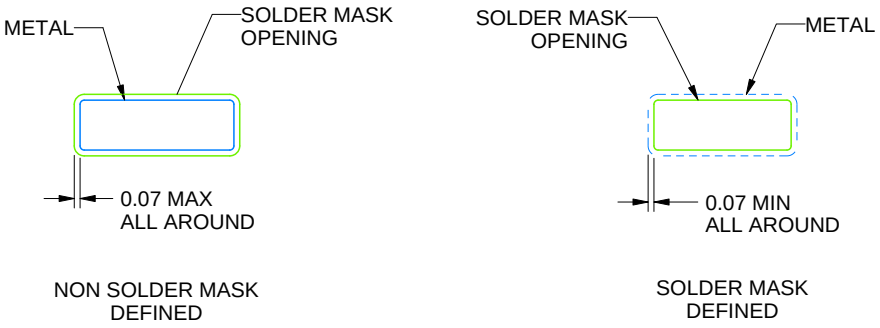


NOTES:

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.



LAND PATTERN EXAMPLE
SCALE:7X



NON SOLDER MASK
DEFINED

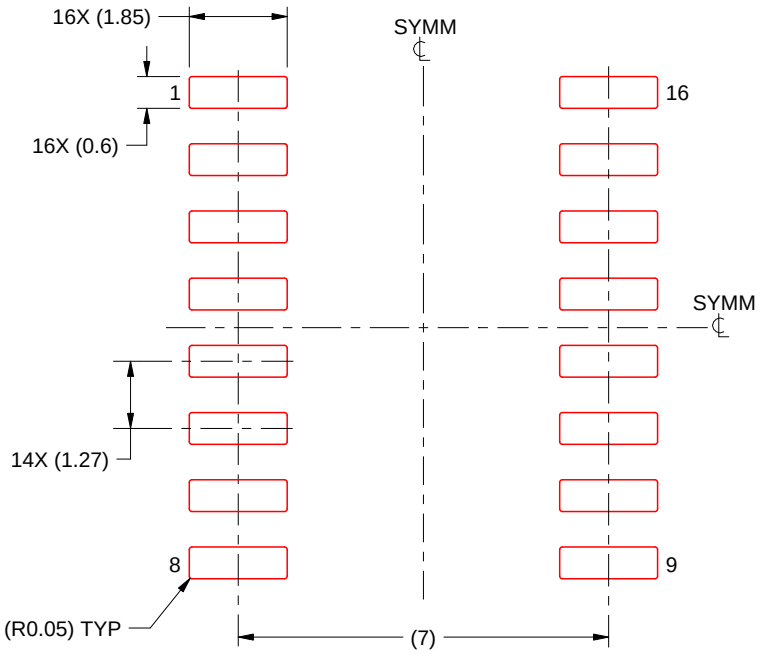
SOLDER MASK
DEFINED

SOLDER MASK DETAILS

4220735/A 12/2021

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. 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

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NOTES: (continued)

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

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