

AM26C31 四路差分线路驱动器

1 特性

- 符合或超出 TIA/EIA-422-B 和 ITU 建议 V.11 的要求
- 低功耗, $I_{CC} = 100 \mu A$ (典型值)
- 由 5V 单电源供电运行
- 高速, $t_{PLH} = t_{PHL} = 7ns$ (典型值)
- 低脉冲失真, $t_{sk(p)} = 0.5ns$ (典型值)
- 在断电情况下具有高输出阻抗
- 经改进可替代 AM26LS31 器件
- 可用于 Q 级温度汽车
 - 高可靠性汽车应用
 - 配置控制和打印支持
 - 通过汽车标准鉴定
- 对于符合 MIL-PRF-38535 标准的产品, 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

- 化学和气体传感器
- 现场变送器: 温度传感器和压力传感器
- 军用: 雷达和声纳
- 电机控制: 无刷直流和有刷直流
- 军用和航空电子成像
- 采用 Modbus 的温度传感器和控制器

3 说明

AM26C31 器件是一款具有互补输出的差分线路驱动器, 可满足 TIA/EIA-422-B 和 ITU (原 CCITT) 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。所有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 (G) 或低电平有效 ($\bar{G}$) 使能输入。BiCMOS 电路可在不牺牲速度的情况下降低功耗。

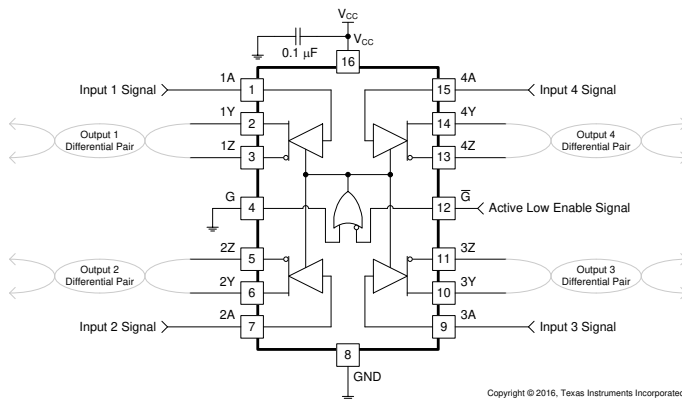
AM26C31C 器件可在 $0^{\circ}C$ 至 $70^{\circ}C$ 的温度范围内运行, AM26C31I 器件可在 $-40^{\circ}C$ 至 $+85^{\circ}C$ 的温度范围内运行。AM26C31Q 器件可在 $-40^{\circ}C$ 至 $+125^{\circ}C$ 的汽车级温度范围内运行, AM26C31M 器件可在 $-55^{\circ}C$ 至 $+125^{\circ}C$ 的整个军用温度范围内运行。

封装信息

器件型号	封装 ⁽¹⁾	封装尺寸 ⁽²⁾
AM26C31	CDIP (J , 16)	19.56mm × 6.92mm
	PDIP (N , 16)	19.3mm × 6.35mm
	SO (NS , 16)	10.3mm × 5.3mm
	CFP (W , 16)	10.3mm × 6.73mm
	SOIC (D , 16)	9.9mm × 3.91mm
	SSOP (DB , 16)	6.2mm × 5.3mm
	TSSOP (PW , 16)	5mm × 4.4mm
	LCCC (FK , 20)	8.89mm × 8.89mm

(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)。



常见应用图



Table of Contents

1 特性	1	7 Detailed Description	11
2 应用	1	7.1 Overview.....	11
3 说明	1	7.2 Functional Block Diagrams.....	11
4 Pin Configuration and Functions	3	7.3 Feature Description.....	12
5 Specifications	4	7.4 Device Functional Modes.....	12
5.1 Absolute Maximum Ratings.....	4	8 Application Information Disclaimer	13
5.2 ESD Ratings.....	4	8.1 Application Information.....	13
5.3 Recommended Operating Conditions.....	4	8.2 Typical Application.....	13
5.4 Thermal Information.....	5	8.3 Power Supply Recommendations.....	14
5.5 Electrical Characteristics: AM26C31C and AM26C31I.....	5	8.4 Layout.....	14
5.6 Electrical Characteristics: AM26C31Q and AM26C31M.....	6	9 Device and Documentation Support	16
5.7 Switching Characteristics: AM26C31C and AM26C31I.....	6	9.1 接收文档更新通知.....	16
5.8 Switching Characteristics: AM26C31Q and AM26C31M.....	7	9.2 支持资源.....	16
5.9 Typical Characteristics.....	7	9.3 Trademarks.....	16
6 Parameter Measurement Information	8	9.4 静电放电警告.....	16
		9.5 术语表.....	16
		10 Revision History	16
		11 Mechanical, Packaging, and Orderable Information	17

4 Pin Configuration and Functions

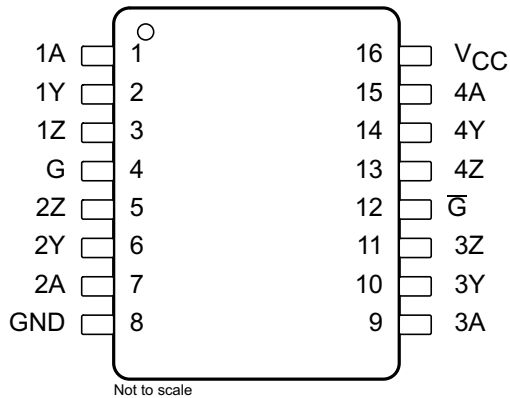


图 4-1. J (CDIP), W (CFP), D (SOIC),
DB (SSOP), NS (SO), N (PDIP), or PW (TSSOP)
Package 16-Pin (Top View)

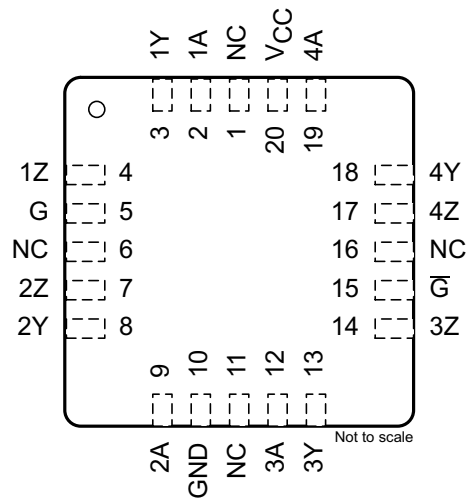


图 4-2. FK (LCCC) Package, 20-Pin
(Top View)

表 4-1. Pin Functions

PIN			TYPE	DESCRIPTION
NAME	CDIP, CFP, SOIC, SSOP, SO, PDIP, TSSOP	LCCC		
1A	1	2	I	Driver 1 input
1Y	2	3	O	Driver 1 output
1Z	3	4	O	Driver 1 inverted output
2A	7	9	I	Driver 2 input
2Y	6	8	O	Driver 2 output
2Z	5	7	O	Driver 2 inverted output
3A	9	12	I	Driver 3 input
3Y	10	13	O	Driver 3 output
3Z	11	14	O	Driver 3 inverted output
4A	15	19	I	Driver 3 input
4Y	14	18	O	Driver 3 output
4Z	13	17	O	Driver 3 inverted output
G	4	5	I	Active high enable
$\bar{G}$	12	15	I	Active low enable
GND	8	10	—	Ground pin
NC ⁽¹⁾	—	1, 6, 11, 16	—	No internal connection
V _{CC}	16	20	—	Power pin

(1) NC - No connection

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⁾	– 0.5	7	V
V _I	Input voltage	– 0.5	V _{CC} + 0.5	V
V _{ID}	Differential input voltage	– 14	14	V
V _O	Output voltage	– 0.5	7	V
I _{IK} I _{OK}	Input or output clamp current		±20	mA
I _O	Output current		±150	mA
	V _{CC} current		200	mA
	GND current	– 200		mA
T _J	Operating virtual junction temperature		150	°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 voltages, are with respect to the network ground terminal.

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		4.5	5	5.5	V
V _{ID}	Differential input voltage			±7		V
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	AM26C31C	0		70	°C
		AM26C31I	– 40		85	
		AM26C31Q	– 40		125	
		AM26C31M	– 55		125	

5.4 Thermal Information

THERMAL METRIC ⁽¹⁾		AM26C31								UNIT
		D (SOIC)	DB (SSOP)	PW (TSSOP)	NS (SO)	N (PDIP)	J (CDIP)	W (CFP)	FK (LCCC)	
		16 PINS	16 PINS	16 PINS	16 PINS	16 PINS	16 PINS	16 PINS	16 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance ^{(2) (3)}	84.6	102.6	107.5	88.5	60.6	—	—	—	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	43.5	48.7	38.4	46.2	48.1	39.3 ⁽⁴⁾	58.9 ⁽⁴⁾	37.1 ⁽⁴⁾	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	43.2	54.3	53.7	50.7	40.6	56.4 ⁽⁴⁾	109.3 ⁽⁴⁾	36.2 ⁽⁴⁾	°C/W
ψ_{JT}	Junction-to-top characterization parameter	10.4	11.8	3.2	13.5	27.5	—	—	—	°C/W
ψ_{JB}	Junction-to-board characterization parameter	42.8	53.5	53.1	50.3	40.3	—	—	—	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	n/a	n/a	n/a	n/a	n/a	12 ⁽⁴⁾	5.7 ⁽⁴⁾	4.3 ⁽⁴⁾	°C/W

- (1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.
- (2) Maximum power dissipation is a function of $T_{J(max)}$, $R_{\theta JA}$, and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_{J(max)} - T_A) / R_{\theta JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
- (3) The package thermal impedance is calculated in accordance with JESD 51-7.
- (4) Modelling assumption: MIL-STD-883 for $R_{\theta JC(top)}$ and $R_{\theta JC(bot)}$ JESD51 for $R_{\theta JB}$.

5.5 Electrical Characteristics: AM26C31C and AM26C31I

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP ⁽¹⁾	MAX	UNIT
V_{OH}	High-level output voltage	$I_O = -20\text{mA}$		2.4	3.4		V
V_{OL}	Low-level output voltage	$I_O = 20\text{mA}$			0.2	0.4	V
V_{OD}	Differential output voltage magnitude	$R_L = 100\Omega$, see 图 6-1		2	3.1		V
$\Delta V_{OD} $	Change in magnitude of differential output voltage ⁽²⁾	$R_L = 100\Omega$, see 图 6-1				±0.4	V
V_{OC}	Common-mode output voltage	$R_L = 100\Omega$, see 图 6-1				3	V
$\Delta V_{OC} $	Change in magnitude of common-mode output voltage ⁽²⁾	$R_L = 100\Omega$, see 图 6-1				±0.4	V
I_I	Input current	$V_I = V_{CC}$ or GND				±1	μA
$I_{O(off)}$	Driver output current with power off	$V_{CC} = 0$	$V_O = 6\text{V}$			100	μA
			$V_O = -0.25\text{V}$			-100	
I_{OS}	Driver output short-circuit current	$V_O = 0$		-30		-150	mA
I_{OZ}	High-impedance off-state output current	$V_O = 2.5\text{V}$				20	μA
		$V_O = 0.5\text{V}$				-20	
I_{CC}	Quiescent supply current	$I_O = 0$	$V_I = 0$ or 5V			100	μA
			$V_I = 2.4\text{V}$ or 0.5V ⁽³⁾	1.5		3	mA
C_i	Input capacitance					6	pF

- (1) All typical values are at $V_{CC} = 5\text{V}$ and $T_A = 25^\circ\text{C}$.
- (2) $\Delta|V_{OD}|$ and $\Delta|V_{OC}|$ are the changes in magnitude of V_{OD} and V_{OC} , respectively, that occur when the input is changed from a high level to a low level.
- (3) This parameter is measured per input. All other inputs are at 0V or 5V.

5.6 Electrical Characteristics: AM26C31Q and AM26C31M

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP ⁽¹⁾	MAX	UNIT
V _{OH}	High-level output voltage	I _O = -20mA	2.2	3.4		V
V _{OL}	Low-level output voltage	I _O = 20mA		0.2	0.4	V
V _{OD}	Differential output voltage magnitude	R _L = 100Ω, see 图 6-1	2	3.1		V
Δ V _{OD}	Change in magnitude of differential output voltage ⁽²⁾	R _L = 100Ω, see 图 6-1			±0.4	V
V _{OC}	Common-mode output voltage	R _L = 100Ω, see 图 6-1			3	V
Δ V _{OC}	Change in magnitude of common-mode output voltage ⁽²⁾	R _L = 100Ω, see 图 6-1			±0.4	V
I _I	Input current	V _I = V _{CC} or GND			±1	μA
I _{O(off)}	Driver output current with power off	V _{CC} = 0			100	μA
		V _O = 6V				
		V _O = -0.25V			-100	μA
I _{OS}	Driver output short-circuit current	V _O = 0			-170	mA
I _{OZ}	High-impedance off-state output current	V _O = 2.5V			20	μA
		V _O = 0.5V			-20	μA
I _{CC}	Quiescent supply current	I _O = 0			100	μA
		V _I = 0 or 5V				
		V _I = 2.4V or 0.5V ⁽³⁾			3.2	mA
C _i	Input capacitance			6		pF

(1) All typical values are at V_{CC} = 5V and T_A = 25°C.

(2) Δ|V_{OD}| and Δ|V_{OC}| are the changes in magnitude of V_{OD} and V_{OC}, respectively, that occur when the input is changed from a high level to a low level.

(3) This parameter is measured per input. All other inputs are at 0V or 5V.

5.7 Switching Characteristics: AM26C31C and AM26C31I

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP ⁽¹⁾	MAX	UNIT
t _{PLH}	Propagation delay time, low-to-high-level output	S1 is open, see 图 6-2	3	7	12	ns
t _{PHL}	Propagation delay time, high-to-low-level output		3	7	12	
t _{sk(p)}	Pulse skew time (t _{PLH} - t _{PHL})	S1 is open, see 图 6-2		0.5	4	ns
t _{r(OD)} , t _{f(OD)}	Differential output rise and fall times	S1 is open, see 图 6-3		5	10	ns
t _{PZH}	Output enable time to high level	S1 is closed, see 图 6-4		10	19	ns
t _{PZL}	Output enable time to low level			10	19	
t _{PHZ}	Output disable time from high level	S1 is closed, see 图 6-4		7	16	ns
t _{PLZ}	Output disable time from low level			7	16	
C _{pd}	Power dissipation capacitance (each driver) ⁽²⁾	S1 is open, see 图 6-2		170		pF

(1) All typical values are at V_{CC} = 5V and T_A = 25°C.

(2) C_{pd} is used to estimate the switching losses according to P_D = C_{pd} × V_{CC}² × f, where f is the switching frequency.

5.8 Switching Characteristics: AM26C31Q and AM26C31M

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP ⁽¹⁾	MAX	UNIT
t_{PLH}	Propagation delay time, low-to-high-level output	S1 is open, see 图 6-2		7	12	ns
t_{PHL}	Propagation delay time, high-to-low-level output			6.5	12	
$t_{sk(p)}$	Pulse skew time ($ t_{PLH} - t_{PHL} $)	S1 is open, see 图 6-2		0.5	4	ns
$t_{r(OD)}, t_{f(OD)}$	Differential output rise and fall times	S1 is open, see 图 6-3		5	12	ns
t_{PZH}	Output enable time to high level	S1 is closed, see 图 6-4		10	19	ns
t_{PZL}	Output enable time to low level			10	19	
t_{PHZ}	Output disable time from high level	S1 is closed, see 图 6-4		7	16	ns
t_{PLZ}	Output disable time from low level			7	16	
C_{pd}	Power dissipation capacitance (each driver) ⁽²⁾	S1 is open, see 图 6-2		100		pF

(1) All typical values are at $V_{CC} = 5V$ and $T_A = 25^\circ C$.

(2) C_{pd} is used to estimate the switching losses according to $P_D = C_{pd} \times V_{CC}^2 \times f$, where f is the switching frequency.

5.9 Typical Characteristics

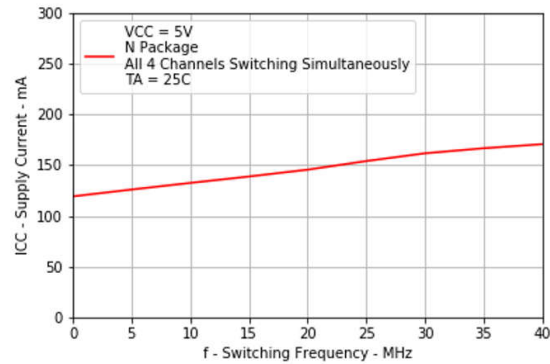


图 5-1. Supply Current vs Switching Frequency

6 Parameter Measurement Information

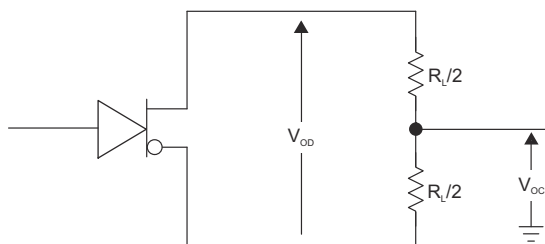
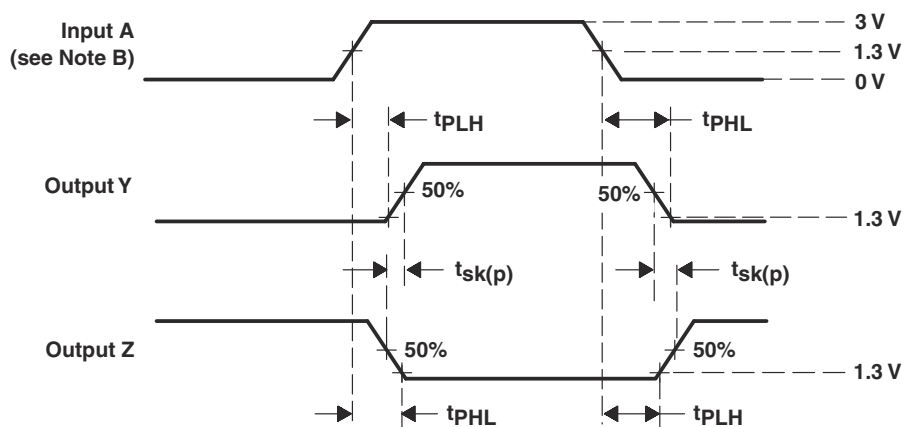
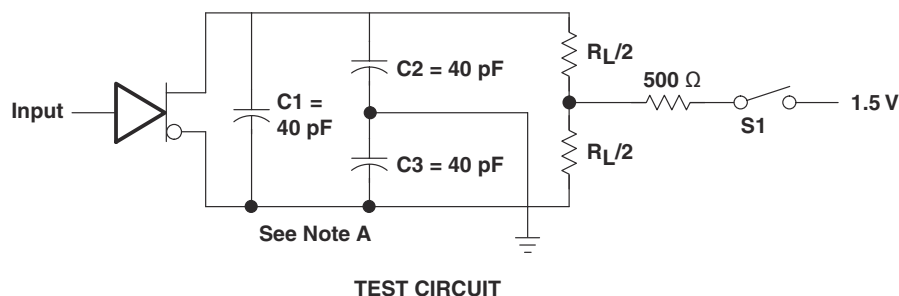
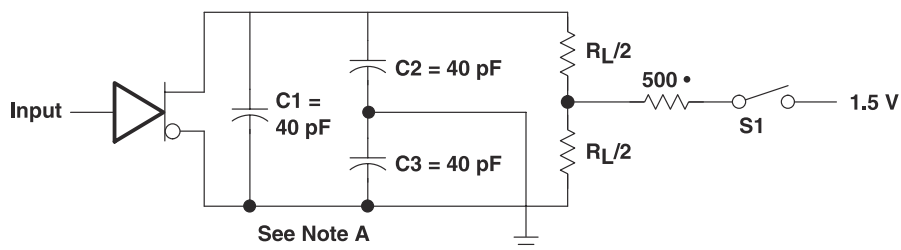


图 6-1. Differential and Common-Mode Output Voltages

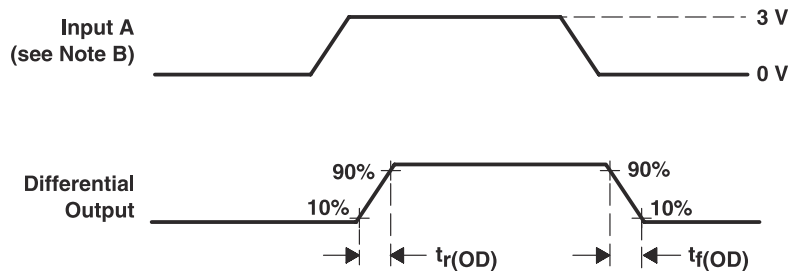


- A. C1, C2, and C3 include probe and jig capacitance.
- B. All input pulses are supplied by generators having the following characteristics: $\text{PRR} \leq 1\text{MHz}$, duty cycle $\leq 50\%$, and $t_r, t_f \leq 6\text{ns}$.

图 6-2. Propagation Delay Time and Skew Waveforms and Test Circuit



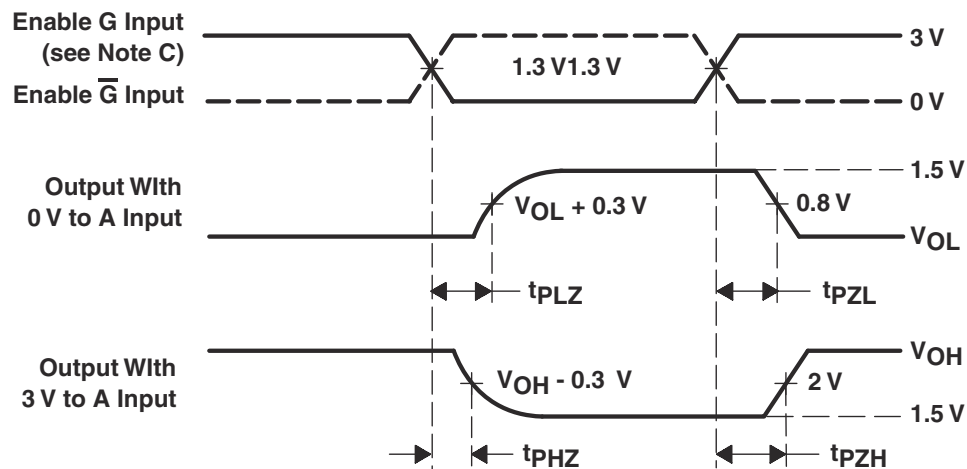
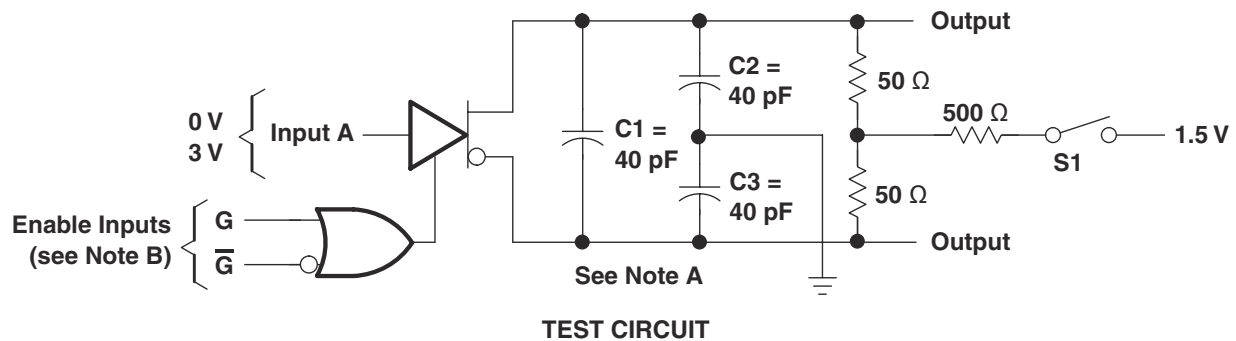
TEST CIRCUIT



VOLTAGE WAVEFORMS

- A. C1, C2, and C3 include probe and jig capacitance.
- B. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1\text{MHz}$, duty cycle $\leq 50\%$, and $t_r, t_f \leq 6\text{ns}$.

图 6-3. Differential-Output Rise and Fall-Time Waveforms and Test Circuit



- A. C1, C2, and C3 include probe and jig capacitance.
- B. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1\text{MHz}$, duty cycle $\leq 50\%$, and $t_r, t_f \leq 6\text{ns}$.
- C. Each enable is tested separately.

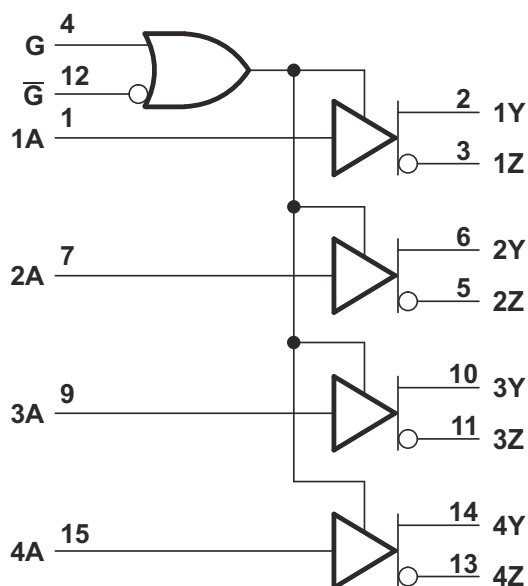
图 6-4. Output Enable and Disable Time Waveforms and Test Circuit

7 Detailed Description

7.1 Overview

The AM26C31 is a quadruple differential line driver with complementary outputs. The device is designed to meet the requirements of TIA/EIA-422-B and ITU (formerly CCITT), and it is generally used to communicate over relatively long wires in noisy environments.

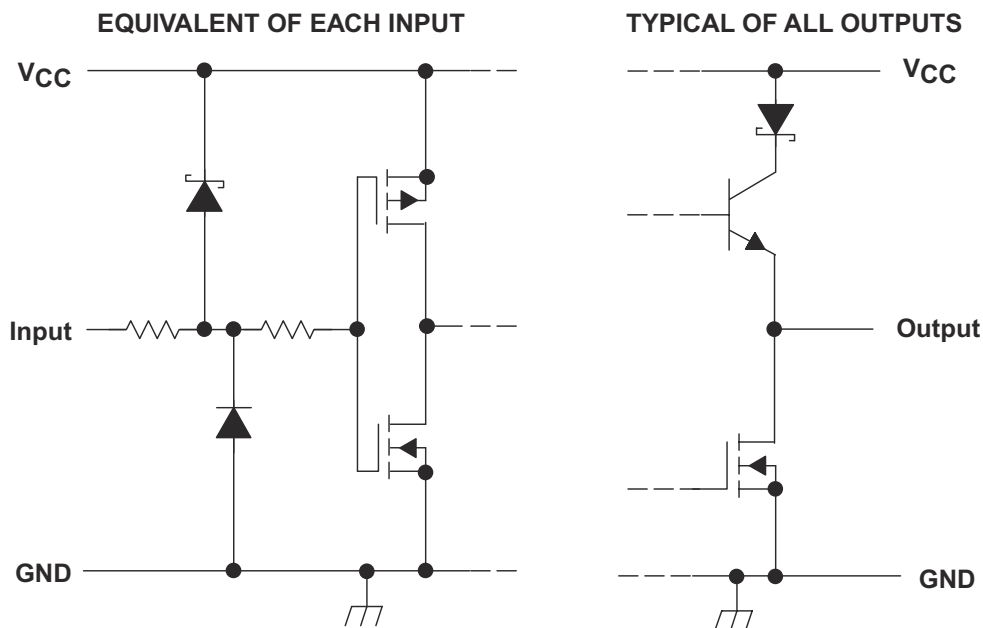
7.2 Functional Block Diagrams



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Pin numbers shown are for the D, DB, J, N, NS, PW, and W packages.

图 7-1. Logic Diagram (Positive Logic)



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图 7-2. Schematics of Inputs and Outputs

7.3 Feature Description

7.3.1 Active-High and Active-Low

The device can be configured using the G and $\bar{G}$ logic inputs to select transmitter output. A logic high on the G pin or a logic low on the $\bar{G}$ pin enables the device to operate. These pins are simply a way to configure the logic to match that of the receiving or transmitting controller or microprocessor.

7.3.2 Operates From a Single 5V Supply

Both the logic and transmitters operate from a single 5V rail, making designs much more simple. The line drivers and receivers can operate off the same rail as the host controller or a similar low voltage supply, thus simplifying power structure.

7.4 Device Functional Modes

表 7-1 lists the functional modes of the AM26C31.

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

INPUT A	ENABLES		OUTPUTS	
	G	$\bar{G}$	Y	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)

8 Application Information Disclaimer

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, 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. 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. For laboratory experiments, 100 feet of 100 Ω , 24-AWG, twisted-pair cable (Bertek) was used. A single driver and receiver, TI AM26C31C and AM26C32C, respectively, were tested at room temperature with a 5V supply voltage. To show voltage waveforms related to transmission-line reflections, the first plot shows output waveforms from the driver at the start of the cable (A/B); the second plot shows input waveforms to the receiver at the far end of the cable (Y).

8.2 Typical Application

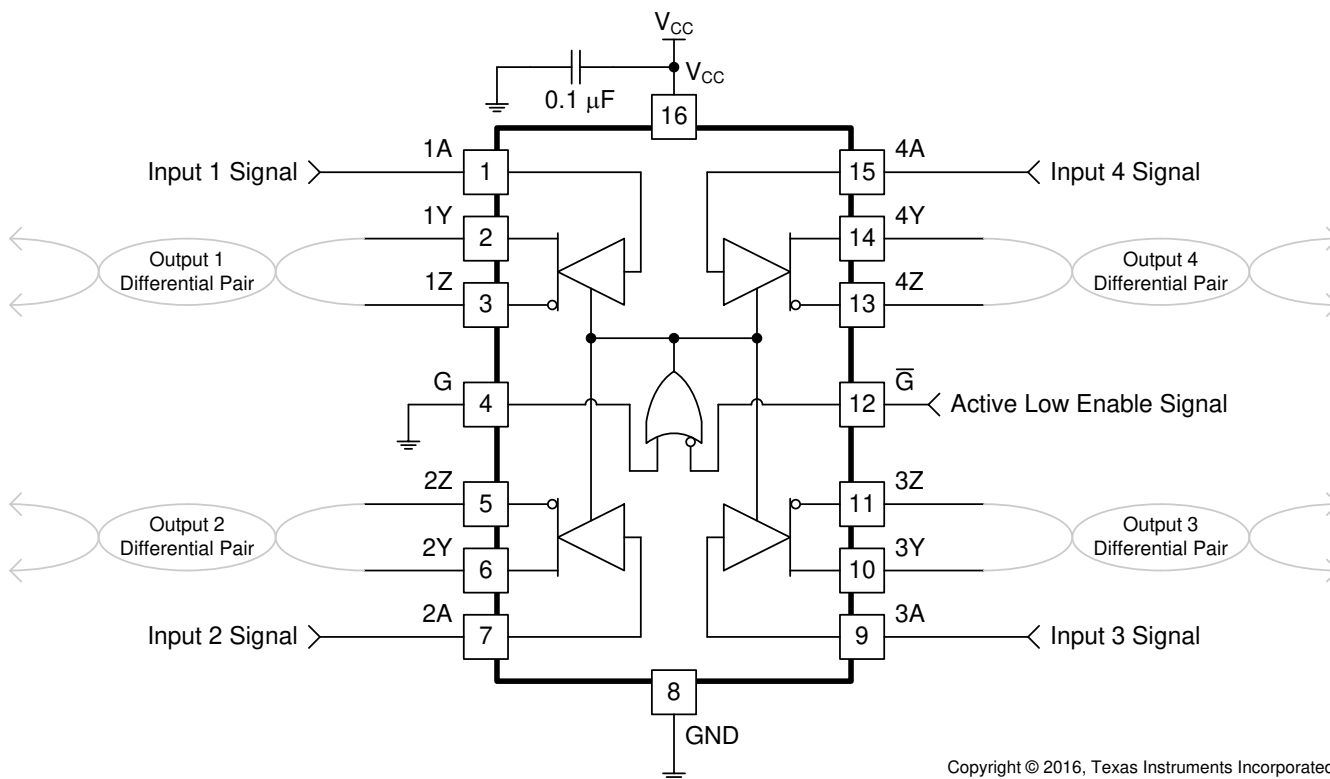


图 8-1. Differential Terminated Configuration With All Channels and Active Low Enable Used

8.2.1 Design Requirements

Resistor and capacitor (if used) termination values are shown for each laboratory experiment, but vary from system to system. For example, the termination resistor, R_T , must be within 20% of the characteristic impedance, Z_0 , of the cable and can vary from about 80 Ω to 120 Ω .

8.2.2 Detailed Design Procedure

Ensure values in [Absolute Maximum Ratings](#) are not exceeded.

Supply voltage, V_{IH} , and V_{IL} must comply with [Recommended Operating Conditions](#).

8.2.3 Application Curve

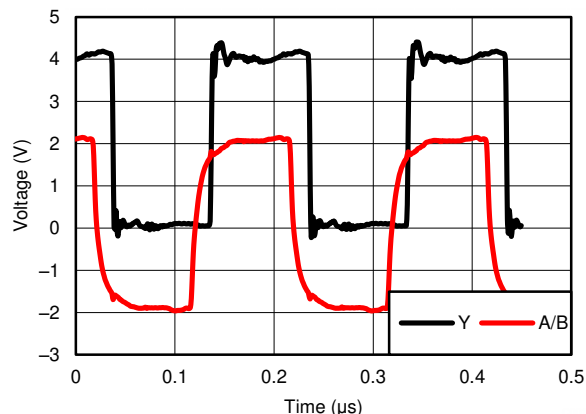


图 8-2. Differential 120 Ω Terminated Output Waveforms (Cat 5E Cable)

8.3 Power Supply Recommendations

Place 0.1 μ F 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 propagate into analog circuitry through the power pins of the circuit as a whole, as well as the operational amplifier. 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- μ F 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.
- Consider a driven, low-impedance guard ring around the critical traces. A guard ring can significantly reduce leakage currents from nearby traces that are at different potentials.

8.4.2 Layout Example

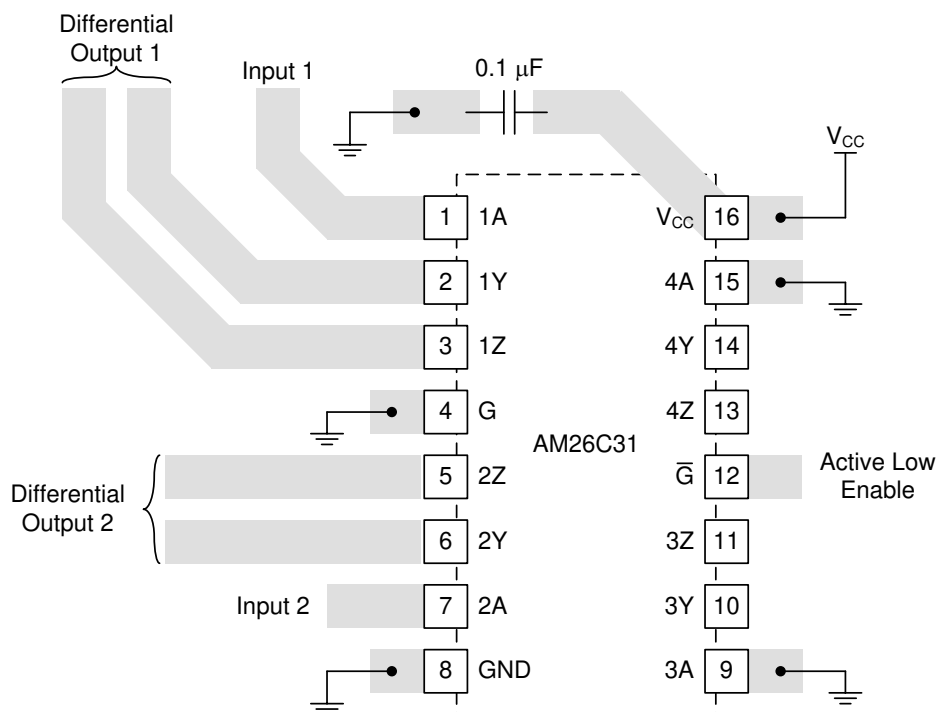


图 8-3. Trace Layout on PCB and Recommendations

9 Device and Documentation Support

9.1 接收文档更新通知

要接收文档更新通知，请导航至 [ti.com](https://www.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。

9.2 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。

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](#)。

9.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.

所有商标均为其各自所有者的财产。

9.4 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。

9.5 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。

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 O (June 2016) to Revision P (March 2024)	Page
• 将“器件信息”表更改为 <i>封装信息</i> 表.....	1
• Changed <i>Thermal Information</i> table.....	5
• Changed 图 5-1	7
• Changed 图 6-1	8

Changes from Revision N (October 2011) to Revision O (February 2014)	Page
• 更新了 <i>特性</i> 部分，并添加了 <i>应用</i> 部分、 <i>器件信息</i> 表、 <i>ESD</i> 等级表、 <i>特性说明</i> 部分、 <i>器件功能模式</i> 、 <i>应用和</i> <i>实施</i> 部分、 <i>电源相关建议</i> 部分、 <i>布局</i> 部分、 <i>器件和文档支持</i> 部分以及 <i>机械</i> 、 <i>封装和可订购信息</i> 部分.....	1
• 删除了 <i>订购信息</i> 表；请参阅数据表末尾的 POA.....	1
• Changed <i>Thermal Information</i> table.....	5

Changes from Revision M (June 2008) to Revision N (October 2011)	Page
• Changed units to mA from μ A to fix units typo.....	4

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.

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)
5962-9163901M2A	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 9163901M2A AM26C31M
5962-9163901M2A.A	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 9163901M2A AM26C31M
5962-9163901MEA	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9163901ME A AM26C31M
5962-9163901MEA.A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9163901ME A AM26C31M
5962-9163901MFA	Active	Production	CFP (W) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9163901MF A AM26C31M
5962-9163901MFA.A	Active	Production	CFP (W) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9163901MF A AM26C31M
5962-9163901Q2A	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 9163901Q2A AM26C31 MFKB
5962-9163901QEA	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9163901QE A AM26C31MJB
5962-9163901QFA	Active	Production	CFP (W) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9163901QF A AM26C31MWB
AM26C31CD	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	0 to 70	AM26C31C
AM26C31CDBR	Obsolete	Production	SSOP (DB) 16	-	-	Call TI	Call TI	0 to 70	26C31
AM26C31CDR	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	0 to 70	AM26C31C
AM26C31CN	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	AM26C31CN
AM26C31CN.A	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	AM26C31CN
AM26C31CNSR	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU NIPDAU	Level-1-260C-UNLIM	0 to 70	26C31

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)
AM26C31CNSR.A	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	26C31
AM26C31ID	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	-40 to 85	AM26C31I
AM26C31IDBR	Active	Production	SSOP (DB) 16	2000 LARGE T&R	Yes	NIPDAU NIPDAU	Level-1-260C-UNLIM	-40 to 85	26C31I
AM26C31IDBR.A	Active	Production	SSOP (DB) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	26C31I
AM26C31IDBRE4	Active	Production	SSOP (DB) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	26C31I
AM26C31IDR	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AM26C31I
AM26C31IDR.A	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AM26C31I
AM26C31IDRG4	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	-40 to 85	AM26C31I
AM26C31IN	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	AM26C31IN
AM26C31IN.A	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	AM26C31IN
AM26C31INE4	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	AM26C31IN
AM26C31INSR	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU NIPDAU	Level-1-260C-UNLIM	-40 to 85	26C31I
AM26C31INSR.A	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	26C31I
AM26C31IPW	Obsolete	Production	TSSOP (PW) 16	-	-	Call TI	Call TI	-40 to 85	26C31I
AM26C31IPWR	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	26C31I
AM26C31IPWR.A	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	26C31I
AM26C31IPWRG4	Obsolete	Production	TSSOP (PW) 16	-	-	Call TI	Call TI	-40 to 85	26C31I
AM26C31MFKB	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9163901Q2A AM26C31 MFKB
AM26C31MFKB.A	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9163901Q2A AM26C31 MFKB
AM26C31MJB	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9163901QE A AM26C31MJB
AM26C31MJB.A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9163901QE A AM26C31MJB
AM26C31MWB	Active	Production	CFP (W) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9163901QF A AM26C31MWB

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)
AM26C31MWB.A	Active	Production	CFP (W) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9163901QF A AM26C31MWB
AM26C31QD	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	-40 to 125	AM26C31Q
AM26C31QDG4	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	-40 to 125	26C31Q
AM26C31QDR	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AM26C31Q
AM26C31QDR.A	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AM26C31Q
AM26C31QDRG4	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	26C31Q
AM26C31QDRG4.A	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	26C31Q

⁽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.

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 AM26C31, AM26C31M :

- Catalog : [AM26C31](#)
- Enhanced Product : [AM26C31-EP](#), [AM26C31-EP](#)
- Military : [AM26C31M](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Enhanced Product - Supports Defense, Aerospace and Medical Applications
- Military - QML certified for Military and Defense Applications

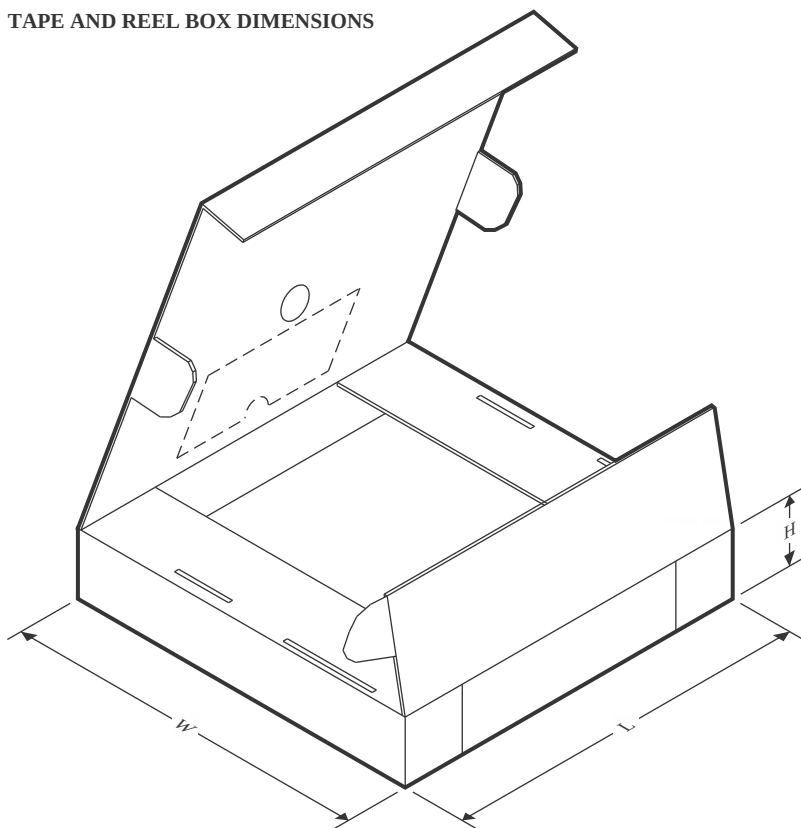
TAPE AND REEL INFORMATION



*All dimensions are nominal

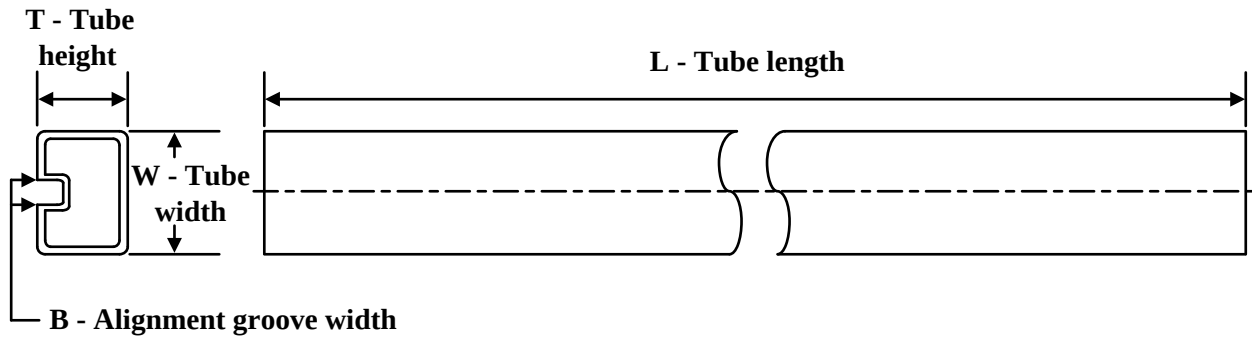
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
AM26C31CNSR	SOP	NS	16	2000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1
AM26C31IDBR	SSOP	DB	16	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
AM26C31IDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
AM26C31IDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
AM26C31INSR	SOP	NS	16	2000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1
AM26C31IPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
AM26C31QDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
AM26C31QDRG4	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



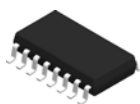
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
AM26C31CNSR	SOP	NS	16	2000	353.0	353.0	32.0
AM26C31IDBR	SSOP	DB	16	2000	353.0	353.0	32.0
AM26C31IDR	SOIC	D	16	2500	353.0	353.0	32.0
AM26C31IDR	SOIC	D	16	2500	340.5	336.1	32.0
AM26C31INSR	SOP	NS	16	2000	353.0	353.0	32.0
AM26C31IPWR	TSSOP	PW	16	2000	353.0	353.0	32.0
AM26C31QDR	SOIC	D	16	2500	353.0	353.0	32.0
AM26C31QDRG4	SOIC	D	16	2500	353.0	353.0	32.0

TUBE


*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
5962-9163901M2A	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-9163901M2A.A	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-9163901MFA	W	CFP	16	25	506.98	26.16	6220	NA
5962-9163901MFA.A	W	CFP	16	25	506.98	26.16	6220	NA
5962-9163901Q2A	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-9163901QFA	W	CFP	16	25	506.98	26.16	6220	NA
AM26C31CN	N	PDIP	16	25	506	13.97	11230	4.32
AM26C31CN.A	N	PDIP	16	25	506	13.97	11230	4.32
AM26C31IN	N	PDIP	16	25	506	13.97	11230	4.32
AM26C31IN.A	N	PDIP	16	25	506	13.97	11230	4.32
AM26C31INE4	N	PDIP	16	25	506	13.97	11230	4.32
AM26C31MFKB	FK	LCCC	20	55	506.98	12.06	2030	NA
AM26C31MFKB.A	FK	LCCC	20	55	506.98	12.06	2030	NA
AM26C31MWB	W	CFP	16	25	506.98	26.16	6220	NA
AM26C31MWB.A	W	CFP	16	25	506.98	26.16	6220	NA

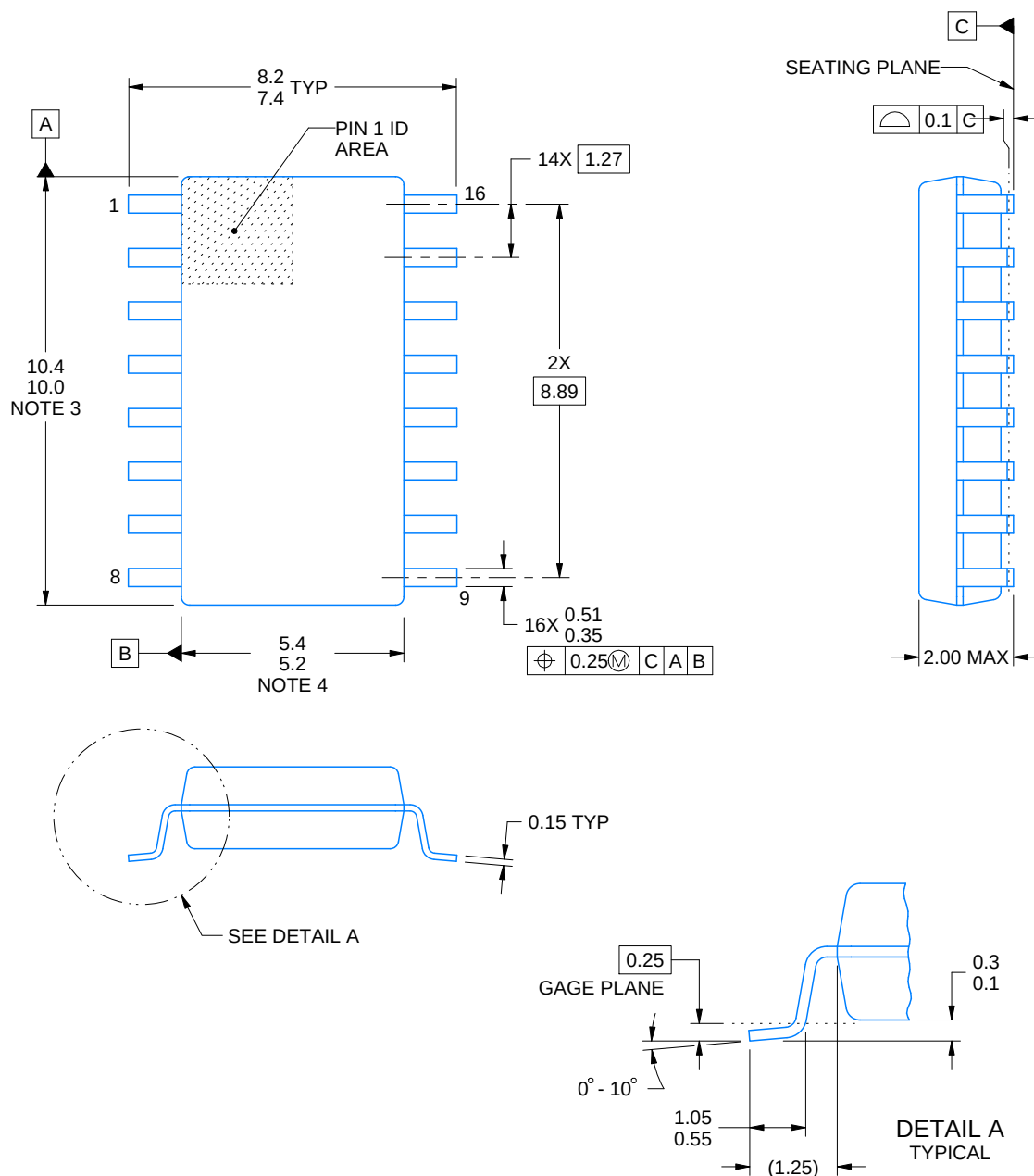


PACKAGE OUTLINE

NS0016A

SOP - 2.00 mm max height

SOP



4220735/A 12/2021

NOTES:

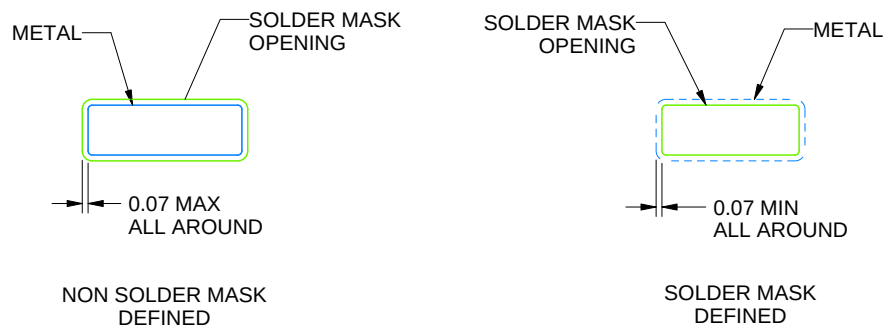
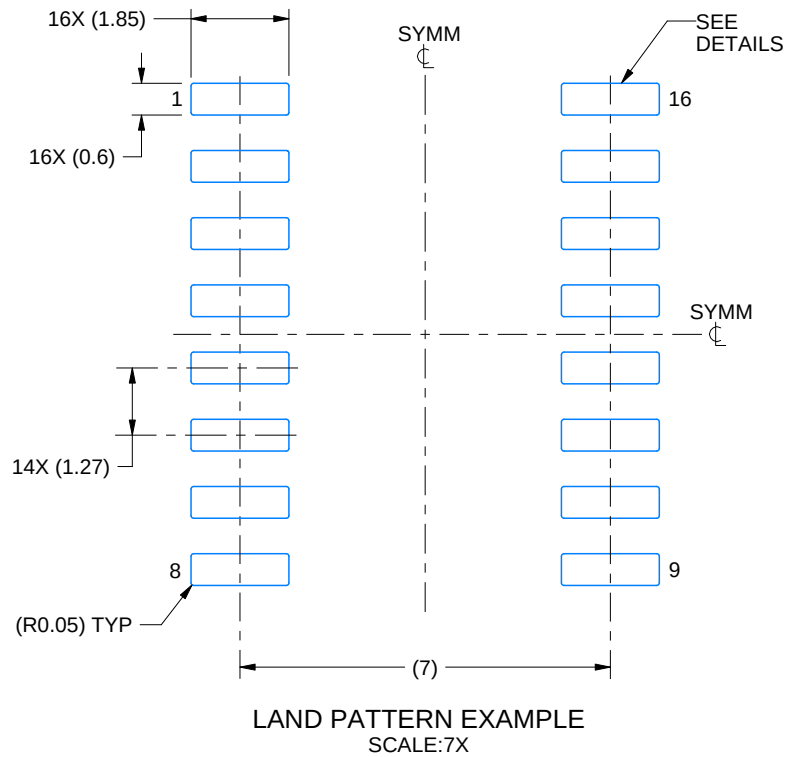
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate 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.

EXAMPLE BOARD LAYOUT

NS0016A

SOP - 2.00 mm max height

SOP

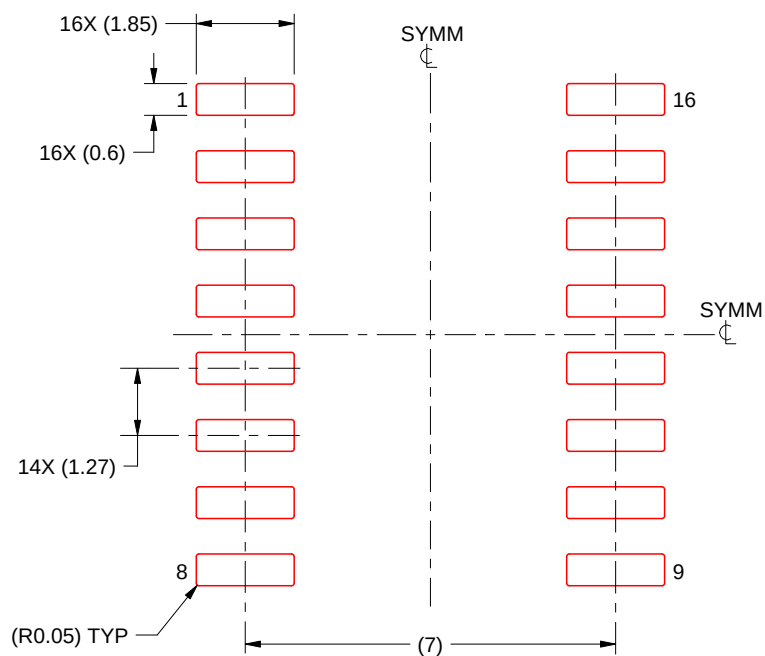


4220735/A 12/2021

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.

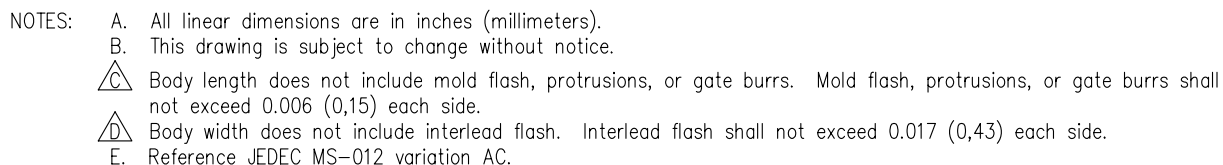


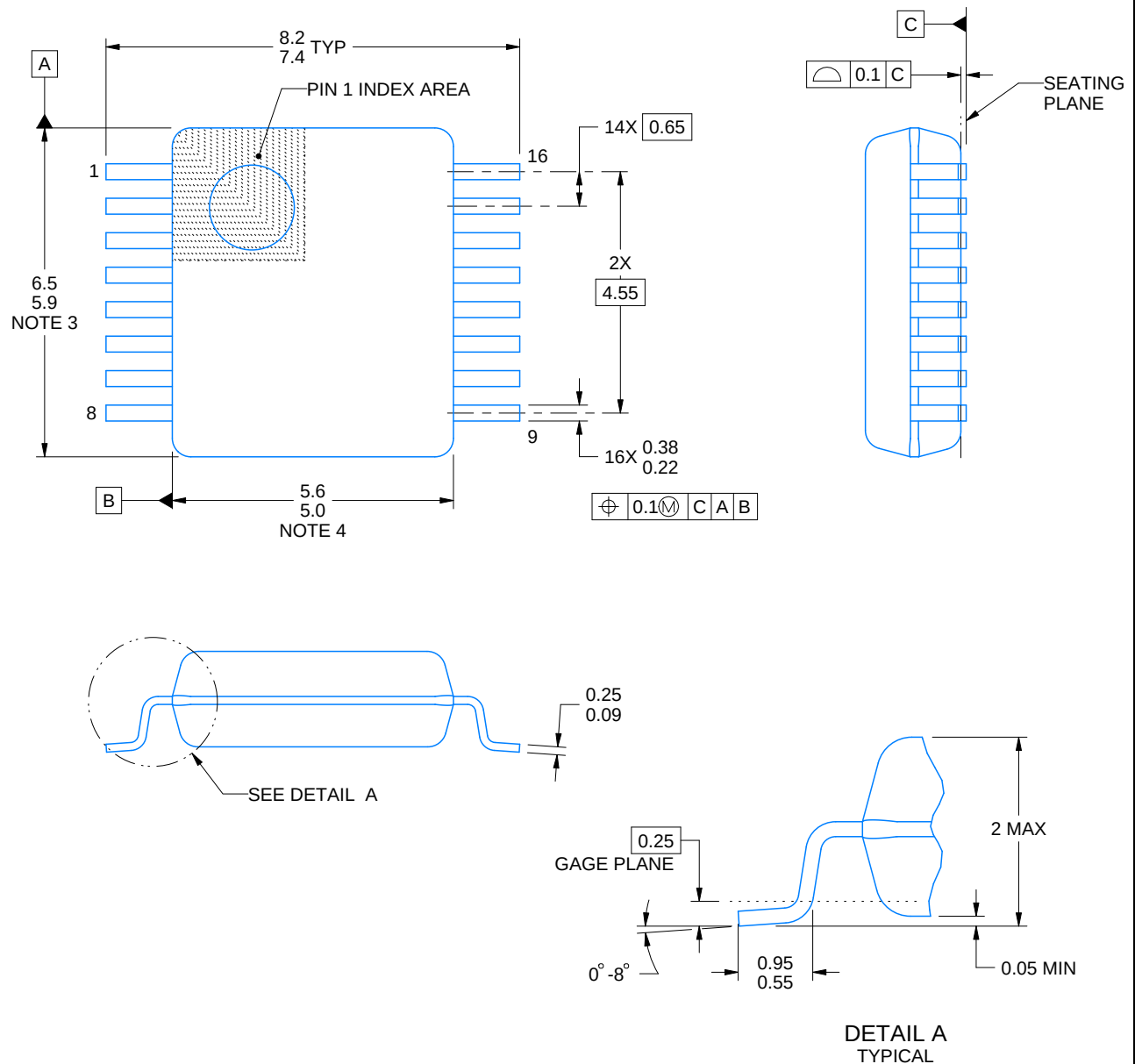
SOLDER PASTE EXAMPLE
 BASED ON 0.125 mm THICK STENCIL
 SCALE:7X

4220735/A 12/2021

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.





4220763/A 05/2022

NOTES:

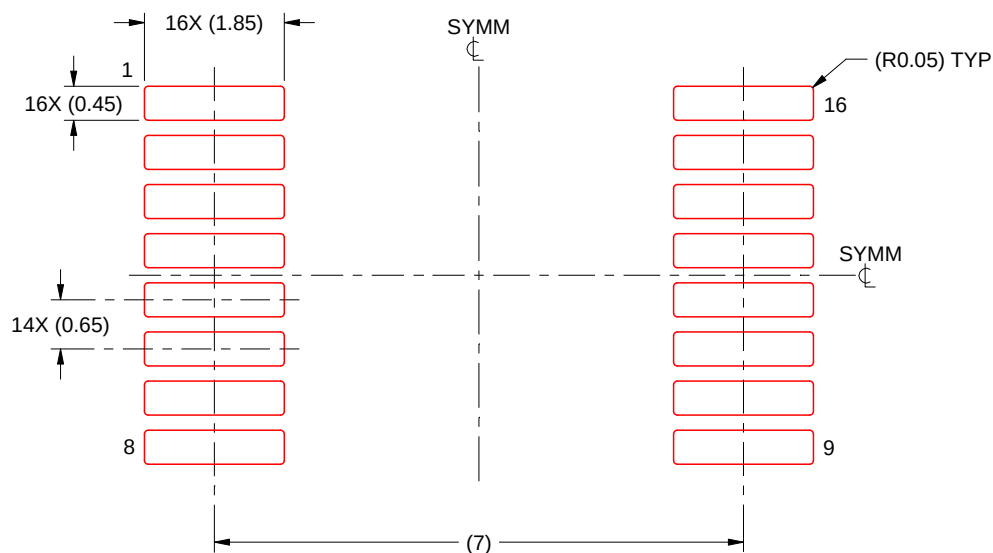
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-150.

EXAMPLE STENCIL DESIGN

DB0016A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



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

4220763/A 05/2022

NOTES: (continued)

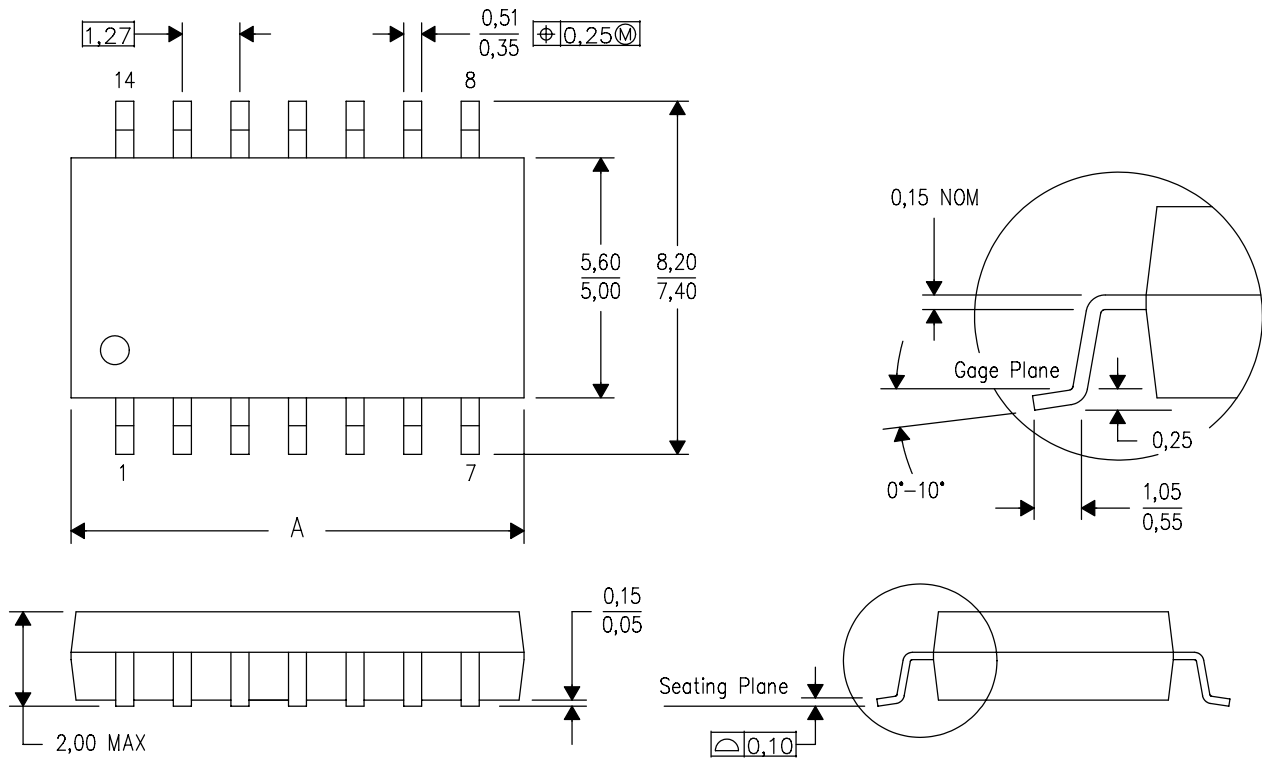
7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



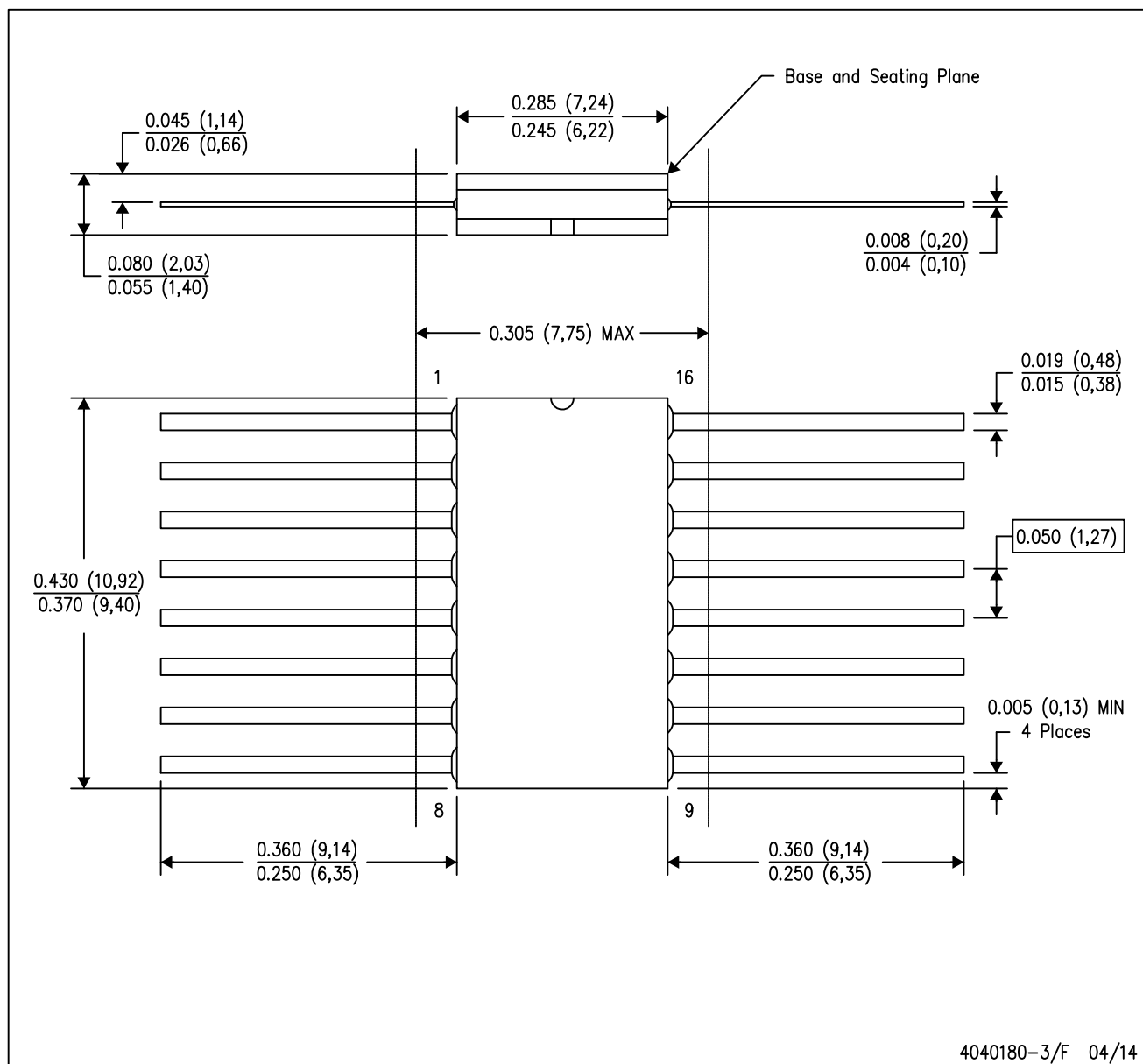
DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

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

GENERIC PACKAGE VIEW

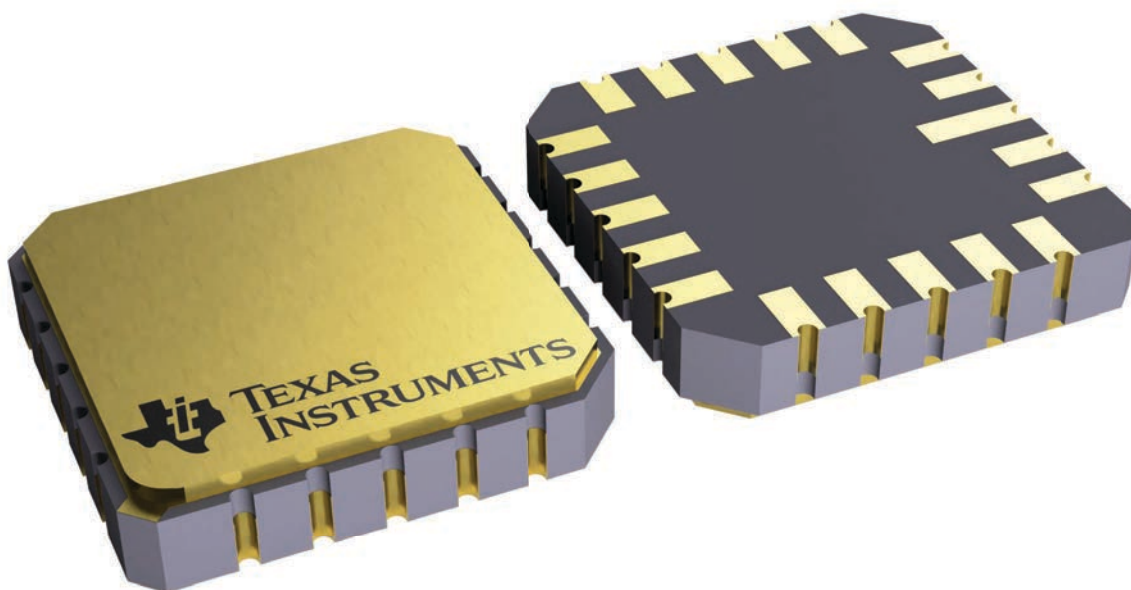
FK 20

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.

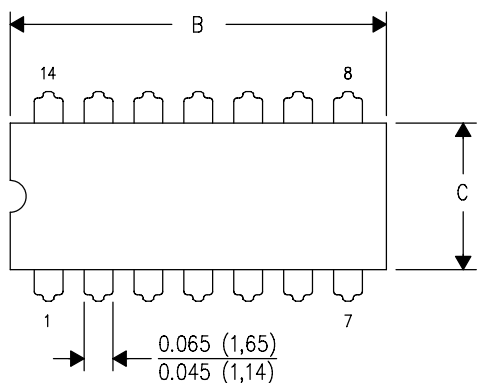


4229370VA\

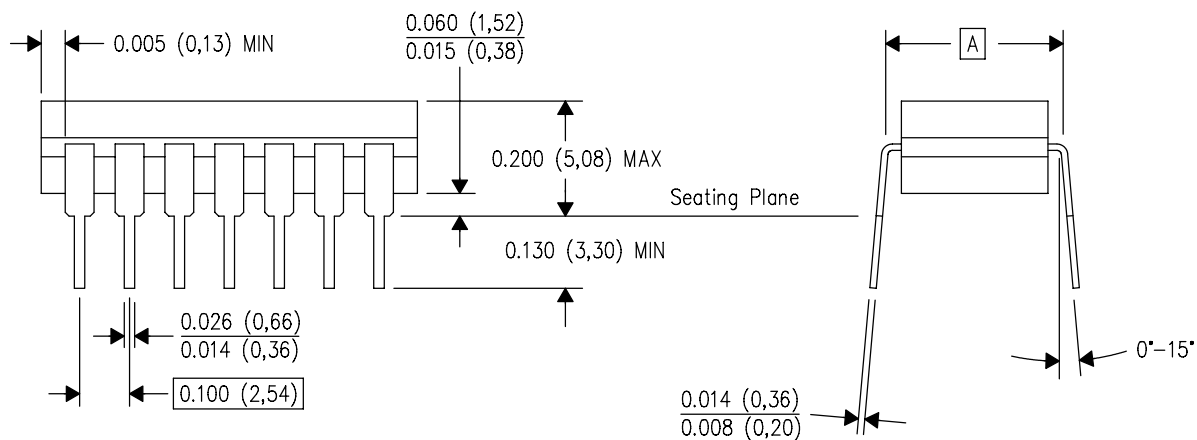
J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE

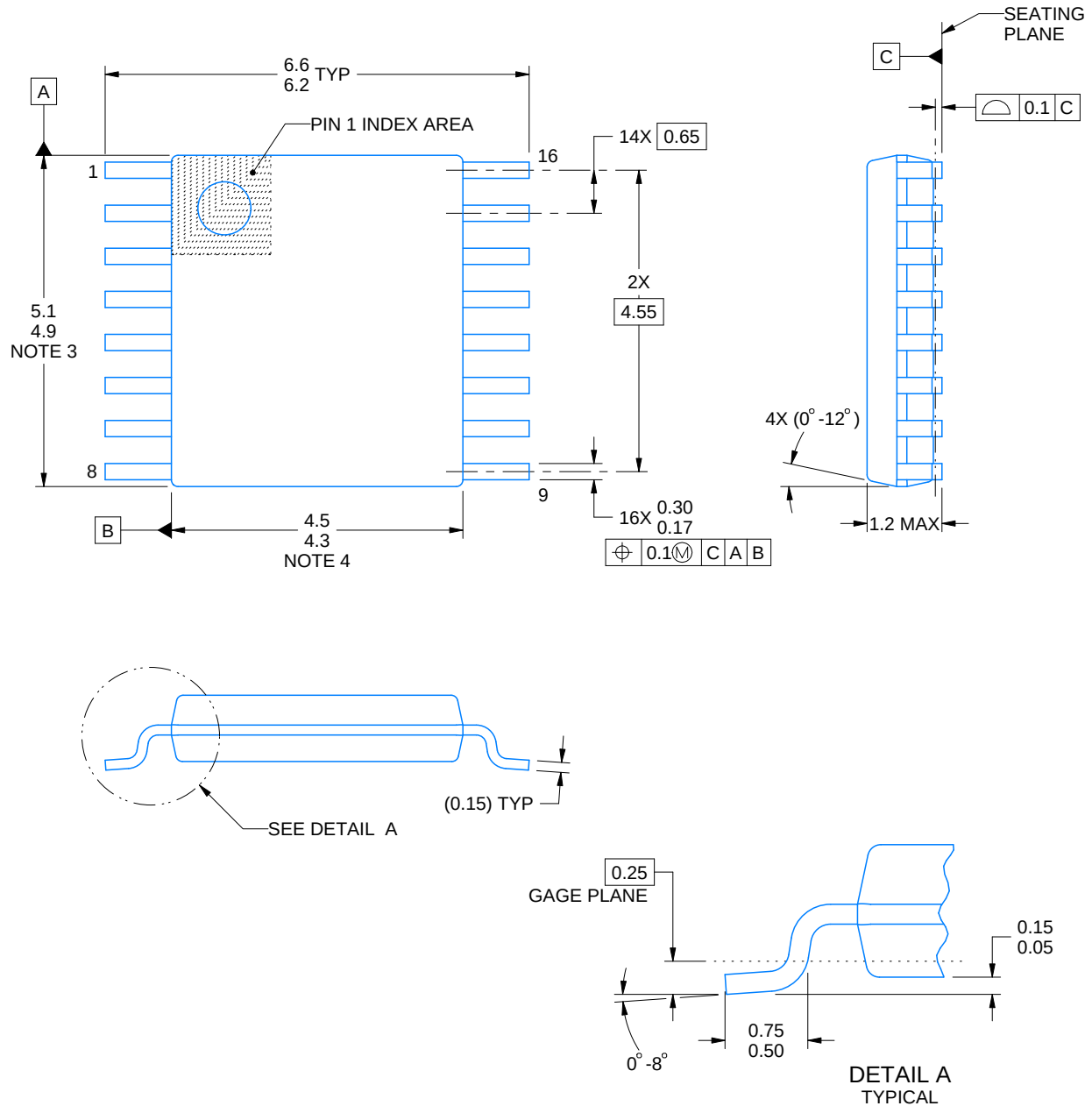
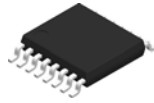


PINS ** DIM	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



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.



4220204/B 12/2023

NOTES:

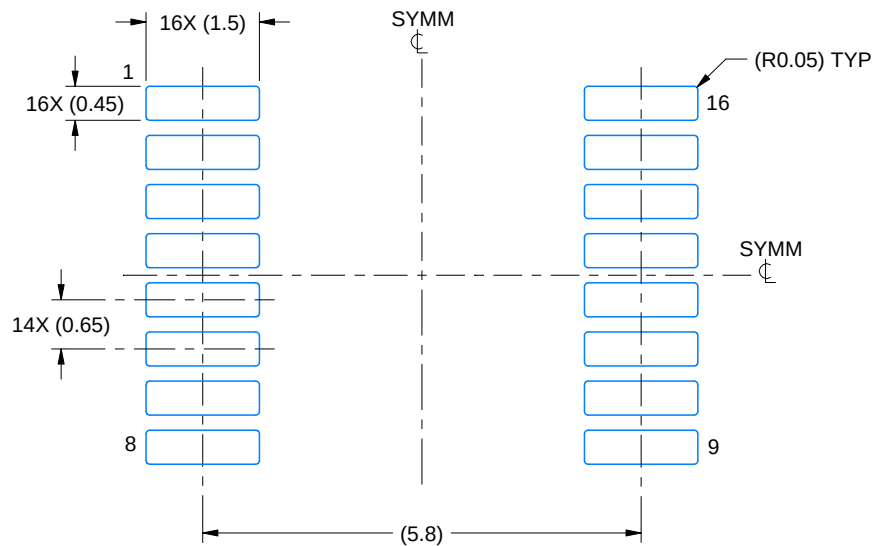
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or 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.

EXAMPLE BOARD LAYOUT

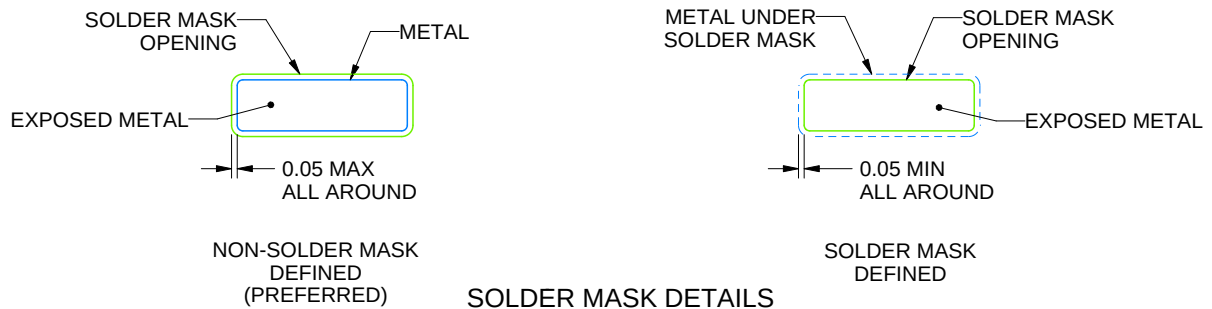
PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4220204/B 12/2023

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

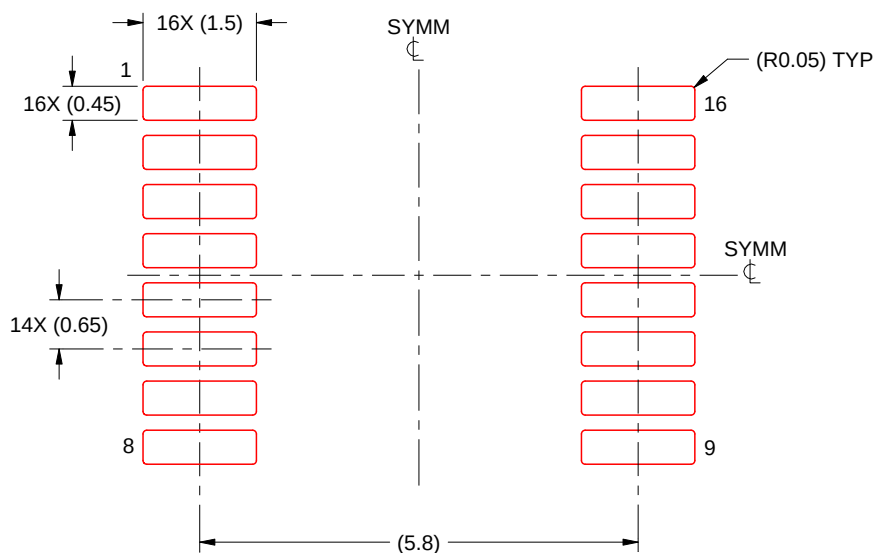
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

4220204/B 12/2023

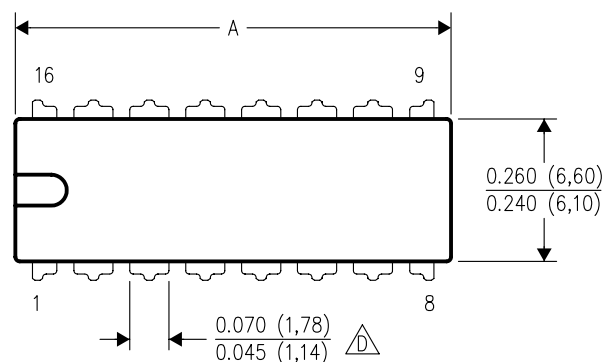
NOTES: (continued)

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.

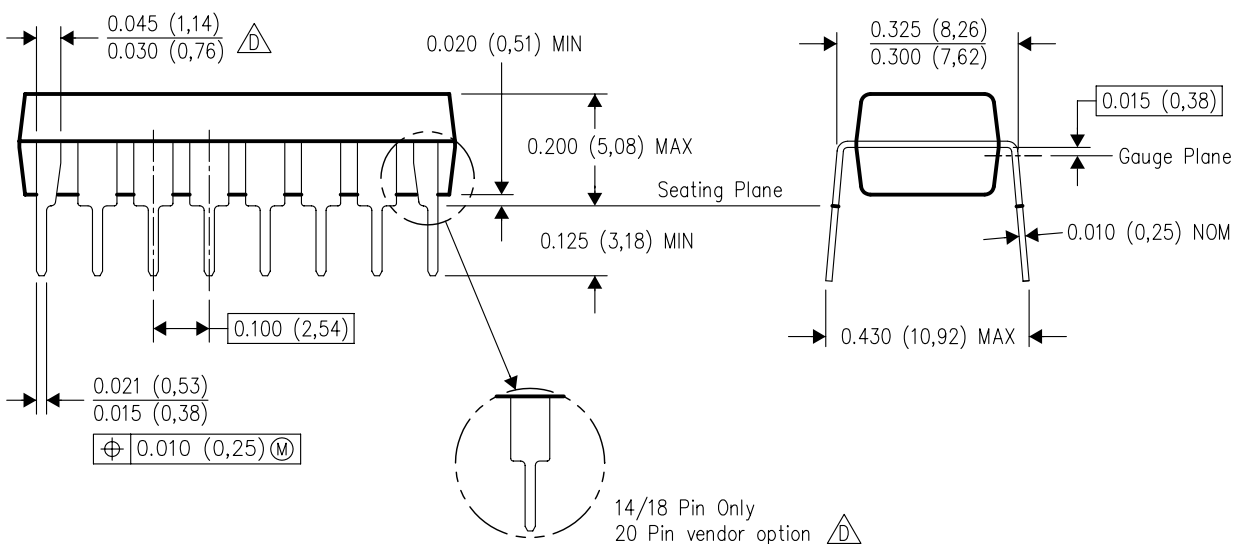
N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS ** DIM	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	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.
-  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 The 20 pin end lead shoulder width is a vendor option, either half or full width.

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