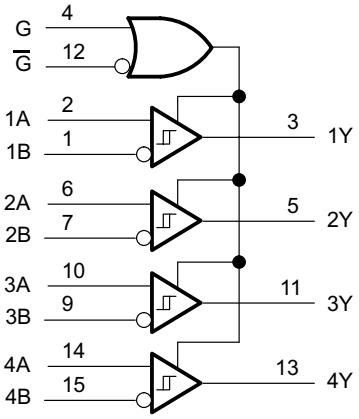
AM26LS32Ax, AM26LS33Ax Quadruple Differential Line Receivers

1 Features

- AM26LS32A Devices meet or exceed the requirements of ANSI TIA/EIA-422-B, TIA/EIA-423-B, and ITU recommendations V.10 and V.11
- AM26LS32A Devices have ±7-V Common-mode range with ±200-mV sensitivity
- AM26LS33A Devices have ±15-V common-mode range with ±500-mV sensitivity
- Input hysteresis 50 mV typical
- Operate from a single 5-V supply
- Low-power Schottky circuitry
- 3-State outputs
- Complementary output-enable inputs
- Input impedance 12 kΩ minimum
- Open input fail-safe

2 Applications

- High-reliability automotive applications
- Factory automation
- ATM and cash counters
- Smart grids
- AC and servo motor drives



Pin numbers are for D, N, NS, or PW packages only.

Logic Diagram (Positive Logic)

3 Description

The AM26LS32Ax and AM26LS33Ax devices are quadruple differential line receivers for balanced and unbalanced digital data transmission. The enable function is common to all four receivers and offers a choice of active-high or active-low input. The 3-state outputs permit connection directly to a bus-organized system. When the inputs are open, the fail-safe design makes sure the outputs always are high.

Compared to the AM26LS32 and the AM26LS33, the AM26LS32A and AM26LS33A incorporate an additional stage of amplification to improve sensitivity. The input impedance has been increased, resulting in less loading of the bus line. The additional stage has increased propagation delay; however, this does not affect interchangeability in most applications.

The AM26LS32AC and AM26LS33AC are characterized for operation from 0°C to 70°C. The AM26LS32AI is characterized for operation from –40°C to 85°C. The AM26LS32AM and AM26LS33AM are characterized for operation over the full military temperature range of –55°C to 125°C.

Package Information

PART NUMBER	PACKAGE(1)	PACKAGE SIZE(2)
AM26LS3xAC AM26LS32AI	PDIP (16)	19.3 mm × 9.4 mm
	SOIC (16)	9.9 mm × 6 mm
AM26LS32AC	SO (16)	10.2 mm × 7.8 mm
	TSSOP (16)	5. mm × 6.4 mm
AM26LS3xAM	CDIP (16)	19.56 mm × 6.92 mm
	LCCC (20)	8.9 mm × 8.9 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.

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4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision F (August 2016) to Revision G (August 2023)	Page
• Changed the Device Information table to the *Package Information* table	1
• Changed the *Thermal Information* table	5
• Changed the *Typical Characteristics*	8

Changes from Revision E (October 2007) to Revision F (August 2016)	Page
• Added *Applications* section, *ESD Ratings* table, *Feature Description* section, *Device Functional Modes*, *Application and Implementation* section, *Power Supply Recommendations* section, *Layout* section, *Device and Documentation Support* section, and *Mechanical, Packaging, and Orderable Information* section	1
• Changed $R_{\theta JA}$ values in the *Thermal Information* table: 73 to 75.7 for (D), 67 to 45.3 (N), 64 to 75.8 (NS), and 108 to 102.7 (PW)	5

5 Pin Configuration and Functions

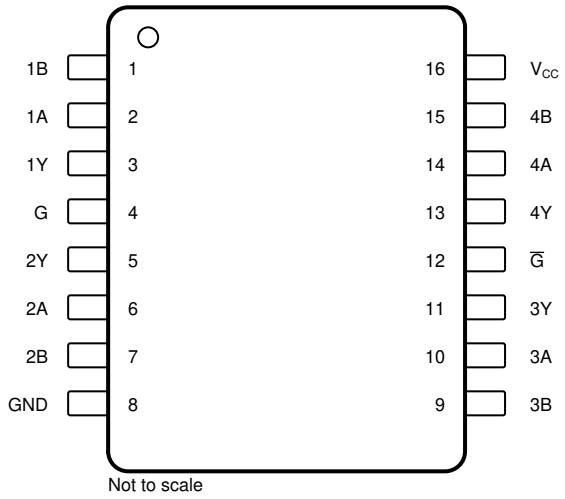
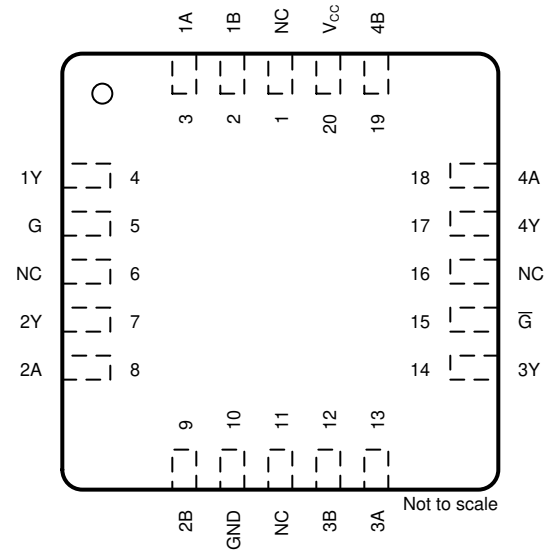


Figure 5-1. D, J, N, NS, and PW Package 16-Pin SOIC, CDIP, PDIP, SO, and TSSOP (Top View)



NC - No internal connection

Figure 5-2. FK Package, 20-Pin LCCC (Top View)

PIN			TYPE	DESCRIPTION
NAME	SOIC, CDIP, PDIP, SO, TSSOP	LCCC		
1A	2	3	I	RS422/RS485 differential input (noninverting)
1B	1	2	I	RS422/RS485 differential input (inverting)
1Y	3	4	O	Logic level output
2A	6	8	I	RS422/RS485 differential input (noninverting)
2B	7	9	I	RS422/RS485 differential input (inverting)
2Y	5	7	O	Logic level output
3A	10	13	I	RS422/RS485 differential input (noninverting)
3B	9	12	I	RS422/RS485 differential input (inverting)
3Y	11	14	O	Logic level output
4A	14	18	I	RS422/RS485 differential input (noninverting)
4B	15	19	I	RS422/RS485 differential input (inverting)
4Y	13	17	O	Logic level output
$\overline{G}$	12	15	I	Active-Low select
G	4	5	I	Active-High select
GND	8	10	—	Ground
NC	—	1, 6, 11, 16	—	No internal connection
V_{CC}	16	20	—	Power supply

6 Specifications

6.1 Absolute Maximum Ratings

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

		MIN	MAX	UNIT
Supply voltage, V_{CC} (2)			7	V
Input voltage, V_I	Any differential input		±25	V
	Other inputs		7	
Differential input voltage, V_{ID} (3)			±25	V
Continuous total power dissipation			See *Section 6.7*	
Case temperature, T_C, FK package (60 s)			260	°C
Lead temperature(4)	D or N package (10 s)		260	°C
	J package (60 s)		300	
Storage temperature, T_{stg}		–65	150	°C

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. 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.
(3) Differential voltage values are at the noninverting (A) input terminals with respect to the inverting (B) input terminals.
(4) 1.6 mm (1/16 inch) from case

6.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1)	±500	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101(2)	±2000	

(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

			MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage	AM26LS32AC, AM26LS32AI, AM26LS33AC	4.75	5	5.25	V
		AM26LS32AM, AM26LS33AM	4.5	5	5.5	
V_{IH}	High-level input voltage		2			V
V_{IL}	Low-level input voltage				0.8	V
V_{IC}	Common-mode input voltage	AM26LS32A			±7	V
		AM26LS33A			±15	
I_{OH}	High-level output current				–440	µA
I_{OL}	Low-level output current				8	mA
T_A	Operating free-air temperature	AM26LS32AC, AM26LS33AC	0		70	°C
		AM26LS32AI	–40		85	
		AM26LS32AM, AM26LS33AM	–55		125	

6.4 Thermal Information

THERMAL METRIC[1]		AM26LS3xAC, AM26LS32AI				AM26LS32AC				UNIT
		D (SOIC)	DR (SOIC-Reel)	N (PDIP)	NR (PDIP-Reel)	NS (SO)	NSR (SO-Reel)	PW (TSSOP)	PWR (TSSOP-Reel)	
		16 PINS	16 PINS	16 PINS	16 PINS	16 PINS	16 PINS	16 PINS	16 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	75.7	84.6	45.3	60.6	75.8	88.5	102.7	107.5	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	35	43.5	32.7	48.1	32.9	46.2	37.8	38.4	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	33.3	43.2	25.3	40.6	36.6	50.7	47.7	53.7	°C/W
ψ_{JT}	Junction-to-top characterization parameter	6.6	10.4	17.8	27.5	6	13.5	3	3.2	°C/W
ψ_{JB}	Junction-to-board characterization parameter	33	42.8	25.1	40.3	36.3	50.3	47.1	53.1	°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

over recommended ranges of V_{CC}, V_{IC}, and operating free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP(1)	MAX	UNIT
V_{IT+}	Positive-going input threshold voltage	V_O = V_{OH}min, I_{OH} = –440 µA	AM26LS32A			0.2	V
			AM26LS33A			0.5	
$V_{IT–}$	Negative-going input threshold voltage	V_O = 0.45 V , I_{OL} = 8 mA	AM26LS32A	–0.2(2)			V
			AM26LS33A	–0.5(2)			
V_{hys}	Hysteresis voltage (V_{IT+} – $V_{IT–}$)				50		mV
V_{IK}	Enable-input clamp voltage	V_{CC} = MIN, I_I = –18 mA				–1.5	V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{ID} = 1 V, $V_{I(G)}$ = 0.8 V, I_{OH} = –440 µA	AM26LS32AC, AM26LS33AC	2.7			V
			AM26LS32AM, AM26LS32AI, AM26LS33AM	2.5			
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{ID} = –1 V, $V_{I(G)}$ = 0.8 V	I_{OL}= 4 mA			0.4	V
			I_{OL}= 8 mA			0.45	
I_{OZ}	Off-state (high-impedance state) output current	V_{CC} = MAX	V_O = 2.4 V			20	µA
			V_O = 0.4 V			–20	
I_I	Line input current	V_I = 15 V, other input at –10 V to 15 V				1.2	mA
		V_I = –15 V, other input at –15 V to 10 V				–1.7	
$I_{I(EN)}$	Enable input current	V_I = 5.5 V				100	µA
I_H	High-level enable current	V_I = 2.7 V				20	µA
I_L	Low-level enable current	V_I = 0.4 V				–0.36	mA
r_i	Input resistance	V_{IC} = –15 V to 15 V, one input to ac ground		12	15		kΩ
I_{OS}	Short-circuit output current(3)	V_{CC} = MAX		–15		–85	mA
I_{CC}	Supply current	V_{CC} = MAX, all outputs disabled			52	70	mA

(1) All typical values are at V_{CC} = 5 V, T_A = 25°C, and V_{IC} = 0.
(2) The algebraic convention, in which the less positive (more negative) limit is designated as minimum, is used in this data sheet for threshold levels only.
(3) Not more than one output must be shorted to ground at a time, and duration of the short circuit must not exceed one second.

6.6 Switching Characteristics

C_L = 15 pF, V_{CC} = 5 V, and T_A = 25°C (see *Section 7*; unless otherwise noted)

PARAMETER		MIN	TYP(1)	MAX	UNIT
t_{PLH}	Propagation delay time, low-to-high-level output		20	35	ns
t_{PHL}	Propagation delay time, high-to-low-level output		22	35	ns
t_{PZH}	Output enable time to high level		17	22	ns
t_{PZL}	Output enable time to low level		20	25	ns
t_{PHZ}	Output disable time from high level		21	30	ns
t_{PLZ}	Output disable time from low level		30	40	ns

(1) All typical values are at V_{CC} = 5 V, T_A = 25°C, and V_{IC} = 0.

6.7 Dissipation Ratings

PACKAGE	$T_A \leq 25°C$ POWER RATING	DERATION FACTOR ABOVE T_A = 25°C	T_A = 70°C POWER RATING	T_A = 125°C POWER RATING
FK	1375 mW	11 mW/°C	880 mW	275 mW
J	1375 mW	11 mW/°C	880 mW	275 mW

6.8 Typical Characteristics

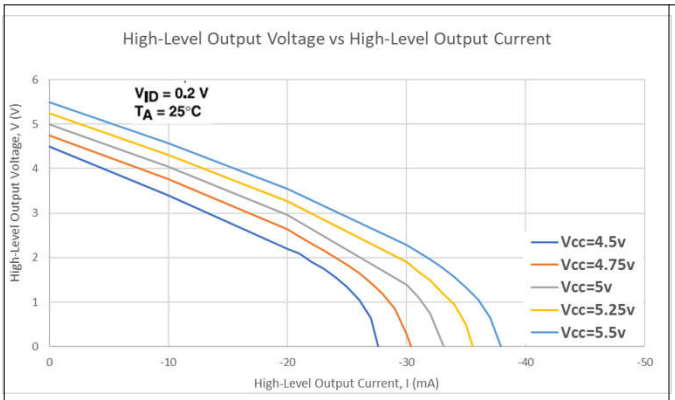


Figure 6-1. High-Level Output Voltage vs High-Level Output Current

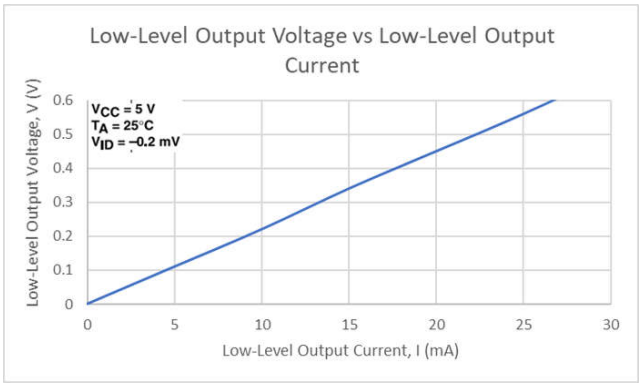


Figure 6-2. Low-Level Output Voltage vs Low-Level Output Current

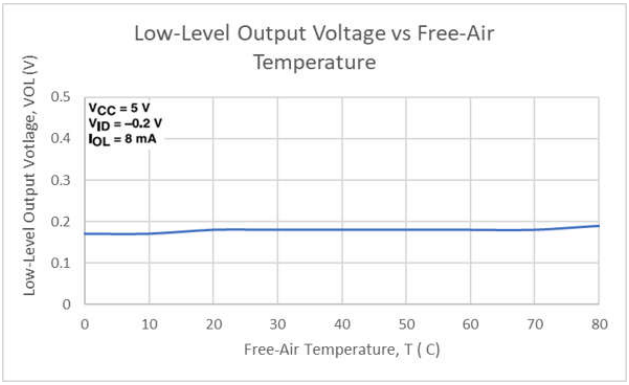


Figure 6-3. Low-Level Output Voltage vs Free-Air Temperature

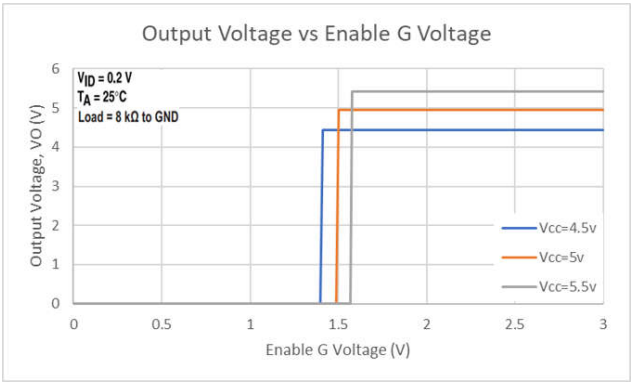


Figure 6-4. Output Voltage vs Enable G Voltage

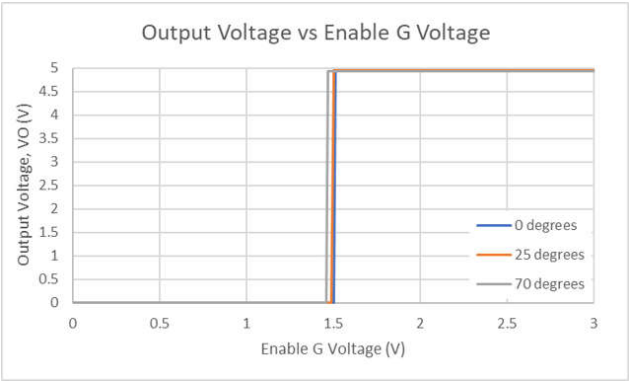


Figure 6-5. Output Voltage vs Enable G Voltage

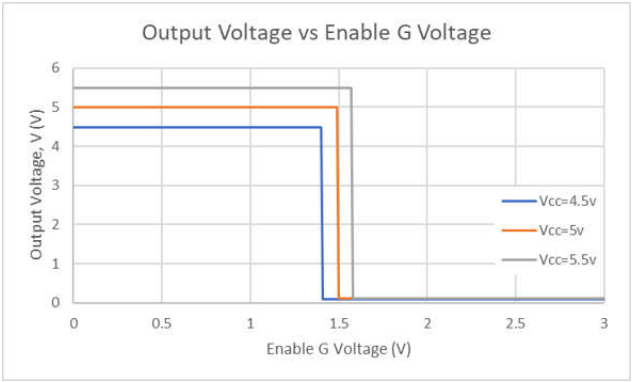


Figure 6-6. Output Voltage vs Enable G Voltage

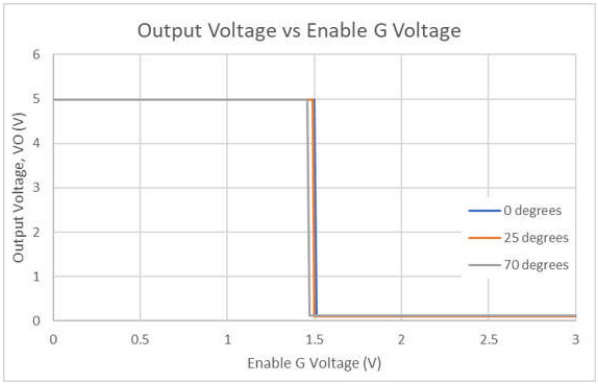


Figure 6-7. Output Voltage vs Enable G Voltage

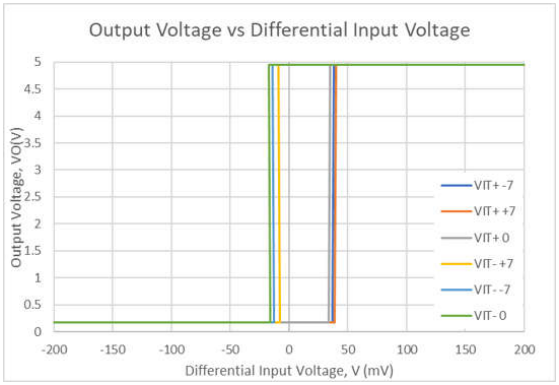


Figure 6-8. AM26LS32A Output Voltage vs Differential Input Voltage

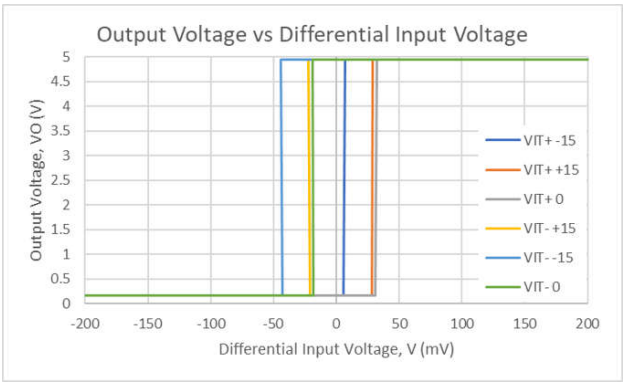
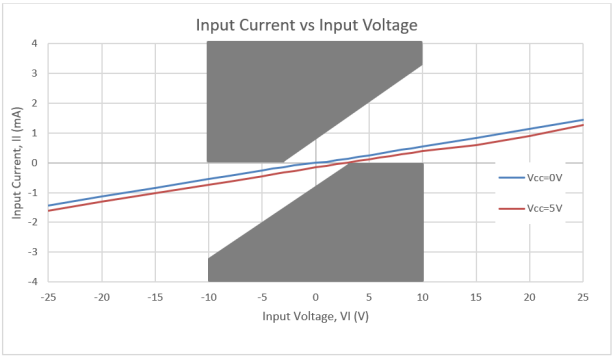


Figure 6-9. AM26LS33A Output Voltage vs Differential Input Voltage



The unshaded area shows requirements of paragraph 4.2.1 of ANSI Standards EIA/TIA-422-B and EIA/TIA-423-B.

Figure 6-10. Input Current vs Input Voltage

7 Parameter Measurement Information

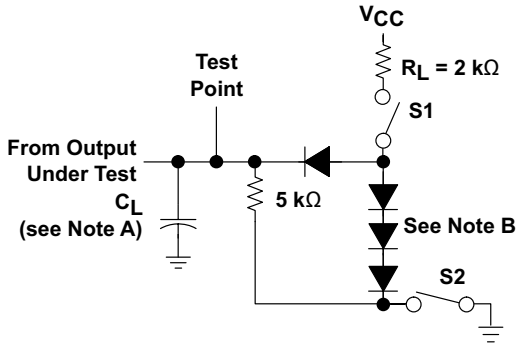


Figure 7-1. Test Circuit

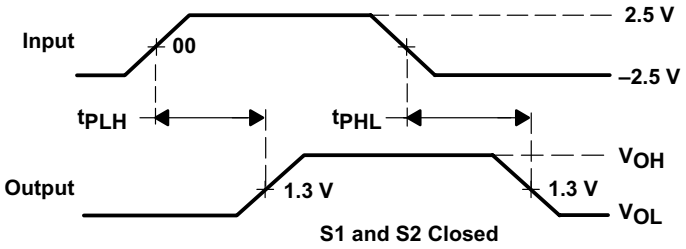


Figure 7-2. Voltage Waveforms For t_{PLH}, t_{PHL}

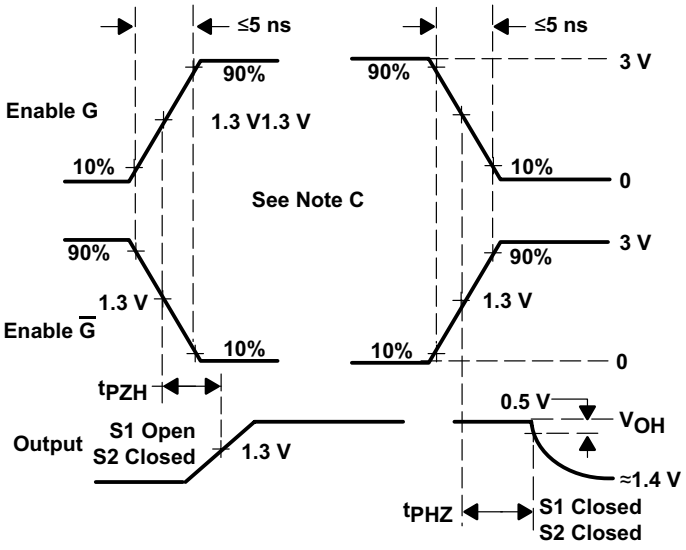
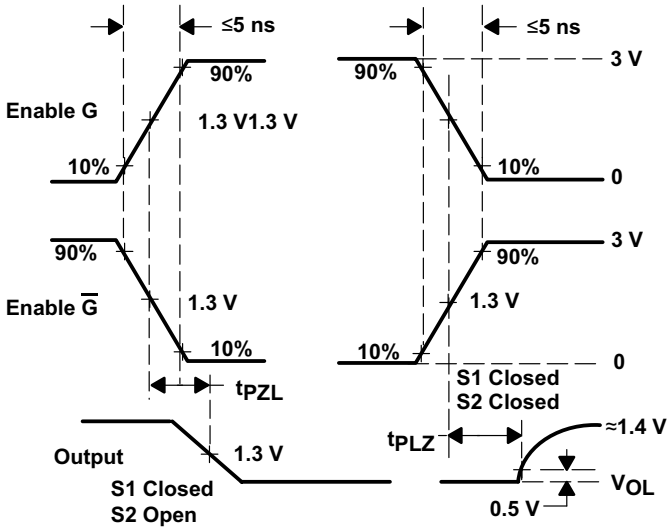


Figure 7-3. Voltage Waveforms For t_{PHZ}, t_{PZH}



A. CL includes probe and jig capacitance.
B. All diodes are 1N3064 or equivalent.
C. Enable G is tested with $\overline{G}$ high, $\overline{G}$ is tested with G low.

Figure 7-4. Voltage Waveforms For t_{PLZ}, t_{PZL}

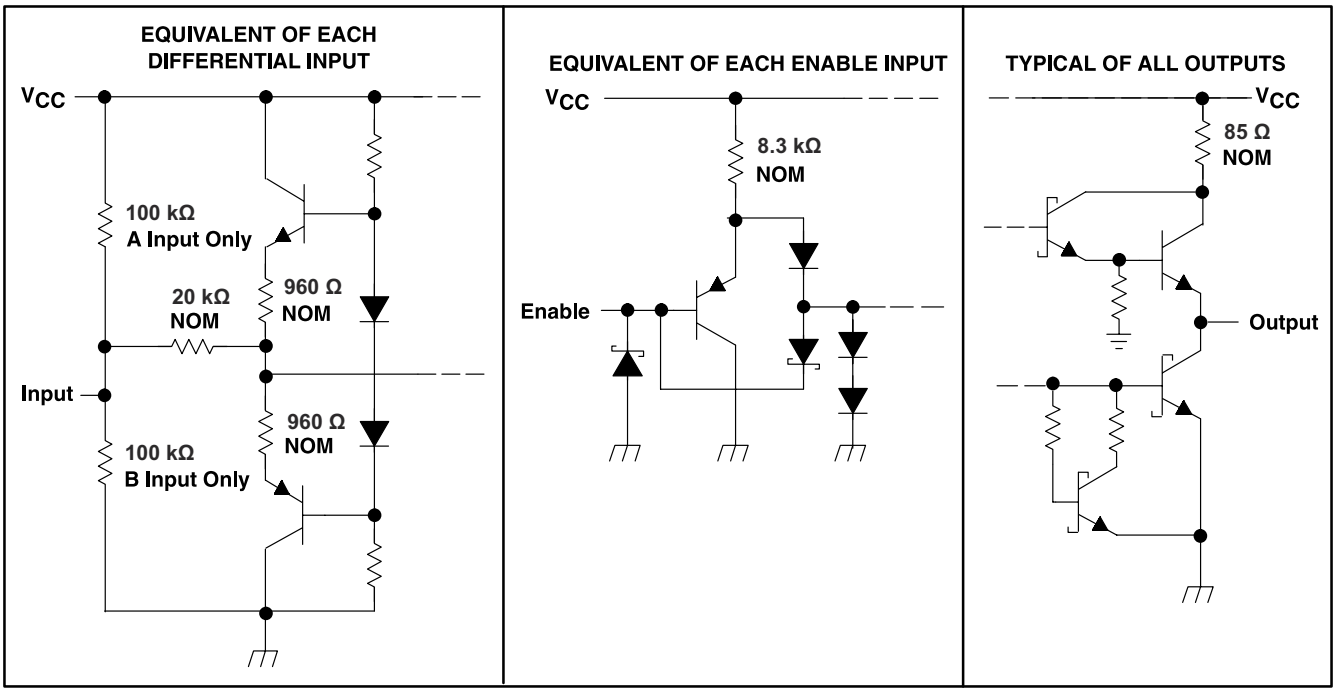


Figure 7-5. Schematics of Inputs and Outputs

8 Detailed Description

8.1 Overview

The AM26LS32 is a quadruple-differential line receiver that meets the necessary requirements for NSI TIA/EIA-422-B, TIA/EIA-423-B, and ITU Recommendation V.10 and V.11. This device allows a low-power or low-voltage MCU to interface with heavy machinery, subsystems, and other devices through long wires of up to 1000 m, giving any design a reliable and easy-to-use connection. As any RS422 interface, the AM26LS32 works in a differential voltage range, which enables very good signal integrity.

8.2 Functional Block Diagram

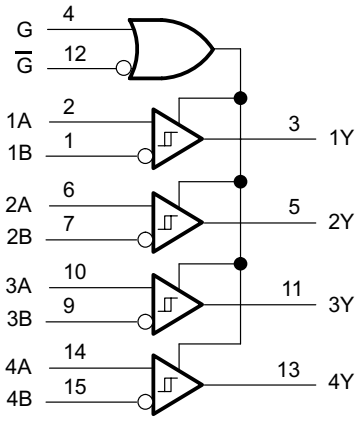


Figure 8-1. Logic Diagram (Positive Logic)

8.3 Feature Description

The device can be configured using the G and $\overline{G}$ logic inputs to select receiver output. The high voltage or logic 1 on the G pin allows the device to operate on an active-high, and having a low voltage or logic 0 on the G enables active low operation. These are simple ways to configure the logic to match that of the receiving or transmitting controller or microprocessor.

8.4 Device Functional Modes

The receivers implemented in these RS422 devices can be configured using the G and $\overline{G}$ logic pins to be enabled or disabled. This allows users to ignore or filter out transmissions as desired.

Table 8-1. Function Table, Each Receiver

DIFFERENTIAL A–B	ENABLES[1]		OUTPUT[1] Y
	G	$\overline{G}$	
$V_{ID} \geq V_{IT+}$	H	X	H
	X	L	H
$V_{IT-} \leq V_{ID} \leq V_{IT+}$	H	X	?
	X	L	?
$V_{ID} \leq V_{IT-}$	H	X	L
	X	L	L
X	L	H	Z
Open	H	X	H
	X	L	H

(1) H = High level, L = Low level, X = Irrelevant, Z = High impedance (off), ? = Indeterminate

9 Application and Implementation

Note

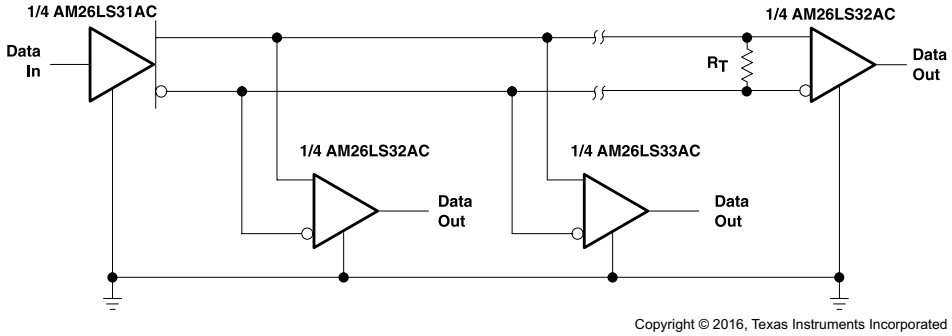
Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation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

9.1 Application Information

When using AM26LS32A as a receiver, the AM26LS31AC can allow multiple AM26LS32As to be used causing an increase in the amount of outputs.

9.2 Typical Application

Figure 9-1 shows a configuration with no termination. Although reflections are present at the receiver inputs at a data signaling rate of 200 kbps with no termination, the RS-422-compliant receiver reads only the input differential voltage and produces a clean signal at the output.



†R_T equals the characteristic impedance of the line.

Figure 9-1. Application Diagram

9.2.1 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_O, of the cable and can vary from about 80 Ω to 120 Ω.

9.2.2 Detailed Design Procedure

Add a V_{CC} bypass capacitor (0.1 µF or more). Either enable (G pin) input can turn on the receivers, so connect the desired enable to a compatible logic line output. The other enable input must be tied to the inactive state supply rail. If the receivers must always be active, then connect both enables to the supply rail such that at least one is set to an active-state rail. V_{CC} must be 5 V within 10% and logic inputs must provide TTL-compatible voltage levels A & B Inputs can lead to an external connector or can be left unconnected. The last receiver on a cable requires termination, either on-board or use as an external resistor. Unused Y outputs can be left unconnected.

9.2.3 Application Curve

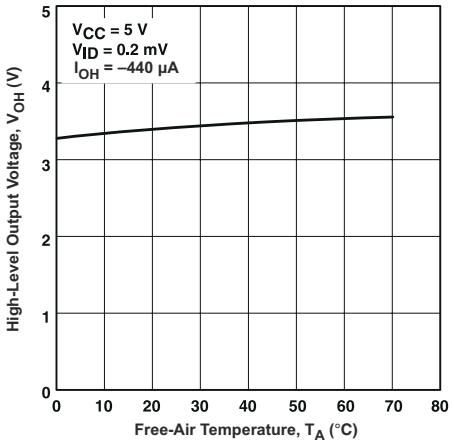


Figure 9-2. High-Level Output Voltage vs Free-Air Temperature

9.3 Power Supply Recommendations

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

9.4 Layout

9.4.1 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-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.
- 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.

9.4.2 Layout Example

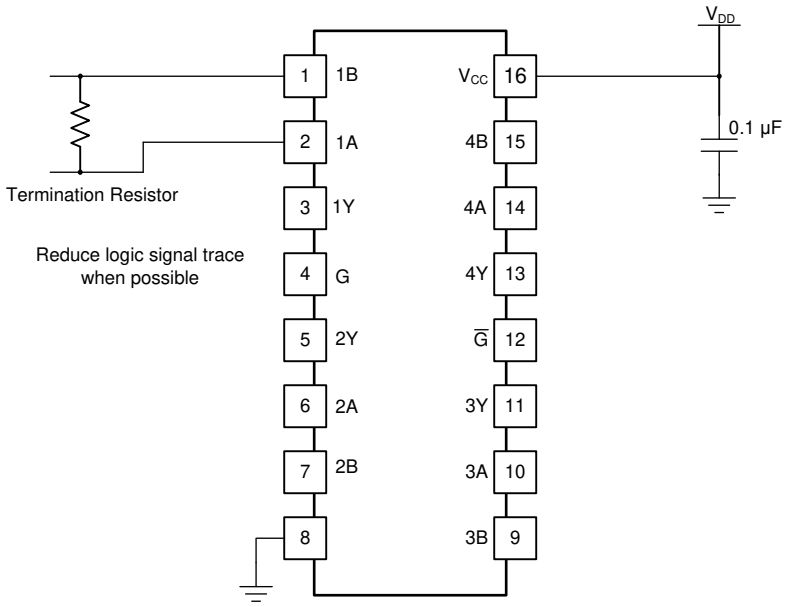


Figure 9-3. Layout with PCB Recommendations

10 Device and Documentation Support

10.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Subscribe to updates* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

10.2 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

10.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.
All trademarks are the property of their respective owners.

10.4 Electrostatic Discharge Caution

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

10.5 Glossary

TI Glossary	This glossary lists and explains terms, acronyms, and definitions.

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)
5962-7802003M2A	Active	Production	LCCC (FK) | 20	55 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-7802003M2A AM26LS32AMFKB
5962-7802003MEA	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-7802003MEA AM26LS32AMJB
5962-7802003MFA	Active	Production	CFP (W) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-7802003MFA AM26LS32AMWB
5962-7802004M2A	Active	Production	LCCC (FK) | 20	55 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-7802004M2A AM26LS33AMFKB
5962-7802004MEA	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-7802004MEA AM26LS33AMJB
5962-7802004MFA	Active	Production	CFP (W) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-7802004MFA AM26LS33AMWB
AM26LS32ACD	Obsolete	Production	SOIC (D) | 16	-	-	Call TI	Call TI	0 to 70	26LS32AC
AM26LS32ACDR	Active	Production	SOIC (D) | 16	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	26LS32AC
AM26LS32ACDRE4	Active	Production	SOIC (D) | 16	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	26LS32AC
AM26LS32ACN	Active	Production	PDIP (N) | 16	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	AM26LS32ACN
AM26LS32ACNSR	Active	Production	SOP (NS) | 16	2000 | LARGE T&R	Yes	NIPDAU | NIPDAU	Level-1-260C-UNLIM	0 to 70	26LS32A
AM26LS32ACNSRG4	Active	Production	SOP (NS) | 16	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	26LS32A
AM26LS32ACPW	Obsolete	Production	TSSOP (PW) | 16	-	-	Call TI	Call TI	0 to 70	SA32A
AM26LS32ACPWR	Active	Production	TSSOP (PW) | 16	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	SA32A
AM26LS32AID	Obsolete	Production	SOIC (D) | 16	-	-	Call TI	Call TI	-40 to 85	26LS32AI
AM26LS32AIDR	Active	Production	SOIC (D) | 16	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	26LS32AI
AM26LS32AIN	Active	Production	PDIP (N) | 16	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	AM26LS32AIN

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)
AM26LS32AMFKB	Active	Production	LCCC (FK) | 20	55 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-7802003M2A AM26LS 32AMFKB
AM26LS32AMJ	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	AM26LS32AMJ
AM26LS32AMJB	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-7802003ME A AM26LS32AMJB
AM26LS32AMWB	Active	Production	CFP (W) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-7802003MF A AM26LS32AMWB
AM26LS33ACD	Obsolete	Production	SOIC (D) | 16	-	-	Call TI	Call TI	0 to 70	26LS33AC
AM26LS33ACDR	Active	Production	SOIC (D) | 16	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	26LS33AC
AM26LS33ACN	Active	Production	PDIP (N) | 16	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	AM26LS33ACN
AM26LS33AMFKB	Active	Production	LCCC (FK) | 20	55 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-7802004M2A AM26LS 33AMFKB
AM26LS33AMJ	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	AM26LS33AMJ
AM26LS33AMJB	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-7802004ME A AM26LS33AMJB
AM26LS33AMWB	Active	Production	CFP (W) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-7802004MF A AM26LS33AMWB

(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.

OTHER QUALIFIED VERSIONS OF AM26LS32A, AM26LS32AM, AM26LS33A, AM26LS33AM :

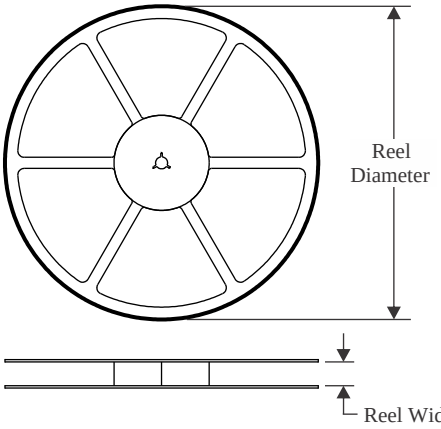
- Catalog : AM26LS32A, AM26LS33A
- Military : AM26LS32AM, AM26LS33AM
- Space : AM26LS33A-SP, AM26LS33A-SP

NOTE: Qualified Version Definitions:

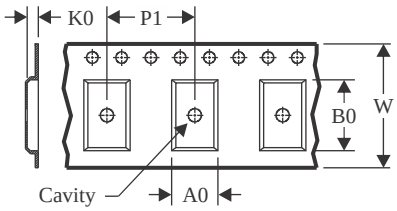
- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

TAPE AND REEL INFORMATION

REEL DIMENSIONS

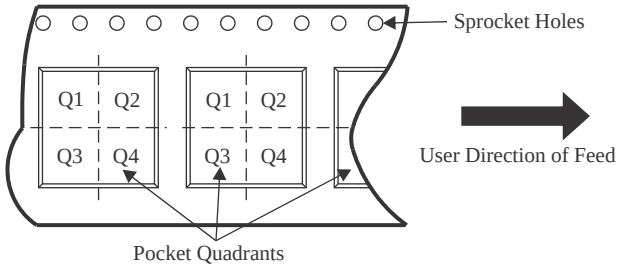


TAPE DIMENSIONS



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

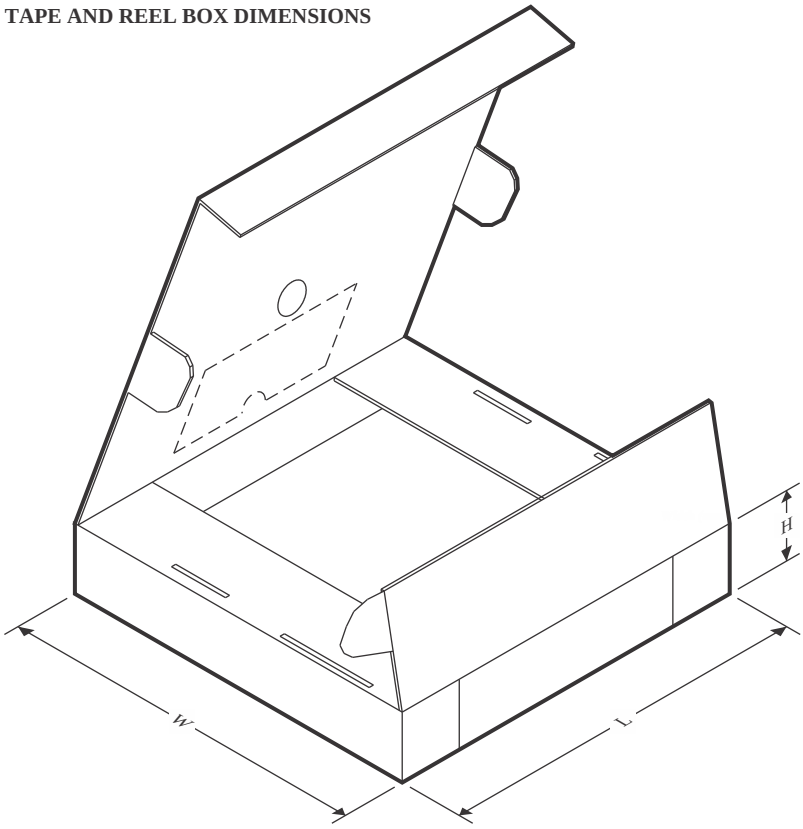
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
AM26LS32ACDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
AM26LS32ACDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
AM26LS32ACDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
AM26LS32ACNSR	SOP	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
AM26LS32ACNSR	SOP	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
AM26LS32ACPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
AM26LS32ACPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
AM26LS32AIDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
AM26LS33ACDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1

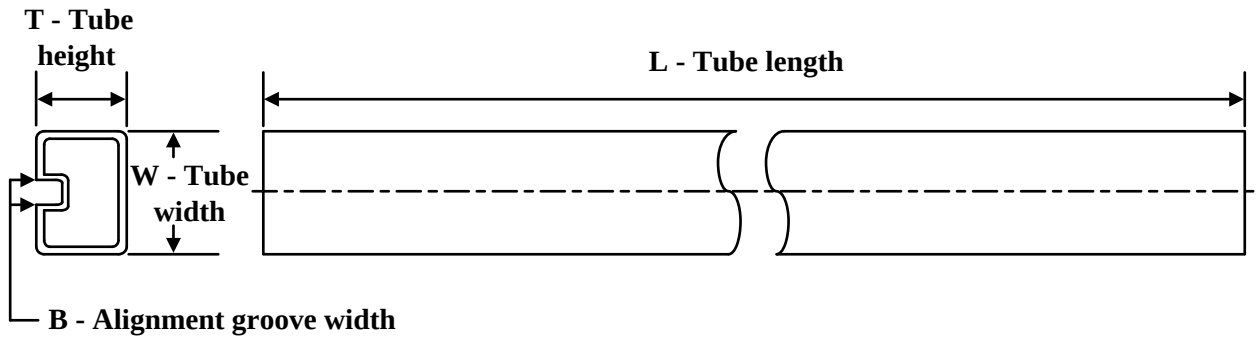
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

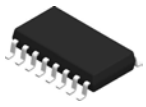
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
AM26LS32ACDR	SOIC	D	16	2500	353.0	353.0	32.0
AM26LS32ACDR	SOIC	D	16	2500	353.0	353.0	32.0
AM26LS32ACDR	SOIC	D	16	2500	356.0	356.0	35.0
AM26LS32ACNSR	SOP	NS	16	2000	353.0	353.0	32.0
AM26LS32ACNSR	SOP	NS	16	2000	367.0	367.0	38.0
AM26LS32ACPWR	TSSOP	PW	16	2000	353.0	353.0	32.0
AM26LS32ACPWR	TSSOP	PW	16	2000	367.0	367.0	35.0
AM26LS32AIDR	SOIC	D	16	2500	353.0	353.0	32.0
AM26LS33ACDR	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)
5962-7802003M2A	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-7802003MFA	W	CFP	16	25	506.98	26.16	6220	NA
5962-7802004M2A	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-7802004MFA	W	CFP	16	25	506.98	26.16	6220	NA
AM26LS32ACN	N	PDIP	16	25	506	13.97	11230	4.32
AM26LS32AIN	N	PDIP	16	25	506	13.97	11230	4.32
AM26LS32AMFKB	FK	LCCC	20	55	506.98	12.06	2030	NA
AM26LS32AMWB	W	CFP	16	25	506.98	26.16	6220	NA
AM26LS33ACN	N	PDIP	16	25	506	13.97	11230	4.32
AM26LS33AMFKB	FK	LCCC	20	55	506.98	12.06	2030	NA
AM26LS33AMWB	W	CFP	16	25	506.98	26.16	6220	NA

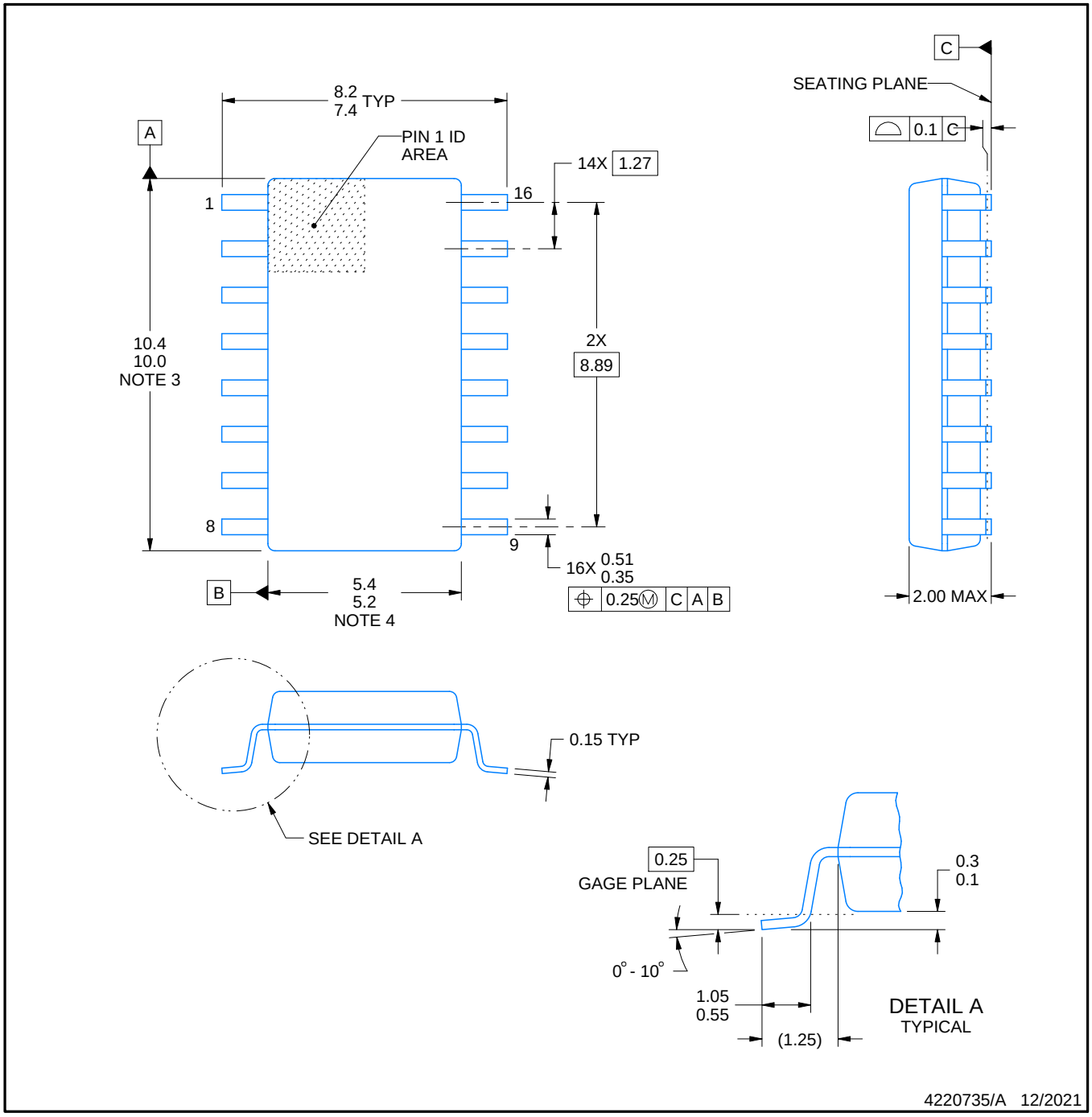


PACKAGE OUTLINE

NS0016A

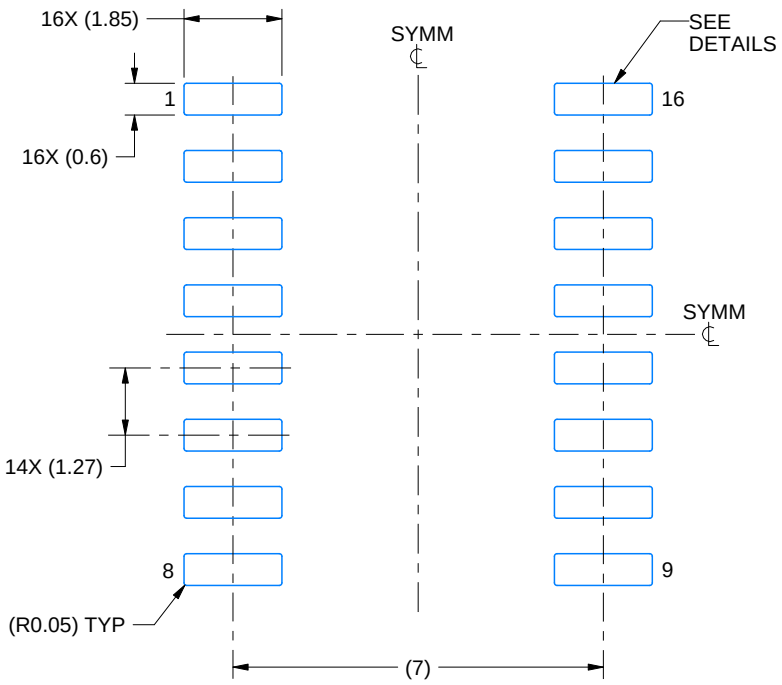
SOP - 2.00 mm max height

SOP

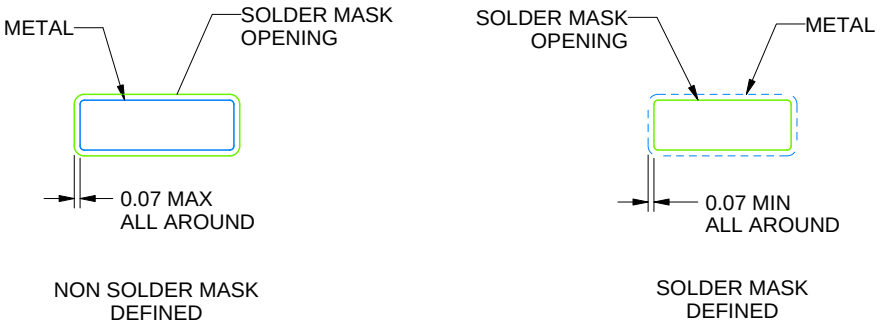


NOTES:

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

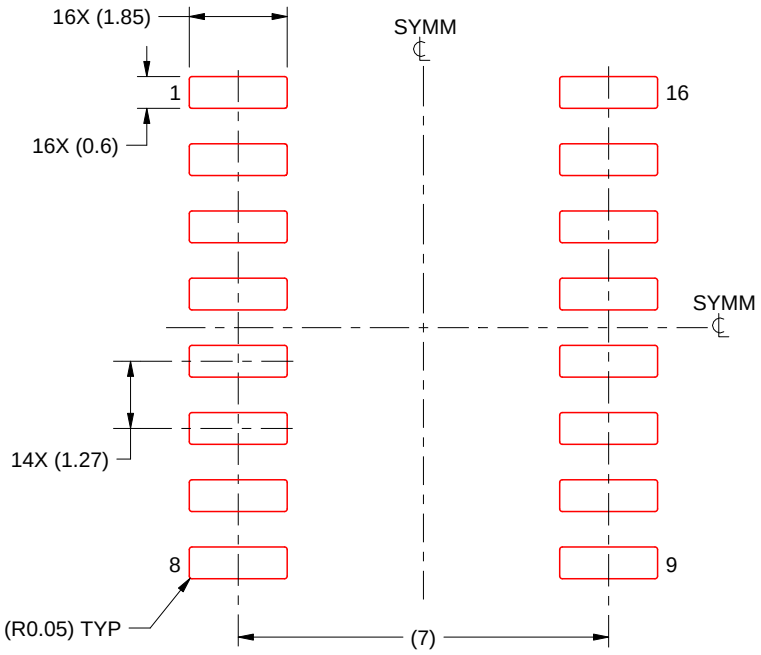
SOLDER MASK
DEFINED

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.



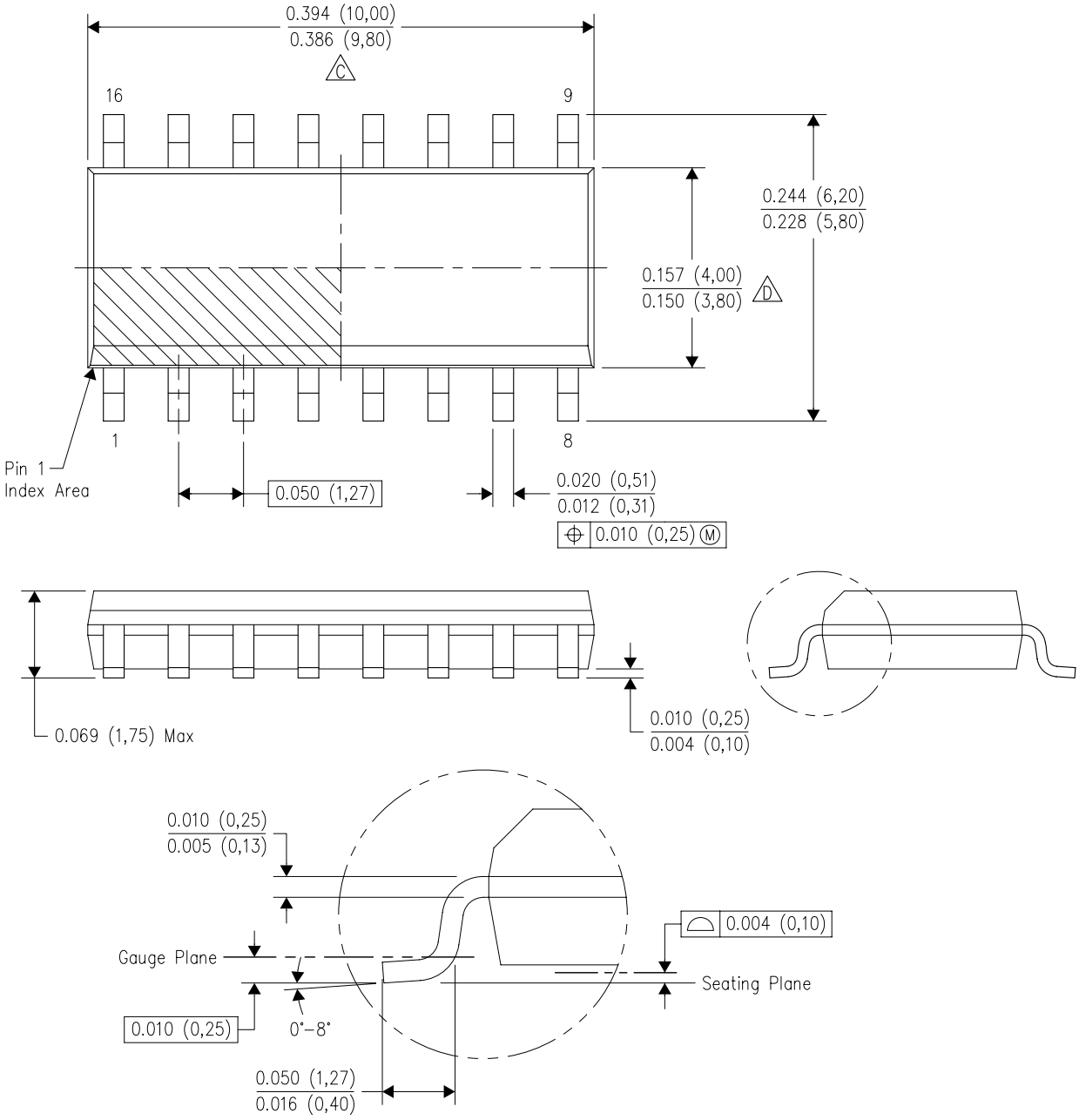
SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:7X

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.

D (R–PDSO–G16) PLASTIC SMALL OUTLINE



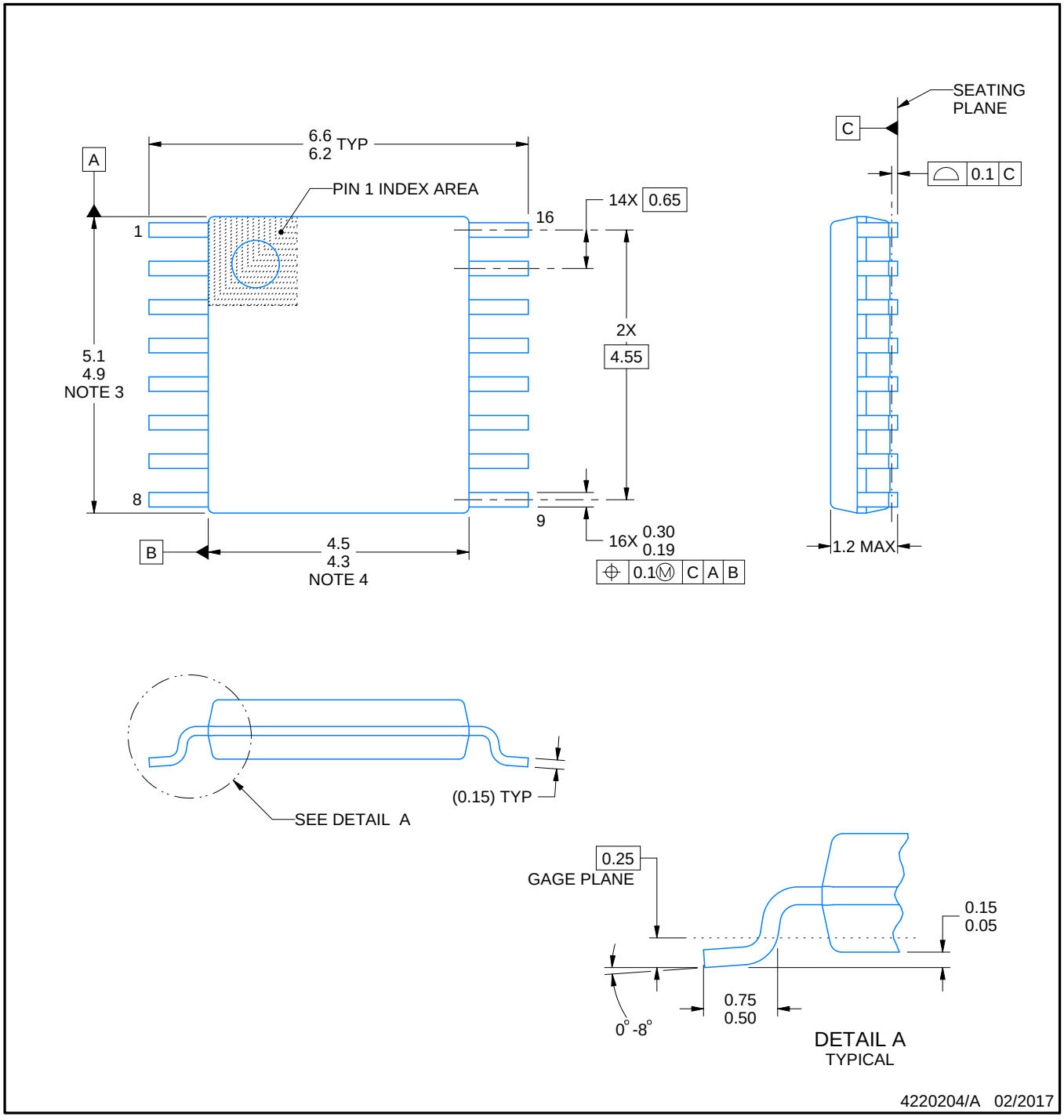
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
D. Body width does not include interlead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

PACKAGE OUTLINE

PW0016A

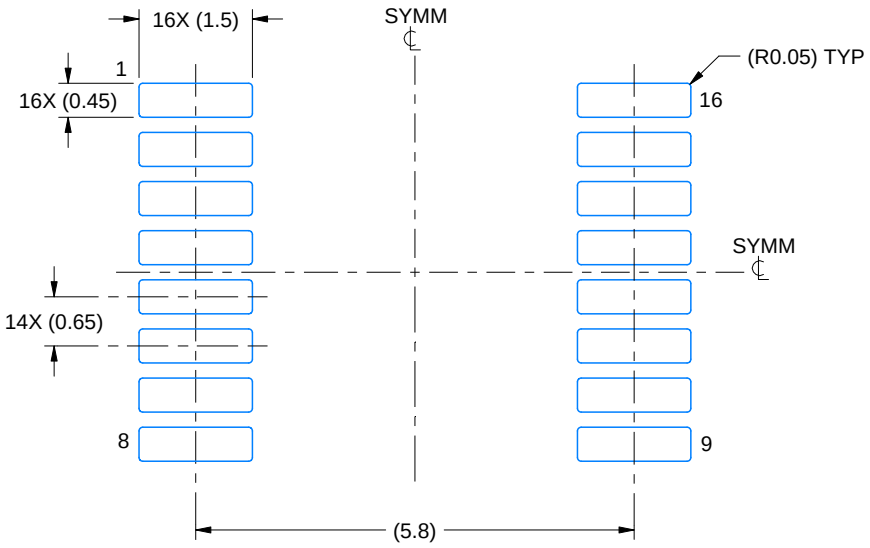
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

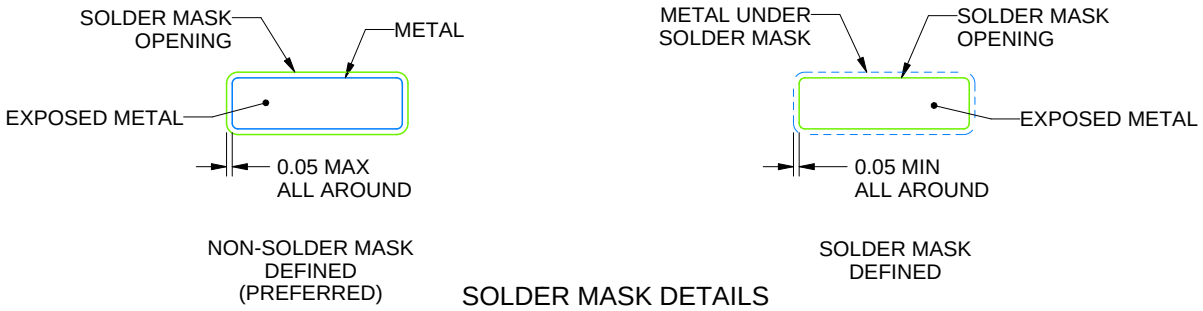


NOTES:

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

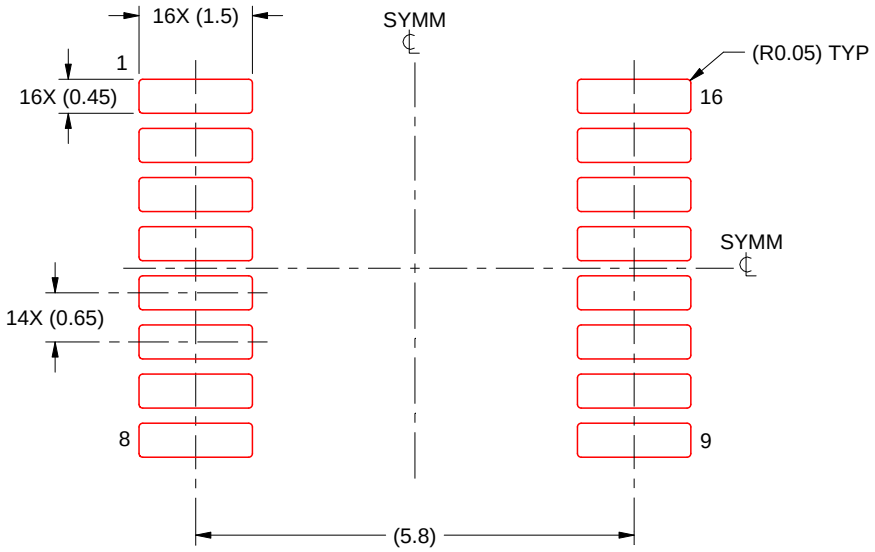


SOLDER MASK DETAILS

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

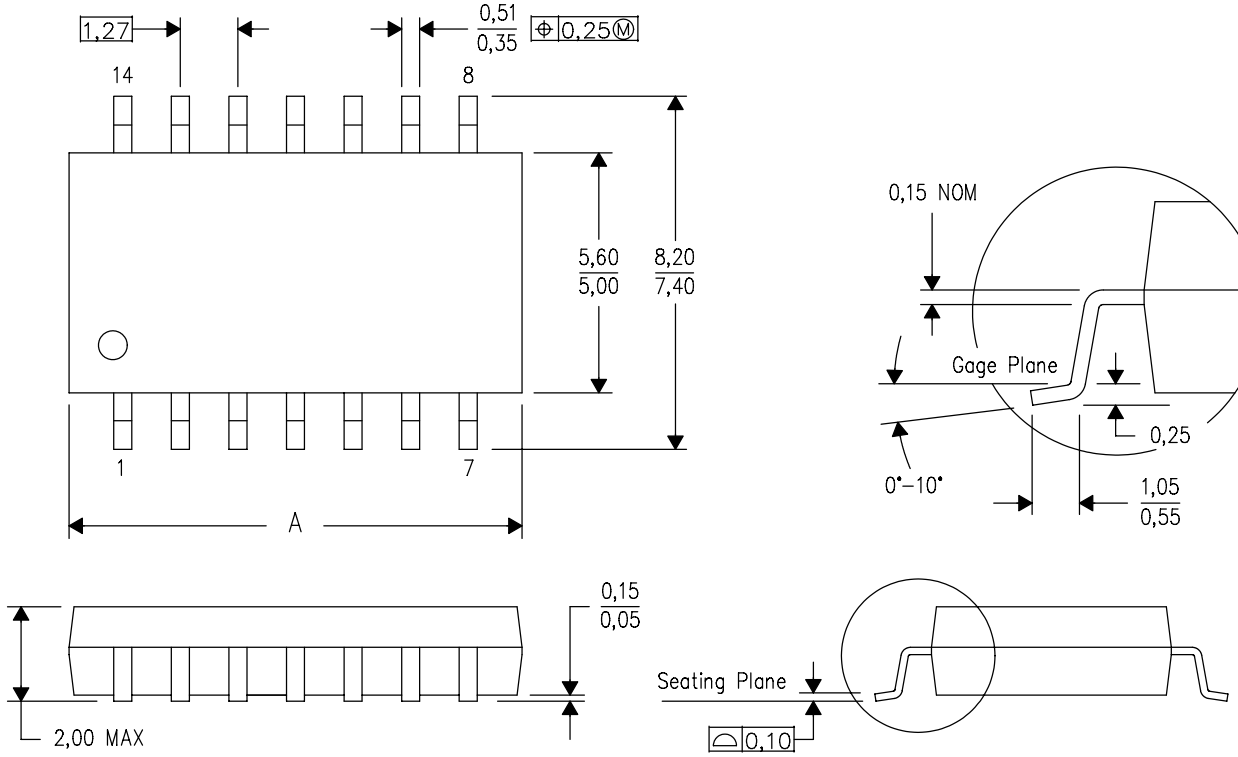
NOTES: (continued)

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.

MECHANICAL DATA

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

14-PINS SHOWN

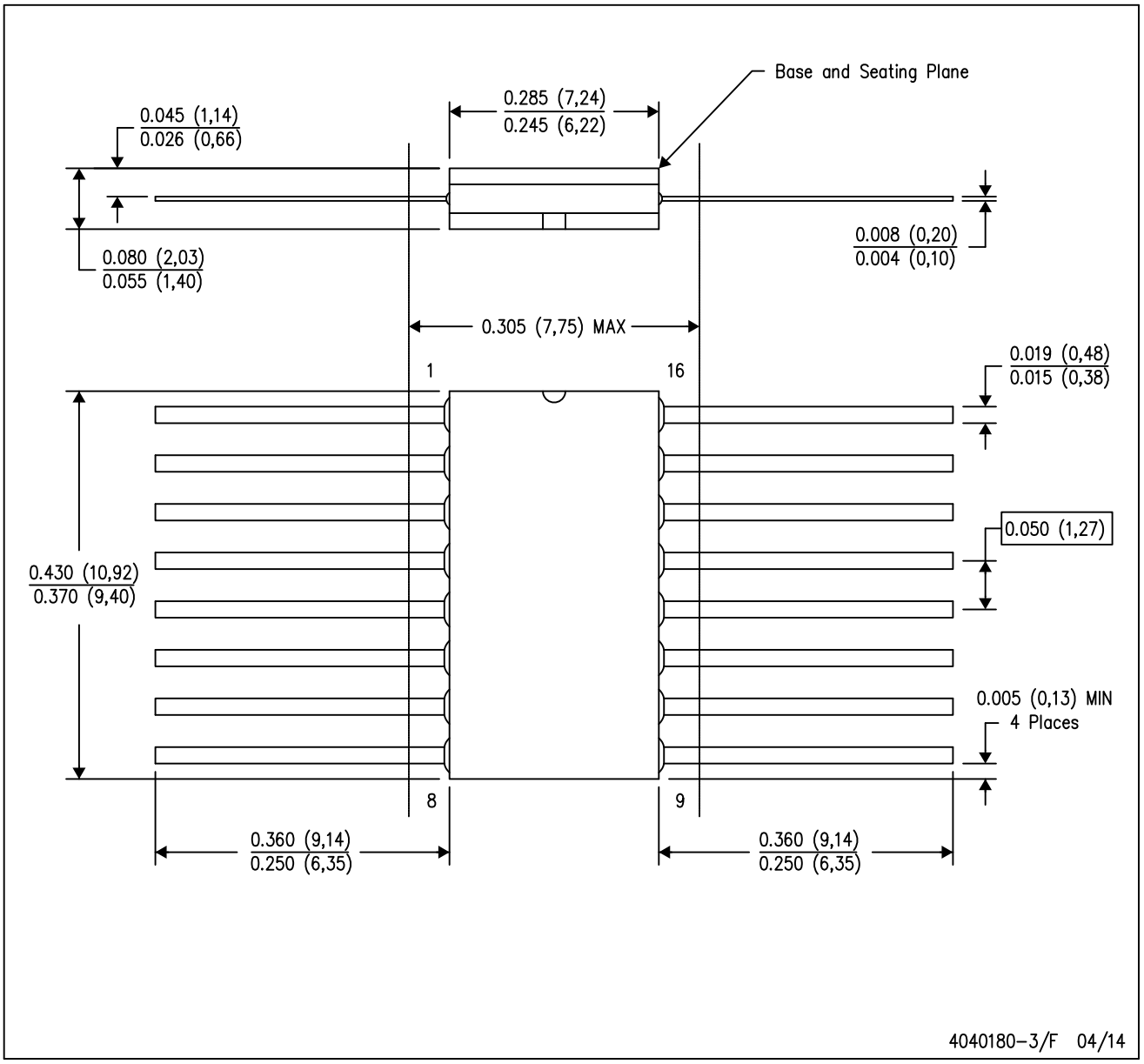


DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

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

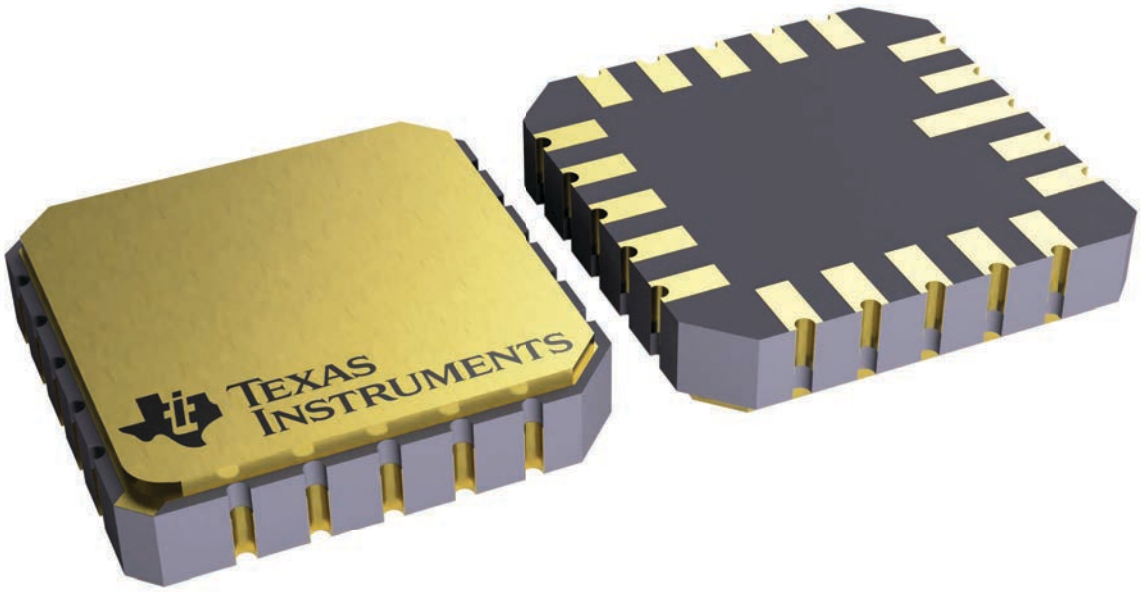
FK 20

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.

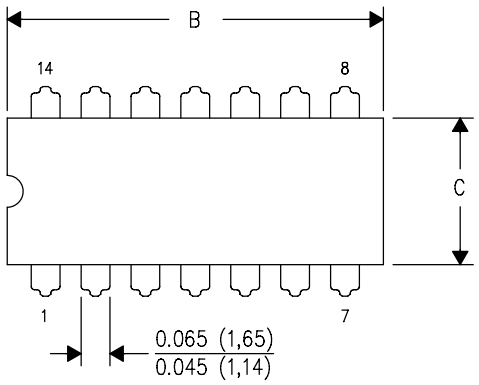


4229370VA\

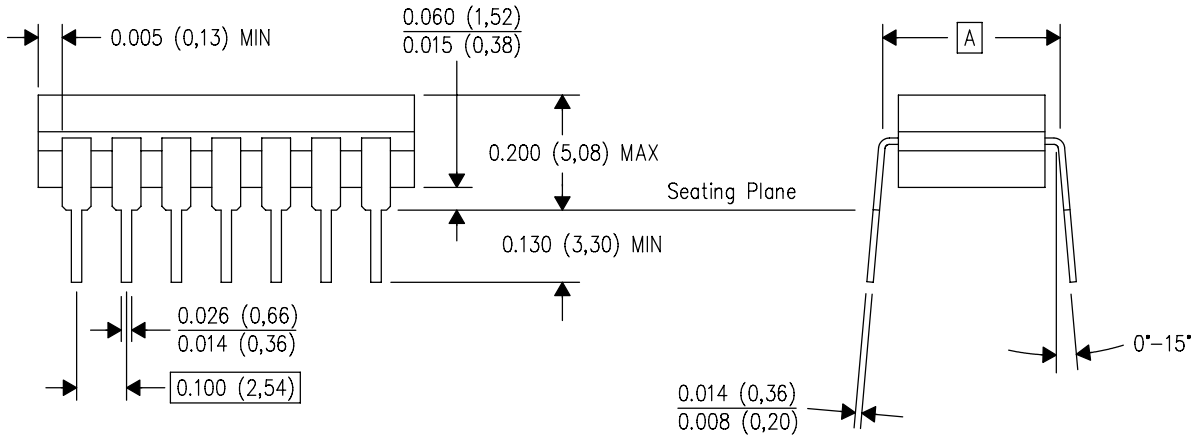
J (R–GDIP–T**)

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)



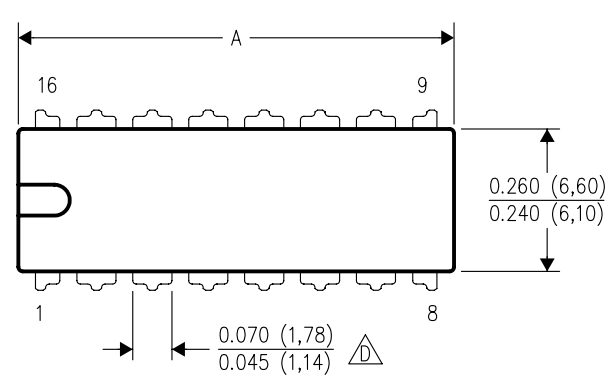
4040083/F 03/03

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.

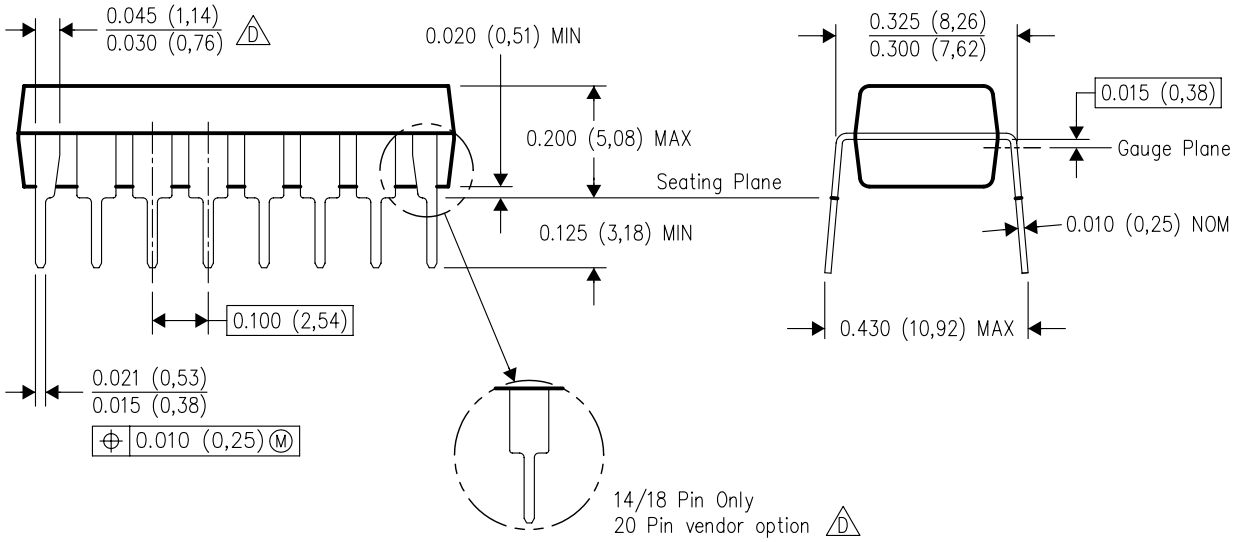
N (R–PDIP–T**)

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.

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