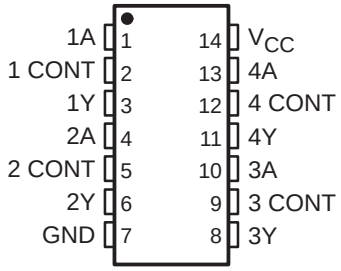
- **Meet or Exceed the Requirements of TIA/EIA-232-F and ITU Recommendation V.28**
- **Low Supply Current . . . 420 μA Typ**
- **Preset On-Chip Input Noise Filter**
- **Built-in Input Hysteresis**
- **Response and Threshold Control Inputs**
- **Push-Pull Outputs**
- **Functionally Interchangeable and Pin-to-Pin Compatible With Texas Instruments SN75189/SN75189A and Motorola MC1489/MC1489A**
- **Package Options Include Plastic Small-Outline (D) and Shrink Small-Outline (DB) Packages, and Standard Plastic (N) DIP**

D, DB, OR N PACKAGE
(TOP VIEW)



description

The SN75C189 and SN75C189A are low-power, bipolar, quadruple line receivers that are used to interface data terminal equipment (DTE) with data circuit-terminating equipment (DCE). These devices have been designed to conform to TIA/EIA-232-F.

The SN75C189 has a 0.33-V typical hysteresis, compared with 0.97 V for the SN75C189A. Each receiver has provision for adjustment of the overall input threshold levels. This is achieved by choosing external series resistors and voltages to provide bias levels for the response-control pins. The output is in the high logic state if the input is open circuit or shorted to ground.

These devices have an on-chip filter that rejects input pulses of less than 1-μs duration. An external capacitor can be connected from the control pins to ground to provide further input noise filtering for each receiver.

The SN75C189 and SN75C189A have been designed using low-power techniques in a bipolar technology. In most applications, these receivers interface to single inputs of peripheral devices such as UARTs, ACEs, or microprocessors. By using sampling, such peripheral devices usually are insensitive to the transition times of the input signals. If this is not the case, or for other uses, it is recommended that the SN75C189 and SN75C189A outputs be buffered by single Schmitt input gates or single gates of the HCMOS, ALS, or 74F logic families.

The SN75C189 and SN75C189A are characterized for operation from 0°C to 70°C.

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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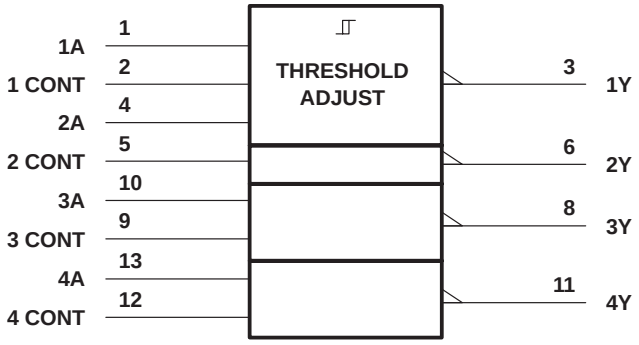
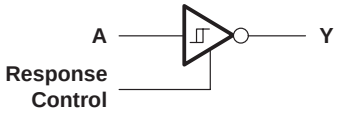
logic symbol†



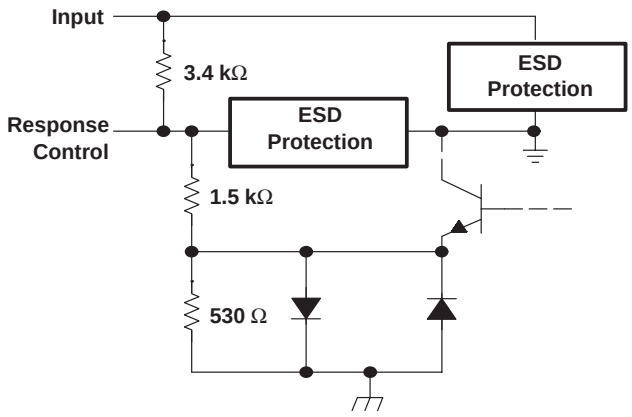
† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (each receiver)



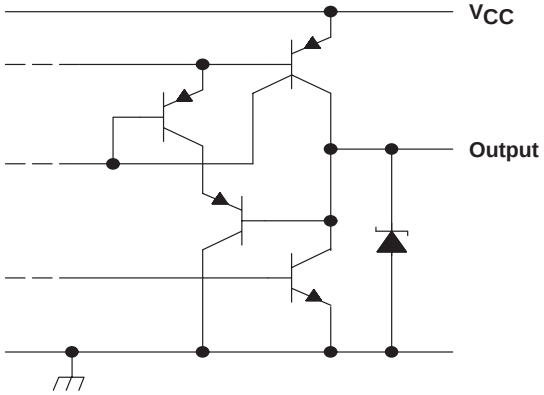
schematic of inputs and outputs

EQUIVALENT OF EACH INPUT‡



‡ All resistor values shown are nominal.

EQUIVALENT OF EACH OUTPUT



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)§

Supply voltage, V_{CC} (see Note 1) . . . . . 7 V
Input voltage range, V_I . . . . . –30 V to 30 V
Output voltage range, V_O . . . . . –0.3 V to V_{CC}+ 0.3 V
Package thermal impedance, θ_{JA} (see Note 2): D package . . . . . 86°C/W
DB package . . . . . 96°C/W
N package . . . . . 80°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . . 260°C
Storage temperature range, T_{stg} . . . . . –65°C to 150°C

§ 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.

NOTES: 1. All voltages are with respect to network GND.
2. The package thermal impedance is calculated in accordance with JESD 51.

recommended operating conditions

		MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage	4.5	5	6	V
V_I	Input voltage (see Note 3)	–25		25	V
I_{OH}	High-level output current			–3.2	mA
I_{OL}	Low-level output current			3.2	mA
	Response-control current			±1	mA
T_A	Operating free-air temperature	0		70	°C

NOTE 3: The algebraic convention, where the more positive (less negative) limit is designated as maximum, is used in this data sheet for logic levels only, e.g., if –10 V is a maximum, the typical value is a more negative voltage.

electrical characteristics over recommended free-air temperature range, V_{CC} = 5 V ±10% (unless otherwise noted) (see Note 4)

PARAMETER			TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V_{IT+}	Positive-going input threshold voltage	’C189	See Figure 1		1		1.5	V
		’C189A			1.6		2.25	
$V_{IT–}$	Negative-going input threshold voltage	’C189	See Figure 1		0.75		1.25	V
		’C189A			0.75	1	1.25	
V_{hys}	Input hysteresis voltage ($V_{IT+} – V_{IT–}$)	’C189	See Figure 1		0.15	0.33		V
		’C189A			0.65	0.97		
V_{OH}	High-level output voltage		V_{CC} = 4.5 V to 6 V, I_{OH} = –20 µA	V_I = 0.75 V,	3.5			V
			V_{CC} = 4.5 V to 6 V, I_{OH} = –3.2 mA	V_I = 0.75 V,	2.5			
V_{OL}	Low-level output voltage		V_{CC} = 4.5 V to 6 V, I_{OL} = 3.2 mA	V_I = 3 V,			0.4	V
I_{IH}	High-level input current		See Figure 2	V_I = 25 V	3.6		8.3	mA
				V_I = 3 V	0.43		1	
I_{IL}	Low-level input current		See Figure 2	V_I = –25 V	–3.6		–8.3	mA
				V_I = –3 V	–0.43		–1	
I_{OS}	Short-circuit output current		See Figure 3				–35	mA
I_{CC}	Supply current		V_I = 5 V, See Figure 2	No load,		420	700	µA

† All typical values are at T_A = 25°C.

NOTE 4: All characteristics are measured with response-control terminal open.

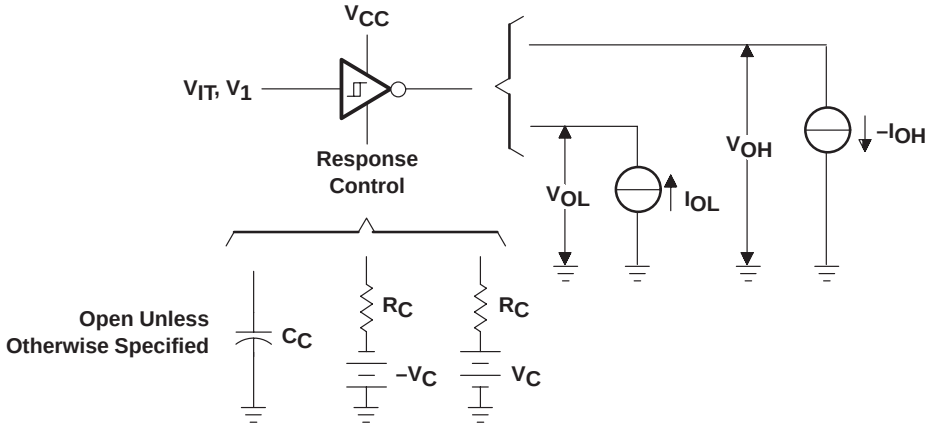
switching characteristics, V_{CC} = 5 V ±10%, T_A = 25°C

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low- to high-level output	R_L = 5 kΩ,	C_L = 50 pF,	See Figure 4			6	µs
t_{PHL}	Propagation delay time, high- to low-level output						6	µs
t_{TLH}	Transition time, low- to high-level output‡						500	ns
t_{THL}	Transition time, high- to low-level output‡						300	ns
$t_{w(N)}$	Duration of longest pulse rejected as noise§				1		6	µs

‡ Measured between 10% and 90% points of output waveform

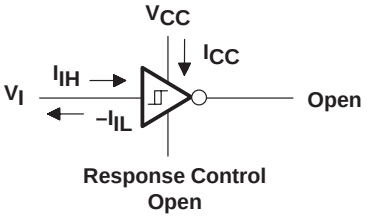
§ The receiver ignores any positive- or negative-going pulse that is less than the minimum value of $t_{w(N)}$ and accepts any postive- or negative-going pulse greater than the maximum of $t_{w(N)}$.

PARAMETER MEASUREMENT INFORMATION



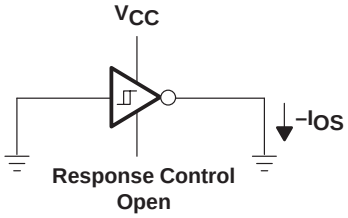
NOTE A: Arrows indicate actual direction of current flow. Current into a terminal is a positive value.

Figure 1. V_{T+}, V_{IT-}, V_{OH}, V_{OL}



NOTE A: Arrows indicate actual direction of current flow. Current into a terminal is a positive value.

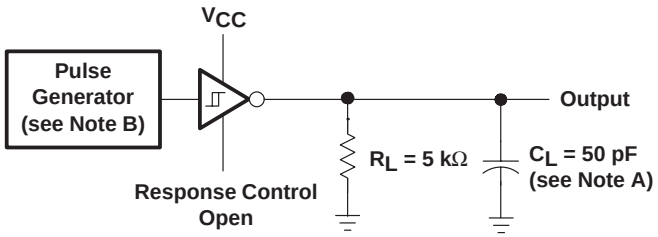
Figure 2. I_{IH}, I_{IL}, I_{CC}



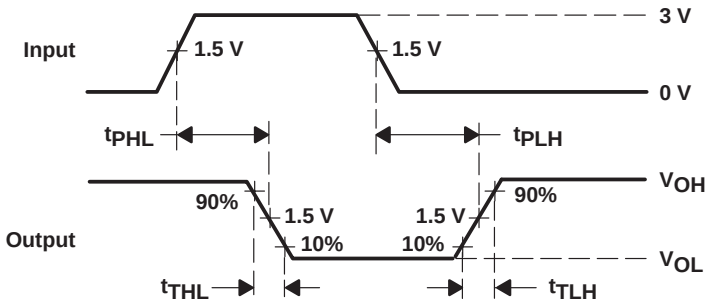
NOTE A: Arrows indicate actual direction of current flow. Current into a terminal is a positive value.

Figure 3. I_{OS}

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

NOTES: A. C_L includes probe and jig capacitances.
B. The pulse generator has the following characteristics: Z_O = 50 Ω, t_W = 25 μs.

Figure 4. Test Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS

SN75C189
INPUT THRESHOLD VOLTAGE (POSITIVE GOING)
vs
FREE-AIR TEMPERATURE

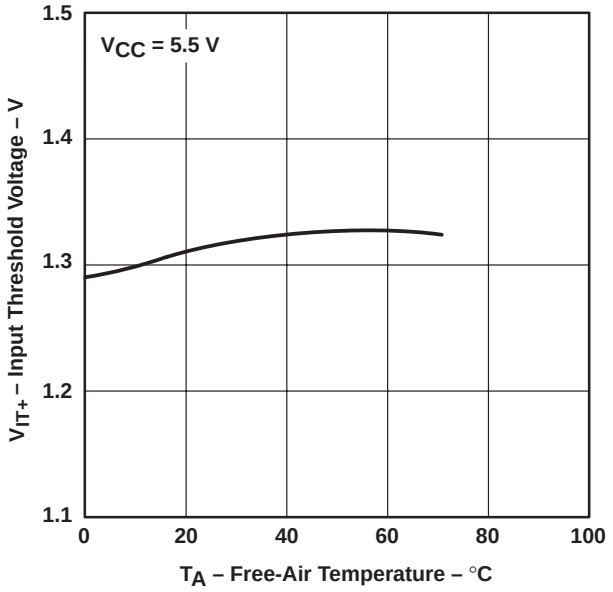


Figure 5

SN75C189A
INPUT THRESHOLD VOLTAGE (POSITIVE GOING)
vs
FREE-AIR TEMPERATURE

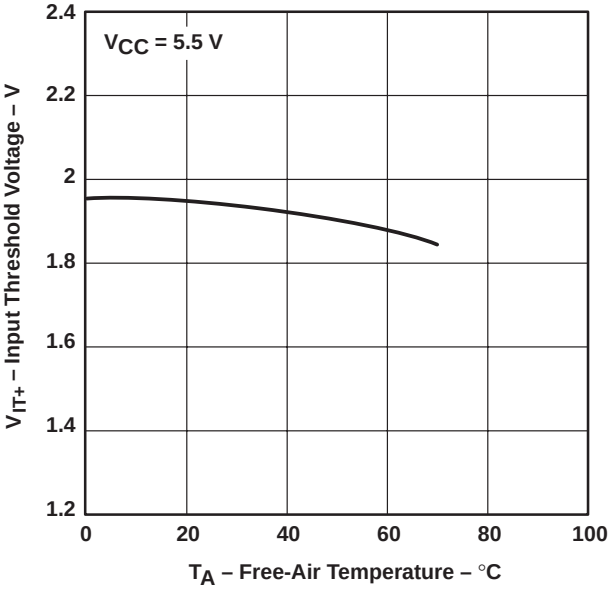


Figure 6

SN75C189
INPUT THRESHOLD VOLTAGE (NEGATIVE GOING)
vs
FREE-AIR TEMPERATURE

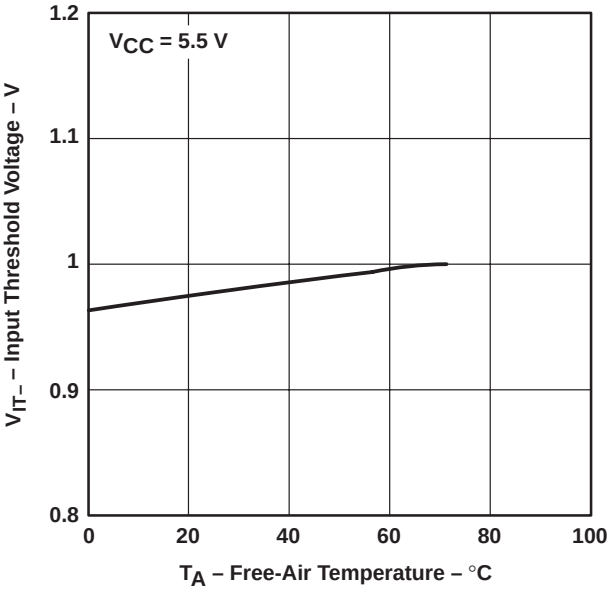


Figure 7

SN75C189A
INPUT THRESHOLD VOLTAGE (NEGATIVE GOING)
vs
FREE-AIR TEMPERATURE

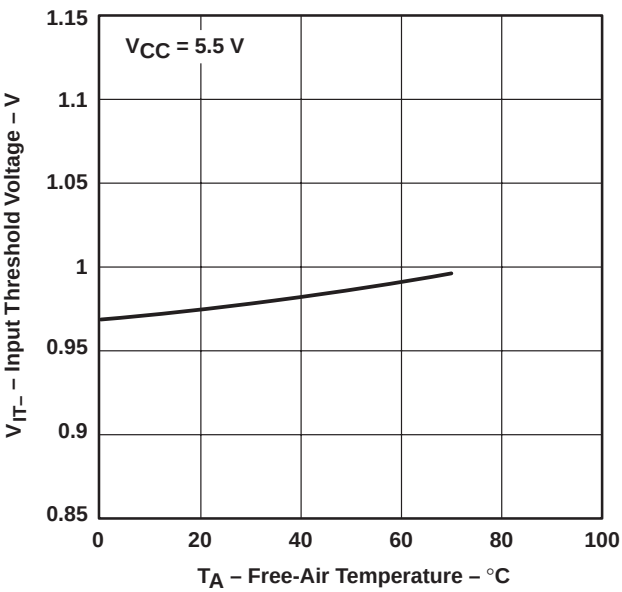


Figure 8

TYPICAL CHARACTERISTICS

**SN75C189
INPUT HYSTERESIS
vs
FREE-AIR TEMPERATURE**

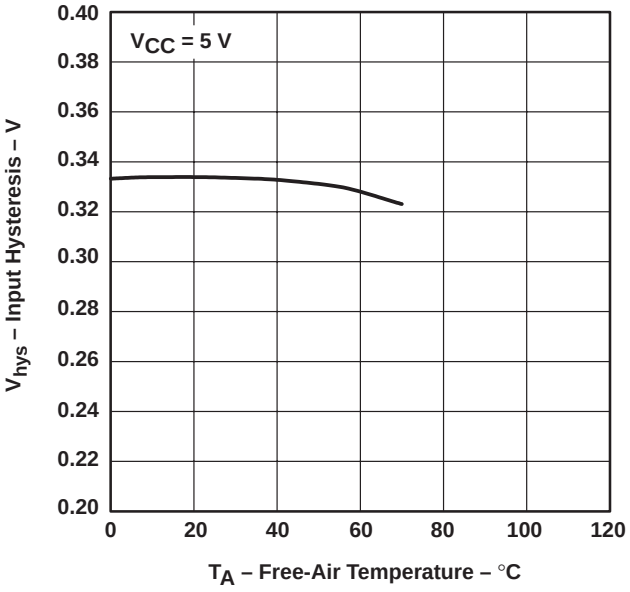


Figure 9

**SN75C189A
INPUT HYSTERESIS
vs
FREE-AIR TEMPERATURE**

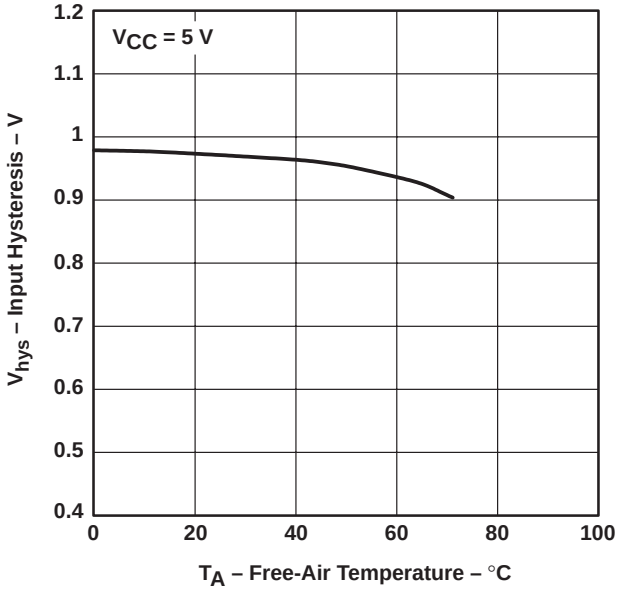


Figure 10

**HIGH-LEVEL OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE**

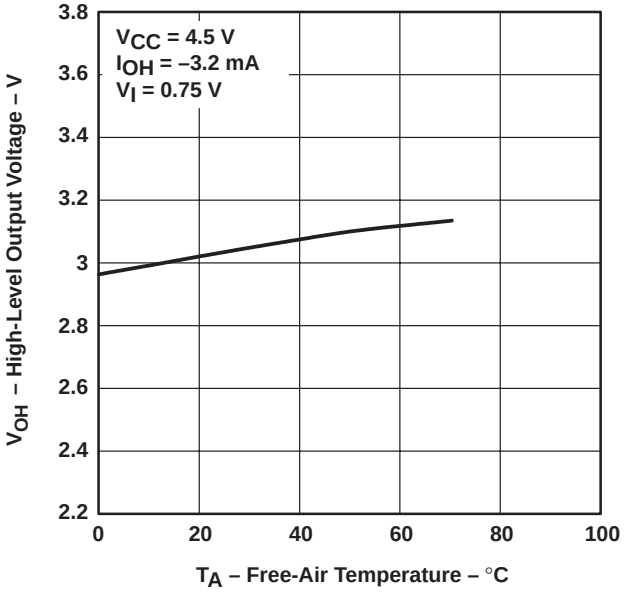


Figure 11

**LOW-LEVEL OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE**

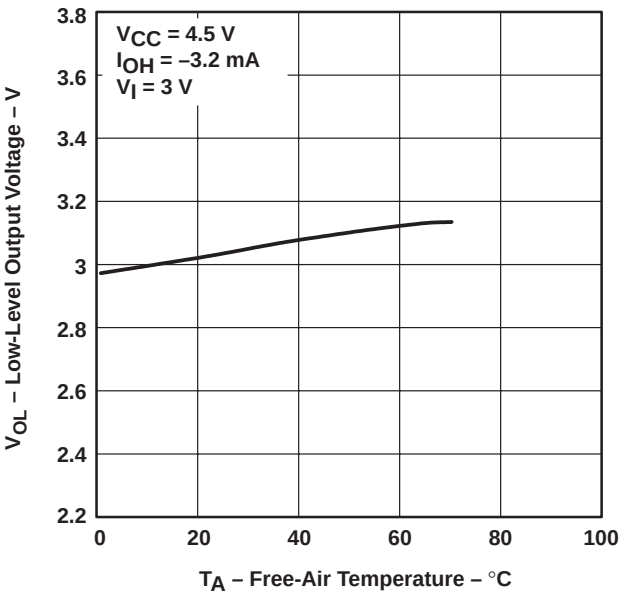


Figure 12

TYPICAL CHARACTERISTICS

**SN75C189
HIGH-LEVEL INPUT CURRENT
vs
FREE-AIR TEMPERATURE**

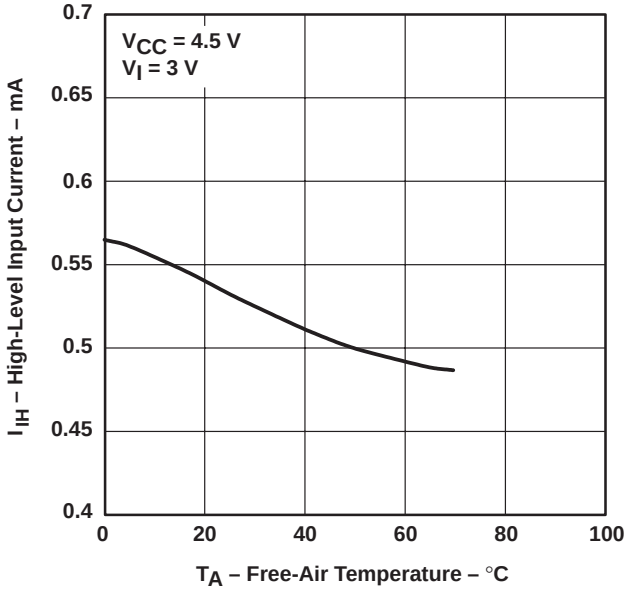


Figure 13

**SN75C189A
HIGH-LEVEL INPUT CURRENT
vs
FREE-AIR TEMPERATURE**

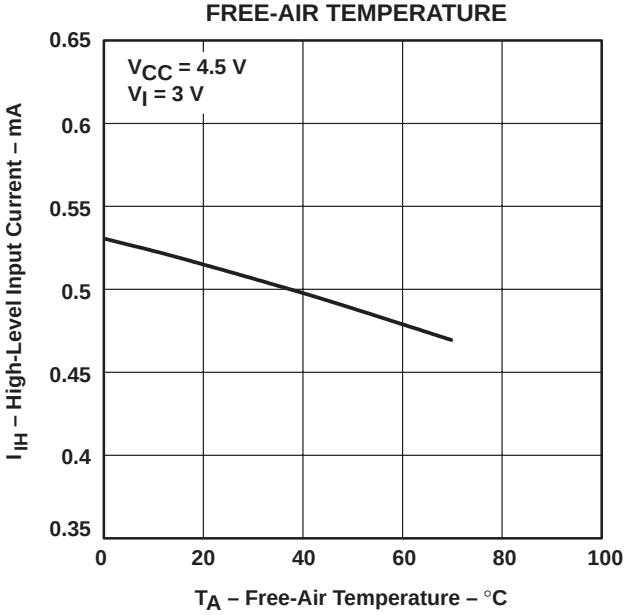


Figure 14

**SN75C189
LOW-LEVEL INPUT CURRENT
vs
FREE-AIR TEMPERATURE**

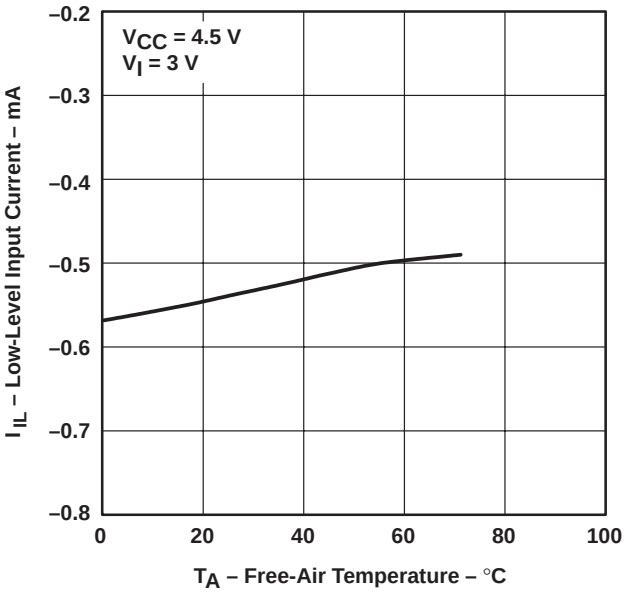


Figure 15

**SN75C189A
LOW-LEVEL INPUT CURRENT
vs
FREE-AIR TEMPERATURE**

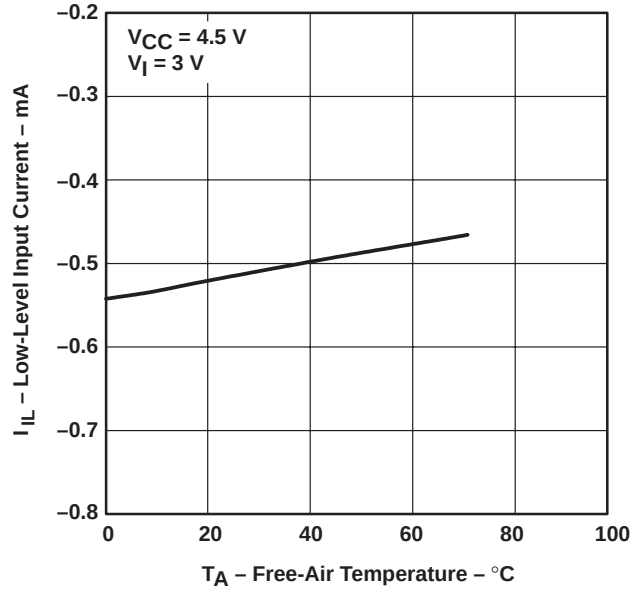


Figure 16

TYPICAL CHARACTERISTICS

HIGH-LEVEL SHORT-CIRCUIT OUTPUT CURRENT vs FREE-AIR TEMPERATURE

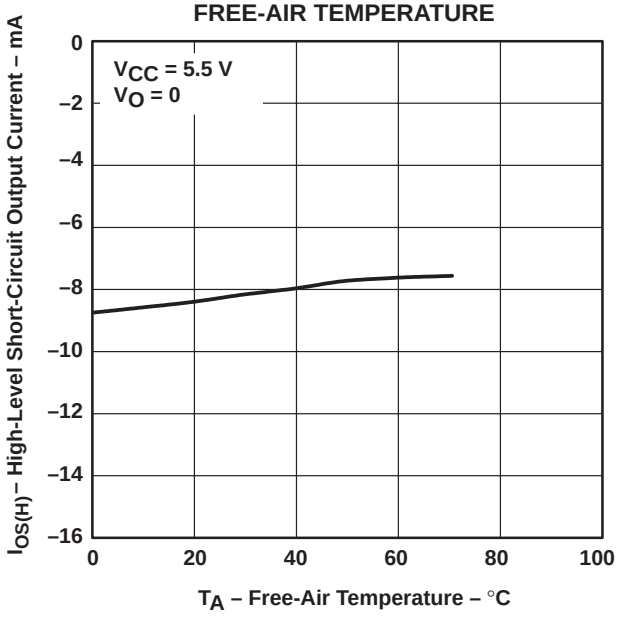


Figure 17

LOW-LEVEL SHORT-CIRCUIT OUTPUT CURRENT vs FREE-AIR TEMPERATURE

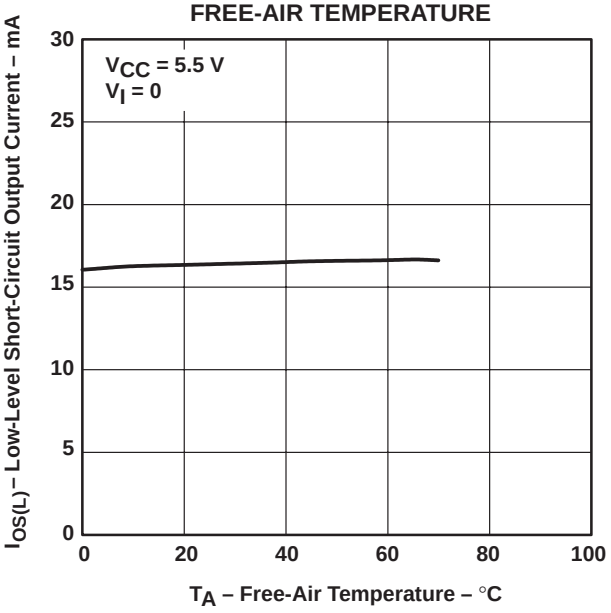


Figure 18

SUPPLY CURRENT vs FREE-AIR TEMPERATURE

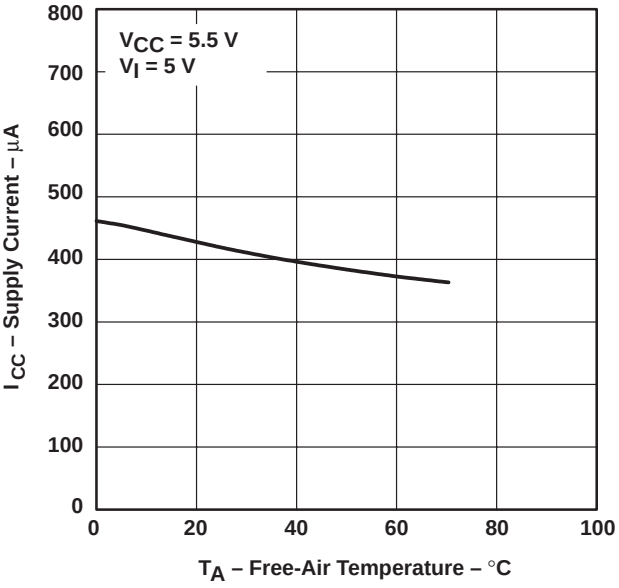


Figure 19

PROPAGATION DELAY TIME, LOW- TO HIGH-LEVEL OUTPUT vs FREE-AIR TEMPERATURE

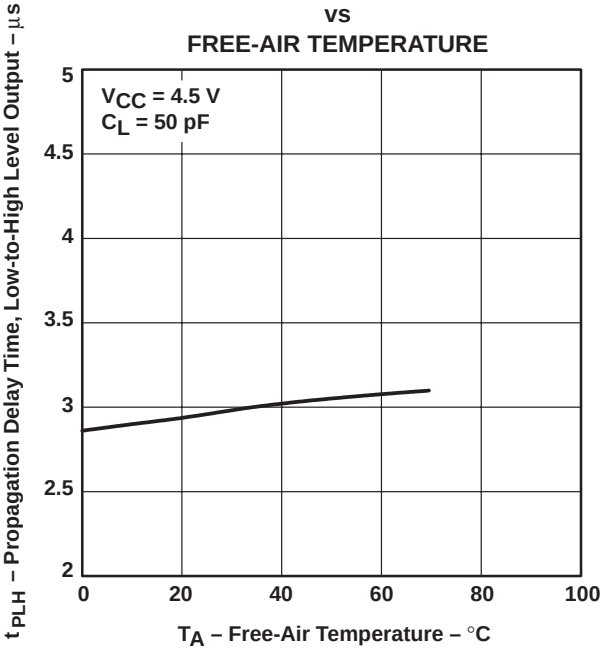


Figure 20

TYPICAL CHARACTERISTICS

PROPAGATION DELAY TIME,
HIGH- TO LOW-LEVEL OUTPUT
vs
FREE-AIR TEMPERATURE

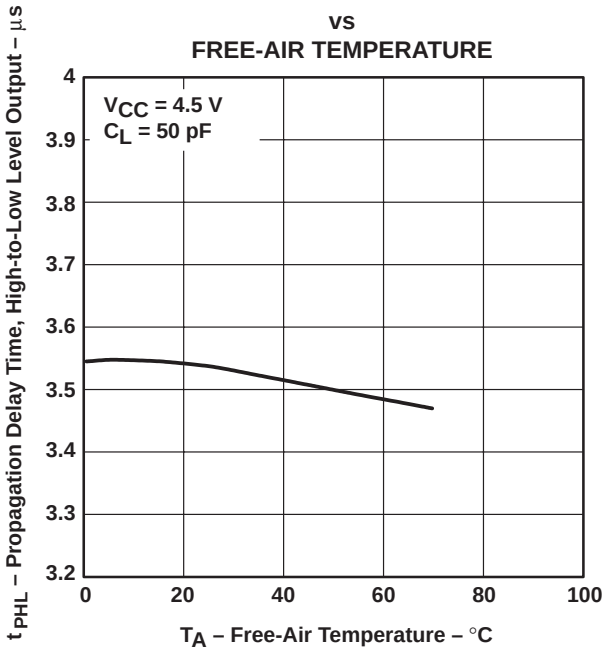


Figure 21

TRANSITION TIME,
LOW- TO HIGH-LEVEL OUTPUT
vs
FREE-AIR TEMPERATURE

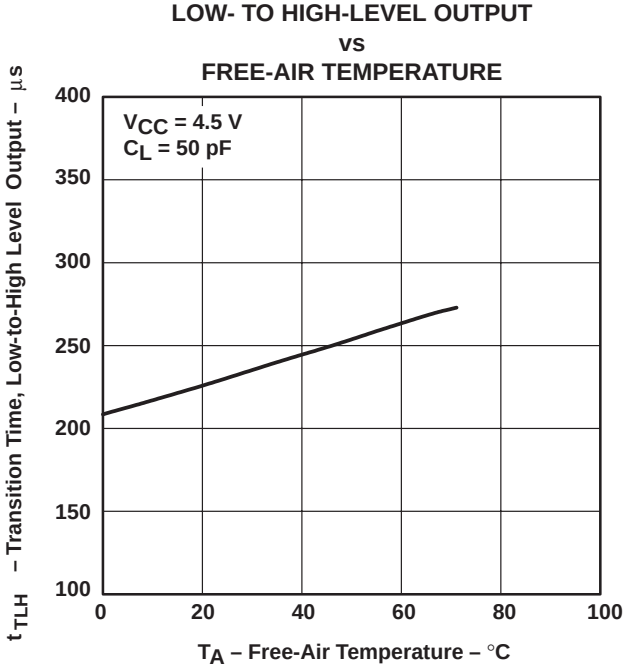


Figure 22

TRANSITION TIME,
HIGH- TO LOW-LEVEL OUTPUT
vs
FREE-AIR TEMPERATURE

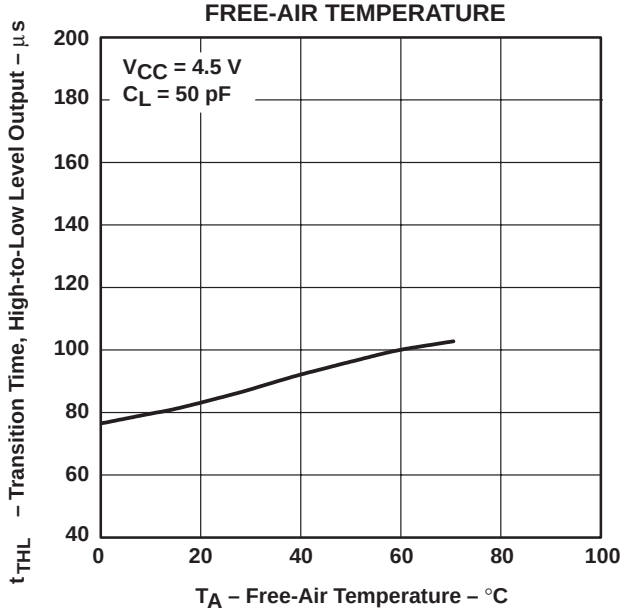


Figure 23

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)
SN75C189AD	Obsolete	Production	SOIC (D) | 14	-	-	Call TI	Call TI	0 to 70	75C189A
SN75C189ADBR	Active	Production	SSOP (DB) | 14	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	CA189A
SN75C189ADBR.A	Active	Production	SSOP (DB) | 14	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	CA189A
SN75C189ADBRE4	Active	Production	SSOP (DB) | 14	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	CA189A
SN75C189ADR	Active	Production	SOIC (D) | 14	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	75C189A
SN75C189ADR.A	Active	Production	SOIC (D) | 14	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	75C189A
SN75C189AN	Active	Production	PDIP (N) | 14	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN75C189AN
SN75C189AN.A	Active	Production	PDIP (N) | 14	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN75C189AN
SN75C189ANE4	Active	Production	PDIP (N) | 14	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN75C189AN
SN75C189ANSR	Active	Production	SOP (NS) | 14	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	75C189A
SN75C189ANSR.A	Active	Production	SOP (NS) | 14	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	75C189A
SN75C189D	Obsolete	Production	SOIC (D) | 14	-	-	Call TI	Call TI	0 to 70	SN75C189
SN75C189DR	Active	Production	SOIC (D) | 14	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	SN75C189
SN75C189DR.A	Active	Production	SOIC (D) | 14	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	SN75C189
SN75C189DRE4	Active	Production	SOIC (D) | 14	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	SN75C189
SN75C189N	Active	Production	PDIP (N) | 14	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN75C189N
SN75C189N.A	Active	Production	PDIP (N) | 14	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN75C189N
SN75C189NSR	Active	Production	SOP (NS) | 14	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	75C189
SN75C189NSR.A	Active	Production	SOP (NS) | 14	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	75C189

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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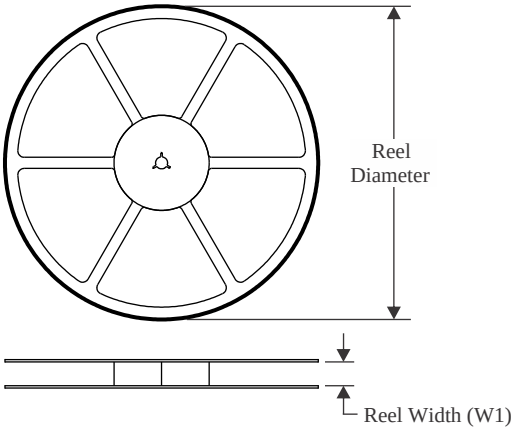
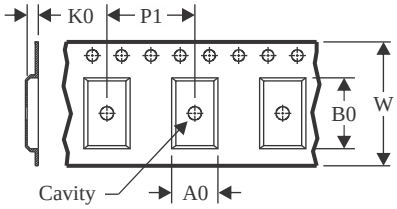
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

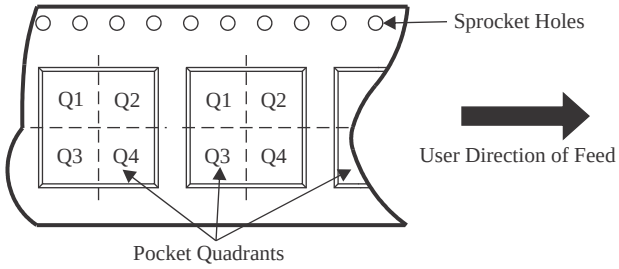


TAPE DIMENSIONS



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

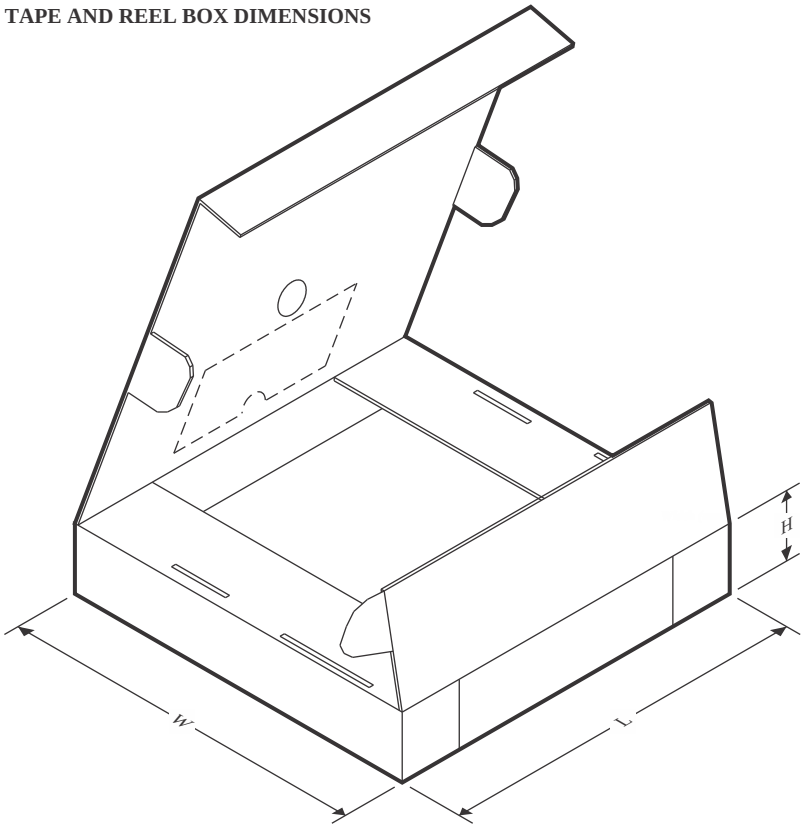
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
SN75C189ADBR	SSOP	DB	14	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
SN75C189ADR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN75C189ADR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN75C189ANSR	SOP	NS	14	2000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1
SN75C189DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN75C189NSR	SOP	NS	14	2000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1

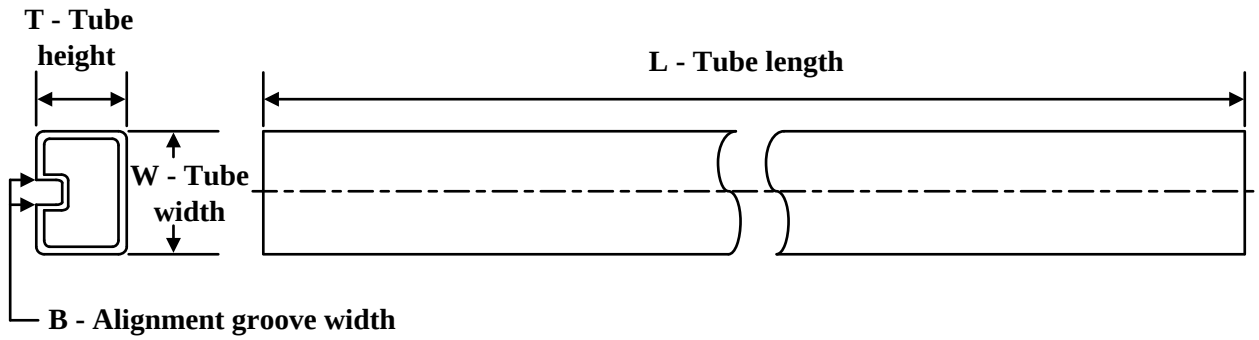
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

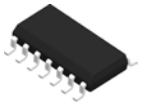
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN75C189ADBR	SSOP	DB	14	2000	353.0	353.0	32.0
SN75C189ADR	SOIC	D	14	2500	353.0	353.0	32.0
SN75C189ADR	SOIC	D	14	2500	353.0	353.0	32.0
SN75C189ANSR	SOP	NS	14	2000	353.0	353.0	32.0
SN75C189DR	SOIC	D	14	2500	353.0	353.0	32.0
SN75C189NSR	SOP	NS	14	2000	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)
SN75C189AN	N	PDIP	14	25	506	13.97	11230	4.32
SN75C189AN.A	N	PDIP	14	25	506	13.97	11230	4.32
SN75C189ANE4	N	PDIP	14	25	506	13.97	11230	4.32
SN75C189N	N	PDIP	14	25	506	13.97	11230	4.32
SN75C189N.A	N	PDIP	14	25	506	13.97	11230	4.32

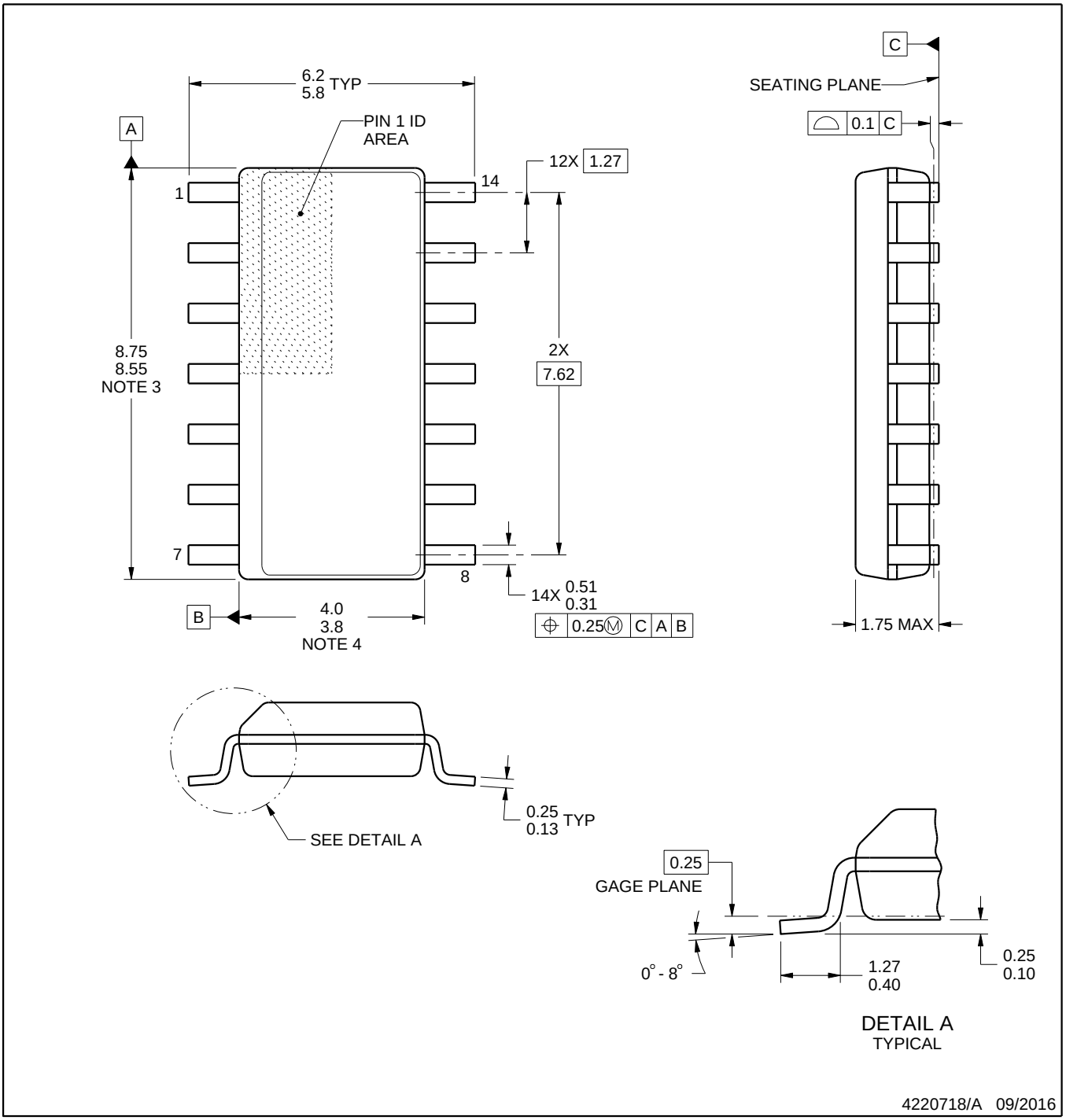


PACKAGE OUTLINE

D0014A

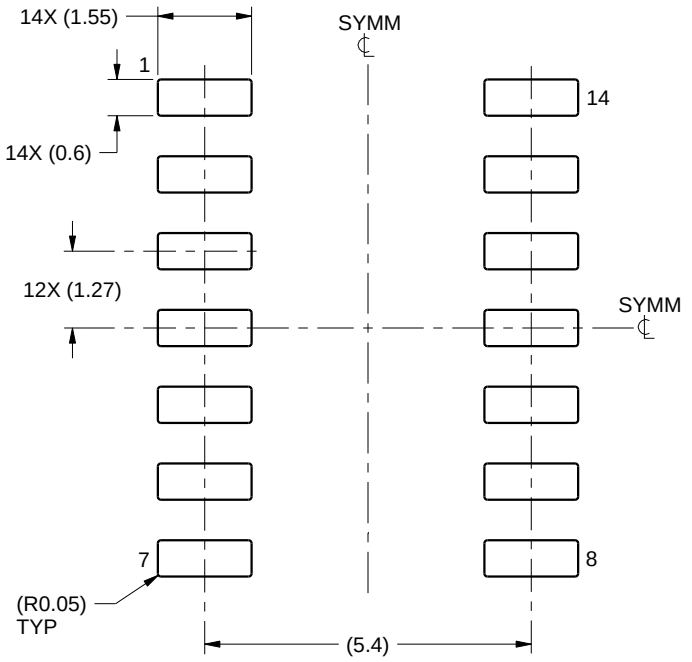
SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT

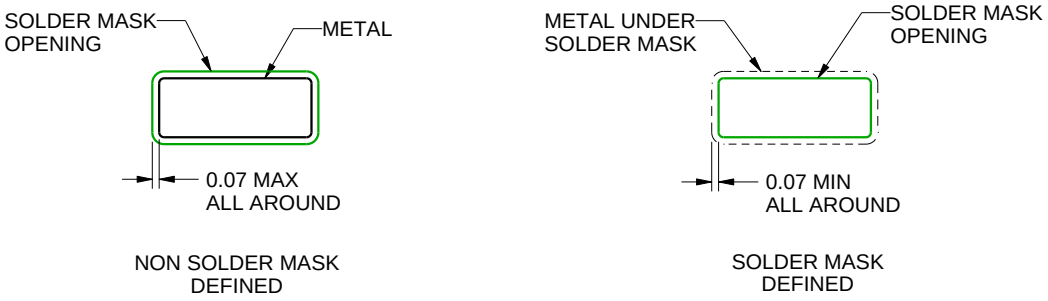


NOTES:

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 0.43 mm, per side.
5. Reference JEDEC registration MS-012, variation AB.



LAND PATTERN EXAMPLE
SCALE:8X



SOLDER MASK DETAILS

4220718/A 09/2016

NOTES: (continued)

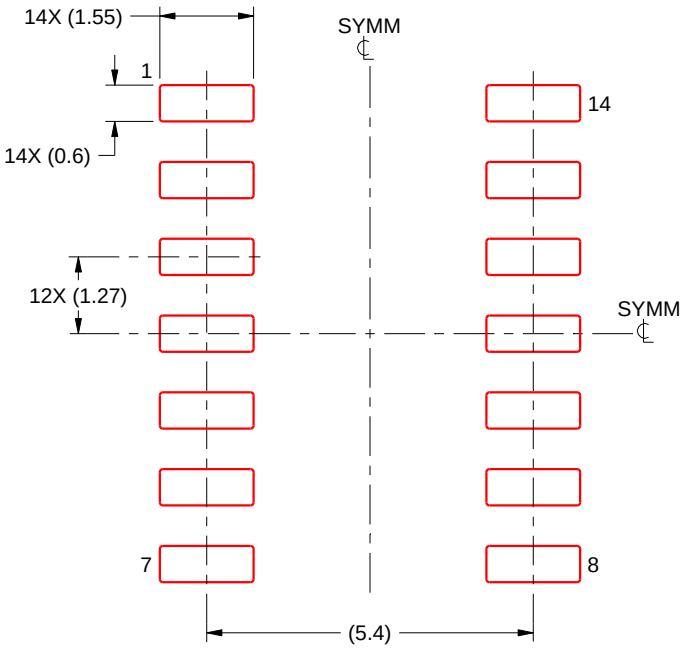
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:8X

4220718/A 09/2016

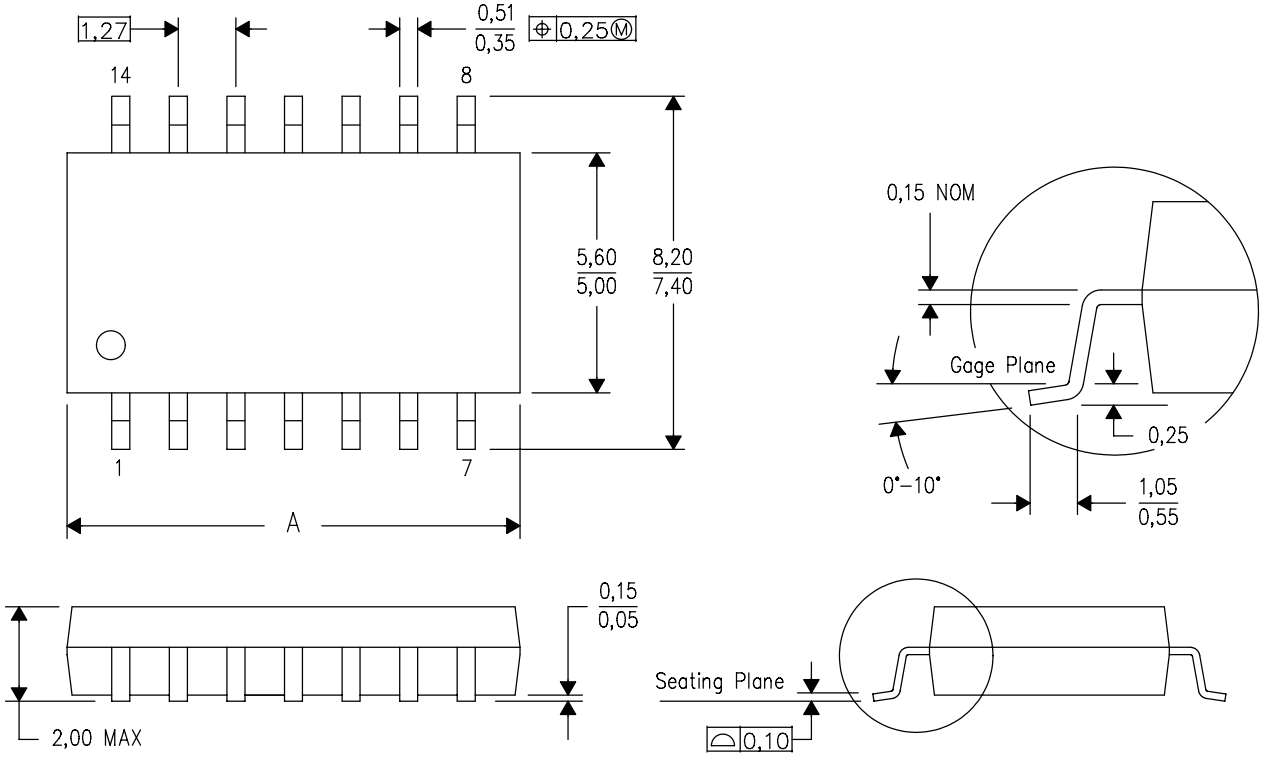
NOTES: (continued)

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

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

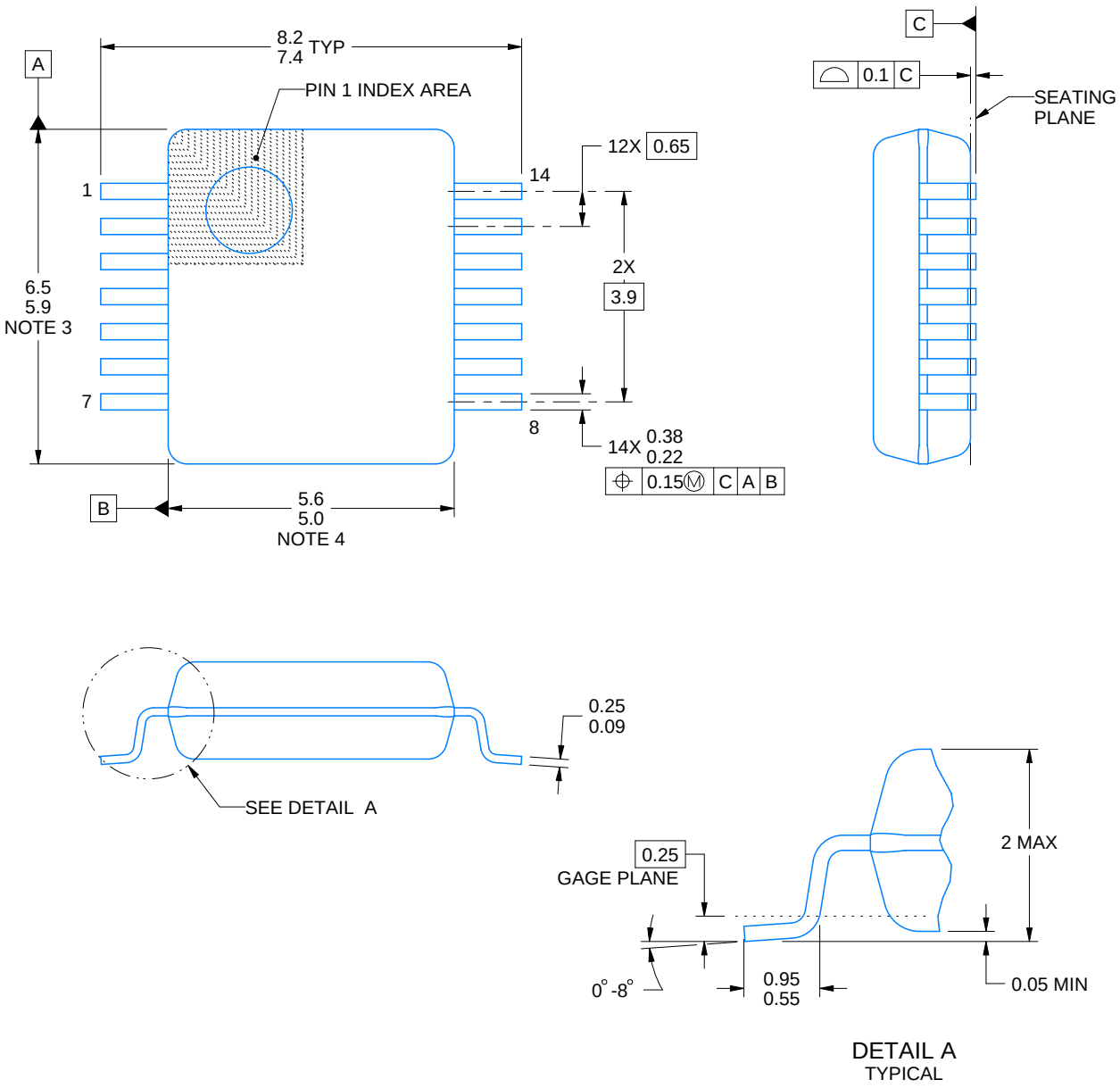
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

PACKAGE OUTLINE

DB0014A

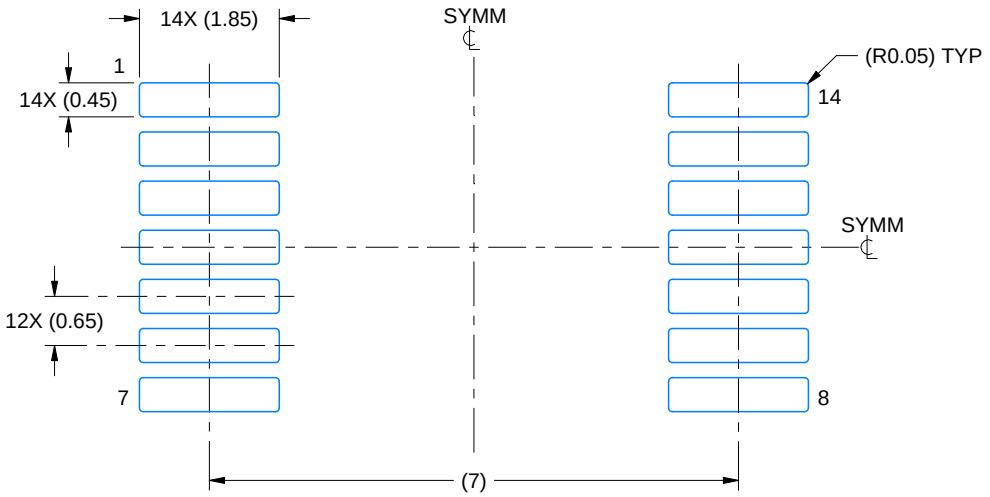
SSOP - 2 mm max height

SMALL OUTLINE PACKAGE

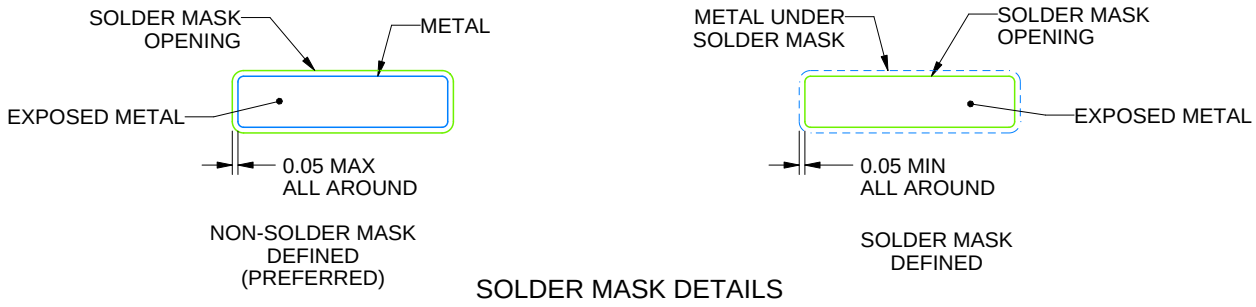


NOTES:

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

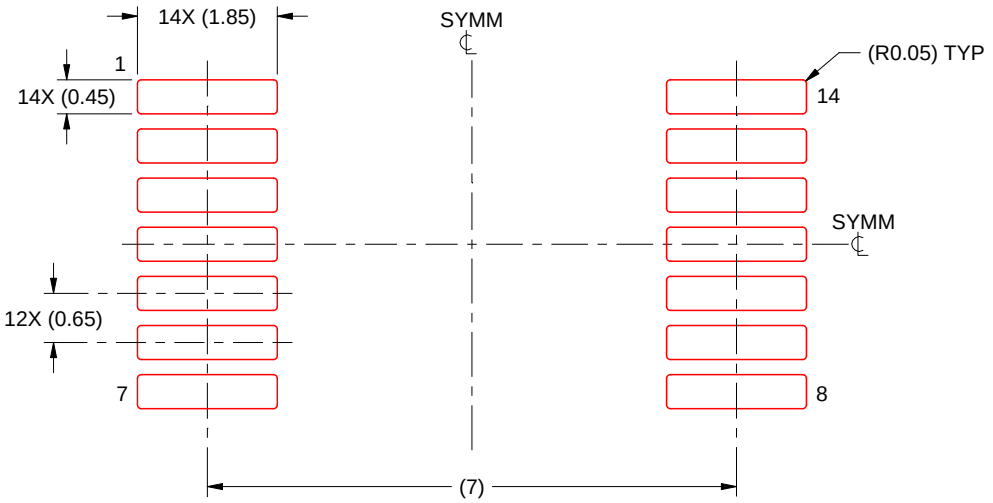


SOLDER MASK DETAILS

4220762/A 05/2024

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

4220762/A 05/2024

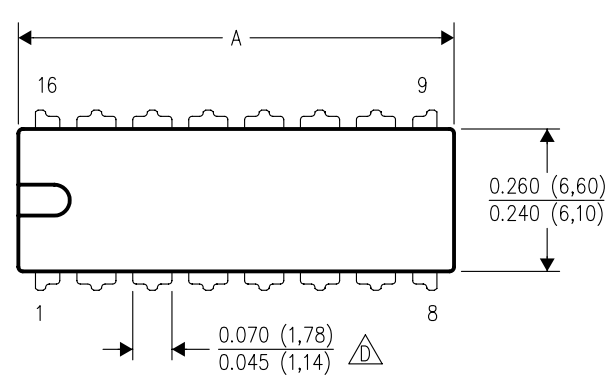
NOTES: (continued)

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.

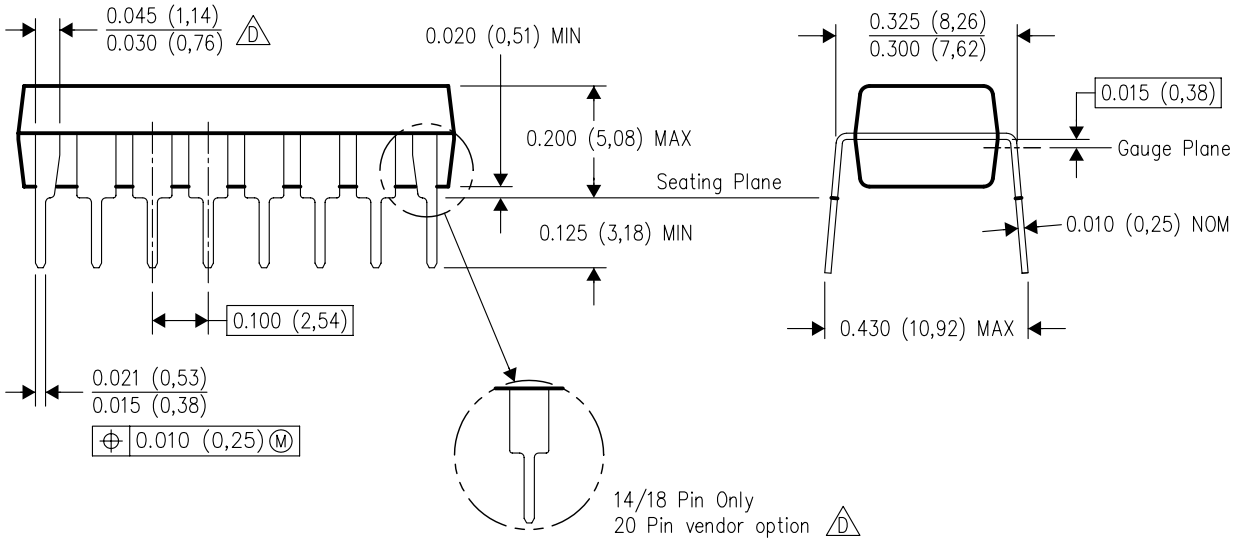
N (R–PDIP–T**)

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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