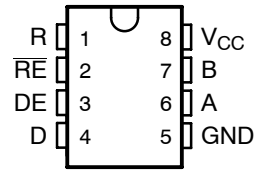
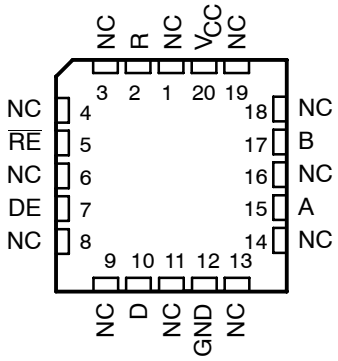
SLLS067H – AUGUST 1990 – REVISED DECEMBER 2010

- **Bidirectional Transceiver**
- **Meets or Exceeds the Requirements of ANSI Standard TIA/EIA–485–A and ISO 8482:1987(E)**
- **High-Speed Low-Power LinBiCMOS™ Circuitry**
- **Designed for High-Speed Operation in Both Serial and Parallel Applications**
- **Low Skew**
- **Designed for Multipoint Transmission on Long Bus Lines in Noisy Environments**
- **Very Low Disabled Supply Current . . . 200 μA Maximum**
- **Wide Positive and Negative Input/Output Bus Voltage Ranges**
- **Thermal-Shutdown Protection**
- **Driver Positive-and Negative-Current Limiting**
- **Open-Circuit Failsafe Receiver Design**
- **Receiver Input Sensitivity . . . ±200 mV Max**
- **Receiver Input Hysteresis . . . 50 mV Typ**
- **Operates From a Single 5-V Supply**
- **Glitch-Free Power-Up and Power-Down Protection**
- **Available in Q-Temp Automotive HighRel Automotive Applications Configuration Control / Print Support Qualification to Automotive Standards**

D, JG, OR P PACKAGE
(TOP VIEW)



FK PACKAGE
(TOP VIEW)



NC – No internal connection

description

The SN55LBC176, SN65LBC176, SN65LBC176Q, and SN75LBC176 differential bus transceivers are monolithic, integrated circuits designed for bidirectional data communication on multipoint bus-transmission lines. They are designed for balanced transmission lines and meet ANSI Standard TIA/EIA–485–A (RS-485) and ISO 8482:1987(E).

Function Tables

DRIVER

INPUT	ENABLE	OUTPUTS	
D	DE	A	B
H	H	H	L
L	H	L	H
X	L	Z	Z

RECEIVER

DIFFERENTIAL INPUTS $V_{ID} = V_{IA} - V_{IB}$	ENABLE $\overline{RE}$	OUTPUT R
$V_{ID} \geq 0.2$ V	L	H
-0.2 V $< V_{ID} < 0.2$ V	L	?
$V_{ID} \leq -0.2$ V	L	L
X	H	Z
Open	L	H

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

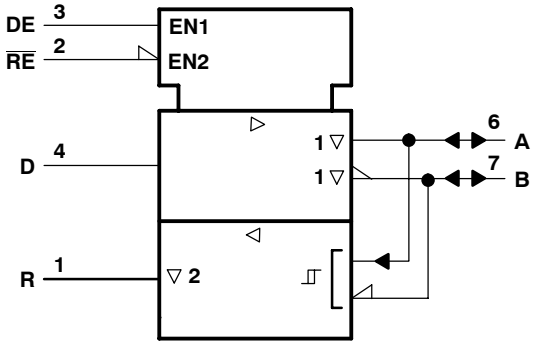
description (continued)

The SN55LBC176, SN65LBC176, SN65LBC176Q, and SN75LBC176 combine a 3-state, differential line driver and a differential input line receiver, both of which operate from a single 5-V power supply. The driver and receiver have active-high and active-low enables, respectively, which can externally connect together to function as a direction control. The driver differential outputs and the receiver differential inputs connect internally to form a differential input/output (I/O) bus port that is designed to offer minimum loading to the bus whenever the driver is disabled or V_{CC} = 0. This port features wide positive and negative common-mode voltage ranges, making the device suitable for party-line applications. Very low device supply current can be achieved by disabling the driver and the receiver.

These transceivers are suitable for ANSI Standard TIA/EIA–485 (RS-485) and ISO 8482 applications to the extent that they are specified in the operating conditions and characteristics section of this data sheet. Certain limits contained in TIA/EIA–485–A and ISO 8482:1987 (E) are not met or cannot be tested over the entire military temperature range.

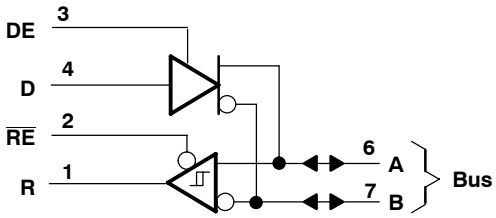
The SN55LBC176 is characterized for operation from –55°C to 125°C. The SN65LBC176 is characterized for operation from –40°C to 85°C, and the SN65LBC176Q is characterized for operation from –40°C to 125°C. The SN75LBC176 is characterized for operation from 0°C to 70°C.

logic symbol†



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

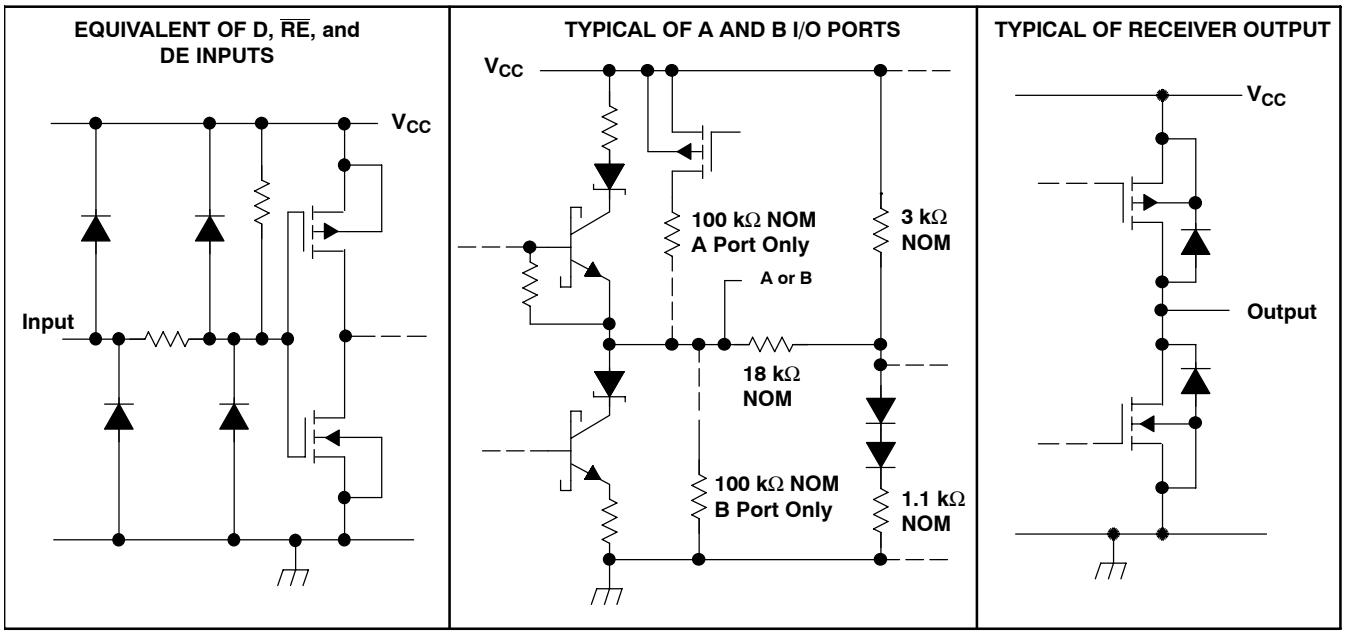
logic diagram (positive logic)



AVAILABLE OPTIONS

T_A	PACKAGE	PART NUMBER	PART MARKING
0°C to 70°C	SOP	SN75LBC176D	7LB176
	PDIP	SN75LBC176P	75LBC176
–40°C to 85°C	SOP	SN65LBC176D	6LB176
	PDIP	SN65LBC176P	65LBC176
–40°C to 125°C	SOP	SN65LBC176QD	LB176Q
	SOP	SN65LBC176QDR	LB176Q
–55°C to 125°C	LCCC	SNJ55LBC176FK	SNJ55LBC176FK
	CDIP	SNJ55LBC176JG	SNJ55LBC176

schematics of inputs and outputs



absolute maximum ratings†

Supply voltage, V_{CC} (see Note 1) . . . . . 7 V
Voltage range at any bus terminal . . . . . −10 V to 15 V
Input voltage, V_I (D, DE, R, or $\overline{RE}$) . . . . . −0.3 V to V_{CC} + 0.5 V
Receiver output current, I_O . . . . . ±10 mA
Continuous total power dissipation . . . . . See Dissipation Rating Table
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.

NOTE 1: All voltage values, except differential I/O bus voltage, are with respect to network ground terminal.

DISSIPATION RATING TABLE

PACKAGE	THERMAL MODEL	T_A < 25°C POWER RATING	DERATING FACTOR ABOVE T_A = 25°C	T_A = 70°C POWER RATING	T_A = 85°C POWER RATING	T_A = 110°C POWER RATING
D	Low K†	526 mW	5.0 mW/°C	301 mW	226 mW	—
	High K‡	882 mW	8.4 mW/°C	504 mW	378 mW	—
P		840 mW	8.0 mW/°C	480 mW	360 mW	—
JG		1050 mW	8.4 mW/°C	672 mW	546 mW	210 mW
FK		1375 mW	11.0 mW/°C	880 mW	715 mW	440 mW

† In accordance with the low effective thermal conductivity metric definitions of EIA/JESD 51–3.
‡ In accordance with the high effective thermal conductivity metric definitions of EIA/JESD 51–7.

recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}		4.75	5	5.25	V
Voltage at any bus terminal (separately or common mode), V_I or V_{IC}		−7		12	V
High-level input voltage, V_{IH}	D, DE, and $\overline{RE}$	2			V
Low-level input voltage, V_{IL}	D, DE, and $\overline{RE}$			0.8	V
Differential input voltage, V_{ID} (see Note 2)		−12		12	V
High-level output current, I_{OH}	Driver	−60			mA
	Receiver	−400			μA
Low-level output current, I_{OL}	Driver			60	mA
	Receiver			8	
Junction temperature, T_J				140	°C
Operating free-air temperature, T_A	SN55LBC176	−55		125	°C
	SN65LBC176	−40		85	
	SN65LBC176Q	−40		125	
	SN75LBC176	0		70	

NOTE 2: Differential input/output bus voltage is measured at the noninverting terminal A with respect to the inverting terminal B.

DRIVER SECTION

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

PARAMETER		TEST CONDITIONS			MIN	MAX	UNIT
V_{IK}	Input clamp voltage	I_I = –18 mA			–1.5		V
V_O	Output voltage	I_O = 0			0	6	V
$\lvert V_{OD1} \rvert$	Differential output voltage	I_O = 0			1.5	6	V
$\lvert V_{OD2} \rvert$	Differential output voltage	R_L = 54 Ω, See Note 3	See Figure 1,	55LBC176, 65LBC176, 65LBC176Q	1.1		V
				75LBC176	1.5	5	
V_{OD3}	Differential output voltage	V_{test} = –7 V to 12 V, See Note 3	See Figure 2,	55LCB176, 65LCB176, 65LBC176Q	1.1		V
				75LBC176	1.5	5	
$\Delta\lvert V_{OD} \rvert$	Change in magnitude of differential output voltage†	R_L = 54 Ω or 100 Ω,	See Figure 1		–0.2	0.2	V
V_{OC}	Common-mode output voltage				–1	3	V
$\Delta\lvert V_{OC} \rvert$	Change in magnitude of common-mode output voltage†				–0.2	0.2	V
I_O	Output current	Output disabled, See Note 4	V_O = 12 V			1	mA
			V_O = –7 V		–0.8		
I_{IH}	High-level input current	V_I = 2.4 V			–100		μA
I_{IL}	Low-level input current	V_I = 0.4 V			–100		μA
I_{OS}	Short-circuit output current	V_O = –7 V			–250		mA
		V_O = 0			–150		
		V_O = V_{CC}				250	
		V_O = 12 V					
I_{CC}	Supply current	V_I = 0 or V_{CC}, No load	Receiver disabled and driver enabled	55LBC176, 65LBC176Q		1.75	mA
				65LBC176, 75LBC176		1.5	
			Receiver and driver disabled	55LBC176, 65LBC176Q		0.25	
				65LBC176, 75LBC176		0.2	

† $\Delta\lvert V_{OD} \rvert$ and $\Delta\lvert V_{OC} \rvert$ are the changes in magnitude of V_{OD} and V_{OC}, respectively, that occur when the input changes from a high level to a low level.

NOTES: 3. This device meets the V_{OD} requirements of TIA/EIA–485–A above 0°C only.
4. This applies for both power on and off; refer to TIA/EIA–485–A for exact conditions.

switching characteristics over recommended ranges of supply voltage and operating free-air temperature

PARAMETER		TEST CONDITIONS	SN55LBC176 SN65LBC176Q			SN65LBC176 SN75LBC176			UNIT
			MIN	TYP	MAX	MIN	TYP†	MAX	
$t_{d(OD)}$	Differential output delay time	R_L = 54 Ω, C_L = 50 pF, See Figure 3	8		31	8		25	ns
$t_{t(OD)}$	Differential output transition time			12			12		ns
$t_{sk(p)}$	Pulse skew ($\lvert t_{d(ODH)} - t_{d(ODL)} \rvert$)				6		0	6	ns
t_{PZH}	Output enable time to high level	R_L = 110 Ω, See Figure 4			65			35	ns
t_{PZL}	Output enable time to low level	R_L = 110 Ω, See Figure 5			65			35	ns
t_{PHZ}	Output disable time from high level	R_L = 110 Ω, See Figure 4			105			60	ns
t_{PLZ}	Output disable time from low level	R_L = 110 Ω, See Figure 5			105			35	ns

† All typical values are at V_{CC} = 5 V, T_A = 25°C.

SYMBOL EQUIVALENTS

DATA SHEET PARAMETER	RS-485
V_O	V_{oa}, V_{ob}
$\lvert V_{OD1} \rvert$	V_o
$\lvert V_{OD2} \rvert$	V_t (R_L = 54 Ω)
$\lvert V_{OD3} \rvert$	V_t (test termination measurement 2)
$\Delta \lvert V_{OD} \rvert$	$\lvert\lvert V_t \rvert - \lvert \overline{V}_t \rvert\rvert$
V_{OC}	$\lvert V_{os} \rvert$
$\Delta \lvert V_{OC} \rvert$	$\lvert V_{os} - \overline{V}_{os} \rvert$
I_{OS}	None
I_O	I_{ia}, I_{ib}

RECEIVER SECTION

electrical characteristics over recommended ranges of common-mode input voltage, supply voltage, and operating free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS			MIN	TYP†	MAX	UNIT
V_{IT+}	Positive-going input threshold voltage	V_O = 2.7 V,	I_O = −0.4 mA				0.2	V
V_{IT-}	Negative-going input threshold voltage	V_O = 0.5 V,	I_O = 8 mA		−0.2‡			V
V_{hys}	Hysteresis voltage ($V_{IT+} - V_{IT-}$) (see Figure 4)					50		mV
V_{IK}	Enable-input clamp voltage	I_I = −18 mA			−1.5			V
V_{OH}	High-level output voltage	V_{ID} = 200 mV, See Figure 6	I_{OH} = −400 μA,		2.7			V
V_{OL}	Low-level output voltage	V_{ID} = −200 mV, See Figure 6	I_{OL} = 8 mA,				0.45	V
I_{OZ}	High-impedance-state output current	V_O = 0.4 V to 2.4 V			−20		20	μA
I_I	Line input current	Other input = 0 V, See Note 5	V_I = 12 V				1	mA
			V_I = −7 V		−0.8			
I_{IH}	High-level enable-input current	V_{IH} = 2.7 V			−100			μA
I_{IL}	Low-level enable-input current	V_{IL} = 0.4 V			−100			μA
r_I	Input resistance				12			kΩ
I_{CC}	Supply current	V_I = 0 or V_{CC}, No load	Receiver enabled and driver disabled				3.9	mA
			Receiver and driver disabled	SN55LBC176, SN65LBC176, SN65LBC176Q			0.25	mA
				SN75LBC176			0.2	

† All typical values are at V_{CC} = 5 V, T_A = 25°C.
‡ The algebraic convention, in which the less-positive (more-negative) limit is designated minimum, is used in this data sheet.
NOTE 5: This applies for both power on and power off. Refer to ANSI Standard RS-485 for exact conditions.

switching characteristics over recommended ranges of supply voltage and operating free-air temperature, C_L = 15 pF

PARAMETER		TEST CONDITIONS	SN55LBC176 SN65LBC176Q		SN65LBC176 SN75LBC176			UNIT
			MIN	MAX	MIN	TYP†	MAX	
t_{PLH}	Propagation delay time, low- to high-level single-ended output	V_{ID} = −1.5 V to 1.5 V, See Figure 7	11	37	11		33	ns
t_{PHL}	Propagation delay time, high- to low-level single-ended output		11	37	11		33	ns
$t_{sk(p)}$	Pulse skew ($\lvert t_{PLH} - t_{PHL} \rvert$)			10		3	6	ns
t_{PZH}	Output enable time to high level	See Figure 8		35			35	ns
t_{PZL}	Output enable time to low level			35			30	ns
t_{PHZ}	Output disable time from high level	See Figure 8		35			35	ns
t_{PLZ}	Output disable time from low level			35			30	ns

† All typical values are at V_{CC} = 5 V, T_A = 25°C.

PARAMETER MEASUREMENT INFORMATION

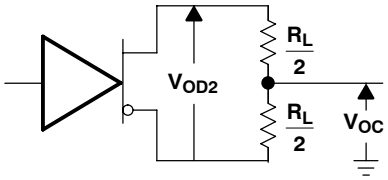


Figure 1. Driver V_{OD} and V_{OC}

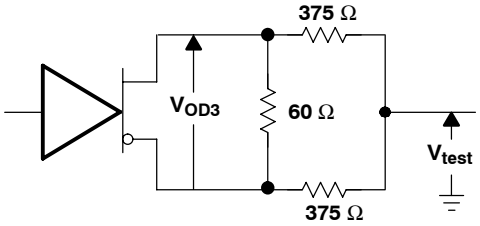


Figure 2. Driver V_{OD3}

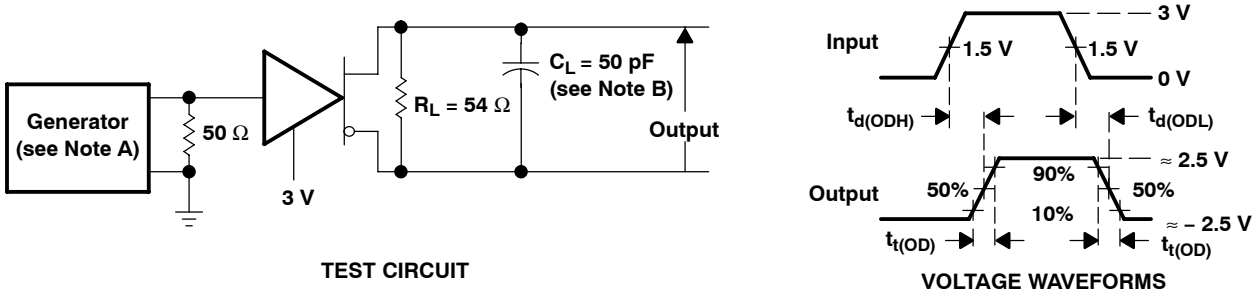


Figure 3. Driver Test Circuit and Voltage Waveforms

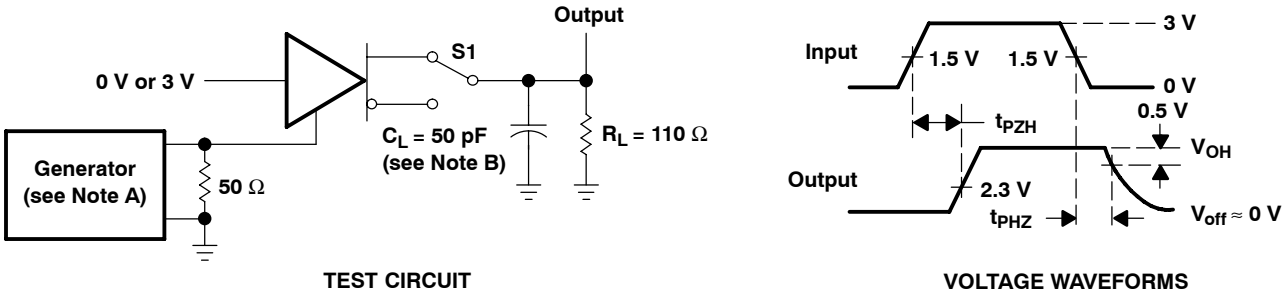


Figure 4. Driver Test Circuit and Voltage Waveforms

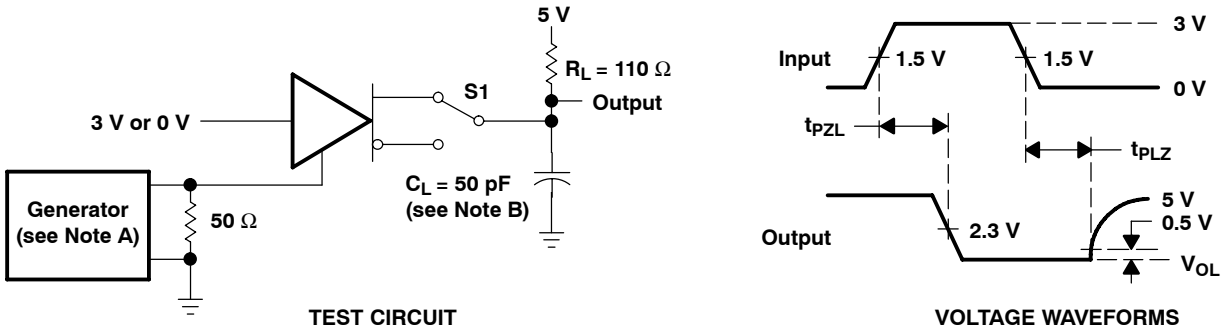


Figure 5. Driver Test Circuit and Voltage Waveforms

NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR ≤ 1 MHz, 50% duty cycle, t_r ≤ 6 ns, t_f ≤ 6 ns, Z_O = 50 Ω.
B. C_L includes probe and jig capacitance.

PARAMETER MEASUREMENT INFORMATION

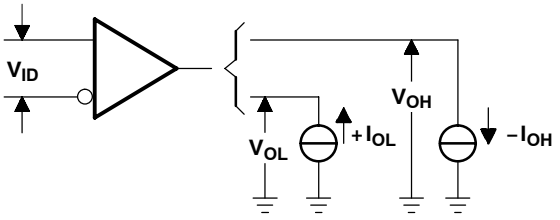
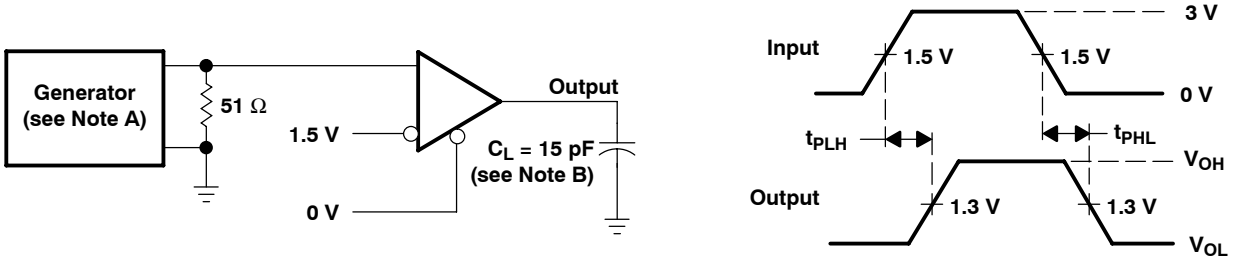


Figure 6. Receiver V_{OH} and V_{OL}



TEST CIRCUIT **VOLTAGE WAVEFORMS**

NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR ≤ 1 MHz, 50% duty cycle, t_r ≤ 6 ns, t_f ≤ 6 ns, Z_O = 50 Ω.
B. C_L includes probe and jig capacitance.

Figure 7. Receiver Test Circuit and Voltage Waveforms

THERMAL CHARACTERISTICS – D PACKAGE

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Junction–to–ambient thermal reisistance, θ_{JA}†	Low-K board, no air flow		199.4		°C/W
	High-K board, no air flow		119		
Junction–to–board thermal reisistance, θ_{JB}	High-K board, no air flow		67		
Junction–to–case thermal reisistance, θ_{JC}			46.6		
Average power dissipation, $P_{(AVG)}$	R_L = 54 Ω, input to D is 10 Mbps 50% duty cycle square wave, V_{CC} = 5.25 V, T_J = 130 °C.			330	mW
Thermal shutdown junction temperature, T_{SD}			165		°C

† See TI application note literature number SZZA003, Package Thermal Characterization Methodologies, for an explanation of this parameter.

PARAMETER MEASUREMENT INFORMATION

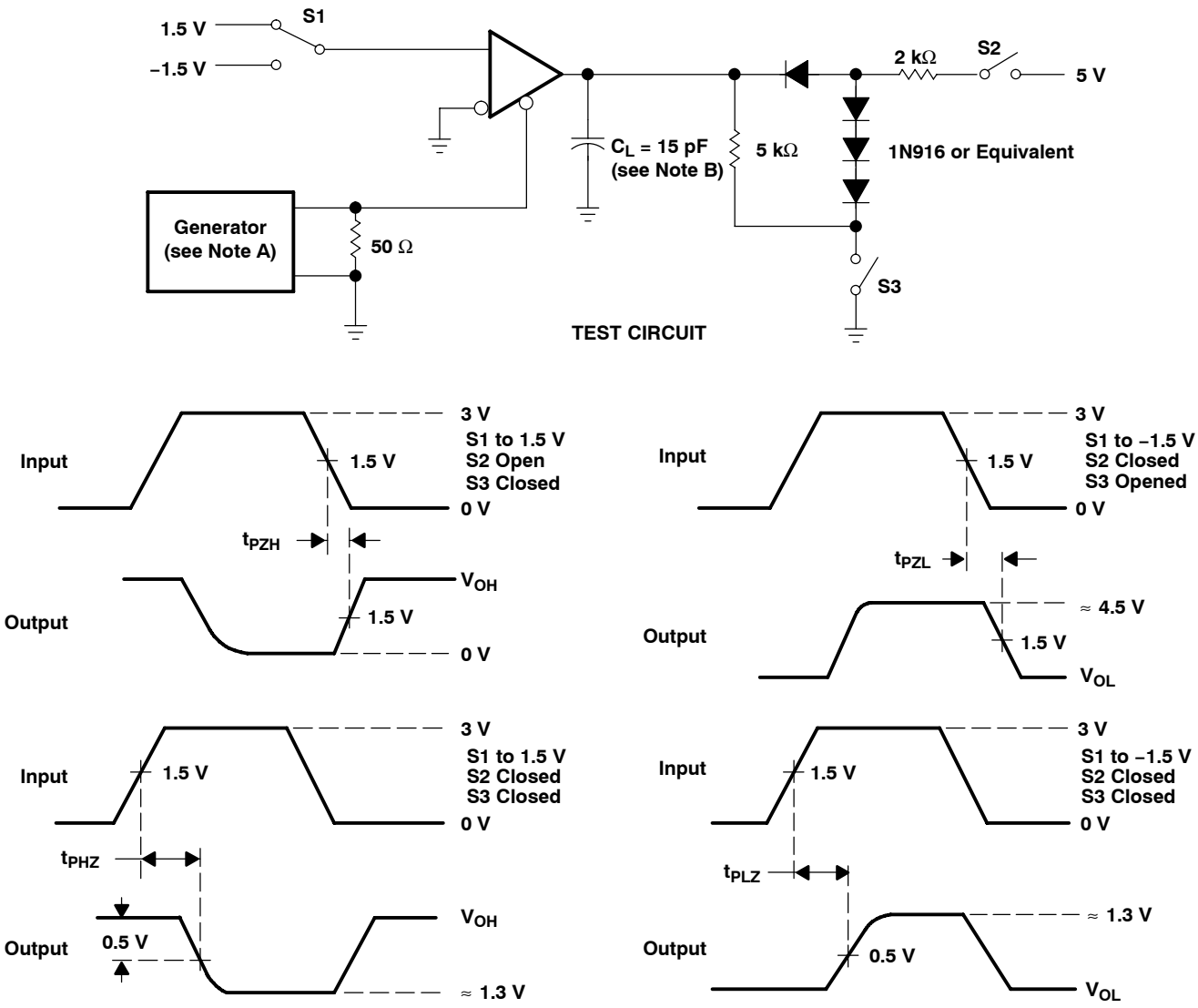


Figure 8. Receiver Test Circuit and Voltage Waveforms

NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR ≤ 1 MHz, 50% duty cycle, t_r ≤ 6 ns, t_f ≤ 6 ns, Z_O = 50 Ω.
B. C_L includes probe and jig capacitance.

THERMAL CHARACTERISTICS OF IC PACKAGES

Θ_{JA} (Junction-to-Ambient Thermal Resistance) is defined as the difference in junction temperature to ambient temperature divided by the operating power

Θ_{JA} is NOT a constant and is a strong function of

- the PCB design (50% variation)
- altitude (20% variation)
- device power (5% variation)

Θ_{JA} can be used to compare the thermal performance of packages if the specific test conditions are defined and used. Standardized testing includes specification of PCB construction, test chamber volume, sensor locations, and the thermal characteristics of holding fixtures. $_{\Theta JA}$ is often misused when it is used to calculate junction temperatures for other installations.

TI uses two test PCBs as defined by JEDEC specifications. The low-k board gives *average* in-use condition thermal performance and consists of a single trace layer 25 mm long and 2-oz thick copper. The high-k board gives *best case* in–use condition and consists of two 1-oz buried power planes with a single trace layer 25 mm long with 2-oz thick copper. A 4% to 50% difference in Θ_{JA} can be measured between these two test cards

Θ_{JC} (Junction-to-Case Thermal Resistance) is defined as difference in junction temperature to case divided by the operating power. It is measured by putting the mounted package up against a copper block cold plate to force heat to flow from die, through the mold compound into the copper block.

Θ_{JC} is a useful thermal characteristic when a heatsink is applied to package. It is NOT a useful characteristic to predict junction temperature as it provides pessimistic numbers if the case temperature is measured in a non-standard system and junction temperatures are backed out. It can be used with Θ_{JB} in 1-dimensional thermal simulation of a package system.

Θ_{JB} (Junction-to-Board Thermal Resistance) is defined to be the difference in the junction temperature and the PCB temperature at the center of the package (closest to the die) when the PCB is clamped in a cold–plate structure. Θ_{JB} is only defined for the high-k test card.

Θ_{JB} provides an overall thermal resistance between the die and the PCB. It includes a bit of the PCB thermal resistance (especially for BGA's with thermal balls) and can be used for simple 1-dimensional network analysis of package system (see Figure 1).

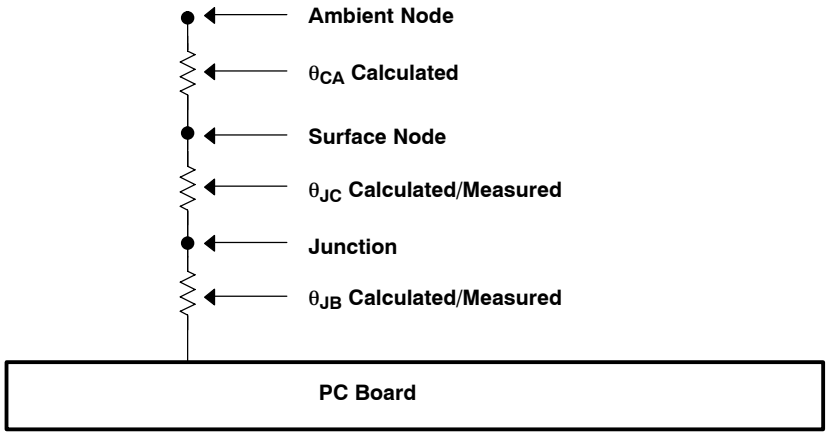
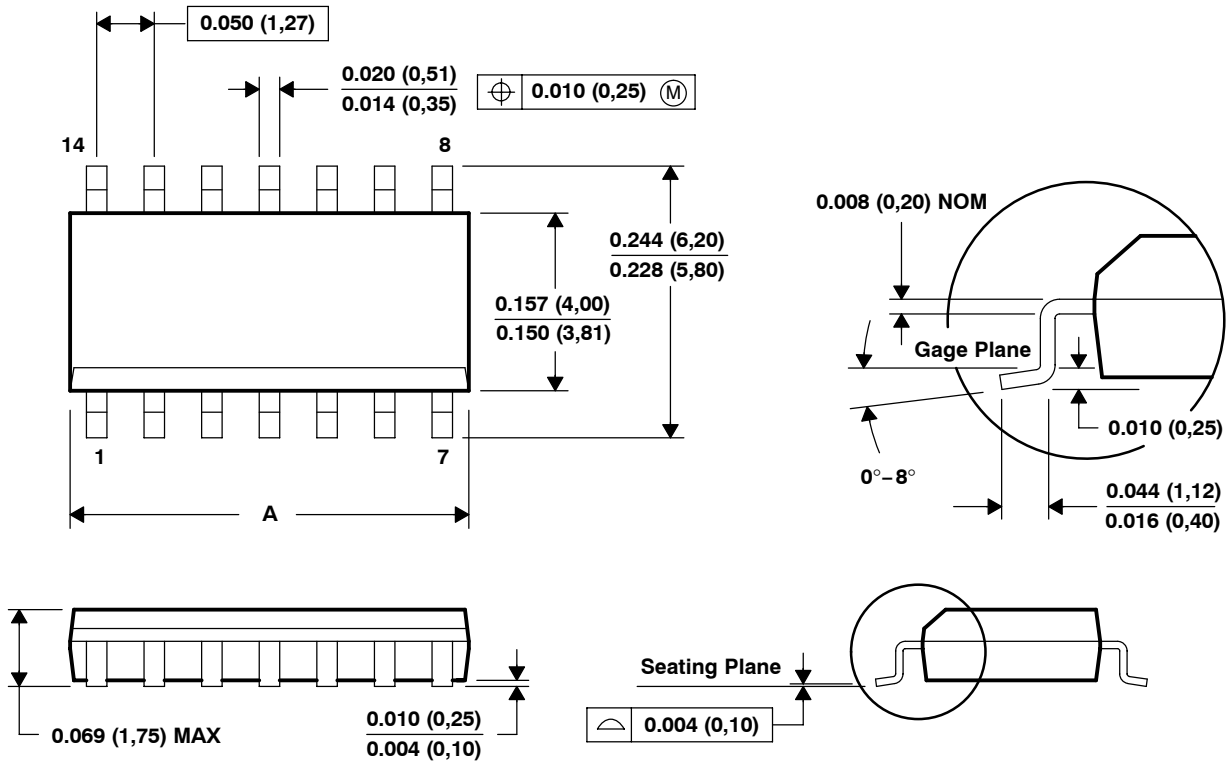


Figure 1. Thermal Resistance

MECHANICAL INFORMATION

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

14 PINS SHOWN



DIM \ PINS **	8	14	16
A MAX	0.197 (5,00)	0.344 (8,75)	0.394 (10,00)
A MIN	0.189 (4,80)	0.337 (8,55)	0.386 (9,80)

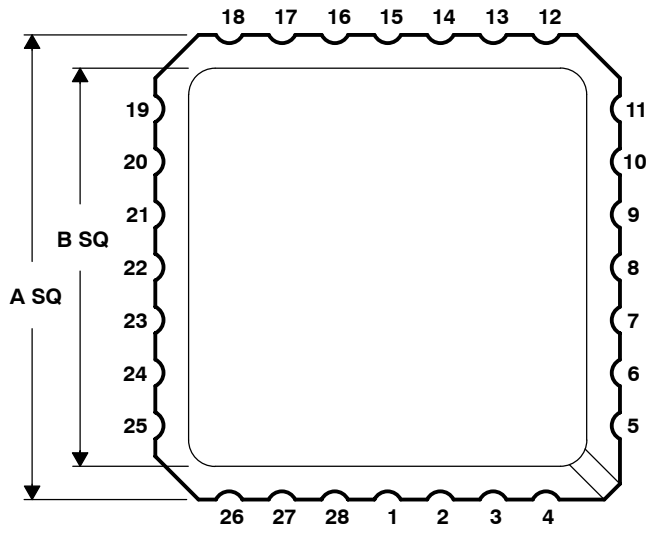
4040047/D 10/96

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).
D. Falls within JEDEC MS-012

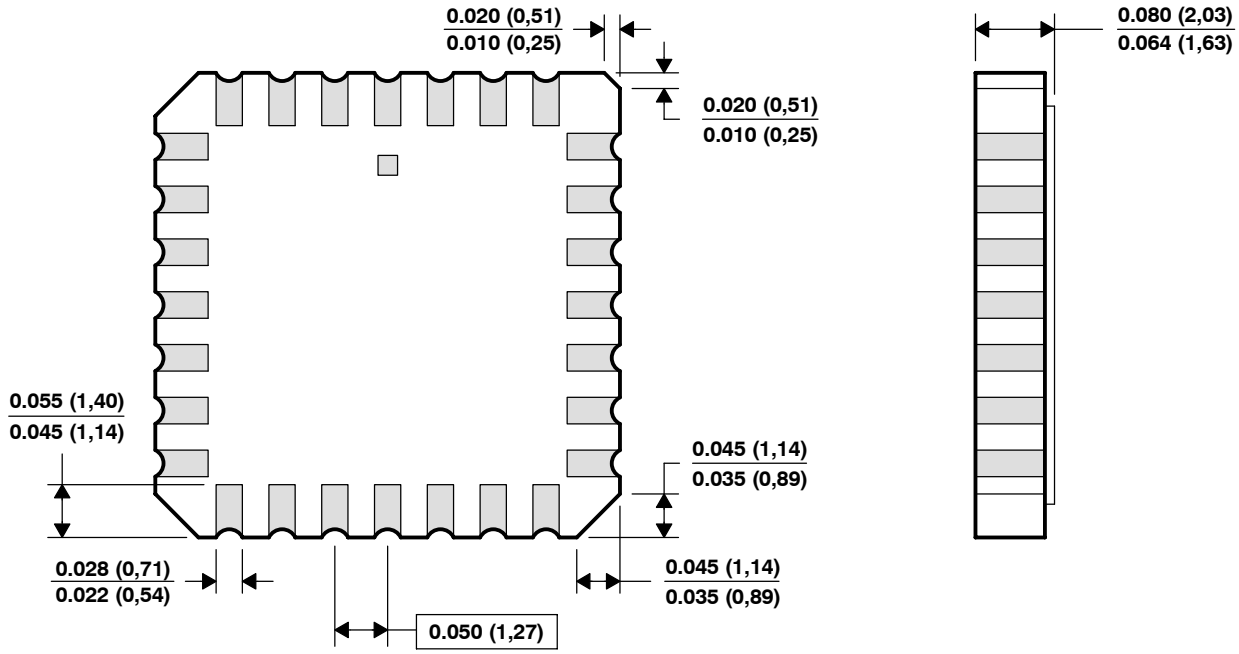
MECHANICAL INFORMATION

FK (S-CQCC-N)** **LEADLESS CERAMIC CHIP CARRIER**

28 TERMINALS SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)

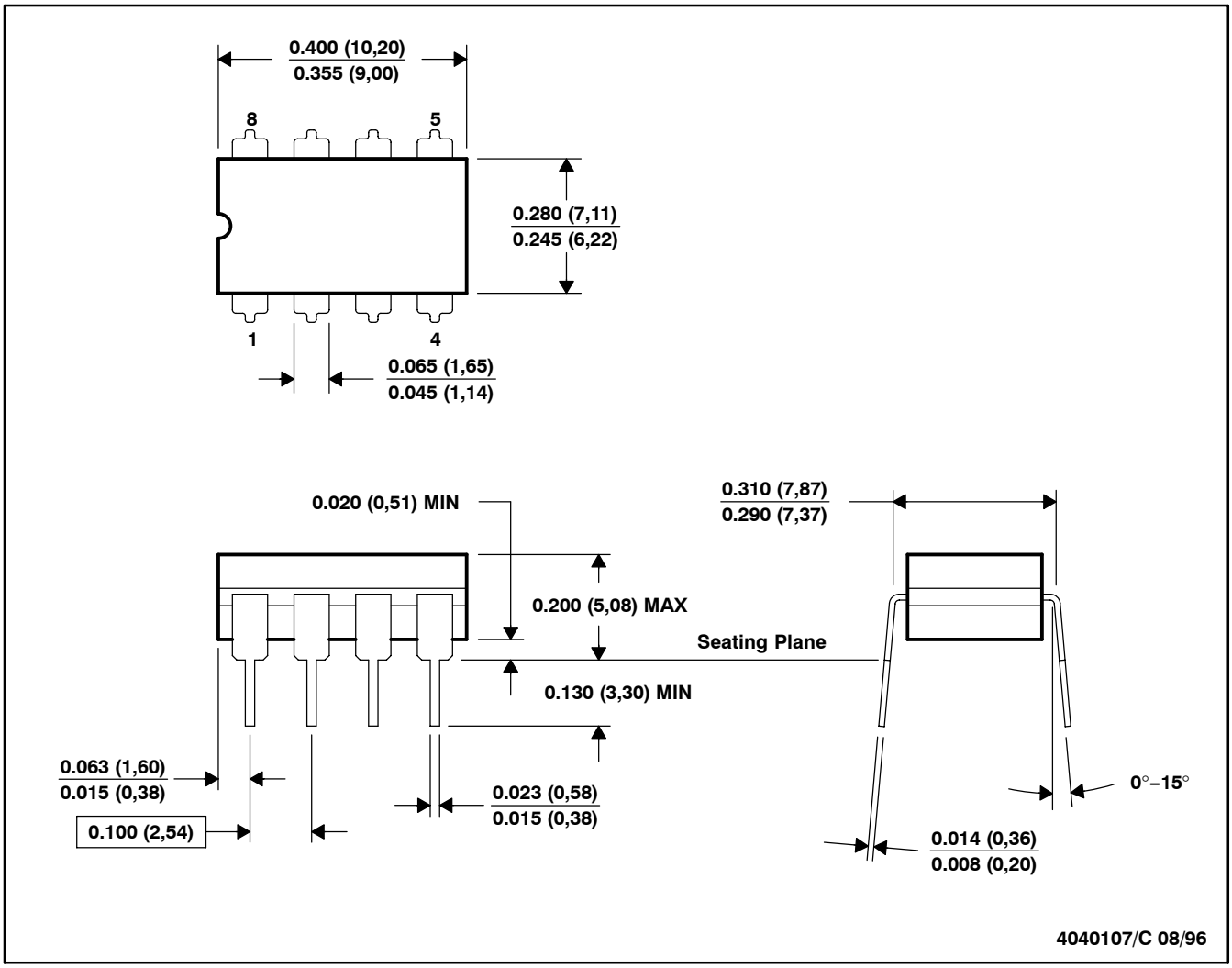


4040140/C 11/95

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 metal lid.
D. The terminals are gold-plated.
E. Falls within JEDEC MS-004

MECHANICAL INFORMATION

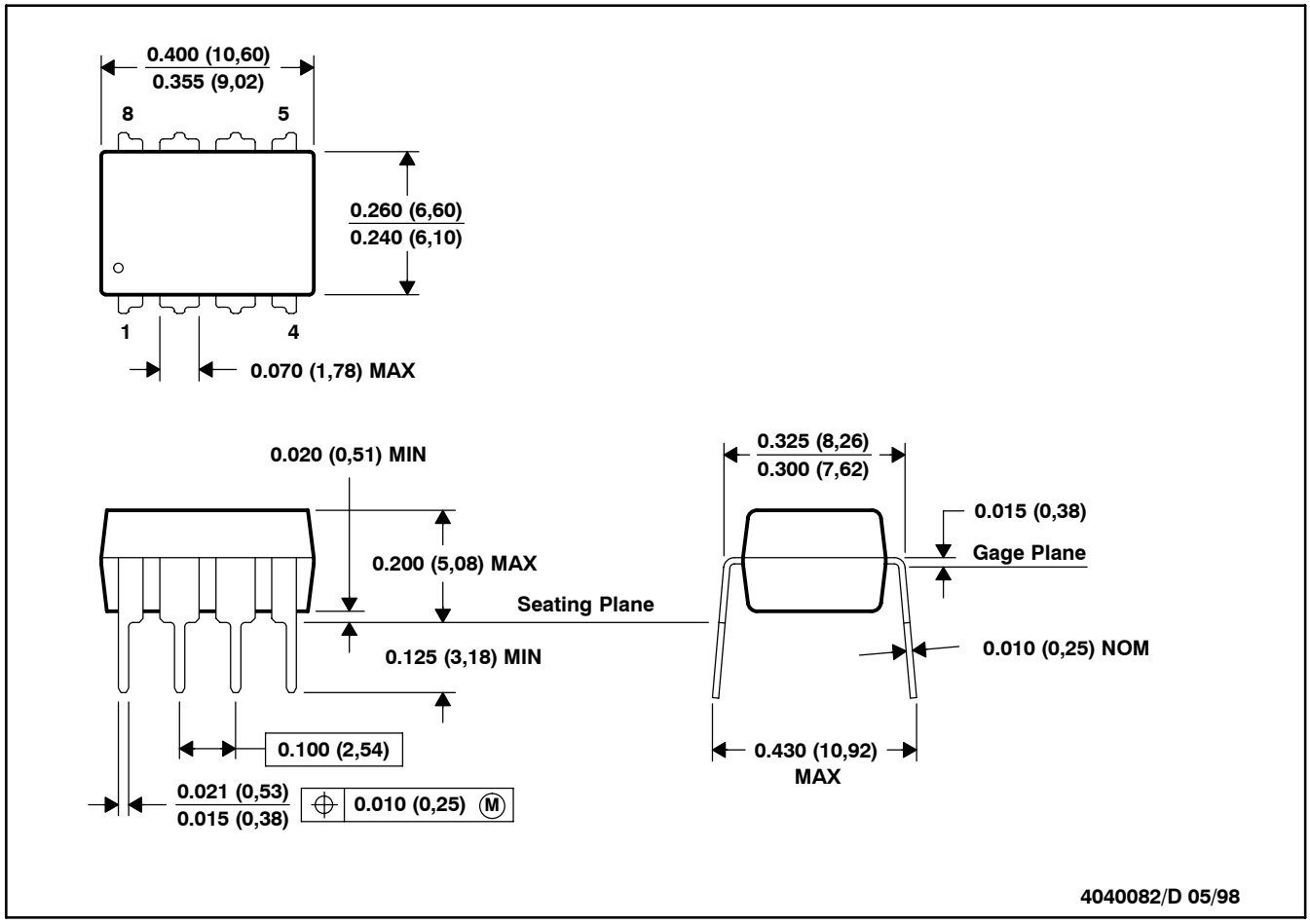
JG (R-GDIP-T8) **CERAMIC DUAL-IN-LINE PACKAGE**



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 on press ceramic glass frit seal only.
E. Falls within MIL-STD-1835 GDIP1-T8

MECHANICAL INFORMATION

P (R-PDIP-T8) **PLASTIC DUAL-IN-LINE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-001

For the latest package information, go to http://www.ti.com/sc/docs/package/pkg_info.htm

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-9318301Q2A	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9318301Q2A SNJ55 LBC176FK	Samples
5962-9318301QPA	ACTIVE	CDIP	JG	8	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	9318301QPA SNJ55LBC176	Samples
SN65LBC176D	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	6LB176	Samples
SN65LBC176DR	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	6LB176	Samples
SN65LBC176DRG4	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	6LB176	Samples
SN65LBC176P	ACTIVE	PDIP	P	8	50	RoHS & Green	NIPDAU	N / A for Pkg Type	-40 to 85	65LBC176	Samples
SN65LBC176QD	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LB176Q	Samples
SN65LBC176QDG4	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LB176Q	Samples
SN65LBC176QDR	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LB176Q	Samples
SN65LBC176QDRG4	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(J176Q1, LB176Q)	Samples
SN75LBC176D	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	7LB176	Samples
SN75LBC176DR	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	7LB176	Samples
SN75LBC176DRG4	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	7LB176	Samples
SN75LBC176P	ACTIVE	PDIP	P	8	50	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	75LBC176	Samples
SNJ55LBC176FK	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9318301Q2A SNJ55 LBC176FK	Samples
SNJ55LBC176JG	ACTIVE	CDIP	JG	8	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	9318301QPA SNJ55LBC176	Samples

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

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

OTHER QUALIFIED VERSIONS OF SN55LBC176, SN65LBC176, SN75LBC176 :

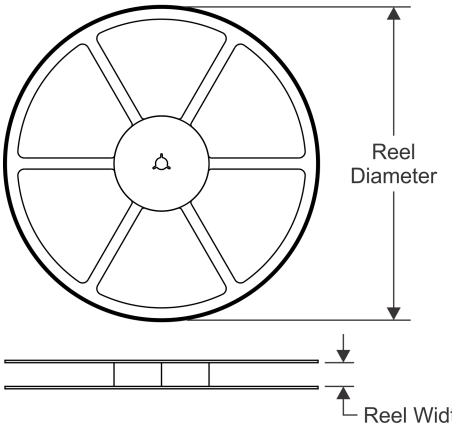
- Catalog : SN75LBC176
- Automotive : SN65LBC176-Q1
- Military : SN55LBC176

NOTE: Qualified Version Definitions:

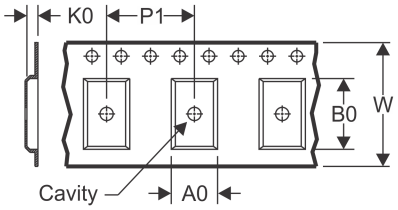
- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION

REEL DIMENSIONS

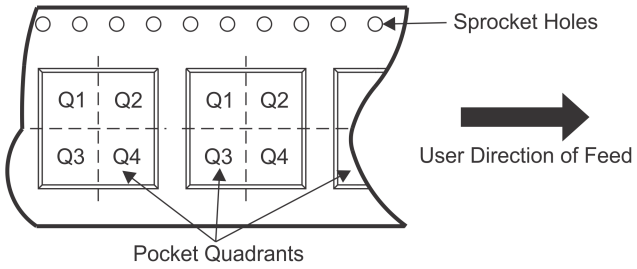


TAPE DIMENSIONS



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

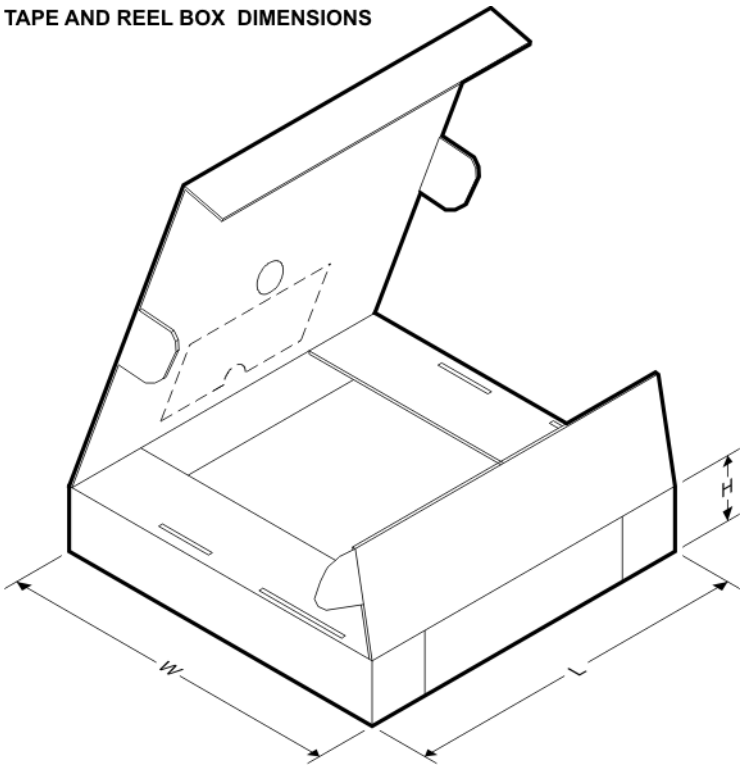
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN65LBC176DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
SN65LBC176QDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
SN65LBC176QDRG4	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
SN75LBC176DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1

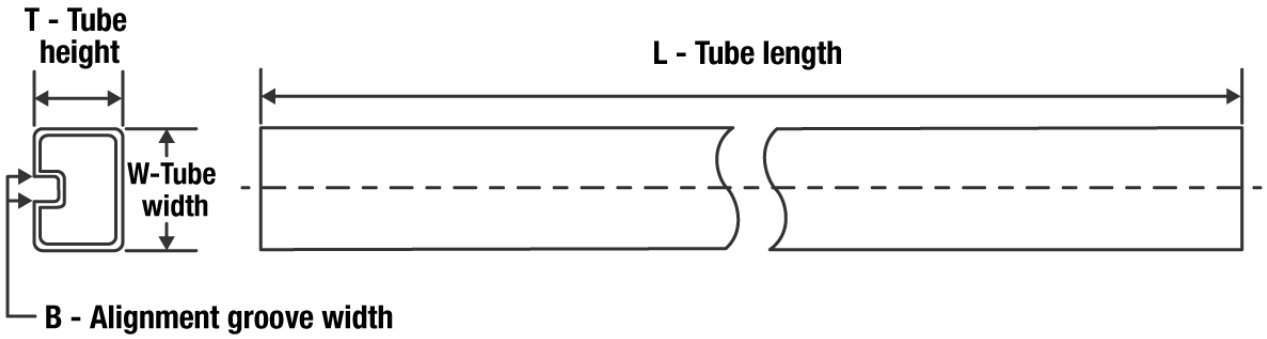
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN65LBC176DR	SOIC	D	8	2500	340.5	336.1	25.0
SN65LBC176QDR	SOIC	D	8	2500	350.0	350.0	43.0
SN65LBC176QDRG4	SOIC	D	8	2500	350.0	350.0	43.0
SN75LBC176DR	SOIC	D	8	2500	340.5	336.1	25.0

TUBE

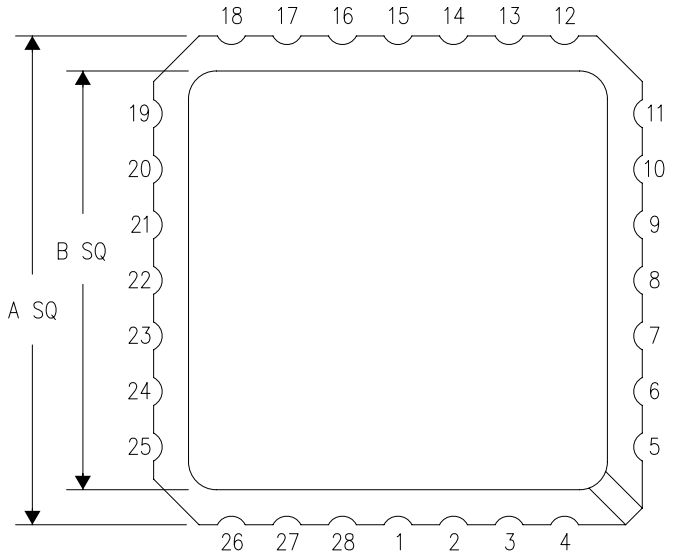


*All dimensions are nominal

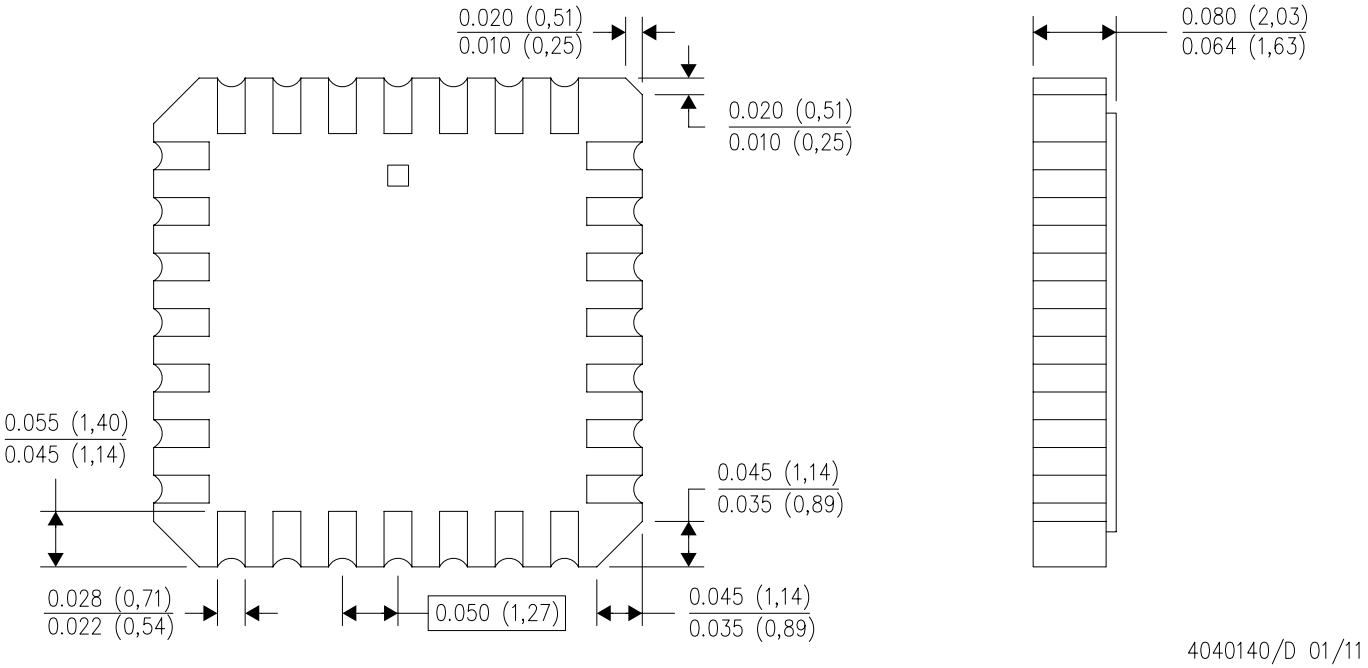
Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
5962-9318301Q2A	FK	LCCC	20	1	506.98	12.06	2030	NA
SN65LBC176D	D	SOIC	8	75	507	8	3940	4.32
SN65LBC176P	P	PDIP	8	50	506	13.97	11230	4.32
SN65LBC176QD	D	SOIC	8	75	505.46	6.76	3810	4
SN65LBC176QDG4	D	SOIC	8	75	505.46	6.76	3810	4
SN75LBC176D	D	SOIC	8	75	507	8	3940	4.32
SN75LBC176P	P	PDIP	8	50	506	13.97	11230	4.32
SNJ55LBC176FK	FK	LCCC	20	1	506.98	12.06	2030	NA

FK (S–CQCC–N**) LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN

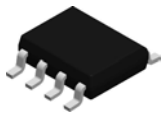


NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)



4040140/D 01/11

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 metal lid.
D. Falls within JEDEC MS–004

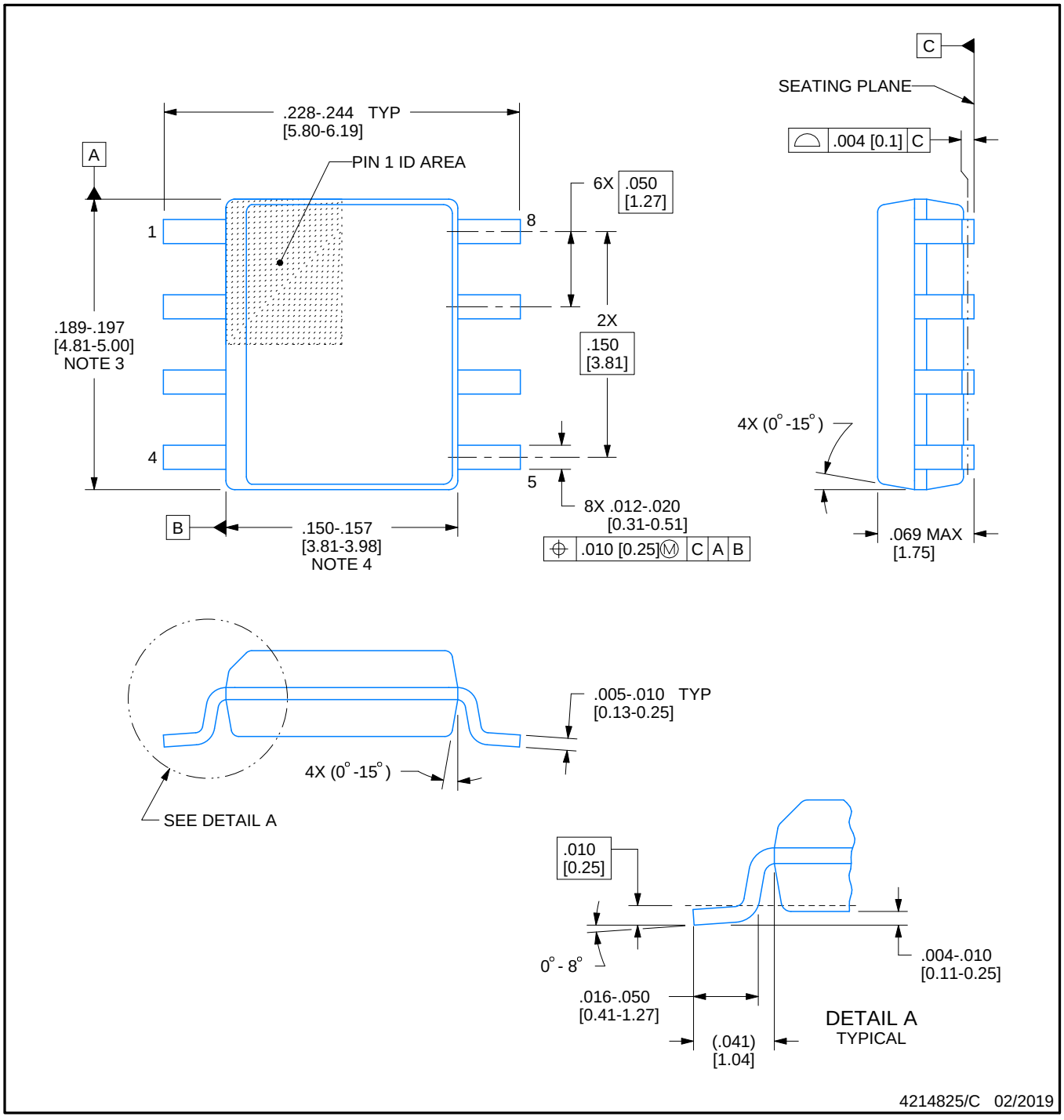


PACKAGE OUTLINE

D0008A

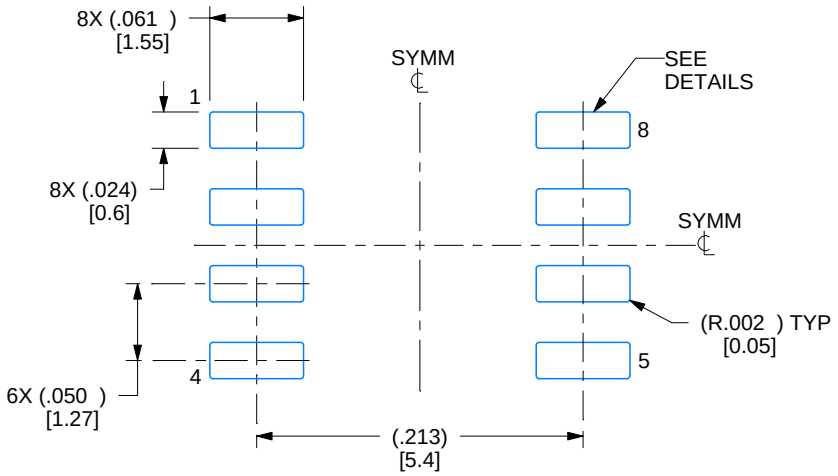
SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT

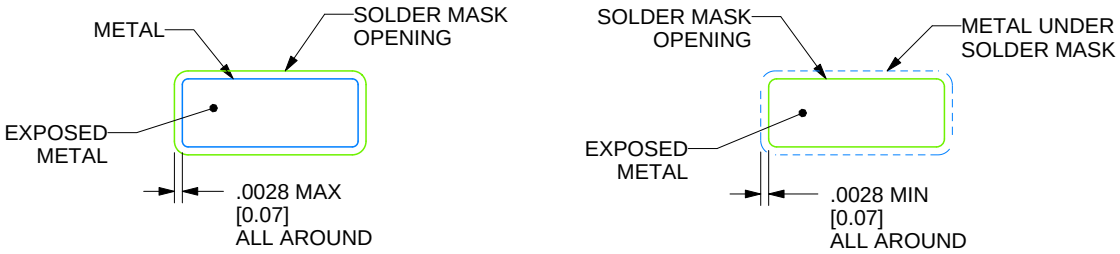


NOTES:

1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. 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 .006 [0.15] per side.
4. This dimension does not include interlead flash.
5. Reference JEDEC registration MS-012, variation AA.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:8X



SOLDER MASK DETAILS

4214825/C 02/2019

NOTES: (continued)

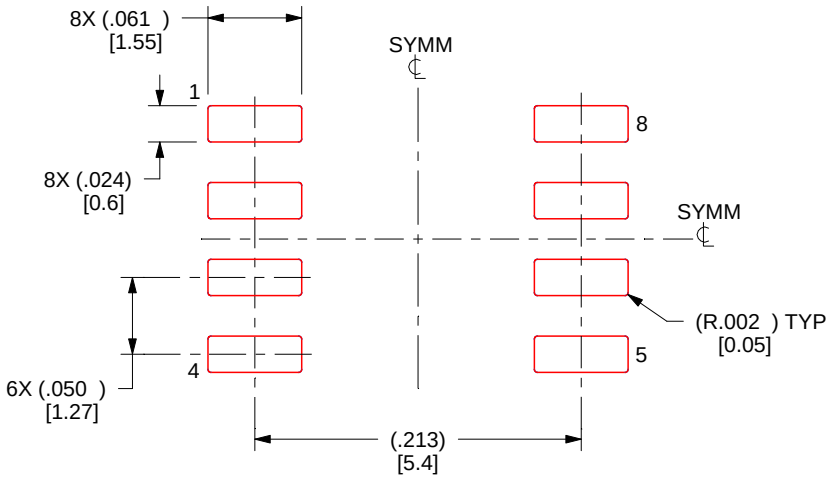
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE
BASED ON .005 INCH [0.125 MM] THICK STENCIL
SCALE:8X

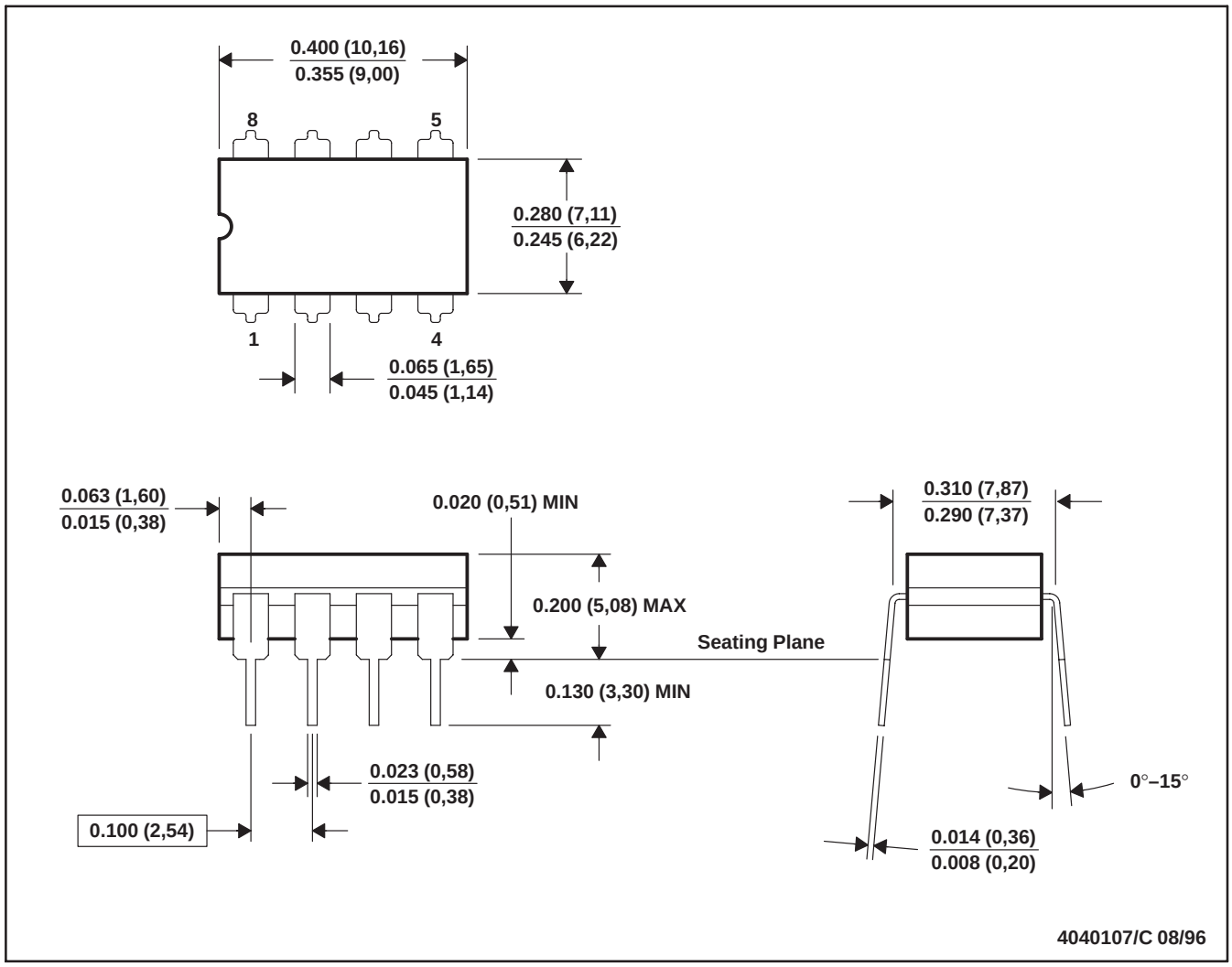
4214825/C 02/2019

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.

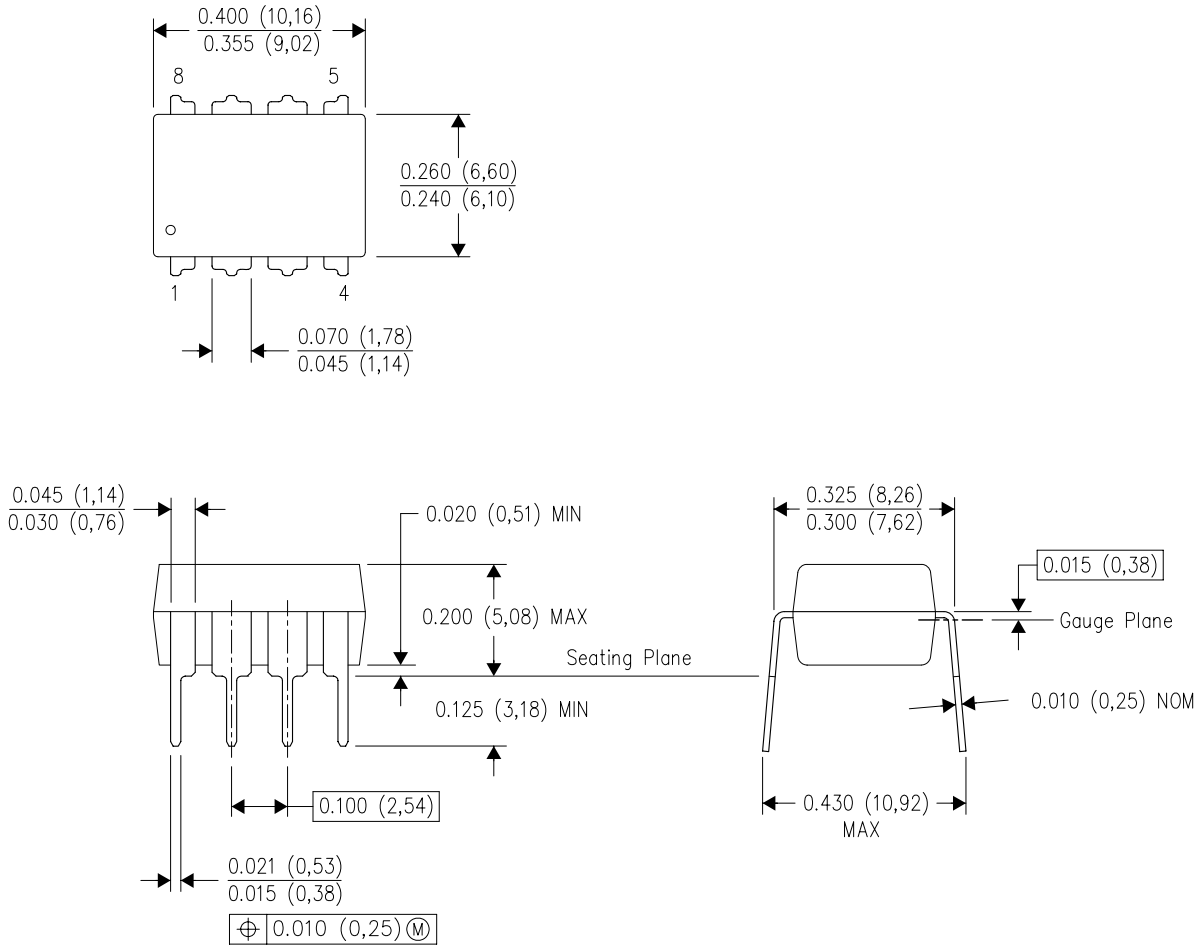
MCER001A – JANUARY 1995 – REVISED JANUARY 1997

JG (R-GDIP-T8) **CERAMIC DUAL-IN-LINE**



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.
E. Falls within MIL STD 1835 GDIP1-T8

P (R–PDIP–T8) PLASTIC DUAL–IN–LINE PACKAGE



NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001 variation BA.

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