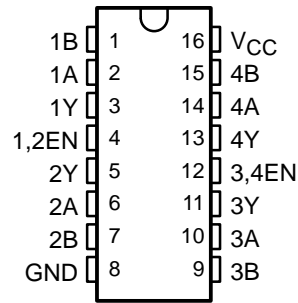


SN65LBC175, SN75LBC175 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

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- Meets or Exceeds the EIA Standards RS-422-A, RS-423-A, RS-485, and CCITT Recommendation V.11
- Designed to Operate With Pulse Durations as Short as 20 ns
- Designed for Multipoint Transmission on Long Bus Lines in Noisy Environments
- Input Sensitivity . . . ± 200 mV
- Low-Power Consumption . . . 20 mA Max
- Open-Circuit Fail-Safe Design
- Common-Mode Input Voltage Range of -7 V to 12 V
- Pin Compatible With SN75175 and LTC489

D, DW, OR N PACKAGE
(TOP VIEW)



description

The SN65LBC175 and SN75LBC175 are monolithic, quadruple, differential line receivers with 3-state outputs designed to meet the requirements of the EIA standards RS-422-A, RS-423-A, RS-485, and CCITT Recommendation V.11. The devices are optimized for balanced multipoint bus transmission at data rates up to and exceeding 10 million bits per second. The receivers are enabled in pairs, with an active-high enable input. Each differential receiver input features high impedance, hysteresis for increased noise immunity, and sensitivity of ± 200 mV over a common-mode input voltage range of 12 V to -7 V. The fail-safe design ensures that when the inputs are open-circuited, the outputs are always high. Both devices are designed using the TI proprietary LinBiCMOS™ technology allowing low power consumption, high switching speeds, and robustness.

These devices offer optimum performance when used with the SN75LBC172 or SN75LBC174 quadruple line drivers. The SN65LBC175 is available in the 16-pin DIP (N), small-outline package (D), and the wide small-outline package (DW). The SN75LBC175 is available in the 16-pin DIP (N) and the small-outline package (D).

The SN65LBC175 is characterized over the industrial temperature range of -40°C to 85°C . The SN75LBC175 is characterized for operation over the commercial temperature range of 0°C to 70°C .

AVAILABLE OPTIONS

PACKAGE	TEMPERATURE RANGE	
	0°C to 70°C	-40°C to 85°C
SOIC	SN75LBC175D	SN65LBC175D
Wide SOIC	—	SN65LBC175DW
PDIP	SN75LBC175N	SN65LBC175N



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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.



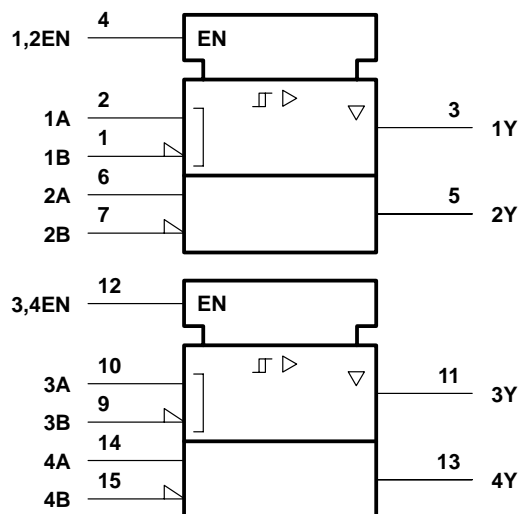
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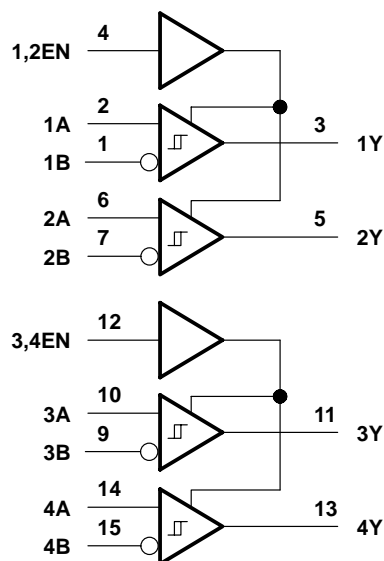
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logic symbol†



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

logic diagram (positive logic)

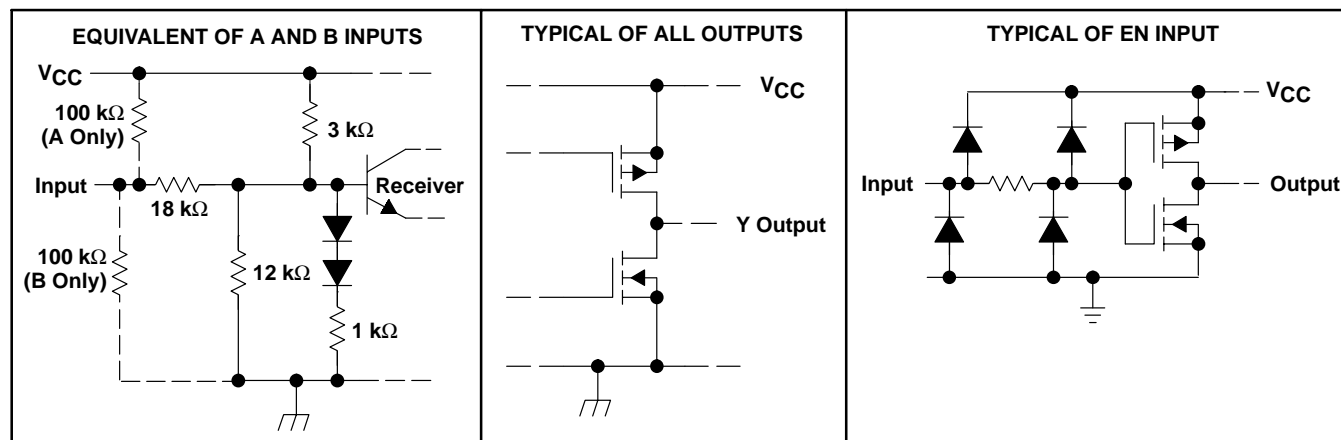


FUNCTION TABLE
(each receiver)

DIFFERENTIAL INPUTS A-B	ENABLE	OUTPUT Y
$V_{ID} \geq 0.2 \text{ V}$	H	H
$-0.2 \text{ V} < V_{ID} < 0.2 \text{ V}$	H	?
$V_{ID} \leq -0.2 \text{ V}$	H	L
X	L	Z
Open circuit	H	H

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

schematics of inputs and outputs



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

Supply voltage range, V_{CC} (see Note 1)	–0.3 V to 7 V
Input voltage, V_I (A or B inputs)	±25 V
Differential input voltage, V_{ID} (see Note 2)	±25 V
Voltage range at Y, 1/2EN, 3/4EN	–0.3 V to $V_{CC} + 0.5$ V
Continuous total dissipation	See Dissipation Rating Table
Operating free-air temperature range, T_A : SN65LBC175	–40°C to 85°C
SN75LBC175	0°C to 70°C
Storage temperature range, T_{stg}	–65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°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 voltage values are with respect to GND.
2. Differential input voltage is measured at the noninverting input with respect to the corresponding inverting input.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$	DERATING FACTOR	$T_A = 70^\circ\text{C}$	$T_A = 85^\circ\text{C}$
	POWER RATING	ABOVE $T_A = 25^\circ\text{C}$	POWER RATING	POWER RATING
D	1100 mW	8.7 mW/°C	709 mW	578 mW
DW	1200 mW	9.6 mW/°C	770 mW	625 mW
N	1150 mW	9.2 mW/°C	736 mW	598 mW

recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}		4.75	5	5.25	V
Common-mode input voltage, V_{IC}		–7		12	V
Differential input voltage, V_{ID}				±6	V
High-level input voltage, V_{IH}	EN inputs	2			V
Low-level input voltage, V_{IL}				0.8	V
High-level output current, I_{OH}				–8	mA
Low-level output current, I_{OL}				8	mA
Operating free-air temperature, T_A	SN65LBC175	–40		85	°C
	SN75LBC175	0		70	

SN65LBC175, SN75LBC175 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

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

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT	
V_{IT+}	Positive-going input threshold voltage	$I_O = -8$ mA			0.2	V	
V_{IT-}	Negative-going input threshold voltage	$I_O = 8$ mA	-0.2			V	
V_{hys}	Hysteresis voltage ($V_{IT+} - V_{IT-}$)			45		mV	
V_{IK}	Enable input clamp voltage	$I_I = -18$ mA	-0.9	-1.5		V	
V_{OH}	High-level output voltage	$V_{ID} = 200$ mV, $I_{OH} = -8$ mA	3.5	4.5		V	
V_{OL}	Low-level output voltage	$V_{ID} = -200$ mV, $I_{OL} = 8$ mA		0.3	0.5	V	
I_{OZ}	High-impedance-state output current	$V_O = 0$ V to V_{CC}			± 20	μ A	
I_I	Bus input current	A or B inputs	$V_{IH} = 12$ V, $V_{CC} = 5$ V, Other inputs at 0 V		0.7	1	mA
			$V_{IH} = 12$ V, $V_{CC} = 0$ V, Other inputs at 0 V		0.8	1	
			$V_{IH} = -7$ V, $V_{CC} = 5$ V, Other inputs at 0 V		-0.5	-0.8	
			$V_{IH} = -7$ V, $V_{CC} = 0$ V, Other inputs at 0 V		-0.4	-0.8	
I_{IH}	High-level enable input current	$V_{IH} = 5$ V			± 20	μ A	
I_{IL}	Low-level enable input current	$V_{IL} = 0$ V			-20	μ A	
I_{OS}	Short-circuit output current	$V_O = 0$	-80	-120		mA	
I_{CC}	Supply current	Outputs enabled, $I_O = 0$, $V_{ID} = 5$ V		11	20	mA	
		Outputs disabled		0.9	1.4		

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

switching characteristics, $V_{CC} = 5$ V, $C_L = 15$ pF, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
t_{PHL}	Propagation delay time, high- to low-level output	$V_{ID} = -1.5$ V to 1.5 V,	11	22	30	ns
t_{PLH}	Propagation delay time, low- to high-level output	See Figure 1	11	22	30	ns
t_{PZH}	Output enable time to high level	See Figure 2		17	30	ns
t_{PZL}	Output enable time to low level	See Figure 3		18	30	ns
t_{PHZ}	Output disable time from high level	See Figure 2		30	40	ns
t_{PLZ}	Output disable time from low level	See Figure 3		23	30	ns
$t_{sk(p)}$	Pulse skew ($ t_{PHL} - t_{PLH} $)	See Figure 2		4	6	ns
t_t	Transition time	See Figure 1		3	10	ns



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PARAMETER MEASUREMENT INFORMATION

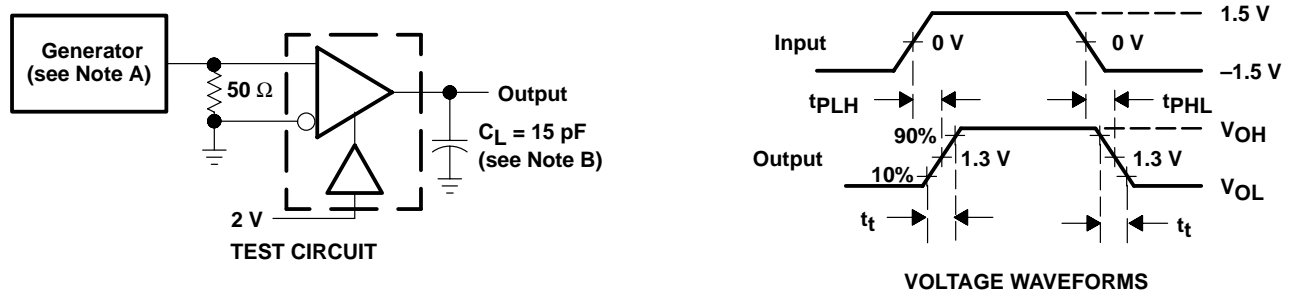
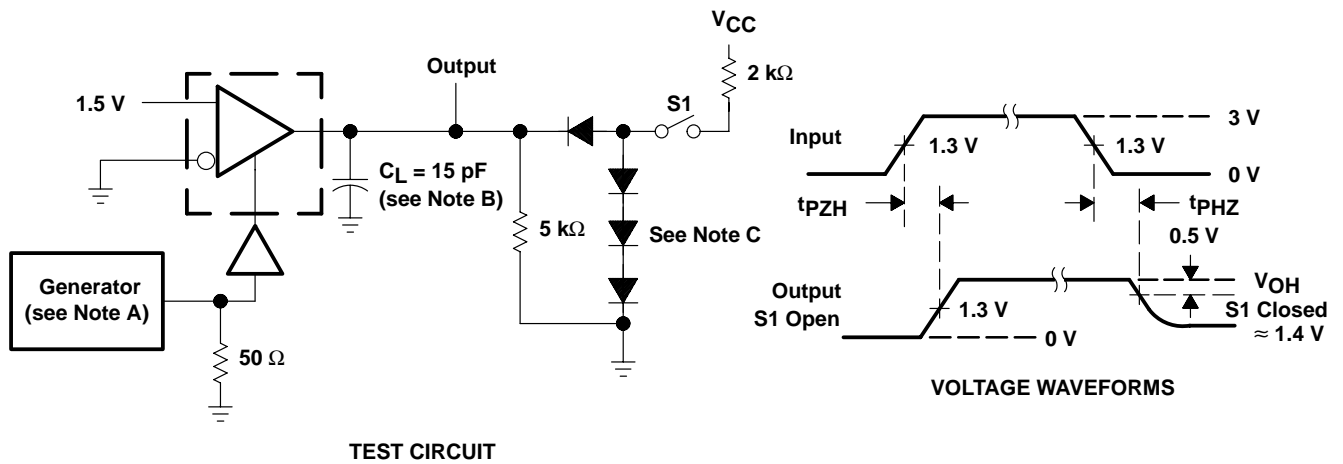


Figure 1. t_{PLH} and t_{PHL} Test Circuit and Voltage Waveforms



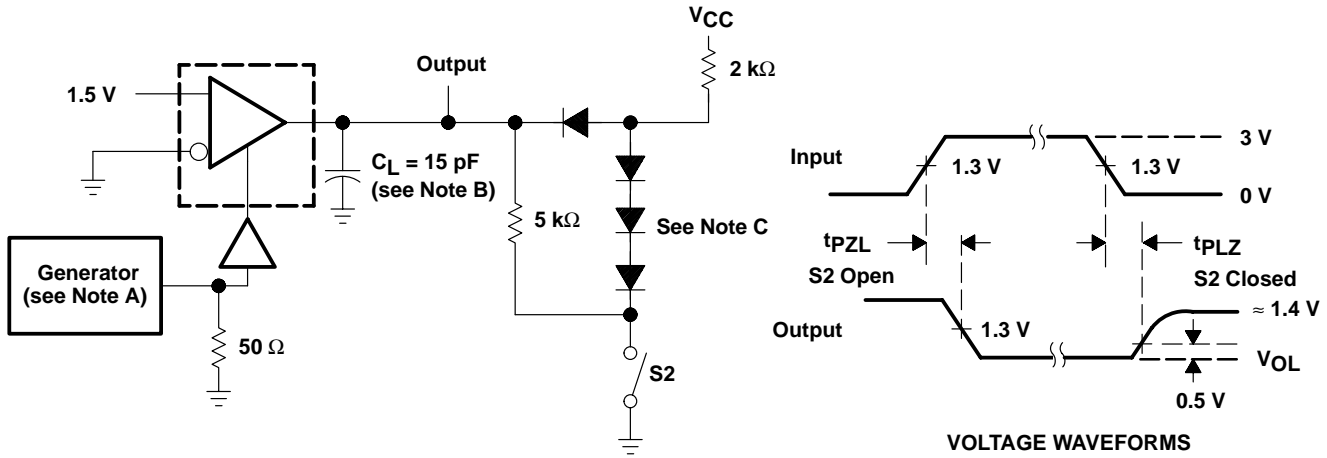
- NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, duty cycle = 50%, $t_r \leq 6$ ns, $t_f \leq 6$ ns, $Z_O = 50 \Omega$.
 B. C_L includes probe and jig capacitance.
 C. All diodes are 1N916 or equivalent.

Figure 2. t_{PHZ} and t_{PZH} Test Circuit and Voltage Waveforms

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PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT

- NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, duty cycle = 50%, $t_r \leq 6$ ns, $t_f \leq 6$ ns, $Z_O = 50 \Omega$.
 B. C_L includes probe and jig capacitance.
 C. All diodes are 1N916 or equivalent.

Figure 3. t_{pZL} and t_{PLZ} Test Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS

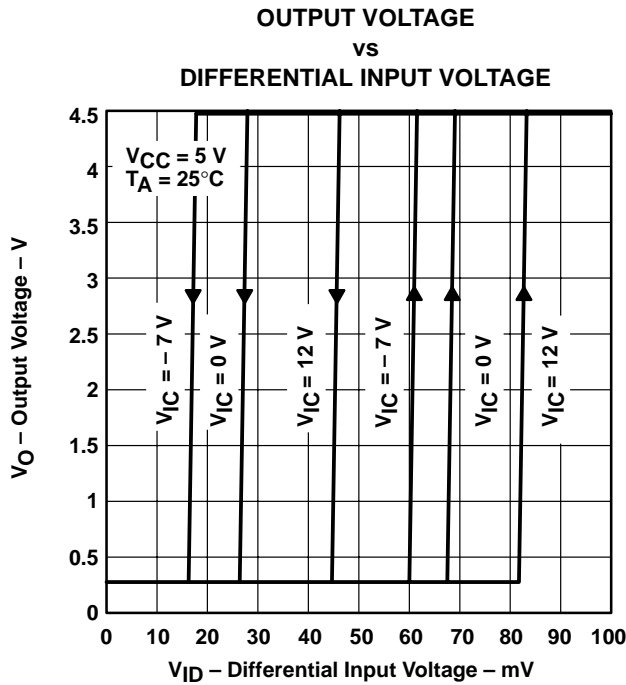


Figure 4

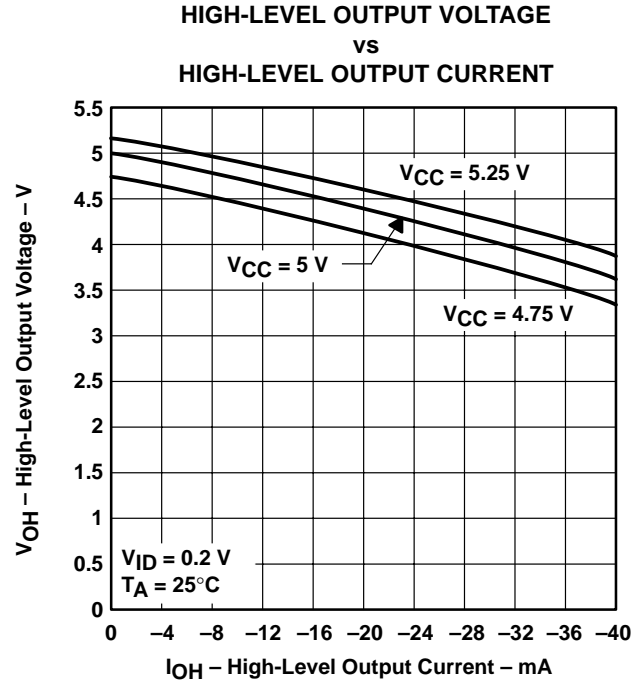


Figure 5

SN65LBC175, SN75LBC175 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

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TYPICAL CHARACTERISTICS

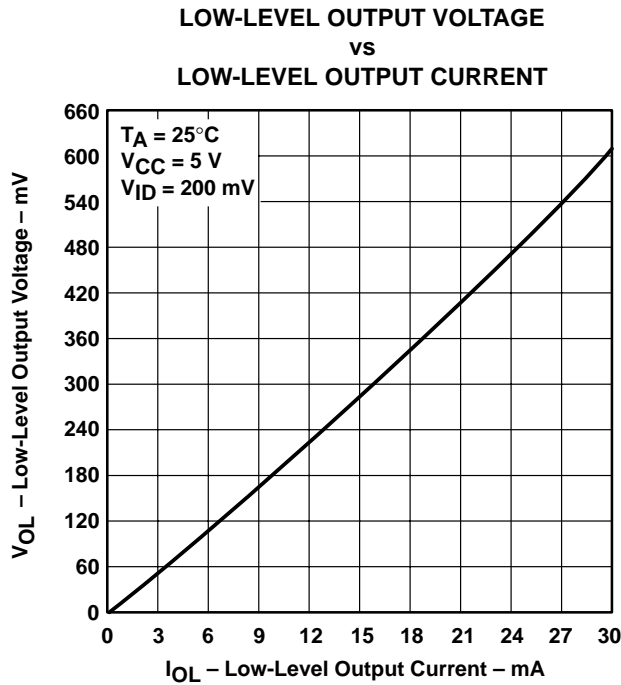


Figure 6

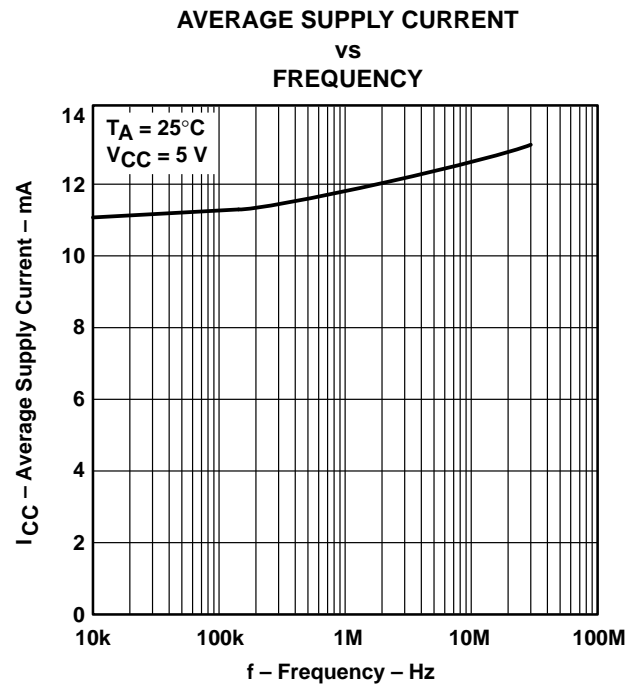


Figure 7

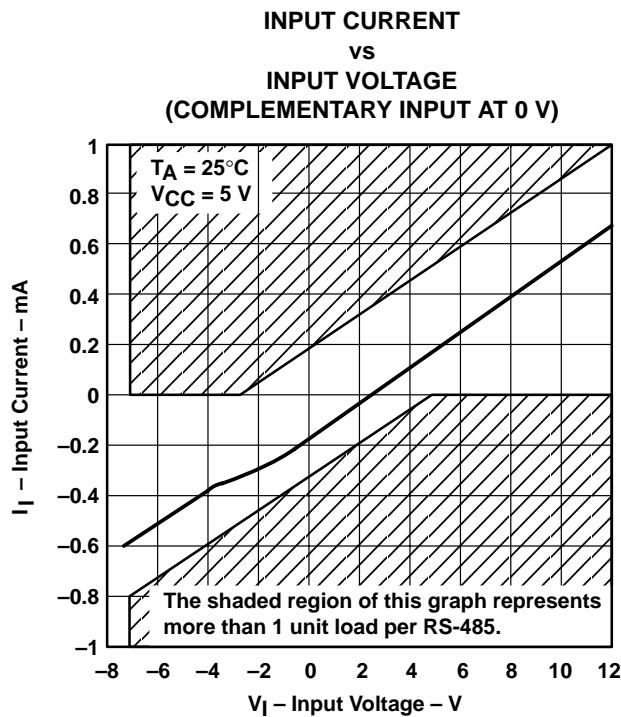


Figure 8

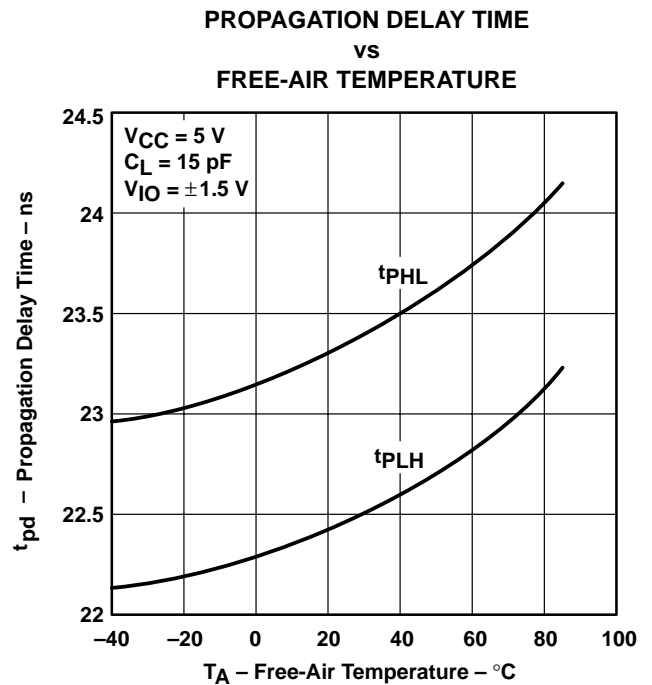


Figure 9

SN65LBC175, SN75LBC175 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

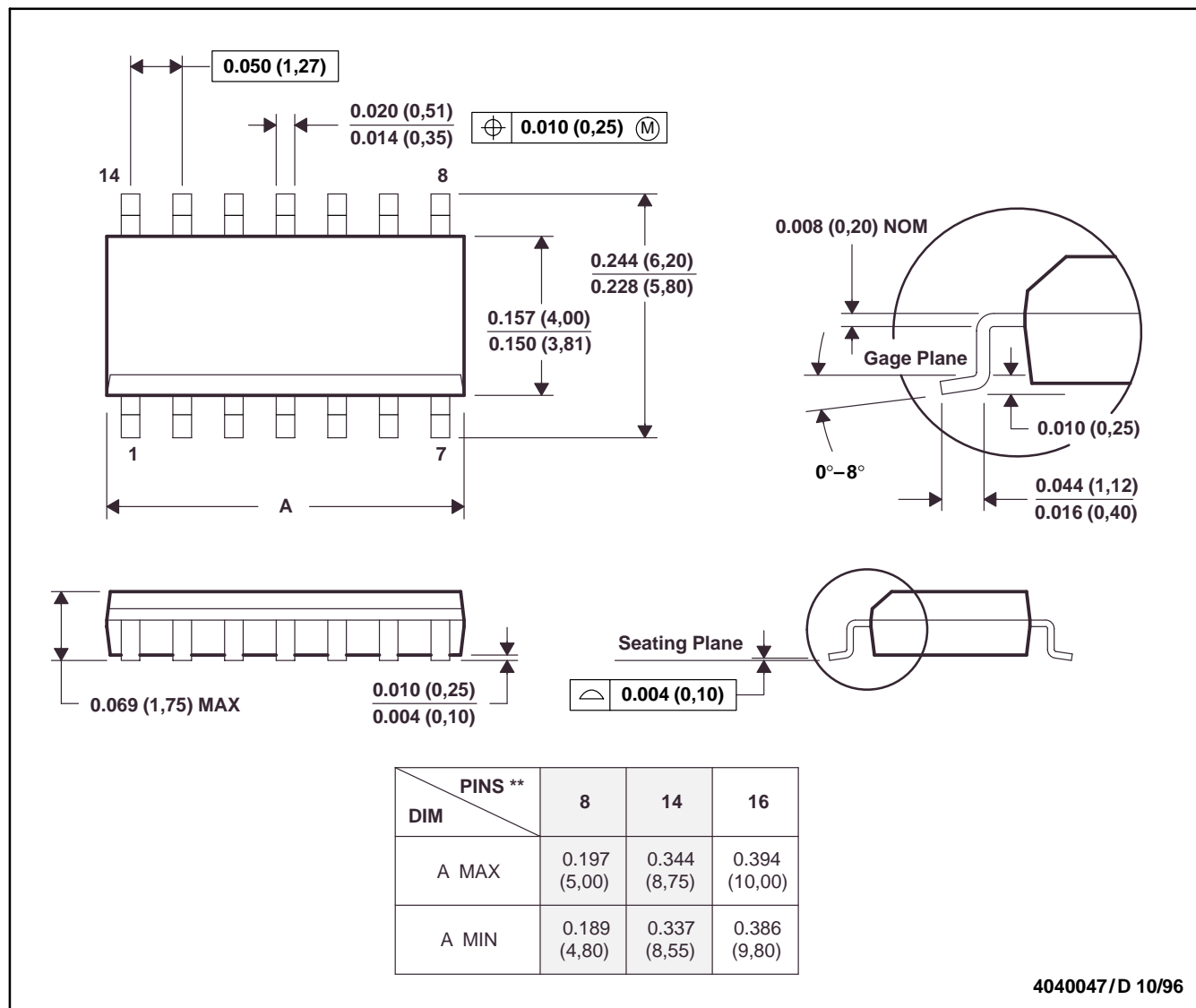
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MECHANICAL DATA

D (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PIN SHOWN



- 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

SN65LBC175, SN75LBC175 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

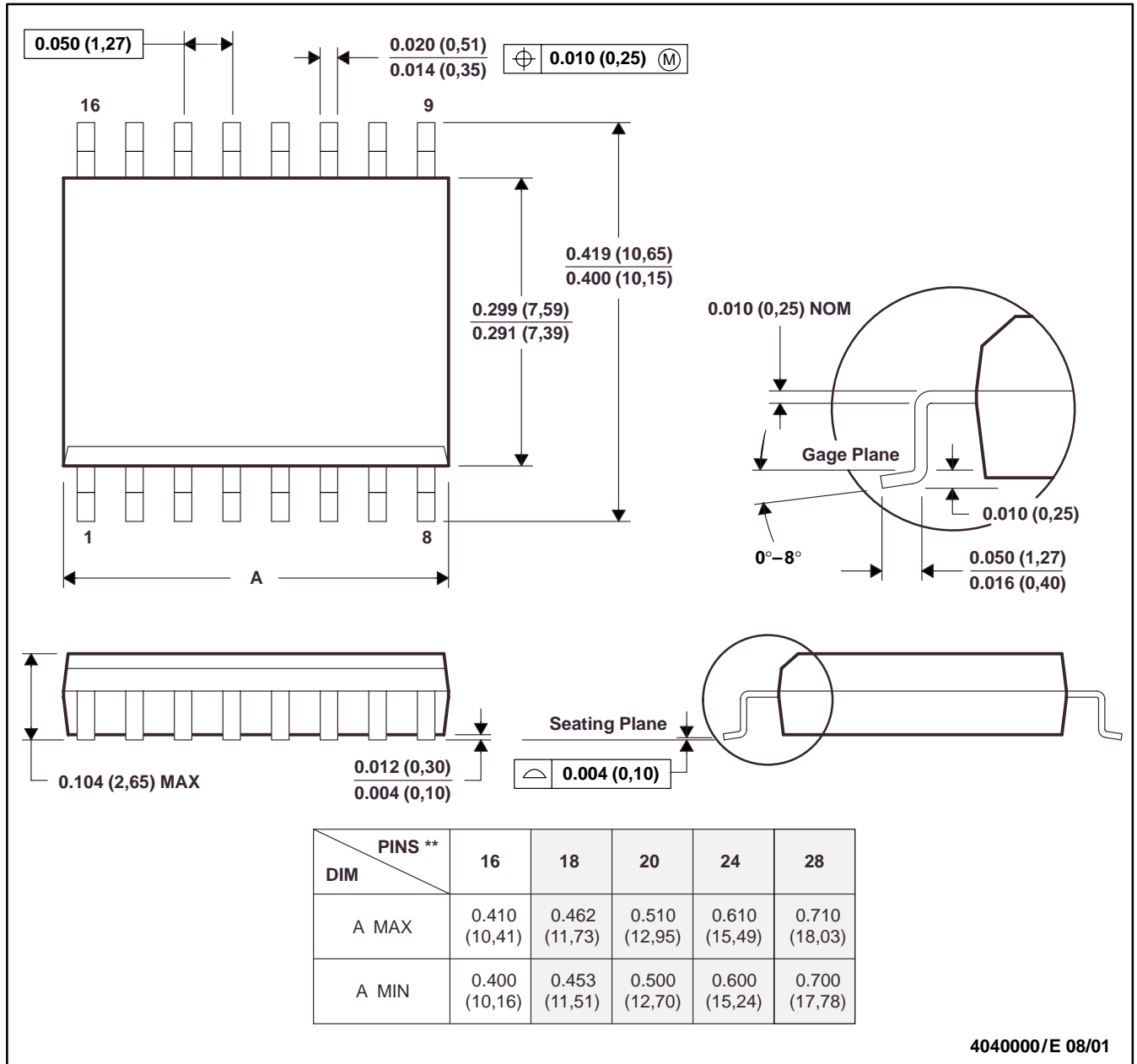
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MECHANICAL DATA

DW (R-PDSO-G)**

PLASTIC SMALL-OUTLINE PACKAGE

16 PINS SHOWN



- 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-013

SN65LBC175, SN75LBC175 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

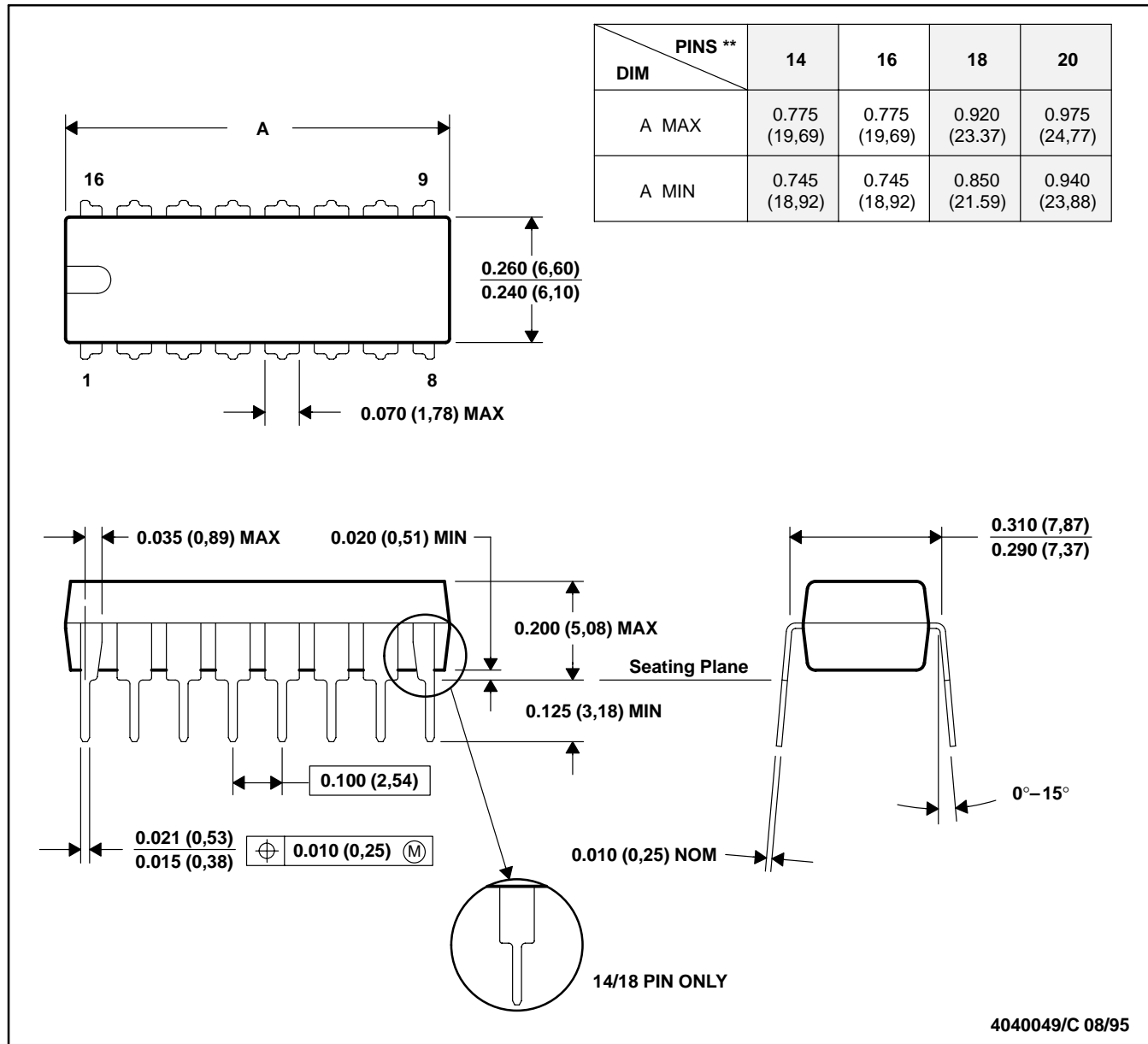
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MECHANICAL DATA

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PIN SHOWN



- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Falls within JEDEC MS-001 (20 pin package is shorter than MS-001.)

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN65LBC175D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65LBC175DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65LBC175DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65LBC175DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65LBC175DW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65LBC175DWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65LBC175DWRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65LBC175N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN65LBC175NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN75LBC175D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75LBC175DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75LBC175DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75LBC175DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75LBC175N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN75LBC175NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type

⁽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.

OBSELETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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