

DIFFERENTIAL BUS TRANSCEIVER

FEATURES

- **One-Fourth Unit Load Allows up to 128 Devices on a Bus**
- **ESD Protection for Bus Terminals:**
 - ± 15 -kV Human Body Model
 - ± 8 -kV IEC61000-4-2, Contact Discharge
 - ± 15 -kV IEC61000-4-2, Air-Gap Discharge
- **Meets or Exceeds the Requirements of ANSI Standard TIA/EIA-485-A and ISO 8482: 1987(E)**
- **Controlled Driver Output-Voltage Slew Rates Allow Longer Cable Stub Lengths**
- **Designed for Signaling Rates† Up to 250-kbps**
- **Low Disabled Supply Current . . . 250 μ A Max**
- **Thermal Shutdown Protection**
- **Open-Circuit Fail-Safe Receiver Design**
- **Receiver Input Hysteresis . . . 70 mV Typ**
- **Glitch-Free Power-Up and Power-Down Protection**

APPLICATIONS

- **Utility Meters**
- **Industrial Process Control**
- **Building Automation**

DESCRIPTION

The SN65LBC182 and SN75LBC182 are differential data line transceivers with a high level of ESD protection in the trade-standard footprint of the SN75176. They are designed for balanced transmission lines and meet ANSI standard TIA/EIA-485-A and ISO 8482. The SN65LBC182 and SN75LBC182 combine a 3-state, differential line driver and 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 be externally connected together to function as a direction control.

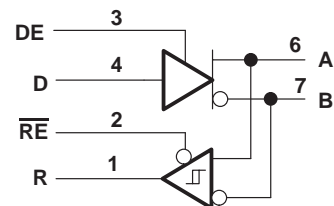
The driver outputs and the receiver inputs connect internally to form a differential input/output (I/O) bus port that is designed to offer minimum loading to the bus. This port operates over a wide range of common-mode voltage, making the device suitable for party-line applications. The device also includes additional features for party-line data buses in electrically noisy environment applications such as industrial process control or power inverters.

The SN75LBC182 and SN65LBC182 bus pins also exhibit a high input resistance equivalent to one-fourth unit load allowing connection of up to 128 similar devices on the bus. The high ESD tolerance protects the device for cabled connections. (For an even higher level of protection, see the SN65/75LBC184, literature number SLLS236.)

The differential driver design incorporates slew-rate-controlled outputs sufficient to transmit data up to 250 kbps. Slew-rate control allows longer unterminated cable runs and longer stub lengths from the main backbone than possible with uncontrolled voltage transitions. The receiver design provides a fail-safe output of a high level when the inputs are left floating (open circuit). Very low device supply current can be achieved by disabling the driver and the receiver.

The SN65LBC182 is characterized for operation from -40°C to 85°C , and the SN75LBC182 is characterized for operation from 0°C to 70°C .

functional block diagram



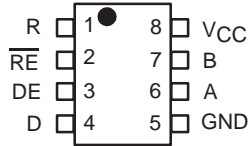
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

†The signaling rate of a line, is the number of voltage transitions that are made per second expressed in the units bps (bits per second).

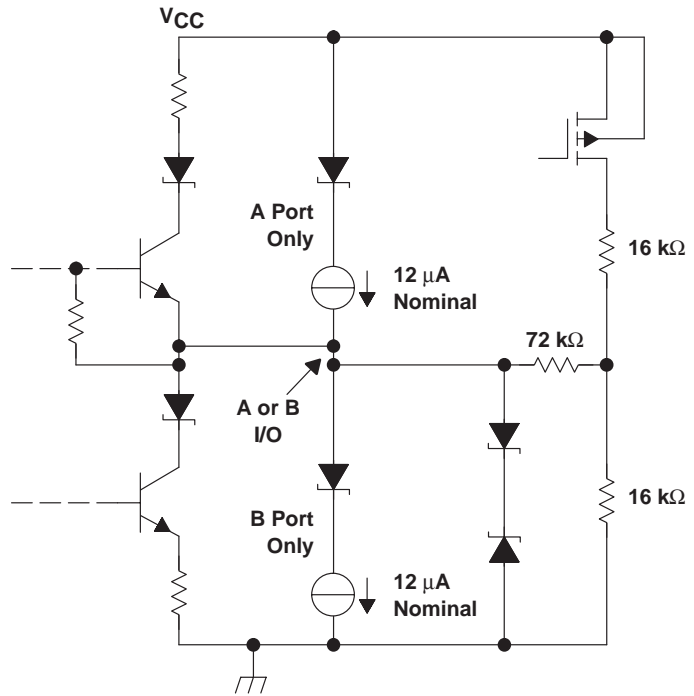
SN65LBC182 SN75LBC182

SLLS500A – MAY 2001 – REVISED MARCH 2005

SN65LBC182D (Marked as 6LB182)
 SN75LBC182D (Marked as 7LB182)
 SN65LBC182P (Marked as 65LBC182)
 SN75LBC182P (Marked as 75LBC182)
 (TOP VIEW)



schematic of inputs and outputs



Function Tables

DRIVER

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

RECEIVER

DIFFERENTIAL INPUTS	ENABLE 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

AVAILABLE OPTIONS

T _A	PACKAGE	
	PLASTIC SMALL-OUTLINE† (JEDEC MS-012)	PLASTIC DUAL-IN-LINE PACKAGE (JEDEC MS-001)
0°C to 70°C	SN75LBC182D	SN75LBC182P
-40°C to 85°C	SN65LBC182D	SN65LBC182P

† Add R suffix for taped and reel.

† For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.

driver electrical characteristics over recommended operating conditions

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
V _{IK}	Input clamp voltage	I _I = -18 mA	-1.5			V
V _O	Output voltage	I _O = 0	0		V _{CC}	V
V _{ODI}	Differential output voltage	R _L = 54 Ω, See Figure 1	1.5	2.2	V _{CC}	V
		V _{test} = -7 V to 12 V, See Figure 2	1.5	2.2	V _{CC}	V
ΔV _{OD}	Change in magnitude of differential output voltage	See Figure 1	-0.2		0.2	V
V _{OC(SS)}	Steady-state common-mode output voltage		1		3	
ΔV _{OC(SS)}	Change in steady-state common-mode output voltage	See Figures 1 and 4	-0.2		0.2	
V _{OC(PP)}	Peak-to-peak change in common-mode output voltage during state transitions		0.8			V
I _{OZ}	High-impedance output current	See receiver input currents				
I _{IH}	High-level input current (D, DE)	V _I = 2.4 V			50	μA
I _{IL}	Low-level input current (D, DE)	V _I = 0.4 V	-50			μA
I _{OS}	Short-circuit output current	V _O = -7 V to 12 V	-250		250	mA
I _{CC}	Supply current	SN75LBC182	No load, DE at V _{CC} , \overline{RE} at V _{CC}	12	25	mA
		SN65LBC182		12	30	

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

driver switching characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t _r	Differential output signal rise time	R _L = 54 Ω, C _L = 50 pF, See Figure 3	0.25	0.72	1.2	μs
t _f	Differential output signal fall time		0.25	0.73	1.2	
t _{PLH}	Propagation delay time, low-to-high-level output				1.3	
t _{PHL}	Propagation delay time, high-to-low-level output				1.3	
t _{sk(p)}	Pulse skew (t _{PHL} - t _{PLH})			0.075	0.15	
t _{PZH}	Output enable time to high level	R _L = 110 Ω, See Figure 5			3.5	μs
t _{PHZ}	Output disable time from high level				3.5	
t _{PZL}	Output enable time to low level	R _L = 110 Ω, See Figure 6			3.5	μs
t _{PLZ}	Output disable time from low level				3.5	

receiver electrical characteristics over recommended operating conditions (unless otherwise noted)

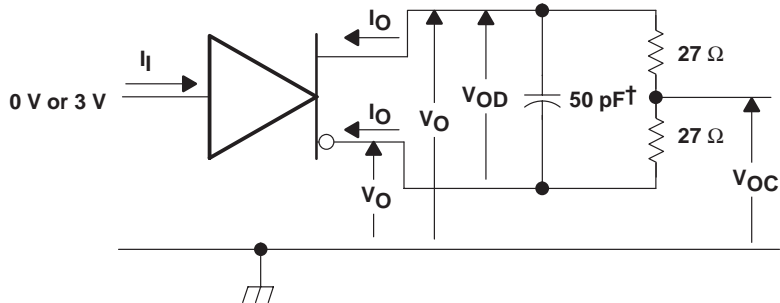
PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
V_{IT+}	Positive-going input threshold voltage				0.2	V
V_{IT-}	Negative-going input threshold voltage		-0.2			
V_{hys}	Hysteresis voltage ($V_{IT+} - V_{IT-}$)			70		mV
V_{IK}	Enable-input clamp voltage	$I_I = -18$ mA	-1.5			V
V_{OH}	High-level output voltage	$V_{ID} = 200$ mV, $I_O = -8$ mA, See Figure 7	2.8			V
V_{OL}	Low-level output voltage	$V_{ID} = 200$ mV, $I_O = 4$ mA, See Figure 7			0.4	V
I_{OZ}	High-impedance-state output current	$V_O = 0.4$ to 2.4 V			± 1	μ A
I_I	Bus input current	$V_{IH} = 12$ V, $V_{CC} = 5$ V	Other input at 0 V		250	μ A
		$V_{IH} = 12$ V, $V_{CC} = 0$ V			250	
		$V_{IH} = -7$ V, $V_{CC} = 5$ V			-200	
		$V_{IH} = -7$ V, $V_{CC} = 0$ V			-200	
I_{IH}	High-level input current (\overline{RE})	$V_{IH} = 2$ V			50	μ A
I_{IL}	Low-level input current (\overline{RE})	$V_{IL} = 0.8$ V	-50			μ A
I_{CC}	Supply current	No load	DE at 0 V, \overline{RE} at 0 V		3.5	mA
			DE at 0 V, \overline{RE} at V_{CC}		175 250	

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

receiver switching characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_r	Differential output signal rise time	$C_L = 50$ pF, See Figure 7		20		ns
t_f	Differential output signal fall time			20		
t_{PLH}	Propagation delay time, low-to-high-level output				150	
t_{PHL}	Propagation delay time, high-to-low-level output				150	
t_{PZH}	Output enable time to high level	See Figure 8		100		ns
t_{PZL}	Output enable time to low level			100		
t_{PHZ}	Output disable time from high level				100	ns
t_{PLZ}	Output disable time from low level				100	
$t_{sk(p)}$	Pulse skew $ t_{PHL} - t_{PLH} $			50		ns

PARAMETER MEASUREMENT INFORMATION



†Includes probe and jig capacitance

Figure 1. Driver Test Circuit, V_{OD} and V_{OC} Without Common-Mode Loading

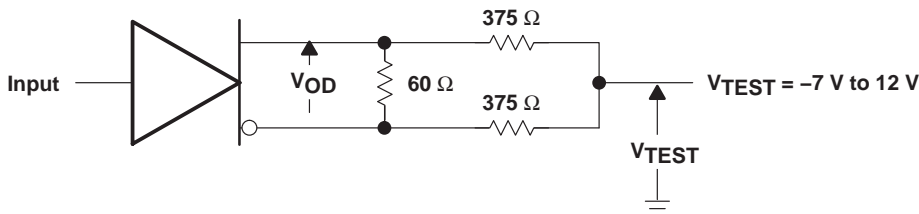
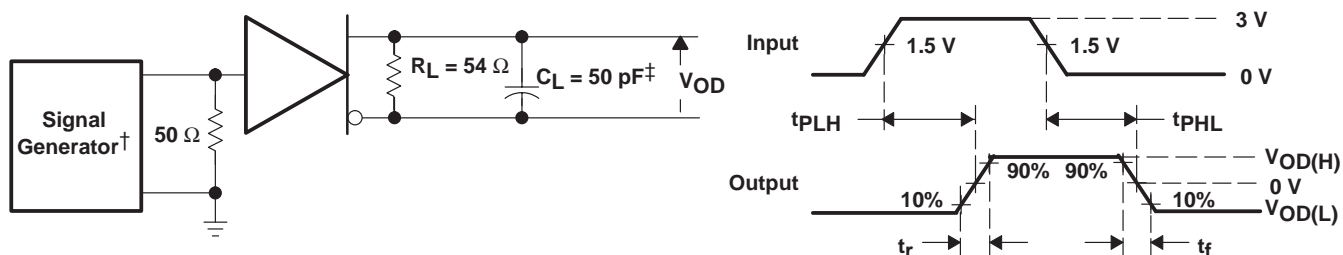


Figure 2. Driver Test Circuit, V_{OD} With Common-Mode Loading



†PRR = 1 MHz, 50% duty cycle, $t_r < 6$ ns, $t_f < 6$ ns, $Z_0 = 50 \Omega$

‡Includes probe and jig capacitance

Figure 3. Driver Switching Test Circuit and Waveforms

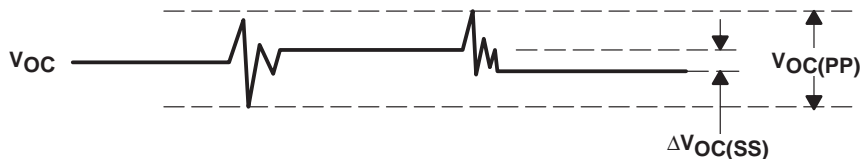
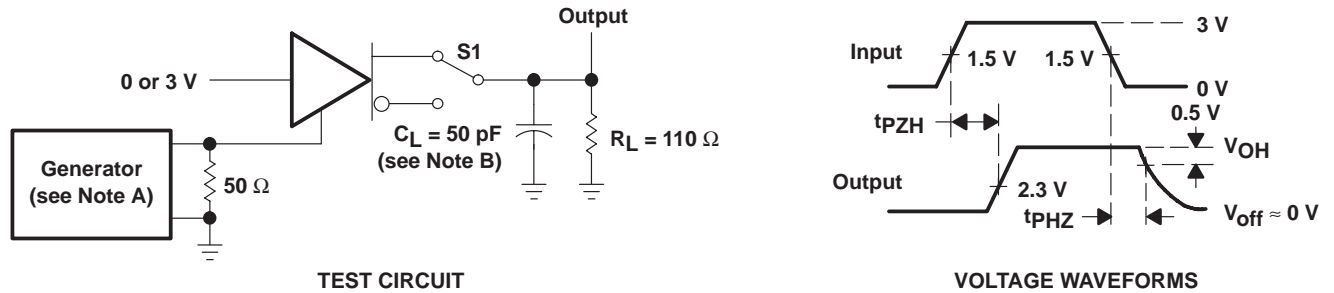


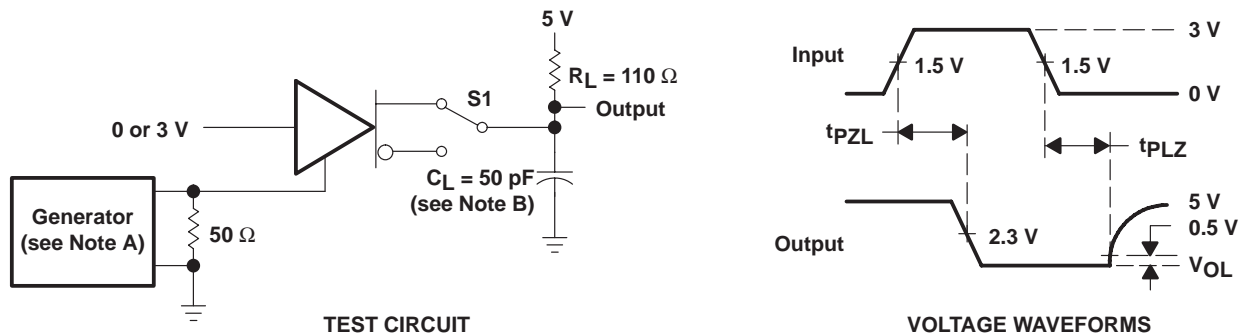
Figure 4. V_{OC} Definitions

PARAMETER MEASUREMENT INFORMATION



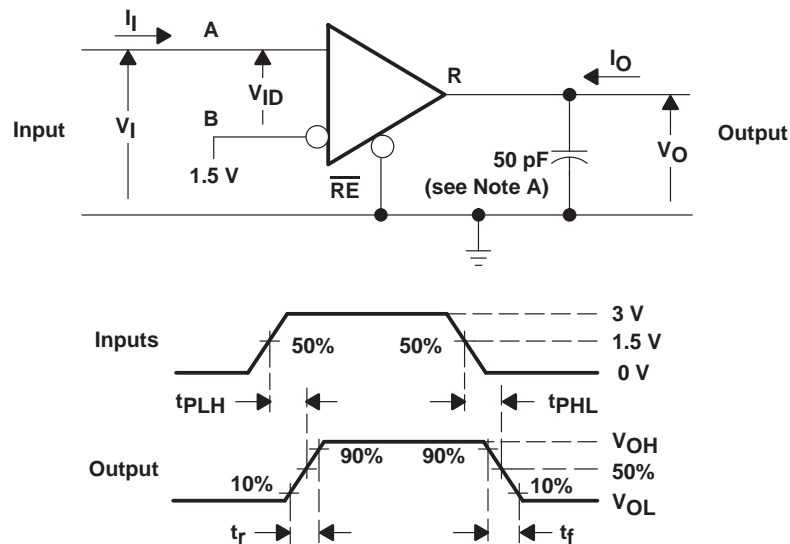
NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1.25 kHz, 50% duty cycle, $t_r \leq 10$ ns, $t_f \leq 10$ ns, $Z_O = 50 \Omega$.
B. C_L includes probe and jig capacitance.

Figure 5. Driver t_{pZH} and t_{pHZ} Test Circuit and Voltage Waveforms



NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1.25 kHz, 50% duty cycle, $t_r \leq 10$ ns, $t_f \leq 10$ ns, $Z_O = 50 \Omega$.
B. C_L includes probe and jig capacitance.

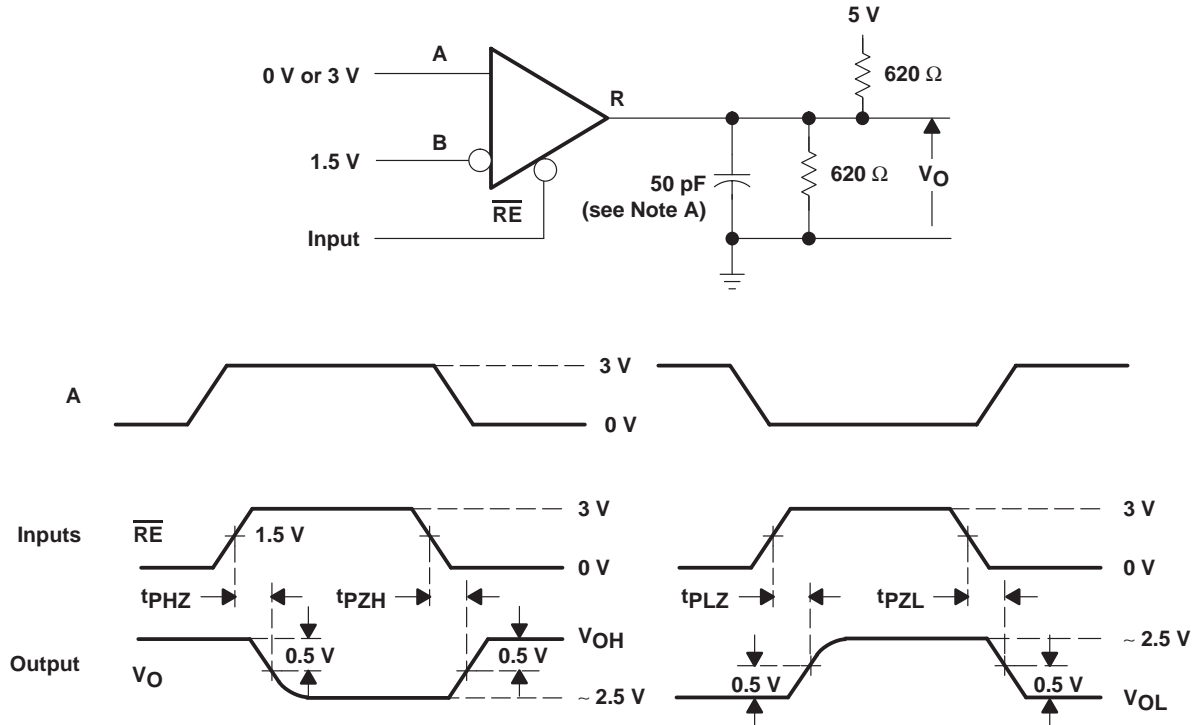
Figure 6. Driver t_{pZL} and t_{pLZ} Test Circuit and Voltage Waveforms



NOTE A: This value includes probe and jig capacitance ($\pm 10\%$).

Figure 7. Receiver t_{pLH} and t_{pHL} Test Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION



NOTE A: This value includes probe and jig capacitance ($\pm 10\%$).

Figure 8. Receiver tPZL, tPLZ, tPZH, and tPHZ Test Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS

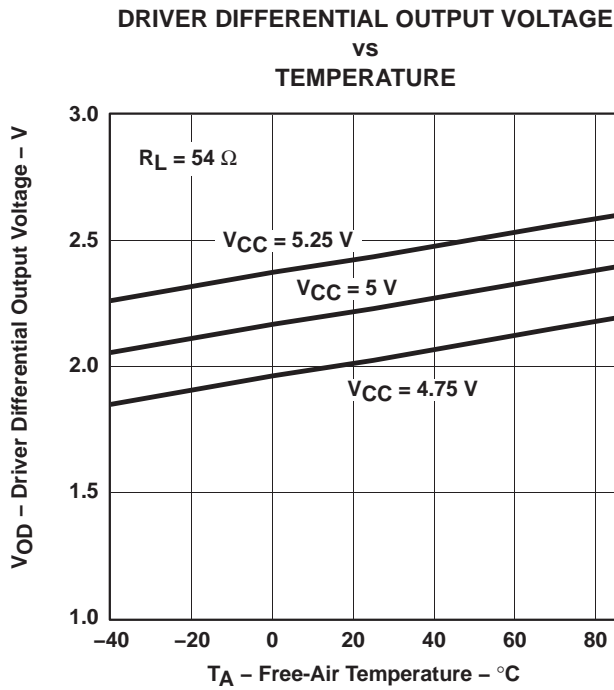


Figure 9

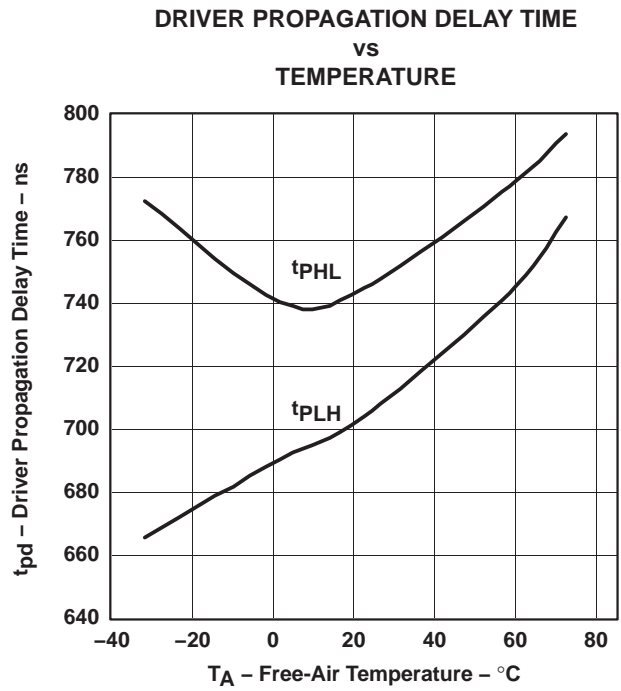


Figure 10

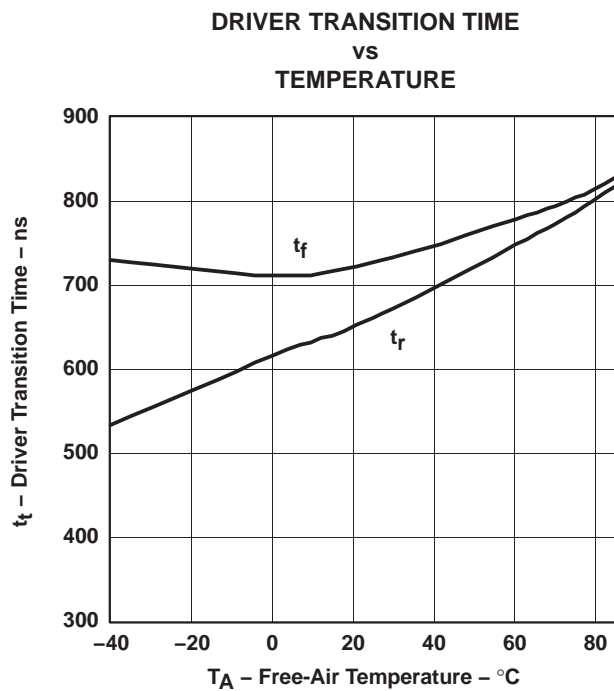


Figure 11

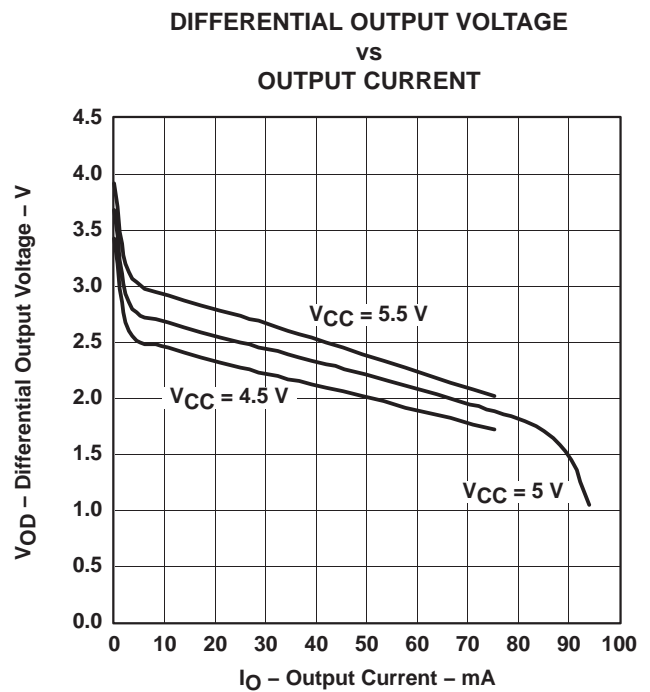


Figure 12

TYPICAL CHARACTERISTICS

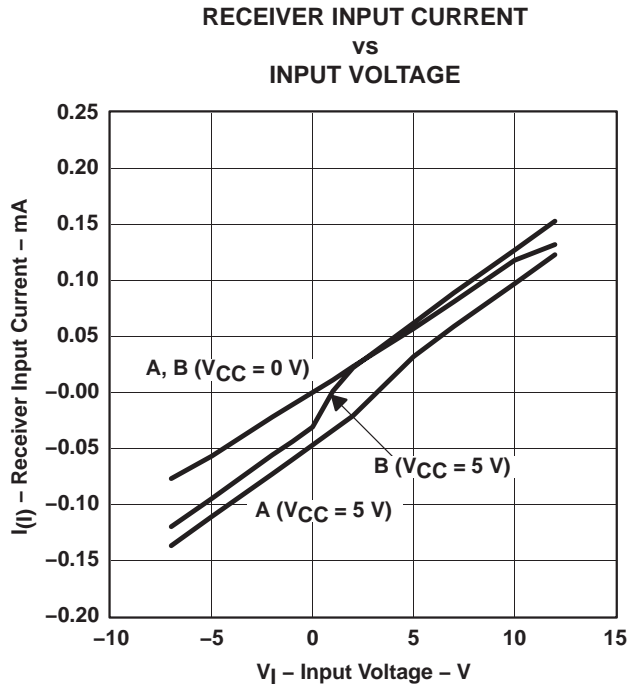
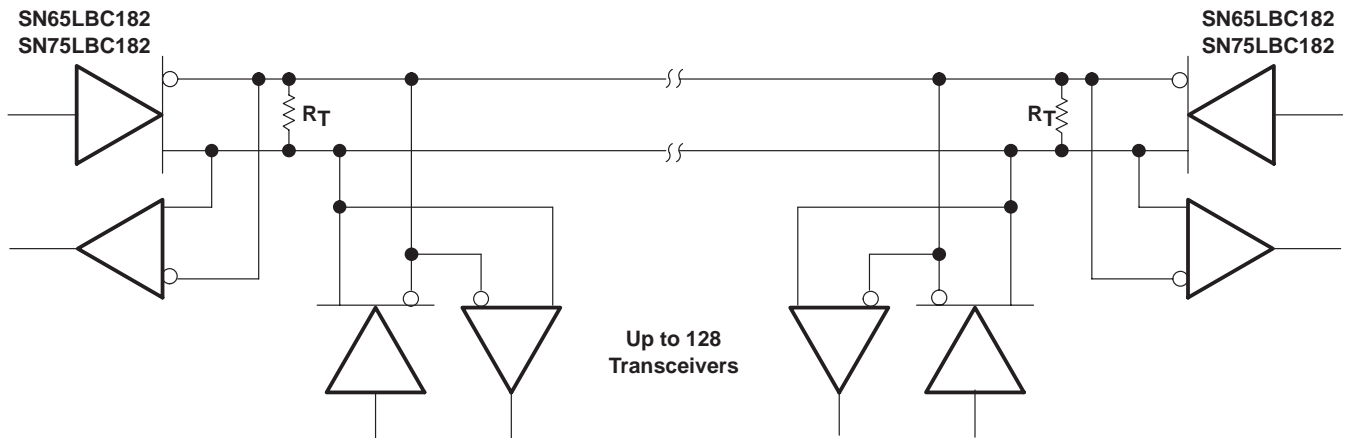


Figure 13

APPLICATION INFORMATION



NOTE A: The line should be terminated at both ends in its characteristic impedance ($R_T = Z_0$). Stub lengths off the main line should be kept as short as possible.

Figure 14. Typical Application Circuit

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
SN65LBC182D	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	6LB182	Samples
SN65LBC182DG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	6LB182	Samples
SN65LBC182DR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	6LB182	Samples
SN65LBC182DRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	6LB182	Samples
SN65LBC182P	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-40 to 85	65LBC182	Samples
SN65LBC182PE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-40 to 85	65LBC182	Samples
SN75LBC182D	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	7LB182	Samples
SN75LBC182DG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	7LB182	Samples
SN75LBC182DR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	7LB182	Samples
SN75LBC182DRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	7LB182	Samples
SN75LBC182P	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	75LBC182	Samples
SN75LBC182PE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	75LBC182	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) 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.

⁽⁴⁾ Multiple Top-Side Markings will be inside parentheses. Only one Top-Side 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 Top-Side Marking for that device.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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

TAPE AND REEL INFORMATION



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
SN65LBC182DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
SN65LBC182DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
SN75LBC182DR	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)
SN65LBC182DR	SOIC	D	8	2500	367.0	367.0	38.0
SN65LBC182DR	SOIC	D	8	2500	340.5	338.1	20.6
SN75LBC182DR	SOIC	D	8	2500	340.5	338.1	20.6

P (R-PDIP-T8)

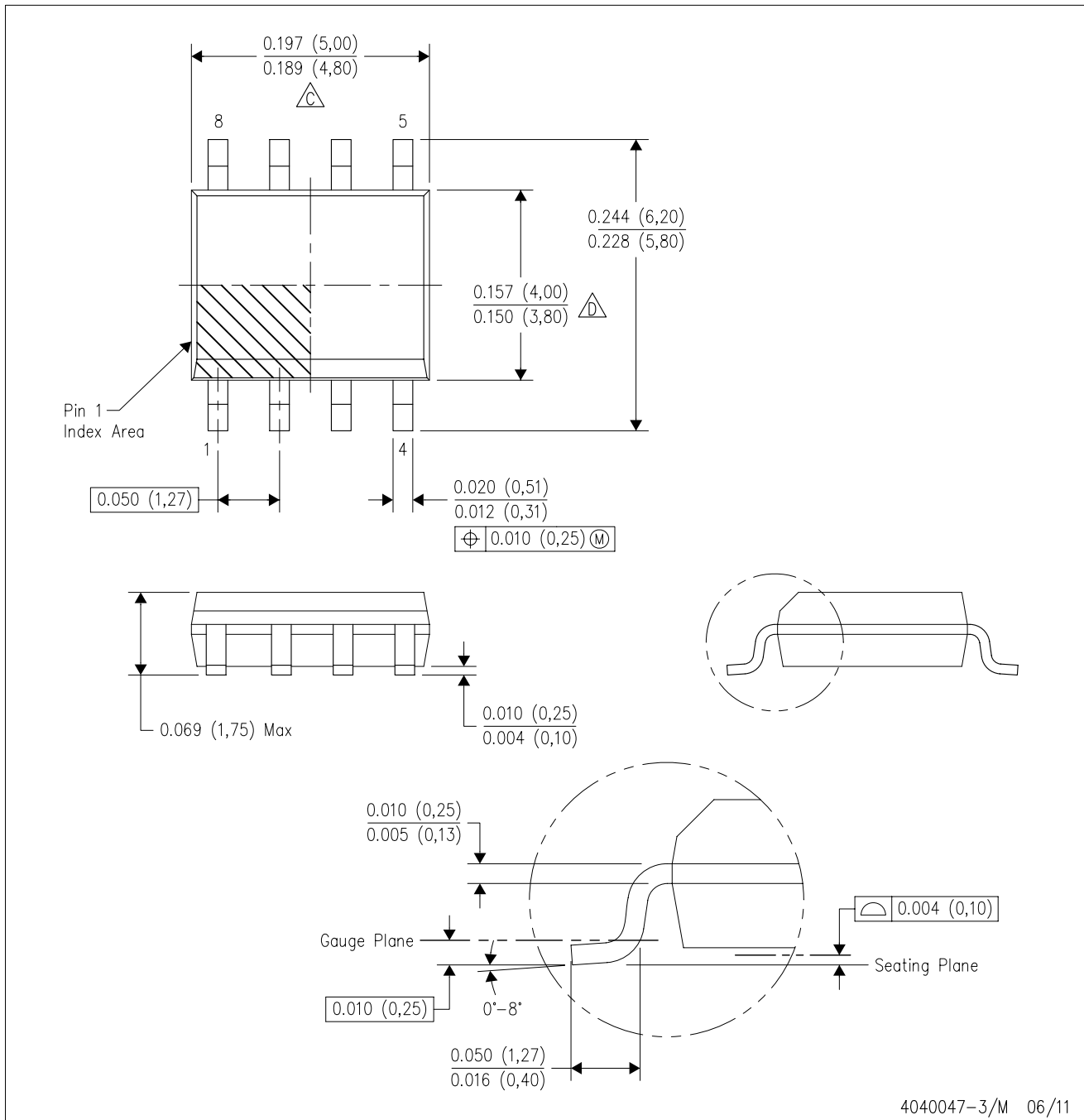
PLASTIC DUAL-IN-LINE PACKAGE



- 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.

D (R-PDSO-G8)

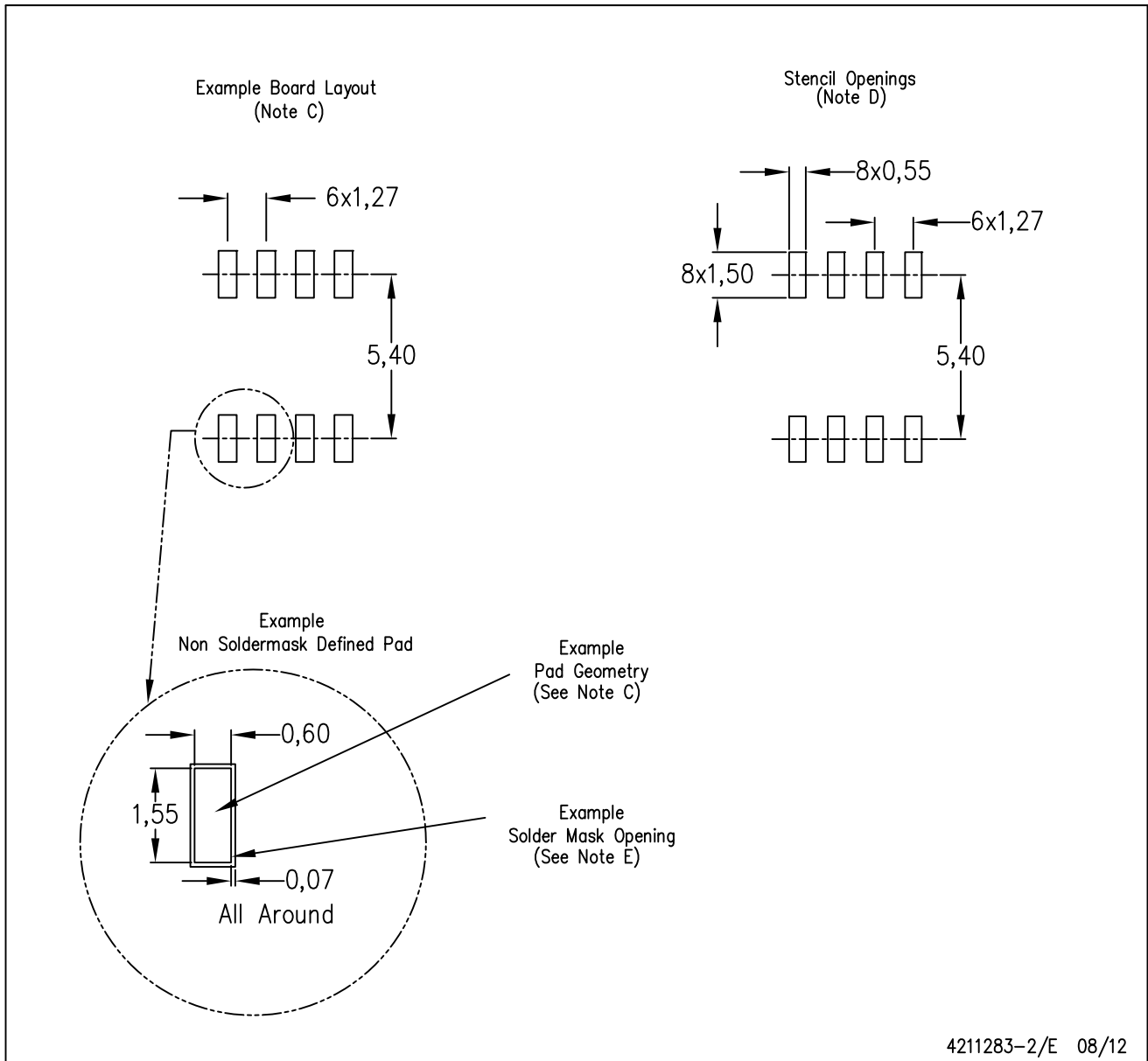
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - $\triangle C$ 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.
 - $\triangle D$ Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AA.

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com