

## 5-V Dual Differential PECL Buffer-to-TTL Translator

### FEATURES

- Dual 5-V Differential PECL-to-TTL Buffer
- 24-mA TTL Outputs
- Operating Range
  - PECL  $V_{CC} = 4.75\text{ V to }5.25\text{ V}$  with  $GND = 0\text{ V}$
- Support for Clock Frequencies of 250 MHz (TYP)
- 3.5-ns Typical Propagation Delay
- Output Default Low with Inputs Left Open or  $<1.3\text{ V}$
- Internal Input 50-k $\Omega$  Pull-Down Resistor
- Built-In Temperature Compensation
- Drop-In Compatible to the MC100ELT23

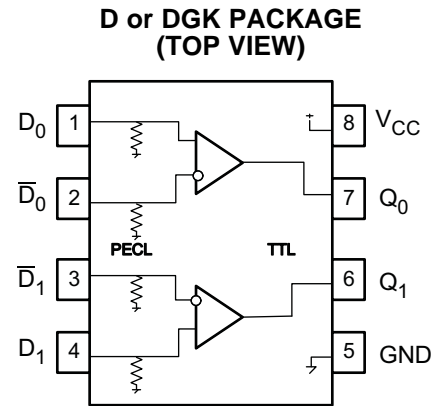
### APPLICATIONS

- Data and Clock Transmission Over Backplane
- Signaling Level Conversion for Clock or Data

### DESCRIPTION

The SN65ELT23 is a low power dual PECL-to-TTL translator device. The device includes circuitry to maintain a known logic low level when inputs are in an open condition. The SN65ELT23 is housed in an industry standard SOIC-8 package and is also available in an optional TSSOP-8 package.

### PIN ASSIGNMENT



**Table 1. Pin Descriptions**

PIN	FUNCTION
$D_0, \bar{D}_0, D_1, \bar{D}_1$	PECL inputs
$Q_0, Q_1$	TTL outputs
$V_{CC}$	Positive supply
GND	Ground

### ORDERING INFORMATION<sup>(1)(2)</sup>

PART NUMBER	PART MARKING	PACKAGE	LEAD FINISH
SN65ELT23D	ELT23	SOIC	NiPdAu
SN65ELT23DGK	SIKI	MSOP	NiPdAu

(1) 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](http://www.ti.com).

(2) Leaded device options are not initially available; contact a sales representative for further details.



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These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

PARAMETER	CONDITIONS	VALUE	UNIT
Absolute supply voltage, $V_{CC}$		6	V
Absolute input voltage, $V_I$	$GND = 0$ and $V_I \leq V_{CC}$	0 to 6	V
Output current	Continuous	50	mA
	Surge	100	
Operating temperature range		–40 to 85	°C
Storage temperature range		–65 to 150	°C

(1) 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 conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

## DISSIPATION RATINGS

PACKAGE	CIRCUIT BOARD MODEL	POWER RATING $T_A < 25^\circ\text{C}$ (mW)	THERMAL RESISTANCE, JUNCTION-TO-AMBIENT NO AIRFLOW	DERATING FACTOR $T_A > 25^\circ\text{C}$ (mW/°C)	POWER RATING $T_A = 85^\circ\text{C}$ (mW)
SOIC	Low-K	719	139	7	288
	High-K	840	119	8	336
MSOP	Low-K	469	213	5	188
	High-K	527	189	5	211

## THERMAL CHARACTERISTICS

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

PARAMETER		MIN	TYP	MAX	UNIT
$\theta_{JB}$	Junction-to-board thermal resistance	SOIC	79		°C/W
		MSOP	120		
$\theta_{JC}$	Junction-to-case thermal resistance	SOIC	98		°C/W
		MSOP	74		

## KEY ATTRIBUTES

CHARACTERISTICS	PARAMETER	VALUE
Moisture sensitivity level		Level 1
Flammability rating (oxygen index: 28 to 34)		UL 94 V-0 at 0.125 in
Internal pull down resistor		50 K $\Omega$
Electrostatic discharge	Human body model	2 KV
	Charged-device model	1.5 KV
	Machine model	200 V
Meets or exceeds JEDEC Spec EIA/JESD78 latchup test		

## PECL INPUT DC CHARACTERISTICS

At  $V_{CC} = 5.0\text{ V}$ ,  $GND = 0.0\text{ V}$  (unless otherwise noted)<sup>(1)(2)</sup>

PARAMETER	TEST CONDITIONS	$T_A = -40^\circ\text{C}$			$T_A = 25^\circ\text{C}$			$T_A = 85^\circ\text{C}$			UNIT			
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX				
$V_{IH}$	High-level input voltage, single-ended	See <sup>(3)</sup>			3835	4120		3835	4120		3835	4120	mV	
$V_{IL}$	Low-level input voltage, single-ended	See <sup>(3)</sup>			3190	2280	3525	3190	2280	3525	3190	2280	3525	mV
$V_{IHCMR}$	High-level input voltage common-mode range, differential	See <sup>(4)</sup>			2.2	5.0		2.2	5.0		2.2	5.0	V	
$I_{IH}$	High-level input current	See <sup>(3)</sup>			255			175			175			$\mu\text{A}$
$I_{IL}$	Low-level input current	See <sup>(3)</sup>			0.5			0.5			0.5			$\mu\text{A}$

- (1) The device meets the specifications after thermal balance has been established when mounted in a socket or printed circuit board with maintained transverse airflow greater than 500 lfm. Electrical parameters are assured only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.
- (2) Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{CC}$  can vary  $\pm 0.25\text{ V}$ .
- (3) TTL output  $R_L = 500\ \Omega$  to GND
- (4)  $V_{IHCMR(\min)}$  varies 1:1 with GND,  $V_{IHCMR(\max)}$  varies 1:1 with  $V_{CC}$ .

## TTL OUTPUT DC CHARACTERISTICS

At  $V_{CC} = 4.75\text{ V}$  to  $5.25\text{ V}$ ,  $T_A = -40^\circ\text{C}$  to  $85^\circ\text{C}$  (unless otherwise noted)<sup>(1)</sup>

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$I_{CCH}$	Power supply current		20	25	mA
$I_{CCL}$	Power supply current		21	27	mA
$I_{OS}$	Output short circuit current	-150		-50	mA
$V_{OH}$	High-level output voltage <sup>(2)</sup>	$I_{OH} = -3.0\text{ mA}$		$V_{CC} - 0.7\text{ V}$	V
$V_{OL}$	Low-level output voltage	$I_{OL} = 24\text{ mA}$		0.5	V

- (1) The device meets the specifications after thermal balance has been established when mounted in a socket or printed circuit board with maintained transverse airflow greater than 500 lfm. Electrical parameters are assured only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.
- (2) Max level is assured by design

## AC CHARACTERISTICS

At  $V_{CC} = 5.0\text{ V}$ ,  $GND = 0.0\text{ V}$  (unless otherwise noted)<sup>(1)(2)(3)</sup>

PARAMETER	TEST CONDITIONS	$T_A = -40^\circ\text{C}$			$T_A = 25^\circ\text{C}$			$T_A = 85^\circ\text{C}$			UNIT	
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX		
$f_{\text{MAX}}$	Max switching frequency	at $V_{ol} < 0.5\text{ V}$ and $V_{oh} > 2.4\text{ V}$ (see Figure 5)			250			250			MHz	
$t_{\text{PLH}}/t_{\text{PHL}}$	Propagation delay times to output	2.0	3.5	5.0	2.0	3.7	5.0	2.0	3.9	5.0	ns	
$t_{\text{JITTER}}$	Random clock jitter (RMS)	4.1			10			3.7			10	ps
$V_{\text{PP}}$	Input voltage swing <sup>(4)</sup>	200			1000			200			1000	mV
$t_r/t_f$	Output rise times (10%–90%)	1.0	1.7	3.0	1.0	1.8	3.0	1.0	1.9	3.0	ns	
	Output fall times (10%–90%)	0.5	1.0	1.6	0.5	1.1	1.6	0.5	1.3	1.6		

- (1) The device meets the specifications after thermal balance has been established when mounted in a socket or printed circuit board with maintained transverse airflow greater than 500 lfm. Electrical parameters are assured only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.
- (2)  $V_{CC}$  can vary  $\pm 0.25\text{ V}$ .
- (3) TTL output  $R_L = 500\ \Omega$  to GND and  $C_L = 20\text{ pF}$  to GND, see Figure 1.
- (4)  $V_{\text{PP}(\min)}$  is the minimum input swing for which AC parameters are assured.

Typical Output Loading Used for Device Evaluation

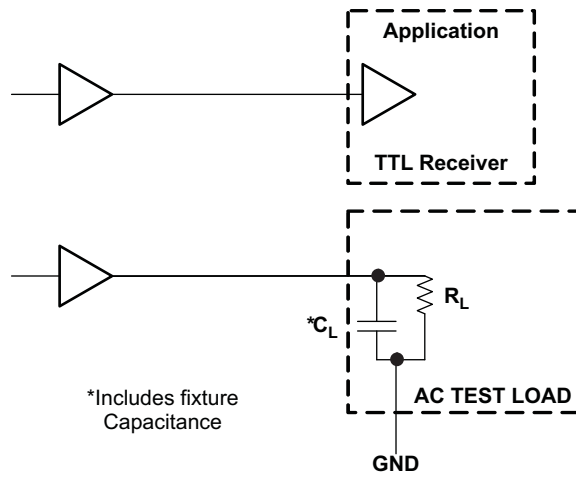


Figure 1. TTL Output Loading Used for Device Evaluation



Figure 2. Output Rise and Fall Times

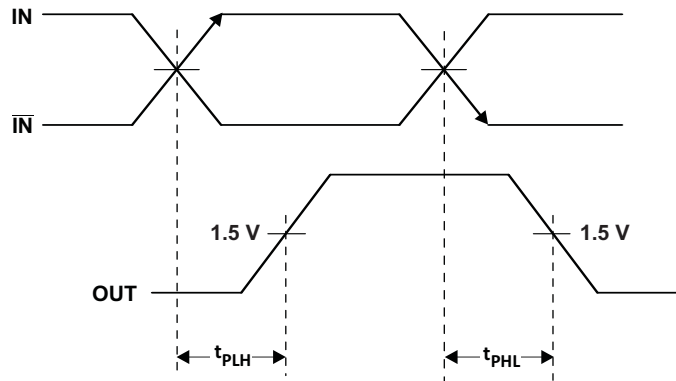


Figure 3. Output Propagation Delay

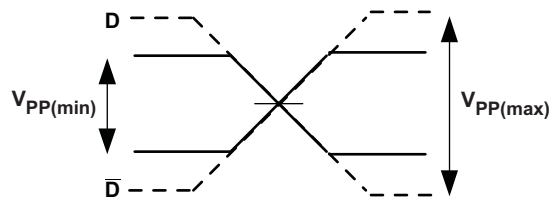


Figure 4. Input Voltage Swing

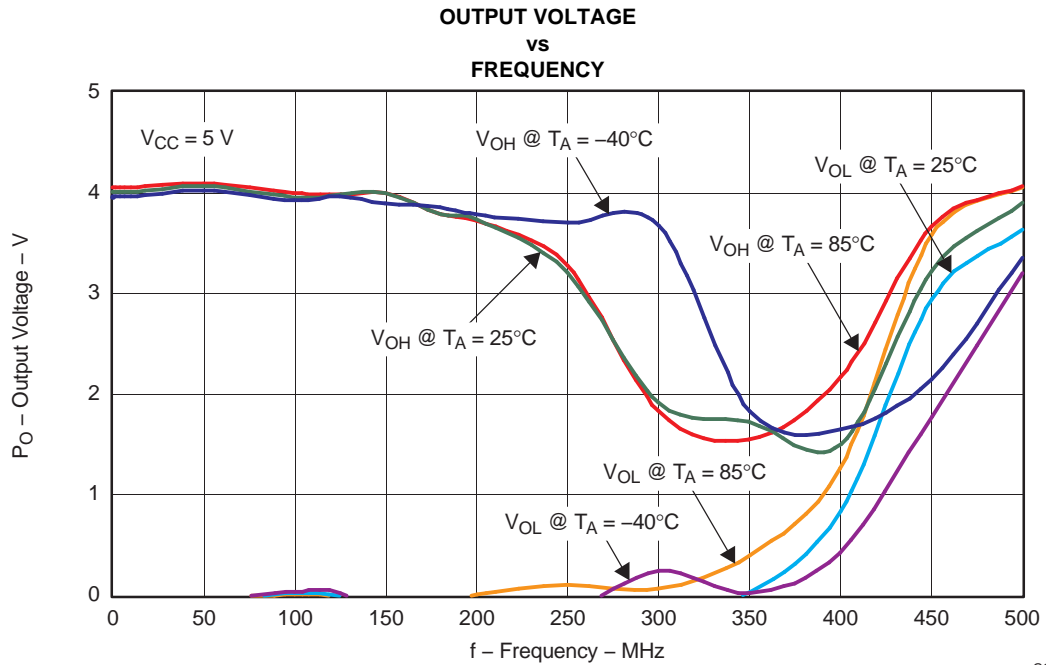


Figure 5.

G001

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN65ELT23D	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65ELT23DGK	ACTIVE	MSOP	DGK	8	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65ELT23DGKR	ACTIVE	MSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN65ELT23DR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

<sup>(1)</sup> 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.

<sup>(2)</sup> 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)

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

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**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
SN65ELT23DGKR	MSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
SN65ELT23DR	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)
SN65ELT23DGKR	MSOP	DGK	8	2500	346.0	346.0	29.0
SN65ELT23DR	SOIC	D	8	2500	346.0	346.0	29.0



DGK (S-PDSO-G8)

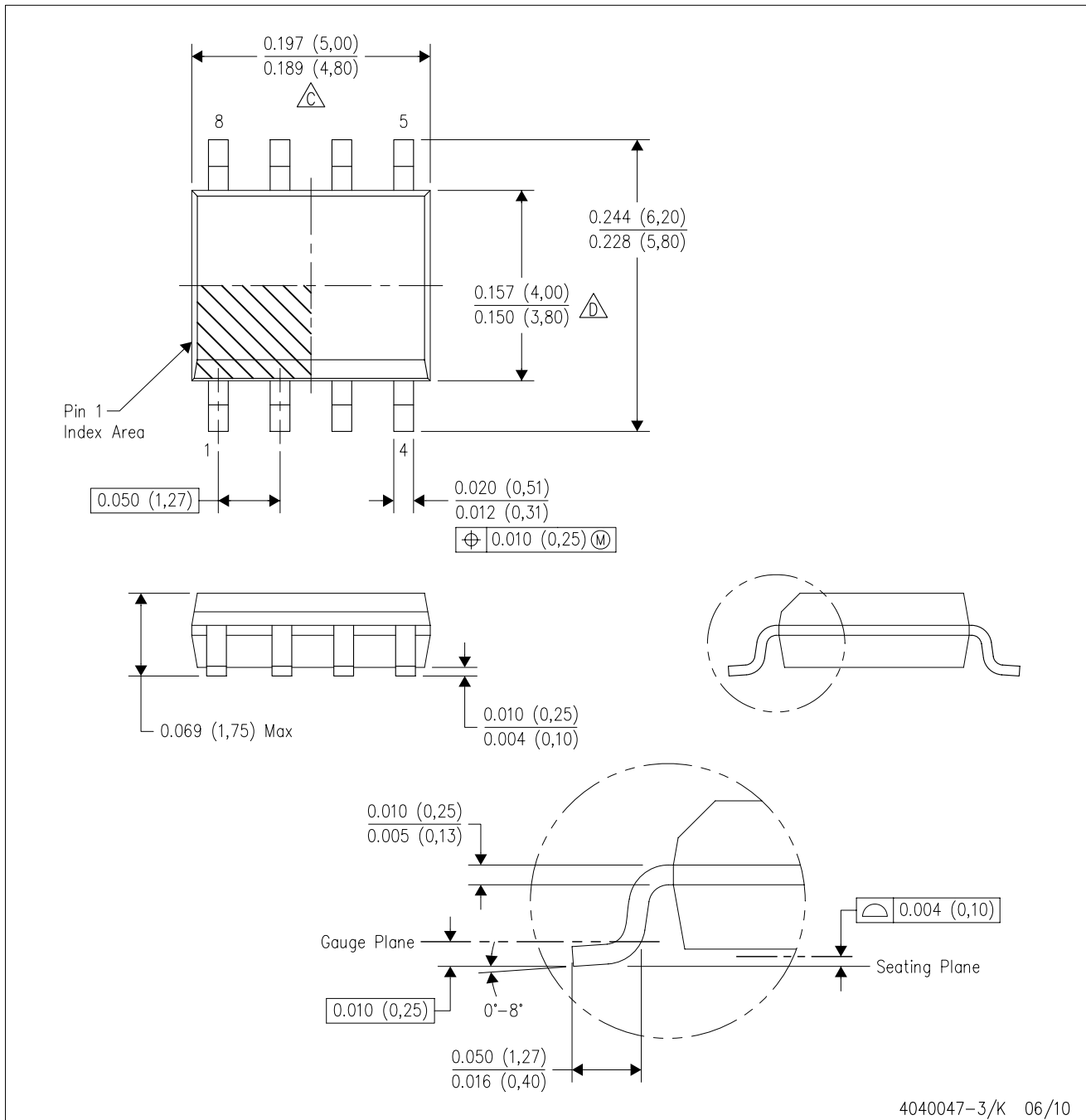
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 per end.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.50 per side.
  - E. Falls within JEDEC MO-187 variation AA, except interlead flash.

D (R-PDSO-G8)

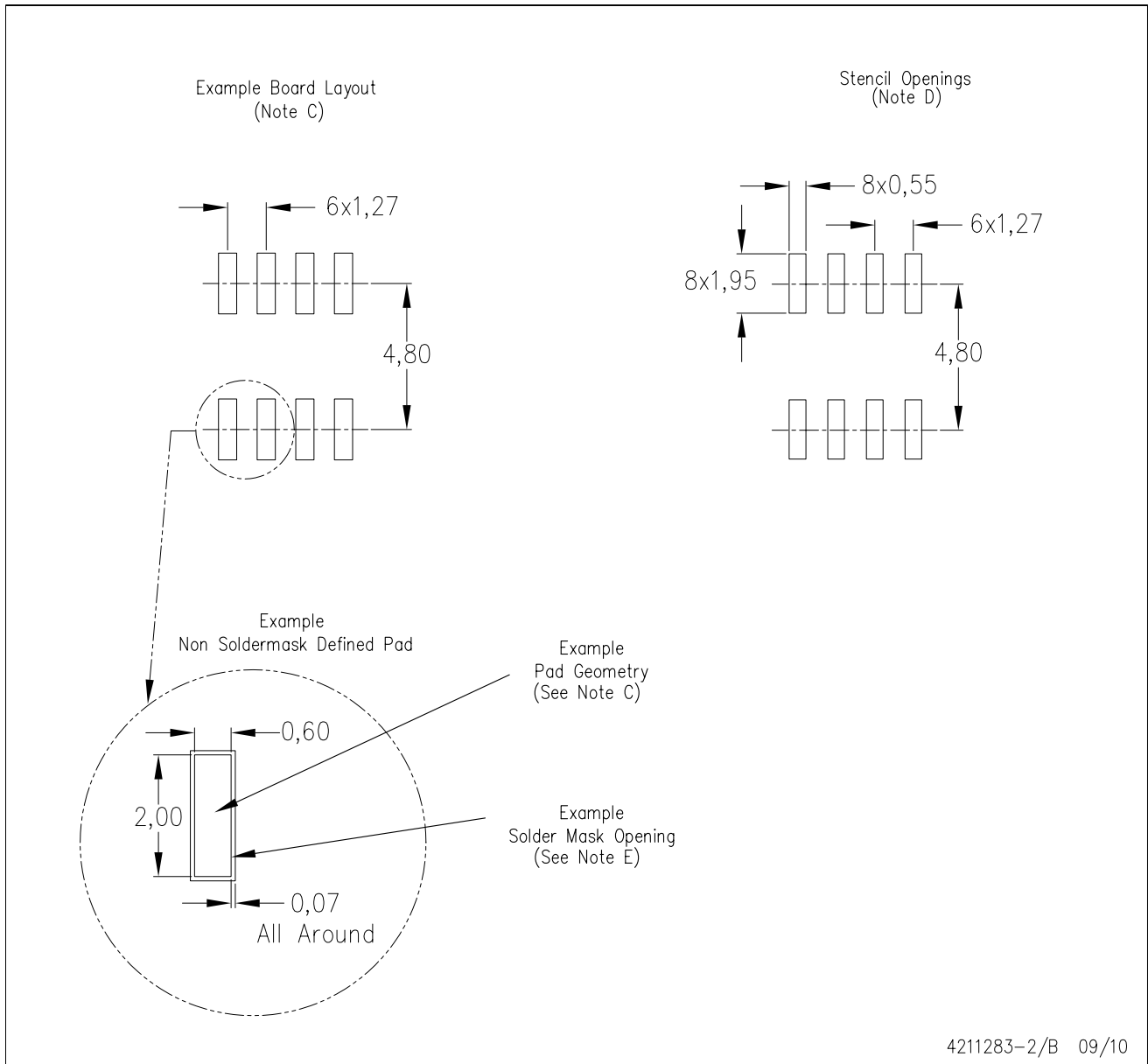
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
  - E. Reference JEDEC MS-012 variation AA.

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - 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.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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