DS9638 RS-422 Dual High Speed Differential Line Driver

Check for Samples: DS9638

FEATURES

- **Single 5V Supply**
- **Schottky Technology**
- **TTL and CMOS Compatible Inputs**
- **Output Short Circuit Protection**
- **Input Clamp Diodes**
- **Complementary Outputs**
- **Minimum Output Skew (<1.0 ns typical)**
- **50 mA Output Drive Capability for 50Ω Transmission Lines**
- **Meets EIA RS-422 Specifications**
- **Propagation Delay of Less Than 10 ns**
- **"Glitchless" Differential Output**
- **Delay Time Stable with V_{CC} and Temperature Variations (<2.0 ns typical) (See Figure 4)**
- **Extended Temperature Range**

DESCRIPTION

The DS9638 is a Schottky, TTL compatible, dual differential line driver designed specifically to meet the EIA Standard RS-422 specifications. It is designed to provide unipolar differential drive to twisted pair or parallel wire transmission lines. The inputs are TTL compatible. The outputs are similar to totem pole TTL outputs, with active pull-up and pull-down. The device features a short circuit protected active pull-up with low output impedance and is specified to drive 50Ω transmission lines at high speed. The mini-DIP provides high package density.

Connection Diagram

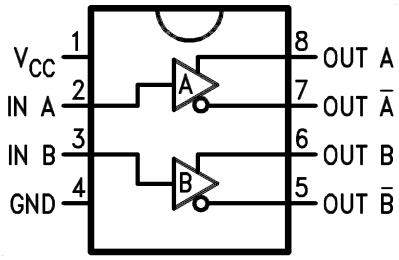


Figure 1. 8-Lead PDIP or CDIP or SOIC (Top View)
See P or NAB0008A or D Package

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(1)(2)

Storage Temperature Range		
Ceramic DIP		−65°C to +175°C
Molded DIP and SO-8		−65°C to +150°C
Lead Temperature	CDIP (Soldering, 60 sec.)	300°C
	PDIP (Soldering, 10 sec.)	265°C
Maximum Power Dissipation at 25°C(3)	CDIP Package	1300 mW
	PDIP Package	930 mW
	SOIC Package	810 mW
V_{CC} Lead Potential to Ground		−0.5V to 7V
Input Voltage		−0.5V to +7V

(1) "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The tables of "Electrical Characteristics provide conditions for actual device operation.

(2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/ Distributors for availability and specifications.

(3) Derate CDIP package 8.7 mW/°C above 25°C; derate PDIP package 7.5 mW/°C above 25°C; derate SOIC package 6.5 mW°C above 25°C.

Recommended Operating Conditions

	DS9638M			DS9638C			
	Min	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Units**
Supply Voltage (V_{CC})	4.5	5.0	5.5	4.75	5.0	5.25	V
Output Current HIGH (I_{OH})			−50			−50	mA
Output Current LOW (I_{OL})			50	40		50	mA
Operating Temperature (T_A)	−55	25	125	0	25	70	°C

Electrical Characteristics (1)(2)

Over recommended operating temperature and supply voltage ranges, unless otherwise specified

Symbol	Parameter	Conditions		Min	Typ	Max	Units
V_{IH}	Input Voltage HIGH			2.0			V
V_{IL}	Input Voltage LOW	0°C to +70°C				0.8	V
		−55°C to +125°C				0.5	
V_{IC}	Input Clamp Voltage	V_{CC} = Min, I_I = −18 mA			−1.0	−1.2	V
V_{OH}	Output Voltage HIGH	V_{CC} = Min, V_{IH} = $V_{IH\ Min}$, V_{IL} = $V_{IL\ Max}$	I_{OH} = −10 mA	2.5	3.5		V
			I_{OH} = −40 mA	2.0			
V_{OL}	Output Voltage LOW	V_{CC} = Min, V_{IH} = $V_{IH\ Min}$, V_{IL} = $V_{IL\ Max}$, I_{OL} = 40 mA				0.5	V
I_I	Input Current at Maximum Input Voltage	V_{CC} = Max, $V_{I\ Max}$ = 5.5V				50	µA
I_{IH}	Input Current HIGH	V_{CC} = Max, V_{IH} = 2.7V				25	µA
I_{IL}	Input Current LOW	V_{CC} = Max, V_{IL} = 0.5V				−200	µA
I_{OS}	Output Short Circuit Current	V_{CC} = Max, V_O = 0V (2)		−50		−150	mA
V_T, $\overline{V}_T$	Terminated Output Voltage	See Equivalent Circuit		2.0			V
V_T–$\overline{V}_T$	Output Balance					0.4	V
V_{OS}, $\overline{V}_{OS}$	Output Offset Voltage					3.0	V
V_{OS}–$\overline{V}_{OS}$	Output Offset Balance					0.4	V
I_X	Output Leakage Current	T_A = 25°C, −0.25V < V_X < 5.5V				100	µA
I_{CC}	Supply Current (Both Drivers)	V_{CC} = 5.5V, All input at 0V, No Load			45	65	mA

(1) Unless otherwise specified min/max limits apply across the −55°C to +125°C temperature range for the DS9638M and across the 0°C to +70°C range for the DS9638C. All typicals are given for V_{CC} = 5V and T_A = 25°C.

(2) All currents into the device pins are positive; all currents out of the device pins are negative. All voltages are referenced to ground unless otherwise specified.

Switching Characteristics

V_{CC} = 5.0V, T_A = 25°C.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{PHL}	Propagation Delay	C_L = 15 pF, R_L = 100Ω, See Figure 3		10	20	ns
t_{PLH}				10	20	ns
t_f	Fall Time, 90%–10%			10	20	ns
t_r	Rise Time, 10%–90%			10	20	ns
t_{PO}–$t_{\overline{PO}}$	Skew Between Outputs A/$\overline{A}$ and B/$\overline{B}$			1.0		ns

Equivalent Circuit

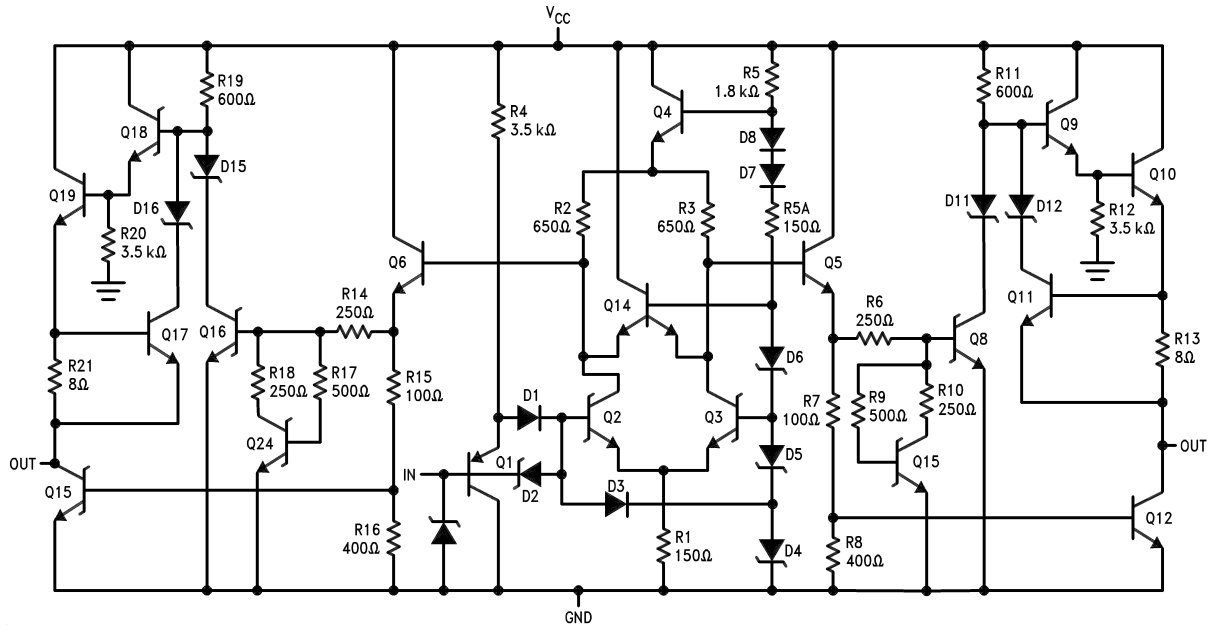


Figure 2. Equivalent Circuit

DC Test Circuit

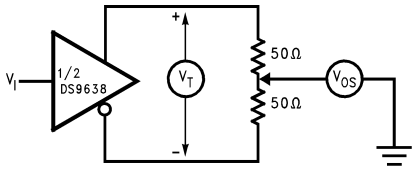
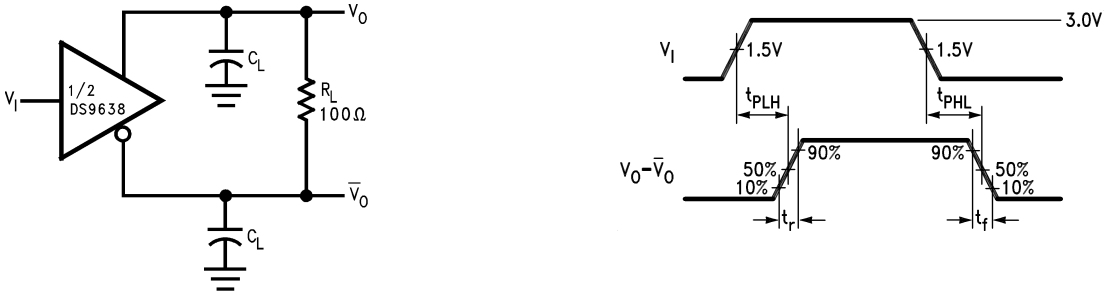


Figure 3. Terminated Output Voltage and Output Balance



(1) The pulse generator has the following characteristics:
C_L includes probe and jig capacitance.
PRR = 500 kHz, t_W = 100 ns,
$t_r \leq 5.0$ ns, $Z_O = 50\Omega$.

Figure 4. AC Test Circuit and Voltage Waveform

Typical Characteristics

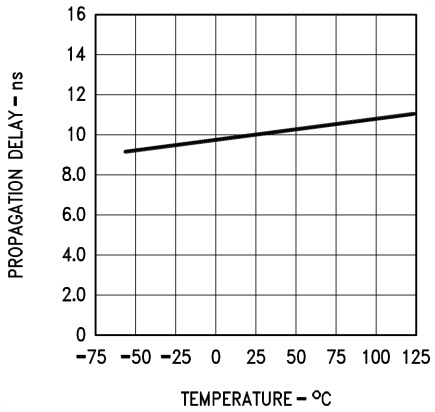


Figure 5. Typical Delay Characteristics (a)

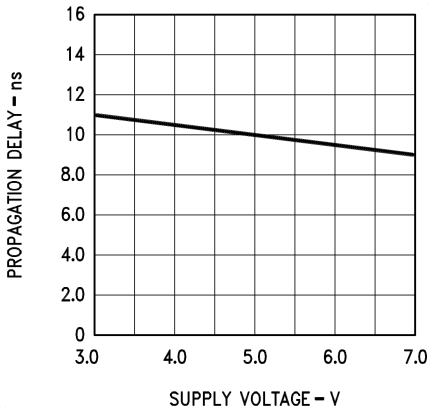


Figure 6. Typical Delay Characteristics (b)

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
DS9638CM	ACTIVE	SOIC	D	8	95	TBD	Call TI	Call TI	0 to 70	DS963 8CM	Samples
DS9638CM/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	DS963 8CM	Samples
DS9638CMX	ACTIVE	SOIC	D	8	2500	TBD	Call TI	Call TI	0 to 70	DS963 8CM	Samples
DS9638CMX/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	DS963 8CM	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.

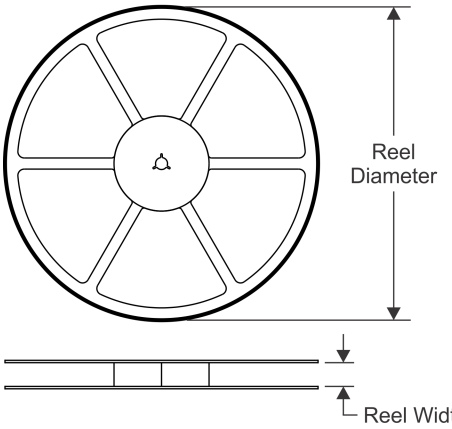
(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been 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.

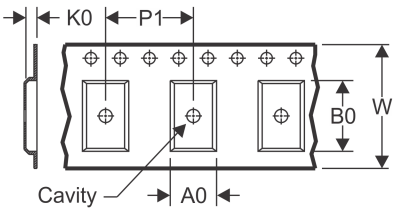
(4) Only one of markings shown within the brackets will appear on the physical device.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

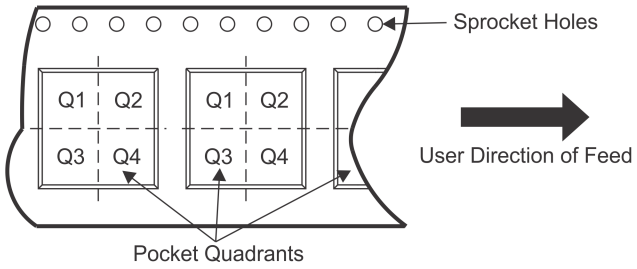


TAPE DIMENSIONS



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

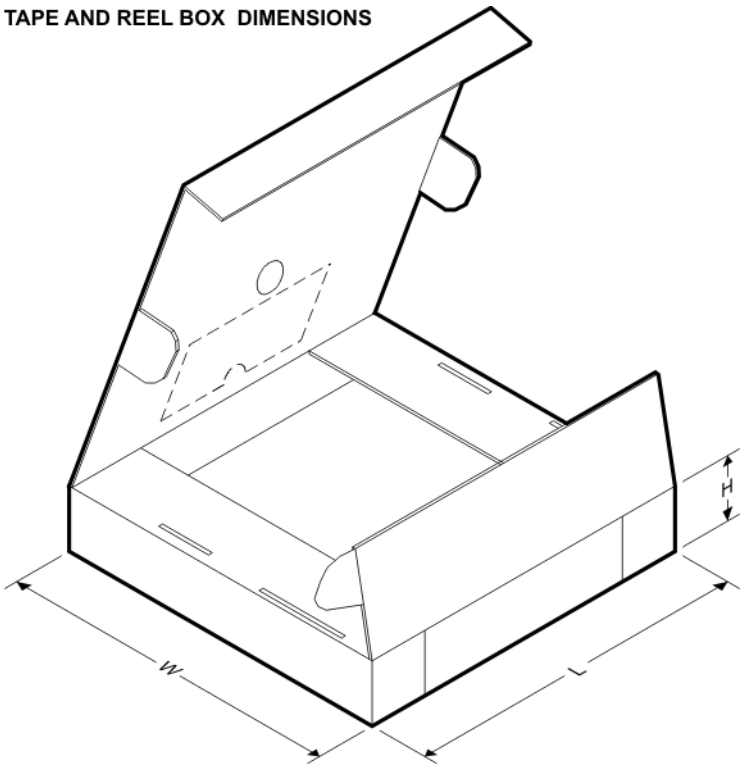
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
DS9638CMX	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
DS9638CMX/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1

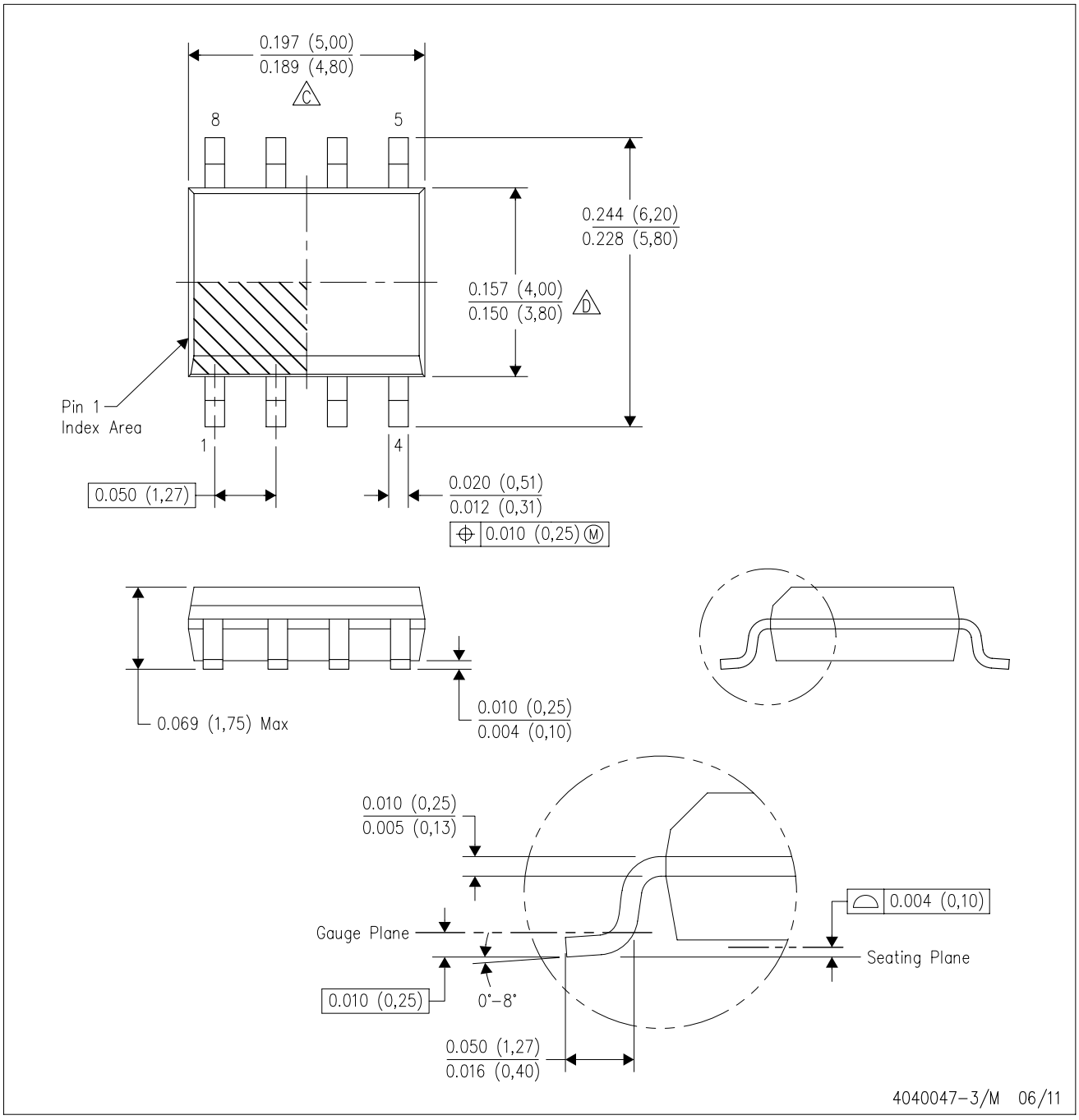
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
DS9638CMX	SOIC	D	8	2500	349.0	337.0	45.0
DS9638CMX/NOPB	SOIC	D	8	2500	349.0	337.0	45.0

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.
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.
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.

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