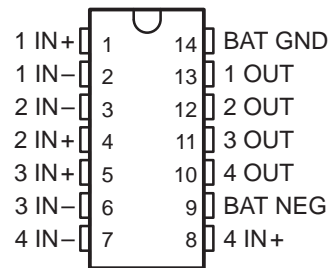


DS3680 QUAD TELEPHONE RELAY DRIVER

SLRS014C – MARCH 1986 – REVISED SEPTEMBER 1995

- Designed for –52-V Battery Operation
- 50-mA Output Current Capability
- Input Compatible With TTL and CMOS
- High Common-Mode Input Voltage Range
- Very Low Input Current
- Fail-Safe Disconnect Feature
- Built-in Output Clamp Diode
- Direct Replacement for National DS3680 and Fairchild μ A3680

D OR N PACKAGE
(TOP VIEW)

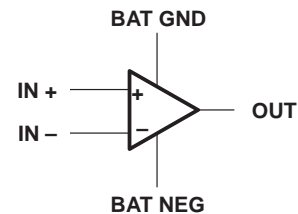


description

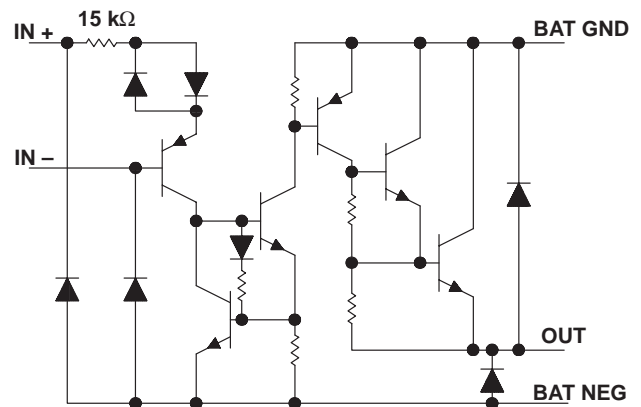
The DS3680 telephone relay driver is a monolithic integrated circuit designed to interface –48-V relay systems to TTL or other systems in telephone applications. It is capable of sourcing up to 50 mA from standard –52-V battery power. To reduce the effects of noise and IR drop between logic ground and battery ground, these drivers are designed to operate with a common-mode input range of ± 20 V referenced to battery ground. The common-mode input voltages for the four drivers can be different, so a wide range of input elements can be accommodated. The high-impedance inputs are compatible with positive TTL and CMOS levels or negative logic levels. A clamp network is included in the driver outputs to limit high-voltage transients generated by the relay coil during switching. The complementary inputs ensure that the driver output is off as a fail-safe condition when either output is open.

The DS3680 is characterized for operation from 0°C to 70°C.

symbol (each driver)



schematic diagram (each driver)



All resistor values shown are nominal.

DS3680

QUAD TELEPHONE RELAY DRIVER

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

Supply voltage range at BAT NEG, V_{BAT-} (see Note 1)	–70 V to 0.5 V
Input voltage range with respect to BAT GND	–70 V to 20 V
Input voltage range with respect to BAT NEG	–0.5 V to 70 V
Differential input voltage, V_{ID} (see Note 2)	± 20 V
Output current, I_O : Resistive load	–100 mA
Inductive load	–50 mA
Inductive output load	5 H
Continuous total dissipation	See Dissipation Rating Table
Operating free-air temperature range, T_A	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 60 seconds	260°C

- NOTES: 1. All voltages are with respect to BAT GND, unless otherwise specified.
2. Differential input voltages are at the noninverting input terminal IN+ with respect to the inverting input terminal IN–.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING
D	950 mW	7.6 mW/°C	608 mW
N	1150 mW	9.2 mW/°C	736 mW

recommended operating conditions

	MIN	MAX	UNIT
Supply voltage, V_{BAT-}	–10	–60	V
Input voltage, either input	–20†	20	V
High-level differential input voltage, V_{IDH}	2	20	V
Low-level differential input voltage, V_{IDL}	–20†	0.8	V
Operating free-air temperature, T_A	0	70	°C

† The algebraic convention, in which the less positive (more negative) limit is designated minimum, is used in this data sheet for input voltage levels.

electrical characteristics over recommended operating free-air temperature range, $V_{BAT-} = -52$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP‡	MAX	UNIT
I_{IH} High-level input current (into IN+)	$V_{ID} = 2$ V		40	100	μA
	$V_{ID} = 7$ V		375	1000	
I_{IL} Low-level input current (into IN+)	$V_{ID} = 0.4$ V		0.01	5	μA
	$V_{ID} = -7$ V		–1	–100	
$V_{O(on)}$ On-stage output voltage	$I_O = 50$ mA, $V_{ID} = 2$ V	–1.6		–2.1	V
$I_{O(off)}$ Off-stage output current	$V_O = V_{BAT-}$, $V_{ID} = 0.8$ V	–2		–100	μA
	Inputs open	–2		–100	
I_R Clamp diode reverse current	$V_O = 0$		2	100	μA
V_{OK} Output clamp voltage	$I_O = 50$ mA		0.9	1.2	V
	$I_O = -50$ mA, $V_{BAT-} = 0$		–0.9	–1.2	
$I_{BAT(on)}$ On-state battery current	All drivers on		–2	–4.4	mA
$I_{BAT(off)}$ Off-state battery current	All drivers off		–1	–100	μA

‡ All typical values are at $T_A = 25^\circ\text{C}$.



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switching characteristics $V_{BAT-} = -52\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{on}	Turn-on time	$V_{ID} = 3\text{-V pulse}$, $R_L = 1\text{ k}\Omega$, $L = 1\text{ H}$, See Figure 2		1	10	μs
t_{off}	Turn-off time			1	10	μs

PARAMETER MEASUREMENT INFORMATION

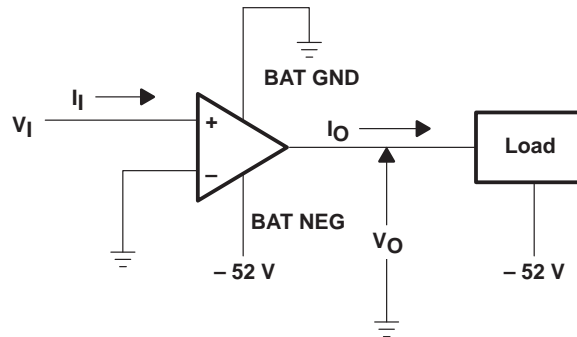


Figure 1. Generalized Test Circuit, Each Driver

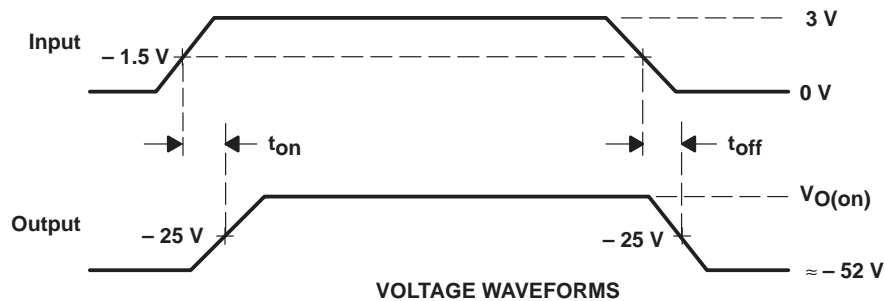
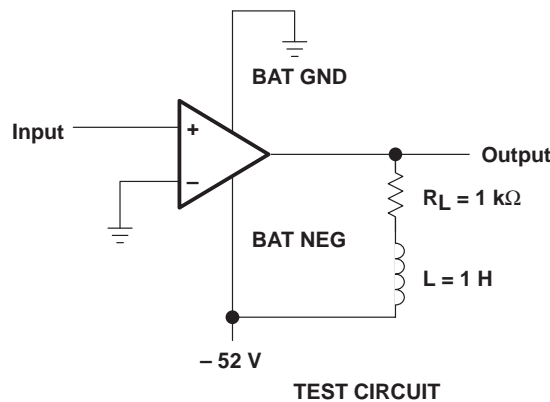


Figure 2. Test Circuit and Voltage Waveforms, Each Driver

DS3680 QUAD TELEPHONE RELAY DRIVER

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APPLICATION INFORMATION

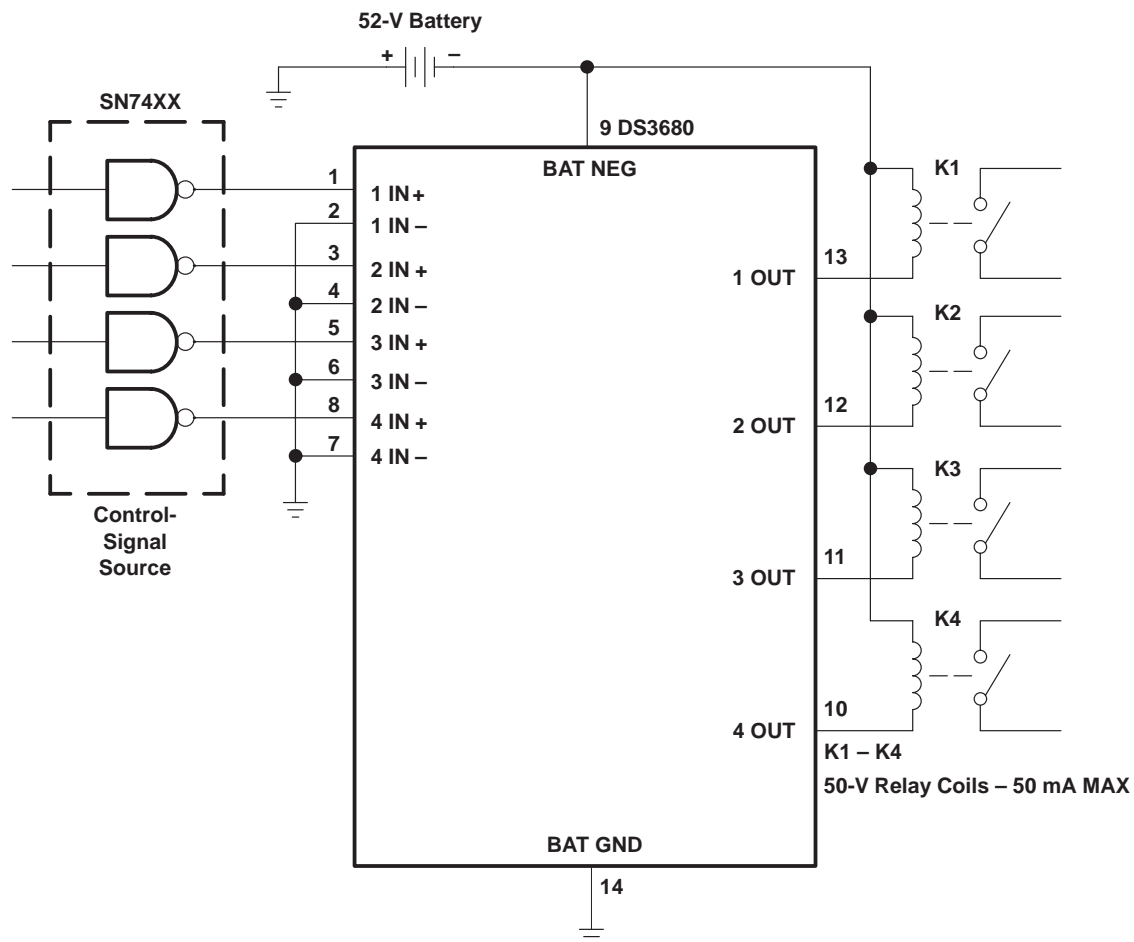


Figure 3. Relay Driver

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
DS3680D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
DS3680DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
DS3680DG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
DS3680DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
DS3680DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
DS3680DRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
DS3680N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
DS3680NE4	ACTIVE	PDIP	N	14	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.

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.

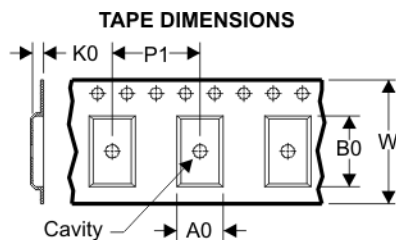
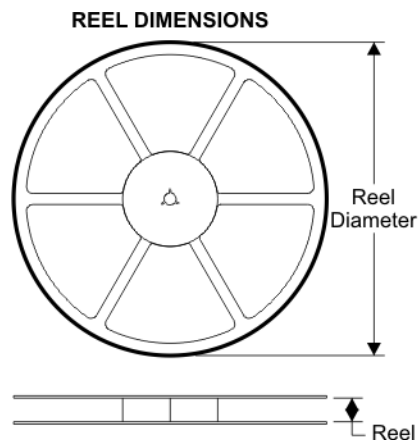
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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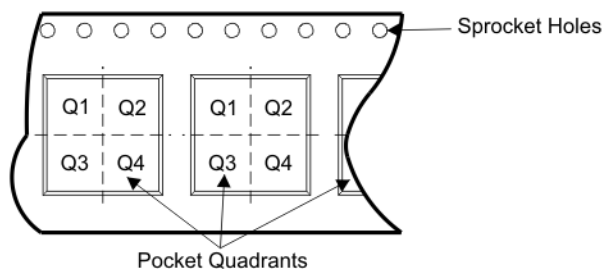
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TAPE AND REEL BOX INFORMATION



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



Device	Package	Pins	Site	Reel Diameter (mm)	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
DS3680DR	D	14	SITE 41	330	16	6.5	9.0	2.1	8	16	Q1

TAPE AND REEL BOX DIMENSIONS



Device	Package	Pins	Site	Length (mm)	Width (mm)	Height (mm)
DS3680DR	D	14	SITE 41	346.0	346.0	33.0

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS **	14	16	18	20
DIM				
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



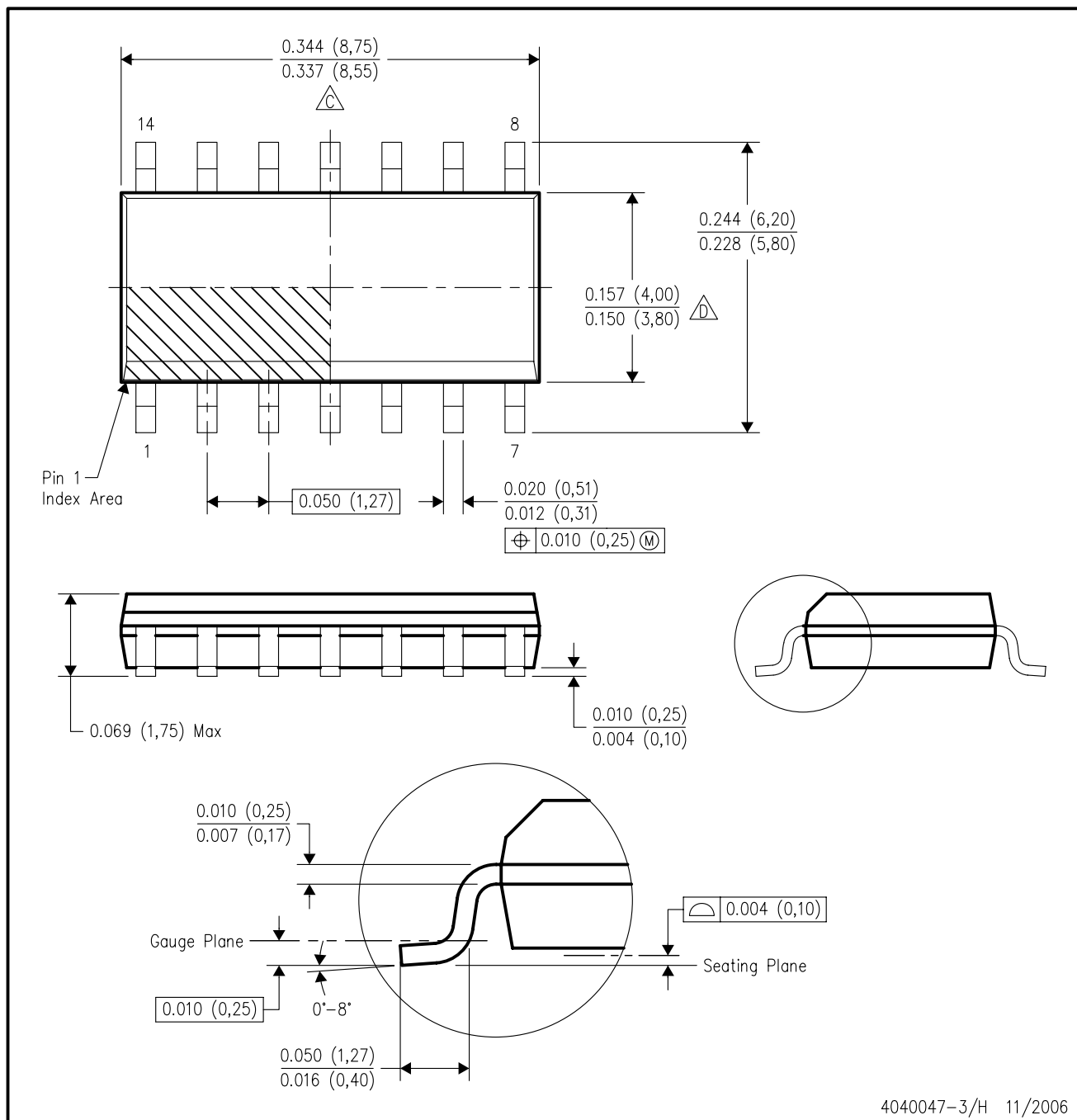
14/18 Pin Only
20 Pin vendor option

4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - The 20 pin end lead shoulder width is a vendor option, either half or full width.

D (R-PDSO-G14)

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 AB.

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