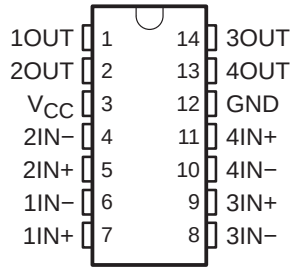
- **Single Supply or Dual Supplies**
- **Wide Range of Supply Voltage . . . 2 V to 28 V**
- **Low Supply-Current Drain Independent of Supply Voltage . . . 0.8 mA Typ**
- **Low Input Bias Current . . . 25 nA Typ**
- **Low Input Offset Current . . . 3 nA Typ**
- **Low Input Offset Voltage . . . 3 mV Typ**
- **Common-Mode Input Voltage Range Includes Ground**
- **Differential Input Voltage Range Equal to Maximum-Rated Supply Voltage . . . ±28 V**
- **Low Output Saturation Voltage**
- **Output Compatible With TTL, MOS, and CMOS**

D OR N PACKAGE
(TOP VIEW)



description/ordering information

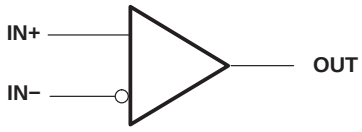
This device consists of four independent voltage comparators that are designed to operate from a single power supply over a wide range of voltages. Operation from dual supplies also is possible as long as the difference between the two supplies is 2 V to 28 V and V_{CC} is a least 1.5 V more positive than the input common-mode voltage. Current drain is independent of the supply voltage. The outputs can be connected to other open-collector outputs to achieve wired-AND relationships.

ORDERING INFORMATION

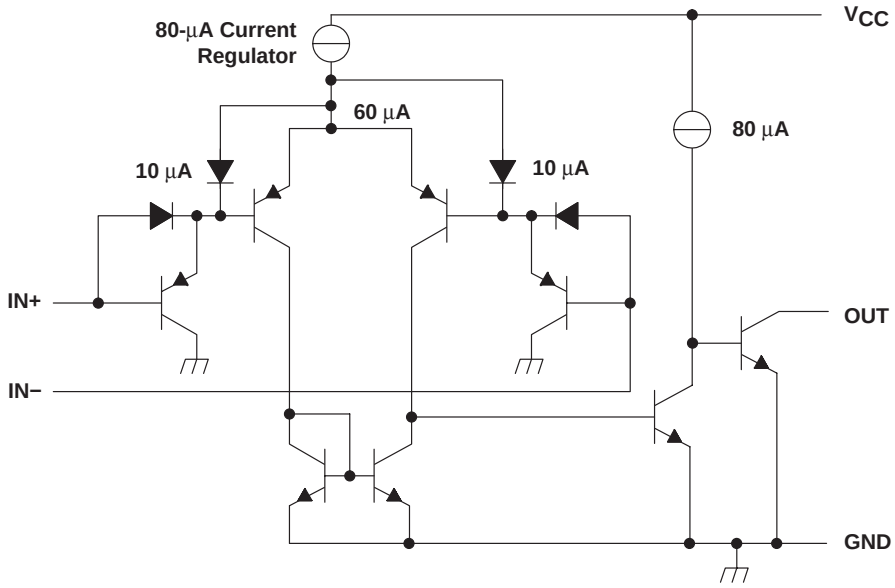
T_A	V_{IO}max AT 25°C	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
−40°C to 85°C	20 mV	PDIP (N)	Tube of 25	LM3302N	LM3302N
		SOIC (D)	Tube of 50	LM3302D	LM3302
			Reel of 2500	LM3302DR	

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

symbol (each comparator)



schematic



Current values shown are nominal.

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

Supply voltage, V_{CC} (see Note 1) . . . . . 28 V
Differential input voltage, V_{ID} (see Note 2) . . . . . ±28 V
Input voltage range, V_I (either input) . . . . . −0.3 V to 28 V
Output voltage, V_O . . . . . 28 V
Output current, I_O . . . . . 20 mA
Duration of output short-circuit to ground (see Note 3) . . . . . Unlimited
Package thermal impedance, θ_{JA} (see Notes 4 and 5): D package . . . . . 86°C/W
N package . . . . . 80°C/W
Operating virtual junction temperature, T_J . . . . . 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or N package . . . . . 260°C
Storage temperature range, T_{stg} . . . . . −65°C to 150°C

† Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. There are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the recommended operating conditions section of this specification is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. All voltage values, except differential voltages, are with respect to the network ground.
2. Differential voltages are at IN+ with respect to IN−.
3. Short circuits from the output to V_{CC} can cause excessive heating and eventual destruction.
4. Maximum power dissipation is a function of $T_J(max)$, θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
5. The package thermal impedance is calculated in accordance with JESD 51-7.

electrical characteristics at specified free-air temperature, V_{CC} = 5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS†		T_A	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	V_{CC} = 5 V to 28 V, V_O = 1.4 V	$V_{IC} = V_{ICR}$min,	25°C		3	20	mV
				−40°C to 85°C			40	
I_{IO}	Input offset voltage	V_O = 1.4 V		25°C		3	100	nA
				−40°C to 85°C			300	
I_{IB}	Input bias current			25°C		−25	−500	nA
				−40°C to 85°C			−1000	
V_{ICR}	Common-mode input voltage range			25°C	0 to V_{CC}−1.5			V
				−40°C to 85°C	0 to V_{CC}−2			
A_{VD}	Large-signal differential voltage amplification	V_{CC} = 15 V, R_L = 15 Ω to V_{CC}	V_O = 1.4 V to 11.4 V,	25°C	2	30		V/mV
I_{OH}	High-level output current	V_{ID} = 1 V,	V_{OH} = 5 V	25°C		0.1		nA
				−40°C to 85°C			1	µA
V_{OL}	Low-level output voltage	V_{ID} = −1 V,	I_{OL} = 4 mA	25°C		150	500	mV
				−40°C to 85°C			700	
I_{OL}	Low-level output current	V_{ID} = 1 V,	V_{OL} = 1.5 V	25°C	6	16		mA
I_{CC}	Supply current (four comparators)	V_O = 2.5 V,	No load	25°C		0.8		mA

† All characteristics are measured with zero common-mode input voltage unless otherwise specified.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER	TEST CONDITIONS				TYP	UNIT
Response time	R_L = 5.1 kΩ to 5 V,	C_L = 15 pF‡,	See Note 6	100-mV input step with 5-mV overdrive	1.3	µs
				TTL-level input step	0.3	

‡ C_L includes probe and jig capacitance.

NOTE 6: The response time specified is the interval between the input step function and the instant when the output crosses 1.4 V.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM3302D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LM3302	Samples
LM3302DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LM3302	Samples
LM3302DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LM3302	Samples
LM3302N	ACTIVE	PDIP	N	14	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	-40 to 85	LM3302N	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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device 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 Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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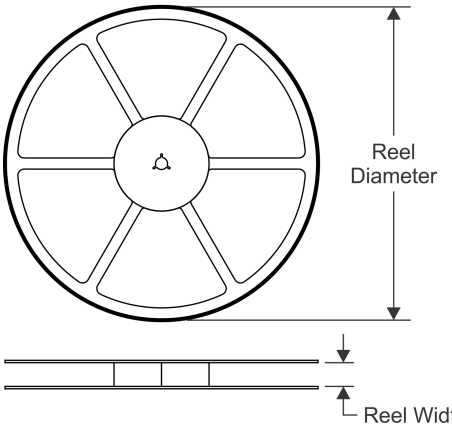
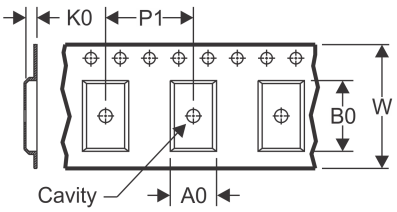
TAPE AND REEL INFORMATION

REEL DIMENSIONS

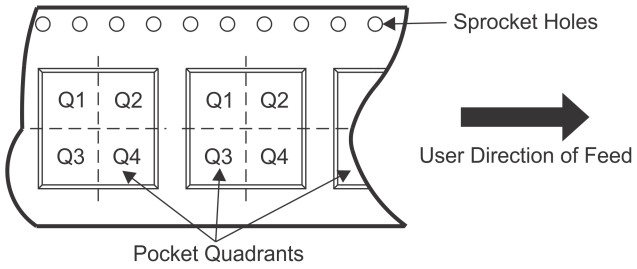


TAPE DIMENSIONS



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

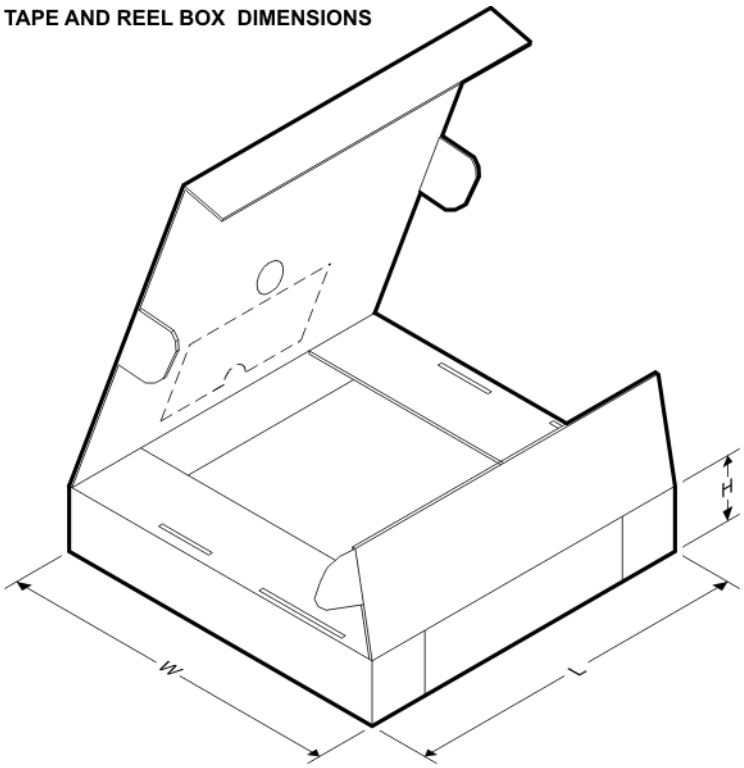
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
LM3302DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
LM3302DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1

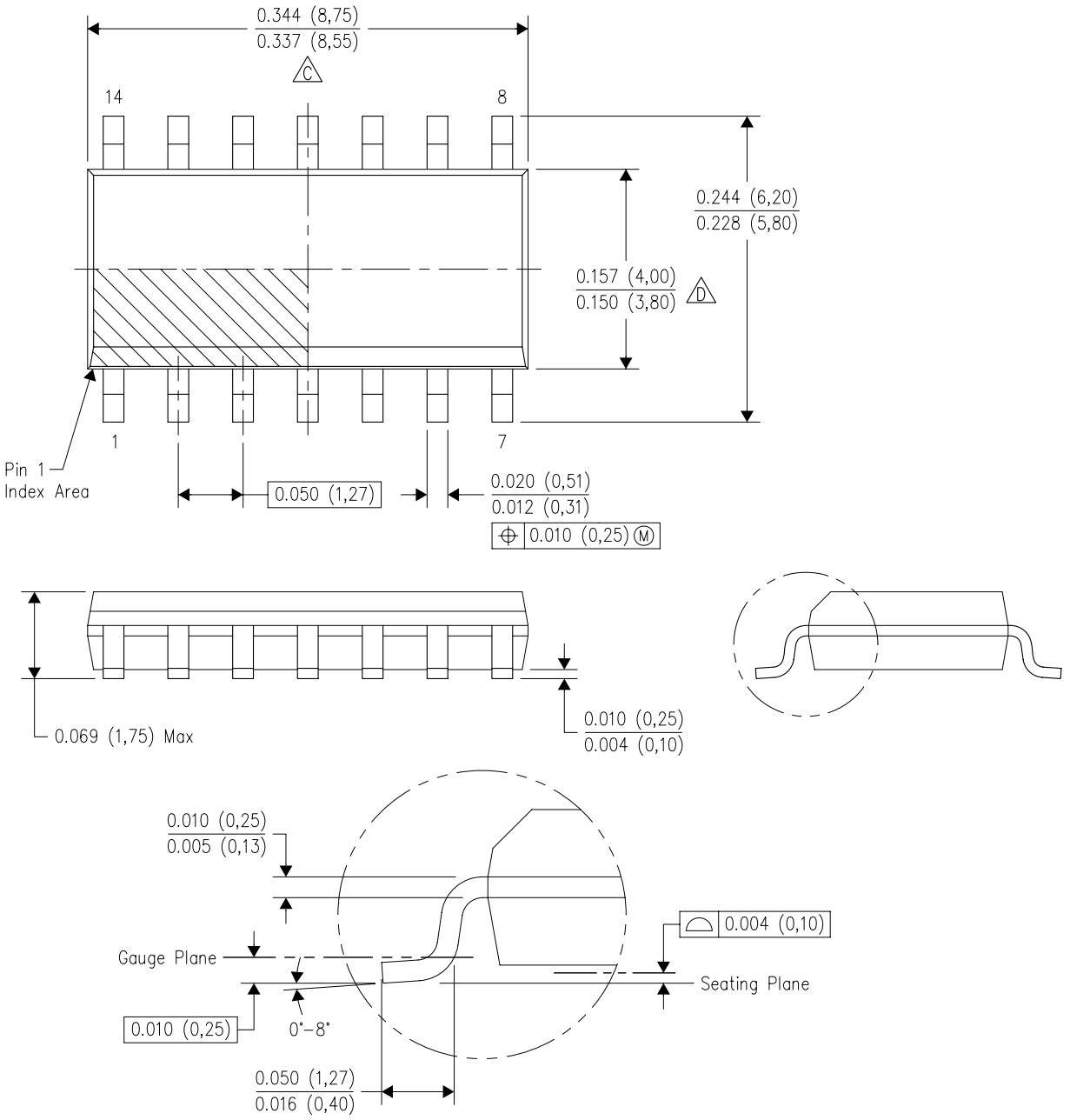
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM3302DR	SOIC	D	14	2500	333.2	345.9	28.6
LM3302DR	SOIC	D	14	2500	367.0	367.0	38.0

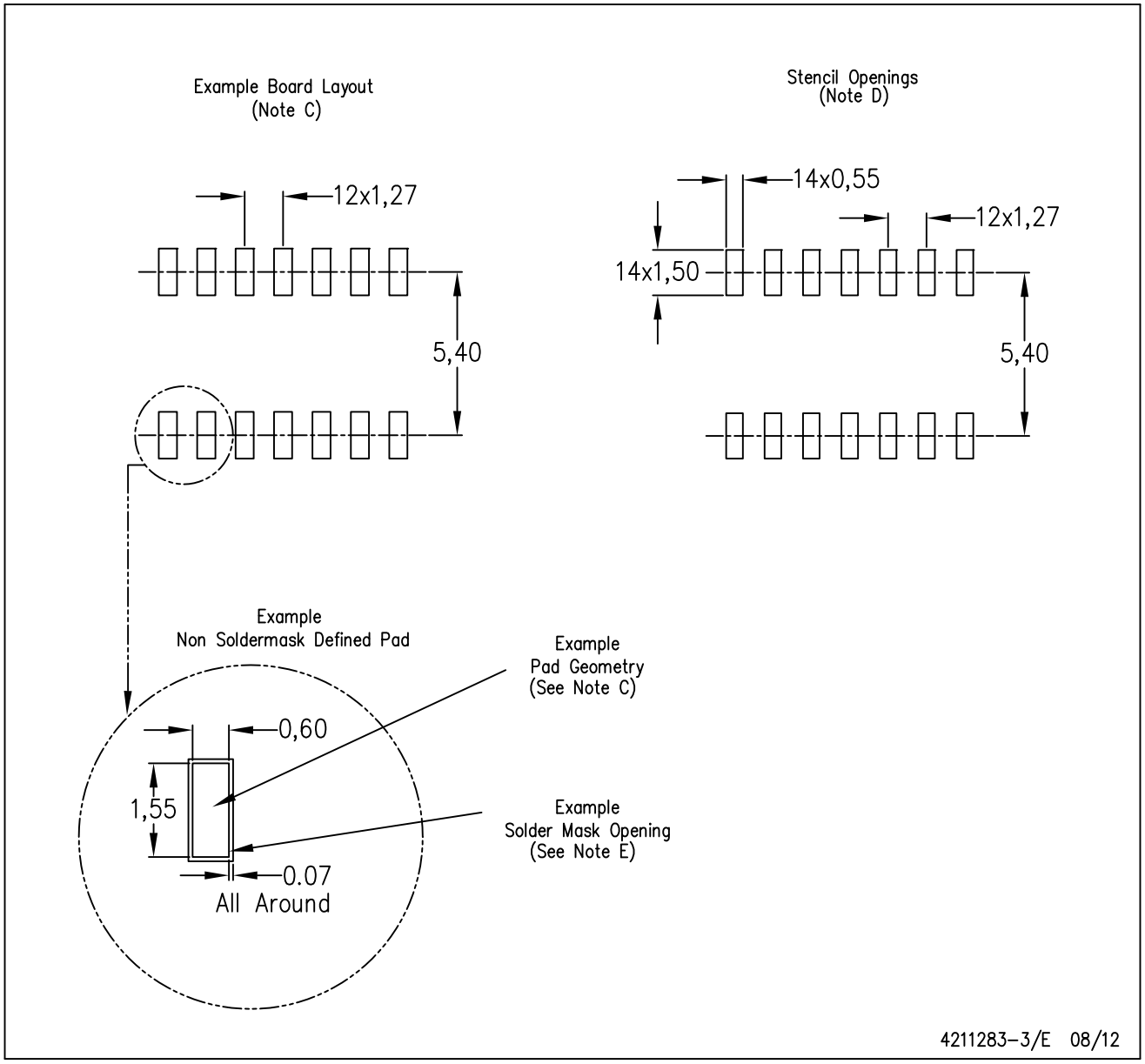
D (R–PDSO–G14) PLASTIC SMALL OUTLINE



4040047–5/M 06/11

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 AB.

D (R–PDSO–G14) PLASTIC SMALL OUTLINE

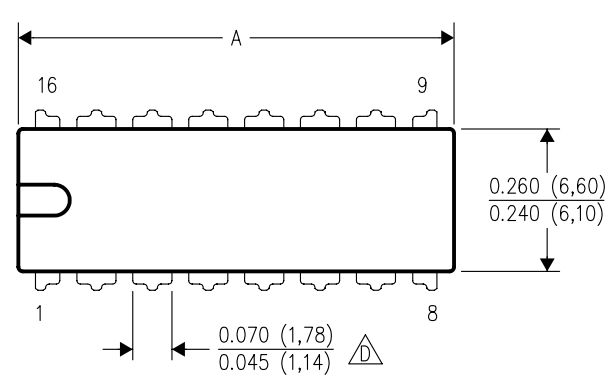


NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact 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.

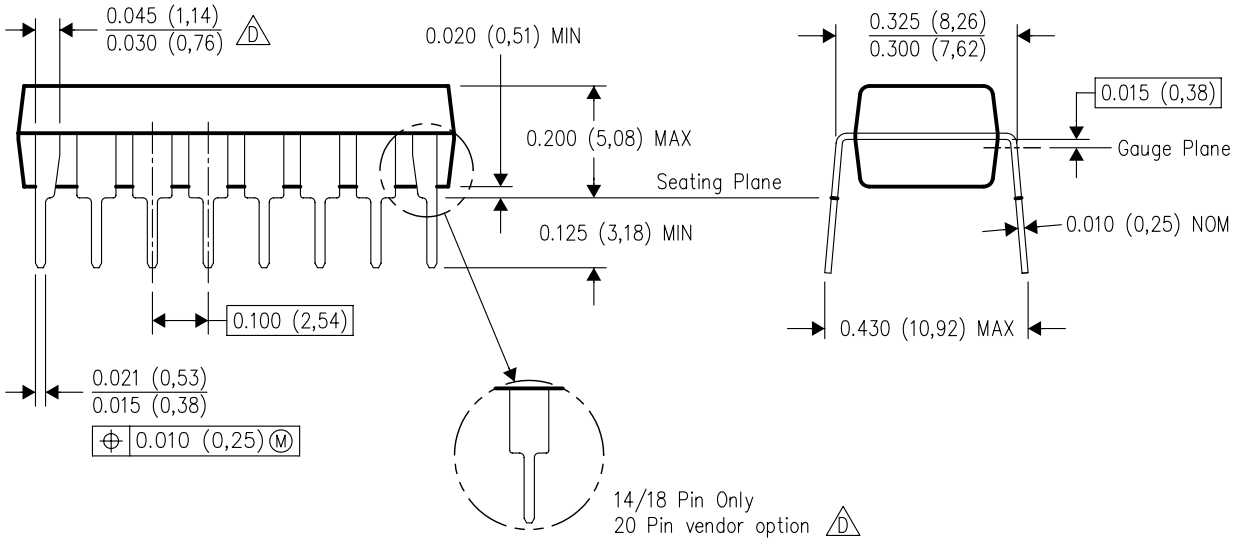
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



DIM \ PINS **	14	16	18	20
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 (C)	AA	BB	AC	AD



4040049/E 12/2002

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

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