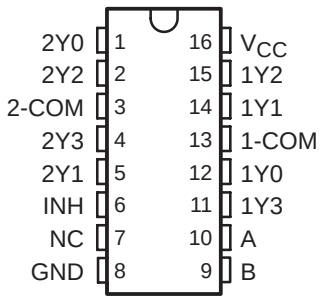
- **Injection Current Cross−Coupling <1mV/mA (see Figure 1)**
- **Low Crosstalk Between Switches**
- **Pin Compatible with SN74HC4052, SN74LV4052A, and CD4052B**
- **2-V to 6-V V_{CC} Operation**
- **Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II**
- **ESD Protection Exceeds JESD 22**
  - **2000-V Human-Body Model (A114-A)**
  - **200-V Machine Model (A115-A)**
  - **1000-V Charged-Device Model (C101)**

D, DGV, N, OR PW PACKAGE
(TOP VIEW)



NC − No internal connection

description/ordering information

This dual 4-to-1 CMOS analog multiplexer/demultiplexer is pin compatible with the 4052 function and also features injection-current effect control. This feature has excellent value in automotive applications where voltages in excess of normal supply voltages are common.

The injection-current effect control allows signals at disabled analog input channels to exceed the supply voltage without affecting the signal of the enabled analog channel. This eliminates the need for external diode/resistor networks typically used to keep the analog channel signals within the supply voltage range.

ORDERING INFORMATION

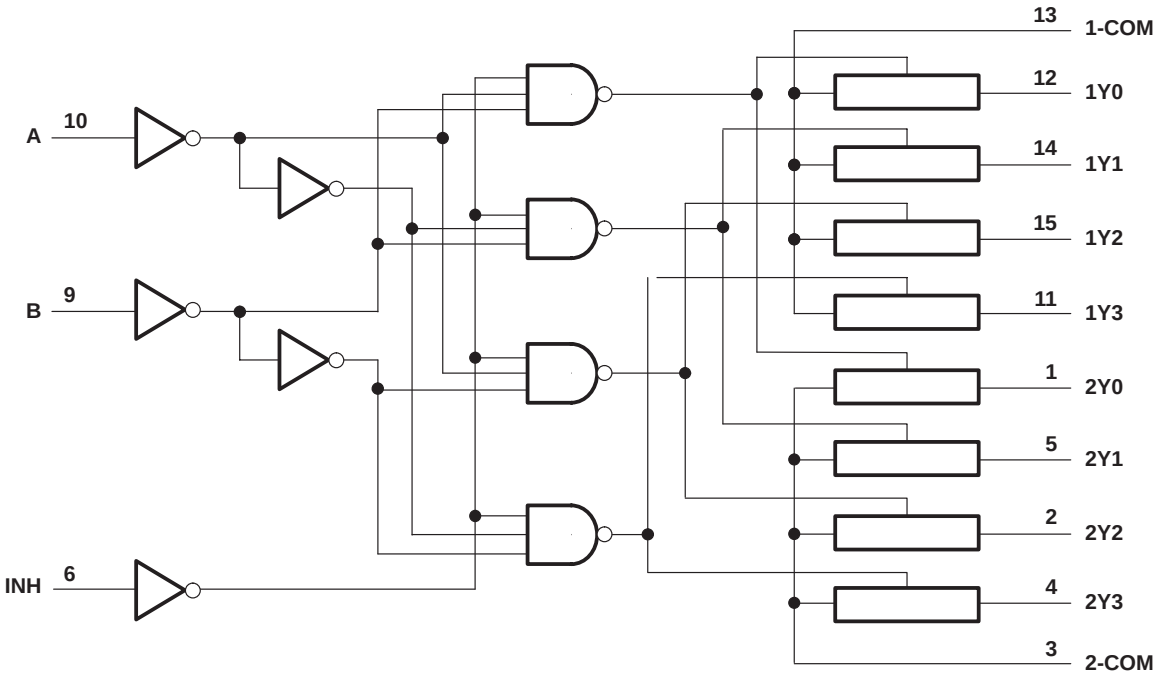
T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
−40°C to 125°C	PDIP − N	Tube	SN74HC4852N	SN74HC4852N
	SOIC − D	Tube	SN74HC4852D	HC4852
		Tape and reel	SN74HC4852DR	
	TSSOP − PW	Tube	SN74HC4852PW	HC4852
		Tape and reel	SN74HC4852PWR	
	TVSOP − DGV	Tape and reel	SN74HC4852DGVR	HC4852

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

FUNCTION TABLE

INPUTS			ON CHANNEL
INH	B	A	
L	L	L	1Y0, 2Y0
L	L	H	1Y1, 2Y1
L	H	L	1Y2, 2Y2
L	H	H	1Y3, 2Y3
H	X	X	None

logic diagram (positive logic)



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

Supply voltage range, V_{CC} . . . . . −0.5 V to 7.0 V
Input voltage range, V_I (see Note 1) . . . . . −0.5 V to V_{CC} + 0.5 V
Switch I/O voltage range, V_{IO} (see Notes 1 and 2) . . . . . −0.5 V to V_{CC} + 0.5 V
Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$) . . . . . ±20 mA
I/O diode current, I_{IOK} ($V_{IO} < 0$ or $V_{IO} > V_{CC}$) . . . . . ±20 mA
Switch through current, I_S (V_{IO} = 0 to V_{CC}) . . . . . ±25 mA
Continuous current through V_{CC} or GND . . . . . ±50 mA
Package thermal impedance, θ_{JA} (see Note 3): D package . . . . . 73°C/W
DGV package . . . . . 120°C/W
N package . . . . . 67°C/W
PW package . . . . . 108°C/W
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. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. This value is limited to 5.5 V maximum.
3. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 4)

			MIN	MAX	UNIT
V_{CC}	Supply voltage		2	6	V
V_{IH}	High-level input voltage, control inputs	V_{CC} = 2 V	1.5		V
		V_{CC} = 3 V	2.1		
		V_{CC} = 3.3 V	2.3		
		V_{CC} = 4.5 V	3.15		
		V_{CC} = 6 V	4.2		
V_{IL}	Low-level input voltage, control inputs	V_{CC} = 2 V		0.5	V
		V_{CC} = 3 V		0.9	
		V_{CC} = 3.3 V		1	
		V_{CC} = 4.5 V		1.35	
		V_{CC} = 6 V		1.8	
V_I	Control input voltage		0	V_{CC}	V
V_{IO}	Input/output voltage		0	V_{CC}	V
$\Delta t/\Delta v$	Input transition rise or fall rate	V_{CC} = 2 V		1000	ns
		V_{CC} = 3 V		800	
		V_{CC} = 3.3 V		700	
		V_{CC} = 4.5 V		500	
		V_{CC} = 6 V		400	
T_A	Operating free-air temperature		–40	125	°C

NOTE 4: All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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

PARAMETER		TEST CONDITIONS	V_{CC}	T_A = 25°C			−40 TO 85°C		−40 TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
r_{on}	On-state switch resistance	$I_S \le 2$ mA, $V_I = V_{CC}$ to GND, $V_{INH} = V_{IL}$ (see Figure 5)	2.V		500	650		670		700	Ω
			3 V		215	280		320		360	
			3.3 V		210	270		305		345	
			4.5 V		160	210		240		270	
			6 V		150	195		220		250	
Δr_{on}	Difference in on-state resistance between switches	$I_S \le 2$ mA, $V_I = V_{CC}/2$, $V_{INH} = V_{IL}$	2.V		4	18		22		24	Ω
			3 V		2	12		14		16	
			3.3 V		2	12		14		16	
			4.5 V		2	8		12		16	
			6 V		3	9		13		18	
I_I	Control input current	$V_I = V_{CC}$ or GND	6 V			±0.1		±0.1		±1	μA
$I_{S(off)}$	Off-state switch leakage current (any one channel)	$V_I = V_{CC}$ or GND, $V_{INH} = V_{IH}$ (see Figure 6)	6 V			±0.1		±0.5		±1	μA
	Off-state switch leakage current (common channel)	$V_I = V_{CC}$ or GND, $V_{INH} = V_{IH}$ (see Figure 7)				±0.2		±2		±4	
$I_{S(on)}$	On-state switch leakage current	$V_I = V_{CC}$ or GND, $V_{INH} = V_{IL}$ (see Figure 8)	6 V			±0.1		±0.5		±1	μA
I_{CC}	Supply current	$V_I = V_{CC}$ or GND	6 V			2		5		10	μA
C_{IC}	Control input capacitance	A, B, INH			3.5	10		10		10	pF
C_{IS}	Common terminal capacitance	Switch off			22	40		40		40	pF
C_{OS}	Switch terminal capacitance	Switch off			6.7	15		15		15	pF

injection-current coupling specifications, T_A = −40°C to 125°C (see Figure 1)

PARAMETER		V_{CC}	TEST CONDITIONS		TYP†	MAX	UNIT
$V\Delta_{out}$	Maximum shift of output voltage of enabled analog channel	3.3 V	I_I‡ ≤ 1 mA,	$R_S \le 3.9$ kΩ	0.05	1	mV
		5 V			0.1	1	
		3.3 V	I_I‡ ≤ 10 mA,		0.345	5	
		5 V			0.067	5	
		3.3 V	I_I‡ ≤ 1 mA,	$R_S \le 20$ kΩ	0.05	2	
		5 V			0.11	2	
		3.3 V	I_I‡ ≤ 10 mA,		0.05	20	
		5 V			0.024	20	

† Typical values are measured at T_A = 25°C.
‡ I_I = total current injected into all disabled channels.

switching characteristics over recommended operating free-air temperature range, V_{CC} = 2 V, C_L = 50 pF (unless otherwise noted) (see Figures 9−14)

PARAMETER		FROM (INPUT)	TO (OUTPUT)	T_A = 25°C			−40 TO 85°C		−40 TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay time	COM or Yn	Yn or COM	14.5	19.5	33	12	34	11	35	ns
t_{PLH} t_{PHL}	Propagation delay time	Channel Select	COM or Yn	19.6	24.5	38	15.4	40	13.8	42	ns
t_{PZH} t_{PZL}	Enable delay time	INH	COM or Yn	19.4	23.6	47.5	15.8	52.5	14.5	57.5	ns
t_{PHZ} t_{PLZ}	Disable delay time	INH	COM or Yn	39.5	48.4	100	39.3	105	39	115	ns

switching characteristics over recommended operating free-air temperature range, V_{CC} = 3 V, C_L = 50 pF (unless otherwise noted) (see Figures 9−14)

PARAMETER		FROM (INPUT)	TO (OUTPUT)	T_A = 25°C			−40 TO 85°C		−40 TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay time	COM or Yn	Yn or COM	8.6	12	16.5	6.5	18	5.8	19.5	ns
t_{PLH} t_{PHL}	Propagation delay time	Channel Select	COM or Yn	12.4	14.6	20	9.3	21.5	8.2	23	ns
t_{PZH} t_{PZL}	Enable delay time	INH	COM or Yn	12.1	13.8	45	9.2	50	8.5	55	ns
t_{PHZ} t_{PLZ}	Disable delay time	INH	COM or Yn	35.2	44.5	90	35.5	100	35	110	ns

switching characteristics over recommended operating free-air temperature range, V_{CC} = 3.3 V, C_L = 50 pF (unless otherwise noted) (see Figures 9−14)

PARAMETER		FROM (INPUT)	TO (OUTPUT)	T_A = 25°C			−40 TO 85°C		−40 TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay time	COM or Yn	Yn or COM	7.9	11	15	5.8	16.5	5	18.5	ns
t_{PLH} t_{PHL}	Propagation delay time	Channel Select	COM or Yn	11.4	13.5	17.5	8.5	19	7.5	22	ns
t_{PZH} t_{PZL}	Enable delay time	INH	COM or Yn	11.2	12.7	42.5	8.4	47.5	7.4	52.5	ns
t_{PHZ} t_{PLZ}	Disable delay time	INH	COM or Yn	34.6	43.9	85	34.6	95	34.5	105	ns

switching characteristics over recommended operating free-air temperature range, V_{CC} = 4.5 V, C_L = 50 pF (unless otherwise noted) (see Figures 9−14)

PARAMETER		FROM (INPUT)	TO (OUTPUT)	T_A = 25°C			−40 TO 85°C		−40 TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay time	COM or Yn	Yn or COM	6.3	8.6	11.6	4.6	12.5	4.5	13.5	ns
t_{PLH} t_{PHL}	Propagation delay time	Channel Select	COM or Yn	9.3	11	14	6.5	15	5.6	17	ns
t_{PZH} t_{PZL}	Enable delay time	INH	COM or Yn	8	9.9	40	5.3	45	4.4	50	ns
t_{PHZ} t_{PLZ}	Disable delay time	INH	COM or Yn	28.5	41.4	80	28.2	90	28	100	ns

switching characteristics over recommended operating free-air temperature range, V_{CC} = 6 V, C_L = 50 pF (unless otherwise noted) (see Figures 9−14)

PARAMETER		FROM (INPUT)	TO (OUTPUT)	T_A = 25°C			−40 TO 85°C		−40 TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay time	COM or Yn	Yn or COM	5.5	8	10.2	4.1	11	3.6	12	ns
t_{PLH} t_{PHL}	Propagation delay time	Channel Select	COM or Yn	7.4	9.5	12.6	4.7	14.5	3.8	16.5	ns
t_{PZH} t_{PZL}	Enable delay time	INH	COM or Yn	6.8	8.4	39	4.8	40	3.8	40	ns
t_{PHZ} t_{PLZ}	Disable delay time	INH	COM or Yn	14.4	38	78	13.5	80	13	80	ns

operating characteristics, T_A = 25°C (see Figure 15)

PARAMETER		V_{CC}	TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance	3.3 V	No load	48	pF
		5 V		60	

APPLICATION INFORMATION

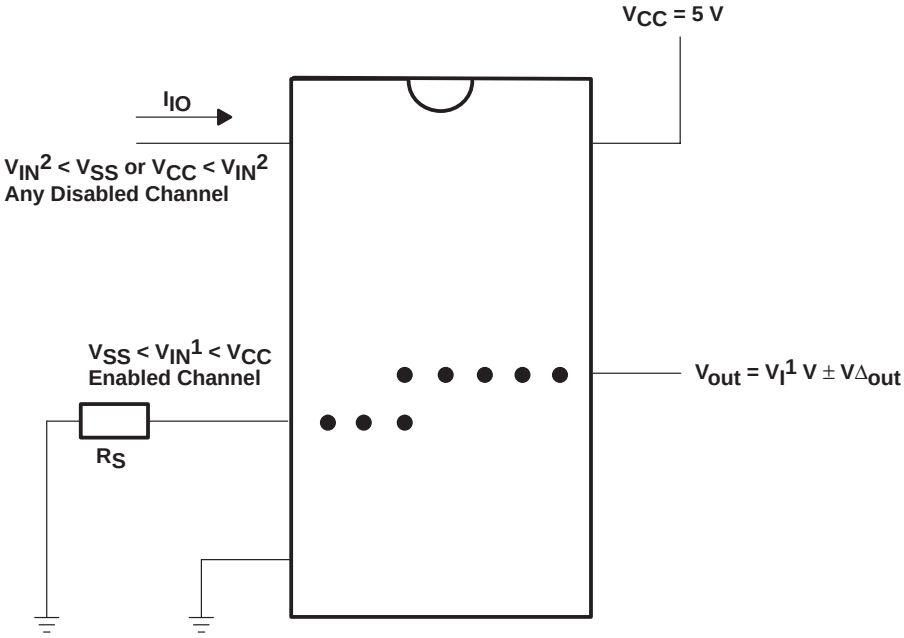


Figure 1. Injection-Current Coupling Specification

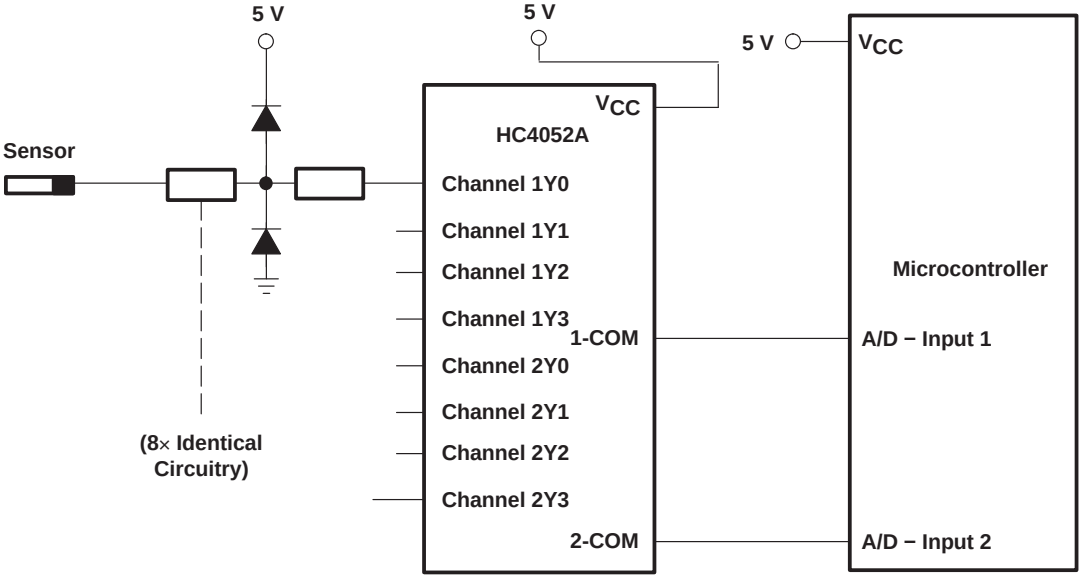


Figure 2. Actual Technology Requires 32 Passive Components and One Extra 6-V Regulator to Suppress Injection Current Into a Standard HC4052 Multiplexer

APPLICATION INFORMATION

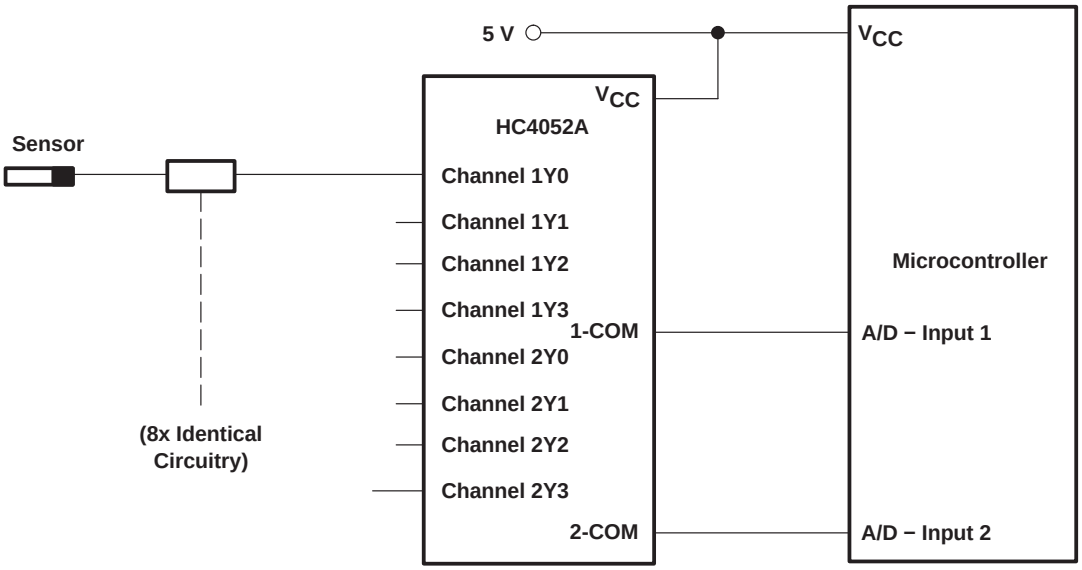


Figure 3. Solution by Applying the HC4852 Multiplexer

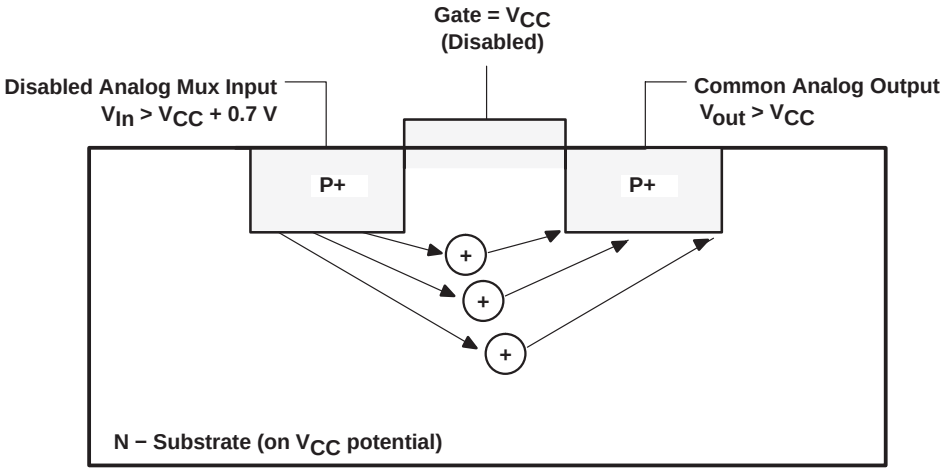


**Figure 4. Diagram of Bipolar Coupling Mechanism
(Appears if V_{In} Exceeds V_{CC}, Driving Injection Current Into the Substrate)**

PARAMETER MEASUREMENT INFORMATION

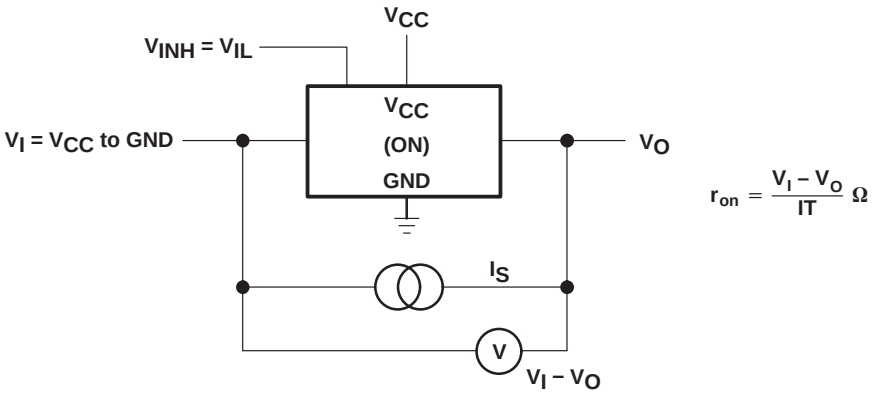


Figure 5. On-State Resistance Test Circuit

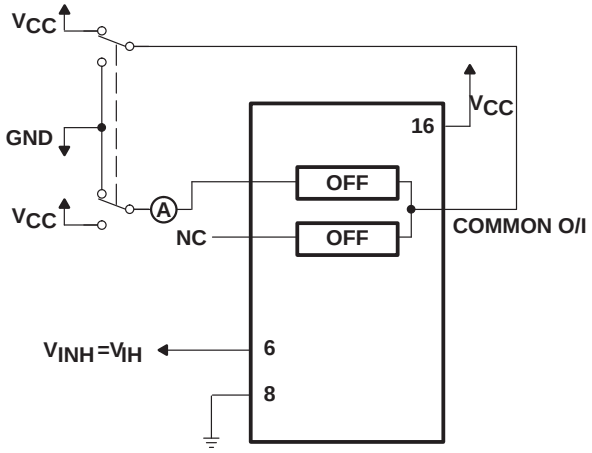


Figure 6. Maximum Off-Channel Leakage Current, Any One Channel, Test Setup

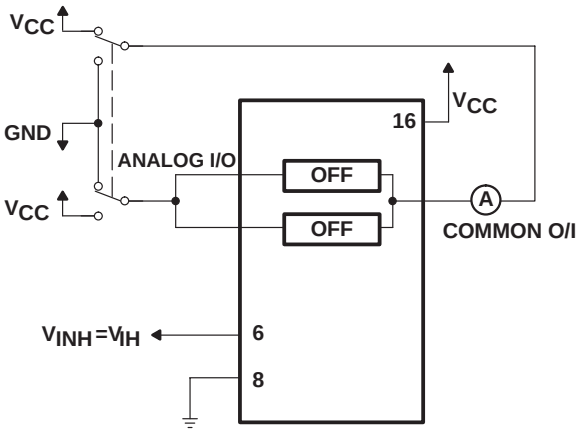


Figure 7. Maximum Off-Channel Leakage Current, Common Channel, Test Setup

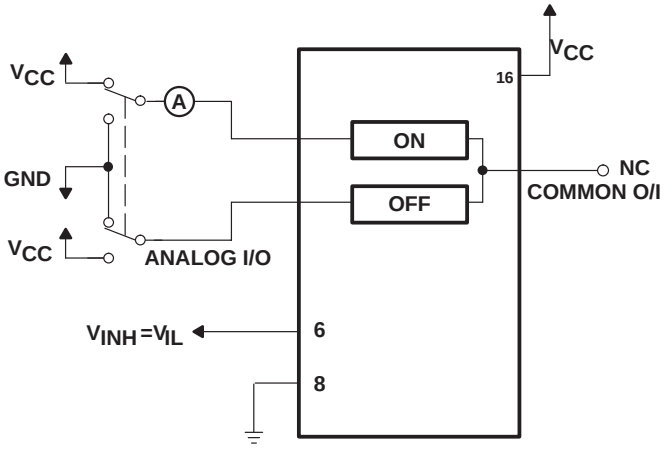


Figure 8. Maximum On-Channel Leakage Current, Channel to Channel, Test Setup

PARAMETER MEASUREMENT INFORMATION

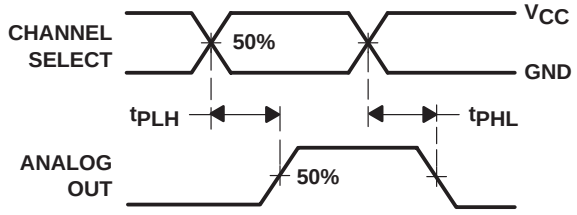
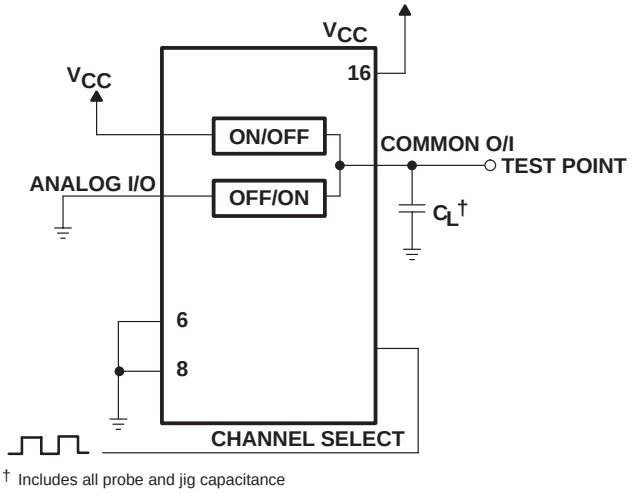


Figure 9. Propagation Delays, Channel Select to Analog Out



† Includes all probe and jig capacitance

Figure 10. Propagation Delay, Channel Select to Analog Out, Test Setup

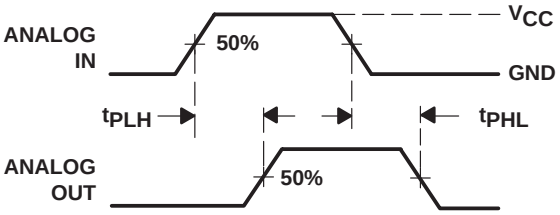
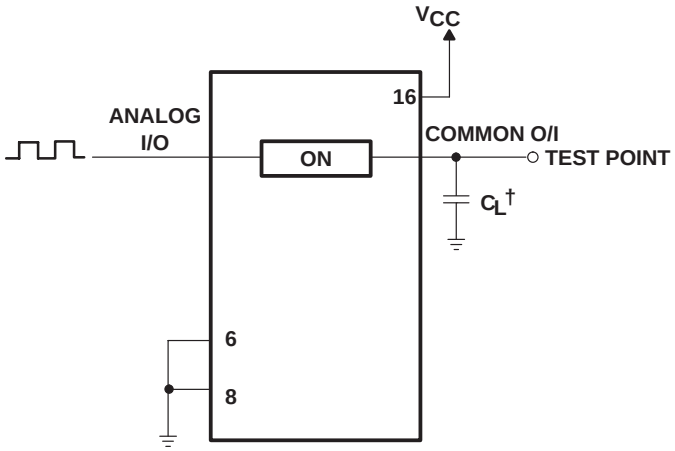


Figure 11. Propagation Delays, Analog In to Analog Out



† Includes all probe and jig capacitance

Figure 12. Propagation Delay, Analog In to Analog Out, Test Setup

PARAMETER MEASUREMENT INFORMATION

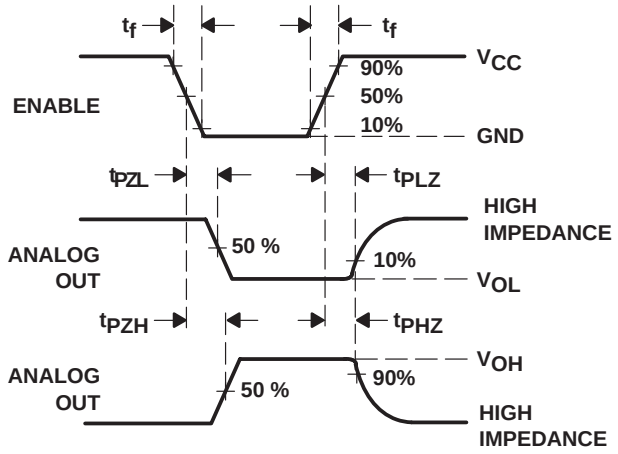


Figure 13. Propagation Delays, Enable to Analog Out

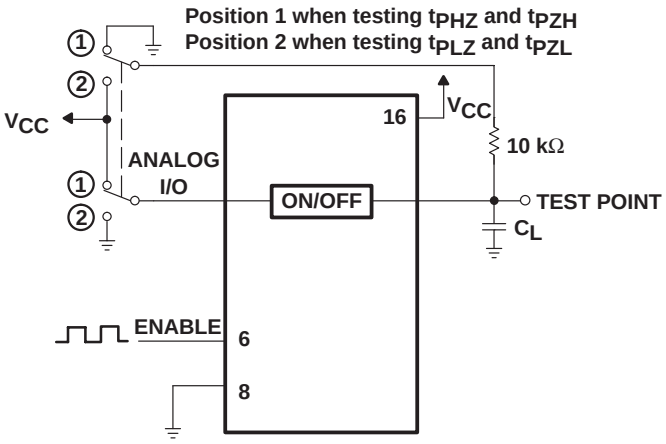


Figure 14. Propagation Delay, Enable to Analog Out, Test Setup

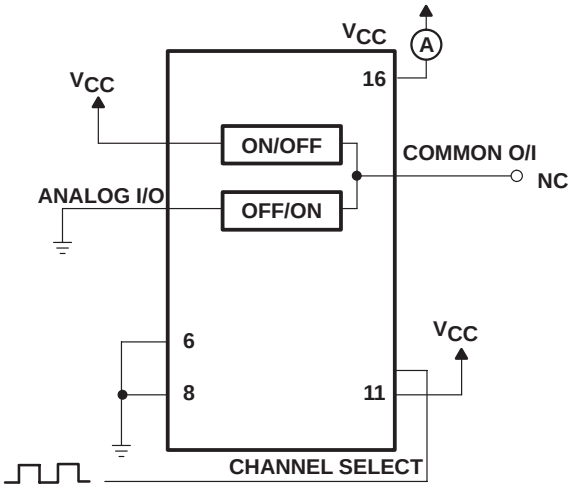


Figure 15. Power-Dissipation Capacitance, Test Setup

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
SN74HC4852D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4852DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4852DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4852DGVR	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4852DGVRE4	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4852DGVRG4	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4852DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4852DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4852DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4852N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74HC4852NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74HC4852PW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4852PWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4852PWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4852PWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4852PWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC4852PWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

(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.

OTHER QUALIFIED VERSIONS OF SN74HC4852 :

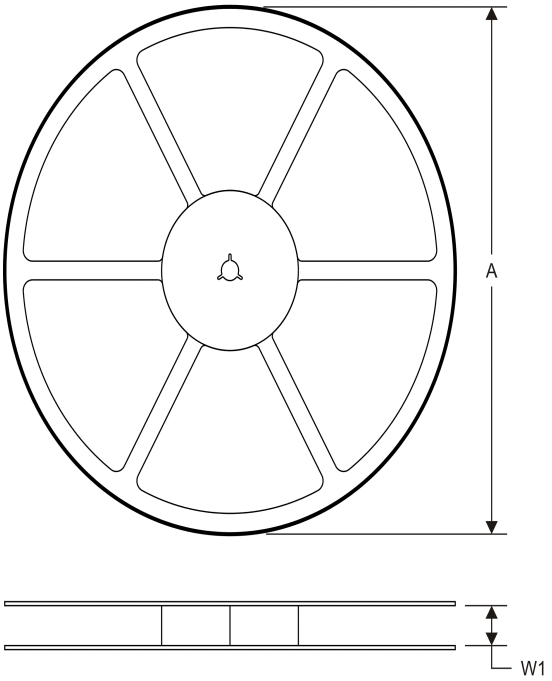
- Automotive: SN74HC4852-Q1

NOTE: Qualified Version Definitions:

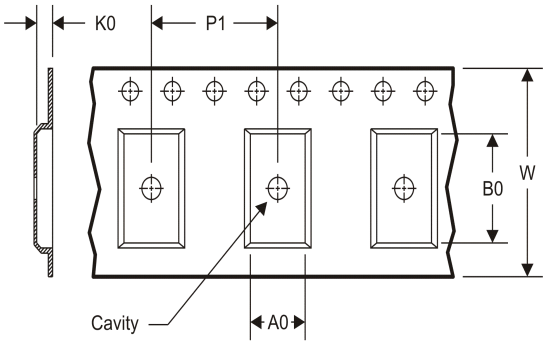
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



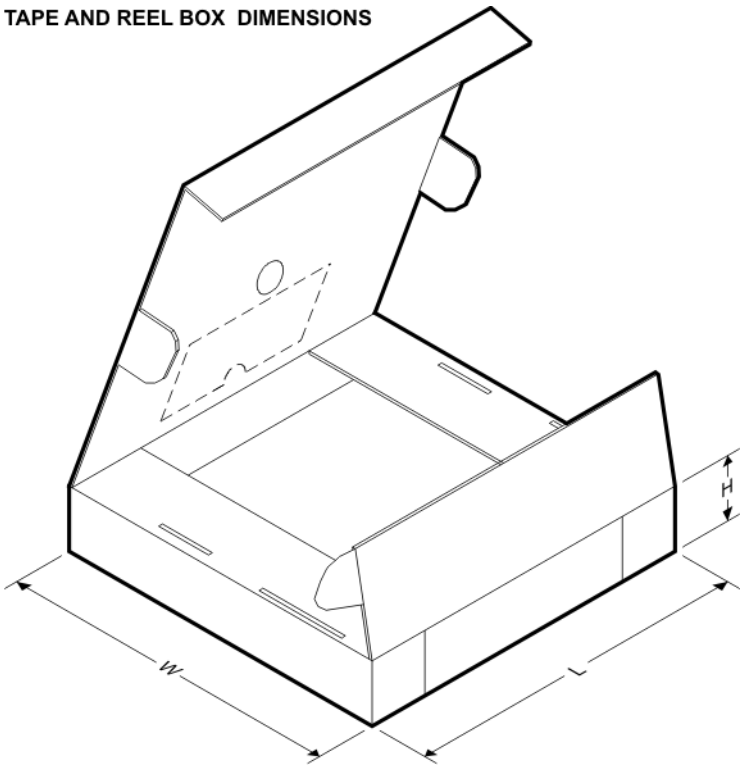
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

TAPE AND REEL INFORMATION

*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
SN74HC4852DGVR	TVSOP	DGV	16	2000	330.0	12.4	6.8	4.0	1.6	8.0	12.0	Q1
SN74HC4852DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74HC4852PWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



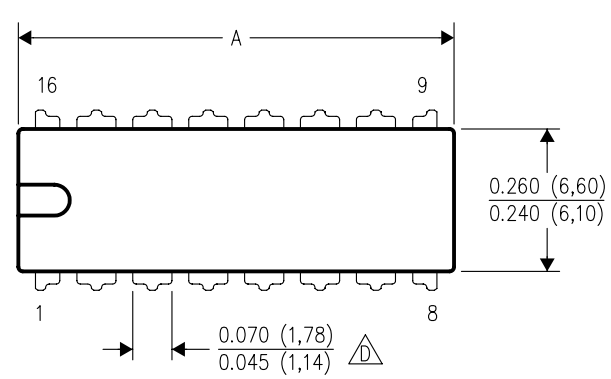
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74HC4852DGVR	TVSOP	DGV	16	2000	367.0	367.0	35.0
SN74HC4852DR	SOIC	D	16	2500	333.2	345.9	28.6
SN74HC4852PWR	TSSOP	PW	16	2000	367.0	367.0	35.0

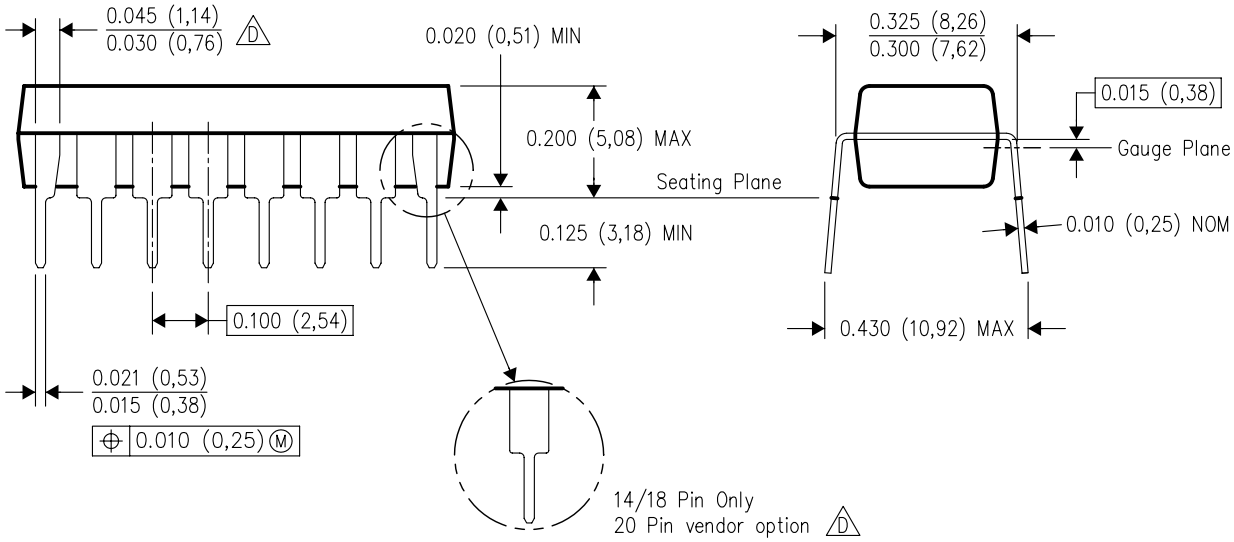
N (R–PDIP–T**)

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

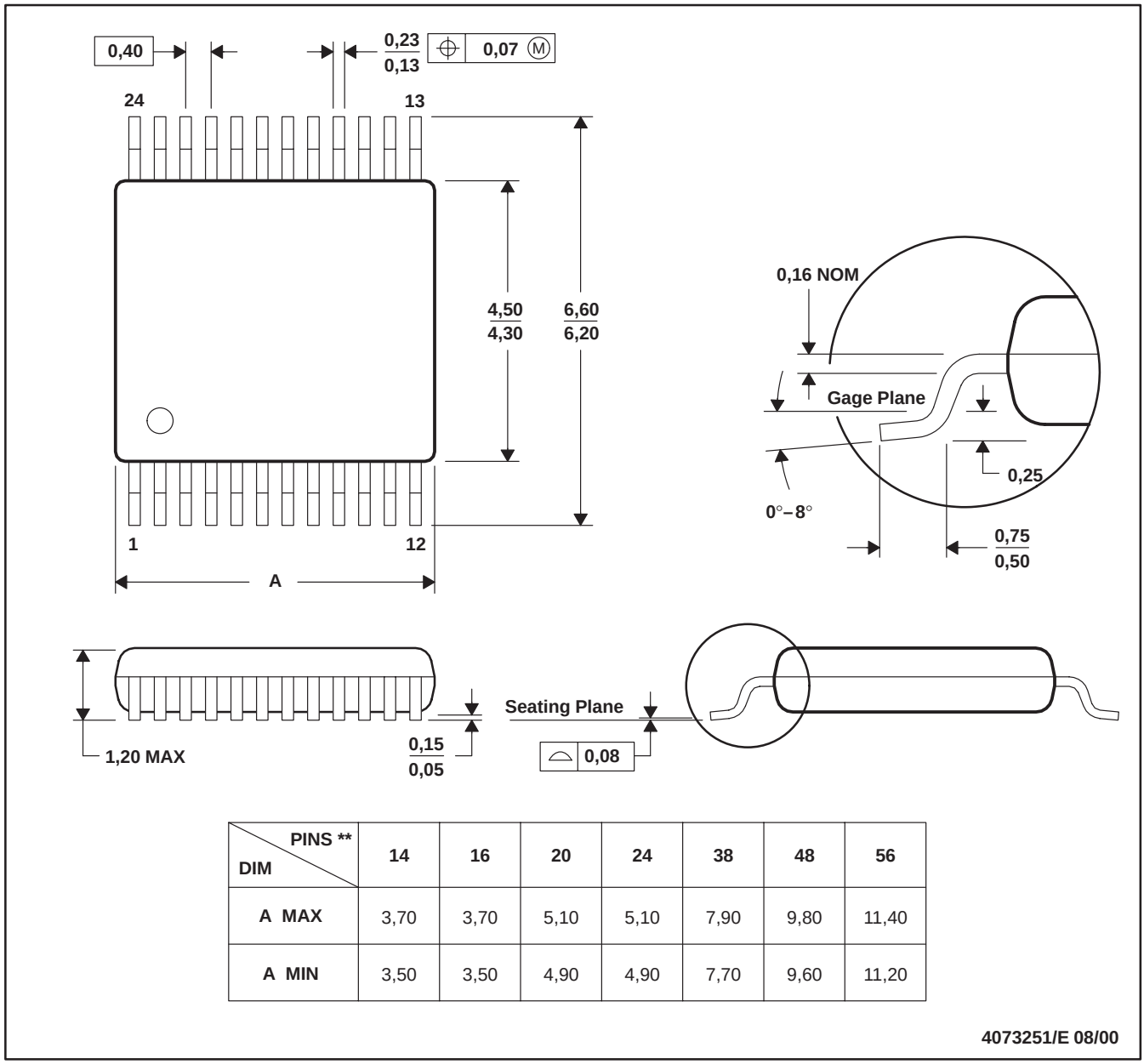


4040049/E 12/2002

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.

DGV (R-PDSO-G)** **PLASTIC SMALL-OUTLINE**

24 PINS SHOWN

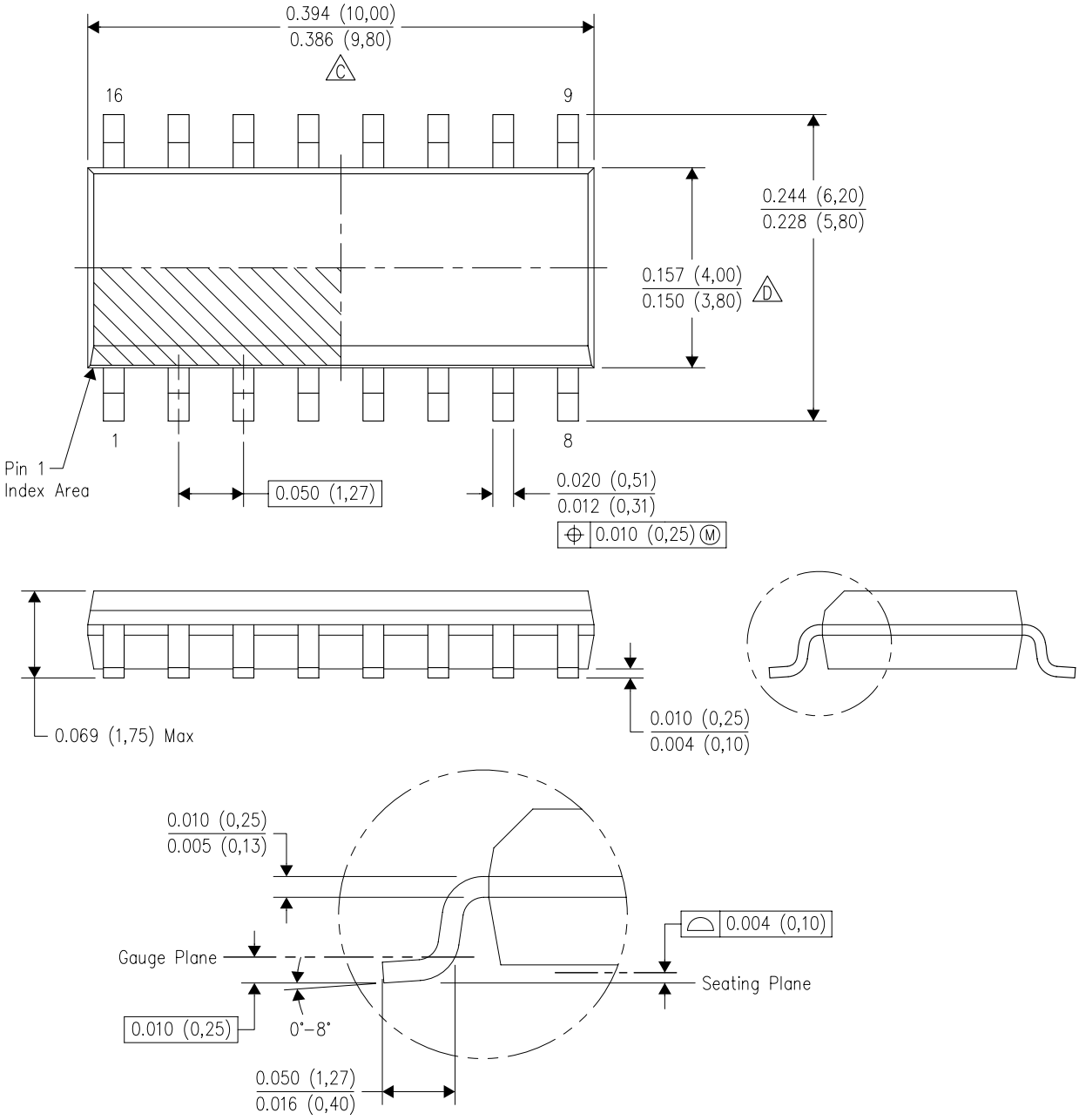


DIM \ PINS **	14	16	20	24	38	48	56
A MAX	3,70	3,70	5,10	5,10	7,90	9,80	11,40
A MIN	3,50	3,50	4,90	4,90	7,70	9,60	11,20

4073251/E 08/00

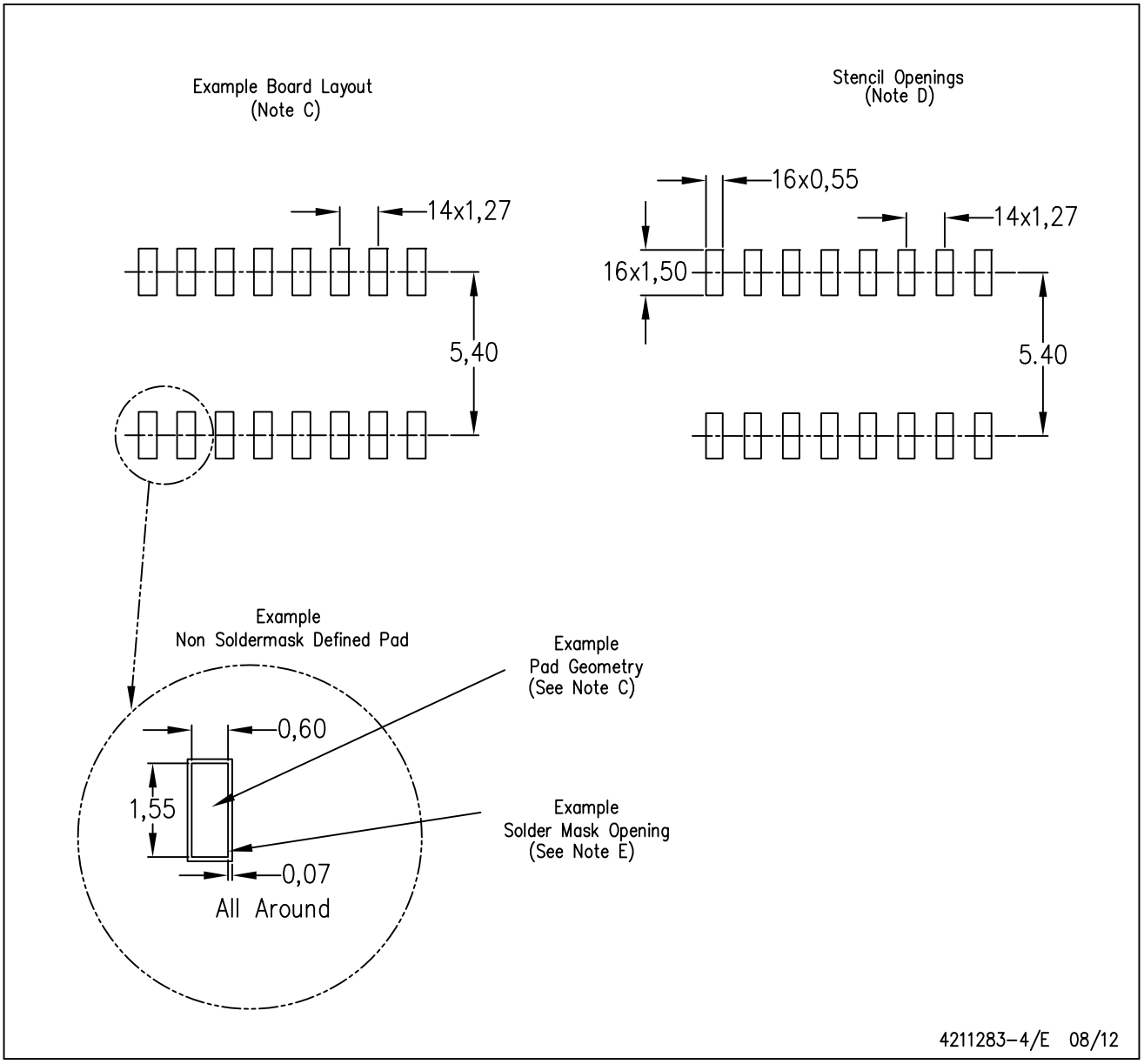
NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.
D. Falls within JEDEC: 24/48 Pins – MO-153
14/16/20/56 Pins – MO-194

D (R–PDSO–G16) PLASTIC SMALL OUTLINE



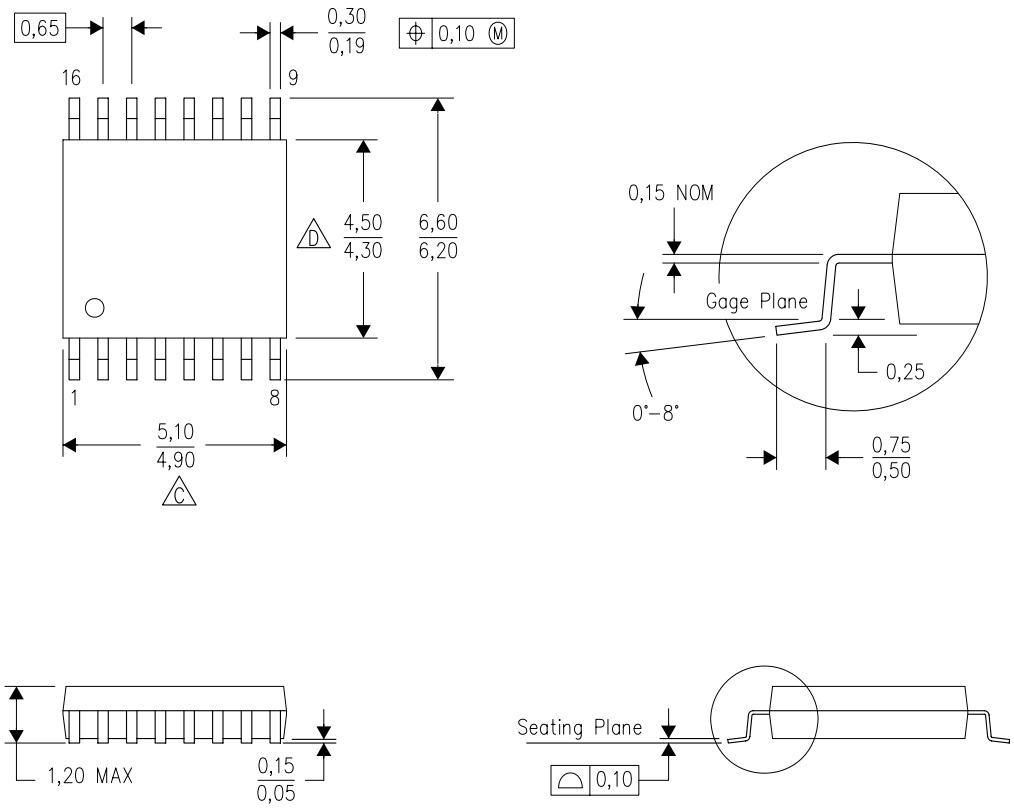
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
E. Reference JEDEC MS–012 variation AC.

D (R–PDSO–G16) 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.

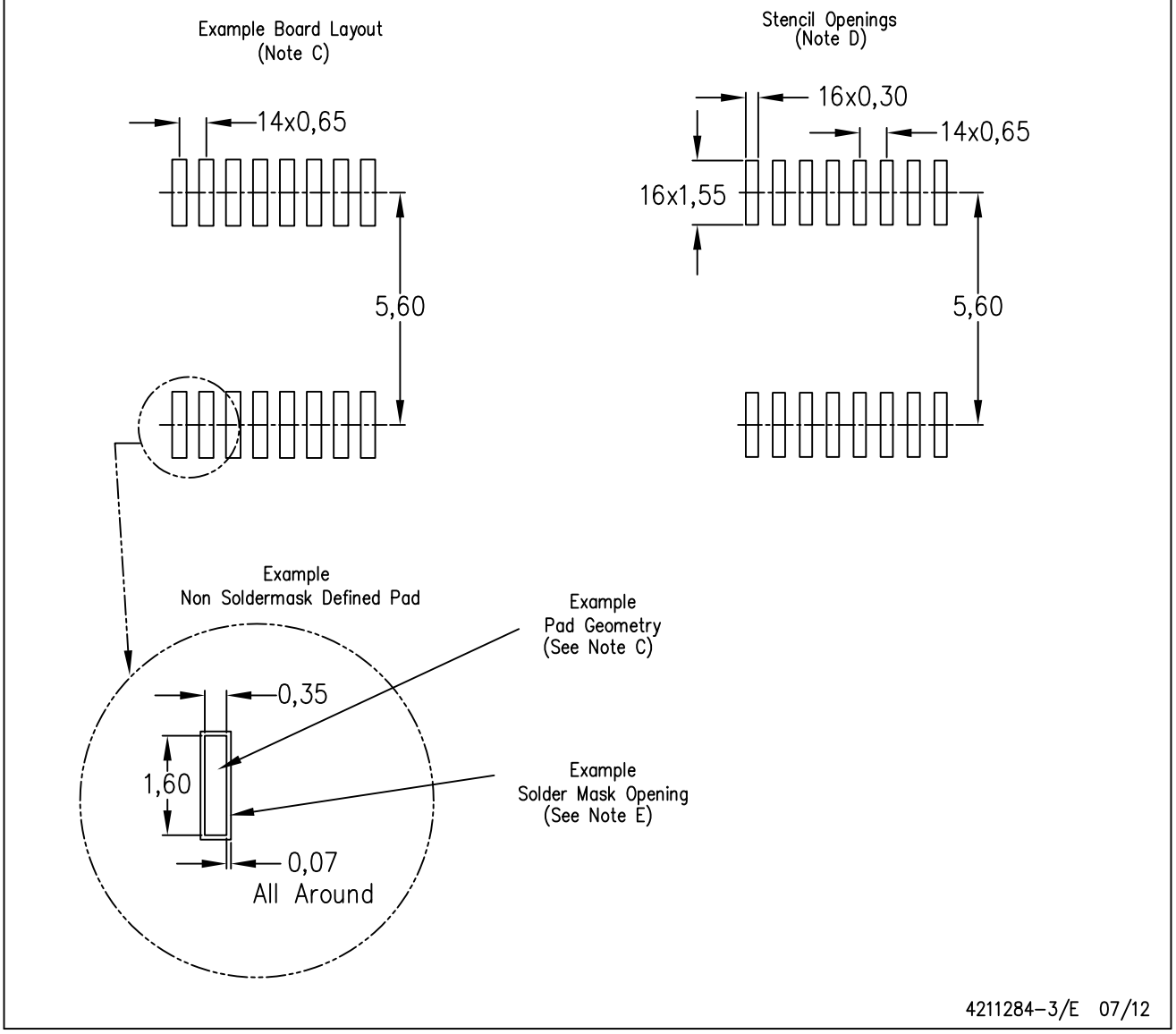
PW (R–PDSO–G16) PLASTIC SMALL OUTLINE



4040064–4/G 02/11

NOTES:
A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
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 each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
E. Falls within JEDEC MO–153

PW (R–PDSO–G16) 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.

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