

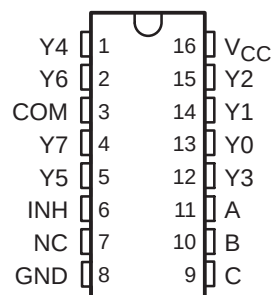
SN74HC4851

8-CHANNEL ANALOG MULTIPLEXER/DEMUTIPLEXER WITH INJECTION-CURRENT EFFECT CONTROL

SCLS542B – SEPTEMBER 2003 – REVISED JANUARY 2004

- Injection-Current Cross Coupling <1mV/mA (see Figure 1)
- Low Crosstalk Between Switches
- Pin Compatible With SN74HC4051, SN74LV4051A, and CD4051B
- 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 eight-channel CMOS analog multiplexer/demultiplexer is pin compatible with the '4051 function and, additionally, features injection-current effect control, which 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	SN74HC4851N	HC4851N
		Tube	SN74HC4851D	HC4851
	SOIC – D	Tape and reel	SN74HC4851DR	
		Tube	SN74HC4851PW	HC4851
	TSSOP – PW	Tape and reel	SN74HC4851PWR	
		Tape and reel	SN74HC4851DGVR	HC4851

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



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

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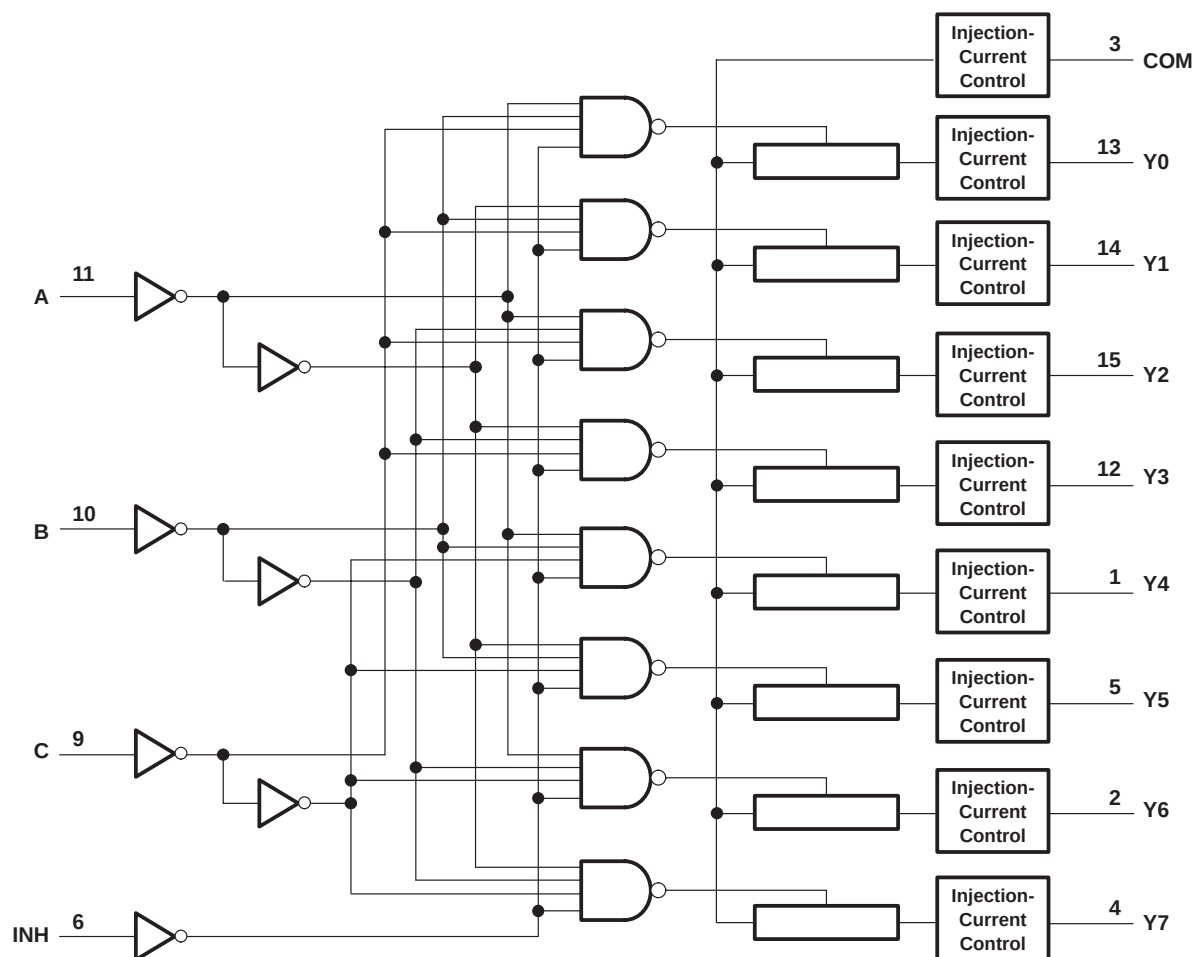
8-CHANNEL ANALOG MULTIPLEXER/DEMULTIPLEXER WITH INJECTION-CURRENT EFFECT CONTROL

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FUNCTION TABLE

INPUTS				ON CHANNEL
INH	C	B	A	
L	L	L	L	Y0
L	L	L	H	Y1
L	L	H	L	Y2
L	L	H	H	Y3
L	H	L	L	Y4
L	H	L	H	Y5
L	H	H	L	Y6
L	H	H	H	Y7
H	X	X	X	None

logic diagram (positive logic)



Supply voltage range, V_{CC}		-0.5 V to 7 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_T ($V_{IO} = 0$ 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

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.

			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
Δt/Δv	Input transition rise or fall time	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



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

PARAMETER		TEST CONDITIONS	V _{CC}	T _A = 25°C			UP TO 85°C		UP TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
r _{on}	On-state switch resistance	I _T ≤ 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 _T ≤ 2 mA, V _I = V _{CC} /2, V _{INH} = V _{IL}	2. V		4	10		15		20	Ω
			3 V		2	8		12		16	
			3.3 V		2	8		12		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		20		40	μA
C _{IC}	Control input capacitance	A, B, C, 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

PARAMETER		V _{CC}	TEST CONDITIONS		MIN	TYP [†]	MAX	UNIT
V _{Δout}	Maximum shift of output voltage of enabled analog channel	3.3 V	R _S ≤ 3.9 kΩ	I _I [‡] ≤ 1 mA		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	R _S ≤ 20 kΩ	I _I [‡] ≤ 1 mA		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

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			UP TO 85°C		UP TO 125°C		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay time	COM or Y_n		19.5	25		29		32	ns
t_{PLH} t_{PHL}	Propagation delay time	Channel Select		23	30		35		40	ns
t_{PZH} t_{PZL}	Enable delay time	INH			95		105		115	ns
t_{PHZ} t_{PLZ}	Disable delay time	INH			95		105		115	ns

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			UP TO 85°C		UP TO 125°C		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay time	COM or Y_n		12	15.5		17.5		19.5	ns
t_{PLH} t_{PHL}	Propagation delay time	Channel Select		13.5	17.5		20		23	ns
t_{PZH} t_{PZL}	Enable delay time	INH			90		100		110	ns
t_{PHZ} t_{PLZ}	Disable delay time	INH			90		100		110	ns

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			UP TO 85°C		UP TO 125°C		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay time	COM or Y_n		11	14.5		16.5		18.5	ns
t_{PLH} t_{PHL}	Propagation delay time	Channel Select		12.5	16.5		19		22	ns
t_{PZH} t_{PZL}	Enable delay time	INH			85		95		105	ns
t_{PHZ} t_{PLZ}	Disable delay time	INH			85		95		105	ns

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

PARAMETER		FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			UP TO 85°C		UP TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay time	COM or Y_n	Y_n or COM		8.6	11.5		12.5		13.5	ns
t_{PLH} t_{PHL}	Propagation delay time	Channel Select	COM or Y_n		10	13		15		17	ns
t_{PZH} t_{PZL}	Enable delay time	INH	COM or Y_n			80		90		100	ns
t_{PHZ} t_{PLZ}	Disable delay time	INH	COM or Y_n			80		90		100	ns

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

PARAMETER		FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			UP TO 85°C		UP TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay time	COM or Y_n	Y_n or COM		8	10		11		12	ns
t_{PLH} t_{PHL}	Propagation delay time	Channel Select	COM or Y_n		9.5	12.5		14.5		16.5	ns
t_{PZH} t_{PZL}	Enable delay time	INH	COM or Y_n			78		80		80	ns
t_{PHZ} t_{PLZ}	Disable delay time	INH	COM or Y_n			78		80		80	ns

operating characteristics, $T_A = 25^\circ\text{C}$ (see Figure 15)

PARAMETER		V_{CC}	TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance	3.3 V	No load	32	pF
		5 V		37	

APPLICATION INFORMATION

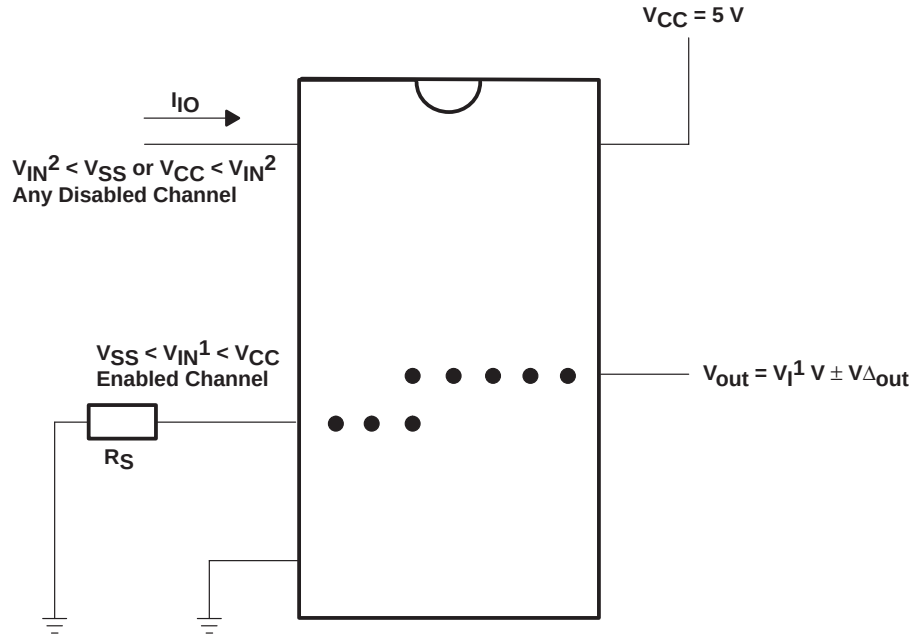


Figure 1. Injection-Current Coupling Specification

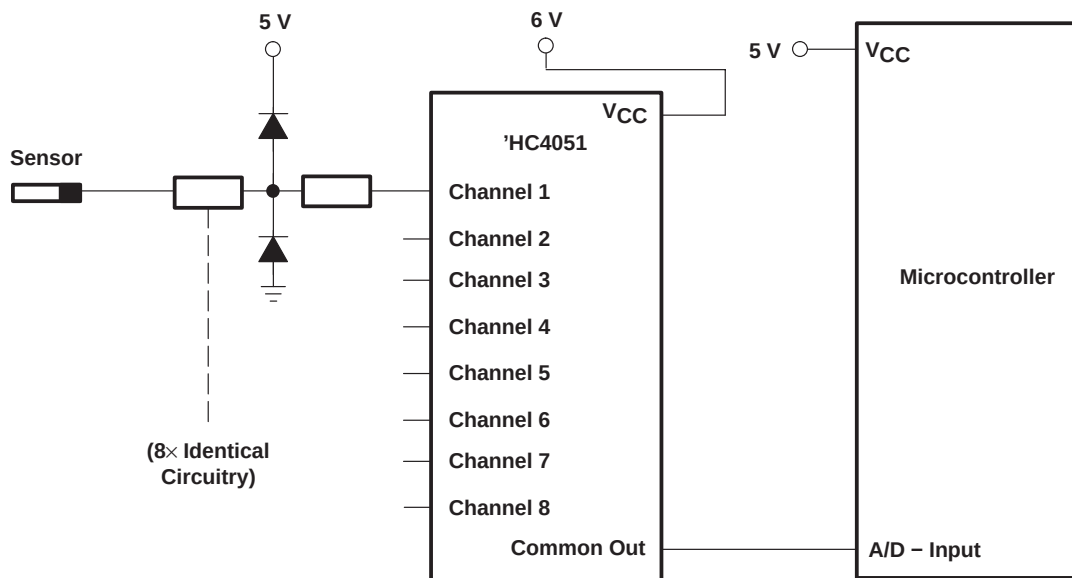


Figure 2. Alternate Solution Requires 32 Passive Components and One Extra 6-V Regulator to Suppress Injection Current Into a Standard 'HC4051 Multiplexer

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APPLICATION INFORMATION

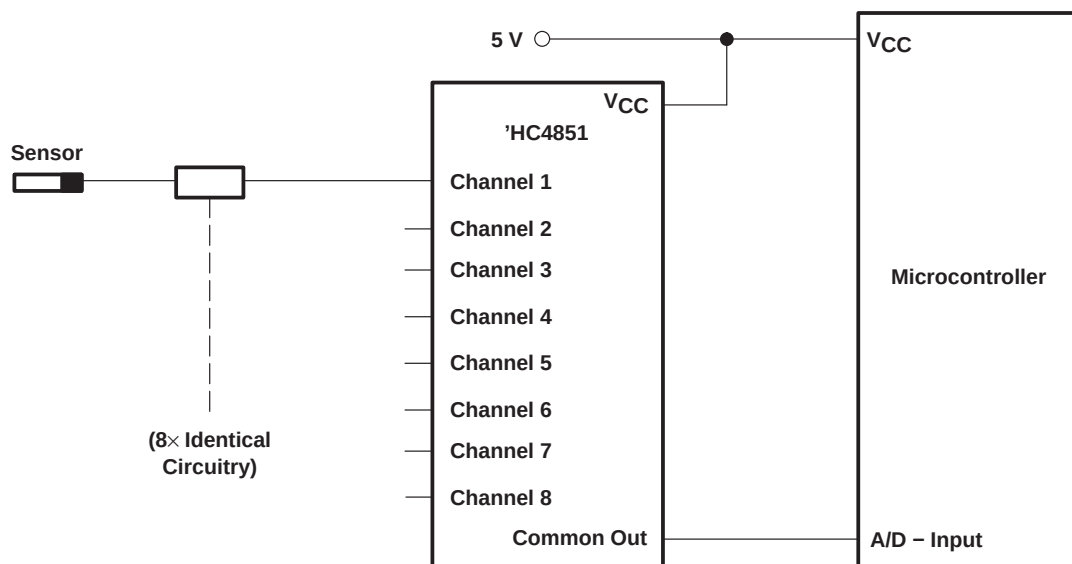


Figure 3. Solution by Applying the 'HC4851 Multiplexer

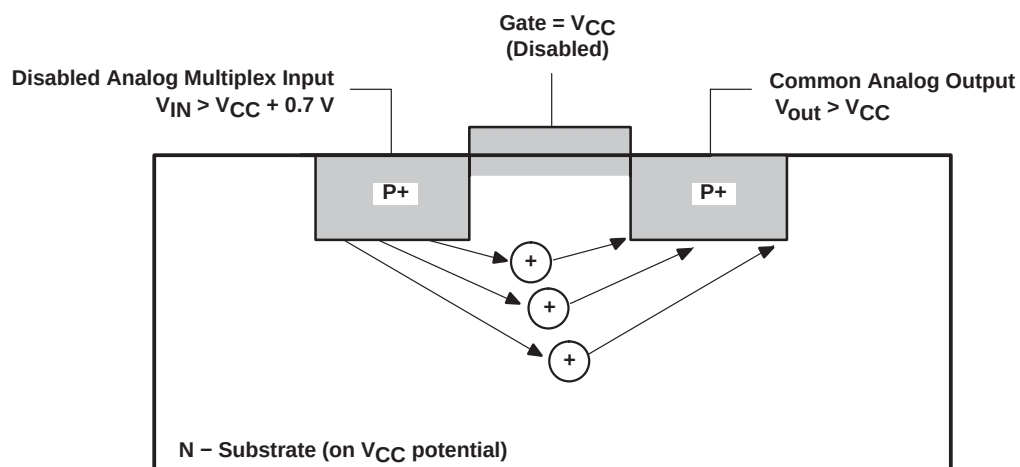


Figure 4. Diagram of Bipolar Coupling Mechanism
(Appears if V_{IN} Exceeds V_{CC} , Driving Injection Current Into the Substrate)

PARAMETER MEASUREMENT INFORMATION

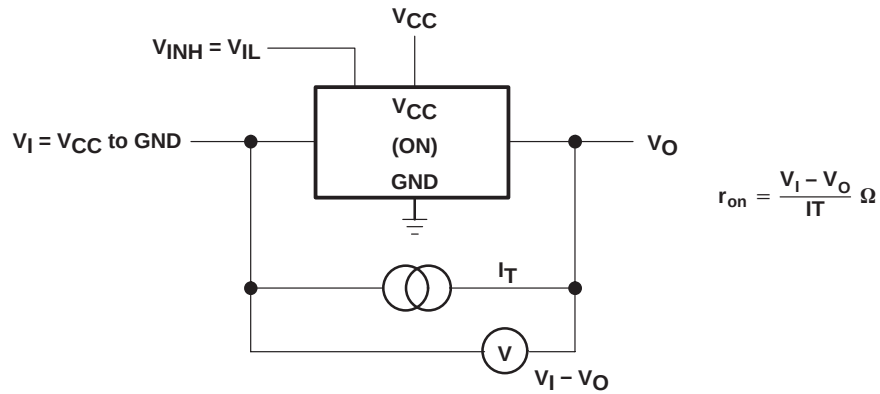


Figure 5. On-State-Resistance Test Circuit

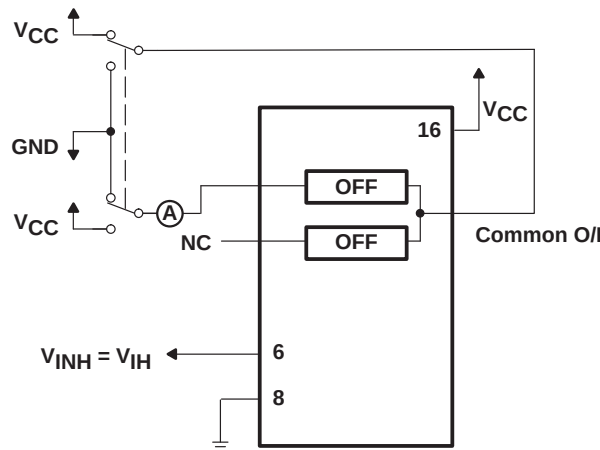


Figure 6. Maximum Off-Channel Leakage Current, Any One Channel, Test Setup

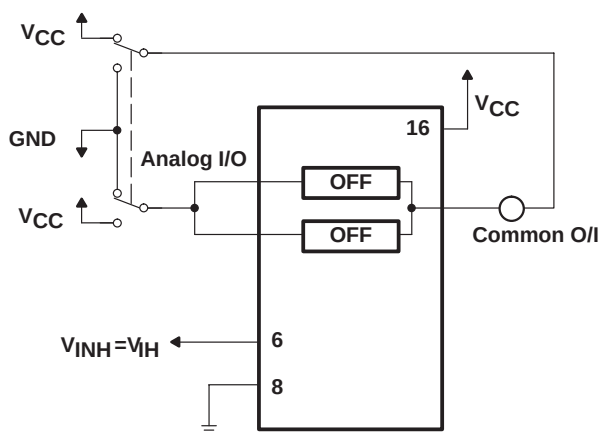


Figure 7. Maximum Off-Channel Leakage Current, Common Channel, Test Setup

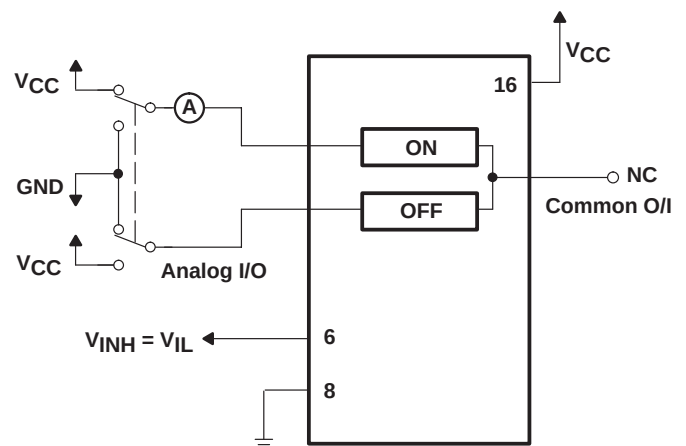


Figure 8. Maximum On-Channel Leakage Current, Channel To Channel, Test Setup

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PARAMETER MEASUREMENT INFORMATION

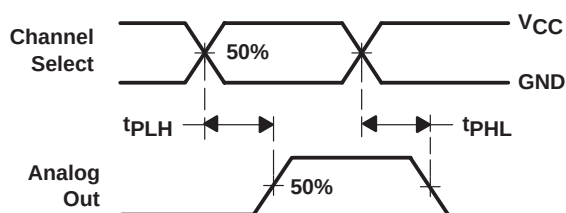


Figure 9. Propagation Delays,
Channel Select to Analog Out

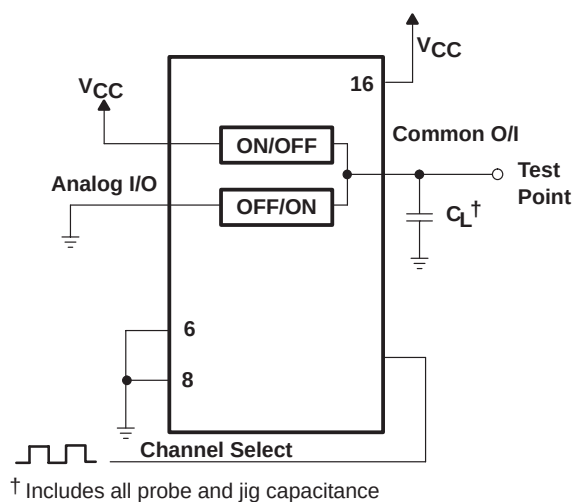


Figure 10. Propagation-Delay Test Setup,
Channel Select to Analog Out

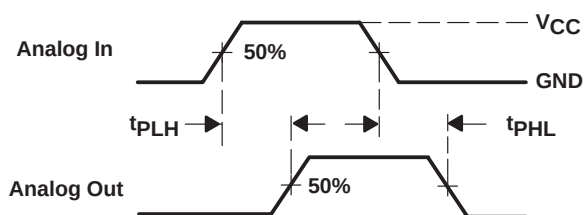


Figure 11. Propagation Delays,
Analog In to Analog Out

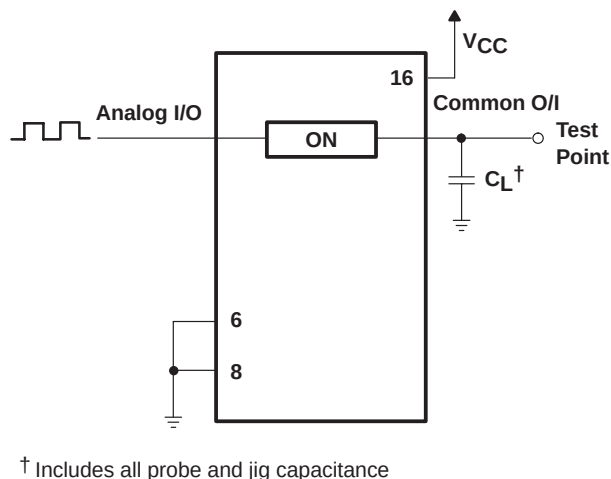


Figure 12. Propagation-Delay Test Setup,
Analog In to Analog Out

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PARAMETER MEASUREMENT INFORMATION

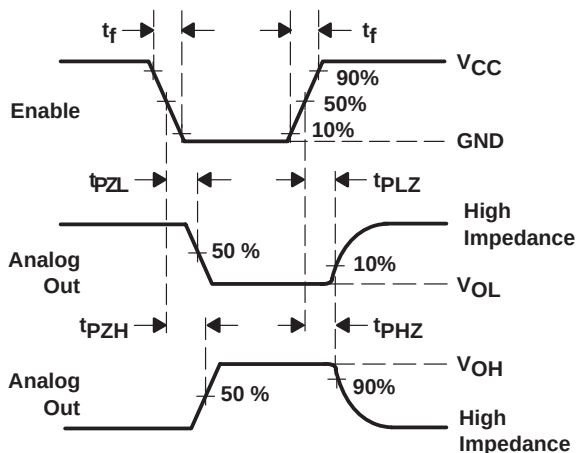


Figure 13. Propagation Delays,
Enable to Analog Out

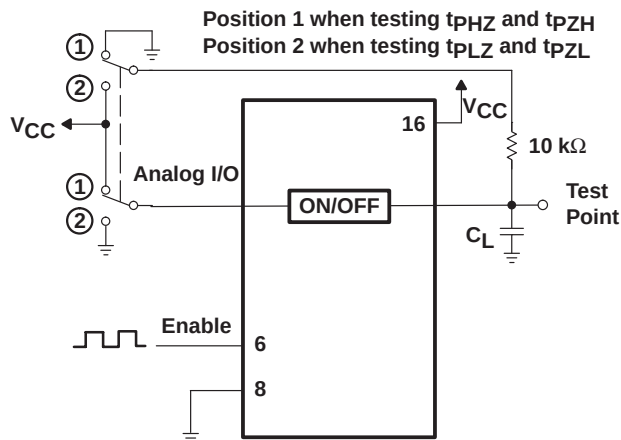


Figure 14. Propagation-Delay Test Setup,
Enable to Analog Out

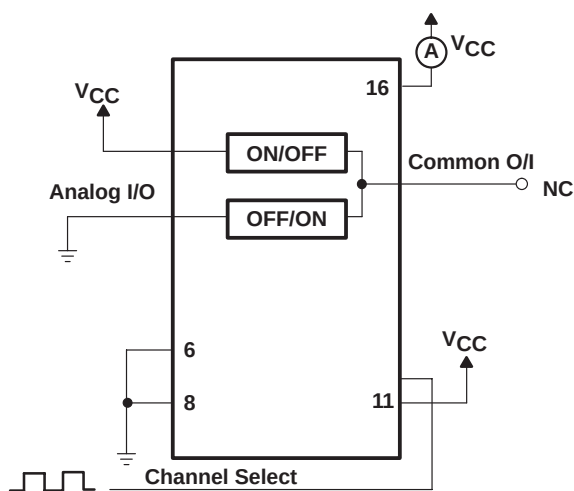
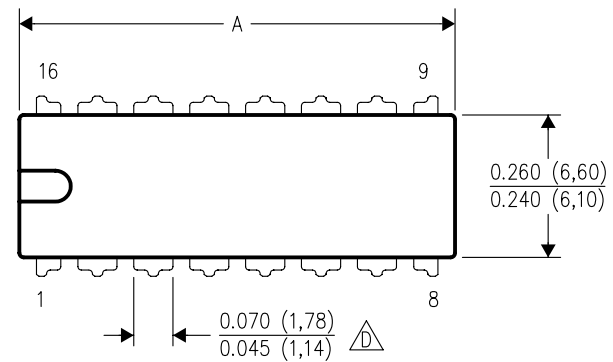


Figure 15. Power-Dissipation Capacitance Test Setup

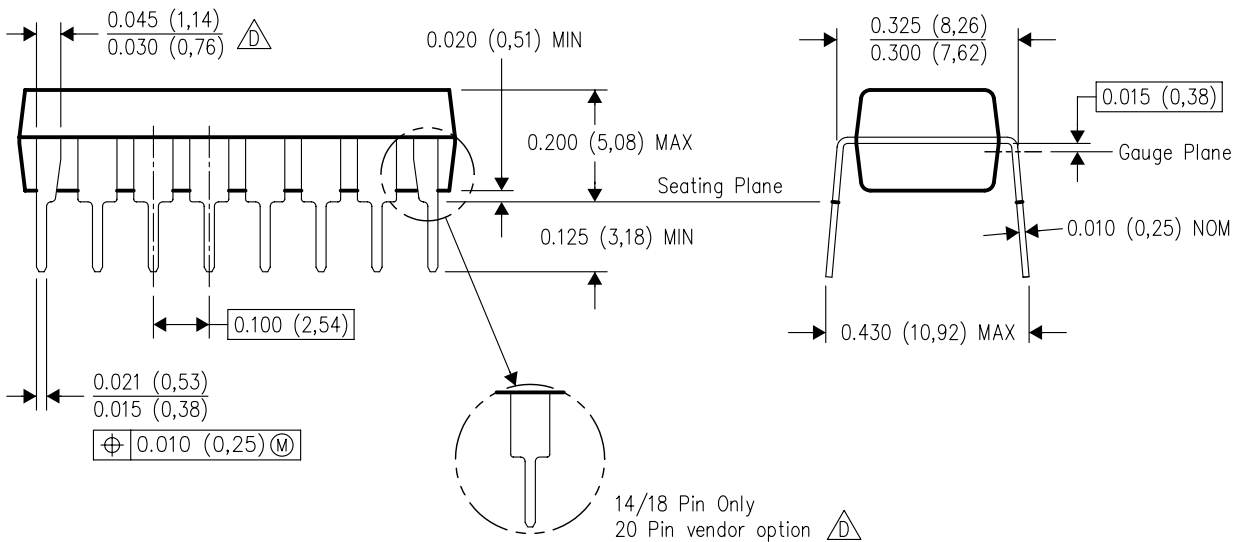
N (R-PDIP-T**)

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



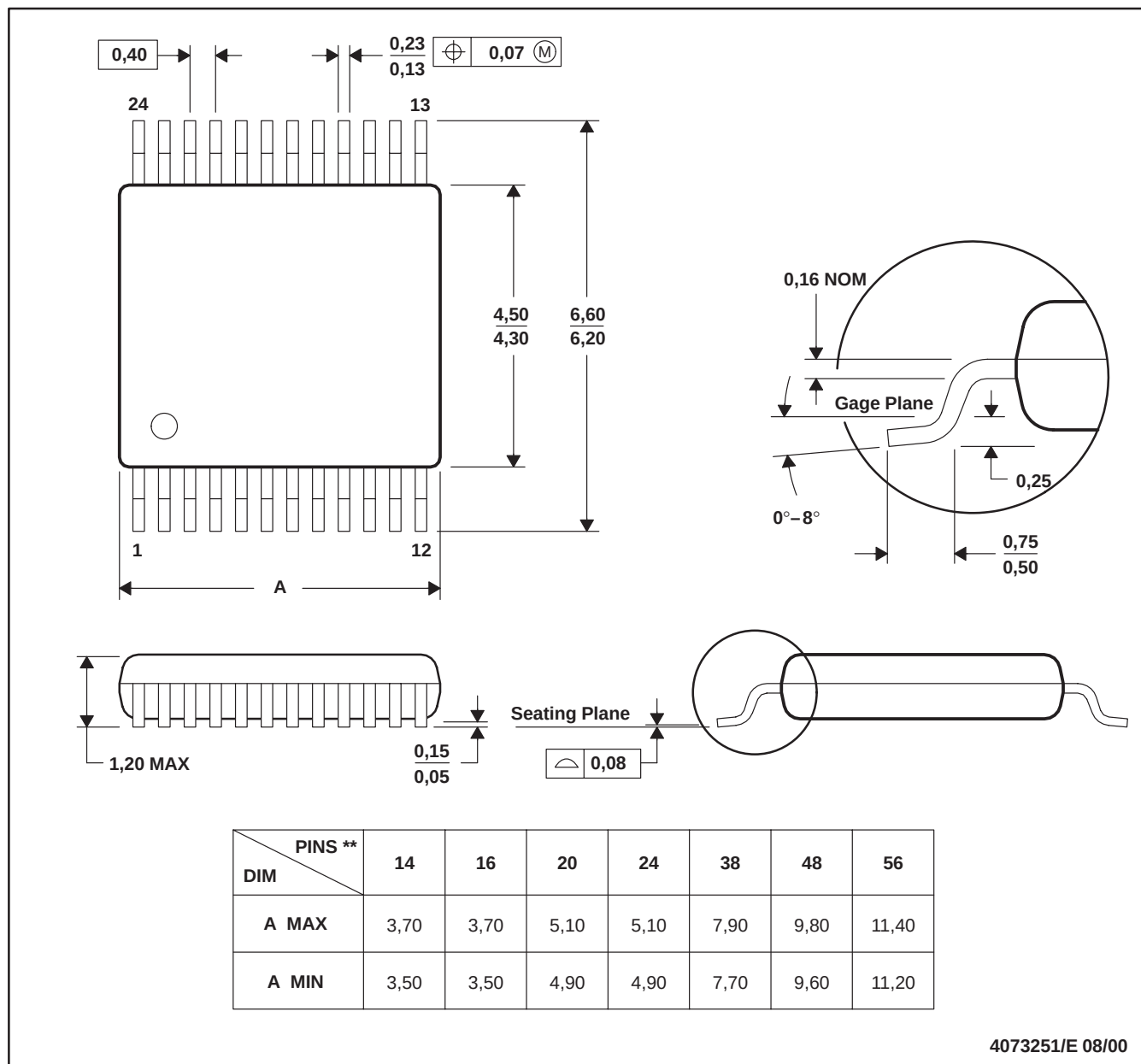
4040049/E 12/2002

- 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

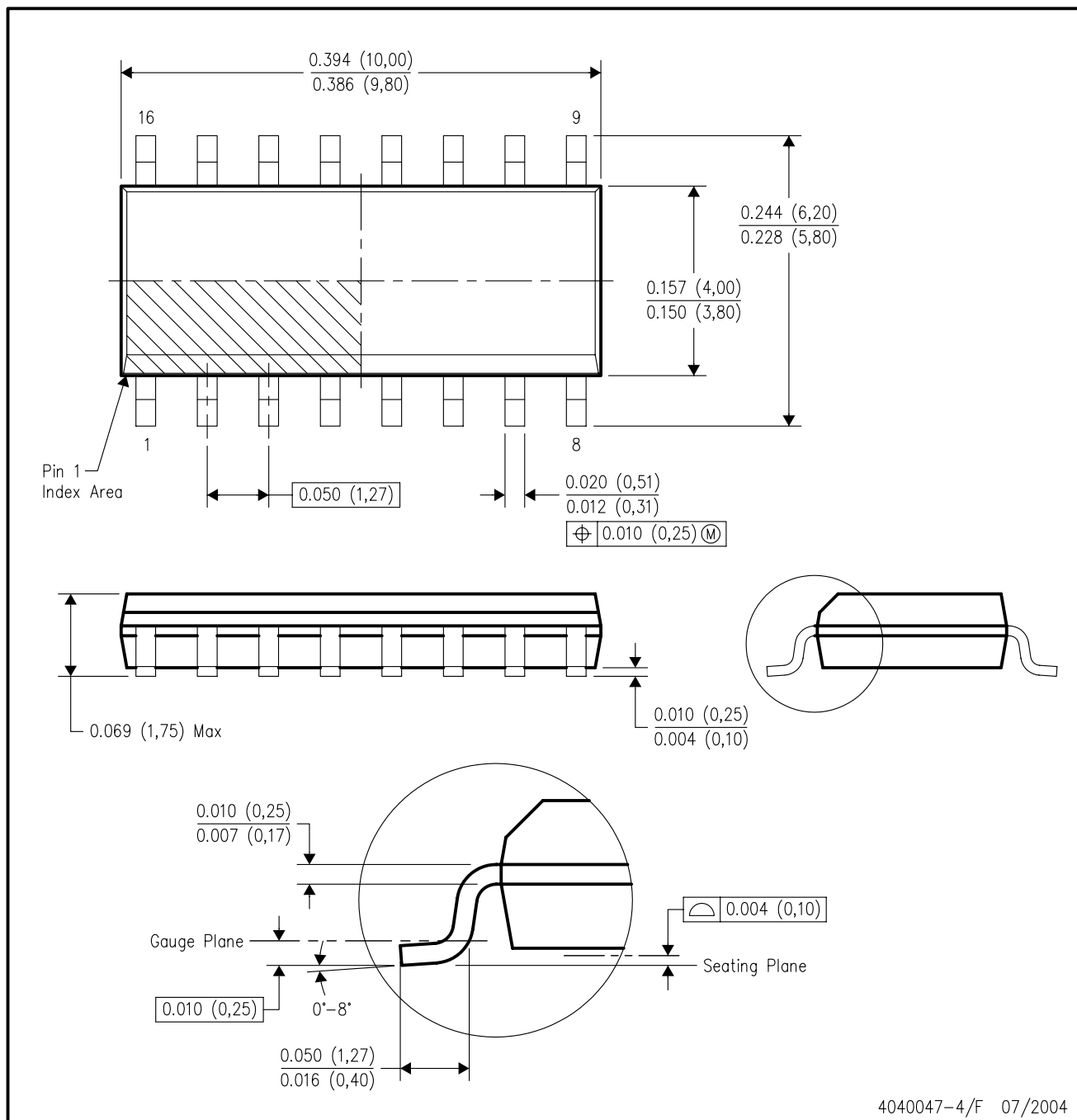
24 PINS SHOWN



- 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 PACKAGE

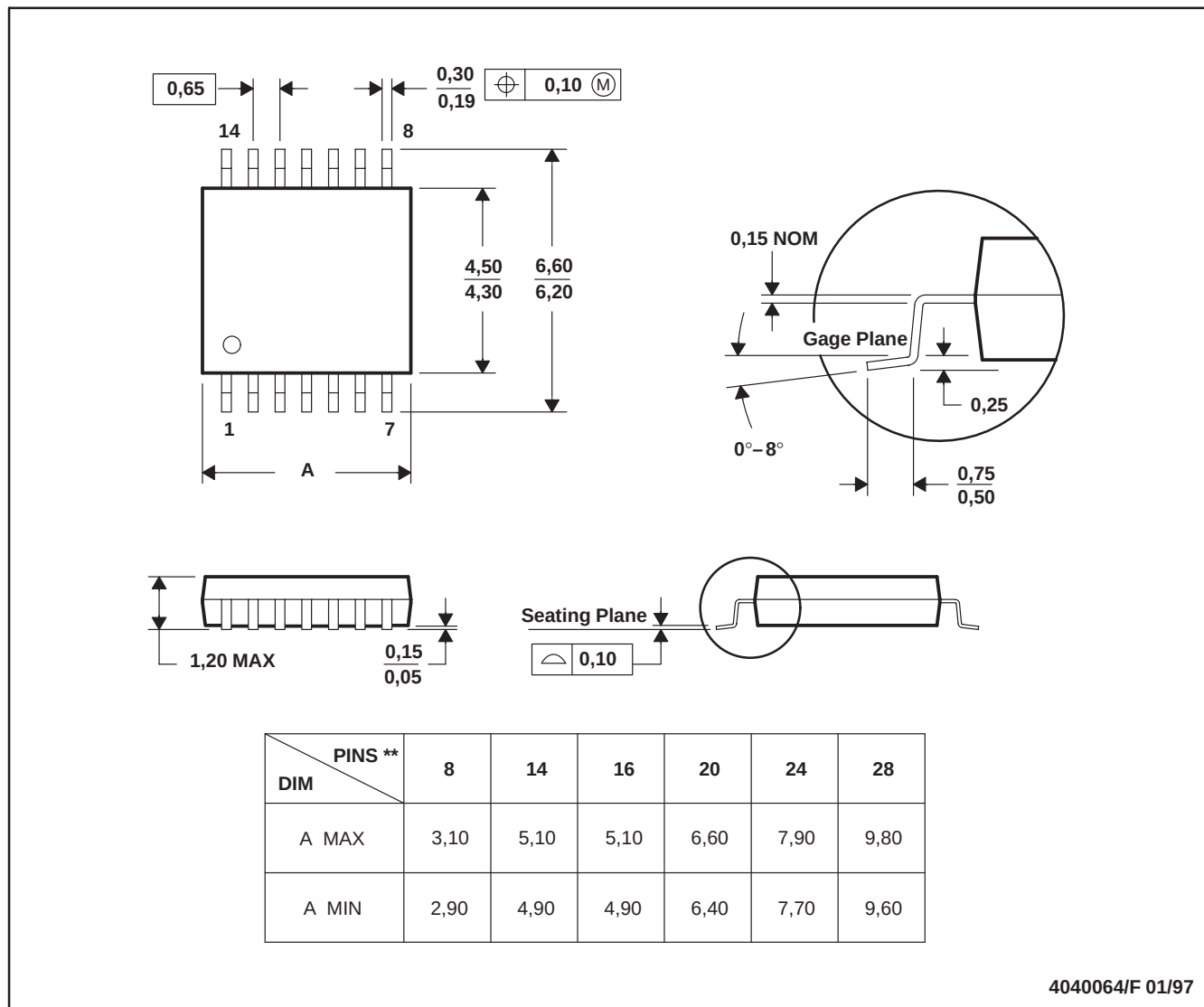


- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - Falls within JEDEC MS-012 variation AC.

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



- 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.
 D. Falls within JEDEC MO-153

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