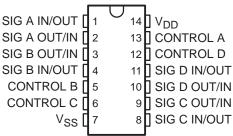
- 15-V Digital or ±7.5-V Peak-to-Peak **Switching**
- 125-Ω Typical On-State Resistance for 15-V Operation
- Switch On-State Resistance Matched to Within 5 Ω Over 15-V Signal-Input Range
- **On-State Resistance Flat Over Full** Peak-to-Peak Signal Range
- High On/Off Output-Voltage Ratio: 80 dB Typical at $f_{is} = 10 \text{ kHz}$, $R_L = 1 \text{ k}\Omega$
- **High Degree of Linearity: <0.5% Distortion** Typical at $f_{is} = 1 \text{ kHz}$, $V_{is} = 5 \text{ V p-p}$, $V_{DD} - V_{SS} \ge 10 \text{ V}, R_L = 10 \text{ k}\Omega$
- Extremely Low Off-State Switch Leakage, Resulting in Very Low Offset Current and High Effective Off-State Resistance: 10 pA Typical at $V_{DD} - V_{SS} = 10 \text{ V}$, $T_A = 25^{\circ}\text{C}$
- **Extremely High Control Input Impedance** (Control Circuit Isolated From Signal Circuit): $10^{12} \Omega$ Typical
- Low Crosstalk Between Switches: -50 dB Typical at $f_{is} = 8 \text{ MHz}$, $R_L = 1 \text{ k}\Omega$

- **Matched Control-Input to Signal-Output** Capacitance: Reduces Output Signal **Transients**
- Frequency Response, Switch On = 40 MHz **Typical**
- 100% Tested for Quiescent Current at 20 V
- 5-V, 10-V, and 15-V Parametric Ratings
- Meets All Requirements of JEDEC Tentative Standard No. 13-B, Standard Specifications for Description of "B" Series CMOS Devices
- **Applications:**
 - Analog Signal Switching/Multiplexing: Signal Gating, Modulator, Squelch Control, Demodulator, Chopper, **Commutating Switch**
 - Digital Signal Switching/Multiplexing
 - Transmission-Gate Logic Implementation
 - Analog-to-Digital and Digital-to-Analog Conversion
 - Digital Control of Frequency, Impedance, Phase, and Analog-Signal Gain

E, F, M, NS, OR PW PACKAGE (TOP VIEW)



description/ordering information

The CD4066B is a quad bilateral switch intended for the transmission or multiplexing of analog or digital signals. It is pin-for-pin compatible with the CD4016B, but exhibits a much lower on-state resistance. In addition, the on-state resistance is relatively constant over the full signal-input range.

The CD4066B consists of four bilateral switches, each with independent controls. Both the p and the n devices in a given switch are biased on or off simultaneously by the control signal. As shown in Figure 1, the well of the n-channel device on each switch is tied to either the input (when the switch is on) or to VSS (when the switch is off). This configuration eliminates the variation of the switch-transistor threshold voltage with input signal and, thus, keeps the on-state resistance low over the full operating-signal range.

The advantages over single-channel switches include peak input-signal voltage swings equal to the full supply voltage and more constant on-state impedance over the input-signal range. However, for sample-and-hold applications, the CD4016B is recommended.



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.

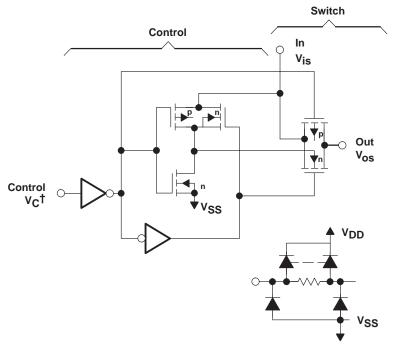


description/ordering information (continued)

ORDERING INFORMATION

TA	PACK	AGE†	ORDERABLE PART NUMBER	TOP-SIDE MARKING	
	CDIP – F	Tube of 25	CD4066BF3A	CD4066BF3A	
	PDIP – E	Tube of 25	CD4066BE	CD4066BE	
		Tube of 50	CD4066BM		
_55°C to 125°C	SOIC - M	Reel of 2500	CD4066BM96	CD4066BM	
-55 C to 125 C		Reel of 250	CD4066BMT		
	SOP - NS	Reel of 2000	CD4066BNSR	CD4066B	
	TSSOP – PW	Tube of 90	CD4066BPW	OMOOOD	
	13307 - PW	Reel of 2000	CD4066BPWR	CM066B	

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



[†] All control inputs are protected by the CMOS protection network.

NOTES: A. All p substrates are connected to $V_{\mbox{\scriptsize DD}}$.

- B. Normal operation control-line biasing: switch on (logic 1), $V_C = V_{DD}$; switch off (logic 0), $V_C = V_{SS}$
- C. Signal-level range: $V_{SS} \le V_{IS} \le V_{DD}$

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Figure 1. Schematic Diagram of One-of-Four Identical Switches and Associated Control Circuitry



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NOTE 1: The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions

		MIN	MAX	UNIT
V_{DD}	Supply voltage	3	18	V
TA	Operating free-air temperature	-55	125	°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.

electrical characteristics

					LIMITS AT INDICATED TEMPERATURES						
	PARAMETER	TEST CONDITIONS	VIN	v_{DD}		1202	85°C	125°C	25	°C	UNIT
			(V)	(V)	–55°C	–40°C			TYP	MAX	
			0, 5	5	0.25	0.25	7.5	7.5	0.01	0.25	
1	Quiescent device		0, 10	10	0.5	0.5	15	15	0.01	0.5	^
IDD	current		0, 15	15	1	1	30	30	0.01	1	μΑ
			0, 20	20	5	5	150	150	0.02	5	
Signal	Inputs (Vis) and Outpu	ıts (V _{OS})							_		
		$V_C = V_{DD}$, $R_L = 10 \text{ k}\Omega \text{ returned}$		5	800	850	1200	1300	470	1050	
r _{on}	On-state resistance (max)	to $\frac{(V_{DD} - V_{SS})}{2}$,		10	310	330	500	550	180	400	Ω
		$V_{iS} = V_{SS}$ to V_{DD}		15	200	210	300	320	125	240	
	On-state resistance			5					15		
$\Delta r_{\mbox{on}}$	difference between	$R_L = 10 \text{ k}\Omega, V_C = V_{DD}$		10					10		Ω
	any two switches			15					5		
THD	Total harmonic distortion	$V_C = V_{DD} = 5 \text{ V}, V_{SS} = -5 $ $V_{is(p-p)} = 5 \text{ V} \text{ (sine wave ce}$ $R_L = 10 \text{ k}\Omega, f_{iS} = 1 \text{-kHz sine}$	entered o	n 0 V),					0.4		%
	-3-dB cutoff frequency (switch on)	$V_C = V_{DD} = 5 \text{ V}, V_{SS} = -5 \text{ V}$ (sine wave centered on 0 V	/, V _{is(p-p}), R _L = 1) = 5 V kΩ					40		MHz
	-50-dB feedthrough frequency (switch off)	$V_C = V_{SS} = -5 \text{ V}, V_{is(p-p)} = 0$ (sine wave centered on 0 V	= 5 V), R _L = 1	kΩ					1		MHz
I _{iS}	Input/output leakage current (switch off) (max)	$V_C = 0 \text{ V}, V_{is} = 18 \text{ V}, V_{os} = $ and $V_C = 0 \text{ V}, V_{is} = 0 \text{ V}, V_{os} = 1 $		18	±0.1	±0.1	±1	±1	±10 ⁻⁵	±0.1	μΑ
	–50-dB crosstalk frequency	$V_{C}(A) = V_{DD} = 5 \text{ V},$ $V_{C}(B) = V_{SS} = -5 \text{ V},$ $V_{is}(A) = 5 V_{p-p}, 50-\Omega \text{ sourc}$ $R_{L} = 1 \text{ k}\Omega$	e,						8		MHz
^t pd	Propagation delay	$R_L = 200 \text{ k}\Omega, V_C = V_{DD},$ $V_{SS} = GND, C_L = 50 \text{ pF},$		5					20	40	ns
	(signal input to signal output)	V _{is} = 10 V (square wave centered on 5	5 V).	10					10	20	
		t_r , $t_f = 20 \text{ ns}$		15					7	15	
Cis	Input capacitance	$V_{DD} = 5 \text{ V}, V_{C} = V_{SS} = -5$	V						8		pF
Cos	Output capacitance	$V_{DD} = 5 \text{ V}, V_{C} = V_{SS} = -5$	V						8		pF
Cios	Feedthrough	$V_{DD} = 5 \text{ V}, V_{C} = V_{SS} = -5$	V						0.5		рF



electrical characteristics (continued)

				LIN	IITS AT II	NDICATE	D TEMPE	RATURE	S	UNIT
0	CHARACTERISTIC	TEST CONDITIONS	V _{DD}		4000		125°C	25°C		
			(V)	–55°C	–40°C	85°C	125-0	TYP	MAX	
Contro	ol (VC)									
	Control inner	$ I_{is} < 10 \mu A,$ $V_{is} = V_{SS}, V_{OS} = V_{DD}, and$ $V_{is} = V_{DD}, V_{OS} = V_{SS}$	5	1	1	1	1		1	
VILC	Control input, low voltage (max)		10	2	2	2	2		2	V
			15	2	2	2	2		2	
	Control innut		5			3.5 (MIN)			
VIHC	Control input, high voltage	See Figure 6	10	7 (MIN)						V
			15	11 (MIN)						
I _{IN}	Input current (max)	$V_{iS} \le V_{DD}$, $V_{DD} - V_{SS} = 18 \text{ V}$, $V_{CC} \le V_{DD} - V_{SS}$	18	±0.1	±0.1	±1	±1	±10 ⁻⁵	±0.1	μΑ
	Crosstalk (control input to signal output)	$V_C = 10 \text{ V (square wave)},$ t_f , $t_f = 20 \text{ ns}$, $R_L = 10 \text{ k}\Omega$	10					50		mV
		$V_{IN} = V_{DD}, t_f, t_f = 20 \text{ ns},$ $C_L = 50 \text{ pF}, R_L = 1 \text{ k}\Omega$	5					35	70	ns
	Turn-on and turn-off propagation delay		10					20	40	
	propagation aciay		15					15	30	
		$V_{is} = V_{DD}$, $V_{SS} = GND$, $R_L = 1 \text{ k}\Omega$ to GND, $C_L = 50 \text{ pF}$, $V_C = 10 \text{ V}$ (square wave centered on 5 V), t_r , $t_f = 20 \text{ ns}$, $V_{OS} = 1/2 V_{OS}$ at 1 kHz	5					6		MHz
	Maximum control input repetition rate		10					9		
			15					9.5		
Cl	Input capacitance							5	7.5	pF

switching characteristics

.,		SWITCH						
V _{DD} (V)	V _{is}		OUTPUT, V _{os} (V)					
	(V)	–55°C	125°C	MIN	MAX			
5	0	0.64	0.61	0.51	0.42	0.36		0.4
5	5	-0.64	-0.61	-0.51	-0.42	-0.36	4.6	
10	0	1.6	1.5	1.3	1.1	0.9		0.5
10	10	-1.6	-1.5	-1.3	-1.1	-0.9	9.5	
15	0	4.2	4	3.4	2.8	2.4		1.5
15	15	-4.2	-4	-3.4	-2.8	-2.4	13.5	

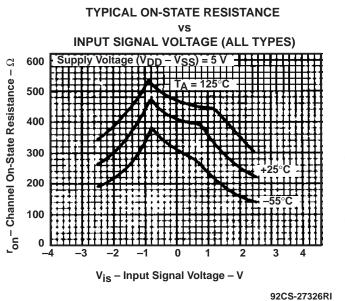


Figure 2

TYPICAL ON-STATE RESISTANCE

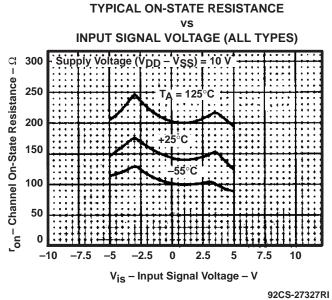


Figure 3

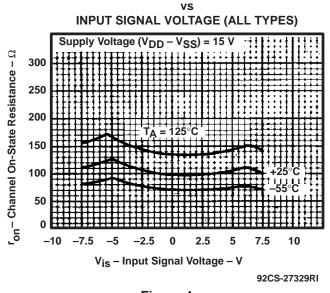


Figure 4

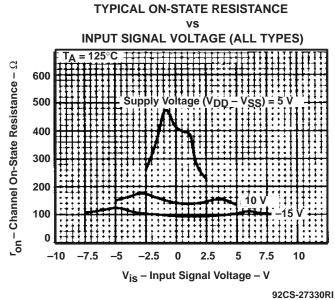
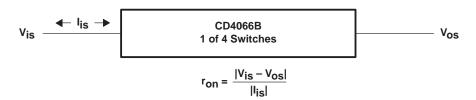
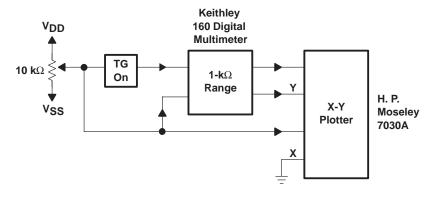


Figure 5



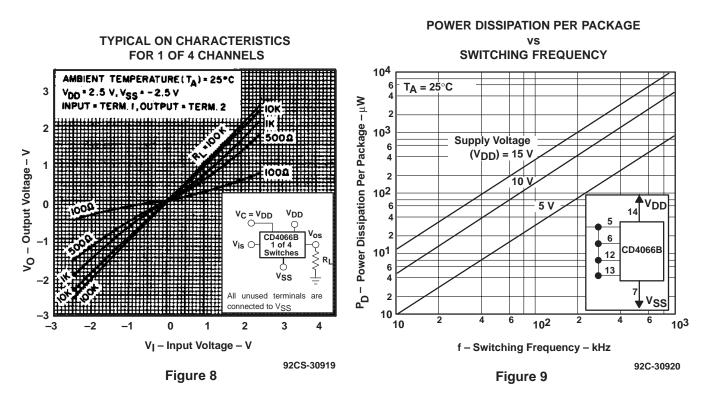
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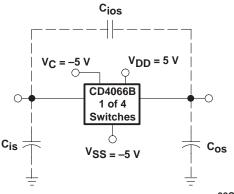
Figure 6. Determination of ron as a Test Condition for Control-Input High-Voltage (VIHC) Specification



92CS-22716

Figure 7. Channel On-State Resistance Measurement Circuit

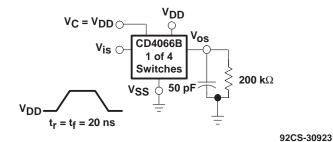




92CS-30921

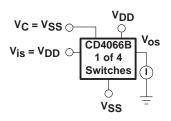
Measured on Boonton capacitance bridge, model 75a (1 MHz); test-fixture capacitance nulled out.

Figure 10. Typical On Characteristics for One of Four Channels



All unused terminals are connected to VSS.

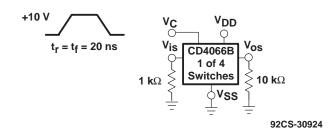
Figure 12. Propagation Delay Time Signal Input (V_{is}) to Signal Output (V_{os})



92CS-30922

All unused terminals are connected to VSS.

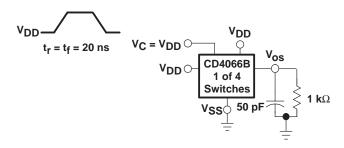
Figure 11. Off-Switch Input or Output Leakage



All unused terminals are connected to VSS.

Figure 13. Crosstalk-Control Input to Signal Output

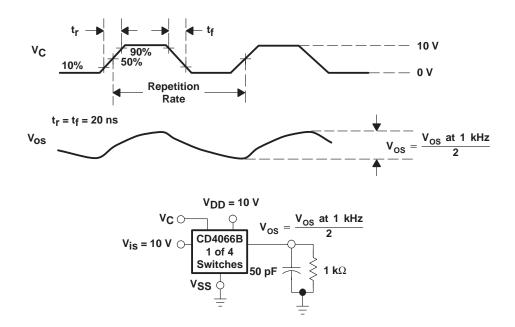




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NOTES: A. All unused terminals are connected to VSS. B. Delay is measured at V_{OS} level of +10% from ground (turn-on) or on-state output level (turn-off).

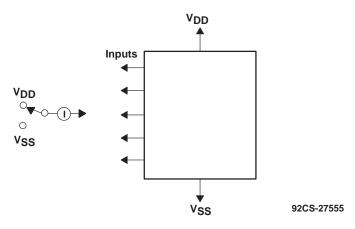
Figure 14. Propagation Delay, t_{PLH}, t_{PHL} Control-Signal Output



All unused terminals are connected to VSS.

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Figure 15. Maximum Allowable Control-Input Repetition Rate



Measure inputs sequentially to both VDD and VSS. Connect all unused inputs to either VDD or VSS. Measure control inputs only.

Figure 16. Input Leakage-Current Test Circuit

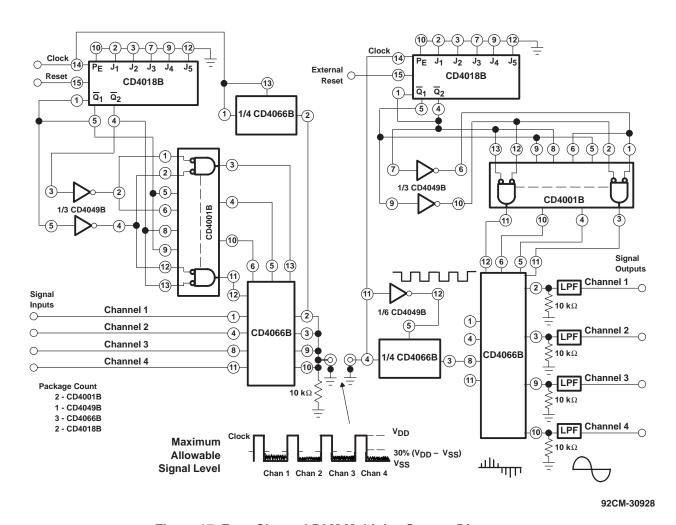
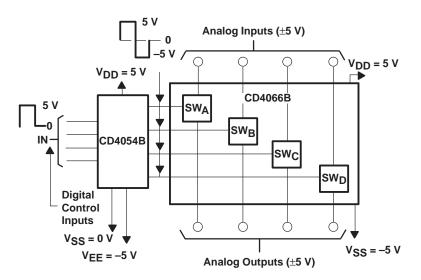


Figure 17. Four-Channel PAM Multiplex System Diagram





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Figure 18. Bidirectional Signal Transmission Via Digital Control Logic

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APPLICATION INFORMATION

In applications that employ separate power sources to drive V_{DD} and the signal inputs, the V_{DD} current capability should exceed V_{DD}/R_L (R_L = effective external load of the four CD4066B bilateral switches). This provision avoids any permanent current flow or clamp action on the V_{DD} supply when power is applied or removed from the CD4066B.

In certain applications, the external load-resistor current can include both V_{DD} and signal-line components. To avoid drawing V_{DD} current when switch current flows into terminals 1, 4, 8, or 11, the voltage drop across the bidirectional switch must not exceed 0.8 V (calculated from r_{on} values shown).

No V_{DD} current will flow through R_L if the switch current flows into terminals 2, 3, 9, or 10.







28-Feb-2005

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
CD4066BE	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
CD4066BF	ACTIVE	CDIP	J	14	1	None	Call TI	Level-NC-NC-NC
CD4066BF3A	ACTIVE	CDIP	J	14	1	None	Call TI	Level-NC-NC-NC
CD4066BM	ACTIVE	SOIC	D	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4066BM96	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4066BMT	ACTIVE	SOIC	D	14	250	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4066BNSR	ACTIVE	SO	NS	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
CD4066BPW	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
CD4066BPWR	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
JM38510/05852BCA	ACTIVE	CDIP	J	14	1	None	Call TI	Level-NC-NC-NC

(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 - May not be currently available - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.

None: Not yet available Lead (Pb-Free).

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.

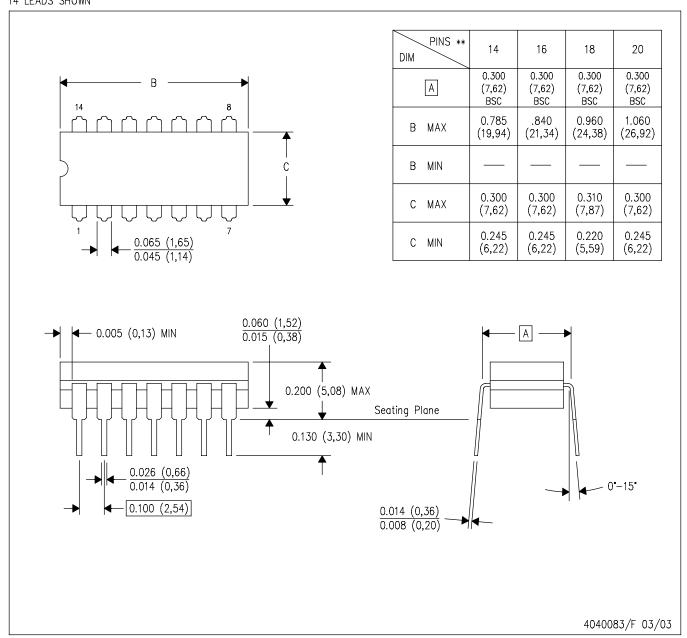
Green (RoHS & no Sb/Br): TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

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

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14 LEADS SHOWN



- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package is hermetically sealed with a ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
- E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN

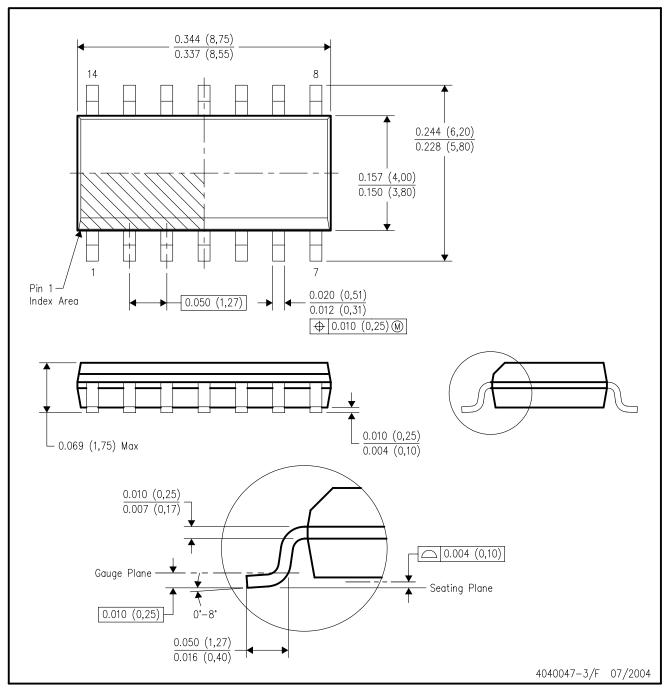


- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
- The 20 pin end lead shoulder width is a vendor option, either half or full width.



D (R-PDSO-G14)

PLASTIC SMALL-OUTLINE PACKAGE



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



MECHANICAL DATA

NS (R-PDSO-G**)

14-PINS SHOWN

PLASTIC SMALL-OUTLINE PACKAGE



- 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.



PW (R-PDSO-G**)

14 PINS SHOWN

PLASTIC SMALL-OUTLINE PACKAGE



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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