

# Precision 16-Channel/Dual 8-Channel CMOS Analog Multiplexers

## DESCRIPTION

The DG506B and DG507B are high performance analog multiplexers. Their ultra-low switch charge injection, low channel capacitance, and low leakage level allows them to achieve superior switching performance. The DG506B is a 16-channel single-ended analog multiplexer designed to connect one of sixteen inputs to a common output as determined by a 4-bit binary address (A0, A1, A2, A3). The DG507B is a dual 8-channel differential analog multiplexer designed to connect one of eight differential inputs to a common dual output as determined by its 3-bit binary address (A0, A1, A2). Break-before-make switching action protects against momentary crosstalk between adjacent channels.

An on channel conducts current equally well in both directions. In the off state each channel blocks voltages up to the power supply rails. An enable (EN) function allows the user to reset the multiplexer/demultiplexer to all switches off for stacking several devices. All control inputs, addresses (Ax) and enable (EN) are TTL compatible over the full specified operating temperature range.

The DG506B and DG507B are fabricated on an enhanced SG-II CMOS process that achieves improved performance on: reduced charge injection, lower device leakage, and minimized parasitic capacitance.

As the DG506, DG507 has a long history in the industry with many suppliers offering copies, and in some cases improved variations, with the best in class improvements, the Vishay Siliconix new version of the DG506B, DG507B are the superior alternatives to what is currently available.

Applications for the DG506B, DG507B include high speed and high precision data acquisition, audio signal switching and routing, ATE systems, and avionics. High performance and low power dissipation make them ideal for battery operated and remote instrumentation applications.

The DG506B and DG507B have the absolute maximum voltage rating extended to 44 V. Additionally, single supply operation is also allowed. An epitaxial layer prevents latch-up.

The DG506B and DG507B are both available in 28-lead SOIC and TSSOP package options with extended temperature range of - 40 °C to + 125 °C.

For more information, refer to Vishay Siliconix DG506B, DG507B evaluation board note.

## FEATURES

- Operate with single or dual power supply
- V+ to V- analog signal swing range
- 44 V power supply maximum rating
- Extended operate temperature range:  
- 40 °C to + 125 °C
- Low leakage typically < 3 pA
- Low charge injection -  $Q_{INJ} = 1 \text{ pC}$
- Low power -  $I_{SUPPLY} = 5 \mu\text{A}$
- TTL compatible logic
- > 250 mA latch up current per JESD78
- Available in SOIC28 and TSSOP28 packages
- Superior alternative to:
  - ADG506A, DG506A, HI-506
  - ADG507A, DG507A, HI-507
- Compliant to RoHS directive 2002/95/EC
- Halogen-free according to IEC 61249-2-21 definition



## BENEFITS

- Reduced switching errors
- Reduced glitching
- Improved data throughput
- Reduced power consumption
- Increased ruggedness
- Wide supply ranges ( $\pm 5 \text{ V}$  to  $\pm 20 \text{ V}$ )

## APPLICATIONS

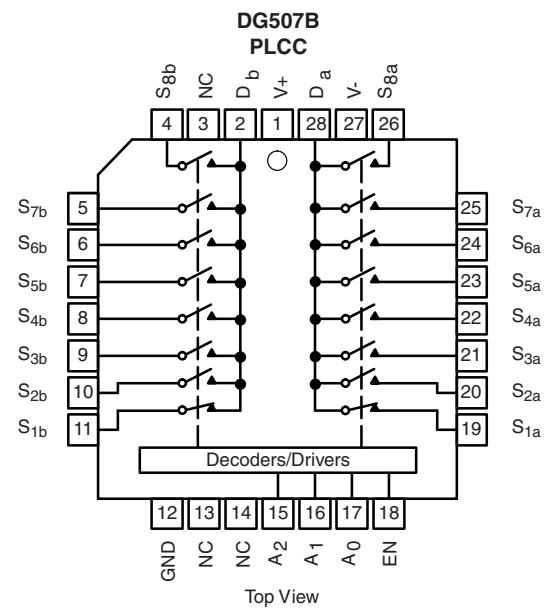
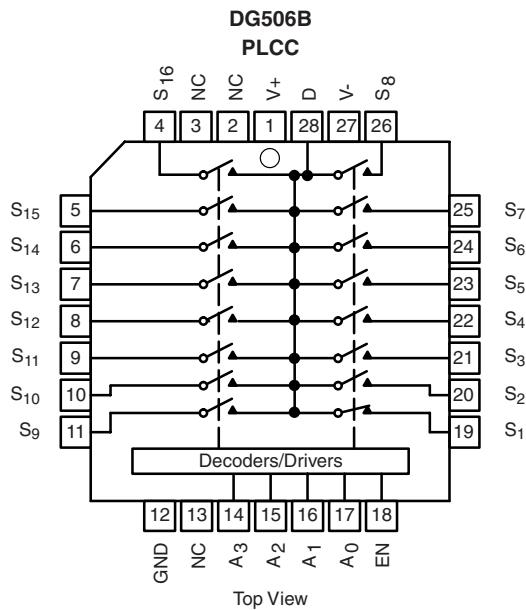
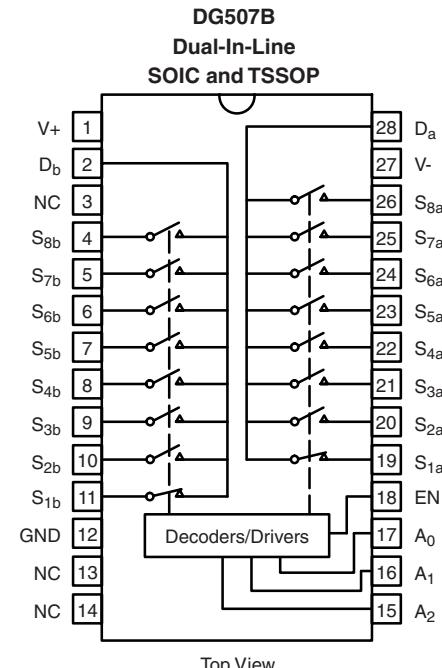
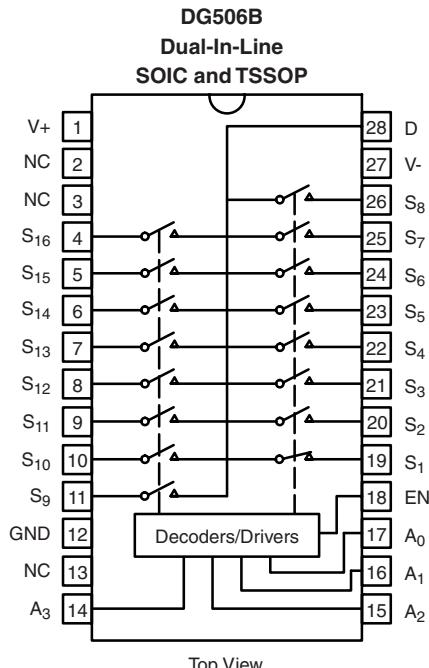
- Data acquisition systems
- Audio and video signal routing
- ATE systems
- Medical instrumentation

# DG506B, DG507B

Vishay Siliconix



## FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



**TRUTH TABLE DG506B**

A <sub>3</sub>	A <sub>2</sub>	A <sub>1</sub>	A <sub>0</sub>	EN	On Switch
X	X	X	X	0	None
0	0	0	0	1	1
0	0	0	1	1	2
0	0	1	0	1	3
0	0	1	1	1	4
0	1	0	0	1	5
0	1	0	1	1	6
0	1	1	0	1	7
1	1	1	1	1	8
1	0	0	0	1	9
1	0	0	1	1	10
1	0	1	0	1	11
1	0	1	1	1	12
1	1	0	0	1	13
1	1	0	1	1	14
1	1	1	0	1	15
1	1	1	1	1	16

**TRUTH TABLE DG507B**

A <sub>2</sub>	A <sub>1</sub>	A <sub>0</sub>	EN	On Switch
X	X	X	0	None
0	0	0	1	1
0	0	0	1	2
0	1	1	1	3
0	1	1	1	4
1	0	0	1	5
1	0	0	1	6
1	1	1	1	7
1	1	1	1	8

Logic "0" = V<sub>IL</sub> ≤ 0.8 VLogic "1" = V<sub>IH</sub> ≥ 2.4 V

X = Do not care

**ORDERING INFORMATION DG506B**

Temp. Range	Package	Part Number
- 40 °C to 125 °C	28-Pin SOIC	DG506BEW-T1-GE3
	28-Pin TSSOP	DG506BEQ-T1-GE3
	28-Pin PLCC	DG506BEN-T1-GE3

**ORDERING INFORMATION DG507B**

Temp. Range	Package	Part Number
- 40 °C to 125 °C	28-Pin SOIC	DG507BEW-T1-GE3
	28-Pin TSSOP	DG507BEQ-T1-GE3
	28-Pin PLCC	DG507BEN-T1-GE3

**ABSOLUTE MAXIMUM RATINGS**

Parameter	Limit	Unit
Voltages Referenced to V-	V+	V
	GND	
	(V-) - 2 to (V+) + 2 or 20 mA, whichever occurs first	
Digital Inputs <sup>a</sup> , V <sub>S</sub> , V <sub>D</sub>	44	
Current (Any terminal)	25	
Peak Current, S or D (Pulsed at 1 ms, 10 % duty cycle max.)	30	
Storage Temperature	100	mA
Power Dissipation (Packages) <sup>b</sup>	- 65 to 150	°C
28-Pin Wide Body SOIC <sup>c</sup>	840	mW
28-Pin TSSOP <sup>d</sup>	817	
28-Pin PLCC <sup>e</sup>	1693	
Thermal Resistance ( $\theta_{J-A}$ ) <sup>b</sup>	28-Pin Wide Body SOIC <sup>c</sup>	95.3
	28-Pin TSSOP <sup>d</sup>	97.9
	28-Pin PLCC <sup>e</sup>	47.3

Notes:

a. Signals on S<sub>X</sub>, D<sub>X</sub> or IN<sub>X</sub> exceeding V+ or V- will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

b. All leads soldered or welded to PC board.

c. Derate 10.5 mW/°C above 70 °C.

d. Derate 10.2 mW/°C above 70 °C.

e. Derate 21.2 mW/°C above 70 °C.

Parameter	Symbol	Test Conditions Unless Otherwise Specified $V_+ = 15 \text{ V}$ , $V_- = -15 \text{ V} (\pm 10\%)$ $V_{AX}, V_{EN} = 2.4 \text{ V}, 0.8 \text{ V}^a$	Temp. <sup>b</sup>	Typ. <sup>c</sup>	A Suffix		D Suffix		Unit
					Min. <sup>d</sup>	Max. <sup>d</sup>	Min. <sup>d</sup>	Max. <sup>d</sup>	
<b>Analog Switch</b>									
Analog Signal Range <sup>e</sup>	$V_{ANALOG}$		Full		-15	15	-15	15	V
Drain-Source On-Resistance	$R_{DS(on)}$	$V_D = \pm 10 \text{ V}$ , $I_S = -1 \text{ mA}$	Room	170		300		300	$\Omega$
			Full			400		400	
$R_{DS(on)}$ Matching	$\Delta R_{DS(on)}$	$V_D = \pm 10 \text{ V}$	Room	10					
Source Off Leakage Current	$I_{S(off)}$	$V_D = \pm 10 \text{ V}$	Room	0.005	-1	1	-1	1	$n\text{A}$
			Full		-50	50	-50	50	
Drain Off Leakage Current	$I_{D(off)}$	$V_D = \pm 10 \text{ V}$ $V_S = \mp 10 \text{ V}$ $V_{EN} = 0 \text{ V}$	DG506B	Room	0.005	-1	1	-1	1
			Full		-100	100	-100	100	
			DG507B	Room	0.005	-1	1	-1	1
			Full		-50	50	-50	50	
Drain On Leakage Current	$I_{D(on)}$	$V_S = V_D = \mp 10 \text{ V}$ sequence each switch on	DG506B	Room	0.005	-1	1	-1	1
			Full		-100	100	-100	100	
			DG507B	Room	0.005	-1	1	-1	1
			Full		-50	50	-50	50	
<b>Digital Control</b>									
Logic High Input Voltage	$V_{INH}$		Full		2.4		2.4		V
Logic Low Input Voltage	$V_{INL}$		Full			0.8		0.8	
Logic High Input Current	$I_{IH}$	$V_{AX}, V_{EN} = 2.4 \text{ V}$	Full		-1	1	-1	1	$\mu\text{A}$
Logic Low Input Current	$I_{IL}$	$V_{AX}, V_{EN} = 0.8 \text{ V}$	Full		-1	1	-1	1	
Logic Input Capacitance <sup>e</sup>	$C_{in}$	$f = 1 \text{ MHz}$	Room	5					pF
<b>Dynamic Characteristics</b>									
Transition Time	$t_{TRANS}$	$VS_1 = +10 \text{ V}/-10 \text{ V}$ , $VS_{16} = -10 \text{ V}/+10 \text{ V}$ , $R_L = 1 \text{ M}\Omega$ , $C_L = 35 \text{ pF}$ see figure 2	Room	190		300		300	ns
			Full			360		360	
Break-Before-Make Interval	$t_{OPEN}$	$VS_1 = VS_{16} = 5.0 \text{ V}$ , $C_L = 35 \text{ pF}$ , $R_L = 1 \text{ k}\Omega$ , see figure 4	Room	84	30		30		
			Full		10		10		
Enable Turn-On Time	$t_{ON(EN)}$	$VS_1 = 5 \text{ V}$ , $VS_2$ to $VS_{16} = 0 \text{ V}$ , $R_L = 1 \text{ k}\Omega$ , $C_L = 35 \text{ pF}$ see figure 3	Room	151		250		250	
			Full			310		310	
Enable Turn-Off Time	$t_{OFF(EN)}$		Room	53		200		200	
			Full			220		220	
Charge Injection <sup>e</sup>	$Q_{INJ}$	$C_L = 1 \text{ nF}$ , $R_{GEN} = 0 \Omega$ , $V_{GEN} = 0 \text{ V}$	Full	1					pC
Off Isolation <sup>e</sup>	$OIRR$	$C_L = 5 \text{ pF}$ , $R_L = 50 \Omega$ , $f = 1 \text{ MHz}$	Room	-85					dB
				-84					
Crosstalk <sup>e</sup>	$XTALK$	$C_L = 5 \text{ pF}$ , $R_L = 50 \Omega$ , $f = 1 \text{ MHz}$	Room	-85					
				-84					
-3 dB Bandwidth <sup>e</sup>	$BW$	$R_L = 50 \Omega$	Room	114					MHz
				217					
Total Harmonic Distortion <sup>e</sup>	$THD$	$R_L = 10 \text{ k}\Omega$ , $5 \text{ V}_{rms}$	Room	0.04					%
Source Off Capacitance <sup>e</sup>	$C_{S(off)}$		Room	3					pF
Drain Off Capacitance <sup>e</sup>	$C_{D(off)}$		Room	31					
				17					
Drain On Capacitance <sup>e</sup>	$C_{D(on)}$		Room	38					
				24					
<b>Power Supply</b>									
Positive Supply Current	$I_+$	$V_{AX}, V_{EN} = 0 \text{ V or } 5 \text{ V}$	Room	0.005		0.1		0.1	mA
			Full			0.1		0.1	
Negative Supply Current	$I_-$		Full		-1		-1		$\mu\text{A}$

Parameter	Symbol	Test Conditions Unless Otherwise Specified $V_+ = 12 \text{ V}$ , $V_- = 0 \text{ V}$ ( $\pm 10\%$ ) $V_{AX}, V_{EN} = 2.4 \text{ V}, 0.8 \text{ V}^a$	Temp. <sup>b</sup>	Typ. <sup>c</sup>	A Suffix - 40 °C to 125 °C		D Suffix - 40 °C to 85 °C		Unit	
					Min. <sup>d</sup>	Max. <sup>d</sup>	Min. <sup>d</sup>	Max. <sup>d</sup>		
<b>Analog Switch</b>										
Analog Signal Range <sup>e</sup>	$V_{ANALOG}$		Full		0	12	0	12	V	
On-Resistance	$R_{DS(on)}$	$V_D = 10 \text{ V}/0 \text{ V}$ , $I_S = 1 \text{ mA}$	Room	270		450		450	$\Omega$	
			Full			650		650		
			Room	10						
$R_{DS(on)}$ Matching	$\Delta R_{DS(on)}$		Room	0.005	- 1	1	- 1	1	$nA$	
Switch Off Leakage Current	$I_{S(off)}$	$V_+ = 12 \text{ V}$ , $V_- = 0 \text{ V}$ $V_D = 0 \text{ V}/10 \text{ V}$ , $V_S = 10 \text{ V}/0 \text{ V}$	Room	0.005	- 50	- 50	- 50	50		
			Full		- 100	100	- 100	100		
	$I_{D(off)}$		Room	0.005	- 1	1	- 1	1		
			Full		- 50	50	- 50	50		
Channel On Leakage Current	$I_{D(on)}$	$V_+ = 12 \text{ V}$ , $V_- = 0 \text{ V}$ $V_S = V_D = 0 \text{ V}/10 \text{ V}$	Room	0.005	- 1	1	- 1	1	$\mu A$	
			Full		- 100	100	- 100	100		
			Room	0.005	- 1	1	- 1	1		
			Full		- 50	50	- 50	50		
<b>Digital Control</b>										
Logic High Input Voltage	$V_{INH}$		Full		2.4		2.4		V	
Logic Low Input Voltage	$V_{INL}$		Full			0.8		0.8		
Logic High Input Current	$I_{IH}$	$V_{AX}, V_{EN} = 2.4 \text{ V}$	Full		- 1	1	- 1	1	$\mu A$	
Logic Low Input Current	$I_{IL}$	$V_{AX}, V_{EN} = 0.8 \text{ V}$	Full		- 1	1	- 1	1		
Logic Input Capacitance <sup>e</sup>	$C_{in}$	$f = 1 \text{ MHz}$	Room	5					pF	
<b>Dynamic Characteristics</b>										
Transition Time	$t_{TRANS}$	$VS_1 = 10 \text{ V}/0 \text{ V}$ , $VS_{16} = 0 \text{ V}/10 \text{ V}$ , $R_L = 1 \text{ M}\Omega$ , $C_L = 35 \text{ pF}$ , see figure 2	Room	228		380		380	$ns$	
			Full			450		450		
Break-Before-Make Interval	$t_{OPEN}$	$VS_1 = VS_{16} = 5 \text{ V}$ , $C_L = 35 \text{ pF}$ , $R_L = 1 \text{ k}\Omega$ , see figure 4	Room	115	40		40			
			Full		10		10			
Enable Turn-On Time	$t_{ON(EN)}$	$VS_1 = 5 \text{ V}$ , $VS_2$ to $VS_{16} = 0 \text{ V}$ , $R_L = 1 \text{ k}\Omega$ , $C_L = 35 \text{ pF}$ see figure 3	Room	197		300		300		
			Full			420		420		
Enable Turn-Off Time	$t_{OFF(EN)}$		Room	46		200		200		
			Full			220		220		
Charge Injection <sup>e</sup>	$Q_{INJ}$	$C_L = 1 \text{ nF}$ , $R_{GEN} = 0 \Omega$ , $V_{GEN} = 0 \text{ V}$	Full	4					pC	
Off Isolation <sup>e</sup>	$OIRR$	$C_L = 5 \text{ pF}$ , $R_L = 50 \Omega$ $f = 1 \text{ MHz}$	Room	- 86					dB	
				- 84						
Crosstalk <sup>e</sup>	$X_{TALK}$	$C_L = 5 \text{ pF}$ , $R_L = 50 \Omega$ $f = 1 \text{ MHz}$	Room	- 85						
				- 84						
- 3 dB Bandwidth <sup>e</sup>	$BW$	$R_L = 50 \Omega$	Room	104					MHz	
				191						
Total Harmonic Distortion <sup>e</sup>	THD	$R_L = 10 \text{ k}\Omega$ , $5 \text{ V}_{RMS}$ , $f = 20 \text{ Hz}$ to $20 \text{ kHz}$	Room	0.23					%	

**SPECIFICATIONS** Single Supply 12 V

Parameter	Symbol	Test Conditions Unless Otherwise Specified $V_+ = 12 \text{ V}$ , $V_- = 0 \text{ V} (\pm 10\%)$ $V_{AX}, V_{EN} = 2.4 \text{ V}, 0.8 \text{ V}^a$	Temp. <sup>b</sup>	Typ. <sup>c</sup>	A Suffix -40 °C to 125 °C		D Suffix -40 °C to 85 °C		Unit		
					Min. <sup>d</sup>	Max. <sup>d</sup>	Min. <sup>d</sup>	Max. <sup>d</sup>			
<b>Dynamic Characteristics</b>											
Source Off Capacitance <sup>e</sup>	$C_{S(\text{off})}$	$f = 1 \text{ MHz}$	Room	4					pF		
Drain Off Capacitance <sup>e</sup>	$C_{D(\text{off})}$			37							
Channel On Capacitance <sup>e</sup>	$C_{D(\text{on})}$			20							
				43							
Power Supply	$I_+$			26							
Power Supply Current	$I_+$	$V_{AX}, V_{EN} = 0 \text{ V, or } 5 \text{ V}$		Room	0.005		0.1		0.1		
				Full			0.1		0.1		

Notes:

a.  $V_{AX}, V_{EN}$  = input voltage perform proper function.

b. Room = 25 °C, Full = as determined by the operating temperature suffix.

c. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

d. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this datasheet.

e. Guaranteed by design, not subject to production test.

f.  $\Delta R_{DS(\text{on})} = R_{DS(\text{on}) \text{ max.}} - R_{DS(\text{on}) \text{ min.}}$ 

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 in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

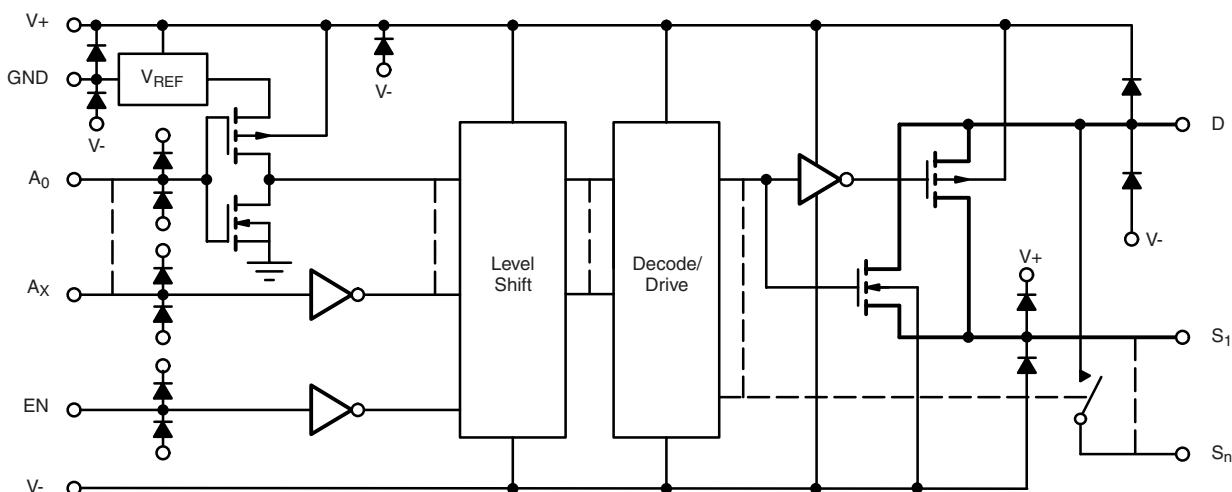
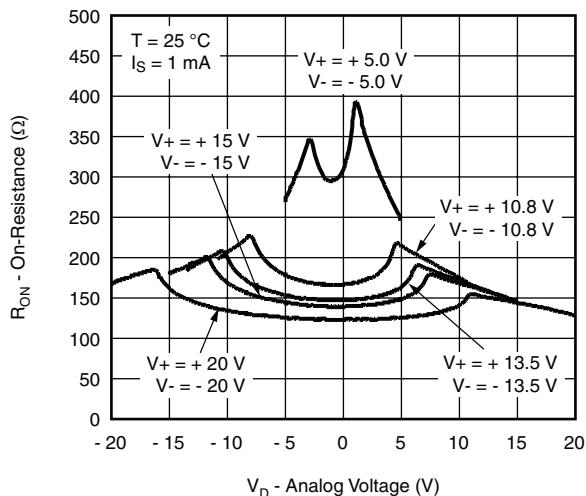
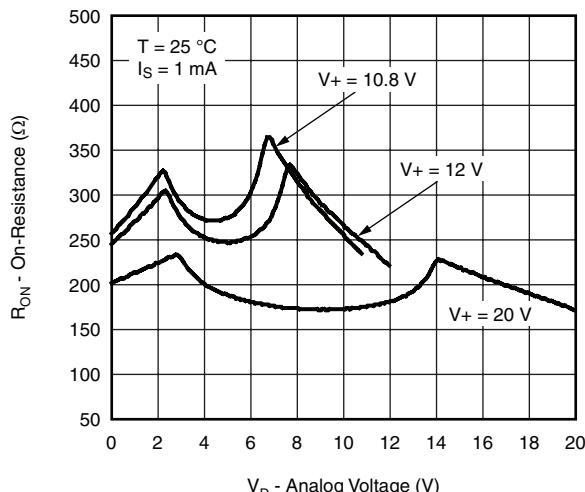
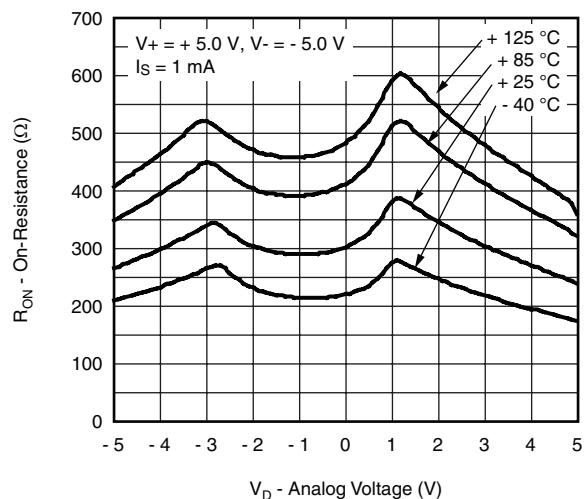
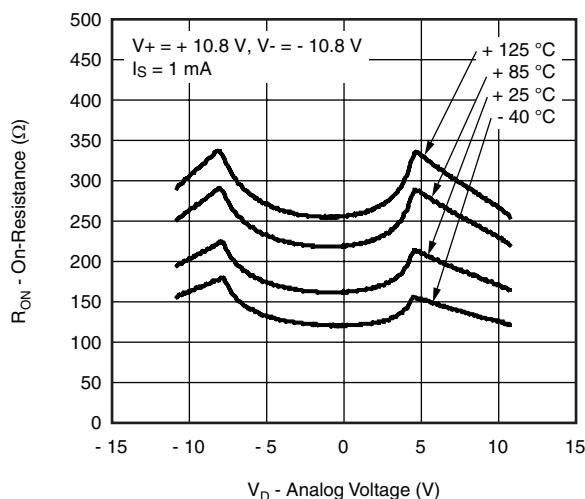
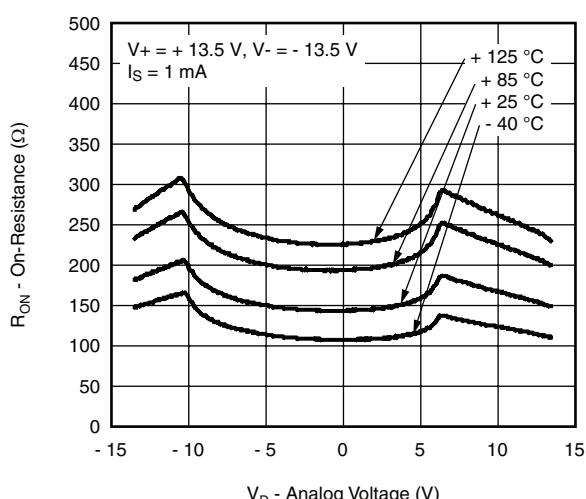
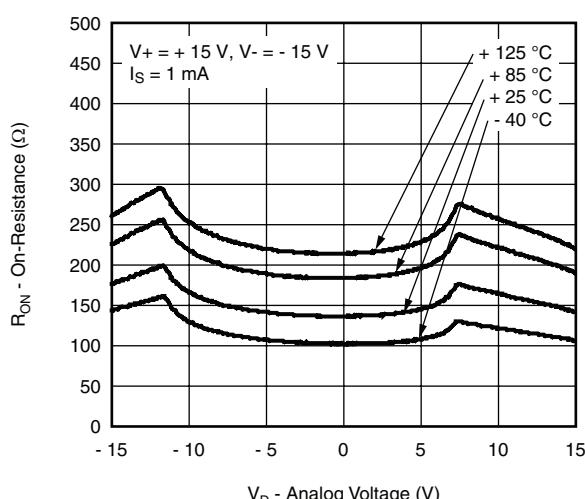
**SCHEMATIC DIAGRAM** Typical Channel

Figure 1.

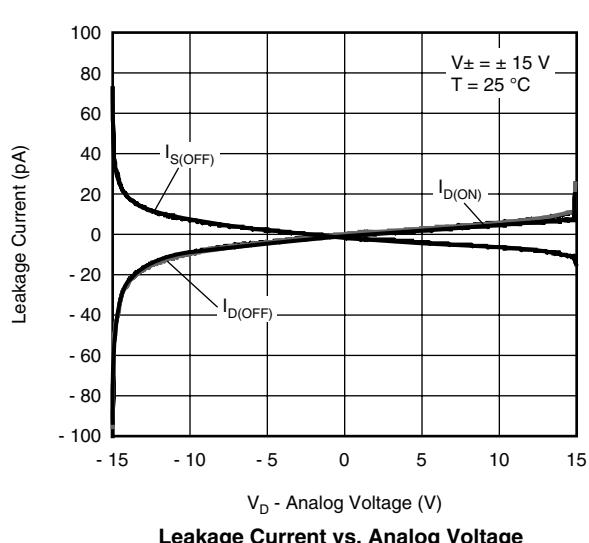
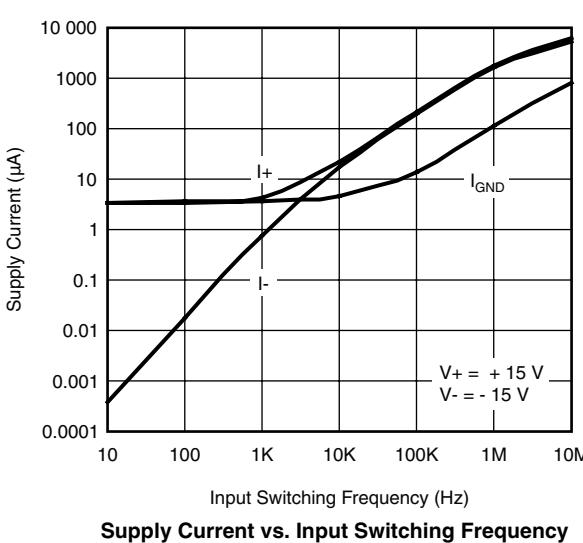
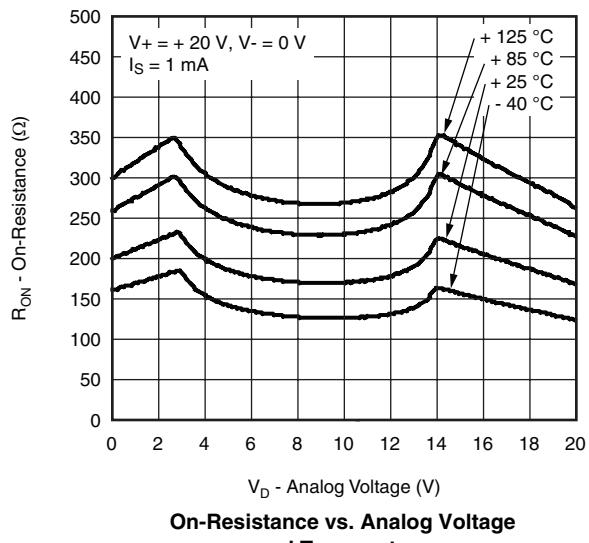
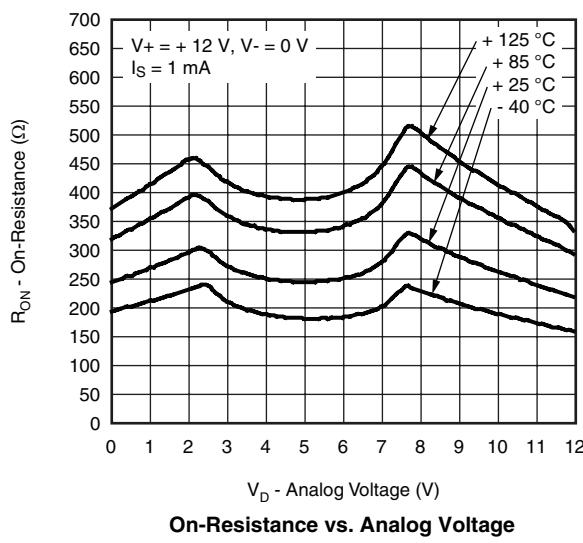
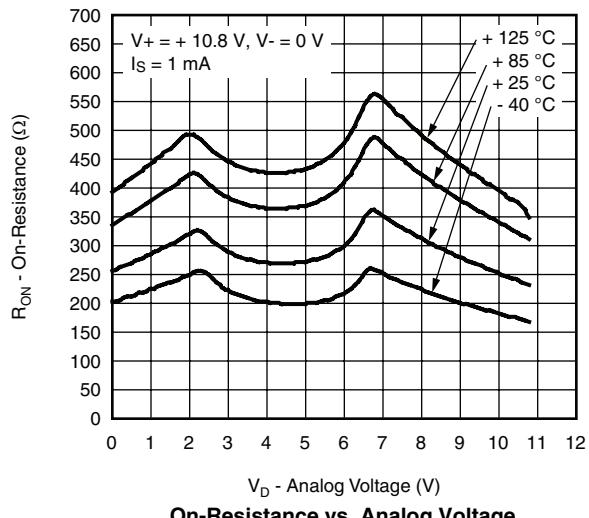
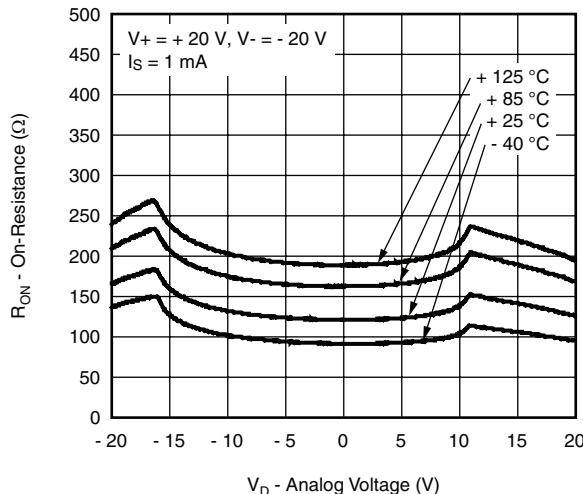
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**On-Resistance vs.  $V_D$  and Dual Supply Voltage**

**On-Resistance vs.  $V_D$  and Single Supply Voltage**

**On-Resistance vs. Analog Voltage and Temperature**

**On-Resistance vs. Analog Voltage and Temperature**

**On-Resistance vs. Analog Voltage and Temperature**

**On-Resistance vs. Analog Voltage and Temperature**

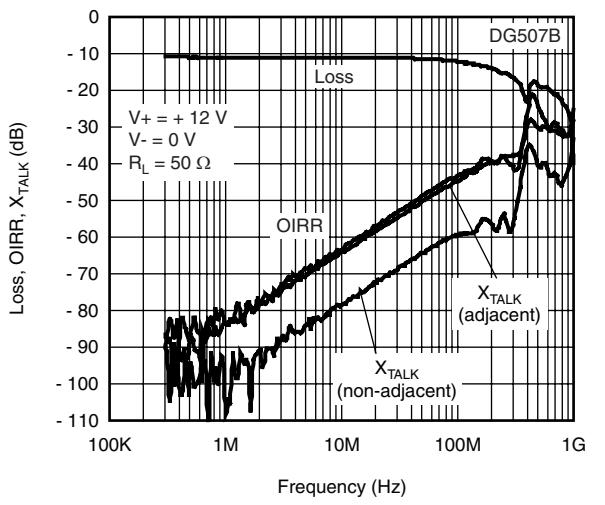
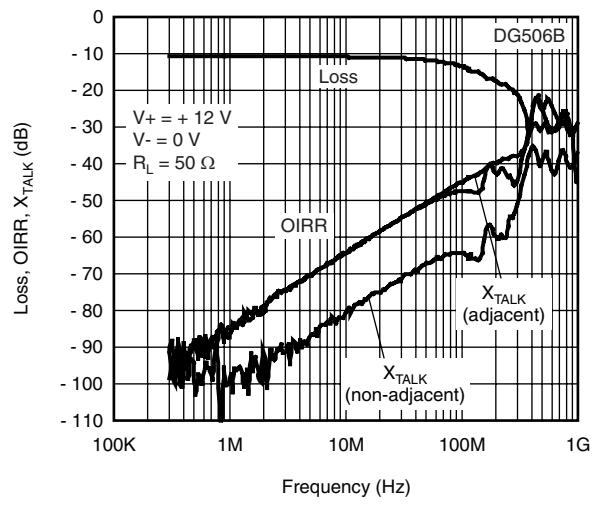
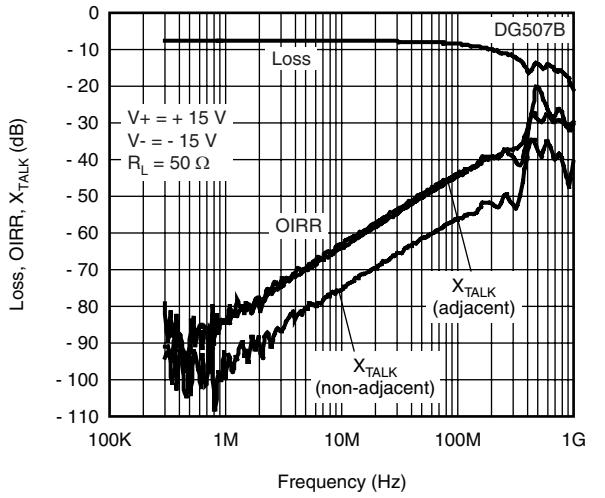
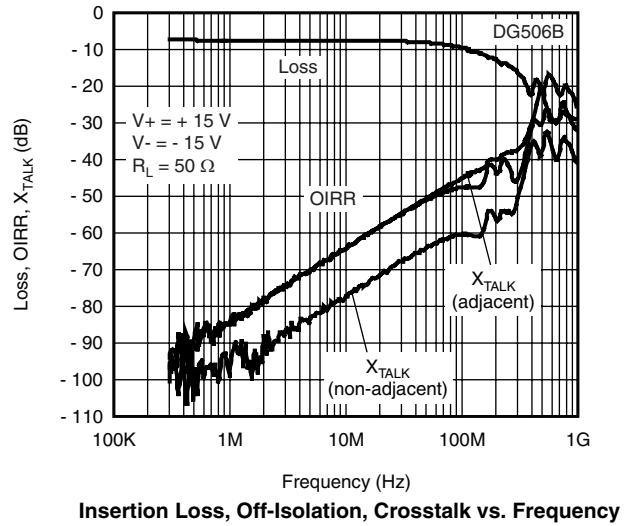
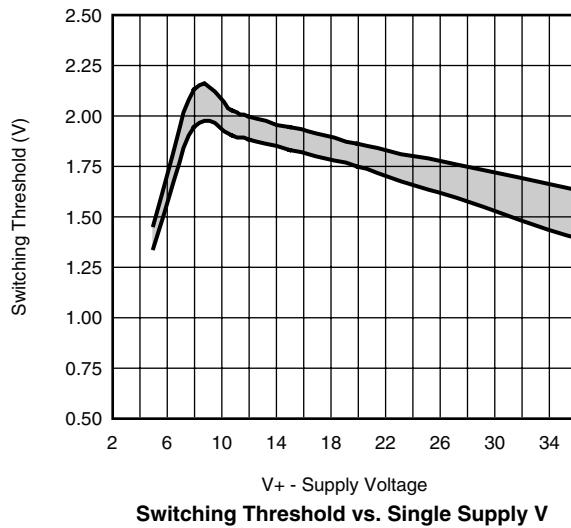
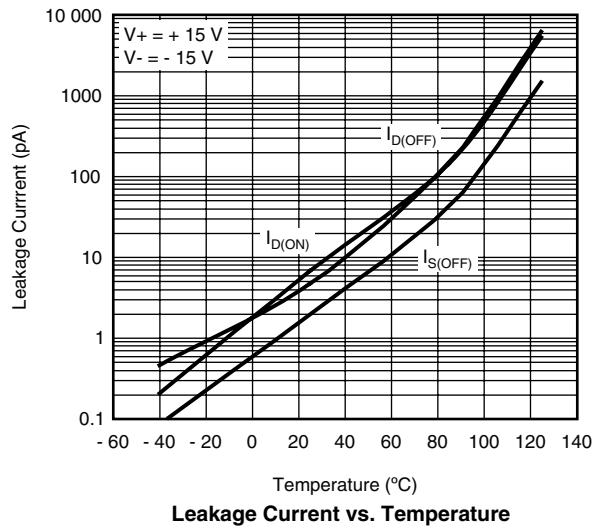
# DG506B, DG507B

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**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



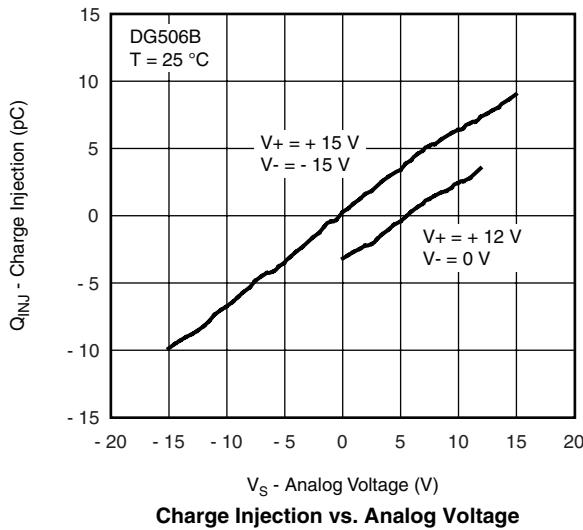
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# DG506B, DG507B

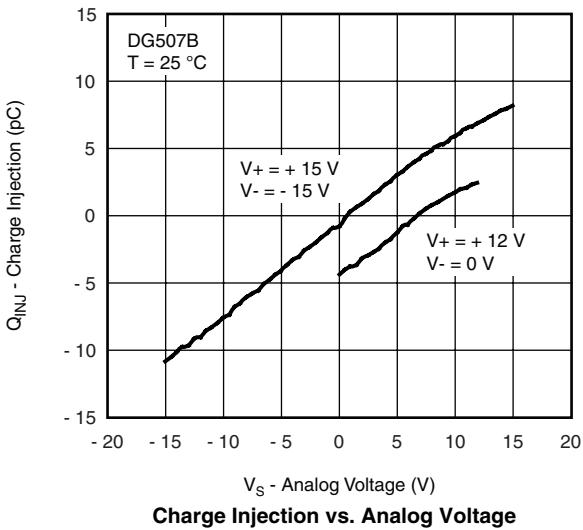
Vishay Siliconix



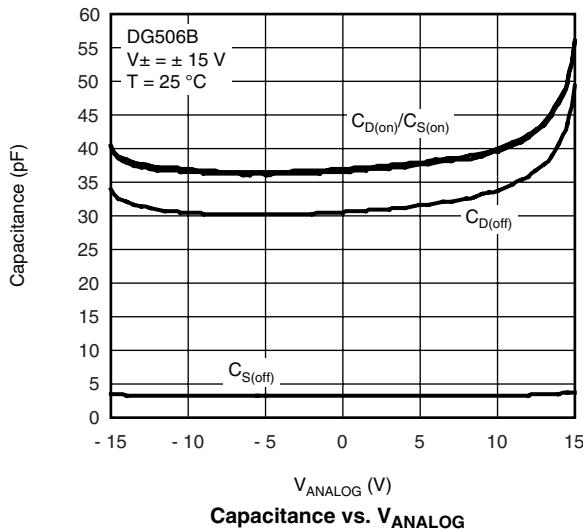
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



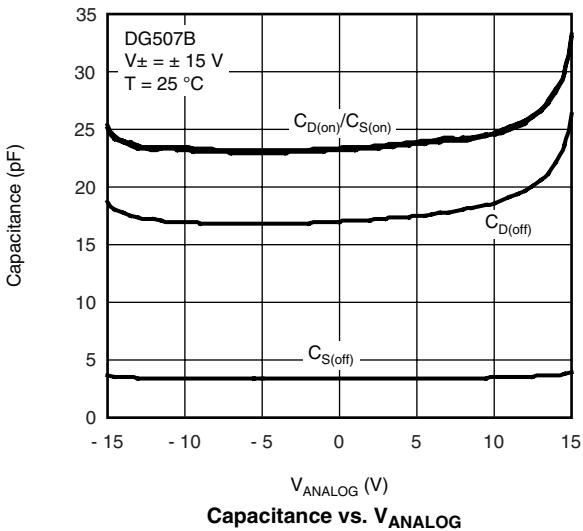
Charge Injection vs. Analog Voltage



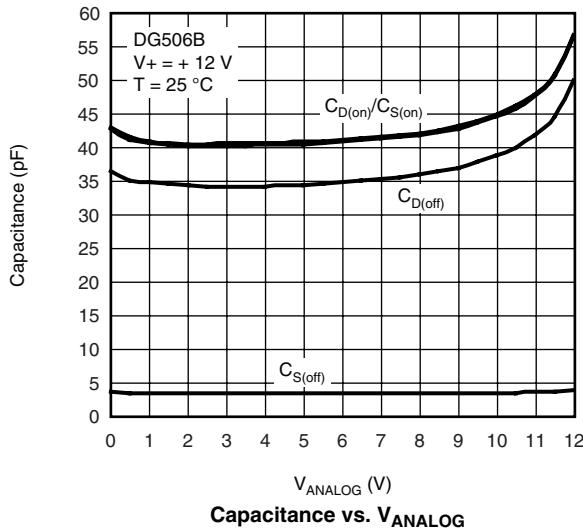
Charge Injection vs. Analog Voltage



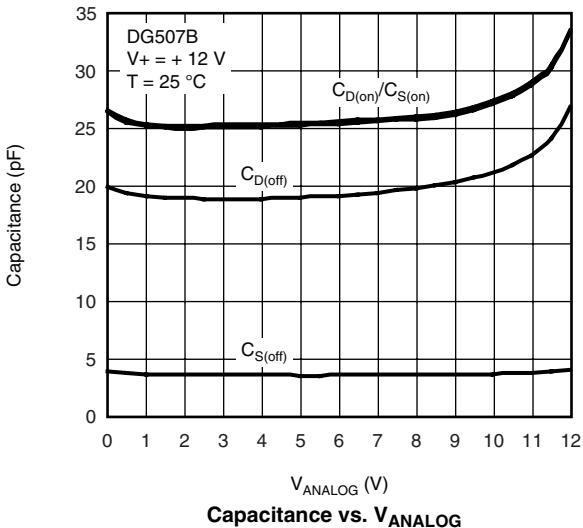
Capacitance vs. V<sub>ANALOG</sub>



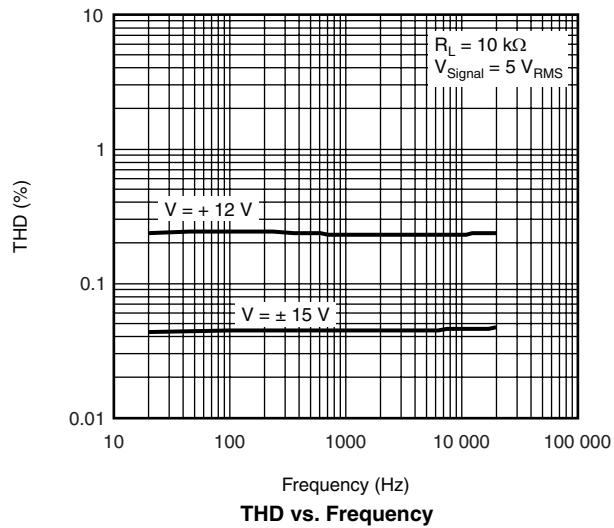
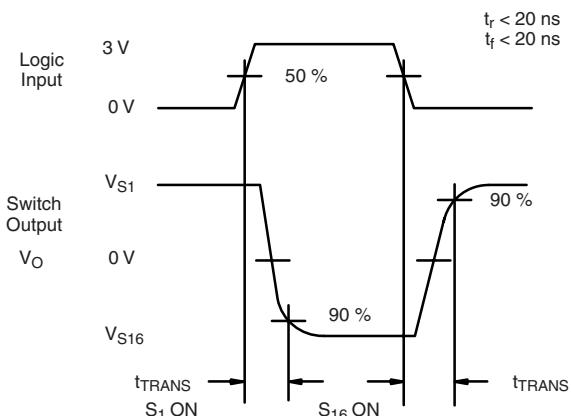
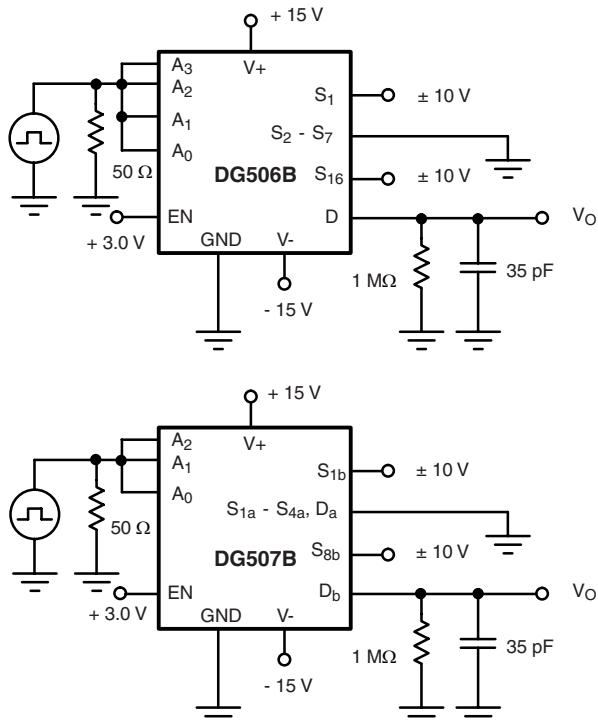
Capacitance vs. V<sub>ANALOG</sub>



Capacitance vs. V<sub>ANALOG</sub>



Capacitance vs. V<sub>ANALOG</sub>

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**TEST CIRCUITS**

**Figure 2. Transition Time**

### TEST CIRCUITS

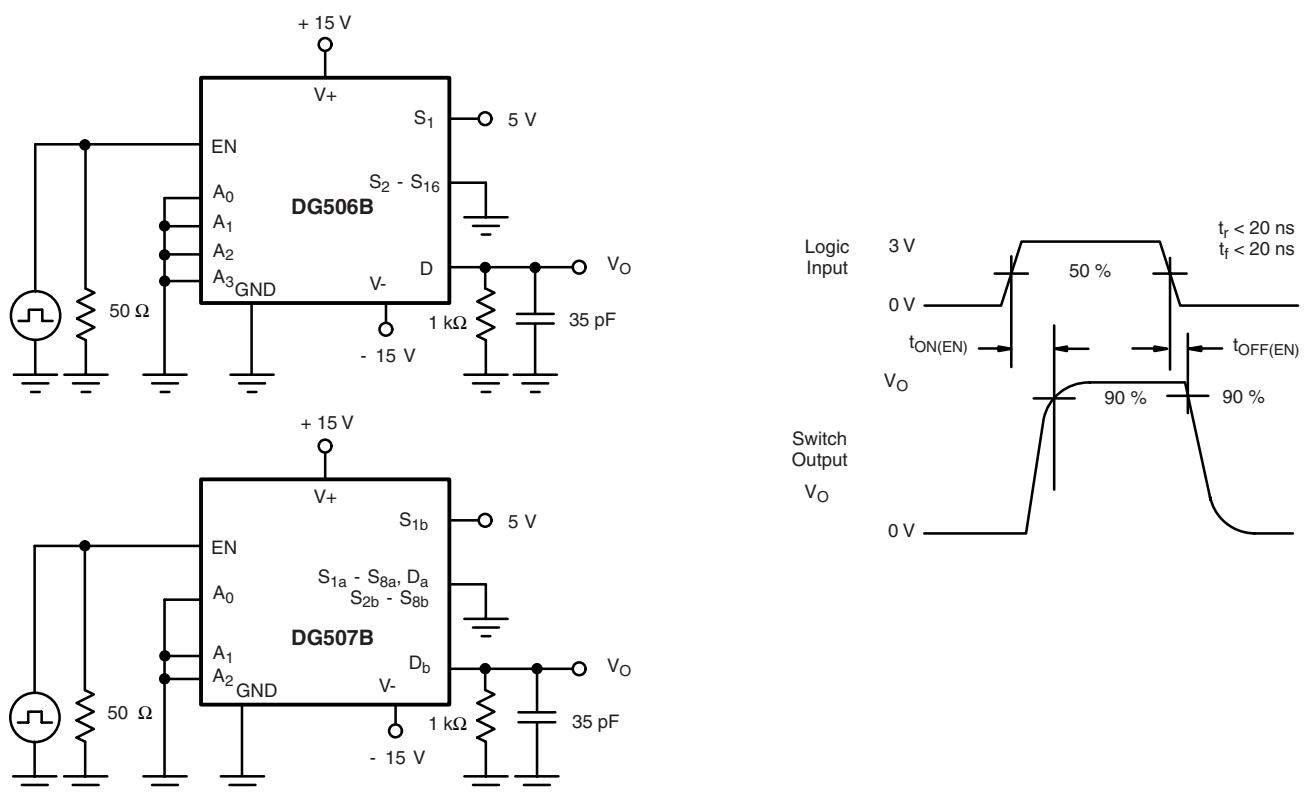


Figure 3. Enable Switching Time

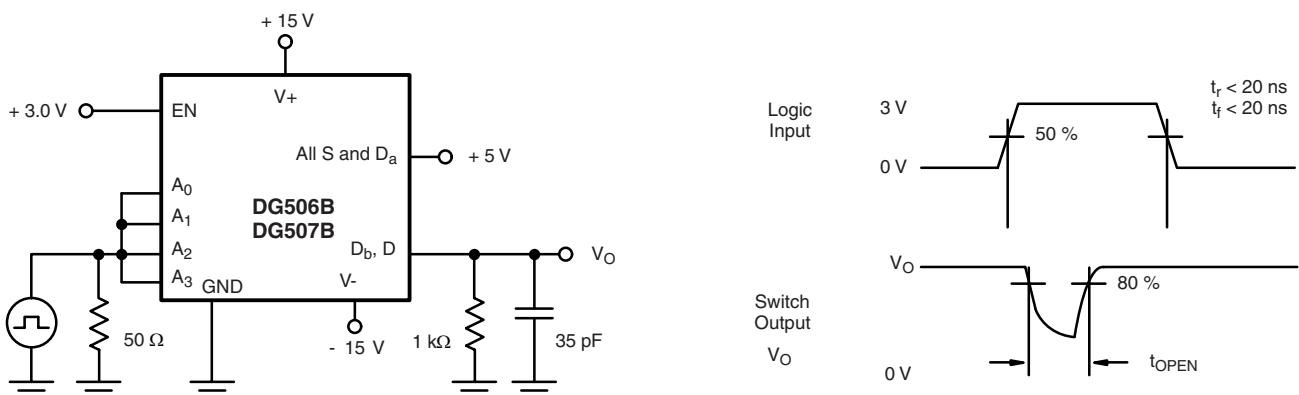
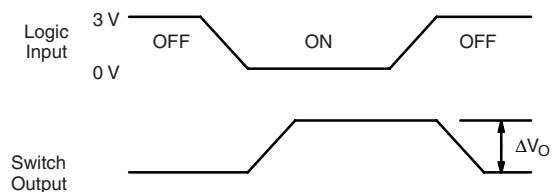
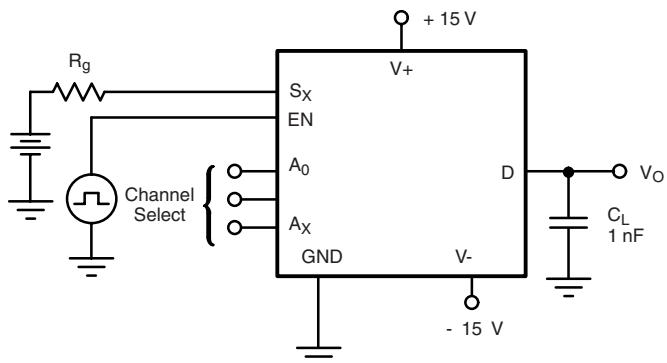


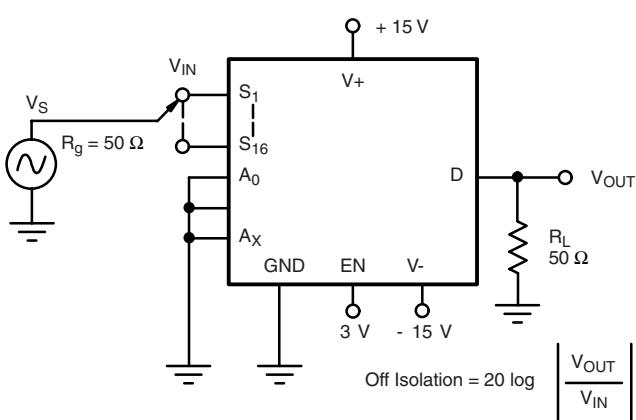
Figure 4. Break-Before-Make Interval

**TEST CIRCUITS**


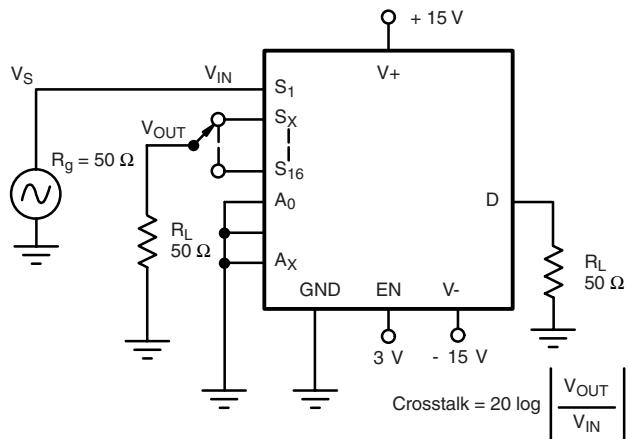
$\Delta V_O$  is the measured voltage due to charge transfer error Q, when the channel turns off.

$$Q_{INJ} = C_L \times \Delta V_O$$

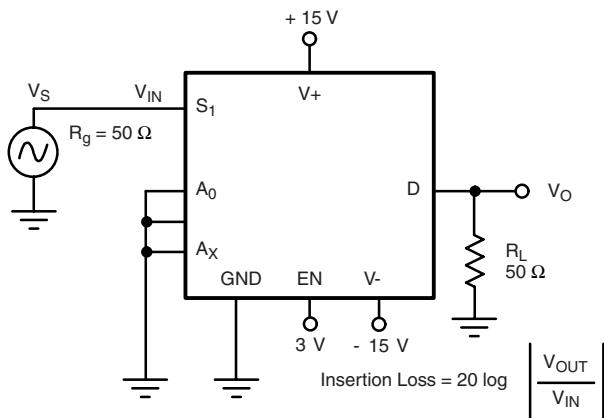
**Figure 5. Charge Injection**



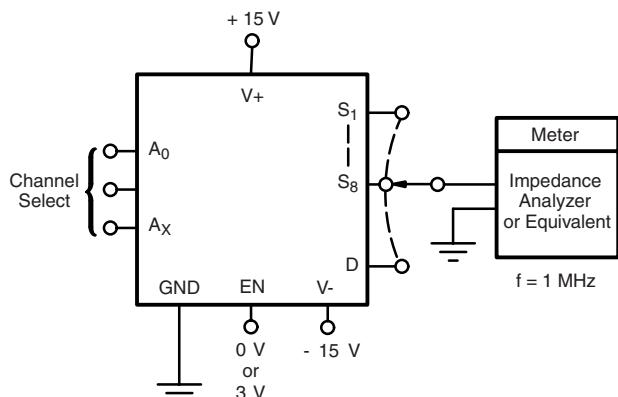
**Figure 6. Off Isolation**



**Figure 7. Crosstalk**

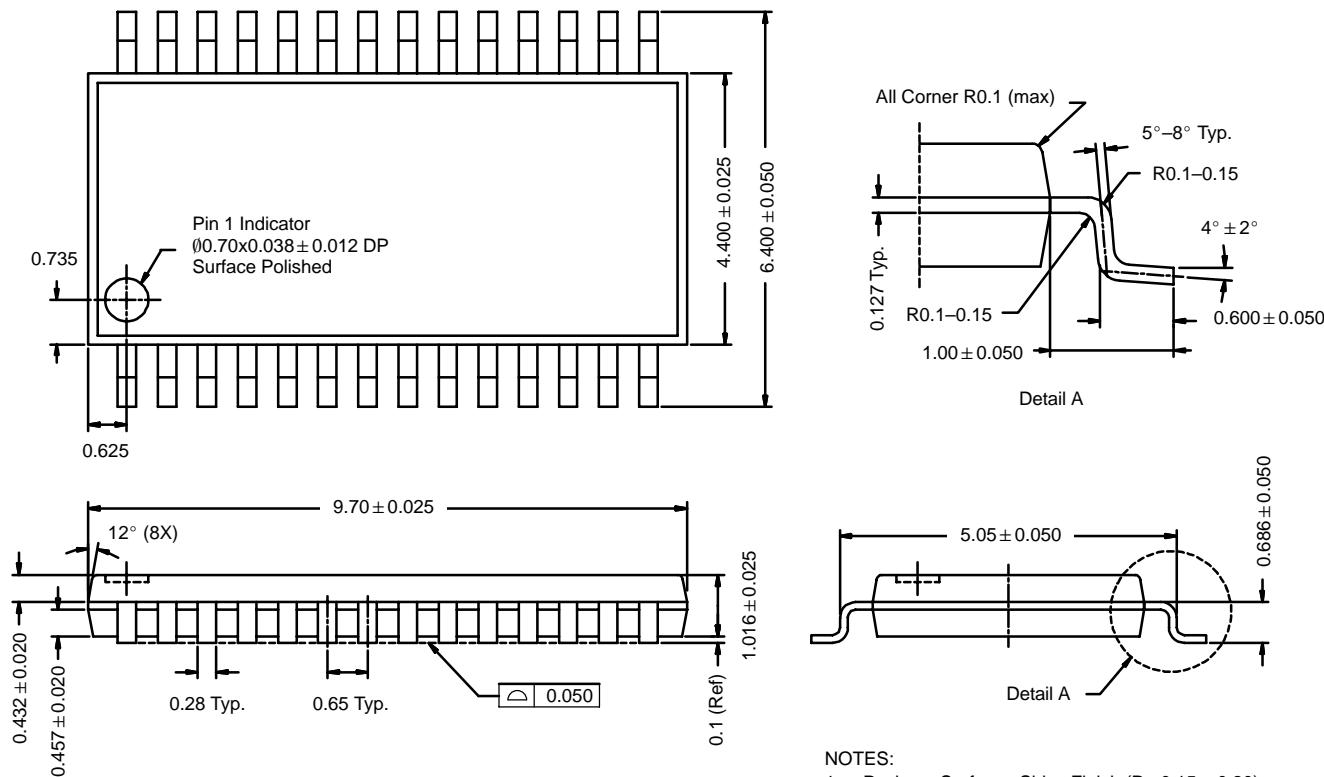


**Figure 8. Insertion Loss**



**Figure 9. Source Drain Capacitance**

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see [www.vishay.com/ppg?65150](http://www.vishay.com/ppg?65150).

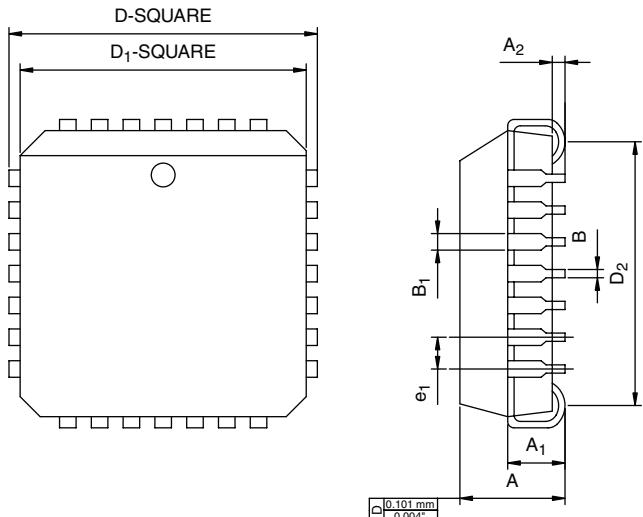
**TSSOP: 28-LEAD**


ECN: S-03946—Rev. C, 09-Jul-01  
DWG: 5851

**NOTES:**

1. Package Surface: Shiny Finish ( $R_o$  0.15 – 0.20).
2. Package Warpage: 0.012 (max).
3. Package Corner Radius: R0.1 mm (max).
4. Top to BTM Cavity Mismatch: 0.037 (max).
5. Tolerance: ± 0.050 unless otherwise specified.
6. End Flash Max: 0.1016 mm.

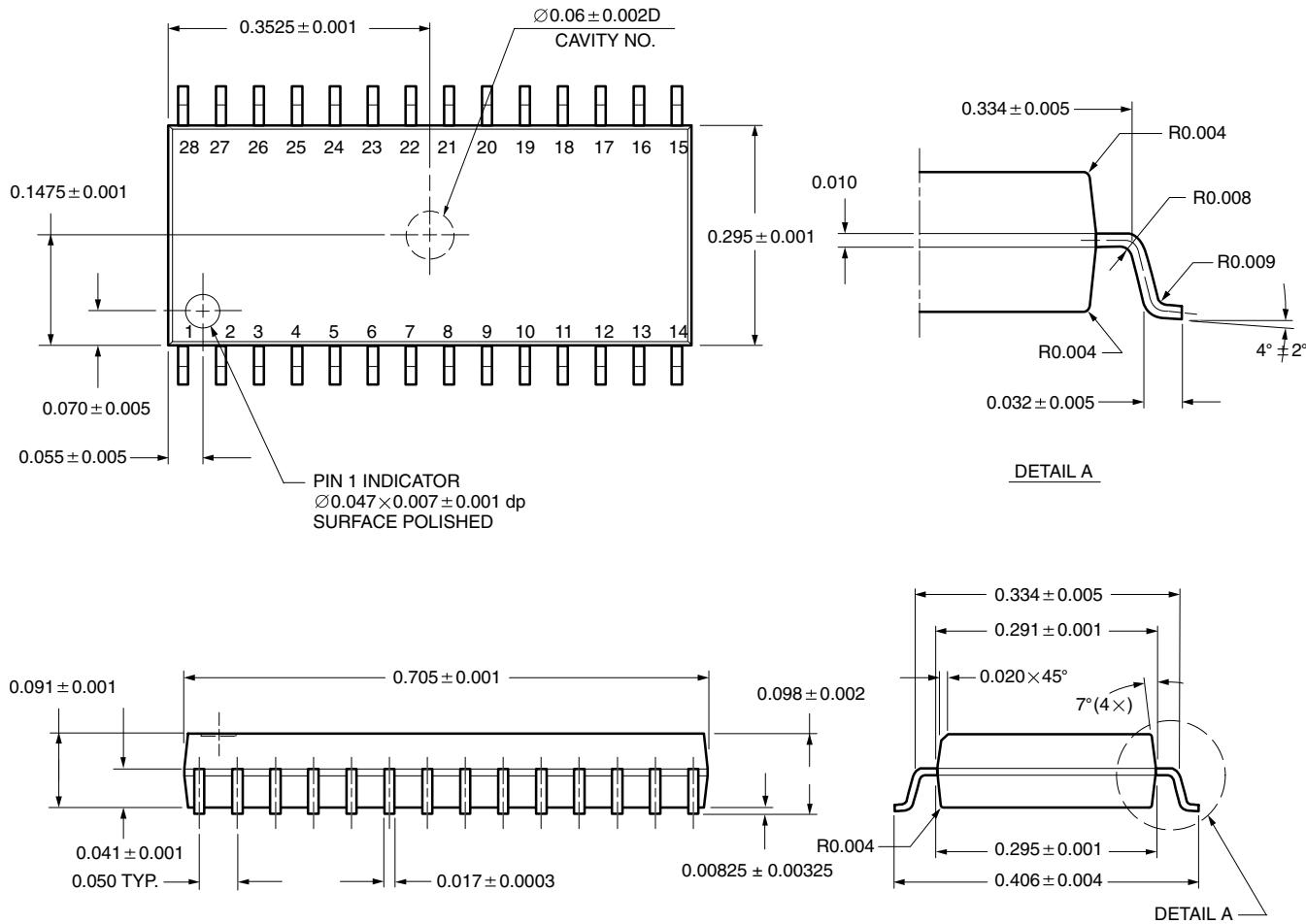
### PLCC: 28-LEAD



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.20	4.57	0.165	0.180
A <sub>1</sub>	2.29	3.04	0.090	0.120
A <sub>2</sub>	0.51	-	0.020	-
B	0.331	0.553	0.013	0.021
B <sub>1</sub>	0.661	0.812	0.026	0.032
D	12.32	12.57	0.485	0.495
D <sub>1</sub>	11.430	11.582	0.450	0.456
D <sub>2</sub>	9.91	10.92	0.390	0.430
e <sub>1</sub>	1.27 BSC		0.050 BSC	

ECN: T09-0766-Rev. D, 28-Sep-09  
DWG: 5491

### SOIC (WIDE-BODY): 28-LEADS



All Dimensions In Inches

ECN: E11-2209-Rev. D, 01-Aug-11

DWG: 5850



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**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**



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Электрон  
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помещение 100-Н Офис 331