



Precision 8-Channel / Dual 4-Channel CMOS Analog Multiplexers

DESCRIPTION

The DG508B is an 8-channel single-ended analog multiplexer designed to connect one of eight inputs to a common output as determined by a 3-bit binary address (A_0 , A_1 , A_2). The DG509B is a dual 4-channel differential analog multiplexer designed to connect one of four differential inputs to a common dual output as determined by its 2-bit binary address (A_0 , A_1). 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 (A_X) and enable (EN) are TTL compatible over the full specified operating temperature range.

The DG508B and DG509B 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 DG508, DG509 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 DG508B, DG509B are the superior alternatives to what is currently available.

Applications for the DG508B, DG509B 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 DG508B and DG509B have the absolute maximum voltage rating extended to 44 V. Additionally, single supply operation is also allowed. An epitaxial layer prevents latch-up.

The DG508B and DG509B are both available in 16-lead SOIC, TSSOP, PDIP, and miniQFN (1.8 mm x 2.6 mm) package options with extended temperature range of -40 °C to +125 °C.

For more information, refer to Vishay Siliconix DG508B, DG509B 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 - $Q_{INJ} = 2$ pC
- Low power - $I_{SUPPLY} = 10$ μ A
- TTL compatible logic
- > 250 mA latch-up current per JESD78
- Available in SOIC16, TSSOP16, PDIP, and miniQFN16 packages
- Superior alternative to:
 - ADG508A, DG508A, HI-508
 - ADG509A, DG509A, HI-509
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

BENEFITS

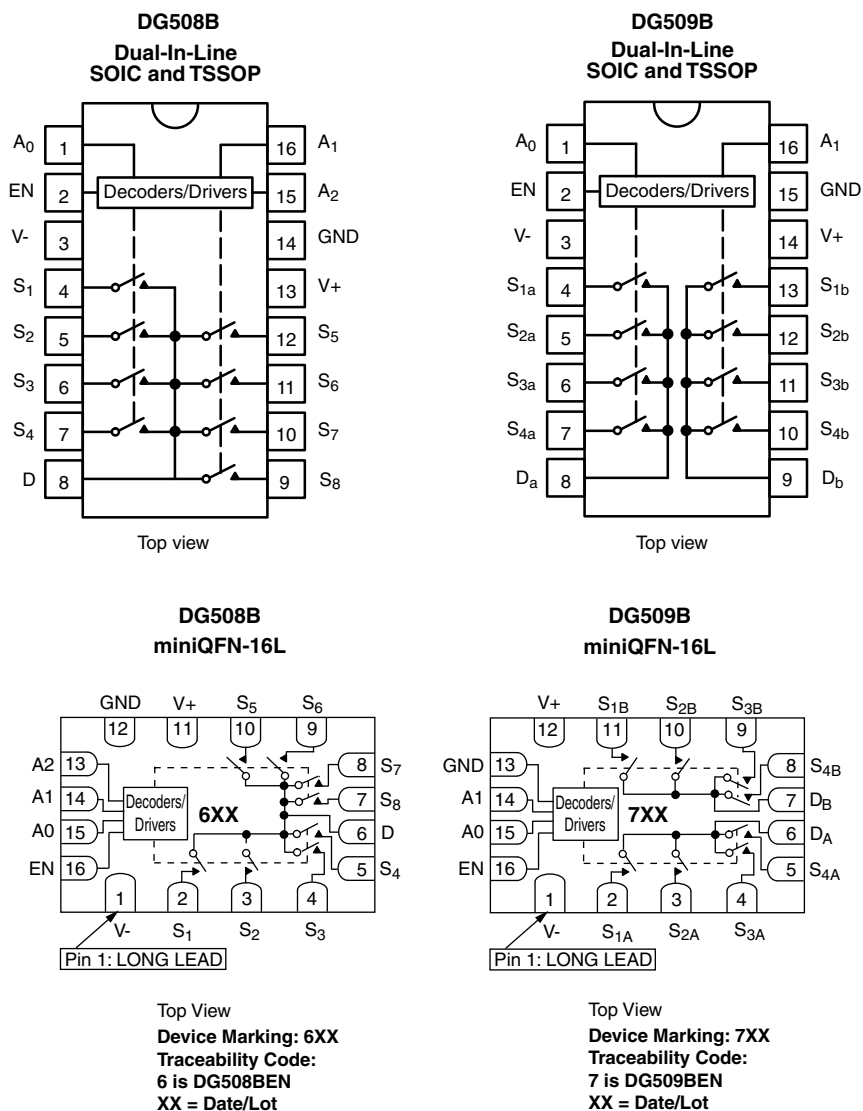
- Reduced switching errors
- Reduced glitching
- Improved data throughput
- Reduced power consumption
- Increased ruggedness
- Wide supply ranges (± 5 V to ± 20 V)

APPLICATIONS

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



RoHS
COMPLIANT
HALOGEN
FREE

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION

TRUTH TABLES AND ORDERING INFORMATION

TRUTH TABLE (DG508B)				
A ₂	A ₁	A ₀	EN	ON SWITCH
X	X	X	0	None
0	0	0	1	1
0	0	1	1	2
0	1	0	1	3
0	1	1	1	4
1	0	0	1	5
1	0	1	1	6
1	1	0	1	7
1	1	1	1	8

TRUTH TABLE (DG509B)			
A ₁	A ₀	EN	ON SWITCH
X	X	0	None
0	0	1	1
0	1	1	2
1	0	1	3
1	1	1	4

Logic "0" = V_{IL} ≤ 0.8 V

Logic "1" = V_{IH} ≥ 2 V

X = Do not care



ORDERING INFORMATION (DG508B)		
TEMP. RANGE	PACKAGE	PART NUMBER
-40 °C to +125 °C ^a	16-Pin SOIC	DG508BEY-T1-E3
	16-Pin TSSOP	DG508BEQ-T1-E3
	16-Pin PDIP	DG508BEJ-E3
	16-Pin MiniQFN	DG508BEN-T1-GE4

Note

a. -40 °C to +85 °C datasheet limits apply.

ORDERING INFORMATION (DG509B)		
TEMP. RANGE	PACKAGE	PART NUMBER
-40 °C to +125 °C ^a	16-Pin SOIC	DG509BEY-T1-E3
	16-Pin TSSOP	DG509BEQ-T1-E3
	16-Pin PDIP	DG509BEJ-E3
	16-Pin MiniQFN	DG509BEN-T1-GE4

ABSOLUTE MAXIMUM RATINGS			
PARAMETER		LIMIT	UNIT
Voltages Referenced to V-	V+	44	V
	GND	25	
Digital Inputs ^a , V _S , V _D		(V-) - 2 to (V+) + 2 or 20 mA, whichever occurs first	
Current (Any terminal)		30	mA
Peak Current, S or D (Pulsed at 1 ms, 10 % duty cycle max.)		100	
Storage Temperature	(EY, EQ, EJ, EN suffix)	-65 to +150	°C
Power Dissipation (Packages) ^b	16-Pin Narrow SOIC ^c	600	mW
	16-Pin TSSOP ^d	450	
	16-Pin PDIP ^e	510	
	16-Pin miniQFN ^f	525	
Thermal Resistance (θJA) ^b	16-Pin Narrow SOIC ^c	125	°C/W
	16-Pin TSSOP ^d	178	
	16-Pin PDIP ^e	159.6	
	16-Pin miniQFN ^f	152	

Notes

- Signals on SX, DX or INX exceeding V+ or V- will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
- All leads soldered or welded to PC board.
- Derate 8 mW/°C above 70 °C.
- Derate 5.6 mW/°C above 70 °C.
- Derate 6.3 mW/°C above 70 °C.
- Derate 6.6 mW/°C above 70 °C.

**SPECIFICATIONS**

PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V+ = 15 V, V- = -15 V (± 10 %) V _{AX} , V _{EN} = 2 V, 0.8 V ^a		TEMP. ^b	TYP. ^c	-40 °C to +125 °C		-40 °C to +85 °C		UNIT	
						MIN. ^d	MAX. ^d	MIN. ^d	MAX. ^d		
Analog Switch											
Analog Signal Range ^e	V _{ANALOG}			Full	-	-15	15	-15	15	V	
Drain-Source On-Resistance	R _{DS(on)}	V _D = ± 10 V, I _S = -1 mA		Room	180	-	380	-	380	Ω	
				Full	-	-	480	-	450		
R _{DS(on)} Matching	ΔR _{DS(on)}	V _D = ± 10 V		Room	10	-	-	-	-		
Source Off Leakage Current	I _{S(off)}	V _D = ± 10 V V _S = ∓ 10 V V _{EN} = 0 V		Room	-	-1	1	-1	1	nA	
				Full	-	-50	50	-50	50		
Drain Off Leakage Current	I _{D(off)}			DG508B	Room	-	-1	1	-1		1
					Full	-	-100	100	-100		100
				DG509B	Room	-	-1	1	-1		1
					Full	-	-50	50	-50		50
Drain On Leakage Current	I _{D(on)}	DG508B	Room	-	-1	1	-1	1			
			Full	-	-100	100	-100	100			
		DG509B	Room	-	-1	1	-1	1			
			Full	-	-50	50	-50	50			
Digital Control											
Logic High Input Voltage	V _{INH}			Full	-	2	-	2	-	V	
Logic Low Input Voltage	V _{INL}			Full	-	-	0.8	-	0.8		
Logic High Input Current	I _{IH}	V _{AX} , V _{EN} = 2 V		Full	-	-1	1	-1	1	μA	
Logic Low Input Current	I _{IL}	V _{AX} , V _{EN} = 0.8 V		Full	-	-1	1	-1	1		
Logic Input Capacitance ^e	C _{IN}	f = 1 MHz		Room	4	-	-	-	-	pF	
Dynamic Characteristics											
Transition Time	t _{TRANS}	VS ₁ = +10 V/-10 V, VS ₈ = -10 V/+10 V, R _L = 1 MΩ, C _L = 35 pF		Room	145	-	300	-	300	ns	
				Full	-	-	400	-	400		
Break-Before-Make Interval	t _{OPEN}	VS ₁ = VS ₈ = 5 V, C _L = 35 pF, R _L = 1 kΩ		Room	37	15	-	15	-		
				Full	-	1	-	1	-		
Enable Turn-On Time	t _{ON(EN)}	VS ₁ = 5 V, VS ₂ to VS ₈ = 0 V, R _L = 1 kΩ, C _L = 35 pF		Room	100	-	250	-	250		
				Full	-	-	340	-	340		
Enable Turn-Off Time	t _{OFF(EN)}			Room	90	-	240	-	240		
				Full	-	-	300	-	300		
Charge Injection ^e	Q _{INJ}	C _L = 1 nF, R _{GEN} = 0 W, V _{GEN} = 0 V		Full	2	-	-	-	-	pC	
Off Isolation ^e	OIRR	C _L = 5 pF, R _L = 50 Ω, f = 1 MHz		Room	-81	-	-	-	-	dB	
Crosstalk ^e	X _{TALK}			Room	-88	-	-	-	-		
-3 dB Bandwidth ^e	BW	R _L = 50 Ω		Room	250	-	-	-	-	MHz	
Total Harmonic Distortion ^e	THD	R _L = 10 kΩ, 5 V _{rms} f = 20 Hz to 20 kHz		Room	0.04	-	-	-	-	%	
Source Off Capacitance ^e	C _{S(off)}	f = 1 MHz		Room	3	-	-	-	-	pF	
Drain Off Capacitance ^e	C _{D(off)}			DG508B	Room	13	-	-	-		-
				DG509B	Room	8	-	-	-		-
Drain On Capacitance ^e	C _{D(on)}			DG508B	Room	18	-	-	-		-
				DG509B	Room	11	-	-	-		-
Power Supply											
Positive Supply Current	I ₊	V _{AX} , V _{EN} = 0.8 V or 2.4 V		Room	0.01	-	0.2	-	0.2	mA	
				Full	-	-	0.3	-	0.3		
Negative Supply Current	I ₋			Full	0.06	-10	-	-10	-	μA	



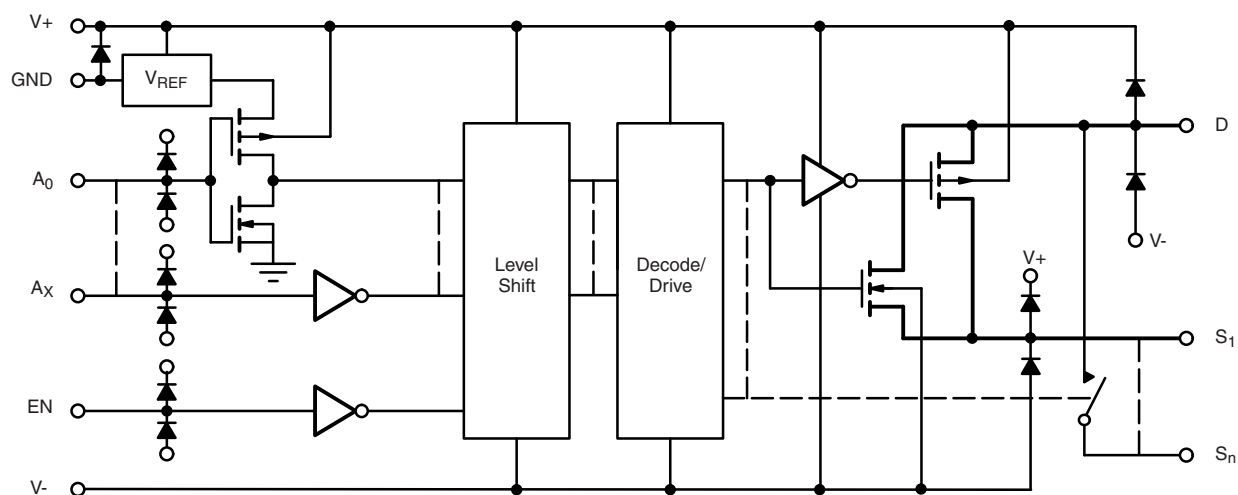
SPECIFICATIONS (Single Supply 12 V)												
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V+ = 12 V, V- = 0 V (± 10 %) VAX, VEN = 2 V, 0.8 V ^a		TEMP. ^b	TYP. ^c	-40 °C to +125 °C		-40 °C to +85 °C		UNIT		
						MIN. ^d	MAX. ^d	MIN. ^d	MAX. ^d			
Analog Switch												
Analog Signal Range ^e	VANALOG			Full	-	0	12	0	12	V		
On-Resistance	RDS(on)	VD = 10 V/0 V, IS = 1 mA		Room	265	-	500	-	500	Ω		
				Full	-	-	650	-	600			
RDS(on) Matching	ΔRDS(on)			Room	10	-	-	-	-			
Switch Off Leakage Current	IS(off)	V+ = 12 V, V- = 0 V VD = 0 V/10 V, VS = 10 V/0 V		DG508B	Room	-	-1	1	-1	1	nA	
					Full	-	-50	-50	-50	50		
	ID(off)			DG508B	Room	-	-1	1	-1	1		
					Full	-	-100	100	-100	100		
	ID(off)			DG509B	Room	-	-1	1	-1	1		
					Full	-	-50	50	-50	50		
Channel On Leakage Current	ID(on)	V+ = 12 V, V- = 0 V VS = VD = 0 V/10 V		DG508B	Room	-	-1	1	-1	1	nA	
					Full	-	-100	100	-100	100		
				DG509B	Room	-	-1	1	-1	1		
					Full	-	-50	50	-50	50		
Digital Control												
Logic High Input Voltage	VINH			Full	-	2	-	2	-	V		
Logic Low Input Voltage	VINL			Full	-	-	0.8	-	0.8			
Logic High Input Current	IIH	VAX, VEN = 2 V		Full	-	-1	1	-1	1	μA		
Logic Low Input Current	IL	VAX, VEN = 0.8 V		Full	-	-1	1	-1	1			
Logic Input Capacitance ^e	CIN	f = 1 MHz		Room	4	-	-	-	-	pF		
Dynamic Characteristics												
Transition Time	tTRANS	VS1 = 10 V/0 V, VS8 = 0 V/10 V, RL = 1 MΩ, CL = 35 pF		Room	165	-	400	-	400	ns		
				Full	-	-	550	-	500			
Break-Before-Make Interval	tOPEN	VS1 = VS8 = 5 V, CL = 35 pF, RL = 1 kΩ		Room	37	15	-	15	-			
				Full	-	1	-	1	-			
Enable Turn-On Time	tON(EN)	VS1 = 5 V, VS2 to VS8 = 0 V, RL = 1 kΩ, CL = 35 pF		Room	125	-	300	-	300			
				Full	-	-	550	-	425			
Enable Turn-Off Time	tOFF(EN)			Room	75	-	250	-	250			
				Full	-	-	350	-	300			
Charge Injection ^e	QINJ			CL = 1 nF, RGEN = 0 Ω, VGEN = 0 V		Full	2.5	-	-	-	-	pC
Off Isolation ^e	OIRR			CL = 5 pF, RL = 50 Ω f = 1 MHz		Room	-80	-	-	-	-	dB
Crosstalk ^e	XTALK	Room	-88			-	-	-	-			
-3 dB Bandwidth ^e	BW	RL = 50 Ω		Room	200	-	-	-	-	MHz		
Total Harmonic Distortion ^e	THD	RL = 10 kΩ, 5 VRMS, f = 20 Hz to 20 kHz		Room	0.26	-	-	-	-	%		
Source Off Capacitance ^e	CS(off)	f = 1 MHz		Room	2	-	-	-	-	pF		
Drain Off Capacitance ^e	CD(off)				DG508B	13	-	-	-		-	
					DG509B	8	-	-	-		-	
Channel On Capacitance ^e	CD(on)				DG508B	17	-	-	-		-	
					DG509B	12	-	-	-		-	

SPECIFICATIONS (Single Supply 12 V)									
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V+ = 12 V, V- = 0 V (± 10 %) VAX, VEN = 2 V, 0.8 V ^a	TEMP. ^b	TYP. ^c	-40 °C to +125 °C		-40 °C to +85 °C		UNIT
					MIN. ^d	MAX. ^d	MIN. ^d	MAX. ^d	
Power Supply									
Positive Supply Current	I+	VAX, VEN = 0.8 V or 2.4 V	Room	0.01	-	0.2	-	0.2	mA
			Full	-	-	0.3	-	0.3	

Notes

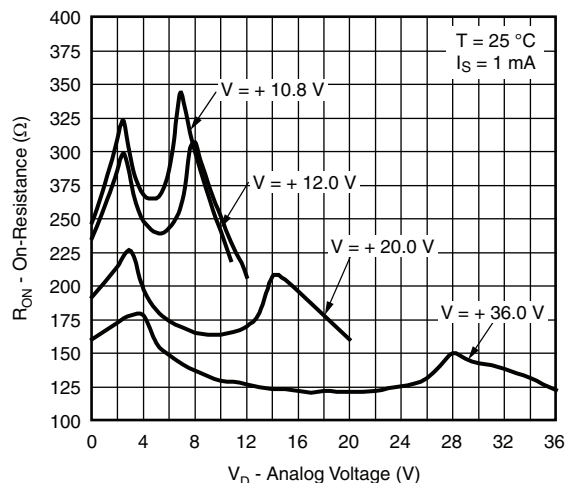
- V_{AX} , V_{EN} = input voltage perform proper function.
- Room = 25 °C, Full = as determined by the operating temperature suffix.
- Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this datasheet.
- Guaranteed by design, not subject to production test.
- $\Delta R_{DS(on)} = R_{DS(on)} \text{ max.} - R_{DS(on)} \text{ min.}$

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.

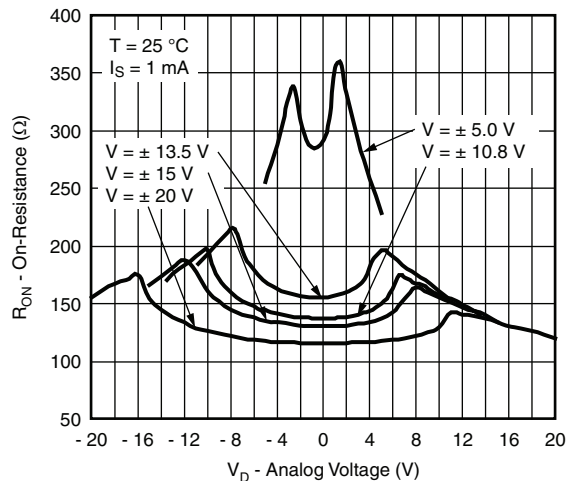
SCHEMATIC DIAGRAM (Typical Channel)

Fig. 1



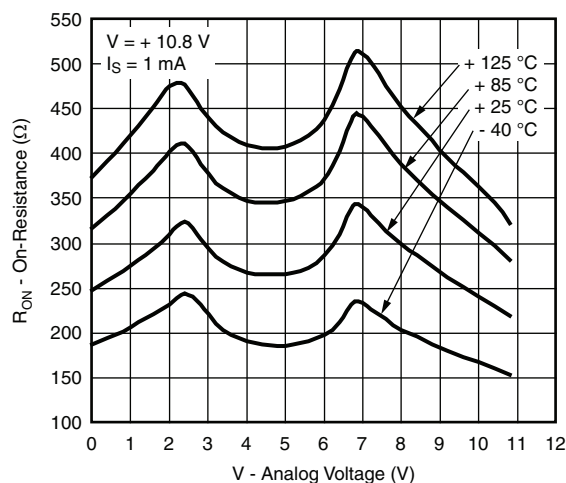
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



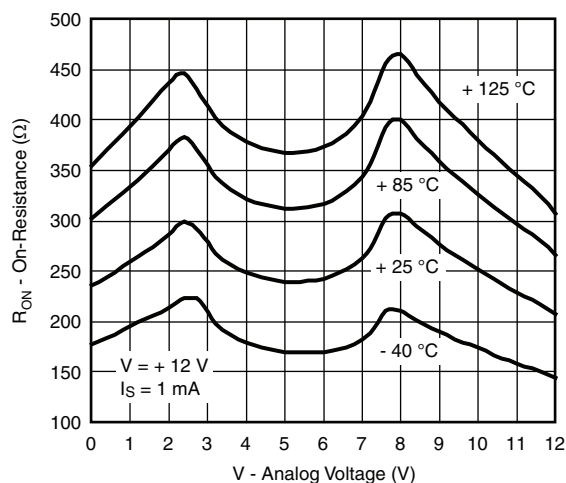
On-Resistance vs. V_D and Single Supply Voltage



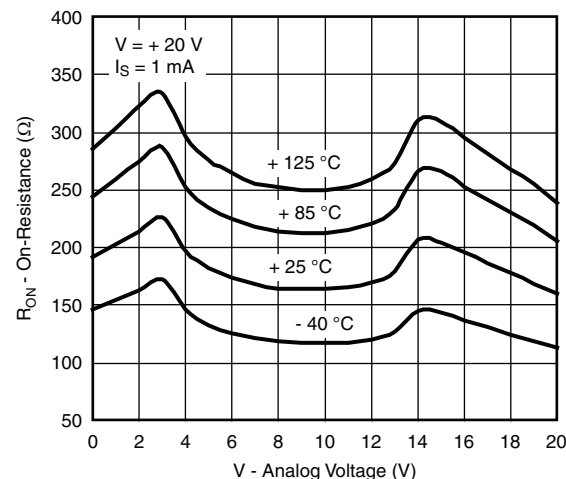
On-Resistance vs. V_D and Dual Supply Voltage



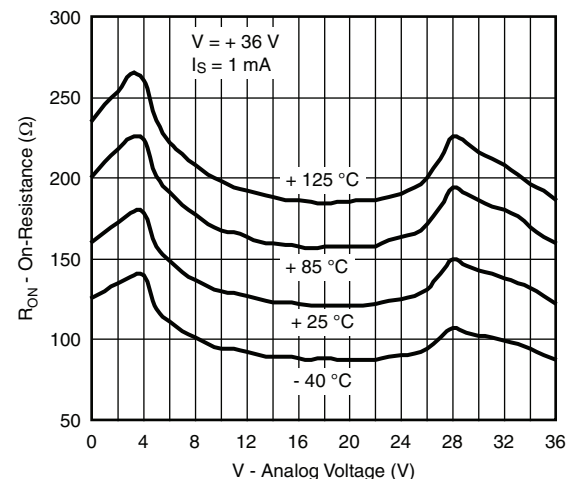
On-Resistance vs. Analog Voltage and Temperature



On-Resistance vs. Analog Voltage and Temperature



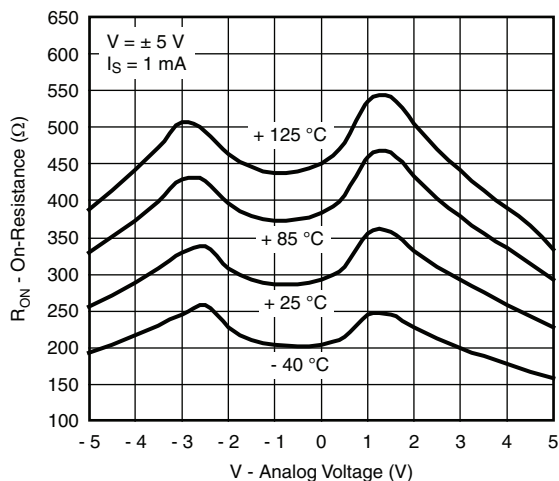
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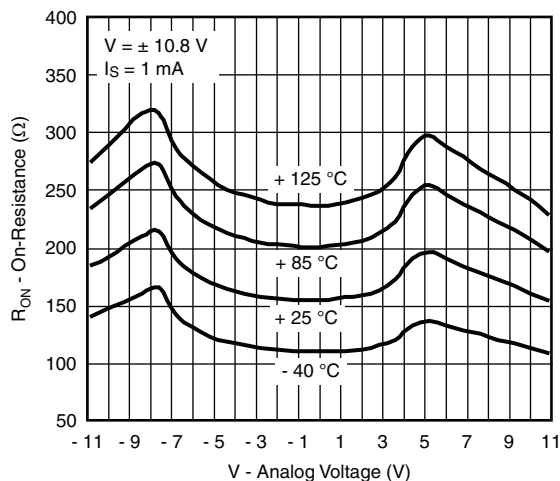
On-Resistance vs. Analog Voltage and Temperature



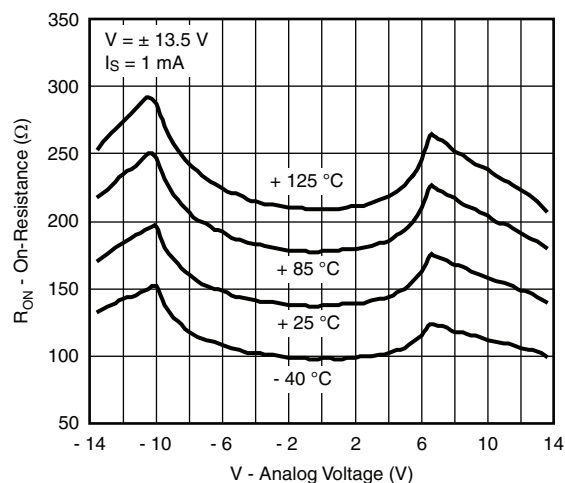
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



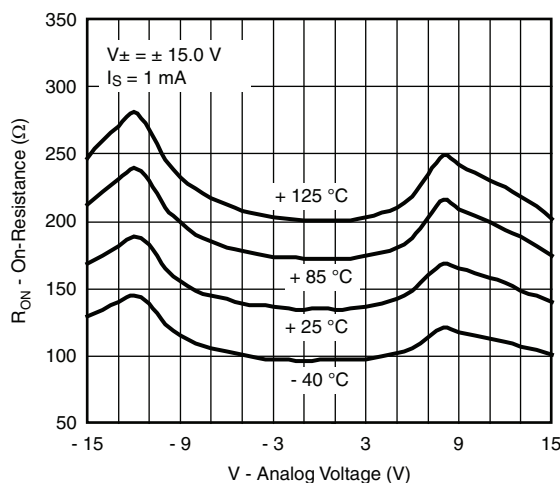
On-Resistance vs. Analog Voltage and Temperature



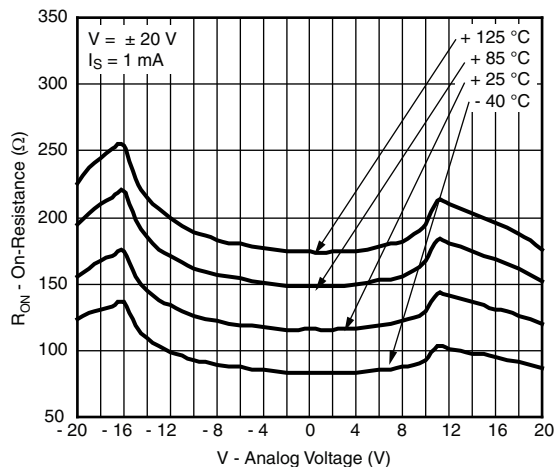
On-Resistance vs. Analog Voltage and Temperature



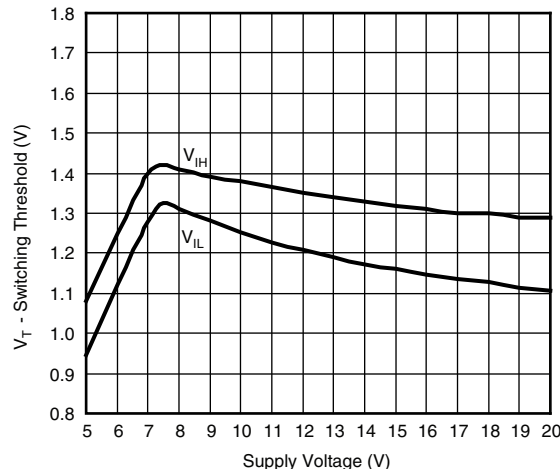
On-Resistance vs. Analog Voltage and Temperature



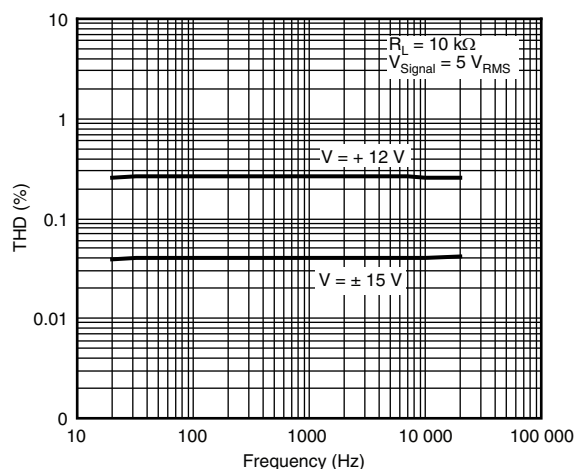
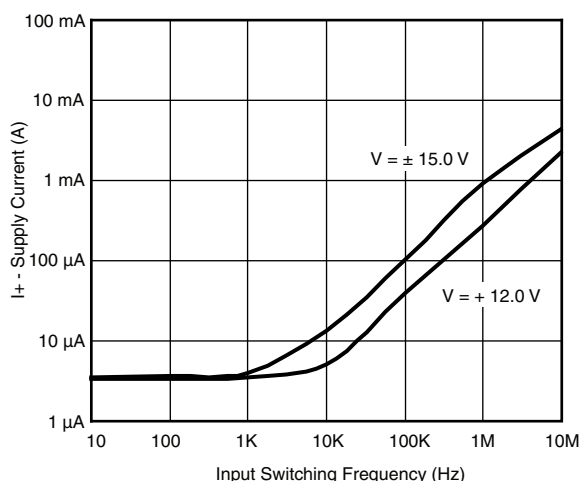
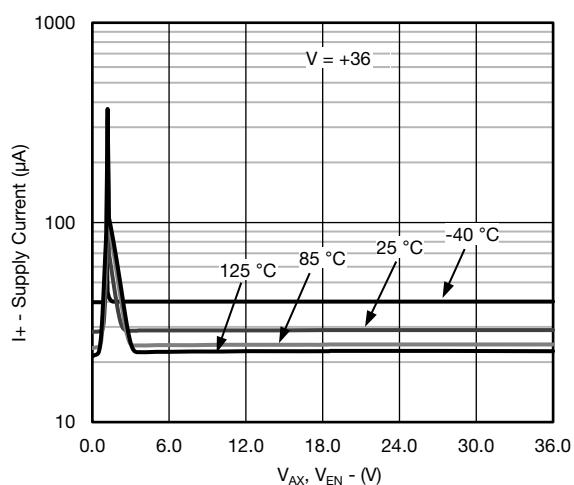
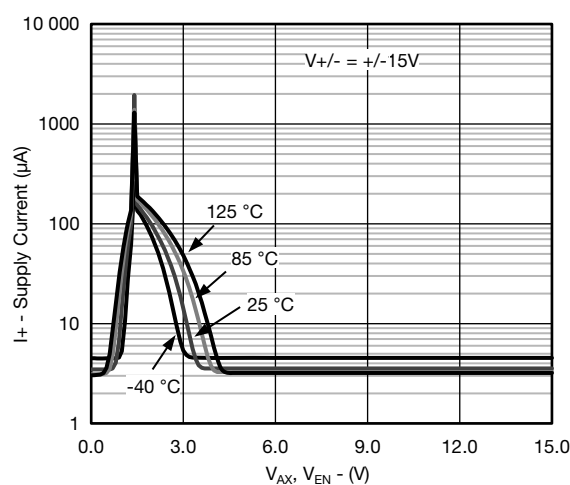
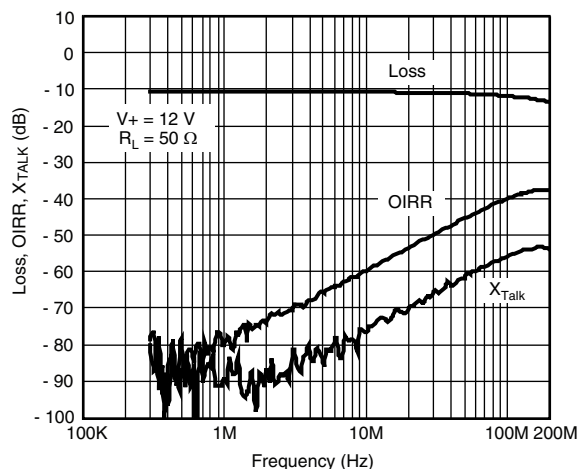
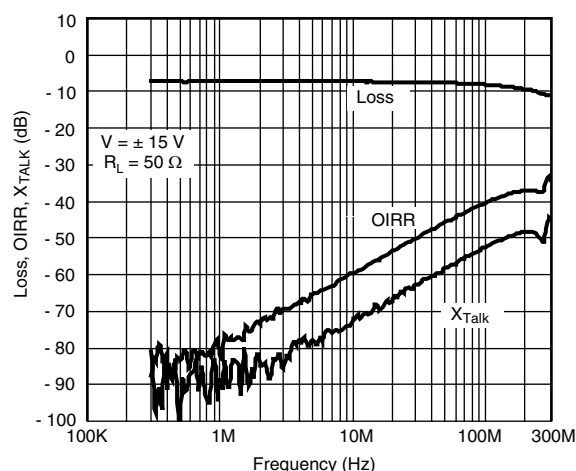
On-Resistance vs. Analog Voltage and Temperature



On-Resistance vs. Analog Voltage and Temperature

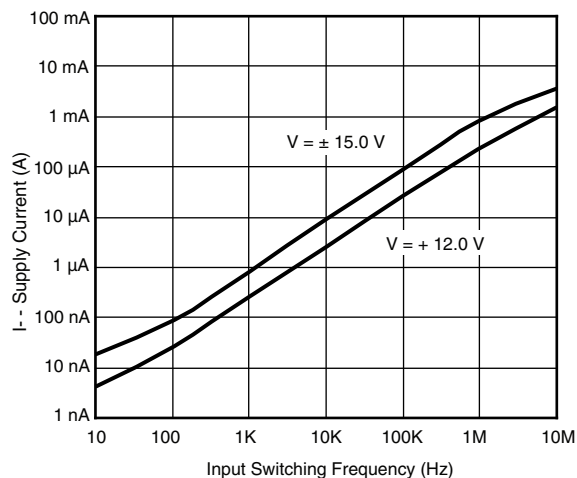


Switching Threshold vs. Supply Voltage

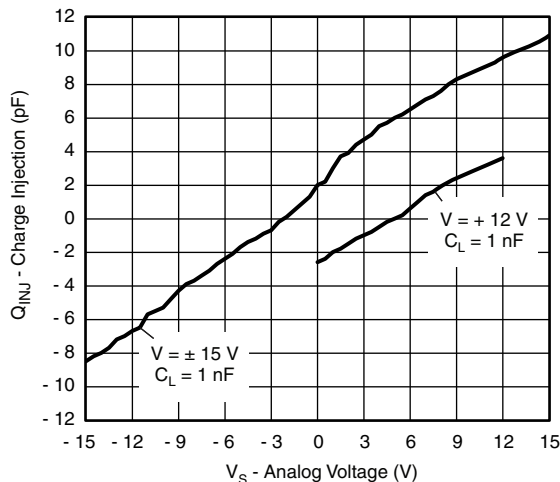
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

THD vs. Frequency

Supply Current vs. Input Switching Frequency

Supply Current vs. $V_{\text{AX}}, V_{\text{EN}}$

Supply Current vs. $V_{\text{AX}}, V_{\text{EN}}$

Insertion Loss, Off-Isolation, Crosstalk vs. Frequency

Insertion Loss, Off-Isolation, Crosstalk vs. Frequency



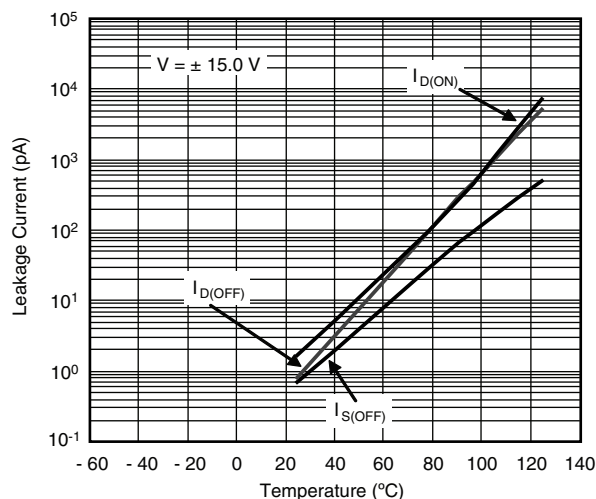
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



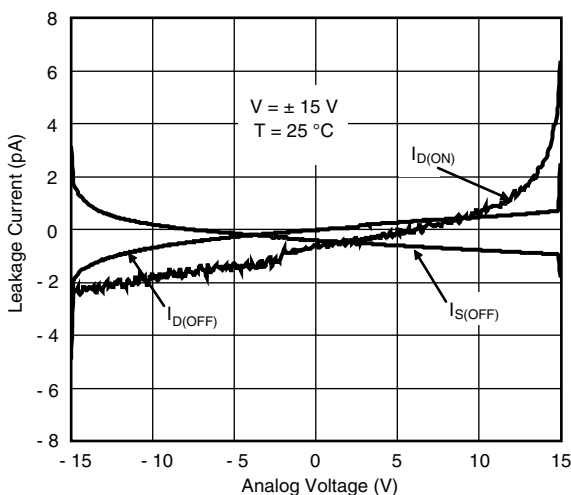
Supply Current vs. Input Switching Frequency



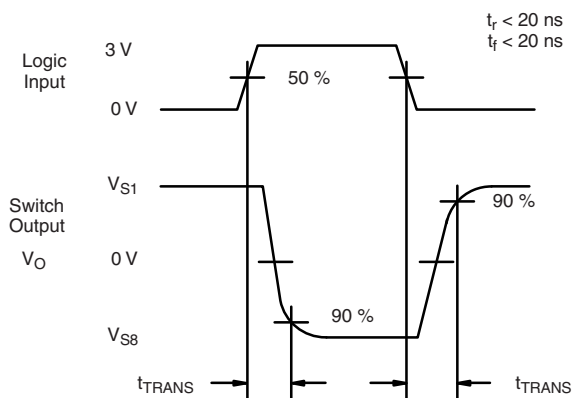
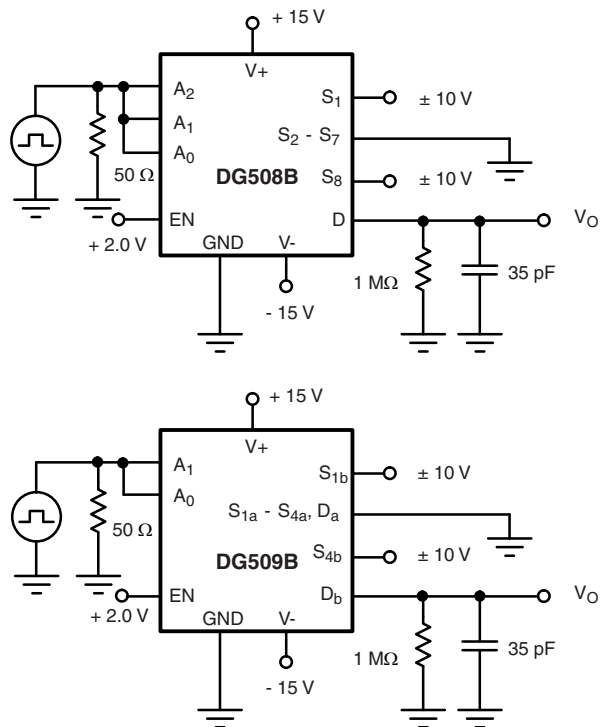
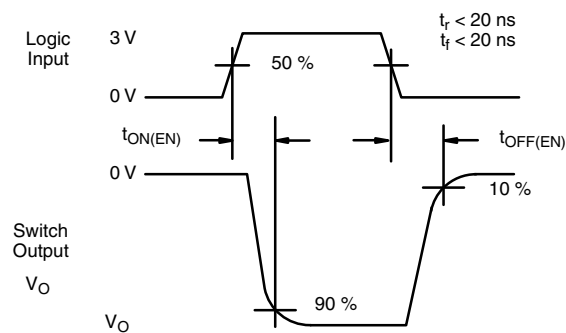
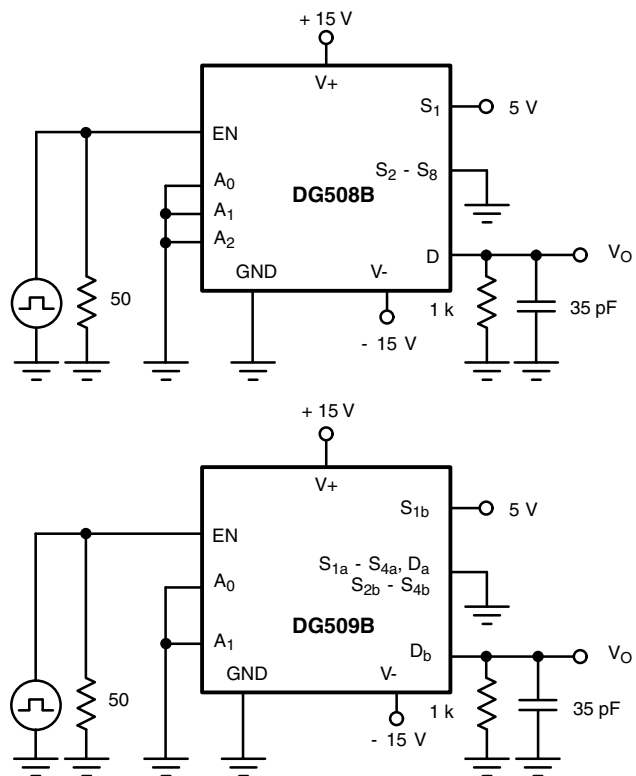
Charge Injection vs. Analog Voltage

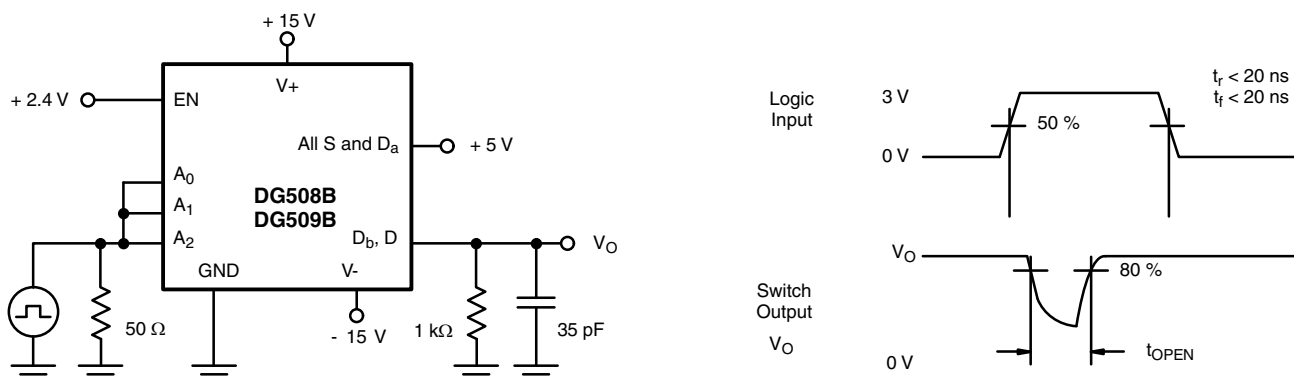
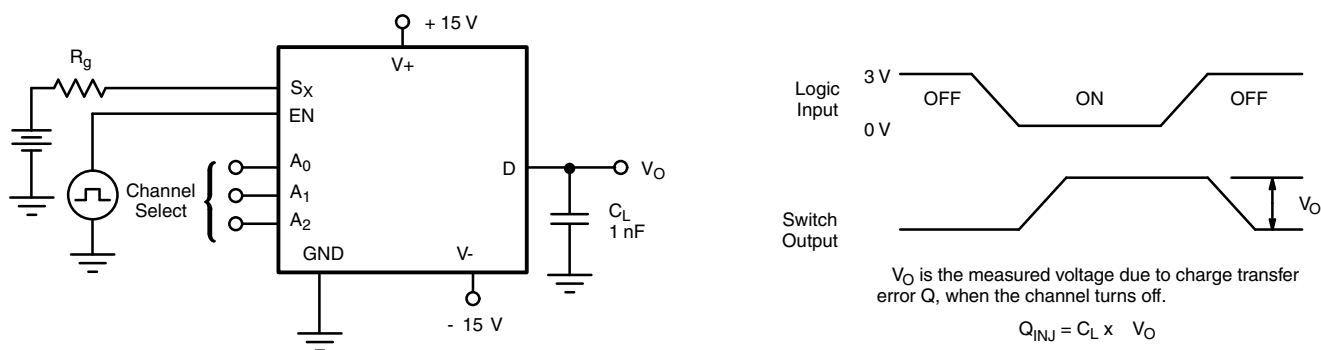
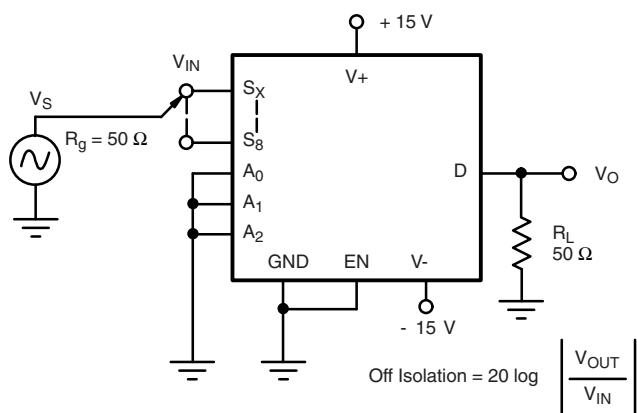
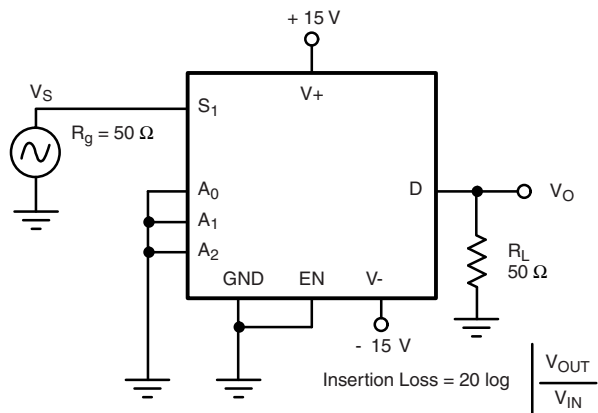


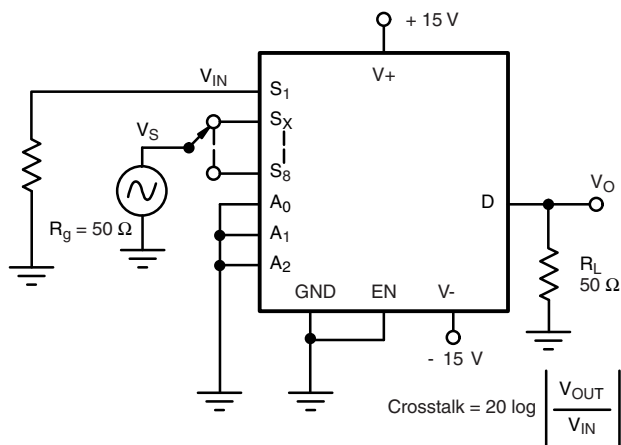
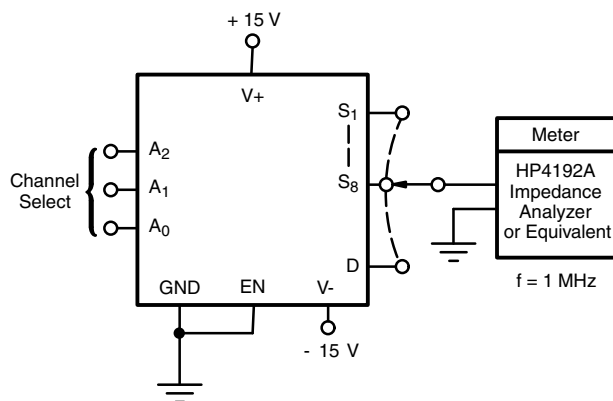
Leakage Current vs. Temperature



Leakage Current vs. Analog Voltage

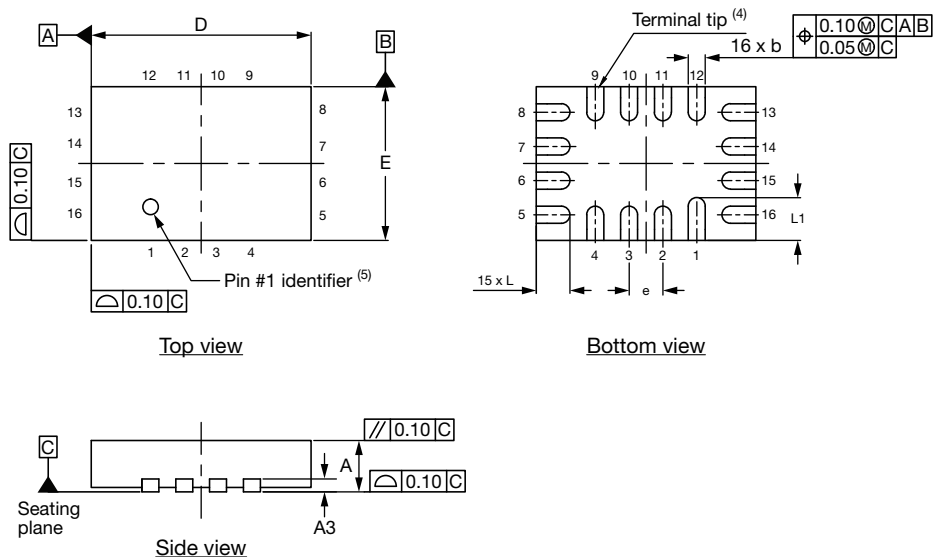
TEST CIRCUITS

Fig. 2 - Transition Time

Fig. 3 - Enable Switching Time

TEST CIRCUITS

Fig. 4 - Break-Before-Make Interval

Fig. 5 - Charge Injection

Fig. 6 - Off Isolation

Fig. 7 - Insertion Loss

TEST CIRCUITS

Fig. 8 - Crosstalk

Fig. 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?64821.

Thin miniQFN16 Case Outline



DIMENSIONS	MILLIMETERS ⁽¹⁾			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.50	0.55	0.60	0.020	0.022	0.024
A1	0	-	0.05	0	-	0.002
A3	0.15 ref.			0.006 ref.		
b	0.15	0.20	0.25	0.006	0.008	0.010
D	2.50	2.60	2.70	0.098	0.102	0.106
e	0.40 BSC			0.016 BSC		
E	1.70	1.80	1.90	0.067	0.071	0.075
L	0.35	0.40	0.45	0.014	0.016	0.018
L1	0.45	0.50	0.55	0.018	0.020	0.022
N ⁽³⁾	16			16		
Nd ⁽³⁾	4			4		
Ne ⁽³⁾	4			4		

Notes

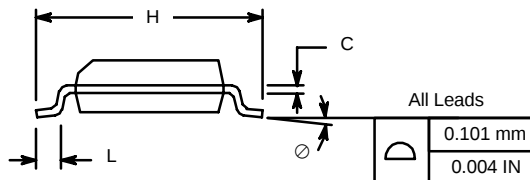
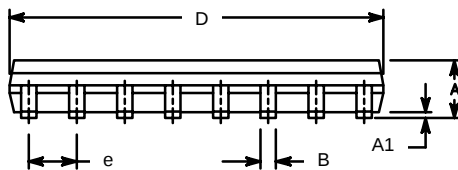
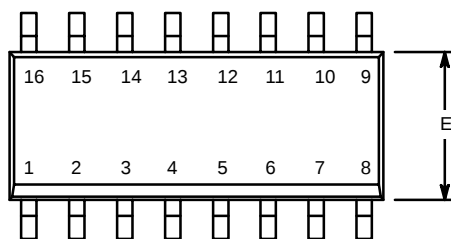
- (1) Use millimeters as the primary measurement.
- (2) Dimensioning and tolerances conform to ASME Y14.5M. - 1994.
- (3) N is the number of terminals. Nd and Ne is the number of terminals in each D and E site respectively.
- (4) Dimensions b applies to plated terminal and is measured between 0.15 mm and 0.30 mm from terminal tip.
- (5) The pin 1 identifier must be existed on the top surface of the package by using identification mark or other feature of package body.
- (6) Package warpage max. 0.05 mm.

ECN: T16-0226-Rev. B, 09-May-16
DWG: 6023



SOIC (NARROW): 16-LEAD

JEDEC Part Number: MS-012

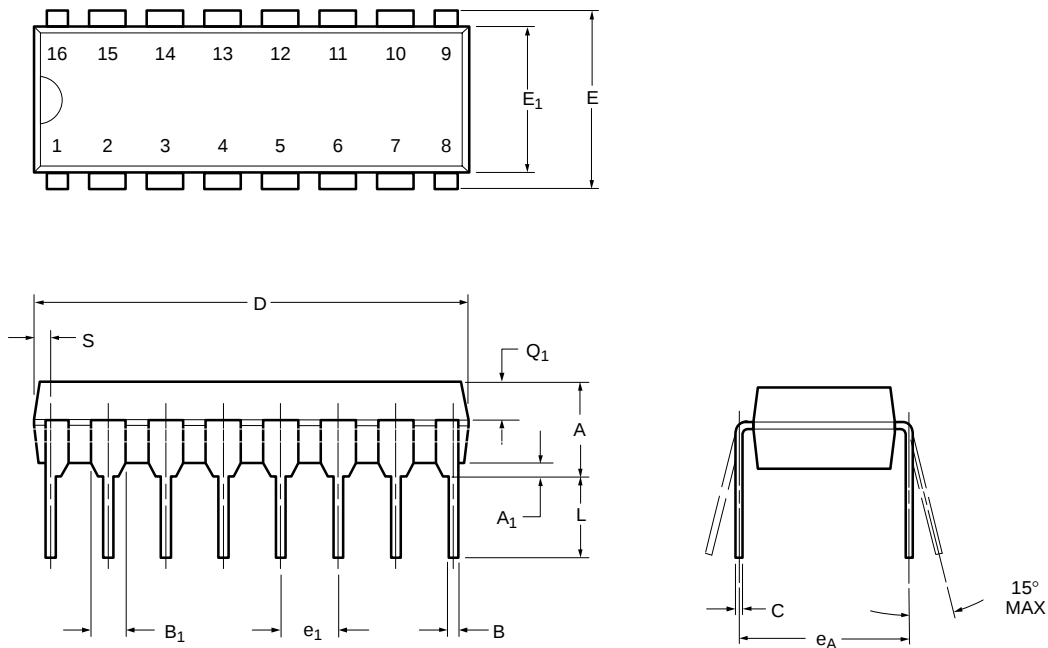


Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A ₁	0.10	0.20	0.004	0.008
B	0.38	0.51	0.015	0.020
C	0.18	0.23	0.007	0.009
D	9.80	10.00	0.385	0.393
E	3.80	4.00	0.149	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
L	0.50	0.93	0.020	0.037
Ø	0°	8°	0°	8°

ECN: S-03946—Rev. F, 09-Jul-01
DWG: 5300



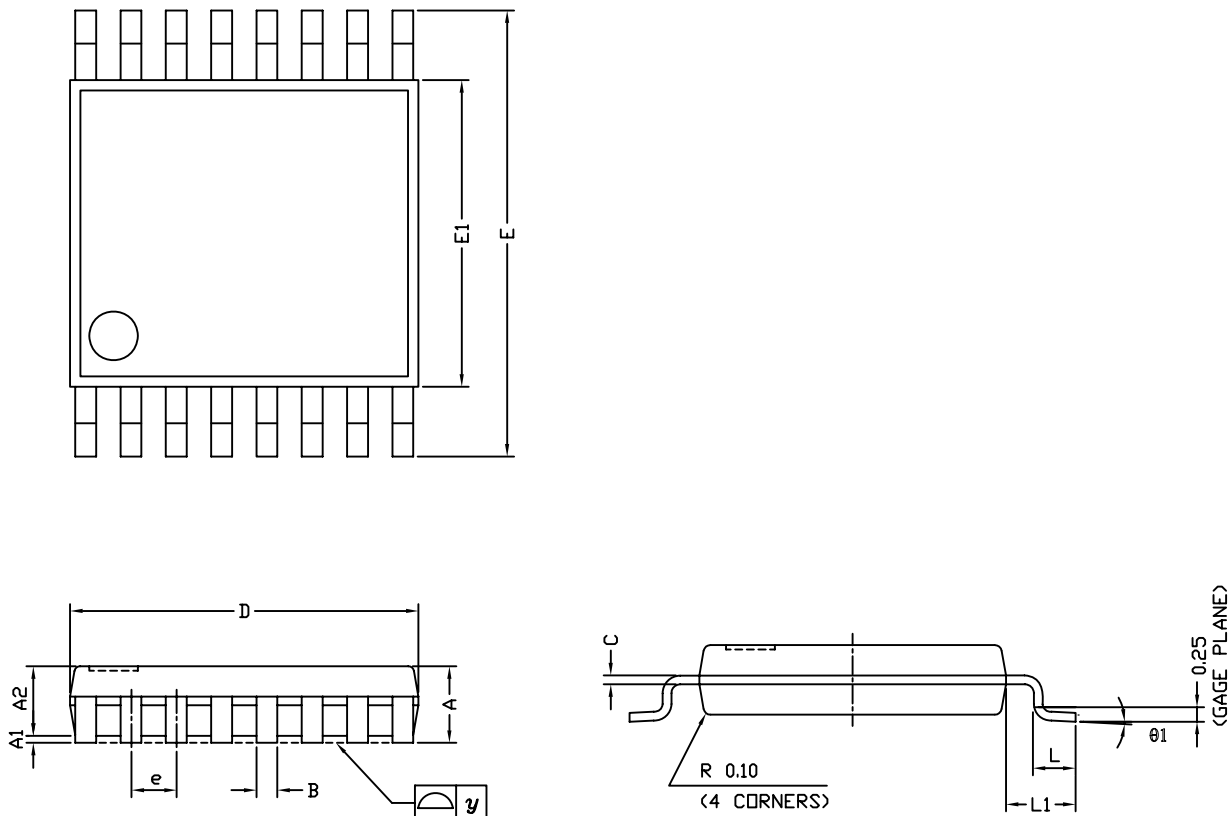
PDIP: 16-LEAD



Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	3.81	5.08	0.150	0.200
A ₁	0.38	1.27	0.015	0.050
B	0.38	0.51	0.015	0.020
B ₁	0.89	1.65	0.035	0.065
C	0.20	0.30	0.008	0.012
D	18.93	21.33	0.745	0.840
E	7.62	8.26	0.300	0.325
E ₁	5.59	7.11	0.220	0.280
e ₁	2.29	2.79	0.090	0.110
e _A	7.37	7.87	0.290	0.310
L	2.79	3.81	0.110	0.150
Q ₁	1.27	2.03	0.050	0.080
S	0.38	1.52	.015	0.060

ECN: S-03946—Rev. D, 09-Jul-01
DWG: 5482

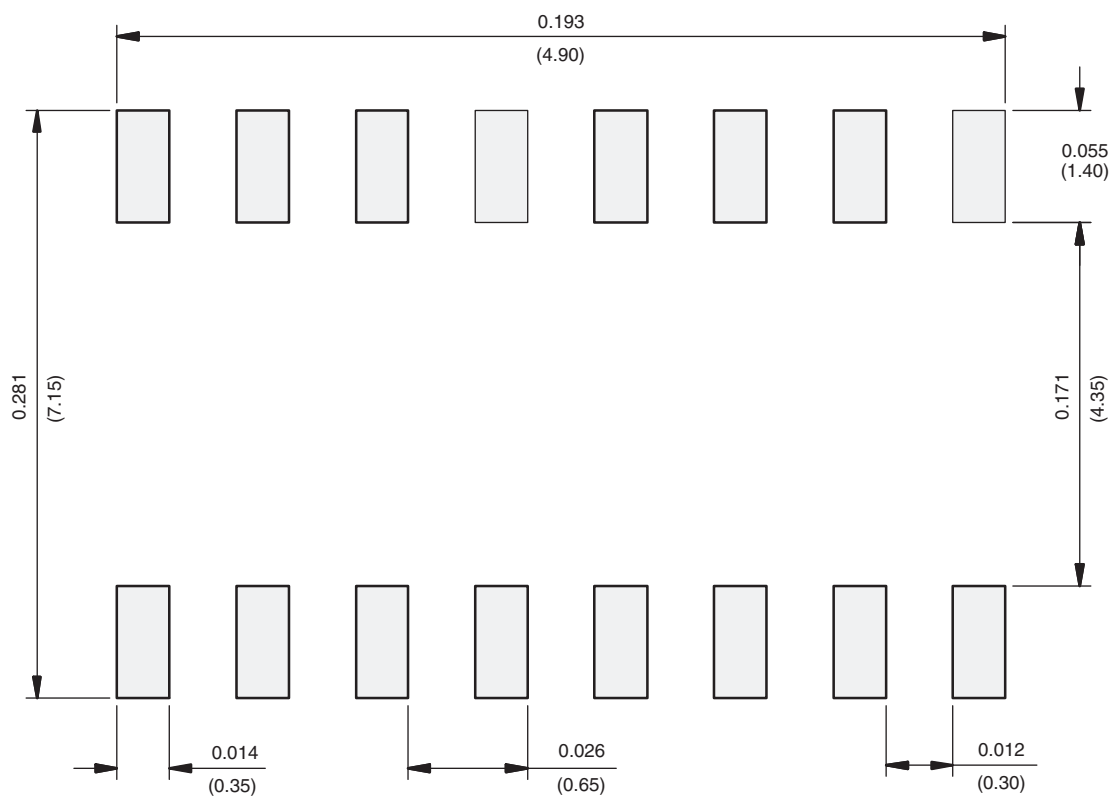
TSSOP: 16-LEAD



Symbols	DIMENSIONS IN MILLIMETERS		
	Min	Nom	Max
A	-	1.10	1.20
A1	0.05	0.10	0.15
A2	-	1.00	1.05
B	0.22	0.28	0.38
C	-	0.127	-
D	4.90	5.00	5.10
E	6.10	6.40	6.70
E1	4.30	4.40	4.50
e	-	0.65	-
L	0.50	0.60	0.70
L1	0.90	1.00	1.10
y	-	-	0.10
θ1	0°	3°	6°
ECN: S-61920-Rev. D, 23-Oct-06			
DWG: 5624			



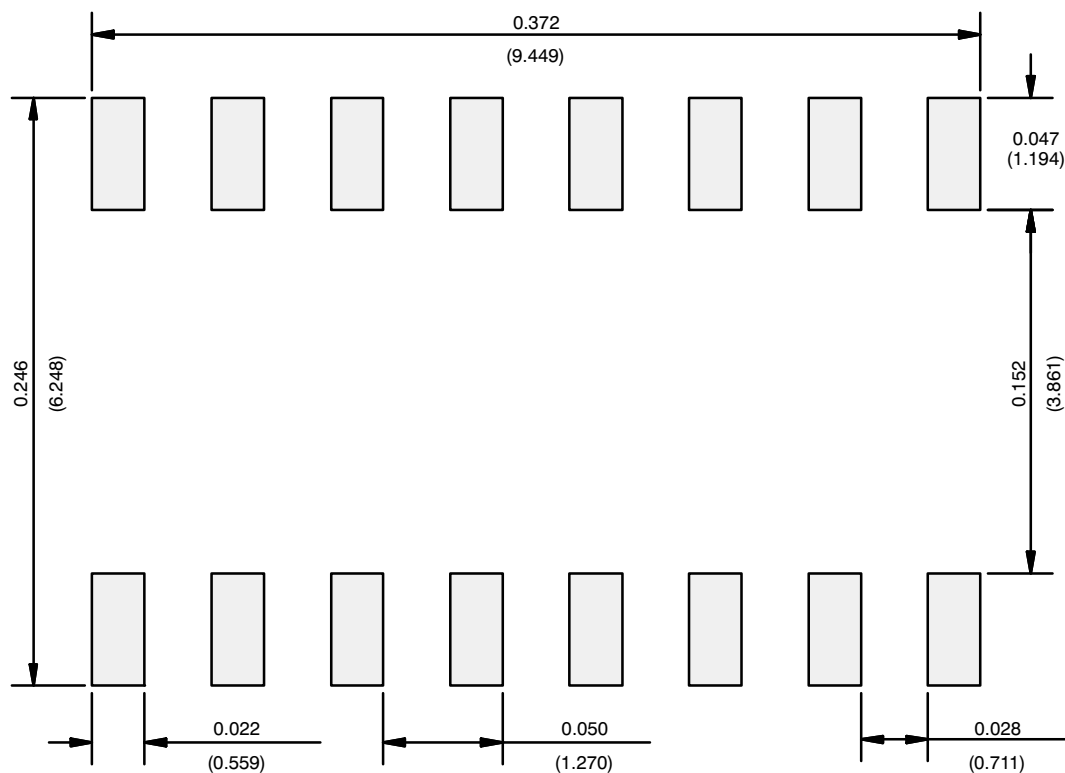
RECOMMENDED MINIMUM PAD FOR TSSOP-16



Recommended Minimum Pads
Dimensions in inches (mm)

www.vishay.com
1

RECOMMENDED MINIMUM PADS FOR SO-16



Recommended Minimum Pads
Dimensions in Inches/(mm)

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