

High-Bandwidth, Low Voltage, Dual SPDT Analog Switches

DESCRIPTION

The DG2519E is monolithic CMOS dual single-pole / double-throw (SPDT) analog switches. It is specifically designed for low-voltage, high bandwidth applications.

The DG2519E on-resistance, matching and flatness are guaranteed over the entire analog voltage range. Wide dynamic performance is achieved with typical at -63 dB for both cross-talk and off-isolation at 1 MHz.

Both SPDT's operate with independent control logic, conduct equally well in both directions and block signals up to the power supply level when off. Break-before-make is guaranteed.

With fast switching speeds, low on-resistance, high bandwidth, and low charge injection, the DG2519E are ideally suited for audio and video switching with high linearity.

Built on Vishay Siliconix's low voltage CMOS technology, the DG2519E contain an epitaxial layer which prevents latch-up

FEATURES

- Single supply (1.8 V to 5.5 V)
- Low on-resistance - R_{ON} : 2.5 Ω
- Crosstalk and off isolation: -63 dB at 1 MHz
- MSOP-10 and DFN-10 package
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

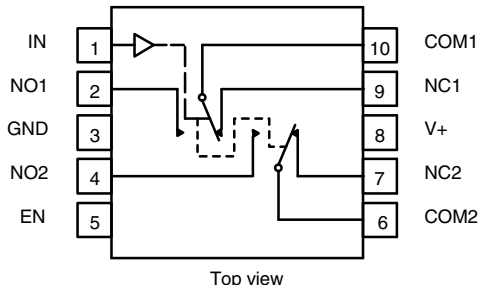
BENEFITS

- Reduced power consumption
- High accuracy
- Reduce board space
- Low-voltage logic compatible
- High bandwidth

APPLICATIONS

- Cellular phones
- Speaker headset switching
- Audio and video signal routing
- PCMCIA cards
- Low-voltage data acquisition
- ATE

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



TRUTH TABLE

LOGIC	EN	NC1 and NC2	NO1 and NO2
0	1	ON	OFF
1	1	OFF	ON
0	0	OFF	OFF
1	0	OFF	OFF

ORDERING INFORMATION

TEMP. RANGE	PACKAGE	PART NUMBER
-40 °C to +85 °C	MSOP-10	DG2519EDQ-T1-GE3
	DFN-10	DG2519EDN-T1-GE4

ABSOLUTE MAXIMUM RATINGS

PARAMETER		LIMIT	UNIT
Reference V+ to GND		-0.3 to +6	V
IN, COM, NC, NO ^a		-0.3 to (V+ + 0.3)	
Continuous current (any terminal)		± 50	mA
Peak current (pulsed at 1 ms, 10 % duty cycle)		± 200	
Storage temperature (D suffix)		-65 to +150	°C
Power dissipation (packages) ^b	MSOP-10 ^c	320	mW
	DFN-10 ^d	1191	
ESD / HBM	EIA / JESD22-A114-A	7.5k	V
ESD / CDM	EIA / JESD22-C101-A	1.5k	
Latch up	JESD78	300	mA

Notes

- Signals on NC, NO, COM, IN, or EN exceeding V+ will be clamped by internal diodes. Limit forward diode current to maximum current ratings
- All leads welded or soldered to PC board
- Derate 4 mW/°C above 70 °C
- Derate 14.9 mW/°C above 70 °C



SPECIFICATIONS (V+ = 3 V)								
PARAMETER	SYMBOL	TEST CONDITIONS OTHERWISE UNLESS SPECIFIED V+ = 3 V, ± 10 %, VIN/ENL = 0.4 V, VIN/ENH = 1.5 V ^e	TEMP. ^a	LIMITS -40 °C to +85 °C			UNIT	
				MIN. ^c	TYP. ^b	MAX. ^c		
Analog Switch								
Analog signal range ^d	V _{ANALOG}		Full	0	-	V+	V	
Drain-source on-resistance	R _{DS(on)}	V+ = 1.8 V, V _{NC/NO} = 0.4 V / V+, I _{NC/NO} = 8 mA	Room	-	7	11	Ω	
			Full	-	-	13		
		V+ = 2.7 V, V _{COM} = 0.8 V / 1.8 V, I _{COM} = 10 mA	Room	-	4.6	5.5		
			Full	-	-	6.5		
On-resistance matching	ΔR _{DS(on)}	V+ = 2.7 V, V _{COM} = 0.8 V / 1.4 V / 1.8 V, I _{COM} = 10 mA	Room	-	0.02	0.3	Ω	
On-resistance flatness ^{d, f}	R _{flat(on)}		Full	-	-	0.6		
			Room	-	0.62	1.1		
			Full	-	-	1.5		
Off leakage current ^g	I _{NC/NO(off)}	V+ = 3.6 V, V _{NC/NO} = 1 V / 3.2 V, V _{COM} = 3.2 V / 1 V, V _{EN} = 0 V	Room	-1	0.01	1	nA	
COM off leakage current ^g	I _{COM(off)}		Full	-5	-	5		
			Room	-1	0.01	1		
			Full	-5	-	5		
Channel-on leakage current ^g	I _{COM(on)}	V+ = 3.3 V, V _{COM} = V _{NC/NO} = 1 V / 3.2 V	Room	-1	0.01	1	nA	
		Full	-5	-	5			
Digital Control								
Input current ^d	I _{INL} or I _{INH}		Full	-1	-	1	μA	
Input high voltage ^d	V _{INH}		Full	1.5	-	-	V	
Input low voltage ^d	V _{INL}		Full	-	-	0.4		
Digital input capacitance ^d	C _{IN}		Room	-	3	-	pF	
Dynamic Characteristics								
Turn-on time	t _{ON}	V _{NC/NO} = 3 V, C _L = 35 pF, R _L = 300 Ω	Room	-	21	45	ns	
Turn-off time	t _{OFF}		Full	-	-	50		
			Room	-	11	35		
			Full	-	-	45		
			Room	3	13	-		
Break-before-make time ^d	t _{BBM}		Full	2	-	-		
Charge injection ^d	Q _{INJ}	C _L = 1 nF, V _{gen} = 1.5 V, R _{gen} = 0 Ω	Room	-	-10.2	-	pC	
Bandwidth ^d	BW	C _L = 5 pF (set up capacitance)	Room	-	222	-	MHz	
Off-isolation ^d	OIRR	R _L = 50 Ω, C _L = 5 pF	f = 1 MHz	Room	-	-63	-	dB
			f = 10 MHz	Room	-	-22	-	
Channel-to-channel crosstalk ^d	X _{TALK}	R _L = 50 Ω, C _L = 5 pF	f = 1 MHz	Room	-	-65	-	
			f = 10 MHz	Room	-	-40	-	
NO, NC Off capacitance ^d	C _{NO(off)}	V+ = 2.7 V, f = 1 MHz	Room	-	7	-	pF	
	C _{NC(off)}		Room	-	7	-		
Channel-on capacitance ^d	C _{NO(on)}		Room	-	24	-		
	C _{NC(on)}		Room	-	24	-		
Power Supply								
Power supply range	V+			2.7	-	3.3	V	
Power supply current ^d	I+	V+ = 2.7 V, V _{IN} = 0 V or 2.7 V	Full	-	-	1	μA	

Notes

- Room = 25 °C, Full = as determined by the operating 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
- Guarantee by design, not subjected to production test
- $V_{IN} = V_+$ voltage to perform proper function
- Crosstalk measured between channels
- Guarantee by 5 V testing

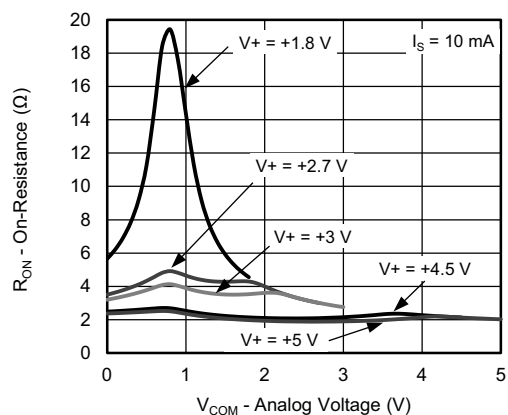
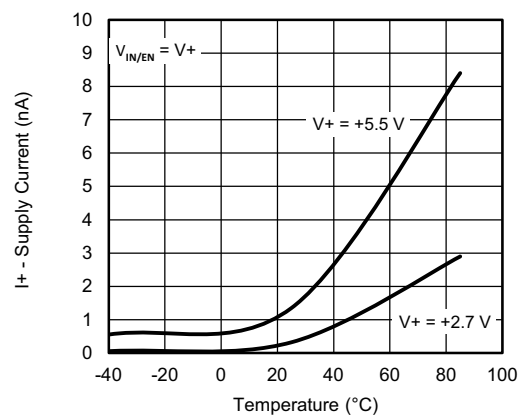
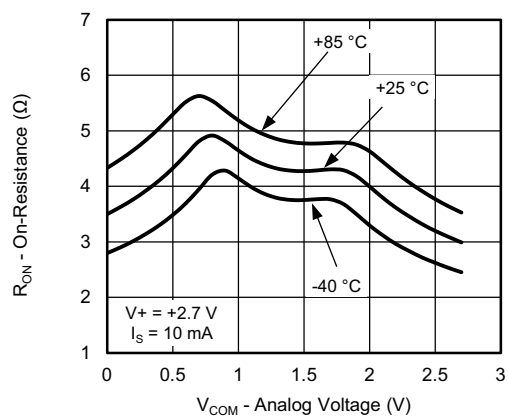
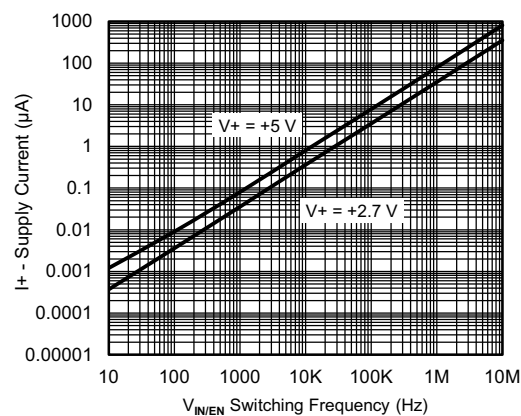
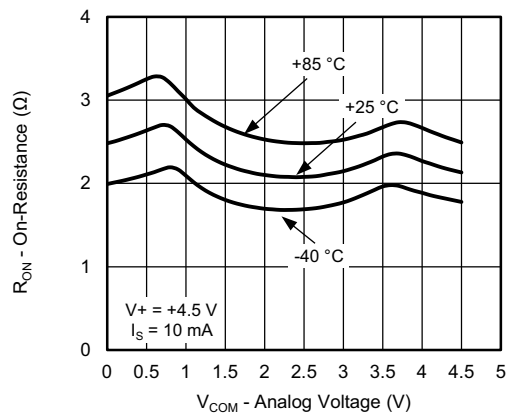
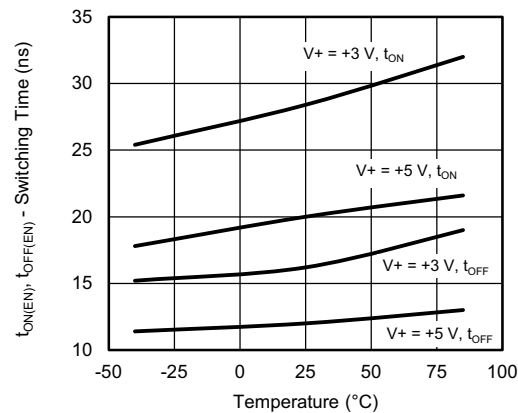


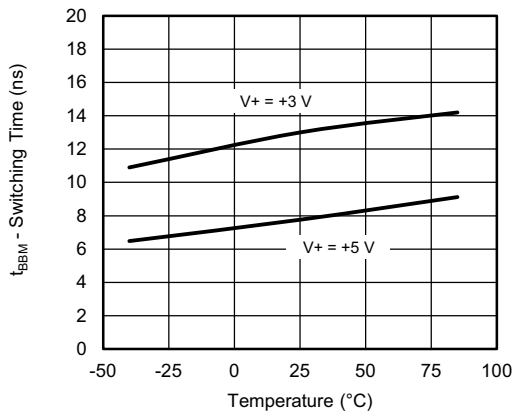
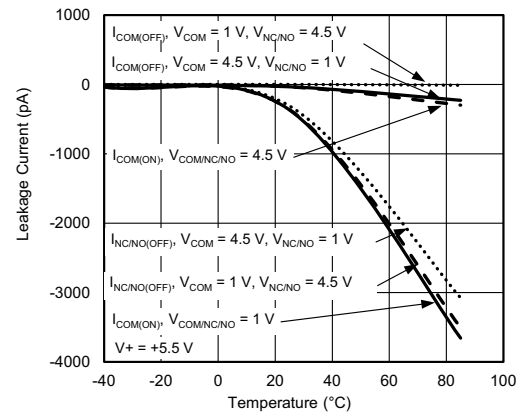
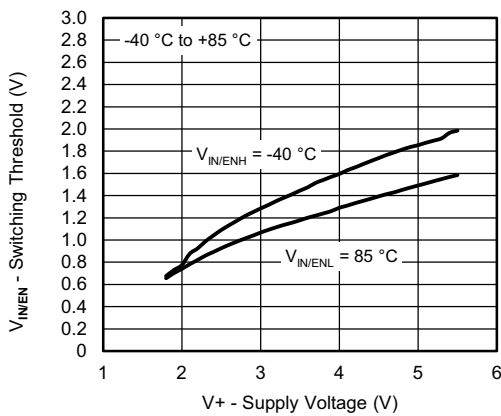
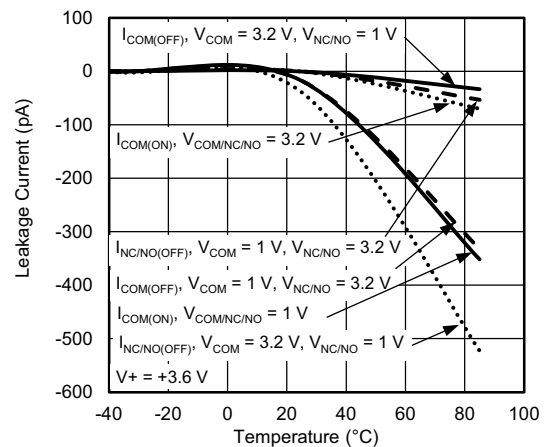
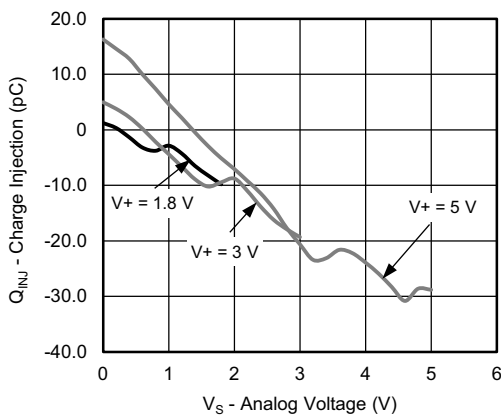
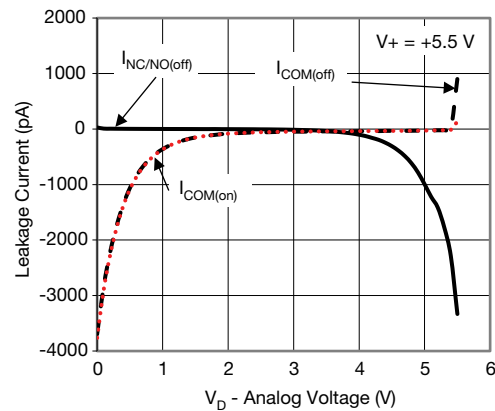
SPECIFICATIONS (V+ = 5 V)									
PARAMETER	SYMBOL	TEST CONDITIONS OTHERWISE UNLESS SPECIFIED V+ = 5 V, ± 10 %, VIN/ENL = 0.5 V, VIN/ENH = 2 V ^e	TEMP. ^a	LIMITS -40 °C to +85 °C			UNIT		
				MIN. ^c	TYP. ^b	MAX. ^c			
Analog Switch									
Analog signal ranged	V _{ANALOG}		Full	0	-	V+	V		
Drain-source on-resistance	R _{DS(on)}	V+ = 4.5 V, V _{COM} = 0.8 V / 3.5 V; I _{COM} = 10 mA	Room	-	2.5	3.1	Ω		
			Full	-	-	4			
On-resistance matching	ΔR _{DS(on)}	V+ = 4.5 V, V _{COM} = 0.8 V / 2.5 V / 3.5 V, I _{COM} = 10 mA	Room	-	0.01	0.4			
			Full	-	-	0.5			
On-resistance flatness ^{d, f}	R _{flat(on)}		Room	-	0.61	1			
			Full	-	-	1.5			
Off leakage current ^g	I _{NC/NO(off)}	V+ = 5.5 V, V _{NC/NO} = 1 V / 4.5 V, V _{COM} = 4.5 V / 1 V, V _{EN} = 0 V	Room	-2	0.16	2	nA		
			Full	-10	-	10			
COM off leakage current ^g	I _{COM(off)}		Room	-2	0.20	2			
			Full	-10	-	10			
Channel-on leakage current ^g	I _{COM(on)}	V+ = 5.5 V, V _{COM} = V _{NC/NO} = 1 V / 4.5 V	Room	-2	0.20	2			
			Full	-10	-	10			
Power down leakage ^d	I _{PD}	V+ = 0 V, V _{COM} = 5.5 V, NC/NO open	Full	-	0.01	5	μA		
		V+ = 0 V, V _{NC/NO} = 5.5 V, COM, open	Full	-	0.01	3	mA		
Digital Control									
Input current ^d	I _{INL} or I _{INH}		Full	-1	-	1	μA		
Input high voltage ^d	V _{INH}		Full	2	-	-	V		
Input low voltage ^d	V _{INL}		Full	-	-	0.5			
Digital input capacitance ^d	C _{IN}		Room	-	3	-	pF		
Dynamic Characteristics									
Turn-on time	t _{ON}	V _{NC/NO} = 3 V, C _L = 35 pF, R _L = 300 Ω	Room	-	14	40	ns		
			Full	-	-	43			
Turn-off time	t _{OFF}		Room	-	7	33			
			Full	-	-	35			
Break-before-make time ^d	t _{BBM}		Room	3	8	-			
			Full	2	-	-			
Propagation delay ^d	t _{pd}	V+ = 5 V, no R _L	Room	-	325	-	ps		
Charge injection ^d	Q _{INJ}	C _L = 1 nF, V _{gen} = 2.5 V, R _{gen} = 0 Ω	Room	-	-14	-	pC		
Bandwidth ^d	BW	C _L = 5 pF (set up capacitance)	Room	-	217	-	MHz		
Off-isolation ^d	OIRR	R _L = 50 Ω, C _L = 5 pF	f = 1 MHz	Room	-	-63	dB		
			f = 10 MHz	Room	-	-22			
Channel-to-channel crosstalk ^d	X _{TALK}	R _L = 50 Ω, C _L = 5 pF	f = 1 MHz	Room	-	-63			
			f = 10 MHz	Room	-	-40			
NO, NC Off capacitance ^d	C _{NO(off)}	V+ = 5 V, f = 1 MHz	Room	-	7	-	pF		
	C _{NC(off)}		Room	-	7	-			
Channel-On capacitance ^d	C _{NO(on)}		Room	-	24	-			
	C _{NC(on)}		Room	-	24	-			
Power Supply									
Power supply range	V+				4.5	-		5.5	V
Power supply current ^d	I+	V+ = 5.5 V, V _{IN} = 0 V or 5.5 V	Full	-	-	1	μA		

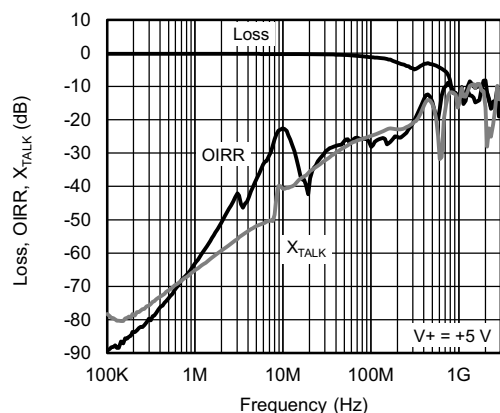
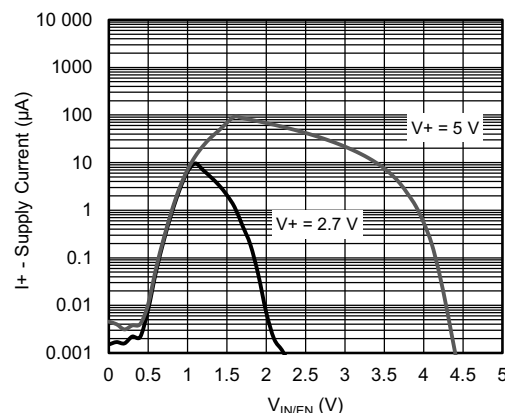
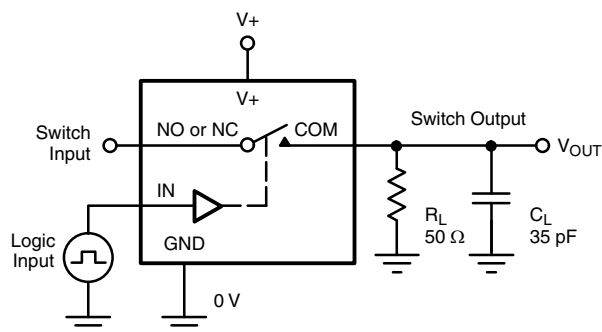
Notes

- a. Room = 25 °C, Full = as determined by the operating suffix
b. Typical values are for design aid only, not guaranteed nor subject to production testing
c. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this datasheet
d. Guarantee by design, not subjected to production test
e. V_{IN} = input voltage to perform proper function
f. Difference of min and max values
g. Guaranteed by 5 V testing.

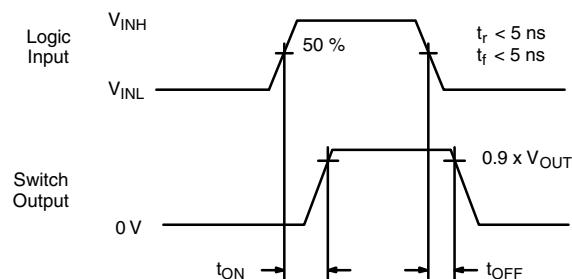
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

 R_{ON} vs. V_{COM} and Single Supply Voltage

Supply Current vs. Temperature

 R_{ON} vs. Analog Voltage and Temperature

Positive Supply Current vs. Switching Frequency

 R_{ON} vs. Analog Voltage and Temperature

Switching Time vs. Temperature

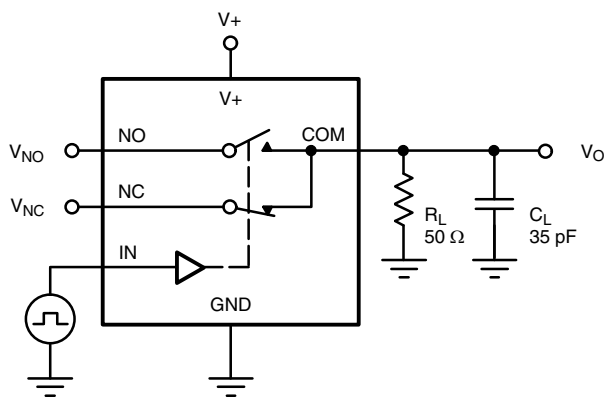
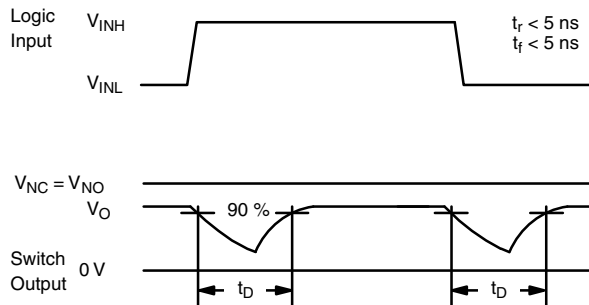
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

Switching Time vs. Temperature

Leakage Current vs. Temperature

Switching Threshold vs. Supply Voltage

Leakage Current vs. Temperature

Charge Injection vs. Source Voltage

Leakage Current vs. Analog Voltage

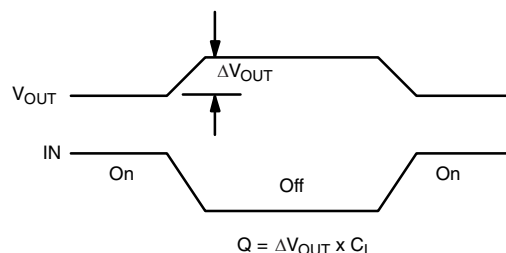
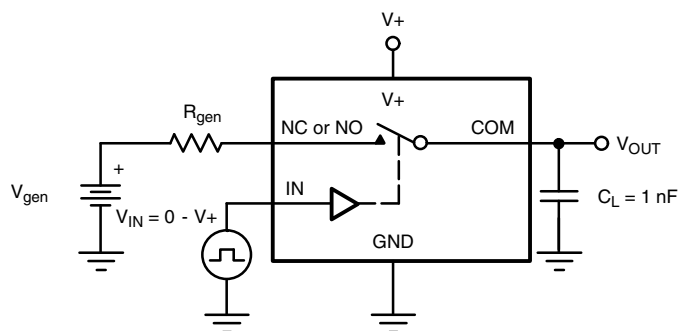
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

Loss, OIRR, X_{TALK} vs. Frequency

Positive Supply Current vs. Logic Voltage
TEST CIRCUITS

 C_L (includes fixture and stray capacitance)

$$V_{OUT} = V_{COM} \left(\frac{R_L}{R_L + R_{ON}} \right)$$

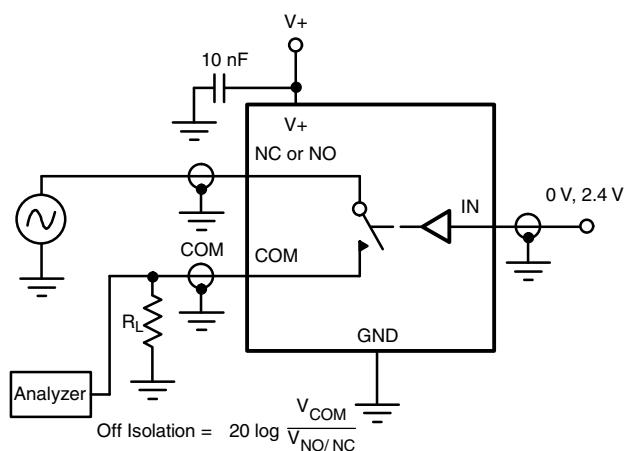
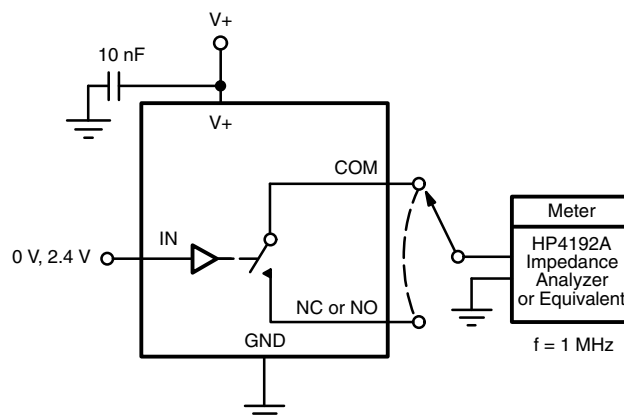
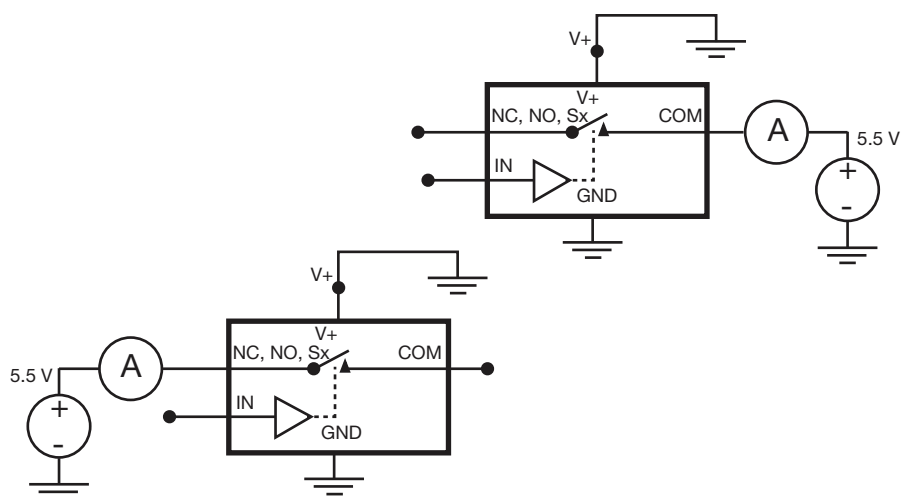


Logic "1" = Switch On
Logic input waveforms inverted for switches that have the opposite logic sense.

Fig. 1 - Switching Time

 C_L (includes fixture and stray capacitance)

Fig. 2 - Break-Before-Make Interval

TEST CIRCUITS


IN depends on switch configuration: input polarity determined by sense of switch.

Fig. 3 - Charge Injection

Fig. 4 - Off-Isolation

Fig. 5 - Channel Off/On Capacitance

Fig. 6 - Source / Drain Power Down Leakage



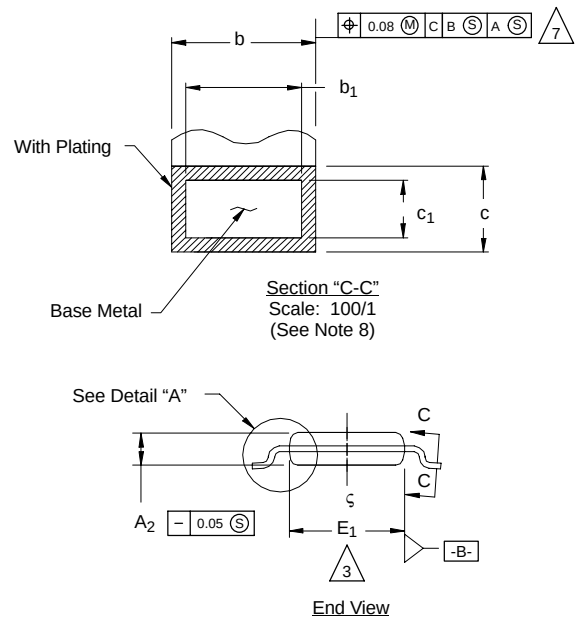
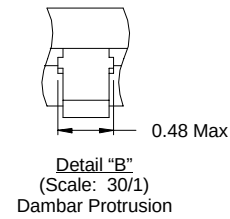
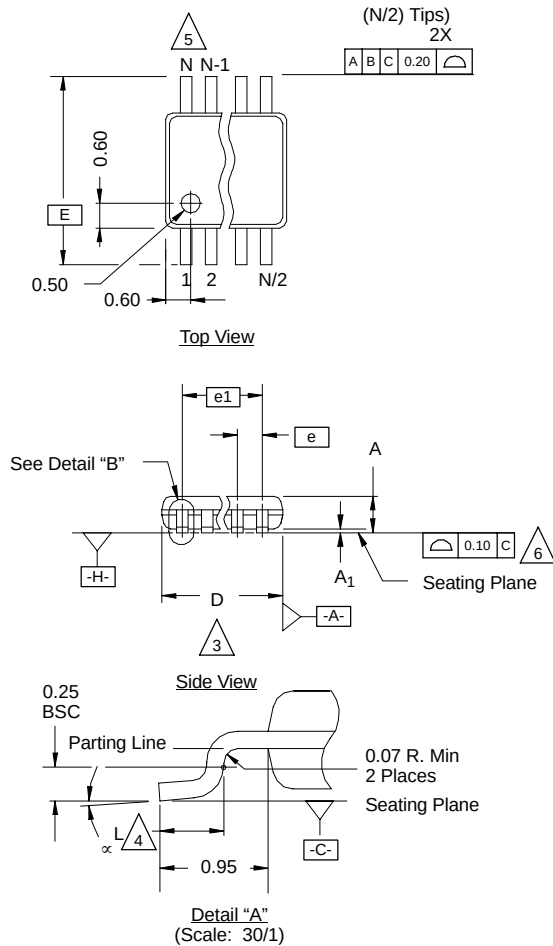
PRODUCT SUMMARY		
Part number	DG2519E	DG2519E
Status code	2	2
Configuration	SPDT x 2	SPDT x 2
Single supply min. (V)	1.8	1.8
Single supply max. (V)	5.5	5.5
Dual supply min. (V)	-	-
Dual supply max. (V)	-	-
On-resistance (Ω)	2.5	2.5
Charge injection (pC)	-14	-14
Source on capacitance (pF)	24	24
Source off capacitance (pF)	7	7
Leakage switch on typ. (nA)	0.2	0.2
Leakage switch off max. (nA)	2	2
-3 dB bandwidth (MHz)	217	217
Package	DFN-10	MSOP-10
Functional circuit / applications	Multi Purpose, instrumentation, medical and healthcare, portable	Multi Purpose, instrumentation, medical and healthcare, portable
Interface	Binary	Binary
Single supply operation	Yes	Yes
Dual supply operation	-	-
Turn on time max. (ns)	14	14
Crosstalk and off isolation (dB)	48	48

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?78595.



MSOP: 10-LEADS

JEDEC Part Number: MO-187, (Variation AA and BA)



NOTES:

- Die thickness allowable is 0.203 ± 0.0127 .
- Dimensioning and tolerances per ANSI.Y14.5M-1994.
- Dimensions "D" and "E₁" do not include mold flash or protrusions, and are measured at Datum plane $\square H$, mold flash or protrusions shall not exceed 0.15 mm per side.
- Dimension is the length of terminal for soldering to a substrate.
- Terminal positions are shown for reference only.
- Formed leads shall be planar with respect to one another within 0.10 mm at seating plane.
- The lead width dimension does not include Dambar protrusion. Allowable Dambar protrusion shall be 0.08 mm total in excess of the lead width dimension at maximum material condition. Dambar cannot be located on the lower radius or the lead foot. Minimum space between protrusions and an adjacent lead to be 0.14 mm. See detail "B" and Section "C-C".
- Section "C-C" to be determined at 0.10 mm to 0.25 mm from the lead tip.
- Controlling dimension: millimeters.
- This part is compliant with JEDEC registration MO-187, variation AA and BA.
- Datums $\square A$ and $\square B$ to be determined Datum plane $\square H$.
- Exposed pad area in bottom side is the same as the leadframe pad size.

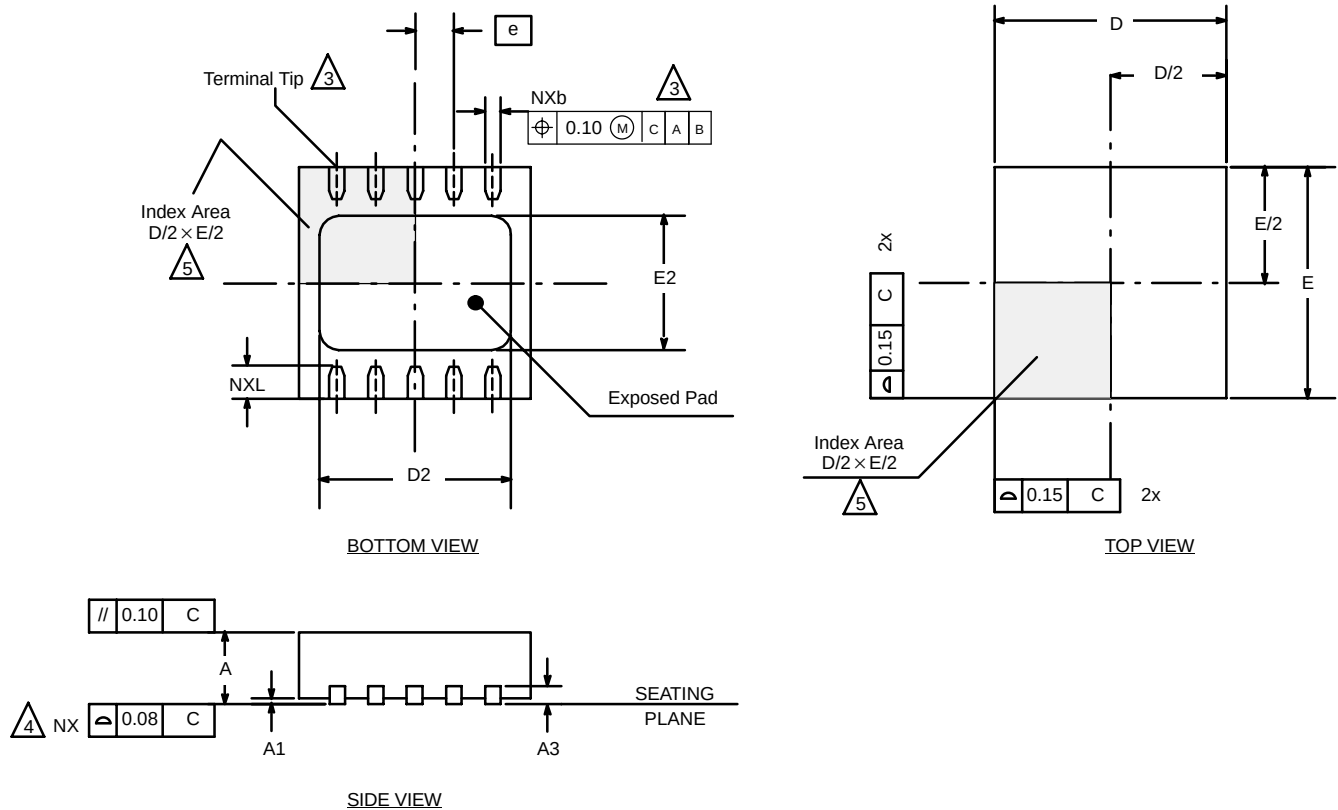
N = 10L

Dim	MILLIMETERS			Note
	Min	Nom	Max	
A	-	-	1.10	
A ₁	0.05	0.10	0.15	
A ₂	0.75	0.85	0.95	
b	0.17	-	0.27	8
b ₁	0.17	0.20	0.23	8
c	0.13	-	0.23	
c ₁	0.13	0.15	0.18	
D	3.00 BSC			3
E	4.90 BSC			
E ₁	2.90	3.00	3.10	3
e	0.50 BSC			
e ₁	2.00 BSC			
L	0.40	0.55	0.70	4
N	10			5
α	0°	4°	6°	

ECN: T-02080—Rev. C, 15-Jul-02
DWG: 5867



DFN-10 LEAD (3 X 3)



NOTES:

1. All dimensions are in millimeters and inches.

2. N is the total number of terminals.

3. Dimension b applies to metallized terminal and is measured between 0.15 and 0.30 mm from terminal tip.

4. Coplanarity applies to the exposed heat sink slug as well as the terminal.

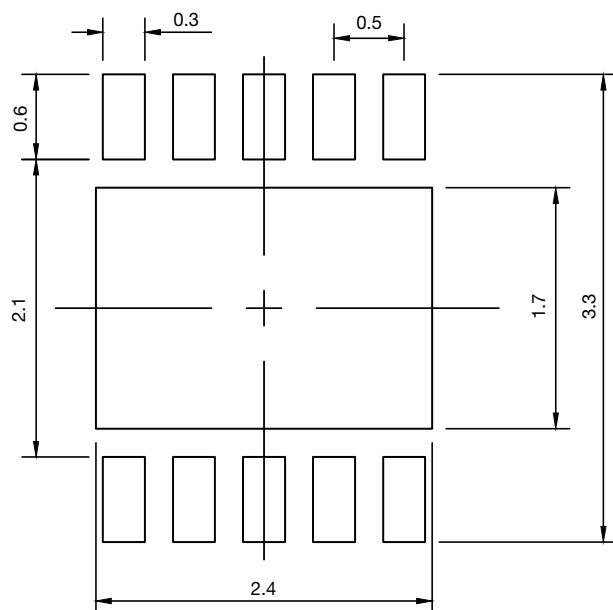
5. The pin #1 identifier may be either a mold or marked feature, it must be located within the zone indicated.

Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.80	0.90	1.00	0.031	0.035	0.039
A1	0.00	0.02	0.05	0.000	0.001	0.002
A3	0.20 BSC			0.008 BSC		
b	0.18	0.23	0.30	0.007	0.009	0.012
D	3.00 BSC			0.118 BSC		
D2	2.20	2.38	2.48	0.087	0.094	0.098
E	3.00 BSC			0.118 BSC		
E2	1.49	1.64	1.74	0.059	0.065	0.069
e	0.50 BSC			0.020 BSC		
L	0.30	0.40	0.50	0.012	0.016	0.020
*Use millimeters as the primary measurement.						
ECN: S-42134—Rev. A, 29-Nov-04						
DWG: 5943						

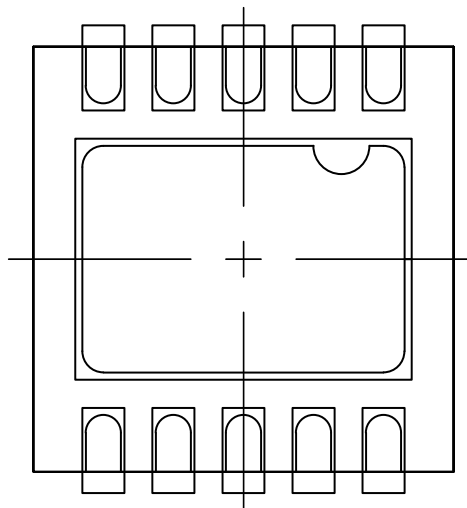


Recommended Minimum PAD for DFN10 3 mm x 3 mm

Recommended Land Pattern



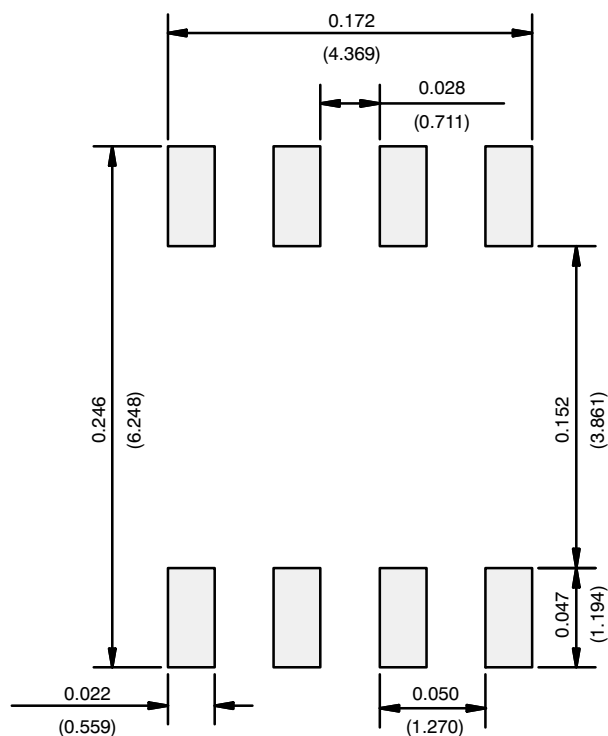
Recommended Land Pattern vs. Case Outline



Note: Dimension are in millimeters

ECN: S22-0379-Rev. A, 02-May-2022
DWG: 3008

RECOMMENDED MINIMUM PADS FOR SO-8



Recommended Minimum Pads
Dimensions in Inches/(mm)

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