

0.4 Ω , Low Resistance and Capacitance, Dual DPDT / Quad SPDT Analog Switch

DESCRIPTION

The DG2523 and DG2524 are four-channel single-pole double-throw (SPDT) analog switches. The DG2523 has two control inputs that each controls a pair of single-pole double-throw (SPDT). It is also known as a two-channel double-pole double-throw (DPDT) configuration. The DG2524 has an $\overline{\text{EN}}$ pin to enable the device when the logic is low.

The parts are designed to operate from 1.8 V to 5.5 V single power rail. All switches conduct equally well in both directions, offering rail to rail signal switching and can be used both as multiplexers as well as de-multiplexers. The parts feature low control logic threshold. Break-before-make switching is guaranteed.

The DG2523 and DG2524 exhibit low parasitic capacitance, low leakage, and highly matched low and flat switch resistance over the full signal range characters that are important for precision analog designs.

The high bandwidth and excellent total harmonic distortion (THD) performance make them ideal for both analog and digital signal switching in space constrain applications requiring high performance and efficient use of board space.

The DG2523 and DG2524 come in lead (Pb)-free QFN-16 package of 3 mm x 3 mm.

BENEFITS

- Low and flat resistance
- Excellent total harmonic distortion
- Low parasitic capacitance
- Low voltage control interface

FEATURES

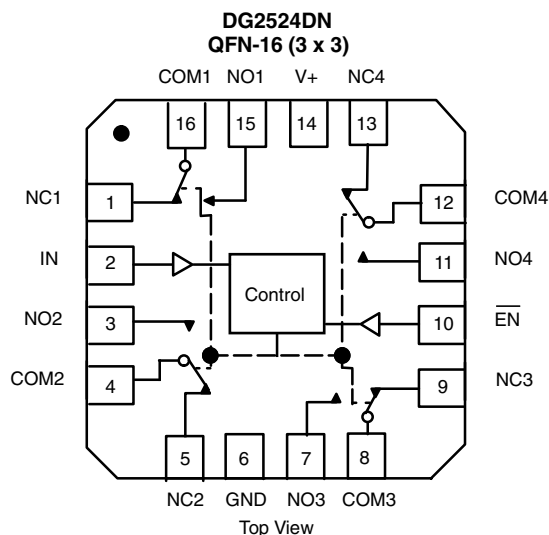
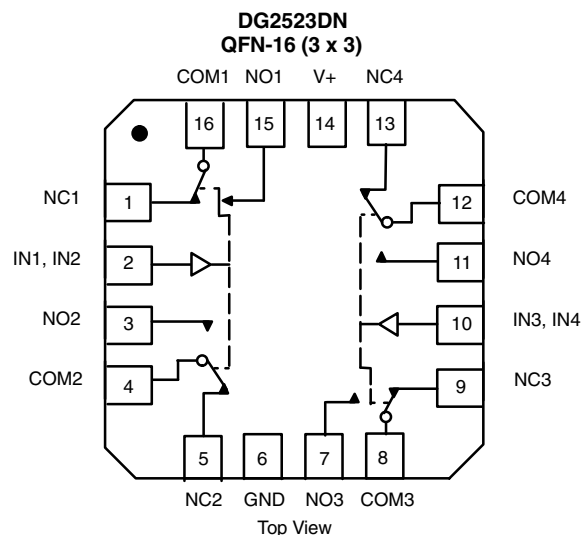
- 1.8 V to 5.5 V single supply operation
- Low resistance: 0.4 Ω / typ. at 2.7 V
- Highly flat and matched R_{on}
- Low parasitic capacitance, $C_{\text{on}} = 26$ pF, $C_{\text{off}} = 14.5$ pF
- Typical switch off leakage of 40 pA
- High bandwidth: 310 MHz
- Guaranteed logic high 1.2 V, logic low 0.3 V
- Break before make switching
- Signal swing over V_{+} capable
- Power down protection
- Latch up current: 300 mA (JESD78)
- ESD/HBM: > 6 kV
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

APPLICATIONS

- Automatic test equipment
- Data acquisition systems
- Meters and instruments
- Medical and healthcare systems
- Communication systems
- Audio and video signal routing
- Battery powered systems
- Computer peripherals
- Data storage
- Relay replacement

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



**TRUTH TABLE DG2523**

INx	NC1, 2, 3, and 4	NO1, 2, 3, and 4
0	On	Off
1	Off	On

TRUTH TABLE DG2524

$\overline{\text{EN}}$	LOGIC IN	NC1, 2, 3, and 4	NO1, 2, 3, and 4
1	x	Off	Off
0	0	On	Off
0	1	Off	On

ORDERING INFORMATION

TEMPERATURE RANGE	PACKAGE	PART NUMBER	MARKING CODE	MIN. ORDER / PACK. QUANTITY
-40 °C to +85 °C lead (Pb)-free	QFN-16 (3 mm x 3 mm) variation 2	DG2523DN-T1-GE4	2523	Tape and reel, 2500 units
		DG2524DN-T1-GE4	2524	

Note

- Exposed pad has no electrical connection

ABSOLUTE MAXIMUM RATINGS ($T_A = 25\text{ °C}$, unless otherwise noted)

PARAMETER	SYMBOL	LIMIT	UNIT
Reference to GND	V+	-0.3 to +6	V
	IN, COM, NC, NO ^a	-0.3 to (V+ + 0.3)	
Current (any terminal except NO, NC, or COM)		30	mA
Continuous current (NO, NC, or COM)		± 300	
Peak current (pulsed at 1 ms, 10 % duty cycle)		± 500	
Storage temperature (D suffix)		-65 to +150	°C
Package solder reflow conditions ^d	QFN-16	250	
Power dissipation (packages) ^b	QFN-16 ^c	1385	mW

Notes

- Signals on NC, NO, or COM, or IN 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 17.3 mW/°C above 70 °C
- Manual soldering with iron is not recommended for leadless components. The miniQFN-16 is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper lip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection

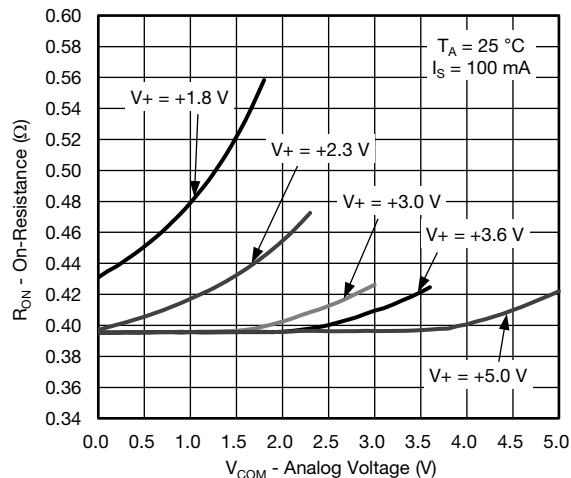
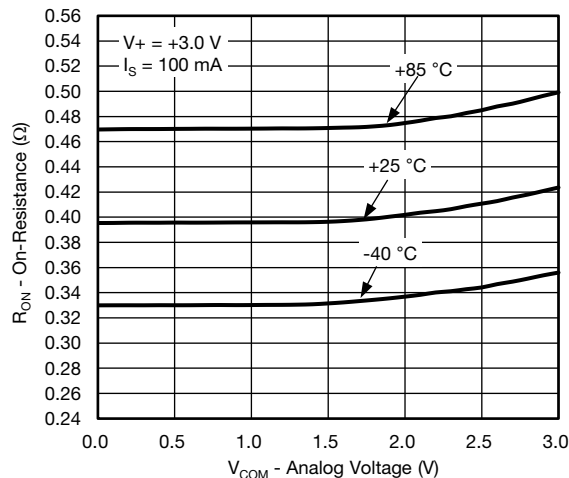
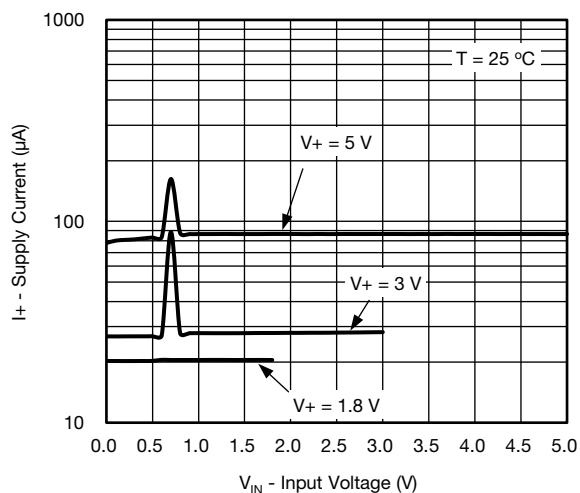
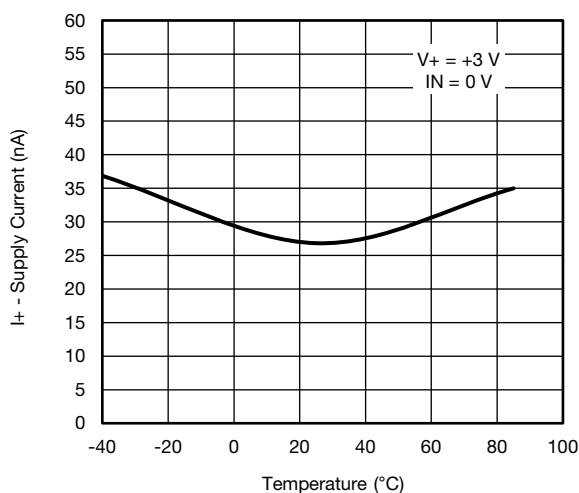
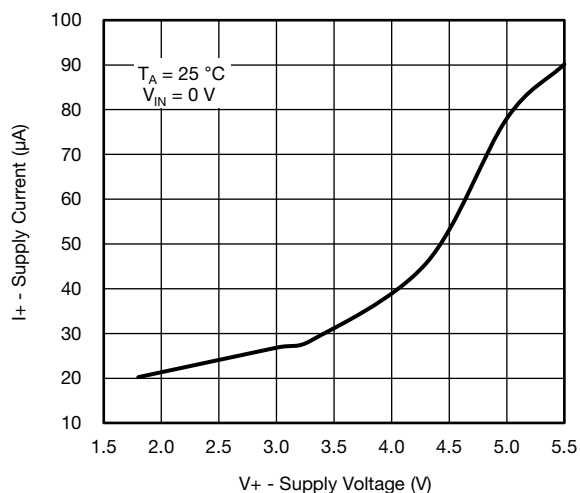
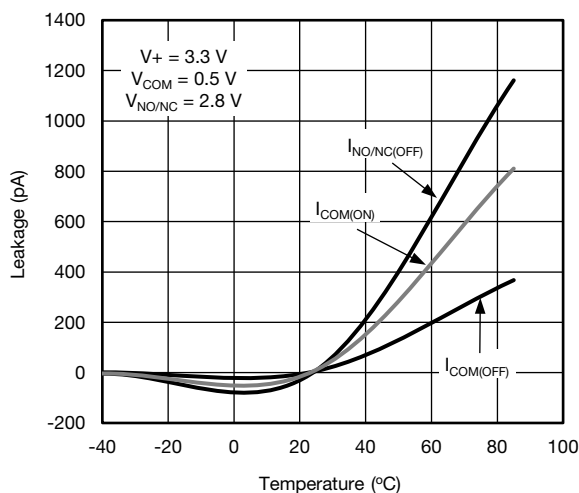
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

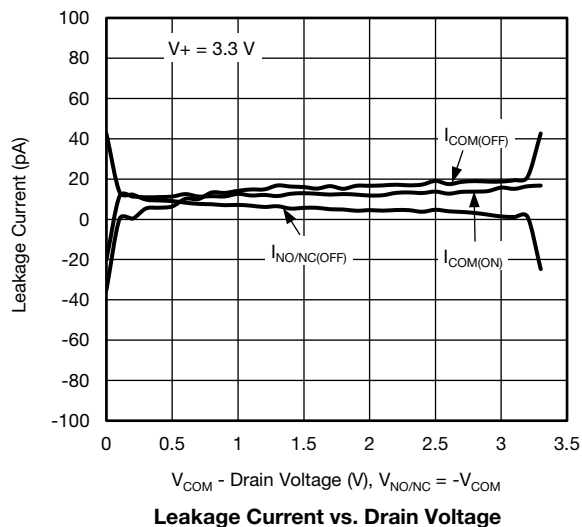
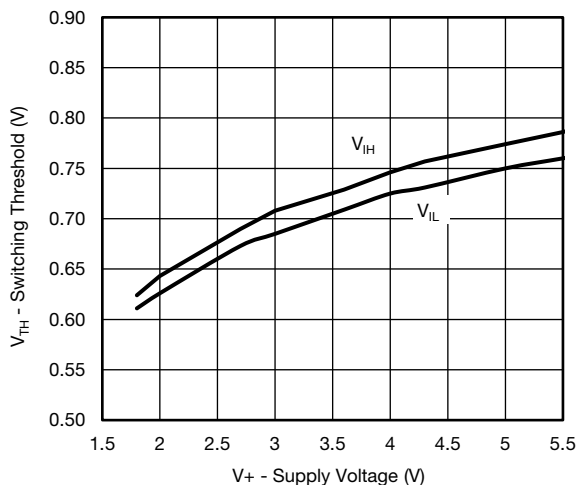
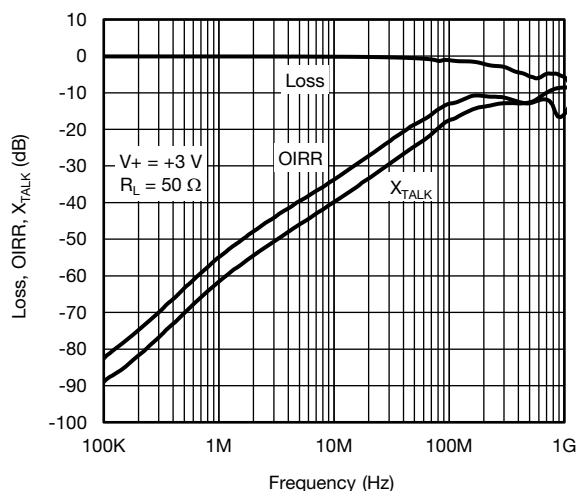
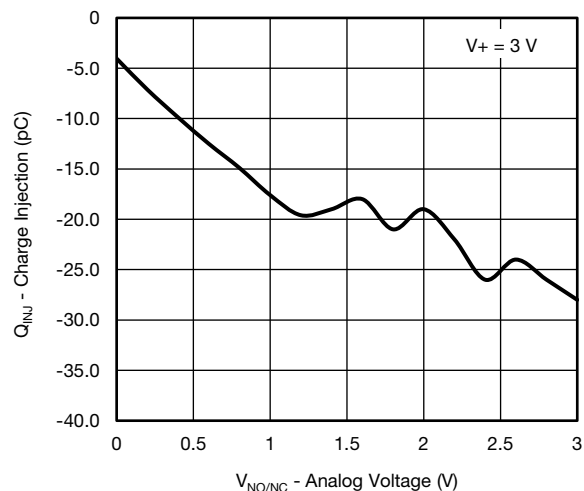
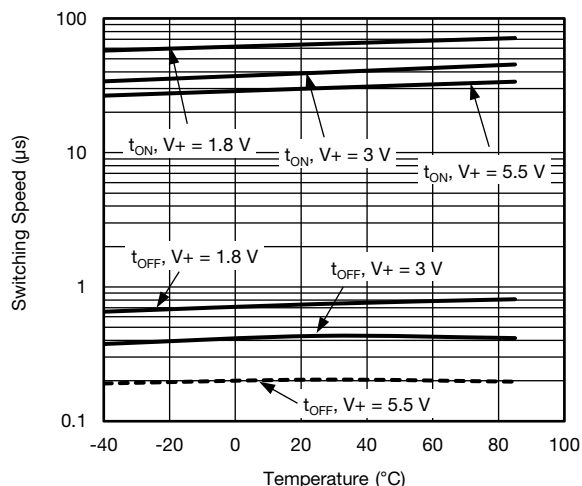
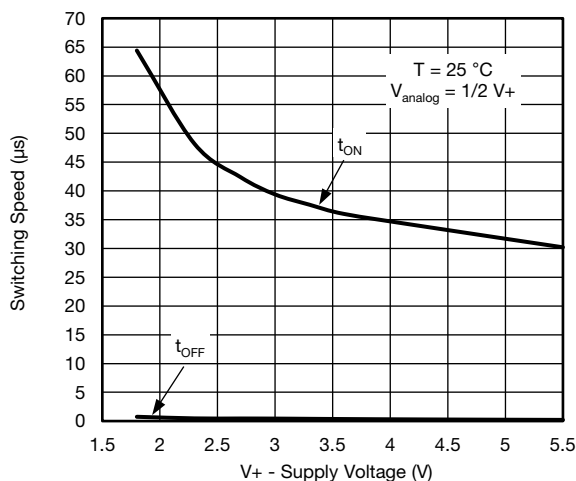


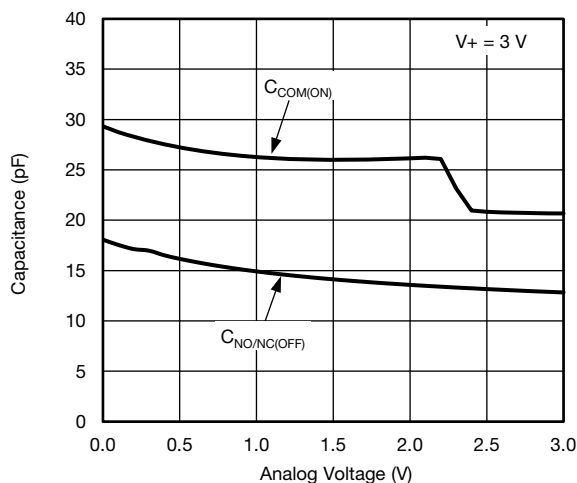
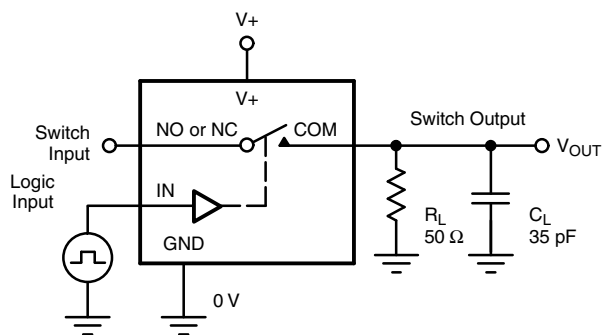
SPECIFICATIONS (V+ = 3 V)							
PARAMETER	SYMBOL	TEST CONDITIONS unless otherwise specified V+ = 3 V, ± 10 %, VIN = 0.5 V or 1.4 V e	TEMP. a	LIMITS -40 °C to +85 °C			UNIT
				MIN. b	TYP. c	MAX. b	
Analog Switch							
Analog signal range d	VNO, VNC, VCOM		Full	0	-	V+	V
On-resistance	RON	V+ = 2.7 V, VCOM = 0 to 2.7 V, INO, INC = 100 mA	Room	-	0.40	0.55	Ω
			Full	-	-	0.65	
RON flatness d	RON flatness	V+ = 2.7 V, VCOM = 0 to V+, INO, INC = 100 mA	Full	-	0.03	0.08	
RON match d	ΔRON		Room	-	0.05	-	
Switch off leakage current	INO(off), INC(off)	V+ = 5.5 V, VNO, VNC = 0.5 V / 4 V, VCOM = 4 V / 0.5 V	Room	-1	0.04	1	nA
			Full	-5	-	5	
			Room	-1	0.17	1	
			Full	-5	-	5	
Channel-on leakage current	ICOM(on)	V+ = 5.5 V, VNO, VNC = VCOM = 0.5 V / 4 V	Room	-1	0.17	1	
			Full	-5	-	5	
Digital Control							
Input high voltage	VINH		Full	1.2	-	-	V
Input low voltage	VINL			-	-	0.3	
Input capacitance	CIN		Full	-	5	-	pF
Input current	IINL or IINH	VIN = 0 or V+	Full	-1	-	1	μA
Dynamic Characteristics							
Turn-on time	tON	VNO or VNC = 1.5 V, RL = 50 Ω, CL = 35 pF	Room	-	38	60	μs
			Full	-	-	70	
Turn-off time	tOFF		Room	-	0.43	1	
			Full	-	-	3	
Break-before-make time	td		Full	1	-	-	
Charge injection d	QINJ	CL = 1 nF, VGEN = 1.5 V, RGEN = 0 Ω	Room	-	-19	-	pC
-3 dB bandwidth	BW	RL = 50 Ω, CL = 5 pF	Room	-	310	-	MHz
Off-isolation d	OIRR	RL = 50 Ω, CL = 5 pF, f = 100 kHz	Room	-	-82	-	dB
		RL = 50 Ω, CL = 5 pF, f = 1 MHz		-	-55	-	
Crosstalk d, f	XTALK	RL = 50 Ω, CL = 5 pF, f = 100 kHz		-	-89	-	
		RL = 50 Ω, CL = 5 pF, f = 1 MHz		-	-61	-	
Total harmonic distortion plus noise	THD + N	2.5 V, signal peak to peak voltage RL = 32 Ω, f = 1 kHz		-	-100	-	
NO, NC off capacitance d	CNO(off)	f = 1 MHz	Room	-	14.5	-	pF
	CNC(off)			-	14.5	-	
Channel-on capacitance d	CNO(on)			-	26	-	
	CNC(on)			-	26	-	
Power Supply							
Power supply range	V+			1.8	-	5.5	V
Power supply current	I+	VIN = 0 or V+	Full	-	29	60	μA

Notes

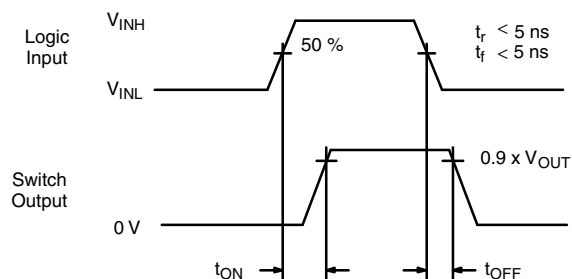
- a. Room = 25 °C, full = as determined by the operating suffix
b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this datasheet
c. Typical values are for design aid only, not guaranteed nor subject to production testing
d. Guarantee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

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

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

 R_{ON} vs. Analog Voltage and Temperature

Supply Current vs. Input Voltage

Supply Current vs. Temperature

Supply Current vs. Supply Voltage

Leakage Current vs. Temperature

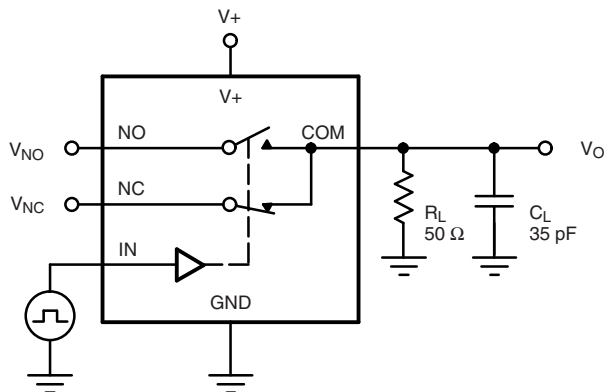
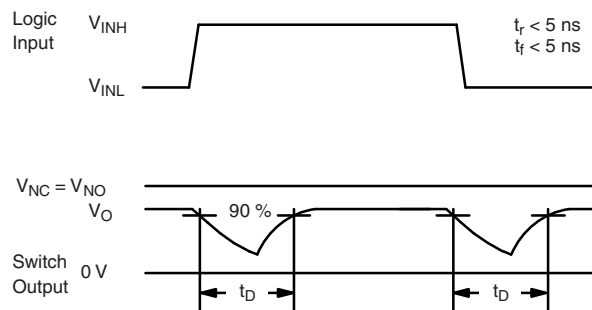
TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise noted)

Leakage Current vs. Drain Voltage

Switching Threshold vs. Supply Voltage

Insertion Loss, Off-Isolation Crosstalk vs. Frequency

Charge Injection vs. Analog Voltage

Switching Time vs. Temperature

Switching Time vs. Supply Voltage

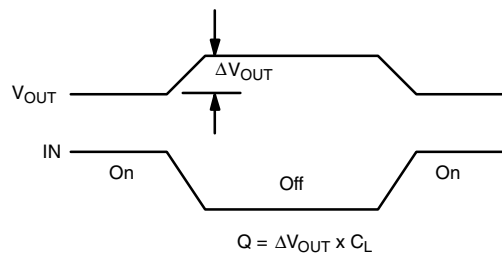
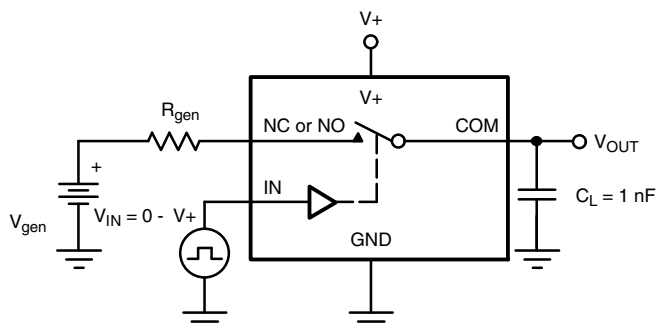
TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise noted)

Capacitance vs. Analog Voltage
TEST CIRCUITS

 C_L (includes fixture and stray capacitance)

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

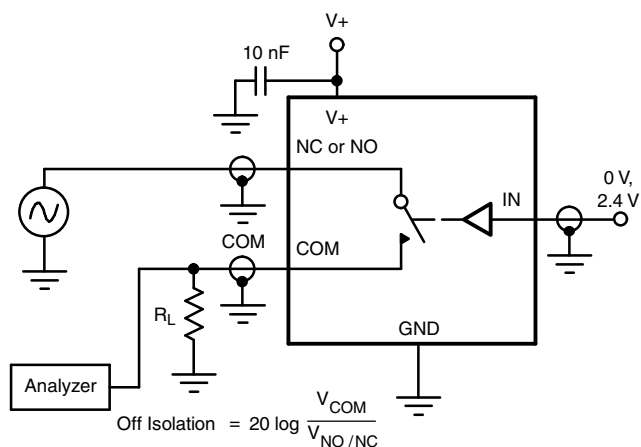
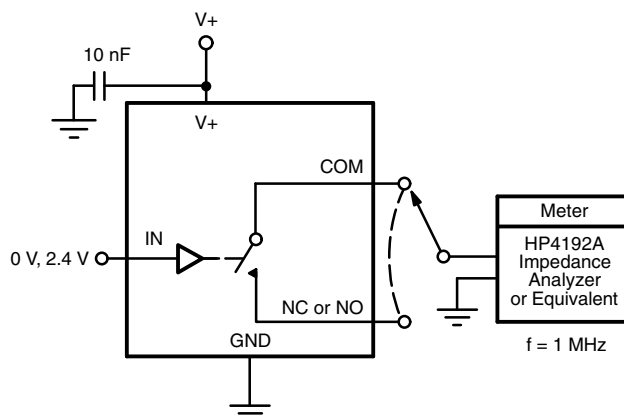


Logic "1" = Switch On
Logic input waveforms inverted for switches that have the opposite logic sense.

Fig. 1 - Switching Time

 C_L (includes fixture and stray capacitance)

Fig. 2 - Break-Before-Make Interval



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

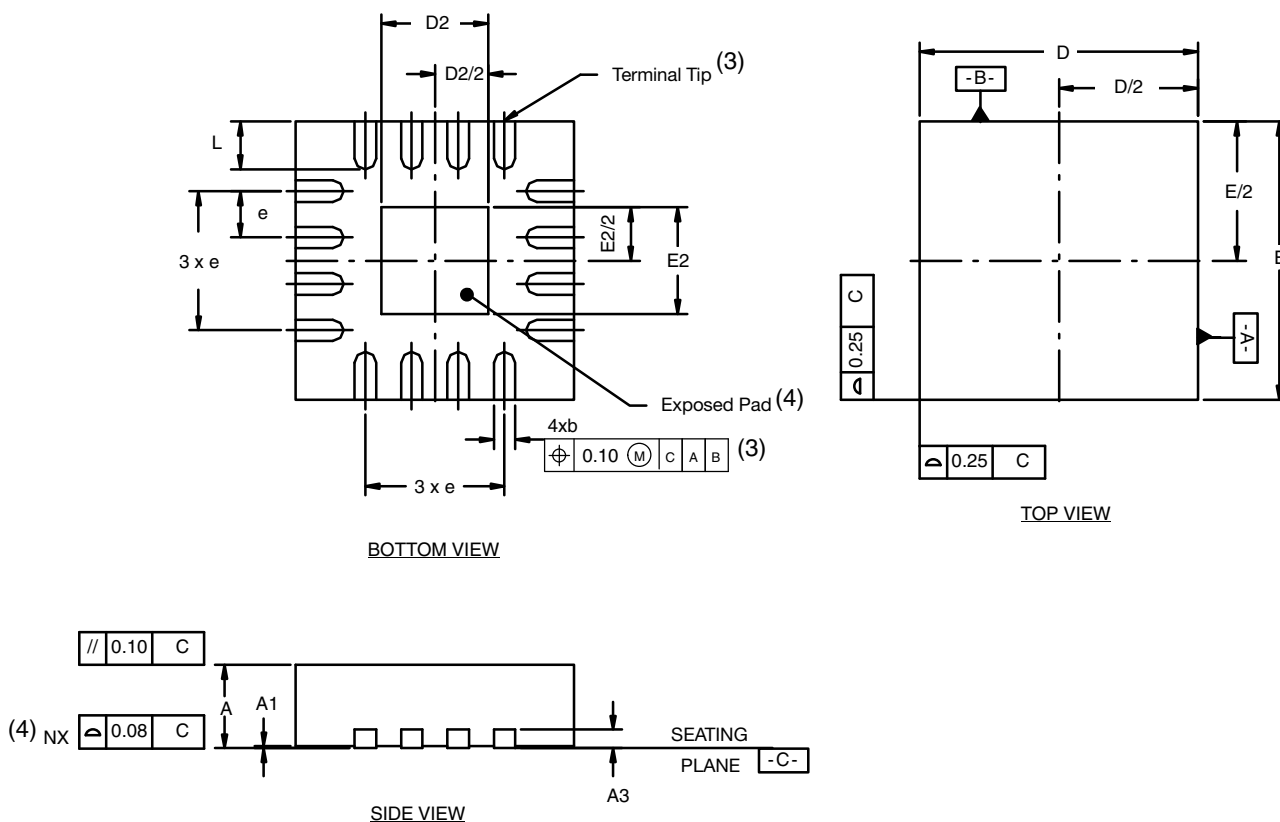
Fig. 3 - Charge Injection

Fig. 4 - Off-Isolation

Fig. 5 - Channel Off / On Capacitance



PRODUCT SUMMARY		
Part number	DG2523	DG2524
Status code	2	2
Configuration	DPDT x 2	SPDT x 4
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)	0.4	0.4
Charge injection (pC)	-19	-19
Source on capacitance (pF)	26	26
Source off capacitance (pF)	14.5	14.5
Leakage switch on typ. (nA)	0.17	0.17
Leakage switch off max. (nA)	1	1
-3 dB bandwidth (MHz)	310	310
Package	QFN-16 3 x 3	QFN-16 3 x 3
Functional circuit / applications	Multi purpose, instrumentation, medical and healthcare, portable	Multi purpose, instrumentation, medical and healthcare, portable
Interface	Parallel	Parallel
Single supply operation	Yes	Yes
Dual supply operation	-	-
Turn on time max. (ns)	60 000	60 000
Crosstalk and off isolation	-55	-55

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QFN-16 Lead (3 x 3)



Notes

- (1) All dimensions are in millimeters.
- (2) N is the total number of terminals.
- (3) Dimension b applies to metallized terminal and is measured between 0.25 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.	VARIATION 1						VARIATION 2					
	MILLIMETERS			INCHES			MILLIMETERS			INCHES		
	MIN.	NOM	MAX.	MIN.	NOM	MAX.	MIN.	NOM	MAX.	MIN.	NOM	MAX.
A	0.80	0.90	1.00	0.031	0.035	0.039	0.80	0.90	1.00	0.031	0.035	0.039
b	0.18	0.23	0.30	0.007	0.009	0.012	0.18	0.25	0.30	0.007	0.010	0.012
D	2.90	3.00	3.10	0.114	0.118	0.122	2.90	3.00	3.10	0.114	0.118	0.122
D2	1.00	1.15	1.25	0.039	0.045	0.049	1.50	1.70	1.80	0.059	0.067	0.071
E	2.90	3.00	3.10	0.114	0.118	0.122	2.90	3.00	3.10	0.114	0.118	0.122
E2	1.00	1.15	1.25	0.039	0.045	0.049	1.50	1.70	1.80	0.059	0.067	0.071
e	0.50 BSC			0.020 BSC			0.50 BSC			0.020 BSC		
L	0.30	0.40	0.50	0.012	0.016	0.020	0.30	0.40	0.50	0.012	0.016	0.020
ECN: T16-0233-Rev. D, 09-May-16 DWG: 5899												



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