

0.37 Ω , Low THD and Capacitance, Dual DPDT / Quad SPDT Analog Switch

DESCRIPTION

The DG2525, is a four-channel single-pole double-throw (SPDT) analog switch with two control inputs. It is also known as a two-channel double-pole double-throw (DPDT) configuration. The part is 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 DG2525 offers low leakage, parasitic capacitance, and highly matched low and flat switch resistance over the full signal range. It features break-before-make switching and low control logic threshold. The part exhibits high bandwidth and excellent total harmonic distortion (THD). It is ideal for both analog and digital signal switching in space constrain applications requiring high performance and efficient use of board space.

The DG2525 comes in a small miniQFN-16 lead package of 2.6 mm x 1.8 mm x 0.55 mm.

BENEFITS

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

FEATURES

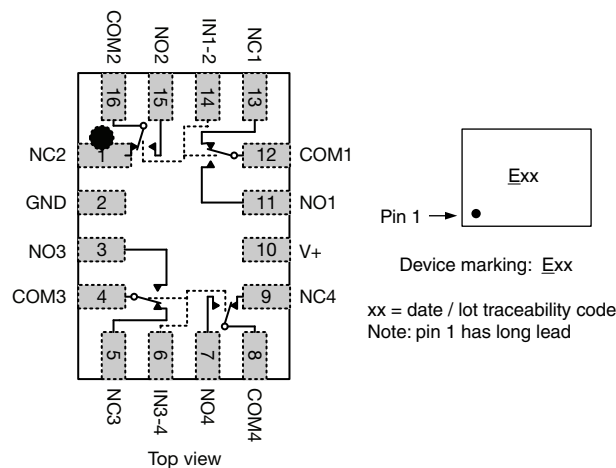
- 1.8 V to 5.5 V single supply operation
- Low resistance: 0.4 Ω /typ. at 2.7 V
- Highly flat and matched R_{ON}
- Low parasitic capacitance, $C_{ON} = 26$ pF, $C_{OFF} = 14.5$ pF
- Switch off leakage: 5 pA at $V_+ = 3.3$ V, 40 pA at $V_+ = 5.5$ V
- High bandwidth: 310 MHz
- -100 dB THD + N at 1 kHz, 0.9 V_{RMS} , $R_{LOAD} = 32$ Ω
- 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

- Smart phones and tablets
- Portable instrumentation
- Audio and video signal switching
- Modems and peripherals
- Data storage
- Wireless pins
- Relay replacement

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



TRUTH TABLE		
LOGIC	NC1, 2, 3, and 4	NO1, 2, 3, and 4
0	On	Off
1	Off	On



ORDERING INFORMATION			
TEMPERATURE RANGE	PACKAGE	PART NUMBER	MIN. ORDER / PACK. QUANTITY
-40 °C to +85 °C lead (Pb)-free	miniQFN-16	DG2525DN-T1-GE4	Tape and reel, 3000 units

ABSOLUTE MAXIMUM RATINGS (T _A = 25 °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	miniQFN-16		250	
Power dissipation (packages) ^b	miniQFN-16 ^c		525	mW

Notes

- a. Signals on NC, NO, or COM, or IN exceeding V+ will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
- b. All leads welded or soldered to PC board.
- c. Derate 6.6 mW/°C above 70 °C.
- d. 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.



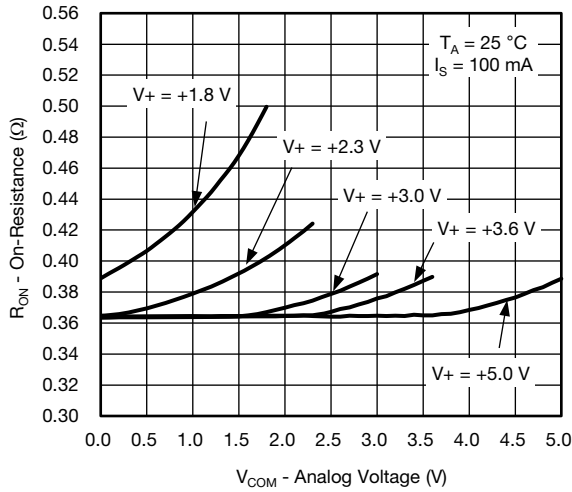
SPECIFICATIONS (V+ = 3 V)								
PARAMETER	SYMBOL	TEST CONDITIONS unless otherwise specified V+ = 3 V, ± 10 %, VIN = 0.5 or 1.4 V e	TEMP. a	LIMITS -40 °C to +85 °C			UNIT	
				MIN. b	TYP. c	MAX. b		
Analog Switch								
Analog signal range d	VNO, VNC, VCOM		Full	0	-	V+	V	
On-resistance	RON	V+ = 2.7 V, VCOM = 0 to 2.7 V, INO, INC = 100 mA	Room	-	0.37	0.5	Ω	
			Full	-	-	0.6		
RON flatness d	RON flatness	V+ = 2.7 V, VCOM = 0 to V+, INO, INC = 100 mA	Full	-	0.03	0.08	Ω	
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	nA	
		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		-
	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

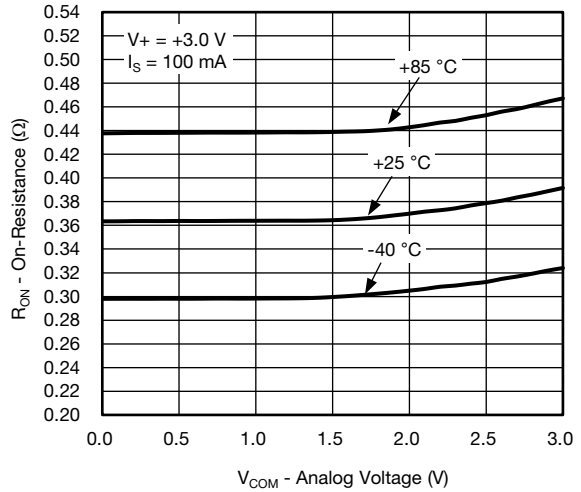
- a. Room = 25 °C, full = as determined by the operating suffix.
- b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- c. Typical values are for design aid only, not guaranteed nor subject to production testing.
- d.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



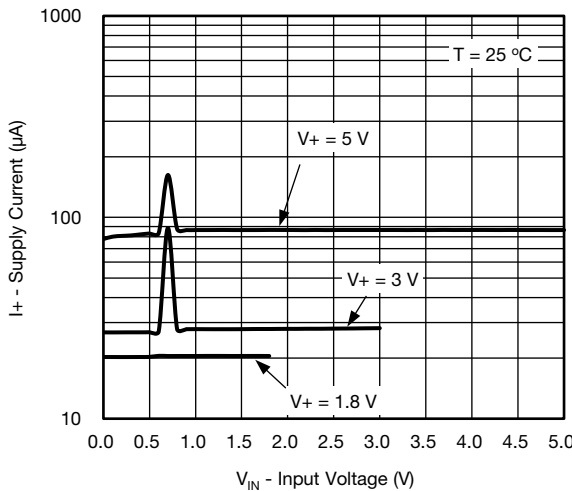
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



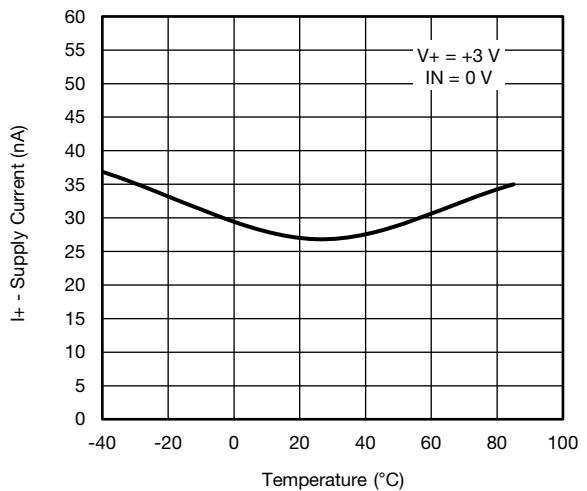
RON vs. VCOM and Supply Voltage



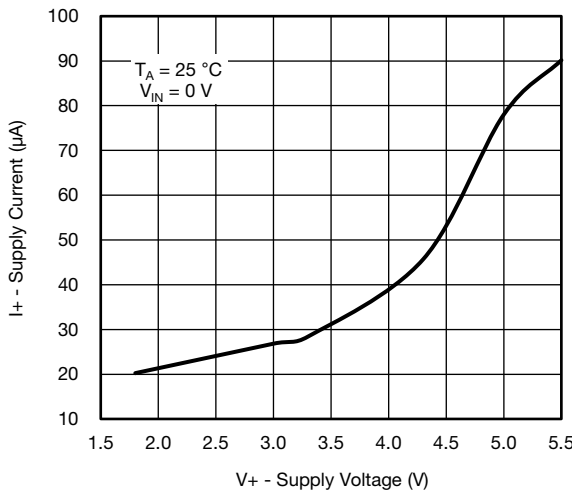
RON vs. Analog Voltage and Temperature



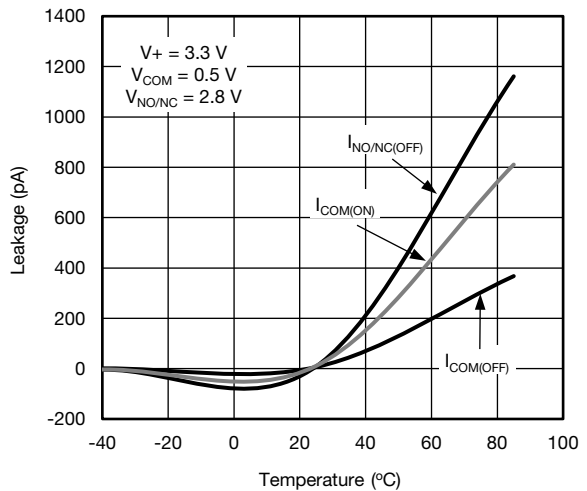
Supply Current vs. Input Voltage



Supply Current vs. Temperature



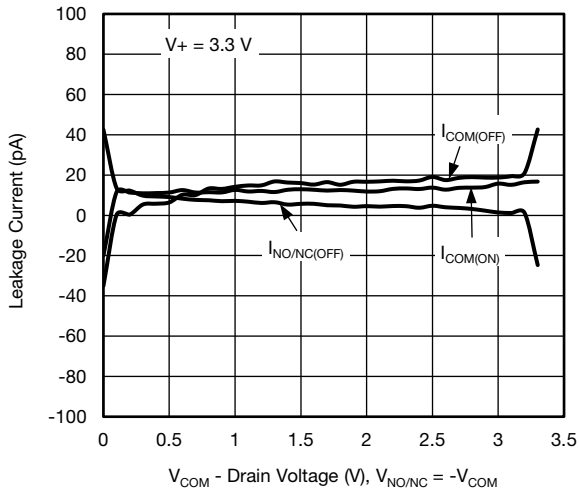
Supply Current vs. Supply Voltage



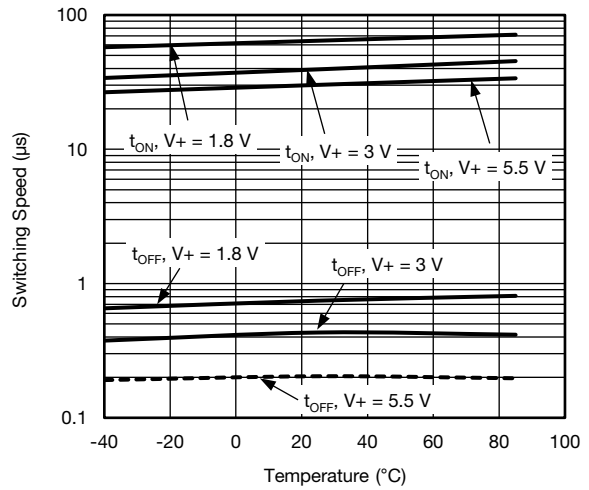
Leakage Current vs. Temperature



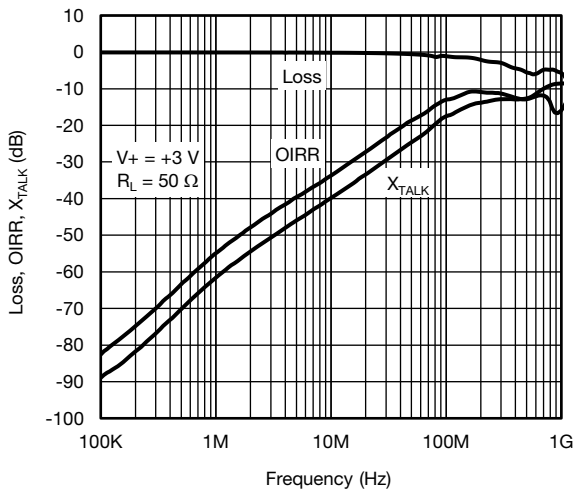
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



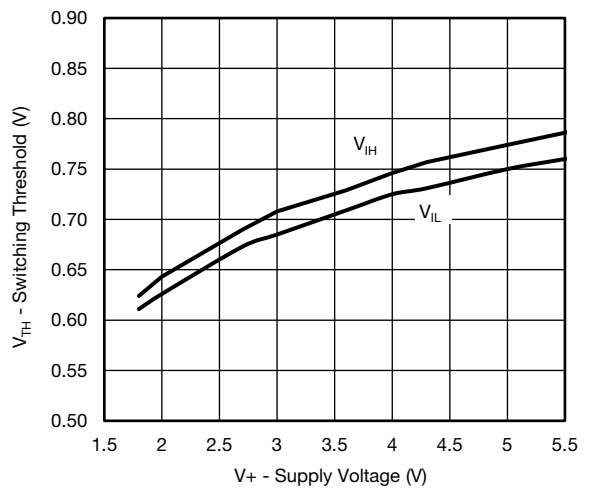
Leakage Current vs. Drain Voltage



Switching Time vs. Temperature

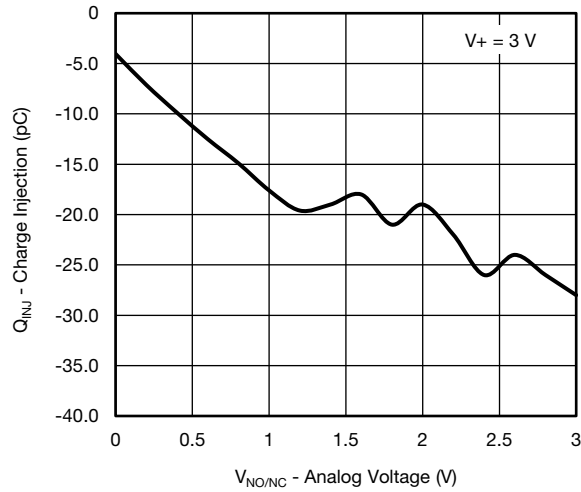


Insertion Loss, Off-Isolation Crosstalk vs. Frequency

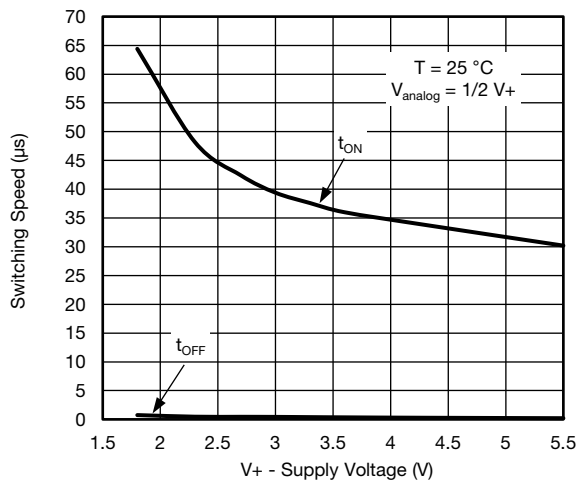


Switching Threshold vs. Supply Voltage

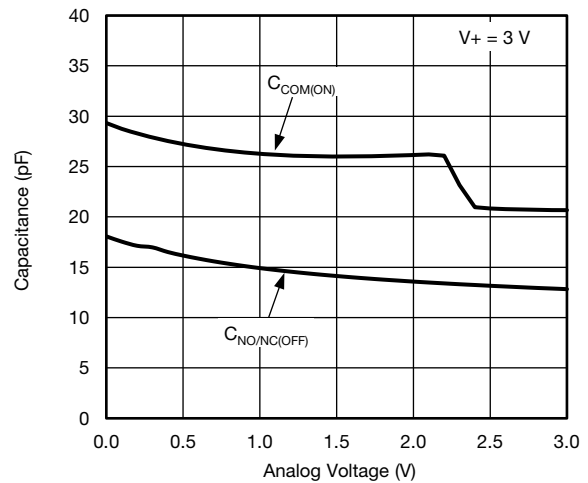
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



Charge Injection vs. Analog Voltage

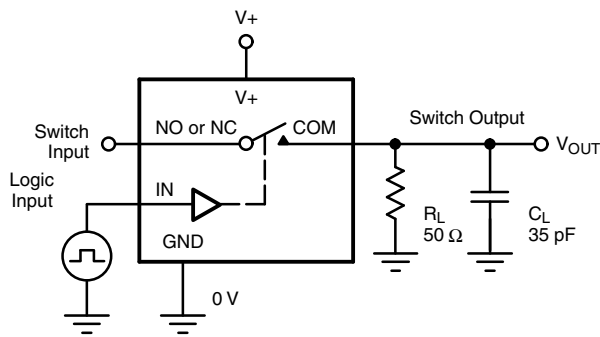


Switching Time vs. Supply Voltage



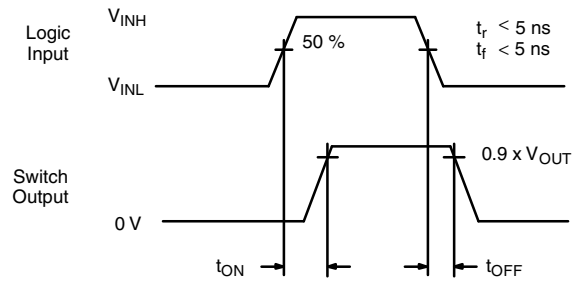
Capacitance vs. Analog Voltage

TEST CIRCUITS



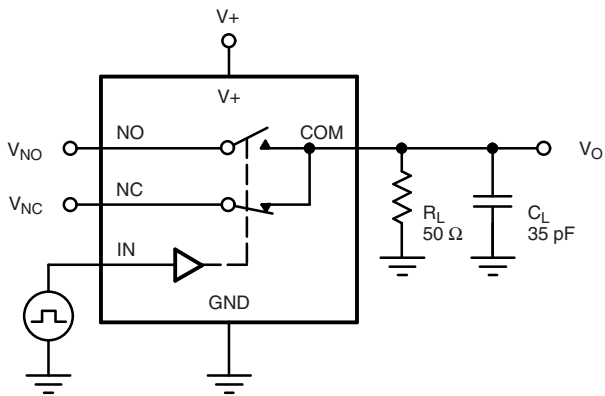
C_L (includes fixture and stray capacitance)

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



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)

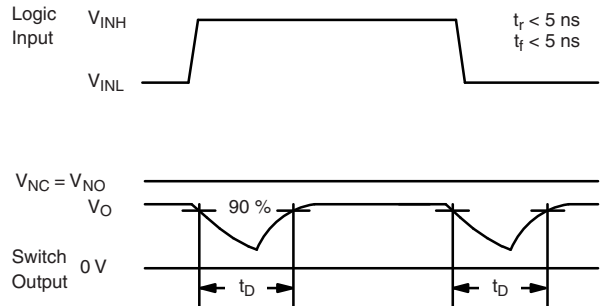
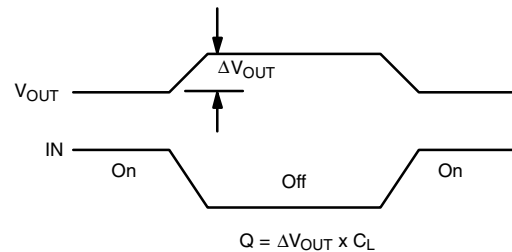
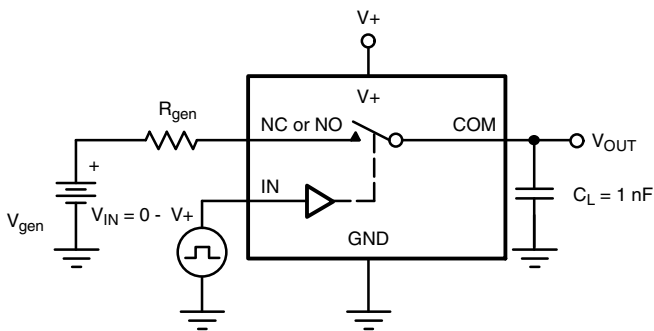


Fig. 2 - Break-Before-Make Interval



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

Fig. 3 - Charge Injection

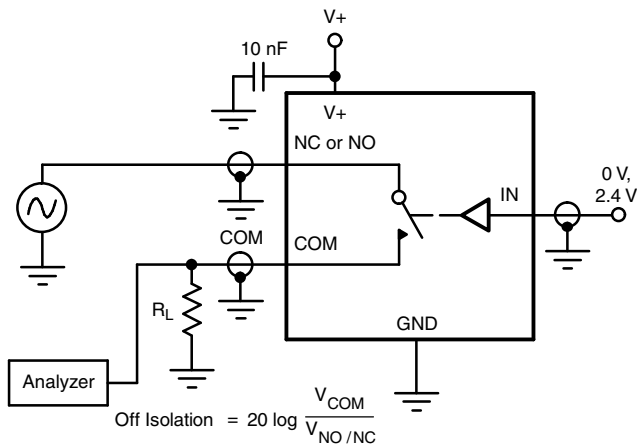


Fig. 4 - Off-Isolation

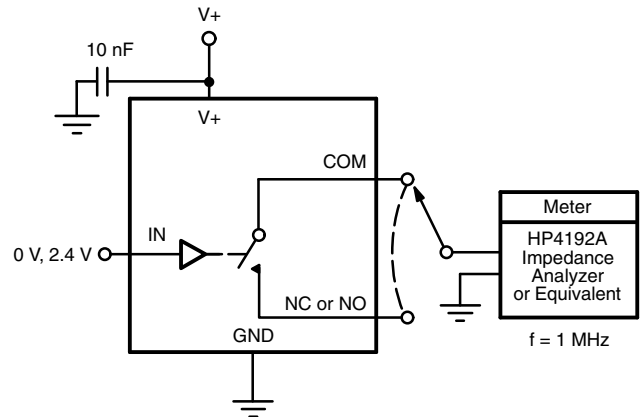


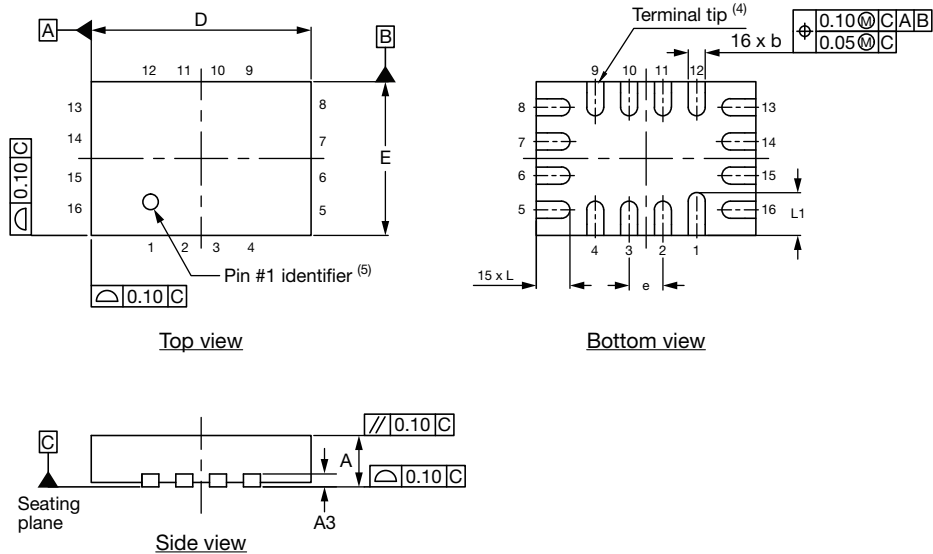
Fig. 5 - Channel Off / On Capacitance



PRODUCT SUMMARY	
Part number	DG2525
Status code	2
Configuration	DPDT x 2
Single supply min. (V)	1.8
Single supply max. (V)	5.5
Dual supply min. (V)	-
Dual supply max. (V)	-
On-resistance (Ω)	0.37
Charge injection (pC)	-19
Source on capacitance (pF)	26
Source off capacitance (pF)	14.5
Leakage switch on typ. (nA)	0.17
Leakage switch off max. (nA)	1
-3 dB bandwidth (MHz)	310
Package	miniQFN-16 (0.55 mm)
Functional circuit / applications	Multi purpose, instrumentation, medical and healthcare, portable
Interface	Binary
Single supply operation	Yes
Dual supply operation	-
Turn on time max. (ns)	60 000
Crosstalk and off isolation	-

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Thin miniQFN16 Case Outline



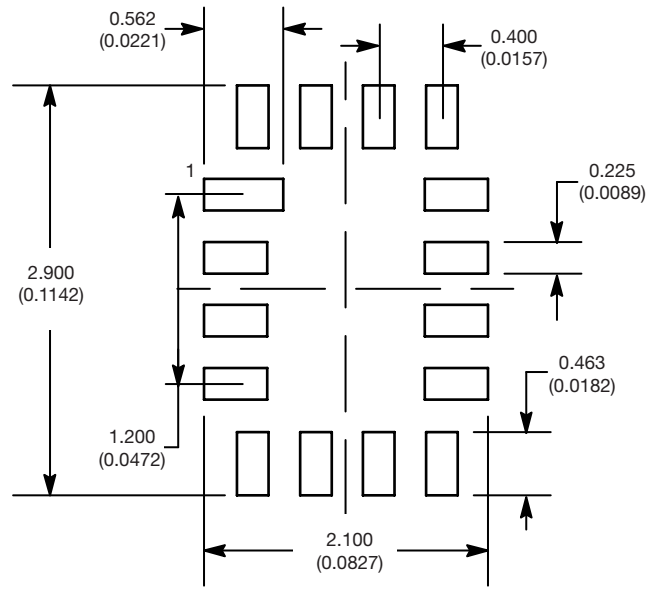
DIMENSIONS	MILLIMETERS ⁽¹⁾			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.50	0.55	0.60	0.020	0.022	0.024
A1	0	-	0.05	0	-	0.002
A3	0.15 ref.			0.006 ref.		
b	0.15	0.20	0.25	0.006	0.008	0.010
D	2.50	2.60	2.70	0.098	0.102	0.106
e	0.40 BSC			0.016 BSC		
E	1.70	1.80	1.90	0.067	0.071	0.075
L	0.35	0.40	0.45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

RECOMMENDED MINIMUM PADS FOR MINI QFN 16L



Mounting Footprint
Dimensions in mm (inch)



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