

COMPLIANT

HALOGEN

FREE

High-Bandwidth, Low Voltage, Dual SPDT Analog Switches

DESCRIPTION

DG2016/DG2026 are monolithic **CMOS** single-pole/double-throw (SPDT) analog switchs. They are specifically designed for low-voltage, high bandwidth applications.

The DG2016/DG2026's on-resistance (3 Ω at 2.7 V), matching and flatness are guaranteed over the entire analog voltage range. Wide dynamic performance is achieved with better than - 80 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 quaranteed.

With fast switching speeds, low on-resistance, high bandwidth, and low charge injection, the DG2016/DG2026 are ideally suited for audio and video switching with high linearity.

Built on Vishay Siliconix's low voltage CMOS technology, the DG2016/DG2026 contain an epitaxial layer which prevents latch-up

FEATURES

- Halogen-free according to IEC 61249-2-21 Definition
- Single Supply (1.8 V to 5.5 V)
- Low On-Resistance R_{ON} : 2.4 Ω
- Crosstalk and Off Isolation: 81 dB at 1 MHz
- MSOP-10 Package
- Compliant to RoHS Directive 2002/95/EC

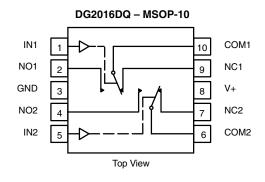
BENEFITS

- Reduced Power Consumption
- High Accuracy
- Reduce Board Space
- Low-Voltage Logic Compatible
- High Bandwidth

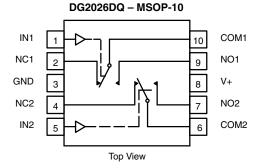
APPLICATIONS

- Cellular Phones
- Speaker Headset Switching
- Audio and Video Signal Routing
- **PCMCIA Cards**
- Low-Voltage Data Acquisition

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



TRUTH TABLE							
Logic	NC1 and NC2	NO1 and NO2					
0	ON	OFF					
1	OFF	ON					



ORDERING I	ORDERING INFORMATION						
Temp Range	Package	Part Number					
- 40 °C to 85 °C	MSOP-10	DG2016DQ-T1-E3					
- 40 C to 65 C	WSOP-10	DG2026DQ-T1-E3					

Document Number: 72030 S11-1185-Rev. D, 13-Jun-11



ABSOLUTE MAXIMUM RATII	NGS		
Parameter		Limit	Unit
Reference V+ to GND		- 0.3 to + 6	V
IN, COM, NC, NO ^a		- 0.3 to (V+ + 0.3)	V
Continuous Current (Any terminal)		± 50	mA
Peak Current (Pulsed at 1 ms, 10 % duty cy	/cle)	± 200	
Storage Temperature (D Suffix)		- 65 to 150	°C
Power Dissipation (Packages) ^b	MSOP-10 ^c	320	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 4 mW/°C above 70 °C.

SPECIFICATIONS (\	/+ = 3 V)						
		Test Conditions Otherwise Unless Specified		- 40	Limits 0 °C to 85	s °C	
Parameter	Symbol	$V+ = 3 V$, $\pm 10 \%$, $V_{IN} = 0.4 V$ or $2 V^e$	Temp.a	Min.b	Typ.c	Max.b	Unit
Analog Switch	•						
Analog Signal Range ^d	$V_{NO}, V_{NC} V_{COM}$		Full	0		V+	V
On-Resistance	R _{ON}	$V+ = 2.7 \text{ V}, V_{COM} = 0.2 \text{ V}/1.5 \text{ V}, I_{NO}, I_{NC} = 10 \text{ mA}$	Room Full		3	4.8 5.3	Ω
R _{ON} Flatness	R _{ON} Flatness	$V+ = 2.7 \text{ V}, V_{COM} = 0 \text{ to } V+, I_{NO}, I_{NC} = 10 \text{ mA}$	Room			1.6	52
Switch Off	I _{NO(off)} I _{NC(off)}	V+ = 3.3 V	Room Full	- 1 - 10		1 10	nA
Leakage Current [†]	I _{COM(off)}	V_{NO} , $V_{NC} = 0.3 \text{ V/3 V}$, $V_{COM} = 3 \text{ V/0.3 V}$	Room Full	- 1 - 10		1 10	
Channel-On Leakage Current ^f	I _{COM(on)}	$V+ = 3.3 \text{ V}, V_{NO}, V_{NC} = V_{COM} = 0.3 \text{ V/3 V}$	Room Full	- 1 - 10		1 10	
Digital Control		<u></u>		l	l .	l	
Input High Voltage ^d	V _{INH}		Full	1.6			V
Input Low Voltage	V_{INL}		Full			0.4	V
Input Capacitance	C _{in}		Full		5		pF
Input Current	I _{INL} or I _{INH}	$V_{IN} = 0 \text{ V or V} +$	Full	1		1	μΑ
Dynamic Characteristics							
Turn-On Time	t _{ON}		Room Full		28	53 59	
Turn-Off Time	t _{OFF}	V_{NO} or $V_{NC} = 2 \text{ V}$, $R_{L} = 50 \Omega$, $C_{L} = 35 \text{ pF}$	Room Full		13	38 38	ns
Break-Before-Make Time	t _d		Full	1			
Charge Injection ^d	Q_{INJ}	$C_L = 1 \text{ nF, } V_{GEN} = 0 \text{ V, } R_{GEN} = 0 \Omega$	Room		38		рC
Off-Isolation ^d	OIRR	$R_1 = 50 \Omega$, $C_1 = 5 pF$, $f = 1 MHz$	Room		- 78		dB
Crosstalk ^d	X _{TALK}	11 = 30 s2, OL = 3 p1, 1 = 1 Will2	Room		- 82		ub
N N Off Capacitaneed	C _{NO(off)}	V _{IN} = 0 V or V+, f = 1 MHz	Room		15		- pF
N _O , N _C Off Capacitance ^d	C _{NC(off)}		Room		15		
Channel On Canacita d	C _{NO(on)}	VIN - 0 V 01 V+, 1 - 1 WI12	Room		49		
Channel-On Capacitance ^d	C _{NC(on)}		Room		45		
Power Supply							
Power Supply Current	l+	V _{IN} = 0 V or V+	Full		0.01	1	μΑ



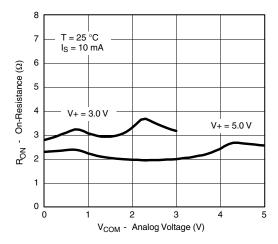
		Test Conditions Otherwise Unless Specified		- 40	Limits 0 °C to 85	°C	
Parameter	Symbol	$V+ = 5 V$, $\pm 10 \%$, $V_{IN} = 0.8 V$ or 2.4 V^e	Temp.a	Min.b	Typ. ^c	Max.b	Unit
Analog Switch							
Analog Signal Range ^d	V_{NO}, V_{NC} V_{COM}		Full	0		V+	٧
On-Resistance	R _{ON}	$V+ = 4.5 \text{ V}, V_{COM} = 3 \text{ V}, I_{NO}, I_{NC} = 10 \text{ mA}$	Room Full		2.4	4 4.3	Ω
R _{ON} Flatness	R _{ON} Flatness	$V+ = 4.5 \text{ V}, V_{COM} = 0 \text{ to } V+, I_{NO}, I_{NC} = 10 \text{ mA}$	Room	1		1.2	52
Switch Off	I _{NO(off)} I _{NC(off)}	V+ = 5.5 V	Room Full	- 1 - 10		1 10	nA
Leakage Current	I _{COM(off)}	V_{NO} , $V_{NC} = 1 \text{ V/4.5 V}$, $V_{COM} = 4.5 \text{ V/1 V}$	Room Full	- 1 - 10		1 10	
Channel-On Leakage Current	I _{COM(on)}	$V+ = 5.5 \text{ V}, V_{NO}, V_{NC} = V_{COM} = 1 \text{ V}/4.5 \text{ V}$	Room Full	- 1 - 10		1 10	
Digital Control							
Input High Voltage ^d	V_{INH}		Full	2			V
Input Low Voltage	V_{INL}		Full			0.8	v
Input Capacitance	C _{in}		Full		5		pF
Input Current	I _{INL} or I _{INH}	$V_{IN} = 0 V \text{ or } V+$	Full	1		1	μΑ
Dynamic Characteristics							
Turn-On Time	t _{ON}		Room Full		23	48 52	
Turn-Off Time	t _{OFF}	V_{NO} or V_{NC} = 3 V, R_L = 50 Ω , C_L = 35 pF	Room Full		8	33 35	ns
Break-Before-Make Time	t _d		Full	1			
Charge Injection ^d	Q_{INJ}	C_L = 1 nF, V_{GEN} = 0 V, R_{GEN} = 0 Ω	Room		79		рС
Off-Isolation ^d	OIRR	$R_1 = 50 \Omega$, $C_1 = 5 pF$, $f = 1 MHz$	Room		- 81		40
Crosstalk ^d	X _{TALK}	$n_L = 50 \text{ sz}, O_L = 5 \text{ pr}, I = 1 \text{ winz}$	Room		- 82		dB
o	C _{NO(off)}	V _{IN} = 0 V or V+, f = 1 MHz	Room		14		
Source-Off Capacitance ^d	C _{NC(off)}		Room		14		
Ohamaal On Oanaaitas and	C _{NO(on)}	VIN - 0 V OI V+, I = I WII IZ	Room		48		pF
Channel-On Capacitance ^d	C _{NC(on}		Room		44		
Power Supply							
Power Supply Range	V+			1.8		5.5	V
Power Supply Current	l+	$V_{IN} = 0 \text{ V or V} +$	Full		0.01	1	μΑ

Notes:

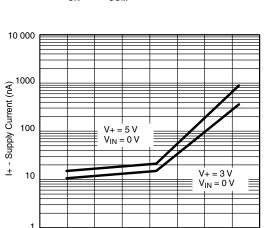
- a. Room = 25 °C, Full = as determined by the operating suffix.
- b. Typical values are for design aid only, not guaranteed nor subject to production testing.
- c. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- d.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

 $Stresses\ beyond\ those\ listed\ under\ "Absolute\ Maximum\ Ratings"\ may\ cause\ permanent\ damage\ to\ the\ device.\ These\ are\ stress\ ratings\ only,\ and\ functional\ operation$ 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 (25 °C, unless otherwise noted)



 $\rm R_{ON}$ vs. $\rm V_{COM}$ and Supply Voltage



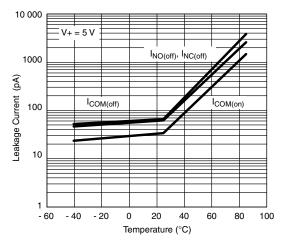
Temperature (°C) Supply Current vs. Temperature

40

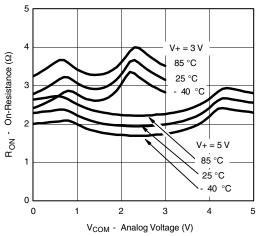
60

80

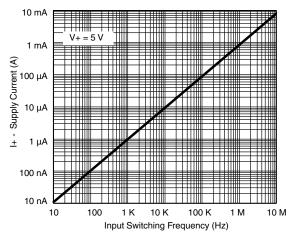
100



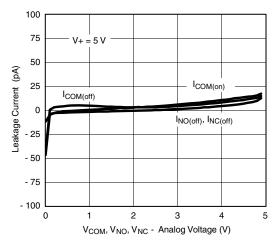
Leakage Current vs. Temperature



R_{ON} vs. Analog Voltage and Temperature



Supply Current vs. Input Switching Frequency



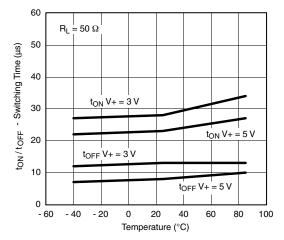
Leakage vs. Analog Voltage

- 60

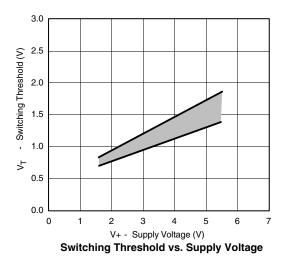
- 40

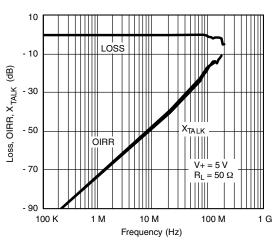


TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

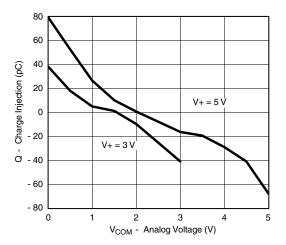


Switching Time vs. Temperature



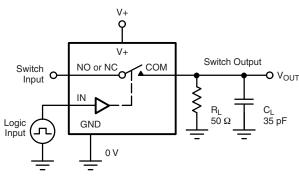


Insertion Loss, Off-Isolation Crosstalk vs. Frequency



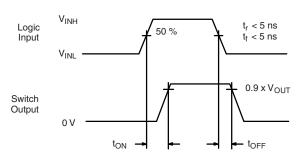
Charge Injection vs. Analog Voltage

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.

Figure 1. Switching Time

TEST CIRCUITS

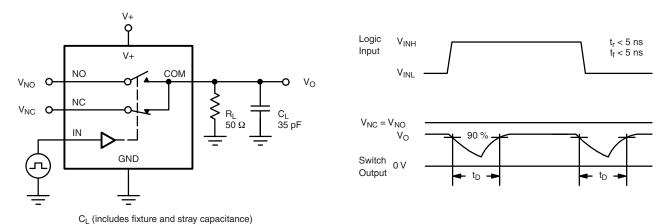


Figure 2. Break-Before-Make Interval

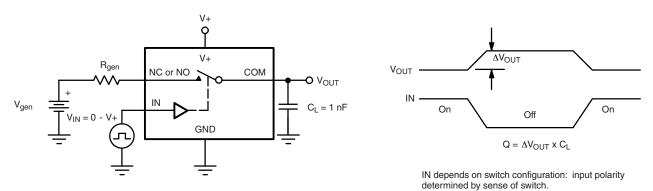


Figure 3. Charge Injection

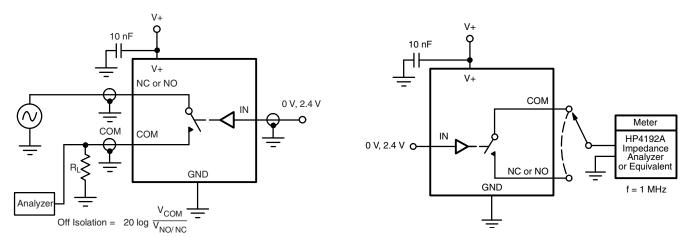


Figure 4. Off-Isolation

Figure 5. Channel Off/On 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?72030.

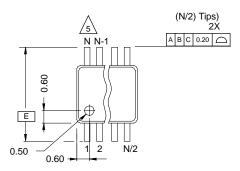




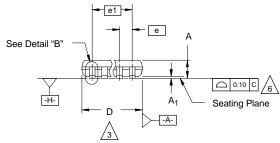


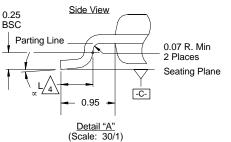
MSOP: 10-LEADS

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



Top View





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 [-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.

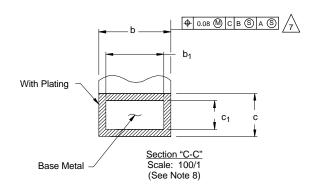
Controlling dimension: millimeters.

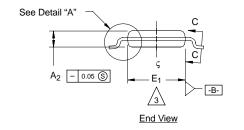
10. This part is compliant with JEDEC registration MO-187, variation AA and BA.



Datums -A- and -B- to be determined Datum plane -H-. Exposed pad area in bottom side is the same as teh leadframe pad size.







N = 10L

	MI			
Dim	Min	Nom	Max	Note
Α	-	-	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
С	0.13	-	0.23	
c ₁	0.13	0.15	0.18	
D		3.00 BSC		3
Е		4.90 BSC		
E ₁	2.90	3.00	3.10	3
е		0.50 BSC		
e ₁		2.00 BSC		
L	0.40	0.55	0.70	4
N		10		5
οc	0°	4°	6°	

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