High-Bandwidth, Low Voltage, Dual SPDT Analog Switches

DESCRIPTION

The DG2016/DG2026 are monolithic CMOS dual 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 guaranteed.

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**

Pb-free
RoHS COMPLIANT
HALOGEN FREE

BENEFITS

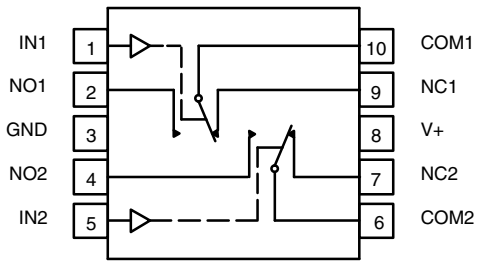
- Reduced Power Consumption
- High Accuracy
- Reduce Board Space
- Low-Voltage Logic Compatible
- High Bandwidth

APPLICATIONS

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

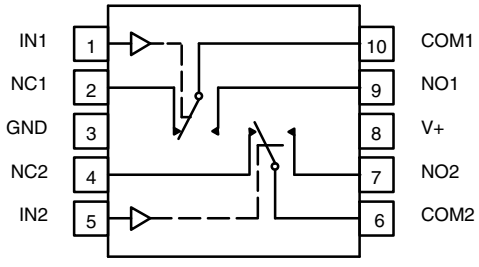
FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION

DG2016DQ – MSOP-10



Top View

DG2026DQ – MSOP-10



Top View

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

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

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

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 (V+ = 3 V)

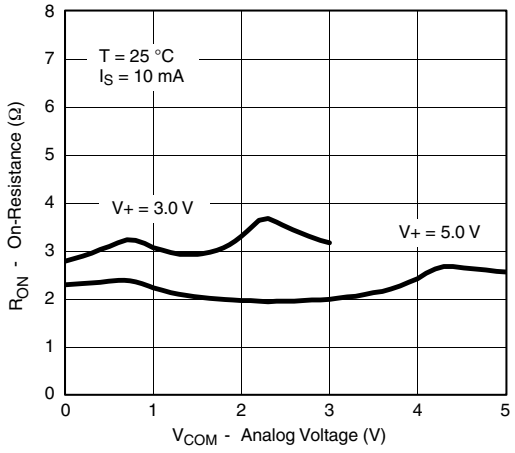
Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 3 V, ± 10 %, V_{IN} = 0.4 V or 2 V[e]	Temp.[a]	Limits - 40 °C to 85 °C Min.[b]	Typ.[c]	Max.[b]	Unit
Analog Switch							
Analog Signal Range[d]	V_{NO}, V_{NC} V_{COM}		Full	0		V+	V
On-Resistance	R_{ON}	V+ = 2.7 V, V_{COM} = 0.2 V/1.5 V, I_{NO}, I_{NC} = 10 mA	Room Full		3	4.8 5.3	Ω
R_{ON} Flatness	R_{ON} Flatness	V+ = 2.7 V, V_{COM} = 0 to V+, I_{NO}, I_{NC} = 10 mA	Room			1.6	
Switch Off Leakage Current[f]	$I_{NO(off)}$ $I_{NC(off)}$	V+ = 3.3 V V_{NO}, V_{NC} = 0.3 V/3 V, V_{COM} = 3 V/0.3 V	Room Full	- 1 - 10		1 10	nA
	$I_{COM(off)}$		Room Full	- 1 - 10		1 10	
Channel-On Leakage Current[f]	$I_{COM(on)}$	V+ = 3.3 V, V_{NO}, V_{NC} = V_{COM} = 0.3 V/3 V	Room Full	- 1 - 10		1 10	
Digital Control							
Input High Voltage[d]	V_{INH}		Full	1.6			V
Input Low Voltage	V_{INL}		Full			0.4	
Input Capacitance	C_{in}		Full		5		pF
Input Current	I_{INL} or I_{INH}	V_{IN} = 0 V or V+	Full	1		1	µA
Dynamic Characteristics							
Turn-On Time	t_{ON}	V_{NO} or V_{NC} = 2 V, R_L = 50 Ω, C_L = 35 pF	Room Full		28	53 59	ns
Turn-Off Time	t_{OFF}		Room Full		13	38 38	
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		38		pC
Off-Isolation[d]	OIRR	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz	Room		- 78		dB
Crosstalk[d]	X_{TALK}		Room		- 82		
N_O, N_C Off Capacitance[d]	$C_{NO(off)}$	V_{IN} = 0 V or V+, f = 1 MHz	Room		15		pF
	$C_{NC(off)}$		Room		15		
Channel-On Capacitance[d]	$C_{NO(on)}$		Room		49		
	$C_{NC(on)}$		Room		45		
Power Supply							
Power Supply Current	I+	V_{IN} = 0 V or V+	Full		0.01	1	µA

SPECIFICATIONS (V+ = 5 V)							
Parameter	**Symbol**	**Test Conditions Otherwise Unless Specified** V+ = 5 V, ± 10 %, V_{IN} = 0.8 V or 2.4 V[e]	**Temp.[a]**	**Limits** - 40 °C to 85 °C **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+ = 4.5 V, V_{COM} = 3 V, I_{NO}, I_{NC} = 10 mA	Room Full		2.4	4 4.3	Ω
R_{ON} Flatness	R_{ON} Flatness	V+ = 4.5 V, V_{COM} = 0 to V+, I_{NO}, I_{NC} = 10 mA	Room			1.2	
Switch Off Leakage Current	$I_{NO(off)}$ $I_{NC(off)}$	V+ = 5.5 V V_{NO}, V_{NC} = 1 V/4.5 V, V_{COM} = 4.5 V/1 V	Room Full	- 1 - 10		1 10	nA
	$I_{COM(off)}$		Room Full	- 1 - 10		1 10	
Channel-On Leakage Current	$I_{COM(on)}$	V+ = 5.5 V, V_{NO}, V_{NC} = V_{COM} =1 V/4.5 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	
Input Capacitance	C_{in}		Full		5		pF
Input Current	I_{INL} or I_{INH}	V_{IN} = 0 V or V+	Full	1		1	µA
Dynamic Characteristics							
Turn-On Time	t_{ON}	V_{NO} or V_{NC} = 3 V, R_L = 50 Ω, C_L = 35 pF	Room Full		23	48 52	ns
Turn-Off Time	t_{OFF}		Room Full		8	33 35	
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		pC
Off-Isolation[d]	OIRR	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz	Room		- 81		dB
Crosstalk[d]	X_{TALK}		Room		- 82		
Source-Off Capacitance[d]	$C_{NO(off)}$	V_{IN} = 0 V or V+, f = 1 MHz	Room		14		pF
	$C_{NC(off)}$		Room		14		
Channel-On Capacitance[d]	$C_{NO(on)}$		Room		48		
	$C_{NC(on}$		Room		44		
Power Supply							
Power Supply Range	V+			1.8		5.5	V
Power Supply Current	I+	V_{IN} = 0 V or V+	Full		0.01	1	µA

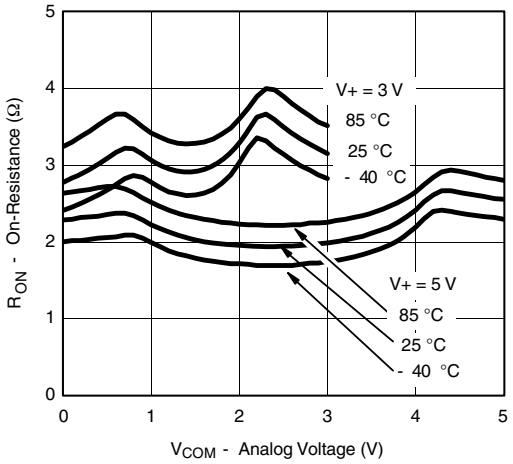
Notes:
a. Room = 25 °C, Full = as determined by the operating suffix.
b. Typical values are for design aid only, not guaranteed nor subject to production testing.
c. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
d. Guarantee 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.

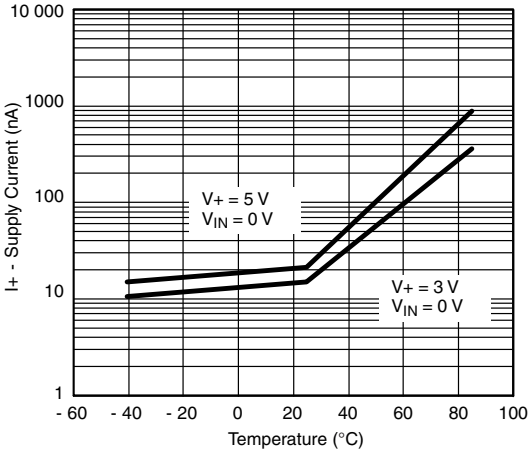
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



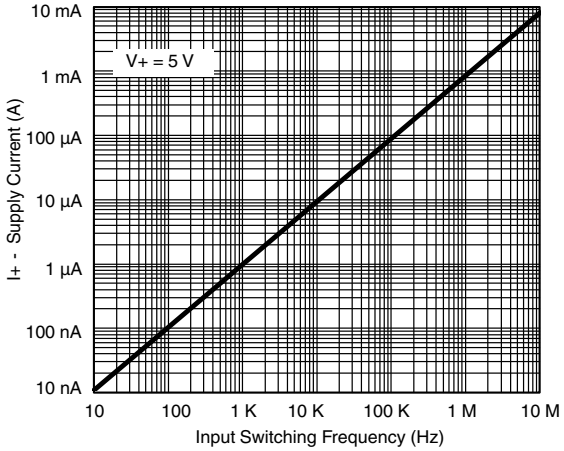
R_{ON} vs. V_{COM} and Supply Voltage



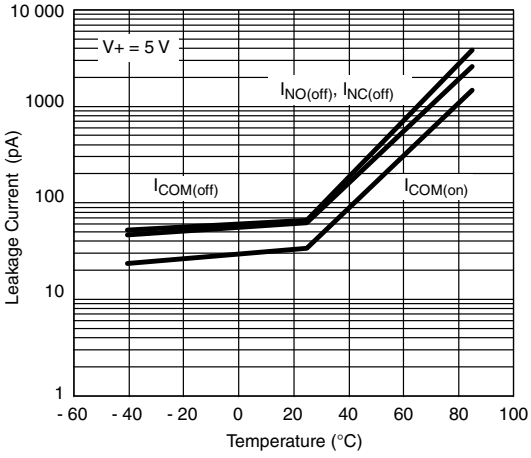
R_{ON} vs. Analog Voltage and Temperature



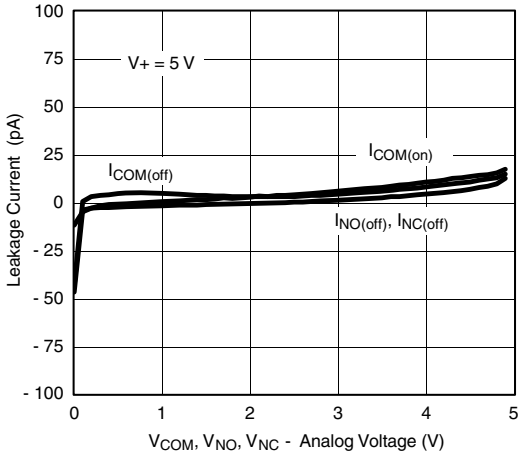
Supply Current vs. Temperature



Supply Current vs. Input Switching Frequency

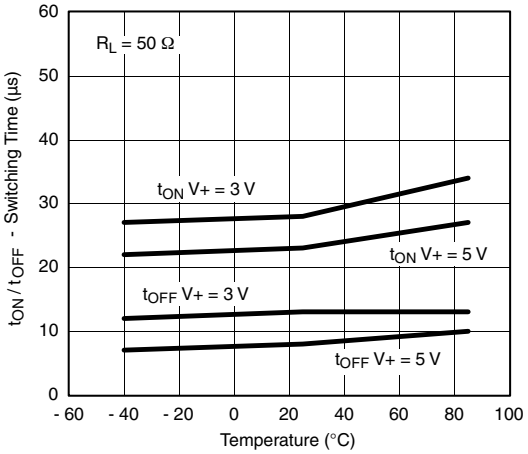


Leakage Current vs. Temperature

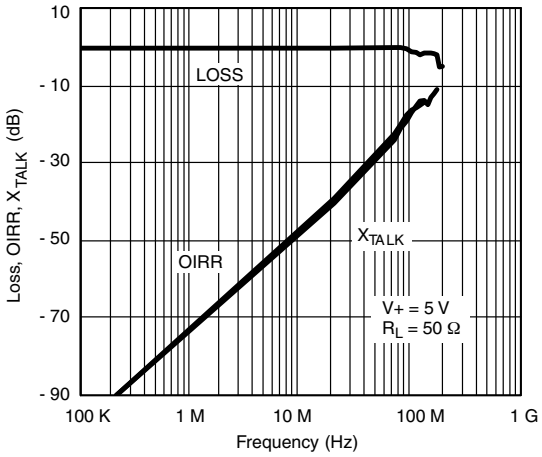


Leakage vs. Analog Voltage

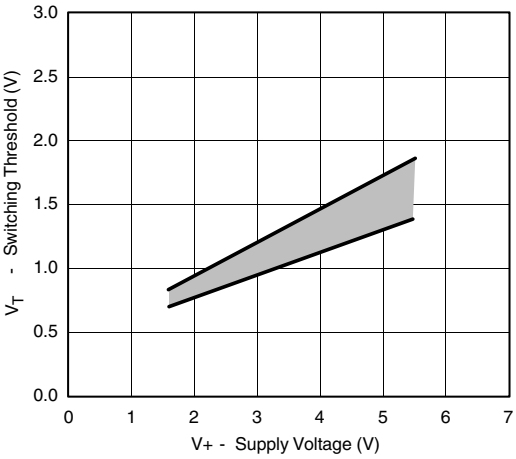
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



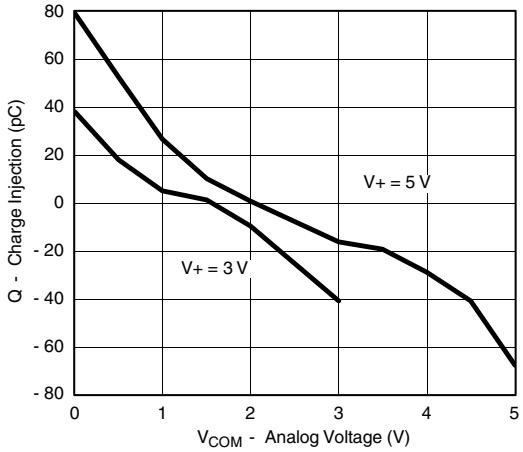
Switching Time vs. Temperature



Insertion Loss, Off-Isolation Crosstalk vs. Frequency

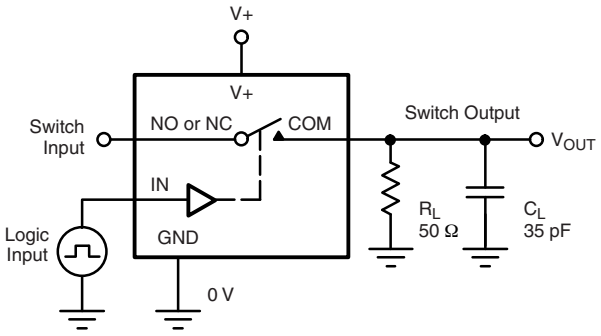


Switching Threshold vs. Supply Voltage



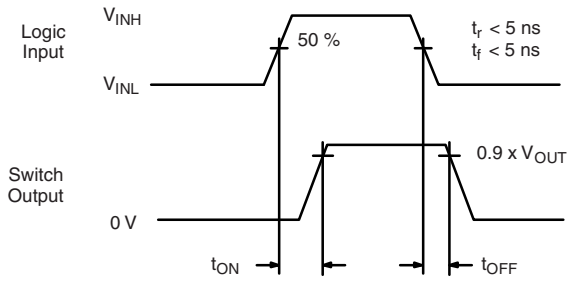
Charge Injection vs. Analog Voltage

TEST CIRCUITS



C_L (includes fixture and stray capacitance)

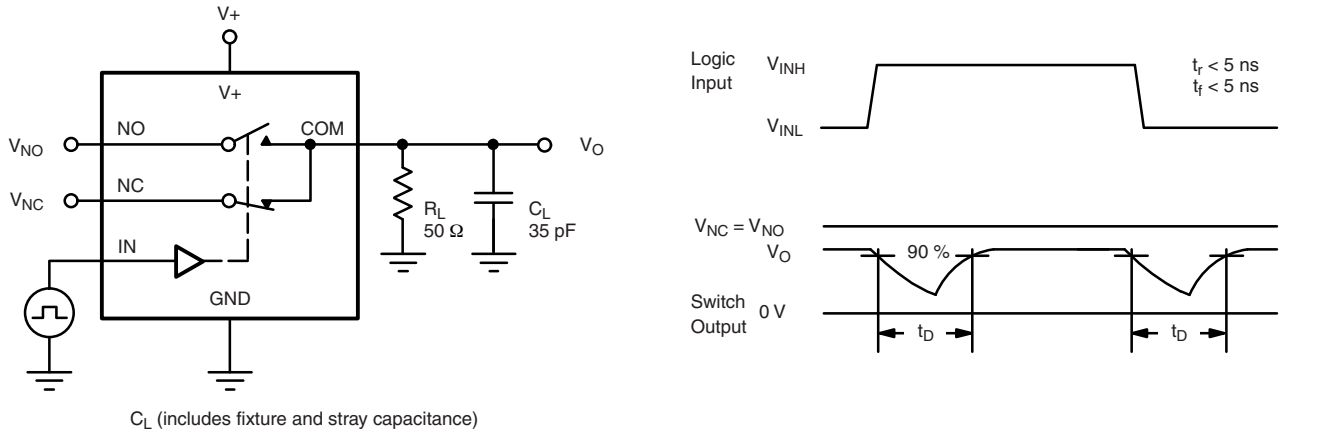
$$V_{OUT} = V_{COM}\left(\frac{R_L}{R_L + R_{ON}}\right)$$



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

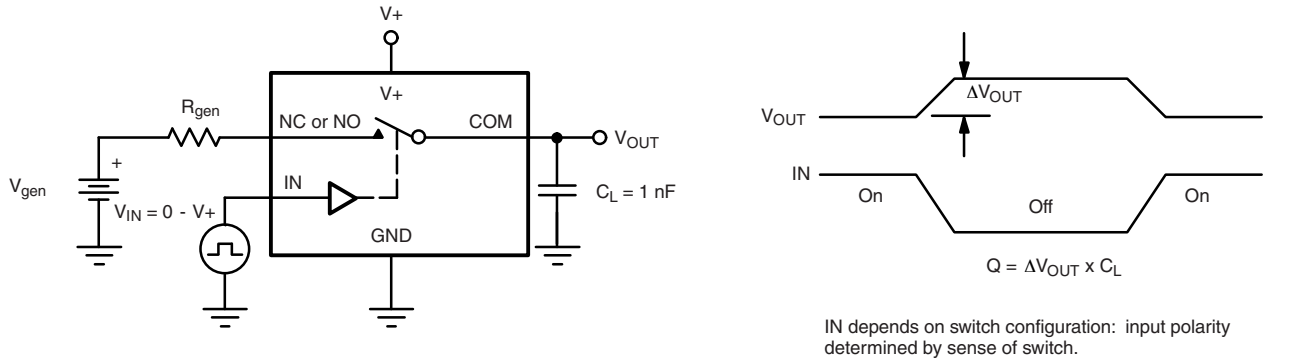
Figure 1. Switching Time

TEST CIRCUITS



C_L (includes fixture and stray capacitance)

Figure 2. Break-Before-Make Interval



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

Figure 3. Charge Injection

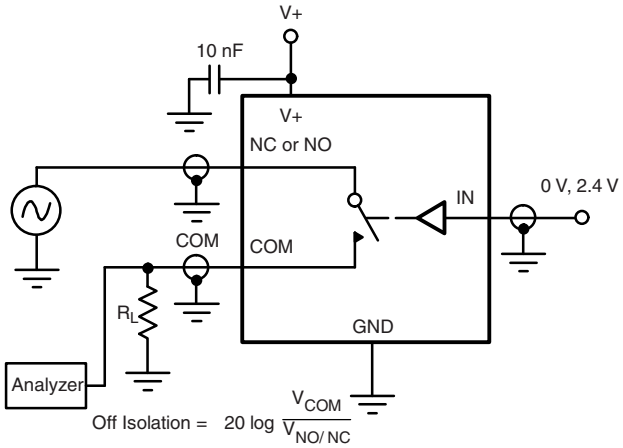


Figure 4. Off-Isolation

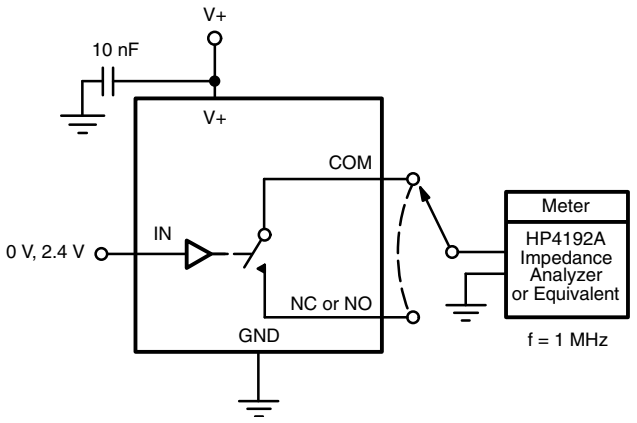
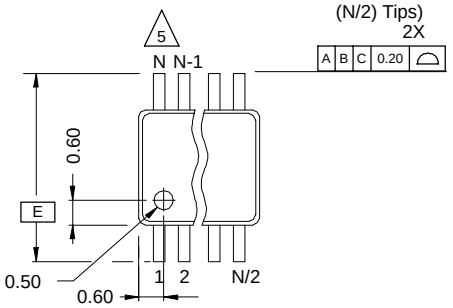


Figure 5. Channel Off/On Capacitance

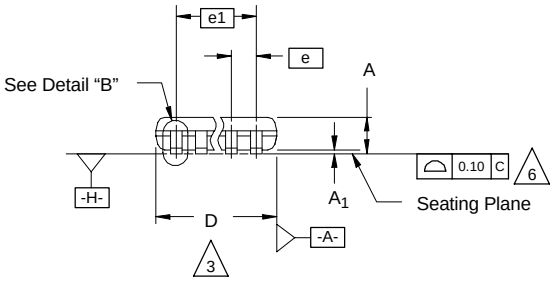
Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?72030.

MSOP: 10-LEADS

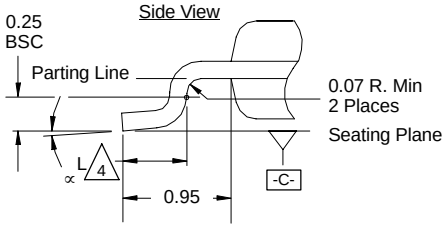
JEDEC Part Number: MO-187, (Variation AA and BA)



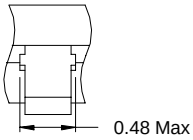
Top View



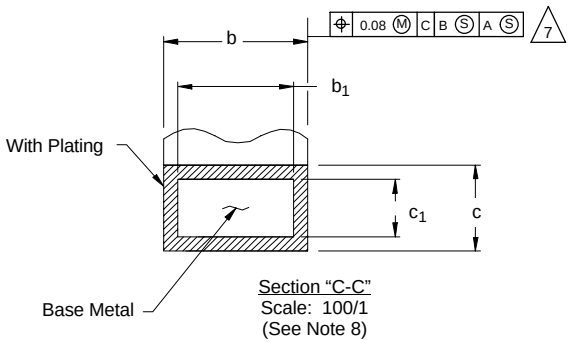
Side View



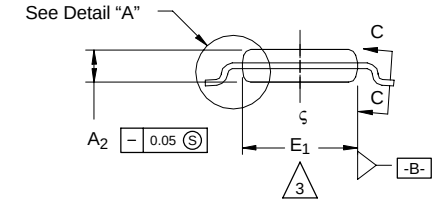
Detail "A"
(Scale: 30/1)



Detail "B"
(Scale: 30/1)
Dambar Protrusion



Section "C-C"
Scale: 100/1
(See Note 8)



End View

NOTES:

1. Die thickness allowable is 0.203 ± 0.0127.
2. Dimensioning and tolerances per ANSI.Y14.5M-1994.
3. Dimensions "D" and "E_1" 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.
4. Dimension is the length of terminal for soldering to a substrate.
5. Terminal positions are shown for reference only.
6. Formed leads shall be planar with respect to one another within 0.10 mm at seating plane.
7. 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".
8. Section "C-C" to be determined at 0.10 mm to 0.25 mm from the lead tip.
9. Controlling dimension: millimeters.
10. This part is compliant with JEDEC registration MO-187, variation AA and BA.
11. Datums -A- and -B- to be determined Datum plane -H- .
12. Exposed pad area in bottom side is the same as teh 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
∝	0°	4°	6°	

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

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