

300-MHz, 2.5-Ω, Dual SPDT Analog Switches

DESCRIPTION

The DG787 are dual SPDT analog switches which operate from 1.8 V to 5.5 V single rail power supply. They are design for audio, video, and USB switching applications.

The devices have 2.5 Ω on-resistance and 300 MHz 3 dB bandwidth. 0.2 Ω on-resistance matching and 1 Ω flatness make the device high linearity. The devices are 1.6 V logic compatible within the full operation voltage range.

These switches are built on a sub-micron high density process that brings low power consumption and low voltage performance.

The switch is package in MSOP 10 package.

As a committed partner to the community and the environment, Vishay Siliconix manufactures this product with lead (Pb)-free device terminations. DG787 is offered in a MSOP package. The MSOP package uses 100 % matte tin device termination and is represented by the lead (Pb)-free “-E3” suffix. Both the matte tin device terminations meet all JEDEC standards for reflow and MSL ratings.

FEATURES

- 1.8 V to 5.5 V operation
- 2.5 Ω at 2.7 V R_{ON}
- 300 MHz - 3 dB bandwidth
- ESD per MIL-STD-883 method 3015.7 > 2 kV
- Latch-up current 200 mA (JESD 78)
- 1.6 V logic compatible
- Compliant to RoHS directive 2002/95/EC
- Halogen-free according to IEC 61249-2-21 definition



RoHS
COMPLIANT
HALOGEN
FREE

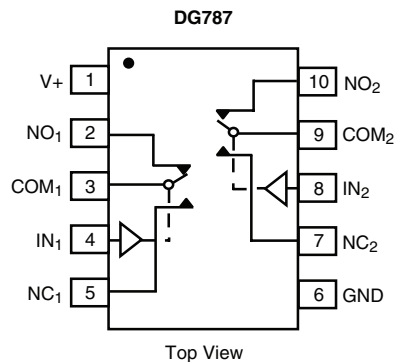
BENEFITS

- Space saving MSOP-10 package
- High linearity
- Low power consumption
- High bandwidth
- Full rail signal swing range

APPLICATIONS

- Cellular phones
- MP3
- Media players
- Modems
- Hard drives
- PCMCIA

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



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	DG787DQ-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 (NO, NC, COM)	± 100	mA
Peak Current (Pulsed at 1 ms, 10 % duty cycle)	± 500	
Storage Temperature (D Suffix)	- 65 to 150	°C
ESD per MIL-STD-883 Method 3015.7	> 2	kV
Power Dissipation (Packages) ^c MSOP-10 ^d	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. Refer to IPC/JEDEC (J-STD-020).
c. All leads welded or soldered to PC board.
d. Derate 4.0 mW/°C above 70 °C.

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

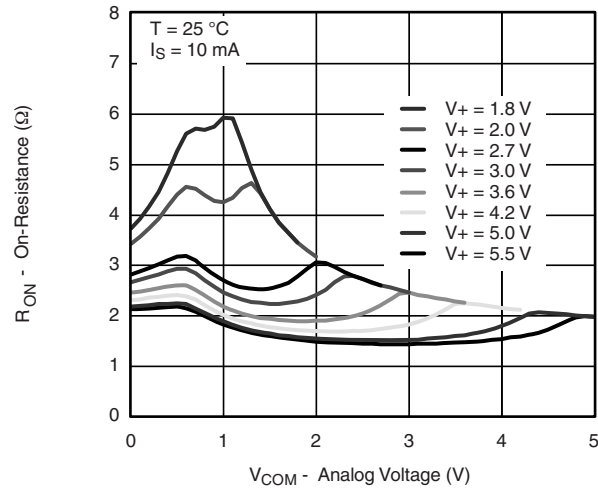
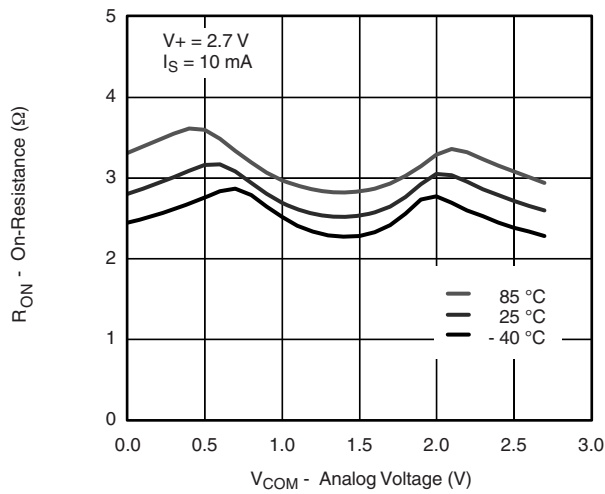
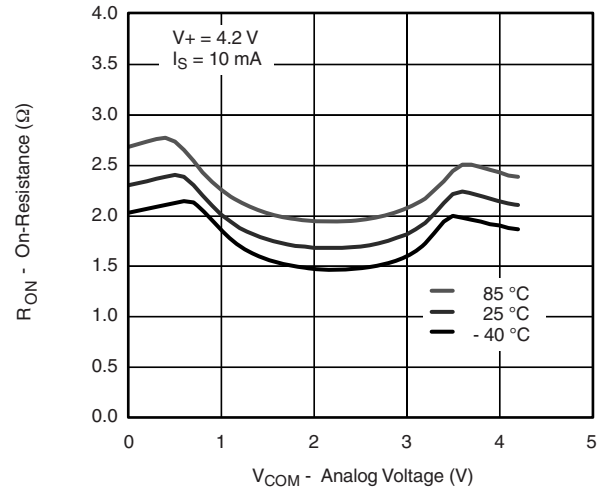
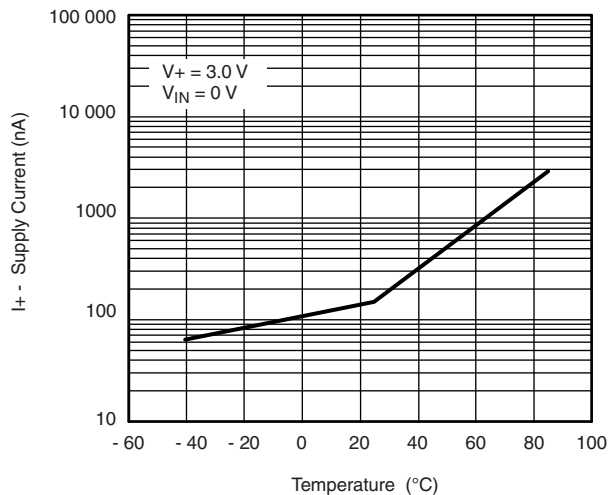
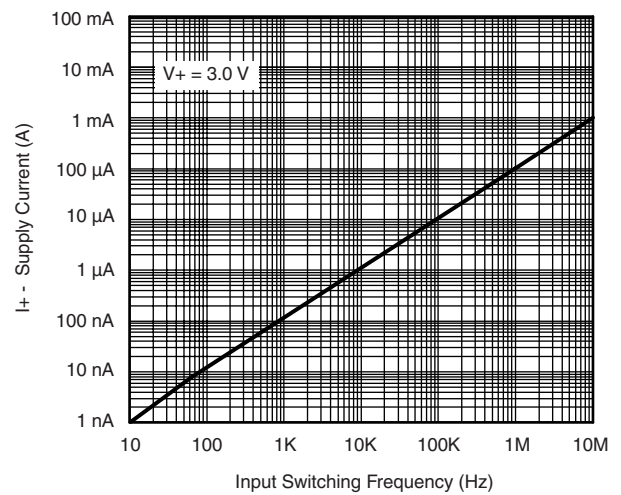
SPECIFICATIONS V ₊ = 0 V								
Parameter	Symbol	Test Conditions Otherwise Unless Specified V ₊ = 2.7 V to 3.6 V, V _{IN} = 0.5 V or 1.4 V ^e		Temp. ^a	Limits - 40 °C to 85 °C			Unit
					Min. ^b	Typ. ^c	Max. ^b	
Analog Switch								
Analog Signal Range ^d	V _{NO} , V _{NC} , V _{COM}			Full	0		V ₊	V
On-Resistance ^d	R _{ON}	V ₊ = 2.7 V I _{NO} , I _{NC} = 10 mA	V _{COM} = 1.5 V	Room Full		2.5	3.5 3.8	Ω
R _{ON} Flatness ^d	R _{ON} Flatness		V _{COM} = 1, 1.5, 2 V	Room		0.52	1.0	
On-Resistance Match Between Channels ^d	ΔR _{DS(on)}		V _{COM} = 1.5 V	Room			0.25	
Switch Off Leakage Current	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 - 20		1 20	nA
	I _{COM(off)}			Room Full	- 1 - 20		1 20	
Channel-On Leakage Current	I _{COM(on)}	V ₊ = 3.3 V, V _{NO} , V _{NC} = V _{COM} = 0.3 V/3 V		Room Full	- 1 - 20		1 20	
Digital Control								
Input High Voltage ^d	V _{INH}			Full	1.4			V
Input Low Voltage	V _{INL}			Full			0.5	
Input Capacitance	C _{in}			Full		5		pF
Input Current	I _{INL} or I _{INH}	V _{IN} = 0 or V ₊		Full	1		1	μA

SPECIFICATIONS V+ = 3 V								
Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 2.7 V to 3.6 V, VIN = 0.5 V or 1.4 V ^e		Temp. ^a	Limits - 40 °C to 85 °C			Unit
					Min. ^b	Typ. ^c	Max. ^b	
Dynamic Characteristics								
Turn-On Time	tON	V+ = 2.7 V, VNO or VNC = 1.5 V RL = 300 Ω, CL = 35 pF		Room Full		21	51 52	ns
Turn-Off Time	tOFF			Room Full		15	45 46	
Break-Before-Make Time	td			Full	1			
Charge Injection ^d	QINJ	CL = 1 nF, VGEN = 2.0 V, RGEN = 0 Ω		Room		1		pC
Off-Isolation ^d	OIRR	RL = 50 Ω, CL = 5 pF	f = 1 MHz	Room		- 74		dB
			f = 10 MHz	Room		- 54		
Crosstalk ^d	XTALK		f = 1 MHz	Room		- 76		
			f = 10 MHz	Room		- 56		
NO, NC Off Capacitance ^d	CNO(off)	VIN = 0 or V+, f = 1 MHz		Room		12		pF
	CNC(off)			Room		12		
Channel-On Capacitance ^d	CNO(on)			Room		40		
	CNC(on)			Room		40		
Power Supply								
Power Supply Current	I+	VIN = 0 or V+		Room Full			1.0 1.0	μA

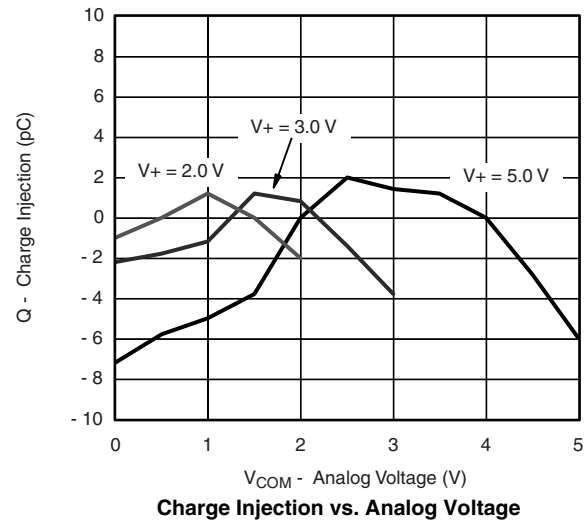
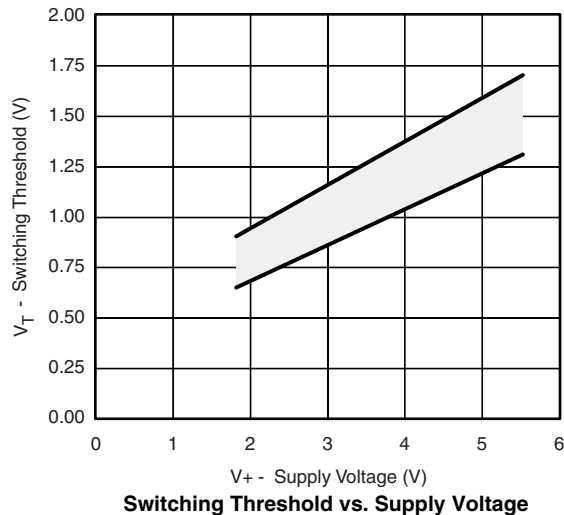
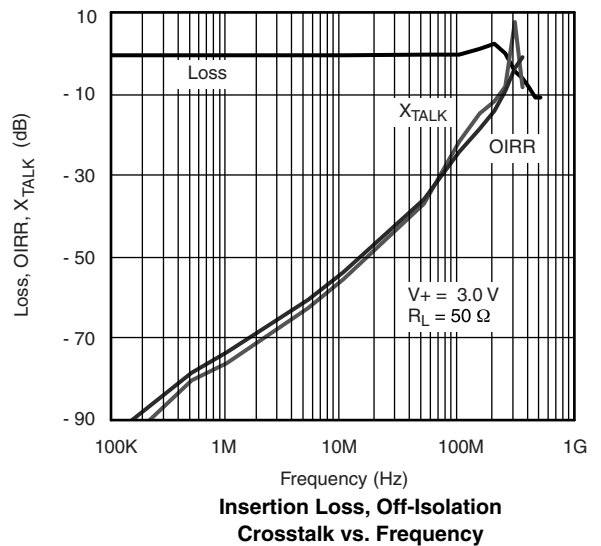
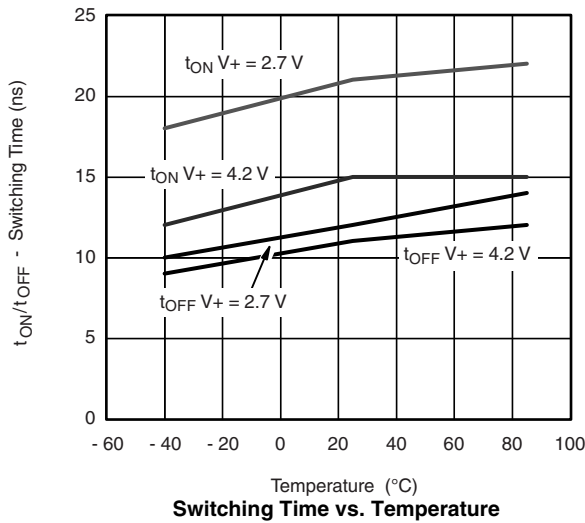
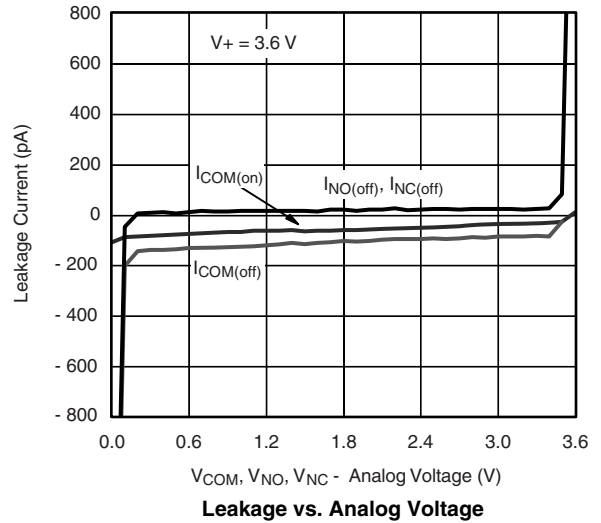
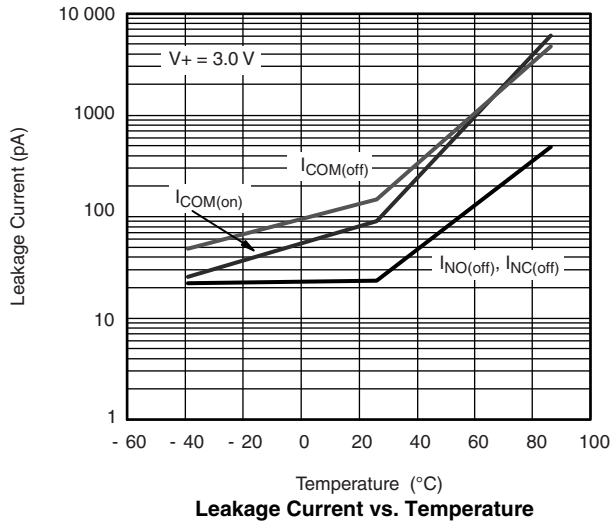
SPECIFICATIONS V ₊ = 5 V								
Parameter	Symbol	Test Conditions Otherwise Unless Specified V ₊ = 4.2 V to 5.5 V, V _{IN} = 0.8 V or 2.0 V ^e		Temp. ^a	Limits - 40 °C to 85 °C			Unit
					Min. ^b	Typ. ^c	Max. ^b	
Analog Switch								
Analog Signal Range ^d	V _{NO} , V _{NC} , V _{COM}			Full	0		V ₊	V
On-Resistance ^d	R _{ON}	V ₊ = 4.2 V I _{NO} , I _{NC} = 10 mA	V _{COM} = 3.5 V	Room Full		2.2	2.9 3.1	Ω
R _{ON} Flatness ^d	R _{ON} Flatness		V _{COM} = 1, 2, 3.5 V	Room		0.53	1.0	
On-Resistance Match Between Channels ^d	ΔR _{DS(on)}		V _{COM} = 3.5 V	Room			0.25	
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 - 20		1 20	nA
	I _{COM(off)}			Room Full	- 1 - 20		1 20	
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 - 20		1 20	
Digital Control								
Input High Voltage ^d	V _{INH}			Full	2.0			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 or V ₊		Full	1		1	μA
Dynamic Characteristics								
Turn-On Time	t _{ON}	V ₊ = 4.2 V, V _{NO} or V _{NC} = 3.0 V R _L = 300 Ω, C _L = 35 pF		Room Full		15	45 46	ns
Turn-Off Time	t _{OFF}			Room Full		12	42 43	
Break-Before-Make Time	t _d			Full	1			
Charge Injection ^d	Q _{INJ}	C _L = 1 nF, V _{GEN} = 2.0 V, R _{GEN} = 0 Ω		Room		1		pC
Off-Isolation ^d	OIRR	R _L = 50 Ω, C _L = 5 pF	f = 1 MHz	Room		- 74		dB
Crosstalk ^d	X _{TALK}		f = 10 MHz	Room		- 54		
			f = 1 MHz	Room		- 78		
			f = 10 MHz	Room		- 56		
N _O , N _C Off Capacitance ^d	C _{NO(off)}	V _{IN} = 0 or V ₊ , f = 1 MHz		Room		12		pF
	C _{NC(off)}			Room		12		
Channel-On Capacitance ^d	C _{NO(on)}			Room		40		
	C _{NC(on)}			Room		40		
Power Supply								
Power Supply Current	I ₊	V _{IN} = 0 or V ₊		Room Full			1.0 1.0	μA

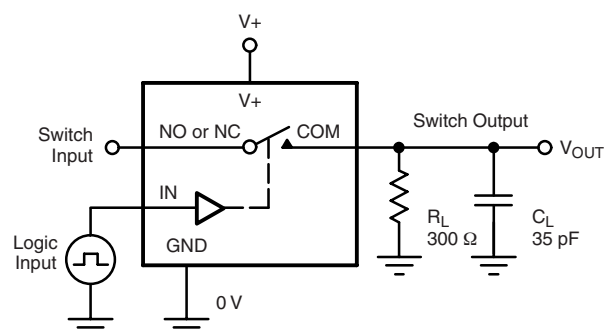
Notes:

- 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, nor subjected to production test.
- V_{IN} = input voltage to perform proper function.
- Guaranteed by 5 V testing, not production tested.

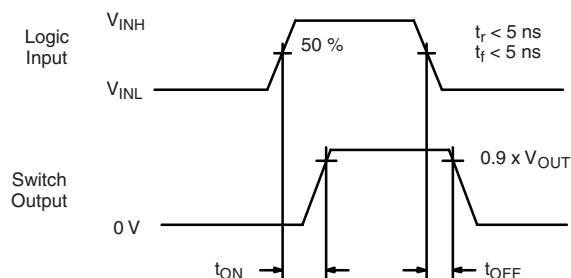
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

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

 R_{ON} vs. Analog Voltage and Temperature

 R_{ON} vs. Analog Voltage and Temperature

Supply Current vs. Temperature

Supply Current vs. Input Switching Frequency

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

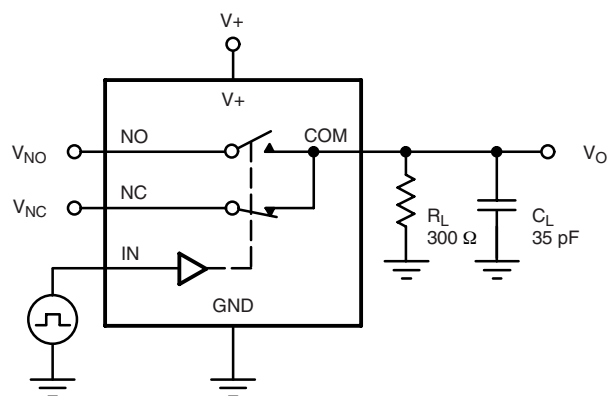
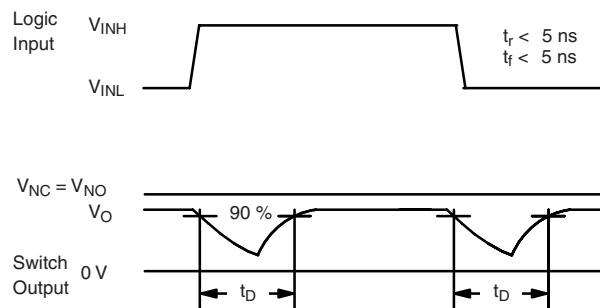
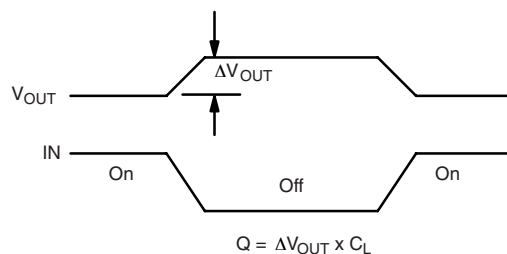
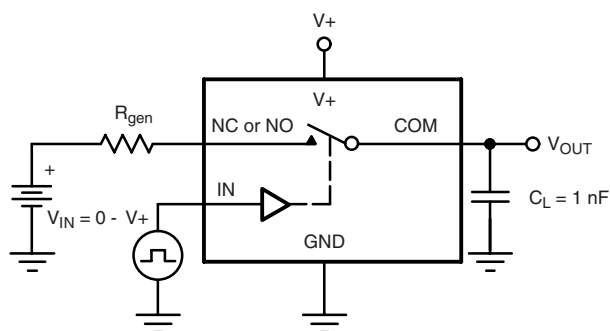


TEST CIRCUITS

 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

 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

TEST CIRCUITS

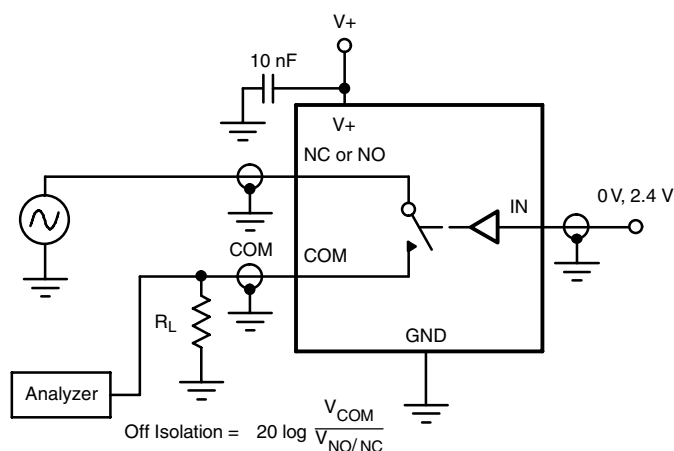


Figure 4. Off-Isolation

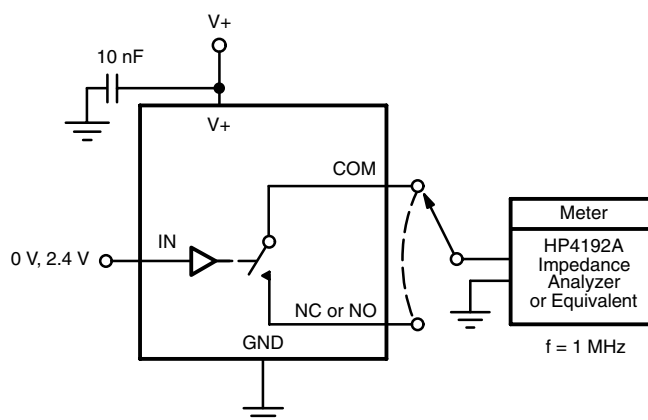


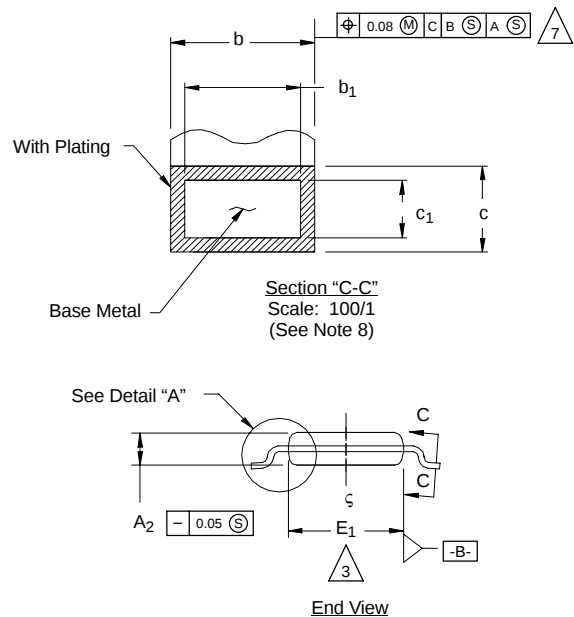
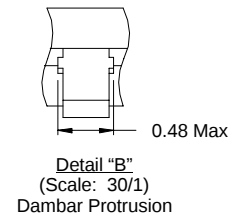
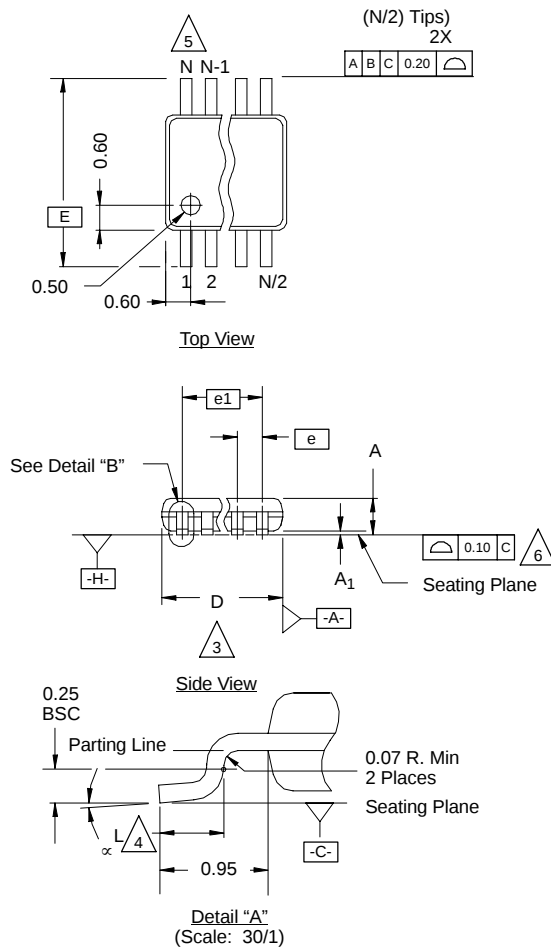
Figure 5. Channel Off/On Capacitance

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?65369.



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



Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

Material Category Policy

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.

Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.