

2.5 Ω , High Bandwidth, Dual SPDT Analog Switch

DESCRIPTION

The DG2032E is a low-voltage dual single-pole / double-throw monolithic CMOS analog switch. Designed to operate from 1.8 V to 5.5 V power supply, the DG2032E achieves a bandwidth of 221 MHz while providing low on-resistance (2.5 Ω), excellent on-resistance matching (0.4 Ω) and flatness (1 Ω) over the entire signal range.

The DG2032E offers the advantage of high linearity that reduces signal distortion, making ideal for audio, video, and USB signal routing applications.

Built on Vishay Siliconix's proprietary sub-micron high-density process, the DG2032E brings low power consumption at the same time as reduces PCB spacing with the QFN12 package.

As a committed partner to the community and the environment, Vishay Siliconix manufactures this product with the lead (Pb)-free device terminations. The QFN12 package has a nickel-palladium-gold device termination and is represented by the lead (Pb)-free "-GE4" suffix. The nickel-palladium-gold device terminations meet all JEDEC® standards for reflow and MSL ratings.

FEATURES

- 1.8 V to 5.5 V single supply operation
- Low R_{ON} : 2.5 Ω at 4.5 V
- 221 MHz, -3 dB bandwidth
- Low off-isolation, -63 dB at 1 MHz
- +1.6 V logic compatible
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

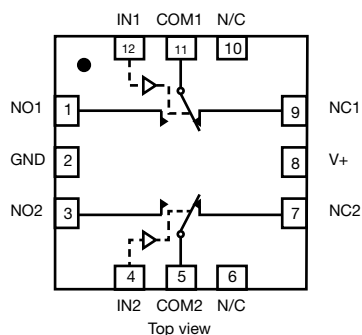
BENEFITS

- High linearity
- Low power consumption
- High bandwidth
- Full rail signal swing range

APPLICATIONS

- USB / UART signal switching
- Audio / video switching
- Cellular phone
- 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	12-Pin QFN (3 mm x 3 mm)	DG2032EDN-T1-GE4

ABSOLUTE MAXIMUM RATINGS

PARAMETER		LIMIT	UNIT
Reference to GND			
V+		-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	12-Pin QFN (3 mm x 3 mm) ^c	1295	mW
ESD / HBM	EIA / JESD22-A114-A	7.5k	V
ESD / CDM	EIA / JESD22-C101-A	1.5k	
Latch up	JESD78	300	mA

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 4 mW/°C above 70 °C



SPECIFICATIONS (V+ = 3 V)									
PARAMETER	SYMBOL	TEST CONDITIONS OTHERWISE UNLESS SPECIFIED V+ = 3 V, ± 10 %, VINL = 0.5 V, VINH = 1.5 V e	TEMP. a	LIMITS -40 °C to +85 °C			UNIT		
				MIN. c	TYP. b	MAX. c			
Analog Switch									
Analog signal range d	VANALOG		Full	0	-	V+	V		
Drain-source on-resistance	RDS(on)	V+ = 1.8 V, VNC/NO = 0.4 V / V+, INC/NO = 8 mA	Room	-	7	11	Ω		
			Full	-	-	13			
		V+ = 2.7 V, VCOM = 0.8 V / 1.8 V, ICOM = 10 mA	Room	-	4.6	5.5			
			Full	-	-	6.5			
On-resistance matching	ΔRDS(on)	V+ = 2.7 V, VCOM = 0.8 V / 1.4 V / 1.8 V, ICOM = 10 mA	Room	-	0.02	0.3			
On-resistance flatness d, f	Rflat(on)		Full	-	-	0.6			
			Room	-	0.62	1			
			Full	-	-	1.5			
Off leakage current g	INC/NO(off)	V+ = 3.6 V, VNC/NO = 1 V / 3.2 V, VCOM = 3.2 V / 1 V	Room	-1	0.01	1	nA		
Channel-on leakage current g	ICOM(on)	Full	-5	-	5				
		Room	-1	0.01	1				
		Full	-5	-	5				
Digital Control									
Input current d	IINL or IINH		Full	-1	-	1	μA		
Input high voltage d	VINH		Full	1.5	-	-	V		
Input low voltage d	VINL		Full	-	-	0.4			
Digital input capacitance d	CIN		Room	-	3	-	pF		
Dynamic Characteristics									
Turn-on time	tON	VNC/NO = 3 V, CL = 35 pF, RL = 300 Ω	Room	-	19	45	ns		
Turn-off time	tOFF		Full	-	-	50			
			Room	-	9	35			
			Full	-	-	45			
			Break-before-make time d	tBBM	Room	4		11	-
Full	3				-	-			
Charge injection d	QINJ	CL = 1 nF, Vgen = 1.5 V, Rgen = 0 Ω	Room	-	-9	-	pC		
Bandwidth d	BW	CL = 5 pF (set up capacitance)	Room	-	226	-	MHz		
Off-isolation d	OIRR	RL = 50 Ω, CL = 5 pF	f = 1 MHz	Room	-	-65	-	dB	
			f = 10 MHz	Room	-	-39	-		
Channel-to-channel crosstalk d	XTALK	RL = 50 Ω, CL = 5 pF	f = 1 MHz	Room	-	-65	-		
			f = 10 MHz	Room	-	-39	-		
NO, NC off capacitance d	CNO(off)	V+ = 2.7 V, f = 1 MHz	Room	-	7	-	pF		
	CNC(off)		Room	-	7	-			
Channel-on capacitance d	CNO(on)		Room	-	23	-			
	CNC(on)		Room	-	23	-			
Power Supply									
Power supply range	V+				2.7	-		3.3	V
Power supply current d	I+	V+ = 2.7 V, VIN = 0 V or 2.7 V	Full	-	-	1	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, not subjected to production test
- V_{IN} = input voltage to perform proper function
- Difference of min. and max. values
- Guaranteed by 5 V testing

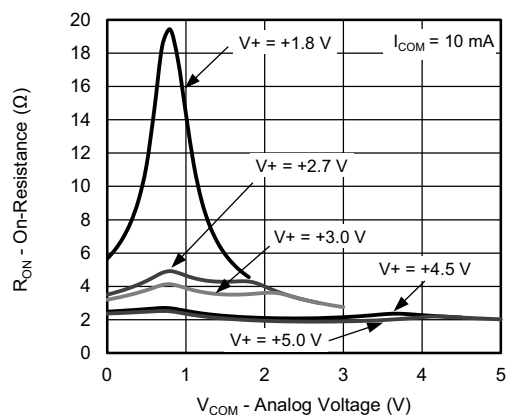
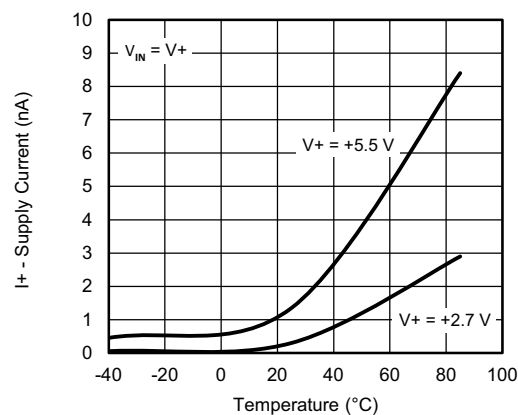
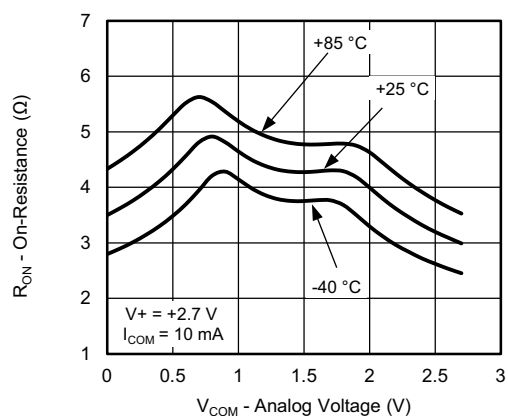
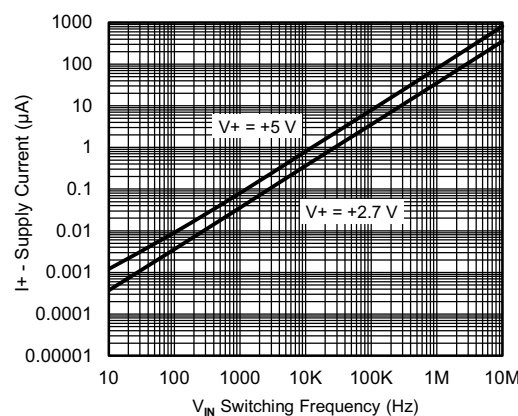
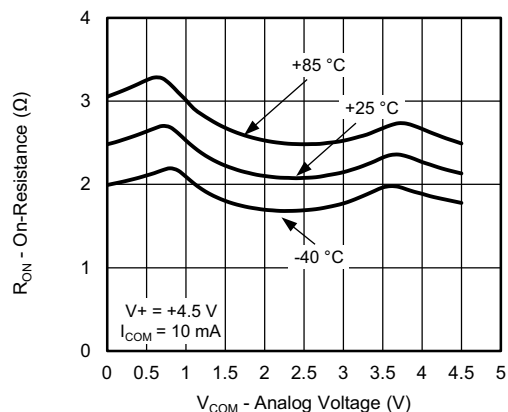
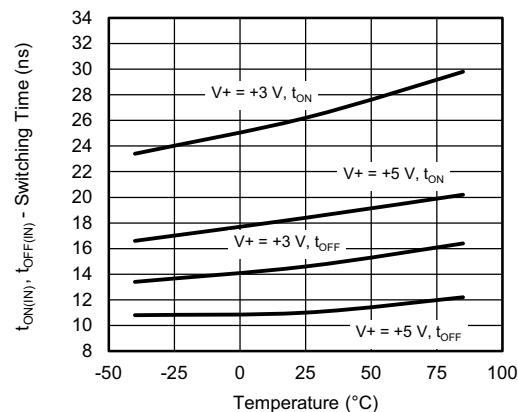


SPECIFICATIONS (V+ = 5 V)								
PARAMETER	SYMBOL	TEST CONDITIONS OTHERWISE UNLESS SPECIFIED V+ = 5 V, ± 10 %, VINL = 0.5 V, VINH = 2 V e	TEMP. a	LIMITS -40 °C to +85 °C			UNIT	
				MIN. c	TYP. b	MAX. c		
Analog Switch								
Analog signal range d	VANALOG		Full	0	-	V+	V	
Drain-source on-resistance	RDS(on)	V+ = 4.5 V, VCOM = 0.8 V / 3.5 V; ICOM = 10 mA	Room	-	2.5	3.1	Ω	
On-resistance matching	ΔRDS(on)	V+ = 4.5 V, VCOM = 0.8 V / 2.5 V / 3.5 V, ICOM = 10 mA	Full	-	-	4		
On-resistance flatness d, f	Rflat(on)		Room	-	0.01	0.4		
			Full	-	-	0.6		
			Room	-	0.61	1		
		Full	-	-	1.5			
Off leakage current g	INC/NO(off)	V+ = 5.5 V, VNC/NO = 1 V / 4.5 V, VCOM = 4.5 V / 1 V	Room	-2	0.15	2	nA	
			Full	-10	-	10		
Channel-on leakage current g	ICOM(on)	V+ = 5.5 V, VCOM = VNC/NO = 1 V / 4.5 V	Room	-2	0.20	2		
			Full	-10	-	10		
Power down leakage d	IPD	V+ = 0 V, VCOM = 5.5 V, NC/NO open	Full	-	0.01	5	μA	
		V+ = 0 V, VNC/NO = 5.5 V, COM, open	Full	-	0.01	3	mA	
Digital Control								
Input current d	IINL or IINH		Full	-1	-	1	μA	
Input high voltage d	VINH		Full	2	-	-	V	
Input low voltage d	VINL		Full	-	-	0.5		
Digital input capacitance d	CIN		Room	-	3	-	pF	
Dynamic Characteristics								
Turn-on time	tON	VNC/NO = 3 V, CL = 35 pF, RL = 300 Ω	Room	-	13	40	ns	
			Full	-	-	43		
Turn-off time	tOFF		Room	-	7	33		
			Full	-	-	35		
Break-before-make time d	tBBM		Room	3	6	-		
			Full	2	-	-		
Propagation delay d	tpd	V+ = 5 V, no RL	Room	-	380	-	ps	
Charge injection d	QINJ	CL = 1 nF, Vgen = 2.5 V, Rgen = 0 Ω	Room	-	-19.4	-	pC	
Bandwidth d	BW	CL = 5 pF (set up capacitance)	Room	-	221	-	MHz	
Off-isolation d	OIRR	RL = 50 Ω, CL = 5 pF	f = 1 MHz	Room	-	-63	-	dB
			f = 10 MHz	Room	-	-22	-	
Channel-to-channel crosstalk d	XTALK	RL = 50 Ω, CL = 5 pF	f = 1 MHz	Room	-	-65	-	
			f = 10 MHz	Room	-	-40	-	
NO, NC off capacitance d	CNO(off)	V+ = 5 V, f = 1 MHz	Room	-	7	-	pF	
	CNC(off)		Room	-	7	-		
Channel-on capacitance d	CNO(on)		Room	-	23	-		
	CNC(on)		Room	-	23	-		
Power Supply								
Power supply range	V+			4.5	-	5.5	V	
Power supply current d	I+	V+ = 5.5 V, VIN = 0 V or 5.5 V	Full	-	-	1	μA	

Notes

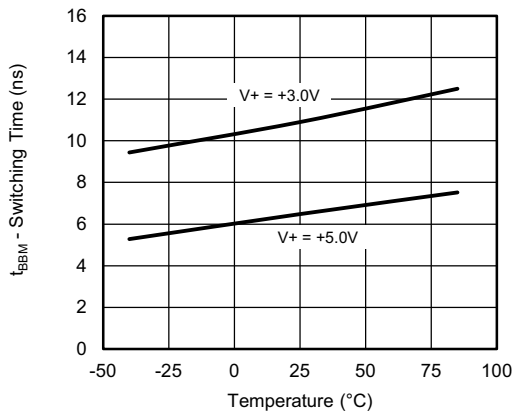
- a. Room = 25 °C, Full = as determined by the operating suffix
b. Typical values are for design aid only, not guaranteed nor subject to production testing
c. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this datasheet
d. Guarantee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

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.

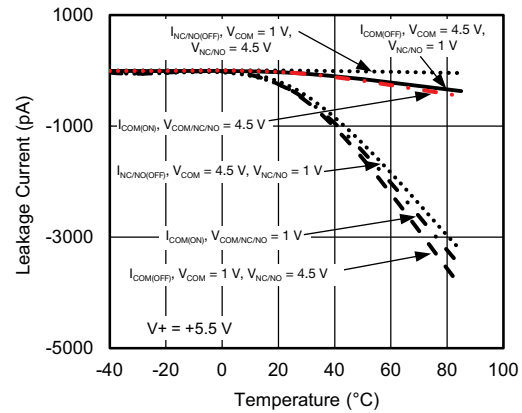
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

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

Supply Current vs. Temperature

 R_{ON} vs. Analog Voltage and Temperature

Positive Supply Current vs. Switching Frequency

 R_{ON} vs. Analog Voltage and Temperature

Switching Time vs. Temperature



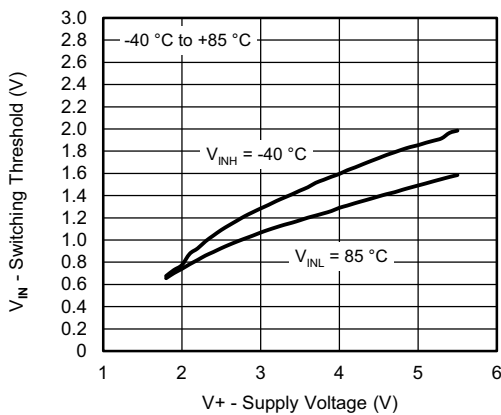
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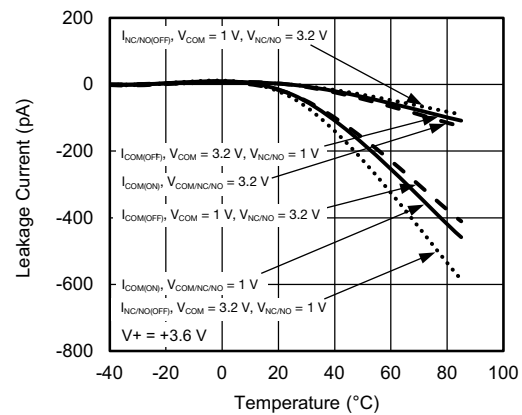
Switching Time vs. Temperature



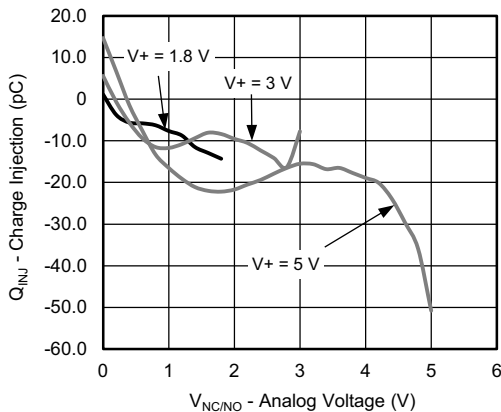
Leakage Current vs. Temperature



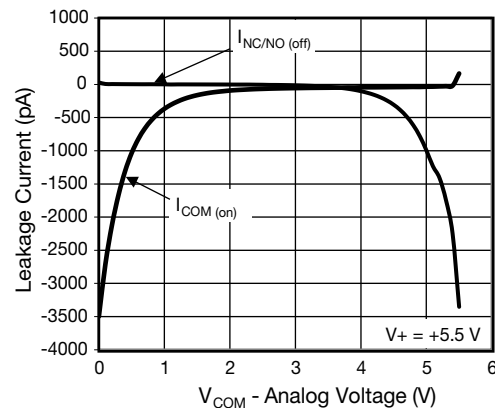
Switching Threshold vs. Supply Voltage



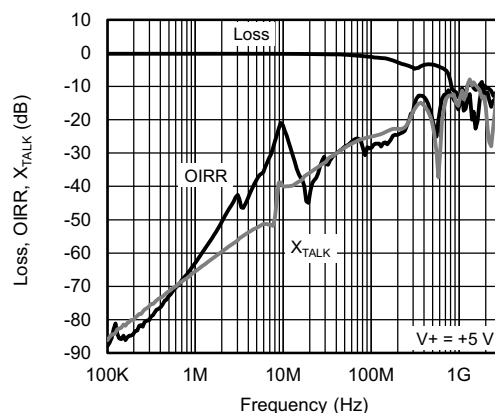
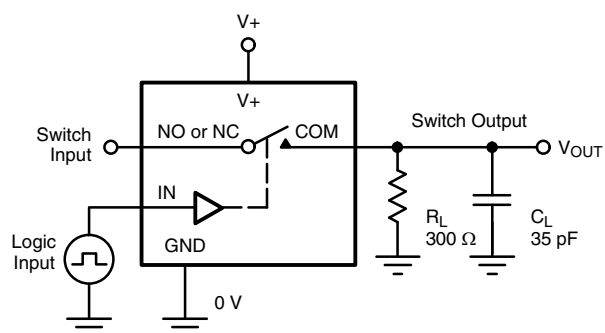
Leakage Current vs. Temperature



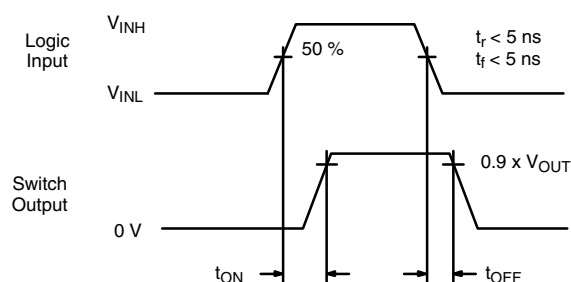
Charge Injection vs. Source Voltage



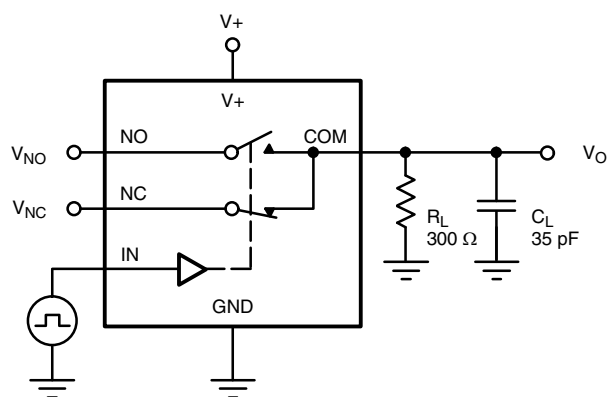
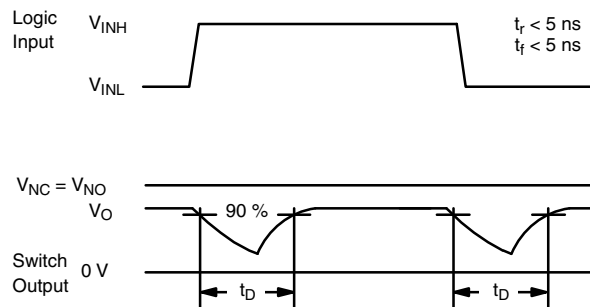
Leakage Current vs. Analog Voltage

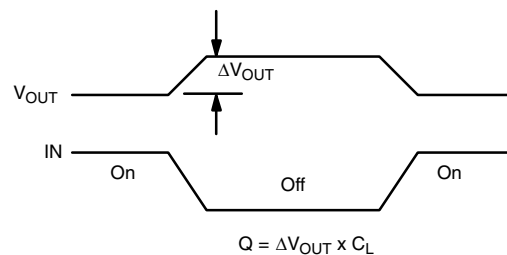
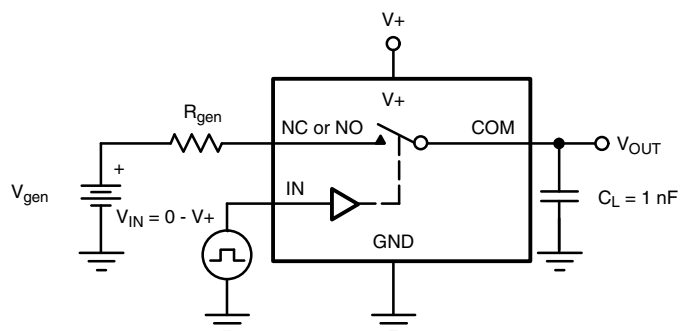
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

Loss, OIRR, X_{TALK} vs. Frequency
TEST CIRCUITS

 C_L (includes fixture and stray capacitance)

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

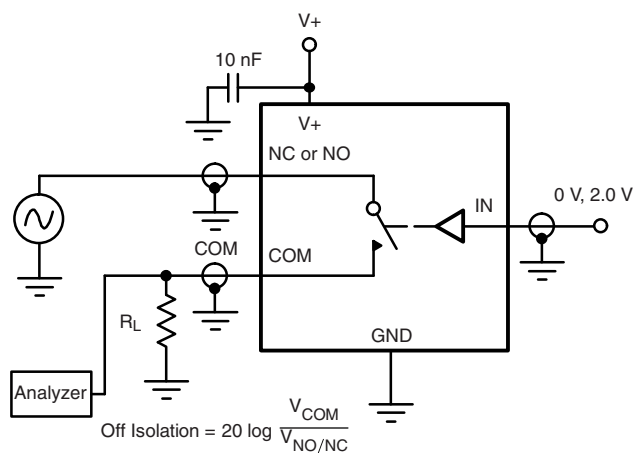
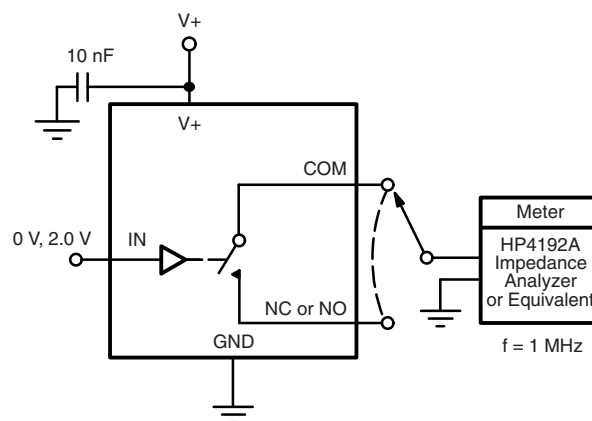
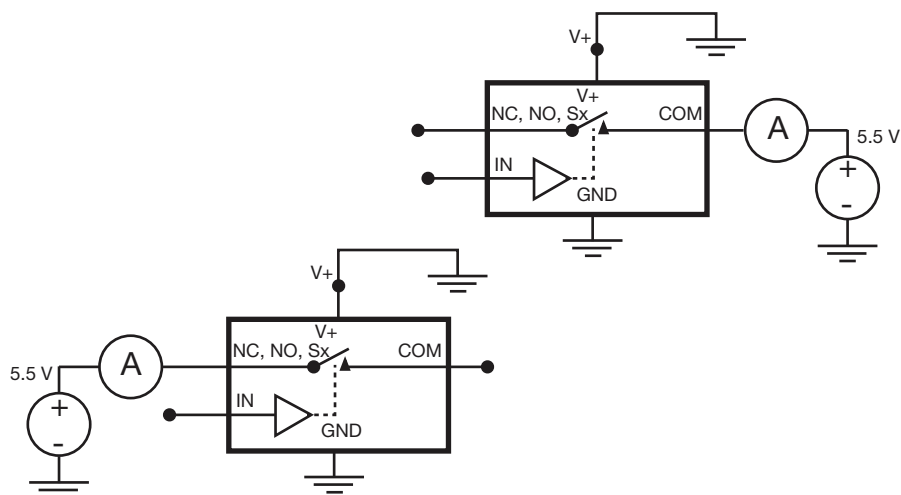


Logic "1" = Switch On
Logic input waveforms inverted for switches that have the opposite logic sense.

Fig. 1 - Switching Time

 C_L (includes fixture and stray capacitance)

Fig. 2 - Break-Before-Make Interval

TEST CIRCUITS


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

Fig. 6 - Source / Drain Power Down Leakage

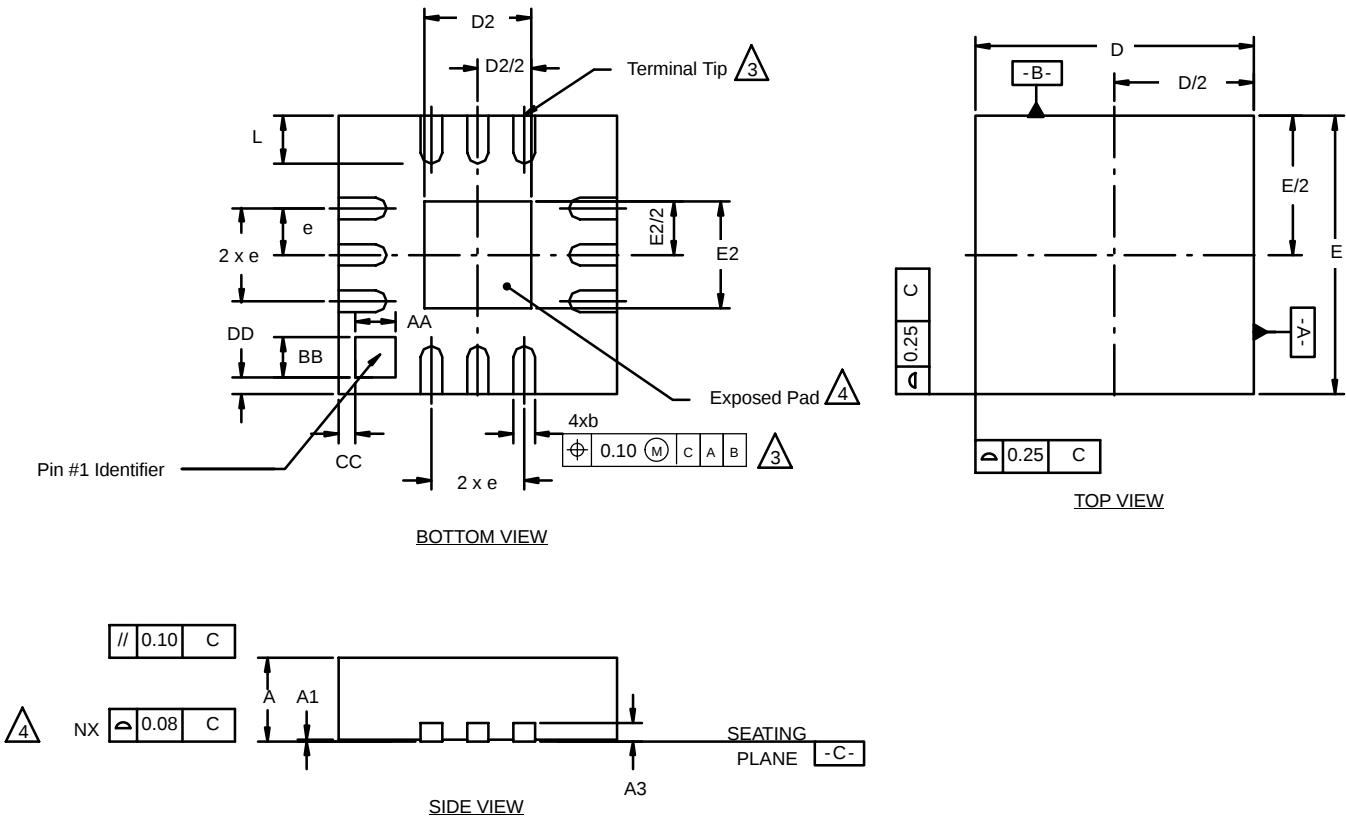


PRODUCT SUMMARY	
Part number	DG2032E
Status code	2
Configuration	SPDT x 2
Single supply min. (V)	1.8
Single supply max. (V)	5.5
Dual supply min. (V)	-
Dual supply max. (V)	-
On-resistance (Ω)	2.5
Charge injection (pC)	-19
Source on capacitance (pF)	23
Source off capacitance (pF)	7
Leakage switch on typ. (nA)	0.01
Leakage switch off max. (nA)	1
-3 dB bandwidth (MHz)	226
Package	QFN-12 3 x 3
Functional circuit / applications	Multi purpose, instrumentation, medical and healthcare, portable
Interface	Binary
Single supply operation	Yes
Dual supply operation	-
Turn on time max. (ns)	45
Crosstalk and off isolation (dB)	44

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QFN-12 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	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.80	0.90	1.00	0.032	0.035	0.039
b	0.18	0.23	0.30	0.007	0.009	0.012
D	3.00 BSC			0.118 BSC		
D2	1.00	1.15	1.25	0.039	0.045	0.049
E	3.00 BSC			0.118 BSC		
E2	1.00	1.15	1.25	0.039	0.045	0.049
e	0.50 BSC			0.02 BSC		
L	0.45	0.55	0.65	0.018	0.022	0.026
AA	0.435			0.017		
BB	0.435			0.017		
CC	0.18			0.007		
DD	0.18			0.007		
ECN: C-03092—Rev. A, 14-Apr-03 DWG: 5898						



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