COMPLIANT





## Single 4:1 Low r<sub>ON</sub> Multiplexers

#### **DESCRIPTION**

The DG2034 is a low voltage, low  $r_{ON}$ , high bandwidth single 4 to 1 analog multiplexer designed for high performance switching of analog and video signals. Combining low power; fast switching; low on-resistance, flatness and matching; and small physical size, the DG2034 is ideal for portable and battery applications.

Built on Vishay Siliconix's low voltage CMOS process, the DG2034 has an epitaxial layer which prevents latchup. Break-before-make is guaranteed.

#### **FEATURES**

- Low voltage operation (1.8 V to 5.5 V)
- Low on-resistance r<sub>DS(on)</sub>: 4 Ω
- Off-isolation and crosstalk: 55 dB at 10 MHz
- Fast switch 25 ns toN
- Low charge injection Q<sub>INJ</sub>: 4.7 pC
- Low power consumption 4 μW

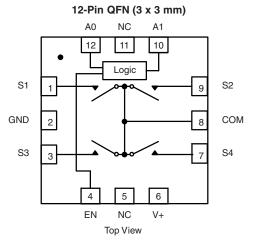
#### **BENEFITS**

- · High accuracy
- High bandwidth
- TTL and low voltage logic compatibility
- · Low power consumption
- Reduced PCB space

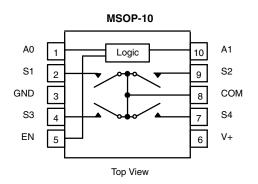
#### **APPLICATIONS**

- · Mixed signal routing
- · Portable and battery operated systems
- Low voltage data acquisition
- Modems
- PCMCIA cards

#### **FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION**



TRUTH TABLE						
A1	A0	EN	ON Switch			
X	X	0	None			
0	0	1	S1			
0	1	1	S2			
1	0	1	S3			
1	1	1	S4			



ORDERING INFORMATION						
Temp Range Package Part Number						
- 40 °C to 85 °C	MSOP-10	DG2034DQ-T1-E3				
	12-pin QFN (3 x 3 mm)	DG2034DN-T1-E4				

## Vishay Siliconix



ABSOLUTE MAXIMUM RATINGS					
Parameter		Limit	Unit		
Referenced V+ to GND		- 0.3 to + 6	,,		
$A_X$ , $E_N$ , $S_X$ , $COM^a$		- 0.3 to (V+ + 0.3)	V		
Continuous Current (Any Terminal)		± 50	A		
Peak Current (Pulsed at 1 ms, 10 % duty cycle)		± 100	— mA		
Barray Biasination (Barray)h	QFN-12 (3 x 3 mm) <sup>c</sup>	1295	mW		
Power Dissipation (Packags) <sup>b</sup>	MSOP-10 <sup>d</sup>	320	IIIVV		
Storage Temperature (D Suffix)		- 65 to 150	°C		

#### Notes:

- a. Signals on  $S_X$ ,  $D_X$ , EN or  $A_X$  exceeding V+ or 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 16.2 mV/°C above 70 °C. d. Derate 4.0 mV/°C above 70 °C.

	Test Conditions Otherwise Unless Specified			<b>Limits</b> - 40 to 85 °C				
Parameter	Symbol	$V+ = 3 V, \pm 10 \%, V_{AL} = 0.4 V, V_{AH} = 1.5 V^{e}$		Temp.a	Min.c	Typ.b	Max.c	Unit
Analog Switch								
Analog Signal Range <sup>d</sup>	V <sub>ANALOG</sub>			Full	0		V+	V
On-Resistance	r <sub>ON</sub>			Room Full		4	7 9	
r <sub>ON</sub> Match	Δr <sub>ON</sub>	$V+ = 2.7 \text{ V}, V_{COM} = 0.5 \text{ V}/1.5$ $I_{S} = 10 \text{ mA}$	5 V/2.0 V	Room		0.1	0.3	Ω
r <sub>ON</sub> Flatness <sup>d,f</sup>	r <sub>ON</sub> Flatness	.3		Room		0.3	1.5	
Off Leakage Current <sup>g</sup>	I <sub>S(off)</sub>	$V+ = 3.3 \text{ V}, V_S = 1 \text{ V/3}$ $V_{COM} = 3 \text{ V/1 V}, V_{EN} =$	3 V	Room Full	- 1 - 10	0.3	1 10	
COM Off Leakage Current <sup>g</sup>	I <sub>COM(off)</sub>	$V_{COM} = 3 \text{ V/1 V}, V_{EN} =$	0 V	Room Full	- 1 - 10	0.3	1 10	nA
Channel-On Leakage Current <sup>g</sup>	I <sub>COM(on)</sub>	$V_{COM} = 3.3 V$ $V_{COM} = V_{S} = 1 V/3 V$	/	Room Full	- 1 - 10	0.3	1 10	
Digital Control				,			l .	ı
Input Current <sup>d</sup>	I <sub>A</sub> or I <sub>EN</sub>	$V_{A/EN} = 0$ or V+, See Truth Table		Full	- 1.0		1.0	μΑ
Input High Voltage <sup>d</sup>	V <sub>AH</sub> or V <sub>ENH</sub>			Full	1.5			V
Input Low Voltage <sup>d</sup>	V <sub>AL</sub> or V <sub>ENL</sub>			Full			0.4	V
Dynamic Characteristics								
Turn-On Time	t <sub>ON</sub>			Room Full		25	35 45	
Turn-Off Time	t <sub>OFF</sub>	$V_S = 1.5 V, R_L = 300$	Ω	Room Full		15	25 35	ns
Break-Before-Make Time <sup>d</sup>	t <sub>D</sub>			Room		10.5		
Transition Time	t <sub>trans</sub>	$V_{S} = 1.5 \text{ V/O V}, V_{S} = 0 \text{ V/1.5 V},$	R <sub>L</sub> = 300 Ω	Room Full		30	45 55	
Charge Injection <sup>d</sup>	$Q_{INJ}$	$C_L = 1 \text{ nF, } V_{gen} = 0 \text{ V, } R_{ger}$	η = 0 Ω	Room		- 4.7		рС
Off-Isolation <sup>d</sup>	OIRR	$R_L = 50 \Omega, C_L = 5 pF$	f = 1 MHz	Room		- 73		
On-isolation*	Ontit	11L = 00 32, OL = 0 pi	f = 10 MHz	Room		- 54		dB
Channel-to-Channel Crosstalk <sup>d</sup>	X <sub>TALK</sub>	$R_L = 50 \Omega$ , $C_L = 5 pF$	f = 1 MHz	Room Room		- 77 - 59		
Off Capacitance <sup>d</sup>	C <sub>S(off)</sub>	V+ = 2.7 V, f = 1 MHz		Room		14		
COM Off Capacitance <sup>d</sup>	C <sub>COM(off)</sub>			Room		46		рF
COM On Capacitance <sup>d</sup>	C <sub>COM(on)</sub>			Room		67		"
Power Supply	(0.1)					<u> </u>		l .
Power Supply Range	V+				2.7		3.3	V
Power Supply Current <sup>d</sup>	l+	$V+=3.3 \text{ V}, V_{\text{A/EN}}=0 \text{ or } 3.3 \text{ V}, \text{ See Truth Table}$		Full			1.0	μΑ





SPECIFICATIONS (V+	= 5 V)								
		Test Conditions Otherwise Unless Specified V+ = 3 V, $\pm$ 10 %, V <sub>AL</sub> = 0.8 V or V <sub>AH</sub> = 2.4 V <sup>e</sup>			<b>Limits</b> - 40 to 85 °C		°C		
Parameter	Symbol			Temp.a	Min.c	Typ.b	Max.c	Unit	
Analog Switch	Analog Switch								
Analog Signal Range <sup>d</sup>	V <sub>ANALOG</sub>			Full	0		V+	V	
On-Resistance	r <sub>ON</sub>	V 45VV 45V05	\/\(\sigma\)	Room Full		3	5.5 7		
r <sub>ON</sub> Match	∆r <sub>ON</sub>	$V+ = 4.5 \text{ V}, V_{COM} = 1.5 \text{ V}/2.5$ $I_S = 10 \text{ mA}$	V/3.5 V	Room		0.16	0.5	Ω	
r <sub>ON</sub> Flatness <sup>d,f</sup>	r <sub>ON</sub> Flatness	,		Room		0.6	1.5		
Off Leakage Current	I <sub>S(off)</sub>	V+ = 5.5 V, V <sub>S</sub> = 1 V/4.5	V	Room Full	- 1 - 10	0.5	1 10		
COM Off Leakage Current	I <sub>COM(off)</sub>	$V_{COM} = 4.5 \text{ V/1 V, } V_{EN} =$	0 V	Room Full	- 1 - 10	0.5	1 10	nA	
Channel-On Leakage Current	I <sub>COM(on)</sub>	$V+ = 5.5 \text{ V}, V_{COM} = V_{S} = 1 \text{ V}$	//4.5 V	Room Full	- 1 - 10	0.5	1 10		
Digital Control									
Input Current <sup>d</sup>	I <sub>AH</sub> or I <sub>ENH</sub>	$V_A$ or $V_{EN} = 0$ or $V_{+}$ , See Truth Table		Full	- 1.0		1.0	μΑ	
Input High Voltage <sup>d</sup>	$V_{AH}$ or $V_{ENH}$			Full	2.4			v	
Input Low Voltage <sup>d</sup>	V <sub>AL</sub> or V <sub>ENL</sub>			Full			0.8	V	
Dynamic Characteristics									
Turn-On Time	t <sub>ON</sub>			Room Full		18	30 40		
Turn-Off Time	t <sub>OFF</sub>	$V_S = 3.0 \text{ V}, R_L = 300 \Omega$	2	Room Full		12	20 30	ns	
Break-Before-Make Time <sup>d</sup>	t <sub>D</sub>			Room		10.5			
Transition Time	t <sub>trans</sub>	$V_S = 3 \text{ V/0 V}, V_S = 0 \text{ V/3 V}, R_L$	= 300 Ω	Room Full		25	40 50		
Off-Isolation <sup>d</sup>	OIRR	$R_L = 50 \Omega, C_L = 5 p$	f = 1 MHz	Room		- 73			
			f = 10 MHz	Room		- 53.5		dB	
Channel-to-Channel Crosstalk <sup>d</sup>	X <sub>TALK</sub>	$R_L = 50 \Omega$ , $C_L = 5 pF$	f = 1 MHz f = 10 MHz	Room Room		- 77 - 60.2			
Charge Injection <sup>d</sup>	Q <sub>INJ</sub>	$C_L = 1 \text{ nF, } V_{qen} = 0 \text{ V, } R_{qen} = 0 \Omega$		Room		- 4.4		рС	
Off Capacitance <sup>d</sup>	C <sub>S(off)</sub>	V+ = 5 V, f = 1 MHz		Room		13			
COM Off Capacitance <sup>d</sup>	C <sub>COM(off)</sub>			Room		43		pF	
COM On Capacitance <sup>d</sup>	C <sub>COM(on)</sub>			Room		64			
Power Supply								L	
Power Supply Range	V+				4.5		5.5	V	
Power Supply Current	I+	$V+ = 5.5 \text{ V}, V_{A/EN} = 0 \text{ or } 5.5 \text{ V}, \text{ See Truth Table}$		Full			1.0	μΑ	

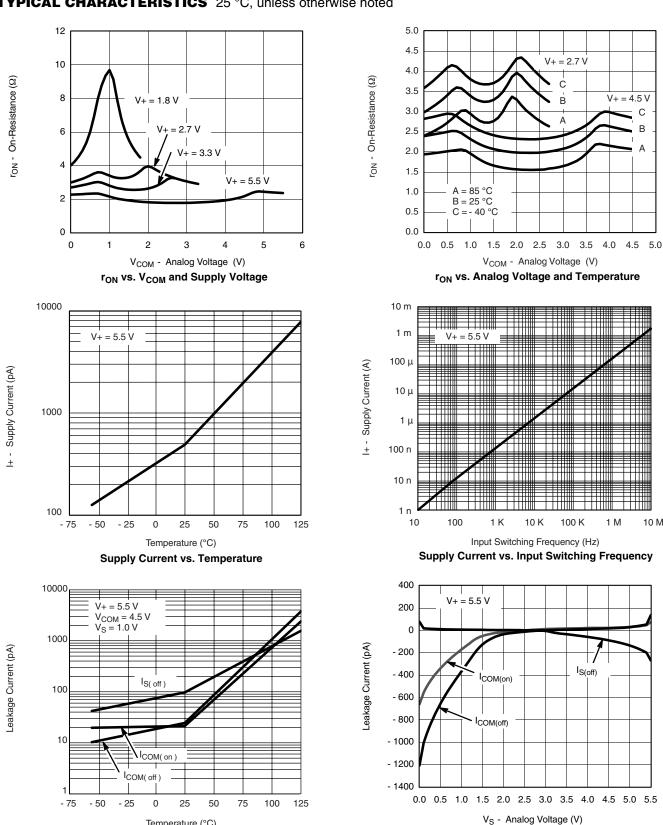
#### Notes:

- a. Room = 25  $^{\circ}$ 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, not subjected to production test.
- e.  $V_A$ ,  $E_N$  = 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.

## Vishay Siliconix

#### TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



Temperature (°C)

Leakage Current vs. Temperature

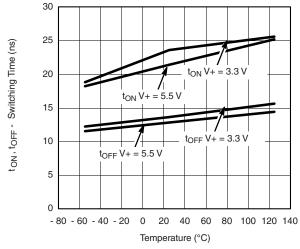
Leakage vs. Analog Voltage



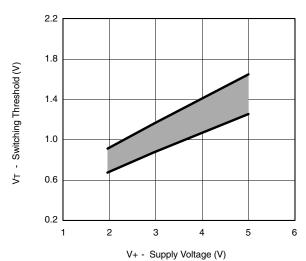




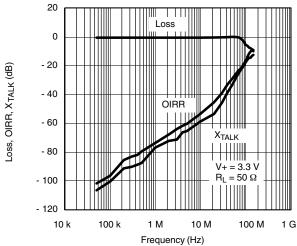
#### TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



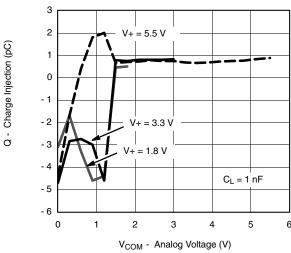
#### Switching Time vs. Temperature



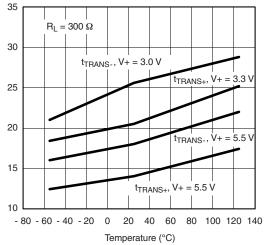
Switching Threshold vs. Supply Voltage



Insertion Loss, Off-Isolation Crosstalk vs. Frequency



Charge Injection vs. Analog Voltage

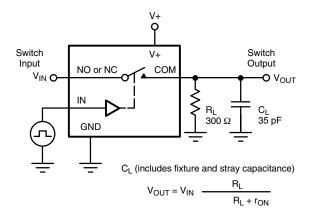


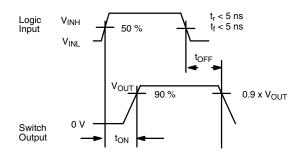
Transistion Time vs. Temperature

## Vishay Siliconix

# VISHAY.

#### **TEST CIRCUITS**





Note: Logic input waveform is inverted for switches that have the opposite logic sense control

Figure 1. Switching Time

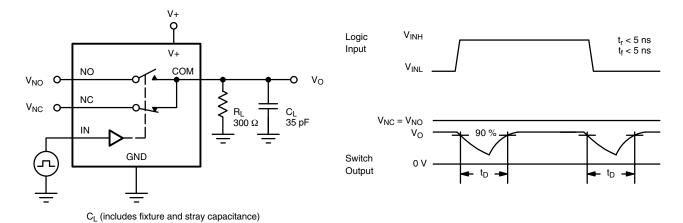


Figure 2. Break-Before-Make

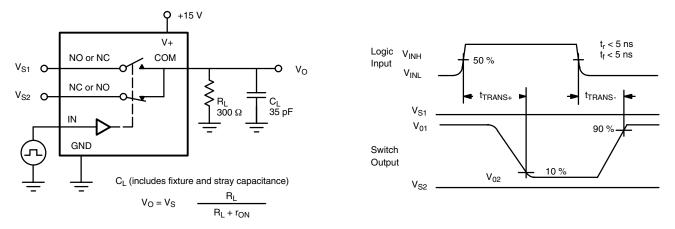
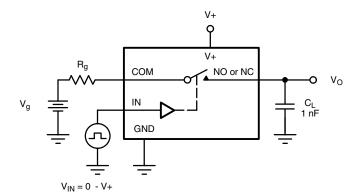
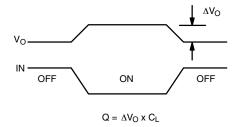


Figure 3. Transition Time



#### **TEST CIRCUITS**





IN dependent on switch configuration Input polarity determined by sense of switch.

Figure 4. Charge Injection

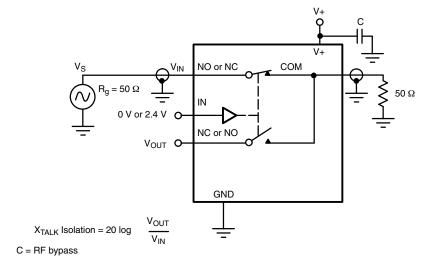


Figure 5. Crosstalk

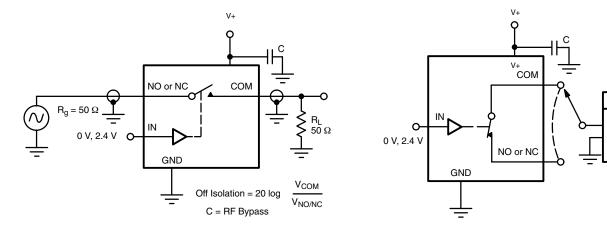


Figure 6. Off Isolation

Figure 7. Source/Drain Capacitances

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 <a href="http://www.vishay.com/ppg?72418">http://www.vishay.com/ppg?72418</a>.

Meter HP4192A

Impedance

Analyzer

or Equivalent

f = 1 MHz

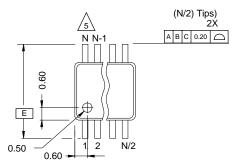




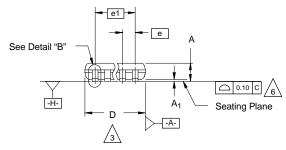


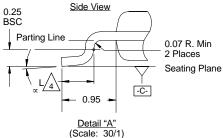
#### MSOP: 10-LEADS

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



Top View





#### NOTES:

. Die thickness allowable is  $0.203 \pm 0.0127$ .

2. Dimensioning and tolerances per ANSI.Y14.5M-1994.

<u>/3.</u>

Dimensions "D" and "E $_1$ " do not include mold flash or protrusions, and are measured at Datum plane  $\boxed{-H_2}$ , 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.

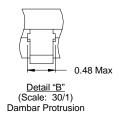
9. Controlling dimension: millimeters.

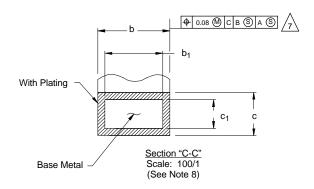
10. This part is compliant with JEDEC registration MO-187, variation AA and BA.

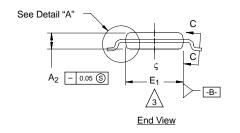


 $\frac{\lambda}{2}$  Exposed pad area in bottom side is the same as teh leadframe pad size.

Datums -A- and -B- to be determined Datum plane -H-.







N = 10L

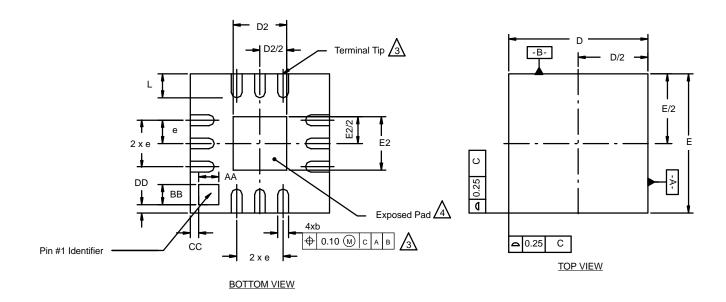
	MI			
Dim	Min	Nom	Max	Note
Α	-	-	1.10	
A <sub>1</sub>	0.05	0.10	0.15	
A <sub>2</sub>	0.75	0.85	0.95	
b	0.17	-	0.27	8
b <sub>1</sub>	0.17	0.20	0.23	8
С	0.13	0.13 - 0.23		
c <sub>1</sub>	0.13 0.15 0.18			
D		3		
Е		4.90 BSC		
E <sub>1</sub>	2.90	3.00 3.10		3
е		0.50 BSC		
e <sub>1</sub>		2.00 BSC		
L	0.40	0.55	0.70	4
N	10			5
œ	0°	4°	6°	
	2080—Rev. 0	· ·	6°	

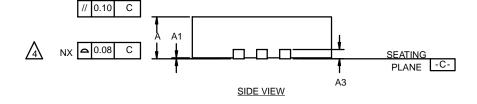
12-Jul-02

Document Number: 71245



#### QFN-12 LEAD (3 X 3)





#### NOTES:

- 1. All dimensions are in millimeters.
- 2. N is the total number of terminals.

Dimension b applies to metallized terminal and is measured between 0.25 and 0.30 mm from terminal tip.  $\,$ 

Coplanarity applies to the exposed heat sink slug as well as the terminal.

The pin #1 identifier may be either a mold or marked feature, it must be located within the zone iindicated.

	MILLIMETERS INCHES							
Dim	Min	Nom	Max	Min	Nom	Max		
Α	0.80	0.90	1.00	0.032	0.035	0.039		
b	0.18	0.23	0.30	0.007	0.012			
D		3.00 BSC		0.118 BSC				
D2	1.00	1.15	1.25	0.039 0.045 0.049				
Е	3.00 BSC			0.118 BSC				
E2	1.00	1.15	1.25	0.039 0.045 0.04				
е		0.50 BSC		0.02 BSC				
L	0.45	0.55	0.65	0.018 0.022 0.02				
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								

Document Number: 72209 www.vishay.com



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Vishay

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