700 MHz, -3 dB Bandwidth; Dual SPDT Analog Switch

DESCRIPTION

DG2723 is a low R_{ON}, high bandwidth analog switch configured in dual SPDT. It achieves 5.5 Ω switch on resistance, greater than 700 MHz -3 dB bandwidth with 5 pF load, and a channel to channel crosstalk at -36 dB and isolation at -29 dB. Fabricated with high density sub micro CMOS process, the DG2723 provides low parasitic capacitance, handles bidirectional signal flow with minimized phase distortion. Guaranteed 1.3 V logic high threshold makes it possible to interface directly with low voltage MCUs. The DG2723 is designed for a wide range of operating voltages from 2.7 V to 5.5 V that can be driven directly from one cell Li-ion battery. On-chip protection circuit protects again fault events when signals at “com” pins goes beyond V+.

Latch up current is 500 mA, as per JESD78, and its ESD tolerance exceeds 5 kV. Packaged in ultra small miniQFN-10 (1.4 mm x 1.8 mm x 0.55 mm), it is ideal for portable high speed mix signal switching application. As a committed partner to the community and the environment, Vishay Siliconix manufactures this product with lead (Pb)-free device termination. The miniQFN-10 package has a nickel-palladium-gold device termination and is represented by the lead (Pb)-free “-E4” suffix to the ordering part number. The nickel-palladium-gold device terminations meet all JEDEC® standards for reflow and MSL rating. As a further sign of Vishay Siliconix's commitment, the DG2723 is fully RoHS-complaint.

FEATURES

Pb-free

RoHS COMPLIANT

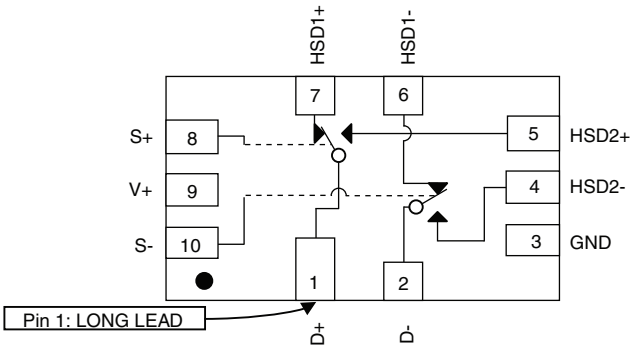
- Wide operation voltage range
- Low on-resistance, 5.5 Ω (typical at 3 V)
- Low capacitance, 5.6 pF (typical)
- -3 dB high bandwidth with 5 pF load: 700 MHz (typical)
- Low bit to bit skew: 40 pS (typical)
- Low power consumption
- Low logic threshold: V
- Power down protection: D+, D-, HSD1+, HSD1-, HSD2+, and HSD2- pins can tolerate up to 5.5 V when V+ = 0 V
- 5 kV ESD protection (HBM)
- Latch-up current 500 mA per JESD78
- Lead (Pb)-free low profile miniQFN-10 (1.4 mm x 1.8 mm x 0.55 mm)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

APPLICATIONS

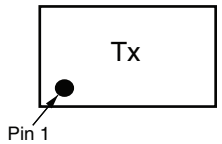
- Cellular phones
- Portable media players
- PDA
- Digital camera
- GPS
- Notebook computer
- TV, monitor, and set top box

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION

miniQFN-10L



Top View



Device marking: Tx for DG2723
x = Date / Lot traceability code

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ORDERING INFORMATION

TEMP. RANGE	PACKAGE	PART NUMBER
-40 °C to +85 °C	miniQFN-10	DG2723DN-T1-E4

TRUTH TABLE

S+ (PIN 8)	S- (PIN 10)	FUNCTION
X	0	D- = HSD1-
X	1	D- = HSD2-
0	X	D+ = HSD1+
1	X	D+ = HSD2+

PIN DESCRIPTION

PIN NAME	DESCRIPTION
S+	Select input for D+
S-	Select input for D-
HSD±, HSD2±, D±	Data port

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise noted)

PARAMETER		LIMIT	UNIT
Reference to GND	V+, D±, HSD1±, HSD2±	-0.3 to+6	V
	S+, S- [a]	-0.3 to (V+ + 0.3)	
Current (any terminal except S+, S-, D±, HSD1±, HSD2±)		30	mA
Continuous current (S+, S-, D±, HSD1±, HSD2±)		± 250	
Peak current (pulsed at 1 ms, 10 % duty cycle)		± 500	
Storage temperature (D suffix)		-65 to +150	°C
Power dissipation (packages) [b]	miniQFN-10 [c]	208	mW
ESD (human body model)		5	kV
Latch-up (current injection)		500	mA

Notes

a. Signals on S+, S-, 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 2.6 mW/°C above 70 °C

SPECIFICATIONS (V+ = 3 V)

PARAMETER	SYMBOL	TEST CONDITIONS OTHERWISE UNLESS SPECIFIED	TEMP.[a]	LIMITS -40 °C to +85 °C			UNIT
				MIN. [b]	TYP. [c]	MAX. [b]	
Analog Switch							
Analog signal range [d]	V_{ANALOG}	$R_{DS(on)}$	Full	0	-	V+	V
On-resistance	$R_{DS(on)}$	V+ = 3 V, $I_{D±}$ = 8 mA, $V_{HSD1/2±}$ = 0.4 V	Room	-	5.5	8	Ω
			Full	-	-	9	
On-resistance match [d]	ΔR_{ON}	V+ = 3 V, $I_{D±}$ = 8 mA, $V_{HSD1/2±}$ = 0.4 V	Room	-	0.8	-	
On-resistance resistance flatness [d]	R_{ON} Flatness	V+ = 3 V, $I_{D±}$ = 8 mA, $V_{HSD1/2±}$ = 0 V, 1 V	Room	-	2	-	
Switch off leakage current	$I_{(off)}$	V+ = 4.3 V, $V_{HSD1/2±}$ = 0.3 V, 3 V, $V_{D±}$ = 3 V, 0.3 V	Full	-100	-	100	nA
Channel on leakage current	$I_{(on)}$	V+ = 4.3 V, $V_{HSD1/2±}$ = 0.3 V, 4 V, $V_{D±}$ = 4 V, 0.3 V	Full	-200	-	200	
Digital Control							
Input voltage high	V_{INH}	V+ = 3 V to 3.6 V	Full	1.3	-	-	V
		V+ = 4.3 V	Full	1.5	-	-	
Input voltage low	V_{INL}	V+ = 3 V to 4.3 V	Full	-	-	0.5	
Input capacitance	C_{IN}		Full	-	6.5	-	pF
Input current	I_{INL} or I_{INH}	V_{IN} = 0 or V+	Full	-1	-	1	µA

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SPECIFICATIONS (V+ = 3 V)							
PARAMETER	**SYMBOL**	**TEST CONDITIONS OTHERWISE UNLESS SPECIFIED**	**TEMP.[a]**	**LIMITS -40 °C to +85 °C**			**UNIT**
				MIN. [b]	**TYP. [c]**	**MAX. [b]**	
Dynamic Characteristics							
Break-before-make time [e, d]	t_{BBM}	V+ = 3 V, $V_{D1/2±}$ = 1.5 V, R_L = 50 Ω, C_L = 35 pF	Room	-	5	-	ns
			Full				
S-, S+ turn-on time [e, d]	t_{ON}		Room	-	-	30	
			Full				
S-, S+ turn-off time [e, d]	t_{OFF}		Room	-	-	25	
			Full				
Charge injection [d]	Q_{INJ}	C_L = 1 nF, R_{GEN} = 0 Ω, V_{GEN} = 0 V	Room	-	3	-	pC
Off-isolation [d]	OIRR	V+ = 3 V to 3.6 V, R_L = 50 Ω, C_L = 5 pF, f = 240 MHz		-	-29	-	dB
Crosstalk [d]	X_{TALK}			-	-36	-	
Bandwidth [d]	BW	V+ = 3 V to 3.6 V, C_L = 5 pF, R_L = 50 Ω, -3 dB		-	700	-	MHz
Channel-off capacitance [d]	$C_{D1± (off)}$	V+ = 3.3 V, f = 1 MHz		-	2.5	-	pF
	$C_{D2± (off)}$			-	2.5	-	
Channel-on capacitance [d]	$C_{D± (off)}$			-	2.5	-	
	$C_{D± (on)}$			-	6.5	-	
Channel-to-channel skew [d]	$t_{SK(O)}$	V+ = 3 V to 3.6 V, R_L = 50 Ω, C_L = 5 pF		-	50	-	ps
Skew off opposite transitions of the same output [d]	$t_{SK(p)}$			-	20	-	
Total jitter [d]	t_J			-	200	-	
Power Supply							
Power supply range	V+			2.6	-	5.5	V
Power supply current	I+	V_{IN} = 0 V, or V+	Full	-	-	2	µA

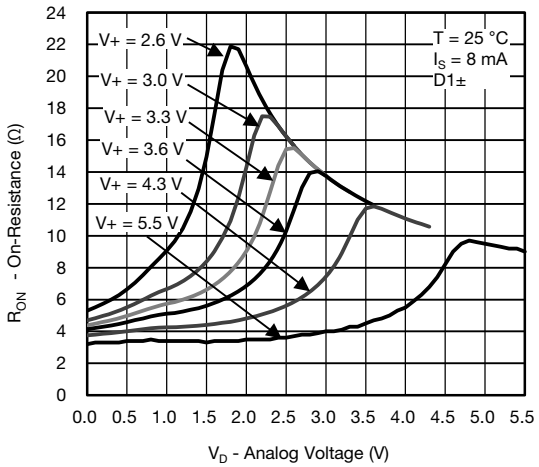
Notes

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

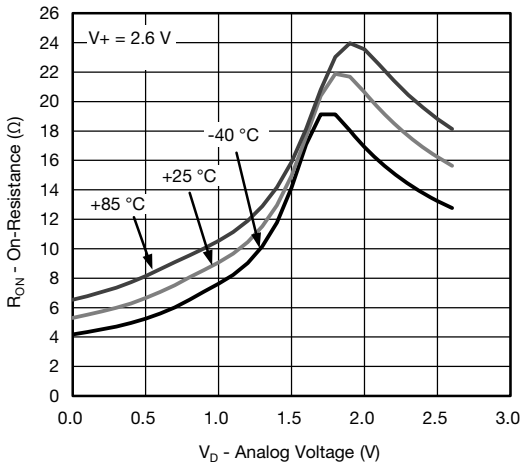
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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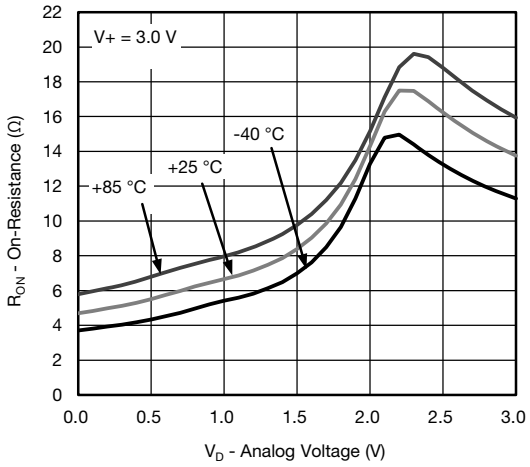
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



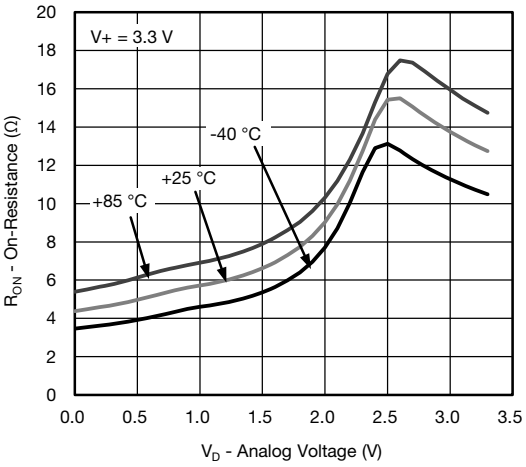
R_{ON} vs. V_D and Single Supply Voltage



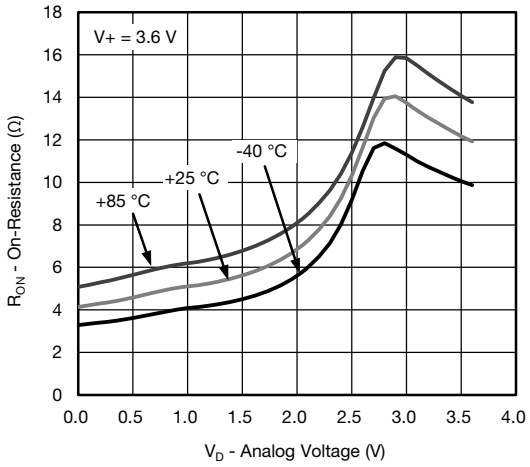
R_{ON} vs. Analog Voltage and Temperature



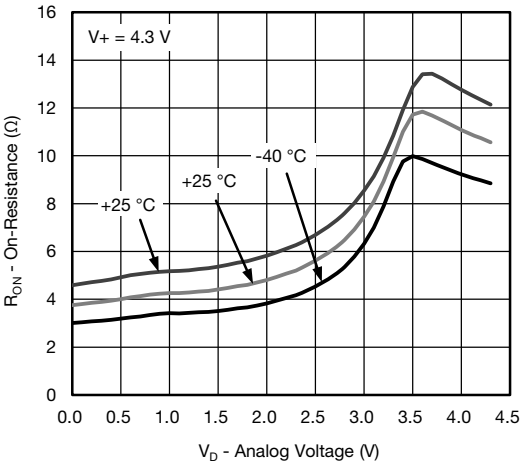
R_{ON} vs. Analog Voltage and Temperature



R_{ON} vs. Analog Voltage and Temperature



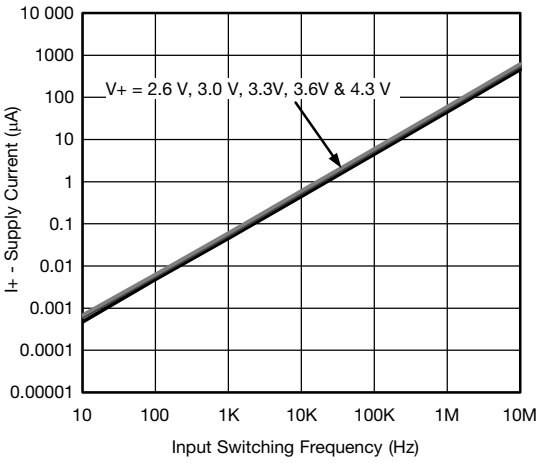
R_{ON} vs. Analog Voltage and Temperature



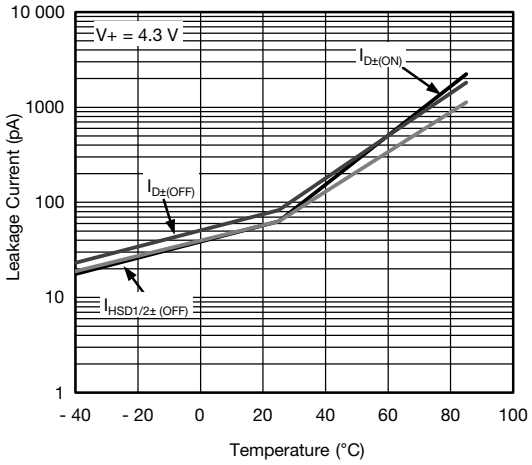
R_{ON} vs. Analog Voltage and Temperature

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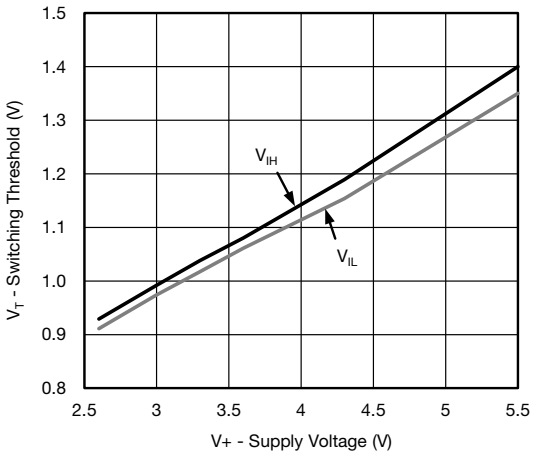
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



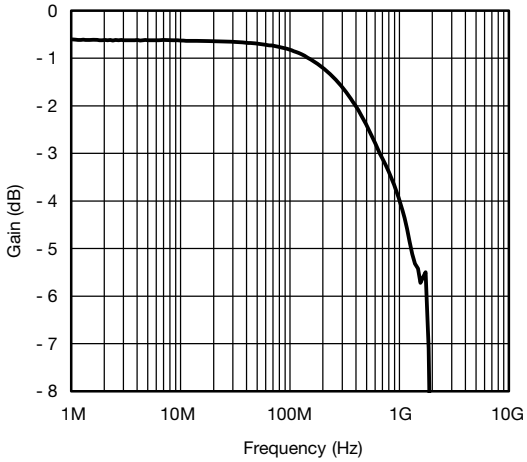
Supply Current vs. Input Switching Frequency



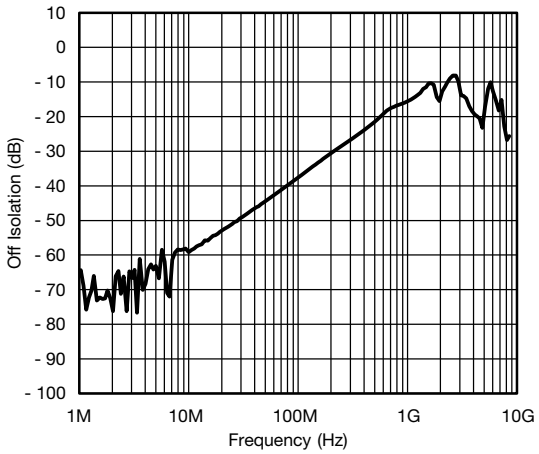
Leakage Current vs. Temperature



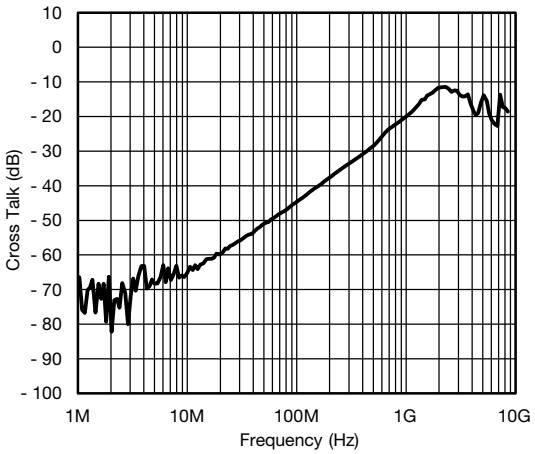
Switching Threshold vs. Supply Voltage



Gain vs. Frequency, V+ = 3.3 V



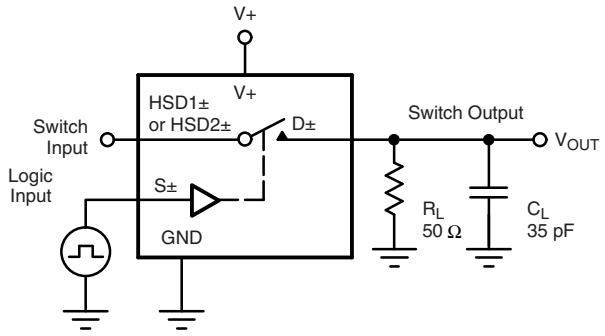
Off-Isolation, V+ = 3.3 V



Crosstalk, V+ = 3.3 V

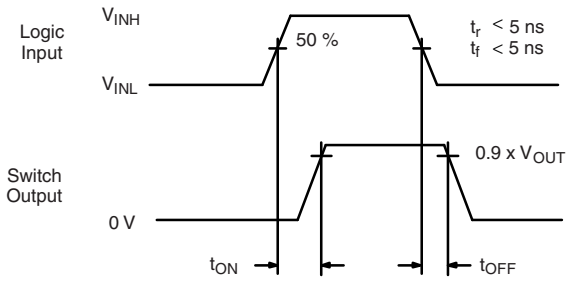
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TEST CIRCUITS



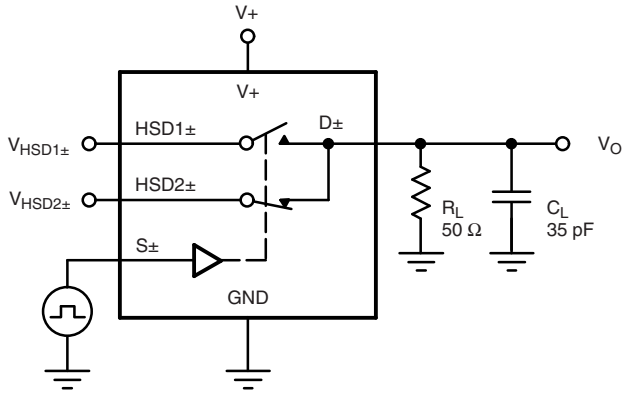
C_L (includes fixture and stray capacitance)

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



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)

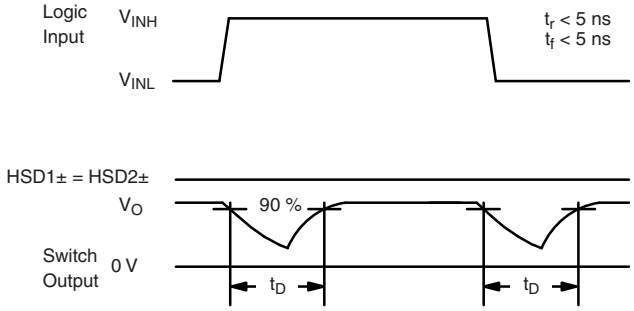
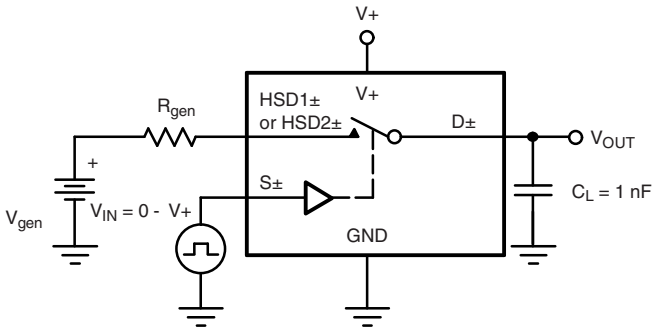
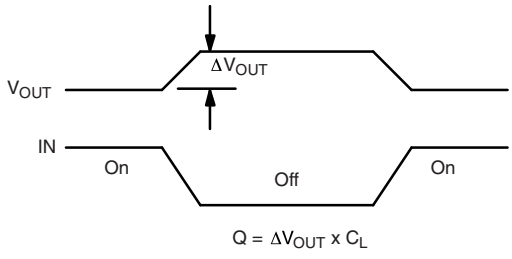


Fig. 2 - Break-Before-Make Interval





$Q = \Delta V_{OUT} \times C_L$

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

Fig. 3 - Charge Injection

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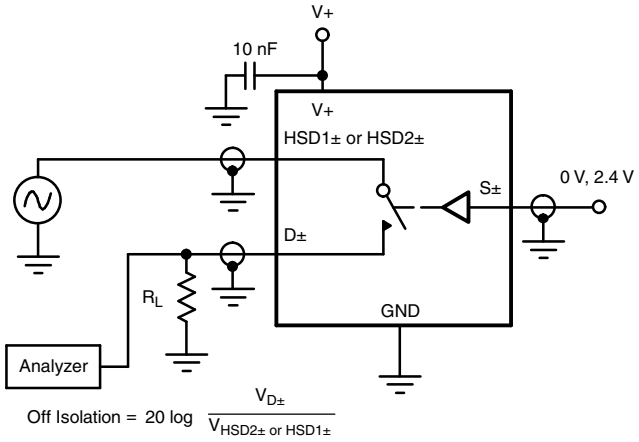


Fig. 4 - Off-Isolation

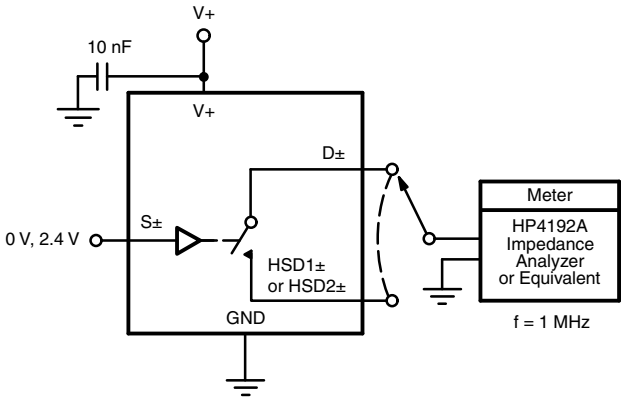


Fig. 5 - Channel Off/On Capacitance

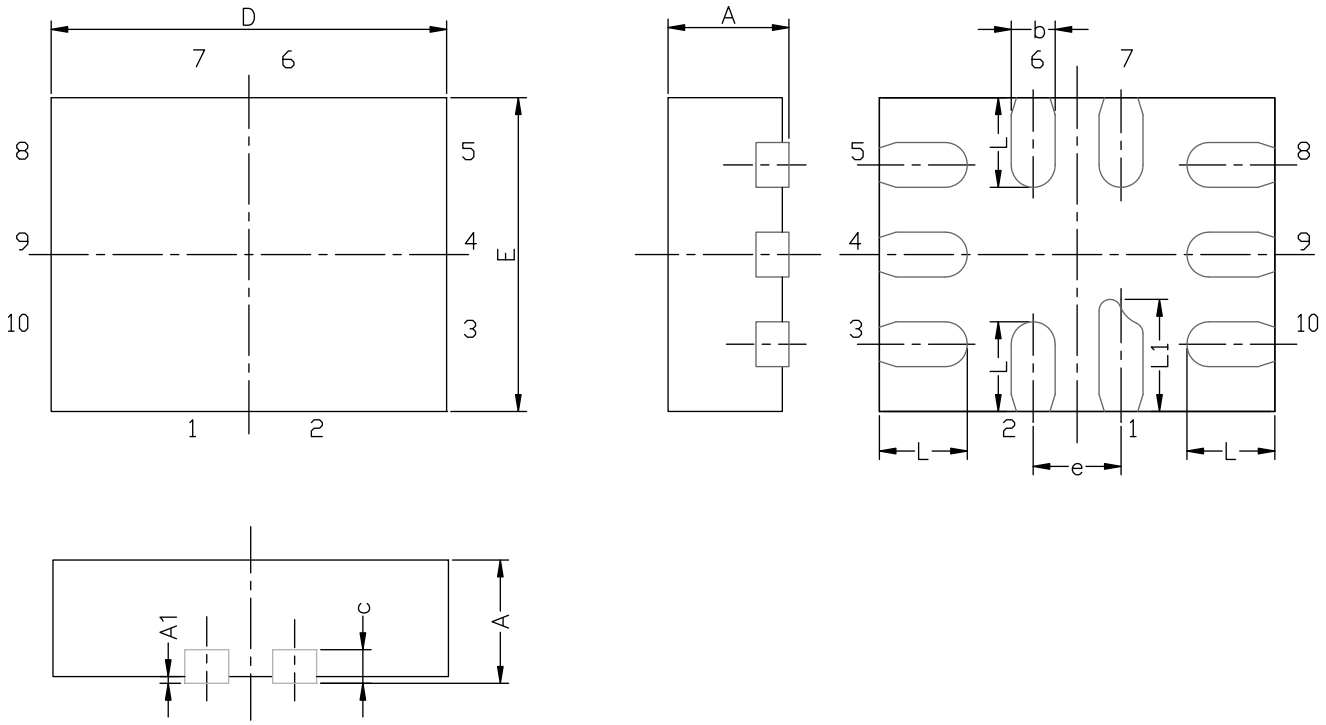
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PRODUCT SUMMARY	
Part number	DG2723
Status code	2
Configuration	SPDT x 2
Single supply min. (V)	2.6
Single supply max. (V)	5.5
Dual supply min. (V)	-
Dual supply max. (V)	-
On-resistance (Ω)	5.5
Charge injection (pC)	3
Source on capacitance (pF)	6.5
Source off capacitance (pF)	2.5
Leakage switch on typ. (nA)	-
Leakage switch off max. (nA)	100
-3 dB bandwidth (MHz)	700
Package	miniQFN-10
Functional circuit / applications	Multi purpose, USB, portable
Interface	Binary
Single supply operation	Yes
Dual supply operation	-
Turn on time max. (ns)	30
Crosstalk and off isolation	-36

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MINI QFN-10L CASE OUTLINE



DIM	MILLIMETERS			INCHES		
	MIN.	NAM.	MAX.	MIN.	NAM.	MAX.
A	0.45	0.55	0.60	0.0177	0.0217	0.0236
A1	0.00	-	0.05	0.000	-	0.002
b	0.15	0.20	0.25	0.006	0.008	0.010
c	0.150 or 0.127 REF (1)			0.006 or 0.005 REF (1)		
D	1.70	1.80	1.90	0.067	0.071	0.075
E	1.30	1.40	1.50	0.051	0.055	0.059
e	0.40 BSC			0.016 BSC		
L	0.35	0.40	0.45	0.014	0.016	0.018
L1	0.45	0.50	0.55	0.0177	0.0197	0.0217

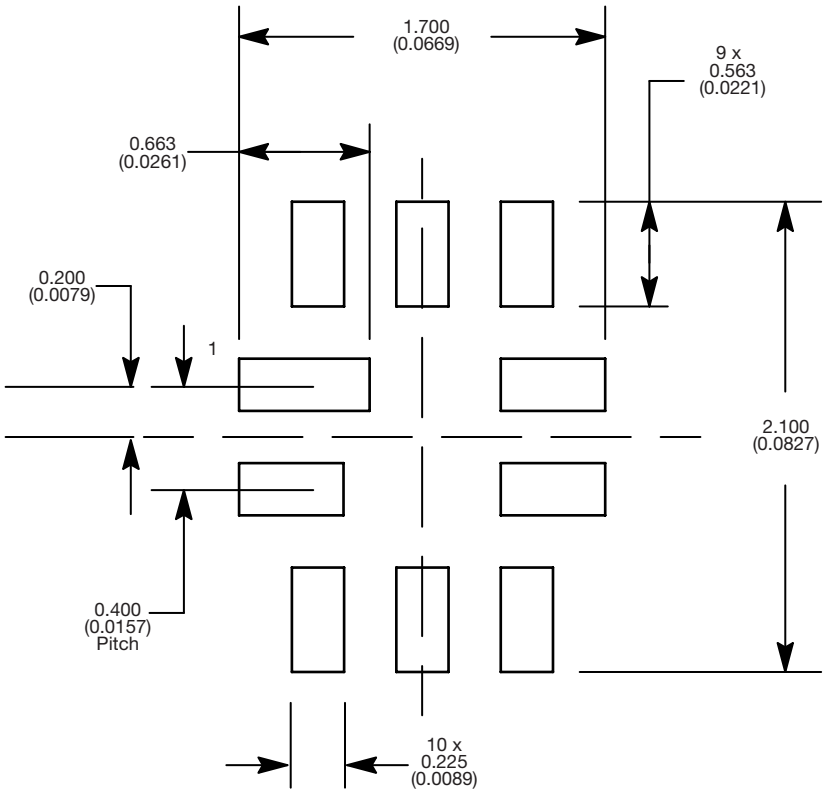
Note

(1) The dimension depends on the leadframe that assembly house used.

ECN T16-0163-Rev. B, 16-May-16
DWG: 5957

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RECOMMENDED MINIMUM PADS FOR MINI QFN 10L



Mounting Footprint
Dimensions in mm (inch)

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