



The Future of Analog IC Technology®

# MP2735/MP2736

## Low-Voltage 0.45Ω Dual SPDT Analog Switches

### GENERAL DESCRIPTION

The MP2735/MP2736 are low voltage, low on-resistance, dual single-pole, double-throw (SPDT) monolithic CMOS analog switches designed for high performance switching of analog signals. Combining low-power, high speed, low on-resistance, and small package size, the MP2735/MP2736 are ideal for portable and battery power applications.

The MP2735/MP2736 have an operation range from 1.65V to 5.5V single supply. The MP2735 has two separate control pins and two separate SPDT switches. The MP2736 includes an  $\overline{EN}$  pin. All switches are at high impedance mode when the  $\overline{EN}$  is high.

The MP2735/MP2736 are guaranteed 1.65V logic compatible for  $V+ < 3.3V$ , allowing the easy interface with low voltage DSP or MCU control logic and ideal for one cell Li-ion battery direct power.

The switch conducts signals within power rails equally well in both directions when on, and blocks up to the power supply level when off. Break-before-make is guaranteed.

The MP2735/MP2736 are offered in a QFN10 package.

### FEATURES

- Low Voltage Operation (1.65V to 5.5V)
- Low On-Resistance -  $R_{ON}$ : 0.45Ω at 2.7V
- Fast Switching:  $T_{ON}$  = 29ns at 2.7V
- $T_{OFF}$  = 23ns at 2.7V
- Latch-Up Current >300mA (JESD78)
- 1.4mm x 1.8mm QFN10 Package
- ESD Human-Body Model ±4000V

### APPLICATIONS

- Cellular Phones
- Speaker Headset Switching
- Audio and Video Signal Routing
- PCMCIA Cards
- Battery Powered Systems
- Portable Media Player
- Handheld Test Instruments

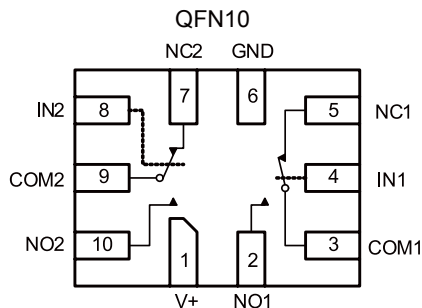
### TRUTH TABLE

	IN1/2	$\overline{EN}$	NC1/2	NO1/2
<b>MP2735</b>	0	-	ON	OFF
	1	-	OFF	ON
<b>MP2736</b>	0	1	OFF	OFF
	1	1	OFF	OFF
	0	0	ON	OFF
	1	0	OFF	ON

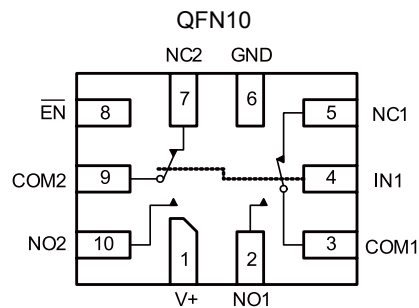
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### FUNCTIONAL BLOCK DIAGRAM PIN CONFIGURATION

MP2735DQG



MP2736DQG

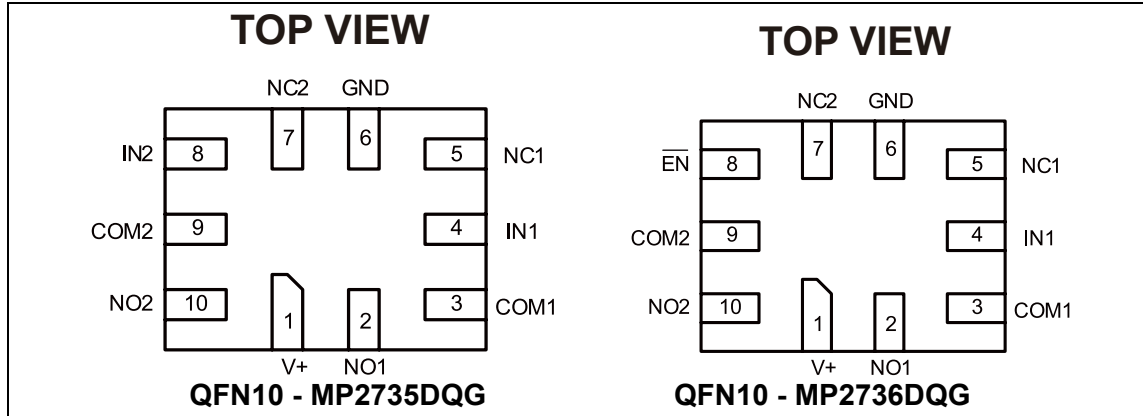


### ORDERING INFORMATION

Part Number*	Package	Top Marking	Free Air Temperature (T <sub>A</sub> )
MP2735DQG	QFN10 (1.4mm x1.8mm)	$\overline{2T}$	-40°C to +85°C
MP2736DQG		$\overline{AM}$	

\* For Tape & Reel, add suffix -Z (e.g. MP2735DQG-Z).  
 For RoHS compliant packaging, add suffix -LF (e.g. MP2735DQG-LF-Z)

### PACKAGE REFERENCE



### ABSOLUTE MAXIMUM RATINGS

V+ Supply Voltage .....-0.3V to +6V  
 IN/COM/NC/NO Voltage <sup>(1)</sup> ... -0.3V to V+ + 0.3V  
 Current  
 (Any terminal except NO, NC or COM) .....  
 ..... 30mA  
 Continuous Current (NO, NC or COM) .....  
 ..... ±250mA  
 Peak Current  
 (Pulsed at 1ms, 10% duty cycle) ..... ±500mA  
 Storage Temperature..... -65°C to +150°C  
 Power Dissipation (QFN10 <sup>(2)</sup> <sup>(3)</sup>) ..... 208mW

#### Notes:

- 1) Signals on NC, or COM or IN exceeding V+ will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
- 2) Derate 4.0mW/°C above 70°C.
- 3) All leads welded or soldered to PC Board.

## ELECTRICAL CHARACTERISTICS

V+=3V, ±10%, V<sub>IN</sub>=0.4 or 1.65V, unless otherwise noted.

Parameter	Symbol	Condition	Min	Typ	Max	Units
<b>Analog Switch</b>						
Analog Signal Range	V <sub>analog</sub>	r <sub>DS(on)</sub> , T <sub>A</sub> = -40°C to +85°C	0		V+	V
On-Resistance	r <sub>DS(on)</sub>	V+=2.7V, I <sub>NO/NC</sub> =100mA, V <sub>COM</sub> =0.5V	T <sub>A</sub> = +25°C	0.28	0.45	Ω
		V+=2.7V, I <sub>NO/NC</sub> =100mA, V <sub>COM</sub> =1.5V				
		V+=2.7V, I <sub>NO/NC</sub> =100mA, V <sub>COM</sub> =0.5V	T <sub>A</sub> = -40°C to +85°C	0.30		
		V+=2.7V, I <sub>NO/NC</sub> =100mA, V <sub>COM</sub> =1.5V				
		V+=5.5V, I <sub>NO/NC</sub> =100mA, V <sub>COM</sub> =0.9V	T <sub>A</sub> = +25°C	0.20	0.30	
		V+=5.5V, I <sub>NO/NC</sub> =100mA, V <sub>COM</sub> =2.5V		0.18		
		V+=5.5V, I <sub>NO/NC</sub> =100mA, V <sub>COM</sub> =0.9V	T <sub>A</sub> = -40°C to +85°C	0.25		
		V+=5.5V, I <sub>NO/NC</sub> =100mA, V <sub>COM</sub> =2.5V				
r <sub>ON</sub> Match	Δr <sub>on</sub>	V+=2.7V, I <sub>NO/NC</sub> =100mA, V <sub>COM</sub> =0.5V/1.5V	T <sub>A</sub> = +25°C	0.01	0.02	
		V+=5.5V, I <sub>NO/NC</sub> =100mA, V <sub>COM</sub> =0.9V/2.5V				
r <sub>ON</sub> Flatness	r <sub>ON</sub> Flatness	V+=2.7V, I <sub>NO/NC</sub> =100mA, V <sub>COM</sub> =0.5V/1.5V				
Switch Off Leakage Current	I <sub>NO/NC(off)</sub>	V+=5.5V, V <sub>NO/NC</sub> =0.3V/4.0V, V <sub>COM</sub> =4.0V/0.3V	T <sub>A</sub> = +25°C	-40	40	nA
			T <sub>A</sub> = -40°C to +85°C	-100	100	
	T <sub>A</sub> = +25°C		-40	40		
	T <sub>A</sub> = -40°C to +85°C		-100	100		
Channel-On Leakage Current	I <sub>COM(on)</sub>	V+=5.5V, V <sub>NO/NC</sub> =V <sub>COM</sub> =4.0V/0.3V	T <sub>A</sub> = +25°C	-40	40	
			T <sub>A</sub> = -40°C to +85°C	-150	150	
<b>Digital Control</b>						
Input High Voltage	V <sub>INH</sub>		T <sub>A</sub> = -40°C to +85°C	1.65		V
Input Low Voltage	V <sub>INL</sub>				0.4	
Input Capacitance	C <sub>IN</sub>			6		pF
Input Current	I <sub>INL</sub> or I <sub>INH</sub>			V <sub>IN</sub> =0 or V+	-1	1

**ELECTRICAL CHARACTERISTICS (continued)**
**V+=3V, ±10%, V<sub>IN</sub>=0.4 or 1.65V, unless otherwise noted.**

Parameter	Symbol	Condition	Min	Typ	Max	Units	
<b>Dynamic Characteristics</b>							
Break-Before-Make Time	t <sub>BBM</sub>	V+=3.6V, V <sub>NO</sub> /V <sub>NC</sub> =1.5V, R <sub>L</sub> =50Ω, C <sub>L</sub> =35pF	T <sub>A</sub> = +25°C		10		ns
Turn-On Time	t <sub>ON</sub>				24	36	
Turn-Off Time	t <sub>OFF</sub>		T <sub>A</sub> = -40°C to +85°C			40	
			T <sub>A</sub> = +25°C		20	30	
Enable Turn-On Time MP2736 ( $\overline{\text{EN}}$ )	t <sub>ON(EN)</sub>		T <sub>A</sub> = -40°C to +85°C			35	
			T <sub>A</sub> = +25°C		24	36	
Enable Turn-Off Time MP2736 ( $\overline{\text{EN}}$ )	t <sub>OFF(EN)</sub>		T <sub>A</sub> = -40°C to +85°C			40	
			T <sub>A</sub> = +25°C		20	30	
Off-Isolation <sup>(4)</sup>	OIRR	R <sub>L</sub> =50Ω, C <sub>L</sub> =5pF, f=100kHz	T <sub>A</sub> = +25°C		-70		dB
Crosstalk <sup>(4)</sup>	XTALK				-70		dB
3dB Bandwidth				R <sub>L</sub> =50Ω, C <sub>L</sub> =5pF		50	
NO, NC Off Capacitance <sup>(4)</sup>	C <sub>NO(off)</sub>	V <sub>IN</sub> =0V, or V+, f=1MHz	T <sub>A</sub> = +25°C		55		pF
	C <sub>NC(off)</sub>				55		
Channel On Capacitance <sup>(4)</sup>	C <sub>NO(on)</sub>				130		
	C <sub>NC(on)</sub>				130		
<b>Power Supply</b>							
Power Supply Range	V+			1.65		5.5	V
Power Supply Current	I+	V <sub>IN</sub> =0 or V+	T <sub>A</sub> = -40°C to +85°C	-1		1	μA

**Note:**

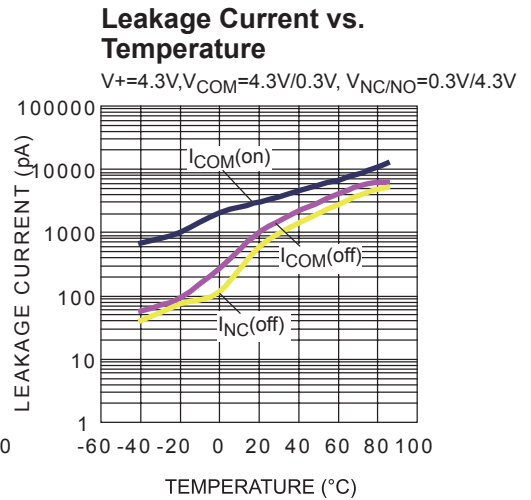
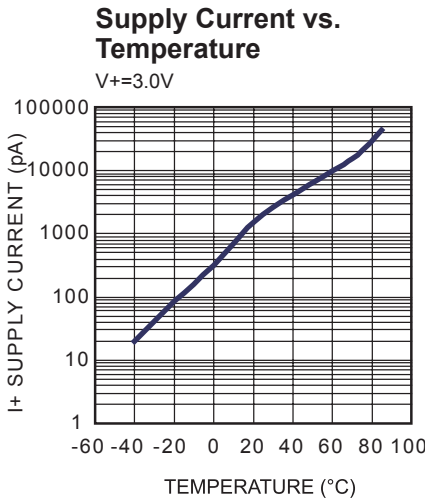
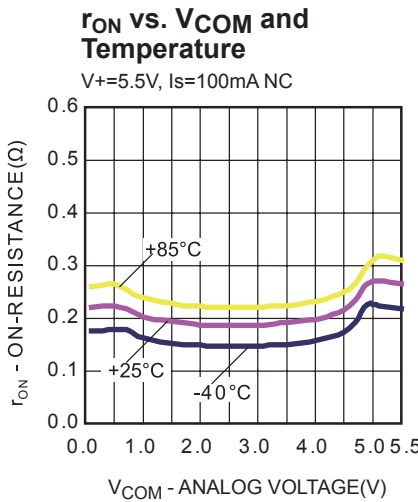
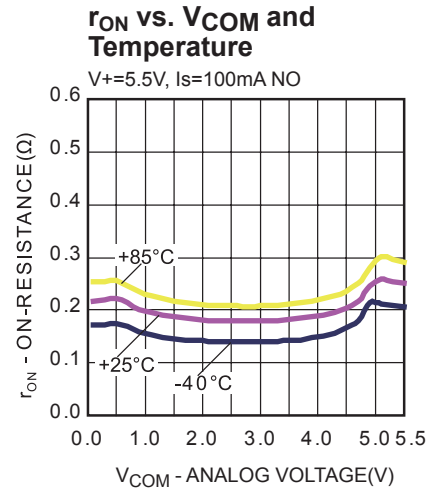
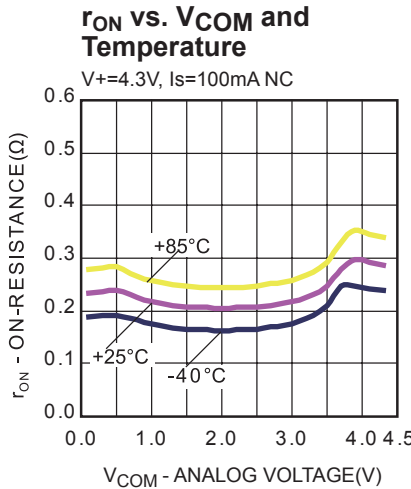
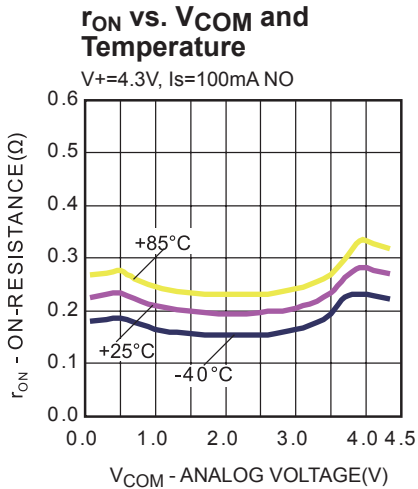
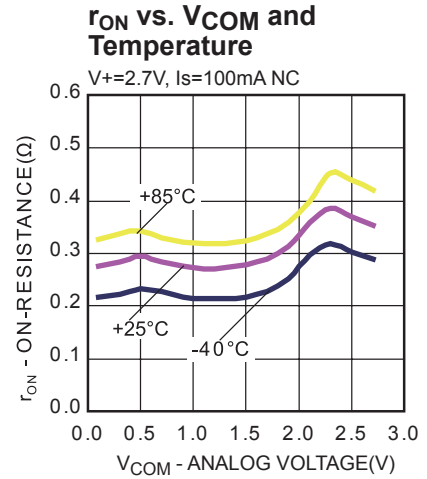
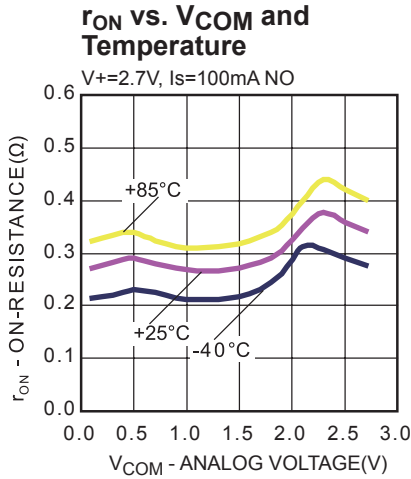
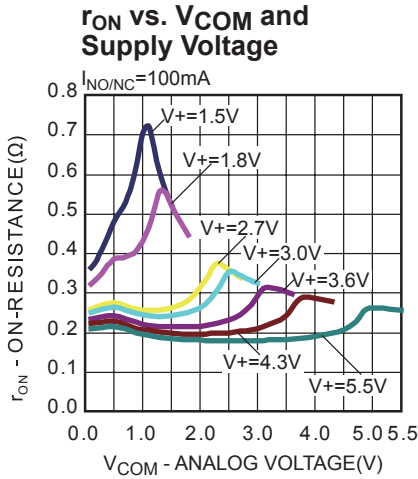
- 4) Guarantee by design, not subjected to production test.

## PIN FUNCTIONS

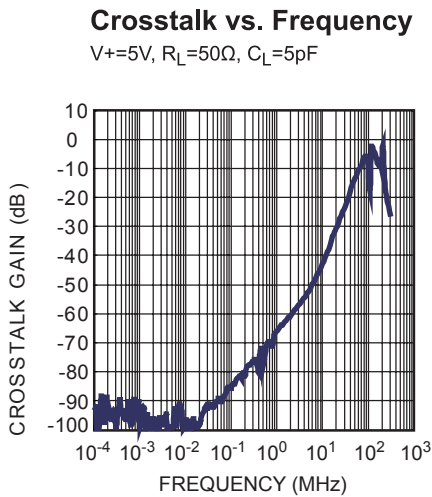
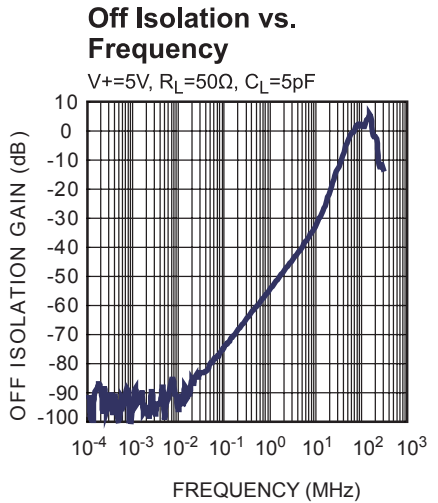
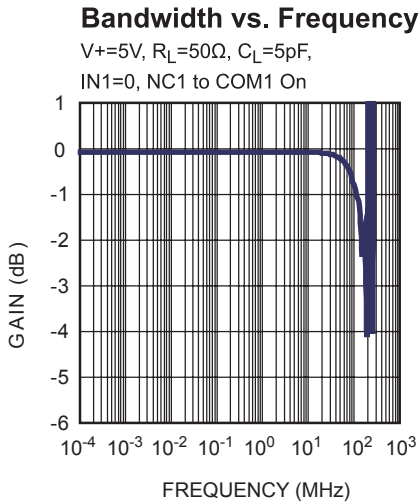
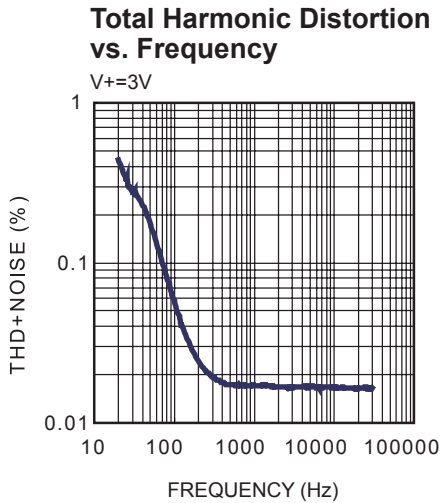
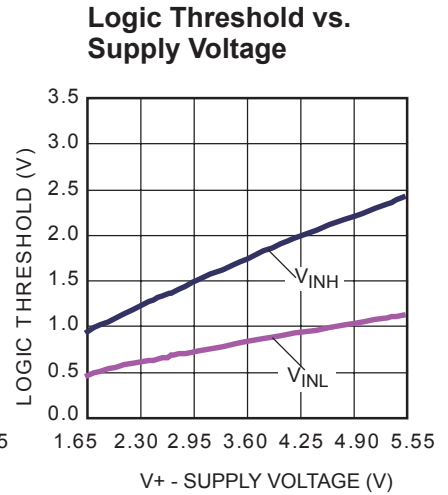
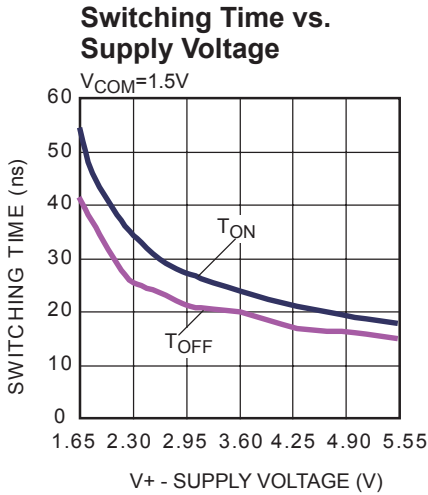
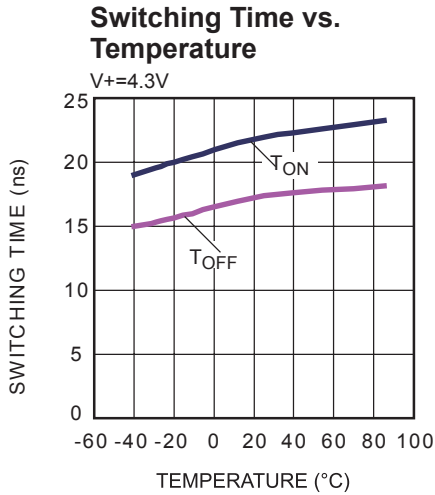
( MP2735DQG) Pin #	( MP2736DQG) Pin #	Name	Description
1	1	V+	Supply Voltage
2	2	NO1	Normally open I/O port of switch1
3	3	COM1	Common I/O port for NC and NO channels of switch1
4	4	IN1	Channel select signal for switch1. IN1 high, NO1 channel is selected. Otherwise, NC1 channel is selected in default. For MP2736, IN1 controls both switch1 and switch2
5	5	NC1	Normally closed I/O port of switch1
6	6	GND	Ground
7	7	NC2	Normally closed I/O port of switch2
8		IN2	Channel select signal for switch2. IN2 high, NO2 channel is selected. Otherwise, NC2 channel is selected in default
	8	$\overline{\text{EN}}$	Enable for two channels, active low
9	9	COM2	Common I/O port for NC and NO channels of switch2
10	10	NO2	Normally open I/O port of switch2

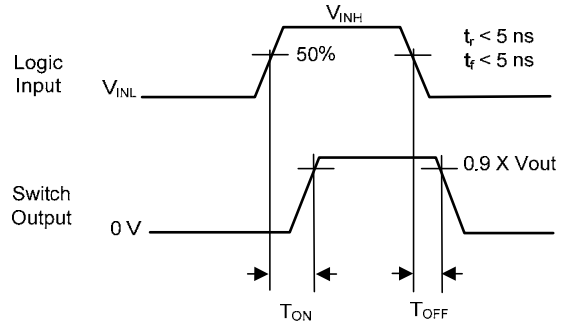
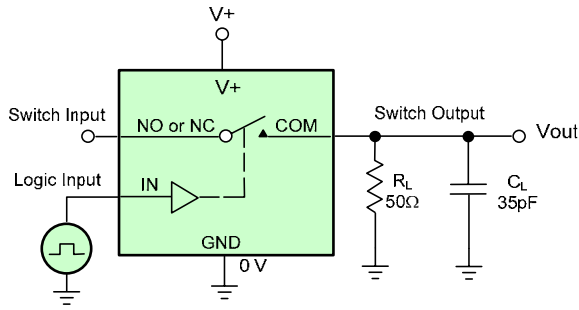
## TYPICAL PERFORMANCE CHARACTERISTICS

$T_A = +25^\circ\text{C}$ , unless otherwise noted.



**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**

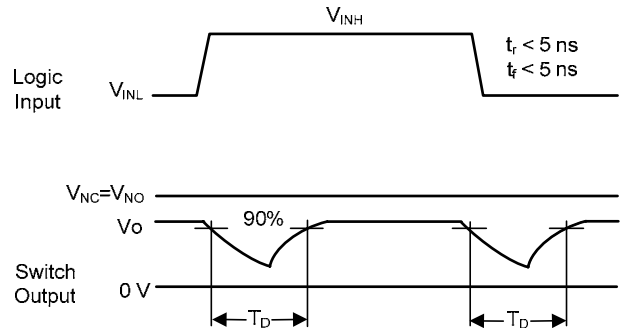
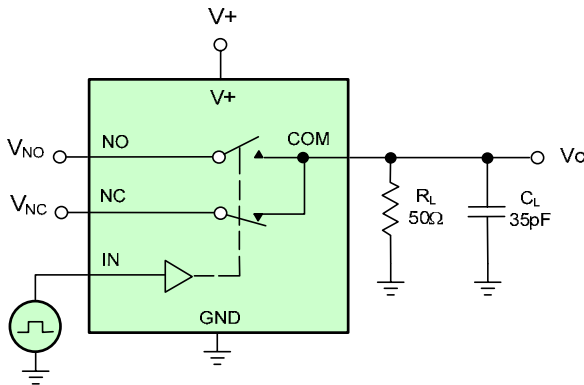
 T<sub>A</sub> = +25°C, unless otherwise noted.


**TEST CIRCUITS**


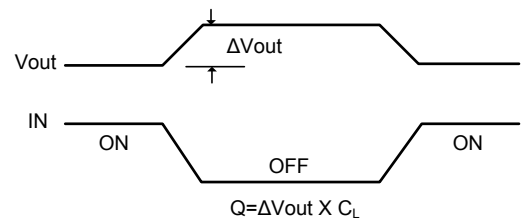
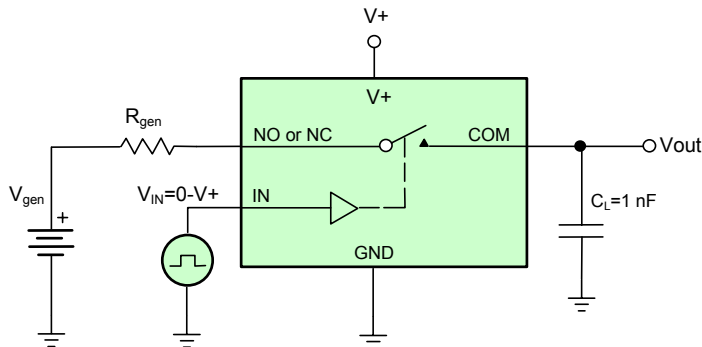
$C_L$  (includes fixture and stray capacitance)

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

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

**Figure 1 — Switching Time**


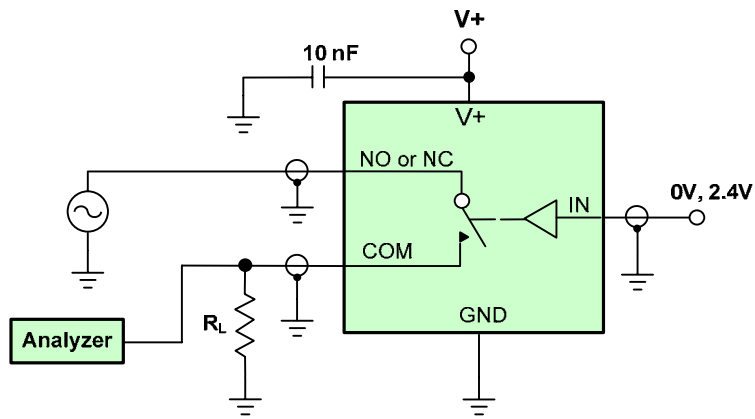
$C_L$  (includes fixture and stray capacitance)

**Figure 2 — Break-Before-Make Interval**


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

**Figure 3 — Charge Injection**





$$\text{Off Isolation} = 20 \log \frac{V_{\text{COM}}}{V_{\text{NO/NC}}}$$

Figure 4 — Off-Isolation

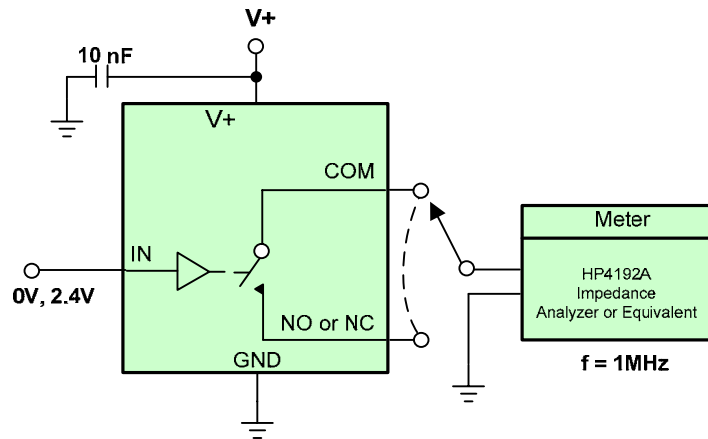
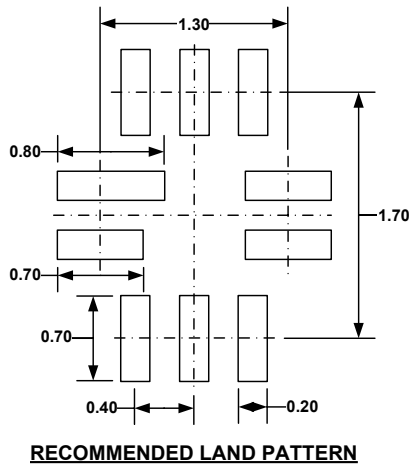
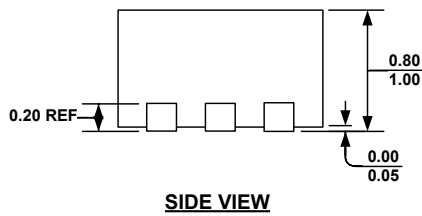
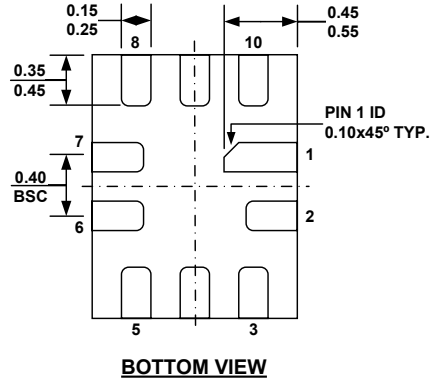
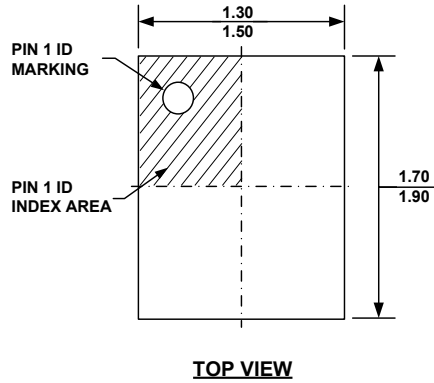


Figure 5 — Channel Off/On Capacitance

## PACKAGE INFORMATION

### PACKAGE OUTLINE DRAWING FOR 10L FCQFN (1.4x1.8mm) MF-PO-D-0084 revision 0.0



**NOTE:**

- 1) ALL DIMENSIONS ARE IN MILLIMETERS.
- 2) EXPOSED PADDLE SIZE DOES NOT INCLUDE MOLD FLASH.
- 3) LEAD COPLANARITY SHALL BE 0.10 MILLIMETER MAX.
- 4) JEDEC REFERENCE IS MO-220.
- 5) DRAWING IS NOT TO SCALE.

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