

## 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  $\overline{\text{EN}}$  pin. All switches are at high impedance mode when the  $\overline{\text{EN}}$  is high.

The MP2735/MP2736 are guaranteed 1.65V logic compatible for  $V_+ < 3.3\text{V}$ , 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 -  $R_{\text{ON}}$ : 0.45Ω at 2.7V
- Fast Switching:  $T_{\text{ON}}$  = 29ns at 2.7V
- $T_{\text{OFF}}$  = 23ns at 2.7V
- Latch-Up Current  $> 300\text{mA}$  (JESD78)
- 1.4mm x 1.8mm QFN10 Package
- ESD Human-Body Model  $\pm 4000\text{V}$

## APPLICATIONS

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

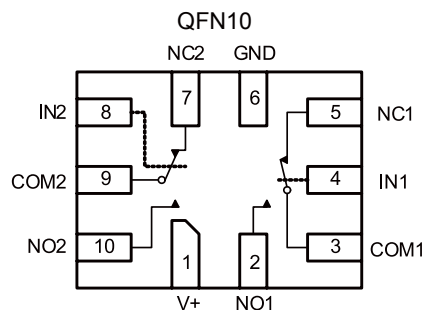
## TRUTH TABLE

|               | IN1/2 | $\overline{\text{EN}}$ | 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    |

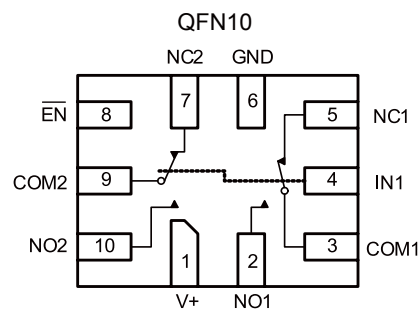
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## FUNCTIONAL BLOCK DIAGRAM PIN CONFIGURATION

**MP2735DQG**



**MP2736DQG**

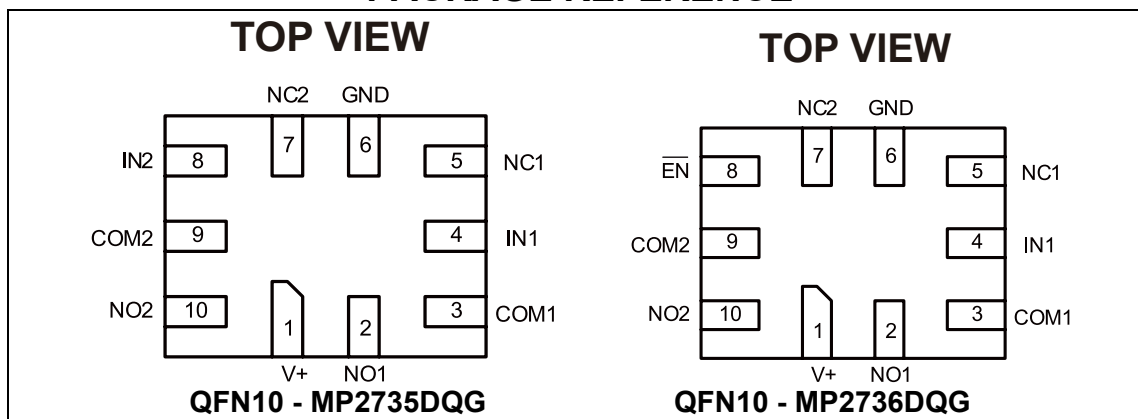


## ORDERING INFORMATION

| Part Number* | Package                 | Top Marking | Free Air Temperature (T <sub>A</sub> ) |
|--------------|-------------------------|-------------|----------------------------------------|
| MP2735DQG    | QFN10<br>(1.4mm x1.8mm) | 2T          | -40°C to +85°C                         |
| MP2736DQG    |                         | 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<sub>+</sub> Supply Voltage .....-0.3V to +6V  
 IN/COM/NC/NO Voltage <sup>(1)</sup> ... -0.3V to V<sub>+</sub> + 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<sub>+</sub> 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 |     |
|----------------------------|--------------------------------------|---------------------------------------------------------------------|---------------------------------|--------------------------|------|-------|-----|
| Analog Switch              |                                      |                                                                     |                                 |                          |      |       |     |
| 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     |                                 |                          | 0.15 |       |     |
| 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  |       |     |
|                            | I <sub>COM(off)</sub>                |                                                                     | 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  |       |     |
| Digital Control            |                                      |                                                                     |                                 |                          |      |       |     |
| 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 |     |
|---------------------------------------|----------------------|--------------------------------------------------------------------------------------------|---------------------------------|------|-----|-------|-----|
| Dynamic Characteristics               |                      |                                                                                            |                                 |      |     |       |     |
| 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 (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 (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                         |                      |                                                                                            |                                 |      | 50  |       | MHz |
| NO, NC Off Capacitance <sup>(4)</sup> | C <sub>NO(off)</sub> | V <sub>IN</sub> =0V, or V+, f=1MHz                                                         |                                 |      | 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 |       |     |
| Power Supply                          |                      |                                                                                            |                                 |      |     |       |     |
| 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:

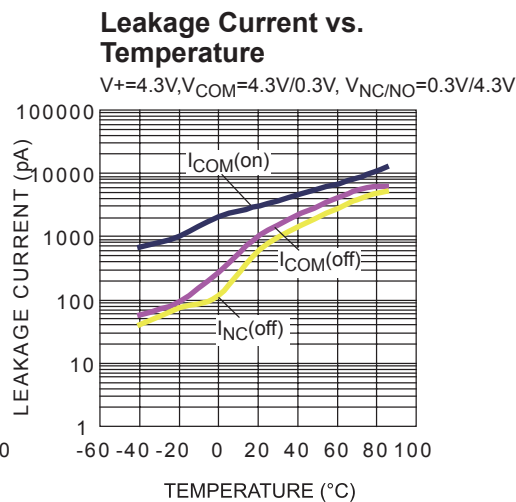
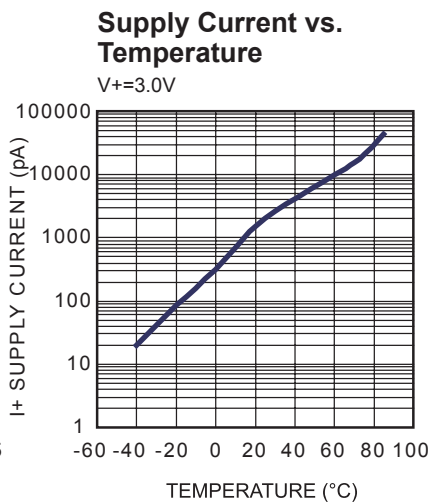
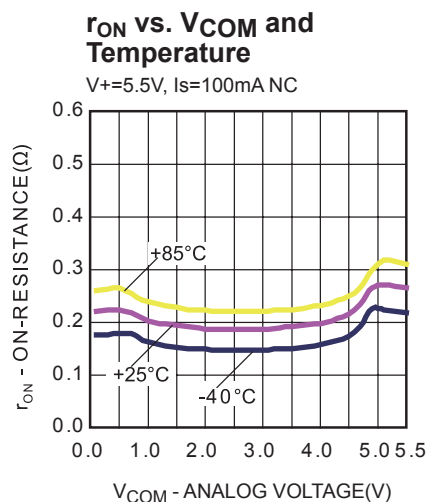
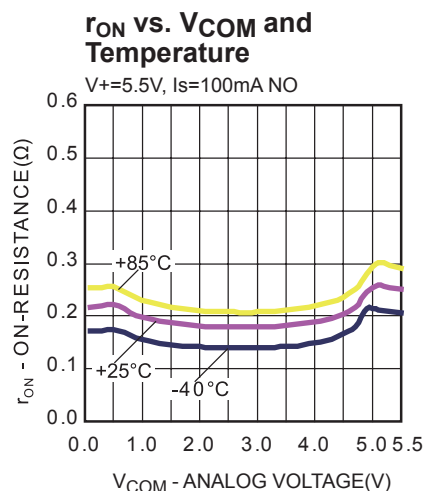
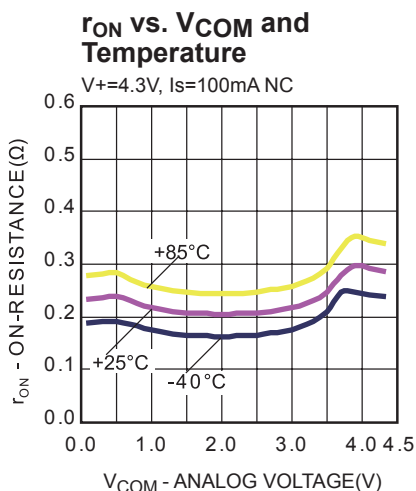
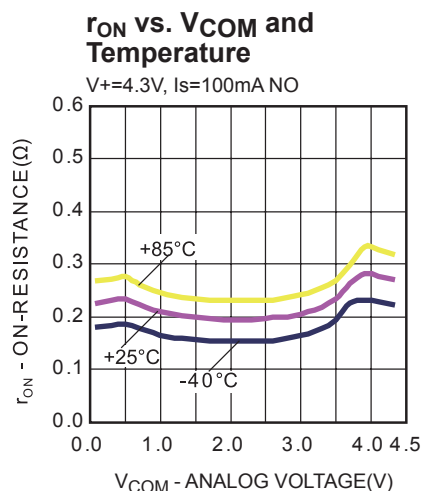
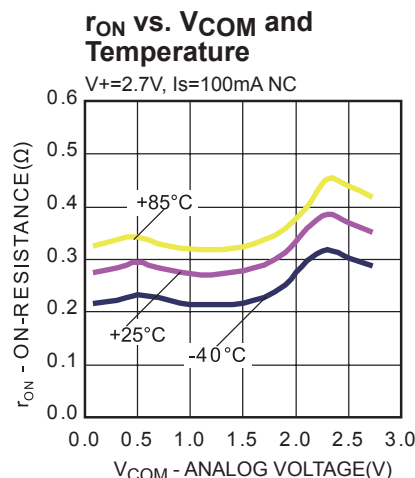
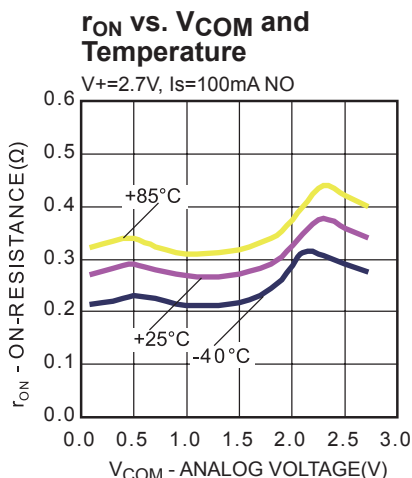
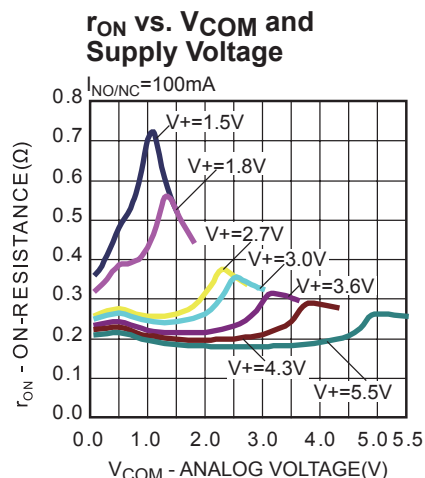
- 4) Guarantee by design, not subjected to production test.

## PIN FUNCTIONS

| ( MP2735DQG)<br>Pin # | ( MP2736DQG)<br>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                                                                                                                                      |

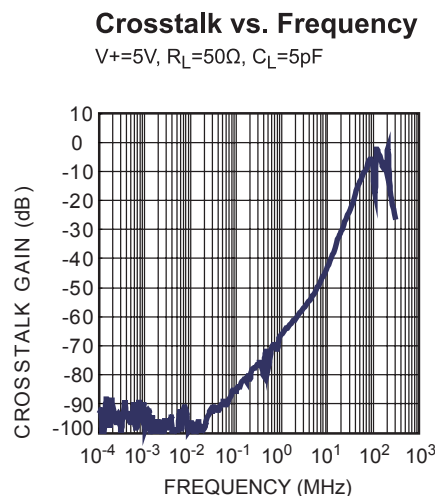
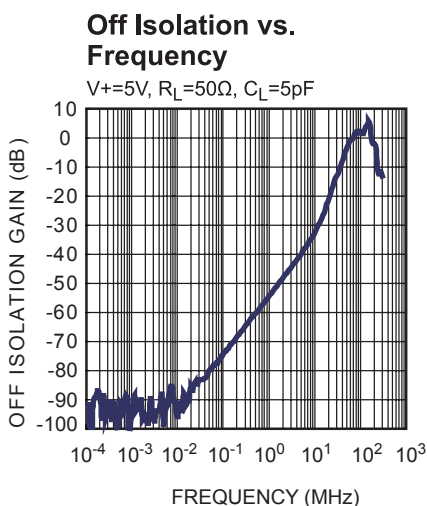
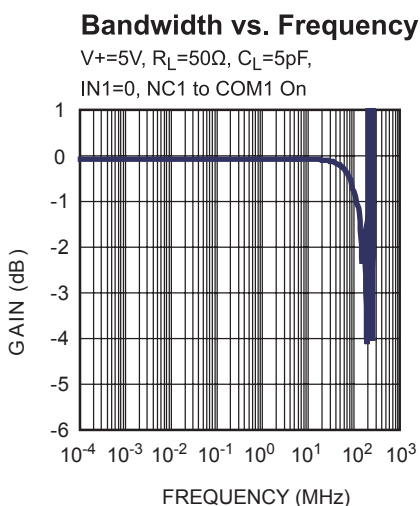
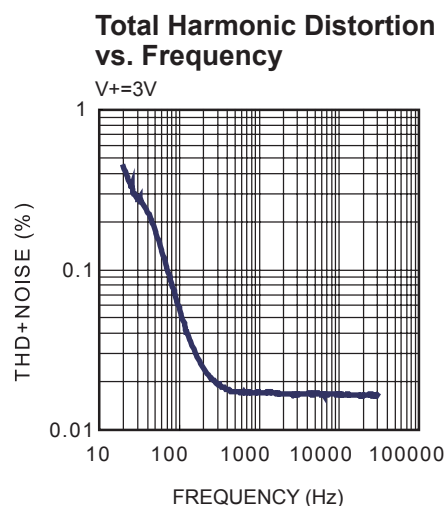
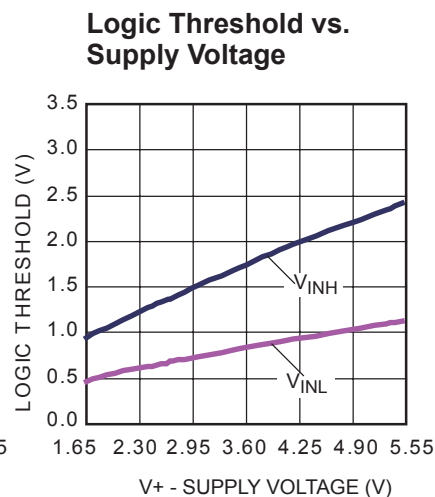
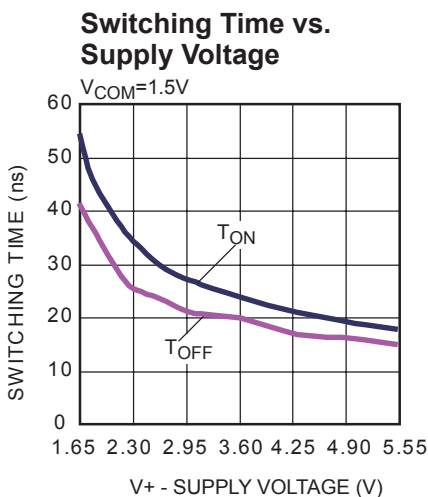
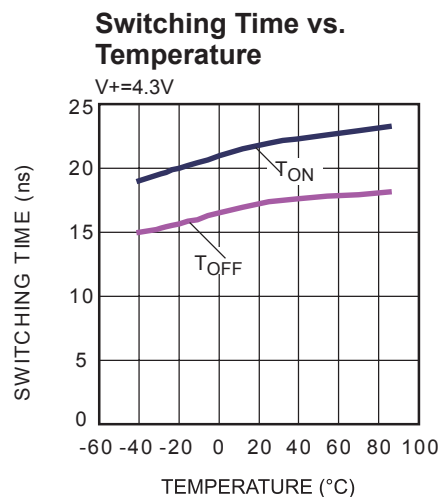
# TYPICAL PERFORMANCE CHARACTERISTICS

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

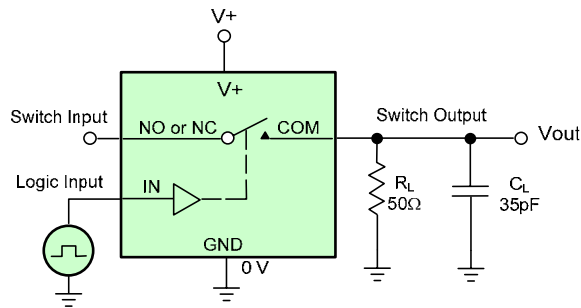


# TYPICAL PERFORMANCE CHARACTERISTICS *(continued)*

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

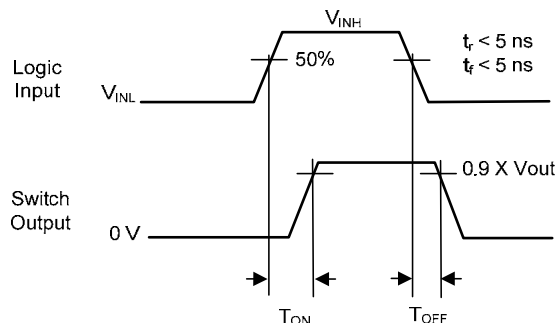


## TEST CIRCUITS



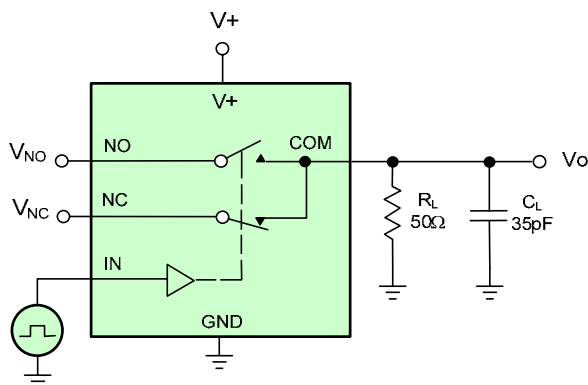
$C_L$  (includes fixture and stray capacitance)

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



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)

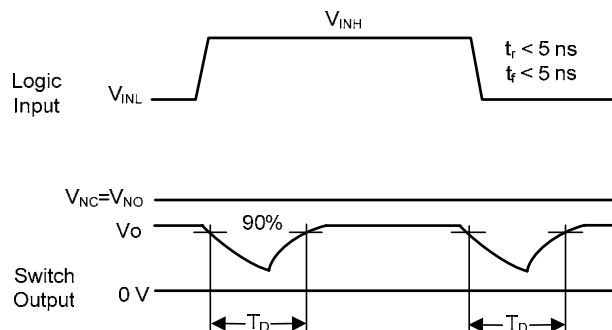
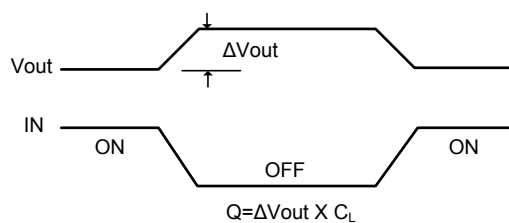
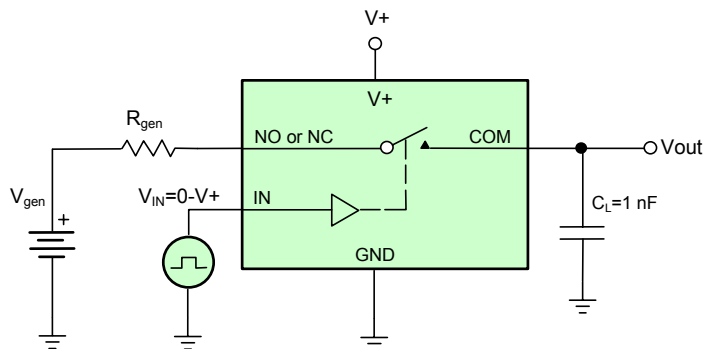
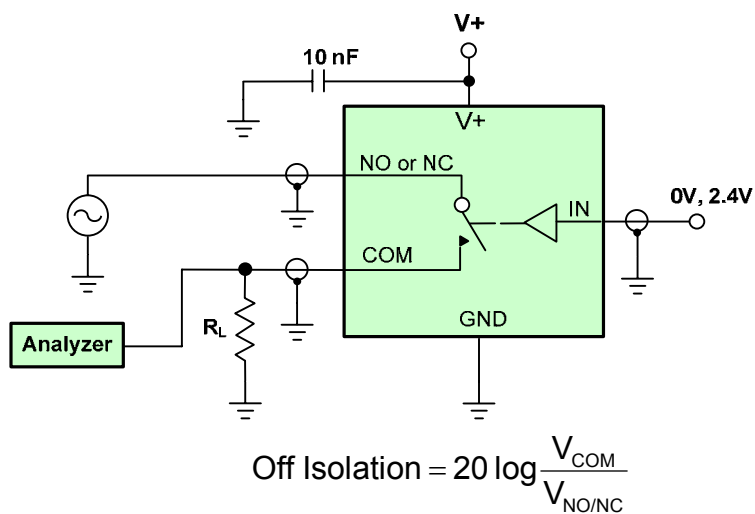


Figure 2 — Break-Before-Make Interval

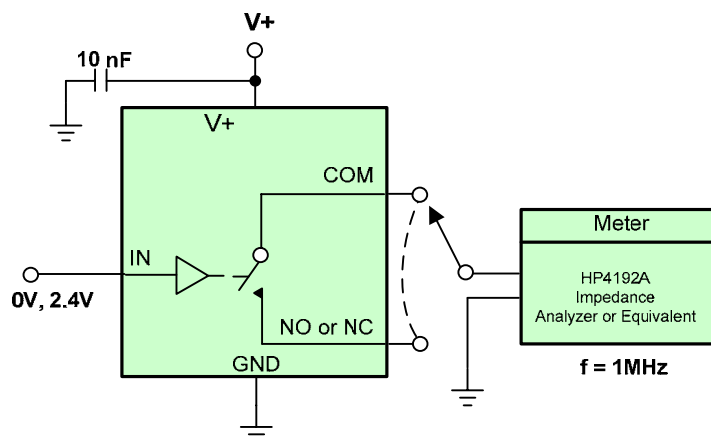


IN depends on switch configuration: input polarity determined by sense of switch.

Figure 3 — Charge Injection



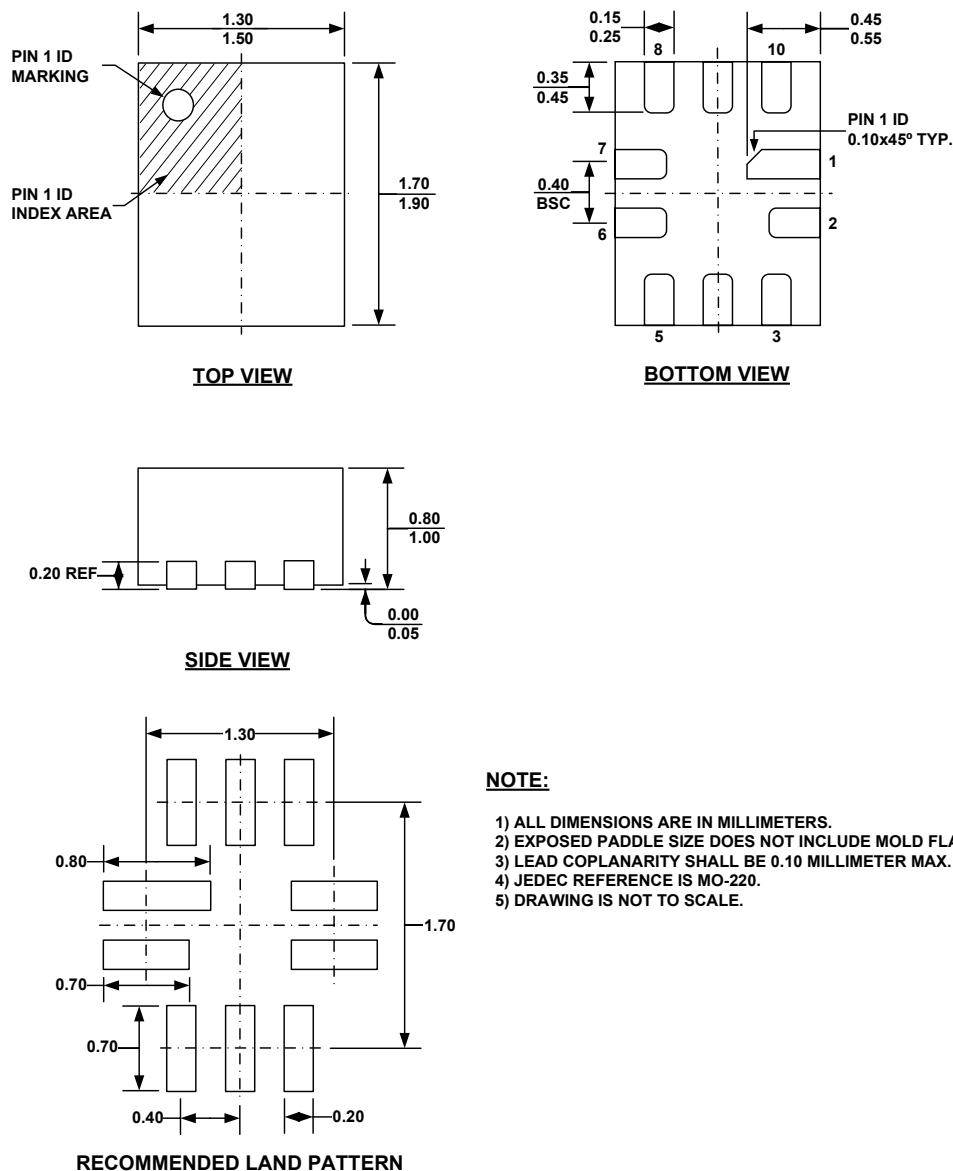
**Figure 4 — Off-Isolation**



**Figure 5 — Channel Off/On Capacitance**

# PACKAGE INFORMATION

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



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## JONHON

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ВЧ соединители, коаксиальные кабели,  
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