

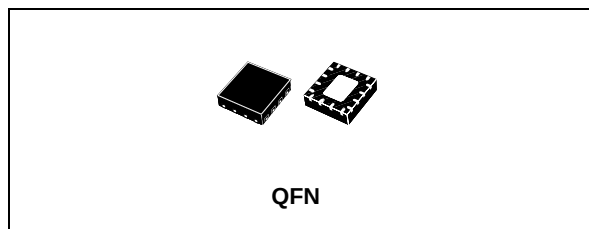
## LOW VOLTAGE 0.5/0.8Ω MAX DUAL SPDT SWITCH WITH BREAK BEFORE MAKE FEATURE

- **HIGH SPEED:**  
 $t_{PD} = 0.3ns$  (TYP.) at  $V_{CC} = 3.0V$   
 $t_{PD} = 0.4ns$  (TYP.) at  $V_{CC} = 2.3V$
- **ULTRA LOW POWER DISSIPATION:**  
 $I_{CC} = 0.2\mu A$  (MAX.) at  $T_A = 85^\circ C$
- **LOW "ON" RESISTANCE  $V_{IN} = 0V$ :**  
 $R_{ON-S1} = 0.5\Omega$  (MAX.  $T_A = 25^\circ C$ ) at  $V_{CC}=2.7V$   
 $R_{ON-S2} = 0.8\Omega$  (MAX.  $T_A = 25^\circ C$ ) at  $V_{CC}=2.7V$
- **WIDE OPERATING VOLTAGE RANGE:**  
 $V_{CC}$  (OPR) = 1.65V to 4.3V SINGLE SUPPLY
- **4.3V TOLERANT AND 1.8V COMPATIBLE THRESHOLD ON DIGITAL CONTROL INPUT** at  $V_{CC} = 2.3$  to  $3.0V$
- **LATCH-UP PERFORMANCE EXCEEDS 300mA (JESD 17)**

### DESCRIPTION

The STG3680 is an high-speed CMOS DUAL ANALOG S.P.D.T. (Single Pole Dual Throw) SWITCH or DUAL 2:1 Multiplexer/Demultiplexer Bus Switch fabricated in silicon gate C<sup>2</sup>MOS technology. It is designed to operate from 1.65V to 4.3V, making this device ideal for portable applications.

It offers very low ON-Resistance (<0.5Ω 1S1 and 2S1 channels; <0.8Ω 1S2 and 2S2 channels) at  $V_{CC}=2.7V$ . The nIN inputs are provided to control the switches. The switches nS1 are ON (they are



### ORDER CODES

| PACKAGE | T & R      |
|---------|------------|
| QFN     | STG3680QTR |

connected to common Ports Dn) when the nIN input is held high and OFF (high impedance state exists between the two ports) when nIN is held low; the switches nS2 are ON (they are connected to common Ports Dn) when the nIN input is held low and OFF (high impedance state exists between the two ports) when IN is held high. Additional key features are fast switching speed, Break Before Make Delay Time and Ultra Low Power Consumption. All inputs and outputs are equipped with protection circuits against static discharge, giving them ESD immunity and transient excess voltage. It's available in the commercial temperature range in the QFN package.

### PIN CONNECTION

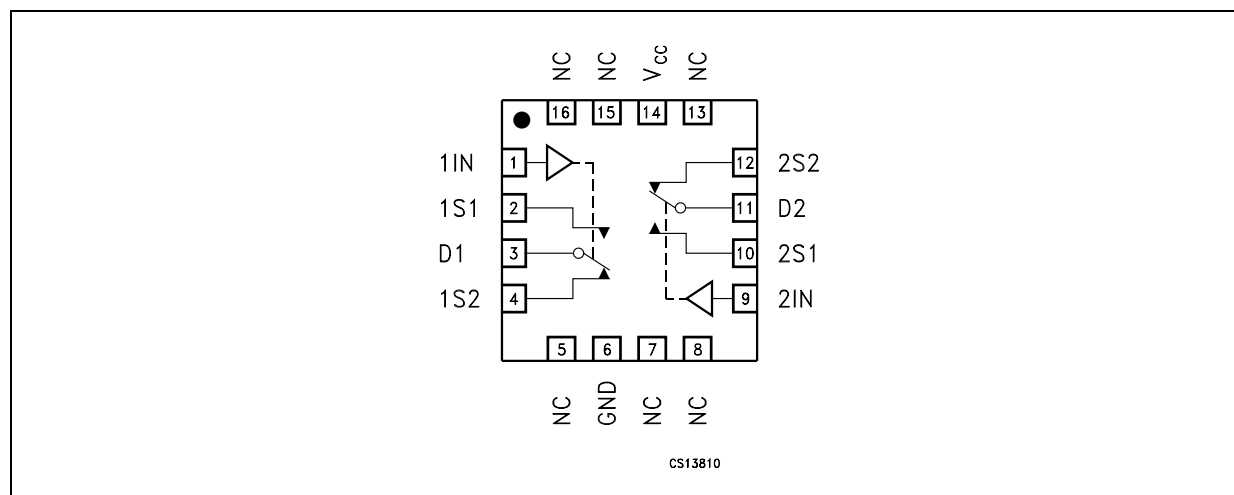




Table 5: DC Specifications

| Symbol             | Parameter                                | Test Conditions        |                                                                | Value                 |      |       |                     |       |                     | Unit |      |
|--------------------|------------------------------------------|------------------------|----------------------------------------------------------------|-----------------------|------|-------|---------------------|-------|---------------------|------|------|
|                    |                                          | V <sub>CC</sub><br>(V) |                                                                | T <sub>A</sub> = 25°C |      |       | -40 to 85°C         |       | -55 to 125°C        |      |      |
|                    |                                          |                        |                                                                | Min.                  | Typ. | Max.  | Min.                | Max.  | Min.                |      | Max. |
| V <sub>IH</sub>    | High Level Input Voltage                 | 1.65-1.95              |                                                                | 0.65V <sub>CC</sub>   |      |       | 0.65V <sub>CC</sub> |       | 0.65V <sub>CC</sub> |      | V    |
|                    |                                          | 2.3-2.5                |                                                                | 1.4                   |      |       | 1.4                 |       | 1.4                 |      |      |
|                    |                                          | 2.7-3.0                |                                                                | 1.4                   |      |       | 1.4                 |       | 1.4                 |      |      |
|                    |                                          | 3.3                    |                                                                | 1.5                   |      |       | 1.5                 |       | 1.5                 |      |      |
|                    |                                          | 3.6                    |                                                                | 1.7                   |      |       | 1.7                 |       | 1.7                 |      |      |
|                    |                                          | 4.3                    |                                                                | 2.2                   |      |       | 2.2                 |       | 2.2                 |      |      |
| V <sub>IL</sub>    | Low Level Input Voltage                  | 1.65-1.95              |                                                                |                       |      | 0.40  |                     | 0.40  |                     | 0.40 | V    |
|                    |                                          | 2.3-2.5                |                                                                |                       |      | 0.50  |                     | 0.50  |                     | 0.50 |      |
|                    |                                          | 2.7-3.6                |                                                                |                       |      | 0.50  |                     | 0.50  |                     | 0.50 |      |
|                    |                                          | 3.3                    |                                                                |                       |      | 0.50  |                     | 0.50  |                     | 0.50 |      |
|                    |                                          | 3.6                    |                                                                |                       |      | 0.50  |                     | 0.50  |                     | 0.50 |      |
|                    |                                          | 4.3                    |                                                                |                       |      | 1.3   |                     | 1.3   |                     | 1.3  |      |
| R <sub>ON-S1</sub> | Switch ON-S1 Resistance (1)              | 4.3                    | V <sub>S</sub> =0V to V <sub>CC</sub><br>I <sub>S</sub> =100mA |                       |      | 0.80  |                     | 0.80  |                     |      | Ω    |
|                    |                                          | 3.0                    |                                                                |                       |      | 0.80  |                     | 0.80  |                     |      |      |
|                    |                                          | 2.7                    |                                                                |                       |      | 0.80  |                     | 0.80  |                     |      |      |
|                    |                                          | 2.3                    |                                                                |                       |      | 2     |                     | 2     |                     |      |      |
|                    |                                          | 1.8                    |                                                                |                       |      | 4.0   |                     | 5.0   |                     |      |      |
|                    |                                          | 1.65                   |                                                                |                       |      | 4.0   |                     | 5.0   |                     |      |      |
| R <sub>ON-S2</sub> | Switch ON-S2 Resistance (1)              | 4.3                    | V <sub>S</sub> =0V to V <sub>CC</sub><br>I <sub>S</sub> =100mA |                       | 0.40 | 0.50  |                     | 0.60  |                     |      | Ω    |
|                    |                                          | 3.0                    |                                                                |                       | 0.40 | 0.50  |                     | 0.60  |                     |      |      |
|                    |                                          | 2.7                    |                                                                |                       | 0.40 | 0.50  |                     | 0.60  |                     |      |      |
|                    |                                          | 2.3                    |                                                                |                       | 0.50 | 0.80  |                     | 0.80  |                     |      |      |
|                    |                                          | 1.8                    |                                                                |                       | 0.70 | 3.0   |                     | 4.0   |                     |      |      |
|                    |                                          | 1.65                   |                                                                |                       | 0.80 | 3.0   |                     | 4.0   |                     |      |      |
| ΔR <sub>ON</sub>   | ON Resist. Match between channels (1, 2) | 2.7                    | V <sub>S</sub> =1.5V<br>I <sub>S</sub> =100mA                  |                       | 0.06 |       |                     |       |                     |      | Ω    |
| R <sub>FLAT</sub>  | ON Resistance FLATNESS (3)               | 4.3                    | V <sub>S</sub> =1.5V<br>I <sub>S</sub> =100mA                  |                       |      |       |                     |       |                     |      | Ω    |
|                    |                                          | 3.0                    |                                                                |                       |      |       |                     |       |                     |      |      |
|                    |                                          | 2.7                    |                                                                |                       | 0.07 | 0.15  |                     | 0.15  |                     |      |      |
|                    |                                          | 2.3                    |                                                                |                       |      |       |                     |       |                     |      |      |
|                    |                                          | 1.65                   | V <sub>S</sub> =0.8V<br>I <sub>S</sub> =100mA                  |                       |      |       |                     |       |                     |      |      |
| I <sub>OFF</sub>   | OFF State Leakage Current (nSn), (Dn)    | 4.3                    | V <sub>S</sub> =0.3 or 4V                                      |                       |      | ±10   |                     | ± 100 |                     |      | nA   |
| I <sub>IN</sub>    | Input Leak. Current                      | 0 - 4.3                | V <sub>IN</sub> = 0 to 3.6V                                    |                       |      | ±0.1  |                     | ± 1   |                     |      | μA   |
| I <sub>CC</sub>    | Quiescent Supply Current (1)             | 1.65-4.3               | V <sub>IN</sub> =V <sub>CC</sub> or GND                        |                       |      | ±0.05 |                     | ±0.2  |                     | ±1   | μA   |

Note 1: Guaranteed by design

Note 2: ΔR<sub>ON</sub> = R<sub>ON(MAX)</sub> - R<sub>ON(MIN)</sub>

Note 3: Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal ranges.

**Table 6: AC Electrical Characteristics** ( $C_L = 35\text{pF}$ ,  $R_L = 50\Omega$ ,  $t_r = t_f \leq 5\text{ns}$ )

| Symbol                              | Parameter                    | Test Condition         |                                                                      | Value                 |      |      |             |      |              |      |  | Unit |
|-------------------------------------|------------------------------|------------------------|----------------------------------------------------------------------|-----------------------|------|------|-------------|------|--------------|------|--|------|
|                                     |                              | V <sub>CC</sub><br>(V) |                                                                      | T <sub>A</sub> = 25°C |      |      | -40 to 85°C |      | -55 to 125°C |      |  |      |
|                                     |                              |                        |                                                                      | Min.                  | Typ. | Max. | Min.        | Max. | Min.         | Max. |  |      |
| t <sub>PLH</sub> , t <sub>PHL</sub> | Propagation Delay            | 1.65-1.95              | V <sub>I</sub> =OPEN                                                 |                       | 0.45 |      |             |      |              |      |  | ns   |
|                                     |                              | 2.3-2.7                |                                                                      |                       | 0.40 |      |             |      |              |      |  |      |
|                                     |                              | 3.0-3.6                |                                                                      |                       | 0.30 |      |             |      |              |      |  |      |
|                                     |                              | 3.6-4.3                |                                                                      |                       | 0.30 |      |             |      |              |      |  |      |
| t <sub>ON</sub>                     | TURN-ON time                 | 1.65-1.95              | V <sub>S</sub> =0.8V                                                 |                       | 70   |      |             |      |              |      |  | ns   |
|                                     |                              | 2.3-2.7                | V <sub>S</sub> =1.5V                                                 |                       | 30   | 50   |             | 60   |              |      |  |      |
|                                     |                              | 3.0-3.6                | V <sub>S</sub> =1.5V                                                 |                       | 30   | 50   |             | 60   |              |      |  |      |
|                                     |                              | 3.6-4.3                | V <sub>S</sub> =1.5V                                                 |                       | 30   | 50   |             | 60   |              |      |  |      |
| t <sub>OFF</sub>                    | TURN-OFF time                | 1.65-1.95              | V <sub>S</sub> =0.8V                                                 |                       | 45   |      |             |      |              |      |  | ns   |
|                                     |                              | 2.3-2.7                | V <sub>S</sub> =1.5V                                                 |                       | 25   | 30   |             | 40   |              |      |  |      |
|                                     |                              | 3.0-3.6                | V <sub>S</sub> =1.5V                                                 |                       | 25   | 30   |             | 40   |              |      |  |      |
|                                     |                              | 3.6-4.3                | V <sub>S</sub> =1.5V                                                 |                       | 25   | 30   |             | 40   |              |      |  |      |
| t <sub>D</sub>                      | Break Before Make Time Delay | 1.65-1.95              | C <sub>L</sub> =35pF<br>R <sub>L</sub> = 50Ω<br>V <sub>S</sub> =1.5V |                       |      |      |             |      |              |      |  | ns   |
|                                     |                              | 2.3-2.7                |                                                                      | 2                     | 15   |      |             |      |              |      |  |      |
|                                     |                              | 3.0-3.6                |                                                                      | 2                     | 15   |      |             |      |              |      |  |      |
|                                     |                              | 3.6-4.3                |                                                                      | 2                     | 15   |      |             |      |              |      |  |      |
| Q                                   | Charge injection             | 1.65-1.95              | C <sub>L</sub> = 100pF                                               |                       |      |      |             |      |              |      |  | pC   |
|                                     |                              | 2.3-2.7                | R <sub>L</sub> = 1MΩ                                                 |                       | 200  |      |             |      |              |      |  |      |
|                                     |                              | 3.0-3.6                | V <sub>GEN</sub> = 0V                                                |                       | 200  |      |             |      |              |      |  |      |
|                                     |                              | 3.6-4.3                | R <sub>GEN</sub> = 0Ω                                                |                       | 200  |      |             |      |              |      |  |      |

**Table 7: Analog Switch Characteristics** ( $C_L = 5\text{pF}$ ,  $R_L = 50\Omega$ ,  $T_A = 25^\circ\text{C}$ )

| Symbol          | Parameter                                 | Test Condition         |                                                                                 | Value                 |      |      |             |      |              |      |     | Unit |
|-----------------|-------------------------------------------|------------------------|---------------------------------------------------------------------------------|-----------------------|------|------|-------------|------|--------------|------|-----|------|
|                 |                                           | V <sub>CC</sub><br>(V) |                                                                                 | T <sub>A</sub> = 25°C |      |      | -40 to 85°C |      | -55 to 125°C |      |     |      |
|                 |                                           |                        |                                                                                 | Min.                  | Typ. | Max. | Min.        | Max. | Min.         | Max. |     |      |
| OIRR            | Off Isolation (1)                         | 1.65-4.3               | V <sub>S</sub> = 1V <sub>RMS</sub><br>f= 100KHz                                 |                       | -64  |      |             |      |              |      | dB  |      |
| Xtalk           | Crosstalk                                 | 1.65-4.3               | V <sub>S</sub> = 1V <sub>RMS</sub><br>f= 100KHz                                 |                       | -54  |      |             |      |              |      | dB  |      |
| THD             | Total Harmonic Distortion                 | 2.3-4.3                | R <sub>L</sub> = 600Ω<br>V <sub>IN</sub> = 2V <sub>PP</sub><br>f= 20Hz to 20kHz |                       | 0.03 |      |             |      |              |      | %   |      |
| BW              | -3dB Bandwidth                            | 1.65-4.3               | R <sub>L</sub> = 50Ω                                                            |                       | 50   |      |             |      |              |      | MHz |      |
| C <sub>IN</sub> | Control Pin Input Capacitance             |                        |                                                                                 |                       | 5    |      |             |      |              |      | pF  |      |
| C <sub>Sn</sub> | Sn Port Capacitance                       | 3.3                    | f= 1MHz                                                                         |                       | 37   |      |             |      |              |      |     |      |
| C <sub>D</sub>  | D Port Capacitance when Switch is Enabled | 3.3                    | f= 1MHz                                                                         |                       | 84   |      |             |      |              |      |     |      |

Note 1: Off Isolation =  $20\text{Log}_{10}(V_D/V_S)$ ,  $V_D$  = output.  $V_S$  = input at off switch

Figure 2: ON Resistance

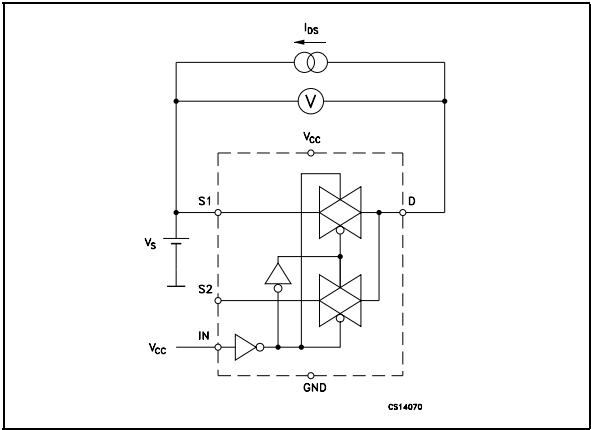


Figure 5: Bandwidth

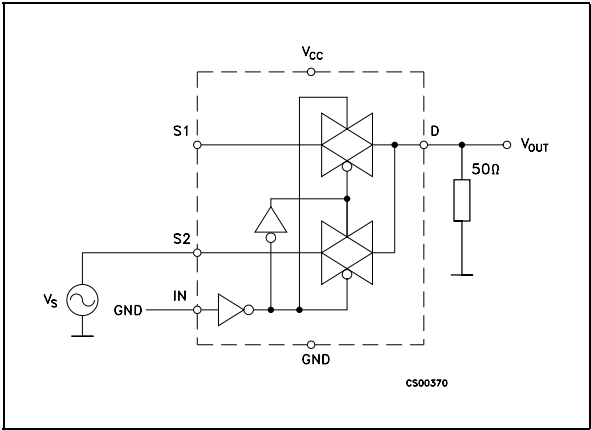


Figure 3: OFF Leakage

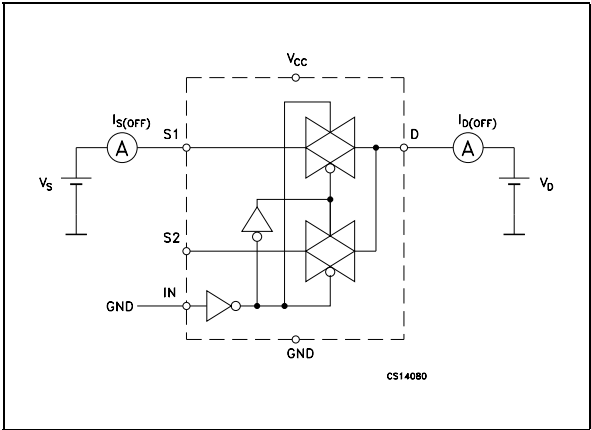


Figure 6: Channel To Channel Crosstalk

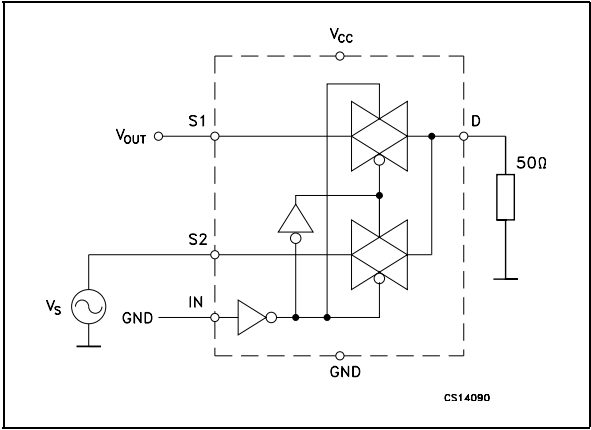


Figure 4: OFF Isolation

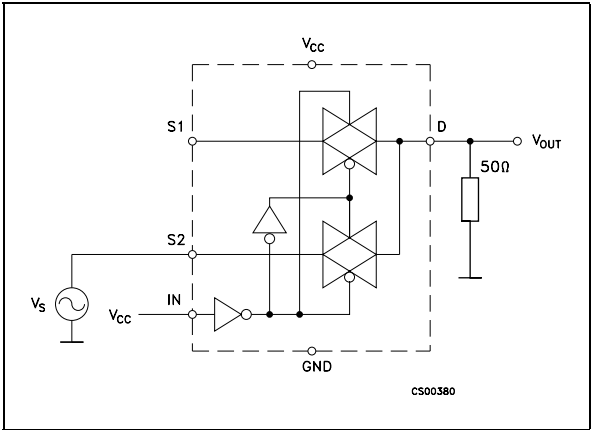
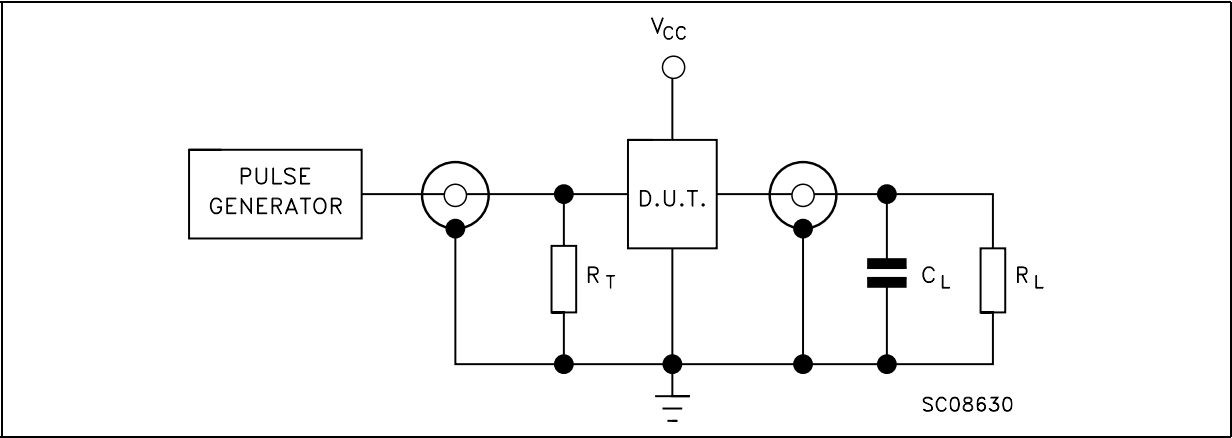


Figure 7: Test Circuit



$C_L = 5/35\text{pF}$  or equivalent (includes jig and probe capacitance)  
 $R_L = 50\Omega$  or equivalent  
 $R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

Figure 8: Break Before Make Time Delay

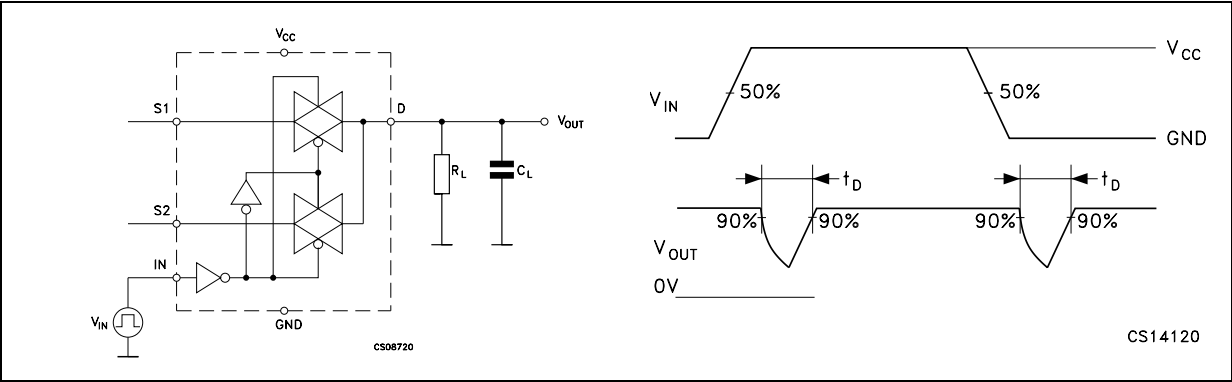


Figure 9: Charge Injection ( $V_{GEN}=0\text{V}$ ,  $R_{GEN}=0\Omega$ ,  $R_L=1\text{M}\Omega$ ,  $C_L=100\text{pF}$ )

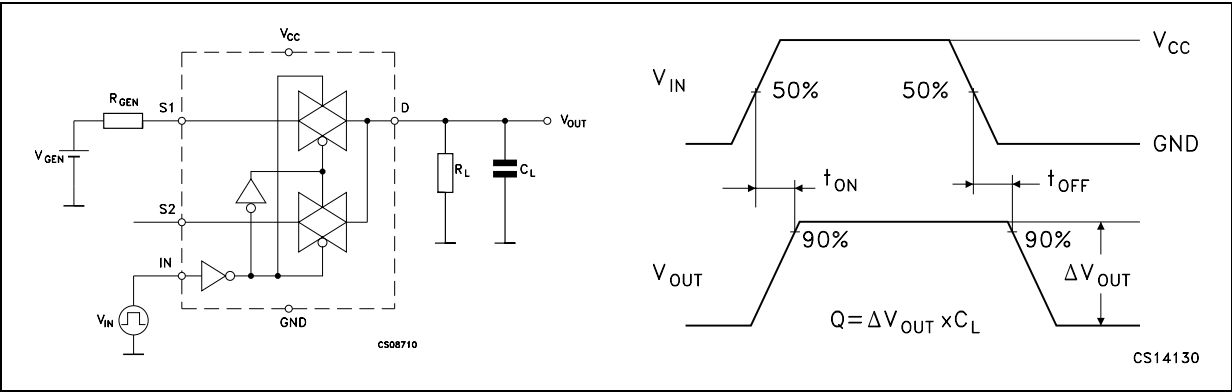
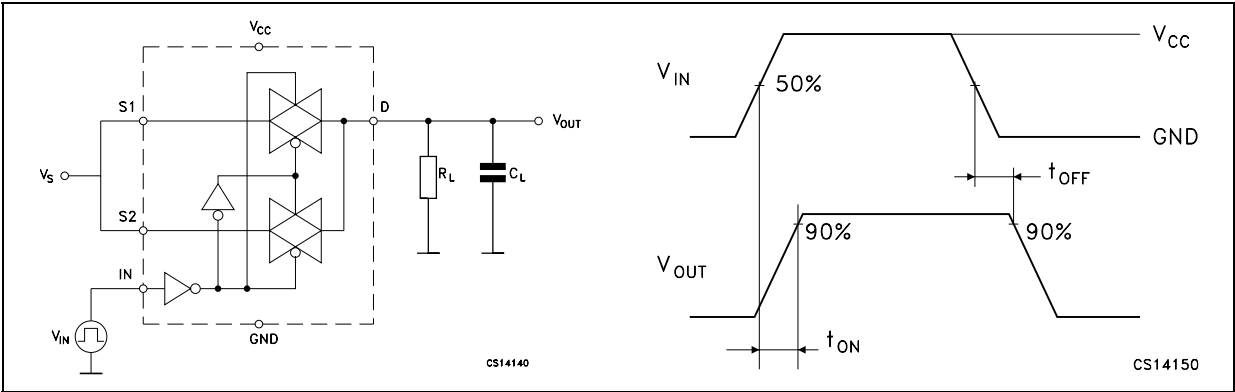
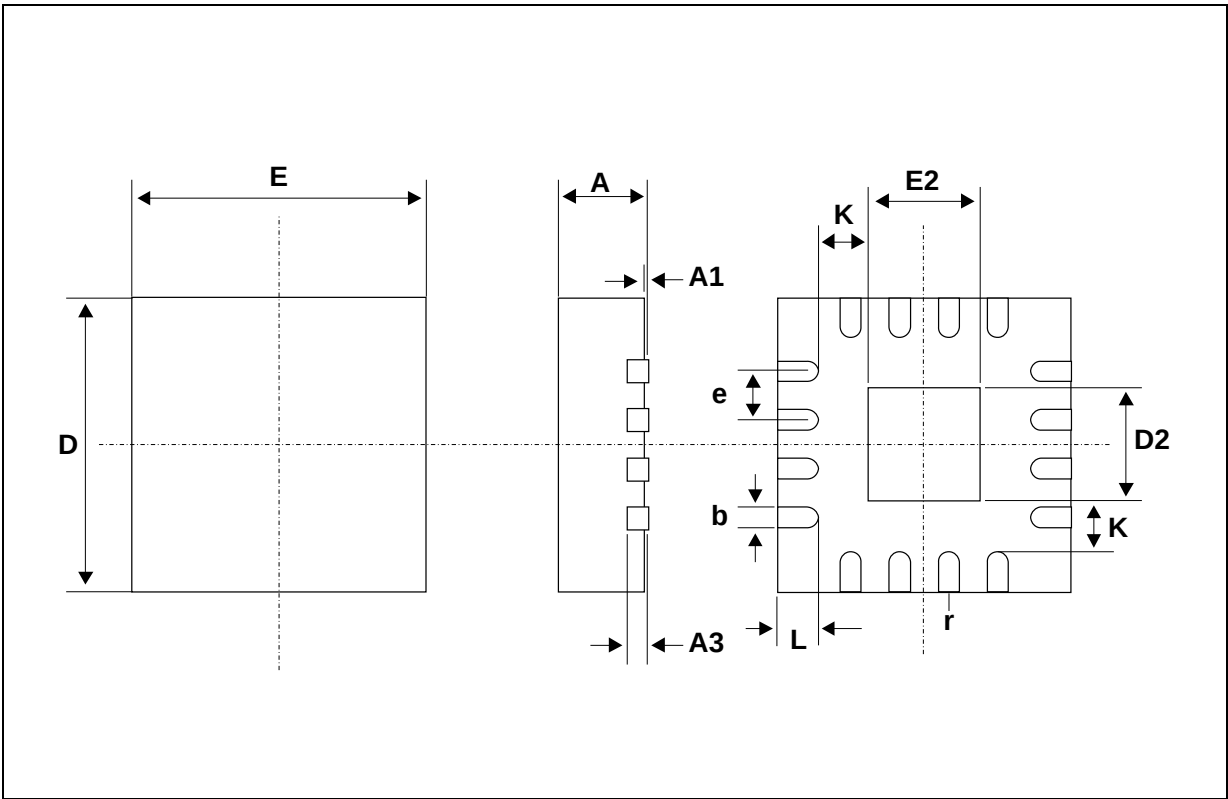


Table 8: Turn ON, Turn OFF Delay Time



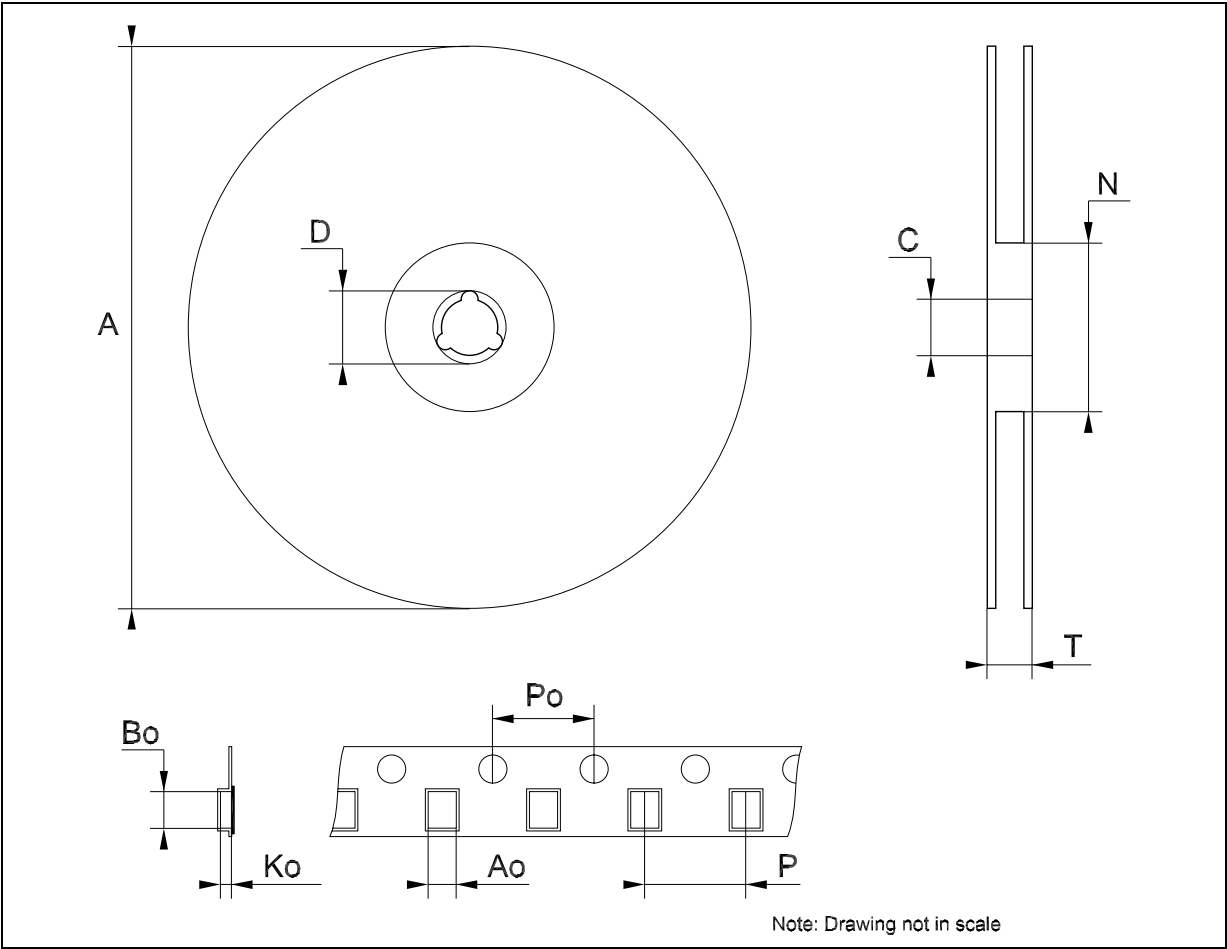
QFN16 (3x3) MECHANICAL DATA

| DIM. | mm.  |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP  | MAX. | MIN.  | TYP.  | MAX.  |
| A    | 0.80 | 0.90 | 1.00 | 0.032 | 0.035 | 0.039 |
| A1   |      | 0.02 | 0.05 |       | 0.001 | 0.002 |
| A3   |      | 0.20 |      |       | 0.008 |       |
| b    | 0.18 | 0.25 | 0.30 | 0.007 | 0.010 | 0.012 |
| D    |      | 3.00 |      |       | 0.118 |       |
| D2   | 1.55 | 1.70 | 1.80 | 0.061 | 0.067 | 0.071 |
| E    |      | 3.00 |      |       | 0.118 |       |
| E2   | 1.55 | 1.70 | 1.80 | 0.061 | 0.067 | 0.071 |
| e    |      | 0.50 |      |       | 0.020 |       |
| K    |      | 0.20 |      |       | 0.008 |       |
| L    | 0.30 | 0.40 | 0.50 | 0.012 | 0.016 | 0.020 |
| r    | 0.09 |      |      | 0.006 |       |       |



Tape & Reel QFNxx/DFNxx (3x3) MECHANICAL DATA

| DIM. | mm.  |     |      | inch  |       |        |
|------|------|-----|------|-------|-------|--------|
|      | MIN. | TYP | MAX. | MIN.  | TYP.  | MAX.   |
| A    |      |     | 330  |       |       | 12.992 |
| C    | 12.8 |     | 13.2 | 0.504 |       | 0.519  |
| D    | 20.2 |     |      | 0.795 |       |        |
| N    | 60   |     |      | 2.362 |       |        |
| T    |      |     | 18.4 |       |       | 0.724  |
| Ao   |      | 3.3 |      |       | 0.130 |        |
| Bo   |      | 3.3 |      |       | 0.130 |        |
| Ko   |      | 1.1 |      |       | 0.043 |        |
| Po   |      | 4   |      |       | 0.157 |        |
| P    |      | 8   |      |       | 0.315 |        |



**Table 9: Revision History**

| Date        | Revision | Description of Changes                                                       |
|-------------|----------|------------------------------------------------------------------------------|
| 17-May-2004 | 3        | Characteristics at $V_{CC} = 4.3\text{ V}$ Added on Tables 3, 4, 5, 6 and 7. |

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