

LOW VOLTAGE 0.5Ω MAX DUAL SPDT SWITCH WITH BREAK BEFORE MAKE

- LOW QUIESCENT SUPPLY CURRENT:
±33μA FOR V_{1-2IN} , $V_{3-4IN} = 1.8V$ at $V_{CC} = 4.3V$
- ULTRA LOW POWER DISSIPATION:
 $I_{CC} = 0.2μA$ (MAX.) at $T_A = 85°C$
- LOW "ON" RESISTANCE $V_{IN} = 0V$:
 $R_{ON} = 0.5Ω$ (MAX. $T_A = 25°C$) at $V_{CC} = 2.7V$
 $R_{ON} = 0.8Ω$ (MAX. $T_A = 25°C$) at $V_{CC} = 2.3V$
 $R_{ON} = 1.2Ω$ (MAX. $T_A = 25°C$) at $V_{CC} = 1.8V$
- 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 4.3V
- LATCH-UP PERFORMANCE EXCEEDS 300mA (JESD 17)

DESCRIPTION

The STG3684A 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 C²MOS 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) at $V_{CC}=3.0V$. The n_{IN} inputs are provided to control the switches. The switches $nS1$ are ON (they are connected to common Ports D_n) when the n_{IN}

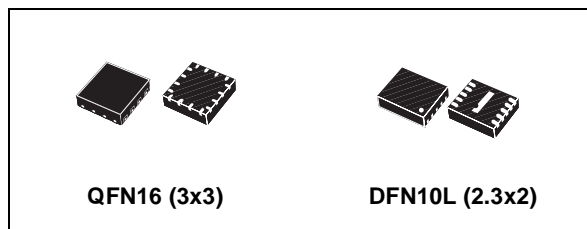


Table 1: Order Codes

PACKAGE	T & R
QFN16	STG3684AQTR
DFN10L	STG3684ADTR

input is held high and OFF (high impedance state exists between the two ports) when n_{IN} is held low; the switches $nS2$ are ON (they are connected to common Ports D_n) when the n_{IN} 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 QFN16 3x3mm and DFN10L 2.3x2mm packages.

Figure 1: Pin Connection

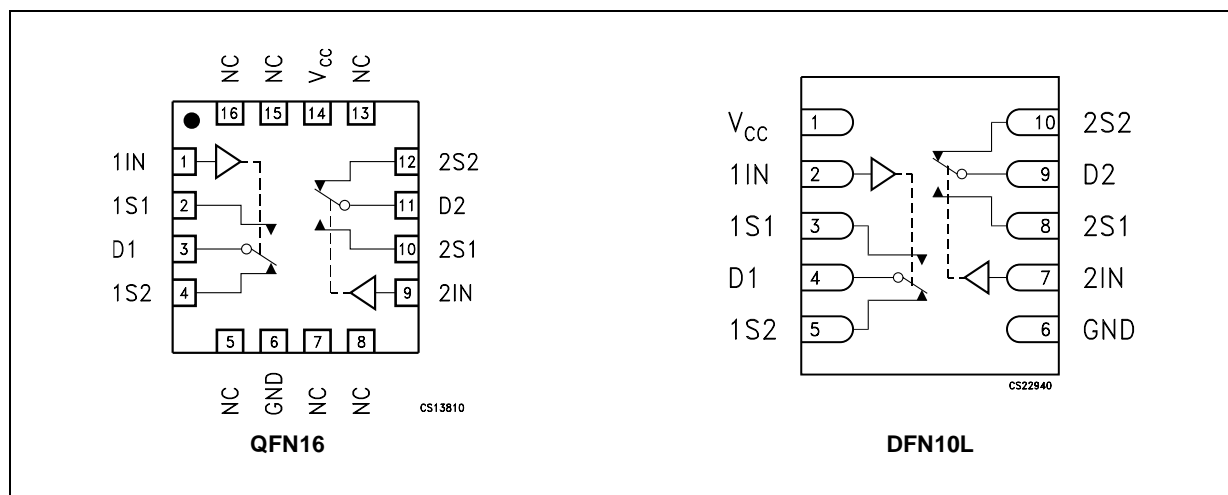


Figure 2: Input Equivalent Circuit

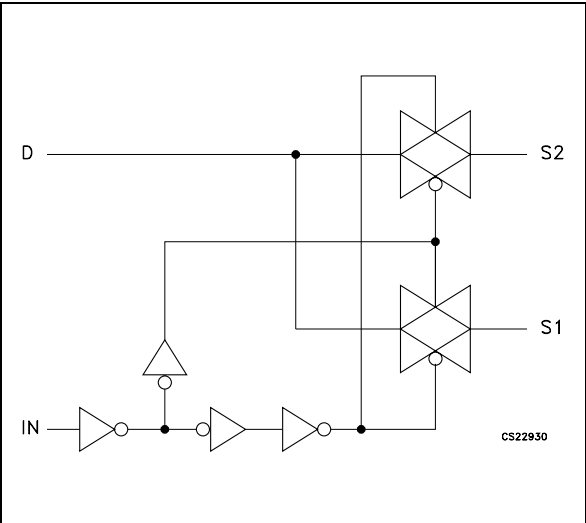


Table 2: Pin Description

QFN16 ⁽¹⁾ PIN N°	DFN10L ⁽¹⁾ PIN N°	SYMBOL	NAME AND FUNCTION
1, 9	2, 7	1IN, 2IN	Controls
2, 10 4, 12	3, 8 5, 10	1S1 to 2S1 1S2 to 2S2	Independent Channels
3, 11	4, 9	D1, D2	Common Channels
5,7,8, 13,15,16	-	NC	Not Connected
6	6	GND	Ground (0V)
14	1	V _{CC}	Positive Supply Volt.

1. Exposed pad must be soldered to a floating plane. Do NOT connect to power or ground.

Table 3: Truth Table

IN	SWITCH S1	SWITCH S2
H	ON	OFF(*)
L	OFF(*)	ON

(*) High Impedance

Table 4: Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V _{CC}	Supply Voltage	-0.5 to 5.5	V
V _I	DC Input Voltage	-0.5 to V _{CC} + 0.5	V
V _{IC}	DC Control Input Voltage	-0.5 to 5.5	V
V _O	DC Output Voltage	-0.5 to V _{CC} + 0.5	V
I _{IKC}	DC Input Diode Current on control pin (V _{IN} < 0V)	- 50	mA
I _{IK}	DC Input Diode Current (V _{IN} < 0V)	± 50	mA
I _{OK}	DC Output Diode Current	± 20	mA
I _O	DC Output Current	± 300	mA
I _{OP}	DC Output Current Peak (pulse at 1ms, 10% duty cycle)	± 500	mA
I _{CC} or I _{GND}	DC V _{CC} or Ground Current	± 100	mA
P _D	Power Dissipation at T _a =70°C (1)	1120	mW
T _{stg}	Storage Temperature	-65 to 150	°C
T _L	Lead Temperature (10 sec)	300	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

(1) Derate above 70°C: by 18.5mW/°C.

Table 5: Recommended Operating Conditions

Symbol	Parameter	Value	Unit
V _{CC}	Supply Voltage (note 1)	1.65 to 4.3	V
V _I	Input Voltage	0 to V _{CC}	V
V _{IC}	Control Input Voltage	0 to 4.3	V
V _O	Output Voltage	0 to V _{CC}	V
T _{op}	Operating Temperature	-55 to 125	°C
dt/dv	Input Rise and Fall Time Control Input	V _{CC} = 1.65V to 2.7V	0 to 20
		V _{CC} = 3.0V to 4.3V	0 to 10

1) Truth Table guaranteed: 1.2V to 4.3V.



Table 6: DC Specifications

Symbol	Parameter	Test Conditions		Value						Unit	
		V _{CC} (V)		T _A = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
V _{IH}	High Level Input Voltage	1.65-1.95		0.65V _{CC}			0.65V _{CC}		0.65V _{CC}		V
		2.3-2.5		1.2			1.2		1.2		
		2.7-3.0		1.3			1.3		1.3		
		3.0-3.6		1.4			1.4		1.4		
		4.3		1.5			1.5		1.5		
V _{IL}	Low Level Input Voltage	1.65-1.95				0.25		0.25		0.25	V
		2.3-2.5				0.25		0.25		0.25	
		2.7-3.0				0.25		0.25		0.25	
		3.0-3.6				0.30		0.30		0.30	
		4.3				0.40		0.40		0.40	
R _{ON}	Switch ON Resistance (1)	4.3	V _S =0V to V _{CC} I _S =100mA		0.35	0.45		0.50			Ω
		3.0			0.40	0.50		0.60			
		2.7			0.40	0.50		0.60			
		2.3			0.45	0.70		0.80			
		1.8			0.55	0.9		1.0			
		1.65			0.65	1.0		1.2			
ΔR _{ON}	ON Resistance Match between channels (1,2)	2.7	V _S =1.5V I _S =100mA		0.1						Ω
R _{FLAT}	ON Resistance FLATNESS (3)	4.3	V _S =1.5V I _S =100mA		0.15	0.20		0.20			Ω
		3.0			0.15	0.20		0.20			
		2.7			0.15	0.20		0.20			
		2.3			0.20	0.25		0.25			
		1.65			0.30	0.35		0.35			
I _{OFF}	OFF State Leakage Current (nSn), (Dn)	4.3	V _S =0.3 or 4V			±20		± 100			nA
I _{IN}	Input Leakage Current	0 - 4.3	V _{IN} = 0 to 4.3V			±0.05		± 1			μA
I _{CC}	Quiescent Supply Current (1)	1.65-4.3	V _{IN} =V _{CC} or GND			±0.05		±0.2		±1	μA
I _{CCLV}	Quiescent Supply Current Low Voltage Driving	4.3	V _{1-2IN} , V _{3-4IN} = 1.65V		±37	±50		±100			μA
			V _{1-2IN} , V _{3-4IN} = 1.80V		±33	±40		±50			
			V _{1-2IN} , V _{3-4IN} = 2.60V		±12	±20		±30			

Note 1: Guaranteed by design

Note 2: ΔR_{ON} = R_{ON(MAX)} - R_{ON(MIN)}

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 7: 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 _{CC} (V)		T _A = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
t _{PLH} , t _{PHL}	Propagation Delay	1.65-1.95	V _I =OPEN		0.45						ns
		2.3-2.7			0.40						
		3.0-3.3			0.30						
		3.6-4.3			0.30						
t _{ON}	TURN-ON time	1.65-1.95	V _S =0.8V		120						ns
		2.3-2.7	V _S =1.5V		65	85		90			
		3.0-3.3			42	55		65			
		3.6-4.3			40	55		65			
t _{OFF}	TURN-OFF time	1.65-1.95	V _S =0.8V		45						ns
		2.3-2.7	V _S =1.5V		18	30		40			
		3.0-3.3			16	30		40			
		3.6-4.3			15	30		40			
t _D	Break Before Make Time Delay	1.65-1.95	C _L =35pF R _L = 50Ω V _S =1.5V	10	80						ns
		2.3-2.7		10	60						
		3.0-3.3		10	55						
		3.6-4.3		10	50						
Q	Charge injection	1.65-1.95	C _L = 100pF		50						pC
		2.3-2.7	R _L = 1MΩ		40						
		3.0-3.3	V _{GEN} = 0V		35						
		3.6-4.3	R _{GEN} = 0Ω		35						

Table 8: 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 _{CC} (V)		T _A = 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 _S = 1V _{RMS} f= 100KHz		-70						dB
Xtalk	Crosstalk	1.65-4.3	V _S = 1V _{RMS} f= 100KHz		-70						dB
THD	Total Harmonic Distortion	2.3-4.3	R _L = 600Ω V _{IN} = 2V _{PP} f= 20Hz to 20kHz		0.02						%
BW	-3dB Bandwidth	1.65-4.3	R _L = 50Ω		60						MHz
C _{IN}	Control Pin Input Capacitance				5						pF
C _{Sn}	Sn Port Capacitance	3.3	f= 1MHz		30						
C _D	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 3: ON Resistance

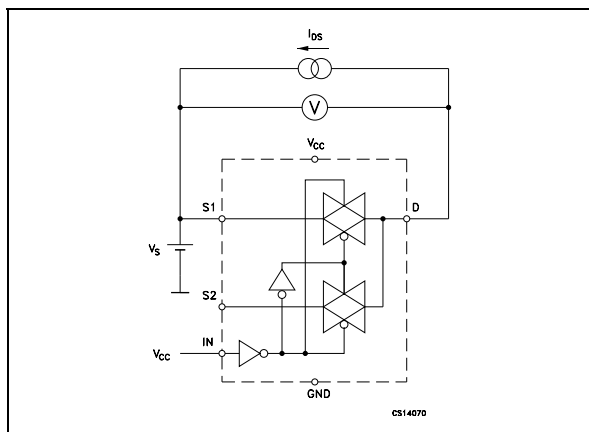


Figure 5: Bandwidth

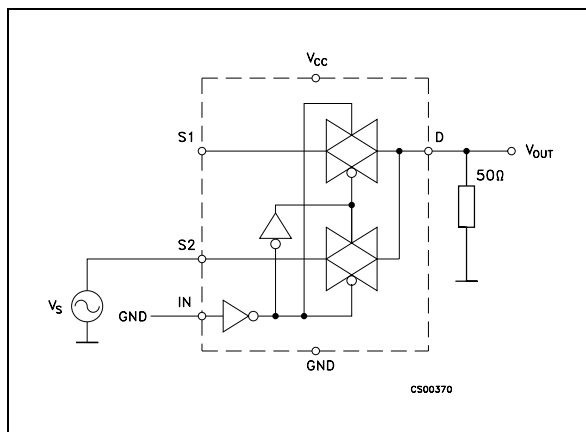


Figure 4: OFF Leakage

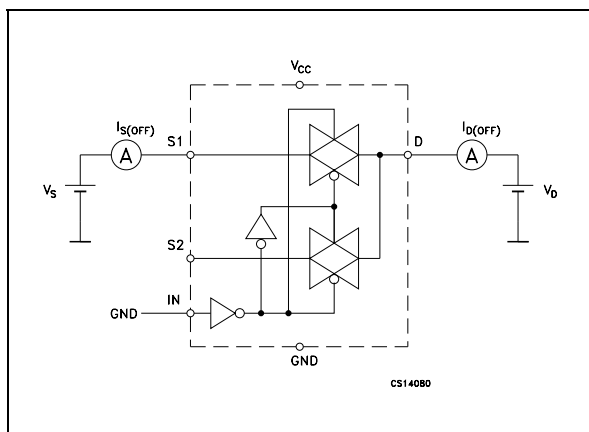
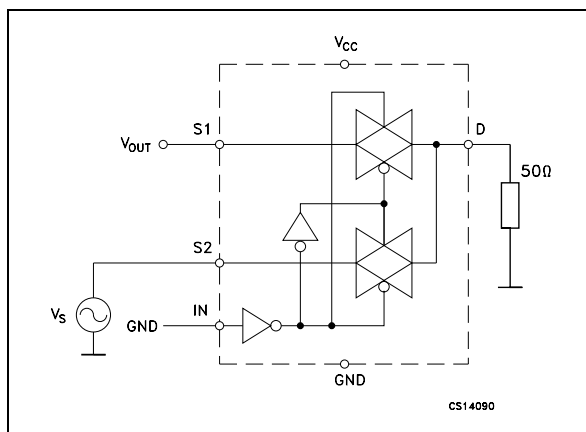


Figure 6: Channel To Channel Crosstalk



OFF Isolation

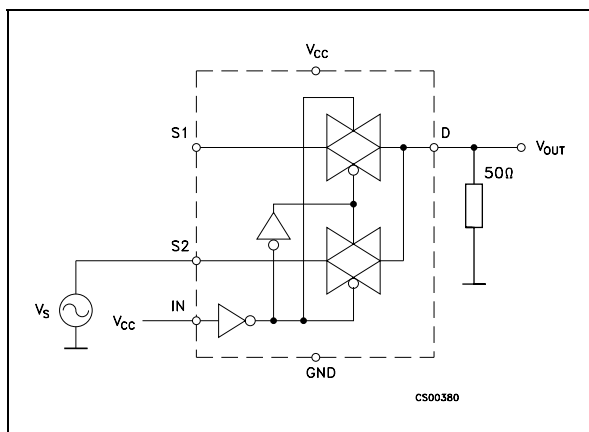
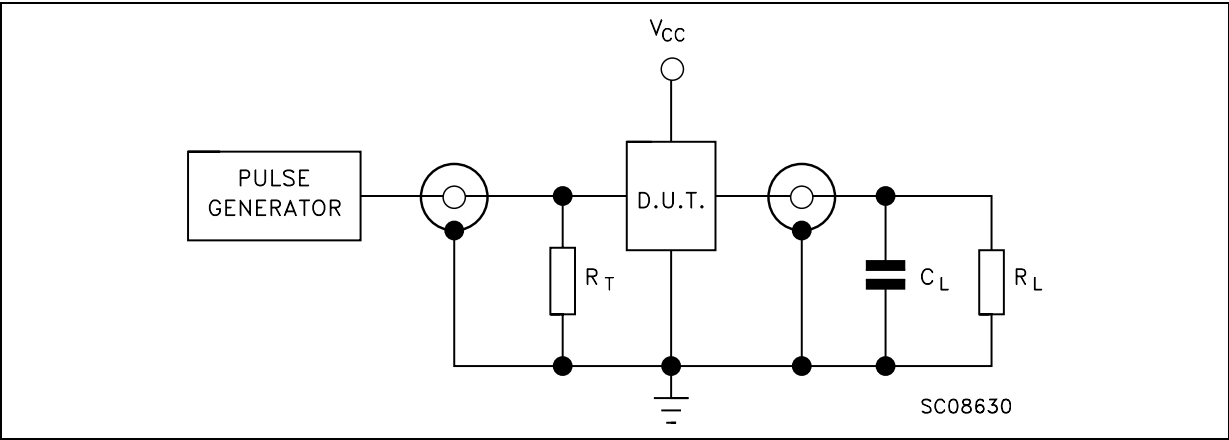


Table 9: Test Circuit



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

Figure 7: Break Before Make Time Delay

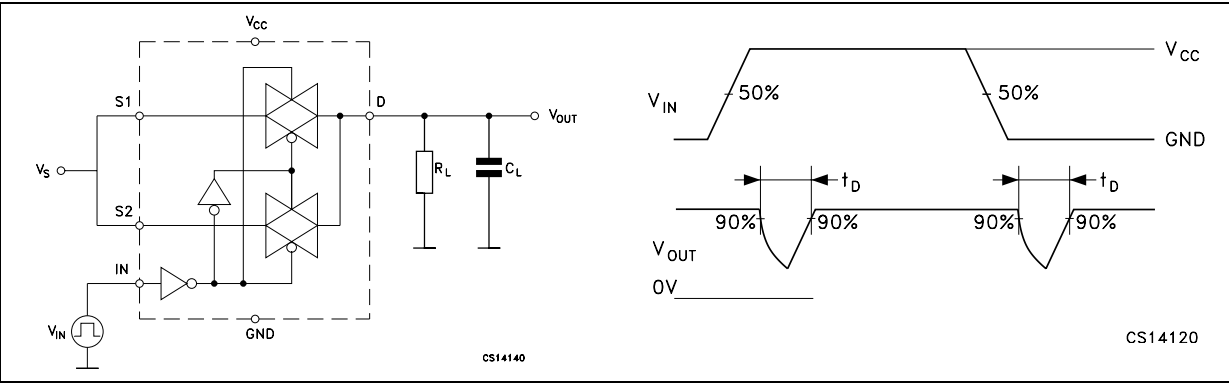


Figure 8: Charge Injection ($V_{GEN}=0\text{V}$, $R_{GEN}=0\Omega$, $R_L=1\text{M}\Omega$, $C_L=100\text{pF}$)

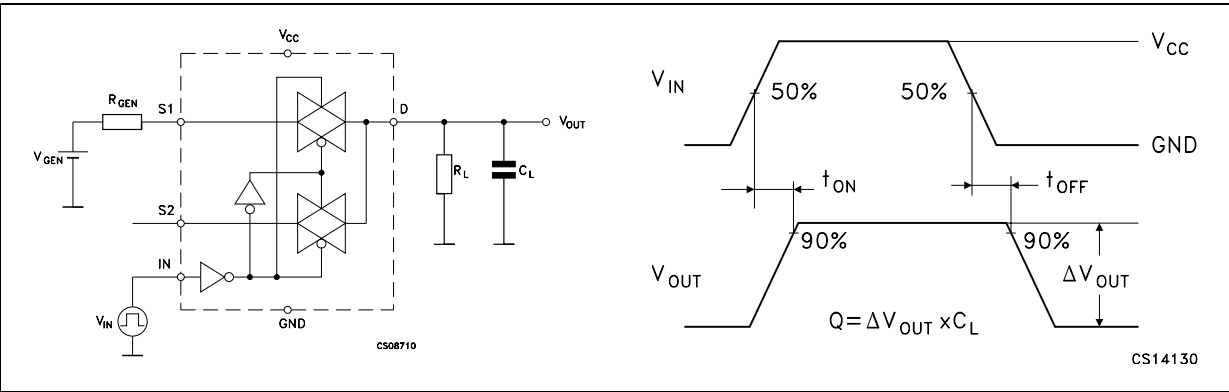
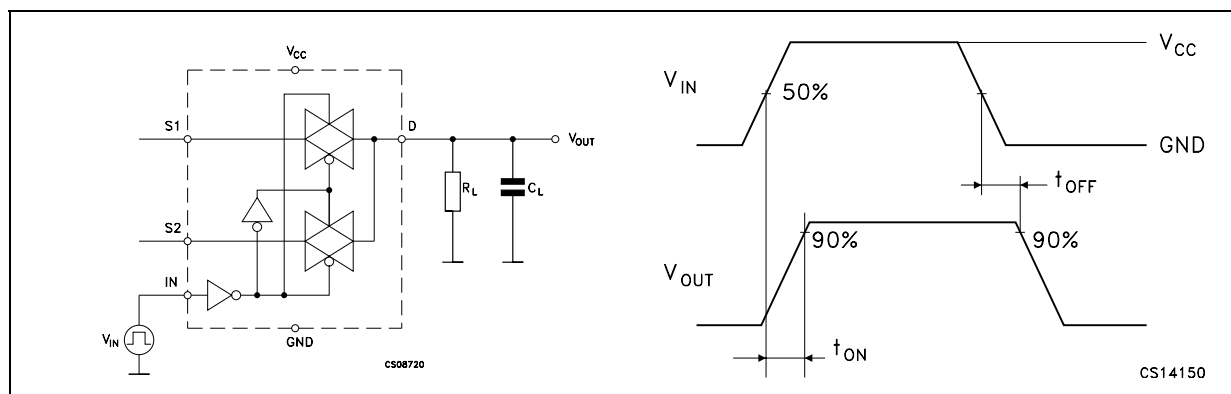
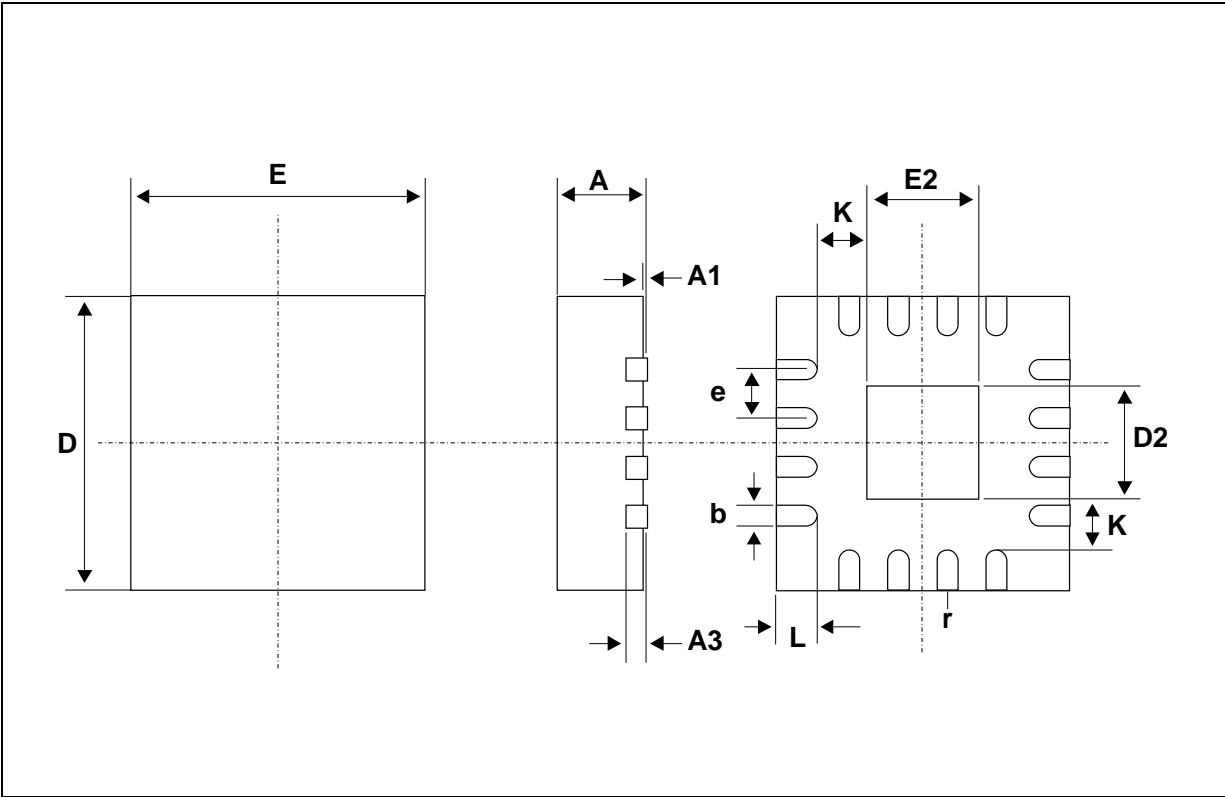


Table 10: Turn On, Turn Off Delay Time



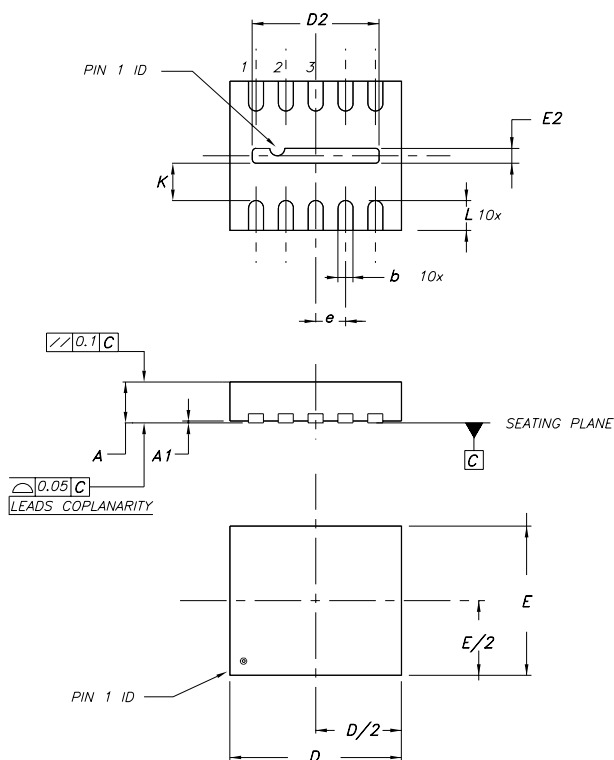
QFN16 (3x3) MECHANICAL DATA

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		



DFN10L (2x2.3) MECHANICAL DATA

DIM.	mm.			mils		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	0.50	0.55	0.60	19.7	21.7	23.6
A1		0.02	0.05		0.8	2.0
b	0.15	0.20	0.25	5.9	7.9	9.8
D	2.20	2.30	2.40	86.6	90.6	94.5
D2	1.65	1.70	1.75	65.0	66.9	68.9
E	1.90	2	2.10	74.8	78.7	82.7
E2	0.15	0.20	0.25	5.9	7.9	9.8
e		0.40			15.7	
L	0.35	0.40	0.45	13.8	15.7	17.7
K	0.20			7.9		



7815723A

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	

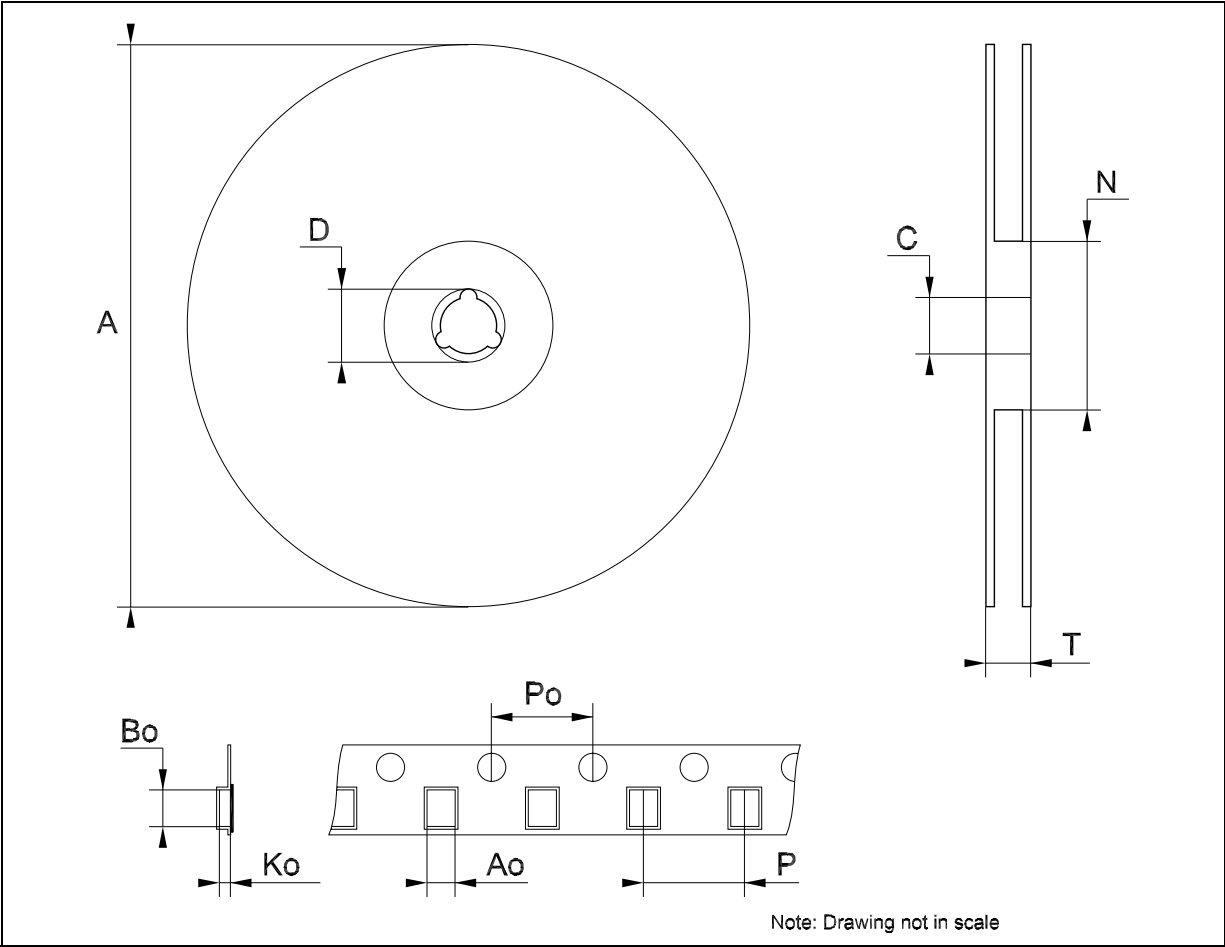


Table 11: Revision History

Date	Revision	Description of Changes
04-Jul-2005	1	First Release.
22-Aug-2005	2	The V_{CC} and V_{IC} values has been changed on Table 4.

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