



# M74HC4851

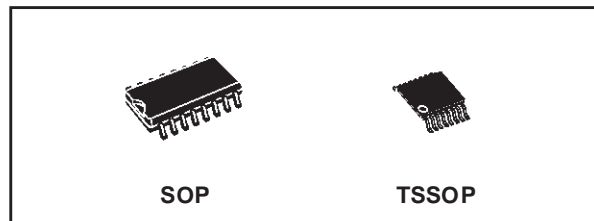
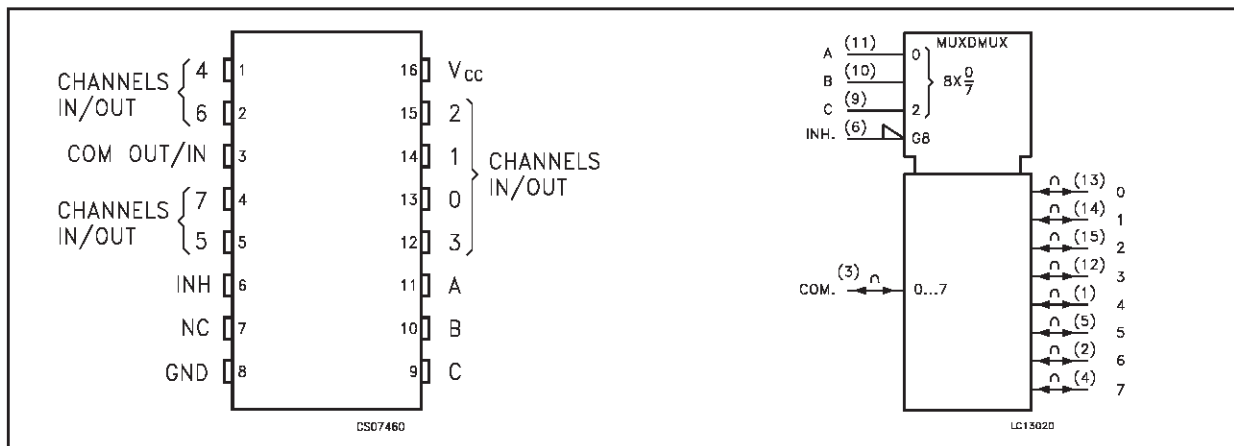
## SINGLE 8 CHANNEL ANALOG MUX/DEMUX WITH INJECTION CURRENT PROTECTION

- **LOW POWER DISSIPATION:**  
 $I_{CC} = 2\mu\text{A}(\text{MAX.})$  at  $T_A=25^\circ\text{C}$
- **INJECTION CURRENT PROTECTION:**  
 $V_{\Delta\text{OUT}} < 1\text{mV}$  at  $V_{CC}=5\text{V}$   $I_{IN} \leq 1\text{mA}$   $R_S \leq 3.9\text{K}\Omega$
- **"ON" RESISTANCE** at  $T_A=25^\circ\text{C}$ :  
 $215\Omega$  TYP. ( $V_{CC} = 3.0\text{V}$ )  
 $150\Omega$  TYP. ( $V_{CC} = 4.5\text{V}$ )  
 $160\Omega$  TYP. ( $V_{CC} = 6\text{V}$ )
- **FAST SWITCHING:**  
 $t_{pd} = 8.6\text{ns}$  (TYP.) at  $T_A = 25^\circ\text{C}$ ,  $V_{CC} = 4.5\text{V}$
- **WIDE OPERATING SUPPLY VOLTAGE RANGE:**  $V_{CC} = 2\text{V TO } 6\text{V}$
- **HIGH NOISE IMMUNITY:**  
 $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (MIN.)
- **PIN AND FUNCTION COMPATIBLE WITH SERIES 4051, 4851**
- **LATCH-UP PERFORMANCE EXCEEDS 500mA** (JESD 17)
- **ESD PERFORMANCE:**  
 $\text{HBM} > 2000\text{V}$  (JESD22-A114B);  
 $\text{MM} > 200\text{V}$

### DESCRIPTION

The M74HC4851 is a single eight-channel analog MULTIPLEXER/DEMULTIPLEXER fabricated with silicon gate CMOS technology. It is pin to pin compatible with the equivalent to standard HC4051 and MC14051, but feature injection current effect control. This make this device especially suited for usage in automotive applications where voltages in excess of normal

### PIN CONNECTION AND IEC LOGIC SYMBOLS

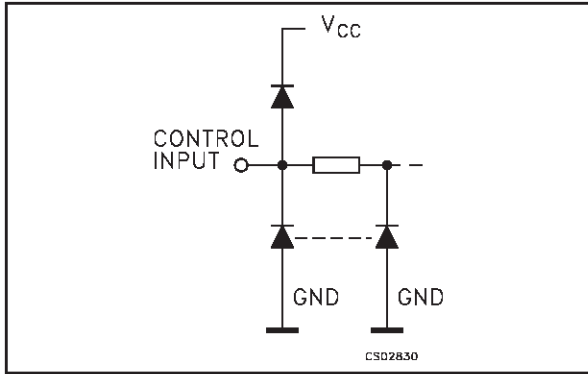


### ORDER CODES

PACKAGE	TUBE	T & R
SOP	M74HC4851M1R	M74HC4851RM13TR
TSSOP		M74HC4851TTR

logic voltage are common. The injection current effect control allows signals at disabled input channels to exceed the supply voltage range or go down ground without affecting the signal of the enabled analog channel. This eliminated the need for external diode-resistor networks typically used to keep the analog channel signals within the supply voltage range. This analog switch is bidirectional and digitally controlled. It have three binary control inputs A, B, and C to select 1 of 8 to be turned on, and connected to the output, and a INH input to disable all channel. All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

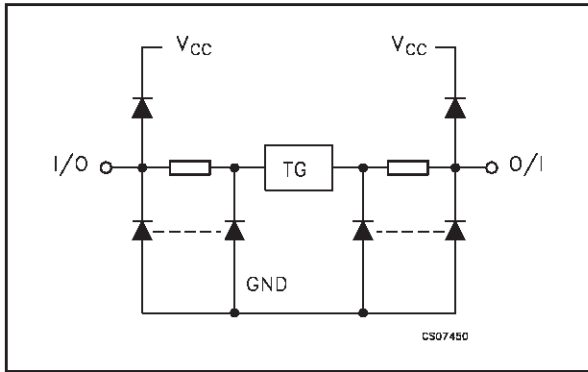
**CONTROL INPUT EQUIVALENT CIRCUIT**



**PIN DESCRIPTION**

PIN No	SYMBOL	NAME AND FUNCTION
3	COM OUT/IN	Common Output/Input
6	INH	INHIBIT Input
7	NC	Not Connected
11, 10, 9	A, B, C	Select Inputs
13, 14, 15, 12, 1, 5, 2, 4	0 to 7	Independent Input/Outputs
8	GND	Ground (0V)
16	V <sub>CC</sub>	Positive Supply Voltage

**I/O EQUIVALENT CIRCUIT**

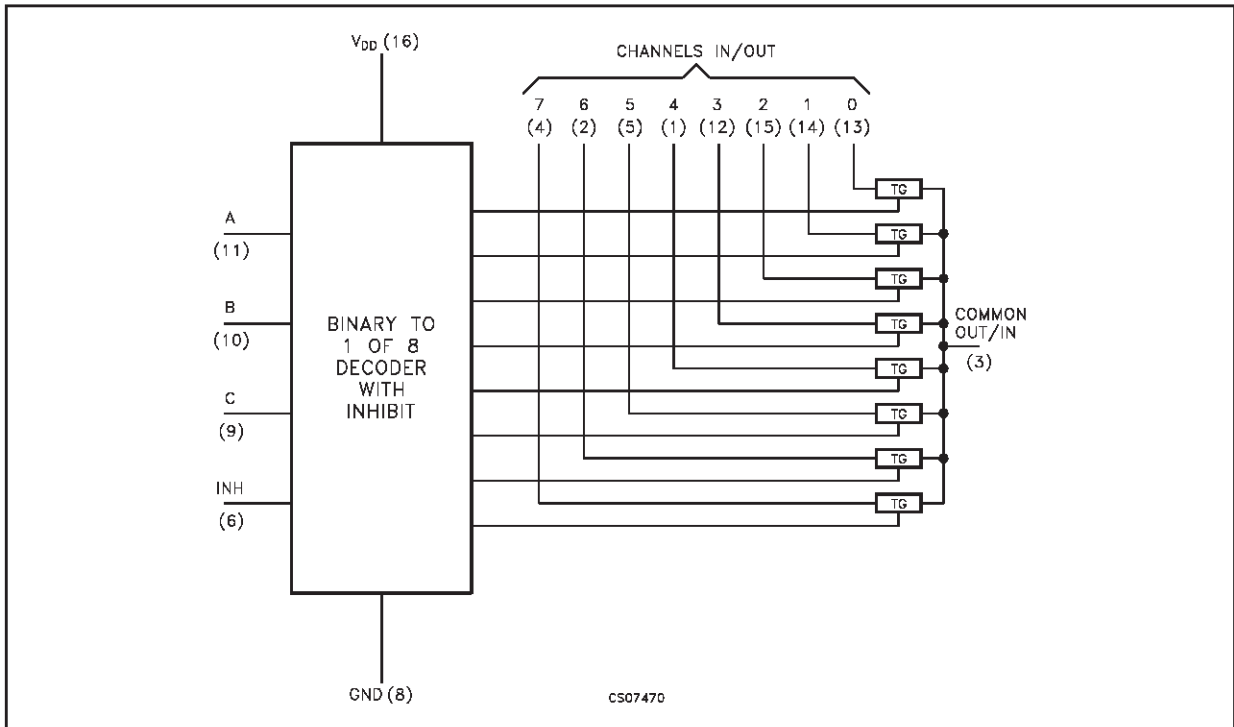


**TRUTH TABLE**

INPUT STATE				ON CHANNEL
INH	C	B	A	
L	L	L	L	0
L	L	L	H	1
L	L	H	L	2
L	L	H	H	3
L	H	L	L	4
L	H	L	H	5
L	H	H	L	6
L	H	H	H	7
H	X	X	X	NONE

X: Don't care

**FUNCTIONAL DIAGRAM**



**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit	
$V_{CC}$	Supply Voltage	-0.5 to +7	V	
$V_{IN}$	Control Input Voltage	-0.5 to $V_{CC} + 0.5$	V	
$V_{I/O}$	Switch I/O Voltage	-0.5 to $V_{CC} + 0.5$	V	
$I_{CK}$	Control Input Diode Current	$\pm 25$	mA	
$I_{I/OK}$	I/O Diode Current	$\pm 25$	mA	
$I_{CC}$	DC $V_{CC}$ or Ground Current	$\pm 50$	mA	
$P_D$	Power Dissipation	SOP	500(*)	mW
		TSSOP	450(*)	mW
$T_{stg}$	Storage Temperature	-65 to +150	$^{\circ}C$	
$T_L$	Lead Temperature (10 sec)	300	$^{\circ}C$	

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

(\*) Power dissipation at 65  $^{\circ}C$ . Derating from 65 $^{\circ}C$  to 125 $^{\circ}C$ : SO Package -7mW/ $^{\circ}C$ ; TSSOP Package -6.1mW/ $^{\circ}C$

**RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Value	Unit	
$V_{CC}$	Supply Voltage	2 to 6	V	
$V_{I/O}$	Input Output Voltage	0 to $V_{CC}$	V	
$V_{I/O}$	Static or Dynamic Voltage Across Switch (note1)	0 to 1.2	V	
$V_{IN}$	Control Input Voltage	0 to $V_{CC}$	V	
$T_{op}$	Operating Temperature	-55 to 125	$^{\circ}C$	
$t_r, t_f$	Input Rise and Fall Time (note2) (Channel Select or Enable Inputs only)	$V_{CC} = 2.0V$	0 to 1000	ns
		$V_{CC} = 3.0V$	0 to 800	
		$V_{CC} = 3.3V$	0 to 700	
		$V_{CC} = 4.5V$	0 to 500	
		$V_{CC} = 6.0V$	0 to 400	

1) For voltage drops across switch greater than 1.2V (switch on), excessive  $V_{CC}$  current may be drawn; i.e., the current out of the switch may contain both  $V_{CC}$  and switch input components. The reliability of the device will be unaffected unless the Maximum Ratings are exceeded.

2)  $V_{IN}$  from 30% to 70%  $V_{CC}$  of channel Selected or Enable Inputs

## DC SPECIFICATIONS

Symbol	Parameter	Test Condition		Value						Unit	
		V <sub>CC</sub> (V)		T <sub>A</sub> = 25°C			up to 85°C		up to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
V <sub>IHC</sub>	High Level Input Voltage	2.0		1.5			1.5		1.5		V
		3.0		2.1			2.1		2.1		
		3.0		2.3			2.3		2.3		
		4.5		3.15			3.15		3.15		
		6.0		4.2			4.2		4.2		
V <sub>ILC</sub>	Low Level Input Voltage	2.0				0.5		0.5		0.5	V
		3.0				0.9		0.9		0.9	
		3.3				1.0		1.0		1.0	
		4.5				1.35		1.35		1.35	
		6.0				1.8		1.8		1.8	
R <sub>ON</sub>	ON Resistance	2.0	V <sub>IN</sub> = V <sub>IHC</sub> or V <sub>ILC</sub> V <sub>IS</sub> = V <sub>CC</sub> to GND I <sub>S</sub> ≤ 2mA		500	650		670		700	Ω
		3.0			215	280		320		360	
		3.3			210	270		305		345	
		4.5			160	210		240		270	
		6.0			150	195		220		250	
ΔR <sub>ON</sub>	Difference of ON Resistance between switches	2.0	V <sub>IN</sub> = V <sub>IHC</sub> or V <sub>ILC</sub> V <sub>IS</sub> = V <sub>CC</sub> /2 I <sub>S</sub> ≤ 2mA		4	10		15		20	Ω
		3.0			2	8		12		16	
		3.3			2	8		12		16	
		4.5			2	8		12		16	
		6.0			3	9		13		18	
I <sub>OFF</sub>	Input/Output Leakage Current (SWITCH OFF) (Any Channel)	6.0	V <sub>IN</sub> = V <sub>CC</sub> or GND			±0.1		± 0.5		± 1.0	μA
I <sub>OFF</sub>	Input/Output Leakage Current (SWITCH OFF) (Common Channel)	6.0				± 0.2		± 2		± 4	μA
I <sub>ON</sub>	Switch Input Leakage Current (SWITCH ON, OUTPUT OPEN)	6.0	V <sub>IN</sub> = V <sub>CC</sub> or GND			±0.1		± 0.5		± 1	μA
I <sub>IN</sub>	Control Input Current	6.0	V <sub>IN</sub> = V <sub>CC</sub> or GND			± 0.1		± 0.1		± 1	μA
I <sub>CC</sub>	Quiescent Supply Current	6.0	V <sub>IN</sub> = V <sub>CC</sub> or GND V <sub>IN(analog)</sub> = GND			2		20		40	μA

AC ELECTRICAL CHARACTERISTICS ( $C_L = 50 \text{ pF}$ , Input  $t_r = t_f = 6 \text{ ns}$ )

Symbol	Parameter	Test Condition		Value						Unit	
		$V_{CC}$ (V)	TEST CIRCUIT 1	$T_A = 25^\circ\text{C}$			up to $85^\circ\text{C}$		up to $125^\circ\text{C}$		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
$t_{PHL}, t_{PLH}$	Propagation Delay Time, Analog Input to Analog Output	2.0			19.5	25		29		32	ns
		3.0			12	15.5		17.5		19.5	
		3.3			11	14.5		16.5		18.5	
		4.5			8.6	11.5		12.5		13.5	
		6.0			8	10		11		12	
$t_{PHL}, t_{PLH}$	Propagation Delay Time Channel-Select to Analog Output	2.0			23	30		35		40	ns
		3.0			13.5	17.5		20		23	
		3.3			12.5	16.5		19		22	
		4.5			10	13		15		17	
		6.0			9.5	12.5		14.5		16.5	
$t_{PHZ}, t_{PZH}$ $t_{PLZ}, t_{PZL}$	Enable Disable Time, Enable or Channel-Select to Analog Output	2.0				95		105		115	ns
		3.0				90		100		110	
		3.3				85		95		105	
		4.5				80		90		100	
		6.0				78		80		80	
$C_{IN}$	Input Capacitance (Digital Pins)				3.5	10		10		10	pF
$C_{IN}$	Input Capacitance (Switches Off, Any Single Analog Pins)				6.7	15		15		15	pF
$C_{IN}$	Input Capacitance (Switches Off, Any Common Analog Pins)				22	40		40		40	pF
$C_{PD}$	Power Dissipation Capacitance (*)	3.3			24						pF
		5.0			28						

(\*)  $C_{PD}$  is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/8$

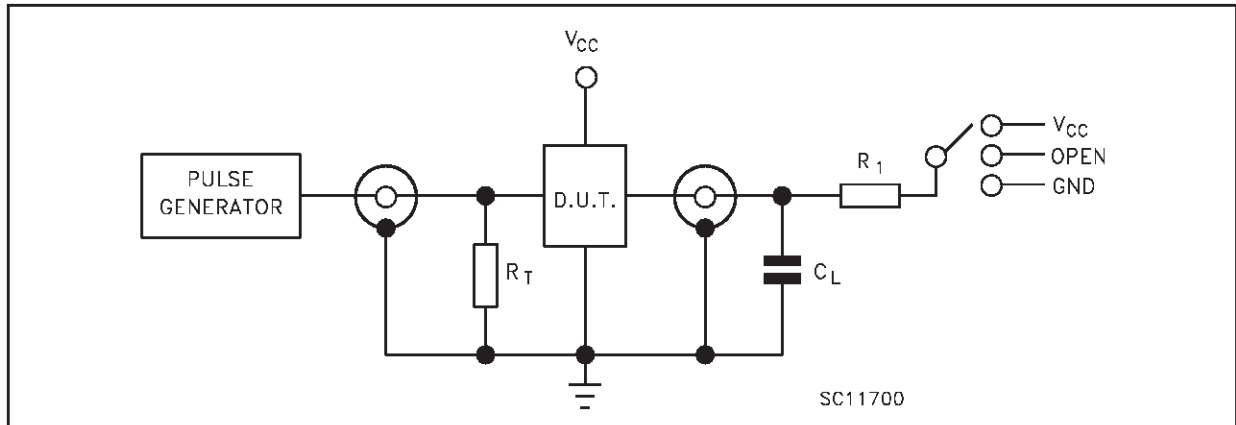
INJECTION CURRENT COUPLING SPECIFICATION ( $T_A = -55^\circ\text{C}$  to  $+125^\circ\text{C}$ )

Symbol	Parameter	Test Condition		Value		Unit
		$V_{CC}$ (V)	TEST CIRCUIT 2	Typ.(1)	Max.	
$V_{\Delta OUT}$	Shift of Output Voltage of Enabled Analog Channel	3.3	$I_{IN} \leq 1 \text{ mA}, R_S \leq 3.9 \text{ K}\Omega$	0.050	1.0	mV
		5.0		0.100	1.0	
		3.3	$I_{IN} \leq 10 \text{ mA}, R_S \leq 3.9 \text{ K}\Omega$	0.345	5.0	
		5.0		0.067	5.0	
		3.3	$I_{IN} \leq 1 \text{ mA}, R_S \leq 20 \text{ K}\Omega$	0.050	2.0	
		5.0		0.110	2.0	
		3.3	$I_{IN} \leq 10 \text{ mA}, R_S \leq 20 \text{ K}\Omega$	0.050	20	
		5.0		0.024	20	

1) Typical values are measured at  $T_A = 25^\circ\text{C}$  e they are calculate as difference from  $V_{out}$  without Injection Current and  $V_{out}$  with Injection Current.

$I_{IN}$  = total current injected into any other disabled channels, one at time.

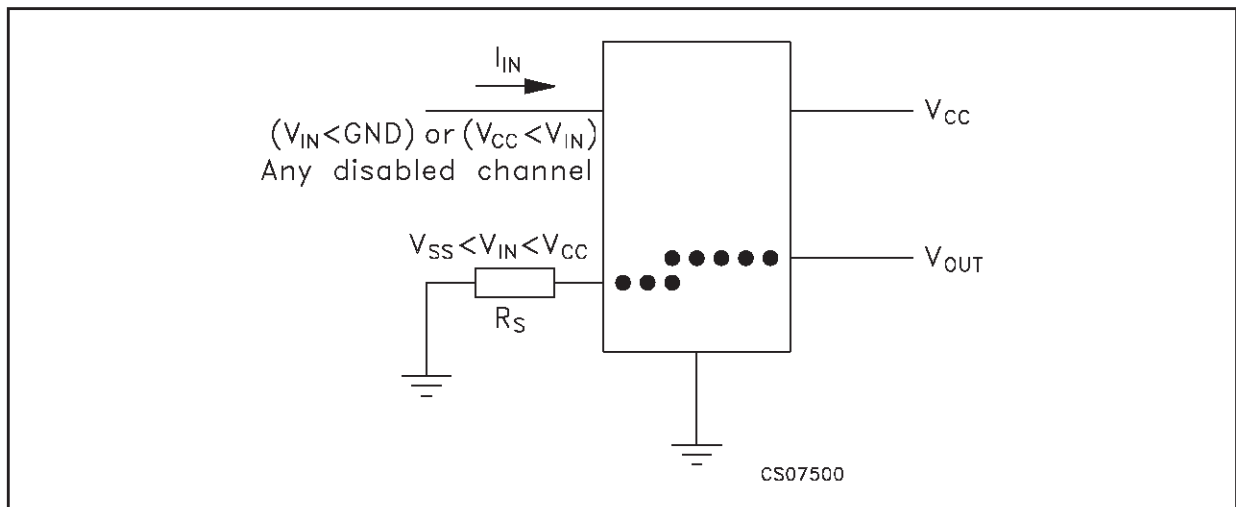
TEST CIRCUIT 1

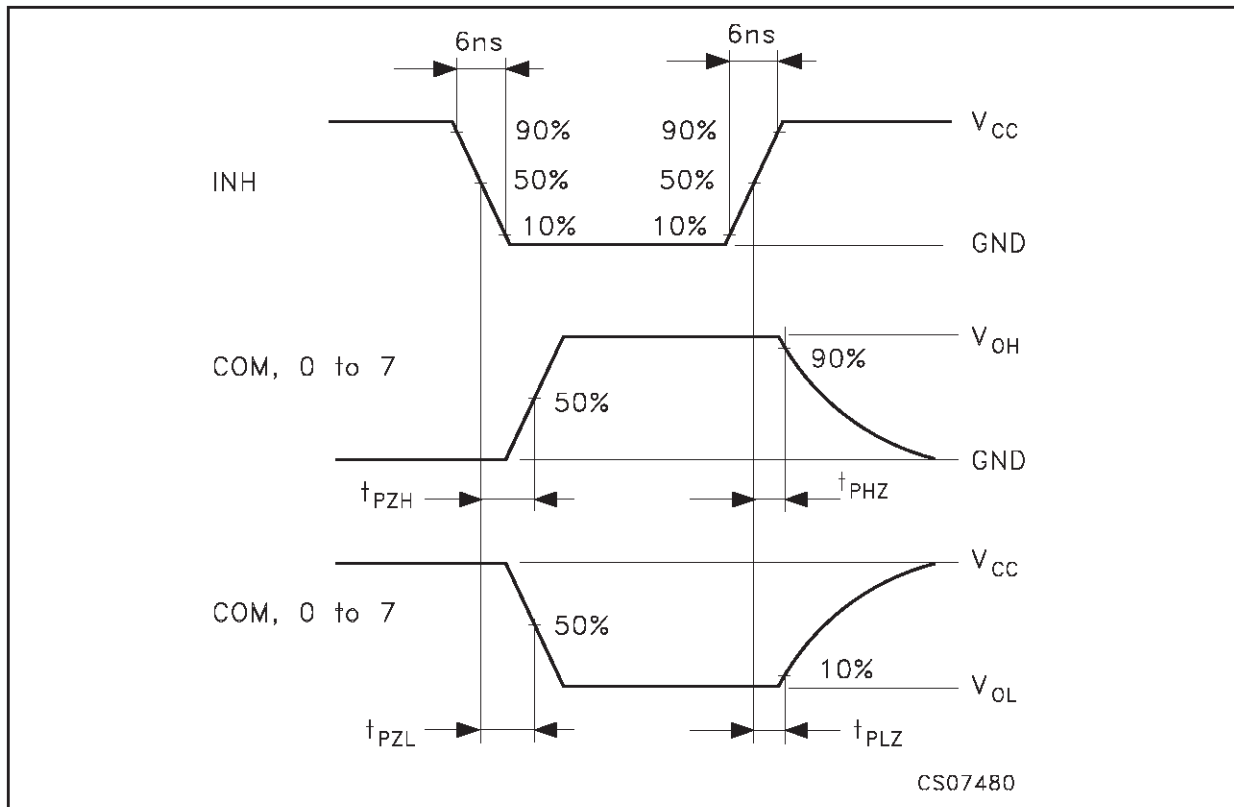
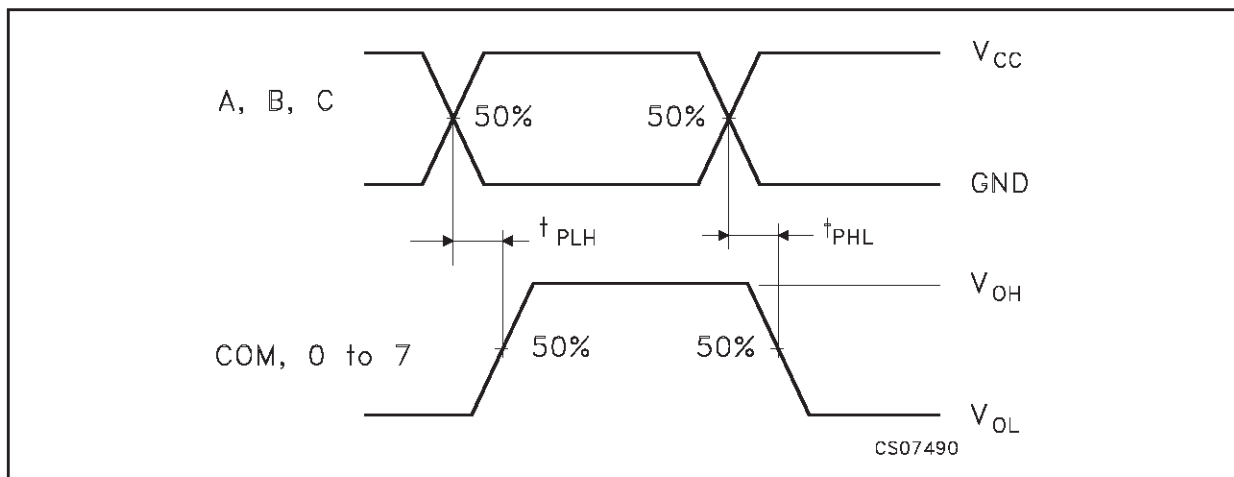


TEST	SWITCH
$t_{PLH}$ , $t_{PHL}$	Open
$t_{PZL}$ , $t_{PLZ}$	$V_{CC}$
$t_{PZH}$ , $t_{PHZ}$	GND

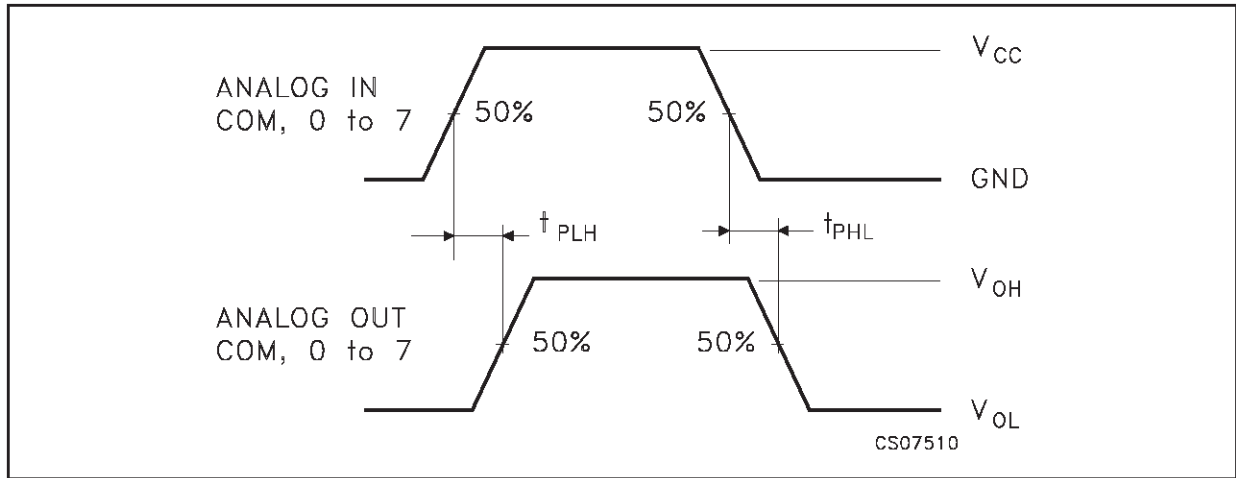
$C_L$  = 50pF or equivalent (includes jig and probe capacitance)  
 $R_L$  =  $R_1$  = 10K $\Omega$  or equivalent  
 $R_T$  =  $Z_{OUT}$  of pulse generator (typically 50 $\Omega$ )

TEST CIRCUIT 2

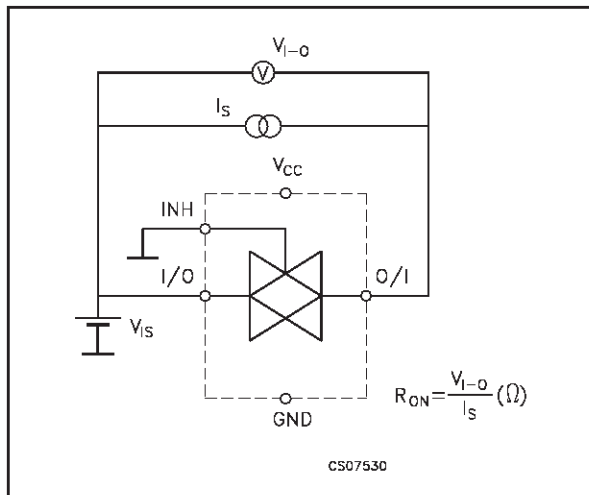


WAVEFORM: PROPAGATION DELAY ( $f=1\text{MHz}$ ; 50% duty cycle)WAVEFORM: PROPAGATION DELAY ( $f=1\text{MHz}$ ; 50% duty cycle)

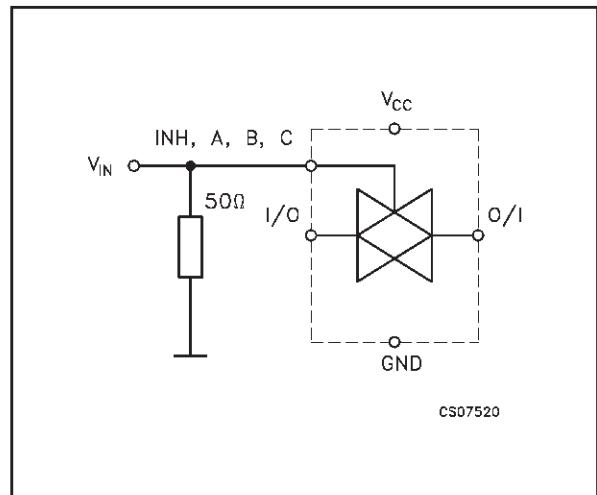
WAVEFORM: PROPAGATION DELAY (f=1MHz; 50% duty cycle)



CHANNEL RESISTANCE (RON)



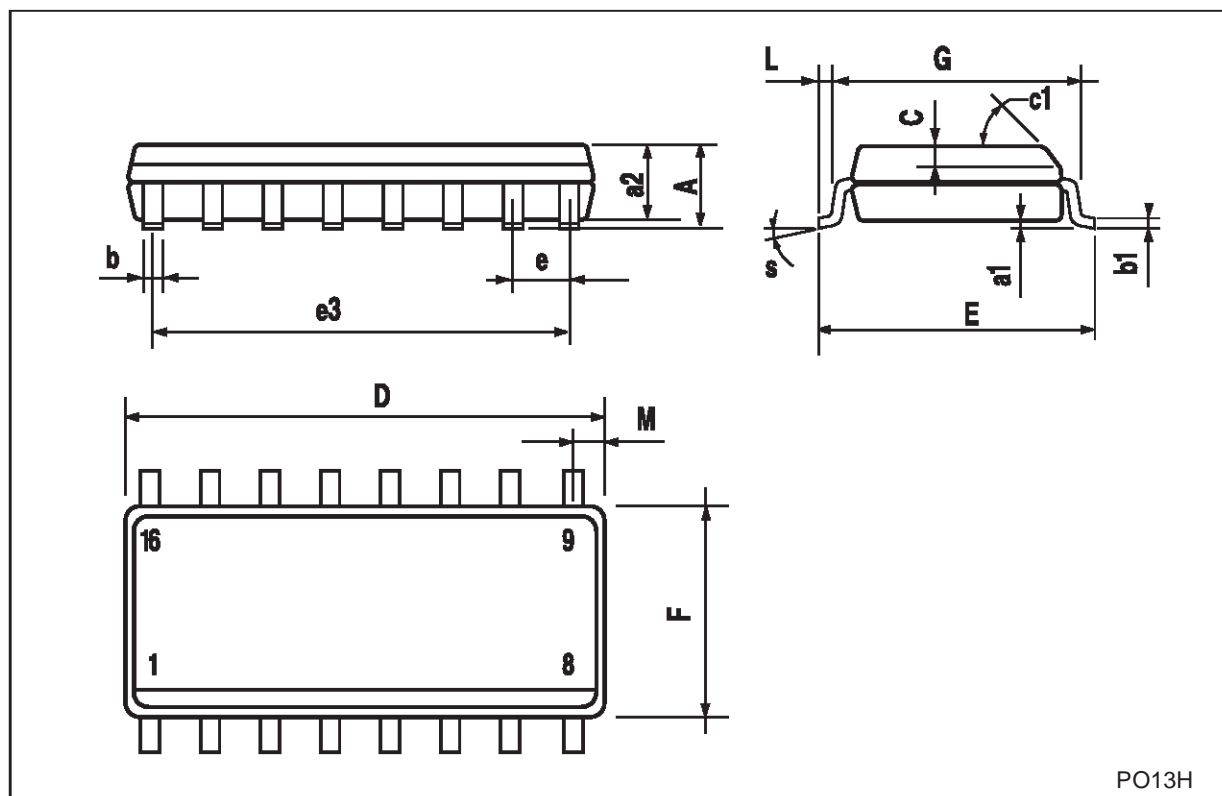
ICC (Opr.)





## SO-16 MECHANICAL DATA

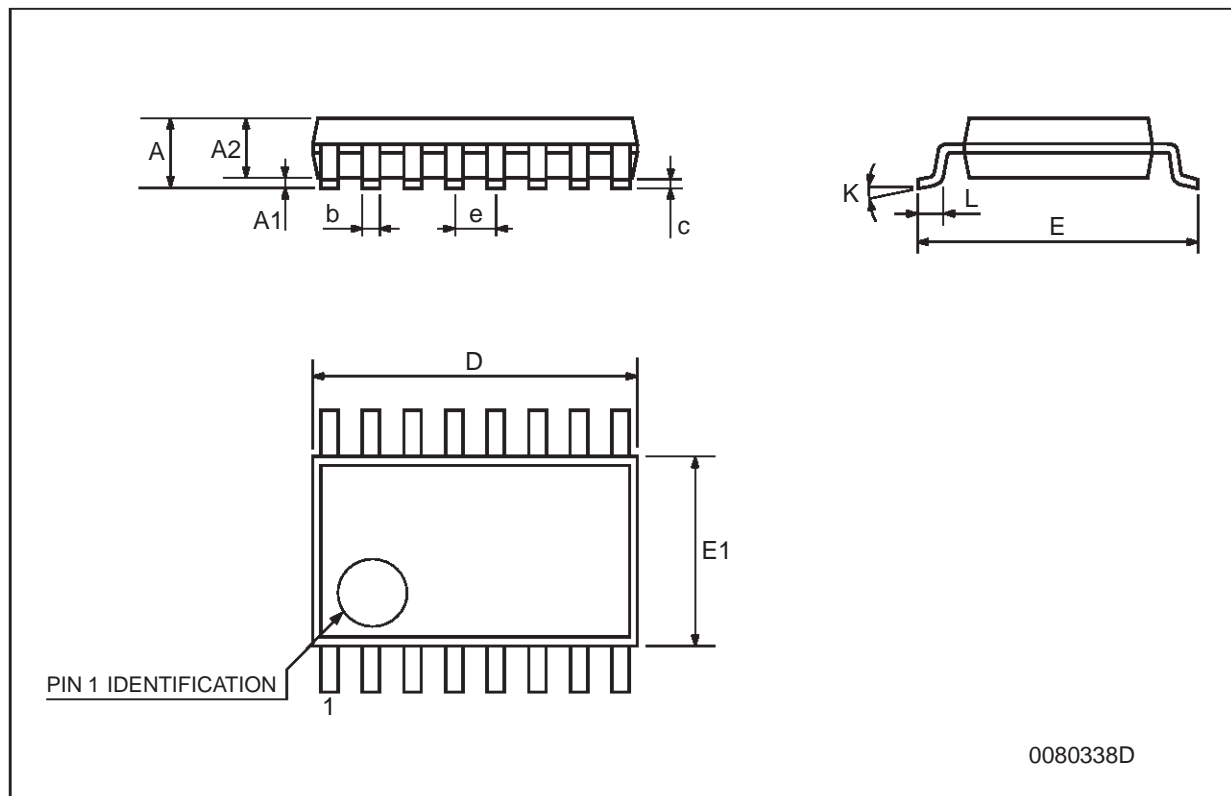
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.003		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.62			0.024
S	8° (max.)					



PO13H

## TSSOP16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.2			0.047
A1	0.05		0.15	0.002	0.004	0.006
A2	0.8	1	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.0089
D	4.9	5	5.1	0.193	0.197	0.201
E	6.2	6.4	6.6	0.244	0.252	0.260
E1	4.3	4.4	4.48	0.169	0.173	0.176
e		0.65 BSC			0.0256 BSC	
K	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030



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