



# M74HC4351

## ANALOG MULTIPLEXER/DEMULTIPLEXER WITH ADDRESS LATCH : SINGLE 8 CHANNEL

- LOGIC LEVEL TRANSLATION TO ENABLE 5V LOGIC SIGNAL TO COMMUNICATE WITH  $\pm 5V$  ANALOG SIGNAL
- LOW POWER DISSIPATION:  
 $I_{CC} = 4\mu A(\text{MAX.})$  at  $T_A = 25^\circ C$
- LOW "ON" RESISTANCE:  
70 $\Omega$  TYP. ( $V_{CC} - V_{EE} = 4.5V$ )  
50 $\Omega$  TYP. ( $V_{CC} - V_{EE} = 9V$ )
- WIDE ANALOG INPUT VOLTAGE RANGE  $\pm 6V$
- LOW CROSSTALK BETWEEN SWITCHES
- FAST SWITCHING
- SINE WAVE DISTORTION:  
0.02% (TYP.) at  $V_{CC} - V_{EE} = 9V$
- HIGH NOISE IMMUNITY:  
 $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (MIN.)
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 4351



### ORDER CODES

PACKAGE	TUBE	T & R
DIP	M74HC4351B1R	
SOP	M74HC4351M1R	M74HC4351RM13TR
TSSOP		M74HC4351TTR

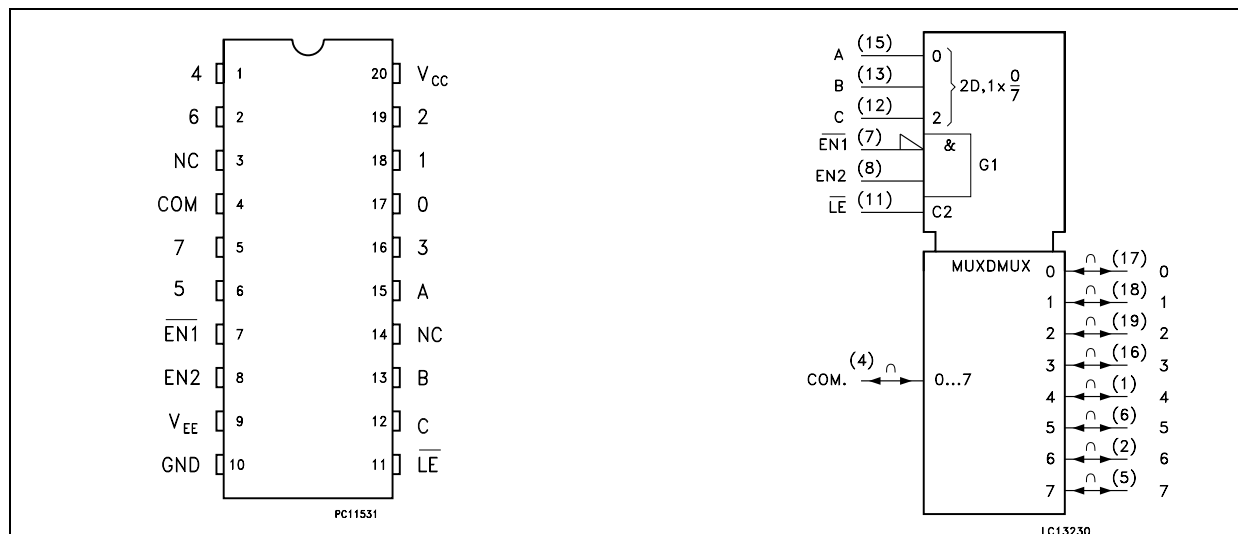
### DESCRIPTION

The M74HC4351 is an high speed CMOS ANALOG MULTIPLEXER/DEMULTIPLEXER fabricated with silicon gate C<sup>2</sup>MOS technology. A built-in level shifting is included to allow an input range up to  $\pm 6V$  (peak) for an analog signal with digital control signal of 0 to 6V.

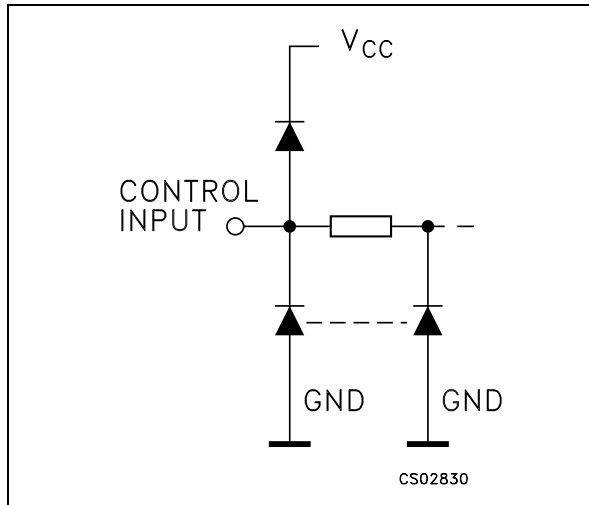
$V_{EE}$  supply pin is provided for analog input signals. It has two enable inputs to enable all the switches when high (EN2) or low (EN1). For operation as a digital multiplexer/demultiplexer,  $V_{EE}$  is connected to GND.

The M74HC4351 is a single 8 channel multiplexer/demultiplexer having three binary control inputs A, B and C to select 1 of 8 to be turned on, and connected to the output.

### PIN CONNECTION AND IEC LOGIC SYMBOLS



**CONTROL INPUT EQUIVALENT CIRCUIT**



**PIN DESCRIPTION**

PIN No	SYMBOL	NAME AND FUNCTION
4	COM	Common
3, 14	NC	Not Connected
7	EN1	Enable Input (Active LOW)
8	EN2	Enable Input (Active HIGH)
9	V <sub>EE</sub>	Negative Supply Voltage
11	LE	Latch Enable Input (Active LOW)
15, 13, 12	A, B, C	Select Inputs
17, 18, 19, 16, 1, 6, 2, 5	0 to 7	Independent Inputs/Outputs
10	GND	Ground (0V)
20	V <sub>CC</sub>	Positive Supply Voltage

**TRUTH TABLE**

CONTROL INPUTS					"ON" CHANNEL ( $\overline{LE} = H$ )**
EN1	EN2	C	B	A	
L	H	L	L	L	0
L	H	L	L	H	1
L	H	L	H	L	2
L	H	L	H	H	3
L	H	H	L	L	4
L	H	H	L	H	5
L	H	H	H	L	6
L	H	H	H	H	7
H	X	X	X	X	NONE
X	L	X	X	X	NONE

X : Don't Care

\*\* : When latch Enable is low, the Channel Selection is latched and the Channel Address Latch does not change state.

**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage	-0.5 to +7	V
V <sub>CC</sub> - V <sub>EE</sub>	Supply Voltage Range	-0.5 to +13	V
V <sub>IN</sub>	DC Input Voltage	-0.5 to V <sub>CC</sub> + 0.5	V
V <sub>I/O</sub>	DC Switch Input/Output Voltage	V <sub>EE</sub> - 0.5 to V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	Input Diode Current	± 20	mA
I <sub>OK</sub>	I/O Diode Current	± 20	mA
I <sub>OUT</sub>	DC Output Current	± 25	mA
I <sub>CC</sub> or I <sub>GND</sub>	DC V <sub>CC</sub> or Ground Current	± 50	mA
P <sub>D</sub>	Power Dissipation	500(*)	mW
T <sub>stg</sub>	Storage Temperature	-65 to +150	°C
T <sub>L</sub>	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

(\*) 500mW at 65 °C; derate to 300mW by 10mW/°C from 65°C to 85°C

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit	
$V_{CC}$	Supply Voltage	2 to 12	V	
$V_{EE}$	Supply Voltage	2 to 12	V	
$V_{CC} - V_{EE}$	Supply Voltage	2 to 12	V	
$V_I$	Input Voltage	0 to $V_{CC}$	V	
$V_{I/O}$	Switch I/O Voltage	0 to $V_{CC}$	V	
$T_{op}$	Operating Temperature	-55 to 125	°C	
$t_r, t_f$	Input Rise and Fall Time	$V_{CC} = 2.0V$	0 to 1000	ns
		$V_{CC} = 4.5V$	0 to 500	
		$V_{CC} = 6.0V$	0 to 400	

## DC SPECIFICATIONS

Symbol	Parameter	Test Condition		Value	Unit							
		$V_{CC}$ (V)	$V_{EE}$ (V)			$T_A = 25^\circ C$			$-40$ to $85^\circ C$		$-55$ to $125^\circ C$	
						Min.	Typ.	Max.	Min.	Max.	Min.	Max.
$V_{IHC}$	High Level Control Input Voltage	2.0		1.5			1.5		1.5		V	
		4.5		3.15			3.15		3.15			
		6.0		4.2			4.2		4.2			
$V_{ILC}$	Low Level Control Input Voltage	2.0				0.5		0.5		0.5	V	
		4.5				1.35		1.35		1.35		
		6.0				1.8		1.8		1.8		
$R_{ON}$	ON Resistance	4.5	GND	$V_I = V_{IHC}$ or $V_{ILC}$ $V_{I/O} = V_{CC}$ to $V_{EE}$ $I_{I/O} \leq 2$ mA	85	180		225			$\Omega$	
		4.5	-4.5		55	120		150				
		6.0	-6.0		50	100		125				
		2.0	GND	$V_I = V_{IHC}$ or $V_{ILC}$ $V_{I/O} = V_{CC}$ or $V_{EE}$ $I_{I/O} \leq 2$ mA	150							
		4.5	GND		70	150		190				
		4.5	-4.5		50	100		125				
		6.0	-6.0		45	80		100				
$\Delta R_{ON}$	Difference of ON Resistance between switches	4.5	GND	$V_I = V_{IHC}$ or $V_{ILC}$ $V_{I/O} = V_{CC}$ to $V_{EE}$ $I_{I/O} \leq 2$ mA	10	30		35			$\Omega$	
		4.5	-4.5		5	12		15				
		6.0	-6.0		5	10		12				
$I_{OFF}$	Input/Output Leakage Current (SWITCH OFF)	6.0	-6.0	$V_{OS} = V_{CC}$ or GND $V_{IS} = V_{CC}$ or GND $V_{IN} = V_{ILC}$			$\pm 100$		$\pm 1000$		nA	
$I_{IZ}$	Switch Input Leakage Current (SWITCH ON, OUTPUT OPEN)	6.0	-6.0	$V_{OS} = V_{CC}$ or GND $V_{INH} = V_{IHC}$			$\pm 100$		$\pm 1000$		nA	
$I_{IN}$	Control Input Current	6.0	GND	$V_{IN} = V_{CC}$ or GND			$\pm 0.1$		$\pm 1$		$\mu A$	
$I_{CC}$	Quiescent Supply Current	6.0	GND	$V_{IN} = V_{CC}$ or GND			4		40		80	$\mu A$
		6.0	-6.0				8		80		160	

**AC ELECTRICAL CHARACTERISTICS** ( $C_L = 50 \text{ pF}$ , Input  $t_r = t_f = 6 \text{ ns}$ , GND = 0)

Symbol	Parameter	Test Condition			Value						Unit	
		V <sub>CC</sub> (V)	V <sub>EE</sub> (V)		T <sub>A</sub> = 25°C			-40 to 85°C		-55 to 125°C		
					Min.	Typ.	Max.	Min.	Max.	Min.		Max.
Φ <sub>I/O</sub>	Phase Difference Between Input and Output	2.0	GND			25	60		75			ns
		4.5	GND			6	12		15			
		6.0	GND			5	10		13			
		4.5	-4.5			4						
t <sub>PZL</sub> t <sub>PZH</sub>	Output Enable Time (E1, E2 - O)	2.0	GND	R <sub>L</sub> = 1KΩ		80	200		250		300	ns
		4.5	GND			20	40		50		60	
		6.0	GND			16	34		43		51	
		4.5	-4.5			18						
t <sub>PZL</sub> t <sub>PZH</sub>	Output Enable Time (LE -I/O)	2.0	GND	R <sub>L</sub> = 1KΩ		80	225		280		340	ns
		4.5	GND			22	45		56		68	
		6.0	GND			17	38		48		57	
		4.5	-4.5			18						
t <sub>PZL</sub> t <sub>PZH</sub>	Output Enable Time (A, B, C - I/O)	2.0	GND	R <sub>L</sub> = 1KΩ		75	225		280		340	ns
		4.5	GND			22	45		56		68	
		6.0	GND			16	38		48		57	
		4.5	-4.5			17						
t <sub>PLZ</sub> t <sub>PHZ</sub>	Output Disable Time (E1, E2 - O)	2.0	GND	R <sub>L</sub> = 1KΩ		120	275		344		415	ns
		4.5	GND			38	55		69		83	
		6.0	GND			33	47		59		71	
		4.5	-4.5			30						
t <sub>PLZ</sub> t <sub>PHZ</sub>	Output Disable Time (LE -I/O)	2.0	GND	R <sub>L</sub> = 1KΩ		120	275		344		415	ns
		4.5	GND			40	55		69		83	
		6.0	GND			35	47		59		71	
		4.5	-4.5			34						
t <sub>PLZ</sub> t <sub>PHZ</sub>	Output Disable Time (A, B, C - I/O)	2.0	GND	R <sub>L</sub> = 1KΩ		120	290		363		433	ns
		4.5	GND			40	58		73		87	
		6.0	GND			35	49		61		74	
		4.5	-4.5			35						
t <sub>W(H)</sub>	Minimum Pulse Width (LE)	2.0	GND				75		95		110	ns
		4.5	GND				15		19		22	
		6.0	GND				13		16		19	
t <sub>s</sub>	Minimum Set-Up Time	2.0	GND				50		60		75	ns
		4.5	GND				10		12		15	
		6.0	GND				9		11		13	
t <sub>h</sub>	Minimum Hold Time	2.0	GND				5		5		5	ns
		4.5	GND				5		5		5	
		6.0	GND				5		5		5	

## CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Condition			Value						Unit	
		V <sub>CC</sub> (V)	V <sub>EE</sub> (V)		T <sub>A</sub> = 25°C			-40 to 85°C		-55 to 125°C		
					Min.	Typ.	Max.	Min.	Max.	Min.		Max.
C <sub>IN</sub>	Input Capacitance					5	10		10		10	pF
C <sub>IS</sub>	Common Terminal Capacitance	5.0	-5.0			36	70		70		70	pF
C <sub>OS</sub>	Switch Terminal Capacitance	5.0	-5.0			7	15		15		15	pF
C <sub>IOS</sub>	Feed Through Capacitance	5.0	-5.0			0.95	2		2		2	pF
C <sub>PD</sub>	Power Dissipation Capacitance (note 1)	5.0	GND			23						pF

1) C<sub>PD</sub> 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.  $I_{CC(oper)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}$

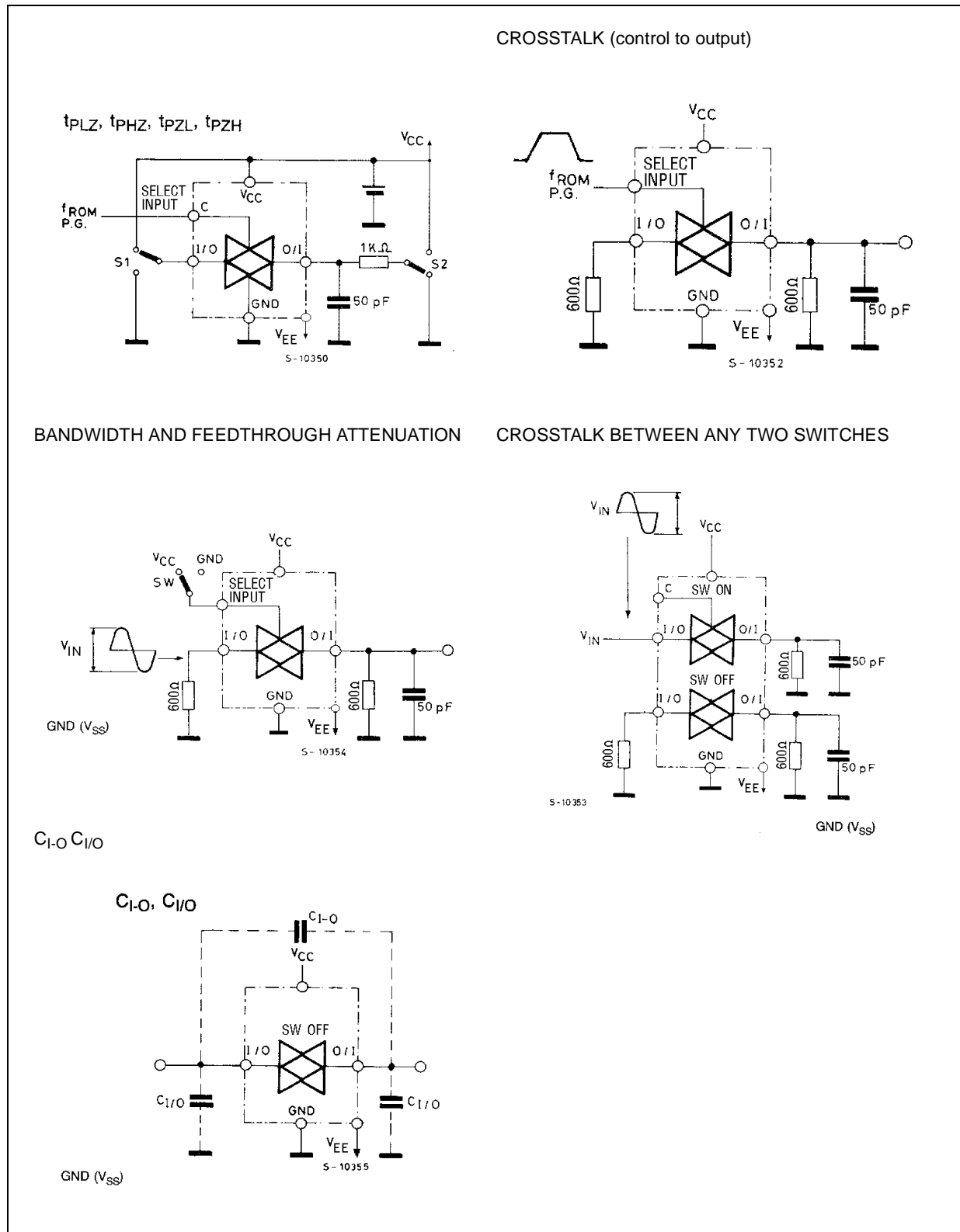
ANALOG SWITCH CHARACTERISTICS (GND = 0V; T<sub>A</sub> = 25°C)

Symbol	Parameter	Test Condition			Value	Unit	
		V <sub>CC</sub> (V)	V <sub>EE</sub> (V)	V <sub>IN</sub> (V <sub>p-p</sub> )			
	Sine Wave Distortion (THD)	2.25	-2.25	4	f <sub>IN</sub> = 1 KHz R <sub>L</sub> = 10 KΩ, C <sub>L</sub> = 50 pF	0.025	%
		4.5	-4.5	8		0.020	
f <sub>MAX</sub>	Frequency Response (Switch ON)	4.5	-4.5	Adjust f <sub>IN</sub> voltage to obtain 0 dBm at V <sub>OS</sub> . Increase f <sub>IN</sub> Frequency until dB meter reads -3dB R <sub>L</sub> = 50Ω, C <sub>L</sub> = 10 pF(*)		200	MHz
	Feed through Attenuation (Switch OFF)	2.25	-2.25	V <sub>IN</sub> is centered at (V <sub>CC</sub> - V <sub>EE</sub> ) / 2. Adjust input for 0 dBm R <sub>L</sub> = 600Ω, C <sub>L</sub> = 50 pF, f <sub>IN</sub> = 1MHz sine wave		-50	dB
		4.5	-4.5			-50	
		6.0	-6.0			-50	
	Crosstalk Control to Switch	2.25	-2.25	t <sub>r</sub> = t <sub>f</sub> = 6ns R <sub>L</sub> = 600Ω, C <sub>L</sub> = 50 pF f <sub>IN</sub> = 1MHz square wave		110	mV
		4.5	-4.5			225	
		6.0	-6.0			310	
	Crosstalk (Between Any Switches)	2.25	-2.25	Adjust V <sub>IN</sub> to Obtain 0 dBm at input R <sub>L</sub> = 600Ω, C <sub>L</sub> = 50 pF, f <sub>IN</sub> = 1MHz sine wave		-50	dB
		4.5	-4.5			-50	
		6.0	-6.0			-50	

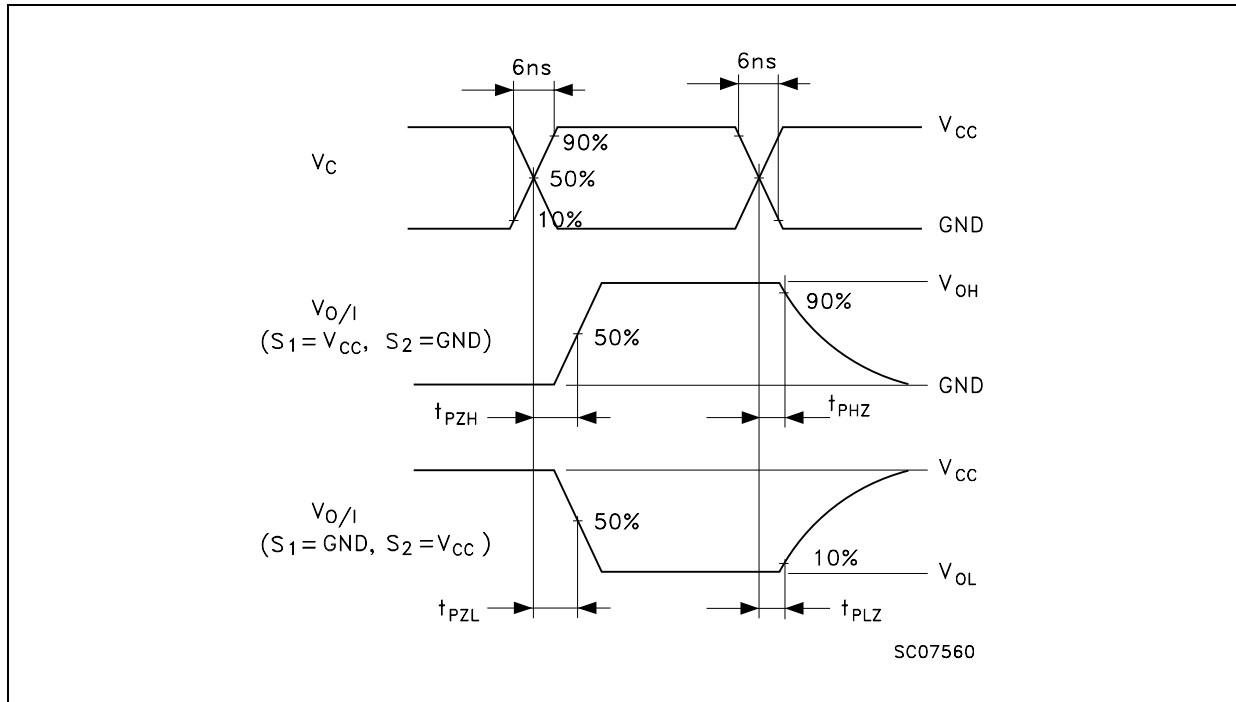
(\*) : Input COMMON Terminal, and measured at SWITCH Terminal.

NOTE : These Characteristics are determined by design of device.

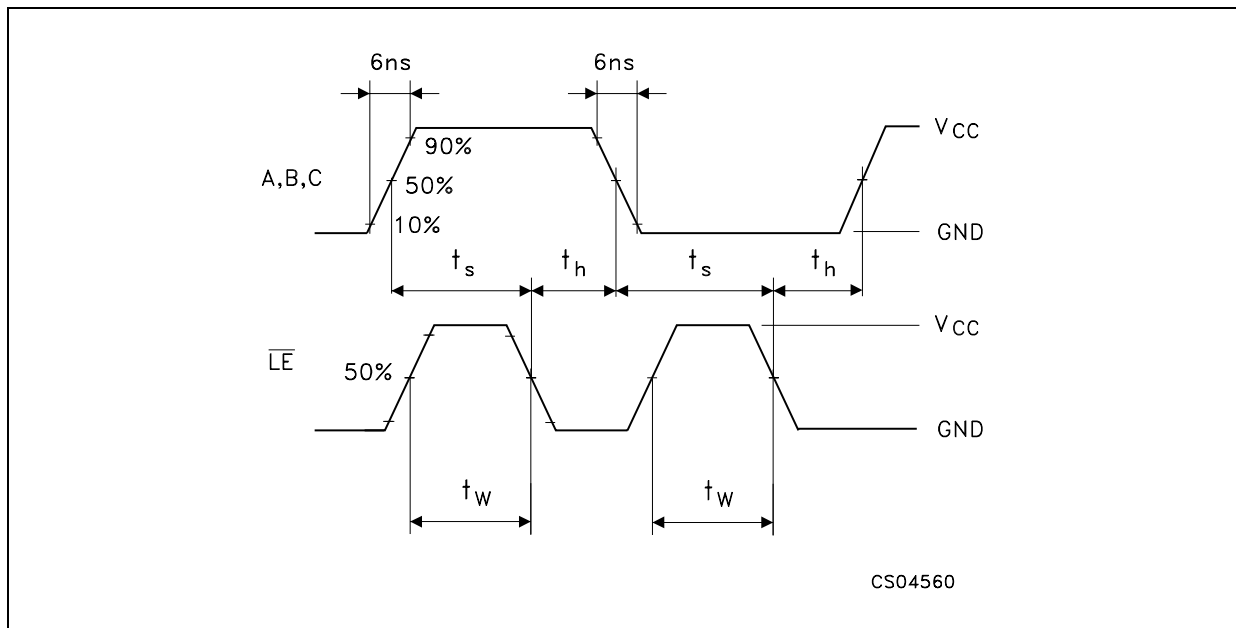
SWITCHING CHARACTERISTICS TEST CIRCUIT



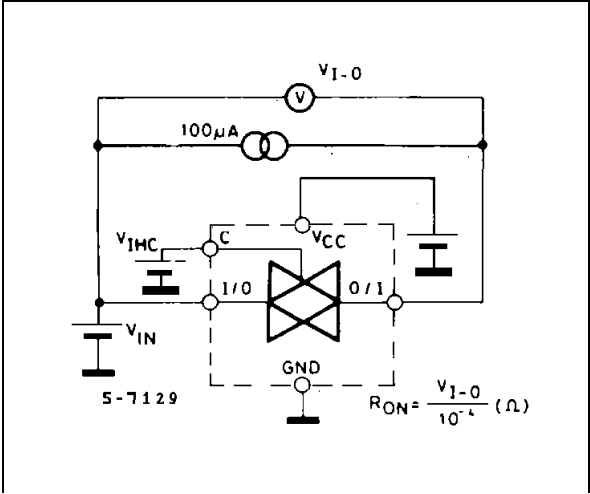
**WAVEFORM 1 : OUTPUT ENABLE AND DISABLE TIME** (f=1MHz; 50% duty cycle)



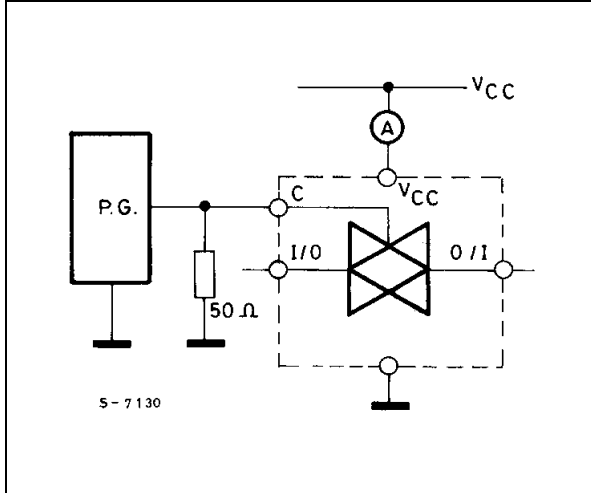
**WAVEFORM 2 : MINIMUM PULSE WIDTH, SETUP AND HOLD TIME** (f=1MHz; 50% duty cycle)



CHANNEL RESISTANCE (R<sub>ON</sub>)



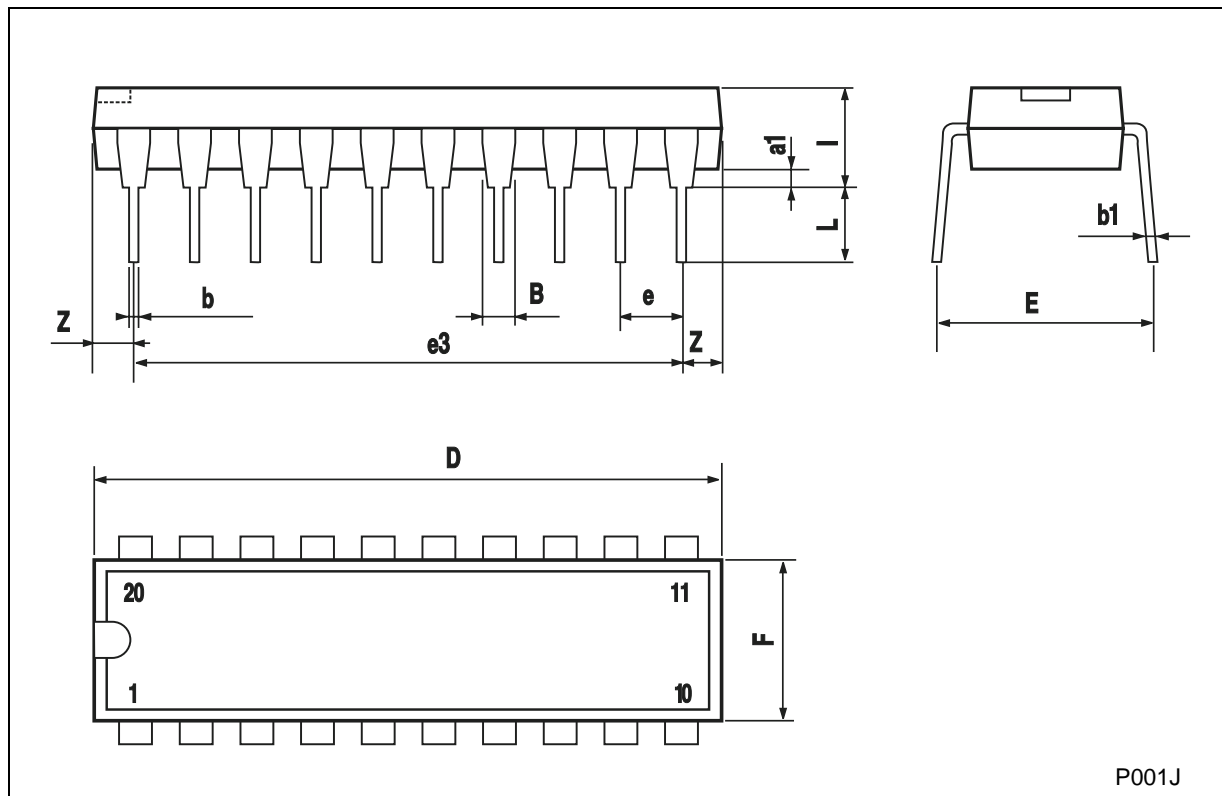
I<sub>CC</sub> (Opr.)





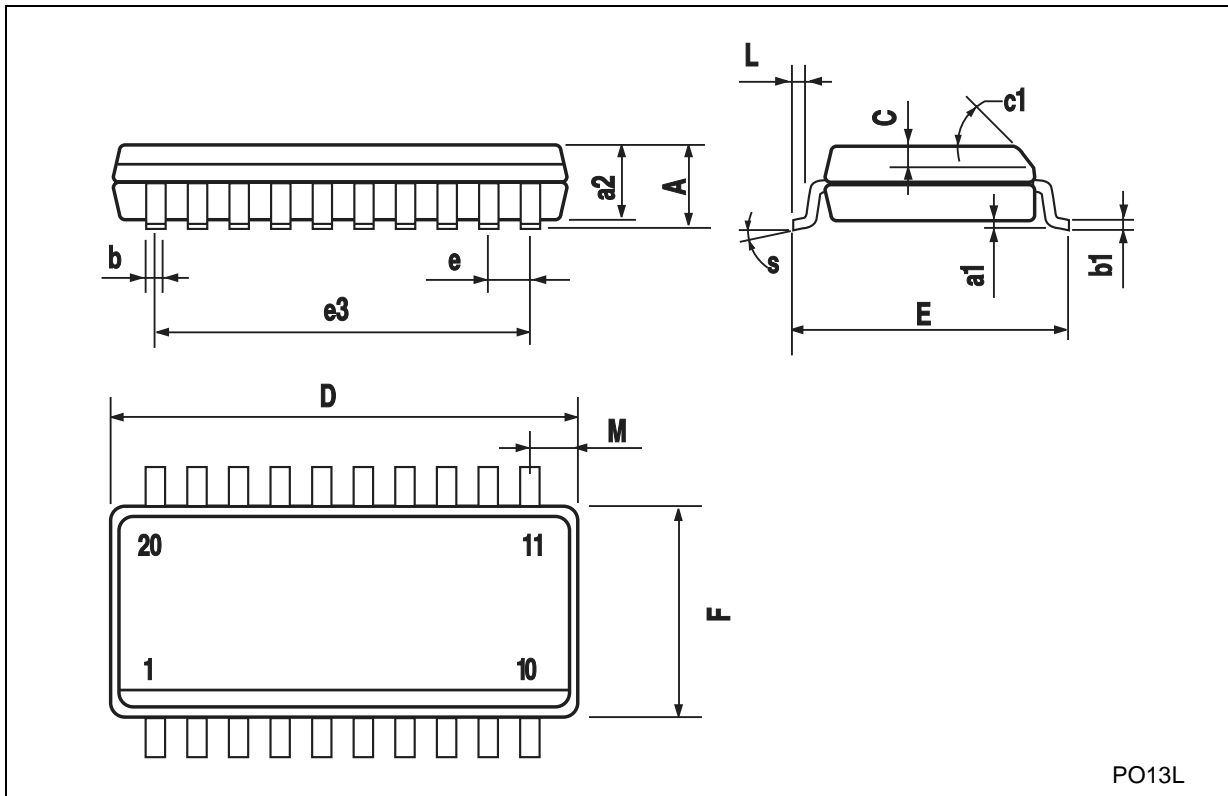
### Plastic DIP-20 (0.25) MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.254			0.010		
B	1.39		1.65	0.055		0.065
b		0.45			0.018	
b1		0.25			0.010	
D			25.4			1.000
E		8.5			0.335	
e		2.54			0.100	
e3		22.86			0.900	
F			7.1			0.280
I			3.93			0.155
L		3.3			0.130	
Z			1.34			0.053



**SO-20 MECHANICAL DATA**

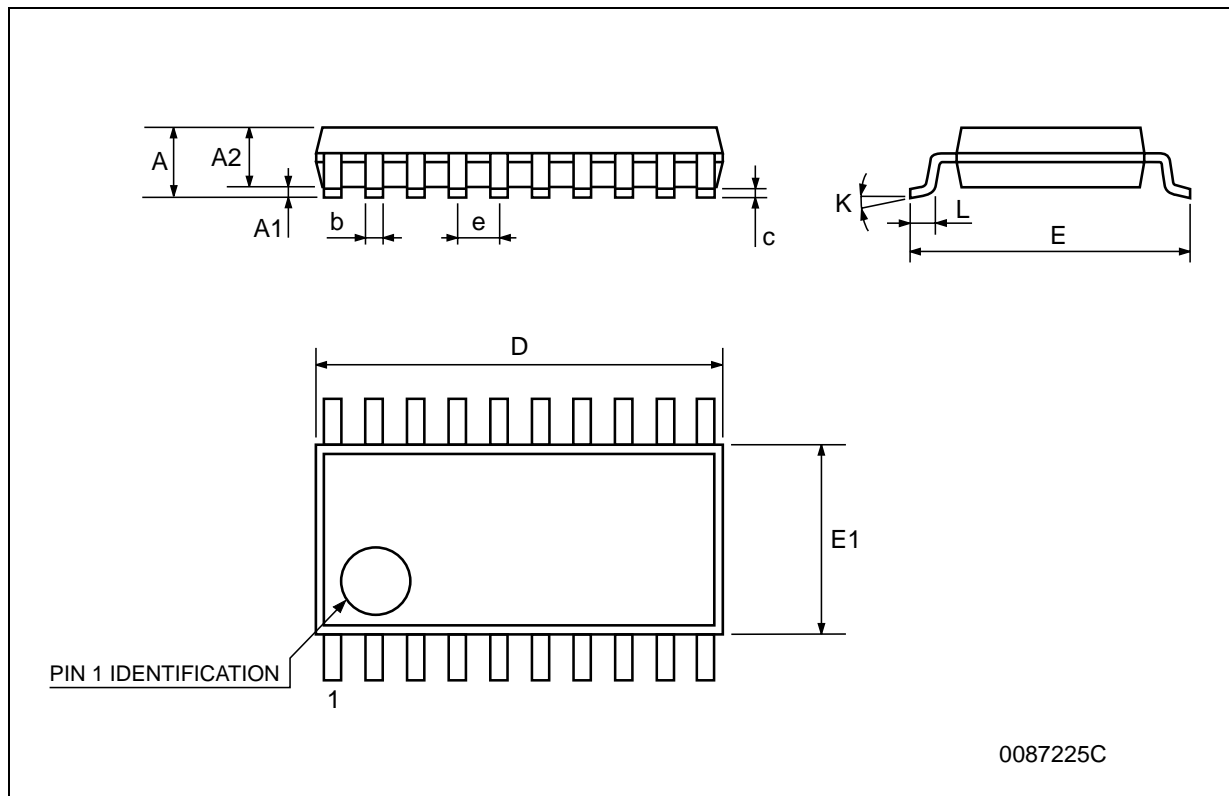
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			2.65			0.104
a1	0.1		0.2	0.004		0.008
a2			2.45			0.096
b	0.35		0.49	0.014		0.019
b1	0.23		0.32	0.009		0.012
C		0.5			0.020	
c1	45° (typ.)					
D	12.60		13.00	0.496		0.512
E	10.00		10.65	0.393		0.419
e		1.27			0.050	
e3		11.43			0.450	
F	7.40		7.60	0.291		0.300
L	0.50		1.27	0.020		0.050
M			0.75			0.029
S	8° (max.)					



PO13L

### TSSOP20 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	6.4	6.5	6.6	0.252	0.256	0.260
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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