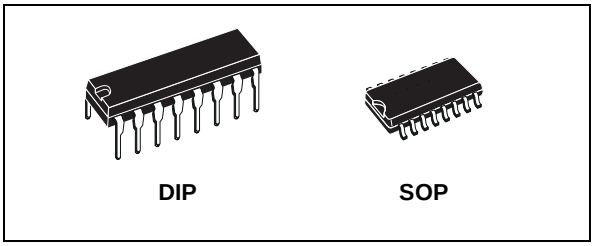
HCF4053B

TRIPLE 2-CHANNEL ANALOG MULTIPLEXER/DEMULTIPLEXER

- LOW "ON" RESISTANCE : 125Ω (Typ.) OVER 15V p.p SIGNAL-INPUT RANGE FOR V_{DD} - V_{EE} = 15V
- HIGH "OFF" RESISTANCE : CHANNEL LEAKAGE ± 100pA (Typ.) at V_{DD} - V_{EE} = 18V
- BINARY ADDRESS DECODING ON CHIP
- HIGH DEGREE OF LINEARITY : < 0.5% DISTORTION TYP. at f_{IS} = 1KHz, V_{IS} = 5 V_{pp}, V_{DD} - V_{SS} ≥ 10V, RL = 10KΩ
- VERY LOW QUIESCENT POWER DISSIPATION UNDER ALL DIGITAL CONTROL INPUT AND SUPPLY CONDITIONS : 0.2 μW (Typ.) at V_{DD} - V_{SS} = V_{DD} - V_{EE} =10V
- MATCHED SWITCH CHARACTERISTICS : R_{ON} = 5Ω (Typ.) FOR V_{DD} - V_{EE} = 15V
- WIDE RANGE OF DIGITAL AND ANALOG SIGNAL LEVELS : DIGITAL 3 to 20, ANALOG TO 20V p.p.
- QUIESCENT CURRENT SPECIF. UP TO 20V
- 5V, 10V AND 15V PARAMETRIC RATINGS
- INPUT LEAKAGE CURRENT I_I = 100nA (MAX) AT V_{DD} = 18V T_A = 25°C
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC JESD13B " STANDARD SPECIFICATIONS FOR DESCRIPTION OF B SERIES CMOS DEVICES"



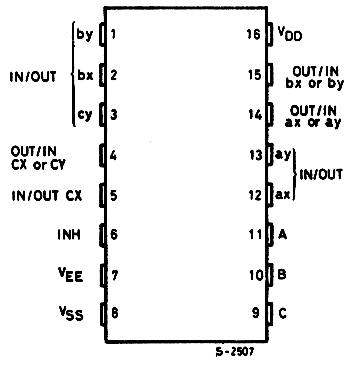
ORDER CODES

PACKAGE	TUBE	T & R
DIP	HCF4053BEY	
SOP	HCF4053BM1	HCF4053M013TR

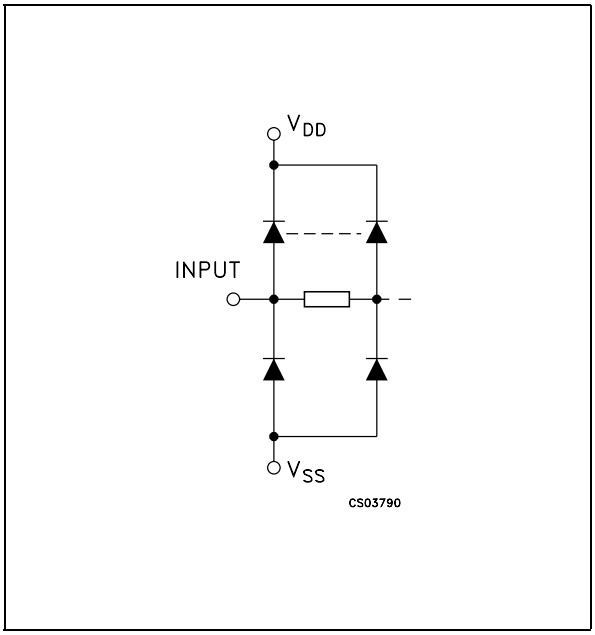
DESCRIPTION

The HCF4053B is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP and SOP packages.
The HCF4053B analog multiplexer/demultiplexer is a digitally controlled analog switch having low ON impedance and very low OFF leakage current. This multiplexer circuit dissipate extremely low quiescent power over the full V_{DD} - V_{SS} and V_{DD} - V_{EE} supply voltage range, independent of the logic state of the control signals.
When a logic "1" is present at the inhibit input terminal all channel are off. This device is a triple 2-channel multiplexer having three separate digital control inputs, A, B, and C, and an inhibit input. Each control input selects one of a pair of channels which are connected in a single pole double-throw configuration.

PIN CONNECTION



INPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

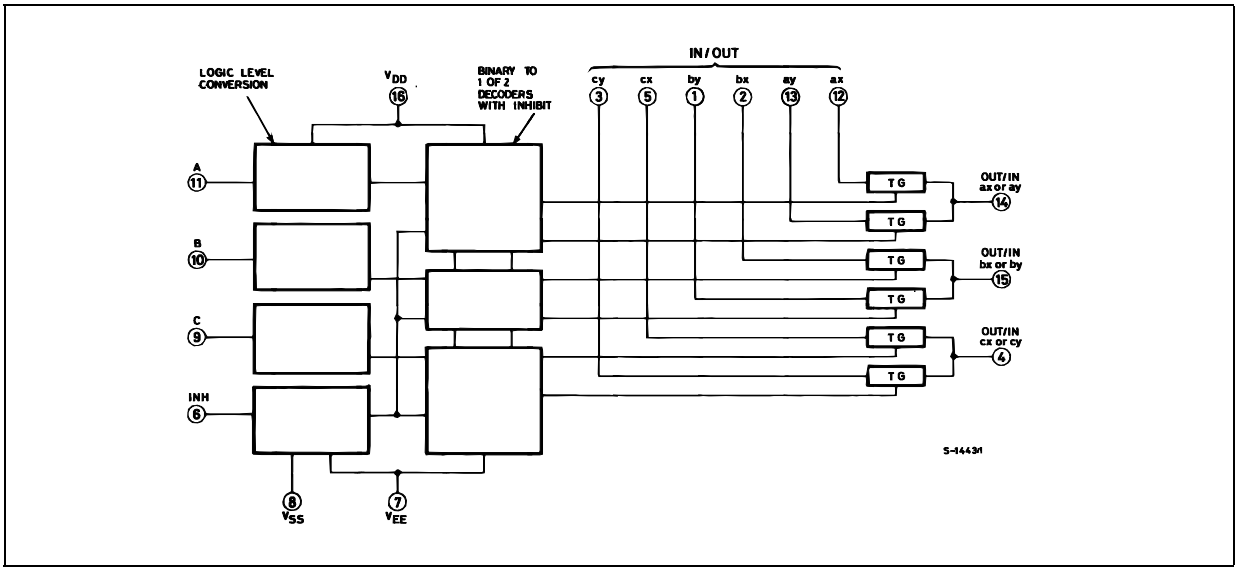
PIN No	SYMBOL	NAME AND FUNCTION
11, 10, 9	A, B, C	Binary Control Inputs
6	INH	Inhibit Inputs
12, 13, 2, 1, 5, 3	IN/OUT	ax,ay,bx,by,cx,cy Input/ Output
14	OUT/IN	ax or ay
15	OUT/IN	bx or by
4	OUT/IN	cx or cy
7	V_{EE}	Supply Voltage
8	V_{SS}	Negative Supply Voltage
16	V_{DD}	Positive Supply Voltage

TRUTH TABLE

INHIBIT	C or B or A	
0	0	ax or bx or cx
0	1	ay or by or cy
1	X	NONE

X : Don't Care

FUNCTIONAL DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{DD}	Supply Voltage	-0.5 to +22	V
V_I	DC Input Voltage	-0.5 to V_{DD} + 0.5	V
I_I	DC Input Current	± 10	mA
P_D	Power Dissipation per Package	500 (*)	mW
	Power Dissipation per Output Transistor	100	mW
T_{op}	Operating Temperature	-55 to +125	°C
T_{stg}	Storage Temperature	-65 to +150	°C

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

All voltage values are referred to V_{SS} pin voltage.

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

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{DD}	Supply Voltage	3 to 20	V
V_I	Input Voltage	0 to V_{DD}	V
T_{op}	Operating Temperature	-55 to 125	°C

DC SPECIFICATIONS

Symbol	Parameter	Test Condition				Value							Unit
		V_{IS} (V)	V_{EE} (V)	V_{SS} (V)	V_{DD} (V)	T_A = 25°C			-40 to 85°C		-55 to 125°C		
						Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
I_L	Quiescent Device Current (all switches ON or all switches OFF)				5		0.04	5		150		150	µA
					10		0.04	10		300		300	
					15		0.04	20		600		600	
					20		0.08	100		3000		3000	
SWITCH													
R_{ON}	Resistance	$0 \le V_I \le V_{DD}$	0	0	5		470	1050		1200		1200	Ω
					10		180	400		520		520	
					15		125	280		360		360	
Δ_{ON}	Resistance Δ_{RON} (between any 2 of 4 switches)	$0 \le V_I \le V_{DD}$	0	0	5		10						Ω
					10		10						
					15		5						
OFF*	Channel Leakage Current (All Channel OFF) (COMMON O/I)		0	0	18		±0.1	100		1000		1000	nA
OFF*	Channel Leakage Current (Any Channel OFF)		0	0	18		±0.1	100		1000		1000	nA
C_I	Input Capacitance		-5	-5	5		5						pF
C_O	Output Capacitance						9						
C_{IO}	Feed through						0.2						
CONTROL (Address or Inhibit)													
V_{IL}	Input Low Voltage	= VDD thru 1KΩ	$V_{EE} = V_{SS}$ R_L = 1KΩ to V_{SS} I_{IS} < 2µA (on all OFF channels)		5			1.5		1.5		1.5	V
					10			3		3		3	
					15			4		4		4	
V_{IH}	Input High Voltage				5	3.5			3.5		3.5		V
					10	7			7		7		
					15	11			11		11		
I_{IH}, I_{IL}	Input Leakage Current	V_I = 0/18V			18		$\pm 10^{-3}$	±0.1		±1		±1	µA
C_I	Input Capacitance						5	7.5					pF

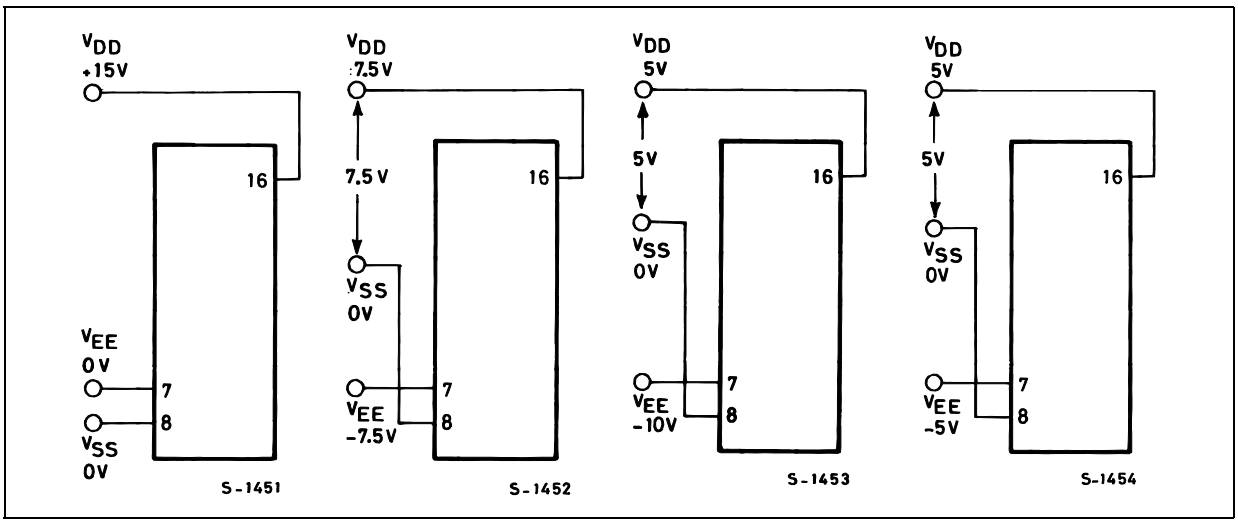
* Determined by minimum feasible leakage measurement for automating testing.

DYNAMIC ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C, C_L = 50pF, all input square wave rise and fall time = 20 ns)

Parameter	Test Condition							Value			Unit
	V_{EE} (V)	R_L (KΩ)	f_I (KHz)	V_I (V)	V_{SS} (V)	V_{DD} (V)		Min.	Typ.	Max.	
Propagation Delay Time (signal input to output)		200		V_{DD}		5			30	60	ns
						10			15	30	
						15			11	20	
Frequency Response Channel "ON" (sine wave input) at 20 log V_O/V_I = - 3dB	= V_{SS}	1		5(*)		10	V_O at Common OUT/IN		25		MHz
							V_O at any channel		60		
Feed through (all channels OFF) at 20 log V_O/V_I = - 40dB	= V_{SS}	1		5(*)		10	V_O at Common OUT/IN		10		MHz
							V_O at any channel		8		
Frequency Signal Crosstalk at 20 log V_O/V_I = -40dB	= V_{SS}	1		5(*)		10	Between any 2 Sections (IN pin 2, OUT pin 14)		2.5		MHz
							Between any 2 Sections (IN pin 15, OUT pin 14)		6		
Sine Wave Distortion f_{IS} = 1KHz Sine Wave	= V_{SS}	10	1	2(*)		5			0.3		%
				3(*)		10			0.2		
				5(*)		15			0.12		
CONTROL (Address or Inhibit)											
Propagation Delay: Address to Signal OUT (Channels ON or OFF)	0				0	5			360	720	ns
	0				0	10			160	320	
	0				0	15			120	240	
	-5				0	5			225	450	
Propagation Delay: Inhibit to Signal OUT (Channel turning ON)	0	1			0	5			360	720	ns
	0				0	10			160	320	
	0				0	15			120	240	
	-10				0	5			200	400	
Propagation Delay: Inhibit to Signal OUT (Channel turning OFF)	0	10				5			200	450	ns
	0					10			90	210	
	0					15			70	160	
	-10					5			130	300	
Address or Inhibit to Signal Crosstalk	0	10 (1)			0	10	$V_C = V_{DD}$-V_{SS} (square wave)		65		mV peak

(1) Both ends of channel.
* Peak to Peak voltage symmetrical about (V_{DD} - V_{EE}) /2

TYPICAL BIAS VOLTAGES

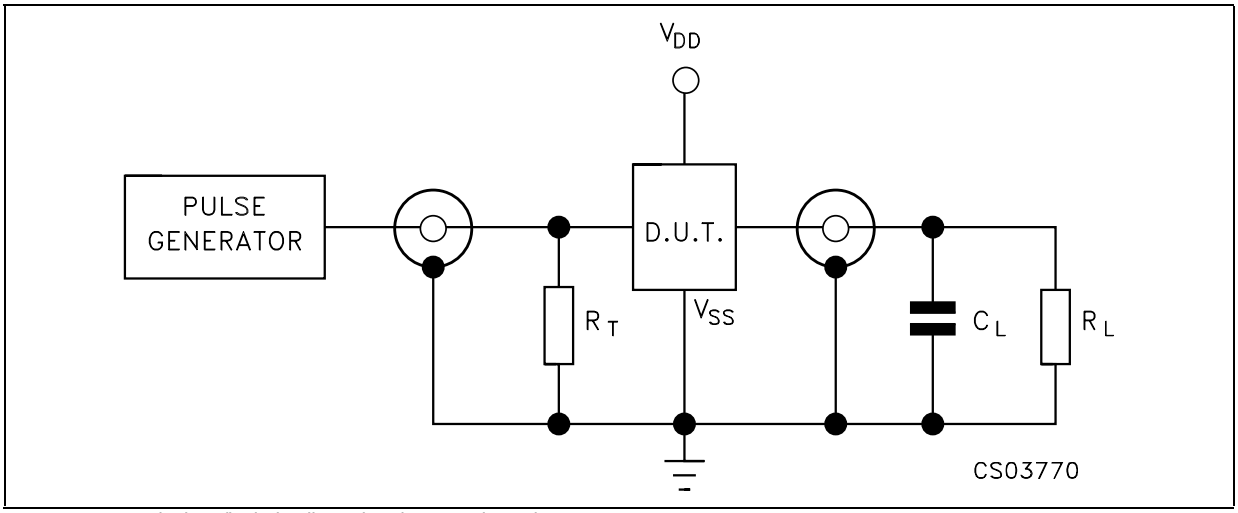


The ADDRESS (digital-control inputs) and INHIBIT logic levels are : "0"=V_{SS} and "1"=V_{DD}. The analog signal (through the TG) may swing from V_{EE} to V_{DD}

SPECIAL CONSIDERATIONS

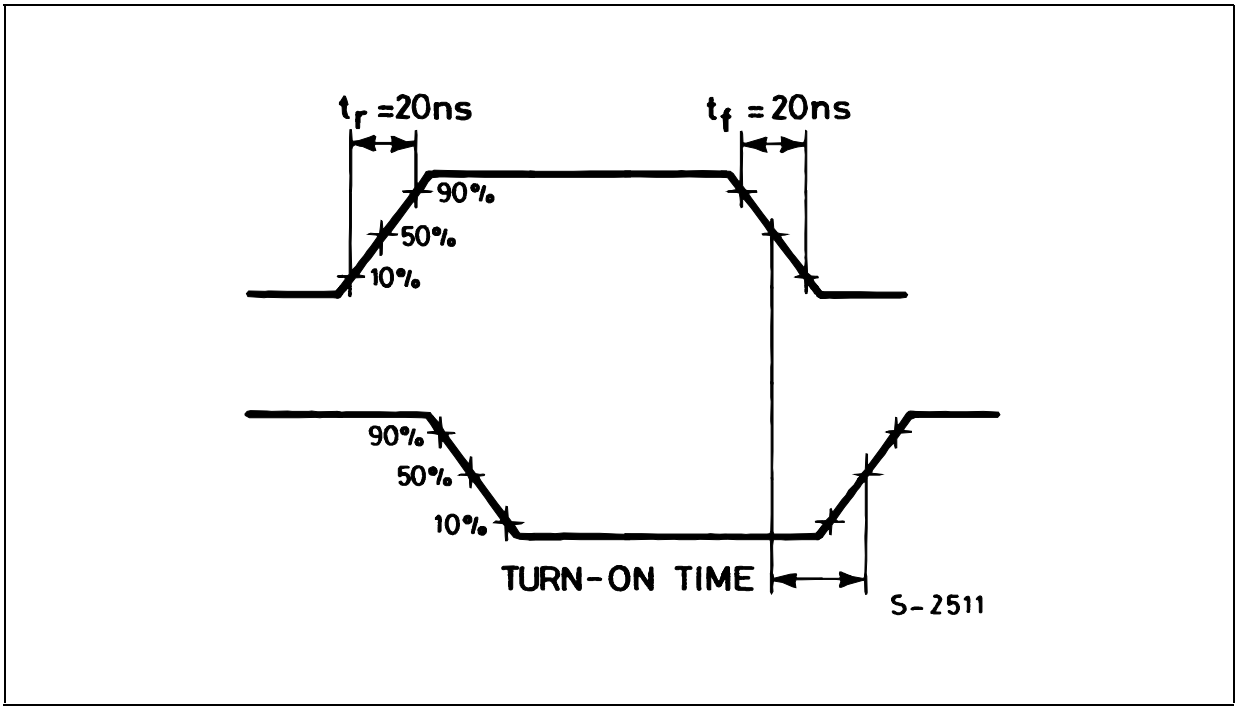
Control of analog signals up to 20V peak to peak can be achieved by digital signal amplitudes of 4.5 to 20V (if V_{DD} - V_{SS} = 3V, a V_{DD} - V_{EE} of up to 13V can be controlled; for V_{DD} - V_{EE} level differences above 13V, a V_{DD} - V_{SS} of at least 4.5V is required. For example, if V_{DD} = +5, V_{SS} = 0, and V_{EE} = -13.5, analog signals from -13.5V to 4.5V can be controlled by digital inputs of 0 to 4.5V. In certain applications, the external load resistor current may include both V_{DD} and signal-line components. To avoid drawing V_{DD} current when switch current flows into the transmission gate inputs, the voltage drop across the bidirectional switch must not exceed 0,8V (calculated from R_{ON} values shown in DC SPECIFICATIONS). No V_{DD} current will flow through R_L if the switch current flows into leads 4, 14 and 15.

TEST CIRCUIT

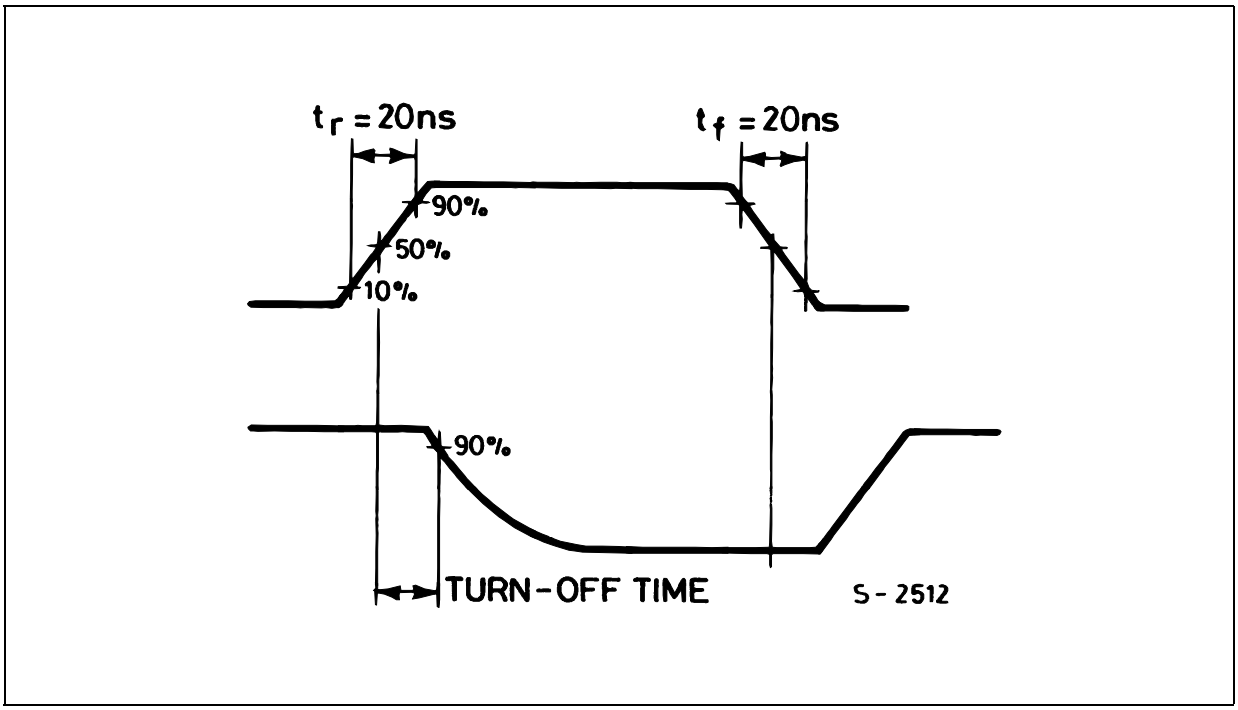


C_L = 50pF or equivalent (includes jig and probe capacitance)
R_L = 200KΩ
R_T = Z_{OUT} of pulse generator (typically 50Ω)

WAVEFORM 1 : CHANNEL BEING TURNED ON (R_L = 1KΩ, f=1MHz; 50% duty cycle)

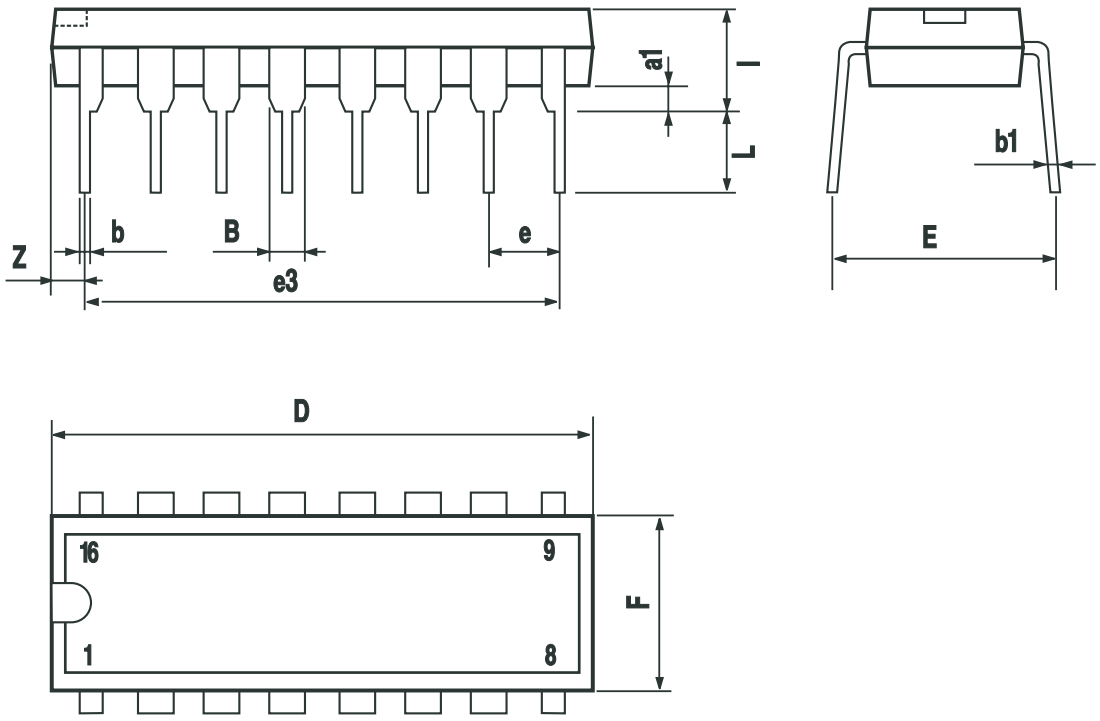


WAVEFORM 2 : CHANNEL BEING TURNED OFF (R_L = 1KΩ, f=1MHz; 50% duty cycle)



Plastic DIP-16 (0.25) MECHANICAL DATA

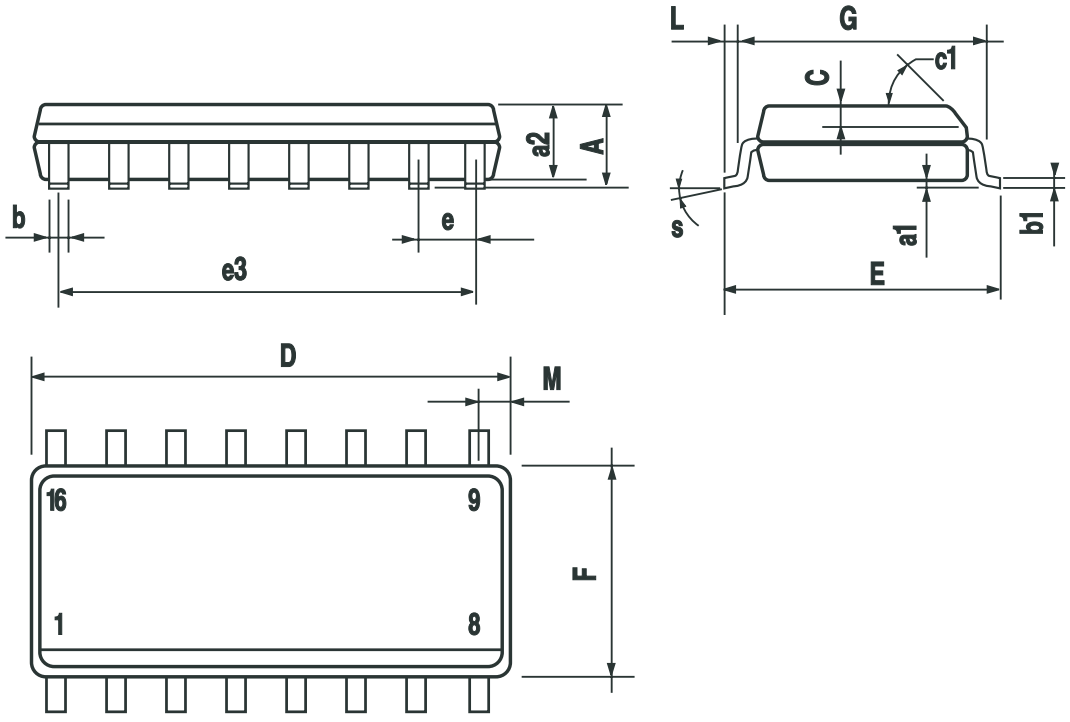
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

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