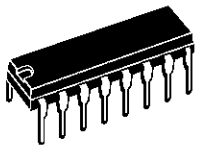
SGS-THOMSON MICROELECTRONICS

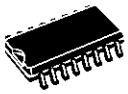
74AC174

HEX D-TYPE FLIP FLOP WITH CLEAR

PRELIMINARY DATA

- HIGH SPEED:
  f_{MAX} =125 MHz (TYP.) at V_{CC} = 5V
- LOW POWER DISSIPATION:
  I_{CC} = 8 µA (MAX.) at T_A = 25 °C
- HIGH NOISE IMMUNITY:
  $V_{NIH} = V_{NIL}$ = 28% V_{CC} (MIN.)
- 50Ω TRANSMISSION LINE DRIVING CAPABILITY
- SYMMETRICAL OUTPUT IMPEDANCE:
  $|I_{OH}| = I_{OL}$ = 24 mA (MIN)
- BALANCED PROPAGATION DELAYS:
  $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:
  V_{CC} (OPR) = 2V to 6V
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 174
- IMPROVED LATCH-UP IMMUNITY





B (Plastic Package) **M** (Micro Package)

ORDER CODES :

74AC174B 74AC174M

DESCRIPTION

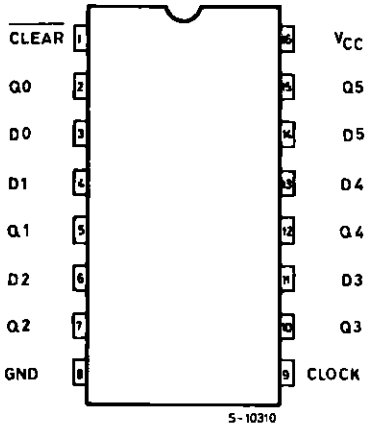
The AC174 is an high-speed CMOS HEX D-TYPE FLIP FLOP WITH CLEAR fabricated with sub-micron silicon gate and double-layer metal wiring C^2MOS technology. It is ideal for low power applications mantaining high speed operation similar to eqivalent Bipolar Schottky TTL.

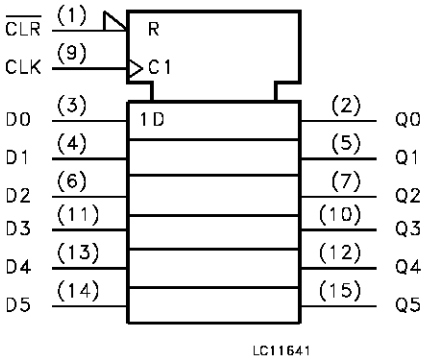
Information signals applied to D inputs are transfered to the Q output on the positive going edge of the clock pulse.

When the $\overline{\text{CLEAR}}$ input is held low, the Q outputs are held low independentely of the other inputs .

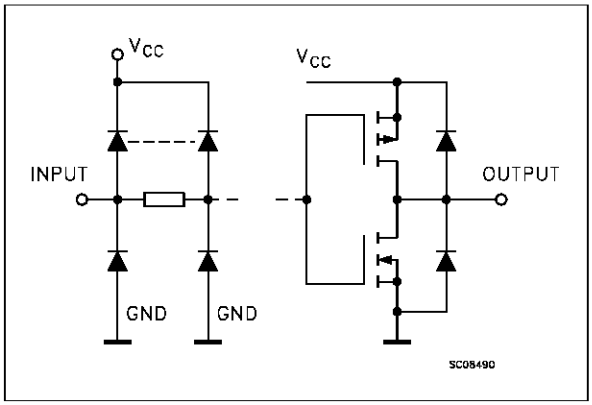
All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

PIN CONNECTION AND IEC LOGIC SYMBOLS





INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

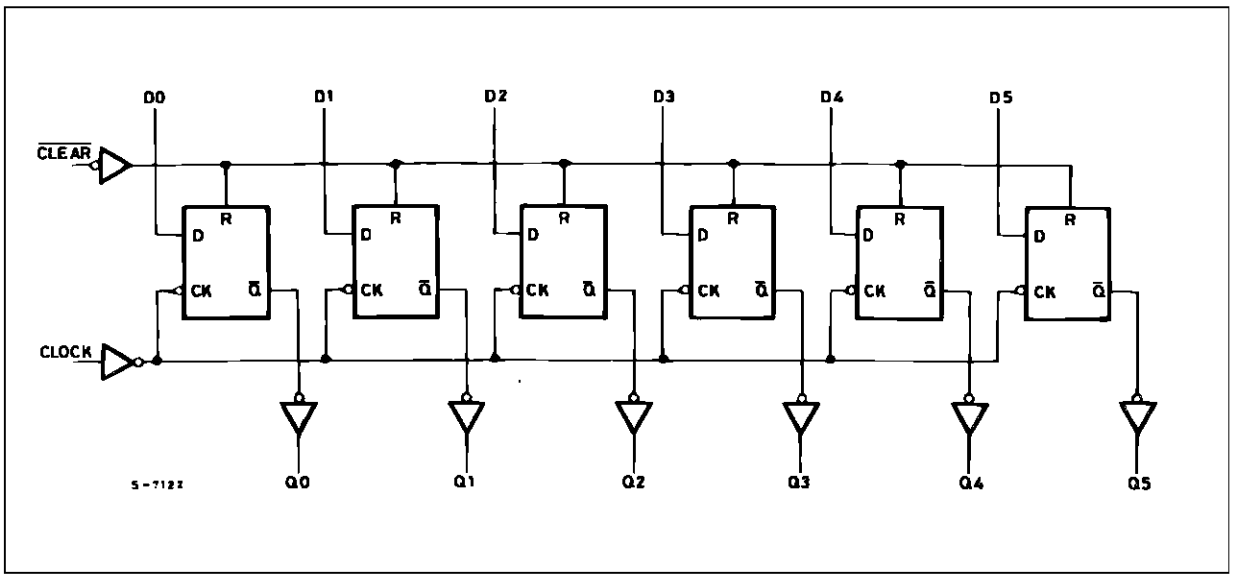
PIN No	SYMBOL	NAME AND FUNCTION
1	$\overline{CLEAR}$	Asyncronous Master Reset (Active LOW)
2, 5, 7, 10, 12, 15	Q0 to Q5	Flip-Flop Outpus
3, 4, 6, 11, 13, 14	D0 to D5	Data Inputs
9	CLOCK	Clock Input (LOW-to-HIGH, Edge- Triggered)
8	GND	Ground (0V)
16	V_{CC}	Positive Supply Voltage

TRUTH TABLE

INPUTS			OUTPUTS	FUNCTION
$\overline{CLEAR}$	D	CLOCK	Q	
L	X	X	L	CLEAR
H	L	⌐	L	
H	H	⌐	H	
H	X	⌐	Q_n	NO CHANGE

X: Don't Care

LOGIC DIAGRAM



This logic diagram has not be used to estimate propagation delays

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	-0.5 to +7	V
V_I	DC Input Voltage	-0.5 to V_{CC} + 0.5	V
V_O	DC Output Voltage	-0.5 to V_{CC} + 0.5	V
I_{IK}	DC Input Diode Current	± 20	mA
I_{OK}	DC Output Diode Current	± 20	mA
I_O	DC Output Current	± 50	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	± 300	mA
T_{stg}	Storage Temperature	-65 to +150	^oC
T_L	Lead Temperature (10 sec)	300	^oC

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

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	2 to 6	V
V_I	Input Voltage	0 to V_{CC}	V
V_O	Output Voltage	0 to V_{CC}	V
T_{op}	Operating Temperature:	-40 to +85	^oC
dt/dv	Input Rise and Fall Time V_{CC} = 3.0, 4.5 or 5.5 V(note 1)	8	ns/V

1) V_{IN} from 30% to 70% of V_{CC}

DC SPECIFICATIONS

Symbol	Parameter	Test Conditions			Value					Unit
		V_{CC} (V)			T_A = 25 °C			-40 to 85 °C		
					Min.	Typ.	Max.	Min.	Max.	
V_{IH}	High Level Input Voltage	3.0	V_O = 0.1 V or V_{CC} - 0.1 V		2.1	1.5		2.1		V
		4.5			3.15	2.25		3.15		
		5.5			3.85	2.75		3.85		
V_{IL}	Low Level Input Voltage	3.0	V_O = 0.1 V or V_{CC} - 0.1 V			1.5	0.9		0.9	V
		4.5				2.25	1.35		1.35	
		5.5				2.75	1.65		1.65	
V_{OH}	High Level Output Voltage	3.0	V_I(*) = V_{IH} or V_{IL}	I_O=-50 µA	2.9	2.99		2.9		V
		4.5		I_O=-50 µA	4.4	4.49		4.4		
		5.5		I_O=-50 µA	5.4	5.49		5.4		
		3.0		I_O=-12 mA	2.56			2.46		
		4.5		I_O=-24 mA	3.86			3.76		
		5.5		I_O=-24 mA	4.86			4.76		
V_{OL}	Low Level Output Voltage	3.0	V_I(*) = V_{IH} or V_{IL}	I_O=50 µA		0.002	0.1		0.1	V
		4.5		I_O=50 µA		0.001	0.1		0.1	
		5.5		I_O=50 µA		0.001	0.1		0.1	
		3.0		I_O=12 mA			0.36		0.44	
		4.5		I_O=24 mA			0.36		0.44	
		5.5		I_O=24 mA			0.36		0.44	
I_I	Input Leakage Current	5.5	V_I = V_{CC} or GND				±0.1		±1	µA
I_{CC}	Quiescent Supply Current	5.5	V_I = V_{CC} or GND				8		80	µA
I_{OLD}	Dynamic Output Current (note 1, 2)	5.5	V_{OLD} = 1.65 V max						75	mA
I_{OHD}			V_{OHD} = 3.85 V min						-75	mA

1) Maximum test duration 2ms, one output loaded at time
2) Incident wave switching is guaranteed on transmission lines with impedances as low as 50 Ω.
(*) All outputs loaded.

AC ELECTRICAL CHARACTERISTICS (C_L = 50 pF, R_L = 500 Ω, Input $t_r = t_f$ = 3 ns)

Symbol	Parameter	Test Condition		Value					Unit
		V_{CC} (V)		T_A = 25 °C			-40 to 85 °C		
				Min.	Typ.	Max.	Min.	Max.	
t_{PLH} t_{PHL}	Propagation Delay Time CK to Q	3.3(*)		1.5	8.5	11.0		12.0	ns
		5.0(**)		1.5	6.0	8.0		9.0	
t_{PLH} t_{PHL}	Propagation Delay Time $\overline{CLR}$ to Q	3.3(*)		1.5	9.0	11.0		12.0	ns
		5.0(**)		1.5	7.0	9.0		10.0	
t_{wL}	$\overline{CLR}$ pulse Width, LOW	3.3(*)			1.0	5.5		7.0	ns
		5.0(**)			1.0	5.0		5.0	
t_w	CK pulse Width	3.3(*)			1.0	5.5		7.0	ns
		5.0(**)			1.0	5.0		5.0	
t_s	Setup Time Q to CK HIGH or LOW	3.3(*)			2.5	6.5		7.0	ns
		5.0(**)			2.0	5.0		5.5	
t_h	Hold Time Q to CK HIGH or LOW	3.3(*)			1.0	3.0		3.0	ns
		5.0(**)			0.5	3.0		3.0	
t_{REM}	Recovery Time $\overline{CLR}$ to CK	3.3(*)			0	2.5		2.5	ns
		5.0(**)			0	2.0		2.0	
f_{MAX}	Maximum Clock Frequency	3.3(*)		90	100		70		MHz
		5.0(**)		100	125		100		

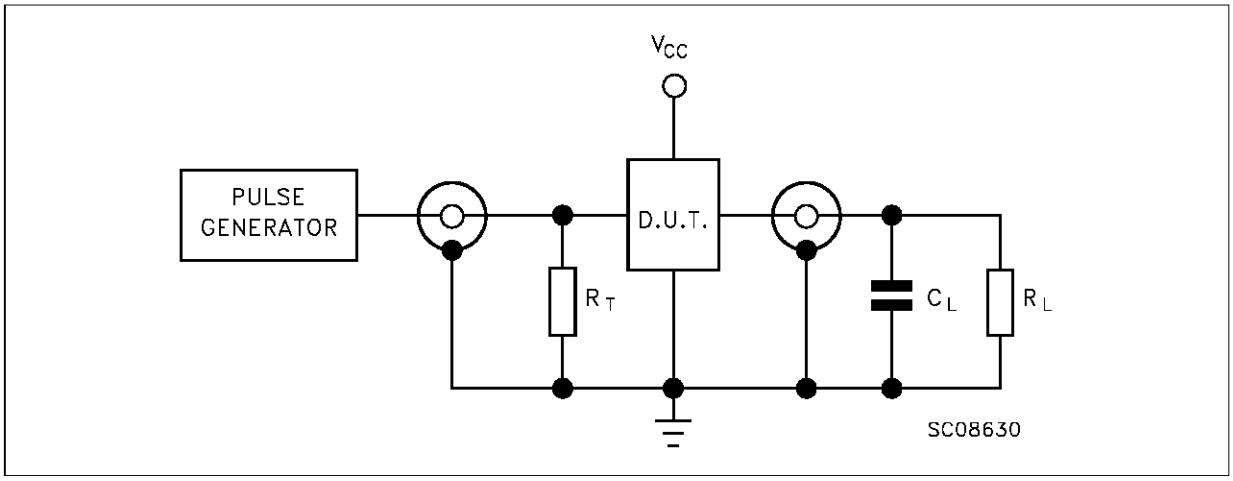
(*) Voltage range is 3.3V ± 0.3V
(**) Voltage range is 5V ± 0.5V

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Conditions		Value					Unit
		V_{CC} (V)		T_A = 25 °C			-40 to 85 °C		
				Min.	Typ.	Max.	Min.	Max.	
C_{IN}	Input Capacitance	5.0			4				pF
C_{PD}	Power Dissipation Capacitance (note 1)	5.0	f_{IN} = 10 MHz		TBD				pF

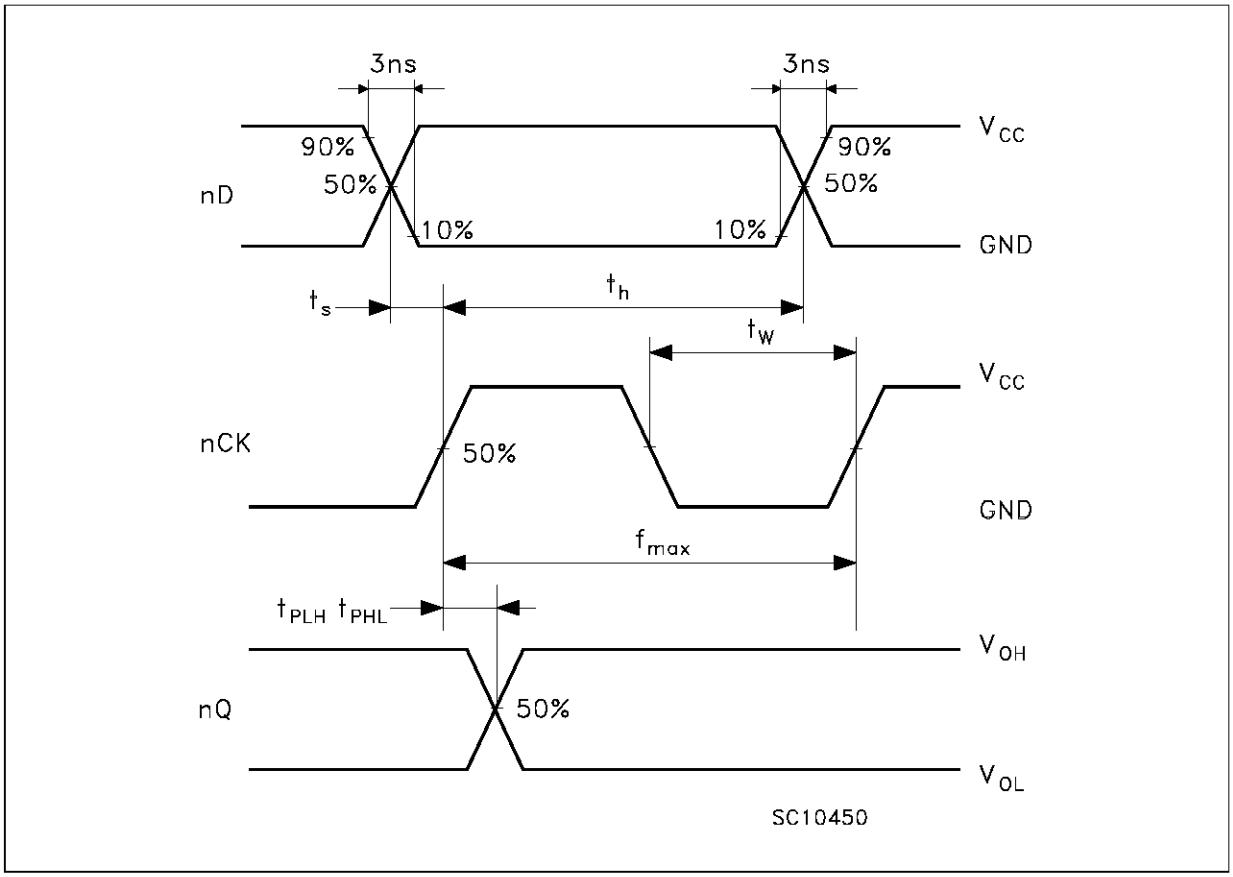
1) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operting current can be obtained by the following equation. $I_{CC}(opr) = C_{PD} \bullet V_{CC} \bullet f_{IN} + I_{CC}/n$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

TEST CIRCUIT

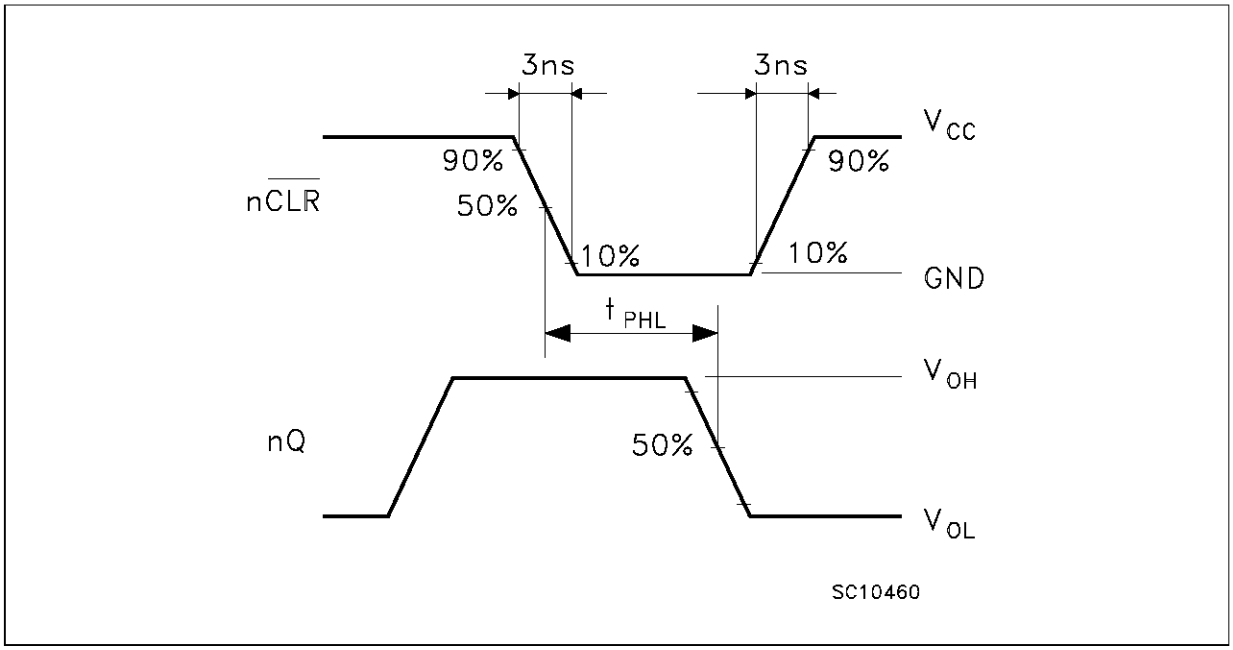


C_L = 50 pF or equivalent (includes jig and probe capacitance)
$R_L = R_1$ = 500Ω or equivalent
$R_T = Z_{OUT}$ of pulse generator (typically 50Ω)

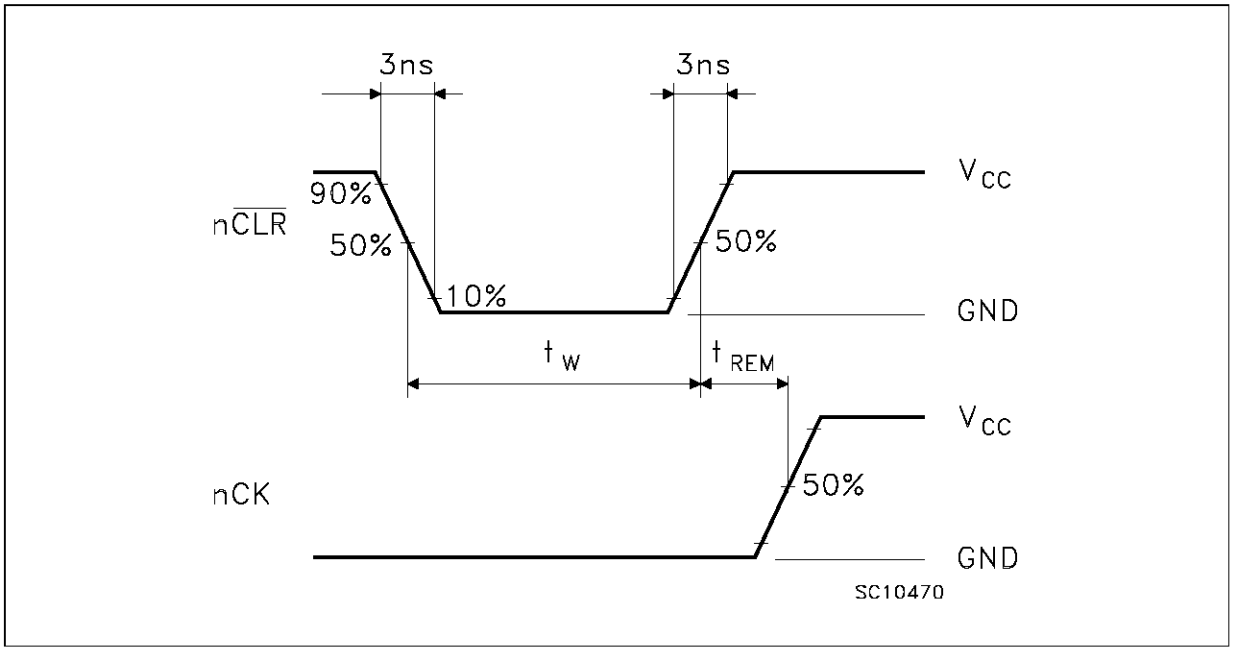
WAVEFORM 1: PROPAGATION DELAYS, SETUP AND HOLD TIMES (f=1MHz; 50% duty cycle)



WAVEFORM 2: PROPAGATION DELAYS (f=1MHz; 50% duty cycle)

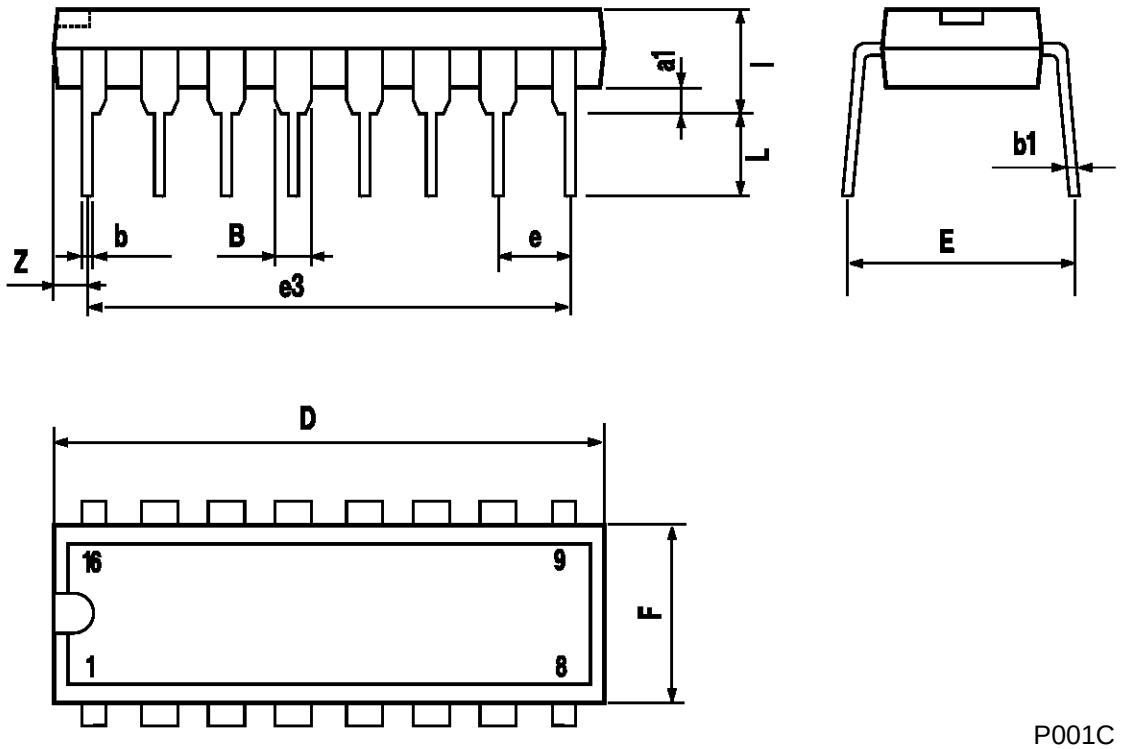


WAVEFORM 3: RECOVERY TIME (f=1MHz; 50% duty cycle)



Plastic DIP-16 (0.25) MECHANICAL DATA

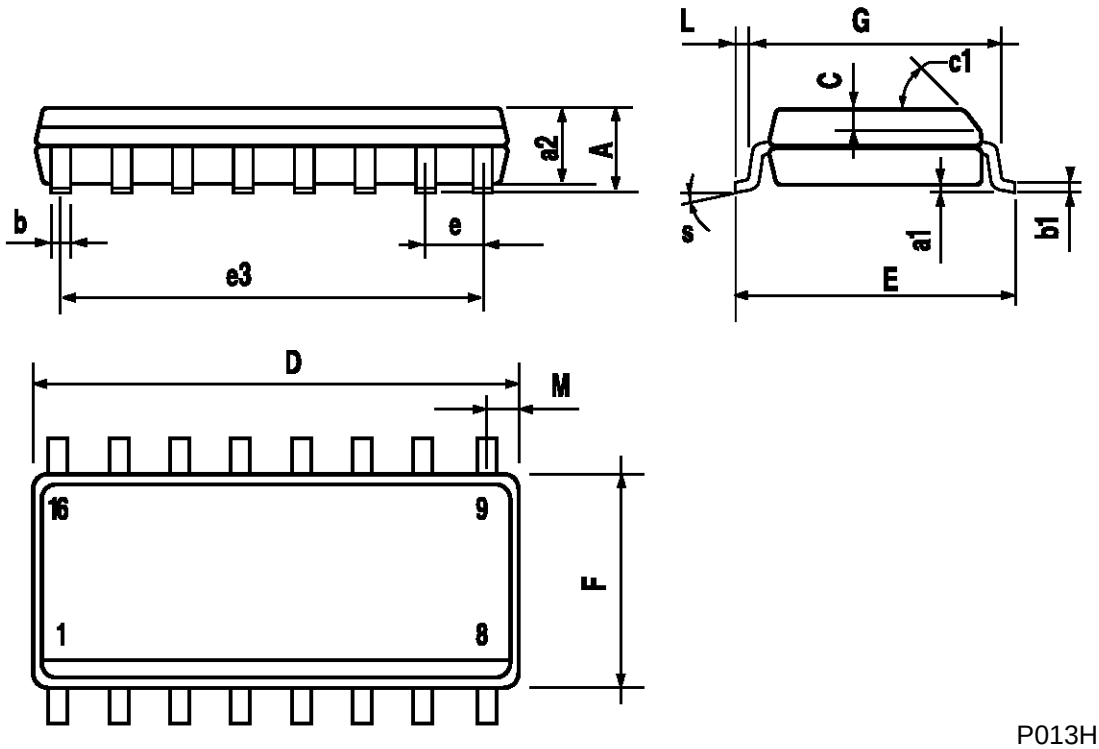
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

SO-16 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.004		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.)					



P013H