



# TS3V556

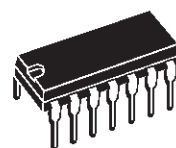
## 3V LOW POWER DUAL TIMERS

- DEDICATED TO 3.3V OR BATTERY SUPPLY  
(Specified at 3V and 5V)
- VERY LOW POWER CONSUMPTION :  
**90µA/tim at V<sub>CC</sub> = 3V**
- WIDE SINGLE SUPPLY RANGE :  
**+2.7V to +16V**
- HIGH OUTPUT CURRENT CAPABILITY
- SUPPLY CURRENT SPIKES REDUCED  
DURING OUTPUT TRANSITIONS
- HIGH INPUT IMPEDANCE : **10<sup>12</sup> Ω**
- PIN-TO-PIN AND FUNCTIONALLY COMPATIBLE  
WITH BIPOLAR NE556 AND CMOS  
TS556
- OUTPUT COMPATIBLE WITH TTL, CMOS  
AND LOGIC MOS

### DESCRIPTION

The TS3V556 with its low consumption (90µA/tim at V<sub>CC</sub> = 3V) is a dual CMOS timer dedicated to 3.3V or battery supply (specified at 3V and 5V offering also a high frequency (f<sub>(max)</sub> 2MHz at V<sub>CC</sub> = 3V and 2.7 MHz at V<sub>CC</sub> = 5V). Thus, either in mono-stable or astable mode, timing remains very accurate.

Timing capacitors can also be minimized due to high input impedance (10<sup>12</sup> Ω).



**N  
DIP14**  
(Plastic Package)

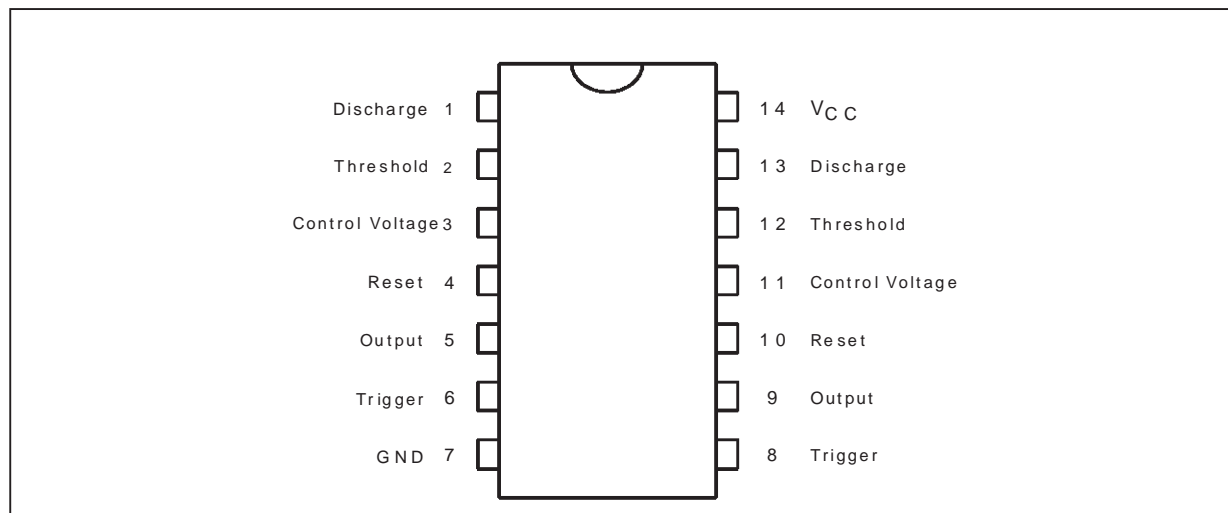


**D  
SO14**

### ORDER CODES

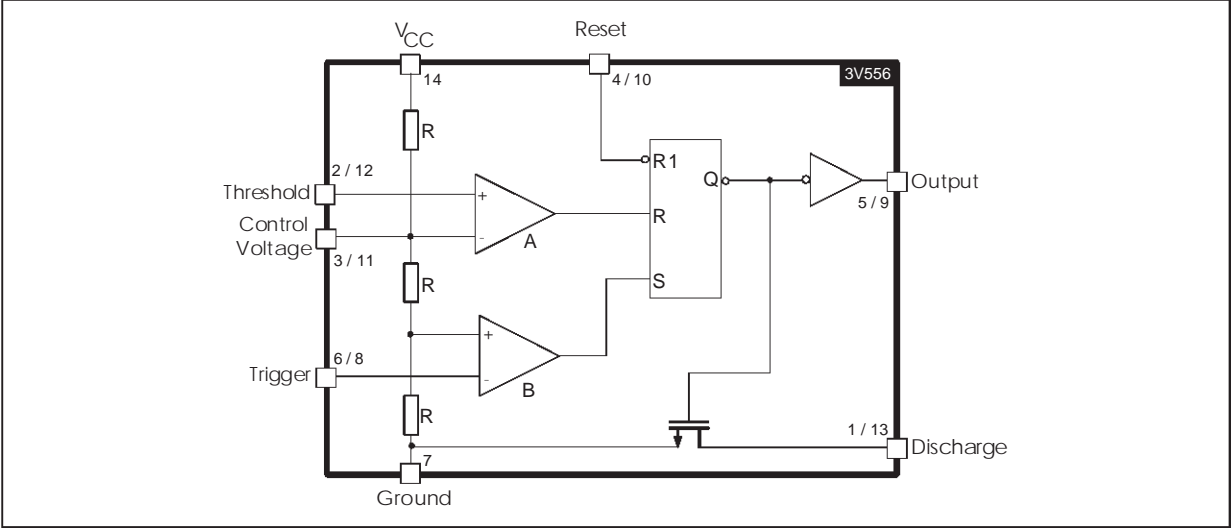
Part Number	Temperature Range	Package	
		N	D
TS3V556I	-40, +125°C	1	1

### PIN CONNECTIONS (top view)



TS3V556

BLOCK DIAGRAM (1/2 TS3V556)



FUNCTION TABLE

RESET	TRIGGER	THRESHOLD	OUTPUT
Low	x	x	Low
High	Low	x	High
High	High	High	Low
High	High	Low	Previous State

**LOW** Level Voltage  $\leq$  Min voltage specified  
**HIGH** Level Voltage  $\geq$  Max voltage specified  
**X** Irrelevant

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage	+18	V
T <sub>J</sub>	Junction Temperature	+150	°C

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
T <sub>oper</sub>	Operating Temperature Range TS3V556I,AI	-40 to +125	°C
T <sub>stg</sub>	Storage Temperature Range	-65 to +150	°C

OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage	+2.7 to +16	V

**ELECTRICAL CHARACTERISTICS**

$V_{CC} = +3V$ ,  $T_{amb} = +25^{\circ}C$ , Reset to  $V_{CC}$  (unless otherwise specified)

**STATIC**

Symbol	Parameter	TS3V556I			Unit
		Min.	Typ.	Max.	
$I_{CC}$	Supply Current - (no load, High and Low States, per timer) $T_{amb} = +25^{\circ}C$ $T_{min.} @ T_{amb} @ T_{max.}$		90	230 230	$\mu A$
$V_{CL}$	Control Voltage $T_{amb} = +25^{\circ}C$ $T_{min.} @ T_{amb} @ T_{max.}$	1.8 1.7	2	2.2 2.3	V
$V_{DIS}$	Discharge Saturation Voltage ( $I_{DIS} = 1mA$ ) $T_{amb} = +25^{\circ}C$ $T_{min.} @ T_{amb} @ T_{max.}$		0.05 -	0.2 0.25	V
$V_{OL}$	Low Level Output Voltage ( $I_{SINK} = 1mA$ ) $T_{amb} = +25^{\circ}C$ $T_{min.} @ T_{amb} @ T_{max.}$		0.1	0.3 0.35	V
$V_{OH}$	High Level Output Voltage ( $I_{SOURCE} = -0.3mA$ ) $T_{amb} = +25^{\circ}C$ $T_{min.} @ T_{amb} @ T_{max.}$	2.5 2.5	2.9		V
$V_{TRIG}$	Trigger Voltage $T_{amb} = +25^{\circ}C$ $T_{min.} @ T_{amb} @ T_{max.}$	0.9 0.8	1	1.1 1.2	V
$I_{TRIG}$	Trigger Current		10		pA
$I_{TH}$	Threshold Current		10		pA
$V_{RESET}$	Reset Voltage $T_{amb} = +25^{\circ}C$ $T_{min.} @ T_{amb} @ T_{max.}$	0.4 0.3	1.1	1.5 2.0	V
$I_{RESET}$	Reset Current		10		pA
$I_{DIS}$	Discharge Pin Leakage Current		1	100	nA

**DYNAMIC**

Symbol	Parameter	TS3V556I			Unit
		Min.	Typ.	Max.	
	Timing Accuracy (Monostable) $R = 10k\Omega$ , $C = 0.1\mu F$ - (note 1)		1		%
	Timing Shift with supply voltage variations (Monostable) $R = 10k\Omega$ , $C = 0.1\mu F$ , $V_{CC} = +3V \pm 0.3V$ - (note 1)		0.5		%/V
	Timing Shift with temperature - (note 1) $T_{min.} @ T_{amb} @ T_{max.}$		75		ppm/ C
$f_{max}$	Maximum astable frequency - (note 2) $R_A = 470\Omega$ , $R_B = 200\Omega$ , $C = 200pF$		2		MHz
	Astable frequency accuracy - (note 2) $R_A = R_B = 1k\Omega$ to $100k\Omega$ , $C = 0.1\mu F$		5		%
	Timing Shift with supply voltage variations (Astable mode) - (note 2) $R_A = R_B = 10k\Omega$ , $C = 0.1\mu F$ , $V_{CC} = +3$ to $+5V$		0.5		%/V
$t_r$	Output Rise Time ( $C_{LOAD} = 10pF$ )		25		ns
$t_f$	Output Fall Time ( $C_{LOAD} = 10pF$ )		20		ns
$t_{PD}$	Trigger Propagation Delay		100		ns
$t_{RPW}$	Minimum Reset Pulse Width ( $V_{TRIG} = +3V$ )		350		ns

**Note :**  
1. See Figure 2  
2. See Figure 4

## TS3V556

### ELECTRICAL CHARACTERISTICS

$V_{CC} = +5V$ ,  $T_{amb} = +25^{\circ}C$ , Reset to  $V_{CC}$  (unless otherwise specified)

#### STATIC

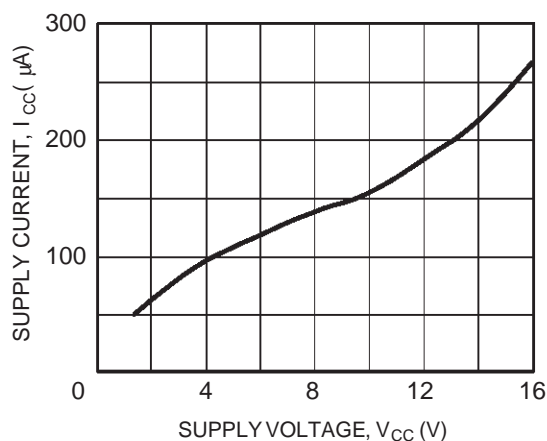
Symbol	Parameter	TS3V556I			Unit
		Min.	Typ.	Max.	
$I_{CC}$	Supply Current - (no load, High and Low States, per timer) $T_{amb} = +25^{\circ}C$ $T_{min.} @ T_{amb} @ T_{max.}$		110	250 250	$\mu A$
$V_{CL}$	Control Voltage $T_{amb} = +25^{\circ}C$ $T_{min.} @ T_{amb} @ T_{max.}$	2.9 2.8	3.3	3.8 3.9	V
$V_{DIS}$	Discharge Saturation Voltage ( $I_{DIS} = 10mA$ ) $T_{amb} = +25^{\circ}C$ $T_{min.} @ T_{amb} @ T_{max.}$		0.2	0.3 0.35	V
$V_{OL}$	Low Level Output Voltage ( $I_{SINK} = 8mA$ ) $T_{amb} = +25^{\circ}C$ $T_{min.} @ T_{amb} @ T_{max.}$		0.3	0.6 0.8	V
$V_{OH}$	High Level Output Voltage ( $I_{SOURCE} = -2mA$ ) $T_{amb} = +25^{\circ}C$ $T_{min.} @ T_{amb} @ T_{max.}$	4.4 4.4	4.6		V
$V_{TRIG}$	Trigger Voltage $T_{amb} = +25^{\circ}C$ $T_{min.} @ T_{amb} @ T_{max.}$	1.36 1.26	1.67	1.96 2.06	V
$I_{TRIG}$	Trigger Current		10		pA
$I_{TH}$	Threshold Current		10		pA
$V_{RESET}$	Reset Voltage $T_{amb} = +25^{\circ}C$ $T_{min.} @ T_{amb} @ T_{max.}$	0.4 0.3	1.1	1.5 2.0	V
$I_{RESET}$	Reset Current		10		pA
$I_{DIS}$	Discharge Pin Leakage Current		1	100	nA

#### DYNAMIC

Symbol	Parameter	TS3V556I			Unit
		Min.	Typ.	Max.	
	Timing Accuracy (Monostable) - (note1) $R = 10k\Omega$ , $C = 0.1\mu F$ - (note 1)		2		%
	Timing Shift with supply voltage variations (Monostable) - (note1) $R = 10k\Omega$ , $C = 0.1\mu F$ , $V_{CC} = +5V \pm 1V$		0.38		%/V
	Timing Shift with temperature - (note1) $T_{min.} @ T_{amb} @ T_{max.}$		75		ppm/ $^{\circ}C$
$f_{max}$	Maximum astable frequency - (note 2) $R_A = 470\Omega$ , $R_B = 200\Omega$ , $C = 200pF$		2.7		MHz
	Astable frequency accuracy - (note 2) $R_A = R_B = 1k\Omega$ to $100k\Omega$ , $C = 0.1\mu F$		3		%
	Timing Shift with supply voltage variations (Astable mode) - (note 2) $R_A = R_B = 10k\Omega$ , $C = 0.1\mu F$ , $V_{CC} = +5V$ to $+12V$		0.1		%/V
$t_r$	Output Rise Time ( $C_{LOAD} = 10pF$ )		25		ns
$t_f$	Output Fall Time ( $C_{LOAD} = 10pF$ )		20		ns
$t_{PD}$	Trigger Propagation Delay		100		ns
$t_{RPW}$	Minimum Reset Pulse Width ( $V_{TRIG} = +5V$ )		350		ns

**Note :** 1. See Figure 2  
2. See Figure 4

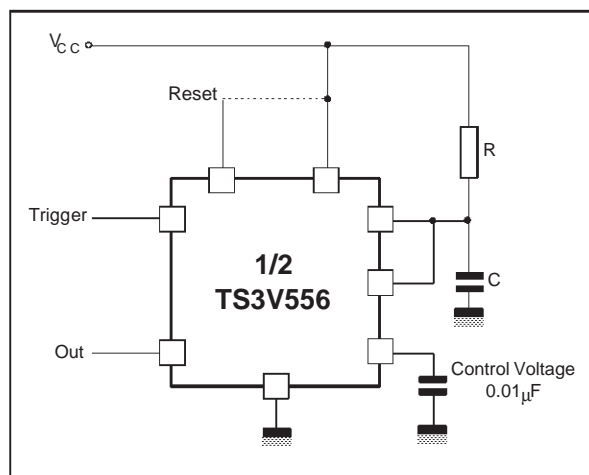
## TYPICAL CHARACTERISTICS

**Figure 1 :** Supply Current (each timer) versus supply voltage.

## APPLICATION INFORMATION

## MONOSTABLE OPERATION

In the monostable mode, the timer functions as a one-shot. Referring to figure 2 the external capacitor is initially held discharged by a transistor inside the timer.

**Figure 2**

The circuit triggers on a negative-going input signal when the level reaches  $1/3 V_{CC}$ . Once triggered, the circuit remains in this state until the set time has elapsed, even if it is triggered again during this interval. The duration of the output HIGH state is given by  $t = 1.1 R \times C$ .

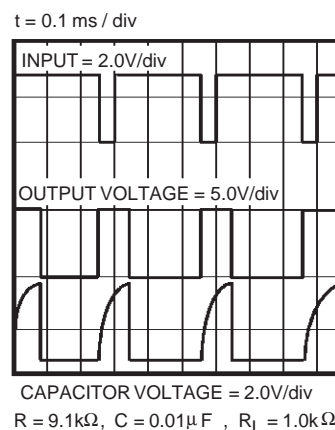
Notice that since the charge rate and the threshold level of the comparator are both directly proportional to supply voltage, the timing interval is independent of supply. Applying a negative pulse simultaneously to the Reset terminal (pin 4 or 10) and the Trigger terminal (pin 2 or 8) during the timing cycle discharges the external capacitor and causes the cycle to start over. The timing cycle now starts on the positive edge of the reset pulse. During the time the reset pulse is applied, the output is driven to its LOW state.

When a negative trigger pulse is applied to the trigger terminal, the flip-flop is set, releasing the short circuit across the external capacitor and driving the output HIGH. The voltage across the capacitor increases exponentially with the time constant  $\tau = R \times C$ .

When the voltage across the capacitor equals  $2/3 V_{CC}$ , the comparator resets the flip-flop which then discharges the capacitor rapidly and drives the output to its LOW state.

Figure 3 shows the actual waveforms generated in this mode of operation.

When Reset is not used, it should be tied high to avoid any possible or false triggering.

**Figure 3**

## ASTABLE OPERATION

When the circuit is connected as shown in figure 4 , it triggers itself and free runs as a multivibrator. The external capacitor charges through  $R_A$  and  $R_B$  and discharges through  $R_B$  only. Thus the duty cycle may be precisely set by the ratio of these two resistors.

In the astable mode of operation, C charges and discharges between  $1/3 V_{CC}$  and  $2/3 V_{CC}$ . As in the triggered mode, the charge and discharge times and therefore frequency, are independent of the supply voltage.

Figure 5 shows actual waveforms generated in this

mode of operation.

The charge time (output HIGH) is given by :

$$t_1 = 0.693 (R_A + R_B) C$$

and the discharge time (output LOW) by :

$$t_2 = 0.693 (R_B) C$$

Thus the total period T is given by :

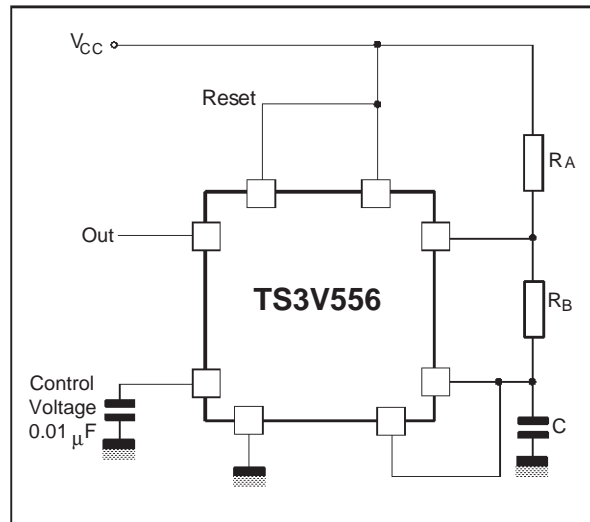
$$T = t_1 + t_2 = 0.693 (R_A + 2R_B) C$$

The frequency of oscillation is then :

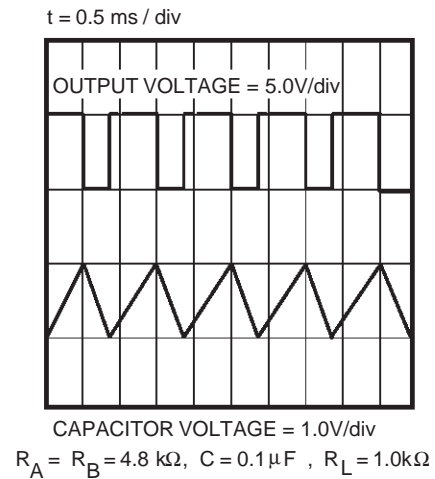
$$f = \frac{1}{T} = \frac{1.44}{(R_A + 2R_B) C}$$

$$\text{The duty cycle is given by : } D = \frac{R_B}{R_A + 2R_B}$$

**Figure 4**

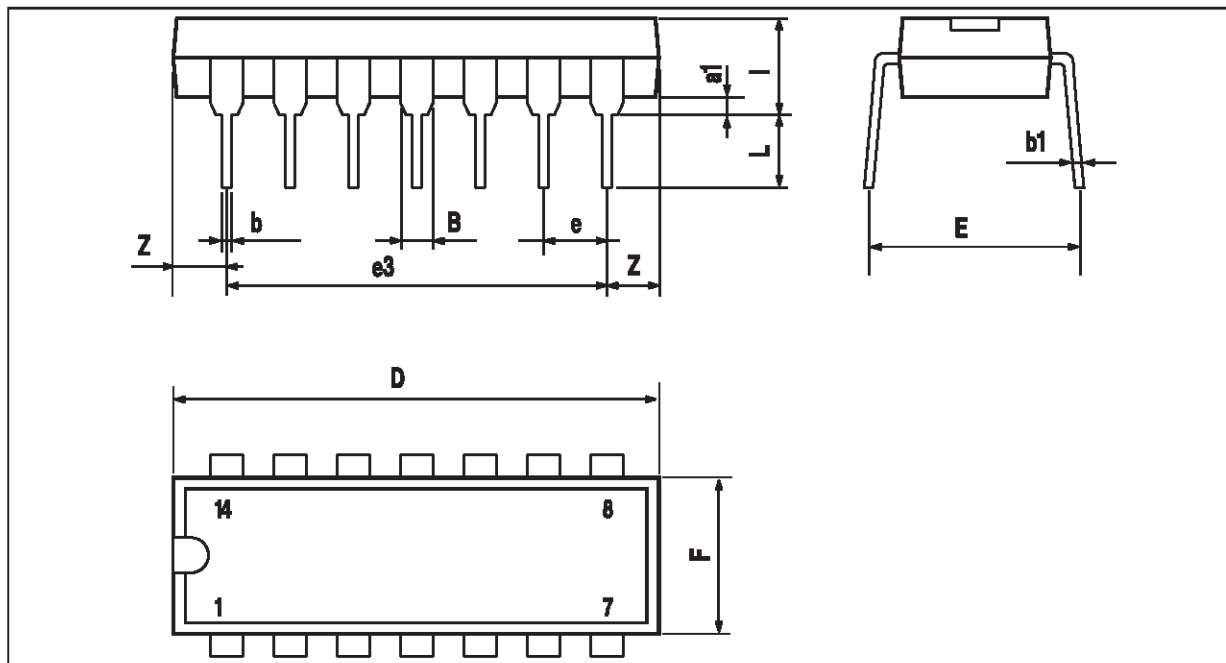


**Figure 5**



**PACKAGE MECHANICAL DATA**

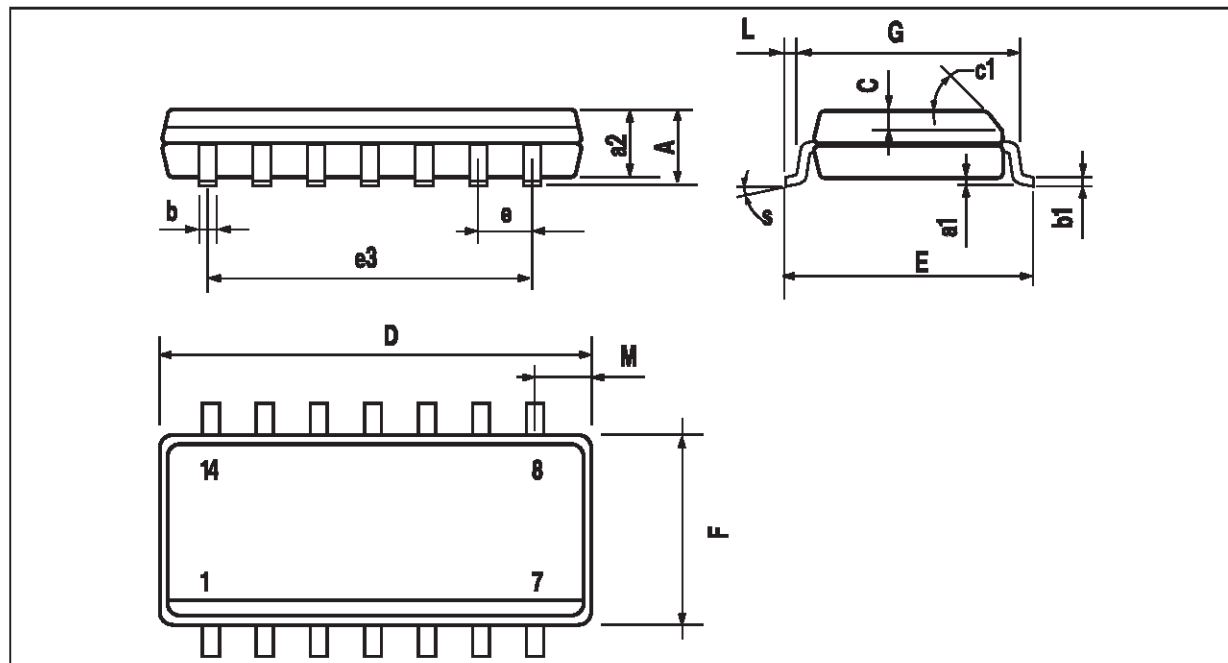
14 PINS - PLASTIC DIP



Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
$a_1$	0.51			0.020		
$B$	1.39		1.65	0.055		0.065
$b$		0.5			0.020	
$b_1$		0.25			0.010	
$D$			20			0.787
$E$		8.5			0.335	
$e$		2.54			0.100	
$e_3$		15.24			0.600	
$F$			7.1			0.280
$i$			5.1			0.201
$L$		3.3			0.130	
$Z$	1.27		2.54	0.050		0.100

**PACKAGE MECHANICAL DATA**

14 PINS - PLASTIC MICROPACKAGE (SO)



Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.2	0.004		0.008
a2			1.6			0.063
b	0.35		0.46	0.014		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.020	
c1	45° (typ.)					
D	8.55		8.75	0.336		0.334
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F	3.8		4.0	0.150		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.020		0.050
M			0.68			0.027
S	8° (max.)					

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