

## General Description

The SN74HC/HCT47 feature active-low outputs designed for driving common-anode LEDs or incandescent indicators directly. Display patterns for BCD input counts above 9 are unique symbols to authenticate input conditions.

## Features

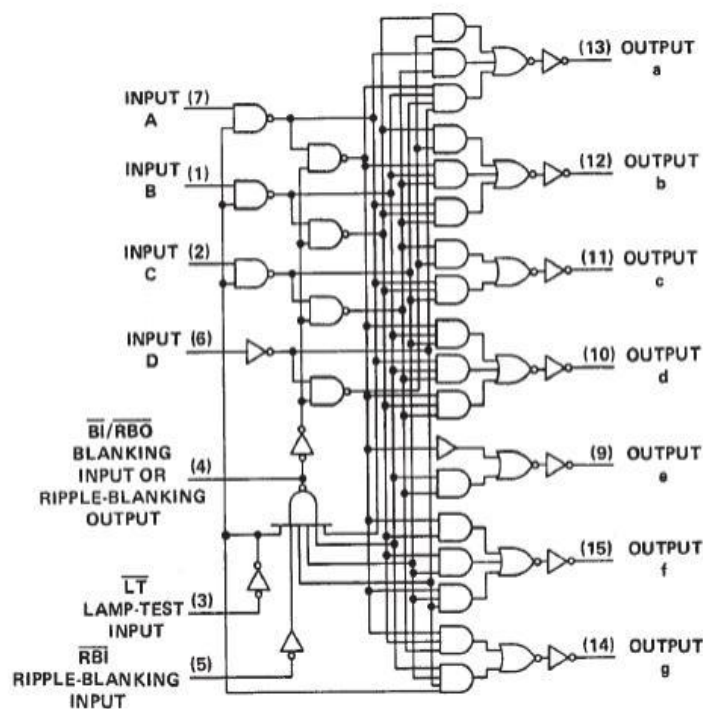
- Supply voltage range:  
SN74HC47: 2V to 6V  
SN74HCT47: 4.5V to 5.5V
- Input levels:  
SN74HC47: CMOS level  
SN74HCT47: TTL level
- Temperature range: -40°C to +125°C
- Packaging information: DIP16/SOP16/TSSOP16

## Ordering Information

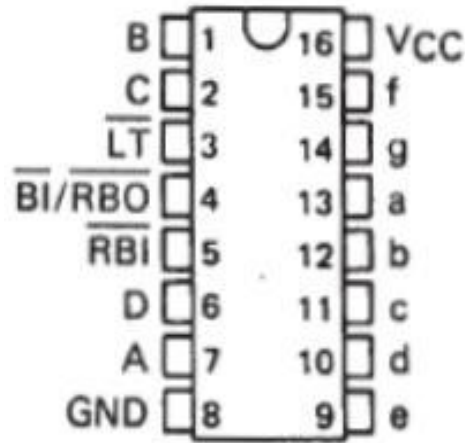
Product Model	Package Type	Marking	Packing	Packing Qty
XBLW SN74HC47N	DIP-16	74HC47N	Tube	1000Pcs/Box
XBLW SN74HC47DTR	SOP-16	74HC47	Tape	2500Pcs/Reel
XBLW SN74HC47TDTR	TSSOP-16	74HC47	Tape	3000Pcs/Reel
XBLW SN74HCT47N	DIP-16	74HCT47N	Tube	1000Pcs/Box
XBLW SN74HCT47DTR	SOP-16	74HCT47	Tape	2500Pcs/Reel
XBLW SN74HCT47TDTR	TSSOP-16	74HCT47	Tape	3000Pcs/Reel

## Block Diagram And Pin Description

### Block Diagram



### Pin Configurations



**Pin Description**

Pin No.	Pin Name	Description
1	B	data input
2	C	data input
3	$\overline{LT}$	lamp test
4	$\overline{BI/RBO}$	blanking input/ripple blanking output
5	$\overline{RBI}$	ripple blanking input
6	D	data input
7	A	data input
8	GND	ground (0V)
9	e	data output
10	d	data output
11	c	data output
12	b	data output
13	a	data output
14	g	data output
15	f	data output
16	V <sub>CC</sub>	supply voltage

**Function Table**

Decimal or function	Input						$\overline{\text{BI/RBO}}$	Output						
	$\overline{\text{LT}}$	$\overline{\text{RBI}}$	D	C	B	A		a	b	c	d	e	f	g
0	H	H	L	L	L	L	H	on	on	on	on	on	on	off
1	H	X	L	L	L	H	H	off	on	on	off	off	off	off
2	H	X	L	L	H	L	H	on	on	off	on	on	off	on
3	H	X	L	L	H	H	H	on	on	on	on	off	off	on
4	H	X	L	H	L	L	H	off	on	on	off	off	on	on
5	H	X	L	H	L	H	H	on	off	on	on	off	on	on
6	H	X	L	H	H	L	H	off	off	on	on	on	on	on
7	H	X	L	H	H	H	H	on	on	on	off	off	off	off
8	H	X	H	L	L	L	H	on	on	on	on	on	on	on
9	H	X	H	L	L	H	H	on	on	on	off	off	on	on
10	H	X	H	L	H	L	H	off	off	off	on	on	off	on
11	H	X	H	L	H	H	H	off	off	on	on	off	off	on
12	H	X	H	H	L	L	H	off	on	off	off	off	on	on
13	H	X	H	H	L	H	H	on	off	off	on	off	on	on
14	H	X	H	H	H	L	H	off	off	off	on	on	on	on
15	H	X	H	H	H	H	H	off	off	off	off	off	off	off
$\overline{\text{BI}}$	X	X	X	X	X	X	L	off	off	off	off	off	off	off
$\overline{\text{RBI}}$	H	L	L	L	L	L	L	off	off	off	off	off	off	off
$\overline{\text{LT}}$	L	X	X	X	X	X	H	on	on	on	on	on	on	on

**Note:**

[1] H=HIGH voltage level; L=LOW voltage level; X=don't care.

[2] The blanking input ( $\overline{\text{BI}}$ ) must be open or held at a high logic level when output functions 0 through 15 are desired. The ripple-blanking input ( $\overline{\text{RBI}}$ ) must be open or high if blanking of a decimal zero is not desired.

[3] When a low logic level is applied directly to the blanking input ( $\overline{\text{BI}}$ ), all segment outputs are off regardless of the level of any other input.

[4] When ripple-blanking input ( $\overline{\text{RBI}}$ ) and inputs A, B, C, D are at a low level with the lamp test input high, all segment outputs go off and the ripple-blanking output ( $\overline{\text{RBO}}$ ) goes to a low level (response condition).

[5] When the blanking input/ripple blanking output ( $\overline{\text{BI/RBO}}$ ) is open or held high and a low is applied to the lamp test input, all segment outputs are on.

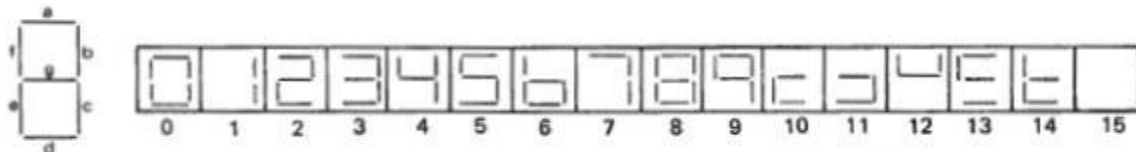


Figure 3. Segment identification



## Electrical Parameter

### Absolute Maximum Ratings

(Voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Max.	Unit
supply voltage	$V_{CC}$	-	-0.5	+7	V
supply current	$I_{CC}$	-	-	50	mA
ground current	$I_{GND}$	-	-50	-	mA
input clamping current	$I_{IK}$	$V_I < -0.5V$ or $V_I > V_{CC}+0.5V$	-	$\pm 20$	mA
output clamping current	$I_{OK}$	$V_O < -0.5V$ or $V_O > V_{CC}+0.5V$	-	$\pm 20$	mA
output current	$I_O$	$-0.5V < V_O < V_{CC}+0.5V$	-	$\pm 25$	mA
storage temperature	$T_{stg}$	-	-65	+150	$^{\circ}C$
soldering temperature	$T_L$	10s	DIP	245	$^{\circ}C$
			SOP/TSSOP	260	

### Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>SN74HC47</b>						
supply voltage	$V_{CC}$	-	2.0	5.0	6.0	V
input voltage	$V_I$	-	0	-	$V_{CC}$	V
output voltage	$V_O$	-	0	-	$V_{CC}$	V
ambient temperature	$T_{amb}$	-	-40	-	+125	$^{\circ}C$
<b>SN74HCT47</b>						
supply voltage	$V_{CC}$	-	4.5	5.0	5.5	V
input voltage	$V_I$	-	0	-	$V_{CC}$	V
output voltage	$V_O$	-	0	-	$V_{CC}$	V
ambient temperature	$T_{amb}$	-	-40	-	+125	$^{\circ}C$

## Electrical Characteristics

### DC Characteristics 1

( $T_{amb} = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ , voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	V <sub>CC</sub>	Conditions	Min.	Typ.	Max.	Unit
<b>SN74HC47</b>							
HIGH-level input voltage	V <sub>IH</sub>	2.0V	-	1.5	1.2	-	V
		4.5V	-	3.15	2.4	-	V
		6.0V	-	4.2	3.2	-	V
LOW-level input voltage	V <sub>IL</sub>	2.0V	-	-	0.8	0.5	V
		4.5V	-	-	2.1	1.35	V
		6.0V	-	-	2.8	1.8	V
LOW-level output voltage	V <sub>OL</sub>	2.0V	I <sub>O</sub> =20uA	-	0	0.1	V
		4.5V	I <sub>O</sub> =20uA	-	0	0.1	V
		6.0V	I <sub>O</sub> =20uA	-	0	0.1	V
		4.5V	I <sub>O</sub> =4.0mA	-	0.15	0.33	V
		6.0V	I <sub>O</sub> =5.2mA	-	0.16	0.33	V
HIGH-level input current	I <sub>IH</sub>	6.0V	V <sub>I</sub> =V <sub>CC</sub>	-	-	20	uA
LOW-level input current	I <sub>IL</sub> (A/B/C/D)	6.0V	V <sub>I</sub> = GND	-	-	-20	uA
	I <sub>IL</sub> (B̄/ R̄BO/ R̄BI/LT)	6.0V	V <sub>I</sub> = GND	-	-	-1.2	mA
supply current	I <sub>CC</sub>	6.0V	V <sub>I</sub> =V <sub>CC</sub> or GND; I <sub>O</sub> =0A	-	-	13	mA
<b>SN74HCT47</b>							
HIGH-level input voltage	V <sub>IH</sub>	4.5V to 5.5V	-	2.0	1.6	-	V
LOW-level input voltage	V <sub>IL</sub>	4.5V to 5.5V	-	-	1.2	0.8	V
LOW-level output voltage	V <sub>OL</sub>	4.5V	I <sub>O</sub> =20uA	-	0	0.1	V
			I <sub>O</sub> =4.0mA	-	0.16	0.26	V
HIGH-level input current	I <sub>IH</sub>	6.0V	V <sub>I</sub> =V <sub>CC</sub>	-	-	20	uA
LOW-level input current	I <sub>IL</sub> (A/B/C/D)	6.0V	V <sub>I</sub> = GND	-	-	-20	uA
	I <sub>IL</sub> (B̄/ R̄BO/ R̄BI/LT)	6.0V	V <sub>I</sub> = GND	-	-	-1.2	mA
supply current	I <sub>CC</sub>	6.0V	V <sub>I</sub> =V <sub>CC</sub> or GND; I <sub>O</sub> =0A	-	-	13	mA
additional supply current	ΔI <sub>CC</sub>	4.5V to 5.5V	One input at V <sub>I</sub> =V <sub>CC</sub> -2.1V; Other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> =0A	-	-	500	uA


**DC Characteristics 2**

 (T<sub>amb</sub>=-40°C to +125°C, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	V <sub>CC</sub>	Conditions	Min.	Typ.	Max.	Unit
<b>SN74HC47</b>							
HIGH-level input voltage	V <sub>IH</sub>	2.0V	-	1.5	-	-	V
		4.5V	-	3.15	-	-	V
		6.0V	-	4.2	-	-	V
LOW-level input voltage	V <sub>IL</sub>	2.0V	-	-	-	0.5	V
		4.5V	-	-	-	1.35	V
		6.0V	-	-	-	1.8	V
LOW-level output voltage	V <sub>OL</sub>	2.0V	I <sub>O</sub> =20uA	-	-	0.1	V
		4.5V	I <sub>O</sub> =20uA	-	-	0.1	V
		6.0V	I <sub>O</sub> =20uA	-	-	0.1	V
		4.5V	I <sub>O</sub> =4.0mA	-	-	0.4	V
		6.0V	I <sub>O</sub> =5.2mA	-	-	0.4	V
HIGH-level input current	I <sub>IH</sub>	6.0V	V <sub>I</sub> =V <sub>CC</sub>	-	-	20	uA
LOW-level input current	I <sub>IL</sub> (A/B/C/D)	6.0V	V <sub>I</sub> = GND	-	-	-20	uA
	I <sub>IL</sub> (B <sub>1</sub> <sup>-</sup> /R <sub>BO</sub> <sup>-</sup> /R <sub>BI</sub> <sup>-</sup> /LT <sup>-</sup> )	6.0V	V <sub>I</sub> = GND	-	-	-1.2	mA
supply current	I <sub>CC</sub>	6.0V	V <sub>I</sub> =V <sub>CC</sub> or GND; I <sub>O</sub> =0A	-	-	13	mA
<b>SN74HCT47</b>							
HIGH-level input voltage	V <sub>IH</sub>	4.5V to 5.5V	-	2.0	-	-	V
LOW-level input voltage	V <sub>IL</sub>	4.5V to 5.5V	-	-	-	0.8	V
LOW-level output voltage	V <sub>OL</sub>	4.5V	I <sub>O</sub> =20uA	-	-	0.1	V
			I <sub>O</sub> =4.0mA	-	-	0.4	V
HIGH-level input current	I <sub>IH</sub>	6.0V	V <sub>I</sub> =V <sub>CC</sub>	-	-	20	uA
LOW-level input current	I <sub>IL</sub> (A/B/C/D)	6.0V	V <sub>I</sub> = GND	-	-	-20	uA
	I <sub>IL</sub> (B <sub>1</sub> <sup>-</sup> /R <sub>BO</sub> <sup>-</sup> /R <sub>BI</sub> <sup>-</sup> /LT <sup>-</sup> )	6.0V	V <sub>I</sub> = GND	-	-	-1.2	mA
supply current	I <sub>CC</sub>	6.0V	V <sub>I</sub> =V <sub>CC</sub> or GND; I <sub>O</sub> =0A	-	-	13	mA
additional supply current	ΔI <sub>CC</sub>	4.5V to 5.5V	One input at V <sub>I</sub> =V <sub>CC</sub> -2.1V; Other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> =0A	-	-	500	uA



### AC Characteristics

( $T_{amb}=25^{\circ}\text{C}$ , voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
<b>SN74HC47</b>							
Turn-on time	$t_{ON}$	$V_{CC}=5.0\text{V};$ $C_L=15\text{pF};$ $R_L=665\Omega$	from A input	-	-	100	ns
			from $\overline{\text{RBI}}$ input, outputs (a-f only)	-	-	100	ns
Turn-off time	$t_{OFF}$	$V_{CC}=5.0\text{V};$ $C_L=15\text{pF};$ $R_L=665\Omega$	from A input	-	-	100	ns
			from $\overline{\text{RBI}}$ input, outputs (a-f only)	-	-	100	ns
<b>SN74HCT47</b>							
Turn-on time	$t_{ON}$	$V_{CC}=5.0\text{V};$ $C_L=15\text{pF};$ $R_L=665\Omega$	from A input	-	-	100	ns
			from $\overline{\text{RBI}}$ input, outputs (a-f only)	-	-	100	ns
Turn-off time	$t_{OFF}$	$V_{CC}=5.0\text{V};$ $C_L=15\text{pF};$ $R_L=665\Omega$	from A input	-	-	100	ns
			from $\overline{\text{RBI}}$ input, outputs (a-f only)	-	-	100	ns

## Testing Circuit

### AC Testing Circuit

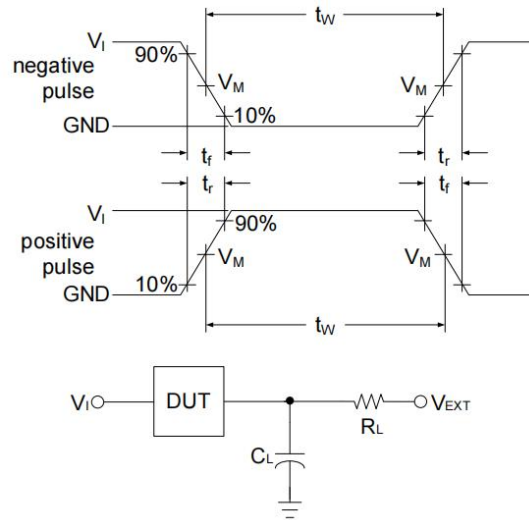


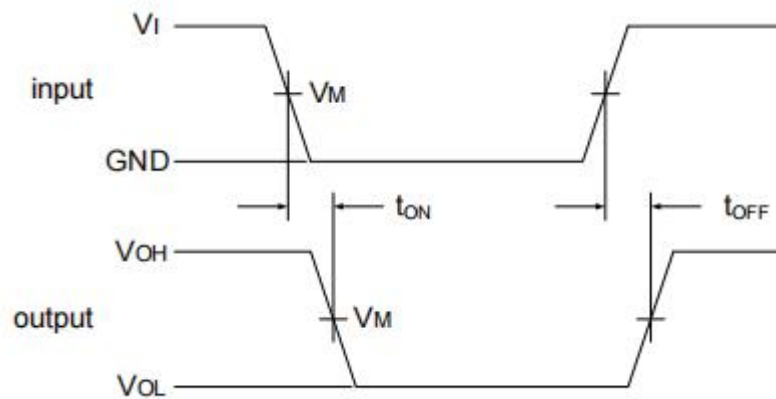
Figure 4. Test circuit for measuring switching times

$C_L$  includes probe and jig capacitance.

### Test Data

Type	Input		Load		$V_{EXT}$
	$V_I$	$t_r = t_f$	$C_L$	$R_L$	$t_{ON}/t_{OFF}$
SN74HC47	$V_{CC}$	3.0ns	15pF	665 $\Omega$	$V_{CC}$
SN74HCT47	3.0V	3.0ns	15pF	665 $\Omega$	$V_{CC}$

### AC Testing Waveforms



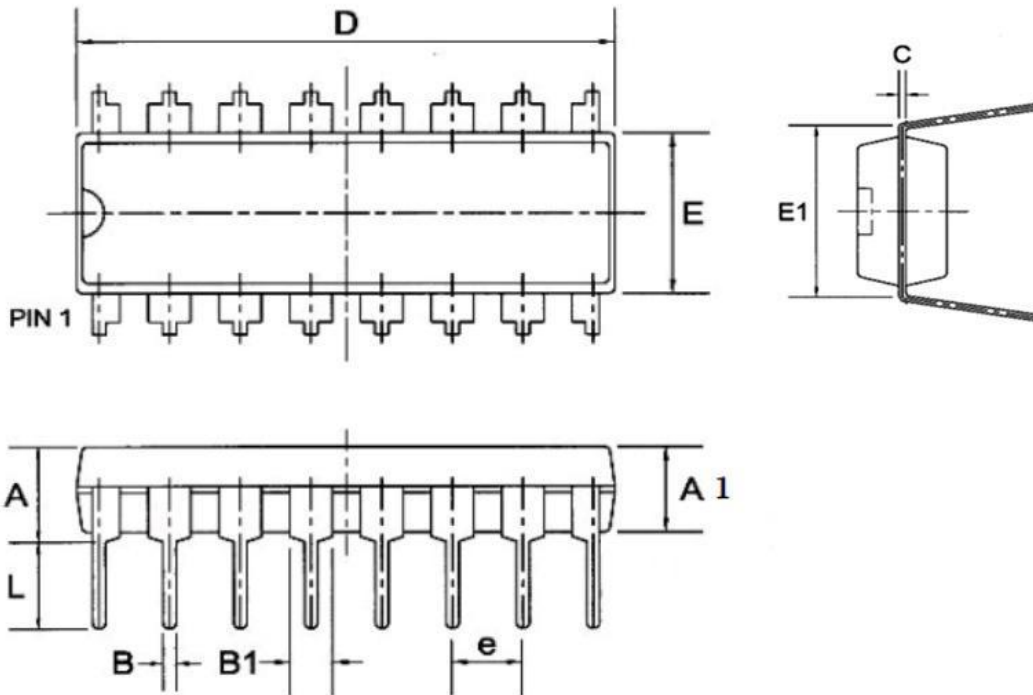
### Measurement Points

Type	Input	Output
	$V_M$	$V_M$
SN74HC47	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
SN74HCT47	1.3V	1.3V



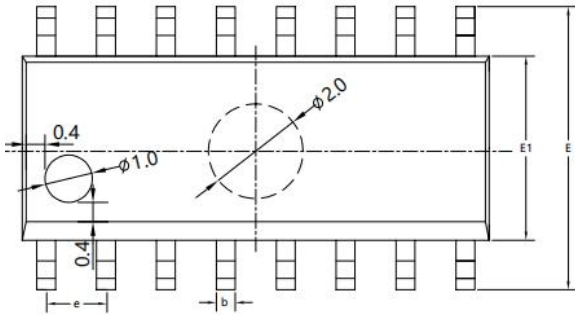
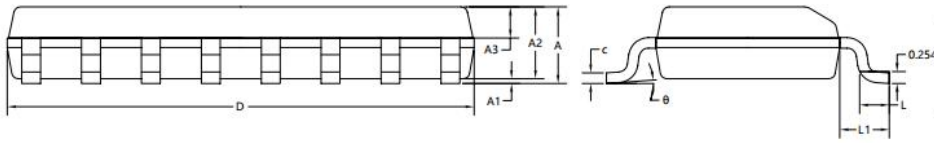
**Package Information**

DIP16



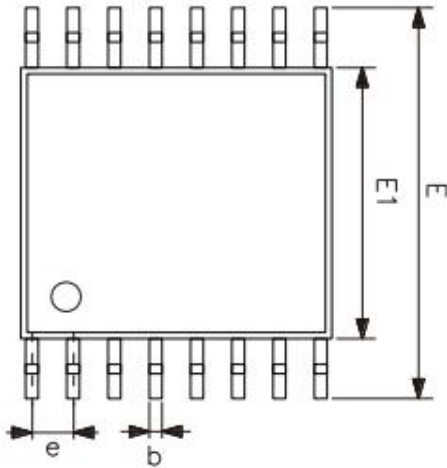
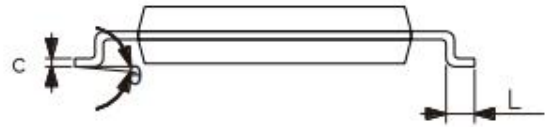
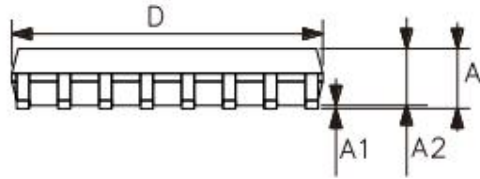
Symbol	Dimensions in Millimeters		
	Min	Nom	Max
A	--	--	4.31
A1	3.15	3.30	3.65
B	--	0.50	--
B1	--	1.6	--
C	--	0.27	--
D	19.00	19.20	19.60
E	6.20	6.50	6.60
E1	--	8.0	--
e	--	2.3	--
L	3.00	3.20	3.60

SOP16



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	1.50	1.60	1.70
A1	0.10	0.15	0.25
A2	1.40	1.45	1.50
A3	0.60	0.65	0.70
b	0.30	0.40	0.50
c	0.15	0.20	0.25
D	9.80	9.90	10.00
E	5.80	6.00	6.20
E1	3.85	3.90	3.95
e	1.27BSC		
L	0.50	0.60	0.70
L1	1.05BSC		
theta	0°	4°	8°

TSSOP16



Symbol	Dimensions (mm)	
	Min.	Max.
A	-	1.20
A1	0.05	0.15
A2	0.80	1.05
b	0.19	0.30
c	0.09	0.20
D	4.90	5.10
E1	4.30	4.50
E	6.20	6.60
e	0.65	
L	0.45	0.75
$\theta$	0°	8°



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