

## CD4511BM/CD4511BC BCD-to-7 Segment Latch/Decoder/Driver

### General Description

The CD4511B BCD-to-seven segment latch/ decoder/driver is constructed with complementary MOS (CMOS) enhancement mode devices and NPN bipolar out- put drivers in a single monolithic structure. The circuit pro- vides the functions of a 4-bit storage latch, an 8421 BCD-to-seven segment decoder, and an output drive capability. Lamp test (LT), blanking (BI), and latch enable (LE) inputs are used to test the display, to turn-off or pulse modulate the brightness of the display, and to store a BCD code, respectively. It can be used with seven-segment light emit- ting diodes (LED), incandescent, fluorescent, gas discharge, or liquid crystal readouts either directly or indirectly.

Applications include instrument (e.g., counter, DVM, etc.) display driver, computer/calculator display driver, cockpitdisplay driver, and various clock, watch, and timer uses.

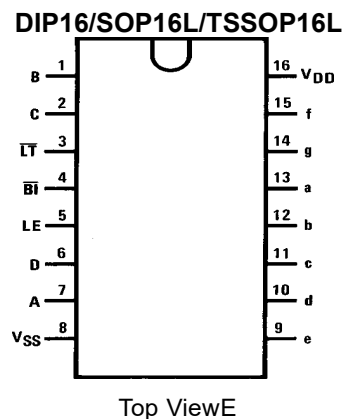
### Features

- Low logic circuit power dissipation
- High current sourcing outputs (up to 25 mA)
- Latch storage of code
- Blanking input
- Lamp test provision
- Lamp intensity modulation capability
- Time share (multiplexing) facility
- Equivalent to Motorola MC14511

### ORDERING INFORMATION

DEVICE	Package Type	MARKING	Packing	Packing Qty
CD4511BEG	DIP-16L	CD4511BE	TUBE	1000pcs/box
CD4511BDRG	SOP-16L	CD4511B	REEL	2500pcs/reel
CD4511BPWRG	TSSOP-16L	CD4511B	REEL	2500pcs/reel

### Connection Diagram

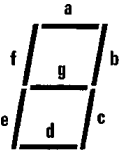


**Truth Table**

Inputs							Outputs							
LE	BI	LT	D	C	B	A	a	b	c	d	e	f	g	Display
X	X	0	X	X	X	X	1	1	1	1	1	1	1	B
X	0	1	X	X	X	X	0	0	0	0	0	0	0	
0	1	1	0	0	0	0	1	1	1	1	1	1	0	0
0	1	1	0	0	0	1	0	1	1	0	0	0	0	1
0	1	1	0	0	1	0	1	1	0	1	1	0	1	2
0	1	1	0	0	1	1	1	1	1	1	0	0	1	3
0	1	1	0	1	0	0	0	1	1	0	0	1	1	4
0	1	1	0	1	0	1	1	0	1	1	0	1	1	5
0	1	1	0	1	1	0	0	0	1	1	1	1	1	6
0	1	1	0	1	1	1	1	1	1	0	0	0	0	7
0	1	1	1	0	0	0	1	1	1	1	1	1	1	8
0	1	1	1	0	0	1	1	1	1	0	0	1	1	9
0	1	1	1	0	1	0	0	0	0	0	0	0	0	
0	1	1	1	0	1	1	0	0	0	0	0	0	0	
0	1	1	1	1	0	0	0	0	0	0	0	0	0	
0	1	1	1	1	0	1	0	0	0	0	0	0	0	
0	1	1	1	1	1	0	0	0	0	0	0	0	0	
0	1	1	1	1	1	1	0	0	0	0	0	0	0	
1	1	1	X	X	X	X				*				*

X-Don't Care

\*Depends upon the BCD code applied during the 0 to 1 transition of LE.

**Segment Identification**

**Display**

**Absolute Maximum Ratings**

DC Supply Voltage ( $V_{DD}$ ).....	-0.5V to a18V
Input Voltage ( $V_{IN}$ ).....	-05V to VDD a0.5V
Power Dissipation ( $P_D$ )	
Storage Temperature Range ( $T_S$ ).....	-b65°C to a150°C
Dual-In-Line .....	700 mW
Small Outline .....	500 mW
Lead Temperature ( $T_L$ )	
(Soldering, 10 seconds).....	260°C

**Recommended Operating Conditions (Note2)**

DC Supply Voltage ( $V_{DD}$ ).....	5V to 15V
Input Voltage ( $V_{IN}$ ).....	0V to VDD
Operating Temperature Range ( $T_A$ ).....	-40°C to +85°C

**DC Electrical Characteristics**

Symbol	Parameter	Conditions	-40°C		+25°C			+85°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
IDD	Quiescent Supply Current	VDD=5V, VIN=VDD or VSS		5			5		150	mA
		VDD=10V, VIN = VDD or VSS		10			10		300	mA
		VDD=15V, VIN = VDD or VSS		20			20		600	mA
VOL	Output Voltage Logical "0" Level	VDD=5V		0.01		0	0.01		0.05	V
		VDD=10V		0.01		0	0.01		0.05	
		VDD=15V		0.01		0	0.01		0.05	
VOH	Output Voltage Logical "1" Level	VDD=5V	4.1		4.1	4.57		4.1		V
		VDD=10V	9.1		9.1	9.58		9.1		
		VDD=15V	14.1		14.1	14.59		14.1		
VIL	Low Level Input Voltage	VDD=5V, VOUT= 3.8V or 0.5V		1.5		2	1.5		1.5	V
		VDD=10V, VOUT=8.8V or 1.0V		3.0		4	3.0		3.0	
		VDD=15V, VOUT=13.8V or 1.5V		4.0		6	4.0		4.0	
VIH	High Level Input Voltage	VDD=5V, VOUT=0.5V or 3.8V	3.5		3.5	3		3.5		V
		VDD=10V, VOUT=1.0V or 8.8V	7.0		7.0	6		7.0		
		VDD=15V, VOUT=1.5V or 13.8V	11.0		11.0	9		11.0		
VOH	Output (Source) Drive Voltage	VDD=5V, IOH=0 mA				4.57				V
		VDD=5V, IOH=5 mA	4.1		4.1	4.24		4.1		
		VDD=5V, IOH=10 mA	3.9		3.9	4.12		3.5		
		VDD=5V, IOH=15 mA	3.4		3.4	3.94		3.0		
		VDD=5V, IOH=20 mA				3.75				
		VDD=5V, IOH=25 mA				3.54				
		VDD=10V, IOH=0 mA				9.58				V
		VDD=10V, IOH=5 mA	9.1		9.1	9.26		9.1		
		VDD=10V, IOH=10 mA	9.0		9.0	9.17		8.6		
		VDD=10V, IOH=15 mA	8.6		8.6	9.04		8.2		
		VDD=10V, IOH=20 mA				8.9				
		VDD=10V, IOH=25 mA				8.75				
VDD=15V, IOH=0 mA				9.58				V		
VDD=15V, IOH=5 mA	14.1		14.1	14.27		14.1				
VDD=15V, IOH=10 mA	14.0		14.0	14.17		13.6				
VDD=15V, IOH=15 mA	13.6		13.6	14.07		13.2				
VDD=15V, IOH=20 mA				13.95						
VDD=15V, IOH=25 mA				13.8						
IOL	Low Level Output Current	VDD=5V, VOL= 0.4V	0.64		0.51	0.88		0.36		mA
		VDD=10V, VOL= 0.5V	1.6		1.3	2.25		0.9		
		VDD=15V, VOL=1.5V	4.2		3.4	8.8		2.4		
IIN	Input Current	VDD=15V, VIN= 0V		-0.10		-10-5	-0.10		-1.0	μA
		VDD=15V, VIN=5V		0.10		10-5	0.10		1.0	μA

Note1: Devices should not be connected with power on.

**DC Electrical Characteristics**

Symbol	Parameter	Conditions	-40°C		+25°C			+85°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
IDD	Quiescent Supply Current	VDD-5V		20			20		150	μA
		VDD-10V		40			40		300	
		VDD-15V		80			80		600	
VOL	Output Voltage Logical "0" Level	VDD-5V		0.01		0	0.01		0.05	V
		VDD-10V		0.01		0	0.01		0.05	
		VDD-15V		0.01		0	0.01		0.05	
VOH	Output Voltage Logical "1" Level	VDD-5V	4.1		4.1	4.57		4.1		V
		VDD-10V	9.1		9.1	9.58		9.1		
		VDD-15V	14.1		14.1	14.59		14.1		
VIL	Low Level Input Voltage	VDD-5V, VOUT-3.8V or 0.5V		1.5		2	1.5		1.5	V
		VDD-10V, VOUT-8.8V or 1.0V		3.0		4	3.0		3.0	
		VDD-15V, VOUT-13.8V or 1.5V		4.0		6	4.0		4.0	
VIH	High Level Input Voltage	VDD-5V, VOUT-0.5V or 3.8V	3.5		3.5	3		3.5		V
		VDD-10V, VOUT-1.0V or 8.8V	7.0		7.0	6		7.0		
		VDD-15V, VOUT-1.5V or 13.8V	11.0		11.0	9		11.0		
VOH	Output (Source) Drive Voltage	VDD-5V, IOH-0 mA				4.57				V
		VDD-5V, IOH-5 mA	4.1		4.1	4.24		4.1		
		VDD-5V, IOH-10 mA	3.6		3.6	4.12		3.3		
		VDD-5V, IOH-15 mA	2.8		2.8	3.94		2.5		
		VDD-5V, IOH-20 mA				3.75				
		VDD-5V, IOH-25 mA				3.54				
		VDD-10V, IOH-0 mA				9.58				V
		VDD-10V, IOH-5 mA	9.1		9.1	9.26		9.1		
		VDD-10V, IOH-10 mA	8.75		8.75	9.17		8.45		
		VDD-10V, IOH-15 mA	8.1		8.1	9.04		7.8		
		VDD-10V, IOH-20 mA				8.9				
		VDD-10V, IOH-25 mA				8.75				
		VDD-15V, IOH-0 mA				14.59				V
		VDD-15V, IOH-5 mA	14.1		14.1	14.27		14.1		
		VDD-15V, IOH-10 mA	13.75		13.75	14.18		13.45		
VDD-15V, IOH-15 mA	13.1		13.1	14.07		12.8				
VDD-15V, IOH-20 mA				13.95						
VDD-15V, IOH-25 mA				13.8						
IOL	Low Level Output Current	VDD-5V, VOL-0.4V	0.52		0.44	0.88		0.36		mA
		VDD-10V, VOL-0.5V	1.3		1.1	2.25		0.9		
		VDD-15V, VOL-1.5V	3.6		3.0	8.8		2.4		
IIN	Input Current	VDD-15V, VIN-0V		-0.30		-10-5	-0.30		-10	μA
		VDD-15V, VIN-15V		0.30		10-5	0.30		1.0	

**AC Electrical Characteristics\***
 $T_A$  –25°C and  $C_L$  50 pF, typical temperature coefficient for all values of  $V_{DD}$  - 0.3%/°C

Symbol	Parameter	Conditions	CD4511B			Units
			Min	Typ	Max	
$C_{IN}$	Input Capacitance	$V_{IN}=0$		5.0	7.5	pF
$t_r$	Output Rise Time (Figure 1a)	VDD-5V		40	80	ns
		VDD-10V		30	60	
		VDD-15V		25	50	
$t_f$	Output Fall Time (Figure 1a)	VDD-5V		125	250	ns
		VDD-10V		75	150	
		VDD-15V		65	130	
$t_{PLH}$	Turn-Off Delay Time (Data) (Figure 1a)	VDD-5V		640	1280	ns
		VDD-10V		250	500	
		VDD-15V		175	350	
$t_{PHL}$	Turn-On Delay Time (Data) (Figure 1a)	VDD-5V		720	1440	ns
		VDD-10V		290	580	
		VDD-15V		195	400	
$t_{PLH}$	Turn-Off Delay Time (Blank) (Figure 1a)	VDD-5V		320	640	ns
		VDD-10V		130	260	
		VDD-15V		100	200	
$t_{PHL}$	Turn-On Delay Time (Blank) (Figure 1a)	VDD-5V		485	970	ns
		VDD-10V		200	400	
		VDD-15V		160	320	
$t_{PLH}$	Turn-Off Delay Time (Lamp Test) (Figure 1a)	VDD-5V		313	625	ns
		VDD-10V		125	250	
		VDD-15V		90	180	
$t_{PHL}$	Turn-On Delay Time (Lamp Test) (Figure 1a)	VDD-5V		313	625	ns
		VDD-10V		125	250	
		VDD-15V		90	180	
$t_{SETUP}$	Setup Time (Figure 1b)	VDD-5V	180	90		ns
		VDD-10V	76	38		
		VDD-15V	40	20		
$t_{HOLD}$	Hold Time (Figure 1b)	VDD-5V	0	-90		ns
		VDD-10V	0	-38		
		VDD-15V	0	-20		
PWLE	Minimum Latch Enable Pulse Width (Figure 1c)	VDD-5V	520	260		ns
		VDD-10V	220	110		
		VDD-15V	130	65		

\*AC Parameters are guaranteed by DC correlated testing.

## Switching Time Waveforms

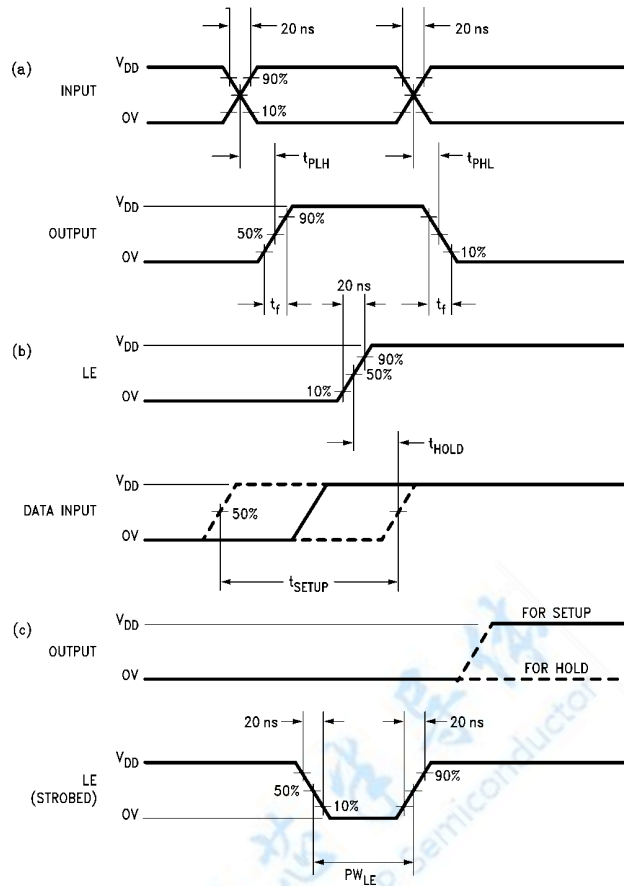
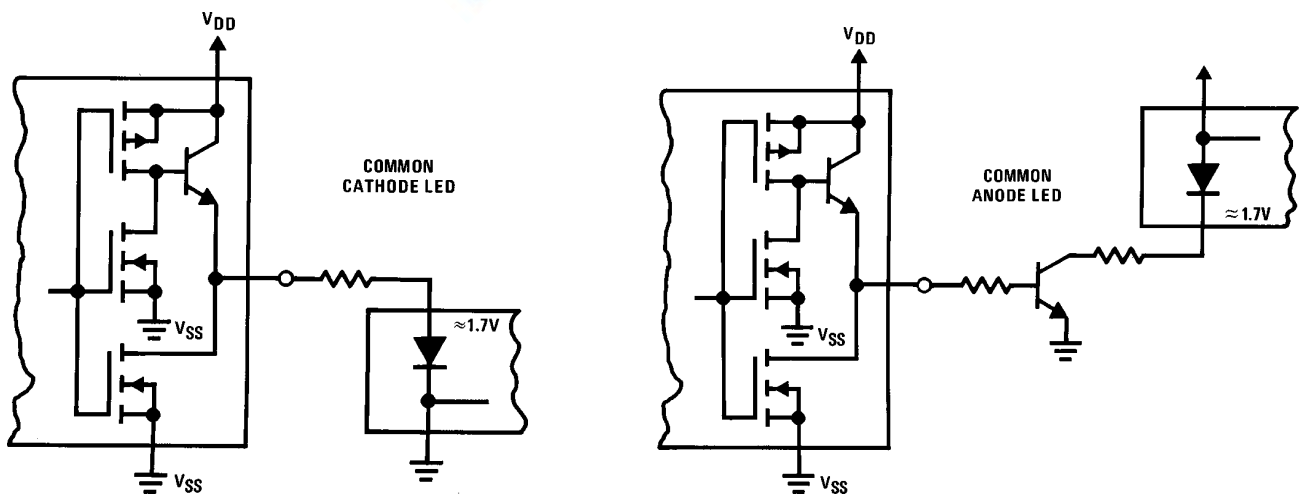


FIGURE 1

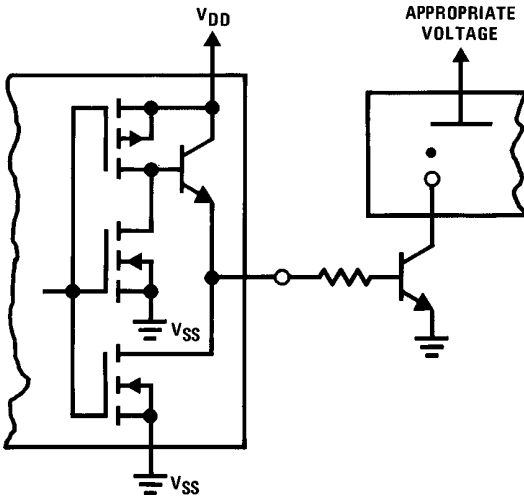
**Typical Applications**

## Light Emitting Diode (LED) Readout

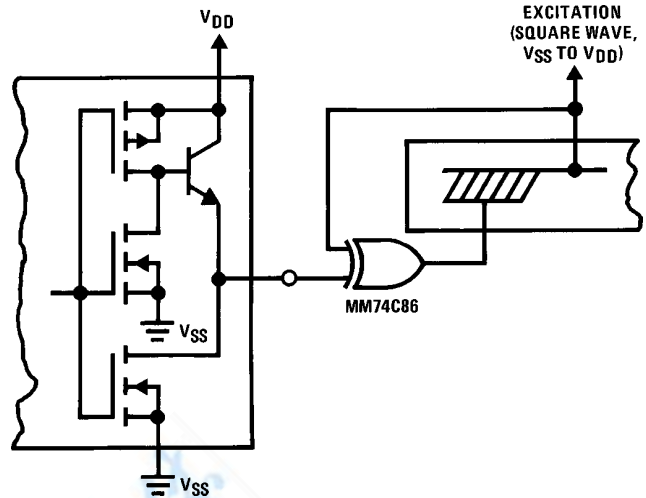


**Typical Applications (Continued)**

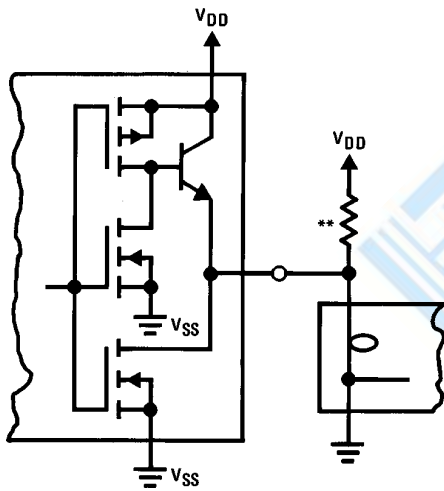
Gas Discharge Readout



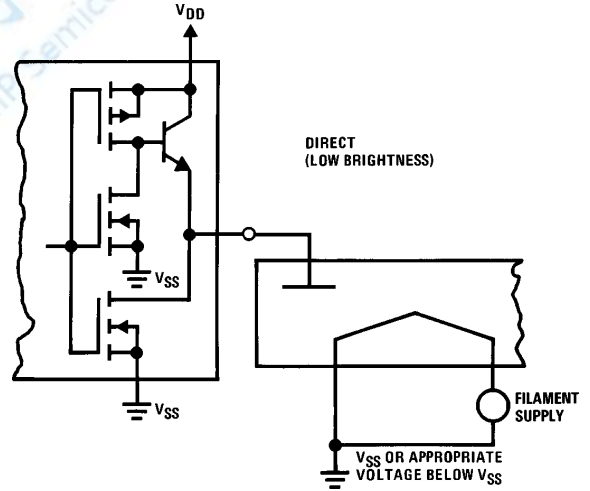
Liquid Crystal (LC) Readout



Incandescent Readout



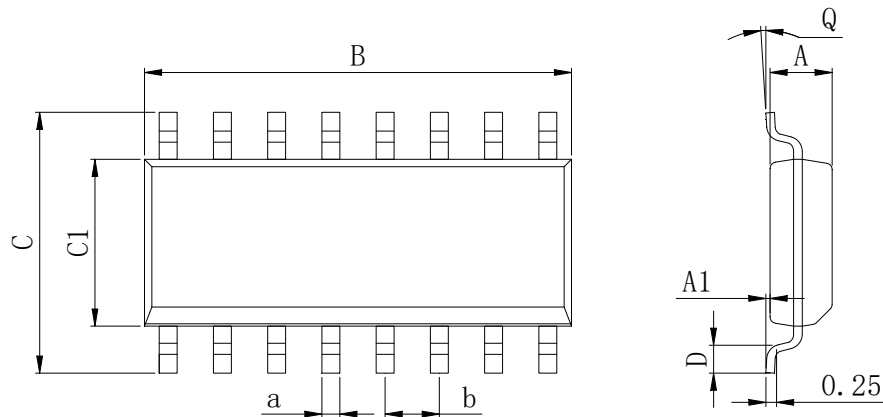
Fluorescent Readout



\*\*A filament pre-warm resistor is recommended to reduce filament thermal shock and increase the effective cold resistance of the filament.

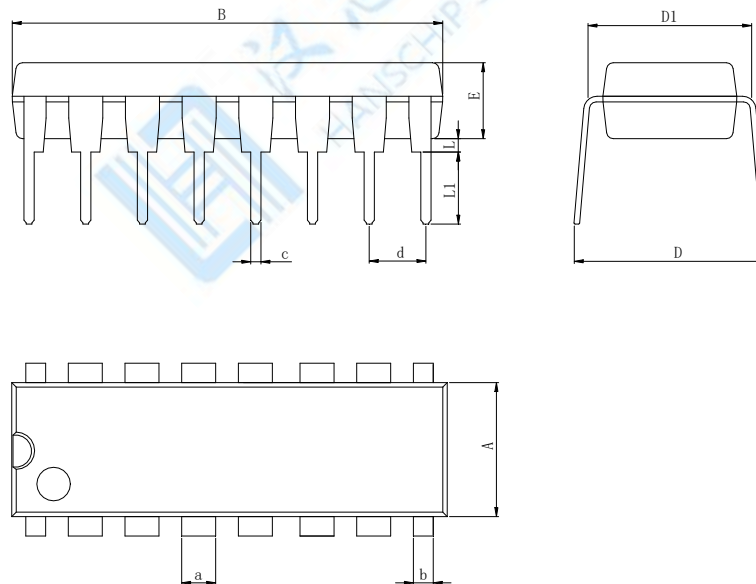
## Physical Dimensions

SOP-16L



Dimensions In Millimeters(SOP16L)									
Symbol:	A	A1	B	C	C1	D	Q	a	b
Min:	1.35	0.05	9.80	5.80	3.80	0.40	0°	0.35	1.27 BSC
Max:	1.55	0.20	10.0	6.20	4.00	0.80	8°	0.45	

DIP-16

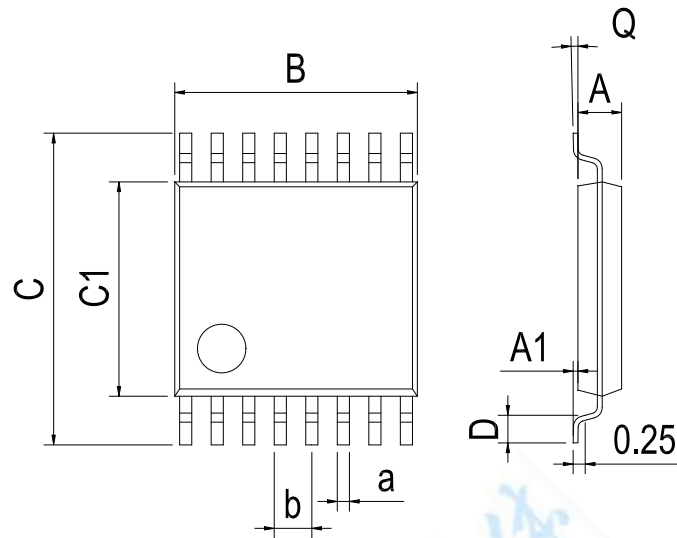


Dimensions In Millimeters(DIP16L)											
Symbol:	A	B	D	D1	E	L	L1	a	b	c	d
Min:	6.10	18.94	8.40	7.42	3.10	0.50	3.00	1.50	0.85	0.40	2.54 BSC
Max:	6.68	19.56	9.00	7.82	3.55	0.70	3.60	1.55	0.90	0.50	



**Physical Dimensions**

TSSOP-16L


**Dimensions In Millimeters(TSSOP16L)**

Symbol:	A	A1	B	C	C1	D	Q	a	b
Min:	0.85	0.05	4.90	6.20	4.30	0.40	0°	0.20	0.65 BSC
Max:	0.95	0.20	5.10	6.60	4.50	0.80	8°	0.25	

**IMPORTANT STATEMENT:**

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