

## CD4511B BCD-to-7 Segment Latch/Decoder/Driver

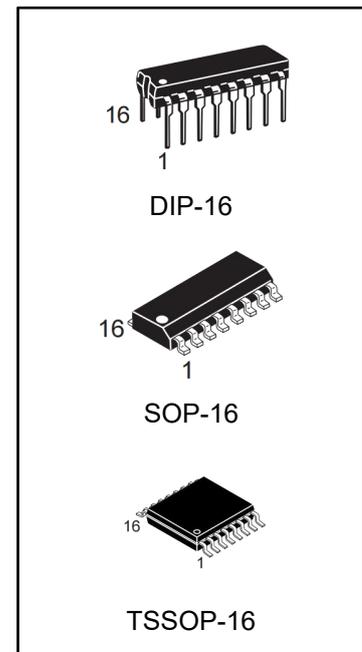
### General Description

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, cockpit display driver, and various clock, watch, and timer uses.

### Features

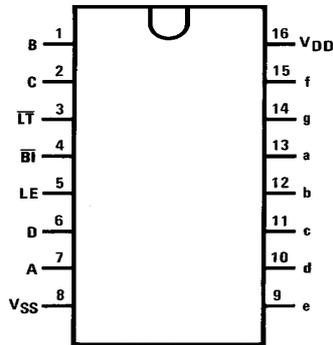
- Low logic circuit power dissipation
- High current sourcing outputs (up to 25 mA)
- Latch storage of code
- Blanking input
- Lamp test provision
- Lamp intensity modulation capability
- Time share (multiplexing) facility
- Equivalent to Motorola MC14511



### Ordering Information

DEVICE	Package Type	MARKING	Packing	Packing Qty
CD4511BPG	DIP-16	CD4511B	TUBE	1000pcs/box
CD4511BDRG	SOP-16	CD4511B	REEL	2500pcs/reel
CD4511BDRG4	SOP-16	CD4511B	REEL	4000pcs/reel
CD4511BPWRG	TSSOP-16	CD4511B	REEL	2500pcs/reel

## Connection Diagram

**DIP-16/SOP-16/TSSOP-16**


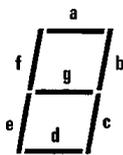
## Truth Table

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
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	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	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	0	0	0	0	0	0	0	*

X-Don't Care

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

## Segment Identification



## Display



## Absolute Maximum Ratings

Condition		Min	Max	Units
DC Supply Voltage ( $V_{DD}$ )		-0.5	18	V
Input Voltage ( $V_{IN}$ )		-0.5	$V_{DD}+0.5$	V
Storage Temperature Range ( $T_S$ )		-65	150	°C
PowerDissipation ( $P_D$ )	Dual-In-Line	-	700	mW
	Small Outline	-	500	
Lead Temperature ( $T_L$ )	(Soldering, 10 seconds)	-	245	°C

Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not ensured.

## Recommended Operating Conditions

Condition		Min	Max	Units
DC Supply Voltage ( $V_{DD}$ )		5	15	V
Input Voltage ( $V_{IN}$ )		0V to $V_{DD}$		V
Operating Temperature Range ( $T_A$ )		40	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 <sup>-5</sup>	-0.10		-1.0	μA
		VDD=15V, VIN=5V		0.10		10 <sup>-5</sup>	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	
I <sub>DD</sub>	Quiescent Supply Current	V <sub>DD</sub> —5V		20			20		150	μA
		V <sub>DD</sub> —10V		40			40		300	
		V <sub>DD</sub> —15V		80			80		600	
V <sub>OL</sub>	Output Voltage Logical “0” Level	V <sub>DD</sub> —5V		0.01		0	0.01		0.05	V
		V <sub>DD</sub> —10V		0.01		0	0.01		0.05	
		V <sub>DD</sub> —15V		0.01		0	0.01		0.05	
V <sub>OH</sub>	Output Voltage Logical “1” Level	V <sub>DD</sub> —5V	4.1		4.1	4.57		4.1		V
		V <sub>DD</sub> —10V	9.1		9.1	9.58		9.1		
		V <sub>DD</sub> —15V	14.1		14.1	14.59		14.1		
V <sub>IL</sub>	Low Level Input Voltage	V <sub>DD</sub> —5V, V <sub>OUT</sub> —3.8V or 0.5V		1.5		2	1.5		1.5	V
		V <sub>DD</sub> —10V, V <sub>OUT</sub> —8.8V or 1.0V		3.0		4	3.0		3.0	
		V <sub>DD</sub> —15V, V <sub>OUT</sub> —13.8V or 1.5V		4.0		6	4.0		4.0	
V <sub>IH</sub>	High Level Input Voltage	V <sub>DD</sub> —5V, V <sub>OUT</sub> —0.5V or 3.8V	3.5		3.5	3		3.5		V
		V <sub>DD</sub> —10V, V <sub>OUT</sub> —1.0V or 8.8V	7.0		7.0	6		7.0		
		V <sub>DD</sub> —15V, V <sub>OUT</sub> —1.5V or 13.8V	11.0		11.0	9		11.0		
V <sub>OH</sub>	Output (Source) Drive Voltage	V <sub>DD</sub> —5V, I <sub>OH</sub> —0 mA				4.57				V
		V <sub>DD</sub> —5V, I <sub>OH</sub> —5 mA	4.1		4.1	4.24		4.1		
		V <sub>DD</sub> —5V, I <sub>OH</sub> —10 mA	3.6		3.6	4.12		3.3		
		V <sub>DD</sub> —5V, I <sub>OH</sub> —15 mA	2.8		2.8	3.94		2.5		
		V <sub>DD</sub> —5V, I <sub>OH</sub> —20 mA				3.75				
		V <sub>DD</sub> —5V, I <sub>OH</sub> —25 mA				3.54				
		V <sub>DD</sub> —10V, I <sub>OH</sub> —0 mA				9.58				V
		V <sub>DD</sub> —10V, I <sub>OH</sub> —5 mA	9.1		9.1	9.26		9.1		
		V <sub>DD</sub> —10V, I <sub>OH</sub> —10 mA	8.75		8.75	9.17		8.45		
		V <sub>DD</sub> —10V, I <sub>OH</sub> —15 mA	8.1		8.1	9.04		7.8		
		V <sub>DD</sub> —10V, I <sub>OH</sub> —20 mA				8.9				
		V <sub>DD</sub> —10V, I <sub>OH</sub> —25 mA				8.75				
V <sub>DD</sub> —15V, I <sub>OH</sub> —0 mA				14.59				V		
V <sub>DD</sub> —15V, I <sub>OH</sub> —5 mA	14.1		14.1	14.27		14.1				
V <sub>DD</sub> —15V, I <sub>OH</sub> —10 mA	13.75		13.75	14.18		13.45				
V <sub>DD</sub> —15V, I <sub>OH</sub> —15 mA	13.1		13.1	14.07		12.8				
V <sub>DD</sub> —15V, I <sub>OH</sub> —20 mA				13.95						
V <sub>DD</sub> —15V, I <sub>OH</sub> —25 mA				13.8						
I <sub>OL</sub>	Low Level Output Current	V <sub>DD</sub> —5V, V <sub>OL</sub> —0.4V	0.52		0.44	0.88		0.36		mA
		V <sub>DD</sub> —10V, V <sub>OL</sub> —0.5V	1.3		1.1	2.25		0.9		
		V <sub>DD</sub> —15V, V <sub>OL</sub> —1.5V	3.6		3.0	8.8		2.4		
I <sub>IN</sub>	Input Current	V <sub>DD</sub> —15V, V <sub>IN</sub> —0V		-0.30		-10-5	-0.30		-10	μA
		V <sub>DD</sub> —15V, V <sub>IN</sub> —15V		0.30		10-5	0.30		1.0	

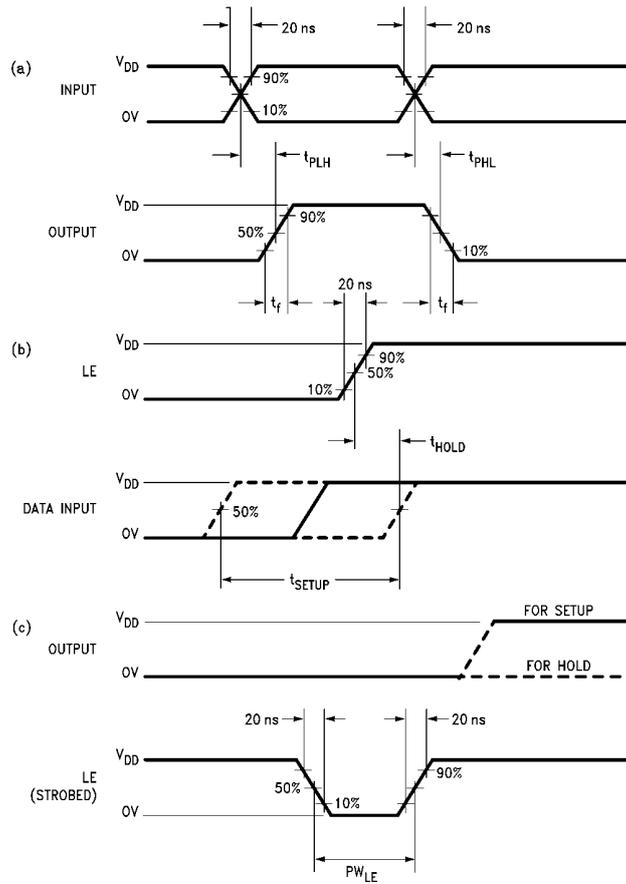
## AC Electrical Characteristics\*

$T_A=25^{\circ}\text{C}$  and  $C_L=50\text{ pF}$ , typical temperature coefficient for all values of  $V_{DD} - 0.3\%/^{\circ}\text{C}$

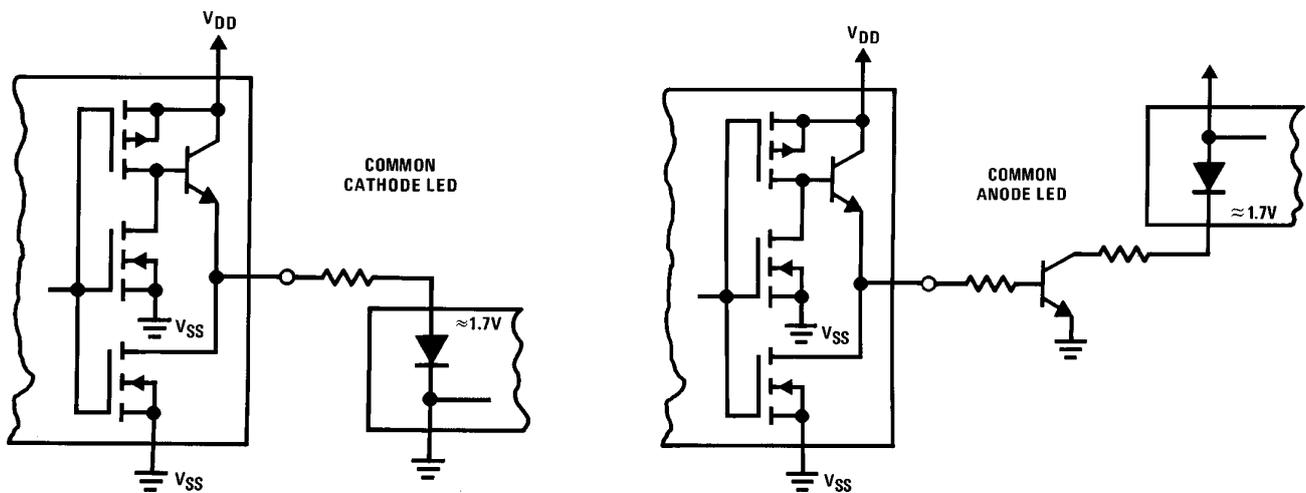
Symbol	Parameter	Conditions	CD4511B			Units
			Min	Typ	Max	
$C_{IN}$	Input Capacitance	$V_{IN}=0$		5.0	7.5	pF
$t_r$	Output Rise Time (Figure 1a)	VDD-5V		40	80	ns
		VDD-10V		30	60	
		VDD-15V		25	50	
$t_f$	Output Fall Time (Figure 1a)	VDD-5V		125	250	ns
		VDD-10V		75	150	
		VDD-15V		65	130	
$t_{PLH}$	Turn-Off 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

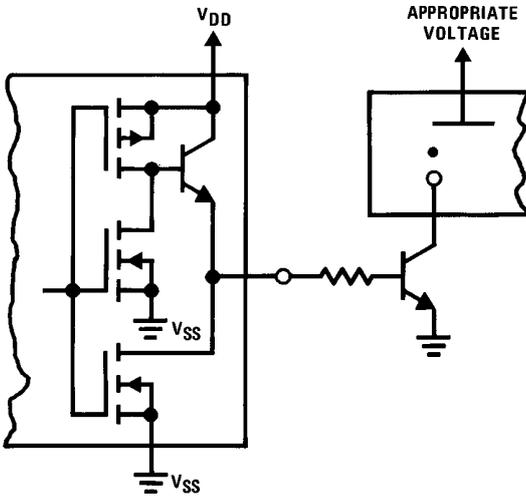

**FIGURE 1**
**Typical Applications**

## Light Emitting Diode (LED) Readout

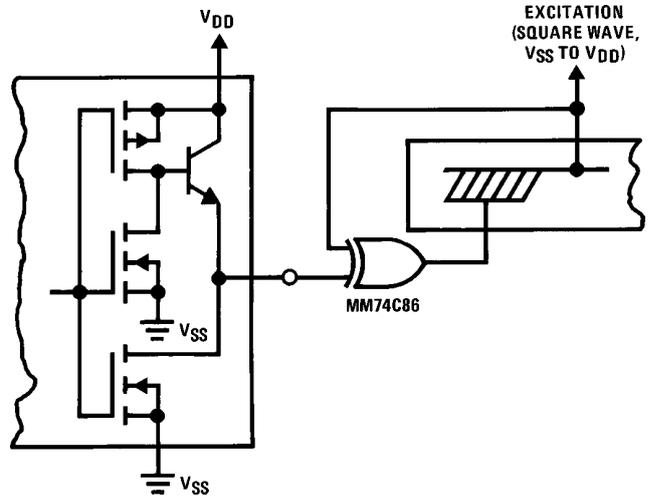


**Typical Applications (Continued)**

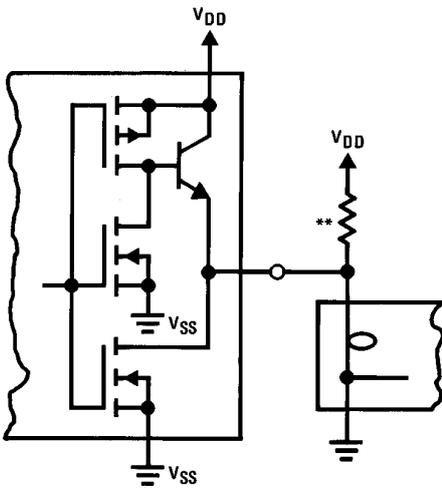
Gas Discharge Readout



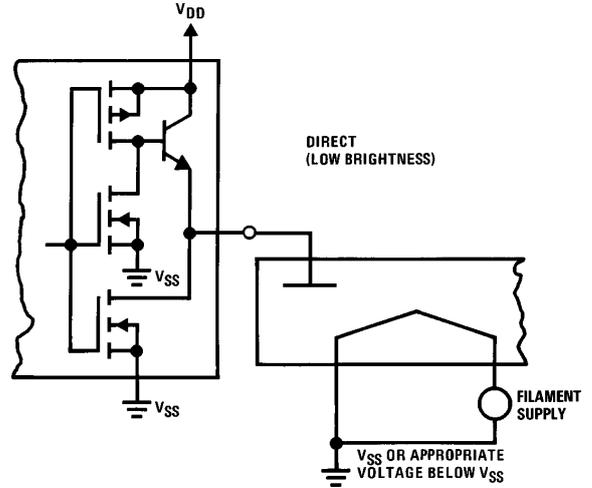
Liquid Crystal (LC) Readout



Incandescent Readout



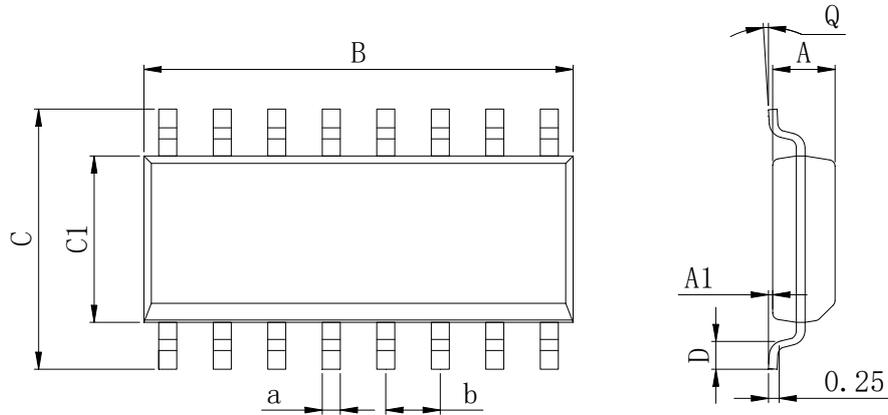
Fluorescent Readout



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

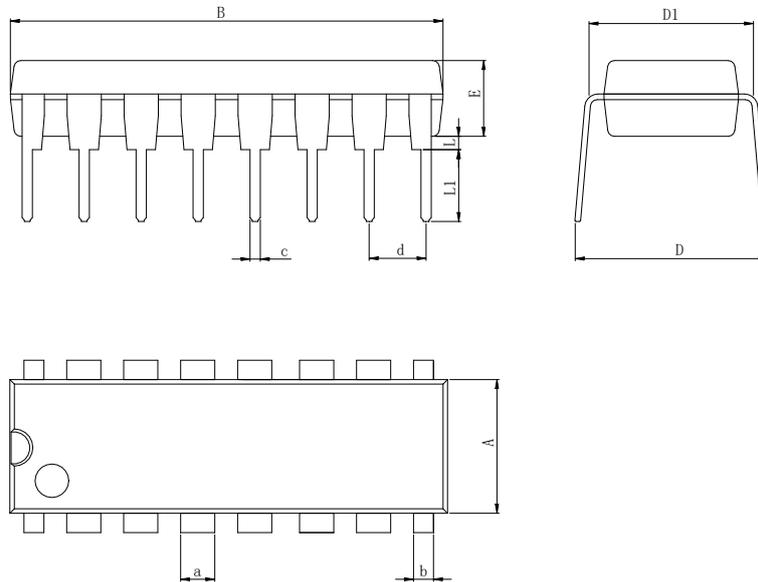
## Physical Dimensions

SOP-16



Dimensions In Millimeters(SOP-16)									
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	

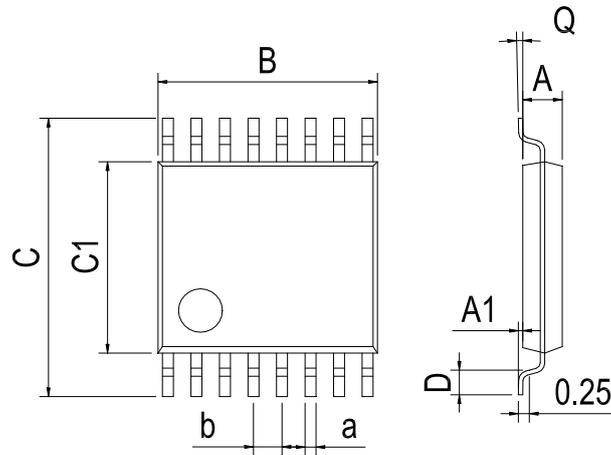
DIP-16



Dimensions In Millimeters(DIP-16)											
Symbol:	A	B	D	D1	E	L	L1	a	b	c	d
Min:	6.10	18.94	8.10	7.42	3.10	0.50	3.00	1.50	0.85	0.40	2.54 BSC
Max:	6.68	19.56	10.9	7.82	3.55	0.70	3.60	1.55	0.90	0.50	

**Physical Dimensions**

TSSOP-16


**Dimensions In Millimeters(TSSOP-16)**

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

## Revision History

REVISION NUMBER	DATE	REVISION	PAGE
V1.0	2018-8	New	1-12
V1.1	2023-9	Update Lead Temperature、 Update encapsulation type、 Updated DIP-16 dimension、 Add annotation for Maximum Ratings.	3、 1、 9

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