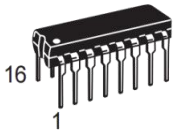
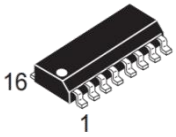
CD4543B BCD-to-7-Segment Latch/Decoder/Driver for Liquid Crystals

Features

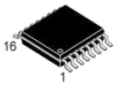
- Wide supply voltage:3.0V to 18V
- range High noise immunity:0.45 V_{DD} (typ.)
- Low power TTL Compatibility:Fan out of 2 driving 74L or 1 driving 74LS
- Low power dissipation:50 nA/package (typ.) at VDD =5.0V
- Latch storage
- Blanking input
- Blank for all illegal inputs
- Direct-drive LCD, LED and VF displays
- Pin-for-pin replacement for CD4056B (with pin 7 tied to Vss)
- Pin-for-pin replacement for Motorola MC14543B



DIP-16



SOP-16



TSSOP-16

Ordering Information

DEVICE	Package Type	MARKING	Packing	Packing Qty
CD4543BE/ CD4543BN	DIP-16	CD4543B	TUBE	1000pcs/box
CD4543BM/TR	SOP-16	CD4543B	REEL	2500pcs/reel
CD4543BMT/TR	TSSOP-16	CD4543B	REEL	2500pcs/reel

General Description

The CD4543BM is a monolithic CMOS BCD-to-7-segment latch/decoder/driver for use with liguid crystal and other types of displavs. The circuit provides the func. tions of a 4-bit storage latch and an 8421 BCD-to-7-seg-ment decoder and driver. The device has the capability to invert the logic levels of the output combination. The phase(Ph),blanking (Bl) and latch disable (LD) inputs are used to reverse the truth table phase, blank the display, and store a BCD code, respectively. For liquid crystal(LC)readouts,a square wave is applied to the Ph input of the circuit and the electrically common backplane of the display, and the out-puts of the circuit are connected directly to the segments of the LCreadout. For other types of readouts, such as light emitting diode (LED), incandescent, gas discharge, and flu- orescent readouts, connection diagrams are given on this data sheet.

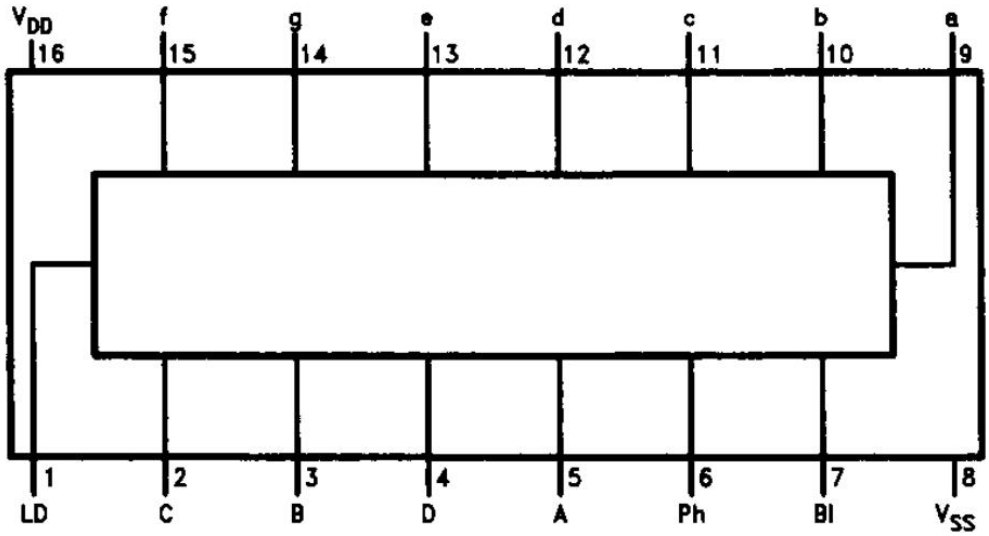
All inputs are protected against static discharge by diode clamps to vop and Vss.

Applications

- Instrument (e.g., counter, DVM, etc.) display driver
- Computer/calculator display driver
- Cockput display driver
- Various clock, watch, and timer users

Connection Diagram and

Dual-In-Line Package



DIP/SOP/TSSOP

Truth Table

inputs							Outputs							
LD	BI	Ph*	D	C	B	A	a	b	c	d	e	f	g	Display
X	1	0	X	X	X	X	0	0	0	0	0	0	0	Blank
1	0	0	0	0	0	0	1	1	1	1	1	1	0	0
1	0	0	0	0	0	1	0	1	1	0	0	0	0	1
1	0	0	0	0	1	0	1	1	0	1	1	0	1	2
1	0	0	0	0	1	1	1	1	1	1	0	0	1	3
1	0	0	0	1	0	0	0	1	1	0	0	1	1	4
1	0	0	0	1	0	1	1	0	1	1	0	1	1	5
1	0	0	0	1	1	0	1	0	1	1	1	1	1	6
1	0	0	0	1	1	1	1	1	1	0	0	0	0	7
1	0	0	1	0	0	0	1	1	1	1	1	1	1	8
1	0	0	1	0	0	1	1	1	1	1	0	1	1	9
1	0	0	1	0	1	0	0	0	0	0	0	0	0	Blank
1	0	0	1	0	1	1	0	0	0	0	0	0	0	Blank
1	0	0	1	1	0	0	0	0	0	0	0	0	0	Blank
1	0	0	1	1	0	1	0	0	0	0	0	0	0	Blank
1	0	0	1	1	1	0	0	0	0	0	0	0	0	Blank
1	0	0	1	1	1	1	0	0	0	0	0	0	0	Blank
0	0	0	X	X	X	X	* *							* *
†	†	1	†				Inverse of Output Combinations Above							Display As Above

X = Don't care

† = Above combinations

* =For tiquid crystal readouts, apply a square wave to Ph.

For common cathode LED readouts, select Ph = 0.

For common anode LED readouts, select Ph = 1.

* * =Depends upon the BCD code previously applied when LD = 1.

Display Format

Absolute Maximum Ratings (Notes 1&2)

Condition		Min	Max	UNITS
DC Supply Voltage(V_{DD})		-0.5	+18	V_{DC}
Input Voltage (V_{IN})		-0.5	V_{DD}+0.5	V_{DC}
Storage Temp. Range(Ts)		-65	+150	℃
Power Dissipation (P_D)	Dual-In-Line	700		mW
	Small Outline	500		mW
Lead Temperature(T_L) (Soldering,10 seconds)		245		℃

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 (Note 2)

Condition	Min	Max	UNITS
DC Supply Voltage(V_{DD})	3	15	V_{DC}
Input Voltage (V_{IN})	0	V_{DD}	V_{DC}
Operating Temperature Range (T_A)	-40	+85	℃

DC Electrical Characteristics (Note 2)

Symbol	Parameter	Conditions	-40℃		+25℃			+85℃		Units
			Min	Max	Min	Typ	Max	Min	Max	
I_{DD}	Quiescent Device Current	V_{DD}=5V, V_{IN} =V_{DD} or Vss	-	20	-	-	20	-	150	μA
		V_{DD} =10V, V_{IN} =V_{DD} or Vss	-	40	-	-	40	-	300	
		V_{DD} =15V, V_{IN} =V_{DD} or Vss	-	80	-	-	80	-	600	
V_{OL}	Low Level Output Voltage	V_{DD} = 5V	-	0.05	-	0	0.05	-	0.05	V
		V_{DD} =10V $\lvert I_O \rvert$ <1 μA	-	0.05	-	0	0.05	-	0.05	
		V_{DD} =15V	-	0.05	-	0	0.05	-	0.05	
V_{OH}	High Level Output Voltage	V_{DD} = 5V	4.95	-	4.95	5	-	4.95	-	V
		V_{DD} =10V $\lvert I_O \rvert$ <1 μA	9.95	-	9.95	10	-	9.95	-	
		V_{DD} =15V	14.95	-	14.95	15	-	14.59	-	
V_{IL}	Low Level Input Voltage	V_{DD}=5V, Vo=0.5V or 4.5V	-	1.5	-	-	1.5	-	1.5	V
		V_{DD}=10V, Vo=1V or 9V	-	3.0	-	-	3.0	-	3.0	
		V_{DD}=15V, Vo=1.5V or 13.5V	-	4.0	-	-	4.0	-	4.0	
V_{IH}	High Level Input Voltage	V_{DD}=5V, Vo=0.5V or 4.5V	3.5	-	3.5	-	-	3.5	-	V
		V_{DD}=10V, Vo=1V or 9V	7.0	-	7.0	-	-	7.0	-	
		V_{DD}=15V, Vo=1.5V or 13.5V	11.0	-	11.0	-	-	11.0	-	
I_{OL}	Low Leve! Output Current (Note 3)	V_{DD}=5V, Vo=0.4V	0.52	-	0.51	-	-	0.36	-	mA
		V_{DD}=10V, Vo=0.5V	1.3	-	1.3	-	-	0.9	-	
		V_{DD} =15V, Vo =1.5V	3.6	-	3.4	-	-	2.4	-	
I_{OH}	High Level Output Current (Note 3)	V_{DD}=5V, Vo=4.6V	-0.52	-	-0.44	-	-	-0.36	-	mA
		V_{DD}=10V,Vo=9.5V	-1.3	-	-1.1	-	-	-0.9	-	
		V_{DD}=15V, Vo=13.5V	-3.6	-	-3.0	-	-	-2.4	-	
I_{IN}	Input Current	V_{DD}=15V,V_{IN} =0V	-	-0.3	-	-10^{-5}	-0.3	-	-1.0	μA
		V_{DD} =15V, V_{IN} =15V	-	0.3	-	10^{-5}	0.3	-	1.0	

AC Electrical Characteristics*T_A=25°C,C_L= 50 pF,Vss = 0, unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_r	Output Rise Time	VDD=5V VDD =10V VDD=15V	-	100 50 40	200 100 80	ns
t_f	Output Fall Time	VDD=5V VDo=10V VDD-15V	-	100 50 40	200 100 80	ns
t_{PLH}	Turn-ON Propagation Delay Time	VDD =5V VDD = 10V VDD-15V	-	450 170 110	1100 440 330	ns
t_{PHL}	Turn-OFF Propagation Dolay Time	VDD =5V VDD = 10V VDD-15V	-	500 180 120	1100 440 330	ns
t_{SET-UP}	Set-Up Time	VDD =5V VDD = 10V VDD-15V	-	-5 -2 0	80 30 20	ns
t_{HOLD}	Hold Time	VDD =5V VDD = 10V VDD-15V	-	30 20 15	120 45 30	ns
PW_{LD}	Latch Disable Pulse Width	VDD =5V VDD = 10V VDD-15V	-	50 30 20	250 100 80	ns
C_{IN}	Input Capacitance	Per input	-	5	7.5	pF
C_{PD}	Power Dissipation Capacitance	See Cpo Measurement Waveforms (Note 4)	-	300	-	pF

* AC Parameters are guaranteed by DC correlated testing.

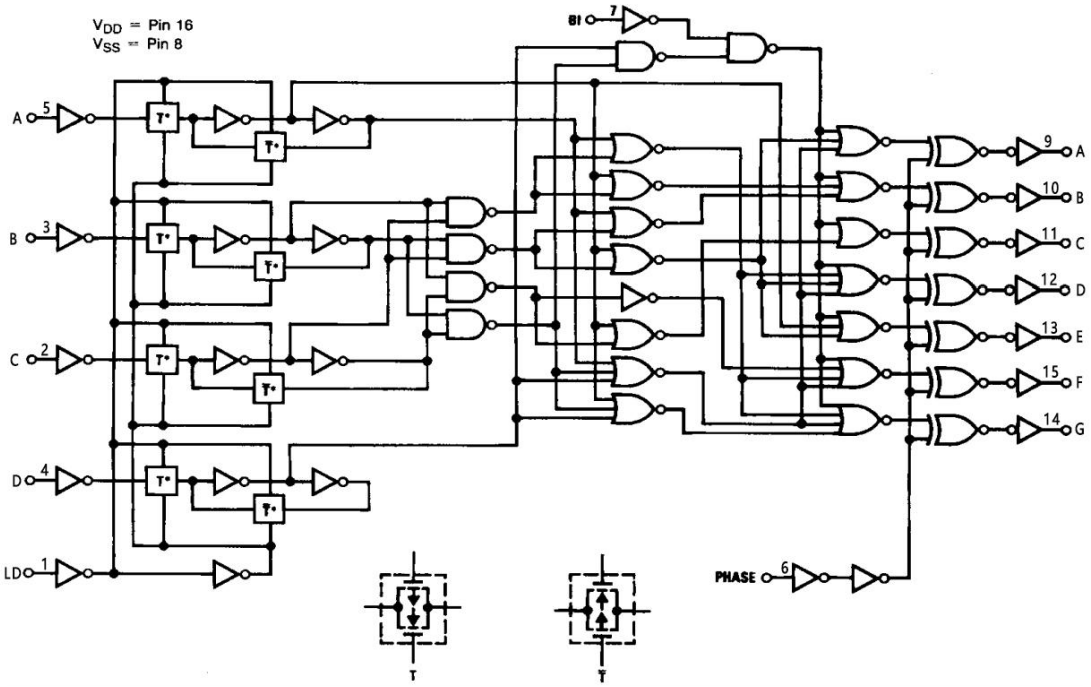
Note 1: "Absolute Maximum Ratings"are those values beyond which the safety of the device cannot be guaranteed; they are not meant to imply that the devices should be operated at these limits. The tables of "Recommended Operating Conditions"and Electrical Characteristics"provide conditions for actual device operation.

Note 2: Vss = OV unless otherwise specified.

Note 3: I_{OH} and I_{OL} are tested one output at a time.

Note 4: C_{PD} determines the no load AC power consumption of a CMOS device. For a complete explanation, see "MM54C/74C Family Characteristics"Application Note AN-90.

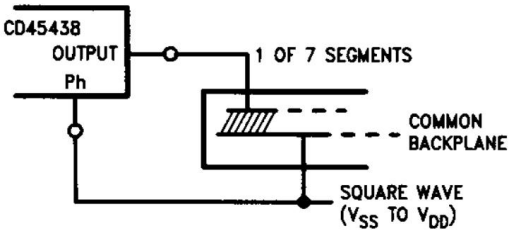
Logic Diagram



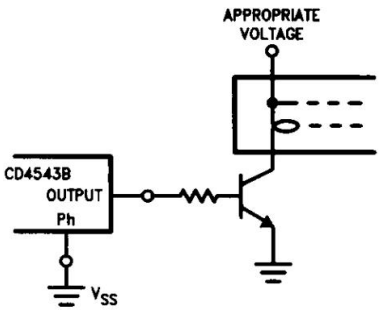
*Transmission gates

Typical Applications

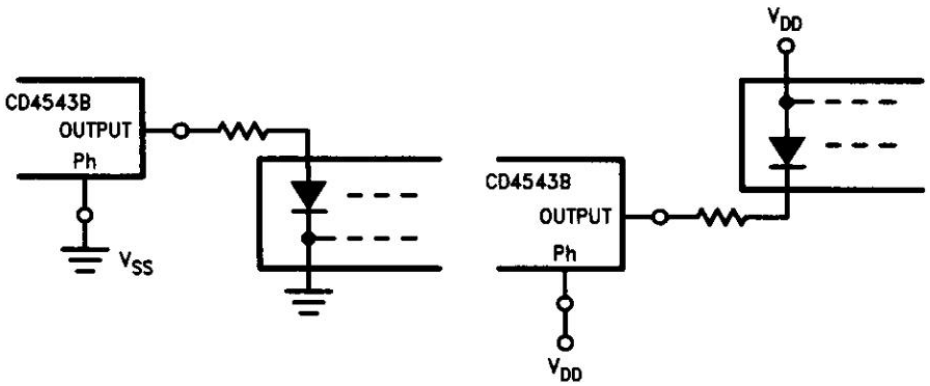
Liquid Crystal (LC) Readout



Incandescent Readout



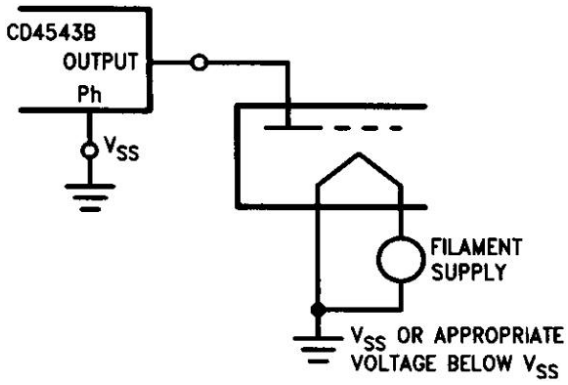
Light Emitting Diode (LED) Readout



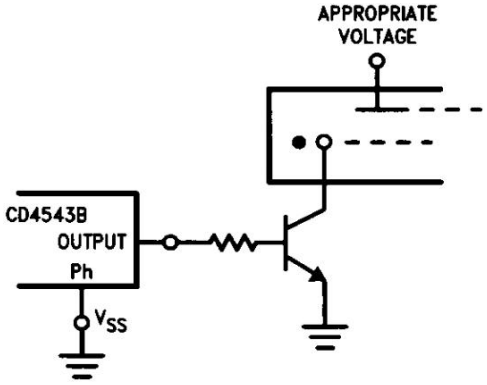
Note: Bipolar transitors may be added for gain (for $V_{DD} \leq 10V$ or $I_{OUT} \geq 10$ mA)

Typical Applications(Continued)

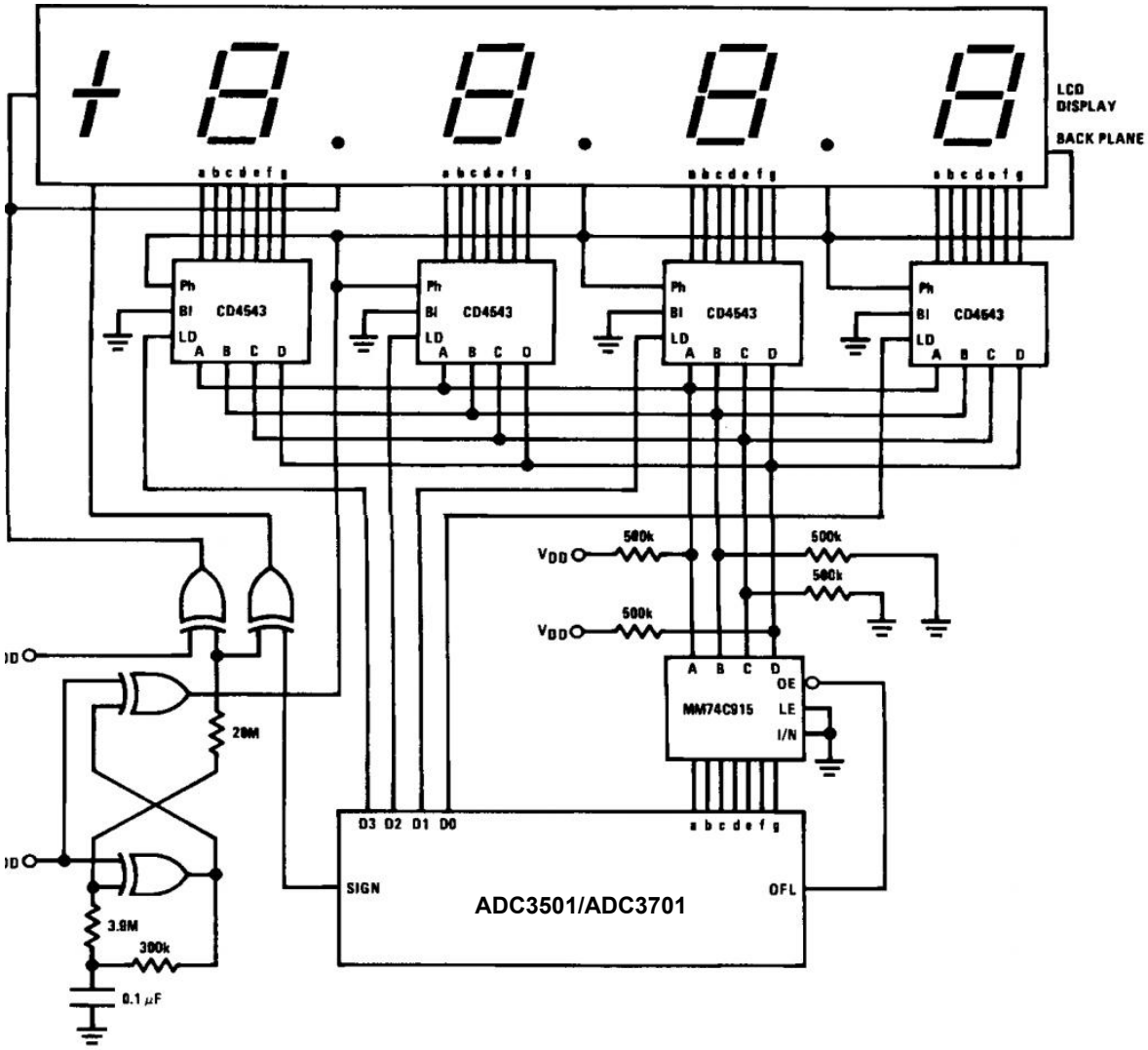
Fluorescent Readout



Gas Discharge Readout



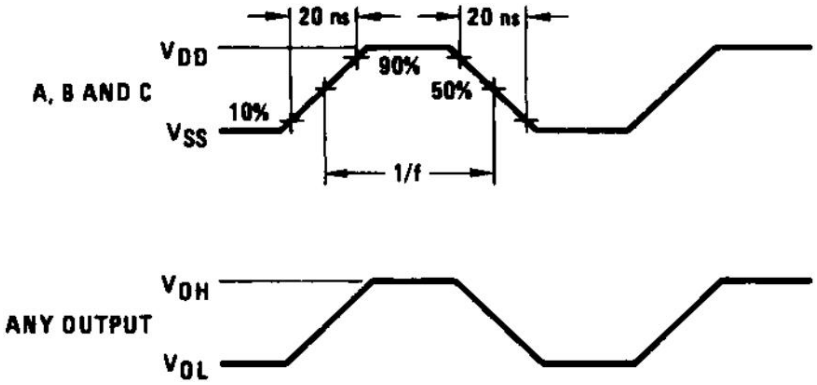
3½-Digit DVM with LCD Display



Display 9.999when overflowed. All digits can also be blanked at overflow by typing OFL to BI on the CD4543's.

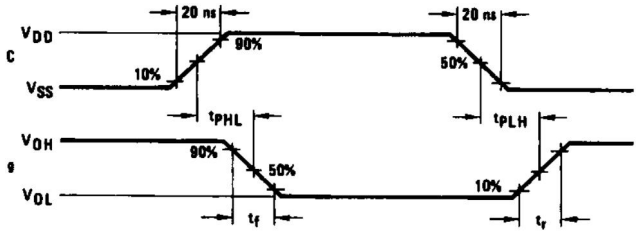
Switching Time Waveforms

CPO MEASUREMENT WAVEFORMS

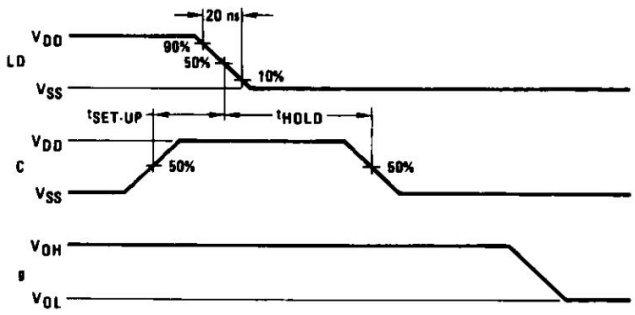


Inputs Bland Ph low, and inputs D and LD high. f in respect to a system clock.
All outputs connected to respective C loads.

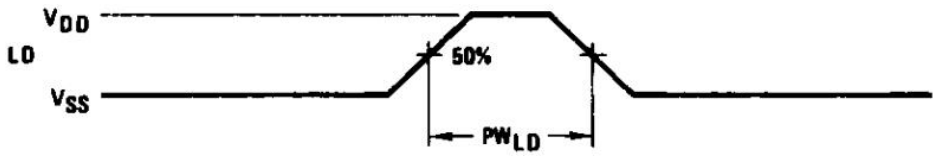
Dynamic SIgnal Waveforms



Inputs D,Ph and BI Low, and Inputs A,B and LD High



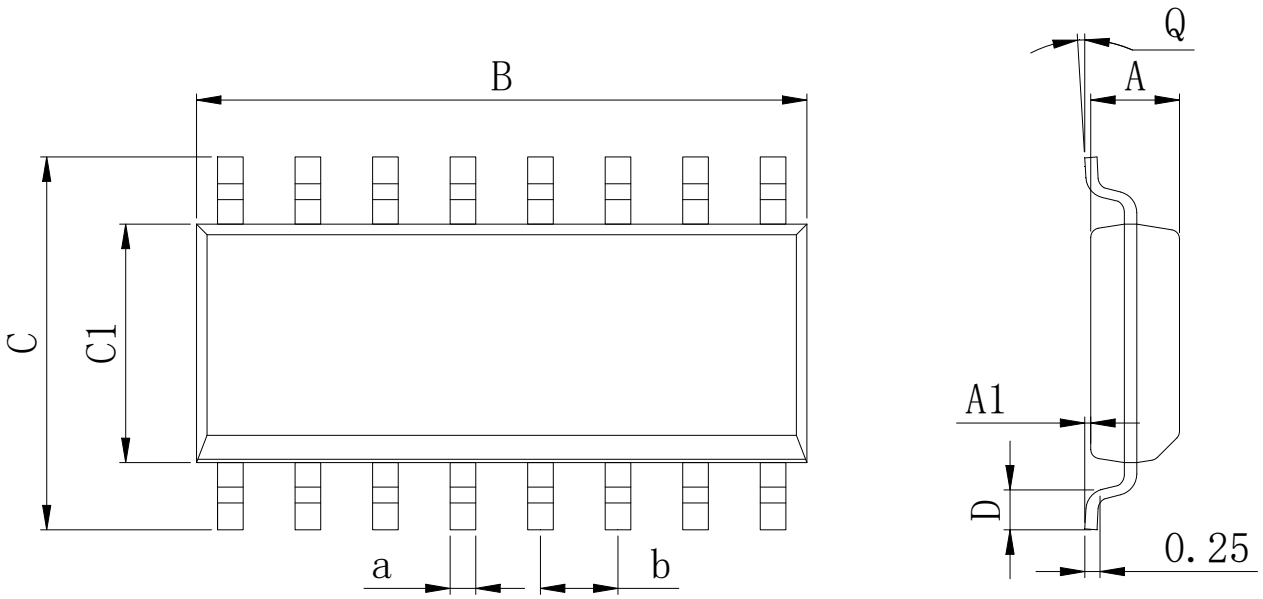
(Inputs D, Ph and BI Low, and inputs A and B Hi



Data DCBA Strobe into Latches

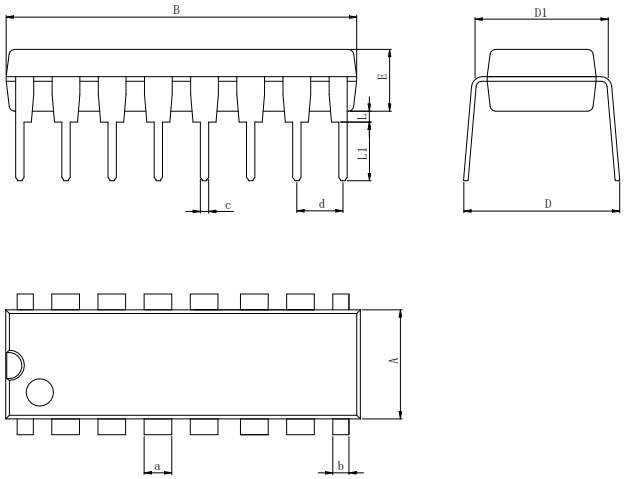
Physical Dimensions

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	

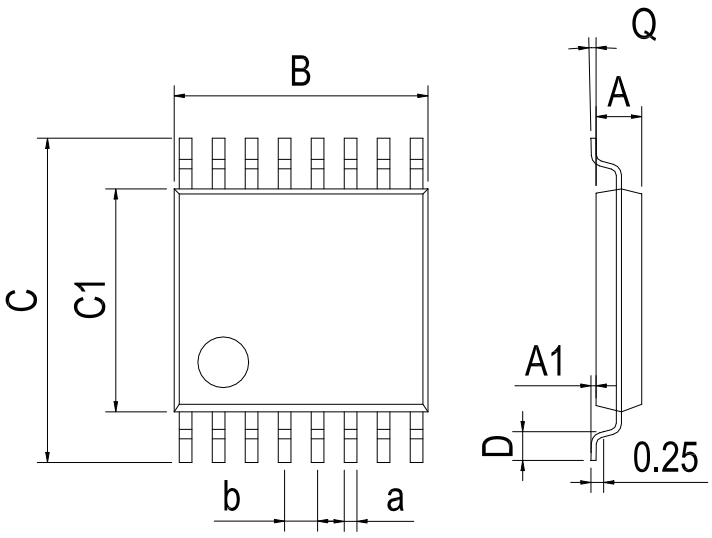
DIP-16



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
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	

Revision History

DATE	REVISION	PAGE
2018-8-9	New	1-13
2023-11-15	Modify the package dimension diagram TSSOP-16、Update encapsulation type、Update Lead Temperature、Updated DIP-16 dimension、Add annotation for Maximum Ratings、Update DIP Package New Model	1、4、9、12

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