

General Description

The CD4543BM is a monolithic CMOS BCD-to-7-segment latch/decoder/driver for use with liquid crystal and other types of displays. The circuit provides the functions of a 4-bit storage latch and an 8421 BCD-to-7-segment 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 outputs of the circuit are connected directly to the segments of the LC readout. For other types of readouts, such as light emitting diode (LED), incandescent, gas discharge, and fluorescent readouts, connection diagrams are given on this data sheet.

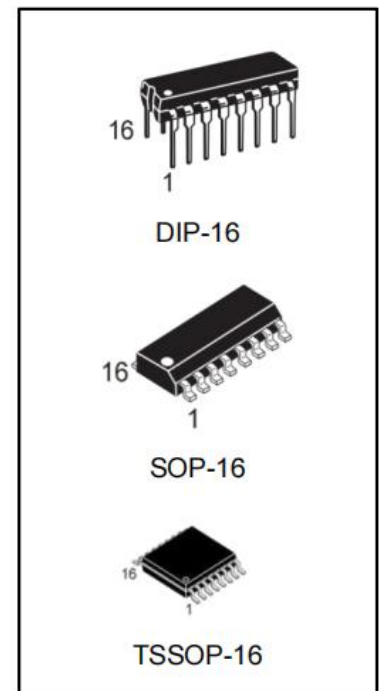
All inputs are protected against static discharge by diode clamps to V_{DD} and V_{SS} .

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 $V_{DD} = 5.0V$
- 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 V_{SS})
- Pin-for-pin replacement for Motorola MC14543B

Applications

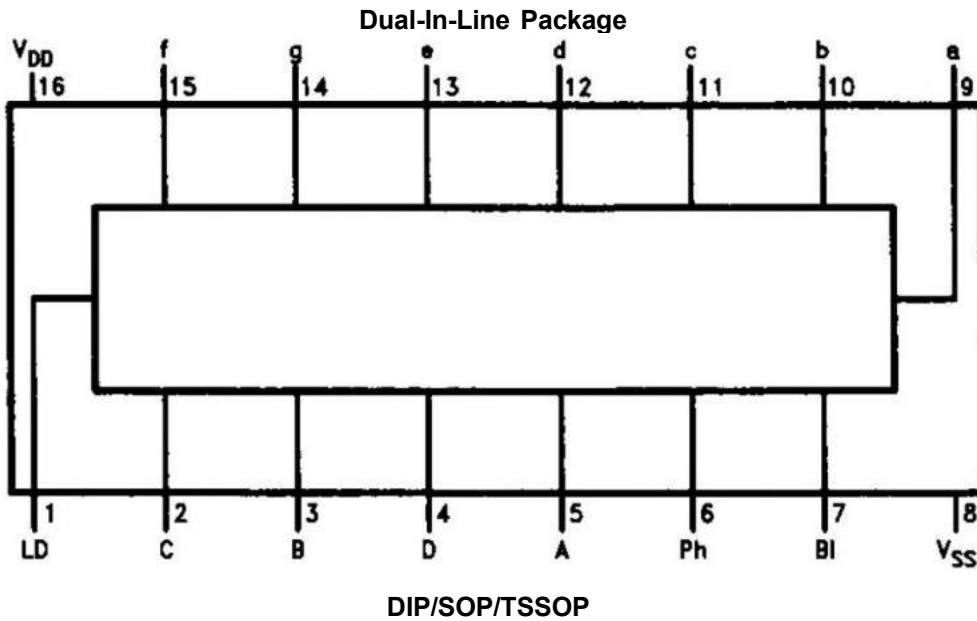
- Instrument (e.g., counter, DVM, etc.) display driver
- Computer/calculator display driver
- Cockpit display driver
- Various clock, watch, and timer users



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

Connection Diagram and



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	1	0	1	0	1	1	5
1	0	0	0	1	1	0	0	1	0	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	0	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

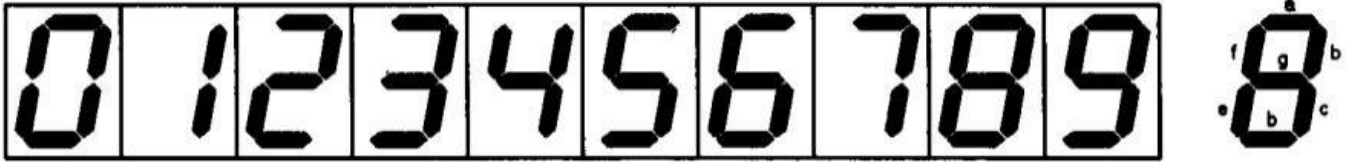
*=For liquid crystal readouts,apply a square wave to Ph.

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(Vbo)		-0.5	+18	VDc
Input Voltage (Vin)		-0.5	VDp+0.5	VDc
Storage Temp.Range(Ts)		65	+150	°C
Power Dissipation (PD)	Dual-In-Line	700		mW
	Small Outline	500		mW
Lead Temperature(T)(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 (Note 2)

Condition		Min	Max	UNITS
DC Supply Voltage(Vod)		3	15	Voc
Input Voltage (Vin)		0	VDD	VDc
Operating Temperature Range (TA)		-40	+85	°C

DC Electrical Characteristics (Note 2)

Symbol	Parameter	Conditions	-40°C		+25°C			+85°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
Ibp	Quiescent Device Current	Voo=5V, Vin =Vpo or Vss Voo=10V, Vn =Voo or Vss Vpo=15V, Vn =Vbo or Vss		20 40 80			20 40 80		150 300 600	µA
Vou	Low Level Output Voltage	Vpp =5V Voo =10V Ilo<1 µA Voo=15V		0.05 0.05 0.05		0 0 0	0.05 0.05 0.05		0.05 0.05 0.05	V
VoH	High Level Output Voltage	VDo =5V Voo=10V Iol<1 µA Voo=15V	4.95 9.95 14.95		4.95 9.95 14.95	5 10 15		4.95 9.95 14.59		V
Vµ	Low Level Input Voltage	Vop=5V, Vo=0.5V or 4.5V Vpo=10V, Vo=1V or 9V Vpo=15V, Vo=1.5V or 13.5V		1.5 3.0 4.0			1.5 3.0 4.0		1.5 3.0 4.0	V
VH	High Level Input Voltage	Vpp=5V, Vo=0.5V or 4.5V Voo=10V, Vo=1V or 9V Voo=15V, Vo=1.5V or 13.5V	3.5 7.0 11.0		3.5 7.0 11.0			3.5 7.0 11.0		V
Iou	Low Level Output Current (Note 3)	Vpo=5V, Vo=0.4V Voo=10V, Vo=0.5V Vpp=15V, Vo=1.5V	0.52 1.3 3.6		0.51 1.3 3.4			0.36 0.9 2.4		mA
IoH	High Level Output Current (Note 3)	Vop=5V, Vo=4.6V Vop=10V, Vo=9.5V Vop=15V, Vo=13.5V	-0.52 -1.3 -3.6		-0.44 -1.1 -3.0			0.36 -0.9 -2.4		mA
Iin	Input Current	VDp=15V, Vin =0V Vpo=15V, ViN=15V		-0.3 0.3		-10-5 10-5	-0.3 0.3		-1.0 1.0	µA

AC Electrical Characteristics*TA=25°C,C₁=50 pF,V_{ss} =0,unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t	Output Rise Time	VDD=5V VDD =10V VDD=15V		100 50 40	200 100 80	ns
t	Output Fall Time	VDD=5V VDo=10V VDD=15V		100 50 40	200 100 80	ns
tPLH	Turn-ON Propagation Delay Time	VDD =5V VDD=10V VDD=15V		450 170 110	1100 440 330	ns
tpHL	Turn-OFF Propagation Delay Time	VDD =5V VDD =10V VDD=15V		500 180 120	1100 440 330	ns
tsET-UP	Set-Up Time	VDD =5V VDD =10V VDD=15V		-5 -2 0	80 30 20	ns
tHoLD	Hold Time	VDD =5V VDD =10V VDD=15V		30 20 15	120 45 30	ns
PWLD	Latch Disable Pulse Width	VDD =5V VDD =10V VDD=15V		50 30 20	250 100 80	ns
CiN	Input Capacitance	Per input		5	7.5	pF
CpD	Power Dissipation Capacitance	See Cpo Measurement Waveforms (Note 4)		300		pF

*AC Parameters are guaranteed by DC correlated testing.

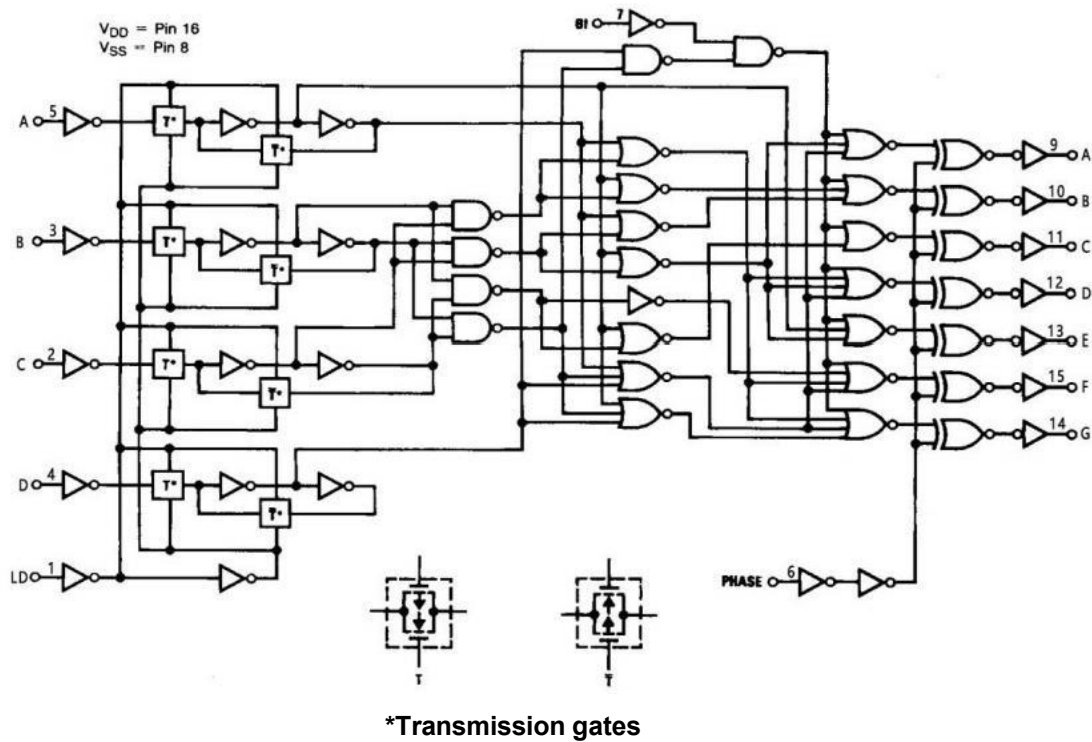
Note 1:"Absolute Maximum Ratings"are those values beyond which the safety of the device cannot be guaranteed;they are not meant to imply that the devices should be operated at these limits.The tables of "Recommended Operating Conditions"and Electrical Characteristics"provide conditions for actual device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

Note 2: V_{ss} =0V unless otherwise specified.

Note 3: loh and lor are tested one output at a time.

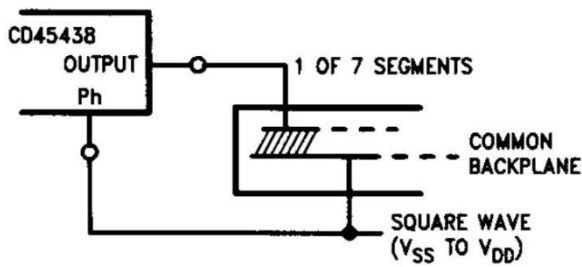
Note 4:C_{pp} determines the no load AC power consumption of a CMOS device.For a complete explanation,see "MM54C/74C Family Characteristics"Application Note AN-90.

Logic Diagram

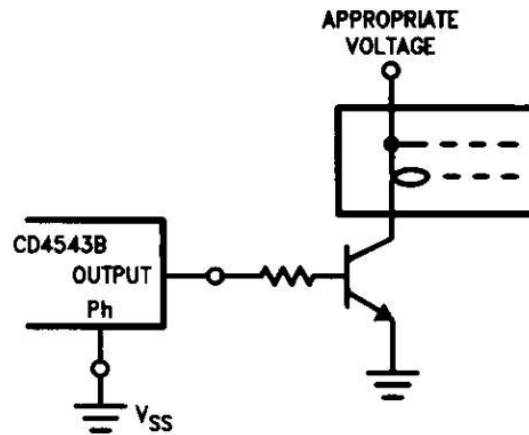


Typical Applications

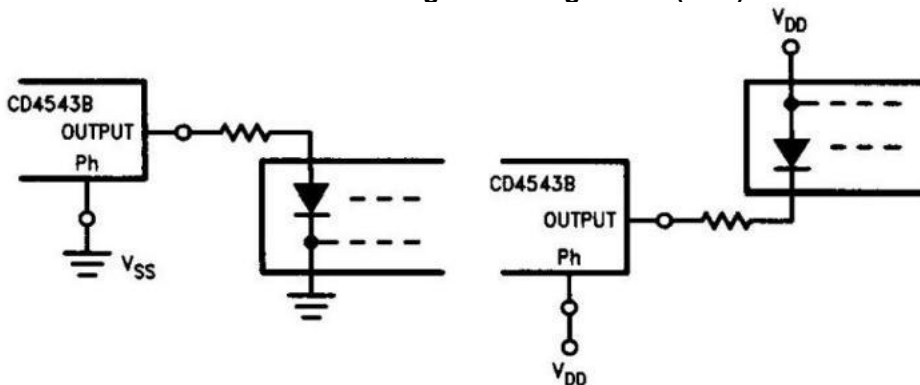
Liquid Crystal (LC) Readout



Incandescent Readout



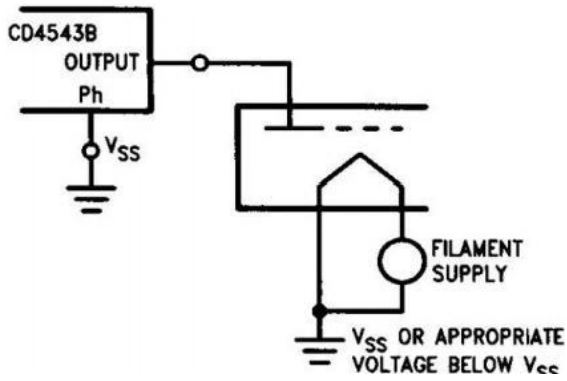
Light Emitting Diode (LED) Readout



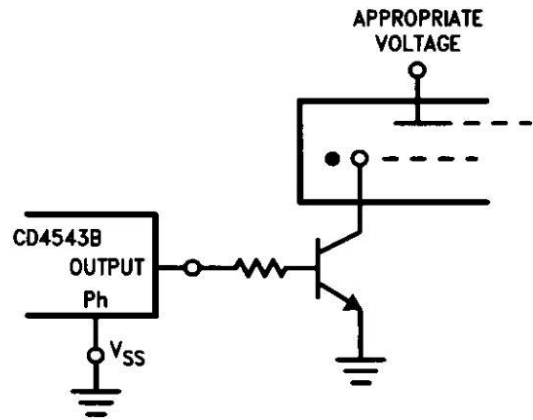
Note: Bipolar transistors may be added for gain (for $V_{bo} \leq 10V$ or $I_{our} \geq 10\text{ mA}$)

Typical Applications(Continued)

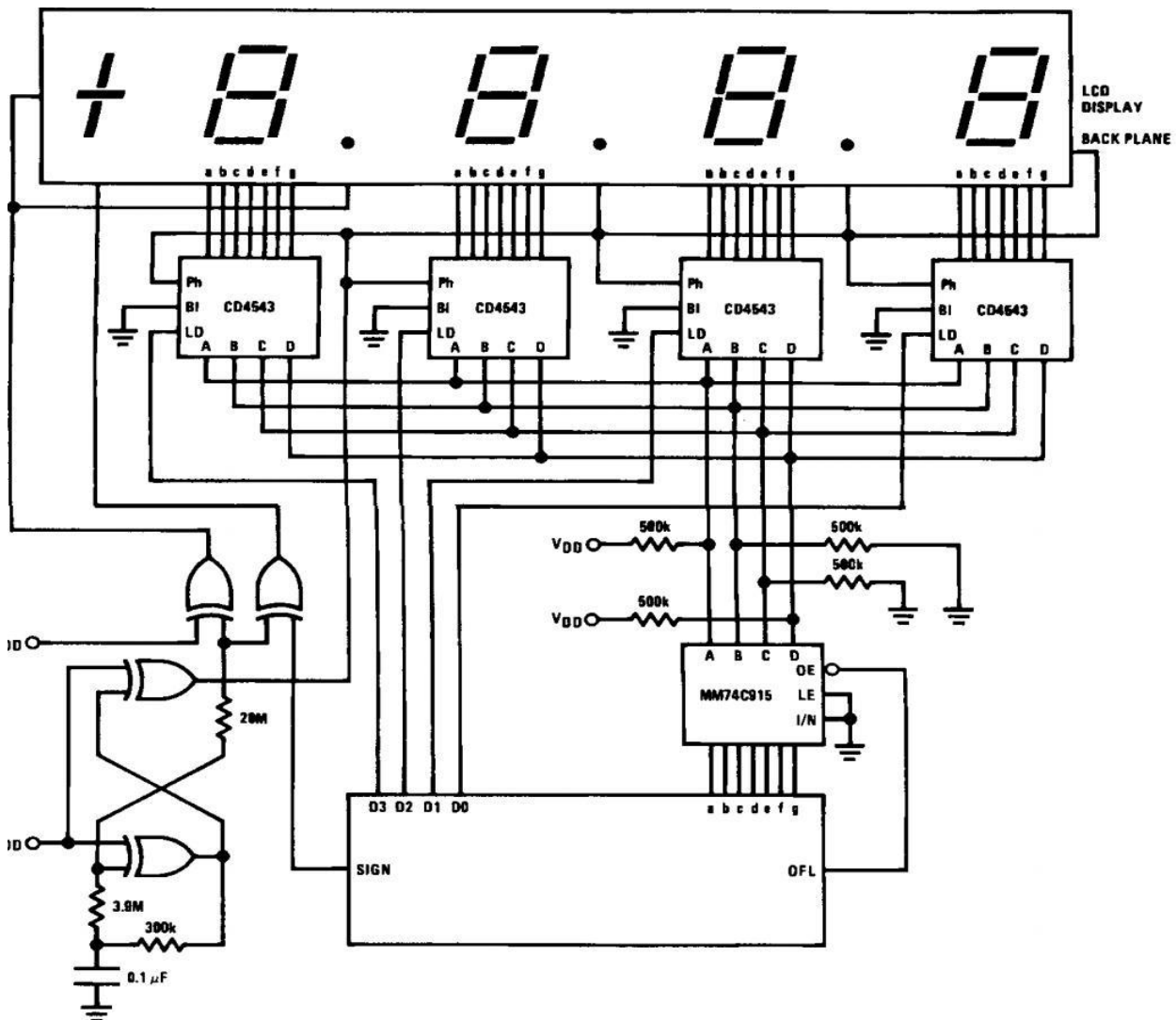
Fluorescent Readout



Gas Discharge Readout

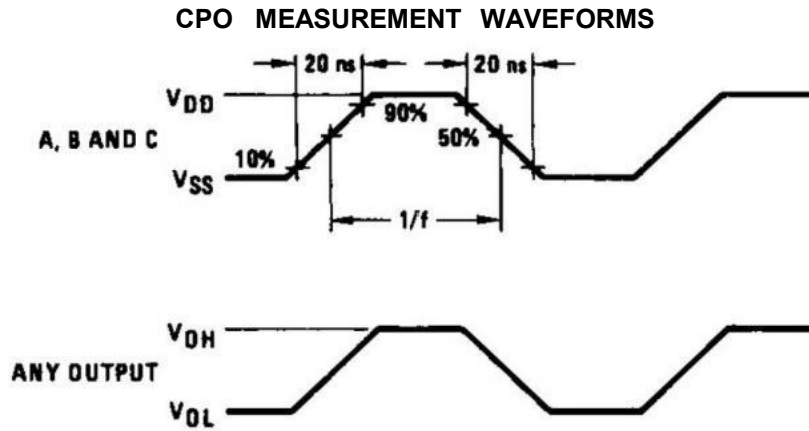


3½-Digit DVM with LCD Display



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

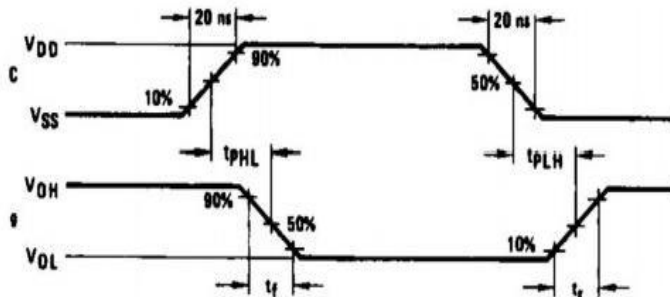
Switching Time Waveforms



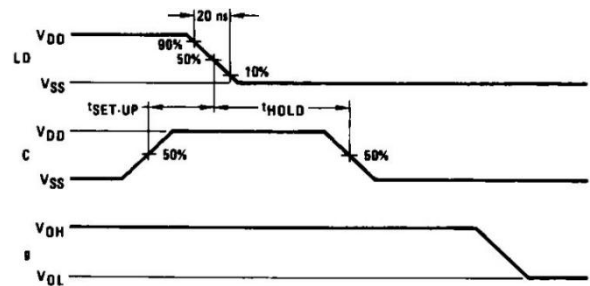
Inputs Bland Ph low, and inputs D and LD high. f in respect to a system clock.

All outputs connected to respective C loads.

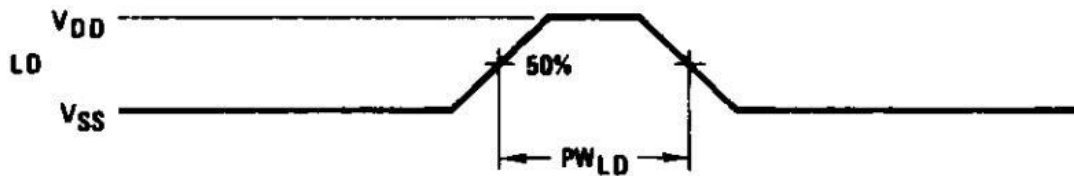
Dynamic Signal Waveforms



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



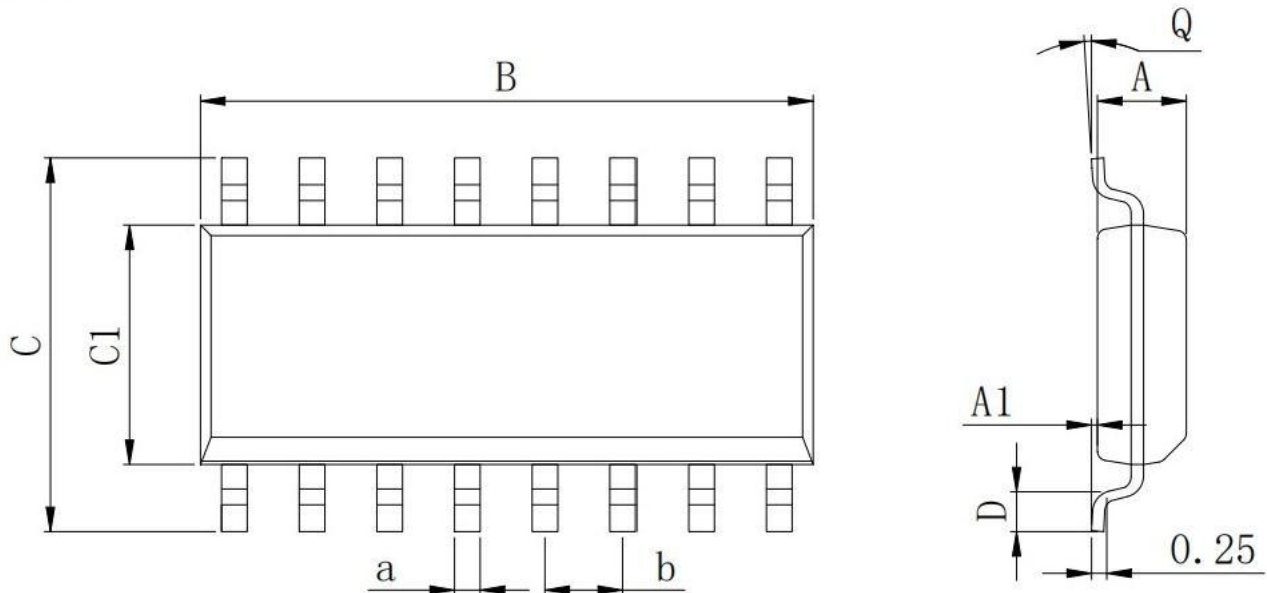
(Inputs D, Ph and BI Low, and inputs A and B Hi



Data DCBA Strobe into Latches

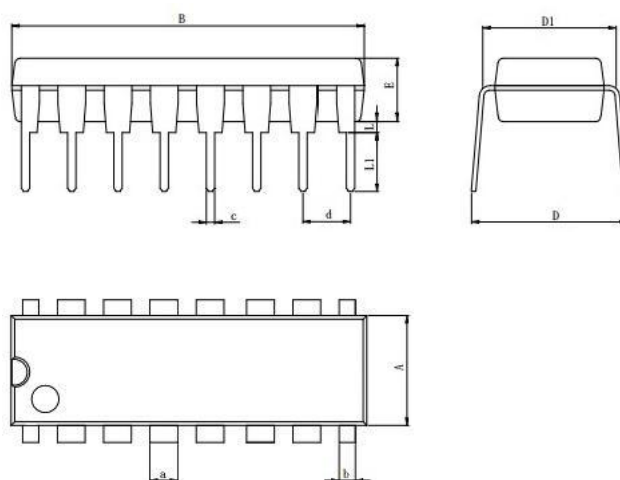
Physical Dimensions

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	

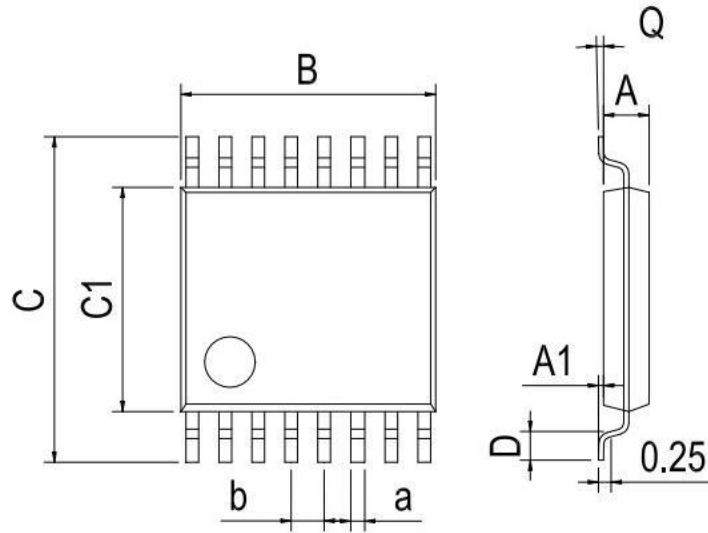
DIP-16



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	