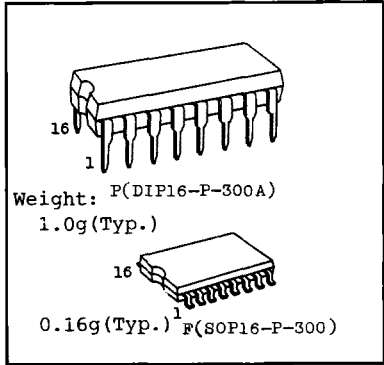


TC4055BP, TC4056BP/BF

TC4055BP LIQUID-CRYSTAL DISPLAY DRIVER
(BCD TO 7-Segment Decoder/Driver with "Display-Frequency" Output)

TC4056BP/TC4056BF LIQUID-CRYSTAL DISPLAY DRIVER
(BCD TO 7-Segment Decoder/Driver with Strobed-Latch Function)

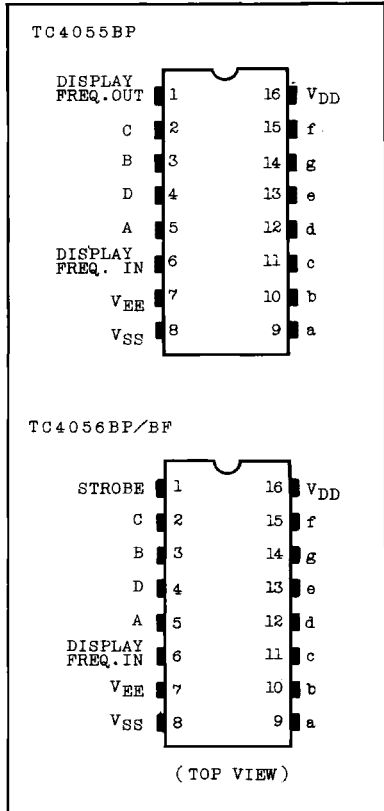
TC4055BP, TC4056BP/BF are LC drivers which drive the field effect type liquid crystal with seven segments by BCD input.
If DF input="L", a selected output among segment outputs of a through g becomes "H" level and if DF input="H", a selected output becomes "L" level.
Seven segment liquid crystal element can be directly driven by applying the pulse in-phase with DF input to the common terminal (back plane) of liquid crystal.
TC4055BP is equipped with DF output for the common terminal and TC4056BP/BF is equipped with the latch.
If $V_{EE} < V_{SS}$, the level conversion operation which lowers only "L" side of logical signal can be achieved.



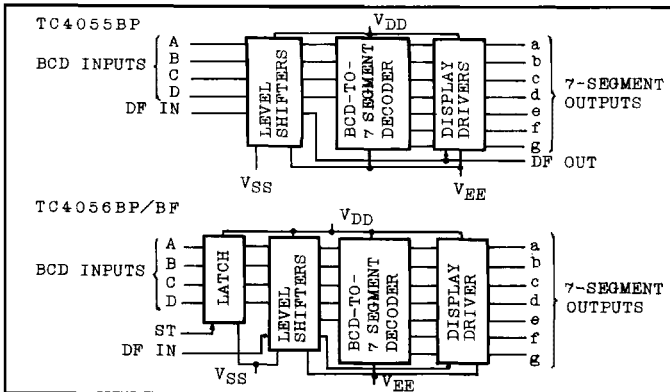
MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	$V_{DD}-V_{SS}$	-0.5 ~ 20	V
	$V_{DD}-V_{EE}$	-0.5 ~ 20	V
Input Voltage	V_{IN}	$V_{SS}-0.5 \sim V_{DD}+0.5$	V
Output Voltage	V_{OUT}	$V_{EE}-0.5 \sim V_{DD}+0.5$	V
DC Input Current	I_{IN}	± 10	mA
Power Dissipation	P_D	300(DIP)/180(SOIC)	mW
Operating Temperature Range	T_A	-40 ~ 85	°C
Storage Temperature Range	T_{stg}	-65 ~ 150	°C
Lead Temp./Time	T_{sol}	260°C · 10sec	

PIN ASSIGNMENT



BLOCK DIAGRAM



TC4055BP, TC4056BP/BF

TRUTH TABLE

BCD INPUTS				7-SEGMENT OUTPUTS (DF IN="L")							7-SEGMENT OUTPUTS (DF IN="H")							DISPLAY CHARACTER
D	C	B	A	a	b	c	d	e	f	g	a	b	c	d	e	f	g	
L	L	L	L	H	H	H	H	H	H	L	L	L	L	L	L	L	H	0
L	L	L	H	L	H	H	L	L	L	L	H	L	L	H	H	H	H	1
L	L	H	L	H	H	L	H	H	L	H	L	L	H	L	L	H	L	2
L	L	H	H	H	H	H	H	L	L	H	L	L	L	L	H	H	L	3
L	H	L	L	L	H	H	L	L	H	H	H	L	L	H	H	L	L	4
L	H	L	H	H	L	H	H	L	H	H	L	H	L	L	H	L	L	5
L	H	H	L	H	L	H	H	H	H	H	L	H	L	L	L	L	L	6
L	H	H	H	H	H	H	L	L	L	L	L	L	H	H	H	H	H	7
H	L	L	L	H	H	H	H	H	H	H	L	L	L	L	L	L	L	8
H	L	L	H	H	H	H	H	L	H	H	L	L	L	L	H	L	L	9
H	L	H	L	L	L	L	H	H	H	L	H	H	H	L	L	L	H	10
H	L	H	H	L	H	H	L	H	H	H	H	L	L	H	L	L	L	11
H	H	L	L	H	H	L	L	H	H	H	L	L	H	H	L	L	L	12
H	H	L	H	H	H	H	L	H	H	H	L	L	L	H	L	L	L	13
H	H	H	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	14
H	H	H	H	L	L	L	L	L	L	L	H	H	H	H	H	H	H	BLANK

RECOMMENDED OPERATING CONDITIONS (V_{SS}=0V)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
DC Supply Voltage	V _{DD} -V _{SS}	3	-	18	V
	V _{DD} -V _{EE}	3	-	18	
Input Voltage	V _{IN}	0	-	V _{DD}	V

STATIC ELECTRICAL CHARACTERISTICS (V_{SS}=V_{EE}=0V)

CHARACTERISTIC	SYM-BOL	TEST CONDITION	V _{DD} (V)	-40°C		25°C			85°C		UNIT
				MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.	
High-Level Output Voltage	V _{OH}	I _{OUT} < 1μA V _{IN} =V _{SS} , V _{DD}	5	4.95	-	4.95	5.00	-	4.95	-	V
			10	9.95	-	9.95	10.00	-	9.95	-	
			15	14.95	-	14.95	15.00	-	14.95	-	
Low-Level Output Voltage	V _{OL}	I _{OUT} < 1μA V _{IN} =V _{SS} , V _{DD}	5	-	0.05	-	0.00	0.05	-	0.05	V
			10	-	0.05	-	0.00	0.05	-	0.05	
			15	-	0.05	-	0.00	0.05	-	0.05	

STATIC ELECTRICAL CHARACTERISTICS (V_{SS}=V_{EE}=0V)

CHARACTERISTIC	SYM-BOL	TEST CONDITION	V _{DD} (V)	-40°C		25°C			85°C		UNIT	
				MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.		
Output High Current	I _{OH}	V _{OH} =4.6V	5	-0.61	-	-0.51	-1.0	-	-0.42	-	mA	
		V _{OH} =2.5V	5	-2.5	-	-2.1	-4.0	-	-1.7	-		
		V _{OH} =9.5V	10	-1.5	-	-1.3	-2.2	-	-1.1	-		
		V _{OH} =13.5V	15	-4.0	-	-3.4	-9.0	-	-2.8	-		
		V _{IN} =V _{SS} , V _{DD}										
Output Low Current	I _{OL}	V _{OL} =0.4V	5	0.61	-	0.51	1.5	-	0.42	-	mA	
		V _{OL} =0.5V	10	1.5	-	1.3	3.8	-	1.1	-		
		V _{OL} =1.5V	15	4.0	-	3.4	15.0	-	2.8	-		
		V _{IN} =V _{SS} , V _{DD}										
Input High Voltage	V _{IH}	V _{OUT} =0.5V, 4.5V	5	3.5	-	3.5	2.75	-	3.5	-	V	
		V _{OUT} =1.0V, 9.0V	10	7.0	-	7.0	5.5	-	7.0	-		
		V _{OUT} =1.5V, 13.5V	15	11.0	-	11.0	8.25	-	11.0	-		
		I _{OUT} < 1μA										
Input Low Voltage	V _{IL}	V _{OUT} =0.5V, 4.5V	5	-	1.5	-	2.25	1.5	-	1.5	V	
		V _{OUT} =1.0V, 9.0V	10	-	3.0	-	4.5	3.0	-	3.0		
		V _{OUT} =1.5V, 13.5V	15	-	4.0	-	6.75	4.0	-	4.0		
		I _{OUT} < 1μA										
Input Current	"H" Level	I _{IH}	V _{IH} =18V	18	-	0.1	-	10 ⁻⁵	0.1	-	1.0	μA
	"L" Level	I _{IL}	V _{IL} =0V	18	-	-0.1	-	-10 ⁻⁵	-0.1	-	-1.0	
Quiescent Device Current	I _{DD}	V _{IN} =V _{SS} , V _{DD} *	5	-	5	-	0.005	5	-	150	μA	
			10	-	10	-	0.010	10	-	300		
			15	-	20	-	0.015	20	-	600		

* All valid input combinations.

DYNAMIC ELECTRICAL CHARACTERISTICS (T_a=25°C, V_{SS}=0V, C_L=50pF)

CHARACTERISTIC	SYMBOL	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
		V _{DD} (V)	V _{EE} (V)				
Output Transition Time	t _{TLH} t _{THL}	5	0	-	80	200	ns
		5	-5	-	50	100	
		10	0	-	50	100	
		15	0	-	40	80	

TC4055BP, TC4056BP/BF

DYNAMIC ELECTRICAL CHARACTERISTICS (Ta=25°C, VSS=0V, CL=50pF)

CHARACTERISTIC	SYMBOL	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
		VDD(V)	VEE(V)				
Propagation Delay Time (BCD IN - 7-SEGMENT OUT)	τ _{pLH} τ _{pHL}	5	0	-	980	2000	ns
		5	-5	-	380	900	
		10	0	-	320	750	
		15	0	-	210	500	
Propagation Delay Time (DF IN - 7-SEGMENT OUT)	τ _{pLH} τ _{pHL}	5	0	-	620	1800	ns
		5	-5	-	240	900	
		10	0	-	200	750	
		15	0	-	130	500	
Propagation Delay Time ⁺ (DF IN - DF OUT)	τ _{pLH} τ _{pHL}	5	0	-	570	1500	ns
		5	-5	-	220	800	
		10	0	-	180	700	
		15	0	-	110	550	
Propagation Delay Time ⁺⁺ (STROBE - 7-SEGMENT OUT)	τ _{pLH} τ _{pHL}	5	0	-	1000	3100	ns
		5	-5	-	400	1300	
		10	0	-	340	1150	
		15	0	-	210	750	
Min. Pulse Width ⁺⁺ (STROBE)	τ _{WH}	5	0	-	55	220	ns
		5	-5	-	60	220	
		10	0	-	25	100	
		15	0	-	20	70	
Min. Set-up Time ⁺⁺ (BCD IN - STROBE)	τ _{SU}	5	0	-	50	220	ns
		5	-5	-	50	220	
		10	0	-	25	100	
		15	0	-	20	70	
Input Capacitance	C _{IN}			-	5	7.5	pF

* TC4055BP, ** TC4056BP/BF

WAVEFORM FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS

