

TC4054BP/BF

C²MOS DIGITAL INTEGRATED CIRCUIT
SILICON MONOLITHIC

TC4054BP/TC4054BF LIQUID-CRYSTAL DISPLAY DRIVER (4-SEGMENT DISPLAY DRIVER)

TC4054BP/BF contains four circuits of liquid crystal (field effect type) drivers.

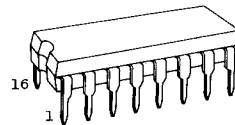
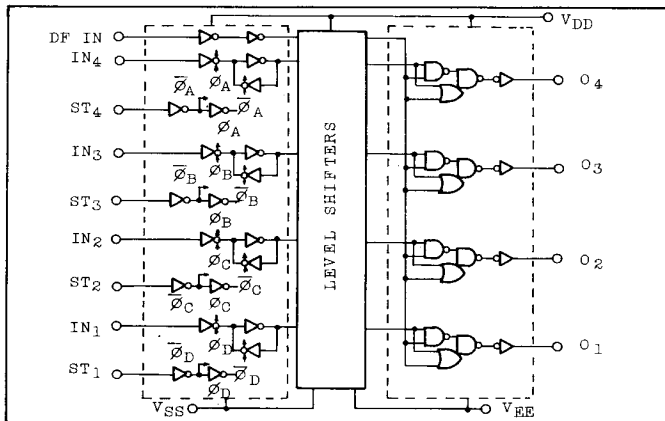
When pulse is applied to DF input, the output with 180° out of phase from DF pulse is obtained at OUT if input IN is "H". If input IN is "L", OUT and DF pulse become in-phase.

By applying DF input pulse to the common terminal (back plane) of liquid crystal, the liquid crystal element can be directly driven by the input signal with "H" level. This is suitable for illuminating the segments of decimal point and positive or negative sign. If $V_{EE} < V_{SS}$, the level conversion operation which lowers only "L" side of logical signal can be achieved.

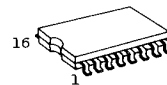
ABSOLUTE MAXIMUM RATINGS

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(MFP)	mW
Operating Temperature Range	T_A	-40 ~ 85	°C
Storage Temperature Range	T_{stg}	-65 ~ 150	°C
Lead Temp./Time	T_{sol}	260°C · 10 sec	

LOGIC DIAGRAM

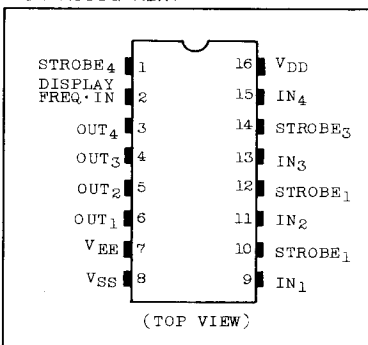


DIP16(3D16A-P)



MFP16(F16GC-P)

PIN ASSIGNMENT



TRUTH TABLE

DF IN	IN _n	STROBE _n	OUT _n
L	L	H	L
H	L	H	H
L	H	H	H
H	H	H	L
*	*	L	△△

* : Don't care

△△ : Depends upon the INPUT mode previously applied when STROBE "H".

RECOMMENDE 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	V
Input Voltage	V _{IN}	V _{SS}	-	V _{DD}	V

STATIC ELECTRICAL CHARACTERISTICS (V_{SS}=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		
Output High Current	I _{OH}	V _{OH} =4.6V V _{OH} =2.5V V _{OH} =9.5V V _{OH} =13.5V V _{IN} =V _{SS} , V _{DD}	5	-0.61	-	-0.51	-1.0	-	-0.42	-	mA	
			5	-2.5	-	-2.1	-4.0	-	-1.7	-		
			10	-1.5	-	-1.3	-2.2	-	-1.1	-		
			15	-4.0	-	-3.4	-9.0	-	-2.8	-		
			15	-4.0	-	-3.4	-9.0	-	-2.8	-		
Output Low Current	I _{OL}	V _{OL} =0.4V V _{OL} =0.5V V _{OL} =1.5V V _{IN} =V _{SS} , V _{DD}	5	0.61	-	0.51	1.5	-	0.42	-	mA	
			10	1.5	-	1.3	3.8	-	1.1	-		
			15	4.0	-	3.4	15.0	-	2.8	-		
			15	4.0	-	3.4	15.0	-	2.8	-		
Input High Voltage	V _{IH}	V _{OUT} =0.5V, 4.5V V _{OUT} =1.0V, 9.0V V _{OUT} =1.5V, 13.5V I _{OUT} < 1μA	5	3.5	-	3.5	2.75	-	3.5	-	V	
			10	7.0	-	7.0	5.5	-	7.0	-		
			15	11.0	-	11.0	8.25	-	11.0	-		
			15	11.0	-	11.0	8.25	-	11.0	-		
Input Low Voltage	V _{IL}	V _{OUT} =0.5V, 4.5V V _{OUT} =1.0V, 9.0V V _{OUT} =1.5V, 13.5V I _{OUT} < 1μA	5	-	1.5	-	2.25	1.5	-	1.5	V	
			10	-	3.0	-	4.5	3.0	-	3.0		
			15	-	4.0	-	6.75	4.0	-	4.0		
			15	-	4.0	-	6.75	4.0	-	4.0		
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	

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

CHARACTERISTIC	SYM-BOL	TEST CONDITION	V _{DD} (V)	-40°C		25°C			85°C		UNIT
				MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.	
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	
Propagation Delay Time (NI - OUT)	t _{pLH} t _{pHL}	5	0	-	660	1800	ns
		5	-5	-	250	800	
		10	0	-	210	680	
		15	0	-	140	500	
Propagation Delay Time (DF IN - OUT)	t _{pLH} t _{pHL}	5	0	-	720	1800	ns
		5	-5	-	260	800	
		10	0	-	240	680	
		15	0	-	150	500	
Propagation Delay Time (STROBE - OUT)	t _{pLH} t _{pHL}	5	0	-	660	1800	ns
		5	-5	-	250	800	
		10	0	-	210	680	
		15	0	-	140	500	
Min. Clock Pulse Width (STROBE)	t _{WH}	5	0	-	60	220	ns
		5	-5	-	70	220	
		10	0	-	20	100	
		15	0	-	15	70	
Min. Set-up Time (IN - STROBE)	t _{SU}	5	0	-	50	220	ns
		5	-5	-	60	220	
		10	0	-	15	100	
		15	0	-	10	70	
Input Capacitance	C _{IN}			-	5	7.5	pF

WAVEFORMS FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS

