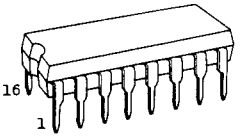
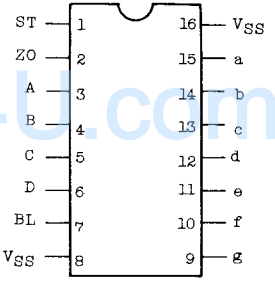
TC5068BP, TC5069BP BCD TO 7-SEGMENT LATCH/DECODER/DRIVER

The TC5068BP and TC5069BP are decoders which convert the inputs of BCD codes into the 7-segment display element driving signals. Since the segment output is of an open drain structure with high breakdown voltage P-channel FET, these decoders can directly drive fluorescent display tubes.
Each of four input lines contains a latch controlled by common strobe input, to facilitate static drive.
Each BL input is used for forcing all the segments to the OFF state; therefore, the decoders can be applied to the leading zero suppress by combining zero output (When input code is at "0", "H" level is output).
The TC5068BP is of a hexadecimal display indicating type, and the TC5069BP is of a BCD display puls "L", "H", "A", "P", "-", and "blank" display indicating type.



DIP16 (3D16A-P)

PIN ASSIGNMENT



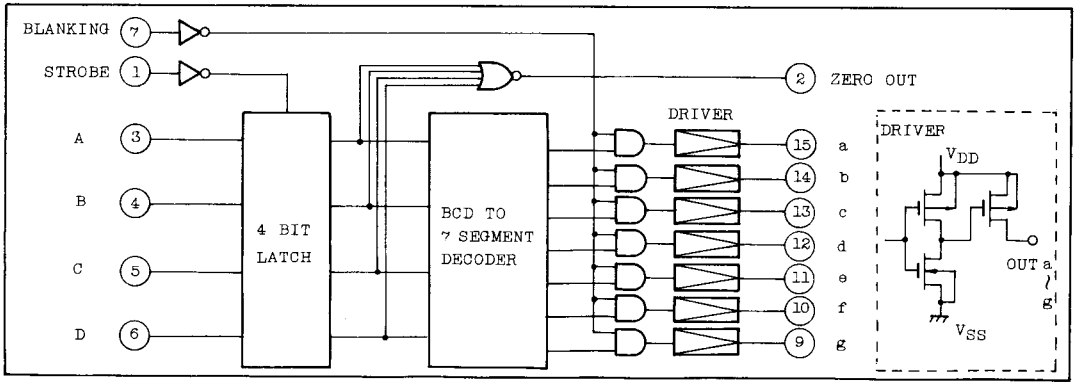
(TOP VIEW)

ABSOLUTE MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	V_{DD}	V_{SS}-0.5 ~ V_{SS}+20	V
Input Voltage	V_{IN}	V_{SS}-0.5 ~ V_{DD}+0.5	V
Output Voltage *	V_{OUT1}	V_{DD}-50 ~ V_{DD}+0.5	V
	V_{OUT2}	V_{SS}-0.5 ~ V_{DD}+0.5	V
DC Input Current	I_{IN}	±10	mA
Power Dissipation	P_D	300	mW
Operating Temperature Range	T_{opr}	-40 ~ 85	°C
Storage Temperature Range	T_{stg}	-65 ~ 150	°C

* V_{OUT1} is applied to segment output, and V_{OUT2} to zero output.

BLOCK DIAGRAM



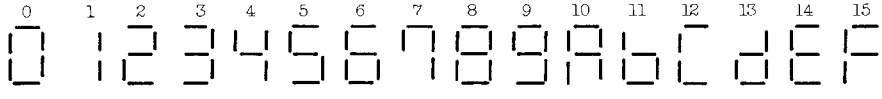
TRUTH TABLE

INPUTS						OUTPUTS													
						TC5068BP △							TC5069BP △							ZERO OUT
ST	BL	D	C	B	A	a	b	c	d	e	f	g	a	b	c	d	e	f	g	
※	H	※	※	※	※	L	L	L	L	L	L	L	L	L	L	L	L	L	L	☆
H	L	L	L	L	L	H	H	H	H	H	H	L	H	H	H	H	H	H	L	H
H	L	L	L	L	H	L	H	H	L	L	L	L	L	H	H	L	L	L	L	L
H	L	L	L	H	L	H	H	L	H	H	L	H	H	H	L	H	H	L	H	L
H	L	L	L	H	H	H	H	H	H	L	L	H	H	H	H	H	L	L	H	L
H	L	L	H	L	L	L	H	H	L	L	H	H	L	H	H	L	L	H	H	L
H	L	L	H	L	H	H	L	H	H	L	H	H	H	L	H	H	L	H	H	L
H	L	L	H	H	L	H	L	H	H	H	H	H	H	L	H	H	H	H	H	L
H	L	L	H	H	H	H	H	H	L	L	H	L	H	H	H	L	L	H	L	L
H	L	H	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L
H	L	H	L	L	H	H	H	H	H	L	H	H	H	H	H	H	L	H	H	L
H	L	H	L	H	L	H	H	H	L	H	H	H	L	L	L	H	H	H	L	L
H	L	H	L	H	H	L	L	H	H	H	H	H	L	H	H	L	H	H	H	L
H	L	H	H	L	L	H	L	L	H	H	H	L	H	H	H	L	H	H	H	L
H	L	H	H	L	H	L	H	H	H	H	L	H	H	H	L	L	H	H	H	L
H	L	H	H	H	L	H	L	L	H	H	H	H	L	L	L	L	L	L	H	L
H	L	H	H	H	H	H	L	L	L	H	H	H	L	L	L	L	L	L	L	L
L	L	※	※	※	※	△△														

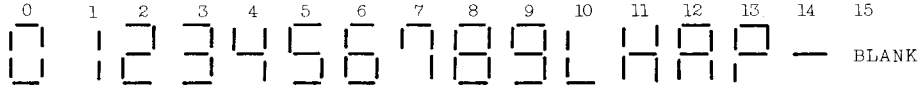
※ ; Don't care
☆ ; Undetermined
△△ ; Depends Upon the BCD code previously applied when ST = "H"
△ ; Required pull down resister "R_L"

DISPLAY INDICATING.TYPE

TC5068BP



TC5069BP



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

項　　目	記　号		MIN	TYP	MAX	単　位
電　源　電　圧	V_{DD}		3	—	18	V
入　力　電　圧	V_{IN}		0	—	V_{DD}	V

ELECTRICAL CHARACTERISTICS (V_{SS}=0V)

CHARACTERISTIC	SYMBOL	TEST CONDITION	V_{DD} (V)	-40°C MIN.	-40°C MAX.	25°C MIN.	25°C TYP.	25°C MAX.	85°C MIN.	85°C MAX.	UNIT
High Level Output Voltage	V_{OH}	$\|I_{OUT}\| < 1\mu A$	5	4.95	-	4.95	5.00	-	4.95	-	V
		$V_{IN}=V_{SS}$ or V_{DD}	10	9.95	-	9.95	10.00	-	9.95	-	
			15	14.95	-	14.95	15.00	-	14.95	-	
Low Level Output Voltage (ZERO OUT)	V_{OL}	$\|I_{OUT}\| < 1\mu A$	5	-	0.05	-	0.00	0.05	-	0.05	V
		$V_{IN}=V_{SS}$ or V_{DD}	10	-	0.05	-	0.00	0.05	-	0.05	
			15	-	0.05	-	0.00	0.05	-	0.05	
High Level Output Current (Segment OUT)	I_{OH}	V_{OH}= 3V(V_{DD}-2V)	5	-6	-	-5		-	-4	-	mA
		V_{OH}= 2V(V_{DD}-3V)	5	-9	-	-8		-	-6	-	
		V_{OH}= 7V(V_{DD}-3V)	10	-12	-	-10		-	-8	-	
		V_{OH}=12V(V_{DD}-3V)	15	-17	-	-15		-	-12	-	
		$V_{IN}=V_{SS}$ or V_{DD}									
High Level Output Current (Zero OUT)	I_{OH}	V_{OH}= 4.6V	5	-0.2	-	-0.16		-	-0.12	-	mA
		V_{OH}= 9.5V	10	-0.5	-	-0.4		-	-0.3	-	
		V_{OH}=13.5V	15	-1.4	-	-1.2		-	-1.0	-	
		$V_{IN}=V_{SS}$ or V_{DD}									
Low Level Output Current (Zero OUT)	I_{OL}	V_{OL}=0.4V	5	0.52	-	0.44		-	0.36	-	mA
		V_{OL}=0.5V	10	1.3	-	1.1		-	0.9	-	
		V_{OL}=1.5V	15	3.6	-	3.0		-	2.4	-	
		$V_{IN}=V_{SS}$ or V_{DD}									
High Level Input Voltage	V_{IH} *	V_{OUT}=0.5, 4.5V	5	3.5	-	3.5	2.75	-	3.5	-	V
		V_{OUT}=1.0, 9.0V	10	7.0	-	7.0	5.5	-	7.0	-	
		V_{OUT}=1.5, 13.5V	15	11.0	-	11.0	8.25	-	11.0	-	
		$\|I_{OUT}\| < 1\mu A$									
Low Level Input Voltage	V_{IL} *	V_{OUT}=0.5, 4.5V	5	-	1.5	-	2.25	1.5	-	1.5	V
		V_{OUT}=1.0, 9.0V	10	-	3.0	-	4.5	3.0	-	3.0	
		V_{OUT}=1.5,13.5V	15	-	4.0	-	6.75	4.0	-	4.0	
		$\|I_{OUT}\| < 1\mu A$									
Output Off-leak Current (Segment OUT)	I_{OFF}	V_{OUT}=0V	15	-	-3	-	-0.01	-3	-	-10	µA
		V_{OUT}=-30V	15	-	-10	-	-1	-10	-	-20	
Input Current "H" Level	I_{IH}	V_{IH}=18V	18	-	0.3	-	10^{-5}	0.3	-	1.0	µA
Input Current "L" Level	I_{IL}	V_{IL}=0V	18	-	-0.3	-	-10^{-5}	-0.3		-1.0	
Quiescent Supply Current	I_{DD}	$V_{IN}=V_{SS}$ or V_{DD}	5	-	20	-	0.005	20	-	150	µA
		Outputs Open	10	-	40	-	0.010	40	-	300	
		**	15	-	80	-	0.015	80	-	600	

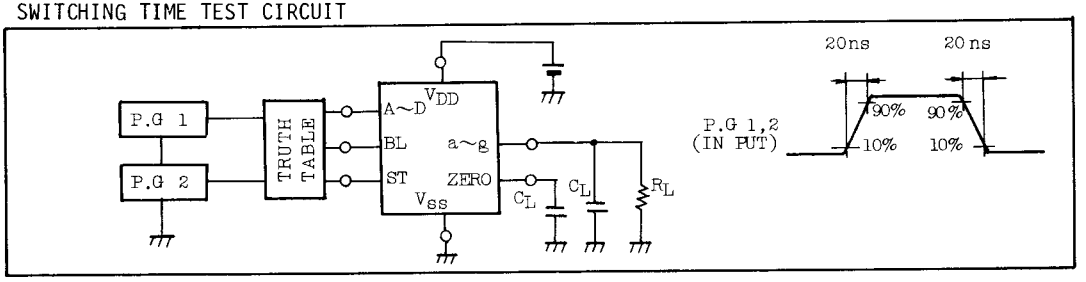
* R_L = 20 kΩ

** All valid input combinations.

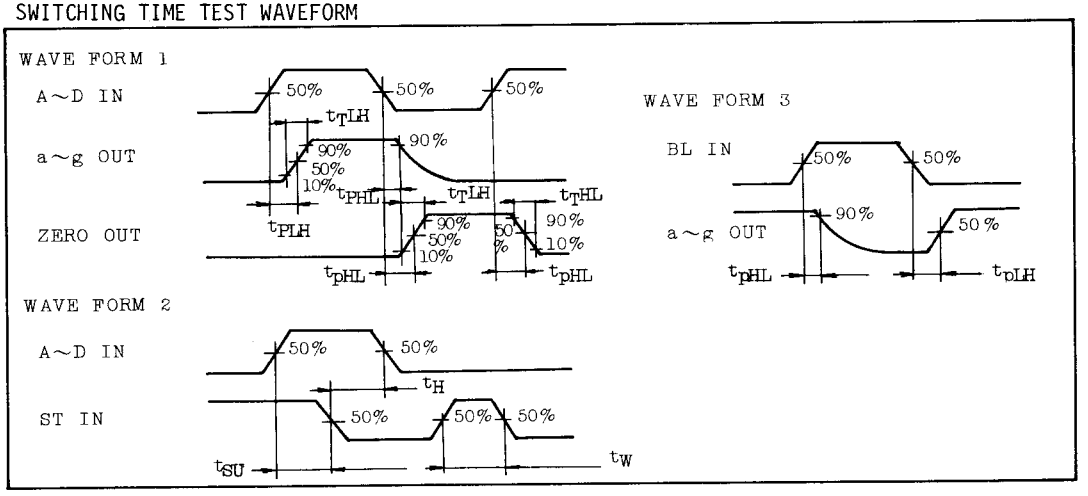
SWITCHING CHARACTERISTICS (Ta=25°C, V_{SS}=0V, C_L=50pF)

CHARACTERISTIC	SYMBOL	TEST CONDITION	V_{DD} (V)	MIN.	TYP.	MAX.	UNIT
Output Rise Time (SEGMENT OUT)	t_{TLH}	R_L = 1 kΩ	5	-	100	200	ns
			10	-	50	100	
			15	-	40	80	
Output Rise Time (ZERO OUT)	t_{TLH}		5	-	130	400	ns
			10	-	65	200	
			15	-	50	160	
Output Fall Time (ZERO OUT)	t_{THL}		5	-	100	200	
			10	-	50	100	
			15	-	40	80	
(Low-High) Propagation Delay Time (A,B,C,D-SEGMENT OUT)	t_{pLH}	R_L = 1 kΩ	5	-	750	1800	ns
			10	-	300	600	
			15	-	200	400	
(High-Low) Propagation Delay Time (A,B,C,D-SEGMENT OUT)	t_{pHL}	R_L = 1 kΩ	5	-	750	1800	
			10	-	300	600	
			15	-	200	400	
(Low-High) Propagation Delay Time (A,B,C,D-ZERO OUT)	t_{pLH}		5	-	250	500	ns
			10	-	125	250	
			15	-	100	200	
(High-Low) Propagation Delay Time (A,B,C,D-ZERO OUT)	t_{pHL}		5	-	250	500	
			10	-	125	250	
			15	-	100	200	
(Low-High) Propagation Delay Time (BL-SEGMENT OUT)	t_{pLH}	R_L = 1 kΩ	5	-	200	400	ns
			10	-	100	200	
			15	-	80	160	
(High-Low) Propagation Delay Time (BL-SEGMENT OUT)	t_{pHL}	R_L = 1 kΩ	5	-	200	400	
			10	-	100	200	
			15	-	80	160	
Minimum ST Pulse Width	$t_{w(ST)}$		5	-	60	200	ns
			10	-	30	100	
			15	-	25	80	
Minimum Setup Time (ST-A,B,C,D IN)	t_{SU}		5	-	35	200	ns
			10	-	20	100	
			15	-	10	80	
Minimum Hold Time (ST-A,B,C,D IN)	t_H		5	-	-	100	
			10	-	-	60	
			15	-	-	40	
Input Capacitance	C_{IN}			-	5	7.5	pF

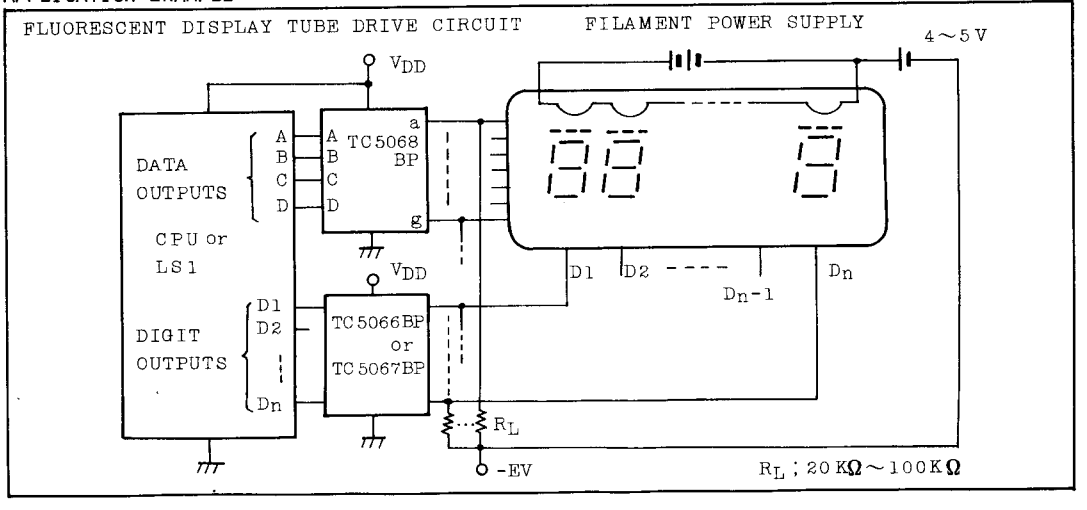
SWITCHING TIME TEST CIRCUIT



SWITCHING TIME TEST WAVEFORM



APPLICATION EXAMPLE



APPLICATION EXAMPLE

LEADING ZERO SUPPRESS CIRCUIT (STATIC DRIVE)