

# MC14532B

## 8-Bit Priority Encoder

The MC14532B is constructed with complementary MOS (CMOS) enhancement mode devices. The primary function of a priority encoder is to provide a binary address for the active input with the highest priority. Eight data inputs (D0 thru D7) and an enable input ( $E_{in}$ ) are provided. Five outputs are available, three are address outputs (Q0 thru Q2), one group select (GS) and one enable output ( $E_{out}$ ).

- Diode Protection on All Inputs
- Supply Voltage Range = 3.0 Vdc to 18 Vdc
- Capable of Driving Two Low-power TTL Loads or One Low-Power Schottky TTL Load over the Rated Temperature Range

### MAXIMUM RATINGS (Voltages Referenced to $V_{SS}$ ) (Note 2.)

Symbol	Parameter	Value	Unit
$V_{DD}$	DC Supply Voltage Range	-0.5 to +18.0	V
$V_{in}, V_{out}$	Input or Output Voltage Range (DC or Transient)	-0.5 to $V_{DD} + 0.5$	V
$I_{in}, I_{out}$	Input or Output Current (DC or Transient) per Pin	$\pm 10$	mA
$P_D$	Power Dissipation, per Package (Note 3.)	500	mW
$T_A$	Ambient Temperature Range	-55 to +125	$^{\circ}C$
$T_{stg}$	Storage Temperature Range	-65 to +150	$^{\circ}C$
$T_L$	Lead Temperature (8-Second Soldering)	260	$^{\circ}C$

2. Maximum Ratings are those values beyond which damage to the device may occur.
3. Temperature Derating:  
Plastic "P and D/DW" Packages: - 7.0 mW/ $^{\circ}C$  From 65 $^{\circ}C$  To 125 $^{\circ}C$

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation,  $V_{in}$  and  $V_{out}$  should be constrained to the range  $V_{SS} \leq (V_{in} \text{ or } V_{out}) \leq V_{DD}$ .

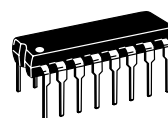
Unused inputs must always be tied to an appropriate logic voltage level (e.g., either  $V_{SS}$  or  $V_{DD}$ ). Unused outputs must be left open.



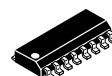
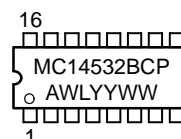
ON Semiconductor

<http://onsemi.com>

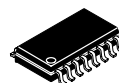
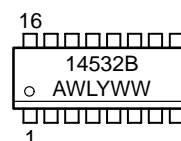
### MARKING DIAGRAMS



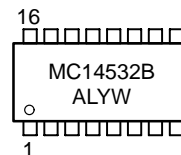
PDIP-16  
P SUFFIX  
CASE 648



SOIC-16  
D SUFFIX  
CASE 751B



SOEIAJ-16  
F SUFFIX  
CASE 966



A = Assembly Location  
WL, L = Wafer Lot  
YY, Y = Year  
WW, W = Work Week

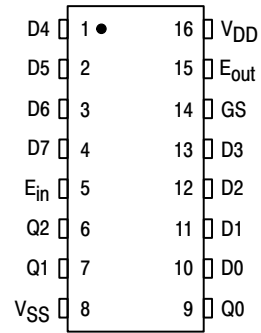
### ORDERING INFORMATION

Device	Package	Shipping
MC14532BCP	PDIP-16	2000/Box
MC14532BD	SOIC-16	48/Rail
MC14532BDR2	SOIC-16	2500/Tape & Reel
MC14532BF	SOEIAJ-16	See Note 1.
MC14532BFEL	SOEIAJ-16	See Note 1.
MC14532BFR1	SOEIAJ-16	See Note 1.

1. For ordering information on the EIAJ version of the SOIC packages, please contact your local ON Semiconductor representative.

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## PIN ASSIGNMENT



## TRUTH TABLE

Input									Output				
Ein	D7	D6	D5	D4	D3	D2	D1	D0	GS	Q2	Q1	Q0	Eout
0	X	X	X	X	X	X	X	X	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	1
1	1	X	X	X	X	X	X	X	1	1	1	1	0
1	0	1	X	X	X	X	X	X	1	1	1	0	0
1	0	0	1	X	X	X	X	X	1	1	0	1	0
1	0	0	0	1	X	X	X	X	1	1	0	0	0
1	0	0	0	0	1	X	X	X	1	0	1	1	0
1	0	0	0	0	0	1	X	X	1	0	1	0	0
1	0	0	0	0	0	0	1	X	1	0	0	1	0
1	0	0	0	0	0	0	0	1	1	0	0	0	0

X = Don't Care

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## ELECTRICAL CHARACTERISTICS (Voltages Referenced to V<sub>SS</sub>)

Characteristic	Symbol	V <sub>DD</sub> Vdc	- 55°C		25°C			125°C		Unit	
			Min	Max	Min	Typ (4.)	Max	Min	Max		
Output Voltage V <sub>in</sub> = V <sub>DD</sub> or 0	"0" Level V <sub>OL</sub>	5.0	—	0.05	—	0	0.05	—	0.05	Vdc	
		10	—	0.05	—	0	0.05	—	0.05		
		15	—	0.05	—	0	0.05	—	0.05		
	"1" Level V <sub>in</sub> = 0 or V <sub>DD</sub>	V <sub>OH</sub>	5.0	4.95	—	4.95	5.0	—	4.95		—
			10	9.95	—	9.95	10	—	9.95		—
			15	14.95	—	14.95	15	—	14.95		—
Input Voltage (V <sub>O</sub> = 4.5 or 0.5 Vdc) (V <sub>O</sub> = 9.0 or 1.0 Vdc) (V <sub>O</sub> = 13.5 or 1.5 Vdc)	"0" Level V <sub>IL</sub>	5.0	—	1.5	—	2.25	1.5	—	1.5	Vdc	
		10	—	3.0	—	4.50	3.0	—	3.0		
		15	—	4.0	—	6.75	4.0	—	4.0		
	"1" Level (V <sub>O</sub> = 0.5 or 4.5 Vdc) (V <sub>O</sub> = 1.0 or 9.0 Vdc) (V <sub>O</sub> = 1.5 or 13.5 Vdc)	V <sub>IH</sub>	5.0	3.5	—	3.5	2.75	—	3.5		—
			10	7.0	—	7.0	5.50	—	7.0		—
			15	11	—	11	8.25	—	11		—
Output Drive Current (V <sub>OH</sub> = 2.5 Vdc) (V <sub>OH</sub> = 4.6 Vdc) (V <sub>OH</sub> = 9.5 Vdc) (V <sub>OH</sub> = 13.5 Vdc)  (V <sub>OL</sub> = 0.4 Vdc) (V <sub>OL</sub> = 0.5 Vdc) (V <sub>OL</sub> = 1.5 Vdc)	Source I <sub>OH</sub>	5.0	-3.0	—	-2.4	-4.2	—	-1.7	—	mAdc	
		5.0	-0.64	—	-0.51	-0.88	—	-0.36	—		
		10	-1.6	—	-1.3	-2.25	—	-0.9	—		
		15	-4.2	—	-3.4	-8.8	—	-2.4	—		
	Sink I <sub>OL</sub>	5.0	0.64	—	0.51	0.88	—	0.36	—	mAdc	
		10	1.6	—	1.3	2.25	—	0.9	—		
15		4.2	—	3.4	8.8	—	2.4	—			
Input Current	I <sub>in</sub>	15	—	± 0.1	—	± 0.00001	± 0.1	—	± 1.0	μAdc	
Input Capacitance (V <sub>in</sub> = 0)	C <sub>in</sub>	—	—	—	—	5.0	7.5	—	—	pF	
Quiescent Current (Per Package)	I <sub>DD</sub>	5.0	—	5.0	—	0.005	5.0	—	150	μAdc	
		10	—	10	—	0.010	10	—	300		
		15	—	20	—	0.015	20	—	600		
Total Supply Current (5.) (6.) (Dynamic plus Quiescent, Per Package) (C <sub>L</sub> = 50 pF on all outputs, all buffers switching)	I <sub>T</sub>	5.0 10 15	I <sub>T</sub> = (1.74 μA/kHz) f + I <sub>DD</sub> I <sub>T</sub> = (3.65 μA/kHz) f + I <sub>DD</sub> I <sub>T</sub> = (5.73 μA/kHz) f + I <sub>DD</sub>							μAdc	

4. Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

5. The formulas given are for the typical characteristics only at 25°C.

6. To calculate total supply current at loads other than 50 pF:

$$I_T(C_L) = I_T(50 \text{ pF}) + (C_L - 50) Vfk$$

where: I<sub>T</sub> is in μA (per package), C<sub>L</sub> in pF, V = (V<sub>DD</sub> - V<sub>SS</sub>) in volts, f in kHz is input frequency, and k = 0.005.

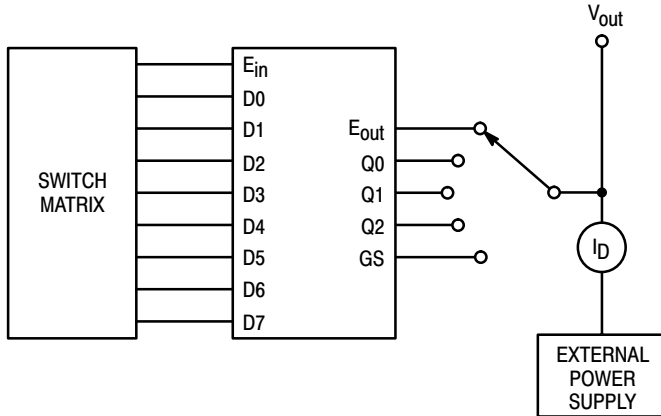
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## SWITCHING CHARACTERISTICS (7.) ( $C_L = 50 \text{ pF}$ , $T_A = 25^\circ\text{C}$ )

Characteristic	Symbol	$V_{DD}$	Min	Typ (8.)	Max	Unit
Output Rise and Fall Time $t_{TLH}, t_{THL} = (1.5 \text{ ns/pF}) C_L + 25 \text{ ns}$ $t_{TLH}, t_{THL} = (0.75 \text{ ns/pF}) C_L + 12.5 \text{ ns}$ $t_{TLH}, t_{THL} = (0.55 \text{ ns/pF}) C_L + 9.5 \text{ ns}$	$t_{TLH}, t_{THL}$	5.0 10 15	— — —	100 50 40	200 100 80	ns
Propagation Delay Time — $E_{in}$ to $E_{out}$ $t_{PLH}, t_{PHL} = (1.7 \text{ ns/pF}) C_L + 120 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.66 \text{ ns/pF}) C_L + 77 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.5 \text{ ns/pF}) C_L + 55 \text{ ns}$	$t_{PLH}, t_{PHL}$	5.0 10 15	— — —	205 110 80	410 220 160	ns
Propagation Delay Time — $E_{in}$ to GS $t_{PLH}, t_{PHL} = (1.7 \text{ ns/pF}) C_L + 90 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.66 \text{ ns/pF}) C_L + 57 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.5 \text{ ns/pF}) C_L + 40 \text{ ns}$	$t_{PLH}, t_{PHL}$	5.0 10 15	— — —	175 90 65	350 180 130	ns
Propagation Delay Time — $E_{in}$ to $Q_n$ $t_{PLH}, t_{PHL} = (1.7 \text{ ns/pF}) C_L + 195 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.66 \text{ ns/pF}) C_L + 107 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.5 \text{ ns/pF}) C_L + 75 \text{ ns}$	$t_{PHL}, t_{PLH}$	5.0 10 15	— — —	280 140 100	560 280 200	ns
Propagation Delay Time — $D_n$ to $Q_n$ $t_{PLH}, t_{PHL} = (1.7 \text{ ns/pF}) C_L + 265 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.66 \text{ ns/pF}) C_L + 137 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.5 \text{ ns/pF}) C_L + 85 \text{ ns}$	$t_{PLH}, t_{PHL}$	5.0 10 15	— — —	300 170 110	600 340 220	ns
Propagation Delay Time — $D_n$ to GS $t_{PLH}, t_{PHL} = (1.7 \text{ ns/pF}) C_L + 195 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.66 \text{ ns/pF}) C_L + 107 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.5 \text{ ns/pF}) C_L + 75 \text{ ns}$	$t_{PLH}, t_{PHL}$	5.0 10 15	— — —	280 140 100	560 280 200	ns

7. The formulas given are for the typical characteristics only at  $25^\circ\text{C}$ .

8. Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.



Output Under Test	$V_{GS} = V_{DD}$ $V_{DS} = V_{out}$ Sink Current		$V_{GS} = -V_{DD}$ $V_{DS} = V_{out} - V_{DD}$ Source Current		
	D0 thru D7	$E_{in}$	D0 thru D6	D7	$E_{in}$
$E_{out}$	X	0	0	0	1
Q0	X	0	0	1	1
Q1	X	0	0	1	1
Q2	X	0	0	1	1
GS	X	0	0	1	1

Figure 1. Typical Sink and Source Current Characteristics

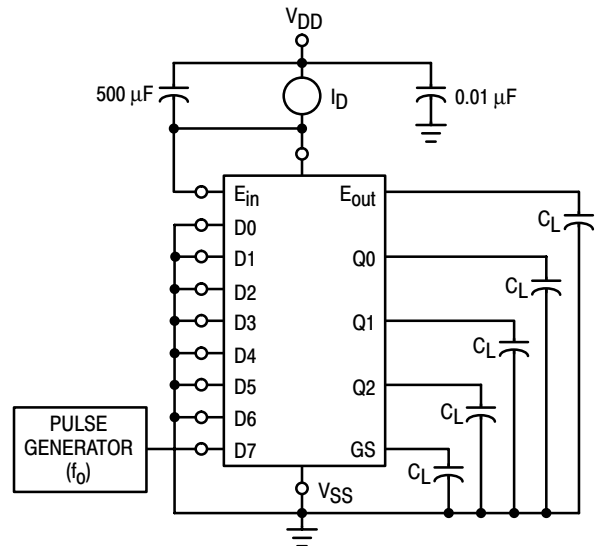


Figure 2. Typical Power Dissipation Test Circuit

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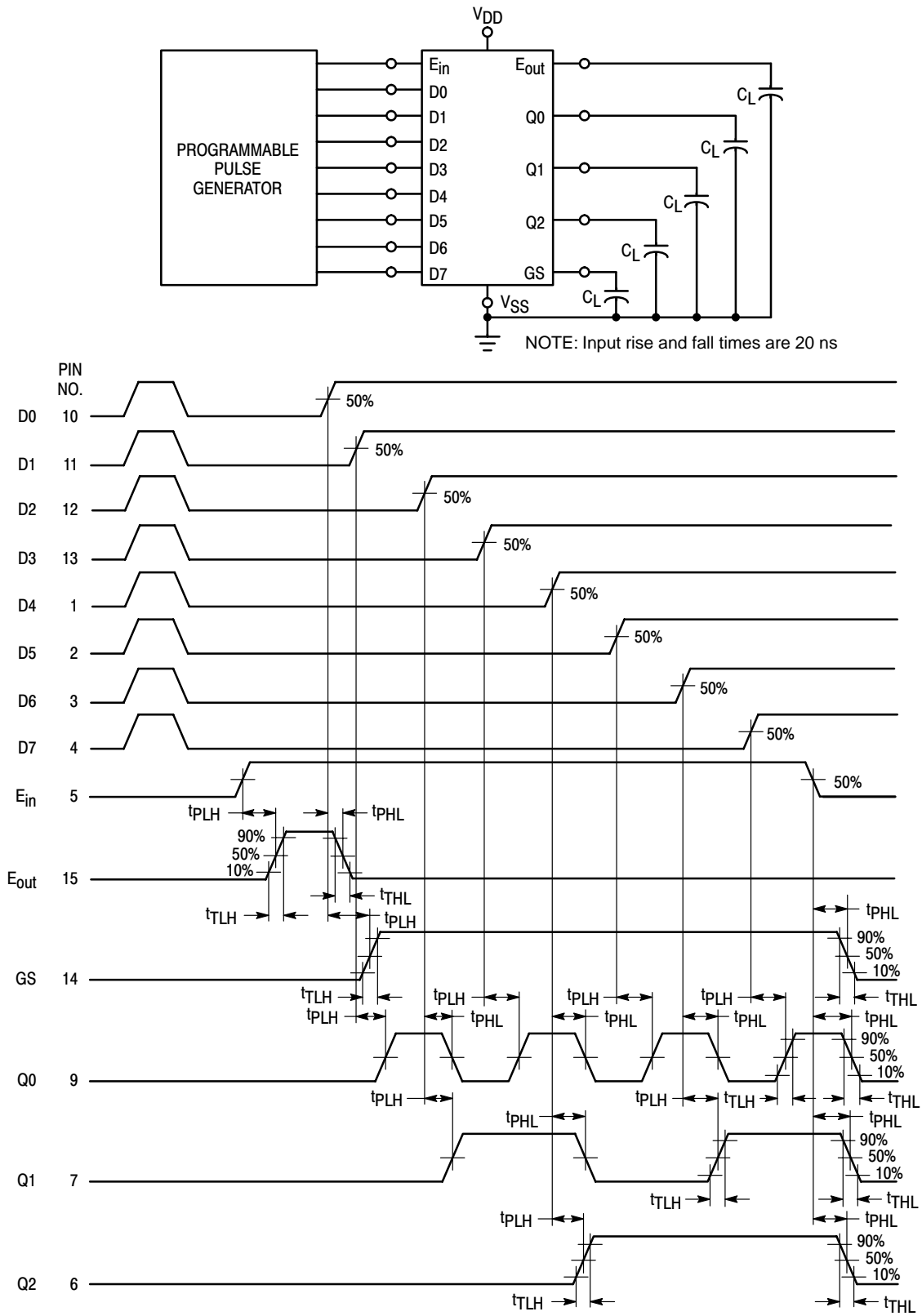


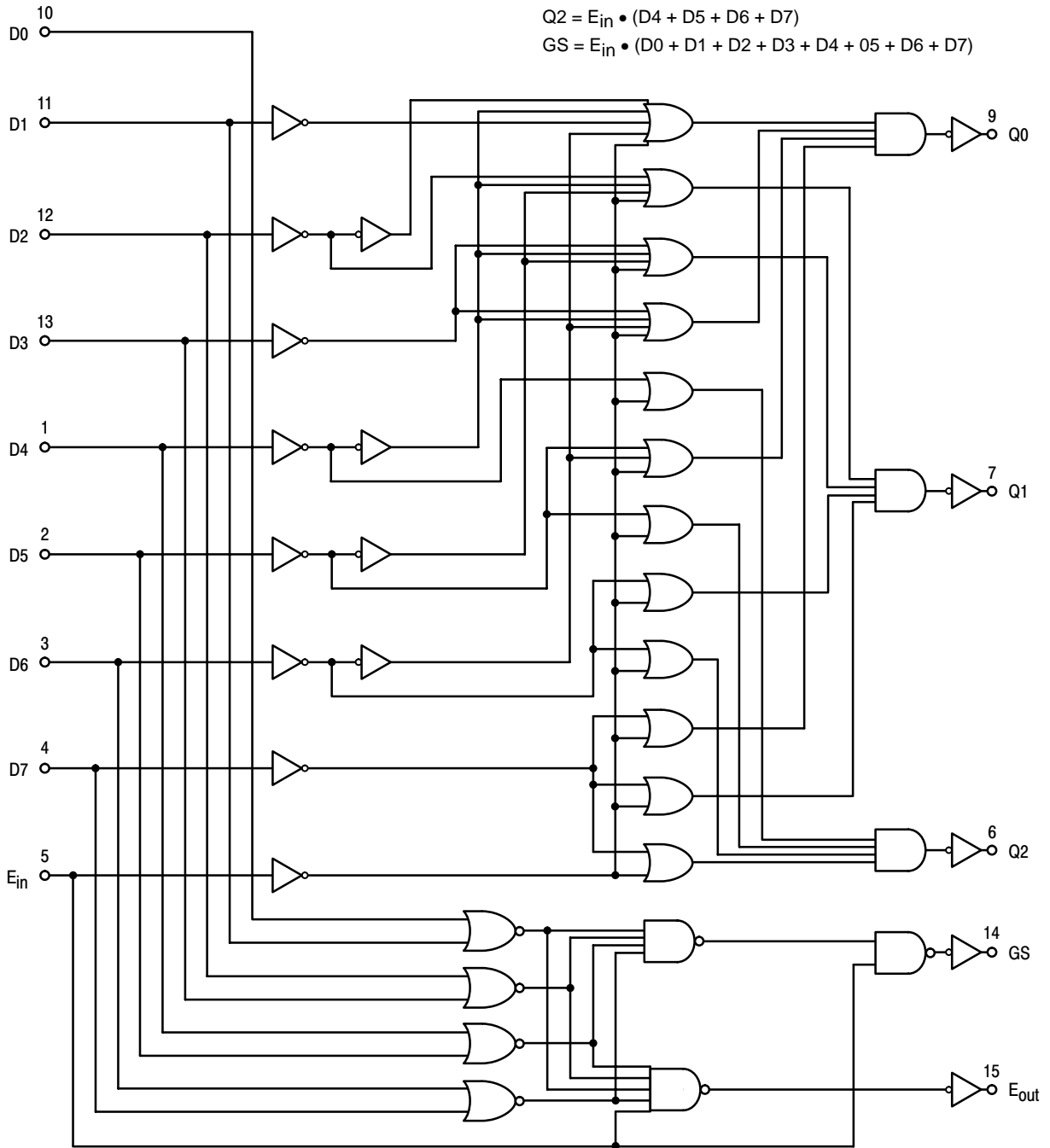
Figure 3. AC Test Circuit and Waveforms

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## LOGIC DIAGRAM (Positive Logic)

## LOGIC EQUATIONS

$$E_{out} = E_{in} \cdot \bar{D}0 \cdot \bar{D}1 \cdot \bar{D}2 \cdot \bar{D}3 \cdot \bar{D}4 \cdot \bar{D}5 \cdot \bar{D}6 \cdot \bar{D}7$$
$$Q0 = E_{in} \cdot (D1 \cdot \bar{D}2 \cdot \bar{D}4 \cdot \bar{D}6 + D3 \cdot \bar{D}4 \cdot \bar{D}6 + D5 \cdot \bar{D}6 + D7)$$
$$Q1 = E_{in} \cdot (D2 \cdot \bar{D}4 \cdot \bar{D}5 + D3 \cdot \bar{D}4 \cdot \bar{D}5 + D6 + D7)$$
$$Q2 = E_{in} \cdot (D4 + D5 + D6 + D7)$$
$$GS = E_{in} \cdot (D0 + D1 + D2 + D3 + D4 + D5 + D6 + D7)$$



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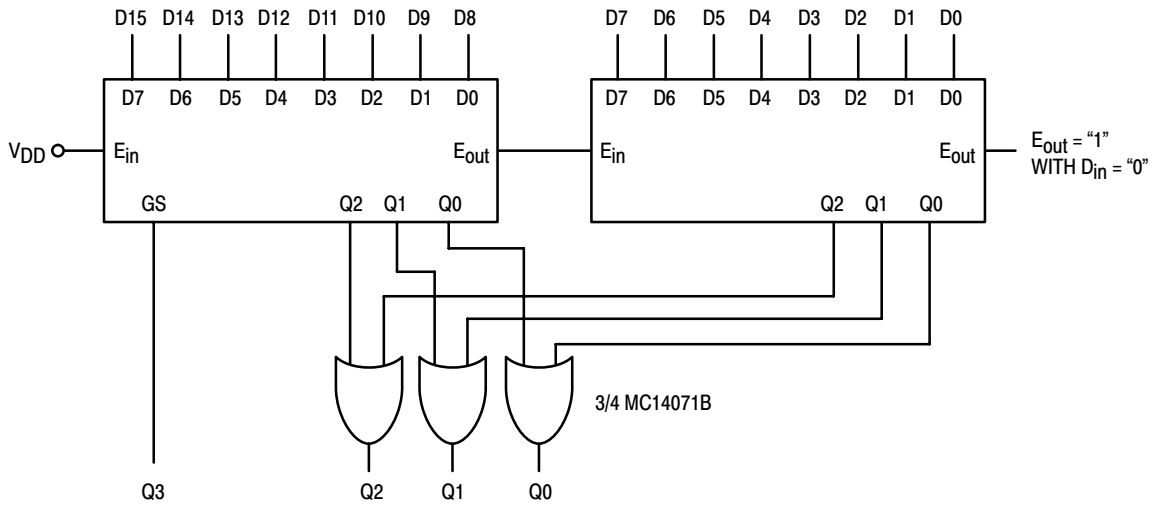


Figure 4. Two MC14532B's Cascaded for 4–Bit Output

### DIGITAL TO ANALOG CONVERSION

The digital eight-bit word to be converted is applied to the inputs of the MC14512 with the most significant bit at X7 and the least significant bit at X0. A clock input of up to 2.5 MHz (at  $V_{DD} = 10\text{ V}$ ) is applied to the MC14520B. A compromise between  $I_{bias}$  for the MC1710 and  $\Delta R$  between N and P-channel outputs gives a value of R of 33 k ohms. In order to filter out the switching frequencies, RC should be about 1.0 ms (if  $R = 33\text{ k ohms}$ ,  $C \approx 0.03\text{ }\mu\text{F}$ ). The analog 3.0 dB bandwidth would then be dc to 1.0 kHz.

### ANALOG TO DIGITAL CONVERSION

An analog signal is applied to the analog input of the MC1710. A digital eight-bit word known to represent a digitized level less than the analog input is applied to the MC14512 as in the D to A conversion. The word is incremented at rates sufficient to allow steady state to be reached between incrementations (i.e. 3.0 ms). The output of the MC1710 will change when the digital input represents the first digitized level above the analog input. This word is the digital representation of the analog word.

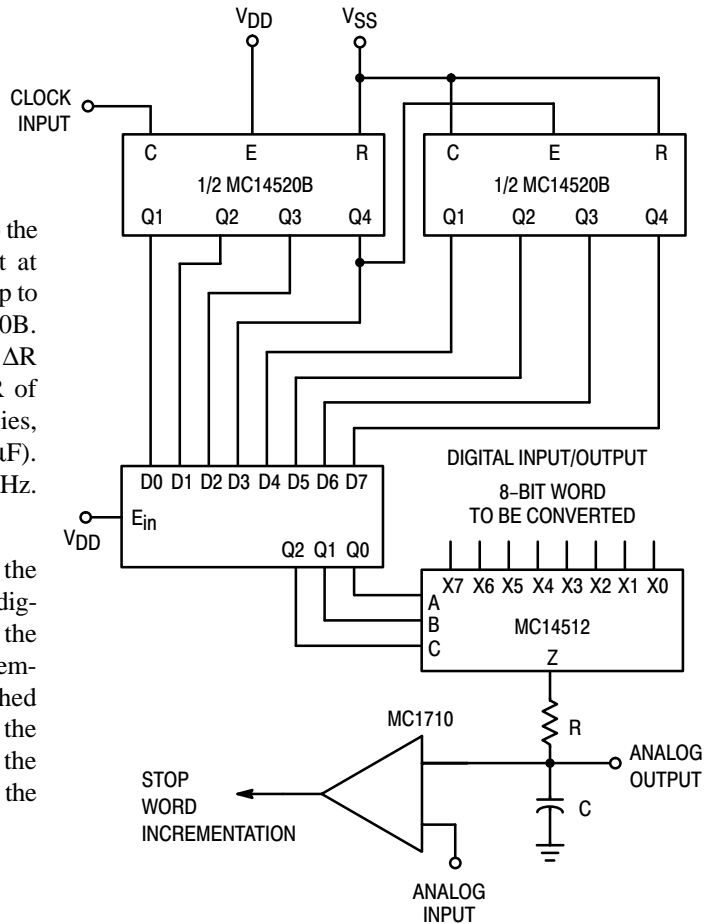


Figure 5. Digital to Analog and Analog to Digital Converter