

100165



Not Intended For New Designs

T-66-31-51

# 100165 Universal Priority Encoder

## General Description

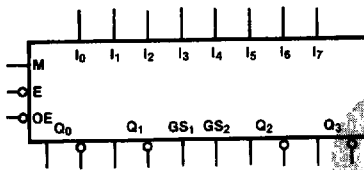
The 100165 contains eight input latches with a common Enable (E) followed by encoding logic which generates the binary address of the highest priority input having a HIGH signal. The circuit operates as a dual 4-input encoder when the Mode Control (M) input is LOW, and as a single 8-input encoder when M is HIGH. In the 8-input mode, Q<sub>0</sub>, Q<sub>1</sub> and Q<sub>2</sub> are the relevant outputs, I<sub>0</sub> is the highest priority input and GS<sub>1</sub> is the relevant Group Signal output. In the dual mode, Q<sub>0</sub>, Q<sub>1</sub> and GS<sub>1</sub> operate with I<sub>0</sub>-I<sub>3</sub>. Q<sub>2</sub>, Q<sub>3</sub> and GS<sub>2</sub>

operate with I<sub>4</sub>-I<sub>7</sub>. A GS output goes LOW when its pertinent inputs are all LOW.

Inputs are latched when E goes HIGH. A HIGH signal on the Output Enable (OE) input forces all Q outputs LOW and GS outputs HIGH. Expansion to accommodate more inputs can be done by connecting the GS output of a higher priority group to the OE input of the next lower priority group. All inputs have 50 kΩ pull-down resistors.

**Ordering Code:** See Section 6

## Logic Symbol

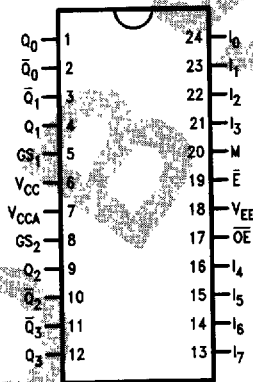


TL/F/9866-3

Pin Names	Description
I <sub>0</sub> -I <sub>7</sub>	Data Inputs
E	Enable Input (Active LOW)
OE	Output Enable Input (Active LOW)
M	Mode Control Input
GS <sub>1</sub> -GS <sub>2</sub>	Group Signal Outputs
Q <sub>0</sub> -Q <sub>3</sub>	Data Outputs
$\bar{Q}_0$ - $\bar{Q}_3$	Complementary Data Outputs

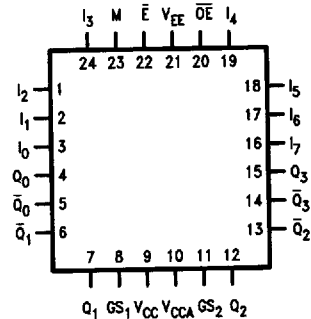
## Connection Diagrams

24-Pin DIP



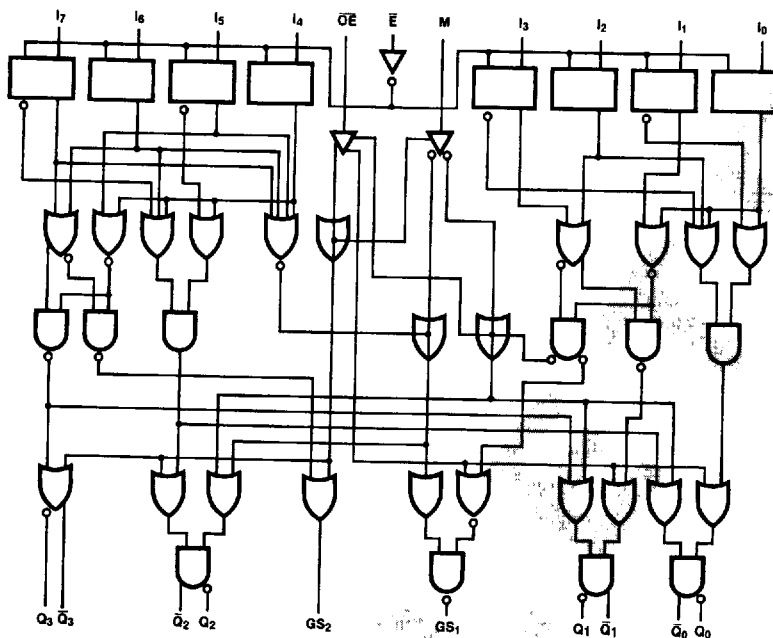
TL/F/9866-1

24-Pin Quad Cerpak



TL/F/9866-2

### Logic Diagram



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### Truth Table

			Inputs								Outputs					
$\bar{E}$	$\overline{OE}$	M	I <sub>0</sub>	I <sub>1</sub>	I <sub>2</sub>	I <sub>3</sub>	I <sub>4</sub>	I <sub>5</sub>	I <sub>6</sub>	I <sub>7</sub>	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	GS <sub>1</sub>	GS <sub>2</sub>
L	L	L	H	X	X	X					L	L			H	
L	L	L	L	H	X	X					H	L			H	
L	L	L	L	L	H	X					L	H			H	
L	L	L	L	L	L	H					H	H			H	
L	L	L	L	L	L	L					L	L			L	
L	L	L					H	X	X	X			L	L		H
L	L	L					L	H	X	X			L	L		H
L	L	L					L	L	H	X			L	L		H
L	L	L					L	L	L	H			L	L		H
L	L	L					L	L	L	L			L	L		H
L	L	H	H	X	X	X	X	X	X	X	L	L	L	L	H	H
L	L	H	L	H	X	X	X	X	X	X	H	L	L	L	H	H
L	L	H	L	L	H	X	X	X	X	X	L	H	L	L	H	H
L	L	H	L	L	L	H	X	X	X	X	H	L	L	L	H	H
L	L	H	L	L	L	L	H	X	X	X	L	H	H	L	H	H
L	L	H	L	L	L	L	L	H	X	X	L	H	H	L	H	H
L	L	H	L	L	L	L	L	L	H	H	H	H	L	H	H	H
L	L	H	L	L	L	L	L	L	L	H	H	H	L	H	H	H
L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	H
X	H	X	X	X	X	X	X	X	X	X	L	L	L	L	H	H
H	L	L	X	X	X	X	X	X	X	X	Given by I <sub>0</sub> -I <sub>7</sub> when $\bar{E}$ was LOW and M = L					
H	L	H	X	X	X	X	X	X	X	X	Given by I <sub>0</sub> -I <sub>7</sub> when $\bar{E}$ was LOW and M = H					

H = HIGH Voltage Level  
 L = LOW Voltage Level  
 Blank = X = Don't Care

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### Absolute Maximum Ratings

Above which the useful life may be impaired. (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Storage Temperature -65°C to +150°C  
 Maximum Junction Temperature (T<sub>J</sub>) +150°C

Case Temperature under Bias (T<sub>C</sub>) 0°C to +85°C  
 V<sub>EE</sub> Pin Potential to Ground Pin -7.0V to +0.5V  
 Input Voltage (DC) V<sub>EE</sub> to +0.5V  
 Output Current (DC Output HIGH) -50 mA  
 Operating Range (Note 2) -5.7V to -4.2V

### DC Electrical Characteristics

V<sub>EE</sub> = -4.5V, V<sub>CC</sub> = V<sub>CCA</sub> = GND, T<sub>C</sub> = 0°C to +85°C (Note 3)

Symbol	Parameter	Min	Typ	Max	Units	Conditions (Note 4)	
V <sub>OH</sub>	Output HIGH Voltage	-1025	-955	-880	mV	V <sub>IN</sub> = V <sub>IH</sub> (Max) or V <sub>IL</sub> (Min)	Loading with 50Ω to -2.0V
V <sub>OL</sub>	Output LOW Voltage	-1810	-1705	-1620			
V <sub>OHC</sub>	Output HIGH Voltage	-1035			mV	V <sub>IN</sub> = V <sub>IH</sub> (Min) or V <sub>IL</sub> (Max)	Loading with 50Ω to -2.0V
V <sub>OLC</sub>	Output LOW Voltage			-1610			
V <sub>IH</sub>	Input HIGH Voltage	-1165		-880	mV	Guaranteed HIGH Signal for All Inputs	
V <sub>IL</sub>	Input LOW Voltage	-1810		-1475	mV	Guaranteed LOW Signal for All Inputs	
I <sub>IL</sub>	Input LOW Current	0.50			μA	V <sub>IN</sub> = V <sub>IL</sub> (Min)	

### DC Electrical Characteristics

V<sub>EE</sub> = -4.2V, V<sub>CC</sub> = V<sub>CCA</sub> = GND, T<sub>C</sub> = 0°C to +85°C (Note 3)

Symbol	Parameter	Min	Typ	Max	Units	Conditions (Note 4)	
V <sub>OH</sub>	Output HIGH Voltage	-1020		-870	mV	V <sub>IN</sub> = V <sub>IH</sub> (Max) or V <sub>IL</sub> (Min)	Loading with 50Ω to -2.0V
V <sub>OL</sub>	Output LOW Voltage	-1810		-1605			
V <sub>OHC</sub>	Output HIGH Voltage	-1030			mV	V <sub>IN</sub> = V <sub>IH</sub> (Min) or V <sub>IL</sub> (Max)	Loading with 50Ω to -2.0V
V <sub>OLC</sub>	Output LOW Voltage			-1595			
V <sub>IH</sub>	Input HIGH Voltage	-1150		-870	mV	Guaranteed HIGH Signal for All Inputs	
V <sub>IL</sub>	Input LOW Voltage	-1810		-1475	mV	Guaranteed LOW Signal for All Inputs	
I <sub>IL</sub>	Input LOW Current	0.50			μA	V <sub>IN</sub> = V <sub>IL</sub> (Min)	

### DC Electrical Characteristics

V<sub>EE</sub> = -4.8V, V<sub>CC</sub> = V<sub>CCA</sub> = GND, T<sub>C</sub> = 0°C to +85°C (Note 3)

Symbol	Parameter	Min	Typ	Max	Units	Conditions (Note 4)	
V <sub>OH</sub>	Output HIGH Voltage	-1035		-880	mV	V <sub>IN</sub> = V <sub>IH</sub> (Max) or V <sub>IL</sub> (Min)	Loading with 50Ω to -2.0V
V <sub>OL</sub>	Output LOW Voltage	-1830		-1620			
V <sub>OHC</sub>	Output HIGH Voltage	-1045			mV	V <sub>IN</sub> = V <sub>IH</sub> (Min) or V <sub>IL</sub> (Max)	Loading with 50Ω to -2.0V
V <sub>OLC</sub>	Output LOW Voltage			-1610			
V <sub>IH</sub>	Input HIGH Voltage	-1165		-880	mV	Guaranteed HIGH Signal for All Inputs	
V <sub>IL</sub>	Input LOW Voltage	-1830		-1490	mV	Guaranteed LOW Signal for All Inputs	
I <sub>IL</sub>	Input LOW Current	0.50			μA	V <sub>IN</sub> = V <sub>IL</sub> (Min)	

**Note 1:** Absolute maximum ratings are those values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

**Note 2:** Parametric values specified at -4.2V to -4.8V.

**Note 3:** The specified limits represent the "worst case" value for the parameter. Since these "worst case" values normally occur at the temperature extremes, additional noise immunity and guard banding can be achieved by decreasing the allowable system operating ranges.

**Note 4:** Conditions for testing shown in the tables are chosen to guarantee operation under "worst case" conditions.

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### DC Electrical Characteristics

$V_{EE} = -4.2V$  to  $-4.8V$  unless otherwise specified,  $V_{CC} = V_{CCA} = GND$ ,  $T_C = 0^\circ C$  to  $+85^\circ C$

Symbol	Parameter	Min	Typ	Max	Units	Conditions
$I_{IH}$	Input HIGH Current All Inputs			230	$\mu A$	$V_{IN} = V_{IH} (Max)$
$I_{EE}$	Power Supply Current	-200	-140	-77	mA	Inputs Open

### Ceramic Dual-In-Line Package AC Characteristics

$V_{EE} = -4.2V$  to  $-4.8V$ ,  $V_{CC} = V_{CCA} = GND$

Symbol	Parameter	$T_C = 0^\circ C$		$T_C = +25^\circ C$		$T_C = +85^\circ C$		Units	Condition
		Min	Max	Min	Max	Min	Max		
$t_{PLH}$ $t_{PHL}$	Propagation Delay $I_0-I_7$ to $Q_0-Q_3$ , $\bar{Q}_0-\bar{Q}_3$ (Transparent Mode)	1.10	4.10	1.10	4.10	1.10	4.60	ns	Figures 1 and 3
$t_{PLH}$ $t_{PHL}$	Propagation Delay $I_0-I_7$ to $GS_1-GS_2$ (Transparent Mode)	1.30	3.90	1.30	3.90	1.30	4.20	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay $\bar{OE}$ to $Q_0-Q_3$ , $\bar{Q}_0-\bar{Q}_3$	1.00	3.00	1.00	3.00	1.10	3.30	ns	Figures 1 and 2
$t_{PLH}$ $t_{PHL}$	Propagation Delay $\bar{OE}$ to $GS_1-GS_2$	1.10	2.60	1.10	2.60	1.20	2.80	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay M to $Q_0-Q_3$ , $\bar{Q}_0-\bar{Q}_3$	0.90	3.60	1.00	3.60	1.00	3.80	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay $\bar{E}$ to $Q_0-Q_3$ , $\bar{Q}_0-\bar{Q}_3$	1.50	4.70	1.50	4.60	1.50	5.00	ns	Figures 1 and 3
$t_{TLH}$ $t_{THL}$	Transition Time 20% to 80%, 80% to 20%	0.45	1.50	0.45	1.40	0.45	1.50	ns	Figures 1, 2 and 3
$t_S$	Setup Time $I_0-I_7$	1.00		0.90		1.00		ns	Figure 4
$t_H$	Hold Time $I_0-I_7$	1.20		1.20		1.20		ns	
$t_{pw(L)}$	Pulse Width LOW $\bar{E}$	2.00		2.00		2.00		ns	Figure 3

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### Cerpak AC Electrical Characteristics

$V_{EE} = -4.2V$  to  $-4.8V$ ,  $V_{CC} = V_{CCA} = GND$

Symbol	Parameter	$T_C = 0^\circ C$		$T_C = +25^\circ C$		$T_C = +85^\circ C$		Units	Conditions
		Min	Max	Min	Max	Min	Max		
$t_{PLH}$ $t_{PHL}$	Propagation Delay $I_0-I_7$ to $Q_0-Q_3, \bar{Q}_0-\bar{Q}_3$ (Transparent Mode)	1.10	3.90	1.10	3.90	1.10	4.40	ns	Figures 1 and 3
$t_{PLH}$ $t_{PHL}$	Propagation Delay $I_0-I_7$ to $GS_1-GS_2$ (Transparent Mode)	1.30	3.70	1.30	3.70	1.30	4.00	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay $\bar{OE}$ to $Q_0-Q_3, \bar{Q}_0-\bar{Q}_3$	1.00	2.80	1.00	2.80	1.10	3.10	ns	Figures 1 and 2
$t_{PLH}$ $t_{PHL}$	Propagation Delay $\bar{OE}$ to $GS_1-GS_2$	1.10	2.40	1.10	2.40	1.20	2.60	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay M to $Q_0-Q_3, \bar{Q}_0-\bar{Q}_3$	0.90	3.40	1.00	3.40	1.00	3.60	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay E to $Q_0-Q_3, \bar{Q}_0-\bar{Q}_3$	1.50	4.50	1.50	4.40	1.50	4.80	ns	Figures 1 and 3
$t_{TLH}$ $t_{THL}$	Transition Time 20% to 80%, 80% to 20%	0.45	1.40	0.45	1.30	0.45	1.40	ns	Figures 1, 2 and 3
$t_S$	Setup Time $I_0-I_7$	0.90		0.80		0.90		ns	Figure 4
$t_H$	Hold Time $I_0-I_7$	1.10		1.10		1.10		ns	
$t_{pw(L)}$	Pulse Width LOW E	2.00		2.00		2.00		ns	Figure 3

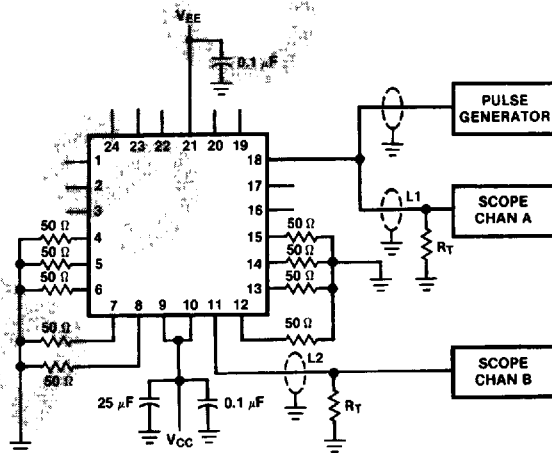
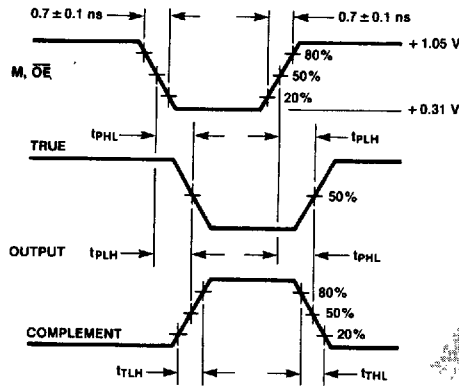


FIGURE 1. AC Test Circuit

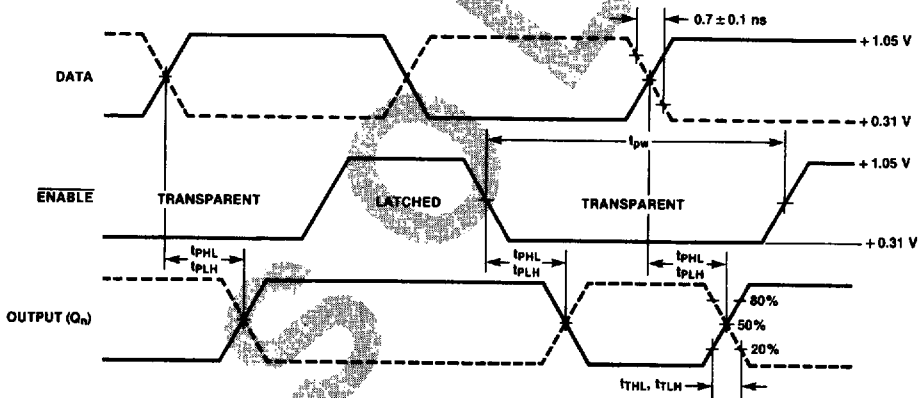
TL/F/9866-6



TL/F/9866-7

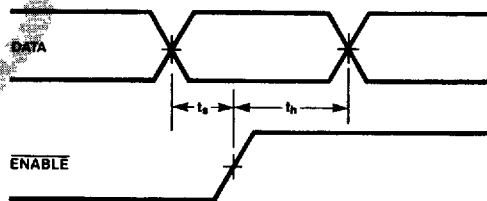
FIGURE 2. Propagation Delay ( $M, \overline{OE}$ ) and Transition Times

- Notes:**  
 $V_{CC}, V_{CCA} = +2V, V_{EE} = -2.5V$   
 $L1$  and  $L2$  = equal length  $50\Omega$  impedance lines  
 $R_T = 50\Omega$  terminator internal to scope  
 Decoupling  $0.1 \mu F$  from GND to  $V_{CC}$  and  $V_{EE}$   
 All unused outputs are loaded with  $50\Omega$  to GND  
 $C_L$  = Fixture and stray capacitance  $\leq 3 pF$   
 Pin numbers shown are for flatpak; for DIP see logic symbol



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FIGURE 3. Enable Timing



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FIGURE 4. Setup and Hold Times

- Notes:**  
 $t_s$  is the minimum time before the transition of the enable that information must be present at the data input.  
 $t_h$  is the minimum time after the transition of the enable that information must remain unchanged at the data input.