

## FEATURES/BENEFITS

- QSFCT139D with 4.0ns propagation delay
- Industrial temperature  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$
- $I_{OL} = 48\text{mA IND}, 32\text{mA MIL}$
- TTL-compatible input and output levels
- Mil product compliant with MIL-STD 883, Class B
- CMOS power levels  $< 7.5\text{mW}$  static
- Available in DIP, SOIC, QSOP, HQSOP
- JEDEC standard pinouts

## DESCRIPTION

The QSFCT139T is a high-speed CMOS TTL-compatible high-speed binary decoder. The QSFCT139T has negative active outputs. The high output current  $I_{OL}$  and  $I_{OH}$  drive high-capacitance loads. All inputs have clamp diodes for undershoot noise suppression. All outputs have ground bounce suppression (see QSI Application Note AN-001), and outputs will not load an active bus when  $V_{CC}$  is removed from the device.

**Figure 1. Functional Block Diagram**

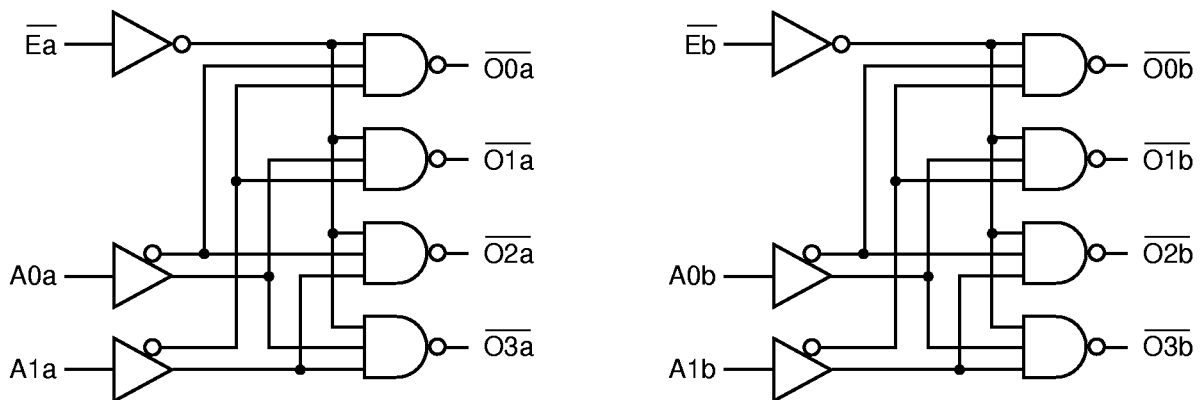
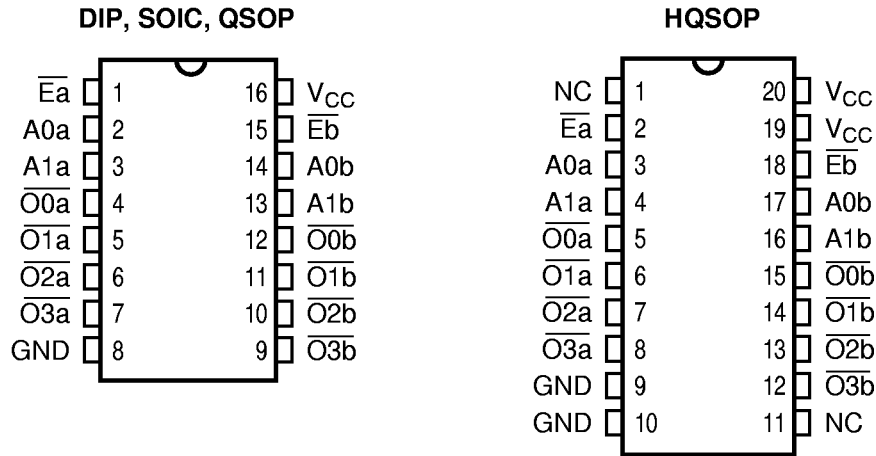


Figure 2. Pin Configurations (All Pins Top View)



Note: Available in both 150 mil wide SOIC (package code S1) and 300 mil SOIC (package code SO).

Table 1. Pin Description

Name	I/O	Description
Ai	I	Select Inputs
$\overline{O_i}$	O	Decode Outputs
$\overline{E_i}$	I	Enable

Table 2. Function Table

Enable $\overline{Ea}, \overline{Eb}$	Select		FCT139 Output				Note
	A1	A0	$\overline{O3}$	$\overline{O2}$	$\overline{O1}$	$\overline{O0}$	
H	X	X	H	H	H	H	Disable Decode
L	L	L	H	H	H	L	A1-0 = 0
L	L	H	H	H	L	H	A1-0 = 1
L	H	L	H	L	H	H	A1-0 = 2
L	H	H	L	H	H	H	A1-0 = 3

**Table 3. Absolute Maximum Ratings**

Supply Voltage to Ground .....	-0.5V to 7.0V
DC Output Voltage $V_{OUT}$ .....	-0.5V to 7.0V
DC Input Voltage $V_{IN}$ .....	-0.5V to 7.0V
AC Input Voltage (for a pulse width $\leq 20$ ns) .....	-3.0V
DC Input Diode Current with $V_{IN} < 0$ .....	-20mA
DC Output Diode Current with $V_{OUT} < 0$ .....	-50mA
DC Output Current Max. Sink Current/Pin .....	120mA
Maximum Power Dissipation .....	0.5 watts
$T_{STG}$ Storage Temperature .....	-65° to 150°C

**Note:** Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to this device resulting in functional or reliability type failures.

**Table 4. Capacitance<sup>(1)</sup>**

$T_A = 25^\circ\text{C}$ ,  $f = 1\text{MHz}$ ,  $V_{IN} = 0\text{V}$ ,  $V_{OUT} = 0\text{V}$

Pins <sup>(2)</sup>	SOIC	QSOP	PDIP	Unit
1-3	4	4	5	pF
7, 9-12	6	6	7	pF
4-6, 13-15	8	8	9	pF

**Notes:**

1. Capacitance is characterized but not tested.
2. Pin reference for 16-pin package.

**Table 5. DC Electrical Characteristics Over Operating Range**

Industrial  $T_A = -40^\circ\text{C}$  to  $85^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 5\%$

Military  $T_A = -55^\circ\text{C}$  to  $125^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 10\%$

Symbol	Parameter	Test Conditions	Min	Typ <sup>(1)</sup>	Max	Unit
$V_{IH}$	Input HIGH Voltage	Logic HIGH for All Inputs	2.0	—	—	V
$V_{IL}$	Input LOW Voltage	Logic LOW for All Inputs	—	—	0.8	V
$\Delta V_T$	Input Hysteresis	$V_{TLH} - V_{THL}$ for All Inputs	—	0.2	—	V
$ I_{IH} $ $ I_{IL} $	Input Current Input HIGH or LOW	$V_{CC} = \text{Max.}$ , $0 \leq V_{IN} < V_{CC}$	—	—	5	$\mu\text{A}$
$I_{OS}$	Short Circuit Current	$V_{CC} = \text{Max.}$ , $V_{OUT} = \text{GND}^{(2,3)}$	-60	—	—	mA
$V_{IC}$	Input Clamp Voltage	$V_{CC} = \text{Min.}$ , $I_{IN} = -18\text{mA}$ , $T_A = 25^\circ\text{C}^{(3)}$	—	-0.7	-1.2	V
$V_{OH}$	Output HIGH Voltage	$V_{CC} = \text{Min.}$ , $I_{OH} = -12\text{mA}$ (MIL) $I_{OH} = -15\text{mA}$ (IND)	2.4 2.4	— —	— —	V
$V_{OL}$	Output LOW Voltage	$V_{CC} = \text{Min.}$ , $I_{OL} = 32\text{mA}$ (MIL) $I_{OL} = 48\text{mA}$ (IND)	— —	— —	0.50 0.50	V

**Notes:**

1. Typical values indicate  $V_{CC} = 5.0\text{V}$  and  $T_A = 25^\circ\text{C}$ .
2. Not more than one output should be shorted and the duration is  $\leq 1$  second.
3. These parameters are guaranteed by design but not tested.

**Table 6. Power Supply Characteristics**

Symbol	Parameter	Test Conditions <sup>(1)</sup>	Min	Max	Unit
$I_{CC}$	Quiescent Power Supply Current	$V_{CC} = \text{Max.}, \text{freq} = 0$ $0V \leq V_{IN} \leq 0.2V$ or $V_{CC} - 0.2V \leq V_{IN} \leq V_{CC}$	—	1.5	mA
$\Delta I_{CC}$	Supply Current per Input @ TTL HIGH	$V_{CC} = \text{Max.}, V_{IN} = 3.4V, \text{freq} = 0^{(2)}$	—	2.0	mA
$Q_{CCD}$	Supply Current per Input per MHz	$V_{CC} = \text{Max.}, \text{Outputs Open and Enabled}$ One Bit Toggling @ 50% Duty Cycle Other Inputs at GND or $V_{CC}^{(3,4)}$	—	0.25	mA/ MHz

**Notes:**

1. For conditions shown as Min. or Max., use the appropriate values specified under DC specifications.
2. Per TTL driven input ( $V_{IN} = 3.4V$ ).
3. For flip-flops,  $Q_{CCD}$  is measured by switching one of the data input pins so that the output changes every clock cycle. This is a measurement of device power consumption only and does not include power to drive load capacitance or tester capacitance. This parameter is guaranteed by design but not tested.
4.  $I_C$  can be computed using the above parameters as explained in the Technical Overview section.

**Table 7. Switching Characteristics Over Operating Range**

Industrial  $T_A = -40^\circ\text{C}$  to  $85^\circ\text{C}$ ,  $V_{CC} = 5.0V \pm 5\%$       Military  $T_A = -55^\circ\text{C}$  to  $125^\circ\text{C}$ ,  $V_{CC} = 5.0V \pm 10\%$   
 $C_{LOAD} = 50\text{pF}$ ,  $R_{LOAD} = 500\Omega$  unless otherwise noted.

Symbol	Description <sup>(1)</sup>		139A		139C		139D		Unit
			Min	Max	Min	Max	Min	Max	
$t_{PHL}$	Propagation Delay	Ind	1.5	5.8	1.5	5.0	1.0	4.0	ns
$t_{PLH}$	$A_i$ to $\overline{O}_i$	Mil	1.5	7.8	1.5	7.0	—	—	
$t_{PHLE}$	Propagation Delay	Ind	1.5	5.9	1.5	5.0	1.0	4.0	ns
$t_{PLHE}$	$\overline{E}_i$ to $\overline{O}_i$	Mil	1.5	8.0	1.5	7.0	—	—	

**Notes:**

1. Minimums guaranteed but not tested. See Test Circuit and Waveforms.