High Speed CMOS Dual Binary 1-of-4 Decoders

QS54/74FCT139T
QS54/74FCT239T

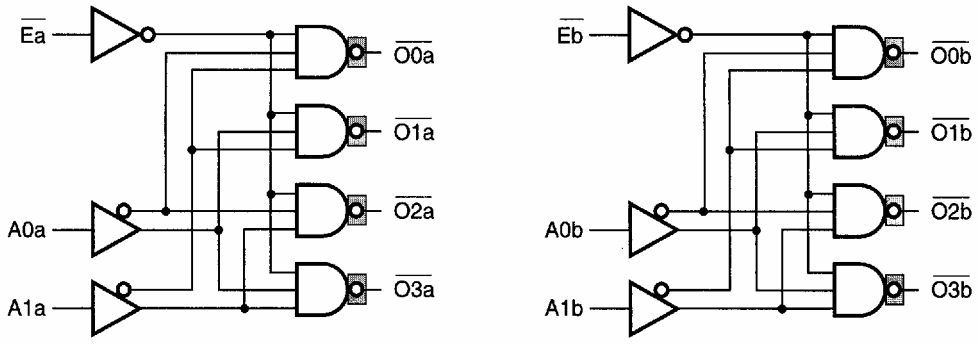
FEATURES/BENEFITS

- QSFCT139D with 4.0 ns propagation delay
- I_{OL} = 48 mA COM, 32 mA MIL
- TTL-compatible input and output levels
- Mil product compliant with MIL-STD 883, Class B
- QSFCT239T has positive active outputs
- CMOS power levels < 7.5 mW static
- Available in DIP, SOIC, QSOP, HQSOP, ZIP
- JEDEC standard pinouts

DESCRIPTION

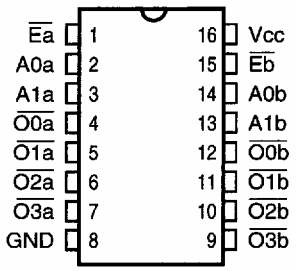
The QSFCT139T and QSFCT239T are high-speed CMOS TTL-compatible high-speed binary decoders. The QSFCT139T has negative active outputs, and the QSFCT239T has positive active outputs. The high output current I_{OL} and I_{OH} drive high-capacitance loads. All inputs have clamp diodes for undershoot noise suppression. All outputs have ground bounce suppression (see QSI Application Note AN-001), and outputs will not load an active bus when Vcc is removed from the device.

FUNCTIONAL BLOCK DIAGRAM

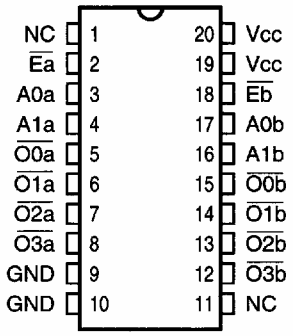


PIN CONFIGURATIONS (All Pins Top View)

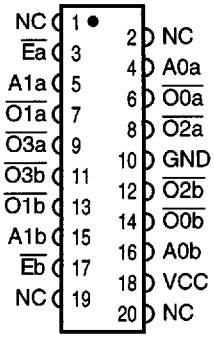
DIP, SOIC, QSOP



HQSOP



ZIP



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

PIN DESCRIPTION

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

FUNCTION TABLE

Enable	Select		FCT139 Output				FCT239 Output				
$\overline{Ea}$, $\overline{Eb}$	A1	A0	$\overline{O3}$	$\overline{O2}$	$\overline{O1}$	$\overline{O0}$	O3	O2	O1	O0	Note
H	X	X	H	H	H	H	L	L	L	L	Disable Decode
L	L	L	H	H	H	L	L	L	L	H	A1-0 = 0
L	L	H	H	H	L	H	L	L	H	L	A1-0 = 1
L	H	L	H	L	H	H	L	H	L	L	A1-0 = 2
L	H	H	L	H	H	H	H	L	L	L	A1-0 = 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 ≤ 20 ns)	–3.0V
DC Input Diode Current with $V_{IN} < 0$	–20 mA
DC Output Diode Current with $V_{OUT} < 0$	–50 mA
DC Output Current Max. Sink Current/Pin	120 mA
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.

CAPACITANCE

T_A = 25°C, f = 1 MHz, V_{IN} = 0V, V_{OUT} = 0V

Pins	SOIC	QSOP	PDIP	ZIP	Unit
1-3	4	4	5	7	pF
7, 9-12	6	6	7	9	pF
4-6, 13-15	8	8	9	10	pF

Note: Capacitance is characterized but not tested.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Commercial T_A = 0°C to 70°C, Vcc = 5.0V ± 5% Military T_A = –55°C to 125°C, Vcc = 5.0V ± 10%

Symbol	Parameter	Test Conditions	Min	Typ(1)	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
ΔV_T	Input Hysteresis	$V_{TLH} - V_{THL}$ for All Inputs	—	0.2	—	V
$\lvert I_{IH} \rvert$ $\lvert I_{IL} \rvert$	Input Current Input HIGH or LOW	Vcc = Max., 0 ≤ V_{IN} < Vcc	—	—	5	µA
I_{OS}	Short Circuit Current	Vcc = Max., V_{OUT} = GND(2,3)	–60	—	—	mA
V_{IC}	Input Clamp Voltage	Vcc = Min., I_{IN} = –18 mA, T_A = 25°C(3)	—	–0.7	–1.2	V
V_{OH}	Output HIGH Voltage	Vcc = Min., I_{OH} = –12 mA (MIL) I_{OH} = –15 mA (COM)	2.4 2.4	— —	— —	V
V_{OL}	Output LOW Voltage	Vcc = Min., I_{OL} = 32 mA (MIL) I_{OL} = 48 mA (COM)	— —	— —	0.50 0.50	V

Notes:
1. Typical values indicate Vcc = 5.0V and T_A = 25°C.
2. Not more than one output should be shorted and the duration is ≤1 second.
3. These parameters are guaranteed by design but not tested.

POWER SUPPLY CHARACTERISTICS

Symbol	Parameter	Test Conditions[1]	Min	Max	Unit
Icc	Quiescent Power Supply Current	Vcc = Max., freq = 0 0V ≤ VIN ≤ 0.2V or Vcc-0.2V ≤ VIN ≤ Vcc	—	1.5	mA
ΔIcc	Supply Current per Input @ TTL HIGH	Vcc = Max., VIN = 3.4V, freq = 0[2]	—	2.0	mA
Qccd	Supply Current per Input per MHz	Vcc = Max., Outputs Open and Enabled One Bit Toggling @ 50% Duty Cycle Other Inputs at GND or Vcc[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 (VIN = 3.4V).
3. For flip-flops, Qccd 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. Ic can be computed using the above parameters as explained in the Technical Overview section.

SWITCHING CHARACTERISTICS OVER OPERATING RANGE

Commercial T_A = 0°C to 70°C, Vcc = 5.0V ± 5% Military T_A = −55°C to 125°C, Vcc = 5.0V ± 10%
C_{LOAD} = 50 pF, R_{LOAD} = 500Ω unless otherwise noted.

Symbol	Description[1]		139 239 Min	139 239 Max	139A 239A Min	139A 239A Max	139C 239C Min	139C 239C Max	139D 239D Min	139D 239D Max	Unit
t_{PHL}	Propagation Delay	Com	1.5	9	1.5	5.8	1.5	5.0	1.0	4.0	ns
t_{PLH}	Ai to $\overline{Oi}$	Mil	1.5	12	1.5	7.8	1.5	7.0	—	—	
t_{PHLE}	Propagation Delay	Com	1.5	9	1.5	5.9	1.5	5.0	1.0	4.0	ns
t_{PLHE}	$\overline{Ei}$ to $\overline{Oi}$	Mil	1.5	12	1.5	8.0	1.5	7.0	—	—	

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