



54FCT/74FCT564

Octal D Flip-Flop with TRI-STATE® Outputs

General Description

The 'FCT564 is a high-speed, low power octal flip-flop with a buffered common Clock (CP) and a buffered common Output Enable (OE). The information presented to the D inputs is stored in the flip-flops on the LOW-to-HIGH Clock (CP) transition.

FACT FCT utilizes NSC quiet series technology to provide improved quiet output switching and dynamic threshold performance.

FACT FCT features GTO™ output control and undershoot corrector in addition to a split ground bus for superior performance.

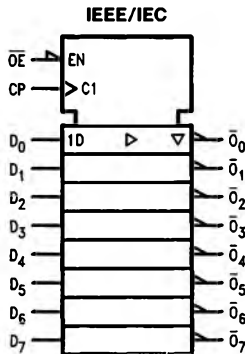
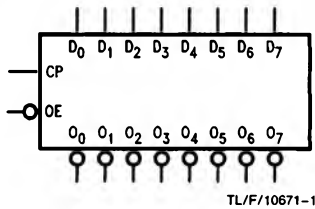
The 'FCT564 device is functionally identical to the 'FCT574, but with inverted outputs.

Features

- NSC 54FCT/74FCT564 is pin and functionally equivalent to IDT 54FCT/74FCT564
- TRI-STATE outputs for bus-oriented applications
- Input clamp diodes to limit bus reflections
- TTL/CMOS input and output level compatible
- $I_{OL} = 48 \text{ mA (com), } 32 \text{ mA (mil)}$
- CMOS power levels
- ESD immunity $\geq 4 \text{ kV typ}$
- Military product compliant to MIL-STD 883

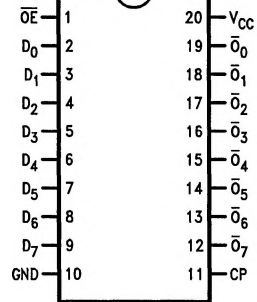
Ordering Code: See Section 8

Logic Symbols



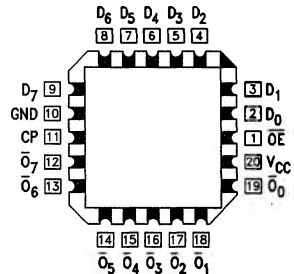
Connection Diagrams

Pin Assignment for DIP, Flatpak and SOIC



Pin Names	Description
D ₀ -D ₇	Data Inputs
CP	Clock Pulse Input
OE	TRI-STATE Output Enable Input
O ₀ -O ₇	TRI-STATE Outputs

Pin Assignment for LCC



Absolute Maximum Ratings (Note 1)

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

Terminal Voltage with respect to GND (V_{TERM})
 54FCT -0.5V to 7.0V
 74FCT -0.5 to 7.0V

Temperature Under Bias (T_{BIAS})
 74FCT -55°C to +125°C
 54FCT -65°C to +135°C

Storage Temperature (T_{STG})
 74FCT -55°C to +125°C
 54FCT -65°C to +150°C

Power Dissipation (P_T) 0.5W

DC Output Current (I_{OUT}) 120 mA

Note 1: Absolute maximum ratings are those values beyond which damage to the device may occur. Exposure to absolute maximum rating conditions for extended periods may affect reliability. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables.

Recommended Operating Conditions

Supply Voltage (V_{CC})
 54FCT 4.5V to 5.5V
 74FCT 4.75V to 5.25V

Input Voltage 0V to V_{CC}

Output Voltage 0V to V_{CC}

Operating Temperature (T_A)
 54FCT -55°C to +125°C
 74FCT 0°C to +70°C

Junction Temperature (T_J)
 CDIP 175°C
 PDIP 140°C

DC Characteristics for 'FCT Family Devices

Typical values are at V_{CC} 5.0V, 25°C ambient and maximum loading. For test conditions shown as Max, use the value specified for the appropriate device type: Com: V_{CC} 5.0V +5%, T_A = 0°C to +70°; Mil: V_{CC} = 5.0V ±10% T_A = 55°C +125°C V_{HC} = V_{CC} -0.2V

Symbol	Parameter	54FCT/74FCT			Units	Conditions	
		Min	Typ	Max			
V_{IH}	Minimum High Level Input Voltage	2.0			V		
V_{IL}	Maximum Low Level Input Voltage			0.8	V		
I_{IH}	Input High Current			5.0 5.0	μ A	$V_{CC} = \text{Max}$	$V_I = V_{CC}$ $V_I = 2.7V$ (Note 2)
I_{IL}	Input Low Current			-5.0 -5.0	μ A	$V_{CC} = \text{Max}$	$V_I = 0.5V$ (Note 2) $V_I = \text{GND}$
I_{OZ}	Maximum TRI-STATE Current			10.0 10.0 -10.0 -10.0	μ A	$V_{CC} = \text{Max}$	$V_O = V_{CC}$ $V_O = 2.7V$ (Note 2) $V_O = 0.5V$ (Note 2) $V_O = \text{GND}$
V_{IK}	Clamp Diode Voltage			-0.7 -1.2	V	$V_{CC} = \text{Min}; I_N = -18 \text{ mA}$	
I_{OS}	Short Circuit Current	-60	-120		mA	$V_{CC} = \text{Max}$ (Note 1); $V_O = \text{GND}$	
V_{OH}	Minimum High Level Output Voltage	2.8	3.0		V	$V_{CC} = 3V; V_{IN} = 0.2V$ or $V_{HC}; I_{OH} = -32 \mu\text{A}$	
		V_{HC}	V_{CC}			$V_{CC} = \text{Min}$	$I_{OH} = -300 \mu\text{A}$
		2.4	4.3			$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -12 \text{ mA}$ (Mil) $I_{OH} = -15 \text{ mA}$ (Com)
V_{OL}	Maximum Low Level Output Voltage		GND	0.2	V	$V_{CC} = 3V; V_{IN} = 0.2V$ or $V_{HC}; I_{OL} = 300 \mu\text{A}$	
			GND	0.2		$V_{CC} = \text{Min}$	$I_{OL} = 300 \mu\text{A}$
			0.3	0.50		$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 32 \text{ mA}$ (Mil)
			0.3	0.50			$I_{OL} = 48 \text{ mA}$ (Com)

DC Characteristics for 'FCT Family Devices (Continued)

Typical values are at $V_{CC} = 5.0V$, $25^{\circ}C$ ambient and maximum loading. For test conditions shown as Max, use the value specified for the appropriate device type: Com: $V_{CC} = 5.0V \pm 5\%$, $T_A = 0^{\circ}C$ to $+70^{\circ}C$; Mil: $V_{CC} = 5.0V \pm 10\%$, $T_A = -55^{\circ}C$ to $+125^{\circ}C$; $V_{HC} = V_{CC} - 0.2V$

Symbol	Parameter	74FCT			Units	Conditions
		Min	Typ	Max		
I_{CC}	Maximum Quiescent Supply Current		0.001	1.5	mA	$V_{CC} = \text{Max}$ $V_{IN} \geq V_{HC}$, $V_{IN} \leq 0.2V$ $f_I = 0$
ΔI_{CC}	Quiescent Supply Current; TTL Inputs HIGH		0.5	2.0	mA	$V_{CC} = \text{Max}$ $V_{IN} = 3.4V$ (Note 3)
I_{CCD}	Dynamic Power Supply Current (Note 4)		0.15	0.25	mA/MHz	$V_{CC} = \text{Max}$ Outputs Open $\overline{OE} = \text{GND}$ One Input Toggling 50% Duty Cycle $V_{IN} \geq V_{HC}$ $V_{IN} \leq 0.2V$
I_C	Total Power Supply Current (Note 6)		1.5	4.0	mA	$V_{CC} = \text{Max}$ Outputs Open $\overline{OE} = \text{GND}$ $f_{CP} = 10 \text{ MHz}$ $f_I = 5 \text{ MHz}$ 50% Duty Cycle One Bit Toggling 50% Duty Cycle $V_{IN} \geq V_{HC}$ $V_{IN} \leq 0.2V$
			1.8	6.0		$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$
			3.0	7.8		(Note 5) $V_{CC} = \text{Max}$ Outputs Open $\overline{OE} = \text{GND}$ $f_{CP} = 10 \text{ MHz}$ 50% Duty Cycle $f_I = 2.5 \text{ MHz}$ Eight Bits Toggling 50% Duty Cycle $V_{IN} \geq V_{HC}$ $V_{IN} \leq 0.2V$
			5.0	16.8		$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$

Note 1: Maximum test duration not to exceed one second, not more than one output shorted at one time.

Note 2: This parameter guaranteed but not tested.

Note 3: Per TTL driven input ($V_{IN} = 3.4V$); all other inputs at V_{CC} or GND.

Note 4: This parameter is not directly testable, but is derived for use in Total Power Supply calculations.

Note 5: Values for these conditions are examples of the I_{CC} formula. These limits are guaranteed but not tested.

Note 6: $I_C = I_{\text{QUIESCENT}} + I_{\text{INPUTS}} + I_{\text{DYNAMIC}}$

$$I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_I N_I)$$

I_{CC} = Quiescent Current

ΔI_{CC} = Power Supply Current for a TTL High Input ($V_{IN} = 3.4V$)

D_H = Duty Cycle for TTL inputs High

N_T = Number of Inputs at D_H

I_{CCD} = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)

f_{CP} = Clock Frequency for Register Devices (Zero for Non-Register Devices)

f_I = Input Frequency

N_I = Number of Inputs at f_I

All currents are in milliamps and all frequencies are in megahertz.

Note 7: For 54FCT, $I_{CCD} = 0.40 \text{ mA/MHz}$.

Refer to applicable standard military drawing or NSC Table I for test conditions and I_C/I_{CC} limits.

AC Electrical Characteristics: See Section 2 for Waveforms

Symbol	Parameter	54FCT/74FCT	74FCT		54FCT		Units	Fig. No.
		$T_A = +25^\circ\text{C}$ $V_{CC} = 5.0\text{V}$	$T_A, V_{CC} = \text{Com}$ $R_L = 500\Omega$ $C_L = 50\text{pF}$		$T_A, V_{CC} = \text{Mil}$ $R_L = 500\Omega$ $C_L = 50\text{pF}$			
		Typ	Min (Note)	Max	Min	Max		
t_{PLH} t_{PHL}	Propagation Delay CP to \bar{O}_n	6.6	2.0	10.0			ns	2-8
t_{PZH} t_{PZL}	Output Enable Time	9.0	1.5	12.5			ns	2-11
t_{PHZ} t_{PLZ}	Output Disable Timed	6.0	1.5	8.0			ns	2-11
t_S	Set-Up Time High or Low D_n to CP	1.0	2.0	—			ns	2-10
t_H	HOLD Time High or Low D_n to CP	0.5	2.0	—			ns	2-10
t_W	CP Pulse Width High or Low	4.0	7.0	—			ns	2-9

Note: Minimum limits are guaranteed but not tested on propagation delays.

Capacitance ($T_A = +25^\circ\text{C}$, $f = 1.0\text{ MHz}$)

Symbol	Parameter	Typ	Max	Units	Conditions
C_{IN}	Input Capacitance	6	10	pF	$V_{IN} = 0\text{V}$
C_{OUT}	Output Capacitance	8	12	pF	$V_{OUT} = 0\text{V}$

Note: This parameter is measured at characterization but not tested.

C_{OUT} for 74FCT only.