

54FCT377

Octal D-Type Flip-Flop with Clock Enable

General Description

The 'FCT377 has eight edge-triggered, D-type flip-flops with individual D inputs and Q outputs. The common buffered Clock (CP) input loads all flip-flops simultaneously, when the Clock Enable (\overline{CE}) is LOW.

The register is fully edge-triggered. The state of each D input, one setup time before the LOW-to-HIGH clock transition, is transferred to the corresponding flip-flop's Q output. The \overline{CE} input must be stable only one setup time prior to the LOW-to-HIGH clock transition for predictable operation.

Features

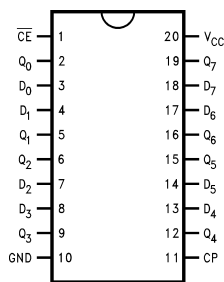
- Clock enable for address and data synchronization applications
- Eight edge-triggered D flip-flops
- Buffered common clock
- See 'FCT273 for master reset version
- See 'FCT373 for transparent latch version
- See 'FCT374 for TRI-STATE® version
- TTL input and output level compatible
- CMOS power consumption
- Output sink capability of 32 mA, source capability of 12 mA
- Standard Microcircuit Drawing (SMD) 5962-8762701

Ordering Code

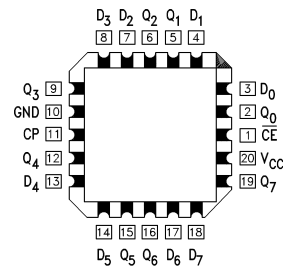
Military	Package Number	Package Description
54FCT377DMQB	J20A	20-Lead Ceramic Dual-In-Line
54FCT377FMQB	W20A	20-Lead Cerpack
54FCT377LMQB	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C

Connection Diagram

Pin Assignment for
DIP and Cerpack



Pin Assignment for LCC



Pin Names	Description
D ₀ -D ₇	Data Inputs
\overline{CE}	Clock Enable (Active LOW)
CP	Clock Pulse Input
Q ₀ -Q ₇	Data Outputs

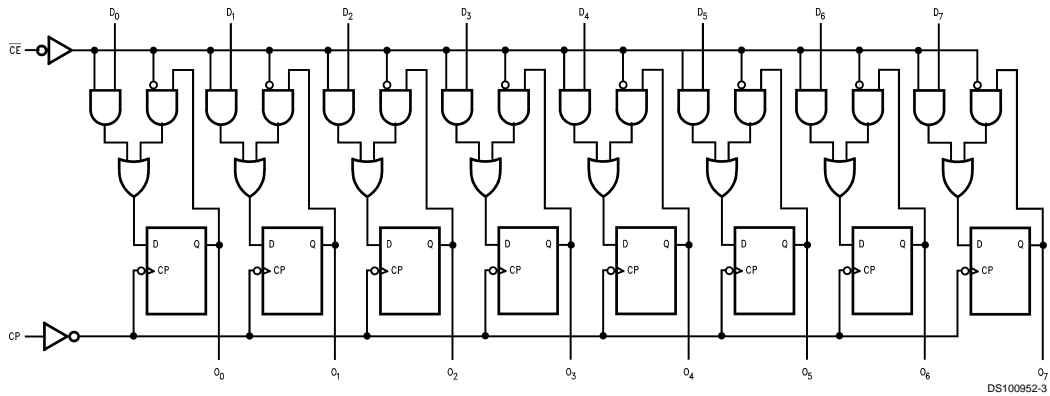
Truth Table

Mode Select-Function Table

Operating Mode	Inputs			Output
	CP	\overline{CE}	D_n	Q_n
Load "1"		l	h	H
Load "0"		l	l	L
Hold (Do Nothing)		h	X	No Change
	X	H	X	No Change

H = HIGH Voltage Level
 h = HIGH Voltage Level one setup time prior to the LOW-to-HIGH Clock Transition
 L = LOW Voltage Level
 l = LOW Voltage Level one setup time prior to the LOW-to-HIGH Clock Transition
 X = Immaterial
 = LOW-to-HIGH Clock Transition

Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings (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
Ambient Temperature under Bias	-55°C to +125°C
Junction Temperature under Bias	
Ceramic	-55°C to +175°C
V _{CC} Pin Potential to Ground Pin	-0.5V to +7.0V
Input Voltage (Note 2)	-0.5V to +7.0V
Input Current (Note 2)	-30 mA to +5.0 mA
Voltage Applied to Any Output in the Disabled or Power-Off State	-0.5V to +4.75V
in the HIGH State	-0.5V to V _{CC}

Current Applied to Output in LOW State (Max)	Twice the rated I _{OL} (mA)
DC Latchup Source Current (Across Comm Operating Range)	-500 mA

Recommended Operating Conditions

Free Air Ambient Temperature	
Military	-55°C to +125°C
Supply Voltage	
Military	+4.5V to +5.5V
Minimum Input Edge Rate	(ΔV/Δt)
Data Input	50 mV/ns
Enable Input	20 mV/ns

DC Electrical Characteristics

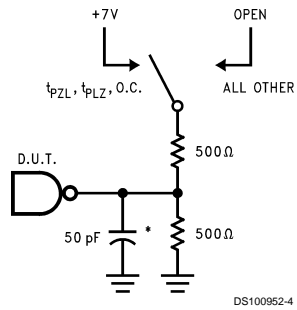
Symbol	Parameter	FCT377			Units	V _{CC}	Conditions
		Min	Typ	Max			
V _{IH}	Input HIGH Voltage	2.0			V		Recognized HIGH Signal
V _{IL}	Input LOW Voltage			0.8	V		Recognized LOW Signal
V _{CD}	Input Clamp Diode Voltage			-1.2	V	Min	I _{IN} = -18 mA
V _{OH}	Output HIGH Voltage	54FCT	4.3		V	Min	I _{OH} = -300 uA I _{OH} = -12 mA
		54FCT	2.4				
V _{OL}	Output LOW Voltage	54FCT		0.2	V	Min	I _{OL} = 300 uA I _{OL} = 32mA
		54FCT		0.5			
I _{IH}	Input HIGH Current			5	μA	Max	V _{IN} = V _{CC}
I _{IL}	Input LOW Current			-5	μA	Max	V _{IN} = 0.5V
I _{OS}	Output Short-Circuit Current		-60		mA	Max	V _{OUT} = 0.0V
I _{CCQ}	Quiescent Power Supply Current			1.5	mA	Max	V _I = 0.2V or V _I = 5.3V, V _{CC} = 5.5V
ΔI _{CC}	Maximum I _{CC} /Input			2.0	mA	Max	V _I = V _{CC} - 2.1V Data Input V _I = V _{CC} - 2.1V All Others at V _{CC} or GND
I _{CCD}	Dynamic I _{CC}			0.4	mA/ MHz	Max	Outputs Open One bit Toggling, 50% Duty Cycle
I _{CC}	Total Power Supply Current			6.0	mA	Max	V _{CC} = 5.5V, Outputs Open, f _{CP} = 10MHz, 50% Duty Cycle, One bit Toggling at f _I = 5 MHz, 50% Duty Cycle

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

Note 2: Either voltage limit or current limit is sufficient to protect inputs.

AC Electrical Characteristics					
Symbol	Parameter	54FCT		Units	Fig. No.
		$T_A = -55^\circ\text{C to } +125^\circ\text{C}$ $V_{CC} = 4.5\text{V to } 5.5\text{V}$ $C_L = 50\text{ pF}$			
		Min	Max		
t_{PLH}	Propagation Delay	2.0	15.0	ns	Figure 4
t_{PHL}	CP to O_n	2.0	8.3		
AC Operating Requirements					
Symbol	Parameter	54FCT		Units	Fig. No.
		$T_A = -55^\circ\text{C to } +125^\circ\text{C}$ $V_{CC} = 4.5\text{V to } 5.5\text{V}$ $C_L = 50\text{ pF}$			
		Min	Max		
$t_s(H)$	Setup Time, HIGH	4.0		ns	Figure 6
$t_s(L)$	or LOW D_n to CP	4.0			
$t_h(H)$	Hold Time, HIGH	2.5		ns	Figure 6
$t_h(L)$	or LOW D_n to CP	2.5			
$t_s(H)$	Setup Time, HIGH	4.5		ns	Figure 6
$t_s(L)$	or LOW \overline{CE} to CP	4.5			
$t_h(H)$	Hold Time, HIGH	2.0		ns	Figure 6
$t_h(L)$	or LOW \overline{CE} to CP	2.0			
$t_w(H)$	Pulse Width, CP,	7.0		ns	Figure 5
$t_w(L)$	HIGH or LOW	7.0			
Capacitance					
Symbol	Parameter	Max	Units	Conditions	
C_{IN}	Input Capacitance	10	pF	$V_{CC} = 0\text{V}, T_A = 25^\circ\text{C}$	
C_{OUT} (Note 3)	Output Capacitance	12	pF	$V_{CC} = 5.0\text{V}$	
Note 3: C_{OUT} is measured at frequency $f = 1\text{ MHz}$, per MIL-STD-883B, Method 3012.					

AC Loading



*Includes jig and probe capacitance

FIGURE 1. Standard AC Test Load

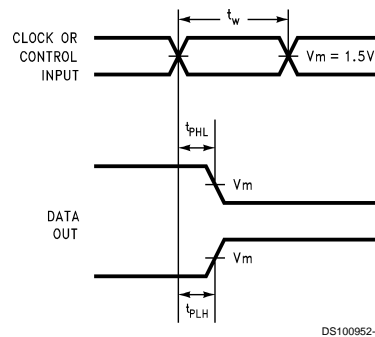


FIGURE 5. Propagation Delay, Pulse Width Waveforms

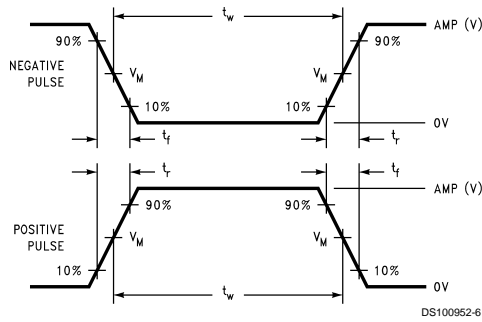


FIGURE 2. V_M = 1.5V

Input Pulse Requirements

Amplitude	Rep. Rate	t _w	t _r	t _f
3.0V	1 MHz	500 ns	2.5 ns	2.5 ns

FIGURE 3. Test Input Signal Requirements

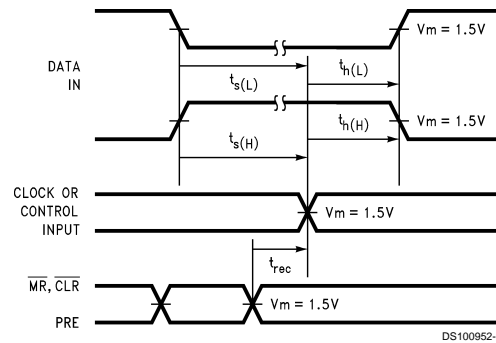


FIGURE 6. Setup Time, Hold Time and Recovery Time Waveforms

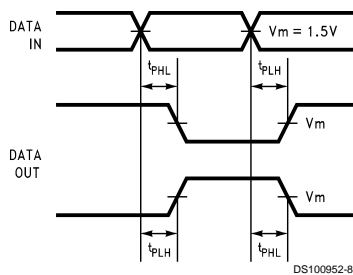
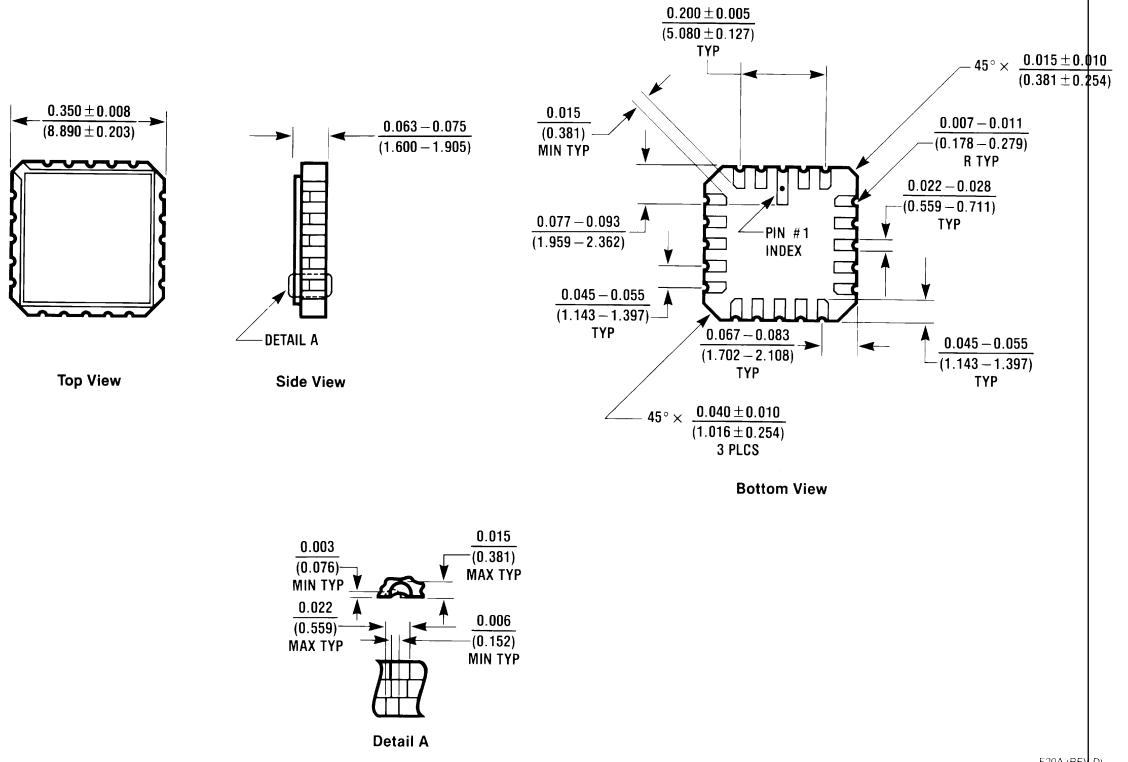


FIGURE 4. Propagation Delay Waveforms for Inverting and Non-Inverting Functions

54FCT377

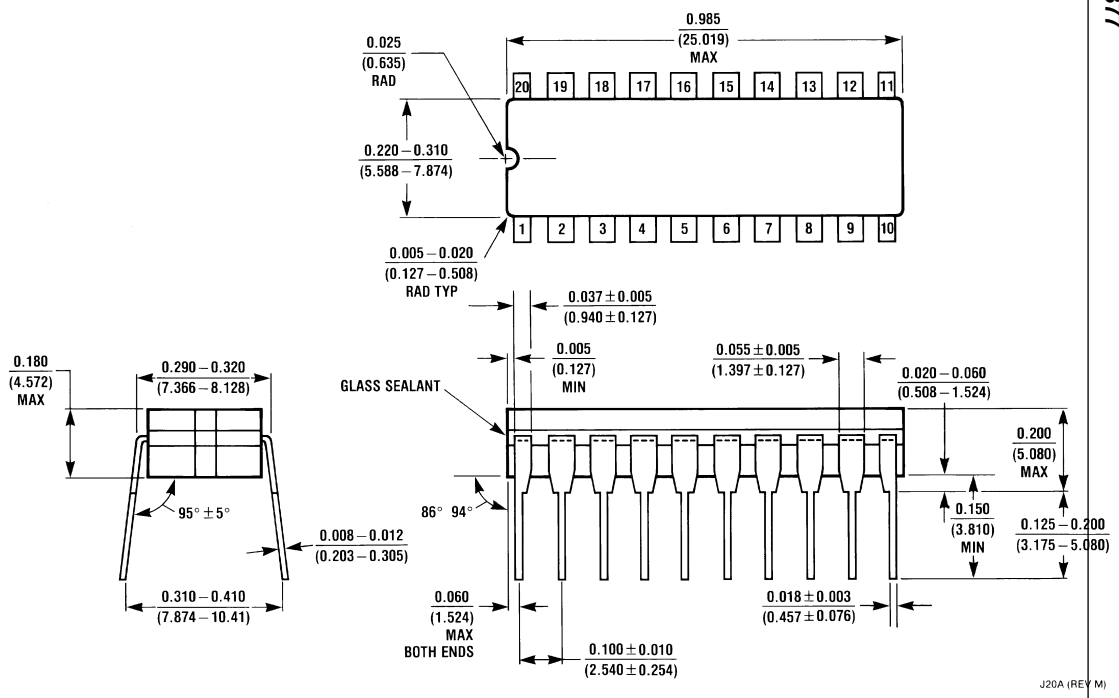
Physical Dimensions inches (millimeters) unless otherwise noted



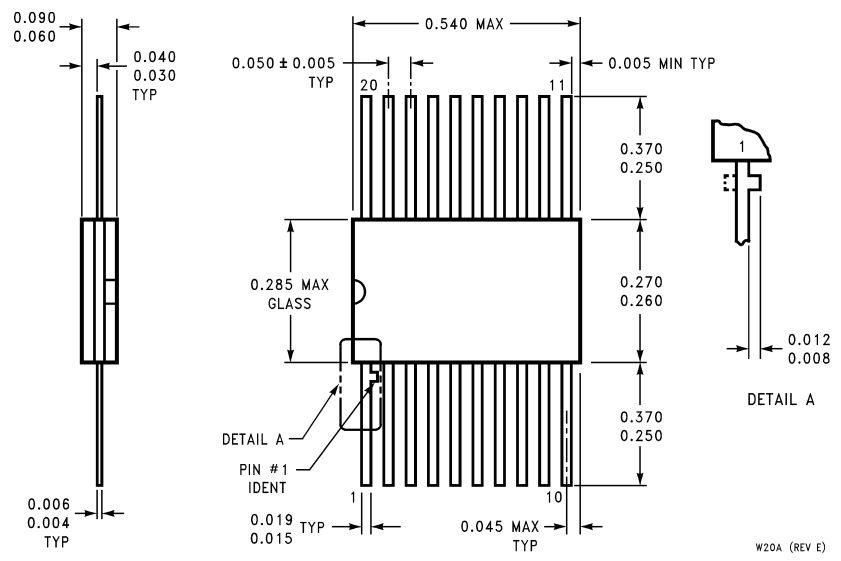
**20-Lead Ceramic Chip Carrier
 NS Package Number E20A**

E20A (REV D)

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



20-Lead Ceramic Dual-In-Line Package
NS Package Number J20A



20-Lead Ceramic Flatpack
NS Package Number W20A

Notes

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National Semiconductor Corporation
Americas
Tel: 1-800-272-9959
Fax: 1-800-737-7018
Email: support@nsc.com

www.national.com

National Semiconductor Europe

Fax: +49 (0) 1 80-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 1 80-530 85 85
English Tel: +49 (0) 1 80-532 78 32
Français Tel: +49 (0) 1 80-532 93 58
Italiano Tel: +49 (0) 1 80-534 16 80

National Semiconductor Asia Pacific Customer Response Group

Tel: 65-2544466
Fax: 65-2504466
Email: sea.support@nsc.com

National Semiconductor Japan Ltd.

Tel: 81-3-5639-7560
Fax: 81-3-5639-7507