

# Octal D-type flip-flop with enable

## 54ABT377

### FEATURES

- Ideal for addressable register applications
- 8-bit positive edge triggered register
- Enable for address and data synchronization applications
- Output capability: +48mA/-24mA
- Latch-up protection exceeds 500mA per Jedec JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883D Method 3015.7 and 200V per Machine Model

### DESCRIPTION

The 54ABT377 high-performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive.

The 54ABT377 has 8 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 Enable (E) input is Low.

The register is fully edge triggered. The state of each D input, one set-up time before the Low-to-High clock transition, is transferred to the corresponding flip-flop's Q output.

The E input must be stable one setup time prior to the Low-to-High clock transition for predictable operation.

### ORDERING INFORMATION

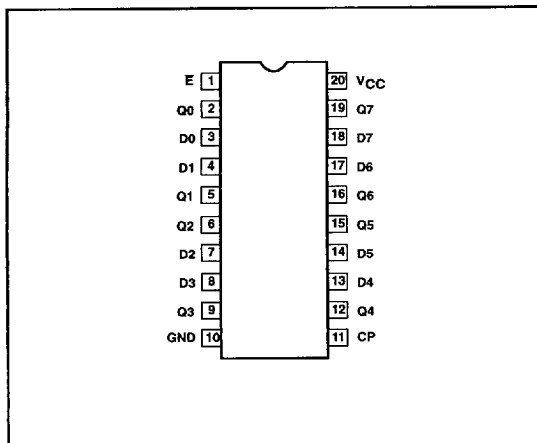
DESCRIPTION	ORDER CODE	PACKAGE DESIGNATOR*
20-Pin Ceramic DIP	54ABT377/BRA	GDIP1-T20
20-Pin Ceramic LLCC	54ABT377/B2A	CQCC2-N20

\* MIL-STD 1835 or Appendix A of 1995 Military Data Handbook

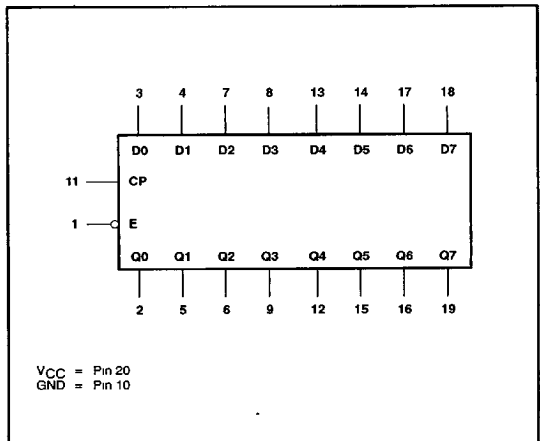
### PIN DESCRIPTION

PIN NUMBER	SYMBOL	FUNCTION
1	E	Enable input (active Low)
3, 4, 7, 8, 13, 14, 17, 18	D0-D7	Data inputs
2, 5, 6, 9, 12, 15, 16, 19	Q0-Q7	Data output <sup>†</sup>
11	CP	Clock Pulse input (active rising edge)
10	GND	Ground (0V)
20	V <sub>CC</sub>	Positive supply voltage

### PIN CONFIGURATION



### LOGIC SYMBOL



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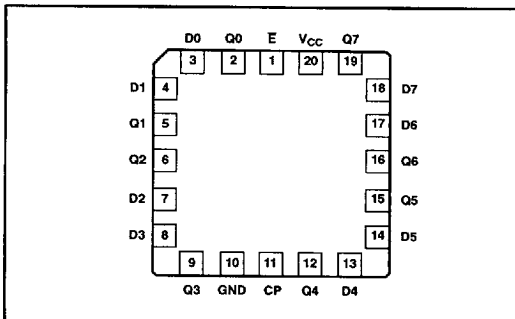
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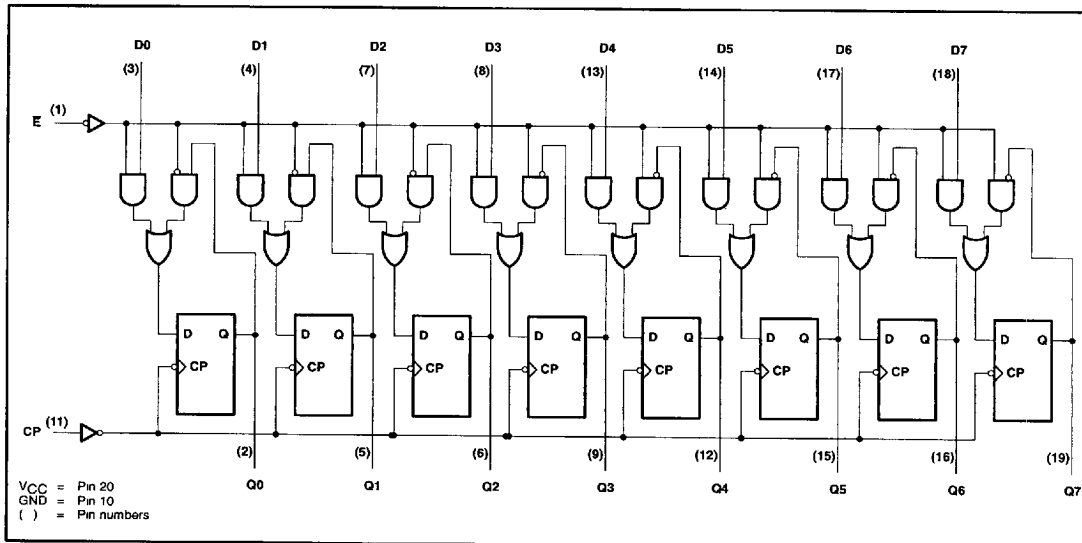
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## LLCC LEAD CONFIGURATION



## LOGIC DIAGRAM



## FUNCTION TABLE

INPUTS	INPUTS		OUTPUTS	OPERATING MODE
	E	CP	Q <sub>n</sub>	
l	↑	h	H	Load "1"
l	↑	l	L	Load "0"
h H	↑ X	X X	no change no change	Hold (do nothing)

- H = High voltage level
- h = High voltage level one set-up time prior to the Low-to-High clock transition
- L = Low voltage level
- l = Low voltage level one set-up time prior to the Low-to-High clock transition
- X = Don't care
- ↑ = Low-to-High clock transition

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## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS		UNIT
		MIN	Max	
V <sub>CC</sub>	DC supply voltage	4.5	5.5	V
V <sub>I</sub>	Input voltage	0	V <sub>CC</sub>	V
V <sub>IH</sub>	High-level input voltage	2.0		V
V <sub>IL</sub>	Low-level input voltage		0.8	V
I <sub>OH</sub>	High-level output current		-24	mA
I <sub>OL</sub>	Low-level output current		48	mA
ΔV/Δv	Input transition rise or fall time	0	5	ns/V
T <sub>amb</sub>	Operating free-air temperature range	-55	+125	°C

ABSOLUTE MAXIMUM RATINGS<sup>1</sup>

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V <sub>CC</sub>	Supply voltage		-0.5 to +7.0	V
I <sub>IK</sub>	DC input diode current	V <sub>I</sub> < 0	-18	mA
V <sub>I</sub>	DC input voltage range <sup>2</sup>		-1.2 to +7.0	V
I <sub>OK</sub>	DC output diode current	V <sub>O</sub> < 0	-50	mA
V <sub>O</sub>	DC output voltage <sup>2</sup>	Output in Off or High state	-0.5 to +5.5	V
I <sub>O</sub>	DC output current	Output in Low state	96	mA
T <sub>STG</sub>	Storage temperature range		-65 to +150	°C

## DC ELECTRICAL CHARACTERISTICS

(Over recommended operating free-air temperature range unless otherwise noted.)

SYMBOL	PARAMETER	TEST CONDITIONS <sup>3</sup>	LIMITS		UNIT
			T <sub>amb</sub> = -55 to 125°C		
			MIN	MAX	
V <sub>IK</sub>	Input clamp voltage	V <sub>CC</sub> = MIN, I <sub>I</sub> = I <sub>IK</sub>		-1.2	V
V <sub>OH</sub>	High-level output voltage	V <sub>CC</sub> = MIN, I <sub>OH</sub> = -3mA	2.5		V
		V <sub>CC</sub> = 5.0V, I <sub>OH</sub> = -3mA	3.0		V
		V <sub>CC</sub> = MIN, I <sub>OH</sub> = MAX	2.0		V
		V <sub>CC</sub> = MIN, I <sub>OL</sub> = MAX		0.55	V
I <sub>I</sub>	Input leakage current	V <sub>I</sub> = GND or 5.5V		±1.0	μA
I <sub>OFF</sub>	Power off leakage current	V <sub>CC</sub> = 0V, V <sub>I</sub> or V <sub>O</sub> ≤ 4.5V	-100	100	μA
I <sub>CEX</sub>	Output high leakage current	V <sub>CC</sub> = 5.5V, V <sub>O</sub> = 5.5V		50	μA
I <sub>O</sub>	Output current <sup>4</sup>	V <sub>O</sub> = 2.5V, V <sub>I</sub> = GND or V <sub>CC</sub>	-50	-180	mA
I <sub>CCH</sub>	Quiescent supply current	Outputs High, V <sub>I</sub> = GND or V <sub>CC</sub>		250	μA
		Outputs Low, V <sub>I</sub> = GND or V <sub>CC</sub>		30	mA
ΔI <sub>CC</sub>	Additional supply current per input pin <sup>5</sup>	One input at 3.4V, other inputs at V <sub>CC</sub> or GND		1.5	mA

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## AC CHARACTERISTICS

GND = 0V,  $t_R = t_F = 2.5\text{ns}$ ,  $C_L = 50\text{pF}$ ,  $R_L = 500\Omega$

SYMBOL	PARAMETER	WAVEFORM	LIMITS					UNIT
			$T_{\text{amb}} = +25^\circ\text{C}$ , $V_{\text{CC}} = +5.0\text{V}$			$T_{\text{amb}} = -55 \text{ to } 125^\circ\text{C}$ $V_{\text{CC}} = +5.0\text{V} \pm 0.5\text{V}$		
			MIN	TYP	MAX	MIN	MAX	
$f_{\text{MAX}}$	Maximum clock frequency	Waveform 1	150	200		150		MHz
$t_{\text{PLH}}$ $t_{\text{PHL}}$	Propagation delay CP to $Q_n$	Waveform 1	2.2 3.1	4.5 5.3	6.0 6.8	2.2 2.0	7.0 7.6	ns ns

## AC SETUP REQUIREMENTS

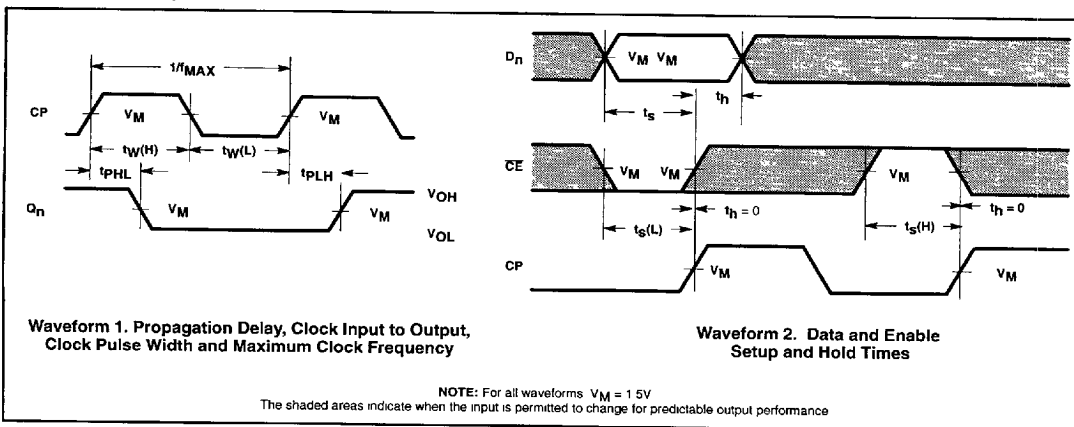
GND = 0V,  $t_R = t_F = 2.5\text{ns}$ ,  $C_L = 50\text{pF}$ ,  $R_L = 500\Omega$

SYMBOL	PARAMETER	WAVEFORM	LIMITS					UNIT
			$T_{\text{amb}} = +25^\circ\text{C}$ , $V_{\text{CC}} = +5.0\text{V}$			$T_{\text{amb}} = -55 \text{ to } 125^\circ\text{C}$ $V_{\text{CC}} = +5.0\text{V} \pm 0.5\text{V}$		
			MIN	TYP	MAX	MIN	MAX	
$t_s(H)$ $t_s(L)$	Setup time, High or Low $D_n$ to CP	Waveform 2 <sup>6</sup>	2.0 2.0			2.5 2.5		ns ns
$t_h(H)$ $t_h(L)$	Hold time, High or Low $D_n$ to CP	Waveform 2 <sup>6</sup>	1.8 1.8			1.8 1.8		ns ns
$t_s(H)$ $t_s(L)$	Setup time, High or Low E to CP	Waveform 2 <sup>6</sup>	3.0 3.0			3.0 3.0		ns ns
$t_h(H)$ $t_h(L)$	Hold time, High or Low E to CP	Waveform 2 <sup>6</sup>	1.0 1.0			1.8 1.8		ns ns
$t_w(H)$ $t_w(L)$	Clock Pulse width High or Low	Waveform 1 <sup>7</sup>	3.3 3.3			3.3 3.3		ns ns

### NOTES:

- Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
- $V_{\text{CC}} = \text{MAX}$ ,  $V_I = V_{\text{IL}}$  or  $V_{\text{IH}}$ , unless otherwise noted.
- Not more than one input should be tested at a time, and the duration of the test should not exceed one second.
- This is the increase in supply current for each input at 3.4V.
- $t_{\text{set}}$  and  $t_{\text{hold}}$  limits that are less than 3.0ns are guaranteed, but are only tested to a 3.0ns limit due to tester limitations.
- $t_w$  limits that are less than 6.0ns are guaranteed, but are only tested to a 6.0ns limit due to tester limitations.

## AC WAVEFORMS



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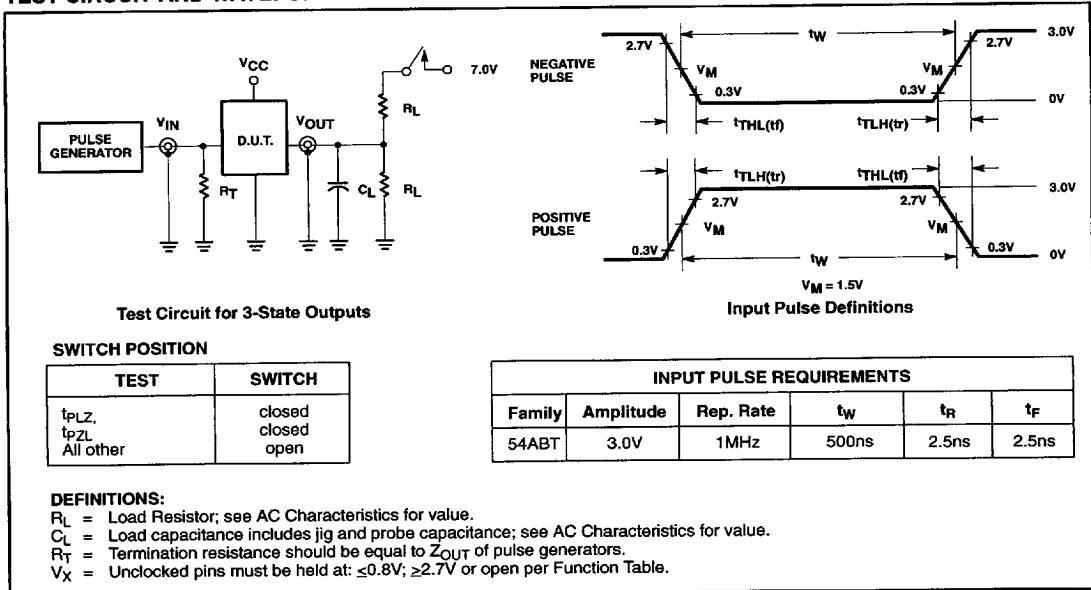
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TEST CIRCUIT AND WAVEFORM



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