Octal D-type flip-flop, inverting (3-State)

54ABT534

FEATURES

- 8-bit positive edge triggered register
- 3-State output buffers
- Output capability: +48mA/-24mA
- Latch-up protection exceeds 500mA per JEDEC JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883 Method 3015 and 200V per Machine Model

DESCRIPTION

The 54ABT534 high-performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive.

The 54ABT534 device is an 8-bit, edge triggered register coupled to eight 3-State output buffers. The two sections of the device are controlled independently by the clock (CP) and Output Enable ($\overline{OE}$) control gates.

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 3-State output buffers are designed to drive heavily loaded 3-State buses, MOS memories, or MOS microprocessors. The active-Low Output Enable ($\overline{OE}$) controls all eight 3-State buffers independent of the latch operation.

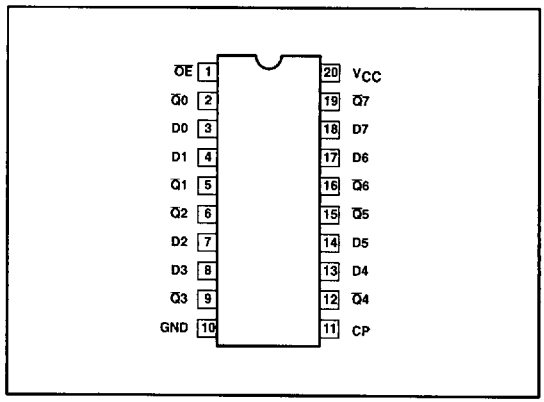
When $\overline{OE}$ is Low, the latched or transparent data appears at the outputs. When $\overline{OE}$ is High, the outputs are in the High-impedance "OFF" state, which means they will neither drive nor load the bus.

ORDERING INFORMATION

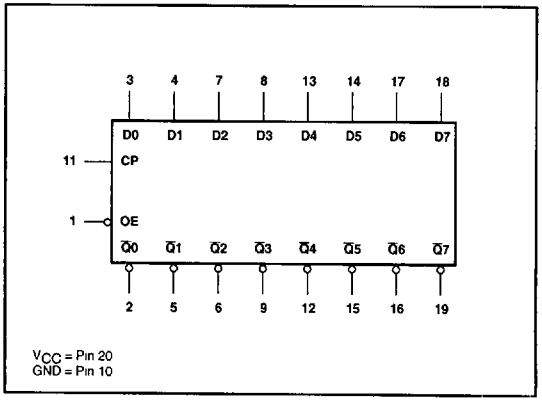
DESCRIPTION	ORDER CODE	PACKAGE DESIGNATOR*
20-Pin Ceramic DIP	54ABT534/BRA	GDIP1-T20
20-Pin Ceramic LLCC	54ABT534/B2A	CQCC2-N20

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

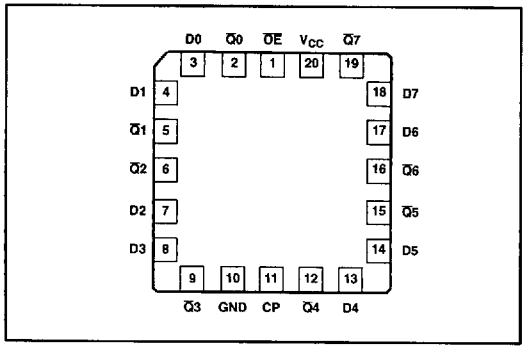
PIN CONFIGURATION



LOGIC SYMBOL



LLCC LEAD CONFIGURATION



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PIN DESCRIPTION

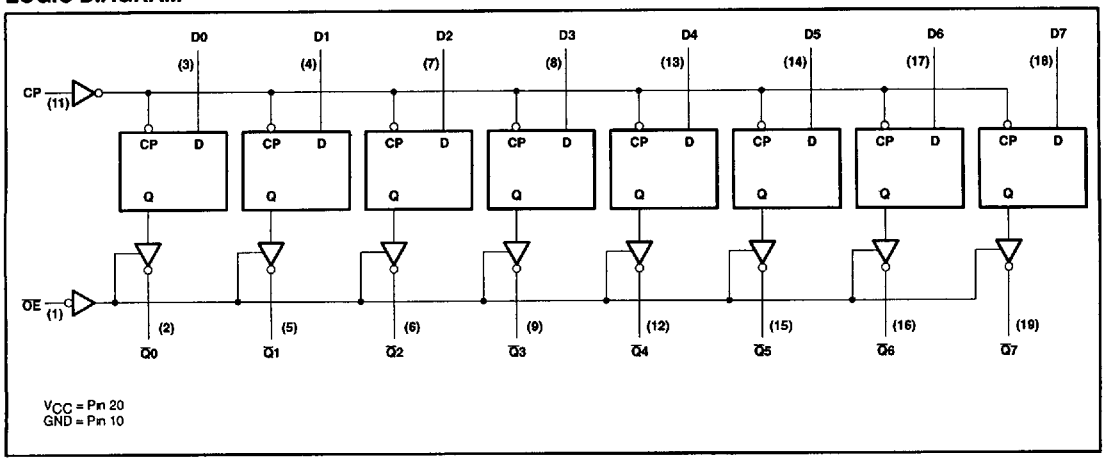
PIN NUMBER	SYMBOL	NAME AND FUNCTION
1	$\overline{OE}$	Output enable input (active Low)
3, 4, 7, 8, 13, 14, 17, 18	D0 - D7	Data inputs
2, 5, 6, 9, 12, 15, 16, 19	$\overline{Q}0$ - $\overline{Q}7$	Inverting 3-State outputs
11	CP	Clock Pulse input (active rising edge)
10	GND	Ground (0V)
20	V_{CC}	Positive supply voltage

FUNCTION TABLE

INPUTS			INTERNAL	OUTPUTS	OPERATING MODE
$\overline{OE}$	CP	Dn	REGISTER	$\overline{Q}0$ - $\overline{Q}7$	
L L	↑ ↑	l h	L H	H L	Load and read register
L	↕	X	NC	NC	Hold
H H	↕ ↑	X Dn	NC Dn	Z Z	Disable outputs

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
NC= No change
X = Don't care
Z = High impedance "off" state
↑ = Low-to-High clock transition
↕ = Not a Low-to-High clock transition

LOGIC DIAGRAM



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ABSOLUTE MAXIMUM RATINGS[1]

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V_{CC}	DC supply voltage range		-0.5 to +7.0	V
I_{IK}	DC input diode current	$V_I < 0$	-18	mA
V_I	DC input voltage range[2]		-1.2 to +7.0	V
I_{OK}	DC output diode current	$V_O < 0$	-50	mA
V_O	DC output voltage range[2]	Output in Off or High state	-0.5 to +5.5	V
I_O	DC output current	Output in Low state	96	mA
T_{STG}	Storage temperature range		-65 to +150	°C

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS		UNIT
		MIN	MAX	
V_{CC}	DC supply voltage	4.5	5.5	V
V_I	Input voltage	0	V_{CC}	V
V_{IH}	High-level input voltage	2.0		V
V_{IL}	Input voltage		0.8	V
I_{OH}	High-level output current		-24	mA
I_{OL}	Low-level output current		48	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	0	5	ns/V
T_{amb}	Operating free-air temperature range	-55	+125	°C

DC ELECTRICAL CHARACTERISTICS

V_{CC} = MAX, V_I = V_{IL} or V_{IH} unless otherwise noted.

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS		UNIT
			T_{amb} = -55 to +125°C		
			MIN	MAX	
V_{IK}	Input clamp voltage	V_{CC} = 4.5V, I_{IK} = -18mA		-1.2	V
V_{OH}	High-level output to voltage	V_{CC} = 4.5V; I_{OH} = -3mA	2.5		V
		V_{CC} = 5.0V; I_{OH} = -3mA	3.0		V
		V_{CC} = 4.5V; I_{OH} = -24mA	2.0		V
V_{OL}	Low-level output voltage	V_{CC} = 4.5V; I_{OL} = 48mA		0.55	V
I_I	Input leakage current	V_I = GND or 5.5V		±1.0	µA
I_{OZH}[8]	3-State output High current	V_O = 2.7V, V_I = V_{IL} or 3.0V		10	µA
I_{OZL}[8]	3-State output Low current	V_O = 0.5V, V_I = V_{IL} or 3.0V		-10	µA
I_O	Short-circuit output current[4]	V_O = 2.5V, V_I = GND or V_{CC}	-50	-180	mA
I_{CCH}	Quiescent supply current	Outputs High, V_I = GND or V_{CC}		250	µA
I_{CCL}		Outputs Low, V_I = GND or V_{CC}		30	mA
I_{CCZ}		Outputs 3-State, V_I = GND or V_{CC}		250	µA
ΔI_{CC}	Additional supply current per input pin[5]	One input at 3.4V, other inputs at V_{CC} or GND		1.5	mA
I_{OFF}	Power OFF leakage current	V_{CC} = 0.0V, V_I or $V_O \leq$ 4.5V TA = 25°C only	–100	100	µA
I_{CEX}	Output High leakage current	V_{CC} = 5.5V, V_O = 5.5V		50	µA

AC ELECTRICAL CHARACTERISTICS

GND = 0V, $t_R = t_F$ = 2.5ns, C_L = 50pF, R_L = 500Ω

SYMBOL	PARAMETER	WAVEFORM	LIMITS					UNIT
			T_{amb} = +25°C, V_{CC} = +5.0V			T_{amb} = -55°C to +125°C, V_{CC} = +5.0V ± 5V		
			MIN	TYP	MAX	MIN	MAX	
f_{MAX}	Maximum Clock frequency	Waveform 1	125	175		125		MHz
t_{PLH} t_{PHL}	Propagation delay CP to $\overline{Q}$n	Waveform 1	2.6 3.4	4.7 5.4	5.9 6.7	2.1 3.0	6.7 7.6	ns ns
t_{PZH} t_{PZL}	Output enable time to High and Low level	Waveform 3 Waveform 4	1.0 2.6	2.9 4.5	4.2 5.8	0.9 2.2	5.3 6.8	ns ns
t_{PHZ} t_{PLZ}	Output disable time from High and Low level	Waveform 3 Waveform 4	2.4 2.3	5.3 4.5	6.6 5.8	2.4 1.3	7.5 6.7	ns ns

AC SETUP REQUIREMENTS

GND = 0V, $t_R = t_F$ = 2.5ns, C_L = 50pF, R_L = 500Ω

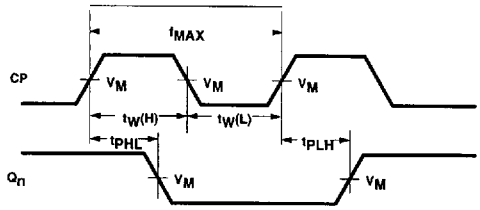
SYMBOL	PARAMETER	WAVEFORM	LIMITS					UNIT
			T_{amb} = +25°C, V_{CC} = +5.0V			T_{amb} = -55°C to +125°C, V_{CC} = +5.0V ± 0.5V		
			MIN	TYP	MAX	MIN	MAX	
t_s(H) t_s(L)	Setup time[6] Dn to CP	Waveform 9	1.6 2.2			1.6 2.2		ns ns
t_h(H) t_h(L)	Hold time[6] Dn to CP	Waveform 9	0.5 0.5			0.5 0.5		ns ns
t_w(H)	CP pulse width[7] High or Low	Waveform 8	3.5 3.5			3.5 3.5		ns ns

NOTES:

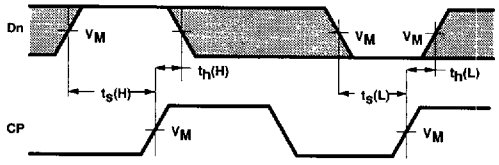
1. Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
2. The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150°C.
3. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
4. Not more than one output should be tested at a time, and the duration of the test should not exceed one second.
5. This is the increase in supply current for each input at 3.4V.
6. t_{set} and t_{hold} limits that are less than 3.0ns are guaranteed, but are only tested to a 3.0ns limit due to tester limitations.
7. t_w limits that are less than 6.0ns are guaranteed, but are only tested to a 6.0ns limit due to tester limitations.
8. To accommodate ATE tester limitations, I_{OZ} tests are tested with V_{IH} = 3.0V, but 2.0V V_{IH} is guaranteed.

AC WAVEFORMS

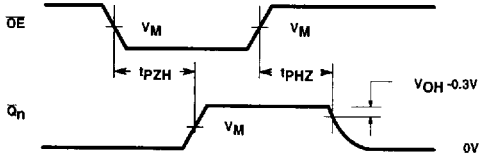
V_M = 1.5V, V_{IN} = GND to 3.0V



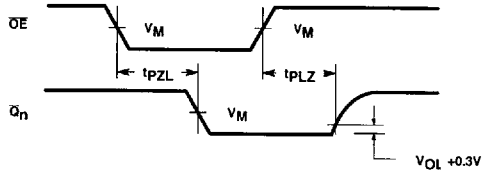
Waveform 8. Propagation Delay, Clock Input to Output, Clock Pulse Width and Maximum Clock Frequency



Waveform 9. Data Setup and Hold Times



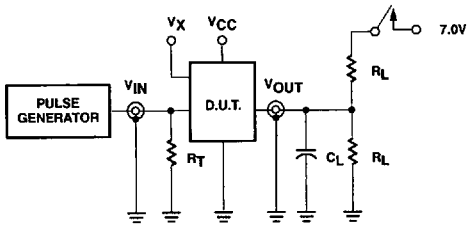
Waveform 10. 3-State Output Enable Time to High Level and Output Disable Time from High Level



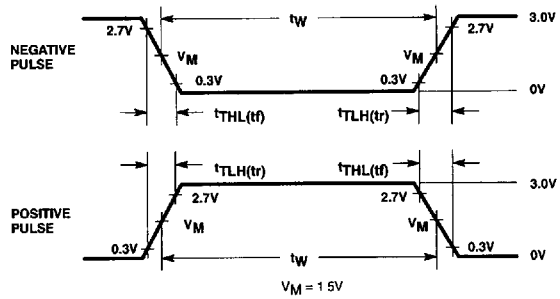
Waveform 11. 3-State Output Enable Time to Low Level and Output Disable Time from Low Level

NOTE: For all waveforms, V_M = 1.5V
The shaded areas indicate when the input is permitted to change for predictable output performance

TEST CIRCUIT AND WAVEFORM



Test Circuit for 3-State Outputs



Input Pulse Definitions

SWITCH POSITION

TEST	SWITCH
t_{PLZ}, t_{PZL}	closed
All other	closed open

INPUT PULSE REQUIREMENTS					
Family	Amplitude	Rep. Rate	t_W	t_R	t_F
54ABT	3.0V	1MHz	500ns	2.5ns	2.5ns

DEFINITIONS:
R_L = Load Resistor; see AC Characteristics for value.
C_L = Load capacitance includes jig and probe capacitance; see AC Characteristics for value.
R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.