TIBPAL16L8-15M, TIBPAL16R4-15M, TIBPAL16R6-15M, TIBPAL16R8-15M
TIBPAL16L8-12C TIBPAL16R4-12C TIBPAL16R6-12C TIBPAL16R8-12C
HIGH-PERFORMANCE *IMPACT*™ *PAL*® CIRCUITS

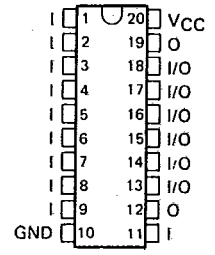
D3338, JANUARY 1986—REVISED AUGUST 1989

T-46-13-47

- **High-Performance Operation**
  Propagation Delay
  M Suffix . . . 15 ns Max
  C Suffix . . . 12 ns Max
- **Functionally Equivalent, but Faster than PAL16L8B, PAL16R4B, PAL16R6B, and PAL16R8B**
- **Power-Up Clear on Registered Devices (All Registered Outputs are Set High but Voltage Levels at the Output Pins Go Low)**
- **Package Options Include Both Plastic and Ceramic Chip Carriers in Addition to Plastic and Ceramic DIPs**
- **Dependable Texas Instruments Quality and Reliability**

DEVICE	INPUTS	3-STATE O OUTPUTS	REGISTERED Q OUTPUTS	I/O PORTS
PAL16L8	10	2	0	6
PAL16R4	8	0	4 (3-state)	4
PAL16R6	8	0	6 (3-state)	2
PAL16R8	8	0	8 (3-state)	0

TIBPAL16L8'
M SUFFIX . . . J OR W PACKAGE
C SUFFIX . . . J OR N PACKAGE
(TOP VIEW)



TIBPAL16L8'
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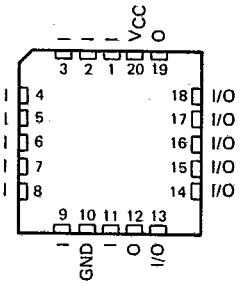
C SUFFIX . . . FN PACKAGE
(TOP VIEW)



Pin assignments in operating mode

description

These programmable array logic devices feature high speed and functional equivalency when compared with currently available devices. These IMPACT™ circuits combine the latest Advanced Low-Power Schottky† technology with proven titanium-tungsten fuses to provide reliable, high-performance substitutes for conventional TTL logic. Their easy programmability allows for quick design of "custom" functions and typically results in a more compact circuit board. In addition, chip carriers are available for further reduction in board space.

The TIBPAL16' M series is characterized for operation over the full military temperature range of −55°C to 125°C. The TIBPAL16' C series is characterized for operation from 0°C to 75°C.

IMPACT is a trademark of Texas Instruments Incorporated.
PAL is a registered trademark of Monolithic Memories, Inc.
†Integrated Schottky-Barrier diode-clamped transistor is patented by Texas Instruments, U.S. Patent Number 3,463,975.

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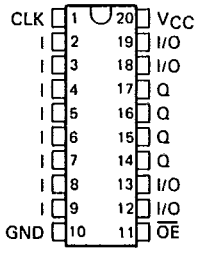
TIBPAL16R4-15M, TIBPAL16R6-15M, TIBPAL16R8-15M
TIBPAL16R4-12C, TIBPAL16R6-12C, TIBPAL16R8-12C
HIGH-PERFORMANCE *IMPACT*™*PAL*® CIRCUITS

TIBPAL16R4'
M SUFFIX . . . J OR W PACKAGE
C SUFFIX. . . J OR N PACKAGE
(TOP VIEW)



TIBPAL16R4'
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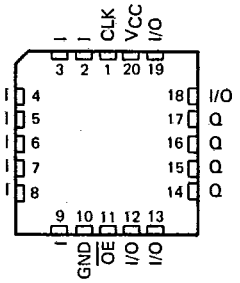
C SUFFIX . . . FN PACKAGE
(TOP VIEW)



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TIBPAL16R6'
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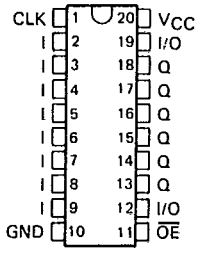
C SUFFIX . . . J OR N PACKAGE
(TOP VIEW)



TIBPAL16R6'
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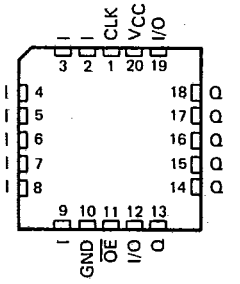
C SUFFIX . . . FN PACKAGE
(TOP VIEW)



TIBPAL16R8'
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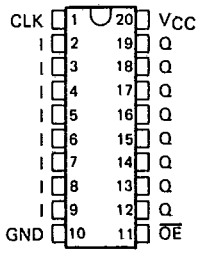
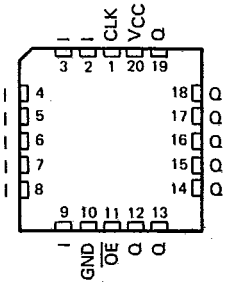
C SUFFIX . . . J OR N PACKAGE
(TOP VIEW)



TIBPAL16R8'
M SUFFIX . . . FK PACKAGE
C SUFFIX. . . FN PACKAGE
(TOP VIEW)



Pin assignments in operating mode

TEXAS INSTRUMENTS
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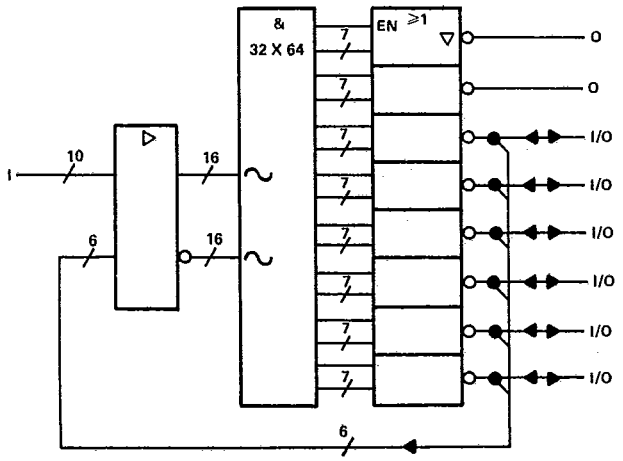
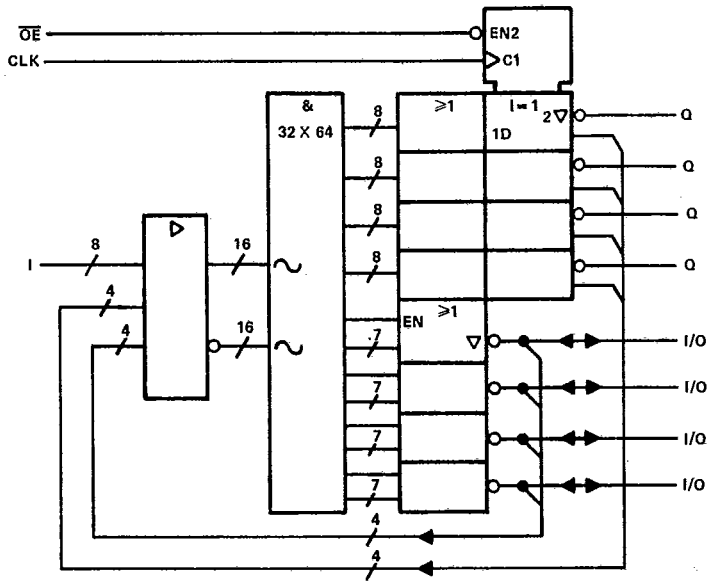
functional block diagrams (positive logic)

'PAL16L8



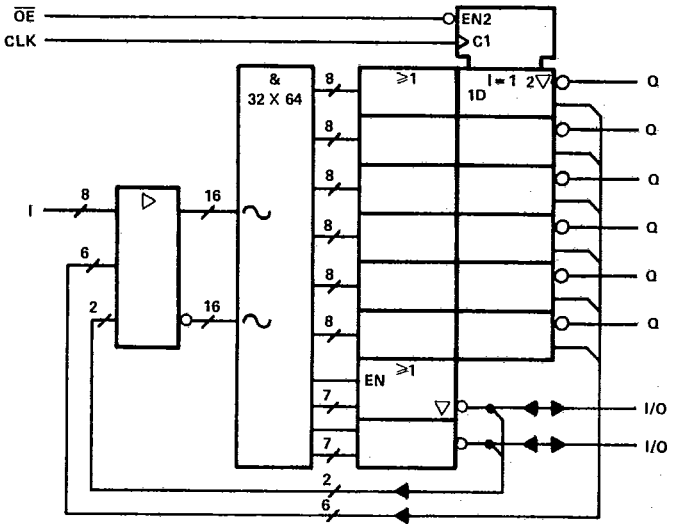
'PAL16R4



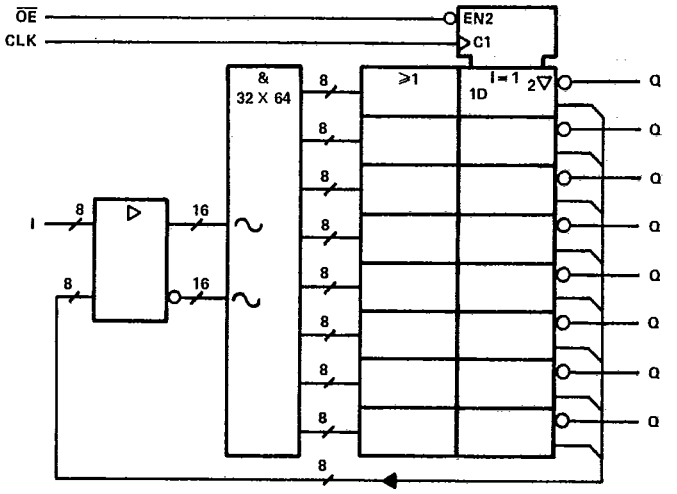
∼ denotes fused inputs

functional block diagrams (positive logic)

'PAL16R6



'PAL16R8



∿ denotes fused inputs

TEXAS INSTRUMENTS
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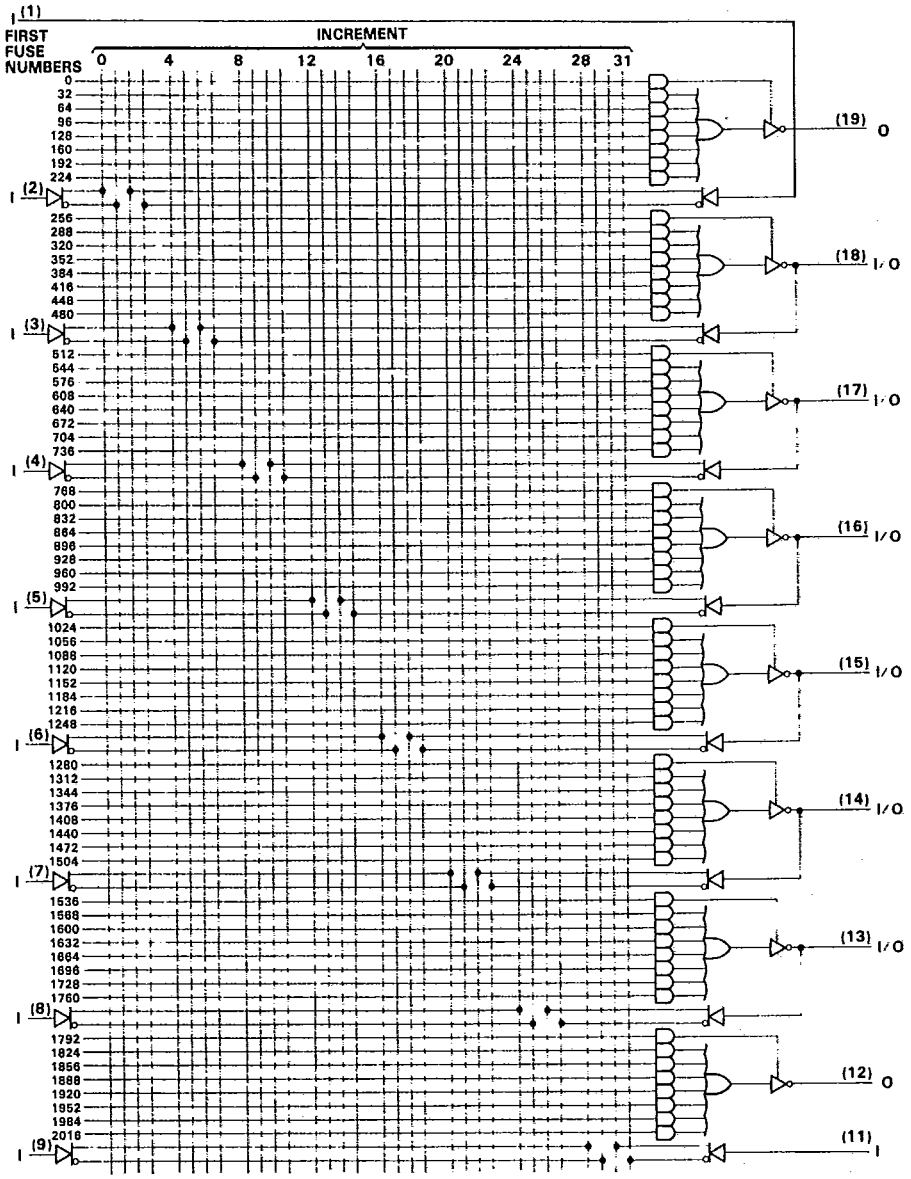
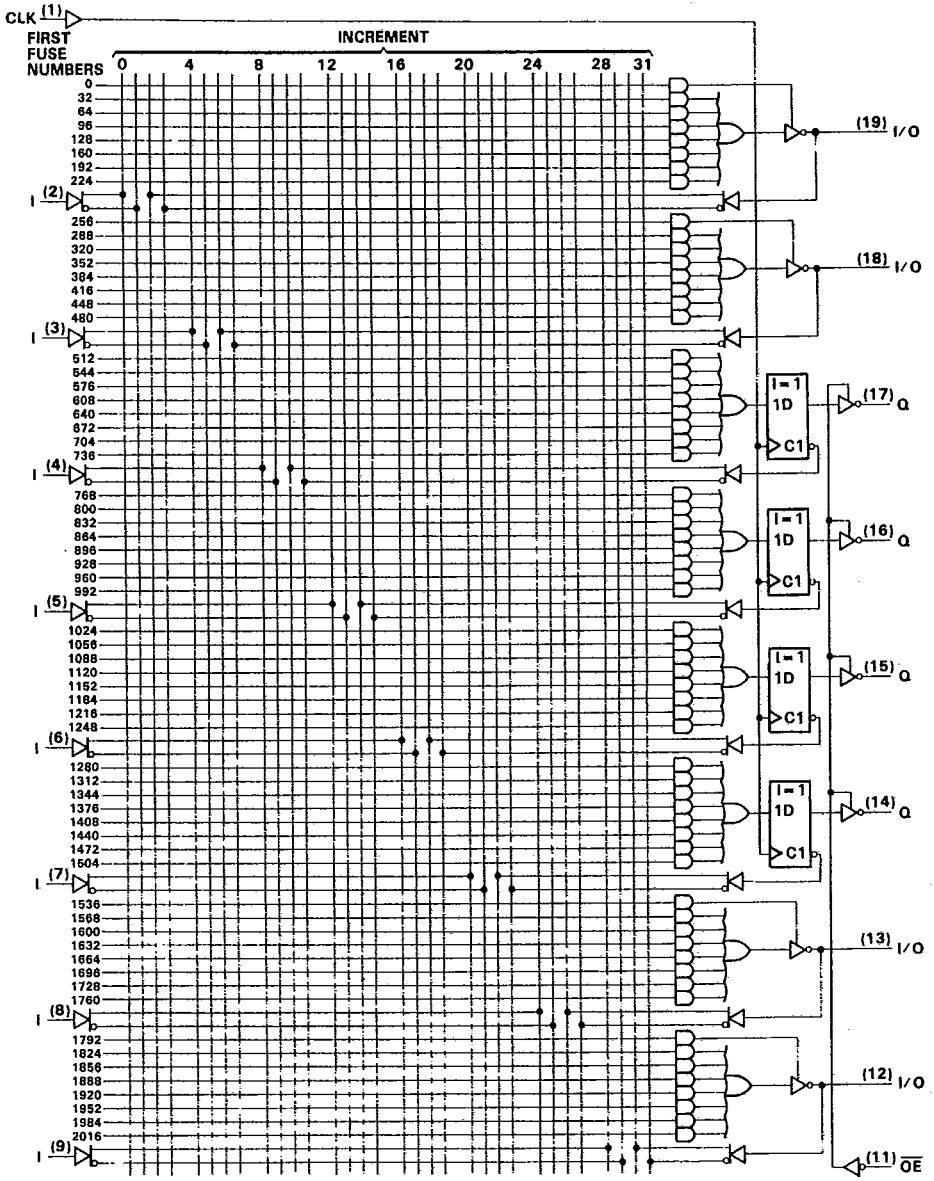
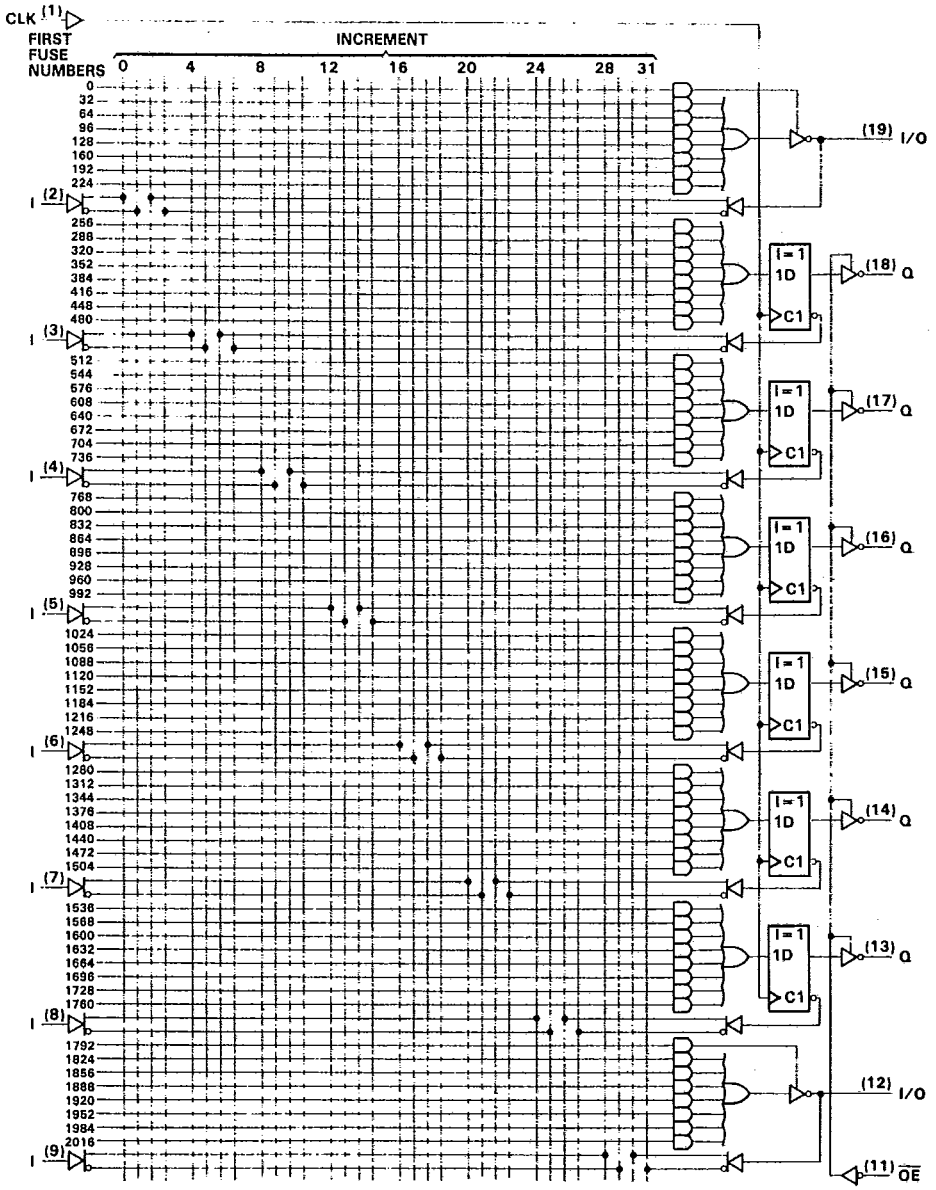


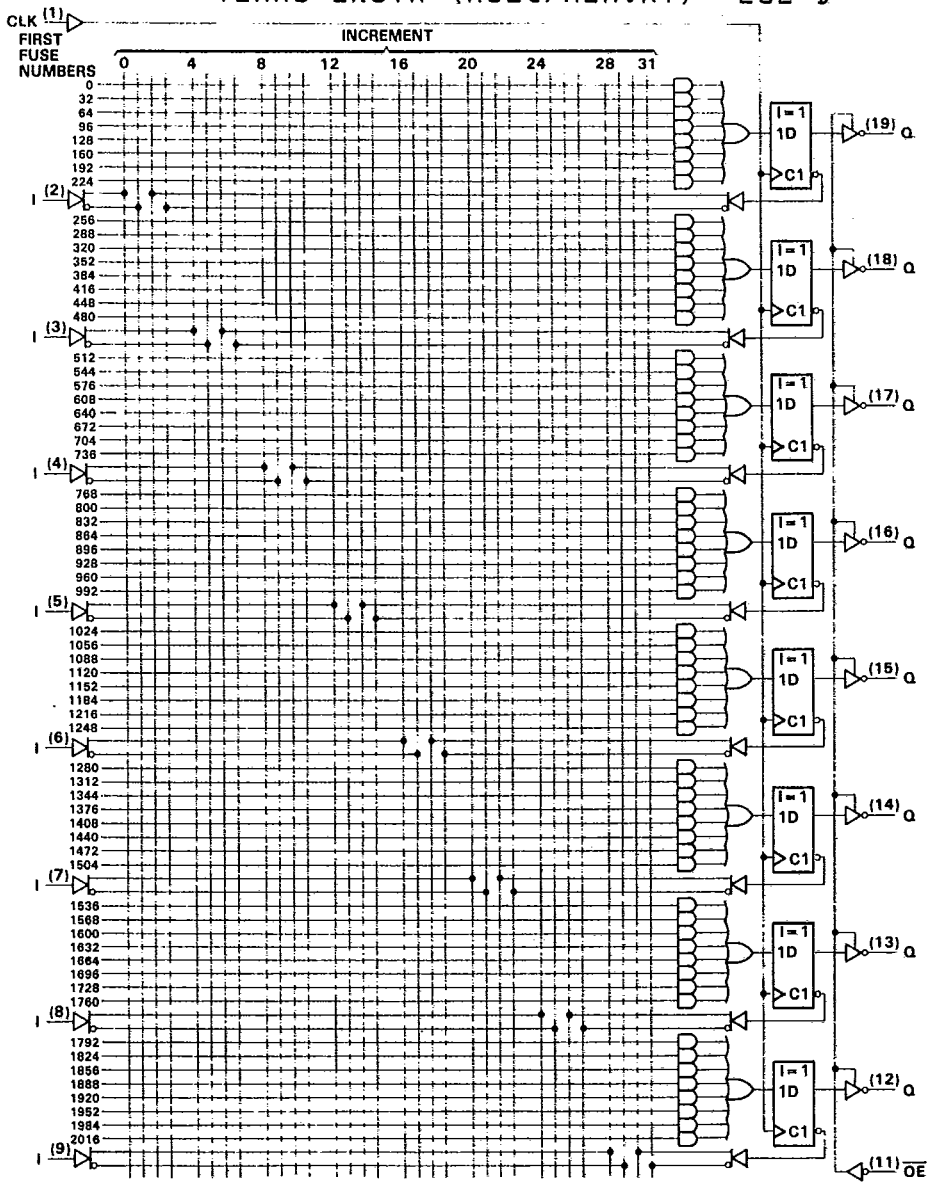
Fuse number = First Fuse number + Increment



Fuse number = First Fuse number + Increment



Fuse number = First Fuse number + Increment



Fuse number = First Fuse number + Increment

TEXAS INSTRUMENTS
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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC} (see Note 1) . . . . . 7 V
Input voltage (see Note 1) . . . . . 5.5 V
Voltage applied to a disabled output (see Note 1) . . . . . 5.5 V
Operating free-air temperature range . . . . . −55°C to 125°C
Storage temperature range . . . . . −65°C to 150°C

NOTE 1: These ratings apply except for programming pins during a programming cycle.

recommended operating conditions (see Note 2)

PARAMETER			MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage		4.5	5	5.5	V
V_{IH}	High-level input voltage		2		5.5	V
V_{IL}	Low-level input voltage				0.8	V
I_{OH}	High-level output current				−2	mA
I_{OL}	Low-level output current				12	mA
f_{clock}	Clock frequency		0		50	MHz
t_w	Pulse duration, clock (see Note 2)	High	9			ns
		Low	10			
t_{su}	Setup time, input or feedback before CLK↑		15			ns
t_h	Hold time, input or feedback after CLK↑		0			ns
T_A	Operating free-air temperature		−55		125	°C

NOTE 2: The total clock period of CLK high and CLK low must not exceed clock frequency, f_{clock}. Minimum pulse durations specified are only for CLK high or CLK low, but not for both simultaneously.

electrical characteristics over recommended operating free-air temperature range

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V_{IK}		V_{CC} = 4.5 V, I_I = −18 mA				−1.5	V
V_{OH}		V_{CC} = 4.5 V, I_{OH} = −2 mA		2.4	3.3		V
V_{OL}		V_{CC} = 4.5 V, I_{OL} = 12 mA			0.35	0.5	V
I_{OZH}	Outputs	V_{CC} = 5.5 V, V_O = 2.7 V				20	μA
	I/O ports					100	
I_{OZL}	Outputs	V_{CC} = 5.5 V, V_O = 0.4 V				−20	μA
	I/O ports					−250	
I_I		V_{CC} = 5.5 V, V_I = 5.5 V	Pin 1, 11			0.2	mA
			All others			0.1	
I_{IH}		V_{CC} = 5.5 V, V_I = 2.7 V	Pin 1, 11			50	μA
			I/O ports			100	
			All others			20	
I_{IL}		V_{CC} = 5.5 V, V_I = 0.4 V	I/O ports			−0.25	mA
			All others			−0.2	
I_{OS}‡		V_{CC} = 5.5 V, V_O = 0.5 V		−30		−250	mA
I_{CC}		V_{CC} = 5.5 V, V_I = 0, Outputs open			170	220	mA

†All typical values are at V_{CC} = 5 V, T_A = 25°C.
‡Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second. Set V_O at 0.5 V to avoid test equipment degradation.

switching characteristics over recommended supply voltage and operating free-air temperature ranges (unless otherwise noted)

PARAMETER	FROM	TO	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
f_{max}‡			R1 = 390 Ω, R2 = 750 Ω, See Figure 1	50			MHz
t_{pd}‡	I, I/O	O, I/O			8	15	ns
t_{pd}	CLK↑	Q			7	12	ns
t_{en}	OE↓	Q			8	12	ns
t_{dis}	OE↑	Q			7	12	ns
t_{en}	I, I/O	O, I/O			8	15	ns
t_{dis}	I, I/O	O, I/O			8	15	ns

†All typical values are at V_{CC} = 5 V, T_A 25°C.
‡Maximum operating frequency and propagation delay are specified for the basic building block. When using feedback, limits must be calculated accordingly.

TEXAS INSTRUMENTS
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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC} (see Note 1) . . . . . 7 V
Input voltage (see Note 1) . . . . . 5.5 V
Voltage applied to a disabled output (see Note 1) . . . . . 5.5 V
Operating free-air temperature range . . . . . 0°C to 75°C
Storage temperature range . . . . . −65°C to 150°C

NOTE 1: These ratings apply except for programming pins during a programming cycle.

recommended operating conditions (see Note 2)

PARAMETER			MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage		4.75	5	5.25	V
V_{IH}	High-level input voltage		2		5.5	V
V_{IL}	Low-level input voltage				0.8	V
I_{OH}	High-level output current				−3.2	mA
I_{OL}	Low-level output current				24	mA
f_{clock}	Clock frequency		0		62	MHz
t_w	Pulse duration, clock (see Note 2)	High	7			ns
		Low	8			
t_{su}	Setup time, input or feedback before CLK↑		10			ns
t_h	Hold time, input or feedback after CLK↑		0			ns
T_A	Operating free-air temperature		0		75	°C

NOTE 2: The total clock period of CLK high and CLK low must not exceed clock frequency, f_{clock}. Minimum pulse durations specified are only for CLK high or CLK low, but not for both simultaneously.

electrical characteristics over recommended operating free-air temperature range

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V_{IK}		V_{CC} = 4.75 V, I_I = −18 mA				−1.5	V
V_{OH}		V_{CC} = 4.75 V, I_{OH} = −3.2 mA		2.4	3.3		V
V_{OL}		V_{CC} = 4.75 V, I_{OL} = 24 mA			0.35	0.5	V
I_{OZH}	Outputs	V_{CC} = 5.25 V, V_O = 2.7 V				20	μA
	I/O ports					100	
I_{OZL}	Outputs	V_{CC} = 5.25 V, V_O = 0.4 V				−20	μA
	I/O ports					−250	
I_I		V_{CC} = 5.25 V, V_I = 5.5 V	Pin 1, 11			0.1	mA
			All others			0.1	
I_{IH}		V_{CC} = 5.25 V, V_I = 2.7 V	Pin 1, 11			20	μA
			All others			20	
I_{IL}		V_{CC} = 5.25 V, V_I = 0.4 V				−0.2	mA
I_O‡		V_{CC} = 5.25 V, V_O = 0.5 V		−30		−125	mA
I_{CC}		V_{CC} = 5.25 V, V_I = 0, Outputs open			170	200	mA

†All typical values are at V_{CC} = 5 V, T_A = 25°C.
‡The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS}.

switching characteristics over recommended supply voltage and operating free-air temperature ranges (unless otherwise noted)

PARAMETER	FROM	TO	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
f_{max}‡				62			MHz
t_{pd}‡	I, I/O	O, I/O			8	12	ns
t_{pd}	CLK↑	Q	R1 = 500 Ω,		7	10	ns
t_{en}	OE↓	Q	R2 = 500 Ω,		8	10	ns
t_{dis}	OE↑	Q	See Figure 1		7	10	ns
t_{en}	I, I/O	O, I/O			8	12	ns
t_{dis}	I, I/O	O, I/O			8	12	ns

†All typical values are at V_{CC} = 5 V, T_A = 25°C.
‡Maximum operating frequency and propagation delay are specified for the basic building block. When using feedback, limits must be calculated accordingly.

programming information

Texas Instruments Programmable Logic Devices can be programmed using widely available software and inexpensive device programmers.

Complete programming specifications, algorithms, and the latest information on hardware, software, and firmware are available upon request. Information on programmers capable of programming Texas Instruments Programmable Logic is also available, upon request, from the nearest TI field sales office, local authorized TI distributor, or by calling Texas Instruments at (214) 995-5666.

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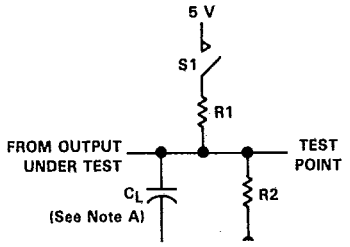
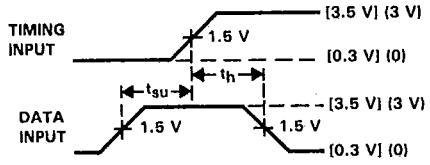
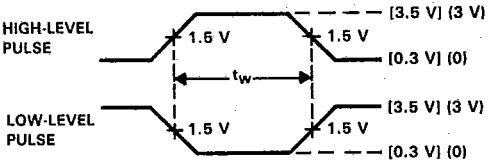
PARAMETER MEASUREMENT INFORMATION



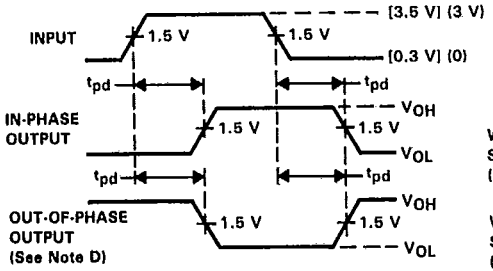
LOAD CIRCUIT FOR THREE-STATE OUTPUTS



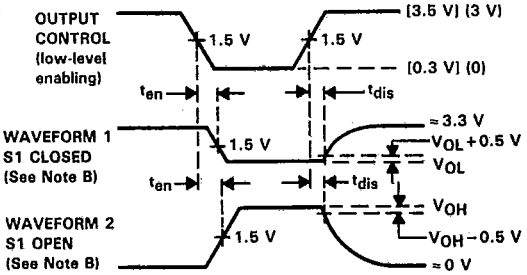
VOLTAGE WAVEFORMS SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS PULSE DURATIONS



VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS ENABLE AND DISABLE TIMES, THREE-STATE OUTPUTS

NOTES: A. C_L includes probe and jig capacitance and is 50 pF for t_{pd} and t_{en}, 5 pF for t_{dis}.
B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
C. All input pulses have the following characteristics: For M suffix, use voltage levels indicated in parentheses ( ), PRR ≤ 10 MHz, t_r and t_f ≤ 2 ns, duty cycle = 50%. For C suffix, use the voltage levels indicated in brackets [ ], PRR ≤ 1 MHz, $t_r = t_f$ = 2 ns, duty cycle = 50%.
D. When measuring propagation delay times of 3-state outputs, switch S1 is closed.
E. Equivalent loads may be used for testing.

FIGURE 1