

# TIBPAL 16L8-15C, TIBPAL 16R4-15C, TIBPAL 16R6-15C, TIBPAL 16R8-15C TIBPAL 16L8-20M, TIBPAL 16R4-20M, TIBPAL 16R6-20M, TIBPAL 16R8-20M HIGH-PERFORMANCE *IMPACT*™ PAL® CIRCUITS

SRPS019A – FEBRUARY 1984 – REVISED APRIL 2000

- **High-Performance Operation:**  
Propagation Delay  
C Suffix . . . 15 ns Max  
M Suffix . . . 20 ns Max
- **Functionally Equivalent, but Faster Than**  
PAL16L8A, PAL16R4A, PAL16R6A, and  
PAL16R8A
- **Power-Up Clear on Registered Devices (All**  
Register 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	I INPUTS	3-STATE O OUTPUTS	REGISTERED Q OUTPUTS	I/O PORTS
PAL16L8	10	2	0	6
PAL16R4	8	0	4 (3-state buffers)	4
PAL16R6	8	0	6 (3-state buffers)	2
PAL16R8	8	0	8 (3-state buffers)	0

## 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.

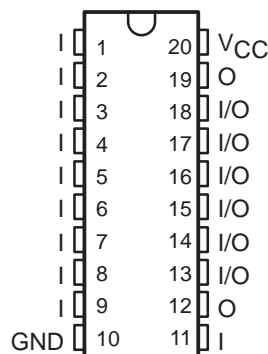
The TIBPAL16' C series is characterized from 0°C to 75°C. The TIBPAL16' M series is characterized for operation over the full military temperature range of -55°C to 125°C.



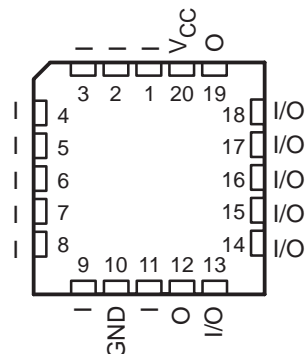
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

These devices are covered by U.S. Patent 4,410,987.  
IMPACT is a trademark of Texas Instruments.  
PAL is a registered trademark of Advanced Micro Devices Inc.

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



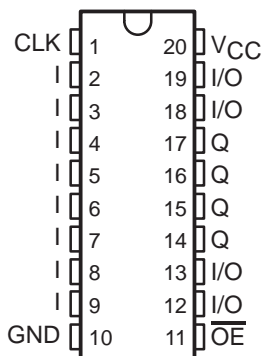
TIBPAL16L8'  
C SUFFIX . . . FN PACKAGE  
M SUFFIX . . . FK PACKAGE  
(TOP VIEW)



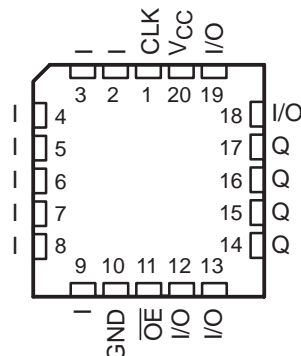
TIBPAL 16R4-15C, TIBPAL 16R6-15C, TIBPAL 16R8-15C  
 TIBPAL 16R4-20M, TIBPAL 16R6-20M, TIBPAL 16R8-20M  
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SRPS019A – FEBRUARY 1984 – REVISED APRIL 2000

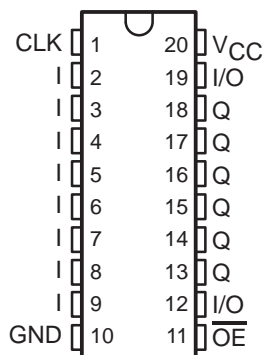
**TIBPAL16R4'**  
 C SUFFIX ... J OR N PACKAGE  
 M SUFFIX ... J OR W PACKAGE  
 (TOP VIEW)



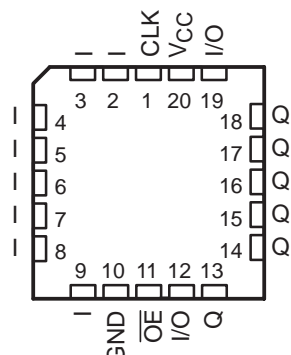
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 M SUFFIX ... FK PACKAGE  
 (TOP VIEW)



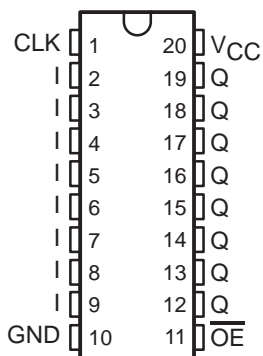
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 M SUFFIX ... J OR W PACKAGE  
 (TOP VIEW)



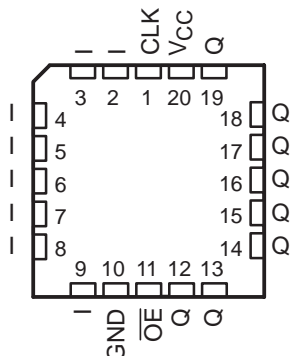
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 M SUFFIX ... FK PACKAGE  
 (TOP VIEW)



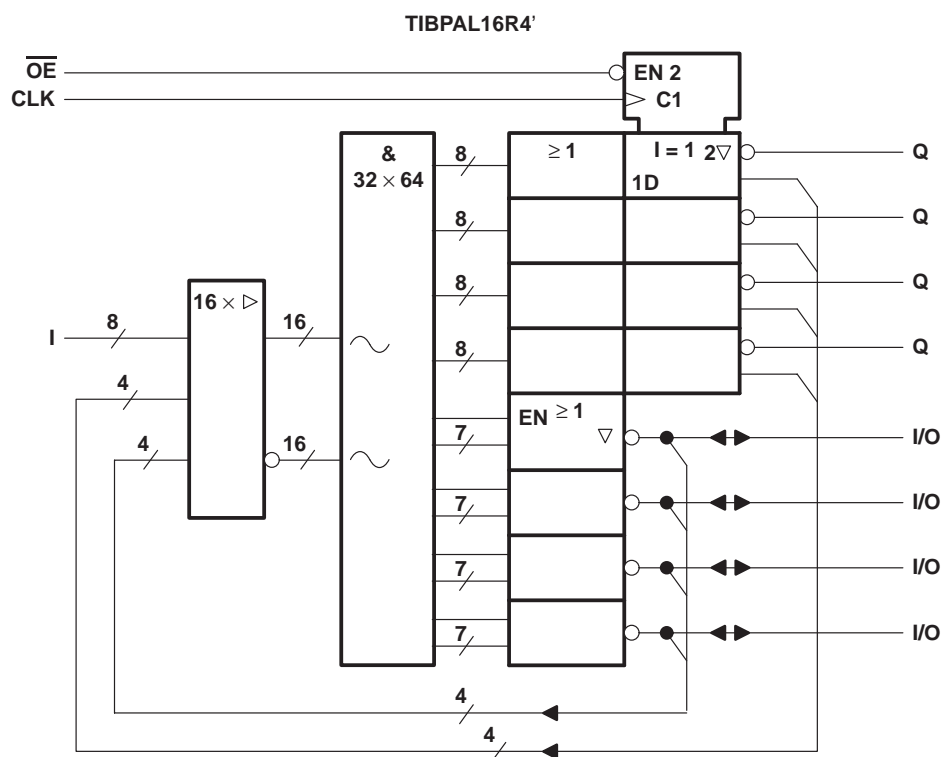
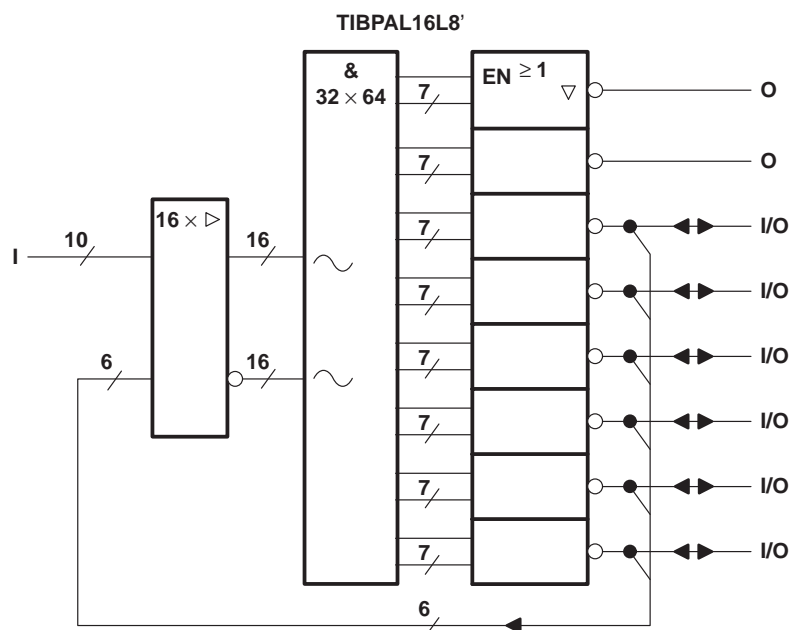
**TIBPAL16R8'**  
 C SUFFIX ... J OR N PACKAGE  
 M SUFFIX ... J OR W PACKAGE  
 (TOP VIEW)



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



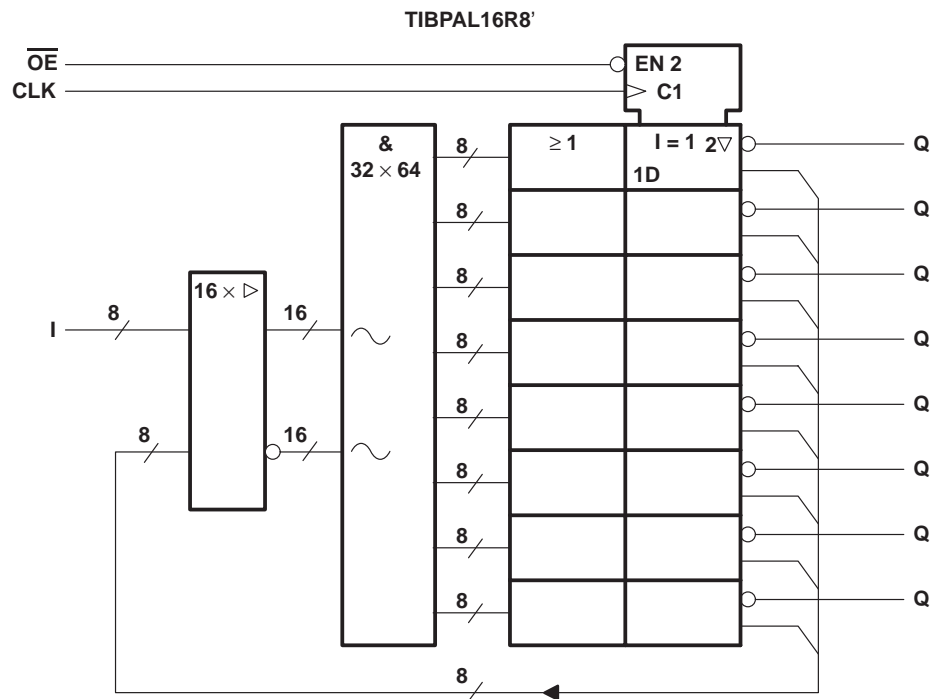
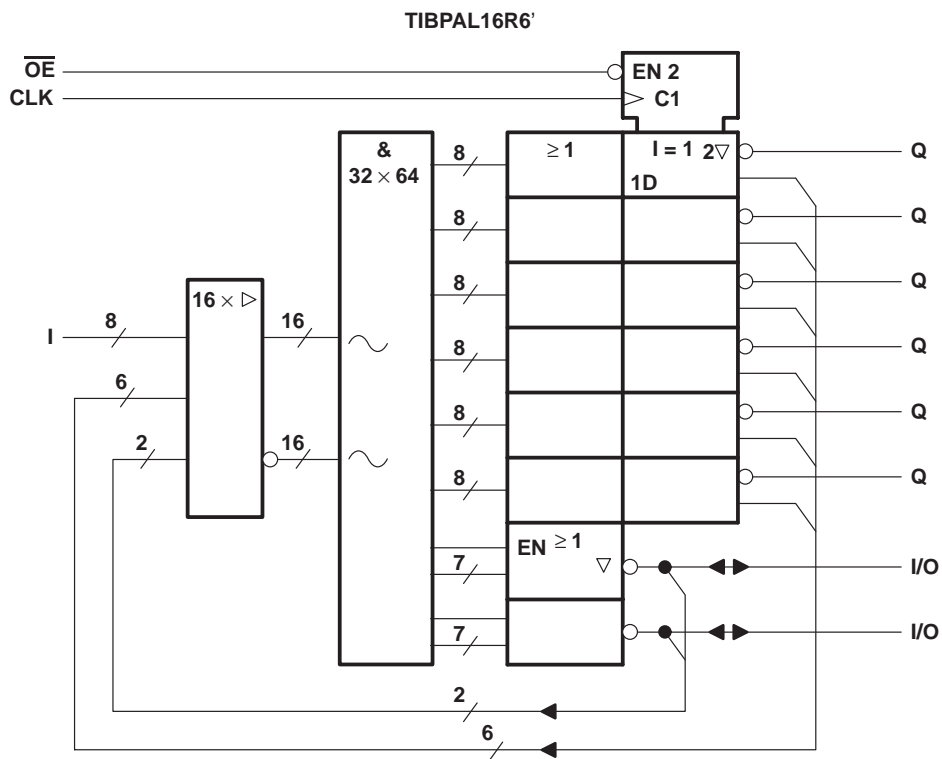
functional block diagrams (positive logic)



~ denotes fused inputs

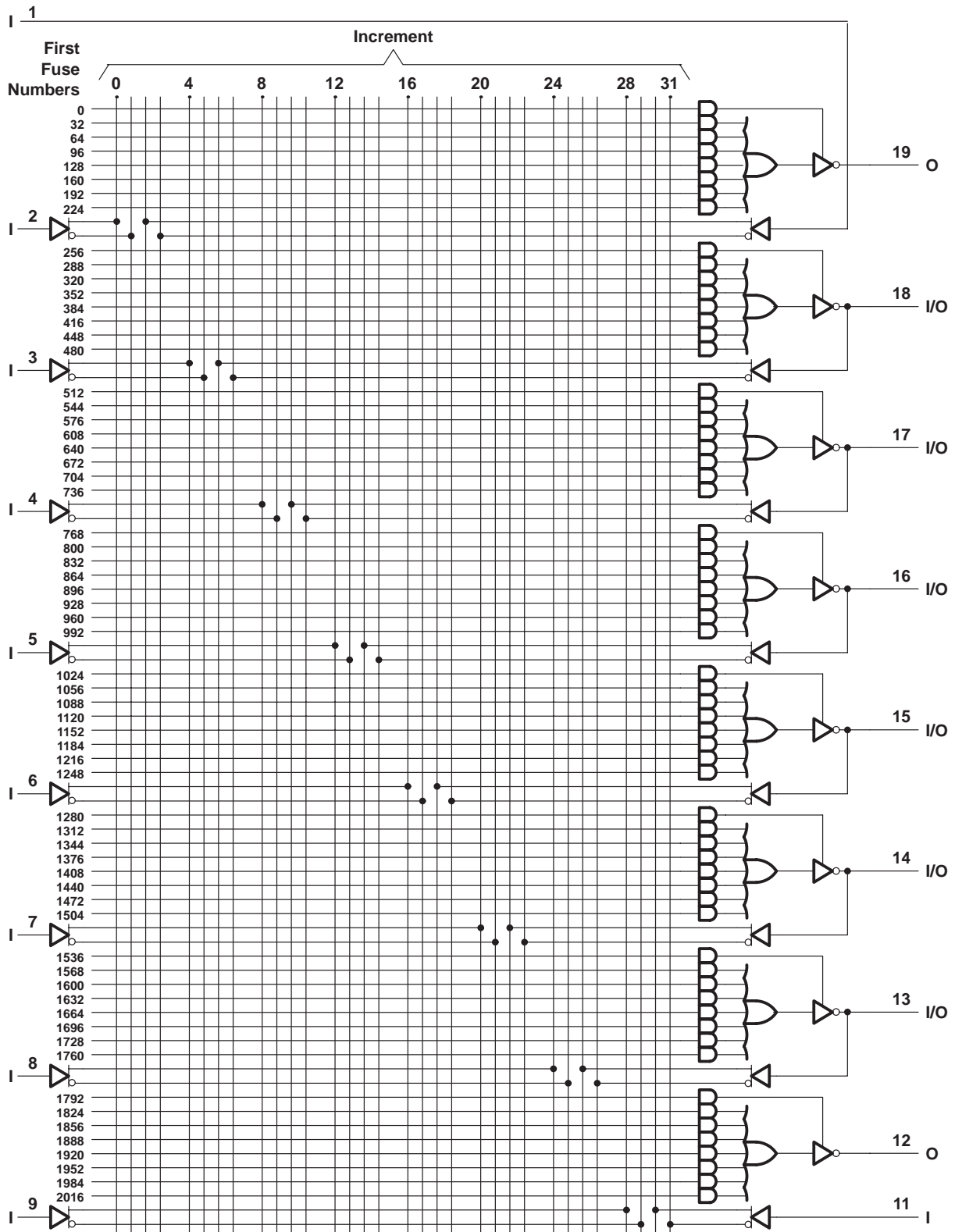
TIBPAL 16R6-15C, TIBPAL 16R8-15C  
 TIBPAL 16R6-20M, TIBPAL 16R8-20M  
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functional block diagrams (positive logic)



⋯ denotes fused inputs

logic diagram (positive logic)



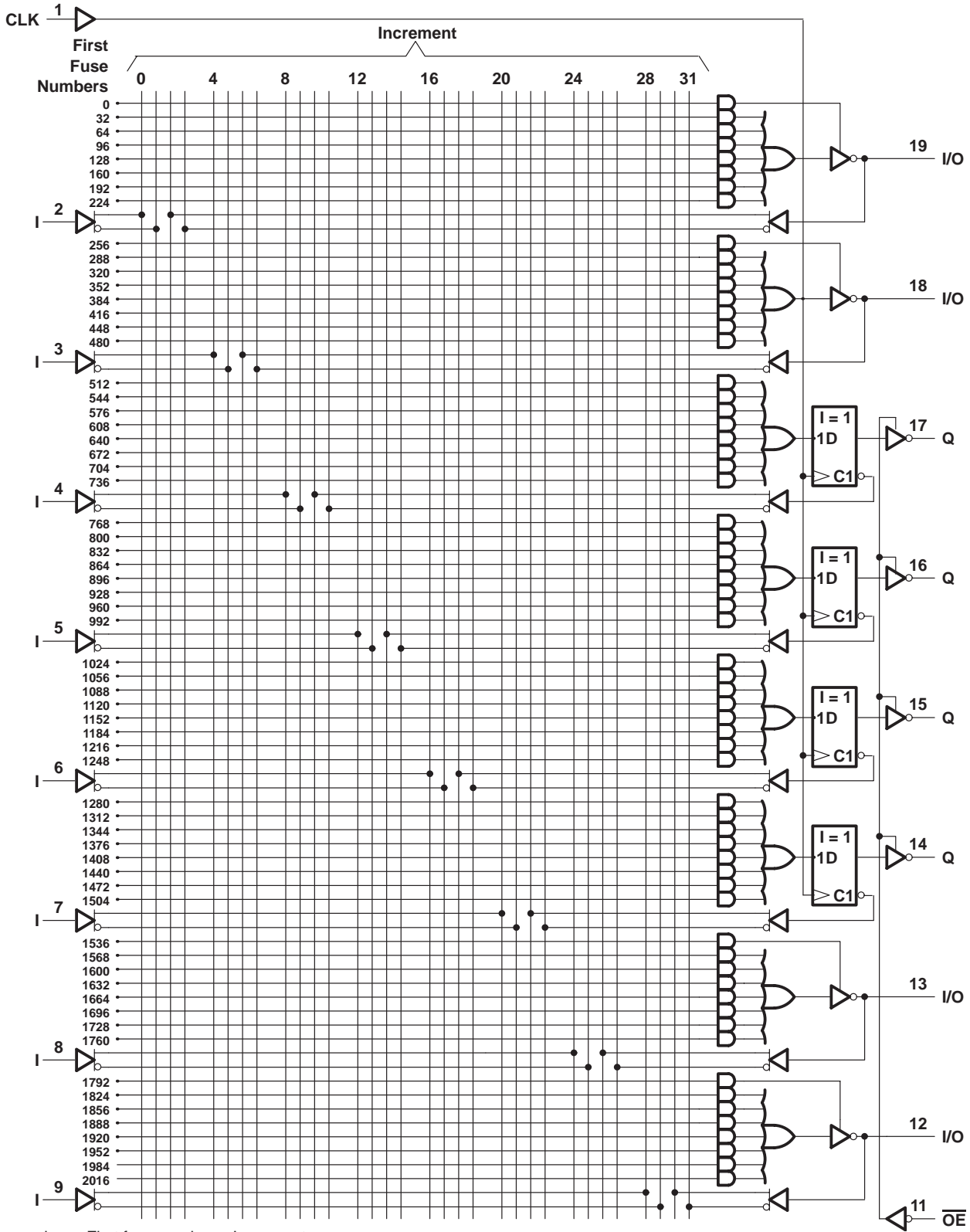
Fuse number = First fuse number + Increment



# TIBPAL 16R4-15C TIBPAL 16R4-20M HIGH-PERFORMANCE *IMPACT*™ PAL® CIRCUITS

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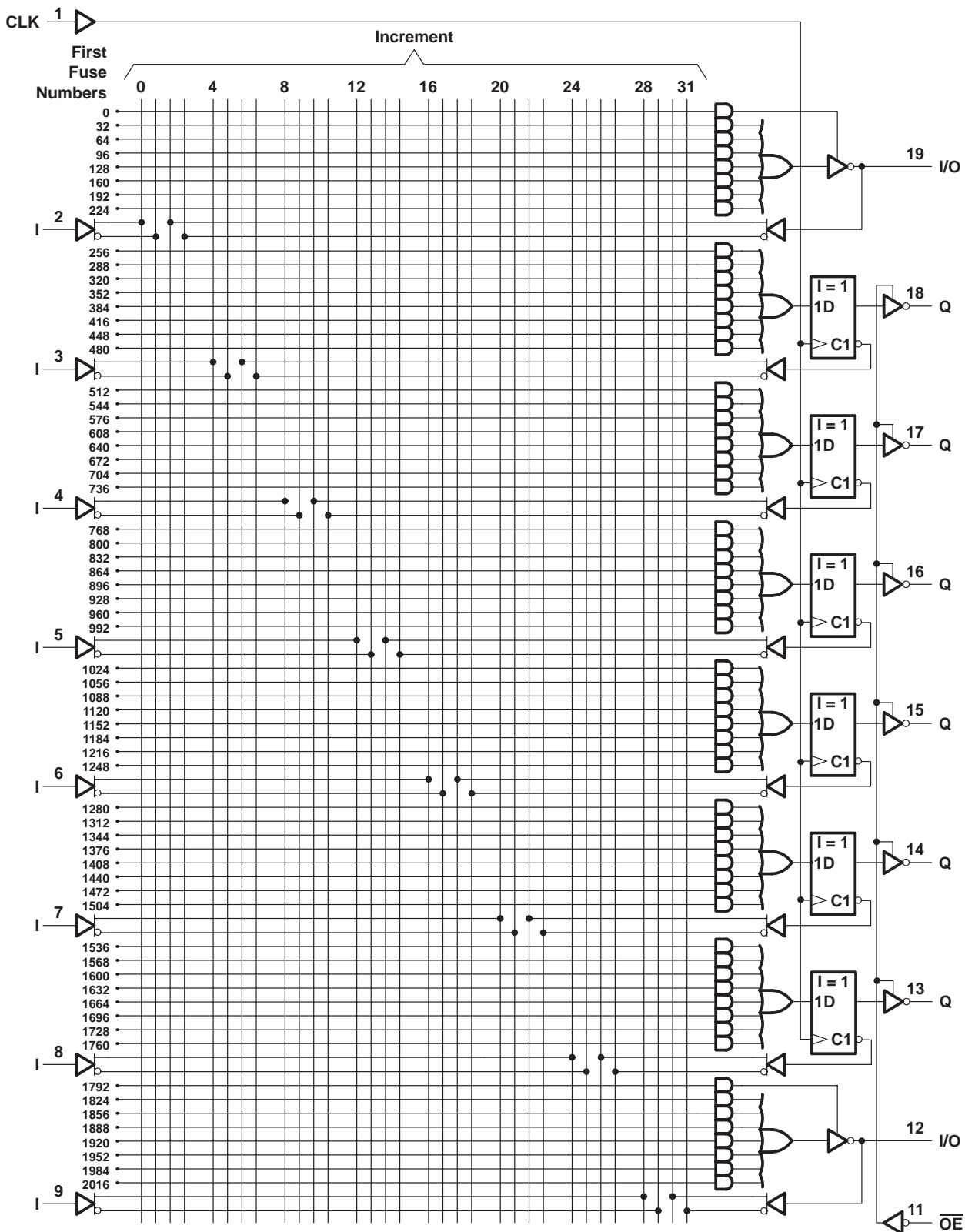
## logic diagram (positive logic)



Fuse number = First fuse number + Increment



logic diagram (positive logic)



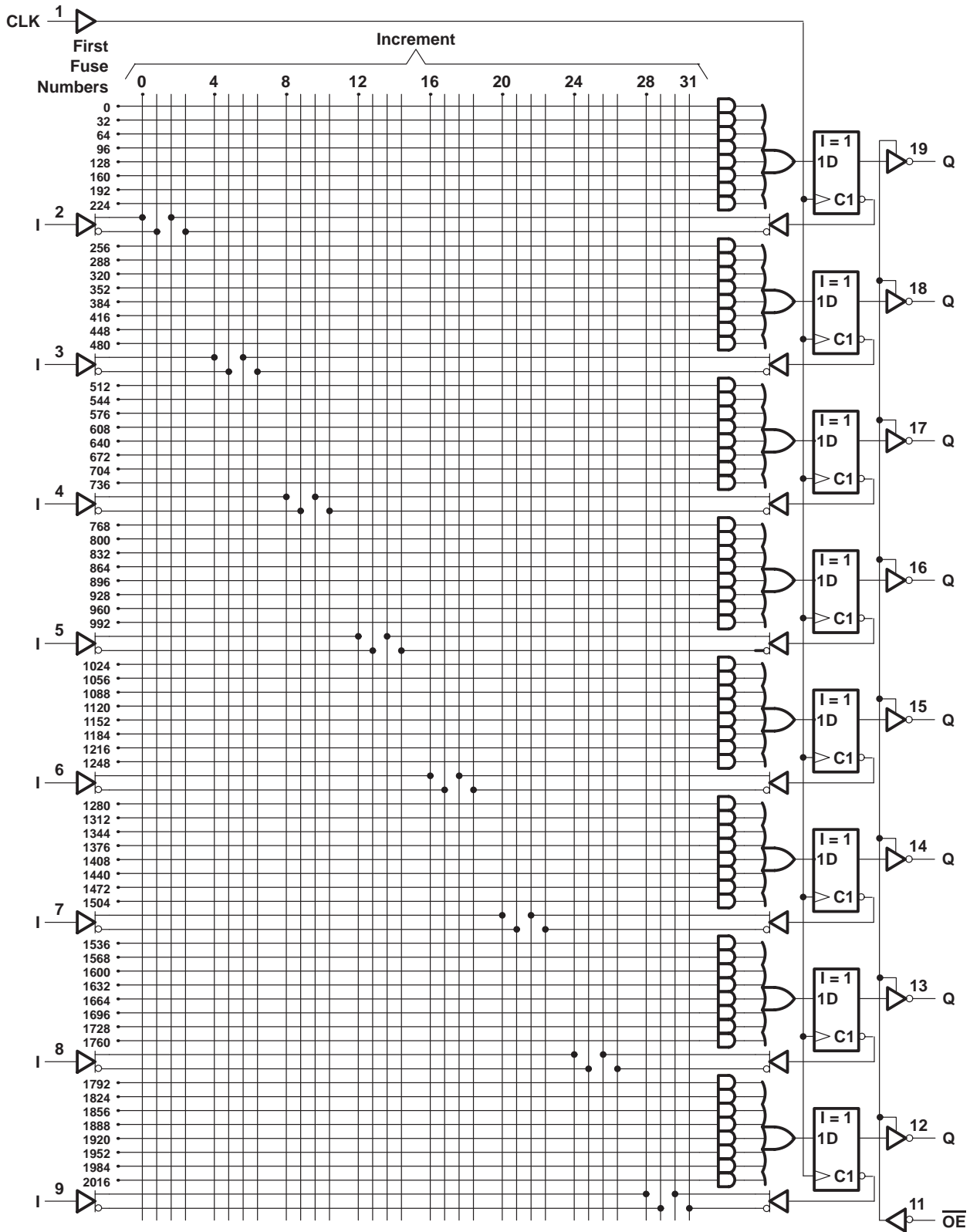
Fuse number = First fuse number + Increment



# TIBPAL 16R8-15C TIBPAL 16R8-20M HIGH-PERFORMANCE *IMPACT*™ PAL® CIRCUITS

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## logic diagram (positive logic)



Fuse number = First fuse number + Increment



# TIBPAL 16L8-15C, TIBPAL 16R4-15C, TIBPAL 16R6-15C, TIBPAL 16R8-15C HIGH-PERFORMANCE *IMPACT*™ *PAL*® CIRCUITS

SRPS019A – FEBRUARY 1984 – REVISED APRIL 2000

## 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 disabled output (see Note 1) .....	5.5 V
Operating free-air temperature range .....	0°C to 75°C
Storage temperature range, $T_{stg}$ .....	-65°C to 150°C

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

## recommended operating conditions

		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		50	MHz
$t_w$	Pulse duration, clock (see Note 2)	High	8		ns
		Low	9		
$t_{su}$	Setup time, input or feedback before clock↑	15			ns
$t_h$	Hold time, input or feedback after clock↑	0			ns
$T_A$	Operating free-air temperature	0	25	75	°C

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

# TIBPAL 16L8-15C, TIBPAL 16R4-15C, TIBPAL 16R6-15C, TIBPAL 16R8-15C HIGH-PERFORMANCE *IMPACT*™ *PAL*® CIRCUITS

SRPS019A – FEBRUARY 1984 – REVISED APRIL 2000

## electrical characteristics over recommended operating free-air temperature range

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V <sub>IK</sub>		V <sub>CC</sub> = 4.75 V,	I <sub>I</sub> = -18 mA			-1.5	V
V <sub>OH</sub>		V <sub>CC</sub> = 4.75 V,	I <sub>OH</sub> = -3.2 mA	2.4	3.3		V
V <sub>OL</sub>		V <sub>CC</sub> = 4.75 V,	I <sub>OL</sub> = 24 mA		0.35	0.5	V
I <sub>IOZH</sub>	Outputs	V <sub>CC</sub> = 5.25 V,	V <sub>O</sub> = 2.7 V			20	μA
	I/O ports					100	
I <sub>IOZL</sub>	Outputs	V <sub>CC</sub> = 5.25 V,	V <sub>O</sub> = 0.4 V			-20	μA
	I/O ports					-250	
I <sub>I</sub>		V <sub>CC</sub> = 5.25 V,	V <sub>I</sub> = 5.5 V			0.1	mA
I <sub>IH</sub>		V <sub>CC</sub> = 5.25 V,	V <sub>I</sub> = 2.7 V			20	μA
I <sub>IL</sub>		V <sub>CC</sub> = 5.25 V,	V <sub>I</sub> = 0.4 V			-0.2	mA
I <sub>O‡</sub>		V <sub>CC</sub> = 5.25 V,	V <sub>O</sub> = 2.25 V	-30		-125	mA
I <sub>CC</sub>		V <sub>CC</sub> = 5.25 V,	V <sub>I</sub> = 0, Outputs open		140	180	mA

† All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

‡ The output conditions have been chosen to produce a current that closely approximates one-half of the short-circuit output current, I<sub>OS</sub>.

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
f <sub>max</sub>			R1 = 500 Ω, R2 = 500 Ω, See Figure 3	50			MHz
t <sub>pd</sub>	I, I/O	O, I/O		10	15		ns
t <sub>pd</sub>	CLK↑	Q		8	12		ns
t <sub>en</sub>	OE↓	Q		8	12		ns
t <sub>dis</sub>	OE↑	Q		7	10		ns
t <sub>en</sub>	I, I/O	O, I/O		10	15		ns
t <sub>dis</sub>	I, I/O	O, I/O		10	15		ns

† All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.



**TIBPAL 16L8-20M, TIBPAL 16R4-20M, TIBPAL 16R6-20M, TIBPAL 16R8-20M  
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SRPS019A – FEBRUARY 1984 – REVISED APRIL 2000

**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 disabled output (see Note 1) .....	5.5 V
Operating free-air temperature range .....	-55°C to 125°C
Storage temperature range, $T_{stg}$ .....	-65°C to 150°C

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

**recommended operating conditions**

		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		41.6	MHz
$t_w$	Pulse duration, clock (see Note 2)	High	10		ns
		Low	11		
$t_{su}$	Setup time, input or feedback before clock↑	20			ns
$t_h$	Hold time, input or feedback after clock↑	0			ns
$T_A$	Operating free-air temperature	-55	25	125	°C

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

# TIBPAL 16L8-20M, TIBPAL 16R4-20M, TIBPAL 16R6-20M, TIBPAL 16R8-20M

## HIGH-PERFORMANCE *IMPACT*™ *PAL*® CIRCUITS

SRPS019A – FEBRUARY 1984 – REVISED APRIL 2000

### electrical characteristics over recommended operating free-air temperature range

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V <sub>IK</sub>		V <sub>CC</sub> = 4.5 V,	I <sub>I</sub> = -18 mA			-1.5	V
V <sub>OH</sub>		V <sub>CC</sub> = 4.5 V,	I <sub>OH</sub> = -2 mA	2.4	3.2		V
V <sub>OL</sub>		V <sub>CC</sub> = 4.5 V,	I <sub>OL</sub> = 12 mA		0.25	0.4	V
I <sub>OZH</sub>	Outputs	V <sub>CC</sub> = 5.5 V,	V <sub>O</sub> = 2.7 V			20	μA
	I/O ports					100	
I <sub>OZL</sub>	Outputs	V <sub>CC</sub> = 5.5 V,	V <sub>O</sub> = 0.4 V			-20	μA
	I/O ports					-250	
I <sub>I</sub>	Pin 1, 11	V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 5.5 V			0.2	mA
	All others					0.1	
I <sub>IH</sub>	Pin 1, 11	V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 2.7 V			50	μA
	I/O ports					100	
	All others					20	
I <sub>IL</sub>	I/O ports	V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 0.4 V			-0.25	mA
	All others					-0.2	
I <sub>OS‡</sub>		V <sub>CC</sub> = 5.5 V,	V <sub>O</sub> = 0.5 V	-30		-250	mA
I <sub>CC</sub>		V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 0,      Outputs open		140	190	mA

† All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.‡ Not more than one output should be shorted at a time and the duration of the short circuit should not exceed one second. Set V<sub>O</sub> at 0.5 V to avoid test-equipment degradation.

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
f <sub>max</sub>			R1 = 390 Ω, R2 = 750 Ω, See Figure 4	41.6			MHz
t <sub>pd</sub>	I, I/O	O, I/O			10	20	ns
t <sub>pd</sub>	CLK↑	Q			8	15	ns
t <sub>en</sub>	OE↓	Q			8	15	ns
t <sub>dis</sub>	OE↑	Q			7	15	ns
t <sub>en</sub>	I, I/O	O, I/O			10	20	ns
t <sub>dis</sub>	I, I/O	O, I/O			10	20	ns

† All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

## programming information

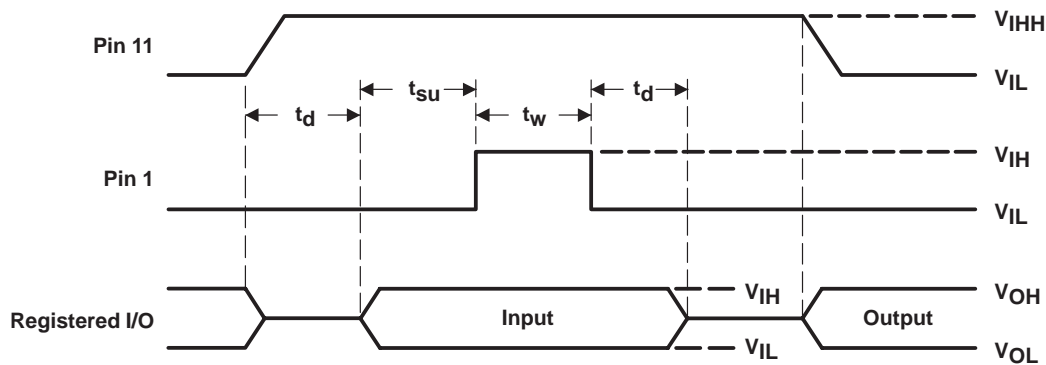
Texas Instruments programmable logic devices can be programmed using widely available software and inexpensive device programmers.

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 also is available, upon request, from the nearest TI field sales office or local authorized TI distributor, by calling Texas Instruments at +1 (972) 644-5580, or by visiting the TI Semiconductor Home Page at [www.ti.com/sc](http://www.ti.com/sc).

## preload procedure for registered outputs (see Figure 1 and Note 3)

The output registers can be preloaded to any desired state during device testing. This permits any state to be tested without having to step through the entire state-machine sequence. Each register is preloaded individually by following the steps given below.

- Step 1. With  $V_{CC}$  at 5 V and Pin 1 at  $V_{IL}$ , raise Pin 11 to  $V_{IHH}$ .
- Step 2. Apply either  $V_{IL}$  or  $V_{IH}$  to the output corresponding to the register to be preloaded.
- Step 3. Pulse Pin 1, clocking in preload data.
- Step 4. Remove output voltage, then lower Pin 11 to  $V_{IL}$ . Preload can be verified by observing the voltage level at the output pin.



NOTE 3:  $t_d = t_{su} = t_h = 100$  ns to 1000 ns  $V_{IHH} = 10.25$  V to 10.75 V

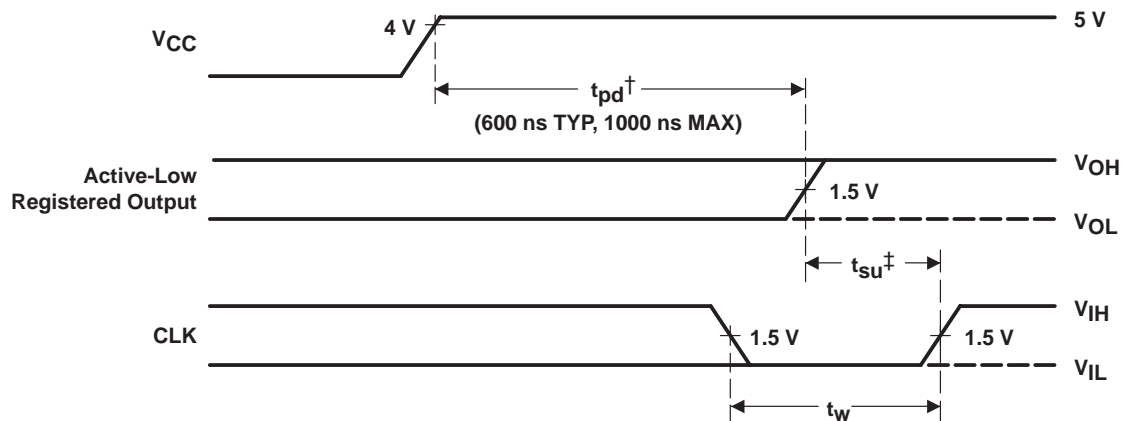
Figure 1. Preload Waveforms

TIBPAL 16L8-15C, TIBPAL 16R4-15C, TIBPAL 16R6-15C, TIBPAL 16R8-15C  
 TIBPAL 16L8-20M, TIBPAL 16R4-20M, TIBPAL 16R6-20M, TIBPAL 16R8-20M  
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SRPS019A – FEBRUARY 1984 – REVISED APRIL 2000

**power-up reset (see Figure 2)**

Following power up, all registers are set high. This feature provides extra flexibility to the system designer and is especially valuable in simplifying state-machine initialization. To ensure a valid power-up reset, it is important that the rise of  $V_{CC}$  be monotonic. Following power-up reset, a low-to-high clock transition must not occur until all applicable input and feedback setup times are met.

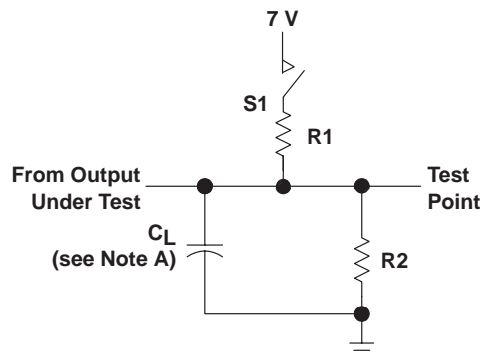


† This is the power-up reset time and applies to registered outputs only. The values shown are from characterization data.

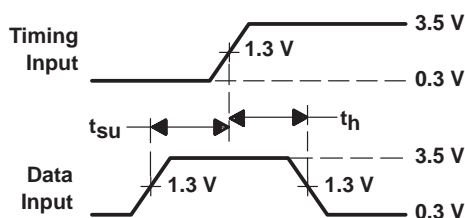
‡ This is the setup time for input or feedback.

**Figure 2. Power-Up Reset Waveforms**

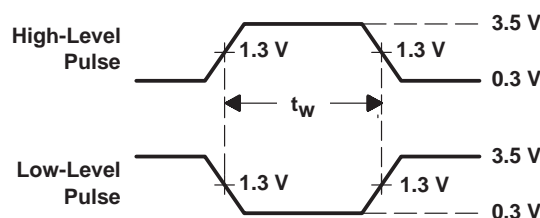
PARAMETER MEASUREMENT INFORMATION



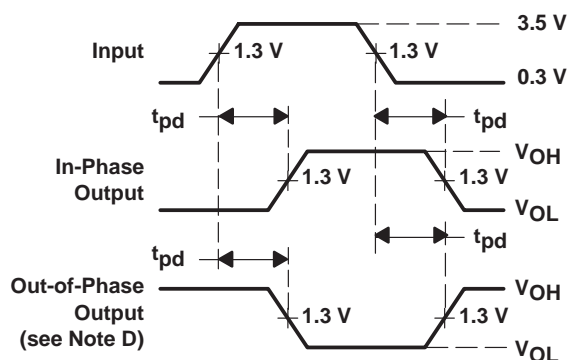
LOAD CIRCUIT FOR 3-STATE OUTPUTS



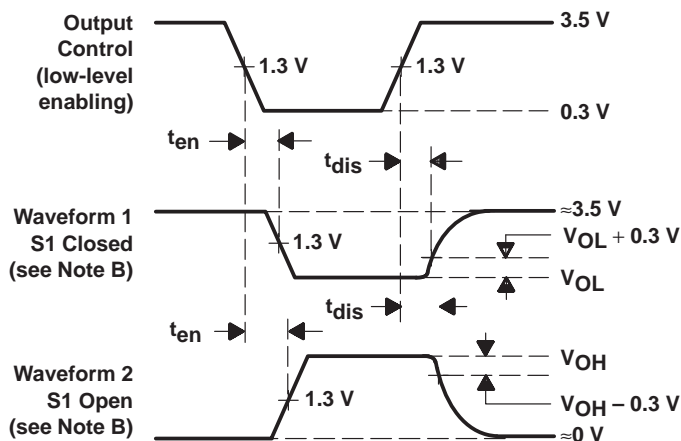
VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS  
PULSE DURATIONS



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES, 3-STATE OUTPUTS

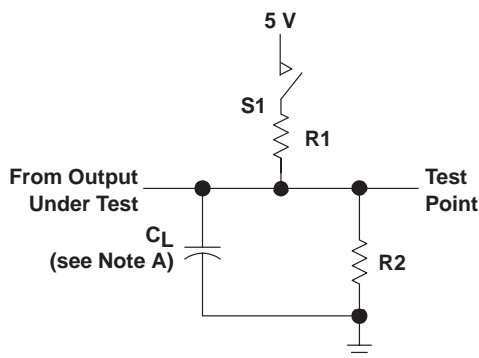
- NOTES: A.  $C_L$  includes probe and jig capacitance and is 50 pF for  $t_{pd}$  and  $t_{en}$ , 5 pF for  $t_{dis}$ .  
 B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.  
 C. All input pulses have the following characteristics:  $PRR \leq 1$  MHz,  $t_r = t_f \leq 2$  ns, duty cycle = 50%.  
 D. When measuring propagation delay times of 3-state outputs from low to high, switch S1 is closed. When measuring propagation delay times of 3-state outputs from high to low, switch S1 is open.  
 E. Equivalent loads may be used for testing.

Figure 3. Load Circuit and Voltage Waveforms

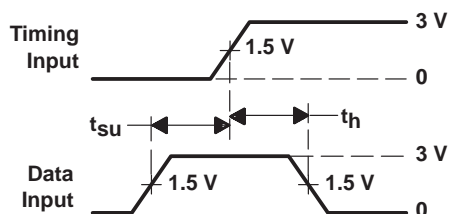
# TIBPAL 16L8-20M, TIBPAL 16R4-20M, TIBPAL 16R6-20M, TIBPAL 16R8-20M HIGH-PERFORMANCE *IMPACT*™ *PAL*® CIRCUITS

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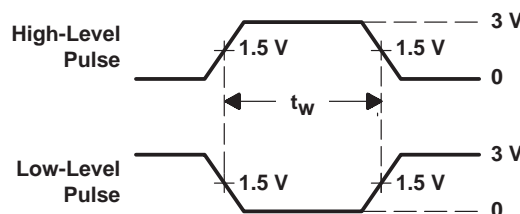
## PARAMETER MEASUREMENT INFORMATION



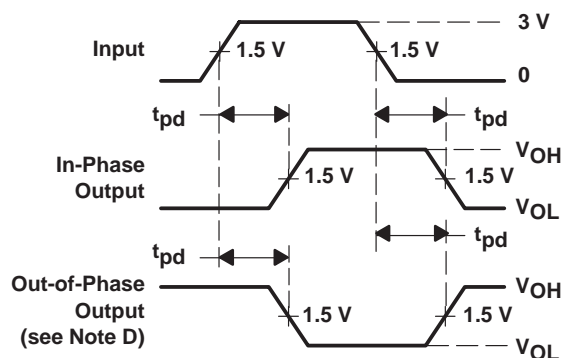
LOAD CIRCUIT FOR 3-STATE OUTPUTS



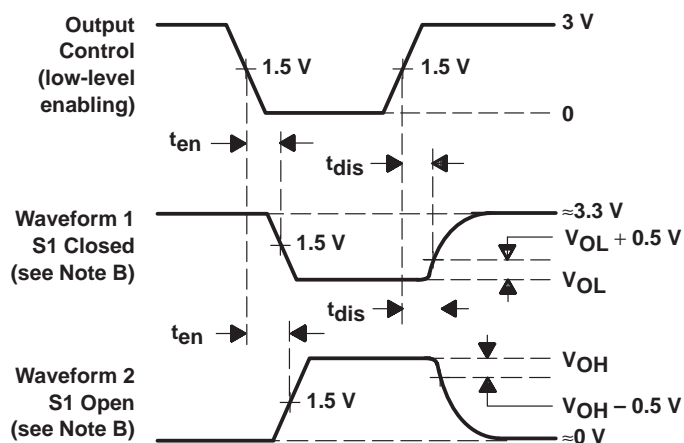
VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS  
PULSE DURATIONS



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES, 3-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:  $PRR \leq 10$  MHz,  $t_r = t_f \leq 2$  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 4. Load Circuit and Voltage Waveforms

**PACKAGING INFORMATION**

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">5962-85155012A</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 85155012A TIBPAL16 L8-20MFKB
<a href="#">5962-8515501RA</a>	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515501RA TIBPAL16L8-20M JB
<a href="#">5962-8515501SA</a>	Active	Production	CFP (W)   20	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515501SA TIBPAL16L8-20M WB
<a href="#">5962-85155022A</a>	NRND	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 85155022A TIBPAL16 R8-20MFKB
<a href="#">5962-8515502RA</a>	NRND	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515502RA TIBPAL16R8-20M JB
<a href="#">5962-85155032A</a>	NRND	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 85155032A TIBPAL16 R6-20MFKB
<a href="#">5962-8515503RA</a>	NRND	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515503RA TIBPAL16R6-20M JB
<a href="#">5962-8515503SA</a>	NRND	Production	CFP (W)   20	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515503SA TIBPAL16R6-20M WB
<a href="#">5962-85155042A</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 85155042A TIBPAL16 R4-20MFKB
<a href="#">5962-8515504RA</a>	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515504RA TIBPAL16R4-20M JB

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">5962-8515504SA</a>	Active	Production	CFP (W)   20	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515504SA TIBPAL16R4-20M WB
<a href="#">JM38510/50601BRA</a>	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 50601BRA
JM38510/50601BRA.A	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 50601BRA
<a href="#">JM38510/50604BRA</a>	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 50604BRA
JM38510/50604BRA.A	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 50604BRA
<a href="#">M38510/50601BRA</a>	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 50601BRA
<a href="#">M38510/50604BRA</a>	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 50604BRA
<a href="#">TIBPAL16L8-20MFKB</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 85155012A TIBPAL16 L8-20MFKB
TIBPAL16L8-20MFKB.A	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 85155012A TIBPAL16 L8-20MFKB
<a href="#">TIBPAL16L8-20MJ</a>	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	TIBPAL16L8-20M J
TIBPAL16L8-20MJ.A	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	TIBPAL16L8-20M J
<a href="#">TIBPAL16L8-20MJB</a>	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515501RA TIBPAL16L8-20M JB
TIBPAL16L8-20MJB.A	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515501RA TIBPAL16L8-20M JB
<a href="#">TIBPAL16L8-20MWB</a>	Active	Production	CFP (W)   20	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515501SA TIBPAL16L8-20M WB

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TIBPAL16L8-20MWB.A	Active	Production	CFP (W)   20	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515501SA TIBPAL16L8-20M WB
<a href="#">TIBPAL16R4-20MFKB</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 85155042A TIBPAL16 R4-20MFKB
TIBPAL16R4-20MFKB.A	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 85155042A TIBPAL16 R4-20MFKB
<a href="#">TIBPAL16R4-20MJB</a>	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515504RA TIBPAL16R4-20M JB
TIBPAL16R4-20MJB.A	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515504RA TIBPAL16R4-20M JB
<a href="#">TIBPAL16R4-20MWB</a>	Active	Production	CFP (W)   20	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515504SA TIBPAL16R4-20M WB
TIBPAL16R4-20MWB.A	Active	Production	CFP (W)   20	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515504SA TIBPAL16R4-20M WB
<a href="#">TIBPAL16R6-20MFKB</a>	NRND	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 85155032A TIBPAL16 R6-20MFKB
TIBPAL16R6-20MFKB.A	NRND	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 85155032A TIBPAL16 R6-20MFKB
<a href="#">TIBPAL16R6-20MJB</a>	NRND	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515503RA TIBPAL16R6-20M JB
TIBPAL16R6-20MJB.A	NRND	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515503RA TIBPAL16R6-20M JB

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">TIBPAL16R6-20MWB</a>	NRND	Production	CFP (W)   20	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515503SA TIBPAL16R6-20M WB
TIBPAL16R6-20MWB.A	NRND	Production	CFP (W)   20	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515503SA TIBPAL16R6-20M WB
<a href="#">TIBPAL16R8-20MFKB</a>	NRND	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 85155022A TIBPAL16 R8-20MFKB
TIBPAL16R8-20MFKB.A	NRND	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 85155022A TIBPAL16 R8-20MFKB
<a href="#">TIBPAL16R8-20MJB</a>	NRND	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515502RA TIBPAL16R8-20M JB
TIBPAL16R8-20MJB.A	NRND	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8515502RA TIBPAL16R8-20M JB

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

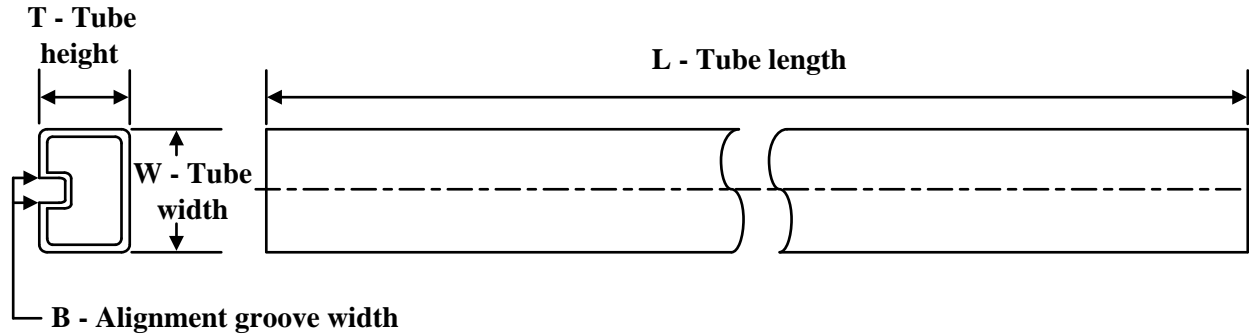
<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "-" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
5962-85155012A	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-8515501SA	W	CFP	20	25	506.98	26.16	6220	NA
5962-85155022A	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-85155032A	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-8515503SA	W	CFP	20	25	506.98	26.16	6220	NA
5962-85155042A	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-8515504SA	W	CFP	20	25	506.98	26.16	6220	NA
TIBPAL16L8-20MFKB	FK	LCCC	20	55	506.98	12.06	2030	NA
TIBPAL16L8-20MFKB.A	FK	LCCC	20	55	506.98	12.06	2030	NA
TIBPAL16L8-20MWB	W	CFP	20	25	506.98	26.16	6220	NA
TIBPAL16L8-20MWB.A	W	CFP	20	25	506.98	26.16	6220	NA
TIBPAL16R4-20MFKB	FK	LCCC	20	55	506.98	12.06	2030	NA
TIBPAL16R4-20MFKB.A	FK	LCCC	20	55	506.98	12.06	2030	NA
TIBPAL16R4-20MWB	W	CFP	20	25	506.98	26.16	6220	NA
TIBPAL16R4-20MWB.A	W	CFP	20	25	506.98	26.16	6220	NA
TIBPAL16R6-20MFKB	FK	LCCC	20	55	506.98	12.06	2030	NA
TIBPAL16R6-20MFKB.A	FK	LCCC	20	55	506.98	12.06	2030	NA
TIBPAL16R6-20MWB	W	CFP	20	25	506.98	26.16	6220	NA
TIBPAL16R6-20MWB.A	W	CFP	20	25	506.98	26.16	6220	NA
TIBPAL16R8-20MFKB	FK	LCCC	20	55	506.98	12.06	2030	NA
TIBPAL16R8-20MFKB.A	FK	LCCC	20	55	506.98	12.06	2030	NA

J (R-GDIP-T\*\*)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package is hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

## GENERIC PACKAGE VIEW

**FK 20**

**LCCC - 2.03 mm max height**

8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

This image is a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.



4229370VA\

W (R-GDFP-F20)

CERAMIC DUAL FLATPACK



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only.
  - Falls within Mil-Std 1835 GDFP2-F20

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