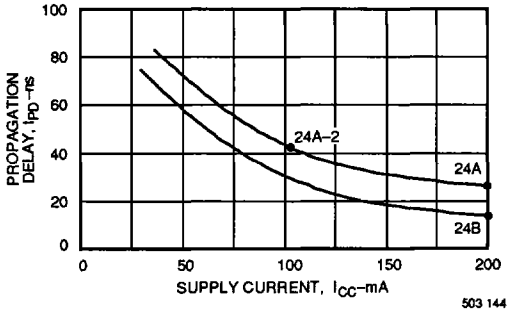
Military 24-Pin PAL Devices

Features

- Registers with feedback
- Programmable three-state outputs
- Security fuse prevents duplication of logic
- Variety of speed/power options available in same architecture
- Register preload to aid in device testing
- Power-up reset to logical high
- Programmable output polarity
- Product term sharing
- Programmable register or combinatorial outputs
- Dual feedback allows buried state registers or input registers (PAL32VX10)
- Programmable flip-flops allow J-K, S-R, T or D types (PAL32VX10)
- Asynchronous preset/synchronous reset, synchronous preset/asynchronous reset (PAL32VX10)
- Through-hole or surface mount device packaging
- Neutron fluence (permanent damage): $1x10^{13}$ N/cm²
- Dose rate (transient upset) junction isolated Bipolar processes: $2x10^{10}$ RADs (Si) per sec recovered in 50 to 70 μs from a 1μs pulse

24-Pin PAL Device Speed vs. Power



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Benefits

- Instant prototyping/zero NRE charge
- Low-cost programmable replacement for TTL logic
- Reduces inventory by reducing chip count
- Programmed on standard PROM/PAL device programmers
- Several software programs available to assist in creating bit pattern designs

Applications

- High speed graphic controllers
- High speed computers
- High frequency state machines
- High frequency counters
- Microprocessor clock generation and interface logic
- DMA controllers
- Asynchronous bus interface
- CRT controllers
- Peripheral/handshaking interface
- Interrupt controllers
- Memory mapped I/O (PAL8L14A)
- Microprocessor decoder (PAL8L14A)

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Register Preload

Register preload is an aid to functional testing, which is usually performed after the device is programmed but before it is installed on the circuit board. Using register preload, the register of a device can be "preloaded" to any desired state value. This is particularly useful in applications where the output is fed back into the array as an input, since it may take many state transitions to reach a desired state in the output register. Register preload also allows the user to set the device to an "illegal" state which cannot be reached through normal state transitions, in order to test for proper recovery.

Power-Up Reset

Another added testability feature found on these Series is power-up reset. Power-up reset makes system initialization simple; registers are reset to logic 0 at power-up, thus all outputs are set to logic 1.

The table below is a brief summary of our current devices that do have register preload and/or power-up reset.

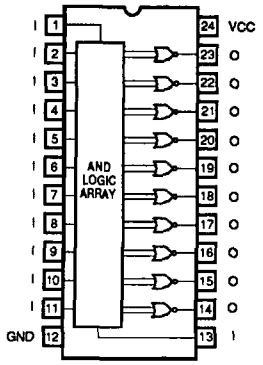
Devices with Register Preload and Power-Up Reset

DEVICE FAMILY	REGISTER PRELOAD	POWER-UP RESET
Exclusive OR 24XA	YES	YES
Shared Product terms 24RS	YES	YES
Asynchronous 24RA	YES	YES
Varied Product terms 24VX*	YES	YES

* The PAL32VX10/10A has power-up preset; registers are set to logical 1 on power up.

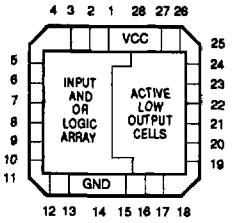
Military 24-Pin PAL Device Pinouts

12L10



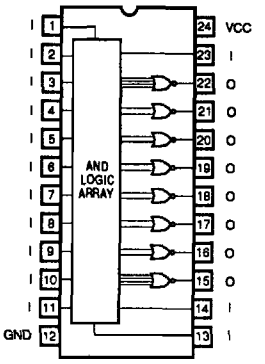
CERDIP CERPACK

12L10



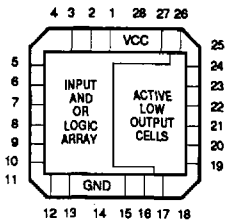
LEADLESS CHIP CARRIER

14L8



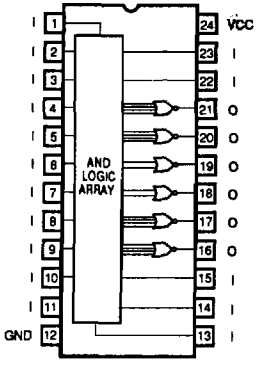
CERDIP CERPACK

14L8



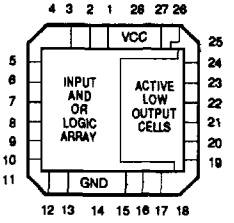
LEADLESS CHIP CARRIER

16L6



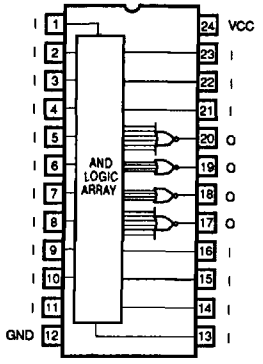
CERDIP CERPACK

16L6



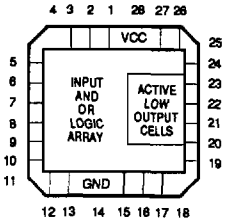
LEADLESS CHIP CARRIER

18L4



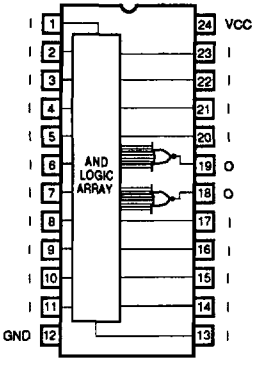
CERDIP CERPACK

18L4



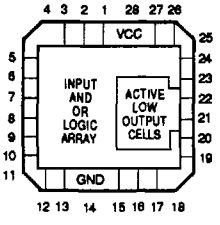
LEADLESS CHIP CARRIER

20L2



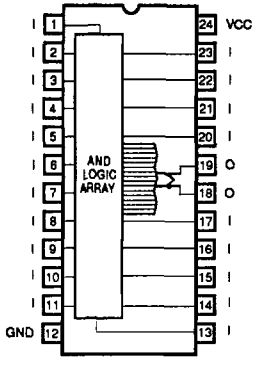
CERDIP CERPACK

20L2



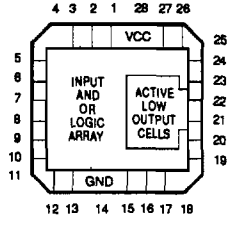
LEADLESS CHIP CARRIER

20C1



CERDIP CERPACK

20C1



LEADLESS CHIP CARRIER

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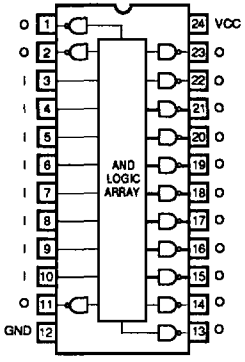
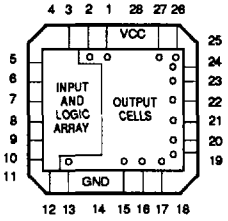
Military 24-Pin PAL Device Pinouts

8L14A



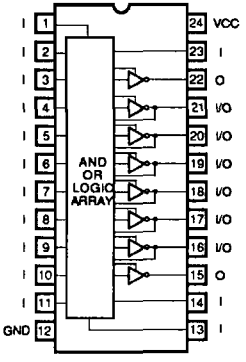
CERDIP CERPACK

8L14A



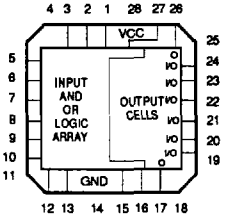
LEADLESS CHIP CARRIER

20L8B/A/A-2



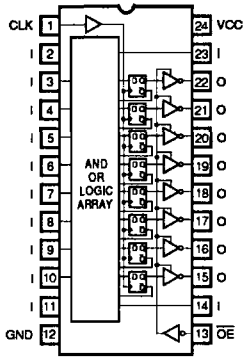
CERDIP CERPACK

20L8B/A/A-2



LEADLESS CHIP CARRIER

20R8B/A/A-2



CERDIP CERPACK

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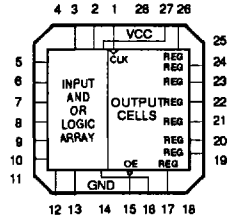
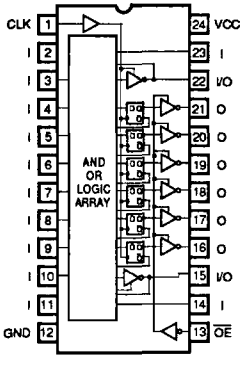


LEADLESS CHIP CARRIER

20R6B/A/A-2



CERDIP CERPACK

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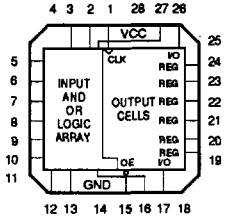
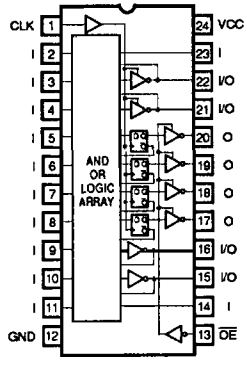


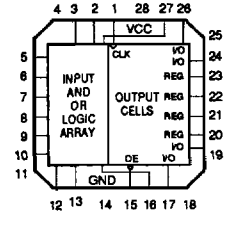
LEADLESS CHIP CARRIER

20R4B/A/A-2



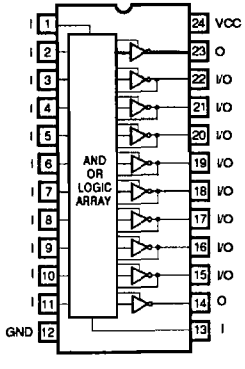
CERDIP CERPACK

20R4B/A/A-2



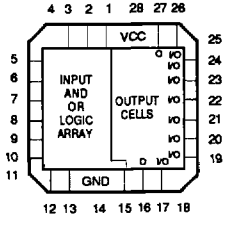
LEADLESS CHIP CARRIER

20L10A



CERDIP CERPACK

20L10A



LEADLESS CHIP CARRIER

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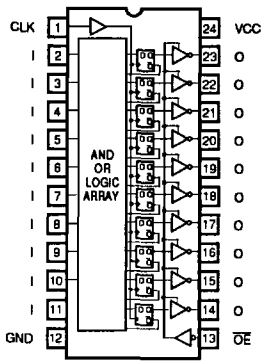
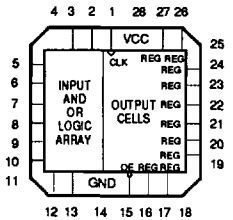
Military 24-Pin PAL Device Pinouts

20X10A



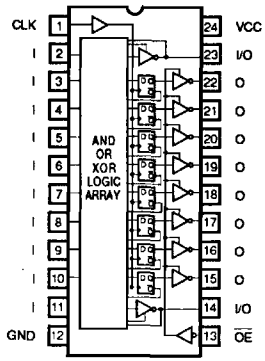
CERDIP CERPACK

20X10A



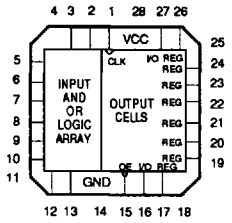
LEADLESS CHIP CARRIER

20X8A



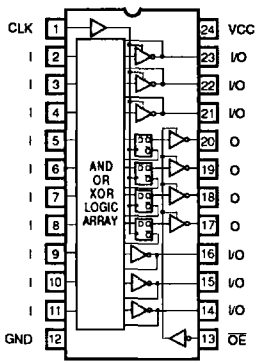
CERDIP CERPACK

20X8A



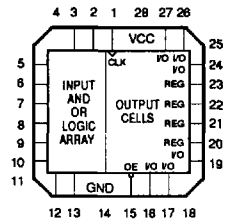
LEADLESS CHIP CARRIER

20X4A



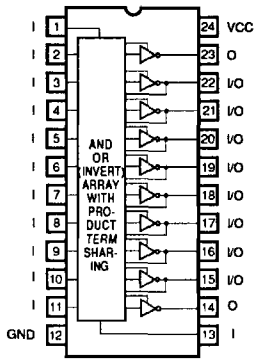
CERDIP CERPACK

20X4A



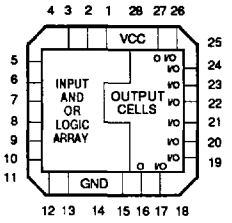
LEADLESS CHIP CARRIER

20S10 (see Fig. 1)



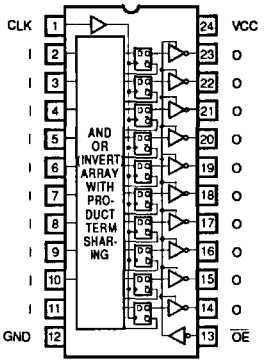
CERDIP CERPACK

20S10 (see Fig.1)



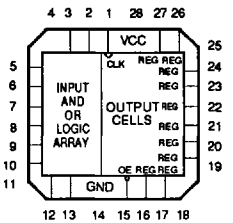
LEADLESS CHIP CARRIER

20RS10 (see Fig. 1)



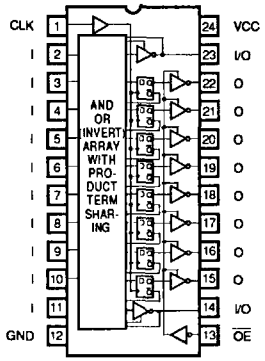
CERDIP CERPACK

20RS10 (see Fig.1)



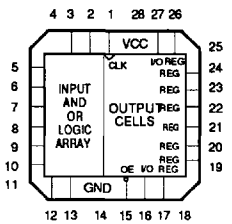
LEADLESS CHIP CARRIER

20RS8 (see Fig 1)



CERDIP CERPACK

20RS8 (see Fig.1)



LEADLESS CHIP CARRIER

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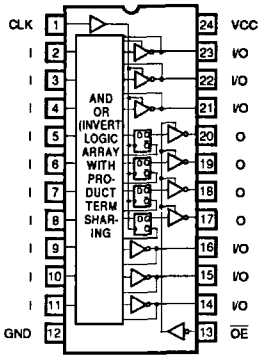
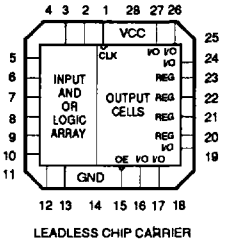
Military 24-Pin PAL Device Pinouts

20RS4
(see Fig.1)



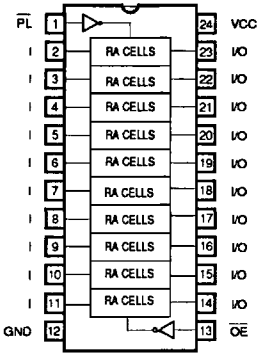
CERDIP CERPACK

20RS4
(see Fig. 1)



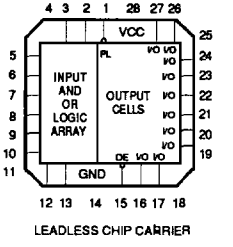
LEADLESS CHIP CARRIER

20RA10
(see Fig.2)



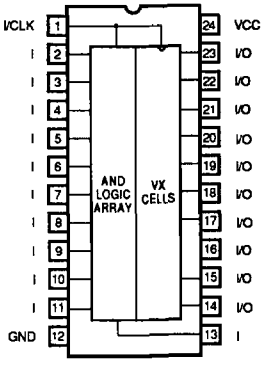
CERDIP CERPACK

20RA10
(see Fig. 2)



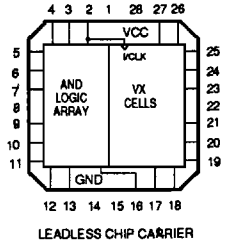
LEADLESS CHIP CARRIER

32VX10/A
(see Fig. 3)



CERDIP CERPACK

32VX10/A
(see Fig 3)



LEADLESS CHIP CARRIER

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Military PAL20S10, 20RS10, 20RS8, 20RS4 Series

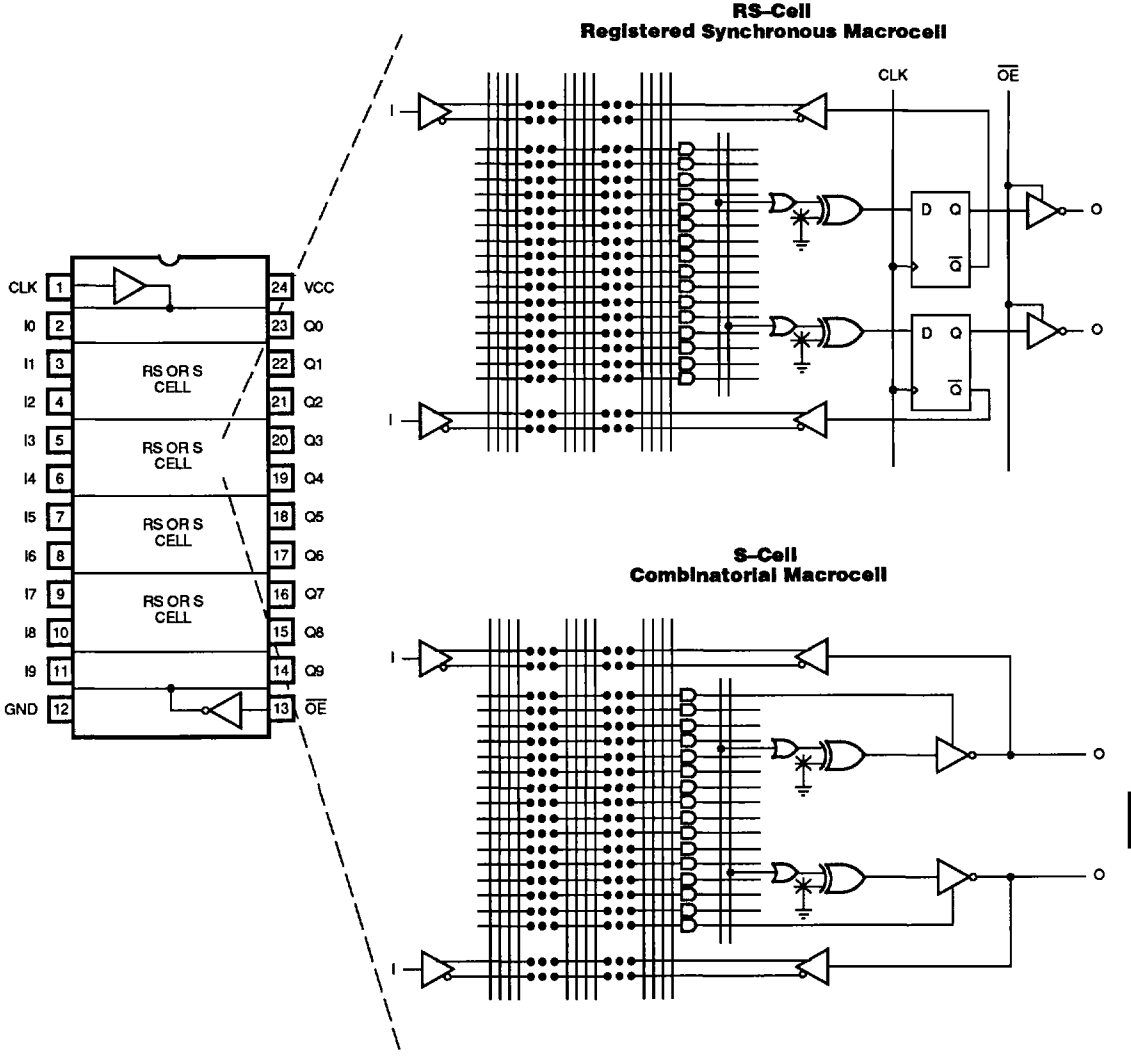

Figure 1.

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Military PAL20RA10 Device

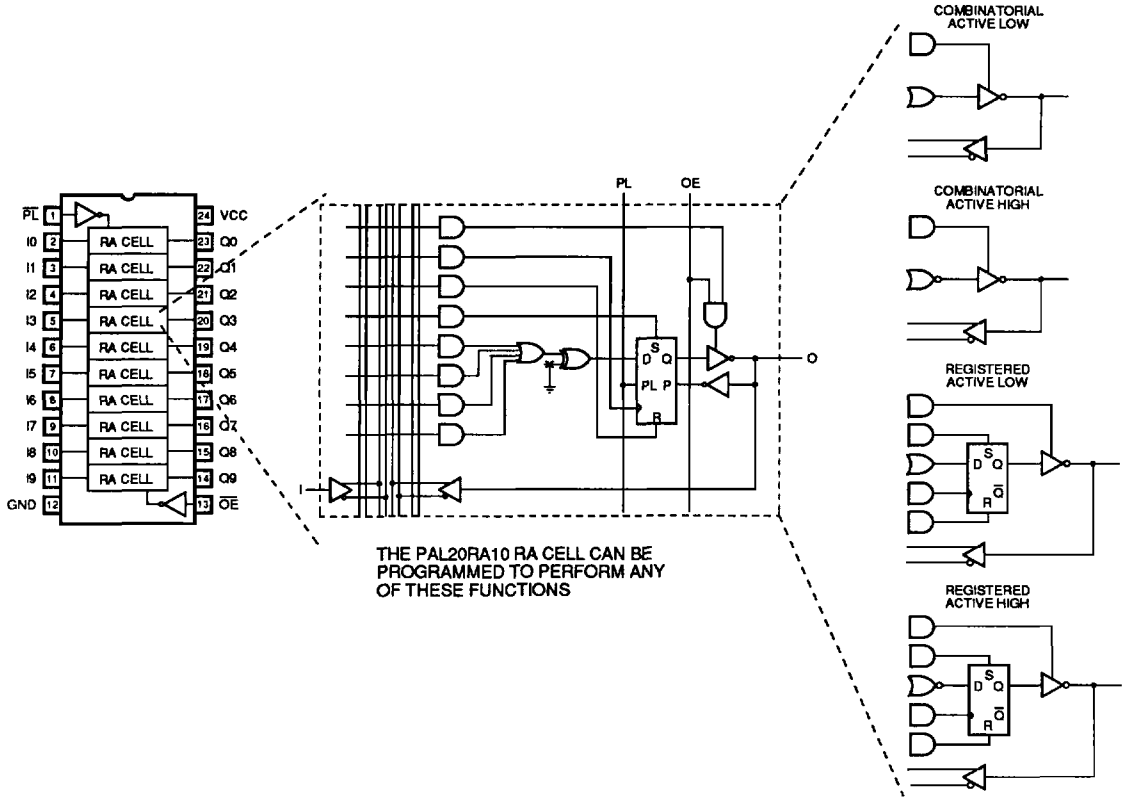

Figure 2.

Military PAL32VX10 Device

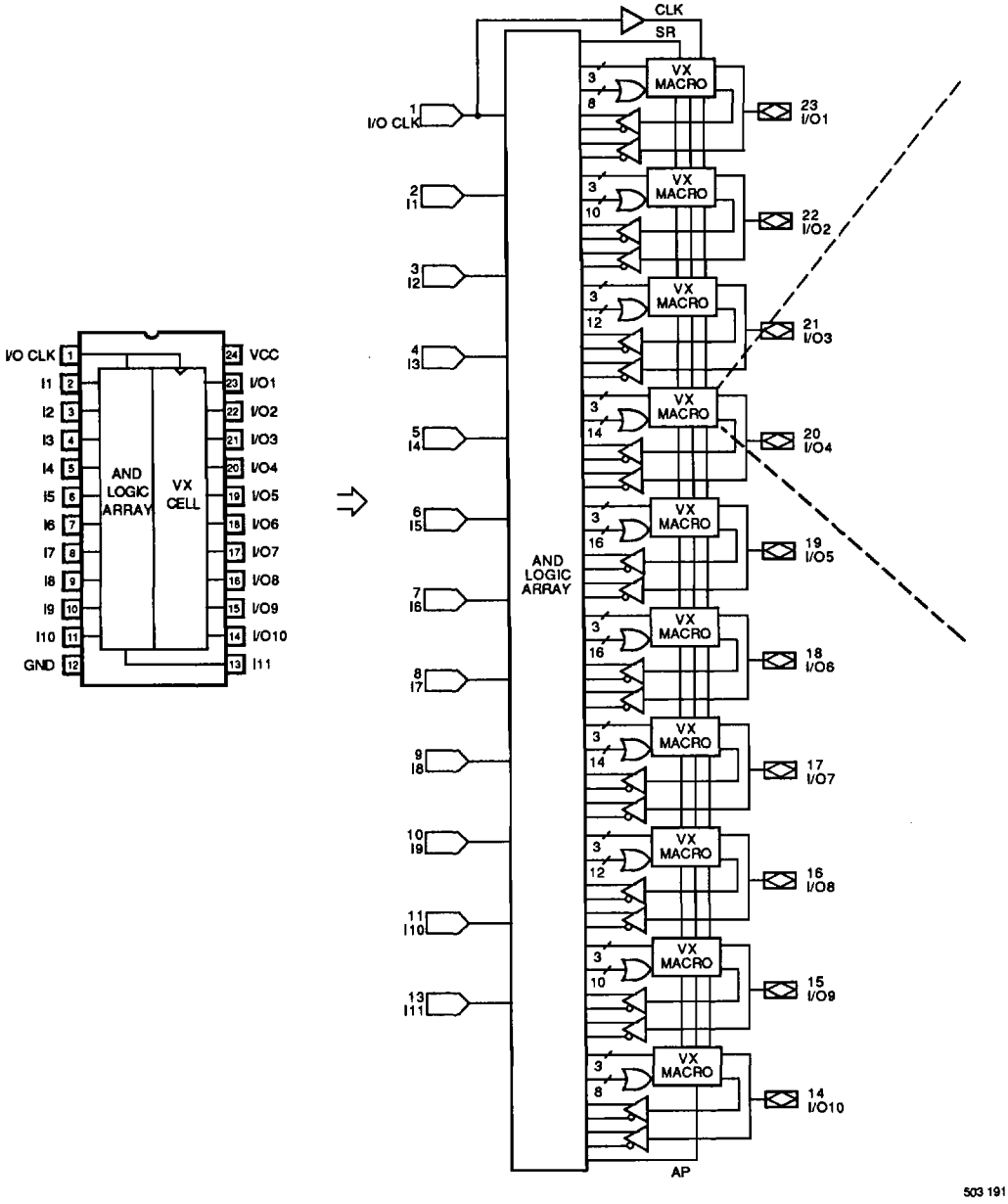

Figure 3.

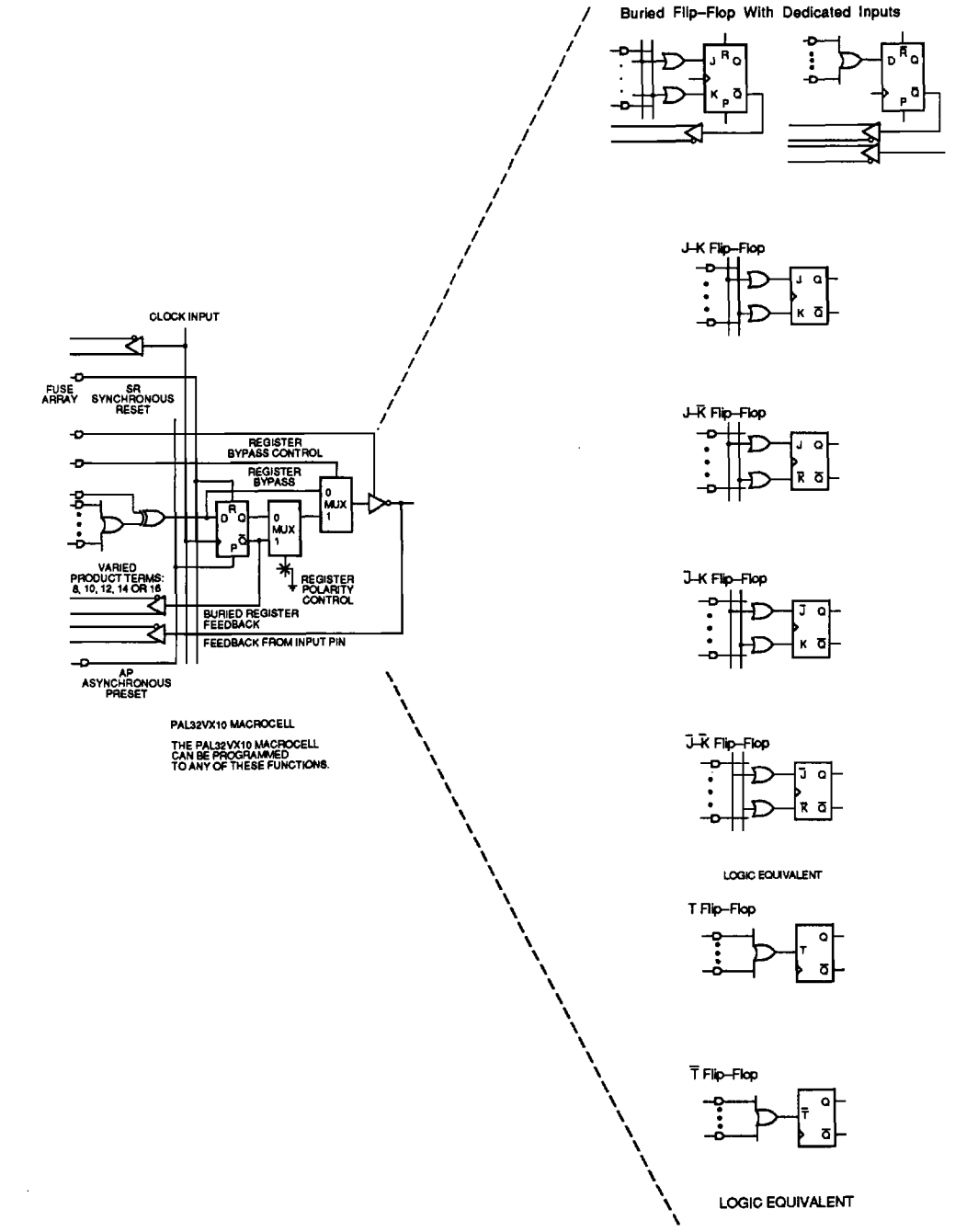

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Figure 3. (Cont'd.)

Military 24-Pin PAL Devices

Absolute Maximum Ratings

	Operating
Supply voltage V_{CC}	–0.5 V to 7 V
Input voltage	–1.5 V to 5.5 V
Off-state output voltage	5.5 V
Storage temperature	–65°C to +150°C
Maximum junction temperature (T_j)	175°C
Lead temperature (soldering, 10 sec max)	300°C
Maximum current density $5x10^{-5}$ A/cm² per Mil-M-38510	$< 5x10^{-5}$ A/cm²
Maximum θ_{jc} = 28°C/W for cerdips per Mil-M-38510	< 28°C/W
Maximum θ_{jc} = 22°C/W for flatpacks per Mil-M-38510	< 22°C/W
Maximum θ_{jc} = 20°C/W for leadless chip carriers per Mil-M-38510	< 20°C/W

5

Military Standard 24-Pin PAL Series

PAL12L10, 14L8, 16L6, 18L4, 20L2, 20C1

Can be purchased to military drawing 5962-86804, latest revision in effect.

Operating Conditions

SYMBOL	PARAMETER	MIN	MAX	UNIT
V_{CC}	Supply voltage	4.5	5.5	V
T_A	Operating free-air temperature	–55		°C
T_C	Operating case temperature		125	°C
V_{IL}*	Low-level input voltage		≤0.8	V
V_{IH}*	High-level input voltage	≥2.0		V

Note: Virgin array verify of unprogrammed PAL device is performed at 25°C only.

* These are absolute voltages with respect to the ground pin on the device and include all overshoots due to system and/or tester noise.

Electrical Characteristics Over Operating Conditions

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	MAX	UNIT
V_{IC}	Input clamp voltage	V_{CC} = MIN	I_I = –18 mA		–1.5	V
I_{IL}	Low-level input current	V_{CC} = MAX	V_I = 0.4 V		–0.25	mA
I_{IH}	High-level input current	V_{CC} = MAX	V_I = 2.4 V		25	µA
I_I	Maximum input current	V_{CC} = MAX	V_I = 5.5 V		1	mA
V_{OL}	Low-level output voltage	V_{CC} = MIN	I_{OL} = 8 mA		0.5	V
V_{OH}	High-level output voltage	V_{CC} = MIN	I_{OH} = –2 mA	2.4		V
I_{OS}*	Output short-circuit current	V_{CC} = 5 V	V_O = 0.5 V	–30	–130	mA
I_{CC}	Supply current	V_{CC} = MAX			100	mA

*Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.

Switching Characteristics Over Operating Conditions

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
t_{PD}	Input or feedback to output	R_1 = 560 Ω R_2 = 1.1 KΩ		45	ns

Programmed devices conform to Mil-Std-883, Method 5005, Group A, Subgroups 1, 2, 3, 7, 8, 9, 10 and 11.

Military Decoder 24-Pin PAL Device

PAL8L14A

Operating Conditions

SYMBOL	PARAMETER	MIN	MAX	UNIT
V_{CC}	Supply voltage	4.5	5.5	V
T_A	Operating free-air temperature	–55		°C
T_C	Operating case temperature		125	°C
V_{IL}*	Low-level input voltage		≤0.8	V
V_{IH}*	High-level input voltage	≥2.0		V

Note: Virgin array verify of unprogrammed PAL device is performed at 25°C only.
* These are absolute voltages with respect to the ground pin on the device and include all overshoots due to system and/or tester noise.

Electrical Characteristics Over Operating Conditions

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	MAX	UNIT
V_{IC}	Input clamp voltage	V_{CC} = MIN	I_I = –18 mA		–1.5	V
I_{IL}	Low-level input current	V_{CC} = MAX	V_I = 0.4 V		–0.25	mA
I_{IH}	High-level input current	V_{CC} = MAX	V_I = 2.4 V		25	µA
I_I	Maximum input current	V_{CC} = MAX	V_I = 5.5 V		1	mA
V_{OL}	Low-level output voltage	V_{CC} = MIN	I_{OL} = 8mA		0.5	V
V_{OH}	High-level output voltage	V_{CC} = MIN	I_{OH} = –2mA	2.4		V
I_{OS}*	Output short-circuit current	V_{CC} = 5 V	V_O = 0.5 V	–30	–130	mA
I_{CC}	Supply current	V_{CC} = MAX			100	mA

*Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.

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Switching Characteristics Over Operating Conditions

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
t_{PD}	Input to output propagation delay	R_1 = 560 Ω R_2 = 1.1 KΩ		30	ns

Programmed devices conform to Mil-Std-883, Method 5005, Group A, Subgroups 1, 2, 3, 7, 8, 9, 10 and 11.

Military Very High Speed 24-Pin PAL Series

PAL20L8B, 20R8B, 20R6B, 20R4B

Can be purchased to standard military drawing 5962-87671, latest revision in effect.

Military High Speed 24-Pin PAL Series

PAL20L8A, 20R8A, 20R6A, 20R4A

Can be purchased to standard military drawing 84129, latest revision in effect.

Operating Conditions

SYMBOL	PARAMETER		24 B		24 A		UNIT
			MIN	MAX	MIN	MAX	
V_{CC}	Supply voltage		4.5	5.5	4.5	5.5	V
T_A	Operating free-air temperature		–55		–55		°C
T_C	Operating case temperature			125		125	°C
t_w†	Width of clock (except 20L8)	Low, t_w	12		20		ns
		High, t_{wh}	12		20		ns
t_{su}†	Set up time from input or feedback to clock (except 20L8)		20		30		ns
t_h†	Hold time		0		0		ns
V_{IL}*	Low-level input voltage			≤0.8		≤0.8	V
V_{IH}*	High-level input voltage		≥2.0		≥2.0		V

Note: Virgin array verify of unprogrammed PAL device is performed at 25°C only.

* These are absolute voltages with respect to the ground pin on the device and include all overshoots due to system and/or tester noise.

† These are device set-up conditions, which are measured during initial qualification, and are not directly tested.

Electrical Characteristics Over Operating Conditions

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	MAX	UNIT
V_{IC}	Input clamp voltage	V_{CC} = 4.5 V	I_I = –18 mA		–1.5	V
I_{IL}*	Low-level input current	V_{CC} = 5.5 V	V_I = 0.4 V		–0.25	mA
I_{IH}*	High-level input current	V_{CC} = 5.5 V	V_I = 2.4 V		25	µA
I_I	Maximum input current	V_{CC} = 5.5 V	V_I = 5.5 V		1.0	mA
V_{OL}	Low-level output voltage	V_{CC} = 4.5 V	I_{OL} = 12 mA		0.5	V
V_{OH}	High-level output voltage	V_{CC} = 4.5 V	I_{OH} = –2 mA	2.4		V
I_{OZL}*	Offstate output current	V_{CC} = 5.5 V	V_O = 0.4 V		–100	µA
I_{OHZ}*			V_O = 2.4 V		100	
I_{OS}**	Output short-circuit current	V_{CC} = 5.5 V	V_O = 0.5 V	–30	–130	mA
I_{CC}	Supply current	V_{CC} = 5.5 V			210	mA

* I/O pin leakage is worst case of IIX or IOZX; i.e., IIL and IOZH.

** Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.

Military Very High Speed 24-Pin PAL Series

PAL20L8B, 20R8B, 20R6B, 20R4B

Military High Speed 24-Pin PAL Series

PAL20L8A, 20R8A, 20R6A, 20R4A

Switching Characteristics Over operating conditions

SYMBOL	PARAMETER	TEST CONDITIONS	24 B		24 A		UNIT
			MIN	MAX	MIN	MAX	
t_{PD}	Input or feedback to output (except 20R8)	R_1 = 390 Ω, R_2 = 750 Ω		20		30	ns
t_{CLK}	Clock to output or feedback (except 20L8)			15		20	ns
t_{PZX}	Pin 13 to output enable (except 20L8)			20		25	ns
t_{PXZ}	Pin 13 to output disable (except 20L8)			20		25	ns
t_{PZX}	Input to output enable (except 20R8)			25		30	ns
t_{PXZ}	Input to output disable (except 20R8)			20		30	ns
f_{MAX}*	State machine maximum operating frequency (except 20L8)		28.5		20		MHz
	Data path register maximum operating frequency (except 20L8)		41.6		25		

*fMAX is calculated and measured on initial qualifications only.
fMAX (state machine) = $1/[t_{su} + t_{CLK}]$
fMAX (data path register) = $1/[t_{WL} + t_{WH}]$ or $1/t_{su}+t_h$, whichever is smaller.

Programmed devices conform to Mil-Std-883, Method 5005, Group A, Subgroups 1, 2, 3, 7, 8, 9, 10 and 11.

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Military Half-Power 24A-Pin Series

PAL20L8A-2, 20R8A-2, 20R6A-2, 20R4A-2

Can be purchased to standard military drawing 84129, latest revision in effect.

Operating Conditions

SYMBOL	PARAMETER		MIN	MAX	UNIT
V_{CC}	Supply voltage		4.5	5.5	V
T_A	Operating free-air temperature		–55	125	°C
t_w†	Width of clock (except 20L8)	Low	25		ns
		High	25		ns
t_{su}†	Setup time from input or feedback to clock (except 20L8)		50		ns
t_h†	Hold time		0		ns
V_{IL}*	Low-level input voltage			≤0.8	V
V_{IH}*	High-level input voltage		≥2.0		V

Note: Virgin array verify of unprogrammed PAL device is performed at 25°C only.

* These are absolute voltages with respect to the ground pin on the device and include all overshoots due to system and/or tester noise.

† These are device set-up conditions, which are measured during initial qualification, and are not directly tested.

Electrical Characteristics Over Operating Conditions

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	MAX	UNIT
V_{IC}	Input clamp voltage	V_{CC} = MIN	I_I = –18 mA		–1.5	V
I_{IL}*	Low-level input current	V_{CC} = MAX	V_I = 0.4 V		–0.25	mA
I_{IH}*	High-level input current	V_{CC} = MAX	V_I = 2.4 V		25	µA
I_I	Maximum input current	V_{CC} = MAX	V_I = 5.5 V		1	mA
V_{OL}	Low-level output voltage	V_{CC} = MIN	I_{OL} = 12 mA		0.5	V
V_{OH}	High-level output voltage	V_{CC} = MIN	I_{OH} = –2 mA	2.4		V
I_{OZL}*	Offstate output current	V_{CC} = MAX	V_O = 0.4 V		–100	µA
I_{OZH}*			V_O = 2.4 V		100	µA
I_{OS}**	Output short-circuit current	V_{CC} = 5 V	V_O = 0.5 V	–30	–130	mA
I_{CC}	Supply Current	V_{CC} = MAX			105	mA

* I/O pin leakage is worst case of IIX or IOZX; i.e., IIL and IOZH.

** Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.

Military Half-Power 24A-Pin Series

PAL20L8A-2, 20R8A-2, 20R6A-2, 20R4A-2

Switching Characteristics Over Operating Conditions

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
t_{PD}	Input or feedback to output (except 20R8)	$R_1 = 390\ \Omega$, $R_2 = 750\ \Omega$		50	ns
t_{CLK}	Clock to output or feedback (except 20L8)			25	ns
t_{PZX}	Pin 13 to output enable (except 20L8)			25	ns
t_{PXZ}	Pin 13 to output disable (except 20L8)			25	ns
t_{PZX}	Input to output enable (except 20R8)			45	ns
t_{PXZ}	Input to output disable (except 20R8)			45	ns
fMAX*	State machine maximum operating frequency (except 20L8)		13.3		MHz
	Data path register maximum operating frequency (except 20L8)		20		

*fMAX is calculated and measured on initial qualifications only.
fMAX (state machine) = $1/[t_{su} + t_{CLK}]$
fMAX (data path register) = $1/[t_{WL} + t_{WH}]$ or $1/t_{su}+t_h$, whichever is smaller.

Programmed devices conform to Mil-Std-883, Method 5005, Group A, Subgroups 1, 2, 3, 7, 8, 9, 10 and 11.

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Military High Speed 24XA-Pin Series

PAL20L10A, 20X10A, 20X8A, 20X4A

Can be purchased to standard miltary print 84129, latest revision in effect.

Operating Conditions

SYMBOL	PARAMETER		MIN	MAX	UNIT
V_{CC}	Supply voltage		4.5	5.5	V
T_A	Operating free-air temperature		–55		°C
T_C	Operating case temperature			125	°C
t_w†	Width of clock (except 20L10)	Low	35		ns
		High	20		
t_{su}†	Setup time from input or feedback to clock (except 20L10)		40		ns
t_h†	Hold time		0		ns
V_{IL}*	Low-level input voltage			≤0.8	V
V_{IH}*	High-level input voltage		≥2.0		V

Note: Virgin array verify of unprogrammed PAL device is performed at 25°C only.

* These are absolute voltages with respect to the ground pin on the device and include all overshoots due to system and/or tester noise.

† These are device set-up conditions, which are measured during initial qualification, and are not directly tested.

Electrical Characteristics Over Operating Conditions

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	MAX	UNIT
V_{IC}	Input clamp voltage	V_{CC} = MIN	I_I = –18 mA		–1.5	V
I_{IL}*	Low-level input current	V_{CC} = MAX	V_I = 0.4 V		–0.25	mA
I_{IH}*	High-level input current	V_{CC} = MAX	V_I = 2.4 V		25	µA
I_I	Maximum input current	V_{CC} = MAX	V_I = 5.5 V		1	mA
V_{OL}	Low-level output voltage	V_{CC} = MIN	I_{OL} = 12 mA		0.5	V
V_{OH}	High-level output voltage	V_{CC} = MIN	I_{OH} = –2 mA	2.4		V
I_{OZL}*	Off-state output current	V_{CC} = MAX	V_O = 0.4 V		–100	µA
I_{OZH}*			V_O = 2.4 V		100	
I_{OS}**	Output short-circuit current	V_{CC} = 5 V	V_O = 0.5 V	–30	–130	mA
I_{CC}	Supply current	V_{CC} = MAX	20X10A, 20X8A, 20X4A		180	mA
			20L10A		165	

* I/O pin leakage is worst case of IIX or IOZX; i.e., IIL and IOZH.

** Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.

Military High Speed 24XA-Pin Series

PAL20L10A, 20X10A, 20X8A, 20X4A

Switching Characteristics Over Operating Conditions

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
t_{PD}	20L10A, 20X8A, 20X4A Input or feedback to output (except 20X10)	R_1 = 390 Ω R_2 = 750 Ω		35	ns
t_{CLK}	Clock to output or feedback (except 20L10)			25	ns
t_{PZX}	Pin 13 to output enable (except 20L10)			25	ns
t_{PXZ}	Pin 13 to output disable (except 20L10)			25	ns
t_{PZX}	Input to output enable (except 20X10)			35	ns
t_{PXZ}	Input to output disable (except 20X10)			35	ns
fMAX*	State machine maximum operating frequency (except 20L10)		15.4		MHz
	Data path register maximum operating frequency (except 20L10)		18.2		

*fMAX is calculated and measured on initial qualifications only.
fMAX (state machine) = $1/[t_{su} + t_{CLK}]$
fMAX (data path register) = $1/[t_{WL} + t_{WH}]$ or $1/t_{su}+t_h$, whichever is smaller.

Programmed devices conform to Mil-Std-883, Method 5005, Group A, Subgroups 1, 2, 3, 7, 8, 9, 10 and 11.

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Military 24RS-Pin Series

PAL20S10, 20RS10, 20RS8, 20RS4

Standard military 5962-87530 is in the process of being generated—Contact the factory.

Operating Conditions

SYMBOL	PARAMETER		MIN	MAX	UNIT
V_{CC}	Supply voltage		4.5	5.5	V
T_A	Operating free-air temperature		−55		°C
T_C	Operating case temperature			125	°C
t_w†	Width of clock (except 20S10)	Low	20		ns
		High	20		
t_{su}†	Setup time from input or feedback to clock (except 20S10)		40		ns
t_h†	Hold time		0		ns
V_{IL}*	Low-level input voltage			≤0.8	V
V_{IH}*	High-level input voltage		≥2.0		V

Note: Virgin array verify of unprogrammed PAL device is performed at 25°C only.

* These are absolute voltages with respect to the ground pin on the device and include all overshoots due to system and/or tester noise.

† These are device set-up conditions, which are measured during initial qualification, and are not directly tested.

Electrical Characteristics Over Operating Conditions

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	MAX	UNIT
V_{IC}	Input clamp voltage	V_{CC} = MIN	I_I = −18 mA		−1.5	V
I_{IL}*	Low-level input current	V_{CC} = MAX	V_I = 0.4 V		−0.25	mA
I_{IH}*	High-level input current	V_{CC} = MAX	V_I = 2.4 V		25	µA
I_I	Maximum input current	V_{CC} = MAX	V_I = 5.5 V		1	mA
V_{OL}	Low-level output voltage	V_{CC} = MIN	I_{OL} = 12 mA		0.5	V
V_{OH}	High-level output voltage	V_{CC} = MIN	I_{OH} = −2 mA	2.4		V
I_{OZL}*	Off-state output current	V_{CC} = MAX	V_O = 0.4 V		−100	µA
I_{OZH}*			V_O = 2.4 V		100	
I_{OS}**	Output short-circuit current	V_{CC} = 5 V	V_O = 0.5 V	−30	−130	mA
I_{CC}	Supply current	V_{CC} = MAX			240	mA

* I/O pin leakage is worst case of IIX or IOZX; i.e., IIL and IOZH.

** Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.

Military 24RS-Pin Series

PAL20S10, 20RS10, 20RS8, 20RS4

Switching Characteristics Over Operating Conditions

SYMBOL	PARAMETER		TEST CONDITIONS	MIN	MAX	UNIT
t_{PD}	Input or feedback to output (except 20RS10)	Polarity fuse intact	$R_1 = 390\ \Omega$ $R_2 = 750\ \Omega$		40	ns
		Polarity fuse Blown			45	
t_{CLK}	Clock to output or feedback (except 20S10)				20	ns
t_{PZX}	Pin 13 to output enable (except 20S10)				25	ns
t_{PXZ}	Pin 13 to output disable (except 20S10)				25	ns
t_{PZX}	Input to output enable (except 20RS10)				35	ns
t_{PXZ}	Input to output disable (except 20RS10)				30	ns
fMAX*	State machine maximum operating frequency (except 20S10)			16.7		MHz
	Data path register maximum frequency (except 20S10)			25		

*fMAX is calculated and measured on initial qualifications only.

fMAX (state machine) = $1/[t_{su} + t_{CLK}]$

fMAX (data path register) = $1/[t_{WL} + t_{WH}]$ or $1/t_{su} + t_h$, whichever is smaller.

Programmed devices conform to Mil-Std-883, Method 5005, Group A, Subgroups 1, 2, 3, 7, 8, 9, 10 and 11.

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Military 24RA-Pin Device

PAL20RA10

Standard military 5962-86803 is in the process of being generated—Contact the factory.

Operating Conditions

SYMBOL	PARAMETER		MIN	MAX	UNIT
V_{CC}	Supply voltage		4.5 5	5.5	V
T_A	Operating free-air temperature		–55		°C
T_C	Operating case temperature			125	°C
t_w↑	Width of clock	Low	25		ns
		High	25		
t_{wp}↑	Preload pulse width		45		ns
t_{su}↑	Setup time from input or feedback to clock		25		ns
t_{sup}↑	Preload setup time		30		ns
t_h↑	Hold time	Polarity fuse intact	10		ns
		Polarity fuse blown	0		
t_{hp}↑	Preload hold time		30		ns
V_{IL}*	Low-level input voltage			≤0.8	V
V_{IH}*	High-level input voltage		≥2.0		V

Note: Virgin array verify of unprogrammed PAL device is performed at 25°C only.

* These are absolute voltages with respect to the ground pin on the device and include all overshoots due to system and/or tester noise.

↑ These are device set-up conditions, which are measured during initial qualification, and are not directly tested.

Electrical Characteristics Over Operating Conditions

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{IC}	Input clamp voltage	V_{CC} = MIN	I_I = –18 mA			–1.5	V
I_{IL}*	Low-level input current	V_{CC} = MAX	V_I = 0.4 V			–0.25	mA
I_{IH}*	High-level input current	V_{CC} = MAX	V_I = 2.4 V			25	µA
I_I	Maximum input current	V_{CC} = MAX	V_I = 5.5 V			1	mA
V_{OL}	Low-level output voltage	V_{CC} = MIN	I_{OL} = 8 mA			0.5	V
V_{OH}	High-level output voltage	V_{CC} = MIN	I_{OH} = –2 mA	2.4			V
I_{OZL}*	Off-state output current	V_{CC} = MAX	V_O = 0.4 V			–100	µA
I_{OZH}*			V_O = 2.4 V			100	
I_{OS}**	Output short-circuit current	V_{CC} = 5 V	V_O = 0.5 V	–30		–130	mA
I_{CC}	Supply current	V_{CC} = MAX				200	mA

* I/O pin leakage is worst case of IIX or IOZX; i.e., IIL and IOZH.

** Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.

Military 24RA-Pin Device

PAL20RA10

Switching Characteristics Over Operating Conditions

SYMBOL	PARAMETER		TEST CONDITIONS	MIN	MAX	UNIT
t_{PD}	Input or feedback to output	Polarity fuse intact	R_1 = 560 Ω, R_2 = 1.1 KΩ		35	ns
		Polarity fuse Blown			40	
t_{CLK}	Clock to output or feedback				35	ns
t_S	Input to asynchronous set				40	ns
t_R	Input to asychronous reset				45	ns
t_{PZX}	Pin 13 to output enable				25	ns
t_{PXZ}	Pin 13 to output disable				25	ns
t_{PZX}	Input to output enable				35	ns
t_{PXZ}	Input to output disable				35	ns
fMAX*	State machine maximum operating frequency			16.7		MHz
	Data path register maximum frequency			20		

*fMAX is calculated and measured on initial qualifications only.
fMAX (state machine) = $1/[t_{su} + t_{CLK}]$
fMAX (data path register) = $1/[t_{WL} + t_{WH}]$ or $1/t_{su} + t_h$, whichever is smaller.

Programmed devices conform to Mil-Std-883, Method 5005, Group A, Subgroups 1, 2, 3, 7, 8, 9, 10 and 11.

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ADVANCE INFORMATION

Operating Conditions

SYMBOL	PARAMETER		STD MIN	STD MAX	A MIN	A MAX	UNIT
V_{CC}	Supply voltage		4.5	5.5	4.5	5.5	V
T_A	Operating free-air temperature		–55	125	–55	125	°C
t_w†	Width of clock	Low	25		23		ns
		High	25		23		
t_{su}†	Setup time from input or feedback to clock	Product terms P_1–P_n, SR	35		30		ns
		Product term XOR	40		35		
t_h†	Hold time		0		0		ns
t_{aw}†	Asynchronous preset width		35		30		ns
t_{ar}†	Asynchronous preset recovery time		35		30		ns
t_{sr}†	Synchronous reset recovery time		35		30		ns
V_{IL}*	Low-level input voltage			≤0.8		≤0.8	V
V_{IH}*	High-level input voltage		≥2.0		≥2.0		V

Note: Virgin array verify of unprogrammed PAL device is performed at 25°C only.
* These voltages apply with respect to the ground pin on the device and include all overshoots due to system and/or tester noise.
† These are device set-up conditions, which are measured during initial qualification, and are not directly tested.

Electrical Characteristics Over Operating Conditions

SYMBOL	PARAMETER	TEST CONDITIONS		MIN	MAX	UNIT
V_{IC}	Input clamp voltage	V_{CC} = MIN	I_I = –18 mA		–1.5	V
I_{IL}*	Low-level input current	V_{CC} = MAX	V_I = 0.4 V		–0.25	mA
I_{IH}*	High-level input current	V_{CC} = MAX	V_I = 2.4 V		25	µA
I_I	Maximum input current	V_{CC} = MAX	V_I = 5.5 V		200	µA
V_{OL}	Low-level output voltage	V_{CC} = MIN	I_{OL} = 12 mA		0.5	V
V_{OH}	High-level output voltage	V_{CC} = MIN	I_{OH} = –2 mA	2.4		V
I_{OZL}*	Off-state output current	V_{CC} = MAX	V_O = 0.4 V		–100	µA
I_{OZH}*			V_O = 2.4 V		100	µA
I_{OS}**	Output short-circuit current	V_{CC} = 5 V	V_O = 0.5 V	–30	–130	mA
I_{CC}	Supply current	V_{CC} = MAX			180	mA

* I/O pin leakage is worst case of IIX or IOZX; i.e., IIL and IOZH.
** Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.

Switching Characteristics Over Operating Conditions

SYMBOL	PARAMETER			TEST CONDITIONS	STD MIN	STD MAX	A MIN	A MAX	UNIT
t_{PD}	Input or feedback to output		Product terms P_1–P_n	R_1 = 390 Ω, R_2 = 750 Ω		35		30	ns
			Product term XOR			40		35	
t_{CLK}	Clock to output or feedback					20		20	ns
t_{PZX}	Input to output enable					35		30	ns
t_{PXZ}	Input to output disable					35		30	ns
t_{AP}	Asynchronous preset to output					35		30	ns
t_{CR}	Input or feedback to registered output from combinatorial configuration					95		95	ns
t_{RC}	Input or feedback to combinatorial output from registered configuration					95		95	ns
fMAX*	Maximum frequency	Feedback ($1/t_{PI}$)	Product terms P_1–P_n		18		20		MHz
			Product term XOR		16.7		18		
		No feedback**			20		21.7		

*fMAX is calculated and measured on initial qualifications only.
fMAX (NO feedback) = $1/[t_{WL} + t_{WH}]$

Programmed devices conform to Mil-Std-883, Method 5005, Group A, Subgroups 1, 2, 3, 7, 8, 9, 10 and 11.

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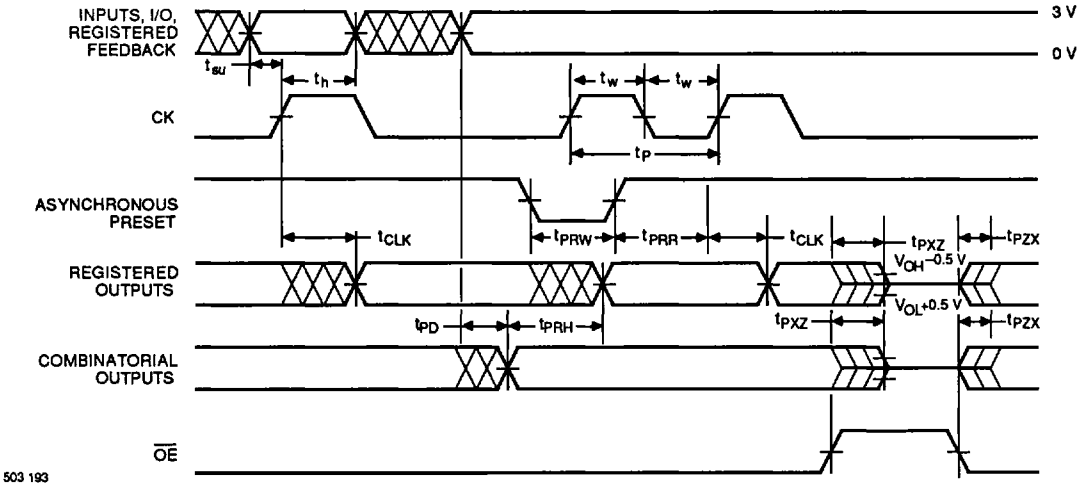
Military 24-Pin PAL Devices

Switching Waveforms



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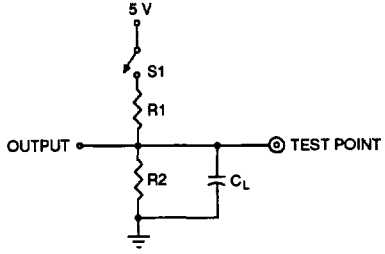
Notes: 1. t_{PD} is tested with switch S_1 closed. C_L = 50 pF and measured at 1.5 V output level.
2. t_{PZX} is measured at the 1.5 V output level with C_L = 50 pF. S_1 is open for high impedance to "1" test and closed for high impedance "0" test.
3. t_{PXZ} is tested with C_L = 5 pF. S_1 is open for "1" to high impedance test measured at V_{OH} −0.5 V output level. S_1 is closed for "0" to high impedance test measured at V_{OL} +0.5 V output level.
4. Equivalent test loads may be used on automatic test equipment.

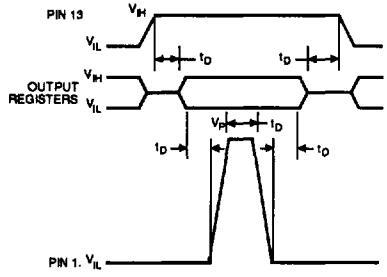
Switching Test Load



503 194

Output Register Preload PAL24XA Series, PAL24RS Series and PAL20RA10 Device

1. Raise V_{CC} to 4.5 V.
2. Disable output registers by setting pin 13 to V_{IH}.
3. Apply V_{IL}/V_{IH} to all registered output pins.
4. Pulse pin 10 to Vp then back to 0 V.
5. Remove V_{IL}/V_{IH} from all output registers.
6. Lower pin 13 to V_{IL} to enable the output registers.
7. Verify for V_{OL}/V_{OH} at all registered output pins.

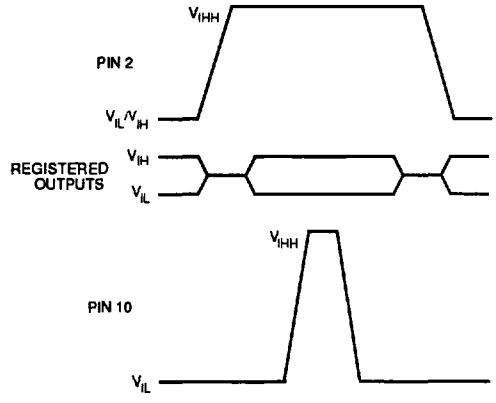


503 195

Output Register Preload PAL32VX10 Device

The preload function allows the register to be loaded from the output pins. This feature aids the functional testing of sequential designs by allowing direct setting of output states. The procedure is:

1. Raise V_{CC} to 4.5 V.
2. Disable output registers by setting pin 2 to V_{IHH}(12 V).
3. Apply V_{IL}/V_{IH} to all registered output pins. Leave combinatorial outputs floating.
4. Pulse pin 10 to V_{IHH}, then back to 0 V.
5. Remove V_{IL}/V_{IH} from all output registers.
6. Remove high voltage from pin 2.
7. Enable registered outputs per programmed pattern.
8. Verify for V_{OL}/V_{OH} at all registered output pins.



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Key to Timing Diagrams

WAVEFORM	INPUTS	OUTPUTS
	DON'T CARE: CHANGE PERMITTED	CHANGING: STATE UNKNOWN
	NOT APPLICABLE	CENTER LINE IS HIGH IMPEDANCE STATE
	MUST BE STEADY	WILL BE STEADY

503 197

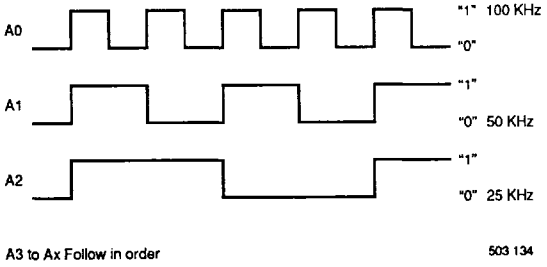
Military 24-Pin PAL Devices

Life Test/Burn-In Circuits

Complies with Mil-Std-883, Method 1005/1015, Condition D.

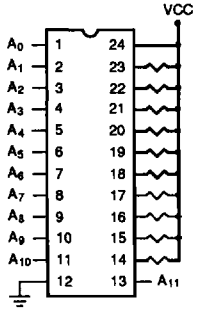
Circuit Configurations

Waveforms

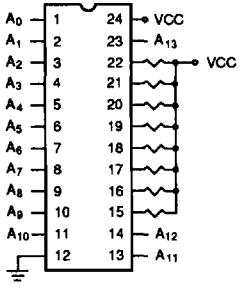


1. All Burn-In will be accomplished at 125°C +5/–0°C
2. V_{CC} = 5.25 volts ± 0.25 V
3. All Clocks (A0 to Ax) are square wave signals 50±15% Duty Cycle, with:
   a. "0" = –0.5 V to +0.7 V
   b. "1" = +2.4 V to V_{CC}
   c. Rise Time (+0.7 V to + 2.4 V) < 1 µsec
   d. Fall Time (+2.4 V to +0.7 V) < 1 µsec
4. Resistor Value
   330 Ω or 470 Ω ±5%
5. All Board Components to be compatible with 150°C Ambient (Min).

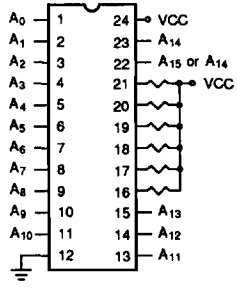
PAL12L10



PAL14L8



PAL16L6



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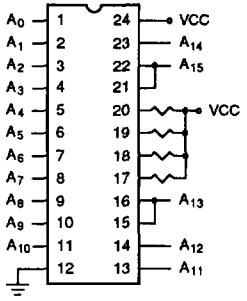
Military 24-Pin PAL Devices

Life Test/Burn-In Circuits

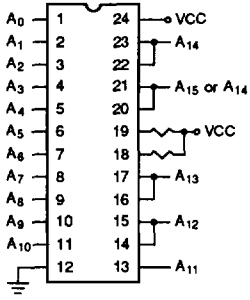
Complies with Mil-Std-883, Method 1005/1015, Condition D.

Circuit Configurations

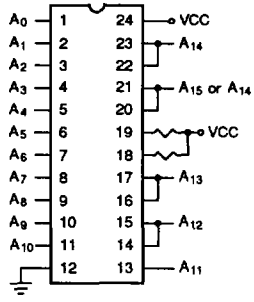
PAL18L4



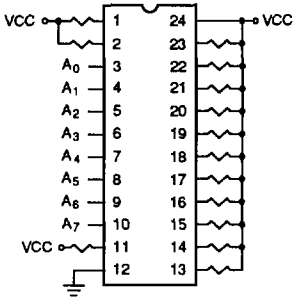
PAL20L2



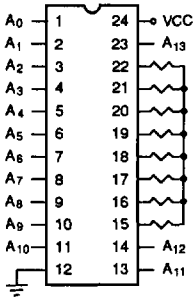
PAL20C1



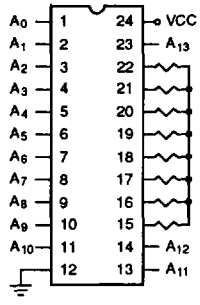
PAL8L14A



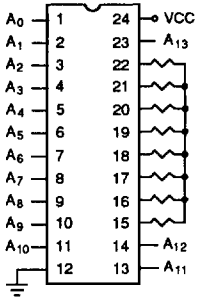
PAL20L8A/B
PAL20L8A-2



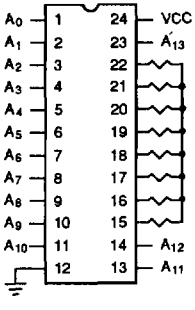
PAL20R8A/B
PAL20R8A-2



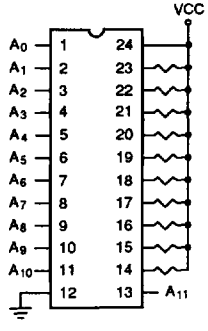
PAL20R6A/B
PAL20R6A-2



PAL20R4A/B
PAL20R4A-2



PAL20L10A



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5

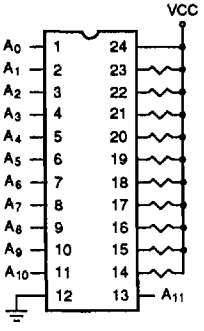
Military 24-Pin PAL Devices

Life Test/Burn-In Circuits

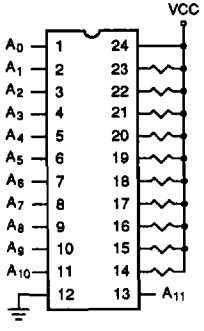
Complies with Mil-Std-883, Method 1005/1015, Condition D.

Circuit Configurations

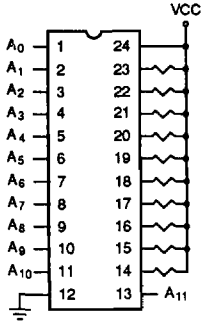
PAL20X10A



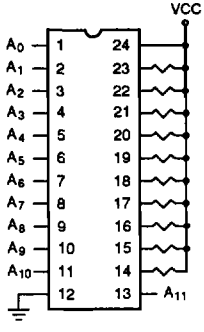
PAL20X8A



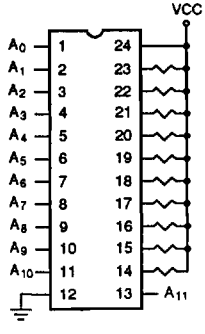
PAL20X4A



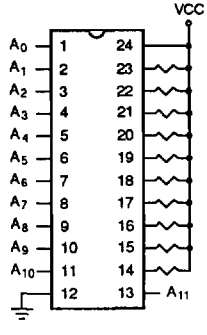
PAL20S10



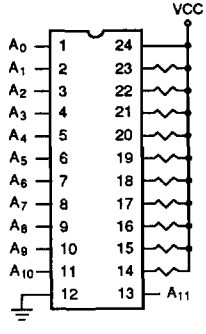
PAL20RS10



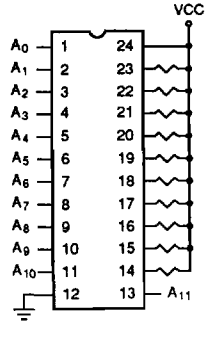
PAL20RS8



PAL20RS4



PAL32VX10/10A



503 211