



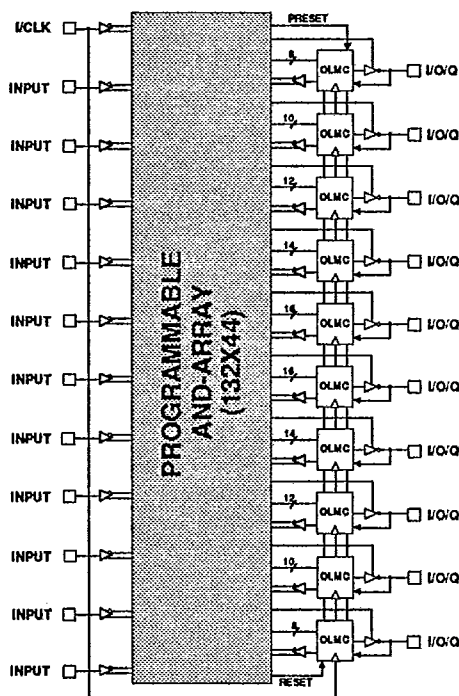
T-4619-07

GAL22V10B

GAL22V10

High Performance E²CMOS PLD**FEATURES**

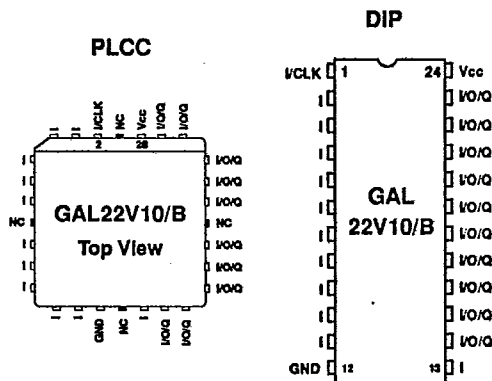
- HIGH PERFORMANCE E²CMOS[®] TECHNOLOGY
 - 10 ns Maximum Propagation Delay
 - F_{max} = 105 MHz
 - 7 ns Maximum from Clock Input to Data Output
 - TTL Compatible 16 mA Outputs
 - UltraMOS[®] Advanced CMOS Technology
- ACTIVE PULL-UPS ON ALL PINS
- COMPATIBLE WITH STANDARD 22V10 DEVICES
 - Fully Function/Fuse-Map/Parametric Compatible with Bipolar and UVCMS 22V10 Devices
- 50% REDUCTION IN POWER VERSUS BIPOLAR
- E² CELL TECHNOLOGY
 - Reconfigurable Logic
 - Reprogrammable Cells
 - 100% Tested/Guaranteed 100% Yields
 - High Speed Electrical Erasure (<100ms)
 - 20 Year Data Retention
- TEN OUTPUT LOGIC MACROCELLS
 - Maximum Flexibility for Complex Logic Designs
- PRELOAD AND POWER-ON RESET OF REGISTERS
 - 100% Functional Testability
- APPLICATIONS INCLUDE:
 - DMA Control
 - State Machine Control
 - High Speed Graphics Processing
 - Standard Logic Speed Upgrade
- ELECTRONIC SIGNATURE FOR IDENTIFICATION

FUNCTIONAL BLOCK DIAGRAM**DESCRIPTION**

The GAL22V10B, at 10ns maximum propagation delay time, combines a high performance CMOS process with Electrically Erasable (E²) floating gate technology to provide the highest performance available of any 22V10 device on the market. CMOS circuitry allows the GAL22V10 to consume much less power when compared to bipolar 22V10 devices. E² technology offers high speed (<100ms) erase times, providing the ability to reprogram or reconfigure the device quickly and efficiently.

The generic architecture provides maximum design flexibility by allowing the Output Logic Macrocell (OLMC) to be configured by the user. The GAL22V10 is fully function/fuse map/parametric compatible with standard bipolar and CMOS 22V10 devices.

Unique test circuitry and reprogrammable cells allow complete AC, DC, and functional testing during manufacture. As a result, LATTICE is able to guarantee 100% field programmability and functionality of all GAL[®] products. LATTICE also guarantees 100 erase/rewrite cycles and data retention in excess of 20 years.

PACKAGE DIAGRAMS

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Tel. (503) 681-0118 or 1-800-FASTGAL; FAX (503) 681-3037

December 1991

Specifications **GAL22V10B****T-46-19-07 Commercial****ABSOLUTE MAXIMUM RATINGS**

Supply voltage V_{CC} -0.5 to +7V
 Input voltage applied -2.5 to $V_{CC} + 1.0V$
 Off-state output voltage applied -2.5 to $V_{CC} + 1.0V$
 Storage Temperature -65 to 150°C
 Ambient Temperature with
 Power Applied -55 to 125°C

1. Stresses above those listed under the "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress only ratings and functional operation of the device at these or at any other conditions above those indicated in the operational sections of this specification is not implied (while programming, follow the programming specifications).

RECOMMENDED OPERATING CONDITIONS**Commercial Devices:**

Ambient Temperature (T_A) 0 to +75°C
 Supply voltage (V_{CC})
 with Respect to Ground +4.75 to +5.25V

DC ELECTRICAL CHARACTERISTICS

Over Recommended Operating Conditions (Unless Otherwise Specified)

SYMBOL	PARAMETER	CONDITION	MIN.	TYP. ³	MAX.	UNITS
V_{IL}	Input Low Voltage		$V_{SS} - 0.5$	—	0.8	V
V_{IH}	Input High Voltage		2.0	—	$V_{CC} + 1$	V
I_{IL}¹	Input or I/O Low Leakage Current	$0V \leq V_{IN} \leq V_{IL} (MAX.)$	—	—	-100	μA
I_{IH}	Input or I/O High Leakage Current	$3.5V \leq V_{IN} \leq V_{CC}$	—	—	10	μA
V_{OL}	Output Low Voltage	$I_{OL} = MAX. V_{IN} = V_{IL} \text{ or } V_{IH}$	—	—	0.5	V
V_{OH}	Output High Voltage	$I_{OH} = MAX. V_{IN} = V_{IL} \text{ or } V_{IH}$	2.4	—	—	V
I_{OL}	Low Level Output Current		—	—	16	mA
I_{OH}	High Level Output Current		—	—	-3.2	mA
I_{OS}²	Output Short Circuit Current	$V_{CC} = 5V \quad V_{OUT} = 0.5V \quad T_A = 25^\circ C$	-30	—	-130	mA
ICC	Operating Power Supply Current	$V_{IL} = 0.5V \quad V_{IH} = 3.0V$ $f_{toggle} = 25MHz \quad \text{Outputs Open}$	—	90	130	mA

1) The leakage current is due to the internal pull-up on all pins. See Input Buffer section for more information.

2) One output at a time for a maximum duration of one second. $V_{out} = 0.5V$ was selected to avoid test problems caused by tester ground degradation. Guaranteed but not 100% tested.

3) Typical values are at $V_{CC} = 5V$ and $T_A = 25^\circ C$

CAPACITANCE ($T_A = 25^\circ C, f = 1.0MHz$)

SYMBOL	PARAMETER	MAXIMUM*	UNITS	TEST CONDITIONS
C_i	Input Capacitance	8	pF	$V_{CC} = 5.0V, V_i = 2.0V$
C_{io}	I/O Capacitance	8	pF	$V_{CC} = 5.0V, V_{io} = 2.0V$

*Guaranteed but not 100% tested.



Specifications **GAL22V10B** Commercial

AC SWITCHING CHARACTERISTICS

T-46-19-07

Over Recommended Operating Conditions

PARAMETER	TEST COND. ¹	DESCRIPTION	-10		-15		UNITS
			MIN.	MAX.	MIN.	MAX.	
t_{pd}	1	Input or I/O to Combinatorial Output	3	10	3	15	ns
t_{co}	1	Clock to Output Delay	2	7	2	8	ns
t_{cf}^2	—	Clock to Feedback Delay	—	2.5	—	2.5	ns
t_{su_1}	—	Setup Time, Input or Feedback before Clock↑	7	—	10	—	ns
t_{su_2}	—	Setup Time, SP before Clock↑	10	—	10	—	ns
t_h	—	Hold Time, Input or Feedback after Clock↑	0	—	0	—	ns
f_{max}^3	1	Maximum Clock Frequency with External Feedback, $1/(t_{su} + t_{co})$	71.4	—	55.5	—	MHz
	1	Maximum Clock Frequency with Internal Feedback, $1/(t_{su} + t_{cf})$	105	—	80	—	MHz
	1	Maximum Clock Frequency with No Feedback	105	—	83.3	—	MHz
t_{wh}^4	—	Clock Pulse Duration, High	4	—	6	—	ns
t_{wl}^4	—	Clock Pulse Duration, Low	4	—	6	—	ns
t_{en}	2	Input or I/O to Output Enabled	3	10	3	15	ns
t_{dis}	3	Input or I/O to Output Disabled	3	9	3	15	ns
t_{ar}	1	Input or I/O to Asynchronous Reset of Register	3	13	3	20	ns
t_{arw}	—	Asynchronous Reset Pulse Duration	8	—	15	—	ns
t_{arr}	—	Asynchronous Reset to Clock↑ Recovery Time	8	—	10	—	ns
t_{spr}	—	Synchronous Preset to Clock↑ Recovery Time	10	—	10	—	ns

1) Refer to Switching Test Conditions section.

2) Calculated from f_{max} with internal feedback. Refer to f_{max} Description section.3) Refer to f_{max} Description section.

4) Clock pulses of widths less than the specification may be detected as valid clock signals.

Specifications **GAL22V10****T-46-19-07 Commercial****ABSOLUTE MAXIMUM RATINGS¹**

Supply voltage V_{CC} -0.5 to +7V
 Input voltage applied -2.5 to $V_{CC} + 1.0V$
 Off-state output voltage applied -2.5 to $V_{CC} + 1.0V$
 Storage Temperature -65 to 150°C
 Ambient Temperature with
 Power Applied -55 to 125°C

1. Stresses above those listed under the "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress only ratings and functional operation of the device at these or at any other conditions above those indicated in the operational sections of this specification is not implied (while programming, follow the programming specifications).

RECOMMENDED OPERATING CONDITIONS²**Commercial Devices:**

Ambient Temperature (T_A) 0 to +75°C
 Supply voltage (V_{CC})
 with Respect to Ground +4.75 to +5.25V

DC ELECTRICAL CHARACTERISTICS³

Over Recommended Operating Conditions (Unless Otherwise Specified)

SYMBOL	PARAMETER	CONDITION	MIN.	TYP. ³	MAX.	UNITS
V_{IL}	Input Low Voltage		$V_{SS} - 0.5$	—	0.8	V
V_{IH}	Input High Voltage		2.0	—	$V_{CC} + 1$	V
I_{IL}¹	Input or I/O Low Leakage Current	$0V \leq V_{IN} \leq V_{IL} (MAX.)$	—	—	-150	μA
I_{IH}	Input or I/O High Leakage Current	$3.5V \leq V_{IN} \leq V_{CC}$	—	—	10	μA
V_{OL}	Output Low Voltage	$I_{OL} = MAX.$ $V_{IN} = V_{IL}$ or V_{IH}	—	—	0.5	V
V_{OH}	Output High Voltage	$I_{OH} = MAX.$ $V_{IN} = V_{IL}$ or V_{IH}	2.4	—	—	V
I_{OL}	Low Level Output Current		—	—	16	mA
I_{OH}	High Level Output Current		—	—	-3.2	mA
I_{OS}²	Output Short Circuit Current	$V_{CC} = 5V$ $V_{OUT} = 0.5V$ $T_A = 25^\circ C$	-50	—	-135	mA
ICC	Operating Power Supply Current	$V_{IL} = 0.5V$ $V_{IH} = 3.0V$ $f_{toggle} = 15MHz$ Outputs Open	—	90	130	mA

1) The leakage current is due to the internal pull-up on all pins. See **Input Buffer** section for more information.

2) One output at a time for a maximum duration of one second. $V_{OUT} = 0.5V$ was selected to avoid test problems caused by tester ground degradation. Guaranteed but not 100% tested.

3) Typical values are at $V_{CC} = 5V$ and $T_A = 25^\circ C$

CAPACITANCE ($T_A \leq 25^\circ C$, $f = 1.0 MHz$)³

SYMBOL	PARAMETER	MAXIMUM*	UNITS	TEST CONDITIONS
C_i	Input Capacitance	8	pF	$V_{CC} = 5.0V$, $V_i = 2.0V$
C_{io}	I/O Capacitance	10	pF	$V_{CC} = 5.0V$, $V_{io} = 2.0V$

*Guaranteed but not 100% tested.



Specifications **GAL22V10** Commercial

AC SWITCHING CHARACTERISTICS

T-46-19-07

Over Recommended Operating Conditions

PARAMETER	TEST COND. ¹	DESCRIPTION	-15		-25		UNITS
			MIN.	MAX.	MIN.	MAX.	
t_{pd}	1	Input or I/O to Combinatorial Output	3	15	3	25	ns
t_{co}	1	Clock to Output Delay	2	8	2	15	ns
t_{cf}²	—	Clock to Feedback Delay	—	5	—	13	ns
t_{su}	—	Setup Time, Input or Feedback before Clock↑	12	—	15	—	ns
t_h	—	Hold Time, Input or Feedback after Clock↑	0	—	0	—	ns
f_{max}³	1	Maximum Clock Frequency with External Feedback, 1/(t _{su} + t _{co})	50	—	33.3	—	MHz
	1	Maximum Clock Frequency with Internal Feedback, 1/(t _{su} + t _{cf})	58.8	—	35.7	—	MHz
	1	Maximum Clock Frequency with No Feedback	62.5	—	38.5	—	MHz
t_{wh}⁴	—	Clock Pulse Duration, High	8	—	13	—	ns
t_{wl}⁴	—	Clock Pulse Duration, Low	8	—	13	—	ns
t_{en}	2	Input or I/O to Output Enabled	3	15	3	25	ns
t_{dis}	3	Input or I/O to Output Disabled	3	15	3	25	ns
t_{ar}	1	Input or I/O to Asynchronous Reset of Register	3	20	3	25	ns
t_{arw}	—	Asynchronous Reset Pulse Duration	15	—	25	—	ns
t_{arr}	—	Asynchronous Reset to Clock↑ Recovery Time	15	—	25	—	ns
t_{spr}	—	Synchronous Preset to Clock↑ Recovery Time	12	—	15	—	ns

1) Refer to Switching Test Conditions section.

2) Calculated from f_{max} with internal feedback. Refer to f_{max} Description section.3) Refer to f_{max} Description section.

4) Clock pulses of widths less than the specification may be detected as valid clock signals.



Specifications **GAL22V10B** **GAL22V10**

GAL22V10B ORDERING INFORMATION

T-46-19-07

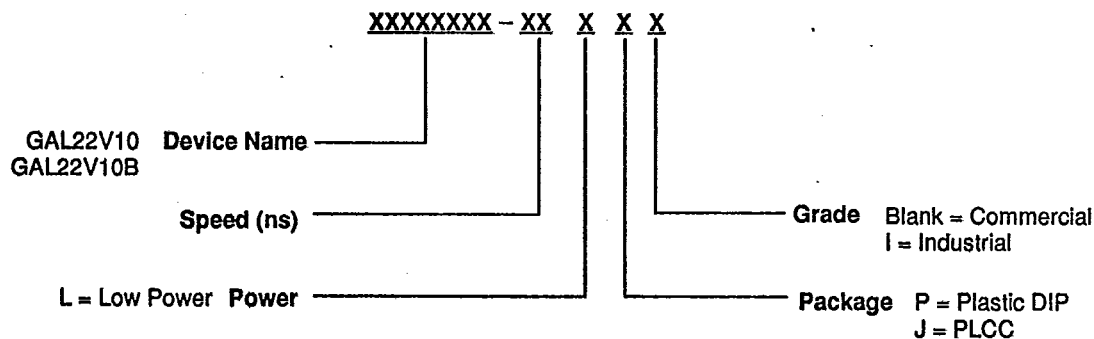
Commercial Grade Specifications

Tpd (ns)	Tsu (ns)	Tco (ns)	Icc (mA)	Ordering #	Package
10	7	7	130	GAL22V10B-10LP	24-Pin Plastic DIP
			130	GAL22V10B-10LJ	28-Lead PLCC
15	10	8	130	GAL22V10B-15LP	24-Pin Plastic DIP
			130	GAL22V10B-15LJ	28-Lead PLCC
15	12	8	130	GAL22V10-15LP	24-Pin Plastic DIP
			130	GAL22V10-15LJ	28-Lead PLCC
25	15	15	130	GAL22V10-25LP	24-Pin Plastic DIP
			130	GAL22V10-25LJ	28-Lead PLCC

Industrial Grade Specifications

Tpd (ns)	Tsu (ns)	Tco (ns)	Icc (mA)	Ordering #	Package
15	10	8	150	GAL22V10B-15LPI	24-Pin Plastic DIP
			150	GAL22V10B-15LJI	28-Lead PLCC
20	14	10	150	GAL22V10-20LPI	24-Pin Plastic DIP
			150	GAL22V10-20LJI	28-Lead PLCC
25	15	15	150	GAL22V10-25LPI	24-Pin Plastic DIP
			150	GAL22V10-25LJI	28-Lead PLCC

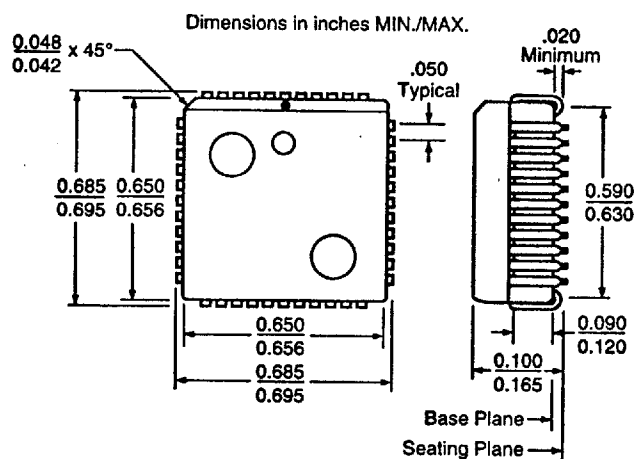
PART NUMBER DESCRIPTION



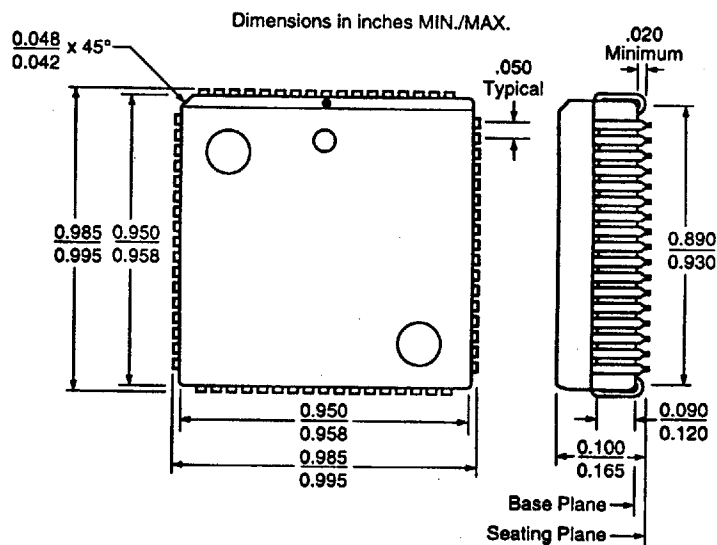
Package Diagrams

T-90-20

44-Pin PLCC



68-Pin PLCC

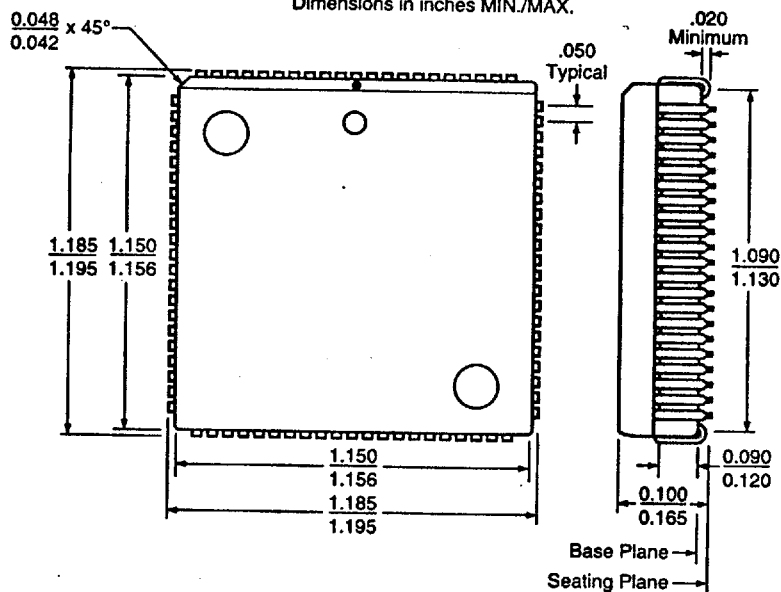


Package Diagrams

T-90-20

84-Pin PLCC

Dimensions in inches MIN./MAX.

**120-Pin PQFP**

Dimensions in inches MIN./MAX.

