Lattice
Semiconductor Corporation

Introduction to GAL Devices

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Overview

Lattice, the inventor of the Generic Array Logic™ (GAL®) family of low density, E²CMOS® PLDs is the leading supplier of low density CMOS PLDs in the world. Features such as industry leading performance, full reprogrammability, low power consumption, 100% testability and 100% programming yields make the GAL family the preferred choice among system designers. The GAL family contains a comprehensive array of product architectures with a variety of performance levels specified across commercial, industrial and military (MIL-STD-883) operating ranges to meet the demands of any system logic design.

A Product for Any System Design Need

Lattice GAL products have the performance, architectural features, low power, and high quality to meet the needs of the most demanding system designs.

Low Voltage Products

This rapidly growing family of 3.3V products support all speed, power and system logic level requirements. Included are the world's fastest PLDs (16LV8D, 20LV8D, 22LV10D and 26CLV12D) which are ideal for high performance, 3.3V logic applications. The 3.3V "zero power" (22LV10Z/ZD, LV22V10Z, 16/20LV8ZD) and the "low power" (16LV8C, 22LV10C) product lines offer the flexibility of working in either 3.3V or mixed 3.3V and 5V systems. In-system programmability is also available with the ispGAL22LV10.

Standard Products

Aimed at providing a superior design alternative to the bipolar PLD, the 16V8, 20V8, 22V10, 20RA10 and 20XV10 replace over 98% of all bipolar PAL devices. These GAL devices meet, and in most cases, beat bipolar PAL performance specifications while consuming significantly lower power and offering higher quality and reliability via Lattice electrically reprogrammable E²CMOS technology.

Extension Products

These products provide enhanced functionality including innovative architectures (GAL18V10, GAL26CV12, and GAL6001/6002), 64mA high output drive (GAL16VP8 and GAL20VP8), "zero power" operation (GAL16V8Z/ZD and GAL20V8Z/ZD), and in-system programmability (ispGAL22V10).

GAL16LV8 and GAL20LV8

Fastest 3.3V PLDs in the World
- Performance ranging from 3.5ns Tpd and 250MHz Fmax to 15ns Tpd and 62.5MHz Fmax
- Ideal for supporting high performance microprocessors
- Supports 5 Volt Interface
- 45 mA typical power consumption
- Available in 20-pin and 28-pin PLCC packages

GAL16LV8ZD and GAL20LV8ZD

3.3 Volt and Zero Stand-by Power
- 50µA I_{CC} typical stand-by power (100µA MAX)
- 15ns Tpd performance
- Dedicated power-down pin
- Available in 20-pin and 28-pin PLCC packages

GAL22LV10

Fastest 3.3V 22V10 in the World
- Performance from 4 ns Tpd and 250 MHz to 15 ns t_{PD} and 83 MHz Fmax
- Ideal for high performance systems
- Supports 5 Volt Interface
- Available in 28-pin PLCC package

GAL22LV10Z/ZD

3.3 Volt and Zero Stand-by Power
- 50µA I_{CC} typical stand-by power (100µA MAX)
- 15ns Tpd performance
- Two power-down modes
    - Input transition detection (Z)
    - Dedicated power-down pin (ZD)
- Available in 28-pin PLCC package

ispGAL22LV10

ISP version of 3.3 Volt GAL22LV10
- Fast 4ns/250MHz performance
- Same 28-pin PLCC footprint as GAL22LV10
- Available in space-saving 28-pin SSOP

GAL26CLV12

World's Fastest 3.3 Volt 28-pin PLD

- Performance ranging from 5ns t_{PD} and 200MHz f_{MAX} to 7.5ns t_{PD} and 142MHz f_{MAX}
- World's fastest 28-pin PLD at 4ns
- Supports 5 Volt Interface
- Fully utilized 28-pin PLCC package gives added functionality over the 22V10 at no space premium!

GAL16V8 and GAL20V8

Industry Standard Architecture

- Performance ranges from the industry's fastest at 3.5ns Tpd (16V8D-3) to popular 25ns versions
- Low power consumption with low power versions rated at 75mA typical and quarter power versions at 45mA typical
- Eight powerful Output Logic Macrocells (OLMCs) with eight product terms each
- Standard 20-pin (DIP and PLCC) and 24/28-pin (DIP/PLCC) packages

GAL16V8Z/ZD and GAL20V8Z/ZD

Zero Stand-by Power
- 15 - 50µA Icc typical stand-by power (100µA MAX)
- 12ns t_{PD}performance
- Two power-down modes
    - Input transition detection (Z)
    - Dedicated power-down pin (ZD)
- Available in 20-pin DIP/PLCC/SOIC and 24/28-pin DIP/PLCC packages

GAL16VP8 and GAL20VP8

Ideal for Bus Interface or Memory Control Logic
- High output drive versions of the GAL16V8 and GAL20V8
- I_{OL} = 64mA vs standard 24mA
- Combines GAL architecture with high drive of 74XX244 buffer families
- Fast 15ns/80MHz performance
- Available in 20-pin DIP/PLCC and 24/28-pin DIP/PLCC packages

GAL18V10

10 Outputs in a 20-pin Package
- 7.5ns Tpd performance
- 20-pin space-saving subset of the popular GAL22V10
- 8-10 Product Terms per OLMC
- Ideal for space constrained designs
- Only 10 output, 20-pin PLD in the market

GAL20RA10

High Performance Asynchronous Logic
- 10 OLMCs
- 10 independently programmable clocks
- Each macrocell has an independent product term clock
- Fast 7.5ns Tpd performance
- Faster and lower power than bipolar PAL
- Available in 24/28-pin DIP/PLCC packages

GAL20XV10

Perfect for Fast Counters, Decoders or Comparators
- Utilizes powerful XOR function for efficient implementation of arithmetic functions
- Replaces: PAL20L10, 20X10, 20X8 and 20X4, 12L10
- 10ns/100MHz performance significantly outperforms bipolar PALs
- Perfect for video, multimedia and graphics applications
- Available in 24/28-pin DIP/PLCC packages

GAL22V10

Industry Standard Architecture
- Available in industry leading 4ns/250MHz versions through 25ns versions
- Low power consumption with Low Power versions at 90mA and Quarter Power versions at 45mA typical and zero power version at 30µA.
- 10 OLMCs with variable Product Terms per OLMC ranging from 8 to 16 for increased logic capability
- Standard 24-pin DIP and 28-pin PLCC packages

ispGAL22V10

Offers the Benefits of ISP in a 22V10
- Popular 22V10 architecture
- In-system programmable

- Fast 7.5ns/111MHz performance
- Same 28-pin PLCC footprint as GAL22V10
- Also available in space-saving 28-pin SSOP

GAL26CV12

Expanded Logic Density in a 28-pin DIP/PLCC Package
- 28-pin superset of the popular GAL22V10
- 7.5ns Tpd performance
- 26 inputs, 12 outputs
- Flexible 22V10 OLMC
- Fully utilized 28-pin PLCC package gives added functionality over the 22V10 at no space premium!

GAL6001 and GAL6002

The Logic Density of an FPLA Architecture
- Unprecedented logic density in a 24/28-pin DIP/PLCC
- Functional equivalent of two GAL22V10s
- 38 macrocells
  - 10 input macrocells
  - 10 output macrocells
  - 10 I/O macrocells
  - 8 buried logic macrocells
- 15ns/75MHz performance
- Ideal for register-intensive applications

Commercial/Industrial/Military Grades Available

The Lattice GAL family is available in a wide range of commercial, industrial and military grade versions. In the military arena, Lattice offers a family of Standard Military Drawing (SMD) GAL devices which have been processed to MIL-STD-883.

Table 1. Lattice GAL Product Offering

		Speed Options by Grade (t_{PD} in ns)		
		Commercial	**Industrial**	**883/Military**
3.3V Products	GAL16LV8	3.5, 5, 7.5, 10, 15		
	GAL16LV8ZD	15, 25	20	
	GAL20LV8	3.5, 5, 7.5		
	GAL20LV8ZD Zero Power	15, 25		
	GAL22LV10	4, 5, 7.5, 10, 15		
	GAL22LV10Z/ZD Zero Power	15, 25	15, 25	
	ispGAL22LV10	4, 5, 7.5, 10, 15	7, 10, 15	
	GAL26CLV12	5, 7.5		
5V Products	GAL16V8Z/ZD	12, 15, 25	12, 15, 25	
	GAL16V8	3.5, 5, 7.5, 10, 15, 25	7.5, 10, 15, 25	7.5, 10, 15, 20, 30
	GAL16V8	10, 15, 25	20, 25	
	GAL16VP8	15, 25		
	GAL18V10	7.5, 10, 15, 20		
	GAL20RA10	7.5, 10, 15, 20, 30	7.5, 10, 15, 20	
	GAL20V8Z/ZD	12, 15		
	GAL20V8	5, 7.5, 10, 15, 25	10, 15, 25	10, 15, 20
	GAL20V8	15, 25	20, 25	
	GAL20VP8	15, 25		
	GAL20XV10	10, 15, 20		
	GAL22V10	4, 5, 7.5, 10, 15, 25	7.5, 10, 15, 20, 25	10, 15, 20, 25, 30
	GAL22V10	10, 15, 25		
	ispGAL22V10	7.5, 10, 15	15	
	GAL26CV12	7.5, 10, 15, 20	10, 15, 20	
	GAL6001	30		
	GAL6002	15, 20		
	Vcc (3.3V Products)	3.3V ±10%		
	Vcc (5V Products)	5V ±5%	5V ±10%	5V ±10%
	Operating Temperature	0 to 75°C	-40 to 85°C	-55 to 125°C
	Packaging	Plastic DIP, PLCC, SOIC* and SSOP**	Plastic DIP and PLCC	CERDIP and LCC

* SOIC available with GAL16V8Z only.
** SSOP available with ispGAL22V10 and ispGAL22LV10 only.