

RoHS Compliant Packaging

"Lattice Semiconductor is committed to conducting business in a manner consistent with the efficient use of resources and materials, and the preservation of the natural environment."

Lattice Corporate Commitment

Due to increased worldwide environmental concerns, the need for lead-free solutions in electronic components and systems is receiving increased attention within the semiconductor and electronics industries. Lattice is fully supportive of the various industry efforts throughout the world to phase out the use of lead and other undesirable elements from electronic equipment materials and manufacturing processes.

Lattice remains committed to continually reducing its impact on the world's natural environment and works closely with its customers and suppliers to identify and rapidly eliminate hazardous substances from its products.

Resource Conservation

Environmental protection is more than just meeting standards. All corporate activities must be implemented with the environment in mind. Lattice's goal is to develop all new products such that they reduce space, materials and power consumption for an equivalent electrical function. In turn, this allows our customers to continually reduce their impact on the environment.

ISO14001

ISO14001 is an international standard for environmental management systems. Companies that are ISO14001 registered have demonstrated an internal program for the management of hazardous waste and implementation of recycling programs. This international recognition certifies a company's commitment to preserving the natural environment. All Lattice subcontract manufacturers are ISO14001 registered, and are routinely reviewed to ensure continued compliance.

Lattice's Lead-Free Solutions

Lattice has qualified a wide variety of package types in lead-free configurations. These qualified packages include the Plastic Leaded Chip Carrier (PLCC), Plastic DIP (PDIP), Thin Quad Flat Pack (TQFP), Plastic Quad Flat Pack (PQFP), Fine Pitch BGA (fpBGA), Fine Pitch Thin BGA (ftBGA), Chip Array BGA (caBGA), Chip Scale BGA (csBGA), Flip Chip BGA (fcBGA), and Quad Flat-Pack No Lead Saw-Singulated (QFNS). To better facilitate the industry transition to lead-free PLDs, Lattice offers the following broad assortment of standard lead-free product families.

- **LatticeSC™ FPGA for Extreme Performance**
 - LatticeSC (1.2V/1.0V)
 - LatticeSCM (1.2V/1.0V)
- **MachXO™ Programmable Logic Devices**
 - MachXO (3.3V/2.5V/1.8V/1.2V)



- AEC-Q100 Qualified LA-MachXO (3.3V/2.5V/1.8V/1.2V)
- **Optimized FPGA Architecture with Non-Volatile Reconfiguration and TransFR™ Technology**
 - LatticeXP2™ (1.2V)
 - AEC-Q100 Qualified LA-LatticeXP2 (1.2V)
 - LatticeXP™ (3.3V/2.5V/1.8V/1.2V)
- **Optimized FPGA Architecture with High-Performance DSP**
 - LatticeECP3™ (1.2V)
 - LatticeECP2M™ (1.2V)
 - LatticeECP2™ (1.2V)
 - LatticeECP-DSP™ (1.2V)
 - LatticeEC™ (1.2V)
- **Ultra Low Power CPLDs**
 - ispMACH™ 4000ZE (1.8V)
- **SuperFAST™ Zero-Power CPLDs**
 - ispMACH 4000Z (1.8V)
- **SuperFAST Low-Power CPLDs**
 - ispMACH 4000V/B/C (3.3V/2.5V/1.8V)
 - AEC-Q100 Qualified LA-ispMACH 4000V (3.3V)
- **ispXP™ CPLDs with Memory**
 - ispXPLD™ 5000MV/MB/MC (3.3V/2.5V/1.8V)
- **Total Power Management Mixed-Signal Devices**
 - ispPAC®-POWR1014/A
 - AEC-Q100 Qualified LA-ispPAC-POWR1014/A
 - ispPAC-POWR1220AT8
 - ispPAC-POWR6AT6
 - ispPAC-POWR1208/604
 - ispPAC-POWR1208P1
- **Programmable Clock Generator**
 - ispClock™5600/A
 - ispClock5400D
 - ispClock5300S
- **Industry's Fastest and Smallest SPLDs**
 - ispGAL®22V10AV (3.3V)

Lead-Free Packaging Initiative

Lattice Semiconductor is a leader in the development of lead-free packaging solutions. Lattice currently offers an extensive list of standard products in lead-free packaging.

Lattice's lead-free products are fully RoHS compliant, meeting the European Parliament Directive entitled "Restrictions on the use Of Hazardous Substances" (RoHS). This directive prohibits the use of the following elements in electrical/electronic equipment sold after 7/1/2006: cadmium (Cd), lead (Pb), mercury (Hg), hexavalent chromium (Cr(VI)), polybrominated biphenyls (PBBs) and polybrominated diphenyl ethers (PBDEs). Lattice's lead-free products are compliant with this directive today, well ahead of the July, 2006 deadline.

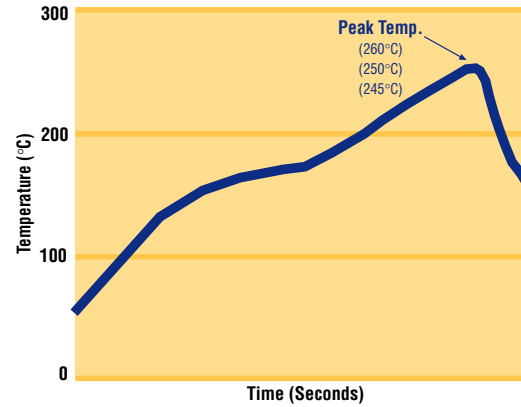
Backward Compatible Packages

All of Lattice's lead-free TQFP, PLCC, PQFP and QFN packages are "backward compatible" with conventional leaded manufacturing methodologies. This backward compatibility allows users to surface mount lead-free packages onto lead-based PCBs and/or use lead-free packaging with lead-containing solders. Users can now procure a single, lead-free component from Lattice and use it in either a leaded or lead-free manufacturing environment without any issues. This capability greatly simplifies the inventory management challenges associated with migration from conventional lead-based to lead-free manufacturing.

Lead-Free Reflow Profile

Lattice lead-free packages are qualified to Level 1, 3 or 4 moisture resistance, depending on the package type, with peak reflow temperatures of either 260°C, 250°C or 245°C, consistent with IPC/JEDEC J-STD-020, *Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices*. Reliability tests include high temperature

Typical Conditions for Lead-Free Reflow Soldering



Lead-Free Peak Reflow Temp.	Moisture Sensitivity Level (MSL)	Package
260 + 0/-5°C	3	TQFP, csBGA, caBGA
	1	QFN
250 + 0/-5°C	1	20 PLCC
	3	fpBGA, ftBGA
245 + 0/-5°C	1	28 PLCC
	3	PQFP, 44 PLCC
	4	fcBGA, 84 PLCC

For specific reflow profiles, see Lattice Technical Note TN1076.

operating life (HTOL), surface mount preconditioning testing, temperature cycling, moisture resistance testing, biased highly accelerated stress test (HAST) and unbiased HAST. Lattice lead-free products are qualified to the reflow profiles described in Product Bulletin *Reflow Profile for Lattice Lead-Free, RoHS Compliant Products*, available on the Lattice web site at www.latticesemi.com.

Lead-Free Device Offerings From Lattice

Product Family	Device Family	Device Family Description	Lead-Free Packages	
			Backward Compatible	Standard
LatticeSC	LatticeSC	Extreme Performance 90nm FPGA		256 fpBGA, 900 fpBGA, 1020 fcBGA, 1152 fcBGA, 1704 fcBGA
LatticeECP3	LatticeECP3	Low Power, High-Value, SERDES-Capable FPGA		256 ftBGA, 484 fpBGA, 672 fpBGA, 1156 fpBGA
LatticeECP2/M	LatticeECP2/M	High-Value FPGA, High End Features + SERDES	144 TQFP, 208 PQFP	256 fpBGA, 484 fpBGA, 672 fpBGA, 900 fpBGA, 1152 fpBGA
MachXO	MachXO "C"	1.8V/2.5V/3.3V PLD	100 TQFP, 144 TQFP	100 csBGA, 132 csBGA, 256 caBGA, 256 ftBGA, 324 ftBGA
	MachXO "E"	1.2V PLD		
	LA-MachXO "C"	1.8V/2.5V/3.3V AEC-Q100 Qualified PLD	100 TQFP, 144 TQFP	256 ftBGA, 324 ftBGA
	LA-MachXO "E"	1.2V AEC-Q100 Qualified PLD		
LatticeXP2	LatticeXP2	Low-cost, non-volatile FPGA with flexiFLASH™ architecture	144 TQFP, 208 PQFP	132 csBGA, 256 ftBGA, 484 fpBGA, 672 fpBGA
	LA-LatticeXP2	AEC-Q100 qualified flexiFLASH architecture FPGA	144 TQFP, 208 PQFP, 256 ftBGA	132 csBGA, 256 ftBGA

Lead-Free Device Offerings From Lattice (Continued)

Product Family	Device Family	Device Family Description	Lead-Free Packages	
			Backward Compatible	Standard
LatticeXP	LatticeXP "C"	1.8V/2.5V/3.3V Low-Cost Non-Volatile FPGAs with TransFR Technology	100 TQFP, 144 TQFP, 208 PQFP	256 fpBGA, 388 fpBGA, 484 fpBGA
	LatticeXP "E"	1.2V Low-Cost Non-Volatile FPGAs with TransFR Technology		
LatticeECP/EC	LatticeECP-DSP	1.2V Low-Cost FPGA with Embedded High-Performance DSP	100 TQFP, 144 TQFP, 208 PQFP	256 fpBGA, 484 fpBGA, 672 fpBGA
	LatticeEC	1.2V Low-Cost FPGA for High-Volume Applications		
ispXPGA ¹	ispXPGA-B, EB	3.3V/2.5V Non-Volatile, Infinitely Reconfigurable FPGA		256 fpBGA, 900 fpBGA
	ispXPGA-C, EC	1.8V Non-Volatile, Infinitely Reconfigurable FPGA		
ispGDX2	ispGDX2-V, EV	3.3V High Performance Digital Crosspoint Switch		100 fpBGA, 208 fpBGA, 484 fpBGA
	ispGDX2-B, EB	2.5V High Performance Digital Crosspoint Switch		
	ispGDX2-C, EC	1.8V High Performance Digital Crosspoint Switch		
ORCA 4 FPSC	ORT82G5 ³ /42G5	1.5V ORCA 4 FPGA Plus Embedded High-Performance ASIC Core		484 fpBGA, 680 fpBGA ³
	ORSO82G5 ³ /42G5			
	ORT8850H/L			
	ORLI10G			
	ORSPI4			1156 fpBGA
ispMACH 4000	ispMACH 4000ZE	1.8V Ultra Low-Power CPLD	48 TQFP, 100 TQFP, 144 TQFP	64 csBGA, 144 csBGA
	ispMACH 4000Z	1.8V SuperFAST Zero-Power CPLD	48 TQFP, 100 TQFP, 176 TQFP	56 csBGA, 132 csBGA
	ispMACH 4000V	3.3V SuperFAST Low-Power CPLD	44 TQFP, 48 TQFP, 100 TQFP, 128 TQFP, 144 TQFP, 176 TQFP	256 ftBGA
	ispMACH 4000B	2.5V SuperFAST Low-Power CPLD		
	ispMACH 4000C	1.8V SuperFAST Low-Power CPLD		
	LA-ispMACH 4000V	3.3V AEC-Q100 Qualified SuperFAST Low-Power CPLD	44 TQFP, 48 TQFP, 100 TQFP, 128 TQFP, 144 TQFP	
ispXPLD 5000MX	ispXPLD 5000MV	3.3V High Density CPLD + Memory	208 PQFP	256 fpBGA, 484 fpBGA, 672 fpBGA
	ispXPLD 5000MB	2.5V High Density CPLD + Memory		
	ispXPLD 5000MC	1.8V High Density CPLD + Memory		
ispPAC Power Manager	ispPAC-POWR1014/A	Power Supply Supervisor, Reset Generator and Sequencing Controller	48 TQFP	
	LA-ispPAC-POWR1014/A	AEC-Q100 Qualified In-System Programmable Power Supply Supervisor, Reset Generator and Sequencing Controller	48 TQFP	
	ispPAC-POWR604	Power Supply Sequencing and Monitoring	44 TQFP	
	ispPAC-POWR1208			
	ispPAC-POWR1208P1	Precision Power Manager		
	ispPAC-POWR1220AT8	Power Supply Supervisor, Reset Generator and Sequencing Controller	100 TQFP	
	ispPAC-POWR6AT6	Power Supply Monitoring and Margining Controller	32 QFNS	
ispClock	ispClock5300S	Ultra-low Jitter In-System Programmable Differential Clock	48 TQFP, 64 TQFP	
	ispClock5400D	Ultra-low Phase Noise, Zero-Delay Buffer Clock	48 QFNS, 64 QFNS	
	ispClock5600/A	In-System Programmable Clock Generator	48 TQFP, 100 TQFP	
ispLSI 1000E	ispLSI 1016E ispLSI 1032E ispLSI 1048E	5V In-System Programmable High Density PLD	44 PLCC, 84 PLCC ² , 44 TQFP, 100 TQFP, 128 TQFP, 128 PQFP	
ispLSI 2000A	ispLSI 2032A ispLSI 2064A ispLSI 2096A ispLSI 2128A	5V In-System Programmable High Density PLD	44 PLCC, 84 PLCC ² , 44 TQFP, 48 TQFP, 100 TQFP, 128 TQFP, 176 TQFP, 128 PQFP, 160 PQFP	

Lead-Free Device Offerings From Lattice (Continued)

Product Family	Device Family	Device Family Description	Lead-Free Packages	
			Backward Compatible	Standard
ispLSI 2000VE	ispLSI 2032VE ispLSI 2064VE ispLSI 2096VE ispLSI 2128VE ispLSI 2192VE	3.3V In-System Programmable High Density SuperFAST PLD	44 TQFP, 48 TQFP, 100 TQFP, 128 TQFP, 176 TQFP	208 fpBGA
ispMACH 4A3	M4A3-32 M4A3-64 M4A3-128 M4A3-192 M4A3-256 M4A3-384 M4A3-512	High Performance E ² CMOS [®] 3.3V CPLD Family	44 TQFP, 44 PLCC, 48 TQFP, 100 TQFP, 144 TQFP, 208 PQFP	256 fpBGA
ispMACH 4A5	M4A5-32 M4A5-64 M4A5-128 M4A5-192	High Performance E ² CMOS 5V CPLD Family	44 TQFP, 44 PLCC, 48 TQFP, 100 TQFP, 100 PQFP, 144 TQFP, 208 PQFP	
ispGDXVA	ispGDX80VA ispGDX160VA ispGDX240VA	3.3V In-System Programmable Generic Digital Crosspoint	100 TQFP	208 fpBGA, 388 fpBGA
ispGAL	ispGAL22V10AV	3.3V, Industry's Fastest and Smallest PLD	32 QFNS	
	ispGAL22V10C	5V In-System Programmable PLD	28 PLCC	
GAL	GAL16LV8C/D	3.3V Universal PLD	20 PLCC	
	GAL22LV10C/D		28 PLCC	
	GAL16V8D GAL20V8B/C GAL22V10D	5V Universal PLD	20 PDIP, 20 PLCC, 24 PDIP, 28 PLCC	

1. Select products only. Refer to data sheet for specific support.
2. MSL4.
3. Pb-free version is supported without heat spreader.

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www.latticesemi.com