Welcome to E-XFL.COM

Understanding Embedded - CPLDs (Complex Programmable Logic Devices)

Embedded - CPLDs, or Complex Programmable Logic Devices, are highly versatile digital logic devices used in electronic systems. These programmable components are designed to perform complex logical operations and can be customized for specific applications. Unlike fixed-function ICs, CPLDs offer the flexibility to reprogram their configuration, making them an ideal choice for various embedded systems. They consist of a set of logic gates and programmable interconnects, allowing designers to implement complex logic circuits without needing custom hardware.

Applications of Embedded - CPLDs

Details	
Product Status	Obsolete
Programmable Type	In System Programmable
Delay Time tpd(1) Max	5 ns
Voltage Supply - Internal	3V ~ 3.6V
Number of Logic Elements/Blocks	8
Number of Macrocells	128
Number of Gates	-
Number of I/O	96
Operating Temperature	-40°C ~ 105°C (TJ)
Mounting Type	Surface Mount
Package / Case	144-LQFP
Supplier Device Package	144-TQFP (20x20)
Purchase URL	https://www.e-xfl.com/product-detail/lattice-semiconductor/lc4128v-5t144i

The Lattice Advantage

Customizable Solutions

Lattice Semiconductor leads the industry in ultra-low power, small form factor, customizable solutions for today's quickly changing connected world. From heterogeneous networks and micro servers, to smartphones, tablets and wearables, Lattice FPGAs and CPLDs are at the heart of solutions that give designers the ability to quickly innovate, or build and add features to their systems that uniquely differentiate their products.

iCE40 Portfolio: World's Smallest FPGAs – Lattice's iCE40 family offers the world's smallest FPGAs at very low power enabling flexible and fast customization on standard platforms – perfect for implementing killer features on smartphones, tablets, wearables, iOT edge, and other mobile devices.

MachXO Portfolio: Control PLD and Bridging – The award-winning MachXO2 FPGA family and new MachXO3 family – the world's smallest, lowest-cost-per I/O, instant-on programmable platform – can be used to quickly implement system control functions, I/O expansion and bridging in applications such as routers, base stations, servers, storage, industrial, medical and consumer.

ECP Portfolio: Connectivity and Acceleration FPGAs – The LatticeECP3, ECP5 and ECP5-5G families are optimized for data and control path bridge and interfacing, architected with high-performance SERDES, full-featured DSP blocks, and for state-of-the-art memory interfaces for supporting a wide range of applications including wireless and wireline communication, video processing, security and surveillance, industrial automation, and automotive.

Power and Thermal Management Products

Lattice's Platform Manager 2 devices implement circuit board hardware management functions (Power Management, Control Plane Functions and Thermal Management). The Platform Manager 2 device family is comprised of a Platform Manager 2 device (Programmable Analog + FPGA) and a Programmable Analog Sense and Control device (L-ASC10).

In simpler boards, the Power Management functions can be integrated into Lattice Power Manager II products.

Standards-Based Products

Lattice enables high-performance digital connectivity for some of the world's biggest brands in mobile, consumer electronic (CE), and PC markets. As the driving force behind global standards including HDMI®, DVI, MHL®, and WirelessHD®, Lattice's understanding of these technologies is second to none.

As a Founder of both the HDMI® and MHL® Specifications, and through extensive experience with compliance and interoperability testing, Lattice is in a unique position to offer tested, field-proven solutions that can be rapidly and reliably integrated into TVs, projectors, A/V receivers, Blu-ray players, set-top boxes, and other digital display and home theater products.

Lattice's mobile semiconductor products are designed for smartphones, tablets, digital cameras, streaming sticks, mobile docks, and other devices where a small form factor and lower power consumption are essential. Lattice offers support for proprietary connectors along with standard micro-USB, USB Type-C, superMHL™, and HDMI connectors.

pASSP™ Solutions

Lattice has combined the flexibility and fast time to market advantage of an FPGA with the power and efficiency of an ASSP to create a new product class called programmable ASSP (pASSP). This gives designers the best of both worlds by delivering the most flexible, highest bandwidth, lowest power and smallest footprint solutions for several high-growth market segments.

CrossLink Portfolio: pASSP Video Interface Bridges – CrossLink is the industry's first programmable bridging device that resolves interface mismatches between application processors, image sensors, and displays. This makes it the optimal solution for VR headsets, drones, smartphones, tablets, cameras, wearables, human machine interfaces (HMIs), and automotive.

SiBEAM

SiBEAM, a Lattice Semiconductor Company, is a pioneer in developing intelligent millimeter-wave technologies for wireless communications. The company was the first to build 60GHz chipsets using standard CMOS technology. SiBEAM is a global leader in driving next-generation architecture and semiconductor implementation of wireless connectivity solutions in the consumer electronics, mobile, enterprise and infrastructure markets.

SiBEAM's WirelessHD transmitter and receiver modules are completely self-contained, autonomous WirelessHD subsystems that connect to a host board and enables. These WirelessHD modules enable a robust high-definition wireless video connectivity between an HDMI® source and a display, delivering a cable-quality connection without wires.

For more information go to LATTICESEMI.COM

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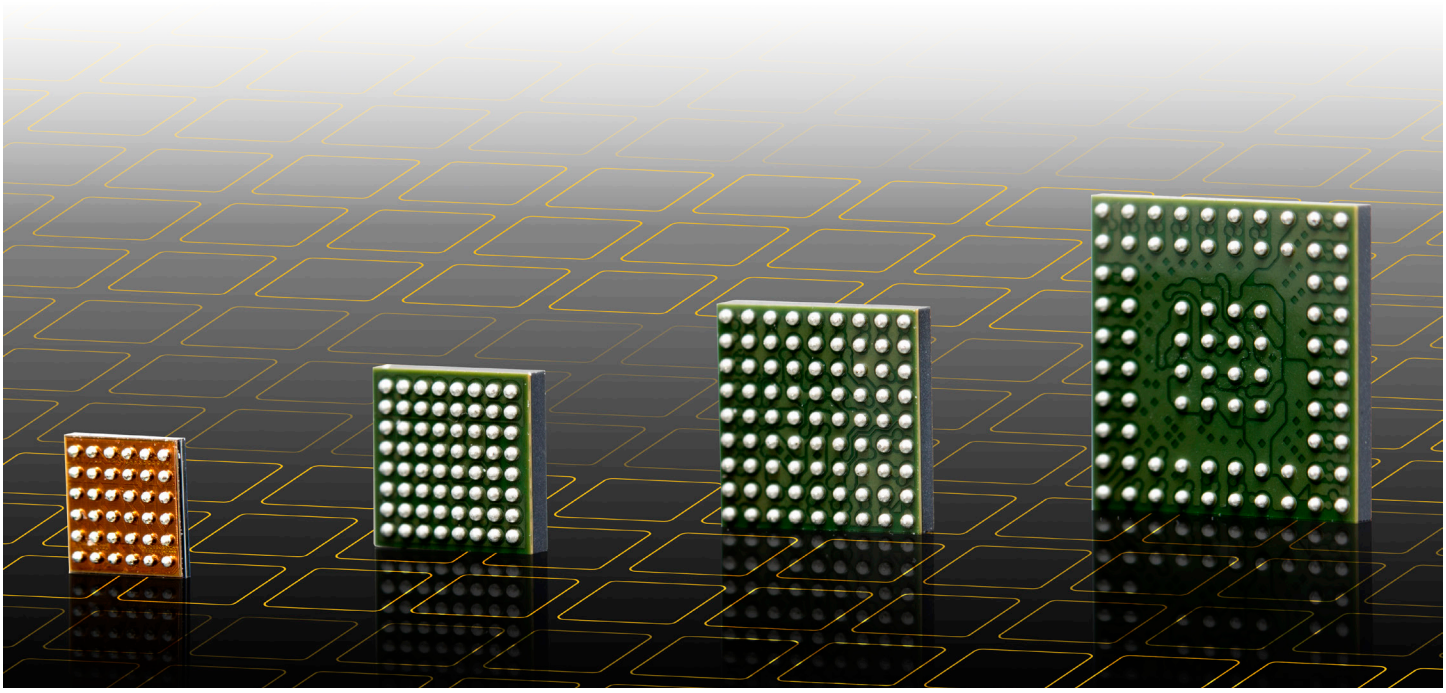
Programmable Products

Standards-based Products



FPGA Products

ECP Series - Connectivity and Acceleration FPGAs

Features		ECP5™-5G			ECP5 Automotive			ECP5™							LatticeECP3™				
Device		LFE5UM5G-25	LFE5UM5G-45	LFE5UM5G-85	LAE5UM-25	LAE5UM-45	LAE5UM-12	LFE5UM-25	LFE5UM-45	LFE5UM-85	LFE5U-12	LFE5U-25	LFE5U-45	LFE5U-85	LFE3-17EA	LFE3-35EA	LFE3-70EA	LFE3-95EA	LFE3-150EA
LUTs		24 k	44 k	84 k	24 k	44 k	12 k	24 k	44 k	84 k	12 k	24 k	44 k	84 k	17 k	33 k	67 k	92 k	149 k
EBR SRAM	# of Blocks	56	108	208	56	108	32	56	108	208	32	56	108	208	38	72	240	240	372
	kbits	1008	1944	3744	1008	1944	576	1008	1944	3744	576	1008	1944	3744	700	1,327	4,420	4,420	6,850
Distrib RAM	kbits	194	351	669	194	351	97	194	351	669	97	194	351	669	36	68	145	188	303
sysDSP™ Blocks	Multipliers	28	72	156	28	72	28	28	72	156	28	28	72	156	24	64	128	128	320
SERDES	Max. Chan.	1/2	2/4		1/2	2/4	0	1/2	2/4		0	0			4		12		16
	Max. Rate	5 Gbps			3.2 Gbps			3.2 Gbps							3.2 Gbps				
PLL + DLL		2+2	4+4		2+2	4+4	2+2	2+2	4+4		2+2	2+2	4+4		2+2	4+2	10+2		
DDR Support		DDR2 800, DDR3 800, LPDDR2 800, LPDDR3 800			DDR2 800, DDR3 800, LPDDR2 800, LPDDR3 800			DDR2 800, DDR3 800, LPDDR2 800, LPDDR3 800							DDR3 800, DDR2 533, DDR 400				
Boot Flash		External			External			External							External				
Dual Boot		✓			✓			✓							✓				
Multiple Boot		✓			✓			✓											
Bit-stream Encryption		✓			✓			✓							✓				
Core Vcc		1.1 V			1.1 V			1.1 V							1.2 V				
Temp.	C	✓			✓			✓							✓				
	I	✓			✓			✓							✓				
	AEC-Q100	✓						✓							✓				
0.5 mm Spacing		**I/O Count / SERDES**			**I/O Count / SERDES**			**I/O Count / SERDES**											
csfBGA	285	10 x 10 mm	118/2	118/2	118/2				118/2	118/2	118/2	118/0	118/0	118/0	118/0					
csBGA	328	10 x 10 mm														116/2				
TQFP	144	20 x 20 mm																		
PQFP	208	28 x 28 mm																		
0.8 mm Spacing		**I/O Count / SERDES**			**I/O Count / SERDES**			**I/O Count / SERDES**											
caBGA	381	17 x 17 mm	197/2	203/4	205/4	197/2	203/4	197/0	197/2	203/4	205/4	197/0	197/0	203/0	205/0					
	554	23 x 23 mm		245/4	259/4					245/4	259/4			245/0	259/0					
	756	27 x 27 mm			365/4						365/4				365/0					
1.0 mm Spacing		**I/O Count / SERDES**			**I/O Count / SERDES**			**I/O Count / SERDES**											
ftBGA	256	17 x 17 mm														133/4	133/4			
fpBGA	256	17 x 17 mm																		
	484	23 x 23 mm														222/4	295/4	295/4	295/4	
	672	27 x 27 mm															310/4	380/8	380/8	380/8
	900	31 x 31 mm																		
	1152	35 x 35 mm																		
	1156	35 x 35 mm																490/12	490/12	586/16

1) No PLL available

MachXO3 Series - Bridging and I/O Expansion FPGAs

Features			MachXO3LF™						MachXO3L™					
Device			LCMXO3LF-640	LCMXO3LF-1300	LCMXO3LF-2100	LCMXO3LF-4300	LCMXO3LF-6900	LCMXO3LF-9400	LCMXO3L-640	LCMXO3L-1300	LCMXO3L-2100	LCMXO3L-4300	LCMXO3L-6900	LCMXO3L-9400
LUTs			640	1300	2100	4300	6900	9400	640	1300	2100	4300	6900	9400
EBR SRAM	# of Blocks		2	7	8	10	26	48	2	7	8	10	26	48
kbits			18	64	74	92	240	432	18	64	74	92	240	432
Distrib. RAM	kbits		5	10	16	34	54	75	5	10	16	34	54	75
UFM	kbits		24	64	80	96	256	456						
Configuration Memory			Flash						Internal NVM					
Dual Boot[4]			✓						✓					
Embedded Function Blocks			I²C (2), SPI (1), Timer (1)						I²C (2), SPI (1), Timer (1)					
Core Vcc	1.2 V		E						E					
	2.5 - 3.3 V		C						C					
Temp.	C		✓						✓					
	I		✓						✓					
0.4 mm Spacing			I/O Count											
WLCSP	36[2]	2.5 x 2.5 mm		28						28				
	49[2]	3.2 x 3.2 mm			38						38			
	81[2]	3.8 x 3.8 mm				63						63		
0.5 mm Spacing			I/O Count											
csfBGA	121[2]	6 x 6 mm	100						100					
	256[2]	9 x 9 mm		206						206				
	324[2]	10 x 10 mm			281						281			
0.8 mm Spacing			I/O Count											
caBGA	256	14 x 14 mm		206[3]						206[3]				
	324	15 x 15 mm			279[3]						279[3]			
	400	17 x 17 mm				335[3]						335[3]		
	484	19 x 19 mm						384						384

1) Contact your Lattice sales representative for the support of the 184-ball csBGA package, available with the HE option only.
2) Package is only available for E=1.2 V devices.
3) Package is only available for C=2.5 V/3.3 V devices.
4) Dual Boot supported with external boot Flash.

Power and Thermal Management Products

		Power & Thermal Management		Power Management				
Features		**L-ASC10**	**LPTM21**	**POWR1220AT8**	**POWR1014A**	**POWR1014**	**POWR607**	**POWR605**
Voltage Monitoring Inputs		10	10	12	10	10	6	6
Current Monitoring Inputs		2	2					
Temperature Monitoring Inputs		2	2					
Number of Trimming Channels		4	4	8				
MOSFET Drives		4	4	4	2	2	2	
On-Chip Non-Volatile Fault Log		✓	✓					
Number of LUTs			1280					
Distributed RAM (Kbits)			10					
EBR SRAM (kBits)			64					
Number of EBR Blocks (9 kBits)			7					
Number of PLLs			1					
Number of Macrocells				48	24	24	16	16
Communication I/F		I^2C	I^2C/JTAG	I^2C	I^2C			
Programming Interface		I^2C	I^2C/JTAG	JTAG	JTAG	JTAG	JTAG	JTAG
Operating Voltage		3.3	2.8V to 12V	3.3V	3.3V	3.3V	3.3V	3.3V
In-system Update Support		✓	✓					
Temp.	**I**	✓	✓	✓	✓	✓	✓	✓
	AEC-Q100				✓	✓		
Package Options		**Digital I/Os**						
48-pin QFN (7 x 7)		9[5]						
237-Ball ftBGA (1 mm) (17 x 17)			95 + 10[4]					
100-pin TQFP (14 x 14)				22[1]				
48-pin TQFP (7 x 7)					16[2]	16[2]		
32-pin QFN (5 x 5)							7[3]	
24-pin QFN (4 x 4)							7[3]	7[3]

1) POWR1220AT8 provides 6 (5V Tolerant) Digital inputs and 16 (5V Tolerant) Open-drain Digital Outputs
2) POWR1014 & PWOR1014A provide 4 (5V Tolerant) Digital inputs and 12 (5V Tolerant) Open-drain Digital Outputs
3) POWR607 & PWOR605 provide 2 (5V Tolerant) Digital inputs and 5 (5V Tolerant) Open Drain I/O
4) LPTM21 provide 95 (3.3V Tolerant) Logic I/Os 10 (5V tolerant) open-drain I/Os
5) 5V Tolerant Open Drain I/O

IP Cores and Reference Designs

Reference Designs

Lattice Reference Designs are reusable as-is codes that allow designers to quickly build their unique applications. These reference designs provide functions such as 7:1 LVDS, Barcode Emulation, Sensor Interfacing & Preprocessing, I²C, SPI, and MIPI solutions. For a complete listing of reference designs from Lattice, please go to latticesemi.com/IP.

Name	Reference Design No.	ECP5/ ECP5-5G	Lattice ECP3	Mach XO3	Mach XO2	Mach XO	Lattice XP2	iCE40 LP/HX/LM	iCE40 Ultra	iCE40 UltraPlus	Format	
											Verilog	VHDL
7:1 LVDS Video Interface	RD1030	✓	✓		✓		✓				✓	✓
8b/10b Encoder/Decoder	RD1012	✓	✓	✓	✓	✓	✓				✓	✓
ADC Interface	RD1089		✓								✓	✓
BSCAN - Multiple Boundary Scan Port Addressable Buffer (BSCAN1)	RD1001				✓	✓	✓					
BSCAN - Multiple Boundary Scan Port Linker (BSCAN 2)	RD1002	✓			✓	✓	✓					
Controller Area Network (CAN) Controller	RD1170							✓			✓	
FPGA Loader	AN8077				✓	✓	✓					
GPIO Expander	RD1065		✓			✓	✓				✓	✓
HDMI/DVI Interface	RD1097	✓	✓								✓	✓
HiSPi-to-Parallel Sensor Bridge	RD1120	✓	✓	✓	✓		✓				✓	✓
I²C Bus Controller for Serial EEPROM	RD1006	✓	✓	✓	✓	✓	✓				✓	✓
I²C Master Controller	RD1005	✓	✓	✓	✓	✓	✓				✓	✓
I²C Master Controller	RD1139							✓			✓	
I²C Master with WISHBONE Controller	RD1046	✓	✓	✓	✓	✓	✓				✓	✓
I²C Slave Controller	RD1140							✓			✓	
I²C Slave Peripheral Using Embedded Function Block - WISHBONE Compatible	RD1124			✓	✓						✓	✓
I²C Slave to SPI Master Bridge	RD1094					✓					✓	✓
I²C Slave/Peripheral	RD1054	✓	✓			✓	✓				✓	✓
I²C to SPI Bridge	RD1172							✓			✓	✓
I²S Controller	RD1101			✓	✓	✓					✓	✓
I²S Controller	RD1171							✓			✓	✓
I3C Host/Device										✓		
iCE40 Ultra Barcode Emulation Reference Design	UG73								✓	✓	✓	
iCE40 Ultra Pedometer	UG76								✓	✓	✓	
iCE40 Ultra RGB LED Controller	UG75								✓	✓	✓	
iCE40 Ultra Self-Learning IR Remote	UG74								✓	✓	✓	
iCE40LM Barcode Emulation	RD1191							✓			✓	
iCE40LM Phillips IR Rx	RD1192							✓			✓	
iCE40LM Sensor Interfacing and Preprocessing	RD1189							✓	✓	✓	✓	
iCE40LM Sony IR Tx Reference Design	RD1190							✓			✓	
Keypad Scanner	RD1180							✓				✓
LatticeMico32 - Embedded Processor - WISHBONE Compatible		✓	✓	✓	✓		✓				✓	✓
LatticeMico8 - Embedded Processor - WISHBONE Compatible		✓	✓	✓	✓		✓				✓	✓
LatticeMico8 Microcontroller User's Guide	RD1026			✓	✓	✓	✓				✓	✓
LatticeMico8 to WISHBONE Interface Adapter	RD1043					✓	✓				✓	✓
LED/OLED Driver	RD1103			✓	✓	✓					✓	
LPC Bus Controller	RD1049		✓		✓	✓	✓				✓	✓
MachXO2 Display Interface	RD1093				✓						✓	✓
MachXO2 I²C Embedded Programming Access Firmware - WISHBONE Compatible	RD1129				✓						✓	
MachXO2 Soft I²C Slave with Clock Stretching - WISHBONE Compatible	RD1186				✓						✓	
MDIO Peripheral - WISHBONE Compatible	RD1074		✓			✓					✓	✓
MIPI CSI-2-to-CMOS Parallel Sensor Bridge	RD1146			✓	✓						✓	
MIPI DPHY Interface IP	RD1182	✓	✓	✓	✓						✓	
MIPI DSI RX to Parallel Bridge	RD1185			✓	✓						✓	
MxN Channel PWM	RD1175							✓				✓
NAND Flash Controller	RD1055				✓	✓	✓				✓	✓
Panasonic Area Sensor-to-Parallel Bridge	RD1121				✓		✓				✓	
Parallel to MIPI CSI-2 TX Bridge	RD1183			✓	✓						✓	
Parallel to MIPI DSI TX Bridge	RD1184			✓	✓						✓	
PCI Target 32 bit/33 MHz	RD1008		✓		✓	✓	✓				✓	✓
PCI/WISHBONE Bridge - WISHBONE Compatible	RD1045		✓			✓	✓				✓	✓
PWM Fan Controller - WISHBONE Compatible	RD1060			✓	✓	✓	✓				✓	✓
PWM Generator	RD1178							✓				✓

Continued on next page

IP Cores and Reference Designs

Hardware Management IPs, that are integrated in the Platform Designer tool, simplify implementation of functions, such as Fault Logging, Fan Controller and PMBus Controller through a simple GUI interface.

Lattice Reference Designs are reusable as-is codes that allow designers to quickly build their unique applications. These reference designs provide functions such as I²C, SPI, BSCAN and LPC Bus Controller interface solutions. For a complete listing of reference designs from Lattice, please go to latticesemi.com/IP.

Hardware Management IPs

			Format			
IP Core	MachXO2+ L-ASC10	PLATFORM MANAGER 2	VHDL	Verilog	LogiBuilder	Analog Circuit
Fault Logging	✓	✓	✓	✓		
Hot Swap Controller	✓	✓	✓	✓		✓
Fan Controller	✓	✓	✓	✓		
PMBus Controller	✓		✓	✓	✓	
Trim & Margin	✓	✓				✓
Power & Reset Sequencing	✓	✓	✓	✓	✓	
Voltage Scaling & VID	✓	✓	✓	✓		✓

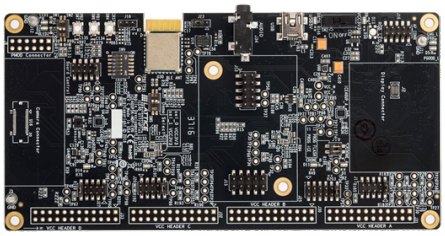
Hardware Management Reference Designs

				Format	
Name	Reference Design No.	MachXO2+ L-ASC10	PLATFORM MANAGER 2	VHDL	Verilog
BSCAN - Multiple Boundary Scan Port Addressable Buffer (BSCAN1)	RD1001	✓	✓	✓	✓
BSCAN - Multiple Boundary Scan Port Linker (BSCAN 2)	RD1002	✓	✓	✓	✓
FPGA Loader	AN8077	✓	✓	✓	✓
I²C Bus Controller for Serial EEPROM	RD1006	✓	✓	✓	✓
I²C Master Controller	RD1005	✓	✓	✓	✓
I²C Slave Peripheral Using Embedded Function Block	RD1124	✓	✓	✓	✓
I2S Controller	RD1101	✓	✓	✓	✓
LPC Bus Controller	RD1049	✓	✓	✓	✓
MachXO2 I²C Embedded Programming Access Firmware	RD1129	✓	✓	✓	✓
MachXO2 Soft I²C Slave with Clock Stretching	RD1186	✓	✓	✓	✓
NAND Flash Controller	RD1055	✓	✓	✓	✓
PWM Fan Controller	RD1060	✓	✓	✓	✓
RAM-Type Interface for Embedded User Flash Memory	RD1126	✓	✓	✓	✓
Read and Write Usercode	RD1041	✓	✓	✓	✓

Development Kits

iCE40 UltraPlus Mobile Development Platform

Enables designers to evaluate key connectivity features of the iCE40 UltraPlus FPGA as well as processing features utilizing multiple DSPs, integrated RAM, and FPGA fabric.



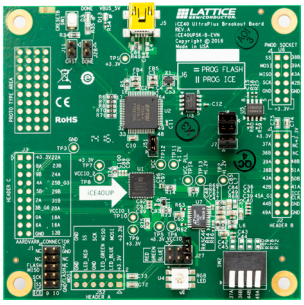
Features

- x1 MIPI DSI interface up to 108 Mbps
- 4x Microphone bridging (2x I2S mics and 2x PDM mics)
- Compass sensor (LSM303), pressure sensor (BMP180), gyro sensor (LSM330), and accelerometer (LIS2D12)
- 640 x 480 Image sensor (OVM7692)
- BLE module to transfer any captured data from iCE40 UltraPlus wirelessly
- iCE40 UltraPlus can be programmed via on-board SPI Flash or via USB port

Ordering Part Number
iCE40UP5K-MDP-EVN

iCE40 UltraPlus Breakout Board

Enables designers to evaluate key connectivity features of the iCE40 UltraPlus FPGA. The breakout board brings out all I/Os and allows the FPGA to be programmed over a USB connector.



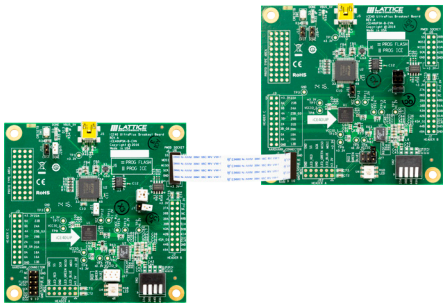
Features

- iCE40 UltraPlus (iCE40UP5K) device in a 48-pin QFN package
- High-current LED output
- iCE40UP5K application based current measurements
- Standard USB cable for device programming
- RoHS-compliant packaging and process
- Pre-loaded RGB LED Demo
- Software run GUI
- USB Connector Cable

Ordering Part Number
iCE40UP5K-B-EVN

iCE40 UltraPlus I3C Evaluation Kit

Enables designers to evaluate I3C host interface along with I3C device interface embedded with iCE40 UltraPlus.



Features

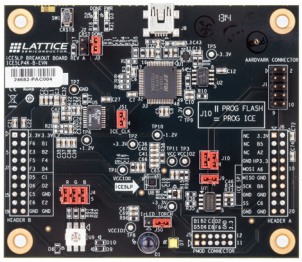
- Reuse iCE40 UltraPlus Breakout Boards
- Signal Generator with I3C host on one FPGA
- I3C device on second FPGA along with additional I^2C host interfaces

Ordering Part Number
ICE40UP5K-VGPIO-I3C-EVN

Development Kits

iCE40 Ultra Breakout Board

Featuring an ultra-small FGPA optimized for mobile applications. Typical mobile interfaces like RGB, IR and high current Torch LEDs are included, as well as access to every device I/O.



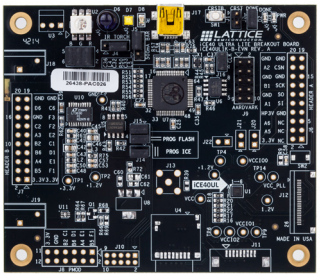
Features

- iCE5LP4K FPGA in 0.35 mm pitch, 36-ball WLCSP
- RGB LED
- High-brightness “torch” LED
- Infrared (IR) LED
- Status LEDs
- Access to all device I/Os
- On-board 32Mbit SPI Flash for reconfiguration
- Windows- & Mac-based GUI for interface to the RGB LED, includes FPGA source code
- USB Type-A to Type-B (mini) cable for FPGA power and programming via PC

Ordering Part Number
ICE5LP4K-B-EVN

iCE40 UltraLite Breakout Board

Featuring the world’s smallest FGPA optimized for mobile applications. Typical mobile interfaces like RGB, IR and high current Torch LEDs are included, as well as access to every device I/O.



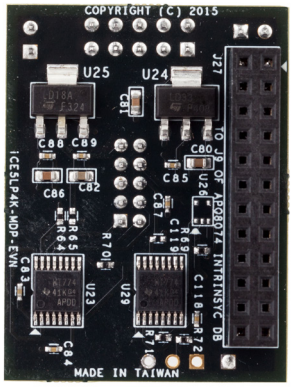
Features

- iCE40UL1K (iCE401K-CM36A) device in a 36-ball BGA package
- Layout example of a board using 0.40 mm pitch BGA package
- High current LED output
- Infrared transmit capability for remote control functions
- iCE40UL1K application-based current measurements
- Standard USB cable for device programming
- RoHS-compliant packaging and process
- Preloaded RGB LED Demo
- Software-run GUI
- USB connector cable

Ordering Part Number
iCE40UL1K-B-EVN

iCE40 Ultra Mobile Development Platform

iCE40 Ultra Mobile Development Platform enables rapid implementation and development of several always-on functions popular in mobile platforms.



Features

- iCE40 Ultra FPGA (iCE5LP4KSWG36)
- USB programming/interface
- High-current LED output
- Infrared transmit and receive
- RGB LED control
- Numerous Sensors
  - Two I2S MICs
  - Proximity sensor
  - Temperature Sensors
  - Barometric pressure sensor
  - Accelerometer
  - Gyroscope
  - Magnetometer
  - Humidity sensor
  - Hall sensor
  - Fingerprint sensor
- On-board oscillator

Ordering Part Number
iCE5LP4K-MDP-EVN

iCE40 Ultra Wearable Development Platform

Peripheral and sensor-rich development platform with iCE40 Ultra and MachXO2 in a wearable watch form factor.

Features

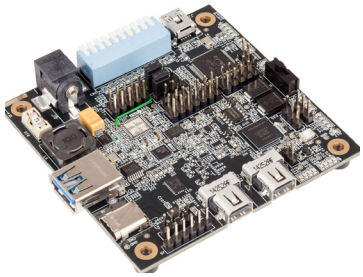
- Approximately (WxLxH) 1.50“x1.57“x0.87“ form factor with wrist strap
- iCE40 Ultra iCE5LP4K and MachXO2 LCMXO2-2000ZE
- LG 1.54” 240x240 single-lane MIPI DSI display
- Bluetooth low-energy module
- Sensors: Heart-rate/SpO2, skin temperature, pressure and accelerometer/ gyroscope
- 2 user LEDs, RGB LEDs, high-current white LED and high-current IR LED
- Stereo MEMs PDM microphones
- 32Mbit Quad SPI-flash
- 27MHz Oscillator
- Power via built-in 3.7V, 250mAh lithium-polymer battery or mini-USB cable
- FTDI 2232HQ USB device allows programming of FPGA and Flash
- Reference design available for download:
  - Parallel RGB to MIPI DIS bridging
  - Health monitoring*
  - Pedometer*
  - IR transmitter*
  - Flashlight*

* Reference Android APK available to interface with mobile phone over Bluetooth

Ordering Part Number
ICE5LP4K-WDEV-EVN

iCE40 USB Type-C Demo Kit

iCE40 USB Type-C Demo kit enables demonstration and development of Downstream Facing Ports(DFP), Upstream Facing Ports(UFP) and Dual Role Ports(DRP) capabilities.



Features

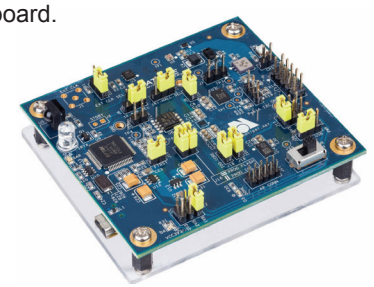
- Supports Cable Configuration
  - UFP/DFP/DRP modes supported
  - Dead battery mode supported
- Supports Power Delivery
  - Dual voltage output *
  - Power and data role swaps *
  - Display port alternate mode *
  - Vendor defined messages *
- UART Monitor of USB Type-C interface *
- Pre-configured bit streams allow rapid testing of common functions
- Source code licensed free of charge to qualified customers
- Note: Some demonstration modes for this product require an available Type-C port on external hardware (PC, tablet, etc.) not included in this kit. Consult the product documentation to make sure you have the required hardware.

* Requires iCE40LP8K-USBC-EVN

Ordering Part Number	
iCE40 Ultra USB Type-C Demo Kit V2	iCE5LP4K-USBC-EVN
iCE40LP8K USB Type-C Demo Kit V2	iCE40LP8K-USBC-EVN

iCE40LM4K Sensor Evaluation Kit

A rich assortment of sensors for FGPA development in mobile applications. Interfaces to Snapdragon development board.



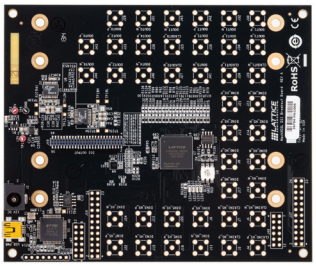
Features

- iCE40LM4K FPGA in 25-WLCSP (0.35 mm ball pitch)
- Infrared transmit and Receive
- Numerous Sensors
  - Proximity sensor
  - RGB Color, Infrared, and Temperature Sensors
  - Barometric pressure sensor
  - Accelerometer
  - Gyro Magnetometer/compass/ accelerometer
  - Humidity & Temp sensor
  - Hall Sensor
- High current LED output
- Barcode LED/emulation
- VLT Adapter board for connection to Snapdragon APQ8060A
- Configuration SPI Flash
- USB A to USB B (mini) Cable for Power and Programming via a PC

Ordering Part Number
ICE40LM4K-S-EVN

MachXO3L Breakout Board

Focusing on evaluating high-speed source synchronous interfaces with the Lattice MachXO3L-2100 and MachXO3L-6900 products in both 49-ball WLCSP and 256-ball caBGA packages respectively.



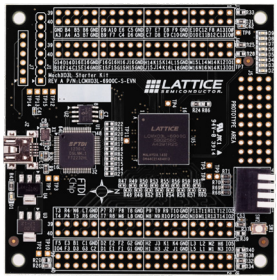
Features

- Two MachXO3L FPGAs
  - XO3L-6900E in 256caBGA
  - XO3L-2100E in 49WLCSP
- Two optional configurations:
  - 50-pin Harwin Archer connector for interface to DSI screen (screen not included)
  - 40 SMA connectors for LVDS I/O evaluation
- Generous prototyping/breakout access
- Switches and LEDs for user input and feedback
- Discrete resistors to support SLVS, subLVDS or DPHY Tx, and DPHY Rx, LP mode
- USB Type-A to Type-B (mini) cable for FPGA power and programming via PC
- DC jack for supplemental power input

Ordering Part Number	
MachXO3L SMA Breakout	LCMXO3L-SMA-EVN
MachXO3L DSI Breakout	LCMXO3L-DSI-EVN

MachXO3L Starter Kit

The MachXO3L Starter Kit is a basic breakout board to allow simple evaluation and development of MachXO3L based designs. It includes the LCMXO3L-6900C-5BG256C device.



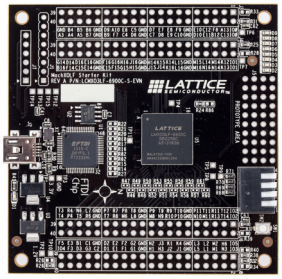
Features

- MachXO3 FPGA – LCMXO3L-6900C-5BG256C
- USB Type-B (mini) connector (program/power)
- Pre-programmed example design (available on latticesemi.com)
- Eight LEDs
- 4-position DIP switch
- 40-hole prototyping area
- Four 2x20 expansion header landings for general I/O, JTAG and external power
- 1x8 expansion header landing for JTAG
- 1x6 expansion header landing for SPI/ I^2C
- SPI Flash for external boot or dual boot
- 3.3V and 1.2V supply rails

Ordering Part Number
LCMXO3L-6900C-S-EVN

MachXO3LF Starter Kit

The MachXO3LF Starter Kit is a basic breakout board to allow simple evaluation and development of MachXO3LF based designs. It includes the LCMXO3LF-6900C-5BG256C device.



Features

- MachXO3 FPGA – LCMXO3LF-6900C-5BG256C
- USB Type-B (mini) connector (program/power)
- Pre-programmed example design (available on latticesemi.com)
- Eight LEDs
- 4-position DIP switch
- 40-hole prototyping area
- Four 2x20 expansion header landings for general I/O, JTAG and external power
- 1x8 expansion header landing for JTAG
- 1x6 expansion header landing for SPI/ I^2C
- SPI Flash for external boot or dual boot
- 3.3V and 1.2V supply rails

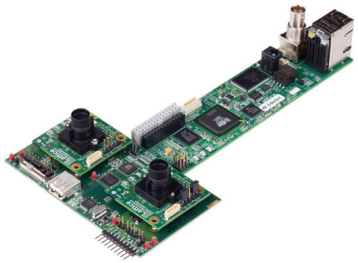
Ordering Part Number
LCMXO3LF-6900C-S-EVN

Development Kits

Video

HDR-60 Video Camera System

This is a family of inter-connectable boards that showcase the video processing capabilities of the LatticeECP3 FPGA in a compact standard format.



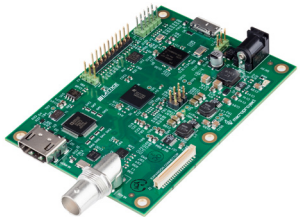
Features

- LatticeECP3-70 in 484 fpBGA package
- Production-ready HDR camera design
- 1080p60 frames per second (fps)
- Extremely low-latency
- Autoexposure
- Supports dual-sensors simultaneously
- Direct HDMI/DVI output from FPGA
- On-board Ethernet PHY
- HDR image processing reference design
- > 120dB HDR Performance
- Additional image processing IP library
- Image shows HDR-60, plus Dual-Sensor interface and two NanoVesta sensor boards

Ordering Part Number	
HDR-60 with MT9M024 NanoVesta	LFE3-70EA-HDR60-DKN
HDR-60 without NanoVesta	LFE3-70EA-HDR60-EVN
Dual Sensor Interface	LCMXO2-4000HE-DSIB-EVN
CSI2-to-Parallel Bridge	LF-C2P-EVN
MT9M024 Sensor NanoVesta	LF-9MT024NV-EVN
MN34041 Sensor NanoVesta	LF-PNV-EVN

Lattice USB3 Video Bridge Development Kit

This is a production-ready, high-definition video capture and conversion system, based on the LatticeECP3™ FPGA family.



Features

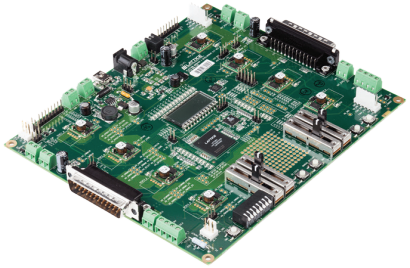
- Production-ready USB3 audio/video bridging reference design
- 1080p video streaming over USB 3.0 at 60fps
- HDMI 1.4a audio and video capture
- SD-, HD-, 3G-SDI audio and video capture
- Supports video capture from external MIPI CSI-2 , SubLVDS or Parallel sensors
- Reference design provides fast USB 3.0 UVC and UAC class data packing
- Plug and play operations as a video capture device on multiple standard platforms (Windows, MacOS, Linux)
- Complete reference design schematics and documentation available

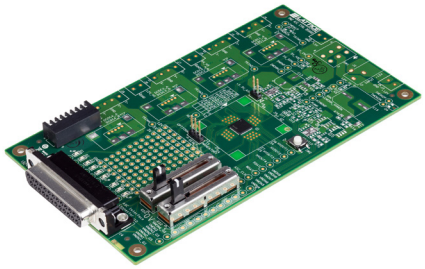
Ordering Part Number
LFE3-17EA-USB3-EVN

LPTM21

Platform Manager 2 Development Kit

The Platform Manager 2 Development Kit is a versatile, ready-to-use hardware platform for evaluating and designing with Platform Manager 2 and L-ASC10 devices. This kit includes a board, programming cable, and assorted example designs and documentation available for download. You can implement and debug your hardware management functions (power, thermal and control plane management) and test them out with this kit.





Features

- LPTM21 (Platform Manager 2 device) & L-ASC10 (Hardware Management expander)
- Temperature monitoring/measurement, with temperature control using fan (included)
- Fault logging under various types of hardware management faults
- 4 potentiometers & 2 POLs for sequencing, VID/Voltage scaling, margining, fault creation
- Background programming support with Dual boot from golden image stored on the SPI Flash
- Hardware management expansion through external L-ASC10 boards
- 3-digit LCD for additional code debug support

L-ASC10 Breakout Board

The L-ASC10 (ASC) Breakout Board is a versatile hardware platform for evaluation and desig with L-ASC10 devices. The board is designed to work alongside the Platform Manager 2 Development Kit.

Features

- L-ASC10 (Hardware Management Expander)
- 2 potentiometers for sequencing & fault creation
- 9 LEDs for sequencing
- Temperature monitor & measurement with 2 on-board temperature sensors
- Connector for use with Platform Manager 2 Development Kit

Ordering Part Number	
Platform Manager 2 Development Kit	LPTM-BPM-EVN
L-ASC10 Breakout Board	LPTM-ASC-B-EVN

Development Kits

POWR1220

Power Manager II Hercules Development Kit

The Hercules Development Kit is an easy-to-use platform for evaluating and designing with the Power Manager II ispPAC®-POWR1220AT8 and MachXO™2280.

Features

The Hercules Evaluation Board with the following circuits:

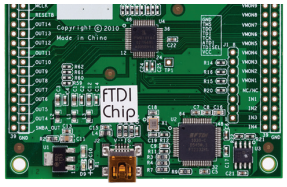
- ispPAC-POWR1220AT8 Power Manager II device
- MachXO 2280 programmable logic device
- ispMACH® 4000 programmable logic device
- USB interface for JTAG, I2C, and SPI
- Main and external 12V supply connections
- 12V Hot Swap for Hot Swap demo
- 12V OR'ing for redundant power puppply demo
- 1.2V DC-DC supply for margin, trim, and VID Demos
- SPI memory for fault logging demo
- 3-digit LCD display
- Various LEDs and switches for status and control

Ordering Part Number
PAC-POWR1220AT8-HS-EVN (Standard)

POWR1014

POWR1014 Breakout Board

The POWR1014A Breakout Board is a simple, low-cost board that provides convenient access to densely-spaced I/Os. Each I/O on the device is connected to 100-mil header holes.



Features

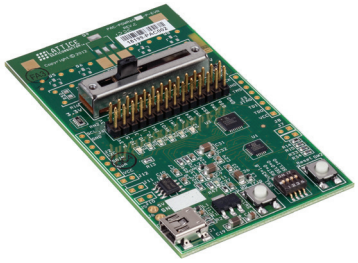
- Power Manager II - POWR1014A-02TN48I device/package
- Pre-programmed hardware test program (Source is downloadable)
- LEDs expansion header landings prototyping area
- USB Type-B (mini) connector for programming and power
- JTAG header landing

Ordering Part Number
Ordering Part Number: POWR1014A-B-EVN

POWR607

POWR607/6AT6 Evaluation Board

The POWR607/6AT6 Evaluation Board is an easy-to-use platform for evaluating and designing with the Lattice Power Manager II devices, POWR607 and POWR6AT6.



Features

- Power Manager II ispPAC® -POWR607
- Power Manager II ispPAC®-POWR6AT6
- LEDs for general purpose I/O, power indicators, and watchdog timer interrupt indication
- Slide potentiometer
- USB Type-B(mini) connector for power and programming
- 2x14 expansion header for general I/O, voltage monitor inputs, and power supply trim outputs
- Thru-hole and surface mount prototyping area for custom design verification
- Push buttons for reset and watchdog timer trigger
- 4-bit DIP switch for watchdog timer period programming and reset pulse stretch enable
- JTAG and I^2C header landings for JTAG cable programming and I^2C interface (cables not included).

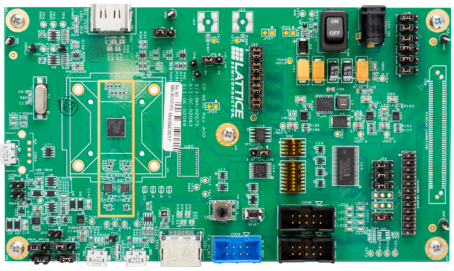
Ordering Part Number
Ordering Part number: PACPOWR607-P-EVN

Development Kits

ASSP Video

Sil9630 evaluation kit

This is an evaluation kit for Sil9630, HDMI/MHL transceiver solution. Input can be eTMDS or HDMI while output can be MHL or HDMI. The evaluation kit allows HDCP decryption and encryption to be evaluated, DSC compression to be evaluated, and MHL/HDMI transmission up to 4K60 444 video resolution.



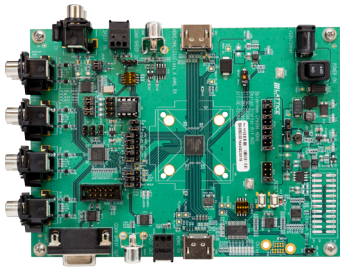
Features

- Dual-Mode MHL or HDMI Transmitter
- Input: HDMI or eTMDS (Up to 4K60 444)
- Output: MHL (Up to 4K60 444) or HDMI (Up to 4K60 444)
- Header pins available to measure power consumption
- DSC encoder support
- RGB/YCbCr/xvYCC support

Ordering Part Number
CP9630

Sil9396 evaluation kit

This is an evaluation kit for Sil9396, which is a DSC decompression IC supporting HDMI and MHL up to 4K60 444.



Features

- Dual inputs (MHL or HDMI)
  - HDMI can support up to 4K60 444
  - MHL1/2 can support up to 1080p60
  - MHL3 can support up to 4K30 422pp
- Ouptut support for HDMI2.0 up to 4K60 444
- DSC decompression supported
- CSC & chroma down/up-sampling support, RGB/YCbCr/xvYCC support
- Two LED supported
  - LED1: Green, ON – source connected
  - LED2: Red, ON – Power error

Ordering Part Number
CP9396

More

Additional Boards and Kits

Lattice and our hardware partners produce many additional boards with a rich selection of features to match your needs.

For additional information, explore our full catalog at www.latticesemi.com/boards

Programming Hardware

Programming Cables

Lattice Programming Cables are used to communicate between a PC and a Lattice device on a target board or system. The most common application is to program a Lattice device. Programming Cables can also be used to help debug your hardware designs via Lattice software tools.

- **USB Programming Cable (HW-USBN-2B – pictured).** The latest-generation Programming Cable adds I^2C programming and various other features.
- **Parallel Cable (HW-DLN-3C).** This connects to a PC parallel port and is best for basic JTAG programming.

Ordering Part Number	
ispDOWNLOAD Parallel Cable	HW-DLN-3C
USB Programming Cable	HW-USBN-2B

Smart Sockets

Lattice Smart Sockets are an all-in-one solution for prototype programming of the latest Lattice products.

These complete solutions include all the functionality of a Desktop Programmer + Socket Adapter combination in a single board. All that's needed is a simple connection to your PC via USB (cable included).

More information about Lattice Smart Sockets is on the Lattice website at **www.latticesmi.com/sockets**.

Desktop Programmers

Lattice offers two desktop programmers for prototype programming of Lattice products.

A Socket Adapter is required for the specific device/package you wish to program. These are available separately, and are designed specifically for one Desktop Programmer or the other.

The Lattice Model 300 Desktop Programmer (pictured) supports most Lattice FPGA and CPLD products.

The iCEprog Desktop Programmer supports all Lattice iCE products.

Ordering Part Number	
Model 300 Desktop Programmer	PDS4102-PM300N
iCEprog Desktop Programmer	ICEPROGM1050-01

Socket Adapters

Lattice Socket Adapters are used in conjunction with a Lattice Desktop programmer to facilitate low-volume, manual programming of Lattice devices.

Socket adapters are generally designed to support a device family/package combination.

iCE Socket Adapters work only with the iCEprog Desktop Programmer. All other Lattice Socket Adapters work only with the Model300 Desktop Programmer.

More information and a complete list of Lattice Socket Adapter products is available at **www.latticesmi.com/sockets**.

Connectivity ASSPs

TV Port Processors	Sil9777	Sil9687A	Sil9589-3	Sil9587-3	Sil9489A	Sil9381A
HDMI® Input	4	4	5	4	5	4
superMHL Input						
MHL® Input	2	1	1	1	1	1
HDMI Output	3	1	1	1	2	1
superMHL™ Output						
InstaPort™		InstaPort™ S	InstaPort™ S	InstaPort™ S	InstaPort™ S	InstaPort™ S
Hardware HDCP Repeater	HDCP 2.2				HDCP 1.4	
HDCP Upstream Authentication Support	HDCP 2.2		HDCP 1.4	HDCP 1.4	HDCP 1.4	
HDMI Bandwidth	18 Gbps	9 Gbps	9 Gbps	9 Gbps	6 Gbps	6 Gbps
Audio Return Channel	✓	✓	✓	✓	✓	✓
Maximum HDMI Resolution	4K60 4:4:4	4K60 4:2:0	4K60 4:2:0	4K60 4:2:0	1080p60 36-bit	1080p60 36-bit
Maximum MHL Resolution	4K30	1080p60	1080p30	1080p30	1080p30	1080p30
HDCP 1.4 support	✓	✓	✓	✓	✓	✓
HDCP 2.2 support	✓					
Pre-programmed HDCP keys	✓	✓	✓	✓	✓	✓
CEC Processor			✓	✓	✓ (2)	✓
Integrated NVRAM EDID		✓	✓	✓	✓	✓
Package	208-pin QFP	76-pin QFN	100-pin QFP	88-pin QFN	128-pin QFP	88-pin QFN
Package Size	28 x 28 mm	9 x 9 mm	14 x 14 mm	10 x 10 mm	14 x 14 mm	10 x 10 mm
Starter Kit	CP9777	CP9687A	CP9589-3	CP9587-3	CP9489A	CP9381A

HDMI Receiver	Sil1127A	Sil9127A	Sil9233A	Sil9679	Sil5293
HDMI® Input Type	HDMI1.3	HDMI1.3	HDMI1.4	HDMI2.0, 300MHz	HDMI 1.4b
Number of HDMI Inputs	2	2	4	1	1
MHL® Input				MHL3.0	MHL2
RGB/YCbCr Output	Up to 36-bit	Up to 36-bit	Up to 36-bit		Up to 24-bit
HDMI Output				HDMI2.0	
Max Video Resolution	1080p60 36-bit	1080p60 36-bit	1080p60 36-bit	4K60 4:2:0	1080p30 HDMI 1080p60 MHL 1080p30 SALT
HDCP support		HDCP 1.1	HDCP 1.4	HDCP 1.4/ HDCP 2.2	HDCP 1.4
Pre-programmed HDCP keys		✓	✓	✓	✓
Audio Extraction (I2S) 192kHz	2-ch	2-ch	8-ch		✓
S/PDIF	✓	✓	✓	✓	✓
High Bit Rate Audio (Dolby TrueHD, DTS-HD)	✓	✓	✓	✓	
I²C Interface	✓	✓	✓	✓	✓
Integrated NVRAM EDID	✓	✓	✓	SRAM EDID	
HDCP Repeater support			✓		
Package	128-pin TQFP	128-pin TQFP	144-pin TQFP	76-pin QFN	72-pin QFN
Package Size	14 x 14 mm	14 x 14 mm	20 x 20 mm	9 x 9 mm	10 x 10 mm
Starter Kit	CP1127HDMI	CP9127HDMI	CP9233HDMI	Yes	Yes

Connectivity ASSPs

MHL Bridges	Sil9292	Sil9293A	Sil9296	Sil9394	Sil9396	Sil1296	Sil1292A	Sil9617
MHL input	MHL1	MHL2	MHL2	MHL3	superMHL	MHL2.0	MHL1	MHL2
HDMI input		HDMI1.4			HDMI2.0	HDMI1.4	HDMI1.4	2x HDMI1.4
eTMDS input					✓			
HDMI output	HDMI1.4		HDMI1.4	HDMI1.4	HDMI2.0		HDMI1.4	HDMI1.4
Other Video Output		Parallel 24-bit			superMHL	VGA		
MAX video resolution	1080p30	1080p60	1080p60	4K30	4K60	1080p60	1080p30 MHL 1080p60 HDMI 12-bit DC	1080p60 MHL 4K30 HDMI
HDCP decryption on input	Pass through	HDCP 1.4	HDCP 1.4	HDCP 1.4/ HDCP 2.2	HDCP 1.4/ HDCP 2.2		Pass through	HDCP 1.3
HDCP encryption on output	Pass through		HDCP 1.4	HDCP 1.4/ HDCP 2.2	HDCP 1.4/ HDCP 2.2		Pass through	HDCP 1.3
Dolby Digital		✓		✓	✓	✓		
DTS digital Audio		✓		✓	✓	✓		
Object Audio - Dolby Atmos, DTS:X		✓			✓			
8-ch I2S interface @ 192KHz		✓		✓	✓			
8ch TDM		✓				✓		
Package	40-pin QFN	72-pin QFN	49-pin QFN	76-pin QFN	76-pin QFN	72-pin QFN	40-pin QFN	76-pin MQFN
Package size	6 x 6 mm	10 x 10 mm	7 x 7 mm	9 x 9 mm	9 x 9 mm	10 x 10 mm	6 x 6 mm	9 x 9 mm
Starter Kit	CP9292	CP9293	CP9296	CP9394	CP9396	CP1296	CP1292	CP9617

USB Switches/ Type-C Port Controllers	Sil6031	Sil7024	Sil7033	Sil7014	LIF-UC110	LIF-UC140
Type-C		✓	✓	✓	✓	✓
Main function	USB2.0/MHL/ UART switch	CC/PD PHY + MHL/debug	CC/PD PHY + MHL/debug/ USB3.1 switch	CC/PD PHY + HPD generator + AUX switch	CC/PD port controller for charger	Full CC/PD port controller
SuperSpeed switch		Gen 1	Gen 1			
HPD generator			✓	✓	✓	✓
High speed video switch	MHL1/2/3/ superMHL	MHL1/2/3/ superMHL/ x 2DP	MHL1/2/3/ superMHL x 2DP	DP AUX		
Billboard support		✓	✓	✓		✓
BMC		✓	✓	✓	✓	✓
VDM		✓	✓	✓	✓	✓
Package	24 -pin QFN	32 -pin QFN	36ball BGA	24 -pin QFN	48 -pin QFN	81ball BGA
Package size	3 x 3 mm	4 x 4 mm	3 x 3 mm	3 x 3 mm	7 x 7 mm	4 x 4 mm
Starter kit	CP7033	CP7033	CP7033	CP7033	iCE5LP4K-USBC-EVN	iCE40LP8K-USBC-EVN

pASSP™ Solutions

		CrossLink™				
Device		**LIF-MD6000-36**	**LIF-MD6000-64**	**LIF-MD6000-81**	**LIF-MD6000-80**	**LIA-MD6000-80[1]**
LUTs		5936	5936	5936	5936	5936
Embedded Memory	kbits	180	180	180	180	180
Distrib. RAM	kbits	47	47	47	47	47
GPLL		1	1	1	1	1
D-PHY PLL		1	2	2	2	2
Embedded I^2C Blocks		2	2	2	2	2
Embedded RX/TX MIPI D-PHY		1 (4 Data + 1 Clock)	2 (8 Data + 2 Clock)	2 (8 Data + 2 Clock)	2 (8 Data + 2 Clock)	2 (8 Data + 2 Clock)
48MHz Oscillator		1	1	1	1	1
10kHz Oscillator		1	1	1	1	1
NVCM		Yes	Yes	Yes	Yes	Yes
Dual Boot		Yes	Yes	Yes	Yes	Yes
Power Management Unit		Yes	Yes	Yes	Yes	Yes
Low Power Sleep Mode		Yes	Yes	Yes	Yes	Yes
Typical Operational Power		5mW – 135mW	5mW – 135mW	5mW – 135mW	5mW – 135mW	5mW – 135mW
Footprint		2.5 mm x 2.5 mm	3.5 mm x 3.5 mm	4.5 mm x 4.5 mm	6.5 mm x 6.5 mm	6.5 mm x 6.5 mm
Package Pitch		0.4 mm	0.4 mm	0.5 mm	0.65 mm	0.65 mm
GPIO		7	8	9	8	8
I/O		17	29	37	36	36

1) Automotive grade.

SiBEAM WirelessHD® Modules

WirelessHD transmitter and receiver modules are completely self-contained, autonomous WirelessHD subsystems that connect to a host board and provide wireless video connectivity between an HDMI® source and a display. The modules eliminate the complexity associated with radio performance, regulatory requirements, and compliance to standards in wireless system design. The module-to-system interface carries video, audio, power, and control signals.
SiBEAM offers three programming cables to suit your needs.

Features

- WirelessHD V 1.1 compliant device
- 60 GHz interference free link for up to 4 Gbps video data rate
- Small form factor module
- Wide support for video resolutions
  - VGA through SXGA+
  - 480i/576i to 1080p/60 Hz
  - 3D video support 720p/1080p
- Subframe latency video for real time control of interactive content, such as video games
- Support for surround sound audio
- Support for CEC or AVC commands
- HDCP content protection
- Automated advanced power control, for energy saving operation

Ordering Part Number	
Wireless Transmitter	MOD6320-T
Wireless Transmitter with Cable	MOD6320-T-C
Wireless Receiver	MOD6321-R
Wireless Receiver with Cable	MOD6321-R-C
Wireless Receiver (Dual Polarization Antenna)	MOD6321-R-12
Wireless Receiver (Dual Polarization Antenna) with Cable	MOD6321-R-12-C

Software Licensing
Email: lic_admn@latticesemi.com
Web: latticesemi.com/licensing

Technical Support
latticesemi.com/support

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