LATTICE SEMICONDUCTOR™

PRODUCT SELECTOR GUIDE

MAY 2016

FPGAs • ASSPs • pASSPs • CPLDs • REFERENCE DESIGNS • IP • DEVELOPMENT KITS • DESIGN TOOLS

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 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 and ECP5 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, and industrial automation.

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 mobile application processors, image sensors, and displays. This makes it the optimal solution for VR headsets, drones, smartphones, tablets, cameras, wearable devices, and human machine interfaces (HMIs).

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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FPGA Products

ECP Series - Connectivity and Acceleration FPGAs

Features			ECP5™-5G			ECP5™							LatticeECP3™				
Device			LFE5UM5G-25	LFE5UM5G-45	LFE5UM5G-85	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	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	208	32	56	108	208	38	72	240	240	372
	kbits		1008	1944	3744	1008	1944	3744	576	1008	1944	3744	700	1,327	4,420	4,420	6,850
Distrib RAM	kbits		194	351	669	194	351	669	97	194	351	669	36	68	145	188	303
sysDSP™ Blocks	Multipliers		28	72	156	28	72	156	28	28	72	156	24	64	128	128	320
SERDES	Max. Chan.		1/2	2/4		1/2	2/4		0	0			4		12		16
	Max. Rate		5 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	4+2	10+2		
DDR Support			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				
Dual Boot			✓			✓							✓				
Multiple Boot			✓			✓											
Bit-stream Encryption			✓			✓							✓				
Core Vcc			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**											
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**											
caBGA	381	17 x 17 mm	197/2	203/4	205/4	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**											
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

FPGA Products

iCE40 Series - World's Smallest FPGAs

Features			iCE40 UltraLite		iCE40 Ultra			iCE40 LM			iCE40 LP					iCE40 HX		
Device			UL640	UL1K	LP1K	LP2K	LP4K	LM1K	LM2K	LM4K	LP384	LP640	LP1K	LP4K	LP8K	HX1K	HX4K	HX8K
Logic			640	1248	1100	2048	3520	1100	2048	3520	384	640	1280	3520	8680	1280	3520	7680
NVCM			Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Static Power			35 µA	35 µA	71 µA	71 µA	71 µA	100 µA	100 µA	100 µA	21 µA	100 µA	100 µA	250 µA	250 µA	296 µA	1140 µA	1140 µA
EBR			56 kb	56 kb	80 kb	80 kb	80 kb	64 kb	80 kb	80 kb	0	64 kb	64 kb	80 kb	128 kb	64 k	80 k	128 k
PLL			1	1	1	1	1	1	1	1			1	2	2	1	2	2
I²C core			2	2	2	2	2	1	2	2								
SPI Core					2	2	2	1	2	2								
Strobe (low)								1	1	1								
Strobe (high)								1	1	1								
Low Power Oscillator			1	1	1	1	1											
High Frequency Oscillator			1	1	1	1	1											
24 mA Drive			3	3	3	3	3	3	3	3		3	3[3]					
100 mA + 400 mA Drive			1	1														
500 mA Drive					1	1	1											
Mult 16 x 16, Accum 32 bit					2	4	4											
PWM Generator			Yes	Yes	Yes	Yes	No											
0.35 mm Spacing			Total I/Os (Dedicated I/Os)[4,5]															
WLCSP	16	1.40 x1.40 mm										11(1)[1]	11(1)[1]					
	16	1.40 x 1.48 mm	10	10														
	25	1.71 x 1.71 mm						20(2)	20(2)	20(2)								
	36	2.08 x 2.08 mm			27(1)	27(1)	27(1)											
0.4 mm Spacing			Total I/Os (Dedicated I/Os)[4,5]															
WLCSP	36	2.5 x 2.5 mm	26	26				30(2)	30(2)	30(2)	27(2)		27(2)[1]					
ucBGA	49	3 x 3 mm						39(2)	39(2)	39(2)	39(2)		37(2)[1]					
	81	4 x 4 mm											65(2)	65(2)[2]	65(2)[2]			
	121	5 x 5 mm											97(2)	95(2)	95(2)			
	225	7 x 7 mm												180(2)	180(2)			180(2)
0.5 mm Spacing			Total I/Os (Dedicated I/Os)[4,5]															
QFN	32	5 x 5 mm									23(2)							
	84	7 x 7 mm											69(2)[1]					
csBGA	81	5 x 5 mm											64(2)[1]					
	121	6 x 6 mm											94(2)					
	132	8 x 8 mm														97(2)	97(2)	97(2)
VQFP	100	14 x 14 mm														74(2)[1]		
TQFP	144	20 x 20 mm														98(2)	109(2)	
0.8 mm Spacing			Total I/Os (Dedicated I/Os)[4,5]															
caBGA	256	14 x 14 mm																208(2)

1) No PLL available on the 16 WLCSP, 36 ucBGA, 81 csBGA, 84 QFN and 100 VQFP packages.
2) Only one PLL available on the 81 ucBGA package.
3) 24 mA constant current sink available on the 16 WLCSP package only.
4) Total I/Os include dedicated I/Os.
5) Dedicated I/Os are defined to be pins that are dedicated and cannot be used by user logic after configuration.

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		✓						✓					
	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.

FPGA Products

MachXO & LatticeXP Series - Bridging and I/O Expansion FPGAs

Features			MachXO2™									MachXO™								LatticeXP2™				
Device			LCMXO2-256	LCMXO2-640	LCMXO2-640U	LCMXO2-1200	LCMXO2-1200U	LCMXO2-2000	LCMXO2-2000U	LCMXO2-4000	LCMXO2-7000	LCMXO256E	LCMXO256C	LCMXO640E	LCMXO640C	LCMXO1200E	LCMXO1200C	LCMXO2280E	LCMXO2280C	LFXP2-5E	LFXP2-8E	LFXP2-17E	LFXP2-30E	LFXP2-40E
LUTs			256	640	640	1280	1280	2112	2112	4320	6864	256		640		1200		2280		5 k	8 k	17 k	29 k	40 k
EBR SRAM	# of Blocks		0	2	7	7	8	8	10	10	26					1		3		9	12	15	21	48
kbits			0	18	64	64	74	74	92	92	240					9.2		27.6		166	221	276	387	885
Distrib. RAM	kbits		2	5	5	10	10	16	16	34	54	2		6.1		6.4		7.7		10	18	35	56	83
UFM	kbits		0	24	64	64	80	80	96	96	256													
sysDSP™ Blocks	18x18 Blocks																			3	4	5	7	8
	Multipliers																			12	16	20	28	32
PLL + DLL					1+2				2+2							1+0		2+0		2+0		4+0		
DDR Support					DDR 266, DDR2 266, LPDDR266															DDR/2 400				
Configuration Memory			Internal Flash									Internal Flash								Internal Flash				
Dual Boot[4]			✓									✓								✓				
Bit-stream Encryption																				✓				
Embedded Function Blocks			I²C (2), SPI (1), Timer (1)																					
Core Vcc	1.2 V		ZE & HE									✓		✓		✓		✓		✓				
	1.8 - 3.3 V												✓		✓		✓		✓					
	2.5 - 3.3 V		HC									HC								HC				
Temp.	C		✓									✓								✓				
	I		✓									✓								✓				
	AEC-Q100												✓					✓			✓			
0.4 mm Spacing																								
WLCSP	25	2.5 x 2.5 mm				18			18															
	49[2]	3.2 x 3.2 mm						38																
ucBGA	64	4 x 4 mm	44																					
0.5 mm Spacing																								
QFN	32	5 x 5 mm	21				21																	
	84	7 x 7 mm								68														
csBGA	100	8 x 8 mm										78		74										
	132	8 x 8 mm	55	79		104		104		104				101										
	184[1]	8 x 8 mm								150[1]														
	132	8 x 8 mm																		86				
TQFP	100	14 x 14 mm	55	78		79		79				78		74		73								
	144	20 x 20 mm			107	107		111		114	114			113						100				
0.8 mm Spacing																								
caBGA	256	14 x 14 mm						206		206	206			159		211								
	332	17 x 17 mm								274	278													
1.0 mm Spacing																								
ftBGA	256	17 x 17 mm					206	206		206	206			159		211				172	201			
	324	19 x 19 mm																271						
fpBGA	484	23 x 23 mm							278	278	334											358	363	
	672	27 x 27 mm																					472	540

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.

CPLD Products

ispMACH 4000 Series

Features			ispMACH® 4000ZE				ispMACH® 4000V					
Parameter			4032ZE	4064ZE	4128ZE	4256ZE	4032	4064	4128	4256	4384	4512
Macrocells			32	64	128	256	32	64	128	256	384	512
tpd (ns)			4.4	4.7	5.8	5.8	2.5	2.5	2.7	3.0	3.5	3.5
tco (ns)			3.0	3.2	3.8	3.8	2.2	2.2	2.7	2.7	2.7	2.7
ts (ns)			2.2	2.5	2.9	2.9	1.8	1.8	1.8	2.0	2.0	2.0
fMAX (MHz)			260	241	200	200	400	400	333	322	322	322
Supply Voltage (V)			ZE=1.8				V=3.3					
I/O Standard Support			LVTTL, LVCMOS3.3/2.5/1.8/1.5, PCI3.3				LVTTL, LVCMOS3.3/2.5/1.8, PCI3.3					
Embedded Oscillator			✓	✓	✓	✓						
5 V Tolerant I/Os			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Typ. Standby Current (@ 3.3 V)			10 µA	11 µA	12 µA	13 µA	11.3 mA	11.5 mA	11.5 mA	12 mA	12.5 mA	13 mA
Temperature Grades			C/I	C/I	C/I	C/I	C/I/E/A	C/I/E/A	C/I/E/A	C/I/E	C/I	C/I
0.4 mm Spacing			I/O Count + Inputs									
ucBGA	64	4 x 4 mm		48 + 4								
	132	6 x 6 mm			96 + 4							
TQFP	128	14 x 14 mm							92 + 4			
0.5 mm Spacing			I/O Count + Inputs									
TQFP	48	7 x 7 mm	32 + 4	32 + 4			32 + 4	32 + 4				
	100	14 x 14 mm		64 + 10	64 + 10	64 + 10		64 + 10	64 + 10	64 + 10		
	144	20 x 20 mm			96 + 4	96 + 14			96 + 4	96 + 14		
	176	24 x 24 mm								128 + 4	128 + 4	128 + 4
csBGA	64	5 x 5 mm	32 + 4	48 + 4								
	144	7 x 7 mm		64 + 10	96 + 4	108 + 4						
0.8 mm Spacing			I/O Count + Inputs									
TQFP	44	10 x 10 mm					30 + 2	30 + 2				
1.0 mm Spacing			Total I/Os (Dedicated I/Os)[4,5]									
ftBGA	256	17 x 17 mm								160 + 4	192 + 4	208 + 4

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

IP Cores

Lattice IP Cores are pre-tested, reusable functions, that allow designers to focus on their unique system architectures. These IP cores provide industry-standard functions such as PCI Express, DDR, Ethernet, CPRI, and embedded microprocessors. In addition, a number of independent IP providers have teamed with Lattice to offer additional high quality, reusable IP cores. Partners are selected for their industry leadership, high development standards, and commitment to customer support. For a complete listing of IP cores from Lattice and its 3rd party partners, please go to latticesemi.com/IP. Note that a Diamond Subscription License and the IP license are required to use the IPs for production.

	IP Core	ECP5	LatticeECP3	LatticeECP2/M	LatticeECP2	MachXO2	MachXO	LatticeXP2
Communications	10 Gigabit Ethernet MAC	✓	✓	✓[1]	✓[1]			
	2.5 Gb Ethernet MAC	✓	✓					
	2.5 Gb Ethernet PCS		✓[1]					
	CPRI	✓	✓	✓[1]				
	SGMII and Gigabit Ethernet PCS	✓	✓	✓[1]				
	Triple Speed 10/100/1G Ethernet MAC	✓	✓	✓[1]	✓[1]			✓
	XAUI	✓	✓	✓[1]				
Connectivity	PCI Express x1 Endpoint	✓	✓	✓[1]				
	PCI Express x2 Endpoint	✓						
	PCI Express x4 Endpoint	✓	✓	✓[1]				
	PCI Express Root Complex Lite X1	✓	✓					
	PCI Express Root Complex Lite X4	✓	✓					
	PIPE		✓					
	PCI Master/Target 33		✓	✓[1]	✓[1]	✓	✓	✓
	PCI Master/Target 66		✓	✓[1]	✓[1]			✓
	PCI Target 33		✓	✓[1]	✓[1]	✓	✓	✓
	PCI Target 66		✓	✓[1]	✓[1]		✓	✓
	Tri-Rate Serial Digital Interface (SDI) PHY	✓	✓					
	JESD204A		✓					
	JESD204B	✓	✓					
	JESD207	✓[1]	✓					
Digital Signal Processing	Block Convolutional Encoder		✓[1]	✓[1]	✓[1]			✓[1]
	Block Viterbi Decoder		✓[1]	✓[1]	✓[1]			✓[1]
	Cascaded Integrator-Comb (CIC) Filter		✓[1]	✓[1]	✓[1]			✓[1]
	CORDIC		✓[1]	✓[1]	✓[1]			✓[1]
	Distributed Arithmetic (DA) FIR Filter		✓[1]	✓[1]	✓[1]			✓[1]
	Divider		✓	✓[1]	✓[1]			✓
	Dynamic Block Reed-Solomon Decoder		✓[1]	✓[1]	✓[1]			✓[1]
	FFT Compiler		✓[1]	✓[1]	✓[1]			✓[1]
	FIR Filter Generator		✓	✓[1]	✓[1]			✓
	Interleaver/De-interleaver		✓[1]	✓[1]	✓[1]			✓[1]
	Median Filter		✓[1]	✓[1]	✓[1]			✓[1]
	Numerically-Controlled Oscillator (NCO)		✓	✓[1]	✓[1]			✓
	Peak Cancellation Crest Factor Reduction (CFR)	✓	✓					
Processor, Controller & Peripheral	DDR SDRAM Controller		✓[1]	✓[1]	✓[1]			✓[1]
	DDR SDRAM Controller Pipelined					✓		
	DDR2 SDRAM Controller	✓[1]	✓	✓[1]	✓[1]			✓
	DDR2 SDRAM Controller Pipelined					✓		
	DDR3 SDRAM Contoller	✓	✓					
	DDR3 SDRAM PHY	✓	✓					
	LPDDR SDRAM Controller					✓		
	LPDDR3 SDRAM Controller	✓						
	Scatter Gather DMA	✓	✓	✓[1]	✓[1]			✓
Video & Imaging	2D Edge Detector		✓[1]	✓[1]	✓[1]			✓[1]
	2D FIR Filter		✓[1]	✓[1]	✓[1]			✓[1]
	2D Scaler	✓[1]	✓	✓[1]	✓[1]			✓
	Color Space Converter	✓	✓	✓[1]	✓[1]	✓		✓
	Deinterlacer	✓[1]	✓	✓[1]	✓[1]			✓
	Display Interface Mux					✓[1]		
	DVB-ASI		✓					
	Gamma Corrector	✓	✓	✓[1]	✓[1]			✓
	Median Filter		✓[1]	✓[1]	✓[1]			✓[1]
	Video Frame Buffer	✓	✓	✓[1]	✓[1]			✓[1]

1) Contact Lattice for version support information.

IP Cores and Reference Designs

Lattice IP Suites provide many of the IP cores required to develop a total solution for common FPGA applications. In addition, multiple Lattice FPGA families are supported with each IP Suite, so designers can develop solutions across multiple Lattice families, taking advantage of the best features of each. The following table summarizes which IP cores are included in each IP Suite, and which FPGA families are supported.

	IP Core	ECP5	Lattice ECP3	Lattice ECP2M	Lattice ECP2	Mach XO2	Mach XO	Lattice XP2	Suite (One Year Subscription)	Annual License Renewal (After First Year)
Value Suite	DDR SDRAM Controller		✓	✓	✓			✓	Order #: DS-VAL-ST-U1	Order #: DS-VAL-ST-UR1
	DDR2 SDRAM Controller	✓[1]	✓	✓	✓	✓		✓		
	DDR3 SDRAM Controller	✓	✓							
	LPDDR SDRAM Controller					✓				
	LPDDR3 SDRAM Controller	✓								
	FIR Filter Generator		✓	✓[1]	✓[1]			✓		
	Triple Speed Ethernet MAC	✓	✓	✓[1]	✓[1]			✓		
PCI Express Suite	PCI Express x1 Endpoint	✓	✓	✓[1]					Order #: DS-PCIE-ST-U1	Order #: DS-PCIE-ST-UR1
	PCI Express x2 Endpoint	✓								
	PCI Express x4 Endpoint	✓	✓	✓[1]						
	PCIe Root Complex Lite x1	✓	✓							
	PCIe Root Complex Lite x4	✓	✓							
	Scatter Gather DMA	✓	✓	✓[1]	✓[1]			✓		
	PCI Master/Target 33		✓	✓[1]	✓[1]	✓	✓	✓		
	PCI Master/Target 66		✓	✓[1]	✓[1]			✓		
	PCI Target 33		✓	✓[1]	✓[1]	✓	✓	✓		
	PCI Target 66		✓	✓[1]	✓[1]		✓	✓		
	DDR SDRAM Controller		✓[1]	✓[1]	✓[1]			✓[1]		
	DDR2 SDRAM Controller	✓[1]	✓	✓[1]	✓[1]			✓		
	DDR3 SDRAM Controller	✓	✓							
	LPDDR SDRAM Controller					✓				
	LPDDR3 SDRAM Controller	✓								
Ethernet Suite	10 Gigabit Ethernet MAC	✓	✓	✓[1]	✓[1]				Order #: DS-ETH-ST-U1	Order #: DS-ETH-ST-UR1
	SGMII and Gigabit Ethernet PCS	✓	✓	✓[1]						
	Triple Speed 10/100/1G Ethernet MAC	✓	✓	✓[1]	✓[1]			✓		
	XAUI	✓	✓	✓[1]						
	Scatter Gather DMA	✓	✓	✓[1]	✓[1]			✓		
	DDR SDRAM Controller		✓[1]	✓[1]	✓[1]			✓[1]		
	DDR2 SDRAM Controller	✓[1]	✓	✓[1]	✓[1]			✓		
	DDR3 SDRAM Controller	✓	✓							
Digital Signal Processing (DSP) Design Suite	Block Convolutional Encoder		✓[1]	✓[1]	✓[1]			✓[1]	Order #: DS-DSP-ST-U1	Order #: DS-DSP-ST-UR1
	Block Viterbi Decoder		✓[1]	✓[1]	✓[1]			✓[1]		
	Cascaded Integrator-Comb (CIC) Filter		✓[1]	✓[1]	✓[1]			✓[1]		
	CORDIC		✓[1]	✓[1]	✓[1]			✓[1]		
	Distributed Arithmetic (DA) FIR Filter		✓[1]	✓[1]	✓[1]			✓[1]		
	Dynamic Block Reed-Solomon Decoder		✓[1]	✓[1]	✓[1]			✓[1]		
	FFT Compiler		✓[1]	✓[1]	✓[1]			✓[1]		
	FIR Filter Generator		✓	✓[1]	✓[1]			✓		
	Interleaver/De-Interleaver		✓[1]	✓[1]	✓[1]			✓[1]		
	Numerically Controlled Oscillators (NCO)		✓	✓[1]	✓[1]			✓		
Video and Display Suite	2D Edge Detector		✓[1]	✓[1]	✓[1]			✓[1]	Order #: DS-VDS-ST-U1	Order #: DS-VDS-ST-UR1
	2D FIR Filter		✓[1]	✓[1]	✓[1]			✓[1]		
	2D Scaler	✓[1]	✓	✓[1]	✓[1]			✓		
	Color Space Converter	✓	✓	✓[1]	✓[1]	✓		✓		
	Deinterlacer	✓[1]	✓	✓[1]	✓[1]			✓		
	Median Filter		✓[1]	✓[1]	✓[1]			✓[1]		
	DVB-ASI		✓							
	Tri-rate Serial Digital Interface (SDI) PHY	✓	✓							
	DDR SDRAM Controller		✓[1]	✓[1]	✓[1]			✓[1]		
	DDR2 SDRAM Controller	✓[1]	✓	✓[1]	✓[1]			✓		
	DDR3 SDRAM Controller	✓	✓							

1) Contact Lattice for version support information.

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.

											Format	
Name	**Reference Design No.**	**ECP5**	**Lattice ECP3**	**Mach XO3**	**Mach XO2**	**Mach XO**	**Lattice XP2**	**iCE40 LP/HX/LM**	**iCE40 Ultra**	**WISHBONE Compatible**	**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							✓			✓	✓
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		✓	✓	✓	✓		✓			✓	✓	✓
LatticeMico8 - Embedded Processor		✓	✓	✓	✓		✓			✓	✓	✓
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	RD1045		✓			✓	✓			✓	✓	✓
PWM Fan Controller - WISHBONE Compatible	RD1060			✓	✓	✓	✓			✓	✓	✓
PWM Generator	RD1178							✓				✓
RAM-Type Interface for Embedded User Flash Memory - WISHBONE Compatible	RD1126				✓					✓	✓	

Continued on next page

IP Cores and Reference Designs

Name	Reference Design No.	ECP5	Lattice ECP3	Mach XO3	Mach XO2	Mach XO	Lattice XP2	iCE40 LP/HX/LM	iCE40 Ultra	WISHBONE Compatible	Format	
											Verilog	VHDL
RC4 Based PRNG Generator	RD1179							✓				✓
Read and Write Usercode	RD1041			✓	✓	✓					✓	✓
RGMII to GMII Bridge	RD1022	✓	✓								✓	✓
SD Flash Controller - WISHBONE Compatible	RD1048					✓	✓				✓	✓
SD Host Controller	RD1165							✓			✓	✓
SDR SDRAM Controller	RD1174			✓				✓			✓	
SDR SDRAM Controller – Advanced	RD1010	✓	✓		✓	✓	✓				✓	✓
Simple Sigma-Delta ADC	RD1066				✓	✓	✓				✓	✓
SMPTE SDI Dual HD from/to 3G Level-B Converter	RD1132		✓								✓	
SPI Master Controller	RD1141							✓			✓	
SPI Peripheral	RD1075					✓					✓	✓
SPI Slave Controller	RD1142							✓			✓	✓
SPI Slave Peripheral Using the Embedded Function Block - WISHBONE Compatible	RD1125			✓	✓					✓	✓	✓
SPI Slave Port Expander	RD1168							✓				✓
SPI to I²C Bridge	RD1173							✓			✓	
SPI to UART Expander	RD1143							✓				✓
SPI Wishbone Compatible	RD1044			✓	✓	✓	✓			✓	✓	✓
Sub-LVDS Serial to CMOS Parallel Sensor Bridge	RD1130				✓						✓	
Sub-LVDS-to-Parallel Sensor Bridge	RD1122	✓	✓		✓		✓				✓	✓
UART - WISHBONE Compatible	RD1042			✓	✓	✓	✓			✓	✓	✓
UART (Universal Asynchronous Receiver/ Transmitter)	RD1011					✓	✓					✓
UART 16550 Transceiver	RD1138							✓			✓	

ispMACH 4000 Reference Designs

Name	Reference Design Number	WISHBONE Compatible	Format		
			Verilog	VHDL	BLIF NGO
8b/10b Encoder/Decoder	RD1012				✓
GPIO Expander	RD1065		✓	✓	
I²C Bus Controller for Serial EEPROMs	RD1006	✓	✓		✓
I²C (Inter-Integrated Circuit) Bus Master	RD1005	✓			✓
I²C (Inter-Integrated Circuit) Slave / Peripheral	RD1054	✓			
LPC (Low Pin Count) Bus Controller	RD1049	✓	✓		✓
Multiple Scan Port Addressable Buffer (BSCAN1)	RD1001	✓			
Multiple Scan Port Linker (BSCAN 2)	RD1002				✓
PCI Target 32 bit/33 MHz	RD1008		✓	✓	
PWM Fan Controller	RD1060		✓	✓	
Read and Write Usercode	RD1041		✓	✓	
SDR SDRAM Controller - Advanced	RD1010	✓	✓		✓
SPI GPIO Expander	RD1073		✓		
SPI Controller - WISHBONE Compatible	RD1044	✓	✓	✓	
SPI (Serial Peripheral Interface) Peripheral	RD1075	✓	✓		✓
UART (Universal Asynchronous Receiver/ Transmitter)	RD1011	✓			

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	✓	✓	✓	✓		✓

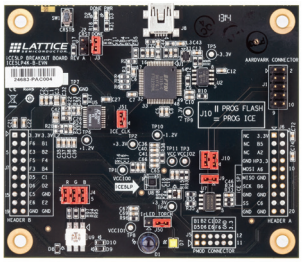
Hardware Management Reference Designs

				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 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.



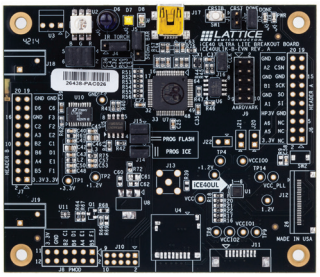
Features

- 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.



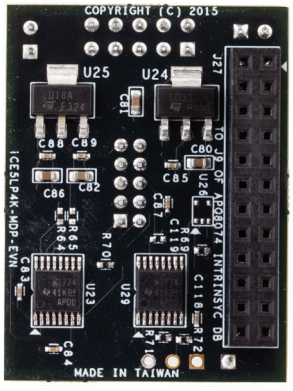
Features

- 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

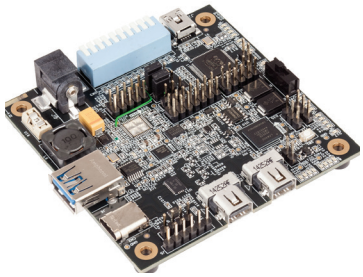
- Approximately (WxLxH) 1.50“x1.57“x0.87“ form factor with wrist strap
- iCE40 Ultra iCE5LP4K and MachXO2 LCMXO2-2000ZE
- LG 1.54” 240x240 single-lane MIPI DSI display
- Bluetooth low-energy module
- Sensors: Heart-rate/SpO2, skin temperature, pressure and accelerometer/ gyroscope
- 2 user LEDs, RGB 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

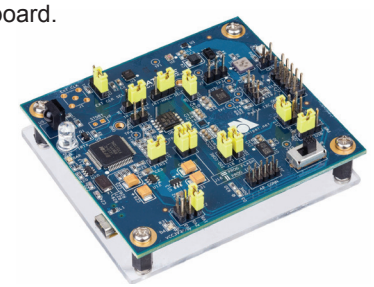
- Supports Cable Configuration
  - UFP/DFP/DRP modes supported
  - Dead battery mode supported
- Supports Power Delivery
  - Dual voltage output *
  - Power and data role swaps *
  - Display port alternate mode *
  - Vendor defined messages *
- UART Monitor of USB Type-C interface *
- Pre-configured 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

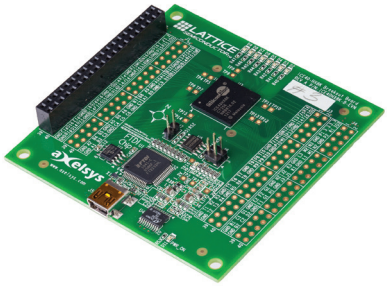
- iCE40LM4K FPGA in 25-WLCSP (0.35 mm ball pitch)
- Infrared transmit and Receive
- Numerous Sensors
  - Proximity sensor
  - RGB Color, Infrared, and Temperature Sensors
  - Barometric pressure sensor
  - Accelerometer
  - Gyro Magnetometer/compass/ accelerometer
  - Humidity & Temp sensor
  - Hall 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

Development Kits

iCE40-HX8K Breakout Board

A simple, low-cost board with an iCE40-HX8K FPGA, and generous I/O access.



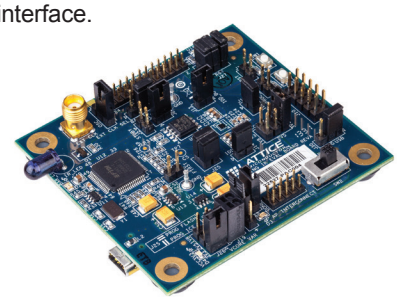
Features

- iCE40-HX8K CT256 device
- 8 user-accessible LEDs
- SPI Flash for programming configuration
- 40-pin 0.1” header for user connectivity
- 0.1” holes for user connectivity
- FTDI 2232H for USB interface
- 12MHz oscillator
- Jumpers to select programming of the SPI Flash or iCE40-HX8K
- USB Type-A to Type-B (mini) cable for FPGA programming via PC
- Demo designs available for download

Ordering Part Number
ICE40HX8K-B-EVN

iCE40LP1K Evaluation Kit

Featuring our ultra-small FPGA – 1K LUTs in a 16-ball WLCSP package (0.35 mm-ball pitch), only 1.4 mm x 1.48 mm, RGB LED control, GUI available for PC or Mac interface.



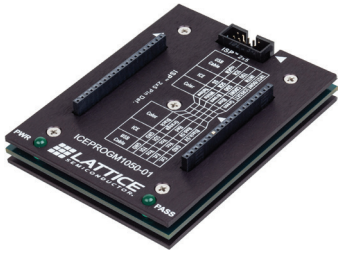
Features

- iCE40LP1K in 16-WLCSP package (0.35 mm-ball pitch)
- High current tri-color LED (RGB)
- Infrared transmit LED
- Barcode emulation LED
- 27MHz on-board oscillator
- SMA connector for external clock input
- SPI configuration Flash
- USB Type-A to Type-B (mini) cable for FPGA power and programming via PC

Ordering Part Number
ICE40LP1K-SWG16-EVN

iCEprog Desktop Programmer

The iCEprog Desktop Programmer supports programming of the OTP fuses of Lattice iCE products (NVCM programming). It can also be used for SPI programming of iCE devices.



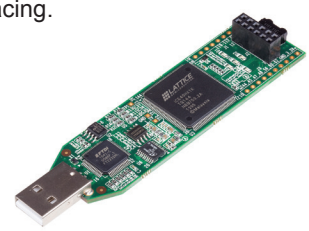
Features

- Support for all Lattice programmable products
  - 1.2V to 3.3V programming (HW-USBN-2B)
  - 1.2V to 5V programming (All other cables)
  - Ideal for design prototyping and debugging
- Connect to multiple PC interfaces
  - USB (v.1.0, v.2.0)
  - PC Parallel Port
- Easy-to-use programming connectors
  - Versatile flywire, 2 x 5 (.100”) or 1 x 8 (.100”) connectors
  - 6 feet (2 meters) or more of programming cable length (PC to DUT)
- Lead-free, RoHS-compliant construction

Ordering Part Number
ICEPROGM1050-01

iCEstick Evaluation Kit

Low-cost evaluation of the iCE40 FPGA, in a convenient USB drive form factor. Includes Pmod™ connector for versatile interfacing.



Features

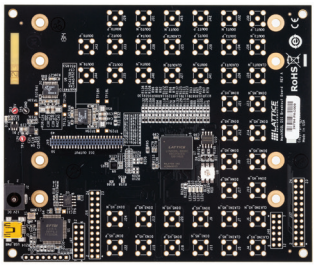
- USB thumb drive form factor
- iCE40HX-1K on board
- 2x6 position Digilent Pmod™ connector for multiple peripheral connections
- Vishay TFDU4101 IrDA transceiver
- FTDI 2232H USB device allows iCE-device programming and UART interface to a PC
- Five user LEDs
- Discera 12MHz MEMS oscillator
- Micron 32Mbit N25Q32 SPI Flash
- USB connector provides the power supply
- 16 LVCMOS/LVTTL (3.3V) digital I/O connections on 0.1” through-hole connections
- IrDA & Tx/Rx reference designs available for download

Ordering Part Number
ICE40HX1K-STICK-EVN

Development Kits

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.



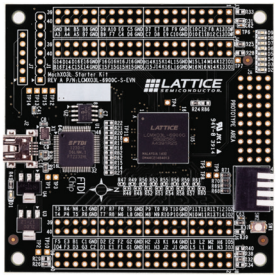
Features

- 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.



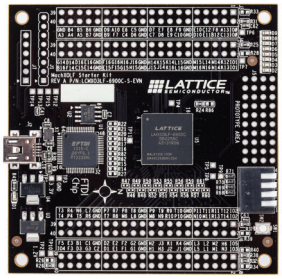
Features

- 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

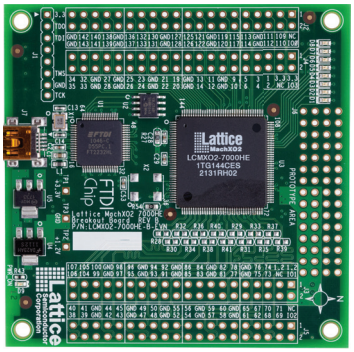
Development Kits

MachXO

MachXO2 Boards and Kits

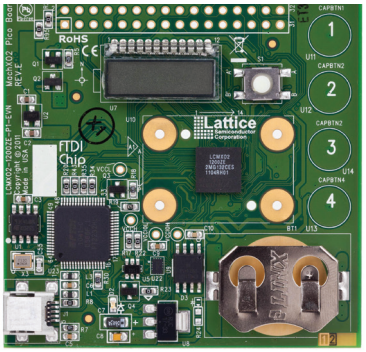
MachXO2 Breakout Board Features

- MachXO2 LCMXO2-7000HE
- Access to all device I/O via four 2x20 expansion header landings for I/O, JTAG and external power
- 60-hole prototype area
- USB Type-B (mini) connector for power and programming (cable included)
- Eight general purpose LEDs
- 3.3V and 1.2V supply rails



MachXO2 Pico Development Kit Features

- MachXO2 LCMXO2-1200ZE
- 4-character, 16-segment LCD display
- 4 capacitive touch sense buttons
- 1Mbit SPI Flash
- I2C temperature sensor
- Current and voltage sensor circuits
- Expansion header for JTAG, I2C
- Standard USB cable for device programming and I2C communication
- RS-232/USB & JTAG/USB interface
- RoHS-compliant packaging and process
- Watch battery



MachXO2 Control Development Kit Features

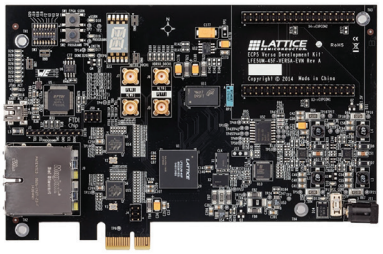
- MachXO2 LCMXO2-4000HC
- Power Manager II ispPAC-POWR1014A
- 128Mbit LPDDR memory, 4Mbit SPI Flash
- Current and voltage sensor circuits
- SD memory card socket
- Microphone
- Audio amplifier and Delta-Sigma ADC
- Up to two DVI sources and one DVI output.
- Up to two Display inputs (7:1 LVDS) and one Display output (7:1 LVDS)
- Audio output channel
- Expansion header for JTAG, SPI, I2C and PLD I/Os.
- LEDs & switches
- Standard USB cable for device programming
- RS-232/USB & JTAG/USB interface
- RoHS-compliant packaging and process
- AC adapter (international plugs)

Ordering Part Number	
Breakout Board	LCMXO2-7000HE-B-EVN
Pico Development Kit	LCMXO2-1200ZE-P1-EVN
Control Development Kit	LCMXO2-4000HC-C-EVN

ECP

ECP5 Versa Development Kit

For evaluation and development with the ECP5 FPGA, including PCI Express, Gigabit Ethernet, DDR3 and generic SERDES performance.



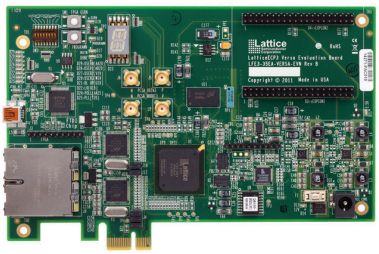
Features

- Half-length PCI Express form factor: allows demonstration of PCI Express x1interconnection
- Electrical testing of one full-duplex SERDES channel via SMA connections
- USB Type-B connection for UART and device programming
- Two RJ45 interfaces to 10/100/1000 Ethernet to RGMII
- On-board boot Flash:128Mbit Serial SPI Flash
- DDR3-1866 memory components (64Mbit/x16)
- Expansion mezzanine interconnection for prototyping
- 14-segment alphanumeric display
- Switches, LEDs and displays for demo purposes
- Diamond® programming support
- On-board reference clock sources

Ordering Part Number
LFE5UM-45F-VERSA-EVN

LatticeECP3 Versa Development Kit

Industry's lowest cost platform for designing PCI Express and Gigabit Ethernet based systems. The kit includes free demos and reference designs.



Features

- The LatticeECP3 Versa Evaluation Board:
  - PCI Express 1.1x1 Edge connector interface
  - Two Gigabit Ethernet ports (RJ45)
  - 4 SMA connectors for SERDES access
  - USB Type-B (mini) for FPGA programming
  - LatticeECP3 FPGA: LFE3-35EA-FF484
  - 64Mbit Serial Flash memory
  - 1GB DDR3 Memory
  - 14 segment alphanumeric display
  - Switches and LEDs for demos
- SERDES Eye Quality Demo
- 4 PCI Express Demos
- Gigabit Ethernet MAC Demo using Mico32
- DDR3 Memory Controller Demo
- Available on Windows and Linux platforms
- USB Type-A to Type-B (mini) cable for FPGA programming via PC
- 12V AC power adapter and international plug adapters

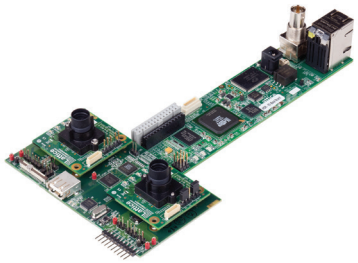
Ordering Part Number
LFE3-35EA-VERSA-EVN

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.



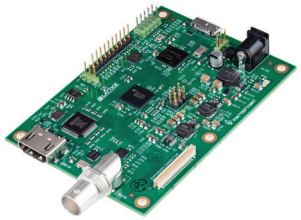
Features

- 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

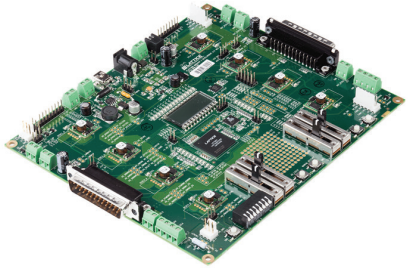
- Production-ready USB3 audio/video bridging reference design
- 1080p video streaming over USB 3.0 at 60fps
- HDMI 1.4a audio and video capture
- SD-, HD-, 3G-SDI audio and video capture
- Supports video capture from external MIPI CSI-2 , SubLVDS or Parallel sensors
- Reference design provides fast USB 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

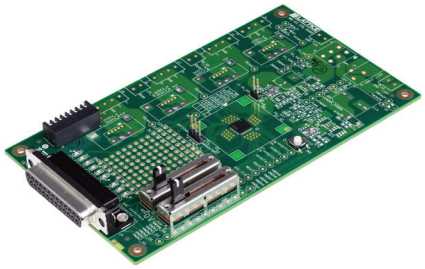
Ordering Part Number
LFE3-17EA-USB3-EVN

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:

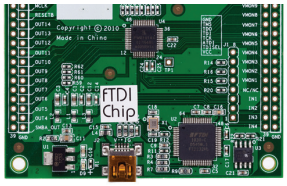
- ispPAC-POWR1220AT8 Power Manager II device
- MachXO 2280 programmable logic device
- ispMACH® 4000 programmable logic device
- USB interface for JTAG, I2C, and SPI
- Main and external 12V supply connections
- 12V Hot Swap for Hot Swap demo
- 12V OR'ing for redundant power puppply demo
- 1.2V DC-DC 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

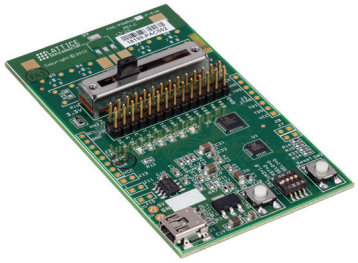
- Power Manager II - POWR1014A-02TN48I device/package
- Pre-programmed hardware test program (Source is downloadable)
- LEDs expansion header landings prototyping area
- USB Type-B (mini) connector for programming and power
- JTAG header landing

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

POWR605

ProcessorPM Development Kit

This kit is a versatile, ready-to-use hardware platform for evaluating and designing with POWR605 (ProcessorPM) power management devices.

Features

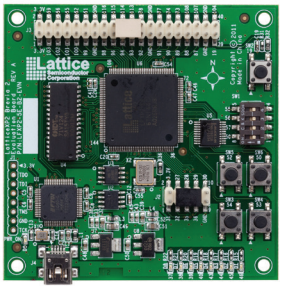
- Power Manager II ProcessorPM-POWR605
- Power Manager II ispPAC®-POWR6AT6
- LEDs for general purpose I/O, power indicators, and watchdog timer interrupt indication
- Slide potentiometer
- USB Type-B(mini) connector for power and programming
- 2x14 expansion header for general I/O, voltage monitor inputs, 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: PACPOWR605-P-EVN

LatticeXP2

LatticeXP2 Brevia2 Development Kit

Easy-to-use, low-cost platform for evaluating and designing with LatticeXP2 FPGAs.



Features

- LatticeXP2 FPGA: LFXP2-5E-6TN144C
- 2Mbit SPI Flash memory
- 1Mbit SRAM
- Programmed via included mini-USB Cable
- 2x20 and 2x5 expansion headers
- Push buttons for general purpose I/O and reset
- 4-bit DIP Switch for user-defined inputs
- 8 Status LEDs for user-defined outputs

Ordering Part Number
LFXP2-5E-B2-EVN

Industrial

HMI Development Kit

An FPGA-based Human Machine Interface kit with touchscreen. Scalable firmware and software makes adapting to your target system easy.

Features

- Includes LatticeECP3 Versa Board
- 480 x 272 touchscreen included
- SD card for loading of new projects
- Licensable HMI-on-chip (HoC) solution features
  - Scalable IP for high-end graphics
  - Fast response times
  - Easy design/re-configuration via GUI
  - No O/S or custom coding – all GUI
  - Implement on ECP3 or MachXO2/3L
  - Only 8K LUTs of FPGA required
  - Eval version included with the board
- USB Type-A to Type-B (mini) cable for FPGA programming via PC
- 12V AC power adapter with international plugs

Ordering Part Number
LFE3-35EA-HMI-DKN

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**.

FPGA and CPLD Design Software

Complete Design Flows - High Ease of Use		Lattice Diamond™ (Subscription License) Windows/Linux	Lattice Diamond™ (Free) Windows/Linux	ispLEVER™ Classic (Free) Windows	iCEcube2™ (Free) Windows/Linux	PAC-Designer
Device Families	ECP5-5G	✓				
	ECP5U	✓	✓			
	ECP5UM	✓				
	LatticeECP3	✓				
	LatticeECP2M/S	✓				
	LatticeECP2S	✓				
	MachXO2	✓	✓			
	MachXO3	✓	✓			
	MachXO	✓	✓			
	LatticeXP2	✓	✓			
	LatticeXP	✓	✓			
	LatticeECP2	✓	✓			
	iCE40				✓	
	ispMACH 4000B/C/V/ZE			✓		
	Platform Manager 2	✓	✓			
	L-ASC10	✓	✓			
	Power Manager II					✓
Software Features	Design Exploration	✓	✓		✓	
	Project Management	✓	✓	✓	✓	
	VHDL & Verilog Support	✓	✓	✓	✓	
	EDIF Support	✓	✓	✓	✓	
	Schematic Support	✓	✓	✓		
	ABEL			✓		ABEL language is supported in PAC-Designer software
	Synopsys® Synplify Pro™ for Lattice-Synthesis	✓	✓	✓		
	Lattice Synthesis Engine (LSE)	MachXO/XO2/XO3 LatticeECP2/ECP3/ ECP5/ECP2M/XP2	MachXO/XO2/XO3 LatticeECP2/ECP5U/ XP2	ispMACH 4000 only	✓	
	IP and Module Configuration	✓	✓	Module Only	Module Only	
	Power Estimation & Calculation	✓	✓		✓	
	Timing Analysis	✓	✓	✓	✓	
	Floorplanning	✓	✓	✓	✓	
	EPIC Device Editor	✓	✓	ORCA FPGA Only		
	On-Chip Debug	✓	✓	ispXPGA Only		
	TCL Scripting Dictionaries	✓	✓			
	Aldec® Active-HDL Lattice Edition Simulation	Windows Only	Windows Only	Windows Only	Windows Only	
Operating Systems	Windows 7/8 (32 bit and 64 bit)	✓	✓	Windows 7/XP	✓	
	Linux (Red Hat Enterprise v4, v5, v6; 32 bit and 64 bit)	✓	✓		✓	
Licensing & Updates	License Terms	One Year Subscription	One Year – Renewable	One Year – Renewable	One Year – Renewable	
	Node-Locked License	✓	✓	✓	✓	
	Floating License	✓			✓	

Connectivity ASSPs

Port Processors	Sil9777	Sil9575	Sil9573	Sil9535	Sil9533
HDMI® Input	4	6	6	4	3
MHL® Input	2	2	2	2	2
HDMI Output	3	2	2	1	1
InstaPort™ S		✓	✓	✓	✓
InstaPrevue™		✓	✓	✓	✓
Hardware HDCP Repeater	✓	✓	✓	✓	✓
HDCP Upstream Authentication Support	✓	✓	✓	✓	✓
HDMI Bandwidth	18 Gbps	9 Gbps	9 Gbps	9 Gbps	9 Gbps
Audio Return Channel	✓	✓	✓	✓	✓
Maximum HDMI Resolution	4K60 4:4:4	4K60 4:2:0	4K60 4:2:0	4K60 4:2:0	4K60 4:2:0
Maximum MHL Resolution	4K30	1080p30	1080p30	1080p60	1080p60
HDCP 1.4 support	✓	✓	✓	✓	✓
HDCP 2.2 support	✓				
Audio Extraction (I2S x 4)	✓	✓	✓	✓	✓
Pre-programmed HDCP keys	✓	✓	✓	✓	✓
CEC Processor		✓	✓		✓
OSD controller		✓	✓	✓	
Integrated NVRAM EDID		✓	✓	✓	✓
Package	208-pin LQFP	176-pin TQFP	176-pin TQFP	100-pin TQFP	88-pin QFN
Package Size	28 x 28 mm	20 x 20 mm	20 x 20 mm	14 x 14 mm	10 x 10 mm
Starter Kit	CP9777	CP9575HDMI	CP9575HDMI	CP9535	CP9533

Video Processors	Sil9612	Sil9616
HDMI® Input	1	1
MHL® Input	1	1
HDMI Output	1	1
Parallel Video Input		✓
Parallel Video Output		✓
OSD controller	✓	✓
Hardware HDCP Repeater	✓	✓
HDCP Upstream Authentication Support	✓	✓
HDMI Bandwidth	9 Gbps	9 Gbps
Audio Return Channel	✓	✓
Maximum HDMI Resolution	4K60 4:2:0	4K60 4:2:0
Maximum MHL Resolution	1080p60	1080p60
HDCP 1.4 support	✓	✓
Audio Extraction (I2S x 4)	✓	✓
Pre-programmed HDCP keys	✓	✓
CEC Processor	✓	✓
Package	76-pin QFN	176-pin TQFP
Package Size	9 x 9 mm	20 x 20 mm
Starter Kit	CP9612	CP9616

Analog Front End	Sil8784	Sil8788
Component Video Input	✓	✓
Composite Video Input	✓	✓
D-Connector Support	✓	
VGA Support	✓	
SCART Suppport	✓	
Parallel Video Output		✓
HDMI Output	✓	
MHL Output	✓	
SPDIF Audio Input	✓	
I2S Audio Input	✓	
Package	88-pin QFN	88-pin QFN
Package Size	10 x 10 mm	10 x 10 mm
Starter Kit	CP8784MHL/ CP8784HDMI	CP8788

Connectivity ASSPs

TV Port Processors	Sil9779	Sil9777	Sil9687A	Sil9589-3	Sil9587-3	Sil9489A	Sil9381A
HDMI® Input	3	4	4	5	4	5	4
superMHL Input	1						
MHL® Input	2	2	1	1	1	1	1
HDMI Output	3	3	1	1	1	2	1
superMHL™ Output	1						
InstaPort™			InstaPort™ S	InstaPort™ S	InstaPort™ S	InstaPort™ S	InstaPort™ S
Hardware HDCP Repeater	HDCP 2.2	HDCP 2.2				HDCP 1.4	
HDCP Upstream Authentication Support	HDCP 2.2	HDCP 2.2		HDCP 1.4	HDCP 1.4	HDCP 1.4	
HDMI Bandwidth	18 Gbps	18 Gbps	9 Gbps	9 Gbps	9 Gbps	6 Gbps	6 Gbps
Audio Return Channel	✓	✓	✓	✓	✓	✓	✓
Maximum HDMI Resolution	4K60 4:4:4	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	8K60 4:2:0 superMHL	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	208-pin QFP	76-pin QFN	100-pin QFP	88-pin QFN	128-pin QFP	88-pin QFN
Package Size	28 x 28 mm	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	CP9779	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

HDMI Transmitter	Sil9022A	Sil9024A	Sil1136	Sil9136-3	Sil9334	Sil9678	Sil7172	Sil164
HDMI® Output Type	HDMI1.3	HDMI1.3	HDMI1.4	HDMI1.4	HDMI1.4	HDMI2.0	iTMDS	DVI
Number of HDMI Outputs	1	1	1	1	1	1		
RGB/YCbCr Input	24-bit / 16-bit	24-bit / 16-bit	Up to 48-bit	Up to 48-bit	Up to 36-bit		Dual 36-bit	Up to 24-bit
HDMI Input						HDMI2.0		
Max Video Resolution	1080p60 4:4:4	1080p60 4:4:4	4K30 4:4:4	4K30 4:4:4	1080p60 (225MHz)	4K60 4:2:0	1080p60	1080p60
HDMI Bandwidth	4.9 Gbps	4.9 Gbps	9 Gbps	9 Gbps	6.75 Gbps	9 Gbps	6.75 Gbps	4.95 Gbps
HDCP support		HDCP 1.3		HDCP 1.2	HDCP 1.4	HDCP 1.4/ HDCP 2.2	HDCP 1.1	
Pre-programmed HDCP keys		✓		✓	✓	✓	✓	✓
Audio Insertion (I2S x 4) 192kHz	✓	✓	✓	✓	✓			
S/PDIF	✓	✓	✓	✓	✓	✓		
High Bit Rate Audio (Dolby TrueHD, DTS-HD)			✓	✓	✓	✓		
I²C Interface	✓	✓	✓	✓	✓	✓	✓	✓
Package	81-ball VFBGA 72-pin QFN 49-ball VFBGA	81-ball VFBGA 72-pin QFN 49-ball VFBGA	100-pin TQFP	100-pin TQFP	100-pin TQFP	76-pin QFN	129-Pin LQFP	64-Pin TQFP
Package Size	4 x 4 mm (VFBGA) 10 x 10 mm (QFN)	4 x 4 mm (VFBGA) 10 x 10 mm (QFN)	14 x 14 mm	14 x 14 mm	14 x 14 mm	9 x 9 mm	14 x 20 mm	12 x 12 mm
Starter Kit			CP1136HDMI	CP9136HDMI-3	CP9334	CP9678		

MHL Transmitters	Sil8334	Sil8620	Sil8240	Sil8346	Sil8348	Sil8630	Sil8632	Sil9630	Sil8558
HDMI input		✓				✓	✓	✓	✓
eTMDS input	✓	✓	✓			✓	✓	✓	✓
MIPI DSI input									
Parallel Digital Video Input				✓	✓				
MHL output	MHL1	MHL3	MHL2	MHL2	MHL2	superMHL	superMHL	superMHL	MHL2
Integrated Analog Switch	USB ID & Data		USB ID			MHL Demux for Type-C	MHL Demux for Type-C	MHL Demux for Type-C	USB, UART, audio
MAX video resolution	1080p30	4K30	1080p60	1080p60	1080p60	4K60	4K60	4K60	1080p60
720p adaptive Scaler									
HDCP decryption on input	Pass through	HDCP1.4				HDCP1.4		HDCP1.4	HDCP1.4
HDCP encryption on output	Pass through	HDCP1.4/ HDCP2.2	HDCP1.4	HDCP1.4		HDCP1.4/ HDCP2.2		HDCP1.4/ HDCP2.2	HDCP1.4
Dolby Digital	✓	✓	✓	✓	✓	✓	✓	✓	
DTS digital Audio	✓	✓	✓	✓	✓	✓	✓	✓	
Object Audio - Dolby Atmos, DTS:X						✓	✓	✓	
8-ch I2S interface @ 192KHz									
Package	49ball VFBGA	64ball VFBGA	49ball VFBGA	64ball VFBGA	64ball VFBGA	64ball VFBGA	64ball VFBGA	64ball BGA	64ball VFBGA
Package size	4 x 4 mm	4 x 4 mm	3.5 x 3.5 mm	4.5 x 4.5 mm	4.5 x 4.5 mm	4 x 4 mm	4 x 4 mm	6.5 x 6.5 mm	4 x 4 mm
Starter Kit	CP8334	CP8620	CP8240	CP8346	CP8348	CP8630	CP8632	CP9630	CP8558

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	Sil7023	Sil7024	Sil7033	Sil7012	Sil7013	Sil7014	LIF-UC110	LIF-UC140
Type-C		✓	✓	✓	✓	✓	✓	✓	✓
Main function	USB2.0/MHL/ UART switch	CC/PD PHY + MHL switch	CC/PD PHY + MHL/debug	CC/PD PHY + MHL/debug/ USB3.1 switch	CC/PD PHY	CC/PD PHY	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 1DP	MHL1/2/3/ superMHL/ x 2DP	MHL1/2/3/ superMHL x 2DP			DP AUX		
Billboard support		✓	✓	✓	✓	✓	✓		✓
BMC		✓	✓	✓	✓	✓	✓	✓	✓
VDM		✓	✓	✓	✓	✓	✓	✓	✓
Package	24 -pin QFN	24 -pin QFN	32 -pin QFN	36ball BGA	16ball CSP	24 -pin QFN	24 -pin QFN	48 -pin QFN	81ball BGA
Package size	3 x 3 mm	3 x 3 mm	4 x 4 mm	3 x 3 mm	2 x 2 mm	3 x 3 mm	3 x 3 mm	7 x 7 mm	4 x 4 mm
Starter kit	CP7033	CP7033	CP7033	CP7033	CP7033	CP7033	CP7033	iCE5LP4K-USBC-EVN	iCE40LP8K-USBC-EVN

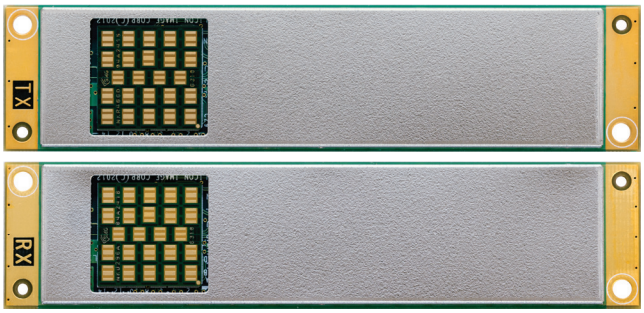
pASSP™ Solutions

		CrossLink™			
Device		**LIF-MD6000-36**	**LIF-MD6000-64**	**LIF-MD6000-81**	**LIF-MD6000-80**
LUTs		5936	5936	5936	5936
Embedded Memory	kbits	180	180	180	180
Distrib. RAM	kbits	47	47	47	47
GPLL		1	1	1	1
D-PHY PLL		1	2	2	2
Embedded I^2C Blocks		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)
48MHz Oscillator		1	1	1	1
10kHz Oscillator		1	1	1	1
NVCM		Yes	Yes	Yes	Yes
Dual Boot		Yes	Yes	Yes	Yes
Power Management Unit		Yes	Yes	Yes	Yes
Low Power Sleep Mode		Yes	Yes	Yes	Yes
Typical Operational Power		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
Package Pitch		0.4 mm	0.4 mm	0.5 mm	0.65 mm
GPIO		7	8	9	8
I/O		17	29	37	36

MOD6320-T & MOD6321-R

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 Receiver	MOD6321-R
Wireless Transmitter and Receiver Pair	MOD6320_6321-PAIR

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

Technical Support
latticesemi.com/support

May 2016 • Order #: I0211K Rev. 4