FPGA Boot Camp $20 FPGA kit with full user IO, some assembly required: soldering & breadboard wiring   **Jim Brakefield** 2022

item	avail	web link	2nd web link	need	part #	high vol price	# per order	min quant price	per kit cost	# kits/item	dx mm	dy mm	IO	K LUTs	Mb block RAM	MB D-RAM	MB flash	SD	vendor	mfg	comments
Seed Tang Nano-9K	yes	https://www.aliexpress.us/item/3256804089225102.html		**FPGA board**	Tang Nano-9K	$13.04	1	**$13.04**	13.040	1.0	25.4	60.0	36	8.6	0.48	8.0	8.0	Y	AliExpres	gowinsem	2PB, 6LED, HDMI & LCD conn, 27MHz os
8 7-seg, 8 PB, 8 LED	yes	https://handsontec.com/index.php/product/tm1638-7-segment-display-keypadled-modu		**User IO**	TM1638 7-Segment Dis	$2.90	1	**$2.90**	2.900	1.0	50.8	76.2	5 pins						HandsOn Tech		user IO except slide switches, used in ap
16 PCS 400 Pin Solderless Board	yes	https://www.amazon.com/MCIGICM-Breadboard-Solderless-Prototype-Protoboard/dp/B		**Breadboard**	MCIGICM Breadboard 4	$19.99	16	**$6.69**	1.249	1.0	58.0	83.8							amazon	MCIGICM	connectable, e.g. connect two for more
12 position DIP switch	yes	https://www.digikey.com/en/products/detail/cts-electrocomponents/210-12MS/250378	12 pos slide switch		CT21012MS-ND	$2,747.45	5000	**$1.06**	0.549	1.0	8.0	32.0							digikey	ctscorp	DIP size pins, tiny lettering & tiny switch
12 position DIP switch	yes	https://www.digikey.com/en/products/detail/cts-electrocomponents/210-12MS/250378	12 pos slide switch		23-DS04-254-1L-12BK-N	$3,511.00	5000	**$1.35**	0.702	1.0	8.0	32.0							digikey	CUI device	DIP size pins, somewhat larger lettering
male-female Jumper Cables	yes	https://www.digikey.com/en/products/detail/adafruit-industri	https://www.adafruit.com	**(20) m/f jumpers**	1528-1964-ND	$156.00	100	**$1.95**	0.624	2.5	2.5	152.4							adafruit	adafruit	6" long, insulated
Seed Tang Nano-9K	yes	https://www.pcbway.com/project/gifts_detail/Sipeed_Tang_Nano_9K_FPGA_kits_with_1		FPGA board	Tang Nano-9K	$22.99	1	$20.64	22.990	1.0	25.4	60.0	36	8.6	0.48	8.0	8.0	Y	pcbway	gowinsem	includes 1.14" LCD screen
Seed Tang Nano-9K	no	https://www.seeedstudio.com/Tang-Nano-9k-FPGA-board-Go	https://www.cnx-software	FPGA board	Tang Nano-9K	$14.90	1	$14.90	14.900	1.0	25.4	60.0	36	8.6	0.48	8.0	8.0	Y	Seeed	gowinsem	2PB, 6LED, HDMI & LCD conn, 27MHz os
10 PCS 830 Point Solderless Board	yes	https://www.amazon.com/MCIGICM-Breadboard-Solderless-Protoboard-Electronics/dp/		Breadboard	MCIGICM Breadboard 8	$19.99	10	$9.99	1.999	1.0	58.0	167.4							amazon	MCIGICM	longer board, more room for other stuff
2+2 400 & 830 Point Solderless Boa	yes	https://www.amazon.com/dp/B086C9HK7V/ref=sspa_dk_detail_3		Breadboard	Deke Home	$9.99	4	$9.99	2.498	1.0	58.0	167.4							amazon	Deke Hom	two short & two long
8 PCS 830 Point Solderless Board	yes	https://www.amazon.com/Pcs-MCIGICM-Points-Solderless-Breadboard/dp/B07PCJP9DY/		Breadboard	MCIGICM Breadboard 8	$16.60	8	$9.99	2.075	1.0	58.0	167.4							amazon	MCIGICM	longer board, more room for other stuff
30 PCS 400 Pin Solderless Board	yes	https://www.amazon.com/dp/B0BRGZDTFR/ref=sr_1_1		Breadboard	VILLCASE Breadboard 4	$46.67	30	$6.69	1.556	1.0	58.0	83.8							amazon	VILLCASE	connectable, e.g. connect two for more
4 PCS 400 Point Solderless Board	yes	https://www.amazon.com/Pcs-MCIGICM-Points-Solderless-Breadboard/dp/B07PCJP9DY/		Breadboard	MCIGICM Breadboard 8	$6.69	4	**$6.69**	1.673	1.0	58.0	83.8							amazon	MCIGICM	best price for quant 4
6 PCS 400 Point Solderless Board	yes	https://www.amazon.com/DEYUE-breadboard-Set-Prototype-Board/dp/B07LFD4LT6/ref=		Breadboard	DEYUE Breadboard 4	$9.99	6	$9.99	1.665	1.0	58.0	83.8							amazon	DEYUE	best price for quant 6
rotary dip switch	yes	https://www.digikey.com/en/products/detail/cts-electrocomponents/220ADC16/474385	HEX rotary switch		CT3070-ND	$5,755.75	5000	$2.28	1.151	1.0									digikey	ctscorp	has knob, also surface mount
5 position DIP switch	yes	https://www.digikey.com/en/products/detail/cui-devices/DS02C-254-1L-05BE/11310939	5X slide switch		DS02C-254-1L-05BE	$2,092.72	4917	$0.82	0.851	0.5									mouser	CUI	two per kit, piano shape
8 position DIP switch	yes	https://www.harfington.com/products/p-1071817		(20) 8pos slide switch		$3,250.00	8125		0.400	1.0									several	uxcell	DIP leads
8 position DIP switch	yes	https://www.newark.com/multicomp/mcei-08/switch-dip-8-position-spst-raised/dp/74M	8 pos slide switch		MCEIR-08	$0.20	1	$0.20	0.203	1.0									newark	multicomp	**DIP leads, end stackable**
100 male-female Jumper Cables	yes	https://www.digikey.com/en/products/detail/schmartboard-inc/920-0023-01/9556952	(100) m/f jumpers		920-0023-01-ND	$45.00	1	$7.00	3.750	12.0									digikey		5" long, has heatshrink covering
20 male-female Jumper Cables	yes	https://www.digikey.com/en/products/detail/adafruit-industries-llc/1954/6827087	(20) m/f jumpers		1528-1964-ND	$1.95	1	$1.95	0.650	3.0									digikey	adafruit	6" long, insulated
Breadboard Jumper Cables Kit	yes	https://www.amazon.com/dp/B07QXXMWRZ/ref=sspa_dk_detail_2		360 jumpers	Elegoo-EL-CP-004	$10.99	1	$6.98	0.733	15.0									amazon	ELEGOO	8X M/M, M/F, F/F per kit?
male-female Jumper Cables	yes	https://www.digikey.com/en/products/detail/adafruit-industri	https://www.digikey.com/	(20) m/f jumpers	1954	$156.00	100	**$1.95**	0.624	2.5	2.5	152.4							digikey	adafruit	6" long, insulated
male-male Jumper Cables	yes	https://tinkererssupply.com/products/10-cm-40-pin-solderless-jumper-wires-male-to-ma	(40) m/m jumpers		olderless Jumper Wires	$2.49	1	$2.49	0.623	4.0									tinkersupply		10 per kit?
HOOK-UP 22AWG SOLID - 5FT	yes	https://www.digikey.com/en/products/detail/cnc-tech/10982-	digikey	breadboarding	1175-2683-5-ND	$318.54	500	$0.99	0.637	1.0									digikey	CNC Tech	green insulation, no spool
HOOK-UP 22AWG SOLID - 1000FT	yes	https://www.digikey.com/en/products/detail/cnc-tech/10982-	digikey	breadboarding	C2004L-1000-ND	$784.76	10	$123	0.392	200.0									digikey	Prysmian	blue insulation
1.14" 1.14 inch 135x240 Full Color	yes	https://www.aliexpress.us/item/3256803585877182.html				$1.93	1	$1.93	1.930	1.0									AliExpress		full color, 8-pin
continental specialities experimenter 600		https://www.ebay.com/itm/325427387658		breadboarding	one set only	$35.00	5	$35.00	1.400	5.0	58.0	149.0							ebay		used, ebay only, wide jap breadboard
narrow FPGA boards		https://shop.trenz-electronic.de/en/Products/Trenz-Electronic/																			
cheap FPGA boards		https://www.joelw.id.au/FPGA/CheapFPGADevelopmentBoards																			

DIP switch mounted on breadboard spanning plugboard ground bus and rows connected to FPGA IOs   **Required parts** **$18.363**   DIP switch only item with high volume price break, also see Newark

Gowin IDE has low level placement tools, supports VHDL, Verilog and constraint files   Low volume cost, some extra parts $25.64   FPGA board has DRAM, Flash & SD socket

Seed Tang Nano-9K includes unsoldered pins, USB cable & case; has 27MHz oscillator   PCBway version includes small LCD display

Tang Nano-9K also supported by LiteX: https://github.com/enjoy-digital/litex   **Breadboards work best with 22awg solid copper and full DIP pin slide switches**