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Proton400k-L™ and Proton400k™ Technical Features

Feature	Subfeature	Description	Parameter	Proton400k-L	Proton400k
Processor	Architecture	CPU Family	Architecture	PowerPC e500	PowerPC e500
			Bits	32 bits (per core)	64 bits (per core)
			Cores	Dual Core	Dual Core
	Speed	MIPS, MHz, SPECINT	Speed	1.2 GHz	1.5 GHz
			MIPS	3600 DMIPS	7200 DMIPS
			Variable Speed?	800 MHz - 1.2 GHz	1.2 GHz - 1.5 GHz
			Memory Controller	2 64-bit SDRAM controllers	64-bit SDRAM controller
			Local Bus	16 bits	32 bits
	Units	CPU, FPU, VMX, DMA	CPU	2 32-bit CPU	2-64 bit CPU
			FPU	2 32-bit FPU	2-64 bit FPU
			DMA controllers	2 4-channel controllers	2 4-channel controllers
			VMX size	32-bit vector integer	64-bit vector integer
	Cache	L1, L2 cache with / without parity and ECC	L1 Instruction	32 KB per core	32 KB per core
			L1 Data	32 KB per core	32 KB per core
			L1 Parity	Yes	Yes
			L1 ECC	No	Yes
			L2 on chip	512 KB	1 MB
			L2 parity	Yes	Yes
			L2 ECC	Yes	Yes
	Technology	ASIC Technology	ASIC	45 nm	90 nm
			ASIC Process	Freescale SOI	Freescale SOI
	Counters/Timers	Internal / on-board counters/timers	Upcounters	> Two 32 bit counters	> Two 32 bit counters
			Downcounters	Available as option	Available as option
			Timers	3 timers	3 timers
			Counter/Timer clock rate	Configurable	Configurable
			Watchdog Timer	Yes, plus Hardened Core Timer	Yes, plus Hardened Core Timer
	Interrupts	Levels, software / hardware	Interrupt Levels	16	16
			Interrupt Latency	< 10 µs	< 10 µs
	Thermistors	To measure temperatures	Thermistors	Available	Available
			Thermistor Interface	SW API to read temperature	SW API to read temperature
	Protection	TMR, TTMR	Protection	TTMR, H-Core, TMR, Hamming Code EDAC, Time redundancy used throughout	TTMR, H-Core, TMR, Hamming Code EDAC, Time redundancy used throughout
	BITE	Built-in test circuitry	BITE	SW API to invoke BITE Functions to test SBC components and interfaces	SW API to invoke BITE Functions to test SBC components and interfaces
Memory	Volatile memory	RAM	RAM Type	SDRAM	SDRAM
			RAM error detection	Hamming Code	Hamming Code
			RAM error correction	8 bit data, 8 bit check	8 bit data, 8 bit check
			RAM capacity	128 MB to 512 MB	128 MB to 512 MB
			RAM access speed	32 bits/ DDR2	64 bits/ DDR2
	Non-volatile RAM	NVRAM, Flash	EEPROM protection	Rad Hard Flash	Rad Hard Flash
			EEPROM/Flash total	1 Mbit EEPROM & 4 GB flash	1 Mbit EEPROM & 4 GB flash
			EEPROM user	4 GB	4 GB

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			EEPROM access speed	64 Mbps	64 Mbps
			SUROM primary	1 Mbit	1 Mbit
			SUROM secondary	available as option	available as option
			SUROM autoswap?	Yes, available as option, ping pong between primary and secondary	Yes, available as option, ping pong between primary and secondary
			SUROM access speed	8 bits 120 ns	8 bits 120 ns
			Flash	yes	yes
			Flash protection	Rad Hard Mitigation Included	Rad Hard Mitigation Included
			Flash File System	Yes	Yes
			Flash access speed	64 Mbps	64 Mbps
Interfaces	Backplane	PCI, cPCI, PCI Express	Backplane bus	cPCI	cPCI
			Backplane form factor	3U or 6U	3U or 6U
			Backplane speed	33 MHz	33 MHz
			Backplane width	32 bits	32 bits
			Backplane electrical	3.3 V	3.3 V
			Backplane mechanical	cPCI	cPCI
	External high speed	SpaceWire, 1553, SPI, I2C, CAN, Ethernet	Spacewire speed	100-200 Mbps/port	100-200 Mbps/port
			Spacewire ports	4-8 ports	4-8 ports
			Spacewire on-board router	yes	yes
			Spacewire core	NASA	NASA
			1553 speed	Available as option	Available as option
			1553 SEU immunity	Available as option	Available as option
			1553 BC/RT/MT	Available as option	Available as option
			SPI ports	Available as option	Available as option
			SPI speed		
			I^2C ports	Available as option	Available as option
			I^2C speed		
			CAN ports	Available as option	Available as option
			CAN speed		
			Ethernet: for SW development	Yes, 10/100	Yes, 10/100
	External Serial	Serial asynchronous, synchronous	Serial UART (async) ports	Two ports standard; more available as option	Two ports standard; more available as option
			UART speed	Programmable to 230 kbps	Programmable to 230 kbps
			UART electrical	RS-422	RS-422
			Serial USRT (sync) ports	Available as option	Available as option
			USRT speed	Available as option	Available as option
			USRT electrical	RS-422	RS-422
	External GPIO	digital ins and outs	GPIO-ins	24-32 bits standard; more available as option	24-32 bits standard; more available as option
			GPIO-outs	24-32 bits standard	24-32 bits standard
			GPIO electrical	3.3 V, TTL	3.3 V, TTL
	External Parallel	Parallel Interfaces	Parallel ports	Available as option	Available as option
			Parallel lines / port	Available as option	Available as option
	GPS receiver	1pps, UTC	1pps	Available as option	Available as option
			UTC	Available as option	Available as option
Electrical	Power consumption	Board Total	Power	8-12 W	15-28 W
	Volts and Amps	Secondary voltages	3.3 V	22 mA required	30 mA required

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			2.5 V	53.2 mA required	60 mA required
			1.05 V	6.9 A required	14.2 A required
Thermal	Temperature	During storage, launch, operation	Acceptance Temperature	-40 C to +100 C	-40 C to +100 C
			Qualification Temperature	-55 C to +110C	-55 C to +110C
			Survival Temperature	Set by program requirements	Set by program requirements
			Rail Temperature	Set by program requirements	Set by program requirements
			Cooling mechanism	Conduction	Conduction
			Power dissipation	Set by program requirements	Set by program requirements
Mechanical	Size	LxWxH, form factor	Length	233.35 mm	233.35 mm
			Width	160 mm	160 mm
			Form Factor	3U or 6U	3U or 6U
	Mass	Fully packed mass	Mass	3U = 12 oz, 6U = 23oz	3U = 12 oz, 6U = 23oz
	Vibration	Sinusoidal and random	Vibration levels	Set by program requirements	Set by program requirements
	Shock		Pyroshock level	Set by program requirements	Set by program requirements
Radiation	Rad Hard	parts selection, protection, by design/process	Parts selection	Commercial Space Grade	Commercial Space Grade
			Physical Protection	No	No
			RHBD	Yes, TTMR, EDAC, etc	Yes, TTMR, EDAC, etc
			RHBP	Some Parts	Some Parts
			SEU	1E-4 SEU per day	1E-4 SEU per day
			SEFI	1E-4 unrecoverable SEFI/day with < 10 msec recovery time	1E-4 unrecoverable SEFI/day with < 10 msec recovery time
			SEL	> 70 MeV/mg/cm^2	> 70 MeV/mg/cm^2
			TID	> 100 krad	> 100 krad