

Radiation Hardened Microelectronics



DDC's microelectronics group has provided space-qualified radiation-tolerant and radiation-shielded products, including semiconductors and single-board computers, to the space industry for more than two decades. Our products include radiation mitigated memory modules, and single-board computers that incorporate powerful commercial silicon for superior performance and high reliability in aerospace applications. We specialize in understanding the radiation performance of commercial semiconductors, qualifying selected components for use in space, integrating them with proprietary radiation mitigation technologies, and manufacturing and screening these products in our DLA approved facility.

Product Description	Part Number	Radiation Technology ²						Package Style # Of Pins ²			Specs		Status		Screening Level ²	
		EDAC	LPT	RH	RP	RT	TRP	XP	FP	DIP	QFP	Data Sheet	SMD	Active		Contact Factory
Computers																
Single Board Computer, PowerPC® Based	SCS750®	■		■	■		■		Standard 6U cPCI			■		■		FS, FB, E
Single Board Computer, PowerPC® Based	SCS750P®	■		■	■		■		Standard 6U cPCI			■		■		Prototype
Single Board Computer, PowerPC® Based with Spacewire & 64 GB NAND	SCS750G4®	■		■	■		■		Standard 6U cPCI			■		■		FS, FB, E
Analog to Digital Converters																
ADC, 8 Bit, 73.5 kSPS	7820				■				20			■		■		S, B, I, E
ADC, 12 Bit, 41 MSPS	9042				■	■			28			■		■		K, H, I, E
ADC, 14 Bit 83 kSPS, Single Supply	7872A				■			16	16			■		■		S, B, I, E
ADC, 14 Bit, 10 MSPS	9240LP		■		■	■				44		■		■		K, H, I, E
ADC, 16 bit, 100 kSPS, Serial	7809C				■			24				■		■		S, B, I, E
ADC, 16 bit, 200 kSPS	976B				■			28				■		■		S, B, I, E
Digital to Analog Converters																
DAC, 12 Bit Serial	8143				■			16				■		■		S, B, I, E
DAC, 12 Bit, Buffered, Multiplying	7545B				■			20	20			■		■		S, B, I, E
DAC, 16 Bit, Low Power	7846B				■			28				■		■		S, B, I, E
DAC, 16 Bit, 30 MSPS	768A					■		28				■		■		S, B, I, E
Low Voltage 3.3V EEPROM (200ns or 250ns Access Time)																
EEPROM, 1 Mb (128kb x 8) .480" Wide	28LV010				■	■		32	32			■		■		S, B, I, E
EEPROM, 1 Mb (128kb x 8) .410" Wide	28LV011				■	■		32				■		■		S, B, I, E
EEPROM, 4 Mb (512kb x 8)	79LV0408				■	■	■	40				■		■		K, H, I, E
EEPROM, 8 Mb (256kb x 32)	79LV0832				■	■				96		■		■		K, H, I, E
EEPROM, 8 Mb (256kb x 32)	79LV0832B				■	■		100				■		■		K, H, I, E
EEPROM, 12 Mb (304kb x 40)	79LV1240B				■	■		100				■		■		K, H, I, E
EEPROM, 16 Mb (400kb x 40)	79LV1640B				■	■		100				■		■		K, H, I, E
EEPROM, 20 Mb (512kb x 40) Dual-Cavity	79LV2040B				■	■		100				■		■		K, H, I, E
5.0V EEPROM (120 ns, 150ns, or 200ns Access Time)																
EEPROM, 1 Mb (128kb x 8) .480" Wide	28C010T				■	■		32	32			■	■	■		V, Q, S, B, E, I
EEPROM, 1 Mb (128kb x 8) .410" Wide	28C011T				■	■		32				■	■	■		V, Q, S, B, E, I
EEPROM, 4 Mb (512kb x 8)	79C0408				■	■	■	40				■		■		K, H, I, E
EEPROM, 8 Mb (256kb x 32)	79C0832				■	■				96		■		■		K, H, I, E
EEPROM, 20 Mb (512kb x 40) Dual-Cavity	79C2040B				■	■		100				■		■		K, H, I, E
Low Voltage 3.3V SRAM (20ns, 25ns or 30ns Access Time)																
SRAM, 4 Mb (512kb x 8)	33LV0408				■			32				■		■		S, B, I, E
SRAM, 16 Mb (512kb x 32)	89LV1632				■					68		■		■		K, H, I, E
SDRAM (100MHz Operating Frequency)																
SDRAM, 256 Mb (16Mb x 16)	48SD1616B				■			72				■		■		K, H, I, E
SDRAM, 256 Mb (32Mb x 8)	48SD3208				■			72				■		■		K, H, I, E
SDRAM, 1.0 Gb (32Mb x 32)	72SD3232B				■			72				■		■		K, H, I, E
SDRAM, 1.25 Gb (32 Mb x 40) Dual-Cavity	97SD3240B				■					132		■		■		K, H, I, E
SDRAM, 1.5 Gb (32Mb x 48) Dual-Cavity	97SD3248B				■					132		■		■		K, H, I, E
PROM - OTP EPROM (120ns, 150ns or 200ns Access Time)																
PROM, 512kb (64kb x 8)	27C512T				■			32	32			■		■		S, B, I, E
PROM, 1 Mb (128kb x 8)	27C010T				■			32	32			■		■		S, B, I, E

1. DDC is certified to QML-V, QML-Q, ISO9001 and AS9100. Please visit www.ddc-web.com for Data Sheets, SMDs and Process Flows.
 2. See legend on page 2.

Product Description	Part Number	Radiation Technology ²						Package Style # Of Pins ²			Specs		Status		Screening Level ²	
		EDAC	LPT	RH	RP	RT	TRP	XP	FP	DIP	QFP	Data Sheet	SMD	Active		Contact Factory
Flash																
FLASH, NAND, 32 Mb (4Mb x 8)	29F0408				■				44			■		■		S, B, I, E
FLASH, NAND, 128 Mb (16Mb x 8)	69F1608				■				24			■		■		K, H, I, E
FLASH, NAND, 32 Gb x8 – High Density	29F32G08				■	■			68			■		■		S, B, I, E
FLASH, NAND, 64 Gb x16 – High Density	69F64G16				■	■			68			■		■		K, H, I, E
FLASH, NAND, 128 Gb x16 – High Density	69F128G16				■	■			68			■		■		K, H, I, E
FLASH, NAND, 256 Gb x16 – High Density	69F256G16				■	■			68			■		■		K, H, I, E
FLASH, NAND, 12 Gb x24 – High Density	69F12G24				■	■			70			■		■		K, H, I, E
FLASH, NAND, 24 Gb x24 – High Density	69F24G24				■	■			70			■		■		K, H, I, E
FLASH, NAND, 96 Gb x24 – High Density	69F96G24				■	■			70			■		■		K, H, I, E
FLASH, NAND, 192 Gb x24 – High Density	69F192G24				■	■			70			■		■		K, H, I, E
FLASH, NOR, 512 Mb (x 8 or x16) – HD	56F6408				■	■			56			■		■		S, B, I, E
Nuclear Event Detectors																
Designed In Rad-Hard w/Event Flag	HSN-1000			■					14	14		■		■		H
Guaranteed Rad-Hard w/Event Flag	HSN-3000			■					14	14		■		■		H
Multiplexers																
8 Channel, Fault Protected	358				■				16			■		■		S, B, I, E
16 Channel	306				■				28			■		■		S, B, I, E
16 Channel, Fault Protected	338				■				16			■		■		S, B, I, E
128 Channel, Fault Protected	81840				■						256	■		■		K, H, I, E
Amplifier and Comparators																
Comparator, High Speed	903				■				8			■		■		S, B, I, E
Operational Amplifier, Quad, Rail to Rail	6484				■				14			■		■		S, B, I, E
Operational Amplifier, Dual	OP220				■				8			■		■		S, B, I, E
Operational Amplifier, Dual, 4 MHz	OP284B				■				8			■		■		S, B, I, E
Operational Amplifier, Quad	OP400A				■				16			■		■		S, B, I, E
Logic																
Buffer/Driver, 8 Bit	54BCT244				■				20			■		■		S, B, I, E
Transceiver, 8 Bit	54BCT245				■				20			■		■		S, B, I, E
Buffer,/Driver, 8 Bit, 3.3V	54LVTH244A				■				20			■		■		S, B, I, E
Transceiver, 8 Bit, 3.3V	54LVTH245A				■				20			■		■		S, B, I, E
Buffer/Driver, 16 Bit, 3.3V	54LVTH162244				■				48			■		■		S, B, I, E
Interface, D-Latch, 16 Bit, 3.3V	54LVTH162373				■				48			■		■		S, B, I, E
Programmable Skew Clock Buffer	7B991				■				32			■		■		S, B, I, E

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2. Legend:

Radiation Technology Definitions

EDAC = Built In Error Detection and Correction
LPT = Latch up Protection Technology
RH = Rad Hard at the Die Level
RP = Rad-Pak® Package
RT = Radiation Tolerant up to 10, 25, or 40 Krad (S)
TRP = Triple Redundant Processing
XP = Xray-Pak® Package

Package Style Definitions

FP = Flat Pack
DIP = Dual In Line Package
QFP = Quad Flat Package

Screening Level Definitions

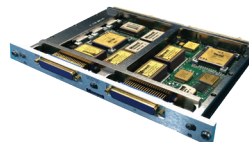
V = QML V Per MIL-PRF-38535
Q = QML Q Per MIL-PRF-38535
S = DDC Microelectronics Class S
K = DDC Microelectronics Class K
B = DDC Microelectronics Class B
H = DDC Microelectronics Class H
I = DDC Microelectronics Class I
E = DDC Microelectronics Class E

RAD-PAK® Solutions



- High radiation protection (TID 100 krad for typical missions)
- RAD-PAK® reduces the number of electrons and protons inside the package (i.e., less total dose on the die)
- Up to 500x improvement for GEO missions
- Up to 10x improvement for LEO missions

Single Board Computer



The SCS750® single board computer for space is DDC's answer to the space industry's need for medium- to high-performance computing. The SCS750 combines the latest generation of IBM PowerPC® processor with large amounts of volatile and non-volatile storage and a variety of interfaces in an industry standard 6u cPCI form factor.

Part Number	CTR (IF = 10 mA) MIN (%)	Isolation Breakdown Voltage VDC	Continuous Forward Current MAX (mA)	VF(v)@IF = 10 mA		BVceo @1 mA MIN (V)	ICEO (Dark) MAX (nA)	VCE Sat MAX (V)	Package Type
				Min.	Max.				
Optocouplers³ - Transistor									
CS200/ 201	100	1500	50	0.7	1.8	40	100 VCE = 20V	IF = 10 mA IC = 2.5 mA 0.3	6-pin DIP, Single
CD500/ 501	50	1500	50	0.7	1.8	40	100 VCE = 20V	IF = 10 mA IC = 2.5 mA 0.3	8-pin DIP, Single
CH300/ 301A	50	1500	50	0.7	1.8	40	100 VCE = 20V	IF = 2mA IC = 0.2mA 0.25	4/5-pin Hybrid, Single
4N24	50	1500	50	0.7	1.8	40	100 VCE = 20V	IF = 10 mA IC = 2.5 mA 0.3	6-pin TO-5, Single
4N49	50	1500	50	0.7	1.8	40	100 VCE = 20V	IF = 10 mA IC = 2.5 mA 0.3	6-pin TO-5, Single
CS224	50	1500	50	0.7	1.8	40	100 VCE = 20V	IF = 10 mA IC = 2.5 mA 0.3	6-pin DIP, Single
CSM200	50	1500	50	0.7	1.8	40	100 VCE = 20V	IF = 10 mA IC = 2.5 mA 0.3	6-pin LCC, Single
CSM1200	50	1500	50	0.7	1.8	40	100 VCE = 20V	IF = 10 mA IC = 2.5 mA 0.3	6-pin LLC, Unique Pinout, Single
CSM1224	50	1500	50	0.7	1.8	40	100 VCE = 20V	IF = 10 mA IC = 2.5 mA 0.3	6-pin LLC, Unique Pinout, Single
CSM2224	50	1500	50	0.7	1.8	40	100 VCE = 20V	IF = 10 mA IC = 2.5 mA 0.3	6-pin LLC, Unique Pinout, Single
CSM165-2	50	1500	50	0.7	1.8	40	100 VCE = 15V	IF = 10mA IC = 10mA 0.9	16-pin Flat Pack, Dual
CSM165-4	50	1500	50	0.7	1.8	40	100 VCE = 15V	IF = 10mA IC = 10mA 0.9	16-pin Flat Pack, Dual
IS49	50	1500	50	0.7	1.8	40	100 VCE = 20V	IF = 10 mA IC = 2.5 mA 0.3	6-pin LCC, Single
Part Number	CTR (IF = 10 mA) MIN (%)	Isolation Breakdown Voltage VDC	Continuous Forward Current MAX (mA)	VF(V)@IF = 20 mA		Typical Data Rate	Propagation Delay Times Vcc = 5V, IF = 16 mA		Package Type
				Max.			tPHL MAX (µs)	tPLH MAX (µs)	
Optocouplers³ - High Speed									
MC800	9	1500	40	1.9		400Mbit/ s	2.0	6.0	6-pin TO-5, Single
CH380	9	1500	40	1.9		1Mbit/ s	2.0	6.0	5-pin Hybrid, Single
CSM1800/ 01	9	1500	40	1.9		1Mbit/ s	2.0	6.0	6-pad LLC, Single
CD850	9	1500	40	1.9		1Mbit/ s	2.0	6.0	8-pin DIP, Single
CS800/ 801	15	1500	40	1.9		700Kbit/ s	2.0	6.0	8-pin DIP, Single
4N55	9	1500	40	1.9		400Kbit/ s	2.0	6.0	15-pin DIP, Single
CSM168-2	9	1500	40	1.9		1Mbit/ s	2.0	6.0	16-pin Flat Pack, Dual
CSM168-4	9	1500	40	1.9		1Mbit/ s	2.0	6.0	16-pin Flat Pack, Dual

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3. DDC is the exclusive sales and support channel for Isocom optocouplers in North America.

Part Number	CTR (IF = 0.5 / 1.6 / 5 mA) MIN / TYP (%)	Isolation Breakdown Voltage VDC	Continuous Forward Current MAX (mA)	VF(V)@IF = 1.6 mA MAX (4.0 mA CSM 160 / 161)	Propagation Delay Times Vcc = 5V, IF = 0.5 mA		Package Type
					tPHL MAX (μS)	tPLH MAX (μS)	
Optocouplers ³ - High Gain							
CH370	300/ 700 200/ 1000 200/ 600	1000	20	1.9	100	60	5 pin Hybrid, Single
CH390	300/ 700 200/ 1000 200/ 600	1000	20	1.9	100	60	10-pin Hybrid, Dual
CSM141A	300/ 700 200/ 1000 200/ 600	1500	20	1.9	100	60	6-pad LLC, Single
CSM1700	300/ 700 200/ 1000 200/ 600	1500	20	1.9	100	60	6-pad LLC, Single
CS700/CS5700	300/ 700 200/ 1000 200/ 600	1500	20	1.9	100	60	8-pin DIP, Single
CD750/CD5731	300/ 700 200/ 1000 200/ 600	1500	20	1.9	100	60	8-pin DIP, Dual
6N140A	300/ 700 200/ 1000 200/ 600	1500	20	1.9	100	60	16-pin DIP, Quad
CSM160/ 161/ 162-2	300/ 700 200/ 1000 200/ 600	1500	20	1.9	100	60	16-pin Flat Pack, Dual
CSM160/ 161/ 162-4	300/ 700 200/ 1000 200/ 600	1500	20	1.9	100	60	16-pin Flat Pack, Quad
Part Number	CTR (IF = 10 mA, 5 mA CS600 / CD650) MIN / TYP (%)	Isolation Breakdown Voltage VDC	Continuous Forward Current MAX (mA)	VF (V)@IF = 10 mA MAX	Propagation Delay Times Vcc = 5V, IF = 16 mA		Package Type
					tPHL MAX (nS)	tPLH MAX (nS)	
Optocouplers ³- High Gain Photon							
CH350	100	1500	40	1.9	200	200	5 pin Hybrid, Single
CSM1600	100	1500	40	1.9	90	90	6-pad LLC, Single
MC600	100	1500	40	1.9	90	90	6-pin Metal Can, Single
CD650/ 651	100/ 300	1500	40	1.9	100 @7.5mA	90	8-pin DIP, Single
CS600	100/ 300	1500	40	1.9	100 @7.5mA	75 @7.5mA	8-pin DIP, Single
6N134	100	1500	40	1.9	90	90	16-pin DIP, Dual
CSM169-2	100	1500	40	1.9	90	90	16-pin Flat Pack, Dual
CSM169-4	100	1500	40	1.9	90	90	16-pin Flat Pack, Quad

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