



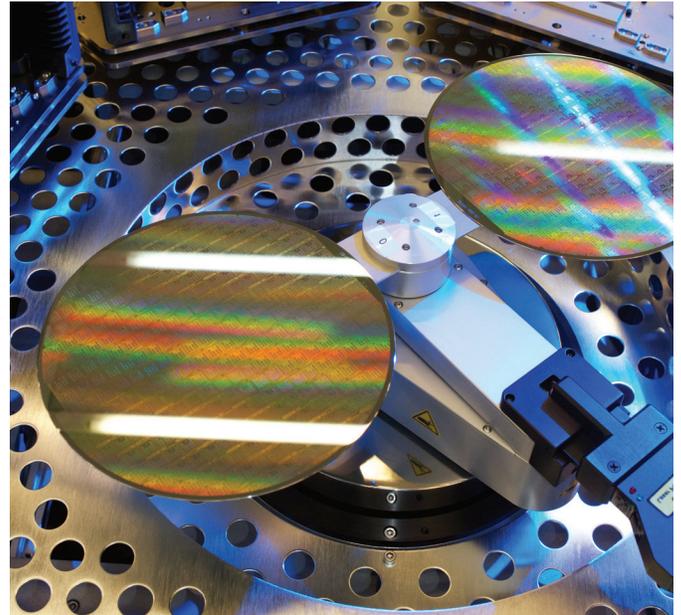
RADIATION- HARDENED **MICROELECTRONICS**

A comprehensive range of radiation-hardened
integrated circuit solutions

Honeywell

YOUR TOTAL INTEGRATED CIRCUIT (IC) PROVIDER

To endure harsh environments in space, including total dose radiation, transient phenomena and extreme temperatures, aerospace systems require intelligent, radiation-hardened components.



Honeywell's products and foundry services offer benefits beyond a high-reliability radiation-hardened construction to ensure systems perform accurately under severe radiation environments and operating conditions. Honeywell's Silicon On Insulator (SOI) CMOS process offers high levels of integration, minimized power dissipation and high performance to enable reliable, cost-effective products for space military and commercial markets.

Our customers benefit from Honeywell's high-reliability ASIC, System-on-Chip (SoC) and MultiChip Module solutions to facilitate a reduction in size, weight and power. These products are designed, manufactured and tested in a QML Space Qualified Trusted Foundry. These include extended access to multiple mature technologies for long-term product availability.

SOI CMOS DELIVERS LOW NOISE AND HIGH PERFORMANCE IDEAL FOR DIGITAL AND MIXED SIGNAL ICs

150nm Radiation-Hardened QML Process and Products

- 3.125Gb/s SERDES, Endpoint and Switch capabilities
- Digital ASICs with 15M+ gates, Structured Arrays
- 16M Monolithic SRAM, 64M MCM SRAM
- 1M, 16M, 64M MRAM
- DDR3 Memory Interface

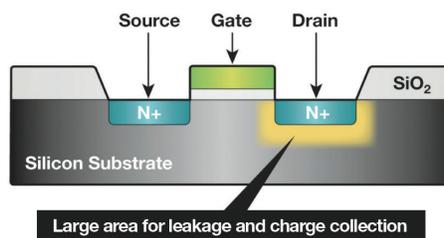


Fig.1. Bulk CMOS

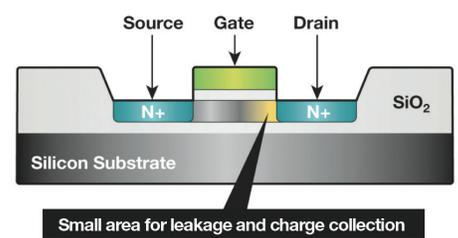


Fig.2. Honeywell SOI CMOS

RADIATION TYPE	CAPABILITY
Total Dose	1Mrad
Dose Rate Survivability	1×10^{12} rad(Si)/s
Dose Rate Upset	1×10^{10} rad(Si)/s
Neutron	1×10^{14} N/cm ²
Latchup	SOI CMOS Immune to latchup
Single Event Upset	$< 1 \times 10^{-15}$ Data Bit Errors/Bits Sent (SERDES)

DIGITAL ASIC AND MIXED SIGNAL PRODUCTS

Honeywell's Application Specific Integrated Circuit (ASIC) product family, fabricated with our patented SOI CMOS technology, provides efficient data processing power in space satellites, avionics and military applications. HX5000 has now expanded to include a lower-power 1.6V core operating voltage and Structured Arrays for lower cost and reduced cycle time. Honeywell offers analog and data conversion cells including Analog-to-Digital converters, SerDes (Serializer/Deserializer) and Phase Lock Loop (PLLs) to support mixed-signal designs.



DIGITAL ASIC AND MIXED SIGNAL

PART NUMBER	CONFIGURATION	VOLTAGE (V)	MAX GATE COUNT	KEY COMPONENTS	TOTAL DOSE (RAD[SI])	SINGLE-EVENT UPSET (UPSETS/BIT-DAY)	PROMPT-DOSE UPSET (RAD[SI]/S)	PROMPT-DOSE SURVIVABILITY (RAD[SI]/S)	LATCHUP	PACKAGE	QUALIFIED
HX2000	Digital	5.0	270k	Embed SRAM ECL I/O	1M	<1x10 ⁻¹¹	1x10 ¹⁰	1x10 ¹²	Immune	FP, CQFP, LGA	QML V, Q
HX3000	Digital	3.3, 2.5	1.0M	Embed SRAM, PLL, LVDS I/O	1M	<1x10 ⁻¹¹	1x10 ¹⁰	1x10 ¹²	Immune	FP, CQFP, LGA	QML V, Q
HX5000	Digital	1.6, 1.8, 2.5, 3.3, 5.0	15M	Embed SRAM, SERDES, PLL	1M	<1x10 ⁻¹²	1x10 ¹⁰	1x10 ¹²	Immune	FP, CQFP, LGA, Flip Chip	QML V, Q
HX5SA10	Structured Array	1.8, 2.5, 3.3	4.5M Usable	2.1Mb Memory	1M	<1x10 ⁻¹²	1x10 ¹⁰	1x10 ¹²	Immune	783 LGA, 512 IO	QML V, Q
HX5SA13	Structured Array with SERDES	1.8, 2.5, 3.3	8M Usable	3.3Mb Memory	1M	<1x10 ⁻¹²	1x10 ¹⁰	1x10 ¹²	Immune	1155 LGA, 520 IO	QML V, Q
HMX2000	Mixed Signal	5.0		Resistors, Caps, DMOS	1M	<1x10 ⁻¹¹	1x10 ¹⁰	1x10 ¹²	Immune	FP, CQFP, LGA	
HMX3000	Mixed Signal	3.3, 2.5		Resistors, Caps, DMOS	1M	<1x10 ⁻¹¹	1x10 ¹⁰	1x10 ¹²	Immune	FP, CQFP, LGA	
HMX5000	Mixed Signal	1.8, 2.5, 3.3, 5.0		Resistors, MIM caps, PLL	1M	<1x10 ⁻¹²	1x10 ¹⁰	1x10 ¹²	Immune	FP, CQFP, LGA	



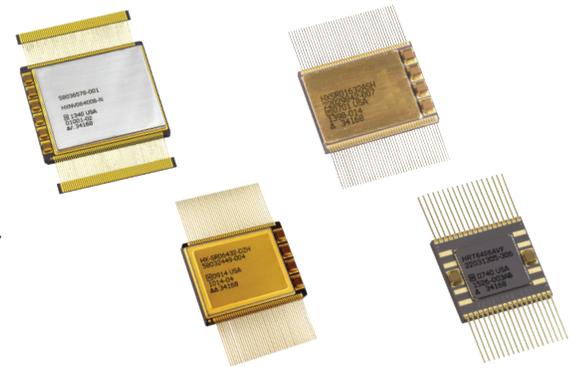
HX5SA13 – STRUCTURED ARRAY WITH SERDES:

Honeywell's Structured Array family enables the benefits of an ASIC with lower cost and faster delivery times. This product offering now includes our rad-hard SerDes. The array offers 16 lanes (4 ports) of SerDes operating up to 3.125 Gbps. This array also includes 8M useable gates, 3.3Mb of embedded SRAM and 3 PLLs. It can also be pin-for-pin compatible with a commercial and a mil-aero FPGA for faster, easier prototyping.

HX5000 ASIC PLATFORM ENHANCEMENTS:

Honeywell has also made multiple enhancements to our HX5000 ASIC offerings. We now offer 5.0V CMOS I/O and lower nominal ASIC core voltage of 1.6V. This can lower the power by 25 percent with no performance or radiation hardness degradation. We've also developed a rad-tolerant, high-density SRAM that is 40 percent smaller than our rad-hard SRAMs enabling ASICs with denser memories. Finally, we've added a rad-hard 600-800Mbps 40-bit DDR3 PHY macrocell to our ASIC library. It includes calibrated impedances and a trained data interface that allows for integration with commercial SDRAM and commercial memory controller IP.

SRAM AND NON-VOLATILE MRAM MEMORY PRODUCTS



For high-speed, low-power consumption data storage applications, including strategic systems, Honeywell's SOI Static Random Access Memory (SRAM) and Non-Volatile Magneto-Resistive RAM Honeywell has a long history of delivering memory products with superior radiation and missile applications.

NON-VOLATILE MAGNETO-RESISTIVE RANDOM ACCESS MEMORY (MRAM)

PART NUMBER	CONFIGURATION	VOLTAGE (V)	MAXIMUM ACCESS/CLOCK (NS)	TOTAL DOSE (RAD[SI])	SINGLE-EVENT UPSET (UPSETS/BIT-DAY)	PROMPT-DOSE UPSET (RAD[SI]/S)	PROMPT-DOSE SURVIVABILITY (RAD[SI]/S)	LATCHUP	PACKAGE	QUALIFIED	SMD NO
HXNV0100	64k x16	1.8, 3.3	R:<80, W:<140	1M	<1x10 ⁻¹⁰	1x10 ⁹	1x10 ¹²	Immune	64 CQFP		NA
HXNV01600	16Mb (x8 or x16)	3.3	R:<95, W:<140	1M	<1x10 ⁻¹⁰	1x10 ¹⁰	1x10 ¹²	Immune	76 CQFP	QML V, Q	5962-13212
HXNV06400	64Mb (x8 or x16)	3.3	R:<130, W:<150	1M	<1x10 ⁻¹⁰	1x10 ⁹	1x10 ¹²	Immune	112 CFP	QML V, Q	5962-14230
HXNV06400S	64Mb (x8 or x16)	3.3	R:<130, W:<150	1M	<1x10 ⁻¹⁰	1x10 ⁹	1x10 ¹²	Immune	112 CFP	QML V, Q	

STATIC RANDOM ACCESS MEMORY (SRAM)

PART NUMBER	CONFIGURATION	VOLTAGE (V)	MAXIMUM ACCESS/CLOCK (NS)	TOTAL DOSE (RAD[SI])	SINGLE-EVENT UPSET (UPSETS/BIT-DAY)	PROMPT-DOSE UPSET (RAD[SI]/S)	PROMPT-DOSE SURVIVABILITY (RAD[SI]/S)	LATCHUP	PACKAGE	QUALIFIED	SMD NO
HX6256	32k x8	5.0	<25	1M	<1x10 ⁻¹⁰	1x10 ⁹	1x10 ¹¹	Immune	28 CFP 36 CFP	QML V, Q	5962-95845
HLX6256	32k x8	3.3	R:<29, W:<25	1M	<1x10 ⁻¹⁰	1x10 ⁹	1x10 ¹¹	Immune	28 CFP 36 CFP		
HX6356	32k x8	5.0	<25	1M	<1x10 ⁻¹⁰	1x10 ¹¹	1x10 ¹²	Immune	36 CFP	QML V, Q	5962-95845
HX6228	128k x8	5.0	<25	1M	<1x10 ⁻¹⁰	1x10 ¹¹ (40 CFP)	1x10 ¹²	Immune	32 CFP 40 CFP	QML V, Q	5962-98537
HLX6228	128k x8	3.3	R:<35, W:<30	1M	<1x10 ⁻¹⁰	1x10 ⁹	1x10 ¹²	Immune	32 CFP 40 CFP		
HX6136	1k x36 FIFO	5.0	R:<36, W:<24	1M	<1x10 ⁻¹⁰	1x10 ⁹	1x10 ¹¹	Immune	132 CQFP		
HX6218	2k x18 FIFO	5.0	R:<36, W:<24	1M	<1x10 ⁻¹⁰	1x10 ⁹	1x10 ¹¹	Immune	68 CQFP		
HX6409	4k x9 FIFO	5.0	R:<36, W:<24	1M	<1x10 ⁻¹⁰	1x10 ⁹	1x10 ¹¹	Immune	32 CFP		
HX6408	512k x8	3.3	<20	1M	<1x10 ⁻¹⁰	1x10 ¹⁰	1x10 ¹²	Immune	36 CFP	QML V, Q	5962-06203
HXS6408	512k x8	1.8 or 3.3	R:<15, W:<10	1M	<2x10 ⁻¹²	1x10 ¹⁰	1x10 ¹²	Immune	36 CFP	QML V, Q	5962-08215
HRT6408	512k x8	1.8 or 3.3	R:<15, W:<10	300k	<2x10 ⁻¹²	1x10 ¹⁰	1x10 ¹²	Immune	36 CFP	QML V, Q	5962-08215
HRT6408V5	512k x8	5.0	R:<15, W:<10	300k	<2x10 ⁻¹²	1x10 ¹⁰	1x10 ¹²	Immune	36 CFP	QML V, Q	TBD Q4 20
HXSR01608	2M x8	1.8, 2.5, 3.3	R:<20, W:<12	1M	<2x10 ⁻¹²	1x10 ¹⁰	1x10 ¹²	Immune	40 CFP	QML V, Q	5962-08202
HLXSR01608	2M x8	1.5, 3.3	R:<25, W:<12	1M	<5x10 ⁻¹²	1x10 ¹⁰	1x10 ¹²	Immune	40 CFP	QML V, Q	5962-08202
HXSR01632	512k x32	1.8, 2.5, 3.3	R:<20, W:<12	1M	<2x10 ⁻¹²	1x10 ¹⁰	1x10 ¹²	Immune	86 CFP	QML V, Q	5962-08203
HLXSR01632	512k x32	1.5, 3.3	R:<25, W:<12	1M	<5x10 ⁻¹²	1x10 ¹⁰	1x10 ¹²	Immune	86 CFP	QML V, Q	5962-08203
HXSR06432	2M x32	1.8, 2.5, 3.3	R:<20, W:<15	1M	<2x10 ⁻¹²	1x10 ¹⁰	1x10 ¹²	Immune	86 CFP	QML V, Q	5962-10232

Honeywell Introduces new 5V 4Mb SRAM HXS6408V5 and HRT6408V5

PROCESSORS

PART NUMBER	CONFIGURATION	VOLTAGE (V)	CLOCK FREQUENCY (MHZ)	TOTAL DOSE (RAD[SI])	SINGLE-EVENT UPSET (UPSETS/BIT-DAY)	PROMPT-DOSE UPSET (RAD[SI]/S)	PROMPT-DOSE SURVIVABILITY (RAD[SI]/S)	LATCHUP	PACKAGE	QUALIFIED	SMD NO
HX1750	16 bit	5.0	40	100k	<1x10 ⁻⁵	NA	NA	Immune	121 PGA 112 LCC 100 PGA	QML Q	5962-05207
HXRHPPC Processor	32 bit (603e)	3.3	80	300k	<1.5x10 ⁻⁵	NA	NA	Immune	240 CQFP 255 LGA/ BGA	QML V, Q	5962-07A01

DIGITAL LOGIC

PART NUMBER	CONFIGURATION	VOLTAGE (V)	CLOCK FREQUENCY (MHZ)	TOTAL DOSE (RAD[SI])	SINGLE-EVENT UPSET (UPSETS/BIT-DAY)	PROMPT-DOSE UPSET (RAD[SI]/S)	PROMPT-DOSE SURVIVABILITY (RAD[SI]/S)	LATCHUP	PACKAGE	QUALIFIED	SMD NO
HXNAND00	Quad 2-input	3.3	4.0 (typ), 6.6 (max)	300k	NA	1x10 ⁹	1x10 ¹²	Immune	14 pin CFP	QML V, Q	5962-07A07

Notes: R= READ, W=WRITE

SERIALIZER/DESERIALIZER (SERDES) PRODUCTS

Honeywell's SerDes offers the space community the highest performing communication link that meets the rad hard needs of both commercial and military systems for 1Gb/s to 10Gb/s serial communications. Offering a significantly

lower power and pin counts than parallel interfaces, our SerDes products convert high-speed serial data to lower-speed parallel clock and data, reducing the number of signals on the IOs with an increased data rate. The SerDes products support systems operating with Gigabit Ethernet, Fibre Channel, XAUI and Serial Rapid IO protocols.



SERDES

PART NUMBER	CONFIGURATION	VOLTAGE (V)	DATA RATE	PROTOCOL	TOTAL DOSE (RAD[SI])	SINGLE-EVENT UPSET (UPSETS/BIT-DAY)	PROMPT-DOSE UPSET (RAD[SI]/S)	PROMPT-DOSE SURVIVABILITY (RAD[SI]/S)	LATCHUP	PACKAGE	QUALIFIED	SMD NO
HXSRD01 Trivor	1-8 Lanes	1.8, 2.5	1.0 to 3.18	Ethernet Fibre Channel 10Gb/S XUA1	1M	1x10 ⁹	1x10 ⁹	1x10 ¹²	Immune	468 LGA	QML V, Q	5962-10208
HXSRD02 Slider	1-4 Lanes	1.8, 2.5	1.0 to 3.125	Serial Rapid IO Bypass	1M	1x10 ⁹	1x10 ⁹	1x10 ¹²	Immune	467 LGA	QML V, Q: Pending	5962-14224

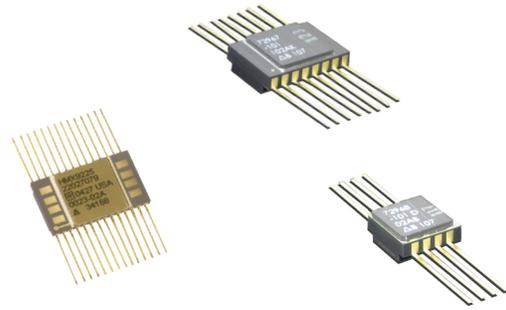
DATA COMMUNICATIONS: BUS INTERFACE

PART NUMBER	CONFIGURATION	VOLTAGE (V)	DATA RATE	TOTAL DOSE (RAD[SI])	SINGLE-EVENT UPSET (UPSETS/BIT-DAY)	PROMPT-DOSE UPSET (RAD[SI]/S)	PROMPT-DOSE SURVIVABILITY (RAD[SI]/S)	LATCHUP	PACKAGE	QUALIFIED	SMD NO
HXBUSX18	18 or 2 x 9	3.3	100 MHz	300k	NA	1x10 ⁹	1x10 ¹²	Immune	68 CQFP	QML V, Q	5962-07A06
HX422D	Quad Driver	3.3	20 MHz	300k	NA	1x10 ⁹	1x10 ¹²	Immune	16 FP	QML V, Q	5962-07A05
HX422R	Quad Receiver	3.3	20 Mb/s	300k	NA	1x10 ⁹	1x10 ¹²	Immune	16 FP	QML V, Q	5962-07A04

DATA COMMUNICATIONS: LVDS

PART NUMBER	CONFIGURATION	VOLTAGE (V)	DATA RATE	TOTAL DOSE (RAD[SI])	SINGLE-EVENT UPSET (UPSETS/BIT-DAY)	PROMPT-DOSE UPSET (RAD[SI]/S)	PROMPT-DOSE SURVIVABILITY (RAD[SI]/S)	LATCHUP	PACKAGE	QUALIFIED	SMD NO
HXLVDS	Quad Driver	3.3	100 MHz	300k	NA	1x10 ⁹	1x10 ¹²	Immune	16 FP	QML V, Q	5962-07A02
HXLVDSR	Quad Receiver	3.3	20 MHz	300k	NA	1x10 ⁹	1x10 ¹²	Immune	16 FP	QML V, Q	5962-07A03

MIXED-SIGNAL PRODUCTS



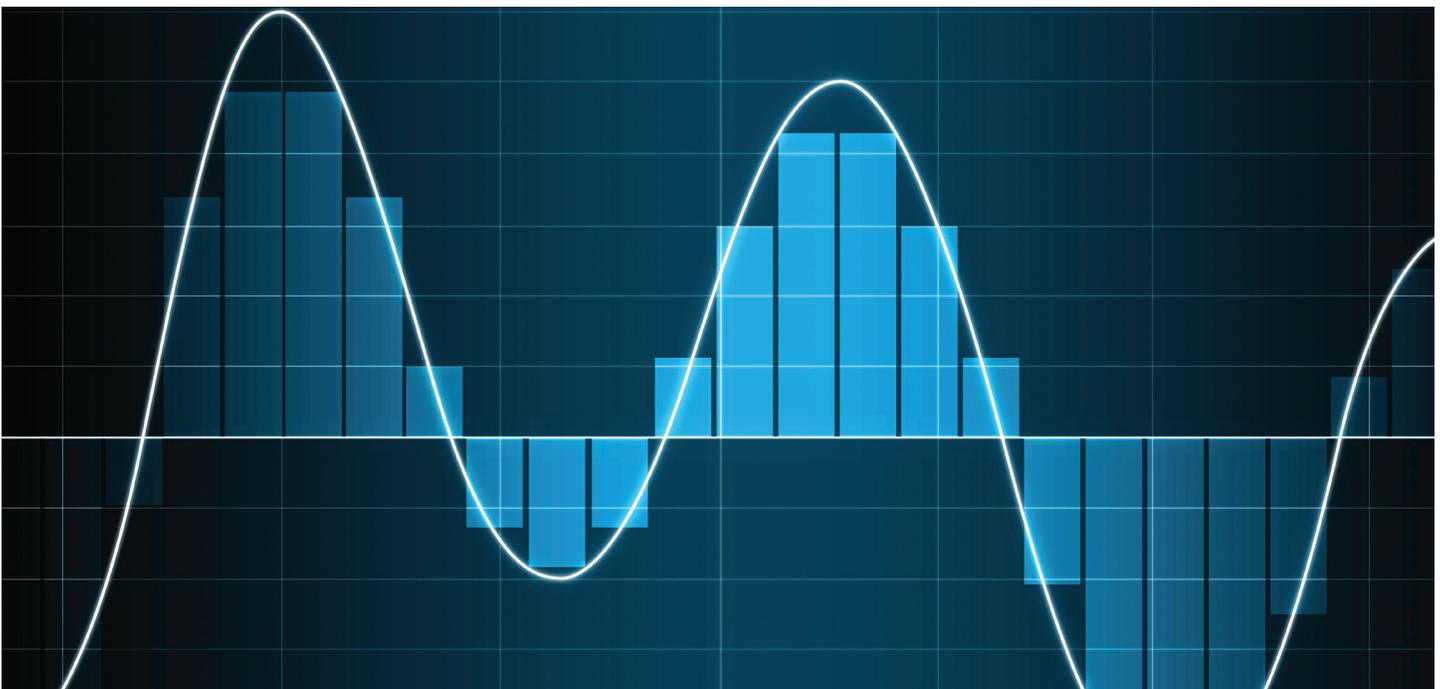
SOI CMOS provides the benefits of low-leakage, low-parasitic capacitance and high isolation to mixed-signal products. Precision design and a low-noise process deliver high performance and radiation hardness. Honeywell mixed-signal products support a wide range of applications.

MIXED SIGNAL

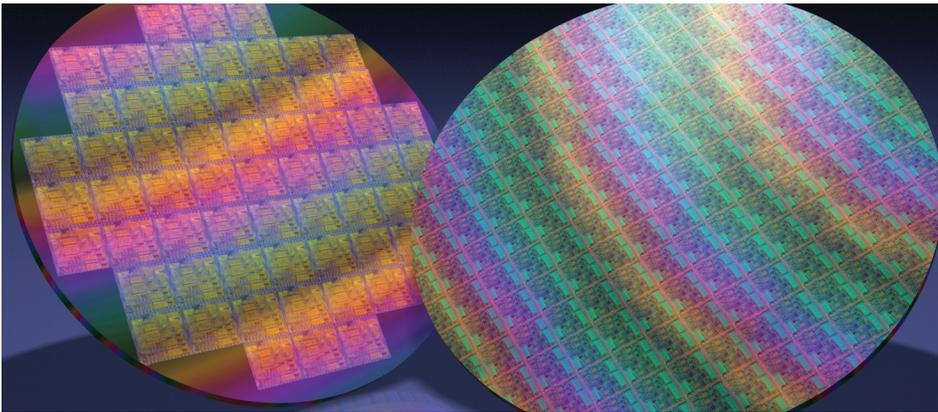
CONVERTER	PART NUMBER	RESOLUTION (BITS)	VOLTAGE (V)	SAMPLE RATE (MS/S)	TYPICAL INL (LSB)	TYPICAL DNL (LSB)	TOTAL DOSE (RAD[SI])	SINGLE-EVENT UPSET (UPSETS/BIT-DAY)	PROMPT-DOSE UPSET (RAD[SI]/S)	PROMPT-DOSE SURVIVABILITY (RAD[SI]/S)	LATCHUP	PACKAGE
A/D	HMXA-DC9225	12 bit	5.0	20	+/- 1.2	+/- 0.4	500K			1x10 ¹²	Immune	28 FP
D/A	HMX-DAC01	12 bit	5.0	3	+/- 3	+/- 1	300K		1x10 ⁹	1x10 ¹²	Immune	28 CQFP

ANALOG

ANALOG	PART NUMBER	VOLTAGE (V)	ON RESISTANCE (OHMS)	PROP. DELAY (NS)	TOTAL DOSE (RAD[SI]/S)	PROMPT-DOSE UPSET (RAD[SI]/S)	PROMPT-DOSE SURVIVABILITY (RAD[SI]/S)	LATCHUP	PACKAGE
Comparator	HMXCMP01	5.0		<125	300k	1x10 ⁹	1x10 ¹²	Immune	8 CQFP
Analog MUX	HMXMUX01	6.0	60		300k	1x10 ⁹	1x10 ¹²	Immune	16 FP



Precision analog



FOUNDRY CAPABILITIES

For non-digital applications, take advantage of the high integration 0.15 μ m, 0.35 μ m and 0.8 μ m rad-hard SOI CMOS fabrication process using Honeywell's wafer foundry. Honeywell foundry offering can be utilized to create multiple dies on the same mask set to save significant costs for our customers. The Honeywell's S150 Foundry offering includes die-stitching capability to enable the creation of very large die arrays for Readout Only Integrated Circuit (ROIC) applications. To augment the ROIC applications, we have extended the temperature range of our S150 modeling capabilities to cryogenic temperatures.

Our S150 and SOI4 Foundry offerings are available as Multi-Project Wafer (MPW) runs, allowing customers to share wafer resources to produce designs in lower quantities and lower cost.

We also are developing Through Silicon Via (TSV) capability to enable wafer and die stacking.

COMPLETE PACKAGING SOLUTIONS

A wide variety of packaging options are available from leaded ceramic flatpacks, wire bond, flip chip, ceramic Land Grid Array, BGA, CGA. Size and power reduction can be attained using QML qualified stacked die process and Multi-Chip Modules.

Packaging Qualifications

The Honeywell packages are manufactured and screened to meet the demanding electrical, thermal and radiation requirements of space and military applications.

- Design, Assembly, Screening Processes Certified to MIL-PRF-38535 supporting QML Q, V and Y.
- MIL-STD-883 DESC Certified for all screening test methods.

DESIGN CONVERSION SERVICES

Complex designs now developed on Field Programmable Gate Arrays (FPGAs) do not always have a clear path to flight hardware. The designs may be too large for flight-qualified FPGAs. This may lead to using multiple FPGAs which increases power consumption and area. Honeywell can optimize your design by converting the single or multiple designs into a single ASIC saving cost, power and area.

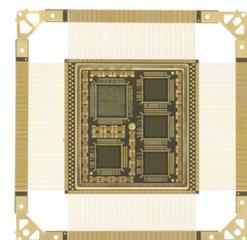
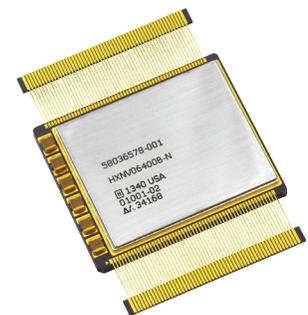
FPGA to ASIC Conversion

This conversion process delivers a form, fit, and function replacement of FPGAs using space-qualified rad hard ASIC technology. Honeywell has established a "FPGA conversion process" with scalable resources to meet the demands of the space industry. This "process" enables a seamless path to convert FPGAs to Honeywell's SOI-based ASICs. Several FPGAs can be converted to a single ASIC to significantly reduce cost and improve performance.

To address obsolete parts issues or reduce the cost of a design implemented in a FPGA, Honeywell can convert your design into a new IC.

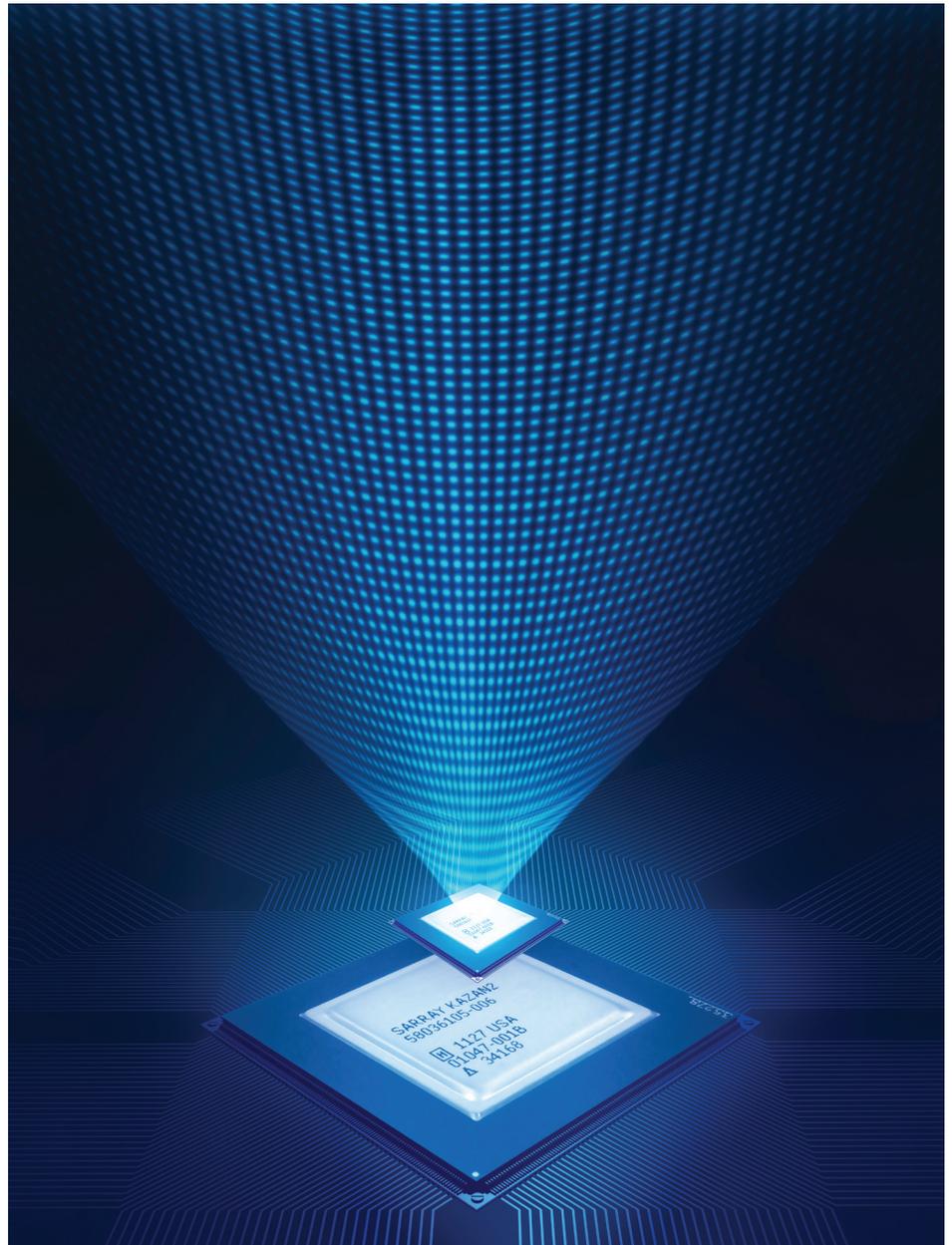
FEATURES

- Silicon On Insulator (SOI) CMOS Technology
- Four Process Nodes
 - SOI4: 0.8 μ m, 5v
 - SOI4-HT: 0.8 μ m, 5V, up to 225°C
 - SOI5: 0.35 μ m, 3.3V and 2.5V
 - S150: 0.15 μ m, 1.8V, 2.5V, 3.3V
- ISO-9001, AS-9100, QML Qualified and a Trusted Foundry
- Space, Military and Industrial applications
- Process Design Kit (PDK), including SPICE models, Design and Layout Rules
- Cadence, Specric, HSPICE, Calibre Tools
- N-Linear Caps and MIM Caps
- Precision Chrome Silicone (CrSiN) resistor (S150 excluded)
- Temp Range:
 - 55°C to +125°C Standard
 - 55°C to +225°C SOI4-HT
- Low-volume engagements
- Wafer process longevity to accommodate your long-term production needs and minimize process obsolescence concerns



HONEYWELL MICROELECTRONICS

Honeywell is recognized as an industry leader in reliable, radiation-hardened electronics due to our unwavering commitment to meet customer requests and superior technology. Honeywell provides the best combination of cost and schedule while reducing program risk.



For More Information

Learn more about Honeywell Radiation-Hardened Microelectronics solutions at aerospace.honeywell.com/en/product-listing/microelectronics

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THE
FUTURE
IS
WHAT
WE
MAKE IT

Honeywell