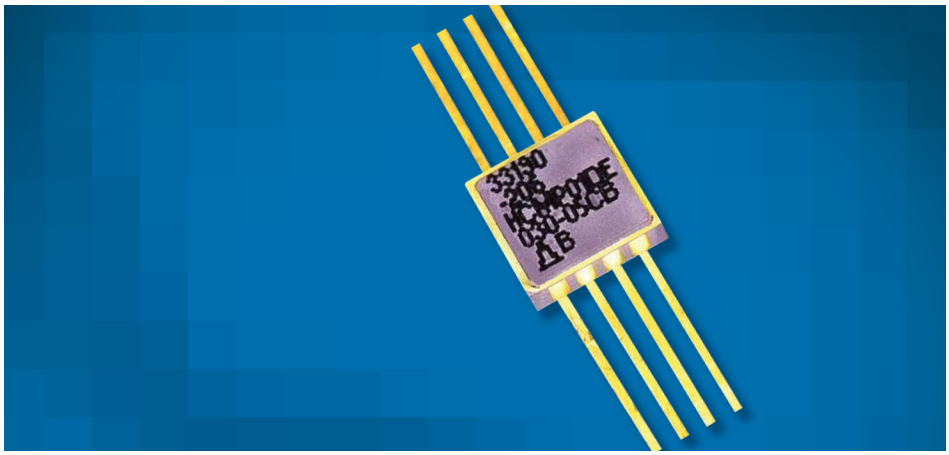
HMXCMP01

Honeywell

Radiation Hardened Comparator

Features

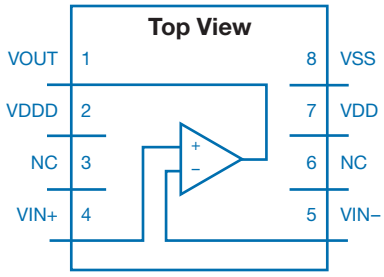
- Rad Hard 300krad (Si)
- Analog supply voltage: 4.75V to 5.25V
- Digital supply voltage: 5.0V or 3.3V IO voltage
- Supply current: <2mA
- Common mode voltage range: 0V to 5V
- Input offset voltage: ±24mV
- Propagation delay: <125ns
- Output rise/ fall times: <30ns
- Power supply rejection ratio: >60dB
- CMRR: >48dB
- Input capacitance: <10pF
- Input bias current: <1nA



The HMXCMP01 is fabricated on a radiation hardened SOI-IV Silicon-On-Insulator (SOI) CMOS process with very low power consumption. It is designed for low input current, low offset voltage and fast response time while operating over the full military temperature range.

Honeywell's SOI-IV technology is radiation hardened through the use of advanced and proprietary design, layout and process hardening techniques.

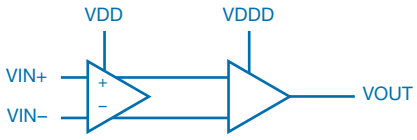
Pinout and Functional Diagram



Signal Definitions

Pin	Signal	Description
1	VOUT	Output
2	VDDD	Digital Power Supply 3.3V or 5V
3	N/C	No Connection
4	VIN+	+ Input
5	VIN-	- Input
6	N/C	No Connection
7	VDD	Analog Power Supply.
8	VSS	Ground

Simplified Functional Block Diagram



The comparator has a low power two-stage architecture. The first stage is a differential amplifier with NMOS and PMOS input differential pairs with constant gm (transconductance). This provides input rail-to-rail operation. The second stage is made up of two inverters that provide logic output at 3.3V or 5V (depending on the value of VDDD). Note that to avoid crow bar currents at Logic high outputs, VDDD must be lower or equal to VDD.

Radiation Characteristics

Total Ionizing Dose Radiation

The device radiation hardness assurance TID level was qualified by ^{60}Co testing per MIL-STD-883 Method 1019 with the exception of overdose and accelerated anneal. Ongoing assurance is provided by wafer level X-ray testing during manufacturing.

Transient Dose Rate Ionizing Radiation

Many aspects of product design are addressed to handle the high energy levels associated with the transient dose rate events. The device will maintain basic functional operation during exposure to a pulse up to the DRU specification. The device will meet functional, timing and parametric specifications after exposure to a pulse up to the DRS specification.

Neutron Irradiation Damage

SOI CMOS is inherently tolerant to damage from neutron irradiation. The device meets functional and timing specifications after exposure to the specified neutron fluence.

Latchup

The device will not latchup when exposed to any of the above radiation environments when applied under recommended operating conditions. SOI CMOS provides oxide isolation between adjacent PMOS and NMOS transistors and eliminates any potential SCR latchup structures.

Radiation Hardness Ratings (1)

Parameter	Symbol	Environment Conditions	Limits	Units
Total Ionizing Dose, F-Level (2)	TID		$3x10^5$	rad(Si)
Transient Dose Rate Upset	DRU	Pulse width ≤ 20ns	$1x10^9$	rad(Si)/s
Transient Dose Rate Survivability	DRS	Pulse width ≤ 20ns	$1x10^{12}$	rad(Si)/s
Neutron Irradiation Damage		1MeV equivalent energy	$1x10^{14}$	N/cm^2

(1) Device will not latch up due to any of the specified radiation exposure conditions.
(2) Parts tested without accelerated annealing.

Absolute Maximum Ratings (1)

		Limits		
Parameter	Symbol	Min	Max	Units
Analog Supply Voltage	VDD	-0.5	6.5	V
Digital Supply Voltage	VDDD	-0.5	6.5	V
Input Voltage (3)	VIN+, VIN-	-0.5	VDD+0.5	V
Input Current	IVIN+, IVIN-	-50	50	mA
Output Voltage (3)	VOUT	-0.5	VDDD+0.5	V
Output Short-Circuit Duration			1	Seconds
Power Dissipation	P_D		200	mW
Storage Temperature Range	T_{STORE}	-65	150	°C
Thermal Resistance, Junction to Case (4)	θ_{JC}		22.3	°C/W
Junction Temperature	T_J		175	°C
Lead Temperature (Soldering, 10 seconds)	T_{LMAX}		300	°C
ESD (Human Body Model)			500	V

(1) Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
(2) Voltages referenced to Ground.
(3) Absolute maximum value is not to exceed 6.5V.
(4) By analysis.

Recommended Operating Conditions (1)(3)

Parameter	Symbol	Limits Min	Max	Units
Analog Power Supply	VDD	4.75	5.25	V
Digital Power Supply	VDDD	4.75	5.25	V
	VDDD	3.135	3.465	V
Case Temperature	T_C	-55	125	°C
Input Slew Rate (2)			12	V/µS
Common-Mode Voltage Range	V_{CMR}	0	5	V

(1) All voltages are with respect to Ground.
(2) For inputs steps > 0.7 volts.
(3) Specifications listed in datasheet apply when used under the Recommended Operating Conditions unless otherwise specified.

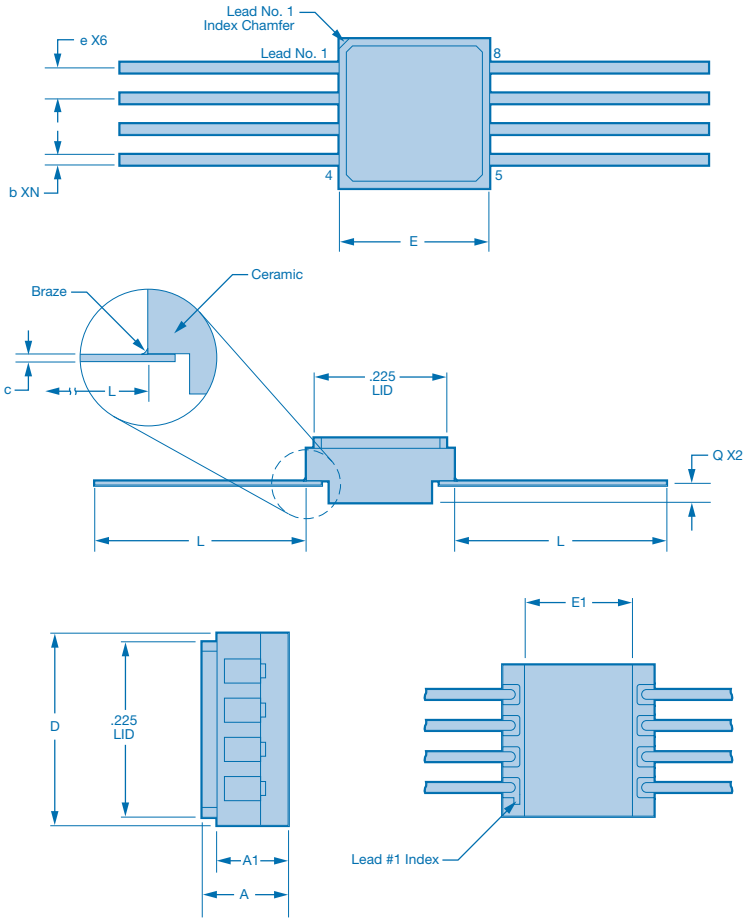
Electrical Characteristics

Parameter	Symbol	Min	Max	Unit	Conditions
Analog Supply Current	I_{DD}	—	900	µA	VIN+ = 0.5 V, VIN- = 0.0V
Digital Supply Current	I_{DDD}	—	1	mA	VIN+ = 0.5 V, VIN- = 0.0V
Power-Supply Rejection Ratio	PSRR	60	—	dB	VDD = 4.75V and 5.25V, VDDD=3.3V, V_{CM} = 2.5V
Input Offset Voltage	V_{OS}	-24	24	mV	V_{CM} = VDD/2
Input Bias Current	I_B	-1.0	1.0	nA	VIN+ = 2.5 V, VIN- = 2.0V
Input Offset Current	I_{OS}	-2.0	2.0	nA	VIN+ = 2.5 V, VIN- = 2.0V
Input Capacitance (1)	C_{IN}	—	10	pF	
Common-Mode Rejection Ratio	CMRR	48	—	dB	Common Mode=0V and 5V
Output Rise Time (1)	t_{RISE}	—	30	ns	C_L = 15pF, 100mV overdrive
Output Fall Time (1)	t_{FALL}	—	30	ns	C_L = 15pF, 100mV overdrive
Propagation Delay (1)	t_{PD}	—	125	ns	C_L = 15pF, 100mV overdrive
Output Short-Circuit Current (2)	I_{SC}	5	50	mA	VDDD = 3.3V ± 5%
		5	85		VDDD = 5.0V ± 5%
High Level Output Voltage	V_{OH}	VDDD-0.5	—	V	VDDD = 3.3V ± 5%, I_{OH} = -5ma
					VIN+ = 2.5 V, VIN- = 2.0 V
		VDDD-0.5			VDDD = 5V ± 5%, I_{OH} = -5ma
					VIN+ = 2.5 V, VIN- = 2.0 V
Low Level Output Voltage	V_{OL}	—	0.5	V	VDDD=3.3V, I_{OL} = 5mA
					VIN+ = 2.0 V, VIN- = 2.5 V

(1) This parameter is guaranteed by design.
(2) VOUT = VDDD or Ground, 1 second maximum.

Package Outline Dimensions

Dimensions in inches.



Symbol	Dimensions - Inches			Dimensions - Millimeters		
	Min	Nom	Max	Min	Nom	Max
A	.100	.111	.123	2.54	2.82	3.12
A1	.083	.092	.101	2.11	2.34	2.57
b	.015	.017	.019	0.38	0.43	0.48
c	.004	.005	.007	0.10	0.13	0.18
D/E	.241	.246	.251	6.12	6.25	6.38
e	.047	.050	.053	1.19	1.27	1.35
E1	.170	.175	.180	4.32	4.45	4.57
L	___	.360	___	___	9.14	___
N	___	8	___	___	8	___
Q	.032	.035	.038	0.81	0.89	0.97

1. Controlling dimensions are in inches.
2. “A” is the height of the package including the lid.

Reliability

For many years Honeywell has been producing integrated circuits that meet the stringent reliability requirements of space and defense systems. Honeywell has delivered hundreds of thousands of QML parts since the early 1990’s. Using this proven approach Honeywell will assure the reliability of the products manufactured with the SOI CMOS process technology. This approach includes adhering to Honeywell’s Quality Management Plan for:

- Designing in reliability by establishing electrical rules based on wear out mechanism characterization performed on specially designed test structures (electromigration, TDDB, hot carriers, bias temperature instability and radiation).
- Statistically controlling wafer fabrication process with a continuous defect reduction process.
- Performing individual wafer lot acceptance through process monitor testing (includes radiation testing).
- Using characterized and qualified packages.
- Performing thorough product testing program based on MIL-PRF-38535 and MIL-STD 883.

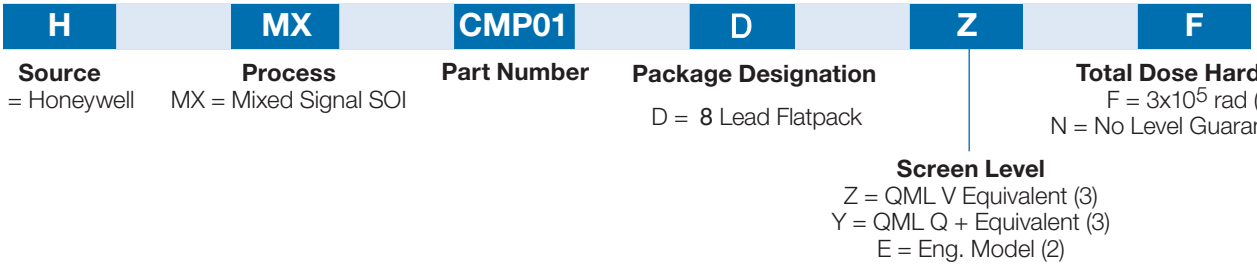
Screening and Conformance Inspection

The product test flow includes screening units with the applicable flow (Engineering Model, QML V, QML Q, Class V and Q equivalent) and the appropriate periodic or lot conformance testing (Groups A, B, C, D, and E). Both the wafer process and the products are subject to periodic or lot based Technology Conformance Inspection (TCI) and Quality Conformance Inspection (QCI) tests as defined by Honeywell’s Quality Management Plan.

Conformance Summary

Group A	General Electrical Tests
Group B	Mechanical – Resistance to Solvents, Bond Strength, Die Shear, Solderability
Group C	Life Tests – 1000 hours at 125°C or equivalent
Group D	Package Related Mechanical Tests – Physical Dimensions, Lead Integrity, Thermal Shock, Temp Cycle, Moisture Resistance, Seal, Mechanical Shock, Vibration, Acceleration, Salt Atmosphere, Internal Water Vapor, Adhesion of Lead Finish
Group E	Radiation Tests

Ordering Information (1)



(1) Orders may be faxed to 763-954-2051. Please contact our Customer Service Representative at 1-763-954-2474 for further information.
(2) Engineering Device Description: Parameters are tested -55°C to 125°C, 24 hour burn-in, no radiation hardness guaranteed.
(3) This is an equivalent screening flow but this device is not QML qualified.

QCI Testing (1)

Classification	QCI Testing
QML Q+ Equivalent	No lot specific testing performed. (2)
QML V Equivalent	Lot specific testing required in accordance with MIL-PRF-38535 Appendix B.

(1) QCI groups, subgroups and sample sizes are defined in MIL-PRF38535 and the Honeywell Quality Management Plan. Quarterly testing is done in accordance with the Honeywell QM Plan.
(2) If customer requires lot specific testing, the purchase order must indicate specific tests and sample sizes.

Find out more

For more information about Honeywell's family of radiation hardened integrated circuit products and services, visit www.honeywellmicroelectronics.com/.

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ADS-14196 rev C
January 2017