

Rad Hard Logic ICs Deliver High Performance And Low Cost For Small Satellites

[Apogee Semiconductor's](#) AP54RHC RadHard logic family is based on the company's Transistor-Adjusted-Layout for Radiation (TalRad) design methodology that improves the radiation performance of commercial process technologies, enabling the rapid creation of rad-hard designs in a fraction of the time and effort normally required to design rad hard ICs. Previewed at NSREC 2020 in December, the AP54RHC family of products is built with cold-sparing capabilities and triple-redundancy providing maximum reliability and area savings.

The family is tailored to small satellite applications with a total ionizing dose (TID) resilience of 30 krad (Si) and single event latch-up (SEL) hardened up to with 80 MeV-cm²/mg, encapsulated in a 14-pin TSSOP plastic package. Parts are designed for class 2 ESD and specified for operation over a -55°C to +125°C temperature range and a 1.65-V to 5.5-V V_{DD} range.

As with other products the company is developing, these new logic chips are meant to bridge the performance gap that exists between commercially available, state-of-the-art devices and lower-performance rad hard components. Meanwhile, they also aim to close the price gap between the very expensive rad hard parts and their commercial counterparts.

"Our products and services are targeted towards enabling small satellites and large constellations that require high performance, small form factors and radiation resilience at a lower cost," stated Anton Quiroz, CEO. "Apogee Semiconductor is aggressively focused on addressing the challenges small satellite spacecraft designers are facing to meet aggressive cost targets while also needing to maintain high reliability."

The AP54RHC family includes functions such as level-translators (such as a two supply level shifter), majority voters (with daisy chain error detect), transceivers and other 7400 series logic functions (see Figs. 1 and 2). Evaluation units are available now and flight units will be available in 2Q21. The company has also been sampling 300-krad versions of the AP54RHC devices. An announcement on these devices is expected soon.

Contact Apogee Semiconductor if you are interested in evaluating the AP54RHC products. For more information, see the [website](#) or email the [company](#).

- 1.65 VDC to 5.5 VDC operation
 - **First in the industry!**
- Provides logic-level down translation to VCC
- Extended operating temperature range
 - (-55 °C to +125 °C)
- Proprietary cold-sparing capability with zero static power penalty
- Built-in triple redundancy
- Internal power-on reset (POR)
- Class 2 ESD protection
 - (4000 V HBM, 500 V CDM)
- TID resilience of 30 krad (Si)
- SEL resilient up to LET of 80 MeV-cm²/mg
- 300krad (Si) version also available

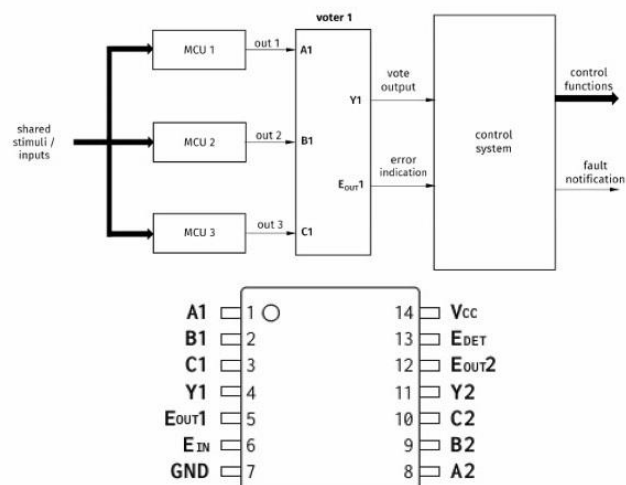


Fig . 1. The AP54RHC301 is a dual three-input majority voter.

- 1.65 VDC to 5.5 VDC operation
 - The only wide-range rad-hard voltage level shifter!
- Inputs tolerant up to 5.5 VDC at any $V_{CC(A)}$ or $V_{CC(Y)}$
- Extended operating temperature range
 - (-55 °C to +125 °C)
- Proprietary cold-sparing capability with zero static power penalty
- Built-in triple redundancy
- Internal power-on reset (POR)
- Class 2 ESD protection
 - (4000 V HBM, 500 V CDM)
- TID resilience of 30 krad (Si)
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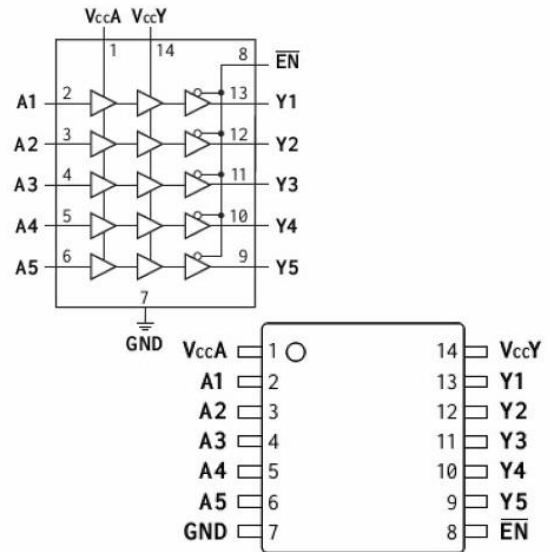


Fig. 2. The AP54RHC504 is a five-channel level translator.