TI Space Products

Innovating your space solution with leading-edge Rad Hard (RHA) and QMLV products

Texas Instruments

MIL-PRF-38535 QML
Class V Qualified

Radiation Hardness
Assured per MIL-STD-883
Method 1019

Single Event Effects
Characterized

www.ti.com/space

2019

Space Products Guide
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TI Space Products

Texas Instruments offers the most comprehensive selection of leading-edge radiation hardness assured (RHA) and QMLV products for space flight. With a proven legacy of 60+ years in the space market and supporting countless space programs both domestically and internationally, TI is a trusted partner. We focus on radiation performance and best-in-class SWaP (Size, Weight, and Power) to enable leading-edge designs. The breadth of TI's space portfolio provides a full signal-chain solution. The portfolio includes the smallest RHA point-of-load power solutions, fast discrete SerDes and some of the world's highest performance data converters.

TI's Space products include MIL-PRF-38535 QML Class V and RHA components. These devices are typically supported with Total Ionizing Dose (TID) and Single Event Effects (SEE) test reports to address potential product degradation in a space environment. The test results for these devices are available in the product folder under the Technical documents tab.

Satellite Applications

- Satellite bus/platform
- General payload
- Communications payload
- Imaging payload
- Data processing and storage
- Telemetry sensors
- Inertial navigation (IMU/INS)
- Manned vehicles
- Launch vehicles
- Power generation and distribution
- Health monitoring

TI Space Products Portfolio

TI offers RHA and radiation-tolerant, hermetically packaged components highlighted in each of the red blocks to the right. TI also offers many of these space grade products in die form (known good die or tested die).

For a complete list of TI's Space Products, see **www.ti.com/space**
To view this guide online, visit **www.ti.com/spaceguide**
For detailed radiation training and information, please visit **training.ti.com/aerospace-defense-training-series** or download our **Radiation handbook for electronics**

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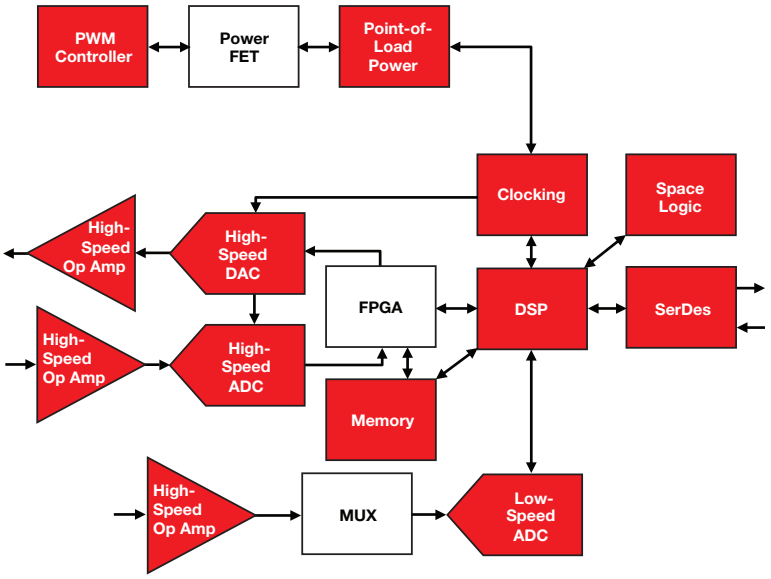


Space Enhanced Plastics
Overview

In addition to the large QMLV selection, TI has begun to offer a leading-edge portfolio of plastic devices for Low Earth Orbit (LEO) missions with short mission life, and requirements for small size. This encompasses the emerging term, “New Space”, loosely defined as covering some of the trends in the space community, including the emerging private spaceflight industry and programs that have reduced reliability, lifetime and radiation requirements. There are unique challenges with the space environment such as radiation requirements, thermal cycling and outgassing. TI has addressed this with a new line of rigorously developed products, Space-Enhanced Plastics (SEP).

Space-EP devices offer the following advantages over standard catalog products:

- Controlled baseline with one wafer fab, one assembly site, one material set.
- Optimized material set with die attach, mold compound, leadframe and bond wire all selected to maximize reliability.
- No high tin (>97% Sn) construction including terminations (SnAgCu solderballs and Matte-Sn plating) or internal package components (die bumps or substrate plating).
- No copper bond wire. Product is either flipchip mounted (no bond wire) or uses gold bond wire.
- Additional assembly processing including 100% temperature cycle or 100% single-pass reflow simulation in lieu of temperature cycle.
- Characterization over target temperature range (–55°C to +125°C).
- Parametric testing is standard at both room and high temperatures with guardbands to assure datasheet limits at cold temperature.
- Assembly lot acceptance including x-ray sampling and CSAM sampling.
- Wafer lot acceptance using MIL-PRF-38535 QML Class V as baseline.
- Radiation Lot Acceptance Testing (Group E) to 20krad TID for each wafer lot per MIL-STD-883.
- One time characterization testing to 30-krad TID per MIL-STD-883.
- SEL characterization to 43 MeV-cm^2/mg.
- Outgassing qualification for each product per ASTM E-595.
- Qualification to SMC-SO-11.

Space applications require known radiation performance. Not only are TI Space-EP products characterized for total dose and single event radiation performance, but in many cases different wafer fabrication processes or alternate die designs are used to achieve specified levels of radiation tolerance. This is further ensured with a radiation lot acceptance test (RLAT or Group E) performed on each Space-EP wafer lot. An OEM may be tempted to characterize one lot of product and then assume that subsequent material will perform the same. This is not always true. Depending on the process technology, some devices exhibit a significant wafer lot to wafer lot variation and, in some cases, a wafer to wafer variation. Since traceability of Commerical Off The Shelf (COTS) material is only to the wafer lot level, it creates a substantial risk to the OEM.

Texas Instruments Space-EP provides a very cost effective means of mitigating the risks associated with using commercial off-the shelf plastic encapsulated microcircuits. TI’s approach, combining the best of the Enhanced Product methodology and Class V-like wafer processing, ensures a product that meets published specifications in critical space and launch vehicle applications, while providing small size and reduced system cost.

TI is currently offering five SEP devices, and is planning to offer many more in a variety of functions.

- **TLV1704-SEP**—2.2-V to 36-V, radiation hardened microPower quad comparator in space-enhanced plastic
- **IN240-SEP**—80-V, low-/high-side, zero-drift, current sense amp with enhanced PWM rejection in space-enhanced plastic
- **TL7700-SEP**—Voltage supervisor in space-enhanced plastic
- **TPS73801-SEP**—Radiation-hardened 1-A low-noise fast-transient-response LDO in space-enhanced plastic
- **SN55HVD233-SEP**—Radiation-hardened 3.3-V CAN transceiver in space-enhanced plastic package with standby mode

For more information on the device roadmap and offerings, please contact your TI representative, or reach out to TI through the E2E™ community or **ti.com/sep**.

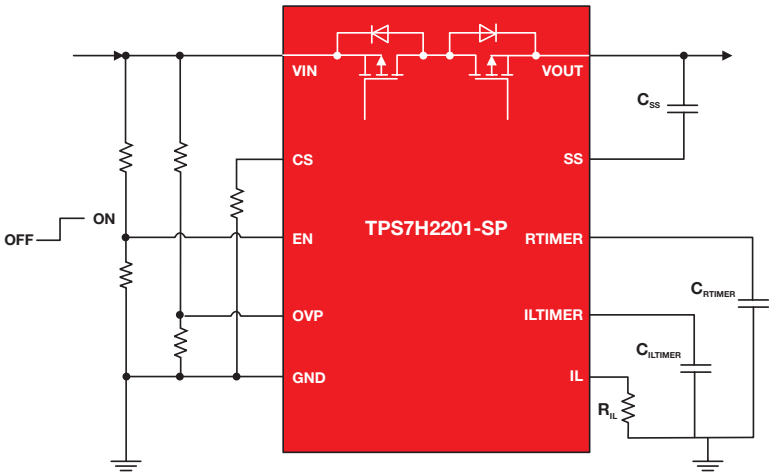
1.5–7 VIN, 6 A, 35 mΩ On-Resistance Load Switch with Reverse Current Protection and Current Limiting
TPS7H2201-SP

Key Features
- VIN = 1.5 to 7 V, 6-A maximum current
- On Resistance (RON) of 35 mΩ max at VIN = 5 V at 25°C
- Reverse current protection
- Configurable rise time
- Programmable current limiting and fault timers
- OVP and UVLO
- Low control input threshold enables use of 1.8-, 2.5- and 3.3-V logic
- Thermally enhanced 16-pin CDFP, 9.88 × 11.26 mm

Radiation Performance
- TID = 100 krad RHA
- SEL, SEB and SEGR immune to LET = 75 MeV-cm^2/mg

Applications
- Satellite power management and distribution
- Radiation-hardened and tolerant power-tree applications

Benefits
- RHA qualified and orderable as SMD: 5962R1722001VXC
- Highly integrated solution eliminating the need for discrete FETs for power management
- Controlled inrush current during system power-up
- Reverse current protection for cold-sparing applications
- Able to parallel for current sharing and reduced RON
- Low threshold enable compatible with multiple IO standards
- Over-current system protection with programmable fault timer



More information at **www.ti.com/product/TPS7H2201-SP**

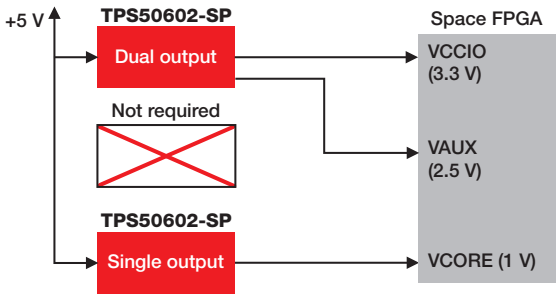
3–7 VIN, 12-A or Dual 6-A Output QMLV POL DC-DC Converter
TPS50602-SP

Key Features
- 2× TPS50601A-SP dice into single package
- Adjustable output voltage down to 0.8 V
- Precision reference accuracy (±1.5% over temp, line/load and TID)
- >90% overall efficiency at 6 A (VIN = 5 V, VOUT = 2.5 and 1.8 V)
- Current mode control and pre-bias startup capability
- 500-kHz fixed frequency
- Selectable softstart, external compensation, power good, enable, integrated tracking
- Thermally enhanced 64-pin CQFP, 16 × 14 mm

Radiation Performance
- TID = 100 krad RHA
- SEL, SEB and SEGR immune to LET = 75 MeV-cm^2/mg

Applications
- Space satellite power management and distribution
- Radiation-hardened and tolerant power-tree applications

Benefits
- RHA qualified and orderable as SMD: 5962R1820701VXC
- Ultra small form factor for powering high-current cores and lower-current I/O and AUX power rails
- Only dual-voltage output POL device on the market
- Easily managed power sequencing schemes
- Outstanding thermal performance, $\Theta_{JC(bot)}$ = 0.56°C/W



More information at **www.ti.com/product/TPS50602-SP**

Radiation-Hardened Power Management
Featured Products

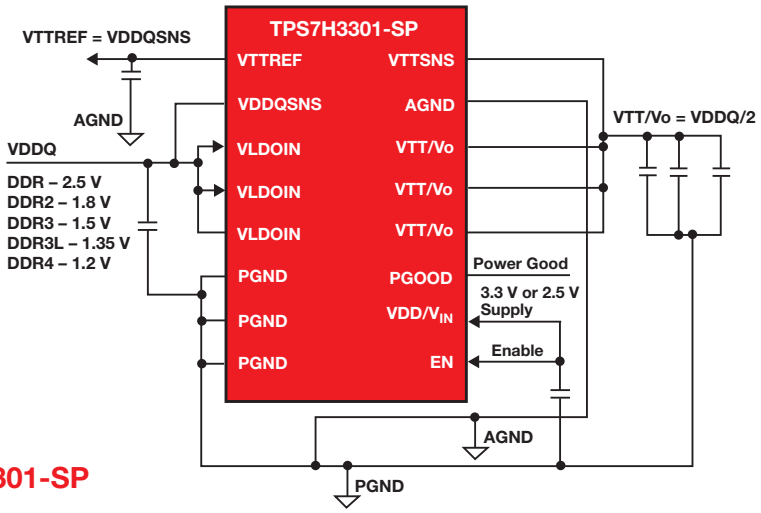
3-A, Sink/Source DDR Termination Regulator with Built-In VTTREF Buffer
TPS7H3301-SP

Key Features
- Control input voltage: 2.5 and 3.3 V
- VLDO input down to 0.9 V
- Enable input and power good output
- 10-mA buffered VTTREF
- Source/sink VTT voltage output with droop compensation
- Thermally enhanced 16-pin CFP (HKR) package

Radiation Performance
- TID = 100 krad RHA
- SEL, SEB and SEGR immune to LET = 65 MeV-cm^2/mg
- SET immune up to LET = 52.5 MeV-cm^2/mg while supporting JEDEC DDR specifications

Applications
- Space payload processing and data storage
- DDR, DDR2, DDR3, LPDDR3 and DDR4 VTT memory termination and VREF buffer

Benefits
- RHA qualified and orderable as SMD: 5962R1422801VXC
- Meets DDR, DDR2, DDR3, LPDDR3 and DDR4 JEDEC specifications
- Smaller size than competing discrete solutions enabling very small form factor designs
- Outstanding SEE performance, VTT-VTTREF < ±5 mV (JESD8-9B standard is VTT-VTTREF < ±40 mV)
- Very low $R_{\theta JC}$ = 0.6°C/W



More information at **www.ti.com/product/TPS7H3301-SP**

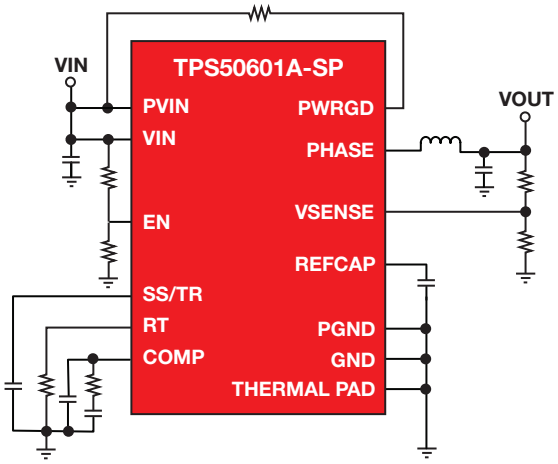
3- to 7-V_{IN}, 6-A, Monolithic Point-of-Load DC/DC Converter
TPS50601A-SP

Key Features
- PVIN = VIN = 3.0 V to 7 V
- 6-A maximum output current
- Min output voltage to 0.8 V
- Integrated 58-mΩ high-side and 50-mΩ low-side power FETs
- Adjustable frequency from 100 kHz to 1.0 MHz
- Parallel operation 180° out of phase with Sync pin
- Integrated tracking function
- $R_{\theta JC}$ = 0.6°C/W
- Packaged in thermally enhanced 20-pin ceramic flatpack (HKH) and known good die (KGD)

Radiation Performance
- TID = 100 krad RHA
- SEL, SEB and SEGR immune to LET = 75 MeV-cm^2/mg
- SET/SEFI onset 65 MeV-cm^2/mg

Applications
- Satellite point-of-load (POL) power supplies

Benefits
- RHA qualified and orderable as SMD: 5962R1022102VSC (RHA) 5962R1022102V9A (KGD)
- 96.6% peak efficiency (VOUT = 3.3 V) and low VOUT optmized
- Excellent for driving 12-A current through current share
- Ease of implementing power sequencing schemes
- Best-in-class thermal performance
- WEBENCH® and PSpice models available



More information at **www.ti.com/product/TPS50601A-SP**

Radiation-Hardened Power Management
Featured Products

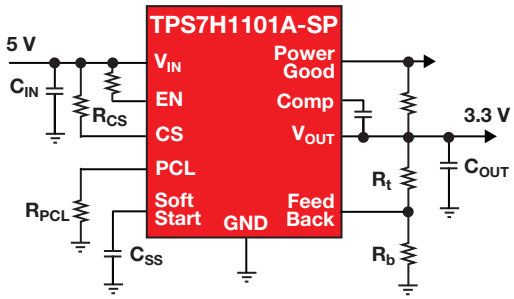
1.5- to 7-V_{IN}, 3-A Low-Drop-Out Regulator
TPS7H1101A-SP

Key Features
- V_{IN} = 1.5 V to 7 V
- Ultra-low dropout, PMOS pass device
  - 62 mV (typ) @ 1 A, 335 mV (Max) at 3 A
- Very-high accuracy = ±2%
  - Internal VREF = ±1.8%
- Ultra-low noise: 20.33 µVRMS
- PSRR: >45 dB at 1 kHz
- Programmable softstart and OCP (with current reading)
- Enable across all input voltages and Power Good output (for sequencing)
- Temperature range: –55°C to 125°C
- Packaged in thermally enhanced 16-pin ceramic flatpack

Radiation Performance
- TID = 100 krad RHA
- SEL immune to LET = 85 MeV-cm^2/mg
- SET onset 52 MeV-cm^2/mg

Applications
- Power management – LDO
- RF components VCOs, receiver, ADC's amplifiers
- High PSRR and low noise for clean analog-supply requirement applications

Benefits
- RHA Qualified: 5962R1320202VXC
- ELDRS Free
- High power savings with lowest V_{IN} on the market for LDO



More information at **www.ti.com/product/TPS7H1101A-SP**

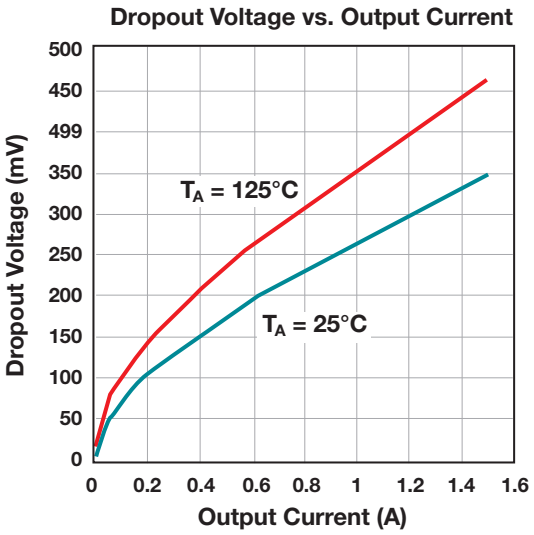
Wide V_{IN} (2.3 to 20 V), 1.5-A Low-Drop-Out Regulator
TPS7A4501-SP

Key Features
- V_{IN} = 2.3 V to 20 V
- Adjustable output from 1.21 V to 20 V
- Optimized for fast transient response
- Low noise: 35 µVRMS (10 Hz to 100 kHz)
- High ripple rejection: 68 dB at 1 kHz
- No protection diodes needed
- Less than 1-µA quiescent current in shutdown
- Reverse battery and reverse current protection
- Thermally enhanced 10-pin CFP (HKU) package

Radiation Performance
- Total Dose (TID) = 100 krad RHA
- SEL immune to LET = 85 MeV-cm^2/mg
- SET immune to LET = 75 MeV-cm^2/mg for VOUT < 5%

Applications
- Power management — LDO
- Satellite point-of-load (POL) power supplies
- Satellite bus and payload

Benefits
- RHA qualified and orderable as SMD: 5962R1222403VXC
- Outstanding low-noise performance
- Widest input voltage range for a RHA LDO



More information at **www.ti.com/product/TPS7A4501-SP**

Radiation-Hardened Interface
Featured Products

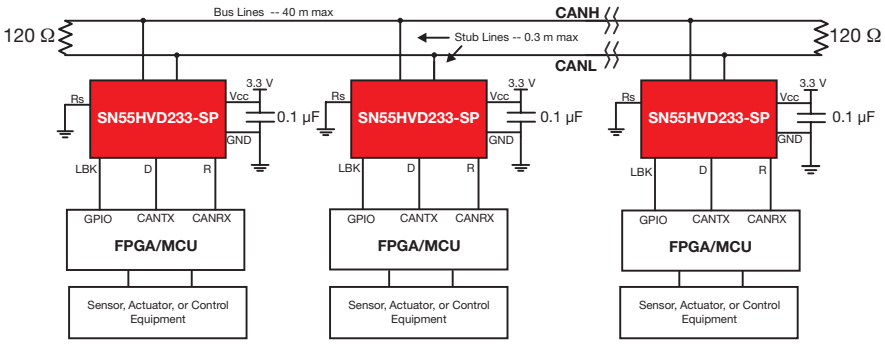
3.3-V CAN Transceiver
SN55HVD233-SP

Key Features
- Compatible with ISO 11898-2
- Data rates up to 1 Mbps
- Extended –7-V to 12-V common mode range
- High input impedance allows for 120 nodes
- LVTTL I/Os are 5-V tolerant
- Unpowered node does not disturb the bus
- Temperature range: –55°C to 125°C
- Available in 8-pin 6.48 × 6.48-mm ceramic flat pack (HKX)
- Bus pins ESD protection exceeds ±16 kV HBM

Radiation Performance
- TID = 50 krad RHA
- SEL immune to LET = 86 MeV-cm^2/mg

Applications
- Spacecraft backplane data bus communication and control
- Telemetry/Sensor data transmission
- CAN bus standards such as CANopen, DeviceNet, CAN Kingdom, ISO 11783, NMEA 2000, SAE J1939

Benefits
- RHA qualified and orderable as SMD: 5962L1420901VXC
- Thermal shutdown protection
- Adjustable driver transition times for improved signal quality



More information at **www.ti.com/product/SN55HVD233-SP**

RS-485 Differential Bus Transceiver
DS16F95QML-SP

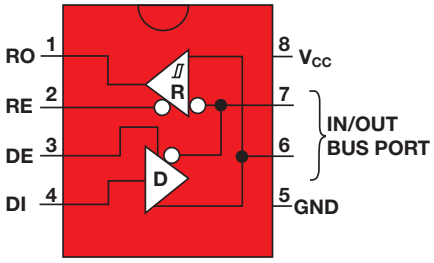
Key Features
- Designed for multipoint transmission
- Wide positive and negative input/output bus voltage ranges
- Thermal shutdown protection
- Driver positive and negative current-limiting
- High-impedance receiver input
- Receiver input hysteresis of 50 mV typical
- Operates from single 5.0 V supply
- Available in 10-pin ceramic flatpack

Radiation Performance
- TID = 300 krad RHA

Applications
- Satellite communication
- Defense electronics
- Radar and guidance systems

Benefits
- Orderable as SMD RHA: 5962F8961501VHA
- Meets EIA-485 and EIA-422A specifications
- Meets SCSI-1 (5 MHz) specifications
- RHA and QMLV qualified

Other Drivers/Receivers in RS-485 Family (Tx, Rx, 3.3 V, 5 V)
- DS96F174MQML-SP Quad high-speed differential driver
- DS96F175MQML-SP Quad high-speed differential receiver



More information at **www.ti.com/product/DS16F95QML-SP**

Octal, 128-kSPS, Simultaneous Sampling 24-Bit Delta-Sigma ADC

ADS1278-SP

Key Features

- Simultaneous sampling of 8 inputs via independent 24-bit Delta-Sigma ADCs capable of converting up to 128 kSPS
- Bandwidth: 70 kHz
- Signal-to-Noise Ratio (SNR): 111dB
- Total Harmonic Distortion (THD): –96 dB (Max.)
- Operating temperature –55 to 125°C
- 84-lead ceramic HFQ 10 mm × 10 mm

Radiation Performance

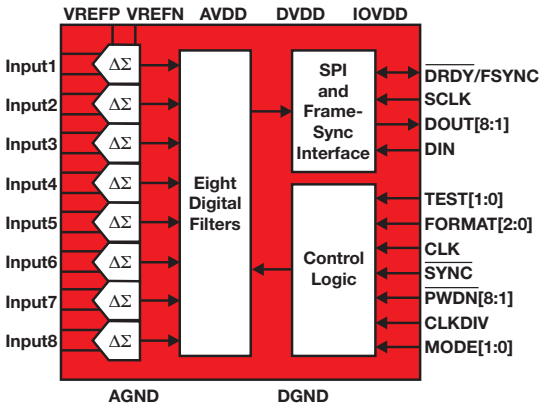
- TID = 75 krad, 50 krad RLAT
- SEL immune to LET = 69 MeV-cm^2/mg (125°C)
- Follows RHA flow without SMD number

Applications

- Orbital observation systems
  - Satellite, shuttles, space stations, launchers
- Satellite sensing
- Space scientific instrumentation

Benefits

- Offers easy implementation of simultaneous analog-to-digital conversion for multiple inputs sourced from a wide range of transducers without the need of using an external multiplexer
- Allows accurate measurement of AC signals in the presence of noise; its highly linear transfer function provides high-fidelity and undistorted conversions
- Allows user to better resolve low-level signals found especially in the fields of satellite sensors



More information at **www.ti.com/product/ADS1278-SP**

High-Resolution Delta-Sigma ADC

ADS1282-SP

Key Features

- Very high resolution:
  - 130-dB SNR (250 SPS, G = 1)
  - 125-dB SNR (250 SPS, G = 16)
- Ultra linear
  - THD = –122 dB, INL = 0.5 ppm
- Two-channel input MUX
- Low power consumption: 25 mW (high-res); 10 µW (standby)
- Flexible digital filter (sync, FIR or IIR)
- Packaged in thermally enhanced CFP package

Radiation Performance

- TID = 50 krad RHA
- SEL immune to LET = 40 MeV-cm^2/mg

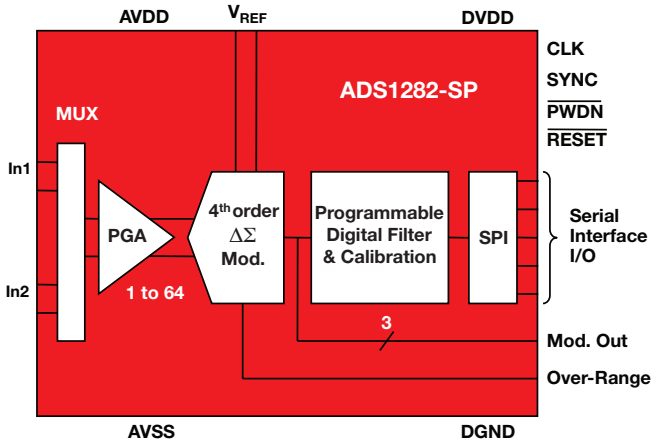
Applications

- Orbital observation systems (e.g., satellite, shuttles, space stations, launchers)
- Satellite sensing
- Space scientific instrumentation

Benefits

- RHA qualified and orderable as SMD: 5962L1423101VXC
- Allows user to acquire wide dynamic-range signals in satellite-telemetry sensors
- Minimal distortion to convert signals for frequency-domain analysis and post processing
- Selectable digital filter assures a flexible design that will meet the requirements of the most demanding applications

ADS1282: MUX + PGA + Modulator + Digital Filter



More information at **www.ti.com/product/ADS1282-SP**

Radiation-Hardened Data Converters
Featured Products

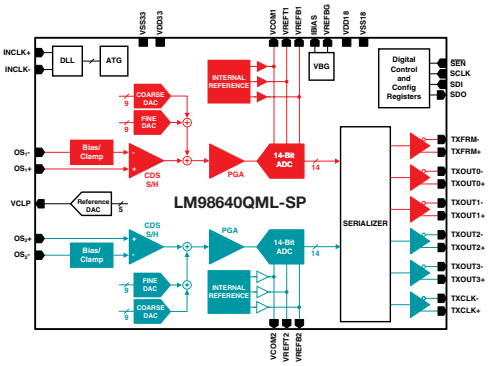
Dual-Channel, 14-Bit, 40-MSPS Analog Front End (AFE)
LM98640QML-SP

Key Features
- Fully integrated signal-processing solution for imaging systems
- Correlated double sampling (CDS) or sample/hold (S/H) processing for CCD or CIS sensors
- Serialized LVDS outputs
- Dual lane at 16× sample rate or quad lane at 8× sample rate
- Programmable sampling edge up to 1/64th pixel period
- Programmable analog gain for each channel
- Programmable analog offset correction

Radiation Performance
- TID = 100 krad RHA
- SEL and SEFI immune to LET > 120 MeV-cm^2/mg

Applications
- CCD arrays
- CMOS image sensors
- Earth observation
- Star tracker

Benefits
- RHA qualified and orderable as SMD: 5962R1820301VXC
- Enables digitization on the focal plane
  - No cabling
  - Reduced weight
- Low power consumption
- Meets space reliability requirements
- TID and SEU characterization data available for faster design in



More information at **www.ti.com/product/LM98640QML-SP**

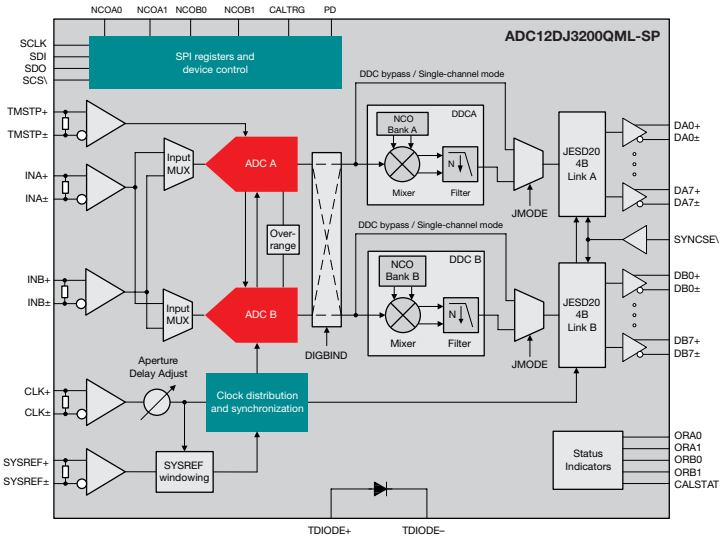
12-Bit, Dual 3.2-GSPS or Single 6.4-GSPS, RF-Sampling Analog-to-Digital Converter (ADC)
ADC12DJ3200QML-SP

Key Features
- JESD204B interface: Up to 12.8 Gbps and 16 lanes
- Digital down-converters: 2×–16× decimation
- Analog input bandwidth (–3 dB): 7 GHz
- Full-scale input voltage: 0.8 VPP
- Noise floor: –152.4 dBFS/Hz
- Noiseless aperture delay adjustment: 19-fs step size
- Easy-to-use synchronization features: SYSREF and timestamp
- Small LGA package: 15 mm × 15 mm
- Power consumption: 3.0 W

Radiation Performance
- TID: 300 krad RHA
- SEL immune to LET = 120 MeV-cm^2/mg
- Single Event Upset (SEU) immune registers

Applications
- Wideband satellite communications
- RADAR/LIDAR
- Software-defined radio

Benefits
- The ADC12DJ3200QML provides direct RF-sampling up to at least 7 GHz and beyond
- All of the dual 3.2-GSPS or single 6.4-GSPS 12-bit data can be offloaded over 8 lanes of 12.8-Gbps JESD204B SERDES
- The data rate can be decimated and the signal down-converted on-chip using the optional DDC (digital down-converters)



More information at **www.ti.com/product/ADC12DJ3200QML-SP**

Radiation-Hardened Data Converters
Featured Products

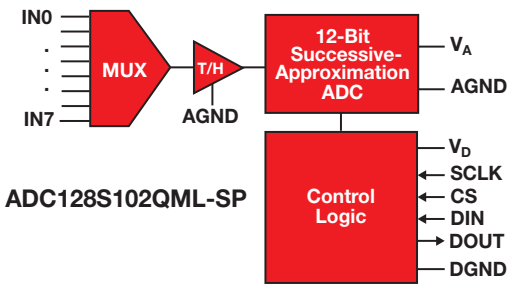
8-Channel, 12-Bit, 50-kSPS to 1-MSPS ADC
ADC128S102QML-SP

Key Features
- Eight input channels
- V_A: 2.7 V to 5.25 V
- V_D: 2.7 V to V_A
- Only 2.3 mW of power at 3 V
- Power down 0.06 µW
- DNL: –0.5 to +0.9 LSB typical
- INL: ±0.9 LSB typical
- SPI digital output
- ADC addressing through CS decoder
- SPI/QSPI/MICROWIRE/DSP compatible
- Available in 16-pin ceramic SOIC, CFP and die

Radiation Performance
- TID = 100 krad RHA
- SEL and SEFI immune to LET > 120 MeV-cm^2/mg

Applications
- Sensors
- Thermistors
- Motor control

Benefits
- Orderable as SMD: 5962R0722701VZA, 5962R0722701VFA and KGD 5962R0722701V9A
- Eight sensors can be monitored with one ADC
- All ADC serialized data shares the same input bus to onboard FPGA/ASIC
- Ultra-low power consumption
- RHA qualified for space applications
- TID and SEU characterization data available for faster design in



More information at **www.ti.com/product/ADC128S102QML-SP**

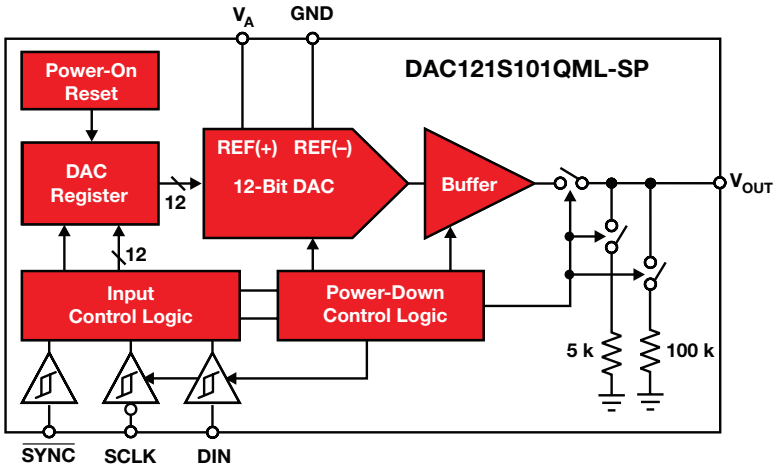
12-Bit Micro-Power DAC with Rail-to-Rail Output
DAC121S101QML-SP

Key Features
- Supply range: +2.7 V to +5.5 V
- Only 0.64 mW of power
- Power down < 1 µW
- Rail-to-rail voltage output
- Power-on reset to zero volts output
- SYNC interrupt facility
- Guaranteed monotonic
- DNL: +0.25/-0.15 LSB
- 3-wire 20-MHz SPI digital interface
- SPI/QSPI/MICROWIRE/DSP compatible
- Full-scale step settling time
- Available in a 10-pin ceramic SOIC

Radiation Performance
- TID = 100 krad RHA
- SEL and SEFI immune > 120 MeV-cm^2/mg

Applications
- Sensors
- Thermistors
- Motor control

Benefits
- Orderable as SMD: 5962R0722601VZA
- Wide operating range
- Ultra-low power consumption
- RHA and QMLV qualified



More information at **www.ti.com/product/DAC121S101QML-SP**

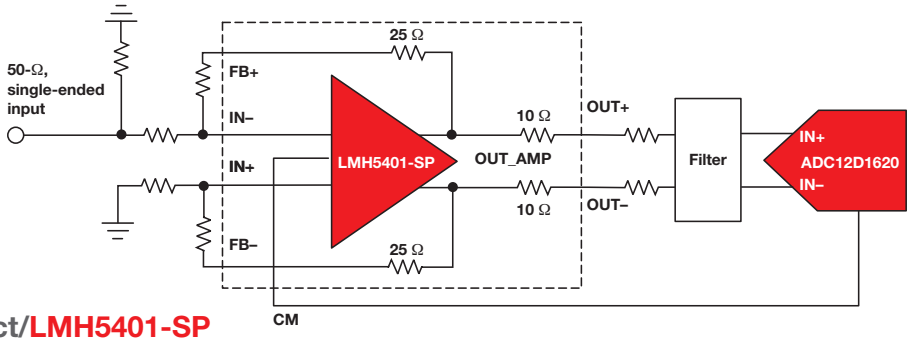
6.5-GHz, Low-Noise, Low-Power, Gain-Configurable Fully Differential Amplifier
LMH5401-SP

Key Features
- Gain bandwidth (GBW) of ~6 GHz
- 17,500 V/µs slew rate
- Gain >3 dB (externally set)
- Low harmonic distortion (SE-DE, 200Ω, G = 17 dB)
  - –80/–80 dBc HD2/3 @ 500 MHz, 1 Vpp
- Low intermodulation distortion (SE-DE, 200Ω, G = 17 dB)
  - –88 dBc IMD3 @ 500 MHz, 1 Vpp
- Output: 5.8 Vpp on 5-V supply
- Supply operation from 3.3 to 5.0 V @ 55 mA
- Power down
- Package: Flipchip Ceramic Leadless Chip Carrier, 5.5 mm × 6.0 mm

Radiation Performance
- TID = 100 krad RHA
- SEL immune to LET = 85 MeV-cm^2/mg at 125°C

Applications
- Balun replacement DC to 2 GHz
- GSPS ADC drivers
- Baseband, IF and RF gain blocks
- Level shifters

Benefits
- RHA orderable as SMD: 5962R1721401VXC
- Unprecedented usable bandwidth and application flexibility DC to 2 GHz
- Excellent linearity performance through 1 GHz
- Supports DC coupled operation, with either single or split supply operation
- Easy single-ended in to differential out conversion without external baluns
- Low power (280 mW on 5-V supply) makes it attractive for a variety of wide-band, high-dynamic-range applications where power and board space savings are desirable



More information at **www.ti.com/product/LMH5401-SP**

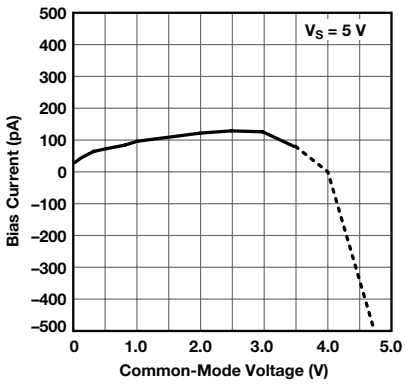
Dual, High-Precision, Rail-to-Rail Output, Operational Amplifier
LMP2012QML-SP

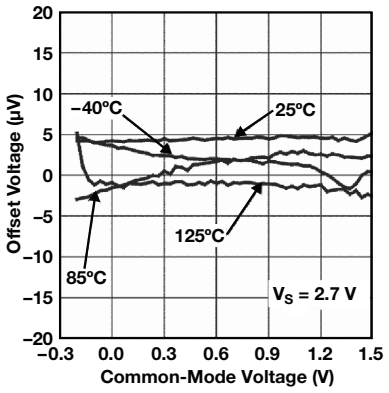
Key Features
- Low guaranteed V_{IO} over temperature: 60 µV
- No popcorn noise
- Low quiescent current: 1.2 mA/Ch
- Wide supply range: 2.7 V–5 V
- Low bias current: –3 pA
- Gain-bandwidth product: 3 MHz
- High slew rate: 4 V/µs
- Rail-to-rail output
- No external capacitors required
- Available in 10-pin ceramic SOIC

Radiation Performance
- TID = 50 krad RHA

Applications
- Satellites
- Gyroscopes
- Star trackers
- Reaction wheels

Benefits
- Orderable as SMD: 5962L0620602VZA
- Very stable – temp coefficient
- RHA and QMLV qualified





More information at **www.ti.com/product/LMP2012QML-SP**

Radiation-Hardened Amplifiers
Featured Products

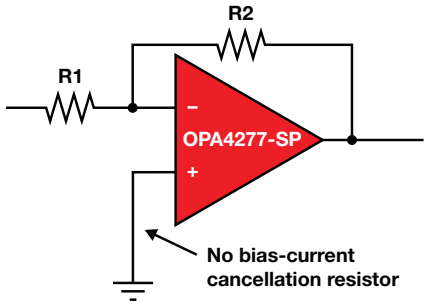
Quad, High-Precision Op Amp
OPA4277-SP

Key Features
- Low offset voltage: 20 µV
- Low offset drift: ±0.15 µV/°C
- Voltage noise: 8 nV/√Hz @ 1 kHz
- Gain Band Width (GBW): 1 MHz
- Low quiescent current: 790 µA/Ch
- Wide supply range: ±2 V to ±18 V
- Low bias current: 17.5 nA (max)
- Available in KGD and CFP packages

Radiation Performance
- TID = 50 krad RHA
- SEL immune to LET = 85 MeV-cm^2/mg

Applications
- Orbital observation systems (e.g., satellite, shuttles, space stations, launchers)
- Satellite sensing
- Space scientific instrumentation

Benefits
- RHA qualified and orderable as SMD: 5962L1620901VYC (CFP) and 5962L1620901V9A (KGD)
- High accuracy and stability for use in bridge-amplifier or transducer-amplifier applications
- Unity gain stable while providing excellent dynamic behavior over a wide range of load conditions
- Various packaging options provide design flexibility
- Excellent replacement for RH1013 or RH1014



More information at **www.ti.com/product/OPA4277-SP**

Radiation-Hardened Clock and Timing
Featured Products

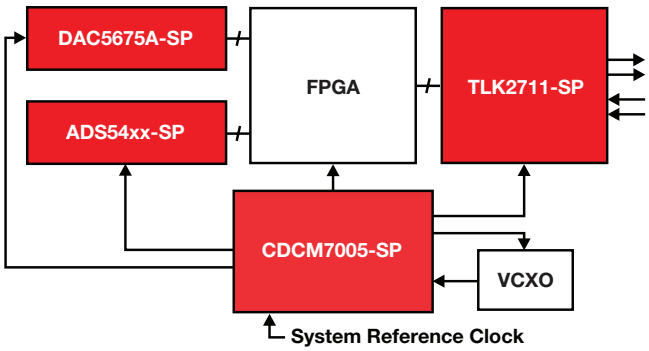
3.3-V, 2.2-GHz, Low Phase Noise, Clock Synchronizer and Jitter Cleaner
CDCM7005-SP

Key Features
- VCXO_IN clock synchronized to primary or secondary reference clock inputs redundancy support with manual/auto selection
- Accepts LVCMOS input frequencies up to 200 MHz
- VCXO_IN frequencies up to 2.2 GHz (LVPECL)
- LVPECL and/or LVCMOS output combinations
- Output frequency is selectable by ×1, /2, /3, /4, /6, /8, /16 on each output Individually
- SPI controllable device setting
- 3.3-V power supply
- Temperature range: –55°C to +125°C
- Available in 52-pin ceramic QFP (HFG) package

Radiation Performance
- TID = 50 krad
- SEL immune to LET = 80 MeV-cm^2/mg

Applications
- Satellites
- Radar and guidance systems
- Defense electronics

Benefits
- Orderable as SMD: 5962-0723001VXC
- Wide input/output frequency range supports high/low end of frequency standards
- Flexible single and differential outputs
- Selectable input/output standards



More information at **www.ti.com/product/CDCM7005-SP**

Radiation-Hardened Clock and Timing
Featured Products

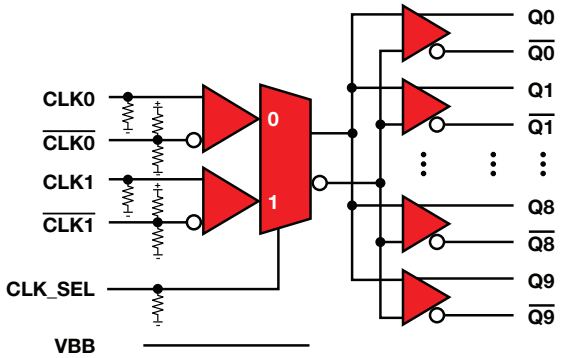
1:10 LVPECL Buffer/Clock Distribution with Selectable Input
CDCLVP111-SP

Key Features
- 1:10 differential LVPECL clock outputs with frequency range from DC to 3.5 GHz
- Supply voltage range: 2.375 V to 3.8 V
- Low output skew: 15 ps (Typ)
- Input MUX
- Flexible input capability: LVDS, CML, SSTL, LVCMOS/TTL input compatible
- VBB reference voltage output for single-ended clocking
- Low additive jitter

Radiation Performance
- TID = 50 krad RHA
- SEL Immune LET = 69.2 MeV-cm^2/mg

Applications
- Orbital observation systems (e.g., satellite, shuttles, space stations, launchers)
- Clock distribution

Benefits
- Orderable as SMD: 5962-1620701VXC
- Wide range supports various applications and use one single device across multiple designs
- Wide supply voltage saves additional cost on LDO
- Low skew ensures high-quality clock distribution
- Selectable input allows flexibility
- QMLV/RHA qualified to full mil temp (–55 to 125°C)



More information at **www.ti.com/product/CDCLVP111-SP**

Radiation-Hardened MCU
Featured Product

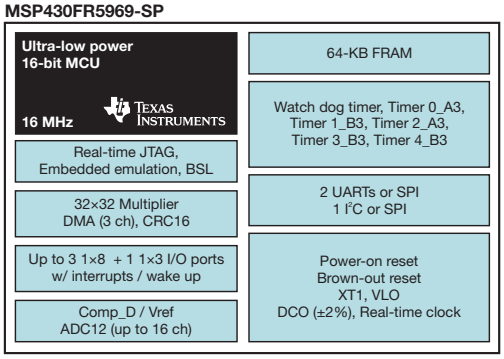
16-MHz Ultra-Low-Power Microcontroller with FRAM and 40 IO
MSP430FR5969-SP

Key Features
- Extremely low power consumption 16-bit RISC architecture:
  - 100 µA/MHz active
  - 0.02 µA shutdown, 0.4 µA standby
- 64 KB of non-volatile, Ferroelectric RAM (FRAM)
- Integrated peripherals for system housekeeping, telemetry
  - Real-time clock (RTC)
  - Five 16-bit timers
  - 16-channel analog comparator
  - 12-bit analog-to-digital converter (ADC) with 16 inputs, internal reference and sample-and-hold
  - Serial interfaces supporting UART, SPI, I^{2}C
  - Multi-function I/O ports
- Support for 32-kHz crystals or internal clock sources
- 48-pin VQFN and TQFP plastic package for reduced size and weight

Radiation Performance
- TID = 50 krad (RLAT performed)
- SEL immune to LET = 72 MeV-cm^2/mg

Applications
- Spacecraft distributed telemetry and housekeeping
- Sensor management and data logging
- Satellite remote terminal units

Benefits
- Reduced SWaP needed for system housekeeping functions
- Housekeeping/telemetry can be offloaded from FPGA
- Reusable RTU architecture across subsystems



More information at **www.ti.com/product/MSP430FR5969-SP**

Radiation-Hardened Sensor Products
Featured Product

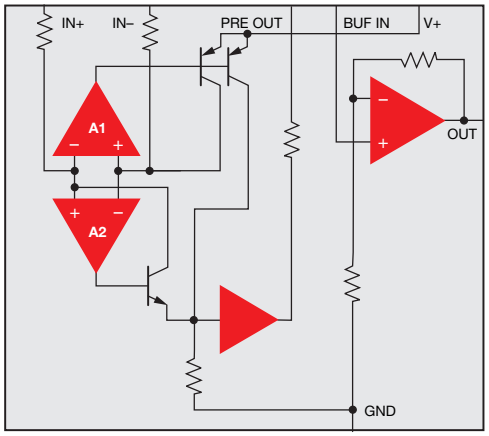
Very Wide Common Voltage Current Sense Amplifier with Split Stage for Filtering
INA901-SP

Key Features
- –15-V to 80-V common-mode range independent of supply
- 2.7-V to 16-V supply
- Split stages for filtering
- Bandwidth up to 130 kHz
- Gain: 20 V/V
- Package: Ceramic 8-lead HKX 6.5 mm × 6.5 mm

Radiation Performance
- TID = 100 krad RHA
- SEL immune to LET = 85 MeV-cm^2/mg

Applications
- Current monitor for current-mode control DC-DC converter
- Current measurement in an H-Bridge for motor control
- Latching current limiters on high common-mode bus
- Current sensing on GaN modules for increased efficiency

Benefits
- Eliminates need for additional protective components in the event of CMR reversals
- Preserves buffered voltage output and saves using an additional op amp
- Simplifies design of current control loops
- Enables a flexible circuit design
- Will be orderable as SMD: 5962R1821001VXC



More information at **www.ti.com/product/INA901-SP**

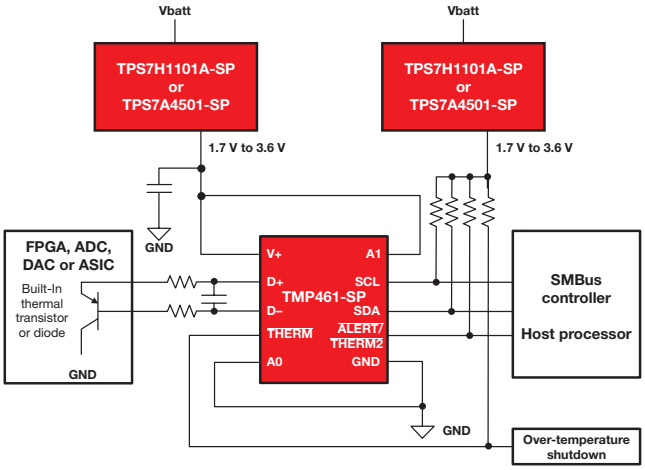
Remote and Local Digital Temperature Sensor
TMP461-SP

Key Features
- Enables measurement of remote diode temperatures in the range of –64°C to +191°C
- Programmable calibration registers
- Remote diode temperature sensor accuracy: ±1.5°C
  Local temperature sensor accuracy: ±2°C
  (across extended temperature range of –55°C to +125°C)
- Accuracy post calibration: ±0.1C
- Supply and logic voltage range: 1.7 V to 3.6 V
- 35-µA operating current (1 SPS),
  3-µA shutdown current

Radiation Performance
- TID = 100 krad RHA
- SEL immune to LET = 76 MeV-cm^2/mg

Applications
- Spacecraft FPGA, ADCs, DACs and ASIC diode temperature monitoring
- Board temperature monitoring
- Spacecraft housekeeping and telemetry

Benefits
- RHA orderable as SMD: 5962R1721801VXC
- Thermal pad on bottom of package for low thermal resistance for board temperature monitoring
- Two-wire and SMBus™ serial interface compatible with pin-programmable address



More information at **www.ti.com/product/TMP461-SP**

Space-Grade Parts List

Amplifiers + Comparators

Generic Part Number	Description	RHA Version Available	Max TID (krad)[1]	MAX SEL (MeV-cm^2/mg)[1]	Orderable Material	Subfamily	Pin	PKG	PKG Group	ECCN[2]
LF411QML-SP	Low offset, low drift JFET input operational amplifier	Yes	100	Bipolar	LF411MWGRLQMLV	Operational amplifiers	10	NAC	CLGA	EAR99
LM111QML-SP	Voltage comparator	Yes	100	Bipolar	LM111WGLQMLV	Comparator	10	NAC	CLGA	EAR99
					LM111WGRLQMLV		10	NAC	CLGA	EAR99
					LM111WLQMLV		10	NAD	CLGA	EAR99
					LM111WRLQMLV		10	NAD	CLGA	EAR99
					LM111HLQMLV		8	LMC	TO-CAN	EAR99
					LM111HRLQMLV		8	LMC	TO-CAN	EAR99
					LM111J-8LQMLV		8	NAB	CDIP	EAR99
					LM111J-8RLQMLV		8	NAB	CDIP	EAR99
LM119QML-SP	High-speed dual comparator	Yes	100	Bipolar	LM119 MDE	Comparator	0	Y	DIESALE	EAR99
					LM119 MDR		0	Y	DIESALE	EAR99
					LM119HRLQMLV		10	LME	TO-CAN	EAR99
					LM119HRQMLV		10	LME	TO-CAN	EAR99
					LM119WGRLQMLV		10	NAC	CLGA	EAR99
					LM119WGRQMLV		10	NAC	CLGA	EAR99
					LM119WRLQMLV		10	NAD	CLGA	EAR99
					LM119WRQMLV		10	NAD	CLGA	EAR99
					LM119J-QMLV		14	J	CDIP	EAR99
					LM119JRLQMLV		14	J	CDIP	EAR99
					LLM119JRQMLV		14	J	CDIP	EAR99
LM124AQML-SP	Low-power quad	Yes	100	Bipolar	LM124 MDE	Operational amplifiers	0	Y	DIESALE	EAR99
					LM124 MDR		0	Y	DIESALE	EAR99
					LM124AJRLQMLV		14	J	CDIP	EAR99
					LM124AJRQMLV		14	J	CDIP	EAR99
					LM124AWGRLQMLV		14	NAC	CLGA	EAR99
					LM124AWGRQMLV		14	NAC	CLGA	EAR99
					LM124AWRLQMLV		14	NAD	CLGA	EAR99
					M124AWRQMLV		14	NAD	CLGA	EAR99
LM124-SP	Quadruple operational amplifier	No	50	Bipolar	5962-9950403V9B	Operational amplifiers	0	KGD	DIESALE	EAR99
					5962-7704301VCA		14	J	CDIP	EAR99
					5962-9950403VCA		14	J	CDIP	EAR99
LM139AQML-SP	Low power, low offset voltage quad comparator	Yes	100	Bipolar	LM139 MDE	Comparator	0	Y	DIESALE	EAR99
					LM139 MDR		0	Y	DIESALE	EAR99
					LM139AJRLQMLV		14	J	CDIP	EAR99
					LM139AJRQMLV		14	J	CDIP	EAR99
					LM139AWG-QMLV		14	NAC	CLGA	EAR99
					LM139AWGRLQMLV		14	NAC	CLGA	EAR99
					LM139AWGRQMLV		14	NAC	CLGA	EAR99
					LM139AW-QMLV		14	NAD	CLGA	EAR99
					LM139AWRLQMLV		14	NAD	CLGA	EAR99
					LM139AWRQMLV		14	NAD	CLGA	EAR99
LM139-SP	Quad differential comparator	No	40	–	5962-9673802V9B	Comparator	0	KGD	DIESALE	EAR99
					5962-7700801VCA		14	J	CDIP	EAR99
					5962-9673802VCA		14	J	CDIP	EAR99
LM158QML-SP	Low power dual operational amplifier	Yes	100	Bipolar	LM158A MDE	Operational amplifiers	0	Y	DIESALE	EAR99
					LM158A MDR		0	Y	DIESALE	EAR99
					LM158AWGRLQMLV		10	NAC	CLGA	EAR99
					LM158AWGRQMLV		10	NAC	CLGA	EAR99
					LM158AHRLQMLV		8	LMC	TO-CAN	EAR99
					LM158AHRQMLV		8	LMC	TO-CAN	EAR99
					LM158AJRLQMLV		8	NAB	CDIP	EAR99
					LM158AJRQMLV		8	NAB	CDIP	EAR99

1) Devices with "–" in the radiation data columns do not have updated detailed radiation data or reports

2) ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please request from: ***gtc_eccn-hts-naftateam@list.ti.com***

Space-Grade Parts List

Amplifiers + Comparators (cont'd)

Generic Part Number	Description	RHA Version Available	Max TID (krad)[1]	MAX SEL (MeV-cm^2/mg)[1]	Orderable Material	Subfamily	Pin	PKG	PKG Group	ECCN[2]
LM193QML-SP	Low power low offset voltage dual comparator	Yes	100	Bipolar	LM193 MDE	Comparator	0	Y	DIESALE	EAR99
					LM193 MDR		0	Y	DIESALE	EAR99
					LM193AHRLQMLV		8	LMC	TO-CAN	EAR99
					LM193AHRQMLV		8	LMC	TO-CAN	EAR99
					LM193AJ-QMLV		8	NAB	CDIP	EAR99
					LM193AJRLQMLV		8	NAB	CDIP	EAR99
					LM193AJRQMLV		8	NAB	CDIP	EAR99
LM6172QML-SP	Dual high-speed, low power, low distortion voltage feedback amplifiers	Yes	100	Bipolar	LM6172 MDR	Operational amplifiers	0	Y	DIESALE	EAR99
					LM6172 MDE		0	Y	DIESALE	EAR99
					LM6172AMGWFQMLV		16	NAC	CLGA	EAR99
					LM6172AMGWRLQV		16	NAC	CLGA	EAR99
					LM6172AMJFQMLV		8	NAB	CDIP	EAR99
LM7171QML-SP	Very high speed, high output current, voltage feedback amplifier	Yes	300	Bipolar	LM7171AMWGFLQV	Operational amplifiers	10	NAC	CLGA	EAR99
					LM7171AMWGFQMLV		10	NAC	CLGA	EAR99
					LM7171AMWFLQMLV		10	NAD	CLGA	EAR99
					LM7171AMWFQMLV		10	NAD	CLGA	EAR99
					LM7171AMJFQMLV		8	NAB	CDIP	EAR99
LMH5401-SP	Radiation hardness assured (RHA) 6.5-GHz ultra wideband fully differential amplifier	Yes	100	85	5962R1721401VXC	Operational amplifiers	14	FFK	LCCC	EAR99
					5962-1721401VXC		14	FFK	LCCC	EAR99
					LMH5401FFK/EM		14	FFK	LCCC	EAR99
LMH6628QML-SP	Dual wideband, low noise, voltage feedback op amp	Yes	300	Bipolar	LMH6628WGFQMLV	Operational amplifiers	10	NAC	CLGA	EAR99
					LMH6628J-QMLV		8	NAB	CDIP	EAR99
LMH6702QML-SP	1.7-GHz, ultra-low-distortion, wideband op amp	Yes	300	Bipolar	LMH6702WG-QMLV	Operational amplifiers	10	NAC	CLGA	EAR99
					LMH6702WGFLQMLV		10	NAC	CLGA	EAR99
					LMH6702WGFQMLV		10	NAC	CLGA	EAR99
					LMH6702J-QMLV		8	NAB	CDIP	EAR99
					LMH6702JFLQMLV		8	NAB	CDIP	EAR99
					LMH6702JFQMLV		8	NAB	CDIP	EAR99
LMH6715QML-SP	Dual wideband video op amp	Yes	300	Bipolar	LMH6715JFQMLV	Operational amplifiers	8	NAB	CDIP	EAR99
LMP2012QML-SP	Dual, high-precision, rail-to-rail output operational amplifier	Yes	50	77.5	LMP2012 MDE	Operational amplifiers	0	Y	DIESALE	EAR99
					LMP2012 MDR		0	Y	DIESALE	EAR99
					LMP2012WG-QMLV		10	NAC	CLGA	EAR99
					LMP2012WGLLQMLV		10	NAC	CLGA	EAR99
					LMP2012WGLQMLV		10	NAC	CLGA	EAR99
OPA4277-SP	High-precision operational amplifier	Yes	50	85	5962L1620901V9A	Operational amplifiers	0	KGD	DIESALE	EAR99
					5962L1620901VYC		14	HFR	CFP	EAR99
					OPA4277HFR/EM		14	HFR	CFP	EAR99
					5962L1620901VXA		28	JDJ	CDIP-SB	EAR99
THS4304-SP	Rad-tolerant class V, wideband operational amplifier	No	150	Bipolar	5962-0721901VHA	Operational amplifiers	10	HKK	CFP	EAR99
THS4511-SP	Rad-tolerant class V, wideband, fully differential amplifier	No	150	Bipolar	5962-0722201VFA	Operational amplifiers	16	HKT	CFP	EAR99
THS4513-SP	Rad-tolerant class V, wideband, fully differential amplifier	No	150	Bipolar	5962-0722301VFA	Operational amplifiers	16	HKT	CFP	EAR99
TLC2201-SP	Space low-noise precision advanced LinCMOS™ single operational amplifier	No	–	–	5962-9088203V2A	Operational amplifiers	20	FK	LCCC	EAR99

1) Devices with "–" in the radiation data columns do not have updated detailed radiation data or reports

2) ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please request from: ***gtc_eccn-hts-naftateam@list.ti.com***

Space-Grade Parts List

Data Converters

Generic Part Number	Description	RHA Version Available	Max TID (krad)[1]	MAX SEL (MeV-cm^2/mg)[1]	Orderable Material	Subfamily	Pin	PKG	PKG Group	ECCN[2]
ADC08D1520QML-SP	8-bit, dual 1.5-GSPS or single 3.0 GSPS, analog-to-digital converter (ADC)	Yes	300	120	5962F0721401VZC	Analog to digital converters	128	NBC	CQFP	–
					ADC08D1520WGFQV		128	NBC	CQFP	–
					ADC08D1520WGMPR		128	NBC	CQFP	–
ADC10D1000QML-SP	Low power, 10-bit, dual 1.0 GSPS or single 2.0 GSPS A/D converter	Yes	100	120	ADC10D1000LDAZ	Analog to digital converters	256	FVA	CLGA	–
					ADC10D1000CCMLS		376	NAA	CCGA	–
					ADC10D1000CCMPR		376	NAA	CCGA	–
ADC12D1600QML-SP	12-bit, dual 1.6-GSPS or single 3.2-GSPS, RF-sampling analog-to-digital converter (ADC)	Yes	300	120	ADC12D1600CCMLS	Analog to digital converters	376	NAA	CCGA	–
					ADC12D1600CCMPR		376	NAA	CCGA	–
ADC12D1620QML-SP	12-bit, dual 1.6-GSPS or single 3.2-GSPS, RF-sampling analog-to-digital converter (ADC)	Yes	300	120	ADC12D1620CCMLS	Analog to digital converters	376	NAA	CCGA	–
					ADC12D1620LGMPR		376	NAA	CCGA	–
					ADC12D1620LGMLS		256	FVA	CLGA	–
					ADC12D1620LGMPR		256	FVA	CLGA	–
ADC12DJ3200QML-SP	12-bit, dual 3.2-GSPS or single 6.4-GSPS, RF-sampling analog-to-digital converter (ADC)	Yes	300	120	5962F1820901VXC	Analog to digital converters	196	ZMX	CLGA	–
					ADC12DJ3200ZMX/EM		196	ZMX	CLGA	–
ADC128S102QML-SP	8-channel, 50 kSPS to 1 MSPS, 12-bit A/D converter	Yes	100	120	5962R0722701V9A	Analog to digital converters	0	Y	DIESALE	–
					ADC128S102 MDR		0	Y	DIESALE	–
					5962R0722701VZA		16	NAC	CLGA	–
					ADC128S102WGMPR		16	NAC	CLGA	EAR99
					ADC128S102WGRQV		16	NAC	CLGA	–
					5962R0722701VFA		16	NAD	CLGA	–
					ADC128S102WRQV		16	NAD	CLGA	–
ADC14155QML-SP	14-bit, 155-MSPS, 1.1-GHz input bandwidth analog-to-digital converter (ADC)	Yes	100	121	5962R0626201VXC	Analog to digital converters	48	NBA	CQFP	–
					ADC14155NBA/EM		48	NBA	CQFP	EAR99
					ADC14155W-MLS		48	NBA	CQFP	–
					ADC14155W-MPR		48	NBA	CQFP	EAR99
ADS1278-SP	Radiation hardened 24-bit 8-ch simulta-neous-sampling Delta-Sigma ADC	Yes	75	68	ADS1278MHFQ-MLS	Analog to digital converters	84	HFQ	CFP	EAR99
					ADS1278WHFQ-MLS		84	HFQ	CFP	EAR99
					ADS1278HFQ/EM		84	HFQ	CFP	EAR99
ADS1282-SP	High-resolution analog-to-digital converter	Yes	50	40	5962L1423101VXC	Analog to digital converters	28	HKV	CFP	–
					5962L1423102VXC		28	HKV	CFP	EAR99
					ADS1282HKV/EM		28	HKV	CFP	EAR99
ADS5400-SP	12-bit, 1.0-GSPS analog-to-digital converter (ADC)	No	50	–	5962-0924001VXC	Analog to digital converters	100	HFS	CFP	–
					ADS5400HFS/EM		100	HFS	CFP	–
					ADS5400MHFSV		100	HFS	CFP	–
ADS5424-SP	14-bit, 125-MSPS analog-to-digital converter (ADC)	No	150	–	5962-0720601VXC	Analog to digital converters	52	HFG	CFP	–
					ADS5424HFG/EM		52	HFG	CFP	–
ADS5444-SP	13-bit, 250-MSPS analog-to-digital converter (ADC)	No	–	86	5962-0720701VXC	Analog to digital converters	84	HFG	CFP	–
					ADS5444HFG/EM		84	HFG	CFP	–
ADS5463-SP	12-bit, 500-MSPS analog-to-digital converter	Yes	100	86	5962-0720801VXC	Analog to digital converters	84	HFG	CFP	–
					5962R0720802VXC		84	HFG	CFP	–
					ADS5463HFG/EM		84	HFG	CFP	–
ADS5474-SP	14-bit, 400-MSPS analog-to-digital converter (ADC)	Yes	100	87	5962R1320801VXC	Analog to digital converters	84	HFG	CFP	–
					ADS5474HFG/EM		84	HFG	CFP	–
					ADS5474MHFGV		84	HFG	CFP	–

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Space-Grade Parts List

Data Converters (cont'd)

Generic Part Number	Description	RHA Version Available	Max TID (krad)[1]	MAX SEL (MeV-cm^2/mg)[1]	Orderable Material	Subfamily	Pin	PKG	PKG Group	ECCN[2]
DAC121S101QML-SP	12-bit micro power digital-to-analog converter with rail-to-rail output	Yes	100	120	DAC121S101 MDP	Analog to digital converters	0	Y	DIESALE	EAR99
					DAC121S101 MDR		0	Y	DIESALE	–
					5962R0722601VZA		10	NAC	CLGA	–
					5962R0722602VZA		10	NAC	CLGA	–
					DAC121S101WGMPR		10	NAC	CLGA	EAR99
					DAC121S101WGRLV		10	NAC	CLGA	–
					DAC121S101WGRQV		10	NAC	CLGA	–
DAC5670-SP	14-bit, 2.4-GSPS, 1×–2× interpolating digital-to-analog converter (DAC) - QML-V qualified	No	100	–	5962-0724701VXA	Analog to digital converters	192	GEM	BGA	–
					DAC5670MGEM/EM		192	GEM	BGA	–
DAC5675A-SP	Class V, 14-bit, 400-MSPS digital-to-analog converter	No	150	109	5962-0720401VXC	Analog to digital converters	52	HFG	CFP	–
					5962-0720402VXC		52	HFG	CFP	EAR99
					DAC5675AHFG/EM		52	HFG	CFP	EAR99
LM98640QML-SP	Dual-channel, 14-bit, 40-MSPS analog front end with LVDS output	Yes	100	120	5962R1820301VXC	Analog to digital converters	68	NBB	CQFP	–
					LM98640W-MLS		68	NBB	CQFP	EAR99
					LM98640W-MPR		68	NBB	CQFP	EAR99

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Clock + Timing

Generic Part Number	Description	RHA Version Available	Max TID (krad)[1]	Max SEL (MeV-cm^2/mg)[1]	Orderable Material	Subfamily	Pin	PKG	PKG Group	ECCN[2]
LMX2615-SP	Space grade 40-MHz to 15-GHz wideband synthesizer with phase synchronization and JESD204B support	No	100	120	LMX2615W-MLS	RF PLL & synthesizer	64	HBD	CFP	EAR99
					LMX2615W-MPR		64	HBC	CFP	EAR99
CDCLVP111-SP	1:10 high-speed clock buffer with selectable input clock driver	No	75	69	5962-1620701VXC	Clock buffer	36	HFG	CFP	EAR99
					CDCLVP111HFG/EM		36	HFG	CFP	EAR99
CDCM7005-SP	3.3-V high-performance rad-tolerant class V, clock synchronizer and jitter cleaner	No	50	–	5962-0723001VXC	Clock jitter cleaner	52	HFG	CFP	EAR99
					CDCM7005HFG/EM		52	HFG	CFP	EAR99
SE555-SP	QML class V precision timer	No	25	–	5962-9855501VPA	Timer	8	JG	CDIP	EAR99

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Embedded Processing + Memory

Generic Part Number	Description	RHA Version Available	Max TID (krad)[1]	MAX SEL (MeV-cm^2/mg)[1]	Orderable Material	Subfamily	Pin	PKG	PKG Group	ECCN[2]
MSP430FR5969-SP	Radiation-hardened mixed-dignal microcontroller	Yes	50	72	M4FR5969SPHPT-MLS	MSP430™ FRxx FRAM Products	48	PHP	HTQFP	EAR99
					M4FR5969SRGZT-MLS		48	RGZ	VQFN	EAR99
SMJ320C6701-SP	Floating-point digital signal processor	No	100	89	5962-9866101VXA	C6000™ DSPs	429	GLP	CFCBGA	–
					5962-9866102VXA		429	GLP	CFCBGA	–
					SMV320C6701GLP/EM		429	GLP	CFCBGA	–
					5962-9866102VYC		429	ZMB	FCBGA	–
SMV320C6727B-SP	Floating-point digital signal processor	No	100	–	SMV320C6727BHFH/EM	C6000 DSPs	256	HFH	CFP	–
					SMV320C6727BHFHM		256	HFH	CFP	–
					SMV320C6727BHFHW		256	HFH	CFP	–
SMV512K32-SP	16-MB radiation-hardened SRAM	No	300	100	5962-1123701VXC	Static RAM	76	HFG	CFP	–
					SMV512K32HFG/EM		76	HFG	CFP	–

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Space-Grade Parts List

Interface

Generic Part Number	Description	RHA Version Available	Max TID (krad)[1]	MAX SEL (MeV-cm²/mg)[1]	Orderable Material	Subfamily	Pin	PKG	PKG Group	ECCN[2]
AM26LS33A-SP	QML class V quadruple differential line receivers	No	25	–	5962-7802007VEA	Differential driver/ receiver (non RS-422/485)	16	J	CDIP	EAR99
DS16F95QML-SP	EIA-485/EIA-422A differential bus transceivers	Yes	300	Bipolar	DS16F95 MDR	RS-232/422/485 products	0	Y	DIESALE	EAR99
					5962F8961501VHA		10	NAD	CLGA	EAR99
					DS16F95WFQMLV		10	NAD	CLGA	EAR99
DS26F31MQML-SP	Quad high-speed differential line drivers	Yes	300	Bipolar	5962F7802302VFA	Differential driver/ receiver (non RS-422/485)	16	NAD	CLGA	EAR99
					DS26F31MWFQMLV		16	NAD	CLGA	EAR99
DS26F32MQML-SP	Quad differential line receivers	Yes	100	Bipolar	5962R7802005VFA	Differential driver/ receiver (non RS-422/485)	16	NAD	CLGA	EAR99
					DS26F32MWRQMLV		16	NAD	CLGA	EAR99
					5962R7802005VEA		16	NFE	CDIP	EAR99
					DS26F32MJRQMLV		16	NFE	CDIP	EAR99
DS90C031QML-SP	LVDS quad CMOS differential line driver	Yes	100	120	DS90C031 MDR	LVDS/M-LVDS/ECL/ CML products	0	Y	DIESALE	–
					5962R9583301VZA		16	NAC	CLGA	–
					DS90C031WGRQMLV		16	NAC	CLGA	–
					5962-9583301VFA		16	NAD	CLGA	–
					5962R9583301VFA		16	NAD	CLGA	–
					DS90C031W-QMLV		16	NAD	CLGA	–
					DS90C031WRQMLV		16	NAD	CLGA	–
DS90C032QML-SP	LVDS quad CMOS differential line receiver	Yes	50	120	DS90C032 MDR	LVDS/M-LVDS/ECL/ CML products	0	Y	DIESALE	EAR99
					5962L9583401VZA		16	NAC	CLGA	EAR99
					DS90C032WGLQMLV		16	NAC	CLGA	EAR99
					5962-9583401VFA		16	NAD	CLGA	EAR99
					5962L9583401VFA		16	NAD	CLGA	EAR99
					DS90C032W-QMLV		16	NAD	CLGA	EAR99
					DS90C032WLQMLV		16	NAD	CLGA	EAR99
DS90LV031AQML-SP	3-V LVDS quad CMOS differential line driver	No	–	–	DS90LV031AWGMLS	LVDS/M-LVDS/ECL/ CML products	16	NAC	CLGA	EAR99
DS90LV032AQML-SP	3-V LVDS quad CMOS differential line receiver	No	–	–	DS90LV032AW-MLS	LVDS/M-LVDS/ECL/ CML products	16	NAD	CLGA	EAR99
DS96F174MQML-SP	EIA-485/EIA-422 quad differential drivers	No	–	Bipolar	5962-9076502VEA	RS-232/422/485 products	16	NFE	CDIP	EAR99
					DS96F174MJ-QMLV		16	NFE	CDIP	EAR99
DS96F175MQML-SP	EIA-485/EIA-422 quad differential receivers	No	–	Bipolar	5962-9076601VEA	RS-232/422/485 Products	16	NFE	CDIP	EAR99
					DS96F175MJ-QMLV		16	NFE	CDIP	EAR99
SN55HVD233-SP	Radiation hardness assured (RHA) 3.3-V CAN transceiver with standby mode, loop-back	Yes	50	86	5962L1420901VXC	CAN products	8	HKX	CFP	EAR99
					HVD233HKX/EM		8	HKX	CFP	EAR99
SN55LVCP22-SP	2×2 crosspoint switch: LVDS outputs	No	100	–	5962-1124201VFA	LVDS/M-LVDS/ECL/ CML products	16	W	CFP	–
					SN55LVCP22W/EM		16	W	CFP	EAR99
SN55LVDS31-SP	Quad LVDS transmitter	No	150	110	5962-9762101VFA	LVDS/M-LVDS/ECL/ CML products	16	W	CFP	EAR99
SN55LVDS32-SP	Quad LVDS receiver	No	100	110	5962-9762201VFA	LVDS/M-LVDS/ECL/ CML products	16	W	CFP	EAR99
SN55LVDS33-SP	High-speed differential receiver	No	100	90	5962-0724801VFA	LVDS/M-LVDS/ECL/ CML products	16	W	CFP	EAR99
TLK2711-SP	Radiation tolerant 1.6-Gbps to 2.5-Gbps class V transceiver	No	25	67.9	5962-0522101VXC	Serializers, deserializers	68	HFG	CFP	EAR99
					TLK2711HFG/EM		68	HFG	CFP	EAR99

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Space-Grade Parts List

Power Management

Generic Part Number	Description	RHA Version Available	Max TID (krad)[1]	MAX SEL (MeV-cm^2/mg)[1]	Orderable Material	Subfamily	Pin	PKG	PKG Group	ECCN[2]
LM117HVQML-SP	Space-grade 60-V input 1.5-A adjustable output linear regulator / LDO	Yes	100	Bipolar	5962R0722901V9A	Linear regulators (LDOs)	0	Y	DIESALE	EAR99
					5962R0722961V9A		0	Y	DIESALE	EAR99
					LM117HVH MDE		0	Y	DIESALE	EAR99
					LM117HVH MDR		0	Y	DIESALE	EAR99
					5962R0722902VZA		16	NAC	CLGA	EAR99
					5962R0722962VZA		16	NAC	CLGA	EAR99
					LM117HVGWRLQMLV		16	NAC	CLGA	EAR99
					LM117HVGWRQMLV		16	NAC	CLGA	EAR99
					5962R0722901VXA		3	NDT	TO-CAN	EAR99
					5962R0722902VXA		3	NDT	TO-CAN	EAR99
					5962R0722961VXA		3	NDT	TO-CAN	EAR99
					LM117HVHRLQMLV		3	NDT	TO-CAN	EAR99
					LM117HVHRQMLV		3	NDT	TO-CAN	EAR99
LM117QML-SP	Space grade 1.5-A adjustable output linear regulator / LDO	Yes	100	Bipolar	5962R9951703V9A	Linear regulators (LDOs)	0	Y	DIESALE	EAR99
					5962R9951705V9A		0	Y	DIESALE	EAR99
					LM117H MDE		0	Y	DIESALE	EAR99
					LM117H MDR		0	Y	DIESALE	EAR99
					5962R9951706VZA		16	NAC	CLGA	EAR99
					5962R9951707VZA		16	NAC	CLGA	EAR99
					LM117GWRLQMLV		16	NAC	CLGA	EAR99
					LM117GWRQMLV		16	NAC	CLGA	EAR99
					5962R9951704VYA		2	K	TO-CAN	EAR99
					LM117KRQMLV		2	K	TO-CAN	EAR99
					5962R9951703VXA		3	NDT	TO-CAN	EAR99
					5962R9951705VXA		3	NDT	TO-CAN	EAR99
					LM117HRLQMLV		3	NDT	TO-CAN	EAR99
					LM117HRQMLV		3	NDT	TO-CAN	EAR99
LM136A-2.5QML-SP	2.5V reference diode	Yes	100	Bipolar	5962R0050101V9A	Voltage reference products	0	Y	DIESALE	EAR99
					5962R0050102V9A		0	Y	DIESALE	EAR99
					LM136-2.5 MDE		0	Y	DIESALE	EAR99
					LM136-2.5 MDR		0	Y	DIESALE	EAR99
					LM136-2.5 MDS		0	Y	DIESALE	EAR99
					5962R0050101VXA		3	NDV	TO-CAN	EAR99
					5962R0050102VXA		3	NDV	TO-CAN	EAR99
					LM136AH-2.5RLQV		3	NDV	TO-CAN	EAR99
					LM136AH-2.5RQV		3	NDV	TO-CAN	EAR99
LM137QML-SP	Space-grade 1.5-A adjustable output linear regulator / LDO	Yes	30	Bipolar	5962P9951708VXA	Linear regulators (LDOs)	3	NDT	TO-CAN	EAR99
					LM137H1PQMLV		3	NDT	TO-CAN	EAR99
LM185-1.2QML-SP	Micropower voltage reference diode	Yes	100	Bipolar	5962R8759461VXA	Voltage reference products	2	NDU	TO-CAN	EAR99
					LM185H-1.2RLQV		2	NDU	TO-CAN	EAR99
LM185-2.5QML-SP	Micropower voltage reference diode	No	–	Bipolar	5962-8759406VXA	Voltage reference products	2	NDU	TO-CAN	EAR99
					LM185BYH2.5-QV		2	NDU	TO-CAN	EAR99
LM2940QML-SP	Space-grade 1-A 5-V output linear regulator / LDO	Yes	100	Bipolar	5962R8958702V9A	Linear regulators (LDOs)	0	Y	DIESALE	EAR99
					LM2940-5.0 MDE		0	Y	DIESALE	EAR99
					5962R8958704VXA		16	NAC	CLGA	EAR99
					LM2940GW5.0RLQV		16	NAC	CLGA	EAR99

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Space-Grade Parts List

Power Management (cont'd)

Generic Part Number	Description	RHA Version Available	Max TID (krad)[1]	MAX SEL (MeV-cm^2/mg)[1]	Orderable Material	Subfamily	Pin	PKG	PKG Group	ECCN[2]
LM2941QML-SP	1-A low dropout adjustable regulator	Yes	100	Bipolar	5962R9166702V9A	Linear regulators (LDOs)	0	Y	DIESALE	EAR99
					LM2941 MDE		0	Y	DIESALE	EAR99
					5962-9166703VYA		16	NAC	CLGA	EAR99
					5962R9166704VYA		16	NAC	CLGA	EAR99
					LM2941GW-QMLV		16	NAC	CLGA	EAR99
					LM2941GWRLQMLV		16	NAC	CLGA	EAR99
LM4050QML-SP	Precision micropower shunt voltage reference	Yes	100	100	5962R0923561VZA	Voltage reference products	10	NAC	CLGA	EAR99
					5962R0923562VZA		10	NAC	CLGA	EAR99
					LM4050WG2.5-MPR		10	NAC	CLGA	EAR99
					LM4050WG2.5RLQV		10	NAC	CLGA	EAR99
					LM4050WG5.0RLQV		10	NAC	CLGA	EAR99
LP2953QML-SP	Adjustable micropower low-dropout voltage regulator	No	–	Bipolar	LP2953 MDS	Linear regulators (LDOs)	0	Y	DIESALE	EAR99
					5962-9233602VXA		16	NAC	CLGA	EAR99
					LP2953AMGW-QMLV		16	NAC	CLGA	EAR99
TL1431-SP	Precision adjustable (programmable) shunt reference	Yes	150	86	5962R9962001VHA	Voltage reference products	10	U	CFP	EAR99
					5962-9962001VPA		8	JG	CDIP	EAR99
					5962R9962001VPA		8	JG	CDIP	EAR99
					TL1431VTDB1		0	TD	DIESALE	EAR99
TPS50601A-SP	Radiation hardness assured (RHA) 3.0-V to 7-V input, 6-A synchronous step-down converter	Yes	100	75	5962R1022102V9A	Non-isolated DC/DC switching regulators	0	KGD	DIESALE	EAR99
					5962R1022102VSC		20	HKH	CFP	EAR99
					5962-1022102VSC		20	HKH	CFP	EAR99
					TPS50601AHKH/EM		20	HKH	CFP	EAR99
TPS50601-SP	Radiation hardened 1.6-V to 6.3-V input, 6-A synchronous step-down converter	Yes	100	85	5962R1022101V9A	Non-isolated DC/DC switching regulators	0	KGD	DIESALE	EAR99
					5962-1022101VSC		20	HKH	CFP	EAR99
					5962R1022101VSC		20	HKH	CFP	EAR99
					TPS50601HKH/EM		20	HKH	CFP	EAR99
					TPS50601MHKHV		20	HKH	CFP	EAR99
					TPS50601VTDC1		0	TD	DIESALE	EAR99
TPS50602-SP	Radiation Hardness Assured (RHA) 3-V to 7-V input, 12A single, 6A dual synchronous buck converter	Yes	100	75	5962R1820701VXC	Non-isolated DC/ DC switching regulators	64	HFG	CFP	EAR99
					TPS50602HFG/EM		64	HFG	CFP	EAR99
TPS7A4501-SP	Wide Vin low-dropout voltage regulator	Yes	100	86	5962-1222402V9A	Linear regulators (LDOs)	0	KGD	DIESALE	EAR99
					5962R1222403V9A		0	KGD	DIESALE	EAR99
					5962R1222403VXC		10	HKU	CFP	EAR99
					TPS7A4501HKU/EM		10	HKU	CFP	EAR99
					5962-1222402VHA		10	U	CFP	EAR99
					TPS7A4501U/EM		10	U	CFP	EAR99
TPS7H1101A-SP	1.5-V to 7-V input, 3-A, radiation-hardened LDO regulator	Yes	100	85	5962R1320202V9A	Linear regulators (LDOs)	0	KGD	DIESALE	EAR99
					5962R1320202VXC		16	HKR	CFP	EAR99
					TPS7H1101HKR/EM		16	HKR	CFP	EAR99
TPS7H2201-SP	Radiation hardness assured 1.5-V to 7-V, 6-A load switch	Yes	100	75	5962-1722001VXC	Load switches	16	HKR	CFP	EAR99
					5962R1722001VXC		16	HKR	CFP	EAR99
					TPS7H2201HKR/EM		16	HKR	CFP	EAR99
TPS7H3301-SP	Radiation hardened 3-Amp sink/source DDR termination regulator w/ built-in VREF	Yes	100	65	5962-1422801VXC	DDR memory power products	16	HKR	CFP	EAR99
					5962R1422801VXC		16	HKR	CFP	EAR99
					TPS7H3301HKR/EM		16	HKR	CFP	EAR99
UC1525B-SP	Regulating pulse width modulators	No	40	Bipolar	5962-8951105VEA	Offline and isolated DC/DC controller and converter	16	J	CDIP	EAR99
					5962-8951105V2A		20	FK	LCCC	EAR99
					5962-8951106V2A		20	FK	LCCC	EAR99

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Space-Grade Parts List

Power Management (cont'd)

Generic Part Number	Description	RHA Version Available	Max TID (krad)[1]	MAX SEL (MeV-cm^2/mg)[1]	Orderable Material	Subfamily	Pin	PKG	PKG Group	ECCN[2]
UC1611-SP	Quad Schottky diode array	No	–	Bipolar	5962-9053801V2A	Power management special function products	20	FK	LCCC	EAR99
					5962-9053801VPA		8	JG	CDIP	EAR99
UC1625-SP	Space-rated brushless DC motor controller	No	40	Bipolar	5962-9168902VYA	Motion/Motor control	28	JDJ	CDIP-SB	EAR99
UC1637-SP	Switched-mode controller for DC motor drive	No	30	Bipolar	5962-8995701VSA	Motion/Motor control	20	W	CFP	EAR99
UC1705-SP	Complementary high-speed power driver with internal regulator	No	–	Bipolar	5962-9579801VPA	MOSFET and IGBT gate driver	8	JG	CDIP	EAR99
UC1707-SP	Complementary high-speed power drivers	No	50	Bipolar	5962-8761901VEA	MOSFET and IGBT gate driver	16	J	CDIP	EAR99
					5962-8761903VEA		16	J	CDIP	EAR99
					5962-8761903VFA		16	W	CFP	EAR99
					5962-8761901V2A		20	FK	LCCC	EAR99
					5962-8761903V2A		20	FK	LCCC	EAR99
UC1708-SP	Non-inverting high-speed power drivers	No	–	Bipolar	5962-0051401VEA	MOSFET and IGBT gate driver	16	J	CDIP	EAR99
					5962-0051401V2A		20	FK	LCCC	EAR99
					5962-0051401VPA		8	JG	CDIP	EAR99
UC1709-SP	Inverting high-speed MOSFET drivers	No	–	Bipolar	5962-0151201VPA	MOSFET and IGBT gate driver	8	JG	CDIP	EAR99
UC1710-SP	Complementary high-current MOSFET driver	No	–	Bipolar	5962-0152001VPA	MOSFET and IGBT gate driver	8	JG	CDIP	EAR99
UC1715-SP	Complementary switch FET drivers	No	–	Bipolar	5962-0052102VFA	MOSFET and IGBT gate driver	16	W	CFP	EAR99
UC1823A-SP	High-speed PWM controller	No	–	Bipolar	5962-8990502VEA	Offline and isolated DC/DC controller and converter	16	J	CDIP	EAR99
UC1825B-SP	High-speed PWM controller	Yes	100	Bipolar	5962R8768106VYC	Offline and isolated DC/DC controller and converter	16	HKT	CFP	EAR99
UC1825A-SP	High-speed PWM controller	Yes	40	Bipolar	5962P8768105VYC	Offline and isolated DC/DC controller and converter	16	HKT	CFP	EAR99
					5962-8768102VEA		16	J	CDIP	EAR99
					5962-8768105VEA		16	J	CDIP	EAR99
					5962P8768105VEA		16	J	CDIP	EAR99
					5962-8768102V2A		20	FK	LCCC	EAR99
					UC1825AVTD2		0	TD	LCCC	EAR99
UC1825-SP	High-speed PWM controller	No	40	Bipolar	5962-8768101VEA	Offline and isolated DC/DC controller and converter	16	J	CDIP	EAR99
					5962-8768104VEA		16	J	CDIP	EAR99
					5962-8768101V2A		20	FK	LCCC	EAR99
					5962-8768104V2A		20	FK	LCCC	EAR99
					UC1825VTD2		0	TD	DIESALE	EAR99
UC1832-SP	Precision low-dropout linear controllers	No	–	Bipolar	5962-9326501VCA	Linear regulators (LDOs)	14	J	CDIP	EAR99
					5962-9326501V2A		20	FK	LCCC	EAR99
UC1834-SP	High-efficiency linear regulator	No	–	Bipolar	5962-8774201VEA	Linear regulators (LDOs)	16	J	CDIP	EAR99
					5962-8774201V2A		20	FK	LCCC	EAR99
					UC1834VTD2		0	TD	DIESALE	EAR99
UC1842A-SP	Current-mode PWM controller	No	–	Bipolar	5962-8670405VPA	Offline and isolated DC/DC controller and converter	8	JG	CDIP	EAR99
UC1842-SP	Current-mode PWM controller	No	–	Bipolar	5962-8670401VPA	Offline and isolated DC/DC controller and converter	8	JG	CDIP	EAR99
UC1843B-SP	Current-mode PWM controller	Yes	100	Bipolar	5962R8670412VYC	Offline and isolated DC/DC controller and converter	10	HKU	CFP	EAR99

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Space-Grade Parts List

Power Management (cont'd)

Generic Part Number	Description	RHA Version Available	Max TID (krad)[1]	MAX SEL (MeV-cm^2/mg)[1]	Orderable Material	Subfamily	Pin	PKG	PKG Group	ECCN[2]
UC1843A-SP	Current-mode PWM controller	Yes	40	Bipolar	5962P8670409VYC	Offline and isolated DC/DC controller and converter	10	HKU	CFP	EAR99
					5962-8670406VXA		20	FK	LCCC	EAR99
					5962-8670406VPA		8	JG	CDIP	EAR99
					5962-8670409VPA		8	JG	CDIP	EAR99
					5962P8670409VPA		8	JG	CDIP	EAR99
					UC1843AVTD2		0	TD	DIESALE	EAR99
UC1843-SP	QML class V current mode PWM controller	No	40	Bipolar	5962-8670410V9A	Offline and isolated DC/DC controller and converter	0	KGD	DIESALE	EAR99
					5962-8670402VXA		20	FK	LCCC	EAR99
					5962-8670402VPA		8	JG	CDIP	EAR99
					5962-8670410VPA		8	JG	CDIP	EAR99
UC1844A-SP	Current-mode PWM controller	No	–	Bipolar	5962-8670407VPA	Offline and isolated DC/DC controller and converter	8	JG	CDIP	EAR99
UC1844-SP	Current-mode PWM controller	No	–	Bipolar	5962-8670403VXA	Offline and isolated DC/DC controller and converter	20	FK	LCCC	EAR99
UC1845A-SP	Current-mode PWM controller	Yes	–	Bipolar	5962P8670411VYC	Offline and isolated DC/DC controller and converter	10	HKU	CFP	EAR99
					5962-8670408VXA		20	FK	LCCC	EAR99
					5962-8670408VPA		8	JG	CDIP	EAR99
					5962P8670411VPA		8	JG	CDIP	EAR99
UC1845-SP	Current-mode PWM controller	No	–	Bipolar	5962-8670404VXA	Offline and isolated DC/DC controller and converter	20	FK	LCCC	EAR99
					5962-8670404VPA		8	JG	CDIP	EAR99
UC1846-SP	Current-mode PWM controller	Yes	40	Bipolar	5962-8680603V9A	Offline and isolated DC/DC controller and converter	0	KGD	DIESALE	EAR99
					5962-8680601VEA		16	J	CDIP	EAR99
					5962-8680603VEA		16	J	CDIP	EAR99
					5962P8680603VEA		16	J	CDIP	EAR99
					5962-8680603VFA		16	W	CFP	EAR99
					5962P8680603VFA		16	W	CFP	EAR99
					5962-8680601V2A		20	FK	LCCC	EAR99
					5962-8680603V2A		20	FK	LCCC	EAR99
					UC1846VTD2		0	TD	DIESALE	EAR99
UC1856-SP	UC1856-SP improved current-mode PWM controller	No	–	Bipolar	5962-9453001VXC	Offline and isolated DC/DC controller and converter	16	HKT	CFP	EAR99
					5962-9453001VEA		16	J	CDIP	EAR99
UC1863-SP	Resonant-mode power supply controllers	No	–	Bipolar	5962-9203103V2A	Offline and isolated DC/DC controller and converter	20	FK	LCCC	EAR99
UC1875-SP	Phase shift resonant controller	No	50	Bipolar	5962-9455501VRA	Offline and isolated DC/DC controller and converter	20	J	CDIP	EAR99
					5962-9455502VRA		20	J	CDIP	EAR99
					5962-9455502VKA		24	W	CFP	EAR99
UC1901-SP	Isolated feedback generator	No	–	Bipolar	5962-8944101VCA	Offline and isolated DC/DC controller and converter	14	J	CDIP	EAR99
UC19432-SP	Precision analog controller	No	30	Bipolar	5962-0923301VPA	Offline and isolated DC/DC controller and converter	8	JG	CDIP	EAR99
UCC1806-SP	Low-power, dual-output, current-mode PWM controller	No	–	–	5962-9457501VEA	Offline and isolated DC/DC controller and converter	16	J	CDIP	EAR99
					5962-9457501V2A		20	FK	LCCC	EAR99

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Space-Grade Parts List

Sensing

Generic Part Number	Description	RHA Version Available	Max TID (krad)	MAX SEL (MeV-cm^2/mg)	Orderable Material	Subfamily	Pin	PKG	PKG Group	ECCN[1]
INA901-SP	Radiation hardened, -15 V to 80 V common mode, unidirectional current-shunt monitor	Yes	100	93	5962-1821001VXC	Current sense amplifier	8	HKX	CFP	EAR99
					5962R1821001VXC		8	HKX	CFP	EAR99
					INA901HKX/EM		8	HKX	CFP	EAR99
TMP461-SP	Radiation hardness assured (RHA) high-accuracy remote and local temperature sensor	Yes	100	76	5962-1721801VXC	Temperature sensor	10	HKU	CFP	EAR99
					5962R1721801VXC		10	HKU	CFP	EAR99
					TMP461HKU/EM		10	HKU	CFP	EAR99

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Logic

Generic Part Number	Description	RHA Version Available	Max TID (krad)[1]	MAX SEL (MeV-cm^2/mg)[1]	Orderable Material	Subfamily	Pin	PKG	PKG Group	ECCN[2]
SN54AC00-SP	Quadruple 2-input positive-NAND gates	Yes	100	–	5962R8754903V9A	Gate products	0	KGD	DIESALE	–
					5962-8754903VCA		14	J	CDIP	EAR99
					5962R8754903VCA		14	J	CDIP	–
					5962-8754903VDA		14	W	CFP	EAR99
					5962R8754903VDA		14	W	CFP	–
					SN54AC00VTD2		0	TD	DIESALE	EAR99
SN54AC02-SP	Quadruple 2-input positive-NOR gates	No	50	–	5962-8761203VCA	Gate products	14	J	CDIP	EAR99
					5962-8761203VDA		14	W	CFP	EAR99
					SN54AC02VTD2		0	TD	DIESALE	EAR99
SN54AC14-SP	Hex Schmitt-trigger inverters	No	50	–	5962-8762401VCA	Buffer drivers	14	J	CDIP	EAR99
					5962-8762402VCA		14	J	CDIP	EAR99
					5962-8762401VDA		14	W	CFP	EAR99
					5962-8762402VDA		14	W	CFP	EAR99
SN54AC244-SP	Octal buffers/drivers with 3-state outputs	No	–	–	5962-8755201VRA	Buffer drivers	20	J	CDIP	EAR99
					5962-8755201VSA		20	W	CFP	EAR99
SN54AC245-SP	Octal bus transceivers with 3-state outputs	No	–	–	5962-8775801VSA	Transceiver	20	W	CFP	EAR99
SN54AC373-SP	Octal D-type transparent latches with 3-state outputs	No	–	–	5962-8755501VSA	Flip-flop/Latch/ Registers	20	W	CFP	EAR99
SN54AC74-SP	Dual positive-edge-triggered D-type flip-flops with clear and preset	No	–	–	5962-8852001VDA	Flip-flop/Latch/ Registers	14	W	CFP	EAR99
SN54ACT04-SP	Hex Inverters	No	–	–	5962-8973401VCA	Buffer drivers	14	J	CDIP	EAR99
					5962-8973401VDA		14	W	CFP	EAR99
SN54ACT244-SP	Octal buffers/drivers with 3-state outputs	No	–	–	5962-8776001SRA	Buffer drivers	20	J	CDIP	EAR99
					5962-8776001SSA		20	W	CFP	EAR99
SN54ACT245-SP	Octal bus transceivers with 3-state outputs	No	–	–	5962-8766301SRA	Transceiver	20	J	CDIP	EAR99
					5962-8766301SSA		20	W	CFP	EAR99
SN54ACT373-SP	Octal D-type transparent latches with 3-state outputs	No	–	–	5962-8755601VRA	Flip-flop/Latch/ Registers	20	J	CDIP	EAR99
SN54ACT374-SP	Octal D-type edge-triggered flip-flops with 3-state outputs	No	–	–	5962-8763101VSA	Flip-flop/Latch/ Registers	20	W	CFP	EAR99
SN54AHC244-SP	Octal buffers/drivers with 3-state outputs	No	–	–	5962-9678201VRA	Buffer drivers	20	J	CDIP	EAR99
					5962-9678201VSA		20	W	CFP	EAR99
SN54AHC245-SP	Octal bus transceivers with 3-state outputs	No	–	–	5962-9681801VSA	Transceiver	20	W	CFP	EAR99

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Space-Grade Parts List

Logic (cont'd)

Generic Part Number	Description	RHA Version Available	Max TID (krad)[1]	MAX SEL (MeV-cm^2/mg)[1]	Orderable Material	Subfamily	Pin	PKG	PKG Group	ECCN[2]
SN54AHCT08-SP	Quadruple 2-input positive-AND gates	No	–	–	5962-9682101VDA	Gate products	14	W	CFP	EAR99
SN54AHCT14-SP	Hex Schmitt-trigger inverters	No	–	–	5962-9680101VCA	Buffer drivers	14	J	CDIP	EAR99
					5962-9680101VDA		14	W	CFP	EAR99
SN54ALS244C-SP	Octal buffers and line drivers with 3-state outputs	No	–	–	5962-8683901VRA	Buffer drivers	20	J	CDIP	EAR99
					5962-8683901VSA		20	W	CFP	EAR99
SN54HC00-SP	Quadruple 2-input positive-NAND gates	No	–	–	5962-8403701VCA	Gate products	14	J	CDIP	EAR99
					5962-8403701VDA		14	W	CFP	EAR99
SN54HC02-SP	Quadruple 2-input positive-NOR gates	No	–	–	5962-8404101VCA	Gate products	14	J	CDIP	EAR99
SN54HC04-SP	Hex inverters	No	–	–	5962-8409801VCA	Buffer drivers	14	J	CDIP	EAR99
					5962-8409801VDA		14	W	CFP	EAR99
					SN54HC04VTDE2		0	TD	DIESALE	EAR99
SN54HC08-SP	Quadruple 2-input positive-AND gates	No	–	–	5962-8404701VCA	Gate products	14	J	CDIP	EAR99
					5962-8404701VDA		14	W	CFP	EAR99
					SN54HC08VTDF2		0	TD	DIESALE	EAR99
SN54HC109-SP	Dual J-K positive edge-triggered flip-flops with clear and preset	No	–	–	5962-8415001VFA	Flip-flop/Latch/ Registers	16	W	CFP	EAR99
SN54HC10-SP	Triple 3-input positive-NAND gates	No	–	–	5962-8403801VCA	Gate products	14	J	CDIP	EAR99
SN54HC11-SP	Triple 3-input positive-AND gates	No	–	–	5962-8404801VCA	Gate products	14	J	CDIP	EAR99
SN54HC132-SP	Quadruple positive-NAND gates with Schmitt-trigger inputs	No	–	–	5962-8984502VCA	Gate products	14	J	CDIP	EAR99
					5962-8984502VDA		14	W	CFP	EAR99
SN54HC138-SP	3-line to 8-line decoders/ demultiplexers	No	–	–	5962-8406201VEA	Decoders/ Encoders/ Multiplexers	16	J	CDIP	EAR99
					5962-8406201VFA		16	W	CFP	EAR99
SN54HC139-SP	Dual 2-line to 4-line decoders/demultiplexers	No	–	–	5962-8409201VFA	Decoders/ Encoders/ Multiplexers	16	W	CFP	EAR99
SN54HC14-SP	Hex Schmitt-trigger inverters	No	–	–	5962-8409101VCA	Buffer drivers	14	J	CDIP	EAR99
					5962-8409101VDA		14	W	CFP	EAR99
SN54HC153-SP	Dual 4-line to 1-line data selectors/multiplexers	No	–	–	5962-8409301VEA	Decoders/ Encoders/ Multiplexers	16	J	CDIP	EAR99
					5962-8409301VFA		16	W	CFP	EAR99
SN54HC157-SP	Quadruple 2-line to 1-line data selectors/multiplexers	No	–	–	5962-8606101VEA	Decoders/ Encoders/ Multiplexers	16	J	CDIP	EAR99
SN54HC161-SP	Synchronous 4-bit binary counters	No	–	–	5962-8407501VEA	Counter/Arithmetic/ Parity function products	16	J	CDIP	EAR99
SN54HC164-SP	8-bit parallel-out serial shift registers	No	–	–	5962-8416201VCA	Flip-flop/Latch/ Registers	14	J	CDIP	EAR99
					5962-8416201VDA		14	W	CFP	EAR99
SN54HC166-SP	Parallel-load 8-bit shift registers	No	–	–	5962-9050101VEA	Flip-flop/Latch/ Registers	16	J	CDIP	EAR99
SN54HC20-SP	Dual 4-input positive-NAND gates	No	–	–	5962-8403901VCA	Gate products	14	J	CDIP	EAR99
SN54HC244-SP	Octal buffers and line drivers with 3-state outputs	No	–	–	5962-8409601VRA	Buffer drivers	20	J	CDIP	EAR99
					5962-8409601VSA		20	W	CFP	EAR99
SN54HC245-SP	Octal bus transceivers with 3-state outputs	No	–	–	5962-8408501VRA	Transceiver	20	J	CDIP	EAR99
					5962-8408501VSA		20	W	CFP	EAR99
SN54HC273-SP	Octal D-type flip-flops with clear	No	–	–	5962-8409901VRA	Flip-flop/Latch/ Registers	20	J	CDIP	EAR99
					5962-8409901VSA		20	W	CFP	EAR99
SN54HC32-SP	Quadruple 2-input positive-OR gates	No	–	–	5962-8404501VCA	Gate products	14	J	CDIP	EAR99
					5962-8404501VDA		14	W	CFP	EAR99

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Space-Grade Parts List

Logic (cont'd)

Generic Part Number	Description	RHA Version Available	Max TID (krad)[1]	MAX SEL (MeV-cm^2/mg)[1]	Orderable Material	Subfamily	Pin	PKG	PKG Group	ECCN[2]
SN54HC373-SP	Octal D-type transparent latches with 3-state outputs	No	–	–	5962-8407201VRA	Flip-flop/Latch/ Registers	20	J	CDIP	EAR99
					5962-8407201VSA		20	W	CFP	EAR99
SN54HC374-SP	Octal D-type edge-triggered flip-flops with 3-state outputs	No	–	–	5962-8407101VRA	Flip-flop/Latch/ Registers	20	J	CDIP	EAR99
					5962-8407101VSA		20	W	CFP	EAR99
SN54HC573A-SP	Octal D-type transparent latches with 3-state outputs	No	–	–	5962-8512801VRA	Flip-flop/Latch/ Registers	20	J	CDIP	EAR99
SN54HC595-SP	8-bit shift registers with 3-state output registers	No	–	–	5962-8681601VEA	Flip-flop/Latch/ Registers	16	J	CDIP	EAR99
					5962-8681601VFA		16	W	CFP	EAR99
SN54HC74-SP	Dual D-type positive edge-triggered flip-flops with clear and preset	No	–	–	5962-8405601VCA	Flip-flop/Latch/ Registers	14	J	CDIP	EAR99
					5962-8405601VDA		14	W	CFP	EAR99
SN54HCT04-SP	Hex inverters	No	–	–	5962-8974701VCA	Buffer drivers	14	J	CDIP	EAR99
					5962-8974701VDA		14	W	CFP	EAR99
SN54HCT244-SP	Octal buffers and line drivers with 3-state outputs	No	–	–	5962-8513001VRA	Buffer drivers	20	J	CDIP	EAR99
					5962-8513001VSA		20	W	CFP	EAR99
SN54HCT245-SP	Octal bus transceivers with 3-state outputs	No	–	–	5962-8550601VRA	Transceiver	20	J	CDIP	EAR99
					5962-8550601VSA		20	W	CFP	EAR99
SN54HCT373-SP	Octal D-type transparent latches with 3-state outputs	No	–	–	5962-8686701VSA	Flip-flop/Latch/ Registers	20	W	CFP	EAR99
SN54LS123-SP	Retriggerable monostable multivibrators	No	–	–	5962-7603901VEA	Monostable multivibrator products	16	J	CDIP	EAR99
					5962-7603901VFA		16	W	CFP	EAR99
SN54LS145-SP	BCD-to-decimal decoders/ drivers	No	–	–	5962-8508401VEA	Decoders/ Encoders/ Multiplexers	16	J	CDIP	EAR99
SN54LS14-SP	Hex Schmitt-trigger inverters	No	–	–	5962-9665801VDA	Buffer drivers	14	W	CFP	EAR99
SN54LS161A-SP	Synchronous 4-bit counters	No	–	–	5962-7600801VEA	Counter/Arithmetic/ Parity function products	16	J	CDIP	EAR99
SN54LS165A-SP	Parallel-load 8-bit shift registers	No	–	–	5962-7700601VEA	Flip-flop/Latch/ Registers	16	J	CDIP	EAR99
					5962-7700601VFA		16	W	CFP	EAR99
SN54LS240-SP	Octal buffers and line drivers with 3-state outputs	No	–	–	5962-7801201VSA	Buffer drivers	20	W	CFP	EAR99
SN54LS245-SP	Octal bus transceivers with 3-state outputs	No	–	–	5962-8002101VSA	Transceiver	20	W	CFP	EAR99
SN54LS26-SP	Quadruple 2-input high-voltage interface positive-NAND gates	No	–	–	5962-7602001VDA	Gate products	14	W	CFP	EAR99
SN54LS273-SP	Octal D-type flip-flop with clear	No	–	–	5962-7801001VRA	Flip-flop/Latch/ Registers	20	J	CDIP	EAR99
SN54LS283-SP	4-bit binary full adders with fast carry	No	–	–	5962-7604301VEA	Counter/Arithmetic/ Parity function products	16	J	CDIP	EAR99
SN54LVC00A-SP	Quadruple 2-input positive-NAND gate	No	–	–	5962-9753301VDA	Gate products	14	W	CFP	EAR99
SN54LVC138A-SP	3-line to 8-line decoder/ demultiplexer	No	–	–	5962-9752601VFA	Decoders/ Encoders/ Multiplexers	16	W	CFP	EAR99
SN54LVC14A-SP	Hex Schmitt-trigger inverters	No	–	–	5962-9761501VCA	Buffer drivers	14	J	CDIP	EAR99
					5962-9761501VDA		14	W	CFP	EAR99
					5962-9761501V2A		20	FK	LCCC	EAR99
SN54LVC646A-SP	Rad-tolerant class V, octal bus transceiver and register with 3-state outputs	No	–	–	5962-9762601VKA	Transceiver	24	W	CFP	EAR99
SN54LVC74A-SP	Dual-positive edge-triggered D-type flip-flops with clear and preset	No	–	–	5962-9761601VDA	Flip-flop/Latch/ Registers	14	W	CFP	EAR99
SN54LVCH244A-SP	Octal buffer/driver with 3-state outputs	No	–	–	5962-9754201V2A	Buffer drivers	20	FK	LCCC	EAR99
					5962-9754201VSA		20	W	CFP	EAR99

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Space-Grade Parts List

Logic (cont'd)

Generic Part Number	Description	RHA Version Available	Max TID (krad)[1]	MAX SEL (MeV-cm^2/mg)[1]	Orderable Material	Subfamily	Pin	PKG	PKG Group	ECCN[2]
SN54LVCH245A-SP	Octal bus transceivers with 3-state outputs	No	–	–	5962-9754301V2A	Transceiver	20	FK	LCCC	EAR99
					5962-9754301VRA		20	J	CDIP	EAR99
					5962-9754301VSA		20	W	CFP	EAR99
SN54LVTH162244-SP	3.3-V ABT 16-bit buffers/ drivers with 3-state outputs	No	–	–	5962-9680901VXA	Buffer drivers	48	WD	CFP	EAR99
SN54LVTH162245-SP	3.3-V ABT 16-bit bus transceivers with 3-state outputs	No	–	–	5962-9678001VXA	Transceiver	48	WD	CFP	EAR99
SN54LVTH162373-SP	3.3-V ABT 16-bit transparent D-type latches with 3-state outputs	No	–	–	5962-9763801VXA	Flip-flop/Latch/ Registers	48	WD	CFP	EAR99
SN54LVTH162374-SP	3.3-V ABT 16-bit edge-triggered D-type flip-flops with 3-state outputs	No	–	–	5962-9854201VXA	Flip-flop/Latch/ Registers	48	WD	CFP	EAR99
SN54LVTH16244A-SP	3.3-V ABT 16-bit buffers/ drivers with 3-state outputs	No	–	–	5962-9668501VXA	Buffer drivers	48	WD	CFP	EAR99
SN54LVTH16245A-SP	3.3-V ABT 16-bit bus transceivers with 3-state outputs	No	–	–	5962-9668601VXA	Transceiver	48	WD	CFP	EAR99
SN54LVTH244A-SP	3.3-V ABT octal buffers/ drivers with 3-state outputs	No	–	–	5962-9584401V2A	Buffer drivers	20	FK	LCCC	EAR99
					5962-9584401VRA		20	J	CDIP	EAR99
					5962-9584401VSA		20	W	CFP	EAR99
SN54LVTH245A-SP	3.3-V ABT octal bus transceivers with 3-state outputs	No	–	–	5962-9564201V2A	Transceiver	20	FK	LCCC	EAR99
					5962-9564201VRA		20	J	CDIP	EAR99
					5962-9564201VSA		20	W	CFP	EAR99
SN54LVTH574-SP	3.3-V ABT octal edge-triggered D-type flip-flops with 3-state outputs	No	–	–	5962-9583201VSA	Flip-flop/Latch/ Registers	20	W	CFP	EAR99

1) Devices with "–" in the radiation data columns do not have updated detailed radiation data or reports

*2) ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please request from: **gtc_eccn-hts-naftateam@list.ti.com**.*

Space-Enhanced Plastic Parts List

Space-Enhanced Plastic Products

Generic Part Number	Description	Orderable Material	Subfamily	Pin	PKG	PKG Group	ECCN[1]
INA240-SEP	80-V, low-/high-side, zero-drift, current sense amp w/ enhanced PWM rejection in space-enhanced plastic package	INA240PMPWPSEP	Current sense amplifiers	8	PW	TSSOP	EAR99
		INA240PMPWTPSEP		8	PW	TSSOP	EAR99
		V62/18615-01XE		8	PW	TSSOP	EAR99
		V62/18615-01XE-T		8	PW	TSSOP	EAR99
SN55HVD233-SEP	3.3-V CAN transceiver in space-enhanced plastic package with standby mode	SN55HVD233MDPSEP	CAN	8	D	SOIC	EAR99
		SN55HVD233MDTPSEP		8	D	SOIC	EAR99
		V62/18617-01XE		8	D	SOIC	EAR99
		V62/18617-01XE-T		8	D	SOIC	EAR99
SN65C1168E-SEP	Dual differential drivers and receivers with ± 8-kV IEC ESD protection in space-enhanced plastic	SN65C1168EMPWSEP	RS-485/RS-422	16	PW	TSSOP	EAR99
		SN65C1168EMPWTSEP		16	PW	TSSOP	EAR99
TL7700-SEP	Supply-voltage supervisor in space-enhanced plastic package	TL7700CMPWPSEP	Supervisor IC	8	PW	TSSOP	EAR99
		TL7700CMPWTPSEP		8	PW	TSSOP	EAR99
		V62/19602-01XE		8	PW	TSSOP	EAR99
		V62/19602-01XE-T		8	PW	TSSOP	EAR99
TLV1704-SEP	2.2-V to 36-V, microPower quad comparator in space-enhanced plastic package	TLV1704AMPWPSEP	Comparator	14	PW	TSSOP	EAR99
		TLV1704AMPWTPSEP		14	PW	TSSOP	EAR99
		V62/18613-01XE		14	PW	TSSOP	EAR99
		V62/18613-01XE		14	PW	TSSOP	EAR99
TPS73801-SEP	1-A low-noise fast-transient-response LDO in space-enhanced plastic package	TPS73801MDCQPSEP	Linear regulators (LDO)	6	DCQ	SOT-223	EAR99
		TPS73801MDCQTPSEP		6	DCQ	SOT-223	EAR99
		V62/18616-01XE		6	DCQ	SOT-223	EAR99
		V62/18616-01XE-T		6	DCQ	SOT-223	EAR99

*1) ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please request from: **gtc_eccn-hts-naftateam@list.ti.com**.*

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