Technical Article

Can Automotive-qualified ICs Be Used in Industrial Applications?

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Have you ever considered using automotive-qualified components for industrial applications? Many industrial sectors such as building automation, factory automation and control, motor drives, white goods, space, defense, and avionics are starting to use automotive-qualified devices, denoted by “-Q1” in the part number. In this post, I’ll talk about why industrial designers are turning to automotive-qualified integrated components, and about the benefits they can reap once making the switch.

Because ICs for the automotive industry typically are designed for applications with extended operating temperature ranges and long vehicle lifetimes, -Q1-qualified components can help industrial system designers develop applications with similar requirements and expectations.

Table 1 summarizes the qualifications needed to meet Automotive Electronics Council (AEC)-Q100 standards. These features allow industrial electronics manufacturers to take advantage of several benefits when using a -Q1 portfolio.

Table 1. Summary of Automotive Qualification Process

Test categories	Qualified test results
Stress conditions	Depending on desired temperature grade: Grade 0: -40°C to 150°C Grade 1: -40°C to 125°C Grade 2: -40°C to 105°C Grade 3: -40°C to 85°C Grade 4: 0°C to 70°C
Electrical test	Room temperature and hot and cold temperature extremes, per temperature grade
Electrostatic discharge (ESD)-charged device model (CDM)	Corner pins = 750V minimum All other pins = 500V minimum depending on different test methods and testers
Unique stress tests to automotive qualification	Power temperature cycle Bond pull after temperature cycle Early-life failure rate
Composition of qualification lots	Three nonconsecutive wafer lots and three nonconsecutive assembly lots for all qualification types

As the components are qualified to these strict conditions, all of the benefits of using an automotive qualified IC (summarized below) are passed on to designers who can be assured that they are purchasing a quality, long-lasting part with back-end support for their projects going forward.

- Extended temperature range that allows for scalability in multiple projects at various temperature ranges as industrial applications move from 85° Celsius to higher temperature ranges.
- Long term supplier availability assures that suppliers will continue to provide volume support for engineers to the best of their abilities.
- A focus on a zero defective parts-per-million (DPPM) strategy (average DPPM rates are typically below 1) which provides assurance that designers have quality devices with low failure-in-time rates.
- Accelerated stress and lifetime simulation tests affirm that the device will function for a long period of time in demanding environmental conditions.

Along with the benefits that the AEC-Q100 qualification provides, using a -Q1 device means that the engineer also has access to a strong back-end support system. All automotive devices are supported by a standard failure analysis (FA) process for customer returns. Each FA request goes through verification, analysis and then corrective action to solve any problems promptly. With all of these advantages, some designers, such as military or space/avionics, can leverage automotive components to reduce development time and cost.

TI Automotive-qualified Devices for Safety Standards Compliance

In addition to a wide portfolio of AEC-Q100 qualified components, TI also offers building blocks for engineers' functional safety systems that are qualified through International Organization for Standardization (ISO) 26262. Moving forward, industrial system developers may have to comply with international functional safety standards.

Automotive standard ISO 26262 is derived from the International Electrotechnical Commission [IEC] 61508 industry safety standard, and therefore the safety system process-development steps and requirements are similar, shown below in Table 2. As part of engineering support, the team developing SafeTI™ devices targeted for designers' functional safety applications provides documentation (such as the device functional safety manual, a detailed functional safety analysis report and a functional safety case report) to assist designers in integrating the device into their system to support the appropriate level of fault coverage.

Table 2. IEC61508 and ISO26262 Safety Standards Summary

<table>
<tr><th colspan="3">Safety Standards</th><th colspan="2">Safety Standard Comparison</th></tr>
<tr><td rowspan="3">IEC61508</td><td colspan="2">Generic industry standard, applicable to electrical/electronic/programmable electronic safety-related systems</td><td colspan="2">No direct correlation for SIL and ASIL levels.</td></tr>
<tr><td>Integrity Levels</td><td>SIL 1, SIL 2, SIL 3, SIL 4</td><td>SIL (IEC)</td><td>ASIL (ISO)</td></tr>
<tr><td>Released</td><td>10 years ago</td><td>4</td><td rowspan="2">D</td></tr>
<tr><td rowspan="3">ISO26262</td><td colspan="2" rowspan="2">Automotive industry standard, adaptation of IEC 61508 for electronic systems in road vehicles</td><td rowspan="2">3</td></tr>
<tr><td rowspan="2">C</td></tr>
<tr><td>Integrity Levels</td><td>ASIL -A, ASIL -B, ASIL -C, ASIL -D</td><td>2</td><td>B</td></tr>
<tr><td>Released</td><td>Released</td><td>1</td><td>A</td></tr>
</table>

TI develops automotive devices as safety elements out of context (SEooC). SEooC outlines assumptions about a variety of applicable systems in which the ICs will be used and allows for the design of appropriate diagnostic features. This saves the designer time, as TI has provided a lot of the analysis groundwork on the device beforehand.

Our development process for products that support functional safety applications includes certification by TÜV SÜD, an internationally recognized and accredited independent assessor of compliance to quality, safety and security standards, which shows our strong commitment in providing suitable devices for end applications requiring adherence to ISO 26262 and IEC 61508 standards. For a list of components qualified under ISO 26262, click here for more information.

TI has a diverse automotive qualified portfolio that spans across signal chain, power and embedded processing products in which we support long-term availability for these components. TI will not make a product obsolete for convenience and has a long obsolescence cycle if end of life (EOL) is necessary: a 180-day notification period before any implementation of major changes. That's twice as long as the Joint Electron Device Engineering Council (JEDEC) industry standard. Engineers have 12 months to place orders to ensure a smooth transition.

For more information about TI's automotive portfolio, visit TI.com/automotive or the Automotive E2E forum for any questions.

Additional Resources

- For more information about ISO 26262 and IEC 61508, see www.ti.com/safeti.
- Read more about standards compliance for functional safety applications
- For more information about specific automotive qualified devices, see the extended temperature range brochure (SLYB221)

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