

### Texas Instruments Enhanced Product Qualification and Reliability Report

TI qualification testing is a risk mitigation process that is engineered to assure device longevity in customer applications. Wafer fabrication processes and package level reliability are evaluated in a variety of ways that may include accelerated environmental test conditions with subsequent derating to actual use conditions. Manufacturability of the device is evaluated to verify a robust assembly flow and assure continuity of supply to customers. TI Enhanced Products are qualified with industry standard test methodologies performed to the intent of Joint Electron Devices Engineering Council (JEDEC) standards and procedures. Texas Instruments Enhanced Products are certified to meet GEIA-STD-0002-1 [Aerospace Qualified Electronic Components](#).

#### Qualification by Similarity (Qualification Family)

A new device can be qualified either by performing full scale quality and reliability tests on the actual device or using previously qualified device(s) through "Qualification by Similarity" (QBS) rules. By establishing similarity between the new device and those qualified previously, repetitive tests will be eliminated, allowing for timely production release. When adopting QBS methodology, the emphasis is on qualifying the differences between a previously qualified product and the new product under consideration. The QBS rules for a technology, product, test parameters or package shall define which attributes are required to remain fixed in order for the QBS rules to apply. The attributes which are expected and allowed to vary will be reviewed and a QBS plan shall be developed, based on the reliability impact assessment above, specifying what subset of the full complement of environmental stresses is required to evaluate the reliability impact of those variations. Each new device shall be reviewed for conformance to the QBS rule sets applicable to that device. See JEDEC JESD47 for more information.

Device Baseline			
<i>TI Device:</i>	OPA2211MDRGTEP	<i>Assembly Site:</i>	MLA
<i>DLA VID:</i>	V62/15606-01XE	<i>Test Site:</i>	MLA
<i>Wafer Fab</i>	FR-BIP-1	<i>Pin/Package Type:</i>	8/ DRG
<i>Fab Process:</i>	BICOM3-HV	<i>Lead frame:</i>	Cu
<i>Fab Technology</i>	BICOM3	<i>Termination Finish:</i>	NiPdAu
<i>Die Revision:</i>	D	<i>Mount Compound:</i>	ABLESTIK 8200TI
<i>Die Name:</i>	RO2211PDAHM	<i>Bond Wire:</i>	24.3μm Au
<i>ESD CDM:</i>	±1000V	<i>Mold Compound:</i>	SUMITOMO EME-G770HCD
<i>ESD HBM:</i>	±3000V	<i>Moisture Sensitivity</i>	MSL2/ 260°C

On-Going Life-Test Monitors For Technology		
<i>Reliability:</i>	0.9	FIT
<i>MTBF:</i>	1.18E+9	Hours
<i>Confidence Level:</i>	60	%
<i>Activation Energy:</i>	0.7	eV
<i>Stress Temperature:</i>	125	°C
<i>Derated Use Temperature:</i>	55	°C
<i>Test Duration:</i>	1000	Hours
<i>Sample Size:</i>	30281	Units
<i>Number of Failures:</i>	0	Units

## Texas Instruments Enhanced Product Qualification and Reliability Report

Enhanced Products New Device Qualification Matrix				
Note that qualification by similarity ("qualification family") per JEDEC JESD47 is allowed				
Description	Condition	Sample Size (Used/Rejects)	Lots Required	Test Method
Electromigration	Maximum Recommended Operating Conditions	N/A	N/A	Per TI Design Rules
Wire Bond Life	Maximum Recommended Operating Conditions	N/A	N/A	Per TI Design Rules
Electrical Characterization	TI Data Sheet	15	3	N/A
Electrostatic Discharge Sensitivity	HBM CDM	3 units/voltage	N/A	EIA/JESD22-A114 EIA/JESD22-C101
Latch-up	Per Technology	5/0	3	EIA/JESD78
Physical Dimensions	TI Data Sheet	5/0	1	EIA/JESD22- B100
Thermal Impedance	Theta-JA on board	Per Pin-Package	N/A	EIA/JESD51
Bias Life Test	125°C / 1000 hours or equivalent	45/0	3	JESD22-A108*
Biased Humidity or Biased HAST	85°C / 85% / 1000 hours or 130°C / 85% / 96 hours	77/0	3	JESD22-A101* JESD22-A110*
Extended Biased Humidity or Extended Biased HAST	85°C / 85% / 2600 hours (for reference) or 130°C / 85% / 250 hours (for reference)	77/0	1	JESD22-A101* JESD22-A110*
Unbiased HAST	130°C / 85% / 96 hours	77/0	3	JESD22-A.118*
Temperature Cycle	-65°C to +150°C non-biased for 500 cycles	77/0	3	JESD22-A104*
Solder Heat	260°C for 10 seconds	22/0	1	JESD22-B106
Resistance to Solvents	Ink symbol only	12/0	1	JESD22-B107
Solderability	Condition A (steam age for 8 hours)	22/0	1	ANSI/J-STD-002-92
Flammability	Method A / Method B	5/0	1	UL-1964
Bond Shear	Per wire size	5 units x 30/0 bonds	3	JESD22-B116
Bond Pull Strength	Per wire size	5 units x 30/0 bonds	3	ASTM F-459
Die Shear	Per die size	5/0	3	TM 2019
High Temp Storage	150 °C / 1,000 hours	15/0	3	JESD22-A103-A*
Moisture Sensitivity	Surface Mount Only	12	1	J-STD-020-A*

\*Precondition performed per JEDEC Std. 22, Method A112/A113

For additional information or technical support please contact the Texas Instruments Customer Support Center at [www.ti.com/support](http://www.ti.com/support) or send an email to [support@ti.com](mailto:support@ti.com)

For more information on TI Enhanced Products please visit [www.ti.com/ep](http://www.ti.com/ep)

## **Texas Instruments Enhanced Product Qualification and Reliability Report**

### Important Limitations on Use of Data Exceeding Specified Limits

TI is providing this data for your convenience. However, we want to make clear the significant limitations of its usefulness as an indicator of how devices may perform in various applications.

THIS DATA IS PROVIDED "AS IS" WITHOUT ANY EXPRESS OR IMPLIED WARRANTY OF ANY KIND INCLUDING WARRANTIES OF MERCHANTABILITY, NONINFRINGEMENT OF INTELLECTUAL PROPERTY, OR FITNESS FOR ANY PARTICULAR PURPOSE. IN NO EVENT SHALL TI OR ITS SUPPLIERS BE LIABLE FOR ANY DAMAGES WHATSOEVER (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF PROFITS, BUSINESS INTERRUPTION, LOSS OF INFORMATION) ARISING OUT OF THE USE OF OR INABILITY TO USE THE INFORMATION, EVEN IF TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Your use of this data, and all consequences of such use, is solely your responsibility. You must perform sufficient engineering and additional qualification testing in order to properly evaluate your application and determine whether a candidate device is suitable for use in that application.

TI semiconductor components are specifically designed and manufactured to be used within the electrical, thermal, mechanical and other parameters set forth in TI's product data sheets. Quality and reliability data provided by Texas Instruments, such as MTBF and fit rate data, is intended to be an estimate of product performance based upon history only. It does not imply that any performance levels reflected in such data can be met if the product is operated outside the conditions expressly stated in the latest published data sheet for a device.

Plastic encapsulated TI semiconductor devices are neither designed nor warranted as suitable for use in military applications and/or military environments.

THIS INFORMATION SHOULD NOT BE USED TO ASSIST IN THE PRACTICE OF "UPRATING" OR "UPSCREENING" DEVICES FOR USE IN MILITARY OR OTHER CRITICAL APPLICATIONS. There are significant limitations of this information as an indicator of how commercial, off-the-shelf (COTS) devices may perform in such applications or environments, and about the hazards of using COTS devices in such applications. TI strongly believes that semiconductor components should never be used outside their specified tolerance levels as up-screening can lead directly to system or component failure. Such failures may present distinct risks to end-users and to third parties. TI cannot accept any responsibility for component or system failures that occur due to the misuse of its products, including misuse that may result from the practice of up-screening.

Any use of TI components beyond their rated limits voids all warranty responsibility of TI with respect to such devices, and also voids all responsibility of TI with respect to any applications assistance, product design, software performance or services of any kind that were or may have been performed in connection with the sale of any such devices. Further, resale of TI's products or services with statements different from or beyond the parameters stated by TI for that product or service in official TI data books or data sheets, or without the warnings or instructions provided by TI, voids all express and any implied warranties for the associated TI product or service, and is an unfair and deceptive business practice.

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)