REF34xx-EP reliability report

ABSTRACT

This report presents the reliability and qualification results for the REF34xx-EP Low Power Series Voltage Reference. The REF34xx-EP is manufactured with a controlled baseline and has the following:

- An extended product life cycle
- One assembly and test site
- One fabrication site
- Product traceability
- Extended product-change notification

Contents

Trademarks

Texas Instruments is a trademark of Texas Instruments.

1 Texas Instruments Enhanced Product Qualification and Reliability Report

Texas Instruments™ (TI) qualification testing is a risk mitigation process that assures device longevity in customer applications. The wafer fabrication process and package level reliability are evaluated in a variety of ways, including accelerated environmental test conditions with subsequent derating to the use conditions. The manufacturability of the device is evaluated to ensure a robust assembly flow and to assure supply continuity to customers. TI-Enhanced Products qualify with industry standard test methodologies performed to meet the Joint Electron Device Engineering Council (JEDEC) standards and procedures. TI-Enhanced Products are certified to meet the GEIA-STD-0002-1 Aerospace Qualified Electronic Components.

2 Qualification by Similarity

A new device qualifies by performing a full-scale quality and reliability test on the actual device, or by using previously qualified devices through "Qualification by Similarity" (QBS) rules. Eliminating repetitive tests expedites the production release by establishing similarities between the new device and previously qualified devices. When adopting QBS methodology, the emphasis is on qualifying the differences between a previously qualified product and the product under consideration. The QBS rule for technology, product, test parameter, or package defines which attributes need to remain fixed for the QBS rules to apply. The varying attributes are reviewed and a QBS plan is developed based on the reliability impact assessment. This assessment specifies which subset of the environmental stresses is required to evaluate the reliability impact of those variations. Each new device is reviewed to ensure it follows the applicable QBS rules. See JEDEC JESD47 for more information.

Device Baseline[1]			
TI Device:	REF3425MDBVTEP	Pin/Package Type:	SOT-23 (DBV) | 6
	V62/18622-01XE	Moisture Sensitivity:	Level2-260C
Wafer Fab:	AIZU		
Fab Technology:	50HPA07		
Die Revision:	A		
Die Name:	G4REF2125BAPM		
[1]Baseline information in effect as of the date of this report			

Device Baseline[1]			
TI Device:	REF3440MDBVTEP	Pin/Package Type:	SOT-23 (DBV) | 6
	V62/18622-02XE	Moisture Sensitivity:	Level2-260C
Wafer Fab:	AIZU		
Fab Technology:	50HPA07		
Die Revision:	A		
Die Name:	G4REF2141AAPM		
[1]Baseline information in effect as of the date of this report			

Device Baseline[1]			
TI Device:	REF3430MDBVTEP	Pin/Package Type:	SOT-23 (DBV) | 6
	V62/18622-03XE	Moisture Sensitivity:	Level2-260C
Wafer Fab:	AIZU		
Fab Technology:	50HPA07		
Die Revision:	A		
Die Name:	G4REF2130AAPM		
[1]Baseline information in effect as of the date of this report			

Device Baseline[1]			
TI Device:	REF3433MDBVTEP	Pin/Package Type:	SOT-23 (DBV) | 6
	V62/18622-04XE	Moisture Sensitivity:	Level2-260C
Wafer Fab:	AIZU		
Fab Technology:	50HPA07		
Die Revision:	A		
Die Name:	G4REF2133AAPM		
[1]Baseline information in effect as of the date of this report			

Figure 1. REF34xx Baseline

Enhanced Products 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	NA	NA	Per TI Design Rules
Wire Bond Life	Maximum Recommended Operating Conditions	NA	NA	Per TI Design Rules
Electrical Characterization	TI Data Sheet	15	3	N/A
Electrostatic Discharge Sensitivity	HBM ±2500V	3 Units/voltage	NA	EIA/JESD22-A114
	CDM ±1000V	3 Units/voltage	NA	JESD22-C101
Latch-up	Per Technology	36/0	3	EIA/JESD78
Physical Dimensions	TI Data Sheet	120/0	1	EIA/JESD22- B100
Thermal Impedance	Theta-JA on board	Per Pin-Package	NA	EIA/JESD51
Bias Life Test	125°C / 1000 hours or equivalent	685/0	3	JESD22-A108*
Biased Humidity or Biased HAST	85°C / 85% / 1000 hours or 130°C / 85% / 96 hours	782/0	3	JESD22-A101* JESD22-A110*
Extended Biased Hast	85°C / 85% / 2600 hours (for reference) or 130°C / 85% / 250 hours (for reference)	79/0	1	JESD22-A101* JESD22-A110*
Unbiased HAST	130°C / 85% / 96 hours	847/0	3	JESD22-A118*
Temperature Cycle	-65°C to +150°C non-biased for 500 cycles or equivalent	539/0	3	JESD22-A104*
Solder Heat	260°C for 10 seconds	NA	NA	JESD22-B106
Resistance to Solvents	Ink Symbol only	NA	NA	JESD22-B107
Solderability	Condition A (steam age for 8 hours)	90/0	1	ANSI/J-STD-002-92
Flamability	Method A/ Method B	5/0	1	UL-1964
Bond Shear	Per wire size	5 units x 90/0 bonds	3	JESD22-B116
Bond Pull Strength	Per wire size	76/0	3	ASTM F-459
Die Shear	Per die size	10/0	3	TM 2019
High Temp Storage	150°C / 1,000 hours	122/0	3	JESD22-A103-A*
Moisture Sensitivity	Surface Mount Only	45/0	1	J-STD-020-A*

* Preconditioning per JEDEC Std. 22, Method A112/A113

Figure 2. Enhanced Products Device Qualification Matrix

3 Technology Family FIT/MTBF Data

Mean Time Between Fails (MTBF) and Failures in Time (FIT) rates are calculated device reliability statistics based on data collected from TI's internal reliability testing (life test). TI's DPPM/FIT/MTBF Estimator Search Tool reports the generic data based on technology groupings and shows conditions under which the rates are derived. All terms used in the tool and definitions is found on the TI reliability terminology page. Failure rates are summarized by technology and mapped to the associated material part numbers. The failure rates are highly dependent on the number of units, so it is not recommended to compare failure rates. Visit the TI DPPM/FIT/MTBF Estimator Search Tool.

4 Device Family Qualification Data

TI's Qualification Summary Search Tool reports generic data representative of the material sets, processes, and manufacturing sites used by the device family. The data may not include all of the testing performed for a specific EP device. See Figure 2 for the full list of qualification testing performed to release Enhanced Product Devices. Visit the TI Qualification Summary Search.

5 Ongoing Reliability Monitoring

TI periodically monitors the reliability of its products, wafer fabrication processes, and package technologies through its Ongoing Reliability Monitor (ORM) program. The ORM program involves collecting environment reliability stress data on representative sets of devices, processes, and packages. The result from the ORM program are updated quarterly in this report. Visit the TI Ongoing Reliability Monitoring Search. For additional information or technical support, contact the Texas Instruments Customer Support Center or send an email to support@ti.com. Visit TI's Enhanced Products page for more information.

Quality and Reliability Data Disclaimer

The attached quality and reliability information is specific to the TI Enhanced Plastic product family of plastic encapsulated commercial-off-the-shelf (COTS) semiconductor products and components. Due to possible differences in product assembly and test baselines, this information is NOT APPLICABLE to TI standard, industrial, or automotive catalog commercial products.

Plastic encapsulated TI semiconductor devices are not designed and are not warranted to be suitable for use in some military applications and/or military environments. Use of plastic encapsulated TI semiconductor devices in military applications and/or military environments, in lieu of hermetically sealed ceramic devices, is understood to be fully at the risk of Buyer.

Quality and reliability data provided by Texas Instruments 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.

Existing industry standards for plastic encapsulated microcircuit qualification and reliability monitors are based upon historical data, experiments, and field experience with the use of these devices in commercial and industrial applications. The applicability of these standards in determining the suitability for use and safety performance in military and aerospace applications has not been established. Due to the multiple variations in field operating conditions, a component manufacturer can only base estimates of product life on models and the results of package and die level qualification.

The buyer's use of this data, and all consequences of such use, is solely the buyer's responsibility. Buyer assumes full responsibility to perform sufficient engineering and additional qualification testing in order to properly evaluate the buyer's application and determine whether a candidate device is suitable for use in that application. The information provided by TI shall not be considered sufficient grounds on which to base any such determination.

THIS INFORMATION 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.

THIS INFORMATION SHOULD NOT BE USED TO ASSIST IN THE PRACTICE OF "UPRATING" OR "UPSCREENING" DEVICES FOR USE BEYOND THEIR RATED LIMITS.

TI may provide technical, applications or design advice, quality characterization, and reliability data or service providing these items shall not expand or otherwise affect TI's warranties as set forth in the Texas Instruments Incorporated Standard Terms and Conditions of Sale for Semiconductor Products and no obligation or liability shall arise from TI's provision of such items.

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265