transphorm

Product Qualification Report

1. Purpose
    a. The purpose of this specification is to document the Qualification Report for TP65H480G4JSG
2. Scope
    a. The products listed in section 1 are fully qualified and released to production.
    b. Qualification test results on these products may reference existing qualification results of similar products per the use of generic data as defined in section 2.2 of AEC-Q101 Rev D1
    c. Each of the referenced part numbers share the same major assembly process and material elements as defined in Stress Test qualification for Automotive Grade Semiconductors, AEC-Q101 and are considered to be part of the same qualification family.
3. Qualification Process
    a. All Fab Lots were processed separately with a discrete amount of time between lots. All lots were assembled using the same Assembly House, on the same assembly line. All lots undergo Final Test using the documented test flow and are screened against documented test limits as appropriate to their part number. All processes and test conditions are documented and maintained under revision control as part of the Transphorm Quality Management System.
    b. Documented process and test conditions that are used for qualification of products are designated “Process of Record”. Changes to the Process of Record are managed through the Process/Product Change Notification Procedure, which is part of the Transphorm Quality Management System.
4. ESD Results: 3 parts pass for each test
    a. Standard Used: ANSI/ESDA/JEDEC JS-002-2018
    b. HBM (Human Body Model): ±550V / Rated 1B
    c. CDM (Charge Device Model): ≥ 2000V / Rated C7

5. Mechanical Tests: All tests passed

Test Name	Reference Standard
Solderability	JESD22 A113
Bond Pull Strength	MIL STD-833 M2011
Bond Shear	JESD22-B116

6. Reliability Testing
    a. Failed devices are analyzed for root cause and correction. Only a representative sample needs to be analyzed, though some level of analysis will be applied to every failed part. Acceptable root cause and corrective action and successful demonstration of corrective and preventative actions will constitute successful qualification of a device. The part and/or qualification family can be qualified as long as containment of any problems are demonstrated until corrective and/or preventative actions are in place.

7. Electrical Test Parameters
    a. Components submitted for qualification testing must meet all datasheet parameters before and after stress testing

Parameter	Symbol	Conditions	LSL	USL	Unit
Drain to source leakage current	I_{DSS}	V_{DS}= 650V V_{GS} = 0V T_J=25ºC		10	µA
Gate to Source Forward Leakage Current	I_{GSS}	V_{GS}=20V		100	nA
Drain source on resistance	R_{DS}	V_{GS}= 8V I_D=5A T_J= 25ºC		560	mΩ
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS} ID=0.5mA	1.6	2.8	V

8. Electrical Reliability Qualification Test Results

TEST	SYMBOL	CONDITIONS	SAMPLE	RESULT
Moisture/Reflow Sensitivity	MSL-3	MSL-3 Pb-free T_C= 260ºC	3 lots 25 units per lot 75 total parts	0 Fails PASS
High Temperature Reverse Bias	HTRB	T_J=150ºC V_{DS} = 520V 1000 HRS	3 lots 77 parts per lot 231 total parts	0 Fails PASS
Highly Accelerated Temp and Humidity Test	HAST	130ºC,85% RH 33.3 PSI Bias = 100V 96 HRS MSL pre-con	3 lots 77 parts per lot 231 total parts	0 Fails PASS
Temperature Cycle	TC	-40ºC / 125ºC 2 Cycles / HR 500 Cycles MSL pre-con	3 lots 77 parts per lot 231 total parts	0 Fails PASS
Power Cycle	PC	25ºC / 125ºC ΔT = 100ºC 7500 Cycles	3 lots 77 parts per lot 231 total parts	0 Fails PASS
High Temperature Gate bias	HTGB	150ºC 1000 HRS V_{GSS}=18V	3 lots 77 parts per lot 231 total parts	0 Fails PASS
Unbiased Highly Accelerated Temp and Humidity Test	UHAST	130C, 85%RH, 33.3 PSI,96 Hrs MSL pre-con	3 lots 77 parts per lot 231 total parts	0 Fails PASS

Parts for Power Cycle and Temperature Cycle will be mounted to printed circuit board.
Parts for TC, HAST and UHAST are preconditioned prior to stress test per JESD22-A113

9. Referenced Documents
    a. AEC-Q101: Stress Test Qualification for Automotive Grade Discrete Semiconductors
    b. JESD47: Stress-Test Driven Qualification of Integrated Circuits
    c. MIL-PRF-38535: Performance specification-Integrated Circuits Manufacturing General Specification for Department of Defense
    d. JESD22-A108C: High Temperature Reverse Bias (HTRB)
    e. JESD22-A110D: Highly Accelerated Temperature and Humidity Stress Test (HAST)
    f. JESD22-A104D: Temperature Cycle (TC)
    g. JESD22-A122: Power Cycle (PC)
    h. JS-001-2012: Electrostatic Discharge Human Body Model
    i. J-STD-020D.1: Moisture/Reflow Sensitivity Classification
    j. JESD22-A102: Pre-conditioning
    k. M2011: Wirebond strength
    l. JESD22-B116: Bond Shear

10. Signature Approval

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