

1. Purpose: The purpose of this specification is to document the Qualification Report for TP65H050G4QS
  - a. This product is fully qualified and released to production.
2. 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. 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
3. ESD Results: 3 parts passes for each test
  - a. Standard Used: ANSI/ESDA/JEDEC JS-001-2017

ESD TEST	RATING
CDM	≥ 2000V / C7
HBM	>1000V/1C

4. 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 is demonstrated until corrective and/or preventative actions are in place.
5. 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 <sub>DSS</sub>	V <sub>DS</sub> = 650V V <sub>GS</sub> = 0V T <sub>J</sub> =25°C		40	µA
Gate to Source Forward Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =20V		400	nA
Drain source on resistance	R <sub>DS</sub>	V <sub>GS</sub> = 10V I <sub>D</sub> =22A T <sub>J</sub> = 25°C		60	mΩ
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> I <sub>D</sub> =.7 mA	3.3	4.8	V

6. Electrical Reliability Qualification Test Results

TEST	SYMBOL	CONDITIONS	SAMPLE	RESULT
Moisture/Reflow Sensitivity	MSL-3	MSL-3 Pb-free T <sub>C</sub> = 260°C	3 lots 270 units per lot 810 total parts	0 Fails <b>PASS</b>
		CSAM	3 lots 11 units per lot	0 Fails <b>PASS</b>
High Temperature Reverse Bias	HTRB	T <sub>J</sub> =150°C V <sub>DS</sub> = 520V 1000 HRS	3 lots 77 parts per lot 231 total parts	0 Fails <b>PASS</b>
Highly Accelerated Temp and Humidity Test	HAST	130°C,85% RH 33.3 PSI Bias = 100V 96 HRS MSL pre-con	3 lots 77 parts per lot 231 total parts	0 Fails <b>PASS</b>
Temperature Cycle	TC	-55°C / 150°C 2 Cycles / HR 1000 Cycles MSL pre-con	3 lots 77 parts per lot 231 total parts	0 Fails <b>PASS</b>
Power Cycle	PC	25°C / 125°C ΔT = 100°C 10,000 Cycles	3 lots 77 parts per lot 231 total parts	0 Fails <b>PASS</b>
High Temperature Gate bias	HTGB	150°C 1000 HRS V <sub>GSS</sub> =20V	3 lots 77 parts per lot 231 total parts	0 Fails <b>PASS</b>
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 <b>PASS</b>
Destructive Physical Analysis	DPA	Mil-Std-1580b	3 lots 2 parts per lot Post TC, HAST	0 Fails <b>PASS</b>

Parts for Power Cycle will be mounted to printed circuit board.

7. Mechanical Qualification Tests: All tests pass

1. Physical Dimension - Per JESD22-B100B
2. WIREPULL
3. BALLSHEAR
4. DIE SHEAR
5. Resistance to Solder Heat- Per JESD22-B106D
6. Solderability Test- Per JESD22-B102E
7. DPA (ASSEMBLY)
8. Externa (FVI)

8. 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

9. Signature Approval



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Ronald Barr  
VP Quality  
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