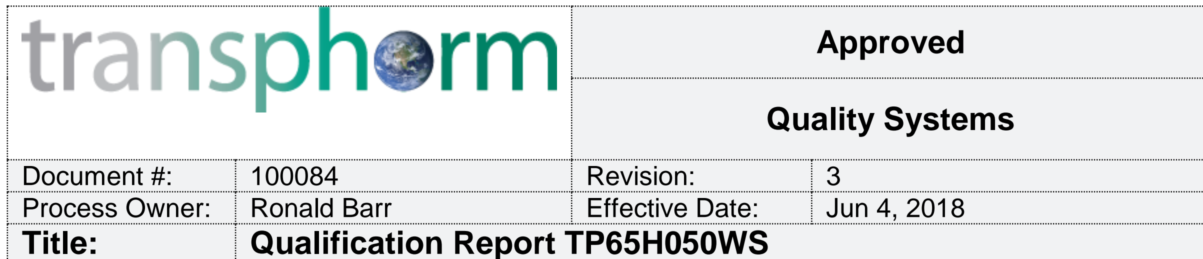

		Approved	
		Quality Systems	
Document #:	100084	Revision:	3
Process Owner:	Ronald Barr	Effective Date:	Jun 4, 2018
Title:	**Qualification Report TP65H050WS**		

1) Purpose
   a) The purpose of this specification is to document the Qualification Report for part number TP65H050WS
2) Scope
   a) Products in section 1 are fully qualified and released to production.
   b) Each of these referenced part numbers share the same major assembly process and material elements as defined in Stress Test Qualification for Automotive Grade Discrete Semiconductors, AEC-Q101 and are considered to be part of the 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
   a) 3 parts passing for each test
   b) Human Body Model: +/- 700V
   c) Charged Device Model: +/- 2000V

5) Reliability Testing
   a) All electrical reliability tests are performed to a Lot Tolerant Percent Defective (LTPD) level of 3% at a 90% confidence level as defined in JESD-47, 3 lots for each test, unless otherwise noted.
   b) All tests were performed using TP65H050WS
   c) 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.

6) Electrical Test Parameters
   a) All devices must pass the following electrical parameters prior to and following stress testing

Parameter	Symbol	Conditions	LSL	USL	Unit
Drain to source leakage current	I_{DSS}	V_{DS}= 650V V_{GS} = 0V T_J=25ºC		60	µA
Gate to Source Forward Leakage Current	I_{GSS}	V_{GS}=20V		400	nA
Drain source on resistance	R_{DS}	V_{GS}= 8V I_D=11A T_J= 25ºC		60	mΩ
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS} ID=0.7mA	3.3	4.8	V

7) Electrical Reliability Qualification Test Results

TEST	SYMBOL	CONDITIONS	SAMPLE	RESULT
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	3 lots 77 parts per lot 231 total parts	0 Fails **PASS**
Temperature Cycle	TC	-40ºC / 150ºC 2 Cycles / HR 1000 Cycles	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**

8) ire bond, die attach
    a) Wire pull
        i) All wires on one unit per lot, all lots
        ii) Result: all lots pass
    b) Ball shear
        i) All wires on one unit per lot, all lots
        ii) Result: all lots pass
    c) Die Shear
        i) 5 units per lot, all lots
        ii) Result: all lots pass

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) JESD22-A103C: High Temperature Storage Life (HTSL)
    i) JESD22-A115B: Electrostatic Discharge Machine Model
    j) JS-001-2012: Electrostatic Discharge Human Body Model
10) Signature Approval

Ronald Barr
VP Quality
May 18, 2018