

PRODUCT RELIABILITY REPORT

Platform: S060E2.5

--60V E-Mode GaN FET

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1. Product Information

Platform	S060E2.5
BV Rating(V)	60
Process Technology	GaN on Silicon

2. Reliability Tests

The testing matrix in this reliability report covers the reliability of INN060FQ043A listed in the below table. Innoscience’s E-mode GaN FETs were subjected to a variety of reliability test under the condition referenced to typical for silicon-based power MOSFETs. These test items and results were shown as below:

Product(INN060FQ043A)				
Test Items	Test Conditions	Sample Size/Product (Unit x Lot)/Product	#Fail	Result
MSL3	Ta=30°C, RH=60%, 3 x reflow, 192hrs	25 x 3	0 Fail	Pass
HTRB	Tj=125°C, VD=48V, 1000hrs	77 x 3	0 Fail	Pass
HTRB	Tj=150°C, VD=48V, 1000hrs	77 x 1	0 Fail	Pass
HTGB(+)	Tj=150°C, VG=6.0V, 1000hrs	77 x 3	0 Fail	Pass
HTGB(-)	Tj=150°C, VG=-4.0V, 1000hrs	77 x 3	0 Fail	Pass
TC	-40 to +125°C, Air, 1000Cys	77 x 3	0 Fail	Pass
H ³ TRB	Ta=85°C, RH=85%, VD=48V, 1000hrs	77 x 3	0 Fail	Pass
uHAST	T=130°C, RH=85%, 96hrs	77 x 3	0 Fail	Pass
Solderability	Pre-Con: 8hrs Pb-free: 245 ± 5°C, 5 ± 0.5s	22 x 3	0 Fail	Pass
DHTOL	BUCK, Vin=36V, Vout=18V, Fsw=600KHz, Tj=125°C, 1000hrs	8 x 3	0 Fail	Pass
HBM	All Pins	3 x 1	0 Fail	Class 1B
CDM	All Pins	3 x 1	0 Fail	Class 2a

Moisture Sensitivity Level (MSL3)

Parts were baked at 125°C for 24 hours, and then subjected to 60%RH at 30°C for a stress period of 192hours. The parts were also subjected to three cycles of Pb-free reflow in accordance with the IPC/JEDEC standard J-STD-020.

Pass criteria: All units must pass the min/max limits of the datasheet.

Test Item	Product Number	Test Condition	Fail #	Sample Size (Unit x Lot)	Duration (Hrs)
MSL3	INN060FQ043A	T=30°C, RH=60%, 3 x reflow	0	25x 3	192

High Temperature Reverse Bias (HTRB)

Parts were subjected to 80% of the rated drain-source voltage at the Tj=125 °C and Tjmax temperature for a stress period of 1000 hours. The testing was done in accordance with the JEDEC Standard JESD22-A108.

Pass criteria: All units must pass the min/max limits of the datasheet.

Test Item	Product Number	Test Condition	Fail #	Sample Size (Unit x Lot)	Duration (Hrs)
HTRB	INN060FQ043A	Tj=125°C, V _{DS} = 48V	0	77 x 3	1000
HTRB	INN060FQ043A	Tj=150°C, V _{DS} = 48V	0	77 x 1	1000

High Temperature Gate Bias (HTGB+)

Parts were subjected to the maximum gate-source bias at the maximum rated temperature for a stress period of 1000 hours. The testing was done in accordance with the JEDEC Standard JESD22-A108.

Pass criteria: All units must pass the min/max limits of the datasheet.

Test Item	Product Number	Test Condition	Fail #	Sample Size (Unit x Lot)	Duration (Hrs)
HTGB(+)	INN060FQ043A	Tj=150°C, V _{GS} = 6.0V	0	77 x 3	1000

Negative High Temperature Gate Bias (HTGB-)

Parts were subjected to -4V gate-source bias at the maximum rated temperature for a stress period of 1000 hours. The testing was done in accordance with the JEDEC Standard JESD22-A108.

Pass criteria: All units must pass the min/max limits of the datasheet.

Test Item	Product Number	Test Condition	Fail #	Sample Size (Unit x Lot)	Duration (Hrs)
HTGB(-)	INN060FQ043A	T _j =150°C, V _{GS} = -4.0V	0	77 x 3	1000

Temperature Cycling (TC)

Parts were subjected to temperature cycling between -40°C and +125°C for a total of 1000 cycles. Heating rate and cooling rate of 15°C/min. Dwell time of 5 minutes were used in accordance with the JEDEC Standard JESD22-A104.

Pass criteria: All units must pass the min/max limits of the datasheet.

Test Item	Product Number	Test Condition	Fail #	Sample Size (Unit x Lot)	Duration (Cys)
TC	INN060FQ043A	-40 to +125°C, Air	0 Fail	77 x 3	1000

High Humidity, High Temperature Reverse Bias (H³TRB)

Parts were subjected to 80% of the rated drain-source bias at 85%RH and 85°C for a stress period of 1000 hours. The testing was done in accordance with the JEDEC Standard JESD22-A101.

Pass criteria: All units must pass the min/max limits of the datasheet.

Test Item	Product Number	Test Condition	Fail #	Sample Size (Unit x Lot)	Duration (Hrs)
H ³ TRB	INN060FQ043A	T=85°C, RH=85%, V _{DS} =48V	0	77 x 3	1000

Accelerated Moisture Resistance- Unbiased HAST (uHAST)

Parts were subjected at 85%RH and 130°C for a stress period of 96 hours. The testing was done in accordance with the JEDEC Standard JESD22-A118.

Pass criteria: All units must pass the min/max limits of the datasheet.

Test Item	Product Number	Test Condition	Fail #	Sample Size (Unit x Lot)	Duration (Hrs)
uHAST	INN060FQ043A	RH=85%, T=130°C	0	77 x 3	96

Solderability

Parts were subjected to surface mount process then reflow test. The testing was done in accordance with the IPC/JEDEC standard J-STD-002.

Pass criteria: All samples pin solder area were wetting >95%.

Test Item	Product Number	Test Condition	# Fail	Sample Size (Unit x Lot)
Solderability	INN060FQ043A	Pre-Con: 8hrs Pb-free: 245 ± 5°C, 5 ± 0.5s	0 Fail	25 x 3

Dynamic High Temperature Operating Life (DHTOL)

Parts were subjected to DC-to-DC system test adapted BUCK topology at Tj=125°C for a stress period of 1000 hours. The testing was done in accordance with the JEDEC standard JEP-180.

Pass criteria: All units efficiency shift lower 0.2%.

Test Item	Product Number	Test Condition	Fail #	Sample Size (Unit x Lot)	Duration (Hrs)
DHTOL	INN060FQ043A	BUCK, Vin=36V, Vout=18V, Fsw=600KHz, Tj=125°C, 1000hrs	0 Fail	22 x 3	1000

Electro-Static discharge (ESD)

Parts were subjected to HBM (ESDA/JEDEC JS-001) and CDM (ESDA/JEDEC JS-002) test to guarantee that the device can with stand electrostatic voltages during handling.

Pass criteria: All units must pass the min/max limits of the datasheet.

Test Item	Product Number	Test Condition	Passed Voltage	JEDEC Class
HBM	INN060FQ043A	All Pins	(±) 500V	Class 1B
CDM	INN060FQ043A	All Pins	(±) 500V	Class 2a

Parts were mounted on to FR4 adaptor cards. Adaptor cards with two copper layers were used. The copper layer thickness was between 1 and 2 oz. SAC305 solder was used to mount the DUTs onto the adaptor cards.

Revision/Updated History

Revision	Reason for Change	Date	Prepared by	Approved by
0.1	Initial version for HTRB 80%BV 150°C only one lot	Feb./28/2022	Ziliang Liu	Blanck, Director