PRODUCT RELIABILITY REPORT

Platform: S100E2.0

--100V E-Mode GaN FET

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1. Platform Information

Platform	S100E2.0
BV Rating(V)	100
Process Technology	GaN on Silicon

2. Reliability Tests

Innoscience's E-mode GaN FET was subjected to a variety of reliability tests under the conditions referenced to typical for silicon-based power MOSFET. Others as spin-off product have the same die process and design rules as INN100W032A.

Category	Product Number	Package	BV Rating(V)
Platform	INN100W032A	WLCSP (3.50mm x 2.13mm)	100
Spin-off	INN100W070A	WLCSP (2.5mm x 1.5mm)	100

These test items and results were shown as below:

Product (INN100W032A)				
Test Items	**Test Condition**	**Sample Size (Unit x Lot)**	**#Fail**	**Result**
MSL1	T=85°C, RH=85%, 3 x reflow, 168hrs	25 x 2	0 Fail	Pass
HTRB	T=150°C, VD=80V, 1000hrs	77 x 3	0 Fail	Pass
HTGB	T=150°C, VG=5.5V, 1000hrs	77 x 3	0 Fail	Pass
TC	-40 to +125°C, Air, 1000Cys	77 x 3	0 Fail	Pass
H^3TRB	T=85°C, RH=85%, VD=80V, 1000hrs	77 x 3	0 Fail	Pass
HAST	T=130°C, RH=85%, VD=42V, 96hrs	77 x 3	0 Fail	Pass
HTSL	T=150°C, 1000hrs	77 x 3	0 Fail	Pass
HTOL	LLC, Vin=60V, Fsw=1MHz, Tj＞125°C	10 x 3	0 Fail	Pass
HBM	All Pins	3 x 1	0 Fail	Class 1C
CDM	All Pins	3 x 1	0 Fail	Class C3

Spin-off Product(INN100W070A)				
Test Items	**Test Conditions**	**Sample Size (Unit x Lot)**	**#Fail**	**Result**
HTRB	T=150°C, VDS= 80V, 168hrs	77 x 1	0 Fail	Pass
HTGB	T=150°C, VGS= 5.5V, 168hrs	77 x 1	0 Fail	Pass
HBM	All Pins	3 x 1	0 Fail	Class 1C
CDM	All Pins	3 x 1	0 Fail	Class C2a

Moisture Sensitivity Level (MSL1)

Parts were baked at 125°C for 24 hours, and then subjected to 85%RH at 85°C for a stress period of 168 hours. 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)
MSL1	INN100W032A	T=85°C, RH=85%, 3 x reflow	0	25 x 2	168

High Temperature Reverse Bias (HTRB)

Parts were subjected to 80% of the rated drain-source voltage 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)
HTRB	INN100W032A	T=150°C, VD=80V, VG=VS=0V	0	77 x 3	1000
	INN100W070A	T=150°C, VD=80V, VG=VS=0V	0	77 x 1	168

High Temperature Gate Bias (HTGB)

Parts were subjected to 5.5V 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	INN100W032A	T=150°C, VG=5.5V, VD=VS=0V	0	77 x 3	1000
	INN100W070A	T=150°C, VG=5.5V, VD=VS=0V	0	77 x 1	168

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	INN100W032A	-40 to +125°C, Air	0	77 x 3	1000

High Humidity, High Temperature Reverse Bias (H^3TRB)

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^3TRB	INN100W032A	T=85°C, RH=85%, VD=80V, VG=VS=0V	0	77 x 3	1000

Highly Accelerated Temperature and Humidity Stress Test (HAST)

Parts were subjected to 42V bias at 85%RH and 130°C for a stress period of 96 hours. The testing was done in accordance with the JEDEC Standard JESD22-A110.

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)
HAST	INN100W032A	T=130°C, RH=85%, VD=42V, VG=VS=0V	0	77 x 3	96

High Temperature Storage Life (HTSL)

Parts were subjected to 150°C for a stress period of 1000 hours. The testing was done in accordance with the JEDEC Standard JESD22-A103.

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)
HTSL	INN100W032A	T=150°C	0	77 x 3	1000

High Temperature Operating Life (HTOL)

Parts were subjected to DC-to-DC system test adapted Full-bridge LLC topology with V_{IN} =60V bias and F_{SW}=1MHz at junction temperature＞125°C for a stress period of 1000 hours. The testing was done in accordance with the Qual. Plan.

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)
HTOL	INN100W032A	LLC, Vin=60V, Fsw=1MHz, Tj＞125°C	0	10 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	INN100W032A	All Pins	(±) 1500V	Class 1C
CDM	INN100W032A	All Pins	(±) 1000V	Class C3
HBM	INN100W070A	All Pins	(±) 1500V	Class 1C
CDM	INN100W070A	All Pins	(±) 500V	Class C2a

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
1.0	Final release	May./17/2022	Mengjin Hu	Blanck, Director
1.1	Add INN100W070A	Feb./7/2023	David Liao/ Huahui wang	Blanck, Director