PRODUCT RELIABILITY REPORT

Platform: V100E2.0I

--100V E-Mode GaN FET

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1. Platform Information

Platform	V100E2.0I
BV Rating(V)	100
Process Technology	GaN on Silicon

2. Scope

The testing matrix in this reliability report covers the reliability of INV100FQ030A (platform product) listed in the below table.

Category	Product Number	Package	BV Rating(V)
Platform	INV100FQ030A	FCQFN 4mm x 6mm	100

3. 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. These test items and results were shown as below:

Platform Product (INV100FQ030A)						
NO.	Test Items	Test Condition	Sample Size (Unit x Lot)	#Fail	Result	Test Product
1	HTRB	T=150°C, VD=80V, 1000hrs	77 x 3	0 Fail	Pass	INV100FQ030A
2	HTGB	T=150°C, VG=5.5V, 1000hrs	77 x 3	0 Fail	Pass	INV100FQ030A
3	HBM	All Pins	3 x 1	0 Fail	Class 1B	INV100FQ030A
4	CDM	All Pins	3 x 1	0 Fail	Class C2a	INV100FQ030A
5	DHTOL	Vg=5V, Load current=16A(DC), Tj=125°C, Always on	8set x 3	0 Fail	Pass	INV100FQ030A

Platform Product (INV100FQ030A)						
No.	**Test Items**	**Test Condition**	**Sample Size (Unit x Lot)**	**#Fail**	**Result**	**Test Product**
6	MSL3	T=30°C, RH=60%, 3 x reflow, 192hrs	25 x 3	0 Fail	Pass	INN150FQ032A
7	HTS	T=150°C	77 x 3	0 Fail	Pass	INN150FQ032A
8	PLTC	-55 to +150°C, Air, 1000Cys.	77 x 3	0 Fail	Pass	INN150FQ032A
9	H^3TRB	T=85°C, RH=85%, VD=120V, 1000hrs	77 x 3	0 Fail	Pass	INN150FQ032A
10	HAST	T=130°C, RH=85%, VD=42V, 96hrs	77 x 3	0 Fail	Pass	INN150FQ032A
11	IOL	ΔTj ≥100°C, ton/ toff=2 min /2 min, 7500cyc	77*3	0 Fail	Pass	INN150FQ032A

Note: INV100FQ030A and INN150FQ032A have same BEOL (Back end of line) process and same package process, INV100FQ030A package reliability refer to INN150FQ032A.

3.1 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	INV100FQ030A	T=150°C, VD1=80V, VG=VD2=0V	0	77 x 3	1000
HTRB	INV100FQ030A	T=150°C, VD2=80V, VG=VD1=0V	0	77 x 3	1000

3.2 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	INV100FQ030A	T=150°C, VG=5.5V, VD1=VD2=0V	0	77 x 3	1000

3.3 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 192 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)
MSL3	INN150FQ032A	T=30°C, RH=60%, 3 x reflow	0	25 x 3	192

3.4 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	INN150FQ032A	T=150°C	0	77 x 3	1000

3.5 Part Level Temperature Cycling (PLTC)

Parts were subjected to temperature cycling between -55°C and +150°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)
PLTC	INN150FQ032A	-55 to +150°C, Air	0	77 x 3	1000

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

Parts were subjected to 80% of the rated drain-source voltage 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	INN150FQ032A	T=85°C, RH=85%, VD=120V, VG=VS=0V	0	77 x 3	1000

3.7 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	INN150FQ032A	T=130°C, RH=85%, VD=42V, VG=VS=0V	0	77 x 3	96

3.8 Dynamic High Temperature Operating Life (DHTOL)

Parts were subjected to always on mode with 16A current at junction temperature 125°C for a stress period of 1000 hours. The testing was done in accordance with the JEP-180.

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

Test Item	Product Number	Test Condition	Fail #	Sample Size (Set x Lot)	Duration (Hrs)
DHTOL	INV100FQ030A	Vg=5V, Load current=16A(DC), Tj=125C, Always on	0	8 x 3	1000

3.9 Intermittent Operating Life (IOL)

Parts are subjected to power cycled over ΔT=100°C temperature range. Devices are heated through internal electrical power dissipation with combined gate and drain bias, and a regulated drain current. With 2 minutes temperature ramp, and 2 minutes cool down for a stress period of 7500 cycles. The testing was done in accordance with the MIL-STD-750 (Method 1037).

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

Test Items	Part Number	Test Conditions	Fail #s	Sample Size (SS x Lot)	Duration
IOL	INN150FQ032A	ΔTj ≥100°C Ton/Toff=2min/2min	0	77 x 3	7500Cys

3.10 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	INV100FQ030A	All Pins	(±) 500V	Class 1B
CDM	INV100FQ030A	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	Nov./23/2023	Huahui Wang Huiping Zhou	RE: Blanck sun, Director