PRODUCT RELIABILITY REPORT

Platform: S700E3.0

--700V E-Mode GaN FET

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1. Product Information

Platform	S700E3.0
BV Rating(V)	700
Process Technology	GaN on Silicon

2. Scope

A reliability qualification by similarity matrix approach is applied, as for the product numbers shown in below table formed by associated die family (same die process and design rules). The reason of reliability qualification by similarity is that all potential failure mechanisms for the product numbers in the below table included could be represented by the samples of each individual test.

Category	Product Number	Package Type	Device Qualification	Assembly Qualification	ESD
Spin-off	INN700DA100E	DFN5*6	V	V	V
Spin-off	INN700DC100E	DFN5X6(C)			V
Spin-off	INN700D100E	DFN 8*8			V
Spin-off	INN700TK100E	TO252	V	V	V
Platform	INN700D130E	DFN 8*8	V	V	V
Spin-off	INN700DA130E	DFN 5*6		V	V
Spin-off	INN700DC130E	DFN5X6(C)			V
Spin-off	INN700DA130D	DFN 5*6			V
Spin-off	INN700DC130D	DFN5X6(C)			V
Spin-off	INN700D130D	DFN 8*8	V		V
Spin-off	INN700TK130D	TO252		V	V
Spin-off	INN700TK130E	TO252			V
Spin-off	INN700N130E	Wafer			
Spin-off	INN700N130D	Wafer			
Spin-off	INN700DA170E	DFN 5*6	V		V
Spin-off	INN700DC170E	DFN5X6(C)			V
Spin-off	INN700D170E	DFN 8*8			V
Spin-off	INN700TK170E	TO252			V
Spin-off	INN700N170E	Wafer			
Spin-off	INN700DA210D	DFN 5*6			V
Spin-off	INN700DC210D	DFN5X6(C)			V
Spin-off	INN700D210D	DFN8*8	V		V
Spin-off	INN700TK210D	TO252			V

Scope-Continued					
Spin-off	INN700N210D	Wafer			
Spin-off	INN700DA260D	DFN 5*6	V		V
Spin-off	INN700DC260D	DFN5X6(C)			V
Spin-off	INN700D260D	DFN 8*8			V
Spin-off	INN700TK260D	TO252			V
Spin-off	INN700N260D	Wafer			
Spin-off	INN700DA350D	DFN 5*6	V		V
Spin-off	INN700DC350D	DFN5X6(C)			V
Spin-off	INN700TK350D	TO252			V
Spin-off	INN700TK350D-L	TO252			V
Spin-off	INN700N350D	Wafer			
Spin-off	INN700DA450D	DFN 5*6	V		V
Spin-off	INN700DC450D	DFN5X6(C)			V
Spin-off	INN700TK450D	TO252			V
Spin-off	INN700N450D	Wafer			
Spin-off	INN700DA600D	DFN 5*6	V		V
Spin-off	INN700DC600D	DFN5X6(C)			V
Spin-off	INN700TK600D	TO252			V
Spin-off	INN700N600D	Wafer			
Spin-off	INN700DA800D	DFN 5*6	V		V
Spin-off	INN700N800D	Wafer			
Spin-off	INN700DA1K2D	DFN 5*6	V		V
Spin-off	INN700N1K2D	Wafer			

3. Reliability Tests

The testing matrix in this reliability report covers the reliability of INN700D130E listed in the below table. Others as spin off product of INN700D130E, which the main die with the same design rule and fab process. Innoscience's E-mode GaN FETs were subjected to a variety of reliability test under the condition referenced to typical silicon-based power MOSFETs. These test items and results were shown as below:

Platform Product(INN700D130E)				
Test Items	**Test Conditions**	**Sample Size/Product (Unit x Lot)/Product**	**#Fail**	**Result**
MSL3	T=30°C, RH=60%, 3 x reflow, 192hrs	25 x 3	0 Fail	Pass
HTRB	T=150°C, VD=700V, 1000hrs	77 x 3	0 Fail	Pass
HTGB(+)	T=150°C, VG=7.0V, 1000hrs	77 x 3	0 Fail	Pass
HTGB(-)	T=150°C, VG=-6.0V, 1000hrs	77 x 3	0 Fail	Pass
TC	-55 to +150°C, Air, 1000Cys	77 x 3	0 Fail	Pass
H^3TRB	T=85°C, RH=85%, VD=560V, 1000hrs	77 x 3	0 Fail	Pass
HAST	T=130°C, RH=85%, VD=100V, 96hrs	77 x 3	0 Fail	Pass
DHTOL	QR flyback, Vin=90V(AC), Power out=150W, Tj=125°C, 1000hrs	8 x 3	0 Fail	Pass
HBM	All Pins	3 x 1	0 Fail	Class 2
CDM	All Pins	3 x 1	0 Fail	Class C3

Spin-off Product(INN700DA130E)				
Test Items	**Test Conditions**	**Sample Size/Product (Unit x Lot)/Product**	**#Fail**	**Result**
MSL3	T=30°C, RH=60%, 3 x reflow, 192hrs	25 x 3	0 Fail	Pass
TC	-55 to +150°C, Air, 1000Cys	77 x 3	0 Fail	Pass
H^3TRB	T=85°C, RH=85%, VD=560V, 1000hrs	77 x 3	0 Fail	Pass
HAST	T=130°C, RH=85%, VD=100V, 96hrs	77 x 3	0 Fail	Pass
HBM	All Pins	3 x 1	0 Fail	Class 2
CDM	All Pins	3 x 1	0 Fail	Class C3

Spin-off Product(INN700TK130D)				
Test Items	**Test Conditions**	**Sample Size/Product (Unit x Lot)/Product**	**#Fail**	**Result**
MSL3	T=30°C, RH=60%, 3 x reflow, 192hrs	25 x 3	0 Fail	Pass
TC	-55 to +150°C, Air, 1000Cys	77 x 3	0 Fail	Pass
H^3TRB	T=85°C, RH=85%, VD=560V, 1000hrs	77 x 3	0 Fail	Pass
HAST	T=130°C, RH=85%, VD=100V, 96hrs	77 x 3	0 Fail	Pass
uHAST	T=130°C, RH=85%, 96hrs	77 x 3	0 Fail	Pass
HBM	All Pins	10 x 1	0 Fail	Class 2
CDM	All Pins	10 x 1	0 Fail	Class C3

Note: the device and assembly related reliability qualification of spin off product followed platform formal qualification results.

4. Reliability Detail Test Data

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	INN700DA100E	T=30°C, RH=60%, 3 x reflow	0	25x 1	192
MSL3	INN700TK100E	T=30°C, RH=60%, 3 x reflow	0	25x 3	192
MSL3	INN700D130E	T=30°C, RH=60%, 3 x reflow	0	25x 3	192
MSL3	INN700DA130E	T=30°C, RH=60%, 3 x reflow	0	25x 3	192
MSL3	INN700TK130D	T=30°C, RH=60%, 3 x reflow	0	25x 3	192

High Temperature Reverse Bias (HTRB)

Parts were subjected to 100% of the rated drain-source voltage at the Tjmax temperature for a stress period of 1000 hours. The testing was done in accordance with the 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	INN700DA100E	T=150°C, V_{DS}= 700V	0	77 x 1	1000
HTRB	INN700TK100E	T=150°C, V_{DS}= 700V	0	77 x 3	1000
HTRB	INN700D130E	T=150°C, V_{DS}= 700V	0	77 x 3	1000
HTRB	INN700D130D	T=150°C, V_{DS}= 700V	0	77 x 1	168
HTRB	INN700DA170E	T=150°C, V_{DS}= 700V	0	77 x 1	168
HTRB	INN700D210D	T=150°C, V_{DS}= 700V	0	77 x 1	168
HTRB	INN700DA260D	T=150°C, V_{DS}= 700V	0	77 x 1	168
HTRB	INN700DA350D	T=150°C, V_{DS}= 700V	0	77 x 1	168
HTRB	INN700DA450D	T=150°C, V_{DS}= 700V	0	77 x 1	168
HTRB	INN700DA600D	T=150°C, V_{DS}= 700V	0	77 x 1	168
HTRB	INN700DA800D	T=150°C, V_{DS}= 700V	0	77 x 1	168
HTRB	INN700DA1K2D	T=150°C, V_{DS}= 700V	0	77 x 1	168

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 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(+)	INN700DA100E	T=150°C, V_{GS}= 7.0V	0	77 x 1	1000
HTGB(+)	INN700TK100E	T=150°C, V_{GS}= 7.0V	0	77 x 3	1000
HTGB(+)	INN700D130E	T=150°C, V_{GS}= 7.0V	0	77 x 3	1000
HTGB(+)	INN700D130D	T=150°C, V_{GS}= 7.0V	0	77 x 1	168

HTGB(+)-Continued					
HTGB(+)	INN700DA170E	T=150°C, V_{GS}= 7.0V	0	77 x 1	168
HTGB(+)	INN700D210D	T=150°C, V_{GS}= 7.0V	0	77 x 1	168
HTGB(+)	INN700DA260D	T=150°C, V_{GS}= 7.0V	0	77 x 1	168
HTGB(+)	INN700DA350D	T=150°C, V_{GS}= 7.0V	0	77 x 1	168
HTGB(+)	INN700DA450D	T=150°C, V_{GS}= 7.0V	0	77 x 1	168
HTGB(+)	INN700DA600D	T=150°C, V_{GS}= 7.0V	0	77 x 1	168
HTGB(+)	INN700DA800D	T=150°C, V_{GS}= 7.0V	0	77 x 1	168
HTGB(+)	INN700DA1K2D	T=150°C, V_{GS}= 7.0V	0	77 x 1	168

Negative High Temperature Gate Bias (HTGB-)

Parts were subjected to -6V gate-source bias at the maximum rated temperature for a stress period of 1000 hours. The testing was done in accordance with the 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(-)	INN700D130E	T=150°C, V_{GS}= -6.0V	0	77 x 3	1000

Temperature Cycling (TC)

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 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	INN700DA100E	-55 to +150°C, Air	0 Fail	77 x 1	1000
TC	INN700TK100E	-55 to +150°C, Air	0 Fail	77 x 3	1000
TC	INN700D130E	-55 to +150°C, Air	0 Fail	77 x 3	1000

TC-Continued					
TC	INN700DA130E	-55 to +150°C, Air	0 Fail	77 x 3	1000
TC	INN700TK130D	-55 to +150°C, Air	0 Fail	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 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	INN700TK100E	T=85°C, RH=85%, V_{DS}=560V	0	77 x 3	1000
H^3TRB	INN700D130E	T=85°C, RH=85%, V_{DS}=560V	0	77 x 3	1000
H^3TRB	INN700DA130E	T=85°C, RH=85%, V_{DS}=560V	0	77 x 3	1000
H^3TRB	INN700TK130D	T=85°C, RH=85%, V_{DS}=560V	0	77 x 3	1000

Highly Accelerated Temperature and Humidity Stress (HAST)

Parts were subjected to 100V drain-source bias at 85%RH and 130°C for a stress period of 96 hours. The testing was done in accordance with the 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	INN700TK100E	RH=85%, T=130°C, V_{DS}=100V	0	77 x 3	96
HAST	INN700D130E	RH=85%, T=130°C, V_{DS}=100V	0	77 x 3	96
HAST	INN700DA130E	RH=85%, T=130°C, V_{DS}=100V	0	77 x 3	96
HAST	INN700TK130D	RH=85%, T=130°C, V_{DS}=100V	0	77 x 3	96

Unbiased Highly Accelerated Stress Test(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 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	INN700TK130D	RH=85%, T=130°C	0	77 x 3	96

Dynamic High Temperature Operating Life (DHTOL)

Parts were subjected to QR flyback system test 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	INN700D130E	QR flyback, Vin=90V(AC), Power out=150W, Tj=125°C	0 Fail	8 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	Fail #	Sample Size (Unit x Lot)	JEDEC Class
HBM	INN700DA100E	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700DA100E	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700DC100E	All Pins	0 Fail	10 x 1	Class 2

ESD-Continued					
CDM	INN700DC100E	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700D100E	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700D100E	All Pins	0 Fail	10 x 1	Class C2b
HBM	INN700TK100E	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700TK100E	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700D130E	All Pins	0 Fail	3 x 1	Class 2
CDM	INN700D130E	All Pins	0 Fail	3 x 1	Class C3
HBM	INN700DA130E	All Pins	0 Fail	3 x 1	Class 2
CDM	INN700DA130E	All Pins	0 Fail	3 x 1	Class C3
HBM	INN700DC130E	All Pins	0 Fail	3 x 1	Class 2
CDM	INN700DC130E	All Pins	0 Fail	3 x 1	Class C3
HBM	INN700DA130D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700DA130D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700DC130D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700DC130D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700D130D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700D130D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700TK130D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700TK130D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700TK130E	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700TK130E	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700DA170E	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700DA170E	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700DC170E	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700DC170E	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700D170E	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700D170E	All Pins	0 Fail	10 x 1	Class C2b
HBM	INN700TK170E	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700TK170E	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700DA210D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700DA210D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700DC210D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700DC210D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700D210D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700D210D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700TK210D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700TK210D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700DA260D	All Pins	0 Fail	10 x 1	Class 2

ESD-Continued					
CDM	INN700DA260D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700DC260D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700DC260D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700D260D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700D260D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700TK260D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700TK260D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700DA350D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700DA350D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700DC350D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700DC350D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700TK350D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700TK350D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700TK350D-L	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700TK350D-L	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700DA450D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700DA450D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700DC450D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700DC450D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700TK450D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700TK450D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700DA600D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700DA600D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700DC600D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700DC600D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700TK600D	All Pins	0 Fail	10 x 1	Class 2
CDM	INN700TK600D	All Pins	0 Fail	10 x 1	Class C3
HBM	INN700DA800D	All Pins	0 Fail	10 x 1	Class 1A
CDM	INN700DA800D	All Pins	0 Fail	10 x 1	Class C2a
HBM	INN700DA1K2D	All Pins	0 Fail	10 x 1	Class 1A
CDM	INN700DA1K2D	All Pins	0 Fail	10 x 1	Class C2a

Revision/Updated History

Revision	Reason for Change	Date	Prepared by	Approved by
1.0	Initial version	Jun./28/2024	Ziliang Liu	Jianping Wang, VP
1.1	Update spin off product	Mar./10/2025	Ziliang Liu	Jianping Wang, VP
1.2	Update spin off product	May./23/2025	Yueling Chen	Jianping Wang, VP
1.3	Update spin off product	June./24/2025	Yueling Chen	Jianping Wang, VP
1.4	Update spin off product	July./16/2025	Yueling Chen	Jianping Wang, VP
1.5	Update spin off product	July./29/2025	Yueling Chen	Jianping Wang, VP
1.6	Update spin off product	Sep./26/2025	Yueling Chen	Jianping Wang, VP
1.7	Update spin off product	Oct./31/2025	Yueling Chen	Jianping Wang, VP