United Silicon Carbide, Inc.

AEC-Q101 Product Qualification Report

Discrete TO Packaged SiC JFETs

Products:

UJ3N120070K3S

UJ3N120065K3S

UJ3N120035K3S

UJ3N065080K3S

UJ3N065025K3S

United Silicon Carbide, Inc.
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This report summarizes the AEC-Q101 qualification results for United Silicon Carbide, Inc.'s UJ3N family of Discrete SiC JFETs in TO-247-3L plastic packages.

The environmental stress tests listed below are performed with pre-stress and post-stress electrical tests. Reviewing the electrical results for new failures and any significant shift performance satisfies the AEC-Q101 qualification requirements, as well as UnitedSiC's Quality requirements.

Reliability Stress Test Summary

Test Name	Test Standard	# Samples x # Lots	Failures
High Temperature Gate Reverse Bias (HTGRB)	MIL-STD-750-1 M1038 Method A (1000 Hours) T_J=175ºC, V_{GS}=-20V, V_{DS} =80% V_{max}	77x4 lots	0/308
Highly Accelerated Stress Test (HAST)	JESD22 A-110 (96 Hours) T_A=130ºC/85%RH, V_{GS}=-20V, V_{DS} =42V	77x4 lots	0/308
Intermittent Operating Life (IOL)	MIL-STD-750 Method 1037 DT_J ≥125ºC, 3000 cycles (5 minutes on/ 5 minutes off)	77x4 lots	0/308
Temperature Cycle (TC)	JESD22 A-104 (1000 Cycles)	77x4 lots	0/308
Autoclave (PCT)	JESD22 A-102 121°C/ RH = 100%, 96 hours, 15psig	77x4 lots	0/308
Parametric Verification	Per Datasheet	100% FT x 4 lots	
Physical Dimensions	Per AEC-Q101 Rev D	30x1 packages	0/30
Bondline Thickness	Per Assembly Spec	10x4 lots	0/40
Die Shear	Per Assembly Spec	10x4 lots	0/40

Die Attach Voids	Per Assembly Spec	10x4 lots	0/40
Wire Pull	Per Assembly Spec	10x6 lots	0/40
Wedge Shear	Per Assembly Spec	10x6 lots	0/40
CSAM	Per Assembly Spec	60x4lots	0/240
Lead Integrity Test	Tested in the Cascode Qual	--	--
Solderability Test	Tested in the Cascode Qual	--	--

Reliability Evaluation:

The FIT rate data presented below is determined according to JEDEC Standard JESD 85 and is determined from the HTRB and HTGB Burn-In sample size.

FIT = 3.9120 failures per billion device hours

MTTF = 29180.7 years

From the equations:

$$\lambda_{hours} = \frac{X^2(\alpha, \nu)}{2 \times D \times H \times A_f}$$

$$FIT = \lambda_{hours} \times 10^9$$

$$MTTF_{hours} = {}^{1}/_{\lambda_{hours}}$$

And

$$A_f = e^{\frac{E_a}{k}\left(\frac{1}{T_{use}} - \frac{1}{T_{test}}\right)}$$

Where:

X^2 = Chi-Squared probability function for a given Confidence Level (α) and Degree of Freedom ($\nu = 2r+2$, where r = the number of failures in the Test Population),

D = Number of Devices in the Test Population,

H = Test Hours per Device,

A_f = Acceleration Factor from the Arrhenius equation,

E_a = Activation Energy (eV),

T_{use} = standardized Use Temperature,

T_{test} = Temperature of Stress Test,

and

k = Boltzmann's Constant.

In our calculations, we used our HTGRB Burn-In data:

D = 308 devices for HTGRB,

H = 1000 hours for HTGRB,

$1 - \alpha$ = 0.6 (60% Confidence Level)

r = 0 Failures

E_a = 0.7 eV

T_{use} = 55 °C or 328 K

T_{test} = 175 °C or 448 K