UnitedSiC

Product Change Notification

PCN Number:	PCN Date:	Initiator:	Implementation Date:
28	6/4/2021	Dixie-Ann Sinnette	10/1/2021

PCN INFORMATION

PCN Phase
- ( ) Pre
- (•) Final

Type of Change
- (•) Major
- ( ) Minor
- ( ) Obsolescence

PCN Requirement
- ( ) Customer Approval Required
- (•) Customer Notification Required
- ( ) Notification Only

Change Affects *Select all that apply*
- [ ] Form
- [ ] Fit
- [ ] Function
- [ ] Reliability
- [x] N/A

*Title** *This will be the name of the PCN folder*

Alternative Bill of Materials (BOM) & Packing Method for TO Packages

Description of Change

Alternative materials for leadframe, molding compound and die attach material used in the assembly of TO packages is being qualified.
The material changes will not impact the performance and functionality of the device.
Qualification results of the alternative materials will be provided with the Final PCN

On the product packing the quantity per inner box may change from 600 per box to 300 per box.

Reason for Change

Utilization of the standard assembly site material

MAJOR AND MINOR CHANGE INFORMATION

Field	Value
Affected Product Specification (if applicable)	PER ATTACHMENT TO THIS PCN. *see unitedsic.com for datasheets
Detail of Potential Impact to Customer	BOM DETAILS PER ATTACHMENT TO THIS PCN.
Qualification Plan or Data (if applicable)	N/A
Customer Samples Available (if applicable)	PLEASE CONTACT SALES@UNITEDSIC.COM
Qualification Results Available (if applicable)	PLEASE CONTACT SALES@UNITEDSIC.COM
Identification of Changed Product (if applicable)	DATECODE START WITH LETTER "H" IDENTIFIER.
Comments and/or Supporting Data	

Customer Acknowledgement/Responses

All Customer responses must be sent via e-mail to PCNResponse@Unitedsic.com When replying, please include the PCN number in subject line. Lack of acknowledgement of the PCN within 30 days constitutes acceptance of the change. After acknowledgement, lack of additional response prior to the planned implementation date constitutes acceptance of the change. An acceptance, concern, sample order request or a request for further information should be submitted to UnitedSiC in a timely fashion, (i.e., customer should not wait to the end of the review period before responding). If the customer requires additional time to perform sample testing, beyond the stated planned implementation date, an extension must be negotiated with UnitedSiC. Any contractual PCN agreements made with UnitedSiC supersede these requirements.

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E-mail (PCN Related Correspondence Only): PCNResponse@UnitedSiC.com

United Silicon Carbide, Inc.

Bill of Material Change Qualification Report

Discrete TO-247-3L 650/1200V Generation 3 Cascode Devices

Included Products:

TO-247-3L – Cascodes	TO-247-3L - JFETs
UJ3C120040K3S	UJ3N065025K3S
UF3C120040K3S	UJ3N065070K3S
UJ3C120070K3S	UJ3N065080K3S
UJ3C120080K3S	UJ3N120035K3S
UJ3C120150K3S	UJ3N120065K3S
UF3C120400K3S	UJ3N120070K3S
UJ3C065030K3S	UF3N120008K3S
UF3C065030K3S	
UF3C065040K3S	
UJ3C065080K3S	
UF3C065080K3S	
UF3C120080K3S	

This report summarizes the qualification of a new Bill of Materials according to AEC-Q101 guidelines for our Generation 3 Discrete SiC Cascodes 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 in performance satisfies the qualification requirements.

Reliability Stress Test Summary

Test Name	Test Standard	# Samples x # Lots	Failures
High Temperature Reverse Bias (HTRB)	MIL-STD-750-1 M1038 Method A (1000 Hours) T_J=175°C, V=80% V_{max}	77x3 lots	0/231
High Temperature Gate Bias (HTGB)	JESD22 A-108 (1000 Hours) T_J=175°C, V=100% V_{max} (+20V), bias in one direction	77x3 lots	0/231
Highly Accelerated Stress Test (HAST)	JESD22 A-110 96 hours at TA=130°C/85%RH, with part reverse bias at 42V.	77x3 lots	0/231
Temperature Cycle (TC)	JESD22 A-104 -55°C to +150°C 2cycles/Hr (1000 Cycles)	77x3 lots	0/231
Autoclave (PCT)	JESD22 A-102 121°C/ RH = 100%, 96 hours, 15psig	77x3 lots	0/231
Intermittent Operating Life (IOL)	MIL-STD-750 Method 1037 DTJ ≥125°C, 3000 cycles (5 minutes on/ 5 minutes off)	77x3 lots	0/231
Parametric Verification	Per Datasheet	100% FT x 3 lots	
Physical Dimensions	Per AEC-Q101 Rev D	30x1 packages	0/30
Bondline Thickness	Per Assembly Spec	10x3 lots	0/30

Die Shear	Per Assembly Spec	10x3 lots	0/30
Die Attach Voids	Per Assembly Spec	10x3 lots	0/30
Wire Pull	Per Assembly Spec	10x3 lots	0/30
Wedge Shear	Per Assembly Spec	10x3 lots	0/30
CSAM	Per Assembly Spec	60x3 lots	0/180
Lead Integrity Test	Per AEC-Q101 Rev D	30x1 lots	0/30
Solderability Test	Per AEC-Q101 Rev D	10x1 lots	0/10

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 = 2.608 failures per billion device hours

MTTF = 43771.03 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 HTGB and HTRB Burn-In data:

D = 231 for HTRB, and 231 for HTGB

H = 1000 hours of HTRB, and 1000 hours of HTGB

$1 - \alpha$ = 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