

APS XFAB SiC Planar MOSFET Technology Qualification Report

APS-QR-07-20

REVISION HISTORY

Revision	Description	Author	Date
1	Initial Release	Wallace Cheng	29-Dec-2020

References

- [1] Bonding diagram of ACM040P120Q
- [2] Bonding diagram of ACM030P065Q
- [3] Datasheet of ACM040P120Q
- [4] Datasheet of ACM030P065Q

Summary

Scope of Qualification

<input checked="" type="checkbox"/> New Technology	<input checked="" type="checkbox"/> New Package	<input type="checkbox"/> Derivative	<input type="checkbox"/> Design change
<input checked="" type="checkbox"/> NPI	<input type="checkbox"/> Process Change	<input type="checkbox"/> New Subcon	
<input type="checkbox"/> Others, please specify:			

Qualification Summary

Qual Vehicles	ACM040P120Q, ACDM30P065Q
Part Number(s) covered	ACM040P120Q, ACDM30P065Q
Max Junction Temperature	+175°C
RDSON & Voltage	40mΩ 1200V, 30mΩ & 650V
Target Package Type	TO-247-4L
Target Assembly Site	ASE(WH)

Qualification Conclusions

This qualification report documents the qualification and reliability test results for Alpha Power Solutions Silicon Carbide (SiC) Power Planar MOSFET Technology in XFAB foundry.

Upon completion of all pre-defined requirements, this report documented the subject SiC Power 30mΩ & 40mΩ MOSFET at 650V & 1200V rating and packaged in TO-247-4L are conditionally qualified per JEDEC STANDARD JESD47-01.

In summary a full qualification has been conducted which covered a variety of operating life and environmental stresses to assess the quality and reliability performance of device over its useful life span. Total over 1600 units from ACM040P120Q and ACM030P065Q were stressed and electrically verified, all passed except for two units of HTRB degradation at extreme junction temperature of 175°C were observed with improvement actions identified.

Qualification Lot Information

Qual Lot ID	Device	Wafer Lot Number
Q1	ACM040P120Q	U17957
Q2	ACM030P065Q	U17959
Q3	ACM040P120Q	U17958
Q4	ACM040P120B	U17958

Qualification Test Results

Product Level Qualification Test Results

Test Items		# of Lots	SS per lot	Total units	Results (Fail/SS)	Qual point	Summary
High Temperature Reverse Bias (HTRB) JESD22-A108 @Tj=175°C, 80% rated voltage		Q1 Q2 Q3	77	231	0/229*1	1000hrs	*1 Two Q1 samples found degradation @ 1000hrs HTRB
High Temperature Gate Bias (HTGB) JESD22-A108 @Tj=175°C & Vgs=+16V (80% rated)		Q1 Q2 Q3	77	231	0/231	1000hrs	PASSED
High Temperature Gate Bias (HTGB) JESD22-A108 @Tj=175°C & Vgs=-4V (80% rated)		Q1 Q2 Q3	77	231	0/231	1000hrs	PASSED
Intermittent Operating Life (IOL) MIL-STD-750 Method 1037 @ΔTj=125°C		Q1 Q2 Q4	60 72 72	204	0/204	7.5Kcyc	PASSED
Parameter Verification (PV)		Q1 Q2 Q3	25	75	0/75	---	PASSED
Temperature Cycling Test (TCT) JESD22-A104 @+150°C/-55°C		Q1 Q2 Q3	77	231	0/231	1000cyc	PASSED
Highly Accelerated Stress Test (HAST) JESD22-A110 @42V, Ta=130°C 33.5psia, 85%RH		Q1 Q2 Q3	77	231	0/231	96hrs	PASSED
Autoclave (AC) JESD22-A102 @ Ta=121°C, 15psig 100% RH		Q1 Q2 Q3	77	231	0/231	96hrs	PASSED
ESD	Human Body Model (HBM) JS-001	Q1	3	3	0/3	2KV	PASSED
	Charged Device Model (CDM) JS-002	Q1	3	3	0/3	1KV	PASSED

Remark :

*1 : Two units (Q1#25 & Q1#76) were found degradation after 1000hrs HTRB. Failure Analysis revealed that polysilicon bridge might produce extra stress. Corrective action (CA#1) is to remove the polysilicon bridges near the corner regions to reduce the stress.

- End of Report -