



AEC-Q101 Qualification Report

Qspeed 200V Silicon Diode Family

LQ10N200CQ & LQ20N200CQ

Package: TO-252 DPAK

Version 1.0 – January 13, 2020

Overview

Reliability testing was conducted per AEC-Q101 Rev-D1 on QSpeed LQ10N200CQ and LQ20N200CQ for automotive qualification of its 200V silicon diode Family in the TO-252 package assembled at TFME.

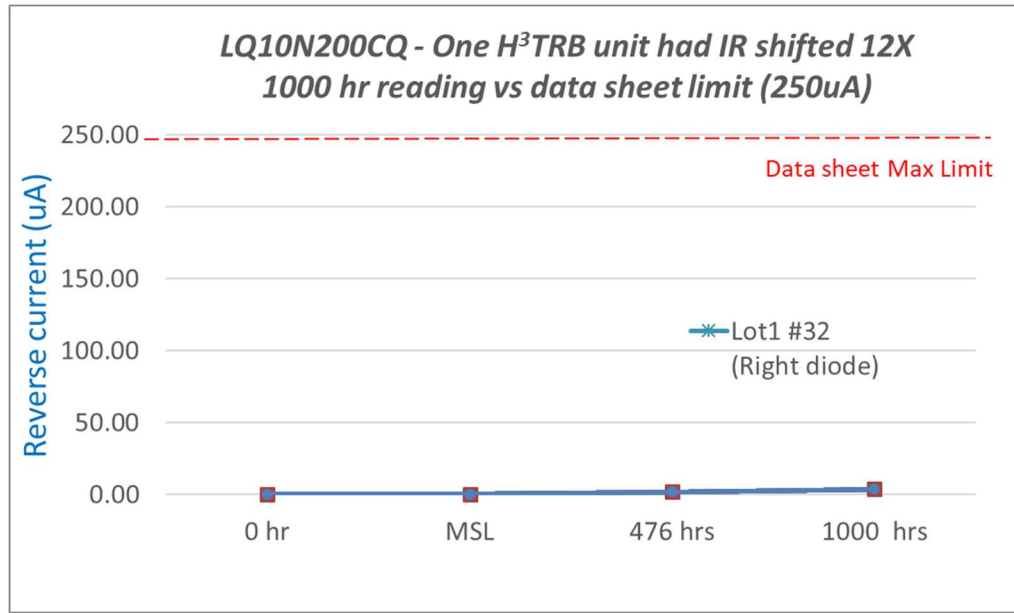
Three qualification lots consisting of two LQ20N200CQ lots and one LQ10N200CQ lot were subjected to a full set of reliability stress tests per AEC-Q101. All tests were completed with passing results per the product datasheet, but there was one H³TRB unit which had marginal shift in its reverse current (IR). However, the final value of IR was still only 1.6% of data sheet maximum limit and thus concluded not to be a reliability risk.

(I) Environmental Testing Summary

Supplier				User Part Number		
Power Integrations				LQ10N200CQ LQ20N200CQ		
Name of Laboratory locations where tests were carried out				Part Description		
Power Integrations, San Jose, USA (PISJ) Eurofins EAG Labs, Santa Clara, USA (EAG) Innovative Circuits Engineering, San Jose, USA (ICE) ISE labs, Fremont, USA (ISE) Tongfu Microelectronics, Nantong, China (TFME)				200V, 10A / 20A Common-Cathode Diode		
Test#	Test Description	Test Conditions	Lab	#Lots	#Tested	#Failed
1	Pre- and Post-Stress Electrical Test	Test all data sheet parameters at 25°C	PISJ	3	1335	0
2	Pre-conditioning (PC)	MSL4; Per JESD22A-113	PISJ	3	924	0
3	External Visual (EV)	Per JESD22B-101	TFME	3	1335	0
4	Parametric Verification (PV)	Test all data sheet parameters at 25°C	PISJ	6	72	0
5	High Temperature Reverse Bias (HTRB)	Reverse Biased @ 160V; T _A = 130°C; 1,000 hours	PISJ	3	231	0
7	Temperature Cycling (TC)	-55°C / +150°C; 1,000 cycles (per JESD22A-104)	PISJ	3	231	0
8	Unbiased Highly Accelerated Stress Test (UHAST)	130°C / 85%RH; 96 hours (per JESD22A-118)	EAG	3	231	0
9	High Humidity High Temp. Reverse Bias (H ³ TRB)	Reverse Biased @ 100V; 85°C / 85%RH; 1,000 hours (per JESD22A-110)	PISJ	3	231	0 ¹
10	Intermittent Operational Life (IOL)	T _A = 25°C; ΔT _J ≥ 100°C, Ton + Toff = 5 mins; 12,000 cycles (per MIL-STD-750, METHOD 1037)	PISJ	3	231	0
11	Human Body Model (ESD HBM)	250V, 500V & 1KV; 10 units per part (per AEC-Q101-001)	PISJ	2	20	0 ²
11	Charge Device Model (ESD CDM)	500V, 750V & 1KV; 10 units per part (per AEC-Q101-005)	PISJ	2	60	0
12	Destructive Physical Analysis (DPA)	Total 4 units (2 TC and 2 H ³ TRB) per AEC-Q101-004	PISJ	1	4	0
13	Physical Dimension (PD)	Per spec JESD22B-100	TFME	1	30	0
14	Terminal Strength (TS)	Per spec MIL-STD-750, METHOD 2036	ISE	1	30	0
20	Resistance to Solder Heat (RSH)	Per JESD22A-111	ICE	1	30	0
21	Solderability (SD)	Per JESD22B-102	TFME	1	10	0
22	Thermal Resistance (TR)	Per JESD24	TFME	1	10	0
23	Wire Bond Strength (WBS)	500g min. with Cpk > 1.67; 10 bonds/unit; total 5 units (Per MIL-STD-750 Method 2037)	TFME	1	50	0
24	Bond Shear (BS)	500g min. with Cpk > 1.67; 1st and 2nd wedge bonds: 10 bonds/unit; total 5 units (Per AEC-Q101-003)	TFME	1	50	0
25	Die Shear (DS)	≥3.96kg; total 10 units (Per MIL-STD-750 Method 2017)	TFME	1	10	0
29	Lead Free (LF)	Per AEC-Q005	TFME	Completed and passed		

Footnote:

1. At 1,000 hours, H³TRB had one LQ10N200CQ unit that passed the datasheet specification for IR (reverse current) but exceeded the < 10X shift requirement marginally.



2. LQ10N200CQ and LQ20N200CQ passed 250V HBM ESD but failed at 500V and 1000V; therefore, they are classified as "H0" level.

(II) Parametric Verification Summary

Supplier: Power Integrations					User Part Number: LQ10N200CQ LQ20N200CQ				
Lot Number: M7P891F (LQ10N200CQ) – 100 units M7P892B (LQ20N200CQ) – 100 units					Temperature: 25°C				
Test Name	Unit	LSL	USL	Min	Max	Mean	Std Dev	Cpk	
LQ10N200CQ									
BV	V	200	-	237	242	240	0.93	23.3	
VF	V	-	1.1	0.95	0.97	0.96	0.005	15.16	
IR	uA	-	250	0.09	0.26	0.16	0.04	0.87	
LQ20N200CQ									
BV	V	200	-	237.8	242	239.85	1.00	23.75	
VF	V	-	1.15	0.97	0.99	0.98	0.005	21.32	
IR	uA	-	500	0.13	0.50	0.21	0.06	1.73	

Conclusion

Based on passing qualification results, Qspeed 200V Silicon Diode Family is qualified to AEC-Q101 requirements.