

Reliability Test Report

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1. Product basic information

Product Name : Dual P-Channel Enhancement Mode MOSFET

Part No : SM4953KC

Package Type : SOP-8

2. Reliability test item

- ☒ Precondition for SMD
- ☒ Power cycling test (HPCT)
- ☒ Temperature cycling test (TCT)
- ☒ Pressure cooking test (PCT)
- ☒ Temperature Humidity Test(THT)
- ☒ Solder-ability
- ☒ High temperature storage test (HTST)
- ☒ High Temperature Gate Bias (HTGB)
- ☒ High Temperature Reverse Bias (HTRB)
- ☒ Electrostatic discharge test (ESD)

3. Reliability test purpose

- ☒ New product evaluation
- ☐ New process / material evaluation
- ☐ Reliability monitor test
- ☐ Other _____

4. Test result

No.	Test Item	Product Name / Package Type	Duration	S.S	Failed #	Conclusion
1	HPCT	SM4953KC	10000 cycles	45	0	PASS
2	TCT	SOP-8	500 cycles	77	0	PASS
3	PCT	SOP-8	168 hrs	77	0	PASS
4	THT	SOP-8	500 hrs	80	0	PASS
5	Solder-ability	SOP-8	5±0.5 sec	5	0	PASS
6	HTST	SOP-8	500 hrs	77	0	PASS
7	HTGB	SM4953KC	1000 hrs	45	0	PASS
8	HTRB	SM4953KC	1000 hrs	45	0	PASS
9	ESD	SM4953KC	0.5 sec	12	0	PASS

5. Conclusion

No failed sample was found after series test, so SM4953KC passed new product evaluation test.

6. Test data

6-1 Preconditioning Flow

No	Process Item	Condition	Note
1	Function Test		
2	SAT		Package Scanning (Option)
3	Temp. Cycle	-65°C ~ 150°C 5Cys	Simulates Worst Shipping
4	Bake 125°C	24 Hrs	Simulate Dry Bakes
5	TH 192Hrs	30°C / 60% RH	Simulates Accelerative Moisture
6	Infrared Reflow	260°C 3Cys	Simulates Solder Reflow
7	SAT		Package Scanning (Option)
8	Function Test		

6-2 Power cycling test (HPCT)

- Test equipment: HSIN-HAO Model : LSS-30-100D
GW Model : GPC-3030
- Standard: JESD22-A122
- Test condition: Devices are switch on at V_G , T_{MIN} . Then the temperature was elevated to T_{MAX} and the device is switch off after thermal equilibrium. and the temperature is drop to T_{MIN} again for one power cycle.
- Stress condition: $V_{DS} = -3.4\text{ V}$, $I_{DS} = 0.5\text{ A}$, $PT = 60\text{ sec}$, $TC = 100^\circ\text{C} \pm 5^\circ\text{C}$, $PD = 1.7\text{ W}$
- Data summary:

Lot Code	Fail/S.S. @ 0 cys	Fail/S.S. @ 5,000 cys	Fail/S.S. @ 10,000 cys	Conclusion
KL80G	0/45	0/45	0/45	PASS

6-3 Temperature cycling test (TCT)

- Test equipment: YASHIMA TSEL-220-2
- Standard: JESD22-A104
- Test condition: $-65^\circ\text{C} \sim 150^\circ\text{C}$, 500 cycles, dwell time 10 minutes
- Test result: All electrical test result after 0, 500 cycles were pass the spec.

6-4 Pressure cooking test (PCT)

- a. Test equipment: HIRAYAMA PC-242III
- b. Standard: JESD22-A102-C
- c. Test condition: 121°C, 100%RH, 2 ATM, 168hrs
- d. Test result: All electrical test result after 0,168 hours were pass the spec.

6-5 Temp/Humidity Storage Test(THT)

- a. Test equipment: KSON THS-G
- b. Standard: JESD22-A101
- c. Test condition: 85±2°C / 85±3% RH, 500 hours
- d. Test result: All electrical test result after 0, 168, 500 hours were pass the spec.

6-6 Solder-ability

- a. Test equipment: WJ40RB
- b. Standard: JESD22-B102D
- c. Test condition:
 - C.1 Steam Ageing: 93±3°C / 6hrs±15min
 - C.2 Sn :Ag:Cu=96.5:3.0:0.5 / 245±5°C / 5±0.5s
- d. Test result: All Soldering area of up to 95% were pass the spec.

6-7 High Temperature storage test (HTST)

- a. Test equipment: TABAI PH-201
- b. Standard: Per JESD22-A103C
- c. Test condition: 150°C
- d. Test result:
All electrical test result after 0, 168, 500 hours were pass. the spec.

6-8 High Temperature Gate Bias (HTGB)

- a. Test equipment: YU-LONG DN-C Oven
- b. Standard: JESD22-A108C
- c. Test condition: Gate Bias= - 20 V, 150°C, 1000hrs
- d. Data summary:

Lot Code	Fail/S.S. @ 168 hrs	Fail/S.S. @ 500 hrs	Fail/S.S. @ 1000 hrs	Conclusion
KL80G	0/45	0/45	0/45	PASS

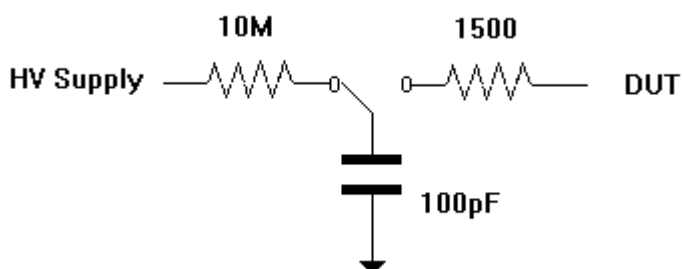
6-9 High Temperature Reverse Bias (HTRB)

- Test equipment: YU-LONG DN-C Oven
- Standard: JESD22-A108C
- Test condition: Drain-Source Bias= - 24 V, 150°C, 1000hrs
- Data summary:

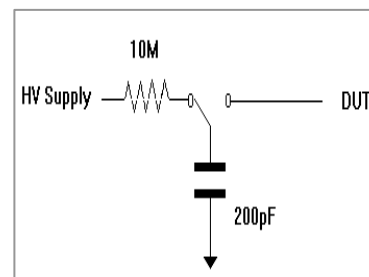
Lot Code	Fail/S.S. @ 168 hrs	Fail/S.S. @ 500 hrs	Fail/S.S. @ 1000 hrs	Conclusion
KL80G	0/45	0/45	0/45	PASS

6-10 Electrostatic discharge test (ESD)

- Test equipment: Thermo Keytek Zapmaster 7/4 tester
- Standard:
 - Human Body Model : MIL-STD-883G
 - Machine Model: JEDEC EIA /JESD22-A115
- Test circuit:



(HBM) Human Body Model Network



(MM) Machine Model Test Circuit

- Test condition:
 - HBM test : start voltage $\pm 50V$, final voltage $\pm 4000V$, per step $\pm 50V$
 - MM test : start voltage $\pm 50V$, final voltage $\pm 2000V$, per step $\pm 25V$
- Failure criteria: (per I-V curve change rate)
Device no longer meets the parts drawing requirements using parametric, functional or IV requirements of voltage drift at $1\mu A \pm 30\%$.

f. Testing result:

MODEL: HBM	ESD SENSITIVITY PASS: <u>±300V</u>		V CLASS: <u>1A</u> NOTE: FOR MIL-STD-883G CLASS 0: ≤249V CLASS 1A: 250V ~ 499V CLASS 1B: 500V ~ 999V CLASS 1C: 1000V ~1999V CLASS 2: 2000V ~3999V CLASS 3A: 4000V ~7999V CLASS 3B: ≥ 8000V
PIN COMBINATION	SAMPLE SIZE	PASSED VOLTS	
G-S	6	±300V	

MODEL: MM	ESD SENSITIVITY PASS: <u>±50V</u>		V CLASS: <u>A</u> NOTE: JEDEC EIA/JESD22-A115 Class A : < 200V. Class B : ≥ 200V , < 400V Class C : ≥ 400V
PIN COMBINATION	SAMPLE SIZE	PASSED VOLTS	
G-S	6	±50V	