

## Reliability Test Report

- 1、*SM4336NSKPC product basic information*
- 2、*Reliability test item*
- 3、*Reliability test purpose*
- 4、*Reliability test result*
- 5、*Conclusion*
- 6、*Test data*

Application date	Jan.29.2013	Test completed date	Mar.12.2013
Written by	Annie Lo	Written date	Mar.12.2013
Approved by	Jackson Su	Approval date	Mar.12.2013

### 1. Product basic information

Product Name : N-Channel Enhancement Mode MOSFET

Part No : SM4336NSKPC

Package Type : DFN5X6-8

### 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
- Reliability monitor test
- New process / material evaluation
- Other \_\_\_\_\_

### 4. Test result

No.	Test Item	Product Name / Package Type	Duration	S.S	Failed #	Conclusion
1	HPCT	SM4336NSKPC	10000 cycles	45	0	PASS
2	TCT	DFN5X6-8	500 cycles	77	0	PASS
3	PCT	DFN5X6-8	168 hrs	77	0	PASS
4	THT	DFN5X6-8	500 hrs	80	0	PASS
5	Solder-ability	DFN5X6-8	5±0.5 sec	5	0	PASS
6	HTST	DFN5X6-8	500 hrs	77	0	PASS
7	HTGB	SM4336NSKPC	1000 hrs	45	0	PASS
8	HTRB	SM4336NSKPC	1000 hrs	45	0	PASS
9	ESD	SM4336NSKPC	0.5 sec	12	0	PASS

## 5. Conclusion

No failed sample was found after series test, so SM4336NSKPC 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)

a. Test equipment: HSIN-HAO Model : LSS-30-100D

GW Model : GPC-3030

b. Standard: JESD22-A122

c. 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.

d. Stress condition:  $V_{DS}= 2.6 V$ ,  $I_D=0.5A$ ,  $PT=60sec$ ,  $TC=100^\circ C \pm 5^\circ C$ ,  $PD= 1.3 W$

e. Data summary:

Lot Code	Fail/S.S. @ 0 cys	Fail/S.S. @ 5,000 cys	Fail/S.S. @ 10,000 cys	Conclusion
CP703	0/45	0/45	0/45	PASS

### 6-3 Temperature cycling test (TCT)

a. Test equipment: YASHIMA TSEL-220-2

b. Standard: JESD22-A104

c. Test condition: -65°C ~ 150°C, 500 cycles, dwell time 10 minutes

d. 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
QOC23	0/45	0/45	0/45	PASS

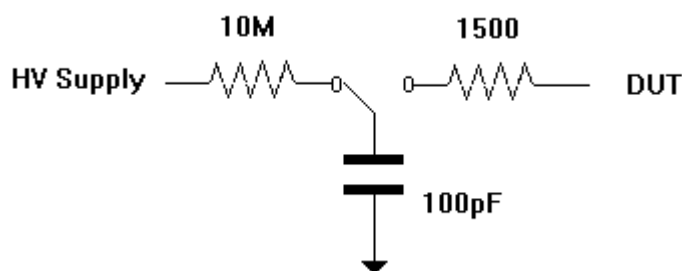
### 6-9 High Temperature Reverse Bias (HTRB)

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

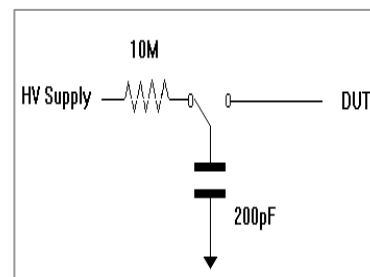
Lot Code	Fail/S.S. @ 168 hrs	Fail/S.S. @ 500 hrs	Fail/S.S. @ 1000 hrs	Conclusion
QOC23	0/45	0/45	0/45	PASS

### 6-10 Electrostatic discharge test (ESD)

- a. Test equipment: Thermo Keytek Zapmaster 7/4 tester
- b. Standard:
  - (1) Human Body Model : MIL-STD-883G
  - (2) Machine Model: JEDEC EIA /JESD22-A115
- c. Test circuit:



(HBM) Human Body Model Network



(MM) Machine Model Test Circuit

- d. Test condition:
  - (1) HBM test : start voltage  $\pm 50V$ , final voltage  $\pm 4000V$ , per step  $\pm 50V$
  - (2) MM test : start voltage  $\pm 50V$ , final voltage  $\pm 2000V$ , per step  $\pm 25V$

e. 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>±2250V</u>		V CLASS: <u>2</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	±2250V	

MODEL: MM	ESD SENSITIVITY PASS: <u>±275V</u>		V CLASS: <u>B</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	±275V	