

# APPLICATION NOTE



## Silicon RF Power Semiconductors

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(Taking charge of Silicon RF by  
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### **SUBJECT: Reliability concept for Silicon RF Products**

Conclusion: This application note shows the reliability concept and reliability level for Silicon RF products. We show the target quality level of Silicon RF products at Item 1. Next we show the our estimate operating time of walkie-talkie at Item2. Item 3 shows the our standard item of reliability test. For reference ,we show the conceivable failure mode at Item4.

#### 1. Quality level

Application; Consumer use two way walkie-talkie for mobile.

Initial Failure Rate; 1000ppm

Failure in Time ; 1000FIT

#### 2. Estimate of walkie-talkie operating time

Transmit :Receive : Wait Time= 1 : 4 : 5 minute/Cycle

Operating time 8.5hours/day

Life Time 5Years (93.075Cycle/Life)

#### 3. Reliability test item and condition

Page 2-4 shows the reliability report of module.

We examine the reliability with these item and condition as standard.

#### 4. Conceivable Failure Mode

Page 5 shows the conceivable failure mode.

# 信頼性資料 RELIABILITY REPORT

三菱半導体デバイス  
MITSUBISHI SEMICONDUCTOR DEVICE

形名 : RoHS 規制適合品 RAシリーズ  
TYPE : RoHS Compliance RA series

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# Reliability concept for MITSUBISHI ELECTRIC Silicon RF Power Semiconductors

AN-GEN030 -E

RoHS 規制適合品 R A シリーズ信頼性結果

RoHS Compliance R A series reliability results

以下の表に RoHS 規制適合品 R A シリーズ (RA45H4452M, RA13H8891MB, RA07M1317M) にて実施した信頼性試験結果を示します。

The following summarizes reliability test on RoHS Compliance RA series (RA45H4452M, RA13H8891MB, RA07M1317M)

表 1 結果

Table 1 Results

グループ Group	サンプル Sample	試験項目 Test item	試験条件 Test condition	試験数量 QTY Of sample	故障数 QTY Of failure
1	RA45H4452M	高温保存 High temperature Storage	125°C 1000hours	1 4	0
2	RA45H4452M	低温保存 Low temperature Storage	-40°C 1000hours	1 4	0
3	RA45H4452M	耐湿性保存 Humidity Storage	85°C/85%RH 1000hours	1 4	0
4	RA45H4452M	温度サイクル Temperature cycling	-40°C/125°C 210cycles	2 2	0
	RA13H8891MB			2 2	
	RA07M1317M			2 2	
5	RA45H4452M	RF 通電試験 RF operation	f=520MHz Pin=50mW Po=46W(Vgg adj.) Vdd=12.5V ON/OFF=2min/2min(ΔTc=60°C) 8400cycles	1 6	0

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表 2 故障判定基準

Table 2 Failure criteria

グループ Group	試験項目 Test	故障判定基準 Failure criteria
1	高温保存 High temperature Storage	For Po and nT , More than the following amount  $\Delta P_o = \pm 20\%$ $\Delta nT = \pm 20\%$  RA45H4452M @ ferq=440,520MHz Pin=50mW Vgg=5V Vdd=12.5V  RA13H8891MB @ ferq=880,915MHz Pin=1mW Vgg=5V Vdd=12.5V  RA07M1317M @ ferq=135,175MHz Pin=20mW Vgg=3.5V Vdd=7.2V
2	低温保存 Low temperature Storage	
3	耐湿性保存 Humidity Storage	
4	温度サイクル Temperature cycling	
5	RF通電 RF operation	

SiRF Products conceivable failure mode and test method.

Mode	Detail	Formation Process	Principal Cause	Test Method
Substrate Crack (Only Module).	Line break on the substrate.	#Wrong assembly procedure. #Foreign object between module flange and chassis. #Expansion by thermal stress.	Excess stress to substrate.	Temperature Cycling
SMD Parts/Solder Crack (Only Module).	Line break on the substrate.	#Poor soldering #High Frequent on/off switching	Excess stress to solder/ SMD parts.	Temperature Cycling
Terminal pull off (Only Module).	Line break on the substrate.	#Poor soldering #High Frequent on/off switching	Excess stress to solder.	Temperature Cycling
Gate leak.	Gate oxide burn out.	#Large RF input power #Load VSWR mismatch #Excess DC or RF voltage applied between drain and source.	Excess input power Excess reflection power Static electricity or surge. Misbiasing	- - ESD -
Drain to Source Breakdown	Termination between drain and source or drain and gate.	# Load VSWR mismatch #Excess DC or RF voltage applied between drain and source.	Excess reflection power Static electricity or surge. Misbiasing	- ESD -
Degradation of ohmic feature.	Migration of electrode.	#High current. #Exposed in higher ambient or heat concentration.	Excess high current Inadequate thermal dissipation.	RF continuation transmission test
Wire snapping	Open between chip and substrate.	#High frequent on/off switching	Excess stress to wire by expansion and reduction of coating resin.	Temperature Cycling