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Subject: The change materials of the Mitsubishi high frequency high power MOSFET module RA series (Notification)

Summary

We will change the materials of the part for the modules, from a rare metal to rare metal-less materials. Because of to maintain stable supply for modules in the future, and to keep the module price against a rise in the price of rare metal materials in recent years.

About a change, we already have verified that It is same RF characteristics, and reliability, before and after.

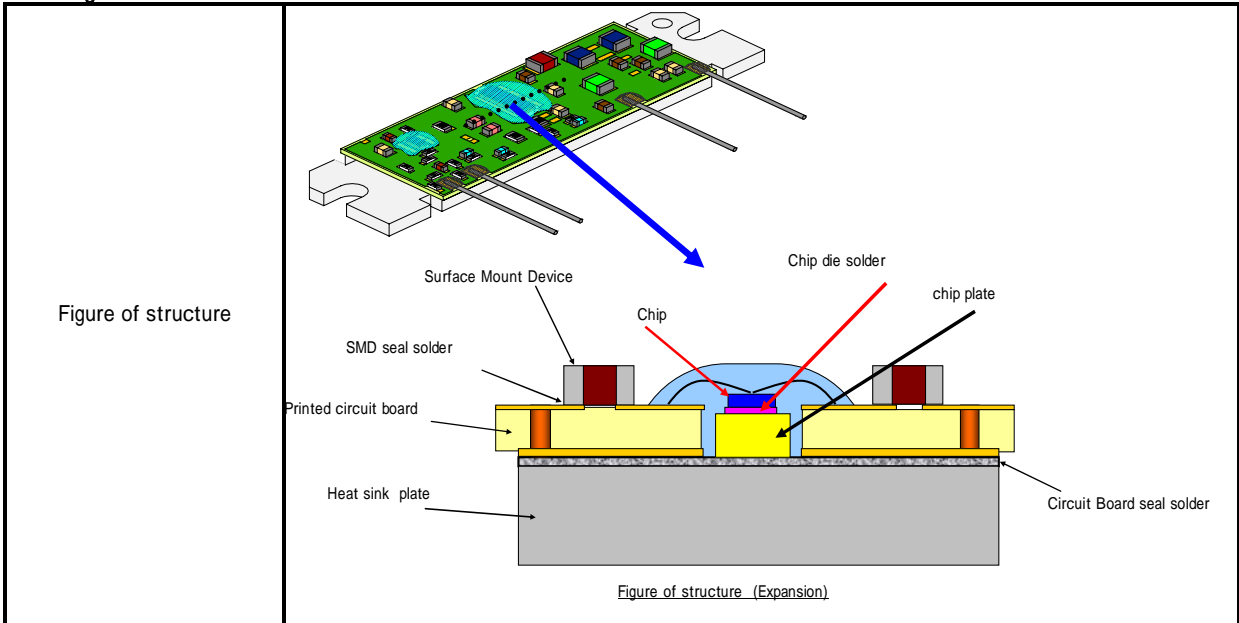
Yours sincerely,

About contents and a plan to change.

	Product name	Type number	Attached document	
object	MOS FET Module	RA series modules. But H46M package(handly metal cap module) and H58 package(RA01L series) are not changed.	-	
Changes	Reason	Because of to maintain stable supply for modules in the future, and to keep the module price against a rise in the price of rare metal materials in recent years.		
	Contents	<ul style="list-style-type: none"> Change of chip plate material (CuMo Cu) Change die bond solder (AuSn SnAgCuSb) 	Sheet Shows figure. The contents for change of module materials and result of thermal stress simulation	
	Current	<table border="1"> <tr> <td></td> <td>NEW</td> </tr> </table> <ul style="list-style-type: none"> 1. Chip plate material: CuMo (Au-Plating) 2. Die bond solder: AuSn 3. Board seal solder: SnAgCu 		
		NEW		
Influence of a function / reliability	<p>There is not the influence, and it is a characteristic same as before.</p> <p>The thermal stress of a FET chip increases by the change of the chip plate material. However, the stress is relaxed to same level as current modules by changing die solder to SnAgCuSb.</p> <p>As a result, We secure good a reliability level same as current module by evaluating of Thermal stress simulation/RF Characteristic/Thermal resistance /Temperature cycling test .</p>	Sheet Shows figure. About characteristic comparison of New module and current module.		
	1 A mass production start day	We are going to change from production in Jan, 2010. It is applied by production lot No.09XSA		
	2 The change of the quality (production) system	No change		
	3 change of worker and examiner.	No change		
	4 Change of production facility and machinery.	No change		
	5 change of test fixture and examiner.	No change		

Sheet The contents for change of module materials and Result of thermal stress simulation

Change materials



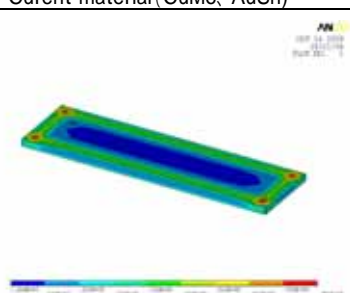
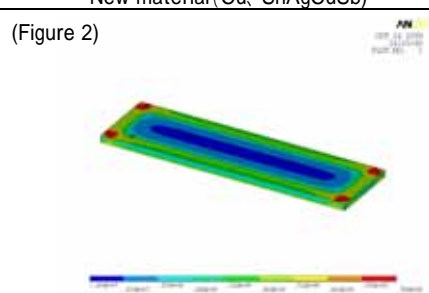
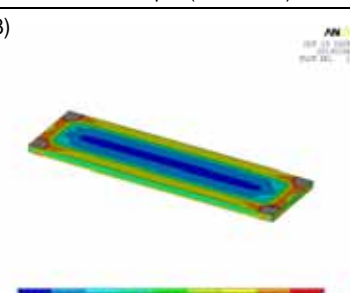
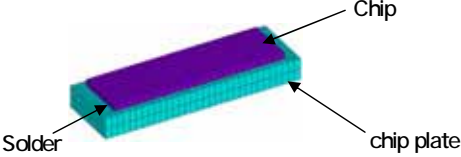
No	material	Curent material	New material
	Chip plete	CuMo (Au-Plating)	Cu (Ag-Plating)
	Chip die solder	AuSn	SnAgCuSb
	Circuit Bord seal solder	SnAgCu	SnAgCuSb
	chip	MOS	No change
	Surface mount device	SMD of the ceramics base	No change
	SMD seal solder	SnAgCuSb	No change
	Heat sink plate	Cu (Ni-Plating)	No change

Reason to change

We will change the materials of the part for the modules, from a rare metal to rare metal-less materials. Because of to maintain stable supply for modules in the future, and to keep the module price against a rise in the price of rare metal materials in recent years.
 The thermal stress of a FET chip is relaxed to same level as current modules by changing die solder to SnAgCuSb. We will unify two kinds of solders(,) to SnAgCuSb. To make more rational for the material control and production management.

Thermal stress simulation

The thermal stress of chip is same level between a current module and a new module from result of Thermal stress simulation.

	Curent material (CuMo, AuSn)	New material (Cu, SnAgCuSb)								
Result (The thermal stress distribution of the chip back side)		(Figure 2) 								
Maximum stress (Melting point 25)	(Figure 1) 77.1Mpa	78.1Mpa								
Result (The thermal stress distribution of the chip back side)	Reference Sample (Cu, AuSn) (Figure 3) 	[Condition of simulation] Analysis tool: ANSYS Mechanical Ver10.0 method of analysis : Thermal stress analysis Analysis model : 1/1 3Dmodel <table border="1" data-bbox="1069 1792 1388 1881"> <thead> <tr> <th>Item</th> <th>size(mm)</th> </tr> </thead> <tbody> <tr> <td>Chip plate</td> <td>2.5 × 8 × 10.8</td> </tr> <tr> <td>Chip (maximum)</td> <td>2.0 × 7 × 10.2</td> </tr> <tr> <td>Bonding solder</td> <td>2.0 × 7 × 10.02</td> </tr> </tbody> </table> 	Item	size(mm)	Chip plate	2.5 × 8 × 10.8	Chip (maximum)	2.0 × 7 × 10.2	Bonding solder	2.0 × 7 × 10.02
Item	size(mm)									
Chip plate	2.5 × 8 × 10.8									
Chip (maximum)	2.0 × 7 × 10.2									
Bonding solder	2.0 × 7 × 10.02									
Maximum stress (Melting point 25)	106Mpa									

Sheet : About characteristic comparison of New module and Current module.

1. Comparison result of the characteristic.

I carried out characteristic comparison of the representative product. (UHF Band/45W : RA45H4452M)

We shows the result of RF Characteristic/Load VSWR Tolerance/Stability/Thermal resistance /Temperature cycling as follows.

<Conclusion >

There was not the difference for electric resistance and thermal resistance.

In addition, there were not the change of the impedance, the influence of the heat.

Therefore, there is not the change of the current module.

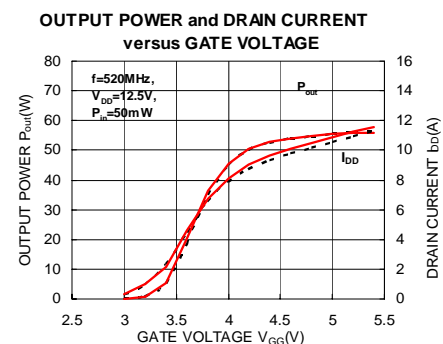
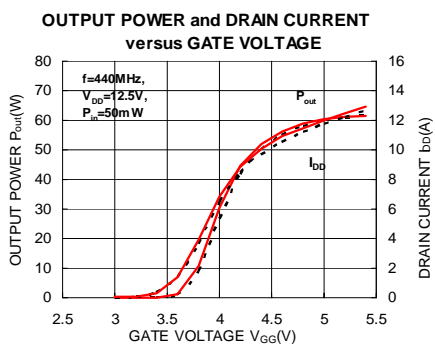
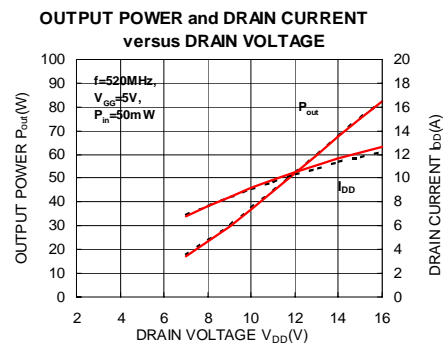
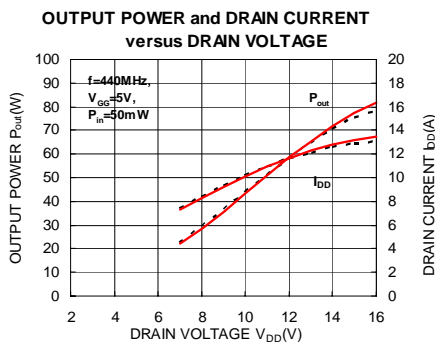
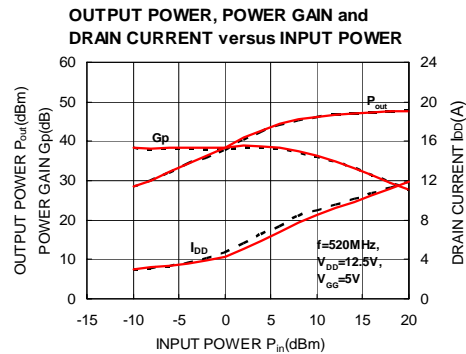
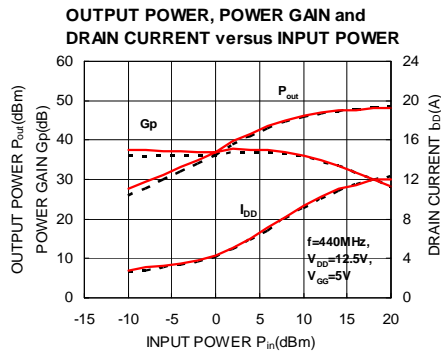
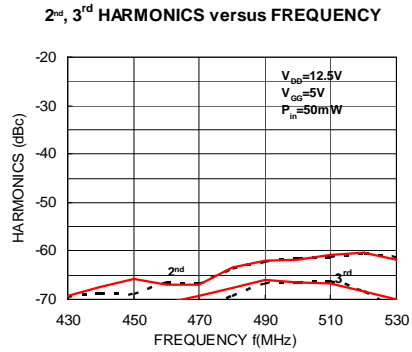
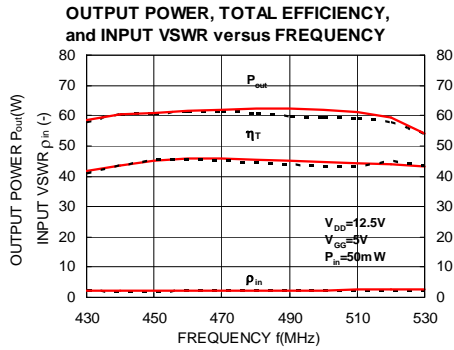
(1)RF Characteristic

RF Characteristic is the same current module as new module.

TYPICAL PERFORMANCE DATA

Red color and Solid Line is change specification.

Black color and dotted line is current specification.



(2)Load VSWR Tolerance

Load VSWR Tolerance is the same current module as new module.

Condition : f=440/520MHz, Vdd=12.5V, Pin=50mW, Pout=57W(Vgg control)
Zg=50 Zl=20:1All phase

Result

Specification	Sample No.	judgment
New module Chip plate : Cu Die bond solder: SnAgCuSb Bord seal solder: SnAgCuSb	No.1	No degradation or destroy
	No.2	
	No.3	
	No.4	
	No.5	
Current module Chip plate : CuMo Die bond solder: AuSn Bord seal solder: SnAgCu	No.1	No degradation or destroy
	No.2	
	No.3	
	No.4	
	No.5	

(3)Stability

Stability is the same current module as new module.

Condition : f=440/520MHz, Vdd=10-15.2V, Pin=25mW-70mW, Pout=55W(Vgg control)
Zg=50 Zl=3:1All phase Tcase = 25 /-30

Result

Specification	Sample No.	judgment
New material Chip plate : Cu Die bond solder: SnAgCuSb Bord seal solder: SnAgCuSb	No.1	
	No.2	
	No.3	
	No.4	
	No.5	
Current material Chip plate : CuMo Die bond solder: AuSn Bord seal solder: SnAgCu	No.1	
	No.2	
	No.3	
	No.4	
	No.5	

(4)Thermal resistance

Thermal resistance is the same or reduce between current module and new module.

Condition : Vds=20V, Ids=1.0A, Vgs=0V, IM=10mA, SAMPLE DELAY=150 μ S

Result

Specification	Thermal resistance value
New module Chip plate : Cu Die bond solder: SnAgCuSb Bord seal solder: SnAgCuSb	Rth(ch-case)=0.58 /W@final stage MOSFET
Current module Chip plate : CuMo Die bond solder: AuSn Bord seal solder: SnAgCu	Rth(ch-case)=0.68 /W@final stage MOSFET

(5)Temperature cycling

Temperature cycling test result is the same current module as new module.

Result

Test condition	QTY of sample	Failure
-40 /125 210cycle	22pcs	0pcs
Failure criteria : Po= ± 20%, T= ± 20%		