

To: Dear customer

Data Apr.15th 2014

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**Subject : Notification of change material of the heat-sink
for MITSUBISHI Silicon RF H46S package modules. (Preannounce)**

We will change the material of heat-sink for H46S package modules, from EFTEC*1) copper to Tough-Pitch copper .

The reasons are stable procurement and stable production.*2)

We have operating experience that this material(EFTEC) have already applied for high power modules(H2S)

We confirmed that there is no problem for RF characteristics and reliability.*3)

As a result, We secure good a reliability level same as current module by comparison result of the evaluation.

We will have no change for specifications and outline drawing.

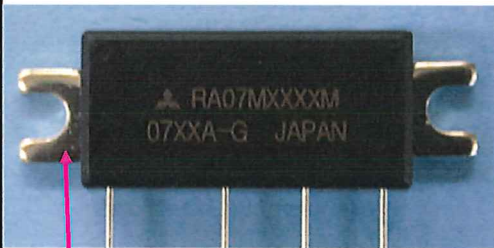
We will be scheduled for mass production from June 2014.

*1)Page2: Attached are the comparison table for the material.

*2)We are difficult to buy steels(EFTEC), because the steel maker suffered great deal of damage due to snow on Feb 2014.

*3)Page 3-6: Attached are the report of comparison result of the RF characteristics.

●Products subject, Reason of change, Change schedule

Subject	Product name		MOS FET Modules (RA series)		H46S Package outline		
	Package outline		H46S package		 Heat-sink		
Reason of change	Reason of change	Stable procurement,stable production.					
	Changed contents	We will change material of the heat-sink.					
	Current		New				
	EFTEC copper (CDA standard: C14410)		Tough-Pitch copper (CDA standard: C11000)				
Change schedule	Change schedule of H46S package (Change copper material)		2014 April	May	June	July	
	1. A mass production of current heat-sink (EFTEC)						
	2. A mass production starting of new heat-sink (Tough-Pitch copper)						

● **Copper material comparison table of H46S package.**

Current (EFTEC copper) vs. New (Tough-Pitch copper)

Comparison material table of copper heat-sink (H46S package)

Properties		Current	New
		EFTEC	Tough-Pitch
		CDA standard C14410	CDA standard C11000
Tensile strength	[kgf/mm ²]	255~333	251~285
Elongation	[%]	15 Over	19~41
Coefficient of Thermal Expansion	[10 ⁻⁶ /°C]	17.3	17.7
Heat conductivity	[W/m·k]	360	391

● Comparison result of the RF characteristics.

We carried out characteristic comparison of the representative product. (VHF Band : RA07M1317M)

We show the result of RF Characteristic/Load VSWR Tolerance/Surface temperature comparison/Stability as follows.

(1) RF Characteristic

■ Test condition: $f = 135/155/175\text{MHz}$, $V_{dd} = 7.2\text{V}$, $P_{in} = 20\text{mW}$, $Z_g = Z_L = 50\Omega$

■ Test item : f-Po Characteristic/Pin-Po Characteristic/VDD-Po Characteristic/VGG-Po Characteristic

■ Result : There is not the influence, and it is a characteristic same as current module.

Page4~5 shows the RF Characteristics comparison.

(2) Load VSWRT Tolerance

■ Test condition: $f = 135/155/175\text{MHz}$, $V_{dd} = 9.2\text{V}$, $P_{in} = 20\text{mW}$, $P_{out} = 9/10/11\text{W}$ (Vgg control)
 $Z_g = 50\Omega$, VSWR20:1 All phase

■ Result : RF Load VSWR Tolerance is the same as current module.

There is not degradation and not destroy.

(3) Surface temperature

■ Test condition: $f = 135/155/175\text{MHz}$, $V_{dd} = 7.2\text{V}/9.2\text{V}$, $P_{in} = 20\text{mW}$, $P_{out} = 6\text{W}$ (Vgg control)
 $Z_g = 50\Omega$, VSWR20:1 All phase

■ Result : Surface temperature result are same temperature level with current module.

Page6 attach a photograph of Surface temperature.

(4) Stability

■ Test condition: $f = 135/155/175\text{MHz}$, $V_{dd} = 4.0/7.2/9.2\text{V}$, $P_{in} = 10\text{-}30\text{mW}$, $P_{out} < 8\text{W}$ (Vgg control)
 $Z_g = 50\Omega$, VSWR4:1 All phase $T_c = -30^\circ\text{C}/25^\circ\text{C}$

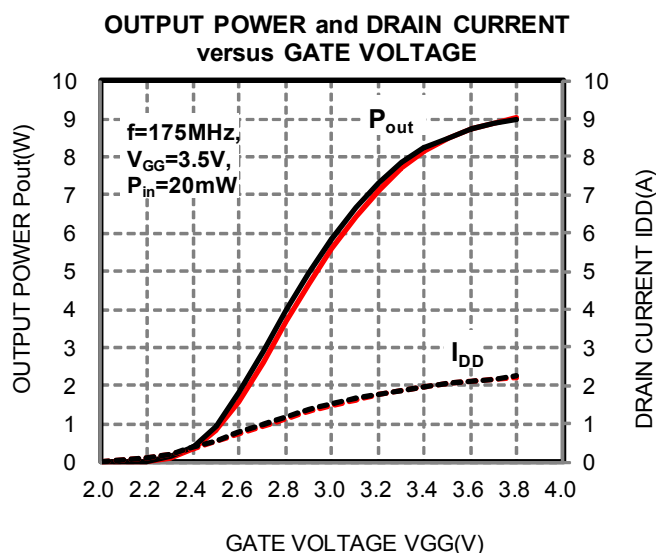
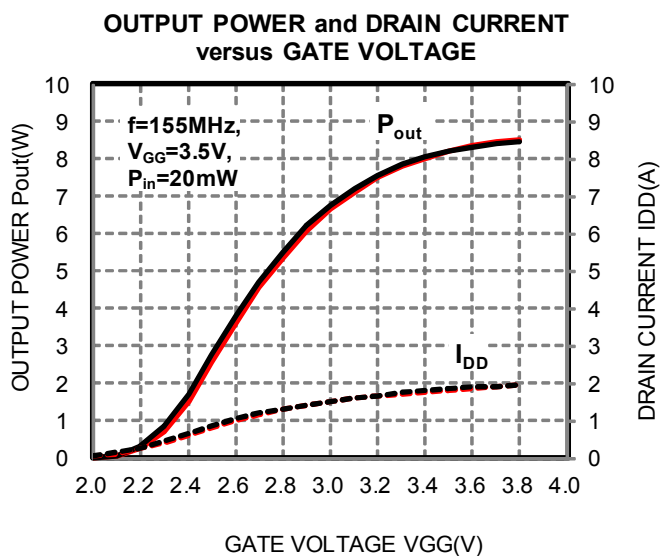
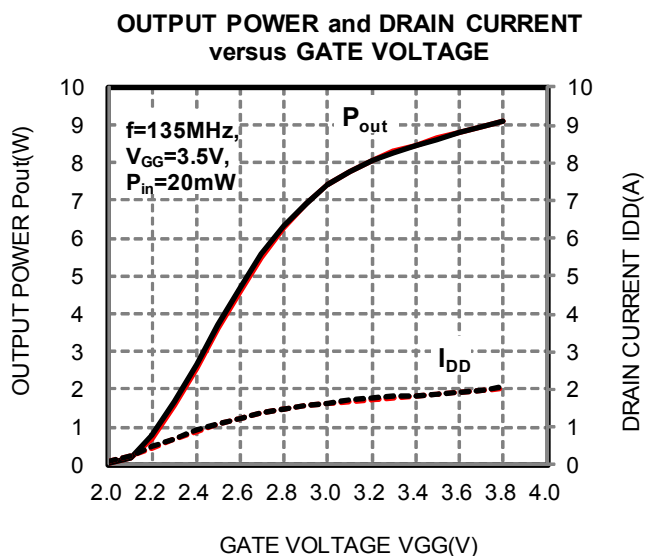
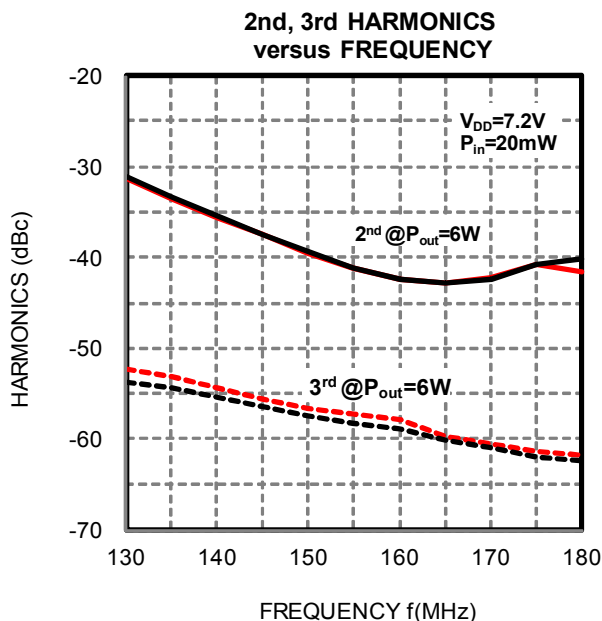
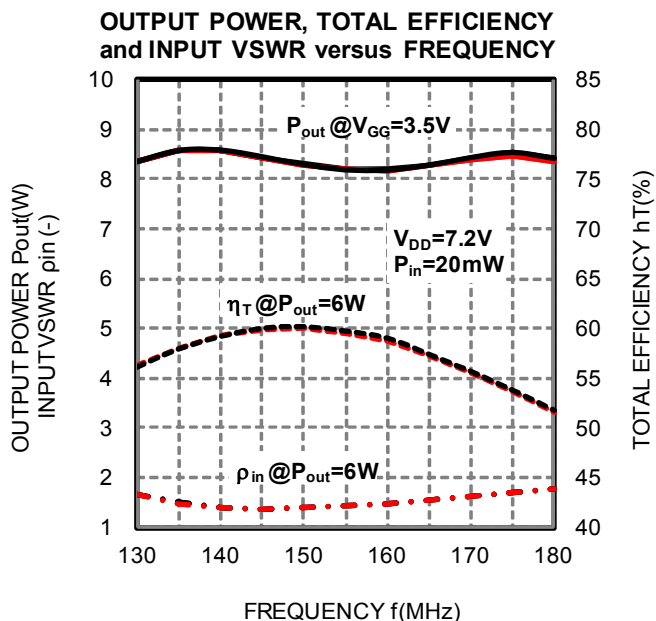
■ Result : Stability is the same as current module. There is not not found oscillation spectrum.

Comparison result of the RF characteristic curve. Current(EFTEC copper) vs. New(Tough-Pitch copper)

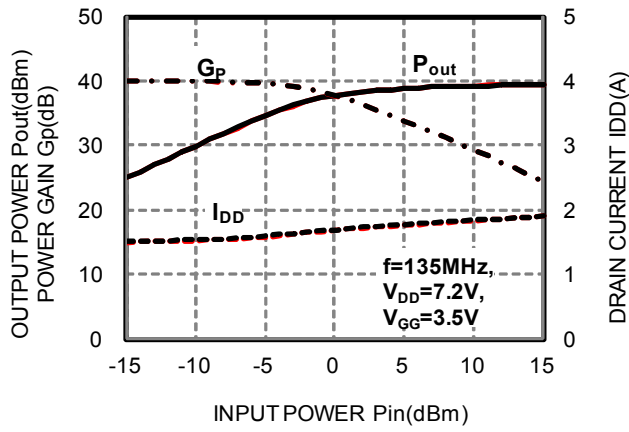
Representative product: RA07M1317M

Black color line : EFTEC copper

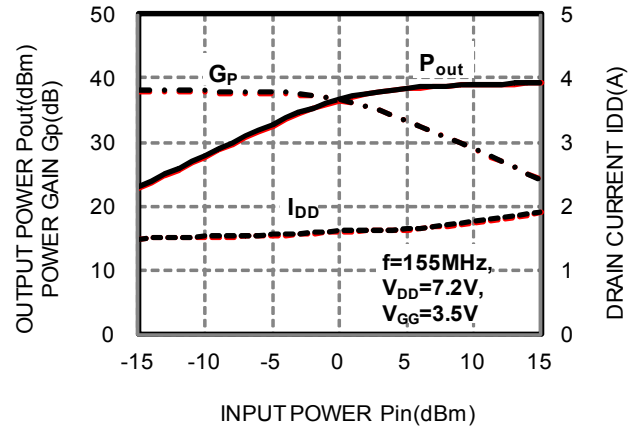
Red color line : Tough-Pitch copper



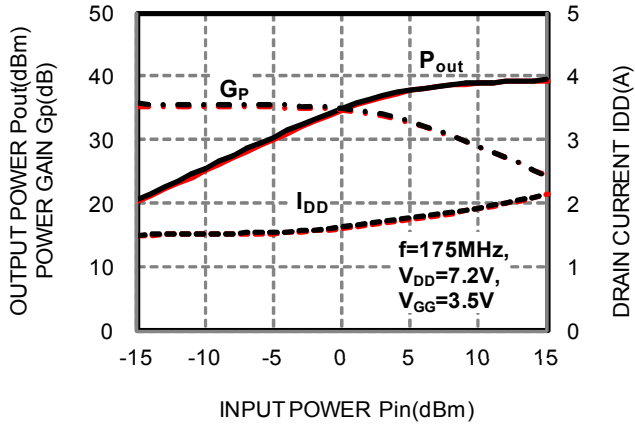
OUTPUT POWER, POWER GAIN and DRAIN CURRENT versus INPUT POWER



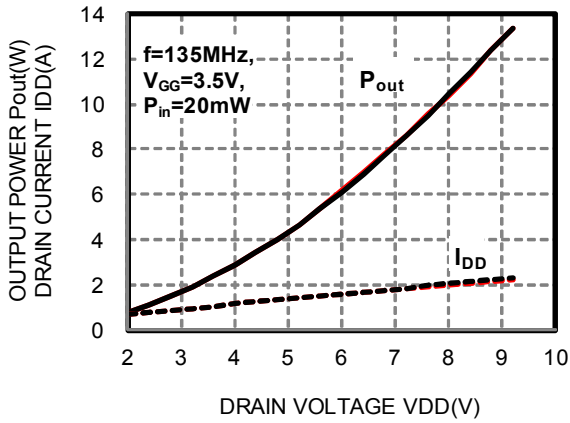
OUTPUT POWER, POWER GAIN and DRAIN CURRENT versus INPUT POWER



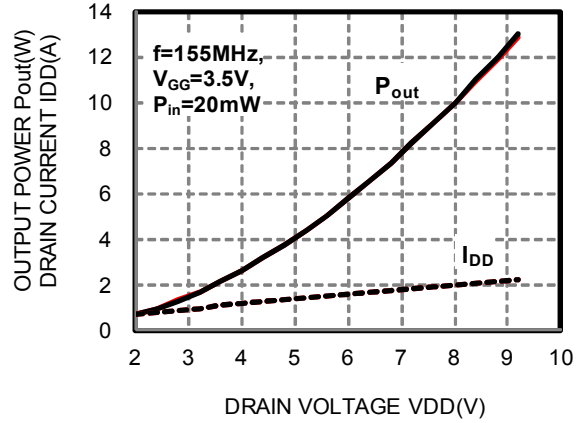
OUTPUT POWER, POWER GAIN and DRAIN CURRENT versus INPUT POWER



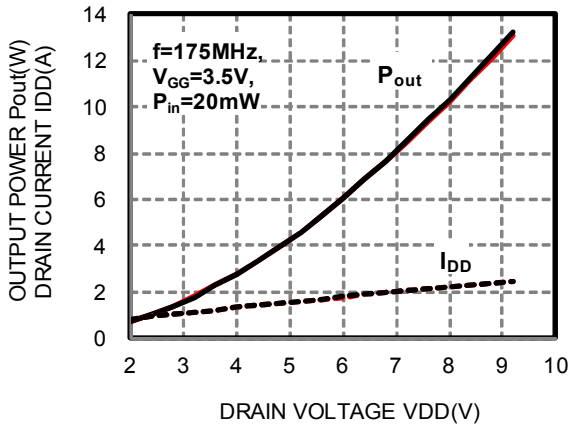
OUTPUT POWER and DRAIN CURRENT versus DRAIN VOLTAGE



OUTPUT POWER and DRAIN CURRENT versus DRAIN VOLTAGE



OUTPUT POWER and DRAIN CURRENT versus DRAIN VOLTAGE



Comparison result of the Surface temperature. Current(EFTEC copper) vs. New (Tough-Pitch copper)
Representative product: RA07M1317M

