

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

MITSUBISHI RF MOSFET MODULE

RA03M4547MD

RoHS Compliance , 450-470MHz 38dBm 7.2V, 2 Stage Amp. For PORTABLE RADIO

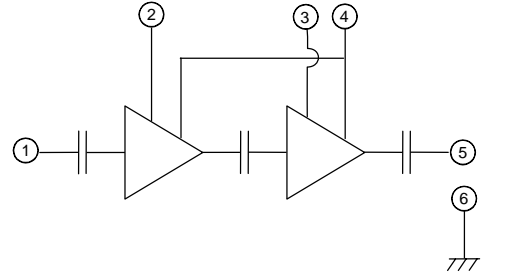
DESCRIPTION

The RA03M4547MD is a 38 dBm output RF MOSFET Amplifier Module for 7.2 volt portable radios that operate in the 450 to 470 MHz range.

FEATURES

- Enhancement-Mode MOSFET Transistors
($I_{DD} \approx 0$ @ $V_{DD} = 7.2V$, $V_{GG} = 0V$)
- $P_{out} > 38dBm$ @ $V_{DD} = 7.2V$, $P_{in} = 19dBm$
 $I_{dq1} = 30mA$ (V_{gg1} adjust.), $I_{dq2} = 1A$ (V_{gg2} adjust.) ,
- $\eta_T > 34\%$ @ $V_{DD} = 7.2V$, $P_{out} = 38dBm$ (P_{in} adjust.),
 $I_{dq1} = 30mA$ (V_{gg1} adjust.), $I_{dq2} = 1A$ (V_{gg2} adjust.)
- $IMD3 < -25dBc$ @ $V_{DD} = 7.2V$, P_{out} (average) = $35dBm$ (P_{in} adjust.)
Two tone test at 1KHz separation
 $I_{dq1} = 30mA$ (V_{gg1} adjust.), $I_{dq2} = 1A$ (V_{gg2} adjust.)
- Broadband Frequency Range: 450-470MHz
- Low-Power Adjust. Current $I_{GG} = 1mA$ (typ) at $V_{GG} = 3.5V$
- Module Size: 30 x 10 x 5.4 mm

BLOCK DIAGRAM



- 1 RF Input (P_{in})
- 2 FIRST STAGE GATE BIAS DC SUPPLY TERMINAL (V_{gg1})
- 3 FINAL STAGE GATE BIAS DC SUPPLY TERMINAL (V_{gg2})
- 4 Drain Voltage (V_{DD}), Battery
- 5 RF Output (P_{out})
- 6 RF Ground (Case)

PACKAGE CODE: H46S

RoHS COMPLIANT

- RA03M4547MD-101 is a RoHS compliant products.
- RoHS compliance is indicate by the letter "G" after the Lot Marking.
- This product include the lead in the Glass of electronic parts and the lead in electronic Ceramic parts.
How ever ,it applicable to the following exceptions of RoHS Directions.
 - 1.Lead in the Glass of a cathode-ray tube, electronic parts, and fluorescent tubes.
 - 2.Lead in electronic Ceramic parts.

ORDERING INFORMATION:

ORDER NUMBER	SUPPLY FORM
RA03M4547MD-101	Antistatic tray, 25 modules/tray



MAXIMUM RATINGS ($T_{case}=+25^{\circ}C$, unless otherwise specified)

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V_{DD}	Drain Voltage	$V_{GG}<3.5V$	9.2	V
V_{GG1}	Gate Voltage	$V_{DD}<7.2V, P_{in}=0mW$	4	V
V_{GG2}	Gate Voltage	$V_{DD}<7.2V, P_{in}=0mW$	4	V
P_{in}	Input Power	$f=450-470MHz,$	100	mW
P_{out}	Output Power	$Z_G=Z_L=50\Omega$	10	W
$T_{case(OP)}$	Operation Case Temperature Range		-30 to +90	$^{\circ}C$
T_{stg}	Storage Temperature Range		-40 to +110	$^{\circ}C$

The above parameters are independently guaranteed.

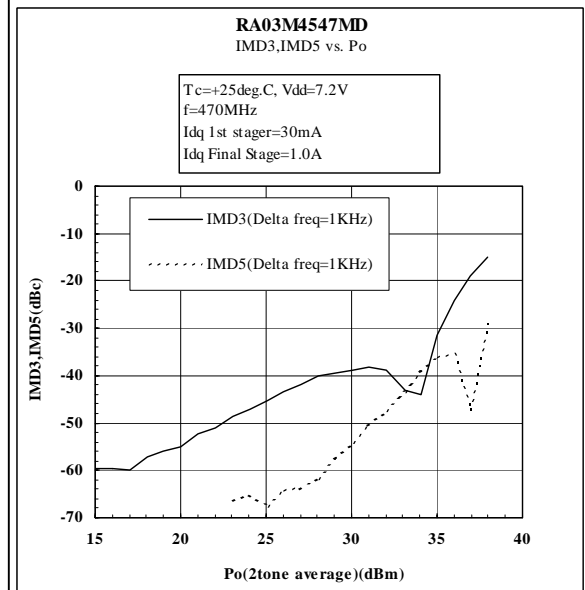
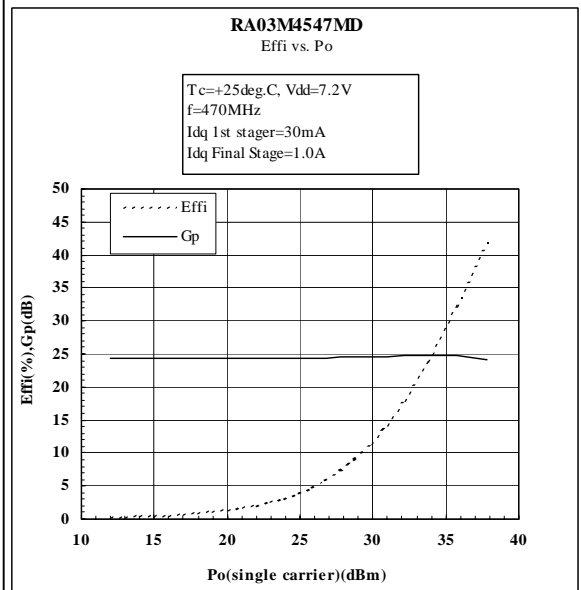
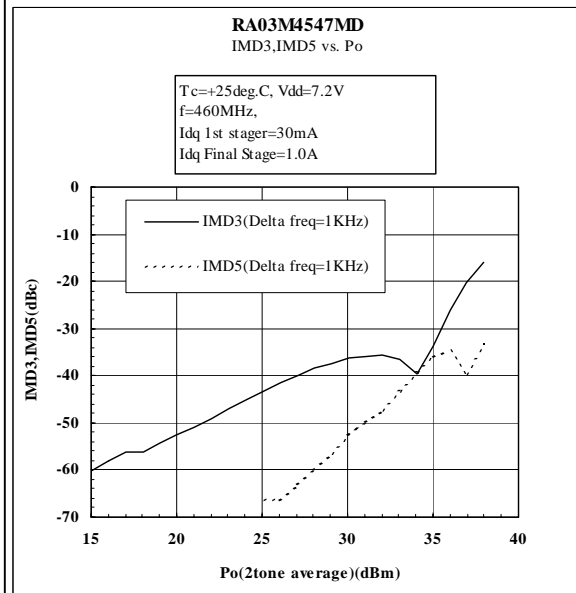
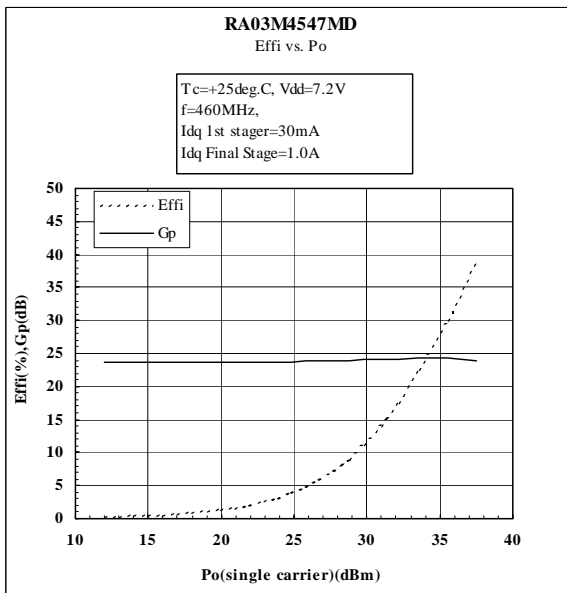
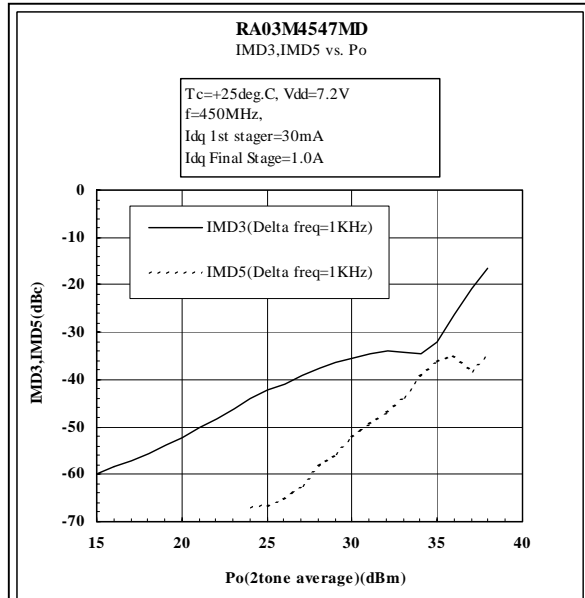
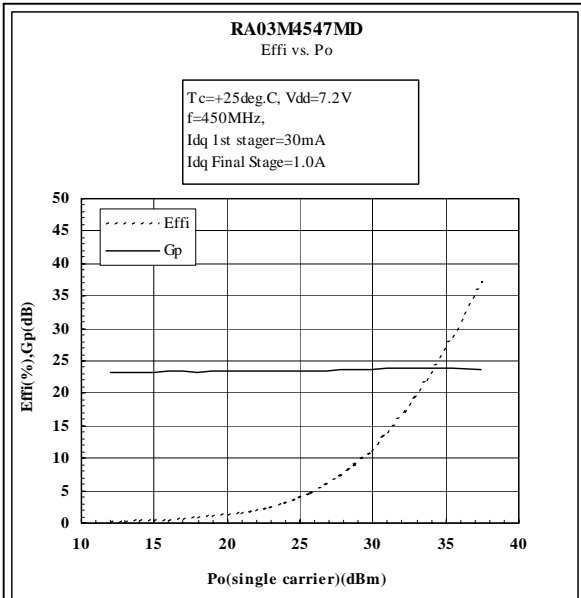
ELECTRICAL CHARACTERISTICS ($T_{case}=+25^{\circ}C, Z_G=Z_L=50\Omega$, unless otherwise specified)

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
f	Frequency Range		450		470	MHz
P_{out}	Output Power	$V_{DD}=7.2V, P_{in}(\text{Single Carrier})=+19dBm,$ $I_{dq1}=30mA(V_{gg1} \text{ adjust.}),$ $I_{dq2}=1A(V_{gg2} \text{ adjust.})$	38			dBm
η_T	Total Efficiency	$V_{DD}=7.2V, P_{out}(\text{Single Carrier})=38dBm$ (Pin adjust.),	34			%
$2f_o$	2 nd Harmonic	$I_{dq1}=30mA(V_{gg1} \text{ adjust.}),$ $I_{dq2}=1A(V_{gg2} \text{ adjust.})$			-25	dBc
ρ_{in}	Input VSWR				4.4:1	—
I_{GG}	Gate Current			1		mA
IMD3	3 rd Inter Modulation Distortion	$V_{DD}=7.2V, P_{out}(\text{average})=35dBm$ (Pin adjust.), $I_{dq1}=30mA(V_{gg1} \text{ adjust.}),$ $I_{dq2}=1A(V_{gg2} \text{ adjust.})$			-25	dBc
IMD5	5 th Inter Modulation Distortion	Two tone test at 1KHz separation			-25	dBc
GV	Gain Variation	$V_{DD}=7.2V, P_{out}(\text{Single Carrier})=35dBm$ (Pin adjust.), Across specified frequency range $I_{dq1}=30mA(V_{gg1} \text{ adjust.}),$ $I_{dq2}=1A(V_{gg2} \text{ adjust.})$	0		4	dB
—	Stability	$V_{dd}=6.0/7.2/9.2V,$ $I_{dq1}=30mA(V_{gg1} \text{ adjust.}),$ $I_{dq2}=1A(V_{gg2} \text{ adjust.}),$ $P_o(\text{Single Carrier})=15-38dBm$ (Pin control) LOAD VSWR=2:1 (All Phase), $Z_g=50\Omega$	No parasitic oscillation			—
—	Load VSWR Tolerance	$V_{dd}=9.2V, P_{out}(\text{Single Carrier})=39dBm$ (Pin adjust.), LOAD VSWR=2:1 (All Phase), $Z_g=50\Omega$, $I_{dq1}=30mA(V_{gg1} \text{ adjust. @ } V_{dd}=7.2V),$ $I_{dq2}=1A(V_{gg2} \text{ adjust. @ } V_{dd}=7.2V)$	No degradation or destroy			—

All parameters, conditions, ratings, and limits are subject to change without notice.

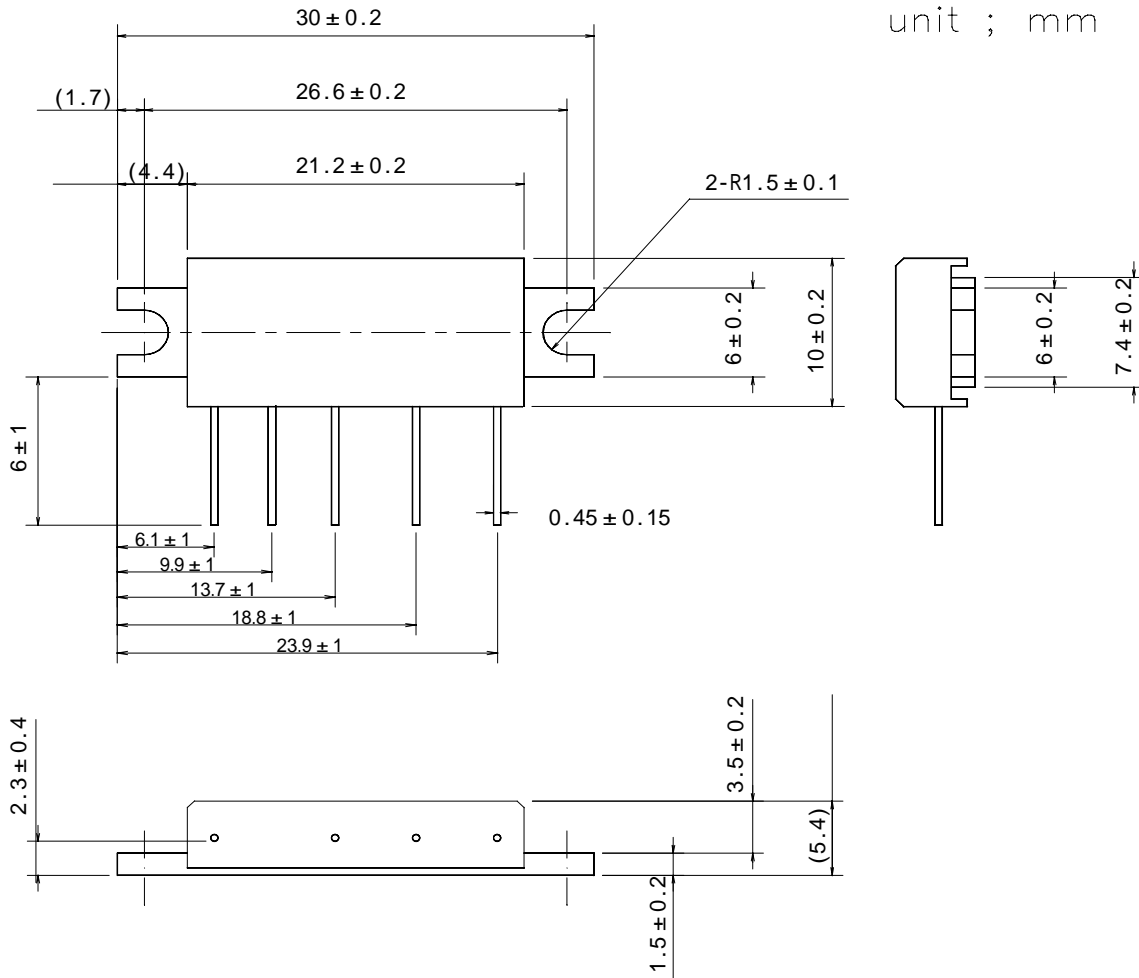


TYPICAL PERFORMANCE ($T_{case}=+25^{\circ}C$, $Z_G=Z_L=50\Omega$, unless otherwise specified)





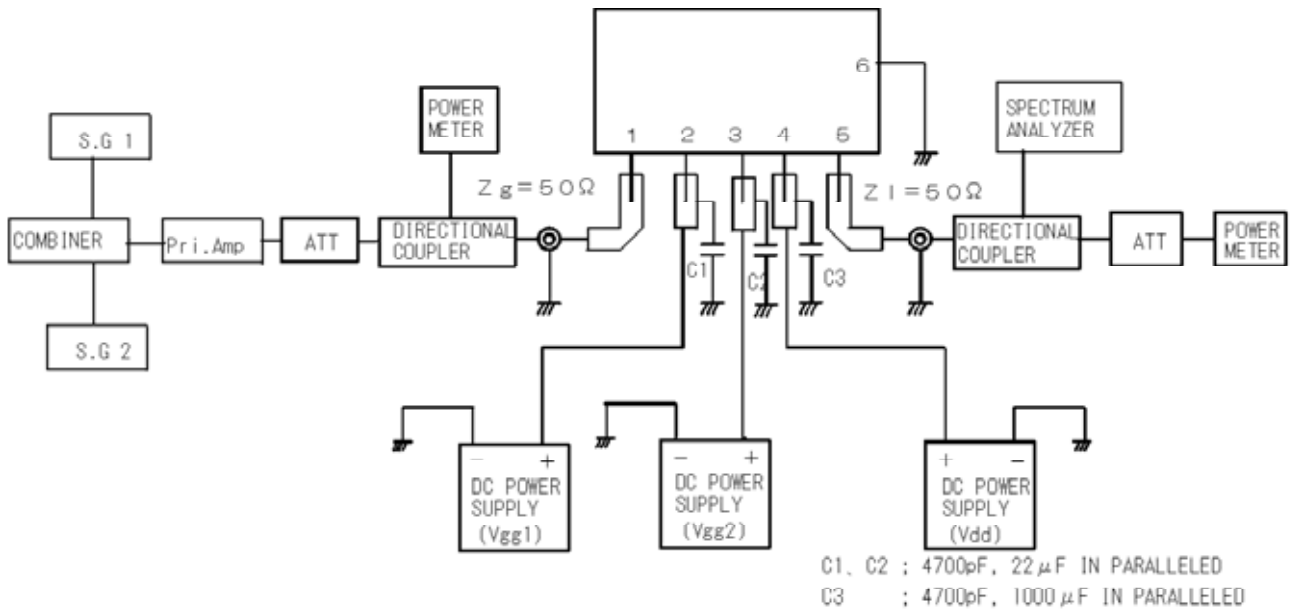
OUTLINE DRAWING (mm)



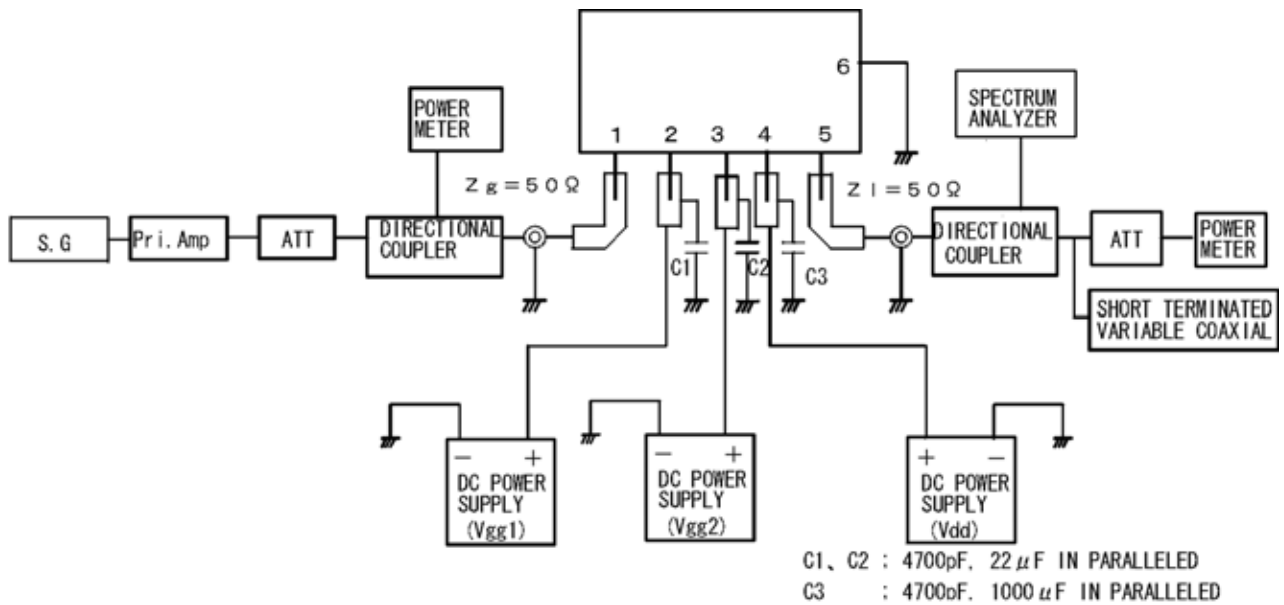
- ① RF Input (P_{in})
- ② Gate Voltage (V_{GG})
- ③ Drain Voltage (V_{DD})
- ④ RF Output (P_{out})
- ⑤ RF Ground (Case)



TEST BLOCK DIAGRAM (TWO TONE)



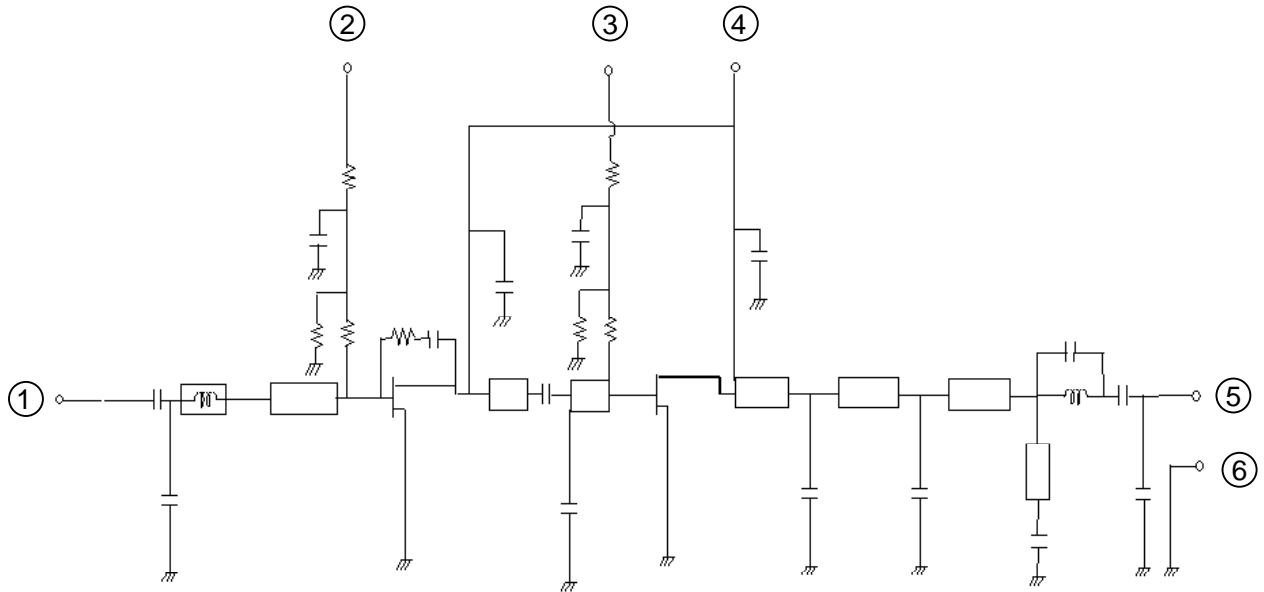
TEST BLOCK DIAGRAM (SINGLE CARRIER)



- ① RF Input (P_{in})
- ② Gate Voltage (V_{GG1})
- ③ Gate Voltage (V_{GG2})
- ④ Drain Voltage (V_{DD})
- ⑤ RF Output (P_{out})
- ⑥ RF Ground (Case)



EQUIVALENT CIRCUIT



- ① RF Input (P_{in})
- ② Gate Voltage (V_{GG1})
- ③ Gate Voltage (V_{GG2})
- ④ Drain Voltage (V_{DD})
- ⑤ RF Output (P_{out})
- ⑥ RF Ground (Case)



Output Power Adjust.:

Depending on linearity, the following two methods are recommended to adjust. the output power:

- a) Non-linear FM modulation:
By the gate voltage (V_{GG}).
- b) Linear AM modulation:
By RF input power P_{in} .

The gate voltage is used to set the drain's quiescent current for the required linearity.

Oscillation:

To test RF characteristics, this module is put on a fixture with two bias decoupling capacitors each on gate and drain, a 4.700 pF chip capacitor, located close to the module, and a 22 μ F (or more) electrolytic capacitor.

When an amplifier circuit around this module shows oscillation, the following may be checked:

- a) Do the bias decoupling capacitors have a low inductance pass to the case of the module.
- b) Is the load impedance $Z_L=50\Omega$.
- c) Is the source impedance $Z_G=50\Omega$.

Frequent on/off switching:

In base stations, frequent on/off switching can cause thermal expansion of the resin that coats the transistor chips and can result in reduced or no output power. The bond wires in the resin will break after long-term thermally induced mechanical stress.

Quality:

Mitsubishi Electric is not liable for failures resulting from base station operation time or operating conditions exceeding those of mobile radios.

This module technology results from more than 20 years of experience, field proven in tens of millions of mobile radios. Currently, most returned modules show failures such as ESD, substrate crack, and transistor burnout, which are caused by improper handling or exceeding recommended operating conditions. Few degradation failures are found.

Keep safety first in your circuit designs!

Mitsubishi Electric Corporation puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur. Trouble with semiconductors may lead to personal injury, fire or property damage. Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of non-flammable material, or (iii) prevention against any malfunction or mishap.