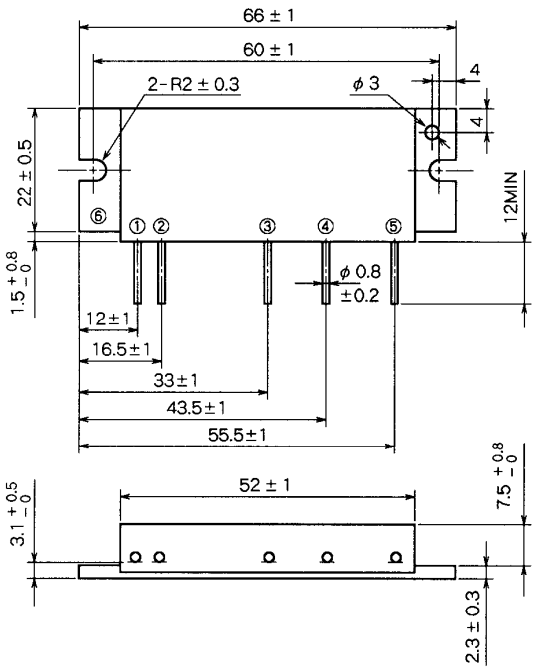
MITSUBISHI RF POWER MODULE

M57745

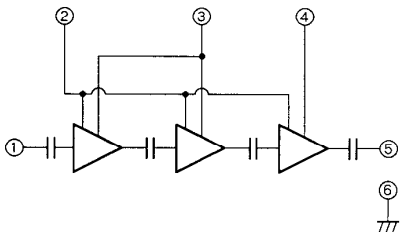
430-450MHz, 12.5V, 33W, SSB MOBILE RADIO

OUTLINE DRAWING Dimensions in mm



H3

BLOCK DIAGRAM



PIN :
①Pin : RF INPUT
②VBB : BASE BIAS SUPPLY
③VCC1 : 1st. DC SUPPLY
④VCC2 : 2nd. DC SUPPLY
⑤Po : RF OUTPUT
⑥GND : FIN

ABSOLUTE MAXIMUM RATINGS (T_C = 25℃ unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
V_{BB}	Base bias		10	V
I_{CC}	Total current		10	A
$P_{in(max)}$	Input power	$Z_G = Z_L = 50\ \Omega$	0.5	W
$P_{O(max)}$	Output power	$Z_G = Z_L = 50\ \Omega$	40	W
$T_{C(OP)}$	Operation case temperature		− 30 to 110	℃
T_{stg}	Storage temperature		− 40 to 110	℃

Note. Above parameters are guaranteed independently.

ELECTRICAL CHARACTERISTICS (T_C = 25℃ unless otherwise noted)

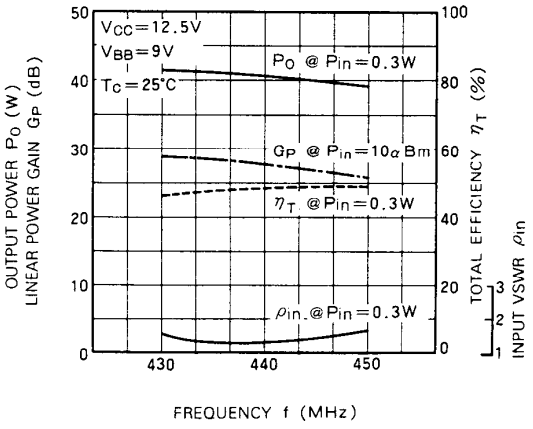
Symbol	Parameter	Test conditions	Limits		Unit
			Min	Max	
f	Frequency range	P_{in} = 0.3W V_{CC} = 12.5V V_{BB} = 9V $Z_G = Z_L = 50\ \Omega$	430	450	MHz
P_O	Output power		33		W
η_T	Total efficiency		40		%
2fo	2nd. harmonic			− 30	dBc
3fo	3rd. harmonic			− 30	dBc
ρ in	Input VSWR			2.5	−
−	Load VSWR tolerance	V_{CC} = 15.2V, V_{BB} = 9V P_O = 30W (P_{in} : controlled) Load VSWR = 8.8 : 1 (All phase), $Z_G = 50\ \Omega$	No degradation or destroy		−

Note. Above parameters, ratings, limits and conditions are subject to change.

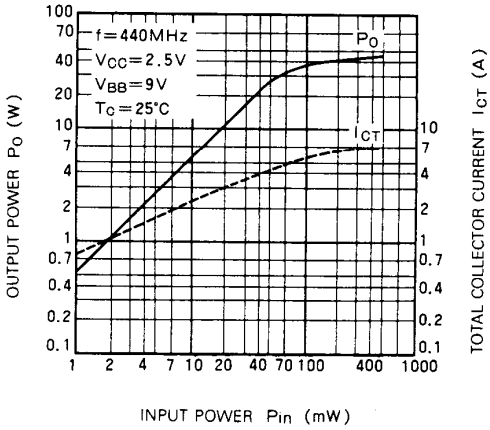
NOV. ' 97

TYPICAL PERFORMANCE DATA

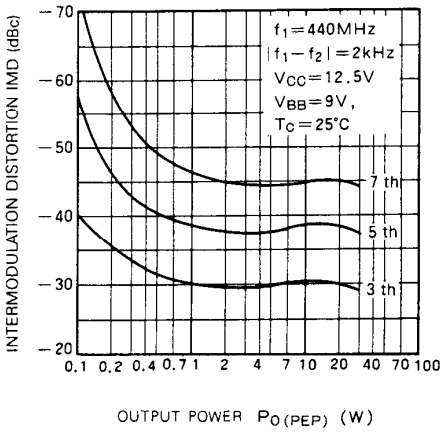
OUTPUT POWER, LINEAR POWER GAIN, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



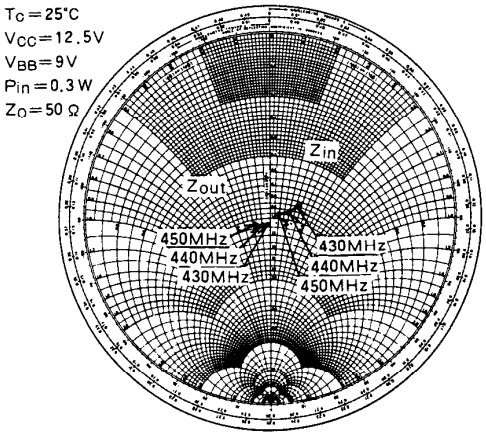
OUTPUT POWER, TOTAL COLLECTOR CURRENT, VS. INPUT POWER



INTERMODULATION DISTORTION VS. OUTPUT POWER



INPUT IMPEDANCE, OUTPUT IMPEDANCE VS. FREQUENCY



DESIGN CONSIDERATION OF HEAT RADIATION.

Please refer to following consideration when designing heat shink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1}$ = 12°C/W (Typ.)

b) Second stage transistor

$R_{th(j-c)2}$ = 4°C/W (Typ.)

c) Final stage transistor

$R_{th(j-c)3}$ = 1.75°C/W (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.

P_O = 30W, V_{CC} = 12.5V, P_{in} = 0.3W, η_T = 40% (minimum rating), P_{O1} (Note 1) = 2W, P_{O2} (2) = 8W, I_T = 6A (I_{T1} (3) = 0.35A, I_{T2} (4) = 1.32A, I_{T3} (5) = 4.33A)

Note 1: Output power of the first stage transistor
Note 2: Output power of the second stage transistor
Note 3: Circuit current of the first stage transistor
Note 4: Circuit current of the second stage transistor
Note 5: Circuit current of the final stage transistor

- Junction temperature of the first stage transistor

$$T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C \text{ (6)}$$
$$= (12.5 \times 0.35 - 2 + 0.3) \times 12 + T_C$$
$$= 32 + T_C \text{ (°C)}$$

Note 6: Package temperature of device

- Junction temperature of the second stage transistor

$$T_{j2} = (V_{CC} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$$
$$= (12.5 \times 1.32 - 8 + 2) \times 4 + T_C$$
$$= 42 + T_C \text{ (°C)}$$

- Junction temperature of the final stage transistor

$$T_{j3} = (V_{CC} \times I_{T3} - P_O + P_{O2}) \times R_{th(j-c)3} + T_C$$
$$= (12.5 \times 4.33 - 30 + 8) \times 1.75 + T_C$$
$$= 56 + T_C \text{ (°C)}$$

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the output power of 30W below 90°C.

The thermal resistance $R_{th(c-a)}$ (7) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(30/0.4) - 30 + 0.3}$$
$$= 0.66 \text{ (°C/W)}$$

Note 7: Inclusive of the contact thermal resistance between device and heat sink.

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 122°C, T_{j2} = 132°C, T_{j3} = 146°C at T_a = 60°C, T_C = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 92°C, T_{j1} = 102°C, T_{j3} = 116°C.

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.