

# RF Power Module

## **M57710-A**

156-160MHz

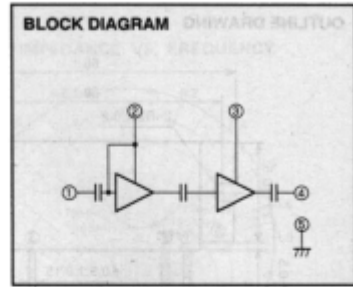
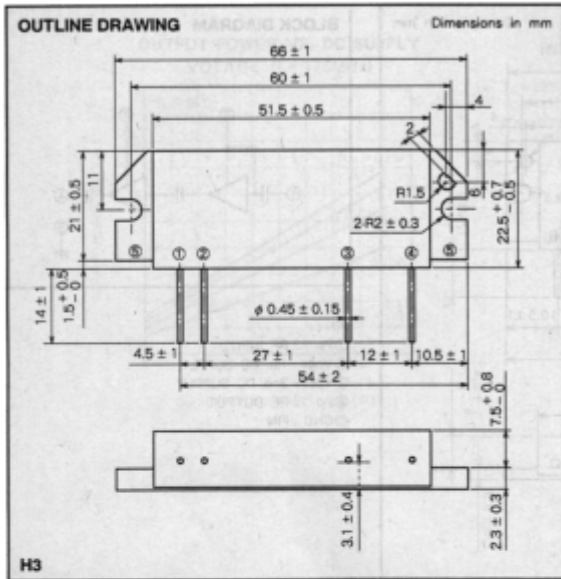
12,5V / 30W

# DATASHEET

OEM –Mitsubishi

Source: Mitsubishi Databook 1995

**MITSUBISHI RF POWER MODULE**  
**M57710-A**  
156-160MHz, 12.5V, 30W, FM MOBILE RADIO



**PIN :**  
 ① Pin : RF INPUT  
 ② Vcc1 : 1st. DC SUPPLY  
 ③ Vcc2 : 2nd. DC SUPPLY  
 ④ Po : RF OUTPUT  
 ⑤ GND : FIN

**ABSOLUTE MAXIMUM RATINGS** (T<sub>c</sub> = 25 °C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V <sub>cc</sub>	Supply voltage		17	V
I <sub>cc</sub>	Total current		7	A
P <sub>in(max)</sub>	Input power	Z <sub>0</sub> = Z <sub>L</sub> = 50 Ω	0.4	W
P <sub>o(max)</sub>	Output power	Z <sub>0</sub> = Z <sub>L</sub> = 50 Ω	40	W
T <sub>c(OP)</sub>	Operation case temperature		- 30 to 110	°C
T <sub>stg</sub>	Storage temperature		- 40 to 110	°C

Note. Above parameters are guaranteed independently.

**ELECTRICAL CHARACTERISTICS** (T<sub>c</sub> = 25 °C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits		Unit
			Min	Max	
f	Frequency range		156	160	MHz
P <sub>o</sub>	Output power		30		W
η <sub>T</sub>	Total efficiency	P <sub>in</sub> = 0.2W V <sub>cc</sub> = 12.5V	45		%
2f <sub>0</sub>	2nd. harmonic	Z <sub>0</sub> = Z <sub>L</sub> = 50 Ω		- 25	dBc
3f <sub>0</sub>	3rd. harmonic			- 30	dBc
ρ <sub>in</sub>	Input VSWR			2.8	-
-	Load VSWR tolerance	V <sub>cc</sub> = 15.2V, P <sub>o</sub> = 35W (P <sub>in</sub> : controlled) Load VSWR=20:1 (All phase), 5sec. Z <sub>0</sub> = 50Ω	No degradation or destroy		-

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

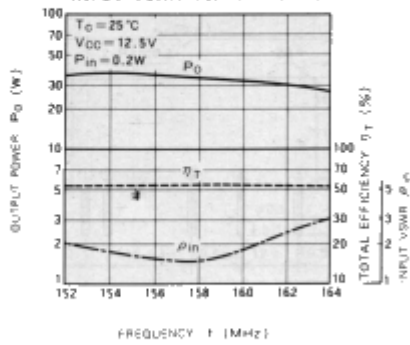
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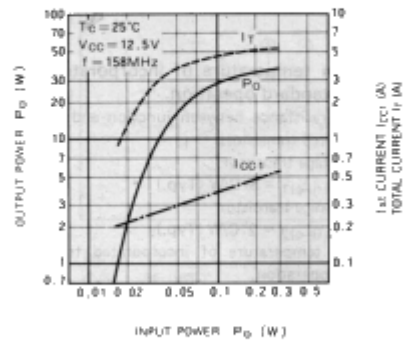
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TYPICAL PERFORMANCE DATA

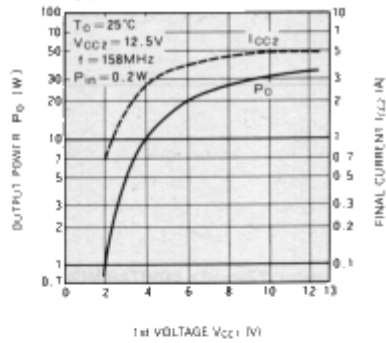
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



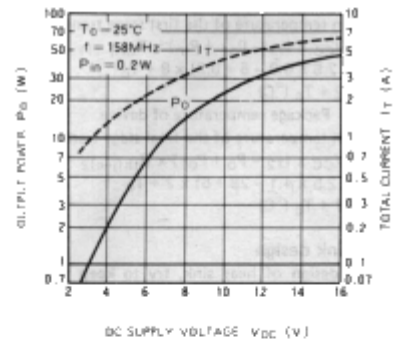
OUTPUT POWER, TOTAL CURRENT, 1st CURRENT VS. INPUT POWER



OUTPUT POWER, FINAL CURRENT VS. 1st VOLTAGE



OUTPUT POWER, TOTAL CURRENT VS. DC SUPPLY VOLTAGE



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**DESIGN CONSIDERATION OF HEAT RADIATION.**

Please refer to following consideration when designing heat sink.

**1. Junction temperature of incorporated transistors at standard operation.**

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

a) First stage transistor

$$R_{th(j-c)1} = 8^{\circ}\text{C/W (Typ.)}$$

b) Final stage transistor

$$R_{th(j-c)2} = 2^{\circ}\text{C/W (Typ.)}$$

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

• Conditions for standard operation.

$P_o = 28\text{W}$ ,  $V_{CC} = 12.5\text{V}$ ,  $P_{in} = 0.2\text{W}$ ,  $\eta_T = 45\%$  (minimum rating),  $P_{o1}$  (Note 1) =  $5\text{W}$ ,  $I_T = 5.0\text{A}$  ( $I_{T1}$  (2) =  $0.9\text{A}$ ,  $I_{T2}$  (3) =  $4.1\text{A}$ )

Note 1: Output power of the first stage transistor

Note 2: Circuit current of the first stage transistor

Note 3: Circuit current of the final stage transistor

• Junction temperature of the first stage transistor

$$\begin{aligned} T_{j1} &= (V_{CC} \times I_{T1} - P_o + P_{in}) \times R_{th(j-c)1} + T_c^{(4)} \\ &= (12.5 \times 0.9 - 5 + 0.2) \times 8 + T_c \\ &= 52 + T_c (^{\circ}\text{C}) \end{aligned}$$

Note 4: Package temperature of device

• Junction temperature of the final stage transistor

$$\begin{aligned} T_{j2} &= (V_{CC} \times I_{T2} - P_o + P_{o1}) \times R_{th(j-c)2} + T_c \\ &= (12.5 \times 4.1 - 28 + 5) \times 2 + T_c \\ &= 57 + T_c (^{\circ}\text{C}) \end{aligned}$$

**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  $T_a = 60^{\circ}\text{C}$ ) and at the output power of  $8\text{W}$  below  $90^{\circ}\text{C}$ .

The thermal resistance  $R_{th(c-a)}$  (5) of the heat sink to realize this:

$$\begin{aligned} R_{th(c-a)} &= \frac{T_c - T_a}{(P_o/\eta_T) - P_o + P_{in}} = \frac{90 - 60}{(28/0.45) - 28 + 0.2} \\ &= 0.87 (^{\circ}\text{C/W}) \end{aligned}$$

Note 5: Inclusive of the contact thermal resistance between device and heat sink

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

$$T_{j1} = 142^{\circ}\text{C}, T_{j2} = 147^{\circ}\text{C} \text{ at } T_a = 60^{\circ}\text{C}, T_c = 90^{\circ}\text{C}.$$

In the annual average of ambient temperature is  $30^{\circ}\text{C}$ ,

$$T_{j1} = 112^{\circ}\text{C}, T_{j2} = 117^{\circ}\text{C}$$

As the maximum junction temperature of these incorporated transistors  $T_{jmax}$  are  $175^{\circ}\text{C}$ , application under fully derated condition is ensure.