MITSUBISHI RF POWER MODULE

M67730L

175-200MHz, 12.5V, 30W, FM MOBILE RADIO

OUTLINE DRAWING

Dimensions in mm

BLOCK DIAGRAM

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 (Tc = 25°C unless otherwise noted)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Ratings</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCC</td>
<td>Supply voltage</td>
<td></td>
<td>17</td>
<td>V</td>
</tr>
<tr>
<td>Icc</td>
<td>Total current</td>
<td></td>
<td>7</td>
<td>A</td>
</tr>
<tr>
<td>Pin(max)</td>
<td>Input power</td>
<td>Zg = ZL = 50 Q, Vcc ≤ 12.5V</td>
<td>0.6</td>
<td>W</td>
</tr>
<tr>
<td>Po(max)</td>
<td>Output power</td>
<td>Zg = ZL = 50 Q</td>
<td>40</td>
<td>W</td>
</tr>
<tr>
<td>T(opp)</td>
<td>Operation case temperature</td>
<td></td>
<td>-30 to 110</td>
<td>°C</td>
</tr>
<tr>
<td>Tsto</td>
<td>Storage temperature</td>
<td></td>
<td>40 to 110</td>
<td>°C</td>
</tr>
</tbody>
</table>

Note: Above parameters are guaranteed independently.

ELECTRICAL CHARACTERISTICS (Tc = 25°C unless otherwise noted)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test conditions</th>
<th>Limits</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>f</td>
<td>Frequency range</td>
<td></td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>175</td>
<td>200</td>
</tr>
<tr>
<td>Po</td>
<td>Output power</td>
<td>Pin = 0.3W</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vcc = 12.5V</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Zg = ZL = 50 Q</td>
<td>-30</td>
<td></td>
</tr>
<tr>
<td>2f0</td>
<td>2nd. harmonic</td>
<td></td>
<td>-35</td>
<td></td>
</tr>
<tr>
<td>3f0</td>
<td>3rd. harmonic</td>
<td></td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td>Pin</td>
<td>Input VSWR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vcc = 15.2V, P0 = 30W (Pin: controlled)</td>
<td>No degradation or destroy</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Load VSWR ≥ 20:1 (All phase), 2sec.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Zg = 50 Q</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

NOV. '97
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
         \[ R_{th1(-c1)} = 8^\circ \text{C/W (Typ.)} \]

      b) Second stage transistor
         \[ R_{th2(-c2)} = 2^\circ \text{C/W (Typ.)} \]

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

      Conditions for standard operation:
      \[ P_o = 30W, V_{CC} = 12.5V, P_{in} = 0.3W, \eta_T = 43\% \text{(minimum rating)} \]
      \[ R_{o1} \text{(Note 1)} = 5W, I_T = 5.6A \text{ (I_{T1}(2)) = 0.9A, I_{T2}(3) = 4.7A} \]

      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
      \[ T_{J1} = (V_{CC} \times I_{T1} - P_{o1} + P_{in}) \times R_{th1(-c1)} + T_C \]
      \[ = (12.5 \times 0.9 - 5 + 0.3) \times 8 + T_C \]
      \[ = 52 + T_C \text{ (°C)} \]

      Note 4: Package temperature of device
      Junction temperature of the final stage transistor
      \[ T_{J2} = (V_{CC} \times I_{T2} - P_{o1} + P_{in}) \times R_{th2(-c2)} + T_C \]
      \[ = (12.5 \times 4.7 - 30 + 5) \times 2 + T_C \]
      \[ = 68 + T_C \text{ (°C)} \]

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 \( T_a = 60^\circ \text{C} \)) and at the output power of 28W below 90°C.

   The thermal resistance \( R_{th1(-c-a)} \) of the heat sink to realize this:
   \[ R_{th1(-c-a)} = \frac{T_C - T_a}{P_o - \eta_T P_o + P_{in}} \]
   \[ = \frac{90 - 60}{(30/0.43) - 30 + 0.3} \]
   \[ = 0.75 \text{ (°C/W)} \]

   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.
   \[ T_{J1} = 142^\circ \text{C}, T_{J2} = 158^\circ \text{C at } T_a = 60^\circ \text{C, } T_C = 90^\circ \text{C.} \]

   In the annual average of ambient temperature is 30°C,
   \[ T_{J1} = 112^\circ \text{C, } T_{J2} = 128^\circ \text{C} \]

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