PF0030 Series
MOS FET Power Amplifier

HITACHI
ADE-208-460 (Z)
1st. Edition
July 1996

Features

- High stability: Load VSWR = 20 : 1
- Low power control current: 400 μA
- Thin package: 5 mmt

Ordering Information

<table>
<thead>
<tr>
<th>Type No</th>
<th>Operating Frequency</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF0030</td>
<td>824 to 849 MHz</td>
<td>AMPS</td>
</tr>
<tr>
<td>PF0032</td>
<td>872 to 905 MHz</td>
<td>E-TACS</td>
</tr>
</tbody>
</table>

Pin Arrangement

- RF-B2

1: Pin
2: V_{APC}
3: V_{DD}
4: P_{out}
5: GND
PF0030 Series

Internal Diagram and External Circuit

![Internal Diagram and External Circuit](image)

- C1 = C2 = 0.01 μF (Ceramic chip capacitor)
- C3 = 10 μF (Aluminum Electrolyte Capacitor)
- FB = Ferrite bead BL01RN1-A62-001 (Manufacture: MURATA) or equivalent
- Z1 = Z2 = 50 Ω (Microstrip line)

Absolute Maximum Ratings (Ta = 25°C)

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>V_{DD}</td>
<td>17</td>
<td>V</td>
</tr>
<tr>
<td>Supply current</td>
<td>I_{DD}</td>
<td>3</td>
<td>A</td>
</tr>
<tr>
<td>APC voltage</td>
<td>V_{APC}</td>
<td>±8</td>
<td>V</td>
</tr>
<tr>
<td>Input power</td>
<td>Pin</td>
<td>20</td>
<td>mW</td>
</tr>
<tr>
<td>Operating case temperature</td>
<td>Tc (op)</td>
<td>−30 to +110</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>T_{stg}</td>
<td>−40 to +110</td>
<td>°C</td>
</tr>
</tbody>
</table>
Electrical Characteristics (Ta = 25°C)

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
<th>Test Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain cutoff current</td>
<td>IDSS</td>
<td>—</td>
<td>—</td>
<td>500</td>
<td>μA</td>
<td>VDD = 17 V, VAPC = 0 V</td>
</tr>
<tr>
<td>Total efficiency</td>
<td>ηT</td>
<td>35</td>
<td>40</td>
<td>—</td>
<td>%</td>
<td>Pin = 2 mW,</td>
</tr>
<tr>
<td>2nd harmonic distortion</td>
<td>2nd H.D.</td>
<td>—</td>
<td>−50</td>
<td>−30</td>
<td>dB</td>
<td>VDD = 12.5 V, Pout = 6 W (at APC controlled)</td>
</tr>
<tr>
<td>3rd harmonic distortion</td>
<td>3rd H.D.</td>
<td>—</td>
<td>−50</td>
<td>−30</td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>Input VSWR</td>
<td>VSWR (in)</td>
<td>—</td>
<td>1.5</td>
<td>3</td>
<td>—</td>
<td>Zin = Zout = 50 Ω</td>
</tr>
<tr>
<td>Output VSWR</td>
<td>VSWR (out)</td>
<td>—</td>
<td>1.5</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Stability</td>
<td>—</td>
<td>—</td>
<td>No parasitic oscillation</td>
<td>—</td>
<td>—</td>
<td>Pin = 2 mW, VDD = 12.5 V, Pout = 6 W (at APC controlled), Zin = 50 Ω, Output VSWR = 20:1 All phases, t = 20 sec</td>
</tr>
</tbody>
</table>

Test System Diagram
PF0030 Series

Test Fixture Pattern/ Unit: mm

Grass Epoxy Double sided PCB
(t = 1.6 mm, εr = 4.8)

Mechanical Characteristics

<table>
<thead>
<tr>
<th>Item</th>
<th>Conditions</th>
<th>Spec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torque for screw up the heatsink flange</td>
<td>M3 Screw Bolts</td>
<td>4 to 6 kg•cm</td>
</tr>
<tr>
<td>Warp size of the heatsink flange: S</td>
<td></td>
<td>S = 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+0.3/-0 mm</td>
</tr>
</tbody>
</table>

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Note for Use

- Unevenness and distortion at the surface of the heatsink attached module should be less than 0.05 mm.
- It should not be existed any dust between module and heatsink.
- MODULE should be separated from PCB less than 1.5 mm.
- Soldering temperature and soldering time should be less than 230°C, 10 sec.  
  (Soldering position spaced from the root point of the lead frame: 2 mm)
- Recommendation of thermal joint compounds is TYPE G746.  
  (Manufacturer: Shin-Etsu Chemical, Co., Ltd.)
- To protect devices from electro-static damage, soldering iron, measuring-equipment and human body etc. should be grounded.
- Torque for screw up the heatsink flange should be 4 to 6 kg·cm with M3 screw bolts.
- Don’t solder the flange directly.
- It should make the lead frame as straight as possible.
- The module should be screwed up before lead soldering.
- It should not be given mechanical and thermal stress to lead and flange of the module.
- When the external parts (Isolator, Duplexer, etc.) of the module are changed, the electrical characteristics should be evaluated enough.
- Don’t washing the module except lead pins.
- To get good stability, ground impedance between the module GND flange and PCB GND pattern should be designed as low as possible.
Characteristics Curve

PF0030

Pout, $\eta_T$ vs. $V_{DD}$ (1)

Output Power $P_{out}$ (W) vs. Supply Voltage $V_{DD}$ (V)

- $f = 824$ MHz
- $P_{in} = 2$ mW
- $V_{APC} = 4$ V

Pout, $\eta_T$ vs. $V_{DD}$ (2)

Output Power $P_{out}$ (W) vs. Supply Voltage $V_{DD}$ (V)

- $f = 849$ MHz
- $P_{in} = 2$ mW
- $V_{APC} = 4$ V

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PF0030 Series

PF0030 (cont)

\[ V_{\text{APC}}, \eta_T, \text{VSWR (in)} \text{ vs. Frequency} \]

\[ \eta_T \]

\[ V_{\text{APC}} \]

\[ V_{\text{SWRin}} \]

\[ \text{Frequency } f \text{ (MHz)} \]

\[ \text{Efficiency } \eta_T \text{ (%)} \]

\[ \text{Output Power } P_{\text{out}} \text{ (W)} \]

\[ \text{Pin} = 2 \text{ mW} \]

\[ V_{DD} = 12.5 \text{ V} \]

\[ P_{\text{out}} = 6 \text{ W} \]
PF0030 Series

PF0030 (cont)

Pout, $\eta_T$ vs. Pin (1)

Input Power Pin (mW)

Output Power Pout (W)

Efficiency $\eta_T$ (%)

Input Power Pin (mW)

Fanout $= 824$ MHz

$V_{DD} = 12.5$ V

$V_{APC} = 4$ V

Pout, $\eta_T$ vs. Pin (2)

Input Power Pin (mW)

Output Power Pout (W)

Efficiency $\eta_T$ (%)

Input Power Pin (mW)

Fanout $= 849$ MHz

$V_{DD} = 12.5$ V

$V_{APC} = 4$ V
PF0030 Series

PF0030 (cont)

\[ P_{\text{out}}, \eta_T \text{ vs. } V_{\text{APC}} \ (1) \]

- Output Power: \( P_{\text{out}} \) (W)
- Efficiency: \( \eta_T \) (%)
- Apc Voltage: \( V_{\text{APC}} \) (V)

- Parameters:
  - \( f = 824 \text{ MHz} \)
  - \( P_{\text{in}} = 2 \text{ mW} \)
  - \( V_{\text{DD}} = 12.5 \text{ V} \)

\[ P_{\text{out}}, \eta_T \text{ vs. } V_{\text{APC}} \ (2) \]

- Output Power: \( P_{\text{out}} \) (W)
- Efficiency: \( \eta_T \) (%)
- Apc Voltage: \( V_{\text{APC}} \) (V)

- Parameters:
  - \( f = 849 \text{ MHz} \)
  - \( P_{\text{in}} = 2 \text{ mW} \)
  - \( V_{\text{DD}} = 12.5 \text{ V} \)
PF0030 Series

PF0030 (cont)

η_T vs. T_C (1)

- f = 824 MHz
- V_DD = 12.5 V
- Pin = 2 mW
- Pout = 6 W

η_T vs. T_C (2)

- f = 849 MHz
- V_DD = 12.5 V
- Pin = 2 mW
- Pout = 6 W
PF0030 Series

PF0030 (cont)

**Pout vs. T\(_C\) (1)**

- \(f = 824\) MHz
- \(V_{DD} = 12.5\) V
- \(P_{in} = 2\) mW
- \(V_{APC} = 7.0\) V

**Pout vs. T\(_C\) (2)**

- \(f = 849\) MHz
- \(V_{DD} = 12.5\) V
- \(P_{in} = 2\) mW
- \(V_{APC} = 7.0\) V
Pout, $\eta_T$ vs. $V_{DD}$ (1)

- $f = 872$ MHz
- $P_{in} = 2$ mW
- $V_{APC} = 4$ V

Pout, $\eta_T$ vs. $V_{DD}$ (2)

- $f = 905$ MHz
- $P_{in} = 2$ mW
- $V_{APC} = 4$ V
PF0032 (cont)

**V\textsubscript{APC}, \eta\textsubscript{T}, VSWR (in) vs. Frequency**

- **Parameters:**
  - Pin = 2 mW
  - V\textsubscript{DD} = 12.5 V
  - Pout = 6 W

**Output Power Pout (W), \eta\textsubscript{T}, VSWR (in) vs. Frequency**

- **Parameters:**
  - Pin = 2 mW
  - V\textsubscript{DD} = 12.5 V
  - V\textsubscript{APC} = 4 V
PF0030 Series

PF0032 (cont)

\[ P_{out}, \eta_T \text{ vs. } P_{in} \]

Two graphs are shown, one for each frequency:

1. **Graph 1 (f = 872 MHz)**
   - Output Power \( P_{out} \) (W)
   - Input Power \( P_{in} \) (mW)
   - Efficiency \( \eta_T \) (%)
   - Specifications:
     - \( V_{DD} = 12.5 \text{ V} \)
     - \( V_{APC} = 4 \text{ V} \)

2. **Graph 2 (f = 905 MHz)**
   - Output Power \( P_{out} \) (W)
   - Input Power \( P_{in} \) (mW)
   - Efficiency \( \eta_T \) (%)
   - Specifications:
     - \( V_{DD} = 12.5 \text{ V} \)
     - \( V_{APC} = 4 \text{ V} \)
PF0032 (cont)

- **PF0030 Series**
- **Output Power** $P_{out}$, **Efficiency** $\eta_T$ vs. **Apc Voltage** $V_{APC}$

### Curve 1
- Frequency: $f = 872$ MHz
- Input Power: $P_{in} = 2$ mW
- Supply Voltage: $V_{DD} = 12.5$ V

![Graph 1](image1.png)

### Curve 2
- Frequency: $f = 905$ MHz
- Input Power: $P_{in} = 2$ mW
- Supply Voltage: $V_{DD} = 12.5$ V

![Graph 2](image2.png)
PF0030 Series

PF0032 (cont)

\[ f = 872 \text{ MHz} \]
\[ V_{DD} = 12.5 \text{ V} \]
\[ P_{in} = 2 \text{ mW} \]
\[ P_{out} = 6 \text{ W} \]

\[
\eta_T vs. T_C (1)
\]

\[
\eta_T vs. T_C (2)
\]

\[ f = 905 \text{ MHz} \]
\[ V_{DD} = 12.5 \text{ V} \]
\[ P_{in} = 2 \text{ mW} \]
\[ P_{out} = 6 \text{ W} \]
PF0030 Series

PF0032 (cont)

**PF0032**

- **f** = 872 MHz
- **V\_DD** = 12.5 V
- **Pin** = 2 mW
- **V\_APC** = 7.0 V

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**Pout vs. T\_C (1)**

- **f** = 872 MHz
- **V\_DD** = 12.5 V
- **Pin** = 2 mW
- **V\_APC** = 7.0 V

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**Pout vs. T\_C (2)**

- **f** = 905 MHz
- **V\_DD** = 12.5 V
- **Pin** = 2 mW
- **V\_APC** = 7.0 V
PF0030 Series

Package Dimensions/ Unit: mm

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hitachi code</td>
<td>RF-B2</td>
<td></td>
</tr>
<tr>
<td>EIAJ code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JEDEC code</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dimensions:
- Width: 60.5 ± 0.5 mm
- Length: 57.5 ± 0.5 mm
- Height: 0.5 ± 0.3 mm
- Thickness: 2.3 ± 0.2 mm
- Height at 1: 13.0 ± 1 mm
- Height at 3: 22.0 ± 1 mm
- Width at 1: 127 ± 0.5 mm
- Width at 3: 11.0 ± 0.3 mm
- Width at 4: 57.5 ± 0.5 mm
- Width at 5: 5.0 ± 0.6 mm
- Width at 6: 3.3 mm
- Width at 7: 5 ± 1 mm
- Width at 8: 6.35 ± 0.5 mm
- Radius: R1.6 mm
- Height at 1: 49.8 ± 0.5 mm
- Height at 3: 9.2 ± 1 mm
- Height at 5: 8.0 ± 1 mm
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