

## TBB1004

Twin Built in Biasing Circuit MOS FET IC  
VHF/UHF RF Amplifier

REJ03G0842-1100

Rev.11.00

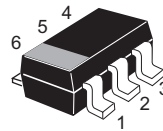
Aug 22, 2006

### Features

- Small SMD package CMTAK-6 built in twin BBFET; To reduce using parts cost & PC board space.
- Suitable for World Standard Tuner RF amplifier.
- Very useful for total tuner cost reduction.
- Withstanding to ESD; Built in ESD absorbing diode. Withstand up to 200V at C=200pF, Rs=0 conditions.
- Provide mini mold packages; CMTAK-6

### Outline

RENESAS Package code: PTSP0006JA-A  
(Package name: CMTAK-6)



1. Drain(1)
2. Source
3. Gate-1(1)
4. Gate-1(2)
5. Gate-2
6. Drain(2)

- Notes:
1. Marking is "DM".
  2. TBB1004 is individual type number of RENESAS TWIN BBFET.

## Absolute Maximum Ratings

(Ta = 25°C)

| Item                      | Symbol        | Ratings     | Unit |
|---------------------------|---------------|-------------|------|
| Drain to source voltage   | $V_{DS}$      | 6           | V    |
| Gate1 to source voltage   | $V_{G1S}$     | +6<br>-0    | V    |
| Gate2 to source voltage   | $V_{G2S}$     | +6<br>-0    | V    |
| Drain current             | $I_D$         | 30          | mA   |
| Channel power dissipation | $P_{ch}^{*3}$ | 250         | mW   |
| Channel temperature       | $T_{ch}$      | 150         | °C   |
| Storage temperature       | $T_{stg}$     | -55 to +150 | °C   |

Note: 3. Value on the glass epoxy board (49mm × 38mm × 1mm).

## Electrical Characteristics

(Ta = 25°C)

The below specification are applicable for UHF unit (FET1)

| Item                              | Symbol         | Min | Typ  | Max  | Unit | Test conditions   |
|-----------------------------------|----------------|-----|------|------|------|---|
| Drain to source breakdown voltage | $V_{(BR)DSS}$  | 6   | —    | —    | V    | $I_D = 200 \mu A, V_{G1S} = V_{G2S} = 0$                                      |
| Gate1 to source breakdown voltage | $V_{(BR)G1SS}$ | +6  | —    | —    | V    | $I_{G1} = +10 \mu A, V_{G2S} = V_{DS} = 0$                                    |
| Gate2 to source breakdown voltage | $V_{(BR)G2SS}$ | +6  | —    | —    | V    | $I_{G2} = +10 \mu A, V_{G1S} = V_{DS} = 0$                                    |
| Gate1 to source cutoff current    | $I_{G1SS}$     | —   | —    | +100 | nA   | $V_{G1S} = +5 V, V_{G2S} = V_{DS} = 0$  |
| Gate2 to source cutoff current    | $I_{G2SS}$     | —   | —    | +100 | nA   | $V_{G2S} = +5 V, V_{G1S} = V_{DS} = 0$  |
| Gate1 to source cutoff voltage    | $V_{G1S(off)}$ | 0.5 | 0.7  | 1.0  | V    | $V_{DS} = 5 V, V_{G2S} = 4 V$<br>$I_D = 100 \mu A$                            |
| Gate2 to source cutoff voltage    | $V_{G2S(off)}$ | 0.5 | 0.7  | 1.0  | V    | $V_{DS} = 5 V, V_{G1S} = 5 V$<br>$I_D = 100 \mu A$                            |
| Drain current                     | $I_{D(op)}$    | 13  | 17   | 21   | mA   | $V_{DS} = 5 V, V_{G1} = 5 V$<br>$V_{G2S} = 4 V, R_G = 100 k\Omega$            |
| Forward transfer admittance       | $ y_{fs} $     | 21  | 26   | 31   | mS   | $V_{DS} = 5 V, V_{G1} = 5 V, V_{G2S} = 4 V$<br>$R_G = 100 k\Omega, f = 1 kHz$ |
| Input capacitance                 | $C_{iss}$      | 1.4 | 1.8  | 2.2  | pF   | $V_{DS} = 5 V, V_{G1} = 5 V$  |
| Output capacitance                | $C_{oss}$      | 1.0 | 1.4  | 1.8  | pF   | $V_{G2S} = 4 V, R_G = 100 k\Omega$  |
| Reverse transfer capacitance      | $C_{rss}$      | —   | 0.02 | 0.04 | pF   | $f = 1 MHz$   |
| Power gain                        | PG             | 16  | 21   | —    | dB   | $V_{DS} = V_{G1} = 5 V, V_{G2S} = 4 V$<br>$R_G = 100 k\Omega, f = 900 MHz$    |
| Noise figure                      | NF             | —   | 1.7  | 2.5  | dB   | $Z_i = S11^*, Z_o = S22^*( :PG)$<br>$Z_i = S11opt (:NF)$                      |

## Electrical Characteristics (cont.)

(Ta = 25°C)

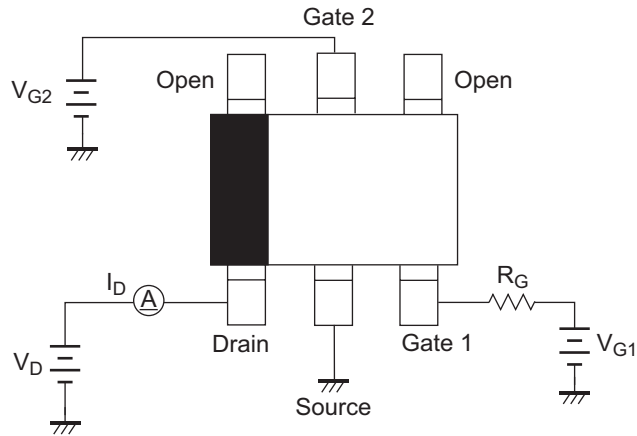
The below specification are applicable for VHF unit (FET2)

| Item                              | Symbol         | Min | Typ  | Max  | Unit | Test conditions   |
|-----------------------------------|----------------|-----|------|------|------|---|
| Drain to source breakdown voltage | $V_{(BR)DSS}$  | 6   | —    | —    | V    | $I_D = 200 \mu A, V_{G1S} = V_{G2S} = 0$                                      |
| Gate1 to source breakdown voltage | $V_{(BR)G1SS}$ | +6  | —    | —    | V    | $I_{G1} = +10 \mu A, V_{G2S} = V_{DS} = 0$                                    |
| Gate2 to source breakdown voltage | $V_{(BR)G2SS}$ | +6  | —    | —    | V    | $I_{G2} = +10 \mu A, V_{G1S} = V_{DS} = 0$                                    |
| Gate1 to source cutoff current    | $I_{G1SS}$     | —   | —    | +100 | nA   | $V_{G1S} = +5 V, V_{G2S} = V_{DS} = 0$  |
| Gate2 to source cutoff current    | $I_{G2SS}$     | —   | —    | +100 | nA   | $V_{G2S} = +5 V, V_{G1S} = V_{DS} = 0$  |
| Gate1 to source cutoff voltage    | $V_{G1S(off)}$ | 0.5 | 0.75 | 1.0  | V    | $V_{DS} = 5 V, V_{G2S} = 4 V$<br>$I_D = 100 \mu A$                            |
| Gate2 to source cutoff voltage    | $V_{G2S(off)}$ | 0.5 | 0.75 | 1.0  | V    | $V_{DS} = 5 V, V_{G1S} = 5 V$<br>$I_D = 100 \mu A$                            |
| Drain current                     | $I_{D(op)}$    | 16  | 20   | 24   | mA   | $V_{DS} = 5 V, V_{G1} = 5 V$<br>$V_{G2S} = 4 V, R_G = 100 k\Omega$            |
| Forward transfer admittance       | $ y_{fs} $     | 27  | 32   | 37   | mS   | $V_{DS} = 5 V, V_{G1} = 5 V, V_{G2S} = 4 V$<br>$R_G = 100 k\Omega, f = 1 kHz$ |
| Input capacitance                 | $C_{iss}$      | 2.3 | 2.7  | 3.1  | pF   | $V_{DS} = 5 V, V_{G1} = 5 V$  |
| Output capacitance                | $C_{oss}$      | 1.4 | 1.8  | 2.2  | pF   | $V_{G2S} = 4 V, R_G = 100 k\Omega$  |
| Reverse transfer capacitance      | $C_{rss}$      | —   | 0.03 | 0.05 | pF   | $f = 1 MHz$   |
| Power gain                        | PG             | 24  | 29   | —    | dB   | $V_{DS} = V_{G1} = 5 V, V_{G2S} = 4 V$  |
| Noise figure                      | NF             | —   | 1.2  | 1.7  | dB   | $R_G = 100 k\Omega, f = 200 MHz$  |

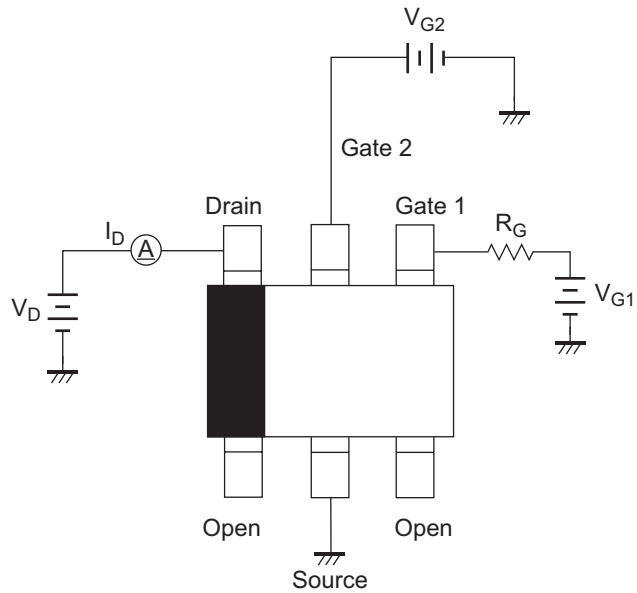
## Test Circuits

- DC Biasing Circuit for Operating Characteristic Items ( $I_{D(op)}$ ,  $|y_{fs}|$ ,  $C_{iss}$ ,  $C_{oss}$ ,  $C_{rss}$ ,  $NF$ ,  $PG$ )

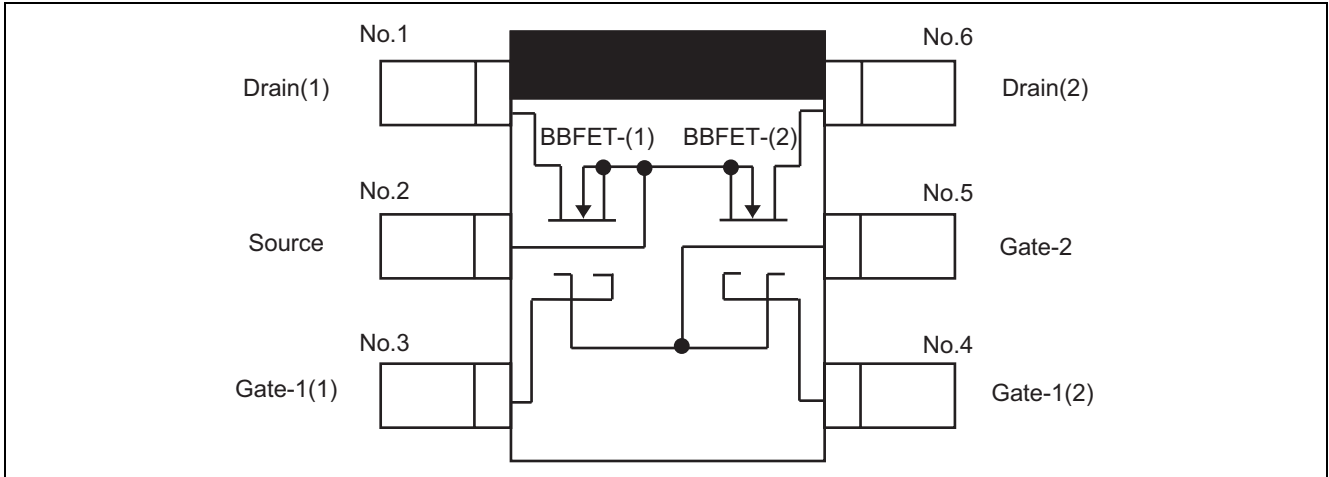
Measurement of FET1



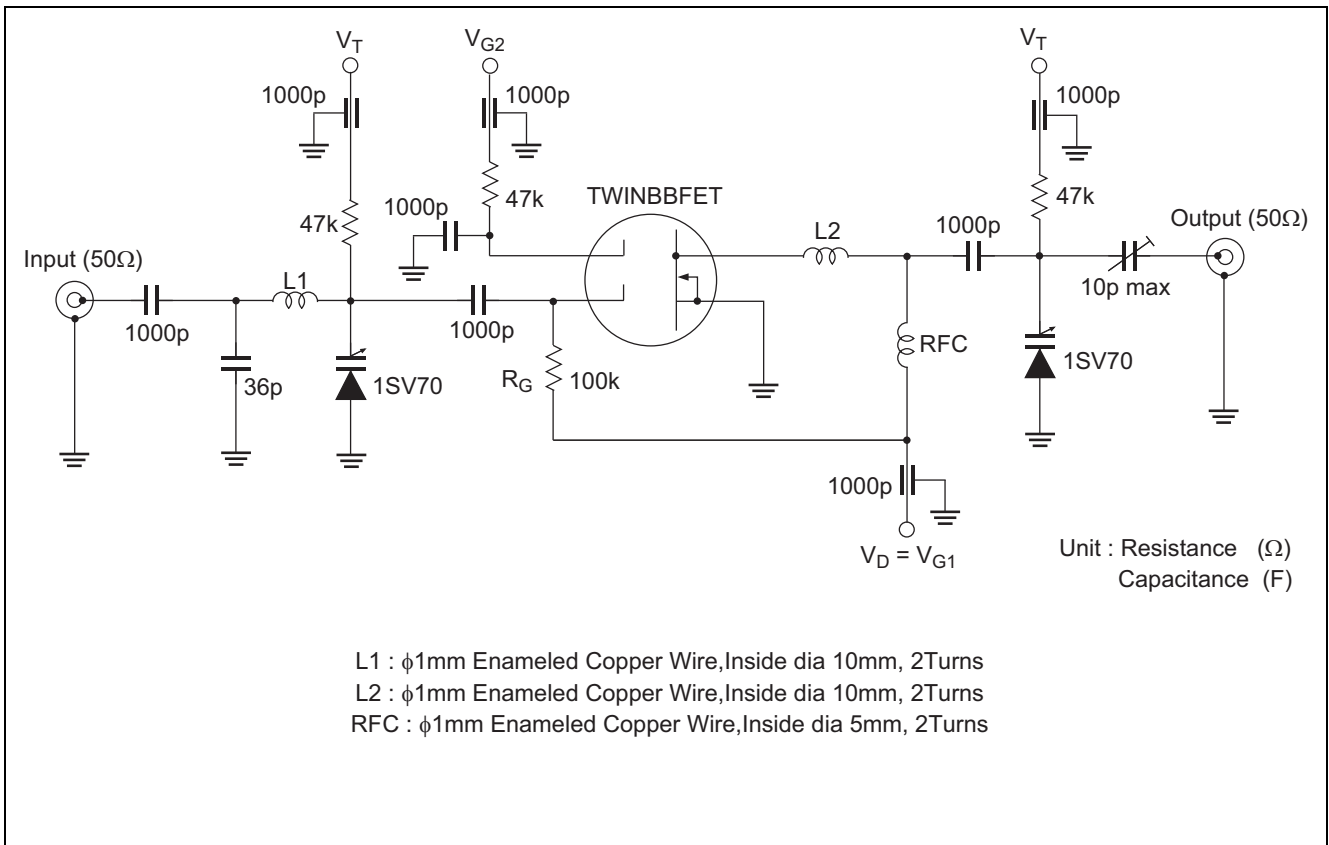
Measurement of FET2



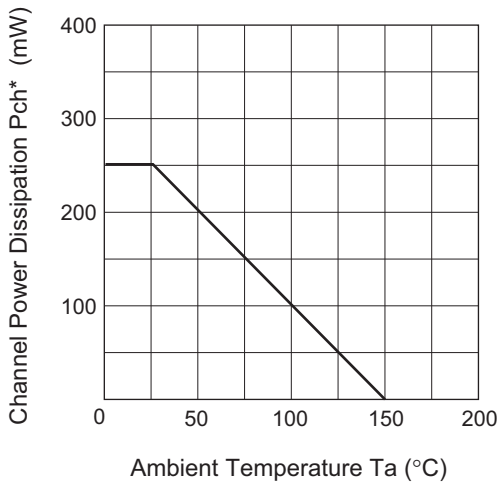
• Equivalent Circuit



• 200 MHz Power Gain, Noise Figure Test Circuit

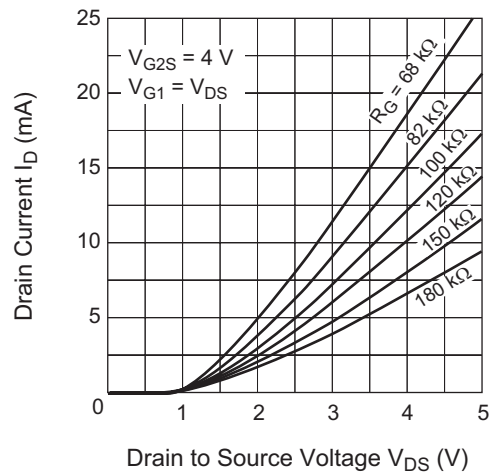


Maximum Channel Power Dissipation Curve

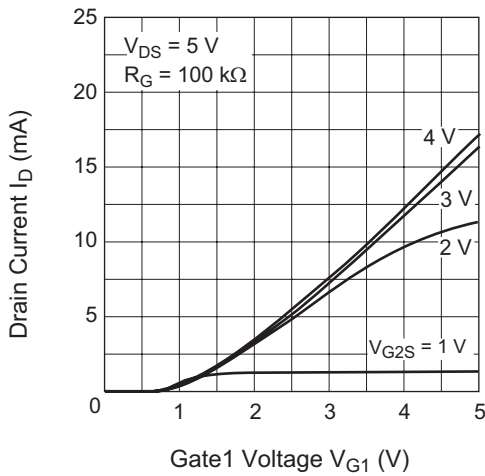


\* Value on the glass epoxy board (49mm × 38mm × 1mm)

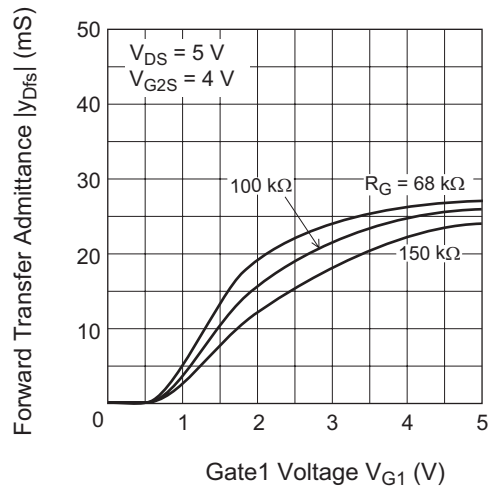
Typical Output Characteristics (FET1)



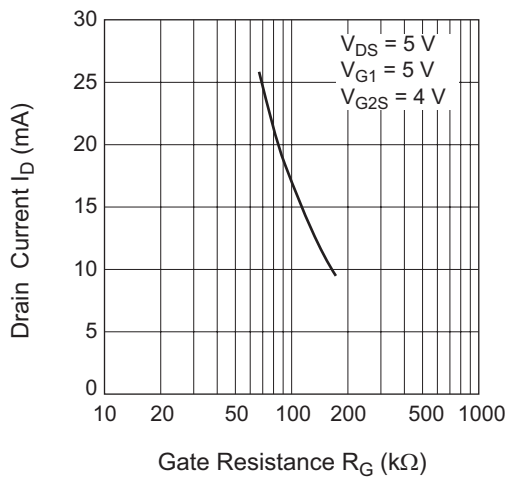
Drain Current vs. Gate1 Voltage (FET1)



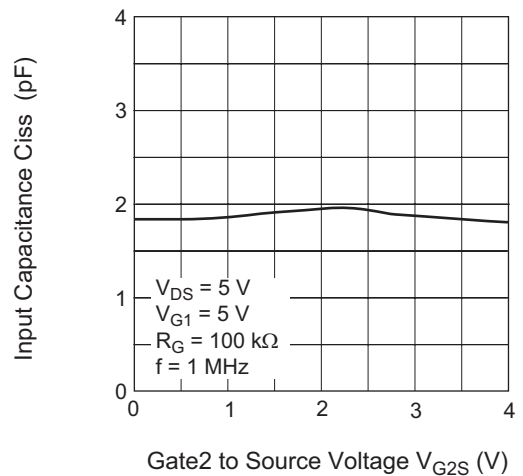
Forward Transfer Admittance vs. Gate1 Voltage (FET1)

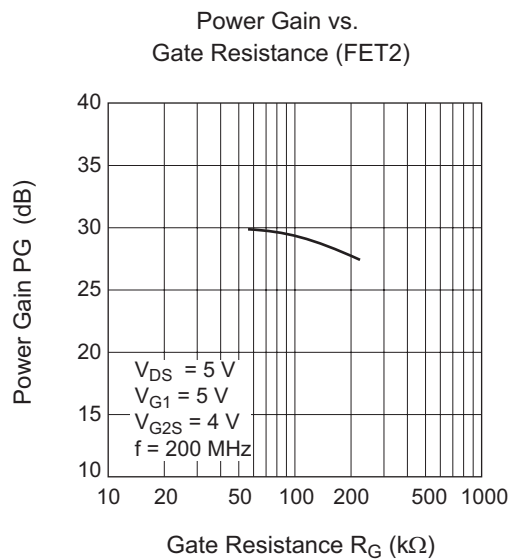
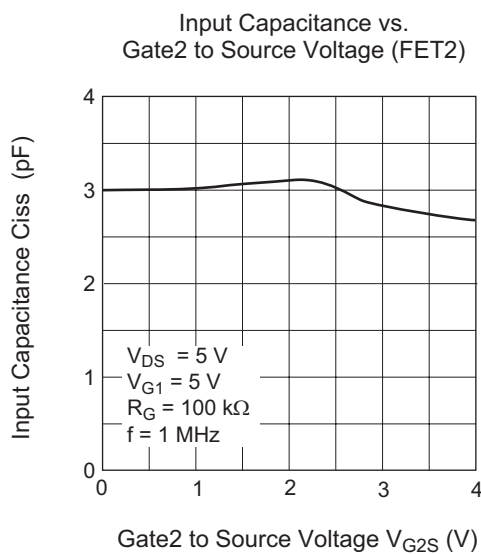
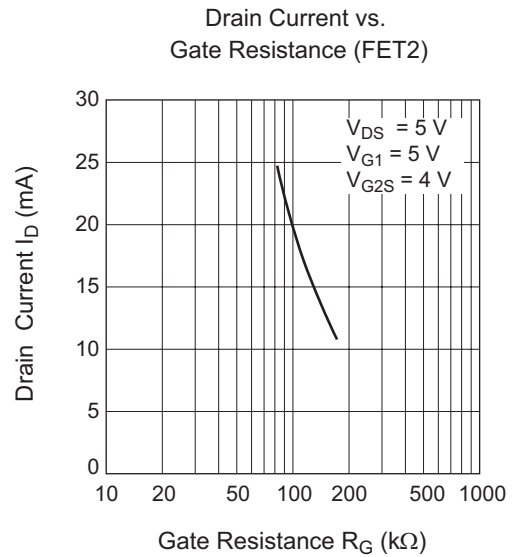
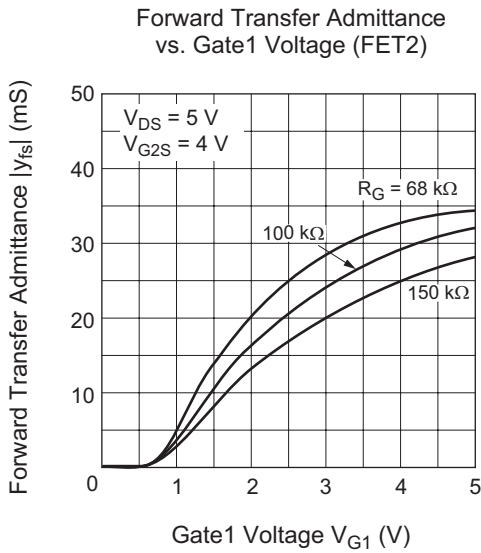
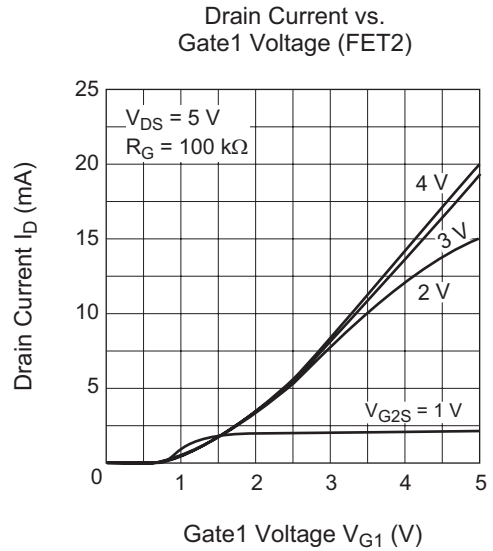
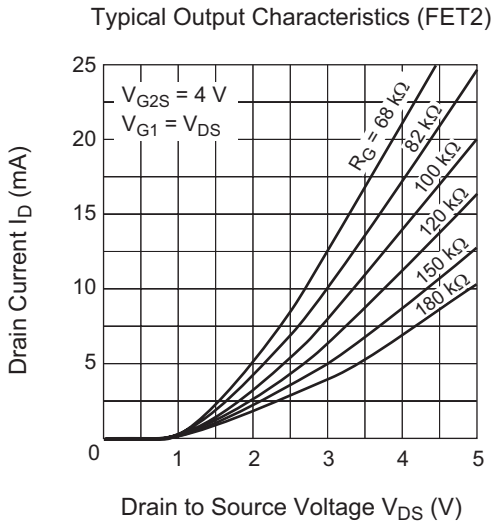


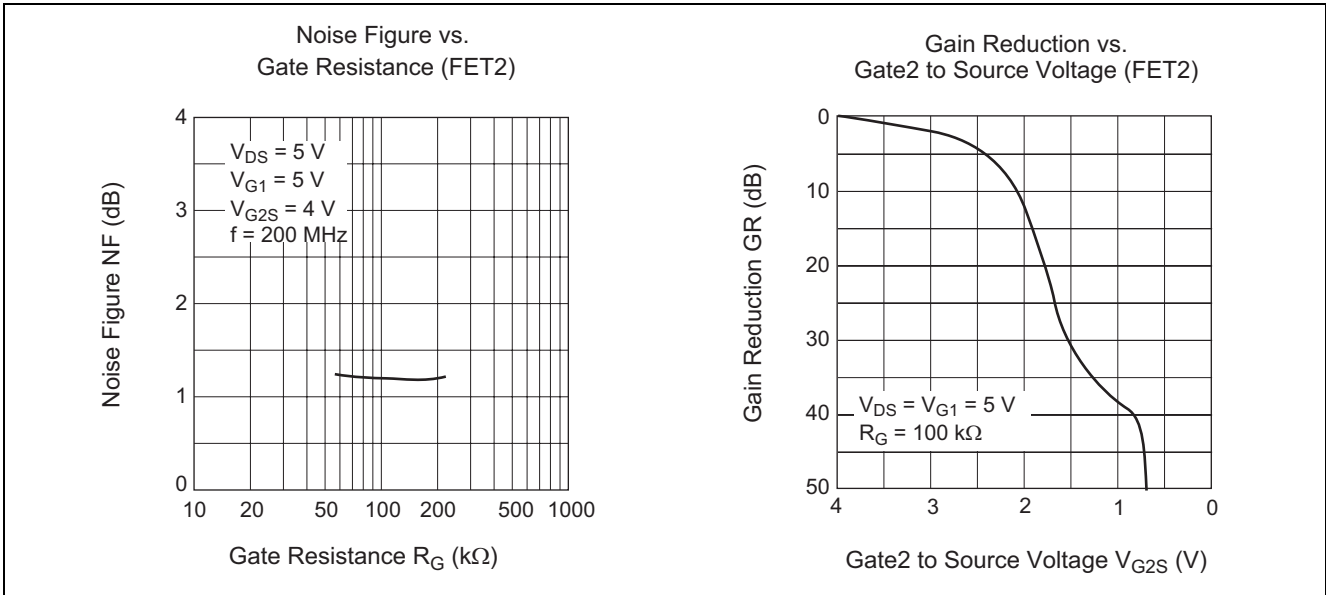
Drain Current vs. Gate Resistance (FET1)



Input Capacitance vs. Gate2 to Source Voltage (FET1)

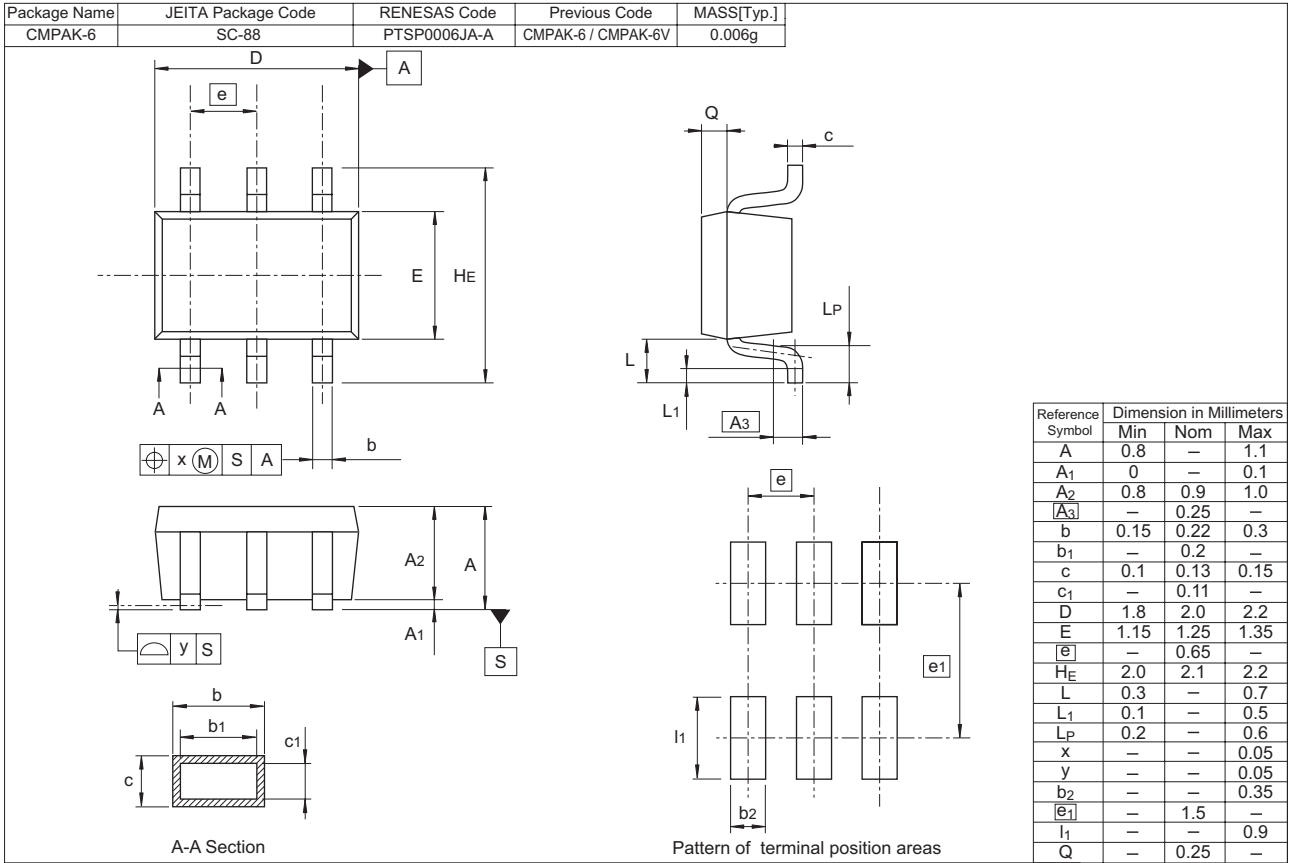








### Package Dimensions



### Ordering Information

| Part Name     | Quantity | Shipping Container                |
|---------------|----------|-----------------------------------|
| TBB1004DMTL-E | 3000     | φ 178 mm Reel, 8 mm Emboss Taping |

Note: For some grades, production may be terminated. Please contact the Renesas sales office to check the state of production before ordering the product.

**Keep safety first in your circuit designs!**

1. Renesas Technology Corp. puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. 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 nonflammable material or (iii) prevention against any malfunction or mishap.

**Notes regarding these materials**

1. These materials are intended as a reference to assist our customers in the selection of the Renesas Technology Corp. product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Renesas Technology Corp. or a third party.
  2. Renesas Technology Corp. assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
  3. All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Renesas Technology Corp. without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor for the latest product information before purchasing a product listed herein.  
The information described here may contain technical inaccuracies or typographical errors.  
Renesas Technology Corp. assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.  
Please also pay attention to information published by Renesas Technology Corp. by various means, including the Renesas Technology Corp. Semiconductor home page (<http://www.renesas.com>).
  4. When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Renesas Technology Corp. assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
  5. Renesas Technology Corp. semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
  6. The prior written approval of Renesas Technology Corp. is necessary to reprint or reproduce in whole or in part these materials.
  7. If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.  
Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
  8. Please contact Renesas Technology Corp. for further details on these materials or the products contained therein.
- 



**RENESAS SALES OFFICES**

<http://www.renesas.com>

Refer to "<http://www.renesas.com/en/network>" for the latest and detailed information.

**Renesas Technology America, Inc.**

450 Holger Way, San Jose, CA 95134-1368, U.S.A  
Tel: <1> (408) 382-7500, Fax: <1> (408) 382-7501

**Renesas Technology Europe Limited**

Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.  
Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

**Renesas Technology (Shanghai) Co., Ltd.**

Unit 204, 205, AZIACenter, No.1233 Lujiazui Ring Rd, Pudong District, Shanghai, China 200120  
Tel: <86> (21) 5877-1818, Fax: <86> (21) 6887-7898

**Renesas Technology Hong Kong Ltd.**

7th Floor, North Tower, World Finance Centre, Harbour City, 1 Canton Road, Tsimshatsui, Kowloon, Hong Kong  
Tel: <852> 2265-6688, Fax: <852> 2730-6071

**Renesas Technology Taiwan Co., Ltd.**

10th Floor, No.99, Fushing North Road, Taipei, Taiwan  
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

**Renesas Technology Singapore Pte. Ltd.**

1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632  
Tel: <65> 6213-0200, Fax: <65> 6278-8001

**Renesas Technology Korea Co., Ltd.**

Kukje Center Bldg. 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea  
Tel: <82> (2) 796-3115, Fax: <82> (2) 796-2145

**Renesas Technology Malaysia Sdn. Bhd**

Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No.18, Jalan Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia  
Tel: <603> 7955-9390, Fax: <603> 7955-9510