

TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

# MT6L78FS

## VHF~UHF Band Low-Noise Amplifier Applications

Two devices are incorporated in a fine-pitch, small-mold package (6 pins): fs6.

- Superior noise characteristics
- Superior performance in buffer and oscillator applications

## Mounted Devices

|  | Q1       | Q2        |
|--|----------|-----------|
| Corresponding three-pin products:<br>fSM mold products | MT3S11FS | MT3S11AFS |

### Absolute Maximum Ratings (Ta = 25°C)

| Characteristic              | Symbol         | Rating       |    | Unit |
|-----------------------------|----------------|--------------|----|------|
|                             |                | Q1           | Q2 |      |
| Collector-base voltage      | $V_{CBO}$      | 13           | 13 | V    |
| Collector-emitter voltage   | $V_{CEO}$      | 6            | 6  | V    |
| Emitter-base voltage        | $V_{EBO}$      | 1            | 1  | V    |
| Collector current           | $I_C$          | 40           | 40 | mA   |
| Base current                | $I_B$          | 10           | 10 | mA   |
| Collector power dissipation | $P_C$ (Note 1) | 100          | 90 | mW   |
|                             |                | 105 (Note 2) |    |      |
| Junction temperature        | $T_j$          | 125          |    | °C   |
| Storage temperature range   | $T_{stg}$      | -55~125      |    | °C   |

Weight: 0.001g (typ.)

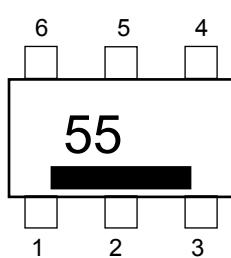
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate etc).

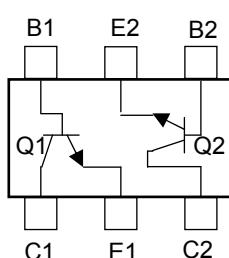
Note 1:  $10 \text{ mm}^2 \times 1.0 \text{ mm}$  (t), mounted on a glass-epoxy printed circuit board.

Note 2: During two-element operation

### Marking (top view)



### Pin Assignment (top view)



## Electrical Characteristics Q1 (Ta = 25°C)

| Characteristic               | Symbol                | Condition  | Min | Typ. | Max | Unit          |
|------------------------------|-----------------------|--|-----|------|-----|---------------|
| Collector cutoff current     | $I_{CBO}$             | $V_{CB} = 5 \text{ V}$ , $I_E = 0$                                   | —   | —    | 0.1 | $\mu\text{A}$ |
| Emitter cutoff current       | $I_{EBO}$             | $V_{EB} = 1 \text{ V}$ , $I_C = 0$                                   | —   | —    | 1   | $\mu\text{A}$ |
| DC current gain              | $h_{FE}$              | $V_{CE} = 1 \text{ V}$ , $I_C = 5 \text{ mA}$                        | 100 | —    | 160 | —             |
| Reverse transfer capacitance | $C_{re}(\text{Note})$ | $V_{CB} = 1 \text{ V}$ , $I_E = 0$ , $f = 1 \text{ MHz}$             | —   | 0.65 | 0.9 | pF            |
| Transition frequency         | $f_T$                 | $V_{CE} = 1 \text{ V}$ , $I_C = 5 \text{ mA}$                        | 4   | 6    | —   | GHz           |
| Insertion gain               | $ S_{21e} ^2 (1)$     | $V_{CE} = 1 \text{ V}$ , $I_C = 5 \text{ mA}$ , $f = 2 \text{ GHz}$  | —   | 3.5  | —   | dB            |
|                              | $ S_{21e} ^2 (2)$     | $V_{CE} = 3 \text{ V}$ , $I_C = 20 \text{ mA}$ , $f = 2 \text{ GHz}$ | 4   | 6.5  | —   |               |
| Noise figure                 | NF                    | $V_{CE} = 1 \text{ V}$ , $I_C = 5 \text{ mA}$ , $f = 2 \text{ GHz}$  | —   | 2.4  | 3.2 | dB            |

## Electrical Characteristics Q2 (Ta = 25°C)

| Characteristic               | Symbol                | Condition  | Min | Typ. | Max  | Unit          |
|------------------------------|-----------------------|--|-----|------|------|---------------|
| Collector cutoff current     | $I_{CBO}$             | $V_{CB} = 5 \text{ V}$ , $I_E = 0$                                   | —   | —    | 0.1  | $\mu\text{A}$ |
| Emitter cutoff current       | $I_{EBO}$             | $V_{EB} = 1 \text{ V}$ , $I_C = 0$                                   | —   | —    | 1    | $\mu\text{A}$ |
| DC current gain              | $h_{FE}$              | $V_{CE} = 1 \text{ V}$ , $I_C = 5 \text{ mA}$                        | 100 | —    | 160  | —             |
| Reverse transfer capacitance | $C_{re}(\text{Note})$ | $V_{CB} = 1 \text{ V}$ , $I_E = 0$ , $f = 1 \text{ MHz}$             | —   | 0.6  | 0.85 | pF            |
| Transition frequency         | $f_T$                 | $V_{CE} = 1 \text{ V}$ , $I_C = 5 \text{ mA}$                        | 4   | 6    | —    | GHz           |
| Insertion gain               | $ S_{21e} ^2 (1)$     | $V_{CE} = 1 \text{ V}$ , $I_C = 5 \text{ mA}$ , $f = 2 \text{ GHz}$  | —   | 3.5  | —    | dB            |
|                              | $ S_{21e} ^2 (2)$     | $V_{CE} = 3 \text{ V}$ , $I_C = 20 \text{ mA}$ , $f = 2 \text{ GHz}$ | 4   | 6.5  | —    |               |
| Noise figure                 | NF                    | $V_{CE} = 1 \text{ V}$ , $I_C = 5 \text{ mA}$ , $f = 2 \text{ GHz}$  | —   | 2.4  | 3.2  | dB            |

Note:  $C_{re}$  is measured with a three-terminal method using a capacitance bridge.

## Caution

This device is sensitive to electrostatic discharge. Ensure that tools and equipment are sufficiently grounded before handling. When handling individual devices (which are not yet mounted on a circuit board), ensure that the environment is protected against electrostatic discharge. Operators should wear antistatic clothing, and containers and other objects that come into direct contact with devices should be made of antistatic materials.

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20070701-EN GENERAL

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