To our customers,

## Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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RENESAS

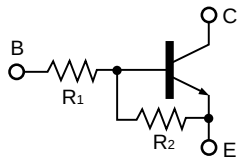
DATA SHEET

# COMPOUND TRANSISTOR
# FB1 SERIES

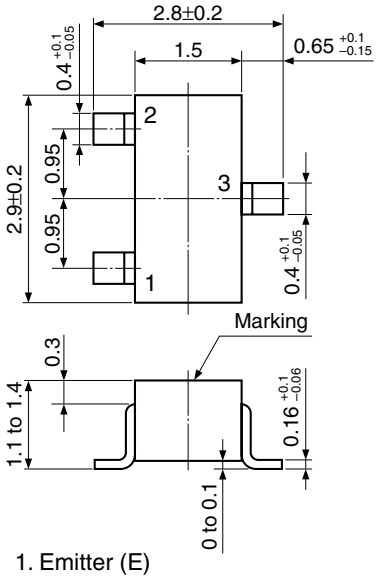
## ON-CHIP RESISTOR NPN SILICON EPITAXIAL TRANSISTOR FOR MID-SPEED SWITCHING

### FEATURES

- Up to 0.7 A current drive available
- On-chip bias resistor
- Low power consumption during drive
- <R> Package: 3-pin Mini Mold (SC-59)




### PACKAGE DRAWING (Unit: mm)




1. Emitter (E)
2. Base (B)
3. Collector (C)

### FB1 SERIES LISTS

| Products | Marking | $R_1$ (kΩ) | $R_2$ (kΩ) |
|---|---|---|---|
| FB1A4A | P30 | – | 10 |
| FB1L2Q | P31 | 0.47 | 4.7 |
| FB1A3M | P32 | 1.0 | 1.0 |
| FB1F3P | P33 | 2.2 | 10 |
| FB1J3P | P36 | 3.3 | 10 |
| FB1L3N | P34 | 4.7 | 10 |
| FB1A4M | P35 | 10 | 10 |

### ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25°C)

| Parameter | Symbol | Ratings | Unit |
|---|---|---|---|
| Collector to Base Voltage | $V_{CBO}$ | 30 | V |
| Collector to Emitter Voltage | $V_{CEO}$ | 25 | V |
| Emitter to Base Voltage | $V_{EBO}$ | 10 | V |
| Collector Current (DC) | $I_{C(DC)}$ | 0.7 | A |
| Collector Current (pulse) **Note** | $I_{C(pulse)}$ | 1.0 | A |
| Base Current (DC) | $I_{B(DC)}$ | 20 | mA |
| Total Power Dissipation | $P_T$ | 200 | mW |
| Junction Temperature | $T_j$ | 150 | °C |
| Storage Temperature | $T_{stg}$ | –55 to +150 | °C |

**Note** PW ≤ 10 ms, Duty Cycle ≤ 50%

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Date Published February 2008 NS
Printed in Japan




**The mark <R> shows major revised points.**
**The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.**

## ELECTRICAL CHARACTERISTICS ($T_A$ = 25°C)

### FB1A4A

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Collector to Base Cut-off Current | $I_{CBO}$ | $V_{CB}$ = 30 V, $I_E$ = 0 A | | | 100 | nA |
| DC Current Gain **Note** | $h_{FE1}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.1 A | 300 | | | – |
| | $h_{FE2}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.5 A | 300 | | | – |
| | $h_{FE3}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.7 A | 135 | | | – |
| Collector Saturation Voltage **Note** | $V_{CE(sat)}$ | $I_C$ = 0.5 A, $I_B$ = 5 mA | | 0.27 | 0.4 | V |
| Low Level Input Voltage **Note** | $V_{IL}$ | $V_{CE}$ = 5.0 V, $I_C$ = 100 $\mu$A | | | 0.3 | V |
| Input Resistance | $R_1$ | | – | – | – | Ω |
| Emitter to Base Resistance | $R_2$ | | 7 | 10 | 13 | kΩ |

**Note** PW ≤ 350 $\mu$s, Duty Cycle ≤ 2%

### FB1L2Q

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Collector to Base Cut-off Current | $I_{CBO}$ | $V_{CB}$ = 30 V, $I_E$ = 0 A | | | 100 | nA |
| DC Current Gain **Note** | $h_{FE1}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.1 A | 150 | 400 | | – |
| | $h_{FE2}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.5 A | 300 | 700 | | – |
| | $h_{FE3}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.7 A | 135 | 600 | | – |
| Low Level Output Voltage **Note** | $V_{OL}$ | $V_{IN}$ = 5.0 V, $I_C$ = 0.5 A | | 0.2 | 0.3 | V |
| Low Level Input Voltage **Note** | $V_{IL}$ | $V_{CE}$ = 5.0 V, $I_C$ = 100 $\mu$A | | 0.62 | 0.3 | V |
| Input Resistance | $R_1$ | | 329 | 470 | 611 | Ω |
| Emitter to Base Resistance | $R_2$ | | 3.29 | 4.7 | 6.11 | kΩ |

**Note** PW ≤ 350 $\mu$s, Duty Cycle ≤ 2%

### FB1A3M

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Collector to Base Cut-off Current | $I_{CBO}$ | $V_{CB}$ = 30 V, $I_E$ = 0 A | | | 100 | nA |
| DC Current Gain **Note** | $h_{FE1}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.1 A | 80 | | | – |
| | $h_{FE2}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.5 A | 100 | | | – |
| | $h_{FE3}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.7 A | 135 | | | – |
| Low Level Output Voltage **Note** | $V_{OL}$ | $V_{IN}$ = 5.0 V, $I_C$ = 0.5 A | | 0.3 | 0.4 | V |
| Low Level Input Voltage **Note** | $V_{IL}$ | $V_{CE}$ = 5.0 V, $I_C$ = 100 $\mu$A | | | 0.3 | V |
| Input Resistance | $R_1$ | | 0.7 | 1.0 | 1.3 | kΩ |
| Emitter to Base Resistance | $R_2$ | | 0.7 | 1.0 | 1.3 | kΩ |

**Note** PW ≤ 350 $\mu$s, Duty Cycle ≤ 2%

**FB1F3P**

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Collector to Base Cut-off Current | $I_{CBO}$ | $V_{CB}$ = 30 V, $I_E$ = 0 A | | | 100 | nA |
| DC Current Gain **Note** | $h_{FE1}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.1 A | 300 | | | – |
| | $h_{FE2}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.5 A | 300 | | | – |
| | $h_{FE3}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.7 A | 135 | | | – |
| Low Level Output Voltage **Note** | $V_{OL}$ | $V_{IN}$ = 5.0 V, $I_C$ = 0.3 A | | | 0.3 | V |
| Low Level Input Voltage **Note** | $V_{IL}$ | $V_{CE}$ = 5.0 V, $I_C$ = 100 $\mu$A | | | 0.3 | V |
| Input Resistance | $R_1$ | | 1.54 | 2.2 | 2.86 | kΩ |
| Emitter to Base Resistance | $R_2$ | | 7 | 10 | 13 | kΩ |

**Note** PW ≤ 350 $\mu$s, Duty Cycle ≤ 2%

**FB1J3P**

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Collector to Base Cut-off Current | $I_{CBO}$ | $V_{CB}$ = 30 V, $I_E$ = 0 A | | | 100 | nA |
| DC Current Gain **Note** | $h_{FE1}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.1 A | 300 | 600 | | – |
| | $h_{FE2}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.5 A | 300 | 700 | | – |
| | $h_{FE3}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.7 A | 135 | 600 | | – |
| Low Level Output Voltage **Note** | $V_{OL}$ | $V_{IN}$ = 5.0 V, $I_C$ = 0.2 A | | 0.14 | 0.3 | V |
| Low Level Input Voltage **Note** | $V_{IL}$ | $V_{CE}$ = 5.0 V, $I_C$ = 100 $\mu$A | | 0.6 | 0.3 | V |
| Input Resistance | $R_1$ | | 2.31 | 3.3 | 4.29 | kΩ |
| Emitter to Base Resistance | $R_2$ | | 7 | 10 | 13 | kΩ |

**Note** PW ≤ 350 $\mu$s, Duty Cycle ≤ 2%

**FB1L3N**

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Collector to Base Cut-off Current | $I_{CBO}$ | $V_{CB}$ = 30 V, $I_E$ = 0 A | | | 100 | nA |
| DC Current Gain **Note** | $h_{FE1}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.1 A | 300 | | | – |
| | $h_{FE2}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.5 A | 300 | | | – |
| | $h_{FE3}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.7 A | 135 | | | – |
| Low Level Output Voltage **Note** | $V_{OL}$ | $V_{IN}$ = 5.0 V, $I_C$ = 0.2 A | | | 0.3 | V |
| Low Level Input Voltage **Note** | $V_{IL}$ | $V_{CE}$ = 5.0 V, $I_C$ = 100 $\mu$A | | | 0.3 | V |
| Input Resistance | $R_1$ | | 3.29 | 4.7 | 6.11 | kΩ |
| Emitter to Base Resistance | $R_2$ | | 7 | 10 | 13 | kΩ |

**Note** PW ≤ 350 $\mu$s, Duty Cycle ≤ 2%

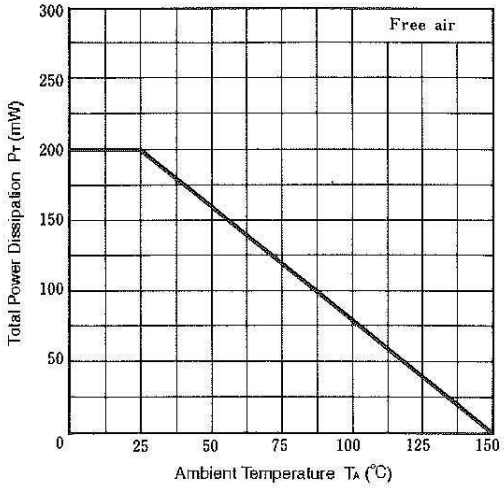
**FB1A4M**

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Collector to Base Cut-off Current | $I_{CBO}$ | $V_{CB}$ = 30 V, $I_E$ = 0 A | | | 100 | nA |
| DC Current Gain [Note] | $h_{FE1}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.1 A | 300 | | | – |
| | $h_{FE2}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.5 A | 300 | | | – |
| | $h_{FE3}$ | $V_{CE}$ = 2.0 V, $I_C$ = 0.7 A | 135 | | | – |
| Low Level Output Voltage [Note] | $V_{OL}$ | $V_{IN}$ = 5.0 V, $I_C$ = 0.2 A | | | 0.3 | V |
| Low Level Input Voltage [Note] | $V_{IL}$ | $V_{CE}$ = 5.0 V, $I_C$ = 100 $\mu$A | | | 0.3 | V |
| Input Resistance | $R_1$ | | 7 | 10 | 13 | kΩ |
| Emitter to Base Resistance | $R_2$ | | 7 | 10 | 13 | kΩ |

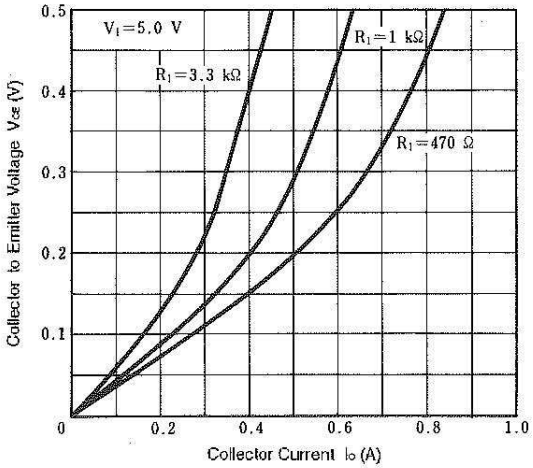
**Note** PW ≤ 350 $\mu$s, Duty Cycle ≤ 2%

## TYPICAL CHARACTERISTICS ($T_A$ = 25°C)

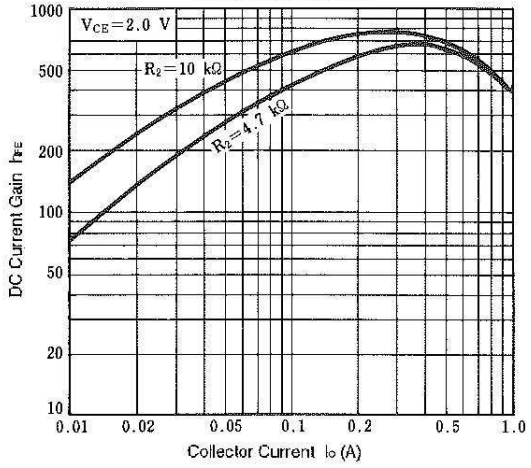
TOTAL POWER DISSIPATION vs.
COLLECTOR CURRENT



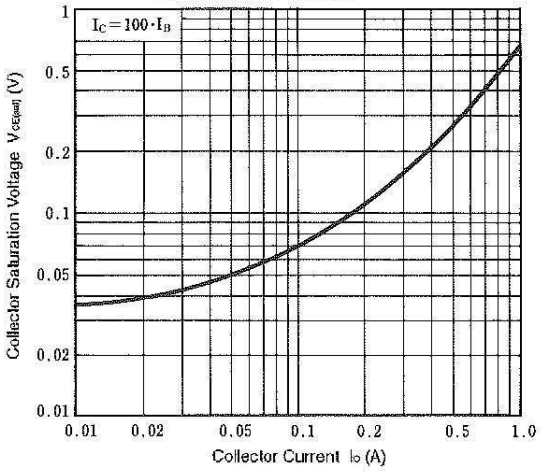

COLLECTOR TO EMITTER VOLTAGE
vs. COLLECTOR CURRENT




DC CURRENT GAIN vs.
COLLECTOR CURRENT




<R>
COLLECTOR SATURATION VOLTAGE
vs. COLLECTOR CURRENT



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