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## 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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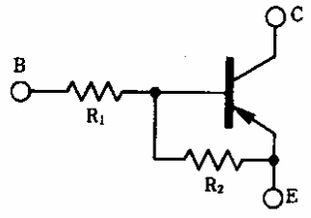
RENESAS

# COMPOUND TRANSISTOR
# HR1 SERIES

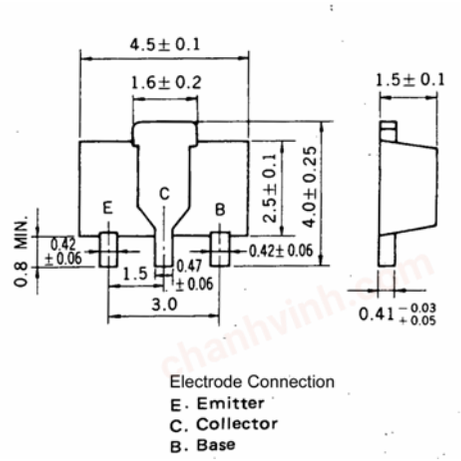
## on-chip resistor PNP silicon epitaxial transistor
## For mid-speed switching

### FEATURES

- Up to 2A high current drives such as IC outputs and actuators available
- On-chip bias resistor
- Low power consumption during drive




### PACKAGE DRAWING (UNIT: mm)




### HR1 SERIES LISTS

| Products | Marking | $R_1$ (kΩ) | $R_2$ (kΩ) |
|---|---|---|---|
| HR1A3M | MP | 1.0 | 1.0 |
| HR1F3P | MQ | 2.2 | 10 |
| HR1L3N | MR | 4.7 | 10 |
| HR1A4M | MS | 10 | 10 |
| HR1L2Q | MT | 0.47 | 4.7 |
| HR1F2Q | MU | 0.22 | 2.2 |
| HR1A4A | MX | – | 10 |

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

| Parameter | Symbol | Ratings | Unit |
|---|---|---|---|
| Collector to base voltage | $V_{CBO}$ | −60 | V |
| Collector to emitter voltage | $V_{CEO}$ | −60 | V |
| Emitter to base voltage | $V_{EBO}$ | −10 | V |
| Collector current (DC) | $I_{C(DC)}$ | −1.0 | A |
| Collector current (Pulse) | $I_{C(pulse)}$ Note1 | −2.0 | A |
| Base current (DC) | $I_{B(DC)}$ | −0.02 | A |
| Total power dissipation | $P_T$ Note2 | 2.0 | W |
| Junction temperature | $T_j$ | 150 | °C |
| Storage temperature | $T_{stg}$ | −55 to +150 | °C |

**Notes 1.** PW ≤ 10 ms, duty cycle ≤ 50 %

**2.** When 0.7 mm × 16 $cm^2$ ceramic board is used

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**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.**

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### HR1A3M

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

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Collector cutoff current | $I_{CBO}$ | $V_{CB}$ = –60 V, $I_E$ = 0 | | | –100 | nA |
| DC current gain | $h_{FE1}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –0.1 A | 50 | | | – |
| DC current gain | $h_{FE2}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –0.5 A | 100 | | | – |
| DC current gain | $h_{FE3}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –1.0 A | 50 | | | – |
| Low level output voltage | $V_{OL}$ Note | $V_{IN}$ = –5.0 V, $I_C$ = –0.4 A | | | –0.4 | V |
| Low level input voltage | $V_{IL}$ Note | $V_{CE}$ = –5.0 V, $I_C$ = –100 μA | | | –0.3 | V |
| Input resistance | $R_1$ | | 0.7 | 1.0 | 1.3 | kΩ |
| E-to-B resistance | $R_2$ | | 0.7 | 1.0 | 1.3 | kΩ |

**Note** PW ≤ 350 μs, duty cycle ≤ 2 %

### HR1F3P

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

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Collector cutoff current | $I_{CBO}$ | $V_{CB}$ = –60 V, $I_E$ = 0 | | | –100 | nA |
| DC current gain | $h_{FE1}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –0.1 A | 150 | | | – |
| DC current gain | $h_{FE2}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –0.5 A | 100 | | | – |
| DC current gain | $h_{FE3}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –1.0 A | 50 | | | – |
| Low level output voltage | $V_{OL}$ Note | $V_{IN}$ = –5.0 V, $I_C$ = –0.3 A | | | –0.3 | V |
| Low level input voltage | $V_{IL}$ Note | $V_{CE}$ = –5.0 V, $I_C$ = –100 μA | | | –0.3 | V |
| Input resistance | $R_1$ | | 1.54 | 2.2 | 2.86 | kΩ |
| E-to-B resistance | $R_2$ | | 7 | 10 | 13 | kΩ |

**Note** PW ≤ 350 μs, duty cycle ≤ 2 %

### HR1L3N

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

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Collector cutoff current | $I_{CBO}$ | $V_{CB}$ = –60 V, $I_E$ = 0 | | | –100 | nA |
| DC current gain | $h_{FE1}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –0.1 A | 150 | | | – |
| DC current gain | $h_{FE2}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –0.5 A | 100 | | | – |
| DC current gain | $h_{FE3}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –1.0 A | 50 | | | – |
| Low level output voltage | $V_{OL}$ Note | $V_{IN}$ = –5.0 V, $I_C$ = –0.2 A | | | –0.3 | V |
| Low level input voltage | $V_{IL}$ Note | $V_{CE}$ = –5.0 V, $I_C$ = –100 μA | | | –0.3 | V |
| Input resistance | $R_1$ | | 3.29 | 4.7 | 6.11 | kΩ |
| E-to-B resistance | $R_2$ | | 7 | 10 | 13 | kΩ |

**Note** PW ≤ 350 μs, duty cycle ≤ 2 %

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### HR1A4M

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

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Collector cutoff current | $I_{CBO}$ | $V_{CB}$ = –60 V, $I_E$ = 0 | | | –100 | nA |
| DC current gain | $h_{FE1}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –0.1 A | 150 | | | – |
| DC current gain | $h_{FE2}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –0.5 A | 100 | | | – |
| DC current gain | $h_{FE3}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –1.0 A | 50 | | | – |
| Low level output voltage | $V_{OL}$ Note | $V_{IN}$ = –5.0 V, $I_C$ = –0.1 A | | | –0.2 | V |
| Low level input voltage | $V_{IL}$ Note | $V_{CE}$ = –5.0 V, $I_C$ = –100 μA | | | –0.3 | V |
| Input resistance | $R_1$ | | 7 | 10 | 13 | kΩ |
| E-to-B resistance | $R_2$ | | 7 | 10 | 13 | kΩ |

**Note** PW ≤ 350 μs, duty cycle ≤ 2 %

### HR1L2Q

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

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Collector cutoff current | $I_{CBO}$ | $V_{CB}$ = –60 V, $I_E$ = 0 | | | –100 | nA |
| DC current gain | $h_{FE1}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –0.1 A | 150 | | | – |
| DC current gain | $h_{FE2}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –0.5 A | 100 | | | – |
| DC current gain | $h_{FE3}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –1.0 A | 50 | | | – |
| Low level output voltage | $V_{OL}$ Note | $V_{IN}$ = –5.0 V, $I_C$ = –0.5 A | | | –0.55 | V |
| Low level input voltage | $V_{IL}$ Note | $V_{CE}$ = –5.0 V, $I_C$ = –100 μA | | | –0.3 | V |
| Input resistance | $R_1$ | | 329 | 470 | 611 | Ω |
| E-to-B resistance | $R_2$ | | 3.29 | 4.7 | 6.11 | kΩ |

**Note** PW ≤ 350 μs, duty cycle ≤ 2 %

### HR1F2Q

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

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Collector cutoff current | $I_{CBO}$ | $V_{CB}$ = –60 V, $I_E$ = 0 | | | –100 | nA |
| DC current gain | $h_{FE1}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –0.1 A | 100 | | | – |
| DC current gain | $h_{FE2}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –0.5 A | 100 | | | – |
| DC current gain | $h_{FE3}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –1.0 A | 50 | | | – |
| Low level output voltage | $V_{OL}$ Note | $V_{IN}$ = –5.0 V, $I_C$ = –0.5 A | | | –0.55 | V |
| Low level input voltage | $V_{IL}$ Note | $V_{CE}$ = –5.0 V, $I_C$ = –100 μA | | | –0.3 | V |
| Input resistance | $R_1$ | | 154 | 220 | 286 | Ω |
| E-to-B resistance | $R_2$ | | 1.54 | 2.2 | 2.86 | kΩ |

**Note** PW ≤ 350 μs, duty cycle ≤ 2 %

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## HR1A4A

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

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Collector cutoff current | $I_{CBO}$ | $V_{CB}$ = –60 V, $I_E$ = 0 | | | –100 | nA |
| DC current gain | $h_{FE1}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –0.1 A | 150 | | | – |
| DC current gain | $h_{FE2}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –0.5 A | 100 | | | – |
| DC current gain | $h_{FE3}$ Note | $V_{CE}$ = –2.0 V, $I_C$ = –1.0 A | 50 | | | – |
| Collector saturation voltage | $V_{CE(sat)}$ Note | $I_C$ = –500 mA, $I_B$ = –10 mA | | 0.20 | 0.35 | V |
| Low level input voltage | $V_{IL}$ Note | $V_{CE}$ = –5.0 V, $I_C$ = –100 μA | –0.3 | | –1.5 | V |
| E-to-B resistance | $R_2$ | | 7 | 10 | 13 | kΩ |

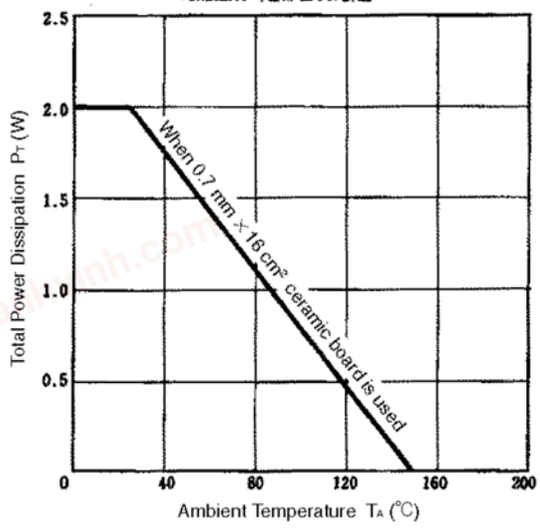
**Note** PW ≤ 350 μs, duty cycle ≤ 2 %

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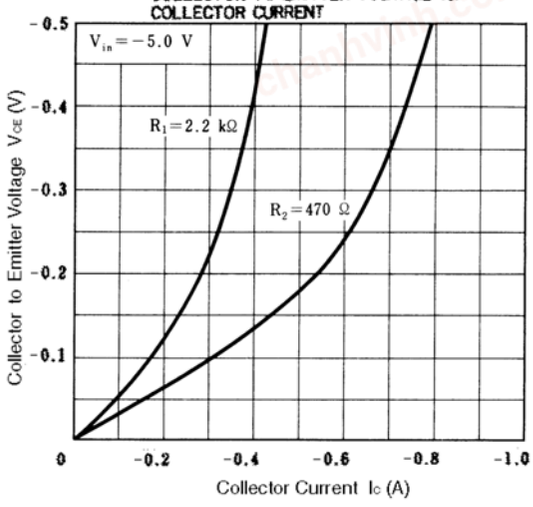


## <R> TYPICAL CHARACTERISTICS ($T_A$ = 25°C)

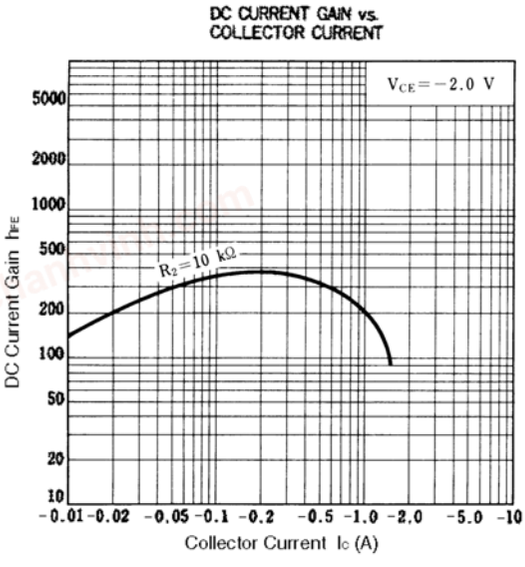
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



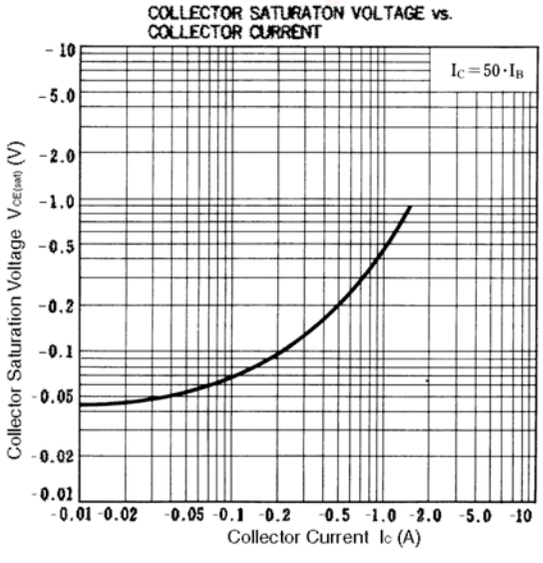

COLLECTOR TO EMITTER VOLTAGE vs. COLLECTOR CURRENT




DC CURRENT GAIN vs. COLLECTOR CURRENT




COLLECTOR SATURATON VOLTAGE vs. COLLECTOR CURRENT



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