

To our customers,

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## Old Company Name in Catalogs and Other Documents

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April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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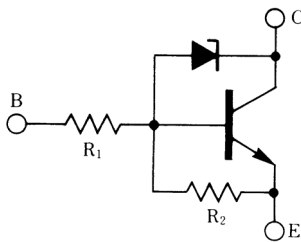
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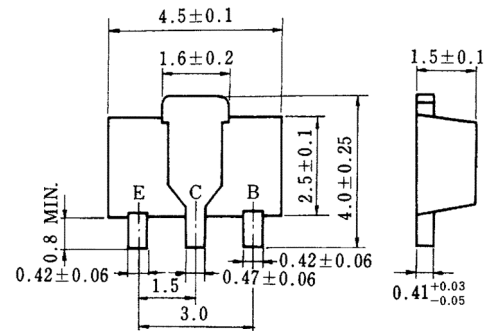
on-chip resistor NPN silicon epitaxial transistor  
For mid-speed switching

FEATURES

- High current drives such as IC outputs and actuators available
- On-chip bias resistor
- The zener diode connected between the collector and base of the transistor
- Low power consumption during drive



PACKAGE DRAWING (UNIT: mm)



Electrode Connection  
E. Emitter  
C. Collector  
B. Base

HD2 SERIES LISTS

| Products | Marking | R <sub>1</sub> (kΩ) | R <sub>2</sub> (kΩ) |
|----------|---------|---------------------|---------------------|
| HD2A3M   | LA      | 1.0                 | 1.0                 |
| HD2F3P   | LB      | 2.2                 | 10                  |
| HD2L3N   | LC      | 4.7                 | 10                  |
| HD2A4M   | LD      | 10                  | 10                  |
| HD2L2Q   | LE      | 0.47                | 4.7                 |
| HD2F2Q   | LF      | 0.22                | 2.2                 |
| HD2A4A   | LY      | —                   | 10                  |

ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C)

| Parameter                    | Symbol                                 | Ratings     | Unit |
|------------------------------|--|-------------|------|
| Collector to base voltage    | V <sub>CB0</sub>                       | 60±10       | V    |
| Collector to emitter voltage | V <sub>CE0</sub>                       | 60±10       | V    |
| Emitter to base voltage      | V <sub>EB0</sub>                       | 10          | V    |
| Collector current (DC)       | I <sub>C(DC)</sub>                     | 1.0         | A    |
| Collector current (Pulse)    | I <sub>C(pulse)</sub> <sup>Note1</sup> | 2.0         | A    |
| Base current (DC)            | I <sub>B(DC)</sub>                     | 20          | mA   |
| Total power dissipation      | P <sub>T</sub> <sup>Note2</sup>        | 2.0         | W    |
| Junction temperature         | T <sub>J</sub>                         | 150         | °C   |
| Storage temperature          | T <sub>stg</sub>                       | -55 to +150 | °C   |

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

2. When 0.7 mm × 16 cm<sup>2</sup> ceramic board is used

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**HD2A3M**

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

| Parameter                | Symbol                               | Conditions                                       | MIN. | TYP. | MAX. | Unit |
|--------------------------|--------------------------------------|--|------|------|------|------|
| Collector cutoff current | I <sub>CBO</sub>                     | V <sub>CB</sub> = 40 V, I <sub>E</sub> = 0 A     |      |      | 100  | nA   |
| DC current gain          | h <sub>FE1</sub> <small>Note</small> | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.1 A  | 80   |      |      | –    |
| DC current gain          | h <sub>FE2</sub> <small>Note</small> | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.5 A  | 200  |      |      | –    |
| DC current gain          | h <sub>FE3</sub> <small>Note</small> | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 1.0 A  | 200  |      |      | –    |
| Low level output voltage | V <sub>OL</sub> <small>Note</small>  | V <sub>IN</sub> = 5.0 V, I <sub>C</sub> = 0.5 A  |      |      | 0.35 | V    |
| Low level input voltage  | V <sub>IL</sub> <small>Note</small>  | V <sub>CE</sub> = 5.0 V, I <sub>C</sub> = 100 μA |      |      | 0.3  | V    |
| Input resistance         | R <sub>1</sub>                       |  | 0.7  | 1.0  | 1.3  | kΩ   |
| E-to-B resistance        | R <sub>2</sub>                       |  | 0.7  | 1.0  | 1.3  | kΩ   |

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

**HD2F3P**

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

| Parameter                | Symbol                               | Conditions                                       | MIN. | TYP. | MAX. | Unit |
|--------------------------|--------------------------------------|--|------|------|------|------|
| Collector cutoff current | I <sub>CBO</sub>                     | V <sub>CB</sub> = 40 V, I <sub>E</sub> = 0 A     |      |      | 100  | nA   |
| DC current gain          | h <sub>FE1</sub> <small>Note</small> | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.1 A  | 200  |      |      | –    |
| DC current gain          | h <sub>FE2</sub> <small>Note</small> | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.5 A  | 300  |      |      | –    |
| DC current gain          | h <sub>FE3</sub> <small>Note</small> | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 1.0 A  | 200  |      |      | –    |
| Low level output voltage | V <sub>OL</sub> <small>Note</small>  | V <sub>IN</sub> = 5.0 V, I <sub>C</sub> = 0.3 A  |      | 0.12 | 0.3  | V    |
| Low level input voltage  | V <sub>IL</sub> <small>Note</small>  | V <sub>CE</sub> = 5.0 V, I <sub>C</sub> = 100 μA |      |      | 0.3  | V    |
| Input resistance         | R <sub>1</sub>                       |  | 1.54 | 2.2  | 2.86 | kΩ   |
| E-to-B resistance        | R <sub>2</sub>                       |  | 7    | 10   | 13   | kΩ   |

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

**HD2L3N**

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

| Parameter                | Symbol                               | Conditions                                       | MIN. | TYP. | MAX. | Unit |
|--------------------------|--------------------------------------|--|------|------|------|------|
| Collector cutoff current | I <sub>CBO</sub>                     | V <sub>CB</sub> = 40 V, I <sub>E</sub> = 0 A     |      |      | 100  | nA   |
| DC current gain          | h <sub>FE1</sub> <small>Note</small> | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.1 A  | 200  |      |      | –    |
| DC current gain          | h <sub>FE2</sub> <small>Note</small> | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.5 A  | 300  |      |      | –    |
| DC current gain          | h <sub>FE3</sub> <small>Note</small> | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 1.0 A  | 200  |      |      | –    |
| Low level output voltage | V <sub>OL</sub> <small>Note</small>  | V <sub>IN</sub> = 5.0 V, I <sub>C</sub> = 0.2 A  |      |      | 0.2  | V    |
| Low level input voltage  | V <sub>IL</sub> <small>Note</small>  | V <sub>CE</sub> = 5.0 V, I <sub>C</sub> = 100 μA |      |      | 0.3  | V    |
| Input resistance         | R <sub>1</sub>                       |  | 3.29 | 4.7  | 6.11 | kΩ   |
| E-to-B resistance        | R <sub>2</sub>                       |  | 7    | 10   | 13   | kΩ   |

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

**HD2A4M**

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

| Parameter                | Symbol                           | Conditions                                       | MIN. | TYP. | MAX. | Unit |
|--------------------------|----------------------------------|--|------|------|------|------|
| Collector cutoff current | I <sub>CBO</sub>                 | V <sub>CB</sub> = 40 V, I <sub>E</sub> = 0 A     |      |      | 100  | nA   |
| DC current gain          | h <sub>FE1</sub> <sup>Note</sup> | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.1 A  | 200  |      |      | –    |
| DC current gain          | h <sub>FE2</sub> <sup>Note</sup> | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.5 A  | 300  |      |      | –    |
| DC current gain          | h <sub>FE3</sub> <sup>Note</sup> | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 1.0 A  | 200  |      |      | –    |
| Low level output voltage | V <sub>OL</sub> <sup>Note</sup>  | V <sub>IN</sub> = 5.0 V, I <sub>C</sub> = 0.1 A  |      |      | 0.2  | V    |
| Low level input voltage  | V <sub>IL</sub> <sup>Note</sup>  | V <sub>CE</sub> = 5.0 V, I <sub>C</sub> = 100 μA |      |      | 0.3  | V    |
| Input resistance         | R <sub>1</sub>                   |  | 7    | 10   | 13   | kΩ   |
| E-to-B resistance        | R <sub>2</sub>                   |  | 7    | 10   | 13   | kΩ   |

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

**HD2L2Q**

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

| Parameter                | Symbol                           | Conditions                                       | MIN. | TYP. | MAX. | Unit |
|--------------------------|----------------------------------|--|------|------|------|------|
| Collector cutoff current | I <sub>CBO</sub>                 | V <sub>CB</sub> = 40 V, I <sub>E</sub> = 0 A     |      |      | 100  | nA   |
| DC current gain          | h <sub>FE1</sub> <sup>Note</sup> | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.1 A  | 200  |      |      | –    |
| DC current gain          | h <sub>FE2</sub> <sup>Note</sup> | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.5 A  | 300  |      |      | –    |
| DC current gain          | h <sub>FE3</sub> <sup>Note</sup> | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 1.0 A  | 200  |      |      | –    |
| Low level output voltage | V <sub>OL</sub> <sup>Note</sup>  | V <sub>IN</sub> = 5.0 V, I <sub>C</sub> = 1.0 A  |      |      | 0.5  | V    |
| Low level input voltage  | V <sub>IL</sub> <sup>Note</sup>  | V <sub>CE</sub> = 5.0 V, I <sub>C</sub> = 100 μA |      |      | 0.3  | V    |
| Input resistance         | R <sub>1</sub>                   |  | 329  | 470  | 611  | Ω    |
| E-to-B resistance        | R <sub>2</sub>                   |  | 3.29 | 4.7  | 6.11 | kΩ   |

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

**HD2F2Q**

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

| Parameter                | Symbol                           | Conditions                                       | MIN. | TYP. | MAX. | Unit |
|--------------------------|----------------------------------|--|------|------|------|------|
| Collector cutoff current | I <sub>CBO</sub>                 | V <sub>CB</sub> = 40 V, I <sub>E</sub> = 0 A     |      |      | 100  | nA   |
| DC current gain          | h <sub>FE1</sub> <sup>Note</sup> | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.1 A  | 100  |      |      | –    |
| DC current gain          | h <sub>FE2</sub> <sup>Note</sup> | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.5 A  | 300  |      |      | –    |
| DC current gain          | h <sub>FE3</sub> <sup>Note</sup> | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 1.0 A  | 200  |      |      | –    |
| Low level output voltage | V <sub>OL</sub> <sup>Note</sup>  | V <sub>IN</sub> = 5.0 V, I <sub>C</sub> = 1.0 A  |      |      | 0.5  | V    |
| Low level input voltage  | V <sub>IL</sub> <sup>Note</sup>  | V <sub>CE</sub> = 5.0 V, I <sub>C</sub> = 100 μA |      |      | 0.3  | V    |
| Input resistance         | R <sub>1</sub>                   |  | 154  | 220  | 286  | Ω    |
| E-to-B resistance        | R <sub>2</sub>                   |  | 1.54 | 2.2  | 2.86 | kΩ   |

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

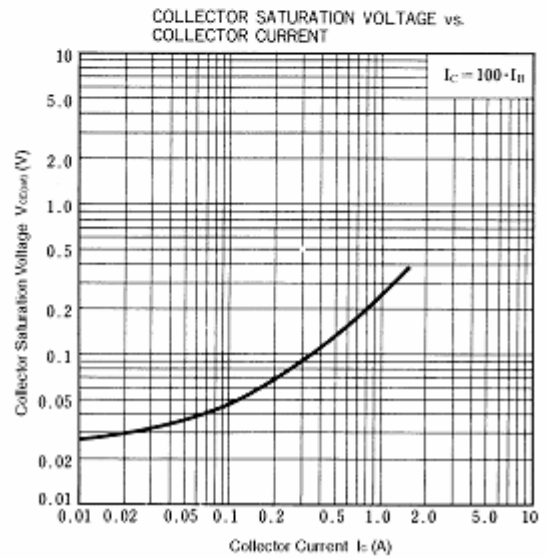
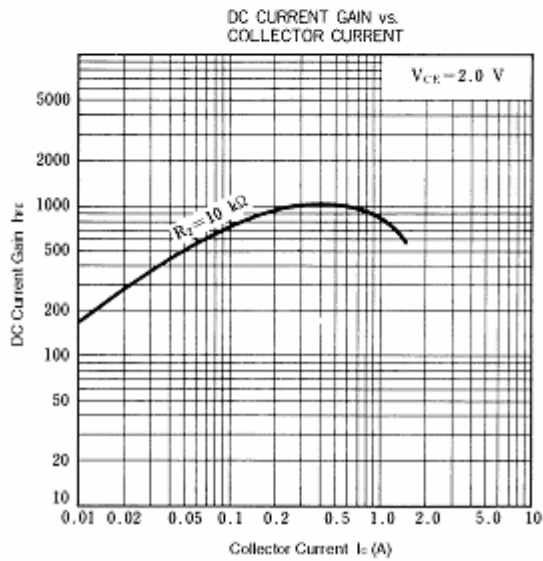
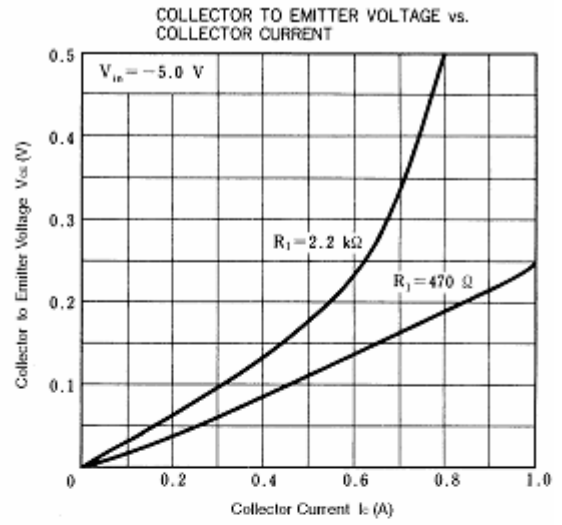
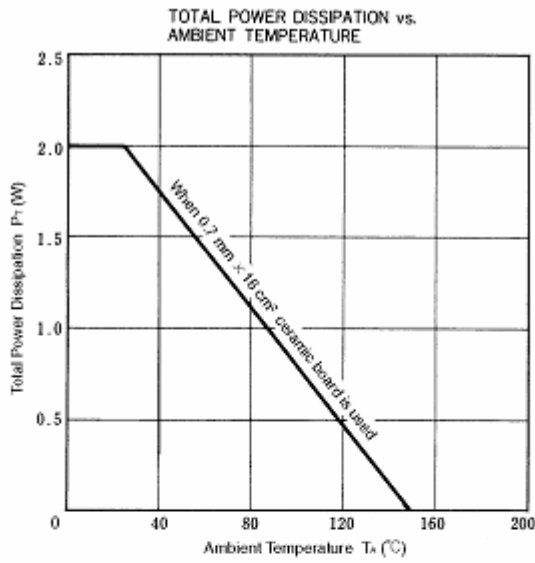
**HD2A4A**

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

| Parameter                    | Symbol                           | Conditions                                       | MIN. | TYP. | MAX. | Unit |
|------------------------------|----------------------------------|--|------|------|------|------|
| Collector cutoff current     | I <sub>CB0</sub>                 | V <sub>CB</sub> = 40 V, I <sub>E</sub> = 0 A     |      |      | 100  | nA   |
| DC current gain              | h <sub>FE1</sub> <b>Note</b>     | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.1 A  | 200  | 760  |      | –    |
| DC current gain              | h <sub>FE2</sub> <b>Note</b>     | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.5 A  | 300  | 1010 |      | –    |
| DC current gain              | h <sub>FE3</sub> <b>Note</b>     | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 1.0 A  | 200  | 830  |      | –    |
| Collector saturation voltage | V <sub>CE(sat)</sub> <b>Note</b> | I <sub>C</sub> = 1.0 A, I <sub>B</sub> = 10 mA   |      | 0.25 | 0.4  | V    |
| Low level input voltage      | V <sub>IL</sub> <b>Note</b>      | V <sub>CE</sub> = 5.0 V, I <sub>C</sub> = 100 μA |      |      | 0.3  | V    |
| E-to-B resistance            | R <sub>2</sub>                   |  | 7    | 10   | 13   | kΩ   |

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

TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)



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