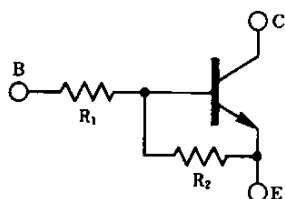


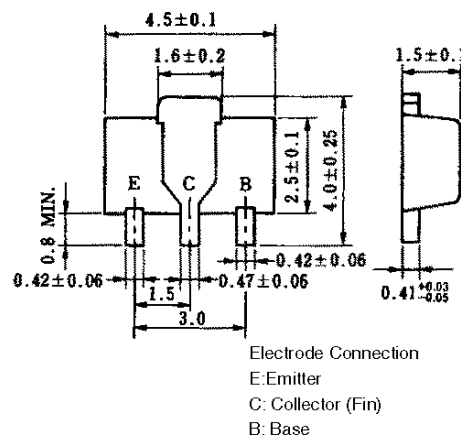
on-chip resistor NPN silicon epitaxial transistor  
For mid-speed switching

FEATURES

- High current drives such as IC outputs and actuators available
- On-chip bias resistor
- Low power consumption during drive



PACKAGE DRAWING (UNIT: mm)



HD1 SERIES LISTS

| Products | Marking | R <sub>1</sub> (KΩ) | R <sub>2</sub> (KΩ) |
|----------|---------|---------------------|---------------------|
| HD1A3M   | LP      | 1.0                 | 1.0                 |
| HD1F3P   | LQ      | 2.2                 | 10                  |
| HD1L3N   | LR      | 4.7                 | 10                  |
| HD1A4M   | LS      | 10                  | 10                  |
| HD1L2Q   | LT      | 0.47                | 4.7                 |
| HD1F2Q   | LU      | 0.22                | 2.2                 |
| HD1A4A   | LX      | —                   | 10                  |

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

| Parameter                    | Symbol                  | Ratings     | Unit |
|------------------------------|-------------------------|-------------|------|
| Collector to base voltage    | V <sub>CBO</sub>        | 80          | V    |
| Collector to emitter voltage | V <sub>CEO</sub>        | 60          | V    |
| Emitter to base voltage      | V <sub>EBO</sub>        | 10          | V    |
| Collector current (DC)       | I <sub>C(DC)</sub>      | 1.0         | A    |
| Collector current (Pulse)    | I <sub>C(pulse)</sub> * | 2.0         | A    |
| Base current (DC)            | I <sub>B(DC)</sub>      | 0.02        | A    |
| Total power dissipation      | P <sub>T</sub> **       | 2.0         | W    |
| Junction temperature         | T <sub>j</sub>          | 150         | °C   |
| Storage temperature          | T <sub>stg</sub>        | -55 to +150 | °C   |

\* PW ≤ 10 ms, duty cycle ≤ 50 %

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

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Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

**HD1A3M**

**ELECTRICAL CHARACTERISTICS (Ta = 25°C)**

| Parameter                | Symbol              | Conditions                                       | MIN. | TYP. | MAX. | Unit |
|--------------------------|---------------------|--|------|------|------|------|
| Collector cutoff current | I <sub>CBO</sub>    | V <sub>CB</sub> = 60 V, I <sub>E</sub> = 0       |      |      | 100  | nA   |
| DC current gain          | h <sub>FE1</sub> ** | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.1 A  | 80   |      |      | –    |
| DC current gain          | h <sub>FE2</sub> ** | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.5 A  | 200  |      |      | –    |
| DC current gain          | h <sub>FE3</sub> ** | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 1.0 A  | 200  |      |      | –    |
| Low level output voltage | V <sub>OL</sub> **  | V <sub>IN</sub> = 5.0 V, I <sub>C</sub> = 0.4 A  |      |      | 0.35 | V    |
| Low level input voltage  | V <sub>IL</sub> **  | 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   |

\*\* PW ≤ 350 μs, duty cycle ≤ 2 %

**HD1F3P**

**ELECTRICAL CHARACTERISTICS (Ta = 25°C)**

| Parameter                | Symbol              | Conditions                                       | MIN. | TYP. | MAX. | Unit |
|--------------------------|---------------------|--|------|------|------|------|
| Collector cutoff current | I <sub>CBO</sub>    | V <sub>CB</sub> = 60 V, I <sub>E</sub> = 0       |      |      | 100  | nA   |
| DC current gain          | h <sub>FE1</sub> ** | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.1 A  | 200  | 630  |      | –    |
| DC current gain          | h <sub>FE2</sub> ** | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.5 A  | 300  | 780  |      | –    |
| DC current gain          | h <sub>FE3</sub> ** | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 1.0 A  | 200  | 430  |      | –    |
| Low level output voltage | V <sub>OL</sub> **  | 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> **  | V <sub>CE</sub> = 5.0 V, I <sub>C</sub> = 100 μA |      | 0.5  | 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   |

\*\* PW ≤ 350 μs, duty cycle ≤ 2 %

**HD1L3N**

**ELECTRICAL CHARACTERISTICS (Ta = 25°C)**

| Parameter                | Symbol              | Conditions                                       | MIN. | TYP. | MAX. | Unit |
|--------------------------|---------------------|--|------|------|------|------|
| Collector cutoff current | I <sub>CBO</sub>    | V <sub>CB</sub> = 60 V, I <sub>E</sub> = 0       |      |      | 100  | nA   |
| DC current gain          | h <sub>FE1</sub> ** | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.1 A  | 200  |      |      | –    |
| DC current gain          | h <sub>FE2</sub> ** | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.5 A  | 300  |      |      | –    |
| DC current gain          | h <sub>FE3</sub> ** | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 1.0 A  | 200  |      |      | –    |
| Low level output voltage | V <sub>OL</sub> **  | 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> **  | 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   |

\*\* PW ≤ 350 μs, duty cycle ≤ 2 %

**HD1A4M**

**ELECTRICAL CHARACTERISTICS (Ta = 25°C)**

| Parameter                | Symbol              | Conditions                                       | MIN. | TYP. | MAX. | Unit |
|--------------------------|---------------------|--|------|------|------|------|
| Collector cutoff current | I <sub>CB0</sub>    | V <sub>CB</sub> = 60 V, I <sub>E</sub> = 0       |      |      | 100  | nA   |
| DC current gain          | h <sub>FE1</sub> ** | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.1 A  | 200  |      |      | —    |
| DC current gain          | h <sub>FE2</sub> ** | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.5 A  | 300  |      |      | —    |
| DC current gain          | h <sub>FE3</sub> ** | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 1.0 A  | 200  |      |      | —    |
| Low level output voltage | V <sub>OL</sub> **  | 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> **  | 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   |

\*\* PW ≤ 350 μs, duty cycle ≤ 2 %

**HD1L2Q**

**ELECTRICAL CHARACTERISTICS (Ta = 25°C)**

| Parameter                | Symbol              | Conditions                                       | MIN. | TYP. | MAX. | Unit |
|--------------------------|---------------------|--|------|------|------|------|
| Collector cutoff current | I <sub>CB0</sub>    | V <sub>CB</sub> = 60 V, I <sub>E</sub> = 0       |      |      | 100  | nA   |
| DC current gain          | h <sub>FE1</sub> ** | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.1 A  | 200  |      |      | —    |
| DC current gain          | h <sub>FE2</sub> ** | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.5 A  | 300  |      |      | —    |
| DC current gain          | h <sub>FE3</sub> ** | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 1.0 A  | 200  |      |      | —    |
| Low level output voltage | V <sub>OL</sub> **  | V <sub>IN</sub> = 5.0 V, I <sub>C</sub> = 0.8 A  |      |      | 0.5  | V    |
| Low level input voltage  | V <sub>IL</sub> **  | 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   |

\*\* PW ≤ 350 μs, duty cycle ≤ 2 %

**HD1F2Q**

**ELECTRICAL CHARACTERISTICS (Ta = 25°C)**

| Parameter                | Symbol              | Conditions                                       | MIN. | TYP. | MAX. | Unit |
|--------------------------|---------------------|--|------|------|------|------|
| Collector cutoff current | I <sub>CB0</sub>    | V <sub>CB</sub> = 60 V, I <sub>E</sub> = 0       |      |      | 100  | nA   |
| DC current gain          | h <sub>FE1</sub> ** | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.1 A  | 100  |      |      | —    |
| DC current gain          | h <sub>FE2</sub> ** | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.5 A  | 300  |      |      | —    |
| DC current gain          | h <sub>FE3</sub> ** | V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 1.0 A  | 200  |      |      | —    |
| Low level output voltage | V <sub>OL</sub> **  | V <sub>IN</sub> = 5.0 V, I <sub>C</sub> = 0.8 A  |      |      | 0.5  | V    |
| Low level input voltage  | V <sub>IL</sub> **  | 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   |

\*\* PW ≤ 350 μs, duty cycle ≤ 2 %

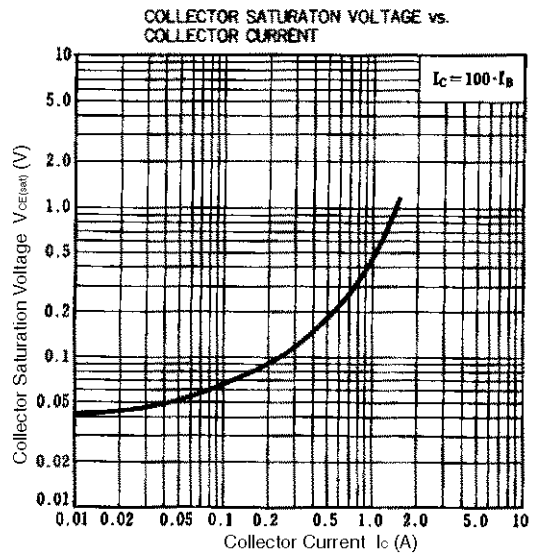
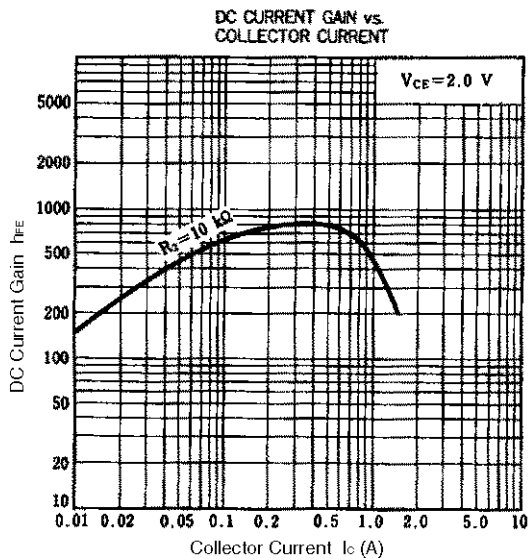
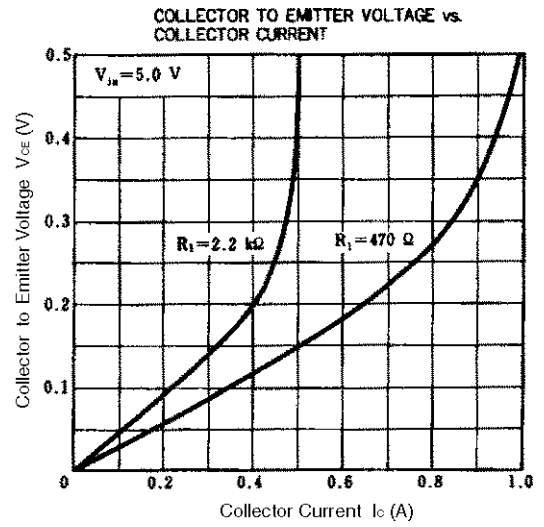
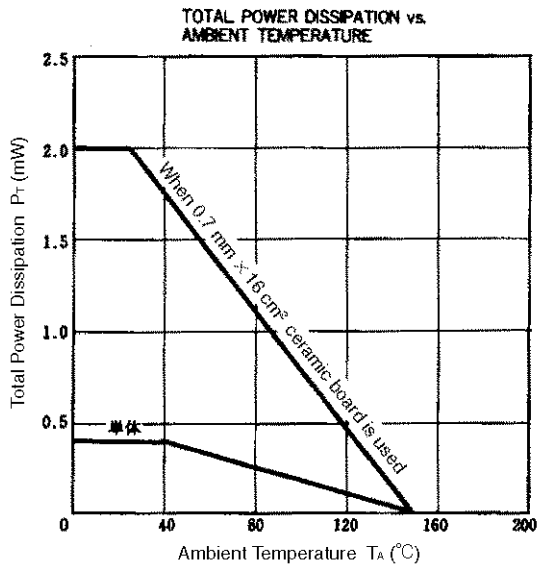
**HD1A4A**

**ELECTRICAL CHARACTERISTICS (Ta = 25°C)**

| Parameter                    | Symbol             | Conditions  | MIN. | TYP. | MAX. | Unit       |
|------------------------------|--------------------|---|------|------|------|------------|
| Collector cutoff current     | $I_{CBO}$          | $V_{CB} = 60\text{ V}, I_E = 0$                       |      |      | 100  | nA         |
| DC current gain              | $h_{FE1}^{**}$     | $V_{CE} = 2.0\text{ V}, I_C = 0.1\text{ A}$           | 200  | 630  |      | –          |
| DC current gain              | $h_{FE2}^{**}$     | $V_{CE} = 2.0\text{ V}, I_C = 0.5\text{ A}$           | 300  | 780  |      | –          |
| DC current gain              | $h_{FE3}^{**}$     | $V_{CE} = 2.0\text{ V}, I_C = 1.0\text{ A}$           | 200  | 430  |      | –          |
| Collector saturation voltage | $V_{CE(sat)}^{**}$ | $I_C = 0.7\text{ A}, I_B = 7\text{ mA}$               |      | 0.25 | 0.4  | V          |
| Low level input voltage      | $V_{IL}^{**}$      | $V_{CE} = 5.0\text{ V}, I_C = 100\text{ }\mu\text{A}$ |      | 0.5  | 0.3  | V          |
| Input resistance             | $R_1$              |   | –    | –    | –    | $\Omega$   |
| E-to-B resistance            | $R_2$              |   | 7    | 10   | 13   | k $\Omega$ |

\*\*  $PW \leq 350\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$

TYPICAL CHARACTERISTICS ( $T_a = 25^\circ\text{C}$ )



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