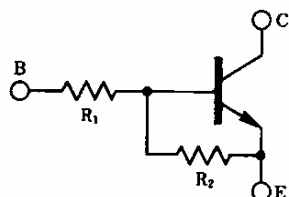


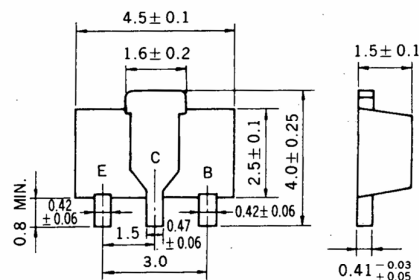
### on-chip resistor NPN silicon epitaxial transistor For mid-speed switching

#### FEATURES

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



#### PACKAGE DRAWING (UNIT: mm)



Electrode Connection  
E. Emitter  
C. Collector  
B. Base

#### 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 (T<sub>A</sub> = 25°C)

Parameter	Symbol	Ratings	Unit
Collector to base voltage	V <sub>CB0</sub>	80	V
Collector to emitter voltage	V <sub>CE0</sub>	60	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>	0.02	A
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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**HD1A3M**

**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> = 60 V, I <sub>E</sub> = 0			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	80			–
DC current gain	h <sub>FE2</sub> <sup>Note</sup>	V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 0.5 A	200			–
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> = 0.4 A			0.35	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>		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 %

**HD1F3P**

**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> = 60 V, I <sub>E</sub> = 0			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	630		–
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	780		–
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	430		–
Low level output voltage	V <sub>OL</sub> <sup>Note</sup>	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> <sup>Note</sup>	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

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

**HD1L3N**

**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> = 60 V, I <sub>E</sub> = 0			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> = 0.2 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>		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 %

**HD1A4M**

**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> = 60 V, I <sub>E</sub> = 0			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 %

**HD1L2Q**

**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> = 60 V, I <sub>E</sub> = 0			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> = 0.8 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 %

**HD1F2Q**

**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> = 60 V, I <sub>E</sub> = 0			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> = 0.8 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 %

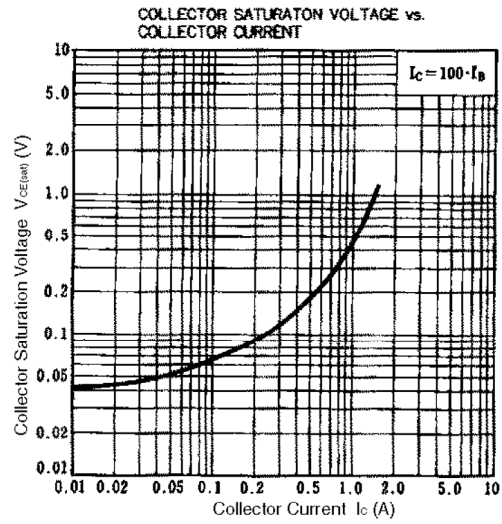
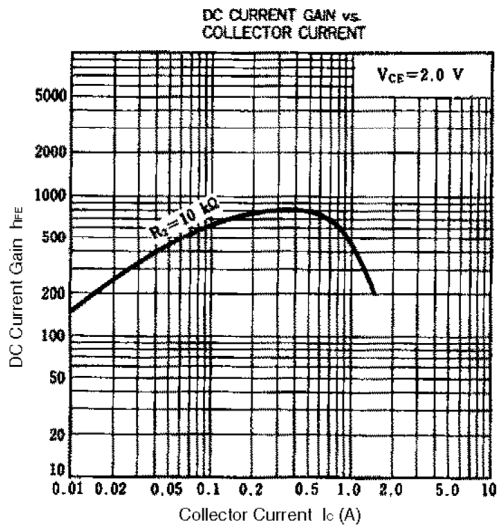
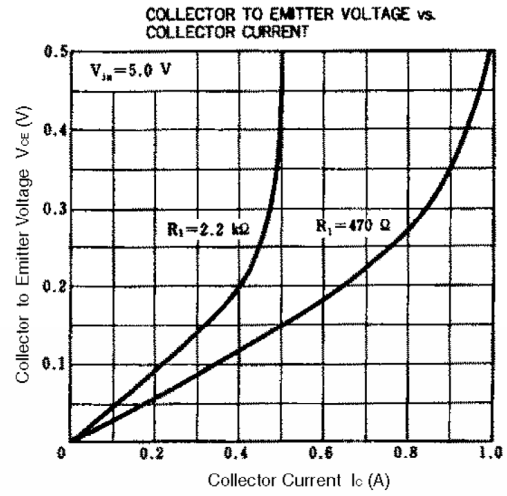
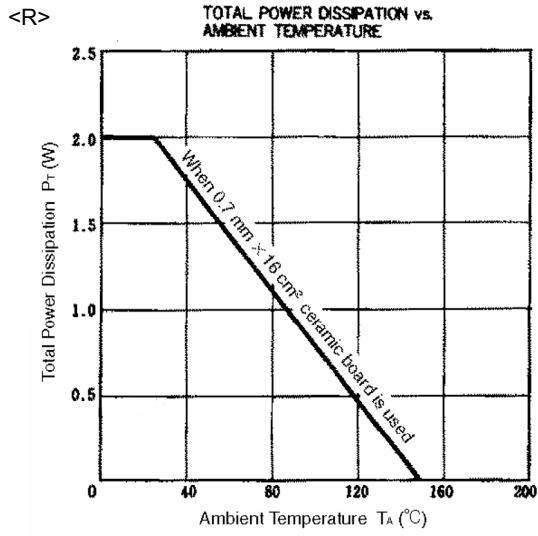
## HD1A4A

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> = 60 V, I <sub>E</sub> = 0			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	630		–
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	780		–
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	430		–
Collector saturation voltage	V <sub>CE(sat)</sub> <sup>Note</sup>	I <sub>C</sub> = 0.7 A, I <sub>B</sub> = 7 mA		0.25	0.4	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		0.5	0.3	V
E-to-B resistance	R <sub>2</sub>		7	10	13	kΩ

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

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



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