# EMD6FHA / UMD6NFHA / IMD6AFRA

**NPN + PNP Complex Digital Transistors (Bias Resistor Built-in Transistors)** Datasheet

**AEC-Q101 Qualified**

<For DTr1(NPN)>

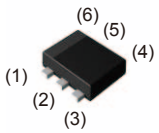
| Parameter | Value |
|---|---|
| $V_{CEO}$ | 50V |
| $I_C$ | 100mA |
| $R_1$ | 4.7kΩ |

<For DTr2(PNP)>

| Parameter | Value |
|---|---|
| $V_{CEO}$ | −50V |
| $I_C$ | −100mA |
| $R_1$ | 4.7kΩ |

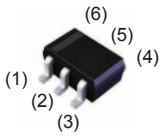
## ●Outline

EMT6



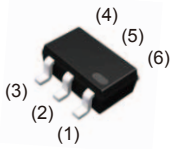

EMD6FHA
(SC-107C)

UMT6




UMD6NFHA
SOT-353 (SC-88)

SMT6

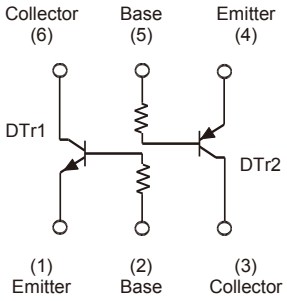



IMD6AFRA
SOT-457 (SC-74)

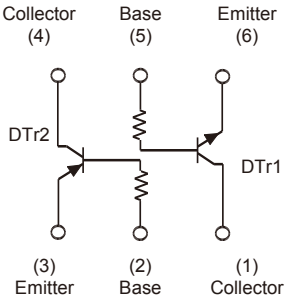
## ●Features

1) Both the DTC143T chip and DTA143T chip in one package.
2) Built-in bias resistors enable the configuration of an inverter circuit without connecting external input resistors (see inner circuit).
3) The bias resistors consist of thin-film resistors with complete isolation to allow negative biasing of the input. They also have the advantage of completely eliminating parasitic effects.
4) Only the on/off conditions need to be set for operation, making the circuit design easy.
5) Lead Free/RoHS Compliant.

## ●Inner circuit




EMD6FHA / UMD6NFHA




IMD6AFRA

## ●Application

Inverter circuit, Interface circuit, Driver circuit

## ●Packaging specifications

| Part No. | Package | Package size (mm) | Taping code | Reel size (mm) | Tape width (mm) | Basic ordering unit (pcs) | Marking |
|---|---|---|---|---|---|---|---|
| EMD6FHA | EMT6 | 1616 | T2R | 180 | 8 | 8,000 | D6 |
| UMD6NFHA | UMT6 | 2021 | TR | 180 | 8 | 3,000 | D6 |
| IMD6AFRA | SMT6 | 2928 | T108 | 180 | 8 | 3,000 | D6 |

●**Absolute maximum ratings** (Ta = 25°C)

| Parameter | | Symbol | DTr1(NPN) | DTr2(PNP) | Unit |
|---|---|---|---|---|---|
| Collector-base voltage | | $V_{CBO}$ | 50 | −50 | V |
| Collector-emitter voltage | | $V_{CEO}$ | 50 | −50 | V |
| Emitter-base voltage | | $V_{EBO}$ | 5 | −5 | V |
| Collector current | | $I_C$ | 100 | −100 | mA |
| Collector Power dissipation | EMD6FHA / UMD6NFHA | $P_C$ *2 | 150 (Total)*3 | | mW |
| | IMD6AFRA | | 300 (Total)*4 | | mW |
| Junction temperature | | $T_j$ | 150 | | °C |
| Range of storage temperature | | $T_{stg}$ | −55 to +150 | | °C |

●**Electrical characteristics**(Ta = 25°C) <For DTr1(NPN)>

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Collector-base breakdown voltage | $BV_{CBO}$ | $I_C$= 50μA | 50 | - | - | V |
| Collector-emitter breakdown voltage | $BV_{CEO}$ | $I_C$= 1mA | 50 | - | - | |
| Emitter-base breakdown voltage | $BV_{EBO}$ | $I_E$= 50μA | 5 | - | - | |
| Collector cut-off current | $I_{CBO}$ | $V_{CB}$ = 50V | - | - | 500 | nA |
| Emitter cut-off current | $I_{EBO}$ | $V_{EB}$ = 4V | - | - | 500 | nA |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C$ / $I_B$= 5mA / 0.25mA | - | - | 300 | mV |
| DC current gain | $h_{FE}$ | $V_{CE}$= 5V, $I_C$= 1mA | 100 | 300 | 600 | - |
| Input resistance | $R_1$ | - | 3.29 | 4.7 | 6.11 | - |
| Transition frequency | $f_T$ *1 | $V_{CE}$ = 10V, $I_E$ = −5mA<br>f = 100MHz | - | 250 | - | MHz |

●**Electrical characteristics**(Ta = 25°C) <For DTr2(PNP)>

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Collector-base breakdown voltage | $BV_{CBO}$ | $I_C$= −50μA | −50 | - | - | V |
| Collector-emitter breakdown voltage | $BV_{CEO}$ | $I_C$= −1mA | −50 | - | - | |
| Emitter-base breakdown voltage | $BV_{EBO}$ | $I_E$= −50μA | −5 | - | - | |
| Collector cut-off current | $I_{CBO}$ | $V_{CB}$ = −50V | - | - | −500 | nA |
| Emitter cut-off current | $I_{EBO}$ | $V_{EB}$ = −4V | - | - | −500 | nA |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C$ / $I_B$= −5mA / −0.25mA | - | - | −300 | mV |
| DC current gain | $h_{FE}$ | $V_{CE}$= −5V, $I_C$= −1mA | 100 | 300 | 600 | - |
| Input resistance | $R_1$ | - | 3.29 | 4.7 | 6.11 | - |
| Transition frequency | $f_T$ *1 | $V_{CE}$ = −10V, $I_E$ = 5mA<br>f = 100MHz | - | 250 | - | MHz |

*1 Characteristics of built-in transistor

*2 Each terminal mounted on a reference footprint

*3 120mW per element must not be exceeded.

*4 200mW per element must not be exceeded.

●**Electrical characteristic curves**(Ta = 25°C) <For DTr1(NPN)>

Fig.1 Grounded emitter propagation characteristics

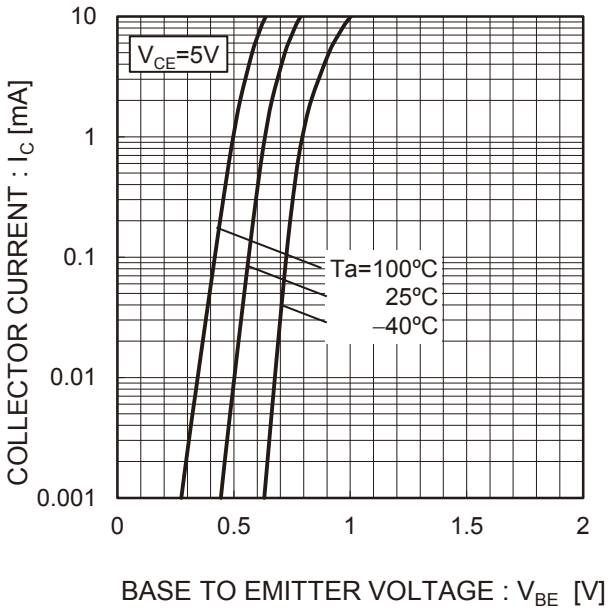



Fig.2 Grounded emitter output characteristics

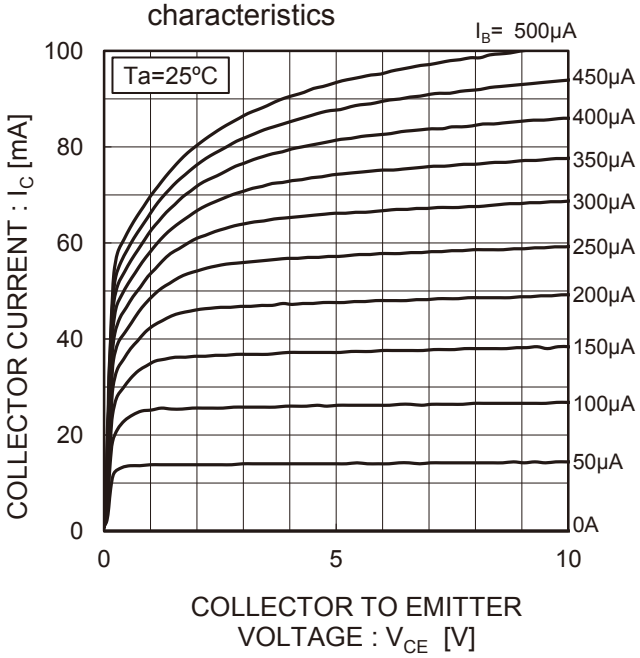



Fig.3 DC Current gain vs. Collector Current

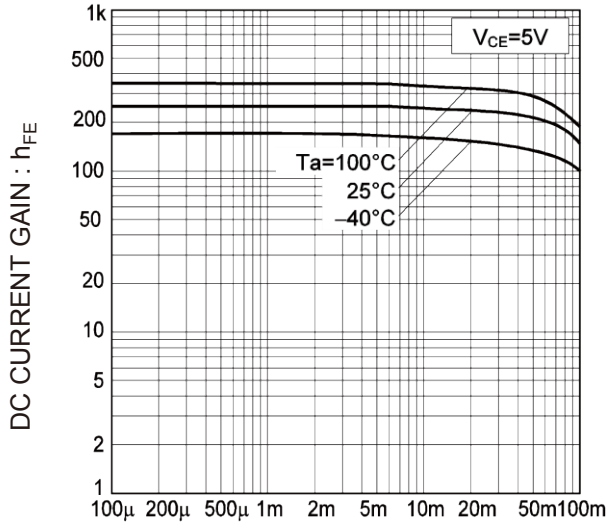
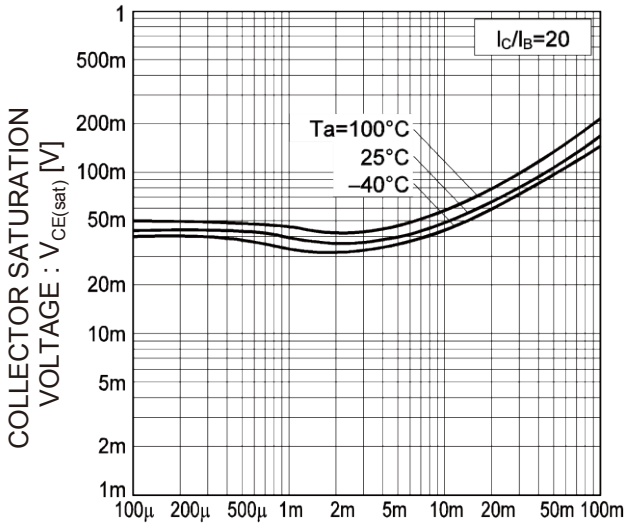



Fig.4 Collector-emitter saturation voltage vs. Collector Current



●**Electrical characteristic curves**(Ta = 25°C) <For DTr2(PNP)>

Fig.1 Grounded emitter propagation characteristics

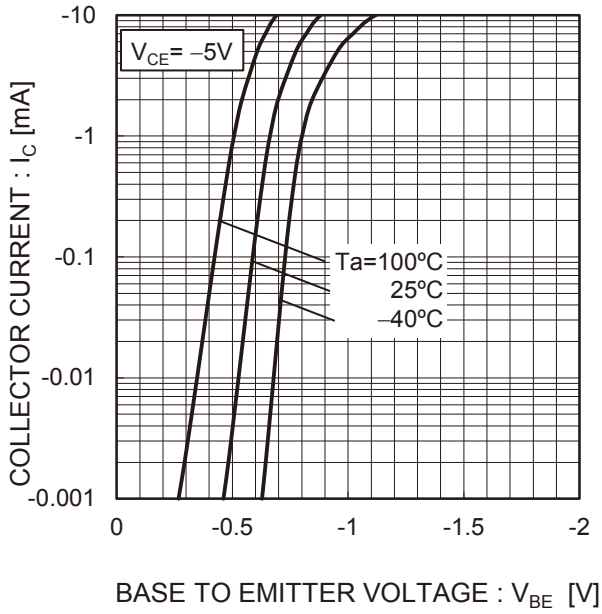



Fig.2 Grounded emitter output characteristics

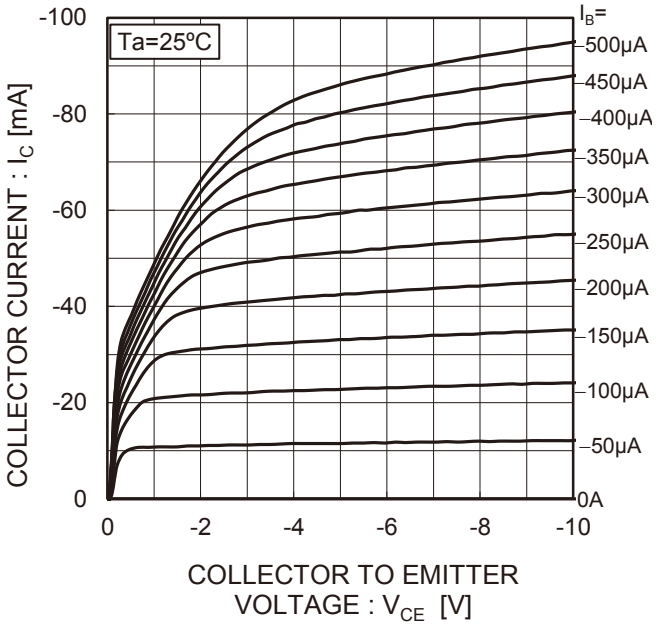



Fig.3 DC Current gain vs. Collector Current

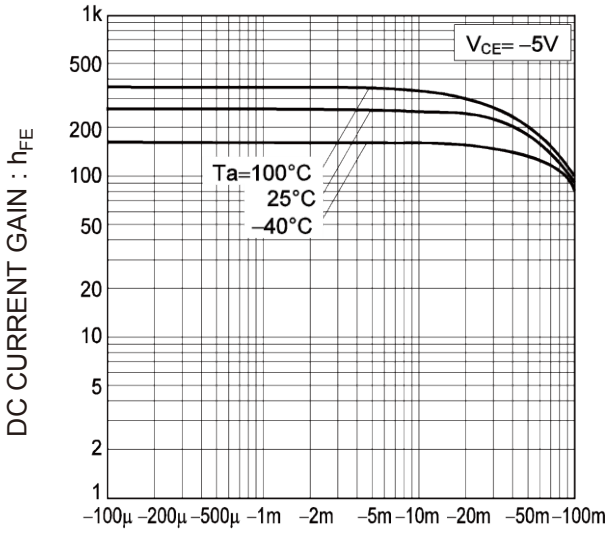
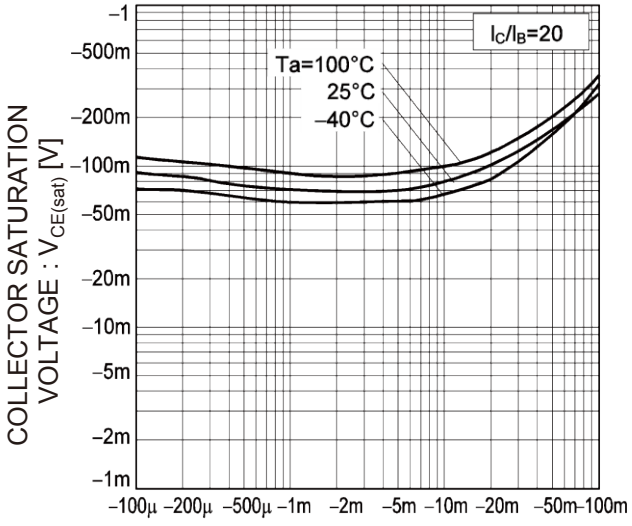
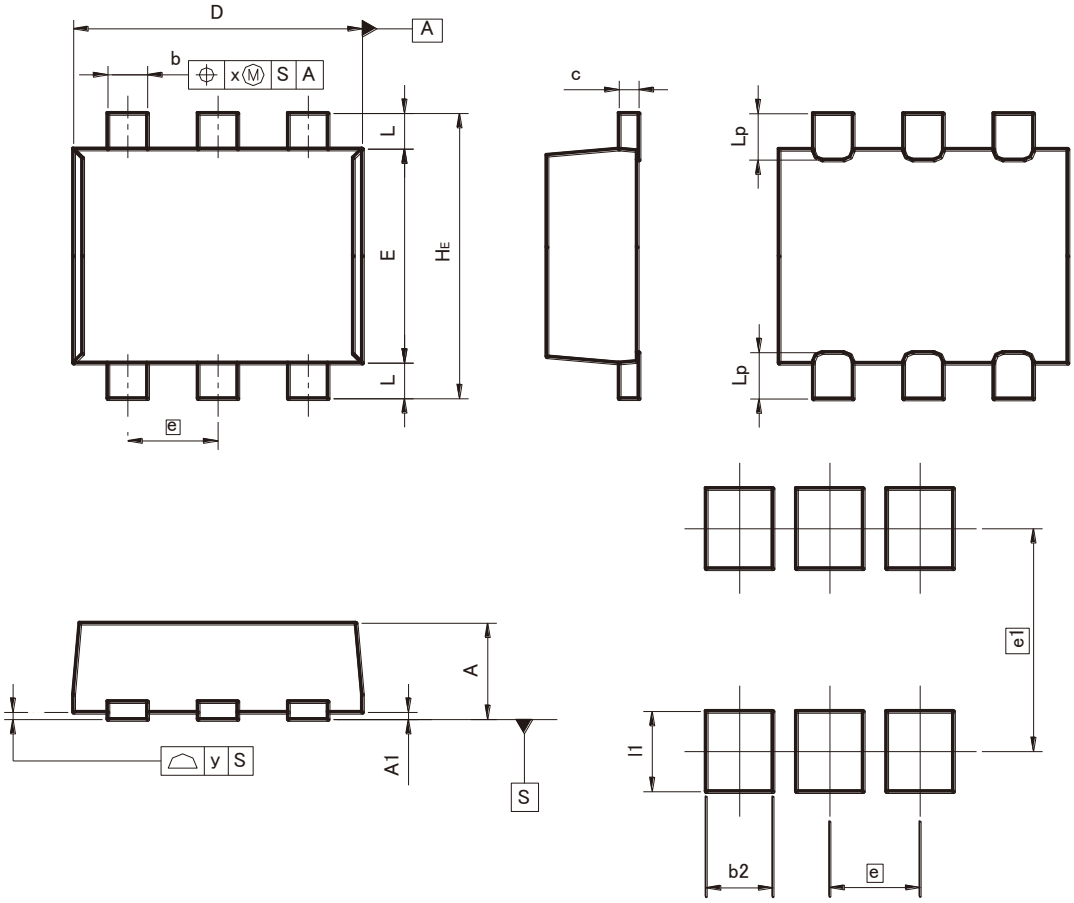



Fig.4 Collector-emitter saturation voltage vs. Collector Current



●**Dimensions** (Unit : mm)

**EMT6**




Pattern of terminal position areas
[Not a recommended pattern of soldering pads]

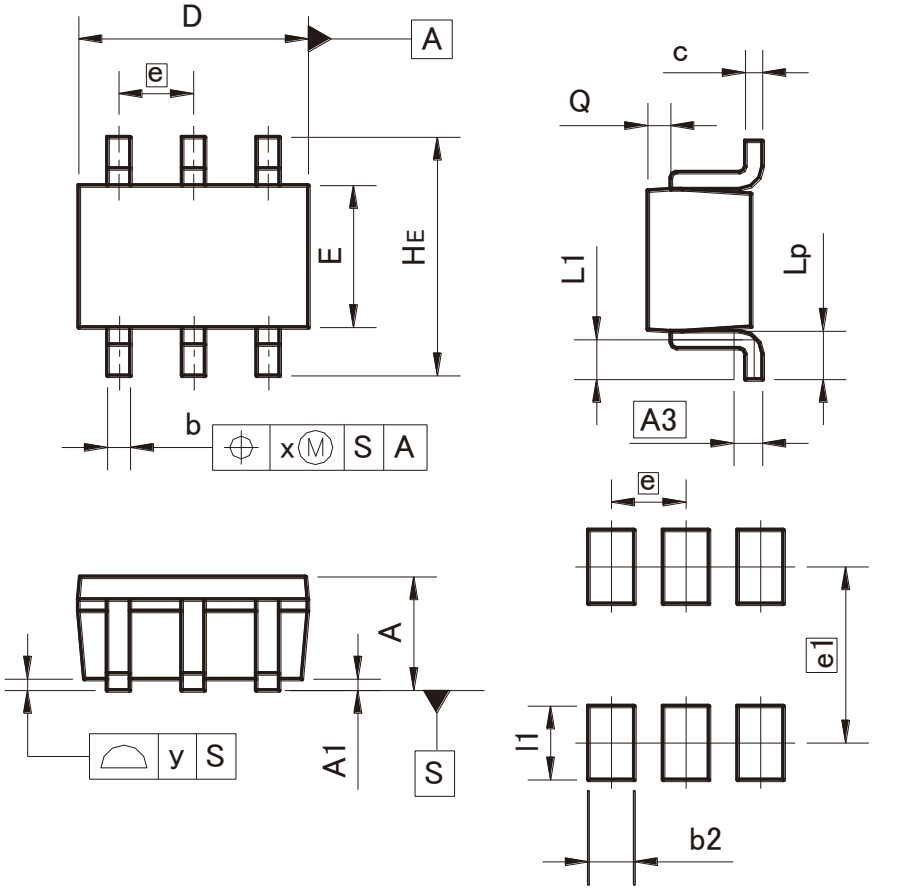
| DIM | MILIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.45 | 0.55 | 0.018 | 0.022 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| b | 0.17 | 0.27 | 0.007 | 0.011 |
| c | 0.08 | 0.18 | 0.003 | 0.007 |
| D | 1.50 | 1.70 | 0.059 | 0.067 |
| E | 1.10 | 1.30 | 0.043 | 0.051 |
| e | 0.50 | | 0.020 | |
| HE | 1.50 | 1.70 | 0.059 | 0.067 |
| L | 0.10 | 0.30 | 0.004 | 0.012 |
| Lp | − | 0.35 | − | 0.014 |
| x | − | 0.10 | − | 0.004 |
| y | − | 0.10 | − | 0.004 |

| DIM | MILIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| b2 | − | 0.37 | − | 0.015 |
| e1 | 1.25 | | 0.049 | |
| l1 | − | 0.45 | − | 0.018 |

Dimension in mm / inches

●**Dimensions** (Unit : mm)

**UMT6**




Pattern of terminal position areas
[Not a recommended pattern of soldering pads]

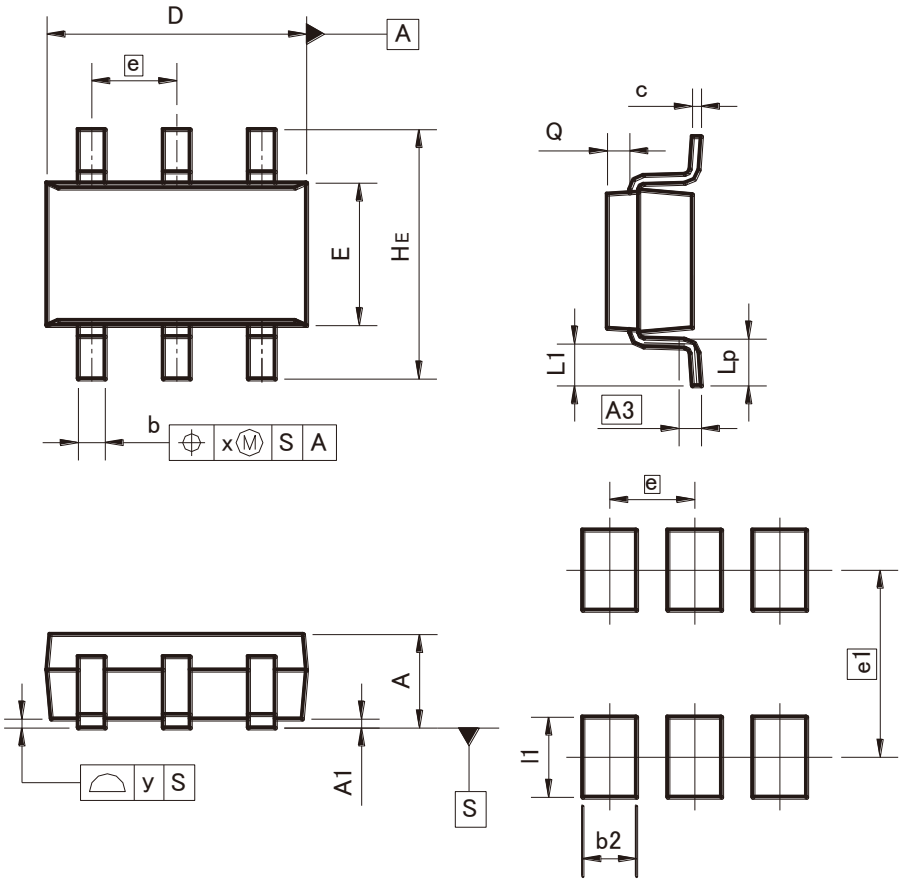
| DIM | MILIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.80 | 1.00 | 0.031 | 0.039 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| A3 | 0.25 | | 0.010 | |
| b | 0.15 | 0.30 | 0.006 | 0.012 |
| c | 0.10 | 0.20 | 0.004 | 0.008 |
| D | 1.90 | 2.10 | 0.075 | 0.083 |
| E | 1.15 | 1.35 | 0.045 | 0.053 |
| e | 0.65 | | 0.026 | |
| HE | 2.00 | 2.20 | 0.079 | 0.087 |
| L1 | 0.20 | 0.50 | 0.008 | 0.020 |
| Lp | 0.25 | 0.55 | 0.010 | 0.022 |
| Q | 0.10 | 0.30 | 0.004 | 0.012 |
| x | – | 0.10 | – | 0.004 |
| y | – | 0.10 | – | 0.004 |

| DIM | MILIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| b2 | – | 0.40 | – | 0.016 |
| e1 | 1.55 | | 0.061 | |
| l1 | – | 0.65 | – | 0.026 |

Dimension in mm / inches

●**Dimensions** (Unit : mm)

**SMT6**




Pattern of terminal position areas
[Not a recommended pattern of soldering pads]

| DIM | MILIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 1.00 | 1.30 | 0.039 | 0.051 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| A3 | 0.25 | | 0.010 | |
| b | 0.25 | 0.40 | 0.010 | 0.016 |
| c | 0.09 | 0.25 | 0.004 | 0.010 |
| D | 2.80 | 3.00 | 0.110 | 0.118 |
| E | 1.50 | 1.80 | 0.059 | 0.071 |
| e | 0.95 | | 0.037 | |
| HE | 2.60 | 3.00 | 0.102 | 0.118 |
| L1 | 0.30 | 0.60 | 0.012 | 0.024 |
| Lp | 0.40 | 0.70 | 0.016 | 0.028 |
| Q | 0.20 | 0.30 | 0.008 | 0.012 |
| x | − | 0.20 | − | 0.008 |
| y | − | 0.10 | − | 0.004 |

| DIM | MILIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| b2 | | 0.60 | − | 0.024 |
| e1 | 2.10 | | 0.083 | |
| l1 | − | 0.90 | − | 0.035 |

Dimension in mm / inches

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