

| Parameter | Value |
|-----------|--------|
| V_{CEO} | -50V |
| I_C | -150mA |







●Features

- 1)Excellent h_{FE} linearity.
- 2)Complements the 2SC5658/2SC4617EB/
2SC4617/2SC4081UB/2SC4081/2SC2412K

●Application

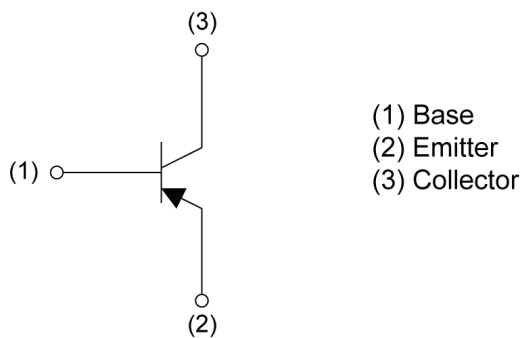
GENERAL PURPOSE SMALL SIGNAL
AMPLIFIER

●Outline

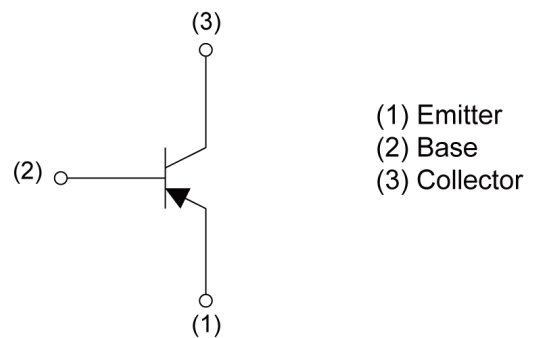
| | |
|---|---|
| <p>VMT3</p>  <p>2SA2029 SC-105AA</p> | <p>EMT3F</p>  <p>2SA1774EB SOT-416FL</p> |
| <p>EMT3</p>  <p>2SA1774 SOT-416</p> | <p>UMT3F</p>  <p>2SA1576UB SOT-323FL</p> |
| <p>UMT3</p>  <p>2SA1576A SOT-323</p> | <p>SMT3</p>  <p>2SA1037AK SOT-346</p> |

●Inner circuit

2SA2029/2SA1774EB/2SA1576UB



2SA1774/2SA1576A/2SA1037AK



●Packaging specifications

| Part No. | Package | Package size | Taping code | Reel size (mm) | Tape width (mm) | Basic ordering unit.(pcs) | h_{FE} rank | Marking |
|-----------|---------|--------------|-------------|----------------|-----------------|---------------------------|---------------|---------|
| 2SA2029 | VMT3 | 1212 | T2L | 180 | 8 | 8000 | QRS | F |
| 2SA1774EB | EMT3F | 1616 | TL | 180 | 8 | 3000 | QRS | F |
| 2SA1774 | EMT3 | 1616 | TL | 180 | 8 | 3000 | QRS | F |
| 2SA1576UB | UMT3F | 2021 | TL | 180 | 8 | 3000 | QRS | F |
| 2SA1576A | UMT3 | 2021 | T106 | 180 | 8 | 3000 | QRS | F |
| 2SA1037AK | SMT3 | 2928 | T146 | 180 | 8 | 3000 | QRS | F |

● Absolute maximum ratings ($T_a = 25^\circ\text{C}$)

| Parameter | | Symbol | Values | Unit |
|------------------------------|-----------|---------------|-------------|------------------|
| Collector-base voltage | | V_{CBO} | -60 | V |
| Collector-emitter voltage | | V_{CEO} | -50 | V |
| Emitter-base voltage | | V_{EBO} | -6 | V |
| Collector current | | I_C | -150 | mA |
| | | I_{CP}^{*1} | -200 | mA |
| Power dissipation | 2SA2029 | P_D^{*2} | 150 | mW |
| | 2SA1774EB | | 150 | |
| | 2SA1774 | | 150 | |
| | 2SA1576UB | | 200 | |
| | 2SA1576A | | 200 | |
| | 2SA1037AK | | 200 | |
| Junction temperature | | T_j | 150 | $^\circ\text{C}$ |
| Range of storage temperature | | T_{stg} | -55 to +150 | $^\circ\text{C}$ |

● Electrical characteristics ($T_a = 25^\circ\text{C}$)

| Parameter | Symbol | Conditions | Values | | | Unit |
|--------------------------------------|---------------|---|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Collector-base breakdown voltage | BV_{CBO} | $I_C = -50\mu\text{A}$ | -60 | - | - | V |
| Collector-emitter breakdown voltage | BV_{CEO} | $I_C = -1\text{mA}$ | -50 | - | - | V |
| Emitter-base breakdown voltage | BV_{EBO} | $I_E = -50\mu\text{A}$ | -6 | - | - | V |
| Collector cut-off current | I_{CBO} | $V_{CB} = -60\text{V}$ | - | - | -100 | nA |
| Emitter cut-off current | I_{EBO} | $V_{EB} = -6\text{V}$ | - | - | -100 | nA |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C = -50\text{mA}, I_B = -5\text{mA}$ | - | - | -500 | mV |
| DC current gain | h_{FE} | $V_{CE} = -6\text{V}, I_C = -1\text{mA}$ | 120 | - | 560 | - |
| Transition frequency | f_T | $V_{CE} = -12\text{V}, I_E = 2\text{mA}, f = 100\text{MHz}$ | - | 140 | - | MHz |
| Output capacitance | C_{ob} | $V_{CB} = -12\text{V}, I_E = 0\text{A}, f = 1\text{MHz}$ | - | 4.0 | 5.0 | pF |

h_{FE} values are classified as follows :

| rank | Q | R | S | - | - |
|----------|---------|---------|---------|---|---|
| h_{FE} | 120-270 | 180-390 | 270-560 | - | - |

*1 $P_w=1\text{ms}$, Single Pulse.

*2 Each terminal mounted on a reference land.

● Electrical characteristic curves ($T_a = 25^\circ\text{C}$)

Fig.1 Ground Emitter Propagation Characteristics

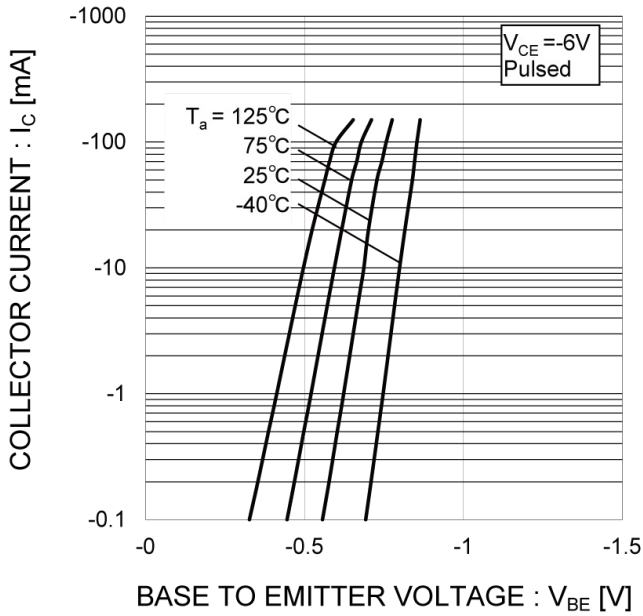


Fig.2 Typical Output Characteristics

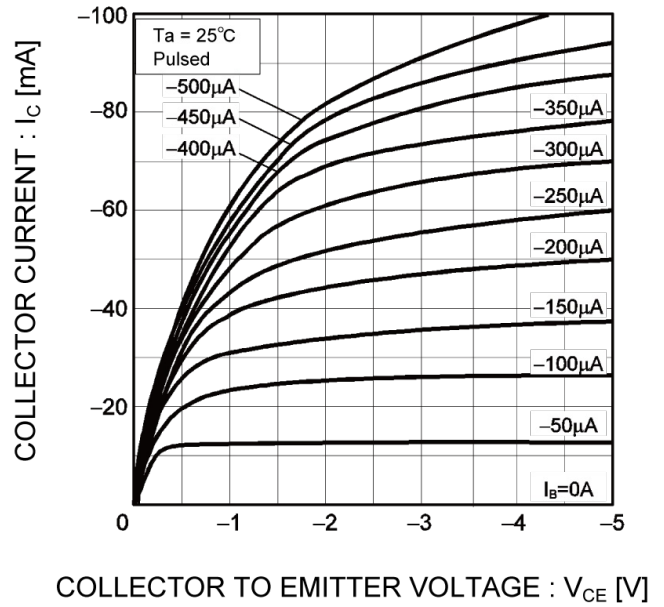


Fig.3 DC Current Gain vs. Collector Current (I)

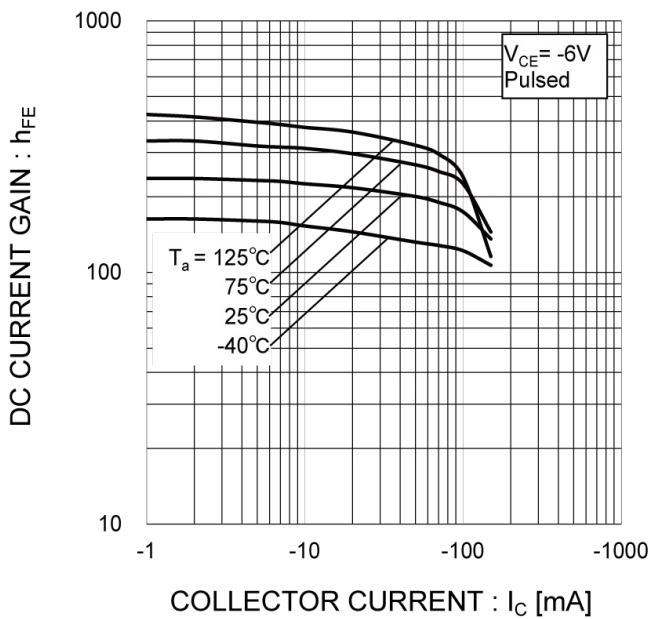
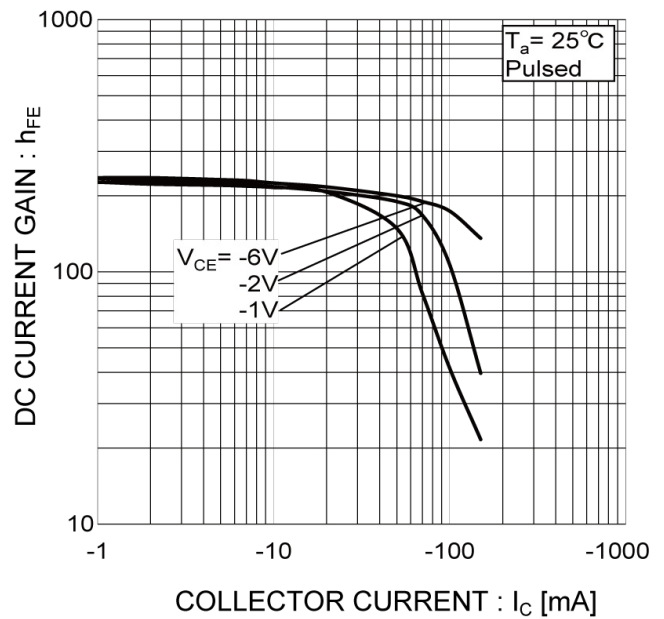


Fig.4 DC Current Gain vs. Collector Current (II)



● Electrical characteristic curves ($T_a = 25^\circ\text{C}$)

Fig.5 Collector-Emitter Saturation Voltage vs. Collector Current (I)

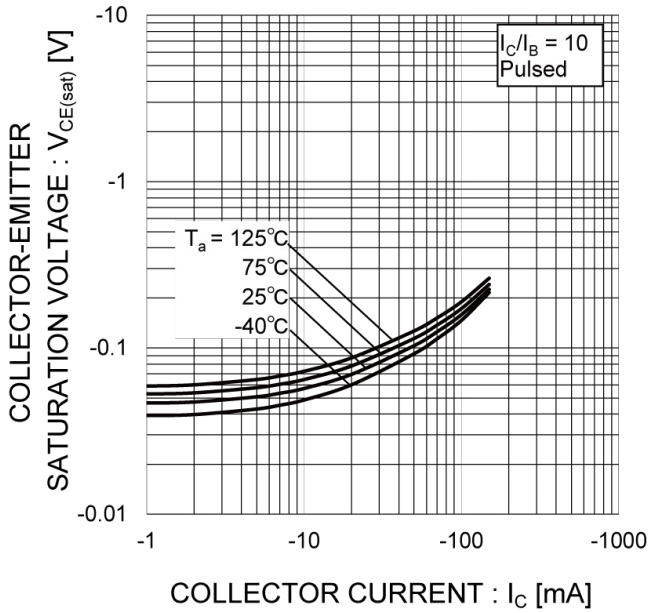


Fig.6 Collector-Emitter Saturation Voltage vs. Collector Current (II)

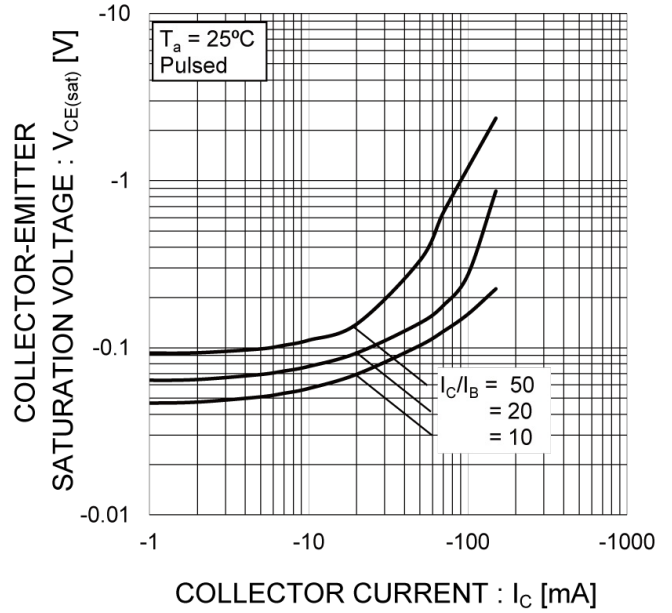


Fig.7 Base-Emitter Saturation Voltage vs. Collector Current

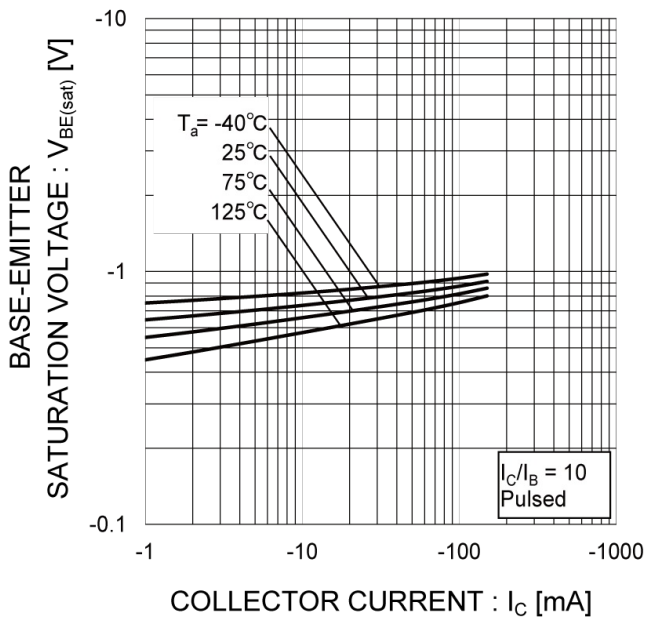
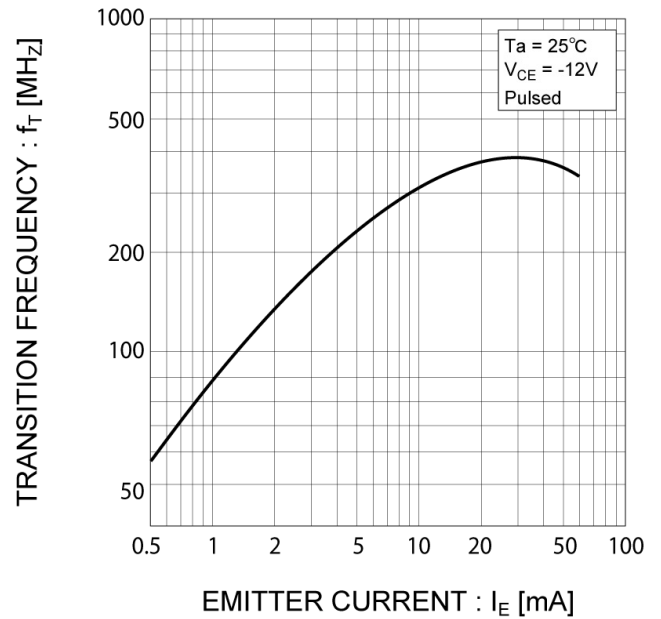


Fig.8 Gain Bandwidth Product vs. Emitter Current



● Electrical characteristic curves ($T_a = 25^\circ\text{C}$)

Fig.9 Emitter Input Capacitance vs. Emitter-Base Voltage
Collector Output Capacitance vs. Collector-Base Voltage

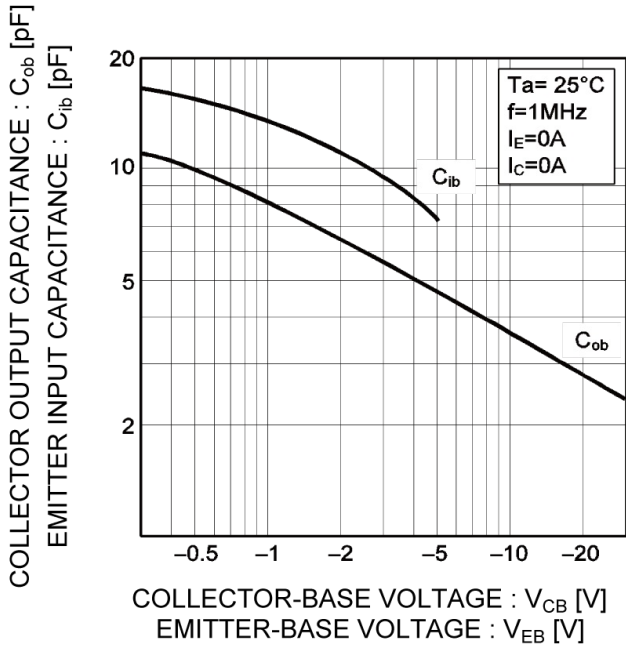


Fig.10 Safe Operating Area

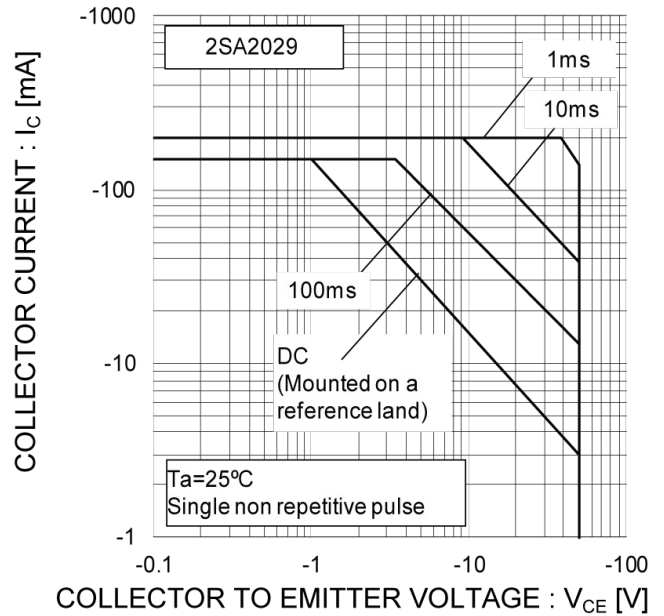


Fig.11 Safe Operating Area

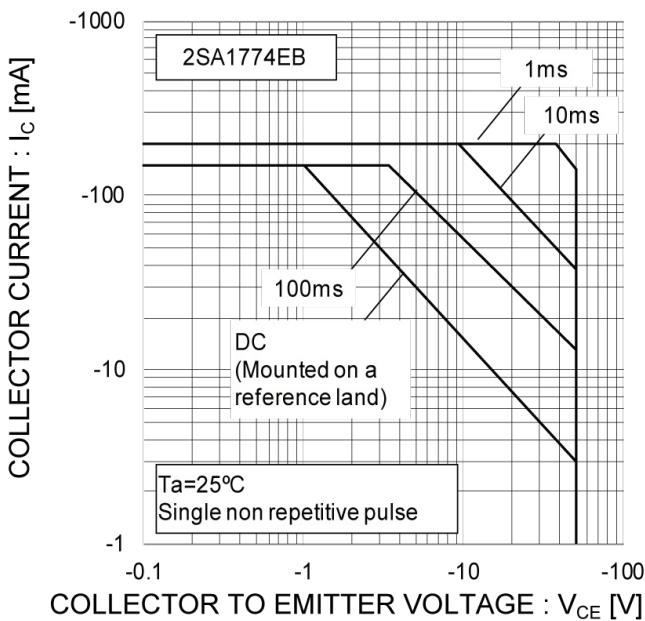
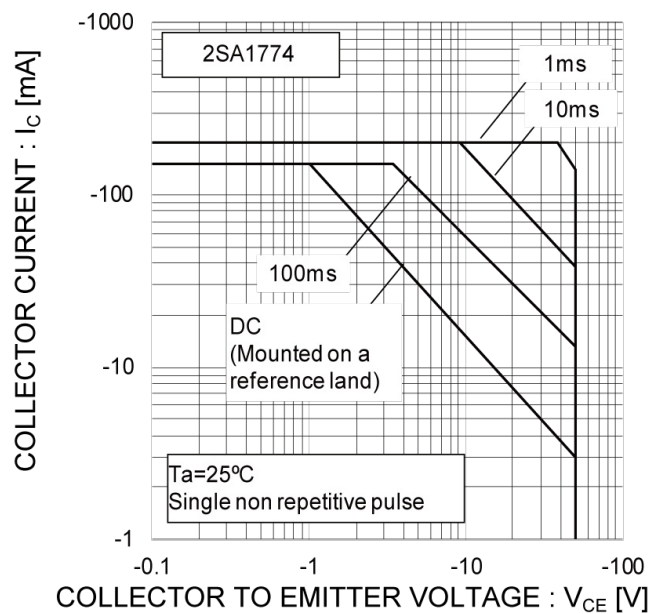


Fig.12 Safe Operating Area



●Electrical characteristic curves(Ta=25°C)

Fig.13 Safe Operating Area

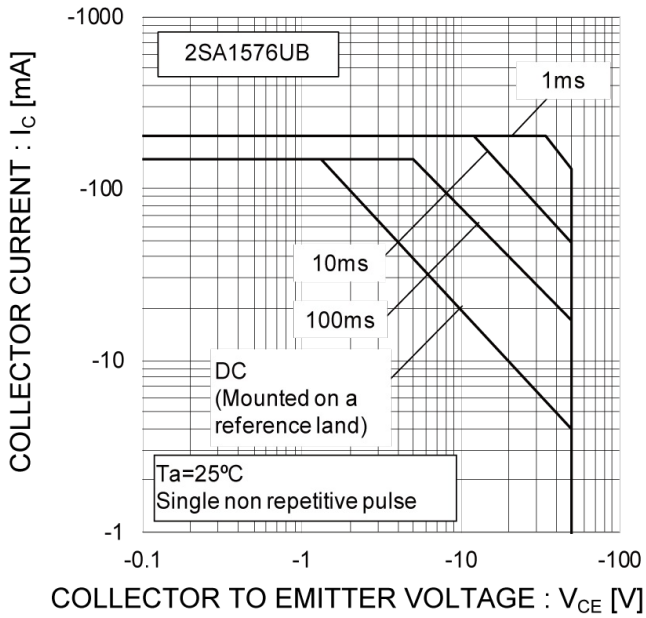


Fig.14 Safe Operating Area

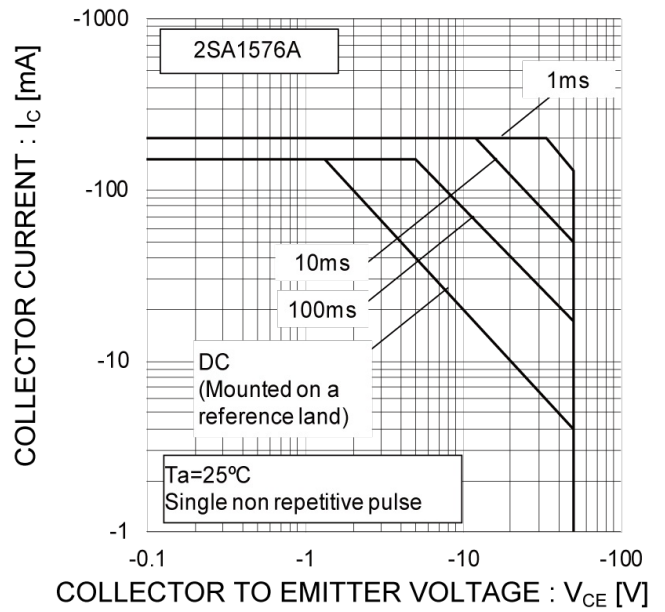
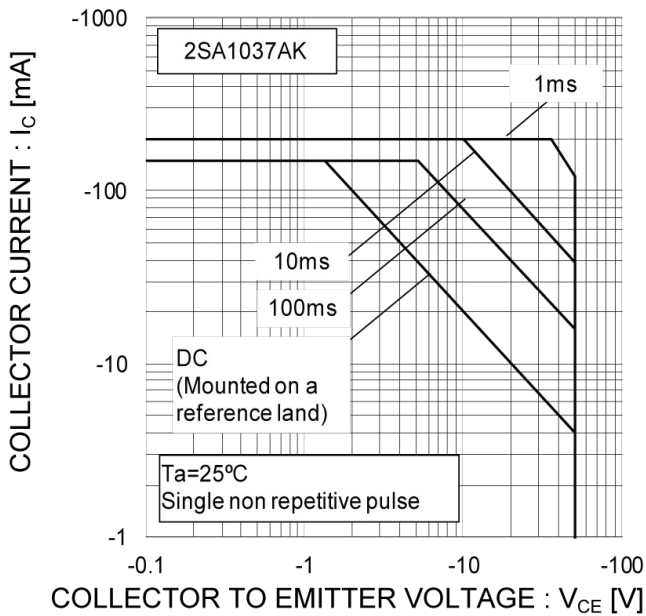
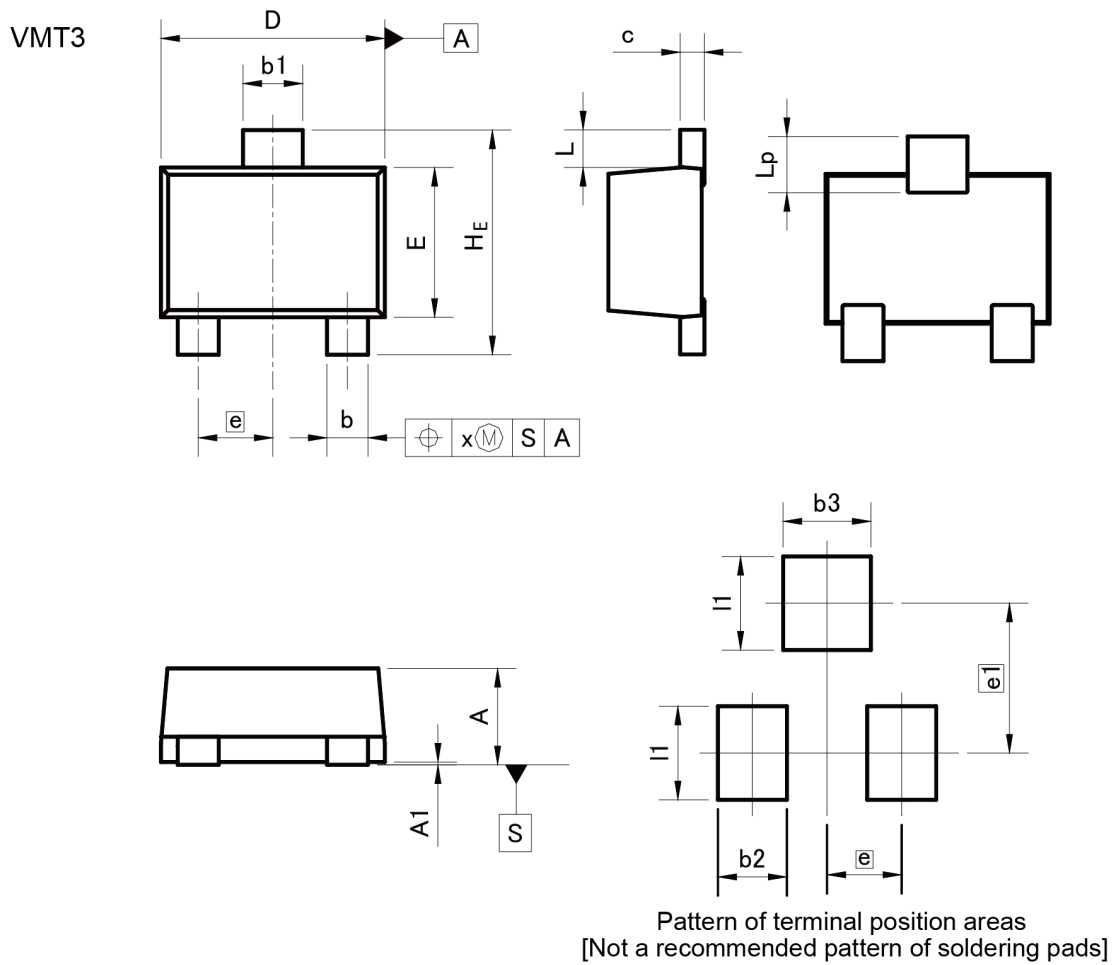


Fig.15 Safe Operating Area



●Dimensions



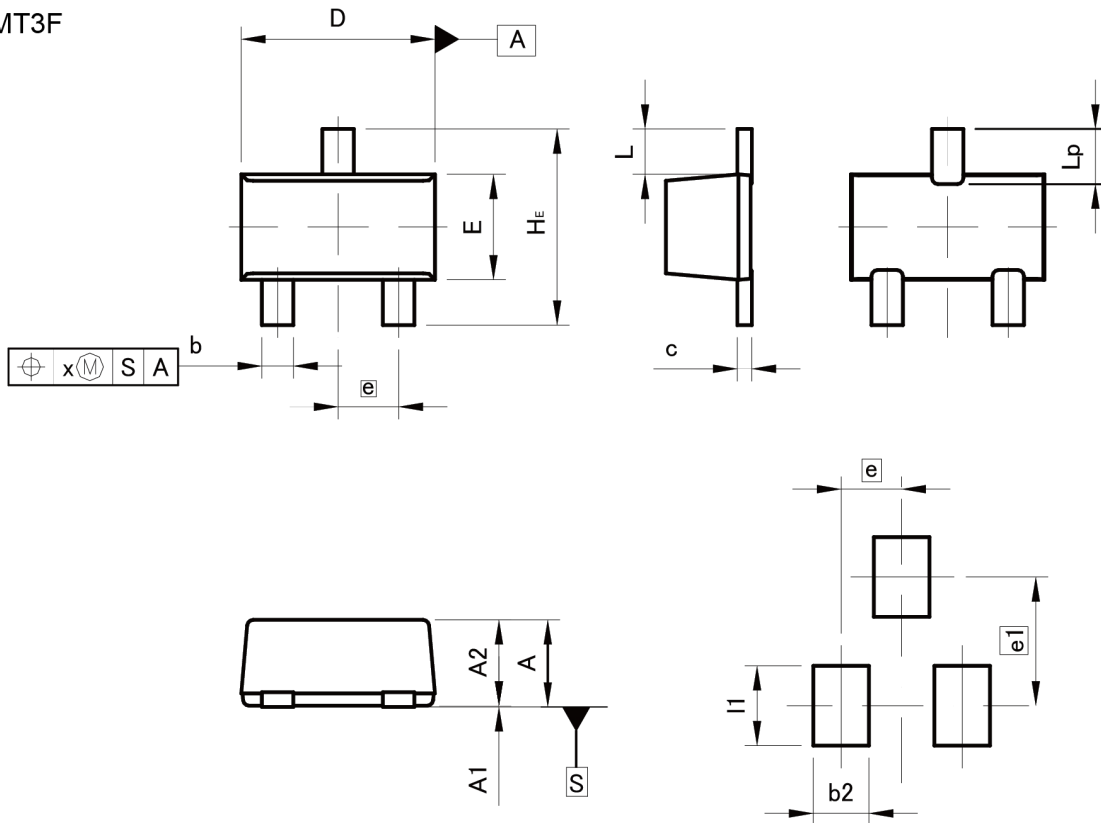
| DIM | MILIMETERS | | INCHES | |
|-----|------------|------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.45 | 0.55 | 0.018 | 0.022 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| b | 0.17 | 0.27 | 0.007 | 0.011 |
| b1 | 0.27 | 0.37 | 0.011 | 0.015 |
| c | 0.08 | 0.18 | 0.003 | 0.007 |
| D | 1.10 | 1.30 | 0.043 | 0.051 |
| E | 0.70 | 0.90 | 0.028 | 0.035 |
| e | 0.40 | | 0.02 | |
| HE | 1.10 | 1.30 | 0.043 | 0.051 |
| L | 0.10 | 0.30 | 0.004 | 0.012 |
| Lp | 0.20 | 0.40 | 0.008 | 0.016 |
| x | - | 0.10 | - | 0.004 |

| DIM | MILIMETERS | | INCHES | |
|-----|------------|------|--------|-------|
| | MIN | MAX | MIN | MAX |
| b2 | - | 0.37 | - | 0.015 |
| b3 | - | 0.47 | - | 0.019 |
| e1 | 0.80 | | 0.031 | |
| I1 | - | 0.50 | - | 0.020 |

Dimension in mm/inches

●Dimensions

EMT3F



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

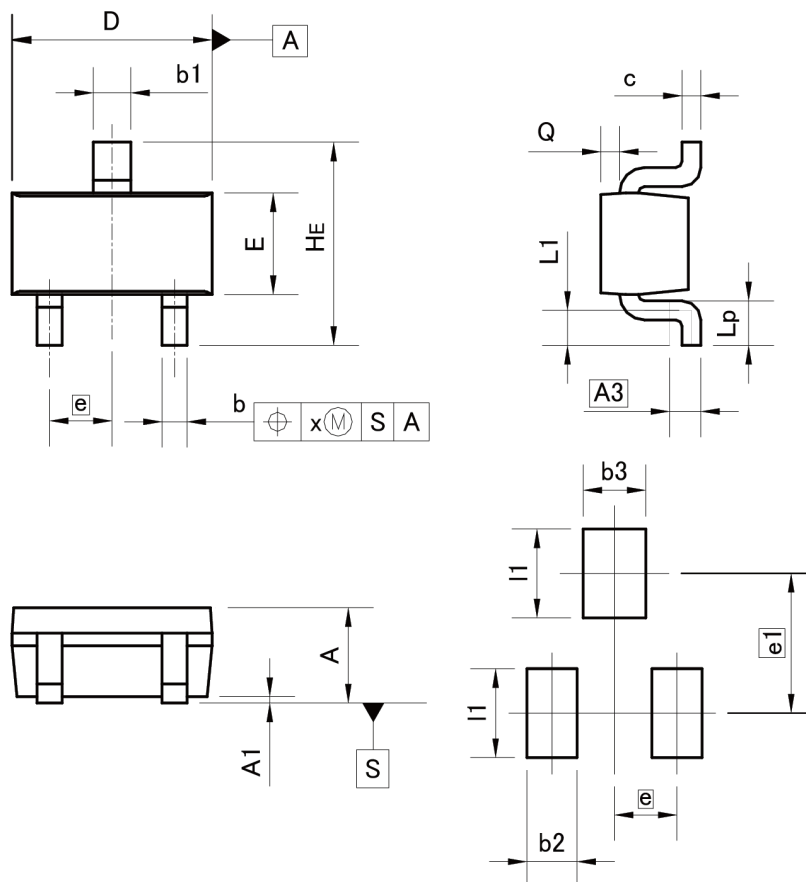
| DIM | MILIMETERS | | INCHES | |
|-----|------------|------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.65 | 0.85 | 0.026 | 0.033 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| A2 | 0.60 | 0.80 | 0.024 | 0.031 |
| b | 0.21 | 0.36 | 0.008 | 0.014 |
| c | 0.08 | 0.18 | 0.003 | 0.007 |
| D | 1.50 | 1.70 | 0.059 | 0.067 |
| E | 0.76 | 0.96 | 0.030 | 0.038 |
| e | 0.50 | | 0.020 | |
| HE | 1.50 | 1.70 | 0.059 | 0.067 |
| L | 0.37 | | 0.015 | |
| Lp | 0.35 | 0.55 | 0.014 | 0.022 |
| x | - | 0.10 | - | 0.004 |

| DIM | MILIMETERS | | INCHES | |
|-----|------------|------|--------|-------|
| | MIN | MAX | MIN | MAX |
| b2 | - | 0.46 | - | 0.018 |
| e1 | - | 1.05 | - | 0.041 |
| l1 | - | 0.65 | - | 0.026 |

Dimension in mm/inches

●Dimensions

EMT3



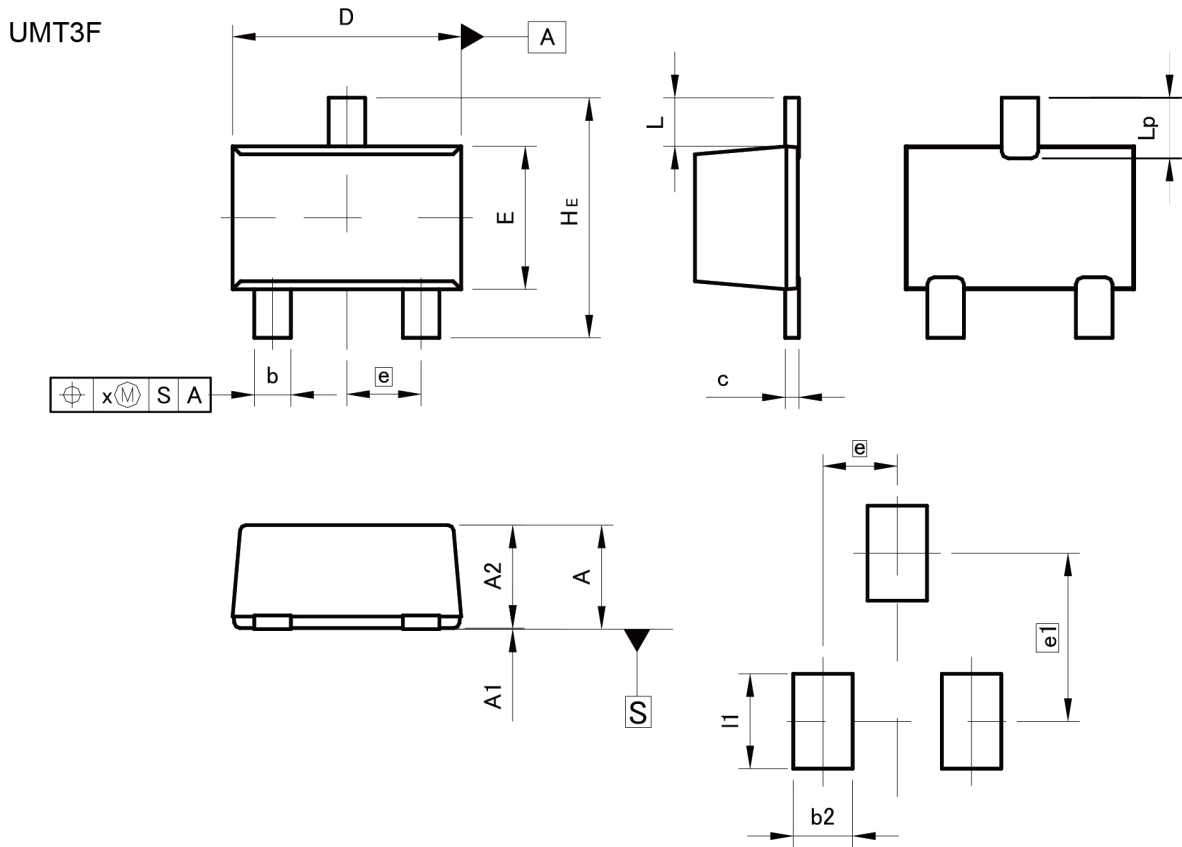
Pattern of terminal position areas
[Not a recommended pattern of soldering pads]

| DIM | MILIMETERS | | INCHES | |
|-----|------------|------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.60 | 0.80 | 0.024 | 0.031 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| A3 | 0.25 | | 0.010 | |
| b | 0.15 | 0.30 | 0.006 | 0.012 |
| b1 | 0.25 | 0.40 | 0.010 | 0.016 |
| c | 0.10 | 0.20 | 0.004 | 0.008 |
| D | 1.50 | 1.70 | 0.059 | 0.067 |
| E | 0.70 | 0.90 | 0.028 | 0.035 |
| e | 0.50 | | 0.020 | |
| HE | 1.40 | 1.80 | 0.055 | 0.071 |
| L1 | 0.10 | - | 0.004 | - |
| Lp | 0.15 | - | 0.006 | - |
| Q | 0.05 | 0.25 | 0.002 | 0.010 |
| x | - | 0.10 | - | 0.004 |

| DIM | MILIMETERS | | INCHES | |
|-----|------------|------|--------|-------|
| | MIN | MAX | MIN | MAX |
| b2 | - | 0.40 | - | 0.016 |
| b3 | - | 0.50 | - | 0.020 |
| e1 | 1.10 | | 0.043 | |
| l1 | - | 0.70 | - | 0.028 |

Dimension in mm/inches

●Dimensions



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

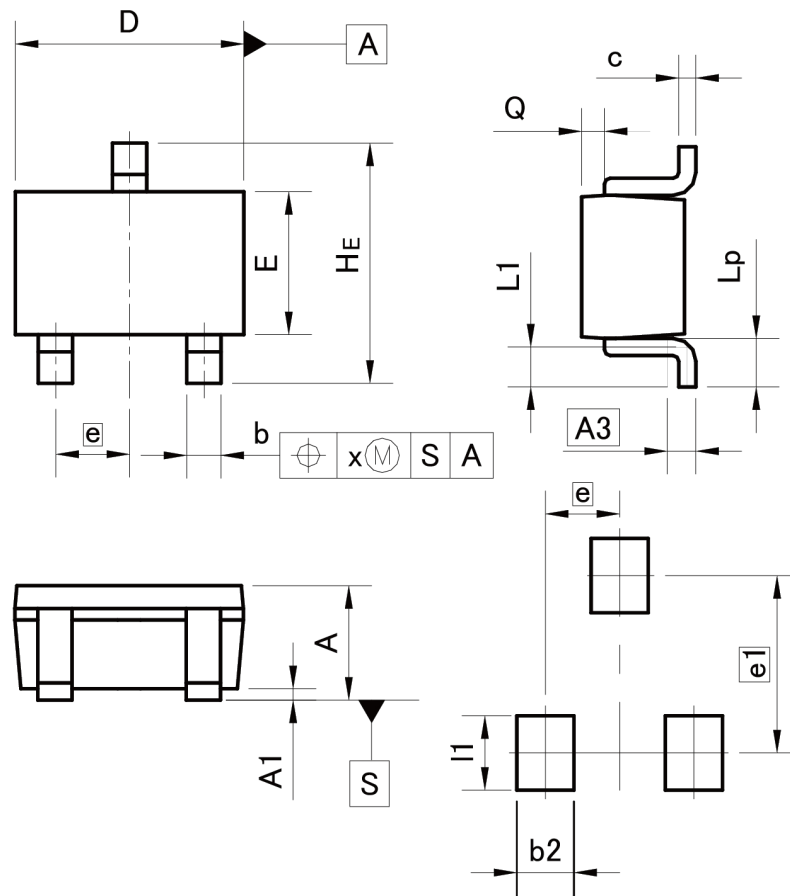
| DIM | MILIMETERS | | INCHES | |
|-----|------------|------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.85 | 1.05 | 0.033 | 0.041 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| A2 | 0.80 | 1.00 | 0.031 | 0.039 |
| b | 0.27 | 0.42 | 0.011 | 0.017 |
| c | 0.08 | 0.18 | 0.003 | 0.007 |
| D | 1.90 | 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 |
| L | 0.43 | | 0.017 | |
| Lp | 0.43 | 0.63 | 0.017 | 0.025 |
| x | - | 0.10 | - | 0.004 |

| DIM | MILIMETERS | | INCHES | |
|-----|------------|------|--------|-------|
| | MIN | MAX | MIN | MAX |
| b2 | - | 0.52 | - | 0.020 |
| e1 | 1.47 | | 0.058 | |
| l1 | - | 0.83 | - | 0.033 |

Dimension in mm/inches

●Dimensions

UMT3



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

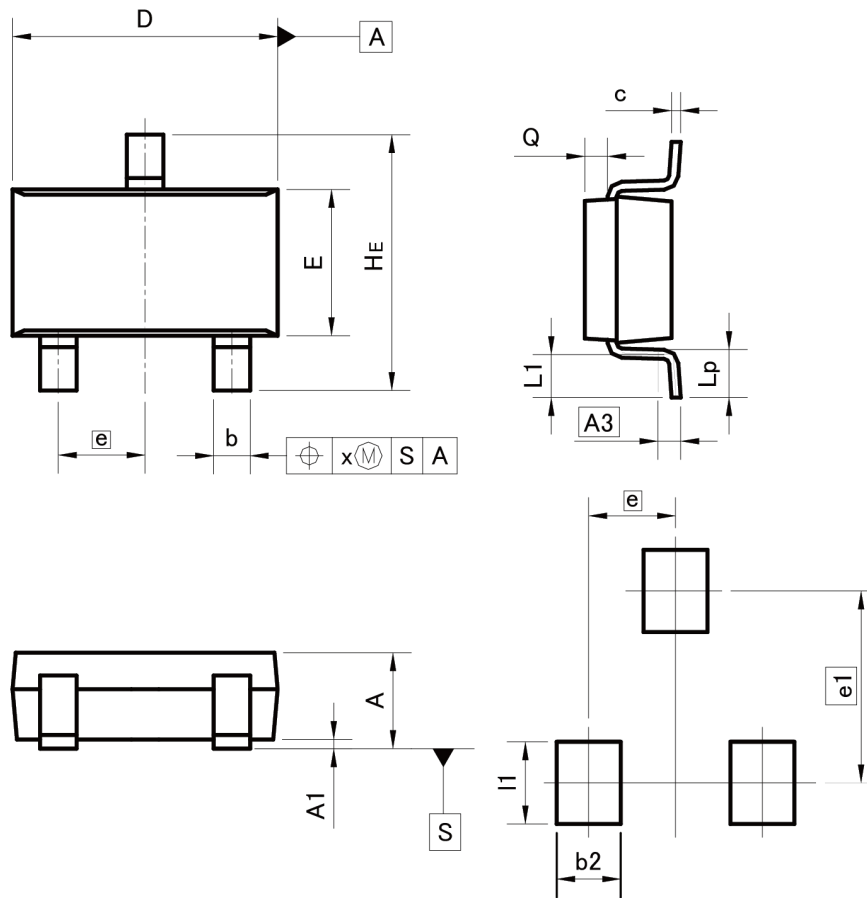
| DIM | MILIMETERS | | INCHES | |
|-----|------------|------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.80 | 1.00 | 0.031 | 0.039 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| A3 | 0.25 | | 0.010 | |
| b | 0.15 | 0.30 | 0.006 | 0.012 |
| c | 0.10 | 0.20 | 0.004 | 0.008 |
| D | 1.90 | 2.10 | 0.075 | 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 |

| DIM | MILIMETERS | | INCHES | |
|-----|------------|------|--------|-------|
| | MIN | MAX | MIN | MAX |
| b2 | - | 0.50 | - | 0.020 |
| e1 | 1.55 | | 0.061 | |
| l1 | - | 0.65 | - | 0.026 |

Dimension in mm/inches

●Dimensions

SMT3



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 | 0.35 | 0.50 | 0.014 | 0.020 |
| 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 | - | 0.10 | - | 0.004 |
| 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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