

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

### ●Features

1)Low Cob.Cob=2.0pF(Typ.)

2)Complements the 2SA2029/  
2SA1774EB/2SA1774/2SA1576UB/  
2SA1576A/2SA1037AK.

### ●Application

GENERAL PURPOSE SMALL SIGNAL  
AMPLIFIER

### ●Outline

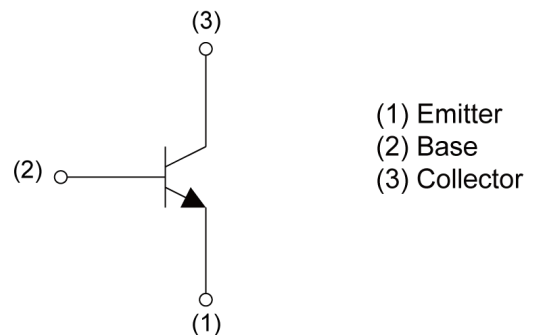
|                                   |                                       |
|-----------------------------------|---------------------------------------|
| <br>SC-105AA<br>2SC5658<br>(VMT3) | <br>SOT-416FL<br>2SC4617EB<br>(EMT3F) |
| <br>SOT-416<br>2SC4617<br>(EMT3)  | <br>SOT-323FL<br>2SC4081UB<br>(UMT3F) |
| <br>SOT-323<br>2SC4081<br>(UMT3)  | <br>SOT-346<br>2SC2412K<br>(SMT3)     |

### ●Inner circuit

2SC5658/2SC4617EB/2SC4081UB



2SC4617/2SC4081/2SC2412K



### ●Packaging specifications

| Part No.  | Package   | Package size | Taping code | Reel size (mm) | Tape width (mm) | Basic ordering unit.(pcs) | hFE rank | Marking |
|-----------|-----------|--------------|-------------|----------------|-----------------|---------------------------|----------|---------|
| 2SC5658   | SC-105AA  | 1212         | T2L         | 180            | 8               | 8000                      | QRS      | B       |
| 2SC4617EB | SOT-416FL | 1616         | TL          | 180            | 8               | 3000                      | QRS      | B       |
| 2SC4617   | SOT-416   | 1616         | TL          | 180            | 8               | 3000                      | QRS      | B       |
| 2SC4081UB | SOT-323FL | 2021         | TL          | 180            | 8               | 3000                      | QRS      | B       |
| 2SC4081   | SOT-323   | 2021         | T106        | 180            | 8               | 3000                      | QRS      | B       |
| 2SC2412K  | SOT-346   | 2928         | T146        | 180            | 8               | 3000                      | QRS      | B       |

● **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         |           | $V_{EBO}$     | 7           | V                |
| Collector current            |           | $I_C$         | 150         | mA               |
|                              |           | $I_{CP}^{*1}$ | 200         | mA               |
| Power dissipation            | 2SC5658   | $P_D^{*2}$    | 150         | mW               |
|                              | 2SC4617EB |               | 150         |                  |
|                              | 2SC4617   |               | 150         |                  |
|                              | 2SC4081UB |               | 200         |                  |
|                              | 2SC4081   |               | 200         |                  |
|                              | 2SC2412K  |               | 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       | $BV_{EBO}$    | $I_E = 50\mu\text{A}$                                       | 7      | -    | -    | V    |
| Collector cut-off current            | $I_{CBO}$     | $V_{CB} = 60\text{V}$                                       | -      | -    | 100  | nA   |
| Emitter cut-off current              | $I_{EBO}$     | $V_{EB} = 7\text{V}$  | -      | -    | 100  | nA   |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C = 50\text{mA}, I_B = 5\text{mA}$                       | -      | -    | 400  | mV   |
| DC current gain                      | $h_{FE}$      | $V_{CE} = 6\text{V}, I_C = 1\text{mA}$                      | 120    | -    | 560  | -    |
| Transition frequency                 | $f_T$         | $V_{CE} = 12\text{V}, I_E = -2\text{mA}, f = 100\text{MHz}$ | -      | 180  | -    | MHz  |
| Output capacitance                   | $C_{ob}$      | $V_{CB} = 12\text{V}, I_E = 0\text{A}, f = 1\text{MHz}$     | -      | 2.0  | 3.5  | pF   |

$h_{FE}$  values are classified as follows :

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

\*1  $P_w=10\text{ms}$ , 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 Grounded Emitter 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 (I)

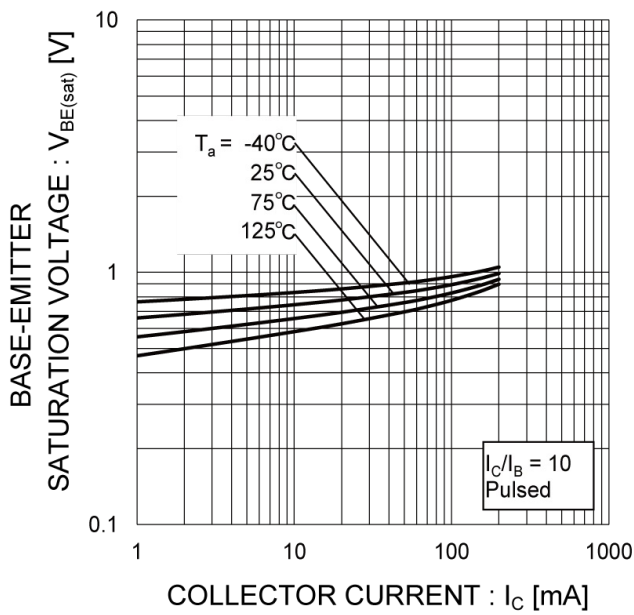


Fig.8 Gain Bandwidth Product vs. Emitter Current



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

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

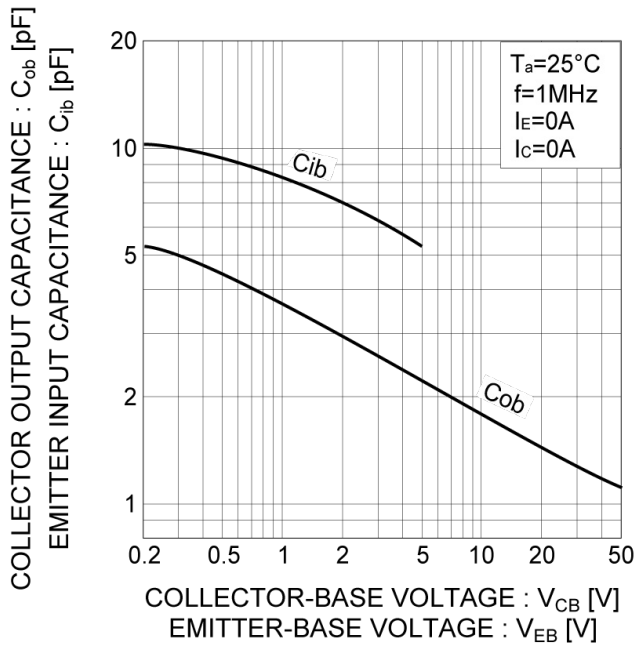


Fig.10 Safe Operating Area

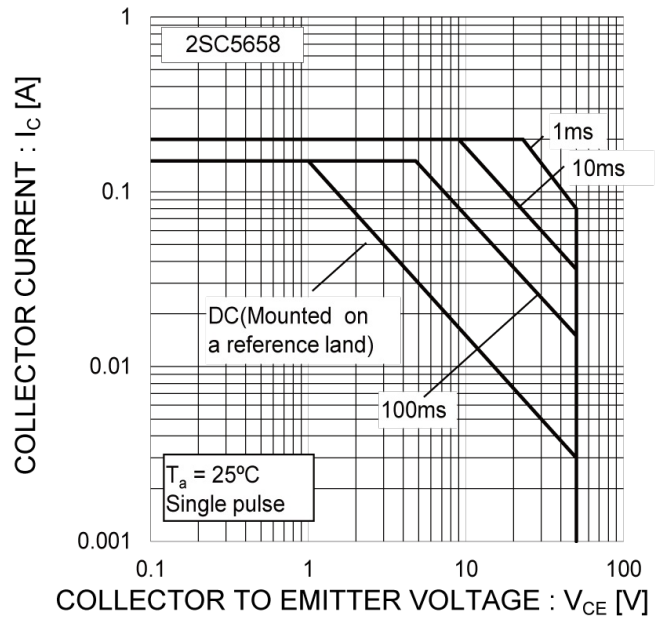


Fig.11 Safe Operating Area

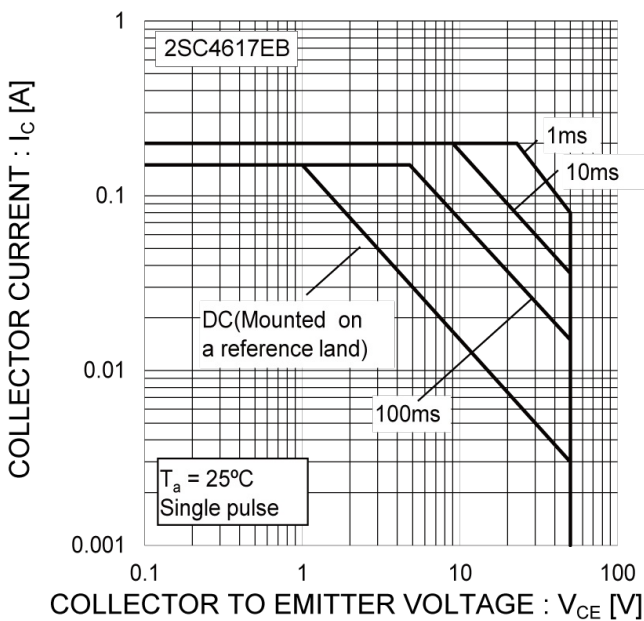
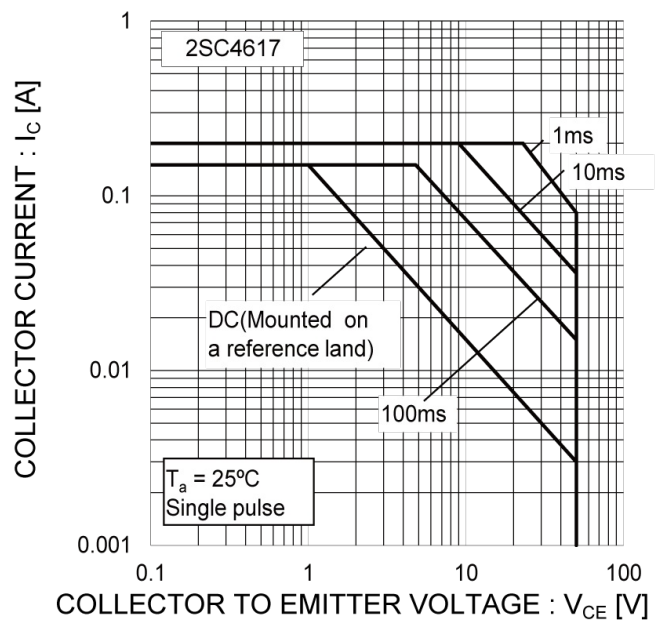


Fig.12 Safe Operating Area



●Electrical characteristic curves(Ta=25°C)

Fig.13 Safe Operating Area



Fig.14 Safe Operating Area

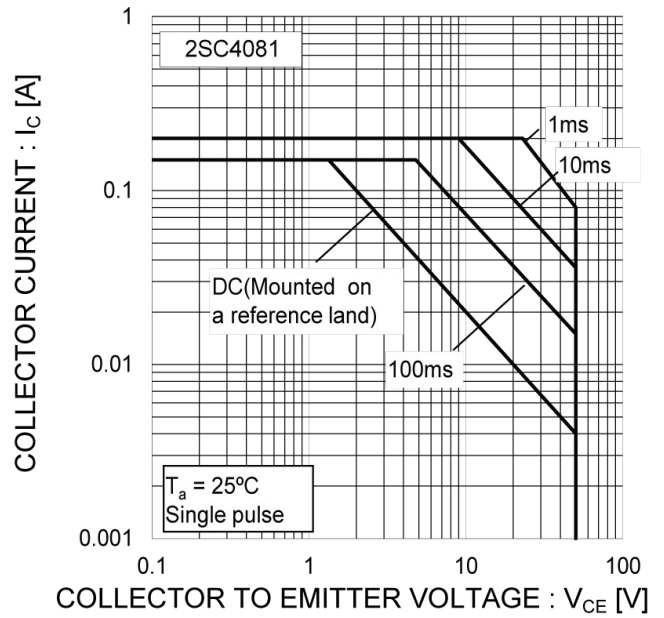
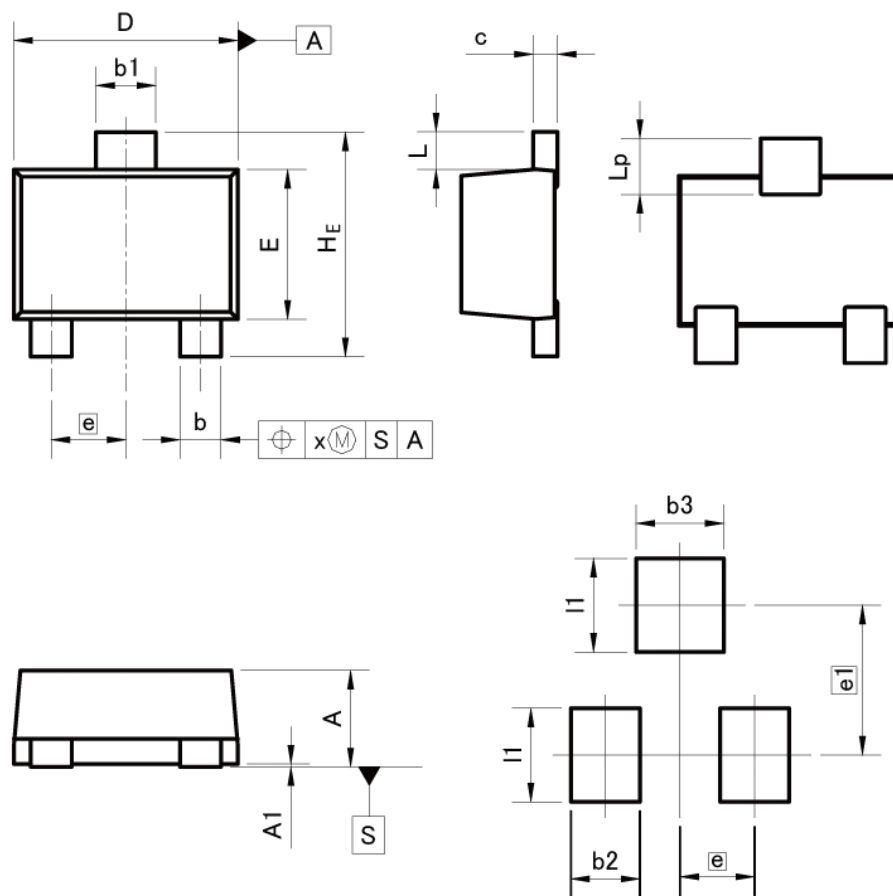


Fig.15 Safe Operating Area



●Dimensions

SOT-723  
SC-105AA  
(VMT3)



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

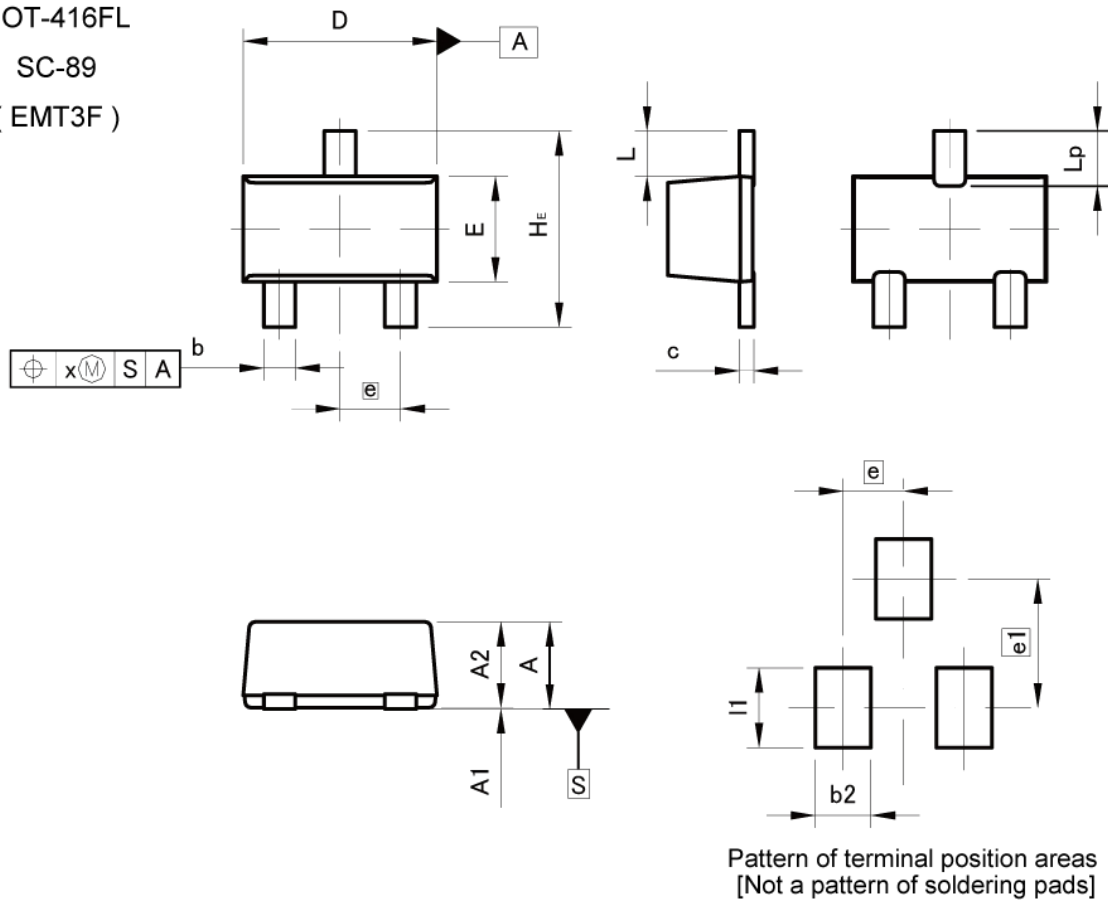
| DIM | MILIMETERS |      | INCHES |       |
|-----|------------|------|--------|-------|
|     | MIN        | MAX  | MIN    | MAX   |
| A   | 0.45       | 0.55 | 0.018  | 0.022 |
| A1  | 0.00       | 0.10 | 0.000  | 0.004 |
| b   | 0.17       | 0.27 | 0.007  | 0.011 |
| b1  | 0.27       | 0.37 | 0.011  | 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

SOT-416FL  
SC-89  
( EMT3F )



| 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

SOT-416  
SC-75A  
(EMT3)



Pattern of terminal position areas  
[Not a 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



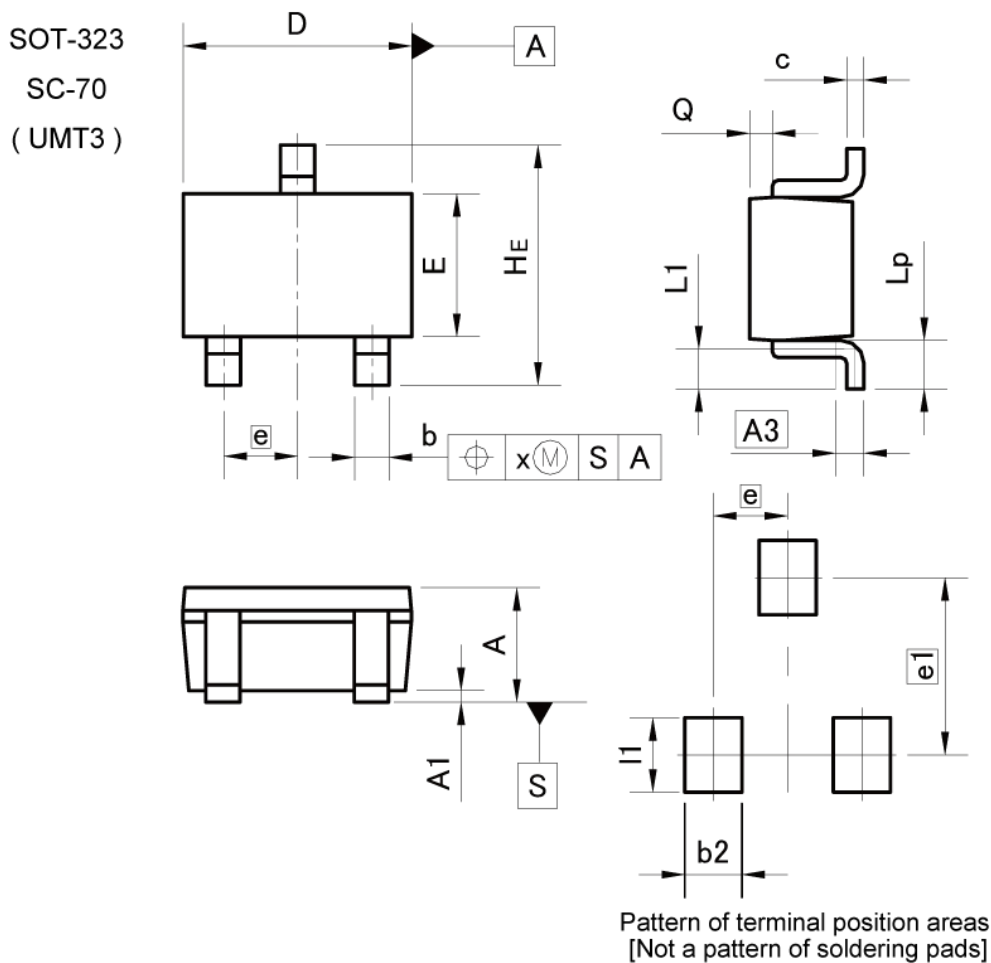
| DIM | MILIMETERS |      | INCHES |       |
|-----|------------|------|--------|-------|
|     | MIN        | MAX  | MIN    | MAX   |
| A   | 0.85       | 1.05 | 0.033  | 0.041 |
| A1  | 0.00       | 0.10 | 0.000  | 0.004 |
| A2  | 0.80       | 1.00 | 0.031  | 0.039 |
| b   | 0.27       | 0.42 | 0.011  | 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  |       |
| I1  | -          | 0.83 | -      | 0.033 |

Dimension in mm/inches

●Dimensions

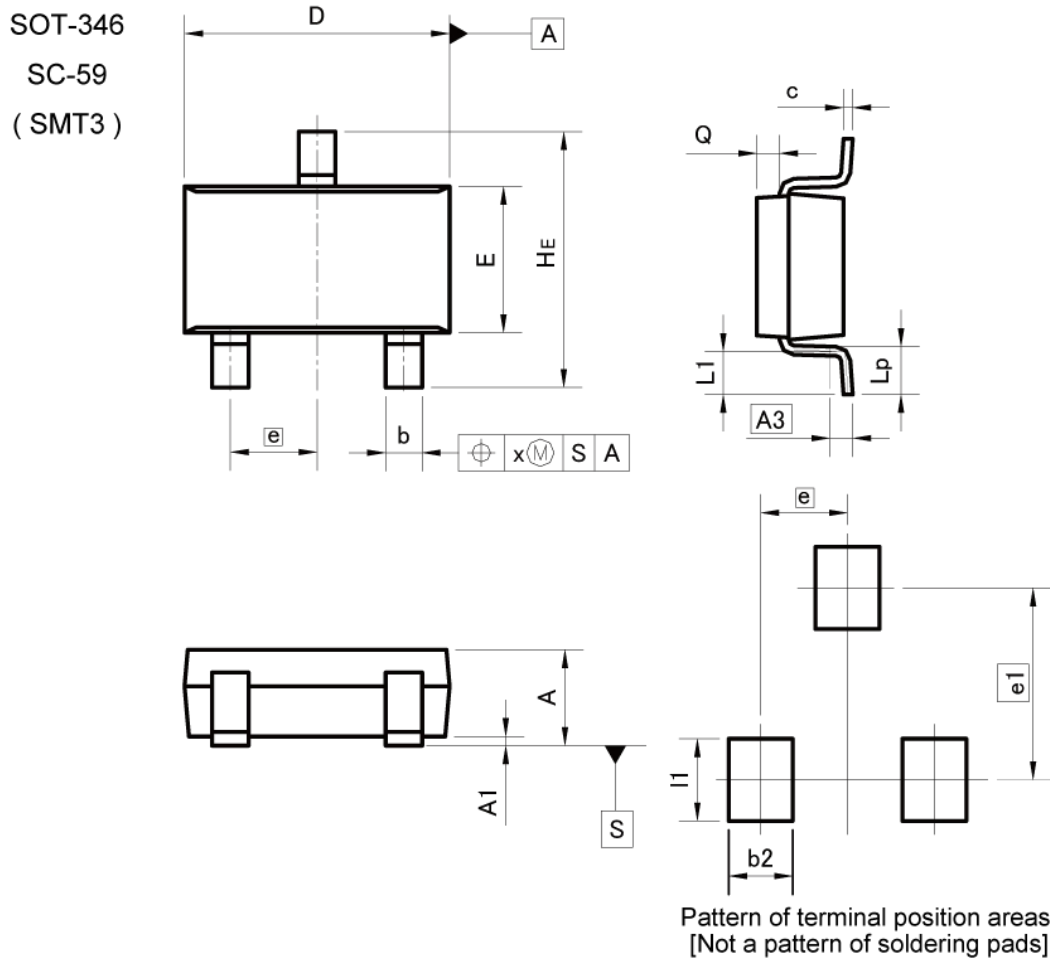


| DIM | MILIMETERS |      | INCHES |       |
|-----|------------|------|--------|-------|
|     | MIN        | MAX  | MIN    | MAX   |
| A   | 0.80       | 1.00 | 0.031  | 0.039 |
| A1  | 0.00       | 0.10 | 0      | 0.004 |
| A3  | 0.25       |      | 0.01   |       |
| b   | 0.25       | 0.40 | 0.01   | 0.016 |
| 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       |      | 0.03   |       |
| HE  | 2.00       | 2.20 | 0.079  | 0.087 |
| L1  | 0.20       | 0.50 | 0.008  | 0.02  |
| Lp  | 0.25       | 0.55 | 0.01   | 0.022 |
| Q   | 0.10       | 0.30 | 0.004  | 0.012 |
| x   | -          | 0.10 | -      | 0.004 |

| DIM | MILIMETERS |      | INCHES |       |
|-----|------------|------|--------|-------|
|     | MIN        | MAX  | MIN    | MAX   |
| e1  | 1.55       |      | 0.06   |       |
| b2  | -          | 0.50 | -      | 0.02  |
| l1  | -          | 0.65 | -      | 0.026 |

Dimension in mm/inches

●Dimensions



| 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  |       |
| I1  | -          | 0.90 | -      | 0.035 |

Dimension in mm/inches

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## 2SC2412K - Web Page

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|                             |          |
|-----------------------------|----------|
| Part Number                 | 2SC2412K |
| Package                     | SMT3     |
| Unit Quantity               | 3000     |
| Minimum Package Quantity    | 3000     |
| Packing Type                | Taping   |
| Constitution Materials List | inquiry  |
| RoHS                        | Yes      |