

# 2SC4197

## Silicon NPN Epitaxial

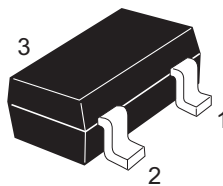
REJ03G0717-0300  
(Previous ADE-208-1097A)  
Rev.3.00  
Aug.10.2005

### Application

UHF frequency converter, wide band amplifier

### Outline

RENESAS Package code: PLSP0003ZB-A  
(Package name: MPAK)



- 1. Emitter
- 2. Base
- 3. Collector

Note: Marking is "TI-".

### Absolute Maximum Ratings

(Ta = 25°C)

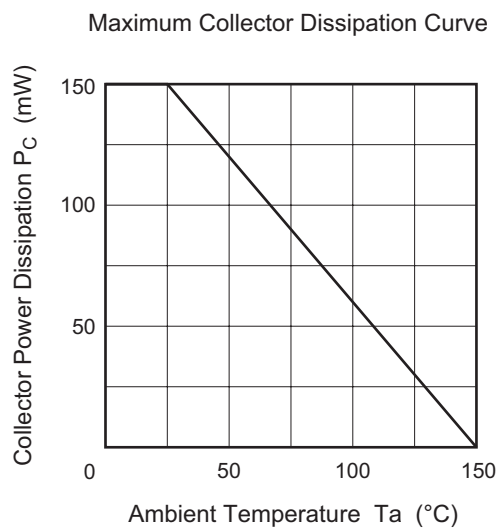
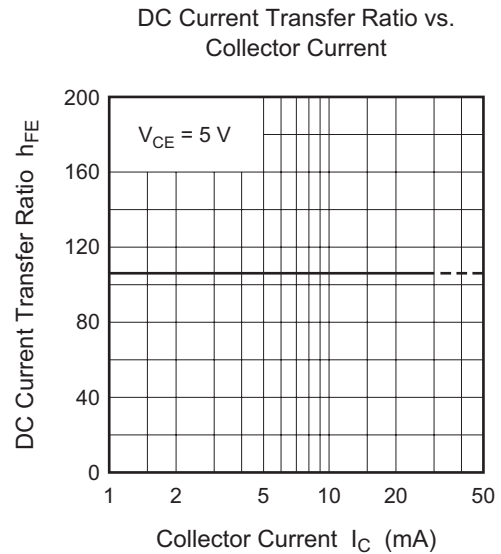
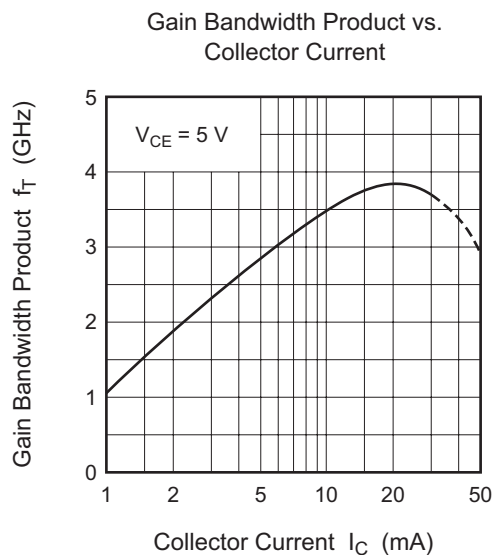
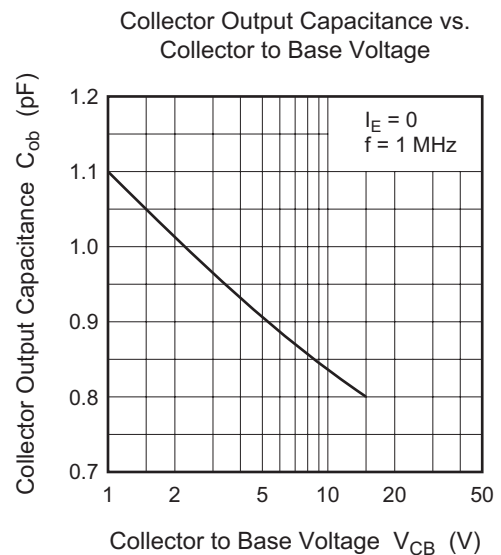
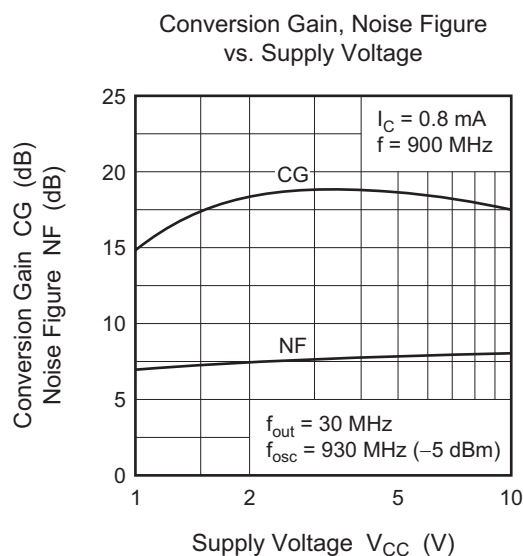
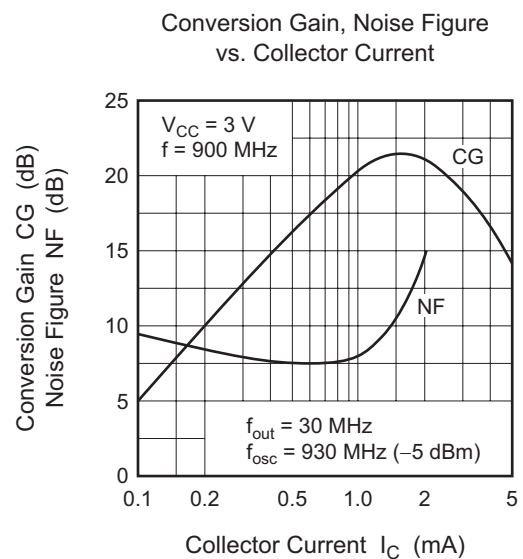
| Item                         | Symbol    | Ratings     | Unit |
|------------------------------|-----------|-------------|------|
| Collector to base voltage    | $V_{CBO}$ | 25          | V    |
| Collector to emitter voltage | $V_{CEO}$ | 13          | V    |
| Emitter to base voltage      | $V_{EBO}$ | 3           | V    |
| Collector current            | $I_C$     | 50          | mA   |
| Collector power dissipation  | $P_C$     | 150         | mW   |
| Junction temperature         | $T_j$     | 150         | °C   |
| Storage temperature          | $T_{stg}$ | -55 to +150 | °C   |

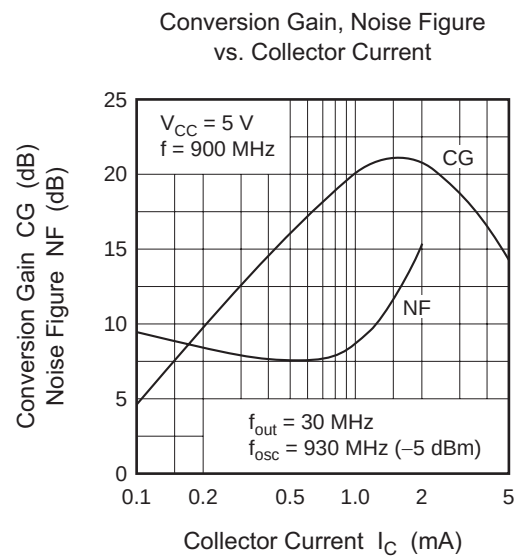
## Electrical Characteristics

(Ta = 25°C)

| Item                                    | Symbol        | Min | Typ  | Max | Unit    | Test conditions                                         |
|-----------------------------------------|---------------|-----|------|-----|---------|---------------------------------------------------------|
| Collector to base breakdown voltage     | $V_{(BR)CBO}$ | 25  | —    | —   | V       | $I_C = 10\ \mu A, I_E = 0$                              |
| Collector cutoff current                | $I_{CBO}$     | —   | —    | 0.1 | $\mu A$ | $V_{CB} = 15\ V, I_E = 0$                               |
| Collector cutoff current                | $I_{CEO}$     | —   | —    | 10  | $\mu A$ | $V_{CE} = 13\ V, R_{BE} = \infty$                       |
| Emitter cutoff current                  | $I_{EBO}$     | —   | —    | 0.3 | $\mu A$ | $V_{EB} = 3\ V, I_C = 0$                                |
| Collector to emitter saturation voltage | $V_{CE(sat)}$ | —   | —    | 0.3 | V       | $I_C = 20\ mA, I_B = 4\ mA$                             |
| DC current transfer ratio               | $h_{FE}$      | 50  | —    | 180 |         | $V_{CE} = 5\ V, I_C = 5\ mA$                            |
| Collector output capacitance            | $C_{ob}$      | —   | 0.85 | 1.3 | pF      | $V_{CB} = 10\ V, I_E = 0, f = 1\ MHz$                   |
| Gain bandwidth product                  | $f_T$         | 3.0 | 3.8  | —   | GHz     | $V_{CE} = 5\ V, I_C = 20\ mA$                           |
| Conversion gain                         | CG            | —   | 19   | —   | dB      | $V_{CC} = 5\ V, I_C = 0.8\ mA,$<br>$f_{in} = 900\ MHz$  |
| Noise figure                            | NF            | —   | 8    | —   | dB      | $f_{osc} = 930\ MHz\ (-5\ dBm),$<br>$f_{out} = 30\ MHz$ |

## Main Characteristics

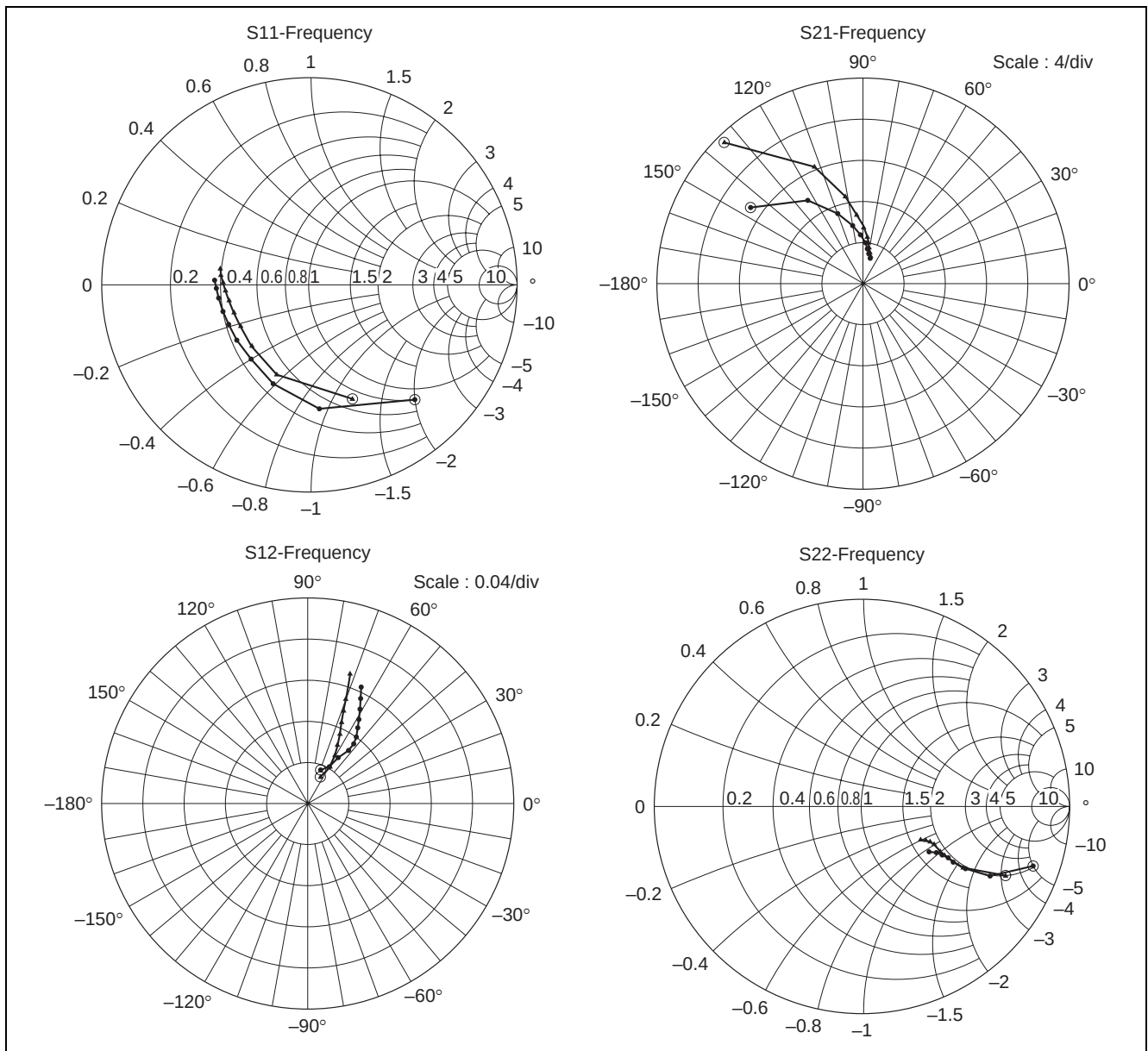




## S Parameters (Emitter Common)

**Test Condition**  $V_{CE} = 5\text{ V}$ , 100 MHz to 1000 MHz (100 MHz Step),  $Z_O = 50\ \Omega$

$I_C = 5\text{ mA}$  ●  
 $I_C = 10\text{ mA}$  ▲



**S Parameters (Emitter Common)****Test Condition**

$$V_{CE} = 5 \text{ V}, I_C = 5 \text{ mA}, Z_O = 50 \Omega$$

| Freq.<br>(MHz) | S11   |        | S21    |       | S12   |      | S22   |       |
|----------------|-------|--------|--------|-------|-------|------|-------|-------|
|                | MAG.  | ANG.   | MAG.   | ANG.  | MAG.  | ANG. | MAG.  | ANG.  |
| 100            | 0.744 | -48.4  | 13.142 | 145.9 | 0.034 | 67.5 | 0.876 | -19.1 |
| 200            | 0.599 | -85.5  | 9.669  | 123.5 | 0.053 | 55.9 | 0.702 | -28.2 |
| 300            | 0.506 | -110.7 | 7.201  | 109.5 | 0.064 | 52.6 | 0.586 | -30.9 |
| 400            | 0.457 | -128.9 | 5.696  | 100.6 | 0.072 | 52.7 | 0.520 | -31.2 |
| 500            | 0.440 | -143.5 | 4.687  | 93.9  | 0.079 | 54.3 | 0.480 | -31.2 |
| 600            | 0.430 | -155.1 | 3.977  | 88.1  | 0.087 | 57.1 | 0.452 | -31.5 |
| 700            | 0.437 | -163.2 | 3.453  | 83.5  | 0.095 | 59.4 | 0.432 | -31.7 |
| 800            | 0.441 | -170.9 | 3.070  | 79.1  | 0.104 | 61.3 | 0.417 | -32.4 |
| 900            | 0.452 | -177.1 | 2.746  | 75.4  | 0.113 | 63.6 | 0.402 | -33.4 |
| 1000           | 0.462 | 177.5  | 2.508  | 71.9  | 0.122 | 65.6 | 0.390 | -34.5 |

**Test Condition**

$$V_{CE} = 5 \text{ V}, I_C = 10 \text{ mA}, Z_O = 50 \Omega$$

| Freq.<br>(MHz) | S11   |        | S21    |       | S12   |      | S22   |       |
|----------------|-------|--------|--------|-------|-------|------|-------|-------|
|                | MAG.  | ANG.   | MAG.   | ANG.  | MAG.  | ANG. | MAG.  | ANG.  |
| 100            | 0.585 | -69.3  | 19.233 | 134.4 | 0.028 | 63.8 | 0.768 | -25.6 |
| 200            | 0.460 | -110.1 | 12.238 | 112.6 | 0.041 | 58.1 | 0.564 | -31.4 |
| 300            | 0.408 | -133.9 | 8.571  | 101.3 | 0.052 | 60.0 | 0.468 | -30.5 |
| 400            | 0.390 | -149.7 | 6.608  | 94.5  | 0.062 | 62.9 | 0.420 | -29.1 |
| 500            | 0.390 | -160.7 | 5.348  | 88.7  | 0.073 | 65.3 | 0.394 | -28.1 |
| 600            | 0.391 | -169.8 | 4.503  | 84.4  | 0.084 | 67.7 | 0.375 | -27.8 |
| 700            | 0.404 | -176.7 | 3.884  | 80.3  | 0.095 | 69.1 | 0.361 | -27.7 |
| 800            | 0.411 | 178.0  | 3.446  | 76.8  | 0.107 | 70.3 | 0.350 | -28.2 |
| 900            | 0.426 | 173.1  | 3.069  | 73.4  | 0.119 | 71.5 | 0.339 | -29.0 |
| 1000           | 0.436 | 169.8  | 2.803  | 70.7  | 0.131 | 72.2 | 0.330 | -29.7 |

**Y Parameters (Emitter Common)****Test Condition**

$$V_{CE} = 5 \text{ V}, I_C = 5 \text{ mA}$$

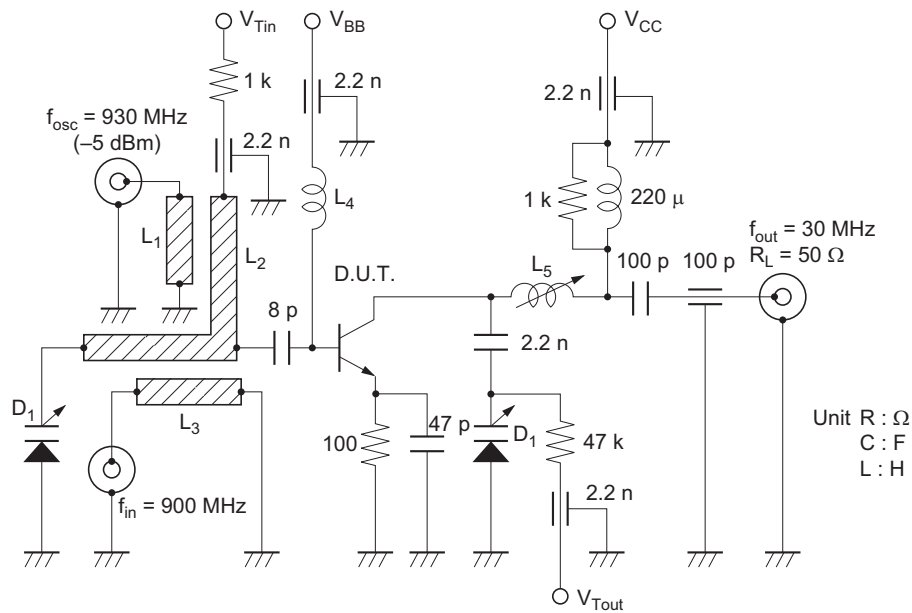
| Freq.<br>(MHz) | Yie (mS) |        | Yfe (mS) |          | Yre (mS) |        | Yoe (mS) |       |
|----------------|----------|--------|----------|----------|----------|--------|----------|-------|
|                | REAL     | IMAG.  | REAL     | IMAG.    | REAL     | IMAG.  | REAL     | IMAG. |
| 100            | 2.663    | 5.357  | 161.804  | -34.193  | -0.002   | -0.425 | 0.055    | 0.627 |
| 200            | 5.558    | 10.174 | 147.899  | -63.499  | -0.012   | -0.880 | 0.025    | 1.270 |
| 300            | 9.651    | 13.450 | 125.634  | -87.205  | -0.041   | -1.354 | 0.026    | 2.024 |
| 400            | 14.160   | 15.066 | 102.261  | -102.289 | -0.093   | -1.820 | 0.044    | 2.772 |
| 500            | 18.753   | 15.624 | 80.041   | -110.827 | -0.150   | -2.309 | 0.048    | 3.510 |
| 600            | 23.019   | 14.727 | 57.826   | -114.923 | -0.214   | -2.798 | 0.124    | 4.301 |
| 700            | 26.444   | 13.908 | 40.437   | -113.783 | -0.263   | -3.305 | 0.211    | 4.964 |
| 800            | 29.378   | 12.040 | 24.049   | -111.316 | -0.379   | -3.822 | 0.268    | 5.828 |
| 900            | 31.931   | 9.960  | 10.602   | -106.726 | -0.466   | -4.371 | 0.407    | 6.578 |
| 1000           | 33.671   | 7.667  | -0.922   | -101.485 | -0.586   | -4.913 | 0.524    | 7.381 |

## Test Condition

$$V_{CE} = 5 \text{ V}, I_C = 10 \text{ mA}$$

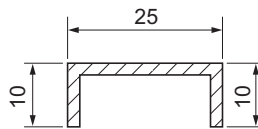
| Freq.<br>(MHz) | Yie (mS) |        | Yfe (mS) |          | Yre (mS) |        | Yoe (mS) |       |
|----------------|----------|--------|----------|----------|----------|--------|----------|-------|
|                | REAL     | IMAG.  | REAL     | IMAG.    | REAL     | IMAG.  | REAL     | IMAG. |
| 100            | 5.212    | 6.660  | 273.909  | -97.915  | -0.002   | -0.430 | 0.029    | 0.527 |
| 200            | 10.124   | 10.767 | 208.225  | -154.453 | -0.015   | -0.876 | 0.011    | 1.307 |
| 300            | 15.094   | 11.730 | 141.558  | -172.198 | -0.044   | -1.347 | 0.047    | 2.035 |
| 400            | 18.933   | 10.991 | 93.174   | -169.490 | -0.089   | -1.817 | 0.064    | 2.735 |
| 500            | 21.811   | 10.074 | 58.181   | -158.809 | -0.133   | -2.299 | 0.096    | 3.501 |
| 600            | 23.927   | 8.389  | 32.829   | -146.284 | -0.195   | -2.785 | 0.173    | 4.226 |
| 700            | 25.848   | 7.170  | 15.188   | -134.592 | -0.276   | -3.302 | 0.224    | 5.010 |
| 800            | 26.851   | 5.955  | 2.733    | -123.322 | -0.353   | -3.808 | 0.282    | 5.760 |
| 900            | 28.097   | 4.633  | -7.642   | -113.209 | -0.443   | -4.375 | 0.394    | 6.551 |
| 1000           | 28.686   | 3.829  | -13.979  | -104.651 | -0.523   | -4.908 | 0.466    | 7.215 |

## Conversion Gain and Noise Figure Test Circuit

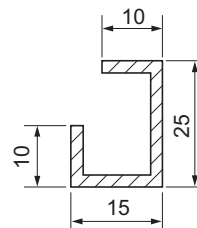


$D_1$  : 1 SV 188

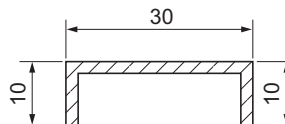
$L_1$  :  $\phi$  1 mm Enameled Copper Wire.



$L_2$  :  $\phi$  1 mm Enameled Copper Wire.



$L_3$  :  $\phi$  1 mm Enameled Copper Wire.



Unit : mm

$L_4$  :  $\phi$  0.5 mm Enameled Copper Wire 1 Turn Inside Dia 3 mm

$L_5$  : Inside Dia 5 mm Bobin,  $\phi$  0.2 mm Enameled Copper Wire 20 Turns with Ferrite Core.

| JEITA Package Code | RENESAS Code | Package Name                         | MASS[Typ.] |
|--------------------|--------------|--------------------------------------|------------|
| SC-59A             | PLSP0003ZB-A | MPAK(T) / MPAK(T)JV,<br>MPAK / MPAKV | 0.011g     |

**A-A Section**

**Pattern of terminal position areas**

| Reference Symbol | Dimension in Millimeters |      |      |
|------------------|--------------------------|------|------|
|                  | Min                      | Nom  | Max  |
| A                | 1.0                      | —    | 1.3  |
| A1               | 0                        | —    | 0.1  |
| A2               | 1.0                      | 1.1  | 1.2  |
| A3               | —                        | 0.25 | —    |
| b                | 0.35                     | 0.42 | 0.5  |
| b1               | —                        | 0.4  | —    |
| c                | 0.1                      | 0.13 | 0.15 |
| c1               | —                        | 0.11 | —    |
| D                | 2.7                      | —    | 3.1  |
| E                | 1.35                     | 1.5  | 1.65 |
| e                | —                        | 0.95 | —    |
| HE               | 2.2                      | 2.8  | 3.0  |
| L                | 0.35                     | —    | 0.75 |
| L1               | 0.15                     | —    | 0.55 |
| LP               | 0.25                     | —    | 0.65 |
| x                | —                        | —    | 0.05 |
| b2               | —                        | —    | 0.55 |
| e1               | —                        | 1.95 | —    |
| l1               | —                        | —    | 1.05 |
| Q                | —                        | 0.3  | —    |

| Part Name      | Quantity | Shipping Container                |
|----------------|----------|-----------------------------------|
| 2SC4197TI-TL-E | 3000     | φ 178 mm Reel, 8 mm Emboss Taping |

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