

# RF Transistor

10 V, 70 mA,  $f_T = 1.5$  GHz, NPN Single MCP

## 15GN03MA

### Features

- High Cut-off Frequency:  $f_T = 1.5$  GHz Typ
- High Gain:  $|S_{21e}|^2 = 13$  dB Typ ( $f = 1$  GHz)
- Ultrasmall Package Permitting Applied Sets to be Small and Slim
- This is a Pb-Free Device

### Applications

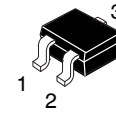
- VHF, RF, MIXER, OSC, IF Amplifier

### Specifications

#### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

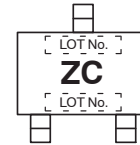
| Symbol    | Parameter                    | Conditions   | Value       | Unit |
|-----------|------------------------------|--|-------------|------|
| $V_{CBO}$ | Collector-to-Base Voltage    |  | 20          | V    |
| $V_{CEO}$ | Collector-to-Emitter Voltage |  | 10          | V    |
| $V_{EBO}$ | Emitter-to-Base Voltage      |  | 3           | V    |
| $I_C$     | Collector Current            |  | 70          | mA   |
| $P_C$     | Collector Dissipation        | When mounted on ceramic substrate (250 mm <sup>2</sup> x 0.8 mm) | 400         | mW   |
| $T_j$     | Junction Temperature         |  | 150         | °C   |
| $T_{stg}$ | Storage Temperature          |  | -55 to +150 | °C   |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



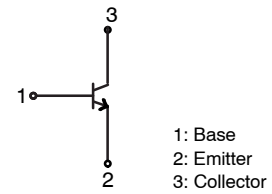
SC-70 / MCP3  
CASE 419AJ

### MARKING DIAGRAM



ZC = Specific Device Code

### ELECTRICAL CONNECTION



### ORDERING INFORMATION

| Device        | Package        | Shipping†           |
|---------------|----------------|---------------------|
| 15GN03MA-TL-E | MCP3 (Pb-Free) | 3,000 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, [BRD8011/D](#).

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

| Parameter                    | Symbol        | Test Condition  | Min | Typ  | Max  | Unit          |
|------------------------------|---------------|---|-----|------|------|---------------|
| Collector Cutoff Current     | $I_{CBO}$     | $V_{CB} = 10\text{ V}, I_E = 0\text{ A}$                      | –   | –    | 0.1  | $\mu\text{A}$ |
| Emitter Cutoff Current       | $I_{EBO}$     | $V_{EB} = 2\text{ V}, I_C = 0\text{ A}$                       | –   | –    | 1    | $\mu\text{A}$ |
| DC Current Gain              | $h_{FE}$      | $V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$                     | 100 | –    | 180  |               |
| Gain–Bandwidth Product       | $f_T$         | $V_{CE} = 5\text{ V}, I_C = 20\text{ mA}$                     | 1.0 | 1.5  | –    | GHz           |
| Output Capacitance           | $C_{ob}$      | $V_{CB} = 10\text{ V}, f = 1\text{ MHz}$                      | –   | 0.95 | 1.25 | pF            |
| Reverse Transfer Capacitance | $C_{re}$      |   | –   | 0.65 | –    | pF            |
| Forward Transfer Gain        | $ S_{21e} ^2$ | $V_{CE} = 5\text{ V}, I_C = 20\text{ mA}, f = 0.4\text{ GHz}$ | 10  | 13   | –    | dB            |
| Noise Figure                 | NF            | $V_{CE} = 3\text{ V}, I_C = 2\text{ mA}, f = 0.4\text{ GHz}$  | –   | 1.6  | –    | dB            |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

# 15GN03MA

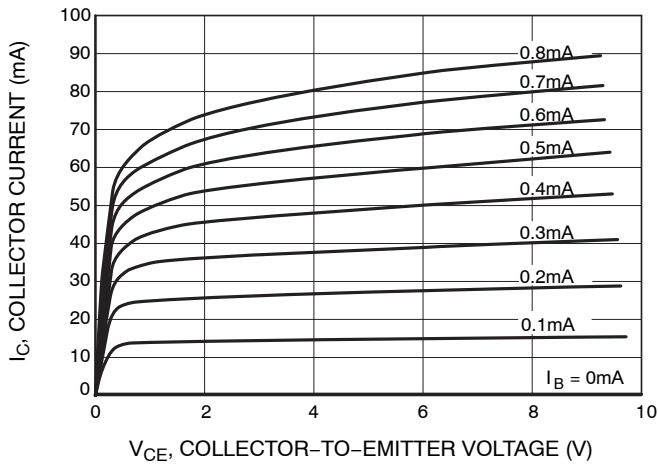


Figure 1.  $I_C - V_{CE}$

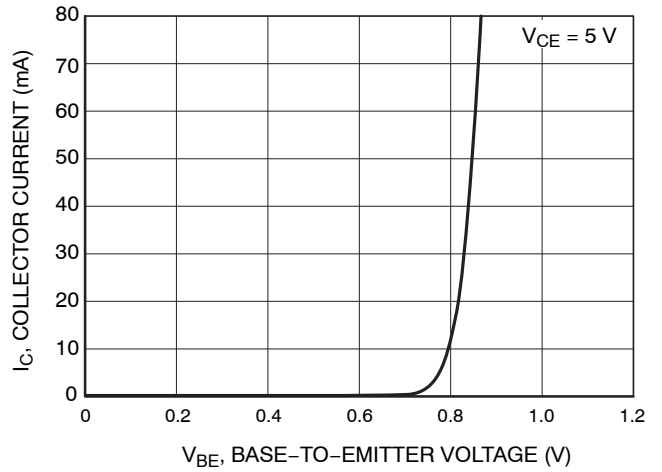


Figure 2.  $I_C - V_{BE}$

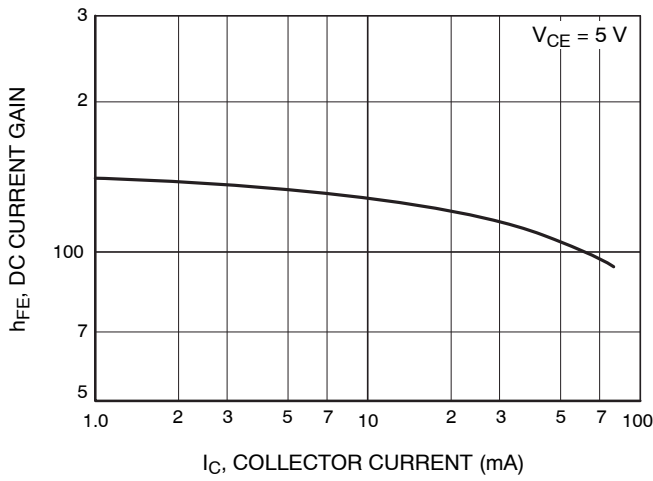


Figure 3.  $h_{FE} - I_C$

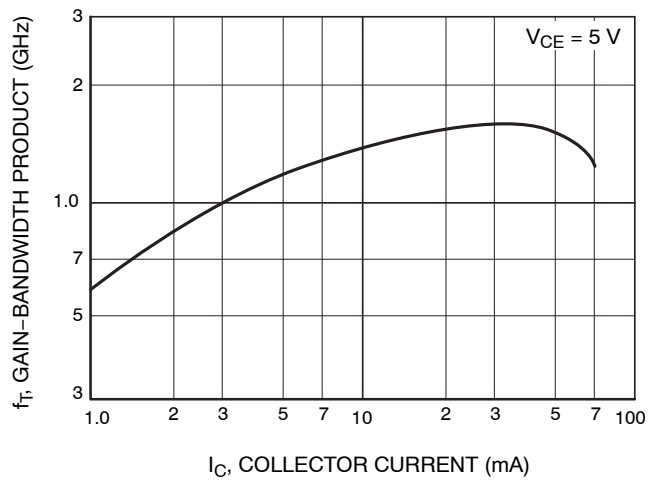


Figure 4.  $f_T - I_C$

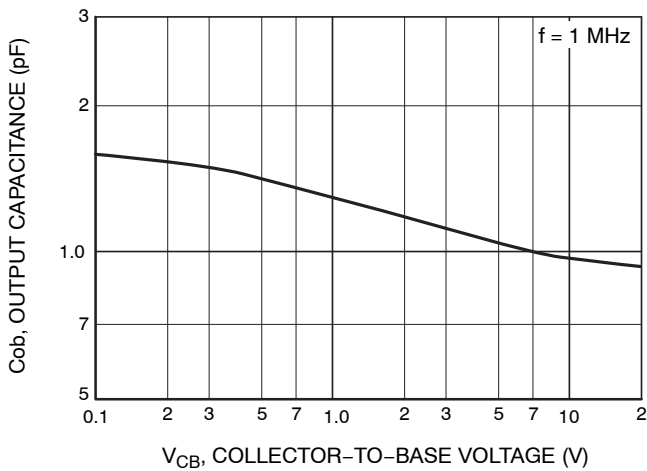


Figure 5.  $C_{ob} - V_{CB}$

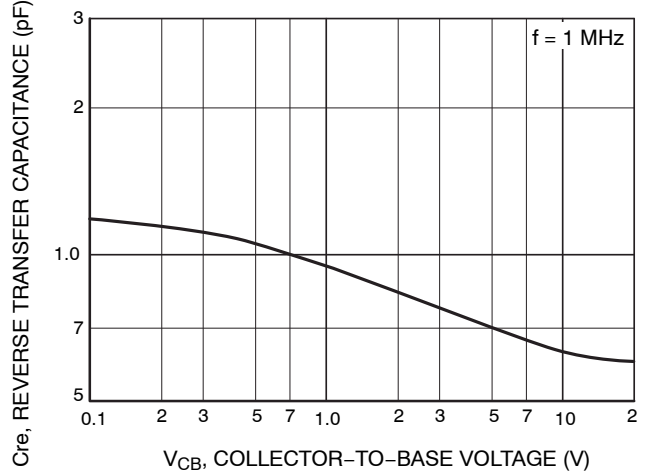


Figure 6.  $C_{re} - V_{CB}$

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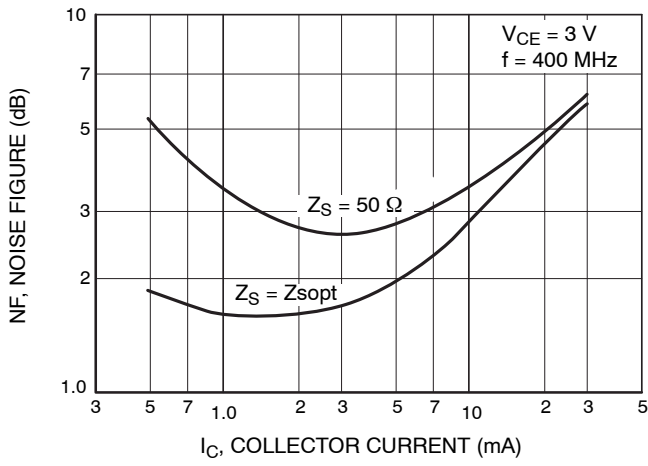


Figure 7. NF -  $I_C$

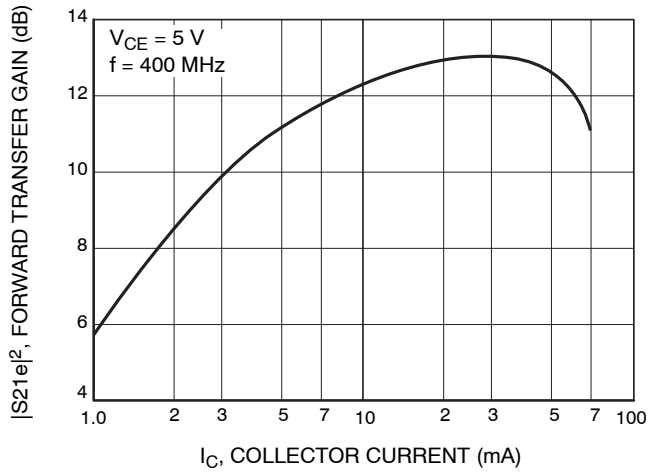


Figure 8.  $|S_{21e}|^2 - I_C$

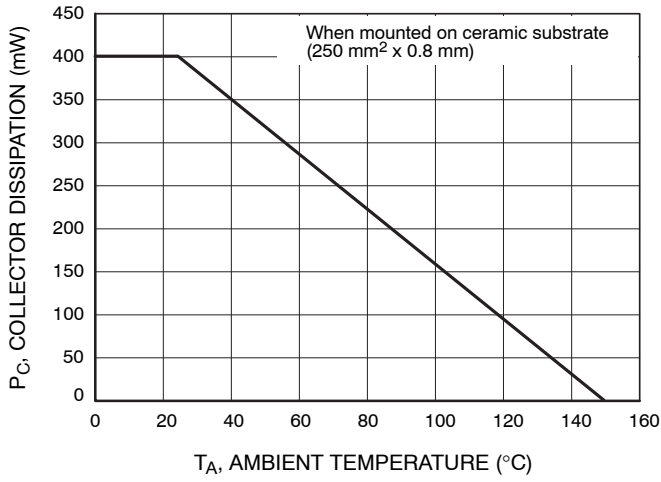


Figure 9.  $P_C - T_A$

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## S Parameters (Common Emitter)

$V_{CE} = 5\text{ V}$ ,  $I_C = 1\text{ mA}$ ,  $Z_O = 50\ \Omega$

| Freq(MHz) | S11   | $\angle S11$ | S21   | $\angle S21$ | S12   | $\angle S12$ | S22   | $\angle S22$ |
|-----------|-------|--------------|-------|--------------|-------|--------------|-------|--------------|
| 100       | 0.927 | -39.48       | 3.051 | 153.95       | 0.045 | 66.57        | 0.938 | -5.28        |
| 200       | 0.877 | -72.13       | 2.643 | 134.85       | 0.072 | 53.42        | 0.879 | -10.12       |
| 300       | 0.831 | -97.09       | 2.258 | 118.70       | 0.090 | 41.89        | 0.834 | -15.17       |
| 400       | 0.796 | -115.43      | 1.925 | 105.65       | 0.093 | 33.66        | 0.806 | -20.70       |
| 500       | 0.772 | -128.51      | 1.645 | 95.12        | 0.090 | 29.42        | 0.796 | -25.57       |
| 600       | 0.759 | -139.76      | 1.420 | 86.92        | 0.085 | 28.20        | 0.796 | -28.96       |
| 700       | 0.754 | -148.33      | 1.255 | 80.31        | 0.080 | 30.19        | 0.792 | -31.48       |
| 800       | 0.750 | -155.54      | 1.132 | 74.68        | 0.072 | 36.45        | 0.790 | -34.42       |
| 900       | 0.746 | -162.07      | 1.033 | 69.44        | 0.067 | 44.81        | 0.793 | -37.89       |
| 1000      | 0.743 | -167.59      | 0.948 | 65.05        | 0.065 | 55.74        | 0.796 | -41.83       |

$V_{CE} = 5\text{ V}$ ,  $I_C = 3\text{ mA}$ ,  $Z_O = 50\ \Omega$

| Freq(MHz) | S11   | $\angle S11$ | S21   | $\angle S21$ | S12   | $\angle S12$ | S22   | $\angle S22$ |
|-----------|-------|--------------|-------|--------------|-------|--------------|-------|--------------|
| 100       | 0.819 | -66.73       | 7.544 | 137.99       | 0.036 | 55.23        | 0.862 | -14.15       |
| 200       | 0.733 | -107.53      | 5.274 | 115.44       | 0.050 | 43.07        | 0.730 | -17.07       |
| 300       | 0.698 | -130.44      | 3.901 | 102.51       | 0.055 | 40.37        | 0.691 | -20.60       |
| 400       | 0.682 | -144.75      | 3.111 | 93.53        | 0.056 | 41.56        | 0.673 | -22.18       |
| 500       | 0.674 | -154.20      | 2.563 | 85.87        | 0.056 | 46.54        | 0.680 | -25.14       |
| 600       | 0.669 | -161.91      | 2.175 | 79.64        | 0.057 | 53.71        | 0.686 | -28.23       |
| 700       | 0.669 | -167.44      | 1.884 | 74.61        | 0.061 | 62.91        | 0.686 | -30.58       |
| 800       | 0.671 | -172.33      | 1.680 | 70.09        | 0.067 | 70.67        | 0.690 | -33.35       |
| 900       | 0.672 | -176.77      | 1.520 | 65.76        | 0.075 | 78.25        | 0.695 | -36.65       |
| 1000      | 0.672 | 179.40       | 1.386 | 61.98        | 0.086 | 83.86        | 0.700 | -40.53       |

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

| Freq(MHz) | S11   | $\angle S11$ | S21    | $\angle S21$ | S12   | $\angle S12$ | S22   | $\angle S22$ |
|-----------|-------|--------------|--------|--------------|-------|--------------|-------|--------------|
| 100       | 0.745 | -85.56       | 10.487 | 129.32       | 0.031 | 52.32        | 0.808 | -17.13       |
| 200       | 0.673 | -125.68      | 6.596  | 107.46       | 0.041 | 43.79        | 0.695 | -19.72       |
| 300       | 0.650 | -144.45      | 4.641  | 95.99        | 0.044 | 45.46        | 0.655 | -20.94       |
| 400       | 0.643 | -155.93      | 3.583  | 88.14        | 0.046 | 51.02        | 0.641 | -22.34       |
| 500       | 0.641 | -163.08      | 2.926  | 81.98        | 0.051 | 57.47        | 0.638 | -24.48       |
| 600       | 0.641 | -169.17      | 2.468  | 76.86        | 0.055 | 65.57        | 0.640 | -27.05       |
| 700       | 0.642 | -173.85      | 2.139  | 72.14        | 0.064 | 72.10        | 0.640 | -29.96       |
| 800       | 0.645 | -177.59      | 1.898  | 68.01        | 0.072 | 78.01        | 0.643 | -32.86       |
| 900       | 0.648 | 179.02       | 1.708  | 64.03        | 0.082 | 84.74        | 0.654 | -36.05       |
| 1000      | 0.649 | 175.69       | 1.565  | 60.67        | 0.096 | 88.35        | 0.663 | -39.64       |

# 15GN03MA

## S Parameters (Common Emitter)

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

| Freq(MHz) | S11   | $\angle S11$ | S21    | $\angle S21$ | S12   | $\angle S12$ | S22   | $\angle S22$ |
|-----------|-------|--------------|--------|--------------|-------|--------------|-------|--------------|
| 100       | 0.648 | -111.11      | 13.755 | 118.07       | 0.025 | 49.17        | 0.710 | -18.60       |
| 200       | 0.617 | -144.00      | 7.787  | 99.84        | 0.031 | 50.50        | 0.618 | -18.94       |
| 300       | 0.610 | -157.84      | 5.322  | 90.62        | 0.035 | 55.71        | 0.593 | -19.18       |
| 400       | 0.611 | -165.84      | 4.071  | 84.05        | 0.042 | 63.53        | 0.585 | -20.81       |
| 500       | 0.612 | -171.10      | 3.295  | 78.75        | 0.049 | 72.26        | 0.585 | -23.14       |
| 600       | 0.616 | -175.51      | 2.770  | 74.15        | 0.059 | 76.93        | 0.591 | -25.68       |
| 700       | 0.620 | -179.00      | 2.401  | 69.78        | 0.068 | 81.33        | 0.595 | -28.62       |
| 800       | 0.622 | 178.16       | 2.122  | 65.84        | 0.080 | 85.49        | 0.598 | -31.66       |
| 900       | 0.629 | 175.42       | 1.906  | 62.06        | 0.091 | 88.11        | 0.610 | -34.80       |
| 1000      | 0.632 | 172.79       | 1.741  | 58.71        | 0.104 | 90.16        | 0.619 | -38.30       |

$V_{CE} = 5\text{ V}$ ,  $I_C = 15\text{ mA}$ ,  $Z_O = 50\ \Omega$

| Freq(MHz) | S11   | $\angle S11$ | S21    | $\angle S21$ | S12   | $\angle S12$ | S22   | $\angle S22$ |
|-----------|-------|--------------|--------|--------------|-------|--------------|-------|--------------|
| 100       | 0.608 | -124.26      | 15.141 | 112.79       | 0.021 | 49.66        | 0.661 | -18.68       |
| 200       | 0.596 | -152.05      | 8.271  | 96.59        | 0.028 | 56.25        | 0.584 | -17.69       |
| 300       | 0.594 | -163.33      | 5.613  | 88.34        | 0.034 | 63.87        | 0.566 | -18.43       |
| 400       | 0.600 | -169.82      | 4.267  | 82.26        | 0.042 | 71.61        | 0.561 | -19.87       |
| 500       | 0.601 | -173.91      | 3.457  | 77.23        | 0.052 | 77.39        | 0.564 | -22.13       |
| 600       | 0.606 | -177.77      | 2.902  | 72.65        | 0.061 | 81.90        | 0.570 | -24.90       |
| 700       | 0.613 | 179.41       | 2.501  | 68.50        | 0.071 | 84.02        | 0.573 | -27.96       |
| 800       | 0.617 | 176.72       | 2.210  | 64.59        | 0.083 | 86.75        | 0.579 | -30.98       |
| 900       | 0.624 | 174.31       | 1.988  | 60.86        | 0.094 | 88.46        | 0.592 | -34.26       |
| 1000      | 0.628 | 171.96       | 1.808  | 57.39        | 0.108 | 90.57        | 0.599 | -37.51       |

$V_{CE} = 5\text{ V}$ ,  $I_C = 20\text{ mA}$ ,  $Z_O = 50\ \Omega$

| Freq(MHz) | S11   | $\angle S11$ | S21    | $\angle S21$ | S12   | $\angle S12$ | S22   | $\angle S22$ |
|-----------|-------|--------------|--------|--------------|-------|--------------|-------|--------------|
| 100       | 0.587 | -132.33      | 15.887 | 109.73       | 0.018 | 50.98        | 0.630 | -18.23       |
| 200       | 0.589 | -156.83      | 8.517  | 94.77        | 0.026 | 60.57        | 0.563 | -17.10       |
| 300       | 0.590 | -166.31      | 5.751  | 86.97        | 0.034 | 66.88        | 0.549 | -17.73       |
| 400       | 0.593 | -171.88      | 4.373  | 80.95        | 0.043 | 73.76        | 0.547 | -19.30       |
| 500       | 0.598 | -175.61      | 3.529  | 76.08        | 0.052 | 79.21        | 0.552 | -21.55       |
| 600       | 0.604 | -178.89      | 2.958  | 71.70        | 0.063 | 82.86        | 0.558 | -24.41       |
| 700       | 0.611 | 178.36       | 2.550  | 67.43        | 0.073 | 85.71        | 0.560 | -27.19       |
| 800       | 0.616 | 176.07       | 2.257  | 63.56        | 0.085 | 87.76        | 0.569 | -30.31       |
| 900       | 0.624 | 173.75       | 2.026  | 59.99        | 0.097 | 89.02        | 0.581 | -33.63       |
| 1000      | 0.628 | 171.39       | 1.838  | 56.47        | 0.109 | 90.88        | 0.590 | -36.92       |

# 15GN03MA

## S Parameters (Common Emitter)

$V_{CE} = 5\text{ V}$ ,  $I_C = 30\text{ mA}$ ,  $Z_O = 50\ \Omega$

| Freq(MHz) | S11   | $\angle S11$ | S21    | $\angle S21$ | S12   | $\angle S12$ | S22   | $\angle S22$ |
|-----------|-------|--------------|--------|--------------|-------|--------------|-------|--------------|
| 100       | 0.574 | -141.90      | 16.518 | 106.28       | 0.017 | 56.75        | 0.594 | -17.60       |
| 200       | 0.584 | -161.69      | 8.702  | 92.68        | 0.024 | 65.21        | 0.541 | -16.13       |
| 300       | 0.587 | -169.42      | 5.851  | 85.19        | 0.033 | 71.56        | 0.531 | -16.69       |
| 400       | 0.596 | -174.12      | 4.433  | 79.42        | 0.042 | 77.01        | 0.532 | -18.41       |
| 500       | 0.599 | -177.29      | 3.570  | 74.54        | 0.053 | 82.34        | 0.536 | -20.78       |
| 600       | 0.609 | -179.93      | 2.987  | 70.07        | 0.063 | 84.47        | 0.545 | -23.60       |
| 700       | 0.616 | -177.48      | 2.574  | 65.88        | 0.073 | 86.83        | 0.550 | -26.54       |
| 800       | 0.621 | -175.27      | 2.268  | 61.99        | 0.085 | 88.18        | 0.559 | -29.78       |
| 900       | 0.631 | -173.12      | 2.033  | 58.20        | 0.096 | 90.72        | 0.571 | -33.08       |
| 1000      | 0.638 | -170.96      | 1.845  | 54.81        | 0.111 | 91.80        | 0.582 | -36.46       |

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

| Freq(MHz) | S11   | $\angle S11$ | S21    | $\angle S21$ | S12   | $\angle S12$ | S22   | $\angle S22$ |
|-----------|-------|--------------|--------|--------------|-------|--------------|-------|--------------|
| 100       | 0.578 | -151.54      | 16.222 | 102.78       | 0.015 | 58.15        | 0.564 | -16.24       |
| 200       | 0.596 | -166.79      | 8.428  | 90.13        | 0.023 | 71.59        | 0.524 | -14.78       |
| 300       | 0.603 | -172.63      | 5.641  | 82.89        | 0.033 | 76.27        | 0.520 | -15.94       |
| 400       | 0.611 | -176.28      | 4.254  | 77.21        | 0.043 | 79.95        | 0.521 | -17.71       |
| 500       | 0.618 | -178.98      | 3.421  | 72.11        | 0.052 | 83.78        | 0.530 | -20.31       |
| 600       | 0.629 | -178.44      | 2.851  | 67.60        | 0.064 | 86.83        | 0.538 | -23.39       |
| 700       | 0.639 | -176.23      | 2.452  | 63.15        | 0.074 | 88.24        | 0.546 | -26.40       |
| 800       | 0.647 | -174.01      | 2.155  | 59.33        | 0.087 | 89.54        | 0.555 | -29.74       |
| 900       | 0.657 | -171.87      | 1.921  | 55.44        | 0.099 | 92.59        | 0.568 | -33.37       |
| 1000      | 0.664 | -169.65      | 1.740  | 51.95        | 0.113 | 94.10        | 0.581 | -36.94       |

Land Pattern Example

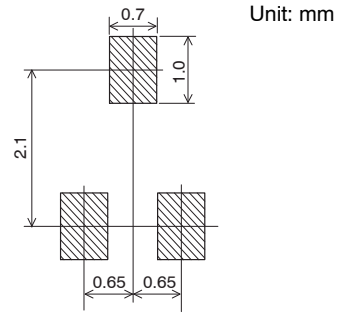
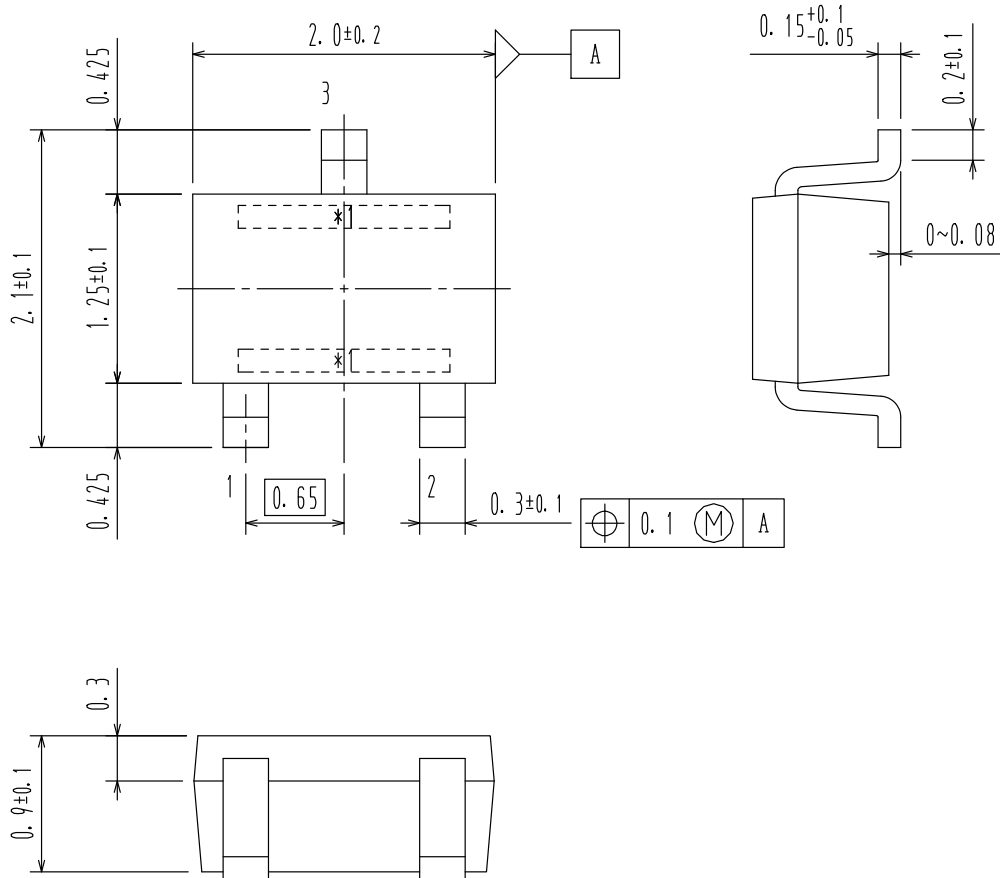


Figure 10. Land Pattern Example



SC-70 / MCP3  
CASE 419AJ  
ISSUE O

DATE 30 NOV 2011



|                         |                     |   |
|-------------------------|---------------------|---|
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