

MCH4009

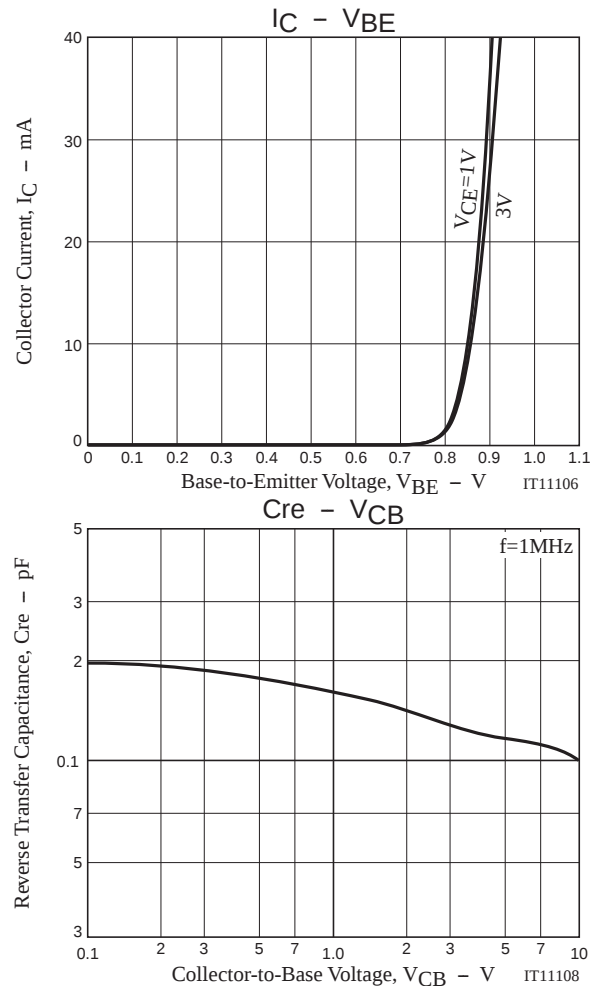
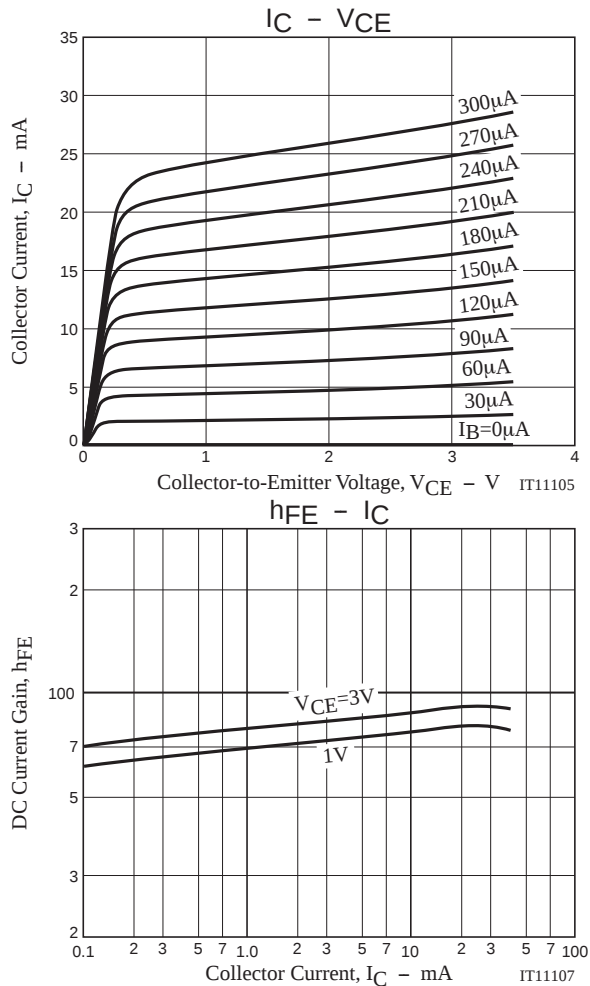
Electrical Characteristics at Ta=25°C

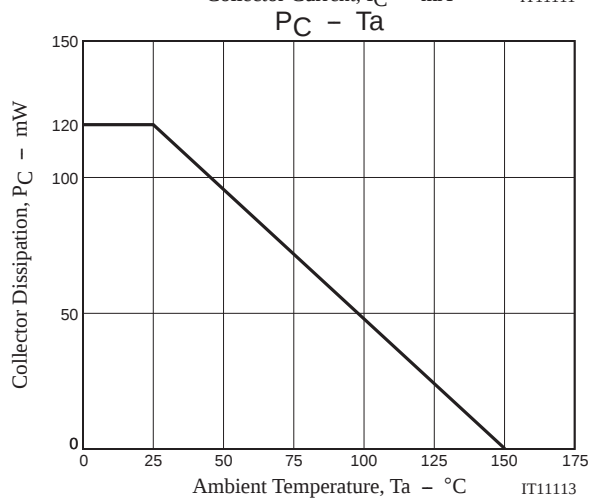
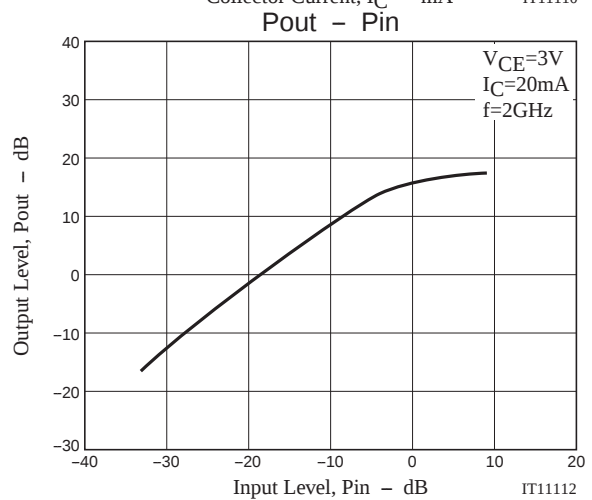
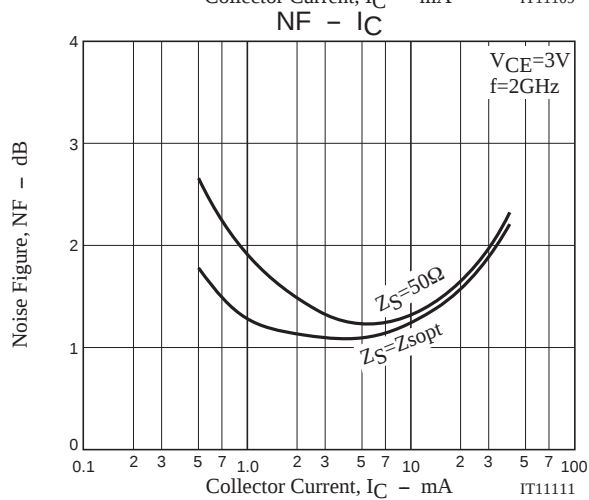
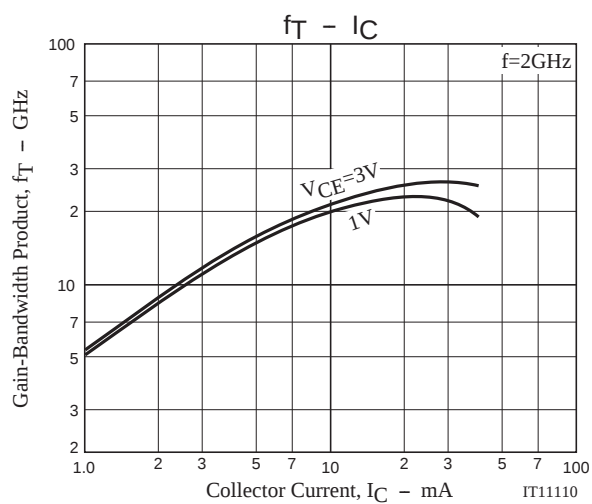
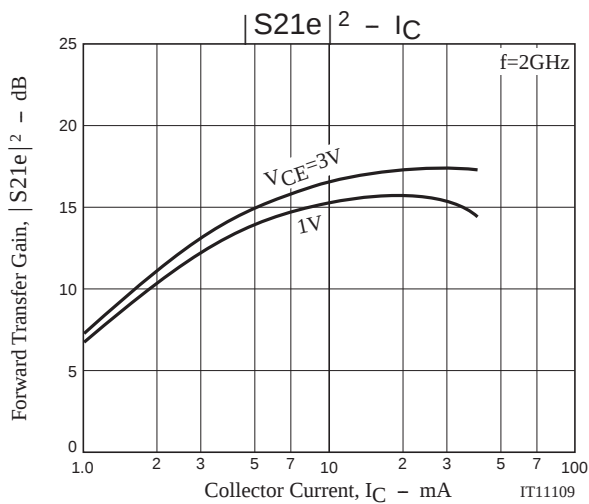
| Parameter                    | Symbol                                       | Conditions                                        | Ratings |      |     | Unit |
|------------------------------|----------------------------------------------|---------------------------------------------------|---------|------|-----|------|
|                              |                                              |                                                   | min     | typ  | max |      |
| Collector Cutoff Current     | ICBO                                         | V <sub>CB</sub> =5V, I <sub>E</sub> =0A           |         |      | 1.0 | μA   |
| Emitter Cutoff Current       | IEBO                                         | V <sub>EB</sub> =1V, I <sub>C</sub> =0A           |         |      | 1.0 | μA   |
| DC Current Gain              | h <sub>FE</sub>                              | V <sub>CE</sub> =1V, I <sub>C</sub> =5mA          | 50      |      | 120 |      |
| Gain-Bandwidth Product       | f <sub>T</sub>                               | V <sub>CE</sub> =3V, I <sub>C</sub> =20mA         | 20      | 25   |     | GHz  |
| Reverse Transfer Capacitance | C <sub>re</sub>                              | V <sub>CB</sub> =1V, f=1MHz                       |         | 0.15 |     | pF   |
| Forward Transfer Gain        | S <sub>21e</sub>   <sup>2</sup> <sub>1</sub> | V <sub>CE</sub> =1V, I <sub>C</sub> =5mA, f=2GHz  | 9       | 13.5 |     | dB   |
|                              | S <sub>21e</sub>   <sup>2</sup> <sub>2</sub> | V <sub>CE</sub> =3V, I <sub>C</sub> =20mA, f=2GHz |         | 17   |     | dB   |
| Noise Figure                 | NF                                           | V <sub>CE</sub> =1V, I <sub>C</sub> =5mA, f=2GHz  |         | 1.1  | 1.5 | dB   |
| 1dB Compression Point        | PO(1dB)                                      | V <sub>CE</sub> =3V, I <sub>C</sub> =20mA, f=2GHz |         | 13.5 |     | dBm  |
| 3rd Order Intercept Point    | OIP <sub>3</sub>                             | V <sub>CE</sub> =3V, I <sub>C</sub> =20mA, f=2GHz |         | 23   |     | dBm  |

Note) Pay attention to handling since it is liable to be affected by static electricity due to the high-frequency process adopted.

Ordering Information

| Device       | Package | Shipping       | memo                     |
|--------------|---------|----------------|--------------------------|
| MCH4009-TL-H | MCPH4   | 3,000pcs./reel | Pb Free and Halogen Free |





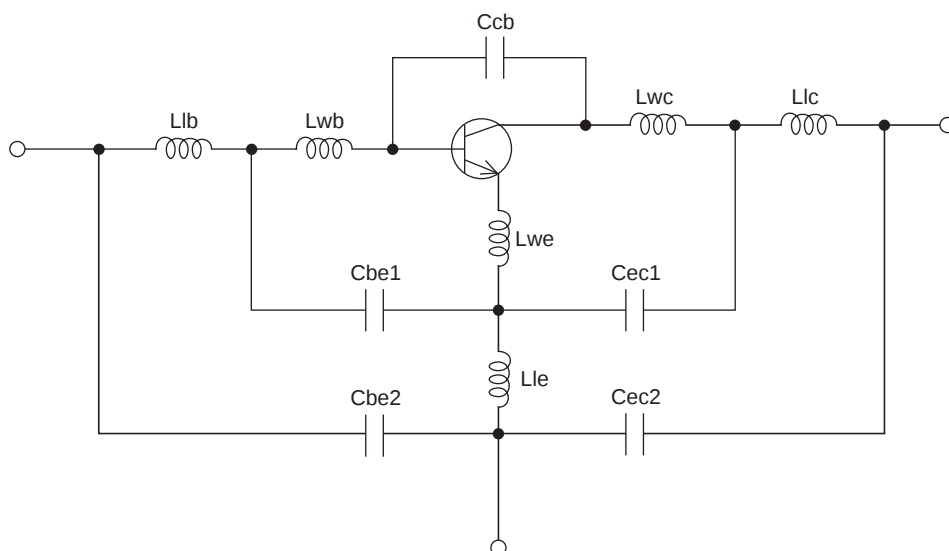
## MCH4009

## SPICE Parameters

model: Gummel-Poon

| Parameter | Value  | Unit | Parameter | Value  | Unit |
|-----------|--------|------|-----------|--------|------|
| IS        | 38.78a | A    | XTF       | 11.00f |      |
| BF        | 107.6  |      | VTF       | 81.1   | V    |
| NF        | 1.002  |      | ITF       | 1.55   | A    |
| VAF       | 34.79  | V    | PTF       | 32     | °C   |
| IKF       | 199.6m | A    | CJC       | 214.0f | F    |
| ISE       | 138.1f | A    | VJC       | 111.7m | V    |
| NE        | 2.5    |      | MJC       | 118.0m |      |
| BR        | 1.5    |      | XCJC      | 833.8m |      |
| NR        | 1.05   |      | TR        | 50.00p | S    |
| VAR       | 200    | V    | FC        | 8.105m |      |
| IKR       | 20.00μ | A    | CJS       | 123.2f | F    |
| ISC       | 0      | A    | VJS       | 140.0f | V    |
| NC        | 2      |      | MJS       | 150    |      |
| RB        | 8.5    | Ω    | Lwb       | 415p   | H    |
| IRB       | 143.2m | A    | Llb       | 210p   | H    |
| RBM       | 1.584  | Ω    | Lwe       | 243.6p | H    |
| RE        | 1.022  | Ω    | Lle       | 12.8p  | H    |
| RC        | 3.675  | Ω    | Lwc       | 330p   | H    |
| XTB       | 0      |      | Llc       | 651.5p | H    |
| EG        | 1.11   | eV   | Ccb       | 26.7f  | F    |
| XTI       | 3      |      | Cec1      | 185.4f | F    |
| CJE       | 250.0f | F    | Cec2      | 40f    | F    |
| VJE       | 23.00m | V    | Cbe1      | 65f    | F    |
| MJE       | 21.60m |      | Cbe2      | 25.2f  | F    |
| TF        | 5.398p | S    |           |        |      |

### Schematic



IT11114

\*Information (including circuit diagrams and circuit parameters) herein is for example only ; it is not guaranteed for volume production.

## MCH4009

### S Parameters (Common emitter)

V<sub>CE</sub>=1V, I<sub>C</sub>=5mA

| Freq(MHz) | S <sub>11</sub> | ∠S <sub>11</sub> | S <sub>21</sub> | ∠S <sub>21</sub> | S <sub>12</sub> | ∠S <sub>12</sub> | S <sub>22</sub> | ∠S <sub>22</sub> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 500       | 0.801           | -49.4            | 10.891          | 140.0            | 0.046           | 63.0             | 0.783           | -36.9            |
| 1000      | 0.662           | -87.0            | 8.137           | 115.4            | 0.071           | 46.0             | 0.571           | -58.5            |
| 1500      | 0.567           | -113.5           | 6.269           | 98.7             | 0.083           | 37.4             | 0.431           | -72.5            |
| 2000      | 0.521           | -131.1           | 4.982           | 86.7             | 0.091           | 32.9             | 0.346           | -82.4            |
| 2500      | 0.479           | -147.7           | 4.152           | 77.3             | 0.097           | 30.1             | 0.294           | -91.0            |
| 3000      | 0.461           | -160.2           | 3.534           | 68.0             | 0.102           | 28.1             | 0.253           | -95.9            |
| 3500      | 0.454           | -170.5           | 3.096           | 60.2             | 0.107           | 27.1             | 0.223           | -100.3           |
| 4000      | 0.450           | -179.1           | 2.762           | 52.9             | 0.113           | 25.3             | 0.201           | -103.1           |
| 4500      | 0.445           | 173.1            | 2.524           | 45.8             | 0.120           | 24.0             | 0.178           | -106.4           |
| 5000      | 0.437           | 165.9            | 2.327           | 38.7             | 0.127           | 21.9             | 0.161           | -109.5           |
| 5500      | 0.426           | 158.4            | 2.132           | 32.0             | 0.135           | 18.9             | 0.161           | -112.6           |
| 6000      | 0.409           | 147.6            | 2.059           | 24.2             | 0.143           | 16.1             | 0.130           | -124.6           |
| 6500      | 0.401           | 135.5            | 1.948           | 16.5             | 0.152           | 12.1             | 0.121           | -137.7           |
| 7000      | 0.408           | 121.5            | 1.840           | 8.4              | 0.157           | 7.8              | 0.117           | -154.8           |
| 7500      | 0.435           | 108.4            | 1.725           | 0.5              | 0.161           | 3.3              | 0.117           | -171.6           |
| 8000      | 0.466           | 97.5             | 1.613           | -7.2             | 0.164           | -0.9             | 0.112           | 168.6            |
| 8500      | 0.509           | 90.3             | 1.513           | -14.4            | 0.168           | -5.5             | 0.114           | 148.9            |
| 9000      | 0.541           | 84.6             | 1.412           | -21.3            | 0.169           | -9.8             | 0.117           | 127.8            |
| 9500      | 0.568           | 80.7             | 1.338           | -27.7            | 0.172           | -13.7            | 0.132           | 107.8            |
| 10000     | 0.588           | 75.4             | 1.276           | -34.8            | 0.175           | -18.9            | 0.164           | 91.3             |
| 10500     | 0.599           | 70.5             | 1.213           | -42.0            | 0.173           | -24.2            | 0.201           | 82.3             |
| 11000     | 0.610           | 60.8             | 1.150           | -49.4            | 0.176           | -29.9            | 0.240           | 77.0             |
| 11500     | 0.622           | 51.5             | 1.093           | -57.0            | 0.177           | -36.1            | 0.275           | 74.3             |
| 12000     | 0.653           | 41.6             | 1.029           | -65.3            | 0.172           | -42.7            | 0.311           | 70.8             |
| 12500     | 0.687           | 33.1             | 0.959           | -72.8            | 0.167           | -48.5            | 0.331           | 67.0             |
| 13000     | 0.711           | 27.0             | 0.886           | -80.1            | 0.161           | -53.6            | 0.347           | 60.4             |
| 13500     | 0.741           | 23.6             | 0.824           | -86.4            | 0.158           | -58.4            | 0.351           | 52.6             |
| 14000     | 0.757           | 22.1             | 0.774           | -92.9            | 0.154           | -63.4            | 0.364           | 42.7             |
| 14500     | 0.757           | 20.6             | 0.725           | -98.7            | 0.157           | -67.6            | 0.382           | 33.0             |
| 15000     | 0.758           | 19.4             | 0.684           | -104.8           | 0.159           | -73.0            | 0.404           | 27.4             |

## MCH4009

### S Parameters (Common emitter)

$V_{CE}=1V$ ,  $I_C=10mA$

| Freq(MHz) | S11   | $\angle S11$ | S21    | $\angle S21$ | S12   | $\angle S12$ | S22   | $\angle S22$ |
|-----------|-------|--------------|--------|--------------|-------|--------------|-------|--------------|
| 500       | 0.665 | -68.4        | 16.105 | 129.6        | 0.040 | 58.4         | 0.676 | -48.9        |
| 1000      | 0.536 | -109.6       | 10.494 | 105.3        | 0.056 | 46.4         | 0.437 | -72.8        |
| 1500      | 0.475 | -134.8       | 7.518  | 90.9         | 0.067 | 42.6         | 0.310 | -87.7        |
| 2000      | 0.448 | -150.5       | 5.820  | 80.6         | 0.076 | 41.3         | 0.240 | -98.9        |
| 2500      | 0.428 | -164.9       | 4.763  | 72.3         | 0.085 | 40.3         | 0.200 | -108.1       |
| 3000      | 0.421 | -175.6       | 4.030  | 64.4         | 0.094 | 39.2         | 0.167 | -114.4       |
| 3500      | 0.419 | 175.8        | 3.511  | 57.3         | 0.104 | 37.4         | 0.141 | -119.4       |
| 4000      | 0.418 | 168.6        | 3.130  | 50.5         | 0.113 | 35.3         | 0.120 | -122.6       |
| 4500      | 0.416 | 162.1        | 2.843  | 43.9         | 0.122 | 32.9         | 0.098 | -126.9       |
| 5000      | 0.409 | 155.7        | 2.616  | 37.1         | 0.132 | 30.1         | 0.082 | -130.0       |
| 5500      | 0.398 | 148.7        | 2.430  | 30.6         | 0.143 | 26.7         | 0.074 | -132.1       |
| 6000      | 0.387 | 138.2        | 2.296  | 23.2         | 0.153 | 22.4         | 0.061 | -154.0       |
| 6500      | 0.385 | 126.4        | 2.162  | 15.8         | 0.162 | 17.6         | 0.066 | -174.5       |
| 7000      | 0.399 | 113.2        | 2.034  | 8.0          | 0.169 | 12.6         | 0.078 | 163.9        |
| 7500      | 0.429 | 101.2        | 1.904  | 0.5          | 0.174 | 7.4          | 0.094 | 147.2        |
| 8000      | 0.463 | 91.5         | 1.774  | -6.8         | 0.178 | 2.7          | 0.110 | 128.3        |
| 8500      | 0.506 | 85.3         | 1.661  | -13.7        | 0.181 | -2.2         | 0.128 | 112.1        |
| 9000      | 0.538 | 80.6         | 1.555  | -20.5        | 0.183 | -7.1         | 0.148 | 95.7         |
| 9500      | 0.566 | 77.1         | 1.473  | -26.6        | 0.187 | -11.8        | 0.174 | 82.1         |
| 10000     | 0.586 | 72.4         | 1.395  | -33.5        | 0.188 | -17.1        | 0.211 | 72.4         |
| 10500     | 0.596 | 67.5         | 1.327  | -40.3        | 0.187 | -22.4        | 0.249 | 66.3         |
| 11000     | 0.611 | 58.0         | 1.261  | -47.4        | 0.188 | -28.5        | 0.282 | 63.3         |
| 11500     | 0.623 | 48.9         | 1.199  | -54.8        | 0.188 | -34.8        | 0.312 | 61.6         |
| 12000     | 0.654 | 39.3         | 1.131  | -62.7        | 0.183 | -41.8        | 0.345 | 59.4         |
| 12500     | 0.691 | 31.0         | 1.056  | -70.1        | 0.177 | -47.7        | 0.361 | 55.5         |
| 13000     | 0.715 | 25.2         | 0.978  | -77.2        | 0.172 | -52.7        | 0.375 | 49.4         |
| 13500     | 0.744 | 22.0         | 0.912  | -83.5        | 0.169 | -57.4        | 0.380 | 41.4         |
| 14000     | 0.756 | 20.6         | 0.859  | -89.6        | 0.167 | -62.0        | 0.394 | 32.0         |
| 14500     | 0.759 | 19.4         | 0.808  | -95.4        | 0.168 | -67.2        | 0.410 | 23.1         |
| 15000     | 0.756 | 18.1         | 0.774  | -101.1       | 0.171 | -72.6        | 0.428 | 16.9         |

## MCH4009

### S Parameters (Common emitter)

V<sub>CE</sub>=1V, I<sub>C</sub>=20mA

| Freq(MHz) | S <sub>11</sub> | ∠S <sub>11</sub> | S <sub>21</sub> | ∠S <sub>21</sub> | S <sub>12</sub> | ∠S <sub>12</sub> | S <sub>22</sub> | ∠S <sub>22</sub> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 500       | 0.537           | -90.6            | 19.515          | 119.9            | 0.033           | 56.6             | 0.560           | -60.3            |
| 1000      | 0.463           | -131.2           | 11.501          | 98.0             | 0.047           | 50.3             | 0.333           | -86.0            |
| 1500      | 0.437           | -152.5           | 7.973           | 85.6             | 0.058           | 49.6             | 0.233           | -102.7           |
| 2000      | 0.425           | -165.4           | 6.106           | 76.7             | 0.070           | 49.8             | 0.179           | -116.2           |
| 2500      | 0.417           | -177.7           | 4.959           | 69.1             | 0.081           | 48.1             | 0.149           | -127.4           |
| 3000      | 0.416           | 173.4            | 4.188           | 61.8             | 0.093           | 46.1             | 0.126           | -136.7           |
| 3500      | 0.417           | 166.1            | 3.640           | 55.1             | 0.104           | 43.9             | 0.104           | -144.6           |
| 4000      | 0.417           | 159.8            | 3.241           | 48.6             | 0.115           | 41.2             | 0.086           | -151.3           |
| 4500      | 0.416           | 154.1            | 2.933           | 42.2             | 0.127           | 38.2             | 0.068           | -162.2           |
| 5000      | 0.408           | 148.1            | 2.702           | 35.7             | 0.138           | 34.3             | 0.053           | -173.4           |
| 5500      | 0.398           | 141.4            | 2.526           | 29.3             | 0.148           | 30.1             | 0.044           | 176.8            |
| 6000      | 0.391           | 131.4            | 2.359           | 22.1             | 0.160           | 25.4             | 0.051           | 150.8            |
| 6500      | 0.392           | 119.9            | 2.216           | 14.7             | 0.169           | 20.1             | 0.068           | 139.9            |
| 7000      | 0.410           | 107.5            | 2.078           | 7.1              | 0.177           | 15.0             | 0.091           | 130.4            |
| 7500      | 0.442           | 96.4             | 1.944           | -0.2             | 0.181           | 9.3              | 0.112           | 120.9            |
| 8000      | 0.478           | 87.6             | 1.804           | -7.5             | 0.187           | 4.2              | 0.136           | 108.3            |
| 8500      | 0.520           | 81.9             | 1.687           | -14.1            | 0.188           | -0.9             | 0.161           | 96.9             |
| 9000      | 0.550           | 77.7             | 1.579           | -20.7            | 0.191           | -6.0             | 0.186           | 83.7             |
| 9500      | 0.576           | 74.5             | 1.497           | -26.6            | 0.194           | -10.9            | 0.215           | 73.0             |
| 10000     | 0.596           | 69.9             | 1.411           | -33.4            | 0.195           | -16.4            | 0.252           | 65.4             |
| 10500     | 0.607           | 65.3             | 1.345           | -40.0            | 0.195           | -21.5            | 0.288           | 60.1             |
| 11000     | 0.623           | 56.0             | 1.276           | -47.0            | 0.195           | -27.9            | 0.320           | 57.3             |
| 11500     | 0.635           | 47.0             | 1.214           | -54.2            | 0.195           | -34.3            | 0.346           | 55.8             |
| 12000     | 0.666           | 37.5             | 1.146           | -62.0            | 0.190           | -41.3            | 0.375           | 53.5             |
| 12500     | 0.700           | 29.5             | 1.068           | -69.1            | 0.183           | -46.7            | 0.391           | 49.9             |
| 13000     | 0.725           | 23.9             | 0.990           | -76.1            | 0.176           | -52.1            | 0.405           | 43.7             |
| 13500     | 0.752           | 21.0             | 0.923           | -82.2            | 0.175           | -56.9            | 0.409           | 36.0             |
| 14000     | 0.766           | 19.6             | 0.869           | -88.3            | 0.171           | -61.8            | 0.423           | 26.6             |
| 14500     | 0.765           | 18.3             | 0.816           | -94.0            | 0.172           | -66.5            | 0.439           | 18.2             |
| 15000     | 0.763           | 17.1             | 0.794           | -99.4            | 0.176           | -71.9            | 0.455           | 12.0             |

## MCH4009

### S Parameters (Common emitter)

V<sub>CE</sub>=1V, I<sub>C</sub>=30mA

| Freq(MHz) | S <sub>11</sub> | ∠S <sub>11</sub> | S <sub>21</sub> | ∠S <sub>21</sub> | S <sub>12</sub> | ∠S <sub>12</sub> | S <sub>22</sub> | ∠S <sub>22</sub> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 500       | 0.489           | -105.9           | 19.643          | 115.2            | 0.031           | 55.0             | 0.490           | -66.6            |
| 1000      | 0.453           | -142.8           | 11.260          | 94.8             | 0.044           | 52.3             | 0.286           | -93.3            |
| 1500      | 0.441           | -161.4           | 7.725           | 83.4             | 0.056           | 52.4             | 0.202           | -111.9           |
| 2000      | 0.435           | -172.7           | 5.906           | 74.8             | 0.068           | 52.5             | 0.158           | -126.9           |
| 2500      | 0.432           | 176.2            | 4.789           | 67.3             | 0.082           | 50.9             | 0.135           | -139.4           |
| 3000      | 0.433           | 168.2            | 4.041           | 60.3             | 0.094           | 48.4             | 0.117           | -149.3           |
| 3500      | 0.435           | 161.4            | 3.509           | 53.7             | 0.105           | 46.0             | 0.099           | -159.4           |
| 4000      | 0.434           | 155.5            | 3.125           | 47.3             | 0.117           | 43.0             | 0.083           | -168.8           |
| 4500      | 0.433           | 150.1            | 2.821           | 40.9             | 0.129           | 39.6             | 0.069           | 176.7            |
| 5000      | 0.426           | 144.2            | 2.604           | 34.4             | 0.140           | 35.6             | 0.059           | 161.8            |
| 5500      | 0.415           | 137.6            | 2.447           | 28.0             | 0.151           | 31.5             | 0.052           | 150.0            |
| 6000      | 0.411           | 127.7            | 2.271           | 20.7             | 0.163           | 26.3             | 0.065           | 132.1            |
| 6500      | 0.413           | 116.6            | 2.129           | 13.3             | 0.173           | 20.9             | 0.083           | 126.0            |
| 7000      | 0.432           | 104.5            | 1.989           | 5.7              | 0.180           | 15.3             | 0.108           | 119.9            |
| 7500      | 0.465           | 93.9             | 1.860           | -1.6             | 0.186           | 9.8              | 0.129           | 112.7            |
| 8000      | 0.500           | 85.4             | 1.723           | -8.7             | 0.189           | 4.4              | 0.155           | 102.6            |
| 8500      | 0.541           | 80.1             | 1.608           | -15.5            | 0.192           | -0.5             | 0.181           | 92.0             |
| 9000      | 0.569           | 76.0             | 1.506           | -21.8            | 0.194           | -5.8             | 0.206           | 80.5             |
| 9500      | 0.594           | 72.9             | 1.428           | -27.7            | 0.197           | -10.6            | 0.235           | 70.8             |
| 10000     | 0.613           | 68.4             | 1.342           | -34.5            | 0.199           | -16.4            | 0.272           | 63.4             |
| 10500     | 0.622           | 63.8             | 1.280           | -41.0            | 0.197           | -21.3            | 0.308           | 58.2             |
| 11000     | 0.638           | 54.6             | 1.215           | -47.9            | 0.197           | -27.7            | 0.338           | 55.5             |
| 11500     | 0.650           | 45.6             | 1.155           | -55.1            | 0.198           | -34.2            | 0.364           | 53.8             |
| 12000     | 0.682           | 36.4             | 1.088           | -62.7            | 0.192           | -41.3            | 0.392           | 51.6             |
| 12500     | 0.715           | 28.4             | 1.013           | -69.8            | 0.185           | -46.9            | 0.406           | 47.7             |
| 13000     | 0.736           | 23.0             | 0.938           | -76.7            | 0.179           | -52.2            | 0.420           | 41.5             |
| 13500     | 0.760           | 20.1             | 0.872           | -82.6            | 0.177           | -57.0            | 0.424           | 34.2             |
| 14000     | 0.772           | 18.9             | 0.822           | -88.7            | 0.173           | -61.9            | 0.440           | 25.2             |
| 14500     | 0.773           | 17.5             | 0.773           | -94.1            | 0.174           | -66.2            | 0.452           | 16.9             |
| 15000     | 0.771           | 16.3             | 0.756           | -99.3            | 0.177           | -71.7            | 0.470           | 10.3             |

## MCH4009

### S Parameters (Common emitter)

$V_{CE}=3V$ ,  $I_C=5mA$

| Freq(MHz) | S11   | $\angle S11$ | S21    | $\angle S21$ | S12   | $\angle S12$ | S22   | $\angle S22$ |
|-----------|-------|--------------|--------|--------------|-------|--------------|-------|--------------|
| 500       | 0.832 | -42.0        | 11.342 | 143.7        | 0.035 | 67.9         | 0.835 | -29.1        |
| 1000      | 0.693 | -76.2        | 8.817  | 119.7        | 0.057 | 52.4         | 0.646 | -47.2        |
| 1500      | 0.581 | -101.6       | 6.951  | 102.7        | 0.068 | 42.9         | 0.507 | -58.3        |
| 2000      | 0.519 | -119.3       | 5.587  | 90.5         | 0.076 | 37.6         | 0.420 | -65.5        |
| 2500      | 0.465 | -135.9       | 4.695  | 80.9         | 0.081 | 35.3         | 0.364 | -71.4        |
| 3000      | 0.436 | -149.0       | 3.997  | 71.6         | 0.085 | 33.3         | 0.327 | -74.4        |
| 3500      | 0.422 | -160.1       | 3.507  | 63.8         | 0.090 | 32.4         | 0.300 | -77.0        |
| 4000      | 0.414 | -169.2       | 3.129  | 56.6         | 0.096 | 31.1         | 0.284 | -78.7        |
| 4500      | 0.406 | -177.3       | 2.861  | 49.6         | 0.101 | 30.6         | 0.266 | -80.3        |
| 5000      | 0.395 | -175.4       | 2.637  | 42.7         | 0.107 | 29.0         | 0.255 | -82.3        |
| 5500      | 0.383 | -168.1       | 2.397  | 36.3         | 0.114 | 26.4         | 0.257 | -86.0        |
| 6000      | 0.359 | -157.5       | 2.340  | 28.9         | 0.122 | 23.8         | 0.227 | -90.3        |
| 6500      | 0.345 | -145.1       | 2.218  | 21.4         | 0.130 | 20.8         | 0.215 | -97.8        |
| 7000      | 0.347 | -130.0       | 2.105  | 13.5         | 0.137 | 16.9         | 0.201 | -107.2       |
| 7500      | 0.370 | -115.2       | 1.981  | 5.8          | 0.141 | 12.7         | 0.188 | -117.5       |
| 8000      | 0.400 | -103.2       | 1.865  | -1.8         | 0.145 | 8.7          | 0.168 | -126.7       |
| 8500      | 0.444 | -95.1        | 1.756  | -9.0         | 0.151 | 5.1          | 0.147 | -137.3       |
| 9000      | 0.480 | -89.2        | 1.645  | -16.0        | 0.153 | 0.6          | 0.120 | -148.1       |
| 9500      | 0.510 | -85.2        | 1.566  | -22.3        | 0.157 | -3.0         | 0.093 | -163.7       |
| 10000     | 0.531 | -79.9        | 1.507  | -29.4        | 0.162 | -7.8         | 0.075 | -165.4       |
| 10500     | 0.547 | -75.2        | 1.436  | -36.6        | 0.161 | -13.2        | 0.090 | -132.6       |
| 11000     | 0.559 | -65.3        | 1.371  | -44.2        | 0.164 | -18.6        | 0.122 | -114.0       |
| 11500     | 0.574 | -55.7        | 1.310  | -52.0        | 0.167 | -24.2        | 0.162 | -106.3       |
| 12000     | 0.608 | -45.4        | 1.242  | -60.7        | 0.165 | -31.6        | 0.206 | -99.1        |
| 12500     | 0.645 | -36.2        | 1.159  | -68.6        | 0.160 | -37.3        | 0.232 | -93.2        |
| 13000     | 0.677 | -29.8        | 1.076  | -76.3        | 0.156 | -42.6        | 0.252 | -85.4        |
| 13500     | 0.710 | -26.1        | 1.001  | -82.9        | 0.154 | -47.7        | 0.258 | -76.6        |
| 14000     | 0.729 | -24.4        | 0.939  | -89.7        | 0.151 | -52.4        | 0.266 | -64.8        |
| 14500     | 0.734 | -23.0        | 0.889  | -95.8        | 0.152 | -57.7        | 0.284 | -52.0        |
| 15000     | 0.735 | -21.6        | 0.828  | -102.4       | 0.156 | -63.5        | 0.310 | -45.1        |

## MCH4009

### S Parameters (Common emitter)

V<sub>CE</sub>=3V, I<sub>C</sub>=10mA

| Freq(MHz) | S <sub>11</sub> | ∠S <sub>11</sub> | S <sub>21</sub> | ∠S <sub>21</sub> | S <sub>12</sub> | ∠S <sub>12</sub> | S <sub>22</sub> | ∠S <sub>22</sub> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 500       | 0.702           | -56.3            | 17.369          | 134.5            | 0.030           | 64.1             | 0.751           | -37.2            |
| 1000      | 0.548           | -95.2            | 11.870          | 109.5            | 0.047           | 51.6             | 0.521           | -56.1            |
| 1500      | 0.460           | -120.2           | 8.647           | 94.5             | 0.056           | 47.3             | 0.386           | -65.7            |
| 2000      | 0.417           | -137.4           | 6.729           | 84.0             | 0.064           | 45.7             | 0.308           | -71.4            |
| 2500      | 0.384           | -152.5           | 5.523           | 75.6             | 0.072           | 44.9             | 0.263           | -75.7            |
| 3000      | 0.371           | -164.2           | 4.678           | 67.6             | 0.080           | 43.7             | 0.234           | -77.6            |
| 3500      | 0.364           | -173.8           | 4.075           | 60.6             | 0.088           | 42.4             | 0.212           | -78.7            |
| 4000      | 0.360           | 178.4            | 3.626           | 53.9             | 0.096           | 40.8             | 0.199           | -78.7            |
| 4500      | 0.356           | 171.7            | 3.298           | 47.5             | 0.105           | 38.7             | 0.188           | -78.3            |
| 5000      | 0.347           | 165.1            | 3.031           | 41.0             | 0.113           | 35.8             | 0.179           | -78.7            |
| 5500      | 0.335           | 158.3            | 2.799           | 34.7             | 0.122           | 33.1             | 0.177           | -80.7            |
| 6000      | 0.317           | 147.9            | 2.664           | 27.8             | 0.131           | 29.5             | 0.161           | -84.8            |
| 6500      | 0.310           | 135.5            | 2.518           | 20.6             | 0.140           | 25.5             | 0.150           | -93.0            |
| 7000      | 0.320           | 120.9            | 2.381           | 13.2             | 0.147           | 21.1             | 0.136           | -104.2           |
| 7500      | 0.348           | 107.1            | 2.239           | 5.8              | 0.152           | 16.0             | 0.124           | -117.2           |
| 8000      | 0.383           | 96.4             | 2.101           | -1.4             | 0.157           | 11.5             | 0.103           | -129.8           |
| 8500      | 0.428           | 89.7             | 1.978           | -8.3             | 0.162           | 7.0              | 0.083           | -145.3           |
| 9000      | 0.464           | 84.7             | 1.859           | -15.0            | 0.164           | 2.9              | 0.057           | -166.6           |
| 9500      | 0.493           | 81.3             | 1.769           | -21.2            | 0.169           | -1.5             | 0.041           | 153.8            |
| 10000     | 0.517           | 77.1             | 1.691           | -28.0            | 0.173           | -6.9             | 0.057           | 106.2            |
| 10500     | 0.533           | 72.1             | 1.616           | -35.0            | 0.173           | -12.3            | 0.095           | 88.8             |
| 11000     | 0.549           | 62.7             | 1.546           | -42.2            | 0.176           | -17.9            | 0.132           | 83.0             |
| 11500     | 0.564           | 53.3             | 1.479           | -49.9            | 0.176           | -24.3            | 0.169           | 82.2             |
| 12000     | 0.602           | 43.2             | 1.405           | -58.1            | 0.175           | -31.1            | 0.211           | 80.5             |
| 12500     | 0.639           | 34.3             | 1.317           | -65.8            | 0.171           | -37.1            | 0.236           | 76.7             |
| 13000     | 0.672           | 28.2             | 1.226           | -73.5            | 0.165           | -42.7            | 0.257           | 69.9             |
| 13500     | 0.704           | 24.8             | 1.141           | -80.0            | 0.163           | -47.9            | 0.262           | 61.4             |
| 14000     | 0.725           | 23.3             | 1.078           | -86.6            | 0.160           | -52.4            | 0.275           | 49.6             |
| 14500     | 0.728           | 21.9             | 1.014           | -92.8            | 0.161           | -58.5            | 0.292           | 38.2             |
| 15000     | 0.729           | 20.5             | 0.966           | -99.0            | 0.163           | -63.4            | 0.315           | 30.9             |

## MCH4009

### S Parameters (Common emitter)

V<sub>CE</sub>=3V, I<sub>C</sub>=20mA

| Freq(MHz) | S <sub>11</sub> | ∠S <sub>11</sub> | S <sub>21</sub> | ∠S <sub>21</sub> | S <sub>12</sub> | ∠S <sub>12</sub> | S <sub>22</sub> | ∠S <sub>22</sub> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 500       | 0.562           | -72.2            | 22.269          | 125.7            | 0.026           | 62.0             | 0.659           | -43.9            |
| 1000      | 0.442           | -113.0           | 13.651          | 102.2            | 0.039           | 56.1             | 0.421           | -61.7            |
| 1500      | 0.389           | -136.8           | 9.560           | 89.2             | 0.049           | 54.2             | 0.302           | -69.8            |
| 2000      | 0.364           | -152.5           | 7.334           | 79.9             | 0.059           | 52.9             | 0.237           | -74.2            |
| 2500      | 0.347           | -165.9           | 5.959           | 72.3             | 0.069           | 52.3             | 0.200           | -77.4            |
| 3000      | 0.341           | -176.1           | 5.031           | 65.2             | 0.078           | 50.2             | 0.178           | -78.2            |
| 3500      | 0.340           | 175.8            | 4.372           | 58.6             | 0.089           | 48.3             | 0.162           | -77.7            |
| 4000      | 0.339           | 169.1            | 3.886           | 52.3             | 0.098           | 46.2             | 0.153           | -76.0            |
| 4500      | 0.335           | 163.4            | 3.524           | 46.1             | 0.108           | 43.5             | 0.145           | -74.3            |
| 5000      | 0.328           | 157.5            | 3.238           | 39.9             | 0.117           | 40.2             | 0.140           | -72.7            |
| 5500      | 0.316           | 150.9            | 3.007           | 33.7             | 0.127           | 36.6             | 0.137           | -73.7            |
| 6000      | 0.302           | 140.8            | 2.833           | 27.1             | 0.137           | 32.4             | 0.126           | -77.4            |
| 6500      | 0.298           | 128.4            | 2.670           | 20.0             | 0.145           | 27.8             | 0.116           | -86.6            |
| 7000      | 0.313           | 114.4            | 2.520           | 12.8             | 0.153           | 23.1             | 0.102           | -99.7            |
| 7500      | 0.346           | 101.7            | 2.367           | 5.7              | 0.159           | 18.1             | 0.088           | -115.9           |
| 8000      | 0.382           | 91.9             | 2.218           | -1.4             | 0.164           | 13.3             | 0.070           | -132.1           |
| 8500      | 0.428           | 86.2             | 2.088           | -8.0             | 0.168           | 8.5              | 0.051           | -156.7           |
| 9000      | 0.462           | 81.8             | 1.964           | -14.6            | 0.171           | 3.9              | 0.033           | 156.9            |
| 9500      | 0.492           | 79.1             | 1.867           | -20.6            | 0.174           | -0.6             | 0.043           | 102.7            |
| 10000     | 0.514           | 75.0             | 1.781           | -27.3            | 0.178           | -6.1             | 0.075           | 79.7             |
| 10500     | 0.532           | 70.2             | 1.705           | -34.1            | 0.180           | -11.2            | 0.115           | 72.5             |
| 11000     | 0.549           | 61.0             | 1.628           | -41.2            | 0.181           | -17.4            | 0.152           | 70.6             |
| 11500     | 0.566           | 51.8             | 1.559           | -48.5            | 0.183           | -23.7            | 0.184           | 72.3             |
| 12000     | 0.603           | 41.9             | 1.484           | -56.7            | 0.180           | -30.6            | 0.224           | 71.7             |
| 12500     | 0.644           | 33.2             | 1.390           | -64.3            | 0.175           | -36.3            | 0.248           | 68.6             |
| 13000     | 0.675           | 27.2             | 1.295           | -71.8            | 0.169           | -41.8            | 0.267           | 62.1             |
| 13500     | 0.707           | 23.9             | 1.210           | -78.3            | 0.167           | -47.1            | 0.275           | 53.7             |
| 14000     | 0.724           | 22.5             | 1.142           | -84.7            | 0.165           | -52.1            | 0.289           | 42.7             |
| 14500     | 0.729           | 21.2             | 1.074           | -91.0            | 0.165           | -57.2            | 0.306           | 31.7             |
| 15000     | 0.730           | 19.9             | 1.032           | -96.8            | 0.167           | -62.9            | 0.328           | 24.1             |

## MCH4009

### S Parameters (Common emitter)

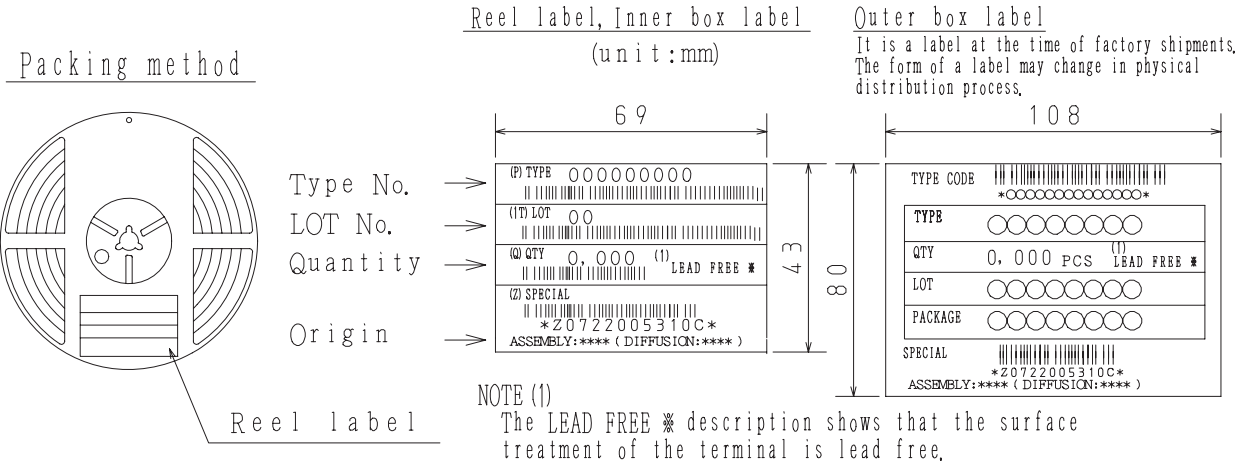
V<sub>CE</sub>=3V, I<sub>C</sub>=30mA

| Freq(MHz) | S <sub>11</sub> | ∠S <sub>11</sub> | S <sub>21</sub> | ∠S <sub>21</sub> | S <sub>12</sub> | ∠S <sub>12</sub> | S <sub>22</sub> | ∠S <sub>22</sub> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 500       | 0.490           | -81.8            | 23.946          | 121.7            | 0.024           | 63.5             | 0.613           | -46.5            |
| 1000      | 0.404           | -123.0           | 14.101          | 99.2             | 0.036           | 57.8             | 0.381           | -62.8            |
| 1500      | 0.368           | -145.3           | 9.747           | 87.1             | 0.047           | 57.2             | 0.271           | -69.8            |
| 2000      | 0.353           | -159.9           | 7.456           | 78.4             | 0.057           | 56.8             | 0.213           | -73.4            |
| 2500      | 0.342           | -172.5           | 6.032           | 70.9             | 0.068           | 55.1             | 0.180           | -75.7            |
| 3000      | 0.340           | 178.3            | 5.086           | 64.0             | 0.078           | 53.1             | 0.161           | -76.2            |
| 3500      | 0.340           | 170.8            | 4.418           | 57.7             | 0.088           | 50.9             | 0.148           | -75.1            |
| 4000      | 0.337           | 164.6            | 3.925           | 51.5             | 0.098           | 48.4             | 0.141           | -73.4            |
| 4500      | 0.336           | 159.1            | 3.556           | 45.4             | 0.108           | 45.3             | 0.135           | -70.8            |
| 5000      | 0.327           | 153.5            | 3.267           | 39.2             | 0.118           | 41.8             | 0.131           | -69.6            |
| 5500      | 0.317           | 147.1            | 3.039           | 33.1             | 0.128           | 38.0             | 0.130           | -70.0            |
| 6000      | 0.306           | 137.1            | 2.856           | 26.4             | 0.138           | 33.5             | 0.120           | -73.8            |
| 6500      | 0.303           | 124.9            | 2.689           | 19.5             | 0.147           | 29.3             | 0.110           | -83.6            |
| 7000      | 0.320           | 111.4            | 2.535           | 12.3             | 0.154           | 24.3             | 0.096           | -96.2            |
| 7500      | 0.354           | 99.2             | 2.380           | 5.3              | 0.161           | 19.0             | 0.082           | -113.2           |
| 8000      | 0.391           | 90.0             | 2.226           | -1.7             | 0.165           | 14.2             | 0.062           | -130.2           |
| 8500      | 0.435           | 84.6             | 2.096           | -8.4             | 0.170           | 9.4              | 0.044           | -158.2           |
| 9000      | 0.469           | 80.4             | 1.971           | -14.8            | 0.172           | 4.3              | 0.029           | 146.9            |
| 9500      | 0.499           | 77.8             | 1.874           | -20.7            | 0.177           | 0.4              | 0.044           | 92.7             |
| 10000     | 0.522           | 73.8             | 1.786           | -27.5            | 0.180           | -5.4             | 0.078           | 75.3             |
| 10500     | 0.537           | 69.3             | 1.709           | -34.2            | 0.182           | -10.4            | 0.120           | 69.4             |
| 11000     | 0.555           | 59.9             | 1.634           | -41.3            | 0.184           | -16.6            | 0.154           | 68.1             |
| 11500     | 0.573           | 50.9             | 1.564           | -48.6            | 0.184           | -22.9            | 0.187           | 69.9             |
| 12000     | 0.611           | 41.2             | 1.487           | -56.7            | 0.182           | -30.1            | 0.225           | 70.0             |
| 12500     | 0.649           | 32.4             | 1.394           | -64.2            | 0.177           | -36.0            | 0.248           | 67.0             |
| 13000     | 0.681           | 26.5             | 1.298           | -71.6            | 0.172           | -41.1            | 0.268           | 60.7             |
| 13500     | 0.711           | 23.4             | 1.210           | -78.1            | 0.169           | -46.4            | 0.278           | 52.2             |
| 14000     | 0.730           | 22.0             | 1.142           | -84.6            | 0.166           | -51.5            | 0.291           | 40.9             |
| 14500     | 0.735           | 20.6             | 1.074           | -90.7            | 0.166           | -56.6            | 0.309           | 30.6             |
| 15000     | 0.734           | 19.3             | 1.037           | -96.5            | 0.169           | -62.7            | 0.332           | 23.0             |

Embossed Taping Specification  
MCH4009-TL-H

1. Packing Format

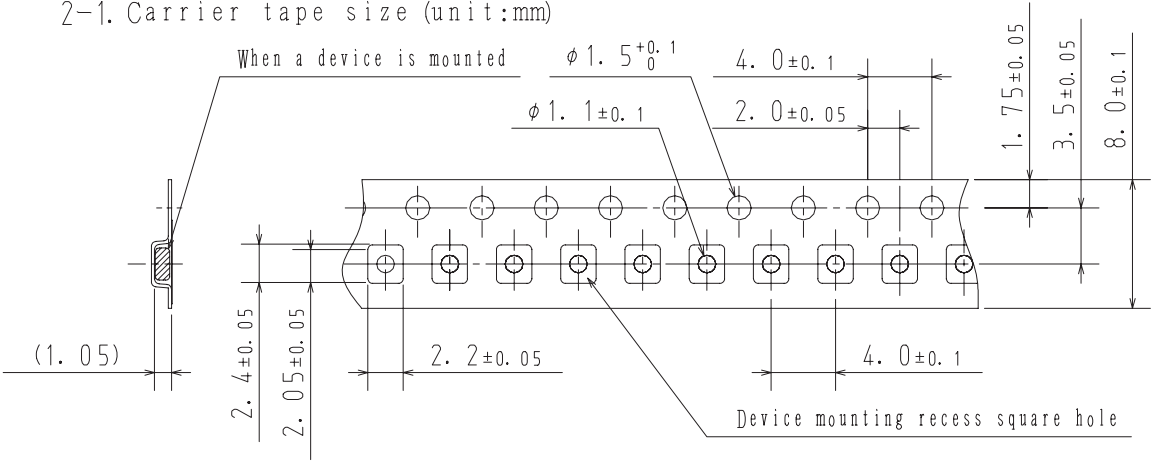
| Package Name | Carrier Tape Type | Maximum Number of devices contained (pcs) |           |           | Packing format                                              |                                                                    |
|--------------|-------------------|-------------------------------------------|-----------|-----------|-------------------------------------------------------------|--------------------------------------------------------------------|
|              |                   | Reel                                      | Inner box | Outer box | Inner BOX (C-1)                                             | Outer BOX (A-7)                                                    |
| MCPH4        | MCP4              | 3,000                                     | 15,000    | 90,000    | 5 reels contained<br>Dimensions:mm (external)<br>183×72×185 | 6 inner boxes contained<br>Dimensions:mm (external)<br>440×195×210 |



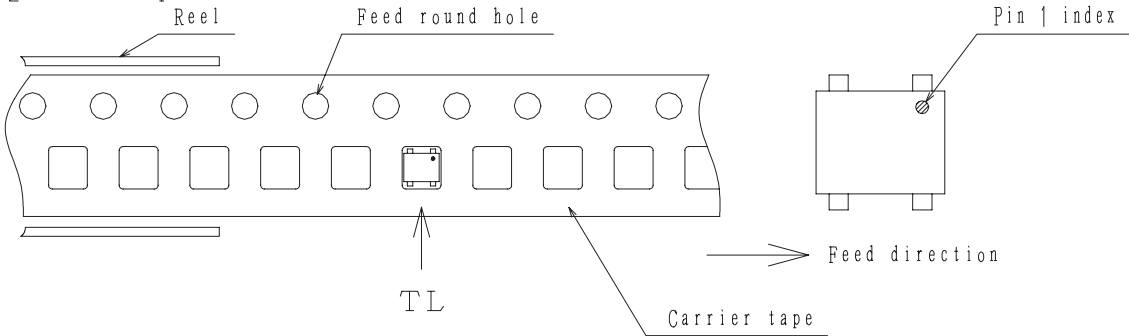
| Label       | JEITA Phase    |
|-------------|----------------|
| LEAD FREE 3 | JEITA Phase 3A |
| LEAD FREE 4 | JEITA Phase 3  |

2. Taping configuration

2-1. Carrier tape size (unit:mm)

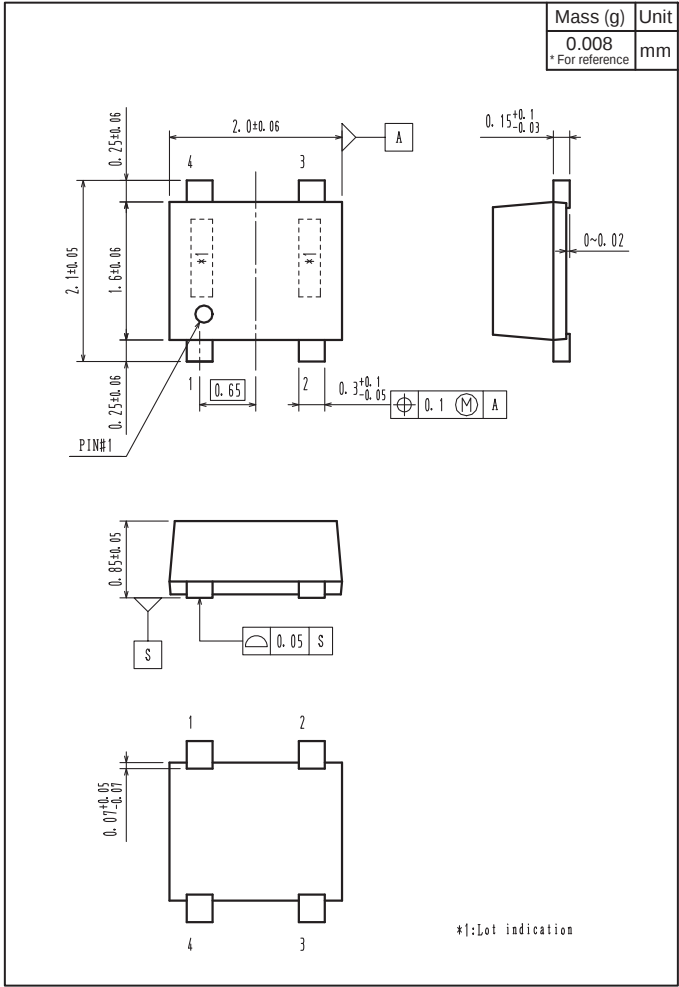


2-2. Device placement direction

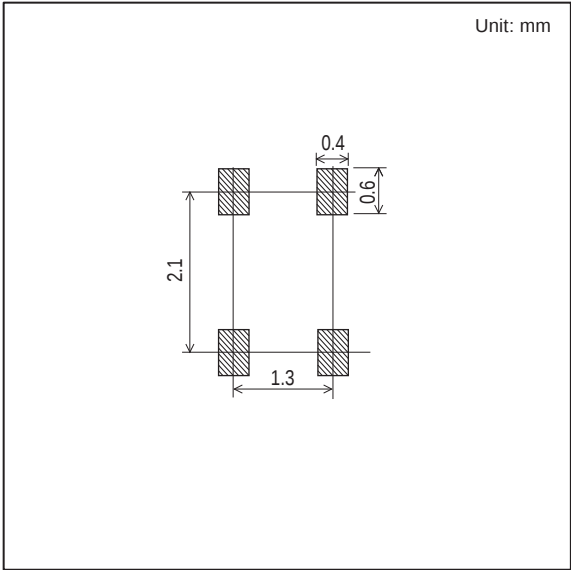


Those with pin 1 index on the feed hole side.....TL

Outline Drawing  
MCH4009-TL-H



Land Pattern Example



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