



MCH4009

RF Transistor

3.5V, 40mA, $f_T=25\text{GHz}$, NPN Single MCPH4

ON Semiconductor®

<http://onsemi.com>

Features

- Low-noise use : $NF=1.1\text{dB typ (}f=2\text{GHz)}$
- High cut-off frequency : $f_T=25\text{GHz typ (}V_{CE}=3\text{V)}$
- Low operating voltage
- High gain : $|S_{21e}|^2=17\text{dB typ (}f=2\text{GHz)}$
- Halogen free compliance

Specifications

Absolute Maximum Ratings at $T_a=25^\circ\text{C}$

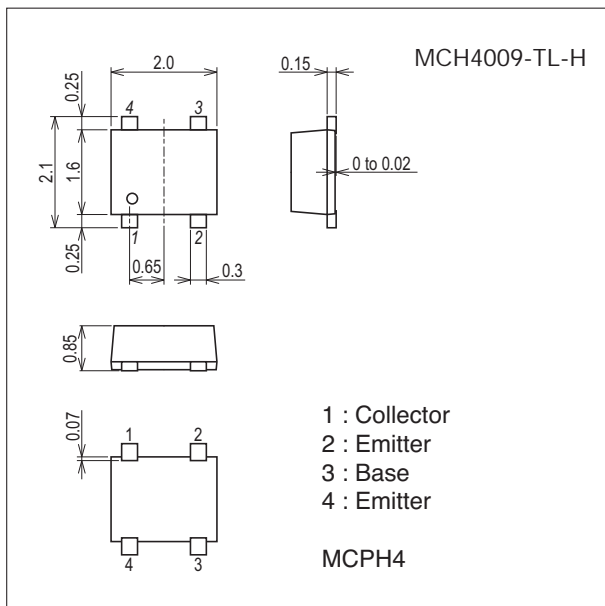
| Parameter | Symbol | Conditions | Ratings | Unit |
|------------------------------|-----------|------------|-------------|------------------|
| Collector-to-Base Voltage | V_{CBO} | | 10 | V |
| Collector-to-Emitter Voltage | V_{CEO} | | 3.5 | V |
| Emitter-to-Base Voltage | V_{EBO} | | 2.5 | V |
| Collector Current | I_C | | 40 | mA |
| Collector Dissipation | P_C | | 120 | mW |
| Junction Temperature | T_j | | 150 | $^\circ\text{C}$ |
| Storage Temperature | T_{stg} | | -55 to +150 | $^\circ\text{C}$ |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Package Dimensions

unit : mm (typ)

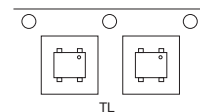
7020A-002



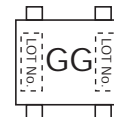
Product & Package Information

- Package : MCPH4
- JEITA, JEDEC : SC-82, SC-82AB, SOT-343
- Minimum Packing Quantity : 3,000 pcs./reel

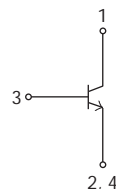
Packing Type : TL



Marking



Electrical Connection



MCH4009

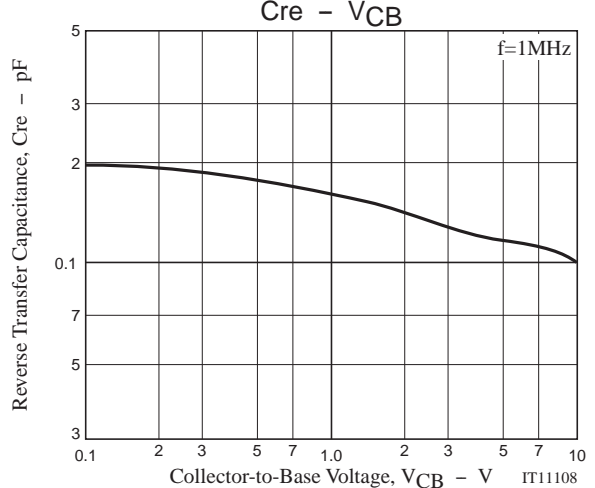
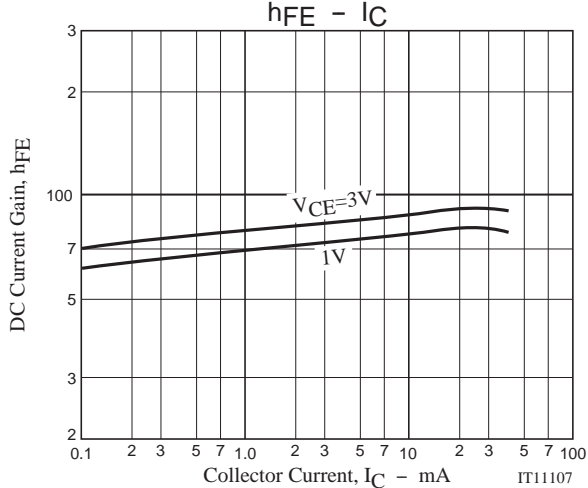
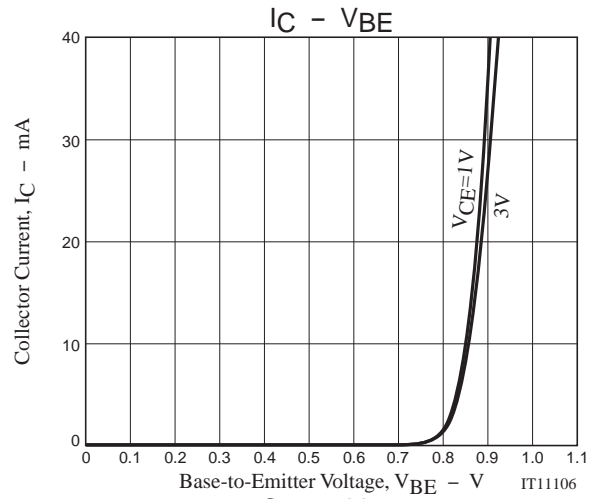
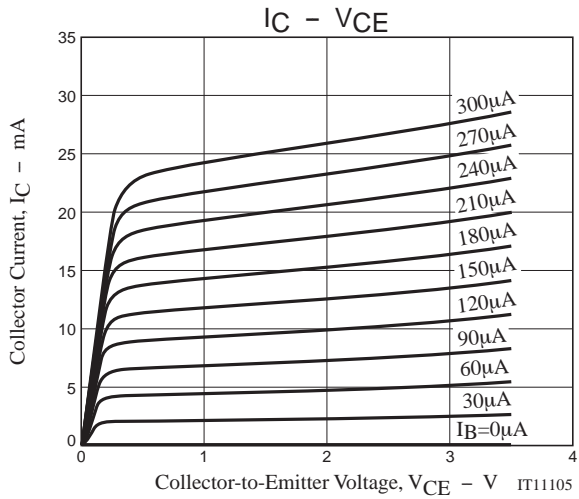
Electrical Characteristics at Ta=25°C

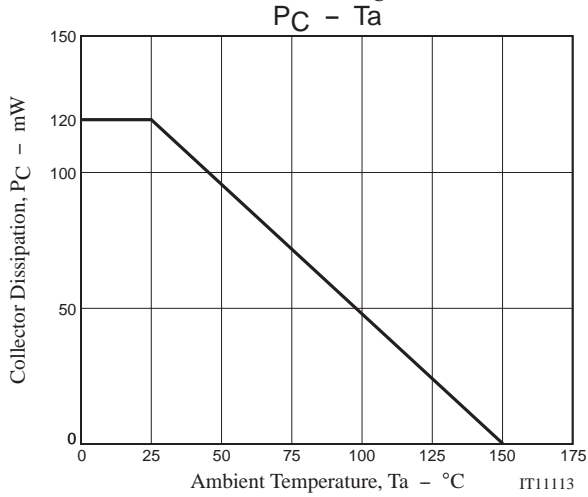
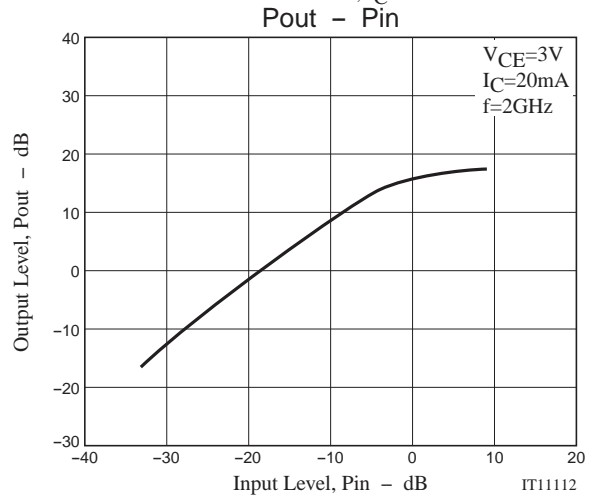
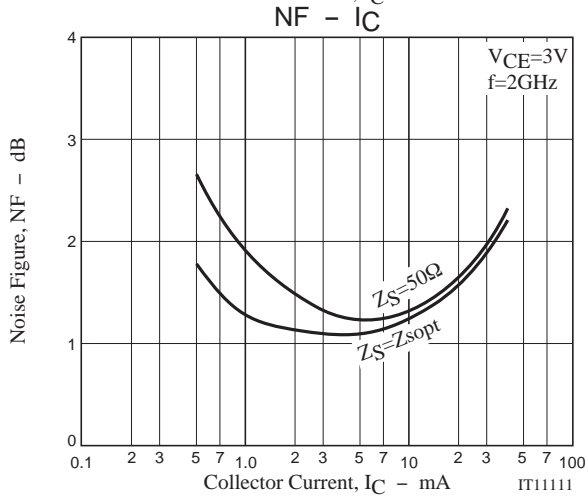
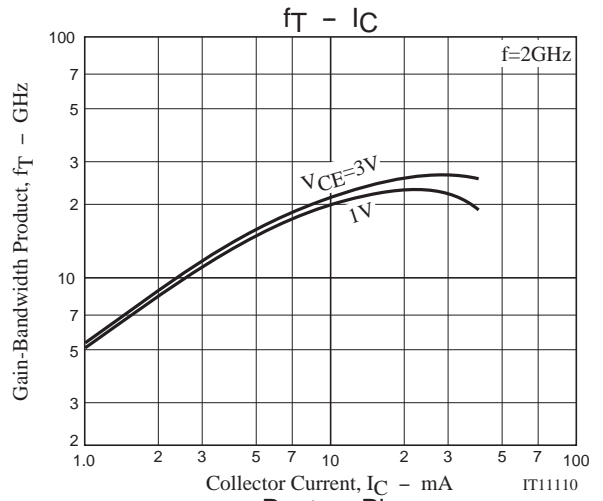
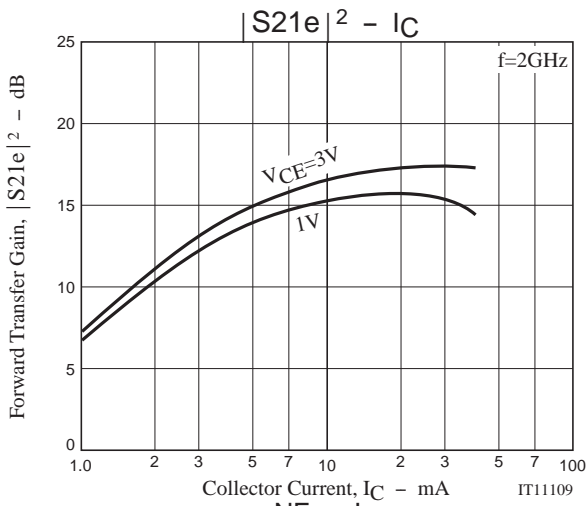
| Parameter | Symbol | Conditions | Ratings | | | Unit |
|------------------------------|----------------------------------------------|---------------------------------------------------|---------|------|-----|------|
| | | | min | typ | max | |
| Collector Cutoff Current | ICBO | V _{CB} =5V, I _E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





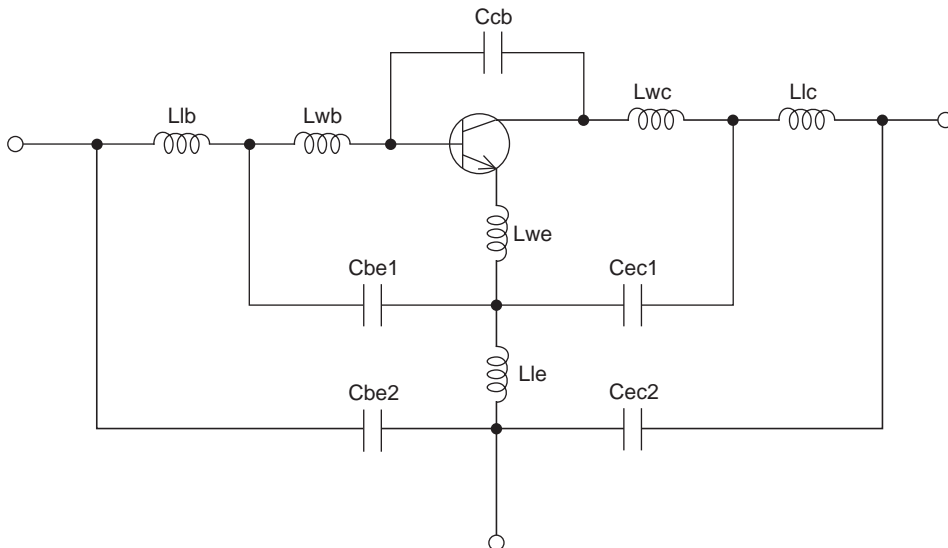
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SPICE Parameters

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_{CE}=1V, I_C=5mA

| Freq(MHz) | S ₁₁ | ∠S ₁₁ | S ₂₁ | ∠S ₂₁ | S ₁₂ | ∠S ₁₂ | S ₂₂ | ∠S ₂₂ |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 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 |

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S Parameters (Common emitter)

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

| Freq(MHz) | S ₁₁ | ∠S ₁₁ | S ₂₁ | ∠S ₂₁ | S ₁₂ | ∠S ₁₂ | S ₂₂ | ∠S ₂₂ |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 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 |

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S Parameters (Common emitter)

V_{CE}=1V, I_C=20mA

| Freq(MHz) | S11 | ∠S11 | S21 | ∠S21 | S12 | ∠S12 | S22 | ∠S22 |
|-----------|-------|--------|--------|-------|-------|-------|-------|--------|
| 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 |

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S Parameters (Common emitter)

V_{CE}=1V, I_C=30mA

| Freq(MHz) | S ₁₁ | ∠S ₁₁ | S ₂₁ | ∠S ₂₁ | S ₁₂ | ∠S ₁₂ | S ₂₂ | ∠S ₂₂ |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 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 |

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S Parameters (Common emitter)

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

| Freq(MHz) | S11 | ∠S11 | S21 | ∠S21 | S12 | ∠S12 | S22 | ∠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_{CE}=3V, I_C=10mA

| Freq(MHz) | S ₁₁ | ∠S ₁₁ | S ₂₁ | ∠S ₂₁ | S ₁₂ | ∠S ₁₂ | S ₂₂ | ∠S ₂₂ |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 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_{CE}=3V, I_C=20mA

| Freq(MHz) | S11 | ∠S11 | S21 | ∠S21 | S12 | ∠S12 | S22 | ∠S22 |
|-----------|-------|--------|--------|-------|-------|-------|-------|--------|
| 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_{CE}=3V, I_C=30mA

| Freq(MHz) | S11 | ∠S11 | S21 | ∠S21 | S12 | ∠S12 | S22 | ∠S22 |
|-----------|-------|--------|--------|-------|-------|-------|-------|--------|
| 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

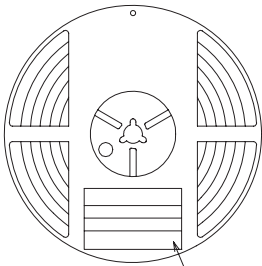
1. Packing Format

| 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 Dimensions:mm (external) 183×72×185 | 6 inner boxes contained Dimensions:mm (external) 440×195×210 |

Reel label, Inner box label
(unit : mm)

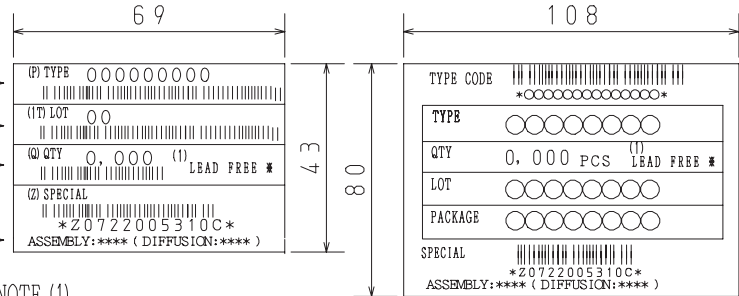
Outer box label
It is a label at the time of factory shipments.
The form of a label may change in physical distribution process.

Packing method



Type No.
LOT No.
Quantity
Origin

Reel label



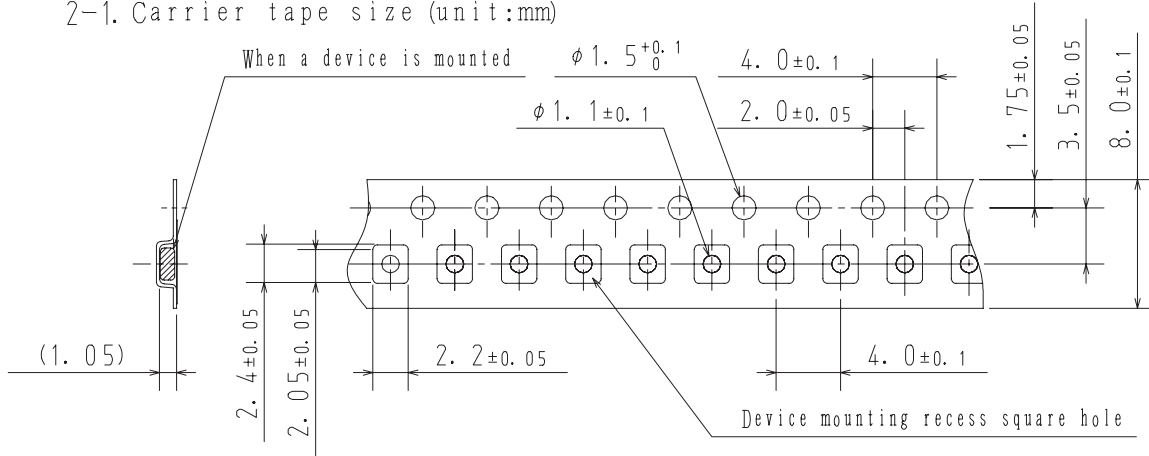
NOTE (1)

The LEAD FREE * description shows that the surface treatment of the terminal is lead free.

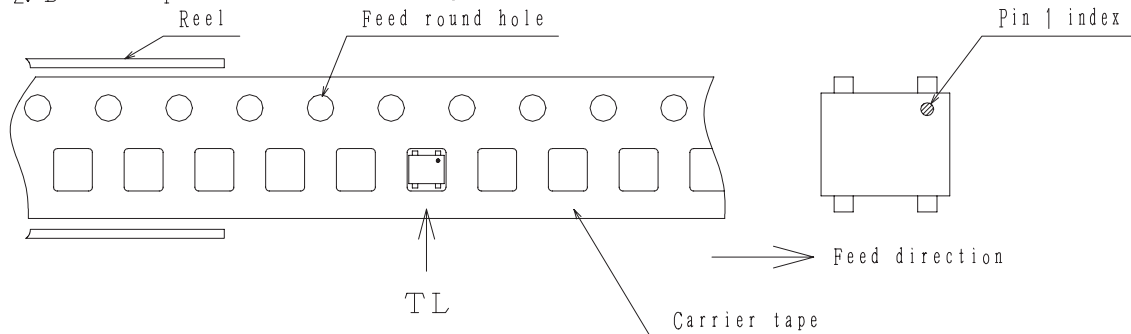
| Label | JEITA Phase |
|-------------|----------------|
| LEAD FREE 3 | JEITA Phase 3A |
| LEAD FREE 4 | JEITA Phase 3 |

2. Taping configuration

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



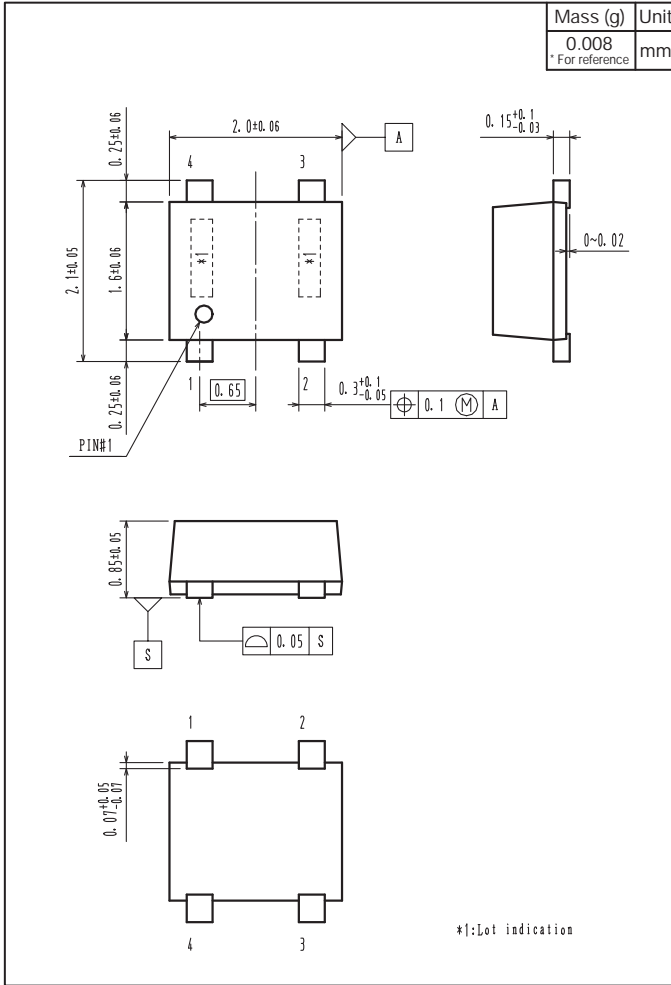
2-2. Device placement direction



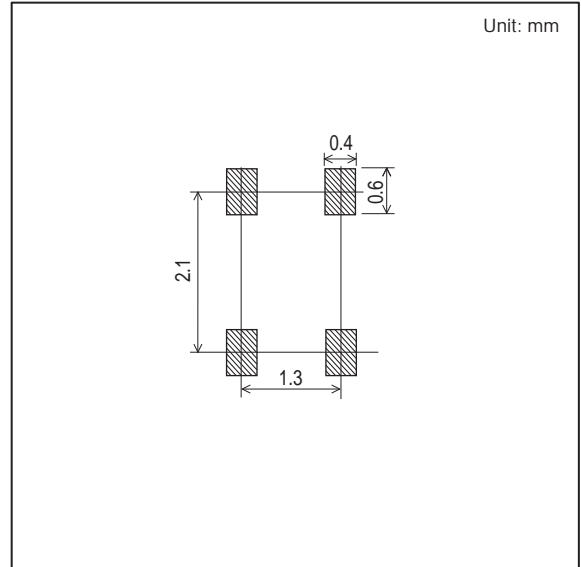
Those with pin 1 index on the feed hole side.....TL

MCH4009

Outline Drawing MCH4009-TL-H



Land Pattern Example



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