

RF Transistor

8 V, 150 mA, $f_T = 16$ GHz
NPN Single MCP4

MCH4020

Features

- Low-Noise use: $NF = 1.2$ dB typ ($f = 1$ GHz)
- High Cut-off Frequency: $f_T = 16$ GHz typ ($V_{CE} = 5$ V)
- High Gain: $|S_{21e}|^2 = 17.5$ dB typ ($f = 1$ GHz)
- Small ON-resistance (R_{on})
- This Device is Pb-Free, Halogen Free and are RoHS Compliant

Specifications

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

| Symbol | Parameter | Conditions | Ratings | Unit |
|-----------|------------------------------|------------|-------------|------------------|
| V_{CBO} | Collector-to-Base Voltage | | 15 | V |
| V_{CEO} | Collector-to-Emitter Voltage | | 8 | V |
| V_{EBO} | Emitter-to-Base Voltage | | 2 | V |
| I_C | Collector Current | | 150 | mA |
| P_C | Collector Dissipation | | 400 | mW |
| T_j | Junction Temperature | | 150 | $^\circ\text{C}$ |
| T_{stg} | Storage Temperature | | -55 to +150 | $^\circ\text{C}$ |

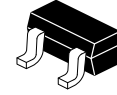
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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

| Symbol | Parameter | Conditions | Ratings | | | Unit |
|---------------|--------------------------|--|---------|------|-----|---------------|
| | | | Min | Typ | Max | |
| I_{CBO} | Collector Cutoff Current | $V_{CB} = 5$ V, $I_E = 0$ A | - | - | 1.0 | μA |
| I_{EBO} | Emitter Cutoff Current | $V_{EB} = 1$ V, $I_C = 0$ A | - | - | 1.0 | μA |
| h_{FE} | DC Current Gain | $V_{CE} = 5$ V, $I_C = 50$ mA | 60 | - | 150 | - |
| f_T | Gain-Bandwidth Product | $V_{CE} = 5$ V, $I_C = 50$ mA | 13 | 16 | - | GHz |
| $ S_{21e} ^2$ | Forward Transfer Gain | $V_{CE} = 5$ V, $I_C = 50$ mA, $f = 1$ GHz | - | 17.5 | - | dB |
| NF | Noise Figure | $V_{CE} = 1$ V, $I_C = 50$ mA, $f = 1$ GHz | - | 1.2 | 1.8 | dB |

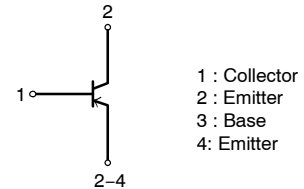
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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

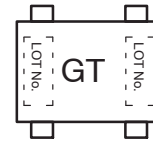


SC-82AB
CASE 419AK

ELECTRICAL CONNECTION



MARKING DIAGRAM



ORDERING INFORMATION

| Device | Package | Shipping [†] |
|--------------|------------------------------|-----------------------|
| MCH4020-TL-H | SC-82AB MCP4 (Pb-Free) | 3000 / Tape & Reel |

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

TYPICAL CHARACTERISTICS

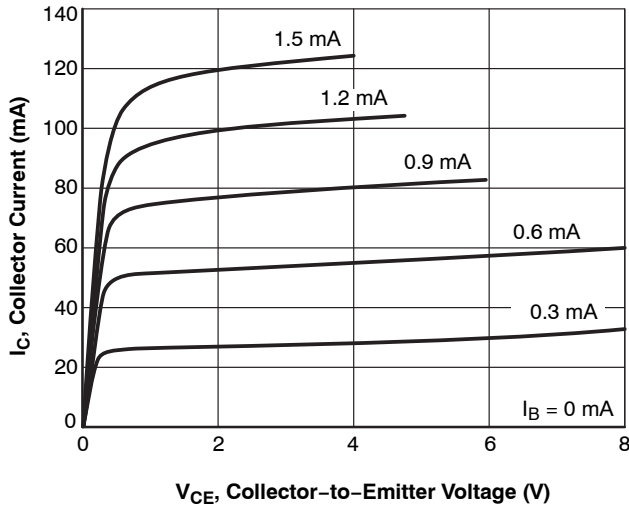


Figure 1. $I_C - V_{CE}$

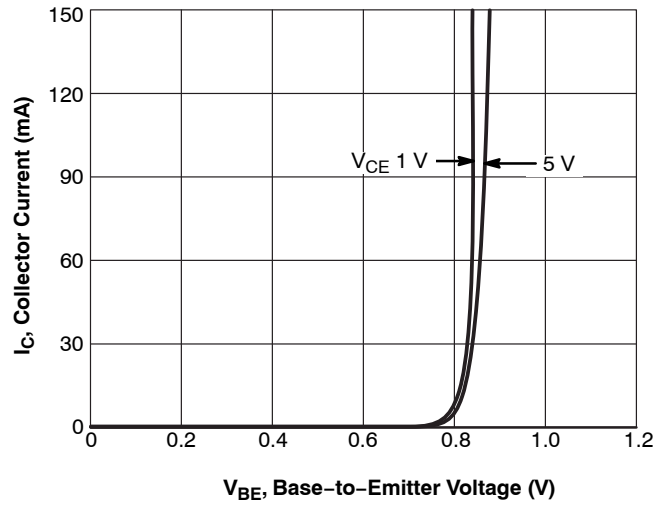


Figure 2. $I_C - V_{BE}$

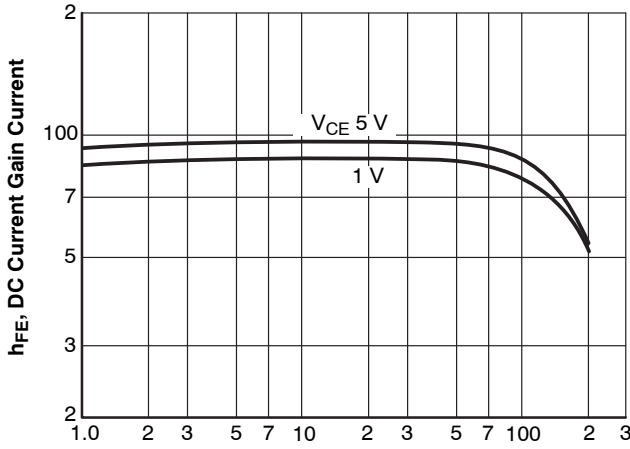


Figure 3. $h_{FE} - I_C$

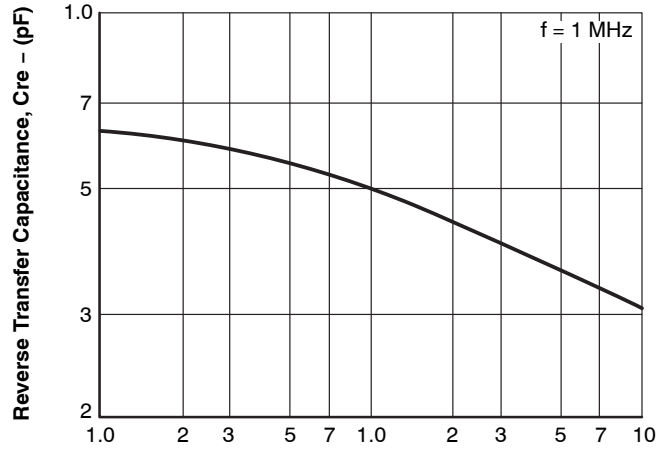


Figure 4. $C_{re} - V_{CB}$

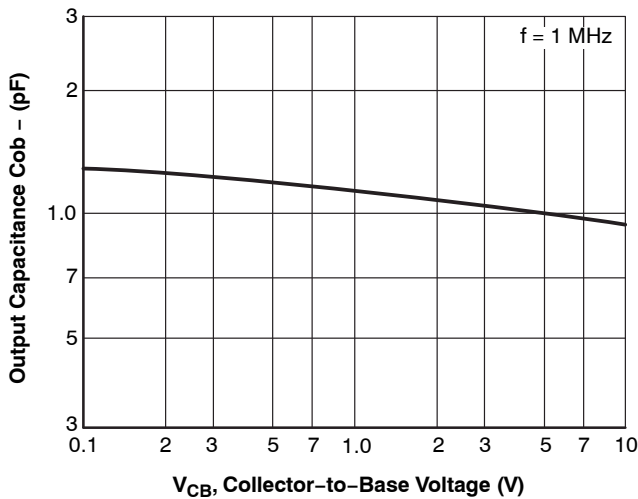


Figure 5. $C_{ob} - V_{CB}$

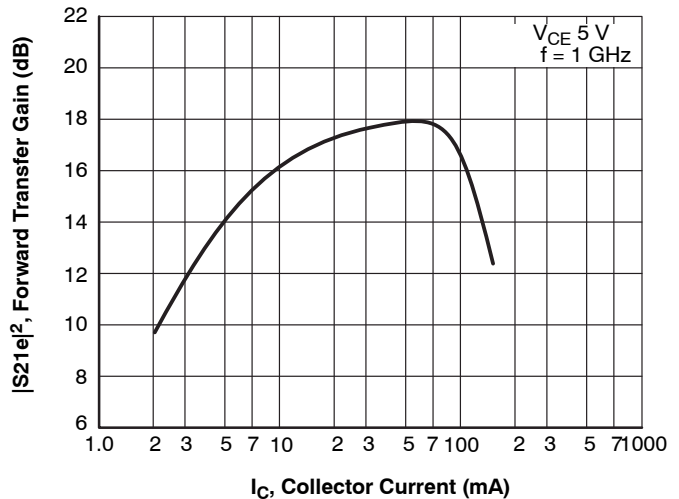


Figure 6. $V_{BE(sat)} - I_C$

TYPICAL CHARACTERISTICS (CONTINUED)

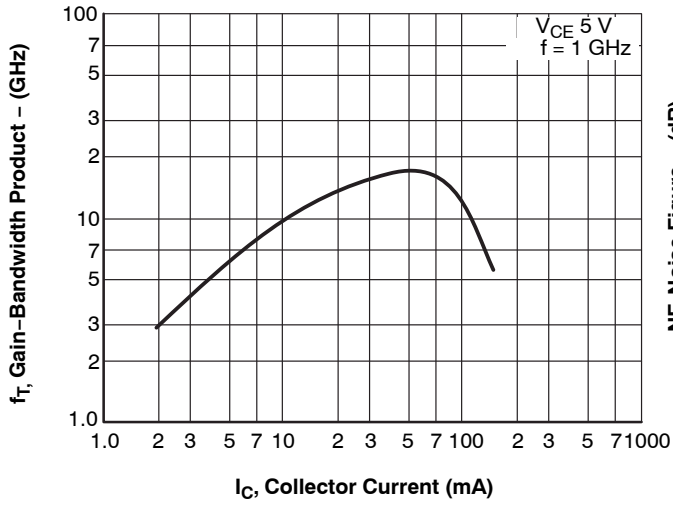


Figure 7. $f_T - I_C$

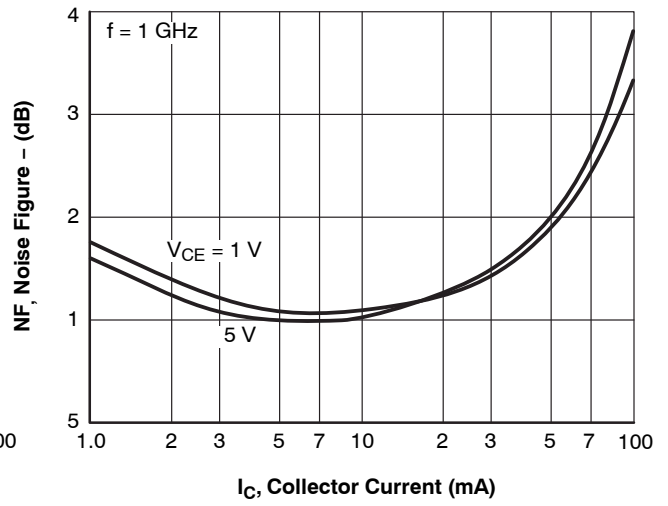


Figure 8. NF - I_C

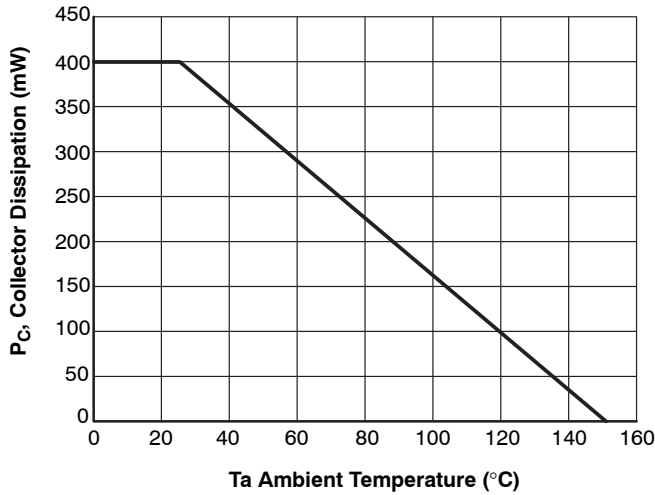


Figure 9. $P_C - T_a$

MCH4020

SPICE Parameters
model: Gummel-Poon

| Parameter | Value | Unit | Parameter | Value | Unit |
|-----------|--------|------|-----------|--------|------|
| IS | 2.155f | A | TF | 6.700p | S |
| BF | 122 | | XTF | 50.00f | |
| NF | 1.05 | | VTF | 750.0m | V |
| VAF | 8 | V | ITF | 50 | A |
| IKF | 206.4m | A | PTF | 200.0m | °C |
| ISE | 1.384p | A | CJC | 175.0f | F |
| NE | 2.278 | | VJC | 200.0f | V |
| BR | 14 | | MJC | 1.150p | |
| NR | 1.042 | | XCJC | 1 | |
| VAR | 4 | V | TR | 0 | S |
| IKR | 360.0m | A | FC | 500.0m | |
| ISC | 140.0f | A | CJS | 550.0f | F |
| NC | 1.6 | | VJS | 150.0m | V |
| RB | 2 | Ω | MJS | 136.0m | |
| IRB | 1.5 | A | Lfc | 110.0p | |
| RBM | 25.00m | Ω | Lwb | 850.0p | H |
| RE | 450.0m | Ω | Lfb | 73.0p | H |
| RC | 1.2 | Ω | Lwe | 145.0p | H |
| XTB | 0 | | Lfe | 280.0p | H |
| EG | 1.11 | eV | Cbc | 325.0f | F |
| XTI | 1 | | Ceb | 175.0f | F |
| CJE | 2.476p | F | Cce | 120.0f | F |
| VJE | 750.0m | V | | | |
| MJE | 10.00m | | | | |

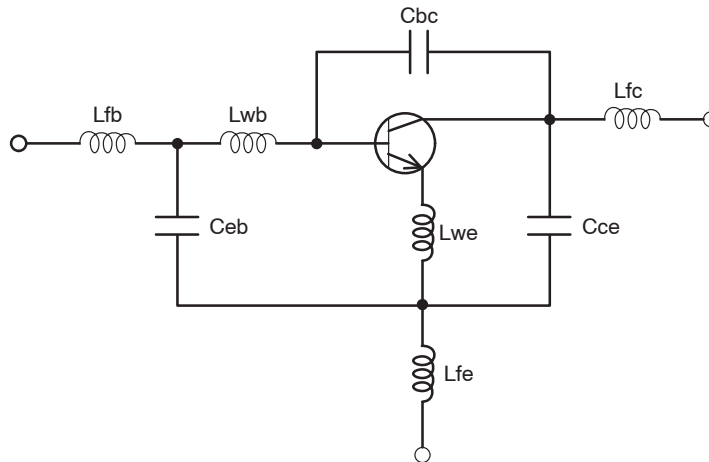


Figure 10. Schematic

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

MCH4020

S Parameters (Common Emitter)

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

| Freq (MHz) | S11 | ∠S11 | S21 | ∠S21 | S12 | ∠S12 | S22 | ∠S22 |
|------------|-------|--------|--------|-------|-------|------|-------|--------|
| 200 | 0.664 | -88.0 | 17.728 | 131.6 | 0.046 | 52.6 | 0.753 | -60.7 |
| 400 | 0.674 | -130.4 | 11.682 | 107.8 | 0.061 | 40.5 | 0.567 | -93.8 |
| 600 | 0.681 | -147.2 | 8.523 | 95.7 | 0.071 | 38.0 | 0.513 | -106.8 |
| 800 | 0.666 | -160.0 | 6.411 | 87.9 | 0.076 | 38.4 | 0.445 | -118.0 |
| 1000 | 0.658 | -168.7 | 5.131 | 82.2 | 0.082 | 39.7 | 0.414 | -126.1 |
| 1200 | 0.657 | -175.3 | 4.280 | 77.4 | 0.087 | 41.3 | 0.393 | -132.2 |
| 1400 | 0.657 | 179.2 | 3.679 | 73.1 | 0.093 | 42.8 | 0.393 | -136.8 |
| 1600 | 0.657 | 174.3 | 3.228 | 69.2 | 0.100 | 44.4 | 0.375 | -141.0 |
| 1800 | 0.658 | 170.2 | 2.878 | 65.5 | 0.107 | 45.5 | 0.372 | -143.9 |
| 2000 | 0.659 | 166.6 | 2.608 | 62.0 | 0.114 | 46.5 | 0.372 | -146.8 |
| 2200 | 0.657 | 162.8 | 2.379 | 58.7 | 0.122 | 47.2 | 0.374 | -149.0 |
| 2400 | 0.658 | 159.4 | 2.193 | 55.3 | 0.130 | 47.6 | 0.378 | -151.2 |
| 2600 | 0.657 | 156.0 | 2.041 | 52.2 | 0.138 | 47.8 | 0.384 | -153.4 |
| 2800 | 0.657 | 152.7 | 1.909 | 49.0 | 0.146 | 47.9 | 0.390 | -154.6 |
| 3000 | 0.655 | 149.4 | 1.793 | 46.0 | 0.155 | 47.8 | 0.399 | -156.0 |
| 3200 | 0.652 | 146.0 | 1.693 | 42.9 | 0.163 | 47.5 | 0.409 | -157.2 |
| 3400 | 0.652 | 142.6 | 1.605 | 39.9 | 0.172 | 47.1 | 0.419 | -158.1 |
| 3600 | 0.651 | 139.0 | 1.528 | 37.1 | 0.180 | 46.6 | 0.432 | -158.9 |
| 3800 | 0.650 | 135.6 | 1.456 | 34.2 | 0.189 | 45.8 | 0.443 | -159.6 |
| 4000 | 0.650 | 131.8 | 1.393 | 31.3 | 0.198 | 45.0 | 0.455 | -160.2 |
| 4200 | 0.650 | 128.2 | 1.337 | 28.6 | 0.206 | 44.2 | 0.467 | -160.8 |
| 4400 | 0.652 | 124.6 | 1.281 | 26.0 | 0.215 | 43.3 | 0.479 | -161.2 |
| 4600 | 0.653 | 120.8 | 1.233 | 23.5 | 0.224 | 42.2 | 0.489 | -161.5 |
| 4800 | 0.654 | 117.3 | 1.185 | 20.8 | 0.232 | 41.1 | 0.499 | -161.7 |
| 5000 | 0.656 | 113.8 | 1.147 | 18.4 | 0.240 | 40.0 | 0.508 | -162.1 |

MCH4020

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

| Freq (MHz) | S11 | ∠S11 | S21 | ∠S21 | S12 | ∠S12 | S22 | ∠S22 |
|------------|-------|--------|--------|-------|-------|------|-------|--------|
| 200 | 0.652 | -152.6 | 22.719 | 111.2 | 0.024 | 50.4 | 0.545 | -102.4 |
| 400 | 0.694 | -168.0 | 12.745 | 95.1 | 0.034 | 54.6 | 0.466 | -133.3 |
| 600 | 0.693 | -174.1 | 8.865 | 86.6 | 0.045 | 58.6 | 0.442 | -140.7 |
| 800 | 0.694 | 179.3 | 6.618 | 81.7 | 0.055 | 61.5 | 0.422 | -149.5 |
| 1000 | 0.693 | 174.3 | 5.279 | 77.7 | 0.066 | 63.1 | 0.415 | -154.8 |
| 1200 | 0.697 | 170.1 | 4.399 | 74.2 | 0.078 | 64.0 | 0.410 | -159.2 |
| 1400 | 0.698 | 166.3 | 3.771 | 70.8 | 0.089 | 64.0 | 0.407 | -162.2 |
| 1600 | 0.700 | 162.8 | 3.307 | 67.7 | 0.100 | 63.8 | 0.405 | -165.0 |
| 1800 | 0.700 | 159.6 | 2.961 | 64.7 | 0.111 | 63.3 | 0.403 | -167.1 |
| 2000 | 0.700 | 156.8 | 2.683 | 61.8 | 0.122 | 62.7 | 0.405 | -169.1 |
| 2200 | 0.699 | 153.5 | 2.457 | 59.0 | 0.134 | 61.8 | 0.407 | -170.8 |
| 2400 | 0.699 | 150.5 | 2.260 | 56.0 | 0.145 | 60.6 | 0.410 | -172.2 |
| 2600 | 0.696 | 147.6 | 2.105 | 53.2 | 0.156 | 59.4 | 0.413 | -173.6 |
| 2800 | 0.696 | 144.6 | 1.976 | 50.5 | 0.167 | 58.2 | 0.416 | -174.4 |
| 3000 | 0.692 | 141.5 | 1.861 | 47.8 | 0.177 | 56.8 | 0.422 | -175.4 |
| 3200 | 0.688 | 138.3 | 1.761 | 45.0 | 0.188 | 55.4 | 0.429 | -175.9 |
| 3400 | 0.687 | 135.0 | 1.674 | 42.3 | 0.198 | 53.8 | 0.433 | -176.3 |
| 3600 | 0.684 | 131.6 | 1.598 | 39.7 | 0.209 | 52.4 | 0.441 | -176.5 |
| 3800 | 0.681 | 128.3 | 1.526 | 37.0 | 0.219 | 50.8 | 0.448 | -176.6 |
| 4000 | 0.680 | 124.7 | 1.462 | 34.3 | 0.229 | 49.2 | 0.456 | -176.6 |
| 4200 | 0.679 | 121.2 | 1.403 | 31.7 | 0.239 | 47.5 | 0.463 | -176.6 |
| 4400 | 0.678 | 117.7 | 1.351 | 29.3 | 0.248 | 46.0 | 0.470 | -176.4 |
| 4600 | 0.678 | 114.1 | 1.305 | 26.8 | 0.266 | 44.3 | 0.476 | -176.2 |
| 4800 | 0.676 | 110.7 | 1.260 | 24.3 | 0.257 | 42.5 | 0.480 | -176.1 |
| 5000 | 0.676 | 107.4 | 1.224 | 22.0 | 0.274 | 40.9 | 0.485 | -176.0 |

MCH4020

$V_{CE} = 1\text{ V}$, $I_C = 100\text{ mA}$

| Freq (MHz) | S11 | ∠S11 | S21 | ∠S21 | S12 | ∠S12 | S22 | ∠S22 |
|------------|-------|--------|--------|-------|-------|------|-------|--------|
| 200 | 0.797 | -170.2 | 11.994 | 103.3 | 0.023 | 46.0 | 0.462 | -142.7 |
| 400 | 0.821 | -178.6 | 6.267 | 90.3 | 0.032 | 55.8 | 0.471 | -159.7 |
| 600 | 0.814 | 176.9 | 4.334 | 82.5 | 0.044 | 60.5 | 0.456 | -162.5 |
| 800 | 0.816 | 172.4 | 3.254 | 78.0 | 0.056 | 63.5 | 0.453 | -167.1 |
| 1000 | 0.815 | 168.6 | 2.616 | 73.9 | 0.068 | 65.0 | 0.452 | -169.7 |
| 1200 | 0.819 | 165.2 | 2.196 | 70.2 | 0.080 | 65.6 | 0.452 | -172.2 |
| 1400 | 0.819 | 162.0 | 1.895 | 66.7 | 0.092 | 65.4 | 0.452 | -173.8 |
| 1600 | 0.821 | 158.9 | 1.674 | 63.1 | 0.104 | 64.8 | 0.453 | -175.5 |
| 1800 | 0.821 | 155.9 | 1.516 | 59.9 | 0.116 | 64.3 | 0.451 | -177.0 |
| 2000 | 0.821 | 153.3 | 1.378 | 56.8 | 0.128 | 63.4 | 0.455 | -178.3 |
| 2200 | 0.819 | 150.2 | 1.270 | 53.8 | 0.140 | 62.4 | 0.458 | -179.4 |
| 2400 | 0.818 | 147.4 | 1.178 | 50.7 | 0.152 | 61.1 | 0.462 | 179.5 |
| 2600 | 0.819 | 144.6 | 1.107 | 47.7 | 0.164 | 59.7 | 0.464 | 178.3 |
| 2800 | 0.814 | 141.6 | 1.048 | 44.9 | 0.176 | 58.3 | 0.469 | 177.7 |
| 3000 | 0.809 | 138.5 | 0.995 | 42.2 | 0.187 | 56.9 | 0.475 | 176.9 |
| 3200 | 0.805 | 135.5 | 0.949 | 39.4 | 0.198 | 55.3 | 0.481 | 176.5 |
| 3400 | 0.803 | 132.2 | 0.909 | 36.7 | 0.209 | 53.8 | 0.486 | 176.1 |
| 3600 | 0.799 | 128.9 | 0.875 | 34.2 | 0.221 | 52.2 | 0.493 | 175.9 |
| 3800 | 0.796 | 125.6 | 0.842 | 31.6 | 0.232 | 50.5 | 0.499 | 175.7 |
| 4000 | 0.794 | 122.1 | 0.812 | 29.1 | 0.242 | 48.7 | 0.505 | 175.6 |
| 4200 | 0.792 | 118.7 | 0.785 | 29.1 | 0.252 | 47.0 | 0.511 | 175.6 |
| 4400 | 0.790 | 115.3 | 0.762 | 24.5 | 0.262 | 45.3 | 0.516 | 175.7 |
| 4600 | 0.788 | 111.8 | 0.743 | 22.3 | 0.272 | 43.4 | 0.519 | 175.8 |
| 4800 | 0.787 | 108.3 | 0.722 | 20.0 | 0.281 | 41.6 | 0.522 | 175.8 |
| 5000 | 0.785 | 105.1 | 0.707 | 17.9 | 0.290 | 39.9 | 0.525 | 175.8 |

MCH4020

$V_{CE} = 3\text{ V}$, $I_C = 10\text{ mA}$

| Freq (MHz) | S11 | ∠S11 | S21 | ∠S21 | S12 | ∠S12 | S22 | ∠S22 |
|------------|-------|--------|--------|-------|-------|------|-------|--------|
| 200 | 0.667 | -73.4 | 19.421 | 137.2 | 0.036 | 59.5 | 0.807 | -46.2 |
| 400 | 0.654 | -117.7 | 13.670 | 112.4 | 0.051 | 46.8 | 0.610 | -74.6 |
| 600 | 0.657 | -137.3 | 10.173 | 99.3 | 0.060 | 43.7 | 0.541 | -86.7 |
| 800 | 0.635 | -152.0 | 7.684 | 90.5 | 0.066 | 43.4 | 0.452 | -96.5 |
| 1000 | 0.624 | -162.0 | 6.158 | 84.2 | 0.071 | 44.2 | 0.407 | -104.3 |
| 1200 | 0.621 | -169.6 | 5.138 | 79.1 | 0.076 | 45.7 | 0.376 | -110.1 |
| 1400 | 0.620 | -175.7 | 4.400 | 74.5 | 0.082 | 47.0 | 0.360 | -114.7 |
| 1600 | 0.619 | 178.9 | 3.867 | 70.4 | 0.088 | 48.7 | 0.347 | -119.0 |
| 1800 | 0.620 | 174.4 | 3.431 | 66.7 | 0.095 | 49.8 | 0.343 | -122.2 |
| 2000 | 0.621 | 170.6 | 3.103 | 63.0 | 0.101 | 50.9 | 0.341 | -125.5 |
| 2200 | 0.620 | 166.6 | 2.828 | 59.5 | 0.108 | 51.7 | 0.343 | -128.1 |
| 2400 | 0.621 | 163.0 | 2.602 | 56.1 | 0.116 | 52.3 | 0.347 | -130.7 |
| 2600 | 0.620 | 159.4 | 2.419 | 52.9 | 0.124 | 52.6 | 0.353 | -133.3 |
| 2800 | 0.622 | 156.1 | 2.253 | 49.6 | 0.131 | 52.8 | 0.361 | -135.1 |
| 3000 | 0.620 | 152.7 | 2.112 | 46.5 | 0.139 | 52.8 | 0.372 | -137.1 |
| 3200 | 0.618 | 149.2 | 1.990 | 43.3 | 0.148 | 52.6 | 0.384 | -138.9 |
| 3400 | 0.619 | 145.6 | 1.881 | 40.3 | 0.156 | 52.3 | 0.396 | -140.4 |
| 3600 | 0.618 | 142.1 | 1.784 | 37.3 | 0.164 | 51.9 | 0.412 | -141.7 |
| 3800 | 0.618 | 138.5 | 1.696 | 34.3 | 0.173 | 51.2 | 0.426 | -143.0 |
| 4000 | 0.618 | 134.7 | 1.618 | 31.4 | 0.182 | 50.5 | 0.441 | -144.1 |
| 4200 | 0.620 | 130.9 | 1.549 | 28.6 | 0.191 | 49.6 | 0.456 | -145.3 |
| 4400 | 0.621 | 127.2 | 1.480 | 25.9 | 0.199 | 48.7 | 0.471 | -146.2 |
| 4600 | 0.623 | 123.4 | 1.419 | 23.2 | 0.208 | 47.7 | 0.485 | -147.0 |
| 4800 | 0.626 | 119.8 | 1.359 | 20.5 | 0.216 | 46.7 | 0.498 | -147.7 |
| 5000 | 0.629 | 116.2 | 1.309 | 18.0 | 0.224 | 45.6 | 0.511 | -148.5 |

MCH4020

S Parameter (Common Emitter)

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

| Freq (MHz) | S11 | ∠S11 | S21 | ∠S21 | S12 | ∠S12 | S22 | ∠S22 |
|------------|-------|--------|--------|-------|-------|------|-------|--------|
| 200 | 0.516 | -135.8 | 31.907 | 119.4 | 0.020 | 59.2 | 0.602 | -73.9 |
| 400 | 0.593 | -158.7 | 17.954 | 99.0 | 0.029 | 60.4 | 0.444 | -104.5 |
| 600 | 0.602 | -166.8 | 12.350 | 89.5 | 0.039 | 63.6 | 0.404 | -113.3 |
| 800 | 0.606 | -174.8 | 9.160 | 83.7 | 0.049 | 65.9 | 0.359 | -123.7 |
| 1000 | 0.608 | 179.2 | 7.261 | 79.3 | 0.059 | 67.0 | 0.341 | -131.0 |
| 1200 | 0.612 | 174.4 | 6.025 | 75.7 | 0.069 | 67.5 | 0.327 | -136.6 |
| 1400 | 0.614 | 170.2 | 5.149 | 72.2 | 0.079 | 67.4 | 0.321 | -140.6 |
| 1600 | 0.615 | 166.4 | 4.503 | 69.0 | 0.089 | 67.2 | 0.316 | -144.0 |
| 1800 | 0.618 | 162.9 | 4.004 | 66.0 | 0.100 | 66.4 | 0.314 | -146.9 |
| 2000 | 0.619 | 159.8 | 3.619 | 63.1 | 0.110 | 65.8 | 0.316 | -149.3 |
| 2200 | 0.618 | 156.5 | 3.299 | 60.1 | 0.120 | 64.9 | 0.319 | -151.3 |
| 2400 | 0.618 | 153.5 | 3.035 | 57.3 | 0.130 | 63.9 | 0.322 | -152.9 |
| 2600 | 0.617 | 150.5 | 2.816 | 54.4 | 0.141 | 62.7 | 0.326 | -154.5 |
| 2800 | 0.617 | 147.4 | 2.630 | 51.7 | 0.150 | 61.6 | 0.334 | -155.5 |
| 3000 | 0.614 | 144.2 | 2.469 | 49.0 | 0.160 | 60.3 | 0.342 | -156.7 |
| 3200 | 0.611 | 141.0 | 2.328 | 46.1 | 0.170 | 58.9 | 0.351 | -157.4 |
| 3400 | 0.611 | 137.6 | 2.204 | 43.4 | 0.180 | 57.5 | 0.360 | -157.9 |
| 3600 | 0.609 | 134.3 | 2.095 | 40.7 | 0.189 | 56.1 | 0.372 | -158.3 |
| 3800 | 0.608 | 130.8 | 1.995 | 38.0 | 0.199 | 54.7 | 0.383 | -158.6 |
| 4000 | 0.606 | 127.2 | 1.906 | 35.3 | 0.209 | 53.1 | 0.395 | -158.7 |
| 4200 | 0.607 | 123.6 | 1.824 | 32.6 | 0.218 | 51.5 | 0.407 | -158.8 |
| 4400 | 0.607 | 120.1 | 1.749 | 30.1 | 0.226 | 49.9 | 0.419 | -158.9 |
| 4600 | 0.607 | 116.5 | 1.681 | 27.6 | 0.235 | 48.3 | 0.430 | -158.8 |
| 4800 | 0.608 | 113.0 | 1.616 | 25.0 | 0.243 | 46.8 | 0.440 | -158.9 |
| 5000 | 0.608 | 109.6 | 1.560 | 22.6 | 0.251 | 45.2 | 0.450 | -159.0 |

MCH4020

$V_{CE} = 3\text{ V}$, $I_C = 100\text{ mA}$

| Freq (MHz) | S11 | ∠S11 | S21 | ∠S21 | S12 | ∠S12 | S22 | ∠S22 |
|------------|-------|--------|--------|-------|-------|------|-------|--------|
| 200 | 0.577 | -155.5 | 28.271 | 114.9 | 0.017 | 60.5 | 0.496 | -77.8 |
| 400 | 0.645 | -169.1 | 15.432 | 96.4 | 0.025 | 64.9 | 0.367 | -105.8 |
| 600 | 0.649 | -174.6 | 10.567 | 87.2 | 0.036 | 68.7 | 0.339 | -111.9 |
| 800 | 0.656 | 179.3 | 7.841 | 81.8 | 0.046 | 70.5 | 0.306 | -121.4 |
| 1000 | 0.658 | 174.4 | 6.227 | 77.4 | 0.056 | 71.3 | 0.295 | -127.8 |
| 1200 | 0.663 | 170.4 | 5.172 | 73.6 | 0.066 | 71.6 | 0.287 | -132.7 |
| 1400 | 0.666 | 166.8 | 4.421 | 70.1 | 0.076 | 71.2 | 0.285 | -136.0 |
| 1600 | 0.668 | 163.4 | 3.860 | 66.9 | 0.087 | 70.6 | 0.285 | -138.9 |
| 1800 | 0.671 | 160.2 | 3.443 | 63.7 | 0.097 | 69.8 | 0.287 | -141.5 |
| 2000 | 0.672 | 157.5 | 3.108 | 60.7 | 0.107 | 69.1 | 0.292 | -143.6 |
| 2200 | 0.671 | 154.3 | 2.835 | 57.5 | 0.118 | 68.1 | 0.297 | -145.5 |
| 2400 | 0.672 | 151.4 | 2.606 | 54.5 | 0.128 | 67.0 | 0.304 | -147.0 |
| 2600 | 0.671 | 148.6 | 2.419 | 51.5 | 0.139 | 65.7 | 0.311 | -148.5 |
| 2800 | 0.671 | 145.6 | 2.260 | 48.7 | 0.148 | 64.4 | 0.321 | -149.6 |
| 3000 | 0.669 | 142.6 | 2.122 | 45.9 | 0.159 | 63.1 | 0.332 | -150.9 |
| 3200 | 0.665 | 139.5 | 2.001 | 42.9 | 0.169 | 61.7 | 0.345 | -151.7 |
| 3400 | 0.666 | 136.2 | 1.895 | 40.1 | 0.179 | 60.2 | 0.357 | -152.5 |
| 3600 | 0.664 | 132.9 | 1.800 | 37.3 | 0.189 | 58.6 | 0.371 | -153.0 |
| 3800 | 0.663 | 129.5 | 1.713 | 34.5 | 0.199 | 57.1 | 0.385 | -153.6 |
| 4000 | 0.662 | 126.0 | 1.635 | 31.7 | 0.209 | 55.5 | 0.399 | -154.0 |
| 4200 | 0.663 | 122.5 | 1.562 | 29.0 | 0.218 | 53.9 | 0.414 | -154.4 |
| 4400 | 0.663 | 119.1 | 1.497 | 26.4 | 0.227 | 52.3 | 0.428 | -154.8 |
| 4600 | 0.663 | 115.5 | 1.438 | 23.9 | 0.236 | 50.6 | 0.441 | -155.0 |
| 4800 | 0.664 | 112.0 | 1.381 | 21.3 | 0.245 | 48.9 | 0.453 | -155.3 |
| 5000 | 0.664 | 108.7 | 1.333 | 18.9 | 0.253 | 47.3 | 0.464 | -155.7 |

MCH4020

S Parameter (Common Emitter)

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

| Freq (MHz) | S11 | ∠S11 | S21 | ∠S21 | S12 | ∠S12 | S22 | ∠S22 |
|------------|-------|--------|--------|-------|-------|------|-------|--------|
| 200 | 0.674 | -68.7 | 19.895 | 138.9 | 0.032 | 61.8 | 0.826 | -41.4 |
| 400 | 0.653 | -112.8 | 14.318 | 114.0 | 0.047 | 49.2 | 0.632 | -67.8 |
| 600 | 0.651 | -133.4 | 10.744 | 100.5 | 0.057 | 45.9 | 0.560 | -79.3 |
| 800 | 0.626 | -148.8 | 8.133 | 91.4 | 0.062 | 45.3 | 0.466 | -88.2 |
| 1000 | 0.613 | -159.3 | 6.522 | 84.8 | 0.067 | 46.0 | 0.415 | -95.5 |
| 1200 | 0.610 | -167.2 | 5.440 | 79.6 | 0.072 | 47.5 | 0.382 | -100.9 |
| 1400 | 0.607 | -173.5 | 4.659 | 74.9 | 0.078 | 48.7 | 0.363 | -105.3 |
| 1600 | 0.606 | -179.1 | 4.091 | 70.7 | 0.084 | 50.5 | 0.349 | -109.4 |
| 1800 | 0.608 | 176.2 | 3.630 | 66.9 | 0.090 | 51.6 | 0.344 | -112.7 |
| 2000 | 0.609 | 172.2 | 3.280 | 63.2 | 0.096 | 52.7 | 0.341 | -116.0 |
| 2200 | 0.608 | 168.1 | 2.988 | 59.7 | 0.103 | 53.5 | 0.343 | -118.8 |
| 2400 | 0.608 | 164.5 | 2.749 | 56.2 | 0.110 | 54.2 | 0.347 | -121.6 |
| 2600 | 0.608 | 160.9 | 2.553 | 52.9 | 0.118 | 54.6 | 0.353 | -124.4 |
| 2800 | 0.610 | 157.5 | 2.377 | 49.6 | 0.125 | 54.9 | 0.361 | -126.4 |
| 3000 | 0.607 | 154.0 | 2.225 | 46.5 | 0.133 | 54.9 | 0.372 | -128.8 |
| 3200 | 0.606 | 150.5 | 2.095 | 43.2 | 0.141 | 54.9 | 0.385 | -130.8 |
| 3400 | 0.607 | 146.9 | 1.979 | 40.2 | 0.150 | 54.6 | 0.398 | -132.6 |
| 3600 | 0.607 | 143.3 | 1.875 | 37.1 | 0.158 | 54.2 | 0.414 | -134.3 |
| 3800 | 0.607 | 139.7 | 1.780 | 34.1 | 0.167 | 53.6 | 0.430 | -136.0 |
| 4000 | 0.608 | 135.9 | 1.697 | 31.1 | 0.175 | 52.9 | 0.446 | -137.4 |
| 4200 | 0.610 | 132.0 | 1.623 | 28.3 | 0.184 | 52.1 | 0.461 | -138.8 |
| 4400 | 0.612 | 128.3 | 1.549 | 25.5 | 0.193 | 51.1 | 0.477 | -140.0 |
| 4600 | 0.613 | 124.5 | 1.484 | 22.8 | 0.202 | 50.1 | 0.492 | -141.1 |
| 4800 | 0.617 | 120.7 | 1.419 | 20.0 | 0.210 | 49.1 | 0.507 | -142.0 |
| 5000 | 0.620 | 117.1 | 1.364 | 17.5 | 0.218 | 48.0 | 0.520 | -143.0 |

MCH4020

S Parameter (Common Emitter)

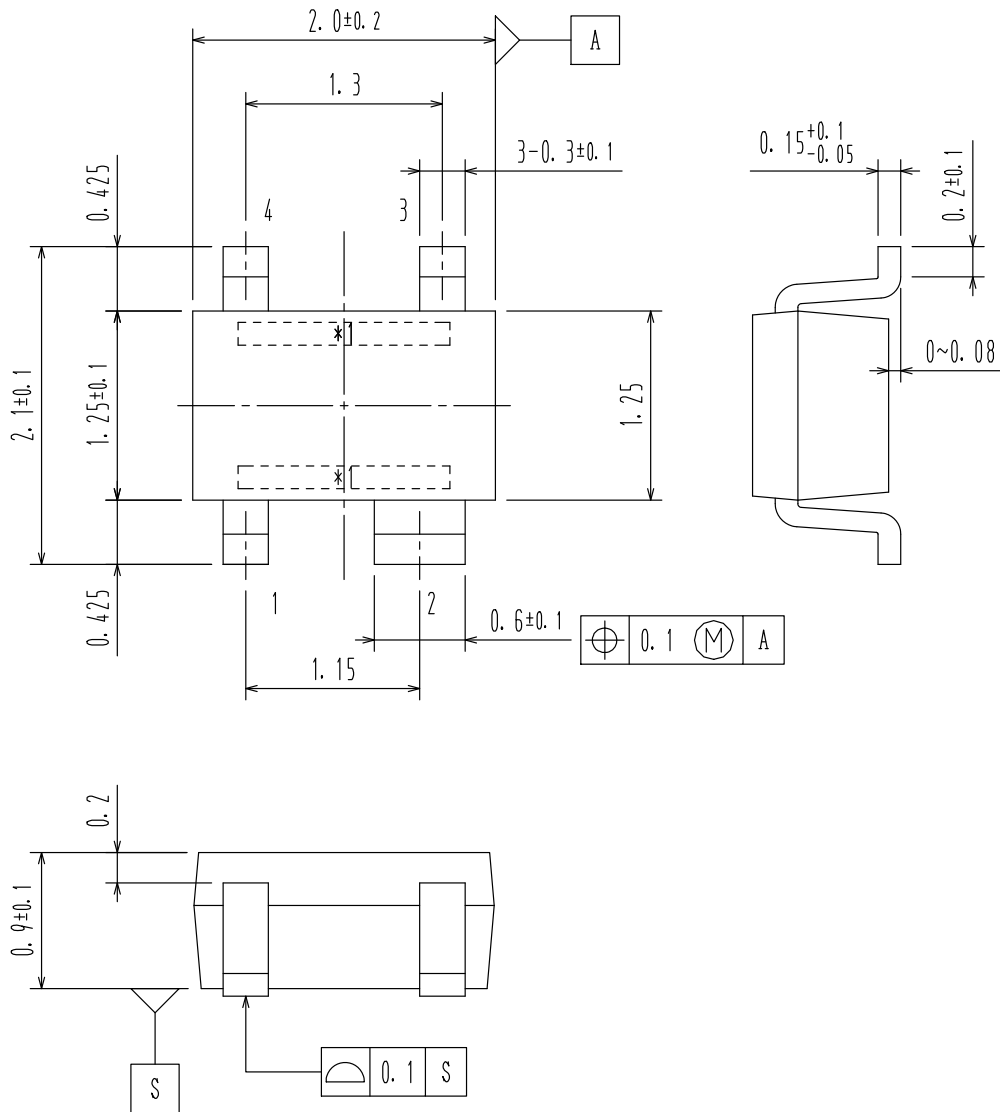
$V_{CE} = 5\text{ V}$, $I_C = 50\text{ mA}$

| Freq (MHz) | S11 | ∠S11 | S21 | ∠S21 | S12 | ∠S12 | S22 | ∠S22 |
|------------|-------|--------|--------|-------|-------|------|-------|--------|
| 200 | 0.489 | -128.9 | 33.664 | 121.6 | 0.019 | 61.0 | 0.625 | -65.5 |
| 400 | 0.568 | -154.7 | 19.269 | 100.2 | 0.028 | 61.3 | 0.449 | -94.0 |
| 600 | 0.579 | -163.6 | 13.271 | 90.3 | 0.038 | 64.6 | 0.404 | -102.5 |
| 800 | 0.583 | -172.3 | 9.829 | 84.2 | 0.047 | 66.7 | 0.350 | -112.6 |
| 1000 | 0.584 | -178.7 | 7.784 | 79.6 | 0.056 | 67.8 | 0.325 | -119.9 |
| 1200 | 0.589 | 176.2 | 6.443 | 75.8 | 0.066 | 68.5 | 0.308 | -125.6 |
| 1400 | 0.591 | 171.8 | 5.505 | 72.3 | 0.076 | 68.4 | 0.300 | -129.7 |
| 1600 | 0.593 | 167.9 | 4.817 | 69.1 | 0.085 | 68.1 | 0.295 | -133.2 |
| 1800 | 0.595 | 164.3 | 4.280 | 66.0 | 0.095 | 67.6 | 0.292 | -136.3 |
| 2000 | 0.596 | 161.2 | 3.857 | 63.1 | 0.105 | 67.0 | 0.294 | -138.9 |
| 2200 | 0.596 | 157.8 | 3.517 | 60.1 | 0.115 | 66.1 | 0.296 | -141.1 |
| 2400 | 0.596 | 154.7 | 3.234 | 57.2 | 0.124 | 65.1 | 0.300 | -142.9 |
| 2600 | 0.595 | 151.7 | 3.000 | 54.3 | 0.134 | 63.9 | 0.306 | -144.7 |
| 2800 | 0.596 | 148.5 | 2.799 | 51.5 | 0.144 | 62.8 | 0.313 | -145.9 |
| 3000 | 0.593 | 145.4 | 2.625 | 48.7 | 0.154 | 61.6 | 0.323 | -147.3 |
| 3200 | 0.591 | 142.2 | 2.472 | 45.9 | 0.163 | 60.2 | 0.334 | -148.3 |
| 3400 | 0.591 | 138.8 | 2.340 | 43.1 | 0.173 | 59.0 | 0.344 | -149.0 |
| 3600 | 0.589 | 135.4 | 2.221 | 40.4 | 0.182 | 57.7 | 0.358 | -149.6 |
| 3800 | 0.589 | 131.9 | 2.114 | 37.6 | 0.191 | 56.2 | 0.371 | -150.2 |
| 4000 | 0.588 | 128.3 | 2.017 | 34.9 | 0.201 | 54.6 | 0.385 | -150.6 |
| 4200 | 0.588 | 124.7 | 1.929 | 32.2 | 0.209 | 53.1 | 0.399 | -150.9 |
| 4400 | 0.589 | 121.1 | 1.847 | 29.6 | 0.218 | 51.7 | 0.412 | -151.3 |
| 4600 | 0.590 | 117.5 | 1.773 | 27.1 | 0.227 | 50.1 | 0.426 | -151.5 |
| 4800 | 0.590 | 113.9 | 1.702 | 24.4 | 0.235 | 48.6 | 0.438 | -151.7 |
| 5000 | 0.592 | 110.6 | 1.642 | 22.0 | 0.243 | 47.0 | 0.450 | -152.0 |

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

SC-82AB / MCP4
CASE 419AK
ISSUE O

DATE 30 NOV 2011



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