NEC

# SILICON TRANSISTOR

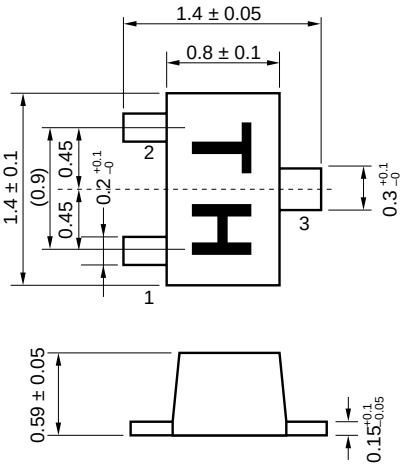
# 2SC5434

## NPN EPITAXIAL SILICON TRANSISTOR FOR HIGH-FREQUENCY LOW-NOISE AMPLIFICATION

### FEATURE

- Ultra super mini-mold thin flat package (1.4 mm × 1.8 mm × 0.59 mm: TYP.)
- Contains same chip as 2SC5008

### PACKAGE DIMENSIONS (in mm)




**PIN CONNECTIONS**
1: Emitter
2: Base
3: Collector

### ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25 °C)

| PARAMETER | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Collector to Base Voltage | $V_{CBO}$ | 20 | V |
| Collector to Emitter Voltage | $V_{CEO}$ | 10 | V |
| Emitter to Base Voltage | $V_{EBO}$ | 1.5 | V |
| Collector Current | $I_C$ | 35 | mA |
| Total Power Dissipation | $P_T$ | 125 | mW |
| Junction Temperature | $T_j$ | 150 | °C |
| Storage Temperature | $T_{stg}$ | –65 to +150 | °C |

### ELECTRICAL CHARACTERISTICS ($T_A$ = 25 °C)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Collector Cut-off Current | $I_{CBO}$ | $V_{CB}$ = 10 V, $I_E$ = 0 | | | 1000 | nA |
| Emitter Cut-off Current | $I_{EBO}$ | $V_{EB}$ = 1 V, $I_C$ = 0 | | | 1000 | nA |
| DC Current Gain | $h_{FE}$ | $V_{CE}$ = 3 V, $I_C$ = 5 mA **Note 1** | 80 | | 145 | |
| Gain Bandwidth Product | $f_T$ | $V_{CE}$ = 3 V, $I_C$ = 5 mA, f = 2 GHz | 5.5 | 80 | | GHz |
| Reverse Transfer Capacitance | $C_{re}$ | $V_{CB}$ = 3 V, $I_E$ = 0, f = 1 MHz **Note 2** | | 0.3 | 0.7 | pF |
| Insertion Power Gain | $\|S_{21e}\|^2$ | $V_{CE}$ = 3 V, $I_C$ = 5 mA, f = 2 GHz | 5.5 | 7.5 | | dB |
| Noise Figure | NF | $V_{CE}$ = 3 V, $I_C$ = 5 mA, f = 2 GHz | | 1.9 | 3.2 | dB |

**Notes 1.** Pulse measurement $P_W \leq 350\ \mu s$, duty cycle ≤ 2 %

**2.** Collector to base capacitance measured by capacitance meter (automatic balance bridge method) when emitter pin is connected to the guard pin.

**Because this product uses high-frequency process, avoid excessive input of static electricity, etc.**



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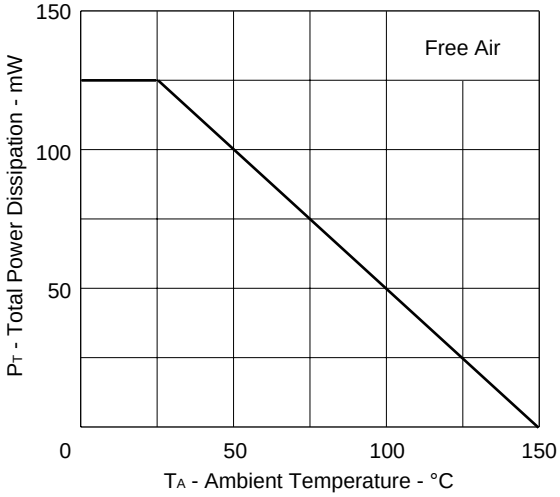
### $h_{FE}$ CLASSIFICATION

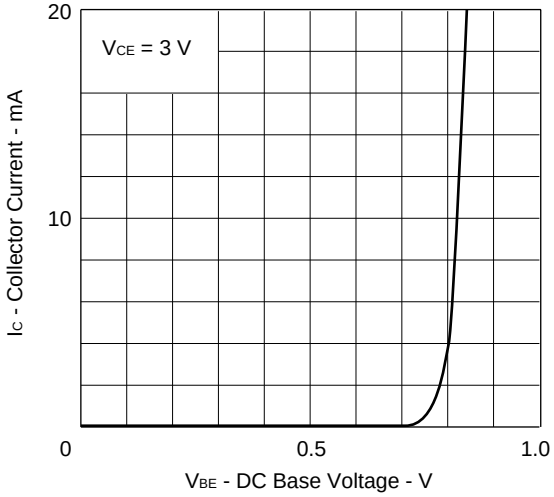
| RANK | EB | FB |
|---|---|---|
| Marking | TH | TJ |
| $h_{FE}$ | 80 to 110 | 100 to 145 |

## TYPICAL CHARACTERISTICS ($T_A$ = 25 °C)

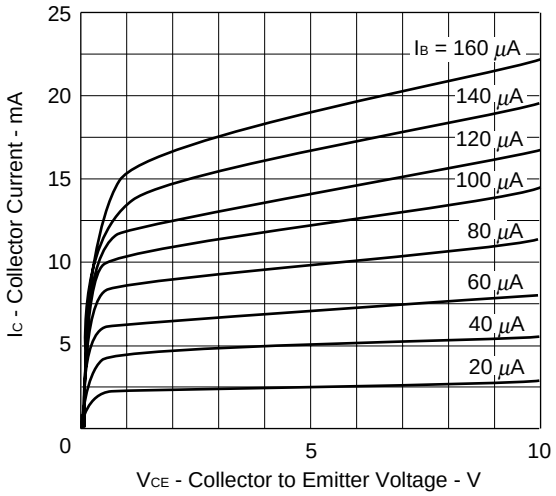
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



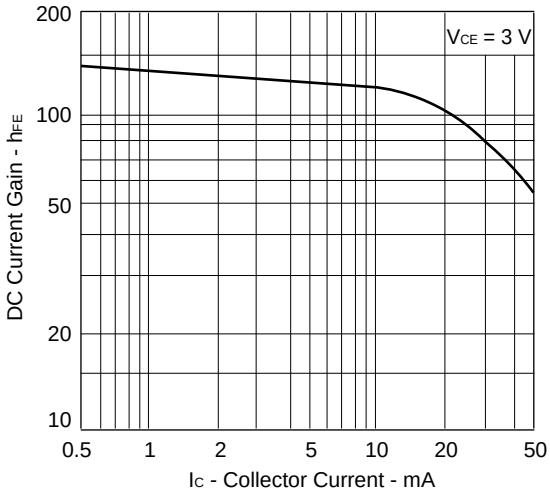

COLLECTOR CURRENT vs. DC BASE VOLTAGE



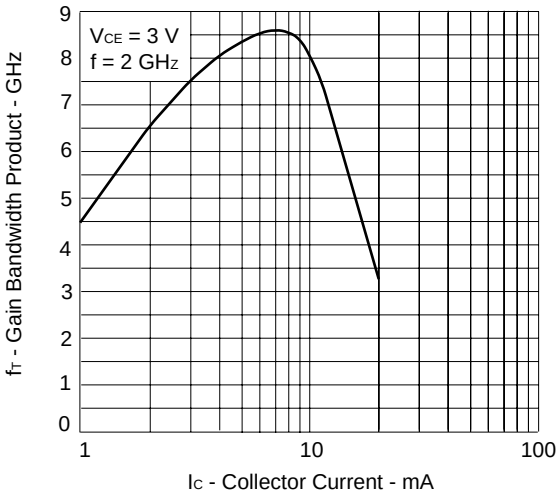

COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



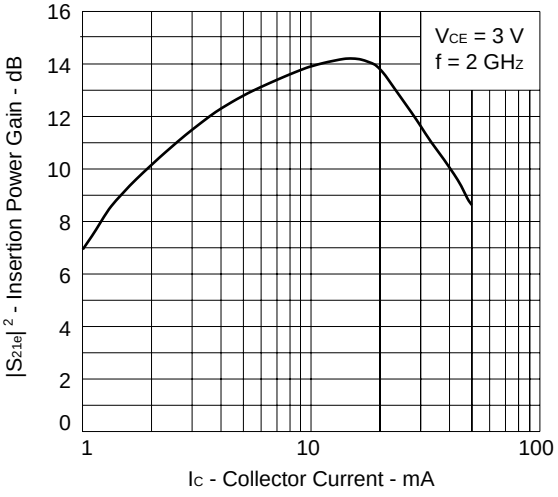

DC CURRENT GAIN vs. COLLECTOR CURRENT



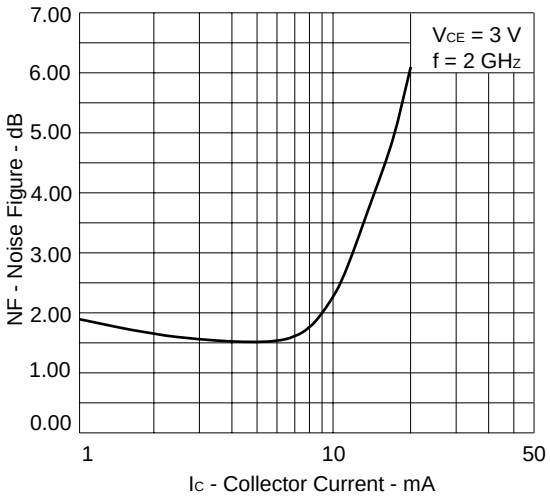
GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



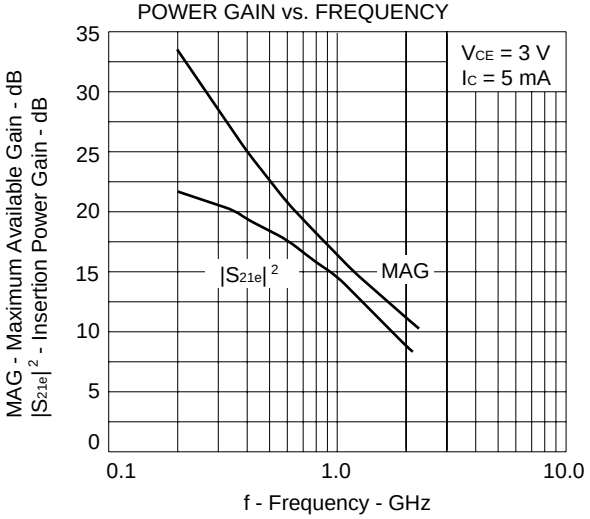

INSERTION POWER GAIN
vs. COLLECTOR CURRENT



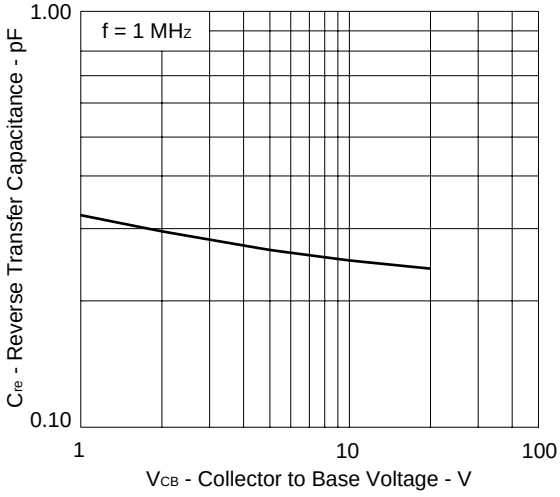

NOISE FIGURE vs. COLLECTOR CURRENT




MAXIMUM AVAILABLE GAIN/INSERTION
POWER GAIN vs. FREQUENCY




REVERSE TRANSFER CAPACITANCE
vs. COLLECTOR TO BASE VOLTAGE



## 2SC5434 S PARAMETER

$V_{CE}$ = 3 V, $I_C$ = 10 mA, $Z_0$ = 50 Ω

| FREQUENCY | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| MHz | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG |
| 200.00 | 0.589 | –46.2 | 15.156 | 134.5 | 0.027 | 63.5 | 0.772 | –23.5 |
| 400.00 | 0.366 | –73.1 | 9.926 | 112.1 | 0.038 | 58.9 | 0.561 | –28.9 |
| 600.00 | 0.265 | –91.3 | 7.179 | 99.2 | 0.048 | 59.0 | 0.465 | –30.3 |
| 800.00 | 0.205 | –104.1 | 5.703 | 92.4 | 0.056 | 61.0 | 0.429 | –31.0 |
| 1000.00 | 0.165 | –117.4 | 4.740 | 87.6 | 0.066 | 62.6 | 0.415 | –30.3 |
| 1200.00 | 0.143 | –132.6 | 4.069 | 82.7 | 0.077 | 63.9 | 0.398 | –28.6 |
| 1400.00 | 0.135 | –145.6 | 3.508 | 77.5 | 0.088 | 64.8 | 0.377 | –28.4 |
| 1600.00 | 0.131 | –158.5 | 3.075 | 73.8 | 0.100 | 65.9 | 0.353 | –29.4 |
| 1800.00 | 0.133 | –171.6 | 2.729 | 70.5 | 0.110 | 68.1 | 0.335 | –31.9 |
| 2000.00 | 0.146 | 176.2 | 2.474 | 67.2 | 0.120 | 67.3 | 0.323 | –35.1 |
| 2200.00 | 0.166 | 168.7 | 2.285 | 62.9 | 0.130 | 66.7 | 0.312 | –37.1 |
| 2400.00 | 0.184 | 164.3 | 2.154 | 58.8 | 0.143 | 65.6 | 0.293 | –40.2 |
| 2600.00 | 0.200 | 159.7 | 2.057 | 56.3 | 0.158 | 65.6 | 0.278 | –44.5 |
| 2800.00 | 0.218 | 155.6 | 1.918 | 54.3 | 0.168 | 66.4 | 0.273 | –49.0 |
| 3000.00 | 0.236 | 152.9 | 1.785 | 50.7 | 0.175 | 65.8 | 0.265 | –52.6 |

$V_{CE}$ = 3 V, $I_C$ = 7 mA, $Z_0$ = 50 Ω

| FREQUENCY | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| MHz | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG |
| 200.00 | 0.687 | –38.0 | 13.645 | 140.8 | 0.030 | 66.7 | 0.830 | –21.6 |
| 400.00 | 0.458 | –63.0 | 9.604 | 118.2 | 0.044 | 58.2 | 0.613 | –30.3 |
| 600.00 | 0.339 | –80.5 | 7.166 | 104.1 | 0.054 | 56.2 | 0.497 | –34.0 |
| 800.00 | 0.264 | –92.0 | 5.746 | 96.1 | 0.062 | 57.4 | 0.447 | –35.5 |
| 1000.00 | 0.210 | –102.5 | 4.830 | 90.8 | 0.072 | 58.2 | 0.422 | –34.6 |
| 1200.00 | 0.172 | –115.0 | 4.162 | 85.7 | 0.082 | 59.5 | 0.396 | –32.8 |
| 1400.00 | 0.153 | –127.5 | 3.604 | 80.1 | 0.093 | 60.3 | 0.370 | –32.5 |
| 1600.00 | 0.141 | –140.3 | 3.164 | 76.0 | 0.105 | 62.1 | 0.343 | –33.4 |
| 1800.00 | 0.134 | –154.2 | 2.816 | 72.5 | 0.114 | 64.1 | 0.324 | –35.5 |
| 2000.00 | 0.139 | –168.8 | 2.546 | 69.0 | 0.122 | 64.1 | 0.309 | –38.2 |
| 2200.00 | 0.155 | –179.6 | 2.355 | 64.7 | 0.133 | 63.2 | 0.296 | –40.0 |
| 2400.00 | 0.172 | 173.9 | 2.219 | 60.5 | 0.145 | 62.2 | 0.276 | –43.1 |
| 2600.00 | 0.187 | 168.0 | 2.120 | 57.9 | 0.159 | 62.4 | 0.261 | –47.1 |
| 2800.00 | 0.203 | 162.6 | 1.983 | 55.9 | 0.170 | 63.3 | 0.255 | –51.5 |
| 3000.00 | 0.221 | 159.0 | 1.843 | 52.3 | 0.176 | 62.9 | 0.247 | –54.9 |

$V_{CE}$ = 3 V, $I_C$ = 5 mA, $Z_0$ = 50 Ω

| FREQUENCY | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| MHz | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG |
| 200.00 | 0.777 | –30.9 | 11.368 | 147.0 | 0.032 | 69.9 | 0.883 | –18.7 |
| 400.00 | 0.562 | –53.6 | 8.634 | 125.2 | 0.051 | 57.8 | 0.688 | –29.1 |
| 600.00 | 0.431 | –71.4 | 6.753 | 109.9 | 0.062 | 53.9 | 0.559 | –35.3 |
| 800.00 | 0.344 | –82.7 | 5.525 | 100.7 | 0.071 | 53.6 | 0.496 | –38.3 |
| 1000.00 | 0.273 | –91.9 | 4.677 | 94.6 | 0.080 | 53.4 | 0.460 | –38.2 |
| 1200.00 | 0.220 | –102.3 | 4.070 | 88.9 | 0.089 | 53.9 | 0.424 | –36.8 |
| 1400.00 | 0.189 | –113.6 | 3.534 | 82.8 | 0.099 | 54.9 | 0.391 | –36.7 |
| 1600.00 | 0.165 | –125.3 | 3.113 | 78.1 | 0.109 | 57.1 | 0.358 | –37.6 |
| 1800.00 | 0.149 | –138.6 | 2.768 | 74.2 | 0.118 | 58.9 | 0.336 | –39.7 |
| 2000.00 | 0.143 | –154.5 | 2.513 | 70.6 | 0.125 | 58.9 | 0.319 | –42.1 |
| 2200.00 | 0.153 | –168.3 | 2.326 | 65.9 | 0.135 | 58.2 | 0.303 | –43.9 |
| 2400.00 | 0.167 | –177.1 | 2.189 | 61.6 | 0.146 | 57.8 | 0.282 | –47.1 |
| 2600.00 | 0.180 | 175.5 | 2.092 | 58.8 | 0.160 | 58.0 | 0.266 | –51.3 |
| 2800.00 | 0.194 | 168.8 | 1.955 | 56.7 | 0.168 | 59.4 | 0.259 | –55.2 |
| 3000.00 | 0.210 | 163.5 | 1.819 | 53.1 | 0.174 | 59.0 | 0.252 | –58.5 |

## 2SC5434 S PARAMETER

$V_{CE}$ = 3 V, $I_C$ = 3 mA, $Z_0$ = 50 Ω

| FREQUENCY | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| MHz | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG |
| 200.00 | 0.866 | –23.3 | 8.242 | 154.2 | 0.034 | 73.1 | 0.934 | –14.4 |
| 400.00 | 0.693 | –42.6 | 6.829 | 134.4 | 0.058 | 61.3 | 0.784 | –24.9 |
| 600.00 | 0.565 | –60.3 | 5.662 | 118.8 | 0.075 | 54.0 | 0.657 | –33.3 |
| 800.00 | 0.474 | –72.1 | 4.819 | 108.1 | 0.084 | 51.0 | 0.588 | –38.5 |
| 1000.00 | 0.390 | –80.9 | 4.196 | 101.0 | 0.092 | 48.6 | 0.543 | –39.9 |
| 1200.00 | 0.321 | –89.8 | 3.702 | 94.7 | 0.102 | 47.7 | 0.495 | –39.5 |
| 1400.00 | 0.274 | –99.4 | 3.260 | 87.8 | 0.111 | 48.6 | 0.453 | –40.0 |
| 1600.00 | 0.237 | –109.3 | 2.889 | 82.1 | 0.119 | 50.7 | 0.413 | –41.4 |
| 1800.00 | 0.209 | –119.5 | 2.590 | 77.8 | 0.124 | 52.1 | 0.386 | –43.8 |
| 2000.00 | 0.187 | –133.1 | 2.383 | 74.0 | 0.130 | 51.9 | 0.365 | –46.2 |
| 2200.00 | 0.183 | –147.1 | 2.189 | 68.7 | 0.138 | 51.5 | 0.344 | –48.2 |
| 2400.00 | 0.190 | –157.5 | 2.066 | 63.9 | 0.148 | 51.3 | 0.321 | –51.6 |
| 2600.00 | 0.197 | –166.2 | 1.982 | 60.8 | 0.161 | 52.3 | 0.306 | –55.8 |
| 2800.00 | 0.204 | –174.4 | 1.861 | 58.4 | 0.167 | 53.7 | 0.299 | –59.6 |
| 3000.00 | 0.215 | 178.1 | 1.735 | 54.5 | 0.171 | 53.6 | 0.289 | –62.5 |

$V_{CE}$ = 3 V, $I_C$ = 1 mA, $Z_0$ = 50 Ω

| FREQUENCY | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| MHz | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG |
| 200.00 | 0.959 | –12.8 | 3.416 | 164.4 | 0.038 | 79.7 | 0.984 | –7.5 |
| 400.00 | 0.880 | –24.9 | 3.110 | 150.1 | 0.070 | 68.7 | 0.922 | –14.6 |
| 600.00 | 0.792 | –38.9 | 2.829 | 136.8 | 0.097 | 60.3 | 0.843 | –22.9 |
| 800.00 | 0.739 | –50.7 | 2.654 | 125.2 | 0.118 | 53.8 | 0.801 | –30.5 |
| 1000.00 | 0.669 | –59.5 | 2.539 | 116.6 | 0.132 | 47.5 | 0.774 | –34.6 |
| 1200.00 | 0.590 | –67.2 | 2.307 | 109.5 | 0.146 | 42.7 | 0.726 | –36.6 |
| 1400.00 | 0.520 | –75.5 | 2.081 | 100.9 | 0.159 | 40.4 | 0.670 | –39.0 |
| 1600.00 | 0.458 | –84.6 | 1.965 | 93.1 | 0.163 | 39.4 | 0.616 | –42.0 |
| 1800.00 | 0.412 | –92.6 | 1.839 | 87.1 | 0.164 | 38.3 | 0.579 | –45.6 |
| 2000.00 | 0.360 | –101.7 | 1.698 | 81.6 | 0.165 | 35.1 | 0.551 | –49.1 |
| 2200.00 | 0.324 | –112.8 | 1.590 | 74.9 | 0.169 | 33.6 | 0.523 | –51.9 |
| 2400.00 | 0.313 | –124.0 | 1.520 | 68.9 | 0.173 | 32.9 | 0.491 | –56.0 |
| 2600.00 | 0.303 | –132.2 | 1.474 | 64.5 | 0.177 | 33.6 | 0.474 | –60.7 |
| 2800.00 | 0.291 | –140.2 | 1.401 | 61.1 | 0.174 | 34.2 | 0.471 | –64.4 |
| 3000.00 | 0.281 | –149.5 | 1.315 | 56.6 | 0.172 | 34.3 | 0.457 | –67.1 |

$V_{CE}$ = 1 V, $I_C$ = 5 mA, $Z_0$ = 50 Ω

| FREQUENCY | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| MHz | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG |
| 200.00 | 0.744 | –36.0 | 10.973 | 143.7 | 0.037 | 66.0 | 0.845 | –22.7 |
| 400.00 | 0.518 | –61.7 | 8.030 | 121.2 | 0.057 | 54.5 | 0.624 | –34.4 |
| 600.00 | 0.395 | –80.9 | 6.108 | 106.2 | 0.068 | 51.2 | 0.494 | –40.8 |
| 800.00 | 0.313 | –93.7 | 4.965 | 97.5 | 0.076 | 50.9 | 0.429 | –43.5 |
| 1000.00 | 0.253 | –105.4 | 4.187 | 91.5 | 0.086 | 50.8 | 0.390 | –43.2 |
| 1200.00 | 0.213 | –118.2 | 3.630 | 86.0 | 0.096 | 51.6 | 0.353 | –41.8 |
| 1400.00 | 0.193 | –130.2 | 3.144 | 79.8 | 0.108 | 53.2 | 0.321 | –41.9 |
| 1600.00 | 0.180 | –142.3 | 2.769 | 75.2 | 0.119 | 55.2 | 0.291 | –43.1 |
| 1800.00 | 0.171 | –155.1 | 2.510 | 72.0 | 0.127 | 56.8 | 0.270 | –45.6 |
| 2000.00 | 0.175 | –168.7 | 2.254 | 68.0 | 0.134 | 56.6 | 0.252 | –48.0 |
| 2200.00 | 0.191 | –179.1 | 2.066 | 63.1 | 0.145 | 55.9 | 0.234 | –50.6 |
| 2400.00 | 0.208 | 174.7 | 1.952 | 58.8 | 0.157 | 55.2 | 0.214 | –55.0 |
| 2600.00 | 0.233 | 168.8 | 1.864 | 56.0 | 0.172 | 55.7 | 0.201 | –60.4 |
| 2800.00 | 0.238 | 163.5 | 1.739 | 53.8 | 0.180 | 56.8 | 0.194 | –65.4 |
| 3000.00 | 0.255 | 159.3 | 1.620 | 50.0 | 0.186 | 56.2 | 0.185 | –69.8 |

## 2SC5434 S PARAMETER

$V_{CE}$ = 1 V, $I_C$ = 3 mA, $Z_0$ = 50 Ω

| FREQUENCY | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| MHz | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG |
| 200.00 | 0.845 | –26.5 | 8.141 | 152.0 | 0.040 | 72.5 | 0.914 | –17.3 |
| 400.00 | 0.659 | –47.9 | 6.589 | 131.2 | 0.067 | 57.7 | 0.740 | –29.5 |
| 600.00 | 0.531 | –66.7 | 5.355 | 115.3 | 0.084 | 50.6 | 0.604 | –38.8 |
| 800.00 | 0.439 | –79.3 | 4.509 | 104.9 | 0.093 | 47.4 | 0.530 | –44.1 |
| 1000.00 | 0.359 | –89.4 | 3.893 | 97.9 | 0.102 | 45.4 | 0.478 | –45.5 |
| 1200.00 | 0.297 | –100.0 | 3.419 | 91.6 | 0.112 | 44.9 | 0.428 | –45.3 |
| 1400.00 | 0.258 | –110.8 | 2.999 | 84.5 | 0.122 | 45.7 | 0.385 | –46.1 |
| 1600.00 | 0.229 | –121.7 | 2.665 | 79.2 | 0.129 | 47.7 | 0.346 | –47.8 |
| 1800.00 | 0.206 | –133.2 | 2.416 | 75.4 | 0.135 | 49.2 | 0.319 | –50.4 |
| 2000.00 | 0.194 | –147.5 | 2.179 | 71.0 | 0.140 | 48.6 | 0.297 | –53.1 |
| 2200.00 | 0.199 | –160.3 | 2.002 | 65.7 | 0.149 | 48.3 | 0.274 | –55.7 |
| 2400.00 | 0.211 | –169.1 | 1.890 | 61.0 | 0.160 | 48.4 | 0.253 | –60.1 |
| 2600.00 | 0.222 | –176.6 | 1.809 | 58.0 | 0.173 | 49.1 | 0.239 | –65.3 |
| 2800.00 | 0.232 | 176.3 | 1.694 | 55.4 | 0.178 | 50.2 | 0.232 | –69.8 |
| 3000.00 | 0.247 | 170.1 | 1.579 | 51.5 | 0.183 | 50.1 | 0.221 | –73.5 |

$V_{CE}$ = 1 V, $I_C$ = 1 mA, $Z_0$ = 50 Ω

| FREQUENCY | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| MHz | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG |
| 200.00 | 0.954 | –14.1 | 3.423 | 163.2 | 0.045 | 78.6 | 0.979 | –8.8 |
| 400.00 | 0.865 | –27.4 | 3.090 | 148.0 | 0.081 | 66.6 | 0.906 | –17.1 |
| 600.00 | 0.772 | –42.4 | 2.783 | 133.9 | 0.113 | 57.5 | 0.818 | –26.4 |
| 800.00 | 0.714 | –54.6 | 2.594 | 122.0 | 0.134 | 50.4 | 0.768 | –34.5 |
| 1000.00 | 0.637 | –63.9 | 2.450 | 113.2 | 0.150 | 44.2 | 0.731 | –38.8 |
| 1200.00 | 0.557 | –72.2 | 2.206 | 105.8 | 0.164 | 39.3 | 0.676 | –41.1 |
| 1400.00 | 0.489 | –81.2 | 1.991 | 97.0 | 0.177 | 36.8 | 0.618 | –43.9 |
| 1600.00 | 0.432 | –90.6 | 1.871 | 89.4 | 0.180 | 35.9 | 0.563 | –47.2 |
| 1800.00 | 0.388 | –99.1 | 1.743 | 83.4 | 0.181 | 34.3 | 0.525 | –51.1 |
| 2000.00 | 0.339 | –109.2 | 1.602 | 77.9 | 0.180 | 31.3 | 0.495 | –54.6 |
| 2200.00 | 0.310 | –120.9 | 1.499 | 71.1 | 0.185 | 29.5 | 0.464 | –57.8 |
| 2400.00 | 0.305 | –132.1 | 1.432 | 65.2 | 0.188 | 28.9 | 0.434 | –62.7 |
| 2600.00 | 0.298 | –140.4 | 1.388 | 61.1 | 0.192 | 29.4 | 0.418 | –67.8 |
| 2800.00 | 0.290 | –148.7 | 1.313 | 57.7 | 0.188 | 29.9 | 0.414 | –71.7 |
| 3000.00 | 0.286 | –157.6 | 1.234 | 53.0 | 0.186 | 29.5 | 0.398 | –74.8 |

[MEMO]