



# SANYO Semiconductors

## DATA SHEET

# MCH4016

— NPN Epitaxial Planar Silicon Transistor

## High-Frequency Low-Noise Amplifier

### Features

- Low-noise use :  $NF=1.2\text{dB typ (f=1GHz)}$
- High cut-off frequency :  $f_T=10\text{GHz typ (V}_{CE}=5\text{V)}$
- High gain :  $|S_{21e}|^2=18\text{dB typ (f=1GHz)}$
- Halogen free compliance

### Specifications

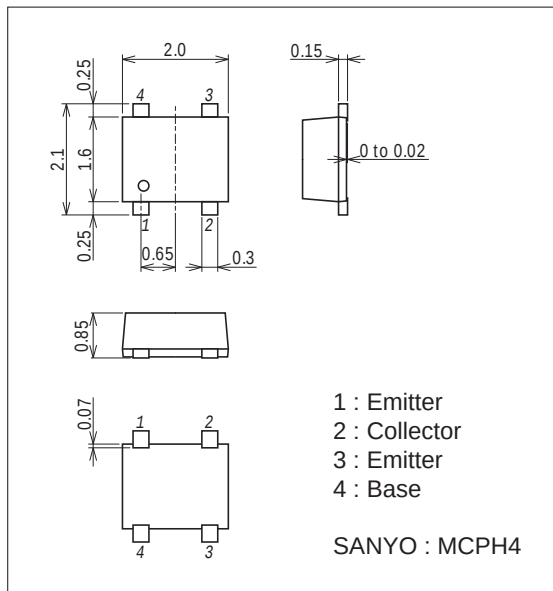
**Absolute Maximum Ratings** at  $T_a=25^\circ\text{C}$

| Parameter                    | Symbol    | Conditions | Ratings     | Unit             |
|------------------------------|-----------|------------|-------------|------------------|
| Collector-to-Base Voltage    | $V_{CBO}$ |            | 20          | V                |
| Collector-to-Emitter Voltage | $V_{CEO}$ |            | 12          | V                |
| Emitter-to-Base Voltage      | $V_{EBO}$ |            | 2           | V                |
| Collector Current            | $I_C$     |            | 30          | mA               |
| Collector Dissipation        | $P_C$     |            | 350         | mW               |
| Junction Temperature         | $T_j$     |            | 150         | $^\circ\text{C}$ |
| Storage Temperature          | $T_{stg}$ |            | -55 to +150 | $^\circ\text{C}$ |

### Package Dimensions

unit : mm (typ)

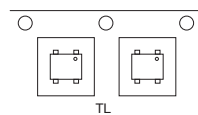
7020A-003



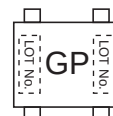
### Product & Package Information

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

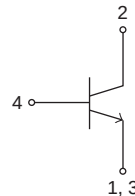
### Packing Type: TL



### Marking



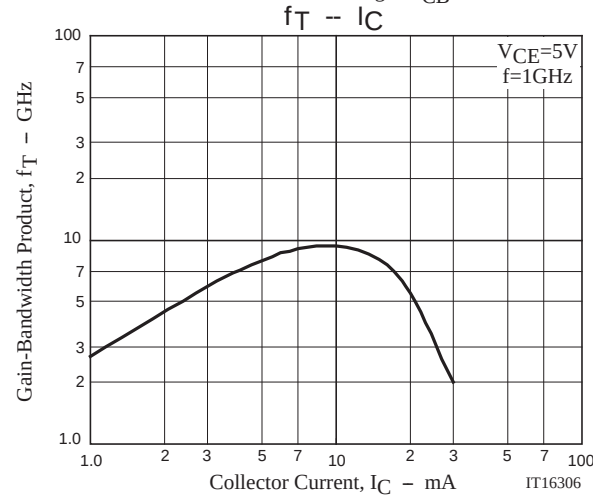
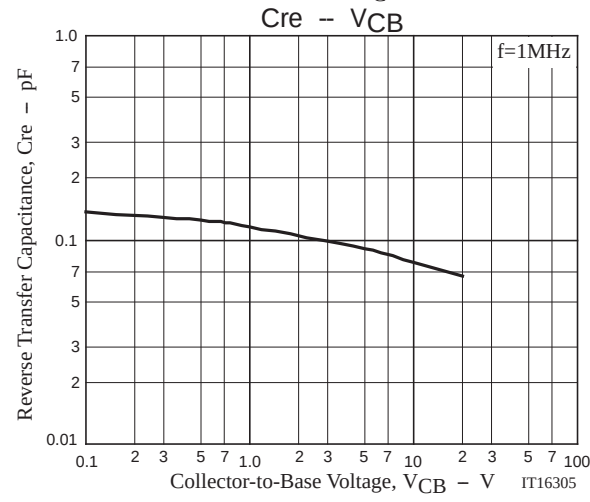
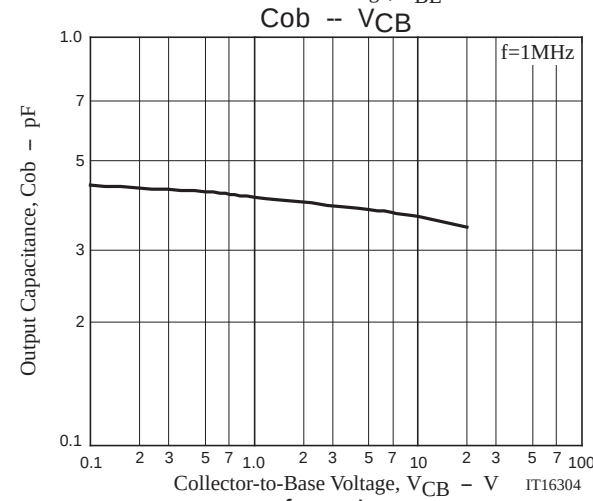
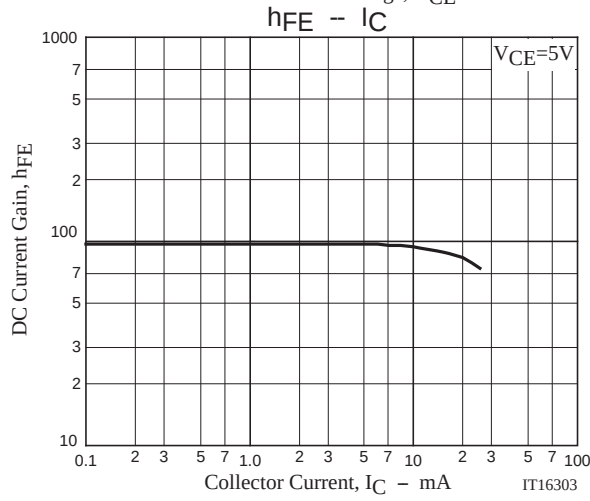
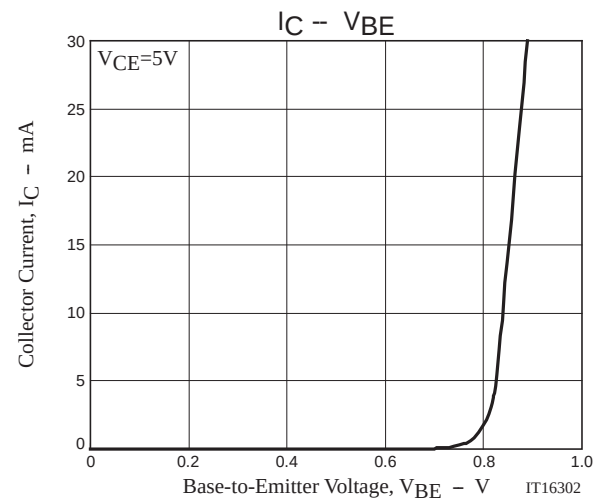
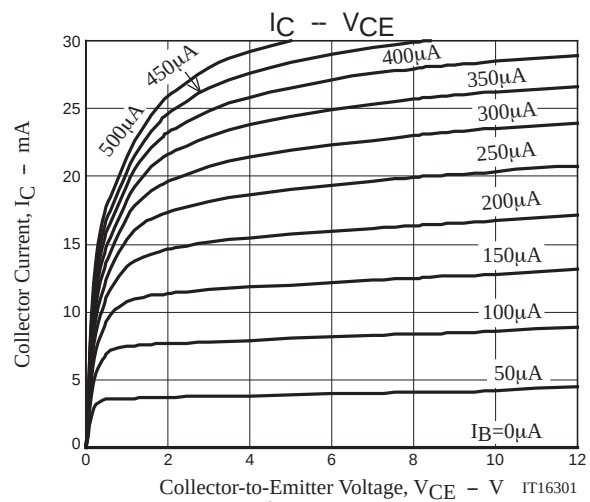
### Electrical Connection



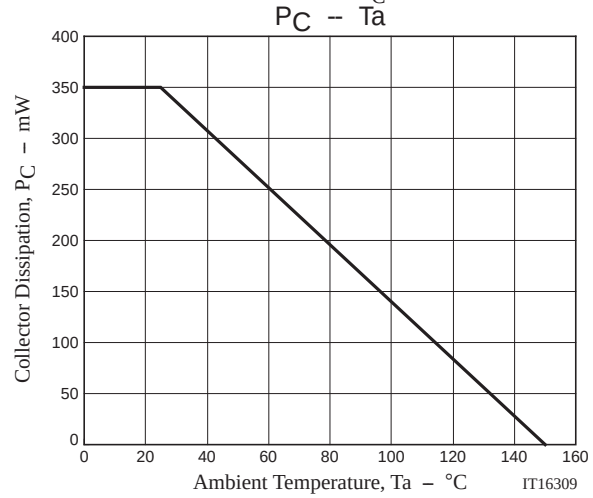
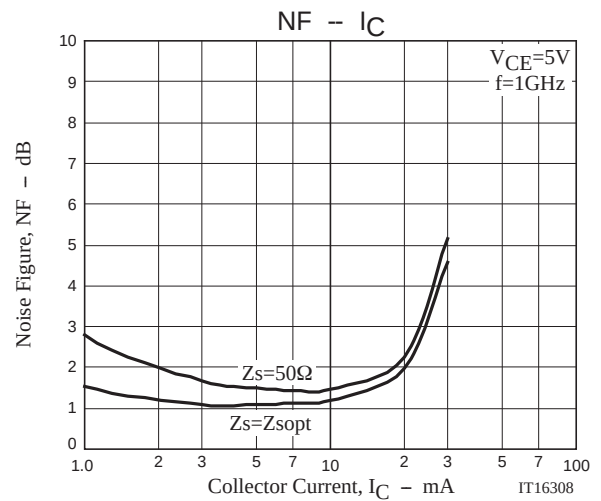
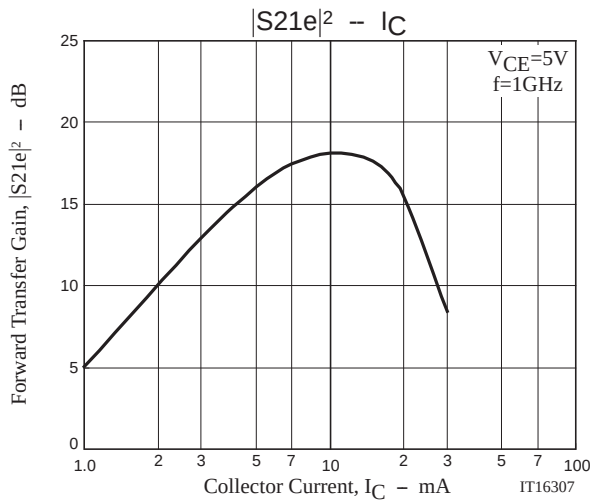
Electrical Characteristics at Ta=25°C

| Parameter                | Symbol             | Conditions              | Ratings |     |     | Unit |
|--------------------------|--------------------|-------------------------|---------|-----|-----|------|
|                          |                    |                         | min     | typ | max |      |
| Collector Cutoff Current | ICBO               | VCE=5V, IE=0A           |         |     | 1.0 | μA   |
| Emitter Cutoff Current   | IEBO               | VEB=1V, IC=0A           |         |     | 1.0 | μA   |
| DC Current Gain          | hFE                | VCE=5V, IC=5mA          | 60      |     | 150 |      |
| Gain-Bandwidth Product   | fT                 | VCE=5V, IC=10mA         | 8       | 10  |     | GHz  |
| Forward Transfer Gain    | S21e  <sup>2</sup> | VCE=5V, IC=10mA, f=1GHz | 15      | 18  |     | dB   |
| Noise Figure             | NF                 | VCE=5V, IC=10mA, f=1GHz |         | 1.2 | 1.8 | dB   |

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



# MCH4016



## S Parameters (Common emitter)

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

| Freq(MHz) | $ S_{11} $ | $\angle S_{11}$ | $ S_{21} $ | $\angle S_{21}$ | $ S_{12} $ | $\angle S_{12}$ | $ S_{22} $ | $\angle S_{22}$ |
|-----------|------------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|
| 100       | 0.885      | -10.8           | 9.149      | 167.9           | 0.006      | 98.4            | 0.991      | -5.9            |
| 200       | 0.888      | -16.7           | 8.897      | 156.7           | 0.013      | 91.0            | 0.991      | -12.6           |
| 300       | 0.849      | -29.7           | 8.746      | 150.1           | 0.020      | 87.4            | 0.976      | -18.8           |
| 400       | 0.849      | -35.3           | 8.564      | 143.8           | 0.027      | 82.6            | 0.960      | -25.3           |
| 500       | 0.797      | -52.2           | 8.342      | 134.4           | 0.035      | 76.3            | 0.919      | -32.9           |
| 600       | 0.784      | -60.4           | 7.915      | 128.4           | 0.042      | 72.1            | 0.887      | -37.8           |
| 700       | 0.752      | -72.5           | 7.637      | 121.1           | 0.047      | 67.4            | 0.846      | -43.5           |
| 800       | 0.716      | -82.3           | 7.303      | 114.4           | 0.052      | 63.7            | 0.806      | -48.2           |
| 900       | 0.691      | -86.9           | 6.819      | 109.1           | 0.055      | 60.5            | 0.773      | -52.4           |
| 1000      | 0.648      | -90.1           | 6.603      | 102.9           | 0.058      | 58.4            | 0.735      | -55.7           |
| 1200      | 0.591      | -95.3           | 5.916      | 93.6            | 0.062      | 55.2            | 0.684      | -61.5           |
| 1400      | 0.553      | -100.4          | 5.241      | 86.7            | 0.065      | 53.9            | 0.651      | -65.5           |
| 1600      | 0.522      | -105.3          | 4.694      | 80.8            | 0.069      | 53.9            | 0.630      | -68.6           |
| 1800      | 0.496      | -110.5          | 4.224      | 75.6            | 0.072      | 54.3            | 0.614      | -71.1           |
| 2000      | 0.475      | -115.3          | 3.835      | 70.8            | 0.075      | 55.2            | 0.604      | -73.5           |
| 2200      | 0.454      | -120.0          | 3.532      | 66.3            | 0.080      | 56.5            | 0.603      | -75.4           |
| 2400      | 0.441      | -124.3          | 3.267      | 61.7            | 0.084      | 57.4            | 0.605      | -78.2           |
| 2600      | 0.426      | -128.5          | 3.033      | 57.7            | 0.088      | 58.6            | 0.601      | -80.1           |
| 2800      | 0.417      | -132.2          | 2.861      | 53.9            | 0.094      | 59.9            | 0.608      | -81.3           |
| 3000      | 0.415      | -137.1          | 2.700      | 49.3            | 0.100      | 60.0            | 0.626      | -84.1           |

## MCH4016

### 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> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.772           | -17.9            | 14.674          | 162.9            | 0.005           | 91.6             | 0.981           | -7.6             |
| 200       | 0.757           | -28.1            | 13.995          | 149.9            | 0.012           | 86.4             | 0.967           | -15.4            |
| 300       | 0.696           | -49.8            | 13.409          | 139.6            | 0.017           | 81.6             | 0.931           | -22.4            |
| 400       | 0.687           | -59.6            | 12.760          | 131.8            | 0.023           | 78.0             | 0.893           | -29.2            |
| 500       | 0.638           | -84.0            | 11.990          | 119.8            | 0.028           | 72.9             | 0.832           | -36.5            |
| 600       | 0.628           | 266.0            | 10.954          | 113.3            | 0.033           | 69.6             | 0.789           | -40.8            |
| 700       | 0.600           | 251.6            | 10.102          | 105.2            | 0.036           | 67.3             | 0.746           | -45.6            |
| 800       | 0.582           | 243.0            | 9.048           | 99.8             | 0.039           | 65.5             | 0.705           | -49.4            |
| 900       | 0.564           | 234.3            | 8.358           | 94.6             | 0.042           | 64.6             | 0.675           | -52.7            |
| 1000      | 0.546           | 227.8            | 7.593           | 90.5             | 0.044           | 63.9             | 0.644           | -55.4            |
| 1200      | 0.520           | 216.4            | 6.467           | 83.3             | 0.049           | 63.8             | 0.606           | -60.0            |
| 1400      | 0.503           | 207.8            | 5.601           | 77.7             | 0.054           | 64.9             | 0.585           | -63.1            |
| 1600      | 0.487           | 200.5            | 4.943           | 72.7             | 0.059           | 66.1             | 0.575           | -65.7            |
| 1800      | 0.474           | 193.8            | 4.412           | 68.3             | 0.064           | 67.1             | 0.568           | -67.9            |
| 2000      | 0.464           | 187.4            | 3.984           | 64.0             | 0.070           | 68.1             | 0.566           | -70.1            |
| 2200      | 0.453           | 181.1            | 3.638           | 60.0             | 0.076           | 68.9             | 0.572           | -72.1            |
| 2400      | 0.447           | 175.5            | 3.353           | 55.9             | 0.083           | 69.5             | 0.580           | -75.0            |
| 2600      | 0.439           | 169.7            | 3.093           | 52.2             | 0.089           | 69.9             | 0.581           | -77.0            |
| 2800      | 0.436           | 164.4            | 2.902           | 48.7             | 0.097           | 70.3             | 0.592           | -78.3            |
| 3000      | 0.438           | 159.4            | 2.730           | 44.4             | 0.105           | 69.6             | 0.614           | -81.2            |

V<sub>CE</sub>=3V, I<sub>C</sub>=15mA

| 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> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.658           | -27.9            | 17.323          | 158.7            | 0.007           | 76.6             | 0.954           | -8.8             |
| 200       | 0.626           | -45.6            | 15.793          | 144.0            | 0.011           | 74.7             | 0.917           | -16.8            |
| 300       | 0.580           | -77.0            | 14.532          | 129.9            | 0.016           | 73.2             | 0.865           | -23.0            |
| 400       | 0.574           | 267.3            | 12.943          | 120.3            | 0.019           | 71.7             | 0.817           | -28.2            |
| 500       | 0.566           | 244.1            | 11.483          | 108.1            | 0.023           | 69.0             | 0.761           | -33.8            |
| 600       | 0.567           | 234.2            | 10.197          | 101.8            | 0.026           | 67.5             | 0.726           | -37.0            |
| 700       | 0.565           | 223.8            | 8.885           | 95.3             | 0.028           | 68.3             | 0.695           | -40.6            |
| 800       | 0.561           | 216.8            | 7.827           | 90.7             | 0.031           | 68.4             | 0.667           | -43.7            |
| 900       | 0.558           | 210.6            | 7.057           | 86.4             | 0.033           | 69.1             | 0.649           | -46.3            |
| 1000      | 0.551           | 205.6            | 6.338           | 82.9             | 0.036           | 69.8             | 0.629           | -48.7            |
| 1200      | 0.544           | 197.0            | 5.285           | 76.6             | 0.041           | 71.6             | 0.608           | -53.1            |
| 1400      | 0.538           | 190.2            | 4.539           | 71.3             | 0.046           | 73.4             | 0.600           | -56.4            |
| 1600      | 0.532           | 184.2            | 3.977           | 66.5             | 0.053           | 75.1             | 0.601           | -59.5            |
| 1800      | 0.526           | 178.6            | 3.536           | 62.1             | 0.059           | 76.2             | 0.602           | -62.3            |
| 2000      | 0.522           | 173.1            | 3.182           | 57.9             | 0.066           | 77.2             | 0.606           | -65.1            |
| 2200      | 0.517           | 167.5            | 2.894           | 53.8             | 0.073           | 77.8             | 0.617           | -67.7            |
| 2400      | 0.514           | 162.6            | 2.657           | 49.7             | 0.081           | 77.9             | 0.628           | -71.1            |
| 2600      | 0.511           | 157.4            | 2.439           | 45.9             | 0.089           | 77.9             | 0.632           | -73.7            |
| 2800      | 0.511           | 152.7            | 2.277           | 42.3             | 0.098           | 77.8             | 0.646           | -75.5            |
| 3000      | 0.513           | 148.3            | 2.136           | 38.0             | 0.107           | 76.6             | 0.671           | -79.0            |

## MCH4016

### 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> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.549           | -44.6            | 18.205          | 153.5            | 0.008           | 79.1             | 0.907           | -10.1            |
| 200       | 0.527           | -76.1            | 15.342          | 135.9            | 0.011           | 62.5             | 0.842           | -16.7            |
| 300       | 0.543           | 248.7            | 12.862          | 118.8            | 0.014           | 63.2             | 0.790           | -21.1            |
| 400       | 0.558           | 231.8            | 10.435          | 108.2            | 0.016           | 62.9             | 0.755           | -24.4            |
| 500       | 0.584           | 215.9            | 8.577           | 98.2             | 0.018           | 63.7             | 0.716           | -28.7            |
| 600       | 0.593           | 208.7            | 7.275           | 92.7             | 0.021           | 66.6             | 0.696           | -31.1            |
| 700       | 0.603           | 201.7            | 6.174           | 87.3             | 0.023           | 68.5             | 0.681           | -34.3            |
| 800       | 0.606           | 196.9            | 5.422           | 83.4             | 0.025           | 71.2             | 0.665           | -37.2            |
| 900       | 0.610           | 192.5            | 4.769           | 79.5             | 0.028           | 73.0             | 0.657           | -39.8            |
| 1000      | 0.608           | 189.0            | 4.284           | 76.3             | 0.030           | 74.7             | 0.646           | -42.4            |
| 1200      | 0.608           | 182.6            | 3.525           | 70.3             | 0.036           | 78.4             | 0.639           | -47.3            |
| 1400      | 0.607           | 177.4            | 3.011           | 65.2             | 0.042           | 80.9             | 0.641           | -51.4            |
| 1600      | 0.605           | 172.4            | 2.624           | 60.2             | 0.049           | 82.5             | 0.648           | -55.2            |
| 1800      | 0.603           | 167.7            | 2.328           | 55.7             | 0.056           | 83.9             | 0.654           | -58.8            |
| 2000      | 0.602           | 162.9            | 2.091           | 51.3             | 0.064           | 84.4             | 0.661           | -62.2            |
| 2200      | 0.600           | 157.9            | 1.897           | 47.1             | 0.073           | 84.7             | 0.673           | -65.5            |
| 2400      | 0.599           | 153.5            | 1.732           | 42.8             | 0.081           | 84.6             | 0.686           | -69.5            |
| 2600      | 0.598           | 148.7            | 1.584           | 38.9             | 0.090           | 84.2             | 0.690           | -72.6            |
| 2800      | 0.598           | 144.3            | 1.474           | 35.2             | 0.100           | 83.6             | 0.706           | -75.0            |
| 3000      | 0.600           | 140.3            | 1.377           | 30.8             | 0.111           | 82.0             | 0.731           | -79.0            |

V<sub>CE</sub>=5V, 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> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.890           | -10.5            | 9.159           | 168.3            | 0.006           | 97.5             | 0.994           | -5.7             |
| 200       | 0.895           | -16.1            | 8.952           | 157.5            | 0.012           | 91.7             | 0.995           | -11.9            |
| 300       | 0.857           | -28.6            | 8.775           | 150.8            | 0.019           | 88.8             | 0.982           | -17.9            |
| 400       | 0.858           | -34.1            | 8.515           | 144.6            | 0.026           | 85.2             | 0.969           | -24.1            |
| 500       | 0.807           | -50.6            | 8.382           | 135.3            | 0.033           | 79.0             | 0.931           | -31.5            |
| 600       | 0.794           | -58.8            | 7.984           | 129.2            | 0.040           | 74.2             | 0.900           | -36.3            |
| 700       | 0.762           | -70.5            | 7.684           | 122.0            | 0.045           | 69.6             | 0.862           | -42.0            |
| 800       | 0.724           | -80.4            | 7.385           | 115.1            | 0.050           | 65.6             | 0.823           | -46.6            |
| 900       | 0.700           | -87.9            | 6.977           | 109.9            | 0.053           | 62.3             | 0.790           | -50.8            |
| 1000      | 0.656           | 262.1            | 6.691           | 103.6            | 0.056           | 60.2             | 0.752           | -54.1            |
| 1200      | 0.597           | 247.3            | 6.001           | 94.2             | 0.060           | 57.0             | 0.701           | -59.8            |
| 1400      | 0.557           | 236.3            | 5.323           | 87.2             | 0.064           | 55.5             | 0.668           | -63.8            |
| 1600      | 0.525           | 227.3            | 4.769           | 81.3             | 0.066           | 55.5             | 0.647           | -66.9            |
| 1800      | 0.498           | 219.4            | 4.288           | 76.0             | 0.070           | 56.0             | 0.631           | -69.8            |
| 2000      | 0.476           | 212.2            | 3.897           | 71.1             | 0.073           | 56.9             | 0.621           | -71.8            |
| 2200      | 0.454           | 204.8            | 3.588           | 66.6             | 0.077           | 58.2             | 0.620           | -73.8            |
| 2400      | 0.440           | 198.1            | 3.319           | 62.0             | 0.082           | 59.1             | 0.622           | -76.6            |
| 2600      | 0.425           | 191.2            | 3.081           | 58.0             | 0.086           | 60.5             | 0.618           | -78.6            |
| 2800      | 0.415           | 184.9            | 2.906           | 54.1             | 0.092           | 61.7             | 0.626           | -79.8            |
| 3000      | 0.413           | 178.7            | 2.743           | 49.5             | 0.098           | 61.8             | 0.644           | -82.6            |

## MCH4016

### S Parameters (Common emitter)

V<sub>CE</sub>=5V, 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> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.786           | -15.9            | 15.297          | 164.4            | 0.004           | 84.8             | 0.985           | -6.9             |
| 200       | 0.783           | -25.0            | 14.577          | 151.8            | 0.011           | 89.1             | 0.977           | -14.4            |
| 300       | 0.724           | -45.0            | 14.127          | 141.8            | 0.016           | 86.4             | 0.947           | -21.2            |
| 400       | 0.718           | -53.7            | 13.473          | 134.2            | 0.022           | 81.6             | 0.914           | -27.9            |
| 500       | 0.658           | -77.4            | 12.720          | 122.1            | 0.027           | 75.2             | 0.857           | -35.2            |
| 600       | 0.645           | -87.3            | 11.734          | 115.6            | 0.031           | 72.3             | 0.814           | -39.6            |
| 700       | 0.611           | 257.7            | 10.764          | 107.2            | 0.035           | 69.8             | 0.771           | -44.5            |
| 800       | 0.588           | 248.7            | 9.679           | 101.5            | 0.038           | 68.0             | 0.730           | -48.4            |
| 900       | 0.567           | 239.6            | 8.908           | 96.2             | 0.041           | 66.7             | 0.698           | -51.7            |
| 1000      | 0.546           | 232.6            | 8.103           | 91.9             | 0.043           | 66.2             | 0.666           | -54.5            |
| 1200      | 0.515           | 220.7            | 6.875           | 84.5             | 0.048           | 65.7             | 0.625           | -59.1            |
| 1400      | 0.495           | 211.6            | 5.944           | 78.8             | 0.053           | 66.2             | 0.602           | -62.3            |
| 1600      | 0.478           | 204.0            | 5.233           | 73.8             | 0.058           | 67.3             | 0.591           | -64.9            |
| 1800      | 0.463           | 197.1            | 4.667           | 69.3             | 0.063           | 68.2             | 0.583           | -67.0            |
| 2000      | 0.452           | 190.6            | 4.211           | 65.0             | 0.069           | 69.3             | 0.579           | -69.2            |
| 2200      | 0.440           | 184.1            | 3.845           | 61.0             | 0.075           | 70.1             | 0.585           | -71.2            |
| 2400      | 0.433           | 178.3            | 3.538           | 56.9             | 0.082           | 70.5             | 0.592           | -74.0            |
| 2600      | 0.425           | 172.3            | 3.263           | 53.3             | 0.088           | 71.0             | 0.592           | -75.9            |
| 2800      | 0.421           | 167.0            | 3.059           | 49.8             | 0.096           | 71.3             | 0.604           | -77.2            |
| 3000      | 0.423           | 161.8            | 2.878           | 45.5             | 0.104           | 70.6             | 0.625           | -80.2            |

V<sub>CE</sub>=5V, I<sub>C</sub>=15mA

| 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> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.690           | -23.0            | 18.633          | 161.1            | 0.004           | 89.2             | 0.977           | -7.7             |
| 200       | 0.671           | -37.6            | 17.368          | 147.1            | 0.010           | 85.7             | 0.954           | -15.5            |
| 300       | 0.614           | -64.9            | 16.210          | 134.0            | 0.014           | 82.3             | 0.912           | -22.2            |
| 400       | 0.604           | -78.6            | 14.819          | 124.8            | 0.019           | 78.2             | 0.868           | -28.1            |
| 500       | 0.571           | 257.3            | 13.309          | 112.3            | 0.023           | 75.6             | 0.808           | -34.5            |
| 600       | 0.567           | 246.6            | 12.148          | 105.7            | 0.026           | 72.8             | 0.768           | -38.2            |
| 700       | 0.555           | 235.0            | 10.514          | 98.8             | 0.029           | 71.6             | 0.730           | -42.3            |
| 800       | 0.547           | 227.1            | 9.296           | 93.9             | 0.032           | 71.3             | 0.696           | -45.5            |
| 900       | 0.539           | 220.1            | 8.434           | 89.4             | 0.035           | 71.4             | 0.671           | -48.4            |
| 1000      | 0.529           | 214.5            | 7.590           | 85.8             | 0.037           | 72.0             | 0.645           | -50.8            |
| 1200      | 0.515           | 205.0            | 6.371           | 79.3             | 0.042           | 72.4             | 0.616           | -55.1            |
| 1400      | 0.505           | 197.5            | 5.483           | 74.1             | 0.048           | 73.6             | 0.602           | -58.2            |
| 1600      | 0.495           | 191.0            | 4.816           | 69.4             | 0.054           | 74.7             | 0.598           | -60.9            |
| 1800      | 0.487           | 184.9            | 4.285           | 65.1             | 0.060           | 75.7             | 0.595           | -63.4            |
| 2000      | 0.481           | 179.1            | 3.860           | 60.9             | 0.066           | 76.5             | 0.596           | -65.8            |
| 2200      | 0.473           | 173.3            | 3.516           | 57.0             | 0.074           | 76.8             | 0.605           | -68.1            |
| 2400      | 0.470           | 168.1            | 3.234           | 53.0             | 0.081           | 76.9             | 0.615           | -71.2            |
| 2600      | 0.465           | 162.7            | 2.975           | 49.3             | 0.088           | 77.1             | 0.617           | -73.5            |
| 2800      | 0.463           | 157.8            | 2.784           | 45.9             | 0.097           | 77.0             | 0.631           | -75.0            |
| 3000      | 0.466           | 153.2            | 2.616           | 41.6             | 0.106           | 75.9             | 0.654           | -78.3            |

## MCH4016

### S Parameters (Common emitter)

V<sub>CE</sub>=5V, 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> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.590           | -34.1            | 20.159          | 157.3            | 0.004           | 89.1             | 0.951           | -8.1             |
| 200       | 0.566           | -57.8            | 18.680          | 141.3            | 0.009           | 75.1             | 0.911           | -15.4            |
| 300       | 0.542           | 268.4            | 15.660          | 125.2            | 0.013           | 73.1             | 0.862           | -20.7            |
| 400       | 0.543           | 251.1            | 13.055          | 114.8            | 0.015           | 73.2             | 0.822           | -25.1            |
| 500       | 0.552           | 231.6            | 11.336          | 103.8            | 0.018           | 73.1             | 0.775           | -30.0            |
| 600       | 0.558           | 222.5            | 9.699           | 97.8             | 0.021           | 73.8             | 0.747           | -32.8            |
| 700       | 0.563           | 213.8            | 8.425           | 91.9             | 0.023           | 74.6             | 0.723           | -36.1            |
| 800       | 0.564           | 207.7            | 7.401           | 87.6             | 0.026           | 75.0             | 0.701           | -39.1            |
| 900       | 0.566           | 202.4            | 6.573           | 83.6             | 0.029           | 76.5             | 0.687           | -41.7            |
| 1000      | 0.563           | 198.0            | 5.899           | 80.3             | 0.031           | 77.5             | 0.670           | -44.2            |
| 1200      | 0.560           | 190.5            | 4.872           | 74.2             | 0.037           | 79.7             | 0.655           | -48.7            |
| 1400      | 0.557           | 184.4            | 4.165           | 69.1             | 0.043           | 81.5             | 0.651           | -52.4            |
| 1600      | 0.553           | 178.9            | 3.633           | 64.4             | 0.049           | 82.9             | 0.654           | -55.8            |
| 1800      | 0.550           | 173.7            | 3.225           | 59.9             | 0.056           | 83.8             | 0.656           | -58.9            |
| 2000      | 0.548           | 168.5            | 2.897           | 55.7             | 0.064           | 84.4             | 0.661           | -62.0            |
| 2200      | 0.544           | 163.2            | 2.631           | 51.7             | 0.072           | 84.5             | 0.672           | -65.0            |
| 2400      | 0.543           | 158.6            | 2.407           | 47.5             | 0.080           | 84.4             | 0.684           | -68.7            |
| 2600      | 0.541           | 153.5            | 2.206           | 43.7             | 0.089           | 84.1             | 0.687           | -71.5            |
| 2800      | 0.541           | 149.0            | 2.056           | 40.2             | 0.098           | 83.6             | 0.702           | -73.6            |
| 3000      | 0.543           | 144.8            | 1.925           | 35.7             | 0.109           | 82.0             | 0.727           | -77.4            |

V<sub>CE</sub>=8V, 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> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.895           | -10.3            | 9.140           | 168.5            | 0.005           | 104.3            | 0.993           | -5.4             |
| 200       | 0.899           | -15.8            | 8.948           | 157.7            | 0.011           | 95.9             | 0.997           | -11.4            |
| 300       | 0.861           | -28.2            | 8.761           | 151.1            | 0.017           | 91.9             | 0.985           | -17.1            |
| 400       | 0.863           | -33.7            | 8.569           | 144.9            | 0.024           | 86.3             | 0.974           | -23.2            |
| 500       | 0.814           | -49.9            | 8.378           | 135.6            | 0.032           | 80.2             | 0.940           | -30.3            |
| 600       | 0.799           | -58.0            | 7.994           | 129.6            | 0.038           | 76.0             | 0.910           | -35.0            |
| 700       | 0.769           | -69.6            | 7.683           | 122.3            | 0.043           | 71.1             | 0.873           | -40.5            |
| 800       | 0.730           | -79.5            | 7.405           | 115.4            | 0.047           | 67.1             | 0.835           | -45.0            |
| 900       | 0.706           | -86.9            | 7.086           | 110.2            | 0.051           | 63.9             | 0.803           | -49.2            |
| 1000      | 0.661           | 263.1            | 6.712           | 103.9            | 0.054           | 61.8             | 0.766           | -52.4            |
| 1200      | 0.601           | 248.3            | 6.025           | 94.4             | 0.058           | 58.6             | 0.716           | -58.1            |
| 1400      | 0.561           | 237.4            | 5.346           | 87.4             | 0.061           | 57.2             | 0.683           | -62.1            |
| 1600      | 0.528           | 228.3            | 4.790           | 81.3             | 0.064           | 57.0             | 0.663           | -65.1            |
| 1800      | 0.500           | 220.4            | 4.303           | 76.1             | 0.068           | 57.5             | 0.648           | -68.2            |
| 2000      | 0.477           | 213.1            | 3.913           | 71.1             | 0.071           | 58.5             | 0.638           | -70.1            |
| 2200      | 0.456           | 205.8            | 3.602           | 66.5             | 0.075           | 59.9             | 0.636           | -72.2            |
| 2400      | 0.440           | 199.0            | 3.332           | 61.9             | 0.080           | 60.9             | 0.640           | -75.0            |
| 2600      | 0.425           | 192.1            | 3.091           | 57.9             | 0.084           | 62.3             | 0.635           | -77.0            |
| 2800      | 0.415           | 185.7            | 2.915           | 53.9             | 0.090           | 63.7             | 0.643           | -78.3            |
| 3000      | 0.413           | 179.5            | 2.752           | 49.3             | 0.097           | 63.9             | 0.662           | -81.2            |

## MCH4016

### S Parameters (Common emitter)

V<sub>CE</sub>=8V, 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> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.800           | -14.8            | 15.446          | 165.2            | 0.004           | 97.8             | 0.988           | -6.4             |
| 200       | 0.800           | -23.6            | 14.773          | 152.8            | 0.010           | 90.4             | 0.982           | -13.6            |
| 300       | 0.741           | -42.8            | 14.286          | 142.9            | 0.015           | 87.2             | 0.957           | -20.1            |
| 400       | 0.738           | -50.8            | 13.553          | 135.5            | 0.021           | 82.8             | 0.926           | -26.6            |
| 500       | 0.672           | -74.3            | 12.891          | 123.3            | 0.026           | 77.6             | 0.873           | -33.8            |
| 600       | 0.659           | -84.2            | 11.828          | 116.7            | 0.030           | 74.6             | 0.832           | -38.2            |
| 700       | 0.621           | 260.7            | 10.924          | 108.2            | 0.034           | 71.9             | 0.790           | -43.0            |
| 800       | 0.595           | 251.5            | 9.849           | 102.4            | 0.037           | 69.7             | 0.749           | -46.9            |
| 900       | 0.573           | 242.3            | 9.050           | 97.0             | 0.040           | 68.3             | 0.717           | -50.2            |
| 1000      | 0.550           | 235.2            | 8.241           | 92.5             | 0.042           | 67.6             | 0.685           | -53.0            |
| 1200      | 0.517           | 223.0            | 6.985           | 85.0             | 0.047           | 67.2             | 0.644           | -57.6            |
| 1400      | 0.496           | 213.7            | 6.037           | 79.2             | 0.051           | 67.5             | 0.621           | -60.8            |
| 1600      | 0.477           | 205.9            | 5.312           | 74.2             | 0.056           | 68.6             | 0.609           | -63.4            |
| 1800      | 0.461           | 198.9            | 4.734           | 69.6             | 0.062           | 69.5             | 0.600           | -65.6            |
| 2000      | 0.449           | 192.3            | 4.273           | 65.3             | 0.067           | 70.5             | 0.597           | -67.8            |
| 2200      | 0.437           | 185.8            | 3.898           | 61.3             | 0.074           | 71.3             | 0.602           | -69.8            |
| 2400      | 0.429           | 179.9            | 3.586           | 57.1             | 0.080           | 71.8             | 0.609           | -72.7            |
| 2600      | 0.420           | 173.8            | 3.305           | 53.4             | 0.086           | 72.2             | 0.609           | -74.7            |
| 2800      | 0.417           | 168.4            | 3.098           | 49.9             | 0.094           | 72.6             | 0.621           | -76.0            |
| 3000      | 0.418           | 163.1            | 2.915           | 45.6             | 0.102           | 71.9             | 0.642           | -79.0            |

V<sub>CE</sub>=8V, I<sub>C</sub>=15mA

| 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> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.709           | -20.9            | 19.385          | 162.4            | 0.006           | 103.7            | 0.982           | -7.2             |
| 200       | 0.697           | -34.3            | 18.267          | 148.6            | 0.009           | 85.4             | 0.966           | -14.6            |
| 300       | 0.638           | -59.6            | 17.076          | 135.9            | 0.014           | 85.2             | 0.930           | -21.1            |
| 400       | 0.626           | -72.1            | 15.568          | 126.9            | 0.018           | 81.0             | 0.889           | -27.1            |
| 500       | 0.581           | 263.6            | 14.172          | 114.3            | 0.022           | 77.5             | 0.832           | -33.7            |
| 600       | 0.574           | 252.7            | 12.755          | 107.5            | 0.026           | 75.6             | 0.790           | -37.5            |
| 700       | 0.557           | 240.4            | 11.234          | 100.4            | 0.029           | 74.2             | 0.752           | -41.7            |
| 800       | 0.545           | 232.0            | 9.951           | 95.2             | 0.031           | 73.4             | 0.716           | -45.1            |
| 900       | 0.535           | 224.6            | 9.003           | 90.7             | 0.034           | 73.0             | 0.690           | -47.9            |
| 1000      | 0.523           | 218.7            | 8.110           | 86.9             | 0.037           | 72.8             | 0.663           | -50.5            |
| 1200      | 0.506           | 208.7            | 6.790           | 80.4             | 0.042           | 73.3             | 0.631           | -54.7            |
| 1400      | 0.495           | 200.8            | 5.833           | 75.1             | 0.047           | 74.5             | 0.614           | -57.8            |
| 1600      | 0.484           | 194.0            | 5.113           | 70.4             | 0.053           | 75.5             | 0.609           | -60.5            |
| 1800      | 0.474           | 187.8            | 4.548           | 66.0             | 0.059           | 76.3             | 0.605           | -62.9            |
| 2000      | 0.467           | 181.8            | 4.094           | 61.9             | 0.066           | 76.9             | 0.605           | -65.2            |
| 2200      | 0.459           | 175.8            | 3.728           | 58.0             | 0.073           | 77.5             | 0.613           | -67.5            |
| 2400      | 0.455           | 170.5            | 3.426           | 53.9             | 0.080           | 77.6             | 0.622           | -70.5            |
| 2600      | 0.449           | 164.9            | 3.151           | 50.3             | 0.087           | 77.7             | 0.624           | -72.7            |
| 2800      | 0.447           | 159.9            | 2.948           | 46.9             | 0.096           | 77.8             | 0.638           | -74.2            |
| 3000      | 0.450           | 155.2            | 2.771           | 42.6             | 0.105           | 76.5             | 0.661           | -77.4            |



## MCH4016

### S Parameters (Common emitter)

V<sub>CE</sub>=8V, 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> |
|-----------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 100       | 0.625           | -28.6            | 21.189          | 159.5            | 0.003           | 96.6             | 0.972           | -7.4             |
| 200       | 0.605           | -48.6            | 19.191          | 144.3            | 0.009           | 84.0             | 0.944           | -14.7            |
| 300       | 0.562           | -79.4            | 17.244          | 129.0            | 0.012           | 81.0             | 0.901           | -20.5            |
| 400       | 0.554           | 264.2            | 15.103          | 118.9            | 0.015           | 79.6             | 0.859           | -25.6            |
| 500       | 0.545           | 243.0            | 13.058          | 107.4            | 0.019           | 77.5             | 0.808           | -31.1            |
| 600       | 0.547           | 233.0            | 11.235          | 101.1            | 0.022           | 76.9             | 0.774           | -34.3            |
| 700       | 0.545           | 223.3            | 9.930           | 95.0             | 0.024           | 76.6             | 0.744           | -37.8            |
| 800       | 0.543           | 216.3            | 8.732           | 90.4             | 0.027           | 77.2             | 0.716           | -40.9            |
| 900       | 0.542           | 210.4            | 7.830           | 86.2             | 0.030           | 77.3             | 0.697           | -43.6            |
| 1000      | 0.536           | 205.4            | 7.027           | 82.8             | 0.033           | 78.4             | 0.676           | -46.0            |
| 1200      | 0.530           | 197.0            | 5.845           | 76.7             | 0.038           | 79.4             | 0.653           | -50.4            |
| 1400      | 0.524           | 190.3            | 5.010           | 71.6             | 0.044           | 80.7             | 0.645           | -53.8            |
| 1600      | 0.518           | 184.4            | 4.383           | 67.0             | 0.050           | 81.8             | 0.644           | -56.8            |
| 1800      | 0.512           | 178.8            | 3.893           | 62.6             | 0.057           | 82.6             | 0.644           | -59.7            |
| 2000      | 0.509           | 173.3            | 3.502           | 58.5             | 0.064           | 83.3             | 0.647           | -62.4            |
| 2200      | 0.503           | 167.8            | 3.183           | 54.6             | 0.071           | 83.4             | 0.657           | -65.1            |
| 2400      | 0.501           | 162.9            | 2.921           | 50.5             | 0.079           | 83.3             | 0.668           | -68.6            |
| 2600      | 0.498           | 157.7            | 2.681           | 46.8             | 0.087           | 83.0             | 0.670           | -71.1            |
| 2800      | 0.497           | 153.0            | 2.504           | 43.3             | 0.097           | 82.7             | 0.685           | -73.0            |
| 3000      | 0.501           | 148.7            | 2.349           | 39.0             | 0.106           | 81.1             | 0.710           | -76.5            |

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