TOSHIBA

*MICROWAVE SEMICONDUCTOR*
**TECHNICAL DATA**

**MICROWAVE POWER MMIC AMPLIFIER**

# TMD1414-2
# TMD1414-2B
# TMD1414-2C

**FEATURES**

- Suitable for Ku-band VSAT
- High Power P1dB=34.5dBm(TYP.)
- High Power Added Efficiency ηadd=29%(TYP.)
- High Gain G1dB=26dB(TYP.)
- Broadband Operation f=13.75 – 14.5GHz.

**ABSOLUTE MAXIMUM RATINGS(Ta=25°C)**

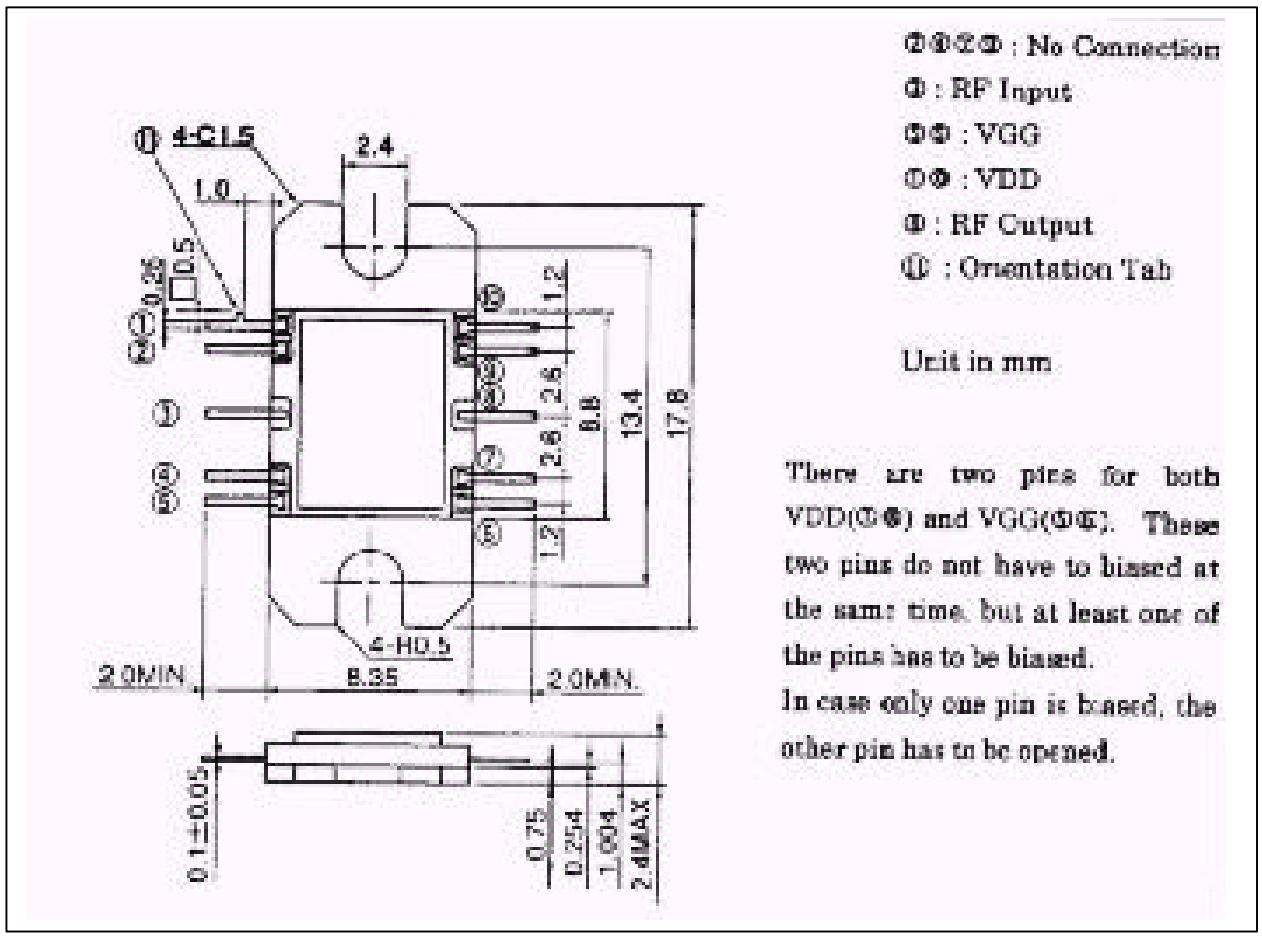
| CHARACTERISTICS | SYMBOL | UNIT | RATINGS |
|---|---|---|---|
| DRAIN SUPPLY VOLTAGE | VDD | V | 10 |
| GATE SUPPLY VOLTAGE | VGG | V | -10 |
| INPUT POWER | Pin | dBm | 20 |
| FLANGE TEMPERATURE | Tf | °C | -40 - +90 |
| STORAGE TEMPERATURE | Tstg | °C | -65 - +175 |

**RF PERFORMANCE SPECIFICATIONS (Ta=25°C)**

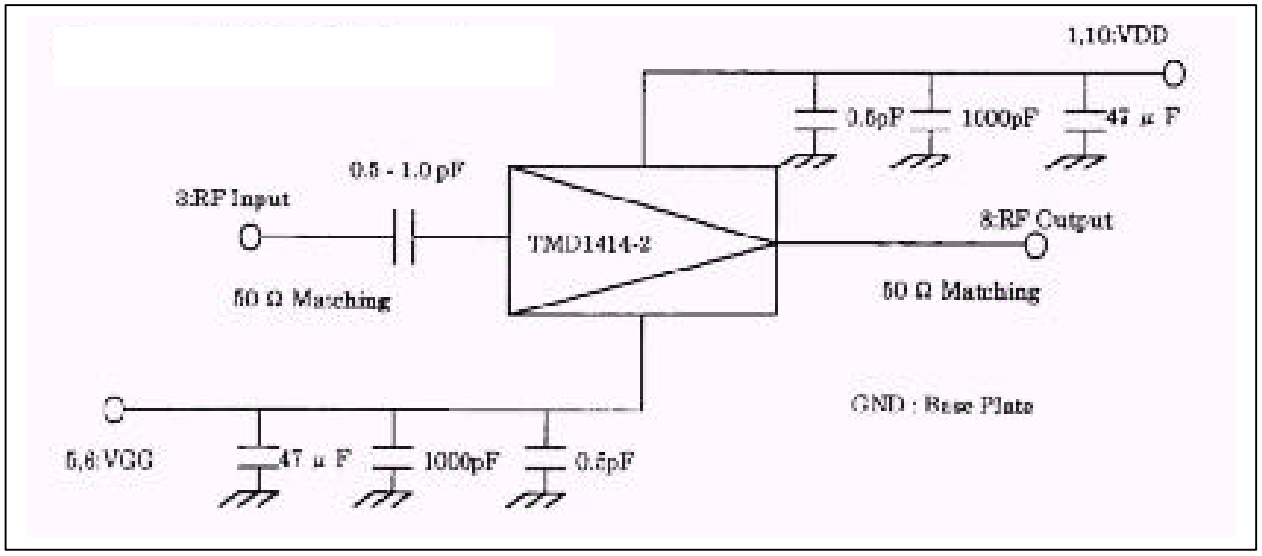
| CHARACTERISTICS | SYMBOL | CONDITION | UNIT | MIN. | TYP. | MAX. |
|---|---|---|---|---|---|---|
| Operaing Frequency | f | | GHz | 13.75 | – | 14.5 |
| Output Power at 1dB Gain Compression Point | P1dB | VDD=7V VGG=-5V | dBm | 32.0 | 34.5 | – |
| Power Gain at 1dB Gain Compression Point | G1dB | | dB | 21.0 | 26.0 | – |
| Gain Flatness | G | | dB | – | – | ±1.0 |
| Drain Current | IDD | | A | – | 1.4 | 1.8 |
| Power Added Efficiency | ηadd | | % | – | 29 | – |
| Third Order Intercept Point | IP3 | | dBm | – | 40 | – |
| VSWRin (small signal) | VSWRin | | – | – | 2.0:1 | 2.5:1 |
| VSWRout (small signal) | VSWRout | | – | – | 2.0:1 | 3.0:1 |
| Detector Output Voltage* | Vdet | @Po=33dBm | V | – | 3.0 | – |

*: For 2B,2C

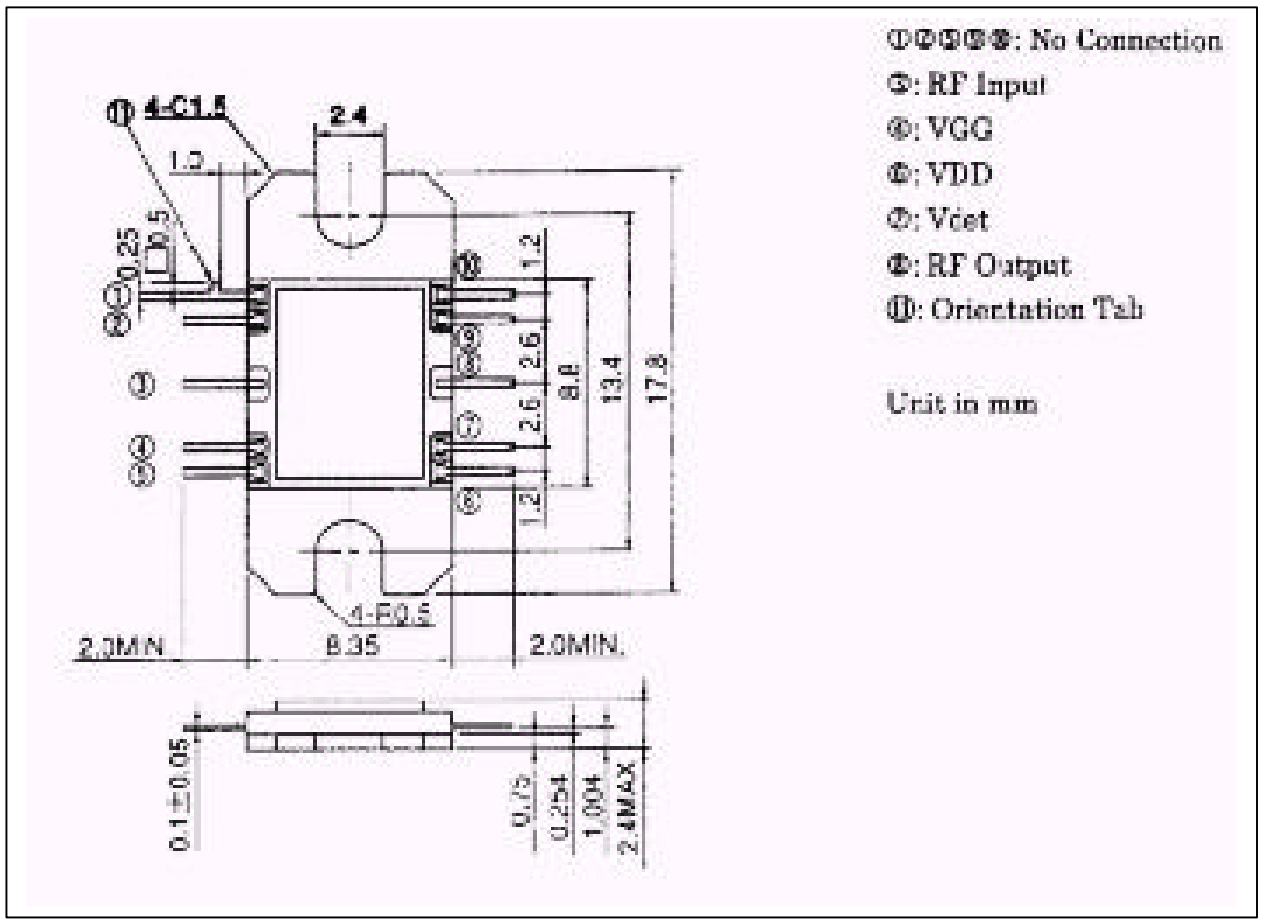
**Package Outline (TMD1414-2)**



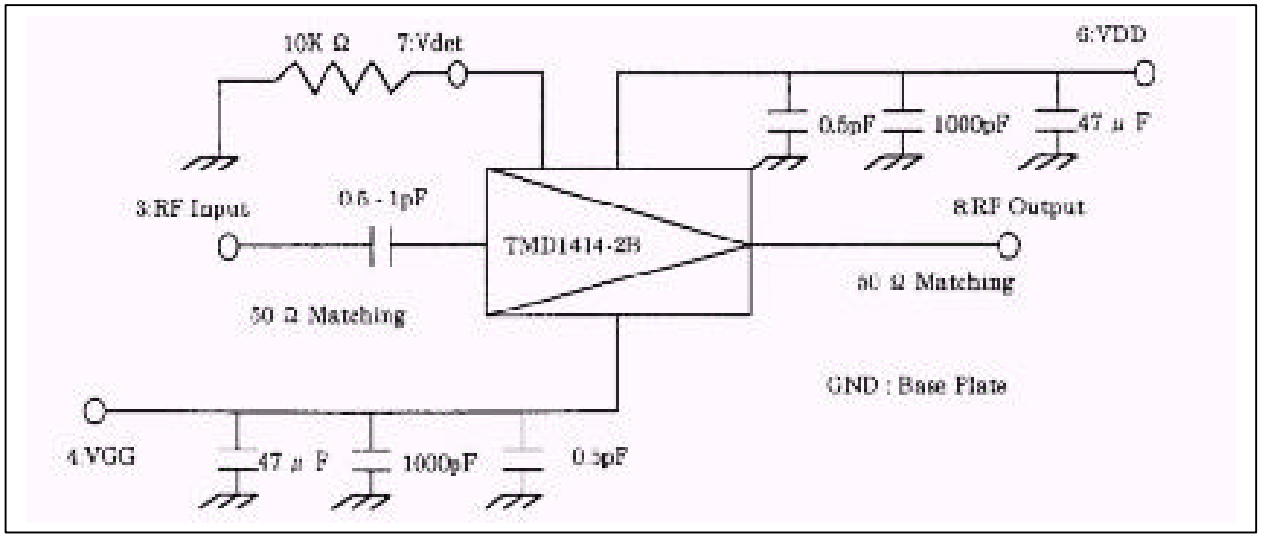

**Recommended Bias Configuration (TMD1414-2)**



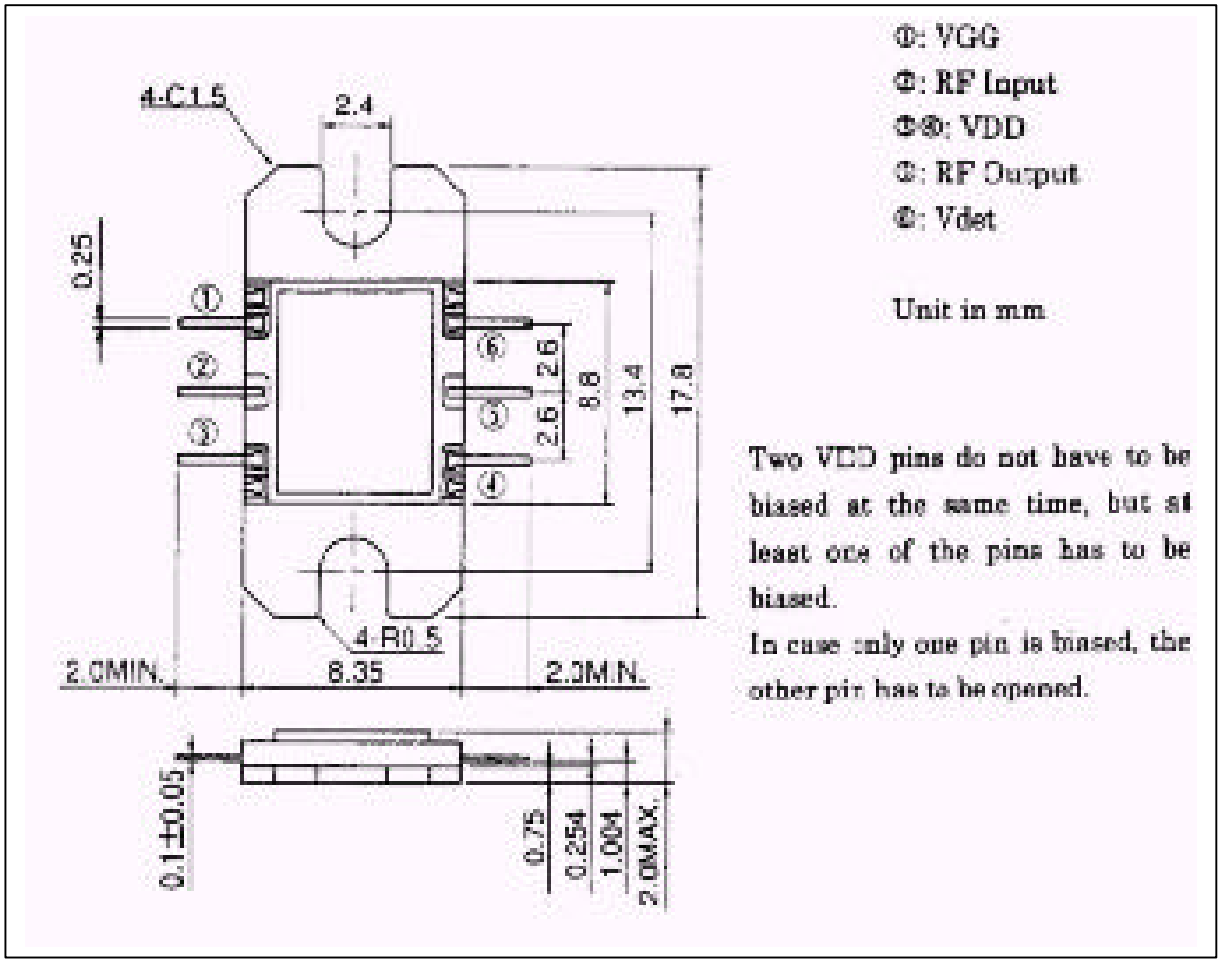
**Package Outline (TMD1414-2B)**



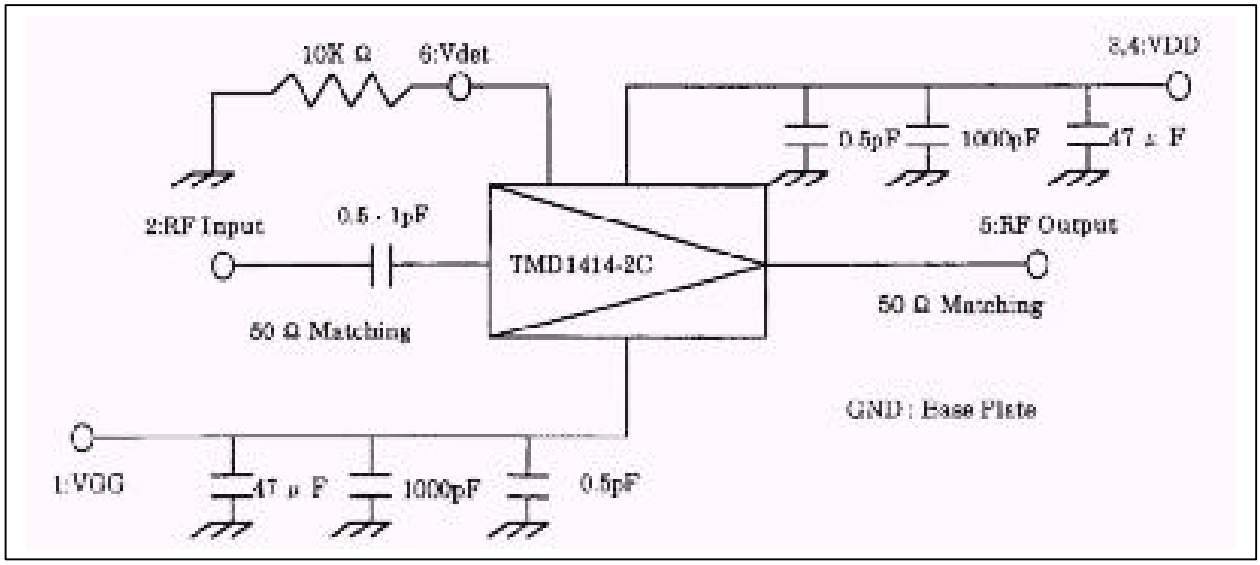

**Recommended Bias Configuration (TMD1414-2B)**



**Package Outline (TMD1414-2C)**




**Recommended Bias Configuration (TMD1414-2C)**

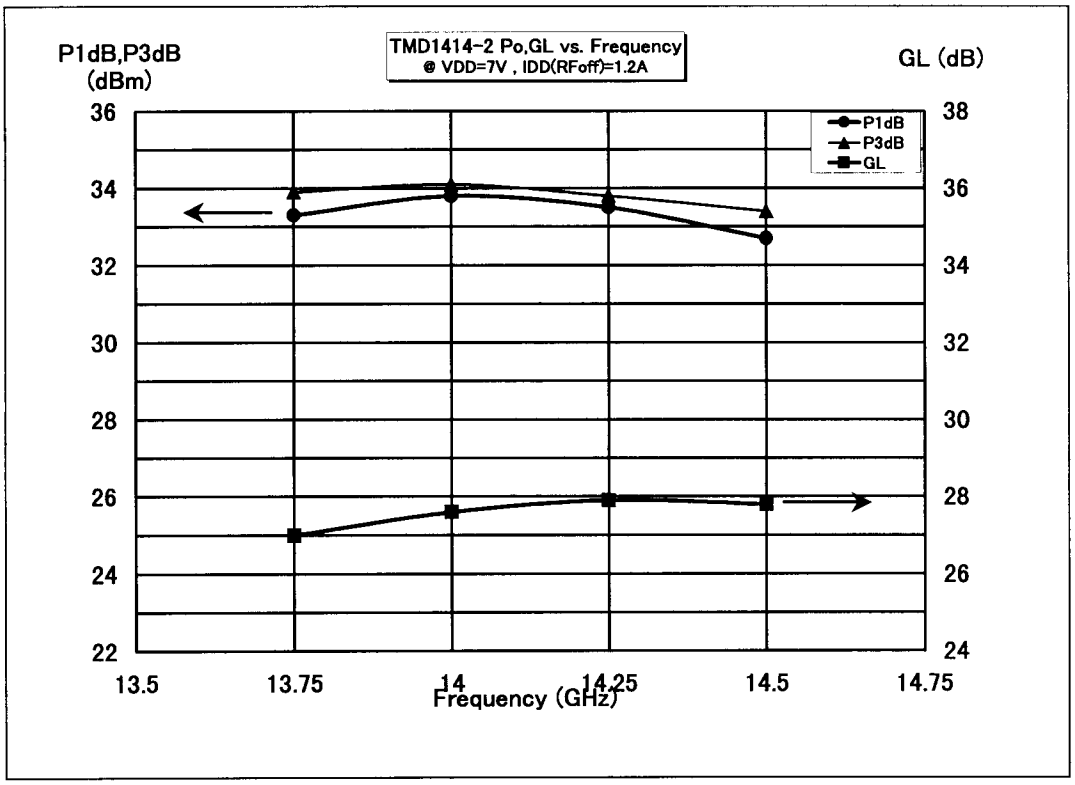


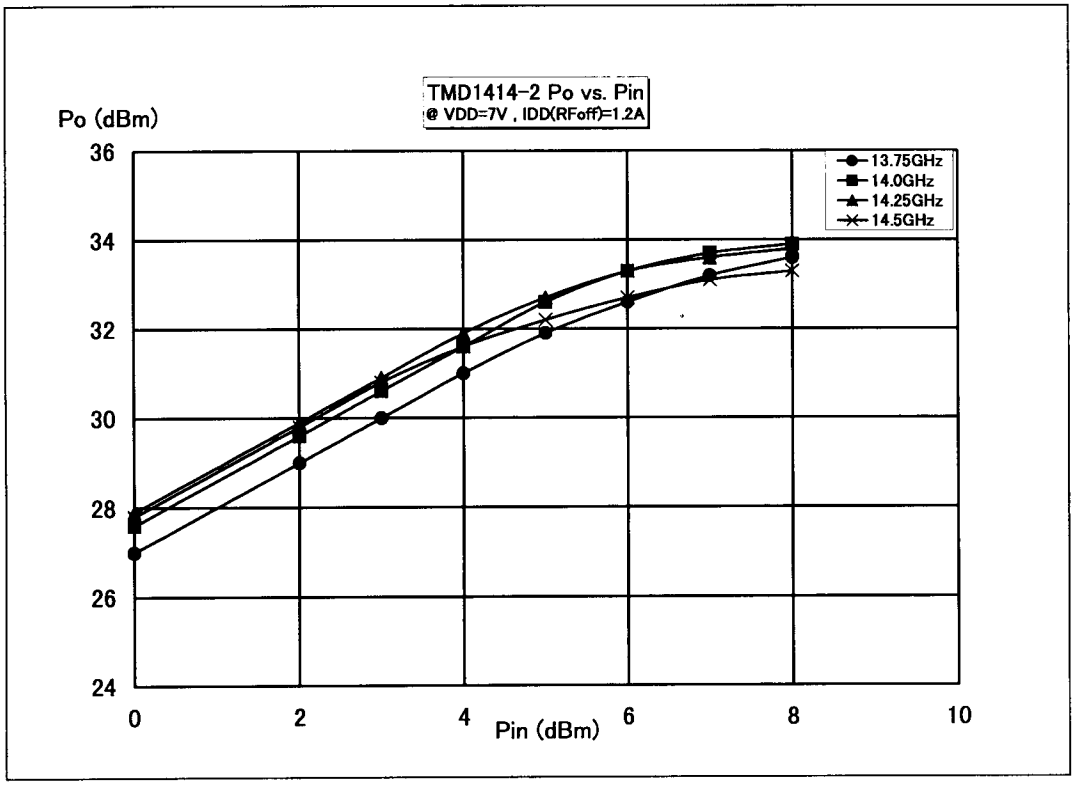
**S-Parameters (TMD1414-2/2B/2C)**

! S-PARAMETERS FOR TMD1414-2 VDD=7 V, VGG=-5V
# GHZ S MA R 50

| ! FREQ | S11 | | S21 | | S12 | | S22 | |
|---|---|---|---|---|---|---|---|---|
| ! | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG |
| 13.475 | 0.247 | -79.9 | 15.958 | 58.0 | 0.004 | 146.2 | 0.415 | -90.2 |
| 13.500 | 0.240 | -79.4 | 16.107 | 55.0 | 0.004 | 150.0 | 0.417 | -91.2 |
| 13.525 | 0.234 | -78.8 | 16.295 | 52.0 | 0.004 | 155.5 | 0.418 | -92.3 |
| 13.550 | 0.229 | -78.1 | 16.469 | 49.0 | 0.004 | 141.2 | 0.421 | -93.3 |
| 13.575 | 0.224 | -77.1 | 16.646 | 45.9 | 0.005 | 145.3 | 0.423 | -94.3 |
| 13.600 | 0.218 | -76.2 | 16.847 | 42.7 | 0.005 | 146.6 | 0.425 | -95.5 |
| 13.625 | 0.213 | -75.0 | 17.001 | 39.5 | 0.004 | 141.5 | 0.426 | -96.7 |
| 13.650 | 0.208 | -74.0 | 17.157 | 36.4 | 0.004 | 139.0 | 0.429 | -97.8 |
| 13.675 | 0.202 | -72.9 | 17.349 | 33.3 | 0.005 | 144.9 | 0.432 | -99.0 |
| 13.700 | 0.198 | -71.7 | 17.519 | 30.2 | 0.005 | 138.8 | 0.435 | -100.3 |
| 13.725 | 0.194 | -70.7 | 17.739 | 26.9 | 0.004 | 141.5 | 0.436 | -101.7 |
| 13.750 | 0.190 | -69.4 | 17.915 | 23.6 | 0.005 | 144.8 | 0.438 | -103.0 |
| 13.775 | 0.186 | -68.4 | 18.098 | 20.3 | 0.005 | 135.4 | 0.441 | -104.6 |
| 13.800 | 0.183 | -67.0 | 18.293 | 17.0 | 0.006 | 142.5 | 0.445 | -106.1 |
| 13.825 | 0.181 | -65.6 | 18.476 | 13.7 | 0.005 | 145.1 | 0.448 | -107.5 |
| 13.850 | 0.177 | -64.4 | 18.674 | 10.2 | 0.005 | 140.0 | 0.449 | -109.3 |
| 13.875 | 0.174 | -63.0 | 18.832 | 6.9 | 0.005 | 136.6 | 0.452 | -110.9 |
| 13.900 | 0.171 | -61.7 | 19.025 | 3.5 | 0.005 | 128.7 | 0.455 | -112.7 |
| 13.925 | 0.169 | -60.2 | 19.236 | 0.0 | 0.005 | 138.8 | 0.456 | -114.5 |
| 13.950 | 0.166 | -59.3 | 19.415 | -3.6 | 0.006 | 139.5 | 0.459 | -116.3 |
| 13.975 | 0.164 | -57.8 | 19.581 | -7.1 | 0.006 | 134.3 | 0.460 | -118.3 |
| 14.000 | 0.163 | -56.4 | 19.740 | -10.8 | 0.006 | 135.0 | 0.462 | -120.4 |
| 14.025 | 0.161 | -55.3 | 19.900 | -14.4 | 0.006 | 134.4 | 0.463 | -122.6 |
| 14.050 | 0.159 | -53.7 | 20.041 | -18.0 | 0.006 | 131.8 | 0.464 | -124.6 |
| 14.075 | 0.158 | -52.4 | 20.195 | -21.7 | 0.006 | 133.0 | 0.466 | -126.8 |
| 14.100 | 0.157 | -51.2 | 20.309 | -25.5 | 0.007 | 134.5 | 0.466 | -129.0 |
| 14.125 | 0.155 | -50.1 | 20.445 | -29.3 | 0.006 | 134.5 | 0.467 | -131.5 |
| 14.150 | 0.154 | -48.6 | 20.539 | -33.0 | 0.006 | 128.5 | 0.465 | -133.8 |
| 14.175 | 0.153 | -47.9 | 20.641 | -36.8 | 0.006 | 132.1 | 0.465 | -136.2 |
| 14.200 | 0.152 | -46.7 | 20.715 | -40.7 | 0.006 | 130.3 | 0.466 | -138.8 |
| 14.225 | 0.150 | -44.9 | 20.751 | -44.6 | 0.007 | 134.3 | 0.467 | -141.6 |
| 14.250 | 0.149 | -43.9 | 20.790 | -48.5 | 0.008 | 130.7 | 0.464 | -144.2 |
| 14.275 | 0.148 | -42.6 | 20.787 | -52.5 | 0.007 | 125.1 | 0.462 | -146.9 |
| 14.300 | 0.146 | -41.3 | 20.788 | -56.3 | 0.007 | 131.7 | 0.460 | -149.7 |
| 14.325 | 0.145 | -39.4 | 20.761 | -60.4 | 0.008 | 123.5 | 0.455 | -152.5 |
| 14.350 | 0.143 | -37.8 | 20.708 | -64.4 | 0.007 | 124.8 | 0.452 | -155.4 |
| 14.375 | 0.140 | -35.4 | 20.610 | -68.3 | 0.008 | 123.0 | 0.447 | -158.4 |
| 14.400 | 0.139 | -33.4 | 20.504 | -72.3 | 0.008 | 119.0 | 0.441 | -161.2 |
| 14.425 | 0.138 | -31.0 | 20.373 | -76.3 | 0.008 | 120.3 | 0.434 | -164.2 |
| 14.450 | 0.136 | -28.4 | 20.220 | -80.2 | 0.008 | 120.5 | 0.427 | -167.3 |
| 14.475 | 0.136 | -25.7 | 20.023 | -84.2 | 0.008 | 119.9 | 0.418 | -170.2 |
| 14.500 | 0.137 | -23.1 | 19.813 | -88.0 | 0.008 | 118.1 | 0.411 | -173.2 |
| 14.525 | 0.138 | -20.3 | 19.592 | -91.8 | 0.008 | 115.8 | 0.402 | -176.1 |
| 14.550 | 0.141 | -17.6 | 19.371 | -95.7 | 0.009 | 115.4 | 0.393 | -179.1 |
| 14.575 | 0.144 | -14.6 | 19.094 | -99.3 | 0.008 | 113.2 | 0.385 | 177.9 |
| 14.600 | 0.148 | -11.6 | 18.830 | -103.0 | 0.008 | 115.2 | 0.375 | 174.9 |
| 14.625 | 0.153 | -8.9 | 18.536 | -106.6 | 0.009 | 113.6 | 0.365 | 172.1 |
| 14.650 | 0.158 | -6.9 | 18.292 | -110.2 | 0.009 | 111.5 | 0.355 | 169.3 |
| 14.675 | 0.164 | -5.2 | 17.990 | -113.7 | 0.009 | 105.5 | 0.345 | 166.4 |
| 14.700 | 0.172 | -3.9 | 17.700 | -117.0 | 0.009 | 111.0 | 0.335 | 163.7 |
| 14.725 | 0.180 | -2.5 | 17.429 | -120.4 | 0.009 | 108.2 | 0.325 | 160.9 |

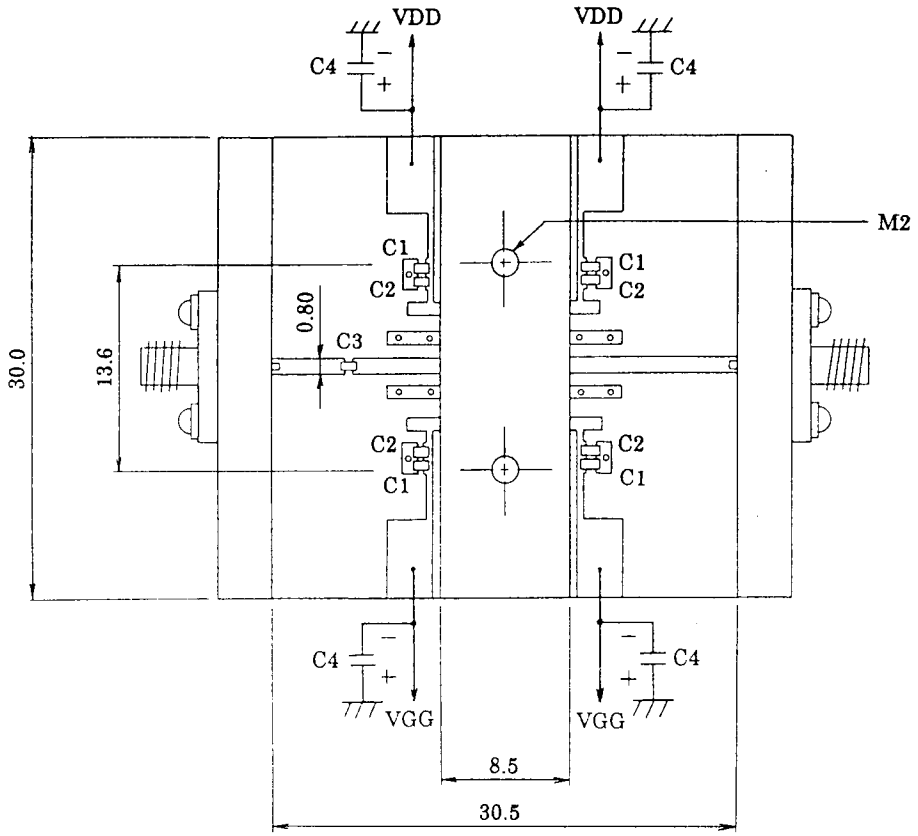
## TYPICAL RF PERFORMANCE

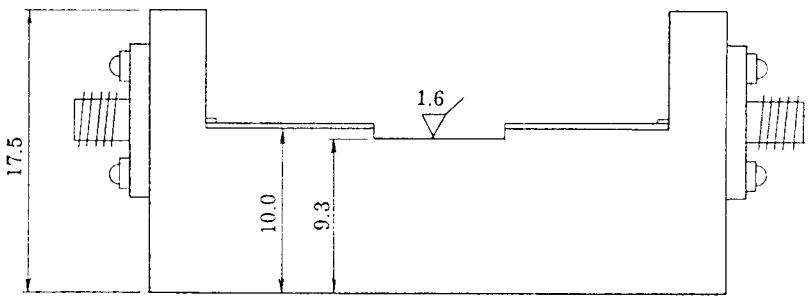


# H. OUTLINE OF TEST JIG AND BIAS CIRCUIT FOR TMD1414-02 / -1 / -2

**Unit in mm**




Substrate : Thickness = 0.25 mm, $\varepsilon$ r= 2.2

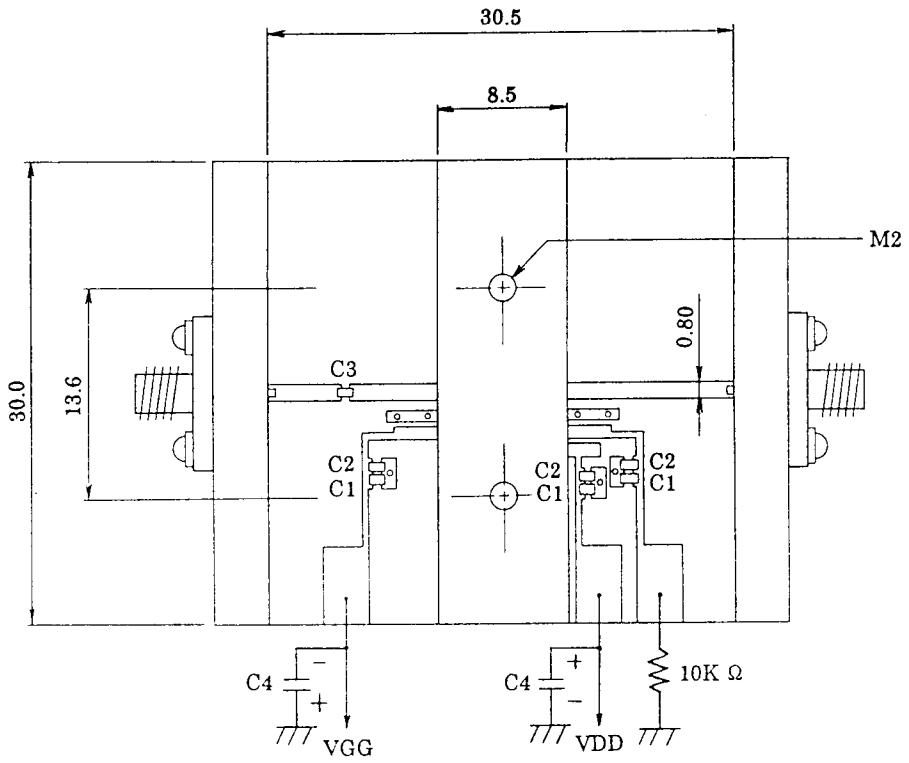
Microstripline : t= 35 $\mu$ m

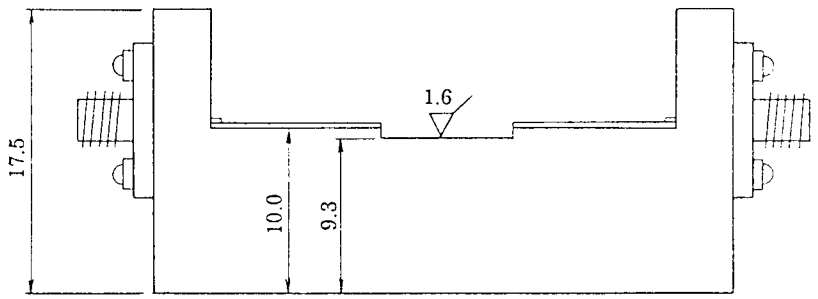
C1 = 1,000 pF , C2= 0.5 pF , C3= 0.5 - 1.0 pF , C4=47 $\mu$ F

* There are two pins for both VDD and VGG. These two pins do not have to be biased at the same time, but at least one of the pins has to be biased. In case only one pin is biased, the other pin has to be opened.

# I. OUTLINE OF TEST JIG AND BIAS CIRCUIT FOR TMD1414-02B / -1B / -2B

Unit in mm



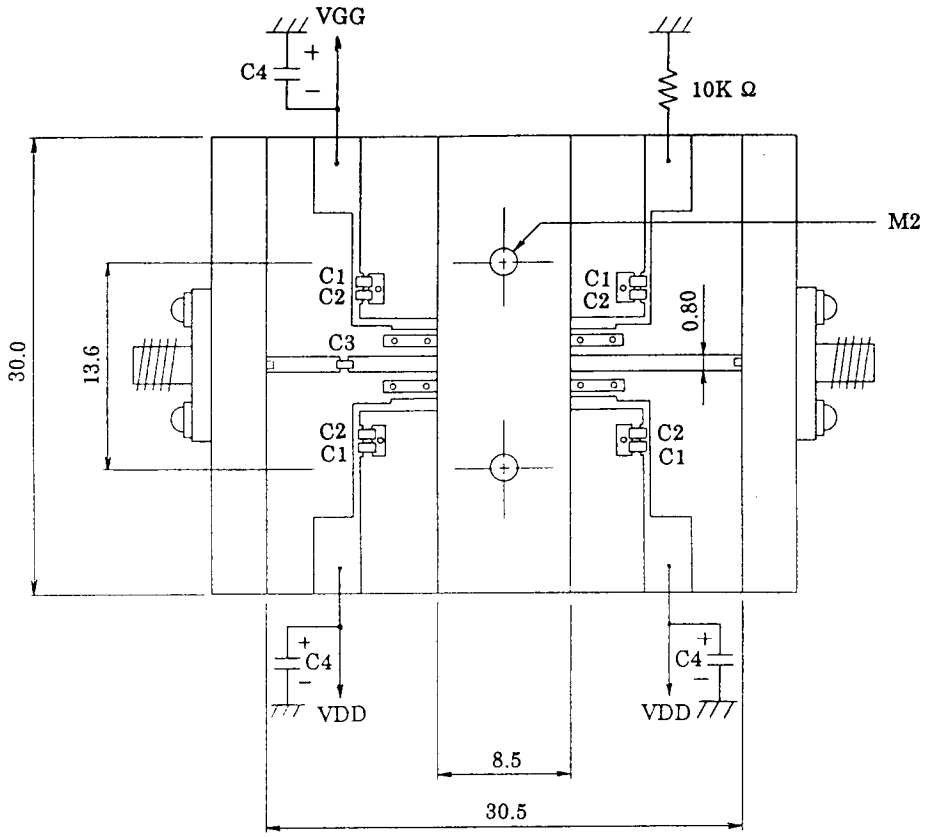

Substrate : Thickness = 0.25 mm, $\varepsilon$ r= 2.2

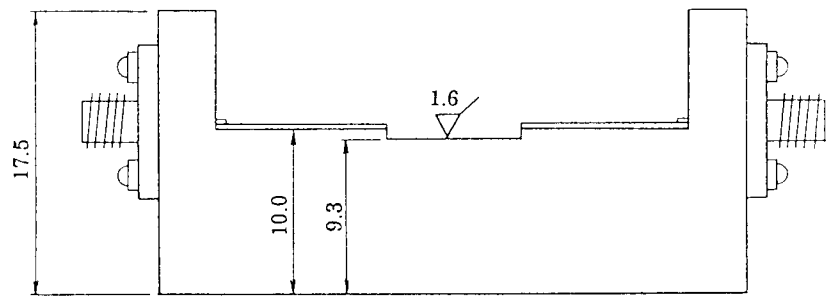
Microstripline : t= 35 $\mu$ m

C1 = 1,000 pF , C2= 0.5 pF , C3= 0.5 - 1.0 pF , C4=47 $\mu$ F

# J. OUTLINE OF TEST JIG AND BIAS CIRCUIT FOR TMD1414-02C / -1C / -2C

Unit in mm




Substrate : Thickness = 0.25 mm, ε r= 2.2

Microstripline : t= 35 μ m

C1 = 1,000 pF , C2= 0.5 pF , C3= 0.5 - 1.0 pF , C4=47 μ F

* Two VDD pins do not have to be biased at the same time, but at least one of the pins has to be biased. In case only one pin is biased, the other pin has to be opened.