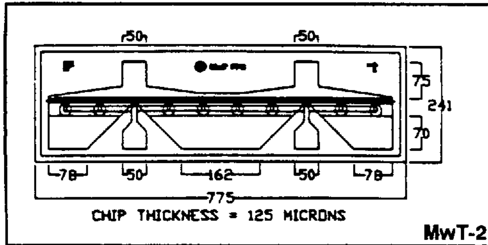
# MwT - 2

## 26 GHz High Power GaAs FET

*MicroWave Technology* *4268 Solar Way Fremont, CA 94538 510-651-6700 FAX 510-651-2208*




## FEATURES

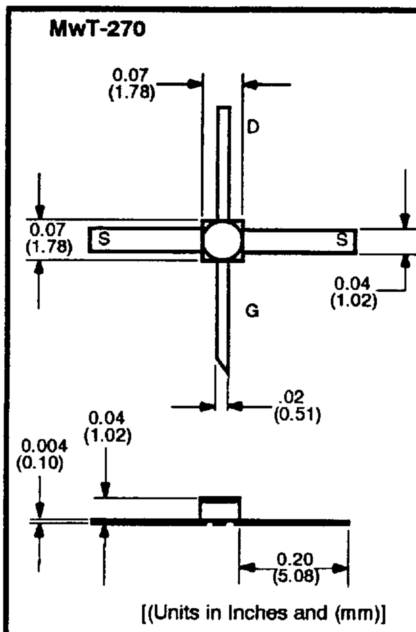
- +24.5 DBM OUTPUT POWER AT 12 GHZ
- 9 DB SMALL SIGNAL GAIN AT 12 GHZ
- 0.3 MICRON REFRACTORY METAL / GOLD GATE
- 630 MICRON GATE WIDTH
- CHOICE OF CHIP AND THREE PACKAGE TYPES

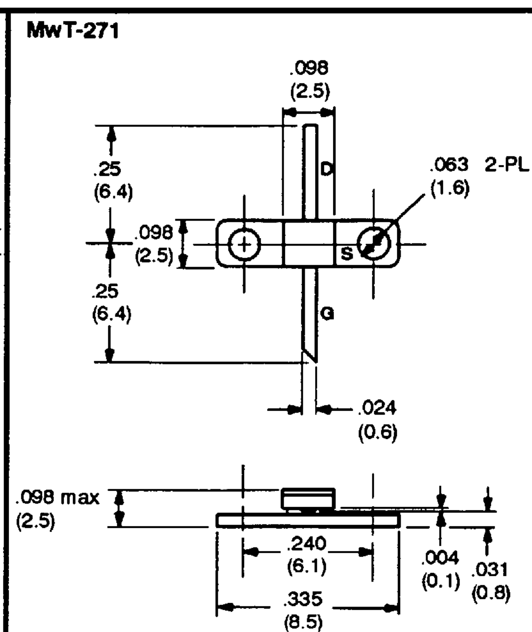
## DESCRIPTION

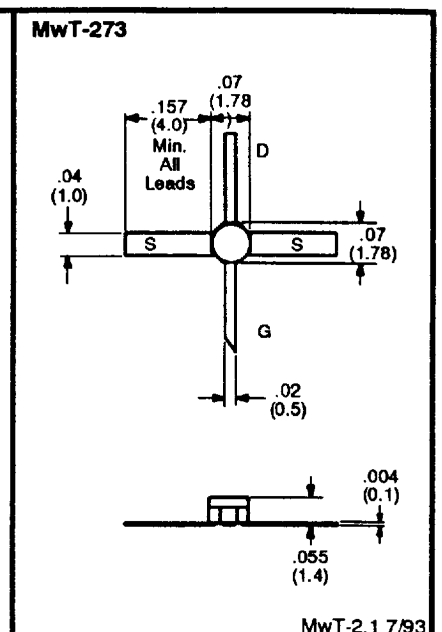
The MwT-2 is a GaAs MESFET device whose nominal quarter-micron gate length and 630 micron gate width make it ideally suited to applications requiring high-gain in the 500 MHz to 26 GHz frequency range with power outputs ranging from 100 to 200 milli-watts. The straight gate geometry of the MwT-2 makes it equally effective for either wideband (ex. 6 to 18 GHz) or narrow-band applications. The chip is produced using MwT's reliable metal system and all devices are screened to insure reliability. All chips are passivated using MwT's patented "Diamond-Like Carbon" process for durability with no degradation in performance. Designers can use MwT's unique BIN selection feature to choose devices from narrow Idss ranges, insuring consistent circuit operation.

## RF SPECIFICATIONS AT Ta = 25°C

| | | | | MWT-273GP | | MwT-2GP MwT-270GP MwT-271GP | | MwT-2SP MwT-270SP MwT-271SP | | MwT-2HP MwT-271HP | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SYMBOL | PARAMETERS AND CONDITIONS | FREQ | UNITS | MIN | TYP | MIN | TYP | MIN | TYP | MIN | TYP |
| P1dB | Output Power at 1dB Compression VDS=6.0V IDS= 0.6 IDSS | 12 GHz<br>18 GHz | dBm<br>dBm | 20.0 | 21.5<br>21.0 | 20.0 | 21.5<br>21.0 | 22.0 | 23.5<br>23.0 | 23.0 | 24.5<br>24.0 |
| IDSS | Recommended IDSS Range for Otimum P1dB | 0.5 to 12 GHz | mA | | 100 - 160 | | 100 - 160 | | 140 - 190 | | 160 - 210 |
| SSG | Small Signal Gain VDS=6.0V IDS=0.6 IDSS | 12 GHz<br>18 GHz | dB<br>dB | | 6.5 | 6.5 | 7.5<br>3.5 | 7.5 | 8.0<br>4.0 | 8.0 | 9.0<br>5.0 |
| η add | Power Added Efficiency VDS = 6.0 V IDS = 0.6 IDSS | 12 GHz | % | | 30 | 25 | 30 | 25 | 30 | 30 | 35 |



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## DC SPECIFICATIONS AT Ta = 25 °C

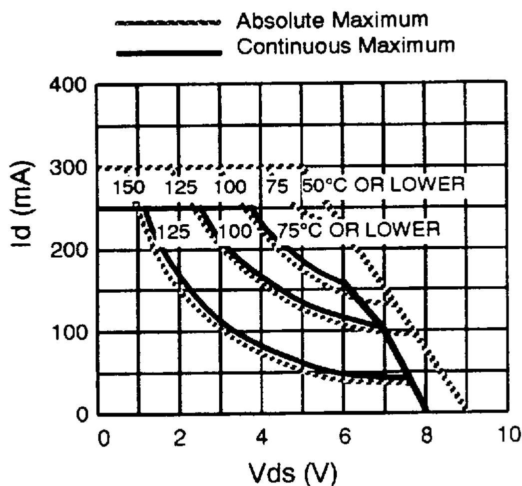
| SYMBOL | PARAMETERS AND CONDITIONS | UNITS | MIN | TYP | MAX |
|---|---|---|---|---|---|
| Idss | Saturated Drain Current<br>Vds = 4.0 V VGS = 0.0 V | mA | 60 | | 240 |
| Gm | Transconductance<br>Vds = 4.0 V VGS = 0.0 V | mS | 75 | 100 | |
| Vp | Pinch-off Voltage<br>Vds = 3.0 V IDS = 4.0 mA | V | | -2.0 | - 5.0 |
| BVGSO | Gate-to-Source Breakdown Voltage<br>Igs = -0.4 mA | V | -6.0 | -12.0 | |
| BVGDO | Gate-to-Drain Breakdown Voltage<br>Igd = -0.4 mA | V | -8.0 | -12.0 | |
| Rth | Thermal Resistance MwT-2 Chip<br>MwT-270, 273<br>MwT-271 | °C/W | | 80<br>180*<br>80* | |

## MAXIMUM RATINGS AT Ta = 25 ° C

| SYMBOL | PARAMETER | UNITS | CONT MAX[1] | ABSOLUTE MAX[2] |
|---|---|---|---|---|
| VDS | Drain to Source Voltage | V | See Safe Operating Limits | |
| Tch | Channel Temperature | °C | +150 | +175 |
| Tst | Storage Temperature | °C | -65 to +150 | +175 |
| Pin | RF Input Power | mW | 315 | 630 |

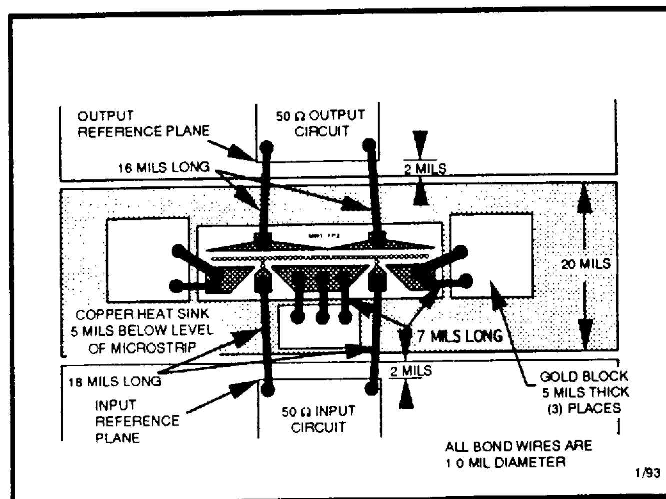
NOTES: 1. Exceeding any one of these limits in continuous operation may reduce the mean-time-to-failure below the design goals.
2. Exceeding any one of these limits may cause permanent damage.

### SAFE OPERATING LIMITS
vs. Case Temperature




### RECOMMENDED ASSEMBLY CONFIGURATION

Shown below is the assembly and bonding configuration used for S-Parameter measurements of the MwT-2 Chip and is recommended for optimum performance. For self-bias applications the gold blocks may be replaced by capacitors. Contact MwT for additional applications information.



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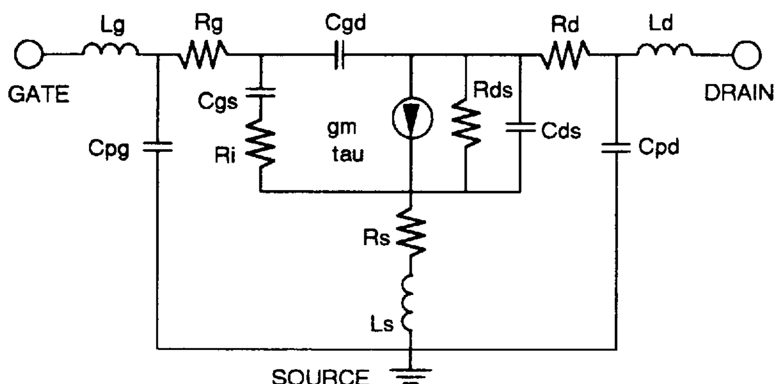
## TYPICAL COMMON SOURCE SCATTERING PARAMETERS

MwT-2 CHIP: VDS = 6.0 V, IDS = 60% IDSS = 122 mA

| FREQUENCY (GHz) | S11 MAG | S11 ANG | S21 MAG | S21 ANG | S12 MAG | S12 ANG | S22 MAG | S22 ANG |
|---|---|---|---|---|---|---|---|---|
| 1.00 | .96 | -34.5 | 5.89 | 156.0 | .03 | 70.9 | .58 | -13.8 |
| 2.00 | .93 | -63.1 | 5.25 | 137.2 | .04 | 55.7 | .55 | -26.2 |
| 3.00 | .89 | -88.0 | 4.55 | 120.1 | .06 | 43.9 | .51 | -35.8 |
| 4.00 | .87 | -108.3 | 3.93 | 106.3 | .06 | 34.2 | .48 | -44.9 |
| 5.00 | .84 | -123.9 | 3.39 | 94.5 | .06 | 28.6 | .46 | -51.5 |
| 6.00 | .84 | -136.6 | 2.99 | 84.4 | .07 | 23.7 | .46 | -57.6 |
| 7.00 | .83 | -147.8 | 2.63 | 75.2 | .07 | 19.6 | .46 | -63.0 |
| 8.00 | .82 | -157.3 | 2.34 | 66.8 | .07 | 16.2 | .46 | -69.3 |
| 9.00 | .82 | -165.0 | 2.10 | 59.6 | .06 | 12.3 | .47 | -75.9 |
| 10.00 | .83 | -172.6 | 1.92 | 52.6 | .06 | 8.0 | .48 | -81.3 |
| 12.00 | .85 | 174.1 | 1.62 | 38.7 | .04 | 10.7 | .49 | -91.0 |
| 14.00 | .85 | 165.2 | 1.38 | 26.3 | .05 | 25.5 | .54 | -101.7 |
| 16.00 | .86 | 158.7 | 1.19 | 15.8 | .05 | 26.0 | .58 | -111.9 |
| 18.00 | .88 | 151.8 | 1.06 | 5.8 | .05 | 34.4 | .62 | -118.8 |
| 20.00 | .90 | 144.7 | .94 | -5.2 | .05 | 45.0 | .63 | -130.7 |
| 22.00 | .90 | 141.5 | .86 | -15.1 | .07 | 42.0 | .71 | -135.4 |
| 24.00 | .87 | 136.8 | .72 | -25.3 | .07 | 36.5 | .76 | -143.9 |
| 26.00 | .88 | 132.2 | .66 | -33.7 | .07 | 32.2 | .80 | -150.4 |

## DEVICE EQUIVALENT CIRCUIT MODEL




| PARAMETER | | VALUE |
|---|---|---|
| Gate Bond Wire Inductance | Lg | .203 nH |
| Gate Pad Capacitance | Cpg | .10 pF |
| Gate Resistance | Rg | .46 Ω |
| Gate-Source Capacitance | Cgs | .67 pF |
| Channel Resistance | Ri | 2.31 Ω |
| Gate-Drain Capacitance | Cgd | .05 pF |
| Transconductance | gm | 92.3 mS |
| Transit time | tau | 2.6 psec |
| Source Resistance | Rs | .73 Ω |
| Source Inductance | Ls | .03 nH |
| Drain-Source Resistance | Rds | 146 Ω |
| Drain-Source Capacitance | Cds | .007 pF |
| Drain Resistance | Rd | 0.84 Ω |
| Drain Pad Capacitance | Cpd | .142 pF |
| Drain Inductance | Ld | .113 nH |

## BIN SELECTION

Every MwT-2 wafer produced is 100% DC probed, binned by Idss in 10 ma increments, and sample devices are evaluated for RF performance. Users may select devices from 18 Idss bins to insure consistent matched performance in the circuit. The shaded bins are typically available in smaller quantity and caution is advised before designing these bins into high production applications. Availability in three visual grades insures the most economical solution for the application.

| BIN # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IDSS (mA) | 60-70 | 70-80 | 80-90 | 90-100 | 100-110 | 110-120 | 120-130 | 130-140 | 140-150 | 150-160 | 160-170 | 170-180 | 180-190 | 190-200 | 200-210 | 210-220 | 220-230 | 230-240 |

**MwT-2**
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## TYPICAL COMMON SOURCE SCATTERING PARAMETERS

MwT-271: VDS = 6.0 V, IDS = 0.6 IDSS = 110 mA

| FREQUENCY (GHz) | S11 MAG | S11 ANG | S21 MAG | S21 ANG | S12 MAG | S12 ANG | S22 MAG | S22 ANG |
|---|---|---|---|---|---|---|---|---|
| 1.00 | .95 | -50.9 | 5.48 | 142.3 | .03 | 59.8 | .59 | -30.1 |
| 2.00 | .89 | -82.8 | 4.07 | 117.1 | .04 | 40.0 | .57 | -49.9 |
| 3.00 | .84 | -99.7 | 3.16 | 101.1 | .04 | 31.8 | .58 | -61.2 |
| 4.00 | .82 | -112.2 | 2.65 | 88.5 | .04 | 21.4 | .57 | -70.0 |
| 5.00 | .78 | -122.3 | 2.40 | 77.8 | .03 | 22.4 | .56 | -75.3 |
| 6.00 | .76 | -137.2 | 2.28 | 64.7 | .03 | 38.1 | .54 | -85.0 |
| 8.00 | .79 | -178.0 | 1.95 | 34.5 | .07 | -16.4 | .44 | -117.2 |
| 10.00 | .83 | 162.6 | 1.48 | 1.2 | .02 | -84.4 | .60 | -146.9 |
| 12.00 | .88 | 155.4 | 1.02 | -15.3 | .01 | 12.9 | .66 | -178.7 |
| 14.00 | .82 | 143.1 | .98 | -35.3 | .05 | -24.6 | .68 | 169.2 |
| 16.00 | .57 | 104.5 | 1.05 | -73.6 | .10 | -36.5 | .72 | 157.2 |

MwT-273: VDS = 6.0 V, IDS = 0.6 IDSS = 81 mA

| FREQUENCY (GHz) | S11 MAG | S11 ANG | S21 MAG | S21 ANG | S12 MAG | S12 ANG | S22 MAG | S22 ANG |
|---|---|---|---|---|---|---|---|---|
| 1.00 | .95 | -43.3 | 5.69 | 146.8 | .03 | 63.8 | .57 | -25.5 |
| 2.00 | .87 | -74.0 | 4.60 | 122.3 | .05 | 47.4 | .55 | -41.2 |
| 3.00 | .79 | -96.3 | 3.83 | 104.9 | .06 | 36.2 | .54 | -49.1 |
| 4.00 | .71 | -125.8 | 3.31 | 87.1 | .07 | 26.9 | .50 | -54.4 |
| 6.00 | .73 | -164.6 | 2.72 | 65.6 | .07 | 32.6 | .38 | -69.2 |
| 8.00 | .82 | 151.2 | 2.37 | 32.0 | .08 | 3.5 | .23 | -127.1 |
| 10.00 | .82 | 142.9 | 1.67 | 5.8 | .08 | -3.2 | .42 | -164.7 |
| 12.00 | .84 | 110.5 | 1.54 | -19.4 | .07 | 0.0 | .55 | -174.3 |
| 14.00 | .77 | 94.6 | 1.27 | -43.7 | .09 | -4.6 | .59 | 174.5 |
| 16.00 | .70 | 59.2 | 1.11 | -75.8 | .12 | -16.0 | .57 | 149.7 |
| 18.00 | .53 | 29.6 | .85 | -89.4 | .17 | -19.4 | .58 | 129.1 |

MwT-270: VDS = 6.0 V, IDS = 0.6 IDSS = 105 mA

| FREQUENCY (GHz) | S11 MAG | S11 ANG | S21 MAG | S21 ANG | S12 MAG | S12 ANG | S22 MAG | S22 ANG |
|---|---|---|---|---|---|---|---|---|
| 1.00 | .94 | -44.0 | 5.27 | 144.7 | .03 | 72.8 | .58 | -23.9 |
| 2.00 | .85 | -75.4 | 4.22 | 118.8 | .04 | 52.7 | .56 | -39.7 |
| 3.00 | .78 | -97.1 | 3.50 | 100.3 | .06 | 51.0 | .56 | -49.8 |
| 4.00 | .71 | -120.1 | 3.06 | 83.2 | .07 | 37.4 | .53 | -59.9 |
| 5.00 | .64 | -141.6 | 2.87 | 69.7 | .06 | 35.5 | .48 | -63.8 |
| 6.00 | .65 | -168.0 | 2.76 | 53.2 | .07 | 35.4 | .42 | -78.7 |
| 8.00 | .75 | 144.8 | 2.39 | 13.0 | .08 | 21.2 | .36 | -133.0 |
| 10.00 | .78 | 119.7 | 1.70 | -21.3 | .08 | 12.3 | .55 | -174.6 |
| 12.00 | .76 | 95.3 | 1.38 | -48.5 | .09 | 2.4 | .66 | 168.1 |
| 14.00 | .69 | 62.9 | 1.26 | -80.5 | .12 | -15.2 | .68 | 144.8 |
| 16.00 | .53 | 10.7 | 1.06 | -121.7 | .18 | -50.5 | .75 | 112.3 |
| 18.00 | .44 | -55.3 | .74 | -136.3 | .21 | -61.7 | .76 | 98.2 |