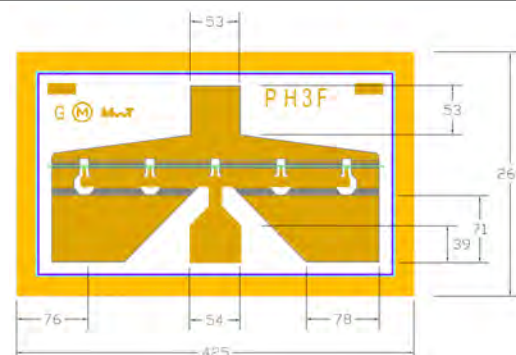


# MwT-PH3F 28 GHz Medium Power AlGaAs / InGaAs pHEMT

## Features:

- 24 dBm typical Output Power at 18 GHz
- 14 dB typical Small Signal Gain at 18 GHz
- 50% typical PAE at 18 GHz
- 0.25 x 300 Micron Refractory Metal/Gold Gate
- Excellent for High Gain, and High Power Added Efficiency
- Ideal for Commercial, Military, Hi-Rel Space Applications



Chip Dimensions: 425 x 260 microns  
Chip Thickness: 100 microns

## Description:

The MwT-PH3F is a AlGaAs/InGaAs pHEMT (Pseudomorphic-High-Electron-Mobility-Transistor) device whose nominal 0.25 micron gate length and 300 micron gate width make it ideally suited for applications requiring high-gain and medium power up to 28 GHz frequency range. The device is equally effective for either wideband (e.g. 6 to 18 GHz) or narrow-band applications. The chip is produced using reliable metal systems and passivated to insure excellent reliability.

## Electrical Specifications: at $T_a = 25^\circ\text{C}$

| PARAMETERS & CONDITIONS                                                                | SYMBOL | FREQ   | UNITS | MIN | TYP  |
|----------------------------------------------------------------------------------------|--------|--------|-------|-----|------|
| Output Power at 1dB Compression<br>$V_{ds}=8.0\text{V}$ $I_{ds}=0.7 \times I_{DSS}$    | P1dB   | 18 GHz | dBm   |     | 23.0 |
| Saturated Power<br>$V_{ds}=8.0\text{V}$ $I_{ds}=0.7 \times I_{DSS}$                    | Psat   | 18 GHz | dBm   |     | 24.0 |
| Output Third Order Intercept Point<br>$V_{ds}=8.0\text{V}$ $I_{ds}=0.7 \times I_{DSS}$ | OIP3   | 18 GHz | dBm   |     | 32.0 |
| Small Signal Gain<br>$V_{ds}=8.0\text{V}$ $I_{ds}=0.7 \times I_{DSS}$                  | SSG    | 18 GHz | dB    |     | 14.0 |
| Power Added Efficiency at P1dB<br>$V_{ds}=8.0\text{V}$ $I_{ds}=0.7 \times I_{DSS}$     | PAE    | 18 GHz | %     |     | 50   |

Note:  $I_{ds}$  should be between 40% and 80% of  $I_{DSS}$ . Currently, our data shows  $I_{ds}$  at 70% of  $I_{DSS}$ . Low  $I_{ds}$  will improve efficiency, but high  $I_{ds}$  will make Psat and IP3 better.

## DC Specifications: at $T_a = 25^\circ\text{C}$

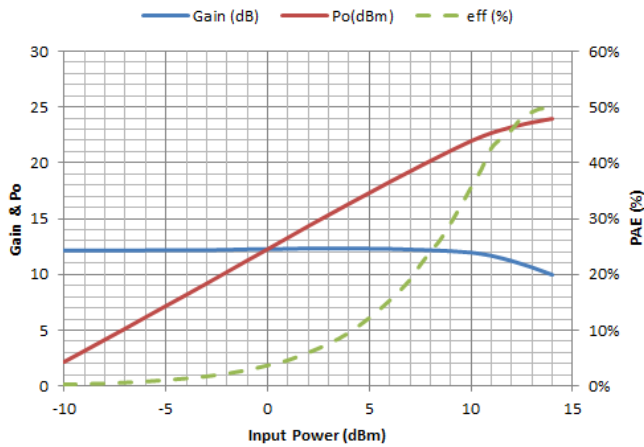
| PARAMETERS & CONDITIONS                                                | SYMBOL    | UNITS | MIN | TYP         | MAX  |
|------------------------------------------------------------------------|-----------|-------|-----|-------------|------|
| Saturated Drain Current<br>$V_{ds}= 3.0\text{V}$ $V_{gs}= 0.0\text{V}$ | $I_{DSS}$ | mA    | 60  |             | 90   |
| Transconductance<br>$V_{ds}= 2.5\text{V}$ $V_{gs}= 0.0\text{V}$        | $G_m$     | mS    |     | 100         |      |
| Pinch-off Voltage<br>$V_{ds}= 3.0\text{V}$ $I_{ds}= 1.0\text{mA}$      | $V_p$     | V     |     | -0.8        | -1.0 |
| Gate-to-Source Breakdown Voltage<br>$I_{gs}= -0.3\text{mA}$            | BVGSO     | V     |     | -17.0       |      |
| Gate-to-Drain Breakdown Voltage<br>$I_{gd}= -0.3\text{mA}$             | BVGDO     | V     |     | -18.0       |      |
| Chip Thermal Resistance                                                | $R_{th}$  | C/W   |     | 120<br>290* |      |

\* Overall  $R_{th}$  depends on case mounting

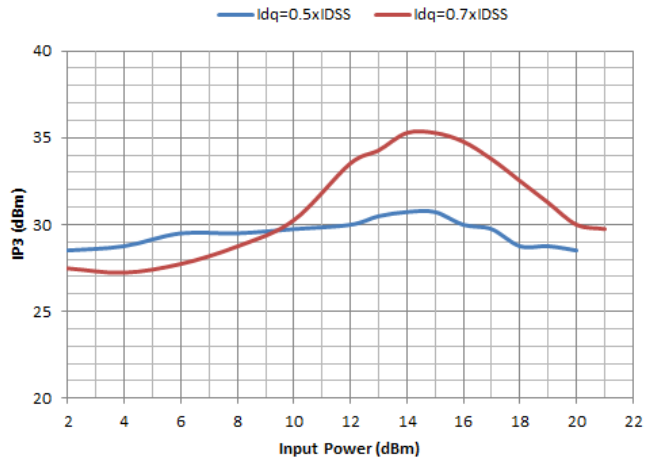
# MwT-PH3F

## 28 GHz Medium Power AlGaAs/InGaAs pHEMT

**MwT-PH3F from GCS, Typical Power at 18GHz**  
Vds=8V; Idq=0.7xIDSS



**MwT-PH3F, OIP3 vs Input Power**  
with different Idq



**MwT-PH3F, Load Pull Data, Vdq=8V; Idq=0.7xIdss**

| Freq (GHz) | Zs   |        | ZL   |       | Psat |
|------------|------|--------|------|-------|------|
|            | Mag  | phase  | mag  | phase | dBm  |
| 2          | 0.55 | 55.00  | 0.34 | 9.79  | 24.9 |
| 4          | 0.70 | 87.00  | 0.33 | 25.34 | 24.6 |
| 6          | 0.77 | 104.00 | 0.36 | 37.49 | 24.4 |
| 8          | 0.75 | 118.00 | 0.38 | 47.61 | 24.3 |
| 10         | 0.78 | 131.00 | 0.41 | 57.36 | 24.2 |
| 12         | 0.77 | 139.00 | 0.43 | 66.17 | 24.1 |
| 14         | 0.80 | 146.00 | 0.45 | 68.70 | 24.1 |
| 16         | 0.83 | 151.00 | 0.49 | 76.41 | 24.1 |
| 18         | 0.84 | 153.00 | 0.54 | 89.62 | 23.9 |

The load pull data is based on nonlinear model provided by the foundry that processes the device.

## ESD Caution

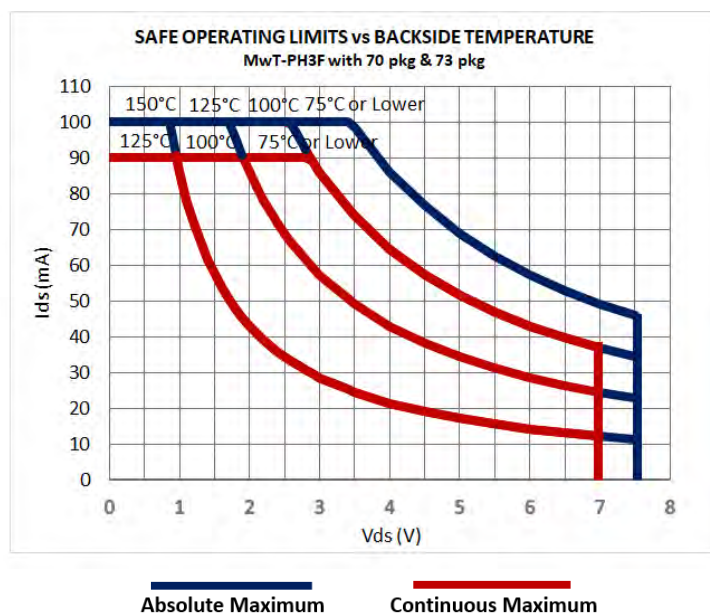
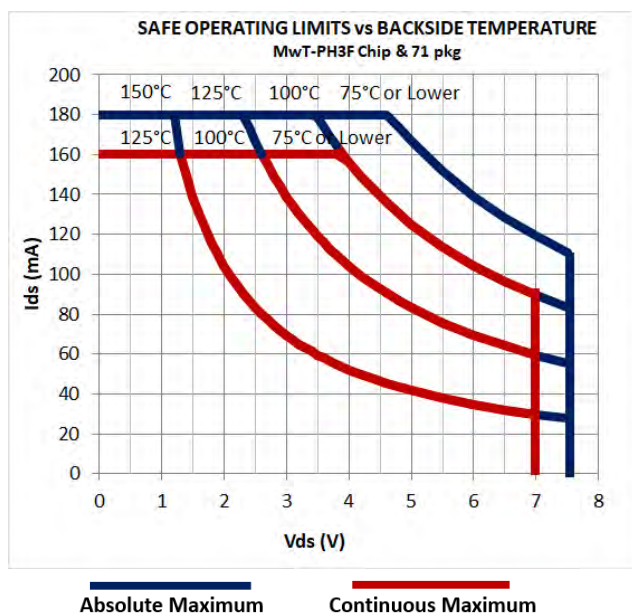
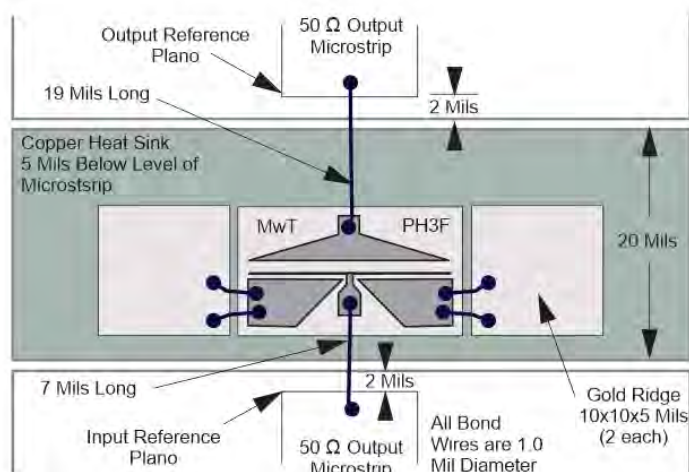


High-performance RF integrated circuits are highly sensitive to electrostatic discharge (ESD) and may contain unprotected inputs and outputs. Handling and assembly should be conducted in an ESD-controlled environment. It is recommended that ESD precautions and protocols are adopted to minimise the risk of electrostatic discharge and protect product integrity.

# MwT-PH3F

28 GHz Medium Power AlGaAs/InGaAs pHEMT

## MwT-PH3F DUAL BIAS



## Absolute Maximum Rating

| Symbol | Parameter             | Units | Cont Max1   | Absolute Max2 |
|--------|-----------------------|-------|-------------|---------------|
| VDS    | Drain to Source Volt. | V     | 7.0         | 7.5           |
| Tch    | Channel Temperature   | °C    | +150        | +175          |
| Tst    | Storage Temperature   | °C    | -65 to +150 | +175          |
| Pin    | RF Input Power        | mW    | 80          | 120           |

### Notes:

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

# MwT-PH3F

## 28 GHz Medium Power AlGaAs/InGaAs pHEMT

### S-Parameters

| S-PARAMETER Vds=7V, Ids= 0.7 x Idss |        |          |        |         |         |         |        |          |       |        |
|-------------------------------------|--------|----------|--------|---------|---------|---------|--------|----------|-------|--------|
| Freq.                               | S11    |          | S21    |         | S12     |         | S22    |          | K     | GMAX   |
| GHz                                 | dB     | Ang (°)  | dB     | Ang (°) | dB      | Ang (°) | dB     | Ang (°)  |       | dB     |
| 1                                   | -0.207 | -26.958  | 18.437 | 161.611 | -35.811 | 75.975  | -1.871 | -8.010   | 0.093 | 27.124 |
| 2                                   | -0.589 | -51.462  | 17.748 | 145.283 | -30.731 | 63.494  | -2.232 | -14.816  | 0.162 | 24.239 |
| 3                                   | -1.052 | -72.815  | 16.749 | 131.154 | -28.069 | 54.936  | -2.740 | -20.416  | 0.216 | 22.409 |
| 4                                   | -1.455 | -90.734  | 15.682 | 119.517 | -26.788 | 47.386  | -3.289 | -24.512  | 0.289 | 21.235 |
| 5                                   | -1.978 | -105.657 | 14.525 | 109.489 | -25.985 | 40.663  | -3.582 | -28.103  | 0.391 | 20.255 |
| 6                                   | -2.305 | -116.551 | 13.563 | 102.505 | -25.510 | 38.875  | -3.766 | -28.179  | 0.461 | 19.537 |
| 7                                   | -2.564 | -127.799 | 12.630 | 94.480  | -25.117 | 35.755  | -3.976 | -30.652  | 0.531 | 18.874 |
| 8                                   | -2.612 | -138.786 | 11.783 | 87.029  | -24.861 | 33.013  | -4.265 | -35.534  | 0.561 | 18.322 |
| 9                                   | -2.730 | -147.742 | 11.010 | 79.577  | -24.842 | 31.599  | -4.666 | -37.908  | 0.664 | 17.926 |
| 10                                  | -2.763 | -157.160 | 10.180 | 73.582  | -24.689 | 29.738  | -4.854 | -40.844  | 0.719 | 17.435 |
| 11                                  | -2.897 | -164.602 | 9.424  | 68.144  | -24.774 | 29.567  | -4.975 | -42.937  | 0.824 | 17.099 |
| 12                                  | -2.869 | -170.932 | 8.798  | 62.626  | -24.750 | 29.591  | -5.053 | -45.868  | 0.870 | 16.774 |
| 13                                  | -2.822 | -177.396 | 8.204  | 57.466  | -24.713 | 29.727  | -5.120 | -49.781  | 0.901 | 16.459 |
| 14                                  | -2.846 | 178.026  | 7.560  | 52.228  | -24.721 | 31.088  | -5.260 | -53.563  | 0.990 | 16.141 |
| 15                                  | -2.854 | 172.269  | 7.031  | 48.601  | -24.737 | 32.183  | -5.450 | -55.464  | 1.076 | 14.199 |
| 16                                  | -2.634 | 167.897  | 6.332  | 42.359  | -24.580 | 34.613  | -5.506 | -61.495  | 1.055 | 14.017 |
| 17                                  | -2.592 | 164.341  | 5.885  | 37.766  | -24.373 | 35.833  | -5.439 | -65.857  | 1.048 | 13.786 |
| 18                                  | -2.480 | 159.777  | 5.443  | 32.561  | -24.055 | 39.522  | -5.418 | -70.660  | 0.995 | 14.749 |
| 19                                  | -2.444 | 156.886  | 4.921  | 29.463  | -23.900 | 41.464  | -5.463 | -74.320  | 1.031 | 13.325 |
| 20                                  | -2.426 | 152.840  | 4.484  | 24.517  | -23.613 | 42.897  | -5.630 | -78.993  | 1.068 | 12.452 |
| 21                                  | -2.335 | 150.013  | 4.032  | 21.184  | -23.258 | 46.457  | -5.322 | -83.283  | 0.985 | 13.645 |
| 22                                  | -2.287 | 147.587  | 3.518  | 16.515  | -22.824 | 46.118  | -5.277 | -88.436  | 0.966 | 13.171 |
| 23                                  | -2.125 | 144.720  | 3.151  | 12.203  | -22.251 | 47.678  | -5.322 | -95.031  | 0.870 | 12.701 |
| 24                                  | -2.200 | 141.726  | 2.718  | 8.153   | -21.957 | 47.983  | -5.225 | -100.633 | 0.918 | 12.337 |
| 25                                  | -2.028 | 139.457  | 2.243  | 4.044   | -21.202 | 51.531  | -5.159 | -105.565 | 0.800 | 11.722 |
| 26                                  | -1.992 | 137.815  | 1.829  | 0.310   | -20.709 | 49.459  | -4.779 | -110.553 | 0.712 | 11.269 |
| 27                                  | -2.105 | 135.778  | 1.380  | -3.350  | -19.968 | 53.389  | -4.538 | -113.699 | 0.706 | 10.674 |
| 28                                  | -1.818 | 134.508  | 0.990  | -6.766  | -19.487 | 51.132  | -4.610 | -120.484 | 0.588 | 10.239 |
| 29                                  | -1.841 | 131.270  | 0.675  | -10.983 | -18.906 | 50.863  | -4.339 | -125.602 | 0.546 | 9.791  |
| 30                                  | -1.716 | 128.616  | 0.274  | -14.750 | -18.467 | 50.134  | -4.226 | -130.296 | 0.484 | 9.370  |

**Available Packaging:**  
 70 Package - MwT-PH3F70  
 71 Package - MwT-PH3F71  
 73 Package - MwT-PH3F73

### RoHS Compliance



CML Micro certifies, to the best of our knowledge, that its products comply with RoHS directive (2011/65/EU), as amended by Directive (EU) 2015/863.

### REACH Compliance



CML Micro certifies, to the best of our knowledge, that its products do not contain any of the banned substances specified in the SVHC list at <https://echa.europa.eu/candidate-list-table>. CML Micro are committed to ensuring the safety of products and the compliance with regulations. Publications will be updated in the event that REACH control is compromised.

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Contact details can be found at [www.cmlmicro.com](http://www.cmlmicro.com).

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