

# M-Pulse Microwave

## Silicon Bipolar MMIC Cascadable Amplifier

## MP4TD0670

V4.00

### Features

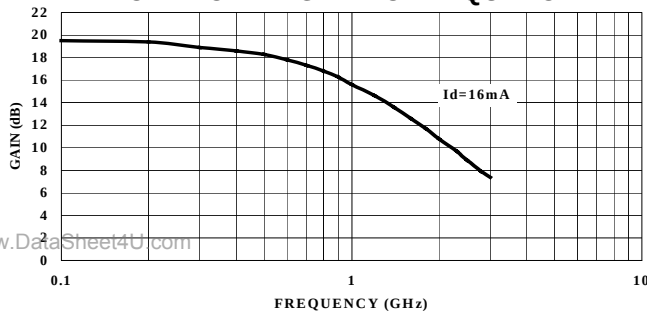
- Cascadable 50Ω Gain Block
- 3dB Bandwidth: DC to 0.8 GHz
- 18.5 dB Typical Gain @ 0.5 GHz
- Unconditionally Stable ( $k > 1$ )
- Low Voltage Operation
- Hermetic Gold-Ceramic Microstrip Package
- Tape and Reel Packaging Available

### Description

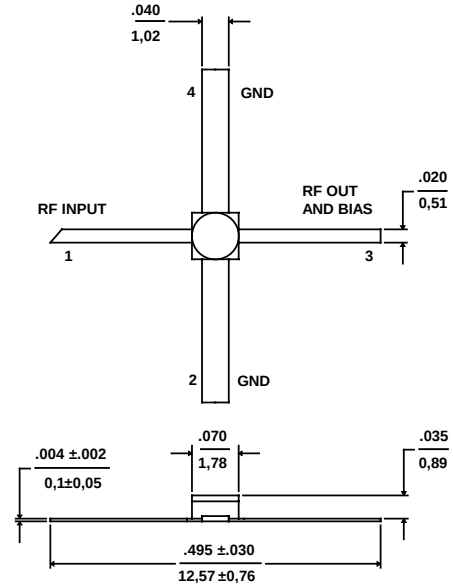
M-Pulse's MP4TD0670 is a high performance silicon bipolar MMIC housed in a hermetic high reliability package for surface mount usage. The MP4TD0670 is useful where a general purpose 50Ω gain block with lower (3.0 dB) noise figure is required. Typical applications include narrow and wide band IF and RF amplifiers in industrial and military applications.

The MP4TD0670 is fabricated using a 10 GHz  $f_T$  silicon bipolar technology that features gold metalization and IC passivation for increased performance and reliability.

**TYPICAL POWER GAIN vs FREQUENCY**



### Gold-Ceramic Microstrip Package Outline<sup>1,2</sup>



Notes: (unless otherwise specified)

1. Dimensions are in / mm
2. Tolerance: in .xxx = ±.005; mm .xx = ±.13

### Pin Configuration

| Pin Number | Pin Description       |
|------------|-----------------------|
| 1          | RF Input              |
| 2 & 4      | AC/DC Ground          |
| 3          | RF Output and DC Bias |

### Ordering Information

| Model No.  | Package       |
|------------|---------------|
| MP4TD0670  | Ceramic       |
| MP4TD0670T | Tape and Reel |

### Electrical Specifications @ $T_A = +25^\circ\text{C}$ , $I_d = 16\text{ mA}$ , $Z_0 = 50\Omega$

| Symbol                    | Parameters                             | Test Conditions                    | Units | Min. | Typ. | Max. |
|---------------------------|----------------------------------------|------------------------------------|-------|------|------|------|
| $G_p$                     | Power Gain ( $ S_{21} ^2$ )            | $f = 0.1\text{ GHz}$               | dB    | 18.5 | 19.5 | 22   |
| $\Delta G_p$              | Gain Flatness                          | $f = 0.1\text{ to }0.6\text{ GHz}$ | dB    | -    | ±0.7 | ±1.0 |
| $f_{3\text{ dB}}$         | 3 dB Bandwidth                         | -                                  | GHz   | -    | 0.8  | -    |
| $\text{SWR}_{\text{in}}$  | Input SWR                              | $f = 0.1\text{ to }1.5\text{ GHz}$ | -     | -    | 1.8  | -    |
| $\text{SWR}_{\text{out}}$ | Output SWR                             | $f = 0.1\text{ to }1.5\text{ GHz}$ | -     | -    | 1.8  | -    |
| $P_{1\text{ dB}}$         | Output Power @ 1 dB Gain Compression   | $f = 0.5\text{ GHz}$               | dBm   | -    | 4.5  | -    |
| NF                        | 50 Ω Noise Figure                      | $f = 0.5\text{ GHz}$               | dB    | -    | 3.0  | 3.5  |
| $\text{IP}_3$             | Third Order Intercept Point            | $f = 0.5\text{ GHz}$               | dBm   | -    | 14.5 | -    |
| $t_D$                     | Group Delay                            | $f = 0.5\text{ GHz}$               | ps    | -    | 200  | -    |
| $V_d$                     | Device Voltage                         | -                                  | V     | 3.1  | 3.5  | 3.9  |
| $dV/dT$                   | Device Voltage Temperature Coefficient | -                                  | mV/°C | -    | -8.0 | -    |

Specification Subject to Change Without Notice

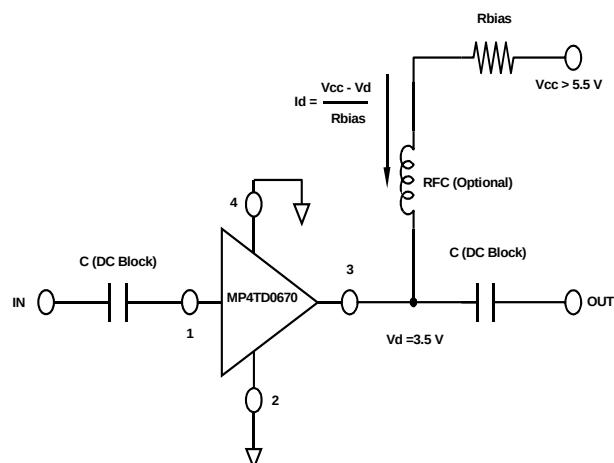
Absolute Maximum Ratings<sup>1</sup>

| Parameter                        | Absolute Maximum |
|----------------------------------|------------------|
| Device Current                   | 50 mA            |
| Power Dissipation <sup>2,3</sup> | 200 mW           |
| RF Input Power                   | +20 dBm          |
| Junction Temperature             | 200°C            |
| Storage Temperature              | -65°C to +200°C  |

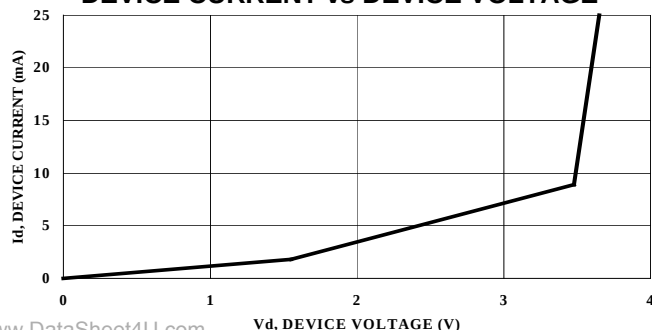
Thermal Resistance:  $\theta_{JC} = 150^\circ\text{C/W}$ 

1. Exceeding these limits may cause permanent damage.
2. Case Temperature ( $T_C$ ) = 25 °C.
3. Derate at 6.7 mW/°C for  $T_C > 170^\circ\text{C}$ .

## Typical Bias Configuration

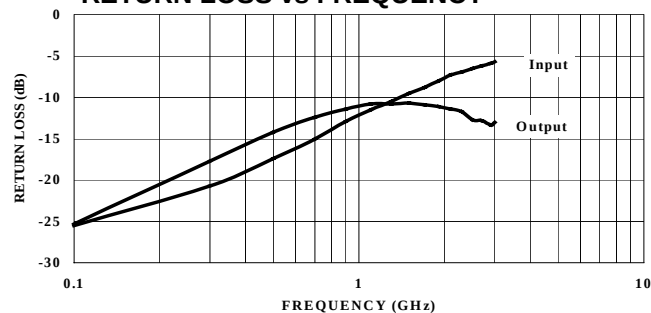
Typical Performance Curves @  $I_D = 16\text{ mA}$ ,  $T_A = +25^\circ\text{C}$  (unless otherwise noted)

DEVICE CURRENT vs DEVICE VOLTAGE

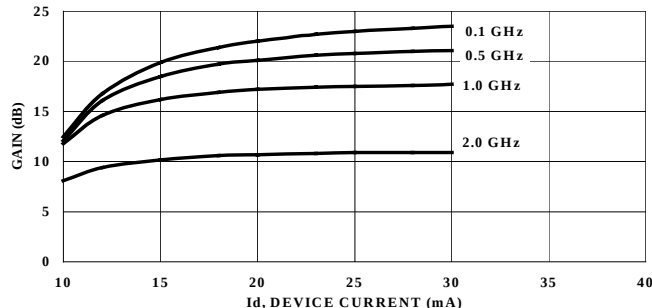
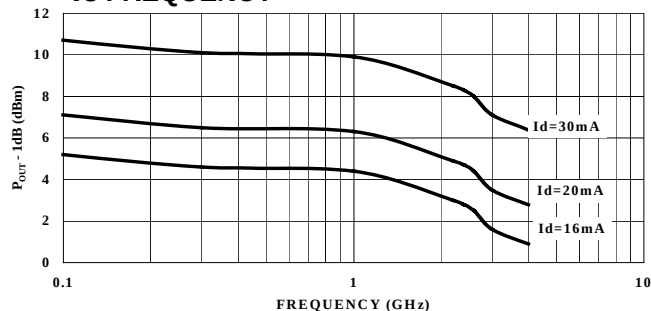


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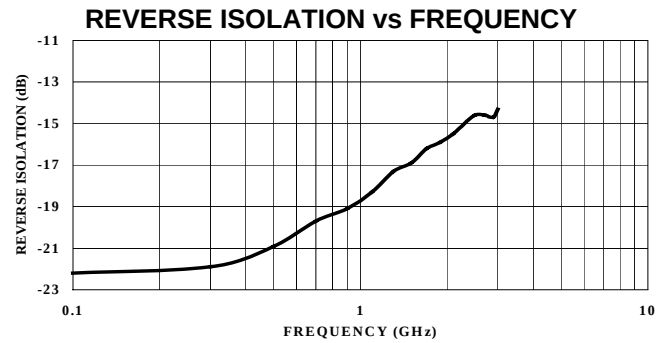
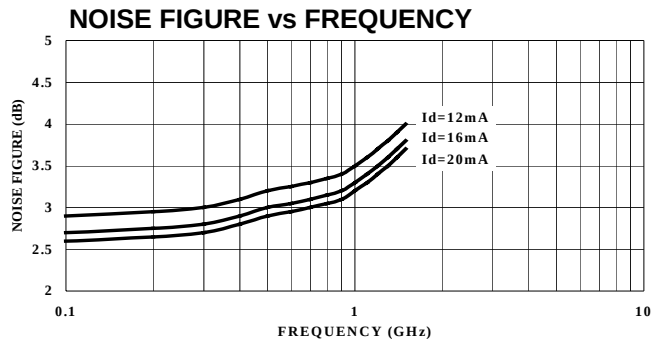
RETURN LOSS vs FREQUENCY



POWER GAIN vs CURRENT

 $P_{OUT}$  @ 1dB GAIN COMPRESSION vs FREQUENCY

Specification Subject to Change Without Notice



### Typical Scattering Parameters

$Z_0 = 50\Omega$ ,  $T_A = +25^\circ\text{C}$ ,  $I_d = 16\text{ mA}$

| Frequency<br>(GHz) | S <sub>11</sub> |        | S <sub>21</sub> |       | S <sub>12</sub> |       | S <sub>22</sub> |        |
|--------------------|-----------------|--------|-----------------|-------|-----------------|-------|-----------------|--------|
|                    | Mag.            | Angle  | Mag.            | Angle | Mag.            | Angle | Mag             | Angle  |
| 0.1                | 0.055           | -153.1 | 9.47            | 171.0 | 0.076           | 5.8   | 0.053           | -55.9  |
| 0.2                | 0.068           | -148.6 | 9.30            | 162.3 | 0.077           | 8.4   | 0.092           | -79.0  |
| 0.3                | 0.094           | -134.8 | 8.90            | 154.3 | 0.080           | 16.3  | 0.131           | -101.8 |
| 0.4                | 0.111           | -135.4 | 8.57            | 146.3 | 0.083           | 20.2  | 0.165           | -113.0 |
| 0.5                | 0.134           | -133.4 | 8.29            | 138.8 | 0.089           | 24.9  | 0.194           | -123.2 |
| 0.6                | 0.156           | -138.3 | 7.78            | 131.9 | 0.096           | 27.3  | 0.215           | -135.2 |
| 0.7                | 0.175           | -139.3 | 7.41            | 125.1 | 0.103           | 28.2  | 0.237           | -142.7 |
| 0.8                | 0.200           | -140.2 | 6.93            | 119.7 | 0.106           | 30.6  | 0.254           | -153.5 |
| 0.9                | 0.224           | -143.2 | 6.54            | 114.0 | 0.109           | 31.2  | 0.266           | -159.7 |
| 1.0                | 0.243           | -147.8 | 6.09            | 109.0 | 0.118           | 33.8  | 0.277           | -167.4 |
| 1.5                | 0.334           | -164.4 | 4.55            | 87.9  | 0.143           | 36.5  | 0.292           | 167.5  |
| 2.0                | 0.408           | 177.9  | 3.48            | 73.0  | 0.163           | 35.7  | 0.278           | 148.9  |
| 2.5                | 0.474           | 163.1  | 2.79            | 60.9  | 0.183           | 36.2  | 0.236           | 135.8  |
| 3.0                | 0.513           | 150.8  | 2.34            | 52.9  | 0.191           | 38.3  | 0.218           | 130.1  |

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