

T1L2003028-SP

30 W, 28V, 500 MHz-2 GHz, Powerband™ LDMOS RF Power Transistor

Introduction

The T1L2003028-SP is a POWERBAND™ discrete LDMOS, enhancement mode RF Power Transistor designed to operate from 500MHz to 2GHz in wide-band circuits. The device has an instantaneous band-width P1dB output power of 30watts across the entire band when operated in the TriQuint wide-band test fixture. The T1L2003028-SP can also be used in narrow band applications and is rated at 45Watts P1dB at 2GHz.

Figure 1. Available Packages



Features

- Exceptional Instantaneous band-width performance from 500MHz - 2GHz
- Increased efficiency results in significant advantages
 - Smaller and lighter systems
 - Reduced system component costs
 - Reduced energy consumption
- Typical Performance ratings
 - Wide-Band 500MHz - 2GHz (as tested in TriQuint Wideband Fixture)
 - 10dB Gain
 - 45% Efficiency
 - 30Watt P1dB
 - Narrow Band up to 2GHz
 - 14dB Gain
 - 59% Efficiency
 - 45Watt P1dB

Table 1. Thermal Characteristics

| Parameter | Sym | Value | Unit |
|---------------------------------------|------|-------|------|
| Thermal Resistance, Junction to Case: | R_JC | 1.3 | °C/W |

Table 2. Absolute Maximum Ratings*

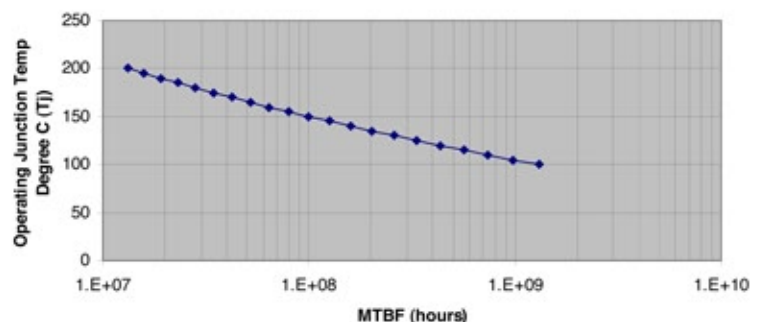
| Parameter | Sym | Value | Unit |
|----------------------------------|------|-----------|------|
| Drain-source Voltage | VDSS | 65 | Vdc |
| Gate-source Voltage | VGS | -0.5, +15 | Vdc |
| Drain Current—Continuous | ID | 4.25 | Adc |
| Total Dissipation at TC = 25 °C: | | | |
| T1L2003028-SP | PD | 135 | W |
| Derate Above 25 °C: | | | |
| T1L2003028-SP | — | 0.77 | W/°C |
| Operating Junction Temperature | TJ | 200 | °C |
| Storage Temperature Range | TSTG | -65, +150 | °C |

* Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Table 3. ESD Rating*

| T1L2003028-SP | Minimum (V) | Class |
|---------------|-------------|-------|
| HBM | 500 | 1B |
| MM | 50 | A |
| CDM | 1500 | 4 |

Figure 2. Lifetime Median Curve



Electrical Characteristics

Recommended operating conditions apply unless otherwise specified: TC = 30° C.

Table 4. dc Characteristics

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|----------|-----|------|-----|------|
| Off Characteristics | | | | | |
| Drain-source Breakdown Voltage (VGS = 0, ID = 200 μA) | V(BR)DSS | 65 | — | — | Vdc |
| Gate-source Leakage Current (VGS = 5 V, VDS = 0 V) | IGSS | — | — | 1.3 | μAdc |
| Zero Gate Voltage Drain Leakage Current (VDS = 28 V, VGS = 0 V) | IDSS | — | — | 75 | μAdc |
| On Characteristics | | | | | |
| Forward Transconductance (VDS = 10 V, ID = 1.0 A) | GFS | — | 3 | — | S |
| Gate Threshold Voltage (VDS = 10 V, ID = 400 μA) | VGS(TH) | — | — | 4.8 | Vdc |
| Gate Quiescent Voltage (VDS = 28 V, IDQ = 450 mA) | VGS(Q) | — | 3.5 | — | Vdc |
| Drain-source On-voltage (VGS = 10 V, ID = 1.0 A) | VDS(ON) | — | 0.25 | — | Vdc |

Table 5. RF Characteristics

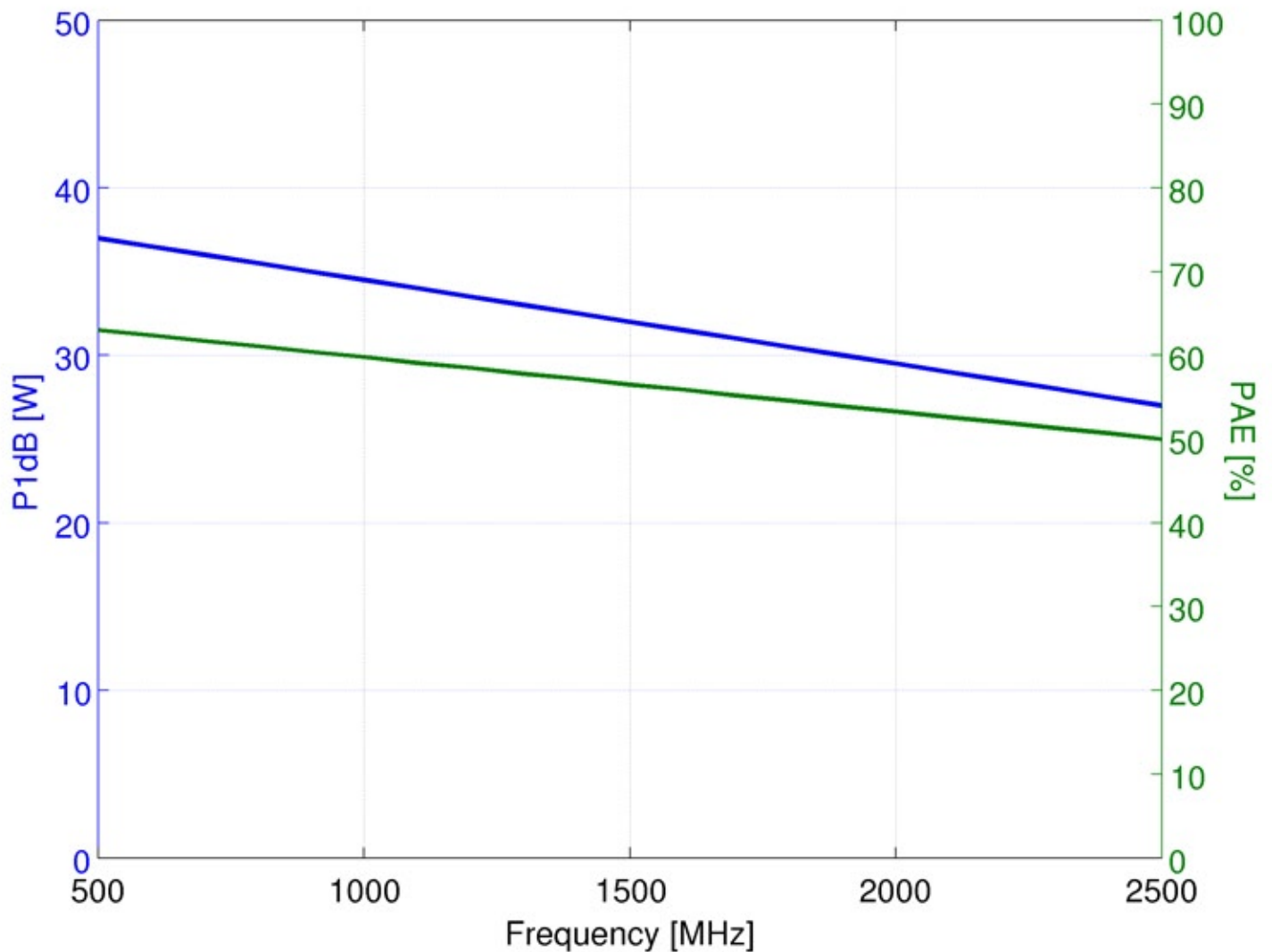
| Parameter | Symbol | Min | Typ | Max | Unit |
|---|--------|---------------------------------|-----|-----|------|
| Dynamic Characteristics | | | | | |
| Input Capacitance (VDS = 28 Vdc, VGS = 0, f = 1 MHz) | CISS | — | 73 | — | pF |
| Output Capacitance (VDS = 28 Vdc, VGS = 0, f = 1 MHz) | COSS | — | 23 | — | pF |
| Reverse Transfer Capacitance (VDS = 28 Vdc, VGS = 0, f = 1 MHz) | CRSS | — | 1.2 | — | pF |
| Functional Tests, Instantaneous Band-Width (Tested in TriQuint's Wide-Band Test Fixture) | | | | | |
| Gain @ P1dB, 500MHz-2GHz (VDS = 28 V, POUT = 30 W, IDD = 200 mA) | G | — | 10 | — | dB |
| P1dB, 500MHz-2GHz (VDS = 28 V, POUT = 30 W, IDD = 200 mA) | P1dB | — | 30 | — | W |
| Power Added Efficiency, 500MHz-2GHz (VDS = 28 V, POUT = 30 W, IDD = 200 mA) | — | — | 45 | — | % |
| Functional Tests, Narrow Band RF Performance (1GHz) | | | | | |
| Linear Power Gain (VDS = 28 V, POUT = 6 W, IDQ = 450 mA) | GL | 19 | 20 | — | dB |
| Output Power (VDS = 28 V, 1 dB compression, IDQ = 450 mA) | P1dB | 45 | 60 | — | W |
| Drain Efficiency (VDS = 28 V, POUT = P1dB, IDQ = 450 mA) | — | — | 59 | — | % |
| Third-order Intermodulation Distortion (100 kHz spacing, VDS = 28 V, POUT = 45 WPEP, IDQ = 450 mA) | IMD | — | -31 | — | dBc |
| Input Return Loss | IRL | — | 10 | — | dB |
| Ruggedness (VDS = 28 V, POUT = 45 W, IDQ = 450 mA, f = 880 MHz, VSWR = 10:1, all angles) | — | No degradation in output power. | | | |

T1L2003028-SP

30 W, 28V, 500 MHz-2 GHz, Powerband™ LDMOS RF Power Transistor

Figure 3.

P1dB and Efficiency (Narrow Band Performance Plotted Over Frequency)

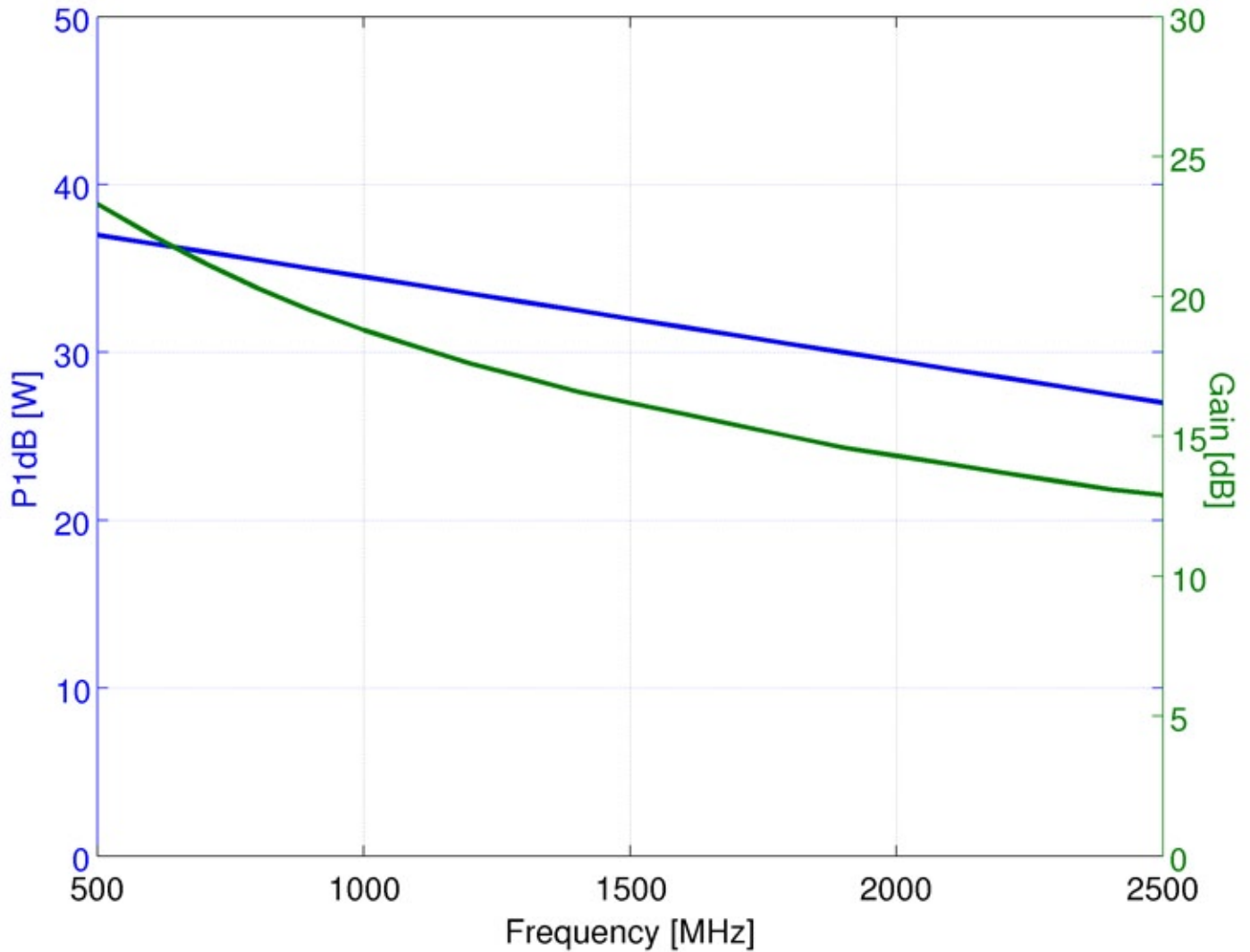


T1L2003028-SP

30 W, 28V, 500 MHz-2 GHz, Powerband™ LDMOS RF Power Transistor

Figure 4.

P1dB and Gain (Narrow Band Performance Plotted Over Frequency)

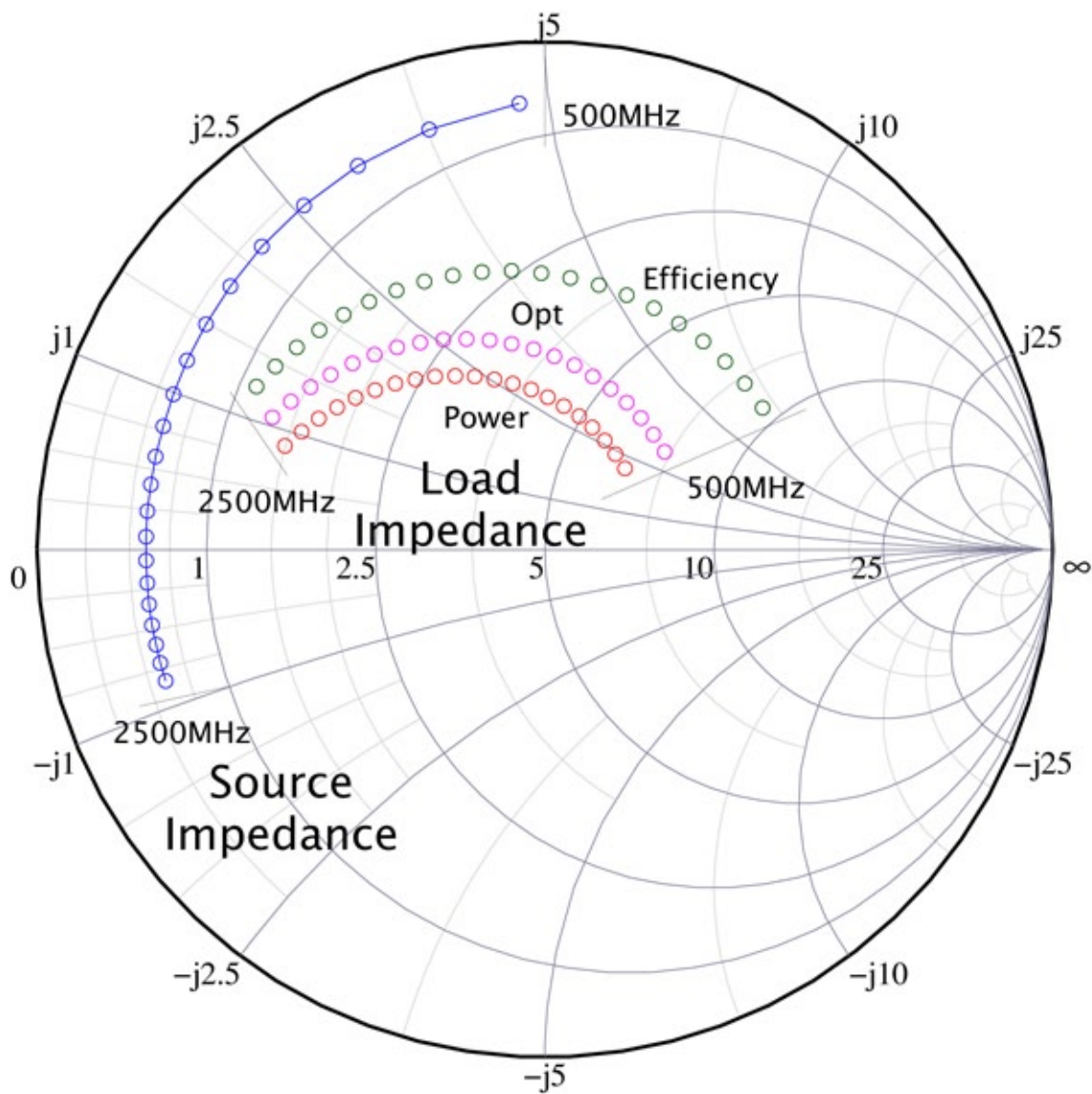


T1L2003028-SP

30 W, 28V, 500 MHz-2 GHz, Powerband™ LDMOS RF Power Transistor

Figure 5.

Plot of Impedances to be Presented to the Source and Load of the device for optimal RF Performance.

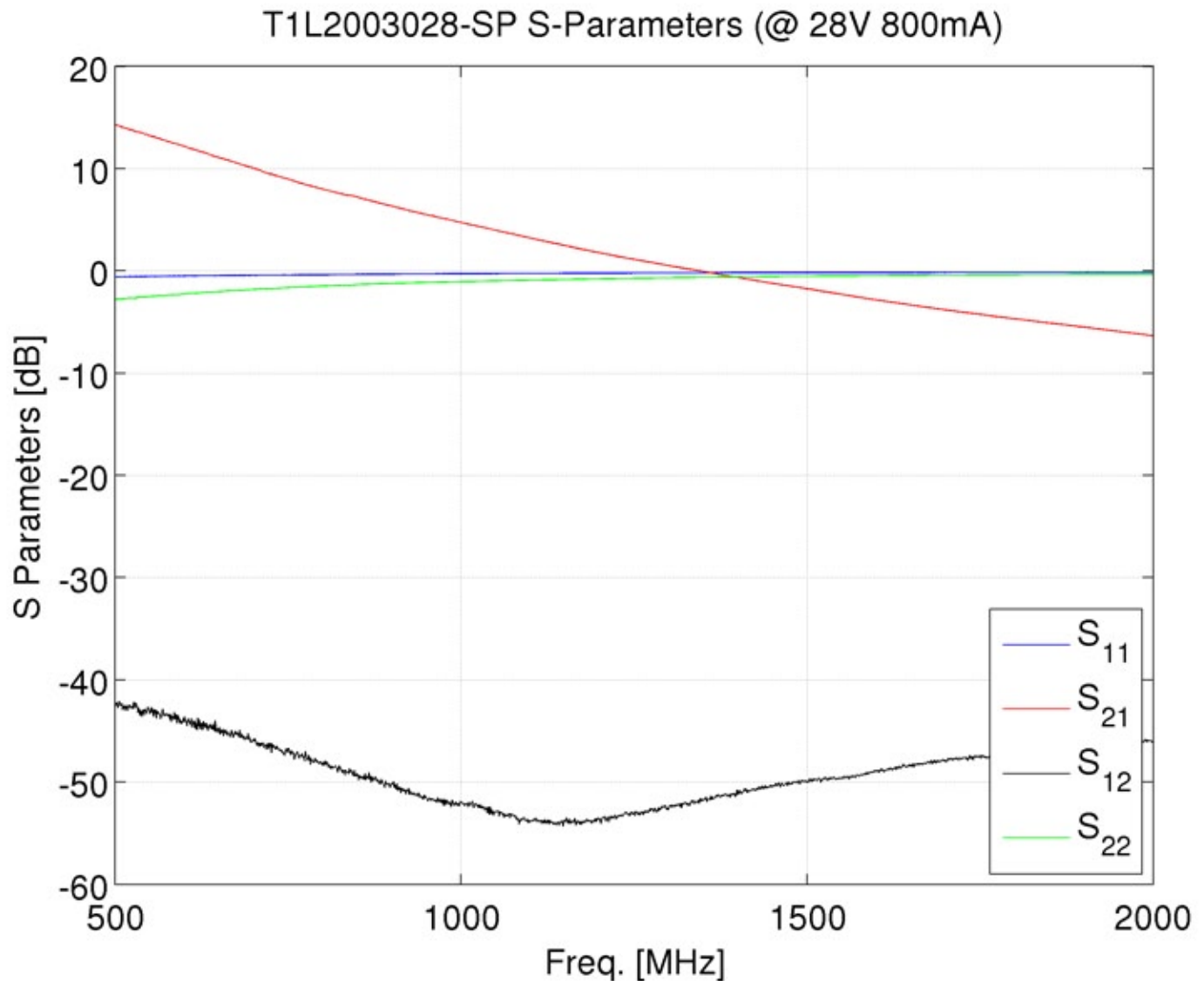


T1L2003028-SP

30 W, 28V, 500 MHz-2 GHz, Powerband™ LDMOS RF Power Transistor

Figure 6.

S Parameters 800mA, 28 Volts



T1L2003028-SP

30 W, 28V, 500 MHz-2 GHz, Powerband™ LDMOS RF Power Transistor

Table 6.

S Parameters 800mA, 28 Volts

| Freq. (MHz) | Real(S11) | Imag(S11) | Real(S21) | Imag(S21) | Real(S12) | Imag(S12) | Real(S22) | Imag(S22) |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 500 | -0.922389 | -0.141939 | 3.442169 | 3.892102 | 0.006702 | -0.003496 | -0.618429 | -0.380168 |
| 600 | -0.937731 | -0.117416 | 2.992273 | 2.726896 | 0.005862 | -0.003025 | -0.667645 | -0.379747 |
| 700 | -0.947335 | -0.100493 | 2.55325 | 1.874774 | 0.004603 | -0.002232 | -0.729357 | -0.359227 |
| 800 | -0.953987 | -0.086006 | 2.132991 | 1.331128 | 0.003609 | -0.001582 | -0.774675 | -0.331553 |
| 900 | -0.960672 | -0.073563 | 1.834709 | 0.966367 | 0.002945 | -0.000901 | -0.810336 | -0.310602 |
| 1000 | -0.966889 | -0.061292 | 1.576766 | 0.707514 | 0.002502 | -0.000112 | -0.838108 | -0.286519 |
| 1100 | -0.970899 | -0.050085 | 1.35123 | 0.521212 | 0.001967 | 0.000565 | -0.861553 | -0.262319 |
| 1200 | -0.974274 | -0.040649 | 1.163025 | 0.392155 | 0.001684 | 0.001208 | -0.88162 | -0.239921 |
| 1300 | -0.977932 | -0.031466 | 1.01994 | 0.291782 | 0.001426 | 0.001866 | -0.898607 | -0.221596 |
| 1400 | -0.979856 | -0.022787 | 0.904409 | 0.216945 | 0.001406 | 0.002393 | -0.91177 | -0.205747 |
| 1500 | -0.980454 | -0.014219 | 0.803326 | 0.157075 | 0.001265 | 0.002897 | -0.923506 | -0.190767 |
| 1600 | -0.981697 | -0.007846 | 0.711266 | 0.120005 | 0.001164 | 0.00341 | -0.931953 | -0.173848 |
| 1700 | -0.982815 | -0.000984 | 0.638323 | 0.08707 | 0.001191 | 0.003867 | -0.940047 | -0.161003 |
| 1800 | -0.984612 | 0.005168 | 0.579693 | 0.058515 | 0.001242 | 0.004149 | -0.946311 | -0.150365 |
| 1900 | -0.985594 | 0.012243 | 0.529564 | 0.035175 | 0.001145 | 0.004692 | -0.951789 | -0.13964 |
| 2000 | -0.985492 | 0.019104 | 0.482132 | 0.021833 | 0.001058 | 0.004946 | -0.956188 | -0.126832 |
| 2100 | -0.985526 | 0.026114 | 0.443472 | 0.008653 | 0.000842 | 0.00545 | -0.961151 | -0.113894 |
| 2200 | -0.985708 | 0.030901 | 0.407919 | -0.00246 | 0.001216 | 0.005788 | -0.963252 | -0.105708 |
| 2300 | -0.985362 | 0.037789 | 0.377957 | -0.014872 | 0.001316 | 0.005982 | -0.968493 | -0.099204 |
| 2400 | -0.98431 | 0.044056 | 0.34692 | -0.022864 | 0.001381 | 0.006186 | -0.971543 | -0.088213 |
| 2500 | -0.98409 | 0.048235 | 0.318019 | -0.023985 | 0.00089 | 0.005922 | -0.971838 | -0.075412 |
| 2600 | -0.985246 | 0.053767 | 0.296934 | -0.029004 | 0.001355 | 0.007366 | -0.974583 | -0.066586 |
| 2700 | -0.985066 | 0.058938 | 0.277241 | -0.035002 | 0.001481 | 0.007292 | -0.974 | -0.059945 |
| 2800 | -0.984571 | 0.066129 | 0.258276 | -0.035971 | 0.001073 | 0.007883 | -0.977731 | -0.052995 |
| 2900 | -0.982003 | 0.071617 | 0.240525 | -0.039954 | 0.001792 | 0.007862 | -0.980927 | -0.044908 |
| 3000 | -0.981434 | 0.074707 | 0.22585 | -0.04251 | 0.001852 | 0.007914 | -0.98103 | -0.037902 |



T1L2003028-SP

30 W, 28V, 500 MHz-2 GHz, Powerband™ LDMOS RF Power Transistor

Table 7.

Table of RF performance that the device typically exhibits when placed in the specified impedance environment. The impedances are not the impedances of the device, they are the impedances presented to the device via an RF circuit or Load-pull system. The data is representative of typical device performance for both 100uSecond pulse width, 10% duty cycle conditions and 1000uSecond pulse width, 10% duty cycle conditions.

| Frequency [MHz] | real(Γ_{in}) | imag(Γ_{in}) | real(Z_{in}) | imag(Z_{in}) | real(Γ_{out}) | imag(Γ_{out}) | real(Z_{out}) | imag(Z_{out}) |
|-----------------|-----------------------|-----------------------|------------------|------------------|------------------------|------------------------|-------------------|-------------------|
| 500 | -0.96 | 0.182 | 0.6 | 4.69 | -0.74 | 0.094 | 7.31 | 3.09 |
| 600 | -0.965 | 0.147 | 0.6 | 3.77 | -0.756 | 0.105 | 6.75 | 3.39 |
| 700 | -0.969 | 0.121 | 0.6 | 3.1 | -0.772 | 0.113 | 6.19 | 3.57 |
| 800 | -0.971 | 0.1 | 0.6 | 2.57 | -0.789 | 0.118 | 5.66 | 3.67 |
| 900 | -0.973 | 0.084 | 0.6 | 2.15 | -0.805 | 0.121 | 5.15 | 3.69 |
| 1000 | -0.974 | 0.07 | 0.6 | 1.79 | -0.821 | 0.122 | 4.68 | 3.65 |
| 1100 | -0.975 | 0.058 | 0.6 | 1.49 | -0.836 | 0.12 | 4.25 | 3.56 |
| 1200 | -0.975 | 0.048 | 0.6 | 1.22 | -0.849 | 0.118 | 3.86 | 3.44 |
| 1300 | -0.976 | 0.039 | 0.6 | 0.99 | -0.862 | 0.114 | 3.51 | 3.29 |
| 1400 | -0.976 | 0.03 | 0.6 | 0.78 | -0.873 | 0.11 | 3.2 | 3.12 |
| 1500 | -0.976 | 0.023 | 0.6 | 0.58 | -0.884 | 0.105 | 2.92 | 2.94 |
| 1600 | -0.976 | 0.016 | 0.6 | 0.4 | -0.893 | 0.099 | 2.67 | 2.76 |
| 1700 | -0.976 | 0.009 | 0.6 | 0.24 | -0.902 | 0.093 | 2.45 | 2.56 |
| 1800 | -0.976 | 0.003 | 0.6 | 0.08 | -0.91 | 0.087 | 2.25 | 2.37 |
| 1900 | -0.976 | -0.003 | 0.6 | -0.07 | -0.917 | 0.08 | 2.08 | 2.18 |
| 2000 | -0.976 | -0.008 | 0.6 | -0.21 | -0.923 | 0.074 | 1.92 | 1.99 |
| 2100 | -0.976 | -0.013 | 0.6 | -0.34 | -0.929 | 0.067 | 1.77 | 1.8 |
| 2200 | -0.976 | -0.018 | 0.6 | -0.47 | -0.934 | 0.06 | 1.64 | 1.61 |
| 2300 | -0.976 | -0.023 | 0.6 | -0.59 | -0.939 | 0.054 | 1.53 | 1.43 |
| 2400 | -0.976 | -0.028 | 0.6 | -0.71 | -0.944 | 0.047 | 1.42 | 1.25 |
| 2500 | -0.976 | -0.032 | 0.6 | -0.83 | -0.947 | 0.041 | 1.33 | 1.07 |

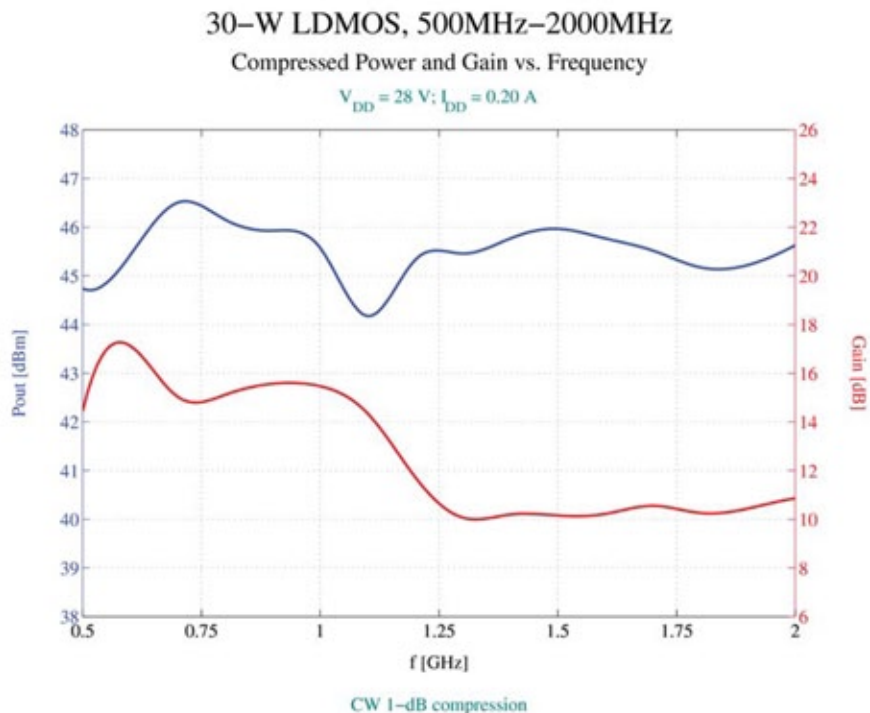
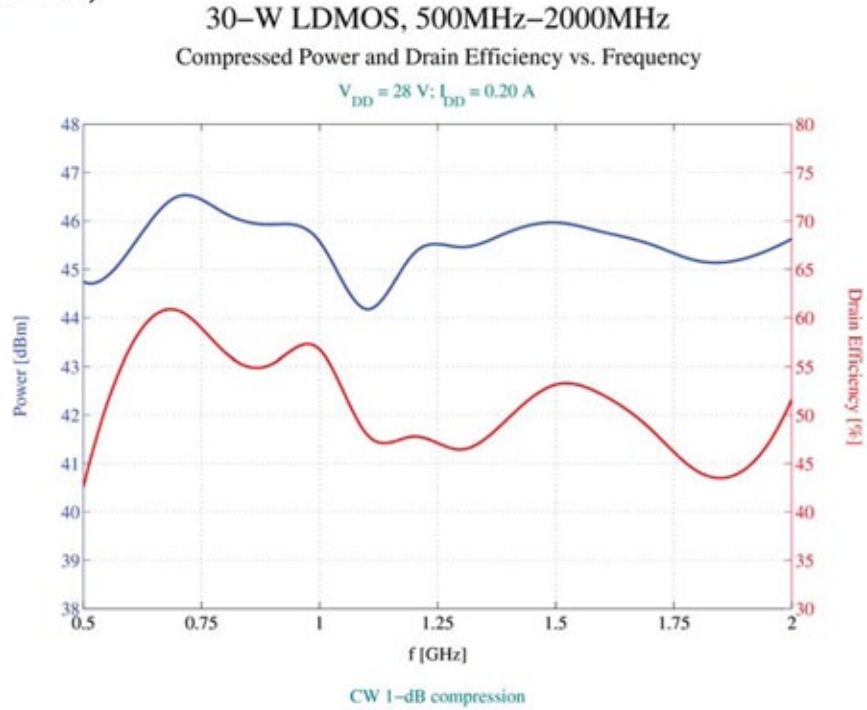


T1L2003028-SP

30 W, 28V, 500 MHz-2 GHz, Powerband™ LDMOS RF Power Transistor

Figure 7.

Typical Instantaneous Wide-Band Performance Data, 500MHz-2GHz
(tested in TriQuint wide-band fixture)



T1L2003028-SP

30 W, 28V, 500 MHz-2 GHz, Powerband™ LDMOS RF Power Transistor

Package Dimensions

Note: All dimensions in inches. Scale 8:1

