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PD57045 PD57045S

RF POWER TRANSISTORS The LdmoST FAMILY

N-CHANNEL ENHANCEMENT-MODE LATERAL MOSFETs

- EXCELLENT THERMAL STABILITY
- COMMON SOURCE CONFIGURATION
- $P_{OUT} = 45\text{ W}$ with 13 dB gain @ 945 MHz / 28V
- NEW RF PLASTIC PACKAGE

DESCRIPTION

The PD57045 is a common source N-Channel, enhancement-mode lateral Field-Effect RF power transistor. It is designed for high gain, broad band commercial and industrial applications. It operates at 28 V in common source mode at frequencies of up to 1 GHz. PD57045 boasts the excellent gain, linearity and reliability of ST's latest LDMOS technology mounted in the first true SMD plastic RF power package, PowerSO-10RF. PD57045's superior linearity performance makes it an ideal solution for base station applications.

The PowerSO-10 plastic package, designed to offer high reliability, is the first ST JEDEC approved, high power SMD package. It has been specially optimized for RF needs and offers excellent RF performances and ease of assembly.

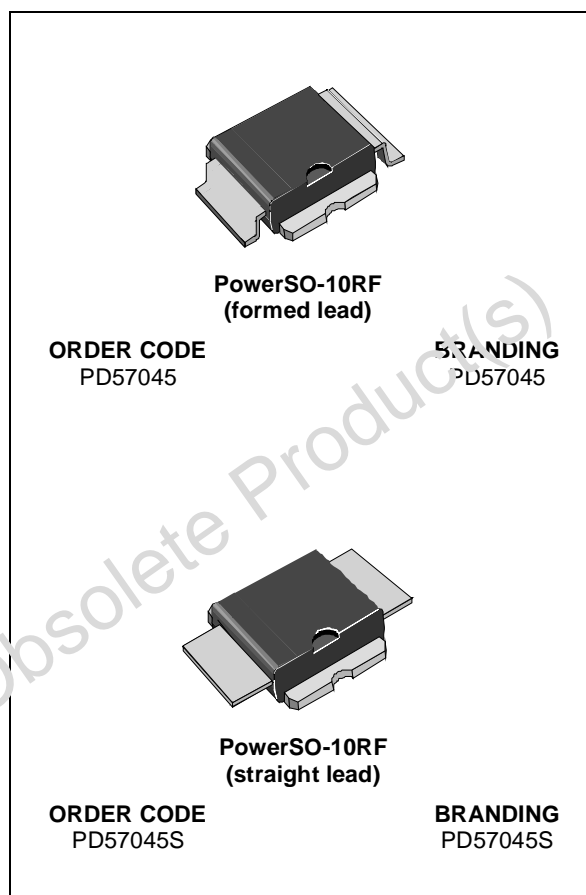
Mounting recommendations are available in www.st.com/rf/ (look for application note AN1294)

ABSOLUTE MAXIMUM RATINGS ($T_{CASE} = 25^{\circ}\text{C}$)

| Symbol | Parameter | Value | Unit |
|---------------|---|-------------|--------------------|
| $V_{(BR)DSS}$ | Drain-Source Voltage | 65 | V |
| V_{GS} | Gate-Source Voltage | ± 20 | V |
| I_D | Drain Current | 5 | A |
| P_{DISS} | Power Dissipation (@ $T_c = 70^{\circ}\text{C}$) | 73 | W |
| T_j | Max. Operating Junction Temperature | 165 | $^{\circ}\text{C}$ |
| T_{STG} | Storage Temperature | -65 to +150 | $^{\circ}\text{C}$ |

THERMAL DATA

| | | | |
|---------------|-----------------------------------|-----|----------------------|
| $R_{th(j-c)}$ | Junction -Case Thermal Resistance | 1.2 | $^{\circ}\text{C/W}$ |
|---------------|-----------------------------------|-----|----------------------|



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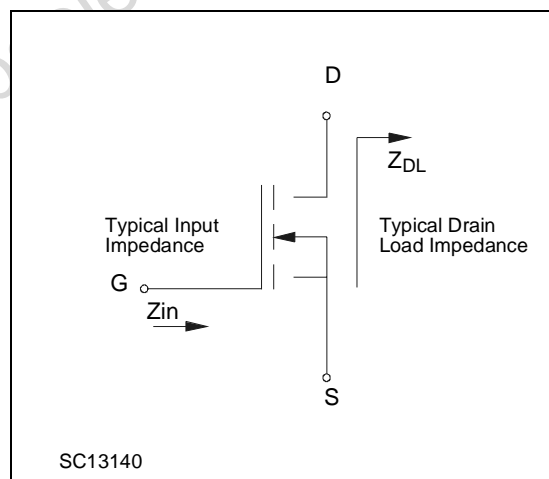
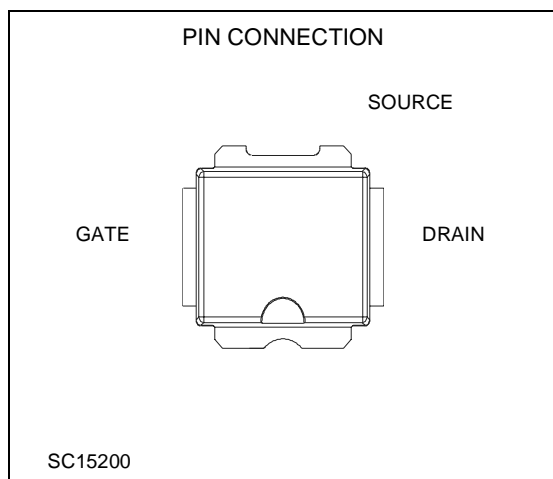
ELECTRICAL SPECIFICATION (T_{CASE} = 25°C)

STATIC

| Symbol | Test Conditions | | Min. | Typ. | Max. | Unit |
|----------------------|------------------------|-------------------------|------|------|------|------|
| V _{(BR)DSS} | V _{GS} = 0 V | I _{DS} = 1 mA | 65 | | | V |
| I _{DSS} | V _{GS} = 0 V | V _{DS} = 28 V | | | 1 | μA |
| I _{GSS} | V _{GS} = 20 V | V _{DS} = 0 V | | | 1 | μA |
| V _{GS(Q)} | V _{DS} = 28 V | I _D = 250 mA | 2.0 | | 5.0 | V |
| V _{DS(ON)} | V _{GS} = 10 V | I _D = 3 A | | 0.7 | 0.9 | V |
| g _{FS} | V _{DS} = 10 V | I _D = 4 A | 2.0 | 2.7 | | mho |
| C _{ISS} | V _{GS} = 0 V | V _{DS} = 28 V | | 86 | | pF |
| C _{OSS} | V _{GS} = 0 V | V _{DS} = 28 V | | 47 | | pF |
| C _{RSS} | V _{GS} = 0 V | V _{DS} = 28 V | | 3.6 | | pF |

DYNAMIC

| Symbol | Test Conditions | | Min. | Typ. | Max. | Unit |
|------------------|------------------------|--|------|------|------|------|
| P _{1dB} | V _{DD} = 28 V | I _{DQ} = 250 mA f = 945 MHz | 45 | | | W |
| G _P | V _{DD} = 28 V | I _{DQ} = 250 mA P _{OUT} = 45 W f = 945 MHz | 13 | 14.5 | | dB |
| η _D | V _{DD} = 28 V | I _{DQ} = 250 mA P _{OUT} = 45 W f = 945 MHz | 50 | | | % |
| Load mismatch | V _{DD} = 28 V | I _{DQ} = 250 mA P _{OUT} = 45 W f = 945 MHz ALL PHASE ANGLES | 10:1 | | | VSWR |



IMPEDANCE DATA

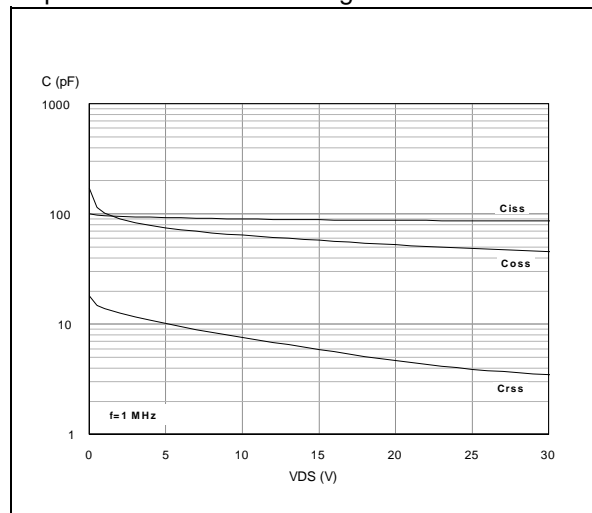
PD57045S

| FREQ. MHz | Z _{IN} (Ω) | Z _{DL} (Ω) |
|-----------|---------------------|---------------------|
| 925 | .71 + j 2.32 | 1.29 - j .35 |
| 945 | .69 + j 2.92 | 1.25 - j .29 |
| 960 | .55 + j 2.78 | 1.18 - j .83 |

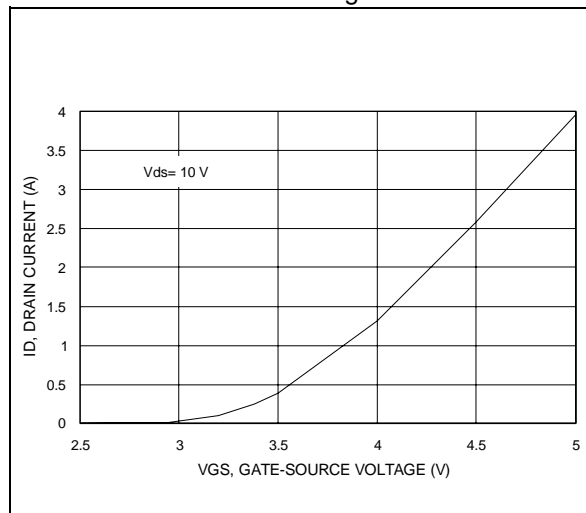
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TYPICAL PERFORMANCE

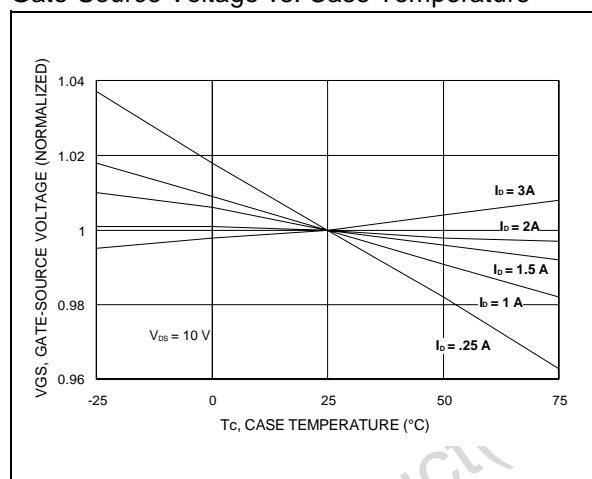
Capacitance vs. Drain Voltage



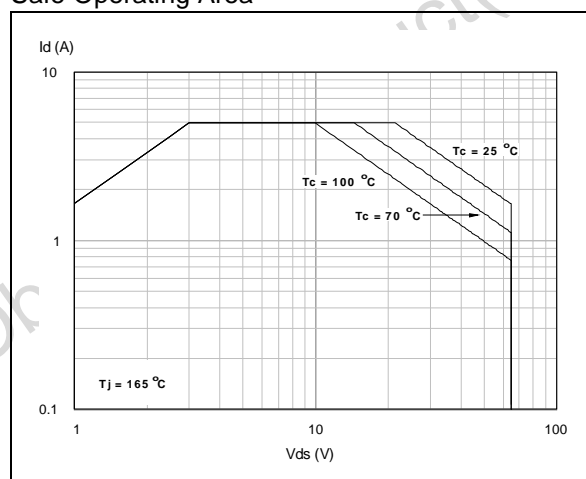
Drain Current vs. Gate Voltage



Gate-Source Voltage vs. Case Temperature



Safe Operating Area

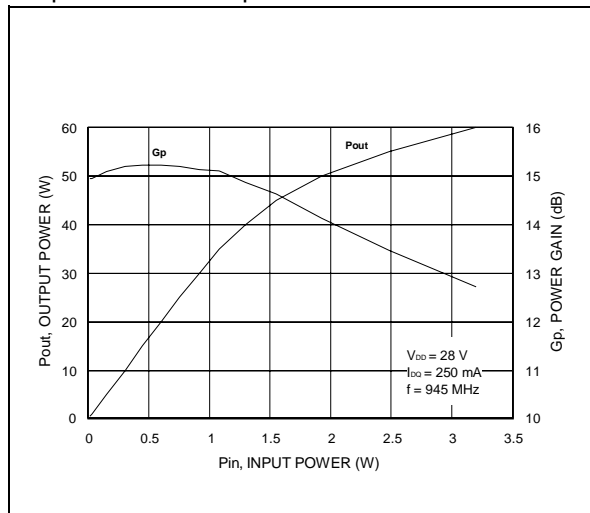


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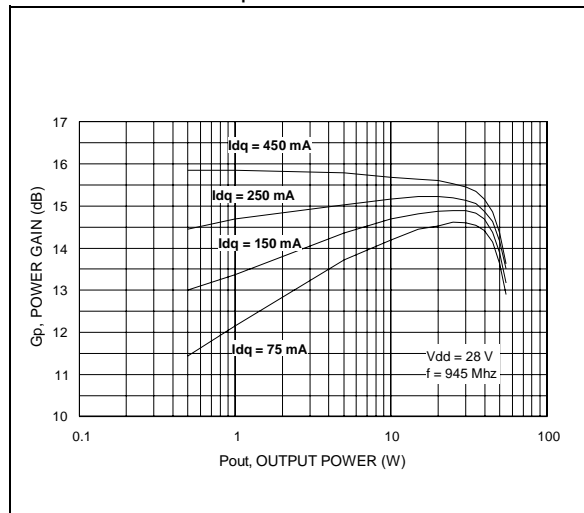
TYPICAL PERFORMANCE

Output Power vs. Input Power

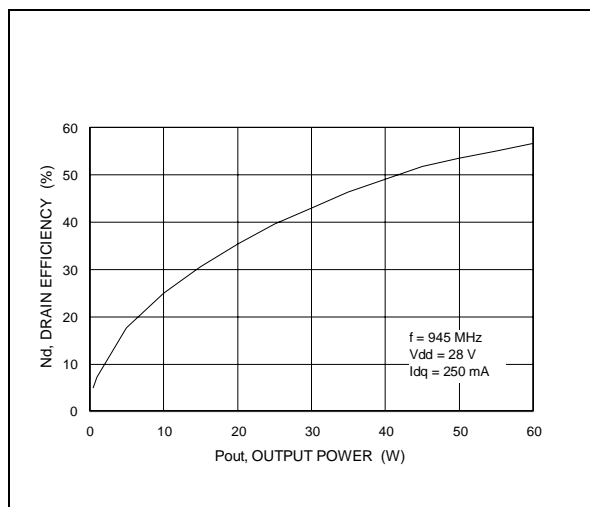
PD57045S



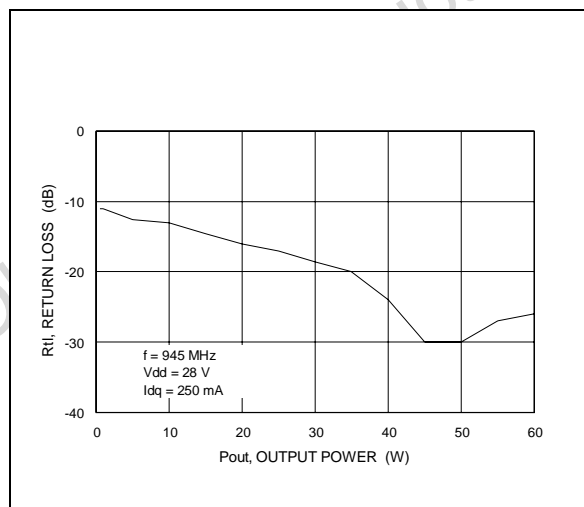
Power Gain vs. Output Power



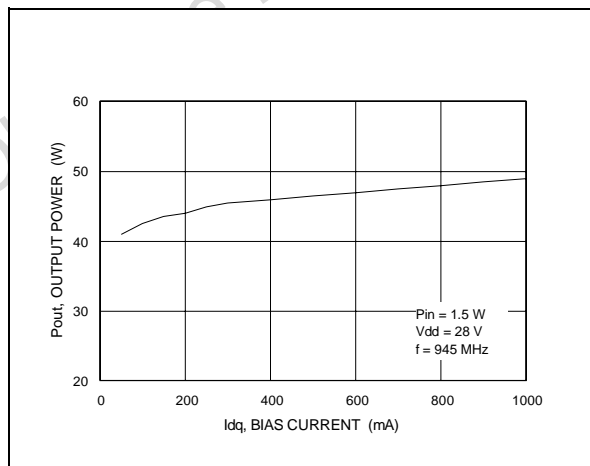
Drain Efficiency vs. Output Power



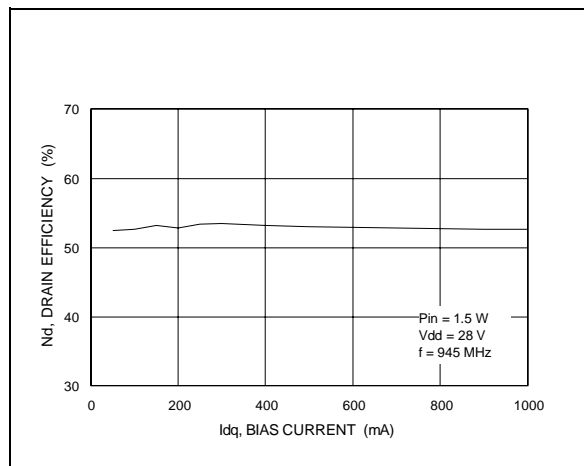
Return Loss vs. Output Power



Output Power vs. Bias Current



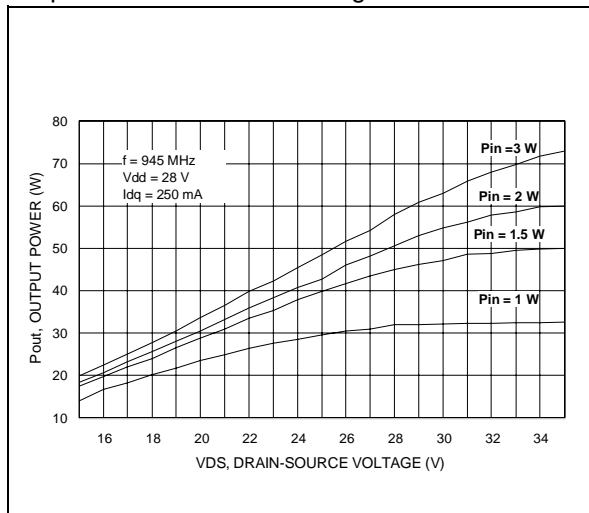
Drain Efficiency vs. Bias Current



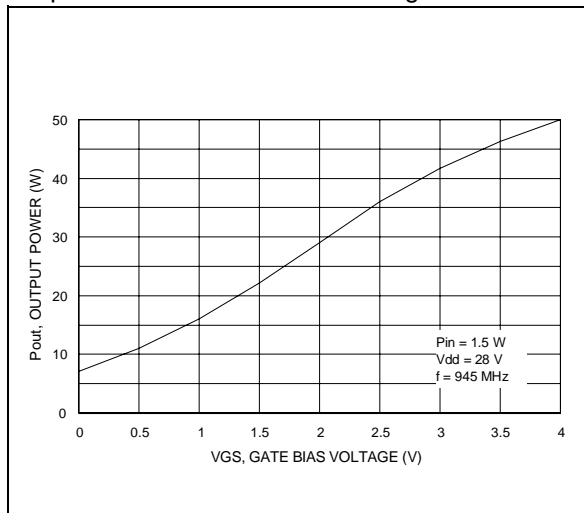
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TYPICAL PERFORMANCE

Output Power vs. Drain Voltage

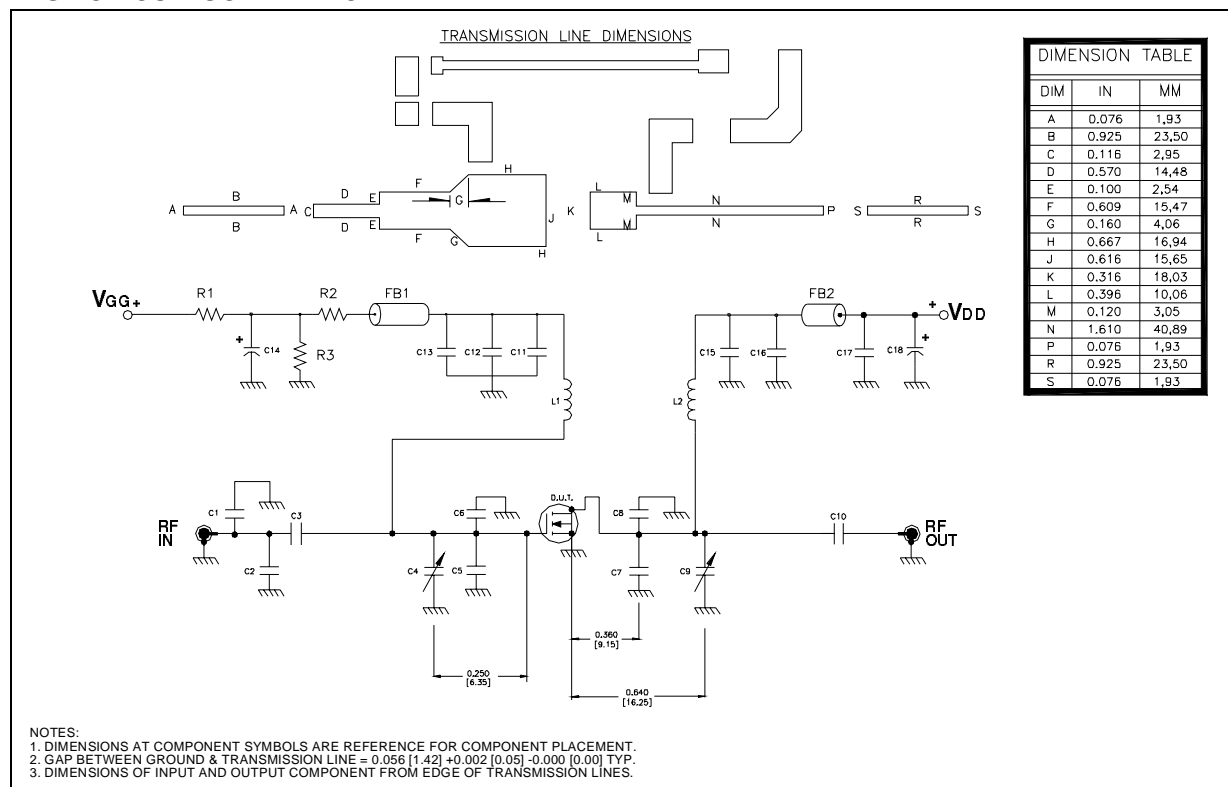


Output Power vs. Gate Bias Voltage



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TEST CIRCUIT SCHEMATIC

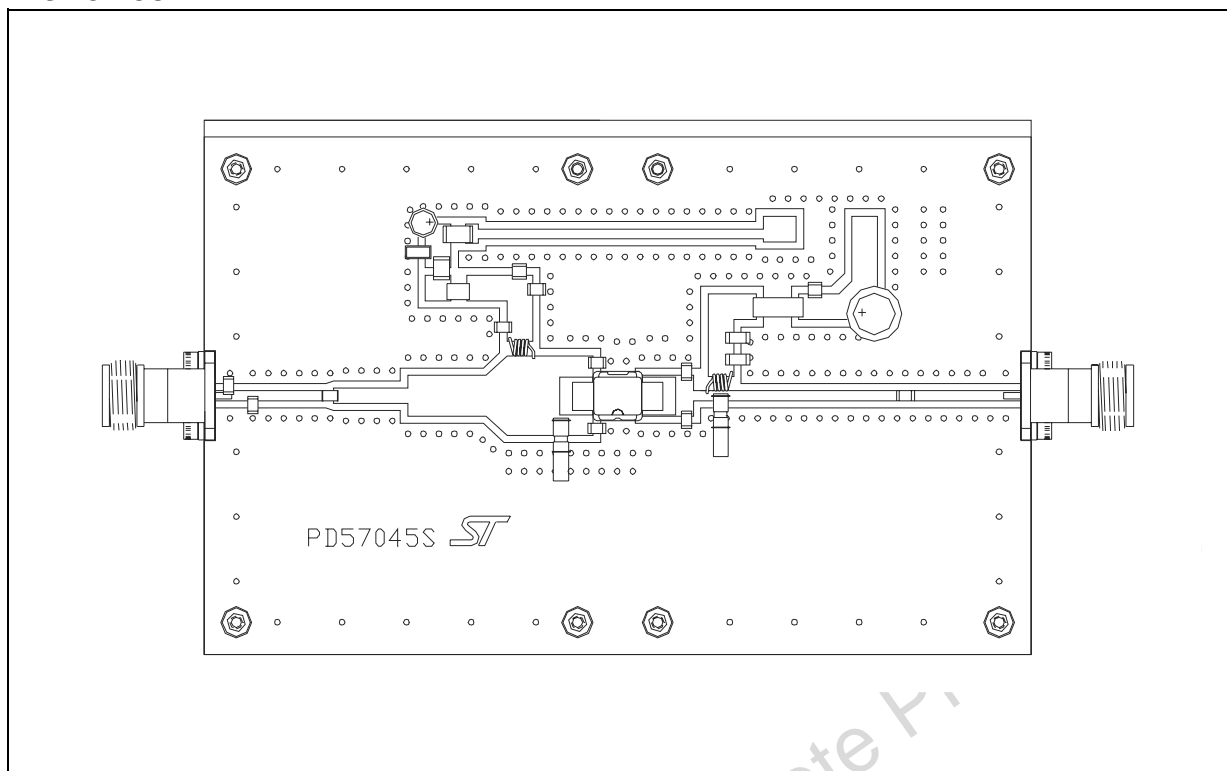


TEST CIRCUIT COMPONENT PART LIST

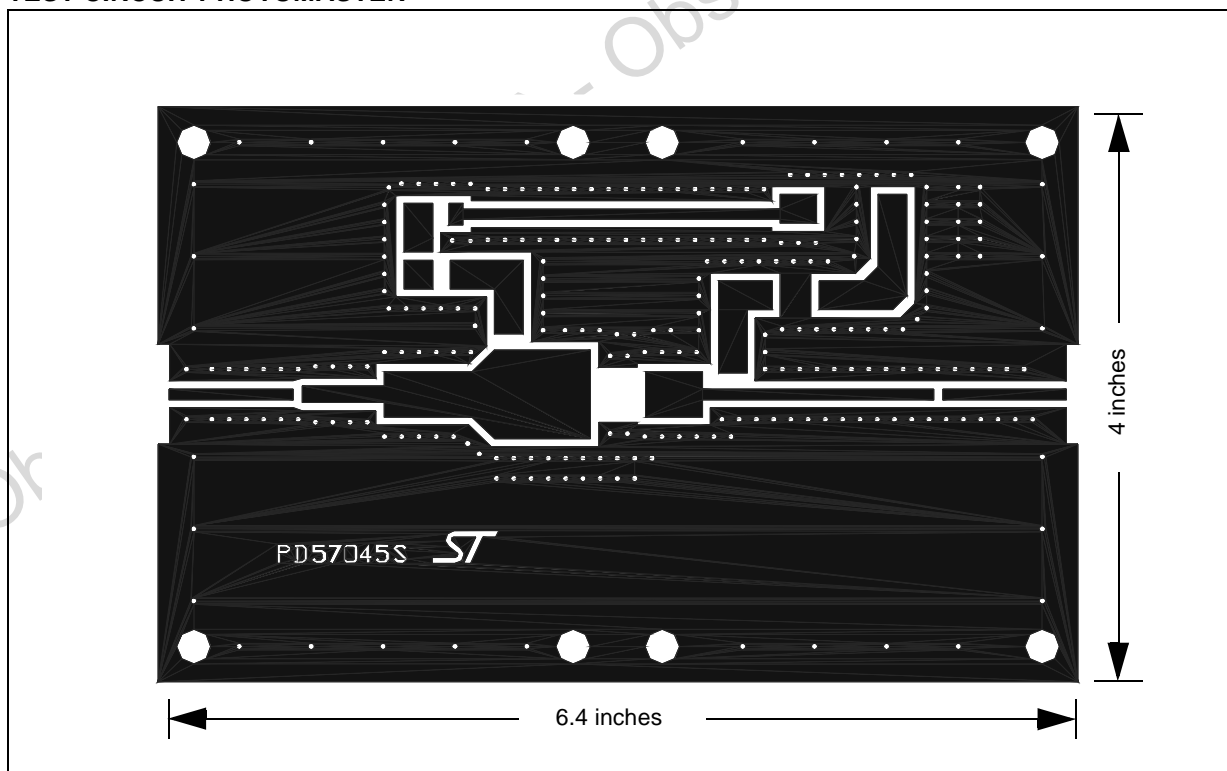
| COMPONENT | DESCRIPTION |
|----------------|--|
| L1,L2 | INDUCTOR, 5 TURNS AIR WOUND #22AWG, ID 0.059{1.49}, NYLON COATED MAGNET WIRE |
| FB1,FB2 | SHIELD BEAD SURFACE MOUNT EMI |
| R1 | 18 K OHM, 1 W SURFACE MOUNT CHIP RESISTOR |
| R2 | 4.7 M OHM, 1 W SURFACE MOUNT CHIP RESISTOR |
| R3 | 120 OHM, 2 W SURFACE MOUNT CHIP RESISTOR |
| C1,C2 | 3 pF ATC 100B SURFACE MOUNT CERAMIC CHIP CAPACITOR |
| C3,C10,C11,C15 | 47 pF ATC 100B SURFACE MOUNT CERAMIC CHIP CAPACITOR |
| C4,C9 | 0.8-8.0 pF GIGA TRIM VARIABLE CAPACITOR |
| C5,C6,C7,C8 | 7.5 pF ATC 100B SURFACE MOUNT CERAMIC CHIP CAPACITOR |
| C12 | 1000 pF ATC 700B SURFACE MOUNT CERAMIC CHIP CAPACITOR |
| C13,C17 | 0.1 μ F/500 V SURFACE MOUNT CERAMIC CHIP CAPACITOR |
| C14 | 10 μ F/50 V ALUMINUM ELECTROLYTIC RADIAL LEAD CAPACITOR |
| C16 | 100 pF ATC 100B SURFACE MOUNT CERAMIC CHIP CAPACITOR |
| C18 | 220 μ F/63 V ALUMINUM ELECTROLYTIC RADIAL LEAD CAPACITOR |
| BOARD | ROGER, ULTRA LAM 2000, THK 0.030", $\epsilon_r = 2.55$ 2oz. ED cu 2 SIDES. |

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TEST CIRCUIT



TEST CIRCUIT PHOTOMASTER



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COMMON SOURCE S-PARAMETER (PD57045S)

($V_{DS} = 13.5V$ $I_{DS} = 1.5A$)

| FREQ (MHz) | $ S_{11} $ | $\angle S_{11}$ | $ S_{21} $ | $\angle S_{21}$ | $ S_{12} $ | $\angle S_{12}$ | $ S_{22} $ | $\angle S_{22}$ |
|---------------|------------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|
| 50 | 0.825 | -170 | 14.34 | 85 | 0.014 | -1 | 0.819 | -171 |
| 100 | 0.875 | -173 | 6.94 | 79 | 0.013 | -6 | 0.824 | -175 |
| 150 | 0.895 | -175 | 4.67 | 75 | 0.013 | -10 | 0.828 | -175 |
| 200 | 0.908 | -176 | 3.44 | 70 | 0.013 | -14 | 0.837 | -176 |
| 250 | 0.910 | -177 | 2.70 | 65 | 0.012 | -16 | 0.842 | -176 |
| 300 | 0.916 | -178 | 2.20 | 60 | 0.012 | -18 | 0.854 | -176 |
| 350 | 0.922 | -178 | 1.82 | 55 | 0.011 | -23 | 0.864 | -176 |
| 400 | 0.926 | -179 | 1.55 | 51 | 0.010 | -25 | 0.874 | -176 |
| 450 | 0.933 | -179 | 1.32 | 47 | 0.010 | -25 | 0.883 | -177 |
| 500 | 0.937 | -179 | 1.14 | 44 | 0.008 | -25 | 0.893 | -177 |
| 550 | 0.942 | -180 | 1.00 | 40 | 0.008 | -24 | 0.901 | -177 |
| 600 | 0.946 | 180 | 0.88 | 37 | 0.007 | -25 | 0.912 | -177 |
| 650 | 0.949 | 180 | 0.79 | 34 | 0.007 | -25 | 0.915 | -178 |
| 700 | 0.951 | 179 | 0.70 | 32 | 0.006 | -20 | 0.922 | -178 |
| 750 | 0.954 | 179 | 0.63 | 29 | 0.005 | -23 | 0.926 | -179 |
| 800 | 0.958 | 178 | 0.57 | 27 | 0.005 | -14 | 0.932 | -179 |
| 850 | 0.961 | 178 | 0.52 | 24 | 0.004 | -6 | 0.932 | -180 |
| 900 | 0.963 | 178 | 0.47 | 22 | 0.004 | 3 | 0.942 | 179 |
| 950 | 0.964 | 177 | 0.44 | 20 | 0.004 | 1 | 0.942 | 180 |
| 1000 | 0.966 | 177 | 0.40 | 18 | 0.004 | 7 | 0.943 | 179 |
| 1050 | 0.967 | 176 | 0.37 | 16 | 0.003 | 26 | 0.946 | 179 |
| 1100 | 0.966 | 176 | 0.35 | 15 | 0.003 | 51 | 0.949 | 178 |
| 1150 | 0.969 | 176 | 0.32 | 13 | 0.003 | 56 | 0.950 | 179 |
| 1200 | 0.970 | 175 | 0.30 | 11 | 0.004 | 62 | 0.953 | 179 |
| 1250 | 0.970 | 175 | 0.29 | 9 | 0.004 | 55 | 0.967 | 178 |
| 1300 | 0.971 | 175 | 0.26 | 7 | 0.004 | 65 | 0.972 | 176 |
| 1350 | 0.972 | 174 | 0.25 | 6 | 0.004 | 71 | 0.958 | 176 |
| 1400 | 0.972 | 174 | 0.23 | 4 | 0.005 | 81 | 0.961 | 176 |
| 1450 | 0.970 | 174 | 0.22 | 3 | 0.006 | 91 | 0.958 | 175 |
| 1500 | 0.970 | 173 | 0.20 | 2 | 0.007 | 100 | 0.963 | 175 |

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COMMON SOURCE S-PARAMETER (PD57045S)

($V_{DS} = 28V$ $I_{DS} = 1.5A$)

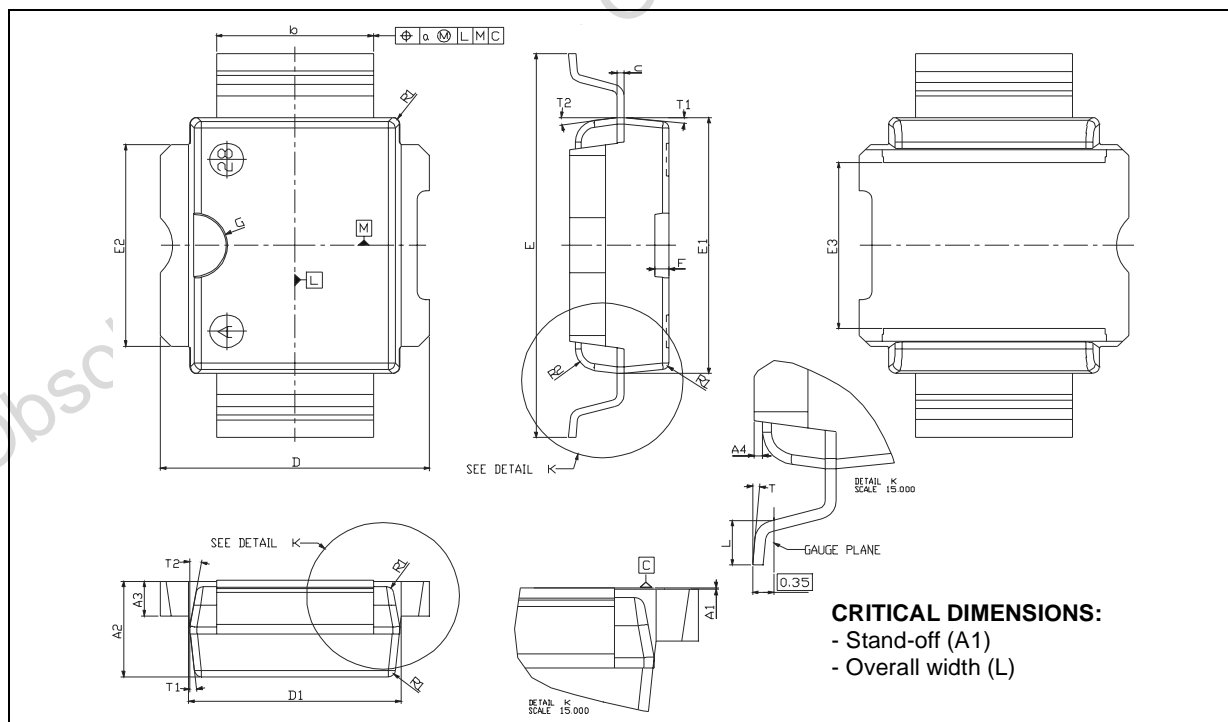
| FREQ (MHz) | $ S_{11} $ | $\angle S_{11}$ | $ S_{21} $ | $\angle S_{21}$ | $ S_{12} $ | $\angle S_{12}$ | $ S_{22} $ | $\angle S_{22}$ |
|---------------|------------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|
| 50 | 0.829 | -161 | 20.72 | 92 | 0.012 | 2 | 0.718 | -166 |
| 100 | 0.872 | -168 | 10.33 | 82 | 0.011 | -6 | 0.731 | -170 |
| 150 | 0.897 | -172 | 6.84 | 74 | 0.011 | -10 | 0.745 | -171 |
| 200 | 0.910 | -174 | 5.02 | 68 | 0.010 | -14 | 0.765 | -171 |
| 250 | 0.913 | -175 | 3.86 | 61 | 0.010 | -17 | 0.783 | -171 |
| 300 | 0.922 | -176 | 3.10 | 55 | 0.009 | -23 | 0.803 | -171 |
| 350 | 0.928 | -176 | 2.53 | 50 | 0.009 | -25 | 0.823 | -172 |
| 400 | 0.934 | -177 | 2.12 | 45 | 0.008 | -27 | 0.839 | -172 |
| 450 | 0.941 | -178 | 1.79 | 41 | 0.007 | -26 | 0.856 | -172 |
| 500 | 0.946 | -178 | 1.53 | 37 | 0.006 | -26 | 0.872 | -173 |
| 550 | 0.949 | -179 | 1.32 | 34 | 0.005 | -27 | 0.884 | -174 |
| 600 | 0.955 | -179 | 1.16 | 31 | 0.005 | -24 | 0.898 | -174 |
| 650 | 0.959 | -180 | 1.03 | 27 | 0.004 | -18 | 0.902 | -175 |
| 700 | 0.960 | 180 | 0.91 | 25 | 0.004 | -17 | 0.914 | -175 |
| 750 | 0.963 | 179 | 0.81 | 22 | 0.003 | -7 | 0.919 | -176 |
| 800 | 0.967 | 179 | 0.73 | 19 | 0.003 | -1 | 0.928 | -176 |
| 850 | 0.968 | 178 | 0.67 | 17 | 0.003 | 11 | 0.927 | -177 |
| 900 | 0.968 | 178 | 0.60 | 15 | 0.003 | 28 | 0.937 | -178 |
| 950 | 0.972 | 178 | 0.55 | 12 | 0.003 | 36 | 0.939 | -178 |
| 1000 | 0.972 | 177 | 0.50 | 11 | 0.003 | 56 | 0.94 | -179 |
| 1050 | 0.972 | 177 | 0.49 | 9 | 0.003 | 56 | 0.944 | -179 |
| 1100 | 0.972 | 176 | 0.43 | 7 | 0.004 | 63 | 0.950 | -180 |
| 1150 | 0.974 | 176 | 0.40 | 5 | 0.004 | 66 | 0.950 | -179 |
| 1200 | 0.975 | 176 | 0.37 | 4 | 0.005 | 72 | 0.950 | -180 |
| 1250 | 0.975 | 175 | 0.35 | 3 | 0.006 | 75 | 0.968 | 180 |
| 1300 | 0.976 | 175 | 0.32 | 0 | 0.006 | 77 | 0.973 | 178 |
| 1350 | 0.977 | 174 | 0.30 | -1 | 0.006 | 81 | 0.960 | 178 |
| 1400 | 0.976 | 174 | 0.28 | -2 | 0.006 | 84 | 0.960 | 177 |
| 1450 | 0.973 | 174 | 0.26 | -3 | 0.007 | 98 | 0.958 | 177 |
| 1500 | 0.973 | 174 | 0.25 | -4 | 0.008 | 102 | 0.963 | 176 |

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PowerSO-10RF Formed Lead (Gull Wing) MECHANICAL DATA

| DIM. | mm | | | Inch | | |
|------|-------|--------|-------|-------|--------|--------|
| | MIN. | TYP. | MAX | MIN. | TYP. | MAX |
| A1 | 0 | 0.05 | 0.1 | 0. | 0.0019 | 0.0038 |
| A2 | 3.4 | 3.5 | 3.6 | 0.134 | 0.137 | 0.142 |
| A3 | 1.2 | 1.3 | 1.4 | 0.046 | 0.05 | 0.054 |
| A4 | 0.15 | 0.2 | 0.25 | 0.005 | 0.007 | 0.009 |
| a | | 0.2 | | | 0.007 | |
| b | 5.4 | 5.53 | 5.65 | 0.212 | 0.217 | 0.221 |
| c | 0.23 | 0.27 | 0.32 | 0.008 | 0.01 | 0.012 |
| D | 9.4 | 9.5 | 9.6 | 0.370 | 0.374 | 0.377 |
| D1 | 7.4 | 7.5 | 7.6 | 0.290 | 0.295 | 0.298 |
| E | 13.85 | 14.1 | 14.35 | 0.544 | 0.555 | 0.565 |
| E1 | 9.3 | 9.4 | 9.5 | 0.365 | 0.37 | 0.375 |
| E2 | 7.3 | 7.4 | 7.5 | 0.286 | 0.292 | 0.294 |
| E3 | 5.9 | 6.1 | 6.3 | 0.231 | 0.24 | 0.247 |
| F | | 0.5 | | | 0.019 | |
| G | | 1.2 | | | 0.047 | |
| L | 0.8 | 1 | 1.1 | 0.030 | 0.039 | 0.042 |
| R1 | | | 0.25 | | | 0.01 |
| R2 | | 0.8 | | | 0.031 | |
| T | 2 deg | 5 deg | 8 deg | 2 deg | 5 deg | 8 deg |
| T1 | | 6 deg | | | 6 deg | |
| T2 | | 10 deg | | | 10 deg | |

Note (1): Resin protrusions not included (max value: 0.15 mm per side)

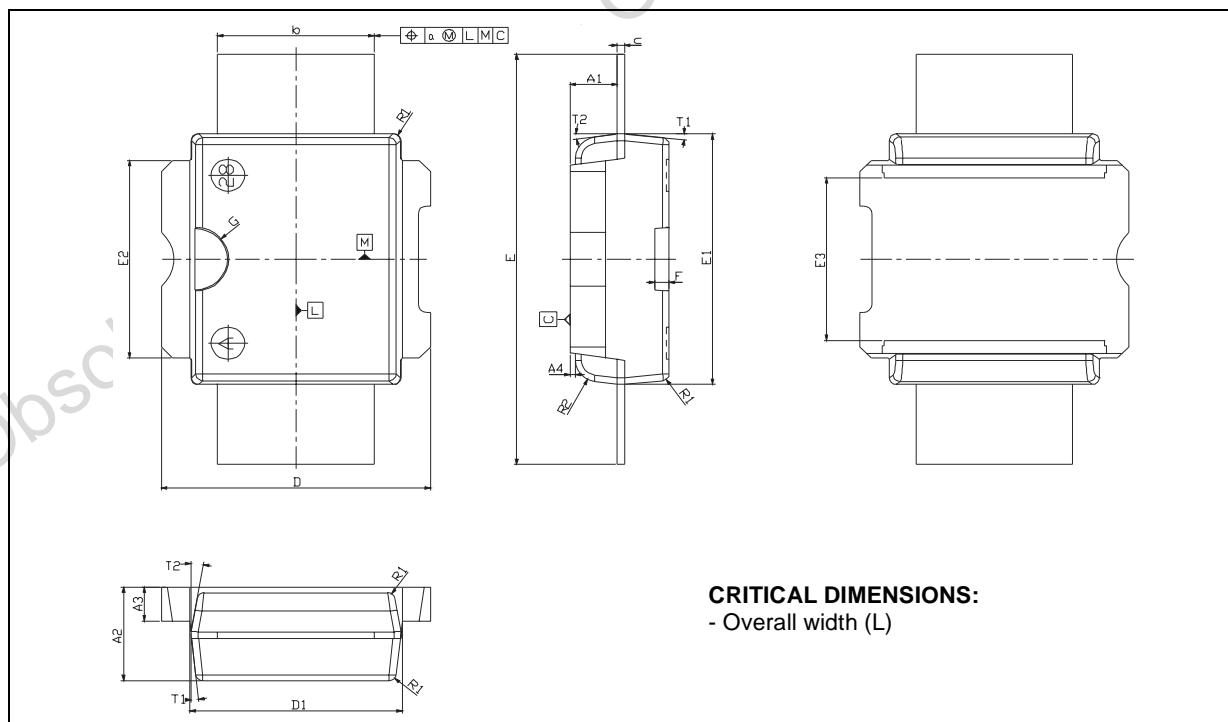


PD57045 - PD57045S

PowerSO-10RF Straight Lead MECHANICAL DATA

| DIM. | mm | | | Inch | | |
|------|-------|--------|-------|-------|--------|-------|
| | MIN. | TYP. | MAX | MIN. | TYP. | MAX |
| A1 | 1.62 | 1.67 | 1.72 | 0.064 | 0.065 | 0.068 |
| A2 | 3.4 | 3.5 | 3.6 | 0.134 | 0.137 | 0.142 |
| A3 | 1.2 | 1.3 | 1.4 | 0.046 | 0.05 | 0.054 |
| A4 | 0.15 | 0.2 | 0.25 | 0.005 | 0.007 | 0.009 |
| a | | 0.2 | | | 0.007 | |
| b | 5.4 | 5.53 | 5.65 | 0.212 | 0.217 | 0.221 |
| c | 0.23 | 0.27 | 0.32 | 0.008 | 0.01 | 0.012 |
| D | 9.4 | 9.5 | 9.6 | 0.370 | 0.374 | 0.377 |
| D1 | 7.4 | 7.5 | 7.6 | 0.290 | 0.295 | 0.298 |
| E | 15.15 | 15.4 | 15.65 | 0.595 | 0.606 | 0.615 |
| E1 | 9.3 | 9.4 | 9.5 | 0.365 | 0.37 | 0.375 |
| E2 | 7.3 | 7.4 | 7.5 | 0.286 | 0.292 | 0.294 |
| E3 | 5.9 | 6.1 | 6.3 | 0.231 | 0.24 | 0.247 |
| F | | 0.5 | | | 0.019 | |
| G | | 1.2 | | | 0.047 | |
| R1 | | | 0.25 | | | 0.01 |
| R2 | | 0.8 | | | 0.031 | |
| T1 | | 6 deg | | | 6 deg | |
| T2 | | 10 deg | | | 10 deg | |

Note (1): Resin protrusions not included (max value: 0.15 mm per side)



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