



## PD55003-E

RF power transistor from the LdmoST plastic family  
of N-channel enhancement-mode lateral MOSFETs

### Features

- Excellent thermal stability
- Common source configuration
- $P_{OUT} = 3\text{ W}$  with 17dB gain @ 500 MHz / 12.5 V

### Description

The PD55003-E 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 12 V in common source mode at frequencies of up to 1 GHz. The PD55003 boasts excellent gain, linearity and reliability thanks to ST's latest LDMOS technology mounted in the first true SMD plastic RF power package, the PowerSO-10RF.

The PD55003's superior linearity performance makes it an ideal solution for car mobile radios.

The PowerSO-10RF plastic package is designed for high reliability, and is the first JEDEC-approved, high power SMD package from ST. It has been optimized for RF requirements and offers excellent RF performance and ease of assembly.

Mounting recommendations are provided in application note AN1294, available on [www.st.com](http://www.st.com).

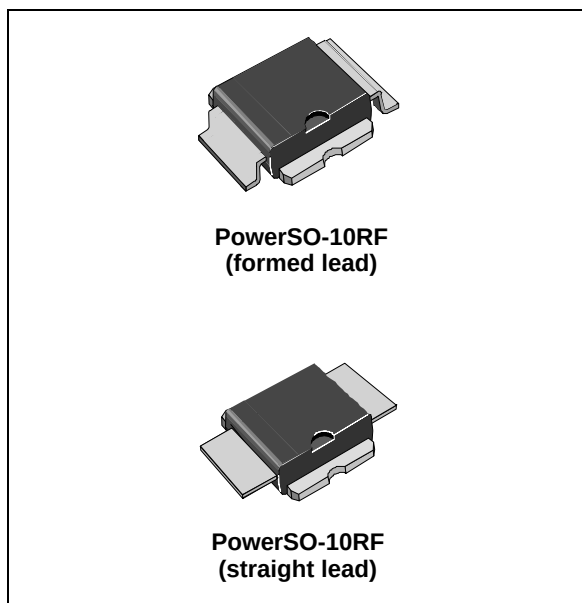


Figure 1. Pin connection

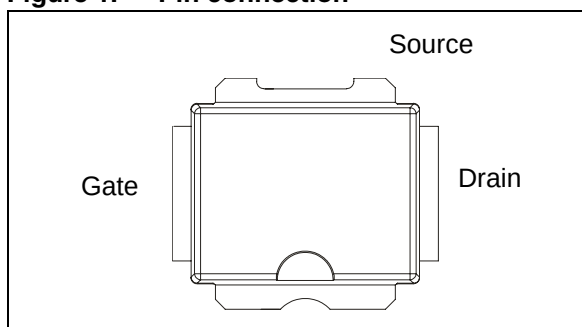


Table 1. Device summary

| Order code   | Package                      | Packing       |
|--------------|------------------------------|---------------|
| PD55003-E    | PowerSO-10RF (formed lead)   | Tube          |
| PD55003S-E   | PowerSO-10RF (straight lead) | Tube          |
| PD55003TR-E  | PowerSO-10RF (formed lead)   | Tape and reel |
| PD55003STR-E | PowerSO-10RF (straight lead) | Tape and reel |

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# 1 Electrical data

## 1.1 Maximum ratings

**Table 2. Absolute maximum ratings** ( $T_{CASE} = 25^{\circ}C$ )

| Symbol        | Parameter                                  | Value       | Unit        |
|---------------|--------------------------------------------|-------------|-------------|
| $V_{(BR)DSS}$ | Drain-source voltage                       | 40          | V           |
| $V_{GS}$      | Gate-source voltage                        | $\pm 20$    | V           |
| $I_D$         | Drain current                              | 2.5         | A           |
| $P_{DISS}$    | Power dissipation (@ $T_C = 70^{\circ}C$ ) | 31.7        | W           |
| $T_J$         | Max. operating junction temperature        | 165         | $^{\circ}C$ |
| $T_{STG}$     | Storage temperature                        | -65 to +150 | $^{\circ}C$ |

## 1.2 Thermal data

**Table 3. Thermal data**

| Symbol     | Parameter                          | Value | Unit          |
|------------|------------------------------------|-------|---------------|
| $R_{thJC}$ | Junction - case thermal resistance | 3.0   | $^{\circ}C/W$ |

## 2 Electrical characteristics

$T_{\text{CASE}} = +25\text{ }^{\circ}\text{C}$

### 2.1 Static

**Table 4. Static**

| Symbol              | Test conditions               |                                 | Min | Typ | Max  | Unit          |
|---------------------|-------------------------------|---------------------------------|-----|-----|------|---------------|
| $I_{\text{DSS}}$    | $V_{\text{GS}} = 0$           | $V_{\text{DS}} = 28\text{ V}$   |     |     | 1    | $\mu\text{A}$ |
| $I_{\text{GSS}}$    | $V_{\text{GS}} = 20\text{ V}$ | $V_{\text{DS}} = 0$             |     |     | 1    | $\mu\text{A}$ |
| $V_{\text{GS(Q)}}$  | $V_{\text{DS}} = 10\text{ V}$ | $I_{\text{D}} = 50\text{ mA}$   | 2.0 |     | 5.0  | V             |
| $R_{\text{DS(ON)}}$ | $V_{\text{GS}} = 10\text{ V}$ | $I_{\text{D}} = 1\text{ A}$     |     |     | 0.75 | $\Omega$      |
| $g_{\text{FS}}$     | $V_{\text{DS}} = 10\text{ V}$ | $I_{\text{D}} = 1\text{ A}$     |     | 1.0 |      | mho           |
| $C_{\text{ISS}}$    | $V_{\text{GS}} = 0$           | $V_{\text{DS}} = 12.5\text{ V}$ |     | 36  |      | pF            |
| $C_{\text{OSS}}$    | $V_{\text{GS}} = 0$           | $V_{\text{DS}} = 12.5\text{ V}$ |     | 24  |      | pF            |
| $C_{\text{RSS}}$    | $V_{\text{GS}} = 0$           | $V_{\text{DS}} = 12.5\text{ V}$ |     | 2.4 |      | pF            |

### 2.2 Dynamic

**Table 5. Dynamic**

| Symbol           | Test conditions                                                                                                                             | Min  | Typ | Max | Unit |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------|------|-----|-----|------|
| $P_{\text{1dB}}$ | $V_{\text{DD}} = 12.5\text{ V}$ , $I_{\text{DQ}} = 50\text{ mA}$ $f = 500\text{ MHz}$                                                       | 3    |     |     | W    |
| $G_{\text{P}}$   | $V_{\text{DD}} = 12.5\text{ V}$ , $I_{\text{DQ}} = 50\text{ mA}$ , $P_{\text{OUT}} = 3\text{ W}$ , $f = 500\text{ MHz}$                     | 14   | 17  |     | dB   |
| $h_{\text{D}}$   | $V_{\text{DD}} = 12.5\text{ V}$ , $I_{\text{DQ}} = 50\text{ mA}$ , $P_{\text{OUT}} = 3\text{ W}$ , $f = 500\text{ MHz}$                     | 45   | 52  |     | %    |
| Load mismatch    | $V_{\text{DD}} = 15.5\text{ V}$ , $I_{\text{DQ}} = 50\text{ mA}$ , $P_{\text{OUT}} = 3\text{ W}$ , $f = 500\text{ MHz}$<br>All phase angles | 20:1 |     |     | VSWR |

### 2.3 Moisture sensitivity level

**Table 6. Moisture sensitivity level**

| Test methodology | Rating |
|------------------|--------|
| J-STD-020B       | MSL 3  |

3 Impedance

Figure 2. Current conventions

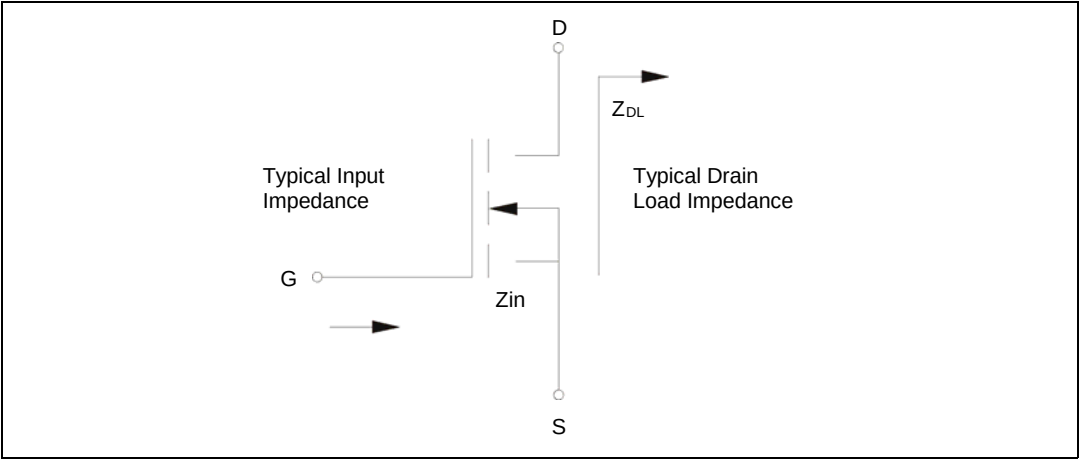


Table 7. Impedance data

| PD55003-E   |                     |                     | PD55003S-E  |                     |                     |
|-------------|---------------------|---------------------|-------------|---------------------|---------------------|
| Freq. (MHz) | Z <sub>IN</sub> (Ω) | Z <sub>DL</sub> (Ω) | Freq. (MHz) | Z <sub>IN</sub> (Ω) | Z <sub>DL</sub> (Ω) |
| 520         | 1.871 - j 1.118     | 4.779 + j 4.956     | 520         | 1.407 - j 3.550     | 6.557 + j 7.844     |
| 500         | 1.542 - j 3.705     | 6.842 + j 6.209     | 500         | 1.306 - j 5.159     | 8.351 + j 9.120     |
| 480         | 1.109 - j 1.783     | 6.789 + j 4.533     | 480         | 1.302 - j 6.141     | 8.994 + j 8.983     |
| 860         | 1.33 + j 1.23       | 2.93 + j 0.62       |             |                     |                     |

# 4 Typical performance

Figure 3. Capacitance vs. drain voltage

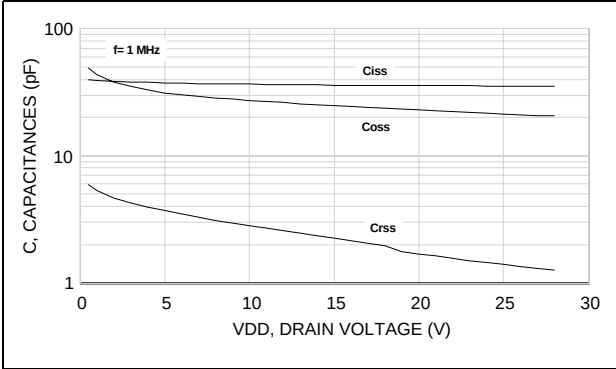


Figure 4. Drain current vs. gate-source voltage

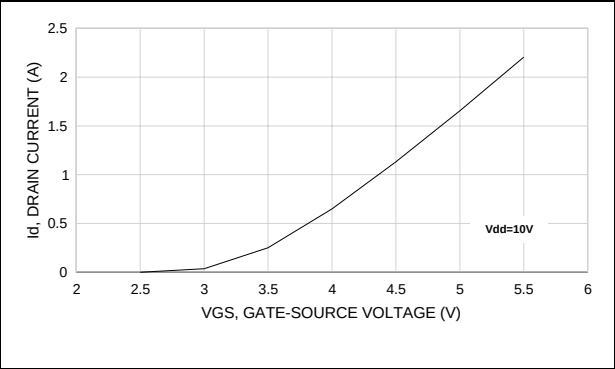


Figure 5. Gate-source voltage vs. case temperature

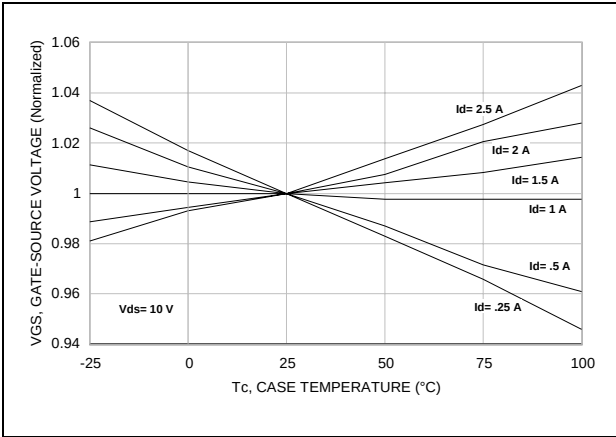
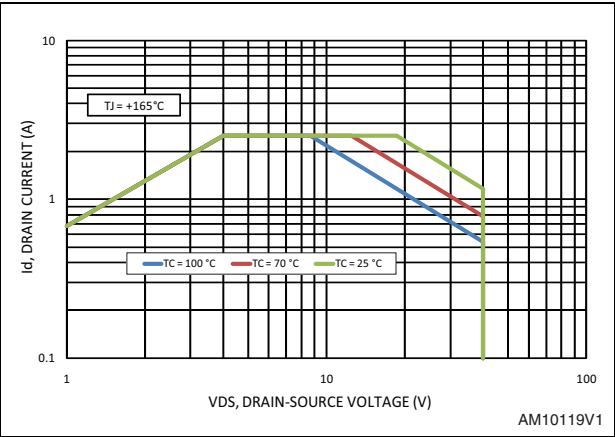


Figure 6. Maximum safe operating area



4.1 Performance for the PowerSO-10RF formed lead

Figure 7. Output power vs. input power

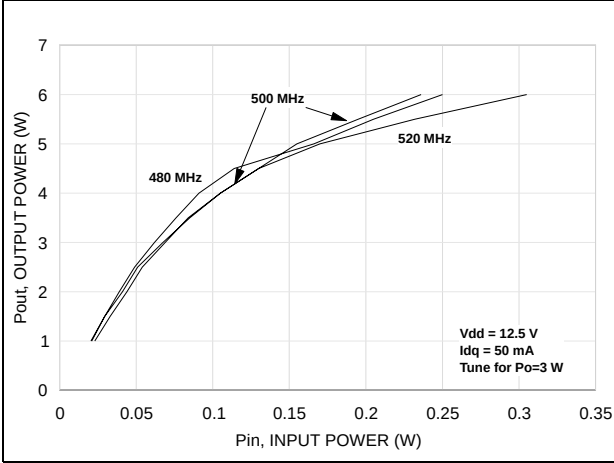


Figure 8. Output power vs. input power

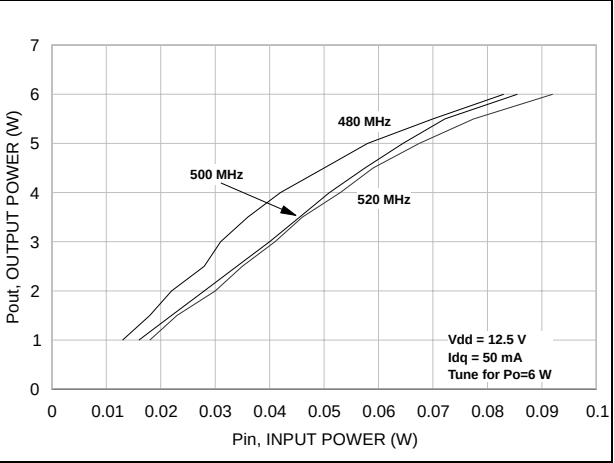


Figure 9. Drain efficiency vs. output power

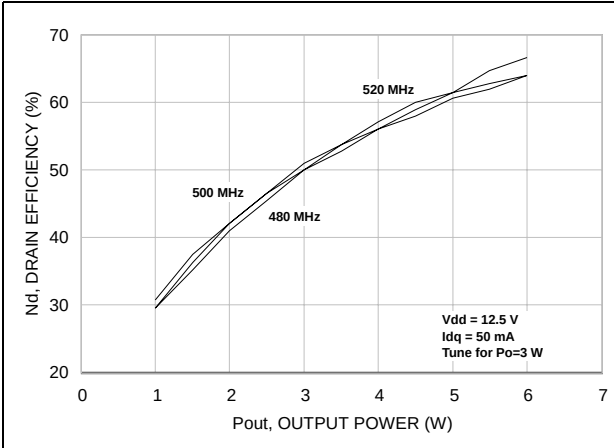


Figure 10. Drain efficiency vs. output power

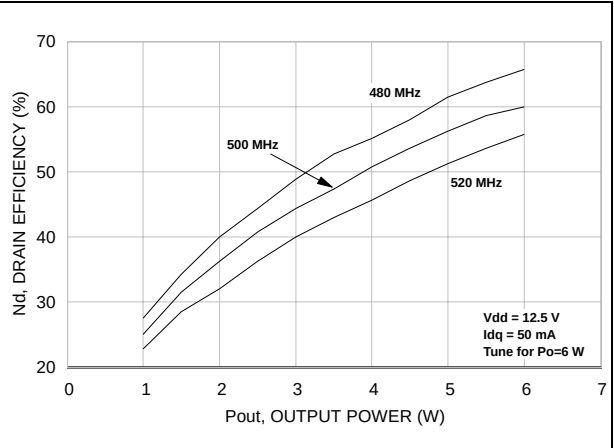


Figure 11. Power gain vs. output power

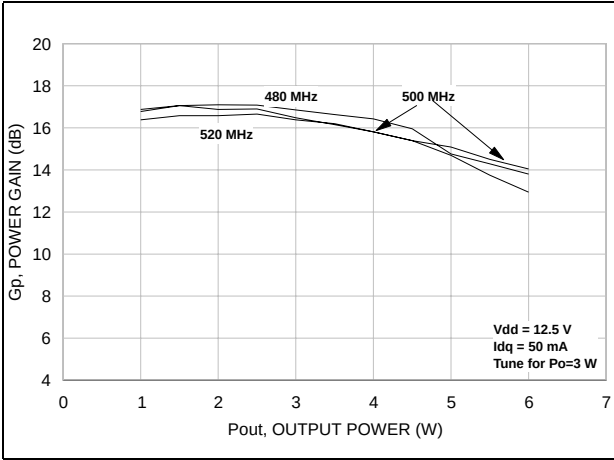


Figure 12. Return loss vs. output power

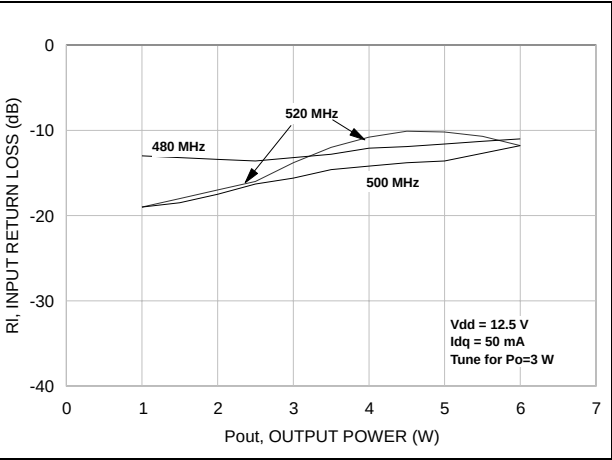


Figure 13. Output power vs. bias current

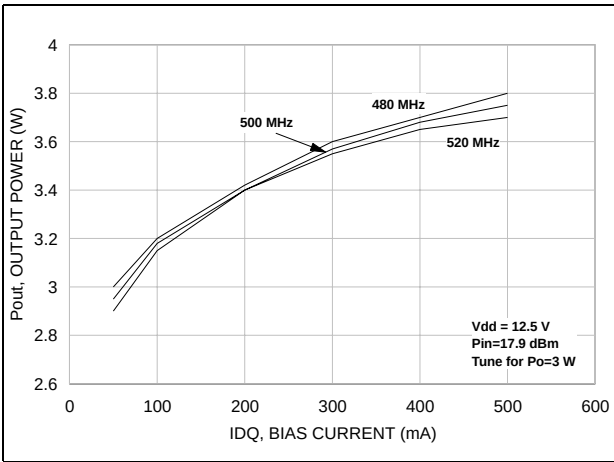


Figure 14. Drain efficiency vs. bias current

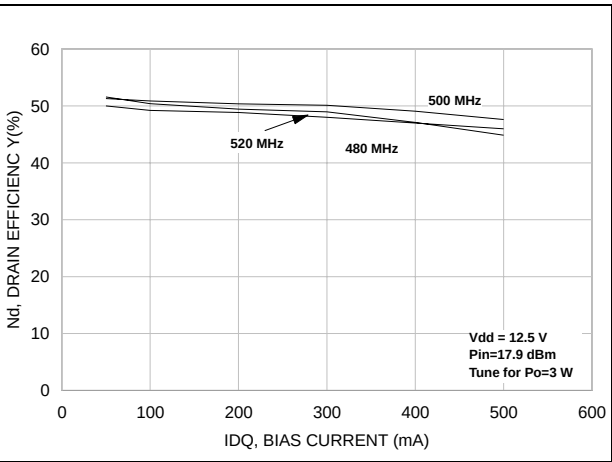


Figure 15. Output power vs. supply voltage

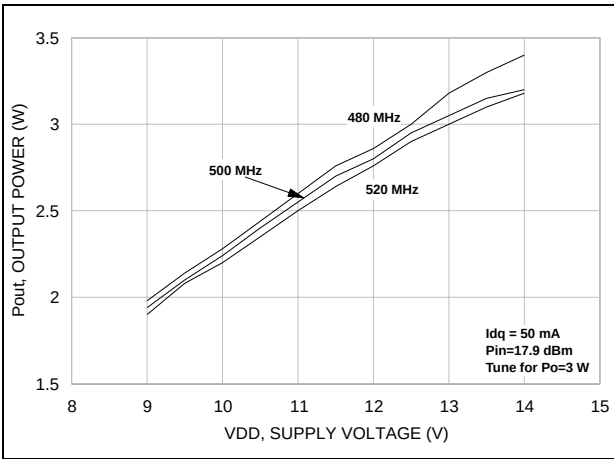


Table 8. Drain efficiency vs. supply voltage

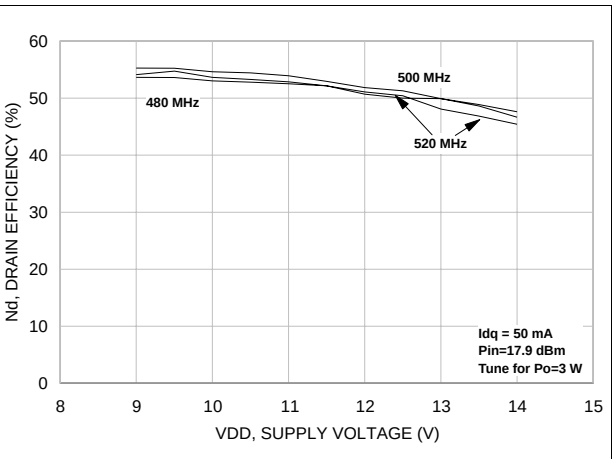
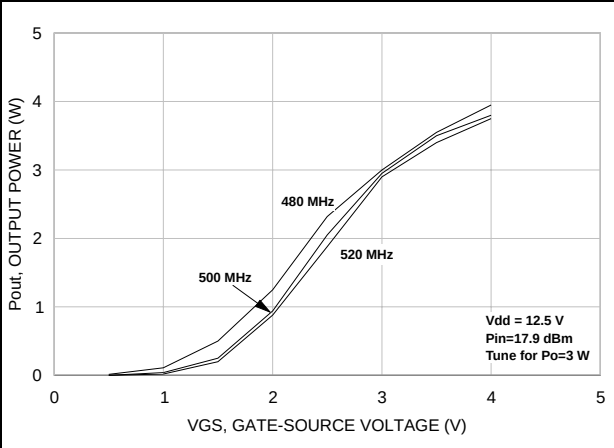




Figure 16. Output power vs. gate voltage



## 4.2 Performance for the PowerSO-10RF straight lead

Figure 17. Output power vs. input power

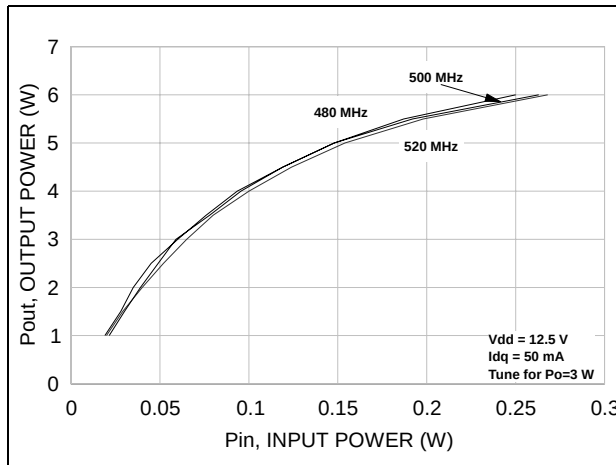


Figure 18. Output power vs. input power

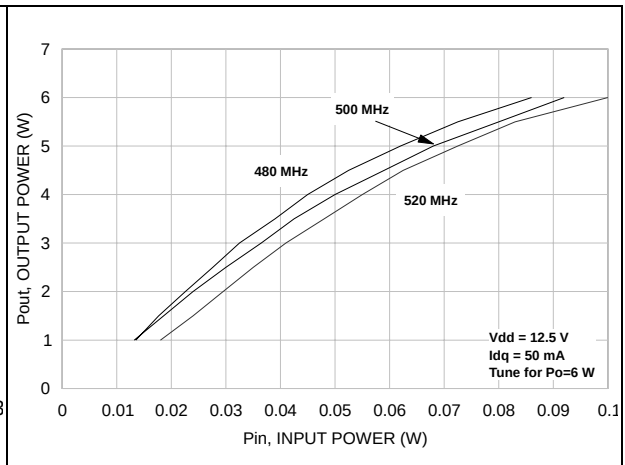


Figure 19. Drain efficiency vs. output power

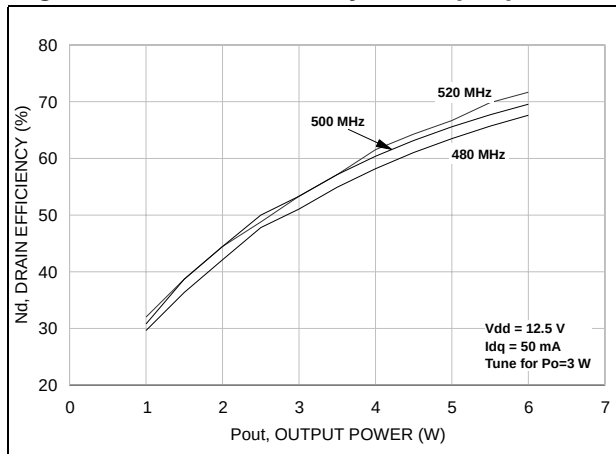


Figure 20. Drain efficiency vs. output power

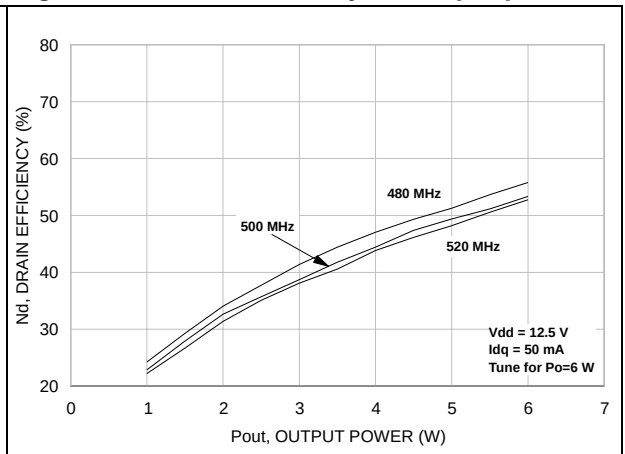


Figure 21. Power gain vs. output power

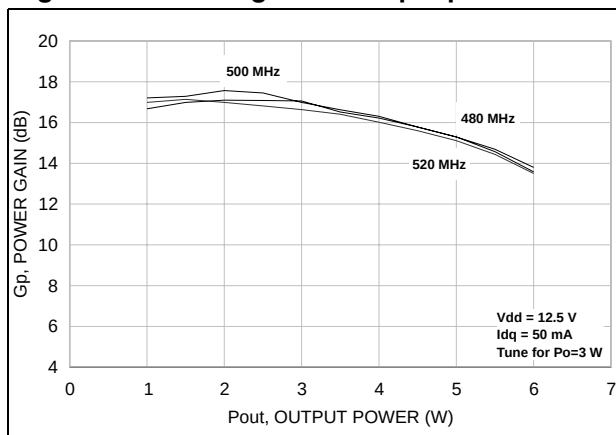


Figure 22. Return loss vs. output power

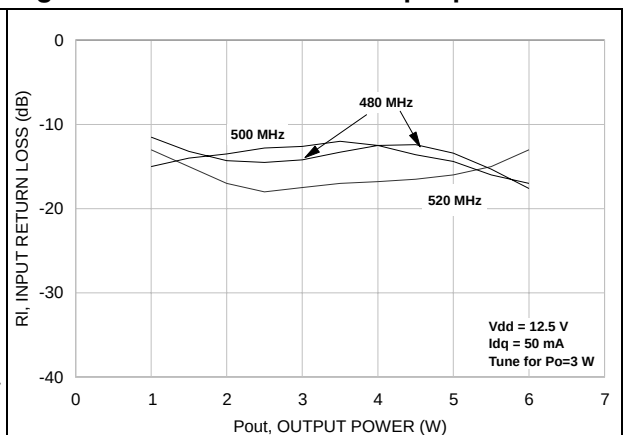


Figure 23. Output power vs. bias current

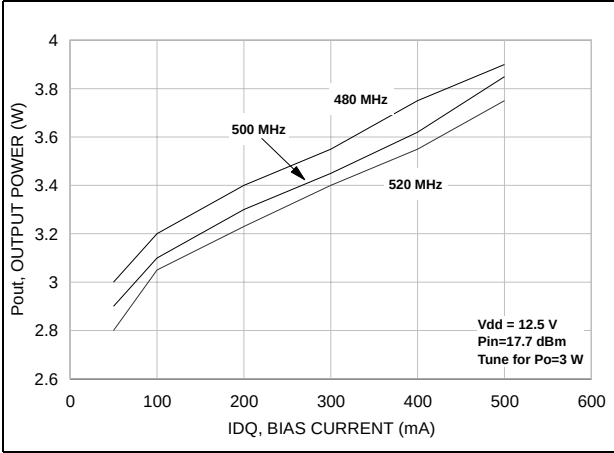


Figure 24. Drain efficiency vs. bias current

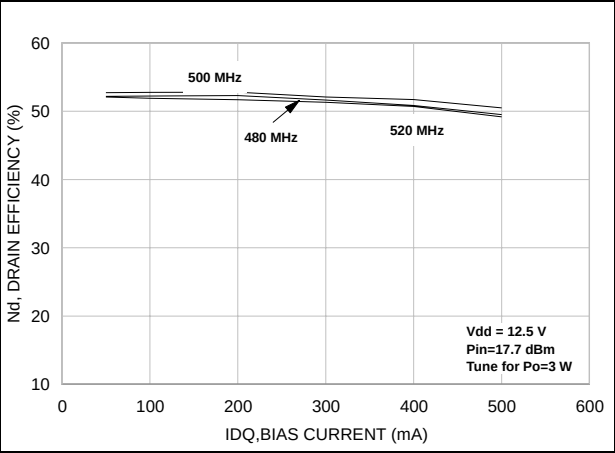


Figure 25. Output power vs. supply voltage

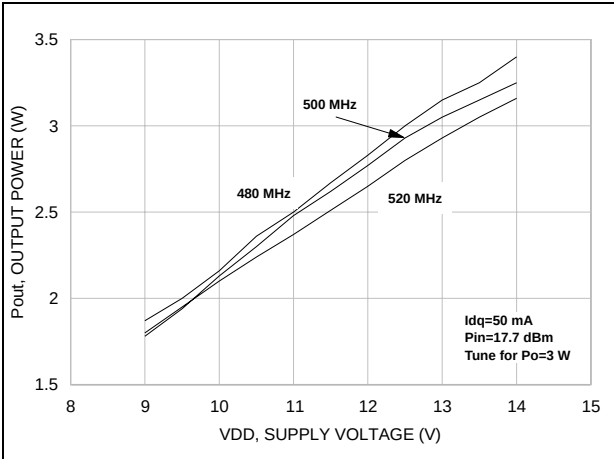


Figure 26. Drain efficiency vs. supply voltage

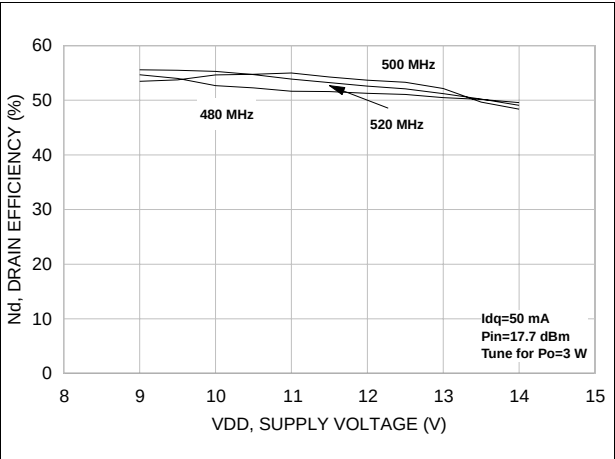
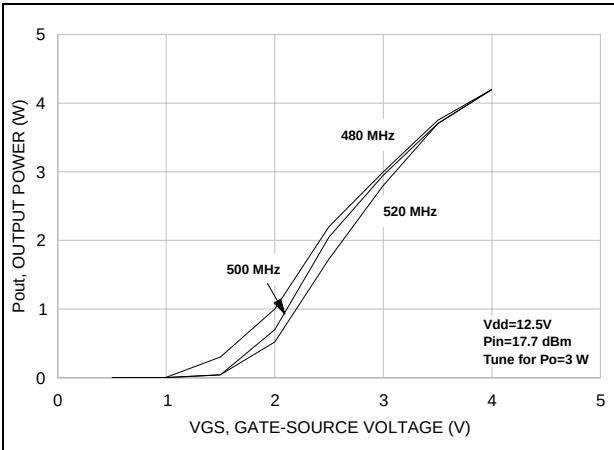


Figure 27. Output power vs. gate voltage



## 5 Typical performance (860 MHz)

### 5.1 Performance for the PowerSO-10RF formed lead

Figure 28. Output power vs. input power

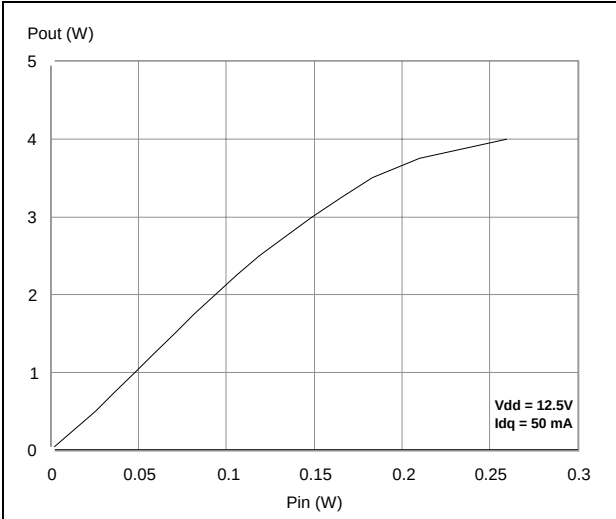


Figure 29. Drain efficiency vs. output power

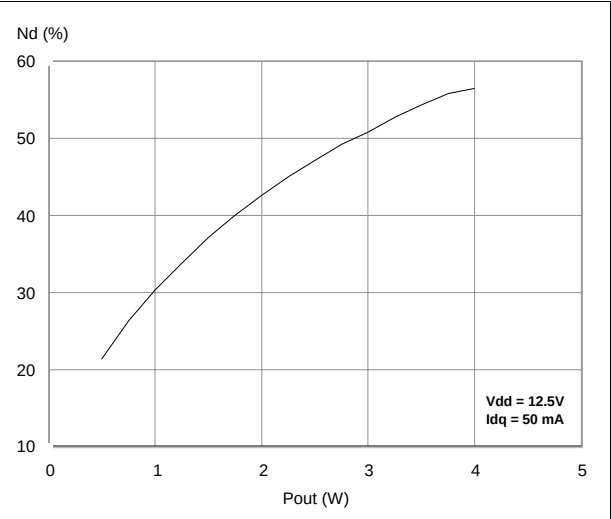
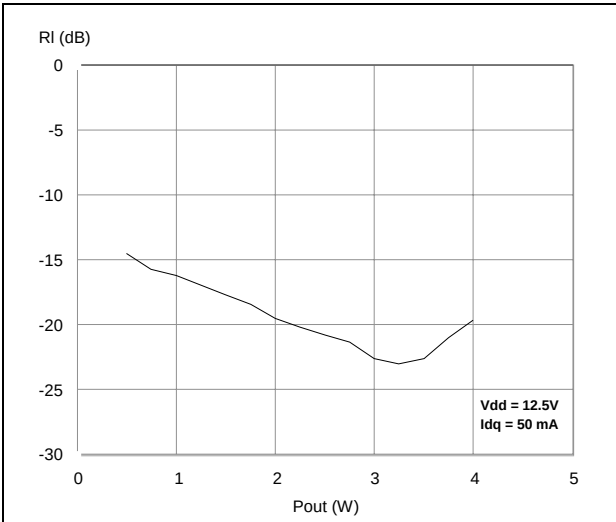


Figure 30. Input return loss vs. output power



## 6 Test circuit

Figure 31. Test circuit schematic

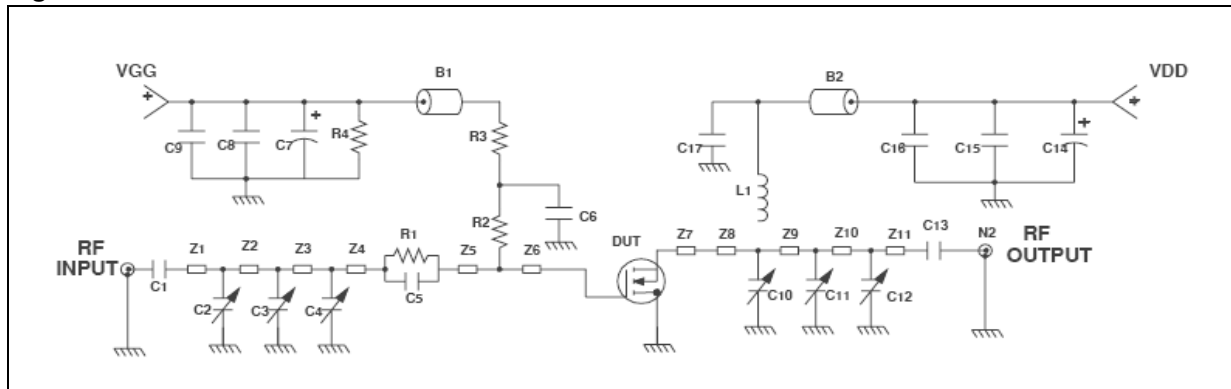


Table 9. Test circuit component list

| Component            | Description                                              |
|----------------------|----------------------------------------------------------|
| B1,B2                | Short ferrite bead, Fair-Rite Products Corp (2743021446) |
| C1,C14               | 240 pF, 100 mil chip capacitor                           |
| C2,C3,C4,C10,C11,C12 | 0 TO 20 pF trimmer capacitor                             |
| C5                   | 130 pF, 100 mil chip cap                                 |
| C6,C17               | 120 pF, 100 mil chip cap                                 |
| C7,C14               | 10 $\mu$ F, 50 V electrolytic capacitor                  |
| C8,C15               | 1.200 pF, 100 mil chip cap                               |
| C9,C16               | 0.1 F, 100 mil chip cap                                  |
| L1                   | 55.5 nH, 5 turn, Coilcraft                               |
| N1,N2                | Type N flange mount                                      |
| R1                   | 15 $\Omega$ , 0805 chip resistor                         |
| R2                   | 1.0 k $\Omega$ , 1/8 W resistor                          |
| R3                   | 15 $\Omega$ , 0805 chip resistor                         |
| R4                   | 33 k $\Omega$ , 1/8 W resistor                           |
| Z1                   | 0.175" X 0.080" microstrip                               |
| Z2                   | 1.049" X 0.080" microstrip                               |
| Z3                   | 0.289" X 0.080" microstrip                               |
| Z4                   | 0.026" X 0.080" microstrip                               |
| Z5                   | 0.192" X 0.223" microstrip                               |
| Z6,Z7                | 0.260" X 0.223" microstrip                               |
| Z8                   | 0.064" X 0.080" microstrip                               |
| Z9                   | 0.334" X 0.080" microstrip                               |

**Table 9. Test circuit component list (continued)**

| Component | Description                                                              |
|-----------|--------------------------------------------------------------------------|
| Z10       | 0.985" X 0.080" microstrip                                               |
| Z11       | 0.472" X 0.080" microstrip                                               |
| Board     | Roger ultra LAM 2000 THK 0.030" $\epsilon_r = 2.55$ 2oz ED Cu both sides |

## 7 Circuit layout

Figure 32. Test fixture component layout

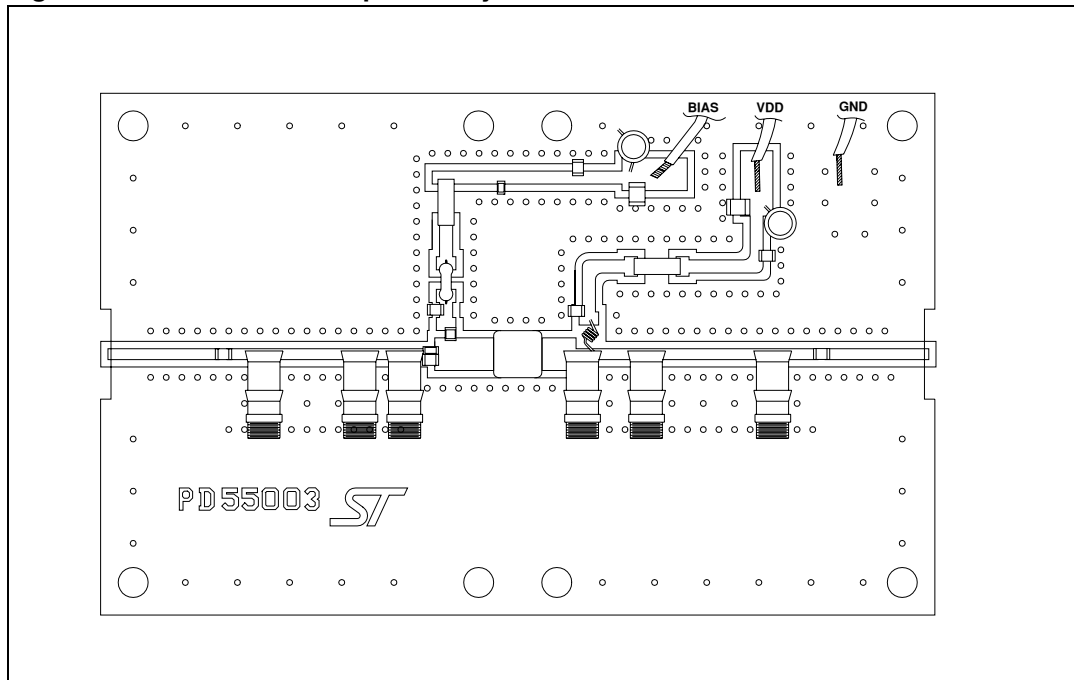
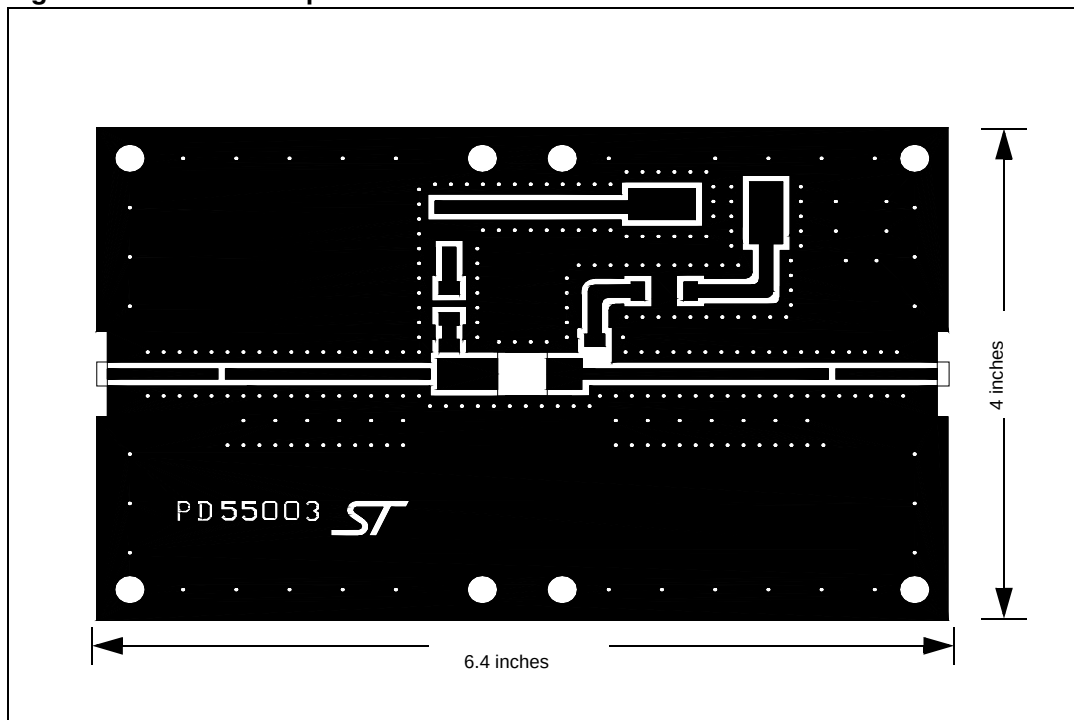


Figure 33. Test circuit photomaster



## 8 Common source s-parameter

Table 10. S-parameter for the PowerSO-10RF formed lead ( $V_{DS} = 12.5$  V,  $I_{DS} = 0.15$  A)

| Freq<br>(MHz) | $ S_{11} $ | $S_{11}\angle\Phi$ | $ S_{21} $ | $S_{21}\angle\Phi$ | $ S_{12} $ | $S_{12} - \text{DF}$ | $ S_{22} $ | $S_{22} - \text{DF}$ |
|---------------|------------|--------------------|------------|--------------------|------------|----------------------|------------|----------------------|
| 50            | 0.780      | -120               | 21.77      | 106                | 0.038      | 19                   | 0.669      | -111                 |
| 100           | 0.764      | -144               | 11.34      | 88                 | 0.040      | -1                   | 0.643      | -137                 |
| 150           | 0.786      | -154               | 7.47       | 77                 | 0.040      | -10                  | 0.634      | -145                 |
| 200           | 0.804      | -159               | 5.45       | 69                 | 0.037      | -19                  | 0.660      | -149                 |
| 250           | 0.817      | -163               | 4.22       | 61                 | 0.036      | -26                  | 0.680      | -152                 |
| 300           | 0.835      | -165               | 3.36       | 55                 | 0.034      | -31                  | 0.720      | -156                 |
| 350           | 0.852      | -167               | 2.75       | 48                 | 0.031      | -36                  | 0.766      | -158                 |
| 400           | 0.865      | -169               | 2.28       | 43                 | 0.028      | -41                  | 0.786      | -160                 |
| 450           | 0.877      | -171               | 1.92       | 38                 | 0.027      | -45                  | 0.816      | -161                 |
| 500           | 0.889      | -172               | 1.65       | 34                 | 0.025      | -49                  | 0.827      | -163                 |
| 550           | 0.899      | -174               | 1.42       | 30                 | 0.022      | -52                  | 0.847      | -165                 |
| 600           | 0.909      | -175               | 1.24       | 27                 | 0.021      | -51                  | 0.856      | -167                 |
| 650           | 0.918      | -177               | 1.09       | 23                 | 0.018      | -56                  | 0.874      | -169                 |
| 700           | 0.924      | -178               | 0.97       | 20                 | 0.018      | -54                  | 0.881      | -170                 |
| 750           | 0.926      | -179               | 0.87       | 17                 | 0.016      | -61                  | 0.895      | -172                 |
| 800           | 0.929      | 180                | 0.78       | 15                 | 0.014      | -62                  | 0.906      | -173                 |
| 850           | 0.935      | 179                | 0.71       | 12                 | 0.011      | -56                  | 0.916      | -174                 |
| 900           | 0.938      | 178                | 0.65       | 10                 | 0.011      | -63                  | 0.913      | -175                 |
| 950           | 0.940      | 177                | 0.59       | 8                  | 0.010      | -62                  | 0.925      | -177                 |
| 1000          | 0.941      | 176                | 0.55       | 5                  | 0.007      | -69                  | 0.928      | -178                 |
| 1050          | 0.944      | 175                | 0.51       | 3                  | 0.007      | -57                  | 0.925      | -180                 |
| 1100          | 0.947      | 174                | 0.47       | 1                  | 0.006      | -56                  | 0.929      | -180                 |
| 1150          | 0.946      | 173                | 0.44       | -1                 | 0.005      | -53                  | 0.928      | 179                  |
| 1200          | 0.944      | 172                | 0.41       | -3                 | 0.004      | -40                  | 0.927      | 178                  |
| 1250          | 0.949      | 171                | 0.38       | -5                 | 0.004      | -54                  | 0.928      | 176                  |
| 1300          | 0.949      | 170                | 0.36       | -7                 | 0.003      | -63                  | 0.940      | 176                  |
| 1350          | 0.947      | 169                | 0.34       | -9                 | 0.001      | -15                  | 0.935      | 175                  |
| 1400          | 0.949      | 168                | 0.31       | -10                | 0.001      | 82                   | 0.938      | 175                  |
| 1450          | 0.946      | 167                | 0.29       | -12                | 0.002      | 76                   | 0.933      | 174                  |
| 1500          | 0.948      | 167                | 0.27       | -12                | 0.002      | 124                  | 0.939      | 173                  |



Table 11. S-parameter for the PowerSO-10RF formed lead ( $V_{DS} = 12.5$  V,  $I_{DS} = 0.8$  A)

| Freq (MHz) | $ S_{11} $ | $S_{11} \angle \Phi$ | $ S_{21} $ | $S_{21} \angle \Phi$ | $ S_{12} $ | $S_{12} - DF$ | $ S_{22} $ | $S_{22} - DF$ |
|------------|------------|----------------------|------------|----------------------|------------|---------------|------------|---------------|
| 50         | 0.786      | -138                 | 26.54      | 100                  | 0.026      | 13            | 0.666      | -137          |
| 100        | 0.791      | -156                 | 13.46      | 87                   | 0.026      | 0             | 0.674      | -155          |
| 150        | 0.816      | -163                 | 8.94       | 80                   | 0.027      | -5            | 0.662      | -160          |
| 200        | 0.829      | -167                 | 6.63       | 73                   | 0.026      | -13           | 0.678      | -163          |
| 250        | 0.835      | -170                 | 5.24       | 67                   | 0.025      | -16           | 0.677      | -164          |
| 300        | 0.846      | -171                 | 4.26       | 62                   | 0.025      | -21           | 0.709      | -167          |
| 350        | 0.854      | -173                 | 3.57       | 56                   | 0.023      | -25           | 0.736      | -167          |
| 400        | 0.864      | -174                 | 3.01       | 51                   | 0.021      | -31           | 0.758      | -168          |
| 450        | 0.872      | -175                 | 2.58       | 47                   | 0.021      | -31           | 0.783      | -167          |
| 500        | 0.878      | -176                 | 2.24       | 43                   | 0.019      | -34           | 0.787      | -168          |
| 550        | 0.890      | -177                 | 1.97       | 39                   | 0.018      | -37           | 0.800      | -170          |
| 600        | 0.896      | -178                 | 1.74       | 36                   | 0.017      | -39           | 0.816      | -171          |
| 650        | 0.902      | -179                 | 1.56       | 32                   | 0.014      | -44           | 0.827      | -173          |
| 700        | 0.910      | 180                  | 1.41       | 29                   | 0.015      | -38           | 0.845      | -173          |
| 750        | 0.909      | 179                  | 1.27       | 26                   | 0.012      | -46           | 0.854      | -175          |
| 800        | 0.917      | 178                  | 1.16       | 23                   | 0.011      | -41           | 0.865      | -175          |
| 850        | 0.918      | 177                  | 1.06       | 21                   | 0.008      | -37           | 0.879      | -176          |
| 900        | 0.925      | 176                  | 0.97       | 18                   | 0.010      | -43           | 0.877      | -177          |
| 950        | 0.926      | 175                  | 0.90       | 15                   | 0.008      | -47           | 0.887      | -179          |
| 1000       | 0.927      | 174                  | 0.83       | 12                   | 0.007      | -44           | 0.889      | 180           |
| 1050       | 0.921      | 173                  | 0.77       | 10                   | 0.007      | -47           | 0.898      | 179           |
| 1100       | 0.932      | 172                  | 0.72       | 8                    | 0.006      | -11           | 0.902      | 179           |
| 1150       | 0.933      | 172                  | 0.67       | 6                    | 0.005      | -35           | 0.895      | 178           |
| 1200       | 0.930      | 171                  | 0.63       | 4                    | 0.004      | -16           | 0.901      | 177           |
| 1250       | 0.937      | 170                  | 0.59       | 1                    | 0.004      | -14           | 0.897      | 176           |
| 1300       | 0.937      | 169                  | 0.55       | -1                   | 0.004      | 4             | 0.916      | 176           |
| 1350       | 0.936      | 168                  | 0.52       | -3                   | 0.003      | 1             | 0.909      | 175           |
| 1400       | 0.937      | 168                  | 0.49       | -4                   | 0.004      | 39            | 0.917      | 174           |
| 1450       | 0.934      | 167                  | 0.45       | -6                   | 0.004      | 60            | 0.910      | 173           |
| 1500       | 0.938      | 166                  | 0.43       | -7                   | 0.002      | 73            | 0.916      | 172           |

Table 12. S-parameter for the PowerSO-10RF formed lead ( $V_{DS} = 12.5$  V,  $I_{DS} = 1.5$  A)

| Freq (MHz) | $ S_{11} $ | $S_{11} \angle \Phi$ | $ S_{21} $ | $S_{21} \angle \Phi$ | $ S_{12} $ | $S_{12} - DF$ | $ S_{22} $ | $S_{22} - DF$ |
|------------|------------|----------------------|------------|----------------------|------------|---------------|------------|---------------|
| 50         | 0.789      | -140                 | 26.35      | 100                  | 0.025      | 15            | 0.666      | -141          |
| 100        | 0.800      | -157                 | 13.35      | 87                   | 0.025      | -1            | 0.675      | -157          |
| 150        | 0.825      | -164                 | 8.88       | 80                   | 0.024      | -6            | 0.667      | -162          |
| 200        | 0.836      | -168                 | 6.59       | 74                   | 0.023      | -13           | 0.678      | -164          |
| 250        | 0.842      | -171                 | 5.22       | 68                   | 0.024      | -16           | 0.678      | -165          |
| 300        | 0.851      | -172                 | 4.26       | 62                   | 0.022      | -18           | 0.713      | -168          |
| 350        | 0.856      | -174                 | 3.56       | 57                   | 0.021      | -25           | 0.738      | -168          |
| 400        | 0.864      | -175                 | 3.02       | 52                   | 0.021      | -28           | 0.754      | -168          |
| 450        | 0.874      | -176                 | 2.60       | 48                   | 0.019      | -32           | 0.770      | -168          |
| 500        | 0.882      | -177                 | 2.25       | 44                   | 0.017      | -32           | 0.782      | -169          |
| 550        | 0.888      | -178                 | 1.98       | 40                   | 0.016      | -33           | 0.796      | -171          |
| 600        | 0.898      | -179                 | 1.76       | 36                   | 0.016      | -37           | 0.806      | -172          |
| 650        | 0.901      | -180                 | 1.58       | 33                   | 0.013      | -34           | 0.825      | -173          |
| 700        | 0.909      | 179                  | 1.42       | 30                   | 0.013      | -42           | 0.843      | -174          |
| 750        | 0.910      | 178                  | 1.29       | 27                   | 0.011      | -36           | 0.852      | -175          |
| 800        | 0.915      | 177                  | 1.18       | 24                   | 0.012      | -36           | 0.861      | -176          |
| 850        | 0.915      | 177                  | 1.08       | 21                   | 0.010      | -26           | 0.863      | -176          |
| 900        | 0.922      | 176                  | 0.99       | 19                   | 0.009      | -28           | 0.873      | -178          |
| 950        | 0.926      | 175                  | 0.92       | 16                   | 0.008      | -39           | 0.880      | -179          |
| 1000       | 0.925      | 174                  | 0.85       | 13                   | 0.007      | -39           | 0.882      | 180           |
| 1050       | 0.927      | 173                  | 0.79       | 11                   | 0.006      | -27           | 0.892      | 179           |
| 1100       | 0.928      | 172                  | 0.74       | 9                    | 0.005      | -35           | 0.891      | 178           |
| 1150       | 0.932      | 171                  | 0.68       | 6                    | 0.006      | -11           | 0.899      | 178           |
| 1200       | 0.929      | 170                  | 0.64       | 4                    | 0.005      | -20           | 0.896      | 177           |
| 1250       | 0.933      | 170                  | 0.60       | 1                    | 0.004      | 8             | 0.889      | 176           |
| 1300       | 0.935      | 169                  | 0.57       | 0                    | 0.005      | 15            | 0.907      | 175           |
| 1350       | 0.933      | 168                  | 0.53       | -3                   | 0.004      | 25            | 0.904      | 174           |
| 1400       | 0.936      | 167                  | 0.50       | -4                   | 0.003      | 53            | 0.911      | 174           |
| 1450       | 0.934      | 166                  | 0.49       | -6                   | 0.004      | 53            | 0.909      | 173           |
| 1500       | 0.936      | 165                  | 0.44       | -7                   | 0.004      | 64            | 0.914      | 172           |

Table 13. S-parameter for the PowerSO-10RF straight lead ( $V_{DS} = 12.5\text{ V}$ ,  $I_{DS} = 0.15\text{ A}$ )

| Freq<br>(MHz) | $ S_{11} $ | $S_{11}\angle\Phi$ | $ S_{21} $ | $S_{21}\angle\Phi$ | $ S_{12} $ | $S_{12} - \text{DF}$ | $ S_{22} $ | $S_{22} - \text{DF}$ |
|---------------|------------|--------------------|------------|--------------------|------------|----------------------|------------|----------------------|
| 50            | 0.790      | -120               | 22         | 107                | 0.038      | 17                   | 0.682      | -114                 |
| 100           | 0.773      | -145               | 11         | 89                 | 0.039      | -2                   | 0.647      | -138                 |
| 150           | 0.791      | -154               | 7          | 78                 | 0.039      | -9                   | 0.640      | -147                 |
| 200           | 0.807      | -159               | 5          | 70                 | 0.037      | -19                  | 0.671      | -151                 |
| 250           | 0.820      | -162               | 4          | 63                 | 0.036      | -23                  | 0.691      | -154                 |
| 300           | 0.836      | -164               | 3          | 56                 | 0.033      | -29                  | 0.728      | -156                 |
| 350           | 0.850      | -166               | 3          | 50                 | 0.032      | -33                  | 0.751      | -158                 |
| 400           | 0.867      | -167               | 2          | 45                 | 0.030      | -36                  | 0.782      | -160                 |
| 450           | 0.880      | -169               | 2          | 40                 | 0.027      | -43                  | 0.808      | -161                 |
| 500           | 0.890      | -170               | 2          | 36                 | 0.024      | -43                  | 0.835      | -163                 |
| 550           | 0.902      | -171               | 1          | 33                 | 0.023      | -50                  | 0.845      | -165                 |
| 600           | 0.911      | -172               | 1          | 29                 | 0.022      | -51                  | 0.864      | -166                 |
| 650           | 0.919      | -173               | 1          | 26                 | 0.020      | -55                  | 0.872      | -167                 |
| 700           | 0.923      | -174               | 1          | 23                 | 0.018      | -52                  | 0.884      | -169                 |
| 750           | 0.924      | -176               | 1          | 20                 | 0.016      | -55                  | 0.887      | -170                 |
| 800           | 0.933      | -177               | 1          | 18                 | 0.015      | -55                  | 0.895      | -172                 |
| 850           | 0.936      | -177               | 1          | 15                 | 0.015      | -56                  | 0.912      | -173                 |
| 900           | 0.940      | -178               | 1          | 13                 | 0.012      | -59                  | 0.916      | -174                 |
| 950           | 0.943      | -179               | 1          | 11                 | 0.011      | -53                  | 0.926      | -176                 |
| 1000          | 0.944      | -180               | 1          | 8                  | 0.008      | -60                  | 0.943      | -177                 |
| 1050          | 0.949      | 180                | 1          | 7                  | 0.007      | -64                  | 0.935      | -177                 |
| 1100          | 0.948      | 179                | 0          | 4                  | 0.007      | -44                  | 0.944      | -178                 |
| 1150          | 0.950      | 178                | 0          | 3                  | 0.006      | -44                  | 0.939      | -179                 |
| 1200          | 0.950      | 177                | 0          | -1                 | 0.005      | -50                  | 0.942      | -180                 |
| 1250          | 0.955      | 177                | 0          | -2                 | 0.004      | -42                  | 0.941      | 179                  |
| 1300          | 0.951      | 176                | 0          | -4                 | 0.004      | -41                  | 0.933      | 178                  |
| 1350          | 0.953      | 175                | 0          | -5                 | 0.004      | -50                  | 0.933      | 177                  |
| 1400          | 0.953      | 175                | 0          | -7                 | 0.002      | -41                  | 0.947      | 176                  |
| 1450          | 0.952      | 173                | 0          | -9                 | 0.002      | -13                  | 0.952      | 175                  |
| 1500          | 0.949      | 173                | 0          | -10                | 0.000      | -3                   | 0.958      | 174                  |

Table 14. S-parameter for the PowerSO-10RF straight lead ( $V_{DS} = 12.5\text{ V}$ ,  $I_{DS} = 0.8\text{ A}$ )

| Freq (MHz) | $ S_{11} $ | $S_{11}\angle\Phi$ | $ S_{21} $ | $S_{21}\angle\Phi$ | $ S_{12} $ | $S_{12} - \text{DF}$ | $ S_{22} $ | $S_{22} - \text{DF}$ |
|------------|------------|--------------------|------------|--------------------|------------|----------------------|------------|----------------------|
| 50         | 0.807      | -137               | 26.18      | 102                | 0.025      | 12                   | 0.682      | -140                 |
| 100        | 0.809      | -156               | 13.41      | 88                 | 0.026      | 0                    | 0.683      | -157                 |
| 150        | 0.827      | -163               | 8.92       | 81                 | 0.025      | -6                   | 0.677      | -162                 |
| 200        | 0.838      | -167               | 6.64       | 75                 | 0.024      | -12                  | 0.698      | -165                 |
| 250        | 0.842      | -169               | 5.24       | 69                 | 0.026      | -13                  | 0.704      | -166                 |
| 300        | 0.849      | -171               | 4.28       | 64                 | 0.022      | -19                  | 0.720      | -167                 |
| 350        | 0.856      | -172               | 3.57       | 59                 | 0.023      | -21                  | 0.736      | -167                 |
| 400        | 0.866      | -173               | 3.03       | 54                 | 0.021      | -28                  | 0.758      | -168                 |
| 450        | 0.873      | -174               | 2.61       | 50                 | 0.020      | -30                  | 0.773      | -168                 |
| 500        | 0.881      | -174               | 2.26       | 46                 | 0.056      | -27                  | 0.797      | -169                 |
| 550        | 0.891      | -175               | 1.99       | 42                 | 0.018      | -36                  | 0.806      | -170                 |
| 600        | 0.896      | -176               | 1.76       | 39                 | 0.017      | -35                  | 0.825      | -171                 |
| 650        | 0.902      | -176               | 1.58       | 36                 | 0.016      | -38                  | 0.831      | -171                 |
| 700        | 0.908      | -177               | 1.42       | 33                 | 0.015      | -39                  | 0.834      | -172                 |
| 750        | 0.910      | -178               | 1.29       | 30                 | 0.014      | -40                  | 0.845      | -174                 |
| 800        | 0.916      | -179               | 1.18       | 27                 | 0.012      | -43                  | 0.859      | -174                 |
| 850        | 0.922      | -180               | 1.08       | 25                 | 0.011      | -40                  | 0.864      | -175                 |
| 900        | 0.926      | 180                | 1.00       | 22                 | 0.009      | -44                  | 0.878      | -176                 |
| 950        | 0.927      | 179                | 0.93       | 19                 | 0.010      | -43                  | 0.892      | -178                 |
| 1000       | 0.929      | 178                | 0.85       | 17                 | 0.007      | -34                  | 0.905      | -178                 |
| 1050       | 0.937      | 178                | 0.80       | 15                 | 0.007      | -30                  | 0.901      | -179                 |
| 1100       | 0.934      | 177                | 0.75       | 12                 | 0.006      | -29                  | 0.910      | -179                 |
| 1150       | 0.934      | 177                | 0.70       | 10                 | 0.006      | -29                  | 0.914      | -180                 |
| 1200       | 0.937      | 176                | 0.65       | 7                  | 0.005      | -23                  | 0.912      | 180                  |
| 1250       | 0.941      | 175                | 0.62       | 5                  | 0.005      | -25                  | 0.912      | 179                  |
| 1300       | 0.938      | 175                | 0.57       | 3                  | 0.005      | -3                   | 0.909      | 177                  |
| 1350       | 0.941      | 174                | 0.54       | 1                  | 0.004      | 3                    | 0.906      | 176                  |
| 1400       | 0.941      | 174                | 0.51       | -1                 | 0.004      | 18                   | 0.918      | 176                  |
| 1450       | 0.939      | 173                | 0.48       | -2                 | 0.003      | 21                   | 0.925      | 174                  |
| 1500       | 0.939      | 172                | 0.45       | -3                 | 0.002      | 42                   | 0.931      | 173                  |

Table 15. S-parameter for the PowerSO-10RF straight lead ( $V_{DS} = 12.5$  V,  $I_{DS} = 1.5$  A)

| Freq (MHz) | $ S_{11} $ | $S_{11} \angle \Phi$ | $ S_{21} $ | $S_{21} \angle \Phi$ | $ S_{12} $ | $S_{12} - DF$ | $ S_{22} $ | $S_{22} - DF$ |
|------------|------------|----------------------|------------|----------------------|------------|---------------|------------|---------------|
| 50         | 0.816      | -140                 | 26.05      | 101                  | 0.024      | 11            | 0.684      | -144          |
| 100        | 0.817      | -157                 | 13.34      | 88                   | 0.025      | -2            | 0.690      | -159          |
| 150        | 0.839      | -164                 | 8.89       | 82                   | 0.024      | -3            | 0.685      | -164          |
| 200        | 0.847      | -168                 | 6.62       | 76                   | 0.024      | -10           | 0.701      | -166          |
| 250        | 0.850      | -170                 | 5.25       | 70                   | 0.023      | -14           | 0.707      | -168          |
| 300        | 0.655      | -171                 | 4.29       | 65                   | 0.023      | -17           | 0.726      | -168          |
| 350        | 0.861      | -173                 | 3.59       | 60                   | 0.021      | -21           | 0.735      | -169          |
| 400        | 0.869      | -174                 | 3.06       | 55                   | 0.020      | -24           | 0.761      | -169          |
| 450        | 0.877      | -174                 | 2.64       | 51                   | 0.019      | -27           | 0.769      | -170          |
| 500        | 0.884      | -175                 | 2.30       | 47                   | 0.017      | -31           | 0.795      | -170          |
| 550        | 0.893      | -176                 | 2.02       | 44                   | 0.017      | -26           | 0.800      | -171          |
| 600        | 0.898      | -177                 | 1.80       | 40                   | 0.015      | -36           | 0.819      | -172          |
| 650        | 0.905      | -177                 | 1.62       | 38                   | 0.015      | -36           | 0.829      | -172          |
| 700        | 0.908      | -178                 | 1.46       | 34                   | 0.014      | -34           | 0.831      | -173          |
| 750        | 0.909      | -179                 | 1.33       | 31                   | 0.012      | -35           | 0.842      | -174          |
| 800        | 0.914      | -179                 | 1.21       | 29                   | 0.012      | -36           | 0.852      | -175          |
| 850        | 0.918      | -180                 | 1.11       | 26                   | 0.011      | -31           | 0.856      | -176          |
| 900        | 0.923      | 179                  | 1.03       | 23                   | 0.009      | -32           | 0.872      | -177          |
| 950        | 0.927      | 179                  | 0.96       | 21                   | 0.009      | -34           | 0.879      | -178          |
| 1000       | 0.926      | 178                  | 0.88       | 18                   | 0.008      | -21           | 0.894      | -178          |
| 1050       | 0.935      | 178                  | 0.83       | 16                   | 0.007      | -20           | 0.898      | -179          |
| 1100       | 0.933      | 177                  | 0.78       | 13                   | 0.007      | -22           | 0.900      | -179          |
| 1150       | 0.933      | 176                  | 0.73       | 10                   | 0.006      | -15           | 0.904      | 180           |
| 1200       | 0.934      | 175                  | 0.68       | 8                    | 0.005      | -18           | 0.903      | 179           |
| 1250       | 0.940      | 175                  | 0.64       | 6                    | 0.004      | -16           | 0.901      | 178           |
| 1300       | 0.935      | 174                  | 0.59       | 4                    | 0.004      | 4             | 0.902      | 177           |
| 1350       | 0.938      | 174                  | 0.56       | 2                    | 0.005      | 5             | 0.898      | 176           |
| 1400       | 0.938      | 173                  | 0.53       | 0                    | 0.005      | 25            | 0.915      | 175           |
| 1450       | 0.939      | 173                  | 0.50       | -2                   | 0.004      | 14            | 0.925      | 174           |
| 1500       | 0.935      | 172                  | 0.47       | -3                   | 0.002      | 48            | 0.928      | 173           |

## 9 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

**Table 16. 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:** *Resin protrusions not included (max value: 0.15 mm per side)*

Figure 34. Package dimensions

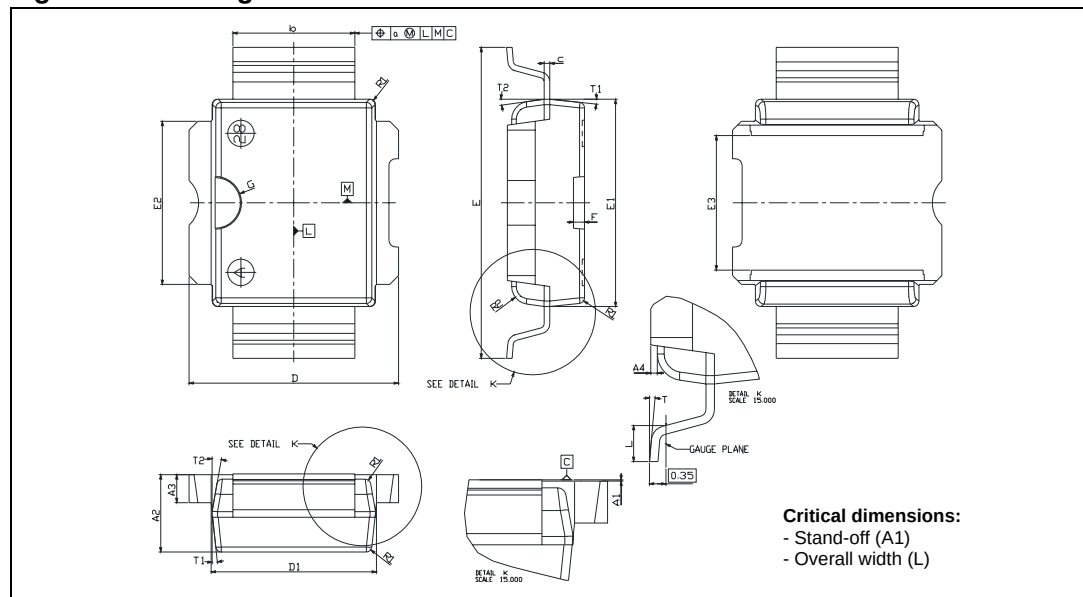


Table 17. PowerSO-10RF straight lead mechanical data

| 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:** Resin protrusions not included (max value: 0.15 mm per side)



Figure 35. Package dimensions

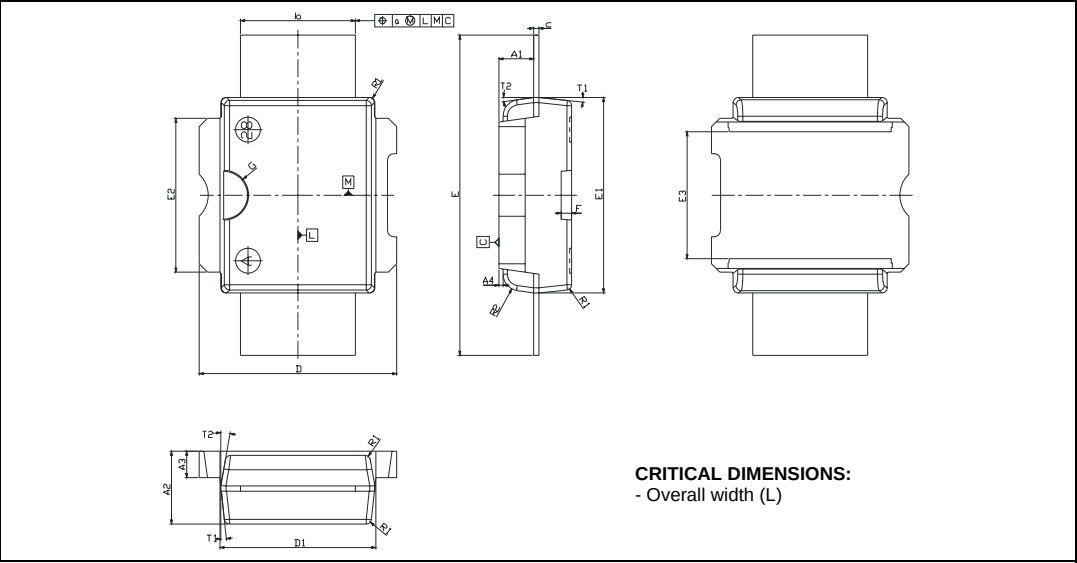


Figure 36. Tube information

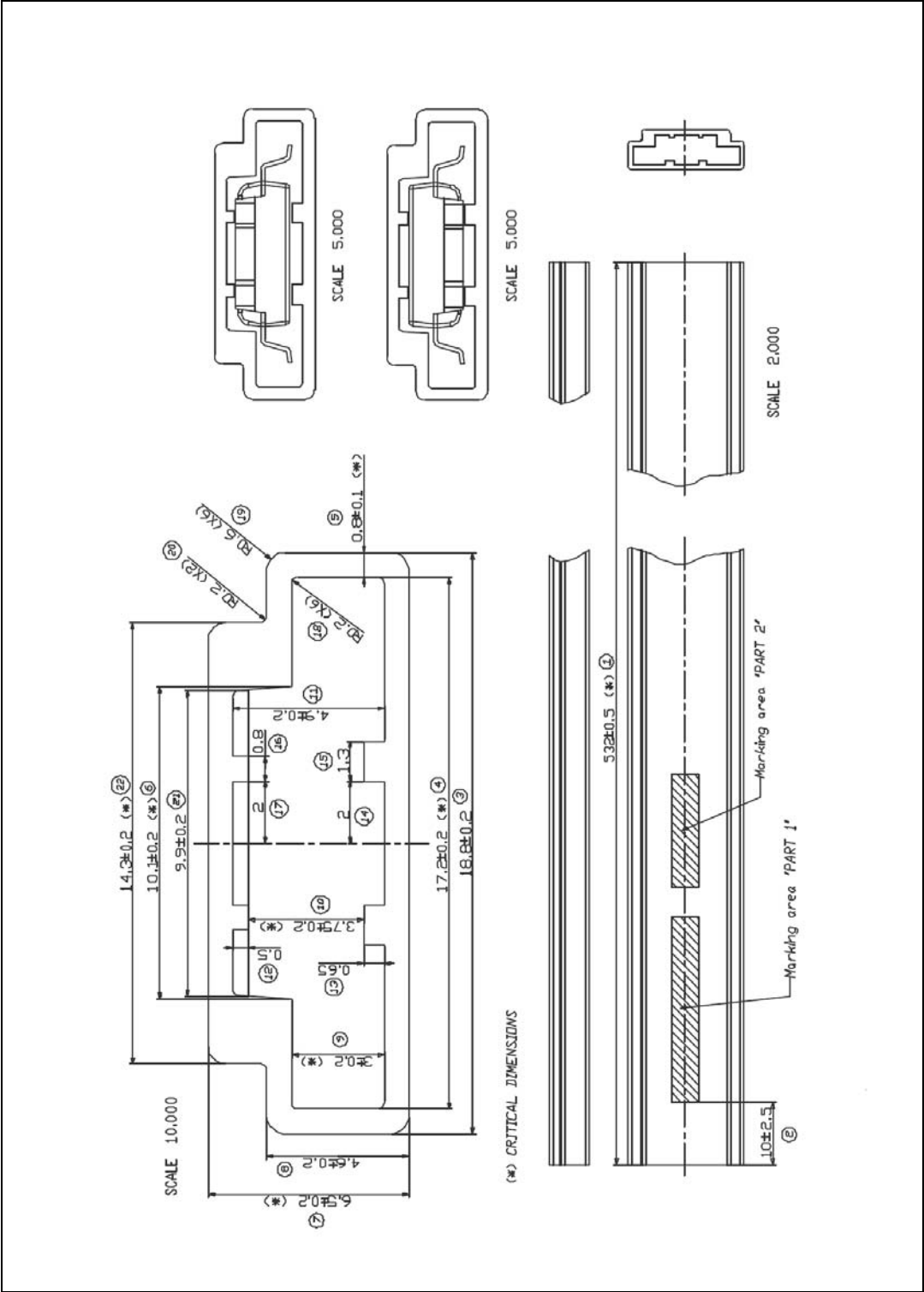
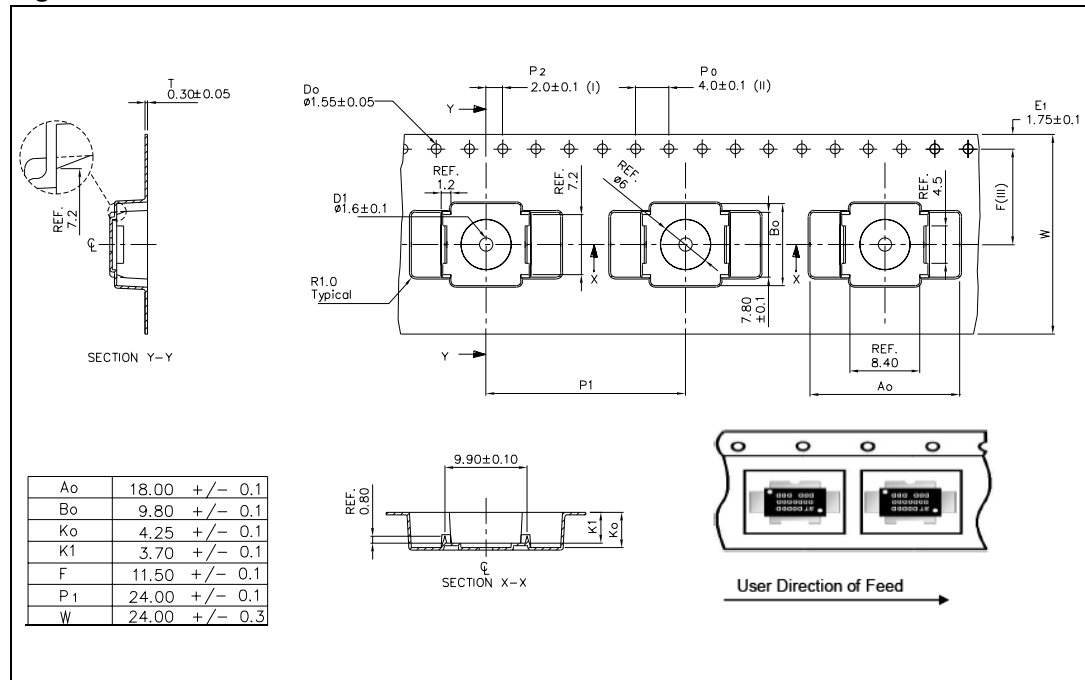


Figure 37. Reel information



## 10 Revision history

**Table 18. Document revision history**

| Date        | Revision | Changes                                                                              |
|-------------|----------|--------------------------------------------------------------------------------------|
| 21-Mar-2006 | 1        | Initial release.                                                                     |
| 01-Aug-2007 | 2        | Update $R_{DS(on)}$ in <a href="#">Table 4: Static</a> .                             |
| 19-May-2010 | 3        | Added: <a href="#">Table 6: Moisture sensitivity level</a> .                         |
| 08-Aug-2011 | 4        | Added <a href="#">Figure 6: Maximum safe operating area</a> .<br>Minor text changes. |

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