

## RF power transistor, LdmoST plastic family N-channel enhancement-mode, lateral MOSFETs

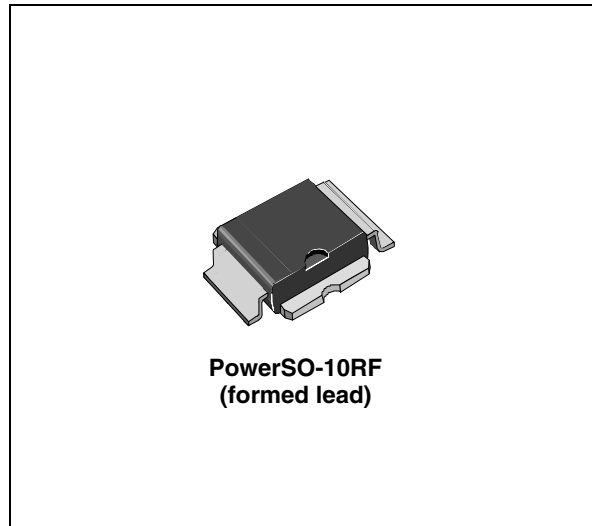
Datasheet — production data

### Features

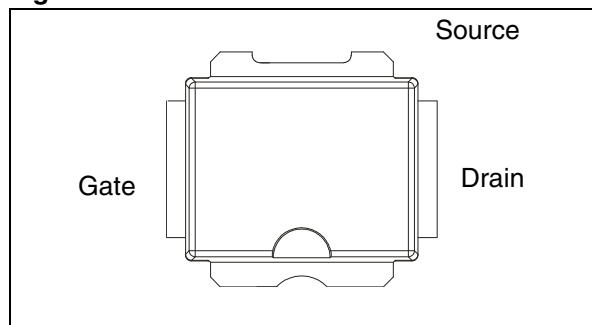
- Excellent thermal stability
- Common source configuration
- $P_{OUT} = 2\text{ W}$  with 15dB gain @ 960 MHz / 28 V
- New RF plastic package

### Description

The device is a common source N-channel, enhancement-mode lateral field-effect RF power transistor designed for broadband commercial and industrial applications at frequencies up to 1 GHz. The device is designed for high gain and broadband performance operating in common source mode at 28 V. It is ideal for digital cellular BTS applications requiring high linearity. 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 performance and ease of assembly.



**Figure 1. Pin connection**



**Table 1. Device summary**

Order code	Package	Packing
PD57002-E	PowerSO-10RF (formed lead)	Tube

# Contents

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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	65	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current	0.25	A
$P_{DISS}$	Power dissipation (@ $T_C = 70^{\circ}C$ )	4.75	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	20	$^{\circ}C/W$

## 2 Electrical characteristics

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

### 2.1 Static

**Table 4. Static**

Symbol	Test conditions		Min	Typ	Max	Unit
$I_{DSS}$	$V_{GS} = 0$	$V_{DS} = 28\text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	$V_{GS} = 20\text{ V}$	$V_{DS} = 0$			1	$\mu\text{A}$
$V_{GS(Q)}$	$V_{DS} = 28\text{ V}$	$I_D = 10\text{ mA}$	2.0		5.0	V
$V_{DS(ON)}$	$V_{GS} = 10\text{ V}$	$I_D = 125\text{ mA}$		0.7	0.9	V
$G_{FS}$	$V_{DS} = 10\text{ V}$	$I_D = 200\text{ mA}$		--		mho
$C_{ISS}$	$V_{GS} = 0$	$V_{DS} = 28\text{ V}$		7.1		pF
$C_{OSS}$	$V_{GS} = 0$	$V_{DS} = 28\text{ V}$		5.8		pF
$C_{RSS}$	$V_{GS} = 0$	$V_{DS} = 28\text{ V}$		0.1		pF

### 2.2 Dynamic

**Table 5. Dynamic**

Symbol	Test conditions		Min	Typ	Max	Unit
$P_{1dB}$	$V_{DD} = 28\text{ V}$ ,	$I_{DQ} = 10\text{ mA}$ $f = 960\text{ MHz}$	2			W
$G_P$	$V_{DD} = 28\text{ V}$ ,	$I_{DQ} = 10\text{ mA}$ , $P_{OUT} = 2\text{ W}$ , $f = 960\text{ MHz}$	15			dB
$h_D$	$V_{DD} = 28\text{ V}$ ,	$I_{DQ} = 10\text{ mA}$ , $P_{OUT} = 2\text{ W}$ , $f = 960\text{ MHz}$	45			%
Load mismatch	$V_{DD} = 28\text{ V}$ ,	$I_{DQ} = 10\text{ mA}$ , $P_{OUT} = 2\text{ W}$ , $f = 960\text{ MHz}$ All phase angles	10:1			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

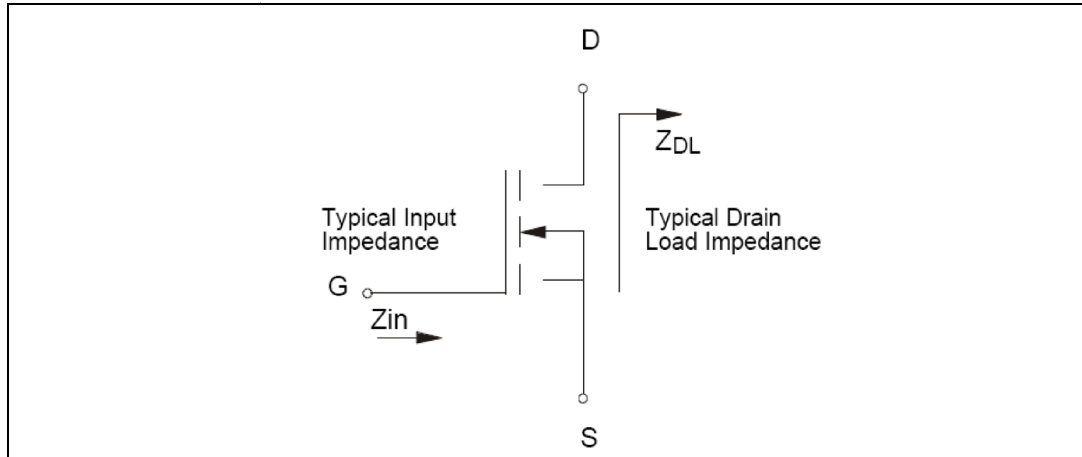
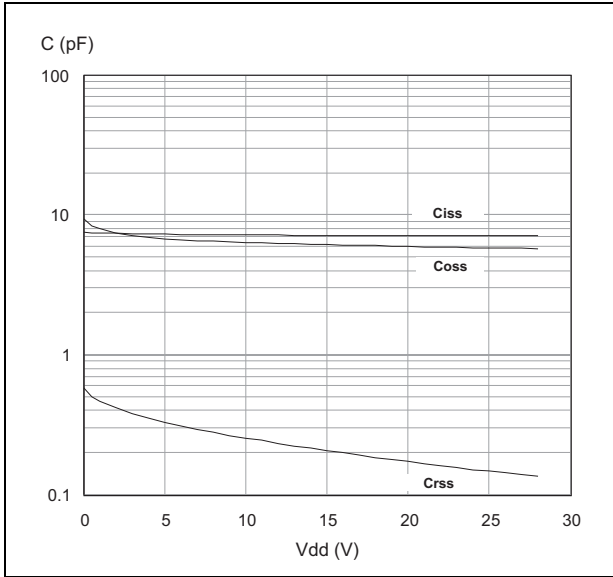


Table 7. Impedance data

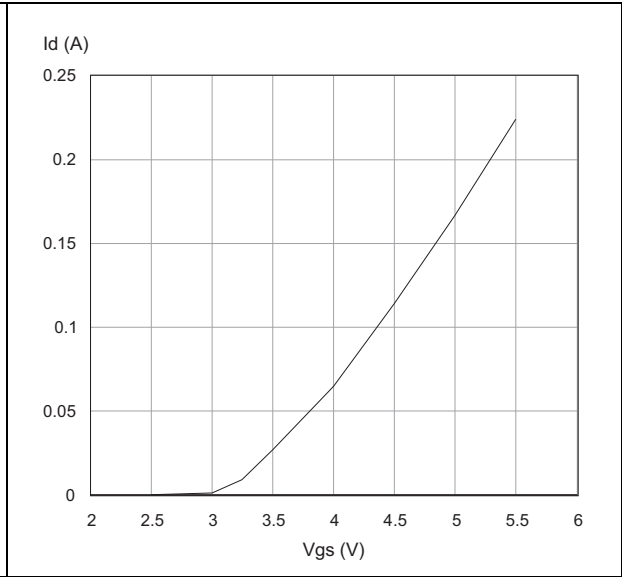
Freq. (MHz)	$Z_{IN} (\Omega)$	$Z_{DL} (\Omega)$
925	1.894 - j 13.43	6.445 + j 23.60
945	2.440 - j 12.53	7.245 + j 25.09
960	2.760 - j 12.13	7.715 + j 25.69

# 4 Typical performance

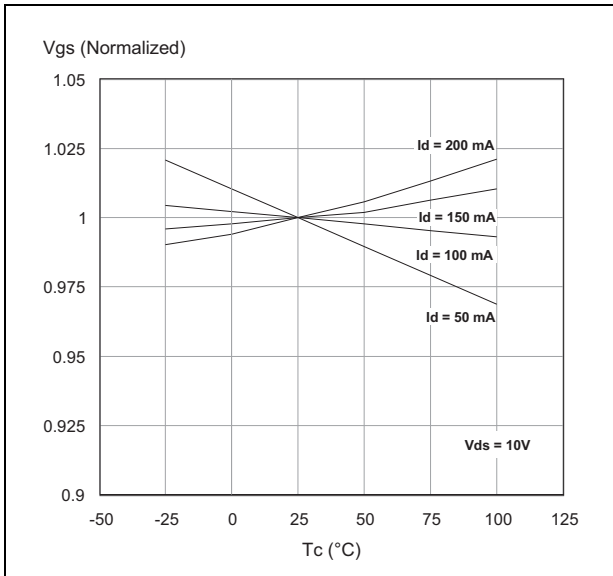
**Figure 3. Capacitance vs supply voltage**



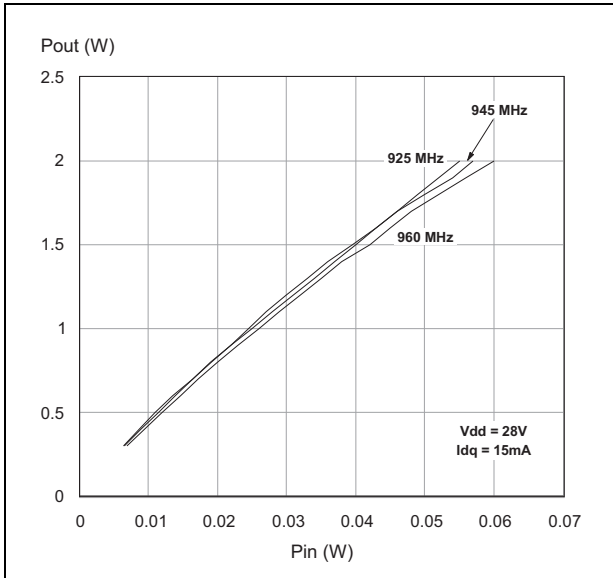
**Figure 4. Drain current vs gate source voltage**



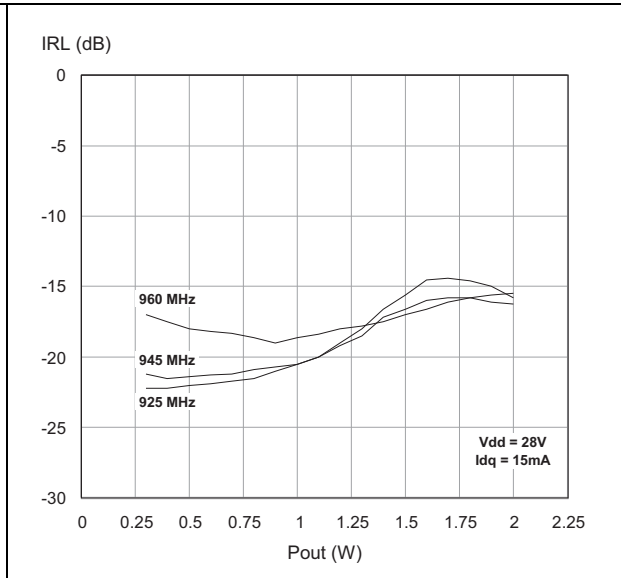
**Figure 5. Gate-source voltage vs case temperature**



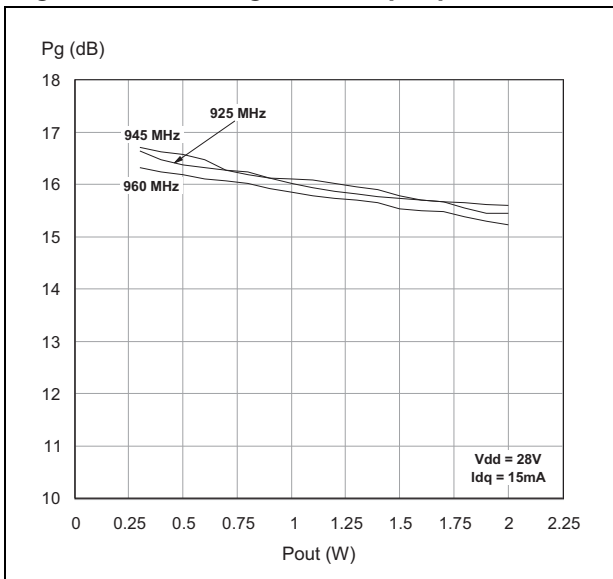
**Figure 6. Output power vs input power**



**Figure 7. Input return loss vs output power**



**Figure 8. Power gain vs output power**



**Figure 9. Efficiency vs output power**

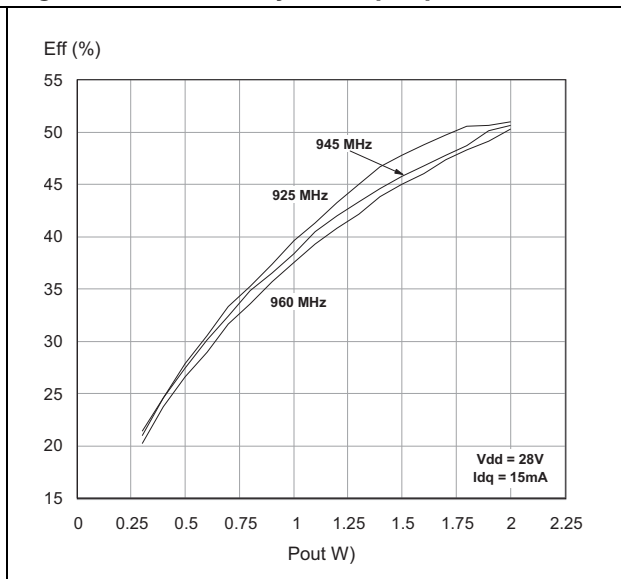


Figure 10. Output power vs drain voltage

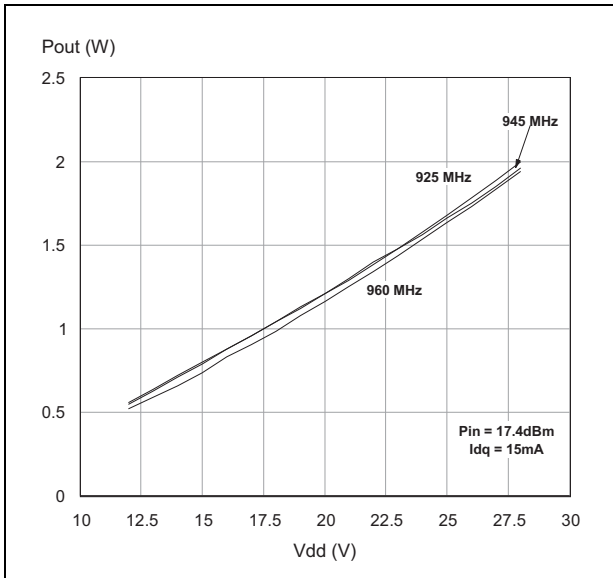


Figure 11. Efficiency vs drain voltage

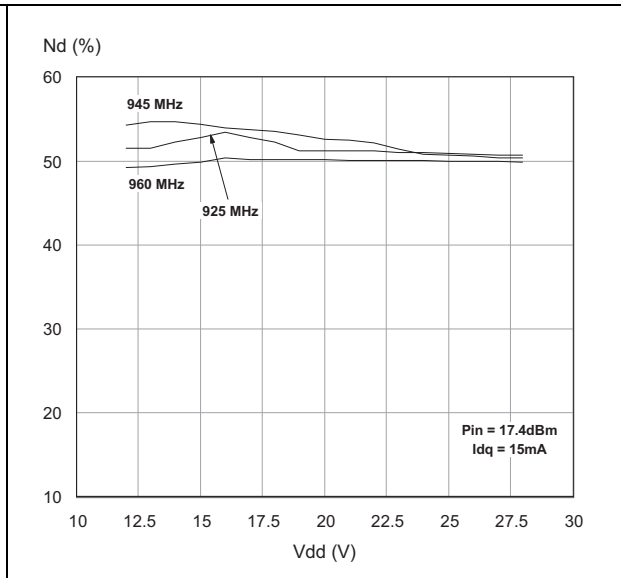


Figure 12. Output power vs drain current

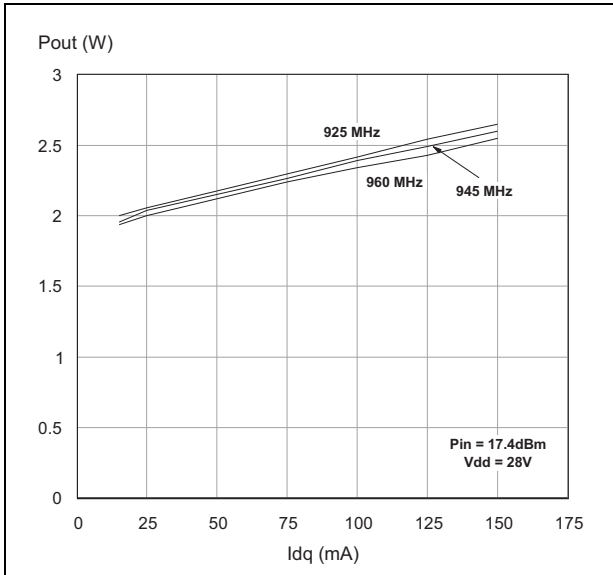


Figure 13. Efficiency vs drain current

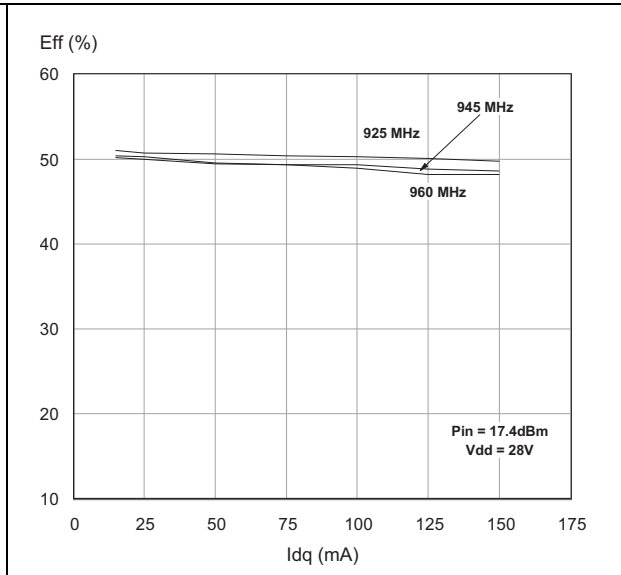
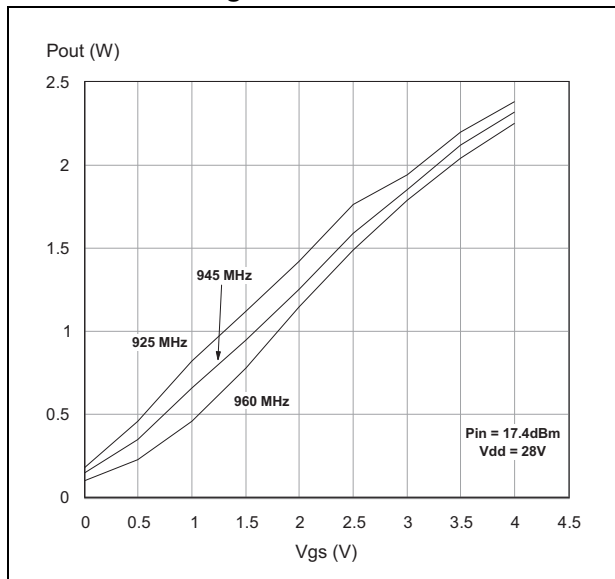




Figure 14. Output power vs gate-source voltage



## 5 Common source s-parameter

Table 8. S-parameter for PD57002-E ( $V_{DS} = 28\text{ V}$   $I_{DS} = 75\text{ mA}$ )

Freq (MHz)	$ S_{11} $	$S_{11} < \Phi$	$ S_{21} $	$S_{21} < \Phi$	$ S_{12} $	$S_{12} < \Phi$	$ S_{22} $	$S_{22} < \Phi$
50	0.980	-16	10.01	166	0.006	75	0.963	-12
100	0.972	-31	9.63	153	0.012	64	0.949	-23
150	0.966	-46	9.04	141	0.017	53	0.942	-35
200	0.951	-59	8.46	129	0.020	42	0.918	-45
250	0.944	-70	7.78	119	0.023	32	0.911	-54
300	0.936	-80	7.09	110	0.025	23	0.896	-63
350	0.925	-90	6.50	101	0.026	16	0.885	-70
400	0.926	-98	5.93	93	0.026	8	0.888	-77
450	0.924	-105	5.43	85	0.026	2	0.886	-83
500	0.919	-112	4.96	78	0.027	-2	0.897	-89
550	0.921	-117	4.52	72	0.027	-9	0.894	-95
600	0.915	-122	4.17	66	0.026	-15	0.896	-99
650	0.920	-127	3.84	61	0.026	-20	0.904	-104
700	0.922	-131	3.55	56	0.024	-25	0.914	-108
750	0.921	-135	3.31	51	0.024	-29	0.920	-112
800	0.922	-138	3.07	46	0.023	-33	0.929	-116
850	0.924	-141	2.87	42	0.022	-38	0.937	-119
900	0.922	-145	2.69	38	0.021	-39	0.934	-123
950	0.926	-147	2.52	34	0.020	-43	0.931	-125
1000	0.919	-150	2.38	30	0.019	-45	0.938	-128
1050	0.920	-153	2.24	27	0.018	-49	0.941	-131
1100	0.918	-155	2.13	23	0.018	-51	0.941	-134
1150	0.916	-158	2.02	19	0.017	-56	0.943	-136
1200	0.921	-160	1.92	16	0.016	-60	0.940	-138
1250	0.912	-162	1.84	12	0.015	-62	0.943	-141
1300	0.914	-164	1.76	9	0.014	-70	0.944	-143
1350	0.914	-166	1.68	6	0.013	-71	0.942	-144
1400	0.908	-168	1.61	3	0.013	-75	0.947	-146
1450	0.909	-170	1.54	0	0.012	-88	0.940	-148
1500	0.900	-172	1.45	-3	0.011	-108	0.934	-149

Table 9. S-parameter PD57002-E ( $V_{DS} = 28\text{ V}$   $I_{DS} = 150\text{ mA}$ )

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
50	0.998	-17	10.95	166	0.006	77	0.960	-12
100	0.989	-32	10.50	153	0.011	63	0.946	-24
150	0.975	-47	9.83	140	0.016	52	0.937	-35
200	0.965	-61	9.15	128	0.020	41	0.912	-45
250	0.954	-72	8.40	118	0.022	31	0.904	-54
300	0.943	-82	7.63	108	0.024	22	0.885	-63
350	0.939	-92	6.98	100	0.025	15	0.876	-70
400	0.934	-100	6.35	92	0.025	7	0.880	-77
450	0.931	-107	5.81	84	0.026	2	0.877	-83
500	0.930	-113	5.30	77	0.026	-3	0.885	-89
550	0.927	-119	4.82	71	0.025	-9	0.886	-95
600	0.925	-124	4.45	65	0.025	-15	0.886	-99
650	0.927	-128	4.09	60	0.025	-21	0.896	-104
700	0.926	-133	3.78	55	0.023	-25	0.906	-108
750	0.930	-136	3.52	50	0.022	-29	0.912	-112
800	0.930	-140	3.27	45	0.021	-33	0.923	-115
850	0.931	-143	3.06	41	0.021	-36	0.929	-119
900	0.930	-146	2.87	36	0.200	-40	0.930	-122
950	0.929	-149	2.68	33	0.019	-42	0.928	-125
1000	0.931	-152	2.53	29	0.018	-46	0.933	-128
1050	0.926	-154	2.38	25	0.017	-48	0.932	-130
1100	0.927	-157	2.27	21	0.016	-54	0.935	-133
1150	0.926	-159	2.15	18	0.016	-57	0.938	-136
1200	0.925	-161	2.04	14	0.015	-58	0.940	-138
1250	0.923	-164	1.95	11	0.014	-62	0.941	-140
1300	0.918	-165	1.87	8	0.013	-68	0.939	-142
1350	0.917	-167	1.79	4	0.012	-71	0.936	-144
1400	0.916	-169	1.72	1	0.012	-74	0.939	-146
1450	0.911	-171	1.63	-2	0.011	-89	0.934	-147
1500	0.904	-172	1.54	-5	0.011	-109	0.933	-148

Table 10. S-parameter for PD57002-E ( $V_{DS} = 13.5\text{ V}$   $I_{DS} = 75\text{ mA}$ )

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
50	0.969	-17	10.14	166	0.009	74	0.973	-14
100	0.959	-33	9.72	152	0.017	63	0.954	-27
150	0.949	-48	9.06	139	0.243	50	0.944	-40
200	0.925	-61	8.31	127	0.030	39	0.910	-51
250	0.915	-73	7.57	117	0.033	28	0.901	-61
300	0.906	-83	6.82	108	0.035	20	0.875	-70
350	0.890	-92	6.23	99	0.038	13	0.862	-77
400	0.892	-100	5.65	91	0.039	5	0.866	-85
450	0.888	-106	5.19	84	0.038	-2	0.858	-90
500	0.881	-113	4.72	77	0.039	-6	0.870	-96
550	0.888	-119	4.30	71	0.039	-13	0.873	-102
600	0.882	-123	3.95	65	0.038	-18	0.872	-106
650	0.888	-128	3.62	60	0.038	-24	0.880	-111
700	0.893	-132	3.36	55	0.036	-28	0.890	-116
750	0.890	-135	3.12	51	0.036	-32	0.895	-119
800	0.895	-139	2.92	46	0.034	-36	0.904	-122
850	0.895	-142	2.73	42	0.033	-41	0.911	-126
900	0.893	-145	2.56	37	0.032	-44	0.914	-129
950	0.898	-148	2.40	34	0.030	-47	0.911	-132
1000	0.892	-150	2.25	30	0.030	-50	0.918	-134
1050	0.895	-153	2.13	26	0.029	-54	0.921	-137
1100	0.896	-155	2.20	23	0.028	-58	0.922	-140
1150	0.894	-158	1.92	19	0.027	-60	0.926	-142
1200	0.900	-160	1.83	16	0.026	-64	0.924	-144
1250	0.890	-162	1.74	12	0.025	-67	0.923	-147
1300	0.895	-164	1.67	9	0.024	-72	0.922	-149
1350	0.898	-166	1.58	6	0.023	-73	0.919	-150
1400	0.893	-169	1.51	3	0.023	-79	0.920	-152
1450	0.895	-170	1.43	0	0.021	-86	0.916	-153
1500	0.885	-172	1.35	-1	0.020	-95	0.912	-154

Table 11. S-parameter for PD57002-E ( $V_{DS} = 13.5\text{ V}$   $I_{DS} = 150\text{ mA}$ )

Freq (MHz)	$ S_{11} $	$S_{11} < \Phi$	$ S_{21} $	$S_{21} < \Phi$	$ S_{12} $	$S_{12} < \Phi$	$ S_{22} $	$S_{22} < \Phi$
50	0.986	-18	11.58	165	0.009	75	0.964	-14
100	0.972	-34	11.04	151	0.017	62	0.940	-28
150	0.955	-50	10.25	138	0.024	49	0.931	-41
200	0.934	-63	9.35	126	0.029	38	0.891	-52
250	0.921	-75	8.48	115	0.032	28	0.883	-62
300	0.909	-85	7.59	106	0.034	19	0.856	-71
350	0.897	-94	6.93	98	0.036	12	0.841	-78
400	0.895	-102	6.27	90	0.037	4	0.847	-86
450	0.892	-109	5.76	83	0.037	-2	0.840	-91
500	0.889	-115	5.23	76	0.037	-7	0.852	-97
550	0.889	-121	4.75	70	0.037	-13	0.852	-103
600	0.886	-125	4.37	65	0.037	-19	0.853	-107
650	0.891	-130	4.00	59	0.036	-23	0.863	-111
700	0.892	-134	3.72	55	0.035	-29	0.871	-116
750	0.895	-137	3.45	50	0.034	-32	0.878	-119
800	0.897	-141	3.23	46	0.033	-36	0.885	-123
850	0.898	-144	3.02	41	0.032	-40	0.897	-126
900	0.898	-147	2.84	37	0.031	-43	0.895	-129
950	0.902	-149	2.66	33	0.029	-47	0.896	-132
1000	0.90058	-152	2.50	29	0.028	-49	0.904	-134
1050	0.897	-155	2.36	26	0.028	-53	0.906	-137
1100	0.900	-157	2.24	22	0.027	-56	0.909	-140
1150	0.898	-159	2.13	19	0.026	-59	0.912	-142
1200	0.901	-162	2.03	15	0.025	-63	0.910	-144
1250	0.898	-164	1.92	12	0.024	-65	0.913	-147
1300	0.897	-166	1.84	8	0.023	-71	0.912	-149
1350	0.897	-167	1.75	5	0.022	-74	0.909	-150
1400	0.896	-170	1.67	2	0.021	-76	0.912	-152
1450	0.895	-171	1.58	-1	0.021	-85	0.905	-153
1500	0.888	-173	1.50	-2	0.020	-97	0.900	-154

## 6 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 12. 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 15. Package dimensions

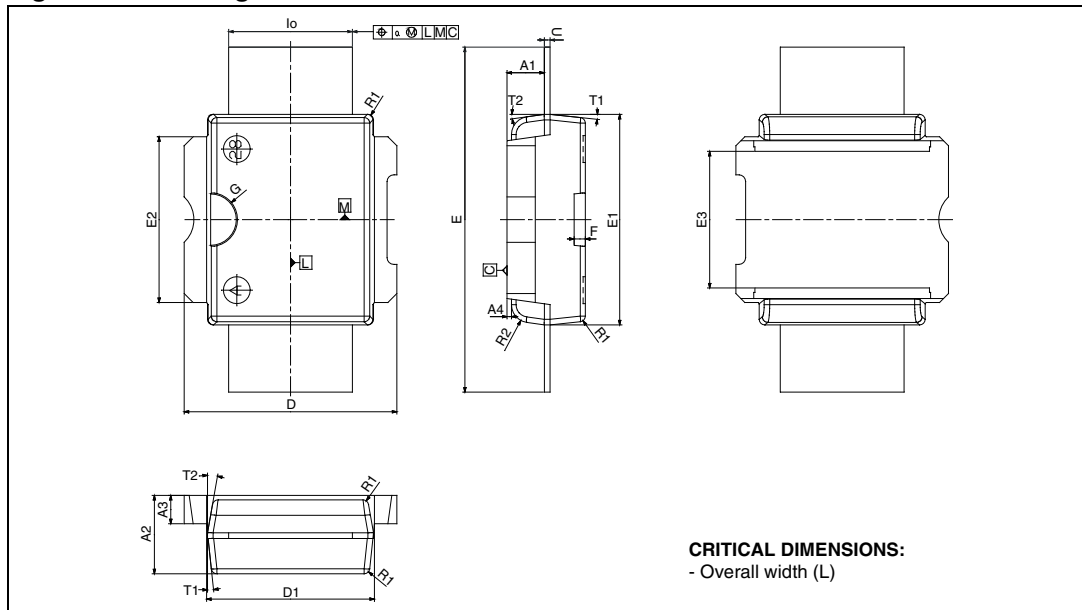
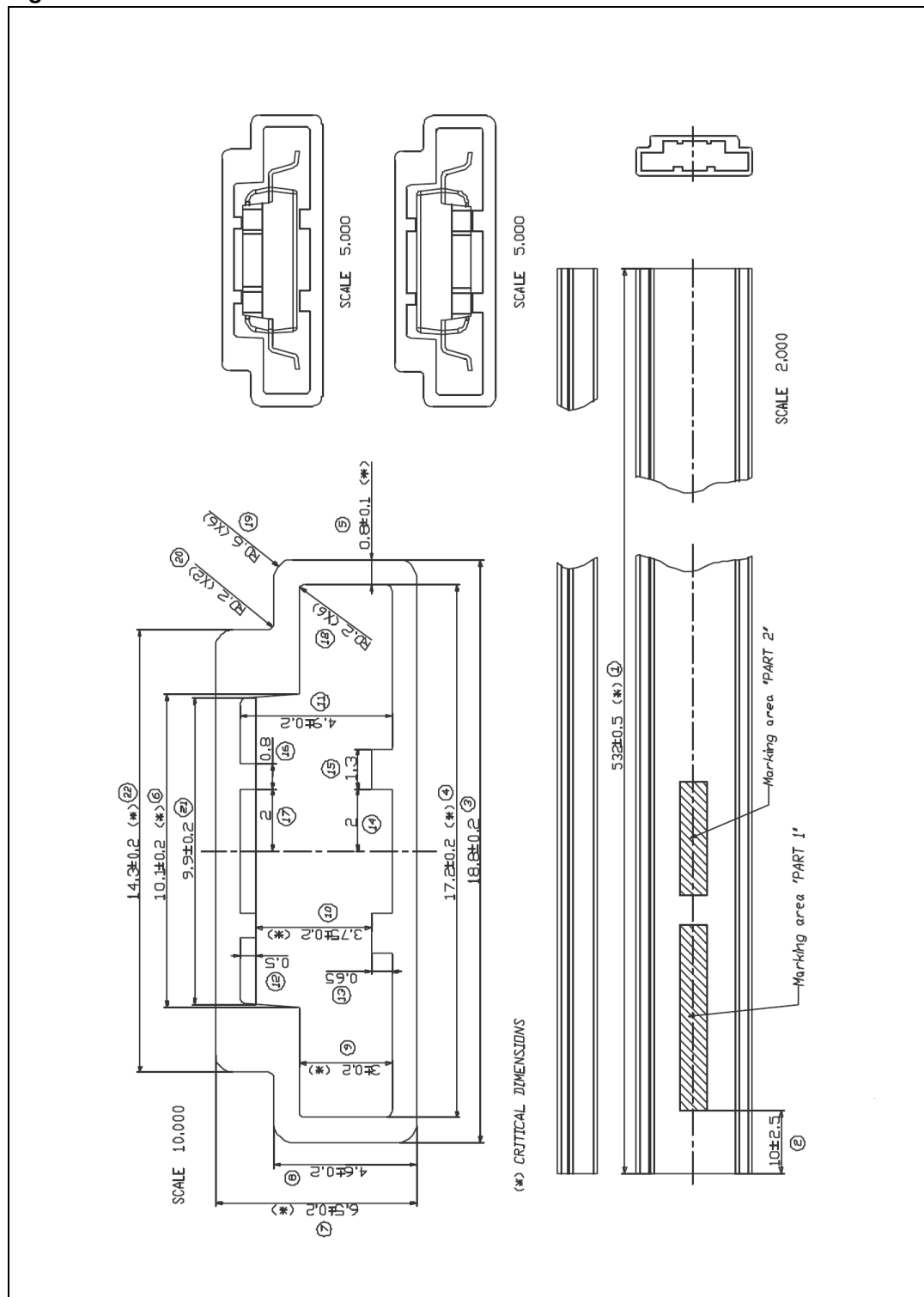




Figure 16. Tube information



## 7 Revision history

**Table 13. Document revision history**

Date	Revision	Changes
11-May-2006	1	Initial release.
28-May-2010	2	Added: <a href="#">Table 6: Moisture sensitivity level</a> .
24-Dec-2010	3	Content reworked to improve readability.
31-May-2012	4	Removed: PD57002S-E from <a href="#">Table 1: Device summary</a> . Minor text changes.

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