



# STAP57045

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

Preliminary Data

### Features

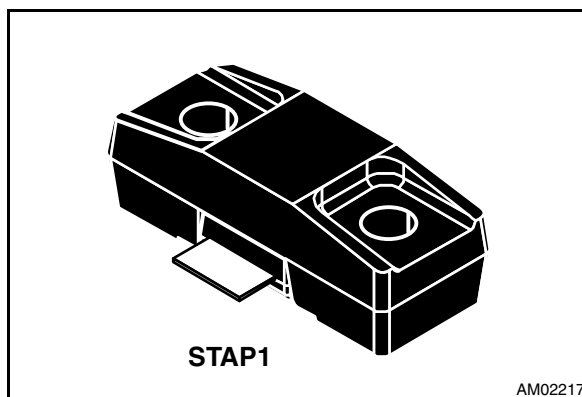
- Excellent thermal stability
- Common source configuration
- $P_{OUT} = 45\text{ W}$  with 13 dB gain @ 945 MHz / 28 V
- ST advanced PowerSO-10RF-STAP package

### Description

The STAP57045 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. STAP57045 boasts the excellent gain, linearity and reliability of ST's latest LDMOS technology mounted in STAP1 plastic RF power package.

STAP package has been specially optimized for RF needs and offers excellent performances and ease of assembly.

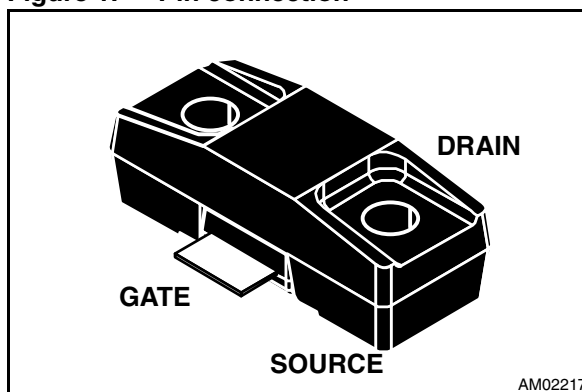
Mounting recommendations are available in [www.st.com/rf/](http://www.st.com/rf/) (look for application note AN1294)



STAP1

AM02217

Figure 1. Pin connection



AM02217

Table 1. Device summary

Order code	Package	Packing
STAP57045	STAP1	Tube

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# 1 Electrical data

## 1.1 Maximum ratings

Table 2. Absolute maximum ratings ( $T_{CASE} = 25\text{ °C}$ )

Symbol	Parameter	Value	Unit
$V_{(BR)DSS}$	Drain-source voltage	65	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current	5	A
$P_{DISS}$	Power dissipation (@ $T_c = 70\text{ °C}$ )	73	W
$T_J$	Max. operating junction temperature	165	$\text{°C}$
$T_{STG}$	Storage temperature	-65 to +150	$\text{°C}$

## 1.2 Thermal data

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thJC}$	Junction - case thermal resistance	1.2	$\text{°C/W}$

## 2 Electrical characteristics

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

### 2.1 Static

**Table 4. Static**

Symbol	Test conditions		Min	Typ	Max	Unit
$V_{(\text{BR})\text{DSS}}$	$V_{\text{GS}} = 0\text{ V}$	$I_{\text{DS}} = 1\text{ mA}$	65			V
$I_{\text{DSS}}$	$V_{\text{GS}} = 0\text{ V}$	$V_{\text{DS}} = 28\text{ V}$			1	$\mu\text{A}$
$I_{\text{GSS}}$	$V_{\text{GS}} = 20\text{ V}$	$V_{\text{DS}} = 0\text{ V}$			1	$\mu\text{A}$
$V_{\text{GS(Q)}}$	$V_{\text{DS}} = 28\text{ V}$	$I_{\text{D}} = 250\text{ mA}$	2.0		5.0	V
$V_{\text{DS(ON)}}$	$V_{\text{GS}} = 10\text{ V}$	$I_{\text{D}} = 3\text{ A}$		0.7	0.9	V
$g_{\text{FS}}$	$V_{\text{DS}} = 10\text{ V}$	$I_{\text{D}} = 4\text{ A}$	2.0	2.7		mho
$C_{\text{ISS}}$	$V_{\text{GS}} = 0\text{ V}$	$V_{\text{DS}} = 28\text{ V}$		86		pF
$C_{\text{OSS}}$	$V_{\text{GS}} = 0\text{ V}$	$V_{\text{DS}} = 28\text{ V}$		47		pF
$C_{\text{RSS}}$	$V_{\text{GS}} = 0\text{ V}$	$V_{\text{DS}} = 28\text{ V}$		3.6		pF

### 2.2 Dynamic

**Table 5. Dynamic**

Symbol	Test conditions		Min.	Typ.	Max.	Unit
$P_{1\text{dB}}$	$V_{\text{DD}} = 28\text{ V}$	$I_{\text{DQ}} = 250\text{ mA}$ $f = 945\text{ MHz}$	45			W
$G_{\text{P}}$	$V_{\text{DD}} = 28\text{ V}$	$I_{\text{DQ}} = 250\text{ mA}$ $P_{\text{OUT}} = 45\text{ W}$ $f = 945\text{ MHz}$	13	14.5		dB
$\eta_{\text{D}}$	$V_{\text{DD}} = 28\text{ V}$	$I_{\text{DQ}} = 250\text{ mA}$ $P_{\text{OUT}} = 45\text{ W}$ $f = 945\text{ MHz}$	50			%
Load mismatch	$V_{\text{DD}} = 28\text{ V}$	$I_{\text{DQ}} = 250\text{ mA}$ $P_{\text{OUT}} = 45\text{ W}$ $f = 945\text{ MHz}$ All phase angles	10:1			VSWR

### 3 Impedance

Figure 2. Current conventions



Table 6. Impedance data

Freq. (MHz)	$Z_{IN} (\Omega)$	$Z_{DL}(\Omega)$
925	$0.71 + j 2.32$	$1.29 - j 0.35$
945	$0.69 + j 2.92$	$1.25 - j 0.29$
960	$0.55 + j 2.78$	$1.18 - j 0.83$

# 4 Typical performance

Figure 3. Capacitance vs drain voltage

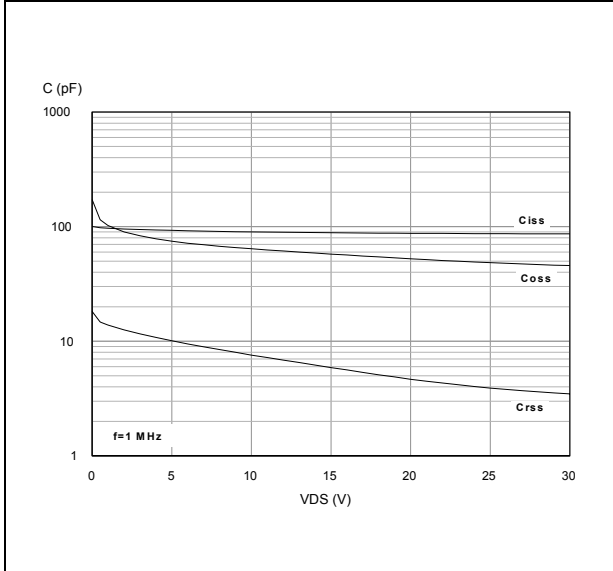


Figure 4. Drain current vs gate voltage

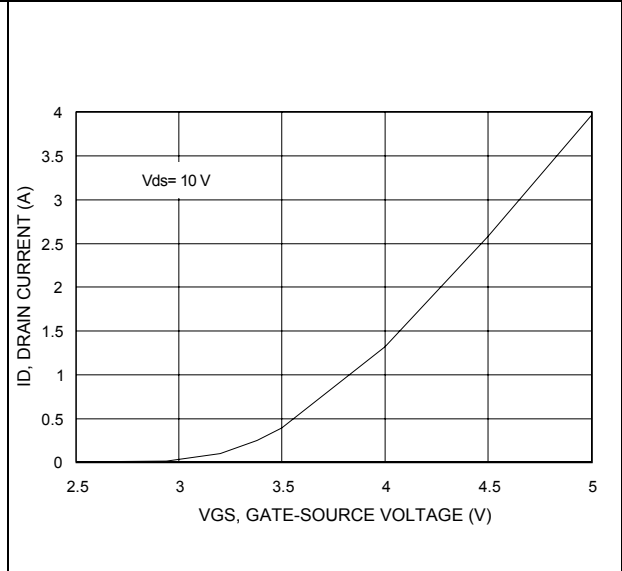


Figure 5. Gate-source voltage vs case temperature

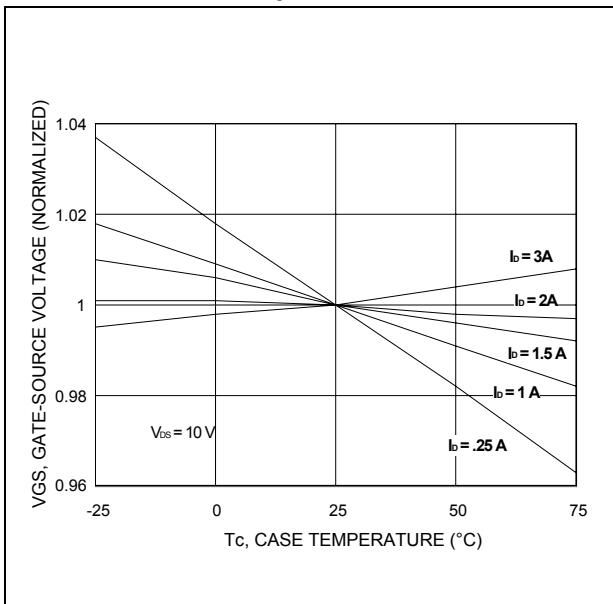
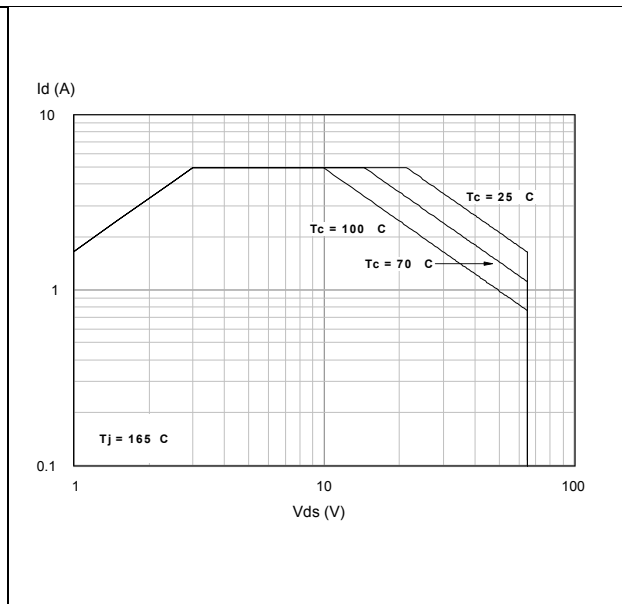


Figure 6. Safe operating area



PD57045S

Figure 7. Output power vs input power

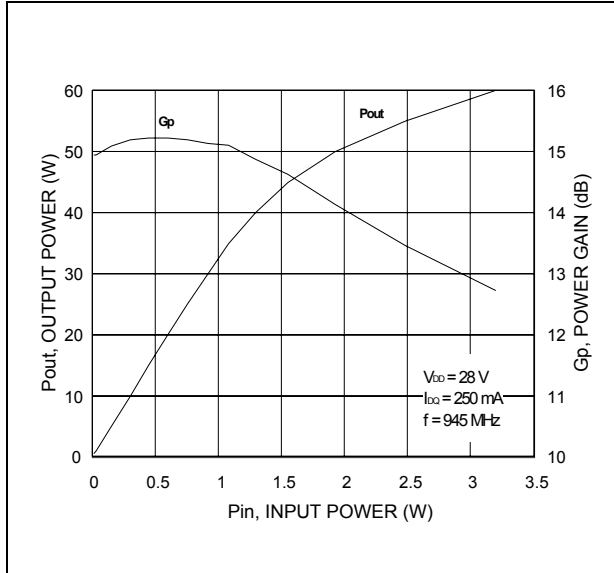


Figure 8. Input return loss vs output power

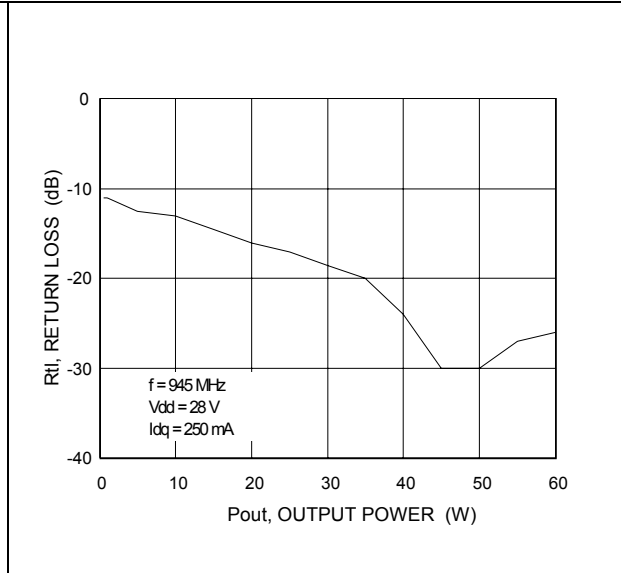


Figure 9. Power gain vs output power

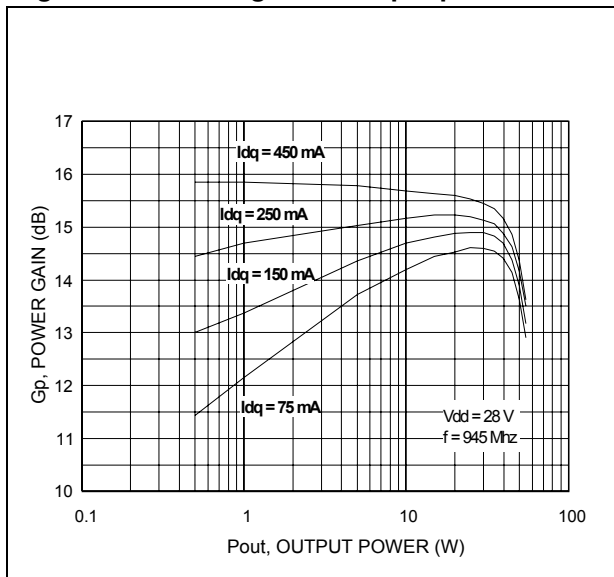


Figure 10. Drain efficiency vs output power

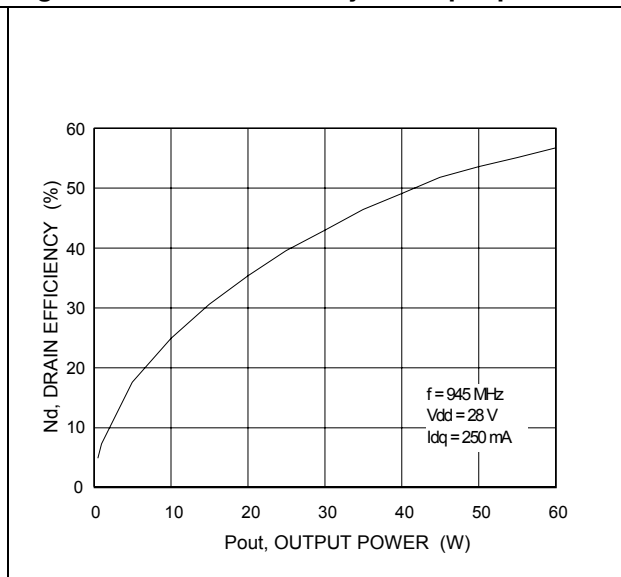


Figure 11. Output power vs bias current

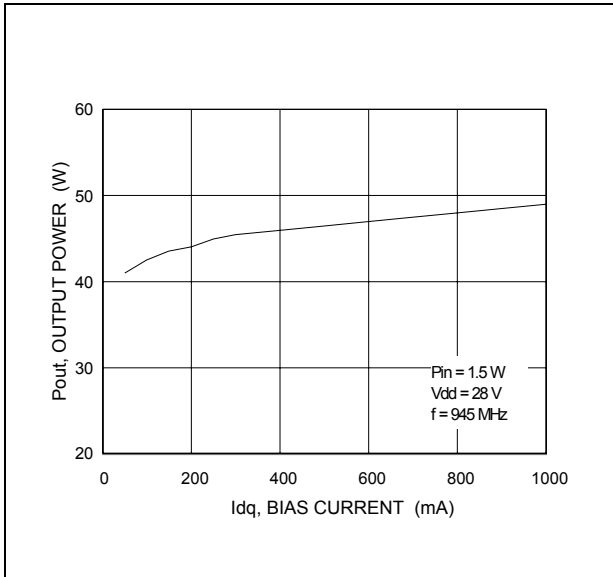


Figure 12. Drain efficiency vs bias current

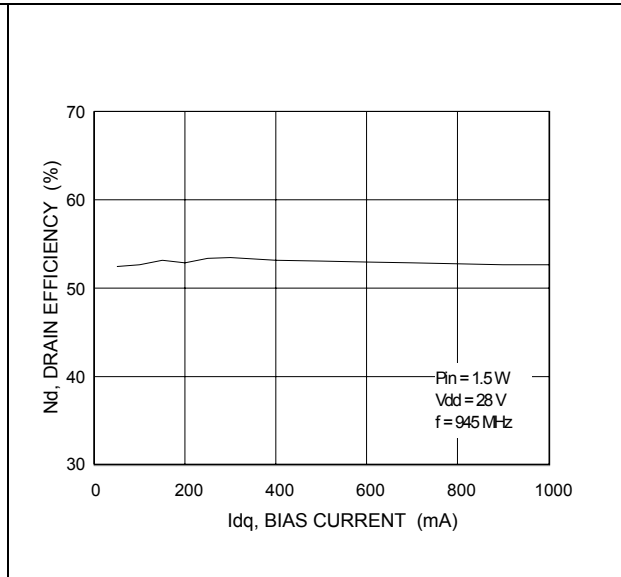


Figure 13. Output power vs drain voltage

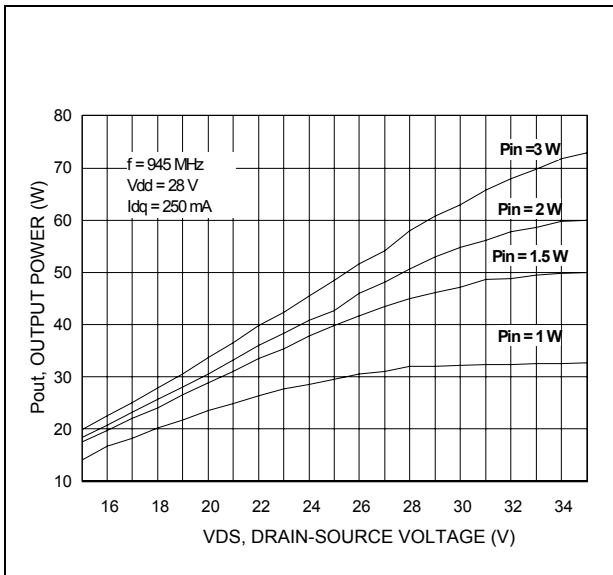
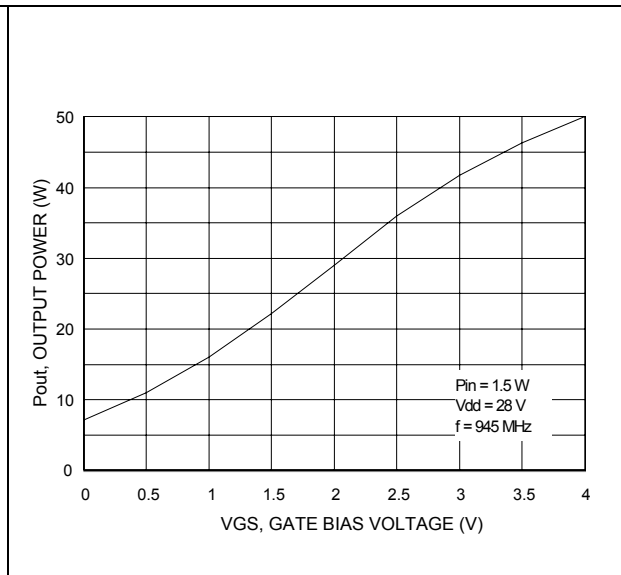


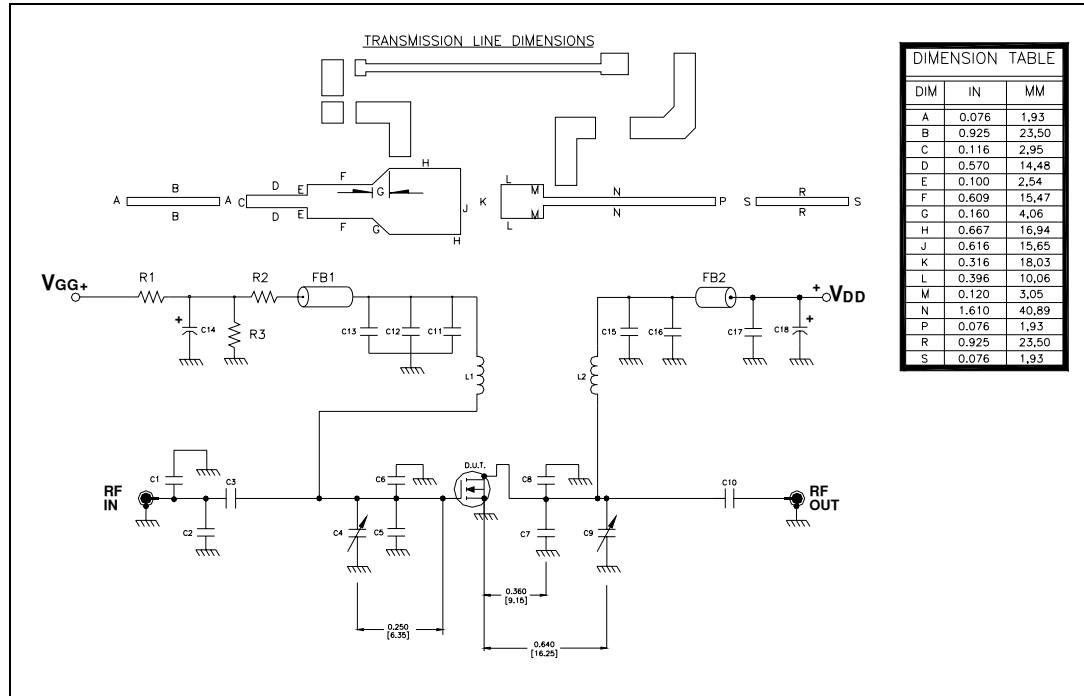
Figure 14. Output power vs gate bias voltage





# 5 Test circuit

Figure 15. Test circuit schematic



- Note:
- 1 Dimensions at component symbols are reference for component placement.
  - 2 Gap between ground & transmission line = 0.056 [1.42] +0.002 [0.05] -0.000 [0.00] typ.
  - 3 Dimensions of input and output component from edge of transmission lines.

**Table 7. 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 $\Omega$ , 1 W surface mount chip resistor
R2	4.7 M $\Omega$ , 1 W surface mount chip resistor
R3	120 $\Omega$ , 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 $\mu$ F/500 V surface mount ceramic chip capacitor
C14	10 $\mu$ F/50 V aluminum electrolytic radial lead capacitor
C16	100 pF ATC 100B surface mount ceramic chip capacitor
C18	220 $\mu$ F/63 V aluminum electrolytic radial lead capacitor
BOARD	ROGER, ultra lam 2000, THK 0.030", $\epsilon_r = 2.55$ 2 oz. ED Cu 2 sides.

**Figure 16. Test circuit**

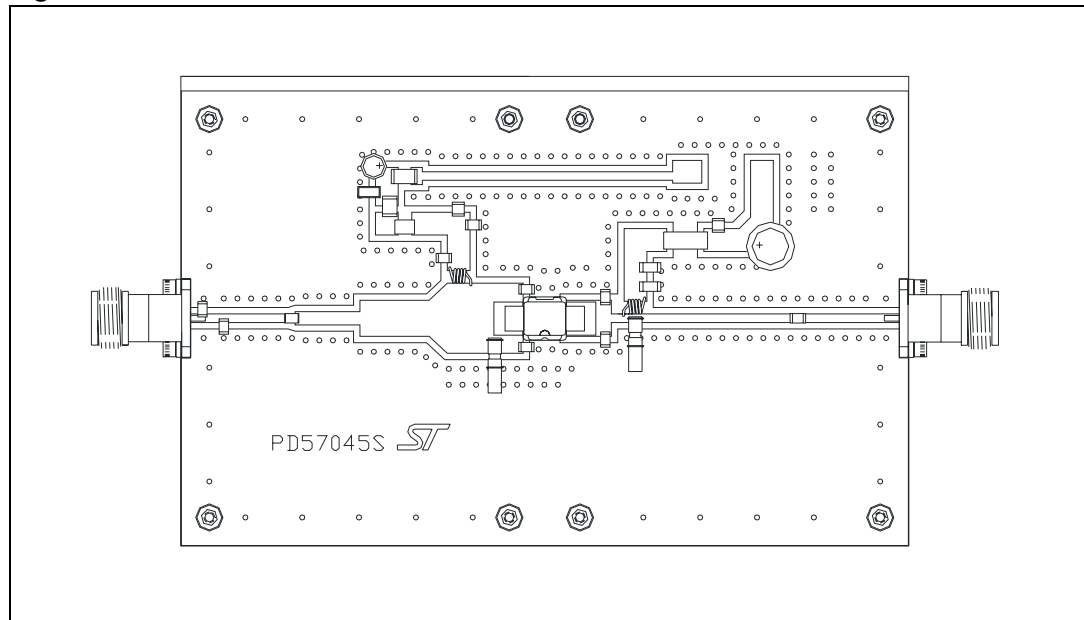
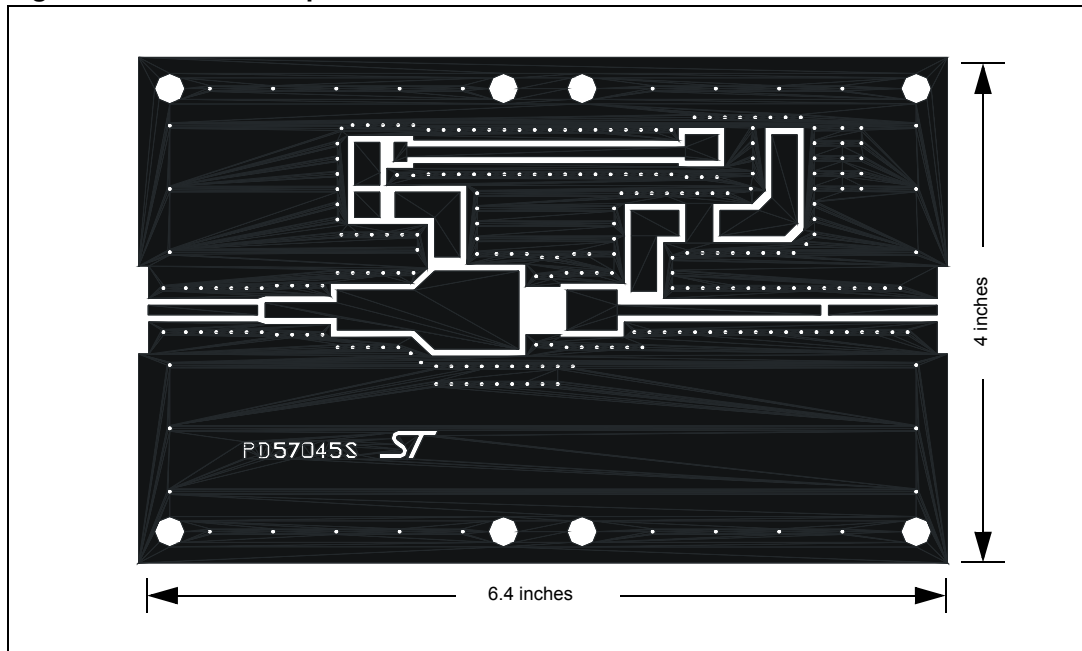


Figure 17. Test circuit photomaster



## 6 Common source s-parameter

### 6.1 STAP57045 ( $V_{DS} = 13.5V$ $I_{DS} = 1.5A$ )

Table 8. S-parameter

Freq (MHz)	$ S_{11} $	$S_{11}\angle\Phi$	$ S_{21} $	$S_{21}\angle\Phi$	$ S_{12} $	$S_{12}\angle\Phi$	$ S_{22} $	$S_{22}\angle\Phi$
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

## 6.2 STAP57045 ( $V_{DS} = 28\text{ V}$ , $I_{DS} = 1.5\text{ A}$ )

Table 9. S-parameter

Freq (MHz)	$ S_{11} $	$S_{11}\angle\Phi$	$ S_{21} $	$S_{21}\angle\Phi$	$ S_{12} $	$S_{12}\angle\Phi$	$ S_{22} $	$S_{22}\angle\Phi$
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

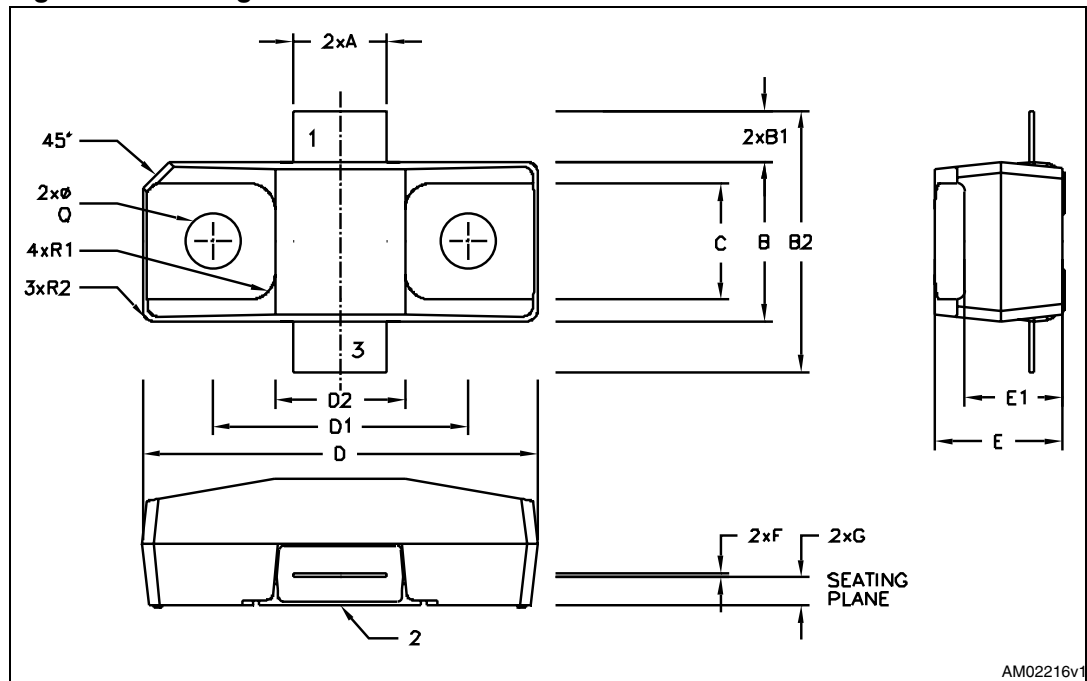
## 7 Package mechanical data

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

Table 10. STAP57045 package dimensions

Dim.	mm.		Inch	
	Min	Max	Min	Max
A	5.40	5.65	0.212	0.222
B	9.27	9.53	0.365	0.375
B1	2.90	3.10	0.114	0.122
B2	15.10	15.65	0.594	0.616
C	6.60	6.99	0.260	0.275
D	23.11	23.42	0.910	0.922
D1	14.88	15.19	0.586	0.598
D2	7.52	7.82	0.296	0.308
E	7.42	7.57	0.292	0.298
E1	5.69	5.84	0.224	0.230
F	0.21	0.31	0.008	0.012
G	1.62	1.72	0.064	0.068
Q	3.15	3.30	0.124	0.130
R1	1.52		0.060	
R2	0.64		0.025	

Figure 18. Package dimensions



## 8 Revision history

Table 11. Document revision history

Date	Revision	Changes
26-Mar-2009	1	Initial release



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