

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

### Features

- Excellent thermal stability
- Common source configuration
- $P_{OUT} = 60\text{ W}$  with 14.3 dB gain @ 945 MHz / 28 V
- ST advanced PowerSO-10 RF-STAP-package

### Description

The STAP57060 is a common source N-Channel, enhancement-mode lateral Field-Effect RF power MOSFET. 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. STAP57060 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)

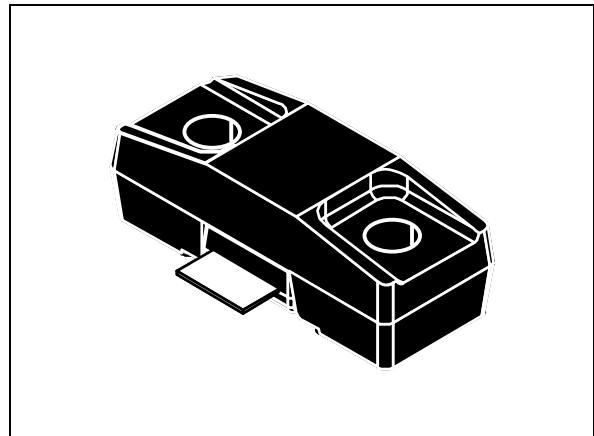


Figure 1. Pin connection

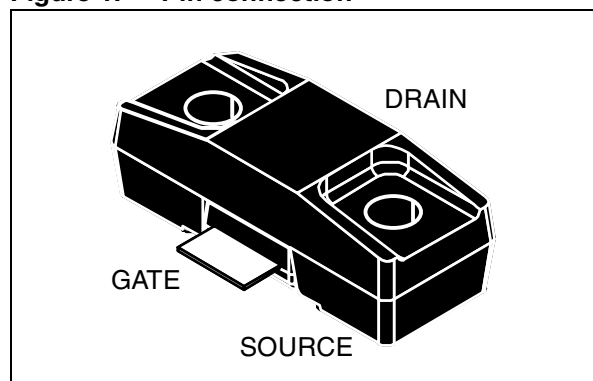


Table 1. Device summary

Order codes	Package	Packaging
STAP57060	STAP1	Tube

# 1 Contents

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## 2 Electrical data

### 2.1 Maximum ratings

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**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	7	A
$P_{DISS}$	Power dissipation ( $T_C = 70\text{ °C}$ )	79	W
$T_J$	Max. operating junction temperature	165	$^{\circ}\text{C}$
$T_{STG}$	Storage temperature	-65 to +150	$^{\circ}\text{C}$

### 2.2 Thermal data

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Junction-case thermal resistance	1.0	$^{\circ}\text{C/W}$

### 3 Electrical characteristics

( $T_{CASE} = 25\text{ °C}$ )

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#### 3.1 Static

**Table 4. Static**

Symbol	Test conditions		Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}$	$I_{DS} = 1\text{ mA}$	65			V
$I_{DSS}$	$V_{GS} = 0\text{ V}$	$V_{DS} = 28\text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	$V_{GS} = 20\text{ V}$	$V_{DS} = 0\text{ V}$			1	$\mu\text{A}$
$V_{GS(Q)}$	$V_{DS} = 28\text{ V}$	$I_D = 100\text{ mA}$	2.0		4.0	V
$V_{DS(ON)}$	$V_{GS} = 10\text{ V}$	$I_D = 3\text{ A}$		0.7	0.8	V
$G_{FS}$	$V_{DS} = 10\text{ V}$	$I_D = 3\text{ A}$	2.5			mho
$C_{ISS}$	$V_{GS} = 0\text{ V}$	$V_{DS} = 28\text{ V}$		83		pF
$C_{OSS}$	$V_{GS} = 0\text{ V}$	$V_{DS} = 28\text{ V}$		58		pF
$C_{RSS}$	$V_{GS} = 0\text{ V}$	$V_{DS} = 28\text{ V}$		3		pF

#### 3.2 Dynamic

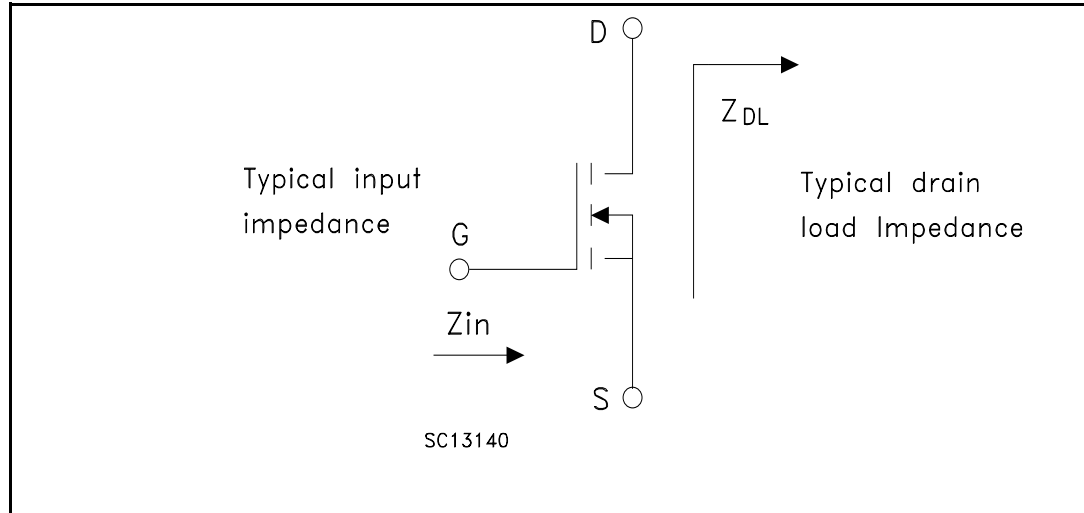
**Table 5. Dynamic**

Symbol	Test conditions		Min.	Typ.	Max.	Unit
$P_{OUT}$	$V_{DD} = 28\text{ V}$	$I_{DQ} = 100\text{ mA}$ $f = 945\text{ MHz}$	60		-	W
$G_{PS}$	$V_{DD} = 28\text{ V}$	$I_{DQ} = 100\text{ mA}$ $P_{OUT} = 60\text{ W}$ $f = 945\text{ MHz}$		14.3		dB
$\eta_D$	$V_{DD} = 28\text{ V}$	$I_{DQ} = 100\text{ mA}$ $P_{OUT} = 60\text{ W}$ $f = 945\text{ MHz}$		54		%
Load mismatch	$V_{DD} = 28\text{ V}$	$I_{DQ} = 100\text{ mA}$ $P_{OUT} = 60\text{ W}$ $f = 945\text{ MHz}$ All phase angles	5:1			VSWR

# 4 Impedances

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**Figure 2. Impedance data schematic**



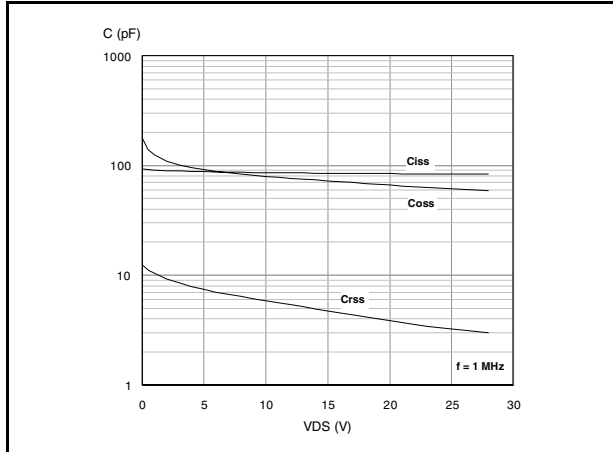
**Table 6. Impedance data**

f	Z <sub>IN</sub> (Ω)	Z <sub>DL</sub> (Ω)
890 MHz	0.646 + j 0.694	1.577 - j 0.997
925 MHz	0.568 + j 0.372	1.427 - j 1.459
945 MHz	0.705 + j 0.692	1.278 - j 1.935
960 MHz	0.591 + j 1.039	1.173 - j 2.464

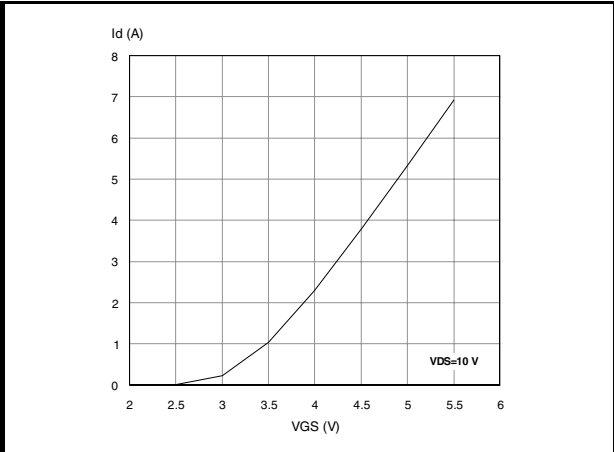
# 5 Typical performance

**Figure 3. Capacitance vs. supply voltage**

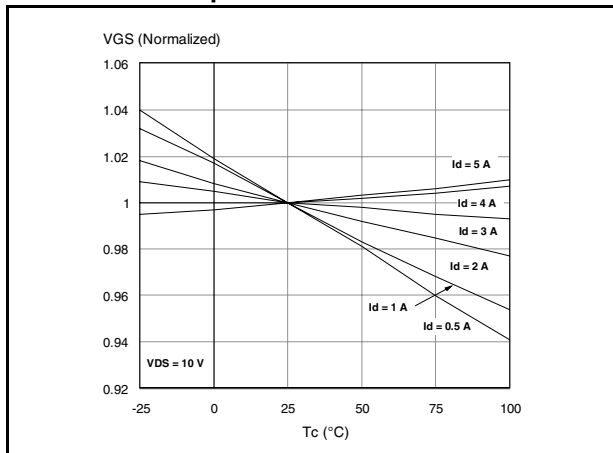
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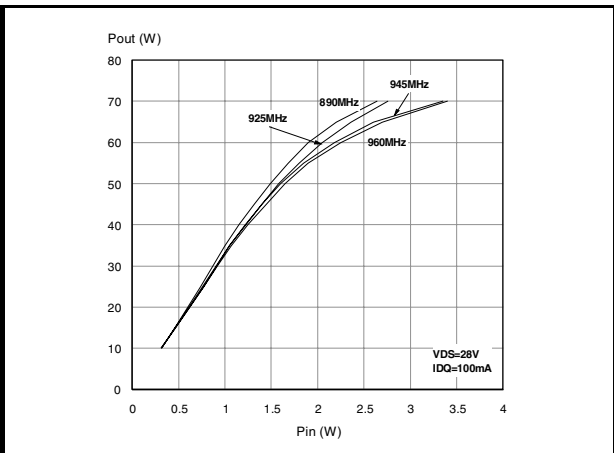
**Figure 4. Drain current vs. gate-source voltage**



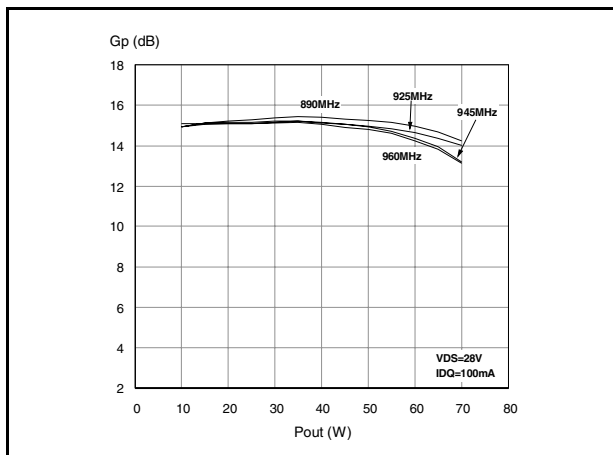
**Figure 5. Gate-source voltage vs. case temperature**



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



**Figure 7. Power gain vs. output power**



**Figure 8. Drain efficiency vs. output power**

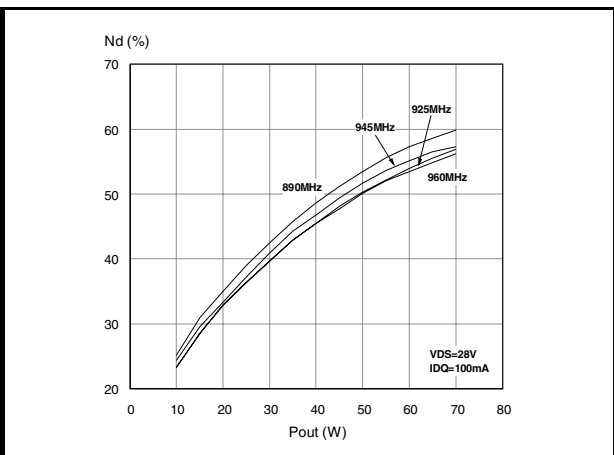


Figure 9. Input return loss vs output power

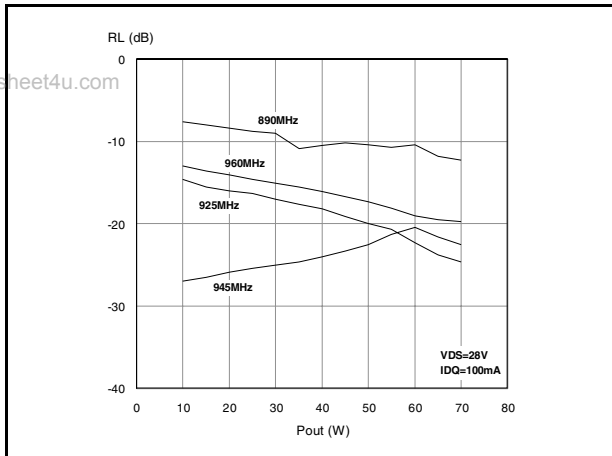


Figure 10. Output power vs bias current

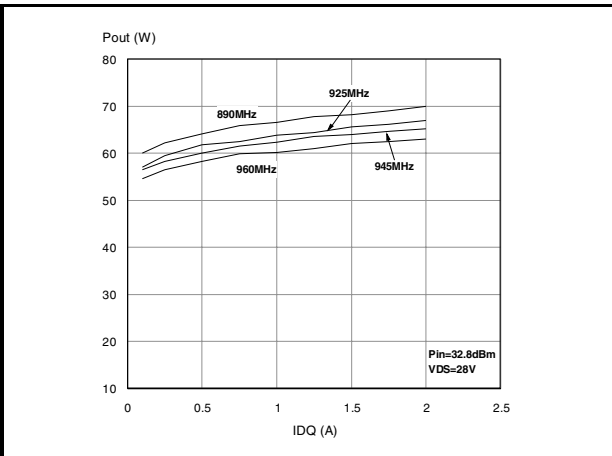


Figure 11. Drain efficiency vs bias current

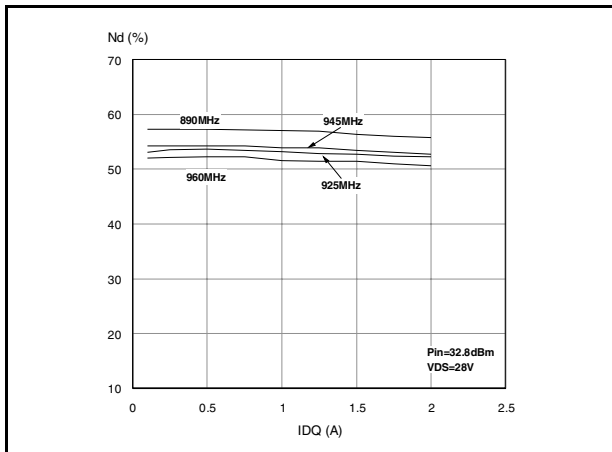


Figure 12. Output power vs supply voltage

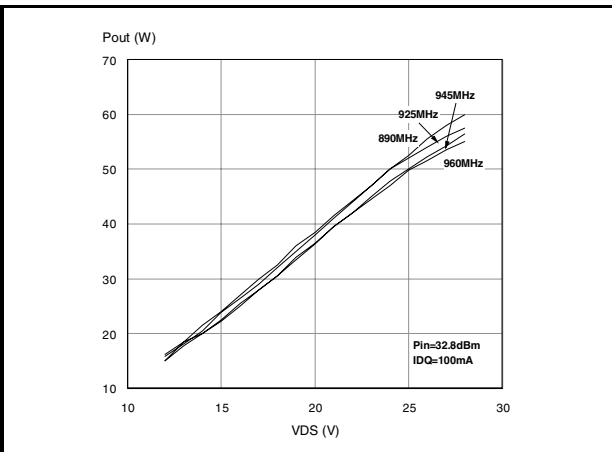


Figure 13. Drain efficiency vs supply voltage

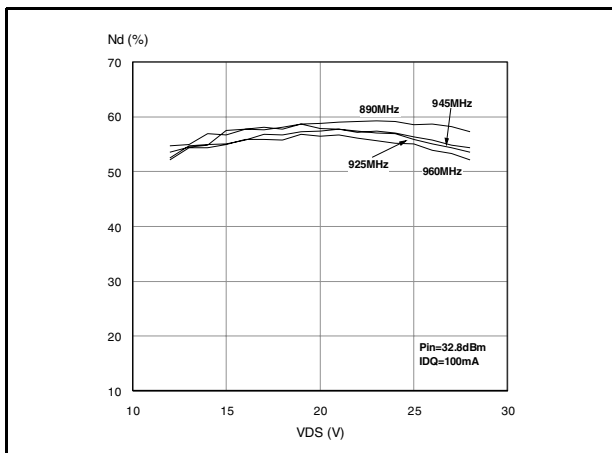
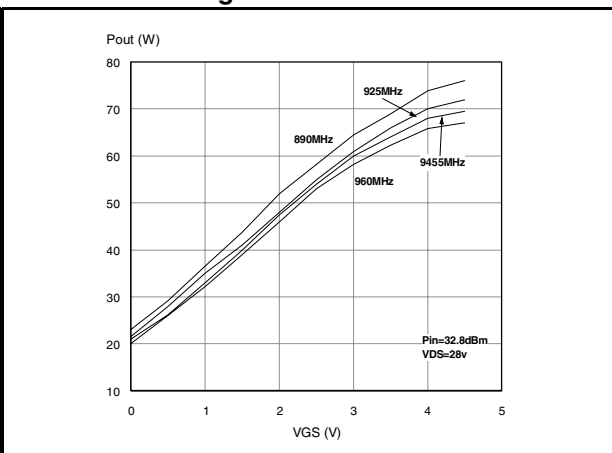


Figure 14. Output power vs gate-source voltage



# 6 Test circuit

Figure 15. Schematic test circuit

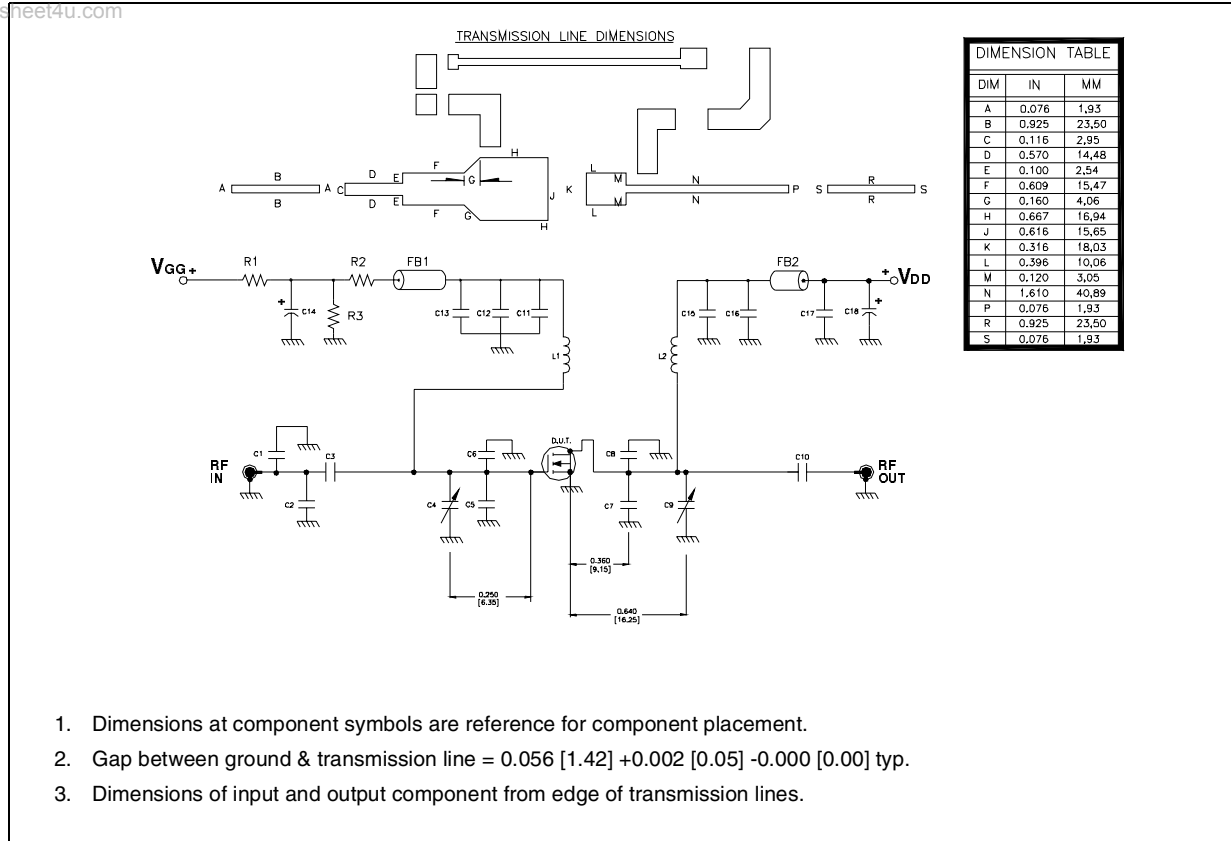


Table 7. Test circuit component part list

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 kΩ 1 W surface mount chip resistor
R2	4.7 MΩ 1 W surface mount chip resistor
R3	120 Ω 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 μF, 500 V surface mount ceramic chip capacitor
C14	10 μF, 50 V aluminum electrolytic radial lead capacitor
C16	100 pF ATC 100B surface mount ceramic chip capacitor
C18	220 μF, 63 V aluminum electrolytic radial lead capacitor
Board	Roger, Ultra Lam 2000, thk 0.030", εr = 2.55 2oz. ED Cu 2 sides.



Figure 16. Test circuit photomaster

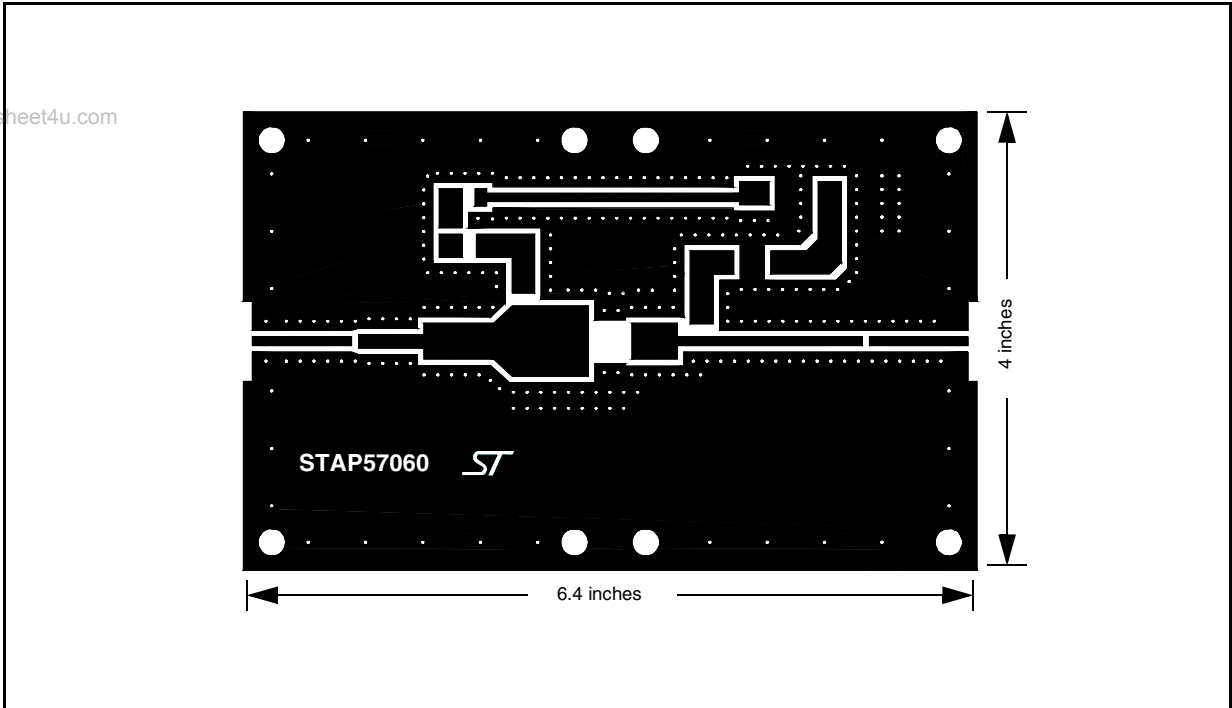
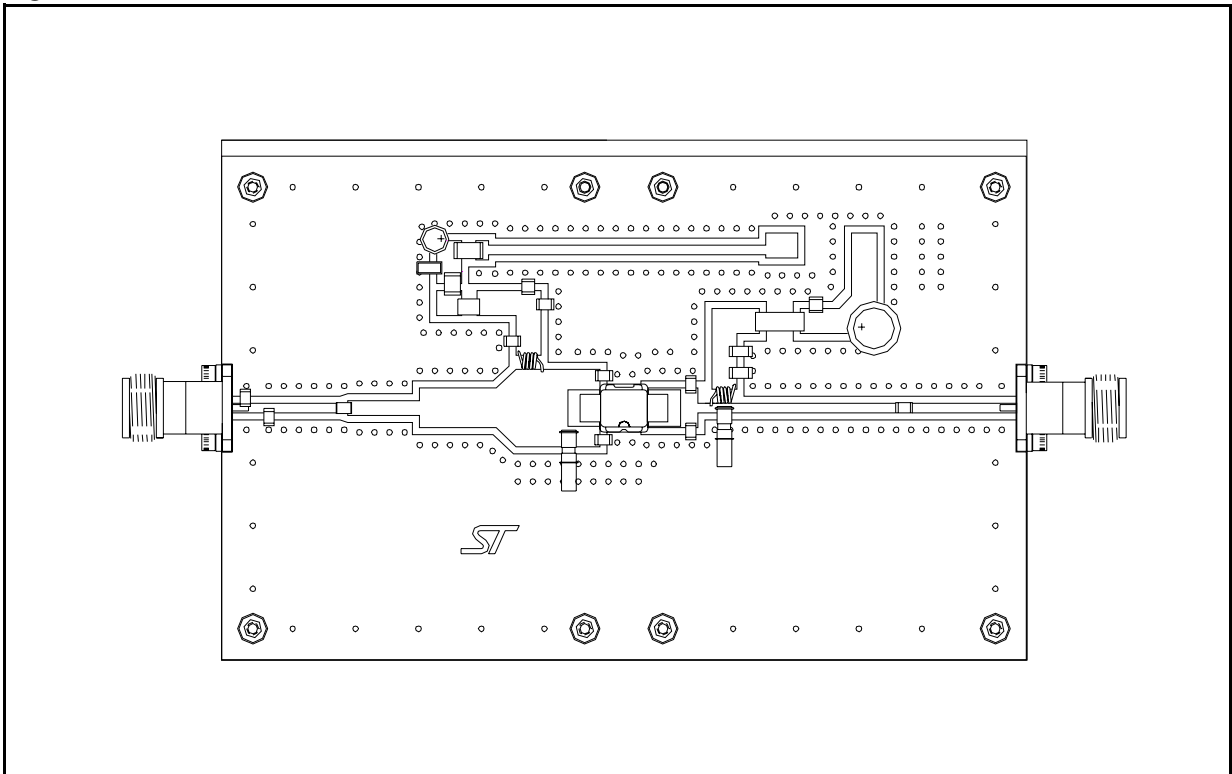


Figure 17. Test circuit



## 7 Common source s-parameters

Table 8. STAP57060 ( $V_{DS} = 28\text{ V}$   $I_D = 1.5\text{ A}$ )

FREQ (MHz)	$ S_{11} $	$S_{11}\angle\Phi$	$ S_{21} $	$S_{21}\angle\Phi$	$ S_{12} $	$S_{12}\angle\Phi$	$ S_{22} $	$S_{22}\angle\Phi$
150	0.876	-168	7.35	63	0.011	-19	0.744	-165
200	0.892	-170	5.08	54	0.011	-23	0.785	-166
250	0.912	-172	3.74	46	0.007	-32	0.823	-167
300	0.927	-173	2.84	39	0.007	-30	0.856	-168
350	0.938	-174	2.23	33	0.006	-30	0.880	-170
400	0.948	-175	1.79	28	0.004	-38	0.903	-171
450	0.956	-176	1.47	24	0.003	-34	0.922	-172
500	0.961	-177	1.22	20	0.003	-12	0.931	-173
550	0.966	-178	1.03	17	0.003	-17	0.938	-174
600	0.968	-179	0.88	14	0.002	-8	0.942	-175
650	0.971	-180	0.76	11	0.002	45	0.945	-176
700	0.974	180	0.67	9	0.003	47	0.954	-177
750	0.975	179	0.59	6	0.003	47	0.960	-178
800	0.976	178	0.52	4	0.003	75	0.963	-179
850	0.977	178	0.47	2	0.004	71	0.968	-180
900	0.977	177	0.42	0	0.005	65	0.971	180
950	0.979	177	0.38	-2	0.005	68	0.970	179
1000	0.978	176	0.34	-4	0.005	80	0.974	179
1050	0.978	176	0.31	-5	0.007	76	0.969	178
1100	0.978	175	0.29	-7	0.007	77	0.972	178
1150	0.978	175	0.27	-8	0.007	78	0.971	177
1200	0.977	174	0.24	-10	0.008	80	0.973	176
1250	0.976	174	0.23	-11	0.008	77	0.974	176
1300	0.974	173	0.21	-13	0.009	74	0.971	175
1350	0.974	173	0.19	-14	0.009	76	0.969	175
1400	0.972	172	0.18	-16	0.009	81	0.970	174
1450	0.971	172	0.17	-16	0.010	86	0.968	174
1500	0.968	171	0.15	-17	0.010	91	0.967	173

Table 9. STAP57060 ( $V_{DS} = 28\text{ V}$   $I_D = 2\text{ A}$ )

FREQ (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
150	0.881	-168	7.27	64	0.011	-20	0.744	-165
200	0.897	-170	5.03	54	0.009	-47	0.792	-166
250	0.915	-172	3.71	46	0.007	-32	0.823	-167
300	0.929	-173	2.82	39	0.007	-28	0.856	-168
350	0.939	-174	2.21	34	0.006	-30	0.879	-170
400	0.949	-175	1.78	29	0.004	-39	0.902	-171
450	0.956	-176	1.46	24	0.002	-30	0.920	-172
500	0.961	-177	1.21	20	0.003	-11	0.929	-173
550	0.966	-178	1.02	17	0.003	-16	0.937	-174
600	0.969	-179	0.87	14	0.001	-2	0.940	-175
650	0.972	-180	0.75	11	0.002	54	0.944	-176
700	0.974	180	0.66	8	0.003	47	0.953	-177
750	0.975	179	0.58	6	0.003	49	0.957	-178
800	0.976	178	0.51	4	0.003	78	0.962	-179
850	0.977	178	0.46	2	0.004	73	0.966	-180
900	0.977	177	0.41	0	0.005	64	0.969	180
950	0.979	177	0.37	-2	0.005	69	0.970	179
1000	0.978	176	0.34	-4	0.005	79	0.972	179
1050	0.979	175	0.31	-6	0.007	75	0.971	178
1100	0.978	175	0.28	-7	0.007	77	0.972	178
1150	0.977	175	0.26	-9	0.007	77	0.971	177
1200	0.977	174	0.24	-10	0.008	80	0.972	176
1250	0.975	174	0.22	-12	0.009	77	0.973	176
1300	0.974	173	0.20	-13	0.009	75	0.970	175
1350	0.974	173	0.19	-15	0.009	76	0.968	175
1400	0.972	172	0.18	-16	0.009	81	0.969	174
1450	0.971	172	0.16	-17	0.010	86	0.967	174
1500	0.969	171	0.15	-18	0.010	-89	0.968	173

Table 10. STAP57060 ( $V_{DS} = 13.8\text{ V}$   $I_D = 2\text{ A}$ )

FREQ (MHz)	$ S_{11} $	$S_{11}\angle\Phi$	$ S_{21} $	$S_{21}\angle\Phi$	$ S_{12} $	$S_{12}\angle\Phi$	$ S_{22} $	$S_{22}\angle\Phi$
150	0.880	-173	4.67	69	0.012	-17	0.829	-174
200	0.891	-173	3.36	61	0.013	-33	0.848	-174
250	0.904	-175	2.54	55	0.010	-26	0.868	-175
300	0.915	-175	1.99	49	0.009	-20	0.881	-175
350	0.924	-176	1.61	43	0.009	-28	0.894	-176
400	0.933	-177	1.32	38	0.007	-36	0.909	-176
450	0.940	-177	1.10	34	0.005	-27	0.915	-177
500	0.946	-178	0.93	30	0.005	-24	0.926	-178
550	0.953	-179	0.80	27	0.005	-28	0.937	-178
600	0.956	-179	0.69	23	0.004	-24	0.942	-179
650	0.961	-180	0.61	20	0.003	-5	0.949	-180
700	0.964	179	0.53	18	0.004	10	0.954	180
750	0.966	179	0.48	15	0.003	4	0.955	179
800	0.967	178	0.43	13	0.002	43	0.960	178
850	0.968	178	0.38	11	0.004	51	0.956	178
900	0.971	177	0.35	9	0.004	43	0.962	177
950	0.971	177	0.32	7	0.004	55	0.966	176
1000	0.971	176	0.29	5	0.004	70	0.968	176
1050	0.975	175	0.26	4	0.006	68	0.971	175
1100	0.973	175	0.24	2	0.006	63	0.970	175
1150	0.974	175	0.22	0	0.006	67	0.971	174
1200	0.973	174	0.21	-1	0.006	74	0.972	174
1250	0.973	174	0.19	-3	0.007	73	0.969	174
1300	0.971	173	0.18	-4	0.008	70	0.967	173
1350	0.970	173	0.17	-5	0.008	77	0.967	172
1400	0.969	172	0.15	-6	0.009	82	0.965	172
1450	0.968	172	0.14	-6	0.010	84	0.966	171
1500	0.967	171	0.13	-7	0.010	89	0.967	171

## 8 Package mechanical data

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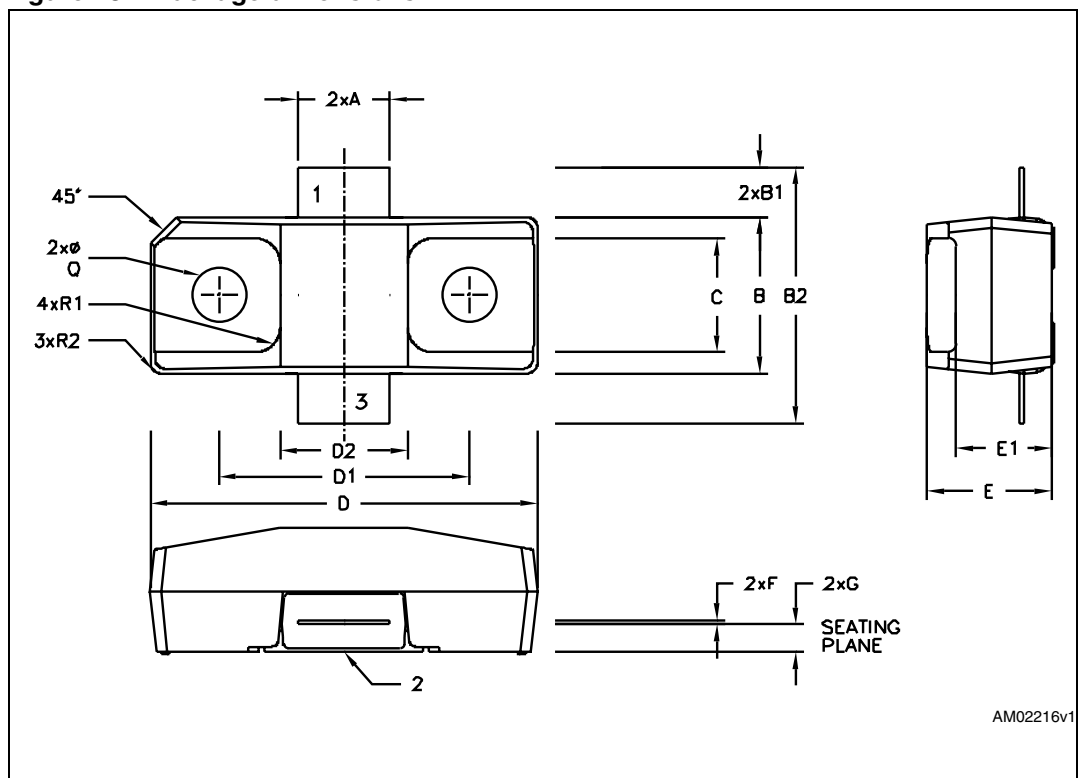
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK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

Table 11. STAP1 mechanical data

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	

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Figure 18. Package dimensions



## 9 Revision history

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**Table 12. Document revision history**

Date	Revision	Changes
12-May-2009	1	Initial release.

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