

RF POWER



10th July '12 STMicroelectronics



Products Overview by Applications

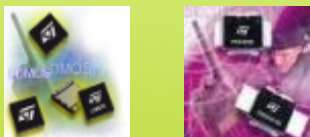
無線通信



Portable/Mobile Radios
Wireless Data Modem
Wireless Alarm Systems
HF/VHF Marine Radio
RFID & Meter Readers

• **LDMOS Plastic**
(7/12V, 2GHzまで)

PD5400x-E
PD550xx-E
PD840xx-E
PD850xx-E
PD200xx-E



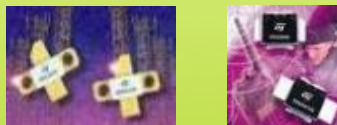
航空/レーダ & 放送通信



UHF Radar
IFF / Mode-S / TCAS
Broadband Comms
DME / TACAN / JTIDS

• **LDMOS**
Plastic/Ceramic
(up to 2GHz)

PD570xx-E
SD57xxx
LET Family



工業 & 医療



Plasma Generators
Magnetic Resonant Imaging
CO2 Laser Drivers
HF transceivers

• **DMOS 50V & 100V**

SD293x
SD294x
SD393x
SD49xx
STAC29xx
STAC39xx
STAC49xx



FM-TV 放送



FM Radio
VHF TV
UHF Digital TV

• **DMOS 50V & 100V**

SD293x
SD294x
SD393x
STAC29xx



• **LDMOS**
PD570xx
SD56120M





RF POWER

製造拠点のご紹介

Catania
Front-End

Casablanca
Back-End

Front-End & Back-end Overview

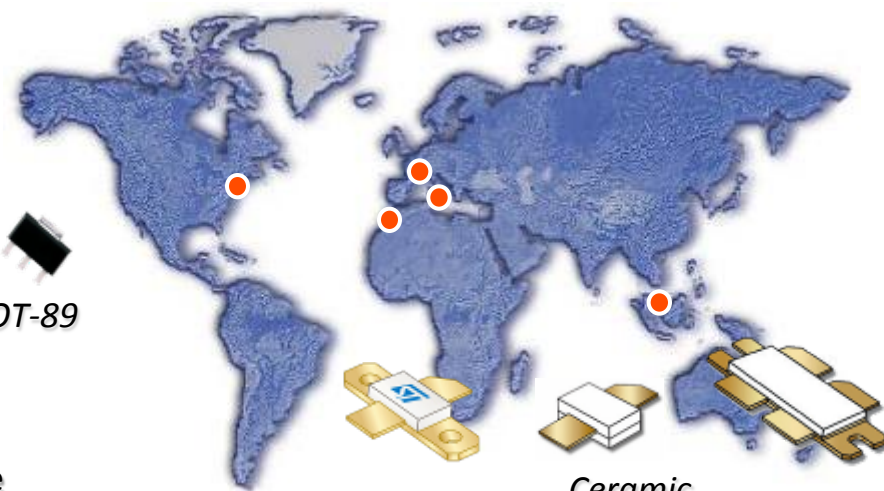
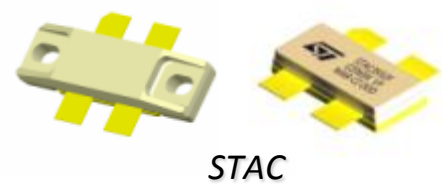
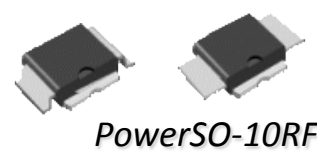
前工程 (Front-End) Catania – Italy
ISO9001/14001/16949 & EMAS certifications

6" & 8" high volume wafer fabs :
Class 100, 10 & 1. Product Management,
Marketing, R&D, QA & Reliability
RF DMOS & LDMOS **6 inch FAB**

Quakertown – USA
RF Power Competence Center

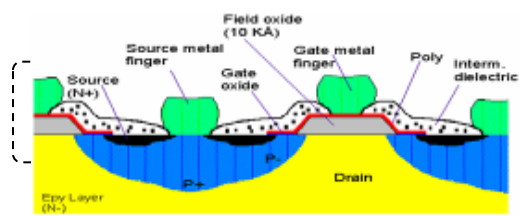
後工程 (Back-End)
• Plastic parts: internal and external
outsourcing

後工程 (Back-End) Casablanca - Morocco
ISO9002/14001/16949 & EMAS certifications
STMicroelectronics Back-End facility for high volume
discrete devices since 1956. Dedicated area for RF
products in **ceramic packages**.



DMOS

Ceramic LDMOS



CATANIA Site

- **ISO 9001**
- **ISO/TS 16949**
- **ISO 14001**
- **EMAS**



3.986
164.800 m²
49.362 m²
21.700 m²
24.500 wafers

People
Total Surface
Plant Surface
class 1 & 10 clean areas
Weekly capacity

CASABLANCA Site



2.607
180.000 m²
85.000 m²
8.100.000 pces

People
Total Surface
Plant Surface
Daily production

- **ISO 9002**
- **OHSAS 18001**
- **ISO/TS 16949**
- **ISO 14001**
- **EMAS**



RFパワー製品のご紹介



Radio Base Station



Mobile Terminal



Fixed Terminal (Control Center)

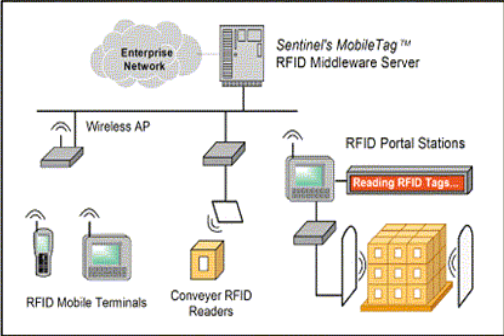


Portable Terminal



携帯型トランシーバ向・製品(携帯バッテリーパック駆動)

UHF RFID Reader



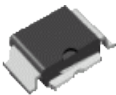
Marine radios



Public Safety & Commercial



Product	Frequency	Pout	Vdd	Gain	Efficiency	Package	Samples
START499ETR	1900 MHz	26dBm	3.6V	12dB	68%	SOT-343	Now
START499D	900 MHz	29dBm	3.6V	14dB	65%	SOT-89	Now
PD84001	870 MHz	>1W	7.2V	15dB	60%	SOT-89	Now
PD84002	870 MHz	2W	7.2V	15dB	65%	SOT-89	Now
PD54003-E	500 MHz	>3W	7.5V	12dB	55%	PowerSO-10RF	Now
PD54003L-E	500 MHz	>3W	7.2V	16dB	60%	PowerFLAT 5x5	Now
PD54008-E	500 MHz	8W	7.5V	12dB	55%	PowerSO-10RF	Now
PD54008L-E	500 MHz	>8W	7.2V	16dB	60%	PowerFLAT 5x5	Now
PD84006L-E	870 MHz	6W	7.2V	13dB	>55%	PowerFLAT 5x5	Now
PD84008L-E	870 MHz	>8W	7.2V	13dB	>55 %	PowerFLAT 5x5	Now
PD84008-E	870 MHz	>8W	7.2V	15dB	>60 %	PowerSO-10RF	Now
PD84010-E	870 MHz	>10W	7.2V	14dB	>60 %	PowerSO-10RF	Now



車載トランシーバ向・製品(車載バッテリー駆動)

Alarm Systems



Marine radios



Public Safety & Commercial



Product	Frequency	Pout	Vdd	Gain	Efficiency	Package	Samples
PD55003-E	500 MHz	>3W	12.5V	16dB	>55%	PowerSO-10RF	Now
PD55003L-E	500 MHz	>3W	12.5V	17dB	>55%	PowerFLAT 5x5	Now
PD55008-E	500 MHz	>8W	12.5V	17dB	>55%	PowerSO-10RF	Now
PD55008L-E	500 MHz	>8W	12.5V	17dB	>55%	PowerFLAT 5x5	Now
PD55015-E	500 MHz	>15W	12.5V	14dB	>55%	PowerSO-10RF	Now
PD55025-E	500 MHz	>25W	12.5V	14dB	>55%	PowerSO-10RF	Now
PD55035-E	500 MHz	>35W	12.5V	15dB	>55%	PowerSO-10RF	Now
PD85004	870 MHz	4W	13.6V	15dB	>60%	SOT-89	Now
PD85006L-E	870 MHz	6W	13.6V	15dB	>55%	PowerFLAT 5x5	Now
PD85006-E	870 MHz	6W	13.6V	15dB	>55%	PowerSO-10RF	Now
PD85015-E	870 MHz	>15W	13.6V	14.5dB	>60%	PowerSO-10RF	Now
PD85025-E	870 MHz	>25W	13.6V	14.5dB	>60 %	PowerSO-10RF	Now
PD85035-E	870 MHz	>35W	13.6V	14.5dB	>60 %	PowerSO-10RF	Now
PD20010	2 GHz	>10W	13.6V	11dB	>50 %	PowerSO-10RF	Now
PD20015	2 GHz	>15W	13.6V	11dB	>50 %	PowerSO-10RF	Now
PD20015C						M243 Ceramic	Now



HF 送信機向・高電圧駆動 1.6-30MHz

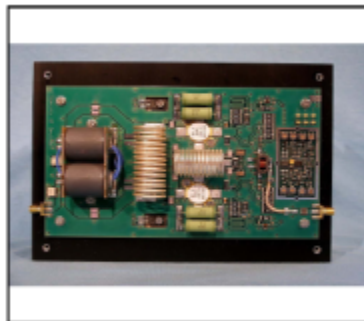


STEVAL-TDR004V1

RF power amplifier demonstration board using two SD2933 N-channel enhancement-mode lateral MOSFETs

Features

- Excellent thermal stability
- Frequency: 1.6 - 54 MHz
- Supply voltage: 48 V
- Output power: 400 W (typ.)
- Input power 10 W max.
- Efficiency: 57 % - 76 %
- IMD at 300 WPEP < -26 dBc
- Load mismatch: 3:1 (all phases)



Product	Freq.	Pout	Vdd	Gain	Efficiency	Package	VSWR
SD2931-10	175 MHz	>150W	50V	14dB	65%	M174 _{low RTH}	10:1
SD4931 New BVDSS > 200V	175 MHz	>150W	50V	14dB	56%	M174 _{low RTH}	20:1
SD2933	30 MHz	>300W	50V	24dB	>60%	M177	3:1
SD4933 New BVDSS > 200V	30 MHz	>300W	50V	24dB	60%	M177	20:1
SD2941-10	175 MHz	>175W	50V	15dB	65%	M174 _{low RTH}	10:1
SD2943	30 MHz	>350W	50V	25dB	>60%	M177	3:1
SD3931-10	150 MHz	>175W	100V	21dB	55%	M174 _{low RTH}	3:1
SD3933	30 MHz	>350W	100V	29dB	70%	M177	3:1



M177



M174

高周波電源用(高電圧駆動)

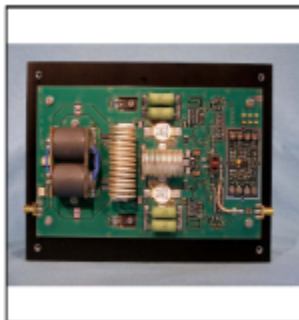


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Solar Cells



CO2 Laser Excitation



Plasma Generators



Induction Heating

Product	Freq.	Pout	Vdd	Gain	Efficiency	Package	VSWR
SD2931-10	175 MHz	>150W	50V	14dB	65%	M174 _{low} RTH	10:1
SD4931 New BVDSS > 200V	175 MHz	>150W	50V	14dB	56%	M174 _{low} RTH	20:1
SD2933	30 MHz	>300W	50V	24dB	>60%	M177	3:1
SD4933 New BVDSS > 200V	30 MHz	>300W	50V	24dB	60%	M177	20:1
SD2941-10	175 MHz	>175W	50V	15dB	65%	M174 _{low} RTH	10:1
SD2943	30 MHz	>350W	50V	25dB	>60%	M177	3:1
SD3931-10	150 MHz	>175W	100V	21dB	55%	M174 _{low} RTH	3:1
SD3933	30 MHz	>350W	100V	29dB	70%	M177	3:1



M177



M174

SD49xx family

The ST advantages

1. 利得、出力飽和レベルの向上
2. 優れた放熱特性
3. 向上した耐力 – 20:1 (全位相)
4. 向上した信頼性
5. ブレークダウン電圧仕様 > 200V

Applications

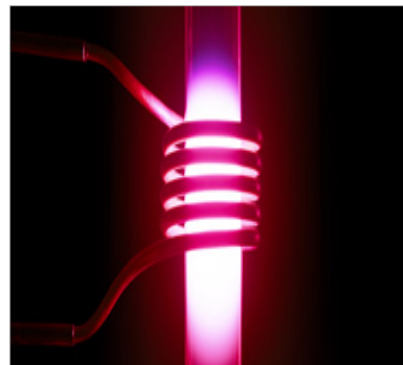
1. 高出力無線送信機、高周波アンプ
2. Plasma Enhanced CV
3. Plasma sputtering
4. Laser for industrial cutting



Semiconductors

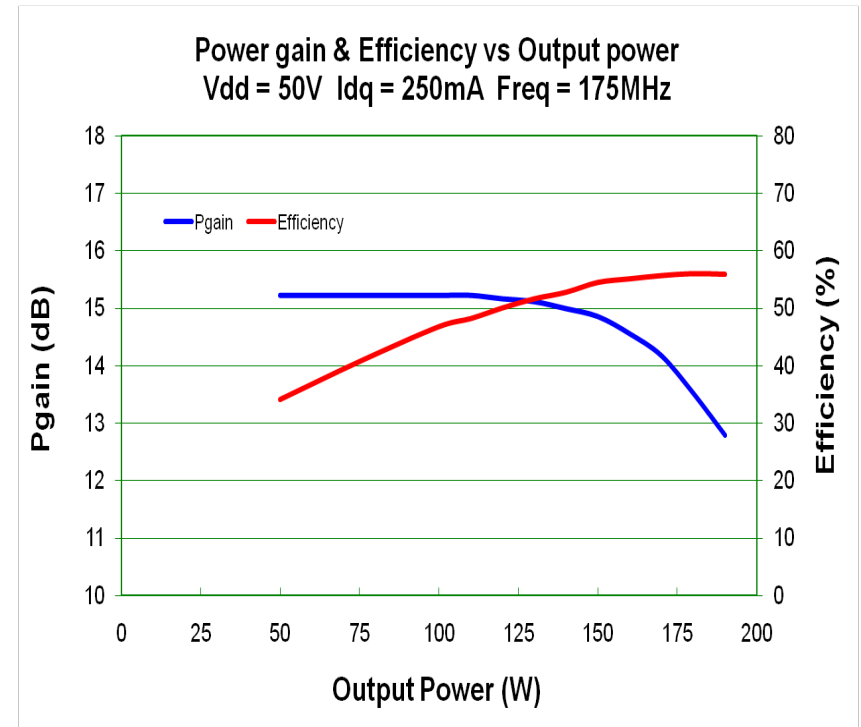
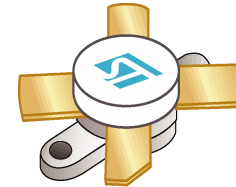


Flat Panel Displays



SD4931

- 非常に高いブレークダウン電圧 **$BVDSS > 200V$**
- 仕様化・周波数 = 175 MHz
- 適用ドレイン電圧 $< 80 V$
- $P_{OUT} > 150W$ @ $V_{DD} = 50V$
- 電力利得 $> 14dB$
- 効率 $> 55\%$
- Load mismatch **20:1 (全位相)**

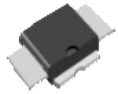
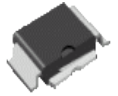


広帯域無線通信用(28~32V駆動) *HF to 2000MHz*

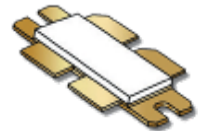
LDMOS PRODUCTS FAMILY

for *Broadband Comms Applications*

Product	Freq.	Pout	Vdd	Gain	Efficiency	Package	Samples
<i>PD57002-E</i>	945 MHz	>2W	28V	15dB	55%	PowerSO-10RF	Now
<i>PD57006-E</i>	945 MHz	>6W	28V	15dB	55%	PowerSO-10RF	Now
<i>PD57018-E</i>	945 MHz	>18W	28V	16dB	55%	PowerSO-10RF	Now
<i>PD57030-E</i>	945 MHz	>30W	28V	14dB	55%	PowerSO-10RF	Now
<i>SD57030</i>	945 MHz	>30W	28V	15dB	60%	M243	Now
<i>PD57045-E</i>	945 MHz	>45W	28V	14dB	55%	PowerSO-10RF	Now
<i>SD57045</i>	945 MHz	>45W	28V	15dB	60%	M243	Now
<i>PD57060-E</i>	945 MHz	>60W	28V	14dB	55%	PowerSO-10RF	Now
<i>SD57060</i>	945 MHz	>60W	28V	15dB	60%	M243	Now
<i>SD56120</i>	860 MHz	>100W	28V	16dB	60%	M246	Now
LET family ^{NEW}							
<i>LET9045 *</i>	960 MHz	>45W	28V	18dB	65%	PowerSO-10RF	Now
<i>LET9045C/F</i>	960 MHz	>45W	28V	18dB	65%	M243/M250	Now
<i>LET9060 *</i>	960 MHz	>60W	28V	18dB	65%	PowerSO-10RF	Now
<i>LET9060C/F</i>	960 MHz	>60W	28V	18dB	65%	M243/M250	Now
<i>LET20030C/F *</i>	2000 MHz	>30W	28V	15dB	50%	M243 / M250	Now
<i>LET20045C/F *</i>	2000 MHz	>45W	28V	15dB	50%	M243 / M250	Now
<i>LET9120</i>	860 MHz	>120W	32V	18dB	65%	M246	Now
<i>LET9150</i>	860 MHz	>150W	32V	18dB	65%	M246	Now



PowerSO-10RF



M246



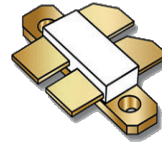
M250



M243

** In development*

LET family



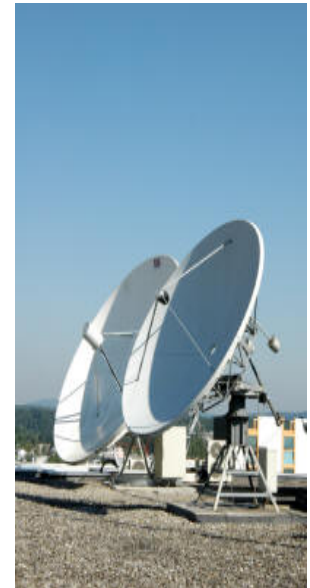
The ST advantages

1. 利得、出力飽和レベルの向上
2. 優れた放熱特性
3. 向上した耐力 20:1 (全位相)
4. 向上した信頼性
5. ブレークダウン電圧仕様 $BVDSS > 80V$
6. Die 供給可能

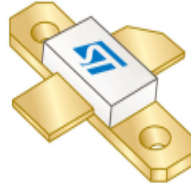


Applications ~2GHz

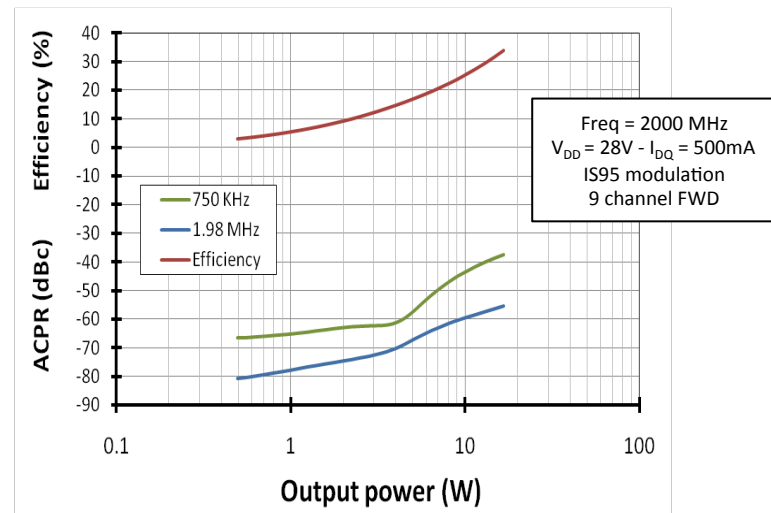
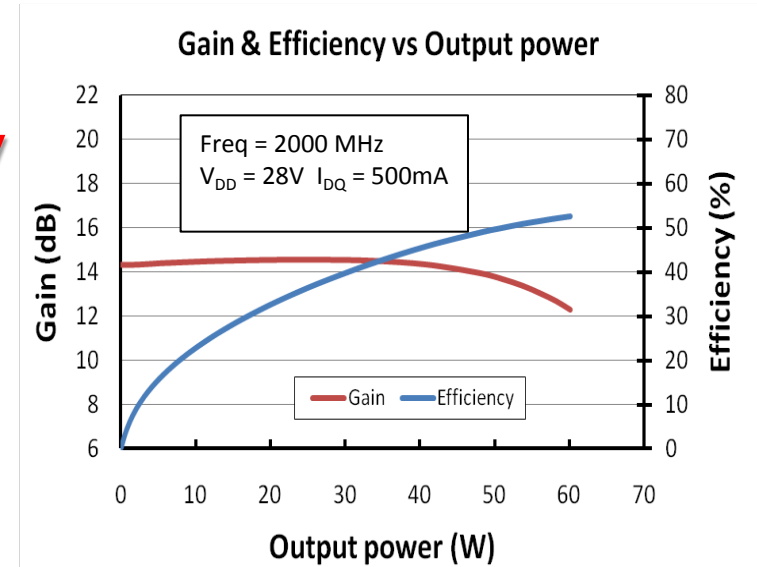
1. Broadband communications
2. Cellular repeaters
3. Private Mobile Radio (PMR) base stations
4. L-Band satellite uplink radios



LET20045



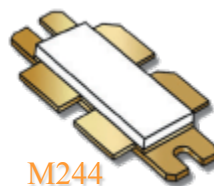
- 高いブレークダウン電圧 **$BVDSS > 80V$**
- 仕様化した周波数 = 2000 MHz
- 適用ドレイン電圧 $< 36 V$
- $P_{OUT} > 45W @ V_{DD} = 28V$
- 電力利得 $> 12dB$
- 効率 $> 45\%$
- Load mismatch **20:1 (全位相)**



1.5T & 3T MRI 用(高電圧駆動)



STAC244B



M244



STAC244F



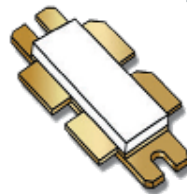
Product	Frequency	Pout	Vdd	Gain	Efficiency	Package	Production
SD3932	123 MHz	>800W / 900W typ 1msec - 10%	100V	23dB	65%	M244	Now
STAC3932B	123 MHz	>800W / 900W typ 1msec - 10%	100V	23dB	65%	STAC244B	Now
STAC3932F	123 MHz	>800W / 900W typ 1msec - 10%	100V	23dB	65%	STAC244 F SMD	Now
New STAC4932B	123 MHz	>1KW / 1.2KW typ. 1msec - 10%	100V	24dB	65%	STAC244B	Now
New STAC4932F	123 MHz	>1KW / 1.2KW typ. 1msec - 10%	100V	24dB	65%	STAC244F SMD	Now

新しいパッケージのご紹介

RF POWER

- Today's DMOS solution is based on ceramic package
- Lower $R_{\theta J-C}$ (-25% vs ceramic) : 従来より低い熱抵抗
- Higher MTTF (4 times higher) : 低熱抵抗 $\Rightarrow$ 低ジャンクション温度 $\Rightarrow$ 高信頼性
- COST EFFECTIVE solution : 安価でご提供

Ceramic

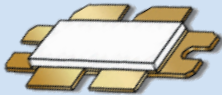
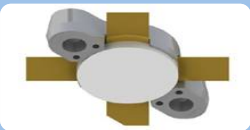
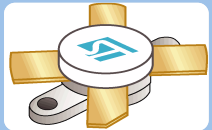
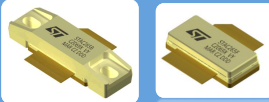


STAC244B
Boltdown



STAC244F
SMD

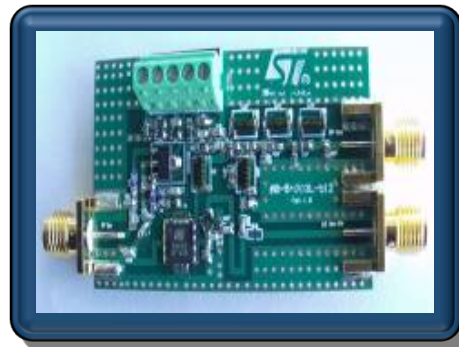
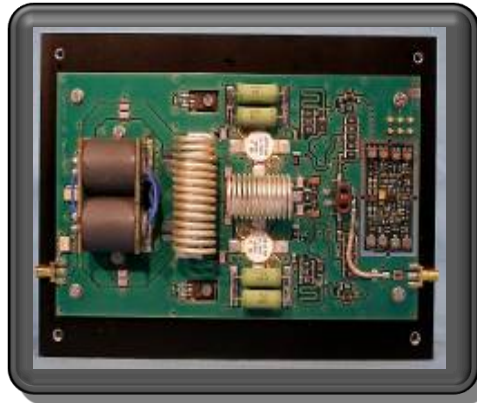
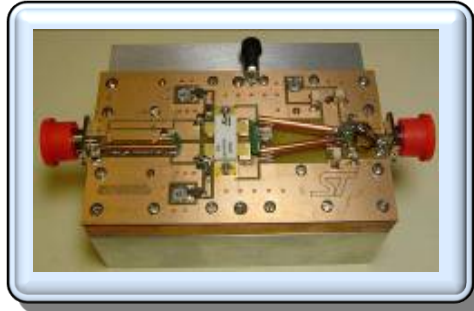
STAC Package Developments

STAC P/N	STAC Photo	Ceramic Replacement	Ceramic Photo	Product P/N	Samples Production
STAC244 DMOS		M244 SOT262A1 GEMINI		STAC2932B STAC2942B STAC3932B STAC4932B	Now
STAC177 LV/HV DMOS		M177		STAC2933B STAC2943B STAC3933B STAC4933B	Q2'12
STAC265 LDMOS		M265		STAC1011-350 STAC0912-250 STAC1214-250	Q2'12

技術サポート

Applications

- **900MHz BTS**
- **SSB transmitter**
- **Plasma generator**
- **MRI**
- **Ham radio**
- **FM Broadcast**
- **IFF Mode-S**
- **Etc...**



Support

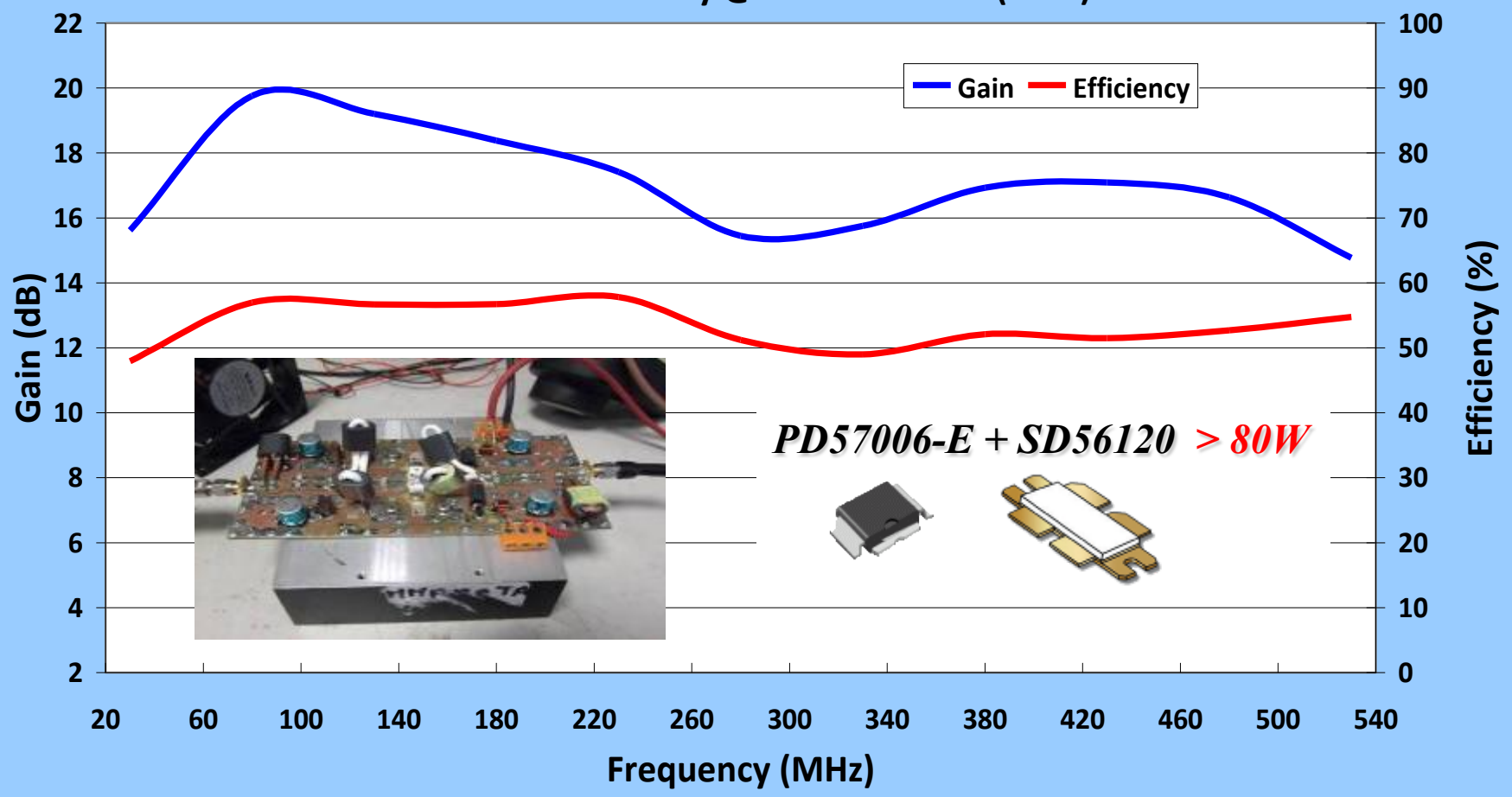
- **Demo boards**
- **Reference designs**
- **Spice / ADS models**
- **S-parameters**
- **Gerber files**
- **Schematics & BOM's**
- **Etc...**

SD56120

Push Pull 30-520MHz

Vdd = 28V
Idq = 2x 200mA

Gain and Efficiency @ Pout = 49dBm (80W)



PD57006-E + SD56120 > 80W

STEVAL-TDR029V1

700W - 48V demo board using 2x STAC2942B for FM Broadcast 87.5 - 108 MHz application.

DESCRIPTION

RF Power evaluation board using 2x STAC2942B

FEATURES

- MOSFET Technology , Class AB operation
- Frequency range: 87.5 to 108 MHz
- Output Power > 700W
- Gain : 20 +/- 1dB
- Supply Voltage : 48 V
- Efficiency :> 70%



STAC2942B

- **STAC2942B** is housed in new **ST Air Cavity** package
- **Cost effective** solution vs Ceramic package
- **25% lower** thermal resistance





RF POWER

Technology Roadmap



LDMOS Technology Roadmap



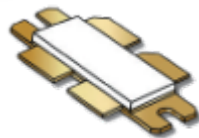
DMOS Technology Roadmap



In development

DMOS HF

- BVDSS > 100V
- VDD 28V to 36V
- Pout > 150W
- Gain > 15dB @ 150MHz
- VSWR 20:1



28V

4926

In Production

- BVDSS > 200V
- VDD 50V to 80V
- Pout > 150W
- Gain > 14dB @ 150MHz
- VSWR 20:1

In Development

DMOS HF

- BVDSS > 125V
- Pout > 350W
- Gain > 20dB @ 108MHz

In Production

1931/1941

- BVDSS > 130V
- Pout > 200W
- Gain 16dB @ 175MHz

50V

4925

In Production

- BVDSS > 250V
- VDD 100V
- Pout > 200W
- Gain > 22dB @ 150 MHz

In Development

5907

- BVDSS > 700V
- VDD 165V
- Pout > 250W
- Gain > 15dB @ 128MHz



100V / 165V



In Development

VJLL

- BVDSS > 1200V
- VDD 300V
- Pout > 1KW
- Gain > 15dB @ 40MHz

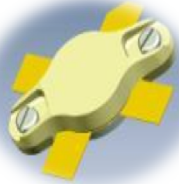


300V

VJLL : 300V DMOS technology

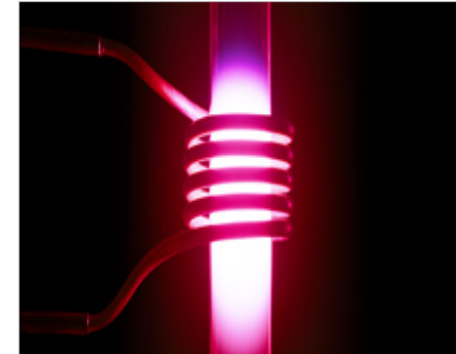
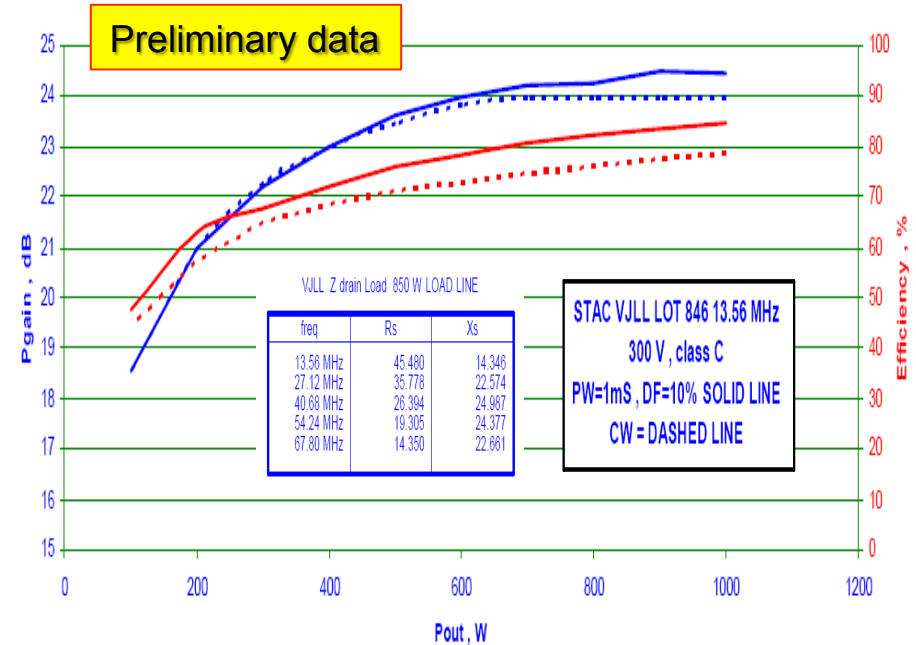
TARGET SPECIFICATION

- BVDSS > 1000V
- Frequency = 13.56 MHz
- POUT > 750W at VDD=250V
- Power gain > 20dB, Efficiency > 75%
- STAC177 package



Applications

- Plasma Enhanced CVD + Plasma sputtering
- Industrial induction heating
- Flat panel display & Solar cells manufacturing



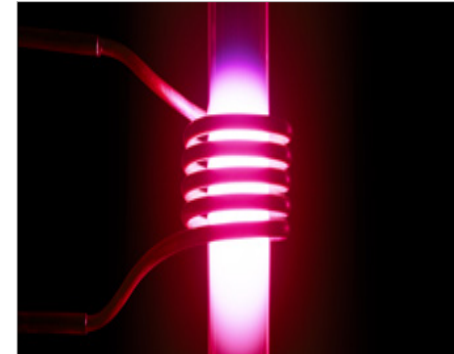
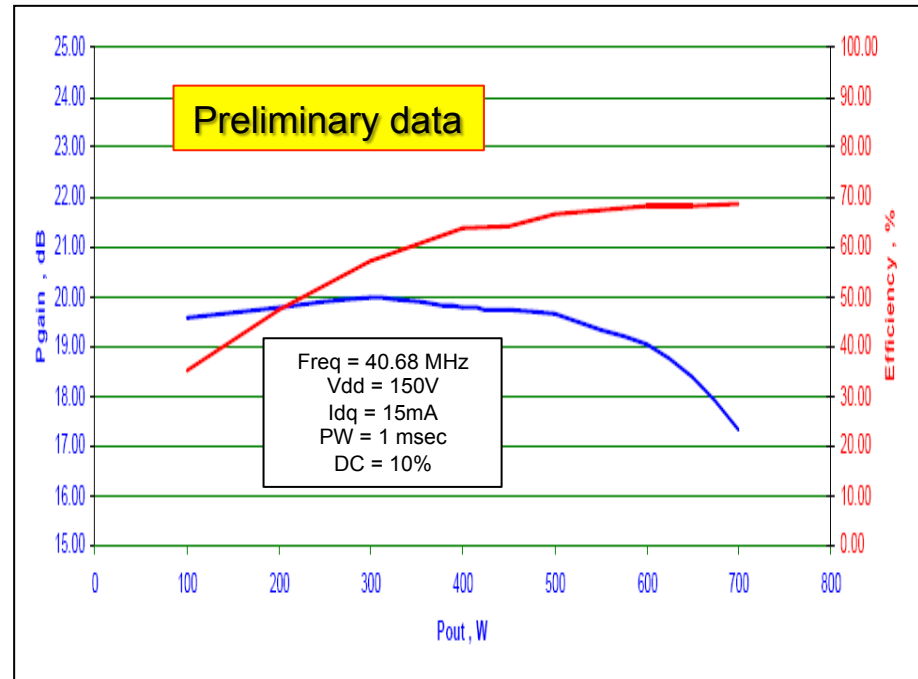
5907 : 150V DMOS technology

TARGET SPECIFICATION

- BVDSS > 700V
- Frequency = 40.68 MHz
- POUT > 450W at VDD=150V
- Power gain > 18dB, Efficiency > 60%
- STAC177 package

Applications

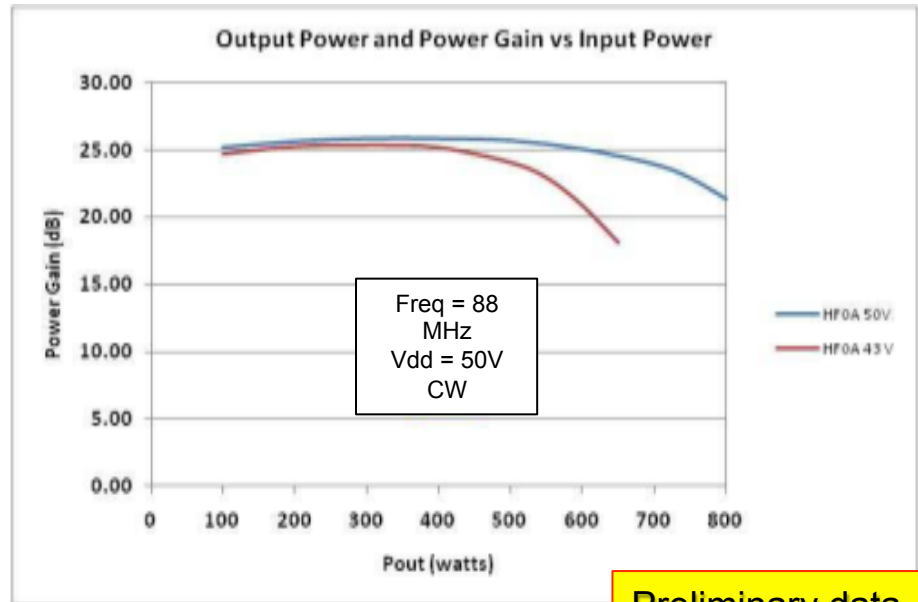
- Plasma Enhanced CVD
- Plasma sputtering
- Flat panel display & Solar cells manufacturing



DMOS HF 50V technology

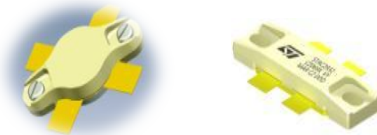
TARGET SPECIFICATION

- Frequency 30 MHz 88 – 108 MHz
- POUT > 500W > 600W
- Power gain > 20dB > 20dB
- Efficiency > 65% > 60%
- Package STAC177 STAC244B



Preliminary data

Applications



- Plasma Enhanced CVD + Plasma sputtering
- Laser for Industrial cutting
- Flat panel display & Solar cells manufacturing



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THANK YOU !



Evaluation boards : www.st.com/evalboards