



STEVAL-TDR011V1

2-stage RF power amplifier with LPF based on the PD85006L-E and STAP85050 RF power transistors

Features

- Excellent thermal stability
- Frequency: 400 - 470 MHz
- Supply voltage: 13.6 V
- Output power: 50 W
- Current: < 10 A
- Input power: 20 dBm
- Harmonics level < -45 dBc
- Output low-pass filter
- Power detection
- Temperature sensor

Description

The STEVAL-TDR011V1 demonstration board is a two-stage 50 W RF power amplifier which includes an output LPF (low-pass filter) for harmonics rejection. It also features power detection and a temperature sensor.

The main purpose of the board is to demonstrate the functioning and performance of the PD85006L-E and the STAP85050 devices from the LdmoST plastic family of RF power transistors.

The application is specifically designed for 2-way analog and digital mobile radios.

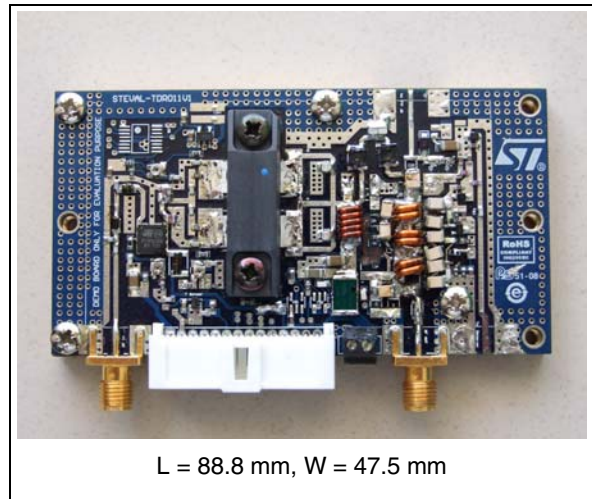


Table 1. Device summary

Order code
STEVAL-TDR011V1

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1 Electrical data

1.1 Maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DD}	Supply voltage ⁽¹⁾	16	V
I_D	Drain current	12	A
T_{CASE}	Operating case temperature	-10 to +85	°C
T_A	Max. ambient temperature	+55	°C

1. Value related to the voltage regulator LD2980ABM50TR used in the application.

1.2 Electrical characteristics

$T_A = +25\text{ °C}$, $V_{DD} = 13.6\text{ V}$, V_{APC} adjusted

Table 3. Electrical specifications

Symbol	Test conditions	Min.	Typ.	Max.	Unit
Freq.	Frequency range	400		470	MHz
P_{IN}	@ $P_{OUT} = 50\text{ W}$		20		dBm
I_{TOTAL}	@ $P_{OUT} = 50\text{ W}$			10	A
Gain	@ $P_{OUT} = 50\text{ W}$		27		dB
Harmonics	@ $P_{OUT} = 50\text{ W}$		-50 / -74		dBc

2 Typical performance

Figure 1. Output power and drain current vs. frequency **Figure 2. Gain vs. frequency**

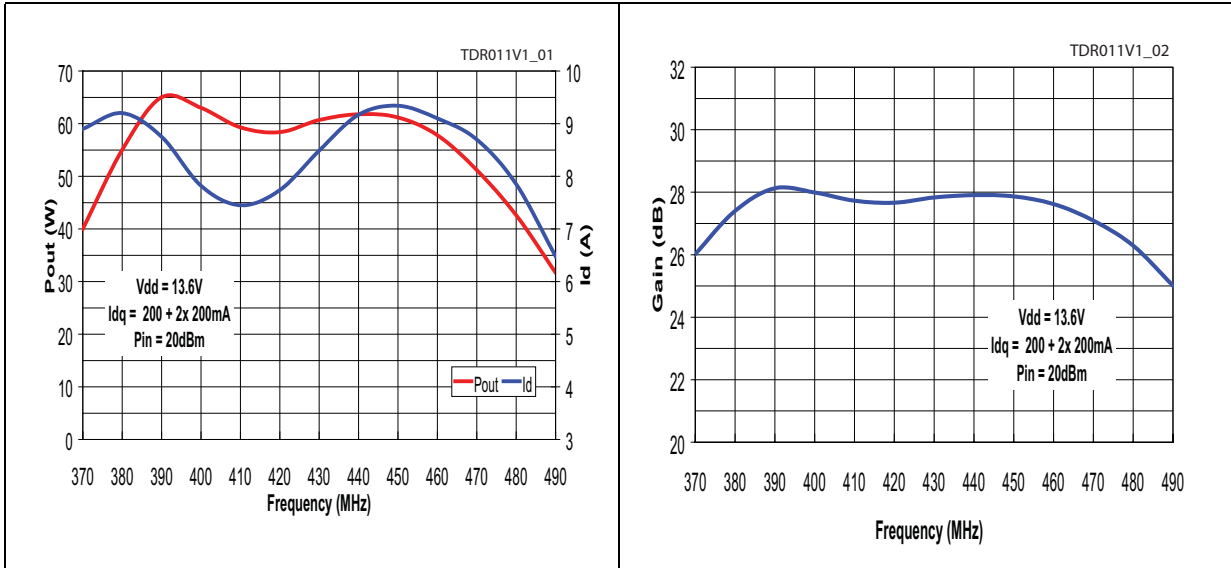


Figure 3. Efficiency vs. frequency **Figure 4. Input return loss vs. frequency**

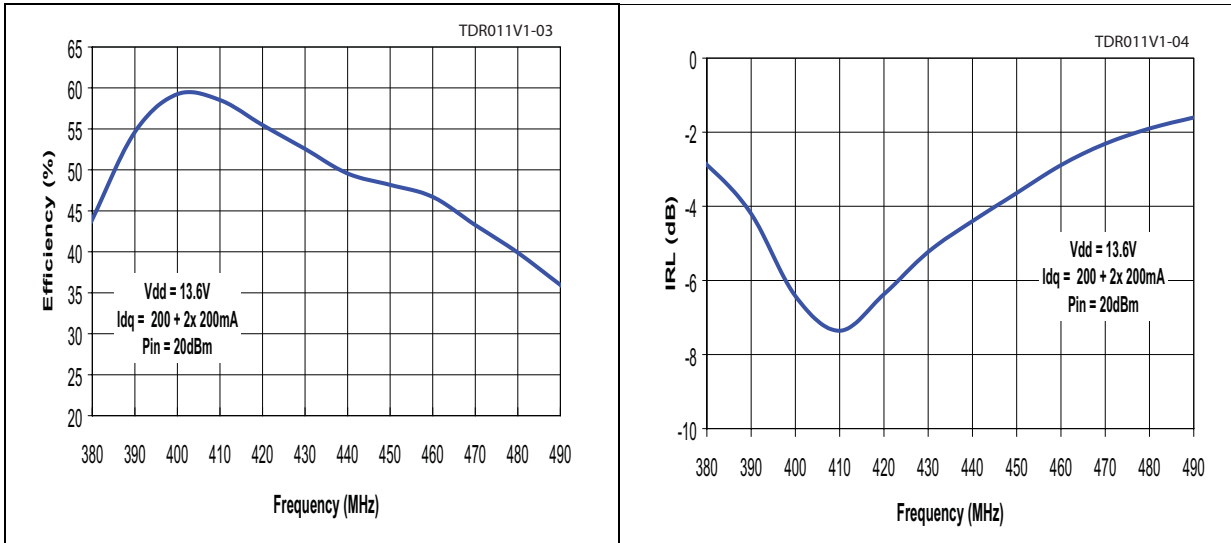


Figure 5. Gain vs. output power

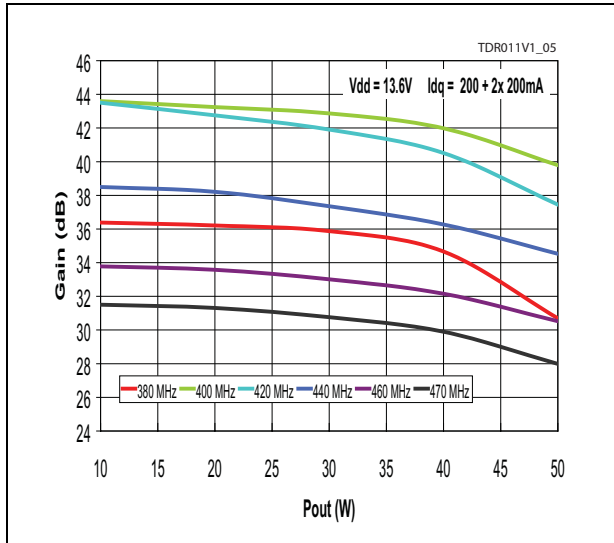


Figure 6. Harmonics

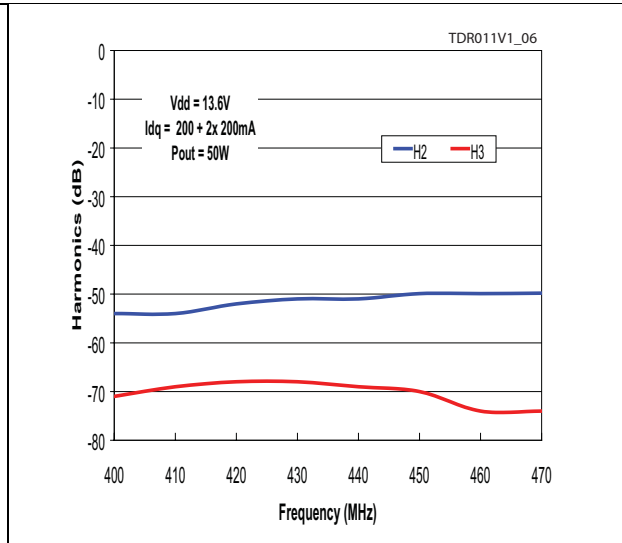


Figure 7. Vp1-Vp2 vs. output power

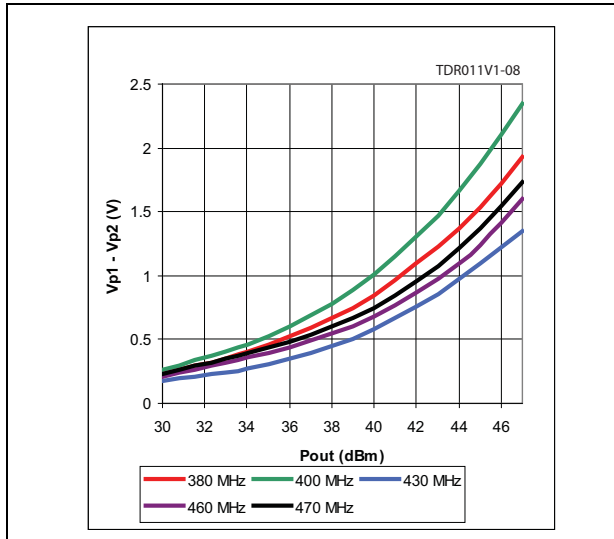


Figure 8. Vp1-Vp2 vs. output power

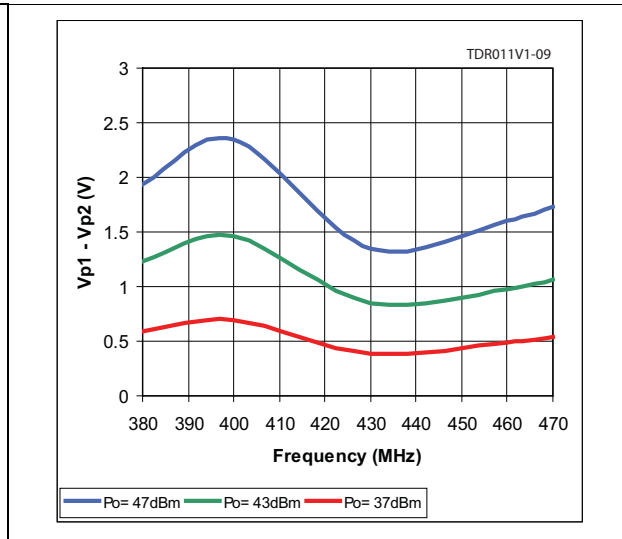


Figure 9. Drain current and temperature record on PCB surface

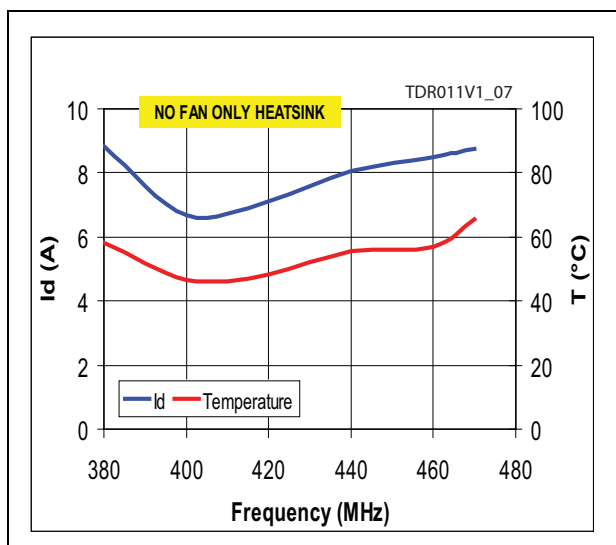


Table 4. Component list

Designator	Value	Qty	Manufacturer	Order code	Size/package
C1	10 μ F	1	Murata	GRM31CR61E106KA12	1206
C1f, C2f, C3f	3.9 pF	3	ATC	ATC 100B 3R9JW	1111
C1p, C2p	5 pF	2	Murata	GRM1885C1H5R0CZ01	0603
C1t	10 pF	1	Murata	GRM1885C1H100JA01	0603
C2	100 pF	1	Murata	GRM42-6 COG 101J 50	1206
C2a, C3a, C5a, C6a	1 pF	4	Murata	GRM1885C1H1R0CZ01	0603
C2t	0.1 μ F	1	Murata	GRM1885C1H101JA01	0603
C3	0.1 μ F	1	Murata	GRM188F5H1104ZA01	0603
C3p, C5p	1 pF	2	ATC	ATC 100B 1R0JW	1111
C4, C9	0.1 μ F	2	Murata	GRM188F51H104ZA01	0603
C4p, C6p	9.1 pF	2	ATC	ATC 100B 9R1JW	1111
C5, C8, C8a, C10, C11, C12	100 pF	6	Murata	GRM1885C1H101JA01	0603
C5f, C6f	5.6 pF	2	ATC	ATC 100B 5R6JW	1111
C6, C7	47 pF	2	Murata	GRM1885C1H470JA01	0603
C9a	4.7 μ F	1	Murata	GRM31CF51H475ZA01	1206
C13	18 pF	1	Murata	GRM1885C1H180JA01	0603
C14	15 pF	1	Murata	GRM1885C1H150JA01	0603
C14a, C14b	18 pF	2	Murata	GRM1885C1H180JZ01B	0603
C15	5.6 pF	1	Murata	GRM1885C1H5R6DZ01	0603
C16	39 pF	1	Murata	GRM1885C1H390JA01	0603

Table 4. Component list (continued)

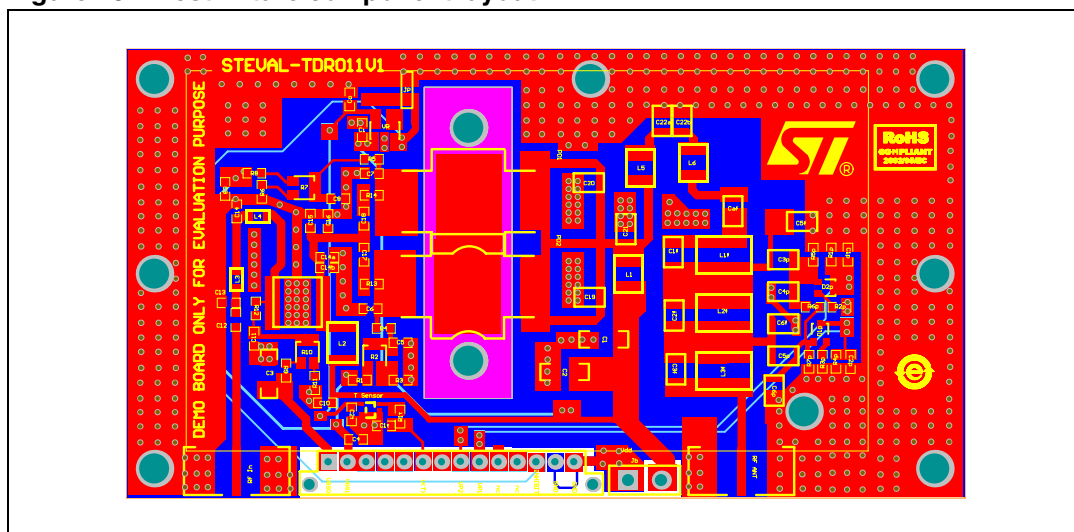
Designator	Value	Qty	Manufacturer	Order code	Size/package
C17, C18	150 pF	2	Murata	GRM1885C1H151JA01	0603
C19, C20	39 pF	2	Murata	ERF1DM5C1H390JD01B	0505
C21	33 pF	1	Murata	MA59C0G330J150	0505
C22a	12 pF	1	Murata	ERF1DM5C1H120JD01B	0505
C22b	4.7 pF	1	Murata	MA59C0G4R7C150	0505
Caf	100 pF	1	ATC	ATC 100B 101JW	1111
Ci	2.2 μ F	1	Murata	GRM188R71A225KE15	0603
Co	1 μ F	1	Murata	GRM188R71C105KA12D	0603
CS1		1	Integration Associates, Inc	IA2410	SOT-23 5-pin
CS2		1	Integration Associates, Inc	IA4210	SOT-23 5-pin
D1a, D2a		2	MACOM	MA4P7101F-1072T	
D1p, D2p		2	STMicroelectronics	BAS70-04WFILM	SOT-323
D3a		1	STMicroelectronics	MA4P7436-1141T	SOD-323
D4a		1	MACOM	MA4P275-1141T	SOD-323
DB		1	MACOM	IA4910	TSSOP 16-pin
J1		1	Integration Associates, Inc	55935-1410	14-pin, single row
Jb		1	Molex	L04220211000	2-pin, 3.5 mm pitch
JP	2 pins - step 2.54 mm -90°	1	LMI	5-826947-0	
L1	33 nH	1	Tyco Electronics	AS080447-33N	
L1a	470 nH	1	Korin Electronics	0805LS-471X_BC	0805LS
L1f, L2f, L3f	9.3 nH	3	Coilcraft	AS120252-9R3N	
L2	12.55 nH	1	Korin Electronics	1606-10	1606
L2a, L3a	6.8 nH	2	Coilcraft	0603HC-6N8X_BW	0603HC
L3	5.4 nH	1	Coilcraft	0906-5	0906
L4	5.4 nH	1	Coilcraft	0906-4	0906
L5, L6	5 nH	2	Korin Electronics	A02T	
PD1, PD2		2	STMicroelectronics	STAP85050 (or 2x PD85035S-E)	PSO-10
PD85006L-E		1	STMicroelectronics	PD85006L-E	PFLAT
TL1		1			W=0.9 mm, L=2 mm
TL2		1			W=0.9 mm, L=5 mm

Table 4. Component list (continued)

Designator	Value	Qty	Manufacturer	Order code	Size/package
TL3, TL15		2			W=0.9 mm, L=8 mm
TL4, TL6, TL16		3			W=0.9 mm, L=4 mm
TL5		1			W=0.9 mm, L=1.2 mm
TL9		1			W=0.9 mm, L=5.7 mm
TL10, TL11, TL18		3			W=0.9 mm, L=6 mm
TL12, TL13		2			W=0.9 mm, L=6.5 mm
TL14, TL17		2			W=0.9 mm, L=2.5 mm
R1, R8, R9	220 Ω	3	Tyco Electronics		0603
R1a, R2, R7, R10	1 k Ω	4	Murata	PVZ2A102C04B00	
R1p, R2p, R3p, R4p	20 k Ω	4	Tyco Electronics		0603
R1t	100 k Ω	1	Tyco Electronics		0603
R3, R6, R11	2.2 k Ω	3	Tyco Electronics		0603
R4, R5	15 k Ω	2	Tyco Electronics		0603
R5p, R6p, R7p, RG3, RG4	50 Ω	5	Tyco Electronics		0603
R12	330 Ω	1	Tyco Electronics		0603
R13, R14	1 Ω	2	Tyco Electronics		0603
RF ant, RF in, RF out PA, to receiver			Johnson	142-0701-801	60 Mils
RG1, RG2	200 Ω	2	Tyco Electronics		0603
RO1	5 k Ω	2	Tyco Electronics		0603
RO2	2 k Ω	2	Tyco Electronics		0603
Thermal Sensor		1	STMicroelectronics	STLM20	SOT323-5
Voltage regulator		1	STMicroelectronics	LD2980ABM50TR	SOT-23-5

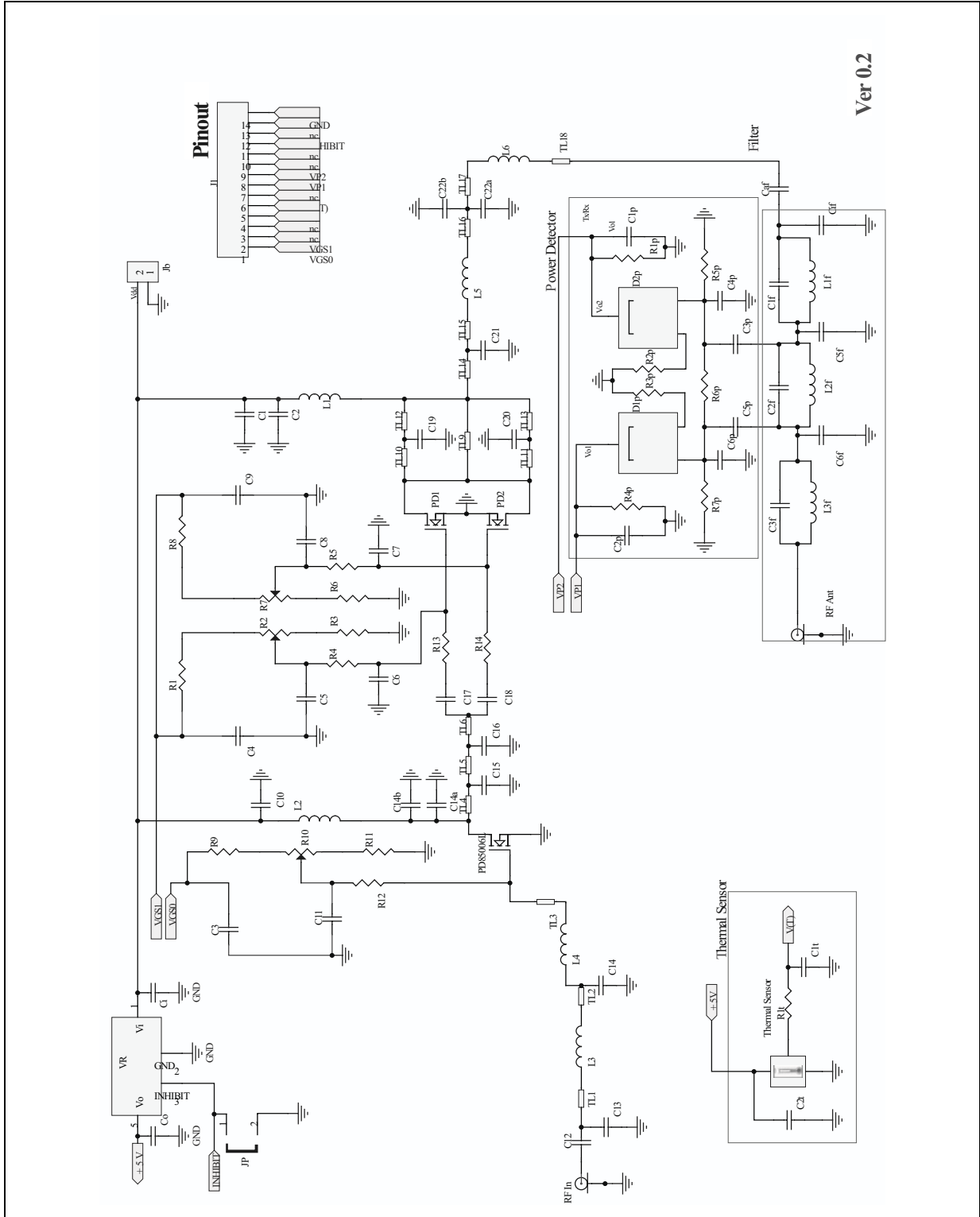
3 Circuit layout

Figure 10. Test fixture component layout



4 Schematic diagram

Figure 11. STEVAL-TDR011V1 schematic diagram



5 Revision history

Table 5. Document revision history

Date	Revision	Changes
31-Mar-2010	1	Initial release.

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