

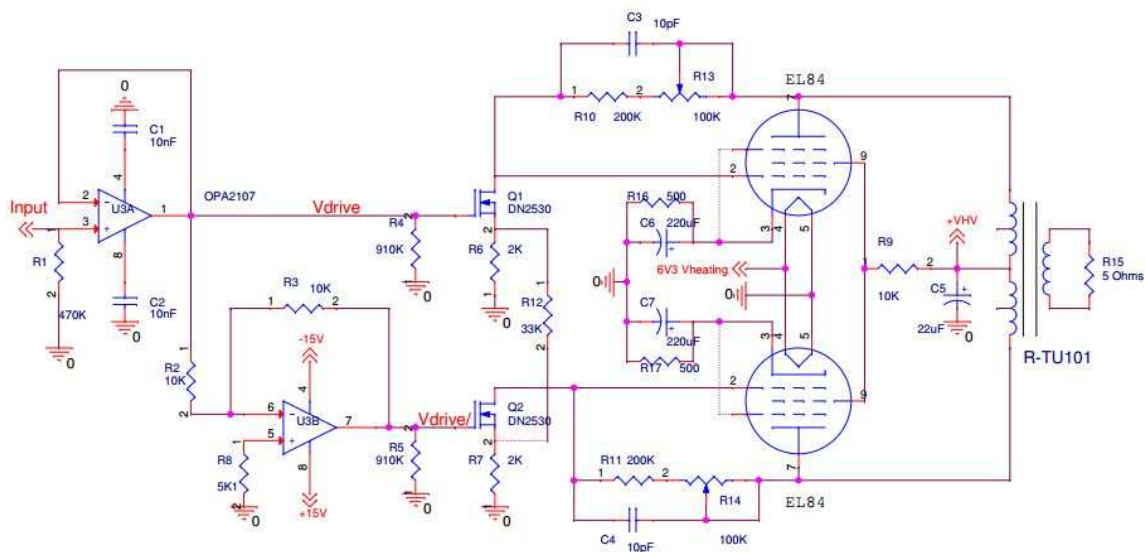
Transconductance Amplifier using S.M.P.S

My design is greatly inspired by Menno Van Der Veen ideas published in his Trans Tube Amplifier book.

2 years ago, I've already assembled a mono prototype using 6v6 tubes in a Push-Pull configuration, the output transformer was a low cost R-TU101 (E.I type) , a "modern" transformer re-issued by the French RADIOFIL magazine from an old AUDAX TU101 ®. The power supplies used were linear ones. The result was already astonishingly good to my hears taking into account the simplicity of the schematic!

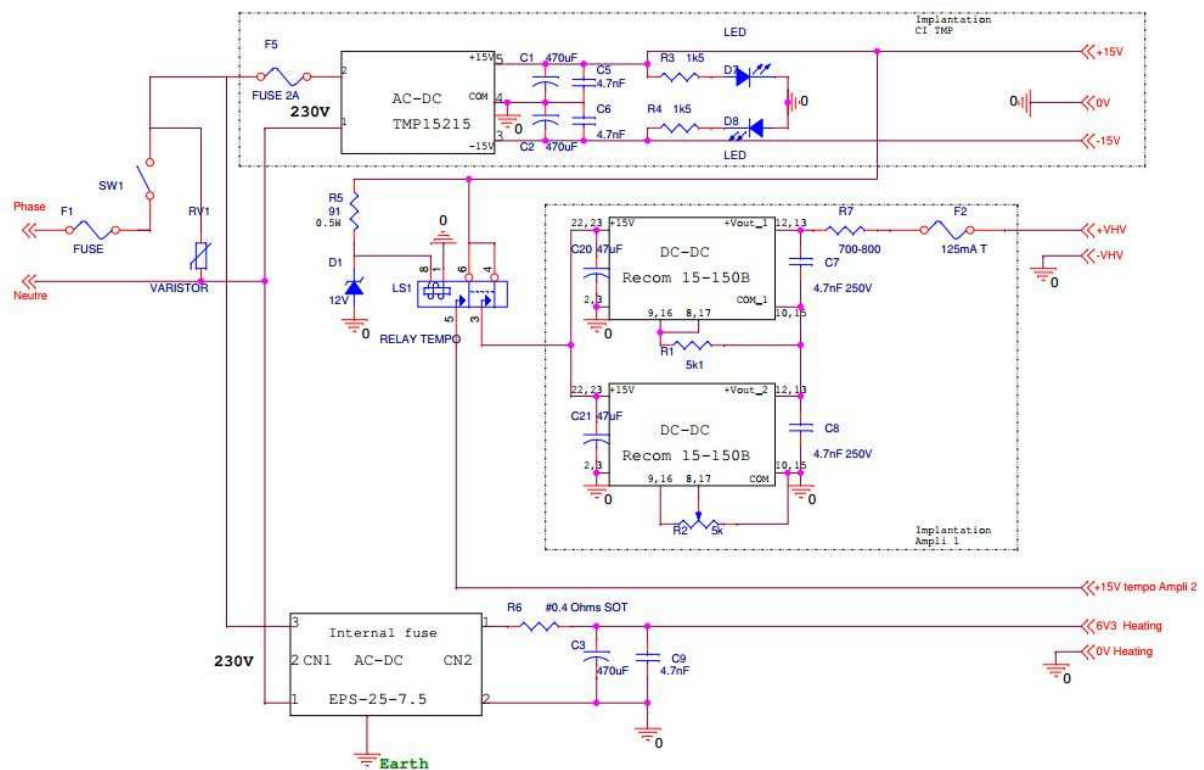
That time, for compactness reasons, I started to assemble a prototype using EL84 tubes, the same output transformer and only a set of switching mode power supplies. I found a small DC/DC dedicated to the plates voltage, delivering from 15V D.C around 300V , of course due to its small size, it could only deliver 50mA, just enough to my needs cause I only want around 1W of audio power using loudspeakers of SPL 92dB@1W in a 11m² room.

Amplifier schematic:



The principle is rather close to Menno's Transie 2 amplifier, concerning the current sources I used FETs DN2530 ® from Supertex Inc. As a phase splitter I use a dual DIFET OPA2107 ® from Burr Brown .See all datasheets in annex. EL84 tubes bias is automatic and set around 22mA for a plate voltage around 250V. On the prototypes, I added 2 pots in serial with the feedback resistors to adjust the differential voltage between the tubes grids; they could be replaced further on with 1% resistors. Nevertheless as noticed by Menno in his book, DC coupling is sensitive to AC line fluctuation, despite the use of SMPS, I could observe this to.

Power supplies schematic:

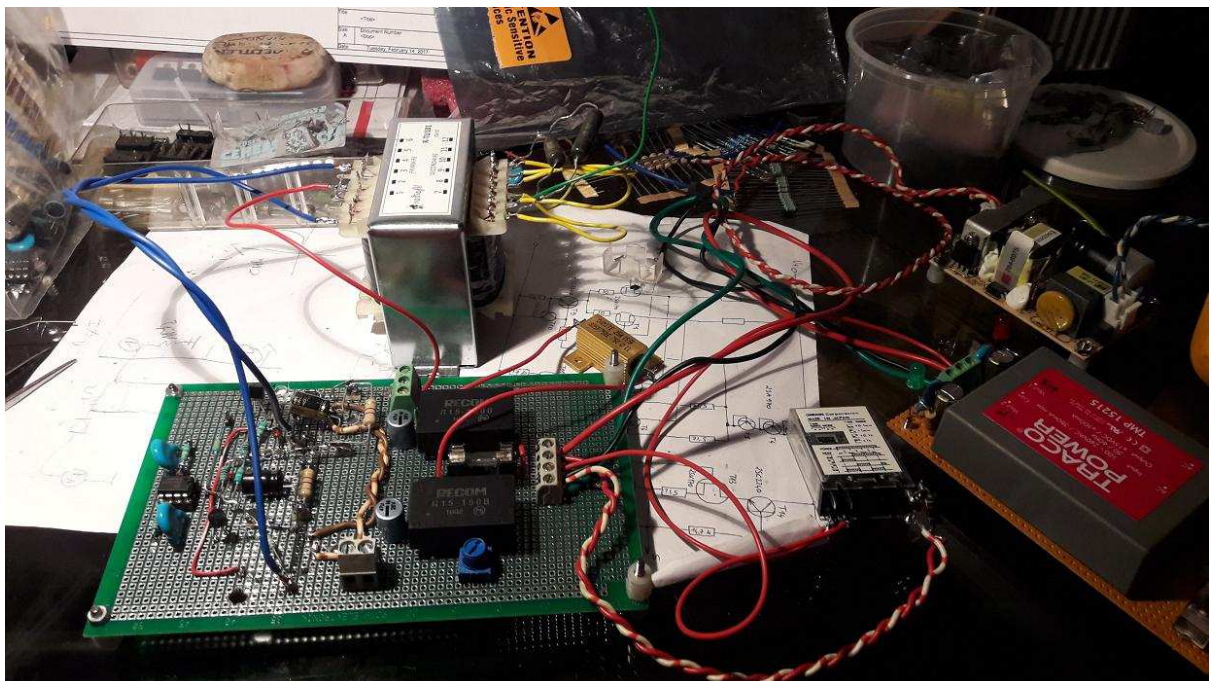


To obtain around 250-300V , I needed to use 2 DC/DC RECOM modules. A temporized relay is used and set to 45 s before applying the H.V.

As expressed above, I was firstly looking for a compact design because I wanted to reuse this Chinese hybrid amplifier rack:

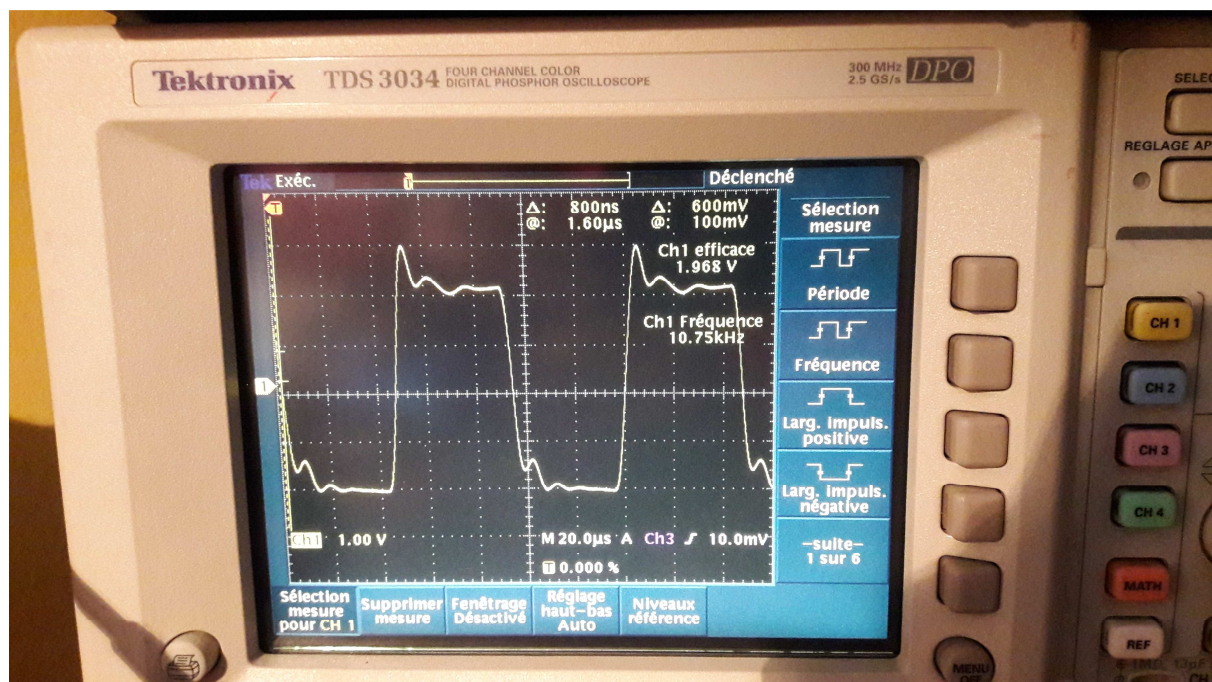
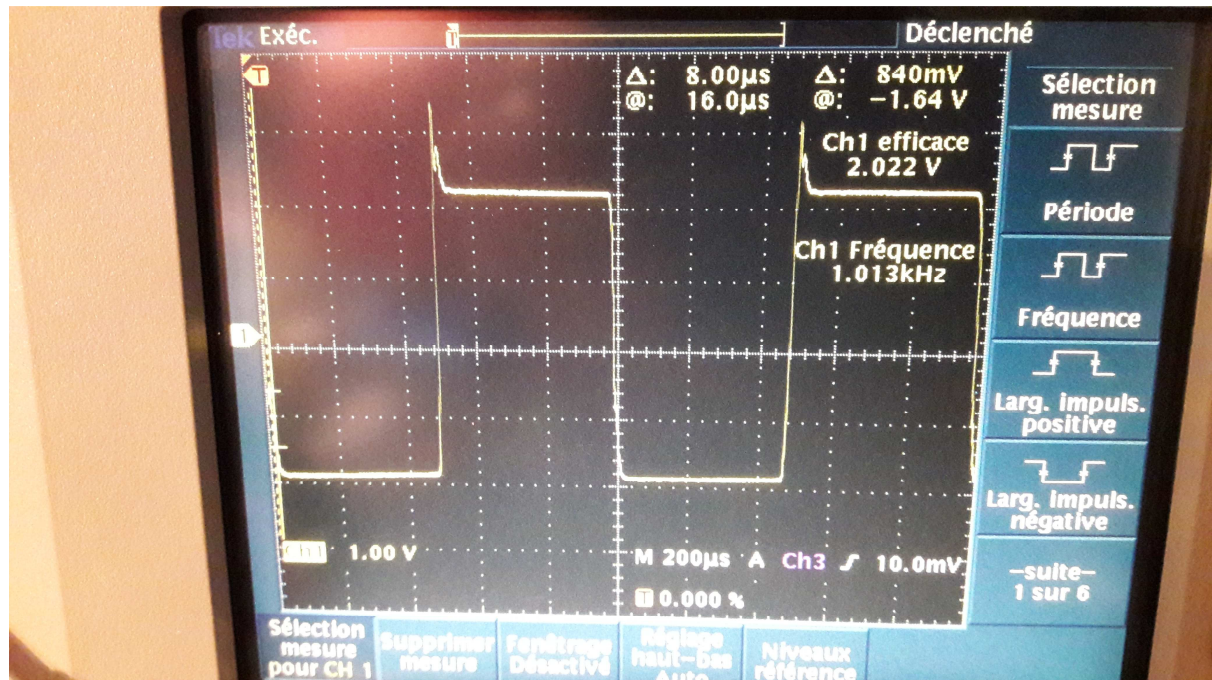


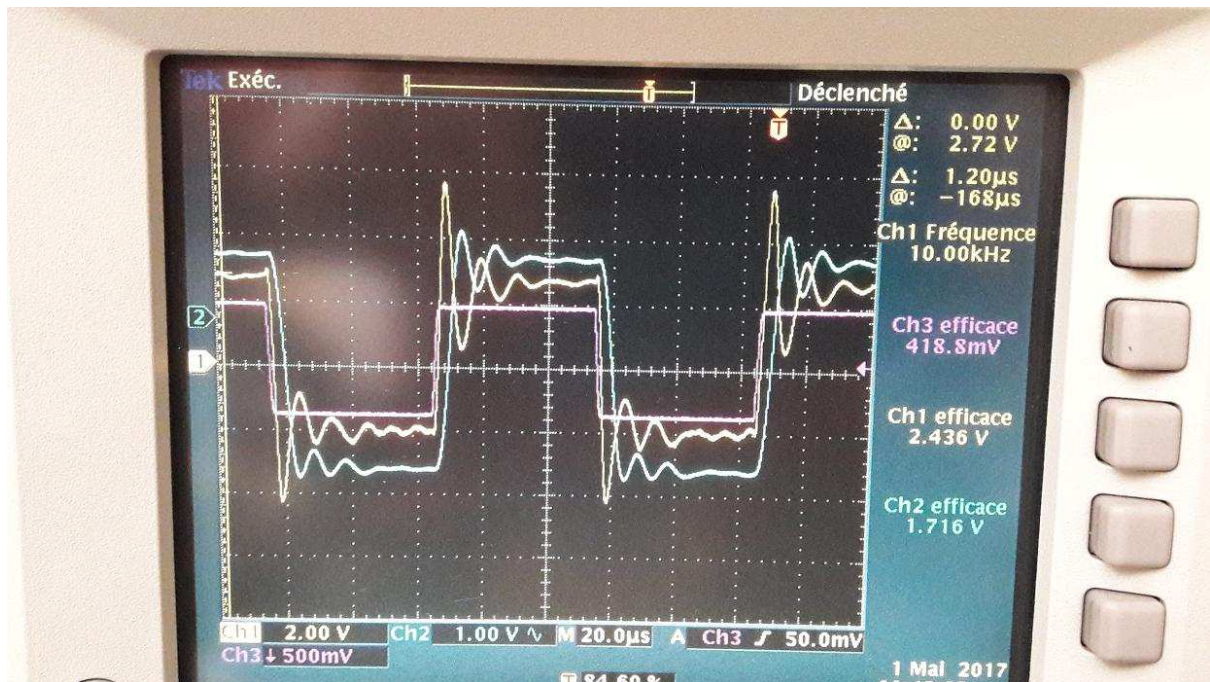
And secondly I was interested in the use of SMPS in my DIY project.



Measurements:

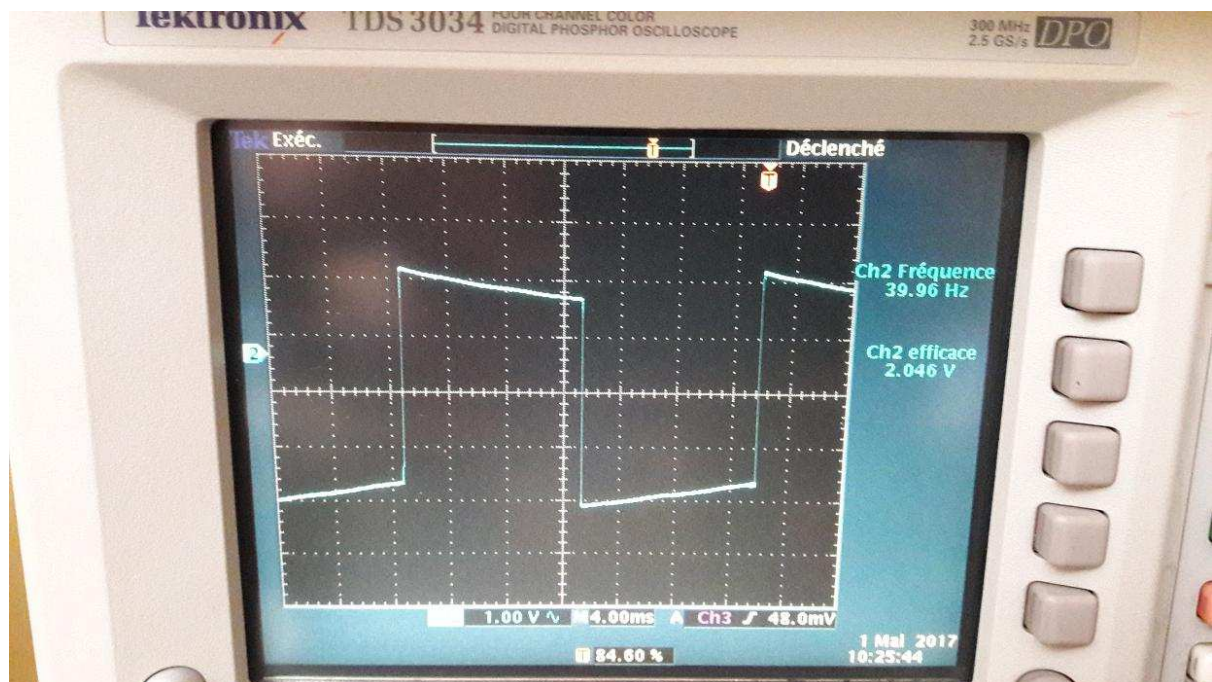
First square wave shapes at the output load:

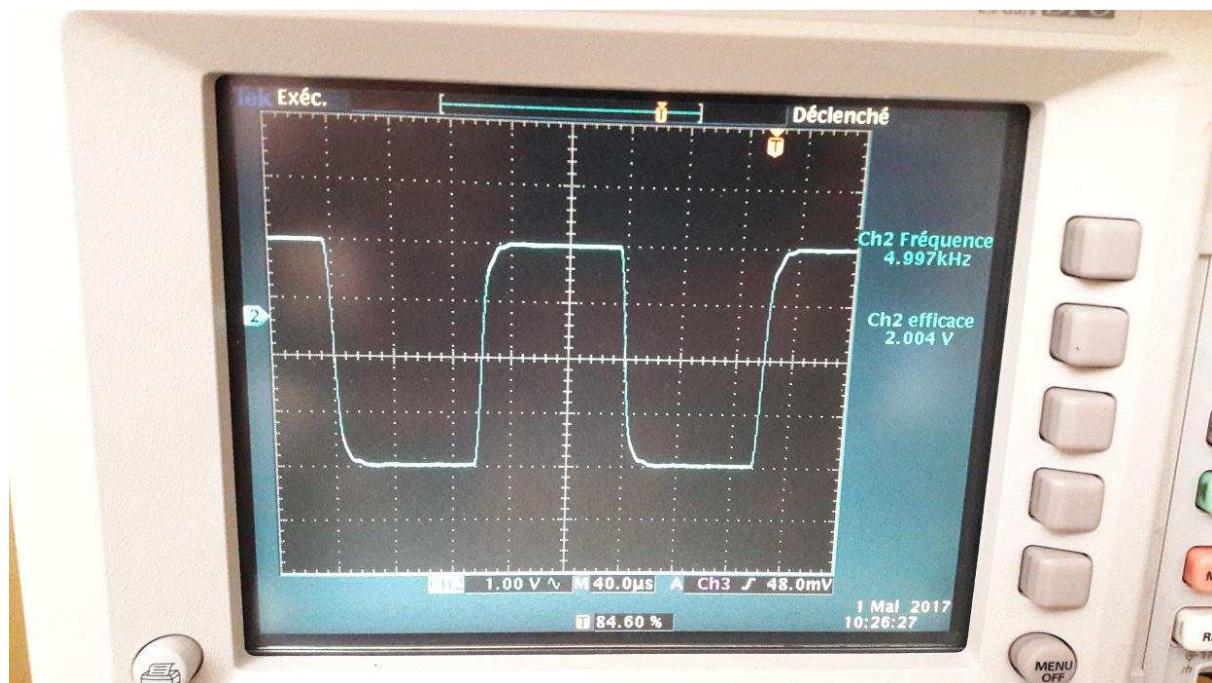
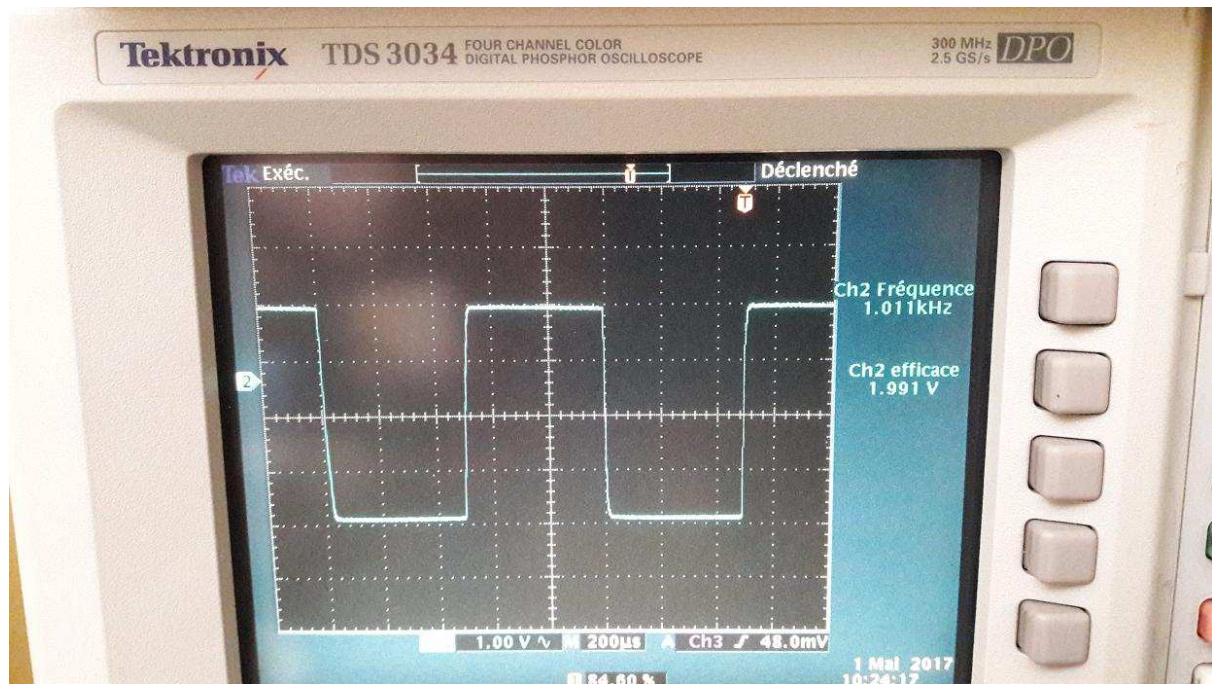


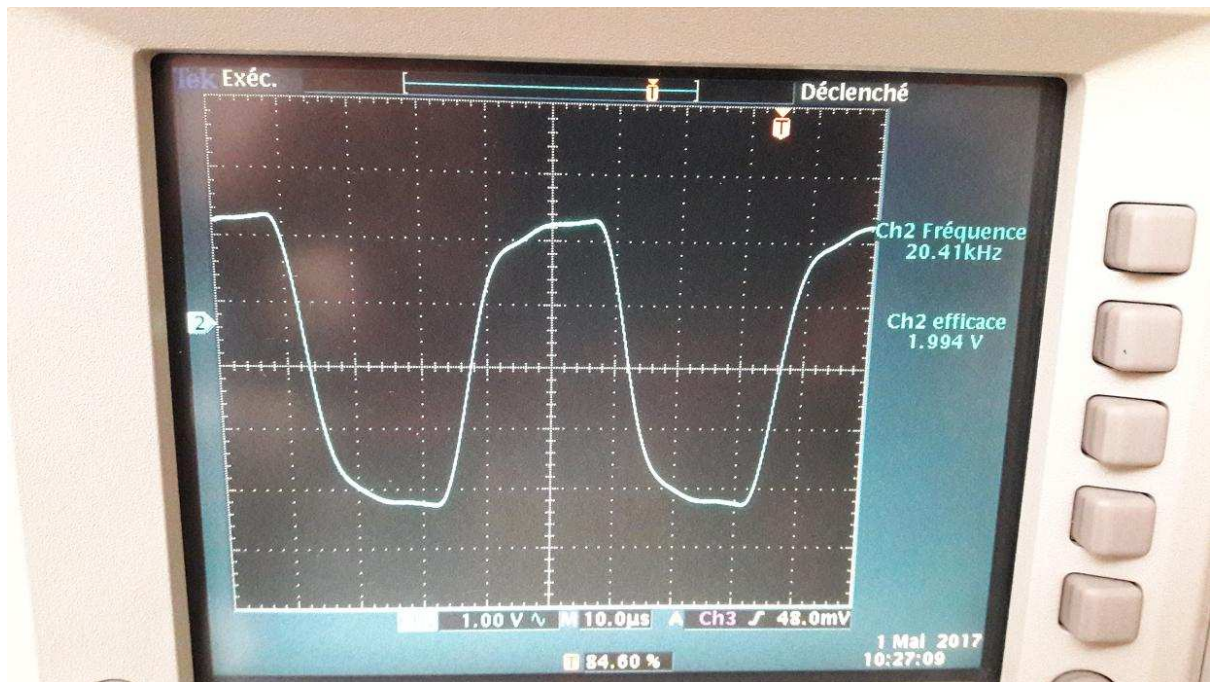


Magenta trace is the input voltage, Yellow one the differential Grids voltage and the blue one the output voltage on the 5 Ohms, obviously it rings a lot!

I had to add 2x10pF in // with the feedback resistors to damp this ringing:

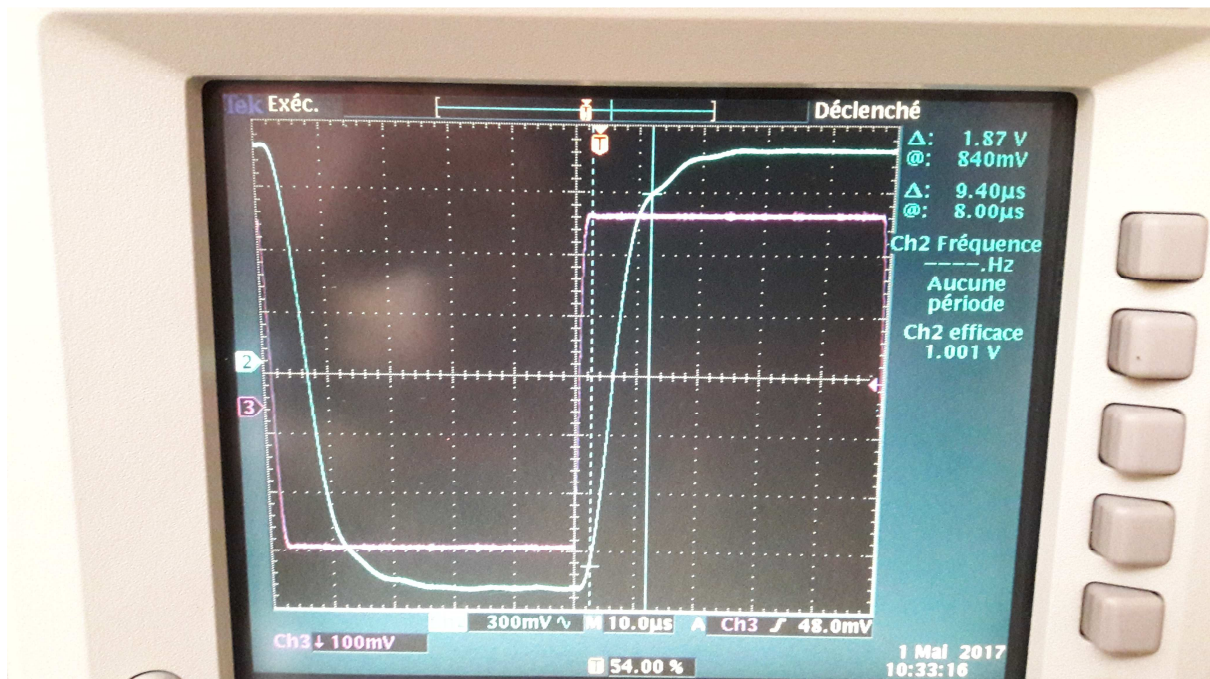




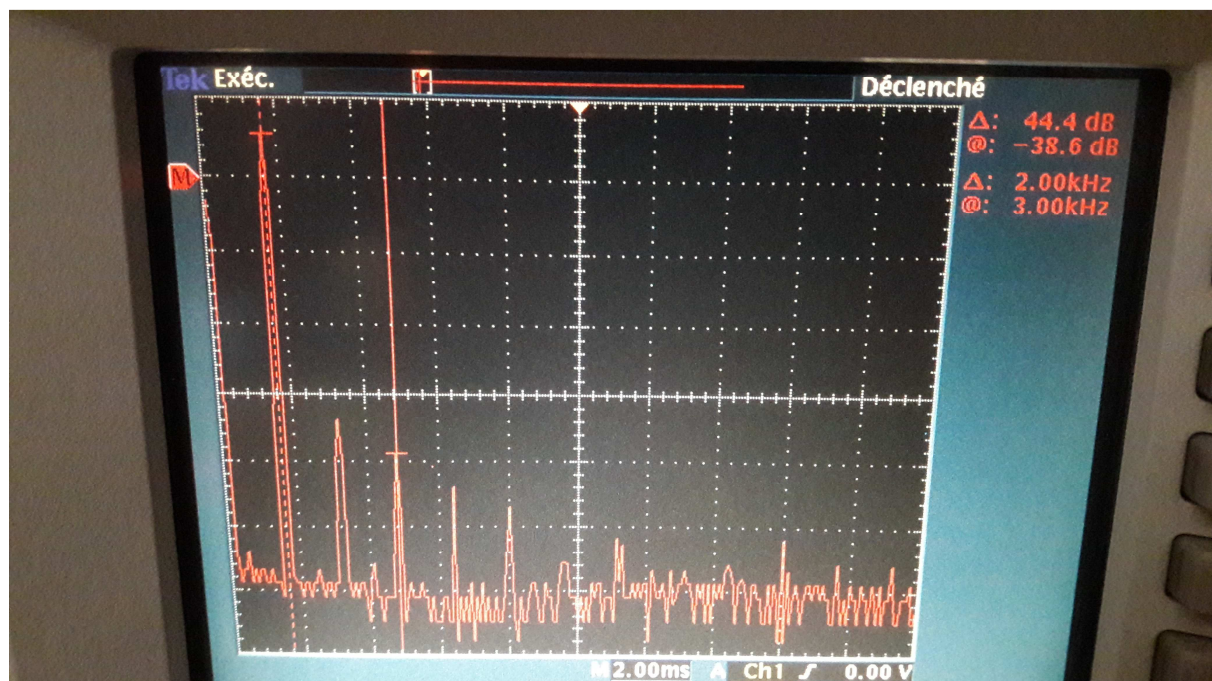
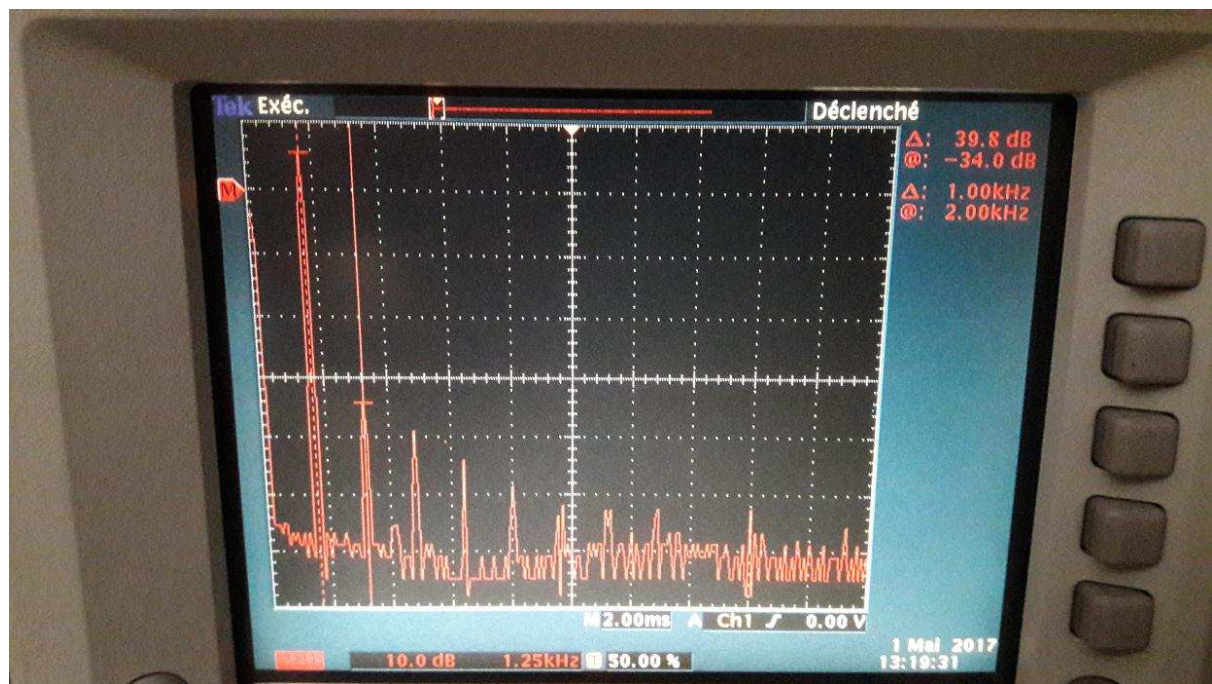


Of course with these 10pF capacitors, the sine response bandwidth falls @-3dB from 90KHz to 50KHz @1W.

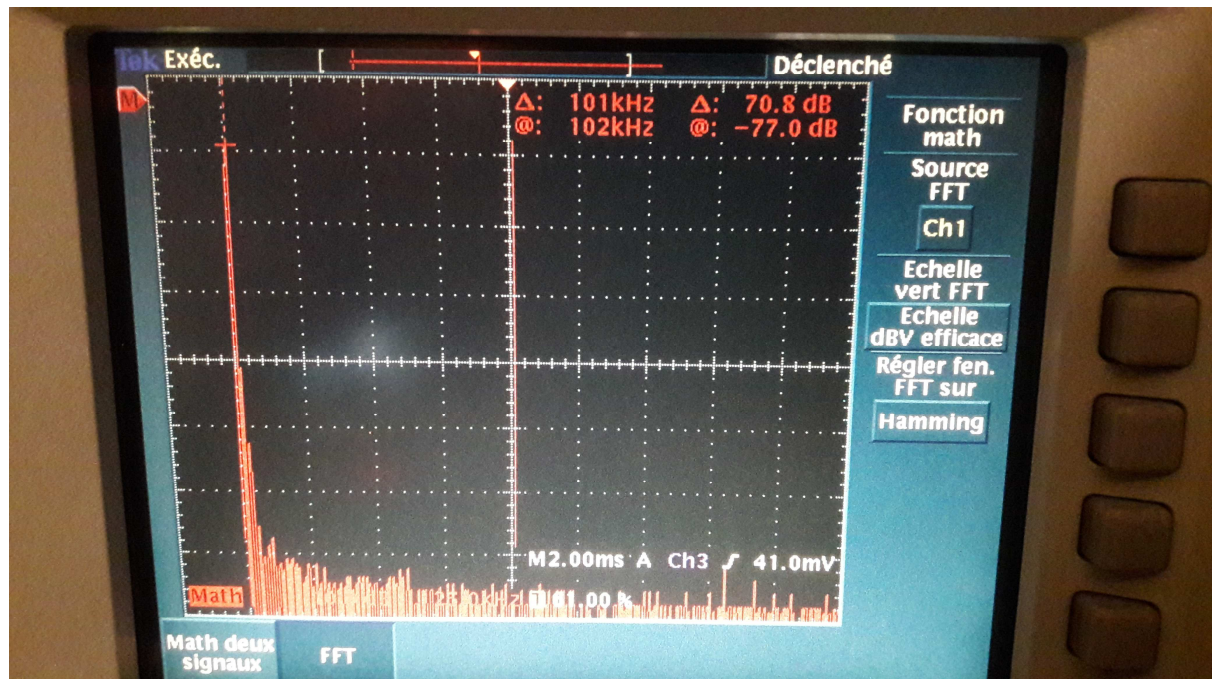
Output signal rise time:



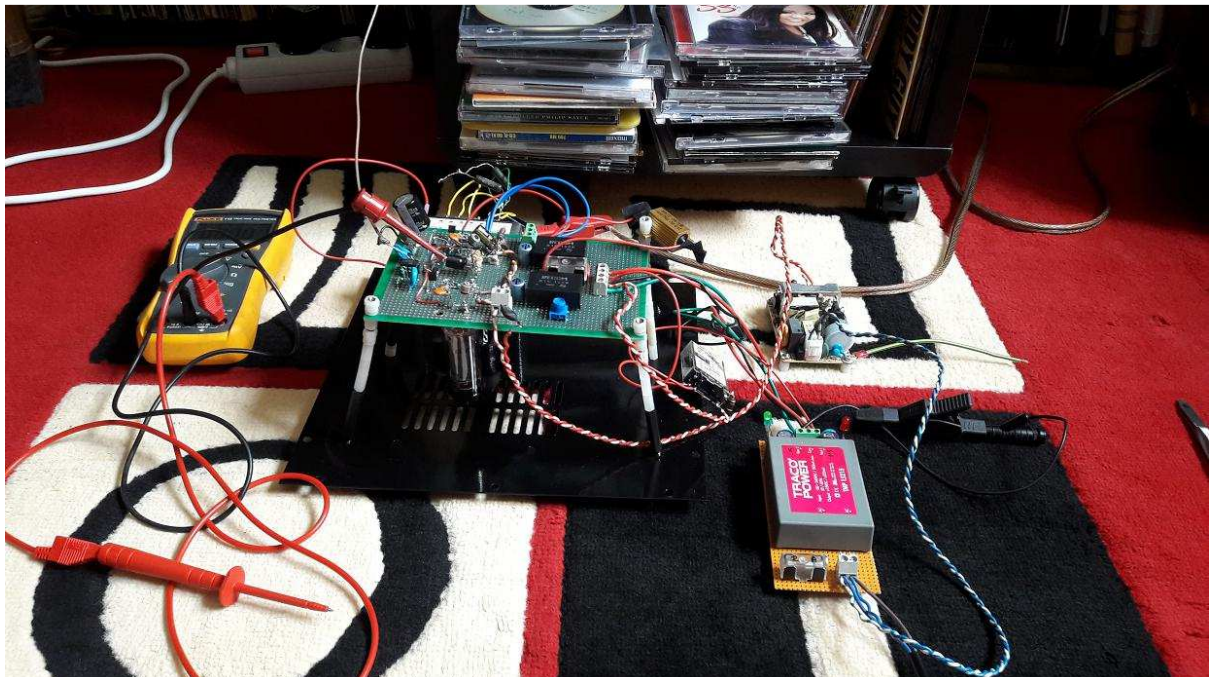
Let's have a look to the spectrum of the output signal @1W: for a 1KHz sine input:



With a wider span, we don't observe within a 70dB dynamic range any spurious peaks coming from the various SMPS:



How does it sound? Well, one more time the feeling was very good, as I wrote to Menno, from my present EL84 Push-Pull amplifier, I never felt so real and clear neither Stevie Ray Vaughan nor Buddy Guy Mi guitar string like I did with this transimpedance amplifier, bass are also tighten!



eric.rabeuf@wanadoo.fr

Annex:

Features

- High Output Voltage DIB4 converter
- Improved Version of Rxx-100_150A Series with higher efficiency and reduced ripple
- Input Voltage 5, 12, 15 or 24VDC
- Adjustable Output Voltage up to 210VDC
- Cascadable for Output Voltages up to 420VDC
- 3kVDC Input/Output Isolation
- Remote Voltage Programming by External Voltage or Resistance
- Continuous Short Circuit Protection
- Ambient Temperature up to +85°C

Regulated Converters

Selection Guide

Part Number	Input Voltage Range (VDC)	Output Voltage Range (VDC)	Max Output Current (mA)	Efficiency at Full Load (%)
DP-24	5 (4.5-6)	+40...+120	25	77
R12-100B	12 (10-14)	+55...+135	50	82
R15-100B	15 (14-17)	+55...+135	50	82
R24-100B	24 (21-27)	+55...+135	50	84
R12-150B	12 (10-14)	+95...+210	50	82
R15-150B	15 (14-17)	+95...+210	50	82
R24-150B	24 (21-27)	+95...+210	50	84

Specifications

(typical at 25°C, nominal input voltage, full load unless otherwise specified)


Input Voltage Range	5, 12, 15 or 24VDC
Rated Power	25mA max. or 3 Watts max. 50mA max. or 5 Watts max.
Output Voltage Adjustment Range	55...135 or 95...210VDC
Output Voltage Accuracy	±0.5% max.
Line Voltage Regulation	0.5% max.
Load Voltage Regulation	20% to 100% full load
Output Ripple and Noise	25mV max. 20kHz typ.
Operating Frequency	20kHz typ.
Efficiency at Full Load	80 - 85% typ.
Isolation Voltage (tested for 1 second)	3000VDC min.
Isolation Capacitance	20pF typ.
Isolation Resistance	1 GΩ min.
Short Circuit Protection	Continuous, Automatic Restart
Short Circuit Input Current	30mA typ.
Temperature Coefficient	±0.02%/°C
Operating Temperature Range (free air convection)	-40°C to +85°C -40°C to +70°C
Storage Temperature Range	-80°C to +125°C
Cable Material	Non-Conductive Black Plastic
Printing Material	Epoxy 84.849 (Q)
Weight	12g
MTPP (25°C)	M6-D2171
Output Voltage Adjust	1400 x 10P potentiometer 0 - 4VDC 0 - 5VDC
Internal Voltage Reference	Regulated 5V with 1403 series resistor
EN General Safety	Report: 3PCLVD 1207005 EN60950-1:2006 + A12:2011

INNOLINE DC/DC-Converter

With 3-year Warranty

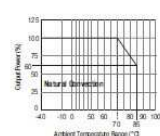
RECOM

5 Watt Single Output



Rxx-B

Derating Graph (Ambient Temperature)



Refer to Application Notes

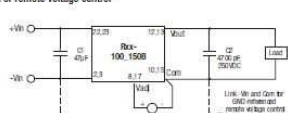
www.recom-power.com

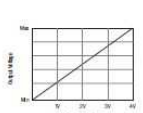
INNOLINE DC/DC-Converter

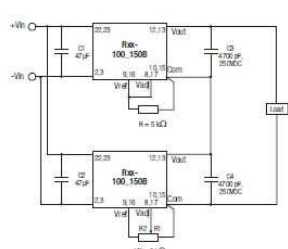
Rxx-100_150B Series

Typical Applications

For remote voltage control







Cascade Combinations


U1	U2	Vout Range
R12-100B	R15-100B	160-240
R15-100B	R15-100B	180-270
R15-100B	R24-100B	230-345
R15-100B	R15-150B	305-420

Note: When cascaded, only one Rxx-B may be adjustable, the other must be fixed voltage.

TRACO POWER

AC/DC Power Modules

TMP & TMPM Series, 4 to 60 Watt



CE CB RoHS

Features

- Ultra compact, low profile plastic casing
- Fully encapsulated (pollution/dust)
- Single-, dual- and triple output models
- 2 package versions:
 - Screw terminal block for chassis mount
 - Solder pins for direct PCB mount
- DIN-rail mount adaptor (optional)
- Universal input 85-264 VAC, 47-440 Hz
- Protection class II
- IEC/EN/UL 60950-1 approval, CB-report
- Over-temperature protection
- Protection against short circuit and overload
- 3-year product warranty

The TMP & TMPM series AC/DC Power Modules is a new range of fully encapsulated power supplies in an ultra-compact casing. They feature easy chassis mounting with screw terminal block connection or direct PCB mounting with solder pins. Full compliance with international safety standards for industrial control equipment qualifies the products for worldwide markets. These power supplies offer a cost effective solution for many space critical applications in commercial and industrial electronic equipment and for polluted and dusty environment.

Single Output Models 4 to 10 Watt

Order code	Output power max.	Output	Efficiency typ.
TMPM 04103	4 W	3.3 VDC / 1200 mA	70 %
TMPM 04105		5.0 VDC / 800 mA	72 %
TMPM 04109		9.0 VDC / 444 mA	75 %
TMPM 04112		12 VDC / 333 mA	76 %
TMPM 04115		15 VDC / 267 mA	76 %
TMPM 04124	24 VDC / 167 mA	77 %	
TMP 07103	4.6 W	3.3 VDC / 1400 mA	70 %
TMP 07105		5.0 VDC / 1400 mA	73 %
TMP 07112	7 W	12 VDC / 583 mA	78 %
TMP 07115		15 VDC / 466 mA	78 %
TMP 07124	24 VDC / 291 mA	78 %	
TMPM 10103	8.3 W	3.3 VDC / 2500 mA	70 %
TMPM 10105		5.0 VDC / 2000 mA	72 %
TMPM 10112		12 VDC / 833 mA	76 %
TMPM 10115		15 VDC / 667 mA	75 %
TMPM 10124	24 VDC / 417 mA	72 %	
TMP 10103	6.6 W	3.3 VDC / 2000 mA	70 %
TMP 10105		5.0 VDC / 2000 mA	73 %
TMP 10112		12 VDC / 833 mA	76 %
TMP 10115		15 VDC / 666 mA	76 %
TMP 10124	24 VDC / 416 mA	76 %	

15 to 60 Watt and multi output models see next page →

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TRACO POWER

AC/DC Power Modules

TMP & TMPM Series 4 to 60 Watt

Single Output Models 15 to 60 Watt

Order code	Output power max.	Output	Efficiency typ.
TMP 15105	15 W	5 VDC / 3000 mA	75 %
TMP 15112		12 VDC / 1250 mA	79 %
TMP 15115		15 VDC / 1000 mA	79 %
TMP 15124		24 VDC / 625 mA	79 %
TMP 15148		48 VDC / 310 mA	79 %
TMP 30105	30 W	5 VDC / 6000 mA	78 %
TMP 30112		12 VDC / 2500 mA	80 %
TMP 30115		15 VDC / 2000 mA	80 %
TMP 30124		24 VDC / 1250 mA	80 %
TMP 30148		48 VDC / 625 mA	80 %
TMP 60105	51 W	5.1 VDC / 10000 mA	79 %
TMP 60112		12 VDC / 5000 mA	82 %
TMP 60115		15 VDC / 4000 mA	83 %
TMP 60124		24 VDC / 2500 mA	84 %
TMP 60136		36 VDC / 1665 mA	84 %
TMP 60148	48 VDC / 1250 mA	84 %	

Multi Output Models 4 to 30 Watt

Order code	Output power	Output 1	Output 2	Output 3	ER typ.
TMPM 04212	4 W	+12 VDC / 166 mA	-12 VDC / 166 mA		77 %
TMPM 04215		+15 VDC / 133 mA	-15 VDC / 133 mA		77 %
TMPM 04253		+5.0 VDC / 600 mA	+3.3 VDC / 150 mA		72 %
TMPM 04255		+12 VDC / 250 mA	+5.0 VDC / 120 mA		75 %
TMP 10212	10 W	+12 VDC / 380 mA	-12 VDC / 380 mA		77 %
TMP 10215		+15 VDC / 300 mA	-15 VDC / 300 mA		77 %
TMP 15212	15 W	+12 VDC / 650 mA	-12 VDC / 650 mA		79 %
TMP 15215		+15 VDC / 500 mA	-15 VDC / 500 mA		79 %
TMP 30212	30 W	+12 VDC / 1300 mA	-12 VDC / 1300 mA		80 %
TMP 30215		+15 VDC / 1000 mA	-15 VDC / 1000 mA		80 %
Models with output 1, isolated from output 2/3 (floating)					
TMP 15252	15 W	5.0 VDC / 1500 mA	12 VDC / 625 mA		72 %
TMP 15512		5.0 VDC / 2000 mA	+12 VDC / 200 mA	-12 VDC / 200 mA	74 %
TMP 15515		5.0 VDC / 2000 mA	+15 VDC / 150 mA	-15 VDC / 150 mA	74 %
TMP 30252	30 W	5.0 VDC / 3000 mA ¹⁾	12 VDC / 1250 mA ²⁾		76 %
TMP 30512		5.0 VDC / 3000 mA ¹⁾	+12 VDC / 600 mA ²⁾	-12 VDC / 600 mA ²⁾	76 %
TMP 30515		5.0 VDC / 3000 mA ¹⁾	+15 VDC / 500 mA ²⁾	-15 VDC / 500 mA ²⁾	76 %
TMP 30522	30 W	5.0 VDC / 3000 mA ¹⁾	+12 VDC / 1000 mA ²⁾	-12 VDC / 250 mA ²⁾	76 %
TMP 30316		3.3 VDC / 4000 mA ¹⁾	+5.0 VDC / 1500 mA ²⁾	+12 VDC / 250 mA ²⁾	71 %
TMP 30317		5.0 VDC / 4500 mA ¹⁾	+3.3 VDC / 1000 mA ²⁾	+12 VDC / 250 mA ²⁾	71 %

Peak current, total power not to exceed 30 Watt
¹⁾ 133 %
²⁾ 150 %
³⁾ 200 %

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25W Single Output Switching Power Supply

EPS-25 series



- Features :
- Universal AC input / Full range
 - High efficiency up to 90%
 - Protections: Short circuit / Overload / Over voltage
 - Cooling by free air convection
 - 3" x 2" compact size
 - LED indicator for power on
 - No load power consumption < 0.3W
 - 3 years warranty



SPECIFICATION

MODEL	EPS-25-3.3	EPS-25-5	EPS-25-7.5	EPS-25-12	EPS-25-15	EPS-25-24	EPS-25-27	EPS-25-36	EPS-25-48	
OUTPUT	DC VOLTAGE	3.3V	5V	7.5V	12V	24V	27V	36V	48V	
	RATED CURRENT	1A	1A	1.6A	2.1A	1.7A	1.55A	0.95A	0.5A	
	CURRENT RANGE	0 ~ 0.5A	0 ~ 0.5A	0 ~ 3.74A	0 ~ 2.34A	0 ~ 1.87A	0 ~ 1.17A	0 ~ 1.05A	0 ~ 0.58A	
	RATED POWER	16.5W	15W	21.5W	25.2W	25.5W	29.2W	25.65W	25.2W	
	PEAK LOAD (10ms)	18.15W	17.25W	24.025W	28.15W	28.55W	32.525W	28.15W	28.25W	
	Ripple Noise (max.)	100mVp-p	100mVp-p	100mVp-p	100mVp-p	100mVp-p	100mVp-p	100mVp-p	100mVp-p	
	VOLTAGE ADJ. RANGE	3.1 ~ 3.5V	4.75 ~ 5.25V	7.15 ~ 8.25V	11.8 ~ 13.8V	13.5 ~ 16.5V	21.6 ~ 27V	24.3 ~ 28.7V	32.4 ~ 38.8V	
	VOLTAGE TOLERANCE	±2.0%	±2.0%	±2.0%	±1.0%	±1.0%	±1.0%	±1.0%	±1.0%	
	LINE REGULATION	±0.2%	±0.2%	±0.2%	±0.2%	±0.2%	±0.2%	±0.2%	±0.2%	
	LOAD REGULATION	±1.0%	±1.0%	±1.0%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	
INPUT	SETUP RISE TIME	1000ms, 30ms/250VAC	1000ms, 30ms/250VAC	1000ms, 30ms/250VAC	1000ms, 30ms/250VAC	1000ms, 30ms/250VAC	1000ms, 30ms/250VAC	1000ms, 30ms/250VAC	1000ms, 30ms/250VAC	
	HOLD UP TIME (Typ.)	10ms/250VAC	10ms/250VAC	10ms/250VAC	10ms/250VAC	10ms/250VAC	10ms/250VAC	10ms/250VAC	10ms/250VAC	
	VOLTAGE RANGE	85 ~ 264VAC	85 ~ 264VAC	85 ~ 264VAC	85 ~ 264VAC	85 ~ 264VAC	85 ~ 264VAC	85 ~ 264VAC	85 ~ 264VAC	
	FREQUENCY RANGE	47 ~ 63Hz	47 ~ 63Hz	47 ~ 63Hz	47 ~ 63Hz	47 ~ 63Hz	47 ~ 63Hz	47 ~ 63Hz	47 ~ 63Hz	
	EFFICIENCY (Typ.)	80%	81%	85%	86%	87%	88%	88%	88%	
	AC CURRENT (Typ.)	0.5A/115VAC	0.4A/230VAC	0.4A/230VAC	0.4A/230VAC	0.4A/230VAC	0.4A/230VAC	0.4A/230VAC	0.4A/230VAC	
	INRUSH CURRENT (Typ.)	10A/250VAC	10A/250VAC	10A/250VAC	10A/250VAC	10A/250VAC	10A/250VAC	10A/250VAC	10A/250VAC	
	LEAKAGE CURRENT	< 1mA/250VAC	< 1mA/250VAC	< 1mA/250VAC	< 1mA/250VAC	< 1mA/250VAC	< 1mA/250VAC	< 1mA/250VAC	< 1mA/250VAC	
	OVER LOAD	110% ~ 115% (auto shutdown)	110% ~ 115% (auto shutdown)	110% ~ 115% (auto shutdown)	110% ~ 115% (auto shutdown)	110% ~ 115% (auto shutdown)	110% ~ 115% (auto shutdown)	110% ~ 115% (auto shutdown)	110% ~ 115% (auto shutdown)	
	OVER VOLTAGE	Protection type: Hiccup mode, recovers automatically after fault condition is removed	Protection type: Hiccup mode, recovers automatically after fault condition is removed	Protection type: Hiccup mode, recovers automatically after fault condition is removed	Protection type: Hiccup mode, recovers automatically after fault condition is removed	Protection type: Hiccup mode, recovers automatically after fault condition is removed	Protection type: Hiccup mode, recovers automatically after fault condition is removed	Protection type: Hiccup mode, recovers automatically after fault condition is removed	Protection type: Hiccup mode, recovers automatically after fault condition is removed	
ENVIRONMENT	WORKING TEMPERATURE	20 ~ +70°C (Refer to "Steady State")	20 ~ +70°C (Refer to "Steady State")	20 ~ +70°C (Refer to "Steady State")	20 ~ +70°C (Refer to "Steady State")	20 ~ +70°C (Refer to "Steady State")	20 ~ +70°C (Refer to "Steady State")	20 ~ +70°C (Refer to "Steady State")	20 ~ +70°C (Refer to "Steady State")	
	WORKING HUMIDITY	20 ~ 90% RH (non-condensing)	20 ~ 90% RH (non-condensing)	20 ~ 90% RH (non-condensing)	20 ~ 90% RH (non-condensing)	20 ~ 90% RH (non-condensing)	20 ~ 90% RH (non-condensing)	20 ~ 90% RH (non-condensing)	20 ~ 90% RH (non-condensing)	
	STORAGE TEMPERATURE	40 ~ 85°C, 10 ~ 90% RH	40 ~ 85°C, 10 ~ 90% RH	40 ~ 85°C, 10 ~ 90% RH	40 ~ 85°C, 10 ~ 90% RH	40 ~ 85°C, 10 ~ 90% RH	40 ~ 85°C, 10 ~ 90% RH	40 ~ 85°C, 10 ~ 90% RH	40 ~ 85°C, 10 ~ 90% RH	
	TEMP. COEFFICIENT	±0.07%/°C (0 ~ 50°C)	±0.07%/°C (0 ~ 50°C)	±0.07%/°C (0 ~ 50°C)	±0.07%/°C (0 ~ 50°C)	±0.07%/°C (0 ~ 50°C)	±0.07%/°C (0 ~ 50°C)	±0.07%/°C (0 ~ 50°C)	±0.07%/°C (0 ~ 50°C)	
SAFETY & EMC (max.)	VIBRATION	10 ~ 50Hz, 0.5 mm/s (rms), 10 ~ 100Hz, 0.5 mm/s (rms), 10 ~ 100Hz, 0.5 mm/s (rms)	10 ~ 50Hz, 0.5 mm/s (rms), 10 ~ 100Hz, 0.5 mm/s (rms), 10 ~ 100Hz, 0.5 mm/s (rms)	10 ~ 50Hz, 0.5 mm/s (rms), 10 ~ 100Hz, 0.5 mm/s (rms), 10 ~ 100Hz, 0.5 mm/s (rms)	10 ~ 50Hz, 0.5 mm/s (rms), 10 ~ 100Hz, 0.5 mm/s (rms), 10 ~ 100Hz, 0.5 mm/s (rms)	10 ~ 50Hz, 0.5 mm/s (rms), 10 ~ 100Hz, 0.5 mm/s (rms), 10 ~ 100Hz, 0.5 mm/s (rms)	10 ~ 50Hz, 0.5 mm/s (rms), 10 ~ 100Hz, 0.5 mm/s (rms), 10 ~ 100Hz, 0.5 mm/s (rms)	10 ~ 50Hz, 0.5 mm/s (rms), 10 ~ 100Hz, 0.5 mm/s (rms), 10 ~ 100Hz, 0.5 mm/s (rms)	10 ~ 50Hz, 0.5 mm/s (rms), 10 ~ 100Hz, 0.5 mm/s (rms), 10 ~ 100Hz, 0.5 mm/s (rms)	10 ~ 50Hz, 0.5 mm/s (rms), 10 ~ 100Hz, 0.5 mm/s (rms), 10 ~ 100Hz, 0.5 mm/s (rms)
	SAFETY STANDARDS	UL60950-1, UL60950-1 approved	UL60950-1, UL60950-1 approved	UL60950-1, UL60950-1 approved	UL60950-1, UL60950-1 approved	UL60950-1, UL60950-1 approved	UL60950-1, UL60950-1 approved	UL60950-1, UL60950-1 approved	UL60950-1, UL60950-1 approved	UL60950-1, UL60950-1 approved
	WITHSTAND VOLTAGE	3000VAC (1min)	3000VAC (1min)	3000VAC (1min)	3000VAC (1min)	3000VAC (1min)	3000VAC (1min)	3000VAC (1min)	3000VAC (1min)	3000VAC (1min)
	ISOLATION RESISTANCE	100MΩ (50VDC)	100MΩ (50VDC)	100MΩ (50VDC)	100MΩ (50VDC)	100MΩ (50VDC)	100MΩ (50VDC)	100MΩ (50VDC)	100MΩ (50VDC)	100MΩ (50VDC)
OTHERS	EMC EMISSION	Compliance to EN61010-2-2, A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, AA, AB, AC, AD, AE, AF, AG, AH, AI, AJ, AK, AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU, AV, AW, AX, AY, AZ, BA, BB, BC, BD, BE, BF, BG, BH, BI, BJ, BK, BL, BM, BN, BO, BP, BQ, BR, BS, BT, BU, BV, BW, BX, BY, BZ, CA, CB, CC, CD, CE, CF, CG, CH, CI, CJ, CK, CL, CM, CN, CO, CP, CQ, CR, CS, CT, CU, CV, CW, CX, CY, CZ, DA, DB, DC, DD, DE, DF, DG, DH, DI, DJ, DK, DL, DM, DN, DO, DP, DQ, DR, DS, DT, DU, DV, DW, DX, DY, DZ, EA, EB, EC, ED, EE, EF, EG, EH, EI, EJ, EK, EL, EM, EN, EO, EP, EQ, ER, ES, ET, EU, EV, EW, EX, EY, EZ, FA, FB, FC, FD, FE, FF, FG, FH, FI, FJ, FK, FL, FM, FN, FO, FP, FQ, FR, FS, FT, FU, FV, FW, FX, FY, FZ, GA, GB, GC, GD, GE, GF, GG, GH, GI, GJ, GK, GL, GM, GN, GO, GP, GQ, GR, GS, GT, GU, GV, GW, GX, GY, GZ, HA, HB, HC, HD, HE, HF, HG, HH, HI, HJ, HK, HL, HM, HN, HO, HP, HQ, HR, HS, HT, HU, HV, HW, HX, HY, HZ, IA, IB, IC, ID, IE, IF, IG, IH, II, IJ, IK, IL, IM, IN, IO, IP, IQ, IR, IS, IT, IU, IV, IW, IX, IY, IZ, JA, JB, JC, JD, JE, JF, JG, JH, JI, JJ, JK, JL, JM, JN, JO, JP, JQ, JR, JS, JT, JU, JV, JW, JX, JY, JZ, KA, KB, KC, KD, KE, KF, KG, KH, KI, KJ, KK, KL, KM, KN, KO, KP, KQ, KR, KS, KT, KU, KV, KW, KX, KY, KZ, LA, LB, LC, LD, LE, LF, LG, LH, LI, LJ, LK, LL, LM, LN, LO, LP, LQ, LR, LS, LT, LU, LV, LW, LX, LY, LZ, MA, MB, MC, MD, ME, MF, MG, MH, MI, MJ, MK, ML, MM, MN, MO, MP, MQ, MR, MS, MT, MU, MV, MW, MX, MY, MZ, NA, NB, NC, ND, NE, NF, NG, NH, NI, NJ, NK, NL, NM, NN, NO, NP, NQ, NR, NS, NT, NU, NV, NW, NX, NY, NZ, OA, OB, OC, OD, OE, OF, OG, OH, OI, OJ, OK, OL, OM, ON, OO, OP, OQ, OR, OS, OT, OU, OV, OW, OX, OY, OZ, PA, PB, PC, PD, PE, PF, PG, PH, PI, PJ, PK, PL, PM, PN, PO, PP, PQ, PR, PS, PT, PU, PV, PW, PX, PY, PZ, QA, QB, QC, QD, QE, QF, QG, QH, QI, QJ, QK, QL, QM, QN, QO, QP, QQ, QR, QS, QT, QU, QV, QW, QX, QY, QZ, RA, RB, RC, RD, RE, RF, RG, RH, RI, RJ, RK, RL, RM, RN, RO, RP, RQ, RR, RS, RT, RU, RV, RW, RX, RY, RZ, SA, SB, SC, SD, SE, SF, SG, SH, SI, SJ, SK, SL, SM, SN, SO, SP, SQ, SR, SS, ST, SU, SV, SW, SX, SY, SZ, TA, TB, TC, TD, TE, TF, TG, TH, TI, TJ, TK, TL, TM, TN, TO, TP, TQ, TR, TS, TT, TU, TV, TW, TX, TY, TZ, UA, UB, UC, UD, UE, UF, UG, UH, UI, UJ, UK, UL, UM, UN, UO, UP, UQ, UR, US, UT, UY, UZ, VA, VB, VC, VD, VE, VF, VG, VH, VI, VJ, VK, VL, VM, VN, VO, VP, VQ, VR, VS, VT, VU, VV, VW, VX, VY, VZ, WA, WB, WC, WD, WE, WF, WG, WH, WI, WJ, WK, WL, WM, WN, WO, WP, WQ, WR, WS, WT, WU, WV, WW, WX, WY, WZ, XA, XB, XC, XD, XE, XF, XG, XH, XI, XJ, XK, XL, XM, XN, XO, XP, XQ, XR, XS, XT, XU, XV, XW, XX, XY, XZ, YA, YB, YC, YD, YE, YF, YG, YH, YI, YJ, YK, YL, YM, YN, YO, YP, YQ, YR, YS, YT, YU, YV, YW, YX, YY, YZ, ZA, ZB, ZC, ZD, ZE, ZF, ZG, ZH, ZI, ZJ, ZK, ZL, ZM, ZN, ZO, ZP, ZQ, ZR, ZS, ZT, ZU, ZV, ZW, ZX, ZY, ZZ	Compliance to EN61010-2-2, A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, AA, AB, AC, AD, AE, AF, AG, AH, AI, AJ, AK, AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU, 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OL, OM, ON, OO, OP, OQ, OR, OS, OT, OU, OV, OW, OX, OY, OZ, PA, PB, PC, PD, PE, PF, PG, PH, PI, PJ, PK, PL, PM, PN, PO, PP, PQ, PR, PS, PT, PU, PV, PW, PX, PY, PZ, QA, QB, QC, QD, QE, QF, QG, QH, QI, QJ, QK, QL, QM, QN, QO, QP, QQ, QR, QS, QT, QU, QV, QW, QX, QY, QZ, RA, RB, RC, RD, RE, RF, RG, RH, RI, RJ, RK, RL, RM, RN, RO, RP, RQ, RR, RS, RT, RU, RV, RW, RX, RY, RZ, SA, SB, SC, SD, SE, SF, SG, SH, SI, SJ, SK, SL, SM, SN, SO, SP, SQ, SR, SS, ST, SU, SV, SW, SX, SY, SZ, TA, TB, TC, TD, TE, TF, TG, TH, TI, TJ, TK, TL, TM, TN, TO, TP, TQ, TR, TS, TT, TU, TV, TW, TX, TY, TZ, UA, UB, UC, UD, UE, UF, UG, UH, UI, UJ, UK, UL, UM, UN, UO, UP, UQ, UR, US, UT, UY, UZ, VA, VB, VC, VD, VE, VF, VG, VH, VI, VJ, VK, VL, VM, VN, VO, VP, VQ, VR, VS, VT, VU, VV, VW, VX, VY, VZ, WA, WB, WC, WD, WE, WF, WG, WH, WI, WJ, WK, WL, WM, WN, WO, WP, WQ, WR, WS, WT, WU, WV, WW, WX, WY, WZ, XA, XB, XC, XD, XE, XF, XG, XH, XI, XJ, XK, XL, XM, XN, XO, XP, XQ, XR, XS, XT, XU, XV, XW, XX, XY, XZ, YA, YB, YC, YD, YE, YF, YG, YH, YI, YJ, YK, YL, YM, YN, YO, YP, YQ, YR, YS, YT, YU, YV, YW, YX, YY, YZ, ZA, ZB, ZC, ZD, ZE, ZF, ZG, ZH, ZI, ZJ, ZK, ZL, ZM, ZN, ZO, ZP, ZQ, ZR, ZS, ZT, ZU, ZV, ZW, ZX, ZY, ZZ					
	EMC IMMUNITY	Compliance to EN61010-2-2, A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, AA, AB, AC, AD, AE, AF, AG, AH, AI, AJ, AK, AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU, AV, AW, AX, AY, AZ, BA, BB, BC, BD, BE, BF, BG, BH, BI, BJ, BK, BL, BM, BN, BO, BP, BQ, BR, BS, BT, BU, BV, BW, BX, BY, BZ, CA, CB, CC, CD, CE, CF, CG, CH, CI, CJ, CK, CL, CM, CN, CO, CP, CQ, CR, CS, CT, CU, CV, CW, CX, CY, CZ, DA, DB, DC, DD, DE, DF, DG, DH, DI, DJ, DK, DL, DM, DN, DO, DP, DQ, DR, DS, DT, DU, DV, DW, DX, DY, DZ, EA, EB, EC, ED, EE, EF, EG, EH, EI, EJ, EK, EL, EM, EN, EO, EP, EQ, ER, ES, ET, EU, EV, EW, EX, EY, EZ, FA, FB, FC, FD, FE, FF, FG, FH, FI, FJ, FK, FL, FM, FN, FO, FP, FQ, FR, FS, FT, FU, FV, FW, FX, FY, FZ, GA, GB, GC, GD, GE, GF, GG, GH, GI, GJ, GK, GL, GM, GN, GO, GP, GQ, GR, GS, GT, GU, GV, GW, GX, GY, GZ, HA, HB, HC, HD, HE, HF, HG, HH, HI, HJ, HK, HL, HM, HN, HO, HP, HQ, HR, HS, HT, HU, HV, HW, HX, HY, HZ, IA, IB, IC, ID, IE, IF, IG, IH, II, IJ, IK, IL, IM, IN, IO, IP, IQ, IR, IS, IT, IU, IV, IW, IX, IY, IZ, JA, JB, JC, JD, JE, JF, JG, JH, JI, JJ, JK, JL, JM, JN, JO, JP, JQ, JR, JS, JT, JU, JV, JW, JX, JY, JZ, KA, KB, KC, KD, KE, KF, KG, KH, KI, KJ, KK, KL, KM, KN, KO, KP, KQ, KR, KS, KT, KU, KV, KW, KX, KY, KZ, LA, LB, LC, LD, LE, LF, LG, LH, LI, LJ, LK, LL, LM, LN, LO, LP, LQ, LR, LS, LT, LU, LV, LW, LX, LY, LZ, MA, MB, MC, MD, ME, MF, MG, MH, MI, MJ, MK, ML, MM, MN, MO, MP, MQ, MR, MS, MT, MU, MV, MW, MX, MY, MZ, NA, NB, NC, ND, NE, NF, NG, NH, NI, NJ, NK, NL, NM, NN, NO, NP, NQ, NR, NS, NT, NU, NV, NW, NX, NY, NZ, OA, OB, OC, OD, OE, OF, OG, OH, OI, OJ, OK, OL, OM, ON, OO, OP, OQ, OR, OS, OT, OU, OV, OW, OX, OY, OZ, PA, PB, PC, PD, PE, PF, PG, PH, PI, PJ, PK, PL, PM, PN, PO, PP, PQ, PR, PS, PT, PU, PV, PW, PX, PY, PZ, QA, QB, QC, QD, QE, QF, QG, QH, QI, QJ, QK, QL, QM, QN, QO, QP, QQ, QR, QS, QT, QU, QV, QW, QX, QY, QZ, RA, RB, RC, RD, RE, RF, RG, RH, RI, RJ, RK, RL, RM, RN, RO, RP, RQ, RR, RS, RT, RU, RV, RW, RX, RY, RZ, SA, SB, SC, SD, SE, SF, SG, SH, SI, SJ, SK, SL, SM, SN, SO, SP, SQ, SR, SS, ST, SU, SV, SW, SX, SY, SZ, TA, TB, TC, TD, TE, TF, TG, TH, TI, TJ, TK, TL, TM, TN, TO, TP, TQ, TR, TS, TT, TU, TV, TW, TX, TY, TZ, UA, UB, UC, UD, UE, UF, UG, UH, UI, UJ, UK, UL, UM, UN, UO, UP, UQ, UR, US, UT, UY, UZ, VA, VB, VC, VD, VE, VF, VG, VH, VI, VJ, VK, VL, VM, VN, VO, VP, VQ, VR, VS, VT, VU, VV, VW, VX, VY, VZ, WA, WB, WC, WD, WE, WF, WG, WH, WI, WJ, WK, WL, WM, WN, WO, WP, WQ, WR, WS, WT, WU, WV, WW, WX, WY, WZ, XA, XB, XC, XD, XE, XF, XG, XH, XI, XJ, XK, XL, XM, XN, XO, XP, XQ, XR, XS, XT, XU, XV, XW, XX, XY, XZ, YA, YB, YC, YD, YE, YF, YG, YH, YI, YJ, YK, YL, YM, YN, YO, YP, YQ, YR, YS, YT, YU, YV, YW, YX, YY, YZ, ZA, ZB, ZC, ZD, ZE, ZF, ZG, ZH, ZI, ZJ, ZK, ZL, ZM, ZN, ZO, ZP, ZQ, ZR, ZS, ZT, ZU, ZV, ZW, ZX, ZY, ZZ	Compliance to EN61010-2-2, A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, AA, AB, AC, AD, AE, AF, AG, AH, AI, AJ, AK, AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU, AV, AW, AX, AY, AZ, BA, BB, BC, BD, BE, BF, BG, BH, BI, BJ, BK, BL, BM, BN, BO, BP, BQ, BR, BS, BT, BU, BV, BW, BX, BY, BZ, CA, CB, CC, CD, CE, CF, CG, CH, CI, CJ, CK, CL, CM, CN, CO, CP, CQ, CR, CS, CT, CU, CV, CW, CX, CY, CZ, DA, DB, DC, DD, DE, DF, DG, DH, DI, DJ, DK, DL, DM, DN, DO, DP, DQ, DR, DS, DT, DU, DV, DW, DX, DY, DZ, EA, EB, EC, ED, EE, EF, EG, EH, EI, EJ, EK, EL, EM, EN, EO, EP, EQ, ER, ES, ET, EU, EV, EW, EX, EY, EZ, FA, FB, FC, FD, FE, FF, FG, FH, FI, FJ, FK, FL, FM, FN, FO, FP, FQ, FR, FS, FT, FU, FV, FW							

- NOTE
1. All parameters NOT specially mentioned are measured at 25VAC input, rated load and 25°C of ambient temperature.
 2. Ripple & noise are measured at 0.05Hz of bandwidth by using a 12" tested pre-wire terminated with a 50Ω load, 47μF parallel capacitor.
 3. Temperature includes self-heating, line regulation and load regulation.
 4. The power supply is considered a component which will be installed in a final equipment. The final equipment must be re-confirmed that it still meets EMC directive.
 5. Cooling may be needed under low input voltage. Please check the static characteristics for more details.
 6. 100% Duty cycle maximum within every 10 seconds. Average output power should not exceed the rated power.

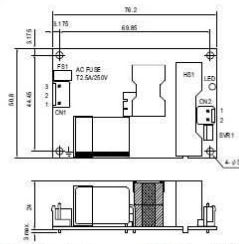


25W Single Output Switching Power Supply

EPS-25 series

Mechanical Specification

Unit: mm



AC Input Connector (CN1): JST B3P-VH or equivalent

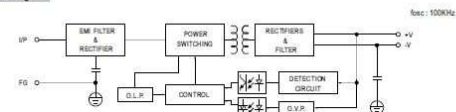
Pin No.	Assignment	Mating Housing	Terminal
1	ACN	JST B3P-VH or equivalent	JST B3P-VH Pin 1
2	NGN	JST B3P-VH or equivalent	JST B3P-VH Pin 2
3	ACG	JST B3P-VH or equivalent	JST B3P-VH Pin 3

DC Output Connector (CN2): JST B3P-VH or equivalent

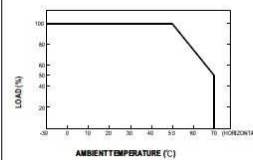
Pin No.	Assignment	Mating Housing	Terminal
1	V+	JST B3P-VH or equivalent	JST B3P-VH Pin 1
2	V-	JST B3P-VH or equivalent	JST B3P-VH Pin 2

① HS1 must have safety isolation distance with system case.
② Grounding required

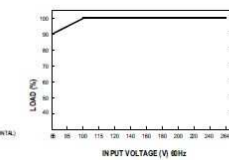
Block Diagram



Output Derating



Static Characteristics





OPA2107

Precision Dual *Difet*® OPERATIONAL AMPLIFIER

FEATURES

- VERY LOW NOISE: $8\text{nV}/\sqrt{\text{Hz}}$ at 10kHz
- LOW V_{OS} : 500 μV max
- LOW DRIFT: 5 $\mu\text{V}/^\circ\text{C}$ max
- LOW I_B : 5pA max
- FAST SETTLING TIME: 2 μs to 0.01%
- UNITY-GAIN STABLE

APPLICATIONS

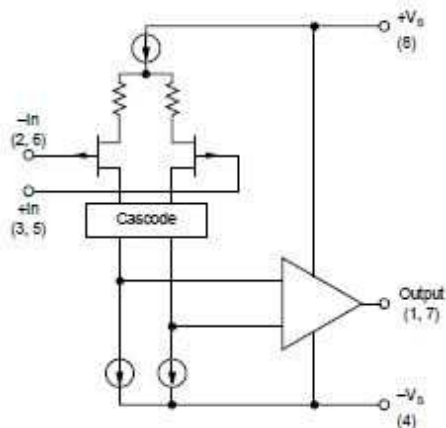
- DATA ACQUISITION
- DAC OUTPUT AMPLIFIER
- OPTOELECTRONICS
- HIGH-IMPEDANCE SENSOR AMPS
- HIGH-PERFORMANCE AUDIO CIRCUITRY
- MEDICAL EQUIPMENT, CT SCANNERS

DESCRIPTION

The OPA2107 dual operational amplifier provides precision *Difet* performance with the cost and space savings of a dual op amp. It is useful in a wide range of precision and low-noise analog circuitry and can be used to upgrade the performance of designs currently using BIFET® type amplifiers.

The OPA2107 is fabricated on a proprietary dielectrically isolated (*Difet*) process. This holds input bias currents to very low levels without sacrificing other important parameters, such as input offset voltage, drift and noise. Laser-trimmed input circuitry yields excellent DC performance. Superior dynamic performance is achieved, yet quiescent current is held to under 2.5mA per amplifier. The OPA2107 is unity-gain stable.

The OPA2107 is available in plastic DIP, metal TO-99, and SOIC packages. Industrial and Military temperature range versions are available.



Difet® Burr-Brown Corp.
BIFET® National Semiconductor

International Airport Industrial Park • Mailing Address: PO Box 11400 • Tucson, AZ 85714 • Street Address: 6730 S. Tucson Blvd. • Tucson, AZ 85706



N-Channel Depletion-Mode Vertical DMOS FETs

Features

- ▶ High input impedance
- ▶ Low input capacitance
- ▶ Fast switching speeds
- ▶ Low on-resistance
- ▶ Free from secondary breakdown
- ▶ Low input and output leakage

Applications

- ▶ Normally-on switches
- ▶ Solid state relays
- ▶ Converters
- ▶ Linear amplifiers
- ▶ Constant current sources
- ▶ Power supply circuits
- ▶ Telecom

General Description

The DN2530 is a low threshold depletion-mode (normally-on) transistor utilizing an advanced vertical DMOS structure and Supertex's well-proven silicon-gate manufacturing process. This combination produces a device with the power handling capabilities of bipolar transistors and with the high input impedance and positive temperature coefficient inherent in MOS devices. Characteristic of all MOS structures, this device is free from thermal runaway and thermally-induced secondary breakdown.

Supertex's vertical DMOS FETs are ideally suited to a wide range of switching and amplifying applications where high breakdown voltage, high input impedance, low input capacitance, and fast switching speeds are desired.

Ordering Information

Part Number	Package Option	Packing
DN2530N3-G	3-Lead TO-92	1000/Bag
DN2530N3-G P002	3-Lead TO-92	2000/Reel
DN2530N3-G P003		
DN2530N3-G P005		
DN2530N3-G P013		
DN2530N3-G P014		
DN2530N8-G	3-Lead TO-243AA (SOT-89)	2000/Reel

-G denotes a lead (Pb)-free / RoHS compliant package.
Contact factory for Wafer / Die availability.
Devices in Wafer / Die form are lead (Pb)-free / RoHS compliant.

Absolute Maximum Ratings

Parameter	Value
Drain-to-source voltage	BV_{DSX}
Drain-to-gate voltage	BV_{DGX}
Gate-to-source voltage	$\pm 20V$
Operating and storage temperature	$-55^{\circ}C$ to $+150^{\circ}C$

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. Continuous operation of the device at the absolute rating level may affect device reliability. All voltages are referenced to device ground.

Typical Thermal Resistance

Package	θ_{JA}
3-Lead TO-92	$132^{\circ}C/W$
3-Lead TO-243AA (SOT-89)	$133^{\circ}C/W$

Product Summary

BV_{DSX}/BV_{DGX}	$R_{DS(on)}$ (max)	I_{DSS} (min)
300V	12Ω	200mA

Pin Configuration



Product Marking

SiDN	YY = Year Sealed
2 5 3 0	WW = Week Sealed
Y Y W W	_____ = "Green" Packaging

Package may or may not include the following marks: SI or TO-92

DN5TW	W = Code for week sealed
	_____ = "Green" Packaging

Package may or may not include the following marks: SI or TO-243AA (SOT-89)