ON Semiconductor

Design Note – DN06029/D

Universal Input, 50W, 5 Output PSU

Device	Application	Input Voltage	Output Power	Topology	I/O Isolation
NCP1308, LM2575	Medical Equipment	85 to 265 Vac	40 W average, 50 W peak	Quasi-Resonant Mode Flyback	Yes – 3kV

Other Specifications

	Output 1	Output 2	Output 3	Output 4
Output Voltage	12 VDC	-12 VDC	5 VDC	3.3 VDC
Ripple	+/- 20mV	+/- 20mV	2% - 5%	2% - 5%
Nominal Current	2.5 A	150 mA	900 mA	150 mA
Max Current	3 A	300 mA	1.2 A	300 mA
Min Current	10 mA	10 mA	10 mA	10 mA

PFC (Yes/No)	No
Minimum Efficiency	75 % at nominal load
Inrush Limiting / Fuse	Yes - both
Operating Temp. Range	0 to +60°C
Cooling Method/Supply Orientation	Convection

Others	5th Output with 350 Vdc @ +/- 20 V at 50 mA max.

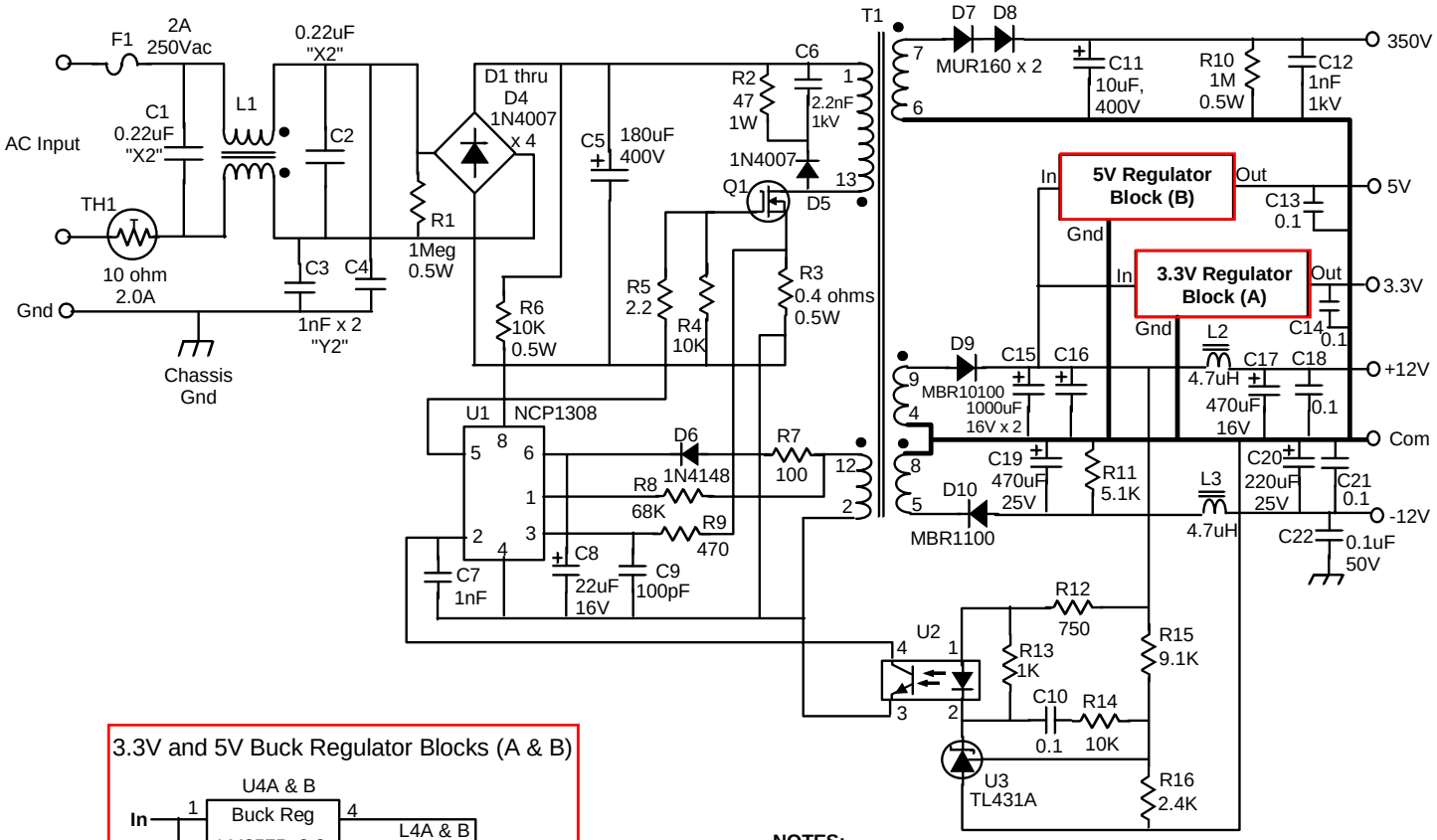
Circuit Description

This Design Note features a universal AC input, 50 watt peak output flyback power supply with 5 separate output voltages. The 3.3 volt and 5 volt outputs are derived from the +12 volt output using identical LM2575 monolithic buck regulators. The 350 volt output is derived from a “slave” secondary flyback winding on the main transformer. ON Semiconductor’s NCP1308 controller provides for quasi-resonant Mosfet switching and current mode control of the flyback topology for high conversion efficiency and low noise generation. Voltage sensing and regulation for the main +12 volt output is achieved utilizing the conventional TL431A error amp and optocoupler feedback scheme. The negative 12 volt output achieves satisfactory regulation via a tightly coupled secondary winding with the main +12 V output’s secondary winding (bifilar wound). The 3.3 V and 5 V outputs require minimal components utilizing the LM2575 buck regulators and off-the-shelf ferrite inductors.

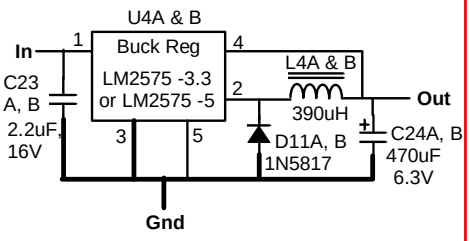
Key Features

- Over-current, over-voltage, and over-temperature protection.
- Input common and differential mode EMI filter for agency EMI compliance.
- NTC thermistor for inrush current limiting at initial supply turn-on.
- Pi-network ripple filters (L2, L3) on the +/-12 V outputs for low output noise and ripple.
- Main flyback transformer designed with common industry standard ETD29 ferrite core.

Schematic



3.3V and 5V Buck Regulator Blocks (A & B)



Buck Regulator Notes:
1. U4B requires small heatsink (TO-220).
2. C23 should be multilayer ceramic cap and located next to U4.
3. L4 is Coilcraft PCV-0-394-03L or equivalent (390 uH, 3A).

NOTES:

1. Crossed lines on schematic are not connected.
2. Heavy lines indicate recommended ground plane area.
3. L1 is Coilcraft BU15-2721R6BL or similar EMI inductor.
4. L2 & L3 are Coilcraft PCV-0-472-05L or equivalent.
5. U2 is Vishay H11A817A or equivalent optocoupler.
6. Q1 is 6A, 650V Mosfet (TO-220).
7. Q1 and D9 will need small stamped heatsinks.

50 Watt, 5 Output Universal Input Power Supply

DN06029/D

MAGNETICS DESIGN DATA SHEET

Project : 50W, 5 output power supply

Part Description: Quasi-resonant flyback transformer, 50W, +/-12Vout/350Vout

Schematic ID: T1

Core Type: ETD29 (Ferroxcube 3C95 material or equivalent)

Core Gap: Gap for 400 uH +/- 5% acros pins 13 to 1

Inductance: 380 to 420 uH nominal across primary (pins 13 to 1)

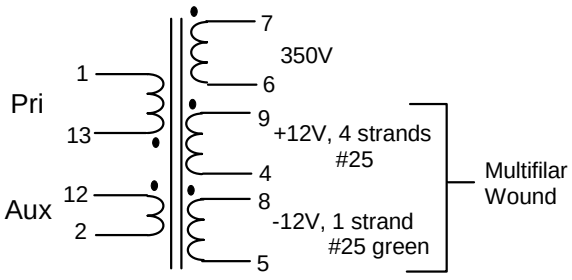
Bobbin Type: ETD 13 pin horizontal pc mount (Ferroxcube PC1-29H)

Windings (in order):

Winding # / type/pins	Turns / Material / Gauge / Insulation Data
Aux winding (12 - 2)	5 turns of # 26HN spiral wound evenly over bobbin. Self-leads to pins. Insulate for 1 kV to next winding.
Primary (13 - 1)	42 turns of #26HN over one full bobbin layer; Self-leads to pins; insulate for 3 kV to next layer.
+/-12V secondary (9,8, - 4,5)	5 turns of 5 strands #25HN; one strand should be green for -12V winding; flat-wind over 1 layer with 3.5 mm approximate end margins. Winding ends should be cuffed with tape. Self-leads to pins with 4 wires per pin on +12 strands. Insulate with tape for 3 kV to next winding.
350V secondary (7 - 6)	135 turns of #38HN over 1 layer; self-leads to pins. Final tape insulation to 3kV.

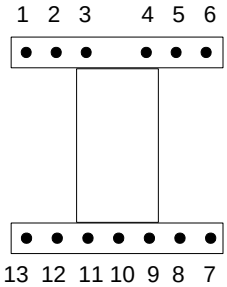
Hipot: 3 kV primary/aux to all secondaries. Vacuum varnish.

Schematic



Lead Breakout / Pinout

Bottom (pin side) view



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