# Design Example Report

| | |
|---|---|
| **Title** | ***7.3 W Dual Output Non-Isolated Power Supply using TNY266P*** |
| **Specification** | Input: 90 – 265 VAC<br>Output: 5V / 500mA, 24V / 200mA |
| **Application** | Cook Top Control |
| **Author** | Power Integrations Applications Department |
| **Document Number** | DER-110 |
| **Date** | October 26, 2005 |
| **Revision** | 1.0 |

## Summary and Features

- Compact 1.5” X 2” X 1” PCB footprint
- Total output power 6.0 W with TNY266P and EE16 core
- Typical Efficiency 75 %
- Good cross regulation using low-cost zener
- Meets EN55022 class B conducted EMI test without Y1 safety capacitor
- No Optocoupler used in the feedback loop

The products and applications illustrated herein (including circuits external to the products and transformer construction) may be covered by one or more U.S. and foreign patents or potentially by pending U.S. and foreign patent applications assigned to Power Integrations. A complete list of Power Integrations’ patents may be found at *www.powerint.com*.

**Power Integrations**
5245 Hellyer Avenue, San Jose, CA 95138 USA.
Tel: +1 408 414 9200 Fax: +1 408 414 9201
*www.powerint.com*

## Table Of Contents



**Important Notes:**
Although this board is designed to satisfy safety isolation requirements, the engineering prototype has not been agency approved. Therefore, all testing should be performed using an isolated source to provide power to the prototype board.

Design Reports contain a power supply design specification, schematic, bill of materials, and transformer documentation. Performance data and typical operation characteristics are included. Typically only a single prototype has been built.



**Power Integrations**
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

# 1 Introduction

This document is an engineering report describing a dual output non-isolated power supply utilizing a TNY266P. This power supply is intended as a power supply for a cooktop control module.

The document contains the power supply specification, schematic, bill-of-materials, transformer documentation, printed circuit layout, and performance data.

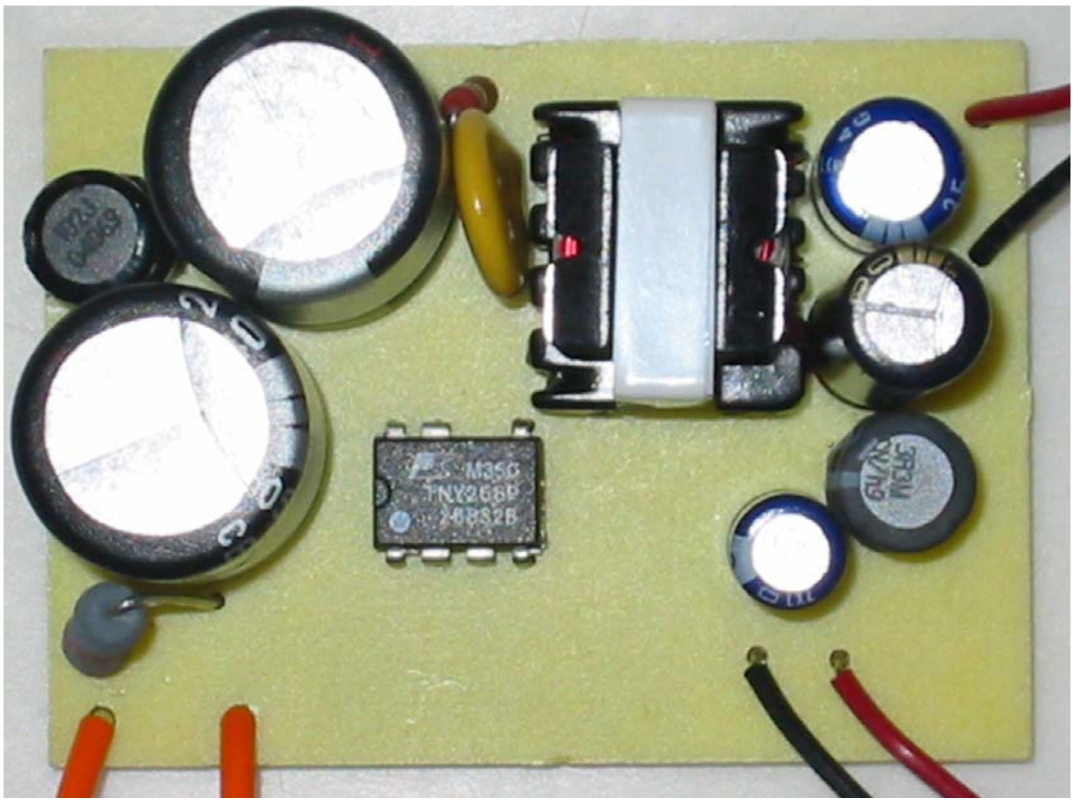


**Figure 1 –** Populated Circuit Board Photograph



**Power Integrations**
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

## 2 Power Supply Specification

| Description | Symbol | Min | Typ | Max | Units | Comment |
|---|---|---|---|---|---|---|
| **Input** | | | | | | |
| Voltage | $V_{IN}$ | 90 | | 265 | VAC | 2 Wire – no P.E. |
| Frequency | $f_{LINE}$ | 47 | 50/60 | 64 | Hz | |
| No-load Input Power (230 VAC) | | | | 0.7 | W | |
| **Output** | | | | | | |
| Output Voltage 1 | $V_{OUT1}$ | | 5 | | V | ± 5% |
| Output Ripple Voltage 1 | $V_{RIPPLE1}$ | | 50 | | mV | 20 MHz bandwidth |
| Output Current 1 | $I_{OUT1}$ | | 500 | | mA | |
| Output Voltage 2 | $V_{OUT1}$ | | 24 | | V | ± 15% |
| Output Ripple Voltage 2 | $V_{RIPPLE1}$ | | 200 | | mV | 20 MHz bandwidth |
| Output Current 2 | $I_{OUT1}$ | | 200 | | mA | |
| Output Power | $P_{OUT}$ | | 7.3 | | W | |
| **Efficiency** | $\eta$ | 80 | | | % | Measured at $P_{OUT}$ (7.3 W), 25 °C |
| **Environmental** | | | | | | |
| Conducted EMI | | Meets CISPR22B / EN55022B | | | | |
| Safety | | Designed to meet IEC950, UL1950 Class II | | | | |
| Surge | | 4 | | | kV | 1.2/50 µs surge, IEC 1000-4-5, Series Impedance: Differential Mode: 2 Ω Common Mode: 12 Ω |
| Surge | | 3 | | | kV | 100 kHz ring wave, 500 A short circuit current, differential and common mode |
| Ambient Temperature | $T_{AMB}$ | 0 | | 70 | °C | Free convection, sea level |


**Power Integrations**
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

## 3 Schematic

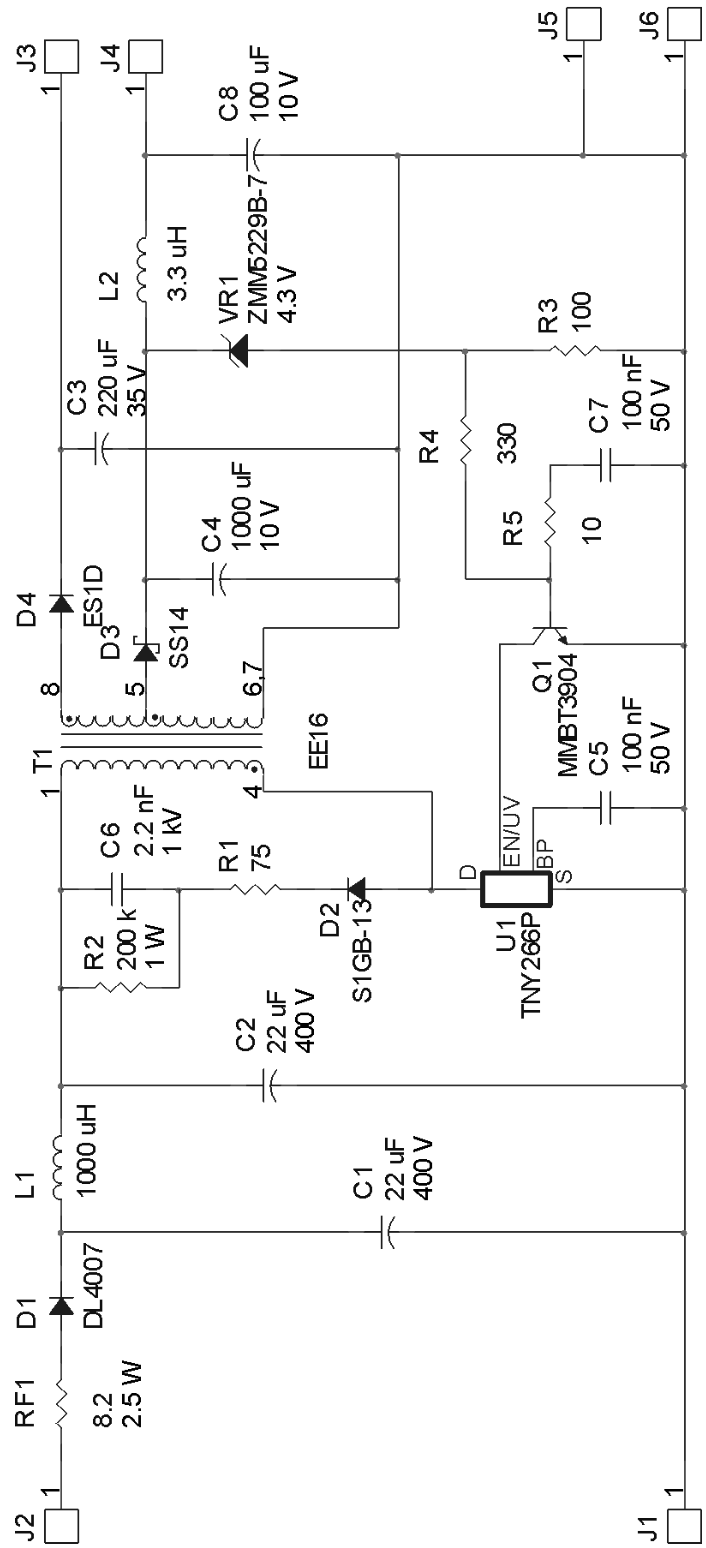


**Figure 2 –** Schematic



Power Integrations
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

# 4 PCB Layout

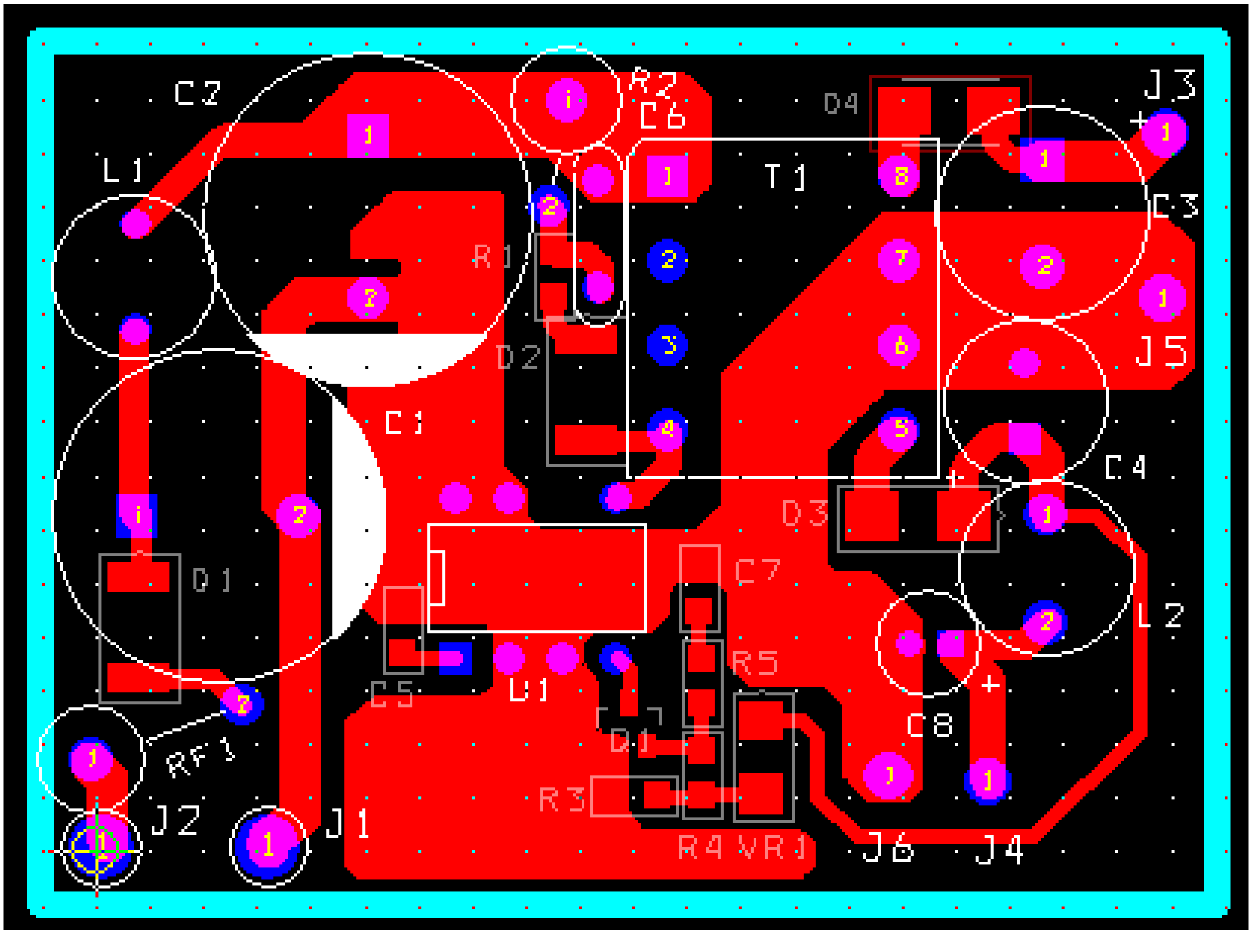


**Figure 3** – Printed Circuit Layout


**Power Integrations**
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

# 5 Bill Of Materials

| Item | QTY | Ref. Des. | Description | Mfg | Mfg Part Number |
|---|---|---|---|---|---|
| 1 | 2 | C1 C2 | 22 uF, 400 V, Electrolytic, Low ESR, 901 mOhm, (16 x 20) | United Chemi-Con | KMX400VB22RM16X20LL |
| 2 | 1 | C3 | 330 uF, 35 V, Electrolytic, Very Low ESR, 38 mOhm, (10 x 16) | United Chemi-Con | KZE35VB331MJ16LL |
| 3 | 1 | C4 | 1000 uF, 10 V, Electrolytic, Low ESR, 80 mOhm, (8 x 20) | United Chemi-Con | LXZ10VB102MH20LL |
| 4 | 2 | C5 C7 | 100 nF, 50 V, Ceramic, X7R, 0805 | Panasonic | ECU-V1H221KBN |
| 5 | 1 | C6 | 2.2 nF, 1 kV, Disc Ceramic | NIC Components Corp | NCD222K1KVY5F |
| 6 | 1 | C8 | 100 uF, 10 V, Electrolytic, Low ESR, 500 mOhm, (5 x 11.5) | United Chemi-Con | LXZ10VB101ME11LL |
| 7 | 1 | D1 | 1000 V, 1 A, Rectifier, Glass Passivated, DO-213AA (MELF) | Diodes Inc | DL4007 |
| 8 | 1 | D2 | 400 V, 1 A, Rectifier, Glass Passivated | Diodes Inc | S1GB-13 |
| 9 | 1 | D3 | 40 V, 1 A, Schottky, DO-214AC | Vishay | SS14 |
| 10 | 1 | D4 | 200 V, 1 A, Ultrafast Recovery, 25 ns, DO-214AC | Vishay | ES1C |
| 11 | 1 | L1 | 1000 uH, 0.29 A | Tokin | SBC4-102-291 |
| 12 | 1 | L2 | 3.3 uH, 2.66 A | Toko | 822LY-3R3M |
| 13 | 1 | Q1 | NPN, Small Signal BJT, 40 V, 0.2 A, SOT-23 | Vishay | MMBT3904 |
| 14 | 1 | R1 | 75 R, 5%, 1/8 W, Metal Film, 0805 | Panasonic | ERJ-6GEYJ750V |
| 15 | 1 | R2 | 200 k, 5%, 1 W, Metal Oxide | Yageo | RSF100JB-200K |
| 16 | 1 | R3 | 100 R, 5%, 1/8 W, Metal Film, 0805 | Panasonic | ERJ-6GEYJ101V |
| 17 | 1 | R4 | 330 R, 5%, 1/8 W, Metal Film, 0805 | Panasonic | ERJ-6GEYJ331V |
| 18 | 1 | R5 | 10 R, 5%, 1/8 W, Metal Film, 0805 | Panasonic | ERJ-6GEYJ100V |
| 19 | 1 | RF1 | 8.2 R, 2.5 W, Fusible/Flame Proof Wire Wound | Vitrohm | CRF253-4 5T 8R2 |
| 20 | 1 | T1 | Bobbin, EE16, Vertical, 8 pins | Bu Chang Ind Co Ltd | |
| 21 | 1 | U1 | TinySwitch-II, TNY266P, DIP-8B | Power Integrations | TNY266P |
| 22 | 1 | VR1 | 4.3 V, 5%, 500 mW, DO-213AA (MELF) | Diodes Inc | ZMM5229B-7 |


**Power Integrations**
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

# 6 Transformer Specification

## 6.1 Electrical Diagram

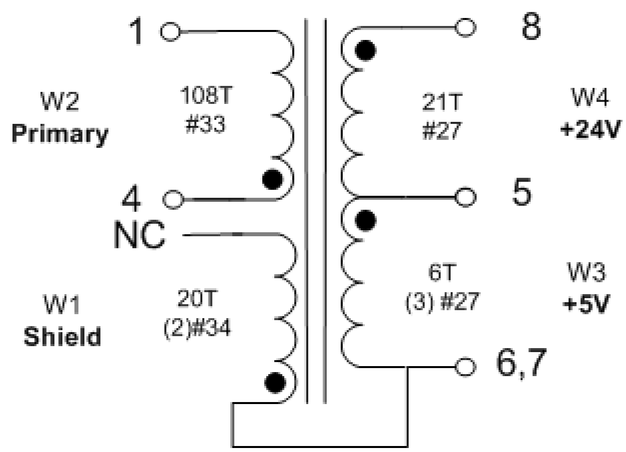


**Figure 4** – Transformer Electrical Diagram

## 6.2 Electrical Specifications

| | | |
|---|---|---|
| **Electrical Strength** | 1 second, 60 Hz, from Pins 1-4 to Pins 5-10 | 200 VAC |
| **Primary Inductance** | Pins 1-4, all other windings open, measured at 100 kHz, 0.4 VRMS | 1570 µH, -0/+20% |
| **Resonant Frequency** | Pins 1-4, all other windings open | 800 kHz (Min.) |
| **Primary Leakage Inductance** | Pins 1-4, with Pins 5-10 shorted, measured at 100 kHz, 0.4 VRMS | 60 µH (Max.) |

## 6.3 Materials

| Item | Description |
|---|---|
| **[1]** | Core: EE16 PC40 Al = 124nH/$T^2$ |
| **[2]** | Bobbin: 10-pin Vertical |
| **[3]** | Magnet Wire: #34 Heavy Build |
| **[4]** | Magnet Wire: #33 Heavy Build |
| **[5]** | Magnet Wire: #27 Heavy Build |
| **[6]** | Tape, 3M |
| **[7]** | Varnish |


**Power Integrations**
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

## 6.4 Transformer Build Diagram

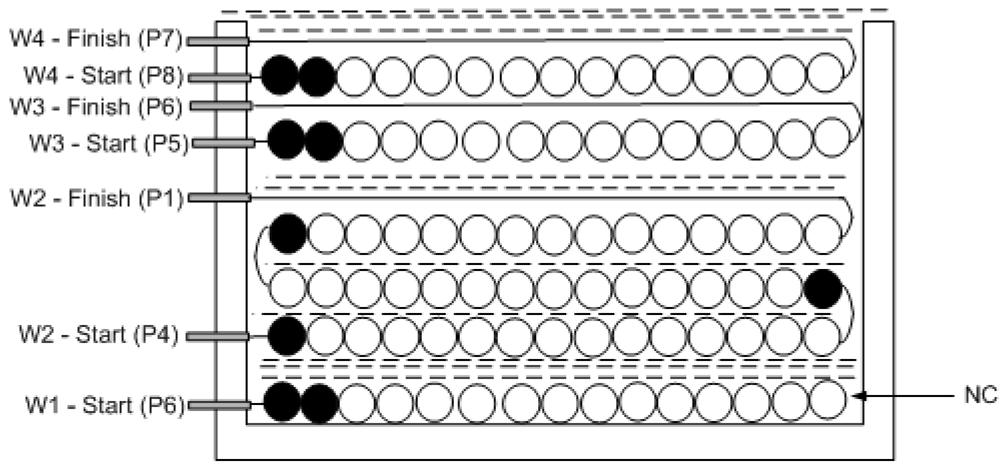


**Figure 5** – Transformer Build Diagram

## 6.5 Transformer Construction

| | |
|---|---|
| **Core Shield** | Start at pin 6 and wind 20 turns of bifilar wound #34. Do not connect finish end of this winding. |
| **Basic Insulation** | Apply three layers of tape for basic insulation. |
| **Primary** | Start on pin 4, wind 108 turns of #33 in three layers. Apply one layer of tape between each adjacent winding layer. |
| **Basic Insulation** | Apply two layers of tape for basic insulation. |
| **Secondary Winding** | Start on pin 5, wind 6 turns of trifilar #27 in one layer. Finish on pin 6. |
| **Secondary Winding** | Start on pin 8, wind 21 turns of #27 in one layer. Finish on pin 5. |
| **Outer Wrap** | Wrap windings with 3 layers of tape. |
| **Final Assembly** | Assemble and secure core halves. Dip varnish, do not impregnate (item [7]). |



**Power Integrations**
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

# 7 Transformer Spreadsheets

| ACDC_TNY-II_020105; Rev.2.4; Copyright Power Integrations Inc. 2005 | INPUT | INFO | OUTPUT | UNIT | ACDC_TNYII_020105_Rev2-4.xls; TinySwitch-II Continuous/Discontinuous Flyback Transformer Design Spreadsheet |
|---|---|---|---|---|---|
| **ENTER APPLICATION VARIABLES** | | | | | **Customer** |
| VACMIN | 85 | | | Volts | Minimum AC Input Voltage |
| VACMAX | 265 | | | Volts | Maximum AC Input Voltage |
| fL | 50 | | | Hertz | AC Mains Frequency |
| VO | 5 | | | Volts | Output Voltage |
| PO | 7.3 | | | Watts | Output Power |
| n | 0.7 | | | | Efficiency Estimate |
| Z | | | 0.5 | | Loss Allocation Factor |
| tC | | | 3 | mSeconds | Bridge Rectifier Conduction Time Estimate |
| CIN | 20 | | | uFarads | Input Filter Capacitor |
| **ENTER TinySwitch-II VARIABLES** | | | | | |
| **TinySwitch-II** | **tny266** | | | *Universal* | *115 Doubled/230V* |
| *Chosen Device* | | *TNY266* | *Power Out* | *9.5W* | *15W* |
| ILIMITMIN | | | *0.325* | Amps | TinySwitch-II Minimum Current Limit |
| ILIMITMAX | | | *0.375* | Amps | TinySwitch-II Maximum Current Limit |
| fS | | | *132000* | Hertz | TinySwitch-II Switching Frequency |
| fSmin | | | *120000* | Hertz | TinySwitch-II Minimum Switching Frequency (inc. jitter) |
| fSmax | | | *144000* | Hertz | TinySwitch-II Maximum Switching Frequency (inc. jitter) |
| VOR | 99 | | | Volts | Reflected Output Voltage |
| VDS | | | 10 | Volts | TinySwitch-II on-state Drain to Source Voltage |
| VD | 0.5 | | | Volts | Output Winding Diode Forward Voltage Drop |
| KP | | | 0.67 | | Ripple to Peak Current Ratio (0.6<KRP<1.0 : 1.0<KDP<6.0) |
| **ENTER TRANSFORMER CORE/CONSTRUCTION VARIABLES** | | | | | |
| **Core Type** | **EE16** | | | | |
| *Core* | | *EE16* | | *P/N:* | PC40EE16-Z |
| *Bobbin* | | *EE16_BOBBIN* | | *P/N:* | BE-16-118CPH |
| AE | | | 0.192 | cm^2 | Core Effective Cross Sectional Area |
| LE | | | 3.5 | cm | Core Effective Path Length |
| AL | | | 1140 | nH/T^ | Ungapped Core Effective Inductance |



**Power Integrations**
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

| | | | | |
|---|---|---|---|---|
| | | 2 | | |
| BW | | 8.5 | mm | Bobbin Physical Winding Width |
| M | 0 | | mm | Safety Margin Width (Half the Primary to Secondary Creepage Distance) |
| L | 3 | | | Number of Primary Layers |
| NS | 6 | | | Number of Secondary Turns |

**DC INPUT VOLTAGE PARAMETERS**

| | | | | |
|---|---|---|---|---|
| VMIN | | 85 | Volts | Minimum DC Input Voltage |
| VMAX | | 375 | Volts | Maximum DC Input Voltage |

**CURRENT WAVEFORM SHAPE PARAMETERS**

| | | | | |
|---|---|---|---|---|
| DMAX | | 0.57 | | Maximum Duty Cycle |
| IAVG | | 0.12 | Amps | Average Primary Current |
| IP | | 0.33 | Amps | Minimum Peak Primary Current |
| IR | | 0.22 | Amps | Primary Ripple Current |
| IRMS | | 0.17 | Amps | Primary RMS Current |

**TRANSFORMER PRIMARY DESIGN PARAMETERS**

| | | | | |
|---|---|---|---|---|
| LP | | 1570 | uH | Primary Inductance |
| NP | | 108 | | Primary Winding Number of Turns |
| ALG | | 135 | nH/T^2 | Gapped Core Effective Inductance |
| BM | | 2840 | Gauss | Maximum Flux Density, (BP<3100) |
| BAC | | 824 | Gauss | AC Flux Density for Core Loss Curves (0.5 X Peak to Peak) |
| ur | | 1654 | | Relative Permeability of Ungapped Core |
| LG | | 0.16 | mm | Gap Length (Lg > 0.1 mm) |
| BWE | | 25.5 | mm | Effective Bobbin Width |
| OD | | 0.24 | mm | Maximum Primary Wire Diameter including insulation |
| INS | | 0.05 | mm | Estimated Total Insulation Thickness (= 2 * film thickness) |
| DIA | | 0.19 | mm | Bare conductor diameter |
| AWG | | 33 | AWG | Primary Wire Gauge (Rounded to next smaller standard AWG value) |
| CM | | 51 | Cmils | Bare conductor effective area in circular mils |
| CMA | | 299 | Cmils/Amp | Primary Winding Current Capacity (200 < CMA < 500) |

**TRANSFORMER SECONDARY DESIGN PARAMETERS**

**Lumped parameters**

| | | | | |
|---|---|---|---|---|
| ISP | | 5.85 | Amps | Peak Secondary Current |
| ISRMS | | 2.66 | Amps | Secondary RMS Current |
| IO | | 1.46 | Amps | Power Supply Output Current |
| IRIPPLE | | 2.22 | Amps | Output Capacitor RMS Ripple Current |
| CMS | | 531 | Cmils | Secondary Bare Conductor minimum circular mils |
| AWGS | | 22 | AWG | Secondary Wire Gauge (Rounded up to next larger |



**Power Integrations**
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

| | | | | |
|---|---|---|---|---|
| | | | | standard AWG value) |
| DIAS | | 0.65 | mm | Secondary Minimum Bare Conductor Diameter |
| ODS | | 1.42 | mm | Secondary Maximum Outside Diameter for Triple Insulated Wire |
| INSS | | 0.39 | mm | Maximum Secondary Insulation Wall Thickness |

## VOLTAGE STRESS PARAMETERS

| | | | | |
|---|---|---|---|---|
| VDRAIN | | 603 | Volts | Maximum Drain Voltage Estimate (Includes Effect of Leakage Inductance) |
| PIVS | | 26 | Volts | Output Rectifier Maximum Peak Inverse Voltage |

**TRANSFORMER SECONDARY DESIGN PARAMETERS (MULTIPLE OUTPUTS)**

### 1st output

| | | | | |
|---|---|---|---|---|
| VO1 | 5 | 5 | Volts | Output Voltage (if unused, defaults to single output design) |
| IO1 | 0.5 | 0.500 | Amps | Output DC Current |
| PO1 | | 2.50 | Watts | Output Power |
| VD1 | 0.5 | 0.5 | Volts | Output Diode Forward Voltage Drop |
| NS1 | | 6.00 | | Output Winding Number of Turns |
| ISRMS1 | | 0.910 | Amps | Output Winding RMS Current |
| IRIPPLE1 | | 0.76 | Amps | Output Capacitor RMS Ripple Current |
| PIVS1 | | 26 | Volts | Output Rectifier Maximum Peak Inverse Voltage |
| CMS1 | | 182 | Cmils | Output Winding Bare Conductor minimum circular mils |
| AWGS1 | | 27 | AWG | Wire Gauge (Rounded up to next larger standard AWG value) |
| DIAS1 | | 0.36 | mm | Minimum Bare Conductor Diameter |
| ODS1 | | 1.42 | mm | Maximum Outside Diameter for Triple Insulated Wire |

### 2nd output

| | | | | |
|---|---|---|---|---|
| VO2 | 24 | | Volts | Output Voltage |
| IO2 | 0.2 | | Amps | Output DC Current |
| PO2 | | 4.80 | Watts | Output Power |
| VD2 | 0.6 | | Volts | Output Diode Forward Voltage Drop |
| NS2 | | 26.84 | | Output Winding Number of Turns |
| ISRMS2 | | 0.364 | Amps | Output Winding RMS Current |
| IRIPPLE2 | | 0.30 | Amps | Output Capacitor RMS Ripple Current |
| PIVS2 | | 117 | Volts | Output Rectifier Maximum Peak Inverse Voltage |
| CMS2 | | 73 | Cmils | Output Winding Bare Conductor minimum circular mils |
| AWGS2 | | 31 | AWG | Wire Gauge (Rounded up to next larger standard AWG value) |
| DIAS2 | | 0.23 | mm | Minimum Bare Conductor Diameter |
| ODS2 | | 0.32 | mm | Maximum Outside Diameter for Triple Insulated Wire |



**Power Integrations**
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

# 8 Performance Data

All measurements performed at room temperature, 60 Hz input frequency.

## *8.1 Efficiency*

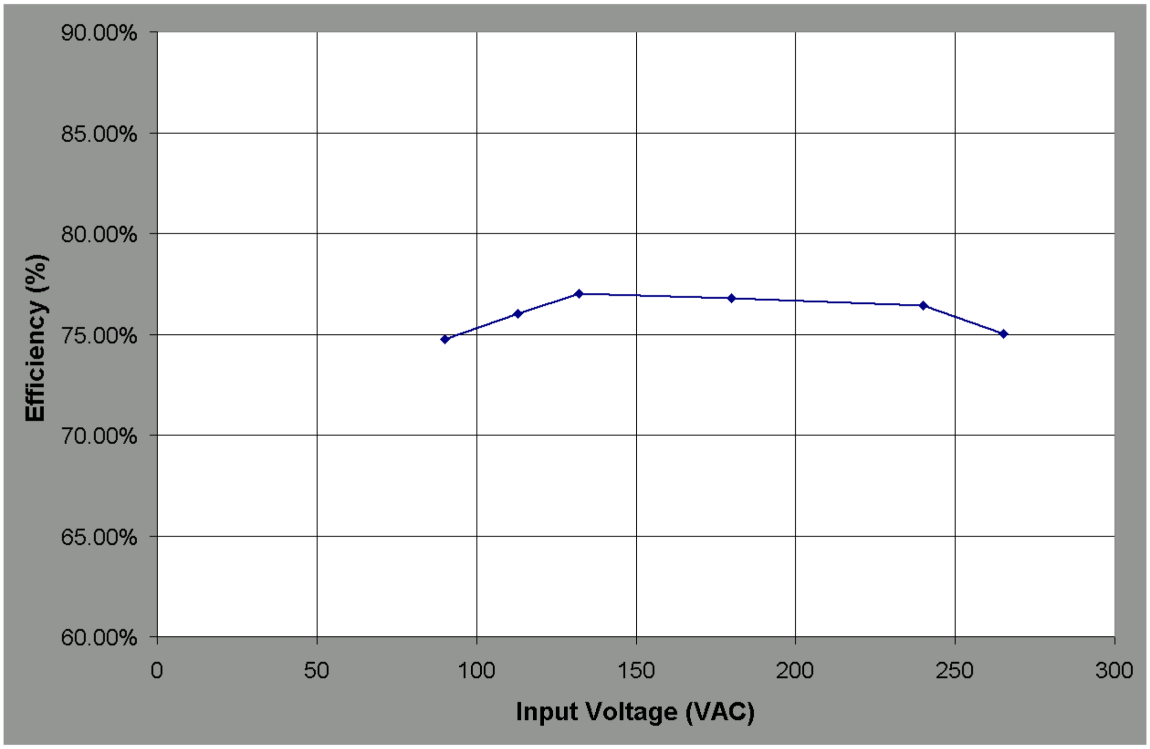


**Figure 6 –** Efficiency at Full Load vs. Input Voltage, Room Temperature, 60 Hz.



**Power Integrations**
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

## *8.2 No-load Input Power*

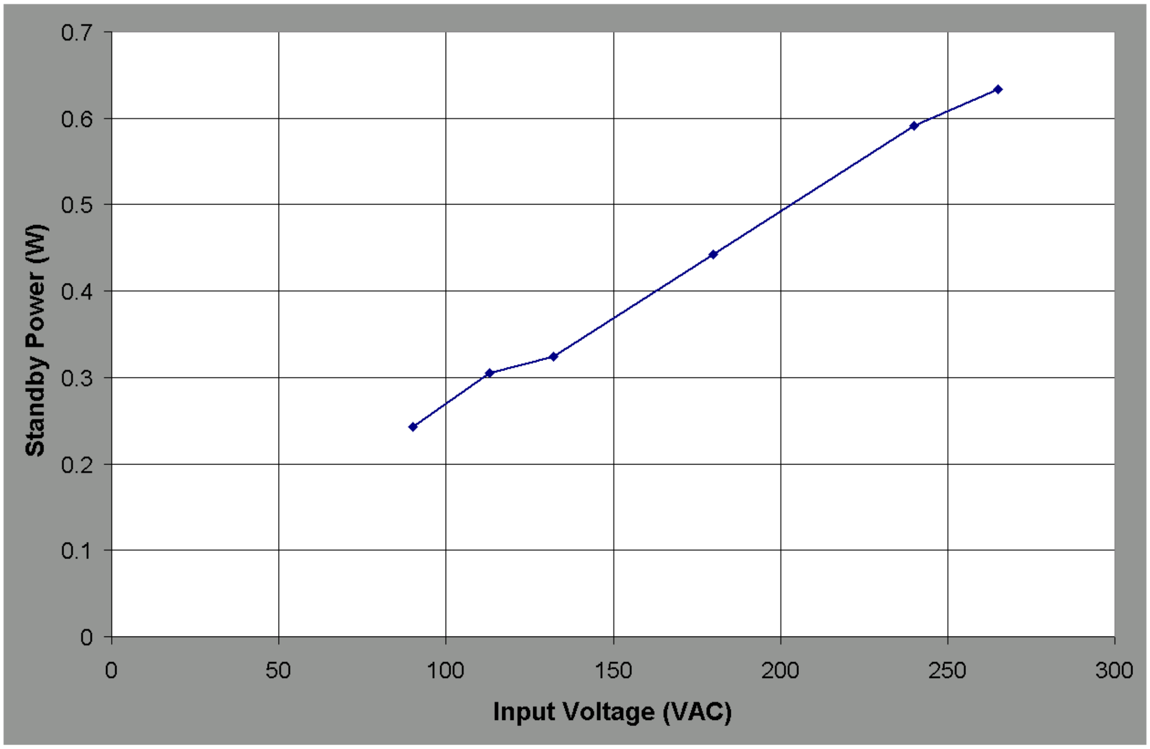


**Figure 7 –** Zero Load Input Power vs. Input Line Voltage, Room Temperature, 60 Hz.


**Power Integrations**
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

## 8.3 Regulation

### 8.3.1 Load

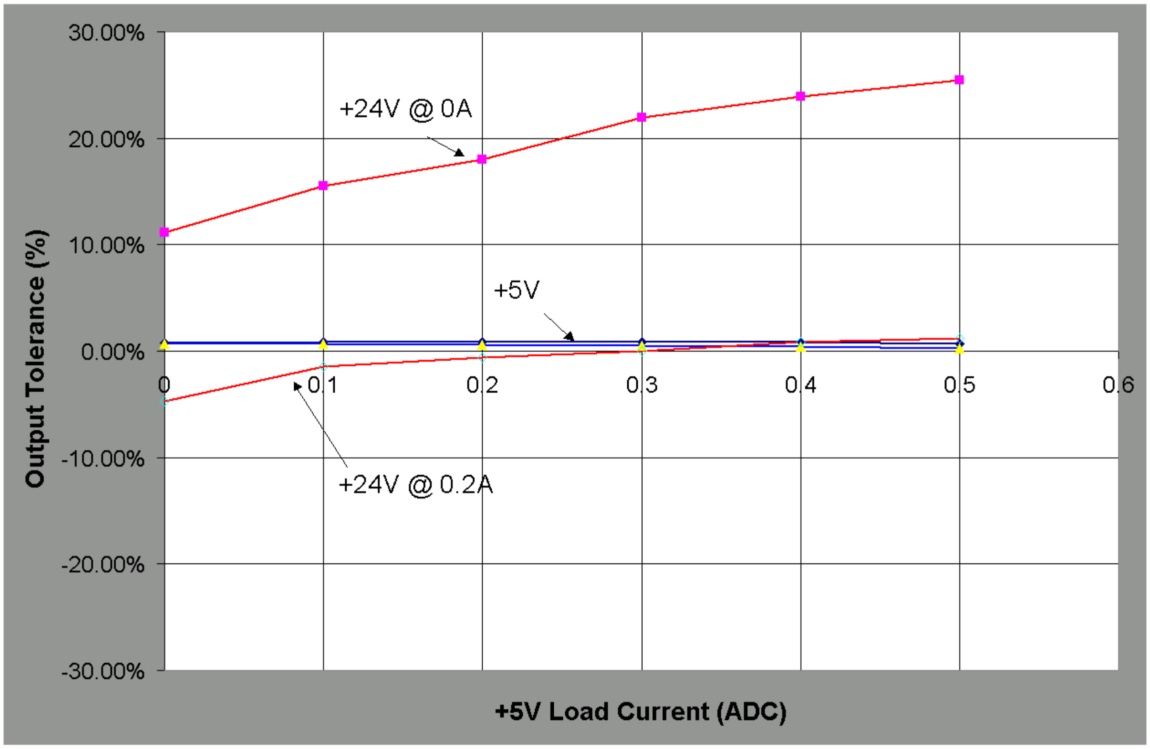


**Figure 8** – Load Regulation @ 120VAC Input, Room Temperature



**Power Integrations**
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

### 8.3.2 Line

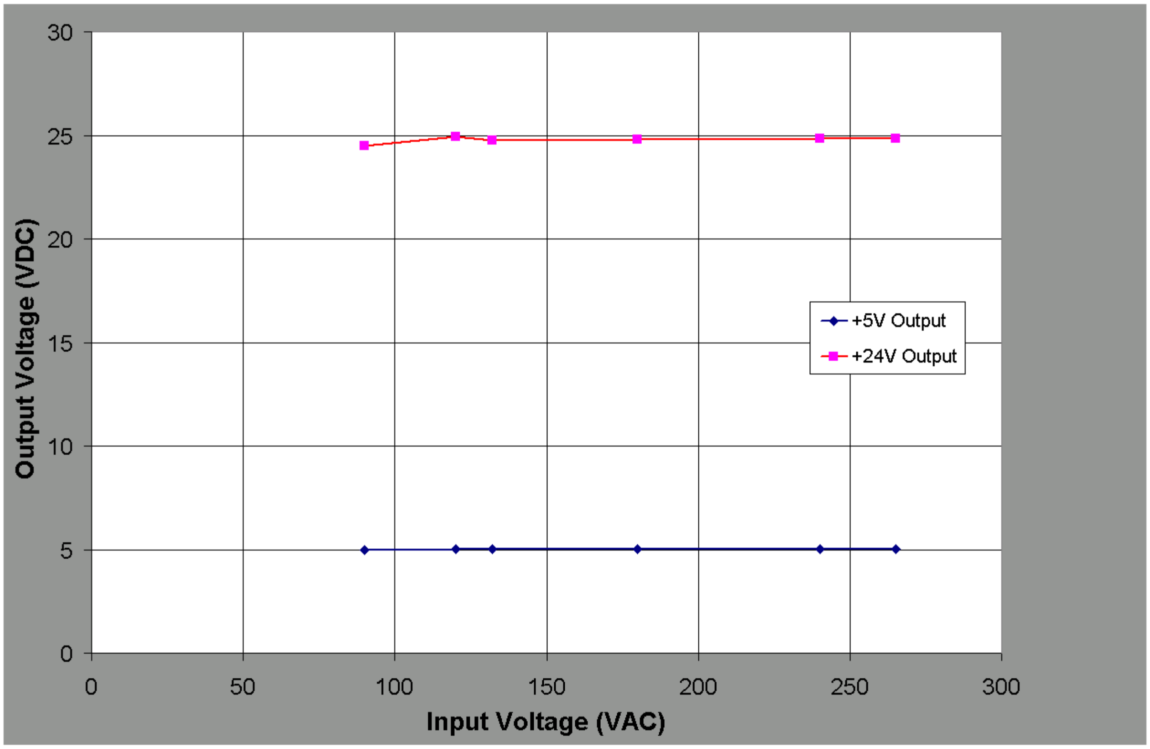


**Figure 9** – Line Regulation, Room Temperature, Full Load



**Power Integrations**
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

# 9 Waveforms

## 9.1 Drain Voltage and Current, Normal Operation

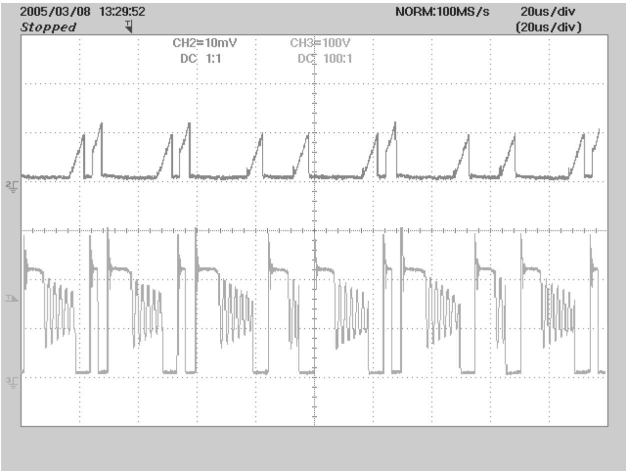


**Figure 10 –** 85 VAC, Full Load.
Upper: $I_{DRAIN}$, 0.5 A / div
Lower: $V_{DRAIN}$, 100 V, 2 µs / div

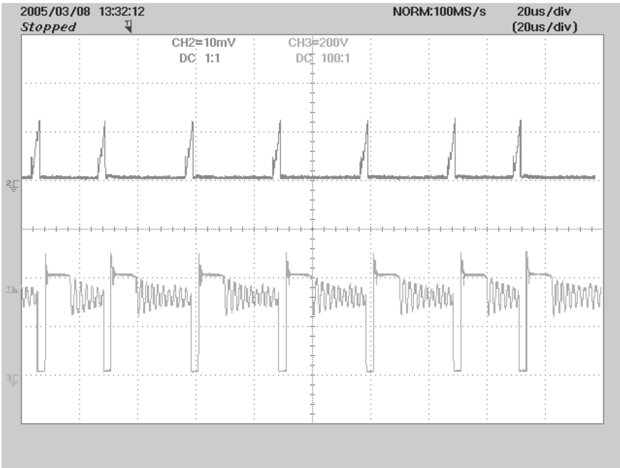


**Figure 11 –** 265 VAC, Full Load
Upper: $I_{DRAIN}$, 0.5 A / div
Lower: $V_{DRAIN}$, 200 V / div

## 9.2 Output Voltage Start-up Profile

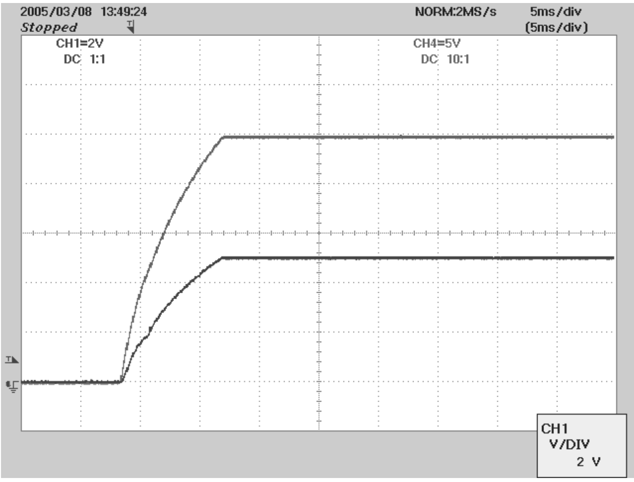


**Figure 12 –** Start-up Profile, 90 VAC
5 ms / div.

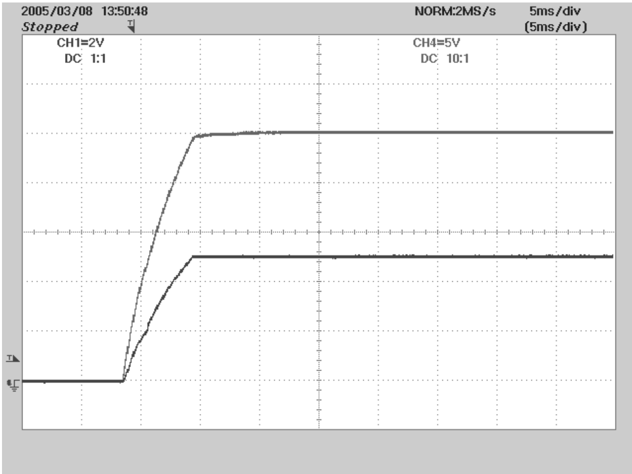


**Figure 13 –** Start-up Profile, 265 VAC
5 ms / div.


Power Integrations
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

## 9.3 Drain Voltage and Current Start-up Profile

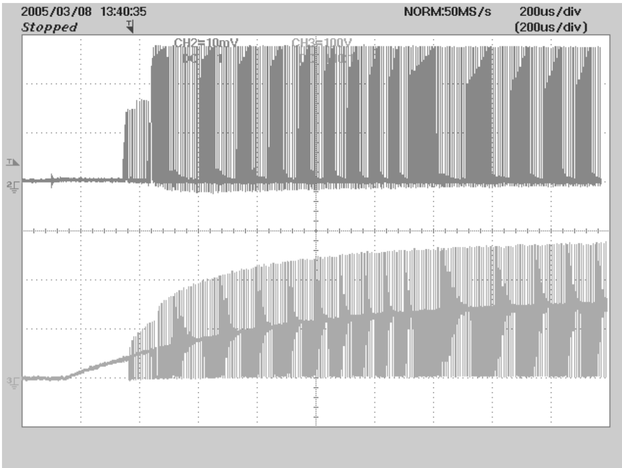


**Figure 14 –** 85 VAC Input and Maximum Load.
Upper: $I_{DRAIN}$, 0.5 A / div.
Lower: $V_{DRAIN}$, 100 V & 1 ms / div.

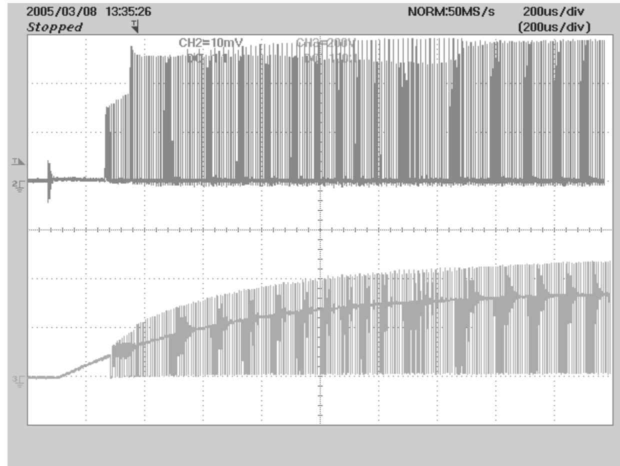


**Figure 15 –** 265 VAC Input and Maximum Load.
Upper: $I_{DRAIN}$, 0.5 A / div.
Lower: $V_{DRAIN}$, 200 V & 1 ms / div.

## 9.4 Load Transient Response (50% to 100% Load Step)

In the figures shown below, signal averaging was used to better enable viewing the load transient response. The oscilloscope was triggered using the load current step as a trigger source. Since the output switching and line frequency occur essentially at random with respect to the load transient, contributions to the output ripple from these sources will average out, leaving the contribution only from the load step response.

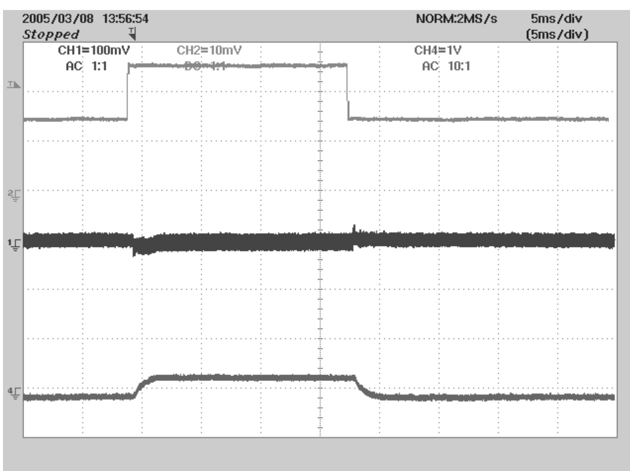


**Figure 16** – Transient Response, 90 VAC, 75-100-75% Load Step.
Top: Load Current, 0.2 A/div.
Bottom: Output Voltage
50 mV, 5ms / div.

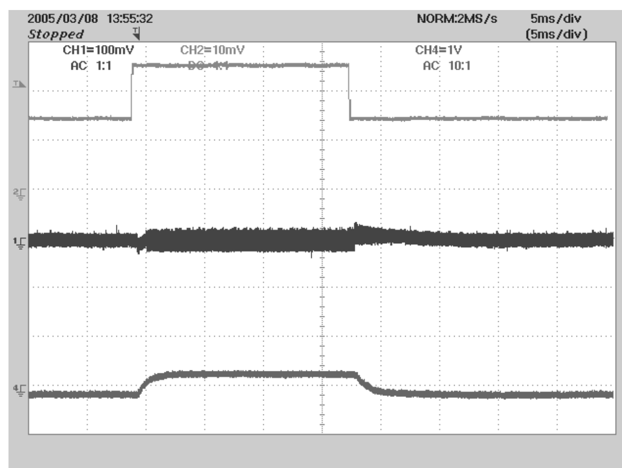


**Figure 17** – Transient Response, 265 VAC, 75-100-75% Load Step
Upper: Load Current, 0.2 A/ div.
Bottom: Output Voltage
50 mV, 5 ms / div.



**Power Integrations**
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

## *9.5 Output Ripple Measurements*

### 9.5.1 Ripple Measurement Technique

For DC output ripple measurements, a modified oscilloscope test probe must be utilized in order to reduce spurious signals due to pickup. Details of the probe modification are provided in Figure 18 and Figure 19.

The 5125BA probe adapter is affixed with two capacitors tied in parallel across the probe tip. The capacitors include one (1) 0.1 µF/50 V ceramic type and one (1) 1.0 µF/50 V aluminum electrolytic. ***The aluminum electrolytic type capacitor is polarized, so proper polarity across DC outputs must be maintained (see below).***

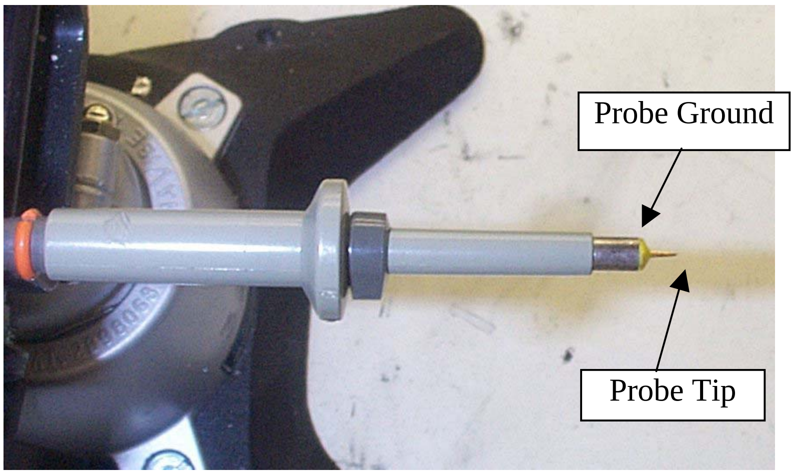


**Figure 18 –** Oscilloscope Probe Prepared for Ripple Measurement. (End Cap and Ground Lead Removed)

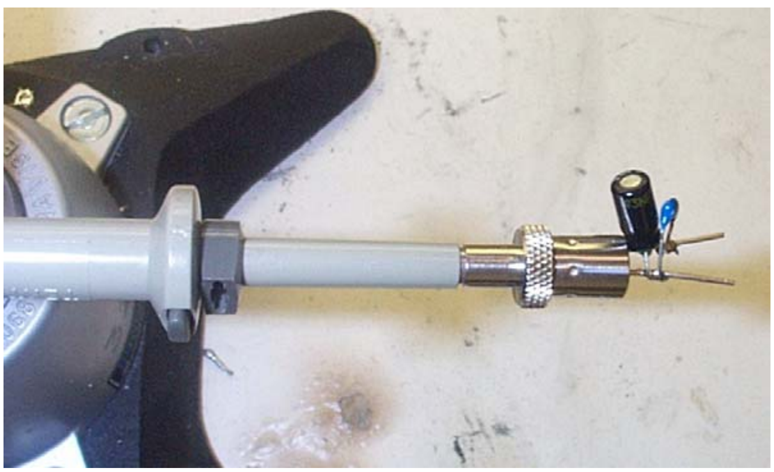

**Figure 19 –** Oscilloscope Probe with Probe Master 5125BA BNC Adapter. (Modified with wires for probe ground for ripple measurement, and two parallel decoupling capacitors added)



**Power Integrations**
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

### 9.5.2 Measurement Results

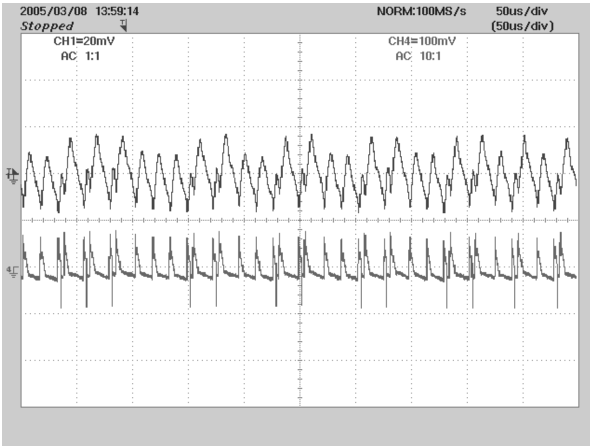


**Figure 20 –** Ripple, 90 VAC, Full Load.
50us

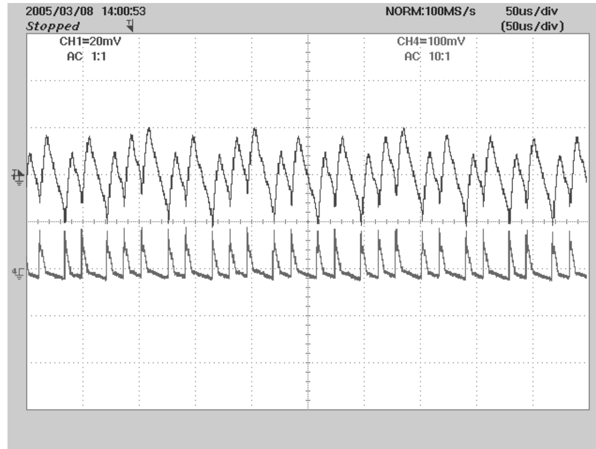


**Figure 21 –** Ripple, 265 VAC, Full Load.
50us



**Power Integrations**
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

## 10 Conducted EMI

A conducted EMI scan of the prototype was taken to determine the effectiveness of the input pi-filter and transformer ESHIELD® construction. The following plots show the peak performance of the converter against quasi-peak (QP) and average (AVG) limits of EN55022 Class B. Both scans were taken at 120VAC/60Hz input with maximum load applied to the outputs. Since the peak scans are below the average limits, it is expected that the QP and Average scans would have greater than 10db of margin below the limits.

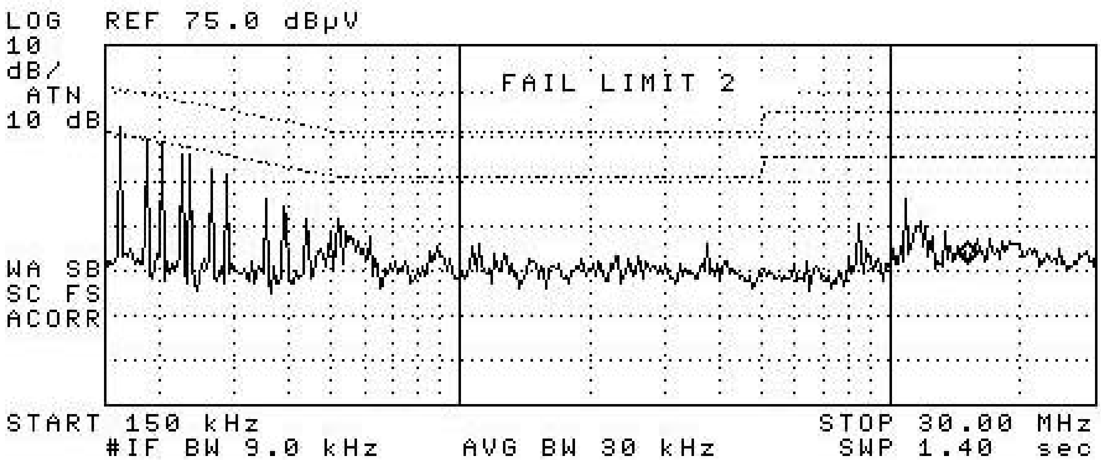


**Figure 22** – Conducted EMI (LINE), Maximum Load, 120 VAC, 60 Hz, and EN55022 B Limits

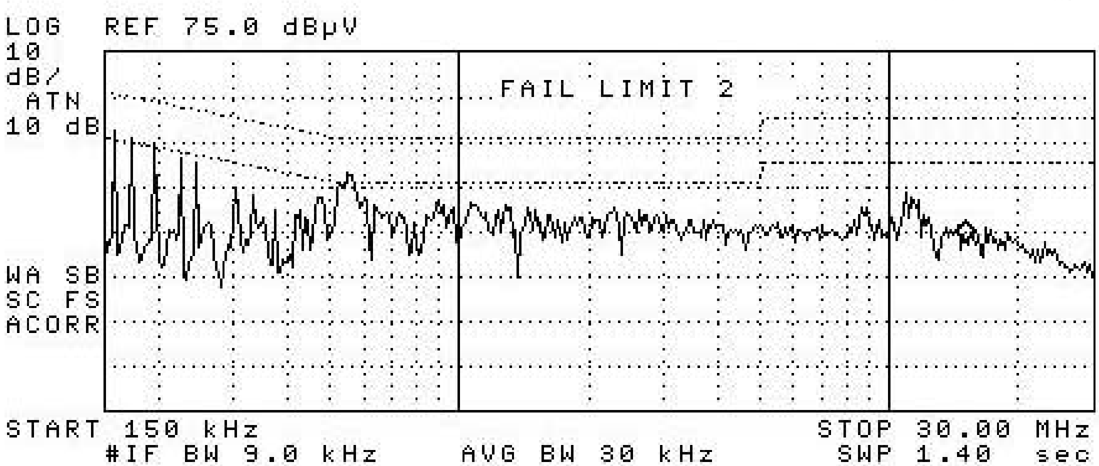


**Figure 23 –** Conducted EMI (Neutral), Maximum Load, 120 VAC, 60 Hz, and EN55022 B Limits



Power Integrations
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

# 11 Revision History

| Date | Author | Revision | Description & changes | Reviewed |
|---|---|---|---|---|
| 10-26-05 | RSP | 1.0 | Initial Release | KM/JC/VC |



**Power Integrations**
Tel: +1 408 414 9200 Fax: +1 408 414 9201
www.powerint.com

## For the latest updates, visit our website: *www.powerint.com*

Power Integrations reserves the right to make changes to its products at any time to improve reliability or manufacturability. Power Integrations does not assume any liability arising from the use of any device or circuit described herein. POWER INTEGRATIONS MAKES NO WARRANTY HEREIN AND SPECIFICALLY DISCLAIMS ALL WARRANTIES INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF THIRD PARTY RIGHTS.

**PATENT INFORMATION**

The products and applications illustrated herein (including transformer construction and circuits external to the products) may be covered by one or more U.S. and foreign patents, or potentially by pending U.S. and foreign patent applications assigned to Power Integrations. A complete list of Power Integrations' patents may be found at www.powerint.com. Power Integrations grants its customers a license under certain patent rights as set forth at http://www.powerint.com/ip.htm.

The PI Logo, ***TOPSwitch***, ***TinySwitch***, ***LinkSwitch***, ***DPA-Switch***, ***EcoSmart***, ***PI Expert*** and ***PI FACTS*** are trademarks of Power Integrations, Inc. Other trademarks are property of their respective companies. ©Copyright 2005 Power Integrations, Inc.

## Power Integrations Worldwide Sales Support Locations

**WORLD HEADQUARTERS**
5245 Hellyer Avenue
San Jose, CA 95138, USA.
Main: +1-408-414-9200
Customer Service:
Phone: +1-408-414-9665
Fax: +1-408-414-9765
*e-mail: usasales@powerint.com*

**GERMANY**
Rueckertstrasse 3
D-80336, Munich
Germany
Phone: +49-89-5527-3910
Fax: +49-89-5527-3920
*e-mail: eurosales@powerint.com*

**JAPAN**
Keihin Tatemono 1st Bldg
2-12-20
Shin-Yokohama, Kohoku-ku,
Yokohama-shi, Kanagawa ken,
Japan 222-0033
Phone: +81-45-471-1021
Fax: +81-45-471-3717
*e-mail: japansales@powerint.com*

**TAIWAN**
5F, No. 318, Nei Hu Rd., Sec. 1
Nei Hu Dist.
Taipei, Taiwan 114, R.O.C.
Phone: +886-2-2659-4570
Fax: +886-2-2659-4550
*e-mail: taiwansales@powerint.com*

**CHINA (SHANGHAI)**
Rm 807-808A,
Pacheer Commercial Centre,
555 Nanjing Rd. West
Shanghai, P.R.C. 200041
Phone: +86-21-6215-5548
Fax: +86-21-6215-2468
*e-mail: chinasales@powerint.com*

**INDIA**
261/A, Ground Floor
7th Main, 17th Cross,
Sadashivanagar
Bangalore, India 560080
Phone: +91-80-5113-8020
Fax: +91-80-5113-8023
*e-mail: indiasales@powerint.com*

**KOREA**
RM 602, 6FL
Korea City Air Terminal B/D,
159-6
Samsung-Dong, Kangnam-Gu,
Seoul, 135-728, Korea
Phone: +82-2-2016-6610
Fax: +82-2-2016-6630
*e-mail: koreasales@powerint.com*

**EUROPE HQ**
1st Floor, St. James's House
East Street, Farnham
Surrey, GU9 7TJ
United Kingdom
Phone: +44 (0) 1252-730-140
Fax: +44 (0) 1252-727-689
*e-mail: eurosales@powerint.com*

**CHINA (SHENZHEN)**
Room 2206-2207, Block A,
Elec. Sci. Tech. Bldg.
2070 Shennan Zhong Rd.
Shenzhen, Guangdong,
China, 518031
Phone: +86-755-8379-3243
Fax: +86-755-8379-5828
*e-mail: chinasales@powerint.com*

**ITALY**
Via Vittorio Veneto 12
20091 Bresso MI
Italy
Phone: +39-028-928-6000
Fax: +39-028-928-6009
*e-mail: eurosales@powerint.com*

**SINGAPORE**
51 Newton Road,
#15-08/10 Goldhill Plaza,
Singapore, 308900
Phone: +65-6358-2160
Fax: +65-6358-2015
*e-mail: singaporesales@powerint.com*

**APPLICATIONS HOTLINE**
World Wide +1-408-414-9660

**APPLICATIONS FAX**
World Wide +1-408-414-9760