



UCC28517 Prototype Reference Design Module

Reference Design

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Power Supply Control Products

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1 Introduction

The UCC28517 module is a 100-W offline ac-to-dc voltage converter with power factor correction (PFC). The prototype was designed to show how the UCC28517 could be configured to control two dc-regulated outputs offline with one control integrated circuit. The module was design to operate over a universal input range of 85 V to 265 V with two dc regulated outputs. Output B is a 12-V, 8-W regulated output intended to be used as a bias supply and output A is a 385-V, 100-W regulated output.

For this module to function correctly output B needs a minimum load of 4 W and boost capacitor C3 needs to be completely discharged before applying power. The input needs a minimum of 85 V_{AC} at power up. If the input voltage is brought up slowly with the use of an ac source or a variable transformer the bootstrap circuitry will not function correctly. If this procedure is not followed the reference design will not regulate properly.

2 Caution

High-voltage levels are present on the evaluation module whenever it is energized. Proper precautions must be taken when working with the module. Output A has a large energy storage capacitor and must be completely discharged before the module can be handled. Serious injury can occur if proper safety precautions are not followed.

3 Schematic

The schematic is broken up into three sections to make it more legible for the user.

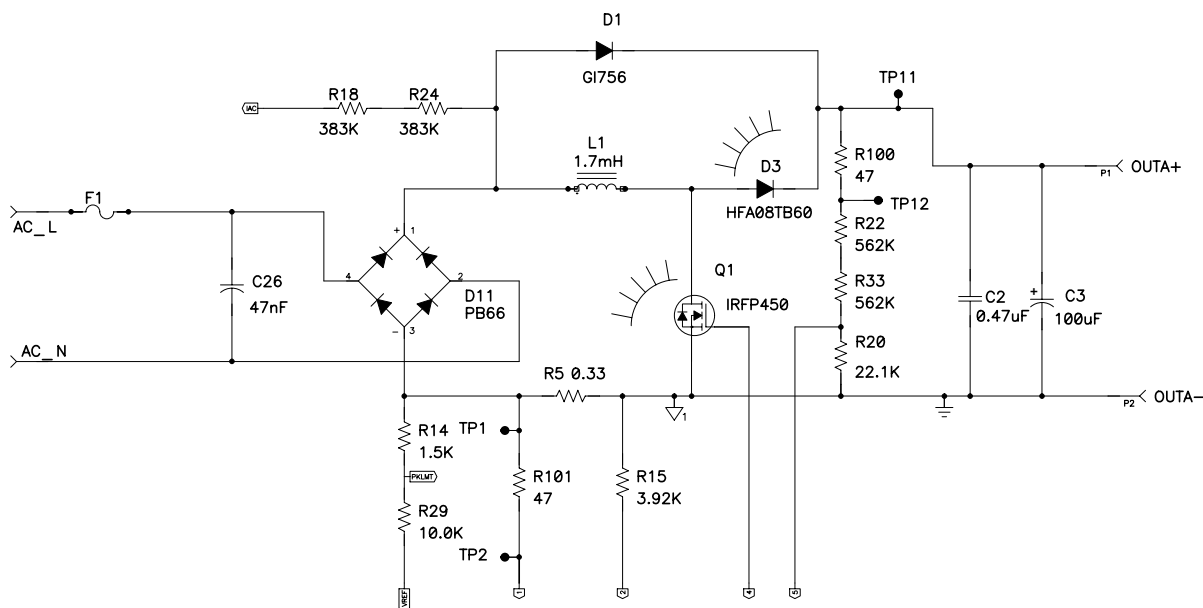


Figure 1. Section A

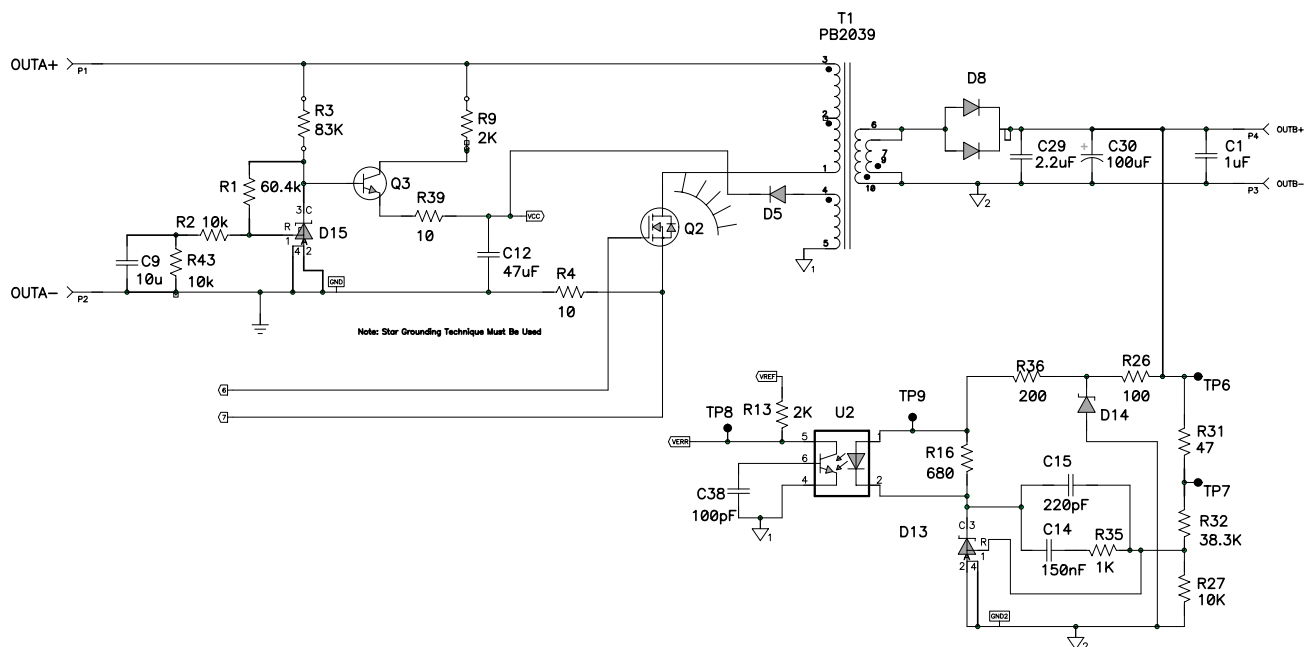


Figure 2. Section B

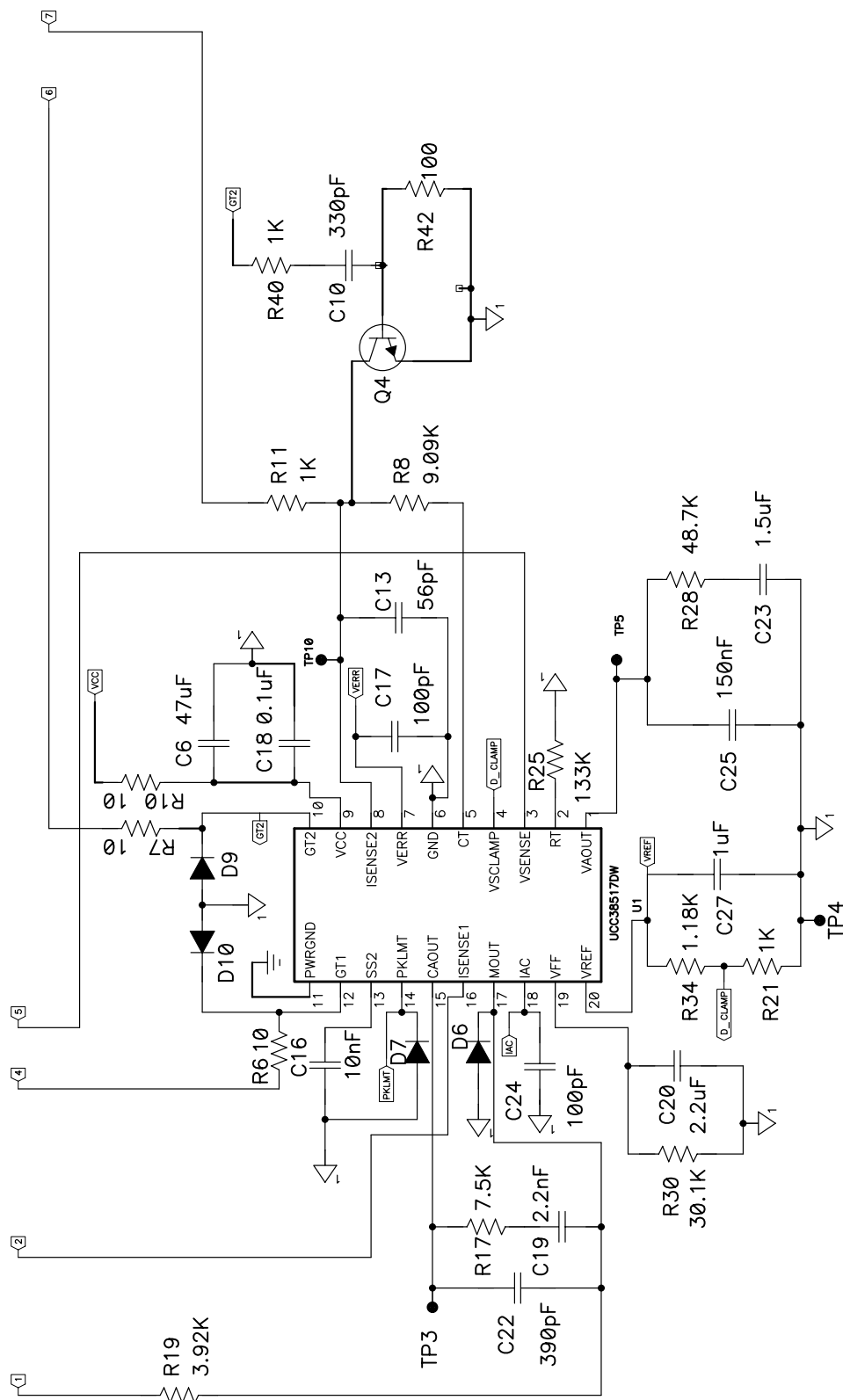


Figure 3. Section C

4 List of Materials

Table 1 lists the components used in this design. With minor component tweaks this design could be modified to meet a wide range of applications.

	Reference	Qty	Description	Manufacturer	Part Number
Capacitor	C1, C27	2	Ceramic, 1 μ F, 25 V	Panasonic	ECJ-3YB1E105K
	C2	1	Multi level, 470 nF, 600 V	AVX	3640CC474KATBE
	C3	1	Electrolytic, 100 μ F, 450 V	Panasonic	ECO-S2WB101BA
	C4,C5	0	Ceramic, 1 μ F, 25 V	Panasonic	ECJ-3YB1E105K
	C6, C12	2	Monolithic ceramic, 47 μ F, 16 V	TDK	C5750X5R16476M7
	C7	0	1.2 nF, 1000 V, high voltage MLC	AVX	1825AA122KA1ME
	C8	0	1.2 nF, 1000 V, high voltage MLC	AVX	1825AA122KA1ME
	C9	1	Solid tantalum, 100 μ F, 4 V	Sprague	595D107X9004B2T
	C10	1	Ceramic, 330 pF 50 V, X7R	Yageo America	08052R331K9B20D
	C11, C17	2	Ceramic, 100 pF, 50 V	Panasonic	ECJ-2VC1H101J
	C13	1	Ceramic, 56 pF, 50 V	Panasonic	ECJ-2VC1H560J
	C14	1	Ceramic, 150 nF, 25 V	Vishay	ECJ-2VF1H154Z
	C15	1	Ceramic, 220 pF, 50 V	Panasonic	ECJ-2VC1H221J
	C16	1	Ceramic, 10 nF, 50 V	Panasonic	ECJ-2VB1H103K
	C18	1	Ceramic, 0.100 μ F, 50 V	Panasonic	ECJ-2YB1H104K
	C19	1	Ceramic, 2.2 nF, 50 V	Panasonic	ECJ-2VB1H222K
	C20, C21	2	Ceramic, 2.2 μ F, 50 V	Panasonic	ECJ-3YB1C225K
	C22	1	Ceramic, 390 pF, 50 V	Panasonic	ECU-V1H391KBN
	C23	1	Ceramic, 1.5 μ F, 16 V	Panasonic	ECJ-3YB1C155K
	C24	1	Ceramic, 100 pF, 50 V	Panasonic	ECJ-2VC1H101J
	C25	1	Ceramic, 150 nF, 25 V	Panasonic	ECJ-2YB1E154K
	C26	1	Metal poly film, 47 nf, 630 V	Panasonic	ECQ-E6473KF
	C28	1	Solid aluminum, 100 μ F, 20 V	Sanyo	20SVP100M
Diode	D1	1	6 A, 600 V	General Semiconductor	GI756CT
	D3	1	Ultra Fast, 6 A, 600 V	International Rectifier	HFA08TB60
	D5	1	Schottky, 1.5 A, 45 V	Vishay	BYS10-45
	D6, D7, D9, D10	4	Schottky, 1.5 A, 25 V	Vishay	BYS10-25
	D8	1	Dual Schottky, 2A, 45V	International Rectifier	20CJQ045
	D14	1	Zener, 10 V, 0.35 W	Diodes Inc	BZX84C10-7
Rectifier	D2	0	Fast, 1.5 A, 800 V	Vishay	BYG21K
	D4	0	Fast, 1.5 A, 800 V	Vishay	BYG21K
	D11	1	Bridge, 6 A, 600 V	Diodes Inc	PB66
	D13, D15	2	Programmable reference, TL431	Texas Instruments	TL431CPK
Fuse Clip	F1	1	Glass Fast Acting Cartridge Type, 6 A, 250 V, 3AG 1.25"x.25"	Littlefuse	312 006
	FH1, FH2	2	3AG, for 1.25"x.25"	Cooper Electronic Technologies	1A1907-06
Heat Sink	HS1	1	Q1	Aavid	513201B02500
	HS2	1	Q2	Aavid	573300D00010
	HS3	1	D3	Aavid	579302 B 0 00 00
Inductor	L1	1	Coupled, 1.7 mH, 2.5 A	Cooper Electronic Technologies	CTX08-14730
	PCB	1	Bare Bd		UCC28517

	Reference	Qty	Description	Manufacturer	Part Number
FET	Q1	1	N Channel, 14 A, 500 V	International Rectifier	IRFP450
	Q2	1	N Channel, 1.7 A, 900 V	International Rectifier	IRFBB20S
Transistor	Q3	1	NPN	On Semiconductor	MJD50
	Q4	1	NPN	Philips	MMBT2222A
Resistor	R1	1	44.2 k Ω , 1/4 W	Panasonic	ERJ-14NF4422U
	R2, R43	2	10 k Ω , 1/4 W	Panasonic	ERJ-14YJ103U
	R3	1	82 k Ω , 2W, 500 V	BC Components	FP698202J
	R4, R6, R7, R10, R39	5	10 Ω , 1/4 W	Panasonic	ERJ-14NF10R0U
	R5	1	0.33 Ω , 3 W	Huntington Electric	ALSR-3-.33
	R8	1	2.55 k Ω , 1/10 W	Panasonic	ERJ-6ENF2551V
	R9	1	2 k Ω , 2 W, 500 V	BC Components	5083NW2K00J12A
	R12	0	1 k Ω , 1/4 W	Panasonic	ERJ-14YJ102U
	R13	1	2 k Ω , 1/10 W	Panasonic	ERJ-6ENF2001V
	R14	1	1.5 k Ω , 1/4 W	Panasonic	ERJ-6ENF1501V
	R15, R19	2	3.92 k Ω , 1/10 W	Panasonic	ERJ-6ENF3921V
	R16	1	681 Ω , 1/10 W	Panasonic	ERJ-6ENF6810V
	R17	1	7.5 k Ω , 1/10 W	Panasonic	ERJ-6ENF7501V
	R18, R24	2	383 k Ω , 1/2 W	Panasonic	ERJ-14NF3923U
	R20	1	22.1 k Ω , 1/4 W	Panasonic	ERJ-125F3833U
	R21, R11, R35	3	1 k Ω , 1/10 W	Panasonic	ERJ-6ENF1001V
	R22, R33	2	562 k Ω , 1/4 W	Panasonic	ERJ-8ENF5623V
	R23, R37, R38	0	200 Ω , 1 W, 5%	Panasonic	ERJ-1WYJ201U
	R25	1	133 k Ω , 1/8 W	Yageo America	9C08052A1333FKHFT
	R26	1	100 Ω , 1/10 W	Panasonic	ERJ-6GEYJ101V
	R27, R29	2	10 k Ω , 1/10 W	Panasonic	ERJ-6ENF1002V
	R28	1	48.7 k Ω , 1/10 W	Panasonic	ERJ-6ENF4872V
	R30	1	30.1 k Ω , 1/10 W	Panasonic	ERJ-6ENF3012V
	R31, R41, R44	3	47 Ω , 1/10 W	Panasonic	ERJ-6GEYJ470V
	R32	1	38.3 k Ω , 1/10 W	Panasonic	ERJ-6ENF3832V
	R34	1	1.18 k Ω , 1/8 W	Yageo America	9C08052A1181FKHFT
	R36	1	200 Ω , 1/10 W	Panasonic	ERJ-6GEYJ201V
	R40	1	1 k Ω , 1/10 W	Yageo America	9C08052A1001FKHFT
	R42	1	RES 100 Ω , 1/8 W	Yageo America	9C08052A1000FKHFT
Transformer	T1	1	Flyback	Pulse	PB2039
IC	U1	1	PWM	Texas Instruments	UCC28517DW
	U2	1	Opto Isolator	QT Optoelectronics	4N36
Thermal Pad	X1 at Q1	1	Silicon TO247	Berquist	SP900S-104
Nut	X2 at Q1	1	#6X32 (steel)		
Washer	X3 at Q1	1	Split lock, #6(steel)		
	X4 at Q1	1	Flat #6 (steel)		
	X6 at Q1	1	Nylon shoulder, #6		
Screw	X5 at Q1	1	Pan head #6-32X7/16 (steel)		
Posts	AC_L, AC_H, OUTA+, OUTA-, OUTB+, OUTB-	0	Binding	Johnson	111-0701-001

5 Reference Design Layout

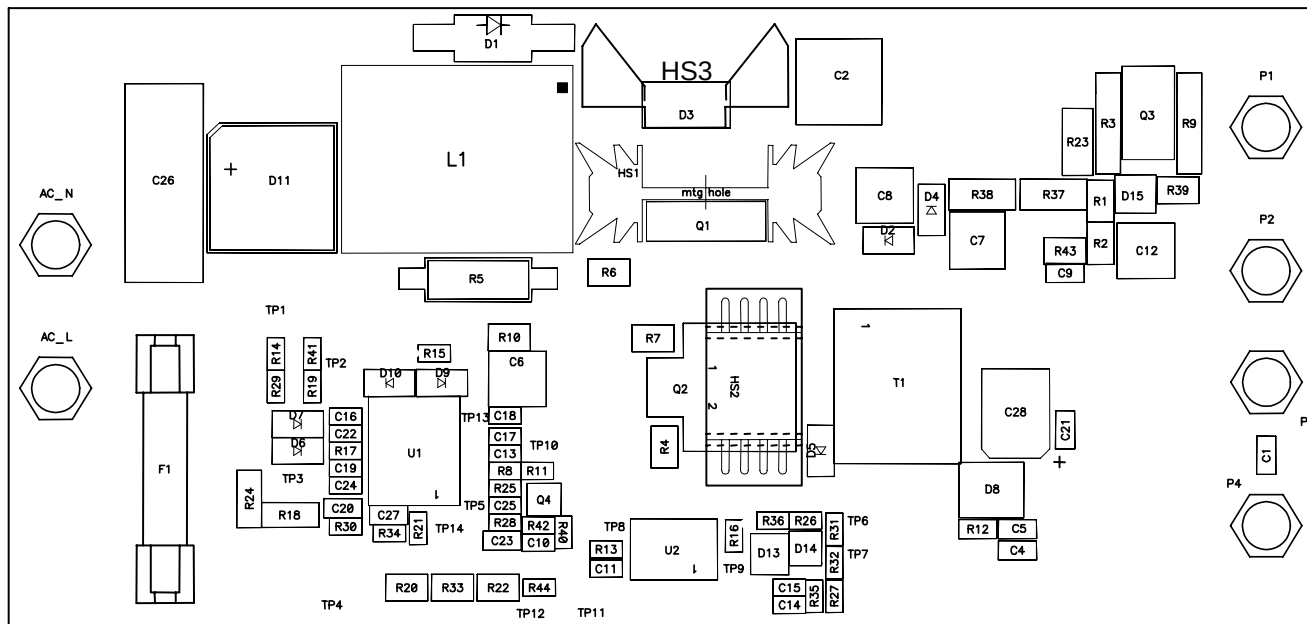


Figure 4. Silkscreen Layer 1

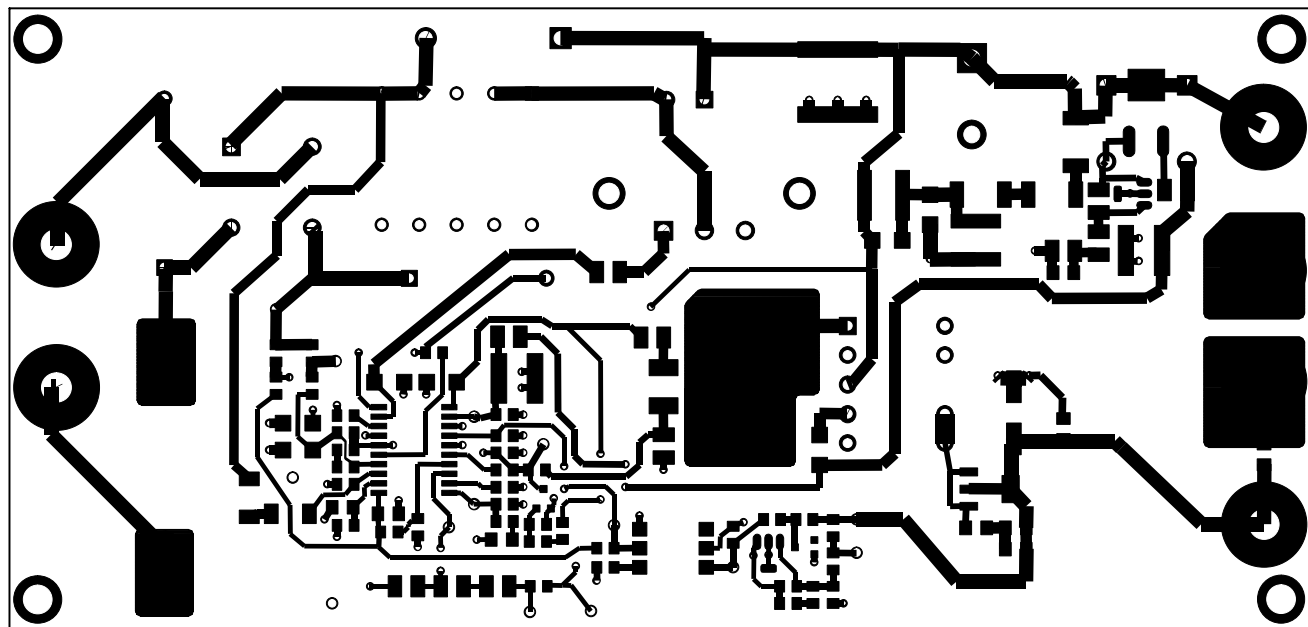


Figure 5. Top View

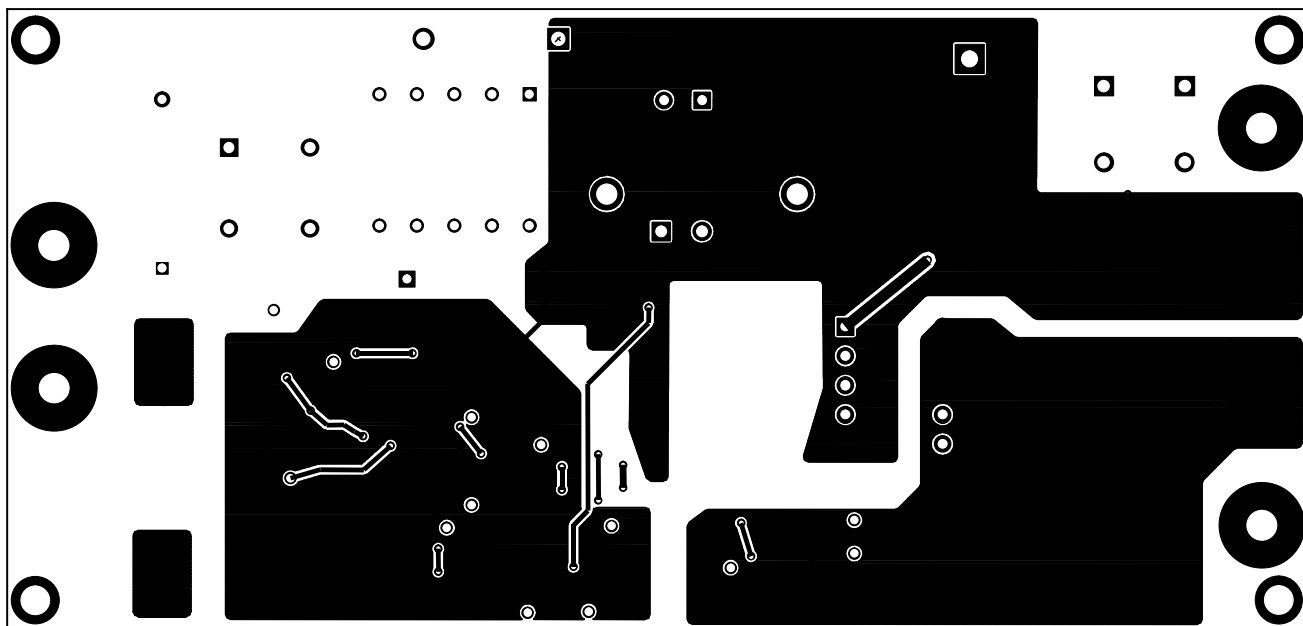


Figure 6. Bottom View

6 Electrical Characteristics

	MIN	TYP	MAX	UNITS
V_{IN}	85		265	V_{RMS}
Output A	370	385	410	V
Output B	11.4	12	12.6	V
Output A Efficiency			95%	
Output B Efficiency		50%		
$P_{OUT\ A}$	10		100	W
$P_{OUT\ B}$	4		8	W
Output Ripple A			12	V
Output Ripple B			750	mV

7 Reference Design Performance

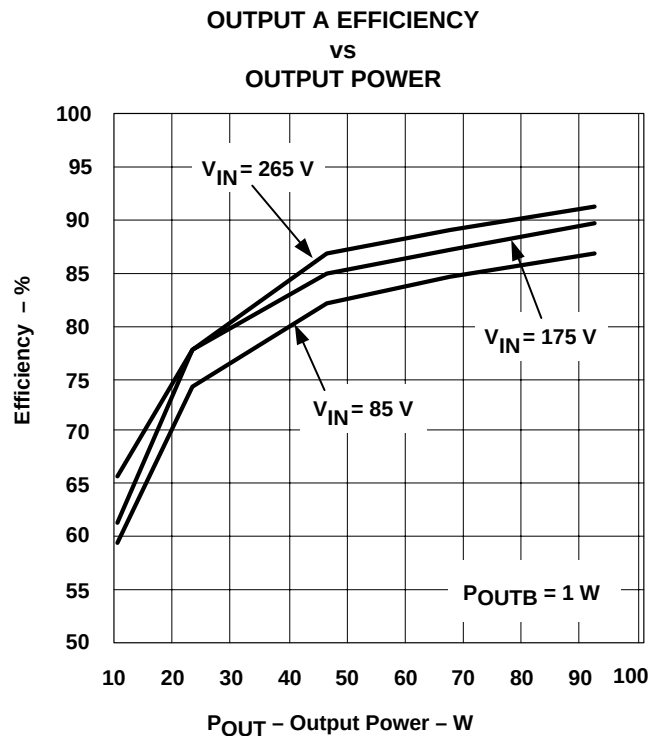


Figure 7

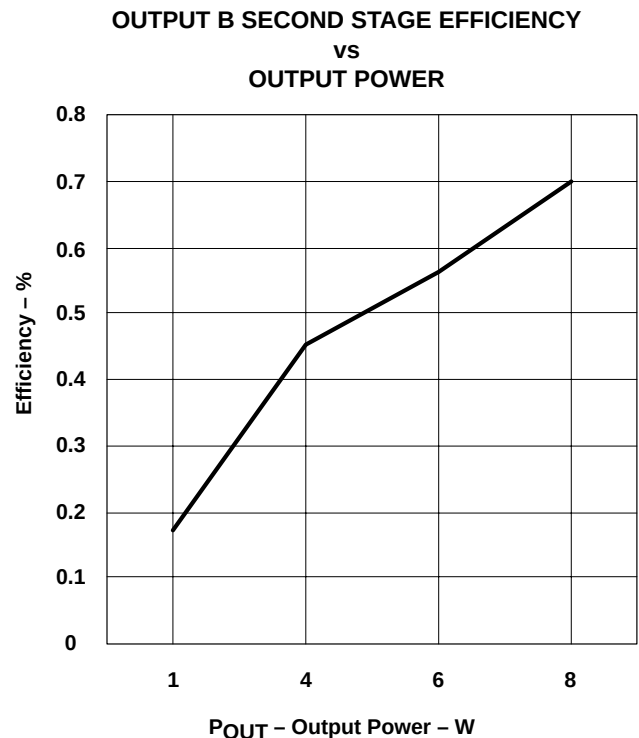


Figure 8

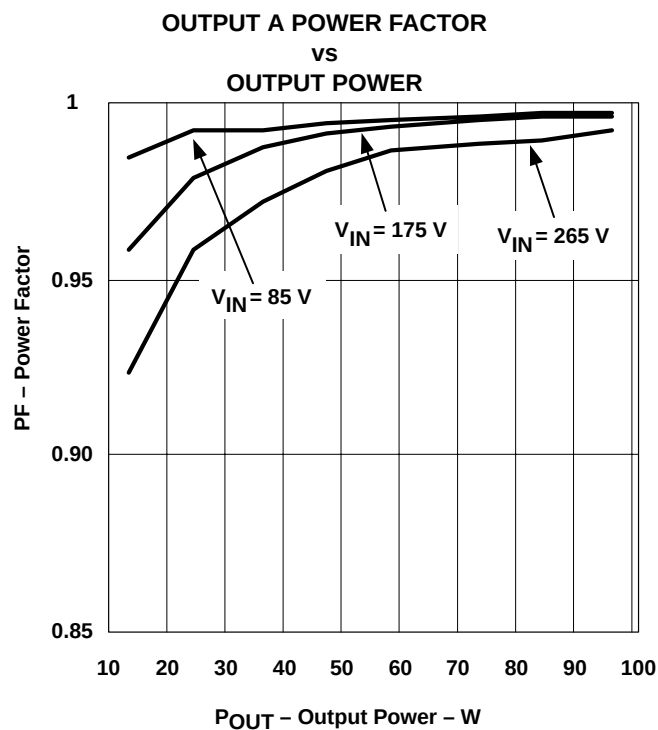


Figure 9

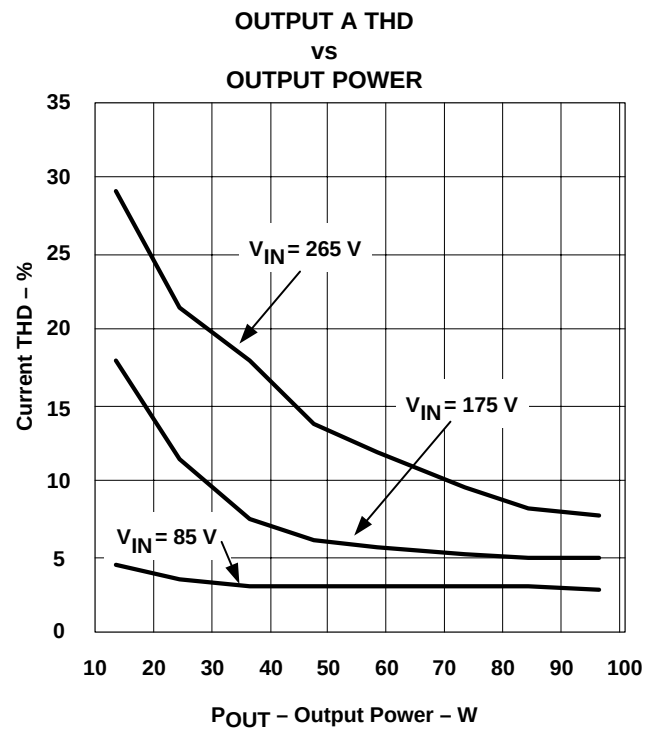


Figure 10

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