Texas Instruments

UCC28517 EVM

User's Guide

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DYNAMIC WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the maximum input voltage ranges specified in Section 6.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 50°C. The EVM is designed to operate properly with certain components above 50°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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UCC28517 EVM

Michael O'Loughlin *Power Supply Control Products*

Contents

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.

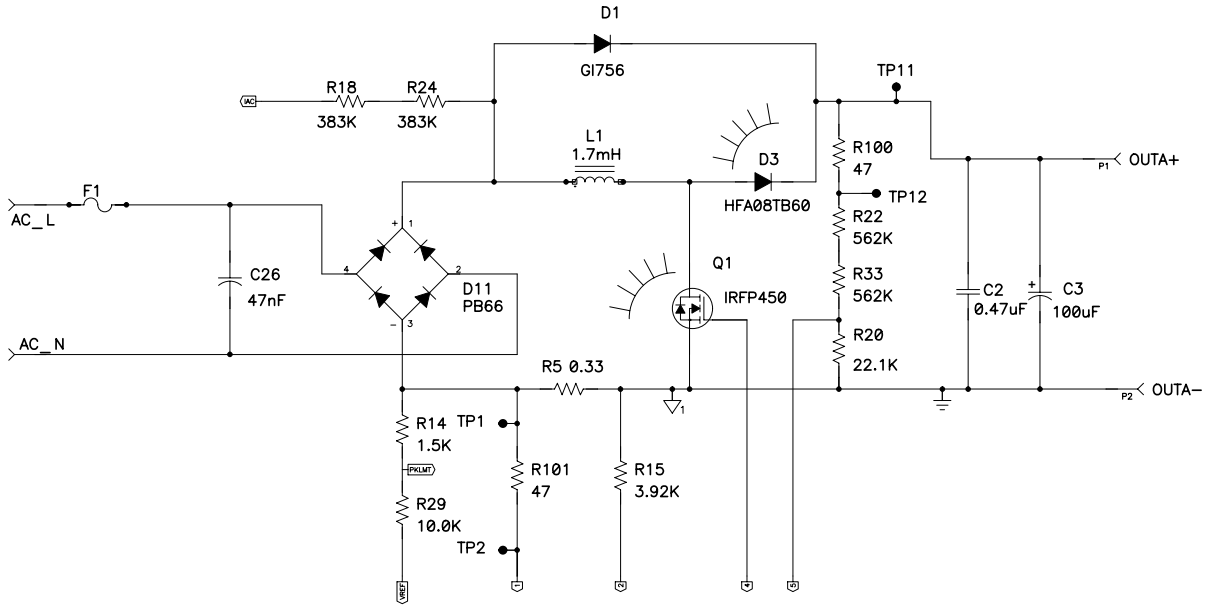

Figure 1. Section A

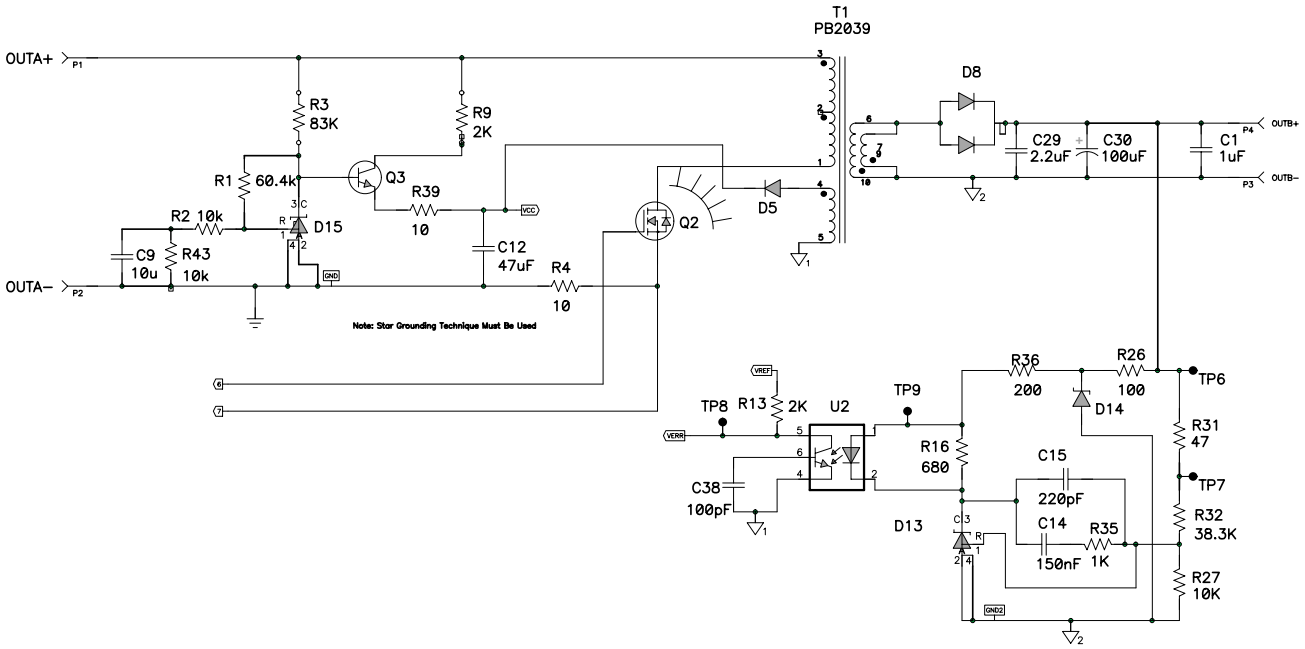

Figure 2. Section B

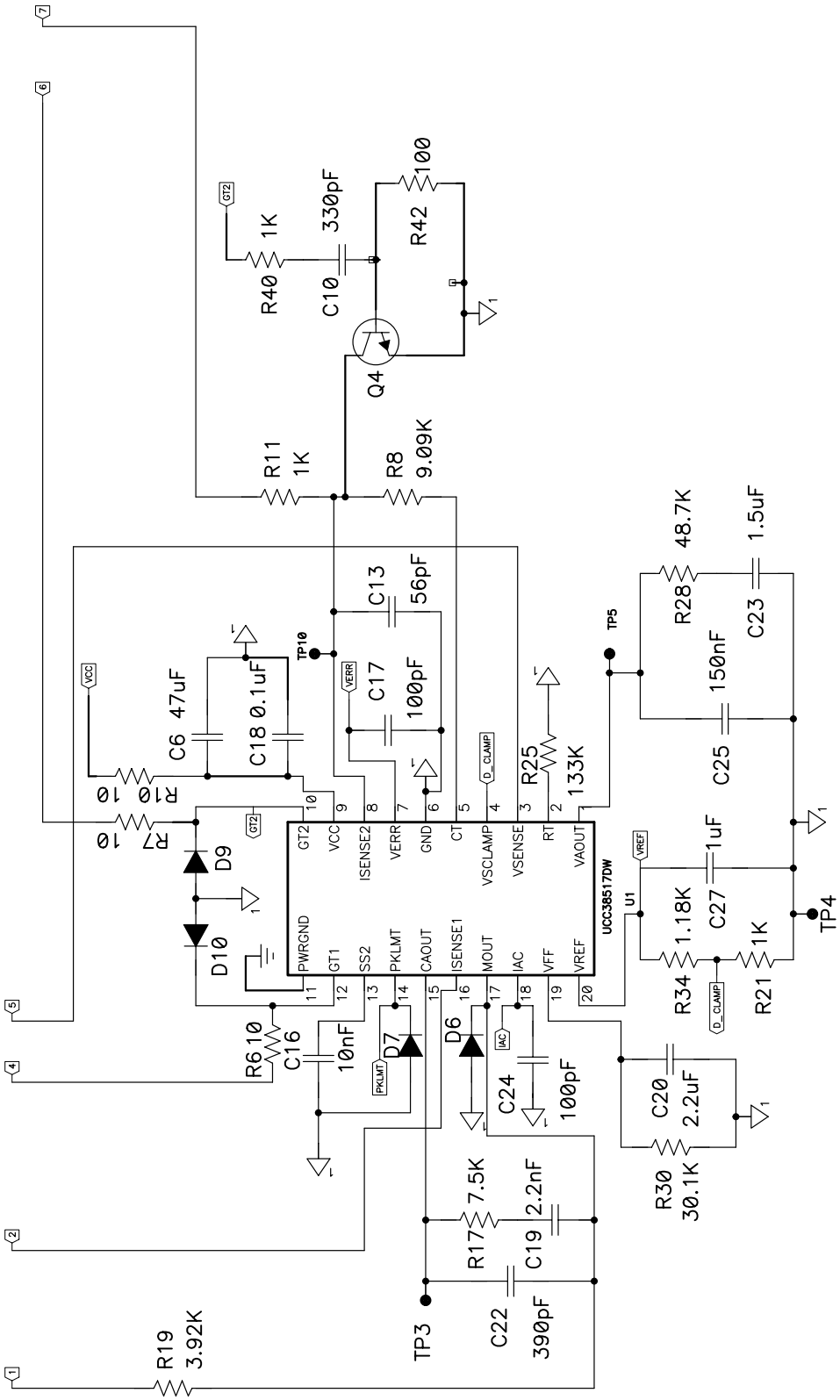

Figure 3. Section C

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 μF, 25 V	Panasonic	ECJ−3YB1E105K
	C2	1	Multi level, 470 nF, 600 V	AVX	3640CC474KATBE
	C3	1	Electrolytic, 100 μF, 450 V	Panasonic	ECO−S2WB101BA
	C4,C5	0	Ceramic, 1 μF, 25 V	Panasonic	ECJ−3YB1E105K
	C6, C12	2	Monolithic ceramic, 47 μF, 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 μF, 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 μF, 50 V	Panasonic	ECJ−2YB1H104K
	C19	1	Ceramic, 2.2 nF, 50 V	Panasonic	ECJ−2VB1H222K
	C20, C21	2	Ceramic, 2.2 μF, 50 V	Panasonic	ECJ−3YB1C225K
	C22	1	Ceramic, 390 pF, 50 V	Panasonic	ECU−V1H391KBN
	C23	1	Ceramic, 1.5 μF, 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 μF, 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	IRFBF20S
Transistor	Q3	1	NPN	On Semiconductor	MJD50
	Q4	1	NPN	Philips	MMBT2222A
Resistor	R1	1	44.2 kΩ, 1/4 W	Panasonic	ERJ−14NF4422U
	R2, R43	2	10 kΩ, 1/4 W	Panasonic	ERJ−14YJ103U
	R3	1	82 kΩ, 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 kΩ, 1/10 W	Panasonic	ERJ−6ENF2551V
	R9	1	2 kΩ, 2 W, 500 V	BC Components	5083NW2K00J12A
	R12	0	1 kΩ, 1/4 W	Panasonic	ERJ−14YJ102U
	R13	1	2 kΩ, 1/10 W	Panasonic	ERJ−6ENF2001V
	R14	1	1.5 kΩ, 1/4 W	Panasonic	ERJ−6ENF1501V
	R15, R19	2	3.92 kΩ, 1/10 W	Panasonic	ERJ−6ENF3921V
	R16	1	681 Ω, 1/10 W	Panasonic	ERJ−6ENF6810V
	R17	1	7.5 kΩ, 1/10 W	Panasonic	ERJ−6ENF7501V
	R18, R24	2	383 kΩ, 1/2 W	Panasonic	ERJ−14NF3923U
	R20	1	22.1 kΩ, 1/4 W	Panasonic	ERJ−125F3833U
	R21, R11, R35	3	1 kΩ, 1/10 W	Panasonic	ERJ−6ENF1001V
	R22, R33	2	562 kΩ, 1/4 W	Panasonic	ERJ−8ENF5623V
	R23, R37, R38	0	200 Ω, 1 W, 5%	Panasonic	ERJ−1WYJ201U
	R25	1	133 kΩ, 1/8 W	Yageo America	9C08052A1333FKHFT
	R26	1	100 Ω, 1/10 W	Panasonic	ERJ−6GEYJ101V
	R27, R29	2	10 kΩ, 1/10 W	Panasonic	ERJ−6ENF1002V
	R28	1	48.7 kΩ, 1/10 W	Panasonic	ERJ−6ENF4872V
	R30	1	30.1 kΩ, 1/10 W	Panasonic	ERJ−6ENF3012V
	R31, R41, R44	3	47 Ω, 1/10 W	Panasonic	ERJ−6GEYJ470V
	R32	1	38.3 kΩ, 1/10 W	Panasonic	ERJ−6ENF3832V
	R34	1	1.18 kΩ, 1/8 W	Yageo America	9C08052A1181FKHFT
	R36	1	200 Ω, 1/10 W	Panasonic	ERJ−6GEYJ201V
	R40	1	1 kΩ, 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

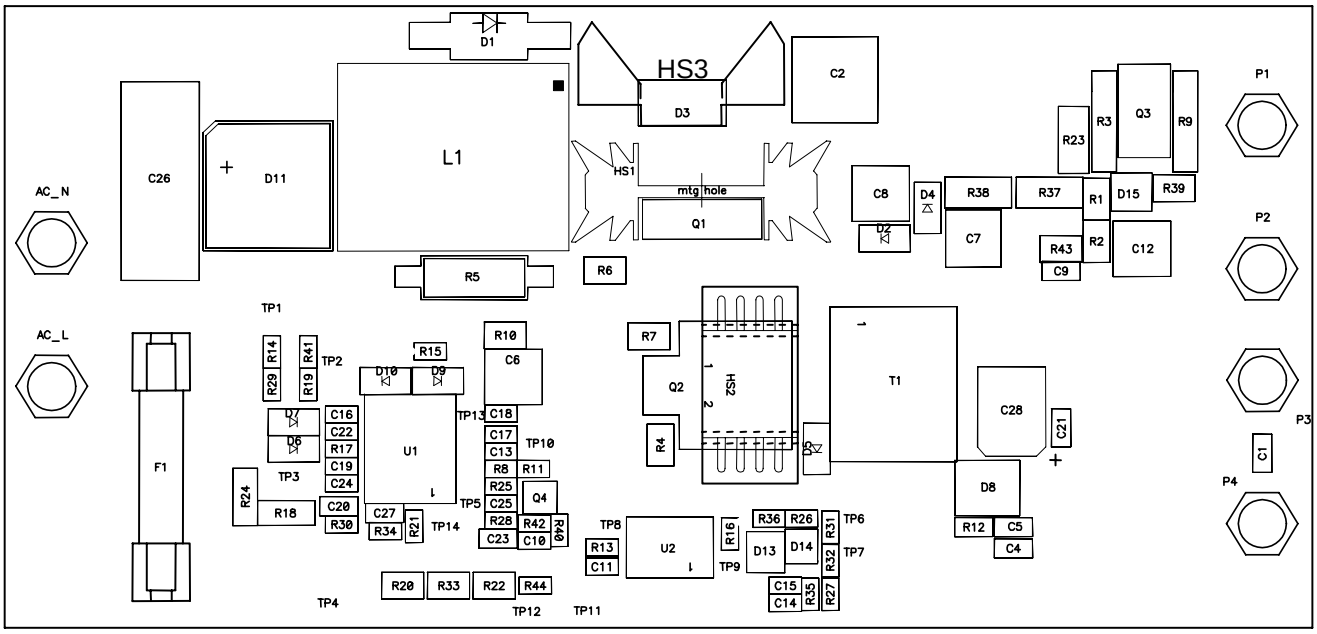

Figure 4. Silkscreen Layer 1

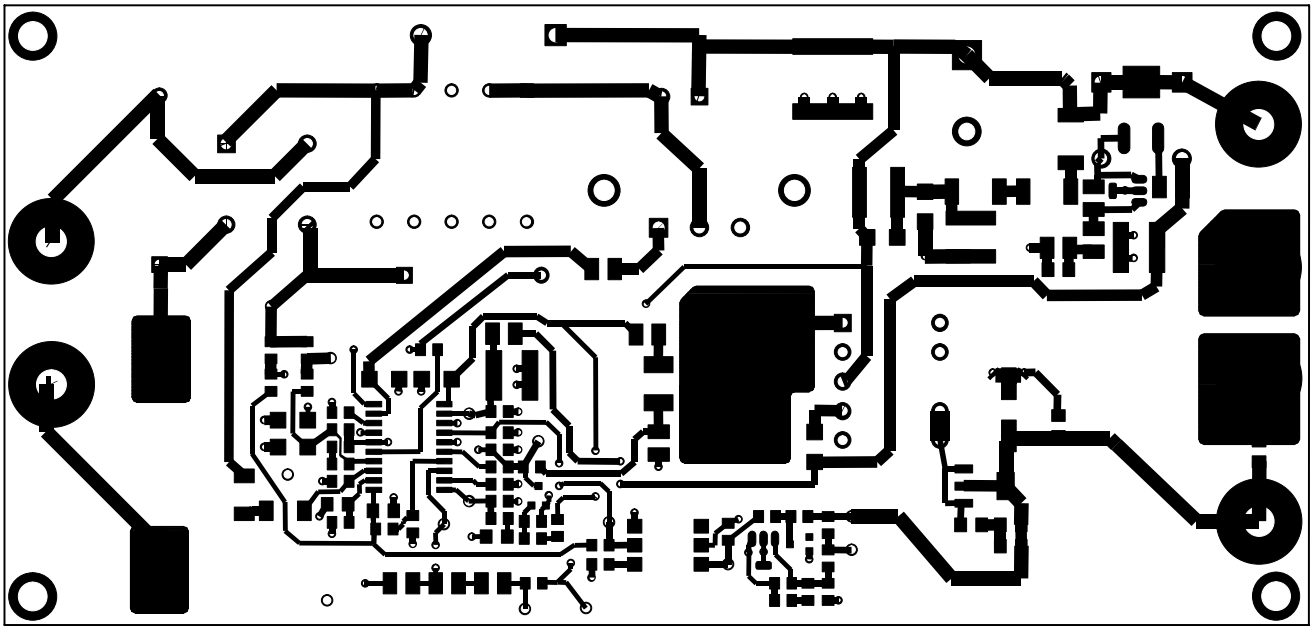

Figure 5. Top View

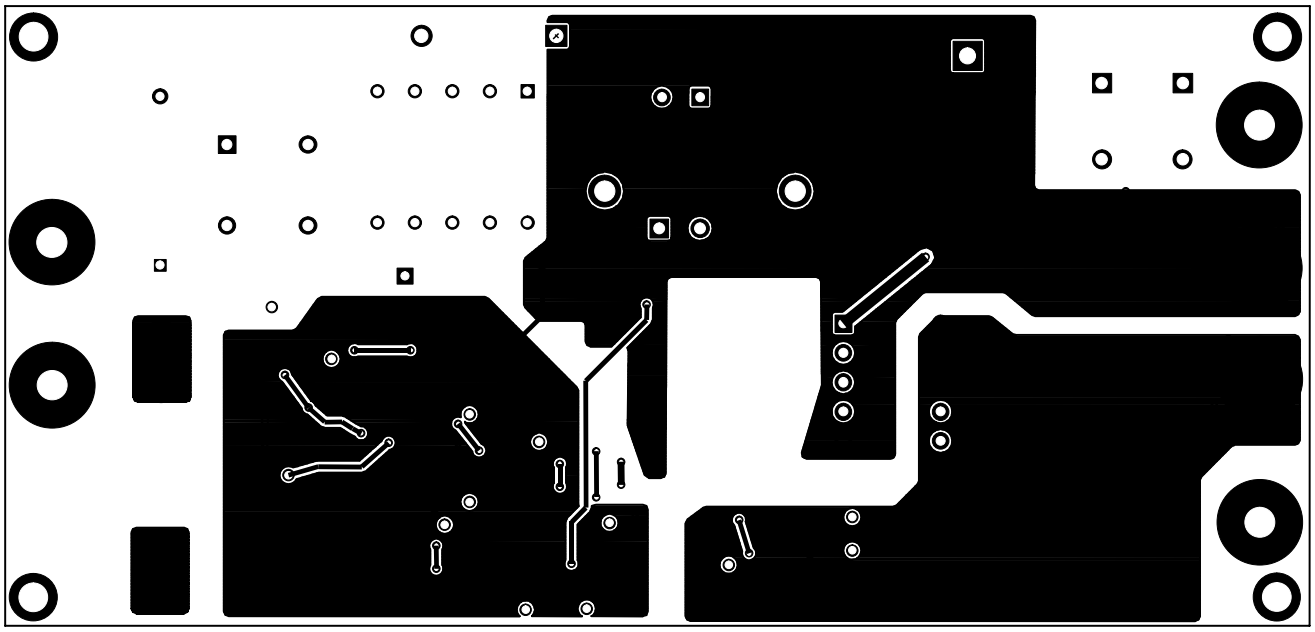

Figure 6. Bottom View

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

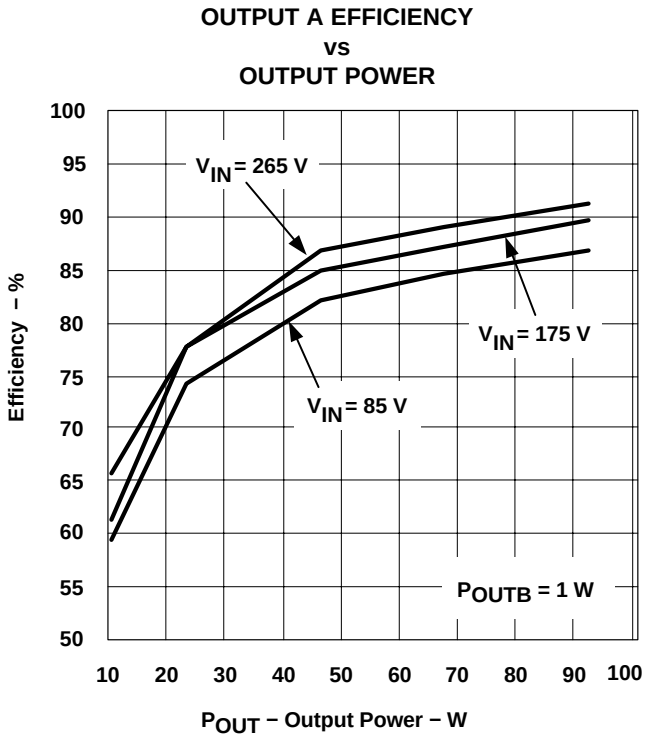

Figure 7

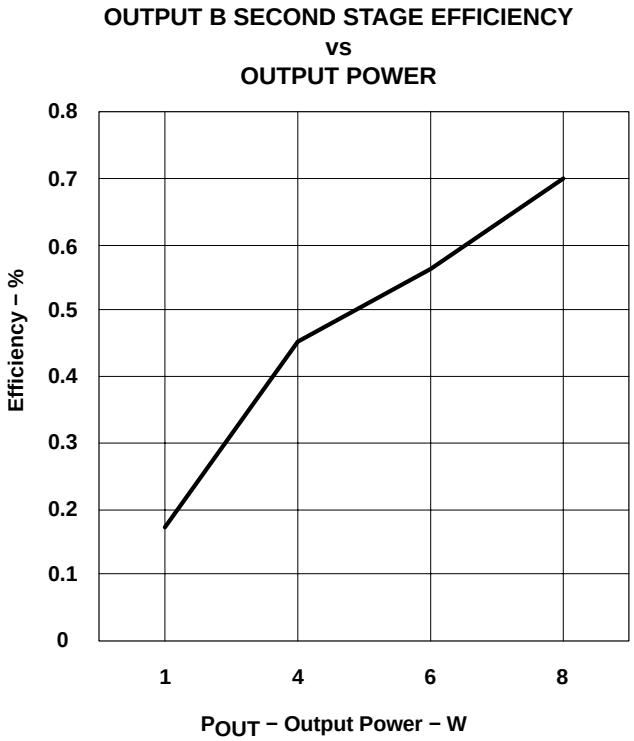

Figure 8

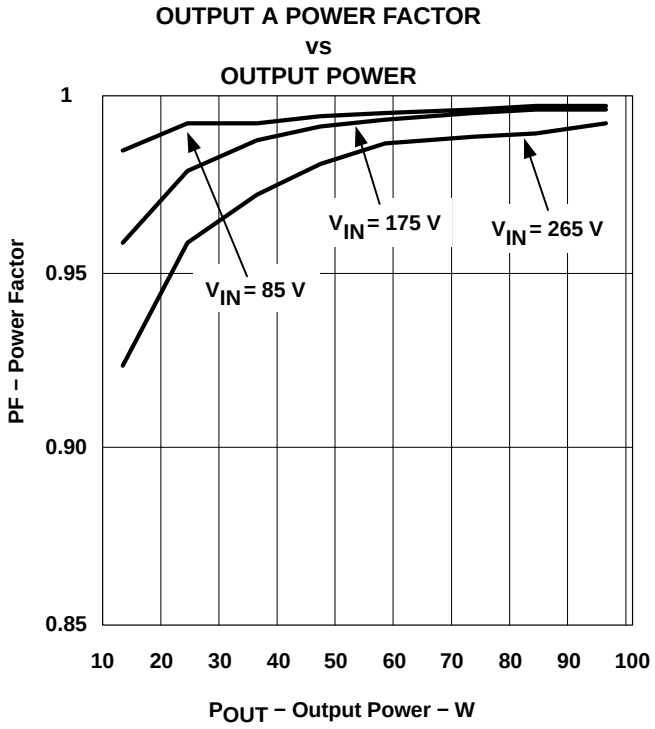

Figure 9

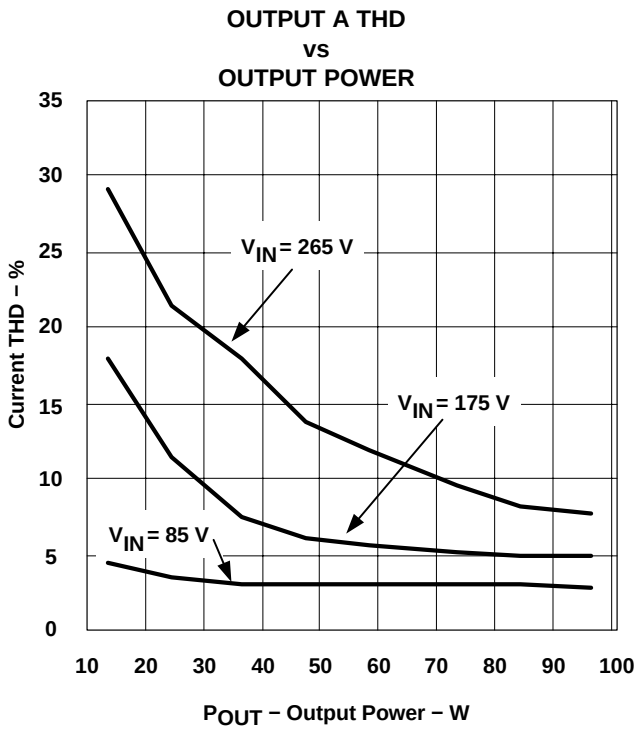

Figure 10

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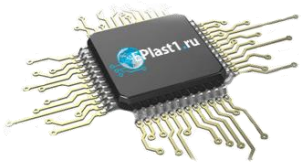

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