65 W QR USB PD adaptor reference design based on VIPERGAN65 and SRK1004

Fully assembled board developed for performance evaluation only, **not available for sale**

Features

- Input voltage range: Universal AC from 90 to 264 Vac with 47 to 63 Hz frequency
- Output voltage: single type-C output from 5 to 20 Vdc
- Maximum output power 65 W
- Efficiency standards: meet CoC tier 2 and DoE level 6 efficiency requirements
- Peak efficiency: 94% @ 230 Vac input, 92.3% @ 90 Vac input
- Support for USB PD 3.0
- EMC compliant: CISPR32B/EN55032B

Description

The STDES-VIPGAN65F is a 65 W USB Type-C® power delivery 3.0 adapter reference design.

It is an isolated power supply with a standalone USB PD controller.

The evaluation board implements at the primary side a quasi-resonant flyback converter based on the VIPERGAN65 HV converter with optocoupler feedback for voltage regulation.

This controller combines a high-performance low-voltage PWM controller chip with a 650 V HV startup cell in the same package.

The advanced power management with the low quiescent helps to achieve low standby consumptions.

At the secondary side, to increase the system efficiency, the rectification is based on the SRK1004 adaptive synchronous rectification controller.

Also on the secondary side, the CC/CV regulation loop drives the power regulation stage and the USB Type-C® PD interface is based on the STUSB4761 controller.

This controller offers the benefits of a full hardware USB PD stack allowing robust, deterministic, and safe negotiation in line with USB PD standards.

The evaluation board implements a robust adapter protected for output overvoltage, output undervoltage, output overpower and output short-circuit.

This reference design, based on STMicroelectronics semiconductors, helps designers to develop adapters with a short bill of materials to obtain a cost-effective and fast design.

Product summary

65 W QR USB PD adaptor reference design based on VIPerGaN65 and SRK1004	STDES-VIPGAN65F
Advanced quasi-resonant offline high voltage converter with E-mode GaN HEMT	VIPERGAN65TR
Synchronous rectifier controller for non-complementary active clamp flyback converter	SRK1004DTR
Stand-alone USB PD controller (with integrated CC/CV)	STUSB4761QTR
Automotive 400 W, 22 V TVS in SMA	SM4T26CAY
Applications	Flyback converter

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For further information contact your local STMicroelectronics sales office.

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1   Electrical characteristics

Table 1. Electrical characteristics

Symbol	Parameter	Test Conditions	Min	Nom	Max	Unit
Input parameters						
V_{IN}	Input Line Voltage		90	115 / 230	264	Vrms
f_{LINE}	Input Line Frequency		47	50 / 60	63	Hz
P_{STBY}	No Load Input Power-5Vout	VIN = 115 V_{RMS}, IOUT = 0 A		30		mW
		VIN = 230 V_{RMS}, IOUT = 0 A		40		
P_{STBY}	No Load Input Power-9Vout	VIN = 115 V_{RMS}, IOUT = 0 A		50		mW
		VIN = 230 V_{RMS}, IOUT = 0 A		70		
P_{STBY}	No Load Input Power-12Vout	VIN = 115 V_{RMS}, IOUT = 0 A		60		mW
		VIN = 230 V_{RMS}, IOUT = 0 A		85		
P_{STBY}	No Load Input Power-15Vout	VIN = 115 V_{RMS}, IOUT = 0 A		90		mW
		VIN = 230 V_{RMS}, IOUT = 0 A		110		
P_{STBY}	No Load Input Power-20Vout	VIN = 115 V_{RMS}, IOUT = 0 A		120		mW
		VIN = 230 V_{RMS}, IOUT = 0 A		150		
Output Parameters-5V Setting						
	Output Voltage	VIN = 90 V_{RMS}~264 V_{RMS} IOUT = 0A~3A		5		V
Vout	Output Voltage Ripple	Peak to Peak Value with 20MHz bandwidth		30	70	mV
I_{out}	Output Current		0		3	A
P_{out}	Continuous Output Power		0		15	W
$ηa_{ve}$	4-Point average efficiency 25%, 50%, 75% and 100% load	At 115 VAC and measured at Type-C receptacle on the board		90.0		%
$ηa_{ve}$	4-Point average efficiency 25%, 50%, 75% and 100% load	At 230 VAC and measured at Type-C receptacle on the board		84.6		%
Output Parameters-9V Setting						
Vout	Output Voltage	VIN = 90 V_{RMS}~264 V_{RMS}		9		V
V_{ripple}	Output Voltage Ripple	Peak to Peak Value with 20MHz bandwidth		35	50	mV
I_{out}	Output Current		0		3	A

Symbol	Parameter	Test Conditions	Min	Nom	Max	Unit
P_{out}	Continuous Output Power		0		27	W
ηa_{ve}	4-Point average efficiency 25%, 50%, 75% and 100% load	At 115 VAC and measured at Type-C receptacle on the board		92.2		%
ηa_{ve}	4-Point average efficiency 25%, 50%, 75% and 100% load	At 230 VAC and measured at Type-C receptacle on the board		88.4		%
Output Parameters-12V Setting						
Vout	Output Voltage	VIN = 90 V_{RMS}~264 V_{RMS} IOUT = 0A~3A		12		V
V_{ripple}	Output Voltage Ripple	Peak to Peak Value with 20MHz bandwidth		40	70	mV
I_{out}	Output Current		0		3	A
P_{out}	Continuous Output Power		0		36	W
ηa_{ve}	4-Point average efficiency 25%, 50%, 75% and 100% load	At 115 VAC and measured at Type-C receptacle on the board		92.6		%
ηa_{ve}	4-Point average efficiency 25%, 50%, 75% and 100% load	At 230 VAC and measured at Type-C receptacle on the board		89.9		%
Output Parameters-15V Setting						
Vout	Output Voltage	VIN = 90 V_{RMS}~264 V_{RMS} IOUT = 0A~3A		15		V
V_{ripple}	Output Voltage Ripple	Peak to Peak Value with 20MHz bandwidth		40	50	mV
I_{out}	Output Current		0		3	A
P_{out}	Continuous Output Power		0		45	W
Symbol	**Parameter**	**Test Conditions**	**Min**	**Nom**	**Max**	**Unit**
ηa_{ve}	4-Point average efficiency 25%, 50%, 75% and 100% load	At 115 VAC and measured at Type-C receptacle on the board		92.7		%
ηa_{ve}	4-Point average efficiency 25%, 50%, 75% and 100% load	At 230 VAC and measured at Type-C receptacle on the board		90.5		%
Output Parameters-20V Setting						
Vout	Output Voltage	VIN = 90 V_{RMS}~264 V_{RMS} IOUT = 0A~3.25A		20		V
V_{ripple}	Output Voltage Ripple	Peak to Peak Value with 20MHz bandwidth		40	50	mV
I_{out}	Output Current		0		3.25	A
P_{out}	Continuous Output Power		0		65	W

Symbol	Parameter	Test Conditions	Min	Nom	Max	Unit
η$_{ave}$	4-Point average efficiency 25%, 50%, 75% and 100% load	At 115 VAC and measured at Type-C receptacle on the board		92.8		%
η$_{ave}$	4-Point average efficiency 25%, 50%, 75% and 100% load	At 230 VAC and measured at Type-C receptacle on the board		91.9		%
Ambient and Emi parameters						
T$_{AMB}$	Ambient temperature	Free convection nsea level	0	25	40	℃
EMI	Conducted EMI		Meets CISPR32B/EN55032			

2 Overview

Figure 1. STDES-VIPGAN65F architecture block diagram
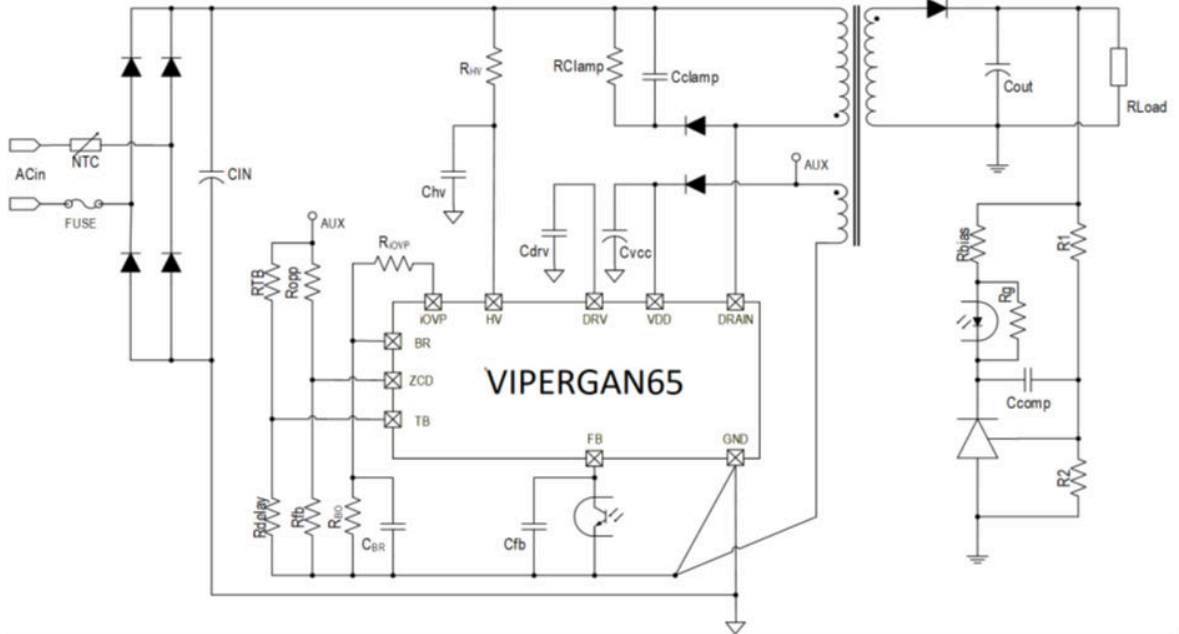
Figure 2. STDES-VIPGAN65F circuit schematic
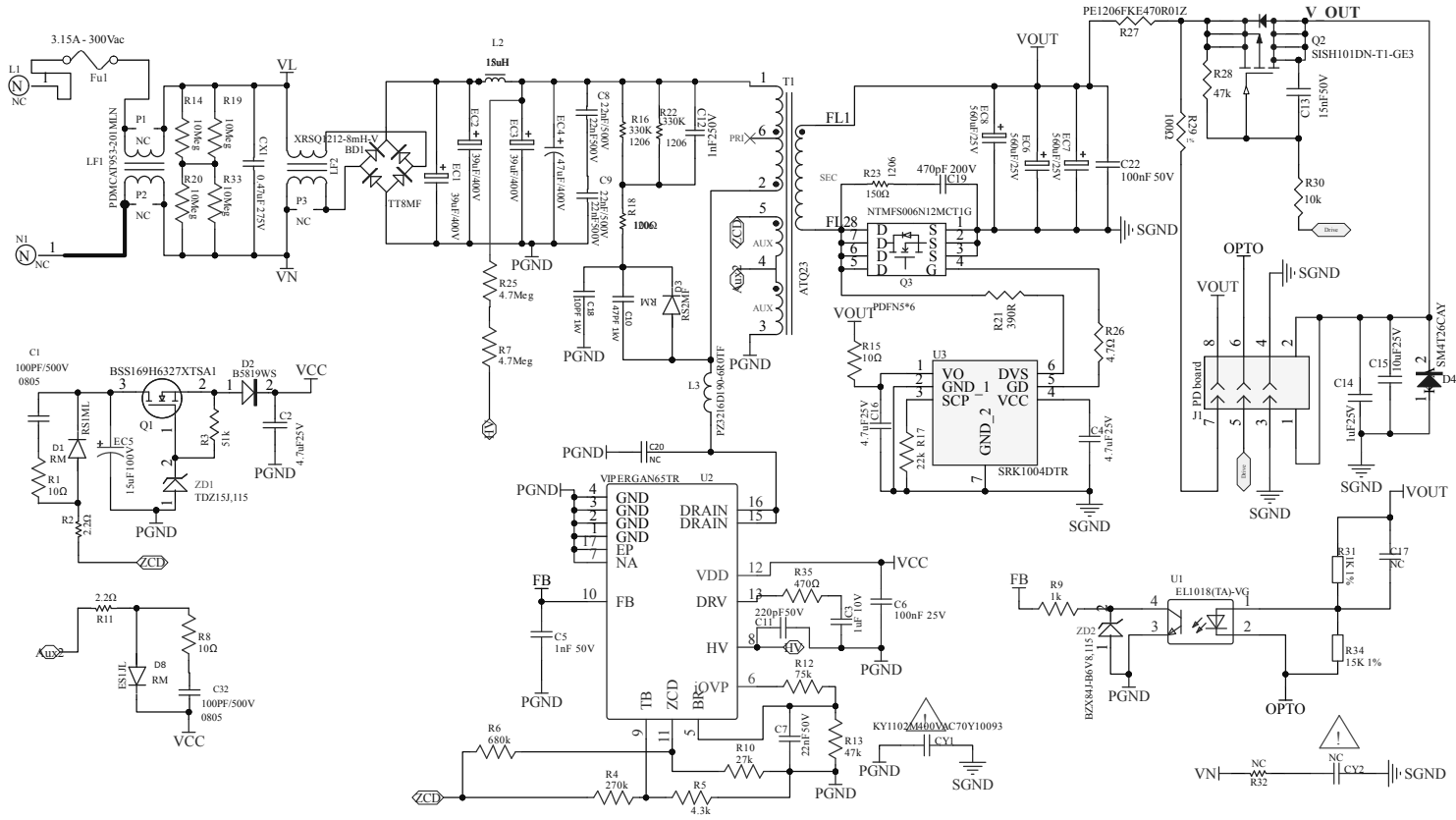
Revision history

Table 2. Document revision history

Date	Revision	Changes
22-Nov-2024	1	Initial release.

IMPORTANT NOTICE – READ CAREFULLY