

## 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	<b>STDES-VIPGAN65F</b>
Advanced quasi-resonant offline high voltage converter with E-mode GaN HEMT	<b>VIPERGAN65TR</b>
Synchronous rectifier controller for non-complementary active clamp flyback converter	<b>SRK1004DTR</b>
Stand-alone USB PD controller (with integrated CC/CV)	<b>STUSB4761QTR</b>
Automotive 400 W, 22 V TVS in SMA	<b>SM4T26CAY</b>
Applications	<b>Flyback converter</b>

# 1 Electrical characteristics

**Table 1. Electrical characteristics**

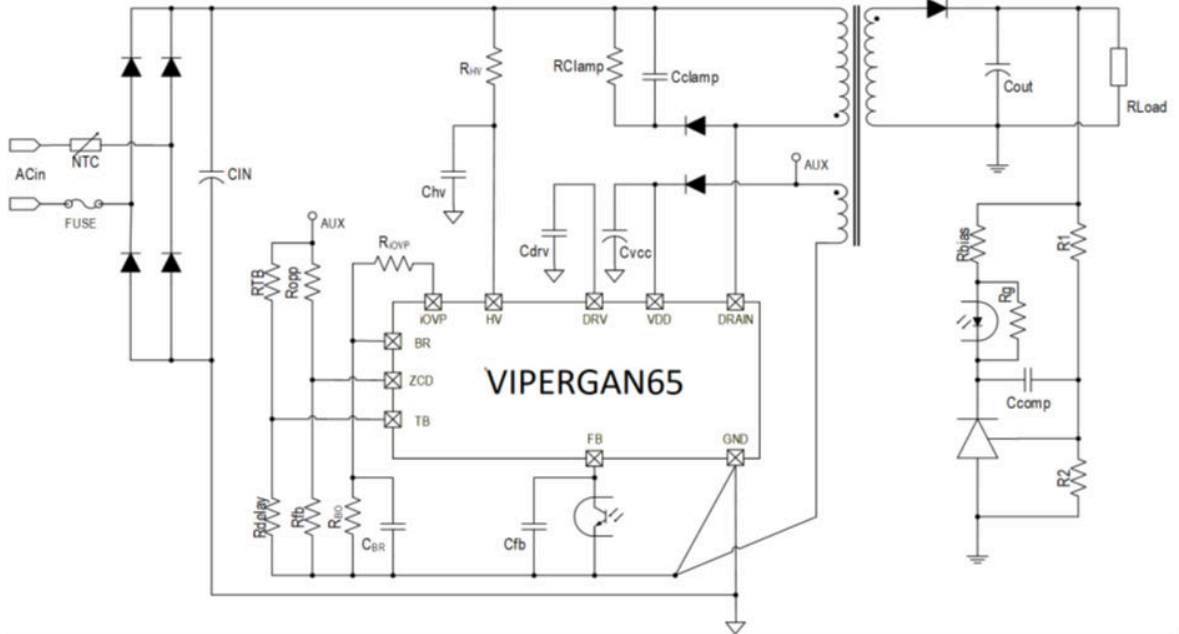
Symbol	Parameter	Test Conditions	Min	Nom	Max	Unit
<b>Input parameters</b>						
$V_{IN}$	Input Line Voltage		90	115 / 230	264	Vrms
$f_{LINE}$	Input Line Frequency		47	50 / 60	63	Hz
$P_{STBY}$	No Load Input Power-5Vout	$V_{IN} = 115 V_{RMS}, I_{OUT} = 0 A$ $V_{IN} = 230 V_{RMS}, I_{OUT} = 0 A$		30 40		mW
$P_{STBY}$	No Load Input Power-9Vout	$V_{IN} = 115 V_{RMS}, I_{OUT} = 0 A$ $V_{IN} = 230 V_{RMS}, I_{OUT} = 0 A$		50 70		mW
$P_{STBY}$	No Load Input Power-12Vout	$V_{IN} = 115 V_{RMS}, I_{OUT} = 0 A$ $V_{IN} = 230 V_{RMS}, I_{OUT} = 0 A$		60 85		mW
$P_{STBY}$	No Load Input Power-15Vout	$V_{IN} = 115 V_{RMS}, I_{OUT} = 0 A$ $V_{IN} = 230 V_{RMS}, I_{OUT} = 0 A$		90 110		mW
$P_{STBY}$	No Load Input Power-20Vout	$V_{IN} = 115 V_{RMS}, I_{OUT} = 0 A$ $V_{IN} = 230 V_{RMS}, I_{OUT} = 0 A$		120 150		mW
<b>Output Parameters-5V Setting</b>						
	Output Voltage	$V_{IN} = 90 V_{RMS} \sim 264 V_{RMS}$ $I_{OUT} = 0A \sim 3A$		5		V
$V_{out}$	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
$\eta_{ave}$	4-Point average efficiency 25%, 50%, 75% and 100% load	At 115 VAC and measured at Type-C receptacle on the board		90.0		%
$\eta_{ave}$	4-Point average efficiency 25%, 50%, 75% and 100% load	At 230 VAC and measured at Type-C receptacle on the board		84.6		%
<b>Output Parameters-9V Setting</b>						
$V_{out}$	Output Voltage	$V_{IN} = 90 V_{RMS} \sim 264 V_{RMS}$		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
$\eta_{ave}$	4-Point average efficiency 25%, 50%, 75% and 100% load	At 115 VAC and measured at Type-C receptacle on the board		92.2		%
$\eta_{ave}$	4-Point average efficiency 25%, 50%, 75% and 100% load	At 230 VAC and measured at Type-C receptacle on the board		88.4		%
<b>Output Parameters-12V Setting</b>						
$V_{out}$	Output Voltage	$V_{IN} = 90 V_{RMS} \sim 264 V_{RMS}$ $I_{OUT} = 0A \sim 3A$		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
$\eta_{ave}$	4-Point average efficiency 25%, 50%, 75% and 100% load	At 115 VAC and measured at Type-C receptacle on the board		92.6		%
$\eta_{ave}$	4-Point average efficiency 25%, 50%, 75% and 100% load	At 230 VAC and measured at Type-C receptacle on the board		89.9		%
<b>Output Parameters-15V Setting</b>						
$V_{out}$	Output Voltage	$V_{IN} = 90 V_{RMS} \sim 264 V_{RMS}$ $I_{OUT} = 0A \sim 3A$		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
<b>Symbol</b>	<b>Parameter</b>	<b>Test Conditions</b>	<b>Min</b>	<b>Nom</b>	<b>Max</b>	<b>Unit</b>
$\eta_{ave}$	4-Point average efficiency 25%, 50%, 75% and 100% load	At 115 VAC and measured at Type-C receptacle on the board		92.7		%
$\eta_{ave}$	4-Point average efficiency 25%, 50%, 75% and 100% load	At 230 VAC and measured at Type-C receptacle on the board		90.5		%
<b>Output Parameters-20V Setting</b>						
$V_{out}$	Output Voltage	$V_{IN} = 90 V_{RMS} \sim 264 V_{RMS}$ $I_{OUT} = 0A \sim 3.25A$		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
$\eta_{ave}$	4-Point average efficiency 25%, 50%, 75% and 100% load	At 115 VAC and measured at Type-C receptacle on the board		92.8		%
$\eta_{ave}$	4-Point average efficiency 25%, 50%, 75% and 100% load	At 230 VAC and measured at Type-C receptacle on the board		91.9		%
<b>Ambient and Emi parameters</b>						
$T_{AMB}$	Ambient temperature	Free convection nsea level	0	25	40	°C
EMI	Conducted EMI		Meets CISPR32B/EN55032			

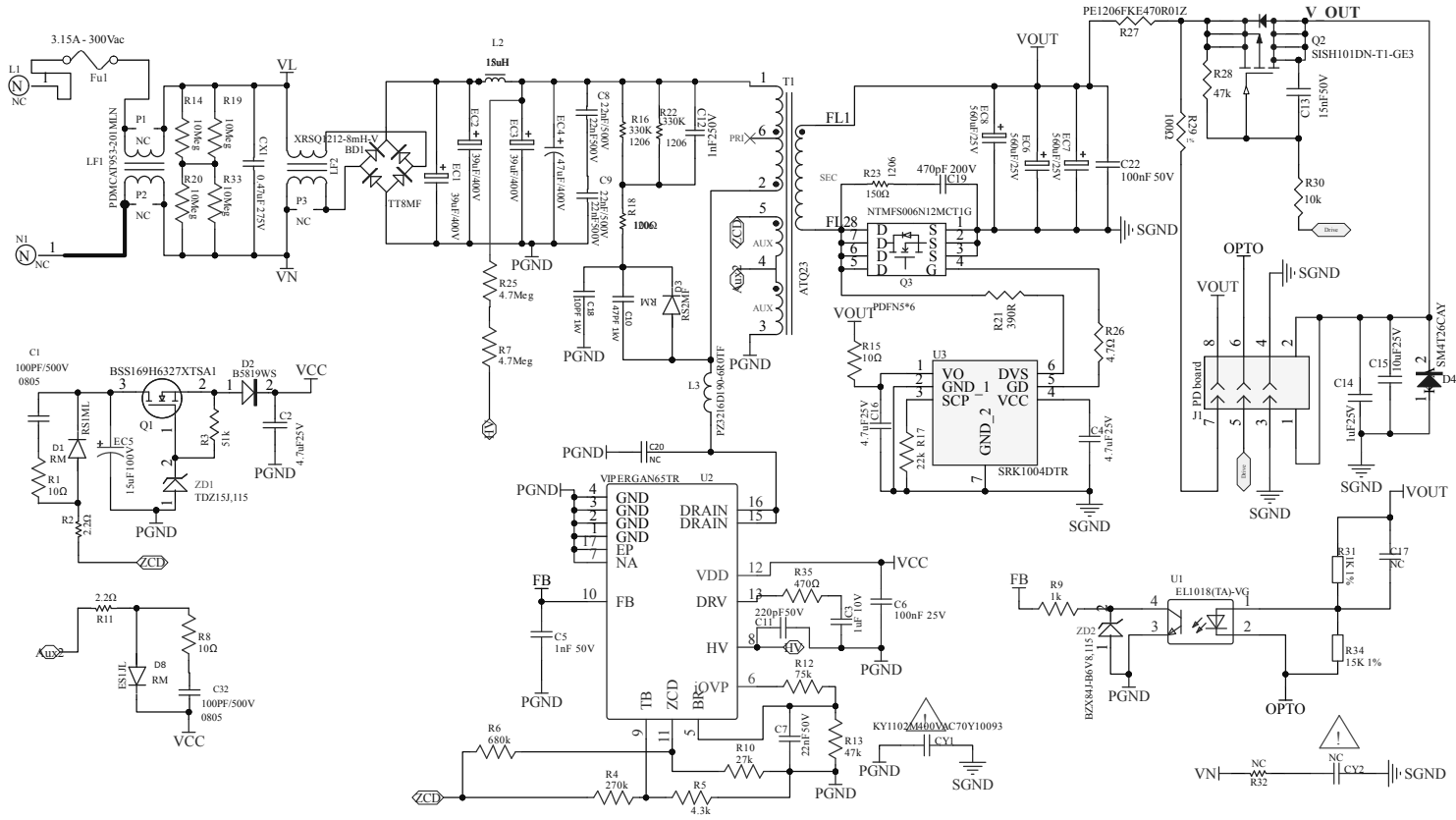
## 2 Overview

Figure 1. STDES-VIPGAN65F architecture block diagram



### 3 Schematic diagram

Figure 2. STDES-VIPGAN65F circuit schematic



## Revision history

Table 2. Document revision history

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

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