TIDA-00617 Class 4 High-Efficiency Driven Flyback Converter (5V/5A) for PoE PD Applications

1 Introduction

TIDA-00617 is a Class 4 high efficiency driven flyback converter capable of 5V/5A for PoE PD applications. It is IEEE802.3.at compliant.

2 Configurable features

2.1 Features

- Excellent efficiency, driven, synchronous flyback design.
- Gigabit Ethernet pass through interface
- 24V and 48V adapter input capability
- 5V @ 5A DC output

2.2 Applications

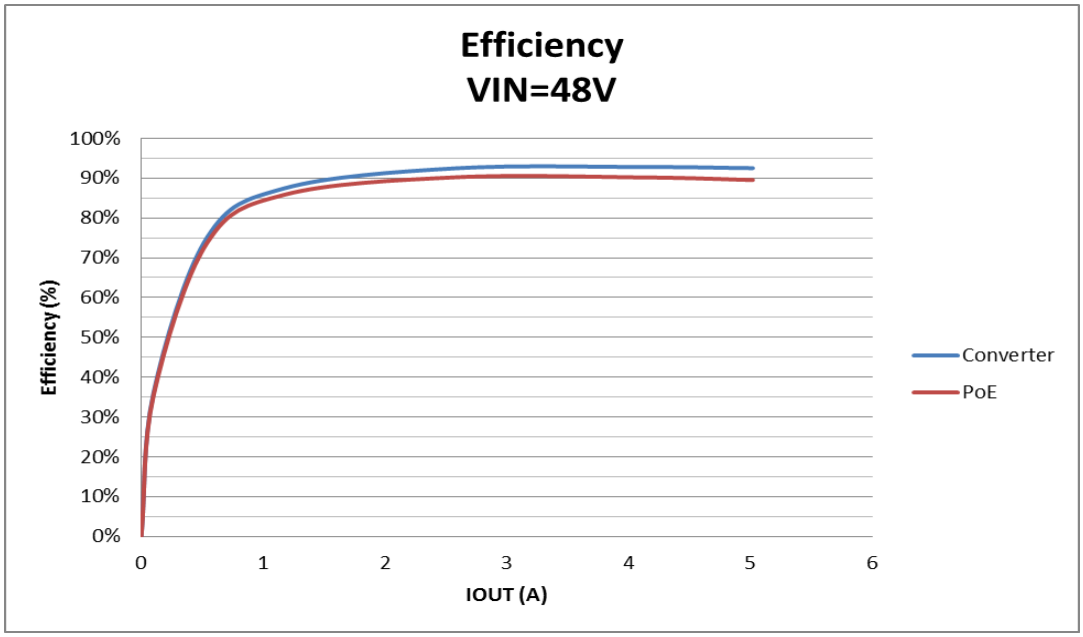
- IEEE802.3at compliant devices
- Video and VoIP Telephones
- Multiband Access Points
- Security Cameras
- Pico-base stations

3 Electrical specifications

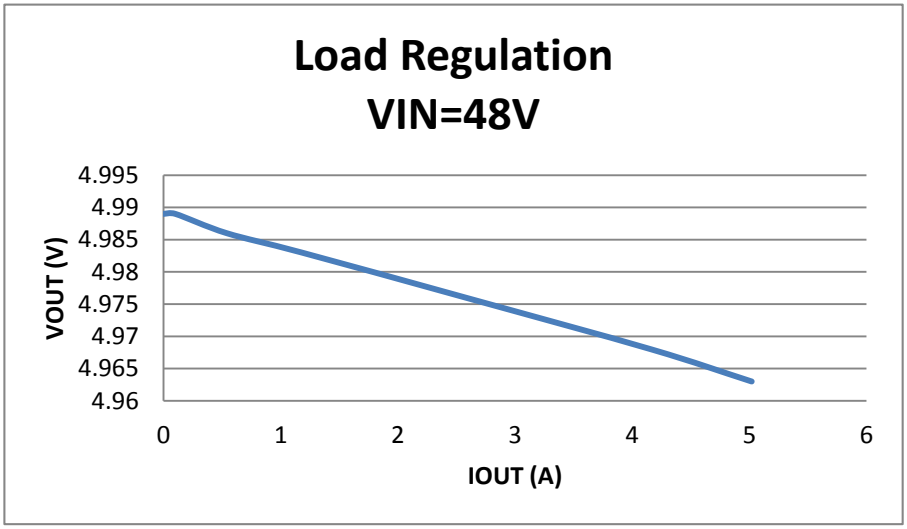
TIDA-00617 Electrical and Performance Specifications

Parameter	Condition		Min	Typ	Max	Units
Power Interface						
Input Voltage	Applied to the power pins of connectors J1		42.5	-	57	Volts
	Applied to the power pins of connectors J3		21.6		57	
Operating Voltage	After start up.		30.5	-	57	
Input UVLO	Rising input voltage		-	-	40	
	Falling input voltage		30.5	-	-	
Detection voltage			1.4	-	10.1	
Classification voltage			11.9	-	23.0	
Classification current	Rclass = 63.4 ohms		38	-	42	mA
Inrush current-limit			100	-	180	
Operating current-limit			850	-	1200	
DC/DC Converter						
Output Voltage	21.6V ≤ Vin ≤ 57V, ILOAD ≤ ILOAD (max)	5V output	-	4.98	-	Volts
Output Current	21.6V ≤ Vin ≤ 57V	5V output	-	-	5	Amps
Output ripple voltage, pk-to-pk	Vin = 48V, ILOAD = 5A	5V output	-	40	-	mV
Efficiency, dc-dc converter	Vin = 48V, ILOAD = 4.2A	5V output	-	93	-	%
Efficiency, end-to-end	Vin = 48V, ILOAD = 5A	5V output	-	90	-	%
Switching frequency			225	-	270	kHz

4 Efficiency

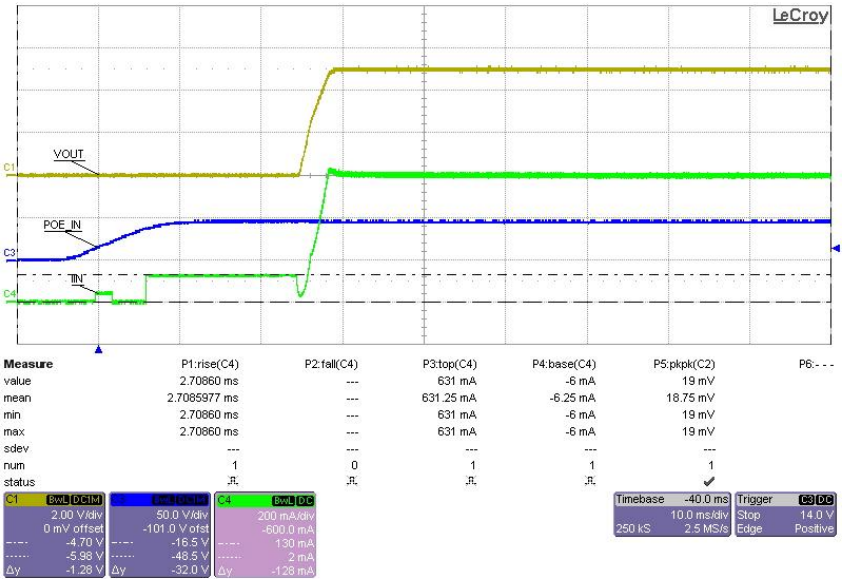


5 Load Regulation



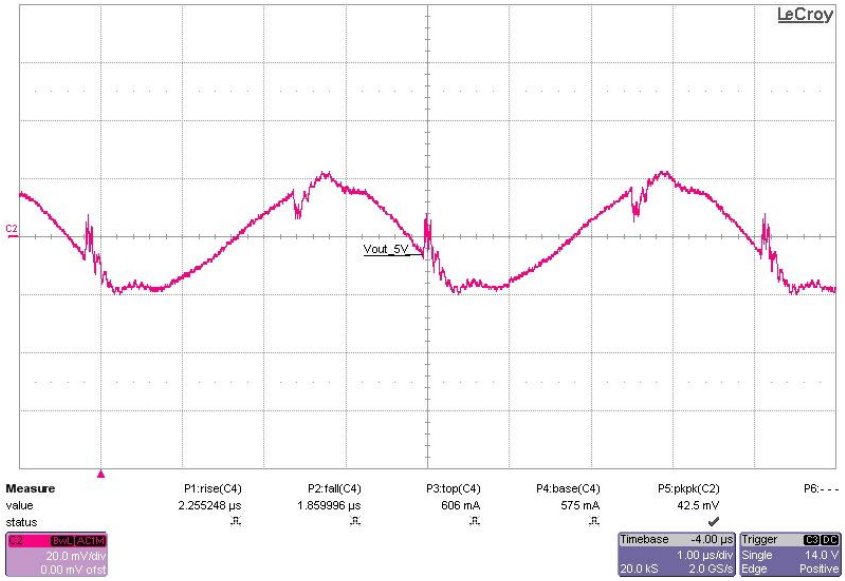
6 Start up

The scope plot below shows the 5V output voltage startup waveform after the application of 48Vdc at J1 (Ethernet connector). The output was loaded to 5A using an electronic load in CR mode.



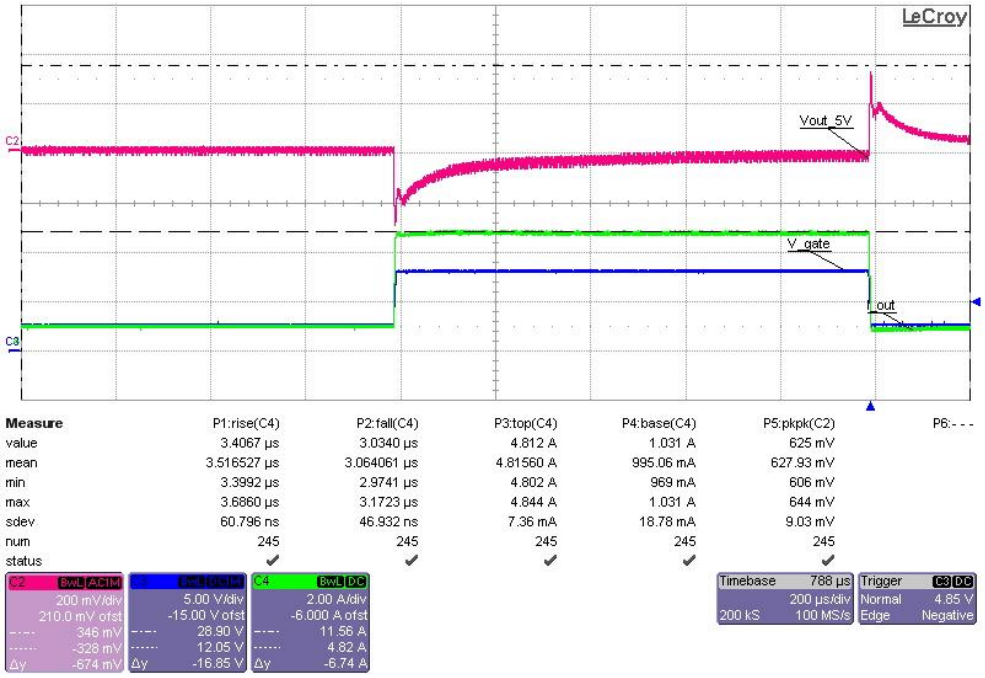
7 Output Ripple Voltage

The 5V output ripple voltage is shown in the scope plot below (J6 connector across pins w/tip and ring). The scope plot was taken with the output loaded to 5A.Vin = 48Vdc at J1.



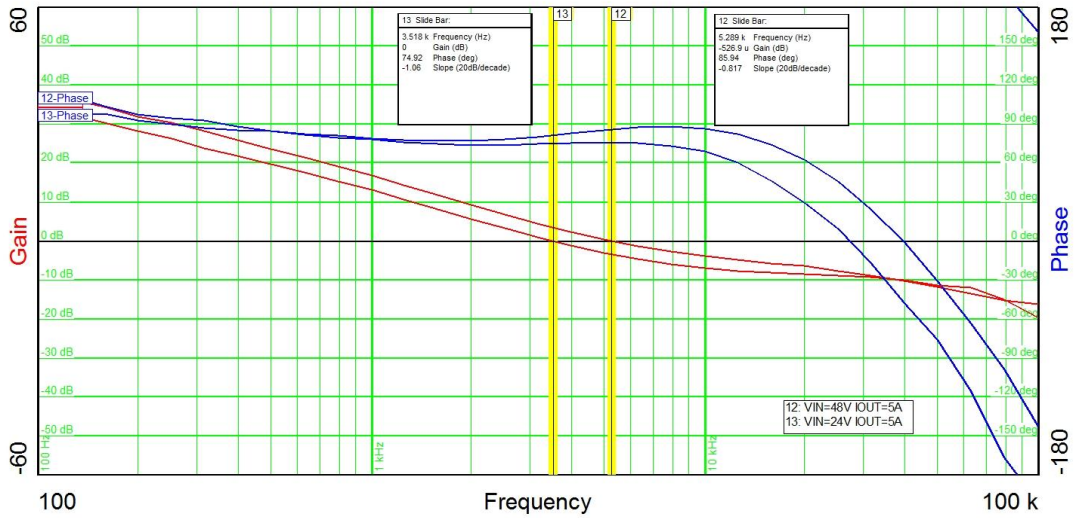
8 Load Transient

The scope plot below shows the 5V output voltage when the load current is pulsed from 0.6 to 4.8A at a 1A/us slew rate. Vin = 48Vdc at J1.



9 Control Loop Gain / Stability

The figure below shows the closed loop response at 48V input and a 5A load.



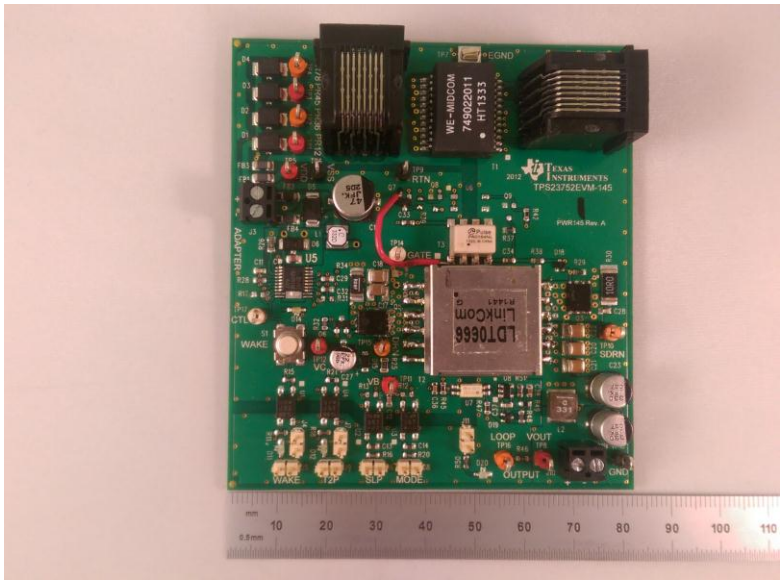
The table below shows the loop gain and phase margin.

Input voltage	Crossover	Phase Margin
48V	5.3kHz	86°
24V	3.5kHz	75°

10 Thermal

The image below shows the board with a 48VDC input. The ambient temperature was 27C with no forced air flow. The output was loaded with 5A

11 Board Image



12 Sifos Test Report

The table below shows the results of the Sifos Technologies PoE Powered Device Analyzer using a 1A load.

PDA-300 TEST RESULTS

802.3at PD Test Report

Sifos Technologies

March 25 2015	4:27 PM
Test Cycles.....	1
Quadrants Tested.....	4
PD Tested:	
firmware ver.	3.32
hardware ver.	2
report version	3.06

Parameters / Test Cycles:	Test Cycle 1	UNITS	Low Limit	P/F	High Limit	P/F
ALT-A, MDI Unpowered PD						
R_detect=	24.74	Kohm	23.70	Pass	26.30	Pass
C_detect=	0.112	uF	0.050	Pass	0.120	Pass
I_Class=	39.4	mA	36.0	Pass	44.0	Pass
Class=	4	****	0	Pass	4	Pass
Type=	2	****	1	Pass	2	Pass
V_on=	38.9	Volts	30.0	Pass	42.0	Pass
V_off=	32.3	Volts	30.0	Pass	42.5	Pass
Inrush_E=	0.114	W-s	0.000	Pass	0.350	Pass
ALT-A, MDI Type-1 Grant						
Pclass_PD_1=	0.94	Watts	0.00	Pass	13.00	Pass
Ppeak_PD_1=	0.96	Watts	0.00	Pass	14.40	Pass
Max_Load_1=	20.1	mA	10.0	Pass	300.0	Pass
MPS_Load_1=	19.4	mA	10.0	Pass	270.8	Pass
Average_Load_1=	19.6	mA	2.3	Pass	270.8	Pass
ALT-A, MDI Type-2 Grant						
I_Mark=	0.9	mA	0.3	Pass	4.0	Pass
Pclass_PD_2=	1.04	Watts	0.00	Pass	25.50	Pass
Ppeak_PD_2=	1.22	Watts	0.00	Pass	28.30	Pass
P_type-1=	0.12	Watts	0.00	Pass	14.40	Pass
Max_Load_2=	22.5	mA	10.0	Pass	524.1	Pass
MPS_Load_2=	18.8	mA	10.0	Pass	472.2	Pass
Average_Load_2=	19.1	mA	2.3	Pass	472.2	Pass
ALT-A, MDI-X Unpowered PD						
R_detect=	24.74	Kohm	23.70	Pass	26.30	Pass
C_detect=	0.110	uF	0.050	Pass	0.120	Pass
I_Class=	39.5	mA	36.0	Pass	44.0	Pass
Class=	4	****	0	Pass	4	Pass
Type=	2	****	1	Pass	2	Pass
V_on=	38.9	Volts	30.0	Pass	42.0	Pass

V_off=	32.3	Volts	30.0	Pass	42.5	Pass
Inrush_E=	0.114	W-s	0.000	Pass	0.350	Pass
ALT-A, MDI-X Type-1 Grant						
Pclass_PD_1=	0.94	Watts	0.00	Pass	13.00	Pass
Ppeak_PD_1=	0.96	Watts	0.00	Pass	14.40	Pass
Max_Load_1=	20.2	mA	10.0	Pass	300.0	Pass
MPS_Load_1=	19.4	mA	10.0	Pass	270.8	Pass
Average_Load_1=	19.6	mA	2.3	Pass	270.8	Pass
ALT-A, MDI-X Type-2 Grant						
I_Mark=	0.9	mA	0.3	Pass	4.0	Pass
Pclass_PD_2=	1.04	Watts	0.00	Pass	25.50	Pass
Ppeak_PD_2=	1.45	Watts	0.00	Pass	28.30	Pass
P_type-1=	0.12	Watts	0.00	Pass	14.40	Pass
Max_Load_2=	26.7	mA	10.0	Pass	524.1	Pass
MPS_Load_2=	18.7	mA	10.0	Pass	472.2	Pass
Average_Load_2=	19.1	mA	2.3	Pass	472.2	Pass
ALT-B, MDI Unpowered PD						
R_detect=	24.73	Kohm	23.70	Pass	26.30	Pass
C_detect=	0.110	uF	0.050	Pass	0.120	Pass
I_Class=	39.5	mA	36.0	Pass	44.0	Pass
Class=	4	****	0	Pass	4	Pass
Type=	2	****	1	Pass	2	Pass
V_on=	38.9	Volts	30.0	Pass	42.0	Pass
V_off=	32.3	Volts	30.0	Pass	42.5	Pass
Inrush_E=	0.114	W-s	0.000	Pass	0.350	Pass
ALT-B, MDI Type-1 Grant						
Pclass_PD_1=	0.94	Watts	0.00	Pass	13.00	Pass
Ppeak_PD_1=	0.96	Watts	0.00	Pass	14.40	Pass
Max_Load_1=	20.0	mA	10.0	Pass	300.0	Pass
MPS_Load_1=	19.3	mA	10.0	Pass	270.8	Pass
Average_Load_1=	19.6	mA	2.3	Pass	270.8	Pass
ALT-B, MDI Type-2 Grant						
I_Mark=	0.9	mA	0.3	Pass	4.0	Pass
Pclass_PD_2=	1.04	Watts	0.00	Pass	25.50	Pass
Ppeak_PD_2=	1.17	Watts	0.00	Pass	28.30	Pass
P_type-1=	0.12	Watts	0.00	Pass	14.40	Pass
Max_Load_2=	21.6	mA	10.0	Pass	524.1	Pass
MPS_Load_2=	18.8	mA	10.0	Pass	472.2	Pass
Average_Load_2=	19.1	mA	2.3	Pass	472.2	Pass
ALT-B, MDI-X Unpowered PD						
R_detect=	24.78	Kohm	23.70	Pass	26.30	Pass
C_detect=	0.110	uF	0.050	Pass	0.120	Pass
I_Class=	39.4	mA	36.0	Pass	44.0	Pass
Class=	4	****	0	Pass	4	Pass
Type=	2	****	1	Pass	2	Pass
V_on=	38.9	Volts	30.0	Pass	42.0	Pass
V_off=	32.3	Volts	30.0	Pass	42.5	Pass
Inrush_E=	0.114	W-s	0.000	Pass	0.350	Pass

ALT-B, MDI-X Type-1 Grant						
Pclass_PD_1=	0.94	Watts	0.00	Pass	13.00	Pass
Ppeak_PD_1=	0.96	Watts	0.00	Pass	14.40	Pass
Max_Load_1=	20.2	mA	10.0	Pass	300.0	Pass
MPS_Load_1=	19.2	mA	10.0	Pass	270.8	Pass
Average_Load_1=	19.6	mA	2.3	Pass	270.8	Pass
ALT-B, MDI-X Type-2 Grant						
I_Mark=	0.9	mA	0.3	Pass	4.0	Pass
Pclass_PD_2=	1.04	Watts	0.00	Pass	25.50	Pass
Ppeak_PD_2=	1.45	Watts	0.00	Pass	28.30	Pass
P_type-1=	0.12	Watts	0.00	Pass	14.40	Pass
Max_Load_2=	26.6	mA	10.0	Pass	524.1	Pass
MPS_Load_2=	18.8	mA	10.0	Pass	472.2	Pass
Average_Load_2=	19.1	mA	2.3	Pass	472.2	Pass
Average-Over-Pairs Unpowered PD						
R_detect=	24.75	Kohm	23.70	Pass	26.30	Pass
C_detect=	0.111	uF	0.050	Pass	0.120	Pass
I_Class=	39.5	mA	36.0	Pass	44.0	Pass
Class=	4	****	0	Pass	4	Pass
Type=	2	****	1	Pass	2	Pass
V_on=	38.9	Volts	30.0	Pass	42.0	Pass
V_off=	32.3	Volts	30.0	Pass	42.5	Pass
Inrush_E=	0.114	W-s	0.000	Pass	0.350	Pass
Average-Over-Pairs Type-1 Grant						
Pclass_PD_1=	0.94	Watts	0.00	Pass	13.00	Pass
Ppeak_PD_1=	0.96	Watts	0.00	Pass	14.40	Pass
Max_Load_1=	20.1	mA	10.0	Pass	300.0	Pass
MPS_Load_1=	19.3	mA	10.0	Pass	270.8	Pass
Average_Load_1=	19.6	mA	2.3	Pass	270.8	Pass
Average-Over-Pairs Type-2 Grant						
I_Mark=	0.9	mA	0.3	Pass	4.0	Pass
Pclass_PD_2=	1.04	Watts	0.00	Pass	25.50	Pass
Ppeak_PD_2=	1.32	Watts	0.00	Pass	28.30	Pass
P_type-1=	0.12	Watts	0.00	Pass	14.40	Pass
Max_Load_2=	24.4	mA	10.0	Pass	524.1	Pass
MPS_Load_2=	18.8	mA	10.0	Pass	472.2	Pass
Average_Load_2=	19.1	mA	2.3	Pass	472.2	Pass

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