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ACT4525 EVK User's Guide
5V/3.4A Dual Output CV/CC Car Charger Solution

Features

- Wide input voltage range from 6V to 32V
- Transparent input voltage surge up to 40V
- 5.1V output voltage
- 4.75V-5.25V during input and load transients
- 125kHz switching frequency
- Standby input current <2mA
- 2.4A+1A dual output with separate CC regulation
- USB Auto-detect Support Apple, Samsung and BC1.2
- Good EMC performance
- Under voltage protection at output short
- <6mA average output current at output short
- Output over voltage protection
- Output cord compensation
- Thermal shutdown protection

Specification

DESCRIPTION	CONDITION	MIN	TYP	MAX	UNITS
Input Voltage		6		36	V
Switching Frequency			125		kHz
Standby Input current	Vin=10V, no load		2		mA
	Vin=24V, no load		1		mA
Output Voltage	No cable, full load range	4.85	5.1	5.25	V
Output1 current limit range		2400	2650	2700	mA
Output2 current limit range		1050	1200	1350	mA
Ripple Voltage	Vin=10V, Iout1=2.4A, Iout2=1A		45		mV
	Vin=24V, Iout1=2.4A, Iout2=1A		55		
Efficiency at full load	Vin=10V, Iout1=2.4A, Iout2=1A		89		%
	Vin=24V, Iout1=2.4A, Iout2=1A		88		%
ENVIRONMENTAL					
ESD	Contact		4		kV
	Through air		8		kV

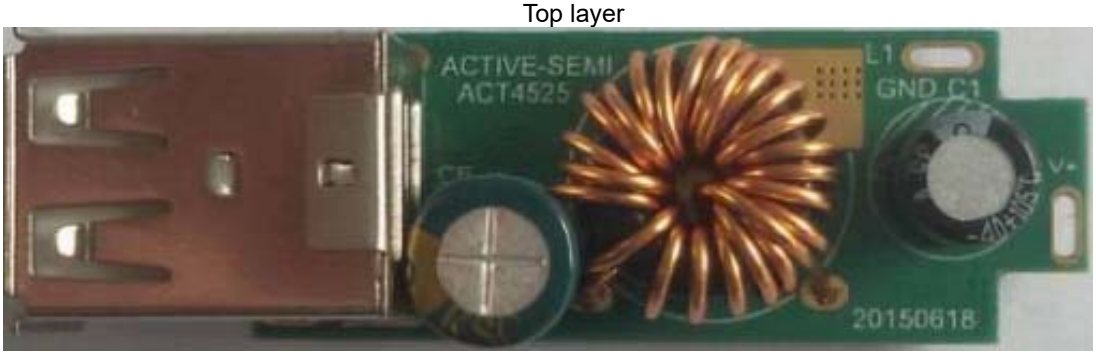
TABLE OF CONTENTS

Introduction

This document supports both the ACT4525YH-T Evaluation Kit (EA4525YH-T) and ACT4525YH-T0001 Evaluation Kit (EA4525YH-T0001). These kits are used for car charger, rechargeable portable device and so on. The EVKs operate at very high charge efficiency of 89% .They contain a dual USB output that provides outputs with 5V/2.4A and 5V/1A. Both EVKs are identical except for the IC. The ACT4525YH-T output cord compensation is 100mV while the ACT4525YH-T0001 output cord compensation is 200mV.

Demo Board Photos

Top layer



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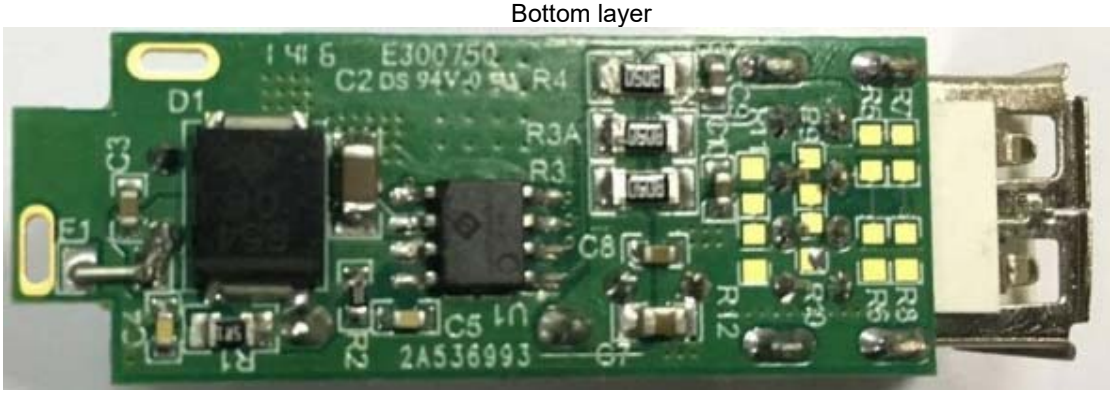
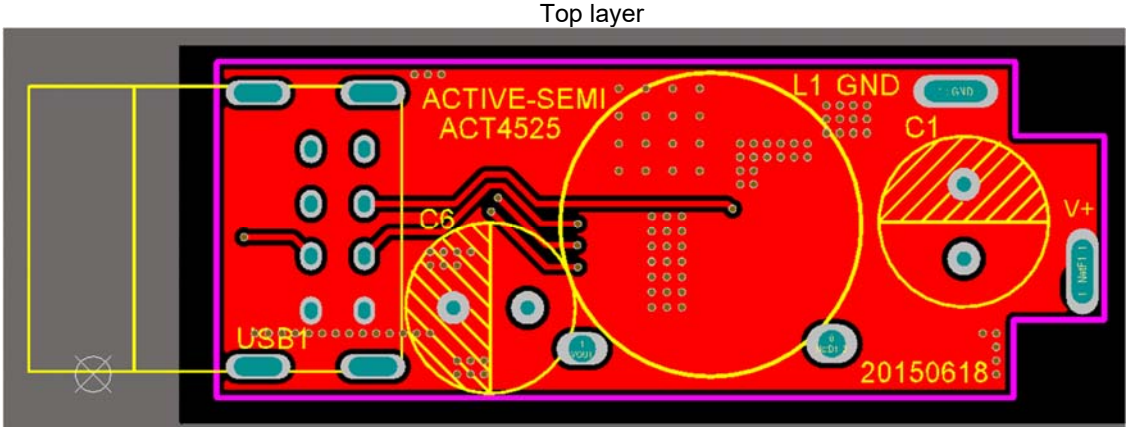


PCB Layout

Top layer



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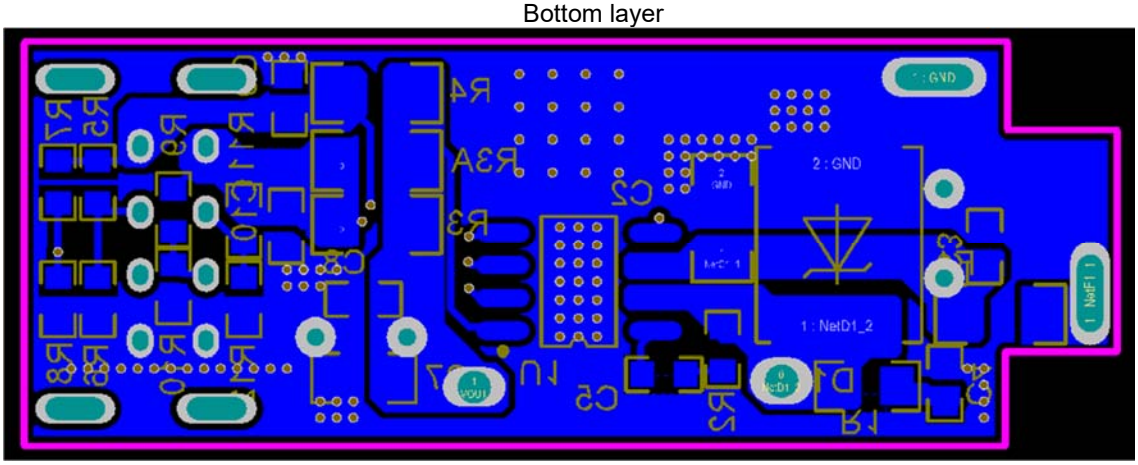
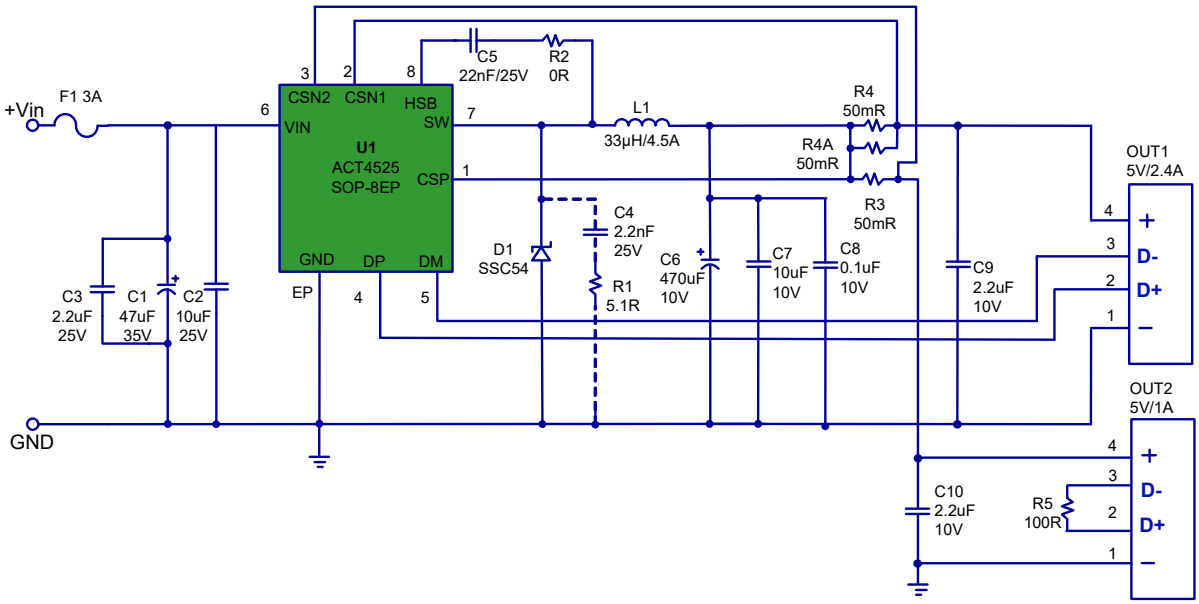


Schematics

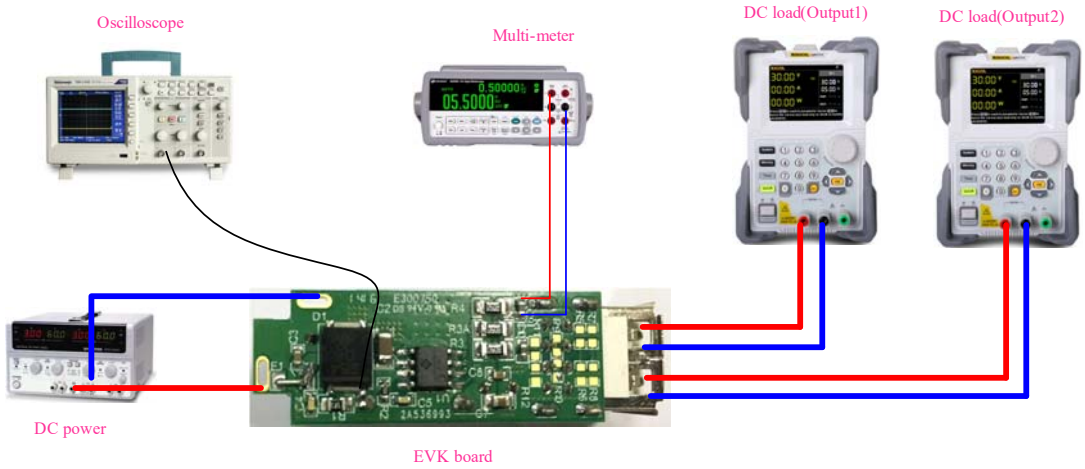

+Vin
F1 3A
GND
U1
ACT4525
SOP-8EP
CSN2
CSN1
HSB
VIN
SW
CSP
GND
DP
DM
EP
C1
47uF
35V
C2
10uF
25V
C3
2.2uF
25V
C4
2.2nF
25V
C5
22nF/25V
R1
5.1R
R2
0R
D1
SSC54
L1
33µH/4.5A
C6
470uF
10V
C7
10uF
10V
C8
0.1uF
10V
R3
50mR
R4
50mR
R4A
50mR
C9
2.2uF
10V
OUT1
5V/2.4A
D-
D+
OUT2
5V/1A
C10
2.2uF
10V
R5
100R

Bill of Materials

Item	Reference	Description	QTY		Manuf.
			EA4525YH-T	EA4525YH-T0001	
1	L1	Choke Coil, Dip,T11.5*5*4mm, phi=0.8mm, L=33uH	1	1	
2	D1	Schottky Diode, SSC54,40V/5A, SMC	1	1	Vishay
3	C1	Electrolytic capacitor,47uF/35V,6.3x8mm	1	1	Koshin
4	C2	Ceramic capacitor,10uF/25V, X7R,1206	1	1	Koshin
5	C3	Ceramic capacitor,2.2uF/25V, X7R,0805	1	1	Murata/TDK
6	C4	Ceramic capacitor, 2.2nF/25V, X7R,0603(optional)	1	1	Murata/TDK
7	C5	Ceramic capacitor, 22nF/25V, X7R, 0603	1	1	Murata/TDK
8	C6	Electrolytic capacitor,470uF/10V,7x11.5mm	1	1	Murata/TDK
9	C7	Ceramic capacitor, 10uF/10V, X7R, 0805	1	1	Murata/TDK
10	C8	Ceramic capacitor, 0.1uF /25V, X7R, 0603	1	1	Murata/TDK
11	C9/C10	Ceramic capacitor, 2.2uF/10V, X7R, 0805	2	2	Murata/TDK
12	F1	Fuse,3A,1206 (Replaced by 0Ω 0805 chip resistor)	1	1	Murata/TDK
13	R1	Chip Resistor, 5.1Ω, 1/10W, 5%, 0603(optional)	1	1	Murata/TDK
14	R2	Chip Resistor, 0Ω, 1/10W, 5%, 0603	1	1	Murata/TDK
15	R3/R3A/R4	Chip Resistor, 50mΩ, 1/4W, 1%, 1206	1	1	Murata/TDK
16	R5	Chip Resistor, 100Ω, 1/16W ,1%,0603	1	1	Murata/TDK
17	U1	IC, ACT4525YH-T,SOP-8-EP	1	0	ACT
18	U1	IC, ACT4525YH-T0001,SOP-8-EP	0	1	ACT
19	USB2.0	USB AF 90 degree double half double bomb	1	1	HLW

Equipment and EVK Test Setup

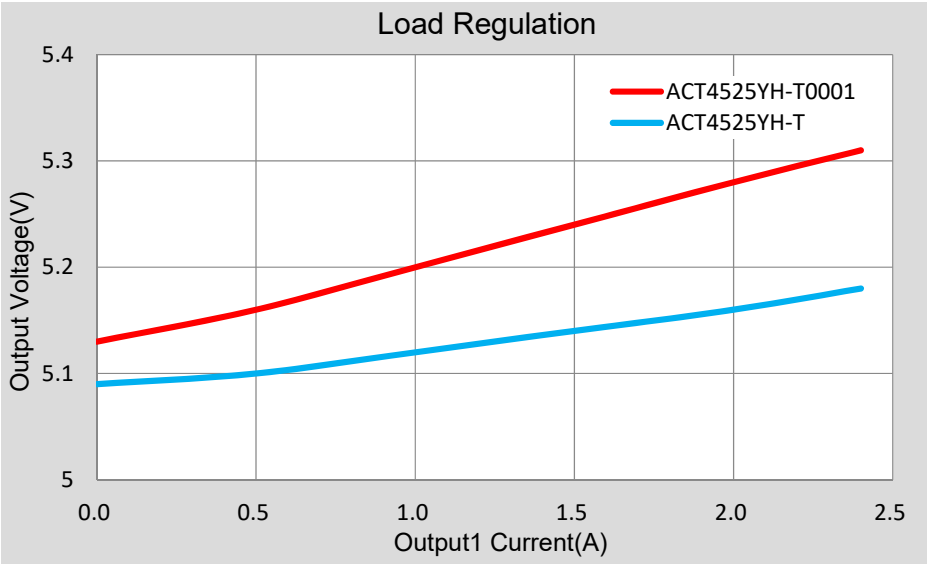
Equipment	Model
DC Load	PRODIGIT 3311F 60V/60A,300W DC ELECTRONIC LOAD
DC Power Supply	GW INSTEK GPC-30600
Multi Meter	FLLIKE 8808A 5-1/2 DIGIT MULTIMETER
Oscilloscope	Tektronix DPO 3014 Digital Phosphor Oscilloscope



Functional Test

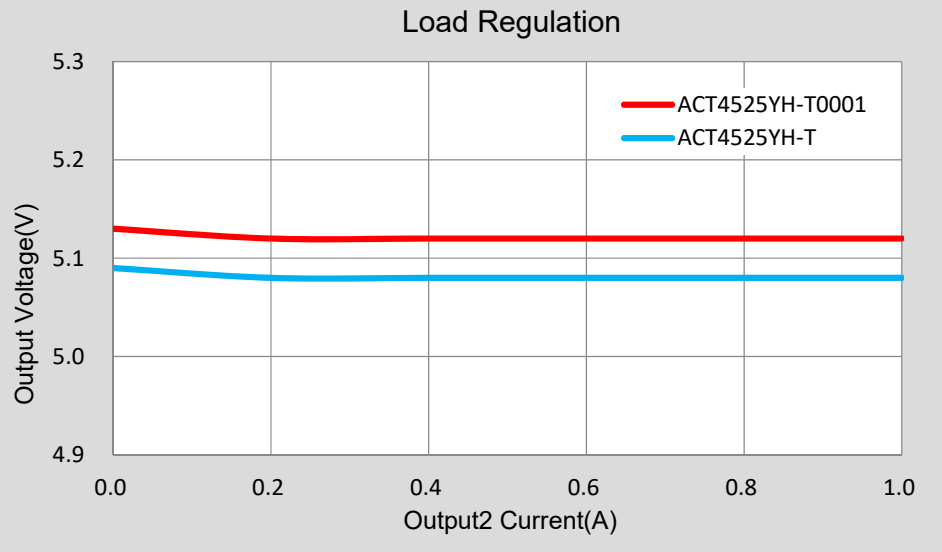
Output1 Regulation

Vin=12V. Iout2=0A. Set DC load (Output1) in CC mode. Increase Iout1 from 0A to 2.4A and measure the voltage on the C7 capacitor.



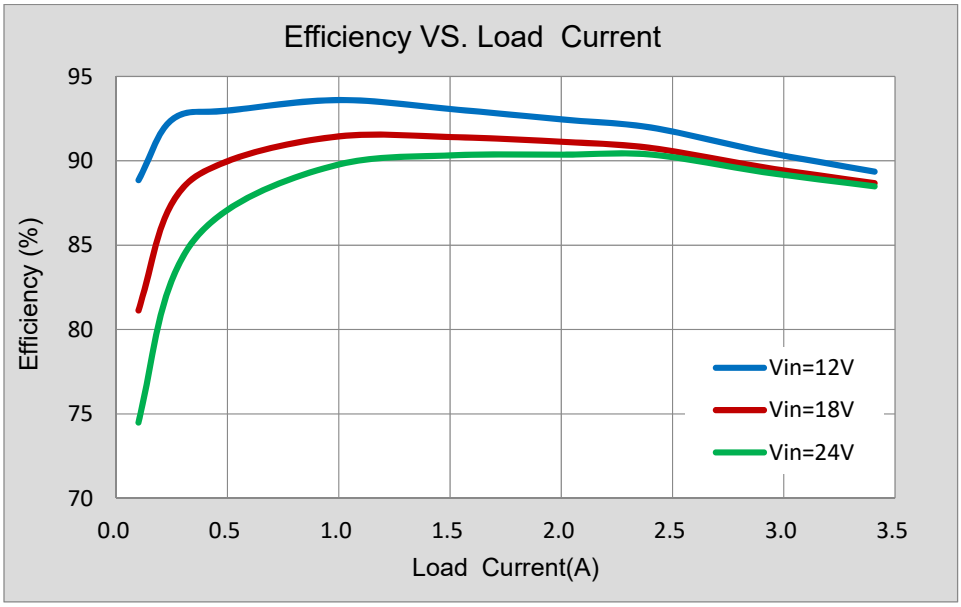
Output2 Regulation

Vin=12V. Iout1=0A. Set DC load (Output2) in CC mode. Increase Iout2 from 0A to 1A and measure the voltage on the C7 capacitor.



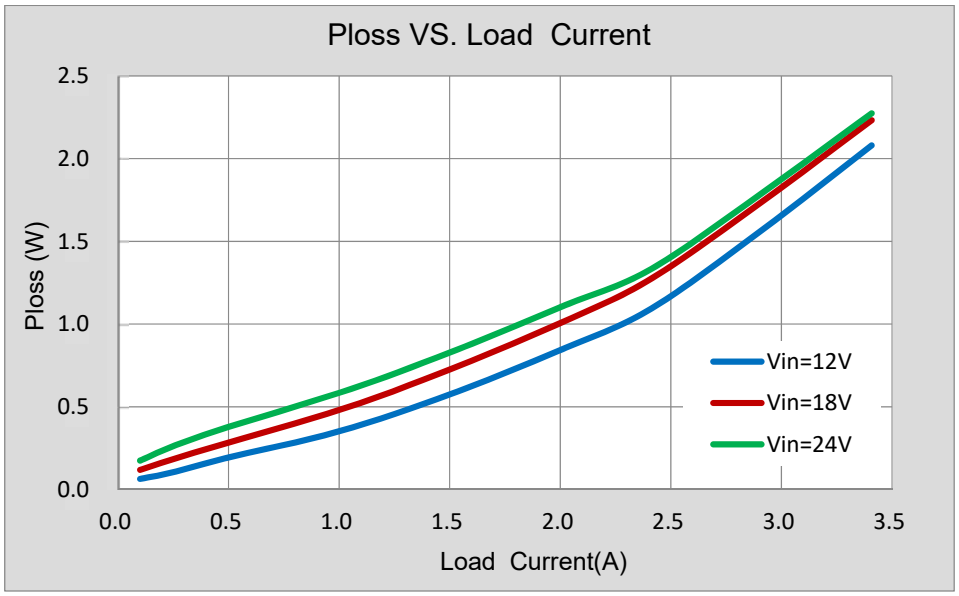
Efficiency (Ta=25℃)

Increase Iout1 from 0A to 2.4A then Increase Iout1 from 0A to 1A and measure the efficiency of the evaluation kit in different input voltage.



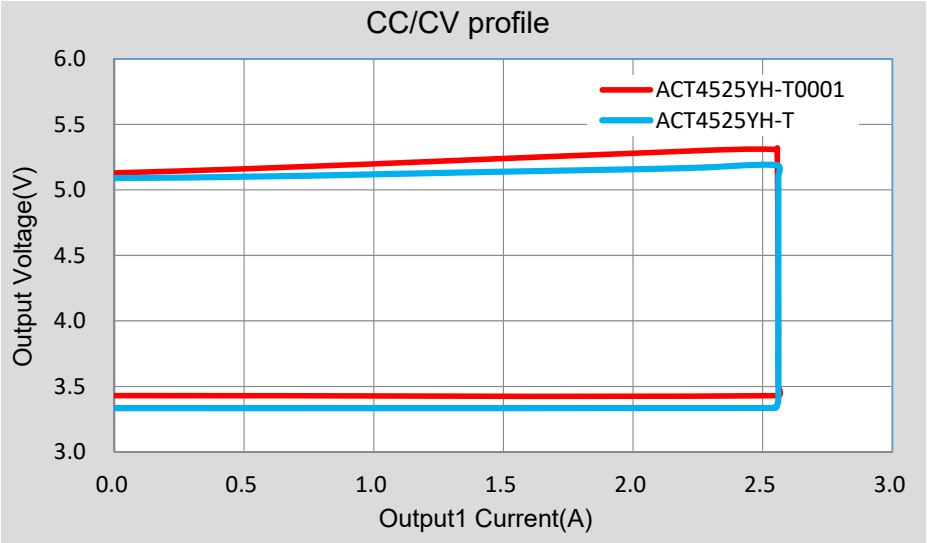
Power Loss

Increase Iout1 from 0A to 2.4A then Increase Iout1 from 0A to 1A and measure the power loss of the evaluation kit in different input voltage.



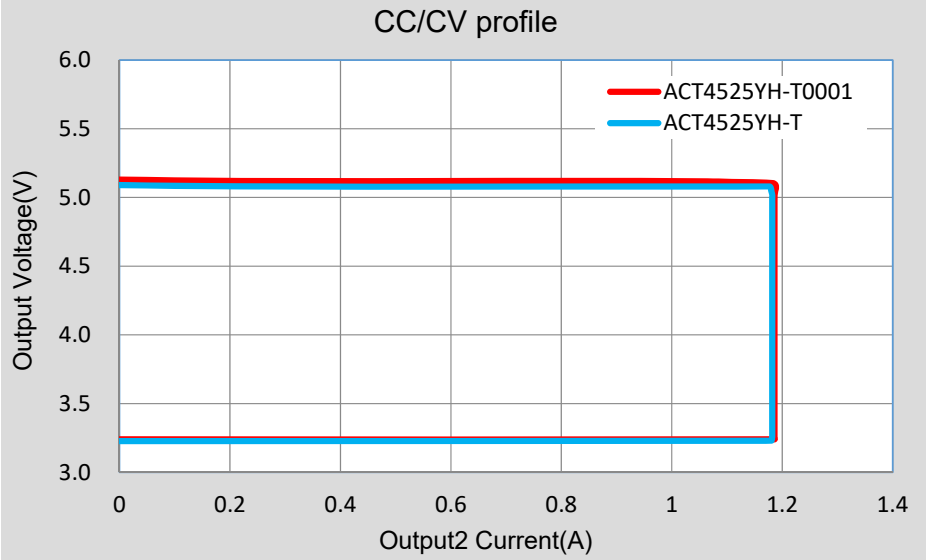
Output1 Constant Current and Constant Voltage (Ta=25°C)

Vin=12V. Iout2=0A. Set DC load (Output1) in CV mode. Increase Vout1 from 0V to the maximum load voltage. Measure the current of output1 and the voltage on the C7 capacitor. Then Set DC load (Output1) in CC mode, increase Iout1 from 0A to the maximum load current and measure the voltage on the C7 capacitor.

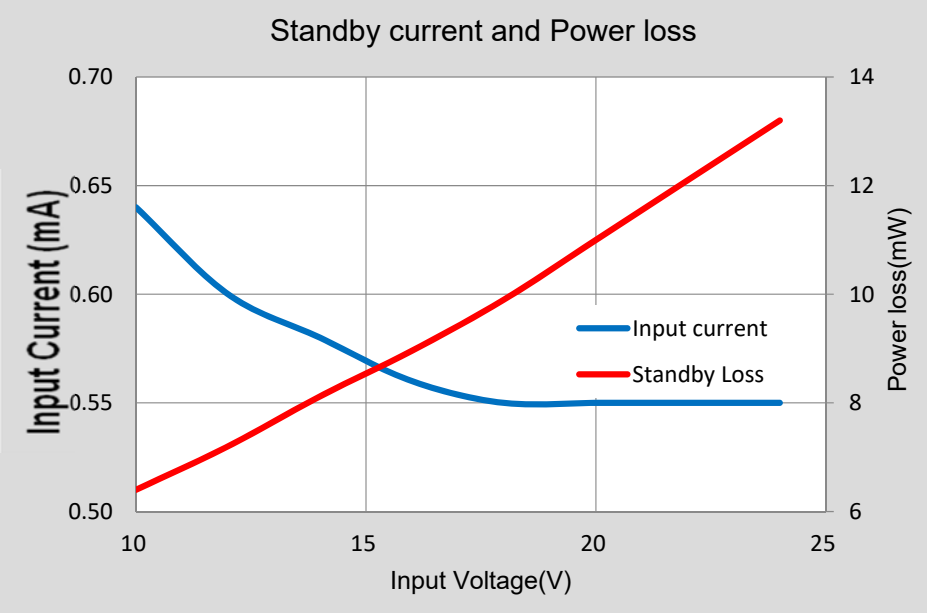


Output2 Constant Current and Constant Voltage (Ta=25℃)

Vin=12V, Iout1=0A. Set DC load (Output2) in CV mode. Increase Vout2 from 0V to the maximum load voltage. Measure the current of output2 and the voltage on the C7 capacitor. Then Set DC load (Output1) in CC mode, increase Iout2 from 0A to the maximum load current and measure the voltage on the C7 capacitor.
Change the IC of the board from ACT4525YH-T to ACT4525YH-T0001 and repeat the above operation.



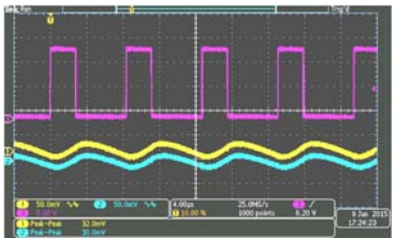
Standby Input Current and Power loss



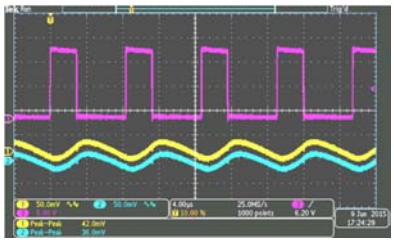
Ripple and Noise

CH1:Vout1, CH2:Vout2, CH3:Vsw

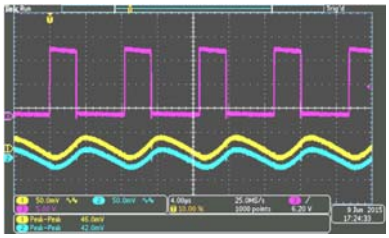
Vin=10V Iout1=0A Iout2=1A



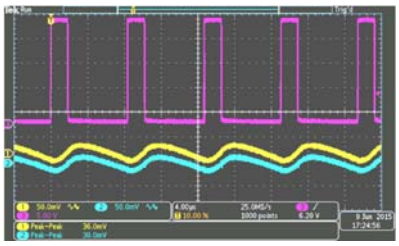
Vin=10V Iout1=2.4A Iout2=0A



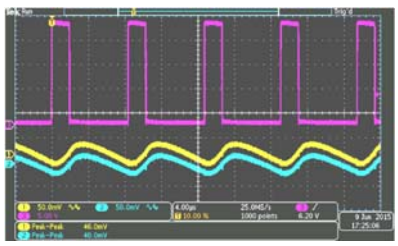
Vin=10V Iout1=2.4A Iout2=1A



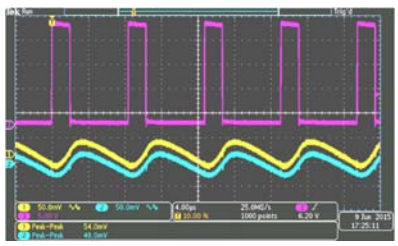
Vin=16V Iout1=0A Iout2=1A



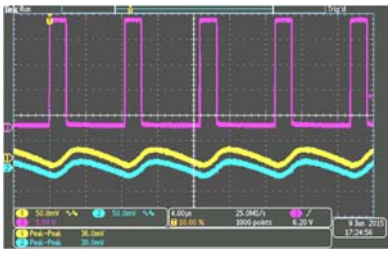
Vin=16V Iout1=2.4A Iout2=0A



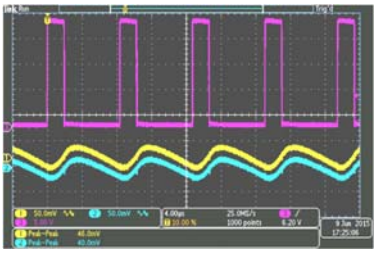
Vin=16V Iout1=2.4A Iout2=1A



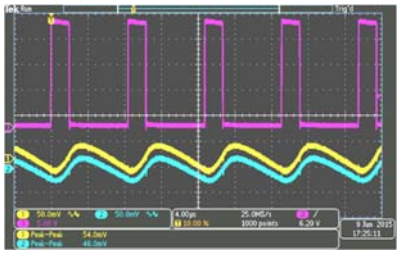
Vin=24V Iout1=0A Iout2=1A



Vin=24V Iout1=2.4A Iout2=0A



Vin=24V Iout1=2.4A Iout2=1A



Ripple & noise are measured by using 20MHz bandwidth limited oscilloscope.

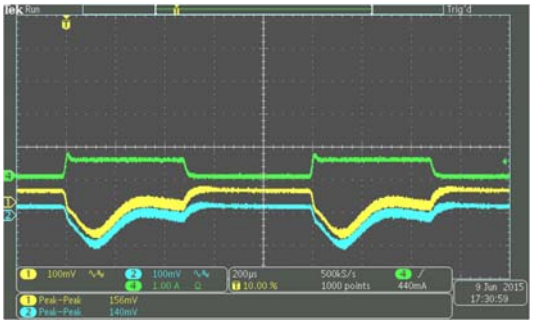
Test Conditions	Iout1=0A,Iout2=1A		Iout1=2.4A,Iout2=0A		Iout1=2.4A,Iout2=1A	
Output Ripple	Vout1(mV)	Vout2(mV)	Vout1(mV)	Vout2(mV)	Vout1(mV)	Vout2(mV)
Vin=10V	32	30	42	36	46	42
Vin=16V	36	30	46	40	54	48
Vin=24V	36	30	46	40	54	48

Load Transient Response

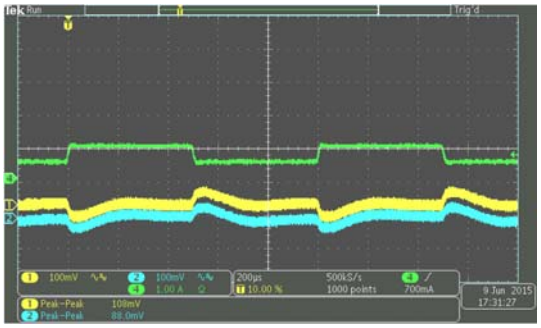
CH1:Vout1, CH2:Vout2, CH4:Iout

Iout2=0A dynamic load on output1

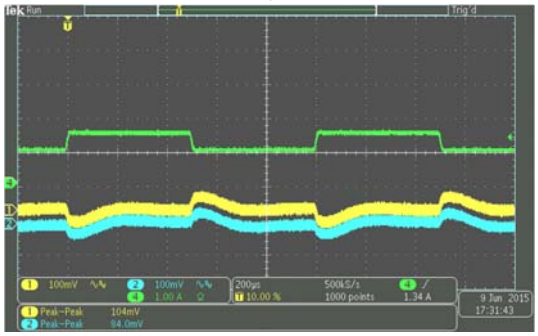
Vin=10V, load step 0A-0.5A-0A



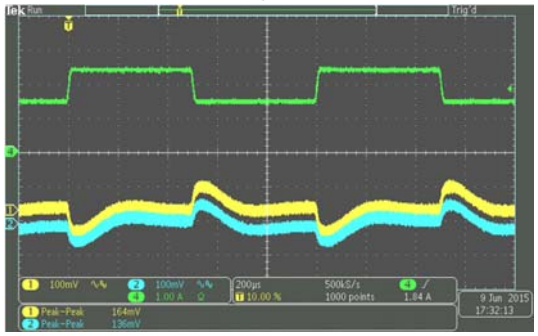
Vin=10V, load step 0.5A-1A-0.5A



Vin=10V, load step 1A-1.5A-1A

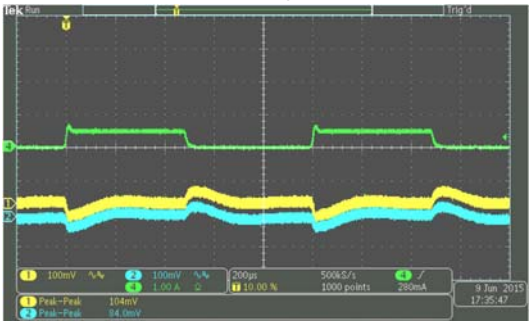


Vin=10V, load step 1.5A-2.4A-1.5A

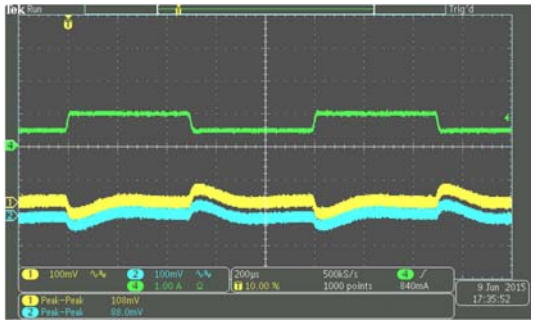


Iout2=1A dynamic load on output1

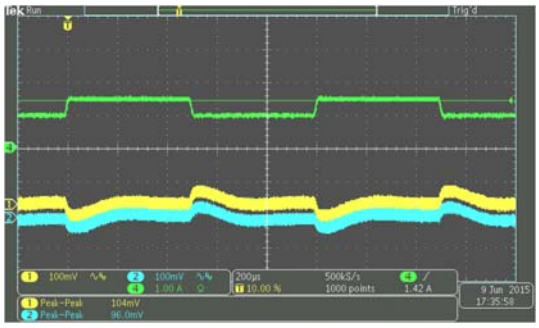
Vin=10V, load step 0A-0.5A -0A



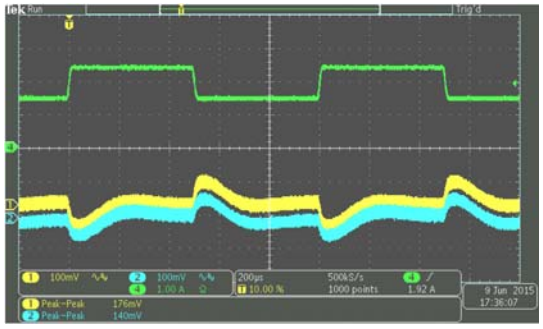
Vin=10V, load step 0.5A-1A-0.5A



Vin=10V, load step 1A-1.5A-1A

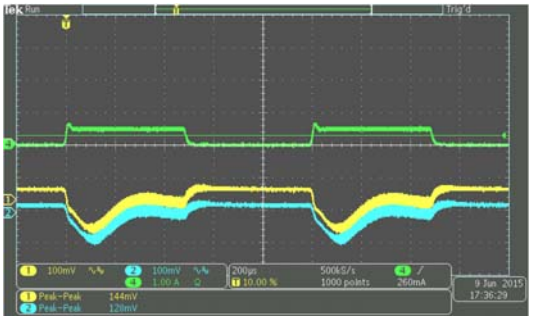


Vin=10V, load step 1.5A-2.4A-1.5A

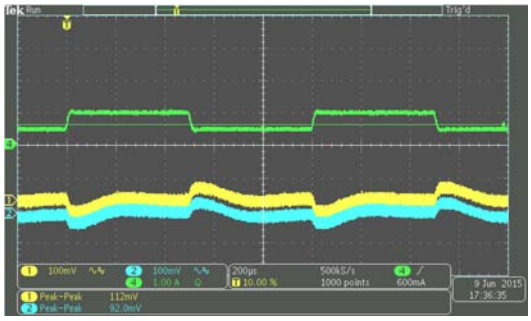


Iout2=0A dynamic load on output1

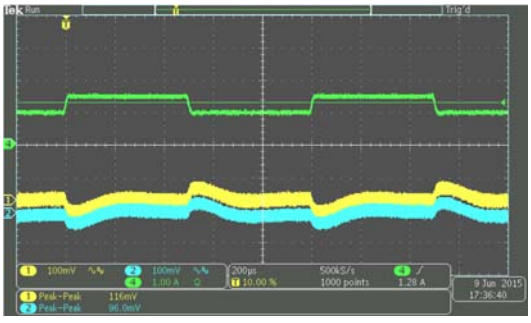
Vin=24V, load step 0A-0.5A -0A



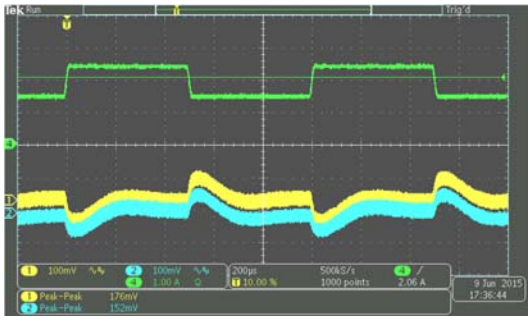
Vin=24V, load step 0.5A-1A-0.5A



Vin=24V, load step 1A-1.5A-1A

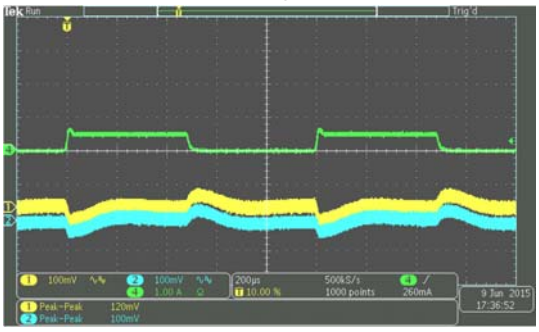


Vin=24V, load step 1.5A-2.4A-1.5A

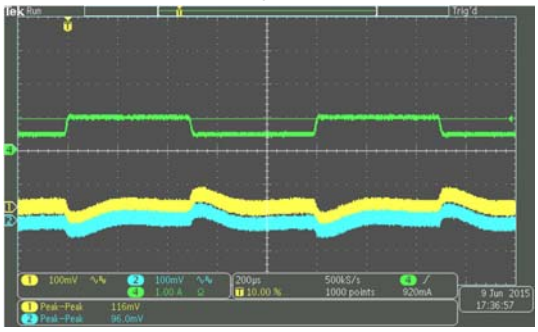


Iout2=1A dynamic load on output1

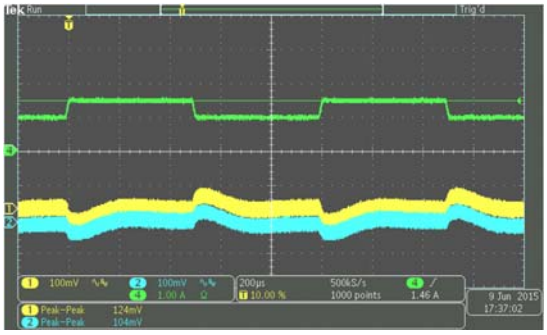
Vin=24V, load step 0A-0.5A -0A



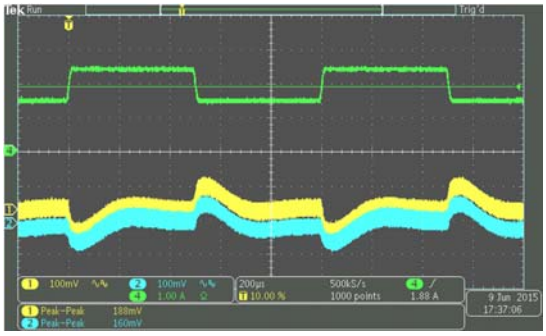
Vin=24V, load step 0.5A-1A-0.5A



Vin=24V, load step 1A-1.5A-1A



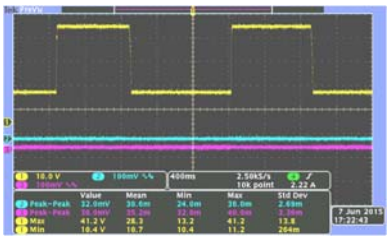
Vin=24V, load step 1.5A-2.4A-1.5A



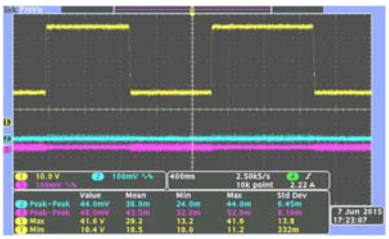
Line Transient Response(Vin change from 12V to 40V， 1V/us)

CH1:Vin, CH2:Vout1,CH3:Vout2

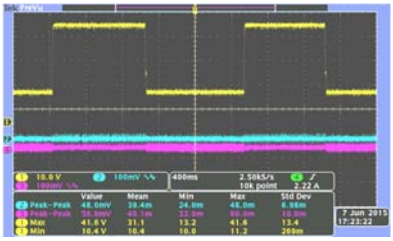
Iout1=0A,Iout2=1A



Iout1=2.4A,Iout2=0A



Iout1=2.4A,Iout2=1A



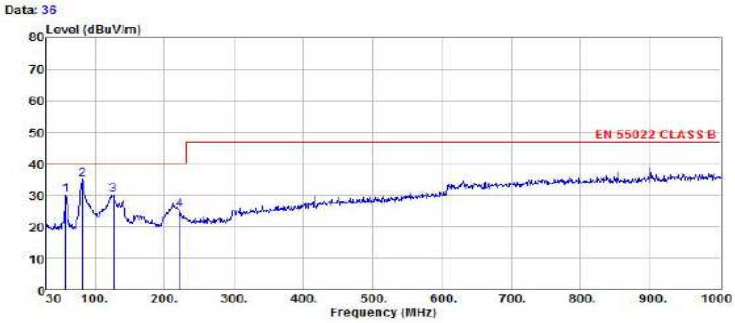
Key Components Temperature Test (Ta=40℃, after 2 hours steady state operation at full load)

	Components temperature(℃)				
Vin/Iout	Ambient	PCB	IC	Diode	Inductor
12V/3.4A	44.5	84.1	106.2	103.8	96.3
24V/3.4A	46.2	90	114.9	116.5	106.5

EMI TEST

Radiated EMI Test

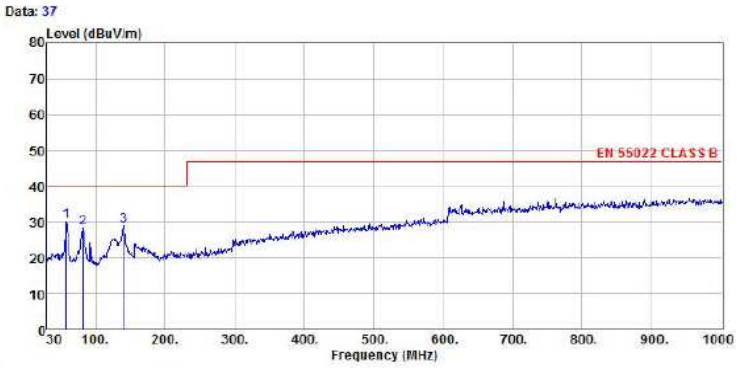
Vin=12V Io=3.4A Horizontal




```
Site          : chamber
Condition     : EN 55022 CLASS B 3m VULB9160 HORIZONTAL
EUT           :
Model Name    : 16
Temp/Humi     : 25℃ /  53  %
Power Rating: AC 230V/50Hz
Mode          :
Memo          :
```

	Freq	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark	Factor
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		dB/m
1	57.16	16.48	12.49	1.02	0.00	29.99	40.00	-10.01	Peak	13.51
2 pp	81.41	25.42	8.73	1.09	0.00	35.24	40.00	-4.76	Peak	9.82
3	126.03	16.20	12.39	1.55	0.00	30.14	40.00	-9.86	Peak	13.94
4	221.09	12.65	10.76	2.11	0.00	25.52	40.00	-14.48	Peak	12.87

Vin=12V Io=3.4A Vertical



Site : chamber
Condition : EN 55022 CLASS B 3m VULB9160 VERTICAL
EUT :
Model Name : 16
Temp/Humi : 25℃ / 53 %
Power Rating: AC 230V/50Hz
Mode :
Memo :

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark	Factor
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		dB/m
1 pp	57.16	16.72	12.49	1.02	0.00	30.23	40.00	-9.77	Peak	13.51
2	81.41	18.41	8.73	1.09	0.00	28.23	40.00	-11.77	Peak	9.82
3	140.58	13.90	13.47	1.62	0.00	28.99	40.00	-11.01	Peak	15.09