

Lifestyle with Energy Efficiency

Analog Power Management Product Selection Guide

ActivePSR™
ActiveQR™
ActivePMU™
ActivePath™
ActiveCC™

1Q 2014

ANALOG POWER SOLUTIONS FOR

Power Banks
Mobile Chargers
Car Chargers

Smartwatches
Tablet PCs & MIDs
Small Appliances

Power Adapters
POS & Barcode Scanners
Industrial & Medical Power

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High Power DC-DC Converter Products

DC-DC Product Selection Guide

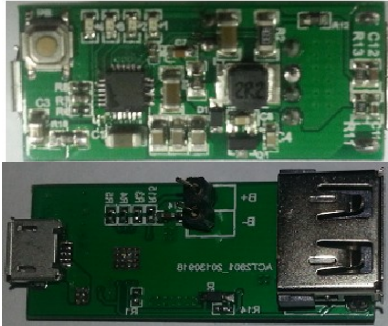
Applications

- *Car Chargers for Smart Phones, iPad / iPhone / iPod, PND , and tablet PCs*
- *Power bank Mobile Power*
- *LED Lighting*

Part Number	Topology	Input Voltage (V)	Output Current (A)	Feedback Voltage (V)	Switching Frequency	Package	Applications
ACT2801	Buck/Boost	4.5-5.5	1.5	N/A	2.2MHZ /1.1MHz	QFN24-44	Power bank, Mobile Power
ACT2802	Buck/Boost	4.5-5.5	2.5	N/A	1.1MHZ /0.55MHz	QFN24-44	Power bank, Mobile Power
ACT4501	Async Buck	10 to 30 (40V surge)	1.25	0.808	125KHz	SOP-8	5V/1A Car Charger
ACT4514	Async Buck	10 to 40	1.5	0.808	210kHz	SOP-8	5V/1-1.4A Car Charger
ACT4523	Async Buck	10 to 40	3	0.808	225kHz	SOP-8EP	5V/1.5-2.1A Car Charger
ACT4523A	Async Buck	10 to 36 (40V surge)	3.5	0.808	250KHz	SOP-8EP	5V/2.4A,5V/3.1A Car Charger
ACT4533A	Async Buck	10 to 36 (40V surge)	3.5	0.808	125KHz	SOP-8EP	5V/2.4A Car Charger
ACT4533B	Async Buck	10 to 36 (40V surge)	3.5	0.808	125KHz	SOP-8EP	5V/2.4A,5V/3.4A Car Charger
ACT4503	Async Buck	7.5 to 36 (40V surge)	3.5	0.800	200kHz	SOP-8EP	5V/2.1A+1.0A Car Charger
ACT4455	Async Buck	7.5 to 36 (40V surge)	5.0	0.800	200kHz	SOP-8EP	5V/2.1A+2.1A and 5V/2.1A+1.0A Dual-Output Car Charger
ACT4065A	Async Buck	6.0 to 30	2	0.808	210kHz	SOP-8	Networking
ACT4070B	Async Buck	6.5 to 30	3	0.808	300kHz	SOP-8EP	Networking
ACT4070C	Async Buck	6 to 40	3	0.808	300kHz	SOP-8EP	Networking
ACT4088	Async Buck	4.5 to 28	1.5	0.810	1.4MHz	SOT23-6	Networking
ACT111A	Async Buck	4.5 to 30	1.5	0.100	1.4MHZ	SOT23-6	LED Lighting, LED Display
ACT2102	Sync Buck	4.5 to 18	2	0.923	310kHz	SOP-8	ADSL, LCD-TV, Networking
ACT2103	Sync Buck	4.5 to 18	3	0.923	310kHz	SOP-8EP	ADSL, LCD-TV, Networking
ACT2113	Sync Buck	4.5 to 18	3	0.923	510kHz	SOP-8EP	ADSL, LCD-TV, Networking

ACT2801 5V/1A Smart Power Bank

Input Voltage	Output Voltage	Charge Current	Boost Output	Efficiency	Topology
4.5-5.5V	5.0V	1A	1.4A	95%@1.0A@V _{BAT} =4.2V	Buck/Boost



L=37.2mm
W=15.5mm

Design Features

- ◆ Dedicated Single Chip Solution for Mobile Power
- ◆ Programmable up to 5V/2.1A Input Current
- ◆ Programmable up to 5V/1.5A Output Current
- ◆ Programmable up to 1.5A Switching Charge Current
- ◆ Programmable 4.1V to 4.35V Battery Voltage
- ◆ Prioritized Power Path from Input to Output
- ◆ 2.2MHz/1.1MHz Switching Frequencies
- ◆ 4LEDs Battery Level and Status Indication
- ◆ <10μA Battery Low Battery Leakage Current
- ◆ No Load Shutdown and Push Button Turn-on
- ◆ Battery Impedance Compensation
- ◆ Battery Over Current, Over Voltage, Over Temperature and Short Circuit Protections
- ◆ Charge Current Foldback at 110°C Die Temperature
- ◆ IC Over Temperature Protection

Operation and Application

ACT2801 is a space-saving and high-performance low-profile single-chip solution for backup battery pack and standalone battery charger. ACT2801 integrates all the functions that backup battery packs need, including switching charger, Boost converter and LED indication.

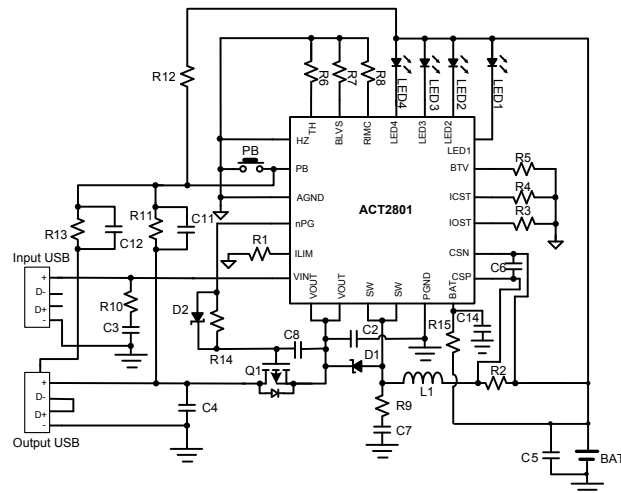
ACT2801 operates at 2.2MHz/1.1MHz for switching charger and 1.1MHz/0.55MHz for Boost converter allowing tiny external inductor and capacitors. ACT2801 provides a direct power path from input to output with programmable current limit while providing power to switching charger. Output has higher priority than battery charger if the programmed input current limit is reached.

ACT2801 charges battery with full cycle of preconditioning, fast charge with constant current and constant voltage until end of charge. The battery charger is thermally regulated at 110°C with charge current foldback.

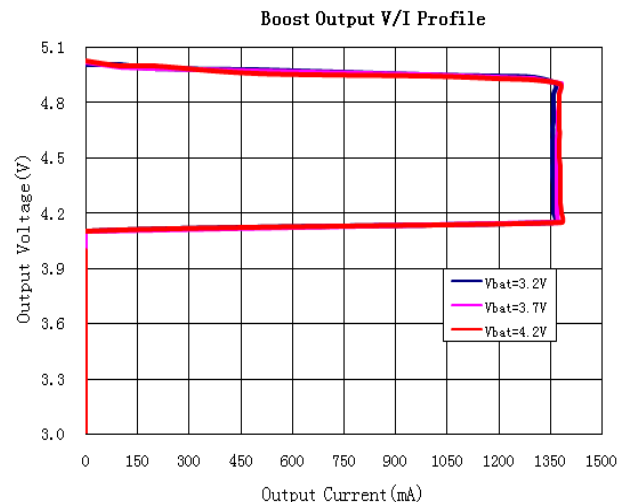
ACT2801 Boost converter steps battery voltage up to 5V. Boost converter features high efficiency, constant current regulation, short circuit protection and over voltage protection.

ACT2801 provides 3.5mA constant currents to drive 4 LEDs to indicate battery level and charging status. Battery impedance is compensated at battery level indication.

Schematic



Boost Output V/I Profile

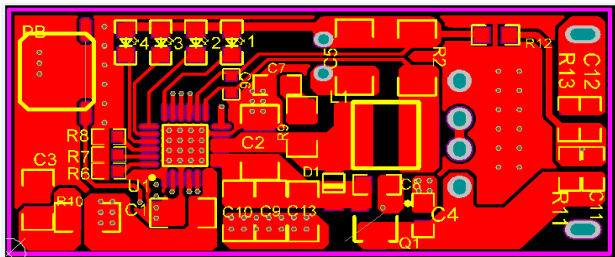


ACT2801 5V/1A Smart Power Bank

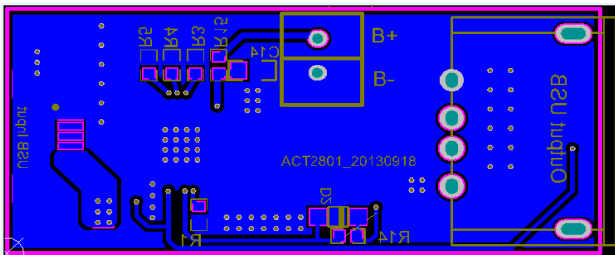
Bill of Materials

REF	Description	MFTR
L1	SWPA4020S1R0NT 2.2uH 3.4A (4*4*2mm)	Sunlord
Q1	SSC8013, R _{ds(on)} =38mΩ at V _{GS} = - 4.5 V	SPIRIT
D1	SS12, V _f =0.5V, 20V Schottky	Mccsemi
D2	1N4148, V _f =0.7V, 75V Schottky	Philips
C2, C5	Ceramic capacitor, 22uF/10V, X7R, 1206	Murata/TDK
C3	Ceramic capacitor, 4.7uF/10V, X7R, 0805	Murata/TDK
C4	Ceramic capacitor, 0.1uF/10V, X7R, 0603	Murata/TDK
C6	Ceramic capacitor, 10nF/10V, X7R, 0402	Murata/TDK
C7	Ceramic capacitor, 1nF/10V, X7R, 0603	Murata/TDK
C8	Ceramic capacitor, 1uF/10V, X7R, 0603	Murata/TDK
C11, C12, C14	Ceramic capacitor, 2.2uF/10V, X7R, 0603	Murata/TDK
R1	Chip Resistor, 1.5kΩ, 1/16W, 1%, 0402	Murata/TDK
R2	Chip Resistor, 50mΩ, 1/8W, 1%, 1206	Murata/TDK
R3	Chip Resistor, 100kΩ, 1/16W, 1%, 0402	Murata/TDK
R4	Chip Resistor, 39kΩ, 1/16W, 1%, 0402	Murata/TDK
R5	Chip Resistor, 25kΩ, 1/16W, 1%, 0402	Murata/TDK
R6	Chip Resistor, 10kΩ, 1/16W, 1%, 0402	Murata/TDK
R7	Chip Resistor, 60kΩ, 1/16W, 1%, 0402	Murata/TDK
R8	Chip Resistor, 50kΩ, 1/16W, 1%, 0402	Murata/TDK
R9	Chip Resistor, 1Ω, 1/10W, 5%, 0805	Murata/TDK
R10	Chip Resistor, 2.7Ω, 1/8W, 5%, 1206	Murata/TDK
R11	Chip Resistor, 200kΩ, 1/16W, 5%, 0603	Murata/TDK
R12, R13	Chip Resistor, 715kΩ, 1/16W, 5%, 0603	Murata/TDK
R14	Chip Resistor, 100kΩ, 1/16W, 5%, 0603	Murata/TDK
R15	Chip Resistor, 2.2Ω, 1/16W, 5%, 0603	Murata/TDK
LED1, LED2, LED3, LED4	LED, 0603, Blue	LED Manu
USB	10.2*14.6*7mm, 4P	
PB	Push Button	
Micro-USB	MICRO USB 5P/F SMT B	
U1	IC, ACT2801 T-QFN 44-24	ACT

PCB Top Layer



PCB Bottom Layer

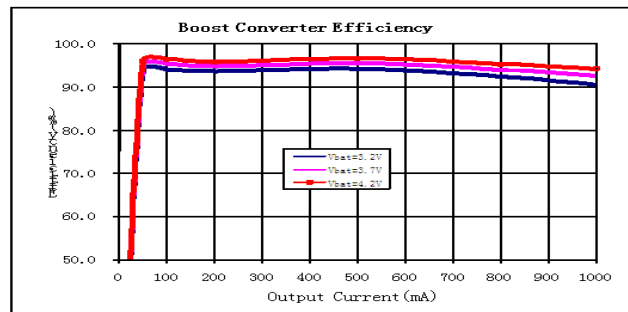


PC Board Layout Guidance

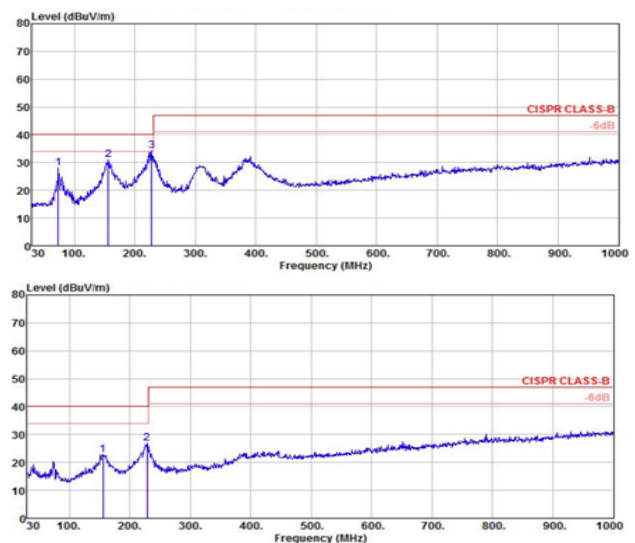
1) Arrange the power components to reduce the AC loop size that consists of C2, VOUT, SW and PGND. C2 (1206 size) must be placed close to the IC and across the VOUT and PGND traces and SW trace goes under the C2 .

- 2) Use copper plane for PGND for best heat dissipation and noise immunity. AGND and PGND are connected under the IC thermal pad with 4x4 vias matrix.
- 3) SW copper area should be limited due to EMI consideration.
- 4) Use Kevin sense from sense resistor R2 to CSP and CSN pins as shown in the layout figure.
- 5) A separate trace is from VBAT input to BAT pin for battery voltage sense accuracy.
- 6) RC snubber is recommended to add across SW to PGND to reduce EMI noise.
- 7) A 10V/1A schottky is added from inductor terminal to VOUT to reduce EMI noise.

Typical performance characteristics



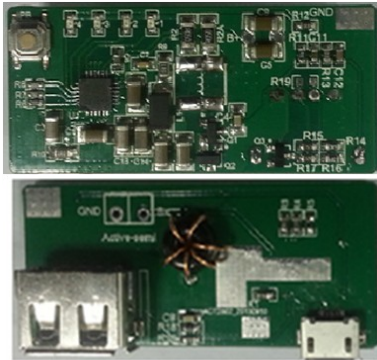
Radiated EMI Test



EVALUATION KITS	V _{BAT}	V _O	I _O
Power Bank ACT2801-DMB-#1	3.0V-4.5V	5V+/-100mV	1000mA

ACT2802 5V/2.1A Smart Power Bank

Input Voltage	Output Voltage	Charge Current	Boost Output	Efficiency	Topology
4.5-5.5V	5.0V	2A	2.5A	92%@2.1A@V _{BAT} =4.1V	Buck/Boost



L=46.4mm
W=21.2mm

Design Features

- ◆ Dedicated Single Chip Solution for Mobile Power
- ◆ Programmable up to 5V/3.0A Input Current
- ◆ Programmable up to 5V/2.1A Output Current
- ◆ Programmable up to 3.0A Switching Charge Current
- ◆ Programmable 4.1V to 4.35V Battery Voltage
- ◆ Prioritized Power Path from Input to Output
- ◆ 1.1MHz/0.55MHz Switching Frequencies
- ◆ 4LEDs Battery Level and Status Indication
- ◆ <10μA Low Battery Leakage Current
- ◆ No Load Shutdown and Push Button Turn-on
- ◆ Battery Impedance Compensation
- ◆ Battery Over Current, Over Voltage, Over Temperature and Short Circuit Protections
- ◆ Charge Current Foldback at 110°C Die Temperature
- ◆ IC Over Temperature Protection

Operation and Application

ACT2802 is a space-saving and high-performance low-profile single-chip solution for backup battery pack and standalone battery charger. ACT2802 integrates all the functions that backup battery packs need, including switching charger, Boost converter and LED indication.

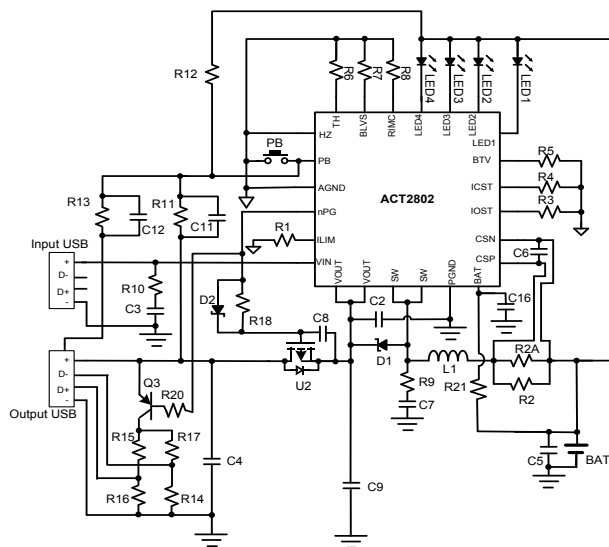
ACT2802 operates at 1.1MHz for switching charger and 0.55MHz for Boost converter allowing tiny external inductor and capacitors. ACT2802 provides a direct power path from input to output with programmable current limit while providing power to switching charger. Output has higher priority than battery charger if the programmed input current limit is reached.

ACT2802 charges battery with full cycle of preconditioning, fast charge with constant current and constant voltage until end of charge. The battery charger is thermally regulated at 110°C with charge current foldback.

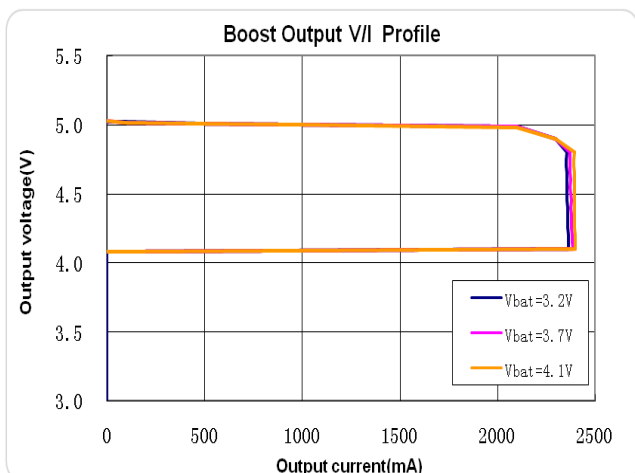
ACT2802 Boost converter steps battery voltage up to 5V. Boost converter features high efficiency, constant current regulation, short circuit protection and over voltage protection.

ACT2802 provides 3.5mA constant currents to drive 4 LEDs to indicate battery level and charging status. Battery impedance is compensated at battery level indication.

Schematic



Boost Output V/I Profile

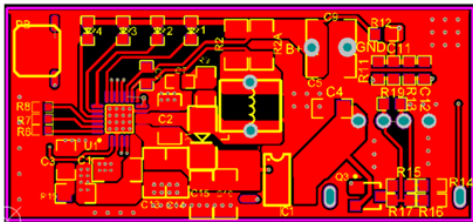


ACT2802 5V/2.1A Smart Power Bank

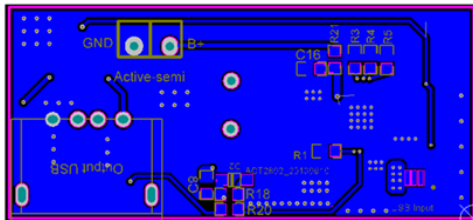
Bill of Materials

REF	Description	MFTR
L1	2.2uH 6*3*3 coil Ø0.55mm 6A	Sunlord
U2	AO4453,Rdson=19mΩ at GS=-4.5V	AOS
Q3	MMBT3906	Vishay
D1	SS12,Vf=0.5V, 20V Schottky	Mccsemi
D2	IN4148, Vf=0.7V, 75V Fast Swith Diode	Philips
C2,C5,C9	Ceramic capacitor, 22uF/10V, X7R, 1206	Murata/TDK
C3	Ceramic capacitor, 4.7uF/10V, X7R, 0805	Murata/TDK
C4	Ceramic capacitor, 0.1uF/10V, X7R, 0603	Murata/TDK
C6	Ceramic capacitor, 10nF/10V, X7R, 0603	Murata/TDK
C7	Ceramic capacitor, 2.2nF/10V, X7R, 0603	Murata/TDK
C8,C11,C12, C16	Ceramic capacitor, 2.2uF/10V, X7R, 0603	Murata/TDK
R1	Chip Resistor, 750Ω, 1/16W, 1%, 0603	Murata/TDK
R2,R2A	Chip Resistor, 50mΩ, 1/8W, 1%, 1206	Murata/TDK
R3	Chip Resistor, 93.1kΩ, 1/16W, 1%, 0603	Murata/TDK
R4,R15	Chip Resistor, 43.2kΩ, 1/16W, 1%, 0603	Murata/TDK
R5	Chip Resistor, 25kΩ, 1/16W, 1%, 0603	Murata/TDK
R6	Chip Resistor, 10kΩ, 1/16W, 5%, 0603	Murata/TDK
R7	Chip Resistor, 60kΩ, 1/16W, 1%, 0603	Murata/TDK
R8	Chip Resistor, 100kΩ, 1/16W, 1%, 0603	Murata/TDK
R9	Chip Resistor, 1Ω, 1/10W, 5%, 0805	Murata/TDK
R10	Chip Resistor, 2.7Ω, 1/8W, 5%, 1206	Murata/TDK
R11	Chip Resistor, 200kΩ, 1/16W, 5%, 0603	Murata/TDK
R12,R13	Chip Resistor, 715kΩ, 1/16W, 5%, 0603	Murata/TDK
R14,R16	Chip Resistor, 49.9kΩ, 1/16W, 1%, 0603	Murata/TDK
R17	Chip Resistor, 75kΩ, 1/16W, 1%, 0603	Murata/TDK
R18,R20	Chip Resistor, 100kΩ, 1/16W, 5%, 0603	Murata/TDK
R21	Chip Resistor, 2.2Ω, 1/16W, 5%, 0603	Murata/TDK
LED1,LED2,LED3,LED4	LED, 0603, Blue	
PB	Push Button	
USB	10.2*14.6*7mm, 4P, DIP, 90°	
Micro-USB	MICRO USB 5P/F SMT B	
U1	IC, ACT2802 T-QFN 44-24	ACT

PCB Top Layer



PCB Bottom Layer



PC Board Layout Guidance

1) Arrange the power components to reduce the AC loop size that consists of C2, VOUT, SW and PGND. C2 (1206 size) must be placed close to the IC and across the VOUT and PGND traces and SW trace goes under the C2 .

2) Use copper plane for PGND for best heat dissipation and noise immunity. AGND and PGND are connected under the IC thermal pad with 4x4 vias matrix.

3) SW copper area should be limited due to EMI consideration.

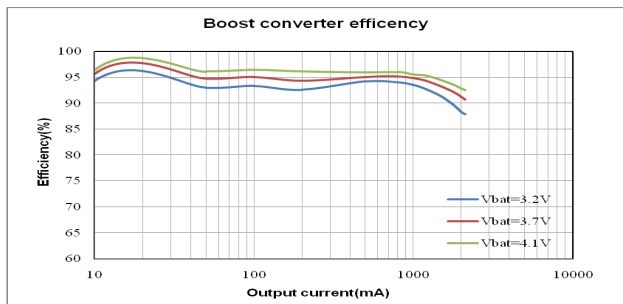
4) Use Kevin sense from sense resistor R2A and R2B to CSP and CSN pins as shown in the layout figure.

5) A separate trace is from VBAT input to BAT pin for battery voltage sense accuracy.

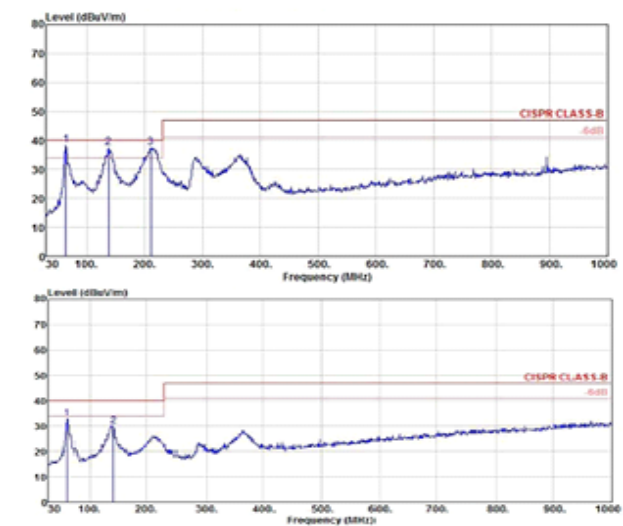
6) RC snubber is recommended to add across SW to PGND to reduce EMI noise.

7) A 20V/3.0A schottky is added from inductor terminal to VOUT to reduce EMI noise.

Typical performance characteristics



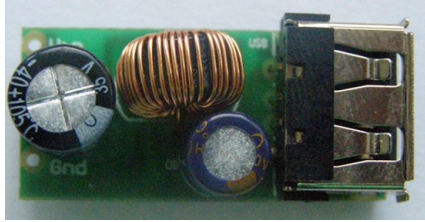
Radiated EMI Test



EVALUATION KITS	V _{BAT}	V _O	I _O
Power Bank ACT2802-DMB-#1	3.0V-4.5V	5V+/-100mV	2100mA

ACT4501 5V/1.0A Smart Phone Car Charger

Input Voltage	Device	Standby Power	Output	Efficiency	Topology
10-28V	ACT4501	60mW@12Vin	5V@1.0A	88%@1A , Vin=12V	Buck



L=30.5mm
W=14.5mm
H=12.8mm

ACT4501 provides constant current (CC) output with patented Active-CC control technology that eliminate external sense resistors and the related efficiency loss.

The ACT4501 operates at constant output voltage mode until it reaches the CC limit set by the ISET resistor. The devices are available in a SOP-8 package.

Design Features

- ◆ Wide input voltage range from 10V to 30V
- ◆ Transparent input voltage surge 12V-40V-12V
- ◆ 0.5A-1.25A output current limit
- ◆ 4.75V-5.25V during input and load transients
- ◆ 5% output voltage accuracy
- ◆ 125kHz switching frequency
- ◆ 88% efficiency at 12V input
- ◆ Least external components
- ◆ Low-cost single layer PCB with very good EMC performance

Operation and Application

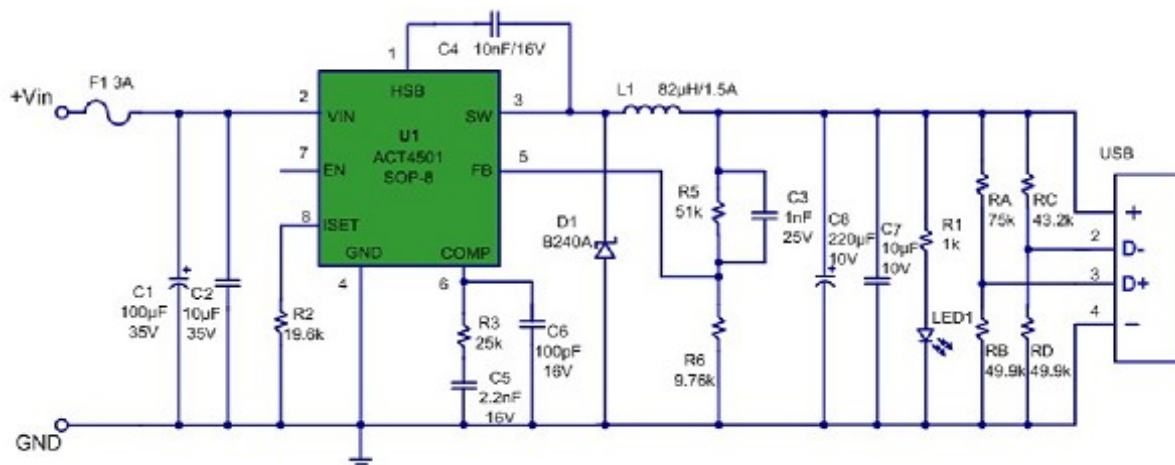
ACT4501 is a step-down DC-DC converter with wide input voltage range and high efficiency dedicated to 5V/1A smart phone micro car chargers. The ACT4501 is internally optimized for good EMC performance and it passed radiated EMI test even on low-cost single layer PCBs without adding any EMC components.

Key Component Selection

Higher output inductance reduces the inductor peak-to-peak current at the expense of higher larger core size and inductance DCR value. Usually, an optimum inductance value is selected to make its peak-to-peak current 20%-40% of the maximum load current. The Schottky diode must have current rating higher than the maximum output current and the reverse voltage rating higher than the maximum input voltage. Output capacitor is selected to keep the peak-to-peak voltage ripple under required value and also meet the load transient requirements. Usually, the combination of low ESR capacitors and tantalum or electrolytic types are used. In this application, 220uF electrolytic capacitor is connected in parallel with a small 2.2uF ceramic capacitor to achieve small output voltage ripple and meet the requirements of input and load dynamic response.

Figure 1:

Schematic of Charger

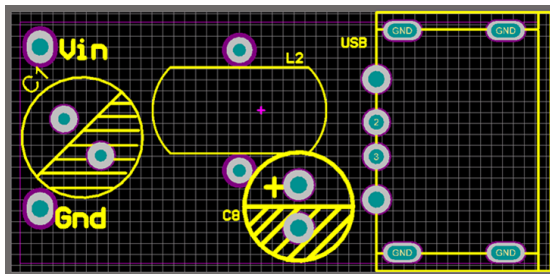


ACT4501 5V/1.0A Smart Phone Car Charger

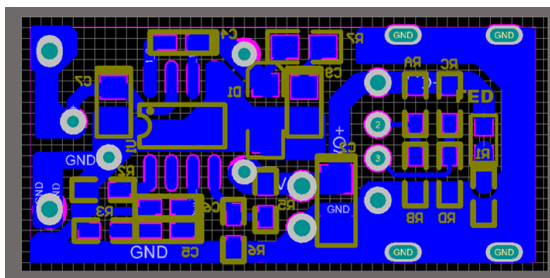
Bill of Materials

REF	DESCRIPTION	MFTR
L1	Choke Coil, ring core:8*4*5mm, Pi=0.35mm, L=82uH, dip	Haining Electronic-Magnetics
D1	Schottky Diode, B240A, 2A/40V, SMA	Diodes
C1	Capacitor,Electrolytic, 100uF/35V, Φ7x8mm, Dip	KSC
C2	Ceramic capacitor, 10uF/35V, X7R, 0805	Murata/TDK
C3	Ceramic capacitor, 1nF/25V, X7R, 0603	Murata/TDK
C4	Ceramic capacitor, 10nF/16V, X7R, 0603	Murata/TDK
C5	Ceramic capacitor, 2.2nF/16V, X7R, 0603	Murata/TDK
C6	Ceramic capacitor, 100pF/16V, X7R, 0603	Murata/TDK
C7	Ceramic capacitor, 10uF/10V, X7R, 0805	Murata/TDK
C8	Ceramic Electrolytic, 220uF/10V, Φ6.3x7mm, Dip	Murata/TDK
R1	Chip Resistor, 1KΩ, 1/10W, 5%, 0603	Murata/TDK
R2	Chip Resistor, 19.6KΩ, 1/10W, 1%, 0603	Murata/TDK
R3	Chip Resistor, 25KΩ, 1/10W, 1%, 0603	Murata/TDK
R5	Chip Resistor, 51KΩ, 1/10W, 1%, 0603	Murata/TDK
R6	Chip Resistor, 9.76KΩ, 1/10W, 5%, 0603	Murata/TDK
RA	Chip Resistor, 75KΩ, 1/10W, 1%, 0603	Murata/TDK
RB/RD	Chip Resistor, 49.9KΩ, 1/10W, 1%, 0603	Murata/TDK
RC	Chip Resistor, 43.2KΩ, 1/10W, 1%, 0603	Murata/TDK
U1	IC, ACT4501, SOP-8	Active semi
USB	15mm*10mm*8mm	USB Manu

PCB Top Layer



PCB Bottom Layer

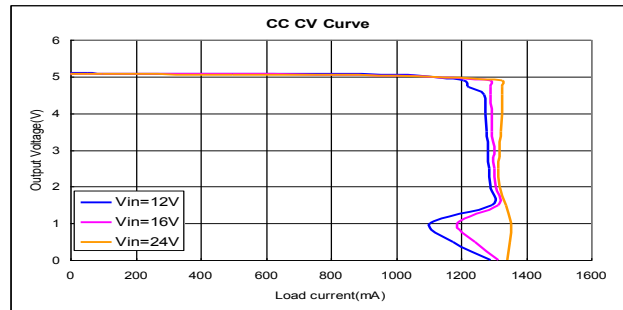
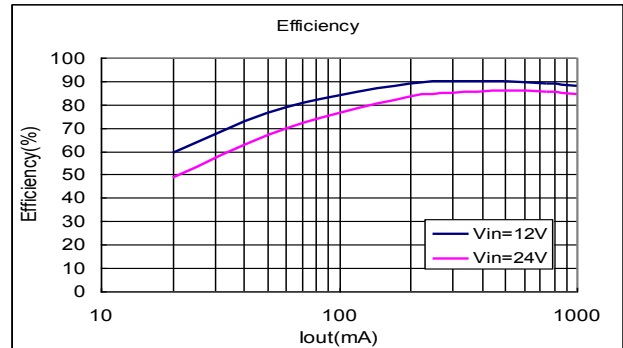


PC Board Layout Guidance

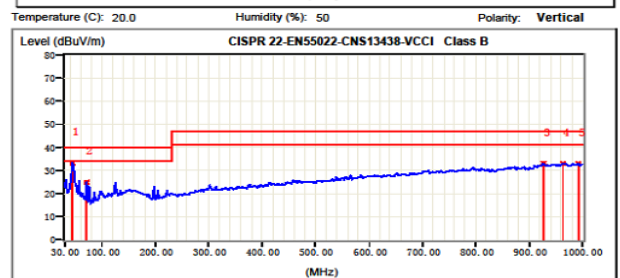
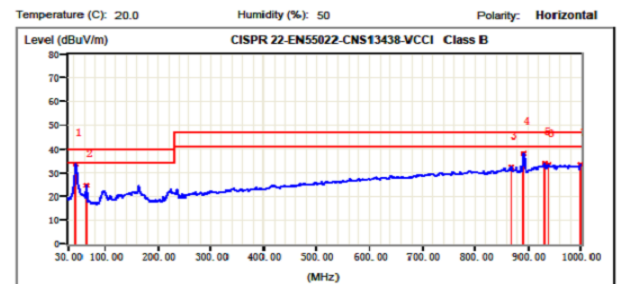
- 1) Arrange the power components to reduce the AC loop size that consists of CIN, IN pin, SW pin the Schottky diode.
- 2) Place input decoupling ceramic capacitor CIN as close to IN pin as possible. CIN is connected power GND with vias or short and wide path.

- 3) Place feedback resistor close to FB pin.
- 4) Use short trace connecting HSB-C4-SW loop.
- 5) SW pad is a noisy node switching from Vin to GND. It should be isolated away from the rest of circuit for good EMI and low noise operation.

Typical performance characteristics



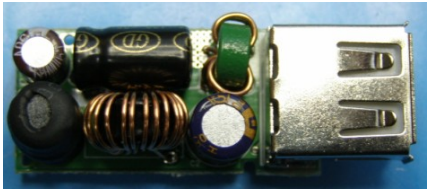
Radiated EMI Test



EVALUATION KITS	Vin	Vo	Io
Car Charger ACT4501-DMB-#1	10-28V	4.75-5.25V	1000mA

ACT4523 5V/2.1A iPad Car Charger

Input Voltage	Device	Standby Power	Output	Efficiency	Topology
10-32V	ACT4523	39mW@12Vin	5V@2.1A	87%@2.1A Vin=12V	Buck



L=39.8mm
W=14.9mm
H=12.6mm

Design Features

- ◆ Wide input voltage range from 10V to 38V
- ◆ Transparent input voltage surge 12V-40V-12V
- ◆ 4.75V-5.25V during input and load transients
- ◆ 5% output voltage accuracy
- ◆ 225kHz switching frequency
- ◆ Standby input current 3.0mA
- ◆ 2.35 accurate current limit
- ◆ Shut down at output short circuit
- ◆ Thermal shutdown protection
- ◆ Output cord compensation
- ◆ Over current protection
- ◆ Meet the EN55022 EMC standard

Operation and Application

ACT4523 is a wide input voltage, high efficiency Active CC step-down DC-DC converter that operates in either CV (Constant Output Voltage) mode or CC (Constant Output Current) mode. ACT4523 provides up to 3.0A output current at 225kHz switching frequency. Active CC is a patent-pending control scheme to

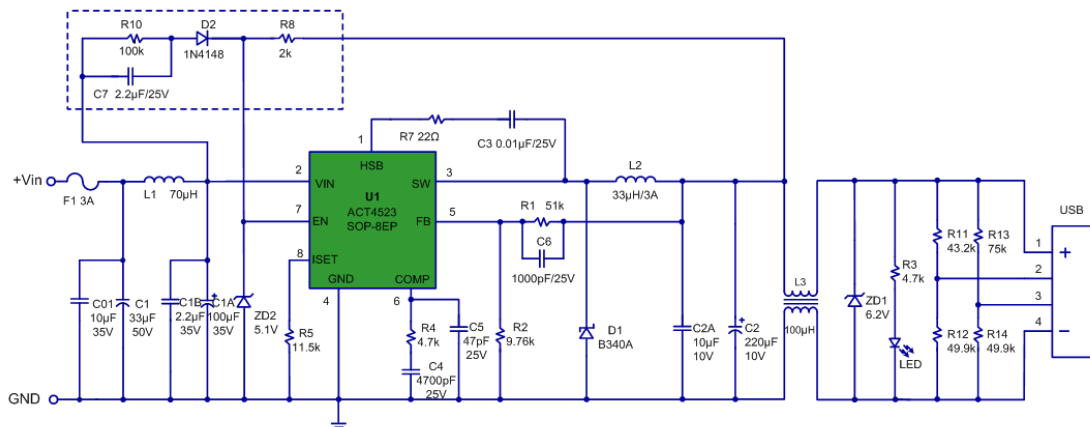
provide CC function accuracy by senseless constant current control, which eliminates the expensive, high accuracy current sense resistor, making it ideal for battery charging applications. The ACT4523 operates at constant output voltage mode until it reaches the CC limit set by the ISET resistor. The devices are available in a SOP8-EP package.

Key Component Selection

Higher output inductance reduces the inductor peak-to-peak current at the expense of higher larger core size and inductance DCR value. Usually, an optimum inductance value is selected to make its peak-to-peak current 20%-40% of the maximum load current. The Schottky diode must have current rating higher than the maximum output current and the reverse voltage rating higher than the maximum input voltage. Output capacitor is selected to keep the peak-to-peak voltage ripple under required value and also meet the load transient requirements. For this application, 22uF ceramic capacitors are needed. In the case of tantalum or electrolytic types, 220uF capacitor is connected in parallel with a small 1uF-10uF ceramic capacitor to achieve small output voltage ripple and meet the requirements of input and load dynamic response.

Figure 1:

Schematic of Charger

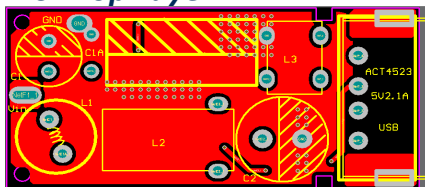


ACT4523 5V/2.1A iPad Car Charger

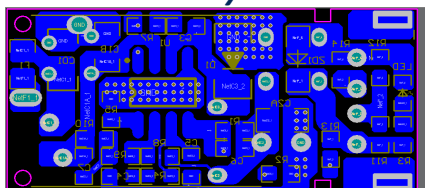
Bill of Materials

REF	DESCRIPTION	MFTR
L1	Choke Coil,Dip, 6*8mm, phi=0.35mm, L=70-75uH	ACT
L2	Choke Coil,Dip,T8*5*4mm, phi=0.45mm, L=33uH	ACT
L3	Common Mode Choke ,Dip,T6*3*3mm, phi=0.45mm, L=100uH	ACT
D1	Schottky Diode, B340A,40V/3A, SMA	Diodes
D2	Switch Diode,1N4148WS, 0.2W, SOD323	Diodes
ZD1	Zener Diode,GMZ16.2A,6.2V,0.5W,Mini-Melf (open)	Panjit
ZD2	Zener Diode,BZT52C5V15, 5.1V, 0.2W, SOD323	Diodes
C1A	Electrolytic capacitor,100uF/35V,6.3x11.5mm	Koshin
C1B	Ceramic capacitor,2.2uF/50V,0805	Murata/TDK
C1	Electrolytic capacitor,33uF/50V,5x7mm	Koshin
C2	Electrolytic capacitor,220uF/10V,6.3x7mm	Koshin
C2A	Ceramic capacitor, 10uF/10V, X7R,0805	Murata/TDK
C01	Ceramic capacitor, 10uF/35V, X7R,1206	Murata/TDK
C3	Ceramic capacitor, 0.01uF/25V, X7R,0603	Murata/TDK
C4	Ceramic capacitor,4700pF/10V, X7R, 0603	Murata/TDK
C5	Ceramic capacitor, 47pF/25V, X7R, 0603	Murata/TDK
C6	Ceramic capacitor, 1000pF/25V, X7R, 0603	Murata/TDK
C7	Ceramic capacitor, 2.2uF/25V, X5R, 0603	Murata/TDK
F1	Fuse,3A,1206 (Replaced by 0Q 1206 chip resistor)	Murata/TDK
R1	Chip Resistor, 51KΩ, 1/16W, 1%, 0603	Murata/TDK
R2	Chip Resistor, 9.76KΩ, 1/16W, 1%, 0603	Murata/TDK
R3,R4	Chip Resistor, 4.7KΩ, 1/16W, 5%, 0603	Murata/TDK
R5	Chip Resistor, 11.5KΩ, 1/16W, 1%, 0603	Murata/TDK
R7	Chip Resistor, 22Ω, 1/16W, 1%, 0603	Murata/TDK
R8	Chip Resistor, 3KΩ, 1/16W, 5%,0603	Murata/TDK
R10	Chip Resistor, 100KΩ, 1/16W ,5%,0603	Murata/TDK
R11	Chip Resistor, 75KΩ, 1/16W ,5%,0603	Murata/TDK
R13	Chip Resistor, 43.2KΩ, 1/16W ,5%,0603	Murata/TDK
R12,R14	Chip Resistor, 49.9KΩ, 1/16W ,5%,0603	Murata/TDK
U1	IC, ACT4523,SOP-8-EP	ACT
USB	USB Rev:A	
LED	LED ,White,Dip	

PCB Top Layer



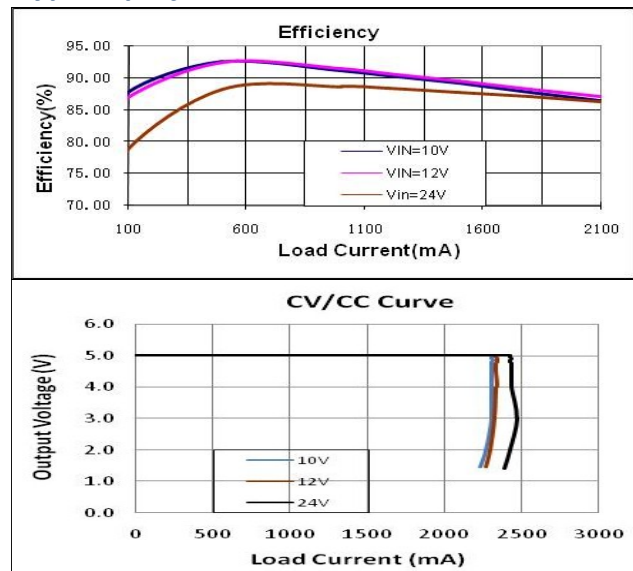
PCB Bottom Layer



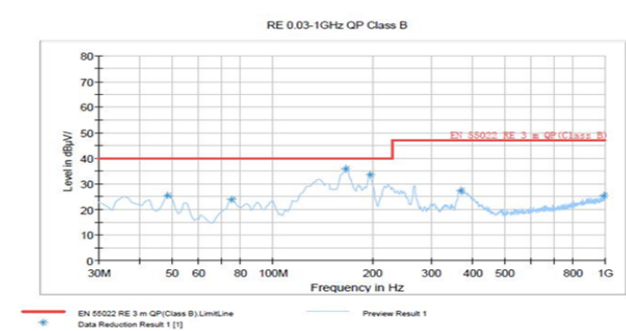
PC Board Layout Guidance

- 1) Arrange the power components to reduce the AC loop size that consists of CIN, IN pin, SW pin the Schottky diode.
- 2) Place input decoupling ceramic capacitor CIN as close to IN pin as possible. CIN is connected power GND with vias or short and wide path.
- 3) Use copper plane for power GND for best heat dissipation and noise immunity.
- 4) Place feedback resistor close to FB pin.
- 5) Use short trace connecting HSB-C3-R7-SW loop. Thermal pad is connected to a large ground copper area.
- 6) SW pad is a noisy node switching from Vin to GND. It should be isolated away from the rest of circuit for good EMI and low noise operation.

Typical performance characteristics



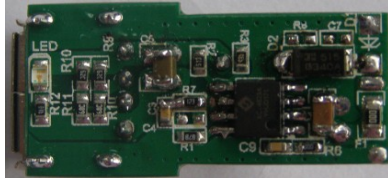
Radiated EMI Test



EVALUATION KITS	Vin	Vo	Io
Car Charger ACT4523-DMB-#2	10-32V	4.75-5.25V	2100mA

ACT4523A 5V/2.4A iPad Car Charger

Input Voltage	Device	Standby Power	Output	Efficiency	Topology
10-36V	ACT4523A	110mW@12Vin	5V@2.4A	89.7%@2.4A Vin=12V	Buck



L=32mm
W=16.2mm
H=14.6mm

Design Features

- ◆ Wide input voltage range from 10V to 36V
- ◆ Transparent input voltage surge 12V-40V-12V
- ◆ 4.75V-5.25V during input and load transients
- ◆ 5% output voltage accuracy
- ◆ 250kHz switching frequency
- ◆ Standby input current 5mA
- ◆ 2.4-2.9A accurate current limit
- ◆ Thermal shutdown protection
- ◆ Output cord compensation
- ◆ Over current protection
- ◆ Output over voltage protection

Operation and Application

ACT4523A is a wide input voltage, high efficiency Active CC step-down DC/DC converter that operates in either CV (Constant Output Voltage) mode or CC (Constant Output Current) mode. ACT4523A provides up to 3.5A output current at 250kHz switching frequency. Active CC is a

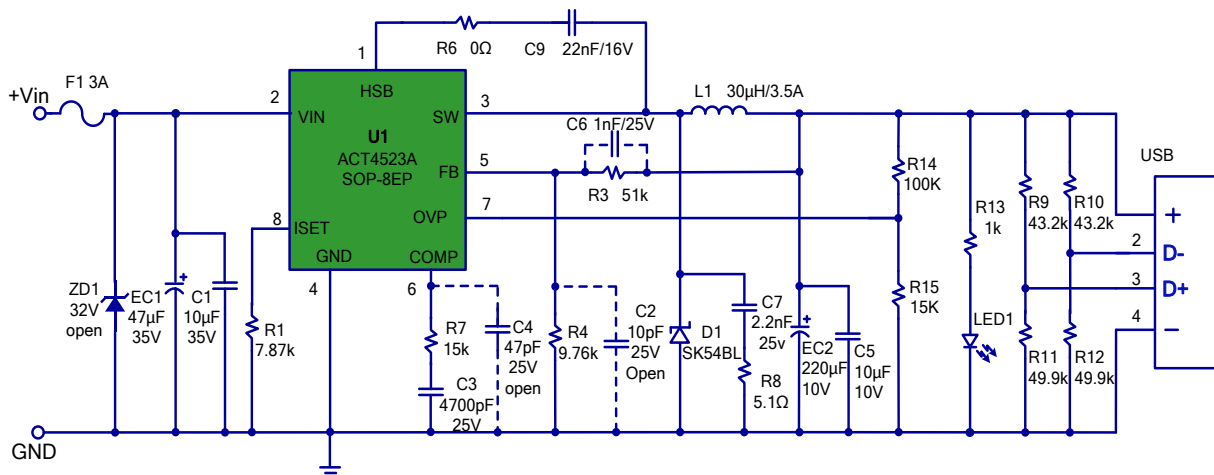
patent-pending control scheme to provide CC function accuracy by senseless constant current control, which eliminates the expensive, high accuracy current sense resistor, making it ideal for battery charging applications. charging applications. The ACT4523A operates at constant output voltage mode until it reaches the CC limit set by the ISET resistor. The devices are available in a SOP8-EP package.

Key Component Selection

Higher output inductance reduces the inductor peak-to-peak current at the expense of higher larger core size and inductance DCR value. Usually, an optimum inductance value is selected to make its peak-to-peak current 20%-40% of the maximum load current. The Schottky diode must have current rating higher than the maximum output current and the reverse voltage rating higher than the maximum input voltage. Output capacitor is selected to keep the peak-to-peak voltage ripple under required value and also meet the load transient requirements. For this application, 22uFx2 ceramic capacitors are needed. In the case of tantalum or electrolytic types, 220uF capacitor is connected in parallel with a small 1uF-10uF ceramic capacitor to achieve small output voltage ripple and meet the requirements of input and load dynamic response.

Figure 1:

Schematic of Charger

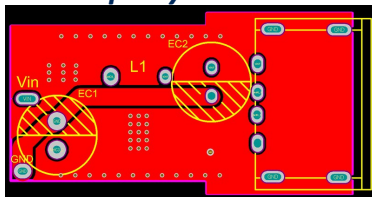


ACT4523A 5V/2.4A iPad Car Charger

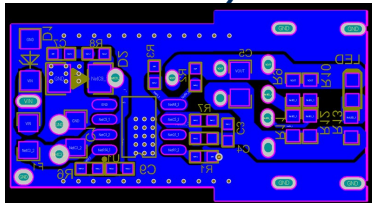
Bill of Materials

REF	DESCRIPTION	MFTR
L1	Choke Coil, Dip, ring core 10*5*4mm, phi=0.45mm, L=30uH	ACT
D1	Schottky Diode, SK54BL, 40V/5A, SMA	Diodes
F1	3A Fuse(Replace by Resistor, 0Ω, 1/8W, 5%, 0805)	
ZD1	32V Zener Diode, Optional	Diodes
EC1	Electrolytic capacitor, 47uF/35V, 5x7mm	Koshin
EC2	Electrolytic capacitor, 220uF/10V, 5x7mm	Koshin
C1	Ceramic capacitor, 10uF/35V, X7R, 1206	Murata/TDK
C2	Ceramic capacitor, 10pF/25V, 6.3x7mm, Optional	Murata/TDK
C3	Ceramic capacitor, 4.7nF/25V, X7R, 0603	Murata/TDK
C4	Ceramic capacitor, 47pF/25V, X7R, 0603, Optional	Murata/TDK
C5	Ceramic capacitor, 10uF/10V, X7R, 0805	Murata/TDK
C6	Ceramic capacitor, 1nF/25V, X7R, 0603, Optional	Murata/TDK
C7	Ceramic capacitor, 2.2nF/25V, X7R, 0603	Murata/TDK
C9	Ceramic capacitor, 22nF/16V, X7R, 0603	Murata/TDK
R1	Chip Resistor, 7.87KΩ, 1/10W, 1%, 0603	Murata/TDK
R3	Chip Resistor, 51KΩ, 1/10W, 1%, 0603	Murata/TDK
R4	Chip Resistor, 9.76KΩ, 1/10W, 1%, 0603	Murata/TDK
R6	Chip Resistor, 0Ω, 1/10W, 5%, 0603	Murata/TDK
R7	Chip Resistor, 15KΩ, 1/10W, 5%, 0603	Murata/TDK
R8	Chip Resistor, 5.1Ω, 1/10W, 5%, 0603, Optional	Murata/TDK
R9, R10	Chip Resistor, 43.2KΩ, 1/10W, 1%, 0603	Murata/TDK
R11, R12	Chip Resistor, 49.9KΩ, 1/10W, 1%, 0603	Murata/TDK
R13	Chip Resistor, 1KΩ, 1/10W, 5%, 0603	Murata/TDK
R14	Chip Resistor, 100KΩ, 1/10W, 1%, 0603	Murata/TDK
R15	Chip Resistor, 15KΩ, 1/10W, 1%, 0603	Murata/TDK
U1	IC, ACT4523A, SOP-8-EP	ACT
USB	USB Rev:A	
LED	LED, White, 0805	

PCB Top Layer



PCB Bottom Layer



PC Board Layout Guidance

1) Arrange the power components to reduce the AC loop size that consists of CIN, IN pin, SW pin the Schottky diode.

2) Place input decoupling ceramic capacitor C1 as close to IN pin as possible. C1 is connected power GND with vias or short and wide path.

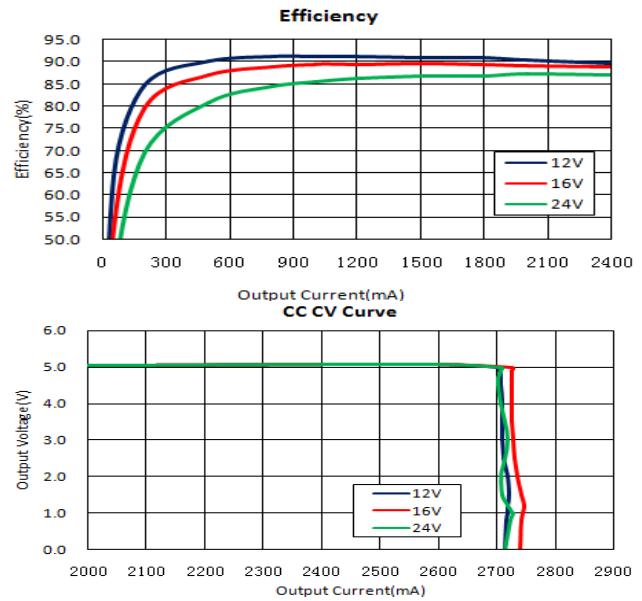
3) Use copper plane for power GND for best heat dissipation and noise immunity.

4) Place feedback resistor close to FB pin.

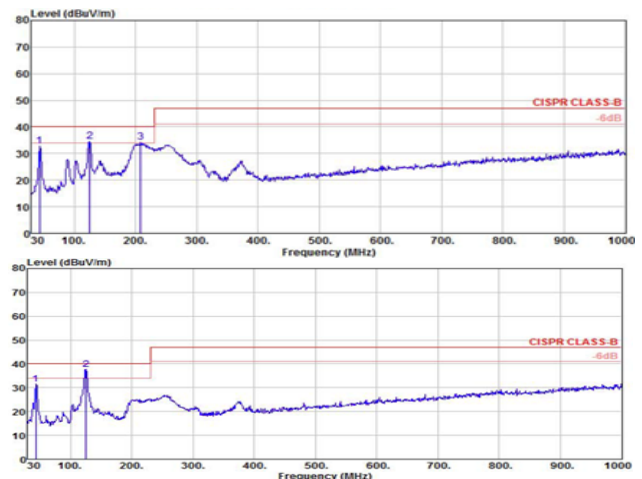
5) Use short trace connecting HSB-R6-C9-SW loop. Thermal pad is connected to a large ground copper area.

6) SW pad is a noisy node switching from Vin to GND. It should be isolated away from the rest of circuit for good EMI and low noise operation.

Typical performance characteristics



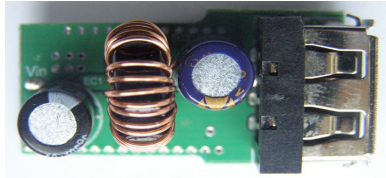
Radiated EMI Test



EVALUATION KITS	Vin	Vo	Io
Car Charger ACT4523A-DMB-#1	10-36V	4.75-5.25V	2400mA

ACT4533A 5V/2.4A iPad Car Charger

Input Voltage	Device	Standby Power	Output	Efficiency	Topology
10-36V	ACT4533A	60mW@12Vin	5V@2.4A	89.3%@2.4A Vin=12V	Buck



L=32mm
W=16.2mm
H=14.6mm

Design Features

- ◆ Wide input voltage range from 10V to 36V
- ◆ Transparent input voltage surge 12V-40V-12V
- ◆ 4.75V-5.25V during input and load transients
- ◆ 5% output voltage accuracy
- ◆ 125kHz switching frequency
- ◆ Standby input current 5.5mA
- ◆ 2.4-2.9A accurate current limit
- ◆ Thermal shutdown protection
- ◆ Output cord compensation
- ◆ Over current protection
- ◆ Output over voltage protection
- ◆ **Pass EN55022 Radiation EMI Standard without adding EMI Components**

Operation and Application

ACT4533A is a wide input voltage, high efficiency Active CC step-down DC/DC converter that operates in either CV (Constant Output Voltage) mode or CC (Constant Output Current) mode. ACT4533A provides up to 3.5A output current at 125kHz switching frequency. Active CC is a

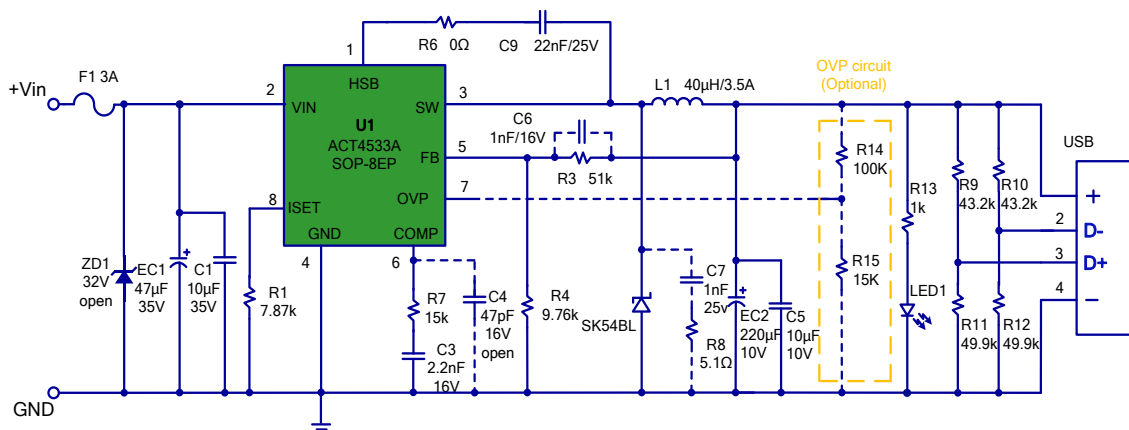
patent-pending control scheme to provide CC function accuracy by senseless constant current control, which eliminates the expensive, high accuracy current sense resistor, making it ideal for battery charging applications. The ACT4533A operates at constant output voltage mode until it reaches the CC limit set by the ISET resistor. The devices are available in a SOP8-EP package.

Key Component Selection

Higher output inductance reduces the inductor peak-to-peak current at the expense of higher larger core size and inductance DCR value. Usually, an optimum inductance value is selected to make its peak-to-peak current 20%-40% of the maximum load current. The Schottky diode must have current rating higher than the maximum output current and the reverse voltage rating higher than the maximum input voltage. Output capacitor is selected to keep the peak-to-peak voltage ripple under required value and also meet the load transient requirements. For this application, 22uF_{x2} ceramic capacitors are needed. In the case of tantalum or electrolytic types, 220uF capacitor is connected in parallel with a small 1uF-10uF ceramic capacitor to achieve small output voltage ripple and meet the requirements of input and load dynamic response.

Figure 1:

Schematic of Charger

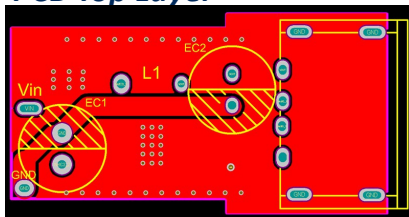


ACT4533A 5V/2.4A iPad Car Charger

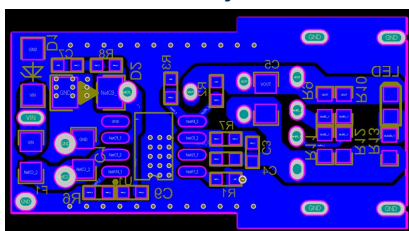
Bill of Materials

REF	DESCRIPTION	MFTR
L1	Choke Coil, Dip, ring core 9*5*4mm, phi=0.55mm, L=40uH	ACT
D1	Schottky Diode, SK54BL, 40V/5A, SMA	Diodes
F1	3A Fuse(Replace by Resistor, 0Ω, 1/8W, 5%, 0805)	
ZD1	32V Zener Diode, Optional	Diodes
EC1	Electrolytic capacitor, 47uF/35V, 5x7mm	Koshin
EC2	Electrolytic capacitor, 220uF/10V, 5x7mm	Koshin
C1	Ceramic capacitor, 10uF/35V, X7R, 1206	Murata/TDK
C3	Ceramic capacitor, 2.2nF/16V, X7R, 0603	Murata/TDK
C4	Ceramic capacitor, 47pF/16V, X7R, 0603, Optional	Murata/TDK
C5	Ceramic capacitor, 10uF/10V, X7R, 0805	Murata/TDK
C6	Ceramic capacitor, 1nF/16V, X7R, 0603, Optional	Murata/TDK
C7	Ceramic capacitor, 1nF/25V, X7R, 0603, Optional	Murata/TDK
C9	Ceramic capacitor, 22nF/25V, X7R, 0603	Murata/TDK
R1	Chip Resistor, 7.87KΩ, 1/10W, 1%, 0603	Murata/TDK
R3	Chip Resistor, 51KΩ, 1/10W, 1%, 0603	Murata/TDK
R4	Chip Resistor, 9.76KΩ, 1/10W, 1%, 0603	Murata/TDK
R6	Chip Resistor, 0Ω, 1/10W, 5%, 0603	Murata/TDK
R7	Chip Resistor, 15KΩ, 1/10W, 5%, 0603	Murata/TDK
R8	Chip Resistor, 5.1Ω, 1/10W, 5%, 0603, OPEN	Murata/TDK
R9,R10	Chip Resistor, 43.2KΩ, 1/10W, 1%, 0603	Murata/TDK
R11,R12	Chip Resistor, 49.9KΩ, 1/10W, 1%, 0603	Murata/TDK
R13	Chip Resistor, 1KΩ, 1/10W, 5%, 0603	Murata/TDK
R14	Chip Resistor, 100KΩ, 1/10W, 1%, 0603, Optional	Murata/TDK
R15	Chip Resistor, 15KΩ, 1/10W, 1%, 0603, Optional	Murata/TDK
U1	IC, ACT4533A, SOP-8-EP	ACT
USB	USB Rev:A	
LED	LED, White, Dip	

PCB Top Layer



PCB Bottom Layer



PC Board Layout Guidance

1) Arrange the power components to reduce the AC loop size that consists of CIN, IN pin, SW pin the Schottky diode.

2) Place input decoupling ceramic capacitor CIN as close to IN pin as possible. CIN is connected power GND with vias or short and wide path.

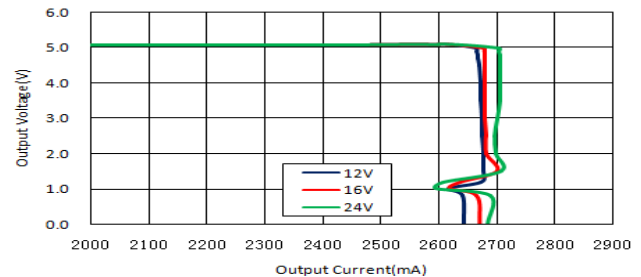
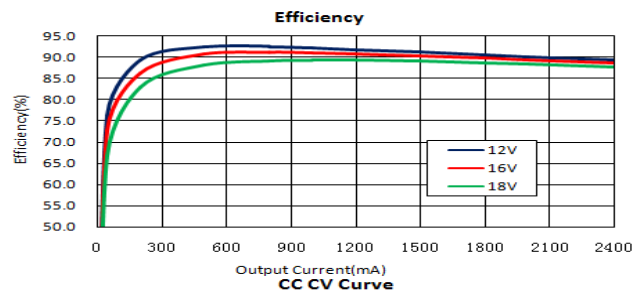
3) Use copper plane for power GND for best heat dissipation and noise immunity.

4) Place feedback resistor close to FB pin.

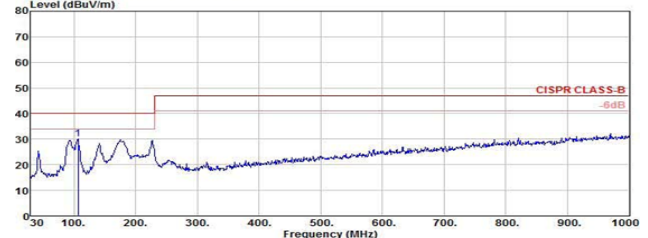
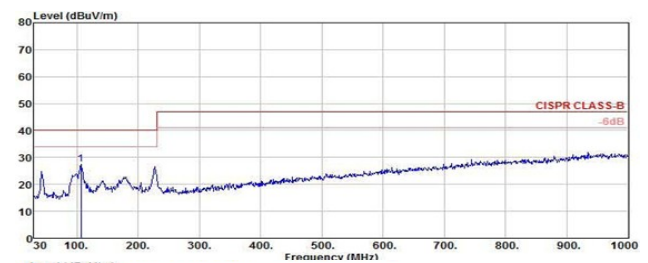
5) Use short trace connecting HSB-R6-C9-SW loop. Thermal pad is connected to a large ground copper area.

6) SW pad is a noisy node switching from Vin to GND. It should be isolated away from the rest of circuit for good EMI and low noise operation.

Typical performance characteristics



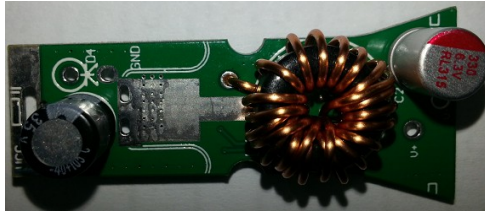
Radiated EMI Test



EVALUATION KITS	Vin	Vo	Io
Car Charger ACT4533A-DMB-#1	10-36V	4.75-5.25V	2400mA

ACT4533B 5V/3.4A iPad Car Charger

Input Voltage	Device	Standby Power	Output	Efficiency	Topology
10-36V	ACT4533B	60mW@12Vin	5V@3.4A	89.2%@3.4A Vin=12V	Buck



L=42mm
W=20mm
H=10mm

Design Features

- ◆ Wide input voltage range from 10V to 32V
- ◆ Transparent input voltage surge up to 40V
- ◆ 4.75V-5.25V during input and load transients
- ◆ 5% output voltage accuracy
- ◆ 125kHz switching frequency
- ◆ Standby input current less than 6mA
- ◆ 3.4-3.9A accurate current limit
- ◆ Shutdown at output short to ground
- ◆ Thermal shutdown protection
- ◆ Output cord compensation
- ◆ Over current protection
- ◆ Output over voltage protection
- ◆ Pass EN55022 Radiation EMI Standard without adding EMI Components

Operation and Application

ACT4533B is a wide input voltage, high efficiency Active CC step-down DC/DC converter that operates in either CV (Constant Output Voltage) mode or CC (Constant Output Current) mode.

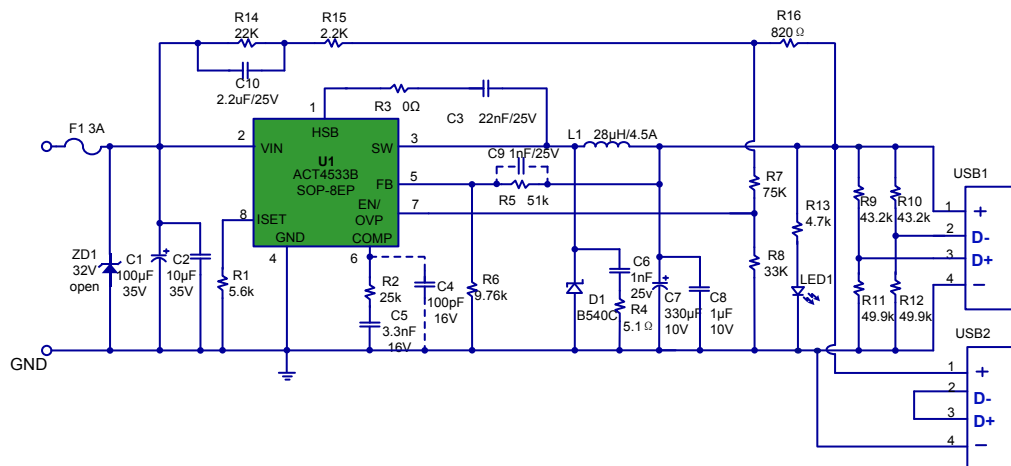
ACT4533B provides up to 3.9A output current at 125kHz switching frequency. Active CC is a patent-pending control scheme to provide CC function accuracy by senseless constant current control, which eliminates the expensive, high accuracy current sense resistor, making it ideal for battery charging applications. charging applications. The ACT4533B operates at constant output voltage mode until it reaches the CC limit set by the ISET resistor. The devices are available in a SOP8-EP package.

Key Component Selection

Higher output inductance reduces the inductor peak-to-peak current at the expense of higher larger core size and inductance DCR value. Usually, an optimum inductance value is selected to make its peak-to-peak current 20%-40% of the maximum load current. The Schottky diode must have current rating higher than the maximum output current and the reverse voltage rating higher than the maximum input voltage. Output capacitor is selected to keep the peak-to-peak voltage ripple under required value and also meet the load transient requirements. For this application, 22uF $\times$ 2 ceramic capacitors are needed. In the case of tantalum or electrolytic types, 220uF capacitor is connected in parallel with a small 1 μ F-10uF ceramic capacitor to achieve small output voltage ripple and meet the requirements of input and load dynamic response.

Figure 1:

Schematic of Charger

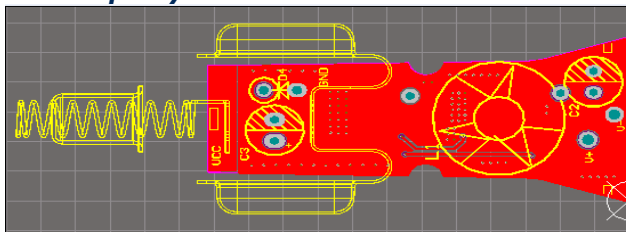


ACT4533B 5V/3.4A iPad Car Charger

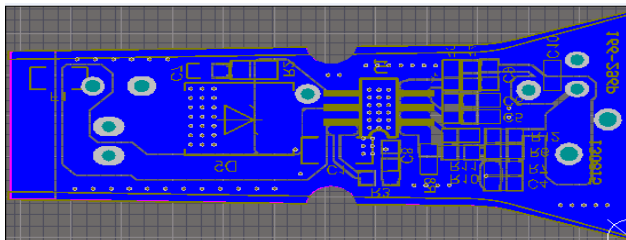
Bill of Materials

REF	Description	MFTR
L1	Choke Coil,Dip,T11.5*5*4mm, phi=0.8mm, L=28uH	
D1	Schottky Diode, B540C,40V/5A, SMC	Diodes
C1	Electrolytic capacitor,100uF/35V, 6.3x11.5mm	Koshin
C2	Ceramic capacitor,10uF/35V, X7R,1206	Koshin
C3	Ceramic capacitor, 22nF/25V, X7R, 0603	Murata/TDK
C4	Ceramic capacitor, 100pF/16V, X7R, 0603(Optional)	Murata/TDK
C5	Ceramic capacitor, 3.3nF/16V, X7R, 0603	Murata/TDK
C6	Ceramic capacitor, 1nF/25V, X7R, 0603	Murata/TDK
C7	Solid capacitor, 330uF/10V, 7x8mm	Murata/TDK
C8	Ceramic capacitor, 1uF/10V, X7R, 0603	Murata/TDK
C9	Ceramic capacitor, 1nF/16V, X7R, 0603	Murata/TDK
C10	Ceramic capacitor, 2.2uF/25V, X7R, 0603	Murata/TDK
F1	Fuse, 3A, 1206 (Replaced by 0Ω 0805 chip resistor)	Murata/TDK
R1	Chip Resistor, 5.6KΩ, 1/10W, 1%, 0603	Murata/TDK
R2	Chip Resistor, 25KΩ, 1/10W, 5%, 0603	Murata/TDK
R3	Chip Resistor, 0Ω, 1/10W, 1%, 0603	Murata/TDK
R4	Chip Resistor, 5.1Ω, 1/10W, 5%, 0805	Murata/TDK
R5	Chip Resistor, 51KΩ, 1/10W, 1%, 0603	Murata/TDK
R6	Chip Resistor, 9.76KΩ, 1/10W, 1%, 0603	Murata/TDK
R7	Chip Resistor, 75KΩ, 1/10W, 1%, 0603	Murata/TDK
R8	Chip Resistor, 33KΩ, 1/10W, 1%, 0603	Murata/TDK
R9,R10	Chip Resistor, 43.2KΩ, 1/10W, 1%, 0603	Murata/TDK
R11,R12	Chip Resistor, 49.9KΩ, 1/10W, 1%, 0603	Murata/TDK
R13	Chip Resistor, 4.7KΩ, 1/10W, 1%, 0603	Murata/TDK
R14	Chip Resistor, 22KΩ, 1/10W, 1%, 0603	Murata/TDK
R15	Chip Resistor, 2.2KΩ, 1/10W, 1%, 0603	Murata/TDK
R16	Chip Resistor, 820Ω, 1/10W, 1%, 0603	Murata/TDK
U1	IC, ACT4533B, SOP-8-EP	ACT
USB	USB Rev:A	
LED	LED, White, Dip	

PCB Top Layer



PCB Bottom Layer



PC Board Layout Guidance

1) Arrange the power components to reduce the AC loop size that consists of CIN, IN pin, SW pin the Schottky diode.

2) Place input decoupling ceramic capacitor CIN as close to IN pin as possible. CIN is connected power GND with vias or short and wide path.

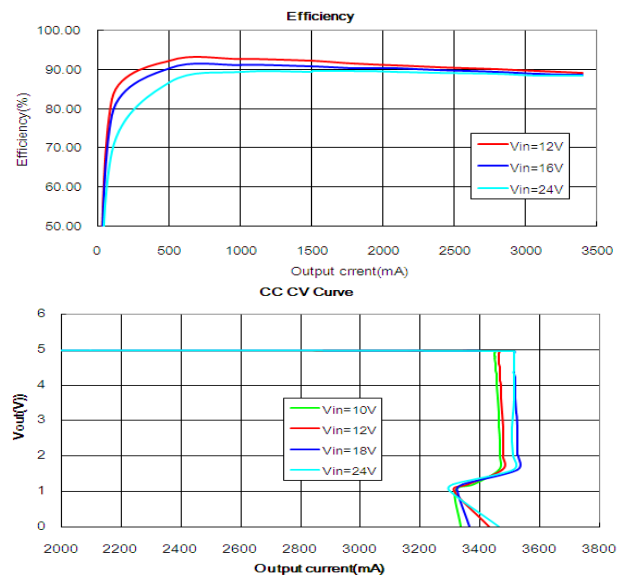
3) Use copper plane for power GND for best heat dissipation and noise immunity.

4) Place feedback resistor close to FB pin.

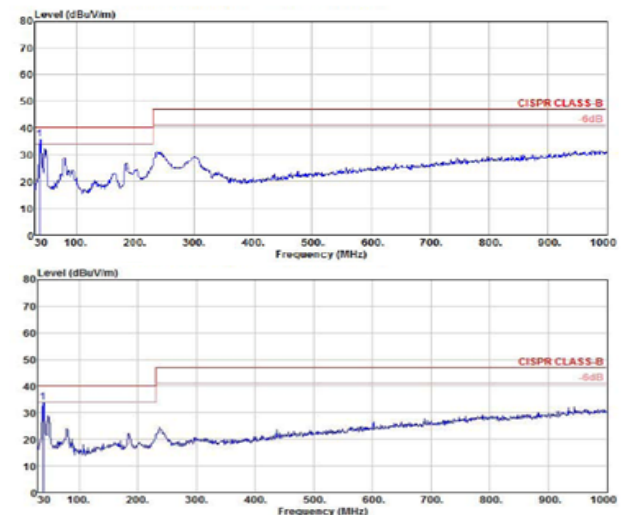
5) Use short trace connecting HSB-R3-C3-SW loop. Thermal pad is connected to a large ground copper area.

6) SW pad is a noisy node switching from Vin to GND. It should be isolated away from the rest of circuit for good EMI and low noise operation.

Typical performance characteristics



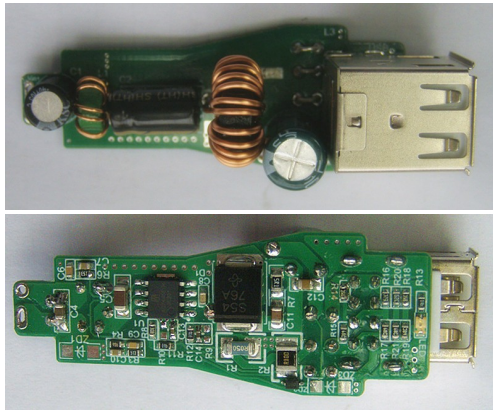
Radiated EMI Test



EVALUATION KITS	Vin	Vo	Io
Car Charger ACT4533B-DMB-#1	10-32V	4.75-5.25V	3400mA

ACT4503–5V/3.4A Dual-Output Car Charger

Input Voltage	Device	Standby Power	Output	Efficiency
7.5-33V	ACT4503	150mW@12Vin	5V@2.4+1A	90%@3.4A,Vin=12V



L=59mm
W=20.2mm
H=18mm

Key Component Selection

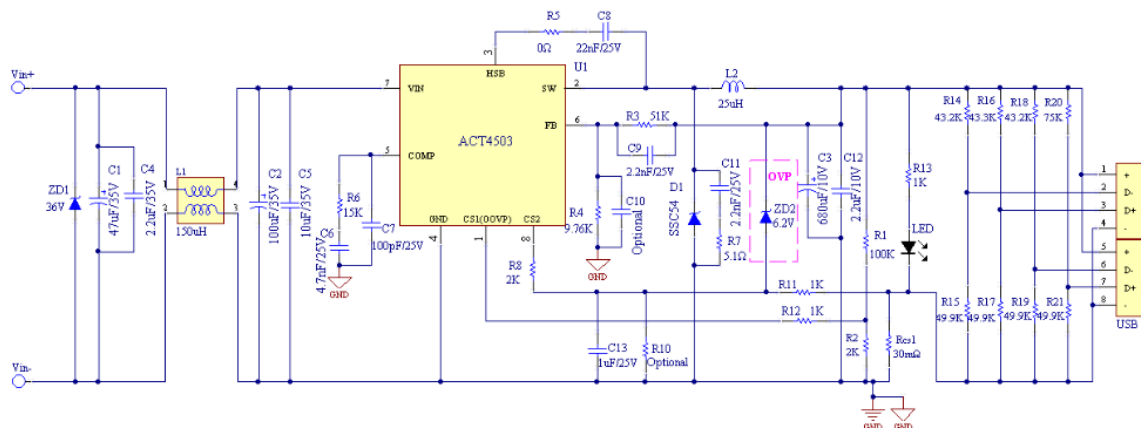
Higher output inductance reduces the inductor peak-to-peak current at the expense of higher larger core size and inductance DCR value. Usually, an optimum inductance value is selected to make its peak-to-peak current 20%-40% of the maximum load current. The Schottky diode must have current rating higher than the maximum output current and the reverse voltage rating higher than the maximum input voltage. Double schottky diodes could be added to achieve higher efficiency and pass single fault test. Output capacitor is selected to keep the peak-to-peak voltage ripple under required value and also meet the load transient requirements. In the case of tantalum or electrolytic types, 680uF capacitor is connected in parallel with a small 1μF-10uF ceramic capacitor to achieve small output voltage ripple and meet the requirements of input and load dynamic response.

Design Features

- ◆ Wide input voltage range from 7.5V to 36V
- ◆ Transparent input voltage surge 12V-40V-12V
- ◆ 4.75V-5.25V during input and load transients
- ◆ 5% output voltage accuracy
- ◆ 200kHz switching frequency
- ◆ Standby input current 10mA
- ◆ Programmable precise output current limit via sensing resistance
- ◆ 3ms internal soft startup time
- ◆ Cycle-by-cycle over current protection
- ◆ Thermal shutdown protection
- ◆ Output cord compensation
- ◆ Nearly zero power loss at over loading or output short
- ◆ Hiccup mode at output over voltage
- ◆ Hiccup mode at output over current
- ◆ Auto recovery into full load after faults
- ◆ Meet EN5502 EMC standard

Figure 1:

Schematic of 5V/3.4A Dual-Output Car Charger

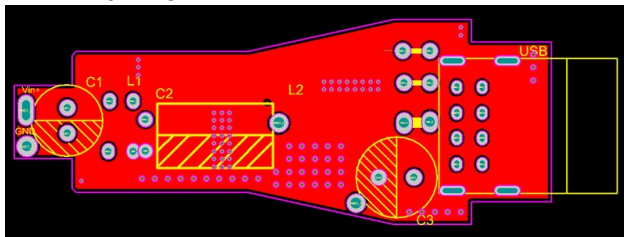


ACT4503–5V/3.4A Dual-Output Car Charger

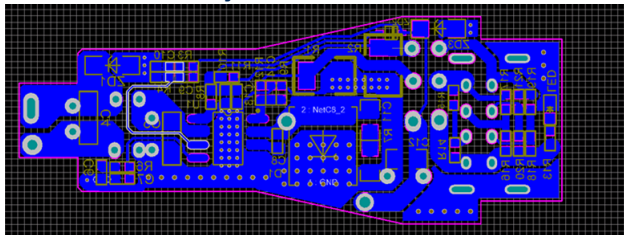
Bill of Materials

REF	DESCRIPTION	MFTR
L1	Choke Coil, 6*3*3mm, L=150uH, dip	ACT
L2	Choke Coil, ring core, 25uH, 11*6.5*4mm, 5A, dip	ACT
D1	Schottky Diode, SSC54, 40V/5A, SMC	Vishay
ZD1	Open	
ZD2	Zener Diode, 6.2V/0.2W	Diodes
C1	Capacitor, Electrolytic, 47uF/35V, Φ6.3x8mm, 105°C	KSC
C2	Capacitor, Electrolytic, 100uF/35V, Φ6.3x11.5mm, 105°C	Koshin
C3	capacitor, Electrolytic, 680uF/10V, Φ8x11.5mm, 105°C	Koshin
C4	Ceramic capacitor, 2.2uF/35V, X7R, 0805	Murata/TDK
C5	Ceramic capacitor, 10uF/35V, X7R, 1206	Murata/TDK
C6	Ceramic capacitor, 4.7nF/25V, X7R, 0402	Murata/TDK
C7	Ceramic capacitor, 100pF/25V, X7R, 0402	Murata/TDK
C8	Ceramic capacitor, 22nF/25V, X7R, 0603	Murata/TDK
C9	Ceramic capacitor, 2.2nF/25V, X7R, 0603	Murata/TDK
C10	Optional	Murata/TDK
C11	Ceramic capacitor, 2.2nF/25V, X7R, 0805	Murata/TDK
C12	Ceramic capacitor, 2.2uF/10V, X7R, 0805	Murata/TDK
C13	Ceramic capacitor, 1uF/25V, X7R, 0603	Murata/TDK
Rcs1	Chip Resistor, 30mΩ, 1/4W, 1%, 1206	ROHM
R1	Chip Resistor, 100KΩ, 1/10W, 1%, 0603	Vishay
R2	Chip Resistor, 2KΩ, 1/10W, 1%, 0603	Murata/TDK
R3	Chip Resistor, 51KΩ, 1/10W, 1%, 0603	Murata/TDK
R4	Chip Resistor, 9.76KΩ, 1/10W, 1%, 0603	Murata/TDK
R5	Chip Resistor, 0Ω, 1/10W, 5%, 0603	Murata/TDK
R6	Chip Resistor, 15KΩ, 1/10W, 5%, 0603	Murata/TDK
R7	Chip Resistor, 5.1Ω, 1/4W, 5%, 1206	Murata/TDK
R8	Chip Resistor, 2KΩ, 1/10W, 1%, 0603	Murata/TDK
R10	Optional	
R11,R12	Chip Resistor, 1KΩ, 1/10W, 1%, 0603	Murata/TDK
R13	Chip Resistor, 1KΩ, 1/10W, 5%, 0603	Murata/TDK
R14,R16,R18	Chip Resistor, 43.2KΩ, 1/10W, 1%, 0603	Murata/TDK
R15,R17,R19,R	Chip Resistor, 49.9KΩ, 1/10W, 1%, 0603	Murata/TDK
R20	Chip Resistor, 75KΩ, 1/10W, 1%, 0603	Murata/TDK
U1	IC, ACT4503, SOP-8 EP	ACT
LED	LED, Red, 0805	
USB	17.5mm*14.5mm*15.7mm	

PCB Top Layer



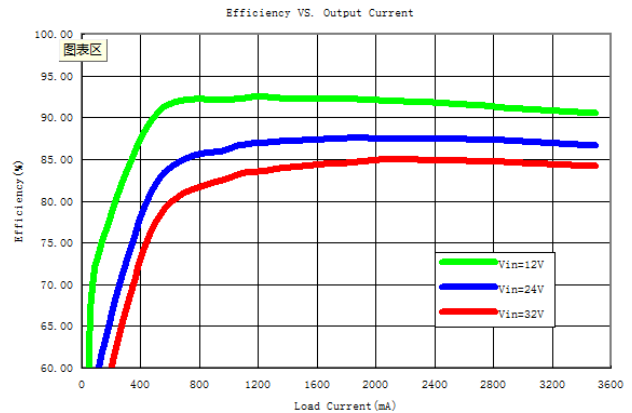
PCB Bottom Layer



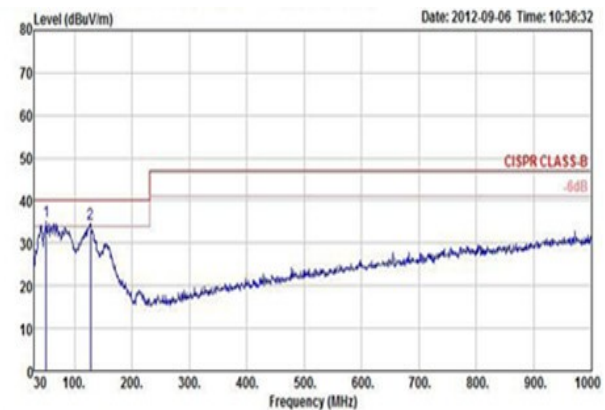
PC Board Layout Guidance

- 1) Arrange the power components to reduce the AC loop size that consists of CIN, IN pin, SW pin the Schottky diode.
- 2) Place input decoupling ceramic capacitor CIN as close to IN pin as possible. CIN is connected power GND with vias or short and wide path.
- 3) Use copper plane for power GND for best heat dissipation and noise immunity.
- 4) Place feedback resistor close to FB pin.
- 5) Use short trace connecting HSB-R5-C8-SW loop.
- 6) SW pad is a noisy node switching from Vin to GND. It should be isolated away from the rest of circuit for good EMI and low noise operation.
- 7) Thermal pad is connected to GND layer through at least 6 vias.

Typical performance characteristics



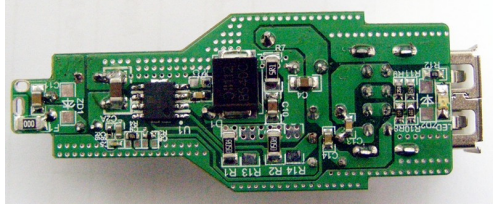
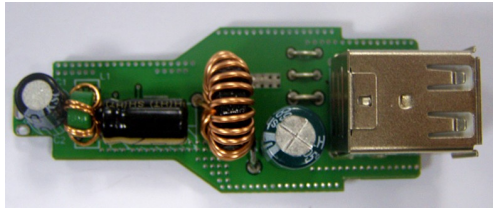
Radiated EMI Test



EVALUATION KITS	Vin	Vo	Io
Car Charger ACT4503-DMB-#2	10-33V	4.75-5.25V	2.4A+1A

ACT4455–5V/4.2A Dual-Output Car Charger

Input Voltage	Device	Standby Power	Output	Efficiency
7.5-33V	ACT4455	150mW@12Vin	5V@2.1+2.1A	88%@4.2A Vin=12V



L=63mm
W=23.5mm
H=18mm

Design Features

- ◆ Wide input voltage range from 7.5V to 36V
- ◆ Transparent input voltage surge 12V-40V-12V
- ◆ 4.75V-5.25V during input and load transients
- ◆ 5% output voltage accuracy
- ◆ 200kHz switching frequency
- ◆ Standby input current 10mA
- ◆ Programmable precise output current limit via sensing resistors
- ◆ 3ms internal soft startup time
- ◆ Cycle-by-cycle over current protection
- ◆ Thermal shutdown protection
- ◆ Output cord compensation
- ◆ Nearly zero power loss at over loading or output short
- ◆ Hiccup mode at output over voltage
- ◆ Auto recovery into full load after faults
- ◆ Meet EN5502 EMC Standard

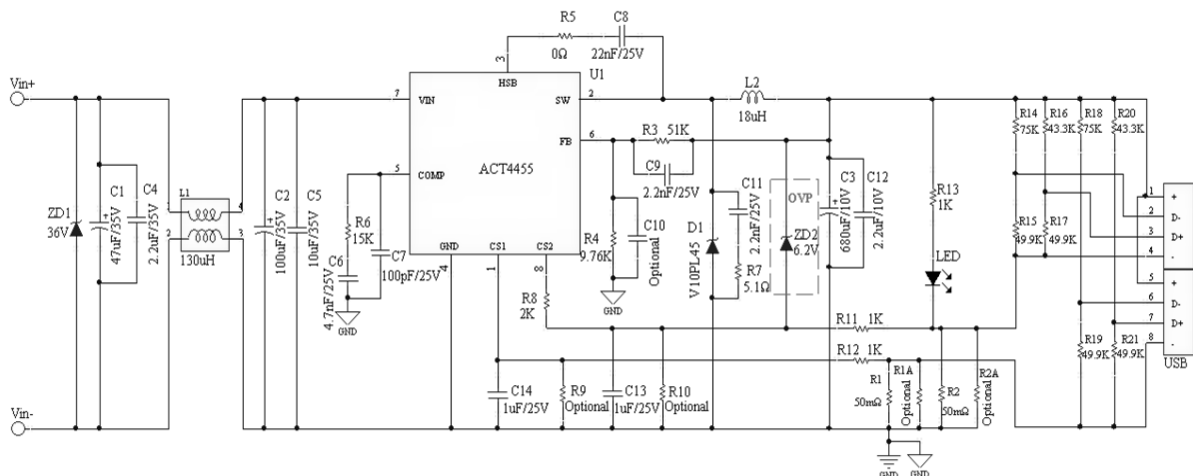
Key Component Selection

Higher output inductance reduces the inductor peak-to-peak current at the expense of higher larger core size and inductance DCR value. Usually, an optimum inductance value is selected to make its peak-to-peak current 20%-40% of the maximum load current. The Schottky diode must have current rating higher than the maximum output current and the reverse voltage rating.

Higher than the maximum input voltage. Double schottky diodes could be added to achieve higher efficiency and pass single fault test. Output capacitor is selected to keep the peak-to-peak voltage ripple under required value and also meet the load transient requirements. In the case of tantalum or electrolytic types, 680uF capacitor is connected in parallel with a small 1uF-10uF ceramic capacitor to achieve small output voltage ripple and meet the requirements of input and load dynamic response.

Figure 1:

Schematic of 5V/4.2A Dual-Output Car Charger

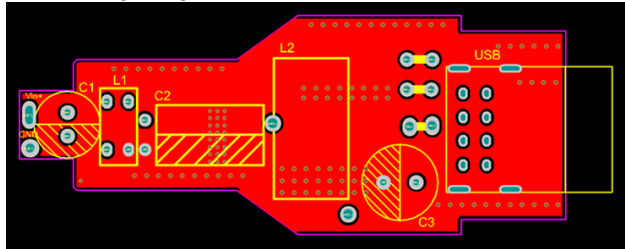


ACT4455–5V/4.2A Dual-Output Car Charger

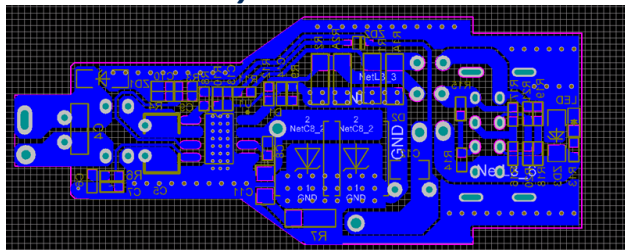
Bill of Materials

REF	DESCRIPTION	MFTR
L1	Choke Coil, 6*3*3mm, L=130uH, dip	ACT
L2	Choke Coil, ring core, 18uH, 11*6.5*4mm, 5A, dip	ACT
D1	Schottky Diode, V10PL45-EH 45V/10A, S MPC	Vishay
ZD1	Open	
ZD2	Zener Diode, 6.2V/0.2W	Diodes
C1	Capacitor, Electrolytic, 47uF/35V, Ø6.3x8mm, 105°C	KSC
C2	Capacitor, Electrolytic, 100uF/35V, Ø6.3x11.5mm, 105°C	Koshin
C3	capacitor, Electrolytic, 680uF/10V, Ø8x11.5mm, 105°C	Koshin
C4	Ceramic capacitor, 2.2uF/35V, X7R, 0805	Murata/TDK
C5	Ceramic capacitor, 10uF/35V, X7R, 1206	Murata/TDK
C6	Ceramic capacitor, 4.7nF/25V, X7R, 0402	Murata/TDK
C7	Ceramic capacitor, 100pF/25V, X7R, 0402	Murata/TDK
C8	Ceramic capacitor, 22nF/25V, X7R, 0603	Murata/TDK
C9	Ceramic capacitor, 2.2nF/25V, X7R, 0603	Murata/TDK
C10	Optional	Murata/TDK
C11	Ceramic capacitor, 2.2nF/25V, X7R, 0805	Murata/TDK
C12	Ceramic capacitor, 2.2uF/10V, X7R, 0805	Murata/TDK
C13,C14	Ceramic capacitor, 1uF/25V, X7R, 0603	Murata/TDK
Rcs1,Rcs2	Chip Resistor, 50mΩ, 1/2W, 1%, 1210	ROHM
R1A,R2A	Optional	
R3	Chip Resistor, 51KΩ, 1/10W, 1%, 0603	Murata/TDK
R4	Chip Resistor, 9.76KΩ, 1/10W, 1%, 0603	Murata/TDK
R5	Chip Resistor, 0Ω, 1/10W, 5%, 0603	Murata/TDK
R6	Chip Resistor, 15KΩ, 1/10W, 5%, 0603	Murata/TDK
R7	Chip Resistor, 5.1Ω, 1/4W, 5%, 1206	Murata/TDK
R8	Chip Resistor, 2KΩ, 1/10W, 1%, 0603	Murata/TDK
R9,R10	Optional	
R11,R12	Chip Resistor, 1KΩ, 1/10W, 1%, 0603	Murata/TDK
R13	Chip Resistor, 1KΩ, 1/10W, 5%, 0603	Murata/TDK
R14,R18	Chip Resistor, 75KΩ, 1/10W, 1%, 0603	Murata/TDK
R15,R17,R19,R	Chip Resistor, 49.9KΩ, 1/10W, 1%, 0603	Murata/TDK
R16,R20	Chip Resistor, 43.2KΩ, 1/10W, 1%, 0603	Murata/TDK
U1	IC, ACT4455, SOP-8 EP	ACT
LED	LED, Red, 0805	
USB	17.5mm*14.5mm*15.7mm	

PCB Top Layer



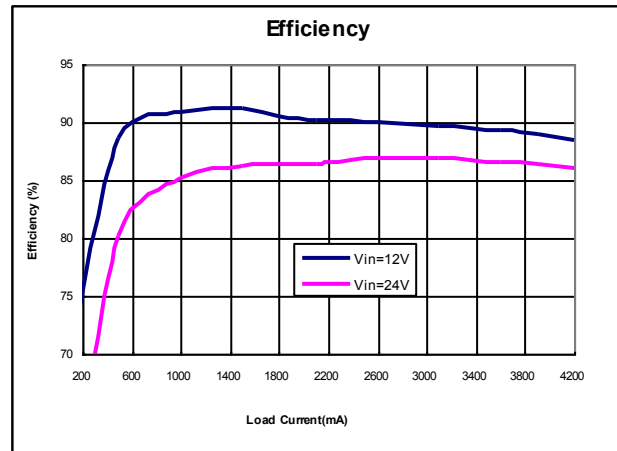
PCB Bottom Layer



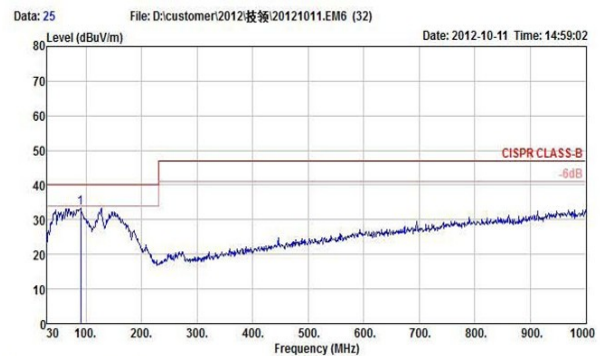
PC Board Layout Guidance

- 1) Arrange the power components to reduce the AC loop size that consists of CIN, IN pin, SW pin the Schottky diode.
- 2) Place input decoupling ceramic capacitor CIN as close to IN pin as possible. CIN is connected power GND with vias or short and wide path.
- 3) Use copper plane for power GND for best heat dissipation and noise immunity.
- 4) Place feedback resistor close to FB pin.
- 5) Use short trace connecting HSB-R5-C7-SW loop.
- 6) SW pad is a noisy node switching from Vin to GND. It should be isolated away from the rest of circuit for good EMI and low noise operation.
- 7) Thermal pad is connected to GND layer through at least 6 vias.

Typical performance characteristics



Radiated EMI Test

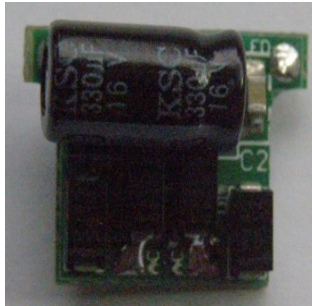


EVALUATION KITS	Vin	Vo	Io
Car Charger ACT4455-DMB-#1	10-33V	4.75-5.25V	2.1A+2.1A

ACT111A High Efficiency, Low Cost HB LED Lighting

Input Voltage	LED #	Output Current	V _{FB}	Topology
4.8 – 30VDC	1-6	1.5A	100mV	Buck

Circuit Bottom View



Circuit Top View



Key Component Selection

An inductor with RMS rating greater than load current and its saturation current at least 30% higher should be used. Inductance value is selected to make its ripple current 20-30% of the load current. A Schottky diode (D5) is usually used for better efficiency as long as the breakdown voltage can withstand the maximum output voltage. The forward current rating of the diode must be at least equal to the maximum LED current.

For AC input, if a conventional step-down line transformer is used, a low cost IN4001 can be used for D1-D4. However, if a high frequency electronic transformer is used, a Schottky diode such as SS14 should be used for high efficiency operation.

For input and output capacitors, small size and low ESR ceramic capacitor is preferred.

Design Features

- ◆ 95% Efficiency
- ◆ 4.8V to 30V Input and up to 1.5A Output
- ◆ 1.4 MHz Switching & Small SOT23-6 Package
- ◆ PWM (0-100%, 0.1-10kHz) Dimming
- ◆ Thermal Shutdown & Short Circuit Protection

Operation and Application

The bridge rectifier is for AC input only. The DC input is directly connected to IN and ground. The ACT111A has an under-voltage lockout (UVLO) at 4.0V with 250mV hysteresis. When input voltage falls below 4.0V, SW stops switching. The device is activated as input voltage goes higher than 4.2V.

The LED output current is sensed by a resistor in series with the LED. The ACT111A precisely regulates the LED current by the internal EA and 0.1V reference. The average LED current is determined by the equation: $I_{LED} = 0.1V / R_{SENSE}$.

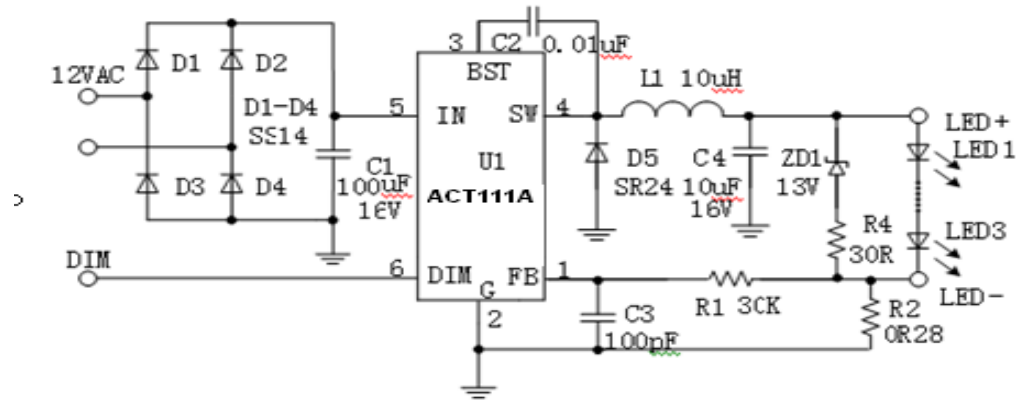
The ACT111A allows dimming with a PWM signal at the DIM pin. A signal level above 1.5V enables switching and turns LED on. To turn off the LED current, the signal level has to be below 1.52V. The dimming signal frequency range is from 100Hz to 10kHz. A 200kΩ resistor is needed to connect between FB pin R_{SENSE} . A 100pF capacitor is recommended to connect from the FB pin to ground.

PC Board Layout Guidance

Place input capacitor (C1) to IN pin, inductor (L1) and diode (D5) to SW pin as close as possible to reduce the voltage ringing at these pins. Place the current sense resistor (R2) close to FB pin. Minimize ground noise by connecting high current ground returns, the input capacitor ground lead, and the output filter ground lead to a single point (star ground configuration). There are two power loops in normal operation, one is formed when the SW is high and the high current flows through input capacitor (C1), internal MOSFET, inductor (L1), LEDs, R_{SENSE} (R2) to ground. The other loop is through inductor (L1), LEDs, R_{SENSE} (R2), ground to diode (D5). Make these loop areas as small as possible to minimize noise interaction.

ACT111A High Efficiency, Low Cost HB LED Lighting

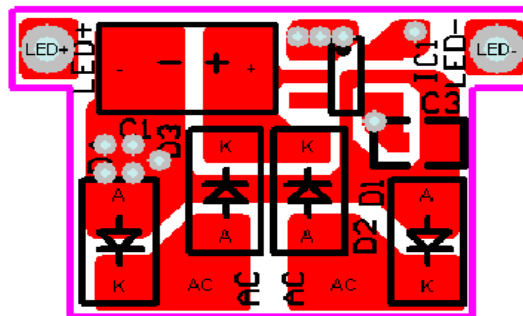
Schematic (VIN=12VDC or AC, 3x350mA LEDs)



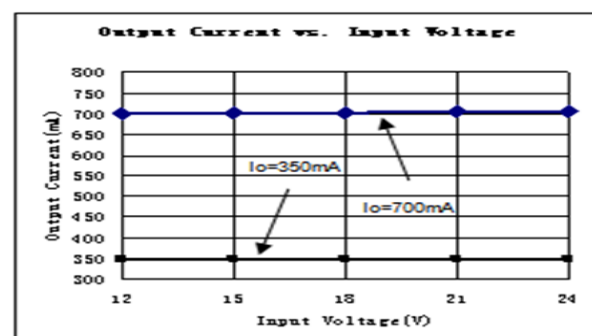
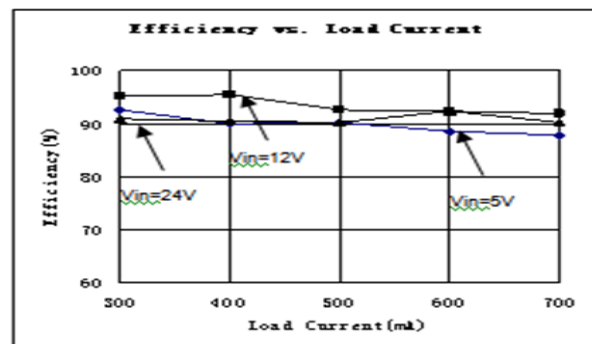
Bill of Materials

Ref.	Description	Mftr
C1	Capacitor Tantalum, 100uF/16V, D Case	AVX
C2	Capacitor, Ceramic, 0.01uF/50V, 0603	POE
C3	Capacitor, Ceramic, 100pF/25V, 0603	POE
C4	Capacitor Ceramic, 10uF/16V, 1206	AVX
D1-D4	Diode shottoky, 40V/1A, SS14, SMA	PANJIT
D5	Schottky Barrier Rectifier, SR24, 40V/2.0A, SMB	PANJIT
ZD1	Diode Zener, GLZ13A, 13V, 0.5W, MINI-MELF	PANJIT
R1	Meter Film Resistor, 30KΩ, 0603, 5%	TY-OHM
R2	Meter Film Resistor, 0.28Ω, 1206, 1%	TY-OHM
R4	Meter Film Resistor, 510Ω, 1206, 5%	TY-OHM
L1	SMD Power Inductor, SR0604220ML, 10uH, ±20%	QianRu
U1	IC, ACT111, SOT23-6	Active

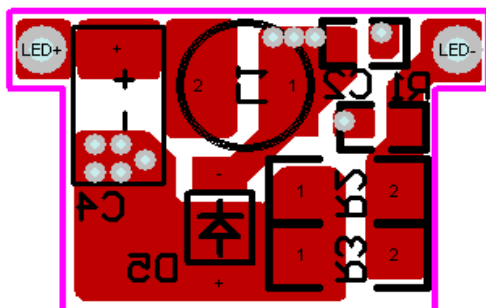
PCB Top Layer



Typical performance characteristics



PCB Bottom Layer



Low Power DC-DC Converter Products

Low Power Step-Down DC-DC Converters

PART NUMBER	MAX V _{IN} (V)	I _{OUT} (mA)	PACKAGE	NOTES
ACT6906	5.5	600	SOT-23-5	Industry-Standard Pinout
ACT6907	5.5	600	SOT-23-5	Industry-Standard Pinout
ACT8309	5.5	900	TDFN33-8	Power-OK Output
ACT8310	5.5	1200	TDFN33-8	Power-OK Output
ACT8311	5.5	1500	TDFN33-8	Power-OK Output

Multi-Function Step-Down DC-DC Converters

Cost-effective, easy-to-use combinations of basic power functions. Pin-control for simple, flexible enable control.

PART NUMBER	MAX V _{IN} (V)	CONFIGURATION	DC/DC I _{OUT} (mA)	LDO I _{OUT} (mA)	WLED	PACKAGE	NOTES
ACT8325	5.5	2×DC/DC	350/550	×	×	TDFN33-10	
ACT8332	5.5	1×DC/DC + 2×LDO	350	360/360	×	TDFN33-10	
ACT8335	5.5	1×DC/DC + 2×LDO	550	360/360	×	TDFN33-10	
ACT8342	5.5	1×DC/DC + 2×LDO	350	80/150	×	TDFN33-16	Reset Output, Push-Button Control
ACT8345	5.5	1×DC/DC + 2×LDO	550	360/360	×	TDFN33-16	Reset Output, Push-Button Control

Step-Up DC-DC Converters

Single-function step-up DC/DC converters for portable applications.

PART NUMBER	MAX V _{IN} (V)	CONFIGURATION	V _{OUT} (V)	I _{LIM} (A)	PACKAGE
ACT6357	5.5	WLED	Up to 40V	0.5	TDFN33-8
ACT6358	5.5	WLED	Up to 40V	1.0	TDFN33-8
ACT6359	5.5	WLED	Up to 40V	0.5	SOT23-6
ACT6360	5.5	WLED	Up to 40V	1.0	SOT23-6
ACT6390	5.5	Voltage Boost	Up to 12V	1.7	MSOP-8
ACT6391	5.5	Voltage Boost	Up to 12V	2.5	MSOP-8

ActivePath™ Battery Chargers

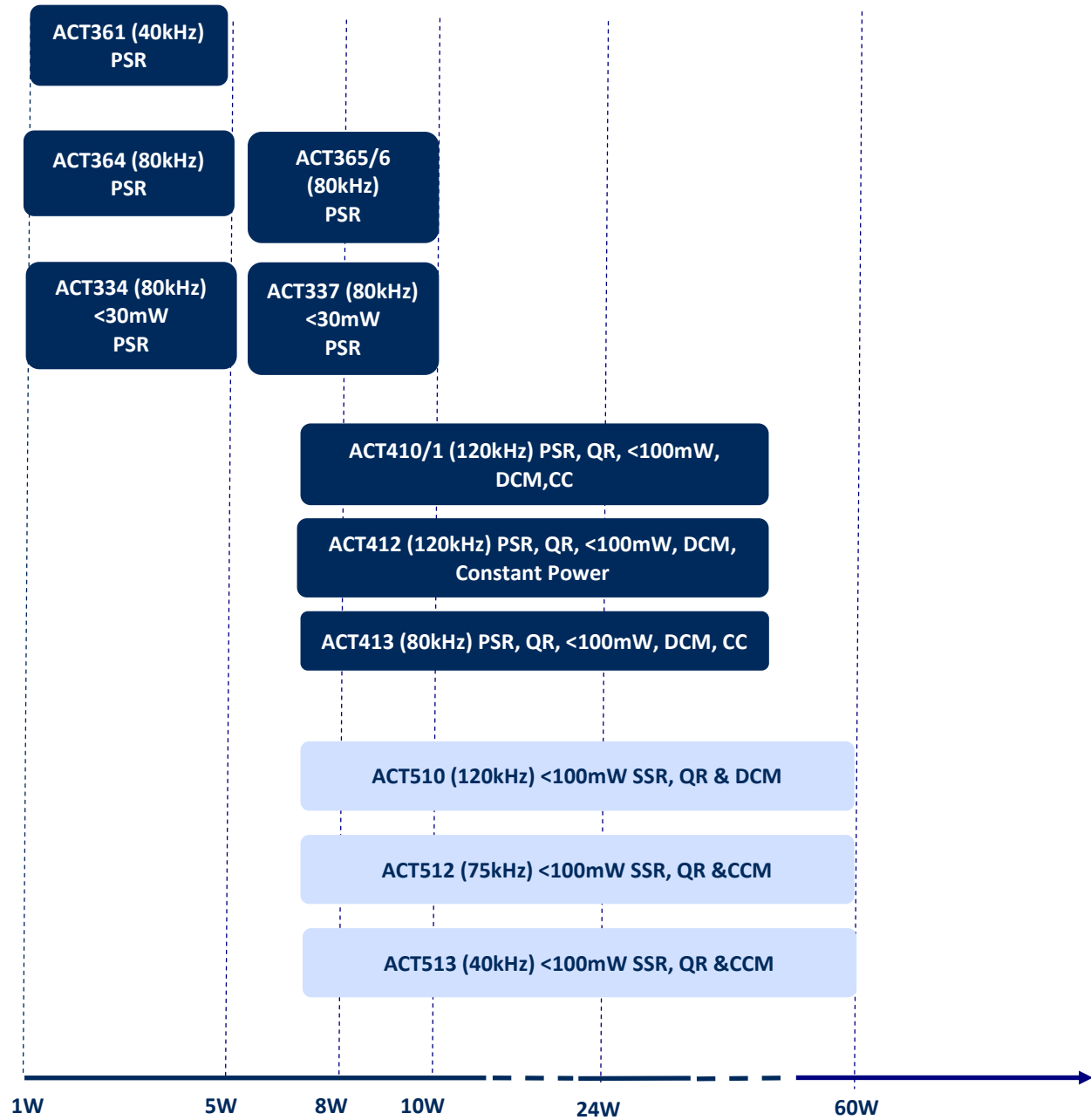
PART NUMBER	MAX V _{IN} (V)	I _{OUT} (A)	PACKAGE
ACT3780	6.5 ^① /12 ^②	Up to 1.5A	TDFN44-20

①: Maximum Operating Input Voltage, Over-Voltage Protection disables charger above this voltage

②: Maximum Sustainable Input Voltage

Green Power AC-DC Converter Products

AC-DC Product Selection Guide



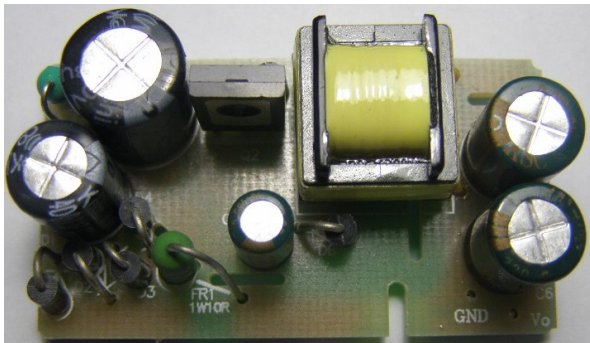
- Primary Side Regulation (PSR) PWM Controllers - ActivePSR™
- Secondary Side Regulation PWM Controllers - ActiveQR™

ACT334 5V/1A Universal Charger For DOE Standard

Input Voltage	Device	Average Efficiency	Standby Power	Output Voltage	Output Power	Topology
90-264VAC	ACT334	75.60%	39mW	5V	5W	PSR flyback

Description

ACT334 is a 5 star high performance PSR CV/CC controller to achieve <30mW standby power. The unique fast startup architecture, 80kHz maximum switching frequency and driving external NPN make ACT334 the most cost effective 5 star solutions for small size cell phone charger.



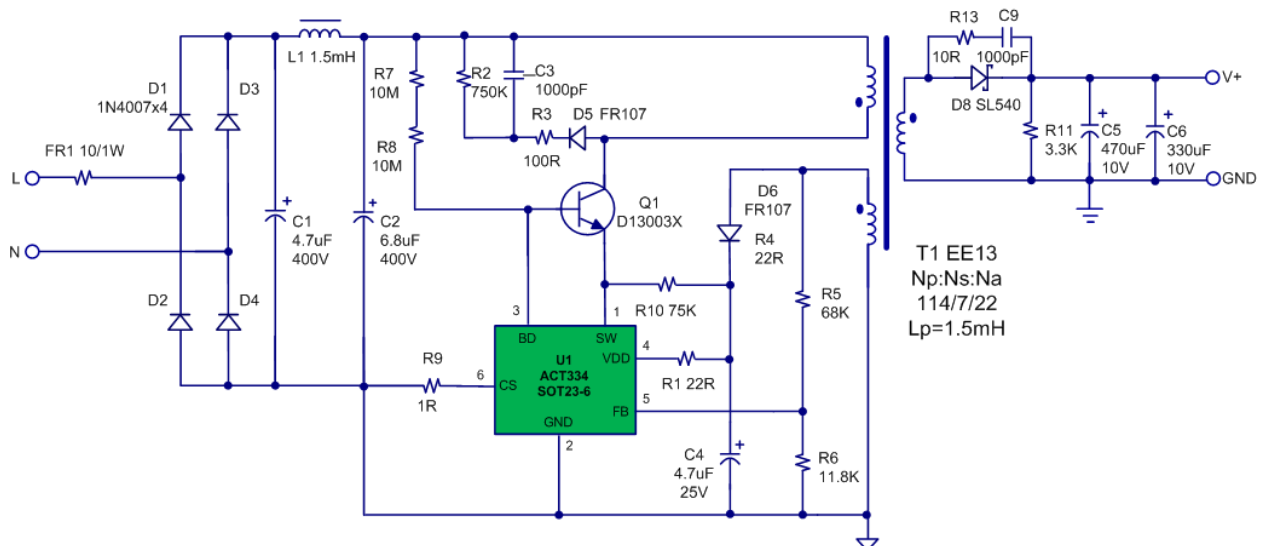
Mini size

W*L*H=25.5mm*46.5mm*16mm

Key Features

- ◆ Patented Primary Side Regulation Technology
- ◆ Lowest total cost solution for cell phone charger using PWM IC
- ◆ Universal input voltage range from 85 to 264 VAC
- ◆ Accurate CV (5%) and CC (10%) performance
- ◆ Adjustable up to 80kHz Switching Frequency
- ◆ Integrated Output Cord Compensation
- ◆ CV & CC correction for Input line, output DC cord and transformer inductance variation
- ◆ No-load standby power < 0.05W
- ◆ Exceed the latest DOE average efficiency requirement
- ◆ No Y capacitor for EMI filter
- ◆ Short circuit and over-voltage protection
- ◆ Tiny SOT23-6 package.

Schematic

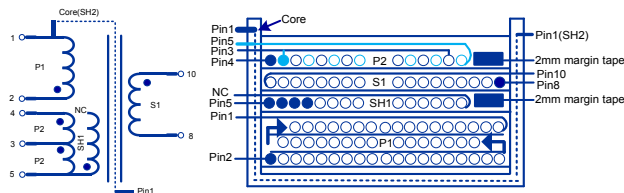


ACT334 5V/1A Universal Charger For DOE Standard

Bill of Materials

REF	DESCRIPTION	MFTR
U1	IC, ACT334,SOT23-6	Active-Semi.
C1	Capacitor, Electrolytic, 4.7uF/400V, 8x12mm	KSC
C2	Capacitor, Electrolytic, 6.8uF/400V, 10x12mm	KSC
C3	Capacitor, Ceramic, 1000pF/500V,1206,SMD	POE
C4	Capacitor, Electrolytic, 4.7uF/35V,5x11mm	KSC
C5	Capacitor, Solid, 470uF/10V, 8x12mm	Rubcon
C6	Capacitor, Electrolytic, 330uF/10V, 8x12mm	KSC
C9	Capacitor, Ceramic,1000pF/50V, 0805, SMD	POE
D1-D4	Diode,Rectifier,1000V/1A,1N4007, DO-41	Good-Ark
D5,D6	Diode,Ultra Fast, FR107,1000V/1.0A, DO-41	Good-Ark
D8	Diode, schottky, 40V/5A, SL540, DO-214AB,SMD	Vishay
L1	Axial Inductor, 1.5mH, 0410,Dip	Amode Tech
Q1	Transistor, HFE 20-25, NPN,13003,TO-126	Huawei
PCB1	PCB, L*W*T=48.5x29x1.6mm,Cem-1,Rev:A	Jintong
FR1	Wire Round Resistor,1W,10 ohm,KNP, 5%	TY-OHM
R1	Chip Resistor, 22 ohm, 0603, 5%	TY-OHM
R2	Chip Resistor, 750K ohm, 1206, 5%	TY-OHM
R3	Chip Resistor, 470 ohm, 1206, 5%	TY-OHM
R4	Chip Resistor, 22 ohm, 0805, 5%	TY-OHM
R5	Chip Resistor, 68K ohm, 0805,1%	TY-OHM
R6	Chip Resistor, 11.8K ohm, 0805, 1%	TY-OHM
R7,R8	Chip Resistor, 10M ohm, 1206, 5%	TY-OHM
R9	Chip Resistor, 1 ohm, 1206,1%	TY-OHM
R10	Chip Resistor, 75K ohm, 0805, 5%	TY-OHM
R11	Chip Resistor, 3.3K ohm, 0805, 5%	TY-OHM
R13	Chip Resistor, 10 ohm, 0805, 5%	TY-OHM
T1	Transformer, Lp=1.5mH, EE13	

Transformer



Build Up

WINDING	TERMINAL		TURNS	WIRE			INSULATION	
	START	FINISH		TYPE	SIZE*QTY	LAYERS	WIDTH	LAYERS
P1	2	-->	38	2UEW	0.15Φ*1	1	0.025*8.5W	1
	<--	<--	38	2UEW	0.15Φ*1	1	0.025*8.5W	1
	-->	1	38	2UEW	0.15Φ*1	1	0.025*8.5W	2
SH1	4	NC	7	2UEW	0.15Φ*4	1	0.025*8.5W	2
S1	6	8	8	TEX-E	0.55Φ*1	1	0.025*8.5W	2
P2	(5)	4	11	2UEW	0.25Φ*2	1	0.025*8.5W	2
	3	(5)						
SH2	Core	1	1	2UEW	0.15Φ*1	1	0.025*8.5W	2

Note: 1. Core and Bobbin: EE13

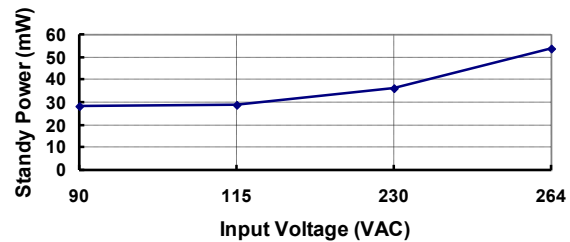
2. SH1 and SH2 are shielding; P1 & P2 are primary and S1 is secondary

3. Reverse the direction of bobbin when doing the S1

Typical performance characteristics

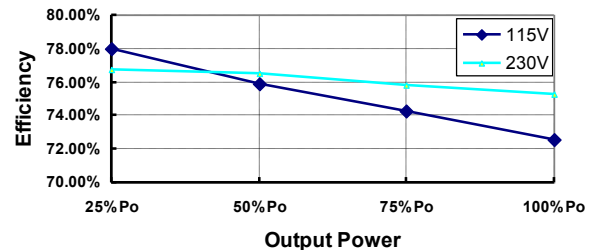
Standby Power

Standby Power Vs Input Voltage



Efficiency (24AWG,1.8m,R=0.308Ω)

Efficiency Vs Po



EVALUATION KITS

ACT334_5V1A_DOE_Rev1.0

Low Cost ACT411 12V/1A Universal Adapter

Input Voltage	Device	Vo	Po	Transformer Core	Standby Power	Efficiency	Topology
90-264VAC	ACT411	12V	12W	EE16	90mW	82%	QR flyback

Description

ACT411 is a high performance peak current mode PWM controller which applies ActivePSR™ and ActiveQR™ technology. By applying frequency fold back and ActiveQR™ technology, ACT411 exceeds the latest ES2.0 efficiency standard. With Quasi-Resonant operation mode ACT411 can effectively improve efficiency, reduce the EMI noise and further reduce the components in input filter.



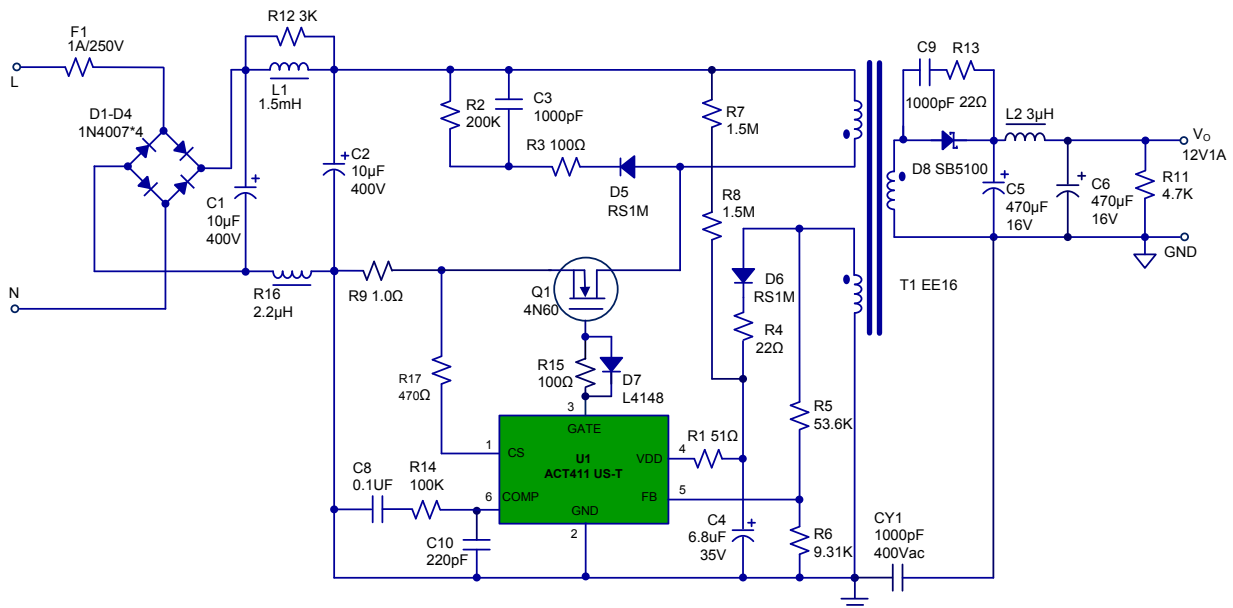
Mini size

W*L*H=30mm*52mm*16mm

Key Features

- ♦ Advanced Quasi-Resonant mode operation.
- ♦ Advanced burst mode operation enables low standby power of 90mW .
- ♦ Frequency jittering and Quasi-Resonant technology to decrease EMI.
- ♦ Patented frequency foldback and *ActiveQR™* technology increases the average system efficiency and exceeds the latest ES2.0 efficiency standard with good margin.
- ♦ Integrated patented line and inductance compensation, provide accurate CC
- ♦ Integrate comprehensive protection. In case of over temperature, over/under voltage, short winding, short current sense resistor, open loop and overload protection.
- ♦ Tiny SOT23-6 package.

Schematic

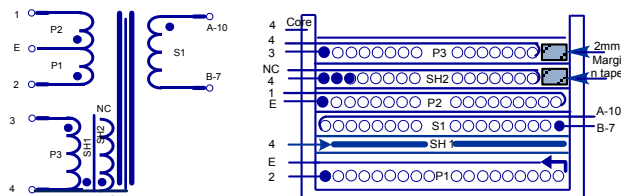


Low Cost ACT411 12V/1A Universal Adapter

Bill of Materials

REF	DESCRIPTION	MFTR
U1	IC, ACT411,SOT23-6	Active-Semi.
C1	Capacitor, Electrolytic, 10uF/400V, 10x16mm	KSC
C2	Capacitor, Electrolytic, 10uF/400V, 10x16mm	KSC
C3	Capacitor, Ceramic, 1000pF/500V, 0805,SMD	POE
C4	Capacitor, Electrolytic, 6.8uF/50V, 5x11mm	KSC
C5,C6	Capacitor, Electrolytic, 470uF/16V, 8x11.5mm	KSC
C8	Capacitor, Ceramic, 0.1uF/25V, 0805,SMD	POE
C9	Capacitor, Ceramic, 1000pF/100V, 0805,SMD	POE
C10	Capacitor, Ceramic, 220pF/25V, 0805,SMD	POE
CY1	Safety Y1,Capacitor,1000pF/400V,Dip	UXT
D1-D4	Diode,Rectifier,1000V/1A,1N4007, DO-41	Good-Ark
D5	Fast Recovery Rectifier, RS1M,1000V/1.0A, SMA	PANJIT
D6	Fast Recovery Rectifier,RS1A,200V/1.0A,SMA	PANJIT
D7	Diode, 1N4148 SMD	PANJIT
D8	Diode, schottky, 100V/5A, SB5100, DO-201AB	Diodes
L1	Axial Inductor, 1.5mH, 5*7,Dip	SoKa
R16	SMD Inductor, 2.2uH, 0805	SoKa
Q1	Mosfet Transistor, 4N60,TO-220	Infineon
PCB1	PCB, L*W*T=52x30x1.6mm,Cem-1,Rev:A	Jintong
FR1	Fuse,1A/250V	TY-OHM
R2	Carbon Resistor, 200K ohm, 1206, 5%	TY-OHM
R3,15	Chip Resistor, 100 ohm, 0805, 5%	TY-OHM
R1	Chip Resistor, 51 ohm, 0805, 5%	TY-OHM
R5	Chip Resistor, 53.6K ohm, 0805,1%	TY-OHM
R6	Chip Resistor, 9.31K ohm, 0805, 1%	TY-OHM
R7,R8	Chip Resistor, 1.5M ohm, 0805 , 5%	TY-OHM
R9	Chip Resistor, 1ohm, 1206,1%	TY-OHM
R12	Chip Resistor, 3K ohm, 0805, 5%	TY-OHM
R11	Chip Resistor, 4.7K ohm, 0805, 5%	TY-OHM
R4,R13	Chip Resistor, 22 ohm, 0805 , 5%	TY-OHM
R14	Chip Resistor, 100K ohm, 0805, 5%	TY-OHM
T1	Transformer, Lp=0.39mH, EE16	Not defined

Transformer



EVALUATION KITS

ACT411_12V1A_Rev1.1

Build Up

WINDING	TERMINAL		TURNS	WIRE			INSULATION	
	START	FINISH		TYPE	SIZE*QTY	LAYERS	WIDTH	LAYERS
P1	2	3	32	2UEW	0.21Φ*1	1	0.025*11W	1
SH1	5	NC	0.9	Copper	0.025*10W	1	0.025*11W	2
S1	B-7	A-10	11	TEX-E	0.5Φ*1	1	0.025*11W	2
P2	3	1	32	2UEW	0.21Φ*1	1	0.025*11W	1
SH2	5	NC	13	2UEW	0.15Φ*3	1	0.025*11W	2
P3	4	5	12	2UEW	0.21Φ*2	1	0.025*11W	2
SH3	5	core	3	Coopper wire	0.1Φ*1	1	0.025*11W	2

- Note: 1. Core and Bobbin: EE16
 2. SH1,SH2, SH3 are shielding; P1, P2, P3 are primary and S1 is secondary
 3. Reverse the direction of bobbin when doing the S1

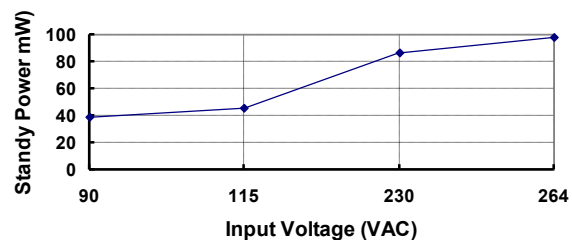
Electrical Specifications

ITEM	DESCRIPTION	CONDITION	LIMITS
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000 Vac
2	P1 Inductance	Inductance between pins 2 and 1 at 1Vac & 1kHz	0.39mH±7%
3	P1 Leakage Inductance	Inductance between 2 pins 1 with pins 4-5 and A-B shorted	75uH

Typical performance characteristics

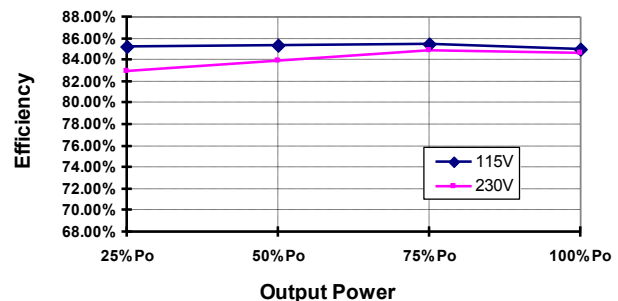
Standby Power

Standby Power Vs Input Voltage



Efficiency (24AWG,1.8m,R=0.308Ω)

Efficiency Vs Po



Low Cost ACT412 12V/0.4A Shaver Charger

Input Voltage	Device	Vo	Po	Transformer Core	Standby Power	Efficiency	Topology
90-264VAC	ACT412	12V	6W	EE16	94mW	77%	QR flyback

Description

ACT412 is a high performance peak current mode PWM controller which applies ActivePSR™ and ActiveQR™ technology. By applying frequency fold back and ActiveQR™ technology, ACT412 exceeds the latest ES2.0 efficiency standard. With Quasi-Resonant operation mode ACT412 can effectively improve efficiency, reduce the EMI noise and further reduce the components in input filter.



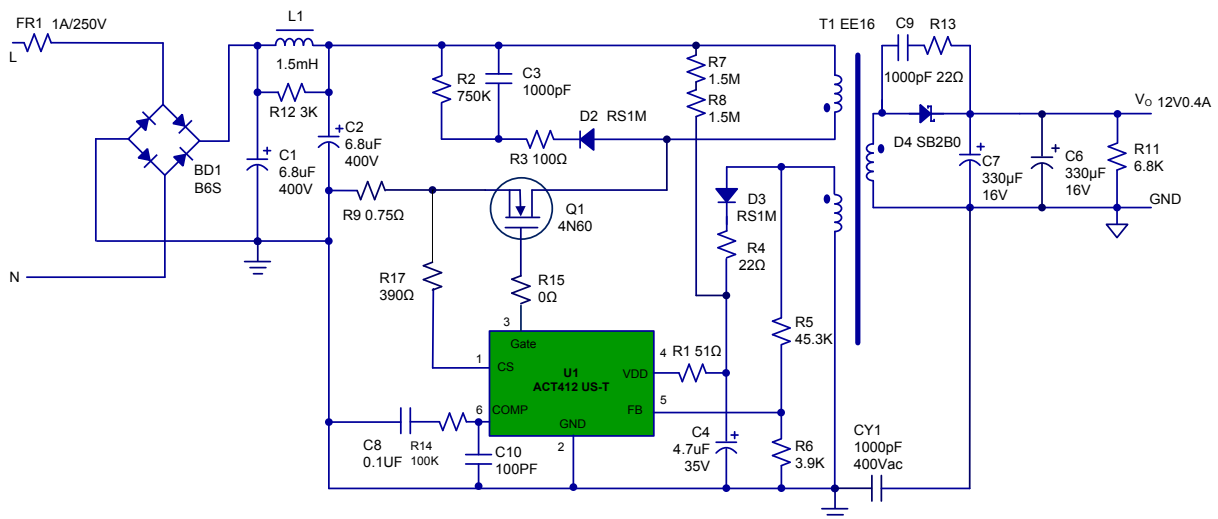
Mini size

W*L*H=30mm*52mm*16mm

Key Features

- ◆ Constant power mode protection for small power motor application
- ◆ Advanced Quasi-Resonant mode operation.
- ◆ Advanced burst mode operation enables low standby power
- ◆ Frequency jittering and Quasi-Resonant technology to decrease EMI.
- ◆ Patented frequency foldback and *ActiveQR™* technology increases the average system efficiency and exceeds the latest ES2.0 efficiency standard with good margin.
- ◆ Integrated patented line compensation
- ◆ Integrate comprehensive protection. In case of over temperature, over/under voltage, short winding, short current sense resistor, open loop and overload protection.
- ◆ Tiny SOT23-6 package.

Schematic

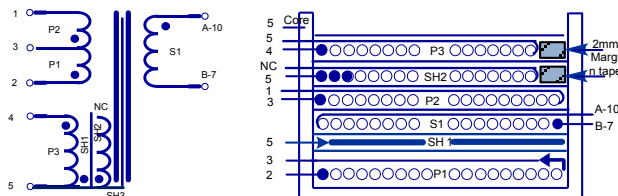


Low Cost ACT412 12V/0.4A Shaver Charger

Bill of Materials

REF	DESCRIPTION	MFTR
U1	IC, ACT412,SOT23-6	Active-Semi.
C1,C2	Capacitor, Electrolytic, 6.8uF/400V, 10x12mm	KSC
C3	Capacitor, Ceramic, 1000pF/500V, 0805,SMD	POE
C4	Capacitor, Electrolytic, 4.7uF/35V, 5x11mm	KSC
C5,C6	Capacitor, Electrolytic, 330uF/16V, 8x11.5mm	KSC
C8	Capacitor, Ceramic, 0.1uF/25V, 0805,SMD	POE
C9	Capacitor, Ceramic, 1000pF/100V, 0805,SMD	POE
C10	Capacitor, Ceramic, 100pF/25V, 0805,SMD	POE
CY1	Safety Y1,Capacitor,1000pF/400V,Dip	INC
D1-D4	Diode,Rectifier,1000V/1A,1N4007, DO-41	Good-Ark
D5	Fast Recovery Rectifier, RS1M,1000V/1.0A, RMA	PANJIT
D6	Fast Recovery Rectifier,RS1D,200V/1.0A,SMA	PANJIT
D7	NC	
D8	Diode, schottky, 100V/2A, SB2100, DO-41	Good-Ark
L1	Axial Inductor, 1.5mH, 5*7,Dip	SoKa
L2	Axial Inductor, 3uH, 0.55*5T, 5*7,Dip	SoKa
Q1	Mosfet Transistor, 4N60,TO-220	Infineon
PCB1	PCB, L*W*T=52.2x30x1.6mm,Cem-1,Rev:A	Jintong
FR1	Fuse,1A/250V	TY-OHM
R1	Chip Resistor, 51 ohm, 0805, 5%	TY-OHM
R2	Carbon Resistor, 750K ohm, 1206, 5%	TY-OHM
R3	Chip Resistor, 100 ohm, 0805, 5%	TY-OHM
R4,R13	Chip Resistor, 22 ohm, 0805, 5%	TY-OHM
R5	Chip Resistor, 45.3K ohm, 0805,1%	TY-OHM
R6	Chip Resistor, 6.9K ohm, 0805, 1%	TY-OHM
R7,R8	Chip Resistor, 1.5M ohm, 0805, 5%	TY-OHM
R9	Chip Resistor, 0.75ohm, 1206,1%	TY-OHM
R10	NC	
R11	Chip Resistor, 6.8K ohm, 0805, 5%	TY-OHM
R12	Chip Resistor, 3K ohm, 0805, 5%	TY-OHM
R14	Chip Resistor, 100K ohm, 0805, 5%	TY-OHM
R15	Chip Resistor, 0 ohm, 0805, 5%	TY-OHM
R16	NC	
R17	Chip Resistor, 390 ohm, 0805, 5%	TY-OHM
T1	Transformer, Lp=0.45mH, EE16	

Transformer



EVALUATION KITS

ACT411_12V1A_Rev1.1

Build Up

WINDING	TERMINAL		TURNS	WIRE			INSULATION	
	START	FINISH		TYPE	SIZE*QTY	LAYERS	WIDTH	LAYERS
P1	2	3	32	2UEW	0.21Φ*1	1	0.025*11W	1
SH1	5	NC	0.9	Copper	0.025*10W	1	0.025*11W	2
S1	B-7	A-10	12	TEX-E	0.45Φ*1	1	0.025*11W	2
P2	3	1	32	2UEW	0.21Φ*1	1	0.025*11W	1
SH2	5	NC	13	2UEW	0.15Φ*3	1	0.025*11W	2
P3	4	5	17	2UEW	0.2Φ*2	1	0.025*11W	2
SH3	5	core	3	Coopper wire	0.1Φ*1	1	0.025*11W	2

- Note: 1. Core and Bobbin: EE16
 2. SH1,SH2, SH3 are shielding; P1, P2, P3 are primary and S1 is secondary
 3. Reverse the direction of bobbin when doing the S1

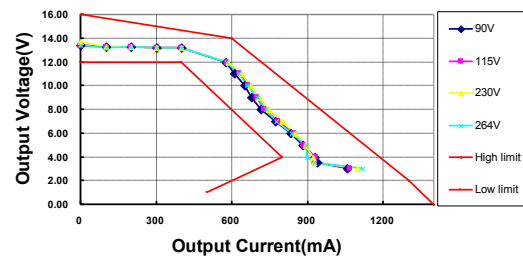
Electrical Specifications

ITEM	DESCRIPTION	CONDITION	LIMITS
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000 Vac
2	P1 Inductance	Inductance between pins 2 and 1 at 1Vac & 1kHz	0.45mH±7%
3	P1 Leakage Inductance	Inductance between 2 pins 1 with pins 4-5 and A-B shorted	75μH

Typical performance characteristics

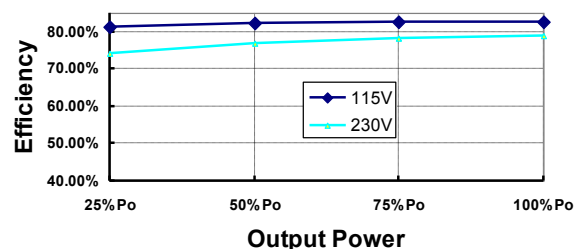
CC/CV Curve

V-I Characteristic Vs Vin(25℃)



Efficiency

Efficiency Vs Po

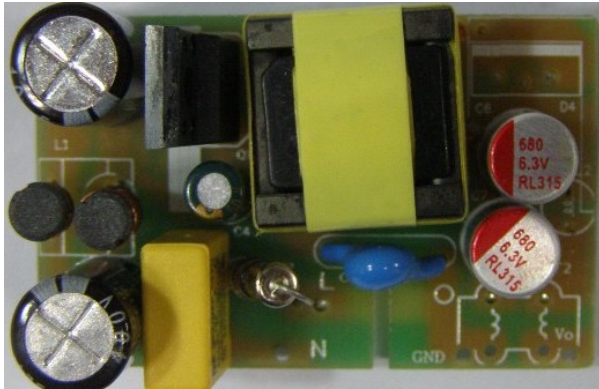


Low Cost ACT413 5V/2.4A Universal Adapter

Input Voltage	Device	Vo	Po	Transformer Core	Standby Power	Efficiency	Topology
90-264VAC	ACT413	5V	12W	EPC17	80mW	78.44%	QR flyback

Description

ACT413 is a high performance QR mode PWM controller. 6-pin tiny package, low standby power and extensive protection features, upto 75kHz full load switching frequency make ACT413 the most attractive performance/cost adaptor solutions.



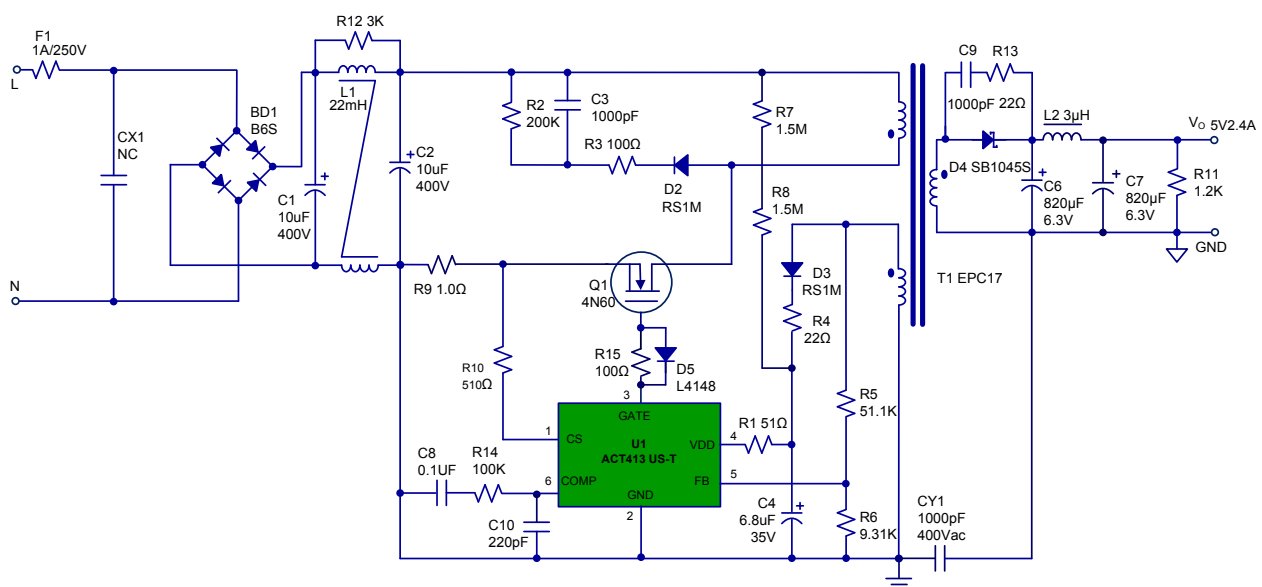
Normal size

W*L*H=33mm*52mm*16mm

Key Features

- ◆ Advanced Quasi-Resonant mode operation.
- ◆ Advanced burst mode operation enables low standby power of 80mW .
- ◆ Frequency jittering and Quasi-Resonant technology to decrease EMI.
- ◆ Patented frequency foldback and *ActiveQR™* technology increases the average system efficiency and exceeds the latest ES2.0 efficiency standard with good margin.
- ◆ Integrated patented line and inductance compensation, provide accurate CC
- ◆ Integrate comprehensive protection. In case of over temperature, over/under voltage, short winding, short current sense resistor, open loop and overload protection.
- ◆ Tiny SOT23-6 package.

Schematic

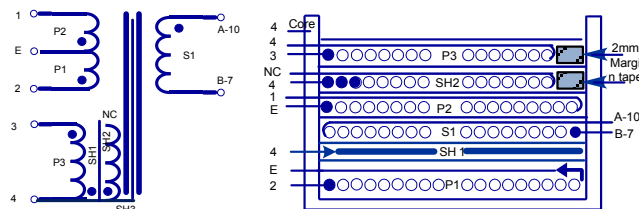


Low Cost ACT413 5V/2.4A Universal Adapter

Bill of Materials

REF	DESCRIPTION	MFTR
U1	IC, ACT413,SOT23-6	Active-Semi.
C1	Capacitor, Electrolytic, 10uF/400V, 10x16mm	KSC
C2	Capacitor, Electrolytic, 10uF/400V, 10x16mm	KSC
C3	Capacitor, Ceramic, 1000pF/500V, 0805,SMD	POE
C4	Capacitor, Electrolytic, 6.8uF/50V, 5x11mm	KSC
C6,C7	Capacitor, Solid, 820uF/6.3V, 8x12mm	KSC
C8	Capacitor, Ceramic, 0.1uF/25V, 0805,SMD	POE
C9	Capacitor, Ceramic, 1000pF/50V, 0805,SMD	POE
C10	Capacitor, Ceramic, 220pF/50V, 0805,SMD	POE
CY1	Safety Y1,Capacitor,1000pF/400V,Dip	UXT
BD1	Diode,Rectifier,1000V/1A,MB6S, SOT-4	Good-Ark
D2,3	Fast Recovery Rectifier, RS1M,1000V/1.0A, SMA	PANJIT
D4	Diode, schottky, SB1045S, 10A/45V, SMA	Diodes
D5	Diode, 1N4148 SMD	PANJIT
L1	CM Inductor, 22mH, EE01,Dip	SoKa
Q1	Mosfet Transistor, 4N60,TO-220	Infineon
PCB1	PCB, L*W*T=52x33x1.6mm,Cem-1,Rev:A	Jintong
FR1	Fuse,1A/250V	TY-OHM
R1	Chip Resistor, 51 ohm, 0805, 5%	TY-OHM
R2	Carbon Resistor, 200K ohm, 1206, 5%	TY-OHM
R3,15	Chip Resistor, 100 ohm, 0805, 5%	TY-OHM
R4,13	Chip Resistor, 22 ohm, 0805, 5%	TY-OHM
R5	Chip Resistor, 51.1K ohm, 0805,1%	TY-OHM
R6	Chip Resistor, 9.31K ohm, 0805, 1%	TY-OHM
R7,R8	Chip Resistor, 1.5M ohm, 0805, 5%	TY-OHM
R9	Chip Resistor, 1ohm, 1206,1%	TY-OHM
R10	Chip Resistor, 510ohm, 0805, 5%	TY-OHM
R11	Chip Resistor, 1.2K ohm, 0805, 5%	TY-OHM
R12	NC	
R14	Chip Resistor, 100K ohm, 0805, 5%	TY-OHM
T1	Transformer, Lp=0.56mH, EPC17	Not defined

Transformer



EVALUATION KITS

ACT413_5V2.4A_Rev1.1

Build Up

WINDING	TERMINAL		TURNS	WIRE			INSULATION	
	START	FINISH		TYPE	SIZE*QTY	LAYERS	WIDTH	LAYERS
P1	2	E	38	2UEW	0.20Φ*1	1	0.025*11W	1
SH1	4	NC	0.9	Copper	0.025*10W	1	0.025*11W	2
S1	B-7	A-10	6	TEX-E	0.55Φ*2	1	0.025*11W	2
P2	E	1	38	2UEW	0.20Φ*1	1	0.025*11W	1
SH2	4	NC	16	2UEW	0.15Φ*3	1	0.025*11W	2
P3	3	4	17	2UEW	0.25Φ*1	1	0.025*11W	2
SH3	4	core	3	Coopper wire	0.1Φ*1	1	0.025*11W	2

- Note: 1. Core and Bobbin: EPC17
 2. SH1,SH2, SH3 are shielding; P1, P2, P3 are primary and S1 is secondary
 3. Reverse the direction of bobbin when doing the S1

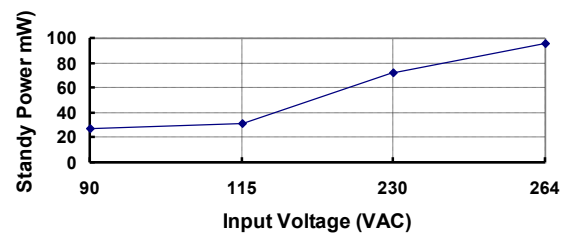
Electrical Specifications

ITEM	DESCRIPTION	CONDITION	LIMITS
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000 Vac
2	P1 Inductance	Inductance between pins 2 and 1 at 1Vac & 1kHz	0.56mH±7%
3	P1 Leakage Inductance	Inductance between 2 pins 1 with pins 3-4 and A-B shorted	75μH

Typical performance characteristics

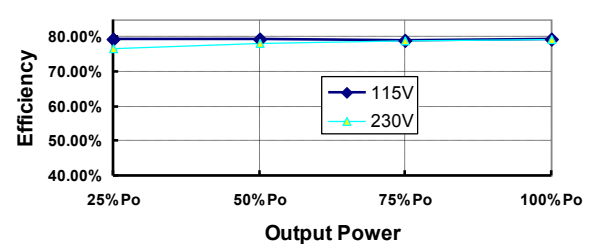
Standby Power

Standby Power Vs Input Voltage



Efficiency (24AWG,1.8m,R=0.308Ω)

Efficiency Vs Po

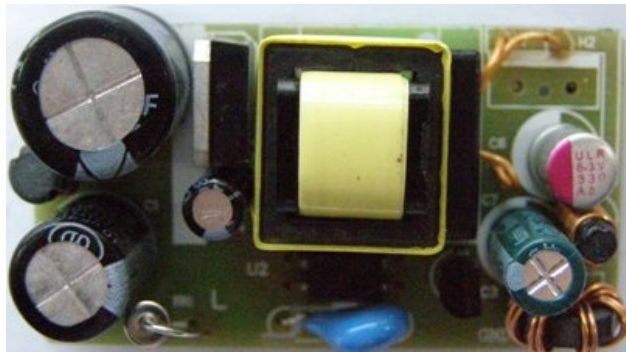


ACT510 5V/2A Universal Adaptor

Input Voltage	Device	Standby Power	Output Voltage	Output Power	Topology
90-264VAC	ACT510	<100mW	5V	10W	QR flyback

Description

ACT510 is a high performance QR mode PWM controller. Very low standby power, extensive protection features, up to 125kHz full load switching frequency and excellent load transient response make ACT510 the very attractive solutions for small size, high performance chargers.



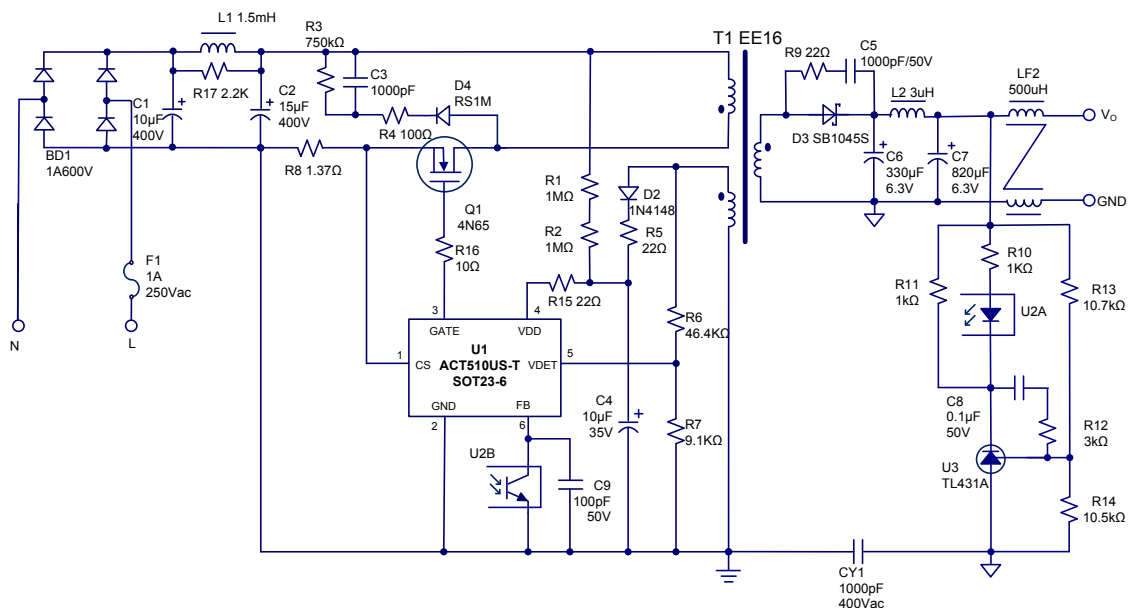
Normal size

W*L*H=29mm*53.5mm*20.5mm

Key Features

- ♦ Optimized advanced Quasi-Resonant operation.
- ♦ Advanced burst mode operation enables low standby power of 100mW and can lower than 50mW with external circuit.
- ♦ Frequency jetting and Quasi-Resonant technology to decrease EMI.
- ♦ Patented frequency foldback and *ActiveQR*[™] technology increases the average system efficiency compared to conventional solutions and exceeds the latest ES2.0 efficiency standard with good margin.
- ♦ Integrated patented line and inductance compensation, provide high accurate OCP/OLP protection.
- ♦ Built-in Soft-Start and Fast-Start circuit to decrease main external Mosfet stress, output voltage rise time and output voltage overshoot.
- ♦ Integrate comprehensive protection. In case of over temperature, over/under voltage, short winding, short current sense resistor, open loop and overload protection.
- ♦ Tiny SOT23-6 package.

Schematic

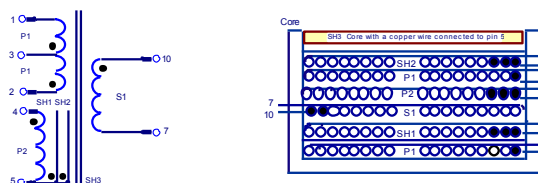


ACT510 5V/2A Universal Adaptor

Bill of Materials

REF	DESCRIPTION	MFTR
C1	Capacitor, Electrolytic, 10 μ F/400V, 12x16mm	RUBYCON
C1	Capacitor, Electrolytic, 15 μ F/400V, 12x16mm	RUBYCON
C3	Capacitor, Ceramic, 1000pF/500V, 0805,SMD	POE
C4	Capacitor, Electrolytic, 10 μ F/35V, 5x11mm	POE
C5	Capacitor, Ceramic, 1000PF/100V, 0805,SMD	POE
C6	Capacitor, Electrolytic, 330 μ F/6.3V, 6.3x8mm	KSC
C7	Capacitor, Electrolytic, 820 μ F/6.3V, 6.5x15mm	KSC
C8	Capacitor, Ceramic, 0.33 μ F/25V, 0805,SMD	POE
C9	Capacitor, Ceramic, 100pF/25V, 0805,SMD	POE
C10	Capacitor, Ceramic, 10 μ F/35V, 0805,SMD Open	POE
CY1	Safety Y1,Capacitor,1000pF/400V,Dip	UXT
BD1	Bridge Rectifier,D1010S,1000V/1.0A,SDIP	PANJIT
D2	Diode, Ultra Fast, LL4148, SMD ,75V/0.2A,	PANJIT
D3	Diode, Schottky, 45V/10A, S10U45S, SMD	Diodes
D4	Fast Recovery Rectifier, RS1M,1000V/1.0A, RMA	PANJIT
D5	Diode, Ultra Fast, LL4148, SMD Open	Good-Ark
L1	Axial Inductor, 1.5mH, 5*7,Dip	SoKa
L2	Axial Inductor, 0.55*5T, 5*7,Dip	SoKa
LF2	CM Filter,0.55*2/6T,R6K,Dip	SoKa
Q1	Mosfet Transistor, 4N65,TO-262	Infineon
PCB	PCB, L*W*T=53x29x1.6mm,Cem-1,Rev:A	Jintong
F1	Fuse,1A/250V	TY-OHM
R1,R2	Chip Resistor, 1.0M Ω 1206, 5%	TY-OHM
R3	Carbon Resistor, 750k Ω , 0805, 5%	TY-OHM
R4	Chip Resistor, 100 Ω , 0805, 5%	TY-OHM
R5,R9,R15	Chip Resistor, 22 Ω , 0805, 5%	TY-OHM
R6	Chip Resistor, 46.4 k Ω , 0805, 1%	TY-OHM
R7	Chip Resistor, 9.1k Ω , 0805, 1%	TY-OHM
R8	Chip Resistor, 1.37 Ω , 1206, 1%	TY-OHM
R10	Chip Resistor, 200 Ω , 0805, 5%	TY-OHM
R11	Chip Resistor, 1.5k Ω , 0805, 5%	TY-OHM
R12	Chip Resistor, 3.3k Ω , 0805, 5%	TY-OHM
R13	Chip Resistor, 10.7k Ω , 0805, 1%	TY-OHM
R14	Chip Resistor, 10k Ω , 0805, 1%	TY-OHM
R16	Chip Resistor, 10 Ω , 0805, 5%	TY-OHM
R17	Chip Resistor, 2.2k Ω , 0805, 5%	TY-OHM
T1	Transformer, Lp=0.54mH, EE16	
U1	IC, ACT510,SOT23-6	Active
U2	OPOT PC817C,CTR=200~300%	Infineon
IC3	TL431A TO-92	Infineon

Transformer



Build Up

WINDING	TERMINAL		TURNS	WIRE			INSULATION	
	START	FINISH		TYPE	SIZE*QTY	LAYERS	WIDTH	LAYERS
P1	2	3	51	2UEW	0.27 Φ *1	2	0.025*11W	2
SH1	NC	5	15	2UEW	0.15 Φ *3	1	0.025*11W	
S1	7	10	5	TEX-E	0.55 Φ *2	1	0.025*11W	2
P2	4	5	11	2UEW	0.20 Φ *3	1	0.025*11W	2
P1	3	1	30	2UEW	0.27 Φ *1	1	0.025*11W	2
SH2	5	NC	15	2UEW	0.15 Φ *3	1	0.025*11W	2
SH3	CORE	5	2	Copper wire	0.2 Φ *1	1	0.025*11W	2

Note: 1. Core and Bobbin: EE16

2. SH1,SH2, SH3 are shielding; P1 & P2 are primary and S1 is secondary

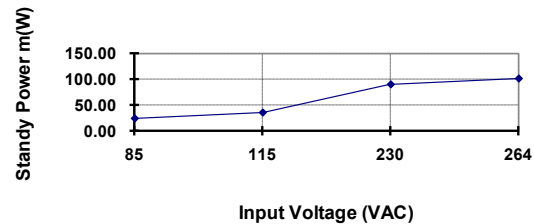
Electrical Specifications

ITEM	DESCRIPTION	CONDITION	LIMITS
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000 Vac
2	P1 Inductance	Inductance between pins 1 and 2 at 1Vac & 1kHz	0.54mH $\pm$ 7%
3	P1 Leakage Inductance	Inductance between 1 pins 2 with pins 4-5 and 7-10 shorted	25 μ H

Typical performance characteristics

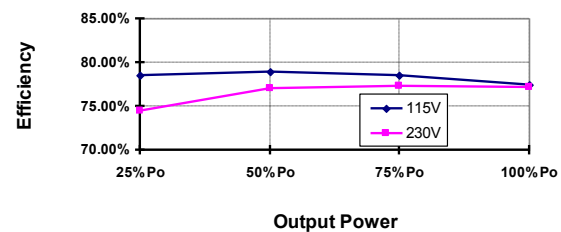
Standby Power

Standby Power Vs Input Voltage



Efficiency

Efficiency Vs Po



EVALUATION KITS

ACT510_5V2A_Rev1.1

ACT512 5V/3A Universal Adaptor Low Profile

Input Voltage	Device	Standby Power	Output Voltage	Output Power	Topology
90-264VAC	ACT512	<100mW	5V	15W	CCM & QR flyback

Description

ACT512 is a high performance QR/CCM mode PWM controller. Low standby power and extensive protection features, up to 75kHz full load switching frequency and excellent load transient response make ACT512 the most attractive for general purpose adaptor solutions.



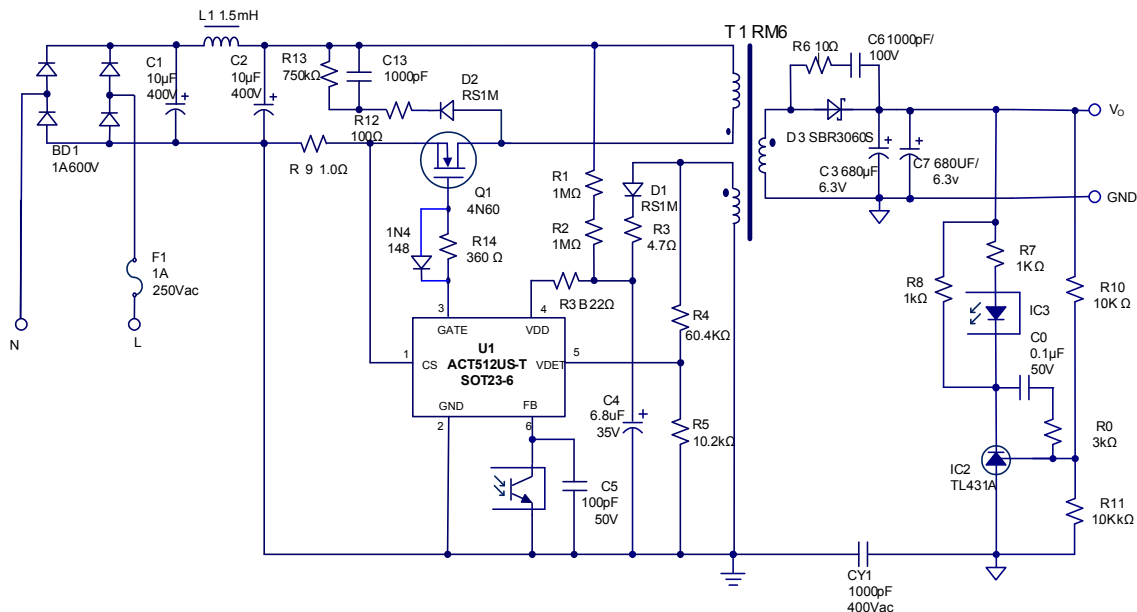
Mini size

W*L*H=38mm*38mm*22mm

Key Features

- Optimized CCM and advanced Quasi-Resonant operation.
- Advanced burst mode operation enables low standby power of 100mW and can lower than 50mW with external circuit.
- Frequency jetting and Quasi-Resonant technology to decrease EMI.
- Patented frequency foldback and *ActiveQR™* technology increases the average system efficiency compared to conventional solutions and exceeds the latest ES2.0 efficiency standard with good margin.
- Integrated patented line compensation, provide accurate OCP/OLP protection.
- Built-in Soft-Start and Fast-Start circuit to decrease main external mosfet stress, output voltage rise time and output voltage overshoot.
- Integrate comprehensive protection. In case of over temperature, over/under voltage, short winding, short current sense resistor, open loop and overload protection.
- Tiny SOT23-6 package.

Schematic

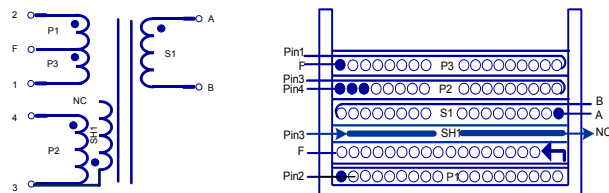


ACT512 5V/3A Universal Adaptor Low Profile

Bill of Materials

REF	DESCRIPTION	MFTR
IC1	IC, ACT512, SOT23-6	Active-Semi
C1	Capacitor, Electrolytic, 10μF/400V, 10 × 14mm	KSC
C2	Capacitor, Electrolytic, 10μF/400V, 10 × 14mm	POE
C3	Capacitor, Electrolytic, 680μF/16V, 8 × 11mm	KSC
C4	Capacitor, Electrolytic, 6.8μF/35V, SMD 0805	KSC
C5	Capacitor, Ceramic, 100PF/50V, 0603, SMD	POE
C6	Capacitor, Ceramic, 1000pF/100V, 0603, SMD	POE
C7	Capacitor, Ceramic, 470μF/10V, 1812, SMD	POE
C0	Capacitor, Ceramic, 100nF/100V, 0603, SMD	
C13	Capacitor, Ceramic, 1000pF/500V, 0805, SMD	POE
BD	MB6S 1.5A/400V	Good-Ark
D1,D2	RS1M SMD	Good-Ark
D3	Diode, Schottky, 60V/30A, SBR3060, DO-220	Good-Ark
Dgate	Diode L4148 SMD	Good-Ark
L1	Axial Inductor, 1.5mH, 5*7, DIP	SoKa
Q1	Mosfet Transistor, 04N65, TO-220	ST
PCB1	PCB, L*W*T = 38x38x1mm, Cem-1, Rev:A	Jintong
F1	Fusible, 2A/250V	TY-OHM
R1	Chip Resistor, 1M Ω, SMD 1206, 5%	TY-OHM
R2	Chip Resistor, 1M Ω, SMD 1206, 5%	TY-OHM
R3	Chip Resistor, 4.7Ω, 0805, 5%	TY-OHM
R3B	Chip Resistor, 22Ω, 0805, 5%	TY-OHM
R4	Chip Resistor, 60.4kΩ, 0603, 1%	TY-OHM
R5	Chip Resistor, 10.2kΩ, 0603, 1%	TY-OHM
R6	Chip Resistor, 10 Ω, 0603, 5%	TY-OHM
R7	Chip Resistor, 1kΩ, 0603, 5%	TY-OHM
R8	Chip Resistor, 1KΩ, 0603, 5%	TY-OHM
R0	Chip Resistor, 3kΩ, 0603, 5%	TY-OHM
R9	Chip Resistor, 1.0Ω, 1206, 1%	TY-OHM
R10,R11	Chip Resistor, 10kΩ, 0603, 1%	TY-OHM
R12	Chip Resistor, 100Ω, 0805, 5%	TY-OHM
R13	Chip Resistor, 750kΩ, 0805, 5%	TY-OHM
R14	Chip Resistor, 360Ω, 0603, 5%	TY-OHM
L1	RM6 Im=0.8mH	ST
CY1	Y capacitance, 1000pF/400V, Y1	SEC
IC3	Opto-coupler, PC817C CTR=200 SMD	Sharp
IC2	Voltage Regulator, TL431A, Vref=2.5V TO-92	ST

Transformer



Build Up

WINDING	TERMINAL		TURNS	WIRE			INSULATION	
	START	FINISH		TYPE	SIZE*QTY	LAYERS	WIDTH	LAYERS
P1	2	F	32	2UEW	0.18Φ*1	1	0.025*11W	2
SH1	3	NC	15	2UEW	0.12Φ*3	1	0.025*11W	
S1	B	A	7	2UEW	0.45Φ*2	1	0.025*11W	2
P2	4	3	17	2UEW	0.15Φ*2	1	0.025*11W	2
P3	F	1	32	2UEW	0.18Φ*1	1	0.025*11W	2

- Note: 1. Core and Bobbin: EE16
 2. SH1, SH2, SH3 are shielding; P1 & P2 are primary and S1 is secondary
 3. Reverse the direction of the bobbin when doing the S1

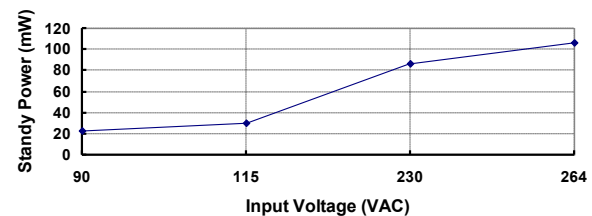
Electrical Specifications

ITEM	DESCRIPTION	CONDITION	LIMITS
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000 Vac
2	P1 Inductance	Inductance between pins 2 and 1 at 1Vac & 1kHz	0.8mH±7%
3	P1 Leakage Inductance	Inductance between pins 3 with pins 4 and A-B shorted	75μH

Typical performance characteristics

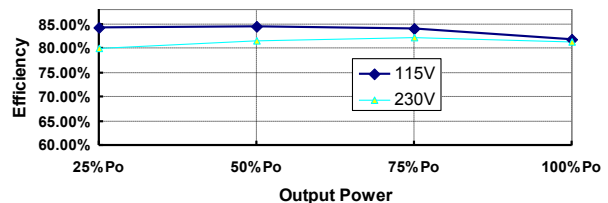
Standby Power

Standby Power Vs Input Voltage



Efficiency

Efficiency Vs Po



EVALUATION KITS

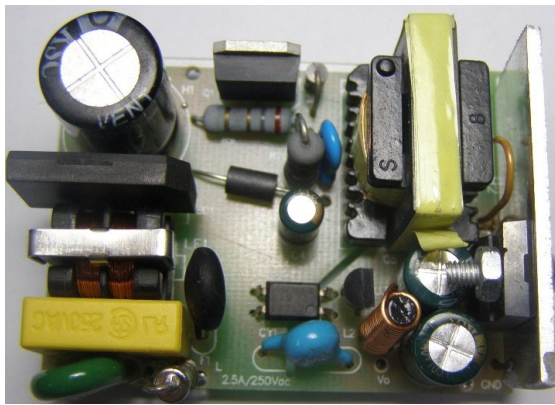
ACT512_5V3A_Rev1.1

ACT512 12V/1A Universal Adaptor For DOE Standard

Input Voltage	Device	Average Efficiency	Standby Power	Output Voltage	Output Power	Topology
90-264VAC	ACT512	84.60%	<100mW	5V	15W	CCM & QR flyback

Description

ACT512 is a high performance QR/CCM mode PWM controller. Low standby power and extensive protection features, up to 75kHz full load switching frequency and excellent load transient response make ACT512 the most attractive for general purpose adaptor solutions.



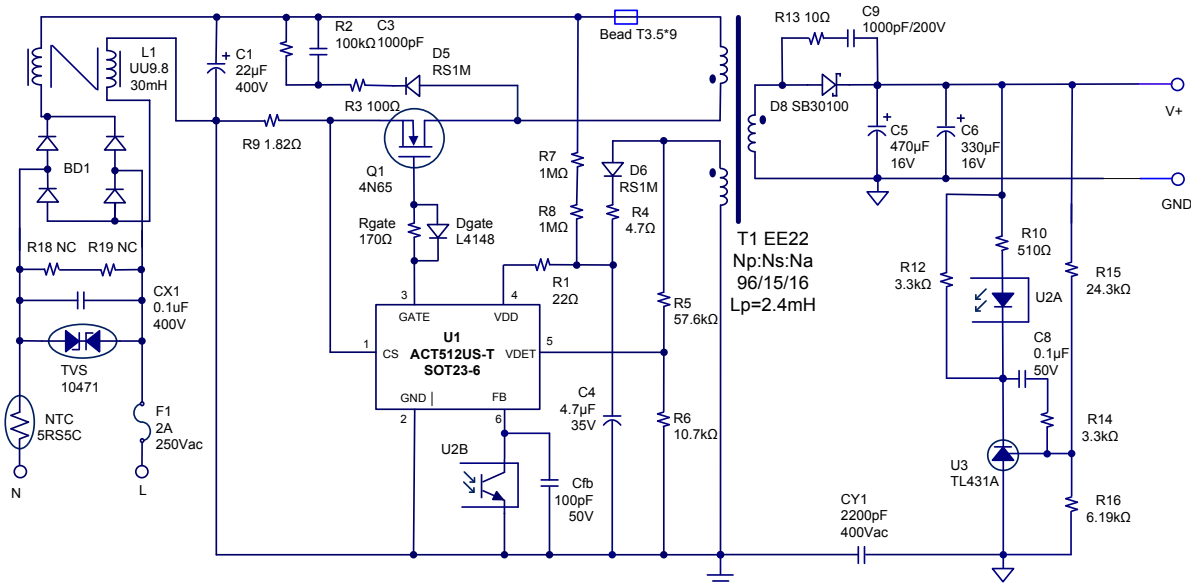
Normal size

W*L*H=41.5mm*57.5mm*25mm

Key Features

- Optimized CCM and advanced Quasi-Resonant operation.
- Advanced burst mode operation enables low standby power of 100mW and can lower than 50mW with external circuit.
- Frequency jetting and Quasi-Resonant technology to decrease EMI.
- Patented frequency foldback and *ActiveQR™* technology increases the average system efficiency compared to conventional solutions and exceeds the latest DOE efficiency standard with good margin.
- Integrated patented line compensation, provide accurate OCP/OLP protection.
- Built-in Soft-Start and Fast-Start circuit to decrease main external Mosfet stress, output voltage rise time and output voltage overshoot.
- Integrate comprehensive protection. In case of over temperature, over/under voltage, short winding, short current sense resistor, open loop and overload protection.
- Tiny SOT23-6 package.

Schematic

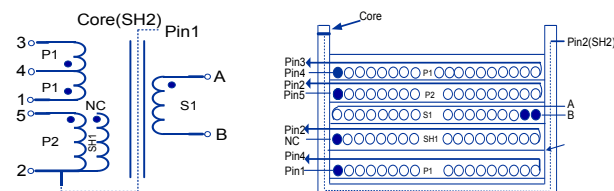


ACT512 12V/1A Universal Adaptor For DOE Standard

Bill of Materials

REF	DESCRIPTION	MFTR
IC1	IC, ACT512, SOT23-6	Active-Semi
C1	Capacitor, Electrolytic, 22μF/400V, 18 × 20mm	KSC
C3	Capacitor, Ceramic, 1000pF/1KV, DIP	POE
C4	Capacitor, Electrolytic, 4.7μF/35V, 5*11mm	KSC
C5	Capacitor, Solid, 470uF/16V, 10*16mm	Rubcon
C6	Capacitor, Electrolytic, 330uF/16V, 8*16mm	KSC
C8	Capacitor, Ceramic, 0.1μF/50V, 0805, SMD	POE
C9	Capacitor, Ceramic, 1000pF/100V, 0805, SMD	POE
Cfb	Capacitor, Ceramic, 100pF/50V, 0805, SMD	POE
BD1	GBL10 2A/600V 4Pin DIP	Good-Ark
D5	Diode, Ultra Fast, FR107, 1000V/1.0A, DO-41	Good-Ark
D6	RS1M SMD	Good-Ark
D8	Diode, Schottky, 100V/30A, SBR30100, DO-220	Diodes
Dgate	Diode L4148 SMD	Good-Ark
L1	CM Inductor, 30mH, UU9.8	SoKa
Q1	Mosfet Transistor, 04N65, TO-220	Infineon
PCB1	PCB, L*W*T = 58x42x1.6mm, Cem-1, Rev:A	Jintong
F1	Fusible, 2A/250V	TY-OHM
R1	Chip Resistor, 22 Ω, SMD 0805, 5%	TY-OHM
R2	metal Resistor, 100K Ω, DIP, 1W, 5%	TY-OHM
R3	Chip Resistor, 100Ω, 0805, 5%	TY-OHM
R4	Chip Resistor, 4.7Ω, 0805, 5%	TY-OHM
R5	Chip Resistor, 57.6kΩ, 0805, 1%	TY-OHM
R6	Chip Resistor, 10.7KΩ, 0805, 1%	TY-OHM
R7,R8	Chip Resistor, 1MΩ, 5%	TY-OHM
R9	metal Resistor, 1.82Ω, 1W, 1%	TY-OHM
R10	Chip Resistor, 510Ω, 1/4W, 5%	TY-OHM
R12	Chip Resistor, 3.3KΩ, 0805, 5%	TY-OHM
R13	Chip Resistor, 10Ω, 0805, 5%	TY-OHM
R14	Chip Resistor, 3.3KΩ, 0805, 5%	TY-OHM
R15	Chip Resistor, 24.3kΩ, 0805, 1%	TY-OHM
R16	Chip Resistor, 6.19KΩ, 0805, 1%	TY-OHM
Rgate	Chip Resistor, 170Ω, 0805, 5%	TY-OHM
T1	EE22 Im=2.4mH	
CX1	X capacitance, 0.1μF/400V, X1	SEC
NTC	Thermistor, SC053	TY-OHM
TVS	Varistor, 10471	TY-OHM
CY1	Y capacitance, 1000pF/400V, Y1	SEC
IC2	Opto-coupler, PC817C CTR=200 dip-4	Sharp
IC3	Voltage Regulator, TL431A, Vref=2.5V TO-92	ST

Transformer

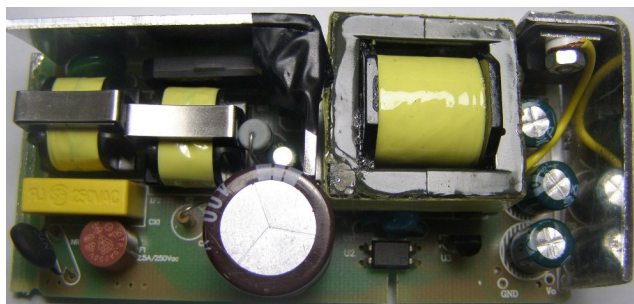


ACT513 12V/2A Universal Adaptor For DOE Standard

Input Voltage	Device	Average Efficiency	Standby Power	Output Voltage	Output Power	Topology
90-264VAC	ACT513	88.22%	94mW	12V	24W	CCM &QR flyback

Description

ACT513 is a high performance QR/CCM mode PWM controller. Low standby power and extensive protection features, up to 75kHz full load switching frequency and excellent load transient response make ACT513 the most attractive for general purpose adaptor solutions.



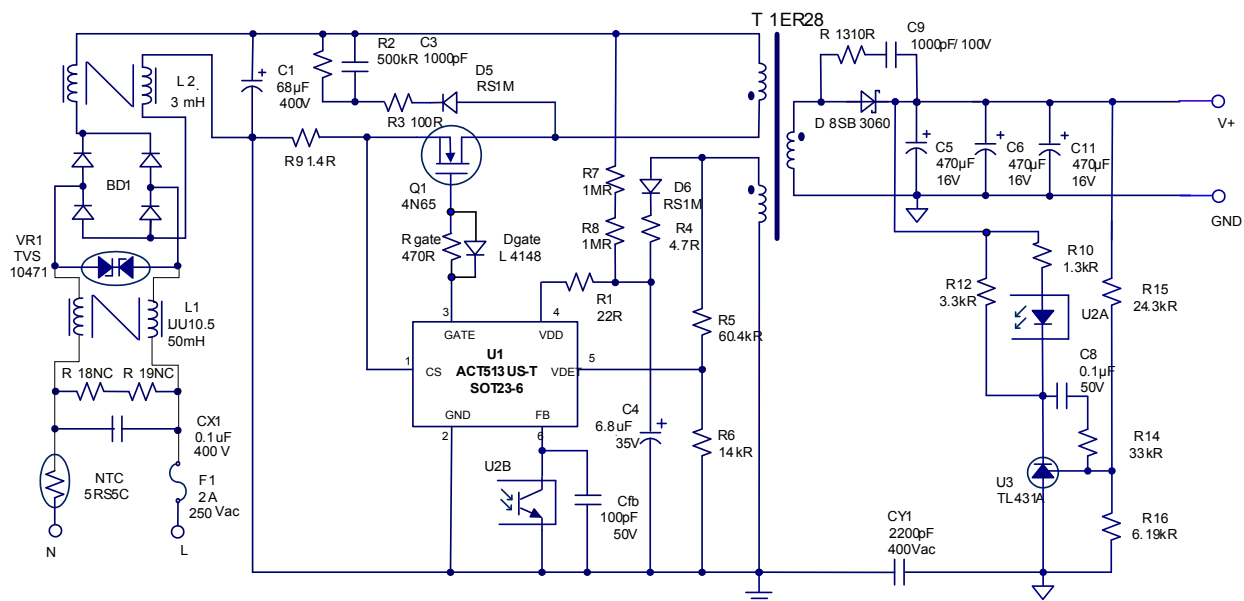
Normal size

W*L*H=44mm*92mm*29mm

Key Features

- ◆ Optimized CCM and advanced Quasi-Resonant operation.
- ◆ Advanced burst mode operation enables low standby power of 100mW and can lower than 50mW with external circuit.
- ◆ Frequency jetting and Quasi-Resonant technology to decrease EMI.
- ◆ Patented frequency foldback and *ActiveQRTM* technology increases the average system efficiency compared to conventional solutions and exceeds the latest DOE efficiency standard with good margin.
- ◆ Integrated patented line compensation, provide accurate OCP/OLP protection.
- ◆ Built-in Soft-Start and Fast-Start circuit to decrease main external mosfet stress, output voltage rise time and output voltage overshoot.
- ◆ Integrate comprehensive protection. In case of over temperature, over/under voltage, short winding, short current sense resistor, open loop and overload protection.
- ◆ Tiny SOT23-6 package.

Schematic

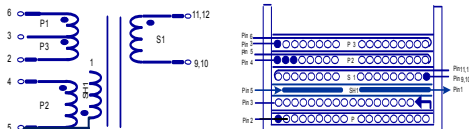


ACT513 12V/2A Universal Adaptor For DOE Standard

Bill of Materials

REF	DESCRIPTION	MFTR
IC1	IC, ACT513, SOT23-6	Active-Semi
C1	Capacitor, Electrolytic, 68μF/400V, 18 × 20mm	Rubycon
C3	Capacitor, Ceramic, 1000pF/1KV, DIP	POE
C4	Capacitor, Electrolytic, 6.8μF/35V, 5*11mm	KSC
C5	Capacitor, Electrolytic, 470uF/16V, 8*16mm	POE
C6	Capacitor, Electrolytic, 470uF/16V, 8*16mm	POE
C8	Capacitor, Ceramic, 0.1μF/50V, 0805, SMD	POE
C9	Capacitor, Ceramic, 1000pF/100V, 0805, SMD	POE
C11	Capacitor, Electrolytic, 470uF/16V, 8*16mm	POE
Cfb	Capacitor, Ceramic, 100pF/50V, 0805, SMD	POE
BD1	GBL10 2A/600V 4Pin DIP	Good-Ark
D5	RS1M, 1000V/1.0A, SMD	Good-Ark
D6	RS1M, 1000V/1A, SMD	Good-Ark
D8	Diode, Schottky, 60V30A, SBR3060, DO-220	Good-Ark
Dgate	Diode L4148 SMD	Good-Ark
LF1	CM Inductor, 50mH, UU10.5	SoKa
LF2	CM Inductor, 3mH	SoKa
Q1	Mosfet Transistor, 04N65, TO-220	AUK
PCB1	PCB, L*W*T = 93x44x1.6mm, Cem-1, Rev:A	Jintong
F1	Fusible, 2A/250V	TY-OHM
R1	Chip Resistor, 22 Ω, SMD 0805, 5%	TY-OHM
R2	metal Resistor, 500K Ω, DIP, 1W, 5%	TY-OHM
R3	Chip Resistor, 100Ω, 0805, 5%	TY-OHM
R4	Chip Resistor, 4.7Ω, 0805, 5%	TY-OHM
R5	Chip Resistor, 60.4kΩ, 0805, 1%	TY-OHM
R6	Chip Resistor, 14KΩ, 0805, 1%	TY-OHM
R7, R8	Chip Resistor, 1MΩ, 5%	TY-OHM
R9	metal Resistor, 1.4Ω, 1W, 1%	TY-OHM
R10	Chip Resistor, 1.3KΩ, 5%	TY-OHM
R12	Chip Resistor, 3.3KΩ, 0805, 5%	TY-OHM
R13	Chip Resistor, 10Ω, 0805, 5%	TY-OHM
R14	Chip Resistor, 33KΩ, 0805, 5%	TY-OHM
R15	Chip Resistor, 24.3kΩ, 0805, 1%	TY-OHM
R16	Chip Resistor, 6.19KΩ, 0805, 1%	TY-OHM
Rgate	Chip Resistor, 470Ω, 0805, 5%	TY-OHM
T1	ER28 Im=4mH	
CX1	X capacitance, 0.1μF/400V, X1	
NTC	Thermistor, SC053	TY-OHM
TVS	Varistor, 10471	TY-OHM
CY1	Y capacitance, 1000pF/400V, Y1	SEC
IC2	Opto-coupler, PC817C CTR=200 dip-4	Sharp
IC3	Voltage Regulator, TL431A, Vref=2.5V TO-92	ST

Transformer



Build Up

WINDING	TERMINAL			WIRE			INSULATION	
	START	FINISH	TURNS	TYPE	SIZE*QTY	LAYERS	WIDTH	LAYERS
P1	2	3	61	2UEW	0.2Φ*1	1	0.025*11W	2
SH1	5	1	20	2UEW	0.2Φ*3	1	0.025*11W	2
S1	9,10	11,12	14	2UEW	0.8Φ1	1	0.025*11W	2
P2	4	5	15	2UEW	0.2Φ*4	1	0.025*11W	2
P3	3	6	61	2UEW	0.2Φ*1	1	0.025*11W	2

- Note: 1. Core and Bobbin: ER28
 2. SH1 is shielding; P1, P2, & P3 are primary and S1 is secondary
 3. Reverse the direction of bobbin when doing the S1

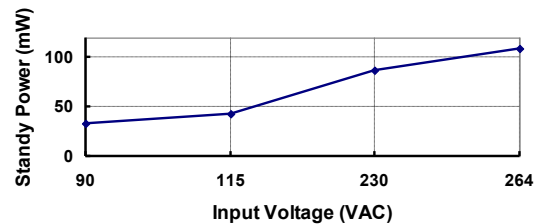
Electrical Specifications

ITEM	DESCRIPTION	CONDITION	LIMITS
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000 Vac
2	P1 Inductance	Inductance between pins 11 and 2 at 1Vac & 1kHz	4mH±7%
3	P1 Leakage Inductance	Inductance between pins 11 and 1 with pins 5-8 and 3-1 shorted	70μH

Typical performance characteristics

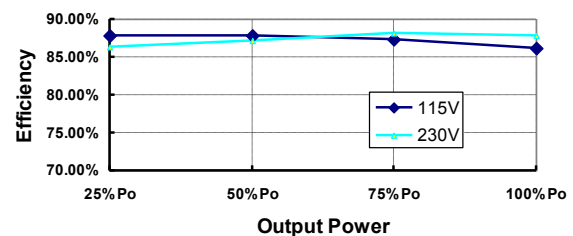
Standby Power

Standby Power Vs Input Voltage



Efficiency (24AWG, 1.8M, R=0.380Ω)

Efficiency Vs Po



EVALUATION KITS

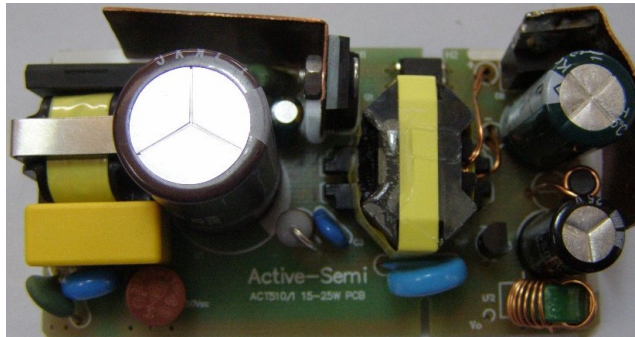
ACT513_12V2A_DOE_Rev1.0

ACT512 15V/3A Universal Adaptor

Input Voltage	Device	Standby Power	Output Voltage	Output Power	Topology
90-264VAC	ACT512	<150mW	15V	45W	CCM & QR flyback

Description

ACT512 is a high performance QR/CCM mode PWM controller. Low standby power and extensive protection features, up to 75kHz full load switching frequency and excellent load transient response make ACT512 the most attractive for general purpose adaptor solutions.



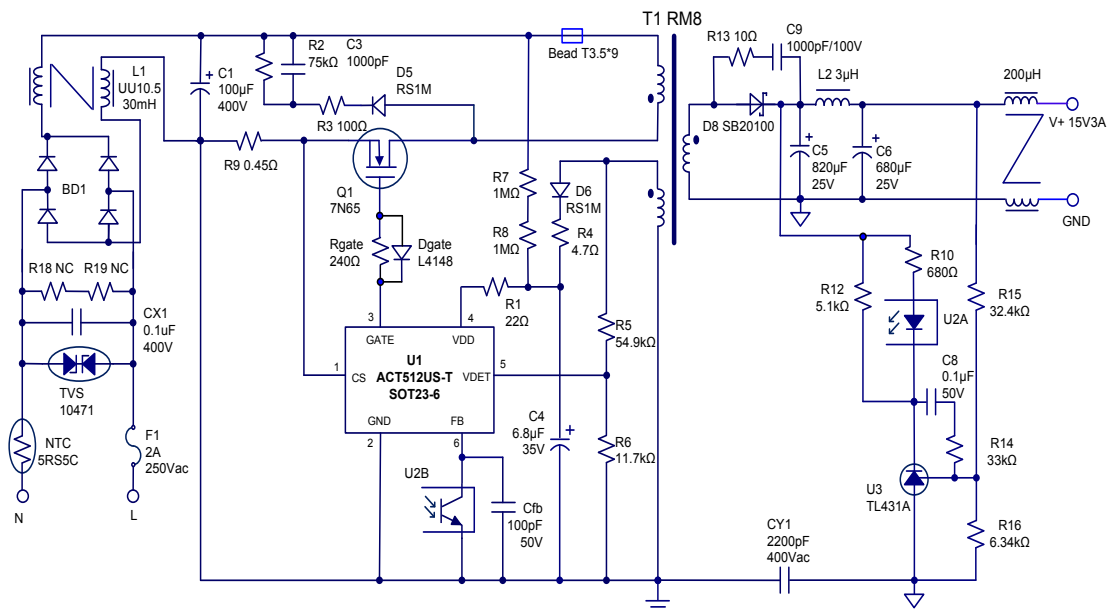
Normal size

W*L*H=44mm*84mm*24mm

Key Features

- Optimized CCM and advanced Quasi-Resonant operation.
- Advanced burst mode operation enables low standby power of 100mW and can lower than 50mW with external circuit.
- Frequency jetting and Quasi-Resonant technology to decrease EMI.
- Patented frequency foldback and *ActiveQR*[™] technology increases the average system efficiency compared to conventional solutions and exceeds the latest ES2.0 efficiency standard with good margin.
- Integrated patented line compensation, provide accurate OCP/OLP protection.
- Built-in Soft-Start and Fast-Start circuit to decrease main external mosfet stress, output voltage rise time and output voltage overshoot.
- Integrate comprehensive protection. In case of over temperature, over/under voltage, short winding, short current sense resistor, open loop and overload protection.
- Tiny SOT23-6 package.

Schematic

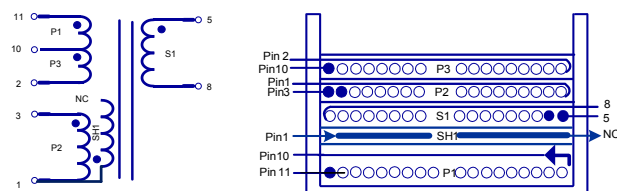


ACT512 15V/3A Universal Adaptor

Bill of Materials

REF	DESCRIPTION	MFTR
IC1	IC, ACT512, SOT23-6	Active-Semi
C1	Capacitor, Electrolytic, 100μF/400V, 18 × 20mm	KSC
C3	Capacitor, Ceramic, 1000pF/1KV, DIP	POE
C4	Capacitor, Electrolytic, 6.8μF/35V, 5*11mm	KSC
C5	Capacitor, Electrolytic, 820μF/25V, 10*16mm	POE
C6	Capacitor, Electrolytic, 680μF/25V, 8*16mm	POE
C8	Capacitor, Ceramic, 0.1μF/50V, 0805, SMD	POE
C9	Capacitor, Ceramic, 1000pF/100V, 0805, SMD	POE
Cfb	Capacitor, Ceramic, 100pF/50V, 0805, SMD	POE
BD1	GBL10 2A/600V 4Pin DIP	Good-Ark
D5	Diode, Ultra Fast, FR107, 1000V/1.0A, DO-41	Good-Ark
D6	RS1M SMD	Good-Ark
D8	Diode, Schottky, 100V/20A, SBR20100, DO-220	Good-Ark
Dgate	Diode L4148 SMD	Good-Ark
LF1	CM Inductor, 50mH, UU10.5	SoKa
LF2	Axial Inductor, 0.55*ST, 5*7, Dip 200uH	SoKa
L2	DM Inductor, 3μH, R5	SoKa
Q1	Mosfet Transistor, 07N65, TO-220	ST
PCB1	PCB, L*W*T=49x68x1.6mm, Cem-1, Rev:A	Jintong
F1	Fusible, 2A/250V	TY-OHM
R1	Chip Resistor, 22 Ω, SMD 0805, 5%	TY-OHM
R2	metal Resistor, 100K Ω, DIP, 1W, 5%	TY-OHM
R3	Chip Resistor, 100Ω, 0805, 5%	TY-OHM
R4	Chip Resistor, 4.7Ω, 0805, 5%	TY-OHM
R5	Chip Resistor, 54.9kΩ, 0805, 1%	TY-OHM
R6	Chip Resistor, 11.8KΩ, 0805, 1%	TY-OHM
R7,R8	Chip Resistor, 1MΩ, 5%	TY-OHM
R9	metal Resistor, 0.45Ω, 1W, 1%	TY-OHM
R10	Chip Resistor, 510Ω, 1/4W, 5%	TY-OHM
R12	Chip Resistor, 3.3KΩ, 0805, 5%	TY-OHM
R13	Chip Resistor, 10Ω, 0805, 5%	TY-OHM
R14	Chip Resistor, 33KΩ, 0805, 5%	TY-OHM
R15	Chip Resistor, 32.4kΩ, 0805, 1%	TY-OHM
R16	Chip Resistor, 6.34KΩ, 0805, 1%	TY-OHM
Rgate	Chip Resistor, 240Ω, 0805, 5%	TY-OHM
T1	Rm8 Im=0.4mH	ST
CX1	X capacitance, 0.1μF/400V, X1	
NTC	Thermistor, SC053	TY-OHM
TVS	Varistor, 10471	TY-OHM
CY1	Y capacitance, 1000pF/400V, Y1	SEC
IC2	Opto-coupler, PC817C CTR=200 dip-4	Sharp
IC3	Voltage Regulator, TL431A, Vref=2.5V TO-92	ST

Transformer



Build Up

WINDING	TERMINAL		TURNS	WIRE			INSULATION	
	START	FINISH		TYPE	SIZE*QTY	LAYERS	WIDTH	LAYERS
P1	11	10	21	2UEW	0.40Φ*1	1	0.025*11W	2
SH1	1	NC	26	2UEW	0.15Φ*2	1	0.025*11W	
S1	8	5	8	2UEW	0.50Φ*2	1	0.025*11W	2
P2	3	1	7	2UEW	0.25Φ*2	1	0.025*11W	2
P3	10	2	21	2UEW	0.40Φ*1	1	0.025*11W	2

- Note: 1. Core and Bobbin: RM8
 2. SH1 is shielding; P1, P2, & P3 are primary and S1 is secondary
 3. Reverse the direction of bobbin when doing the S1

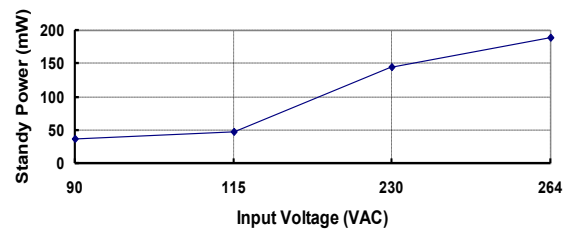
Electrical Specifications

ITEM	DESCRIPTION	CONDITION	LIMITS
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000 Vac
2	P1 Inductance	Inductance between pins 11 and 2 at 1Vac & 1kHz	0.4mH±%7
3	P1 Leakage Inductance	Inductance between pins 11 and 1 with pins 5-8 and 3-1 shorted	40μH

Typical performance characteristics

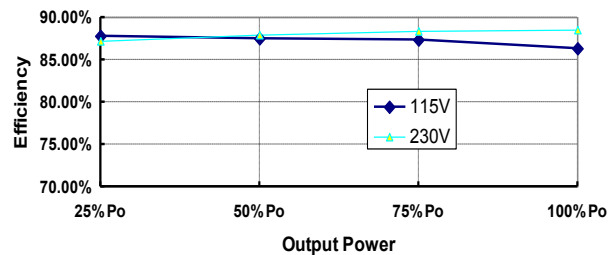
Standby Power

Standby Power Vs Input Voltage



Efficiency (24AWG, 1.8M, R=0.380Ω)

Efficiency Vs Po



EVALUATION KITS

ACT512_15V3A_Rev1.0

Power Management Units (PMU/PMICs)

PMU Product Selection Guide

Applications

- *Smartwatches, Wearables, POS, HMI, M2M & White Goods*
- *Smartphones & Tablets*
- *Automobile Black Box*

ACT88xx Family

PART #	POWER MANAGER		I ² C	APPLICATION PROCESSORS
	STEP-DOWN	LDO		
ACT8848	4	9	•	TELECHIPS (TCC88xx)
ACT8847	4	9	•	FREESCALE (i.MX51, i.MX53) SAMSUNG (S5PC210, S5PV310)
ACT8846	4	9	•	ROCKCHIP (RK3066, RK3188)
ACT8865	3	4	•	ATMEL (SAMA5D[31/33/34/35/36], SAM9G[15/25/35/45/46], SAM9X[25/35], SAM9M[10/11], SAM9N[11/12])
ACT8899	3	4	•	FREESCALE (i.MX51, i.MX53)
ACT8898	3	4	•	MARVELL (88AP166E, 88AP168)
ACT8897	3	4	•	SAMSUNG (S5PC100/110, S5PV210)
ACT8896	3	4	•	SAMSUNG (S3C6410)
ACT8895	3	4	•	SIRF (Atlas IV)
ACT8894	3	4	•	SAMSUNG (S3C2416/2440/2450)
ACT8893	3	4	•	CORELOGIC (Lucy)
ACT8892	3	4	•	TI (DM368) DaVinci™ Digital Video Processor Family
ACT8891	3	4	•	ROCKCHIP (RK2918, RK2928, RK2926)
ACT8890	3	4	•	Generic

PMU Product Selection Guide

ACT89xx Family

PART #	POWER MANAGER			I ² C	APPLICATION PROCESSORS
	CHARGER	STEP-DOWN	LDO		
ACT8945A	ActivePath™	3	4	•	ATMEL (SAMA5D[31/33/34/35/36], SAM9G[15/25/35/45/46], SAM9X[25/35], SAM9M[10/11], SAM9N[11/12])
ACT8942	ActivePath™	3	4	•	AMLOGIC (AML8726-M3)
ACT8939	ActivePath™	3	4	•	FREESCALE (i.MX51, i.MX53)
ACT8938	ActivePath™	3	4	•	MARVELL (88AP166E, 88AP168)
ACT8937A	ActivePath™	3	4	•	SAMSUNG (S5PC100/110, S5PV210)
ACT8936	ActivePath™	3	4	•	SAMSUNG (S3C6410)
ACT8935	ActivePath™	3	4	•	SIRF (Atlas IV)
ACT8934A	ActivePath™	3	4	•	SAMSUNG (S3C2416/2440/2450)
ACT8933	ActivePath™	3	4	•	CORELOGIC (Lucy)
ACT8931A	ActivePath™	3	4	•	ROCKCHIP (RK2918, RK2928, RK2926)
ACT8930	ActivePath™	3	4	•	Generic

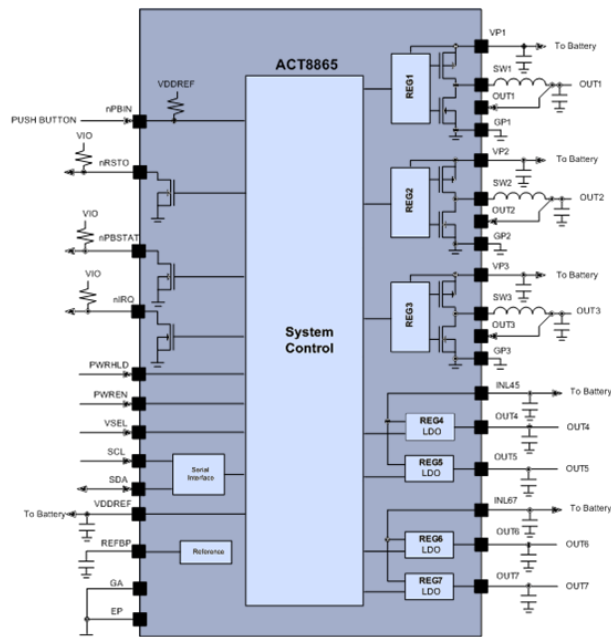
PART NUMBER	PROCESSOR
ACT8600/ACT8601	Ingenic JZ4770/JZ4775/JZ4780/JZ4785
ACT8626/ACT8627	Amlogic AML8726-M3/AML8726-Mx
ACT8931A	Rockchip RK2918/RK/2926/RK2928/RK3026/RK3028
ACT8846	Rockchip RK3168/RK3188
ACT8840	CoreLogic Falcos
ACT8847	Samsung Exynos 4210
ACT8847+ACT8849	Samsung Exynos 4412
ACT8865	Atmel SAMA5 Cortex-A5 Series and SAM9 Series
ACT8945A	Atmel SAMA5 Cortex-A5 Series and SAM9 Series

ACT8865

IC Features

- ◆ Features
 - ◆ Three Step-Down DC/DC Converters
 - ◆ Four Low-Dropout Linear Regulators
 - ◆ Minimal External Components
 - ◆ Tiny 4x4mm TQFN44-32 Package
 - ◆ 0.75mm Package Height
- ◆ Power manager
 - ◆ I²C™ Serial Interface for PMIC control
 - ◆ Integrated Enable/Disable Sequencing
 - ◆ Push Button for Power-Up/ Power-Down and Reset.
 - ◆ System Voltage Monitor with programmable threshold
 - ◆ Power Fail detector on each output channel
 - ◆ Interrupt Output for Power Fail Conditions
 - ◆ Interrupt Output line for Power fail conditions

Application Circuit

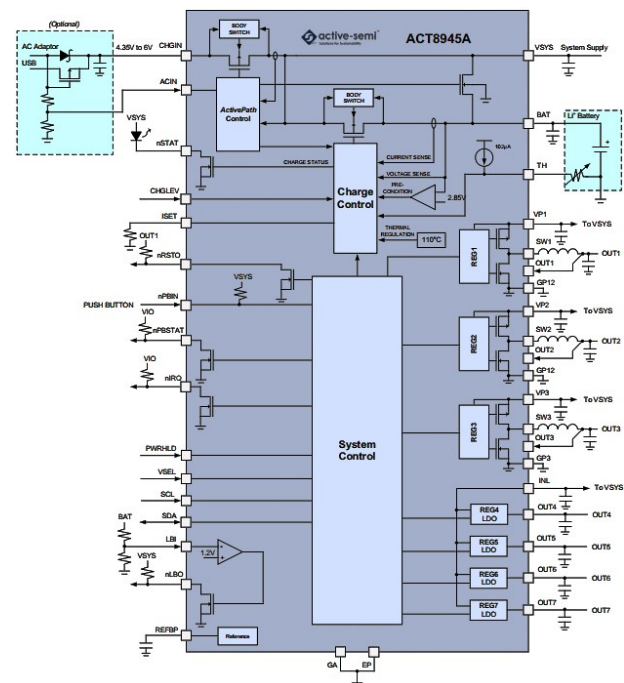


ACT8945A

IC Features

- ◆ Features
 - ◆ Three Step-Down DC/DC Converters
 - ◆ Four Low-Dropout Linear Regulators
 - ◆ Integrated ActivePath™ Charger
 - ◆ Advanced Power Source Management
 - ◆ Input Protection up to 12V
 - ◆ Tiny 5x5mmTQFN55-40 Package
 - ◆ Minimal External Components
- ◆ Power manager
 - ◆ I²C™ Serial Interface for PMIC control
 - ◆ Integrated Enable/Disable Sequencing
 - ◆ Push Button for Power-Up/ Power-Down and Reset.
 - ◆ System Voltage Monitor with programmable threshold
 - ◆ Power Fail detector on each output channel
 - ◆ Interrupt Output for Power Fail Conditions

Application Circuit



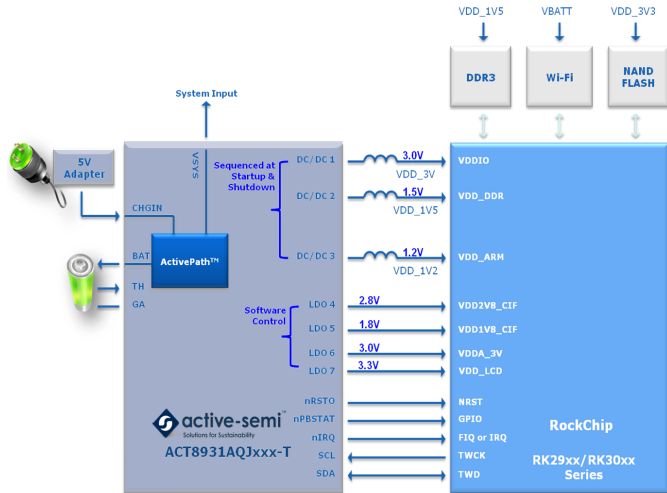
Highly Intergrated Power Management Solutions

Rockchip RK2918/RK2926/RK2928/RK3026/RK3028 Solution

Description

The ACT8931A is an advanced *ActivePMU*[™] that was developed specifically for powering applications using high-performance processors, such as the Rockchip RK2918, RK2926, RK2928, RK3026 and RK3028. This device supplies all major power rails and interface signals required by the RK2918, RK2926, RK2928, RK3026 and RK3028 as well as an *ActivePath*[™] charger, and a variety of features that greatly simplify the power management system design.

Application Diagram

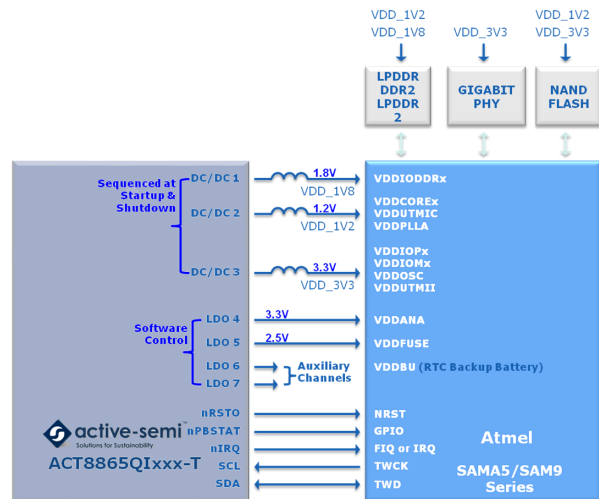


Atmel SAM5A5 Cortex-A5 and SAM9 Solution

Description

The ACT8865 is a complete, cost effective, highly-efficient *ActivePMU*[™] power management solution, optimized for the unique power, voltage-sequencing, and control requirements of the Atmel SAM5A5D3 series: SAM5A5D3[31/33/34/35/36] and SAM9 series: SAM9G[15/25/35/45/46], SAM9X[25/35], SAM9M[10/11], SAM9N[11/12] processors. It is ideal for a wide range of high performance portable handheld applications such as human-machine interfaces, control panels, smart grid infrastructures, network gateways, M2M systems, 2D barcode scanners, barcode printers, machine vision equipment, as well as home and commercial building automations, POS terminals, medical devices and white goods.

Application Diagram



For complete list of Parts, Datasheets, EVKs and Applications info, visit
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Or write to
sales@active-semi.com

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www.active-semi.com

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