



Innovative Green Power Solutions



AC/DC Charger/Adapter Reference Designs ACT41X

Rev 1.5 Jan 2014

Application Change Note

Revision History	2014 - Jan - 23	Rev 1.5
Page 4.5	Update ACT410 5V2.1A application solution transformer and parameter.	
Page 6.7	Remove ACT410 5V2.4A solution, Add ACT413 5V2.4A application solution (EPC17).	
Page 8.9	Add ACT411 12V1A application solution(EE16).	
Page 10.11	Add ACT412 12V0.4A shaver charger solution .	
Page 4.6.8	Update changed schematic pin definition.	

AC/DC Converters – ActiveQR™

Applications

- AC/DC Adaptors/Chargers for Cell Phones, Cordless Phone, PDAs, E-books
- Adaptors for Portable Media Player, DSCs, Set-top boxes, DVD players, records
- Linear Adapter Replacements

	ACT410	ACT411	ACT412	ACT413	
Topology	PSR+QR	PSR+QR	PSR+QR	PSR+QR	
Power	<30W	<30W	<30W	<30W	
Standby Power	<100mW	<100mW	<150mW	<100mW	
Package	SOT23-6	SOT23-6	SOT23-6	SOT23-6	
Max Frequency	100~120kHz	100~120KHz	100~120KHz	70~80KHz	
Frequency Foldback	Y	Y	Y	Y	
Frequency Jittering	Y	Y	Y	Y	
Auto Restart	Y	Y	Y	Y	
Soft-Start	Y	Y	Y	Y	
VDD OVP	Y	Y	Y	Y	
Lm Compensation	Y	Y	Y	Y	
CC/CP Accuracy	+/-15%	+/-15%	Constant power	+/-15%	
Brown Out Protection	Y	Y	Y	Y	
OTP	Y	Y	Y	Y	
Short Circuit Protection	Y	Y	Y	Y	
Short Winding Protection	Y	Y	Y	Y	
Compensation	External	External	External	External	
Open Loop Protection	Y	Y	Y	Y	

①: QR is quasi-resonant.

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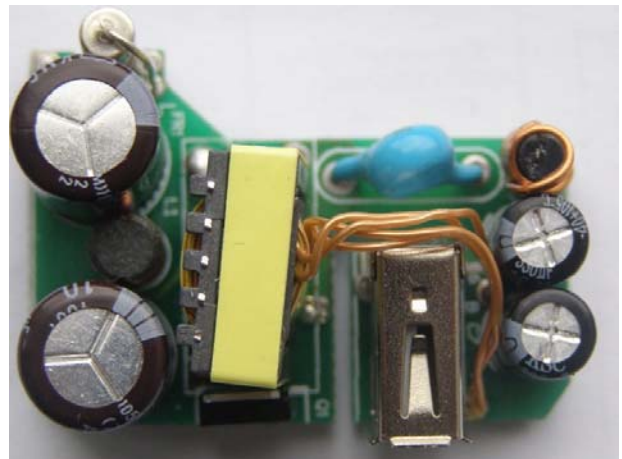
LOW COST ACT410 5V/2.1A UNIVERSAL ADAPTOR

Input Voltage	Device	Vo	Po	Transformer Core	Standby Power	Efficiency	Topology
90-264VAC	ACT410	5V	10.5W	EFD15	90mW	77.56%	QR flyback

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.

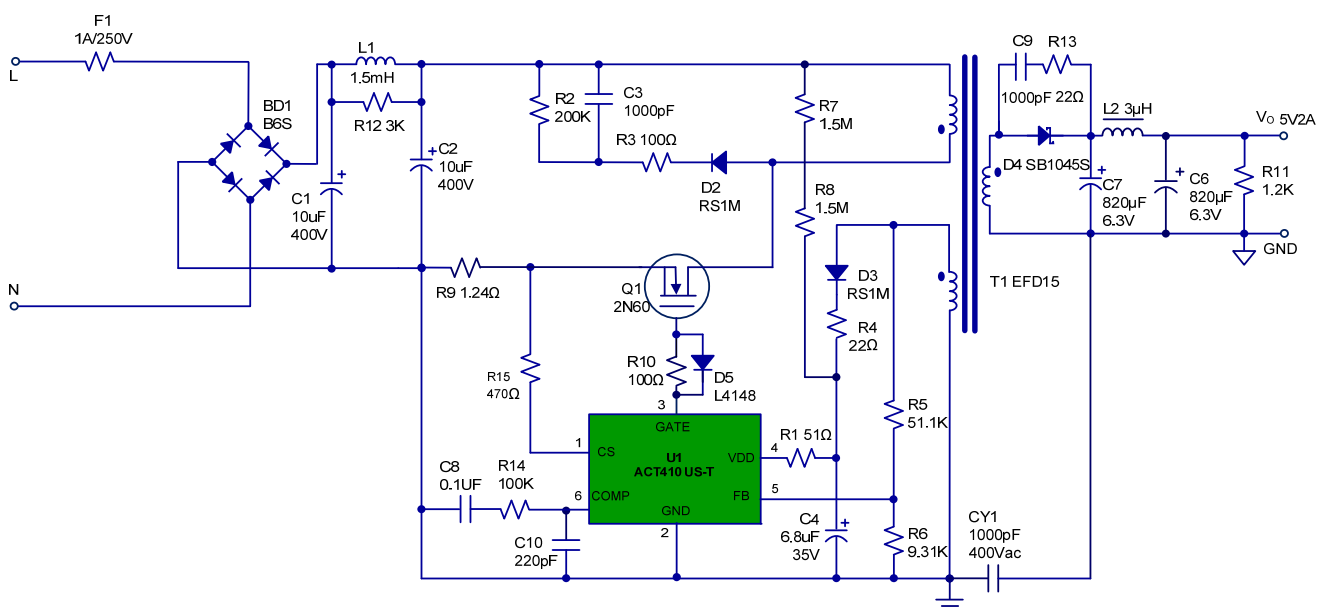
Demo Board Picture



Mini size

W*L*H=28mm*40mm*16mm

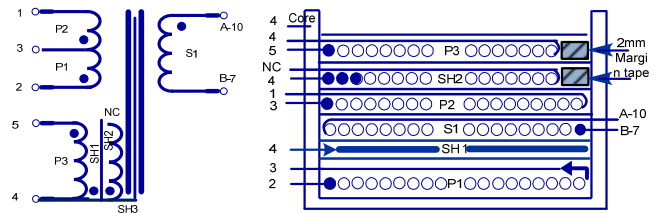
Schematic



Picture 1

Bill of Materials

REF	DESCRIPTION	MFTR
U1	IC, ACT410,SOT23-6	Active-Semi.
C1,C2	Capacitor, Electrolytic, 10uF/400V, 10x15mm	KSC
C3	Capacitor, Ceramic, 1000pF/500V, 0805,SMD	POE
C4	Capacitor, Electrolytic,6.8uF/35V,5x11mm	KSC
C6,C7	Capacitor, Electrolytic, 820µF/6.3V, 6.3 × 16mm	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	Bridge Rectifier,D1010S,1000V/1.0A,SDIP	PANJIT
D2,D3	Fast Recovery Rectifier, RS1M,1000V/1.0A, RMA	PANJIT
D4	Diode, Schottky, 45V/10A, S10U45S, SMD	Diodes
D5	Diode, 1N4148 SMD	PANJIT
L1	Axial Inductor, 1.5mH, 5*7,Dip	SoKa
L2	Axial Inductor, 0.55*5T, 5*7,Dip	SoKa
Q1	Mosfet Transistor, 2N60,TO-251	Infineon
PCB1	PCB, L*W*T=40x28x1.6mm,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,R10	Chip Resistor, 100 ohm, 0805, 5%	TY-OHM
R4,R13	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, 1.24ohm, 1206,1%	TY-OHM
R11	Chip Resistor, 1.2K 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, 470 ohm, 0805, 5%	TY-OHM
T1	Transformer, Lp=0.41mH, EED15	Not defined



Build up

Winding	Terminal		Turns	Wire			Insulation	
	Start	Finish		Type	Size*QT Y	La yer	Thick/ Wide	La yer
P1	2	3	34	2UEW	0.20Φ*1 0.025 *10W	1	0.025*11W	1
SH1	4	NC	0.9	Copper		1	0.025*11W	2
S1	B-7	A-10	5	TEX-E	0.55Φ*2	1	0.025*11W	2
P2	3	1	34	2UEW	0.20Φ*1	1	0.025*11W	1
SH2	4	NC	16	2UEW	0.15Φ*3	1	0.025*11W	2
P3	5	4	14	2UEW	0.25Φ*1	1	0.025*11W	2
SH3	4	core	3	Cooper wire	0.1Φ*1	1	0.025*11W	2

Note:1,Core and Bobbin:EFD15

2,SH1,SH2,SH3 are shielding; P1,P2,P3 are primary and S1 is secondary

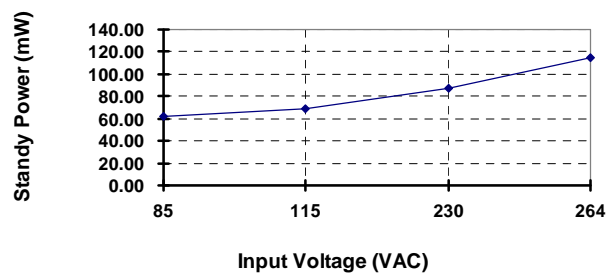
3,Reverse the direction of bobbin when do the S1

Electrical specifications

Item	Description	Condition	Limits
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000 Vac
2	P1 Inductance	Inductance between pins 2and 1at 1Vac & 1kHz	0.41mH±%7
3	P1 Leakage Inductance	Inductance between 2 pins 1 with pins 4-5 and A-B shorted	75µH

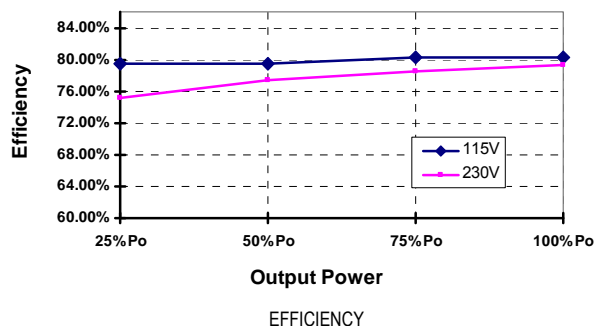
Typical Performance Characteristics

Standby Power Vs Input Voltage



STANDBY POWER

Efficiency Vs Po



Output Power

EFFICIENCY

Transformer

EVALUATION KITS	ACT410_5V2.1A_Rev1.1
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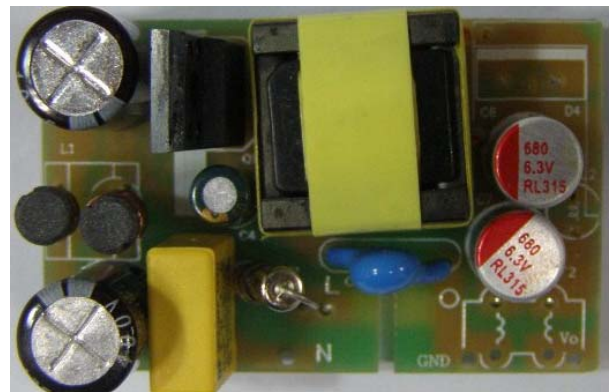
LOW COST ACT413 5V/2.4A UNIVERSAL ADAPTOR

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

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.

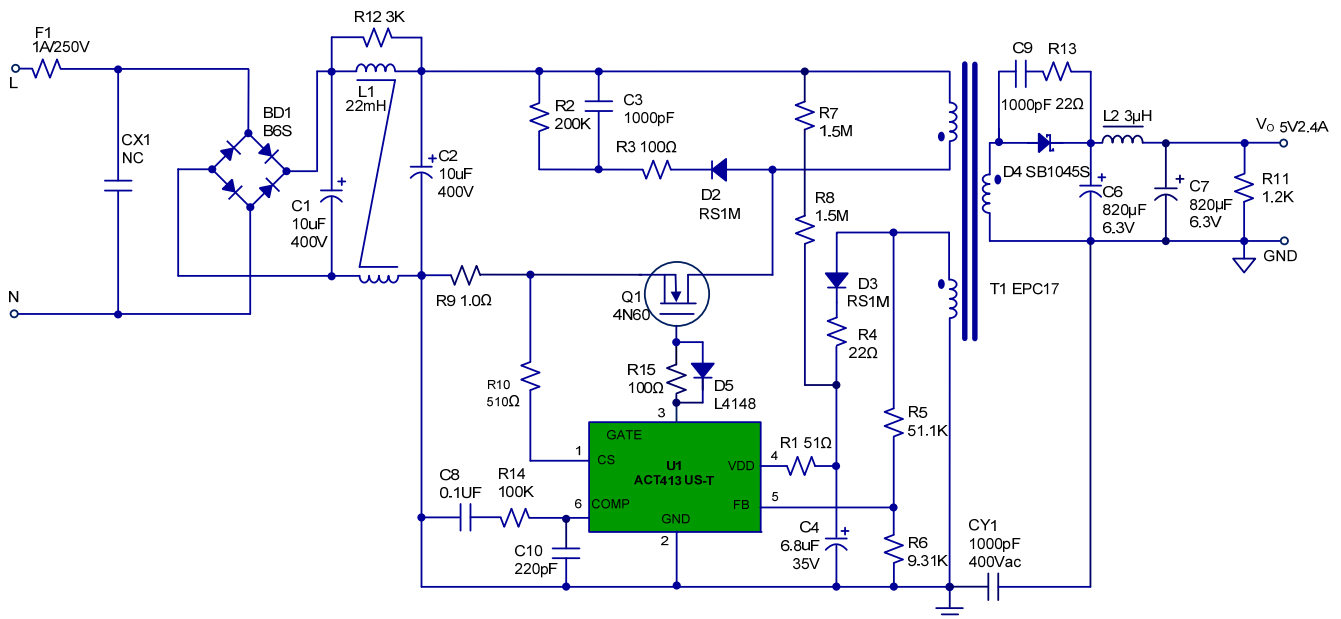
Demo Board Picture



Normal size

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

Schematic

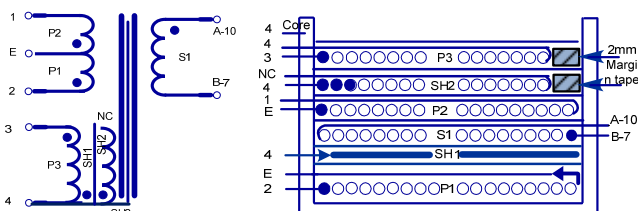


Picture 2

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



Build up

Winding	Terminal		Turns	Wire			Insulation	
	Start	Finish		Type	Size*QT Y	Layer	Thick/ Wide	Layer
P1	2	E	38	2UEW	0.20Φ*1 0.025 *10W	1	0.025*11W	1
SH1	4	NC	0.9	Copper		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	Coop- per wire	0.1Φ*1	1	0.025*11W	2

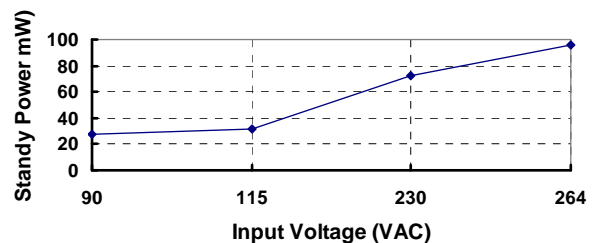
Note:1,Core and Bobbin:EPC17
2,SH1,SH2,SH3 are shielding; P1,P2,P3 are primary and S1 is secondary
3,Reverse the direction of bobbin when do the S1

Electrical specifications

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

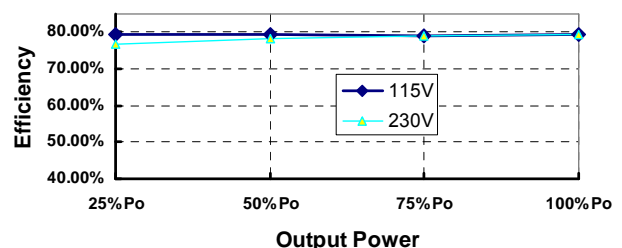
Typical Performance Characteristics

Standby Power Vs Input Voltage



STANDBY POWER

Efficiency Vs Po



Output Power

EFFICIENCY

EVALUATION KITS

ACT413_5V2.4A_Rev1.1

LOW COST ACT411 12V/1A UNIVERSAL ADAPTOR

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

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.

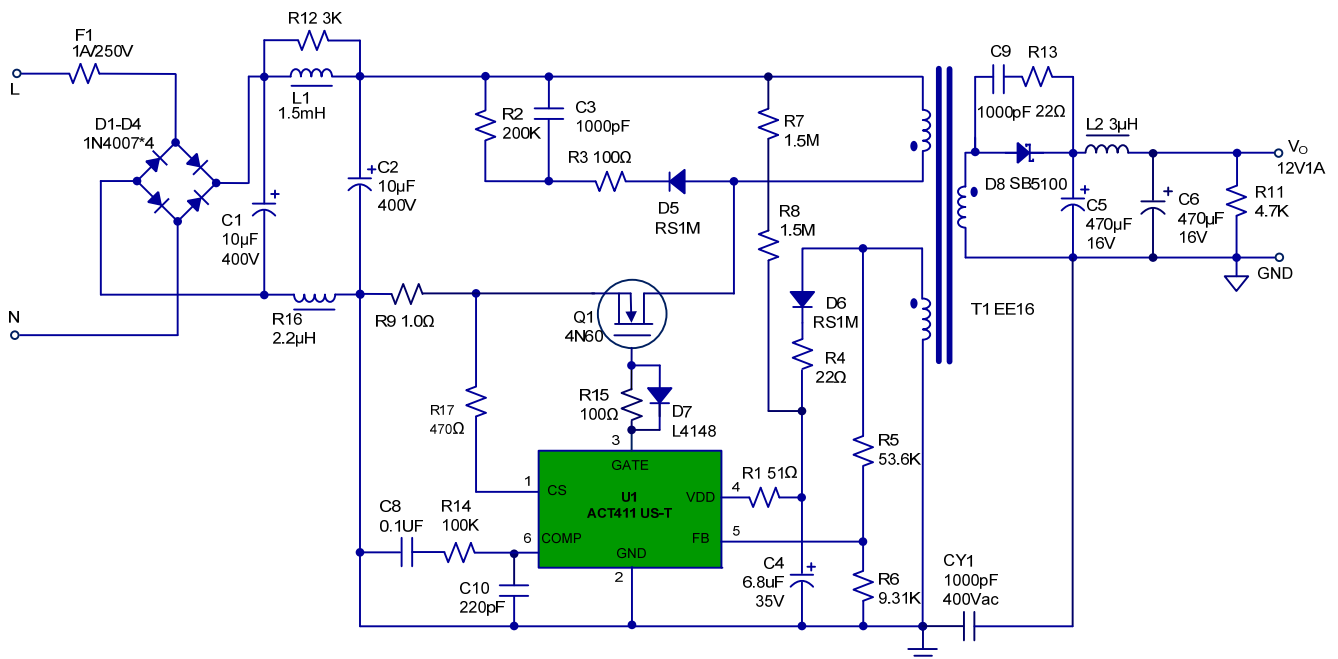
Demo Board Picture



Mini size

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

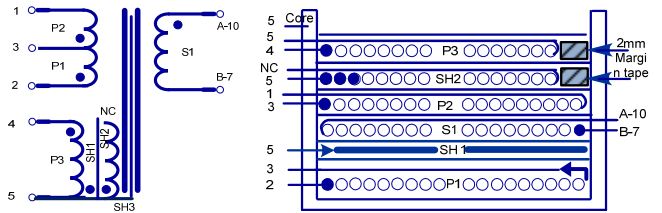
Schematic



Picture 3

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



Build up

Winding	Terminal		Turns	Wire			Insulation	
	Start	Finish		Type	Size*QTY	Layer	Thick/Wide	Layer
P1	2	3	32	2UEW	0.21Φ*1 0.025*10W	1	0.025*11W	1
SH1	5	NC	0.9	Copper		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	Copper wire	0.1Φ*1	1	0.025*11W	2

Note:1,Core and Bobbin:EE16

2,SH1,SH2 and SH3 are shielding; P1,P2,P3 are primary and S1 is secondary

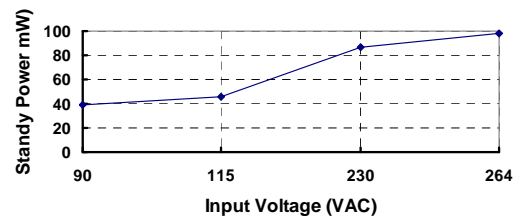
3,Reverse the direction of bobbin when do the S1

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

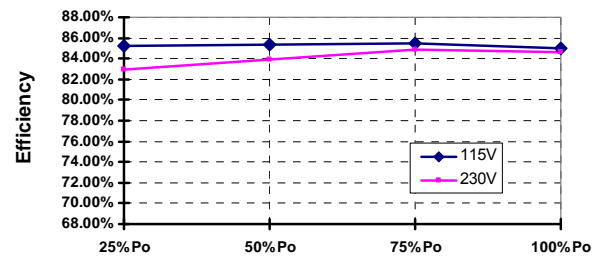
Typical Performance Characteristics

Standby Power Vs Input Voltage



STANDBY POWER

Efficiency Vs Po



Output Power

EFFICIENCY

Transformer

EVALUATION KITS	ACT411_12V1A_Rev1.1
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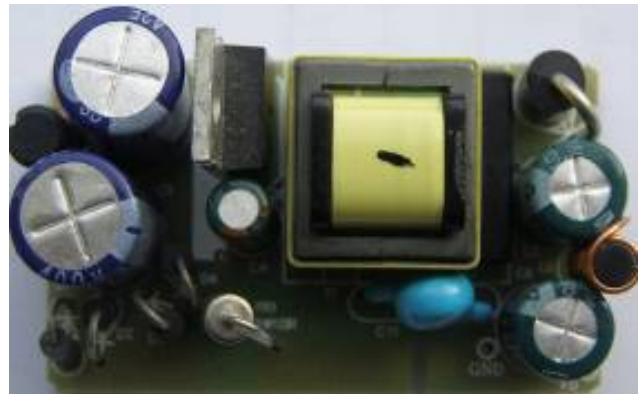
LOW COST ACT412 12V/0.4A SHAVER CHARGER

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

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.

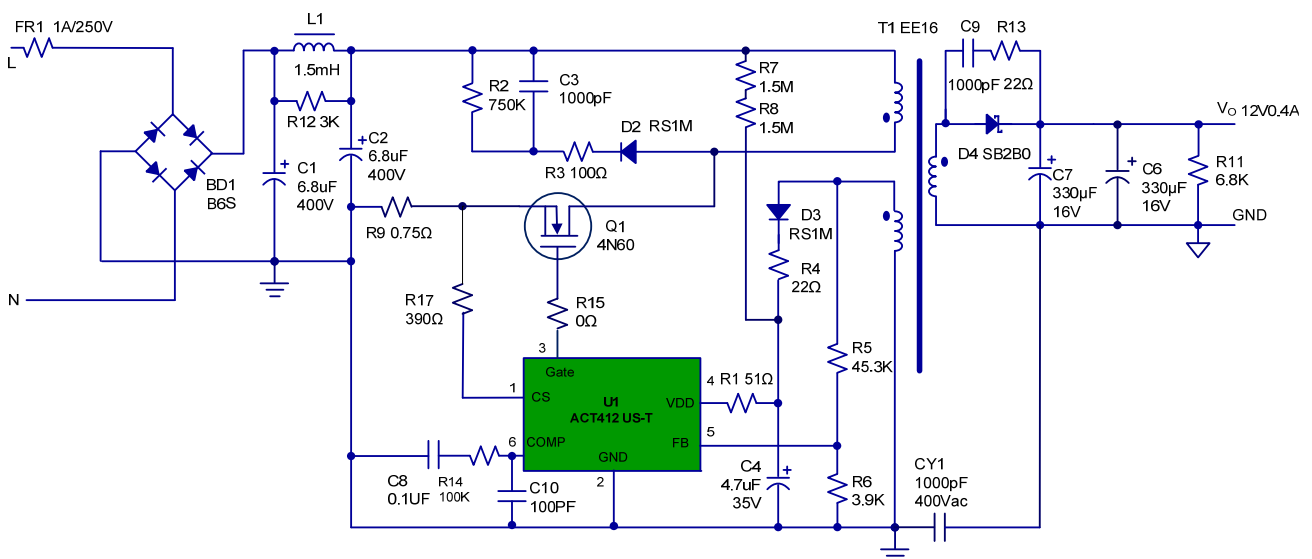
Demo Board Picture



Mini size

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

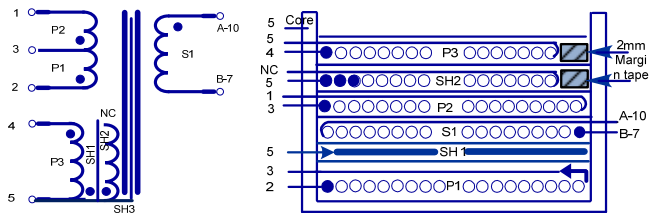
Schematic



Picture 4

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	



Build up

Winding	Terminal		Turns	Wire			Insulation	
	Start	Finish		Type	Size*QT Y	Layer	Thick/ Wide	Layer
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	Coop- per wire	0.1Φ*1	1	0.025*11W	2

Note:1,Core and Bobbin:EE16

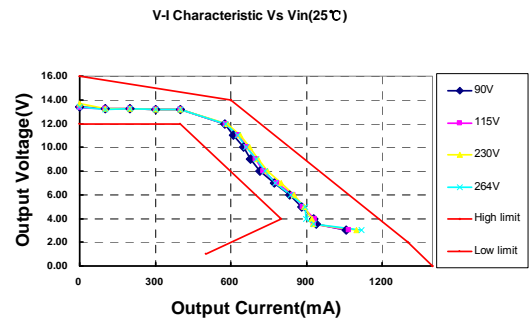
2,SH1,SH2 and SH3 are shielding; P1,P2,P3 are primary and S1 is secondary

3,Reverse the direction of bobbin when do the S1

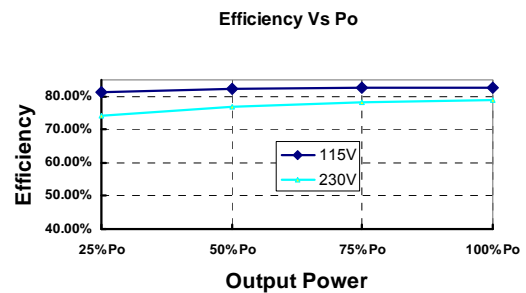
Electrical specifications

Item	Description	Condition	Limits
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000 Vac
2	P1 Inductance	Inductance between pins 2and 1at 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



CCCV VURVE



EFFICIENCY

Transformer

EVALUATION KITS	ACT412_12V0.4A_Rev1.0
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