SP6850
Green-Mode PWM Controller

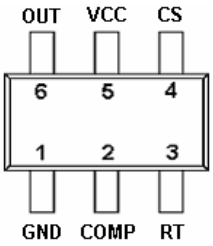
DESCRIPTION
The SP6850 is the current mode PWM controller with green-mode power-saving operation, to meet the low standby-power needs of low-power SMPS. This green-mode function enables the power supply to easily meet even the strictest power conservation requirements. The functions such as the leading-edge blanking of the current sensing, internal slope compensation and the small package provide the high efficiency / low cost for SMPS power applications. SP6850 is processed by BiCMOS fabrication, that enables reducing the start-up current and the operating current. SP6850 is available by SOT-23-6L / DIP-8P packages.

APPLICATIONS
- AC/DC Switching Power Adaptor
- Battery Charger
- PC 5V Standby Power.
- Open-Frame Switching Power Supply

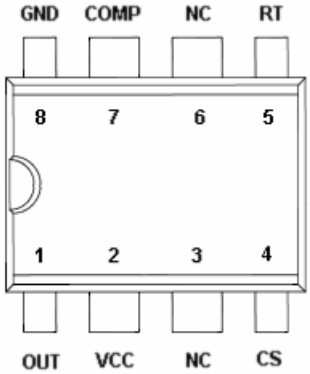
FEATURES
- High-Voltage BiCMOS Process
- Very Low Startup Current (Typ≡ 8μA)
- Under Voltage Lockout (UVLO)
- Current Mode Control with Cycle Peak
- Current Limiting
- Leading-Edge Blanking
- Programmable Switching Frequency
- Internal Slope Compensation
- Green-Mode Control for Power Saving
- Non-audible-noise Green Mode Control
- 300mA Driving Capability
- OVP (Over Voltage Protection) on Vcc Pin

PIN CONFIGURATION

SOT-23-6L

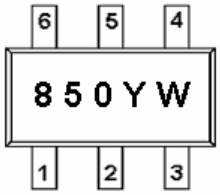


DIP-8P



PART MARKING

SOT-23-6L

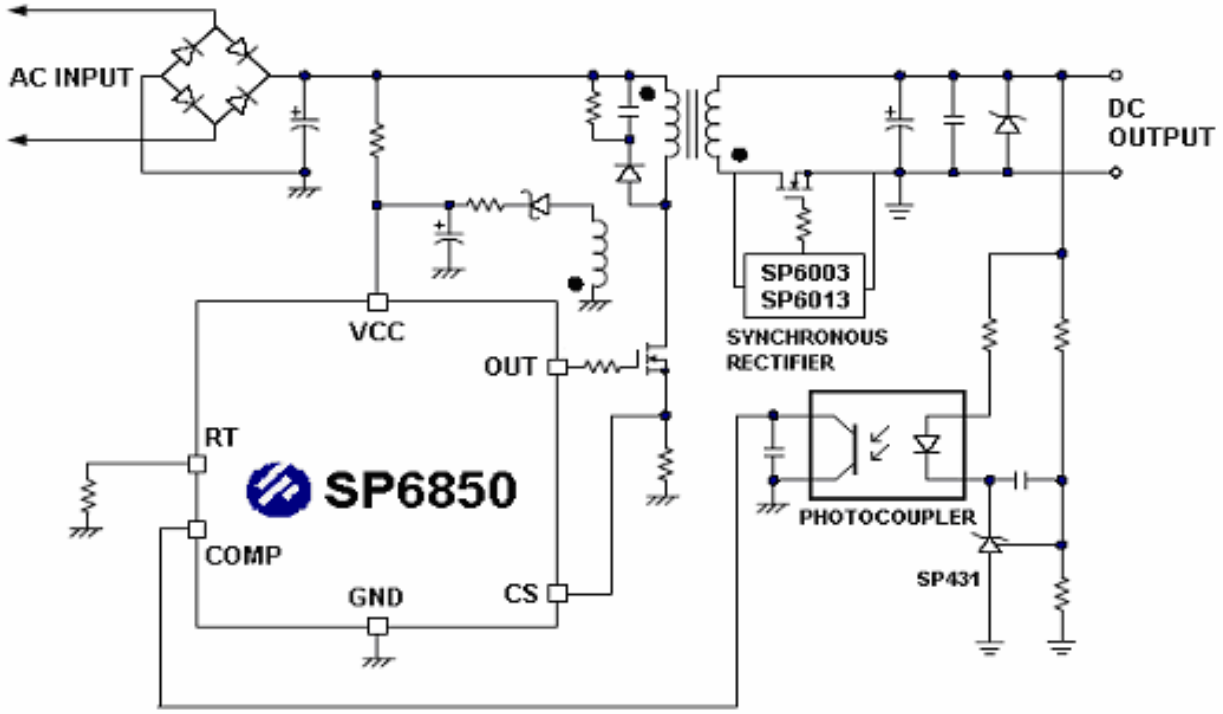


Y : Year Code
W : Week Code

DIP-8P

A : Lot Code
B : Date Code

TYPICAL APPLCATION CIRCUIT (High Efficiency SMPS)



PIN DESCRIPTION

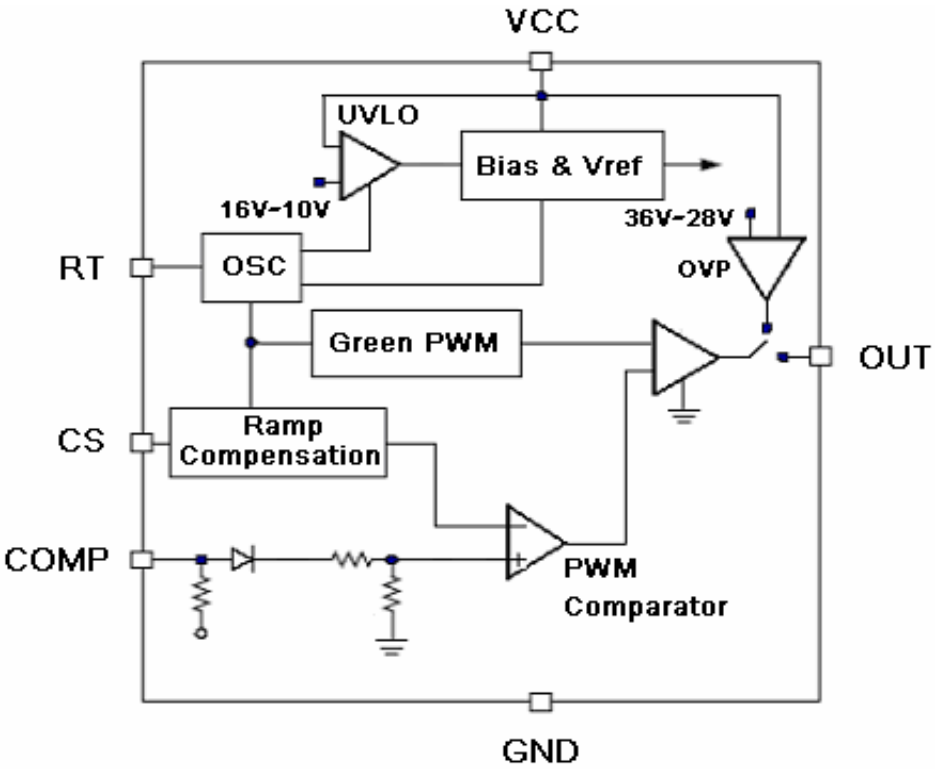
SP6850D8TG

Pin	Symbol	Description
1	OUT	Gate driver output to drive the external MOSFET
2	VCC	Supply Voltage in
3	NC	Unconnected pin
4	CS	Current sense. This pin senses the voltage across a resistor, to control PWM output. This pin also provides current amplitude information for current-mode control.
5	RT	This current is used to charge an internal capacitor, to determine the switching frequency.
6	NC	Unconnected pin
7	COMP	Voltage feedback. The pin provides the output voltage regulation signal., it provides feedback to the internal PWM comparator, so that the PWM comparator can control the duty cycle.
8	GND	Ground

SP6850S26RG

Pin	Symbol	Description
1	GND	Ground
2	COMP	Voltage feedback. The pin provides the output voltage regulation signal., it provides feedback to the internal PWM comparator, so that the PWM comparator can control the duty cycle
3	RT	This current is used to charge an internal capacitor, to determine the switching frequency.
4	CS	Current sense. This pin senses the voltage across a resistor, to control PWM output. This pin also provides current amplitude information for current-mode control
5	VCC	Supply Voltage in
6	OUT	Gate driver output to drive the external MOSFET

BLOCK DIAGRAM



ORDERING INFORMATION

Part Number	Package	Part Marking
SP6850D8TG	DIP-8P	SP6850**I**
SP6850S26RG	SOT-23-6L	850YW

※ SP6850D8TG : Tube ; Pb – Free

※ SP6850S26RG : Tape Reel ; Pb – Free

ABSOULTE MAXIMUM RATINGS (T_A=25℃, unless otherwise specified.)

The following ratings designate persistent limits beyond which damage to the device may occur.

Symbol	Parameter		Value	Unit
V_{CC}	DC Supply Voltage		36	V
$V_{COMP\,/\,RT\,/\,CS}$	SYNC Voltage		-0.3 ~ 7.0	V
P_D	Power Dissipation @ T_A=85℃ (*)		0.3	W
ESD	Human Body Model		4	KV
	Machine Model		300	V
T_J	Operating Junction Temperature Range		150	℃
T_{STG}	Storage Temperature Range		150	℃
T_{LEAD}	Pb-Free Lead Soldering Temperature for 5 sec.		260	℃
$R_{\Theta JC}$	Thermal Resistance Junction – Case (*)	SOT-23-6L	210	℃/W
		DIP-8P	95	

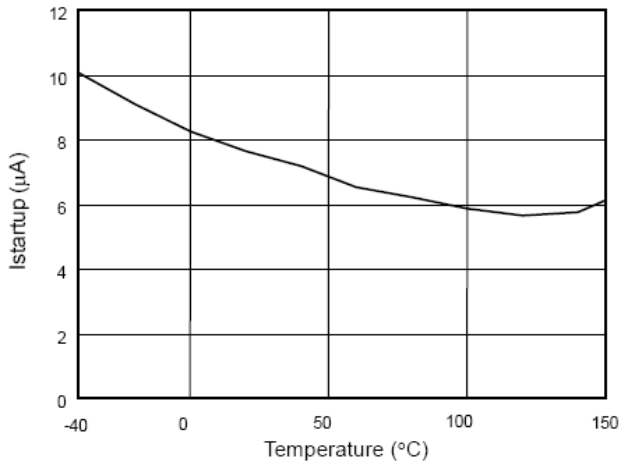
(*) The power dissipation and thermal resistance are evaluated under copper board mounted with free air conditions.

ELECTRICAL CHARACTERISTICS

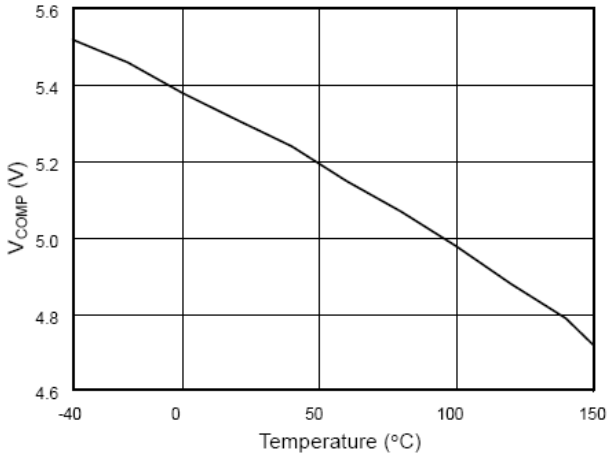
(T_A=25℃, V_{CC}=15V, unless otherwise specified.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Supply Voltage (Vcc Pin)						
Istt	Startup Current			8	20	uA
Iop	Operating Current	VCOMP = 3V		2	4	mA
UVLO (off)	Min. Operating Voltage		9.0	10.0	11.0	V
UVLO (on)	Start Threshold Voltage		15.0	16.0	17.0	V
Voltage Feedback (Comp Pin)						
Isc	Short Circuit Current			2.2	3.0	mA
Vop	Open Loop Voltage			5.0		V
VTH(GM)	Green Mode Threshold VCOMP			2.35		V
Oscillator (RT Pin)						
FOSC	Frequency	RT=100KΩ	60.0	65.0	75.0	KHz
FOSC(GM)	Green Mode Frequency	Fs=65.0KHz		20		KHz
Fdt	Frequency Variation versus Temp. Deviation	(-40°C ~105°C)			3	%
Fdv	Frequency Variation versus VCC Deviation	(VCC=11V-25V)			1	%
Current Sensing (CS Pin)						
Vcs(off)	Maximum Input Voltage		0.8	0.85	0.95	V
Zcs	Input impedance			50		KΩ
TPD	Delay to Output			150		nS
Gate Driver Output (OUT Pin)						
VOL	Output Low Level	VCC=15V, Io=20mA			1	V
VOH	Output High Level	VCC=15V, Io=20mA	8			V
Tr	Rising Time	Load Cap=1000pF		50	200	nS
Tf	Falling Time	Load Cap=1000pF		30	120	nS

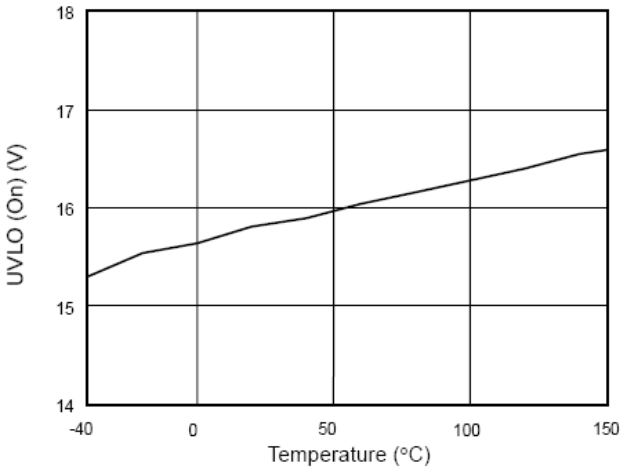
PERFORMANCE CHARACTERISTICS (T_A=25℃, unless otherwise specified.)



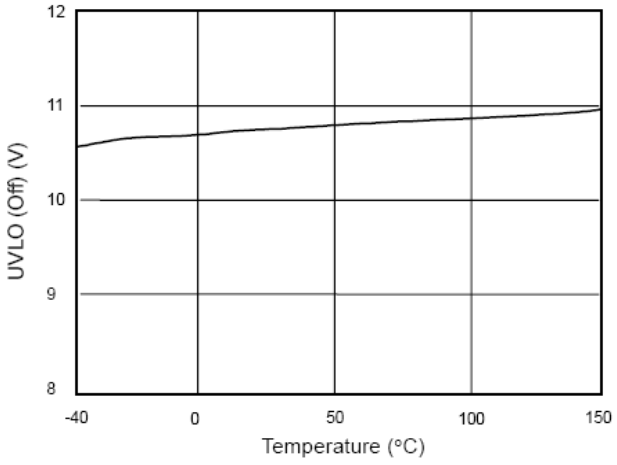
Startup Current (Istartup) vs. Temperature



V_{COMP} open loop voltage v.s. Temperature

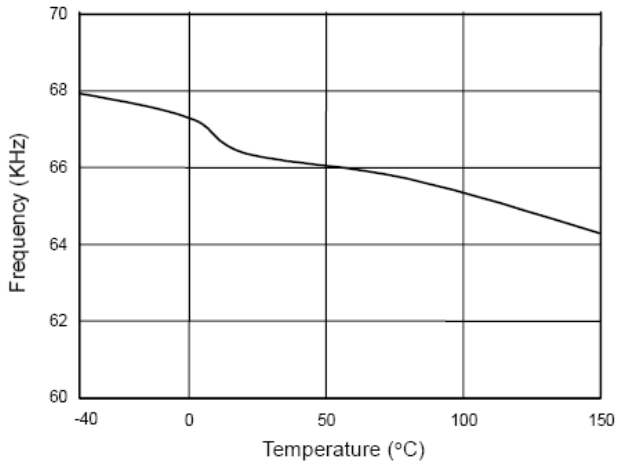


UVLO (On) vs. Temperature

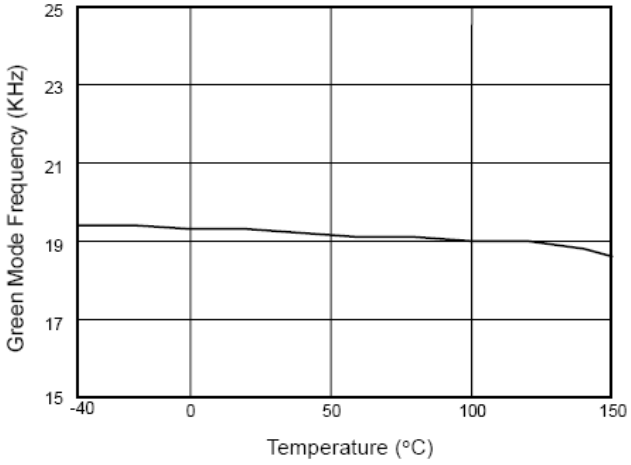


UVLO Off v.s. Temperature

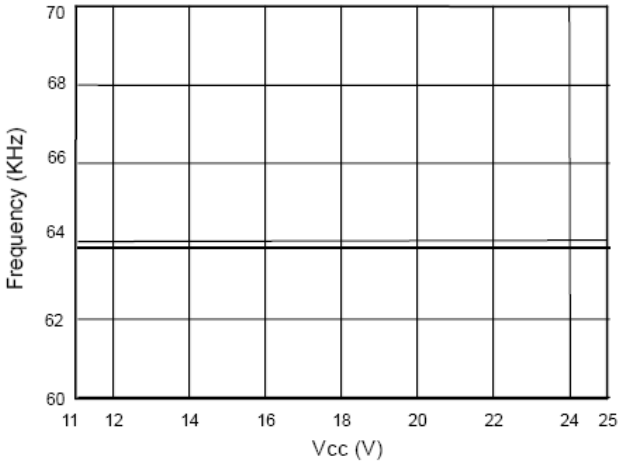
PERFORMANCE CHARACTERISTICS (T_A=25℃, unless otherwise specified.)



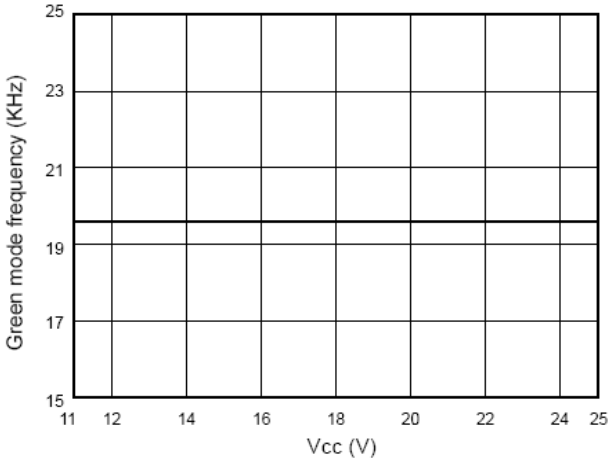
Frequency v.s. Temperature



Green Mode Frequency v.s. Temperature

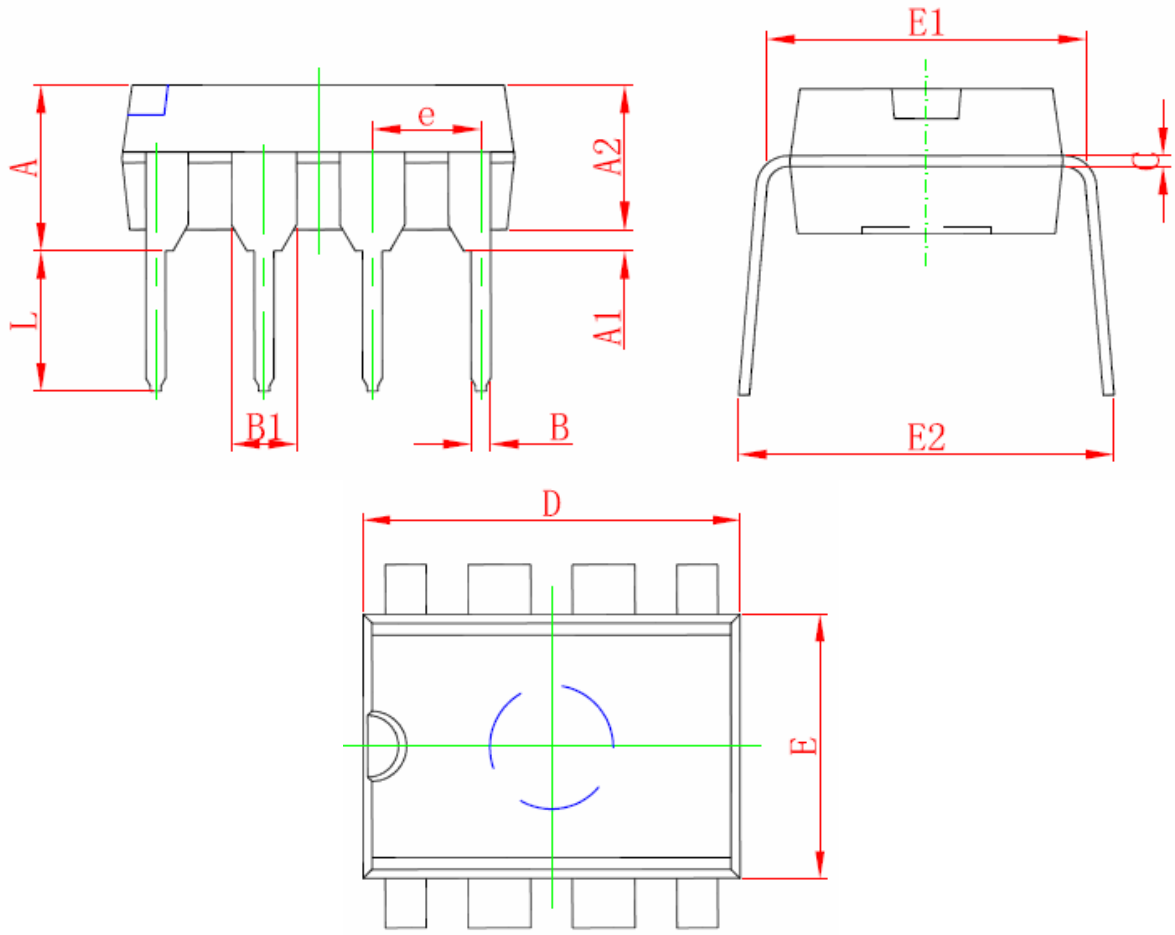


Frequency v.s. Vcc



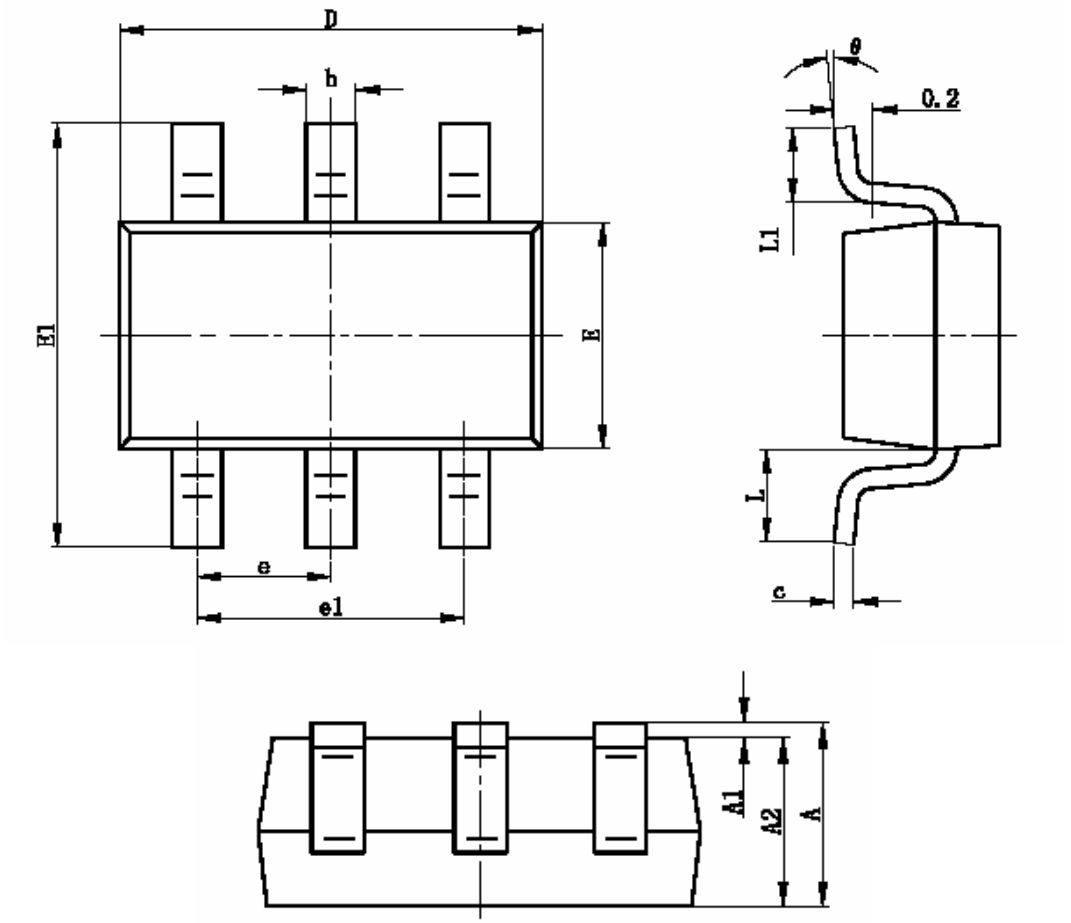
Green mode frequency v.s. Vcc

DIP- 8P PACKAGE OUTLINE



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.710	4.310	0.146	0.170
A1	0.510		0.020	
A2	3.200	3.600	0.126	0.142
B	0.380	0.570	0.015	0.022
B1	1.524 (BSC)		0.060 (BSC)	
C	0.204	0.360	0.008	0.014
D	9.000	9.400	0.354	0.370
E	6.200	6.600	0.244	0.260
E1	7.320	7.920	0.288	0.312
e	2.540 (BSC)		0.100 (BSC)	
L	3.000	3.600	0.118	0.142
E2	8.400	9.000	0.331	0.354

SOT-23-6L PACKAGE OUTLINE



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.400	0.012	0.016
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950TYP		0.037TYP	
e1	1.800	2.000	0.071	0.079
L	0.700REF		0.028REF	
L1	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

SYNC Power Corporation
9F-5, No.3-2, Park Street
NanKang District (NKSP), Taipei, Taiwan, 115, R.O.C
Phone: 886-2-2655-8178
Fax: 886-2-2655-8468
http://www.syncpower.com

SP6850EVM

20 Watts Adaptor with SP6850 Green-Mode Controller

FEATURES

- Universal input
- Overload and short circuit protection
- High performance and low cost
- High Efficiency

ELECTRICAL SPECIFICATIONS

INPUT

- Voltage

-- 90 ~ 240 VAC (Wide Range)

- Current

-- 600mA RMS Max

- Frequency

-- 60Hz ~ 75 Hz

ENVIRONMENTAL

- Operating Temperature

-- 0℃ ~ 45℃

- Storage Temperature

-- -10℃ ~ +75℃

CONFIGURATION

ELECTRICAL SPECIFICATIONS

OUTPUT

- Voltage

-- +12V / 1.66A

- Tolerance

-- 5 %

- Power (Po)

-- 20W (max)

- Hold Up Time

-- 10ms (min) , full load , 115VAC

- Short Circuit Protection

-- Pulse Mode, Auto recovery

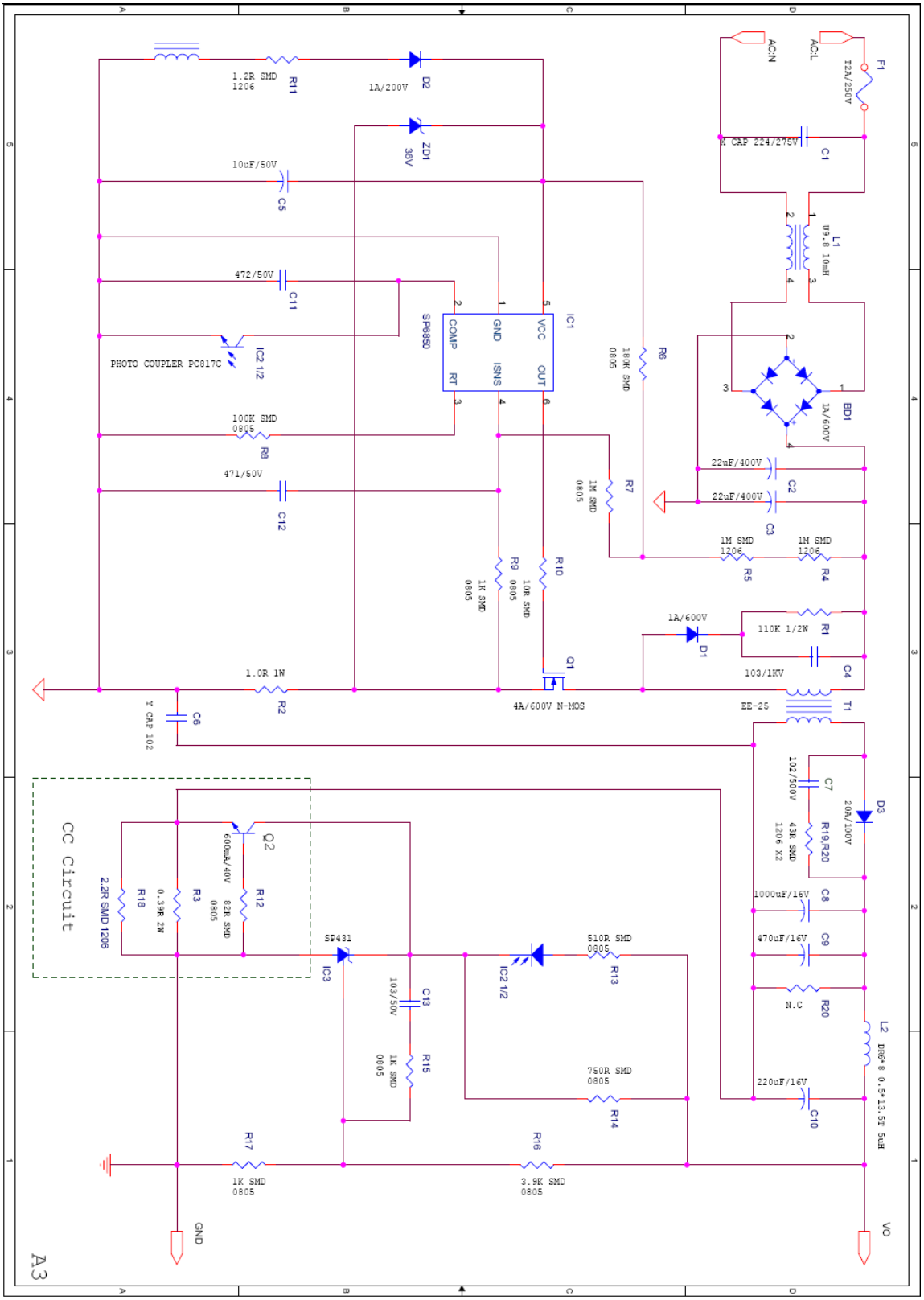
- Efficiency

-- 83 %(Typical) , full load , 90VAC

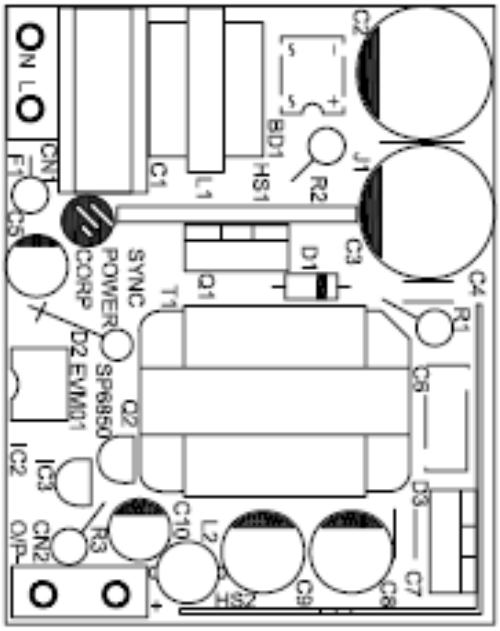
SP6850EVM

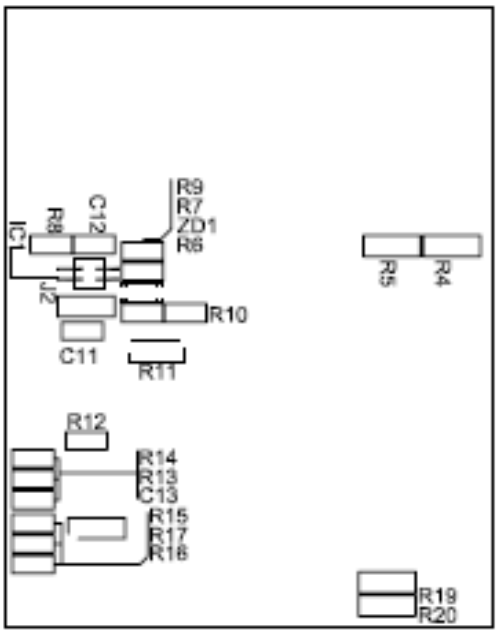
20 Watts Adaptor with SP6850 Green-Mode Controller

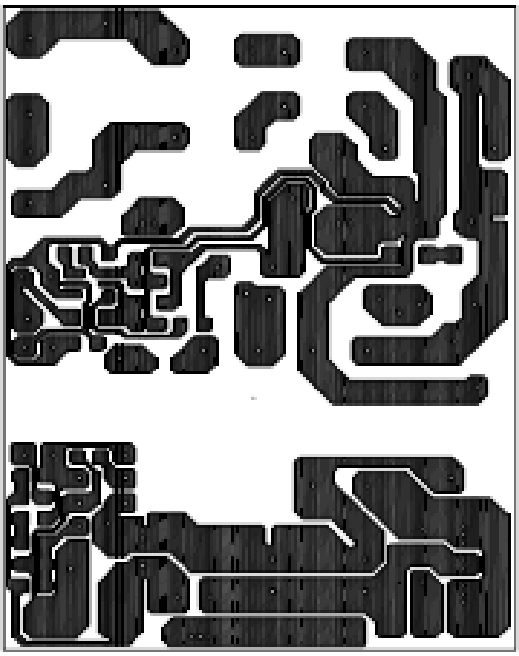
DEMO BOARD CIRCUIT DIAGRAM

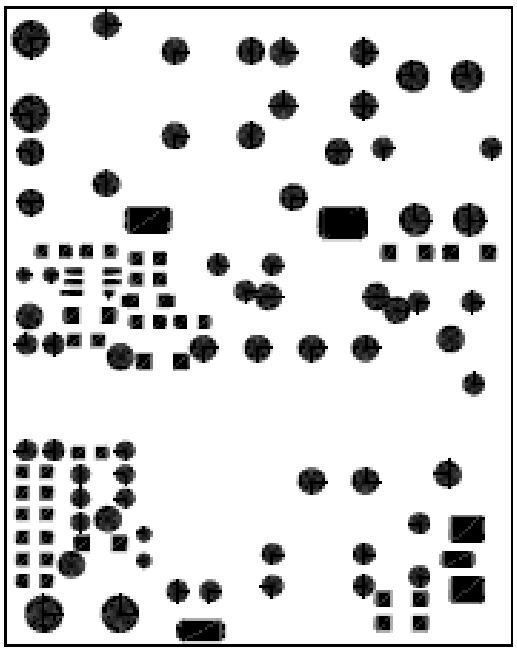


PCB LAYOUT DIAGRAM









DEMO BOARD BOM

Quantity	Part Number	Description	Note
1	IC1	SMD PWM Controller (SP6850)	SYNC POWER
1	IC2	PHOTO COUPLER DIP-4P SHARP PC817C	
1	IC3	REG, IC SP431	SYNC POWER
1	Q1	N-MOS 4A/600V TO-220F 絕緣型	
1	Q2	NPN TR 600mA/40V	
1	D1	ULTRA FAST SWITCHING RECTIFIER 1A/600V DO-41(T/P)	
1	D2	ULTRA FAST SWITCHING RECTIFIER 1A/200V DO-41(T/P)	
1	D3	SCHOTTKY 20A/100V TO-220	
1	BD1	BRIDGE 1A/600V	
1	ZD1	SMD ZENER DIODE 0.5W 36V	
1	C1	X CAP 224/275V 18*14.5*8.5mm (小型化)	
2	C2 , C3	EC 22U/400V 105℃ 13*20 P=5mm	
1	C4	CER CAP 103/500V P=5mm	
1	C5	EC 10U/50V 105℃ 5*11 P=2.5mm	
1	C6	Y CAP 102	
1	C7	CER CAP 102/500V P=5mm	
1	C8	EC 1000U/16V 105℃ 8*20 P=5mm	
1	C9	EC 470U/16V 105℃ 8*15 P=5mm	
1	C10	EC 220U/16V 105℃ 6*11 P=2.5mm	
1	C11	SMD MCC 472/50V (K) (X7R) 0805	
1	C12	SMD MCC 471/50V (K) (X7R) 0805	
1	C13	SMD MCC 103/50V (K) (X7R) 0805	
1	R1	1/2W ±5% 110K MOFR	
1	R2	1W ±5% 1Ω WWR 疏繞	
1	R3	2W ±5% 0.39Ω WWR 疏繞	
2	R4 , R5	1/4W ±5% 1M SMD (1206)	
1	R6	1/8W ±5% 180K SMD (0805)	
1	R7	1/8W ±5% 1M SMD (0805)	
1	R8	1/8W ±5% 100K SMD (0805)	
3	R9 , R15 , R17	1/8W ±5% 1K SMD (0805)	
1	R10	1/8W ±5% 10Ω SMD (0805)	
1	R11	1/4W ±5% 1.2Ω SMD (1206)	
1	R12	1/8W ±5% 82Ω SMD (0805)	
1	R13	1/8W ±5% 510Ω SMD (0805)	
1	R14	1/8W ±5% 750Ω SMD (0805)	
1	R16	1/8W ±5% 3.9K SMD (0805)	
1	R18	1/4W ±5% 2.2Ω SMD (1206)	
2	R19 , R20	1/4W ±5% 43Ω SMD (1206)	
1	J2	1/4W ±5% 0Ω SMD (1206)	
1	T1	X'FMR EE-25 立式 8PIN	
1	L1	COMMON CHECK UU9.8	
1	L2	CHOKE DR6*8 0.5φ13.5T	
1	F1	FUSE S-BLOW 2A/250V 3.6*10 (+PIN) (美規)	
2	CN1 , CN2	BASE 2 PIN	
1	J1	JUMP WIRE 0.6φ 10mm	

EFFICIENCY (TA=25℃)

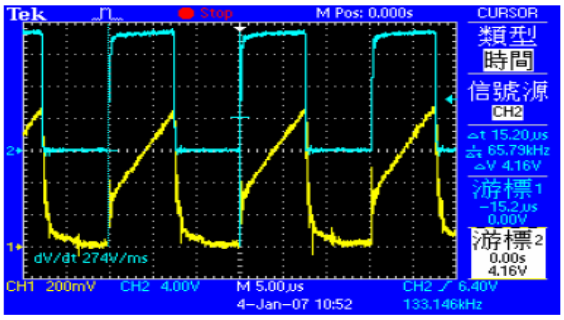
	Pin(W)	Iin(A)	Iout(A)	Vout(V)	Pout(W)	Eff(%)
90V/47Hz	26.31	0.468	1.8	12.2	21.98	83.54
115V/60Hz	25.84	0.394	1.8	12.215	21.98	85.06
132V/60Hz	25.74	0.358	1.8	12.215	21.98	85.39
180V/60Hz	25.74	0.267	1.8	12.215	21.98	85.39
230V/60Hz	25.75	0.234	1.8	12.215	21.98	85.36
264V/60Hz	25.72	0.2036	1.8	12.215	21.98	85.46

CHARACTERISTIC WAFEFROMS (TA=25℃)

Duty Cycle , Ft : (Full load = 1.66A)

90V /47 Hz

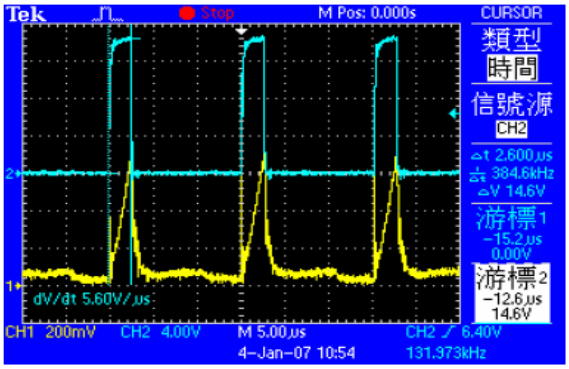
f_T .....= 65.79khz
Ton .....=7.8us
T.....=15.2us
Duty Cycle = 51.3%



CH1- CS PIN
CH2- Gate output

264V /60 Hz

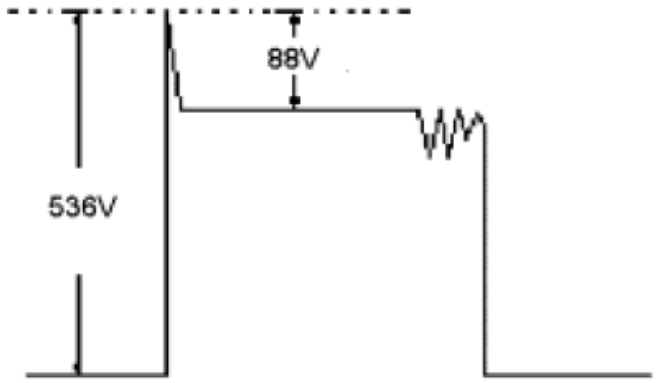
f_T .....= 65.79khz
Ton .....= 2.6us
T.....= 15.2us
Duty Cycle = 17.1%

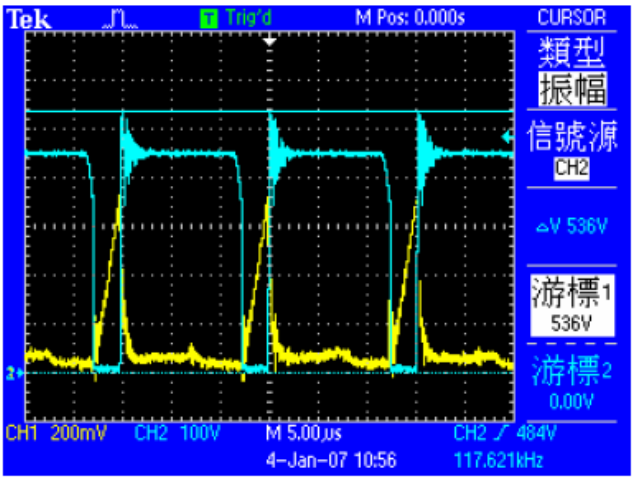


CH1- CS PIN
CH2- Gate output

Stress (264V / 63Hz full load) :

Q1 MOSFET:





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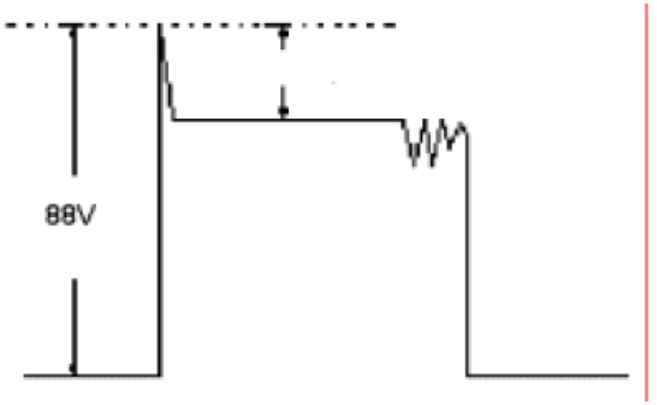

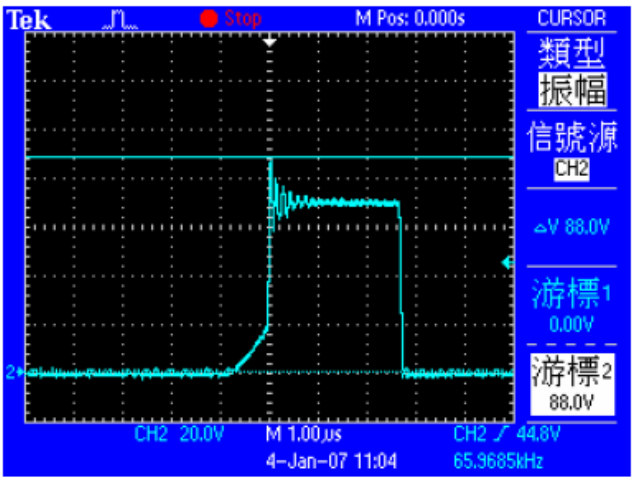

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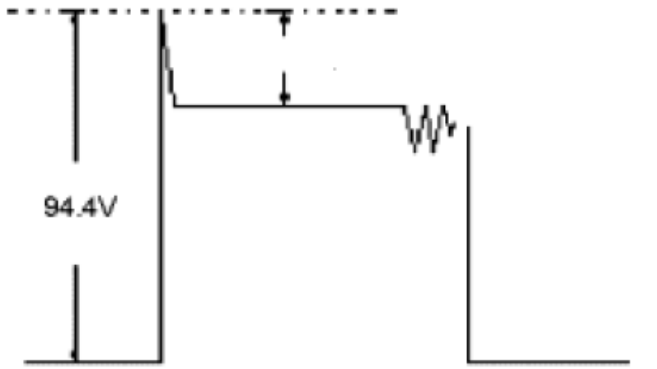

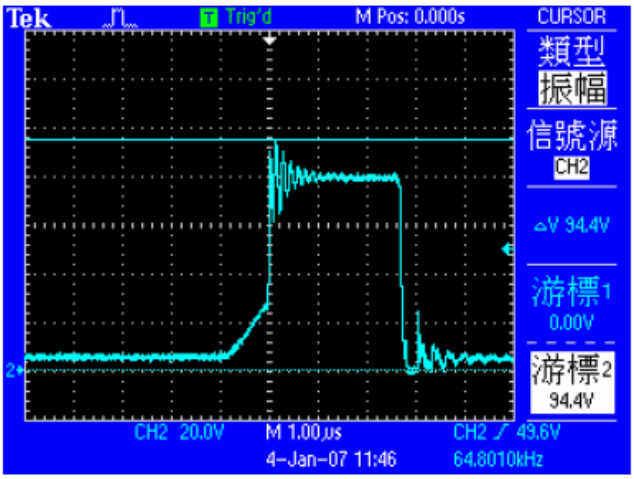

110V EMI Test Report

SPORTON EMC LAB.
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Taiwan, R.O.C.
Tel:+886-2-26962468
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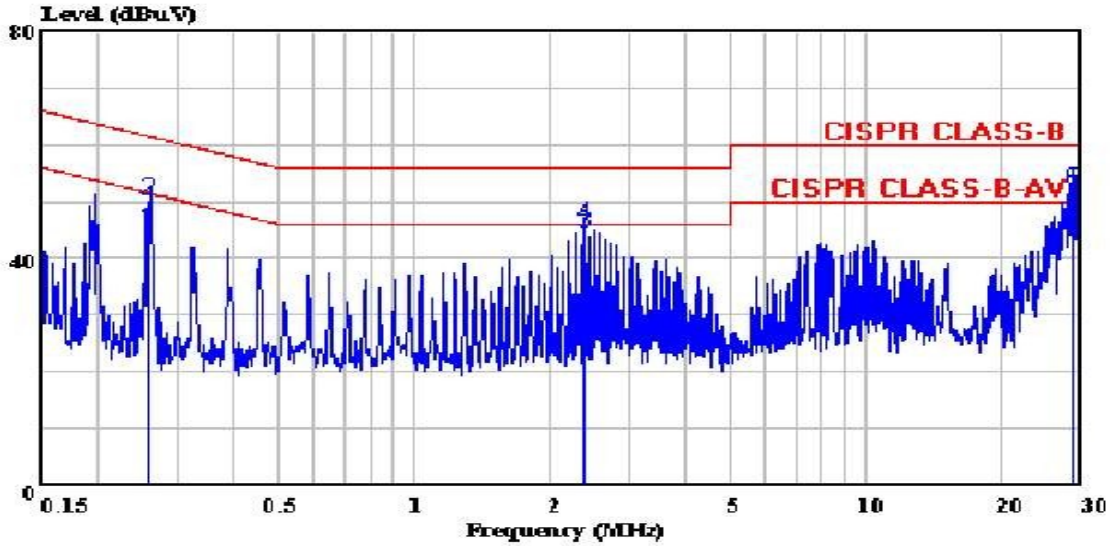
Date: 2007-03-14 Time: 11:03:39



Site : CSO1
Condition: CISPR CLASS-B LISN R&S LINE
EUT : SP6850
Power : AC 110V 60HZ
Memo : QP+AV
: PRETEST

Page: 1

	Freq	Level	Over Limit	Limit Line	Read Level	Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.259	44.68	-6.79	51.47	34.96	9.72	0.16	Average
2	0.259	50.22	-11.25	61.47	40.50	9.72	0.16	QP
3	2.395	44.45	-1.55	46.00	34.62	9.83	0.23	Average
4	2.395	45.84	-10.16	56.00	36.01	9.83	0.23	QP
5	28.786	47.20	-2.80	50.00	36.69	10.51	0.67	Average
6	28.786	52.14	-7.86	60.00	41.63	10.51	0.67	QP

230V EMI Test Report

SPORTON EMC LAB.
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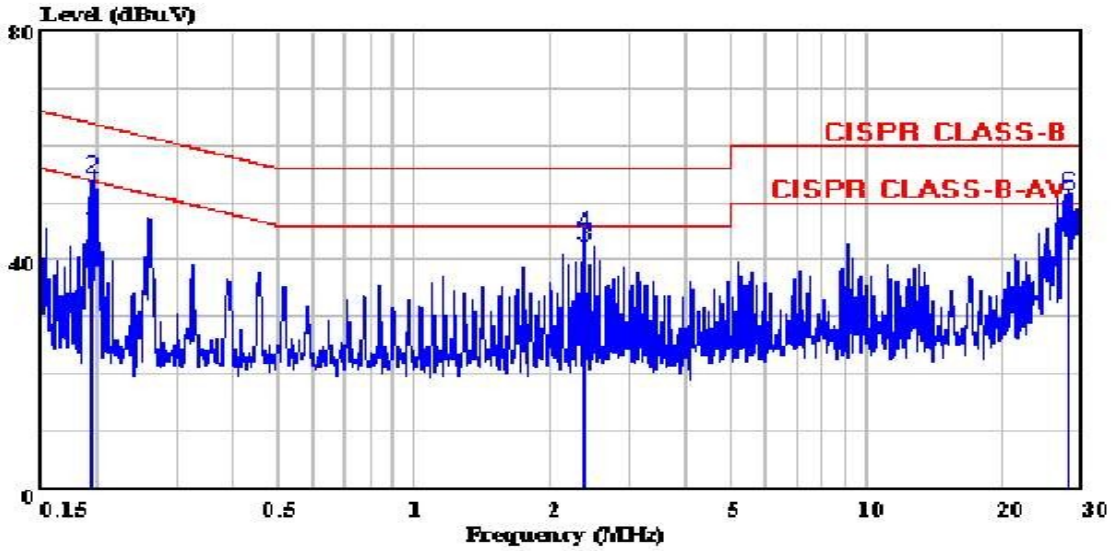
Data#: 11 File#: D:\e3\客戶\擎力\96-03-14.EMI
Date: 2007-03-14 Time: 11:06:31



Site : CSO1
Condition: CISPR CLASS-B LISN R&S LINE
EUT : SP6850
Power : AC 230V 50HZ
Memo : QP+AV
: PRETEST

Page: 1

	Freq	Level	Over Limit	Limit Line	Read Level	Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.193	44.62	-9.28	53.90	34.93	9.69	0.13	Average
2	0.193	54.25	-9.65	63.90	44.56	9.69	0.13	QP
3	2.391	42.50	-3.50	46.00	32.67	9.83	0.23	Average
4	2.391	44.43	-11.57	56.00	34.60	9.83	0.23	QP
5	28.172	43.98	-6.02	50.00	33.48	10.50	0.66	Average
6	28.172	51.21	-8.79	60.00	40.71	10.50	0.66	QP

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