

Data Sheet

Type Description : Current-Mode PWM Controller (SSR)

Product Name : EST.2200E

Reversion : V1.0

Reversion Date : Mar, 2020

Page : 9 Pages

Description

EST.2200E is highly integrated current mode PWM control IC optimized for high performance, low standby power and cost effective offline flyback converter up to 60W output power system.

PWM switching frequency is internally fixed at 65KHz. At no load or light load condition, the IC operates in 'burst mode' to minimize switching dissipation. Therefore, lower standby power dissipation and higher conversion efficiency are achieved.

Due to very small startup current and low operating current, a big resistor can be used in the startup circuit to minimize standby power dissipation.

EST.2200E offers comprehensive protection functions, including Cycle-by-Cycle current limitation (OCP), over temperature protection (OTP), Over voltage clamp (OVP) and under voltage lockout (UVLO) on VDD. The Gate output is clamped up to 16V to protect the gate of the power MOSFET.

Features

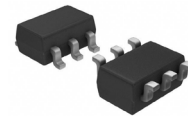
- Digit frequency shuffling technology to improve EMI performance.
- Fixed 65kHz PWM switching frequency.
- Leading-edge blanking on current sense.
- Internal synchronized slope compensation.
- Low standby power consumption (<75mW@AC 230V)
- Soft-start to reduce MOSFET Vds stress during power on
- Comprehensive protection function
- Under voltage locked with hysteresis (UVLO) on VDD.
- Over voltage protection (OVP) on VDD.
- Cycle-by-Cycle current limitation.
- Over load protection (OLP)
- Over temperature protection (OTP)
- Current limitation compensation to obtain the same output current in universal ac line input
- Low start-up current (<10uA@VDD=12V)
- 300mA of sinking and 150mA of sourcing current capability in GATE pin

Application Circuit

Two large value resistors are connected to VCC capacitor in startup circuit

Application

- Cell Phone Charger
- Digital Cameras Charger
- Battery charger

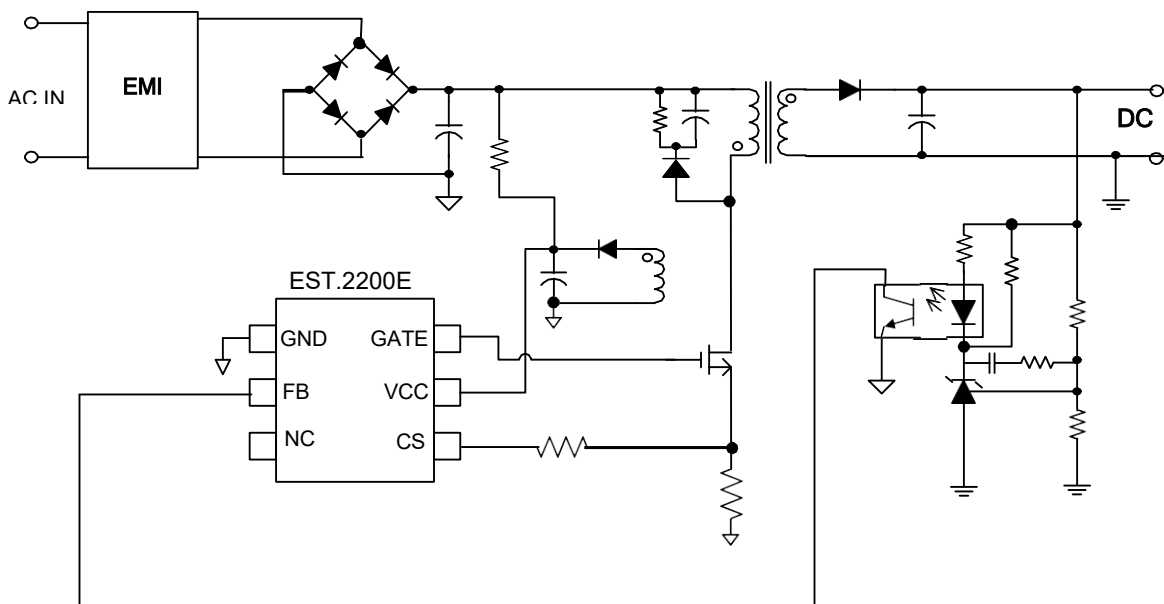


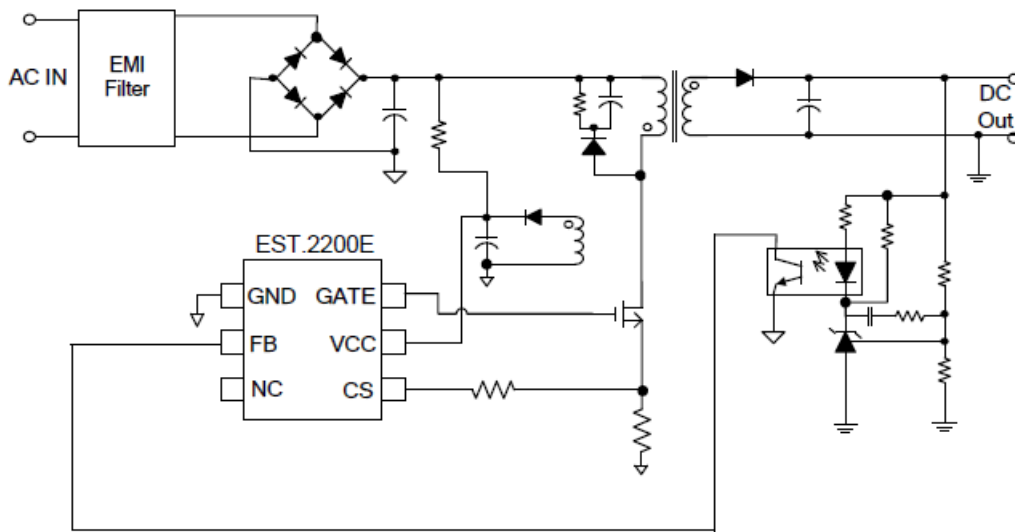
SOT23-6

Ordering Information

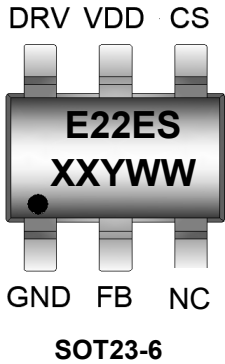
Part Number	Package	Packaging	Note
EST.2200E	SOT23-6	Tape	Green

Application Circuit





Pin Assignments and Package Type



Marking:
 E22XS: Product Name
 E: FAB code
 S: SMD
 XXYWW:
 XX: Wafer code
 YWW: Date code

Pin	Symbol	Description
1	GND	ground
2	FB	Voltage input pin by connecting a photo-coupler
3	NC	NC
4	CS	Current Sensing
5	VDD	Power Supply
6	DRV	Totem-pole gate diver output for the power MOSFET

Absolute Maximum Ratings

Parameter	Value	Unit
V _{DD} clamp voltage	29	V
V _{DD} clamp current	10	mA
V _{FB} input voltage	-0.3 to 7	V
V _{SENSE} input voltage to SENSE pin	-0.3 to 7	V
Min/Max operating junction temperature	-55 to 150	°C
Operating ambient temperature	-20 to 85	°C
Thermal resistance, Junction to ambient SOT23-6	250	°C/W

Stress beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

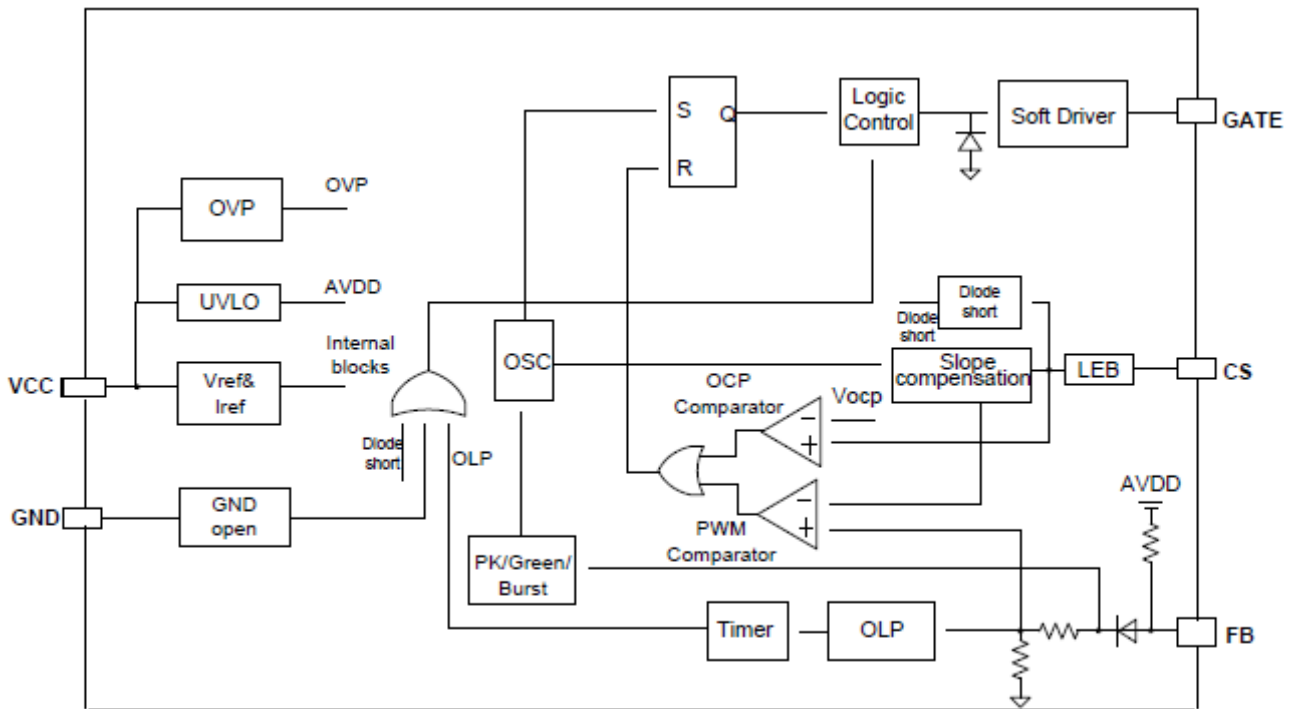
Recommended Operating Conditions

Symbol	Parameter	Value	Unit
V _{cc}	Supply Voltage V _{cc}	9 to 25.5	V
Toa	Operating Ambient temperature	-20 to 85	°C
ESD-HM	Human Model	2	KV
ESD-MM	Machine Model	150	V

Electrical Characteristics (TA = 25 °C, if not otherwise noted)

Symbol	Parameter	Conditions	Value			Unit
			Min	Typ	Max	
Supply Voltage (VDD Pin)						
I _{DD_start-up}	VDD start-up current	V _{DD} =12.5V		3	10	uA
I _{DD}	VDD Operation current	V _{DD} =16V , FB=2V		1.5		mA
U _{VLO(ON)}	VDD under voltage lockout enter		6.8	7.8	8.2	V
U _{VLO(OFF)}	VDD under voltage lockout exit		13	13.4	16.5	V
O _{VP}	VDD over voltage protection		25.5	26.5	28	V
Voltage Feedback (FB Pin)						
A _{VCS}	PWM input gain	V _{FB} /V _{SENSE}		2		V/V
V _{FB_open}	VFB open loop voltage			5.7		V
I _{FB_short}	FB pin short current	Short FB pin to GND	90	150	300	uA
V _{FB_burst}	Burst mode voltage			1.1		V
V _{TH_PL}	Power limiting FB threshold voltage			3.7		V
T _{D_PL}	Power limiting delay time			60		mS
DC_MAX	Maximum duty cycl	V _{DD} =18V, SENSE=0V FB=2.2V		75		%
Current Sensing (SENSE Pin)						
T _{blanking}	Leading-edge blanking time		100	400	750	nS
Z _{SENSE_IN}	Input impedance			40		KΩ
V _{TH_sense}	Over current threshold voltage	Duty=0%	0.62	0.65	0.68	V
Oscillator						
F _{osc}	Normal oscillation frequency		60	66.5	73	KHz
Δf _{temp}	Frequency temperature stability	TA= -20°C to 100°C		5		%
f _{VDD}	Frequency voltage stability	V _{DD} =16.5V to 25V		5		%
F _{osc_BM}	Burst mode base frequency		17	25	28	KHz
Δf _{OSC}	Frequency modulation range Base frequency		-5		+5	%
Gate Drive Output						
V _{OL}	Output low level	V _{DD} =16V, IO=-20mA			0.8	V
V _{OH}	Output high level	V _{DD} =16V, IO=20mA	10			V
V _{Clamp}	Output clamp voltage level			12		V
T _r	Output rising time	V _{DD} =16V, CL=1nF		1300		nS
T _f	Output falling time	V _{DD} =16V, CL=1nF		50		nS

Block Diagram



Application Information

EST.2200E is a highly integrated PWM control IC for the flyback converter. EST.2200E is designed specifically for switching power supply that requires level 6 energy-efficiency. The input power is less than 75mW at No-load condition in universal input voltage rang.

Start up Control

EST.2200E has very low start-up current that is less than 10uA. Therefore, a large resistor can be used in start-up circuit of switch power supply. This will minimize standby dissipation. The typical resistance of start-up resistor is 4M ohms.

Operating Current

The Operating current of EST.2200E is less than 1.5mA. Therefore, EST.2200E can have good efficiency.

Frequency shuffling for EMI improvement

The frequency Shuffling is implemented in EST.2200E. The oscillation frequency is modulated with a random source so that the harmonic energy is spread out. The spread spectrum minimizes the conduction EMI and therefore reduces system design challenge.

Burst Mode Operation

At zero load or light load condition, the main power dissipation in a switching mode power supply is from switching on the MOSFET, the core of transformer and the snubber circuit. The magnitude of power dissipation is proportional to the number of switching frequency within certain period. Less switching frequency can reduce the power dissipation. EST.2200E adjusts the switching frequency according to the loading condition. The PWM pulse width is kept greater than 1.2uS at any load condition. From light load to no load, the FB voltage drops. While the FB voltage is less than 1.1V, the gate pin output is disabled and kept low, while the FB voltage is higher than 1.2V, the gate output recovers to normal working mode. This is called ‘burst mode’. To reduce audio noise, the switching frequency will be kept higher than 20KHz in burst mode.

Oscillator Operation

The switching frequency is internally fixed at 65kHz. No external frequency setting components are required on PCB design.

Current Sensing and Leading-Edge Blanking

Cycle-by-Cycle current limitation is offered in EST.2200E. The switching current is detected by a resistor into the SENSE pin. An internal leading-edge blanking circuit chops off the SENSE voltage spike at initial so that the external RC filtering on SENSE pin is no longer required. The current limiting comparator is disabled and thus cannot turn off the external MOSFET during the blanking period. PWM duty cycle is determined by the voltage in the SENSE pin and the FB pin.

Internal Synchronized Slope Compensation

Slope compensation circuit adds voltage ramp onto the SENSE voltage according to PWM pulse width. This greatly improves the close loop stability at CCM and prevents the sub-harmonic oscillation and thus reduces the output ripple voltage. Slope compensation can help EST.2200E obtain the same output current in universal ac input voltage.

Gate Drive

The GATE pin of EST.2200E has 300mA of sinking and 150mA of sourcing current capability. Therefore, the MOSFET would be turned on slowly and turned off fast so that EST.2200E has high efficiency and low radiation EMI. The highest voltage of drive voltage is clamped at 12V.

Protection Controls

EST.2200E has comprehensive protection functions, including Cycle-by- Cycle current limitation (OCP), Over Load Protection (OLP) and over voltage clamp, Under Voltage Lockout on VDD (UVLO), Over Temperature Protection (OTP).

Current limitation compensation

To obtain the same output current capability, the OLP threshold voltage is compensated for the different input AC voltage. This function makes the current of OLP is in consistency whatever the AC input is (110V or 220V).

Package Information

SOT-23-6L:

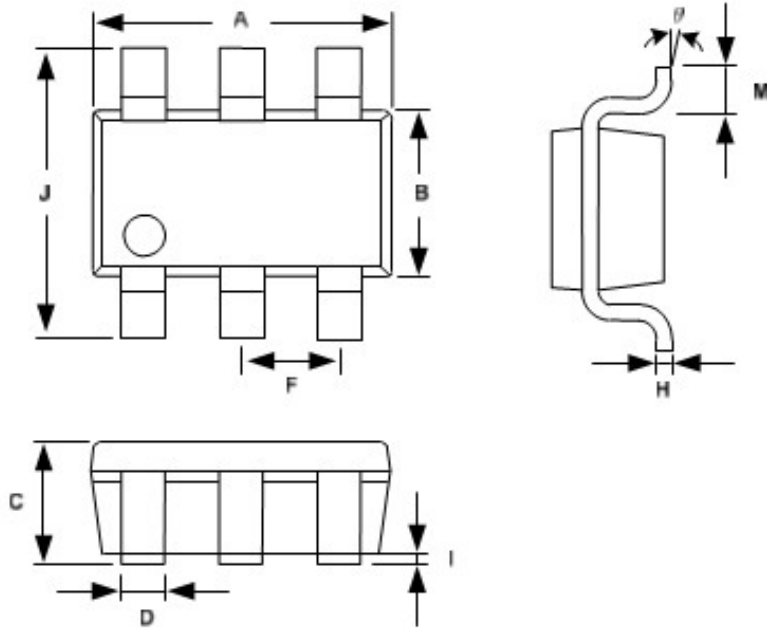
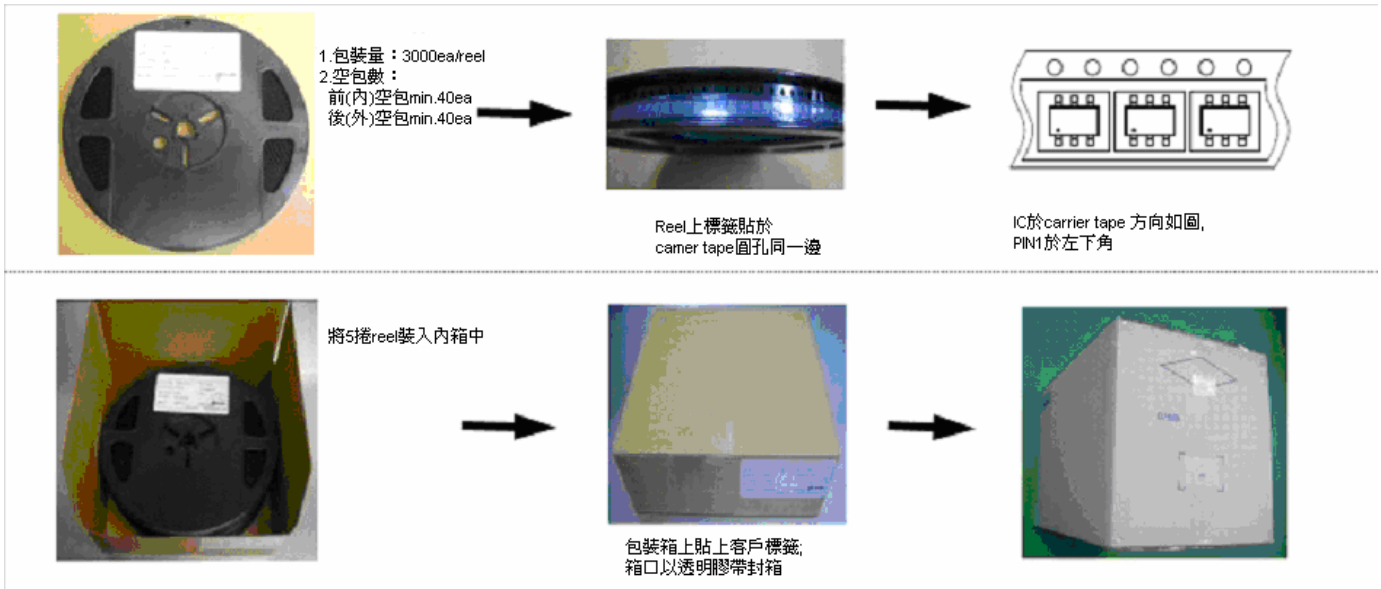


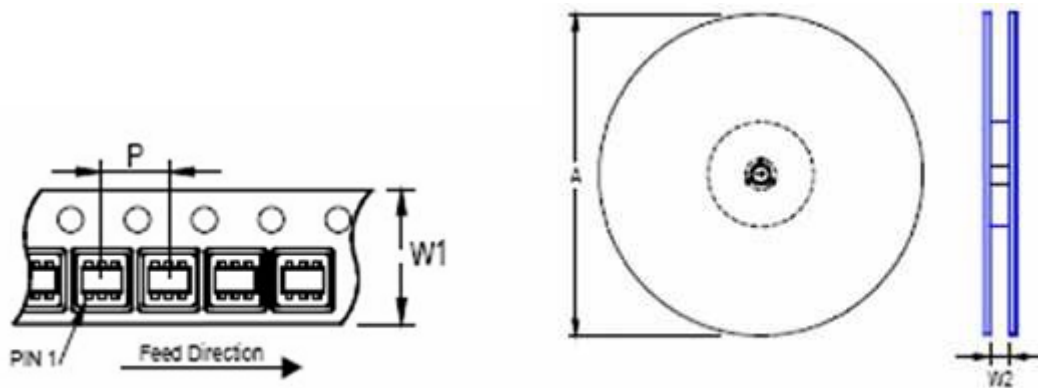
Fig 8

Symbol	Dimension in mm		Dimension in inch	
	MIN.	MAX.	MIN.	MAX.
A	2.692	3.099	0.106	0.122
B	1.397	1.803	0.055	0.071
C	-----	1.450	-----	0.057
D	0.300	0.550	0.012	0.022
F	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
I	0.050	0.150	0.002	0.006
J	2.600	3.000	0.102	0.118
M	0.300	0.600	0.012	0.024
θ	0	10°	0°	10°

Shipping packing



Tape Reel Data



Package Type SOT23-6	Tape Size (W1) (mm)	Pocket Pitch (P) (mm)	Reel Size (A) (mm)	Reel Width (W2) Min./Max. (mm)	Units Per Reel pcs.
6 Lead	8	4	180	8.4/9.9	3000

Revision History

REVISION	DESCRIPTION	PAGE	DATE
1.0	First Release		2020/03/08
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