

Data Sheet

Type Description : Current-Mode PWM Controller (SSR)

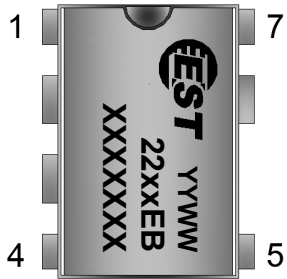
Product Name : EST.22xxEB

Reversion : V1.0

Reversion Date : May, 2020

Page : 12 Pages

Pin Assignments and Package Type



EST: LOGO
 YYWW: Date code
 22xxEB: xxEB=MOS Type;
 XXXXXX: Production lot code

DIP-7

DIP-7	NAME Description	Pin type	Description
1	VDD	Power	Power Supply
2	VDD	Power	Power Supply
3	GND	GND	Ground
4	FB	Feedback Input	Feedback Input Pin.The PWM duty cycle is determined by this pin voltage level and current-sense signal at Pin 5.
5	CS	Current Monitoring	Current Sensing
6	DRAIN	Internal MOSFET Drain	Internal HV MOSFET Drain.Connected to the primary lead of the transformer
7	DRAIN	Internal MOSFET Drain	Internal HV MOSFET Drain.Connected to the primary lead of the transformer

Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
D_{rain}	Internal HV MOS Drain voltage	-0.7~660	V
V_{FB}	FB Input Voltage	-0.3~7	V
V_{CS}	Current-sense Input Voltage	-0.3~7	V
T_j	Operating Junction Temperature	-20~150	°C
T_{stg}	Storage Temperature	-40~150	°C
$V_{cc-clamp}$	VCC Clamp Voltage	29	V
I_{cc}	VCC DC Clamp Current	10	mA

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
VCC	VCC supply voltage	9-25.5	V
T_s	Operating shell temperature	-10-110	°C
Drain	Internal HV MOS Drain voltage	-0.7-700	V

ESD information

Symbol	Parameter	Value	Unit
Vesd-HBD	Human Model except Drain Pin	2	KV
Vesd-MM	Machine Model	150	V

Thermal characteristics

Characteristics	Symbol	Rating	Unit
Thermal resistance, Junction to shell	R θ jc	170	°C/W

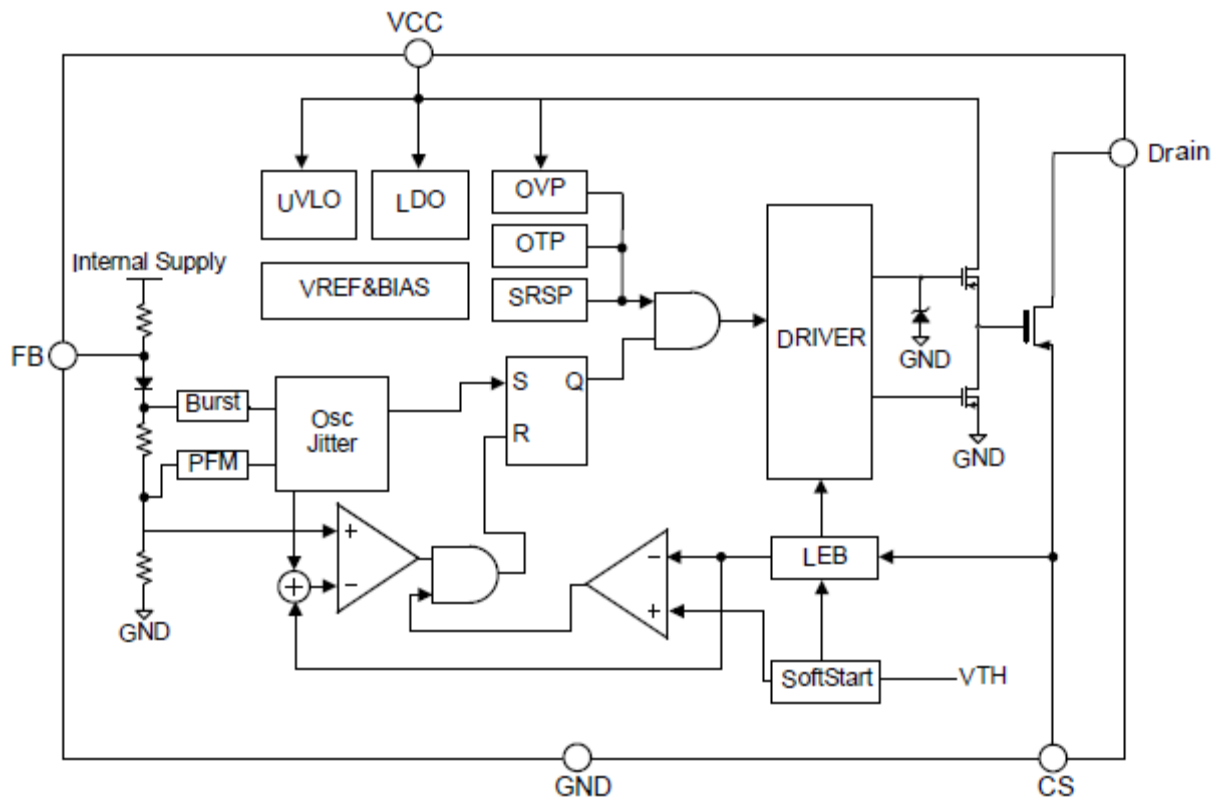
Electrical Characteristics (TA = 25 °C, if not otherwise noted)

Symbol	Parameter	Test Condition	MIN	Type	MAX	Unit
VCC:						
VCC-Op	Operation Voltage		9		25.5	V
UVLO-On	Turn-Off threshold		6.8	7.8	8.2	V
UVLO-Off	Turn-on threshold		13	13.4	16.5	V
I_VCC-ST	Start-up Current	Vcc=12V			10	uA
I_VCC-Op	Operation Current	Vcc=16V;FB=2.0V		1.5		mA
VCC-Clamp	VCC Zener Clamp Voltage	I_Vcc=10mA		29		V
FB:						
VFB_Open	V_FB Open Loop Voltage			5.7		V
IFB_Short	FB Pin Short Current	FB Shorted to GND	90	150	300	uA
VTH_PL	Power limiting FB Threshold		2	2.5		V
TD_PL	Power limiting Debounce			60		ms
ZFB_IN	Input Impedance			30		kΩ
Max_Duty	Maximum duty cycle			75		%
CS:						
TLEB	Leading edge Blanking Time		150	400	750	ns
Zsense	Input impedance			40		kΩ
VTH_OC	OCP threshold	Duty=0	0.62	0.65	0.68	V
Oscillator Section:						
Fosc	Frequency	Oscillation	60	66.5	73	khz
Fosc_BM	Burst mode frequency		17	25	28	khz

HV MOSFET (Drain Pin) :

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit	Remark	Package
MOSFET Drain-source Breakdown Voltage	BV_{DSS}	VGS=0V ID=250uA	650			V		
Static drain-source on-resistance	$RDS_{(on)}$	VGS=10V ID=0.4A		14	17	Ω	EST.2210EB	DIP-7
		VGS=10V ID=0.5A		8	10	Ω	EST.2212EB	DIP-7
		VGS=10V ID=1.0A		4.0	5.0	Ω	EST.2214EB	DIP-7
		VGS=10V ID=1.5A		3.0	3.6	Ω	EST.2216EB	DIP-7
		VGS=10V ID=0.5A		2.5	2.9	Ω	EST.2218EB	DIP-7

Block Diagram



Application Information

EST.22xxEB combines a dedicated current mode PWM mode controller with a 1-17 Ω /650V MOSFET. EST.22xxEB has high efficiency, low standby power consumption, low EMC and low cost.

Start up Control

EST.22xxEB has very low start-up current that is less than 10 μ A. 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.22xxEB is less than 1.5mA. Therefore, EST.22xxEB can have good efficiency.

Frequency shuffling for EMI improvement

The frequency Shuffling is implemented in EST.22xxEB. 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.22xxEB adjusts the switching frequency according to the loading condition. The PWM pulse width is kept greater than 1.2 μ S 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.22xxEB. 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 also help EST.22xxEB obtain the same output current in universal ac input voltage.

Protection Controls

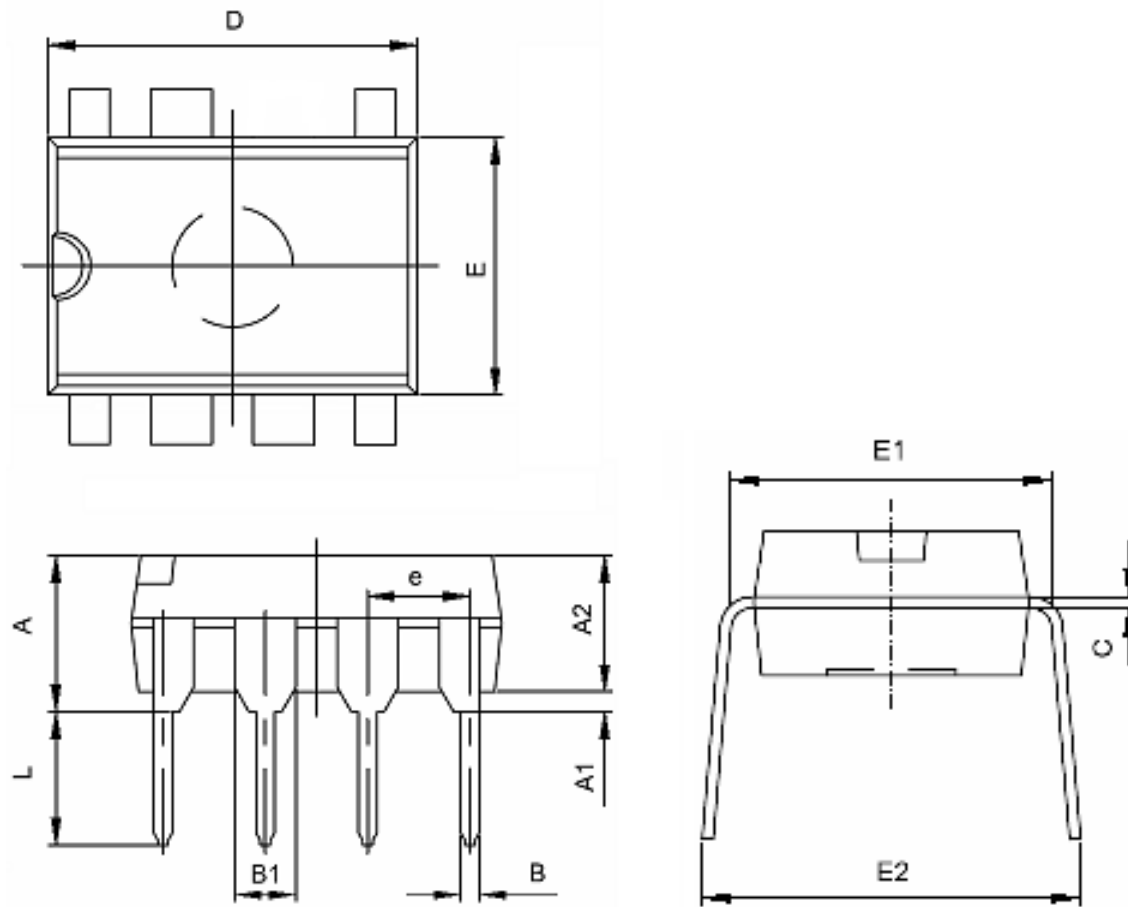
EST.22xxEB has comprehensive protection functions, including Cycle-by-Cycle current limitation (OCP), Over Load Protection (OLP) and over voltage clamp, Under Voltage Lockout on VCC (UVLO), Over Temperature Protection (OTP).

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

DIP-7 Package



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	0.360	0.560	0.014	0.022
B1	1.524(TYP)		0.060(TYP)	
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	7.620(TYP)		0.300(TYP)	
e	2.540(TYP)		0.100(TYP)	
L	3.000	3.600	0.118	0.142
E2	8.200	9.400	0.323	0.370



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