

## **Data Sheet**

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**Type Description :** **Green-Mode PWM Flyback (SSR) Controller**

**Product Name :** **EST.2700X**

**Reversion :** **V1.0**

**Reversion Date :** **May, 2019**

**Page :** **16 Pages**

# EST.2700X Green-Mode PWM Flyback (SSR) Controller



## General Description

EST.2700X is a higher integrated PWM flyback controller. It provides several functions to enhance the efficiency to meet the criteria of global standards such as DoE Level VI and EU CoC V5 Tier-2. Meantime, it also provides excellent EMI-improved solution, and also built in complete protection.

EST.2700X is a multi-mode controller. At full load, the IC operates in fixed frequency CCM mode or QR mode based on the AC line. In this way, high efficiency in the universal input voltage at full load can be achieved. At normal load, it operates in QR mode. When the load goes low, it operates in Green mode with Valley switching for high efficiency. When the load is very small, the IC operates in Burst mode to minimize the standby power loss. As a result, high efficiency can be achieved in the whole loading range.

EST.2700X also built-in the leading-edge blanking (LEB) of the current sensing and feedback loop to screen the spike noise from any input signal. The internal slope compensation can limit the constant output over universal AC input range. The sawtooth over frequency function for EMI improved solution.

Meanwhile, EST.2700X also provides various protection, such as, OLP (Over Load Protection), VCC OVP (Over Voltage Protection), Output OLP and output OVP to prevent the circuit damage from the abnormal conditions.

EST.2700X is available in SOT-23-6, SOP-8 and TSOT-23-8 (with AC pin).

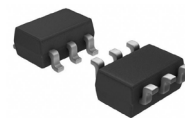
EST.2700X works with current sensing synchronous rectifier controllers, such as EST.6100A/B, to achieve higher conversion efficiency and very compact power density.

## Features

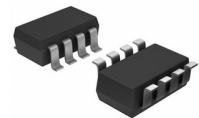
- 65KHz fix frequency mode at PWM Mode
- Internal 12ms Soft-start in 65KHz
- Very low startup current (<6 uA)
- 0.5mA ultra-low operating current at light load
- Programmable adaptive burst control for light-load efficiency with low output ripple and audible noise suppression.
- Programmable adaptive Frequency Shuffling and Slope Compensation @ QR and PWM Mode
- Current mode control with Cycle-by-Cycle current limit
- Built-in slope and load regulation compensation
- LEB (Leading-edge blanking) on CS Pin
- UVLO (Under voltage lockout)
- Fault Protections : VCC Over Voltage, RTL OVP(Over Voltage & UVP (Under Voltage), Output Short-Circuit, Over-Current, OLP (Over load protection) OTP(Over temperature protection) and Pin Fault
- Photo coupler short protection & Feedback open protection
- High voltage CMOS process with excellent ESD protection
- Hazardous Substance Free
- RoHs/REACH Compliant

## Application

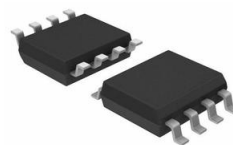
- Switching AC/DC adapter and battery charger
- ATX standby power
- Open frame switching power and CD(R)
- Set-top-boxes(STB) 384Xreplacement



SOT23-6



SOT-23-8



SOP-8L



DIP-8L

## Function and Protection Options

Part No.	Package	Freq.	Protection							
		KHZ	VCC OVP	OLP	AUX. OVP	AUX. UVP	CS Open	SDSP	AC-Line OVP	BNO
EST2700A	SOT-23-6L	65KHz	Hiccup	Hiccup / 65mS	Hiccup	Hiccup	Hiccup	Hiccup	NA	NA
EST2700R			Latch	Hiccup / 65mS	Hiccup	Hiccup	Hiccup	Hiccup		
EST2700L			Latch	Latch / 65mS	Latch	Latch	Hiccup	Hiccup		
EST2700M		100KHz	Hiccup	Hiccup / 42mS	Hiccup	Hiccup	Hiccup	Hiccup	NA	NA
EST2700H		135KHz	Hiccup	Hiccup / 32mS	Hiccup	Hiccup	Hiccup	Hiccup	NA	NA
EST2700B	SOT-23-8 SOP-8L DIP-8L	65KHz	Hiccup	Hiccup / 65mS	Hiccup	Hiccup	Hiccup	Hiccup	Hiccup	Hiccup

Note: EST lead-free products contain molding compounds/die attach materials and 100% matte tin plate termination finish; which are fully compliant with RoHS. EST lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J-STD-020C for MSL classification at lead-free peak reflow temperature. EST defines "Green" to mean lead-free (RoHS compliant) and halogen free (Br or Cl does not exceed 900ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500ppm by weight)

# EST.2700X Green-Mode PWM Flyback (SSR) Controller



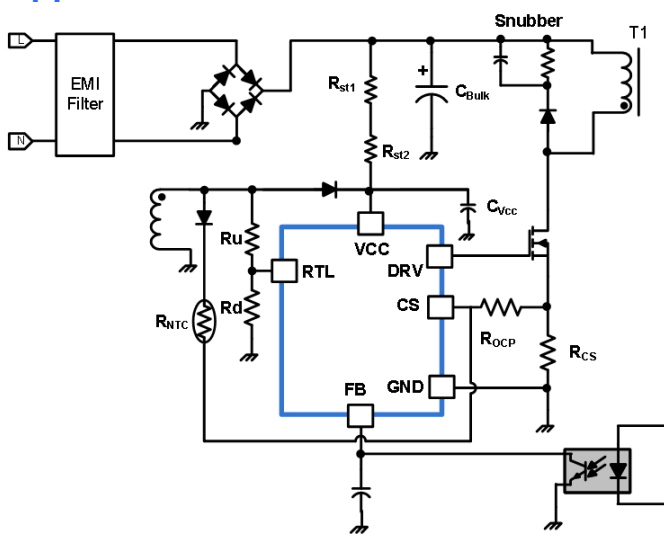
## Ordering Information

Part Number	Package	Packaging	Note
EST2700A/R/L/M/H	SOT-23-6	Tape & Reel	Green
EST2700BS	SOT-23-8	Tape & Reel	Green
EST2700BS	SOP-8L	Tape & Reel	Green
EST2700B	DIP-8L	Tape	Green

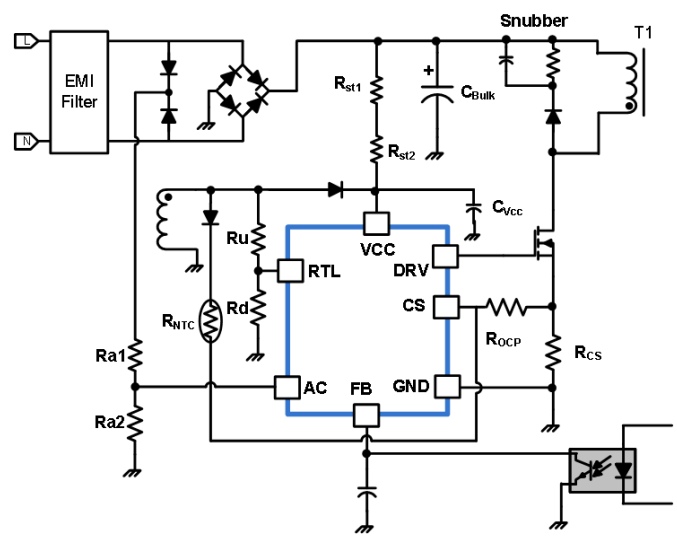
## Pin Assignments and Package Type

SOT-23-8L SOP-8L DIP-8L	SOT-23-6L	NAME Description	Description
1	3	RTL	Auxiliary voltage sense, Quasi Resonant and Vout OVP&UVP detection.
2	2	FB	Voltage input pin by connecting a photo-coupler
3	--	AC	AC Brown in/out and Line OVP detection.
4	1	GND	Ground
5	6	DRV	Driver output to driver the external MOSFET
6	5	VDD	Power supply pin
7	--	NC	
8	4	CS	Current Sense input. The current sense resistor between this pin and GND is used for current limit setting.

## Application Circuit



EST.2700A/R/L/M/H



EST.2700B/BS

# EST.2700X Green-Mode PWM Flyback (SSR) Controller



## Absolute Maximum Ratings

Parameter Symbol	Symbol	Limit Values		Unit	Remark
		Min.	Max		
Supply Voltage $V_{DD}$	$V_{DD}$	-0.3	32	V	
AC,FB,CS,ZCD Voltage	$V_{AC}, V_{FB}, V_{CS}, V_{ZCD}$	-0.3	7	V	
Gate Driver Voltage	$V_{GATE}$	-0.3	$V_{CC}+0.3$	V	
Operation Junction Temperature	$T_j$	-40	125	°C	
Operation Ambient Temperature	$T_A$	-25	85	°C	
Storage Temperature	$T_{stg}$	-55	150	°C	
Power Dissipation	PD	-	408	mW	SOT23-6
			513		SOT23-8
			556		SOP-8
Junction-to-Ambient Thermal Resistance*	$\theta_{JA}$	-	245	°C/W	SOT23-6
			195		SOT23-8
			180		SOP-8
Junction-to-Case Thermal Resistance**	$\theta_{JC}$	-	55	°C/W	SOT23-6
			47		SOT23-8
			39		SOP-8
Lead temperature (Soldering, 10 sec)		-	260	°C	
ESD Voltage Protection	HBM	$V_{ESD-HBM}$	-	3.0	KV
	MM	$V_{ESD-MM}$	-	300	V

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

Parameter Symbol	Symbol	Limit Values		Unit	Remarks
		Min.	Max		
Supply Voltage $V_{DD}$	$V_{DD}$	10	25	V	
Startup Resistor Value	$R_{star}$	1	14	MΩ	
Ambient temperature range	$T_{opr}$	-40	85	°C	
Capacitance of FB pin	$C_{FB}$		2.2	nF	

# EST.2700X Green-Mode PWM Flyback (SSR) Controller



## DC Electrical Characteristics (VCC =15V, Ta=25°C)

### Supply Voltage (VCC Pin):

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Startup Current	I <sub>CC-ST</sub>	2.0	3.5	5.5	μA	UVLO ON - 0.1V
Operating Current (with 1nF load on DRV pin)	I <sub>CC-OP</sub>	0.4	0.6	0.8	mA	V <sub>FB</sub> =0V
	I <sub>CC-OP</sub>	1.5	2.0	2.5	mA	V <sub>FB</sub> =2.5V CL=1nF
	I <sub>CC-OLP</sub>	0.2	0.35	0.5	mA	OLP
UVLO (off)	V <sub>UVLO-OFF</sub>	7.5	8.0	8.5	V	
UVLO (on)	V <sub>UVLO-ON</sub>	17	18	19	V	
V <sub>DD</sub> OVP Level	V <sub>OVP</sub>	26	27	28	V	
OVP Debounce Time	T <sub>OVP</sub>		4.0		cycle	Guarantee by Design
V <sub>CC</sub> Simulation mode(ON)	V <sub>CC-HD_ON</sub>	9.7	10.2	10.7	V	
V <sub>CC</sub> Simulation mode(Off)	V <sub>CC-HD_OFF</sub>	10.2	10.7	11.2	V	

### Voltage Feedback(FB Pin):

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Short Circuit Current	I <sub>zero</sub>	0.10	0.14	0.18	mA	V <sub>FB</sub> =0V
Open Loop Voltage	V <sub>FB-OP</sub>	4.8	5.0	5.2	V	FB pin open
Burst mode start voltage(on)	V <sub>BUR_ON</sub>	0.9	1.0	1.1	V	
Burst Mode Hysteresis	V <sub>BUR_HY</sub>	0.05	0.1	0.15	V	
Green Mode Threshold	V <sub>th_GR</sub>		1.5		V	
Green Mode End Threshold	V <sub>th_GR_end</sub>		1.1		V	

### Current Sensing (CS Pin):

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Leading Edge Blanking Time	T <sub>LEB</sub>	300	400	500	ns	
Propagation Delay to Output	T <sub>pd</sub>	300	400	500	nS	
Maximum CS Off Voltage	V <sub>CSSTH1</sub>	0.65	0.70	0.75	V	
OCP source current	I <sub>OCP</sub>	18.5		21.5	%	I <sub>OCP</sub> /I <sub>AUX</sub>
Over Load Protection	V <sub>OLP</sub>	0.45	0.50	0.55	V	T <sub>ON</sub>
Debounce Time of OLP	T <sub>OLP</sub>	54	64	74	mS	
Over temperature protection	V <sub>OTP</sub>	0.45	0.5	0.55	V	T <sub>OFF</sub>
Debounce Time of OTP	T <sub>OTP</sub>	54	64	74	mS	
OTP Leading Blanking time	T <sub>OTP_LEB</sub>		2		uS	Guarantee by Design
Short Circuit Protection Voltage	V <sub>SCP</sub>		0.85		V	
Debounce Time of VSCP	T <sub>SCP</sub>		2		cycle	

### Multiple functions. Auxiliary voltage sense (RTL Pin):

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Output OVP Trigger Point	V <sub>TH_OVP</sub>	2.9	3	3.1	V	FB>4
Output OVP Deglitch Time Constant	T <sub>OVP_delay</sub>		4		Cycle	Guarantee by Design
Output UVP Trigger Point	V <sub>TH_OVP</sub>	0.7	0.8	0.9	V	FB>4
Output UVP Deglitch Time Constant	T <sub>OVP_delay</sub>		4		Cycle	Guarantee by Design
Positive Clamped voltage	V <sub>POS</sub>	6		7	V	
Negative Clamped voltage	V <sub>NEG</sub>	-0.05		0.05	V	
RTL Leading Blanking time	T <sub>RTL_LEB</sub>		2		uS	Guarantee by Design

### Alternating Current Detect(AC Pin):

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Brown In trigger point	V <sub>BNI</sub>	0.8	0.85	0.9	V	
Brown Out trigger point	V <sub>BNO</sub>	0.65	0.7	0.75	V	
BNO De-bounce time	T <sub>BNO</sub>	16	21	33	mS	
Line OVP trigger point	V <sub>LNOVP</sub>	2.95	3.0	3.05	V	
Line OVP release point	V <sub>LNOVP_HYS</sub>	2.85	2.9	2.95	V	
Line OVP De-bounce time	T <sub>LNOVP</sub>	130	140	150	mS	
AC detect time	T <sub>ACD</sub>	20	22.5	25	mS	

# EST.2700X Green-Mode PWM Flyback (SSR) Controller



### Driver(DRV Pin) :

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Output Low Level	$V_{OL}$			1	V	$V_{DD} = 16V, I_o=20mA$
Output High Level	$V_{OH}$	8			V	$V_{DD} = 16V, I_o=20mA$
Output Clamp Voltage Level	$V_{G\_Clamp}$	11	12.5	14	V	$V_{DD} = 25V$
Rising Time	$T_R$	200	300	400	nS	$V_{DD} = 16V, C_L = 1nF$
Falling Time	$T_F$	10	30	50	nS	$V_{DD} = 16V, C_L = 1nF$

### Timer Section:

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Burst Mode Frequency	$F_{Burst}$	20	22.5	25	KHz	
PWM Mode Frequency	$F_{PWM}$	61	65	69	KHz	
Peak Mode Frequency	$F_{Peak}$	120	130	140	KHz	
Voltage stability of Frequency	$F_{PSRR}$	-1		+1	%	$V_{DD} = 11V\sim 25V$
Frequency Shuffling Range	$F_{jitter}$	+/-4	+/-6	+/-8	%	
Maximum duty cycle	$D_{MAX}$	70	75	80	%	
Internal Soft Startup Time	$T_{SS}$	10		15	mS	

### On chip Thermal shut down:

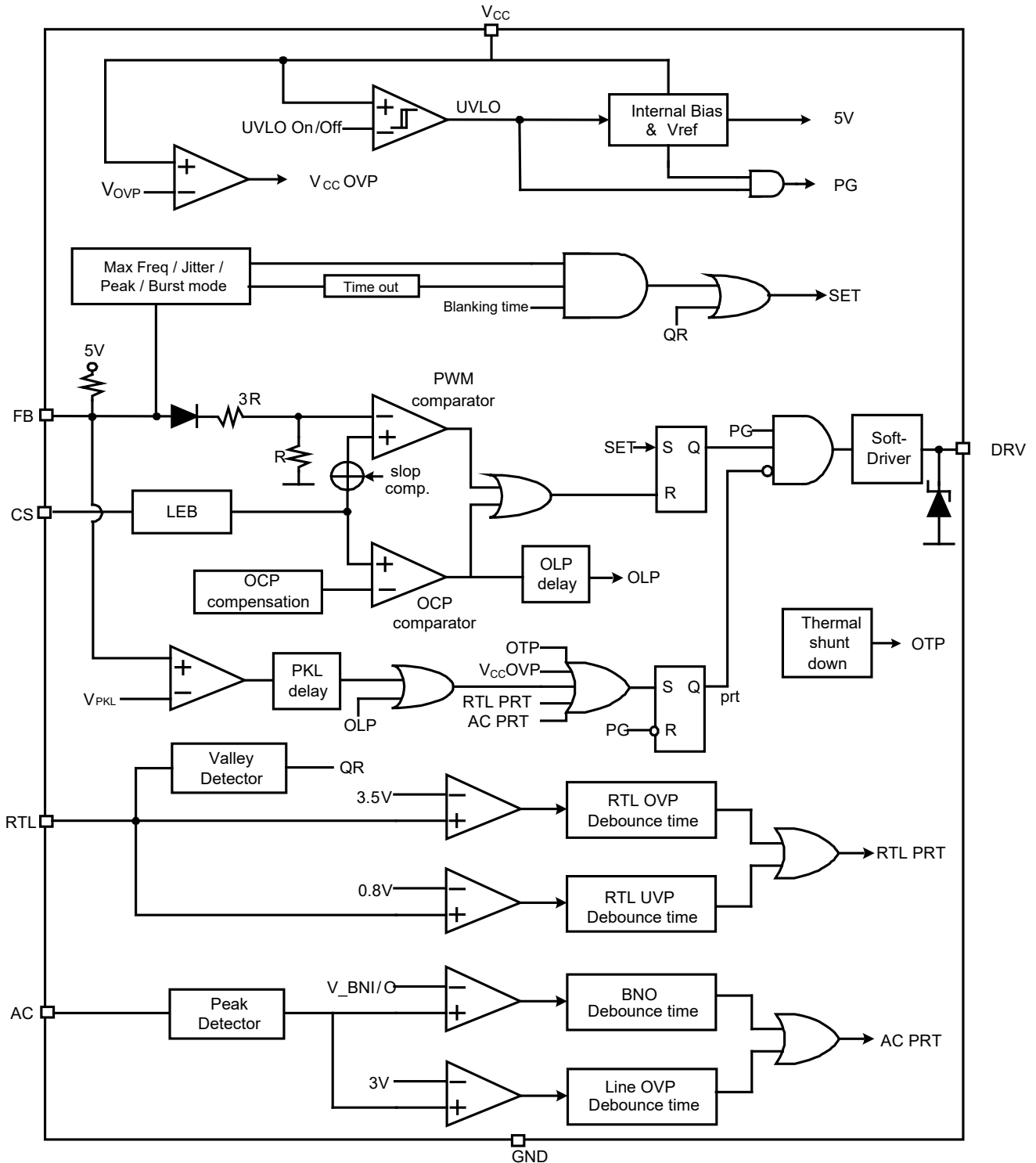
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
IOTP Level	$V_{IOTP}$		150		°C	Guarantee by Design
Output High Level	$V_{OOTP}$		120		°C	

# EST.2700X Green-Mode PWM Flyback (SSR) Controller



EST.2700X Green-Mode PWM Flyback (SSR) Controller

## Block Diagram EST2700X



## Application Note

### Operation Overview

The EST.2700X meets the green power requirement and very suitable for the use in those networking adaptors, TV open frame and various consumer power, which can provide more power efficiency and lower power loss. It also supports various kind of protection for every abnormal environments.

### V<sub>DD</sub> Start-up and Control

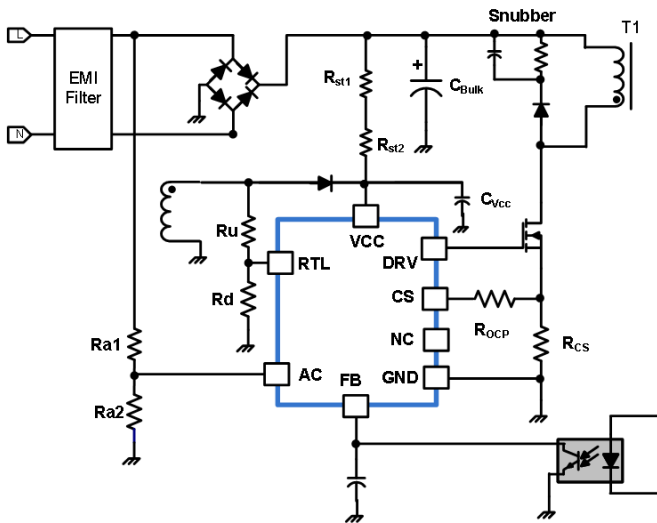


Fig-1.

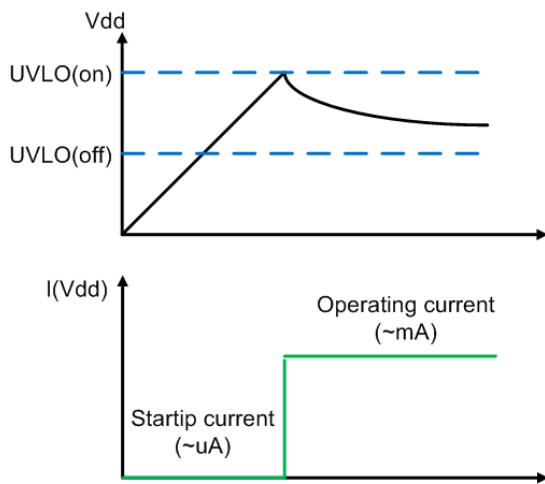


Fig-2.

The start-up circuit of EST.2700X is shown in Fig.1 . It's internal comparator will detect the voltage on the Vcc pin, and assures the supply voltage enough to turn on the EST.2700X. At beginning, the startup current is provided by  $(R_{st1}/R_{st2})$  to charge the capacitor  $C_{VCC}$  till  $V_{CC}$  get enough voltage (UVLO\_ON) to turn on itself,

refers to fig.2. Meantime, it go a step further to deliver the gate drive signal to enable the Aux. winding of transformer , and then provides supply current. The startup current of EST.2700X is designed to be very low so that  $C_{VCC}$  could be charged up above UVLO\_on threshold level and it starts up quickly.

EST.2700X series is process with low power mix-mode process (5V and 32V), which max start-up current is below 5.5uA, R-start calculate as below :

$$\frac{V_{bulk} - V_{UVLO\_ON}}{R_{start}} > I_{cc-st}$$

It is trade-off between startup time and a higher startup resistance. Therefore, carefully select the value of Rstart,  $C_{VCC}$  to optimize the power consumption and startup time.

### SS, Soft-start Sequence

EST.2700X also built-up 12.5ms (typical) soft-start to soften the electrical stress occurring in the power supply during startup, refer to Fig.3. As soon as  $V_{CC}$  reaches  $U_{VLO\_on}$ , the  $C_s$  peak voltage is gradually increased from 0.2V to the maximum level, see fig.4.

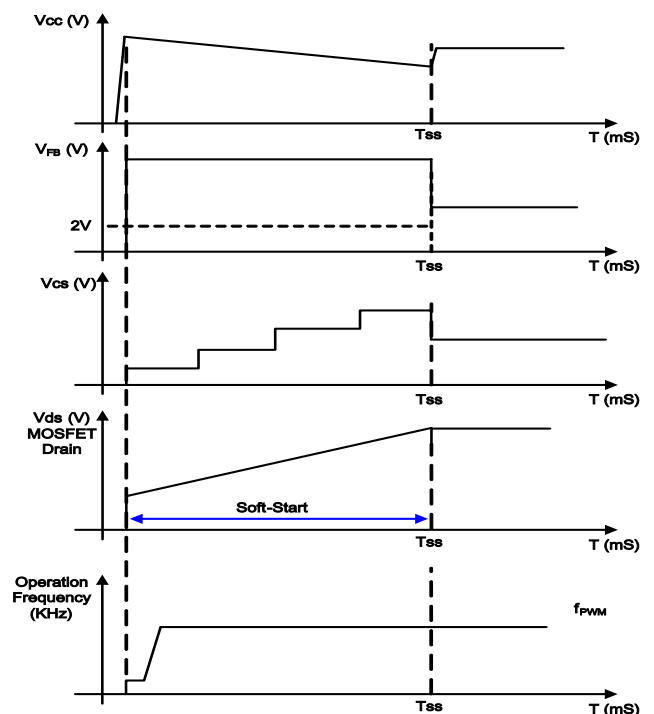


Fig.3



## VDD Stimulation Mode

EST.2700X provides stimulation mode to avoid abnormal re-start-up under heavy loading to no-load, caused by non-balance of discharge of  $V_{CC}$  cap and output cap, which is different with burst mode. The waveform is shown in fig.5.

Condition :  $V_{FB} < V_{BUR\_ON}$  &  $V_{CC} < 9.5V$  trigger, Hysteresis Voltage 1V

Action : IC fix output  $F_{Burst}$ , and  $V_{CS}$  keeps as 0.15V

Notice : Design  $V_{AUX}$  higher than 11V

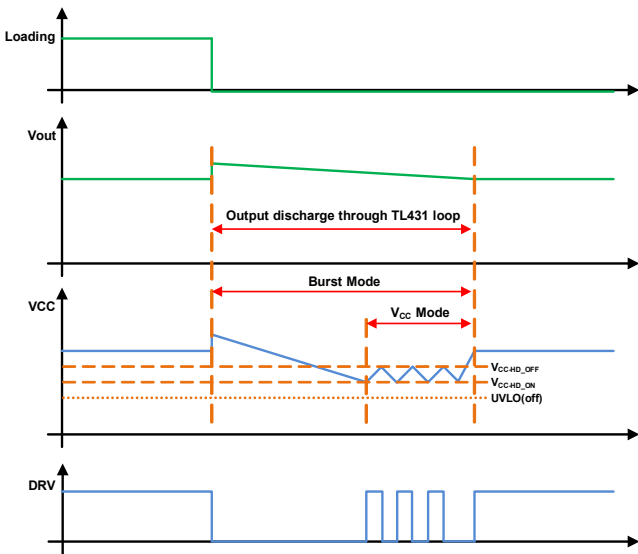


Fig.4

## OLP (Over Load Protection)

EST.2700X has new OLP built-in at CS pin, and its merit of close loop methodology makes audio noise free.

The adjustment of OCP is through RTL and CS, please refer to Fig.5. It detects the status of AC line and output voltage through the resistance divider ( $R_u, R_d$ ) by the reflection waveform of Aux-winding. At negative cycle,  $V_{RTL}$  will keep "0" and output IOCP at CS pin to change the level of slope compensation, please see Fig.5. Therefore, it can modify the  $R_u$  and  $R_{OCP}$  to get target of OCP @full range. Please follow the procedure as below :

- Step 1. Set  $R_U=200K\Omega$ ,  $R_d=39K\Omega$  (initial setting) &  $R_{OCP} = 1K\Omega$  and modifies  $R_{CS}$  to target of OCP@90Vac
- Step 2. Increase  $R_{OCP}$  impedance to reduce OCP and check the OCP of AC full range. Modifies  $R_{OCP}$  to make sure the consistency of OCP for AC full angle.

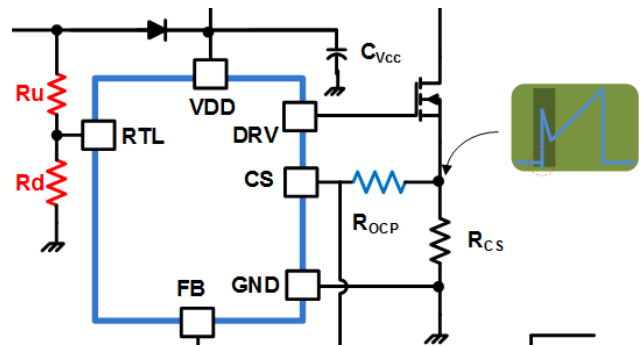


Fig.4

## RTL: Demagnetization Detection from RTL pin (QR Mode Detection)

After MOSFET turns off, the current of secondary side diodes goes down to zero, and then the transformer core will be demagnetized completely, see fig.6. At the same time, a Quasi resonant signal will be detected from auxiliary winding by ZCD pin through the external resistor divider.

## Programmable $V_{O\_OVP}$ & burst mode level

This ZCD pin is also used to program the burst level at light load and high output voltage at system open loop. A resistive divider between Aux winding and GND is used to set a voltage at this pin to determine the peak current level when power enters the adaptive burst mode. At the same time, it also detects voltage level of output.

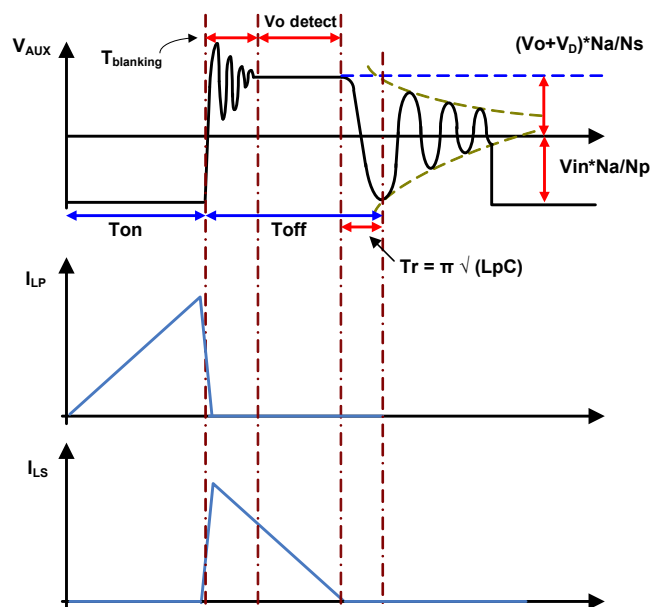


Fig.6

**VO\_OVP :**

Modifies Rd to target of VO\_OVP

Calculate the ratio of Rd to (Ru+Rd)

$$R_u = 200K\Omega$$

$$\frac{R_d}{R_u + R_d} = \frac{V_{TH\_OVP}}{(V_{O\_OVP} + V_d)} \times \frac{N_s}{N_a}$$

**Adjust Burst :**

$$V_{BUR\_ON} = (V_o + V_d) \times \frac{N_a}{N_s} \times \frac{R_d}{R_u + R_d} - 1.7$$

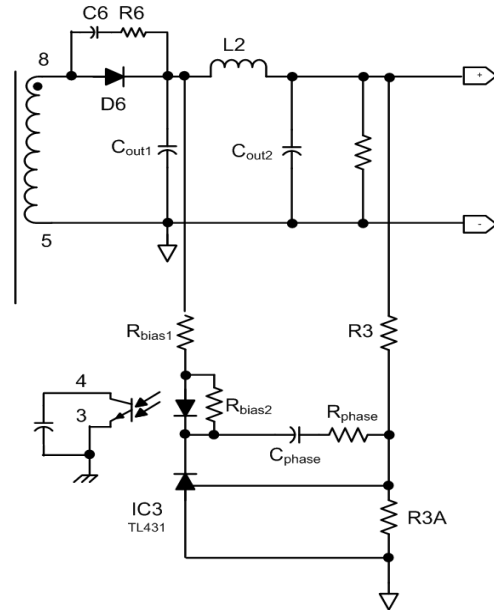
**FB , Voltage Feedback Loop**

EST.2700X series adopt current mode control, that is say, the voltage feedback signal is provided from TL431 at secondary side through the photo-coupler to FB pin and compare to the current signal sensing from Cs pin at primary side of MOS current to control the on/off of MOSFET.

In order to enhance light load efficiency, the loss of the feedback resistor in parallel with photo-coupler is reduced. Due to small feedback resistor current, shunt regulator selection and minimum regulation current design have to be considered more carefully to make sure it's able to regulate under low cathode current.

To make sure the stability of feedback is very important. Unstable feedback signal will introduce output oscillate or audio noise. You can monitor the ripple & Noise of output to adjust the phase and gain margin of close loop.

- (1).  $R_{bias1}$  and  $R_{bias2}$  to prevent the abnormal output voltage at heavy loading. Generally, we suggest  $R_{bias1}$  100~1KΩ ,  $R_{bias2}$  1.5~2.5KΩ
- (2).  $R_{phase}/C_{phase}$  is for RC phase compensation and prevent oscillate to adjust the value of CFB
- (3). Generally, we suggest  $R_{phase}$  1~10KΩ ,  $C_{phase}$  0.1uF , CFB 1~2.2nF
- (3). The ratio of  $R_3$  and R3A is Depent on the output voltage spec (TL431 ,V= 2.5V)



**Fig.7**

In addition,  $V_{FB}$  is also used to determine the green mode level .When  $V_{FB}$  is under  $V_{BUR\_ON}$  , it is under no load or light load condition; at light loading, burst mode can effectively reduces the switching loss. When  $V_{FB}$  is larger than  $V_{BUR\_ON}$ , it will leave away the standby mode. The normal operation of  $V_{FB}$  is from  $V_{BUR\_ON}$  to 2.4V,; meanwhile, short-circuit current is around  $I_{zero}$ .

**CS, Current sense Loop**

Current mode PWM control mode detects the current command (CS) from the Rsense (the primary MOSFET current sense resistor) and voltage command from photocoupler (FB) to determine whether the system reaches a stable or not. There is a potential risk of sub-harmonic when the duty of flyback methodology is larger than 50% and the operation under continues conduction mode (CCM) , therefore, IN2P083X series of built-in high and low slope compensation to avoid the sub-harmonic risk.

A leading-edge blanking (LEB) time is included in the input of CS pin to prevent the false-trigger from the current spike. Meanwhile, it is strongly recommended to put a suitable R-C filter for higher power application to prevent the CS pin being damaged by the unknow negative spike.

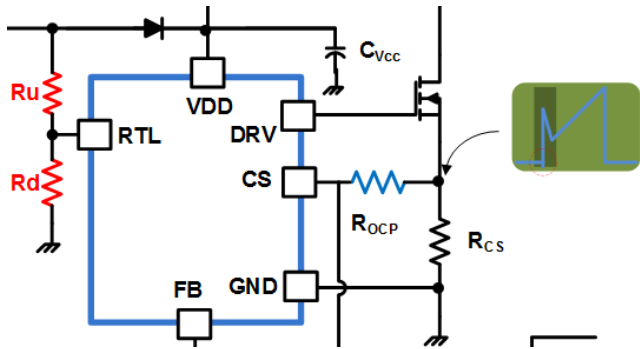


Fig.8

**OTP (Over Temperature Protection on CS)**

EST.2700X is implemented over temperature protection on CS pin which senses voltage to determine NTC status during gate off region. As VCS is greater than 0.5V and continues for 64ms, CS\_OTP is triggered, than EST2700X is in protection mode till the temperature drops to setting work condition.

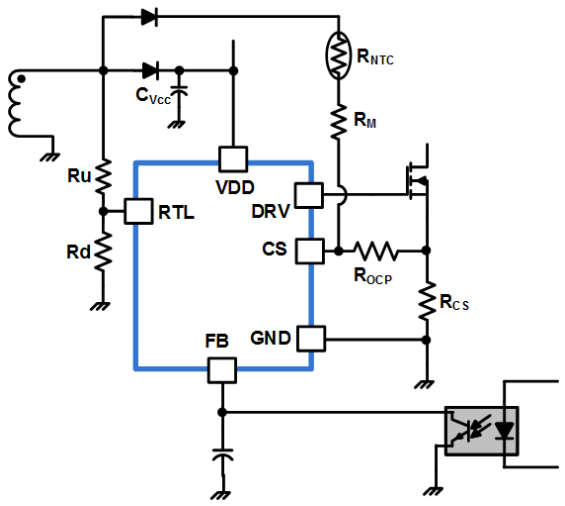


Fig.9

**DRV**

The driving capability of EST.2700X is around 450mA, which can support power rate around 60~70W, and it is limited the maximum duty-cycle below 80% to avoid the transformer saturation. Typically, the threshold of MOSFET is about 20V, and the maximum clamp voltage of EST.2700X is 14V to prevent breakdown of MOSFET.

**Complete Protection**

EST.2700X integrates various kind of protection to make sure operation safety.

**VDD OVP (Over Voltage Protection)**

The maximum ratings of the EST.2700X are around 30V. To prevent the V<sub>CC</sub> enter breakdown condition, EST.2700X series are integrated with OVP function on V<sub>CC</sub> pin. Whenever the V<sub>CC</sub> voltage is higher than the V<sub>OVP</sub> threshold, the output gate drive circuit will be turn-off simultaneously and the power MOSFET is turn-off until the next UVLO(on) cycle.

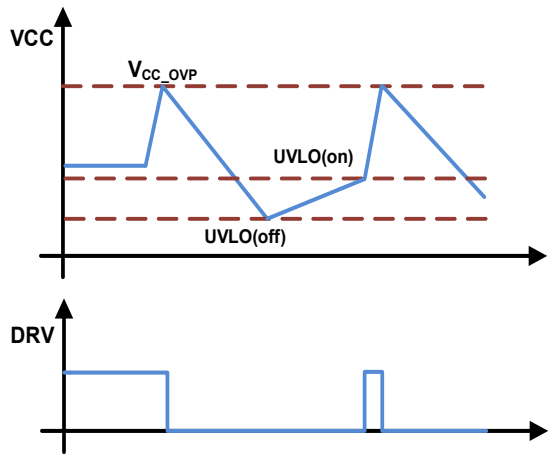


Fig.8

**SCP (Short Circuit Protection)**

A resistive divider between Aux winding and GND is used to monitor output voltage. When output circuit is short, Therefore, as V<sub>RTL</sub> is lower than 0.8V during date off region, then V<sub>TH\_UVP</sub> is triggered, EST.2700X is to enable UVP function in order to reduce input power

**SDSP, Secondary Diode Short Protection**

After short circuit of 2nd side schotkky, the inductance current is too low to discharge completely caused by lower output voltage, and then it will continues to increasing to induce abnormal saturation of transformer during LEB timing, therefore, higher peak current induce serious high V<sub>ds</sub> to damage MOSFET.

EST.2700X detects the inductance current through the resistance, R<sub>cs</sub>, of CS pin, and will trigger protection (latch or hiccup) when V<sub>cs</sub> higher than 0.85V and sustains 2cycle timing.

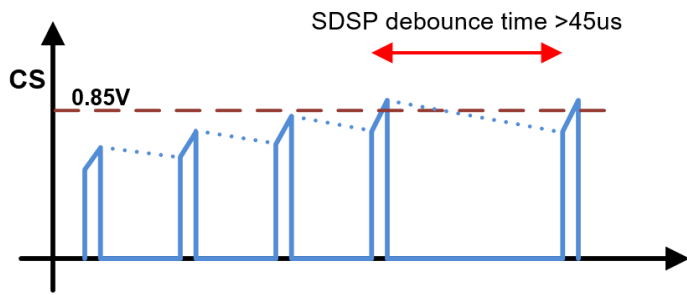
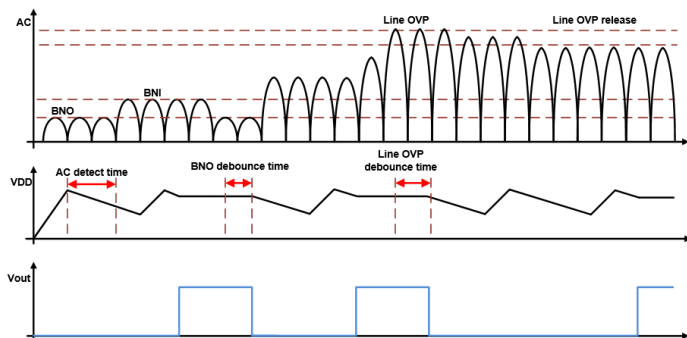


Fig.10

## AC, Brown-in/out & Line OVP

EST.2700B provides real detection of AC line through AC pin connected directly to AC line. When the VDD of EST.2700B reaches UVLO\_ON, it is into the state of AC detection, and sustains a delay time  $T_{ADC}$ . This AC pin is used to program the AV over and under voltage level through a resistive divider ( $R_{a1}/R_{a2}$ ).

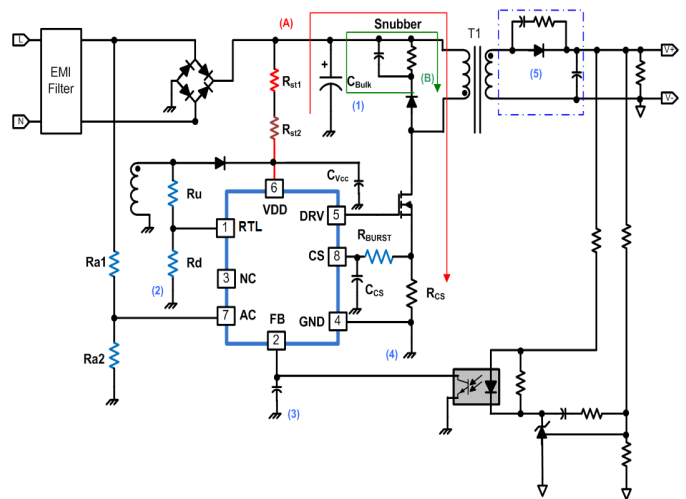
If  $V_{ac}$  is lower than below  $V_{BNI}$  or higher than  $V_{LNOVP\_HYS}$ , it will turn-off the output till next cycle to check the condition is removed or not. Even after it turn-off, this pin is continues to detect line status. If  $V_{ac}$  is lower than below  $V_{BNO}$  or higher than  $V_{LNOVP}$  for the timing  $T_{BNO}$  and  $T_{LNOVP}$ , it will be turn-off, and re-start again. Please refers to fig11.



## Layout Guide line

Better layout plan can reduce unknow noise no matter signal or EMI, please refer to the list below :

- ✓ **Big current path** : A&B (Area 1) area are high frequency current loop, line to line is as close as possible, and avoid near low voltage control area
- ✓ **Low voltage area** : R divider need to be as near FB\_Pin as possible.
- ✓ **Secondary Side Schottky** : routing as close as possible
- ✓ **Grounding** : (2).(3) and (4) grounding separated with each other, and end connects to (1) ground.
- ✓ **RTL** :  $R_u$  &  $R_d$  as close as possible to avoid noise coupling to trigger OVP.



**Table 1: Complete Protection**

Issue	Protection		Pin	Protection Conditions
1st	V-Sense	VCC OVP	Vcc	Vcc > 28V
1st	V-Sense	VCC UVLO Off	Vcc	Vcc < 7.5V
1st	V-Sense	Brown In Fail	AC	V <sub>AC</sub> <0.85
1st	V-Sense	Brown out	AC	V <sub>AC</sub> >0.75V
1st	V-Sense	Line OVP	AC	V <sub>AC</sub> >3.0V
1st	V-Sense	T1 Aux gnd open	ZCD	ZCD UVP trigger
1st	V-Sense	MOS short/Gate to GND	ZCD	ZCD UVP trigger
1st	V-Sense	CS pin open	CS	V <sub>CS</sub> >0.7V after 4 cycles
1st	ZCD	ZCD upper R open	ZCD	ZCD UVP : after soft-start ZCD<0.85V & FB>4V
1st	ZCD	ZCD upper R short	ZCD	ZCD OVP : ZCD>3V & FB>4V
1st	ZCD	ZCD down side open	ZCD	ZCD OVP : ZCD>3V & FB>4V
1st	ZCD	ZCD down-side short	ZCD	ZCD UVP : after soft-start time ZCD<0.85V & FB>4V
2nd	SDSP	2nd side Schottkey short	CS	VCS >0.85V after 4 cycles
2nd	SCP	Output short	ZCD	1. 12ms blank time during start-up 2. after 4 cycles 3. ZCD UVP = 0.8V & FB>4V trigger
2nd	OVP	Output OVP	ZCD	V <sub>ZCD</sub> compares to 3V through the resistance divider
1nd	OCP	OCP	CS	Hi/Low line OCP external adjust , Max current limit CS=0.7V
2nd	OLP	OLP	CS	CS > 0.5V
2nd	Short before power on		ZCD	1. 12ms blank time at start-up 2. after 4 cycles 3. ZCD UVP = 0.8V & FB>4V trigger
2nd	Short after power on		ZCD	1. after 4 cycles 2. ZCD UVP = 0.8V & FB>4V trigger
IC	Chip OTP			chip OTP at 150 °C

# EST.2700X Green-Mode PWM Flyback (SSR) Controller



EST.2700X Green-Mode PWM Flyback (SSR) Controller

## Package Information

SOT-23-6L:

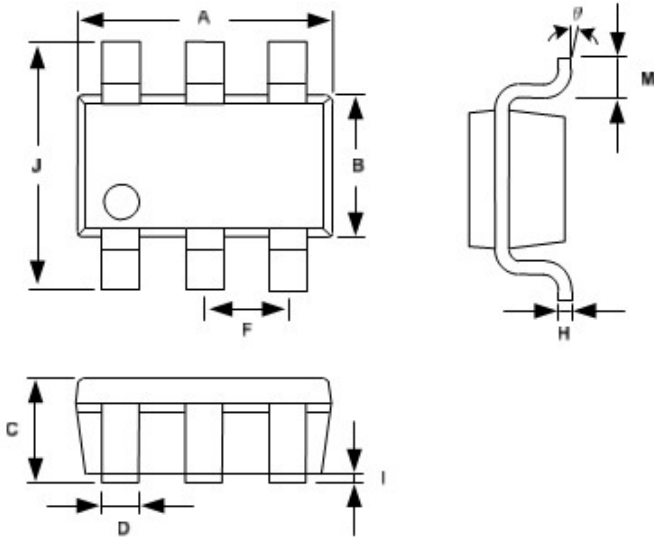
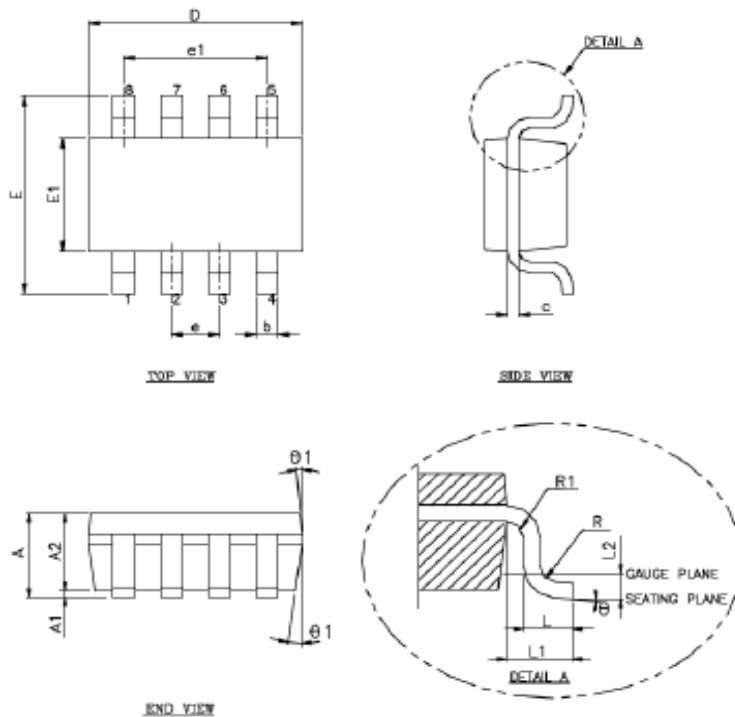


Fig 8

Symbo	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°

SOT-23-8L:



VARIATION (ALL DIMENSIONS SHOWN IN MM)

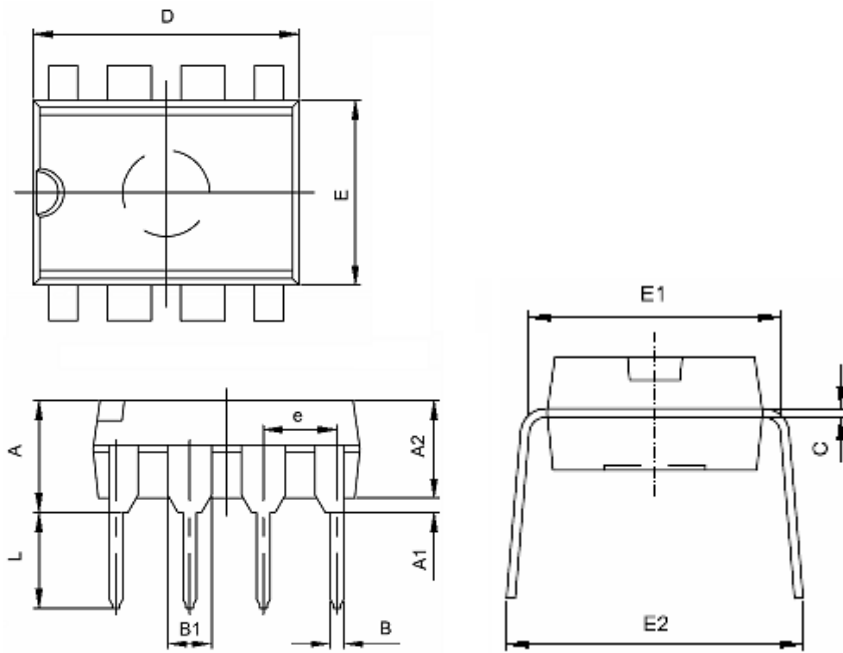
SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.45
A1	0.00	-	0.15
A2	0.90	1.15	1.30
b	0.22	-	0.38
c	0.08	-	0.22
D	2.90 BSC.		
E	2.80 BSC.		
E1	1.60 BSC.		
e	0.65 BSC.		
e1	1.95 BSC.		
L	0.30	0.45	0.60
L1	0.60 REF.		
L2	0.25 BSC.		
R	0.10	-	-
R1	0.10	-	0.25
θ	0°	4°	8°
θ1	5°	10°	15°

NOTE :  
1. JEDEC OUTLINE : MO-178 BA.

# EST.2700X Green-Mode PWM Flyback (SSR) Controller



## DIP-8 Package

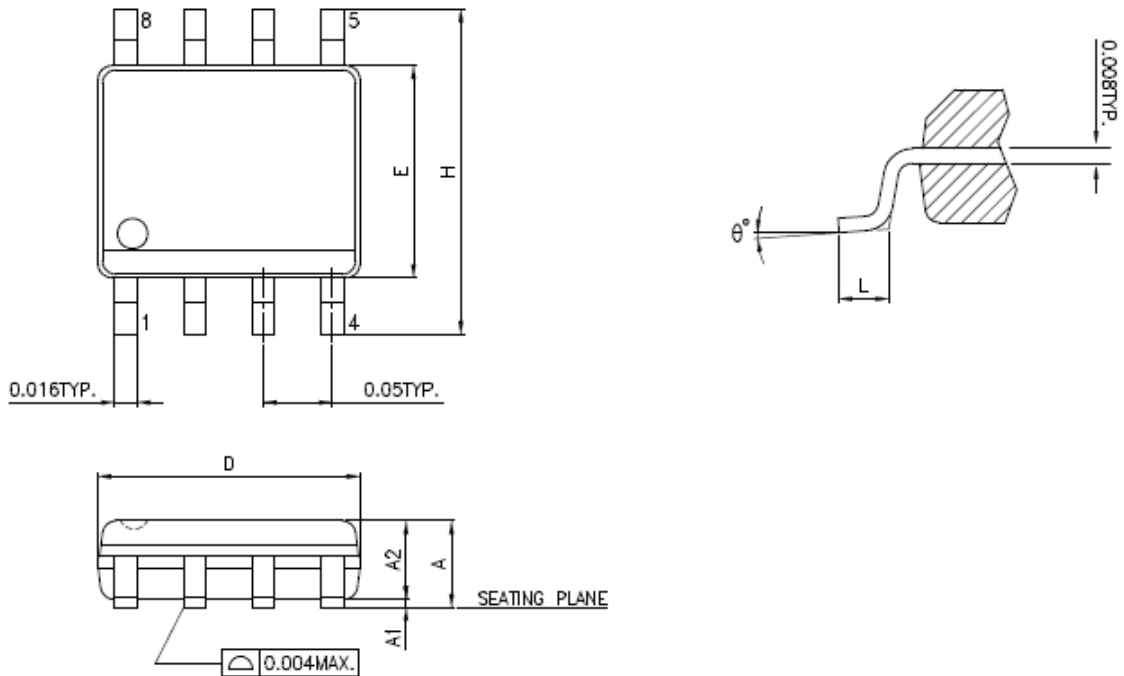


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.710	4.310	0.146	0.170
A1	0.510		0.020	
A2	3.200	3.600	0.126	0.142
B	0.360	0.560	0.014	0.022
B1	1.524(TYP)		0.060(TYP)	
C	0.204	0.360	0.008	0.014
D	9.000	9.400	0.354	0.370
E	6.200	6.600	0.244	0.260
E1	7.620(TYP)		0.300(TYP)	
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

# EST.2700X Green-Mode PWM Flyback (SSR) Controller



## SOP-8 Package ( mm )



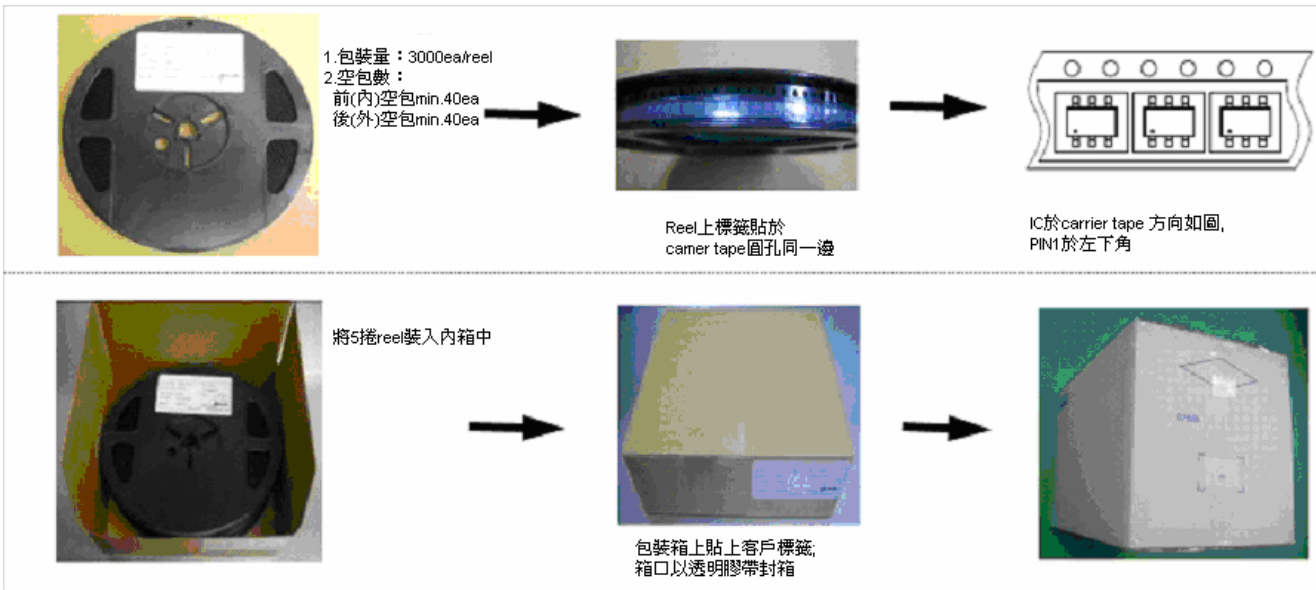
Symbols	Dimensions In Inches			Dimensions In millimeters		
	MIN.	NOR.	MAX.	MIN.	NOR.	MAX.
A	0.050	0.061	0.072	1.270	1.549	1.829
A1	0.000	-----	0.010	0.000	-----	0.254
A2	-----	-----	0.062	-----	-----	1.575
D	0.185	0.193	0.200	4.699	4.902	5.080
E	0.147	0.154	0.160	3.734	3.912	4.064
H	0.225	0.237	0.249	5.715	6.020	6.325
L	0.013	0.033	0.053	0.330	0.838	1.346
θ	0°	4°	8°	0°	4°	8°



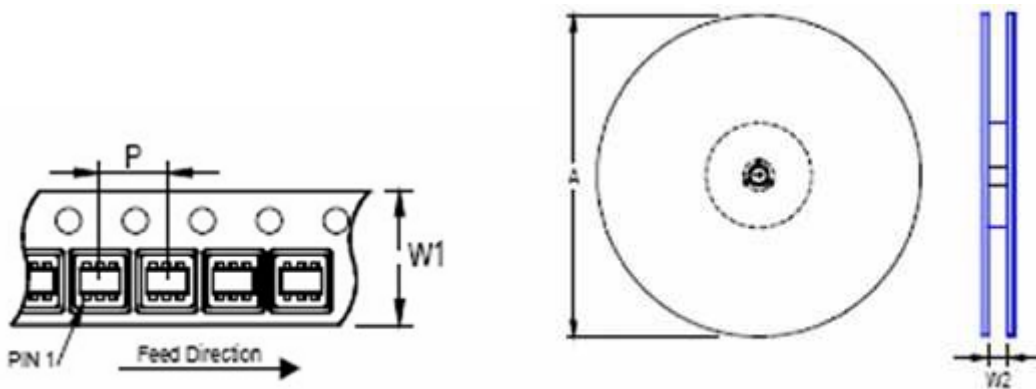
# EST.2700X Green-Mode PWM Flyback (SSR) Controller



## Shipping packing



## Tape Reel Data



Package Type SOT-26	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

# EST.2700X Green-Mode PWM Flyback (SSR) Controller

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