

EST.1252X

Current Mode PWM Flyback & Forward Controller

Datasheet

The data contained in this preliminary are for reference only, Users should verify for a current and complete document before placing orders.

General Description

The EST.1252X controller offers everything needed to build cost-effective and reliable ac-dc switching supplies dedicated to ATX power supplies. Thanks to the use of an internally fixed timer, EST.1252X detects an output overload without relying on the auxiliary Vcc. A Brown-Out input offers protection against low input voltages and improves the converter safety. Finally a SOIC-8 package saves PCB space and represents a solution of choice in cost sensitive project.

EST.1252X is available in SOP-8.

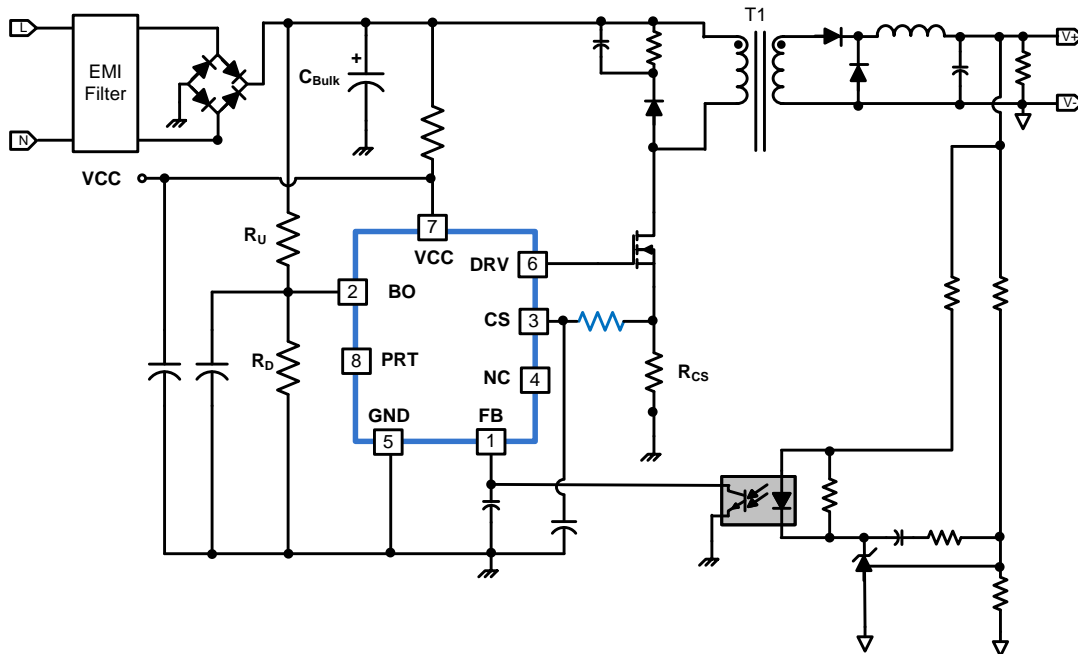
Application

- ◆ Switching AC/DC adapter for PC silver Boxes, Games Adapter
- ◆ Flyback and Forward Converter

Key Feature

- ◆ High voltage CMOS process with excellent ESD protection
- ◆ 8ms Soft-start
- ◆ Very low startup current (<6 uA)
- ◆ Adaptive Frequency Shuffling and Slope Compensation @ Fix Frequency CCM 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)
- ◆ VDD OVP (Over Voltage Protection)
OLP (Over load protection)

Application Circuit



Ordering Information

Part Number	Package	Packaging	Note
EST.1252A/M/P	SOP-8L	Tape & Reel	Green

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).

Function and Protection Options

Protection Options

Part Number	Freq. KHZ	Protection						
		V _{DD} OVP	AUX. OVP	AUX. UVP	OLP	BNI/O	CS Open	SCP
EST.1252A	PWM (Max) 87KHz	Hiccup	Hiccup	Hiccup	Hiccup/64ms	NA	Hiccup	Hiccup
EST.1252M	PWM (Max) 100KHz	Hiccup	Hiccup	Hiccup	Hiccup/64ms	NA	Hiccup	Hiccup
EST.1252P	PWM (Max) 50-400KHz	Hiccup	Hiccup	Hiccup	Hiccup/64ms	NA	Hiccup	Hiccup

Pin connection (Top View/ Marking)

Pin Assignments and Package Type

SOP-8	NAME Description	Description
1	FB	This pin directly connects to an optocoupler collector.
2	BIO	This pin monitors the input voltage image to offer a Brown in/out protection.
3	CS	Monitors the primary current and allows the selection of the ramp compensation amplitude.
4	NC	No connect
5	GND	Ground
6	DRV	This pin connects to the MOSFET gate
7	V _{CC}	This pin accepts voltage range from 8 V up to 26 V
8	PRT	Prevent protection latch pin.

Absolute Maximum Ratings

Parameter Symbol	Symbol	Limit Values		Unit	Remark
		Min.	Max		
Supply Voltage V_{DD}	V_{DD}	-0.3	40	V	
FB,CS,RTL Voltage	V_{RTL}, V_{FB}, V_{CS}	-0.3	7	V	
Gate Driver Voltage	V_{GATE}	-0.3	$V_{DD}+0.3$	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	-	550	mW	SOP-8
Junction-to-Ambient Thermal Resistance*	θ_{JA}		180	°C/W	
Junction-to-Case Thermal Resistance**	θ_{JC}		39	°C/W	
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_{CC}	V_{CC}	9	26	V	
Startup Resistor Value	R_{star}	1	14	MΩ	
Ambient temperature range	T_{opr}	-40	85	°C	

DC Electrical Characteristics ($V_{DD}=15V, T_a=25^\circ C$)

Supply Voltage (V_{DD} Pin):

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Startup Current	I_{CC-ST}	2		15	μA	UVLO ON - 0.1V
Operating Current (with 1nF load on DRV pin)	I_{CC-OP}	1.2		2.2	mA	$V_{FB}=2.5V$ DRV=Open
	I_{CC-OP}	2.3	2.5	3.3	mA	$V_{FB}=2.5V$ DRV=1nF
	I_{CC-OLP}	0.6	0.8	1	mA	OLP
UVLO (off)	$V_{UVLO-OFF}$	8	9	10	V	
UVLO (on)	$V_{UVLO-ON}$	9	10	11	V	
Hystercis UVLO	V_{HYS_UVLO}	0.8	1		V	
V_{DD} OVP Level	V_{OVP}	27.5	28	29.5	V	
OVP Debounce Time	T_{OVP}		100		uS	Guarantee by Design

Voltage Feedback(FB Pin):

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Short Circuit Current	I_{Zer0}	1.7		1.5	mA	$V_{FB}=0V$
Open Loop Voltage	V_{FB-OP}	4.5	5	5.5	V	FB pin open
Burst Mode	V_{BTM}	0.25	0.3	0.35	V	
Burst Mode Hystercis	V_{BST_H}		100		mV	

Current Sensing (CS Pin):

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Leading Edge Blanking Time	T_{LEB}	400	500	600	ns	
Current Sense Voltage Threshold	V_{IOLP}	0.9	0.95	1	V	
Current Sense Voltage Limit	V_{LIM}	0.95	1	1.05	V	
Hysteresis OCP	$V_{LIM} - V_{IOLP}$	0.03		0.07	V	
Over Load Protection Time	T_{OLP}		15		mS	Freq = 87KHz
Propagation Delay to Output	T_{pd}	80	100	120	nS	Guarantee by Design
Slop Compensation Current	I_{SLOP}	119	132	145	uA	I_{SLOP} in D_{MAX}
Short Circuit Protection Voltage	V_{SCP}		1.3			

Prevent (PRT Pin):

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Protection Voltage Source	V_{PRT}	4.5	5	5.5	V	

Timer Section:

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Internal Soft Startup Time	T_{SS}		6		ms	Freq = 87KHz
Frequency at PWM	F_{PWM}	80	87	94	KHz	EST.1252A
		93	100	107		EST.1252M
		50	-	400		EST.1252P
Frequency Shuffling Range	F_{jitter}	+/-4	+/-6	+/-8	%	
Max Duty cycle	D_{max}		46		%	
Frequency v.s Voltage Stability	f_{DV}		1		%	

Driver(DRV Pin) :

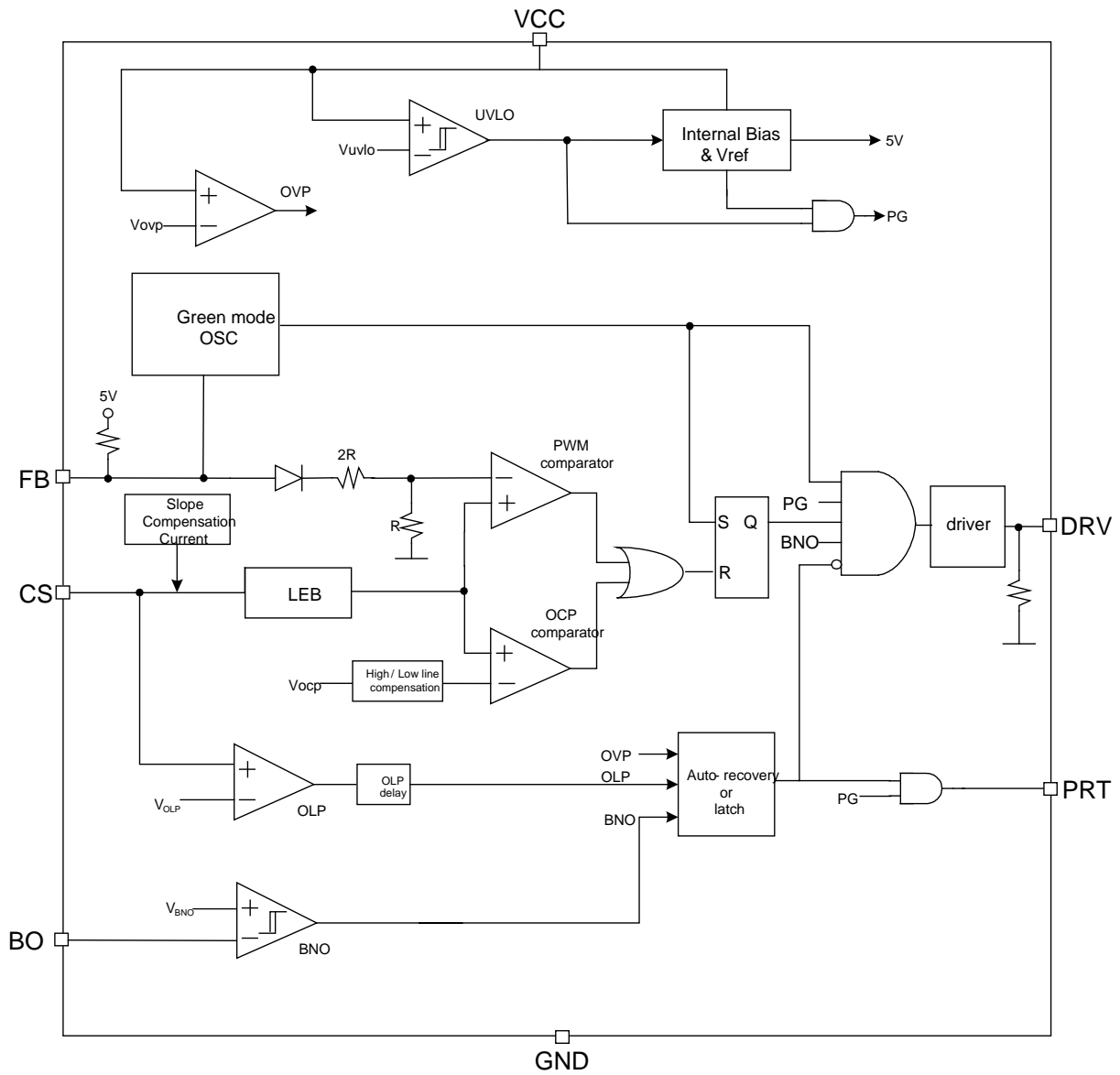
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Output Low Level	V_{OL}			1	V	$V_{DD} = 16V, I_O = 20mA$
Output High Level	V_{OH}	8			V	$V_{DD} = 16V, I_O = 20mA$
Output Clamp Voltage Level	V_{G_Clamp}	14	15	18	V	$V_{DD} = 25V$
Rising Time	T_R	110	150	190	nS	$V_{DD} = 15V, C_L = 1nF$
Falling Time	T_F	50	80	100	nS	$V_{DD} = 15V, C_L = 1nF$

Brown In/Out(BO Pin) :

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Brownout Turn-On Trip Level	V_{BNO_ON}	0.9	1	1.1	V	
Brownout Turn-Off Trip Level	V_{BNO_Off}	0.7	0.8	0.9	V	
BO pin de-bounce time	T_{DBNO}		100		uS	Guarantee by Design

Block Diagram

EST.1252A/M



Application Note

Operation Overview

The EST.1252X is a high-performance forward controller specifically developed to drive power supplies designed for the ATX, the adapter and outdoor LED lighting market: Its current Mode operation implementing peak current-mode control topology, which offers UC384X-like features to build rugged power supplies.

EST.1252X provide fix (87KHz/100KHz) and programmable (50~450KHz) switching frequency for various application. Meanwhile, it also built Internal frequency jittering to spreading out peak energy for the merit of lower EMI.

Start-up

The start-up circuit of IN1252 by used the internal comparator, which will detect the voltage on the Vcc pin, and assure the supply voltage enough to turn on it (UVLO_on) . At beginning, the startup current is provided by (Rstart) to charge the capacitor C_{Vcc} till V_{CC} get enough voltage (UVLO_ON) to turn on it. Once the start-up sequence has been activated the internal soft-start delay triggers, and waiting BO pin level is above brown-in level to let soft-start allowed.

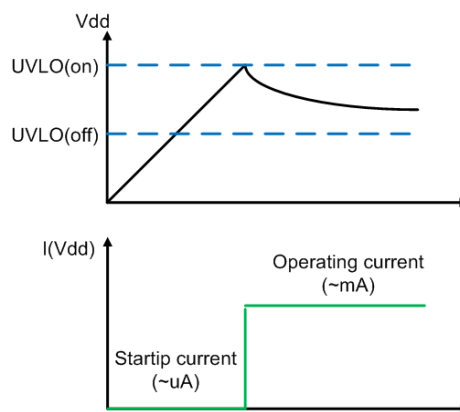


Fig.1

EST.1252X series is process with low power mix-mode process (5V and 40V), which max start-up current is around I_{CC-ST}. R-start calculate as below

$$\frac{V_{\text{bulk}} - V_{\text{UVLO_ON}}}{R_{\text{start}}} > I_{\text{CC-ST}}$$

It is trade off between startup time and a higher startup resistance. Therefore, carefully select the value of R_{start}, C_{Vcc} to optimize the power consumption and startup time.

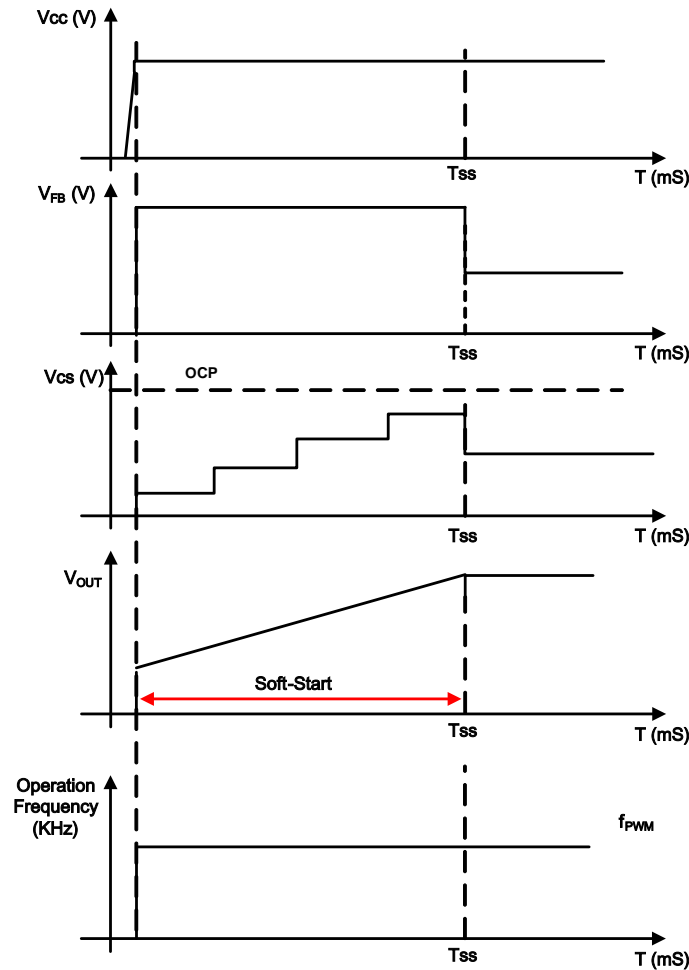


Fig.2

PRT , Prevent protection PG pin -EST.1252A/M

This pin is monitor flag of protection. It keeps low at normal operation, and pull high after V_{CC} OVP trigger or OLP. This pin is similar to PG function, that is say, normal operation is 0V, and protection trigger is 5V. If system doesn't need PG function, can let it floating.

If the start-up current of original solution is more than 600uA(I_{CC-OLP}), suggest to connect 1KΩ~10KΩ to ground for V_{CC-cap} discharge.

BO, Brown-out Protection

By monitoring the level on BO pin, the controller protects the forward power against low input voltage conditions. When the BO pin level falls below the V_{BNO} level, it will stop pulsing until the input level goes back to normal and kick off the operation via a new soft-start sequence.

$$V_{AC_BNO} \times 1.414 \times \frac{R_d}{R_u + R_d} = V_{BNO_OFF}$$

$$\frac{R_d}{R_u + R_d} = \frac{V_{BNO_OFF}}{V_{AC} \times 1.414}$$

Choose the resistance of R_u and R_d

Brown in $V_{AC_BNI} = \frac{V_{BNO_On}}{1.414} \times \frac{R_u + R_d}{R_d}$

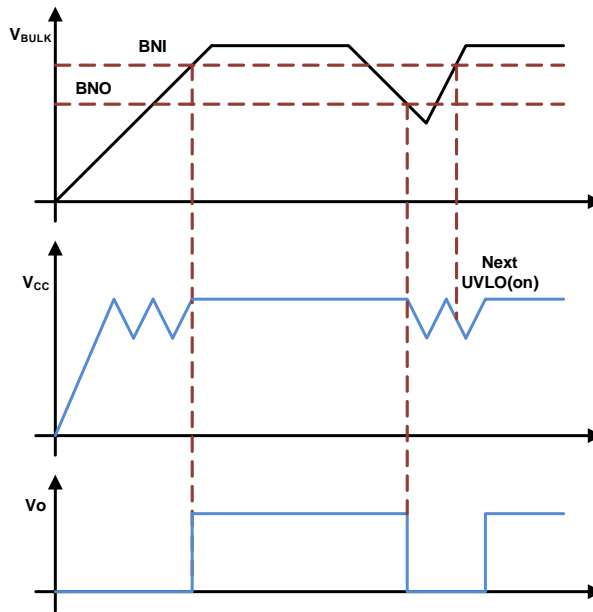


Fig.3

FB, Voltage feedback

EST.1252X 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.

No load burst mode :

Burst cycle operation is for the power saving of full no-load operation. Based on the voltage of comp. it will decrease following by the reduce of output load, and reach V_{skip} level to stop the driver pulses. No switching at some periods that can saves switching loss and reduces the standby power consumption. For forward application, it prevents over voltage on the output in case of light or no-load operation.

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.

Complete Protection

SCP , Short circuit protection

EST.1252X provide various short circuit protection, secondary side schottky short protection (SDSP) , output over load

protection (OLP).

OLP : A output short circuit or an overload situation is detected when the CS pin level reaching its maximum level at V_{IOLP} . In that case the fault status is stored in the latch and allows the digital timer count. If the digital timer ends then the fault is latched and the controller permanently stops the pulses on the driver pin.

If the fault is gone before ending the digital timer, the timer is reset only after 3 switching controller periods without fault detection (or when the CS pin < 1 V during at least 3 switching periods).

If the fault is latched the controller can be reset if a BO reset is sensed or if VCC is cycled down to VCC(off).

SDSP, Secondary side schottky short protection

EST.1252X provide various short circuit protection, secondary side schottky short protection (SDSP), output over load protection (OLP).

VCC OVP (Over Voltage Protection)

The maximum ratings of the EST.1252X are around 32V. To prevent the V_{CC} enter breakdown condition,

EST.1252X series are integrated with OVP function on VCC pin. Whenever the VCC voltage is higher than the VOVP threshold, the output gate drive circuit will be turn-off simultaneously and the power MOSFET is turn-off until the next UVLO(on) cycle.

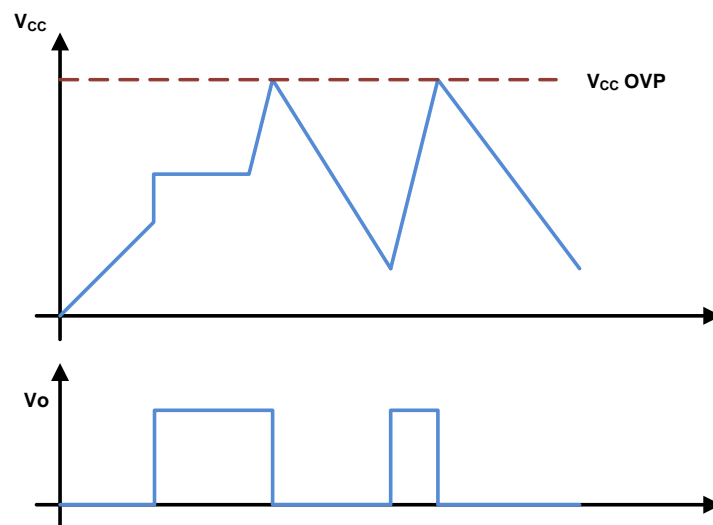


Fig.4

Revision History

REVISION	DESCRIPTION	PAGE	DATE
0.1	First Release		2018/09/01

<http://www.esthome.com>