High performance auxiliary power controller

1. Feature

- Designed for wide supply voltage for PWM chips
- Optimized for QC2.0 / 3.0 / 4.0 fast charging system
- Optimized for USB Type-C PD power supply system
- The maximum allowable input voltage up to 75V
- Automatically limit the maximum output voltage is not higher than 17V
- Low standby power requirements for 20V output in USB PD system
- Built-in reverse isolation function，No start-up leakage
- The total effective series voltage is less than 1.5V
- Ultra low static operating current can be as low as 100uA
- Ultra-simple structure without any external settings device
- Saving at least three electronic components in USB PD system
- Minimize the board space to optimize the PCB design
- Available a small SOT23-3 package，Easy to use

2. Applications

- QC2.0/3.0/4.0 charger
- USB Type-C PD charger
- Battery charger
- Other wide output voltage range power supply

3. Description

The LN3210 is a high-performance switching power supply PWM chip-assisted power management IC that can easily be used in QuickCharge (QC2.0 / 3.0 / 4.0) and USB Type-C PD power supply systems with extremely wide output voltage variations In the PWM chip for power supply, the system output voltage increases when the VCC voltage is not higher than 17V, which can guarantee the normal operation of the PWM chip, power supply chip can allow up to 75V input voltage range, so that the system can easily meet such as The output voltage varies from 5V to 20V.

At the same time designed in the chip within the exclusive reverse isolation circuit can effectively prevent the PWM chip in the start when the VCC charge current bypass, to ensure that the system boot performance without any impact. Two-stage VCC power system structure can further optimize the system start-up speed and work stability of the balance and balance, the higher power supply rejection ratio can also effectively reduce the PWM chip power supply ripple, improve power quality.

The output limit circuit integrated in the chip can effectively limit the power supply output voltage to no more than 17V in extremely high input voltage conditions, ensuring that the PWM chip does not enter the overvoltage protection state and reduces the PWM chip operation Power consumption, improve system life and reliability.

The highly integrated design makes the chip work without any external auxiliary devices, greatly simplifying the system application design, effectively reducing the board area, very suitable for high device density with a small power supply system.

Available in a standard SOT23-3 package that meets RoHs requirements.

4. Functional Block Diagram

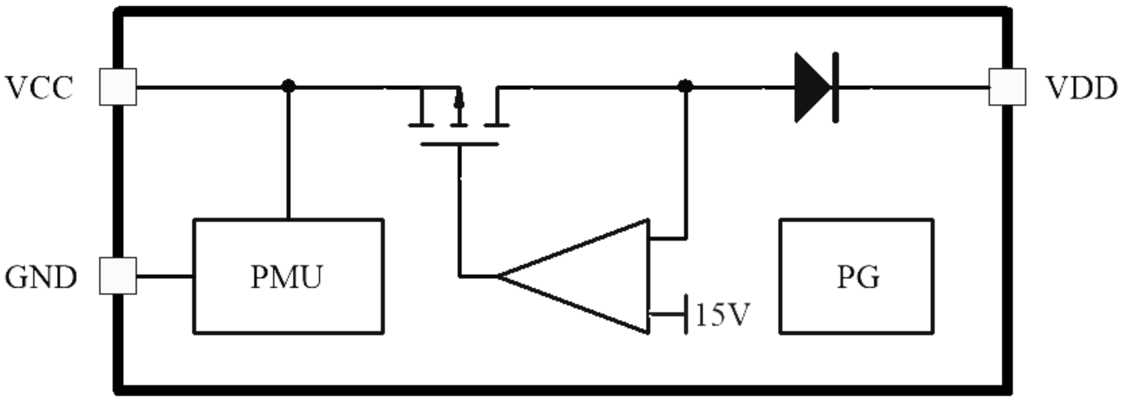


Fig1. Internal functional block diagram

5. Pin Definitions

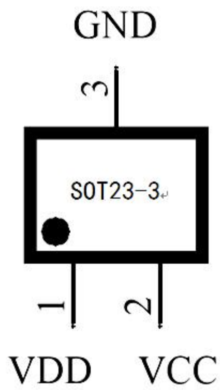


Fig2. Pin Definitions

6. Pin Function Description

PIN	Symbol	Function
1	VDD	Output voltage pin, connected to PWM chip's VDD
2	VCC	Power supply pin, connect the auxiliary power supply circuit
3	GND	Ground pin

7. Typical Simplified Schematic

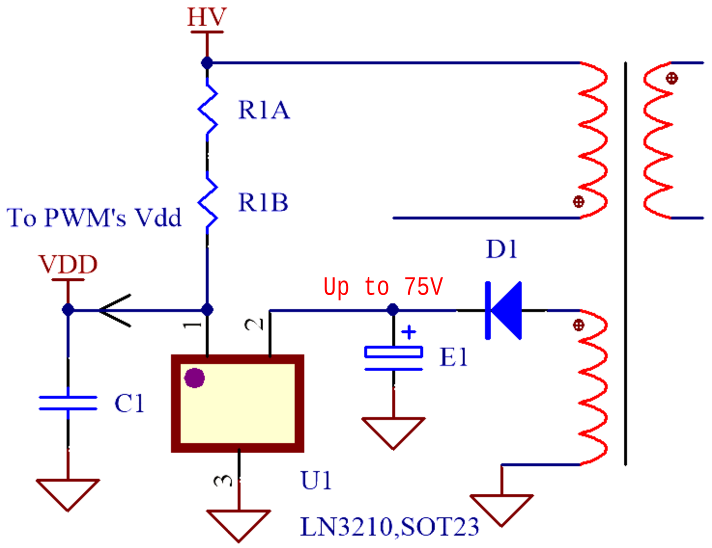


Fig3. Typical Simplified Schematic

8. Absolute Maximum Ratings *

Item	Parameter	unit
VCC Pin Voltage	80**	V
VDD Pin Voltage	60***	V
VDD Pin Current	30****	Ma
Min/Max T_J	-20 to 150	℃
Min/Max Tstg	-55 to 160	℃
PD	250	Mw
ESD:		
HBM	2500	V
MM	250	V

Note*: Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute maximum-rated conditions for ex tended periods may affect device reliability.** with 1Ma limit. *** with 1Ma limit. ****: For test, Pulse width is 1ms and cycle is 1S.

9. Recommended Operating Conditions

Symbol	Parameter	Min	Type	Max	Unit
VCC	VCC Voltage			60	V
VDD	VDD Voltage			40	V
IVDD	VDD Current			5	mA
TA	Operating ambient temperature	-10		100	℃

10. Electrical Characteristics(Ta = 25℃, VCC=18V, if not otherwise noted)

VCC Section

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{VCC}	VCC range	I_{VDD}=1mA	0		75	V
I_Q	Operating current	VCC=15V,VDD=OPEN	-	-	0.1	mA
V_{STOP}	UVLO Threshold voltage	VCC=18V **à** 0V	-	4	-	V
V_{START}		VDD=0V **à** 25V	-	5	-	V

VDD Section

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{VDD}	VDD range	VCC=0V	0	-	60	V
V_{VDD1}	VDD out voltage	VCC=30V，I_{VDD}=1mA	14	15	17	V
V_{VDD2}	VDD out voltage	VCC=14V，I_{VDD}=1mA	12.5	-	14	V
I_{VDD}	Max VDD current	VCC=14V	-	20	-	mA
I_{LK}	VDD Leakage current	VCC=0V, VDD=30V	-	-	1	uA

Thermal Data

Symbol	Parameter	Rating	Unit
θ_{JA}[1]	Thermal Resistance Junction-Ambient	350	℃/W
θ_{JC}[2]	Thermal Resistance Junction-Case	20	℃/W

Notes: 1. All leads are soldered on a $100mm^2$ copper foil with 1oz thick to measuring. 2. Measured on the surface of the package near pin 3.

11. Typical parameter charts and test waveforms

Chart1. VDD vs VCC

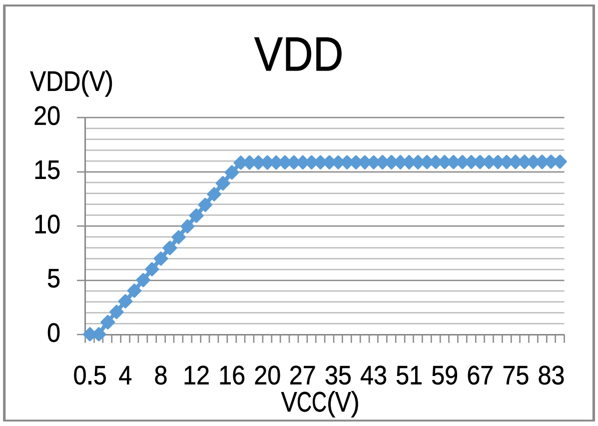


Chart2. VDD vs VCC @out=5mA

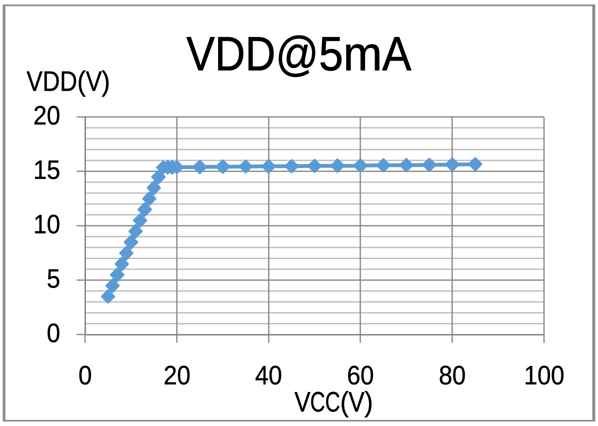


Chart3. VDD vs VCC @out=10mA

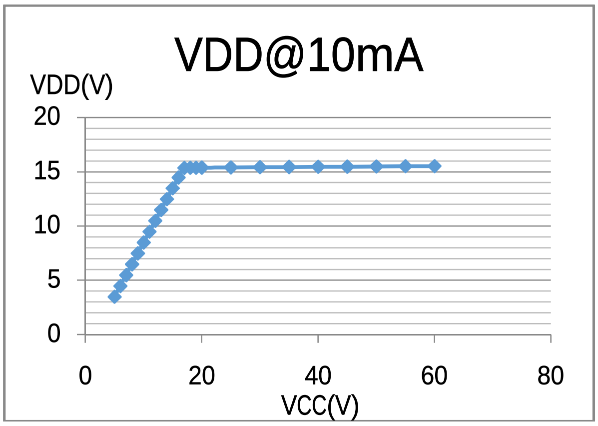


Chart4. IQ vs VCC

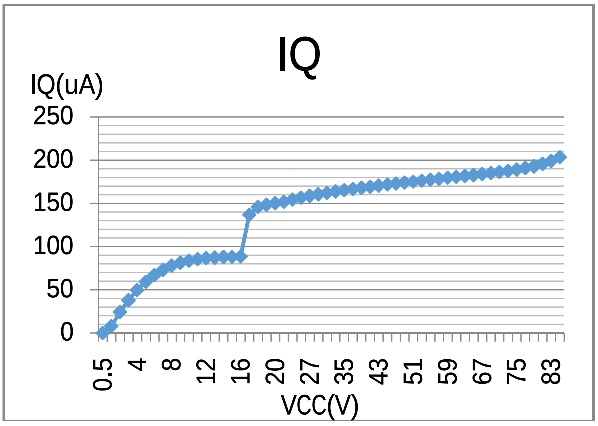


Chart5. ILK vs VDD

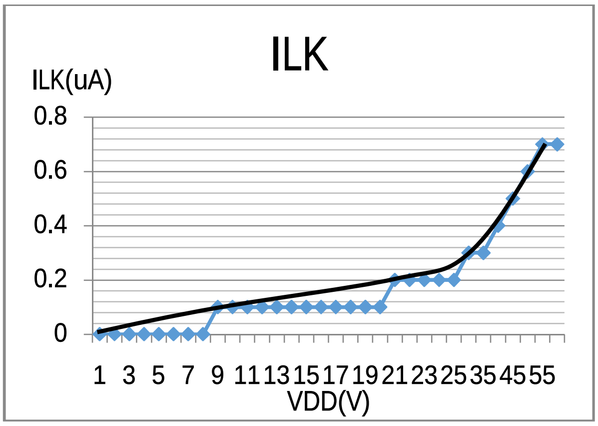


Chart6. VCC=60V vs VDD

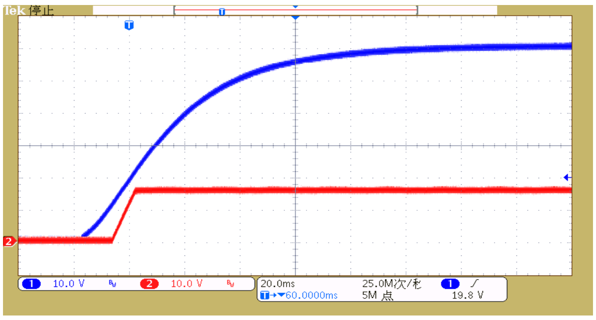
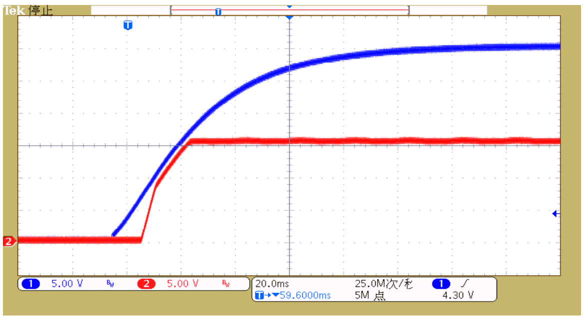


Chart7. VCC=30V vs VDD



12. Application and Implementation

The LN3210 is a PWM chip for wide output voltage switching power supply systems designed for use in a wide range of output voltage variations. It allows the system to operate in applications such as 5V to 20V output voltage range Without worrying about overpressure.

12.1 VCC supply and VDD voltage output

The LN3210 internal power management unit starts operation after VCC is powered up and generates the required internal reference voltage signal and outputs a maximum voltage-limited voltage (typically 15V) at the VDD pin for use by an external PWM chip. Only need to apply the necessary decoupling capacitor at the VCC terminal (usually not less than 1uF) to meet the system, the VDD pin can be in accordance with the requirements of the PWM chip to connect its required storage capacitor (usually 4.7uF Of the electrolytic or non-polar capacitor) to build a complete system, auxiliary winding design should make VCC is not greater than 75V.

Typical capacitor connections are shown below:

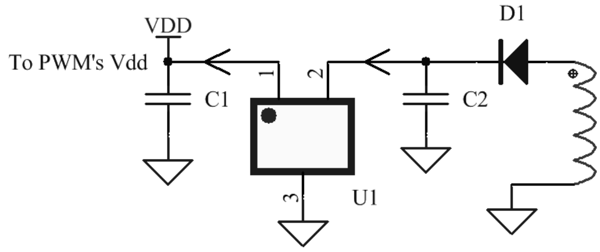


Fig4 Typical capacitor connections Schematic

VDD terminal can still be based on the PWM chip to start charging the normal connection to the original start circuit, including high-voltage start or resistance start mode.

A complete resistor start-up system typical connection circuit is shown below:

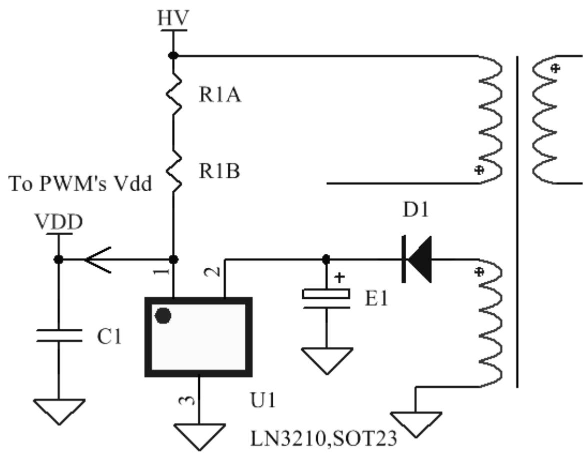


Fig5. Typical resistor start-up system Schematic

A complete high-voltage start-up system typical connection circuit as follows:

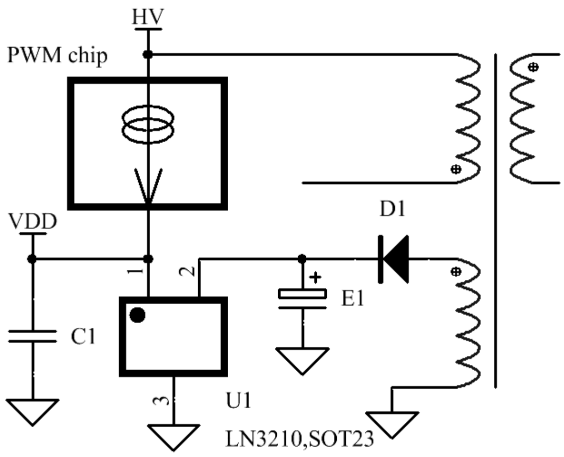


Fig6. Typical high-voltage start-up system Schematic

In general applications only need to connect the LN3210 in the auxiliary winding rectifier circuit and the PWM chip can be between, when the PWM chip operating current is larger to cause the system to high output voltage, VCC follow the voltage rise after the LN3210 produced Or when the system is required to have a low standby power level when the system is switched to a high output voltage, it is possible to further add an additional second auxiliary winding to the system transformer and pass it as follows Circuit and system can be connected to:

In this circuit, it is necessary to select the position of the auxiliary winding taps according to the system voltage parameters reasonably so that the voltage of the tap position can be slightly exceeded by 17V under the required conditions to block the LN3210 output so that the PWM chip can draw from the lower voltage The current required to effectively reduce the system loss, LN3210 static loss will be reduced to below 5mW.

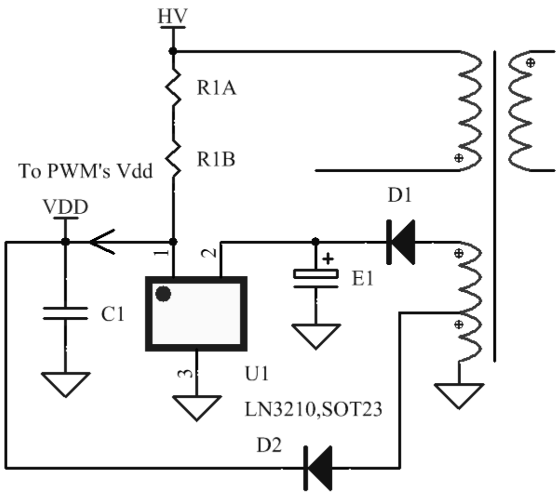


Fig7. Typical low power loss system Schematic

12.2 Reasonable power consumption design

Should be reasonable design of power supply and parameters to ensure that LN3210 work will not produce excessive power consumption. It is recommended that the power consumption is not more than 0.2W is better. The typical power loss during operation is related to the PWM chip current as follows:

$$P_D = (V_{CC} - V_{DD}) * I_{PWM\_VDD}$$

13. PCB Layout Guidelines

13.1 VCC retrograde and PCB loop design

The position and loop size of the transformer auxiliary winding rectifier circuit should be designed reasonably, and the VCC decoupling capacitor should be placed near to get the best system noise level and anti-interference level.

The following figure is a typical layout loop diagram:

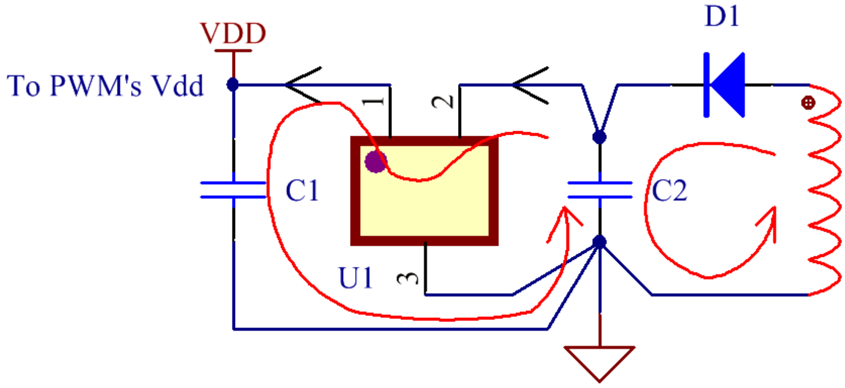


Fig8. Typical PCB Layout loop Schematic

13.2 Typical layout reference

An example of a typical PCB layout is shown below.

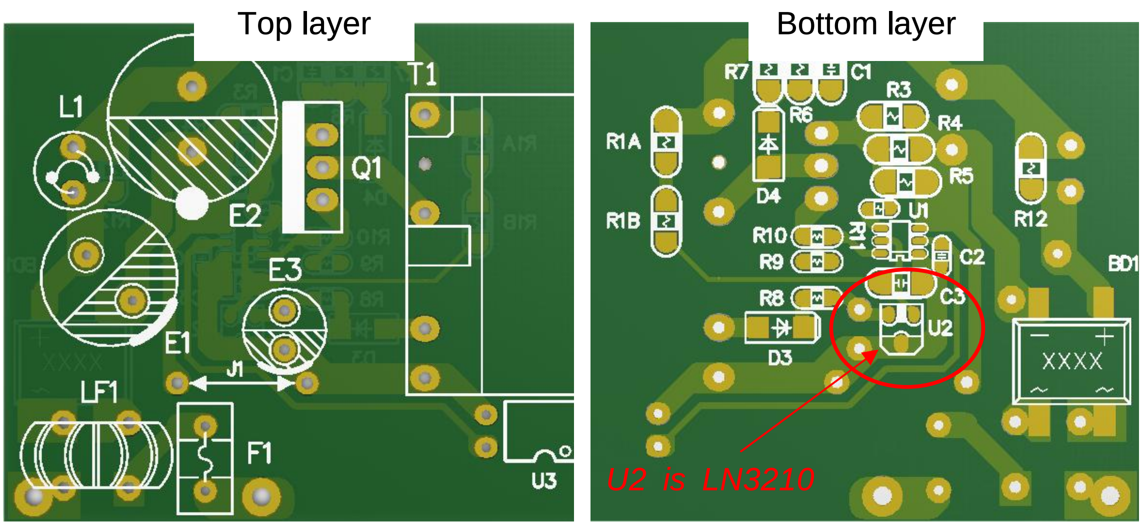


Fig9. Typical layout reference

14. Typical Application Circuit Schematic (90~265Vac，5V3A/20V2A USB-C PD ADP)

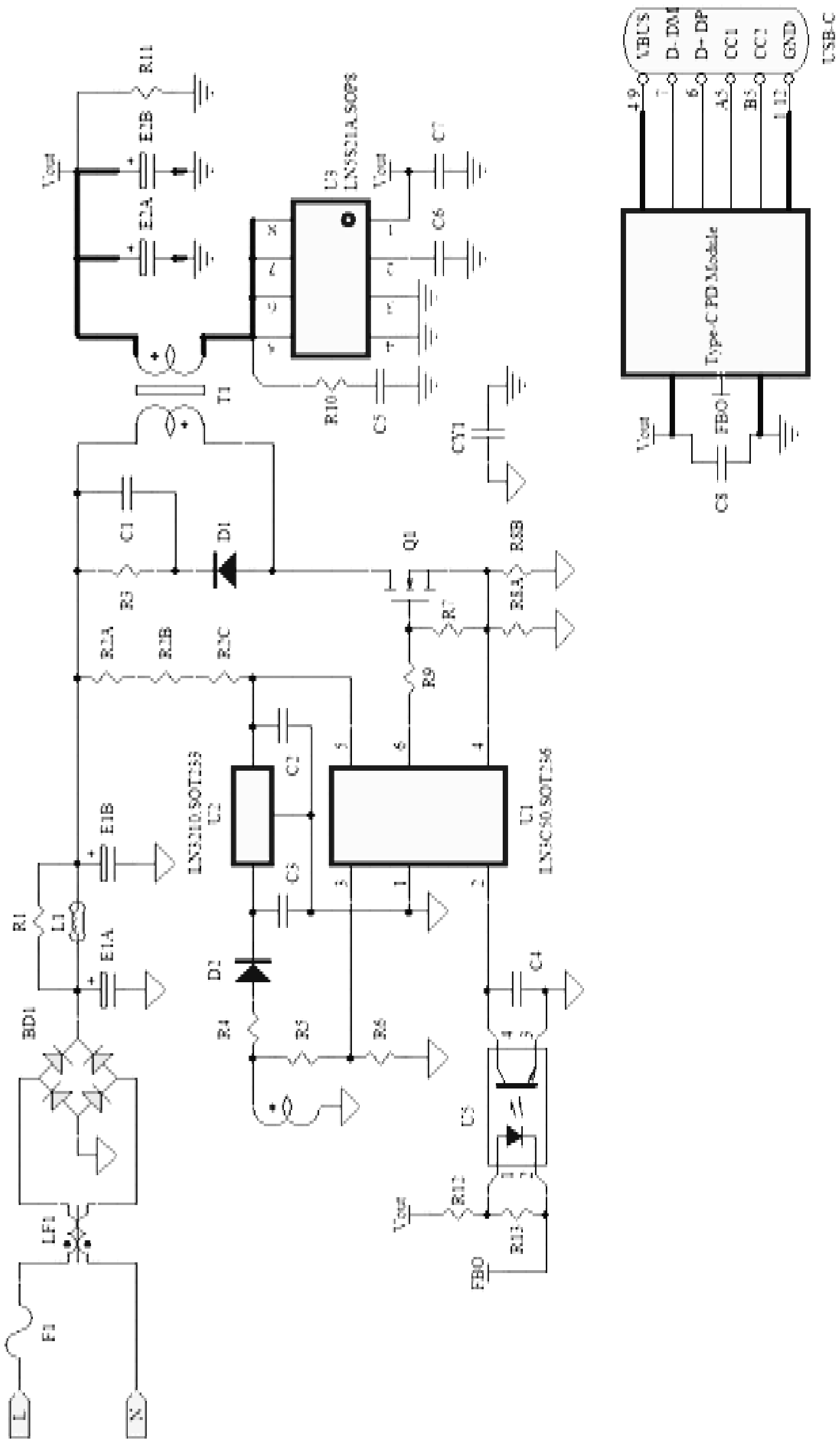
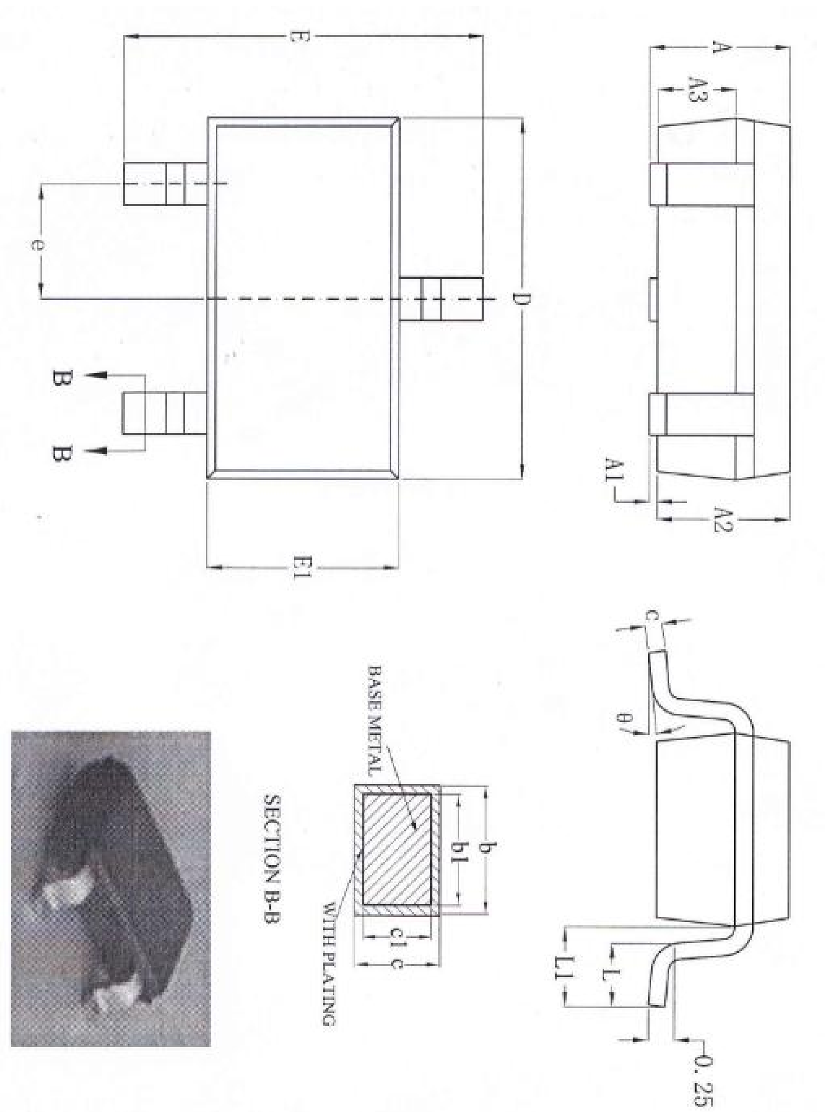


Fig10. Typical Application Circuit Schematic

15. Mechanical and Packaging

SOT23-3



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.25
A1	0.04	—	0.10
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.33	—	0.41
b1	0.32	0.35	0.38
c	0.15	—	0.19
c1	0.14	0.15	0.16
D	2.82	2.92	3.02
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.95BSC		
L	0.30	—	0.60
L1	0.60REF		
θ	0	—	8°

Fig11. Mechanical Dimensional Drawings

16. Orderable Information

Part Number	RoHs	Package	Packing
LN3210	Halogen Free	SOT23-3	3000PCS/Reel

17. Important Notice

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