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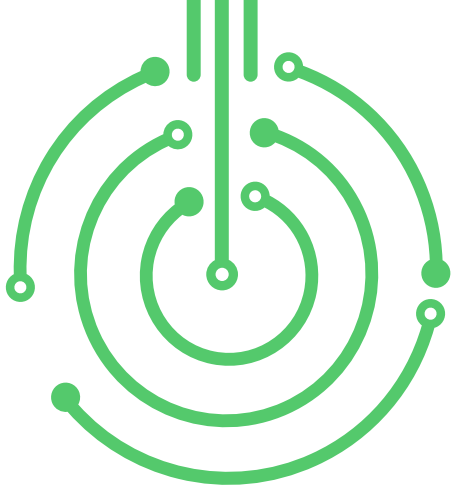


Universal AC Voltage Step-Down Power Converter – 18V DC Output From 85-265V AC Input

SKU: EL130780

Universal AC Voltage Step-Down Power Converter – 18V DC Output From 85-265V AC Input

The project described here is an off-line universal AC Voltage input step-down regulator which provides accurate constant voltage (CV) output, outstanding low standby power, high efficiency at light load, and excellent dynamic response based on non-isolated buck topology. The project is built using the AP3928 chip. The project provides 18Vdc output @ 250mA from AC input 85V to 265V AC. The project can be used for many applications such as home appliances, IoT applications, industrial controls, standby power, and auxiliary power.

WARNING: Dangerous voltage exists until the power is off. Wait at least 1 minute after the input power is disconnected before touching the board and discharge HV capacitors.

Features

- Universal 85V to 265V VAC Input
- Output 18V DC
- 250mA Output Current (Rated Up to 500mA)
- Low Standby Power Consumption (<30mW at no load)
- High Light-Loading and Average efficiency can meet DOE and CoC requirement
- Frequency Modulation to suppress EMI to meet EN55022 class B
- Rich Protection including OTP, OLP, OLD, SCP
- Extremely low system component counts small size
- PCB Dimensions 60.80 x 21.75 mm
- 4 x 3mm Mounting Holes

The AP3928 is a universal AC voltage step-down power switcher, specially designed for home appliances and IoT applications with non-isolated buck solution. The device integrates a 700V high-performance power MOSFET. Coordinating with a single-winding inductor, it uses fewer external components and provides a low bill of materials (BOM) cost solution. The AP3928 can achieve high output current, excellent constant voltage regulation, and high conversion efficiency. The peak current and switching frequency continuously reduces as the load decreases, so the device can achieve excellent efficiency performance at light load and improve overall system efficiency. The AP3928 has multiple protection features to enhance the system safety and reliability. The device has overtemperature protection, under-voltage lock function, output short protection, overload protection, and open-loop protection. The AP3928 is available in the SO-8 (Standard) package.

Connections and other details

Overload Protection (OLP)

With the increase in load, the peak current and the switching frequency also increase. When the peak current reaches the maximum limitation, and the OFF time is the minimum OFF time, the internal OLP timer begins to count. For avoiding false triggering during start-up and other load transition condition, OLP activates only when the switching pulses reach the OLP_counting cycles requirement.

Short-Circuit Protection (SCP)

The AP3928 shuts down when the peak current exceeds short-circuit threshold, and the AP3928 resumes operation when the fault is removed. Note that the inductor saturation current should be higher than ISCP to avoid SCP being triggered during start-up. Otherwise, the device may not turn on normally.

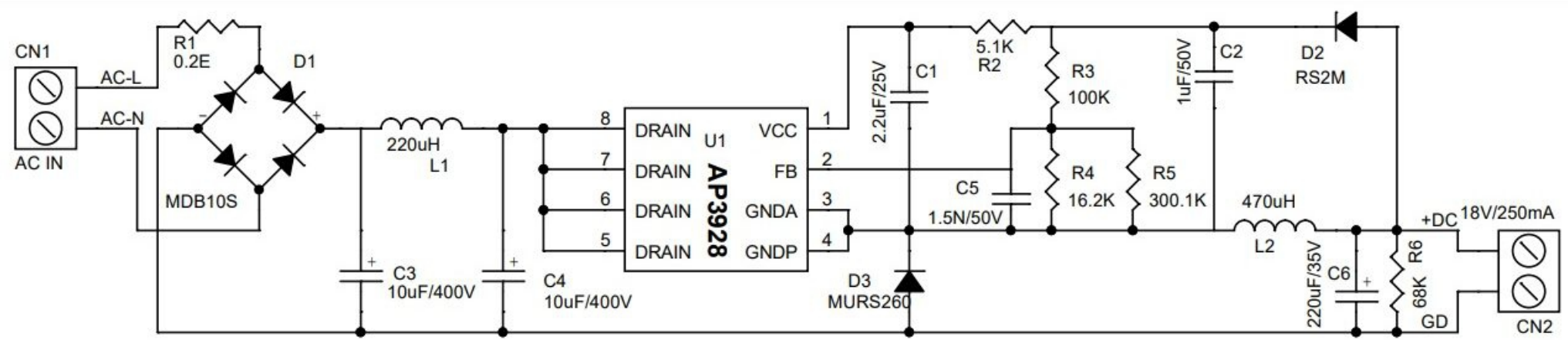
Overtemperature Protection (OTP)

The AP3928 integrates an internal overtemperature protection function. The AP3928 shuts down when the inner junction temperature exceeds the thermal shutdown threshold TOTP (+150°C). After exceeding the threshold, the VCC voltage begins to drop, and when VCC voltage drops to VCC_RESTART (4.5V), the internal high-voltage regulator turns on to charge the external VCC capacitor.

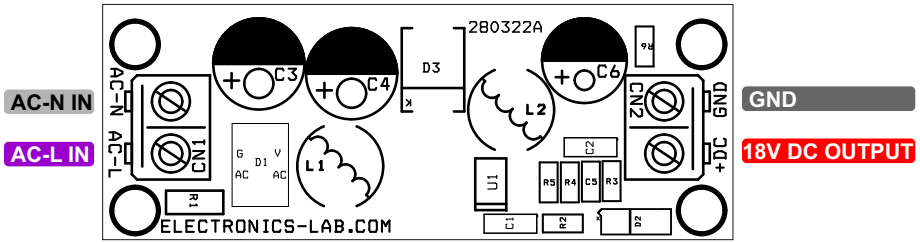
Open-Loop Detection (OLD)

When the FB voltage drops below the open-loop detection threshold voltage VOLD, the AP3928 stops working and begins a restart cycle. The open-loop detection is blanked for 64 switching cycles during start-up process. Moreover, if FB pin was floating, output voltage will be fixed to 12V typically. Overshoot Improvement In general, there is no capacitor between FB pin and GNDA (GNDP) pin. But in some cases where strict overshoot is required, we recommend a ceramic capacitor C6 (390pF to 2.2nF) in Figure 6. In addition, adding a C6 can improve output voltage ripple as well.

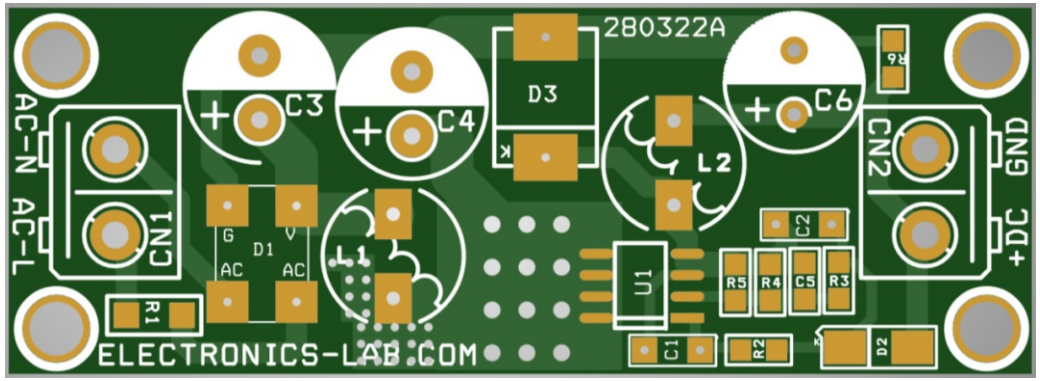
Schematic

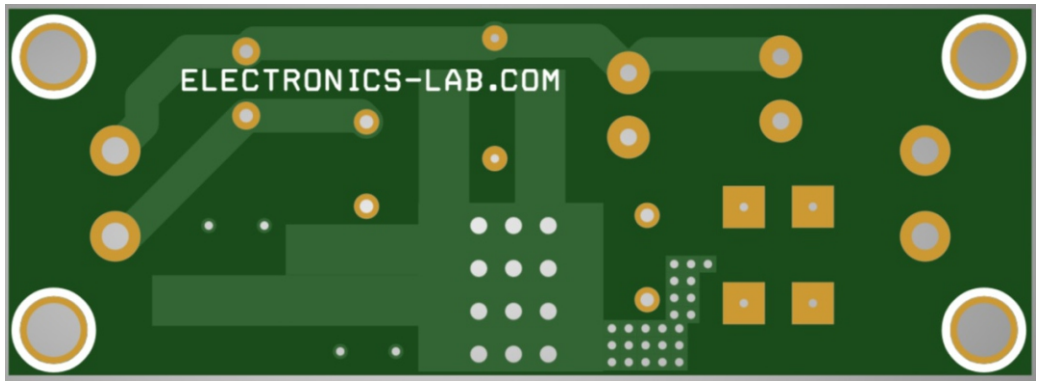

CN1
AC-L
AC-N
AC IN
R1
0.2E
D1
MDB10S
220uH
L1
C3
10uF/400V
C4
10uF/400V
8
7
6
5
DRAIN
DRAIN
DRAIN
DRAIN
U1
AP3928
VCC
FB
GNDA
GNDP
1
2
3
4
2.2uF/25V
C1
5.1K
R2
R3
100K
C5
1.5N/50V
R4
16.2K
R5
300.1K
1uF/50V
C2
D2
RS2M
470uH
L2
D3
MURS260
220uF/35V
C6
R6
68K
GD
+DC
18V/250mA
CN2

Connections

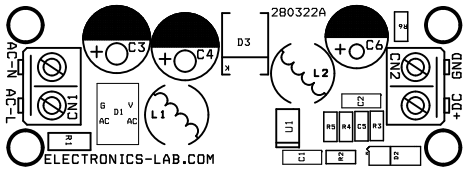


PCB

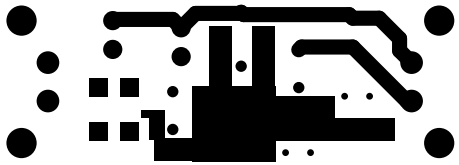




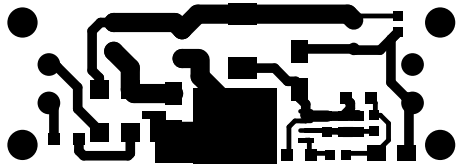
PCB GERBER FILES AVAILABLE



SILK SCREEN TOP



BOTTOM LAYER



TOP LAYER

PCB DIMENSIONS 60.80MM X 21.75MM

Parts List

BOM						
NO.	QNTY	REF.	DESC.	MANUFACTURER	SUPPLIER	SUPPLIER PART NO
1	1	CN1	2 PIN SCREW TERMINAL PITCH 5.08MM	PHOENIX	DIGIKEY	277-1247-ND
2	1	CN2	2 PIN SCREW TERMINAL PITCH 5.08MM	PHOENIX	DIGIKEY	277-1247-ND
3	1	C1	2.2uF/25V CERAMIC SMD SIZE 1206	MURATA/YAGEO	DIGIKEY	
4	1	C2	1uF/50V CERAMIC SMD SIZE 1206	MURATA/YAGEO	DIGIKEY	
5	2	C3,C4	10uF/400V ELECTROLYTIC 8MM	RUBYCON	DIGIKEY	1189-3119-ND
6	1	C5	1.5N/50V CERAMIC SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
7	1	C6	220uF/35V ELECTROLYTIC 8MM	RUBYCON	DIGIKEY	1189-4002-1-ND
8	1	D1	MDB10S BRIDGE SMD	ON SEMI	DIGIKEY	MDB10SS-ND
9	1	D2	RS2M SMD FAST DIODE	TAIWAN SEMI	DIGIKEY	1801-RS2MTR-ND
10	1	D3	MURS260 SMD FAST DIODE	VISHAY	DIGIKEY	MURS260-E3/5BTGITR-ND
11	1	L1	220uH THT OR SMD 8MM DIA	SUMIDA	DIGIKEY	308-CDRH70D45BT150NP-221MCCT-ND
12	1	L2	470uH THT OR SMD DIA 8MM	BOURNS	DIGIKEY	RLB0914-471KL-ND
13	1	R1	0.2E 5% SMD 1206	MURATA/YAGEO	DIGIKEY	
14	1	R2	5.1K 1% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
15	1	R3	100K 5% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
16	1	R4	16.2K 1% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
17	1	R5	300.1K 1% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
18	1	R6	68K 5% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
19	1	U1	AP3928 SOIC8	DIODE INC	DIGIKEY	31-AP3928S-13TR-ND

Notes

APP

Android App

DOWNLOAD

Android App launched in 2017 and has 100k+ downloads - rated with 4.5 stars.

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