



AN1246 APPLICATION NOTE

VIPower: AUXILIARY BIAS POWER SUPPLY USING VIPer20A

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INTRODUCTION

Most power supplies and associated logic circuitry need a means of powering up the switching regulator, MOSFETs. This application note describes a bias power supply to meet these needs and also provide standby power when the main unit is off.

The VIPer20A, a part of STMicroelectronics proprietary VIPower (Vertical Intelligent Power), is a current mode PWM with a 700 volt avalanche rugged MOSFET. It uses a fabrication process which allows the integration of analog control circuits with a vertical power device on the same chip. It can provide an output with 10W power capability for wide range input, or 20W for single input voltage range.

KEY FEATURES OF THE VIPer20A

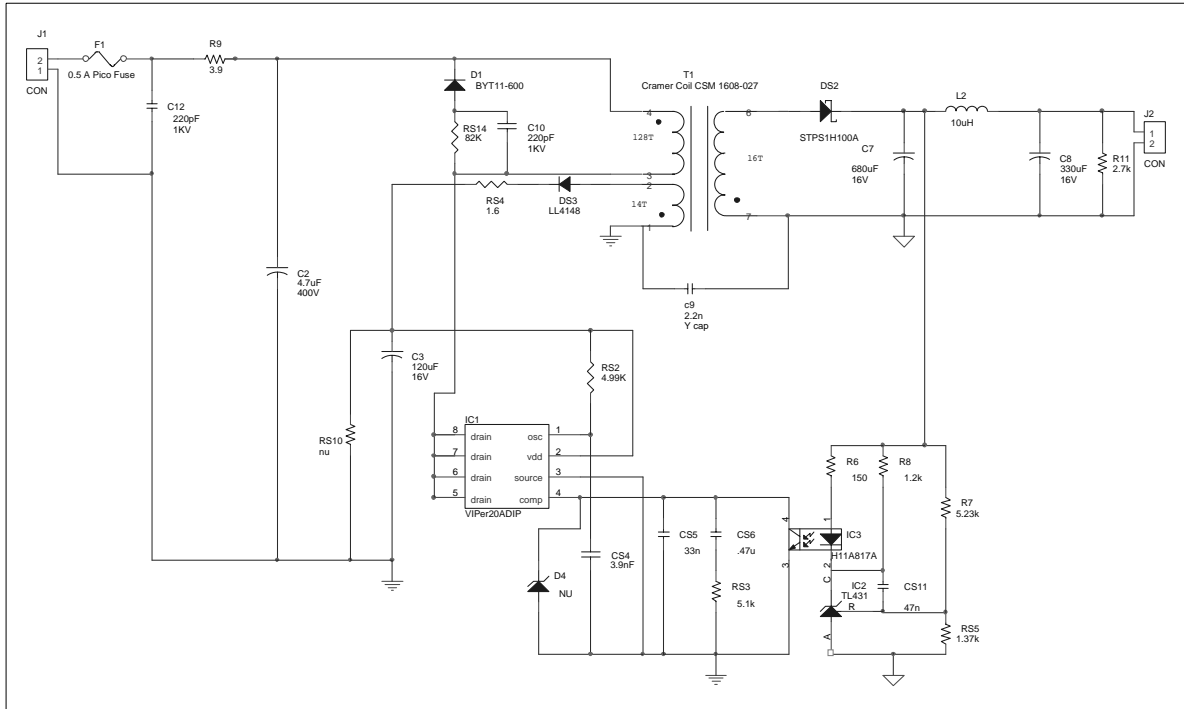
- Adjustable switching Frequency Up to 200KHz
- Current mode Control
- Burst Mode Operation in Stand-by Mode, Meets "Blue Angel" standards
- Undervoltage Lock-out with Hysteresis
- Integrated Start-up Supply
- Avalanche Rugged
- Overtemperature Protection
- Primary or secondary Regulation

GENERAL CIRCUIT DESCRIPTION

This demoboard (see schematic in Fig. 1) is a 110 to 375 Vdc input discontinuous Flyback, working at 100 kHz. The output can deliver 12 volts at 0.5 amps continuous. This circuit can be powered from the: main bulk capacitors of an off-line power supply, power factor correction output stage, or the AC line with the addition of a low current bridge rectifier. It benefits from the EMI filter present in a typical power supply. The output uses a Schottky diode for better efficiency. C7 is a low ESR capacitor to manage the ripple current. IC2 provides the reference and the feedback to tightly regulate the output. CS5, CS6, and RS3 form the feedback loop compensation to optimize stability during transients. The demoboard can be tested with convection air. Depending on the final application, air flow might be needed to keep the VIPer20A under the thermal shutdown limit.

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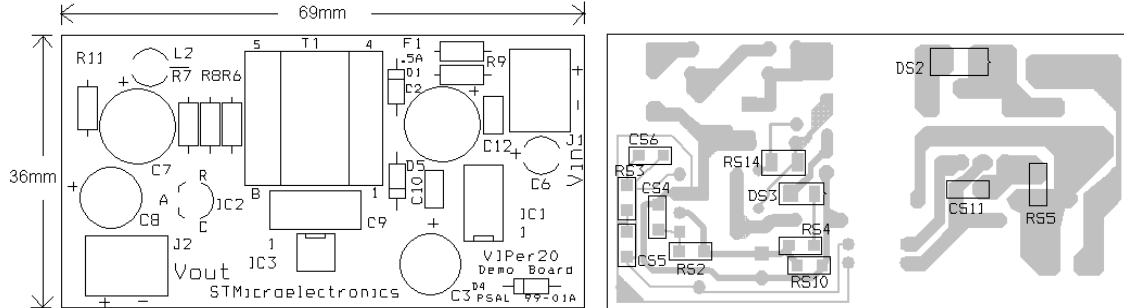
Figure 1: Schematic



ELECTRICAL SPECIFICATION FROM MEASURED RESULTS

PARAMETER	RESULTS
Input voltage range J1	110 to 375 VDC
Output J2	12V from 0 to 0.5A
Load regulation (0 to 0.5A) from setpoint	+/- 25mV or +/- 0.2%
Line regulation (at max load)	+/- 1mV
Efficiency	84% at 120VDC and 79% at 375 VDC
Output ripple voltage	35 mV MAX
Input power at no load	0.65W MAX
Transient response, 50% load step	+/-60 mV typical

PC BOARD TOP LEGEND BOTTOM FOIL AND SURFACE MOUNT COMPONENTS



COMPONENT LIST

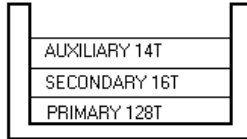
QUANTITY	REFERENCE	DESCRIPTION	VALUE
1	C2		F4.7μF 400V
1	C3		120μF 16V (low ESR)
1	CS4		3.9nF 50V
1	CS5		33nF 50V
1	CS6		47μF 25V
1	C7		680μF 16V (low ESR)
1	C8		330μF 16V (low ESR)
1	C9	Y1 Rated safety cap	2.2nF
1	C10		220pF 1KV
1	CS11		47μF 50V
1	C12		220pF 1KV
1	D1	*BYT11-600	600V 1A Ultrafast
1	DS2	*STPS1H100A	100V 1A Schottky
1	DS3	LL4148	
1	F1	fuse	0.5 A pico
1	IC1	*VIPer20ADIP	
1	IC2	*TL431	
1	IC3	H11A817A (optocoupler)	
1	J1	Connector terminal	
1	J2	Connector terminal	
1	L2	Coilcraft PCH-27-103	10μH
1	RS2		4.99KΩ 1% 1/8W
1	RS3		5.1KΩ 1/8W
1	RS4		1.6Ω 1/8W
1	RS5		1.37Ω 1% 1/8W
1	R6		150Ω 1/4W
1	R7		5.23KΩ 1% 1/4W
1	R8		1.2KΩ 1/4W
1	R9		3.9Ω 1/4W
1	R11		2.7KΩ 1/4W
1	RS14		82KΩ 1/4W
1	T1	Cramer Coil CSM 1608-027	

* Parts available from STMicroelectronics. "S" in legend denotes a surface mount part.

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TRANSFORMER SPECIFICATION

Primary inductance	1.65mH
Core	C40 EE16



Cramer Coil CSM 1608-027
Secondary is tripple insulated wire

CONNECTING THE DEMOBOARD

This demo board has two connectors. Connect a DC voltage source capable of delivering up to 400 volts DC to connector J1. Be sure to connect the positive source to the + terminal of J1 and the negative to the - terminal **before turning on the input power**. The minimum voltage to operate this demo board is 110 volt DC. Connect an electronic load or resistive load to J2.

LAYOUT CONSIDERATIONS

Some simple rules to improve performance and minimize noise should be followed:

1. Minimize power loops. The switched power current paths inner loop area must be as small as possible. This can be accomplished by careful layout of the printed circuit board and the use of surface mount components. This avoids radiated and conducted EMI noise, and improves the efficiency by eliminating parasitic inductance, thus reducing or eliminating the need for snubbers and EMI filtering.
- 2 Use separate tracks for low level signal and power traces carrying fast switching pulses. This can be seen on the VIPer20A pin 3 on the printed circuit lay out. When signal paths are sharing the same trace as a power path, instabilities may result. The compensation components, CS6, RS3, and CS4 are on a separate trace connected directly to the source of the device.

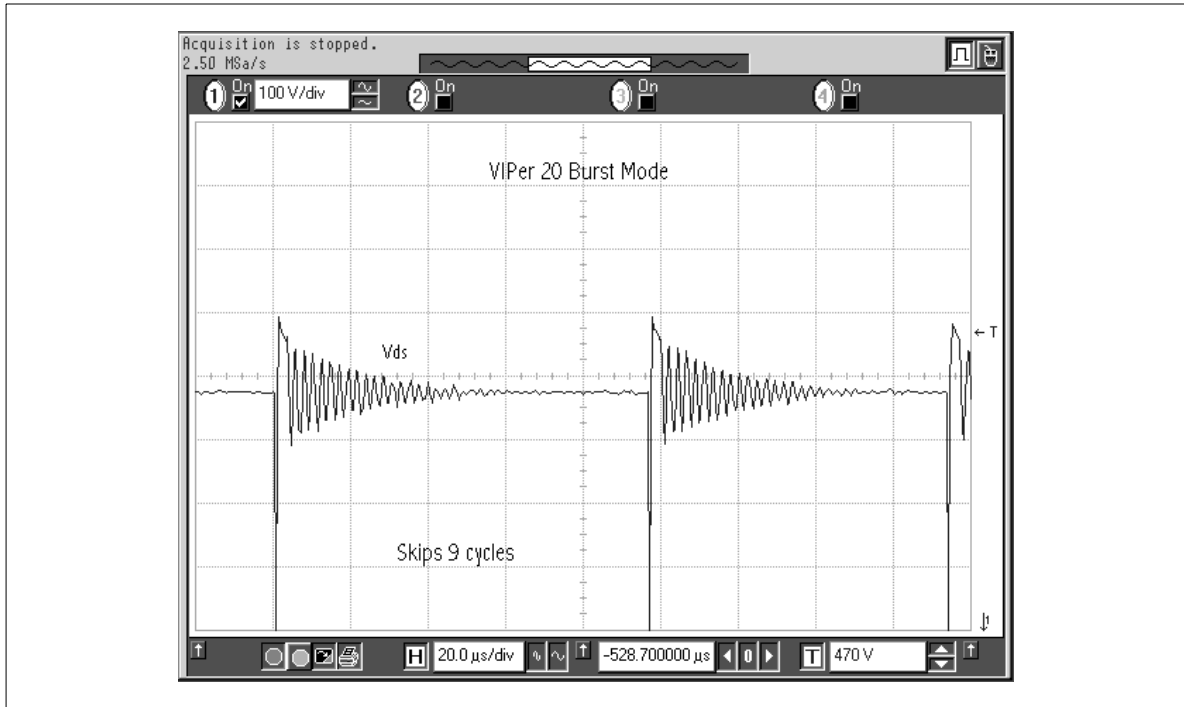
BURST MODE

When the output current is too low, the burst mode operation takes over automatically. This results in missing cycles as shown on the following scope wave form (Figure 2). Vin is 375 Vdc lout is at no load. As can be seen, there is one pulse out of ten pulses to reduce power consumption. The output ripple is negligible.

PERFORMANCE AND COST CONSIDERATION

This demo board has been optimized for performance. Cost trade off can be accomplished by configuring the VIPer for primary regulation. The output regulation will degrade to +/- 5% but the cost of the optocoupler, the TL431 and 5 other passive components can be eliminated. If more output ripple voltage can be tolerated, than L2 and C8 can be eliminated.

Figure 2: Burst mode Waveform



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