



Si9160 Demonstration Board

FEATURES

- Synchronous Boost Converter with Efficiency up to 93%
- 1-MHz Switching Frequency
- Operates with Input Voltages of 3.0 V to 5 V
- 5-V Output at 0 A to 1.0 A

DESCRIPTION

The Si9160 Synchronous Boost Controller combined with high frequency Si6801 MOSFET provides efficiency up to 93% at 1-MHz switching frequency. In the past, switching frequency beyond 300 kHz was not realizable due to high switching loss in the MOSFET. The Si6801 high frequency MOSFET has been specifically designed to minimize gate charge and turn on/off delay time in order to optimize converter efficiency at 1 MHz. This high switching frequency reduces the output inductor and capacitor size without increasing the output voltage ripple. The combination of small component size and high efficiency makes Si9160 synchronous boost converter ideal for RF power amplifiers in cellular or Personal Communications Systems (PCS).

The Si9160 demo board has been configured to generate 5-V output with input voltage range of 3.0 V to 5 V. The converter efficiency is greatly enhanced by using the synchronous rectification instead of a free-wheeling Schottky diode. The Si6801 is a complementary MOSFET pair with p- and n-channel devices in a TSSOP package. The n-channel MOSFET is used as the low-side switch and p-channel is

used as the high-side rectifier. The converter efficiency is further enhanced by using the 5-V output to power the Si9160 and the gate drives when the output voltage exceeds the input voltage by a diode drop.

The output voltage on the demo board can be easily changed to generate various output voltages by changing resistor value R11 as described by the equation below. Do not change resistor value R10 to generate different output voltages. This might cause instability, if the other feedback components are not adjusted to stabilize the loop. If higher current is required, inductor and MOSFET should be properly adjusted to prevent damaging the board. See the Si9160 data sheet for detailed product information.

$$R11 = 5.4k / (V_{OUT} - 1.5)$$

Included in this document are the Bill of Materials, Demo Board Schematic, and PCB layout.

The demonstration board layout is available in Gerber file format. Please contact your Vishay Siliconix sales representative or distributor for a copy.

ORDERING INFORMATION: PART NUMBER Si9160DB

POWER-UP CHECK LIST—INSTALLED IN VRM MOTHER BOARD SOCKET

1. Attach an electronic load set to either resistive or current mode to the output pins. Set the current to any level between 0 and 1.0 A. Alternatively, you can use a resistor of value between 5 Ω and 1 M Ω .
2. Attach a 2.7- to 5-V supply and ground to the pins on the left side of the board. This can be done with a grabber to one each of the two pins; it is not necessary to use all four pins.
3. Put an oscilloscope ground on the input ground, and the Ch1 probe on pin 1 of the Si6801 (the MOSFET drain).

Connect the Ch2 probe on pin 14 of Si9160 and Ch3 probe on pin 15 of Si9160. Set the oscilloscope at 5 V/div and 500 nsec/div; the result will appear approximately as shown in Figure 1.

4. To synchronize to external clock frequency, connect square wave clock to pin 3 to ground on connect pin marked with "S". External clock frequency should be faster than the free running converter frequency. The converter frequency is synchronized during high to low transition.

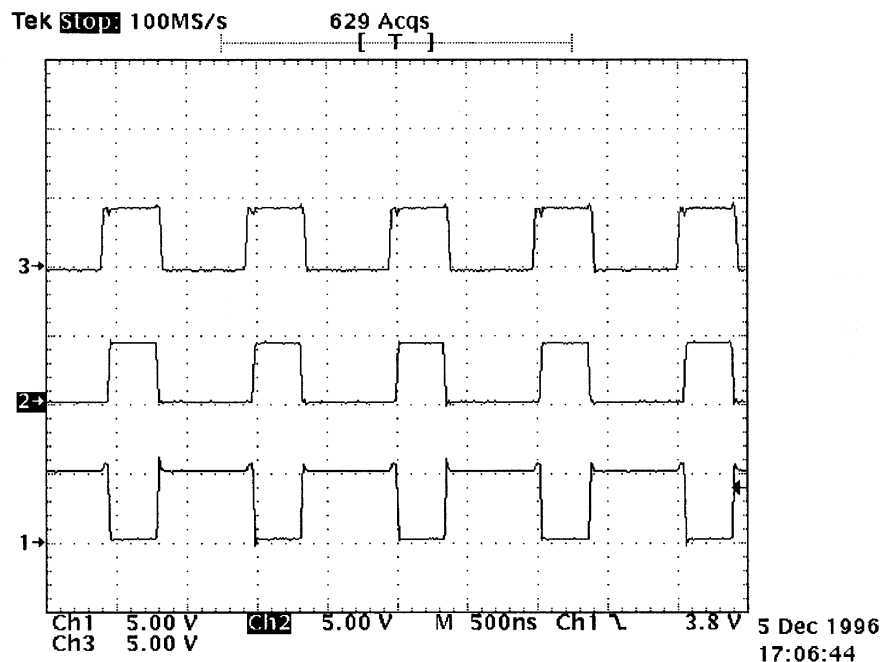


FIGURE 1. Ch1 - Drain to ground voltage on pin 1 of Si6801.
Ch2 - Low side switch gate drive voltage on pin 14 of Si9160.
Ch3 - High-side rectifier gate drive voltage on pin 15 of Si9160.

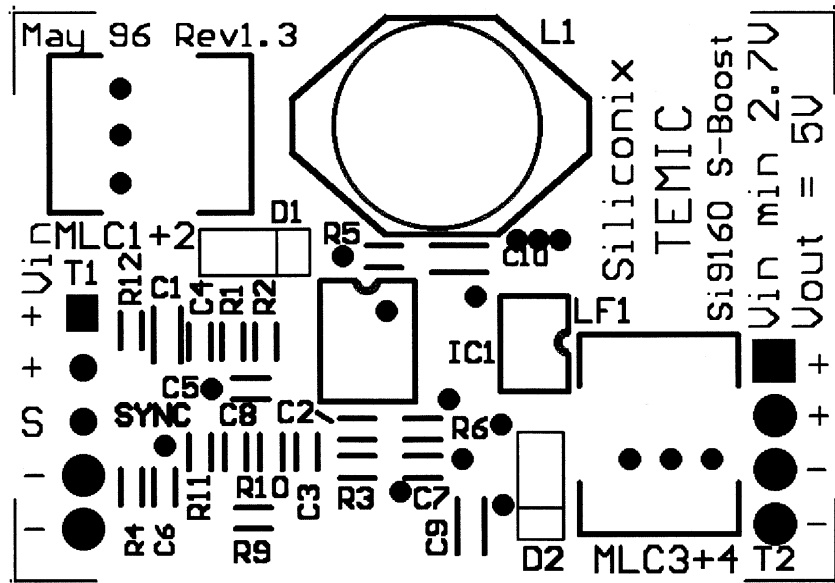


FIGURE 2. Silk Screen

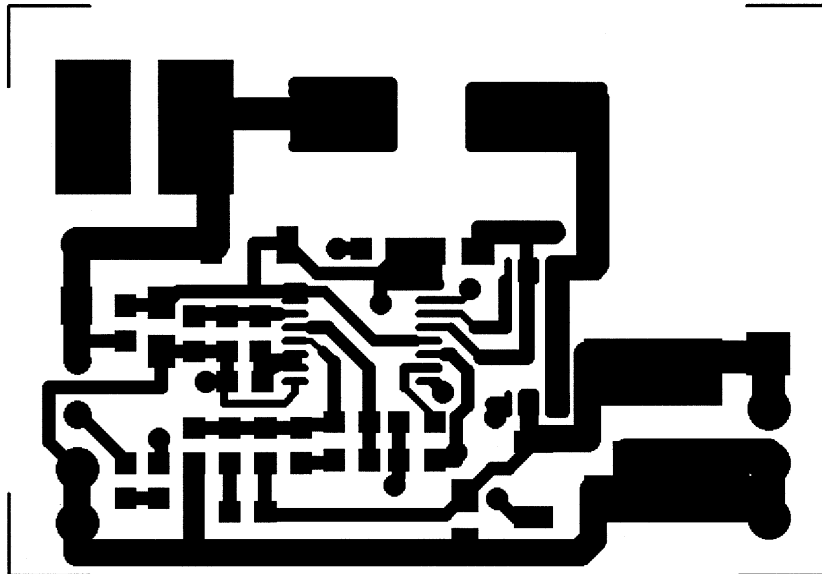


FIGURE 3. Top Layer

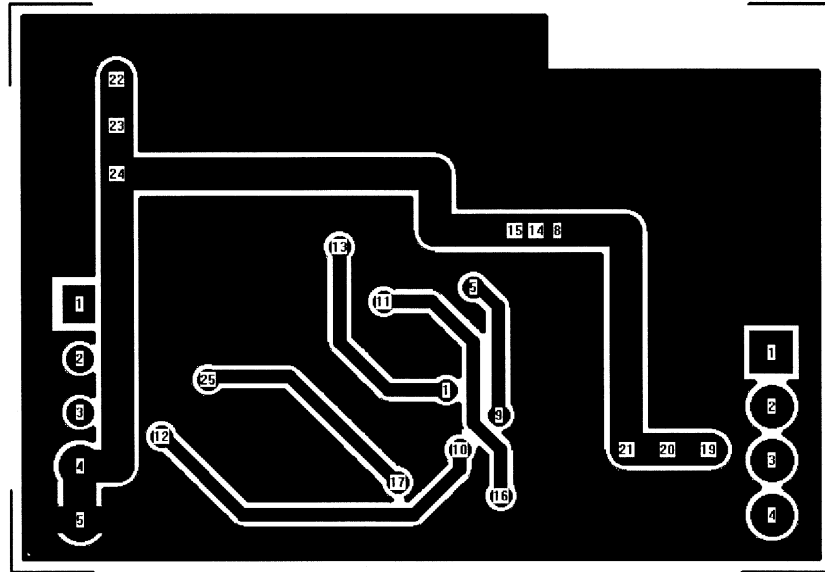


FIGURE 4. Bottom Layer

Si9160DB APPLICATION CIRCUIT

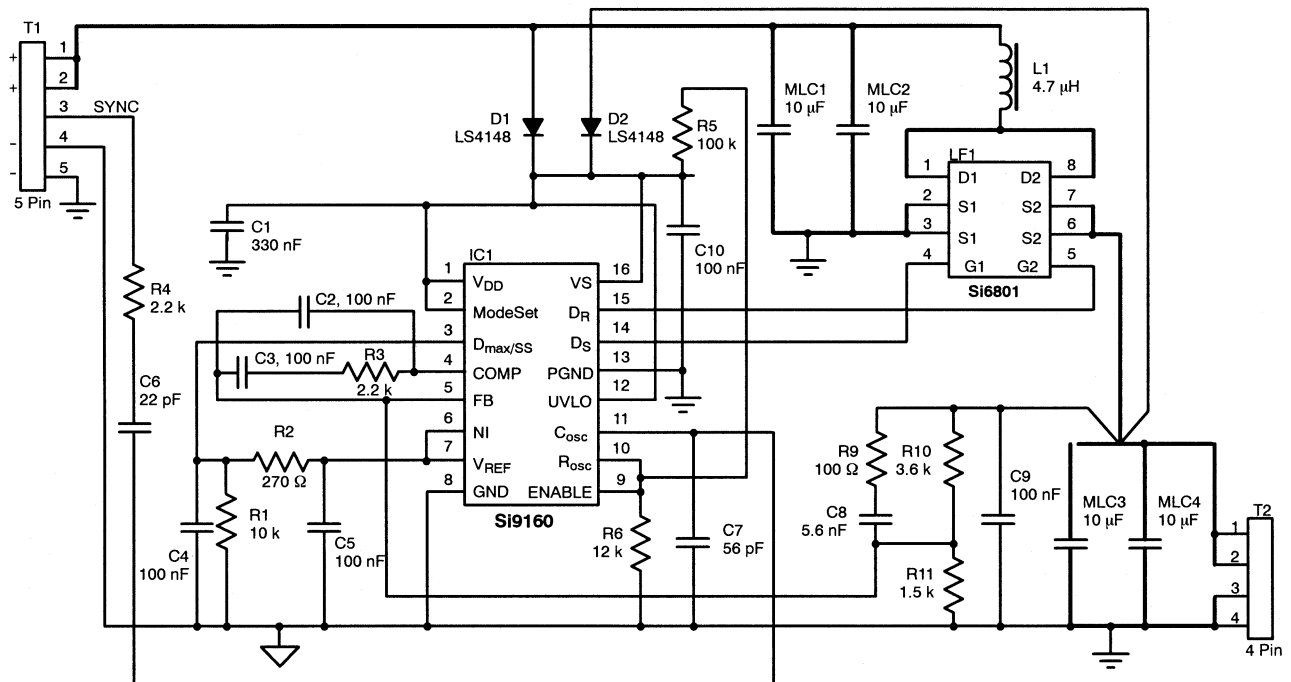


FIGURE 5. Si9160 Synchronous Boost Converter for Mobile/Cellular Communication

Specification

2.7 to $V_{OUT} - 0.1$ V (7 V max)

5 V_{OUT} at 1A (can be pulsed to a higher current such as GSM PA 5 V at approx. 1.6 A at 1/7 duty cycle)

$f = 1$ MHz (can be set up to 1.8 MHz with RC change)



BILL OF MATERIAL FOR Si9160 SYNCHRONOUS BOOST CONVERTER						
Part	Used	Reference Designators	Part Type	Description/ Part Number	Part Number	Manufacturer
1	1	C1	330 nF	Capacitor, 330 nF	08053G334ZAT2	AVX
2	5	C2-C5, C10	100 nF	Capacitor, 100 nF	VJ0805Y104KXXAT	Vishay Vitramon
3	1	C6	22 pF	Capacitor, 22 pF	VJ0603A220KXAAT	Vishay Vitramon
4	1	C7	56 pF	Capacitor, 56 pF	VJ0603A560KXAAT	Vishay Vitramon
5	1	C8	5.6 nF	Capacitor, 5.6 nF	VJ0603Y562KXXAT	Vishay Vitramon
6	1	C9	100 nF	Capacitor, 100 nF	VJ0805Y104KXXAT	Vishay Vitramon
7	2	D1, D2	LS4148	Diode, LS4148	LS4148	Vishay Vitramon
8	1	IC1	TSSOP-16	Sync Boost	Si9160	Vishay Siliconix
9	1	L1	SMDL	Inductor, 4.7 μ H	D03316P-472	Coilcraft
10	1	LF1	TSSOP-8	High-Frequency MOSFET	Si6801	Vishay Siliconix
11	4	MLC1-MLC4	10 μ F, 16 V	Capacitor	1210YG106ZAT	AVX
12	1	R1	10 k Ω	Resistor, 10 k Ω	CRCW0603103JRT1	Vishay Dale
13	1	R10	3.6 k Ω	Resistor, 3.6 k Ω	CRCW0603362JRT1	Vishay Dale
14	1	R11	1.5 k Ω	Resistor, 1.5 k Ω	CRCW0603152JRT1	Vishay Dale
15	1	R2	270 Ω	Resistor, 270 Ω	CRCW0603271JRT1	Vishay Dale
16	1	R3	2.2 k Ω	Resistor, 2.2 k Ω	CRCW0603222JRT1	Vishay Dale
17	1	R4	2.2 k Ω	Resistor, 2.2 k Ω	CRCW0603222JRT1	Vishay Dale
18	1	R5	100 k Ω	Resistor, 100 k Ω	CRCW0603104JRT1	Vishay Dale
19	1	R6	12 k Ω	Resistor, 12 k Ω	CRCW0603123JRT1	Vishay Dale
20	1	R9	100 Ω	Resistor, 100 Ω	CRCW0603101JRT1	Vishay Dale
21	1	T1	5 Pin	5-Pin Header	SIP5	Multi-Source
22	1	T2	4 Pin	4-Pin Header	SIP4	Multi-Source