Si9136 Demonstration Board

FEATURES

- Up to 95% Efficiency
- 3% Total Regulation
- 5.5-V to 30-V Input Voltage Range
- 3.3-V, 5-V, and 12-V Outputs
- 200-kHz Fixed Frequency Operation
- Precision 3.3-V Reference Output
- 30-mA Linear Regulator Output
- Pulse Skipping Mode (PSM) at Light Load
- No Transformer Required
- LITTLE FOOT® Optimized Output Driver
- Internal Soft-Start
- Minimal External Control Components
- 28-Pin SSOP Package

DESCRIPTION

The Si9136 is a multi-output controller for dc-dc converters. With 5.5-V to 30-V input voltage, it offers three switching regulators with output voltage set at 3.3 V, 5 V, and 12 V. The 3.3-V and 5-V converters are synchronous buck and are configured to deliver 5-A maximum output current on the demo board (DB). Load current higher than 5 A (approximately) will put converters in current limit and output voltage will drop out of regulation. A buck-boost, or a non-isolated flyback, converter is used to generate 12-V output capable of delivering maximum of 250-mA load. The maximum current level can also be selected by the users. Proper current sense resistor value and maybe even the MOSFETs with different current rating are required.

The Si9136 also provides 5-V output at maximum of 30 mA even when all converters are shut down. With any one of the converters active, a precision 3.3-V reference voltage becomes available which can supply up to 1-mA load.

The nominal pulse width modulation (PWM) switching frequency is set to 200 kHz for all three converters. However, the switching frequency reduces automatically in light load to save power loss due to switching, which is defined as pulse skipping modulation (PSM) mode.

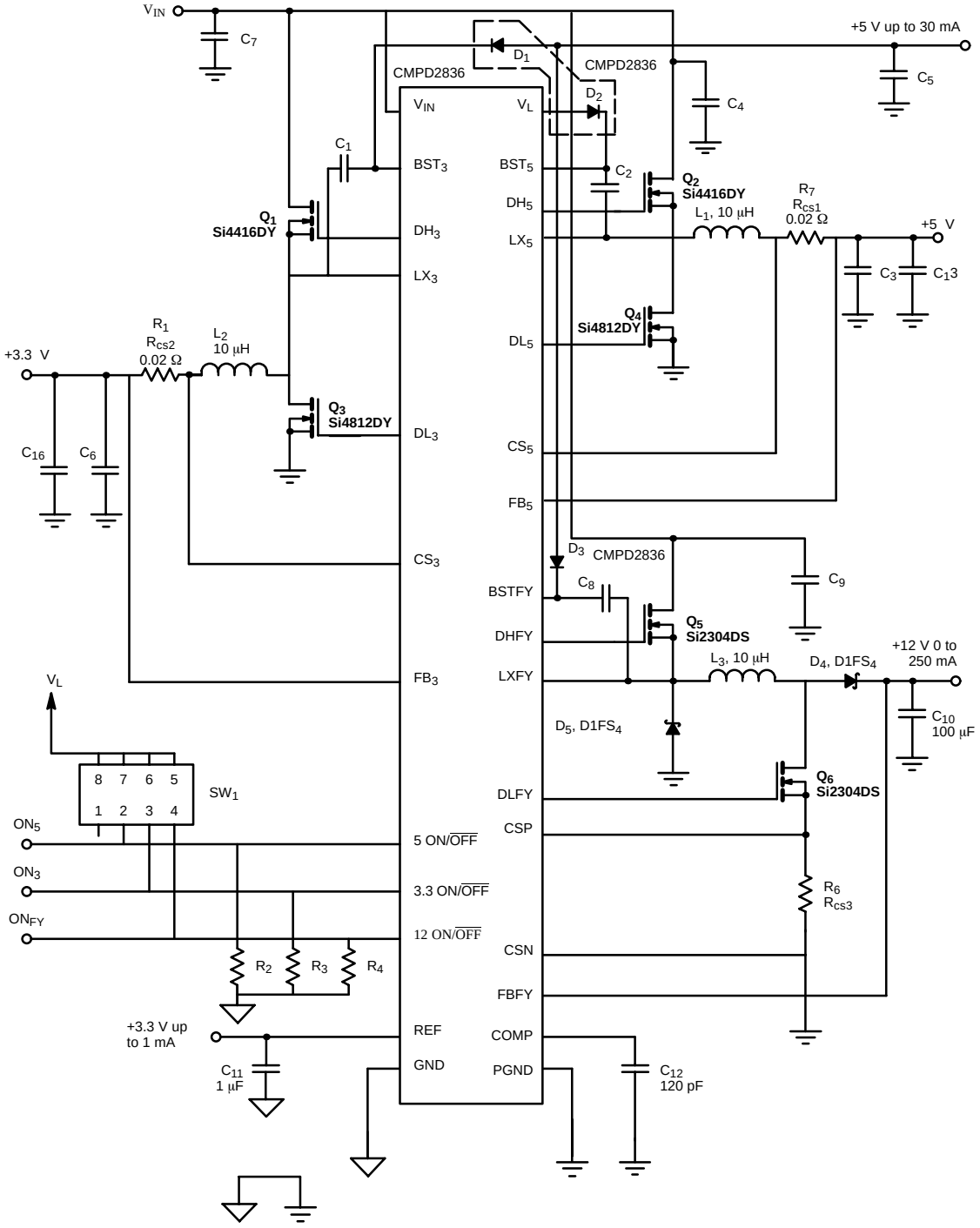
Included in this document are demo board schematics (Figure 1), demo board sample waveform (Figure 2 to 4), PCB layout (Figure 5 to 8), and Bill-Of-Material (Table 1).

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 Si9136DB

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

1. Visually inspect demo board and make sure there is no apparent defect. Find SW1 on the lower right corner and make sure all dip switches are at OFF position (to the left).
2. Attach an electronic load set to either resistive or current mode to the 5-V output pins (on the right hand side) of the demo board. Set the load current to zero.
3. Attach a dc power supply, with at least 10-A current capability, to the input pins (on the top) of the demo board. The input voltage can be adjusted between 6 V and 30 V.
4. Use a DMM to measure the voltage at the V_L pin to verify the 5-V linear regulator with input applied.
5. Monitor the voltage of the 5-V output to come up when dip switch 2 of SW_1 is flipped. Apply 2-A load to put the converter in PWM mode. Put an oscilloscope ground on the output ground, and the Ch1 probe on 5-V output. Connect Ch2 probe to Pin 17 (LX5) of Si9136. The waveform should appear approximately as shown in Figure 2. Decrease the load to 200mA to put the converter in PSM mode. The typical waveforms are shown in Figure 3.
6. Repeat Step 5 on 3.3-V and 12-V output to observe similar results. Note that the 12-V output is designed for 250-mA maximum load. MOSFETs and inductor with higher current rating are required if load level on the 12-V output is higher than 250 mA.
7. To observe the start-up waveform and soft-start process, leave all switches of SW_1 at ON position. Put scope probe Channel 1, 2, 3, and 4 on 5-V output, 3.3-V output, 12-V output, and input voltage, respectively. Set scope trigger on rising edge of Channel 4. The single event captured should look like Figure 4.



Notes
a. R_2, R_3, R_4 = 1 MΩ. All other resistors as noted.
b. C_1, C_2, C_8 = 0.1 µF.
c. C_3, C_6, C_{13}, C_{16} = 330 µF.
d. C_4, C_7 = 33 µF.
e. C_5, C_9 = 4.7 µF.
f. All other capacitors as noted.

FIGURE 1. Schematics of Si9136 Demo Board.

The channel lineup for Figures 2 and 3 is as follows:

Ch1: 5-V Output Voltage
Ch2: Inductor Voltage Pin 17(LX) of Si9136

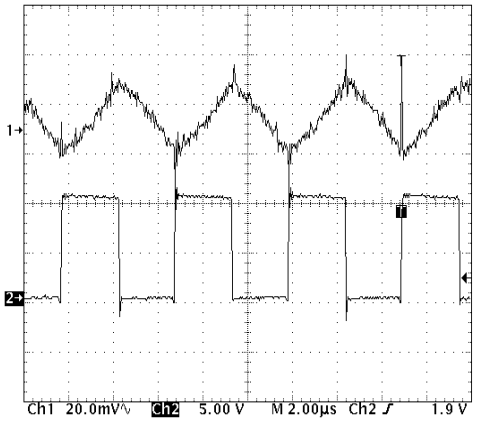


FIGURE 2. PWM Mode: V_{IN} = 10 V, V_O = 5 V, Load = 2 A

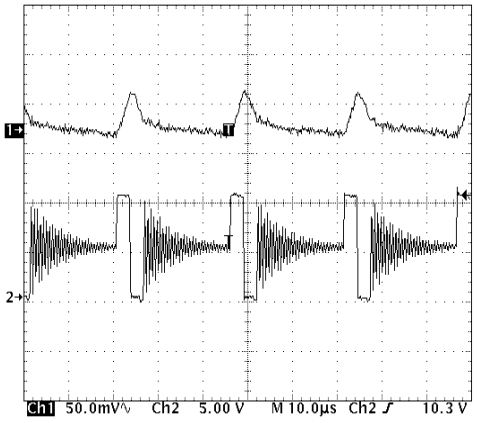


FIGURE 3. PSM Mode: V_{IN} = 10 V, V_O = 5 V, Load = 200 mA

The channel lineup for Figure 4 is as follows:

Ch1: 5-V Output Voltage
Ch2: 3.3-V Output Voltage
Ch3: 12-V Output Voltage
Ch4: Input Voltage

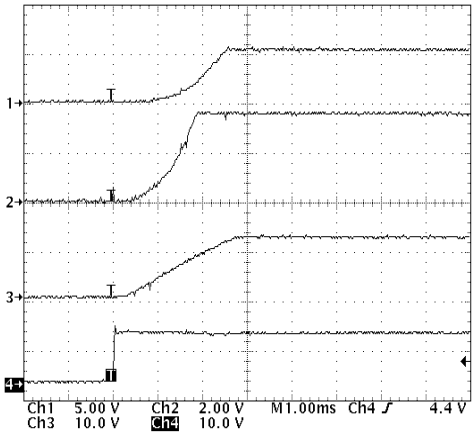


FIGURE 4. Start-Up

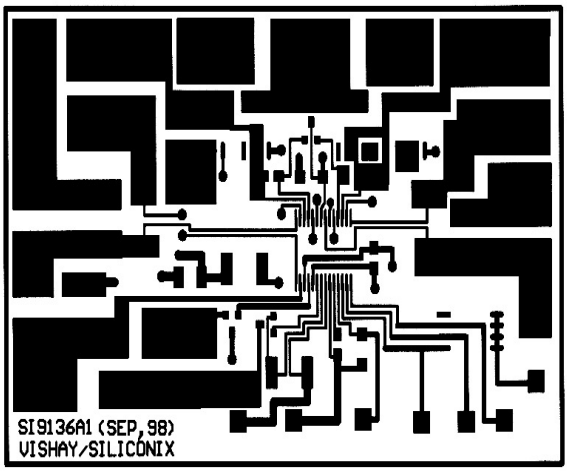


FIGURE 5. Si9136DB Top Layer

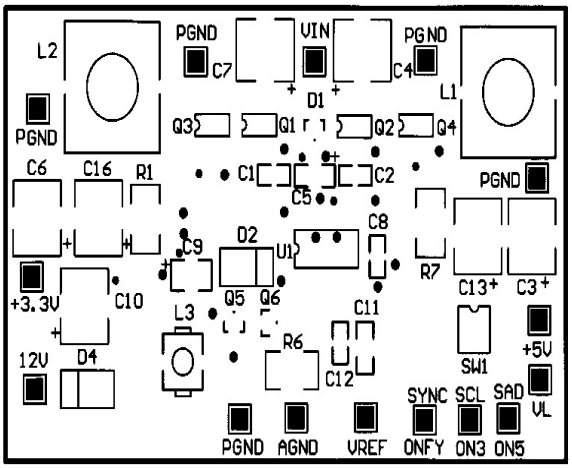


FIGURE 6. Si9136DB Top Silk Screen

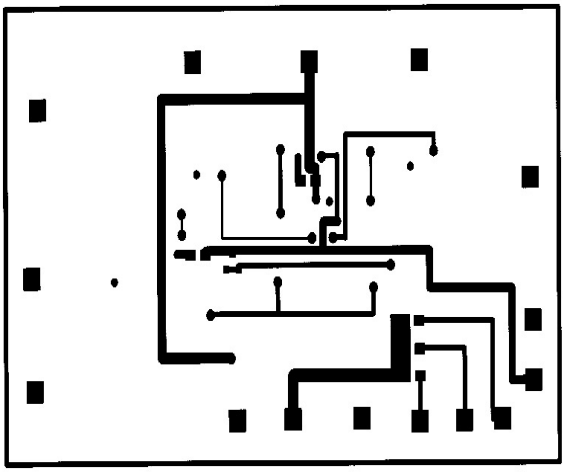


FIGURE 7. Si9136DB Bottom Layer

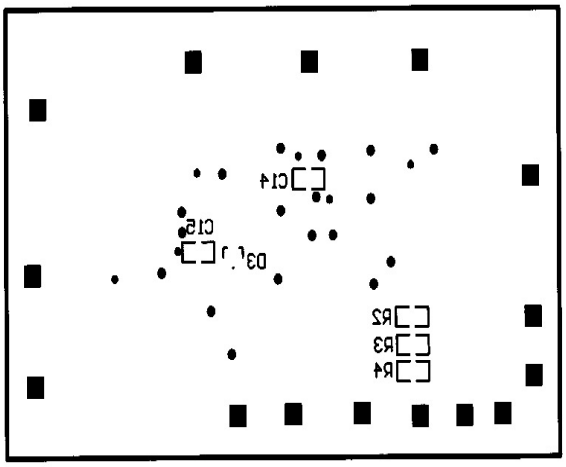


FIGURE 8. Si9136DB Bottom Silk Screen

TABLE 1. DEMO BOARD BILL-OF-MATERIAL

Item	Qty	Designator	Part Type	Description	Footprint	Part Number	Manufacturer
1	2	R_1, R_7	0.02 Ω ±1%	Resistor, 1 W, 1%	2512A	WSL25120.02 Ω ±1% B43	Vishay Dale
2	3	R_2, R_3, R_4	1 MΩ	Resistor, $^1/_4$ W, 5%	0805	CRCW0805103JRT1	Vishay Dale
3	1	R_6	0.1 Ω ±1%	Resistor, 1 W, 1%	2512A	WSL25	Vishay Dale
4	5	C_1, C_2, C_8, C_{14}, C_{15}		Capacitor, Cer	1206	VJ1206Y104KXXAT	Vishay Vitramon
5	4	C_3, C_6, C_{13}, C_{16}	293D337X96R3E2T	Capacitor, Tan, 6.3 V	7243		Vishay Sprague
6	2	C_4, C_7	595D336X003RR2T	Capacitor, Tan, 35 V	CDR74B		Vishay Sprague
7	1	C_5	4.7 µF	Capacitor, Tan, 6.3 V	1206		Multi-Source
8	1	C_9	293D475X9035C2T	Capacitor, Tan, 35 V	1210		Vishay Sprague
9	1	C_{10}	595D007X002SR2T	Capacitor, Tan, 20 V	CDR74B		Vishay Sprague
10	1	C_{11}	1 µF	Capacitor, Cer	1206		Multi-Source
11	1	C_{12}	120 µF	Capacitor, Cer	0805		Multi-Source
12	2	D_1, D_3	CMPD2836	Diode, dual 1N4148	SOT-23		Central Semiconductor
13	2	D_2, D_4	D1FS4	Schottky Diode	DIFS4		Shindengen
14	2	L_1, L_2	CDRH125-100	10-µH Inductor	CDRH125		Sumida
15	1	L_3	CDRH62B	10-µH Inductor	DO3308		Sumida
16	1	SW_1	GDS04	4 Position SMT Switch	SW–SO8		Augat
17	2	Q_1, Q_2		N-Channel MOSFET	SO-8	Si4416DY	Vishay Siliconix
18	2	Q_3, Q_4		N-Channel MOSFET	SO-8	Si4812DY	Vishay Siliconix
19	2	Q_5, Q_6		N-Channel MOSFET	SOT-23	Si2304DS	Vishay Siliconix
20	1	U_1		Power IC	SSOP-28	Si9136	Vishay Siliconix
21	14	Power, GND and TP	Header	1-Pin Header	TP1		Multi-Source