

High-Frequency Switchmode Controller

FEATURES

- 15- to 200-V Input Range
- Current-Mode Control
- Internal Start-Up Circuit
- Latched SHUTDOWN
- Soft-Start
- 1.8-MHz Error Amp

DESCRIPTION

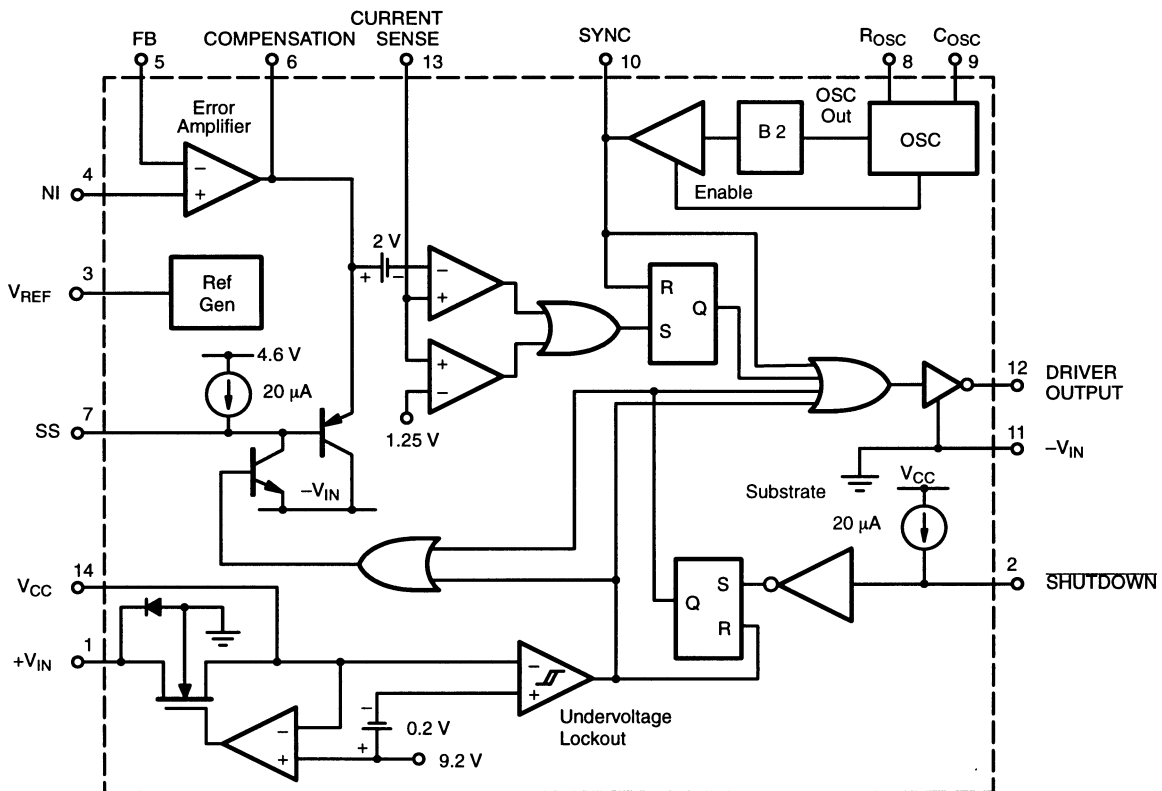
The Si9114A is a BiC/DMOS current-mode pulse width modulation (PWM) controller IC for high-frequency dc/dc converters. Single-ended topologies (forward and flyback) can be implemented at frequencies up to 1 MHz. The oscillator has an internal divide-by-two that limits the duty ratio to 50%. An oscillator sync output allows converters to be synchronized in phase as well as in frequency, in a master/slave configuration.

The output inverter can typically source 500 mA and sink 700 mA. Shoot-through current is all but eliminated to minimize supply current requirements.

The high-voltage DMOS transistor allows the IC to interface directly to bus voltages up to 200 V. Other features include a 1.5% accurate voltage reference, 1.8-MHz (min) bandwidth error amplifier, shutdown logic control, soft-start and undervoltage lockout circuits.

The Si9114A is available in 14-pin plastic DIP and SOIC packages, and is specified over the industrial, D suffix (-40°C to 85°C) temperature range.

FUNCTIONAL BLOCK DIAGRAM





ABSOLUTE MAXIMUM RATINGS

Voltages Referenced to $-V_{IN}$

V_{CC}	18 V
$+V_{IN}$ (Note: $V_{CC} < +V_{IN} + 0.3$ V)	200 V
Logic Input (SHUTDOWN, SYNC)	-0.3 V to $V_{CC} + 0.3$ V
Linear Inputs (FEEDBACK, SENSE, SOFT-START)	-0.3 V to $V_{CC} + 0.3$ V
HV Pre-Regulator Input Current (continuous)	5 mA
Storage Temperature	-65 to 150°C
Operating Temperature	-40 to 85°C
Junction Temperature (T_J)	150°C

Power Dissipation (Package)^a

14-Pin Plastic Dip (J Suffix) ^b	750 mW
14-Pin SOIC (Y Suffix) ^c	900 mW

Thermal Impedance (θ_{JA})

14-Pin Plastic Dip	167°C/W
14-Pin SOIC	140°C/W

Notes

- Device mounted with all leads soldered or welded to PC board.
- Derate 6 mW/°C above 25°C.
- Derate 7.2 mW/°C above 25°C.

RECOMMENDED OPERATING RANGE

Voltages Referenced to $-V_{IN}$

V_{CC}	9.5 V to 16.5 V
$+V_{IN}$	15 V to 200 V
f_{OSC}	20 kHz to 2 MHz

 R_{OSC}

C_{OSC}

Linear Inputs

Digital Inputs

SPECIFICATIONS						
Parameter	Symbol	Test Conditions Unless Otherwise Specified Oscillator Disabled $-V_{IN} = 0$ V, $V_{CC} = 10$ V	Limits D Suffix -40 to 85°C			Unit
			Min ^a	Typ ^b	Max ^a	
Reference						
Output Voltage	V_R	OSC Disabled, $T_A = 25^\circ\text{C}$	3.94	4.0	4.06	V
		OSC Disabled Over Voltage and Temperature Ranges ^c	3.88	4.0	4.12	
Short Circuit Current	I_{SREF}	$V_{REF} = -V_{IN}$		-30	-5	mA
Load Regulation	$\Delta V_R / \Delta I_R$	$I_{REF} = 0$ to -1 mA		10	40	mV
Oscillator						
Initial Accuracy	f_{OSC}^d	$R_{OSC} = 374$ k Ω , $C_{OSC} = 200$ pF	90	100	110	kHz
		$R_{OSC} = 70$ k Ω , $C_{OSC} = 200$ pF	450	500	550	
Voltage Stability ^c	$\Delta f / f$	$R_{OSC} = 70$ k Ω , $C_{OSC} = 200$ pF $\Delta f / f = [f(16.5 \text{ V}) - f(9.5 \text{ V})] / f(9.5 \text{ V})$		4	7	%
Temperature Coefficient ^c	OSC TC	$-40 \leq T_A \leq 85^\circ\text{C}$, $f_{OSC} = 100$ kHz		200	500	ppm/°C
Sync Output Current (Master Mode)	$I_{SYNC(M)}$	$V_{ROSC} \leq 5$ V	± 1.0	± 3.0		mA
Sync Output Current (Slave Mode)	$I_{SYNC(S)}$	$V_{ROSC} = V_{CC}$		± 1	± 500	nA
Error Amplifier ($C_{OSC} = -V_{IN}$ OSC Disabled)						
Input BIAS Current	I_{FB}	$V_{FB} = 5$ V, $I_I = V_{REF}$		<1.0	± 200	nA
Input OFFSET Voltage	V_{OS2}			± 5	± 25	mV
Open Loop Voltage Gain ^c	A_{VOL}		65	80		dB
Unity Gain Bandwidth ^c	BW		1.8	2.7		MHz
Output Current	I_{OUT}	Source ($V_{FB} = 3.5$ V, $I_I = V_{REF}$)		-2.7	-1.0	mA
		Sink ($V_{FB} = 4.5$ V, $I_I = V_{REF}$)	1.0	2.4		
Power Supply Rejection	PSRR	$9.5 \text{ V} \leq V_{CC} \leq 16.5 \text{ V}$	50	80		dB

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SPECIFICATIONS							
Parameter	Symbol	Test Conditions Unless Otherwise Specified Oscillator Disabled -V _{IN} = 0 V, V _{CC} = 10 V	Limits D Suffix -40 to 85°C			Unit	
			Min ^a	Typ ^b	Max ^a		
Pre-Regulator/Start-Up							
Input Leakage Current	+I _{IN}	+V _{IN} = 200 V, V _{CC} ≥ 10 V		<1	10	μA	
Pre-Regulator Start-Up Current	I _{START}	+V _{IN} = 48 V, t _{PW} ≤ 300 μs, V _{CC} = V _{UVLO}	8	20		mA	
V _{CC} Pre-Regulator Voltage	V _{PR}	+V _{IN} = 48 V	8.8	9.1	9.4	V	
V _{PR} -V _{UVLO} (Turn-On)	V _{DELTA}		0.1	0.25	0.7		
Undervoltage Lockout Hysteresis	V _{HYST}		0.18	0.28	0.4		
Supply							
Supply Current	I _{CC}	C _{LOAD} ≤ 50 pF	f _{OSC} = 100 kHz		1.5	2.5	mA
			f _{OSC} = 500 kHz		2.2	3.0	
Protection							
Current Limit Threshold Voltage	V _{SENSE}	V _{FB} = 0 V, NI = V _{REF}	1.15	1.23	1.30	V	
Current Limit Delay to Output ^c	t _d	V _{SENSE} = 1.5 V, See Figure 1.		77	100	ns	
SHUTDOWN Logic Threshold	V _{SD}			2.8	0.5	V	
SHUTDOWN Delay to Latched Output ^c	t _{SD}	See Figure 2.		0.20	1.0	μs	
SHUTDOWN Pull-Up Current	I _{SD}	V _{SD} = 0 V	12	23	30	μA	
Soft-Start Current	I _{SS}		12	23	30		
Output Inhibit Voltage	V _{SS(off)}	Soft-Start Voltage to Disable Driver Output		1.6	0.5	V	
MOSFET Driver							
Output High Voltage	V _{OH}	I _{OUT} = -10 mA	9.85	9.9		V	
Output Low Voltage	V _{OL}	I _{OUT} = 10 mA		0.05	0.15		
Peak Output Current ^c	I _{SOURCE}	V _{OUT} = 0 V		-400	-200	mA	
	I _{SINK}	V _{OUT} = V _{CC}	500	1000			

Notes

- a. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum.
- b. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- c. Guaranteed by design, not subject to production test.
- d. C_{STRAY} ≤ 5 pF on C_{OSC}.

TYPICAL CHARACTERISTICS (25°C UNLESS OTHERWISE NOTED)

