

High Voltage Switching Regulator Non-Isolated CV Buck Converter

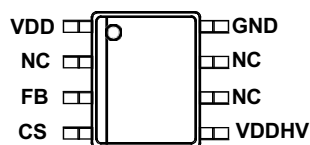
SMD916

FEATURES	DESCRIPTION
<ul style="list-style-type: none">■ Built-in HV regulator, operate from a rectified 85~265 VAC line source directly input to VDDHV pin for internal device bias power.■ Integrated 4.5Ω 650V Power MOSFET.■ Typical oscillation frequency: 90 kHz■ Unnecessary external DC Power supply■ Output voltage external setting (FB) type available.■ FB terminal voltage (VFB) 1.0 V.■ Duty ratio: 0% to 5% typ.- PFM control, 5% to 85% typ. - PWM control■ Built-in current limiting circuit: Assigned by external resistor.■ Soft-start function: Built-in Soft-start circuit.■ Over Temperature Protection (OTP) for thermal shut down at junction temperature Typ. 150°C.	<p>The SMD916 is a monolithic high voltage switching converter with PWM/PFM control that is specifically designed to operate from a rectified 85~265 VAC line source.</p> <p>This device contains a reference voltage source, oscillation circuit, error amplifier, phase compensation circuit, PWM control circuit, power supply 450 V regulator, and other components. The oscillation frequency is at high Typ. 90 kHz, the IC can operate as switching regulator with a small external components.</p> <p>The SMD916 provides low-ripple power, high-efficiency, and excellent transient characteristics because of the PWM control circuit being capable of varying the duty ratio from 0% to 85% linearly and the optimized error amplifier with the phase compensation circuit.</p> <p>The SMD916 contains PWM/PFM switching control circuit such that it operates in PWM mode at 5% or higher duty ratio and in PFM mode below 5% duty ratio to ensure high efficiency in all load ranges.</p>

APPLICATIONS

- Non-isolated ACDC Constant Voltage Source
- ACDC Auxiliary Power
- BLDC Motor, BLDC Fan

PACKAGE/ORDER INFORMATION



8-Pin Plastic S.O.I.C.
(Top View)

Order Part Number

SMD916MSC

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ABSOLUTE MAXIMUM RATINGS (Note 1)

Item	Symbol	Ratings	Units
V _{DD} pin voltage	V _{DD}	-0.3 to 16	V
V _{DD(HV)} pin voltage	V _{DD(HV)}	-0.3 to 450	V
DRIVER pin voltage	V _{DRIVER}	-0.3 to 16	V
DRIVER pin current	I _{DRIVER}	250	mA
FB pin voltage	V _{FB}	-0.3 to 16	V
SENSE pin voltage	V _{SENSE}	-0.3 to 16	V
Operational ambient temperature	T _A	-25 to +85	°C
Operational junction temperature	T _J	140	°C
Storage Temperature Range	T _{STG}	-65 to 150	°C

Note 1: Exceeding these ratings could cause damage to the device. All voltages are with respect to ground. Currents are positive into, negative out of the specified terminal.

POWER MOSFET ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Rating	Units
Drain-Source Voltage	VDSS	650	V
Gate-Source Voltage	VGSS	±30	V
Continue Drain Current	ID	2	A

POWER DISSIPATION TABLE

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Power dissipation (P _D), T _A = 25 °C	670mW
Thermal Resistance-Junction to Ambient, θ _{JA}	165°C /W

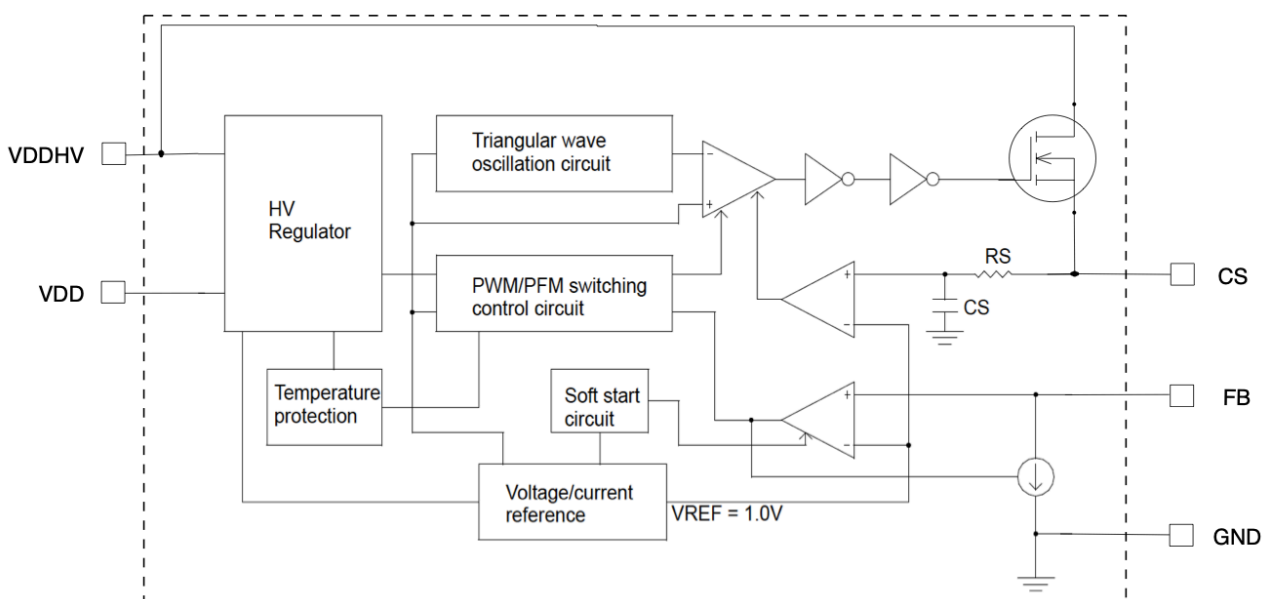
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PIN DESCRIPTION

Pin No.	Pin Name	Pin Function
1	VDD	Internally regulated supply voltage. A sufficient storage capacitor is used to provide storage when the rectified AC input is near the zero crossings.
2	NC	Not Internally Connected
3	FB	Error amplifier input. It is normally connected to the switching power supply output through a resistor divider.
4	CS	Current limit sensed threshold voltage, adjusted by external resistor.
5	VDDHV	Input of 22V - 450V linear regulator. Internally Connect to the 650V power MOSFET for switching mode regulator
6,7	NC	Not Internally Connected
8	GND	Ground for all internal circuits

BLOCK DIAGRAM



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TYPICAL APPLICATIONS

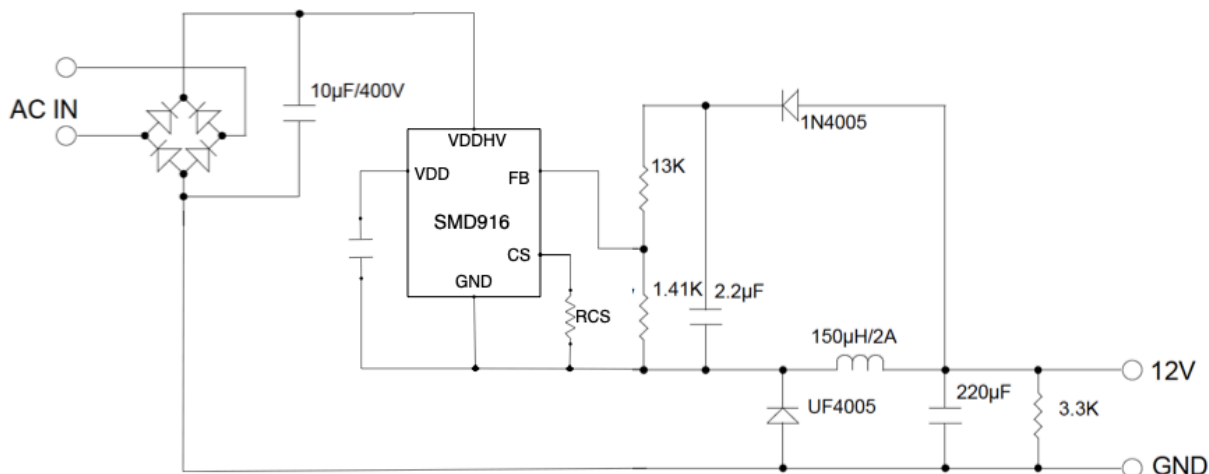


Fig.1 Non-isolated AC/DC Buck Converter

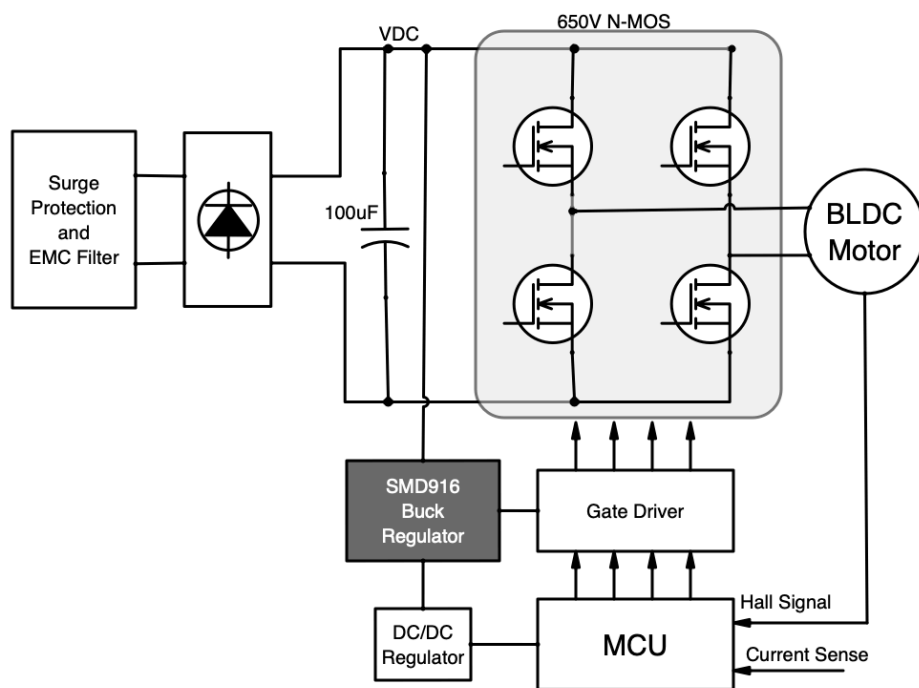


Fig.2 Auxiliary Power for AC Input Single-phase or Three-phase BLDC Motor/Fan

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ELECTRICAL CHARACTERISTICS

Unless otherwise specified, $T_A = -25^{\circ}\text{C} \sim 85^{\circ}\text{C}$; $V_{\text{ddHV}} = 120\text{V}_{\text{DC}}$

Parameter	Test Conditions	Symbol	Min	Typ	Max	Units
Output resistance at low level output voltage	$I_{\text{OL}} = 20\text{mA}$	R_{OL}	4.4	6.5	16	Ω
Output resistance at high level output voltage	$I_{\text{OH}} = -20\text{mA}$	R_{OH}	13	16	30	Ω
Minimum supply voltage		V_{HVmin}	---	22	30	V
Current consumption in static mode	$I_{\text{FB}} = 0.25\text{mA}$	I_{CC1}	0.3	0.61	1.0	mA
Current consumption without load		I_{CC2}	0.4	0.67	1.0	mA
Current consumption with load	1nF Output Load on Pin 5	I_{CC3}	1.2	1.72	2.2	mA
Operating frequency		f_{OSC}	80	90	100	kHz
Maximum duty ratio	$I_{\text{FB}} = 1\mu\text{A}$	d_{max}	77	81	89	%
PWM/PFM switch duty ratio		d_{min}		5.0		%
Duty ratio	$I_{\text{FB}} = 0.1\text{mA}$	$d_{0.1\text{mA}}$		32		%
Maximum control current at FB pin	Duty Cycle = 0 %	I_{FBmax}		140	200	μA
FB pin voltage	Switching Phase, $I_{\text{FB}} = 0.1\text{mA}$ (25°C)	V_{FB}	0.98	1	1.02	V
FB pin voltage	Switching Phase, $I_{\text{FB}} = 0.1\text{mA}$	V_{FB}	0.96		1.04	V
Load regulation	$I_{\text{FB}} = 0.02\text{mA} \sim 0.25\text{mA}$	ΔV_{FB1}		25	40	mV
Input bias current	Through Pin 1	$I_{\text{B-CS}}$	-4.0	0	4.0	μA
Threshold at current detector input		$V_{\text{CS-th}}$	0.9	0.98	1.05	V
Output voltage fall time	$C_{\text{DRIVER}} = 1\text{nF}$, from 90% down to 10% of Output Signal	t_f		---	250	ns
Output voltage rise time	$C_{\text{DRIVER}} = 1\text{nF}$, from 10% up to 90% of Output Signal	t_r		---	250	ns
Soft-start time	From appearance pulses at DRIVER pin to increase Duty Cycle more 50%	t_{SS}	4	9	15	ms
Star voltage at Vdd pin		V_{stup}	12.2	13.0	13.4	
Overvoltage protection threshold		V_{ovp}	14.4	15.4	16	
On-voltage of high voltage power supply		$V_{\text{cc-on}}$	7.3	7.7	8.1	
Off-voltage of high voltage power supply		$V_{\text{cc-off}}$	7.6	8.0	8.4	
Thermal Shutdown		T_{OTP}		150		$^{\circ}\text{C}$

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MOSFET ELECTRICAL CHARACTERISTICS (T_J=25°C unless otherwise noted)

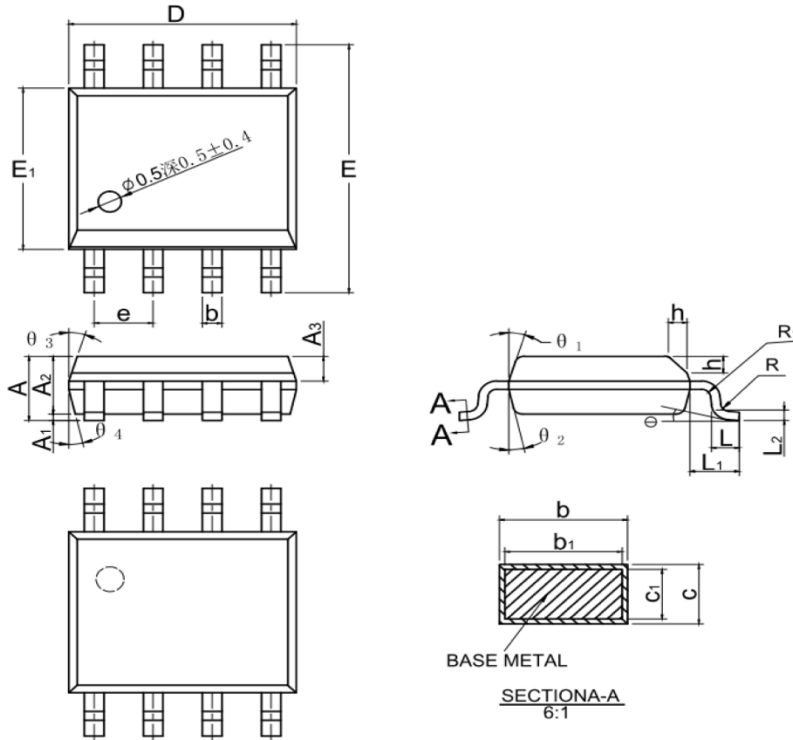
Parameter	Test Condition	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V _{GS} =0V, I _D =250uA	B _{V_{DSS}}	650	--	--	V
Static Drain-Source On-Resistance	V _{GS} =10V, I _D =1A	R _{DS(ON)}	--	4.5	5.0	Ω
Gate Threshold Voltage	V _{GS} =V _{DS} , I _{DS} =250uA	V _{GS(th)}	2	--	4	V
Gate-to-Source Leakage Current	V _{DS} =650V, V _{GS} =0V	I _{DSS}	--	--	1	uA
Gate-Body Leakage Current	V _{DS} =0V, V _{GS} =±30V	I _{GSS}	--	--	±100	nA

Notes: MOS static characteristics test by wafer base (CP)

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PACKAGE DESCRIPTION



DIMENSIONS IN MILLIMETERS

SYMBOL	MIN	NOM	MAX
A	1.35	1.55	1.75
A ₁	0.10	—	0.25
A ₂	1.25	1.40	1.65
A ₃	0.50	0.60	0.70
b	0.39	—	0.49
b ₁	0.28	—	0.48
c	0.10	—	0.25
c ₁	0.10	—	0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E ₁	3.80	3.90	4.00
e	1.27BSC		
L	0.45	—	1.00
L ₁	1.04REF		
L ₂	0.25BSC		
R	0.07	—	—
R ₁	0.07	—	—
h	0.3	0.4	0.5
Θ	0°		
θ ₁	11°	17°	19°
θ ₂	11°	13°	15°
θ ₃	15°	17°	19°
θ ₄	11°	13°	15°

NOTES:

1. Dimensions in Millimeters (Angles in Degrees).
2. All dimensions do not include flash or protrusions
3. All dimensions meet Jedec Standard MS-012F

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