

DC3131A 32V, 100% Duty Cycle CC&CV Buck Convertor

DESCRIPTION

DC3131A has an optimum input voltage, step-down converter that operates in either CV (Constant Output Voltage) mode or CC (Constant Output Current) mode. The maximum input voltage is up to 36V and the operation input voltage from 7V to 32V.

MOSFET what build in 35m Ω High-Side and 25m Ω Low-Side, could deliver up to 3.5A of continuous output current and the output current accurate to within \pm 7%. No external compensation component requirement. The line compensation and the constant current can be set by an external resistance.

In conclusion, DC3131A is a full function and high performance, high reliability buck DC-DC converter, especially suits for BC1.2 and QC2.0/3.0/PFC/AFC application.

APPLICATIONS

- ♦ Car Charger
- ♦ Wall Charger
- ◆Power Strip/Hub
- Portable charger device

Typical Application

- ♦Car DVD
- ♦Black Box
- ◆Industry Application
- ♦ Other

FEATURES

- ◆100% Duty Cycle Car Charge Scheme
- ◆Build in High-Side and Low-Side MOSFET
- ◆Max Output Current: 3.5A
- Adjustable Output Voltage, VFB=1.0V
- Excellent Constant Current Accuracy: $\pm 7\%$
- Constant Voltage Accuracy: $\pm 2\%$
- ◆Jitter Function ◆
- ♦Efficiency: Up to 95%
- ◆Adjustable Line Compensation
- Short Circuit Protection
- ♦Over Voltage Protection
- Thermal shutdown Protection
- ◆Under Voltage Lock Output
- ♦ Available in SOP-8L Package



TYPICAL APPLICATION

Package	PIN	NAME	DESCRIPTION
			Power Supply Input. Bypass this pin with a 2.2µF ceramic
	1	VIN	capacitor to GND, placed as close to the IC as possible.
1 VIN SW 8			Power to the internal high-side MOSFET gate driver. Connect
	2	BS	a 22~100nF capacitor from BS pin to VIN pin
2 BS SW 7	3	CSN	Negative Of Current Sense
3 CSN GND 6	4	CSP	Positive Of Current Sense
	5	VFB	Feed Back Of Output Voltage
	6	GND	Ground
	7	SW	Power Switching Node to External Inductor
	8	SW	Power Switching Node to External Inductor

ABSOLUTE MAXIMUM RATINGS (at TA = 25° C)

Characteristics	Symbol	Rating	Unit
V _{IN} to GND		-0.3 to 36	V
SW to GND		-0.3 to 36	V
BS to GND		-0.3 to 36	V
CSP, CSN to GND		-0.3 to 36	V
V _{FB} to GND		-0.3 to 6	V
Junction to Ambient Thermal Resistance		105	C/W
Operating Junction Temperature		-40 to 140	С
Storage Junction Temperature		-55 to 150	С
Lead Temperature (Soldering 10 sec.)		300	С
Thermal Resistance from Junction to case	θЈС	45	C/W
Thermal Resistance from Junction to ambient	θJA	105	C/W
ESD (HBM)		>4000	V

Note: Exceed these limits to damage to the device. Exposure absolute maximum rating condition may affect device reliability.

ELECTRICAL CHARACTERISTICS(VIN=12V, TA= 25° C, unless otherwise stated)

Parameter	Symbol	Conditions	Min	Тур	Max	Units
Input Voltage	VIN		7	-	32	V
Input OVP Threshold	VOVP-VIN		30	32	34	V
UVLO Voltage	VUVLO		6	7	8	V
UVLO Hysteresis			0.5	1	1.5	V
Quiescent Current	ICCQ	V_{FB} =1.5V, force driver off.	-	1.5	-	mA
Standby Current	ISB	No Load	-	1.6	2	mA
Reference Voltage Of VFB	VFB		0.98	1	1.02	V
Output OVP detect Voltage	VOVP	Internal define	-	1.2	-	V
Switching Frequency	FSW	I _{OUT} =1A	120	135	155	KHz
Maximum Duty Cycle	DMAX			100	-	%
Minimum On -Time			-	250	-	ns

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Reference Voltage Of Constant Current	Reference Of CSP-VSN	0.4V <vfb<0.95v< th=""><th>46.5</th><th>50</th><th>53.5</th><th>mV</th></vfb<0.95v<>	46.5	50	53.5	mV
V OUT-Short			2.2	2.4	2.6	V
	High side	I _{OUT} =1A	30	35	40	m Ω
KDS _{ON} Of Power MOS	Low side	I _{OUT} =1A	22	25	30	m Ω
Thermal Shutdown Temp	TSD		-	140	-	°C
Thermal Shutdown Hysteresis	TSH		-	30	-	°C

BLOCK DIAGRAM



TYPICAL APPLICATION CIRCUIT



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FUNCTIONAL DESCRIPTION

Input Under Voltage Protection

DC3131A can suffer an input voltage up to 36V and operates from an input voltage range of 7V to 32V. If VIN drops below 6V, the UVLO circuit inhibits switching. Once VIN rises above 7V, the UVLO clears, and the soft-start sequence activates.

Input Over Voltage Protection

If VIN rises above 32V, the OVP circuit inhibits switching.DC3131A will not be damaged until the voltage exceeds 36V. Once VIN drops below 30V, the OVP clears, and the soft-start sequence activates.

Soft-start

DC3131A has an internal soft-start circuitry to reduce supply inrush current during startup conditions. When the device exits under-voltage lockout (UVLO), shutdown mode, or restarts following a thermal-overload event, the soft-start circuitry slowly ramps up current available after 800us.

Constant Voltage Output



DC3131A presets the VFB voltage to 1V. The Output Voltage can be set by extra resistance.

$$VOUT = VFB \times \left(\frac{RFB1}{RFB2} + 1\right)$$

Output Over Voltage Protection

Once VFB rises above 1.2V,DC3131A shuts down to avoid damage caused by abnormal use of electrical equipment.

Constant Current Output

DC3131A senses the current by sampling the voltage difference between the CSP and the CSN, and adjusts the output current to the default value by the loop.

Ioutput = $\frac{50 \text{mV}}{\text{Rsen}}$

Constant current operates normally when CSN is higher than 2.4V. When CSN is below 2.2V causing by overload,DC3131A will enter short circuit protection mode.

Short Circuit Protection

When CSN drops below 2.2V since too heavy load,DC3131A will enter short circuit protection function, and the system will enter hit-cup mode, and frequency drop to 40KHz per cycle and stop switching for 220mS.

Line Compensation

When users use different cables, it will produce different voltage drop, the users can set their own cable compensation voltage according to the need: VCable Compensation = $2.5\mu A \times R1 \times \frac{VCSP-VCSN}{50mV}$

Thermal Shutdown

Thermal-overload protection limits total power dissipation in the device. When the junction temperature exceeds TJ= +140° C, a thermal sensor forces the device into shutdown, allowing the die to cool. The thermal sensor turns the device on again after the junction temperature cools by 25° C, resulting in a pulsed output during continuous overload conditions. Following a thermal-shutdown condition, the soft-start sequence begins.

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TYPICAL PERFORMANCE CHARACTERISTICS











APPLICATION GUIDELINES

Input capacitance selection

Input capacitance selection pressure 50V, the total capacity of 40 μ F ceramic capacitor, of course, if the considering cost factor, can also choose a more than 50V voltage, capacity of more than 100 μ F electrolytic capacitor, parallel a 50V voltage, capacity of 2.2 μ F ceramic capacitors.

The location of the input capacitance, try to close to the chip VIN PIN position, if it is electrolytic capacitors and ceramic capacitors in parallel, ceramic capacitor is more close to the chip.

Inductance selection

DC3131A selection are amount at 22μ H~51 μ H inductance, if the demand is higher, the output ripple is advised to choose a larger inductance sense of values, such as 33μ H or 47μ H.

Require inductor saturation current must be not less than 1.5 times of the preset constant current value.

Output capacitance selection

Generally recommended to use a 220 μ F electrolytic capacitor and a 4.7 μ F ceramic capacitors in parallel as the output capacitance, the demand is higher, if the output ripple is proposed to 4.7 μ F ceramic capacitor replacement for one or two ESR lower 22 μ F ceramic capacitors, ceramic capacitors capacitance value, the greater the output ripple is smaller.

BS capacitance selection

BS and select let VIN proposal in 22nF~100nF ceramic capacitor, withstand voltage value of not less than 50V. **EMI/EMC**

SW reserved RC circuit, resistance to choose 4.7R, 2.2nF capacitance advice; If the application version enough volume, can be reserved at input end type π circuit. SW pin reserved RC circuit of R2 4.7 Ω and C4 1nF; BS pin reserved R1 5.1 Ω string C3 100nF; Being enough, if the PCB can be reserved in the input circuit π type.(The following figure)

Anti-ESD Policy

MOS Device Process are highly electrostatic sensitive. In order to avoid damage caused by electrostatic discharge during trans-portation and application, the following electrostatic precautionary measures are strictly acknowledged:

Operators should wear Anti- ESD wrist straps;
Outer case of production facilities should be equipped well to earth;

3. Any tools related to assembly and manufacturing must be tight to ground;

4. Conductive or anti- ESD Packaging material should be adopted during transport.

Layout design reference



The input capacitors C1 and C2 must be close to the 1 pin of the IC. The distance should not exceed 3 mm. The ground wire is connected to the 6 pin through the bottom of the IC. It cannot be connected

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through other paths. The bootstrap capacitor C3 must be placed close to the pins 1 and 2 of the IC.

The output capacitor must first pass through the ceramic capacitor C5 and then to the electrolytic capacitor C4. To output the current sampling point, be sure to trace from the inside of the resistor RSEN to prevent the introduction of trace error, and the two lines should be parallel as much as possible. Since the current on RSEN is very large, it is necessary to use a large package and copper on both ends to increase heat dissipation and reduce the resistance error caused by high temperature.

All high current traces should be as wide as possible to 2-3mm to reduce losses caused by copper trace resistance.

When matching different fast charging chips, pay attention to whether the parameter values of the voltage dividing resistors meet the requirements.

Package



Symbol	Dimensions In Millimeters				
Symbol	Min	NOM	Max		
A			1.65		
A1	0.05		0.15		
A2	1.30	1.40	1.50		
A3	0.60	0.65	0.70		
D	4.70	4.90	5.10		
E	5.80	6.00	6.20		
E1	3.70	3.90	4.10		
е		1.27BSC			
	0.25		0.50		
L	0.50	0.60	0.80		
L1		1.05BSC			



Top Mark and Ordering Information



Package	Top mark	Product No.	Packing	SPQ
SOP8 Pb-free	DC3131A	DC3131A	T/R	4000PCS

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