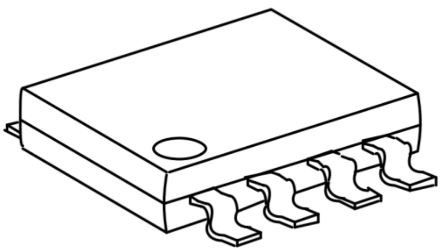
GENERAL DESCRIPTION

MST8430 is a wide input voltage, high efficiency CC and CV step-down DC/DC converter that operates in either CV (Constant Output Voltage) mode or CC (Constant Output Current) mode.

MST8430 provides low-ripple power, high efficiency, and excellent transient characteristics. The PWM control circuit is able to the duty ratio linearly forms 0 up to 90%. An over current protection and short circuit protection functions are built outside that it can set by a resistance. An external compensation is easily to system stable; the low ESR output capacitor can be used.

With the addition of an internal N-channel Power MOS, a coil, capacitors, and a diode connected externally, these ICs can function as step-down switching regulators. They serve as ideal power supply units for portable devices when coupled with the SOP-8L and SOP-8L-EP packages, providing such outstanding features as low current consumption. Since this converter can accommodate an input voltage up to 40V, it is also suitable for the operation via an AC adapter.

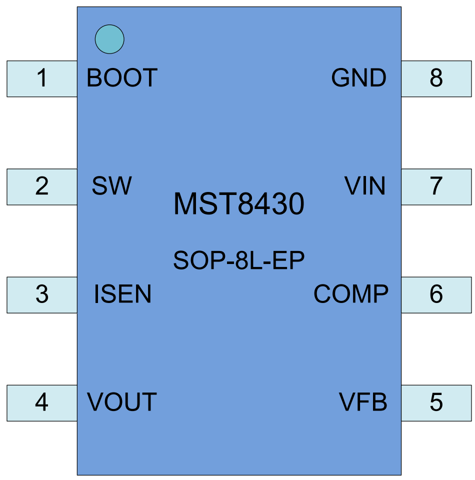


FEATURES

- Perfect Solution for Car Charger
- Input Voltage : 7V to 40V
- High CC accuracy ±5%
- High CV accuracy ±2%
- Duty ratio : 0% to 90% PWM control
- Oscillation frequency :

  120K Hz for MST8430A

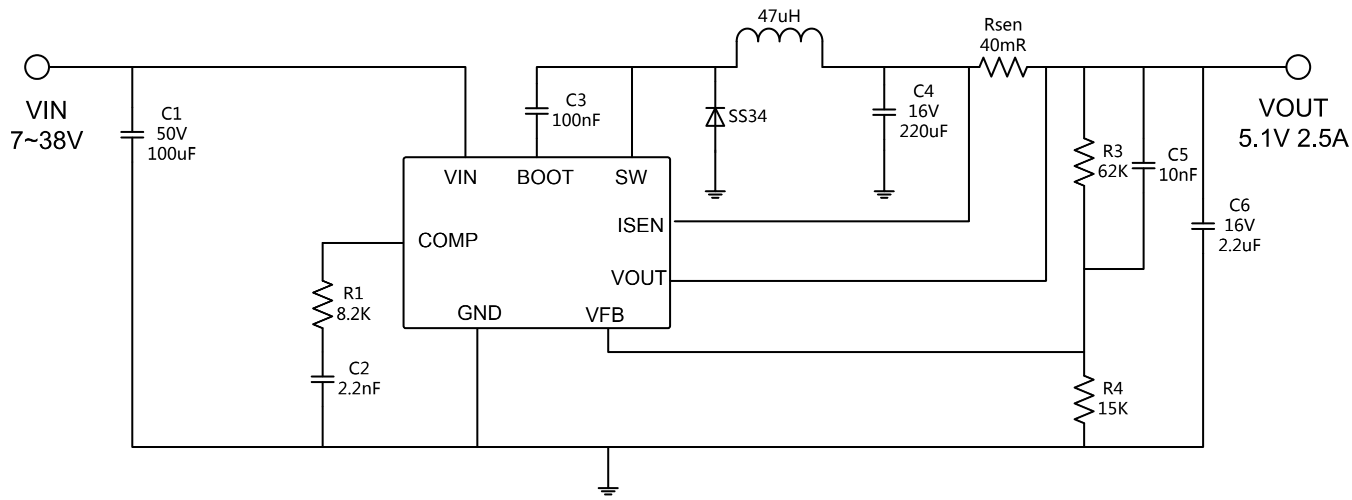
  250K Hz for MST8430B
- Thermal Shutdown function.
- Short Circuit Protect (SCP).
- Built-in internal SW N-channel MOS.
- Current mode non-synchronous PWM converter
- Cycle to cycle Current Limiting
- External current limit setting.
- Under Voltage Lockout.
- Over Voltage Protection.



PIN ASSIGNMENT

PIN	NAME	DISCRIPTION
1	BOOT	Power to the internal high-side MOSFET gate driver. Connect a 10~100nF capacitor from BS pin to SW pin
2	SW	Power Switching Output to External Inductor
3	ISEN	Current Sense Input
4	VOUT	Output of DC/DC Converter, Connect To The Anodes Of Output Capacitor
5	VFB	The Feedback Of Output Voltage, Connect To The Divider Resistor
6	COMP	Error Amplifier Output. This pin is used to compensate the Converter.
7	VIN	Power Supply Input. Bypass this pin with a 10μF ceramic capacitor to GND, placed as close to the IC as possible.
8	GND	Ground

APPLICATION CIRCUIT



ABSOLUTE MAXIMUM RATINGS (at TA = 25°C)

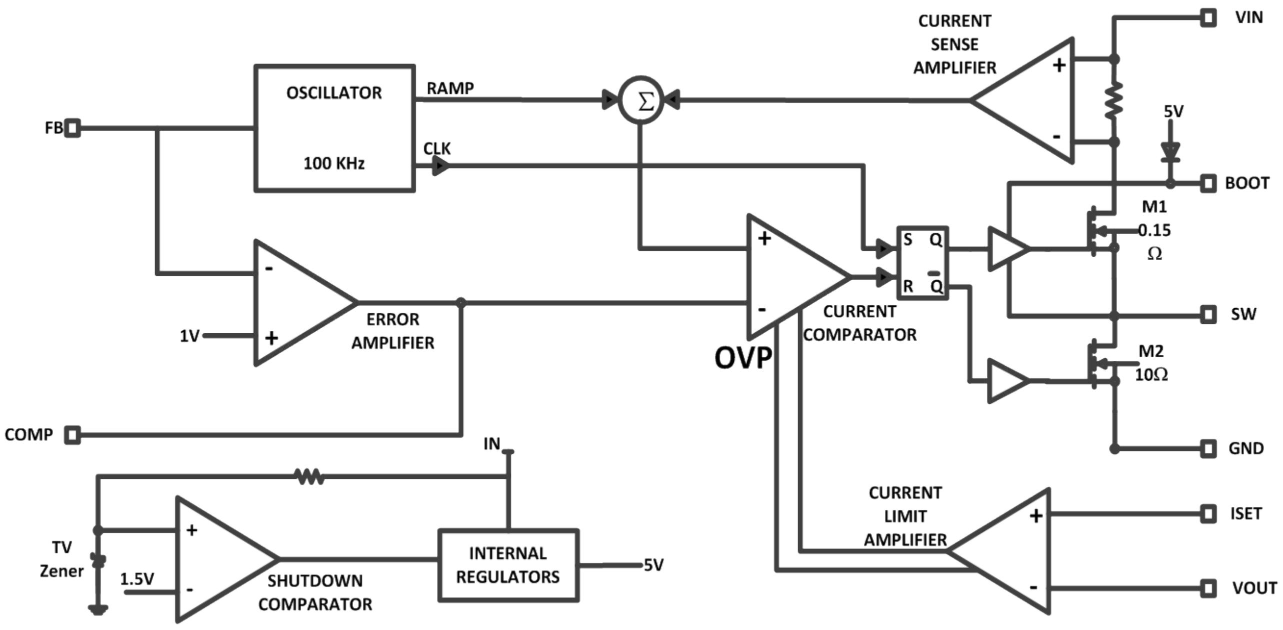
Characteristics	Symbol	Rating	Unit
IN to GND		-0.3 to 40	V
LX to GND		-1 to V_{IN} + 1	V
BS to GND		V_{LX} - 0.3 to V_{LX} + 7	V
FB, SENSE1, SENSE2, COMP LDG to GND		-0.3 to + 6	V
Junction to Ambient Thermal Resistance		105	°C/W
Operating Junction Temperature		-40 to 150	°C
Storage Junction Temperature		-55 to 150	°C
Lead Temperature (Soldering 10 sec.)		300	°C

Thermal Resistance from Junction to case	θ_{JC}	15	°C/W
Thermal Resistance from Junction to ambient	θ_{JA}	40	°C/W

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

Characteristics	Symbol	Conditions	Min	Typ	Max	Units
Input Voltage			8	-	40	V
OVP detect voltage	V_{OVP}	Internal define	-	5.8	-	V
Quiescent Current	I_{CCQ}	V_{FB} = 1.5V, force driver off.	-	2	-	mA
Standby Supply Current		V0 = 5V, No Load	-	10	15	mA
Feedback Voltage			0.98	1	1.02	V
High-Side Switch On Resistance	R_{DSON}	V_{IN}=12V, I_{OUT} = 1A	-	150	200	mΩ
Low-Side Switch On Resistance	R_{DSON}	V_{IN}=12V	-	10	-	Ω
Switching Frequency		I_{OUT}=200mA	80	100	120	KHz
Maximum Duty Cycle			90	93	-	%
Minimum On-Time			-	150	-	ns
Secondary Cycle-by-Cycle Current Limit		Minimum Duty Cycle, no CC	-	3.5	-	A
Sense Voltage	V_{SENSE}	V_{SENSE1}-V_{SENSE2}	96	100	104	mV
Thermal shutdown Temp	T_{SD}		-	140	-	°C
Thermal Shutdown Hysteresis	T_{SH}		-	30	-	°C

BLOCK DIAGRAM



FUNCTION DESCRIPTIONS

CV/CC Loop Regulation

As seen in Functional Block Diagram, the MST8430 is a peak current mode pulse width modulation (PWM) converter with CC and CV control. The converter operates as follows:

A switching cycle starts when the rising edge of the Oscillator clock output causes the High-Side Power Switch to turn on. With the SW side of the inductor now connected to Sense1, the inductor current ramps up to store energy in the magnetic field. The inductor current level is measured by the Current Sense Amplifier and added to the Oscillator ramp signal. If the resulting summation is higher than the COMP voltage, the output of the PWM Comparator goes high. When this happens or when Oscillator clock output goes low, the High-Side Power Switch turns off.

At this point, the SW side of the inductor swings to a diode voltage below ground, causing the inductor current to decrease and magnetic energy to be transferred to output. This state continues until the cycle starts again. The High-Side Power Switch is driven by logic using BS as the positive rail. This pin is charged to VSW + 5V when the Low-Side Power Switch turns on. The COMP voltage is the integration of the error between FB input and the internal 1V reference. If FB is lower than the reference voltage, COMP tends to go higher to increase current to the output. Output current will increase until it reaches the CC limit set by the R1 resistor. At this point, the device will transition from regulating output voltage to regulating output current, and the output voltage will drop with increasing load.

The Oscillator normally switches at 200KHz. However, if FB voltage is less than 0.45V, then the switching frequency decreases until it reaches a typical value of 30KHz at VFB = 0.15V.

Thermal Shutdown

The MST8430 disables switching when its junction temperature exceeds 140°C and resumes when the temperature has dropped by 30°C.

Output Voltage Setting

Select the proper ratio of the two feedback resistors RFB1 and RFB2 based on the output voltage. Typically, use RFB2 ≈ 10kΩ and determine RFB1 from the following equation:

$$R_{FB1} = R_{FB2}\left(\frac{V_{OUT}}{1V} - 1\right)$$

Inductor Selection

The inductor maintains a continuous current to the output load. This inductor current has a ripple that is dependent on the inductance value:

Higher inductance reduces the peak-to-peak ripple current. The trade off for high inductance value is the increase in inductor core size and series resistance, and the reduction in current handling capability. In general, select an inductance value L based on ripple current requirement:

$$L = \frac{V_{OUT} \times (V_{IN} - V_{OUT})}{V_{IN} f_{SW} I_{OUTMAX} K_{RIPPLE}}$$

where VIN is the input voltage, VOUT is the output voltage, fSW is the switching frequency, IOUTMAX is the maximum output current, and KRIPPLE is the ripple factor. Typically, choose KRIPPLE = 30% to correspond to the peak-to-peak ripple current being 30% of the maximum output current.

With this inductor value, the peak inductor current is IOUT × (1 + KRIPPLE/2). Make sure that this peak inductor current is less than the controller’s current limit. Finally, select the inductor core size so that it does not saturate at the peak inductor current.

Table1: Typical Inductor Values

VOUT	1.5V	1.8V	2.5V	3.3V	5V
L	22μH	22μH	33μH	47μH	68μH

Input Capacitor

The input capacitor needs to be carefully selected to maintain sufficiently low ripple at the supply input of the converter. A low ESR capacitor is highly recommended. Since large current flows in and out of this capacitor during switching, its ESR also affects efficiency.

The input capacitance needs to be higher than 10μF. The best choice is the ceramic type, however, low ESR tantalum or electrolytic types may also be used provided that the RMS ripple current rating is higher than 50% of the output current. The input capacitor should be placed close to the IN and G pins of the IC, with the shortest traces possible. In the case of tantalum or electrolytic types, they can be further away if a small parallel 0.1μF ceramic capacitor is placed right next to the IC.

Output Capacitor

The output capacitor also needs to have low ESR to keep low output voltage ripple. The output ripple voltage is:

$$V_{RIPPLE} = I_{OUTMAX} K_{RIPPLE} R_{ESR} + \frac{V_{IN}}{28 \times f_{SW}{}^{2} L C_{OUT}}$$

where IOUTMAX is the maximum output current, KRIPPLE is the ripple factor, RESR is the ESR of the output capacitor, fSW is the switching frequency, L is the inductor value, and COUT is the output capacitance. In the case of ceramic output capacitors, RESR is very small and does not contribute to the ripple. Therefore, a lower capacitance value can be used for ceramic type. In the case of tantalum or electrolytic capacitors, the ripple is dominated by R_{ESR} multiplied by the ripple current. In that case, the output capacitor is chosen to have sufficiently low ESR.

For ceramic output capacitor, typically choose a capacitance of about 22μF. For tantalum or electrolytic capacitors, choose a capacitor with less than 50mΩ ESR.

Rectifier Diode

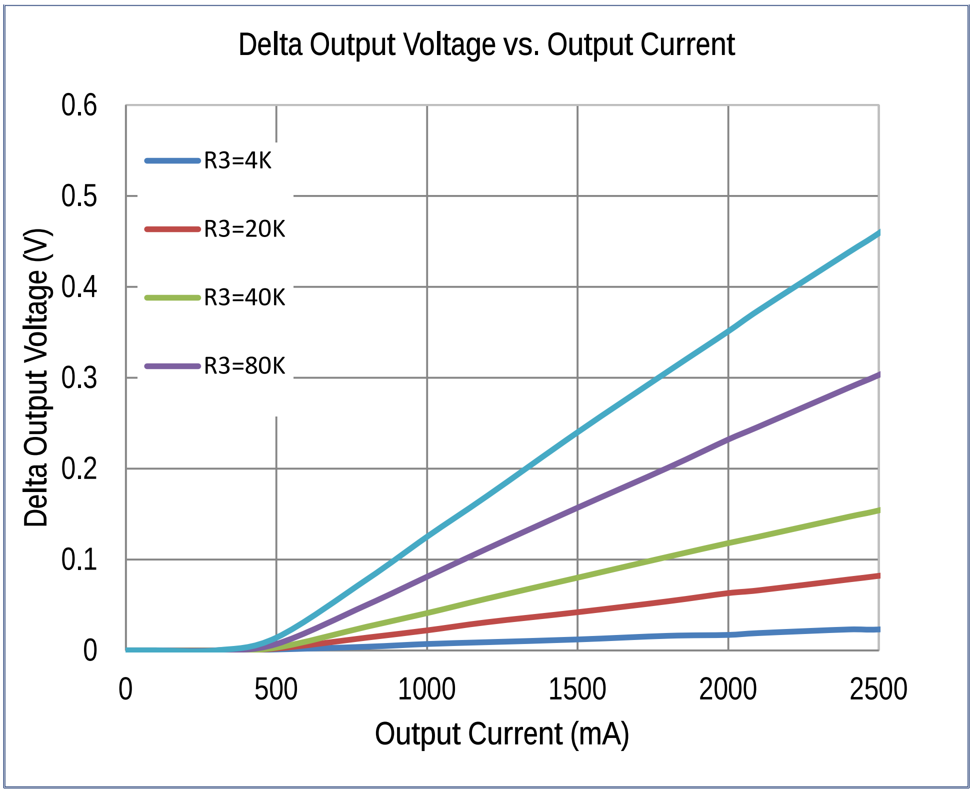
Use a Schottky diode as the rectifier to conduct current when the High-Side Power Switch is off.

The Schottky diode must have current rating higher than the maximum output current and a reverse voltage rating higher than the maximum input voltage.

Output Cable Resistance Compensation

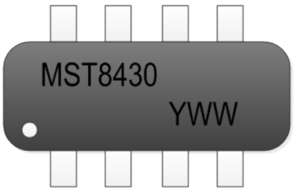
To compensate for resistive voltage drop across the charger's output cable, the MST8430 integrates a simple, user-programmable cable voltage drop compensation using the impedance at the FB pin. Use the curve bellow to choose the proper feedback resistance values for cable compensation. RFB1 is the high side resistor of voltage divider.

$$V_{OUT} = 1 + \frac{R_{FB1}}{R_{FB2}} \times V_{FB} + R_{FB1} \times \frac{V_{Rsen}}{100mV} \times 6uA$$



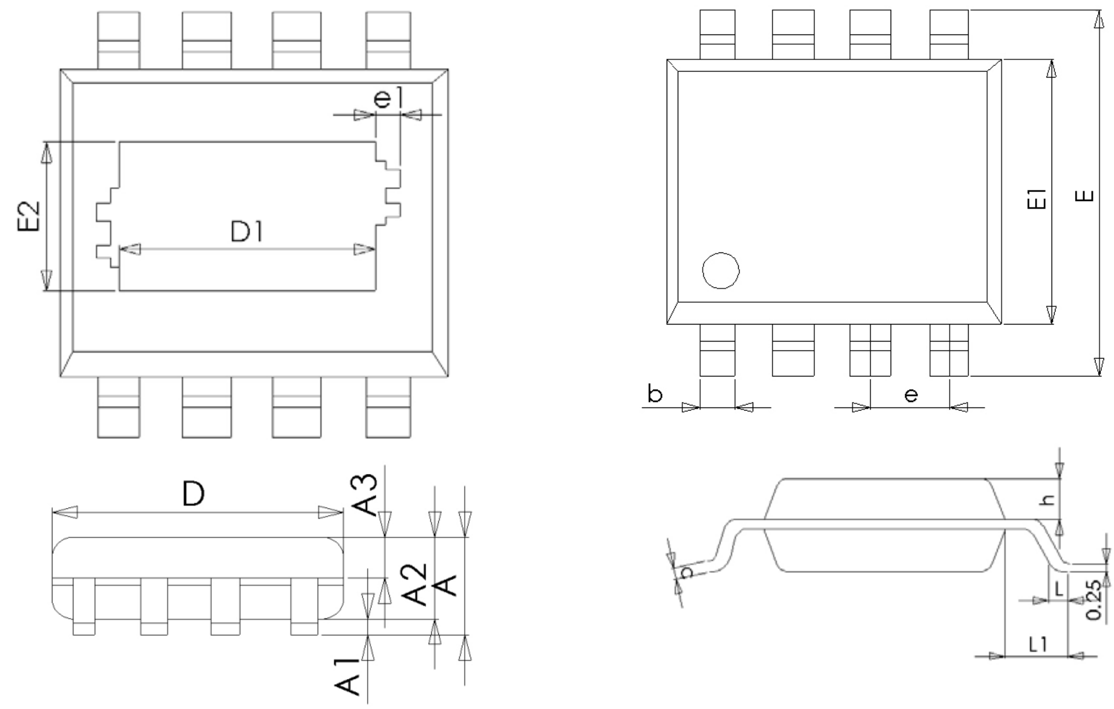
Cable Compensation at Various Resistor Divider Values

■ MARKING INFORMATION



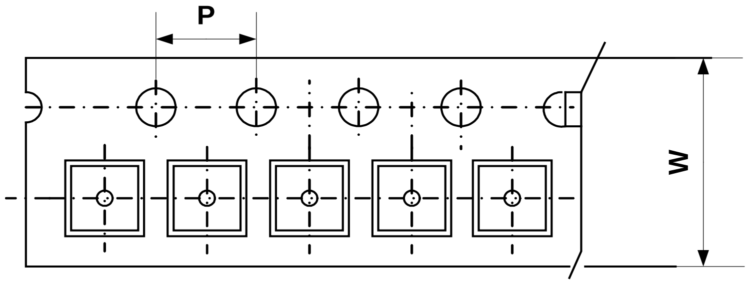
Y: Year (3=2013, 4=2014)
WW: Weekly (01-54)

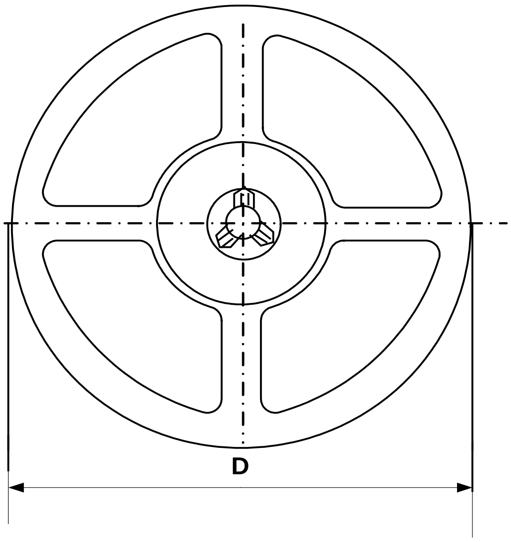
PACKAGE INFORMATION



Symbol	Dimensions In Millimeters		
	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
e	1.27BSC		
h	0.25	--	0.50
L	0.50	0.60	0.80
L1	1.05BSC		

TAPE AND REEL INFORMATION





Package Type	Carrier Width (W)	Pitch (P)	Reel Size(D)	Packing Minimum
SOP-EP-8L	12.0±0.1 mm	8.0±0.1 mm	330±1 mm	3000pcs

Note: Carrier Tape Dimension, Reel Size and Packing Minimum