



■ Introduction

SE3835 is designed to work from 7~35V, and with the maximum voltage rating at 40V. It is DC/DC converter capable of both Constant Voltage (CV) and Constant Current (CC) control over the load.

It has internal Power NMOS built-in, which has a typical $R_{ds(ON)}$ of 85 m Ω , and capable of 3.5A continuous current.

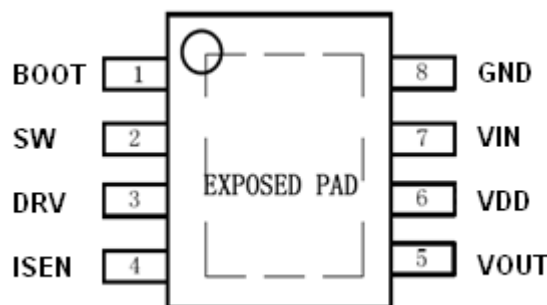
SE3835 has much better Line regulation and Load regulation, and with high precision of $\pm 3\%$ CC control. The overall spec is much better than similar DC/DC converter on the market.

SE3835 does not need external compensations. The Line IR Drop compensation is built-in. The CC limit can be set with external resistor.

SE3835 is designed to drive external NMOS for Synchronous DC/DC operation to achieve up to 93% efficiency. Alternatively, a regular Schottky can also be used to non-sync operation.

■ Key Specs

- Complete Car Charger Solution
- $V_{in(max)}$ is up to 40V
- Internal 85m Ω NMOS capable of 3.5A continuous current.
- High precision internal CV and CC Control.
- High precision CC $\pm 3\%$
- High precision CV $\pm 1.5\%$
- No external compensations
- CC Limit can be set via a resistor
- Support both Sync and Non-Sync Operations.
- The efficiency is up to 93% at 5V.
- External Low-side NMOS control allows for high power applications.
- 150k Hz fixed operating frequency.
- Internal Dither for better EMC.
- 0/100mV/300mV/500mV Line IR Drop compensation.
- Internal SCP, OTP, OVP, and UVLO
- SOP8 Pkg





■ Pin Definition

PIN	NAME	DISCRIPTION
1	BOOT	Power to the internal high-side MOSFET gate driver. Connect a 22~100nF capacitor from BS pin to SW pin
2	SW	Power Switching Output to External Inductor
3	DRV	Driver of Lowside NMOS, Connect To The Gate Of NMOS
4	ISEN	Current Sense Input
5	VOUT	Output of DC/DC Converter, Connect To The Anodes Of Output Capacitor
6	VDD	The Power Source Of Internal Control Circuits, Connect a 1uF Capacitor to GND
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

■ Absolutely Maximum Conditions (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, ISEN, VOUT, DRV, VDD 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 Parameters

Characteristics	Symbol	Conditions	Min	Typ	Max	Units
Input Voltage	V _{IN}		7	-	40	V
Input OVP Threshold	V _{OVP-VIN}		33	35	36	V
UVLO Voltage	V _{UVLO}		6	6.5	7	V
UVLO Hysteresis			0.3	0.5	0.8	V
Output OVP detect Voltage	V _{OVP-VOUT}	Internal define	-	6	-	V
	V _{OVP-VOUT}	Internal define	-	6	-	V
Quiescent Current	I _{CCQ}	V _{FB} = 1.5V, force driver off.	-	750	-	uA
Standby Current	I _{SB}	No Load	-	1.5	2	mA



Output Voltage			5.05	5.1	5.15	V
High-Side Switch On Resistance	R_{DSON}	$V_{IN}=12V, I_{OUT} = 1A$	-	85	-	m Ω
Low-Side Switch On Resistance	R_{DSON}	$V_{IN}=12V$	-	10	-	Ω
Switching Frequency		$I_{OUT}=200mA$	135	150	165	KHz
Maximum Duty Cycle			85	90	-	%
Minimum On-Time			-	120	-	ns
Cable Voltage Compensation	$V_{Cab-SE3835A}$	$V_{ISEN}-V_{VOUT}=100$ mV		0		mV
	$V_{Cab-SE3835A1}$			100		mV
	$V_{Cab-SE3835A3}$			300		mV
	$V_{Cab-SE3835A5}$			500		mV
Secondary Cycle-by-Cycle Current Limit		Minimum Duty Cycle, no CC	3.5	4	-	A
Sense Voltage	V_{SENSE}	$V_{ISEN}-V_{VOUT}$	97	100	103	mV
$V_{OUT-Short}$	$V_{OUT-Short}$		1.9	2	2.1	V
VDD Regulated Voltage	V_{VDD}		5.0	5.2	5.5	V
DRV MAX Current	$IMAX_{SINK}$	$V_{DD}=5.2V$	-	-	1.2	A
	$IMAX_{PULL}$	$V_{DD}=5.2V$	-	-	700	mA
MAX Cg of Low Side MOS	Cg_{MAX}		-	-	2	nF
Thermal shutdown Temp	T_{SD}		-	140	-	$^{\circ}C$
Thermal Shutdown Hysteresis	T_{SH}		-	30	-	$^{\circ}C$

Typical Application

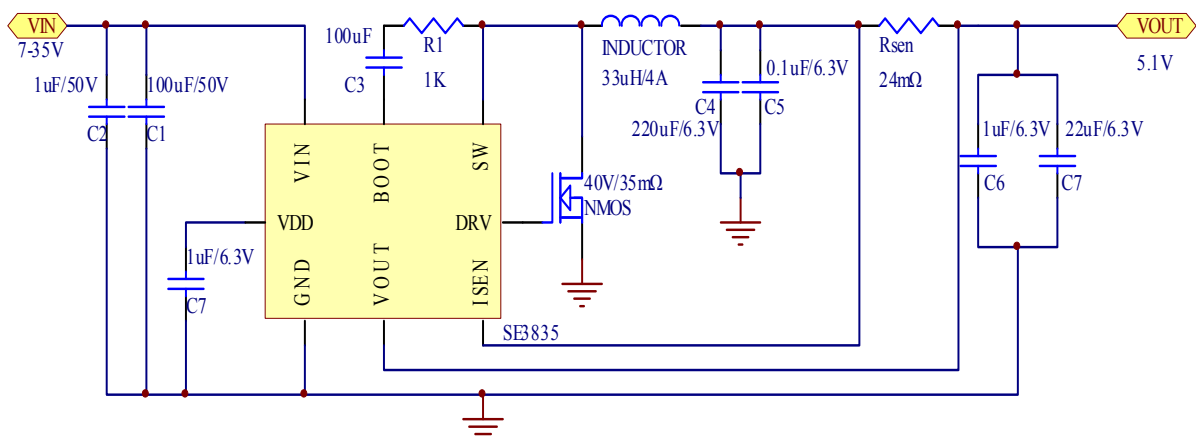


Figure 1 Synchronous Bulk Application Circuit

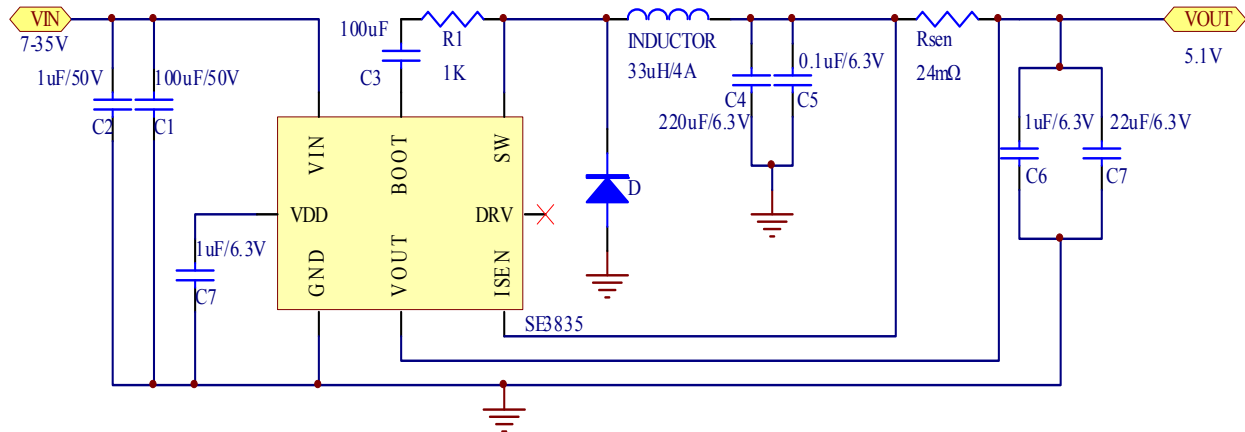


Figure 2 Non-Synchronous Bulk Application Circuit

■ Operation Description

UVLO

SE3835 can take VIN up to 40V, while the recommended operating condition is 7V~35V. When the Vin reaches 7V, starting from 0V, SE3835 starts to deliver fixed voltage and current to Vout. When Vin drops below 6V, SE3835 ceases to work.

Over Voltage Protection on Vin

When Vin rises beyond 35V, SE3835 ceases to work. When Vin drops down to 33V, SE3835 restarts working.

System Soft-start Function

When SE3835 just starts to work, such as from the initial power-on or Short-Circuit Protection (SCP), the internal CC and CV functions will re-calculate and re-start gradually. The typical time to go from 0A/0V to the fixed voltage and current is 300uS. This is to prevent surge current to damage the other system components.

Constant Voltage Output

SE3835 has a fixed Vout at 5.1V.

Over Voltage Protection on Other Pins

When SE3835 detects voltage on any pin, including Vout and ISEN and other pins, exceeding 6V, SE3835 will stop working to protect the system from malfunctions.

Constant Current Output

SE3835 detects the voltage difference between ISEN and Vout to monitor and control the output current to the user selected value.



The output current is determined by the following equation:

$$I_{OUTPUT} = \frac{100mV}{R_{ISET}}$$

This constant current is valid as long as Vout is greater than 2V. When Vout is below 2V, SE3835 enters SCP.

Short Circuit Protection (SCP)

When the load on Vout becomes shorted and brings Vout to below 2V, SE3835 enters SCP. Under the SCP condition, SE3835 lowers the operating frequency to 30% of the normal operating frequency. If the Vout remains under 2V for longer than 2mS, SE3835 will stop working, and re-start in 16mS.

Line IR Drop Compensation

The different wire length in any given application can vary. SE3835 has internal Line IR Drop compensations. The internal LineIR Drop compensation can be selected from one of the following four options: SE3835A, SE3835A1, SE3835A3, SE3835A5.

Part Number	Voltage Of Cable Compensation
SE3835A	0
SE3835A1	$V_{ISEN}-V_{VOUT}$
SE3835A3	$3 * (V_{ISEN}-V_{VOUT})$
SE3835A5	$5 * (V_{ISEN}-V_{VOUT})$

Dither Function for Better EMC Performance

To get better EMC performance , SE3835 has internal Dither function, which dithers $\pm 7\%$ during 256 working cycles. This can effectively reduce the peak radiated energy for better EMC performance. This does not compromise the other functions within SE3835.

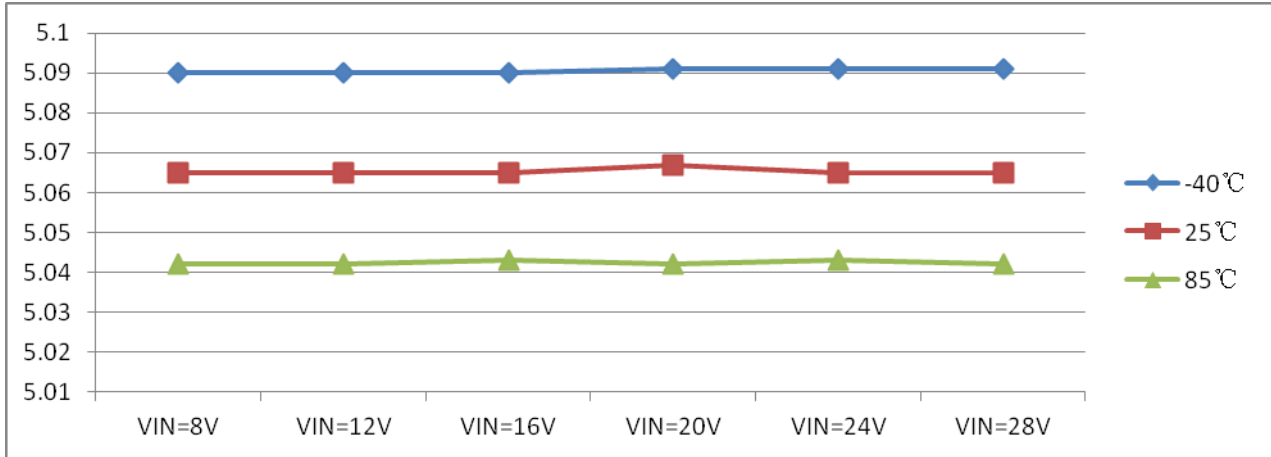
Over Temperature Protection (OTP)

When SE3836 detects die temperature reaches 140C, SE3835 stops working, and will re-start when the temperature drops under 115C.

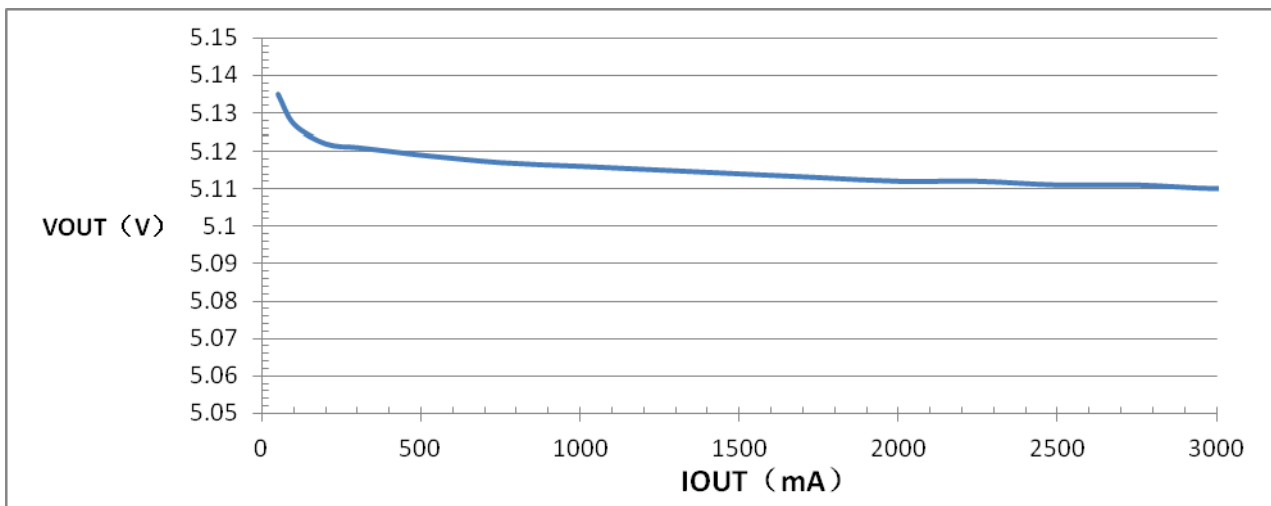


Typical Performance Charts

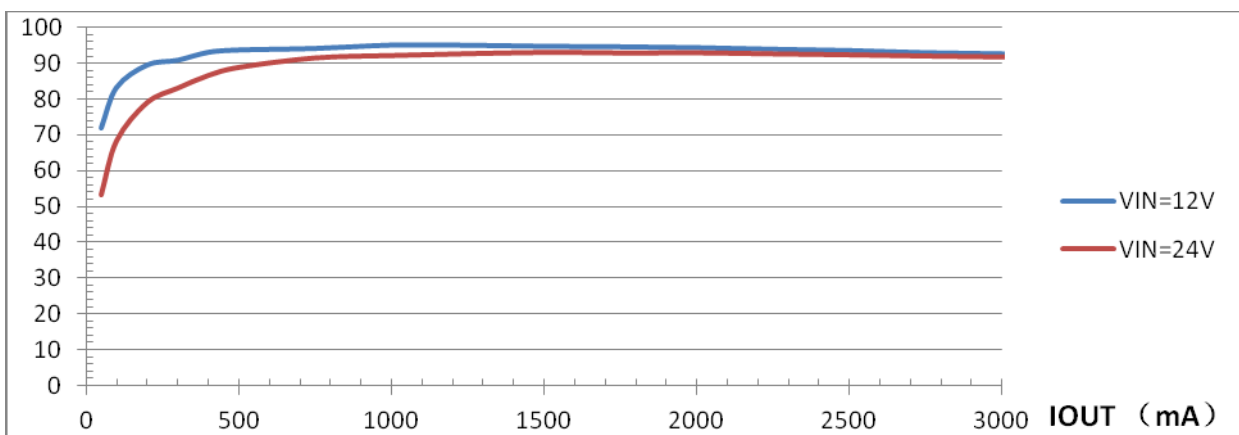
Output Voltage and Current relationship at different temperatures



Load Regulation

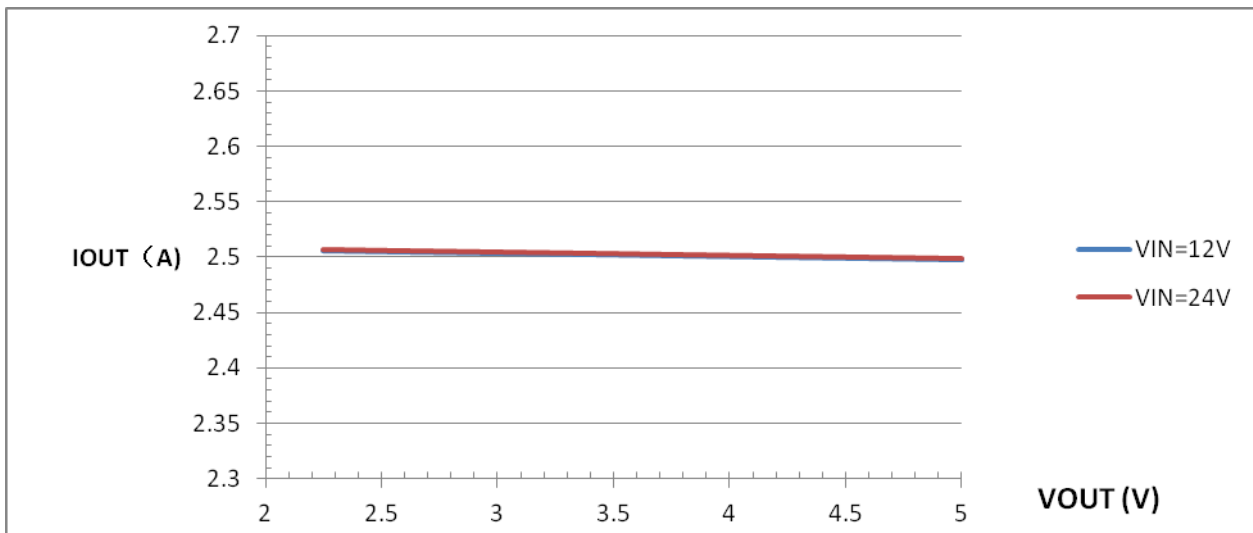


效率测试 VIN=12V/24V VOUT=5.1V

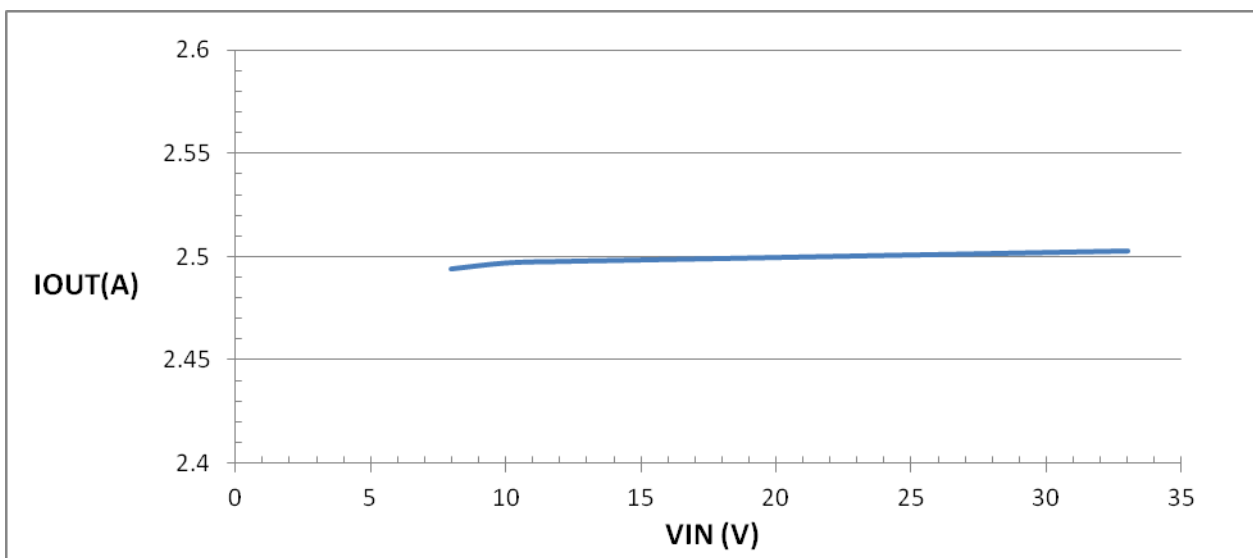




Constant CC at VIN=12V/24V Rsen=33mΩ



Constant CC at VOUT=4V Rsen=33mΩ



■ Application Introduction

Cin Selection

It is best to select Ceramic Cin to have 50V or better voltage rating. If Electrolyte Capacitor is used for lower cost, it is best to have a 50V/2.2uF Ceramic capacitor in parallel.

The location of the Cin should be as close to VIN pin as possible. The Ceramic cap should be the closest to the VIN pin.

Inductor Selection



It is recommended that the value is 25uH~47uH, typically 33uH. The inductor should be selected to have a current rating that is 1.5x of the pre-selected CC.

Output Capacitor Selection

Typically two 22uF/6.3V Ceramic capacitor can be used in parallel between Vout and GND. A 47uF Electrolyte Capacitor can be used between ISEN and GND. If the capacitor between ISEN and GND is 100uF, the capacitor between Vout and GND can reduced to between 4.7~10uF ceramic capacitor.

VDD Capacitor Selection

It is highly recommended that 100n~1uF ceramic capacitor is used on VDD. Electrolyte Capacitor is not recommended.

BOOT Capacitor Selection

It is recommended that a 22n~100nF/6.3V ceramic capacitor is used between BOOT and SWBOOT与SW.

MOSFET Selection

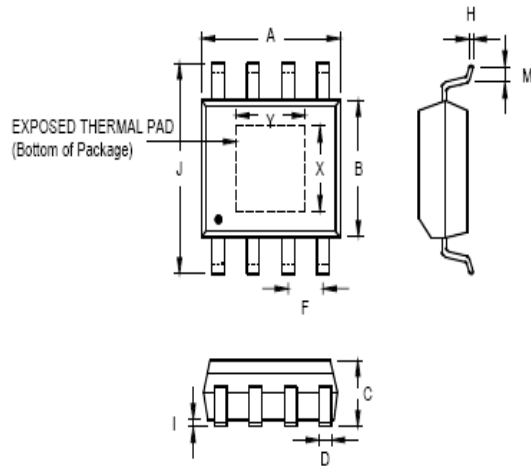
It is recommended that the NMOS with $R_{ON}=30\sim 50m\Omega$ at $V_{GS}=4.5$, and C_g is no more than 2nF. V_{DS} Max Voltage rating must be greater than the highest possible voltage on V_{in} .

Schottky election

If Non-Sync option is preferred, the selected Schottky should have higher operating current than the pre-set CC limit. The lower VF is preferred for better efficiency.



Package Info PSOP8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.801	5.004	0.189	0.197
B	3.810	3.988	0.150	0.157
C	1.346	1.753	0.053	0.069
D	0.330	0.508	0.013	0.020
F	1.194	1.346	0.047	0.053
H	0.191	0.254	0.008	0.010
I	0.000	0.152	0.000	0.006
J	5.791	6.198	0.228	0.244
M	0.406	1.270	0.016	0.050
X	2.057	2.515	0.081	0.099
Y	2.057	3.404	0.081	0.134