

4A 180KHz 36V Buck DC to DC Converter

XL4013

Features

- Wide 8V to 36V Input Voltage Range
- Output Adjustable from 1.25V to 32V
- Maximum Duty Cycle 100%
- Minimum Drop Out 0.3V
- Fixed 180KHz Switching Frequency
- 4A Constant Output Current Capability
- Internal Optimize Power MOSFET
- High efficiency
- Excellent line and load regulation
- Built in thermal shutdown function
- Built in current limit function
- Built in output short protection function
- Available in TO252-5L package

Applications

- LCD Monitor and LCD TV
- Portable instrument power supply
- Telecom / Networking Equipment

General Description

The XL4013 is a 180 KHz fixed frequency PWM buck (step-down) DC/DC converter, capable of driving a 4A load with high efficiency, low ripple and excellent line and load regulation. Requiring a minimum number of external components, the regulator is simple to use and include internal frequency compensation and a fixed-frequency oscillator.

The PWM control circuit is able to adjust the duty ratio linearly from 0 to 100%. An over current protection function is built inside. When short protection function happens, the operation frequency will be reduced from 180KHz to 48KHz. An internal compensation block is built in to minimize external component count.

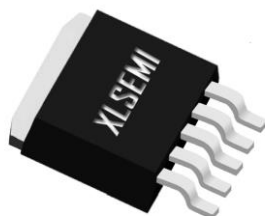


Figure1. Package Type of XL4013

Pin Configurations

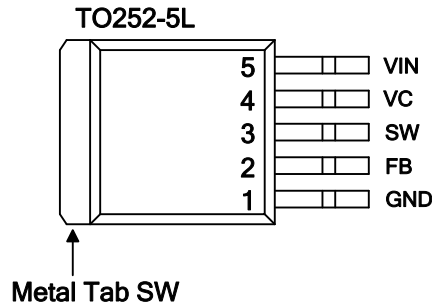


Figure2. Pin Configuration of XL4013 (Top View)

Table 1 Pin Description

Pin Number	Pin Name	Description
1	GND	Ground Pin. Care must be taken in layout. This pin should be placed outside of the Schottky Diode to output capacitor ground path to prevent switching current spikes from inducing voltage noise into XL4013.
2	FB	Feedback Pin (FB). Through an external resistor divider network, FB senses the output voltage and regulates it. The feedback threshold voltage is 1.25V.
3	SW	Power Switch Output Pin (SW). SW is the switch node that supplies power to the output.
4	VC	Internal Voltage Regulator Bypass Capacitor Pin (VC). The VC pin connect a 1uf capacitor to VIN.
5	VIN	Supply Voltage Input Pin. XL4013 operates from a 8V to 36V DC voltage. Bypass Vin to GND with a suitably large capacitor to eliminate noise on the input.

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Function Block

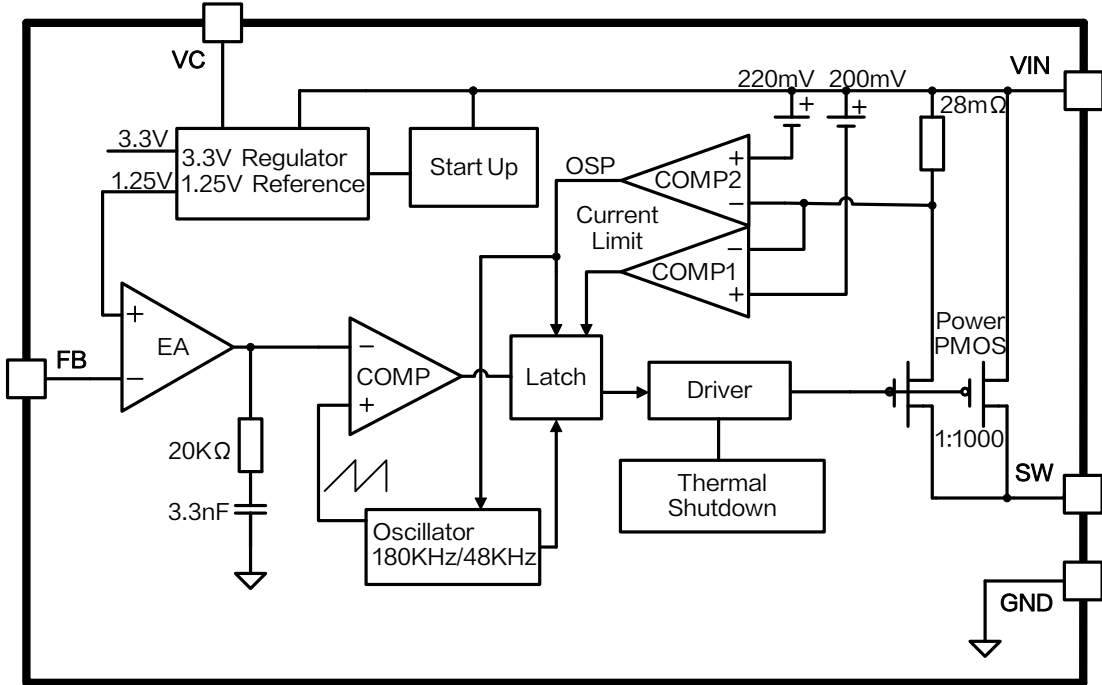


Figure3. Function Block Diagram of XL4013

Typical Application Circuit

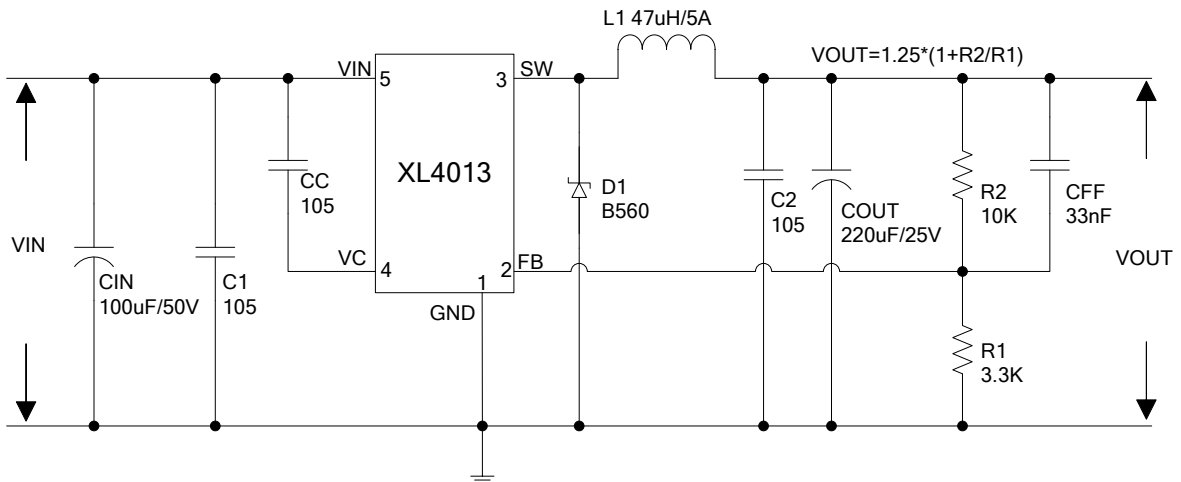


Figure4. XL4013 Typical Application Circuit (VIN=8V~36V, VOUT=5V/4A)

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Ordering Information

Order Information	Marking ID	Package Type	Packing Type Supplied As
XL4013E1	XL4013E1	TO252-5L	2500 Units on Tape & Reel

XLSEMI Pb-free products, as designated with “E1” suffix in the par number, are RoHS compliant.

Absolute Maximum Ratings (Note1)

Parameter	Symbol	Value	Unit
Input Voltage	V_{in}	-0.3 to 40	V
Feedback Pin Voltage	V_{FB}	-0.3 to 7	V
Output Switch Pin Voltage	V_{SW}	-0.3 to V_{in}	V
Power Dissipation	P_D	Internally limited	mW
Thermal Resistance (TO252-5L) (Junction to Ambient, No Heatsink, Free Air)	R_{JA}	50	°C /W
Operating Junction Temperature	T_J	-40 to 125	°C
Storage Temperature	T_{STG}	-65 to 150	°C
Lead Temperature (Soldering, 10 sec)	T_{LEAD}	260	°C
ESD (HBM)		>2000	V

Note1: Stresses greater than those listed under Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

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XL4013 Electrical Characteristics

$T_a = 25^{\circ}\text{C}$; unless otherwise specified.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
System parameters test circuit figure4						
V _{FB}	Feedback Voltage	V _{in} = 8V to 36V, V _{out} =5V I _{load} =0.5A to 4A	1.225	1.25	1.275	V
η	Efficiency	V _{in} =12V, V _{out} =5V I _{out} =4A	-	86	-	%
η	Efficiency	V _{in} =24V, V _{out} =12V I _{out} =3A	-	94	-	%

Electrical Characteristics (DC Parameters)

V_{in} = 12V, GND=0V, V_{in} & GND parallel connect a 100uf/50V capacitor; I_{out}=500mA, $T_a = 25^{\circ}\text{C}$; the others floating unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input operation voltage	V _{in}		8		36	V
Quiescent Supply Current	I _q	V _{FB} =5V		2.1	5	mA
Oscillator Frequency	F _{osc}		144	180	216	KHz
Output Short Frequency	F _{osp}			48		KHz
Switch Current Limit	I _L	V _{FB} =0V		7		A
Max. Duty Cycle	D _{MAX}	V _{FB} =0V		100		%
Output Power PMOS	R _{dson}	V _{FB} =0V, V _{in} =12V, I _{SW} =4A		60	80	mohm

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Typical System Application (VOUT=5V/4A)

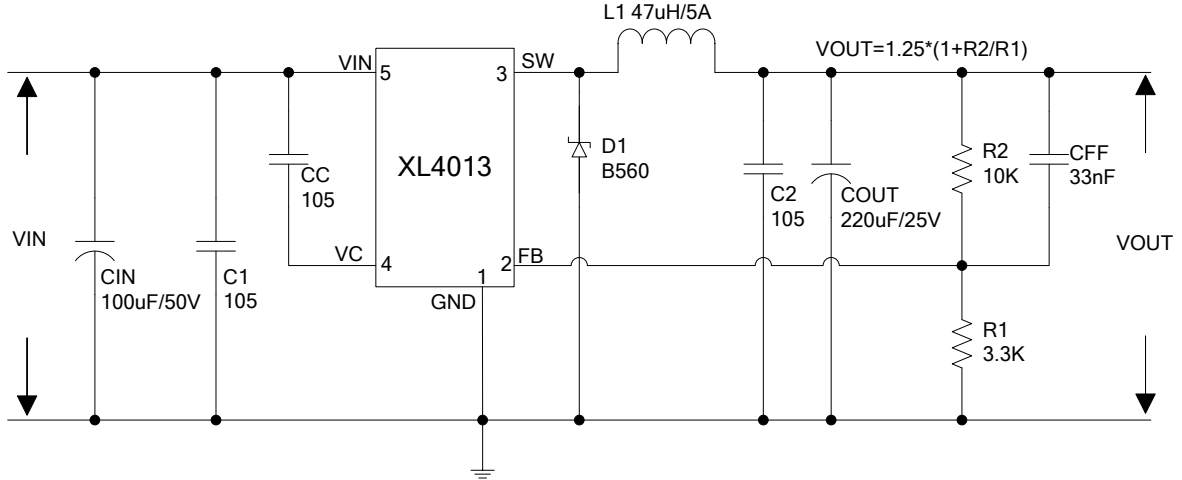


Figure5. XL4013 System Parameters Test Circuit (VIN=8V~36V, VOUT=5V/4A)

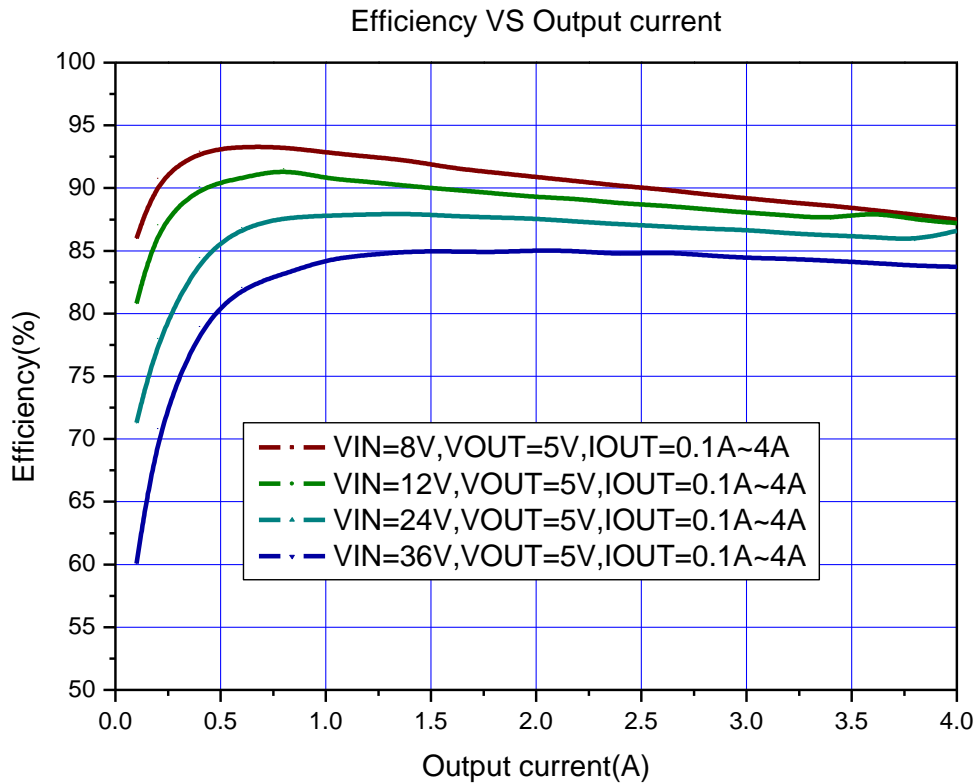


Figure6. XL4013 System Efficiency Curve

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Typical System Application (VOUT=12V/3A)

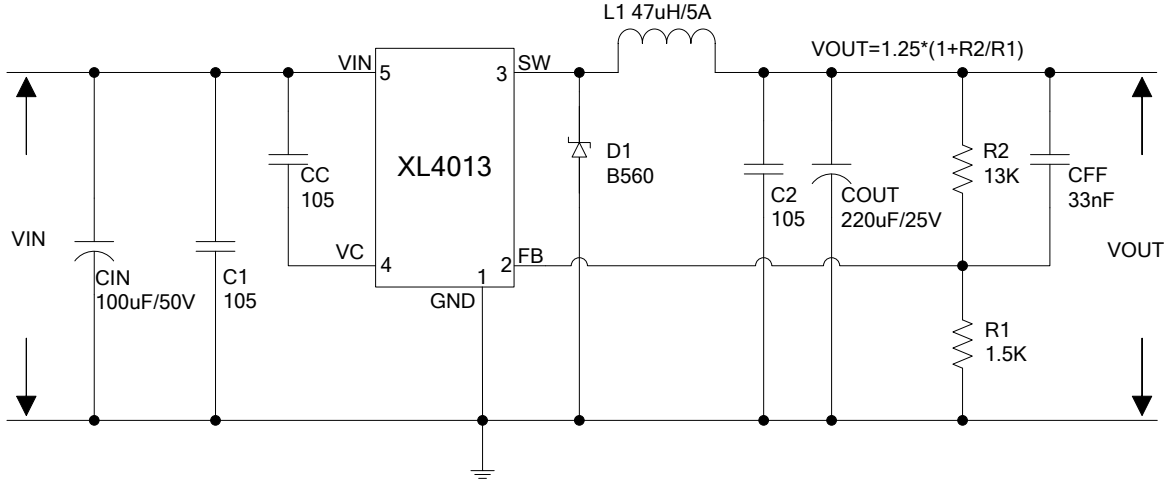


Figure7. XL4013 System Parameters Test Circuit (VIN=15V~36V, VOUT=12V/3A)

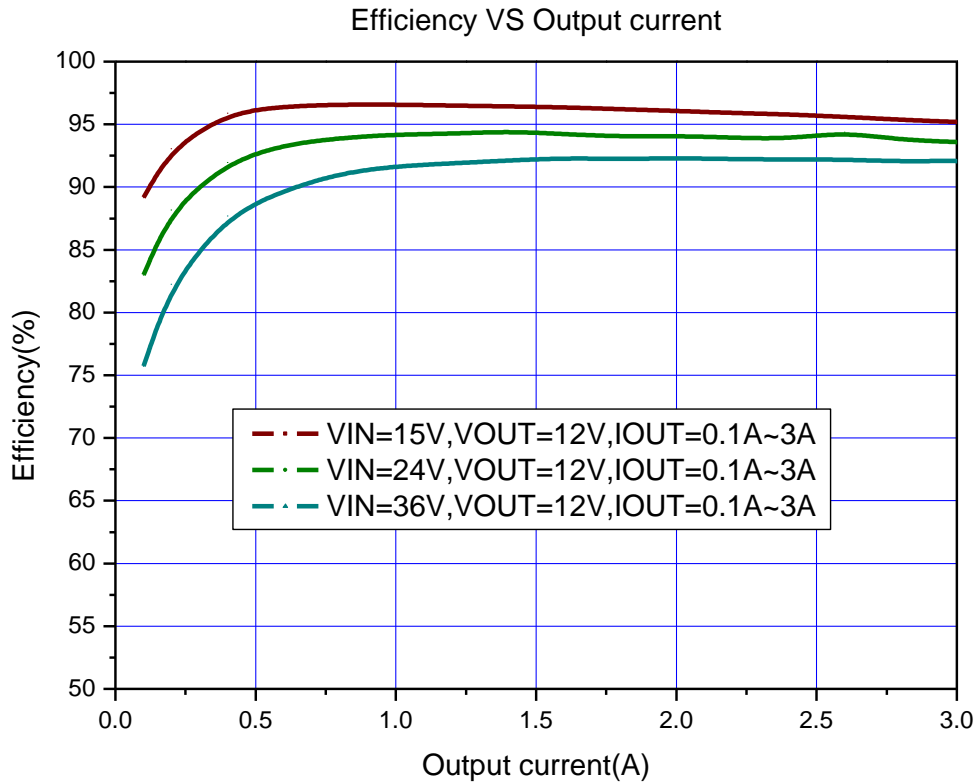


Figure8. XL4013 System Efficiency Curve

Typical System Application (TTL shutdown function)

Logic level signals shutdown function can be used in typical system application with external components. When the TTL high voltage above 3.3V (referenced to ground, lower than 7V), the converter will shutdown, input current less than 5mA; when the TTL Low voltage below 0.8V (referenced to ground), the converter will turn on.

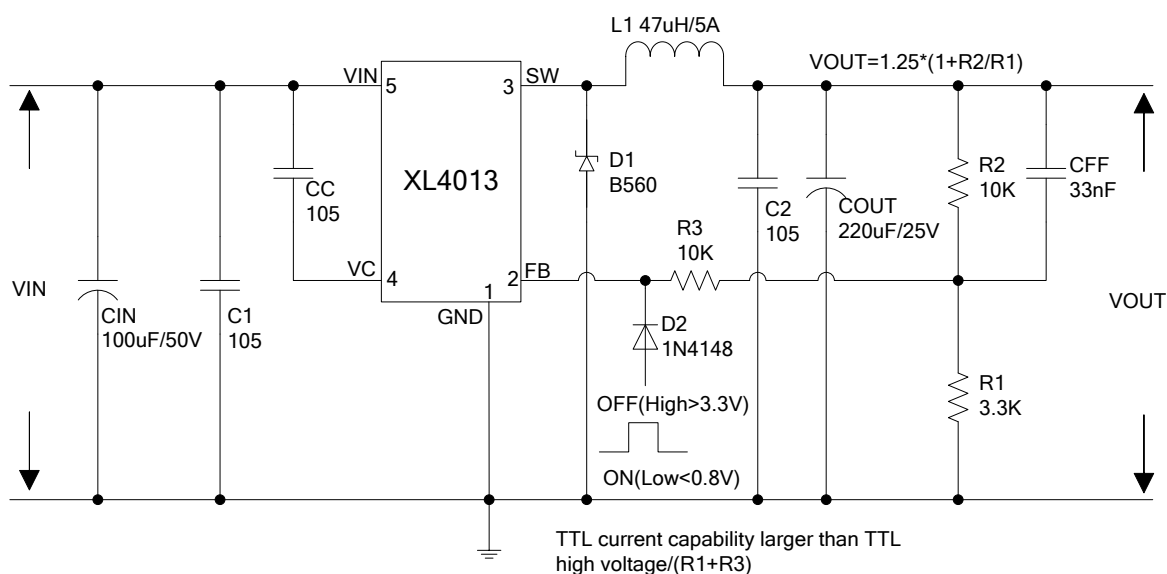
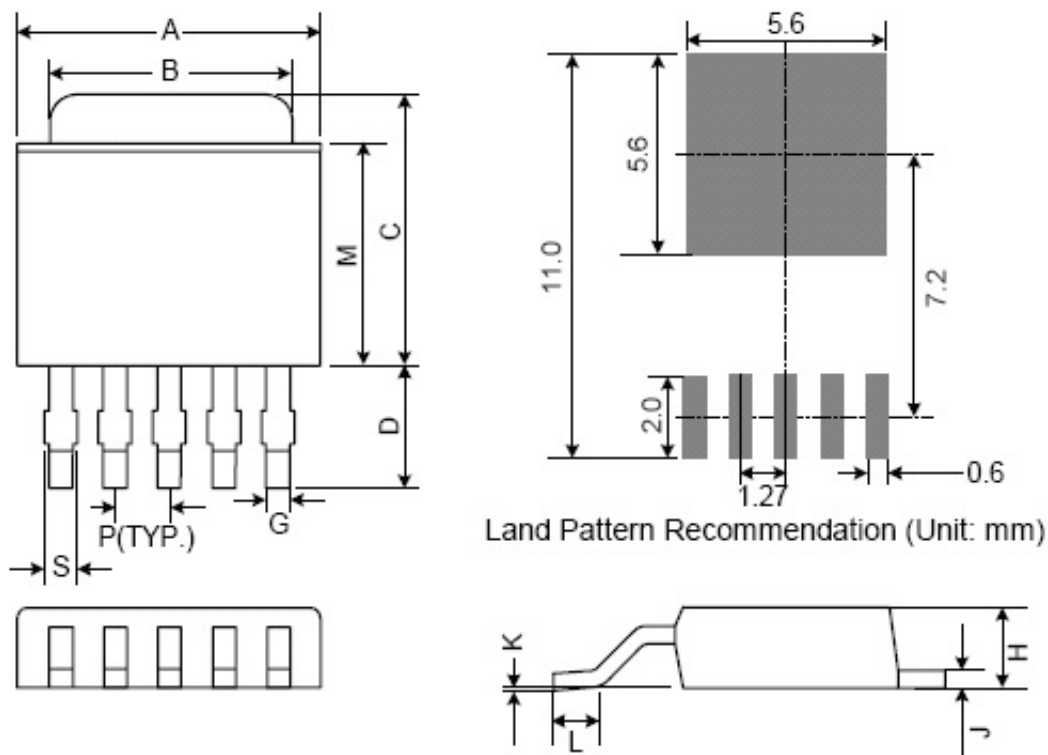


Figure9. XL4013 Typical Application Circuit

Package Information

TO252-5L



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	6.35	6.60	6.85	0.250	0.260	0.270
B	5.20	5.35	5.50	0.205	0.211	0.217
C	6.80	7.00	7.30	0.268	0.276	0.287
D	2.40	2.80	3.20	0.094	0.110	0.126
P	1.27 REF.			0.05 REF.		
S	0.50	0.65	0.80	0.020	0.026	0.031
G	0.40	0.50	0.63	0.016	0.020	0.025
H	2.20	2.30	2.40	0.087	0.091	0.094
J	0.45	0.52	0.58	0.018	0.020	0.023
K	0.00	0.08	0.15	0.000	0.003	0.006
L	0.90	1.20	1.77	0.035	0.047	0.064
M	5.40	5.80	6.20	0.213	0.228	0.244

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