SM16188B

Feature

◆ CMOS process

◆ Operation voltage: 4.5V - 5.5V

◆ Display mode: common cathode 4-bit *8-segment LED digital tube

◆ RZ code protocol, communication rate: 1MHz

◆ Single-line serial cascaded connector (DIN, DOUT)

◆ Built-in signal reproduction, no cascaded signal attenuation

◆ 16-level of adjustable constant current driver, constant current precision: ±5%

◆ Strong antijamming capability of input port

◆ Package:SOP16

Application

◆ Monochrome screen display control and driver

◆ STB display

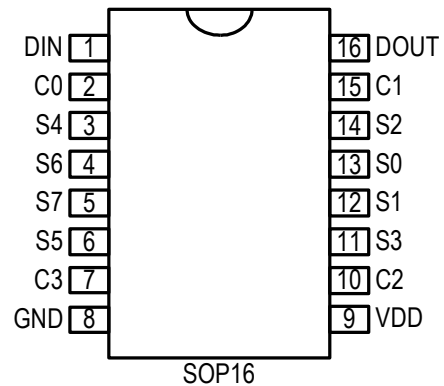◆ Home appliances LED digital display

Description

The SM16188B is a patented circuit of LED display cascaded driver which adopts single RZ code communication protocol.

The SM16188B integrates RZ code protocol digital connector, data latch, 4*8 display constant current driver, 16-level constant current output adjustment circuit, powered-on reset circuit, built-in sampling oscillator and PWM oscillator circuit.

Order Information

Type	Package	Packing		Reel Size
		Tube	Tape	
SM16188B	SOP16	50 pcs/tube	4000 pcs/ tape	13 inches

Pin Definition

DIN	1		16	DOUT
C0	2		15	C1
S4	3		14	S2
S6	4		13	S0
S7	5		12	S1
S5	6		11	S3
C3	7		10	C2
GND	8		9	VDD

SOP16

Pin Description

Symbol	Pin Name	Pin No.	Pin Description
DIN	Data input	1	RZ code protocol data input
C0~C3	Bit driver output	2,7,10,15	LED bit driver output. Low level output is effective during dynamic scan period. High resistor Z output during non-dynamic scan period.
VDD	Power supply	9	System power supply
GND	Ground	8	Ground
S0~S7	Segment driver output	3~6,11~14	LED constant current driver output. High level output is effective during dynamic scan period. High resistor Z output during non-dynamic scan period.
DOUT	Data output	16	Data outputs after shaping, provides input data for next cascaded chip.

Internal Function Diagram
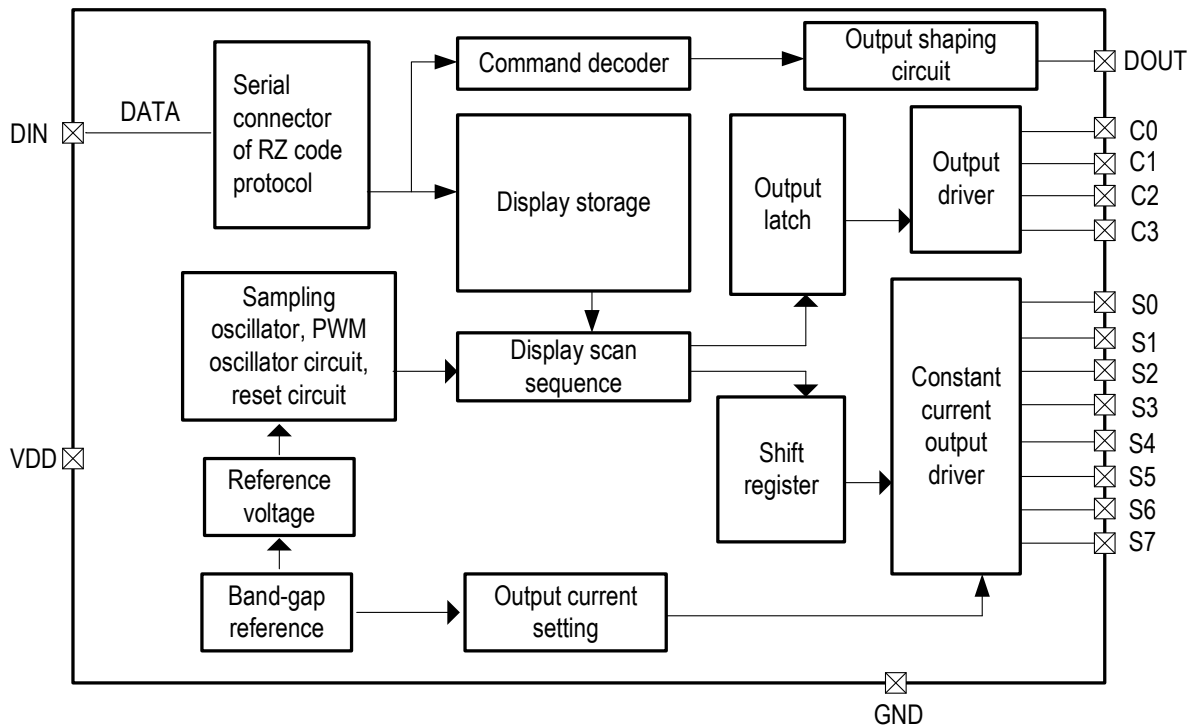
Fig. SM16188B Internal Function Diagram

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Note: The latest datasheet is subject to the web (www.chinaasic.com).

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Electric Parameter

Absolute Maximum Parameter（Ta = 25℃）

Parameter	Symbol	Range	Unit
Logic power voltage	VDD	-0.5——+5.5	V
Logic input voltage	VI1	-0.5——VDD + 0.5	V
Segment output current	I_{OH}	45	mA
Bit output current	I_{OL}	800	mA
ESD	V_{ESD}	>2	KV
Operating temperature	T_{OPT}	-40——+100	℃
Storage temperature	T_{STG}	-50——+150	℃

Electrical Characteristic（Ta = 25℃）

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic power voltage	VDD		4.5	5.0	5.5	V
High level input voltage	VIH		0.7*VDD	-	-	V
Low level input voltage	VIL		-	-	0.3*VDD	V
DOUT driver ability	IOH	VDD=5.0V，DOUT: high level output	-	28	-	mA
	IOL	VDD=5.0V，DOUT: low level output		32	-	mA
Quiescent current	IDD	VDD=5.0V，S0~S7: on	-	2.5	-	mA
Sn output current	I_{Sn}	VDD=5.0V, current adjustment: see next page	18	-	38	mA
Cn output current	I_{Cn}	VDD=5.0V，Cn output port connects to VDD	500	-	-	mA
Sn constant current characteristic	ΔIOUT	VDD=5.0V，ISn=40mA	37.5	-	42.5	mA
	%/ΔVDD	ISn=40mA，VDD=4.0V~5.5V	-	2	-	%
	%/ΔTemp	ISn=40mA，Temp=-40°C ~ +100°C	-	-	5	%
Cn frequency	F_{Cn}	VDD=5.0V	-	1.0	-	KHz
RZ code frequency	$f_{CLK(max)}$		-	100	-	KHz

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Typical Application Circuit

Fig. 4x8 LED display mode diagram

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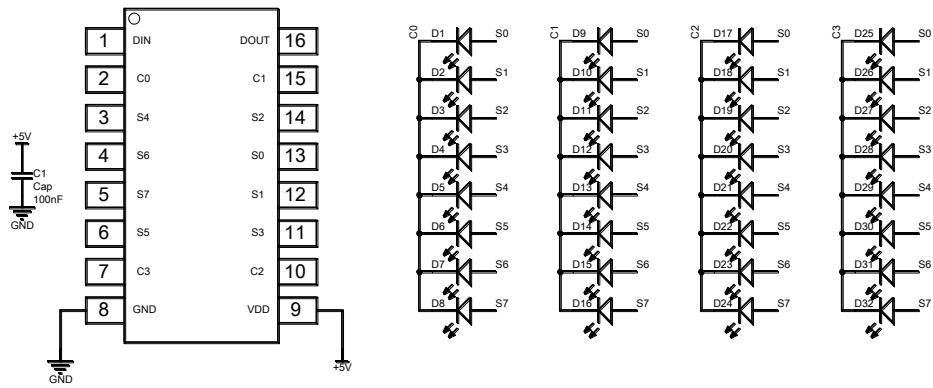Note: The latest datasheet is subject to the web (www.chinaasic.com).

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Code Description

The protocol of the SM16188B adopts single polarity RZ code, LOW level must be contained in each code element. Each code element in the protocol initiates with HIGH level, and the width of the HIGH level time determines 0 code or 1 code.
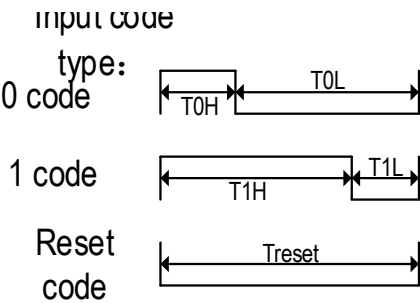
Input code type：

0 code

| T0H | T0L |

1 code

| T1H | T1L |

Reset code

| Treset |

Fig. SM16188B RZ code data communication protocol diagram

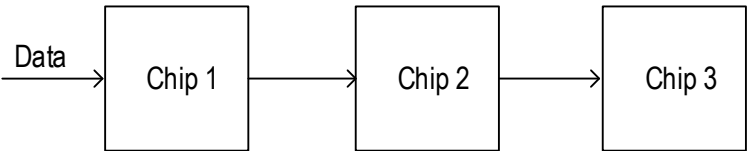| Name	Description	Min.	Typ.	Max.	Allowable deviation	Unit
T0H	0, HIGH level	-	0.24	-	±0.05	us
T1H	1, HIGH level	-	0.72	-	±0.05	us
T0L	0, LOW level	-	0.72	-	±0.05	us
T1L	1, LOW level	-	0.24	-	±0.05	us
Trst	Reset, LOW level	150	-	-	-	us

Protocol Data Format

Trst+ First chip 32bits data +Second chip 32bits data + The third chip 32bits data +4bits current gain +Trst

32 bits gray scale data structure: High levels first, sent by the order of : C0C1C2C3

C0_7	C0_6	C0_5	C0_4	C0_3	C0_2	C0_1	C0_0	C1_7	......	C1_0	C2_7	......	C2_0	C3_7	......	C3_0

Bit31………........................………..bit0

- System Topological Graph:

Data → Chip 1 → Chip 2 → Chip 3

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● Input Data Stream of every chip (3 chips as an example):

Chip 1	Trst	1st Set of 32bits Data	2nd Set of 32bits Data	3rd Set of 32bits Data	4bits Current Gain	Trst		
Chip 2	Trst		2nd Set of 32bits Data	3rd Set of 32bits Data	4bits Current Gain	Trst		
Chip 3	Trst			3rd Set of 32bits Data	4bits Current Gain	Trst		
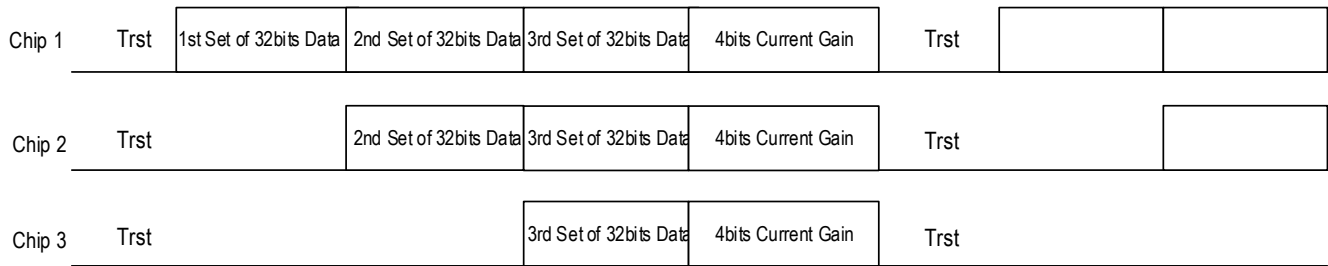
● **Internal register display data**
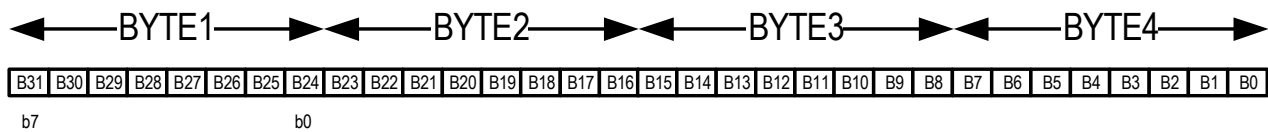
Note: After powered-on reset, the data in display register will be cleared.
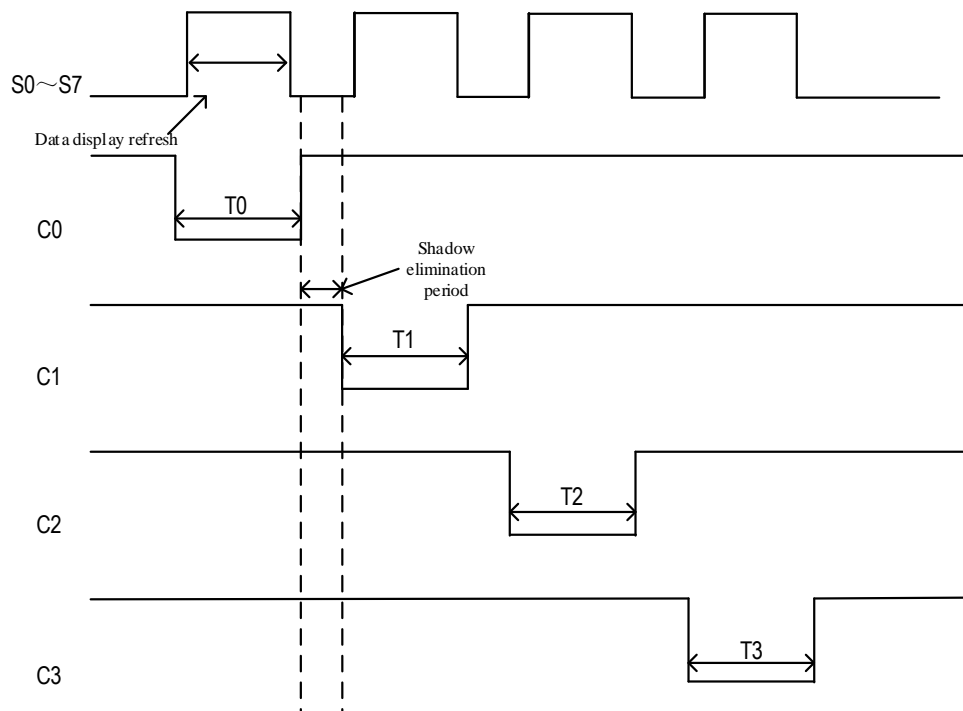
● **Display period**

Fig. SM16188B display period diagram

In the diagram above, 1）High level of S0~7: constant current is on and segment selection signal.

2）C0~3: effective low level and bit selection signal.

3）"shadow elimination" locates between two adjacent bits signal (C signal) . The "shadow elimination" on rows and columns of SM16188B can avoid LED display "smear".

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Current Gain Adjustment Description

Total 4 bits of current gain data. Default output is 37mA. Users can regulate other current value by changing current gain value. The current value refers to the sheet below:

X3	X2	X1	X0	Iout (Typ.)
1	1	1	1	38.3 mA
1	1	1	0	37.0 mA
1	1	0	1	35.7 mA
1	1	0	0	34.3 mA
1	0	1	1	33.0 mA
1	0	1	0	31.6 mA
1	0	0	1	30.3 mA
1	0	0	0	29.0 mA
0	1	1	1	27.7 mA
0	1	1	0	26.3 mA
0	1	0	1	25.0 mA
0	1	0	0	23.7 mA
0	0	1	1	22.3 mA
0	0	1	0	21.0 mA
0	0	0	1	19.7 mA
0	0	0	0	18.3 mA

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Encapsulation Soldering Process

Semiconductors of Sunmoon follow the European RoHs standard, solder temperature in encapsulation soldering process follows J-STD-020 standard.
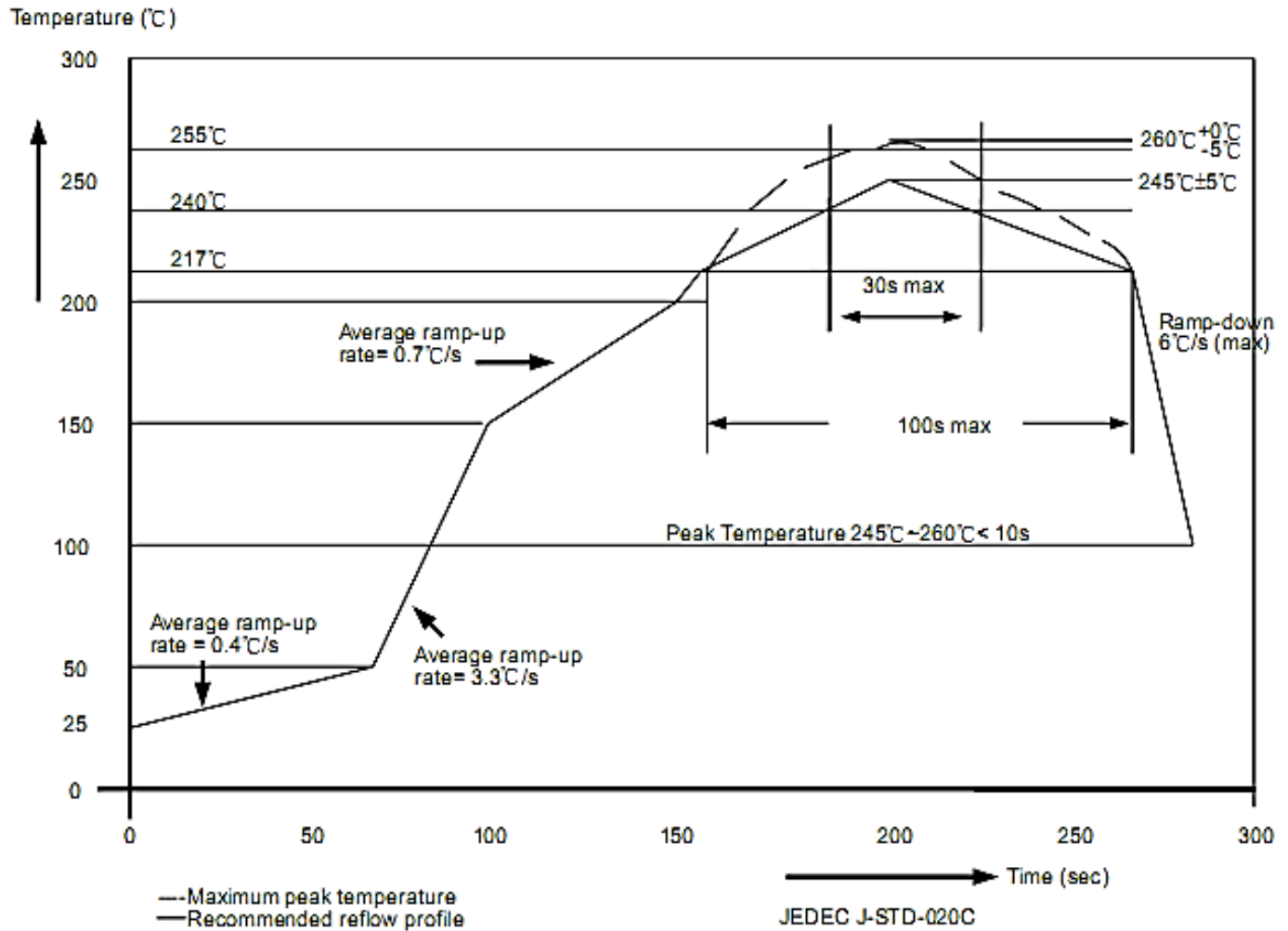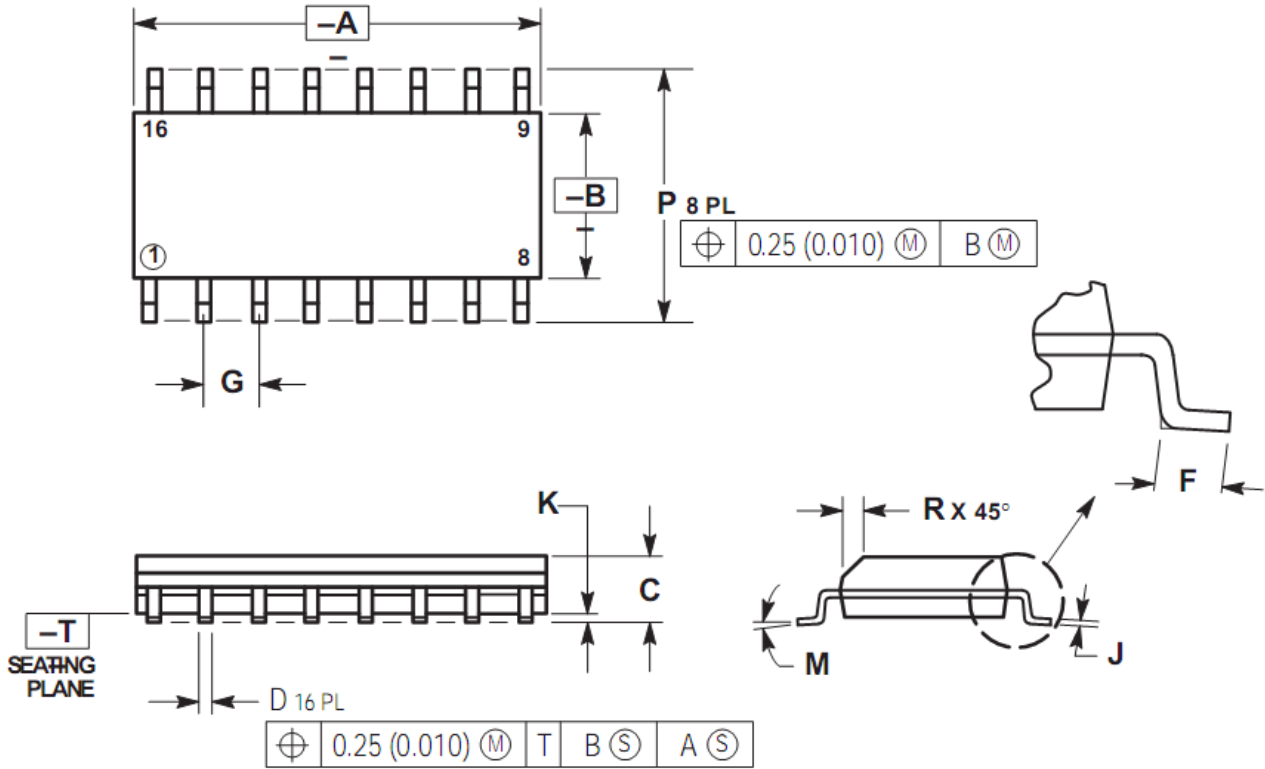

Encapsulation Thickness	Volume mm³ < 350	Volume mm³：350~2000	Volume mm³ ≥ 2000
<1.6mm	260+0℃	260+0℃	260+0℃
1.6mm~2.5mm	260+0℃	250+0℃	245+0℃
≥2.5mm	250+0℃	245+0℃	245+0℃

Package

SOP16

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.224
R	0.25	0.50	0.010	0.019

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