

Bias Resistor Transistor

NPN Silicon Surface Mount Transistor with Monolithic Bias Resistor Network

This new series of digital transistors is designed to replace a single device and its external resistor bias network. The BRT (Bias Resistor Transistor) contains a single transistor with a monolithic bias network resistor. The BRT eliminates these individual components by integrating them into a single device. The use of a BRT can reduce both system cost and board space. The device is housed in the SOT-23 package which is designed for low power surface mount applications.

- Simplifies Circuit Design
- Reduces Board Space and Component Count
- The SOT-23 package can be soldered using wave or reflow. The modified gull-winged leads absorb thermal stress during soldering eliminating the possibility of damage to the die.
- Available in 8 mm embossed tape and reel. Use the Device Number to order the 7 inch/3000 unit reel. Replace “T1” with “T3” in the Device Number to order the 13 inch/10,000 unit reel.
- S- Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable.

MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

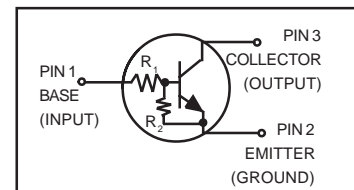
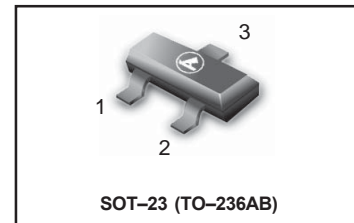
Rating	Symbol	Value	Unit
Collector-Base Voltage	V _{CBO}	50	Vdc
Collector-Emitter Voltage	V _{CEO}	50	Vdc
Collector Current	I _C	100	mAdc
Total Power Dissipation @ T _A = 25°C (Note 1.) Derate above 25°C	P _D	246 1.5	mW °C/W

DEVICE MARKING AND RESISTOR VALUES

Device	Marking	R1(K)	R2(K)
LMUN2211LT1G	A8A	10	10
LMUN2212LT1G	A8B	22	22
LMUN2213LT1G	A8C	47	47
LMUN2214LT1G	A8D	10	47
LMUN2215LT1G	A8E	10	∞
LMUN2216LT1G	A8F	4.7	∞
LMUN2230LT1G	A8G	1.0	1.0
LMUN2231LT1G	A8H	2.2	2.2
LMUN2232LT1G	A8J	4.7	4.7
LMUN2233LT1G	A8K	4.7	47
LMUN2234LT1G	A8L	22	47
LMUN2235LT1G	A8M	2.2	47
LMUN2236LT1G	A8N	100	100
LMUN2237LT1G	A8P	47	22
LMUN2238LT1G	A8R	2.2	∞
LMUN2240LT1G	A8T	47	∞
LMUN2241LT1G	A8U	100	∞

1. Device mounted on a FR-4 glass epoxy printed circuit board using the minimum recommended footprint.

LMUN2211LT1G Series S-LMUN2211LT1G Series



We declare that the material of product compliance with RoHS requirements.

ORDERING INFORMATION

Device	Package	Shipping
LMUN2211LT1G	SOT23	3000/Tape&Reel
LMUN2211LT3G	SOT23	10000/Tape&Reel

LMUN2211LT1G Series,S-LMUN2211LT1G Series

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance – Junction-to-Ambient (Note 1.)	$R_{\theta JA}$	508	°C/W
Operating and Storage Temperature Range	T_J, T_{stg}	-55 to +150	°C
Maximum Temperature for Soldering Purposes, Time in Solder Bath	T_L	260 10	°C Sec

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector-Base Cutoff Current ($V_{CB} = 50\text{ V}, I_E = 0$)	I_{CBO}	-	-	100	nAdc
Collector-Emitter Cutoff Current ($V_{CE} = 50\text{ V}, I_B = 0$)	I_{CEO}	-	-	500	nAdc
Emitter-Base Cutoff Current ($V_{EB} = 6.0\text{ V}, I_C = 0$)	I_{EBO}	-	-	0.5	mAdc
LMUN2211LT1G		-	-	0.2	
LMUN2212LT1G		-	-	0.1	
LMUN2213LT1G		-	-	0.2	
LMUN2214LT1G		-	-	0.9	
LMUN2215LT1G		-	-	1.9	
LMUN2216LT1G		-	-	4.3	
LMUN2230LT1G		-	-	2.3	
LMUN2231LT1G		-	-	1.5	
LMUN2232LT1G		-	-	0.18	
LMUN2233LT1G		-	-	0.13	
LMUN2234LT1G		-	-	0.2	
LMUN2235LT1G		-	-	0.05	
LMUN2236LT1G		-	-	0.13	
LMUN2237LT1G		-	-	4.0	
LMUN2238LT1G		-	-	0.2	
LMUN2240LT1G		-	-	0.1	
LMUN2241LT1G		-	-		
Collector-Base Breakdown Voltage ($I_C = 10\ \mu\text{A}, I_E = 0$)	$V_{(BR)CBO}$	50	-	-	Vdc
Collector-Emitter Breakdown Voltage (Note 2.), ($I_C = 2.0\text{ mA}, I_B = 0$)	$V_{(BR)CEO}$	50	-	-	Vdc

ON CHARACTERISTICS (Note 2.)

DC Current Gain ($V_{CE} = 10\text{ V}, I_C = 5.0\text{ mA}$)	LMUN2211LT1G LMUN2212LT1G LMUN2213LT1G LMUN2214LT1G LMUN2215LT1G LMUN2216LT1G LMUN2230LT1G LMUN2231LT1G LMUN2232LT1G LMUN2233LT1G LMUN2234LT1G LMUN2235LT1G LMUN2236LT1G LMUN2237LT1G LMUN2238LT1G LMUN2240LT1G LMUN2241LT1G	h_{FE}	35 60 80 80 160 160 3.0 8.0 15 80 80 80 80 80 80 160 160 160	60 100 140 140 350 350 5.0 15 30 200 150 140 150 140 350 350 350	- - - - - - - - - - - - - - - - -	
Collector-Emitter Saturation Voltage ($I_C = 10\text{ mA}, I_B = 0.3\text{ mA}$) ($I_C = 10\text{ mA}, I_B = 5\text{ mA}$) LMUN2230LT1G/LMUN2231LT1G LMUN2237LT1G ($I_C = 10\text{ mA}, I_B = 1\text{ mA}$) LMUN2215LT1G/LMUN2216LT1G LMUN2232LT1G/LMUN2233LT1G/LMUN2234LT1G/ LMUN2235LT1G/LMUN2238LT1G/LMUN2240LT1G		$V_{CE(sat)}$	-	-	0.25	Vdc

2. Pulse Test: Pulse Width < 300 μs , Duty Cycle < 2.0%.

LMUN2211LT1G Series,S-LMUN2211LT1G Series

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (Continued)

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS (Note 3.)					
Output Voltage (on) (V _{CC} = 5.0 V, V _B = 2.5 V, R _L = 1.0 k Ω)	V _{OL}	–	–	0.2	Vdc
LMUN2211LT1G		–	–	0.2	
LMUN2212LT1G		–	–	0.2	
LMUN2214LT1G		–	–	0.2	
LMUN2215LT1G		–	–	0.2	
LMUN2216LT1G		–	–	0.2	
LMUN2230LT1G		–	–	0.2	
LMUN2231LT1G		–	–	0.2	
LMUN2232LT1G		–	–	0.2	
LMUN2233LT1G		–	–	0.2	
LMUN2234LT1G		–	–	0.2	
LMUN2235LT1G		–	–	0.2	
LMUN2238LT1G		–	–	0.2	
(V _{CC} = 5.0 V, V _B = 5.5 V, R _L = 1.0 k Ω)		–	–	0.2	
(V _{CC} = 5.0 V, V _B = 4.0 V, R _L = 1.0 k Ω)		–	–	0.2	
(V _{CC} = 5.0 V, V _B = 3.5 V, R _L = 1.0 k Ω)		–	–	0.2	
LMUN2213LT1G		–	–	0.2	
LMUN2240LT1G		–	–	0.2	
(V _{CC} = 5.0 V, V _B = 5.0 V, R _L = 1.0 k Ω)		–	–	0.2	
LMUN2241LT1G		–	–	0.2	
Output Voltage (off) (V _{CC} = 5.0 V, V _B = 0.5 V, R _L = 1.0 k Ω)	V _{OH}	4.9	–	–	Vdc
(V _{CC} = 5.0 V, V _B = 0.050 V, R _L = 1.0 k Ω)					
(V _{CC} = 5.0 V, V _B = 0.25 V, R _L = 1.0 k Ω)					
LMUN2230LT1G					
LMUN2215LT1G					
LMUN2216LT1G					
LMUN2233LT1G					
LMUN2238LT1G					
LMUN2236LT1G					
LMUN2237LT1G					
LMUN2240LT1G					
Input Resistor	R ₁	7.0	10	13	kΩ
LMUN2211LT1G		15.4	22	28.6	
LMUN2212LT1G		32.9	47	61.1	
LMUN2213LT1G		7.0	10	13	
LMUN2214LT1G		7.0	10	13	
LMUN2215LT1G		3.3	4.7	6.1	
LMUN2216LT1G		0.7	1.0	1.3	
LMUN2230LT1G		1.5	2.2	2.9	
LMUN2231LT1G		3.3	4.7	6.1	
LMUN2232LT1G		3.3	4.7	6.1	
LMUN2233LT1G		15.4	22	28.6	
LMUN2234LT1G		1.54	2.2	2.86	
LMUN2235LT1G		1.54	2.2	2.88	
LMUN2238LT1G		70	100	130	
LMUN2241LT1G		70	100	130	
LMUN2236LT1G		32.9	47	61.1	
LMUN2237LT1G		32.9	47	61.1	
LMUN2240LT1G					
Resistor Ratio	R ₁ /R ₂	0.8	1.0	1.2	
LMUN2211LT1G/LMUN2212LT1G/LMUN2213LT1G		0.17	0.21	0.25	
LMUN2214LT1G		–	–	–	
LMUN2215LT1G/LMUN2216LT1G/LMUN2238LT1G		–	–	–	
LMUN2241LT1G/LMUN2240LT1G		–	–	–	
LMUN2230LT1G/LMUN2231LT1G/LMUN2232LT1G		0.8	1.0	1.2	
LMUN2236LT1G		0.8	1.0	1.2	
LMUN2237LT1G		1.7	2.15	2.6	
LMUN2233LT1G		0.055	0.1	0.185	
LMUN2234LT1G		0.38	0.47	0.56	
LMUN2235LT1G		0.038	0.047	0.056	

3. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%.

LMUN2211LT1G Series,S-LMUN2211LT1G Series

TYPICAL ELECTRICAL CHARACTERISTICS
LMUN2212LT1G

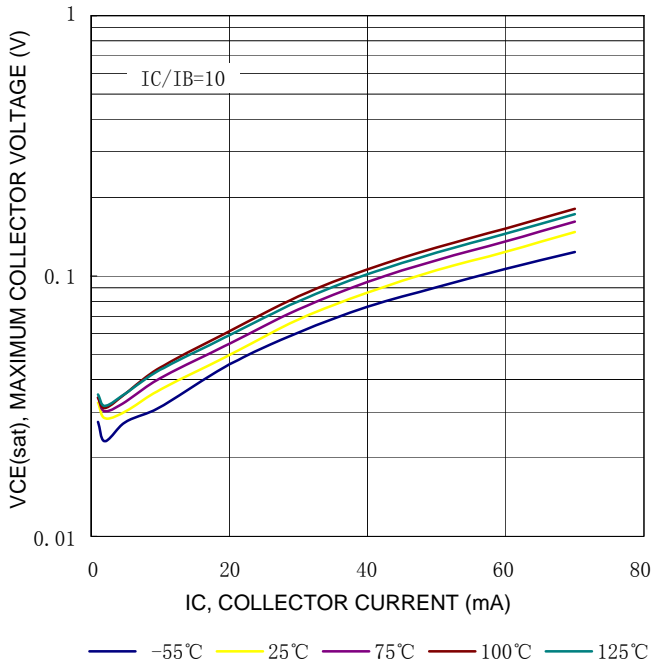


Fig. 1 VCE(sat) VS IC

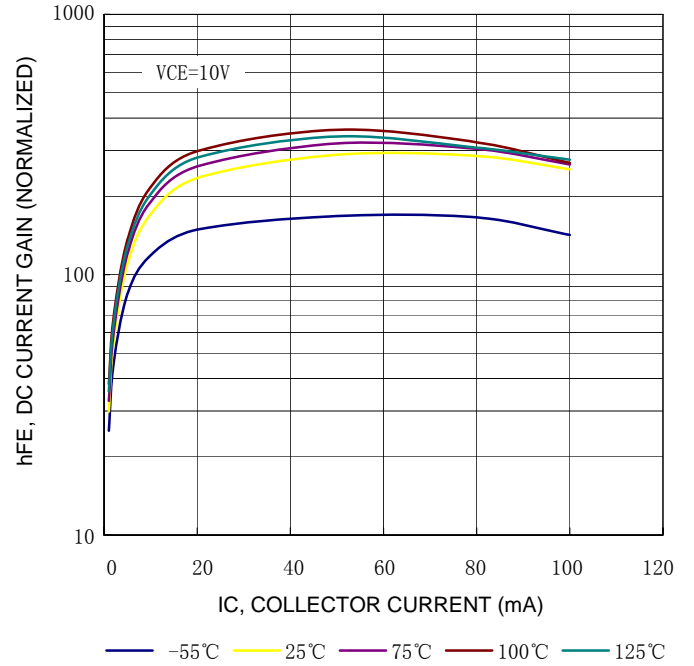


Fig. 2 DC CURRENT GAIN

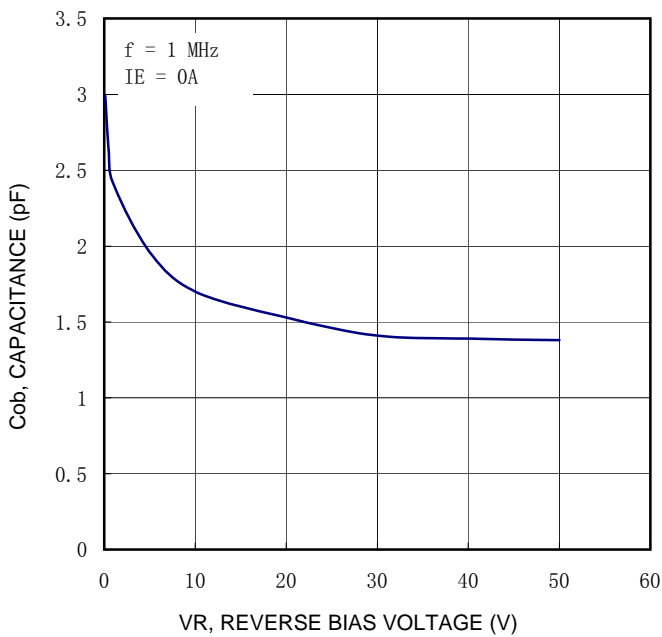


Fig. 3 OUTPUT CAPACITANCE

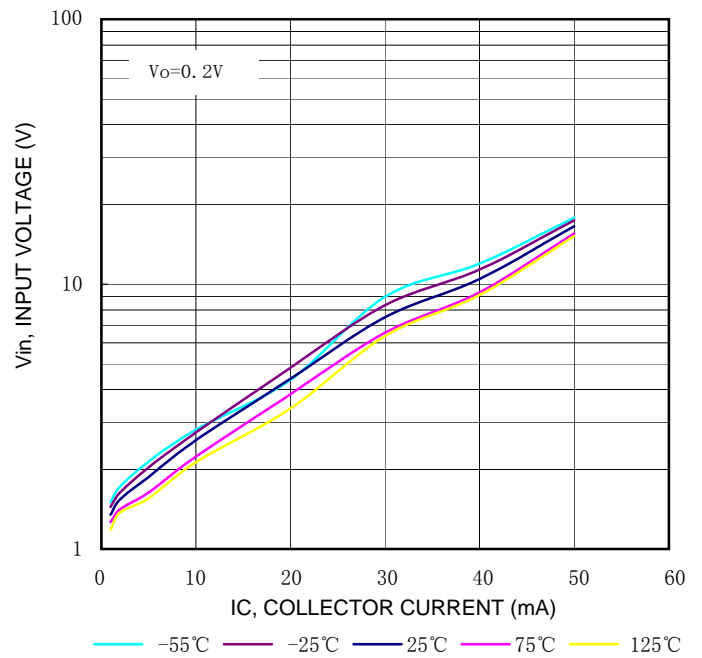


Fig. 4 INPUT VOLTAGE VS OUTPUT CURRENT

LMUN2211LT1G Series,S-LMUN2211LT1G Series

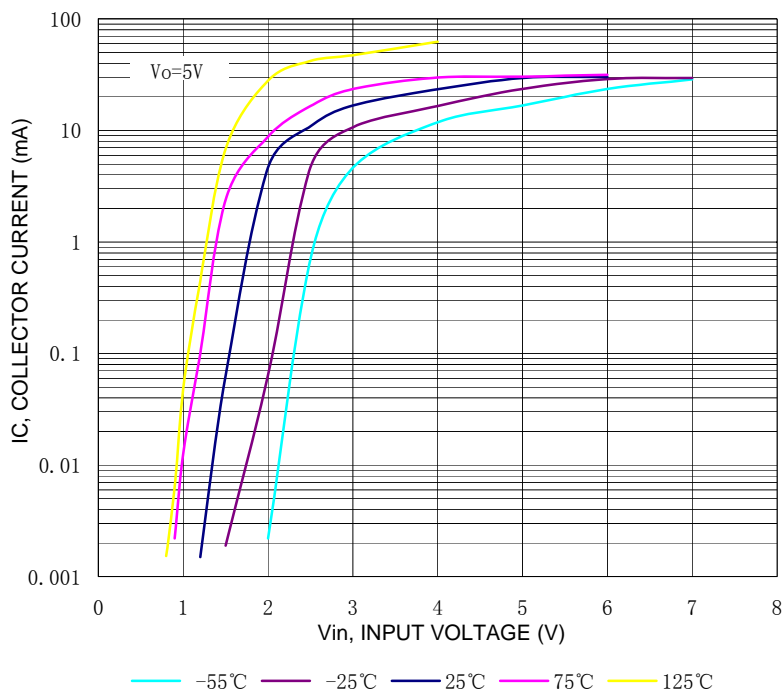
**TYPICAL ELECTRICAL CHARACTERISTICS
LMUN2212LT1G**

Fig. 5 OUTPUT CURRENT VS INPUT VOLTAGE

TYPICAL APPLICATIONS FOR NPN BRTs

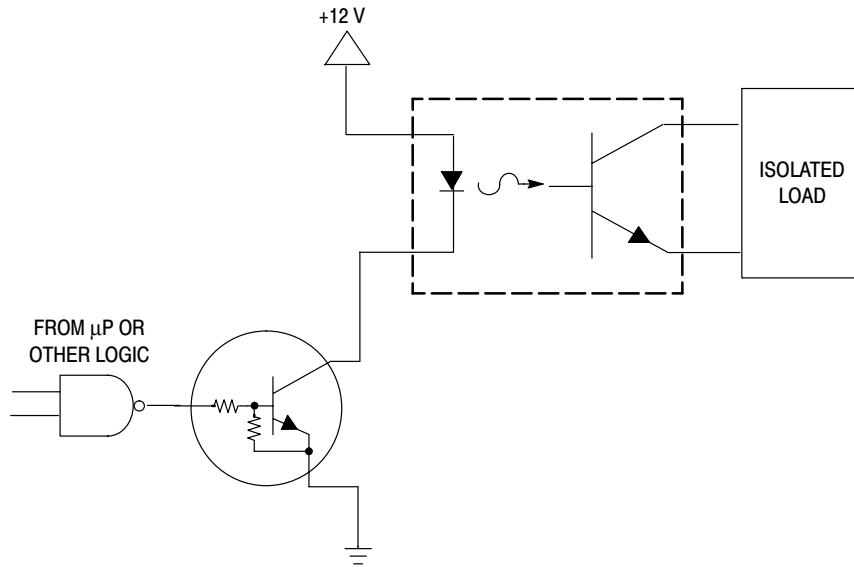


Fig. 6 LEVEL SHIFTER:CONNECTS 12 TO 24 VOLT CIRCUITS TO LOGIC

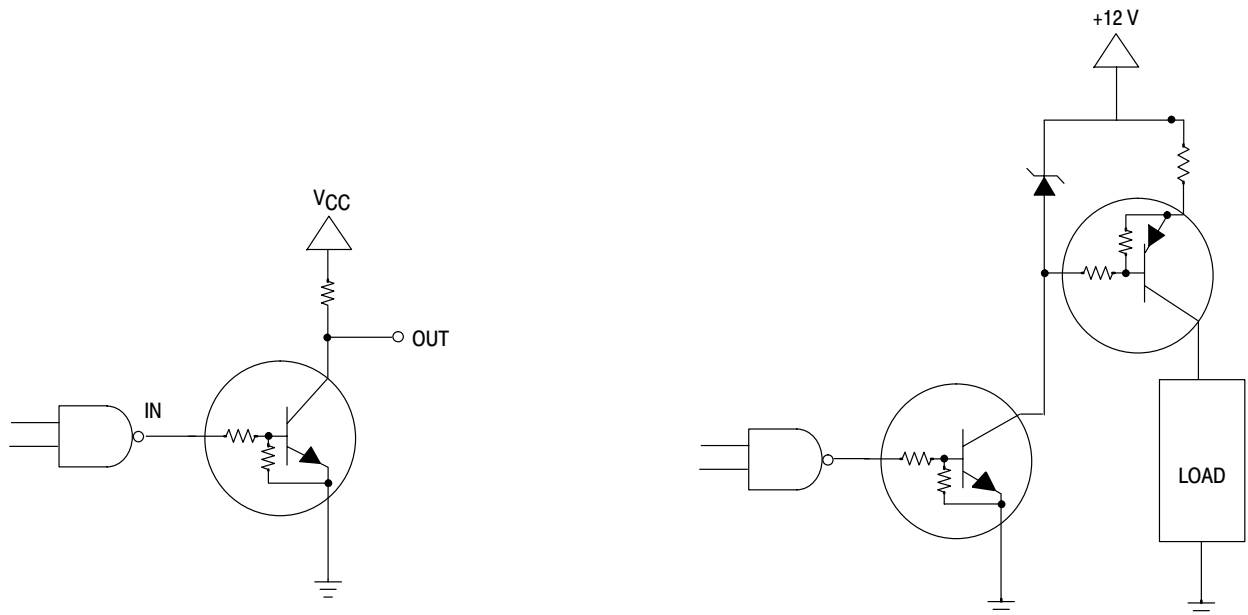
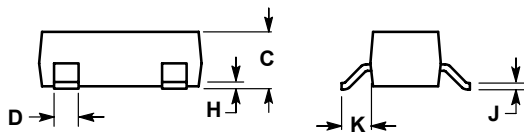
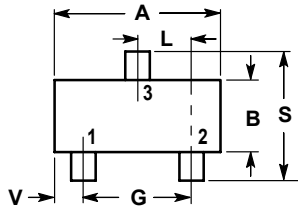


Fig. 7 OPEN COLLECTOR INVERTER:
INVERTS THE INPUT SIGNAL

Fig. 8 INEXPENSIVE, UNREGULATED CURRENT SOURCE

LMUN2211LT1G Series, S-LMUN2211LT1G Series

SOT-23



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.1102	0.1197	2.80	3.04
B	0.0472	0.0551	1.20	1.40
C	0.0350	0.0440	0.89	1.11
D	0.0150	0.0200	0.37	0.50
G	0.0701	0.0807	1.78	2.04
H	0.0005	0.0040	0.013	0.100
J	0.0034	0.0070	0.085	0.177
K	0.0140	0.0285	0.35	0.69
L	0.0350	0.0401	0.89	1.02
S	0.0830	0.1039	2.10	2.64
V	0.0177	0.0236	0.45	0.60

