

SK6117 1A Bipolar Linear Regulator

General Description

SK6117 is a series of low dropout three-terminal regulators with a dropout of 1.3V at 1A load current. SK6117 features a very low standby current 2mA compared to 5mA of competitor.

Other than a fixed version, $V_{out} = 1.2V, 1.5V, 1.8V, 2.5V, 2.85V, 3.3V,$ and 5V, SK6117 has an adjustable version, which can provide an output voltage from 1.25 to 12V with only two external resistors.

SK6117 offers thermal shut down function, to assure the stability of chip and power system. And it uses trimming technique to guarantee output voltage accuracy within 2%. Other output voltage accuracy can be customized on demand, such as 1%.

SK6117 is available in SOT-223, TO-252 power package.

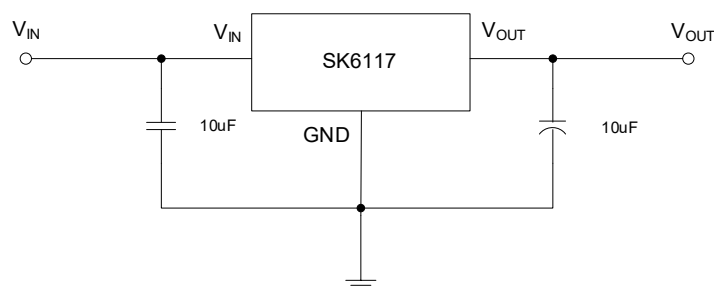
Features

- Maximum output current is 1.4A
- Range of operation input voltage: Max 15V
- Line regulation: 0.03%/V (typ.)
- Standby current: 2mA (typ.)
- Load regulation: 0.2%/A (typ.)
- Environment Temperature: $-20^{\circ}C \sim 85^{\circ}C$

Applications

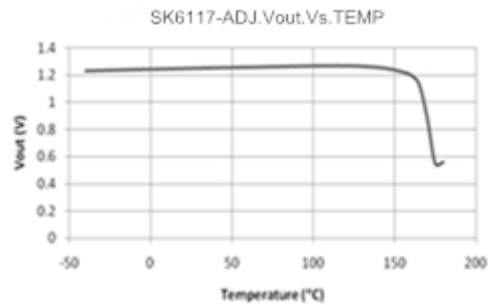
- Power Management for Computer Mother Board, Graphic Card
- LCD Monitor and LCD TV
- DVD Decode Board
- ADSL Modem
- Post Regulators For Switching Supplies

Typical Application



Application circuit of SK6117 fixed version

Typical Electrical Characteristic



Selection Table

Device	Part No.	Output Voltage	Package
SK6117	XX=12	1.2V	SOT-223 TO-252
	XX=15	1.5V	
	XX=18	1.8V	
	XX=28	2.85V	
	XX=25	2.5V	
	XX=33	3.3V	
	XX=50	5.0V	
	XX=AD	Adj	

Ordering Information

Part no	Designator	Description
SK6117	6117	Product code
	XX	Output Voltage(1.2~5.0V)
	YY	LR SOT223 OR TO-252

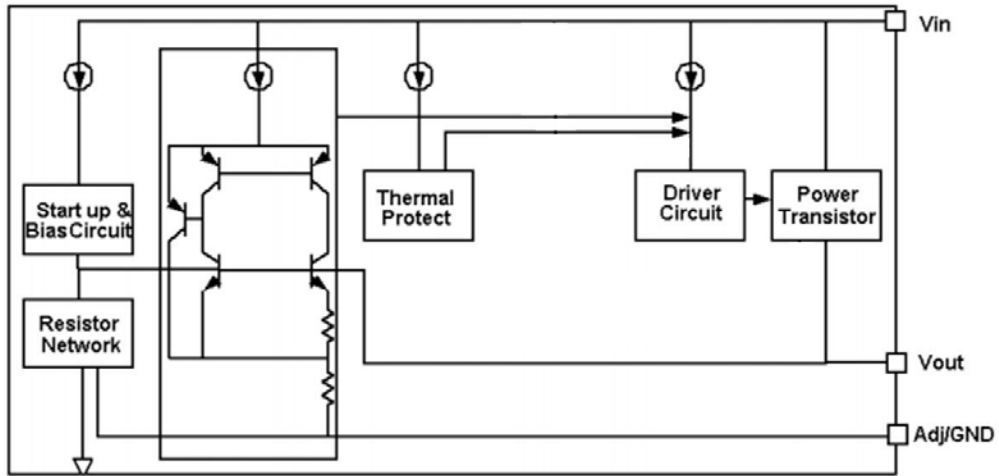
Note: "XX" stands for output voltages. Other voltages can be specially customized

Parameters	Description
Temperature & Rohs	C: -40~85°C , Pb Free Rohs Std.
Package type	L: SOT-223 O: TO-252
Packing type:	TR: Tape & Reel (Standard)
Voltage accuracy	2%(Customized)

Part Number	Package	Temperature	Quantity/ Reel
SK6117-XXLR	SOT223	-40~85 °C	2500
SK6117-XXOR	TO252	-40~85 °C	2000

SK6117 devices are Pb-free and RoHS compliant.

Block Diagram



Pin Configuration

SOT223 (Top View)

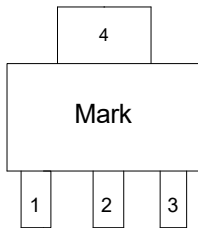


Table1: SK6117 series (SOT223 PKG)

PIN NO.	PIN NAME	FUNCTION
1	VSS/ADJ	VSS/ADJ pin
2	VOUT	Output voltage pin
3	VIN	Input voltage pin
4	VOUT	Output voltage pin

TO252 (Top View)

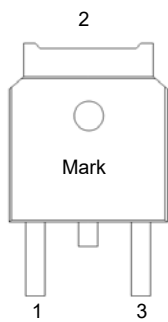


Table2: SK6117 series (TO252 PKG)

PIN NO.	PIN NAME	FUNCTION
1	VSS/ADJ	VSS/ADJ pin
2	VOUT	Output voltage pin
3	VIN	Input voltage pin

Absolute Maximum Ratings

Max Input Voltage 30V
 Max Operating Junction Temperature(Tj) 150°C
 Ambient Temperature(Ta) -40°C~ 85°C
 Storage Temperature(Ts) -40°C~150°C
 Lead Temperature & Time 260°C 10S
 Caution: Exceed these limits to damage to the device. Exposure to absolute maximum rating conditions may affect device reliability.

Recommended Work Conditions

Recommended maximum input voltage 15V
 Recommended operating junction temperature(Tj) -20~125°C

Thermal Information

Parameter	Package	Rating	Unit
Package thermal resistance	SOT-223	20	°C/W
	TO-252	12.5	°C/W
P _D	Power Dissipation	1	W

Electrical Characteristics

T_A=25°C, unless otherwise noted.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{ref}	Reference voltage	SK6117-Adj 10mA ≤ I _{out} ≤ 1A, V _{in} =3.25V	1.225	1.25	1.275	V
V _{out}	Output voltage	SK6117-1.2V 0 ≤ I _{out} ≤ 1A, V _{in} =3.2V	1.176	1.2	1.224	V
		SK6117-1.5V 0 ≤ I _{out} ≤ 1A, V _{in} =3.5V	1.47	1.5	1.53	V
		SK6117-1.8V 0 ≤ I _{out} ≤ 1A, V _{in} =3.8V	1.764	1.8	1.836	V
		SK6117-2.5V 0 ≤ I _{out} ≤ 1A, V _{in} =4.5V	2.45	2.5	2.55	V
		SK6117-2.85V 0 ≤ I _{out} ≤ 1A, V _{in} =4.85V	2.793	2.85	2.907	V
		SK6117-3.3V 0 ≤ I _{out} ≤ 1A, V _{in} =5.3V	3.234	3.3	3.366	V
		SK6117-5.0V 0 ≤ I _{out} ≤ 1A, V _{in} =7.0V	4.9	5	5.1	V

ΔV_{out}	Line regulation	SK6117-1.2V $I_{out}=10mA, 2.7V \leq V_{in} \leq 10V$	0.03	0.2	%/V
		SK6117-1.5V $I_{out}=10mA, 3.0V \leq V_{in} \leq 10V$	0.03	0.2	%/V
		SK6117-ADJ $I_{out}=10mA, 2.75V \leq V_{in} \leq 12V$	0.03	0.2	%/V
		SK6117-1.8V $I_{out}=10mA, 3.3V \leq V_{in} \leq 12V$	0.03	0.2	%/V
		SK6117-2.5V $I_{out}=10mA, 4.0V \leq V_{in} \leq 12V$	0.03	0.2	%/V
		SK6117-2.85V $I_{out}=10mA, 4.35V \leq V_{in} \leq 12V$	0.03	0.2	%/V
		SK6117-3.3V $I_{out}=10mA, 4.8V \leq V_{in} \leq 12V$	0.03	0.2	%/V
		SK6117-5.0V $I_{out}=10mA, 6.5V \leq V_{in} \leq 12V$	0.03	0.2	%/V
ΔV_{out}	Load regulation	SK6117-1.2V $V_{in} = 2.7V, 10mA \leq I_{out} \leq 1A$	2	8	mV
		SK6117-1.5V $V_{in} = 3.0V, 10mA \leq I_{out} \leq 1A$	2	8	mV
		SK6117-ADJ $V_{in} = 2.75V, 10mA \leq I_{out} \leq 1A$	2	8	mV
		SK6117-1.8V $V_{in} = 3.3V, 10mA \leq I_{out} \leq 1A$	3	12	mV
		SK6117-2.5V $V_{in} = 4.0V, 10mA \leq I_{out} \leq 1A$	4	16	mV
		SK6117-2.85V $V_{in} = 4.35V, 10mA \leq I_{out} \leq 1A$	5	20	mV
		SK6117-3.3 $V_{in} = 4.8V, 10mA \leq I_{out} \leq 1A$	6	24	mV
		SK6117-5.0 $V_{in} = 6.5V, 10mA \leq I_{out} \leq 1A$	9	36	mV
Vdrop	Dropout voltage	$I_{out} = 100mA$		1.15	V
		$I_{out} = 800mA$		1.2	V
		$I_{out} = 1A$	1.3	1.5	V
Imin	Minimum load current	SK6117-ADJ	2	10	mA
Iq	Quiescent Current	SK6117-1.2V, $V_{in}=10V$	2	5	mA
		SK6117-1.5V, $V_{in}=10V$	2	5	mA
		SK6117-1.8V, $V_{in}=12V$	2	5	mA
		SK6117-2.5V, $V_{in}=12V$	2	5	mA
		SK6117-2.85V, $V_{in}=12V$	2	5	mA
		SK6117-3.3V, $V_{in}=12V$	2	5	mA
		SK6117-5.0V, $V_{in}=12V$	2	5	mA

I _{Adj}	Adjust pin current	SK6117-ADJ V _{in} =5V, 10mA ≤ I _{out} ≤ 1A		55	120	μA
I _{change}	I _{adj} change	SK6117-ADJ V _{in} =5V, 10mA ≤ I _{out} ≤ 1A		0.2	10	μA
PSRR	Power Supply Rejection Rate	SK6117-3.3V, f=1kHz		60		dB
		SK6117-3.3V, f=10kHz		55		
ΔV/ΔT	Temperature coefficient			±100		ppm
θ _{JC}	Thermal resistance	SOT-223		20		°C/W
		TO-252		10		

Note1: All test are conducted under ambient temperature 25° C and within a short period of time 20ms

Note2: Load current smaller than minimum load current of SK6117-ADJ will lead to unstable or oscillation output.

Detailed Description

SK6117 is a series of low dropout voltage, three terminal regulators. Its application circuit is very simple: the fixed version only needs two capacitors and the adjustable version only needs two resistors and two capacitors to work. It is composed of some modules including start-up circuit, bias circuit, bandgap, thermal shutdown, power transistors and its driver circuit and so on.

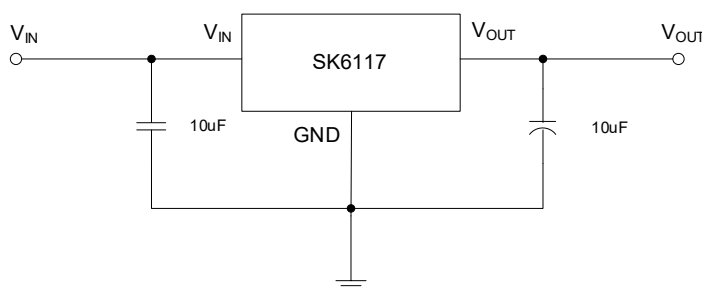
The thermal shut down modules can assure chip and its application system working safety when the junction temperature is larger than 140°C.

The bandgap module provides stable reference voltage, whose temperature coefficient is compensated by careful design considerations. The temperature coefficient is under 100 ppm/°C. And the accuracy of output voltage is guaranteed by trimming technique.

Typical Application

SK6117 has an adjustable version and six fixed versions (1.2V, 1.5V, 1.8V, 2.5V, 2.85V, 3.3V and 5V)

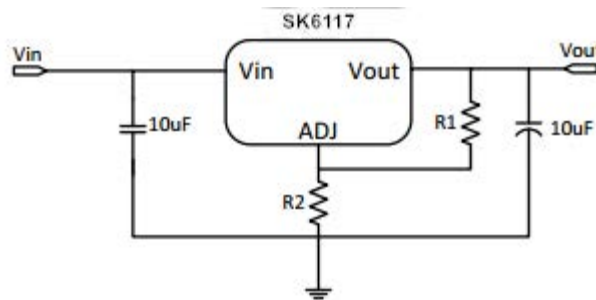
Fixed Output Voltage Version



Application circuit of SK6117 fixed version

- 1) Recommend using 10μF tan capacitor as bypass capacitor (C1) for all application circuit.
- 2) Recommend using 10μF tan capacitor to assure circuit stability.

Adjustable Output Voltage Version



Application Circuit of SK6117-ADJ

The output voltage of adjustable version follows the equation: $V_{out} = 1.25 \times (1 + R_2/R_1) + I_{Adj} \times R_2$. We can ignore I_{Adj} because I_{Adj} (about 50uA) is much less than the current of R_1 (about 2~10mA).

- 1) To meet the minimum load current (>10mA) requirement, R_1 is recommended to be 125ohm or lower. As SK6117-ADJ can keep itself stable at load current about 2mA, R_1 is not allowed to be higher than 625ohm.
- 2) Using a bypass capacitor (C_{ADJ}) between the ADJ pin and ground can improve ripple rejection. This bypass capacitor prevents ripple from being amplified as the output voltage is increased. The impedance of C_{ADJ} should be less than R_1 to prevent ripple from being amplified. As R_1 is normally in the range of 100Ω~500Ω, the value of C_{ADJ} should satisfy this equation: $1/(2\pi \times f_{ripple} \times C_{ADJ}) < R_1$.

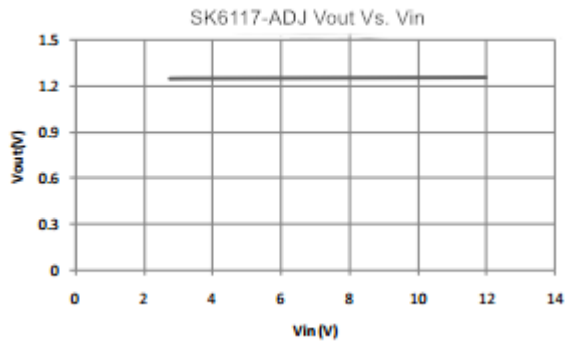
Thermal Considerations

We have to take heat dissipation into great consideration when output current or differential voltage of input and output voltage is large. Because in such cases, the power dissipation consumed by SK6117 is very large. SK6117 series uses SOT-223 package type and its thermal resistance is about 20°C/W. And the copper area of application board can affect the total thermal resistance. If copper area is 5cm*5cm (two sides), the resistance is about 30°C/W. So the total thermal resistance is about 20°C/W + 30°C/W. We can decrease total thermal resistance by increasing copper area in application board. When there is no good heat dissipation copper are in PCB, the total thermal resistance will be as high as 120°C/W, then the power dissipation of SK6117 could allow on itself is less than 1W. And furthermore, SK6117 will work at junction temperature higher than 125°C under such condition and no lifetime is guaranteed.

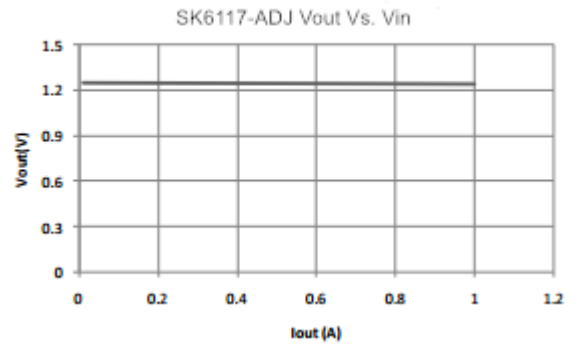
Typical Performance Characteristics

$T_A=25^{\circ}\text{C}$, unless otherwise noted.

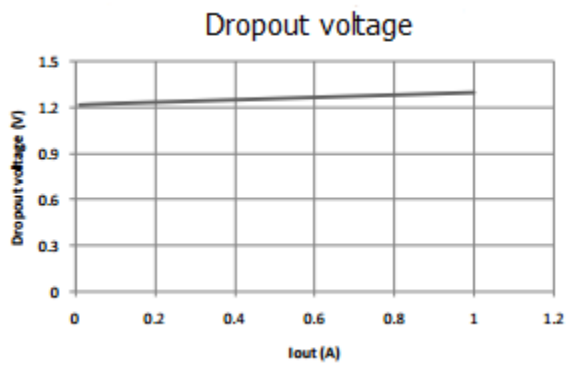
Line regulation



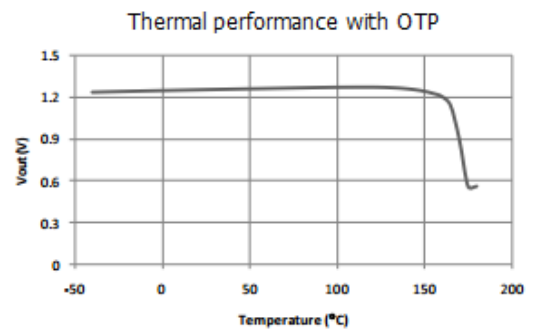
Load regulation



Dropout voltage

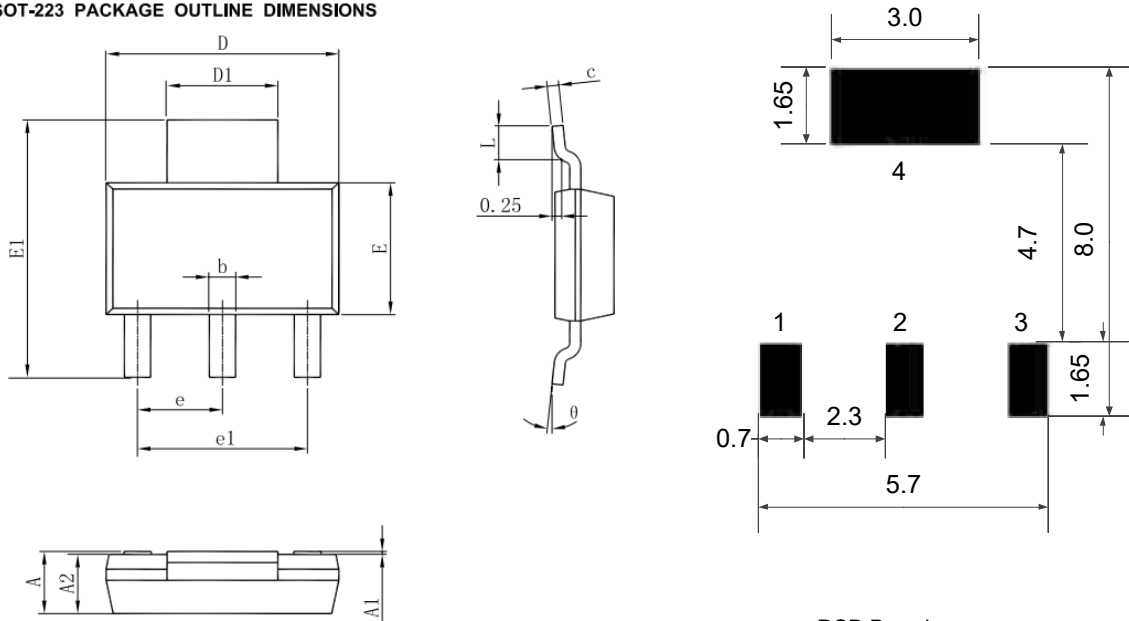


Thermal performance with OTP



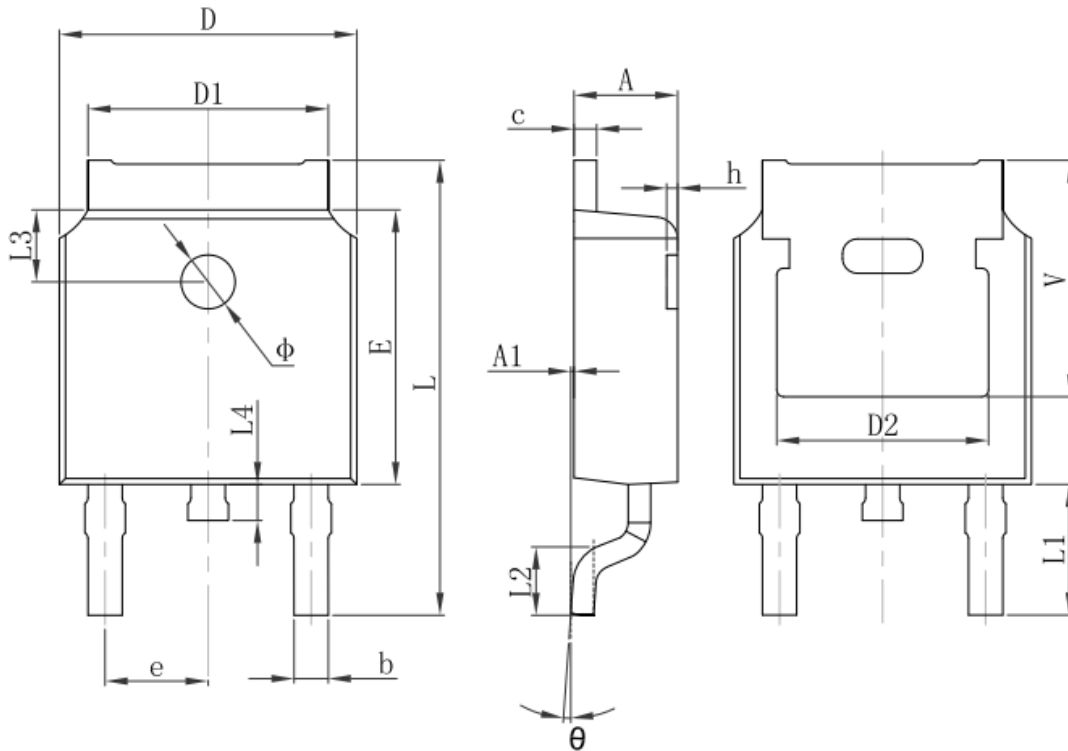
Package Information

SOT-223 PACKAGE OUTLINE DIMENSIONS



PCB Board

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.520	1.800	0.060	0.071
A1	0.000	0.100	0.000	0.004
A2	1.500	1.700	0.059	0.067
b	0.660	0.820	0.026	0.032
c	0.250	0.350	0.010	0.014
D	6.200	6.400	0.244	0.252
D1	2.900	3.100	0.114	0.122
E	3.300	3.700	0.130	0.146
E1	6.830	7.070	0.269	0.278
e	2.300(BSC)		0.091(BSC)	
e1	4.500	4.700	0.177	0.185
L	0.900	1.150	0.035	0.045
θ	0°	10°	0°	10°

TO-252-2L PACKAGE OUTLINE DIMENSIONS


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.660	0.860	0.026	0.034
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	4.830 REF.		0.190 REF.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.800	10.400	0.386	0.409
L1	2.900 REF.		0.114 REF.	
L2	1.400	1.700	0.055	0.067
L3	1.600 REF.		0.063 REF.	
L4	0.600	1.000	0.024	0.039
Φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 REF.		0.211 REF.	