1A Bipolar Linear Regulator

DESCRIPTION

SUM1117 is a series of low dropout three-terminal regulators with a dropout of 1.3 V at 1 A load current. SUM1117 features a low standby current 2 mA.

Other than a fixed version (V_{OUT} = 1.2 V, 1.5 V, 1.8 V, 2.5 V, 3.3 V, 5 V, and 12 V), SUM1117 has an adjustable version, which can provide an output voltage from 1.25 V to 12 V with only two external resistors.

SUM1117 offers thermal shut down and current limit functions, to assure stability of chip and power system. Trimming technique is used to guarantee output voltage accuracy within 2%. Other output voltage accuracy such as 1% can be customized on demand.

SUM1117 is available in SOT-223, TO-252 power packages.

FEATURES

- Other than a fixed version and an adjustable version, output value can be customized on demand.
- Maximum output current is 1 A
- Range of operation input voltage: Max 18 V
- Standby current: 2 mA (typ.)
- Line regulation: 0.1%/V (typ.)
- Load regulation: 10 mV (typ.)
- Environment Temperature: -40℃ ~ 85℃
- Compatible with tantalum capacitor, electrolytic capacitor and MLCC.

APPLICATIONS

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

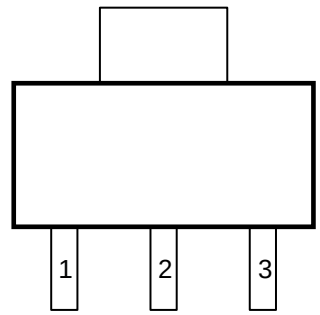
ORDER INFORMATION

Model	Package	Ordering Number	Packing Option
SUM1117	SOT-223	SUM1117-XXKD	Tape and Reel 2500
		SUM1117-ADJKD	
	TO-252	SUM1117-XXAB	Tape and Reel 2500
		SUM1117-ADJAB	

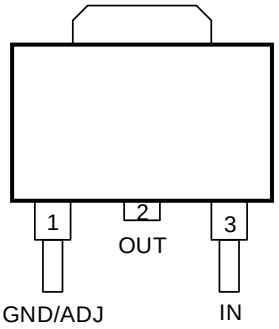
*XX: When expressed as 18, the output voltage is 1.8 V; when expressed as 30 the output voltage is 3.0 V.

ADJ = Output adjustable

PIN CONFIGURATION (TOP VIEW)



SOT-223



TO-252

PIN DESCRIPTIONS

Pin		Symbol	Description
SOT-223	TO-252		
1	1	GND/ADJ	Ground Pin/Adjustable
2	2	OUT	Supply Voltage Input
3	3	IN	Output Voltage

RECOMMENDED WORK CONDITIONS

Parameter	Value
Input Voltage Range	Max. 16V*
Operating Junction Temperature(Tj)	-40℃ ~ 85℃

* Exceptional for SUM1117-12, the maximum input voltage for SUM1117-12 is 20 V.

ABSOLUTE MAXIMUM RATING(1)

Parameter		Value
Max Input Voltage		18 V
Junction Temperature(T_j)		150℃
Ambient Temperature(Ta)		-40℃ ~ 85℃
Junction to Ambient Thermal Resistance (θ_{JA})(2)	SOT-223	70℃/ W
	TO-252	50℃/ W
Storage Temperature(Ts)		-65℃ ~ 150℃
Lead Temperature & Time		260℃, 10 S

NOTES:

(1) Stresses beyond those listed under “ABSOLUTE MAXIMUM RATINGS” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

(2) This particular frame decreases the total thermal resistance of the package and increases its ability to dissipate power when an appropriate area of copper on the printed circuit board is available for heat-sinking.

CAUTION

This integrated circuit can be damaged by ESD if you don’t pay attention to ESD protection. SUMSEMI recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications. SUMSEMI reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact SUMSEMI sales office to get the latest datasheet.

ELECTRICAL CHARACTERISTICS

Tj = 25℃

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{REF}	Reference Voltage	SUM1117-ADJ 10 mA ≤ I_{OUT} ≤ 1 A, V_{IN} = 3.25 V	1.225	1.25	1.275	V
V_{OUT}	Output Voltage	SUM1117-1.2 V 0 ≤ I_{OUT} ≤ 1 A, V_{IN} = 3.2 V	1.176	1.2	1.224	V
		SUM1117-1.5 V 0 ≤ I_{OUT} ≤ 1 A, V_{IN} = 3.5 V	1.47	1.5	1.53	V
		SUM1117-1.8 V 0 ≤ I_{OUT} ≤ 1 A, V_{IN} = 3.8 V	1.764	1.8	1.836	V
		SUM1117-2.5 V 0 ≤ I_{OUT} ≤ 1 A, V_{IN} = 4.5 V	2.45	2.5	2.55	V
		SUM1117-3.3 V 0 ≤ I_{OUT} ≤ 1 A, V_{IN} = 5.3 V	3.234	3.3	3.366	V
		SUM1117-5.0 V 0 ≤ I_{OUT} ≤ 1 A, V_{IN} = 7.0 V	4.9	5	5.1	V
		SUM1117-12.0 V 0 ≤ I_{OUT} ≤ 1 A, V_{IN} = 14 V	11.76	12	12.24	V
ΔV_{OUT}	Line Regulation	SUM1117-1.2 V I_{OUT} = 10 mA, 2.7 V ≤ V_{IN} ≤ 15 V		0.1	0.2	%/V
		SUM1117-ADJ I_{OUT} = 10 mA, 2.75 V ≤ V_{IN} ≤ 16 V		0.1	0.2	%/V
		SUM1117-1.5 V I_{OUT} = 10 mA, 3.0 V ≤ V_{IN} ≤ 16 V		0.1	0.2	%/V
		SUM1117-1.8 V I_{OUT} = 10 mA, 3.3 V ≤ V_{IN} ≤ 16 V		0.1	0.2	%/V
		SUM1117-2.5 V I_{OUT} = 10 mA, 4.0 V ≤ V_{IN} ≤ 16 V		0.1	0.2	%/V
		SUM1117-3.3 V I_{OUT} = 10 mA, 4.8 V ≤ V_{IN} ≤ 16 V		0.1	0.2	%/V
		SUM1117-5.0 V I_{OUT} = 10 mA, 6.5 V ≤ V_{IN} ≤ 16 V		0.1	0.2	%/V
		SUM1117-12.0 V I_{OUT} = 10 mA, 13.5 V ≤ V_{IN} ≤ 20 V		0.1	0.2	%/V
ΔV_{OUT}	Load Regulation	SUM1117-ADJ V_{IN} = 2.7 V, 10 mA ≤ I_{OUT} ≤ 1 A		10	30	mV
		SUM1117-ADJ V_{IN} = 2.75 V, 10 mA ≤ I_{OUT} ≤ 1 A		10	30	mV
		SUM1117-1.5 V V_{IN} = 3.0 V, 10 mA ≤ I_{OUT} ≤ 1 A		10	30	mV

ELECTRICAL CHARACTERISTICS

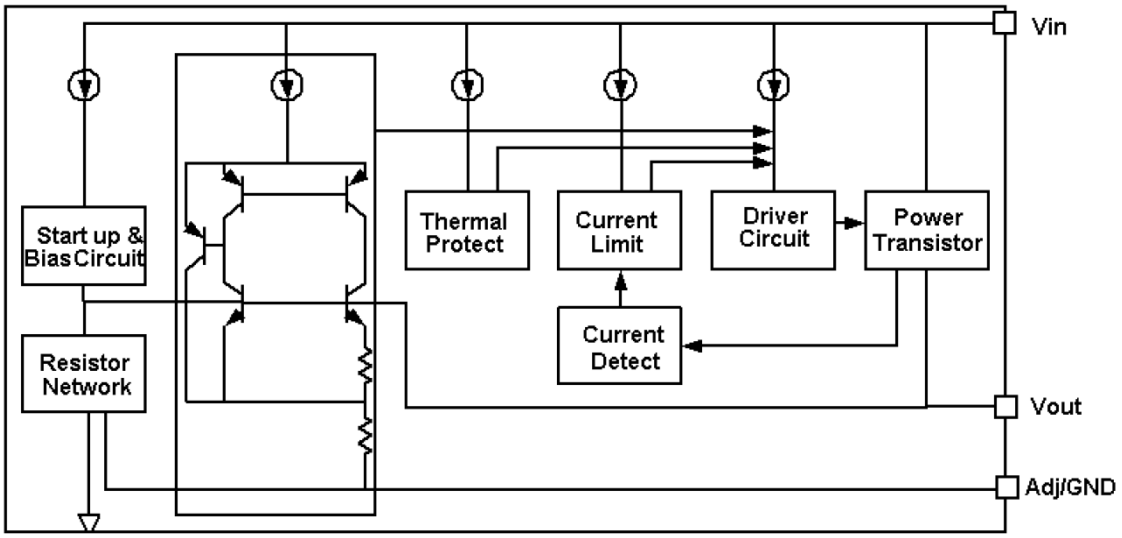
Tj = 25℃

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
ΔV_{OUT}	Load Regulation	SUM1117-1.8 V V_{IN} = 3.3 V, 10 mA ≤ I_{OUT} ≤ 1 A		10	30	mV
		SUM1117-2.5 V V_{IN} = 4.0 V, 10 mA ≤ I_{OUT} ≤ 1 A		10	30	mV
		SUM1117-3.3 V V_{IN} = 4.8 V, 10 mA ≤ I_{OUT} ≤ 1 A		10	30	mV
		SUM1117-5.0 V V_{IN} = 6.5 V, 10 mA ≤ I_{OUT} ≤ 1 A		10	30	mV
		SUM1117-12.0 V V_{IN} = 13.5 V, 10 mA ≤ I_{OUT} ≤ 1 A		10	30	mV
V_{DROP}	Dropout Voltage	I_{OUT} = 100 mA		1.23	1.3	V
		I_{OUT} = 1 A		1.3	1.5	V
I_{LIMIT}	Current Limit	V_{IN} – V_{OUT} = 2 V, Tj = 25°C	1			A
I_{MIN}	Minimum Load Current	SUM1117-ADJ		2	10	mA
I_Q	Quiescent Current	SUM1117-1.2 V, V_{IN} = 10 V		2	5	mA
		SUM1117-1.5 V, V_{IN} = 12 V		2	5	mA
		SUM1117-1.8 V, V_{IN} = 12 V		2	5	mA
		SUM1117-2.5 V, V_{IN} = 12 V		2	5	mA
		SUM1117-3.3 V, V_{IN} = 12 V		2	5	mA
		SUM1117-5.0 V, V_{IN} = 12 V		2	5	mA
		SUM1117-12.0 V, V_{IN} = 20 V		2	5	mA
I_{ADJ}	Adjust Pin Current	SUM1117-ADJ		55	120	μA
		V_{IN} = 5 V, 10 mA ≤ I_{OUT} ≤ 1 A				
Ichange	Iadj change	SUM1117-ADJ		0.2	10	μA
		V_{IN} = 5 V, 10 mA ≤ I_{OUT} ≤ 1 A				
ΔV/ΔT	Temperature coefficient			±100		ppm
PSRR	Power Supply Rejection Ratio	f = 100 Hz, C_{OUT} = 22 μF, I_{OUT} = 10 mA, V_{OUT} = 3.3 V		62		dB
		f = 1 kHz, C_{OUT} = 22 μF, I_{OUT} = 10 mA, V_{OUT} = 3.3 V		60		dB

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

Note2: Load current smaller than minimum load current of SUM1117-ADJ will lead to unstable or oscillation output.

BLOCK DIAGRAM



DETAILED DESCRIPTION

SUM1117 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, current limit, power transistors and its driver circuit and so on.

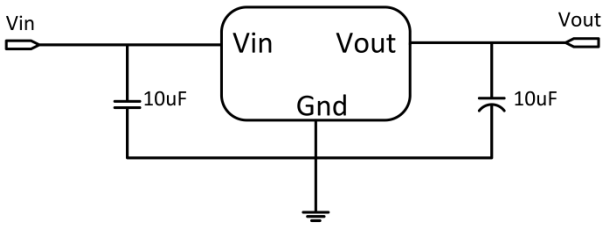
The thermal shut down modules can assure chip and its application system working safety when the junction temperature is larger than 140°C.

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

SUM1117 has an adjustable version and six fixed versions (1.2 V, 1.5 V, 1.8 V, 2.5 V, 3.3 V, 5 V and 12 V)

Fixed Output Voltage Version

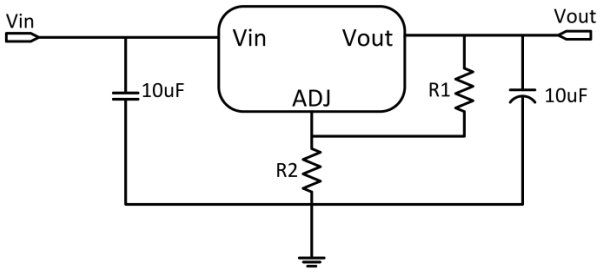


Application circuit of SUM1117 fixed version

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

SUM1117-ADJ provides a 1.25 V reference voltage. Any output voltage between 1.25 V ~ 12 V can be achievable by choosing two external resistors (schematic is shown below), R1 and R2



Application Circuit of SUM1117-ADJ

The output voltage of adjustable version follows the equation: V_{OUT} = 1.25 × (1+R2/R1) + IAdj × R2. We can ignore IAdj because IAdj (about 50 μA) is much less than the current of R1 (about 2 ~ 10 mA).

1) To meet the minimum load current (>10mA) requirement, R1 is recommended to be 125 ohm or lower. As SUM1117-ADJ can keep itself stable at load current about 2 mA, R1 is not allowed to be higher than 625 ohm.

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 R1 to prevent ripple from being amplified. As R1 is normally in the range of 100 Ω ~ 500 Ω, the value of C_{ADJ} should satisfy this equation: $1/(2\pi \times f_{ripple} \times C_{ADJ}) < R1$.

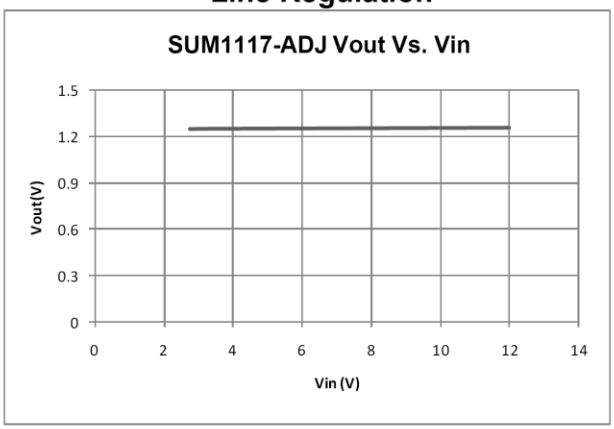
THERMAL CONSIDERATIONS

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 SUM1117 is very large. SUM1117 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 5 cm*5 cm (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 SUM1117 could allow on itself is less than 1 W. And furthermore, SUM1117 will work at junction temperature higher than 125°C under such condition and no lifetime is guaranteed.

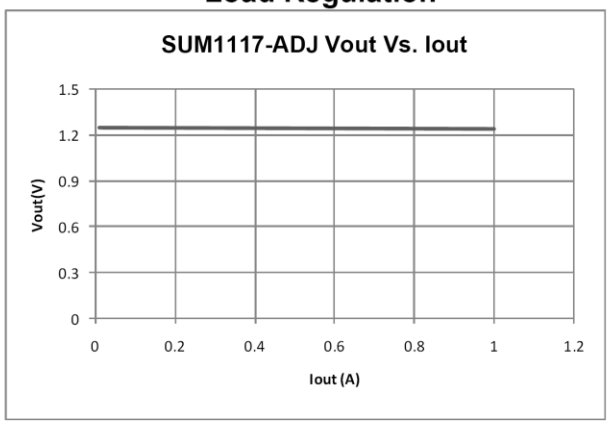
TYPICAL PERFORMANCE CHARACTERISTICS

T=25°C unless specified.

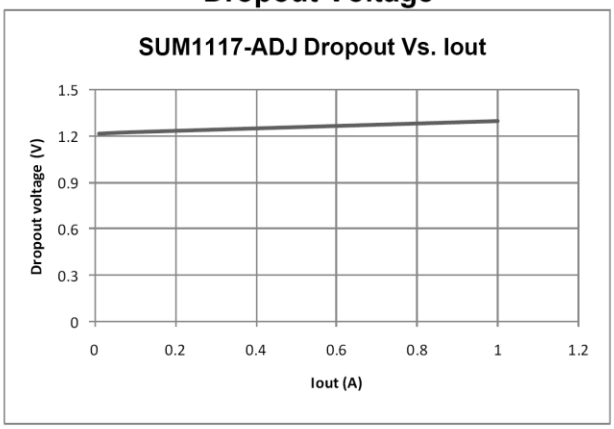
Line Regulation



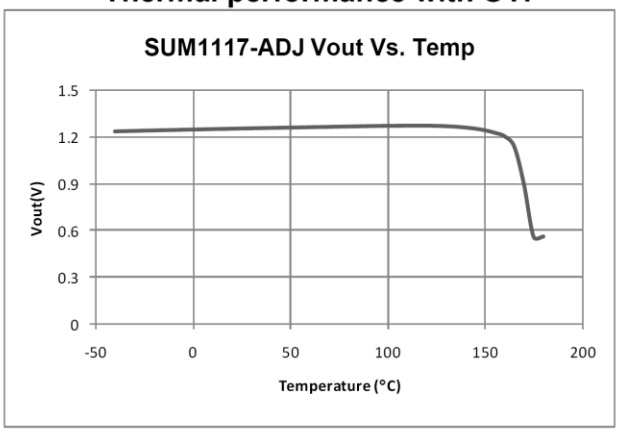
Load Regulation



Dropout Voltage

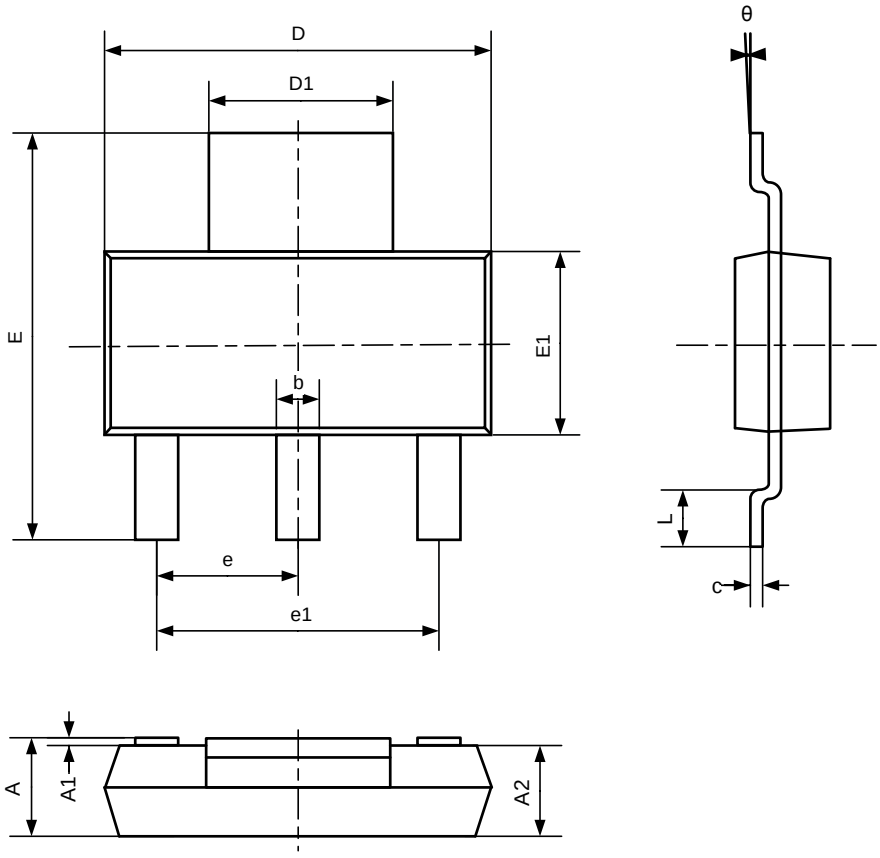


Thermal performance with OTP



PACKAGE OUTLINE

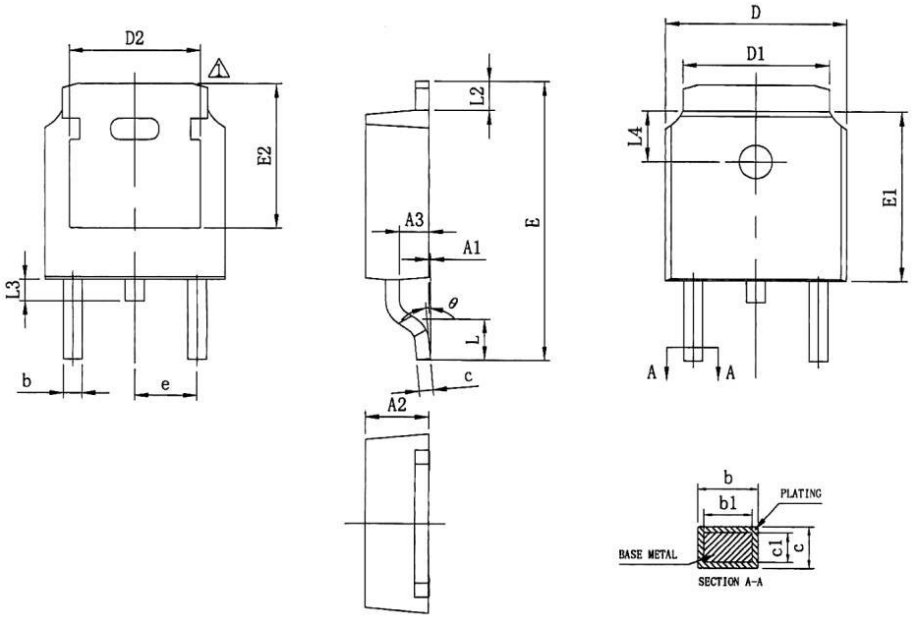
SOT-223



Symbol	Dimensions In Millimeters	
	Min	Max
A		1.800
A1	0.020	0.100
A2	1.500	1.700
b	0.670	0.800
c	0.300	0.350
D	6.480	6.580
D1	2.950	3.050
E	6.800	7.200
E1	3.400	3.600
e	2.300BSC	
e1	4.500	4.700
L	0.800	1.200
θ	0°	8°

PACKAGE OUTLINE

TO-252



Symbol	Dimensions In Millimeters	
	Min	Max
A1	0	0.100
A2	2.200	2.400
A3	1.020	1.120
b	0.750	0.840
b1	0.740	0.790
c	0.490	0.570
c1	0.480	0.520
D	6.500	6.700
D1	5.334REF	
D2	4.700	4.920
E	9.900	10.30
E1	6.000	6.200
E2	5.300REF	
e	2.286BSC	
L	1.400	1.600
L2	0.900	1.250
L3	0.600	1.000
L4	1.700	1.900
θ	0	8°

V 1.5