AS1115

600mA Low Dropout NPN Voltage Regulator

FEATURES
- Guaranteed 600mA Output
- Three Terminal Adjustable Or Fixed 1.5V, 2.5V, 3V, 3.3V & 5V
- Very Low Quiescent Current
- Low Dropout Voltage Of 1.2 Volts At Full Load
- Extremely Tight Load And Line Regulation
- Very Low Temperature Coefficient
- Logic-Controlled Electronic Shutdown
- Internal Overcurrent Limiting & Thermal Overload Protection
- Surface Mount Package SOT-223, TO-263, TO-252 , TO-220 & SO-8

APPLICATIONS
- Portable/ Palm Top / Notebook Computers
- Battery Chargers
- Disk Drives
- Portable Consumer Equipment
- Portable Instrumentation
- SMPS Post-Regulator

PRODUCT DESCRIPTION
The AS1115 is a low power positive-voltage regulator designed to meet 600mA output current. This device is an excellent choice for use in battery-powered applications, as active terminators for the SCSI bus, and portable computers. The AS1115 features very low quiescent current and very low dropout voltage of 1.2V at a full load and lower as output current decreases. This product is available as an adjustable or fixed 3V, 3.3V, and 5V output voltages.

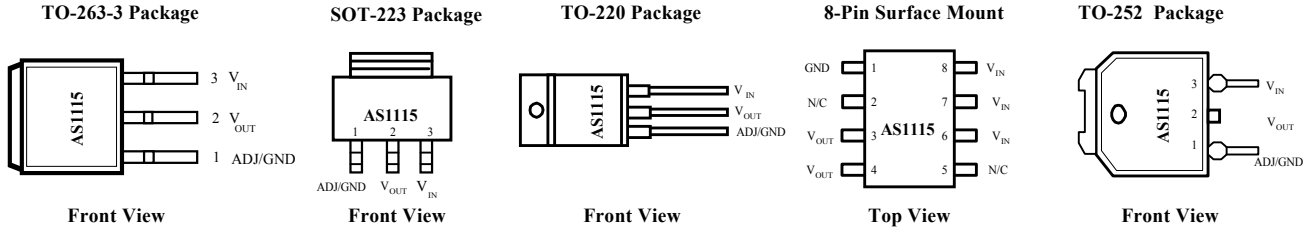
The AS1115 is offered in a 3-pin surface mount package SOT-223, TO-252, TO-220 & TO-263. The output capacitor of 10µF or larger is needed for output stability of AS1115 as required by most of the other regulator circuits.

ORDERING INFORMATION

TO-220 3-PIN	TO-263 3-PIN	SOT-223 3-PIN	PLASTIC SOIC 8-PIN	TO-252 DPAK	Oper. Temp. Range
AS1115U	AS1115T	AS1115M3	AS1115S	AS1115R	-40°C to +85°C
AS1115U-X	AS1115T-X	AS1115M3-X	AS1115S-X	AS1115R-X	-40°C to +85°C

X = Output Voltage (X = 1.5V, 2.5V, 3.0V, 3.3V, 5.0V or Blank for Adjustable).

PIN CONNECTIONS



ABSOLUTE MAXIMUM RATINGS

Power Dissipation.....Internally Limited
Lead Temp. (Soldering, 5 Seconds) ..... 260°C
Storage Temperature Range ..... -65° to +150°C
Operating Junction Temperature Range
AS1115 ..... -40C° to +125°C

Input Supply Voltage ..... -20V to +20V
ESD Rating ..... 2KV Min

ELECTRICAL CHARACTERISTICS

at $V_{IN} = V_{OUT} + 1$, Ta=25°C, CL =3.3µf, unless otherwise specified. Limits in **Boldface** apply over the full operating temperature range.

Parameter	Conditions	Typ	AS1115 Min	AS1115 Max	Units
1.5V Version					
Output Voltage	I_{OUT}=10mA, V_{IN}=5.00V $0 \le I_{OUT} \le 600mA$, $4.50 \le V_{IN} \le 10V$	1.500	1.485 **1.470**	1.515 **1.530**	V
2.5V Version					
Output Voltage	I_{OUT}=10mA, V_{IN}=5.00V $0 \le I_{OUT} \le 600mA$, $4.50 \le V_{IN} \le 10V$	2.500	2.475 **2.450**	2.525 **2.550**	V
3.0V Version					
Output Voltage	I_{OUT}=10mA, V_{IN}=5.00V $0 \le I_{OUT} \le 600mA$, $4.50 \le V_{IN} \le 10V$	3.000	2.970 **2.940**	3.030 **3.060**	V
3.3 V Version					
Output Voltage	I_{OUT}=10mA, V_{IN}=5.00V $0 \le I_{OUT} \le 600mA$, $4.50 \le V_{IN} \le 10V$	3.300	3.267 **3.234**	3.333 **3.366**	V
5.0V Version					
Output Voltage	I_{OUT}=10mA, V_{IN}=5.00V $0 \le I_{OUT} \le 600mA$, $4.50 \le V_{IN} \le 10$	5.000	4.950 **4.900**	5.050 **5.100**	V
All Output Voltage					
Reference Voltage	I_{OUT}=10mA, $(V_{IN}- V_{IN}) = 2V$ $10 \le I_{OUT} \le 600mA$, $1.4 \le (V_{IN} - V_{IN}) \le 10V$	1.250	1.238 1.225	1.262 1.270	V
Output Voltage Temperature Stability	(Note 1)			**0.05**	%
Line Regulation	$4.50V \le V_{IN} \le 12V$, V_{OUT}=3.00, I_{OUT}=0 $4.80V \le V_{IN} \le 12V$, V_{OUT}=3.30, I_{OUT}=0 $6.50V \le V_{IN} \le 15V$, V_{OUT}=5.00, I_{OUT}=0	1.00 1.00 1.00		7.00 7.00 10.00	mV
Load Regulation	$0 \le I_{OUT} \le 600mA$, V_{IN}=4.50V, V_{OUT}=3.00 $0 \le I_{OUT} \le 600mA$, V_{IN}=4.80V, V_{OUT}=3.30 $0 \le I_{OUT} \le 600mA$, V_{IN}=6.50V, V_{OUT}=5.00	1.00 1.00 1.00		12.00 12.00 15.00	mV
Dropout Voltage (Note 2)	I_L = 100mA I_L = 600mA	1.00 1.05		1.10 1.15	V
Quiescent Current	$4.25V \le V_{IN} \le 6.5V$	5.00		10.00	mA
Current Limit	$(V_{IN}-V_{OUT})$=5V	850		1000	mA
Thermal Regulation	25°°C,30mS Pulse	0.01		0.1	%/W
Ripple Rejection	f_{RIPPLE}=120Hz, $(V_{IN}-V_{OUT})$ = 3V, $V_{RIPPLE}=1V_{p-p}$	60		75	dB
Long Term Stability	125°C, 1000Hrs			0.03	%
RMS Output Noise	% of V_{OUT}, 10Hz≤f≤10kHz			0.003	%
Thermal Resistance	Junction to case, at tab			15	°C/W°

Note 1: Output temperature coefficient is defined as the worst case voltage change divided by the total temperature range

Note 2: Dropout voltage is defined as the input to output differential at which the output voltage drops 100mV below its nominal value measured at 1V differential at very low values of programmed output voltage, the minimum input supply voltage of 2V (2.3V over temperature) must be taken into account.

Note 3: Thermal regulation is defined as the change in output voltage at a time T after a change in power dissipation is applied. excluding loads or line regulation effect

APPLICATION NOTES EXTERNAL CAPACITOR

To ensure the stability of the AS1115 an output capacitor of at least 10µF (tantalum)or 50µF (aluminum) is required. The value may change based on the application requirements on the output load or temperature range. The capacitor equivalent series resistance (ESR) will effect the AS1115 stability. The value of ESR can vary from the type of capacitor used in the applications. The recommended value for ESR is 0.5Ω. The output capacitance could increase in size to above the minimum value. The larger value of output capacitance as high as 100µF can improve the load transient response.

SOLDERING METHODS

The AS1115 SOT-223 package is designed to be compatible with infrared reflow or vapor-phase reflow soldering techniques. During soldering the non-active or mildly active fluxes may be used. The AS1115 die is attached to the heatsink lead which exits opposite the input, output, and ground pins.

Hand soldering and wave soldering should be avoided since these methods can cause damage to the device with excessive thermal gradients on the package. The SOT-223 recommended soldering method are as follows: vapor phase reflow and infrared reflow with the component preheated to within 65°C of the soldering temperature range.

THERMAL CHARACTERISTICS

The thermal resistance of AS1115 is 15°C/W from junction to tab and 31 °C/W from tab to ambient for a total of 46 °C/W from junction to ambient. The AS1115 features the internal thermal limiting to protect the device during overload conditions. Special care needs to be taken during continuos load conditions the maximum junction temperature does not exceed 125 °C.

Taking the FR-4 printed circuit board and 1/16 thick with 1 ounce copper foil as an experiment (fig.1 & fig.2), the PCB material is effective at transmitting heat with the tab attached to the pad area and a ground plane layer on the backside of the substrate. Refer to table 1 for the results of the experiment.

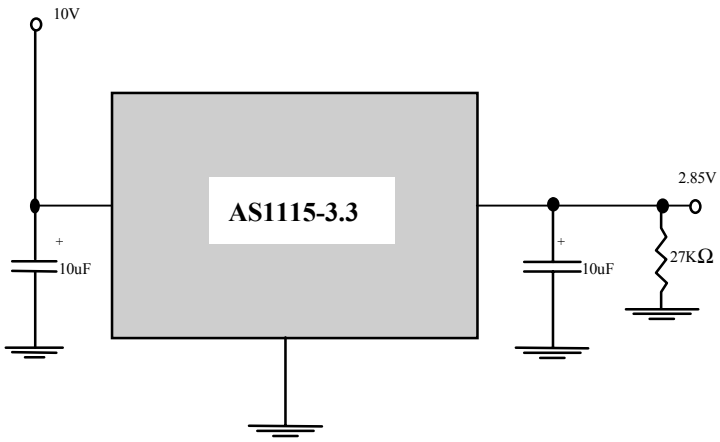
The thermal interaction from other components in the application can effect the thermal resistance of the AS1115. The actual thermal resistance can be determined with experimentation. AS1115 power dissipation is calculated as follows:

$$P_D = (V_{IN} - V_{OUT})(I_{OUT})$$

Maximum Junction Temperature range:

$T_J = T_{ambient}$ (max) + P_D* thermal resistance(Junction-to-ambient)

Maximum Junction temperature must not exceed the 125°C.



$P_O = (10V - 2.85)(105mA) = (7.15)(105mA) = 703mW$

Fig. 1. Circuit Layout, Thermal Experiments.

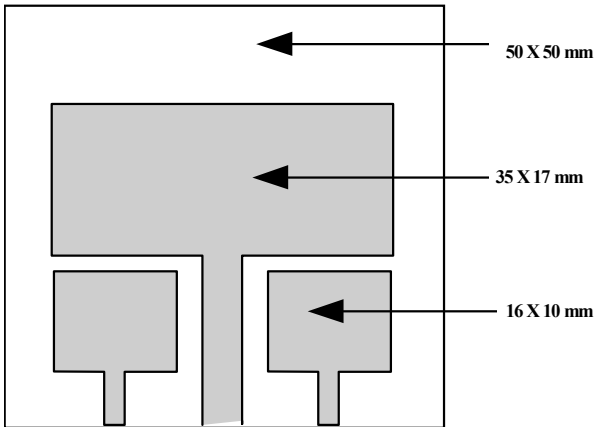
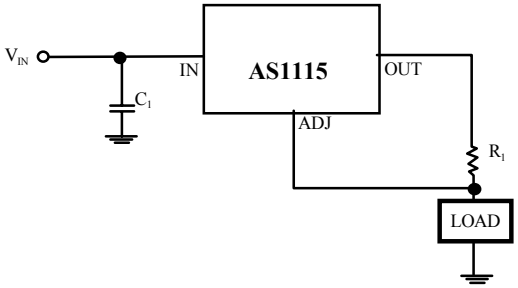


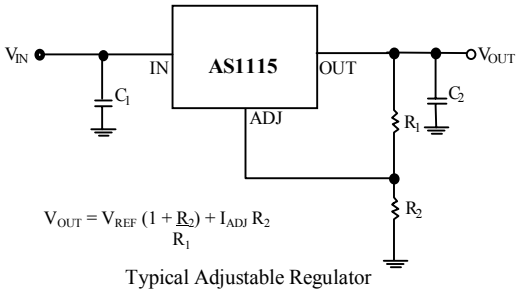
Fig. 2. Substrate Layout for SOT-223

Table 1.

TOTAL PC BOARD AREA	TOPDIDE COPPER AREA	BACKSIDE COPPER AREA	THERMAL RESISTANCE JUNCTION TO AMBIENT
2500mm	2500mm	2500mm	46°C/W°
2500mm	1250mm	2500mm	47°C/W°
2500mm	950mm	2500mm	49°C/W°
2500mm	2500mm	0	51°C/W°
2500mm	1800mm	0	53°C/W°
1600mm	600mm	1600mm	55°C/W°
2500mm	1250mm	0	58°C/W°
2500mm	915mm	0	59°C/W°
1600mm	600mm	0	67°C/W°
900mm	240mm	900mm	72°C/W°
900mm	240mm	0	85°C/W°



600mA Current Output



Typical Adjustable Regulator