DESCRIPTION

The A6318 is a positive, adjustable linear regulator features enable pin function and low quiescent current (Typ. 65uA) with low dropout voltage, making it ideal for battery powered applications.

The A6318 output voltage is adjustable from 1.2V to 5V. The extreme high PSRR can suppress the ripples effectively from the input, especially the AC ripples. Space-saving SOT-25 is attractive for portable and handheld applications. They have both Thermal shutdown and current limit feature to prevent device failure under extreme operating conditions. A6318 is stable with an output capacitor of value 2.2uF or greater.

The A6318 is available in a SOT-25 package.

ORDERING INFORMATION

Package Type	Part Number	
SOT-25	E5	A6318E5R-ADJ
Note	ADJ- Adjustable R: Tape & Reel	
AiT provides all Pb free products		

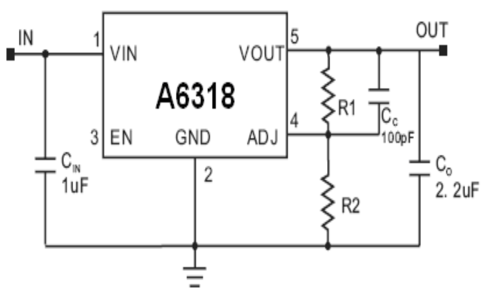
FEATURES

- Low Dropout Voltage: 180mV@300mA
- Accuracy within ±2%
- Quiescent Current: Typ. 65uA
- High PSRR: 67dB@100Hz
- Excellent Line/Load Regulation
- Fast Response
- Current Limiting
- Short Circuit Protection
- Low Temperature Coefficient
- Shutdown Current : 0.5uA
- Thermal Shutdown
- Available in SOT-25 Package

APPLICATION

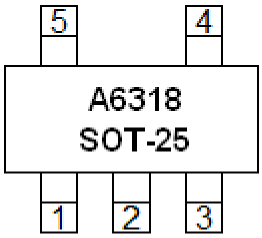
- Cordless Phone
- Cellular Phone
- Bluetooth Earphone
- Digital Camera
- Portable Electronics
- WLAN

Typical Application



$V_{OUT} = V_{REF} * (R1+R2) / R2$

PIN DESCRIPTION



Pin #	Pin Name	Description
1	V_{IN}	Input
2	GND	Ground
3	EN	Chip Enable (Active High)
4	ADJ	Adjustable Pin
5	V_{OUT}	Output

Absolute Maximum Ratings

Input Voltage	6V
Output Current	300mA
Output Pin Voltage	GND -0.3 to V_{IN} +0.3V
Lead Soldering Temperature (5sec)	300°C
Storage Temperature	-65°C to 150°C
Junction Temperature	-40 °C to 125 °C
Ambient Temperature	-40°C
Thermal Information	
Thermal Resistance - Junction to Case (θ_{JC})	130 °C/W
Thermal Resistance - Junction to Ambient (θ_{JA})	250 °C/W
Internal Power Dissipation (P_D)	400mW

Stresses above 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 Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

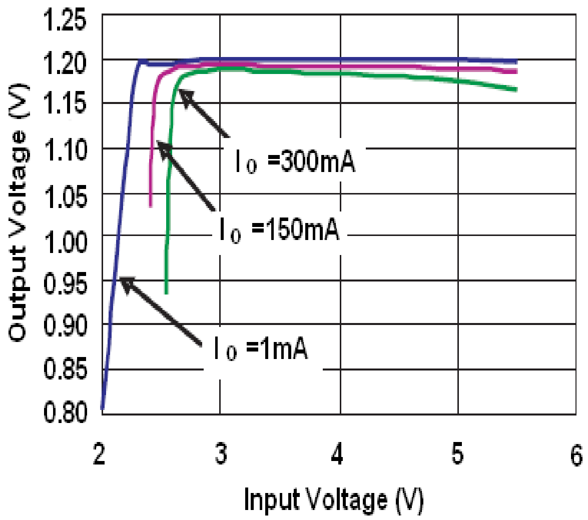
T_A=25°C, V_{IN}=4V, V_O=3V, C_{IN}=1uF, C_O=2.2uF, unless otherwise noted.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{IN}	Input Voltage					5.5	V
V_O	Output Voltage			1.2		5	V
V_{REF}	Reference Voltage				1.235		V
V_O	Output Voltage Accuracy	I_O=1mA		-2		2	%
I_O	Output Current			300			mA
I_{SC}	Short Circuit Current	V_O=0V			150		mA
V_{DROP}	Dropout Voltage	I_O=300mA	2.5V≦V_O<3.3V		370	450	mV
			V_O≧3.3V		180	230	
I_{GND}	Ground Current	I_O=1mA to 300mA			70	90	uA
I_Q	Quiescent Current	I_O=0mA			65	90	uA
LNR	Line Regulation	I_O=1mA, V_{IN}=3V to 5V		-0.4	0.2	0.4	%V
LDR	Load Regulation	I_O=1mA to 300mA		-1	0.2	1	%
T_C	Temperature Coefficient				40		ppm/℃
OTS	Over Temperature Shutdown	I_O=1mA			150		℃
OTH	Over Temperature Hysteresis	I_O=1mA			30		℃
PSRR	Power Supply Ripple Rejection	I_O=100mA, V_O=1.2V	f=100Hz		67		dB
			f=1kHz		65		
			f=10kHz		42		
Vn	Output Noise	f=10Hz to 100kHz			50		uVrms
V_{IH}	EN Input High Threshold	V_{IN}=2.5V to 5V		1.5			V
V_{IL}	En Input Low Threshold	V_{IN}=2.5V to 5V				0.3	V
I_{SC}	Shutdown Current	V_{EN}=0V			0.01	1	uA

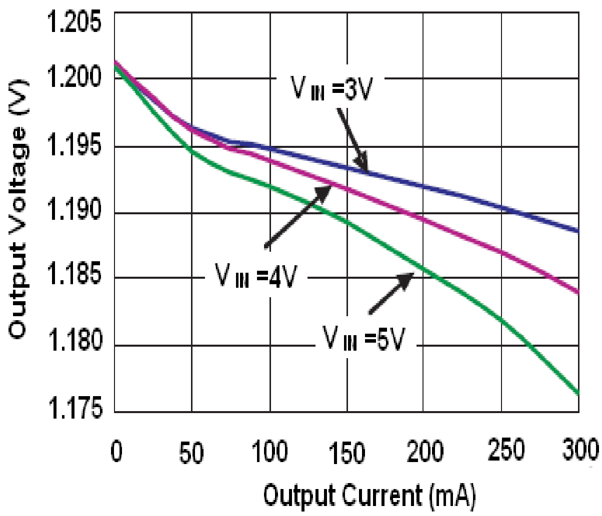
TYPICAL PERFORMANCE CHARACTERISTICS

T_A=25℃, V_O=1.2V, C_{IN}=1uF, C_O=2.2uF, unless otherwise noted.

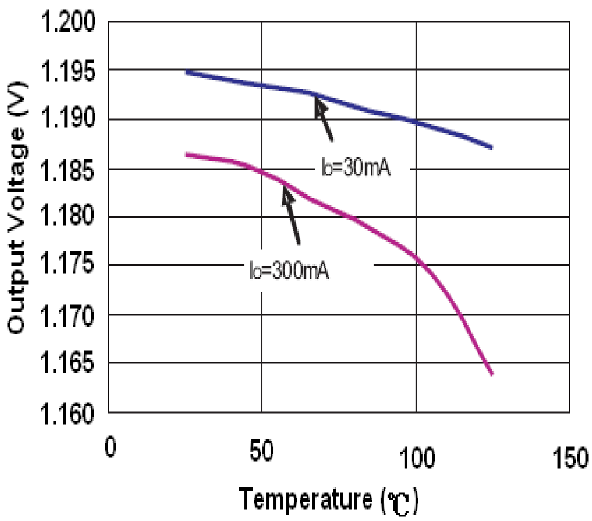
1. Output Voltage vs. Input Voltage



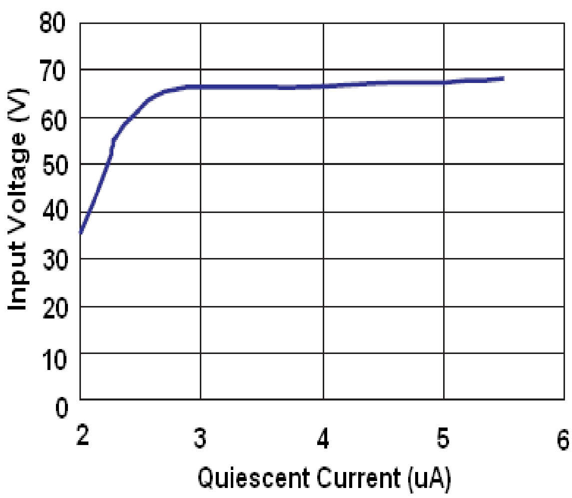
2. Output Voltage vs. Output Current



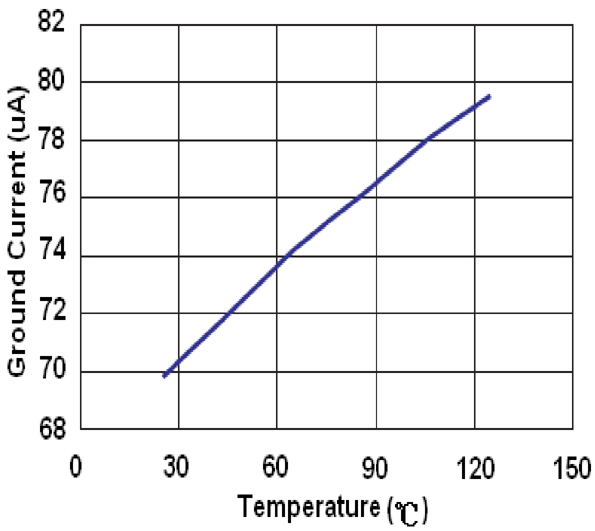
3. Output Voltage vs. Temperature



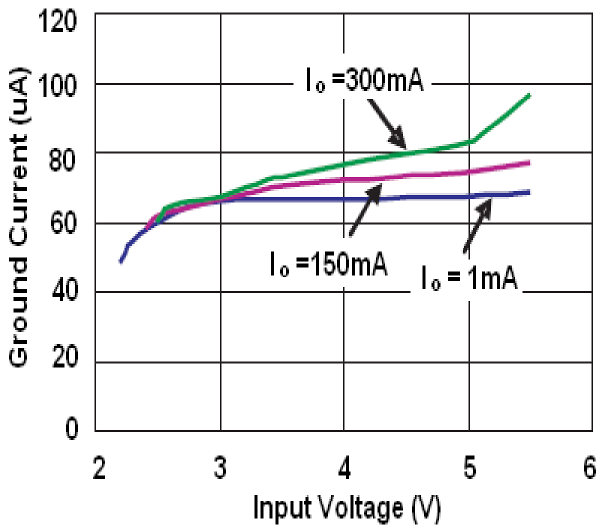
4. Quiescent Current vs. Input Voltage



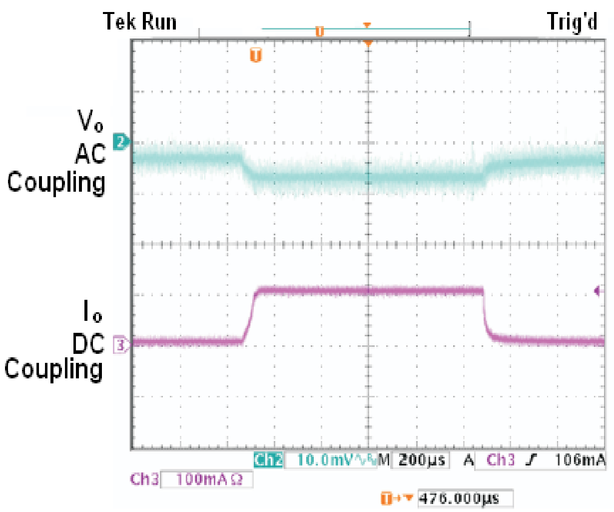
5. Ground Current vs. Temperature



6. Ground Current vs. Input Voltage

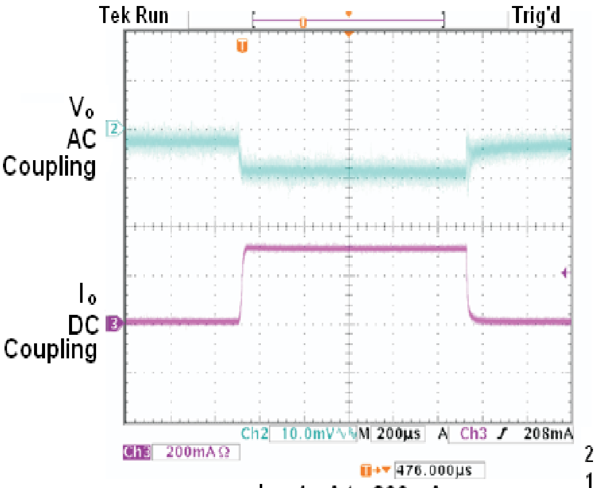


7-a. Load Regulation Transient Response



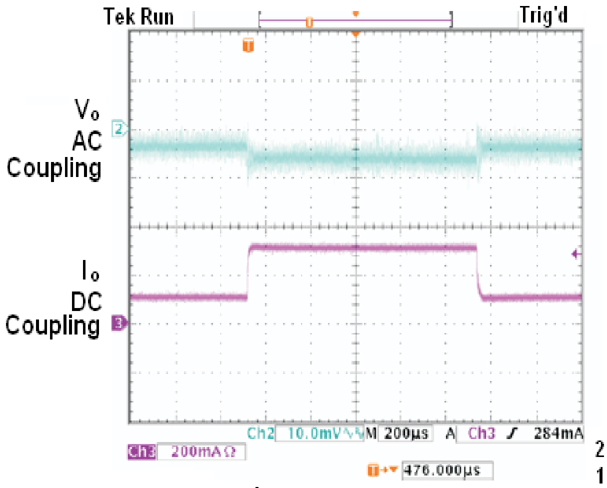
I_o =1mA to 100mA

7b.



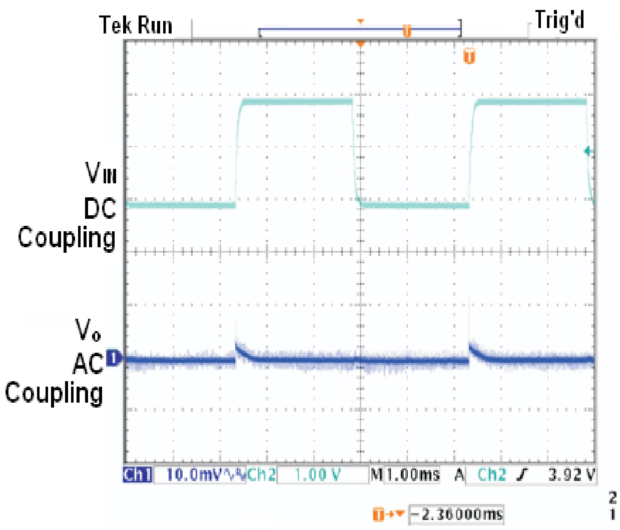
Io =1mA to 300mA

7c.



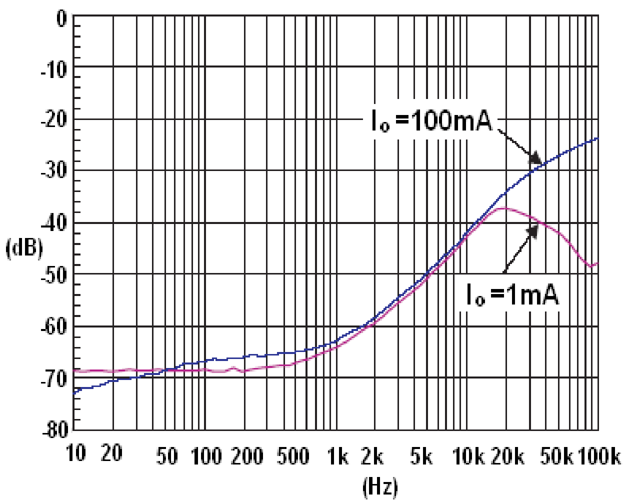
Io =100mA to 300mA

8. Line Regulation Transient Response

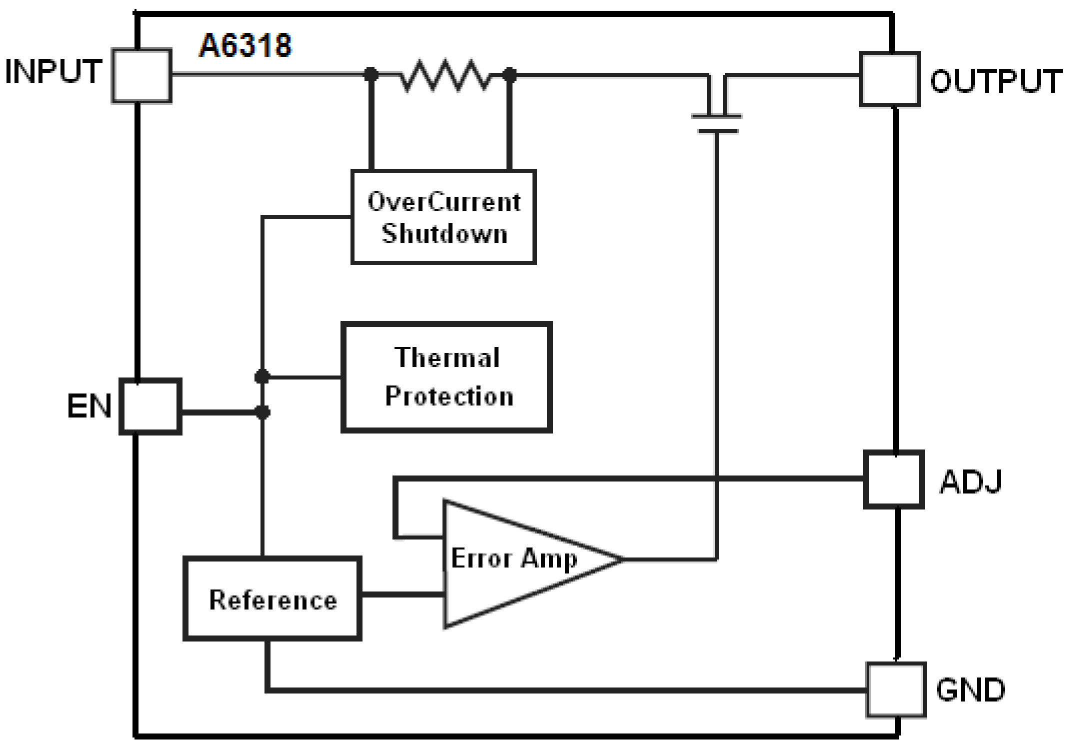


Io =1mA, VIN =3V to 5V

9.



BLOCK DIAGRAM



DETAILED INFORMATION

Capacitor Selection and Regulator Stability

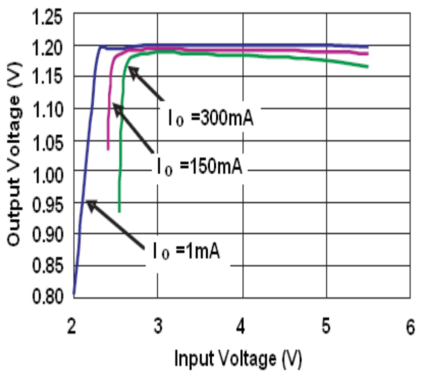
Similar to any low dropout regulator, the external capacitors used with the A6318 must be carefully selected for regulator stability and performance.

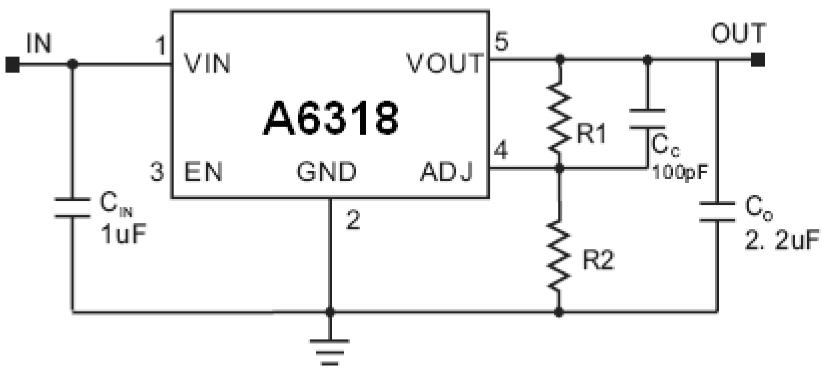
Using a capacitor, C_{IN} whose value is >1uF at the A6318 input pin, the amount of the capacitance can be in creased without limit. It is noted that the distance between C_{IN} and the input pin of the A6318 does not exceed 0.5 inch. A ceramic capacitor is suitable for the A6318. A capacitor with larger value and lower ESR (equivalent series resistance) provide better PSRR and line-transient response.

The A6318 is designed specifically to work with low ESR ceramic output capacitor in space-saving and performance consideration. Using a ceramic capacitor whose value is >2.2uF with ESR is >5mΩ on the A6318 output ensures stability.

ADJ Output Voltage Programming

The output voltage of the A6318 adjustable regulator is programmed by using an external resistor divider as show as below; the output voltage is calculated using:





Output Voltage vs. Input Voltage

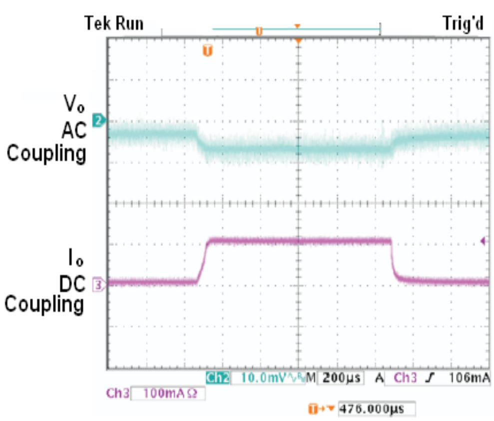
$V_O = V_{REF} (1+R1/R2)$

Resistor R1 and R2 should be chosen for approximately 7uA divider current. Lower value resistors can be used but offer no advantage and waste more power. Higher value should be avoided as leakage current at ADJ pin increase the output voltage error. C_C is unnecessary when R1 or R2 <20k. The recommended design procedure is to choose R2=169KΩ to set the divider current at 7uA and then calculate R1 using:

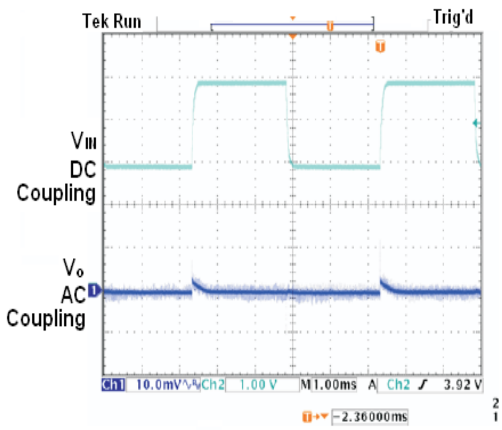
$$R1 = (V_O/V_{REF} - 1)R2$$

Load Transient Considerations

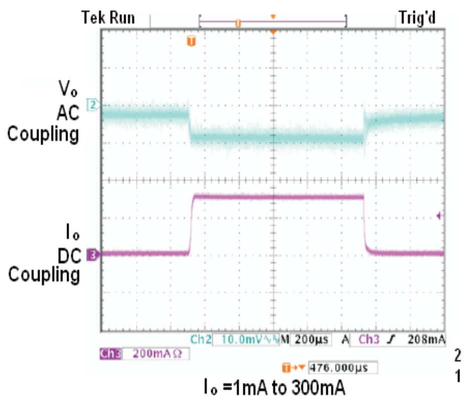
Below shows the A6318 load Transient response. It shows two components of the output response: a DC shift from the output impedance due to the load current change and transient response. The DE shift is quite small due to excellent load regulation of the A6318. The transient spike, resulting from a step change in the load current from 1mA to 300mA, is 20mV. The ESR of the output capacitor is critical to the transient spike. A larger capacitance along with smaller ESR results in a smaller spike.



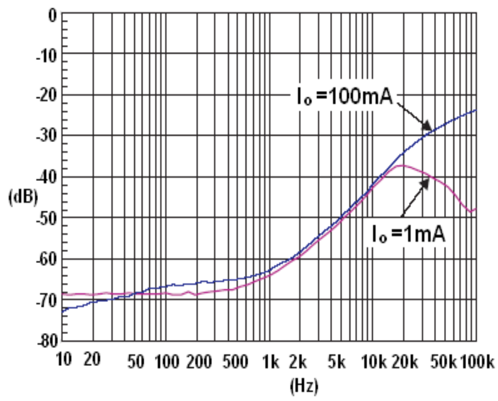
I_o =1mA to 100mA

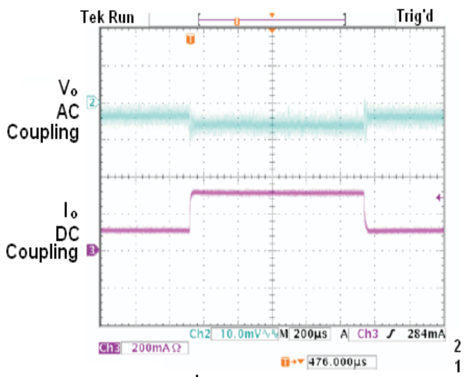


I_o =1mA, V_{IN} =3V to 5V



I_o =1mA to 300mA





I_o =100mA to 300mA

Shutdown Input Operation

The A6318 is shutdown by pulling the EN input low, and is also turned on by tying the EN input to VIN or leaving EN input floating.

Internal P-Channel Pass Transistor

The A6318 features a typical 0.75Ω P-Channel MOSFET device as a pass transistor.
The P-MOS pass transistor enables the A6318 to consume only 65uA of the ground current during low dropout, light-load, or heavy load operations. This feature will increase the battery operation life time.

Input-Output (Dropout) Voltage

A regulator's minimum input-output voltage differential (or dropout voltage) determines the lowest usable supply voltage. The A6318 has a typical 300mV dropout voltage. In battery powered systems, this will determine the useful end-of-life battery voltage.

Current Limit and Short Circuit Protection

The A6318 features a current limit, which monitors and controls the gate voltage of the pass transistor. The regulated gate voltage can limit the output current to 400mA. The A6318 has built-in short circuit current limit.

Thermal considerations

Thermal protection limits power dissipation in the A6318. When the operation junction in the A6318. When the operation junction temperature exceeds 150℃, the OTP (Over Temperature Protection) starts the thermal shutdown and turns the pass transistor off. The pass transistor resumes operation after the junction temperature drops below 120℃
For continuous operation, the junction temperature should be maintained below 125℃. The power dissipation is defined as:

$$P_D = (V_{IN} - V_{OUT}) * I_O + V_{IN} * I_{GND}$$

The maximum power dissipation depends on the thermal resistance of IC package, PCB layout, the rate of surrounding airflow and temperature difference between junction and ambient. The maximum power dissipation can be calculated by the following formula:

$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$

Where $T_{J(MAX)}$ is the maximum operation junction temperature 125℃. T_A is the ambient temperature. θ_{JA} is the thermal resistance from the junction the ambient.

For example, θ_{JA} is 250℃ /W for SOT-23, based on the standard JEDEC 51-3 for a single-payer thermal test board. The maximum power dissipation at T_A = 25℃ can be calculated by following formula:

$$P_{D(MAX)} = (125℃-25℃) / 250 = 0.4W$$

For Example, how to calculate the junction temperature of the A6318 SOT-23 package? If we use input voltage V_{IN} = 3.3V, at an output current I_O = 300mA and the case temperature T_A = 40℃ measured by the thermal couple while operating, then our power dissipation is defined as:

$$P_D = (3.3V-2.8V) * 300mA + 3.3V * 70uA \cong 150mW$$

And the junction temperature, TJ could be calculated as follows:

$T_J = T_A + P_D * \theta_{JA}$

T_J = 40℃ + 0.15W * 250℃/W

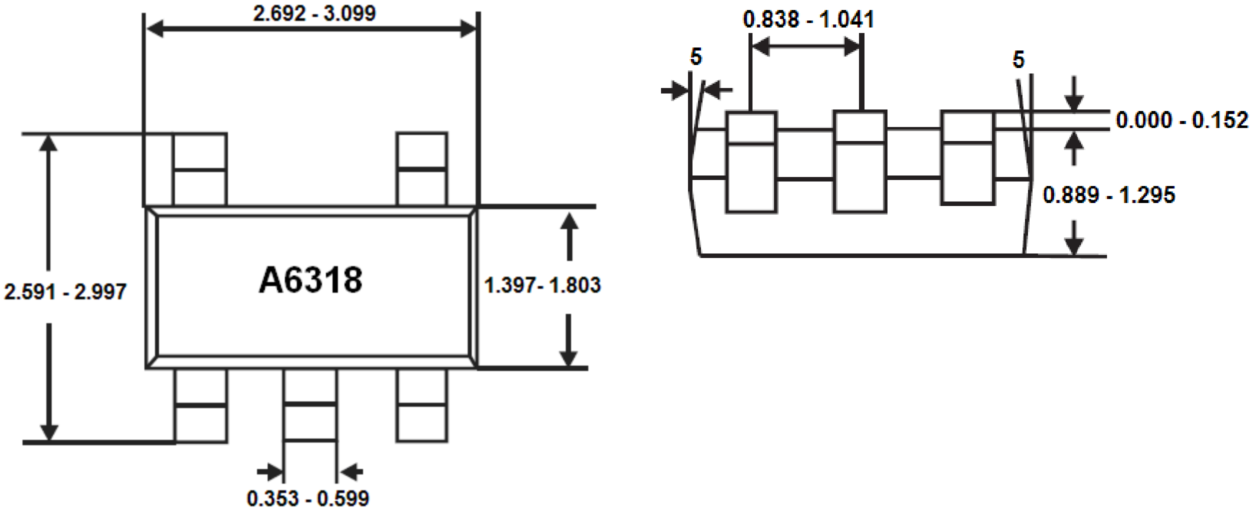
= 40℃ + 37.5℃

= 77.5℃ < $T_{J(MAX)}$ = 125℃

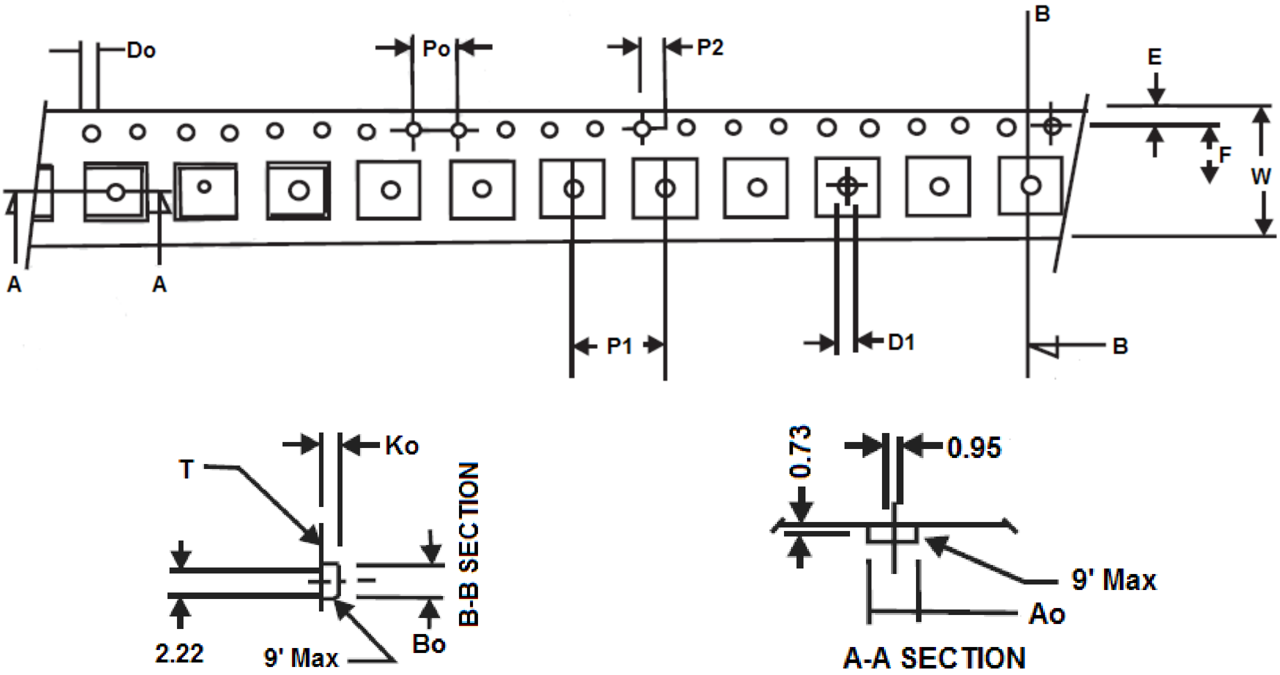
For this operation application, T_J is lower than absolute maximum operation junction temperature 125℃ and it's safe to use the A6318.

PACKAGE INFORMATION

Dimension in SOT-25 Package (Unit: mm)

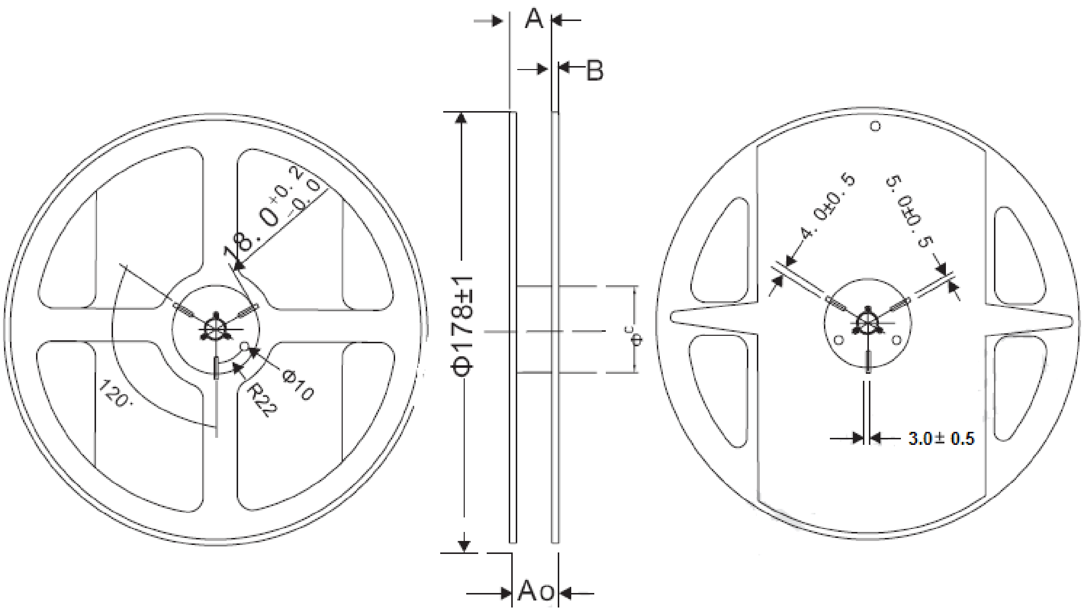


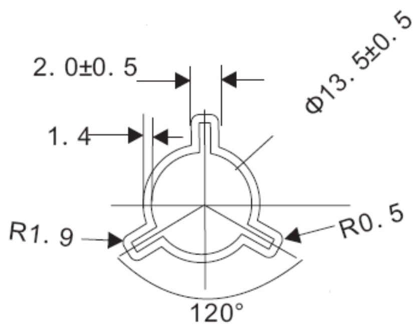
Tape Dimension



Symbol	Ao	Bo	Ko	Po	P1	P2	T
Spec	3.20±0.1	3.10±0.1	1.40±0.1	4.0±0.1	4.0±0.1	2.0±0.05	0.254±0.013
Symbol	E	F	Do	D1	W	10Po	
Spec	1.75±0.1	3.50±0.05	1.55±0.05	1.0±0.25	8.0+0.3 -0.1	40.0±0.2	

Reel Dimension





Symbol	mm
A±0.05	9.0
Ao±0.05	12.0
B	1.5
ØC$^{+1}_{-0}$	60