GJ2138

1.5A CMOS Low Dropout Voltage Regulator

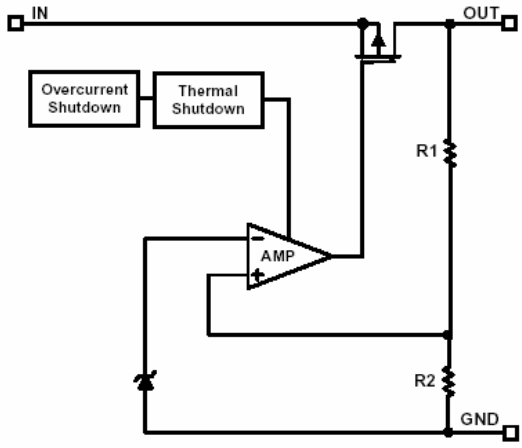
Description

The GJ2138 series of positive, linear regulators feature low quiescent current (45μA typ.) with low dropout voltage, making them ideal for battery applications.
These rugged devices have both Thermal Shutdown, and Current Fold-back to prevent device failure under the "Worst" of operating conditions.
The GJ2138 is stable with an output capacitance of 4.7μF or greater.

Features

- Very Low Dropout Voltage
- Guaranteed 1.5A output
- Over-Temperature Shutdown
- Current Limiting
- Short Circuit Current Fold-back
- Highly Accurate± 1.5%
- Low Temperature Coefficient

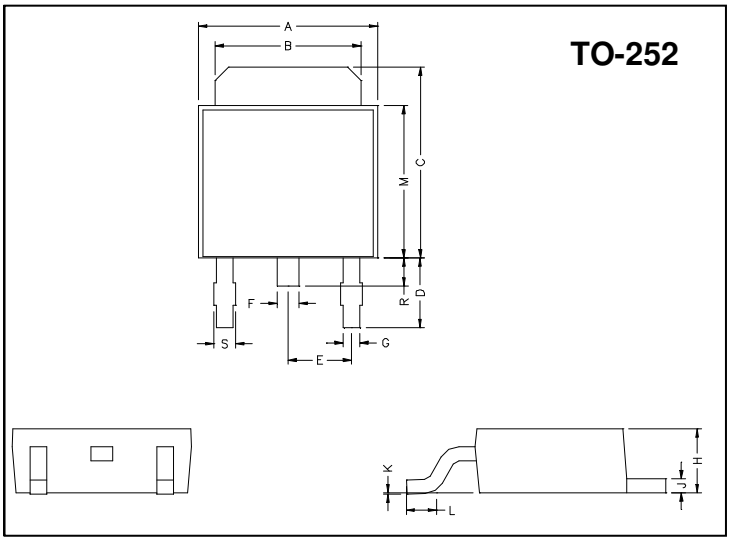
Functional Block Diagram

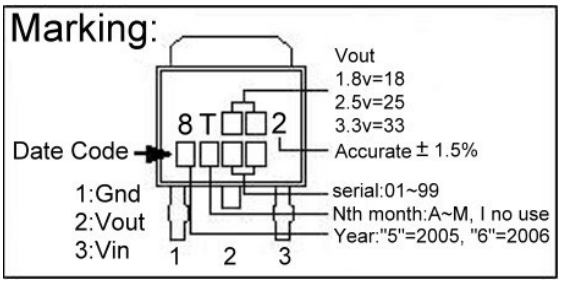


Applications

- Battery Powered Widgets
- Instrumentation
- Wireless Devices
- PC Peripherals
- Portable Electronics

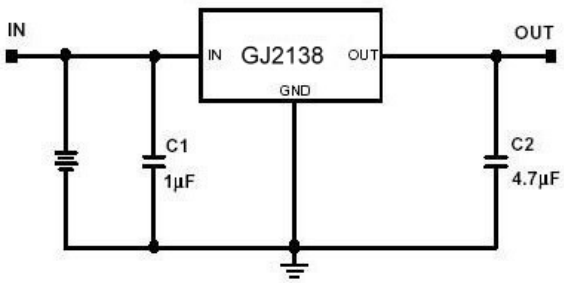
Package Dimensions





REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A	6.40	6.80	G	0.50	0.70
B	5.20	5.50	H	2.20	2.40
C	6.80	7.20	J	0.45	0.55
D	2.40	3.00	K	0	0.15
E	2.30 REF.		L	0.90	1.50
F	0.70	0.90	M	5.40	5.80
S	0.60	0.90	R	0.80	1.20

Typical Application Circuit



Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Input Max Voltage	V_{IN}	8	V
Output Current	I_{OUT}	$P_D/(V_{IN}-V_O)$	A
Output Voltage	V_{OUT}	1.5~5.0	V
Operating Ambient Temperature	Topr	-40 ~ +85	℃
Junction Temperature	Tj	-40 ~ +125	℃
Maximum Junction Temperature	Tj Max	150	℃
Thermal Resistance	θjc (Non-Conductive Epoxy)*	30	℃/W
	θja	140	℃/W
Internal Power Dissipation	PD	1	W
EDS Classification		B	

*Measure θjc on backside center of tab.

Electrical Characteristics $V_{IN}=V_{OUT}(T)+2V$, Ta=25℃ unless otherwise noted

Parameter	Symbol	Condition		Min	TYP	Max	Unit
Output Voltage	$V_{OUT}(E)$ (Note1)	I_O=1mA		-1.5%	$V_{OUT}(T)$ (Note2)	1.5%	V
Output Current	I_O	V_O>1.2V		1.5	-	-	A
Current Limit	I_{LIM}	V_O>1.2V		1.5	2.0	-	A
Load Regulation	REG_{LOAD}	$V_{IN}=V_{OUT}(T)+2V$, I_O=1mA to 1.5A		-1	0.2	1	%
Dropout Voltage	$V_{DROPOUT}$	I_O=1.5A $V_O=V_{OUT}(E)$-2%	1.4V<$V_{OUT}(T)$≤2.0V	-	-	1300	mV
			2.0V<$V_{OUT}(T)$≤2.8V	-	-	800	
			2.8V<$V_{OUT}(T)$	-	-	600	
Quiescent Current	I_Q	$V_{IN}=V_{OUT}(T)+2V$, I_O=0mA		-	45	70	μA
Ground Pin Current	I_{GND}	$V_{IN}=V_{OUT}(T)+2V$, I_O=1mA~1.5A		-	45	-	μA
Line Regulation	REG_{LINE}	I_O=1mA $V_{IN}=V_{OUT}(T)+1$ to $V_{OUT}(T)+2$	$V_{OUT}(T)$<2.0V	-0.15	-	0.15	%
			2.0V≤$V_{OUT}(T)$<4.0V	-0.1	0.02	0.1	
			4.0V≤$V_{OUT}(T)$	-0.4	-	0.4	
Input Voltage	V_{IN}			Note3	-	7	V
Over Temperature Shutdown	OTS			-	150	-	℃
Over Temperature Hysterisis	OTH			-	30	-	℃
Output Voltage Temperature Coefficient	TC			-	30	-	ppm/℃
Short Circuit Current	I_{SC}	$V_{IN}=V_{OUT}(T)+1V$, V_{OUT}<0.4V		-	750	-	mA
Power Supply Rejection	PSRR	Io=100mA Co=4.7μF	f=100Hz	-	70	-	dB
			f=1kHz	-	50	-	
			f=10kHz	-	20	-	
Output Voltage Noise	eN	f=10Hz~100kHz, Io=10mA, Co=4.7μF		-	30	-	μVrms

Note 1: V_{OUT} (E) =Effective Output Voltage (i.e. the output voltage when "V_{OUT} (T) + 2.0V" is provided at the V_{IN} pin while maintaining a certain I_{OUT} value).

2: V_{OUT} (T) =Specified Output Voltage

3: $V_{IN\ (MIN)}=V_{OUT}+V_{DROPOUT}$

Ordering Information (contd.)

Part Number	Marking	Output Voltage	Part Number	Marking	Output Voltage
GJ2138-15	8T152 XXXX	1.5V	GJ2138-18	8T182 XXXX	1.8V
GJ2138-19	8T192 XXXX	1.9V	GJ2138-25	8T252 XXXX	2.5V
GJ2138-33	8T332 XXXX	3.3V	GJ2138-47	8T472 XXXX	4.75V
GJ2138-50	8T502 XXXX	5.0V			

Detailed Description

The GJ2138 series of COMS regulators contain a PMOS pass transistor, voltage reference, error amplifier, over-current protection, and thermal shutdown.

The P-channel pass transistor receives data from the error amplifier, over-current shutdown, and thermal protection circuits. During normal operation, the error amplifier compares the output voltage to a precision reference. Over-current and Thermal shutdown circuits become active when the junction temperature exceeds 150℃, or the current exceeds 2.2A. During thermal shutdown, the output voltage remains low. Normal operation is restored when the junction temperature drops below 120℃.

The GJ2138 behaves like a current source when the load reaches 2.2A. However, if the load impedance drops below 0.3Ω, the current drops back to 600mA to prevent excessive power dissipation. Normal operation is restored when the load resistance exceeds 0.75Ω.

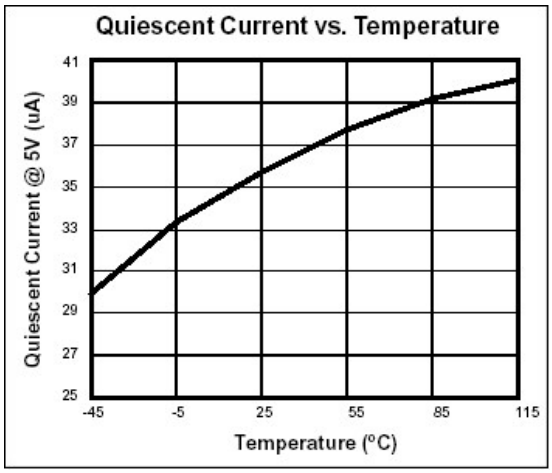
External Capacitors

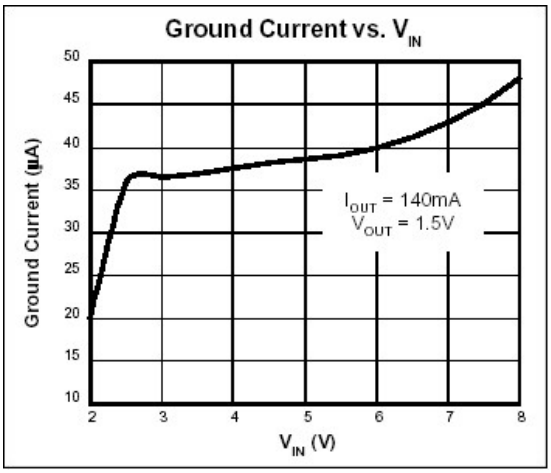
The GJ2138 is stable with an output capacitance to ground of 4.7μF or greater. Ceramic capacitors have the lowest ESR, and will offer the best AC performance. Conversely, Aluminum Electrolytic capacitors exhibit the highest ESR, resulting in the poorest AC response. Unfortunately, large value ceramic capacitors are comparatively expensive. One option is to parallel a 0.1μF ceramic capacitor with a 10μF Aluminum Electrolytic. The benefit is low ESR, high capacitance, and low overall cost.

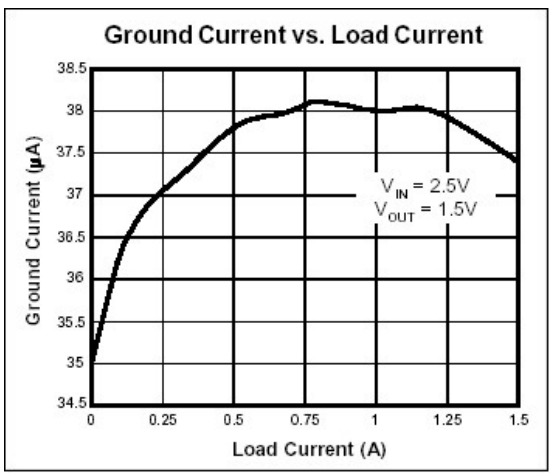
A second capacitor is recommended between the input and ground to stabilize Vin. The input capacitor should be at least 0.1μF to have a beneficial effect.

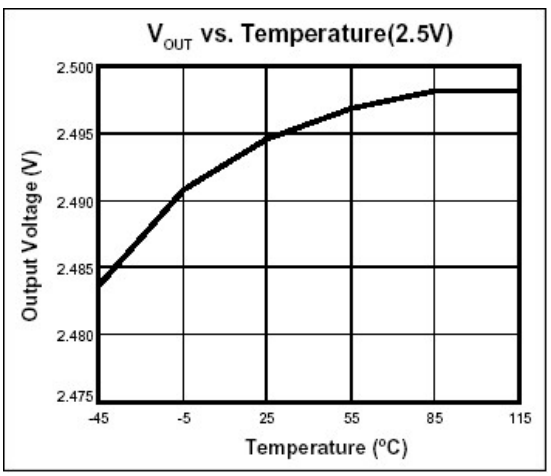
All capacitors should be placed in close proximity to the pins. A “Quiet” ground termination is desirable. This can be achieved with a “Star” connection.

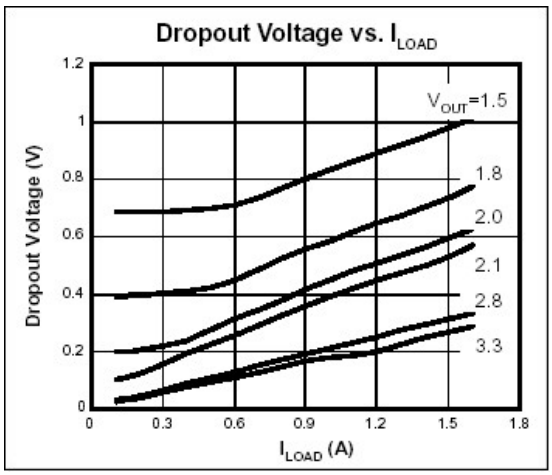
Characteristics Curve

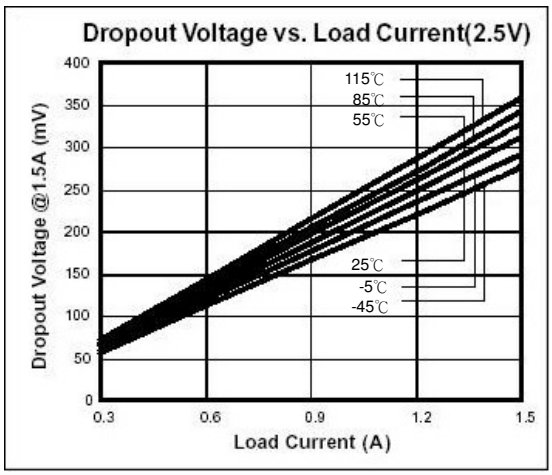


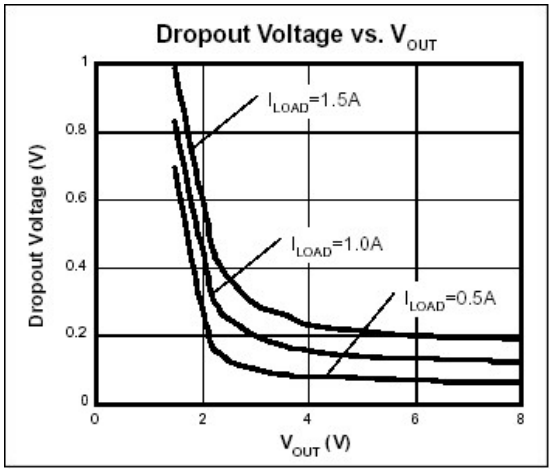


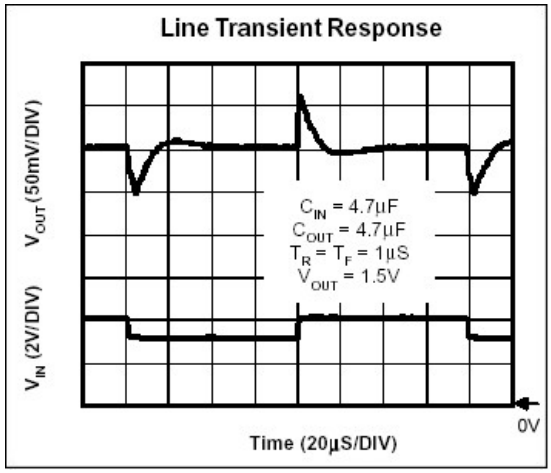


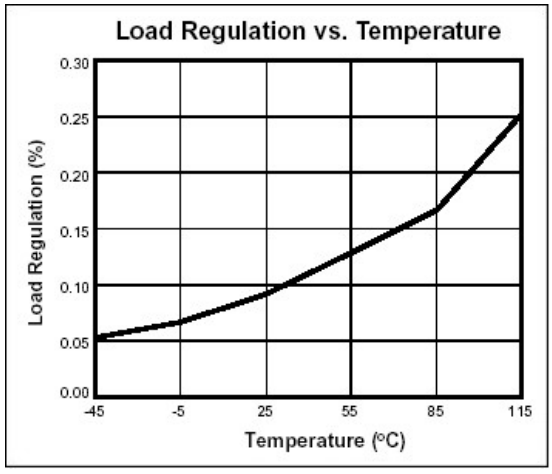


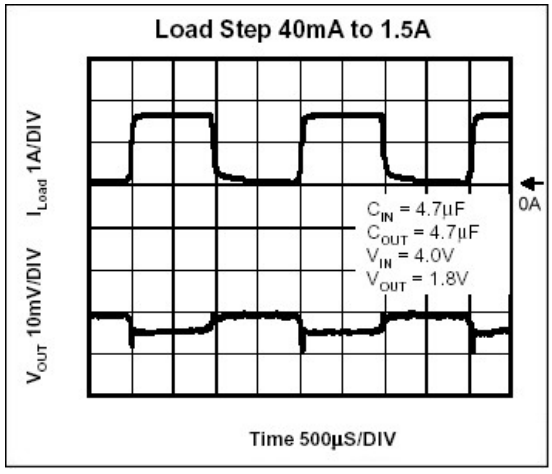

Dropout Voltage vs. I_{LOAD}
Dropout Voltage (V)
I_{LOAD} (A)
V_{OUT}=1.5
1.8
2.0
2.1
2.8
3.3

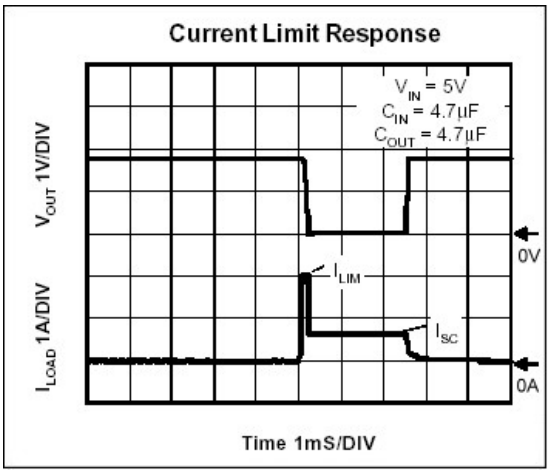

Dropout Voltage vs. Load Current(2.5V)
Dropout Voltage @1.5A (mV)
Load Current (A)
115℃
85℃
55℃
25℃
-5℃
-45℃

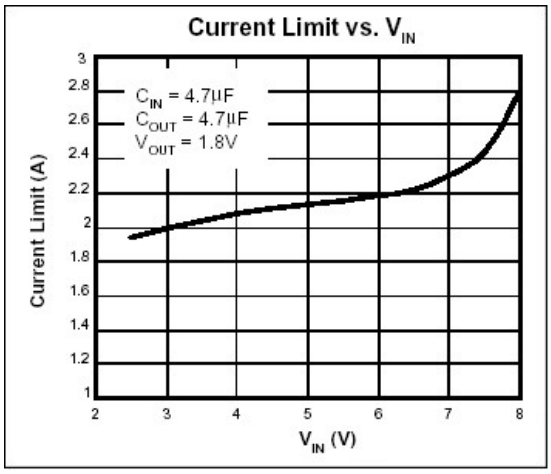

Dropout Voltage vs. V_{OUT}
Dropout Voltage (V)
V_{OUT} (V)
I_{LOAD}=1.5A
I_{LOAD}=1.0A
I_{LOAD}=0.5A

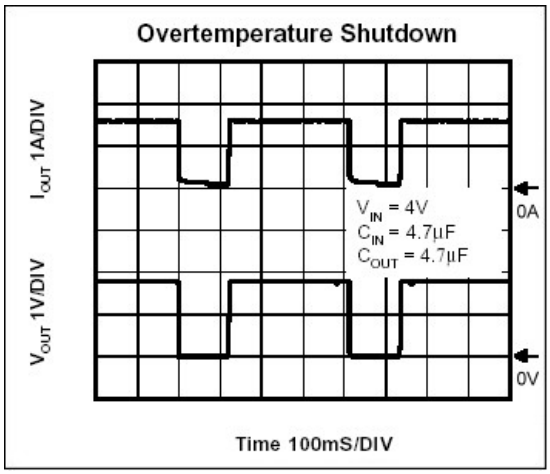

Line Transient Response
V_{OUT}(50mV/DIV)
V_{IN} (2V/DIV)
C_{IN} = 4.7µF
C_{OUT} = 4.7µF
T_R = T_F = 1µS
V_{OUT} = 1.5V
0V
Time (20µS/DIV)

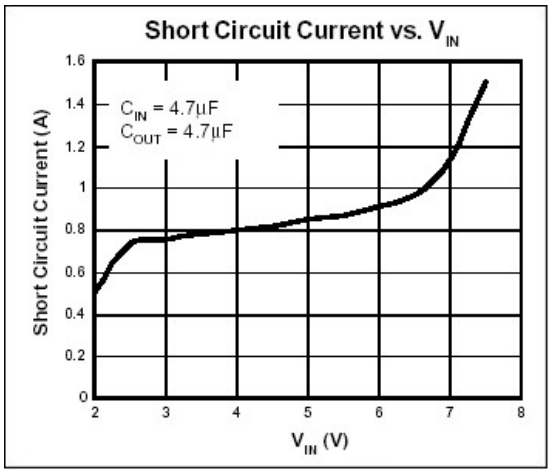

Load Regulation vs. Temperature
Load Regulation (%)
Temperature (°C)

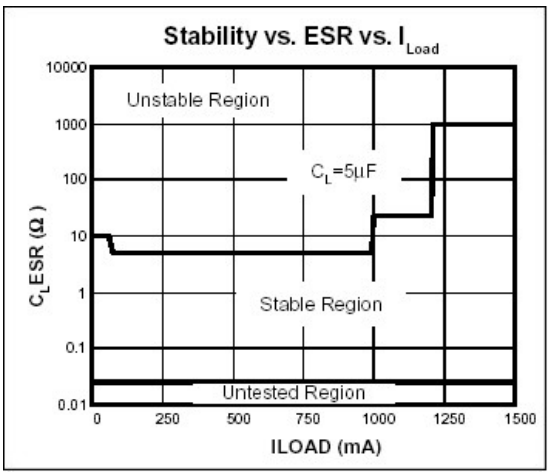

Load Step 40mA to 1.5A
I_{Load} 1A/DIV
V_{OUT} 10mV/DIV
C_{IN} = 4.7µF
C_{OUT} = 4.7µF
V_{IN} = 4.0V
V_{OUT} = 1.8V
0A
Time 500µS/DIV

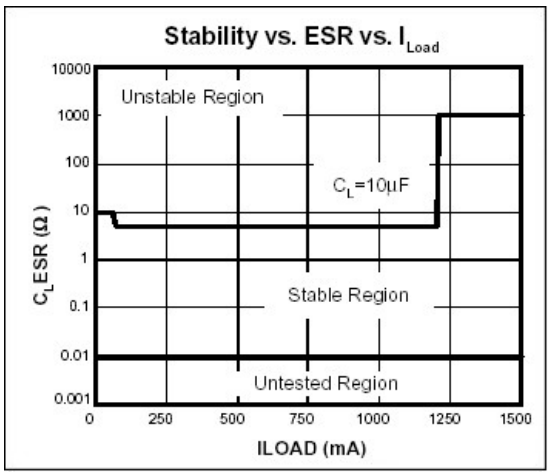












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