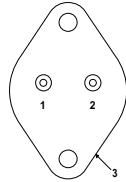


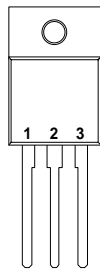
Pin 1 – ADJ.
 Pin 2 – V_{OUT}
 Case – V_{IN}

Q Package – TO-254



Pin 1 – ADJ.
 Pin 2 – V_{IN}
 Case – V_{OUT}

K Package – TO-3



Pin 1 – ADJ.
 Pin 2 – V_{OUT}
 Pin 3 – V_{IN}
 Case – V_{OUT}

V Package – TO-218

5 AMP POSITIVE ADJUSTABLE VOLTAGE REGULATOR

FEATURES

- **OUTPUT VOLTAGE RANGE OF 1.25 TO 35V**
- **1% OUTPUT VOLTAGE TOLERANCE (-A VERSIONS)**
- **0.3% LOAD REGULATION**
- **0.01%/V LINE REGULATION**
- **COMPLETE SERIES OF PROTECTIONS:**
 - **CURRENT LIMITING**
 - **THERMAL SHUTDOWN**
 - **SOA CONTROL**

Order Information

Part Number	K-Pack (TO-3)	V-Pack (TO-218)	Q-Pack (TO-254)	Temp. Range	Note:
IP138A	✓		✓	-55 to +150°C	To order, add the package identifier to the part number. eg. IP138AQ
IP138	✓		✓	"	
LM138	✓		✓	"	
IP338A	✓	✓		0 to 125°C	
IP338	✓	✓		"	
LM338	✓	✓		"	

ABSOLUTE MAXIMUM RATINGS ($T_{case} = 25^{\circ}C$ unless otherwise stated)

V_{I-O}	Input - Output Differential Voltage	35V
P_D	Power Dissipation	Internally limited
T_J	Operating Junction Temperature Range	See Table Above
T_{STG}	Storage Temperature	-65 to 150°C
T_L	Lead Temperature (Soldering, 10 sec.)	300°C

Parameter	Test Conditions	IP138A			LM138 IP138			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{REF} Reference Voltage	$I_{OUT} = 10\text{mA}$	1.238	1.25	1.262				V
	$I_{OUT} = 10\text{mA to } 5\text{A}$ $V_{IN} - V_{OUT} = 3\text{V to } 35\text{V}$ $P \leq 50\text{W}$ $T_J = -55 \text{ to } +150^\circ\text{C}$	1.225	1.250	1.270	1.190	1.240	1.290	V
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$ Line Regulation 1	$V_{IN} - V_{OUT} = 3\text{V to } 35\text{V}$ $T_J = -55 \text{ to } +150^\circ\text{C}$		0.005	0.010		0.005	0.010	% / V
			0.020	0.040		0.020	0.040	
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$ Load Regulation 1	$I_{OUT} = 10\text{mA to } 5\text{A}$	$V_{OUT} \leq 5\text{V}$	5	15		5	15	mV
		$V_{OUT} \geq 5\text{V}$	0.1	0.3		0.1	0.3	%
	$T_J = -55 \text{ to } +150^\circ\text{C}$	$V_{OUT} \leq 5\text{V}$	20	30		20	30	mV
		$V_{OUT} \geq 5\text{V}$	0.3	0.6		0.3	0.6	%
Thermal Regulation	$t_p = 20\text{ms}$		0.002	0.010		0.002	0.010	%/W
Ripple Rejection	$V_{OUT} = 10\text{V}$ $f = 120\text{Hz}$	$C_{ADJ} = 0$ $T_J = -55 \text{ to } +150^\circ\text{C}$		60		60		dB
		$C_{ADJ} = 10\mu\text{F}$ $T_J = -55 \text{ to } +150^\circ\text{C}$	60	75		60	75	dB
I_{ADJ} Adjust Pin Current	$T_J = -55 \text{ to } +150^\circ\text{C}$		45	100		45	100	μA
ΔI_{ADJ} Adjust Pin Current Change	$I_{OUT} = 10\text{mA to } 5\text{A}$ $V_{IN} - V_{OUT} = 3\text{V to } 35\text{V}$ $T_J = -55 \text{ to } +150^\circ\text{C}$		0.2	5		0.2	5	μA
I_{MIN} Minimum Load Current	$V_{IN} - V_{OUT} = 35\text{V}$ $T_J = -55 \text{ to } +150^\circ\text{C}$		3.5	5		3.5	5	mA
I_{SC} Current Limit	$V_{IN} - V_{OUT} \leq 10\text{V}$ $T_J = -55 \text{ to } +150^\circ\text{C}$	DC	5	8		5	8	A
		0.5ms Peak	7	12		7	12	
	$V_{IN} - V_{OUT} = 30\text{V}$		0.25	1		1		A
$\frac{\Delta V_{OUT}}{\Delta \text{TEMP}}$ Temperature Stability	$T_J = -55 \text{ to } +150^\circ\text{C}$		1	2		1		%
$\frac{\Delta V_{OUT}}{\Delta \text{TIME}}$ Long Term Stability	$T_A = 125^\circ\text{C}$ $t = 1000 \text{ Hrs}$		0.3	1		0.3	1	%
e_n RMS Output Noise (% of V_{OUT})	$f = 10 \text{ Hz to } 10 \text{ kHz}$		0.001			0.001		%
$R_{\theta JC}$ Thermal Resistance Junction to Case	K Package (TO-3)			1			1	$^\circ\text{C/W}$

1) Regulation is measured at constant junction temperature, using pulse testing at a low duty cycle. Changes in output voltage due to heating effects are covered under thermal regulation specifications. Load regulation is measured from the bottom of the package for the TO-3 package.

2) Test Conditions unless otherwise stated: $V_{IN} - V_{OUT} = 5\text{V}$, $T_J = 25^\circ\text{C}$, $I_{OUT} = 2.5\text{A}$.
 Although power dissipation is internally limited, these specifications apply for dissipations of 50W and $I_{MAX} = 5\text{A}$.

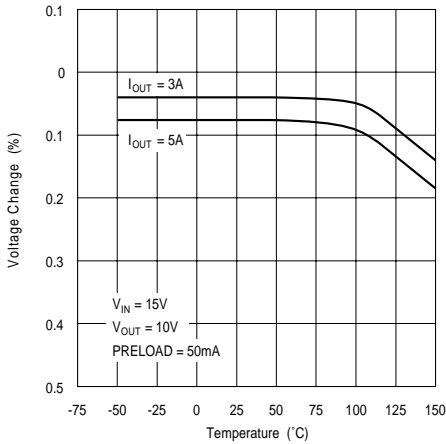
Parameter	Test Conditions	IP338A			LM338 IP338			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{REF} Reference Voltage	$I_{OUT} = 10mA$	1.238	1.25	1.262				V
	$I_{OUT} = 10mA$ to 5A $V_{IN} - V_{OUT} = 3V$ to 35V $P \leq 50W$ $T_J = 0$ to +125°C	1.225	1.250	1.270	1.190	1.240	1.290	V
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$ Line Regulation 1	$V_{IN} - V_{OUT} = 3V$ to 35V $T_J = 0$ to +125°C		0.005	0.010		0.005	0.030	% / V
			0.020	0.040		0.020	0.060	
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$ Load Regulation 1	$I_{OUT} = 10mA$ to 5A $T_J = 0$ to +125°C	$V_{OUT} \leq 5V$	5	15		5	25	mV
		$V_{OUT} \geq 5V$	0.1	0.3		0.1	0.5	%
	$I_{OUT} = 10mA$ to 5A $T_J = 0$ to +125°C	$V_{OUT} \leq 5V$	20	30		20	50	mV
		$V_{OUT} \geq 5V$	0.3	0.6		0.3	1	%
Thermal Regulation	$t_p = 20ms$		0.002	0.020		0.002	0.020	%/W
Ripple Rejection	$V_{OUT} = 10V$ $f = 120Hz$	$C_{ADJ} = 0$ $T_J = 0$ to +125°C		60		60		dB
		$C_{ADJ} = 10\mu F$ $T_J = 0$ to +125°C	60	75		60	75	dB
I_{ADJ} Adjust Pin Current	$T_J = 0$ to +125°C		45	100		45	100	μA
ΔI_{ADJ} Adjust Pin Current Change	$I_{OUT} = 10mA$ to 5A $V_{IN} - V_{OUT} = 3V$ to 35V $T_J = 0$ to +125°C		0.2	5		0.2	5	μA
I_{MIN} Minimum Load Current	$V_{IN} - V_{OUT} = 35V$ $T_J = 0$ to +125°C		3.5	10		3.5	10	mA
I_{SC} Current Limit	$V_{IN} - V_{OUT} \leq 10V$ $T_J = 0$ to +125°C	DC	5	8		5	8	A
		0.5ms Peak	6	12		6	12	
	$V_{IN} - V_{OUT} = 30V$		0.25	1		1		A
$\frac{\Delta V_{OUT}}{\Delta TEMP}$ Temperature Stability	$T_J = 0$ to +125°C		1	2		1		%
$\frac{\Delta V_{OUT}}{\Delta TIME}$ Long Term Stability	$T_A = 125^\circ C$ $t = 1000$ Hrs		0.3	1		0.3	1	%
e_n RMS Output Noise (% of V_{OUT})	$f = 10$ Hz to 10 kHz K Package (TO-3)		0.001			0.003		%
$R_{\theta JC}$ Thermal Resistance Junction to Case	V Package (TO-218)			1			1	°C/W
				1			1	

1) Regulation is measured at constant junction temperature, using pulse testing at a low duty cycle. Changes in output voltage due to heating effects are covered under thermal regulation specifications. Load regulation is measured from the bottom of the package for the TO-3 package and at the junction of the wide and narrow portion of the output lead for the TO-218 package.

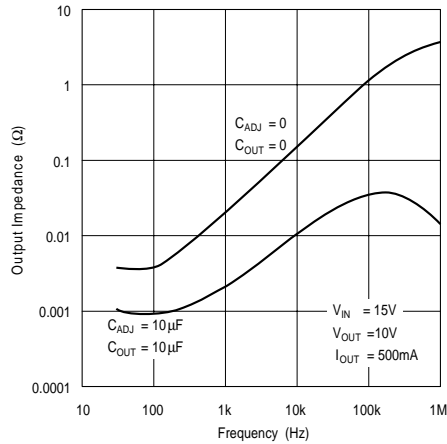
2) Test Conditions unless otherwise stated: $V_{IN} - V_{OUT} = 5V$, $T_J = 25^\circ C$, $I_{OUT} = 2.5A$.
 Although power dissipation is internally limited, these specifications apply for dissipations of 50W and $I_{MAX} = 5A$.

TYPICAL PERFORMANCE CHARACTERISTICS

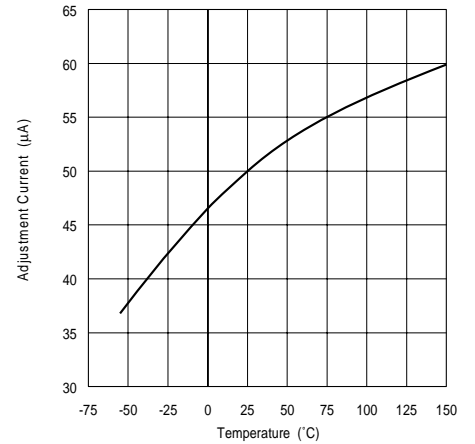
Load Regulation



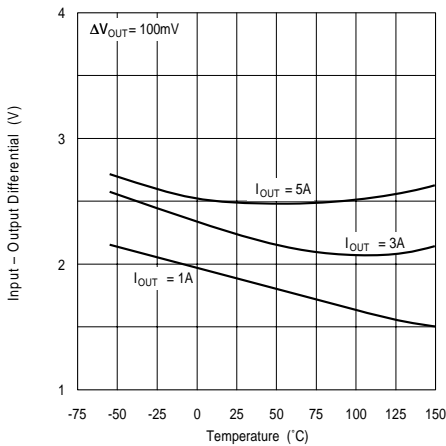
Output Impedance



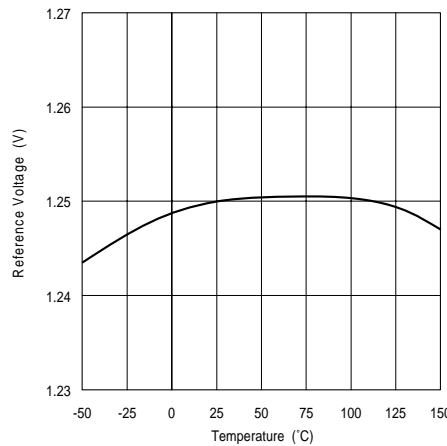
Adjustment Current



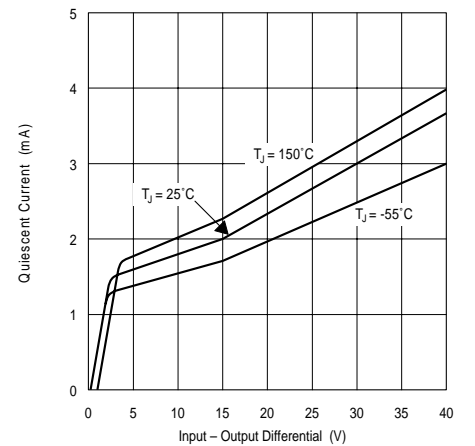
Droput Voltage



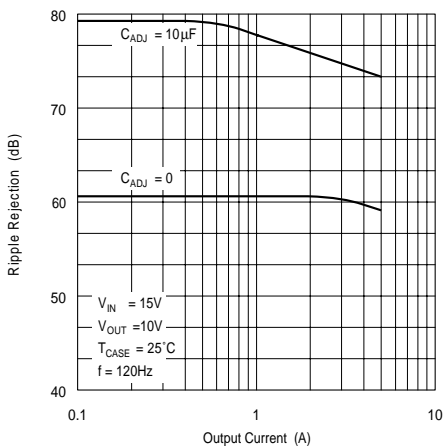
Temperature Stability



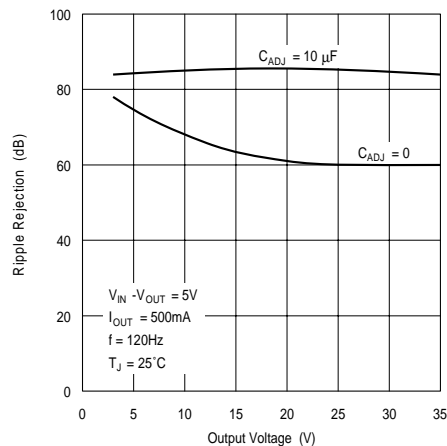
Minimum Operating Current



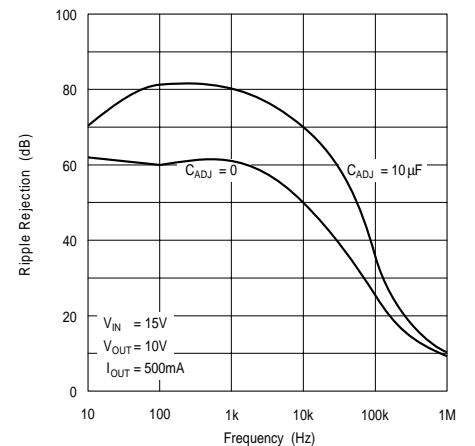
Ripple Rejection



Ripple Rejection

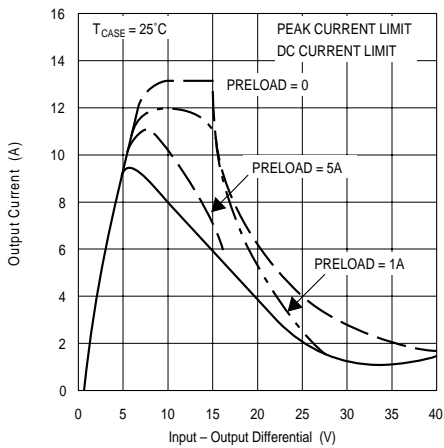


Ripple Rejection

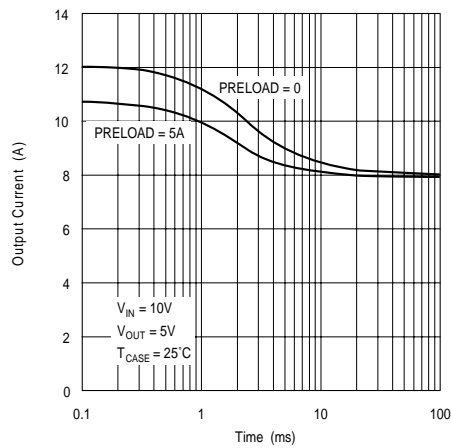


TYPICAL PERFORMANCE CHARACTERISTICS

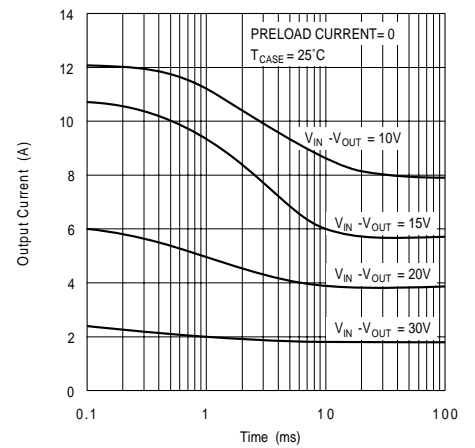
Current Limit



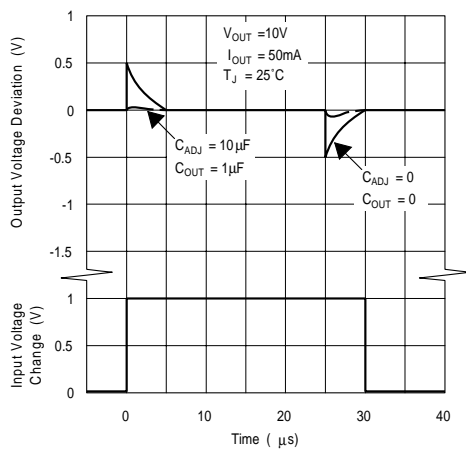
Current Limit



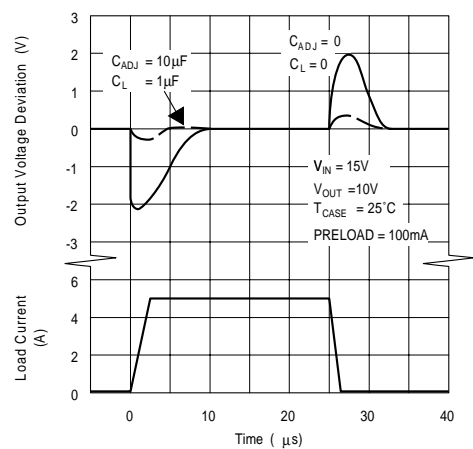
Current Limit



Line Transient Response

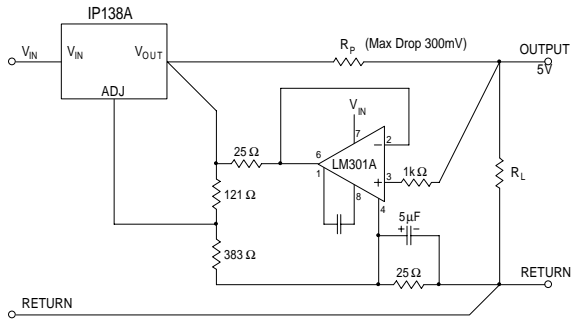


Load Transient Response

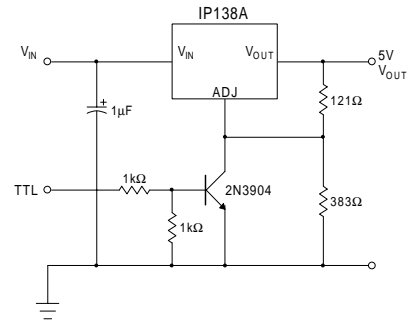


APPLICATIONS INFORMATION

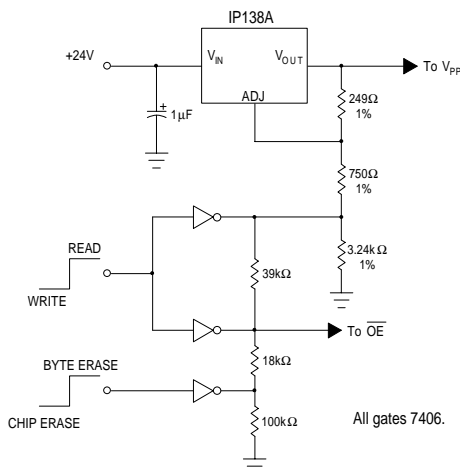
Remote Sensing



5V Regulator with Shut Down

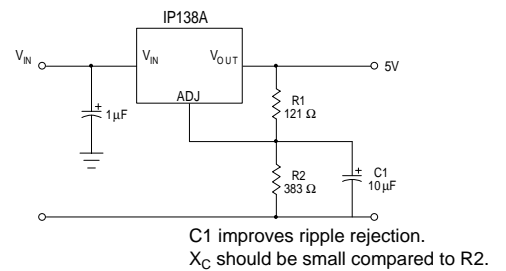


2816 EEPROM Supply Programmer for Read/Write Control



	\overline{OE}	V_{PP}
READ	0V	5V
WRITE		
BYTE ERASE	5V	21V
CHIP ERASE	12V	21V

Improving Ripple Rejection



Temperature Compensated Lead-Acid Battery Charger

