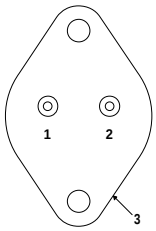
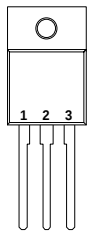
IP138A SERIES
IP138 SERIES
IP338A SERIES
IP338 SERIES
LM138 SERIES



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)	Temp. Range
IP138A	✔		-55 to +150°C
IP138	✔		”
LM138	✔		”
IP338A	✔	✔	0 to 125°C
IP338	✔	✔	”
LM338	✔	✔	”

Note:

To order, add the package identifier to the part number.

eg. IP138AK

ABSOLUTE MAXIMUM RATINGS (T_{case} = 25°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

IP138A SERIES
IP138 SERIES
IP338A SERIES
IP338 SERIES
LM138 SERIES

Parameter		Test Conditions		IP138A Min.	IP138A Typ.	IP138A Max.	LM138 IP138 Min.	LM138 IP138 Typ.	LM138 IP138 Max.	Units
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 ≤ 50W T_J = –55 to +150°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			0.005	0.010		0.005	0.010	% / V
			T_J = –55 to +150°C		0.020	0.040		0.020	0.040	
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation [1]	I_{OUT} = 10mA to 5A	$V_{OUT} \le 5V$		5	15		5	15	mV
			$V_{OUT} \ge 5V$		0.1	0.3		0.1	0.3	%
		I_{OUT} = 10mA to 5A T_J = –55 to +150°C	$V_{OUT} \le 5V$		20	30		20	30	mV
			$V_{OUT} \ge 5V$		0.3	0.6		0.3	0.6	%
	Thermal Regulation	t_p = 20ms			0.002	0.010		0.002	0.010	%/W
	Ripple Rejection	V_{OUT} = 10V f = 120Hz	C_{ADJ} = 0 T_J = –55 to +150°C		60			60		dB
			C_{ADJ} = 10µF T_J = –55 to +150°C	60	75		60	75		dB
I_{ADJ}	Adjust Pin Current	T_J = –55 to +150°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 = –55 to +150°C			0.2	5		0.2	5	µA
I_{MIN}	Minimum Load Current	$V_{IN} - V_{OUT}$ = 35V T_J = –55 to +150°C			3.5	5		3.5	5	mA
I_{SC}	Current Limit	$V_{IN} - V_{OUT} \le 10V$ T_J = –55 to +150°C	DC	5	8		5	8		A
			0.5ms Peak	7	12		7	12		
		$V_{IN} - V_{OUT}$ = 30V		0.25	1			1		A
$\frac{\Delta V_{OUT}}{\Delta TEMP}$	Temperature Stability	T_J = –55 to +150°C			1	2		1		%
$\frac{\Delta V_{OUT}}{\Delta TIME}$	Long Term Stability	T_A = 125°C t = 1000 Hrs			0.3	1		0.3	1	%
e_n	RMS Output Noise (% of V_{OUT})	f = 10 Hz to 10 kHz			0.001			0.001		%
$R_{\theta JC}$	Thermal Resistance Junction to Case	K Package (TO–3)				1			1	°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 othewise stated: $V_{IN} - V_{OUT}$ = 5V , T_J = 25°C , I_{OUT} = 2.5A.
Although power dissipation is internally limited, these specifications apply for dissipations of 50W and I_{MAX} = 5A.

IP138A SERIES
IP138 SERIES
IP338A SERIES
IP338 SERIES
LM138 SERIES

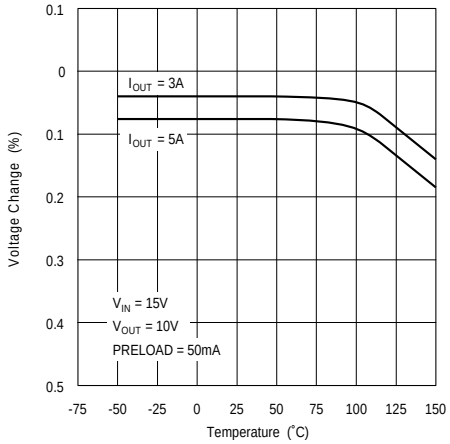
Parameter		Test Conditions		IP338A Min.	IP338A Typ.	IP338A Max.	LM338 IP338 Min.	LM338 IP338 Typ.	LM338 IP338 Max.	Units
V_{REF}	Reference Voltage	I_{OUT} = 10mA		1.238	1.25	1.262				V
		I_{OUT} = 10mA to 5A $V_{IN} - V_{OUT}$ = 3V to 35V P ≤ 50W	T_J = 0 to +125°C	1.225	1.250	1.270	1.190	1.240	1.290	V
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation [1]	$V_{IN} - V_{OUT}$ = 3V to 35V			0.005	0.010		0.005	0.030	% / V
			T_J = 0 to +125°C		0.020	0.040		0.020	0.060	% / V
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation [1]	I_{OUT} = 10mA to 5A	$V_{OUT} \leq 5V$		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} = 10µF 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		A
		$V_{IN} - V_{OUT}$ = 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°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	°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 and at the junction of the wide and narrow portion of the output lead for the TO–218 package.

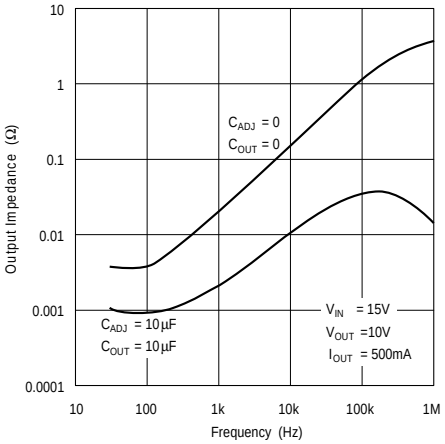
2) Test Conditions unless othewise stated: $V_{IN} - V_{OUT}$ = 5V , T_J = 25°C , I_{OUT} = 2.5A.
Although power dissipation is internally limited, these specifications apply for dissipations of 50W and I_{MAX} = 5A.

TYPICAL PERFORMANCE CHARACTERISTICS

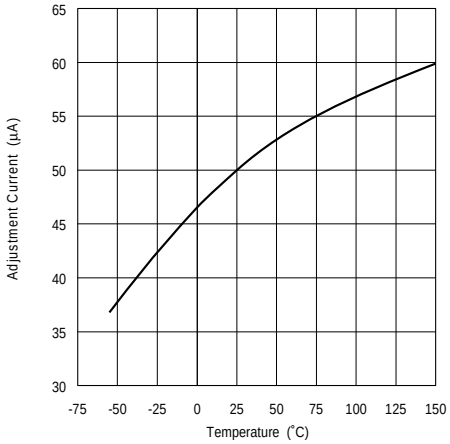
Load Regulation



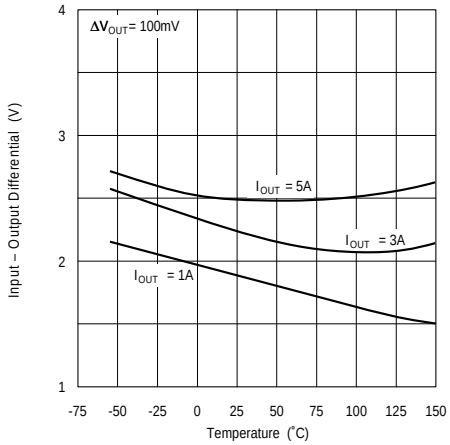
Output Impedance



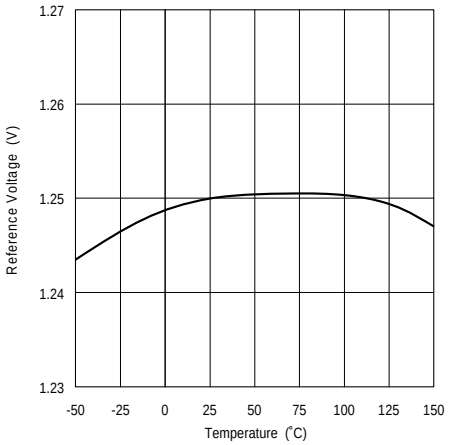
Adjustment Current



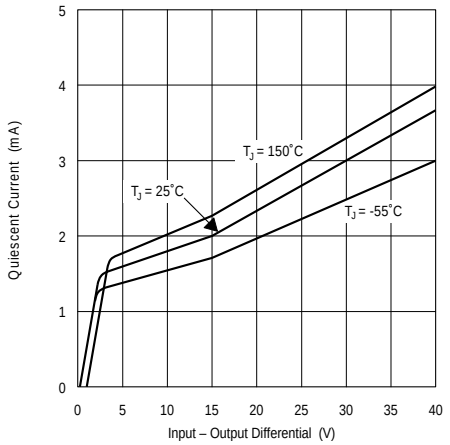
Droput Voltage



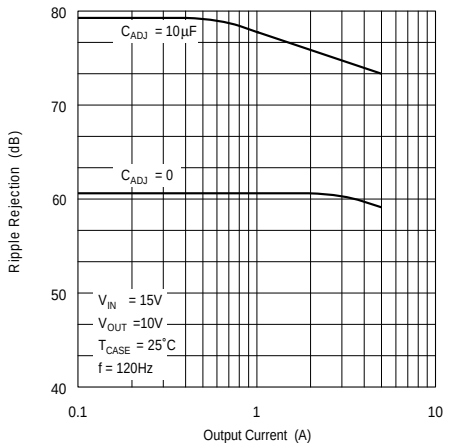
Temperature Stability



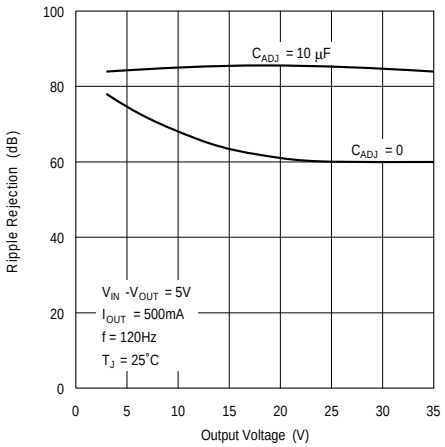
Minimum Operating Current



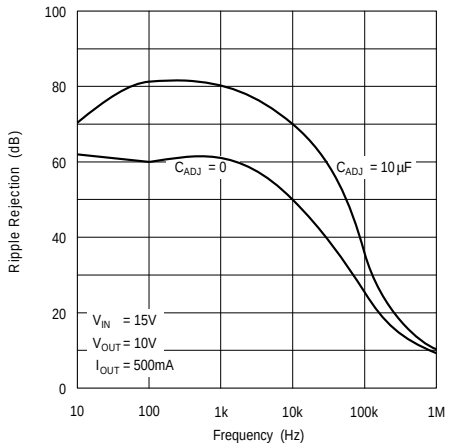
Ripple Rejection



Ripple Rejection

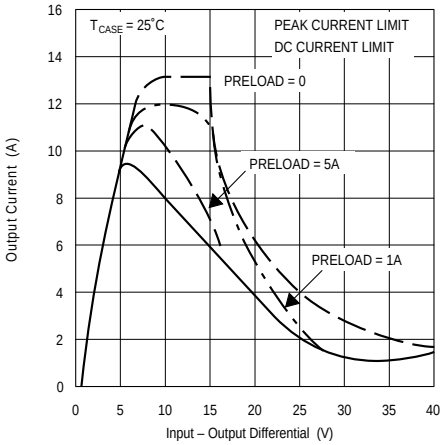


Ripple Rejection

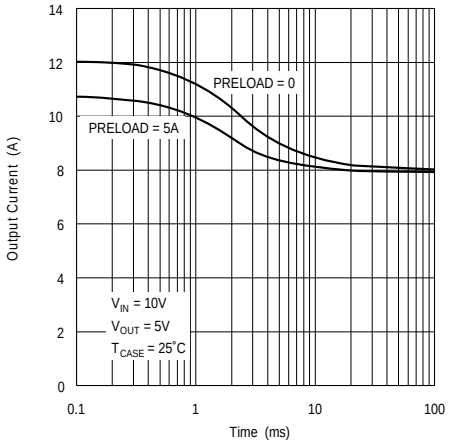


TYPICAL PERFORMANCE CHARACTERISTICS

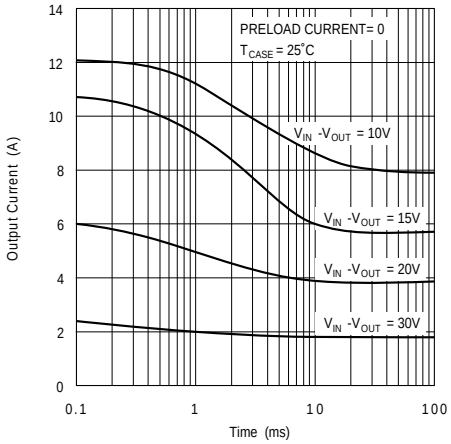
Current Limit



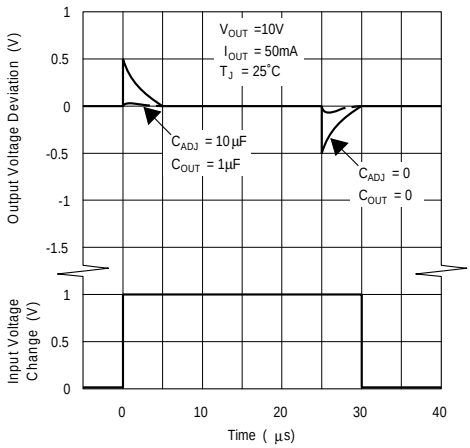
Current Limit



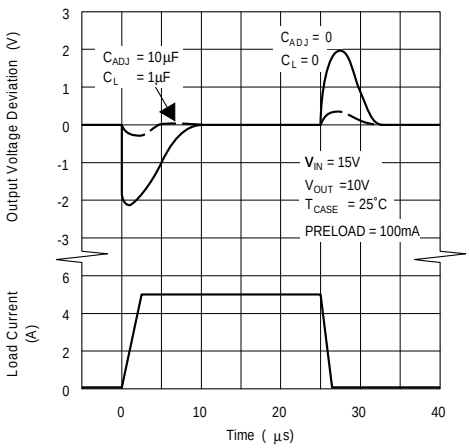
Current Limit



Line Transient Response

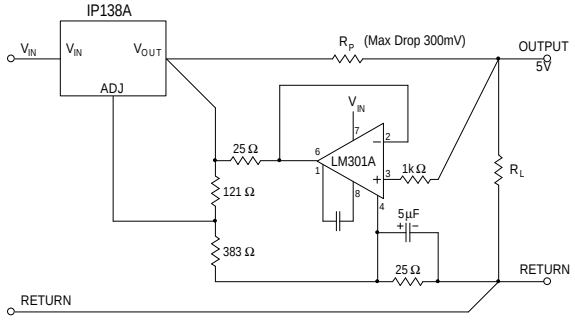


Load Transient Response

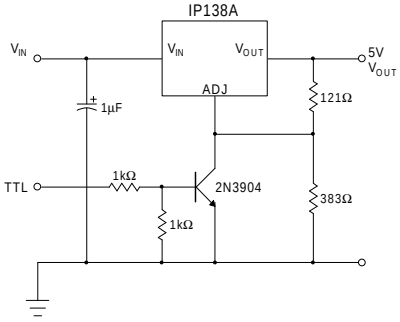


APPLICATIONS INFORMATION

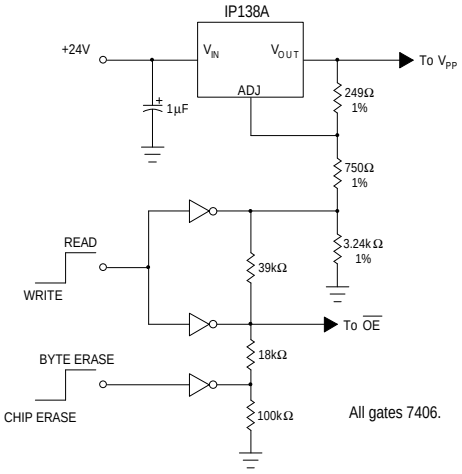
Remote Sensing



5V Regulator with Shut Down

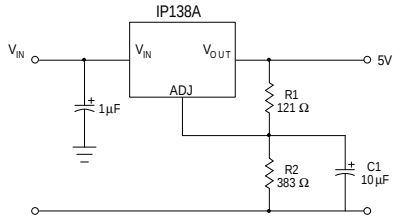


2816 EEPROM Supply Programmer for Read/Write Control



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

Improving Ripple Rejection



C1 improves ripple rejection.
X_C should be small compared to R2.

Temperature Compensated Lead–Acid Battery Charger