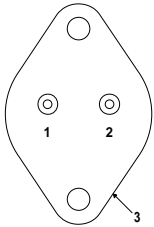
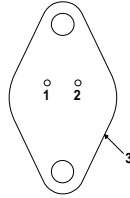


## 1 AMP POSITIVE VOLTAGE REGULATOR



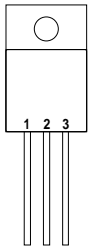
Pin 1 –  $V_{IN}$   
 Pin 2 –  $V_{OUT}$   
 Case – Ground

**K Package – TO-3**



Pin 1 –  $V_{IN}$   
 Pin 2 –  $V_{OUT}$   
 Case – Ground

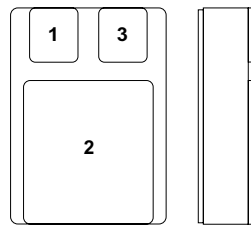
**R Package – TO-66**



Pin 1 –  $V_{IN}$   
 Pin 2 – Ground  
 Pin 3 –  $V_{OUT}$   
 Case – Ground\*

**G Package – TO-257**  
**IG Package – TO-257\***

\* isolated Case on IG package



Pin 1 –  $V_{IN}$   
 Pin 2 – Ground  
 Pin 3 –  $V_{OUT}$

**SMD 1 PACKAGE**  
 Ceramic Surface Mount

### FEATURES

- **OUTPUT CURRENT UP TO 1.0A**
- **OUTPUT VOLTAGES OF 5, 12, 15V**
- **0.01% / V LINE REGULATION**
- **0.3% / A LOAD REGULATION**
- **THERMAL OVERLOAD PROTECTION**
- **SHORT CIRCUIT PROTECTION**
- **OUTPUT TRANSISTOR SOA PROTECTION**
- **1% VOLTAGE TOLERANCE (–A VERSIONS)**

### DESCRIPTION

The IP140A / LM140 / IP7800A / IP7800 series of 3 terminal regulators is available with several fixed output voltage making them useful in a wide range of applications.

The A suffix devices are fully specified at 1A, provide 0.01% / V line regulation, 0.3% / A load regulation and  $\pm 1\%$  output voltage tolerance at room temperature.

Protection features include Safe Operating Area current limiting and thermal shutdown.

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

$V_I$	DC Input Voltage (for $V_O = 5, 12, 15V$ )	35V
$P_D$	Power Dissipation	Internally limited <sup>1</sup>
$T_j$	Operating Junction Temperature Range	$-55$ to $150^{\circ}C$
$T_{stg}$	Storage Temperature	$-65$ to $150^{\circ}C$

Note 1. Although power dissipation is internally limited, these specifications are applicable for maximum power dissipation  $P_{MAX}$  of 20W.  $I_{MAX} = 1.0A$ .

Parameter	Test Conditions	IP7805A LM,IP140-05			IP7805 LM,IP140-05			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V <sub>O</sub> Output Voltage	I <sub>O</sub> = 1A V <sub>IN</sub> = 10V	4.95	5	5.05	4.8	5	5.2	V
	I <sub>O</sub> = 5mA to I <sub>MAX</sub> P <sub>D</sub> ≤ P <sub>MAX</sub> V <sub>IN</sub> = 7.5V to 20V T <sub>J</sub> = -55 to 150°C	4.85		5.15	4.75		5.25	
V <sub>O</sub> Low Supply	I <sub>O</sub> = 5mA to I <sub>MAX</sub> P <sub>D</sub> ≤ P <sub>MAX</sub> V <sub>IN</sub> = 7V to 20V	4.75		5.15	4.75		5.25	V
ΔV <sub>O</sub> Line Regulation	I <sub>O</sub> = 0.5 I <sub>MAX</sub>	V <sub>IN</sub> = 7V to 25V	3	10			50	mV
		V <sub>IN</sub> = 7.5V to 25V T <sub>J</sub> = -55 to 150°C	3	10			50	
	I <sub>O</sub> ≤ I <sub>MAX</sub> V <sub>IN</sub> = 7.3V to 20V	3	10			50		
	V <sub>IN</sub> = 8V to 12V	1	4			20		
		T <sub>J</sub> = -55 to 150°C	2	12			25	
ΔV <sub>O</sub> Load Regulation	V <sub>IN</sub> = 10V	I <sub>O</sub> = 5mA to 1.5A	10	25			50	mV
		I <sub>O</sub> = 250mA to 750mA	4	15			25	
	V <sub>IN</sub> = 10V	I <sub>O</sub> = 5mA to I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C	7	25			50	
I <sub>Q</sub> Quiescent Current	I <sub>O</sub> ≤ I <sub>MAX</sub> V <sub>IN</sub> = 10V	T <sub>J</sub> = -55 to 150°C	4	6			6	mA
			4	6.5			7	
ΔI <sub>Q</sub> Quiescent Current Change	I <sub>O</sub> = 5mA to I <sub>MAX</sub> V <sub>IN</sub> = 10V		0.2	0.5			0.5	mA
		I <sub>O</sub> ≤ I <sub>MAX</sub> V <sub>IN</sub> = 7.5V to 20V T <sub>J</sub> = -55 to 150°C	0.1	0.8			0.8	
	I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub> V <sub>IN</sub> = 8V to 25V	0.1	0.8			0.8		
	I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub> V <sub>IN</sub> = 7V to 25V T <sub>J</sub> = -55 to 150°C	0.2	1			1.0		
V <sub>N</sub> Output Noise Voltage	f = 10Hz to 100kHz V <sub>IN</sub> = 10V	40	200			40	μV	
ΔV <sub>IN</sub> / ΔV <sub>O</sub> Ripple Rejection	f = 120Hz V <sub>IN</sub> = 8V to 18V	I <sub>O</sub> ≤ I <sub>MAX</sub>	68	80			68	dB
		I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C	68	80			68	
Dropout Voltage	I <sub>O</sub> = I <sub>MAX</sub>	2	2.5			2	V	
R <sub>O</sub> Output Resistance	f = 1 kHz	5				5	mΩ	
I <sub>sc</sub> Short Circuit Current	V <sub>IN</sub> = 35V	0.6	1.2			0.6	1.2	A
I <sub>pk</sub> Peak Output Current	V <sub>IN</sub> = 10V	2.4	3.3			2.4	3.3	
Average Temperature Coefficient of V <sub>O</sub>	I <sub>O</sub> = 5mA	0.2	2			0.6		mV/°C
Input Voltage required to maintain line regulation	I <sub>O</sub> ≤ I <sub>MAX</sub>	7.3				7.3		V

- All characteristics are measured with a capacitor across the input of 0.22μF and a capacitor across the output of 0.1μF. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques (t<sub>p</sub> ≤ 10ms, δ ≤ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.
- Although power dissipation is internally limited, these specifications are applicable for maximum power dissipation P<sub>MAX</sub> of 20W, I<sub>MAX</sub> = 1.0A.
- T<sub>J</sub> = 25°C unless otherwise stated.

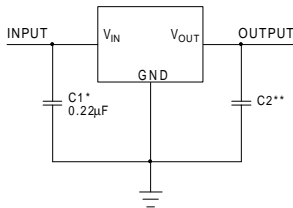
Parameter	Test Conditions	IP7812A LM,IP140-12			IP7812 LM,IP140-12			Units	
		Min.	Typ.	Max.	Min.	Typ.	Max.		
V <sub>O</sub> Output Voltage	I <sub>O</sub> = 1A V <sub>IN</sub> = 19V	11.88	12	12.12	11.5	12	12.5	V	
	I <sub>O</sub> = 5mA to I <sub>MAX</sub> P <sub>D</sub> ≤ P <sub>MAX</sub> V <sub>IN</sub> = 14.8V to 27V T <sub>J</sub> = -55 to 150°C	11.64			12.36				11.4 12.6
V <sub>O</sub> Low Supply	I <sub>O</sub> = 5mA to I <sub>MAX</sub> P <sub>D</sub> ≤ P <sub>MAX</sub> V <sub>IN</sub> = 14.5V to 27V	11.40			12.36			11.4 12.6	V
ΔV <sub>O</sub> Line Regulation	I <sub>O</sub> = 0.5 I <sub>MAX</sub>	V <sub>IN</sub> = 14.5V to 30V	4 18		120			mV	
		V <sub>IN</sub> = 14.8V to 30V T <sub>J</sub> = -55 to 150°C	4 18		120				
	I <sub>O</sub> ≤ I <sub>MAX</sub> V <sub>IN</sub> = 14.5V to 27V	4 18		120					
	V <sub>IN</sub> = 16V to 22V	2 9		50					
ΔV <sub>O</sub> Load Regulation	V <sub>IN</sub> = 19V	I <sub>O</sub> = 5mA to 1.5A	12 32		120			mV	
		I <sub>O</sub> = 250mA to 750mA	4 19		60				
	V <sub>IN</sub> = 19V	I <sub>O</sub> = 5mA to I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C	8 60		120				
I <sub>Q</sub> Quiescent Current	I <sub>O</sub> ≤ I <sub>MAX</sub> V <sub>IN</sub> = 19V	T <sub>J</sub> = -55 to 150°C		4 6		6		mA	
		T <sub>J</sub> = -55 to 150°C		4 6.5		7			
ΔI <sub>Q</sub> Quiescent Current Change	I <sub>O</sub> = 5mA to I <sub>MAX</sub> V <sub>IN</sub> = 19V	0.2 0.5		0.5			mA		
	I <sub>O</sub> ≤ I <sub>MAX</sub> V <sub>IN</sub> = 14.8V to 27V T <sub>J</sub> = -55 to 150°C	0.1 0.8		0.8					
	I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub> V <sub>IN</sub> = 15V to 30V	0.1 0.8		0.8					
	I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub> V <sub>IN</sub> = 14.5V to 30V T <sub>J</sub> = -55 to 150°C	0.2 1		1					
V <sub>N</sub> Output Noise Voltage	f = 10Hz to 100kHz V <sub>IN</sub> = 19V	75 480		75			μV		
ΔV <sub>IN</sub> / ΔV <sub>O</sub> Ripple Rejection	f = 120Hz V <sub>IN</sub> = 15V to 25V	I <sub>O</sub> ≤ I <sub>MAX</sub>	61 72		61			dB	
		I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C	61 72		61				
Dropout Voltage	I <sub>O</sub> = I <sub>MAX</sub>	2 2.5		2			V		
R <sub>O</sub> Output Resistance	f = 1 kHz	8		8			mΩ		
I <sub>sc</sub> Short Circuit Current	V <sub>IN</sub> = 35V	0.6 1.2		0.6 1.2			A		
I <sub>pk</sub> Peak Output Current	V <sub>IN</sub> = 19V	2.4 3.3		2.4 3.3					
Average Temperature Coefficient of V <sub>O</sub>	I <sub>O</sub> = 5mA	0.5 4.8		1.5			mV / °C		
Input Voltage required to maintain line regulation	I <sub>O</sub> ≤ I <sub>MAX</sub>	14.5			14.6			V	

- All characteristics are measured with a capacitor across the input of 0.22μF and a capacitor across the output of 0.1μF. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques (t<sub>p</sub> ≤ 10ms, δ ≤ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.
- Although power dissipation is internally limited, these specifications are applicable for maximum power dissipation P<sub>MAX</sub> of 20W, I<sub>MAX</sub> = 1.0A.
- T<sub>J</sub> = 25°C unless otherwise stated.

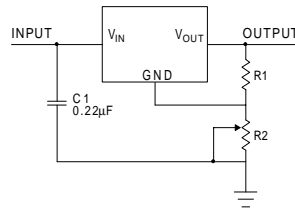
Parameter	Test Conditions	IP7815A LM,IP140A-15			IP7815 LM,IP140-15			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V <sub>O</sub> Output Voltage	I <sub>O</sub> = 1A V <sub>IN</sub> = 23V	14.85	15	15.15	14.4	15	15.60	V
	I <sub>O</sub> = 5mA to I <sub>MAX</sub> P <sub>D</sub> ≤ P <sub>MAX</sub> V <sub>IN</sub> = 17.9V to 30V T <sub>J</sub> = -55 to 150°C	14.55		15.45	14.25		15.75	
V <sub>O</sub> Low Supply	I <sub>O</sub> = 5mA to I <sub>MAX</sub> P <sub>D</sub> ≤ P <sub>MAX</sub> V <sub>IN</sub> = 17.5V to 30V	14.25		15.45	14.25		15.75	V
ΔV <sub>O</sub> Line Regulation	I <sub>O</sub> = 0.5 I <sub>MAX</sub>	V <sub>IN</sub> = 17.5V to 30V	4	22			150	mV
		V <sub>IN</sub> = 17.9V to 30V T <sub>J</sub> = -55 to 150°C	4	22			150	
	I <sub>O</sub> ≤ I <sub>MAX</sub> V <sub>IN</sub> = 17.5V to 30V	4	22			150		
	V <sub>IN</sub> = 20V to 26V T <sub>J</sub> = -55 to 150°C	2	10			60		
ΔV <sub>O</sub> Load Regulation	V <sub>IN</sub> = 23V	I <sub>O</sub> = 5mA to 1.5A	12	35			150	mV
		I <sub>O</sub> = 250mA to 750mA	4	21			75	
	V <sub>IN</sub> = 23V	I <sub>O</sub> = 5mA to I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C	9	75			150	
I <sub>Q</sub> Quiescent Current	I <sub>O</sub> ≤ I <sub>MAX</sub> V <sub>IN</sub> = 23V	T <sub>J</sub> = -55 to 150°C	4	6			6	mA
			4	6.5			7	
ΔI <sub>Q</sub> Quiescent Current Change	I <sub>O</sub> = 5mA to I <sub>MAX</sub> V <sub>IN</sub> = 23V		0.2	0.5			0.5	mA
		I <sub>O</sub> ≤ I <sub>MAX</sub> V <sub>IN</sub> = 17.9V to 30V T <sub>J</sub> = -55 to 150°C	0.1	0.8			0.8	
	I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub> V <sub>IN</sub> = 18.5V to 30V	0.1	0.8			0.8		
	I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub> V <sub>IN</sub> = 17.5V to 30V T <sub>J</sub> = -55 to 150°C	0.2	1			1		
V <sub>N</sub> Output Noise Voltage	f = 10Hz to 100kHz V <sub>IN</sub> = 23V	90	600		90		μV	
ΔV <sub>IN</sub> / ΔV <sub>O</sub> Ripple Rejection	f = 120Hz V <sub>IN</sub> = 18.5V to 28.5V	I <sub>O</sub> ≤ I <sub>MAX</sub>	60	70		60		dB
		I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C	60	70		60		
Dropout Voltage	I <sub>O</sub> = I <sub>MAX</sub>	2	2.5		2		V	
R <sub>O</sub> Output Resistance	f = 1 kHz	9			9		mΩ	
I <sub>sc</sub> Short Circuit Current	V <sub>IN</sub> = 35V	0.6	1.2		0.6	1.2	A	
I <sub>pk</sub> Peak Output Current	V <sub>IN</sub> = 23V	2.4	3.3		2.4	3.3		
Average Temperature Coefficient of V <sub>O</sub>	I <sub>O</sub> = 5mA	0.6	6		1.8		mV/°C	
Input Voltage required to maintain line regulation	I <sub>O</sub> ≤ I <sub>MAX</sub>	17.5			17.7		V	

- All characteristics are measured with a capacitor across the input of 0.22μF and a capacitor across the output of 0.1μF. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques (t<sub>p</sub> ≤ 10ms, δ ≤ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.
- Although power dissipation is internally limited, these specifications are applicable for maximum power dissipation P<sub>MAX</sub> of 20W, I<sub>MAX</sub> = 1.0A.
- T<sub>J</sub> = 25°C unless otherwise stated.

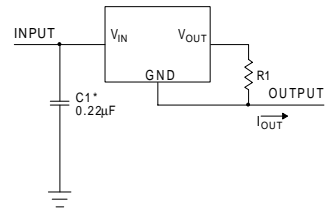
**APPLICATIONS INFORMATION**



**Fixed Output Regulator**



**Adjustable Output Regulator**



**Current Regulator**

- \* Required if the regulator is located far from the power supply.
- \*\* Although no output capacitor is needed for stability, it does help transient response. (If needed, use 0.1µF ceramic disc)

$$V_{OUT} = 5V + \left( \frac{5V}{R1 + V} \right) R2$$

$$\left( \frac{5V}{R1} \right) > 3I_Q, \text{ Load Regulation } \approx$$

$$\left[ \frac{R1+R2}{R1} \right] (L_R \text{ of Regulator})$$

$$I_{OUT} = \left( \frac{V2 - V3}{R1} \right) + I_Q$$

$$\Delta I_Q = 1.3\text{mA over line and load changes}$$

**Order Information**

Part Number	K-Pack (TO-3)	R-Pack (TO-66)	G/IG-Pack (TO-257)	SMD 1	Temp. Range	<b>Note:</b> To order, add the package identifier to the part number. eg. IP7805AK IP140SMD-12
IP7800A	✓	✓	✓	✓	-55 to +150°C	
IP7800	✓	✓	✓	✓	"	
IP140A	✓	✓	✓	✓	"	
IP140	✓	✓	✓	✓	"	
LM140	✓	✓	✓	✓	"	