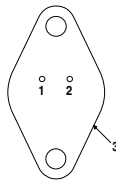


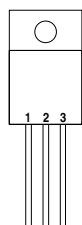
Pin 1 –  $V_{IN}$   
Pin 2 –  $V_{OUT}$   
Case – Ground

**K Package – TO-3**



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

**R Package – TO-66**

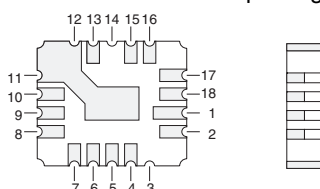


Pin 1 –  $V_{IN}$   
Pin 2 – Ground  
Pin 3 –  $V_{OUT}$   
Case – Ground\*

**G Package – TO-257**

**IG Package– TO-257\***

\* isolated Case on IG package

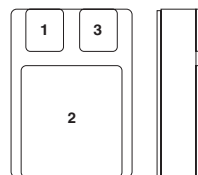


**LCC4  
CERAMIC SURFACE  
MOUNT**

Pins 4,5 –  $V_{IN}$

Pins 6,7,8,9,10,11,12,13 –  $V_{OUT}$

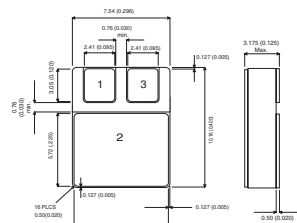
Pins 15,16,17,18,1,2 – Ground



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

**SMD 1 PACKAGE**

Ceramic Surface Mount



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

**SMD 05 PACKAGE**

Ceramic Surface Mount

## 1 AMP POSITIVE VOLTAGE REGULATOR

### 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°C
$T_{stg}$	Storage Temperature	–65 to 150°C

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

Semelab Plc reserves the right to change test conditions, parameter limits and package dimensions without notice. Information furnished by Semelab is believed to be both accurate and reliable at the time of going to press. However Semelab assumes no responsibility for any errors or omissions discovered in its use. Semelab encourages customers to verify that datasheets are current before placing orders.

Parameter	Test Conditions	IP7805A LM,IP140A-05			IP7805 LM,IP140-05			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
$V_O$ Output Voltage	$I_O = 1A$ $V_{IN} = 10V$	4.95	5	5.05	4.8	5	5.2	V
	$I_O = 5mA$ to $I_{MAX}$ $P_D \leq P_{MAX}$ $V_{IN} = 7.5V$ to $20V$ $T_J = -55$ to $150^\circ C$	4.85		5.15	4.75		5.25	
$V_O$ Low Supply	$I_O = 5mA$ to $I_{MAX}$ $P_D \leq P_{MAX}$ $V_{IN} = 7V$ to $20V$	4.75		5.15	4.75		5.25	V
$\Delta V_O$ Line Regulation	$I_O = 0.5 I_{MAX}$	$V_{IN} = 7V$ to $25V$		3	10		50	mV
		$V_{IN} = 7.5V$ to $25V$ $T_J = -55$ to $150^\circ C$		3	10		50	
	$I_O \leq I_{MAX}$	$V_{IN} = 7.3V$ to $20V$		3	10		50	
	$V_{IN} = 8V$ to $12V$			1	4		20	
		$T_J = -55$ to $150^\circ C$		2	12		25	
$\Delta V_O$ Load Regulation	$V_{IN} = 10V$	$I_O = 5mA$ to $1.5A$		10	25		50	mV
		$I_O = 250mA$ to $750mA$		4	15		25	
	$V_{IN} = 10V$	$I_O = 5mA$ to $I_{MAX}$ $T_J = -55$ to $150^\circ C$		7	25		50	
$I_Q$ Quiescent Current	$I_O \leq I_{MAX}$			4	6		6	mA
	$V_{IN} = 10V$	$T_J = -55$ to $150^\circ C$		4	6.5		7	
$\Delta I_Q$ Quiescent Current Change	$I_O = 5mA$ to $I_{MAX}$	$V_{IN} = 10V$		0.2	0.5		0.5	mA
	$I_O \leq I_{MAX}$	$V_{IN} = 7.5V$ to $20V$ $T_J = -55$ to $150^\circ C$		0.1	0.8		0.8	
	$I_O \leq 0.5 I_{MAX}$	$V_{IN} = 8V$ to $25V$		0.1	0.8		0.8	
	$I_O \leq 0.5 I_{MAX}$	$V_{IN} = 7V$ to $25V$ $T_J = -55$ to $150^\circ C$		0.2	1		1.0	
$V_N$ Output Noise Voltage	$f = 10Hz$ to $100kHz$ $V_{IN} = 10V$		40	200		40		$\mu V$
$\frac{\Delta V_{IN}}{\Delta V_O}$ Ripple Rejection	$f = 120Hz$ $V_{IN} = 8V$ to $18V$	$I_O \leq I_{MAX}$		68	80		68	dB
		$I_O \leq 0.5 I_{MAX}$ $T_J = -55$ to $150^\circ C$		68	80		68	
Dropout Voltage	$I_O = I_{MAX}$		2	2.5		2		V
$R_O$ Output Resistance	$f = 1 kHz$		5			5		m $\Omega$
$I_{sc}$ Short Circuit Current	$V_{IN} = 35V$		0.6	1.2		0.6	1.2	A
$I_{pk}$ Peak Output Current	$V_{IN} = 10V$		2.4	3.3		2.4	3.3	
Average Temperature Coefficient of $V_O$	$I_O = 5mA$		0.2	2		0.6		mV/ $^\circ C$
Input Voltage required to maintain line regulation	$I_O \leq I_{MAX}$		7.3			7.3		V

- 1) All characteristics are measured with a capacitor across the input of  $0.22\mu F$  and a capacitor across the output of  $0.1\mu F$ . All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques ( $t_p \leq 10ms$ ,  $\delta \leq 5\%$ ). Output voltage changes due to changes in internal temperature must be taken into account separately.
- 2) Although power dissipation is internally limited, these specifications are applicable for maximum power dissipation  $P_{MAX}$  of  $20W$ ,  $I_{MAX} = 1.0A$ .
- 3)  $T_J = 25^\circ C$  unless otherwise stated.

Parameter	Test Conditions	IP7812A LM,IP140A-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	
	T <sub>J</sub> = -55 to 150°C		4	30			60	
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>			4	6		6	mA
	V <sub>IN</sub> = 19V	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
$\frac{\Delta V_{IN}}{\Delta V_O}$ 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

- 1) 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.
- 2) 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.
- 3) T<sub>J</sub> = 25°C unless otherwise stated.

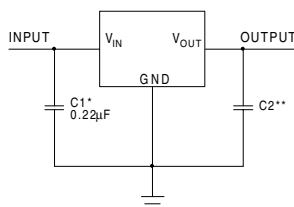
Parameter	Test Conditions	IP7815A LM,IP140A-15			IP7815 LM,IP140-15			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V <sub>O</sub> Output Voltage	I <sub>O</sub> = 1A V <sub>IN</sub> = 23V	14.85	15	15.15	14.4	15	15.60	V
	I <sub>O</sub> = 5mA to I <sub>MAX</sub> P <sub>D</sub> ≤ P <sub>MAX</sub> V <sub>IN</sub> = 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		2	10			60	
	T <sub>J</sub> = -55 to 150°C		5	30			75	
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		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> = 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	I <sub>O</sub> ≤ I <sub>MAX</sub>		60	70		60	dB
	V <sub>IN</sub> = 18.5V to 28.5V	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

- 1) 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.
- 2) 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.
- 3) T<sub>J</sub> = 25°C unless otherwise stated.

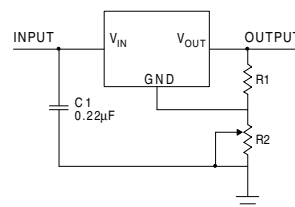
## THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	MAX	
		K-Pack	3°C/W
		R-Pack	7°C/W
		G/IG-Pack	5°C/W
		LCC4	13°C/W
		SMD	1.3°C/W

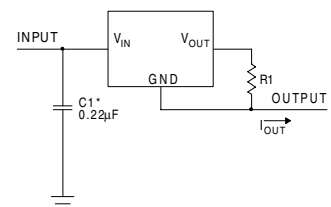
## APPLICATIONS INFORMATION



**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 SMD 05	LCC4	Temp. Range	Note: To order, add the package identifier to the part number. eg. IP7805AK IP140SMD-12
IP7800A	✓	✓	✓	✓	✓	-55 to +150°C	
IP7800	✓	✓	✓	✓	✓	"	
IP140A	✓	✓	✓	✓	✓	"	
IP140	✓	✓	✓	✓	✓	"	
LM140	✓	✓	✓	✓	✓	"	

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