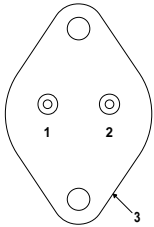
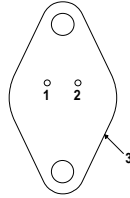


1 AMP POSITIVE VOLTAGE REGULATOR



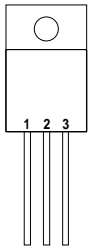
Pin 1 – V_{IN}
 Pin 2 – V_{OUT}
 Case – Ground

K Package – TO-3



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

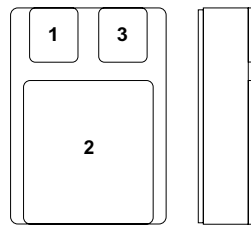
R Package – TO-66



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 ¹
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 IP140A-05			IP7805 IP140A-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 ≤ P _{MAX} V _{IN} = 7.5V to 20V T _J = -55 to 150°C	4.85		5.15	4.75		5.25	
V _O Low Supply	I _O = 5mA to I _{MAX} P _D ≤ P _{MAX} V _{IN} = 7V to 20V	4.75		5.15	4.75		5.25	V
ΔV _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°C	3	10			50	
	I _O ≤ I _{MAX} V _{IN} = 7.3V to 20V	3	10			50		
	V _{IN} = 8V to 12V	1	4			20		
		T _J = -55 to 150°C	2	12			25	
ΔV _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°C	7	25			50	
I _Q Quiescent Current	I _O ≤ I _{MAX} V _{IN} = 10V	T _J = -55 to 150°C	4	6			6	mA
			4	6.5			7	
ΔI _Q Quiescent Current Change	I _O = 5mA to I _{MAX} V _{IN} = 10V		0.2	0.5			0.5	mA
		I _O ≤ I _{MAX} V _{IN} = 7.5V to 20V T _J = -55 to 150°C	0.1	0.8			0.8	
	I _O ≤ 0.5 I _{MAX} V _{IN} = 8V to 25V	0.1	0.8			0.8		
	I _O ≤ 0.5 I _{MAX} V _{IN} = 7V to 25V T _J = -55 to 150°C	0.2	1			1.0		
V _N Output Noise Voltage	f = 10Hz to 100kHz V _{IN} = 10V	40	200		40		μV	
ΔV _{IN} / ΔV _O Ripple Rejection	f = 120Hz V _{IN} = 8V to 18V	I _O ≤ I _{MAX}	68	80		68		dB
		I _O ≤ 0.5 I _{MAX} T _J = -55 to 150°C	68	80		68		
Dropout Voltage	I _O = I _{MAX}	2	2.5		2		V	
R _O Output Resistance	f = 1 kHz	5			5		mΩ	
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/°C	
Input Voltage required to maintain line regulation	I _O ≤ I _{MAX}	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_p ≤ 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_{MAX} of 20W, I_{MAX} = 1.0A.
- T_J = 25°C unless otherwise stated.

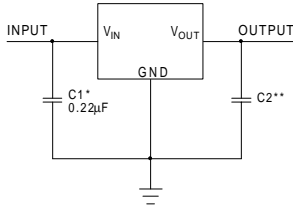
Parameter	Test Conditions	IP7812A IP140A-12			IP7812 IP140A-12			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V _O Output Voltage	I _O = 1A V _{IN} = 19V	11.88	12	12.12	11.5	12	12.5	V
	I _O = 5mA to I _{MAX} P _D ≤ P _{MAX} V _{IN} = 14.8V to 27V T _J = -55 to 150°C			12.36			12.6	
V _O Low Supply	I _O = 5mA to I _{MAX} P _D ≤ P _{MAX} V _{IN} = 14.5V to 27V	11.40		12.36	11.4		12.6	V
ΔV _O Line Regulation	I _O = 0.5 I _{MAX}	V _{IN} = 14.5V to 30V		4	18		120	mV
		V _{IN} = 14.8V to 30V T _J = -55 to 150°C		4	18		120	
	I _O ≤ I _{MAX} V _{IN} = 14.5V to 27V		4	18		120		
	V _{IN} = 16V to 22V		2	9		50		
					4	30	60	
ΔV _O Load Regulation	V _{IN} = 19V	I _O = 5mA to 1.5A		12	32		120	mV
		I _O = 250mA to 750mA		4	19		60	
	V _{IN} = 19V	I _O = 5mA to I _{MAX} T _J = -55 to 150°C		8	60		120	
I _Q Quiescent Current	I _O ≤ I _{MAX} V _{IN} = 19V	T _J = -55 to 150°C		4	6		6	mA
				4	6.5		7	
ΔI _Q Quiescent Current Change	I _O = 5mA to I _{MAX} V _{IN} = 19V			0.2	0.5		0.5	mA
		I _O ≤ I _{MAX} V _{IN} = 14.8V to 27V T _J = -55 to 150°C		0.1	0.8		0.8	
	I _O ≤ 0.5 I _{MAX} V _{IN} = 15V to 30V		0.1	0.8		0.8		
	I _O ≤ 0.5 I _{MAX} V _{IN} = 14.5V to 30V T _J = -55 to 150°C		0.2	1		1		
V _N Output Noise Voltage	f = 10Hz to 100kHz V _{IN} = 19V		75	480		75		μV
ΔV _{IN} / ΔV _O Ripple Rejection	f = 120Hz V _{IN} = 15V to 25V	I _O ≤ I _{MAX}	61	72		61		dB
		I _O ≤ 0.5 I _{MAX} T _J = -55 to 150°C	61	72		61		
Dropout Voltage	I _O = I _{MAX}		2	2.5		2		V
R _O Output Resistance	f = 1 kHz		8			8		mΩ
I _{sc} Short Circuit Current	V _{IN} = 35V		0.6	1.2		0.6	1.2	A
I _{pk} Peak Output Current	V _{IN} = 19V		2.4	3.3		2.4	3.3	
Average Temperature Coefficient of V _O	I _O = 5mA		0.5	4.8		1.5		mV / °C
Input Voltage required to maintain line regulation	I _O ≤ I _{MAX}	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_p ≤ 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_{MAX} of 20W, I_{MAX} = 1.0A.
- T_J = 25°C unless otherwise stated.

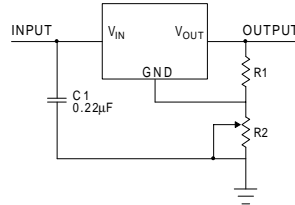
Parameter	Test Conditions	IP7815A IP140A-15			IP7815 IP140A-15			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V _O Output Voltage	I _O = 1A V _{IN} = 23V	14.85	15	15.15	14.4	15	15.60	V
	I _O = 5mA to I _{MAX} P _D ≤ P _{MAX} V _{IN} = 17.9V to 30V T _J = -55 to 150°C	14.55		15.45	14.25		15.75	
V _O Low Supply	I _O = 5mA to I _{MAX} P _D ≤ P _{MAX} V _{IN} = 17.5V to 30V	14.25		15.45	14.25		15.75	V
ΔV _O Line Regulation	I _O = 0.5 I _{MAX}	V _{IN} = 17.5V to 30V	4	22			150	mV
		V _{IN} = 17.9V to 30V T _J = -55 to 150°C	4	22			150	
	I _O ≤ I _{MAX} V _{IN} = 17.5V to 30V	4	22			150		
	V _{IN} = 20V to 26V T _J = -55 to 150°C	2	10			60		
ΔV _O Load Regulation	V _{IN} = 23V	I _O = 5mA to 1.5A	12	35			150	mV
		I _O = 250mA to 750mA	4	21			75	
	V _{IN} = 23V	I _O = 5mA to I _{MAX} T _J = -55 to 150°C	9	75			150	
I _Q Quiescent Current	I _O ≤ I _{MAX} V _{IN} = 23V	T _J = -55 to 150°C	4	6			6	mA
			4	6.5			7	
ΔI _Q Quiescent Current Change	I _O = 5mA to I _{MAX} V _{IN} = 23V		0.2	0.5			0.5	mA
		I _O ≤ I _{MAX} V _{IN} = 17.9V to 30V T _J = -55 to 150°C	0.1	0.8			0.8	
	I _O ≤ 0.5 I _{MAX} V _{IN} = 18.5V to 30V	0.1	0.8			0.8		
	I _O ≤ 0.5 I _{MAX} V _{IN} = 17.5V to 30V T _J = -55 to 150°C	0.2	1			1		
V _N Output Noise Voltage	f = 10Hz to 100kHz V _{IN} = 23V	90	600		90		μV	
ΔV _{IN} / ΔV _O Ripple Rejection	f = 120Hz V _{IN} = 18.5V to 28.5V	I _O ≤ I _{MAX}	60	70		60		dB
		I _O ≤ 0.5 I _{MAX} T _J = -55 to 150°C	60	70		60		
Dropout Voltage	I _O = I _{MAX}	2	2.5		2		V	
R _O Output Resistance	f = 1 kHz	9			9		mΩ	
I _{sc} Short Circuit Current	V _{IN} = 35V	0.6	1.2		0.6	1.2	A	
I _{pk} Peak Output Current	V _{IN} = 23V	2.4	3.3		2.4	3.3	A	
Average Temperature Coefficient of V _O	I _O = 5mA	0.6	6		1.8		mV/°C	
Input Voltage required to maintain line regulation	I _O ≤ I _{MAX}	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_p ≤ 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_{MAX} of 20W, I_{MAX} = 1.0A.
- T_J = 25°C unless otherwise stated.

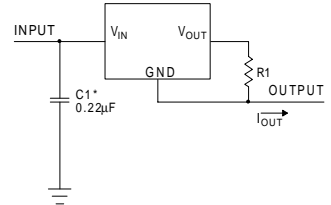
APPLICATIONS INFORMATION



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	Note: To order, add the package identifier to the part number. eg. IP7805AK IP140SG-12
IP7800A	✓	✓	✓	✓	-55 to +150°C	
IP7800	✓	✓	✓	✓	"	
IP140A	✓	✓	✓	✓	"	
IP140	✓	✓	✓	✓	"	
LM140	✓	✓	✓	✓	"	