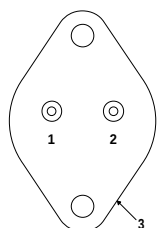
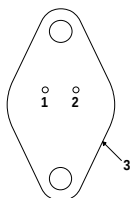


1 AMP POSITIVE VOLTAGE REGULATOR



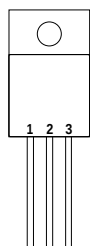
Pin 1 – V_{IN}
Pin 2 – V_{OUT}
Case – Ground

K Package – TO-3



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

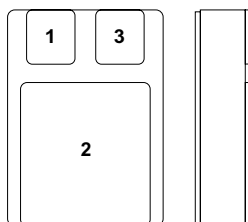
R Package – TO-66



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°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. $I_{MAX} = 1.0A$.

Parameter		Test Conditions		IP7805A LM,IP140-05			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 ≤ 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}		4		6		6		mA
		V _{IN} = 10V T _J = -55 to 150°C	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
$\frac{\Delta V_{IN}}{\Delta V_O}$	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		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		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.

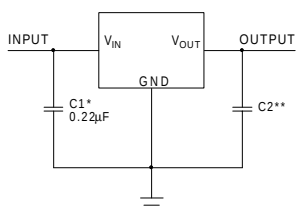
Parameter	Test Conditions	IP7812A LM,IP140-12			IP7812 LM,IP140-12			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_O Output Voltage	$I_O = 1A$ $V_{IN} = 19V$	11.88	12	12.12	11.5	12	12.5	V
	$I_O = 5mA$ to I_{MAX} $P_D \leq P_{MAX}$ $V_{IN} = 14.8V$ to $27V$ $T_J = -55$ to $150^\circ C$	11.64		12.36	11.4		12.6	
V_O Low Supply	$I_O = 5mA$ to I_{MAX} $P_D \leq P_{MAX}$ $V_{IN} = 14.5V$ 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 $150^\circ C$		4	18		120	
	$I_O \leq I_{MAX}$	$V_{IN} = 14.5V$ to $27V$		4	18		120	
	$V_{IN} = 16V$ to $22V$		2	9			50	
	$T_J = -55$ to $150^\circ C$		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 $150^\circ C$		8	60		120	
I_Q Quiescent Current	$I_O \leq I_{MAX}$			4	6		6	mA
	$V_{IN} = 19V$	$T_J = -55$ to $150^\circ C$		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
	$I_O \leq I_{MAX}$	$V_{IN} = 14.8V$ to $27V$ $T_J = -55$ to $150^\circ C$		0.1	0.8		0.8	
	$I_O \leq 0.5 I_{MAX}$	$V_{IN} = 15V$ to $30V$		0.1	0.8		0.8	
	$I_O \leq 0.5 I_{MAX}$	$V_{IN} = 14.5V$ to $30V$ $T_J = -55$ to $150^\circ C$		0.2	1		1	
V_N Output Noise Voltage	$f = 10Hz$ to $100kHz$ $V_{IN} = 19V$		75	480		75		μV
$\frac{\Delta V_{IN}}{\Delta V_O}$ Ripple Rejection	$f = 120Hz$ $V_{IN} = 15V$ to $25V$	$I_O \leq I_{MAX}$		61	72		61	dB
		$I_O \leq 0.5 I_{MAX}$ $T_J = -55$ to $150^\circ C$		61	72		61	
Dropout Voltage	$I_O = I_{MAX}$		2	2.5		2		V
R_O Output Resistance	$f = 1 kHz$		8			8		$m\Omega$
I_{sc} Short Circuit Current	$V_{IN} = 35V$		0.6	1.2		0.6	1.2	A
I_{pk} Peak Output Current	$V_{IN} = 19V$		2.4	3.3		2.4	3.3	
Average Temperature Coefficient of V_O	$I_O = 5mA$		0.5	4.8		1.5		$\frac{mV}{^\circ C}$
Input Voltage required to maintain line regulation	$I_O \leq I_{MAX}$		14.5			14.6		V

- 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.
- Although power dissipation is internally limited, these specifications are applicable for maximum power dissipation P_{MAX} of $20W$, $I_{MAX} = 1.0A$.
- $T_J = 25^\circ C$ unless otherwise stated.

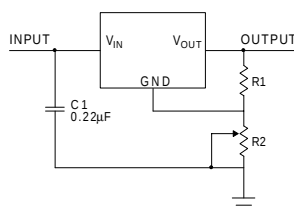
Parameter		Test Conditions		IP7815A LM,IP140A–15			IP7815 LM,IP140–15			Units
				Min.	Typ.	Max.	Min.	Typ.	Max.	
V _O	Output Voltage	I _O = 1A V _{IN} = 23V		14.85	15	15.15	14.4	15	15.60	V
		I _O = 5mA to I _{MAX} P _D ≤ P _{MAX} V _{IN} = 17.9V to 30V T _J = -55 to 150°C		14.55		15.45		14.25 15.75		
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		2		10		60		
		T _J = -55 to 150°C		5		30		75		
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		4		6		6		mA
		T _J = -55 to 150°C		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
$\frac{\Delta V_{IN}}{\Delta V_O}$	Ripple Rejection	f = 120Hz	I _O ≤ I _{MAX}	60	70	60				dB
		V _{IN} = 18.5V to 28.5V	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		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		
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		17.7		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.

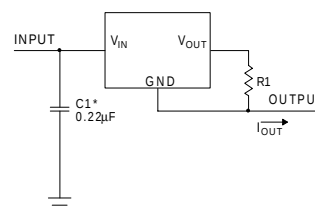
APPLICATIONS INFORMATION



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 IP140SMD-12
IP7800A	✓	✓	✓	✓	-55 to +150°C	
IP7800	✓	✓	✓	✓	"	
IP140A	✓	✓	✓	✓	"	
IP140	✓	✓	✓	✓	"	
LM140	✓	✓	✓	✓	"	

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