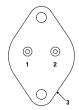
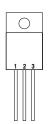


IP140A **SERIES SERIES IP140 IP7800A SERIES IP7800 SERIES** LM140 **SERIES** 



Pin 1 - V<sub>IN</sub> Pin 2 – V<sub>OUT</sub> Case - Ground

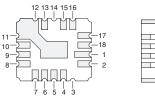
#### K Package - TO-3



Pin 1 – V<sub>IN</sub> Pin 2 - Ground Pin 3 - V<sub>OUT</sub> Case - Ground\*

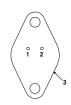
## G Package - TO-257 IG Package- TO-257\*

\* isolated Case on IG package



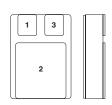
#### LCC4 **CERAMIC SURFACE MOUNT**

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  $-V_{OUT}$ Case - Ground

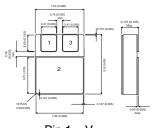
#### R Package – TO–66



Pin 1 – V<sub>IN</sub> Pin 2 - Ground Pin 3 - V<sub>OUT</sub>

#### **SMD 1 PACKAGE**

Ceramic Surface Mount



Pin  $1 - V_{IN}$ Pin 2 - Ground

#### Pin 3 – V<sub>OUT</sub>

#### **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 ±1% output voltage tolerance at room temperature.

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

## **ABSOLUTE MAXIMUM RATINGS** (T<sub>case</sub> = 25°C unless otherwise stated)

$\overline{V_{I}}$	DC Input Voltage (for V <sub>O</sub> = 5, 12, 15V)	35V
$P_{D}$	Power Dissipation	Internally limited <sup>1</sup>
Tj	Operating Junction Temperature Range	−55 to 150°C
T <sub>stg</sub>	Storage Temperature	−65 to 150°C

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

Semelab PIc 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.

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Document Number 2833



**IP140A SERIES IP140 SERIES IP7800A SERIES SERIES IP7800** LM140 **SERIES** 

			IP7805A				IP7805	05		
Parameter		Test Conditions		LM,IP140A-05 Min. Typ. Max.		LM,IP140–05 Min. Typ. Max.			Units	
raiaii	letei	I <sub>O</sub> = 1A	V <sub>IN</sub> = 10V	4.95	<b>Typ.</b> 5	<b>Max.</b> 5.05	4.8	т <b>ур.</b> 5	5.2	Units
V <sub>O</sub>	Output Voltage	$I_O = 5$ mA to $I_{MAX}$		4.55		5.15	7.0		J.L	- V
•0	Output Voltage	-	$T_{J} = -55 \text{ to } 150^{\circ}\text{C}$	4.85			4.75		5.25	'
		$I_O = 5\text{mA to } I_{MAX}$								
$V_O$	Low Supply	$V_{IN} = 7V \text{ to } 20V$	ı D ≥ ı MAX	4.75		5.15	4.75		5.25	V
		V <sub>IN</sub> = 7 V to 20 V	V <sub>IN</sub> = 7V to 25V		3	10			50	
		I <sub>O</sub> = 0.5 I <sub>MAX</sub>	$V_{IN} = 7.5V \text{ to } 25V$			10				-
		10 = 0.3 IMAX	$V_{IN} = 7.5V \text{ to } 25V$ $T_{.1} = -55 \text{ to } 150^{\circ}\text{C}$		3	10			50	
$\Delta V_{O}$	Line Regulation	1 /1			3	10			50	mV
		$I_0 \le I_{MAX}$	V <sub>IN</sub> = 7.3V to 20V			10				-
		$V_{IN} = 8V \text{ to } 12V$	T 55 to 45000		1	4			20	-
			$T_{J} = -55 \text{ to } 150^{\circ}\text{C}$		2	12			25	
		V <sub>IN</sub> = 10V	$I_O = 5$ mA to 1.5A		10	25			50	
$\Delta V_{O}$	Load Regulation	V <sub>IN</sub> = 10V	O = 250mA to 750mA		4	15			25	mV
	3		$I_O = 5mA \text{ to } I_{MAX}$	7	7 25			50		
			$T_{J} = -55 \text{ to } 150^{\circ}\text{C}$							
ΙQ	Quiescent Current	$I_O \le I_{MAX}$			4	6			6	mA
·Q	Quioconi Guii Giii	V <sub>IN</sub> = 10V	$T_{J} = -55 \text{ to } 150^{\circ}\text{C}$		4	6.5			7	L
		$I_O = 5mA \text{ to } I_{MAX}$	V <sub>IN</sub> = 10V		0.2	0.5			0.5	_
		$I_{O} \leq I_{MAX}$	$V_{IN} = 7.5V \text{ to } 20V$		0.1	0.8			0.8	
$\Delta I_{Q}$	Quiescent Current		$T_J = -55 \text{ to } 150^{\circ}\text{C}$		0.1	0.0			0.0	mA
	Change	$I_O \le 0.5 I_{MAX}$	$V_{IN} = 8V \text{ to } 25V$		0.1	0.8			8.0	] ""
		I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub>	V <sub>IN</sub> = 7V to 25V	0.2	0.2 1		1.0			
			$T_J = -55 \text{ to } 150^{\circ}\text{C}$		0.2	I			1.0	
V <sub>N</sub>	Output Noise	f = 10Hz to 100kH	łz		40	200		40		/
	Voltage	$V_{IN} = 10V$			40	200		40		μV
41/		f 100U-	$I_{O} \leq I_{MAX}$	68	80		68			
$\frac{\Delta V_{IN}}{\Delta V_{I}}$	Ripple Rejection	f = 120Hz	I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub>	00	00		00			dB
$\Delta V_{O}$		$V_{IN} = 8V \text{ to } 18V$	$T_{J} = -55 \text{ to } 150^{\circ}\text{C}$	68	80	30	68			
	Dropout Voltage	$I_O = I_{MAX}$	l .		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	
I <sub>pk</sub> Peak Output Current					2.4	3.3		2.4	3.3	A
-	erage Temperature				•					mV_
,	Coefficient of V <sub>O</sub>	$I_O = 5mA$			0.2	2		0.6		√°C
	t Voltage required to			_						
	ntain line regulation	$I_{O} \leq I_{MAX}$		7.3			7.3			V

<sup>1)</sup> 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 ( $t_p \le 10 ms$ ,  $\delta \le 5\%$ ). Output voltage changes due to changes in internal temperature must be taken into account separately.

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<sup>2)</sup> Although power dissipation is internally limited, these specifications are applicable for maximum power dissipation  $P_{MAX}$  of 20W,  $I_{MAX} = 1.0A.$ 

<sup>3)</sup>  $T_J = 25^{\circ}C$  unless otherwise stated.



**IP140A SERIES IP140 SERIES IP7800A SERIES SERIES IP7800** LM140 **SERIES** 

			IP7812A			, ,	IP7812	10			
Parameter		Test Conditions		LM,IP140A- Min. Typ.		–12 Max.	LM,IP140–12 Min. Typ. Max.			Units	
ı aram	etei	I <sub>O</sub> = 1A	V <sub>IN</sub> = 19V	11.88	12 12	12.12	11.5	12	12.5	Units	
v <sub>o</sub>	Output Voltage	$I_O = 5mA \text{ to } I_{MAX}$		11.00	12	12.36	11.4		12.0	V	
*0	Output Voltago	-	$V T_J = -55 \text{ to } 150^{\circ}\text{C}$	11.64					12.6	'	
		$I_O = 5\text{mA to } I_{MAX}$	-							_	
Vo	Low Supply	$V_{IN} = 14.5V \text{ to } 27$		11.40		12.36	11.4		12.6	V	
		* III	V <sub>IN</sub> = 14.5V to 30V		4	18			120	+-+	
		I <sub>O</sub> = 0.5 I <sub>MAX</sub>	$V_{IN} = 14.8V \text{ to } 30V$							-	
		O - WAX	T <sub>.1</sub> = -55 to 150°C		4	18			120		
$\Delta V_{O}$	Line Regulation	I <sub>O</sub> ≤ I <sub>MAX</sub>	V <sub>IN</sub> = 14.5V to 27V		4	18			120	mV	
		$V_{IN} = 16V \text{ to } 22V$	114		2	9			50	1	
			T <sub>.1</sub> = -55 to 150°C		4	30			60	1	
			I <sub>O</sub> = 5mA to 1.5A		12	32			120		
		$V_{IN} = 19V$	<sub>O</sub> = 250mA to 750mA		4	19			60	1	
$\Delta V_{O}$	Load Regulation	V <sub>IN</sub> = 19V	$I_O = 5$ mA to $I_{MAX}$	8		60				mV	
			$T_J = -55 \text{ to } 150^{\circ}\text{C}$		8				120		
	0	I <sub>O</sub> ≤ I <sub>MAX</sub>			4	6			6	<b>†</b> .	
IQ	Quiescent Current	V <sub>IN</sub> = 19V	$T_J = -55 \text{ to } 150^{\circ}\text{C}$		4	6.5			7	mA	
		$I_O = 5$ mA to $I_{MAX}$	V <sub>IN</sub> = 19V		0.2	0.5			0.5		
		I <sub>O</sub> ≤ I <sub>MAX</sub>	V <sub>IN</sub> = 14.8V to 27V		0.1	0.0			0.0		
$\Delta I_Q$	Quiescent Current		$T_{J} = -55 \text{ to } 150^{\circ}\text{C}$		0.1	8.0			8.0		
	Change	I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub>	V <sub>IN</sub> = 15V to 30V		0.1	0.8			0.8	mA	
		I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub>	V <sub>IN</sub> = 14.5V to 30V	0.2	0.0 1			1			
			$T_{J} = -55 \text{ to } 150^{\circ}\text{C}$		0.2	1			1		
V <sub>N</sub>	Output Noise	f = 10Hz to 100kH	łz		75	400		75		μV	
	Voltage	V <sub>IN</sub> = 19V			75	480		75		μν	
$\Delta V_{IN}$		f = 120Hz	$I_{O} \le I_{MAX}$	61	72		61				
$\frac{\Delta V_{IN}}{\Delta V_{O}}$	Ripple Rejection	$V_{IN} = 15V \text{ to } 25V$	$I_O \le 0.5 I_{MAX}$	61	72		61			dB	
ΔνΟ		V <sub>IN</sub> = 15V to 25V	$T_{J} = -55 \text{ to } 150^{\circ}\text{C}$	01	72	12	01				
	Dropout Voltage	$I_O = I_{MAX}$			2	2.5		2		٧	
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	Α	
I <sub>pk</sub> Peak Output Current		t V <sub>IN</sub> = 19V			2.4	3.3		2.4	3.3	] ^	
Average Temperature		I <sub>O</sub> = 5mA			0.5	4.8		1.5		mV	
	Coefficient of V <sub>O</sub>					7.0		1.0			
	t Voltage required to	 		14.5			14.6			V	
maintain line regulation		$I_0 \le I_{MAX}$		14.5			1 7.0				

<sup>1)</sup> 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 ( $t_p \le 10 ms$ ,  $\delta \le 5\%$ ). Output voltage changes due to changes in internal temperature must be taken into account separately.

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<sup>2)</sup> Although power dissipation is internally limited, these specifications are applicable for maximum power dissipation  $P_{MAX}$  of 20W,  $I_{MAX} = 1.0A.$ 

<sup>3)</sup>  $T_J = 25^{\circ}C$  unless otherwise stated.



**SERIES** IP140A **IP140 SERIES IP7800A SERIES IP7800 SERIES SERIES** LM140

Parameter				IP7815A LM,IP140A–15			IP7815 LM,IP140-15			
		Test Conditions		Min. Typ.		Max.			Max.	. Units
		I <sub>O</sub> = 1A	V <sub>IN</sub> = 23V	14.85	15	15.15	14.4	15	15.60	
Vo	Output Voltage	$I_O = 5mA \text{ to } I_{MAX}$	$P_D \le P_{MAX}$	44.55		15.45	14.05			V
		$V_{IN} = 17.9V \text{ to } 30$	V T <sub>J</sub> = -55 to 150°C	14.55			14.25		15.75	
.,		$I_O = 5mA \text{ to } I_{MAX}$	$P_D \le P_{MAX}$	440=						<b>T</b> ,,
V <sub>O</sub>	Low Supply	$V_{IN} = 17.5V \text{ to } 30$	V	14.25		15.45	14.25		15.75	V
			V <sub>IN</sub> = 17.5V to 30V		4	22			150	
		$I_O = 0.5 I_{MAX}$	$V_{IN} = 17.9V \text{ to } 30V$							1
			$T_{\rm J} = -55 \text{ to } 150^{\circ}\text{C}$		4	22			150	١.,
$\Delta V_{O}$	Line Regulation	$I_{O} \leq I_{MAX}$	$V_{IN} = 17.5V \text{ to } 30V$		4	22			150	⊢ mV
		V <sub>IN</sub> = 20V to 26V			2	10			60	1
			$T_{J} = -55 \text{ to } 150^{\circ}\text{C}$		5	30			75	1
		V 00V	I <sub>O</sub> = 5mA to 1.5A		12	35			150	
437	Laad Dawdatian	$V_{IN} = 23V$ $V_{IN} = 23V$	I <sub>O</sub> = 250mA to 750mA		4	21			75	,
$\Delta V_{O}$	Load Regulation		$I_O = 5$ mA to $I_{MAX}$			75			150	mV
			$T_{J} = -55 \text{ to } 150^{\circ}\text{C}$		9				150	
	Ouissant Current	$I_{O} \leq I_{MAX}$			4	6			6	m_1
IQ	Quiescent Current	$V_{IN} = 23V$	$T_{J} = -55 \text{ to } 150^{\circ}\text{C}$		4	6.5			7	mA
		$I_O = 5mA \text{ to } I_{MAX}$	V <sub>IN</sub> = 23V		0.2	0.5			0.5	
		$I_{O} \leq I_{MAX}$	V <sub>IN</sub> = 17.9V to 30V		0.1	0.8			0.8	
$\Delta I_{Q}$	Quiescent Current		$T_{J} = -55 \text{ to } 150^{\circ}\text{C}$	0.1		0.8			0.6	
	Change	I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub>	V <sub>IN</sub> = 18.5V to 30V		0.1	0.8			8.0	mA
		I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub>	V <sub>IN</sub> = 17.5V to 30V	0.2	0.0 1			•		
			$T_{J} = -55 \text{ to } 150^{\circ}\text{C}$		0.2	1			1	
V <sub>N</sub>	Output Noise	f = 10Hz to 100kl	Чz		00	600		00		/
	Voltage	$V_{IN} = 23V$			90	600		90		μV
417		f = 120Hz	$I_{O} \le I_{MAX}$	60	70		60			
$\frac{\Delta V_{IN}}{\Delta V}$	Ripple Rejection	$V_{IN} = 18.5V \text{ to}$	I <sub>O</sub> ≤ 0.5 I <sub>MAX</sub>	60	70		00			dB
$\Delta V_{O}$		28.5V	$T_{J} = -55 \text{ to } 150^{\circ}\text{C}$	60	70	70	60			
	Dropout Voltage	$I_O = I_{MAX}$			2	2.5		2		٧
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	
I <sub>pk</sub>	Peak Output Current	V <sub>IN</sub> = 23V			2.4	3.3		2.4	3.3	A
	erage Temperature	Em^			0.6	6		1.0		mV_
(	Coefficient of V <sub>O</sub>	$I_O = 5mA$			0.6	6		1.8		
Inpu	t Voltage required to	1 21		175			177			
maintain line regulation		$I_0 \le I_{MAX}$		17.5			17.7			V

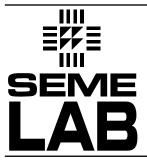
<sup>1)</sup> All characteristics are measured with a capacitor across the input of  $0.22\mu F$  and a capacitor across the output of  $0.1\mu F$ . All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques ( $t_p \le 10 \text{ms}$ ,  $\delta \le 5\%$ ). Output voltage changes due to changes in internal temperature must be taken into account separately.

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<sup>2)</sup> Although power dissipation is internally limited, these specifications are applicable for maximum power dissipation  $P_{\mbox{MAX}}$  of 20W ,  $I_{MAX} = 1.0A.$ 

<sup>3)</sup>  $T_J = 25^{\circ}C$  unless otherwise stated.

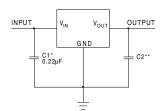


IP140A **SERIES IP140 SERIES IP7800A SERIES SERIES IP7800 SERIES** LM140

## THERMAL DATA

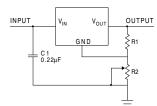
			MAX
$R_{thj\text{-case}}$		K-Pack	3°C/W
	Thermal Resistance Junction-case	R-Pack	7°C/W
	Thermal Resistance Junction-case	G/IG-Pack	5°C/W
		LCC4	13°C/W
		SMD	1.3°C/W

#### **APPLICATIONS INFORMATION**



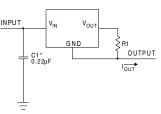
#### **Fixed Output Regulator**

- 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)



## **Adjustable Output Regulator**

$$\begin{split} &V_{OUT} = 5V + \left(\frac{5V}{R1 + V}\right)R2 \\ &\left(\frac{5V}{R1}\right) > 3I_Q \ , \ Load \ Regulation \approx \\ &\left[\frac{R1 + R2}{R1}\right] (L_R \ of \ Regulator) \end{split}$$



#### **Current Regulator**

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

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

### **Order Information**

Part	K-Pack	R-Pack	G/IG-Pack	SMD 1	LCC4	Temp.	Note:
Number	(TO-3)	(TO-66)	(TO-257)	SMD 05		Range	
IP7800A	✓	✓	✓	<b>√</b>	✓	-55 to +150°C	To order, add the package identifier
IP7800	✓	✓	✓	✓	$\checkmark$	"	to the part number.
IP140A	✓	✓	✓	✓	✓	,,	eg. IP7805AK
IP140	✓	✓	✓	✓	$\checkmark$	"	IP140SMD-12
LM140	<b>√</b>	<b>√</b>	<b>√</b>	<b>√</b>	<b>√</b>	"	

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