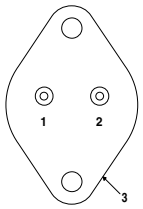
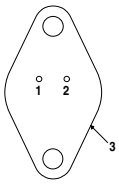
IP140A SERIES
IP140 SERIES
IP7800A SERIES
IP7800 SERIES
LM140 SERIES

1 AMP POSITIVE VOLTAGE REGULATOR



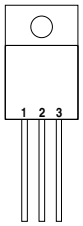
Pin 1 – V_{IN}
Pin 2 – V_{OUT}
Case – Ground

K Package – TO–3



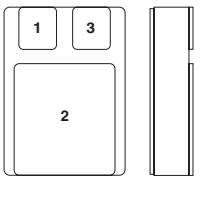
Pin 1 – V_{IN}
Pin 2 – V_{OUT}
Case – Ground

R Package – TO–66



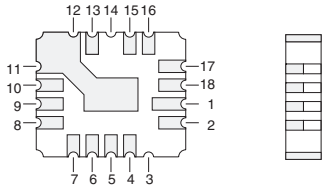
Pin 1 – V_{IN}
Pin 2 – Ground
Pin 3 – V_{OUT}
Case – Ground*

G Package – TO–257
IG Package– TO–257*
* isolated Case on IG package

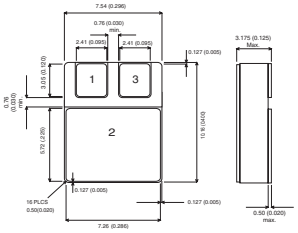


Pin 1 – V_{IN}
Pin 2 – Ground
Pin 3 – V_{OUT}

SMD 1 PACKAGE
Ceramic Surface Mount



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 05 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 ±1% output voltage tolerance at room temperature.

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

ABSOLUTE MAXIMUM RATINGS (T_{case} = 25°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.

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Issue 2

IP140A SERIES
IP140 SERIES
IP7800A SERIES
IP7800 SERIES
LM140 SERIES

Parameter		Test Conditions		IP7805A LM,IP140A–05 Min.	IP7805A LM,IP140A–05 Typ.	IP7805A LM,IP140A–05 Max.	IP7805 LM,IP140–05 Min.	IP7805 LM,IP140–05 Typ.	IP7805 LM,IP140–05 Max.	Units
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} V_{IN} = 7.5V to 20V	$P_D \le P_{MAX}$ T_J = -55 to 150°C	4.85		5.15	4.75		5.25	
V_O	Low Supply	I_O = 5mA to I_{MAX} V_{IN} = 7V to 20V	$P_D \le P_{MAX}$	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	
		$I_O \le I_{MAX}$	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	$I_O \le I_{MAX}$			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
		$I_O \le I_{MAX}$	V_{IN} = 7.5V to 20V T_J = -55 to 150°C		0.1	0.8			0.8	
		$I_O \le 0.5\ I_{MAX}$	V_{IN} = 8V to 25V		0.1	0.8			0.8	
		$I_O \le 0.5\ I_{MAX}$	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	$I_O \le I_{MAX}$	68	80		68			dB
			$I_O \le 0.5\ I_{MAX}$ 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		$I_O \le I_{MAX}$		7.3			7.3			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 ($t_p \le$ 10ms, $\delta \le$ 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°C unless otherwise stated.

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IP140A SERIES
IP140 SERIES
IP7800A SERIES
IP7800 SERIES
LM140 SERIES

Parameter		Test Conditions		IP7812A LM,IP140A–12 Min.	Typ.	Max.	IP7812 LM,IP140–12 Min.	Typ.	Max.	Units
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} V_{IN} = 14.8V to 27V	$P_D \le P_{MAX}$ T_J = -55 to 150°C	11.64		12.36	11.4		12.6	
V_O	Low Supply	I_O = 5mA to I_{MAX} V_{IN} = 14.5V to 27V	$P_D \le P_{MAX}$	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	
		$I_O \le I_{MAX}$	V_{IN} = 14.5V to 27V		4	18			120	
		V_{IN} = 16V to 22V			2	9			50	
			T_J = -55 to 150°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°C		8	60			120	
I_Q	Quiescent Current	$I_O \le I_{MAX}$			4	6			6	mA
		V_{IN} = 19V	T_J = -55 to 150°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
		$I_O \le I_{MAX}$	V_{IN} = 14.8V to 27V T_J = -55 to 150°C		0.1	0.8			0.8	
		$I_O \le 0.5\ I_{MAX}$	V_{IN} = 15V to 30V		0.1	0.8			0.8	
		$I_O \le 0.5\ I_{MAX}$	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
$\frac{\Delta V_{IN}}{\Delta V_O}$	Ripple Rejection	f = 120Hz V_{IN} = 15V to 25V	$I_O \le I_{MAX}$	61	72		61			dB
			$I_O \le 0.5\ I_{MAX}$ 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		$I_O \le I_{MAX}$		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 ($t_p \le$ 10ms, $\delta \le$ 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°C unless otherwise stated.

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IP140A SERIES
IP140 SERIES
IP7800A SERIES
IP7800 SERIES
LM140 SERIES

Parameter		Test Conditions		IP7815A LM,IP140A–15 Min.	IP7815A LM,IP140A–15 Typ.	IP7815A LM,IP140A–15 Max.	IP7815 LM,IP140–15 Min.	IP7815 LM,IP140–15 Typ.	IP7815 LM,IP140–15 Max.	Units
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} V_{IN} = 17.9V to 30V	$P_D \le P_{MAX}$ T_J = -55 to 150°C	14.55		15.45	14.25		15.75	
V_O	Low Supply	I_O = 5mA to I_{MAX} V_{IN} = 17.5V to 30V	$P_D \le P_{MAX}$	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	
		$I_O \le I_{MAX}$	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	$I_O \le I_{MAX}$			4	6			6	mA
		V_{IN} = 23V	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
		$I_O \le I_{MAX}$	V_{IN} = 17.9V to 30V T_J = -55 to 150°C		0.1	0.8			0.8	
		$I_O \le 0.5\ I_{MAX}$	V_{IN} = 18.5V to 30V		0.1	0.8			0.8	
		$I_O \le 0.5\ I_{MAX}$	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 V_{IN} = 18.5V to 28.5V	$I_O \le I_{MAX}$	60	70		60			dB
			$I_O \le 0.5\ I_{MAX}$ 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	
Average Temperature Coefficient of V_O		I_O = 5mA			0.6	6		1.8		mV/°C
Input Voltage required to maintain line regulation		$I_O \le I_{MAX}$		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 ($t_p \le$ 10ms, $\delta \le$ 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°C unless otherwise stated.

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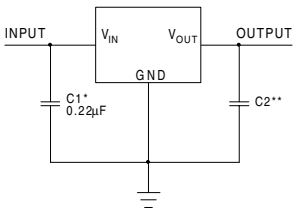
THERMAL DATA

			MAX
$R_{thj\text{-}case}$	Thermal Resistance Junction-case	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

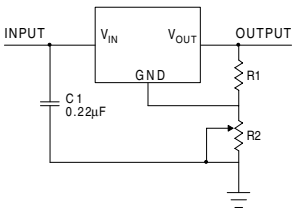
APPLICATIONS INFORMATION



Fixed Output Regulator

* 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)

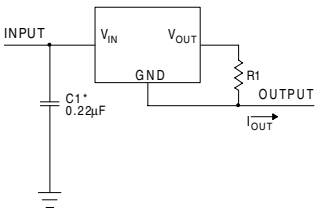


Adjustable Output Regulator

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

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

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



Current Regulator

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

ΔI_Q = 1.3mA 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
IP7800A	✓	✓	✓	✓	✓	-55 to +150°C
IP7800	✓	✓	✓	✓	✓	”
IP140A	✓	✓	✓	✓	✓	”
IP140	✓	✓	✓	✓	✓	”
LM140	✓	✓	✓	✓	✓	”

Note:

To order, add the package identifier to the part number.

eg. IP7805AK
IP140SMD-12

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Document Number 2833
Issue 2

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