Positive-Voltage Regulators

Rev.2 Feb. 2011

VSP MIKRON

78XXnd4

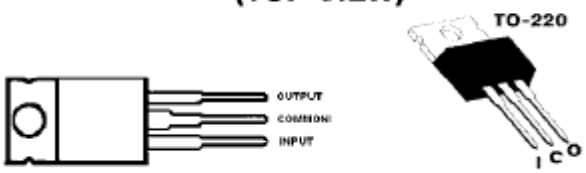
- **3-Terminal Regulators**
- **Output Current Up to 1.5 A**
- **No External Components**
- **Internal Thermal Overload Protection**
- **High Power Dissipation Capability**
- **Internal Short-Circuit Current Limiting**
- **Output Transistor Safe-Area Compensation**

DESCRIPTION

This series of fixed-voltage monolithic integrated-circuit voltage regulators is designed for a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems associated with single-point regulation. Each of these regulators can deliver up to 1.5 amperes of output current. The internal current limiting and termal shutdown features of these regulators make them essentially immune to overload.

Nominal output voltage	Regulator
5V	7805nd4
6V	7806nd4
8V	7808nd4
8.5V	7885nd4
9V	7809nd4
10V	7810nd4
12V	7812nd4
15V	7815nd4
18V	7818nd4
20V	7820nd4
24V	7824nd4
27V	7827nd4

KC PACKAGE
(TOP VIEW)



absolute maximum ratings over operating temperature range (unless otherwise noted)

		78--	UNIT
Input voltage	7824, 7827	40	V
	All others	35	
Continuous total dissipation at 25 °C free-air temperature		2	W
Continuous total dissipation at (or below) 25 °C case temperature		15	
Operating free-air, case, or virtual junctions temperature range		0 to 150	°C
Storage temperature range		-65 to 150	
Lead temperature 1.6 mm (1/16 inch) from case for 10 seconds		260	

Recommended operating conditions

PARAMETER		MIN	MAX	UNIT
Input voltage V_I	7805	7	25	V
	7806	8	25	
	7808	10.5	25	
	7885	10.5	25	
	7809	11.5	27	
	7810	12.5	28	
	7812	14.5	30	
	7815	17.5	30	
	7818	21	33	
	7820	23	36	
	7824	27	38	
	7827	30	40	
Output current, I_O			1.5	A
Operating virtual junction temperature, T_J		0	125	°C

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7805 electrical characteristics at specified virtual junction temperature, V_I= 10V, I_O= 500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7805			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	4.8	5	5.2	V
	I_O= 5mA to 1A, V_I= 7V to 20V, P≤15W	0°C to 125°C	4.75	5	5.25	
Input regulation	V_I= 7V to 25V	25°C		3	100	mV
	V_I= 8V to 12V			1	50	
Ripple rejection	V_I= 8V to 18V, f= 120Hz	0°C to 125°C	62	78		dB
Output regulation	I_O= 5mA to 1.5A	25°C		15	100	mV
	I_O= 250mA to 750mA			5	50	
Output resistance	f= 1KHz	0°C to 125°C		0.017		Ω
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-1.1		mV/°C
Output noise voltage	f= 10 Hz to 100 KHz	25°C		40		μV
Dropout voltage	I_O= 1A	25°C		2.0		V
Bias current		25°C		5.6	8	mA
Bias current change	V_I= 7V to 25V	0°C to 125°C			1.3	
	I_O= 5mA to 1A				0.5	
Short-circuit output current		25°C		750		
Peak output current		25°C		2.2		A

7806 electrical characteristics at specified virtual junction temperature, V_I= 11V, I_O= 500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7806			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	5.75	6	6.25	V
	I_O= 5mA to 1A, V_I= 8V to 21V, P≤15W	0°C to 125°C	5.7	6	6.3	
Input regulation	V_I= 8V to 25V	25°C		5	120	mV
	V_I= 9V to 13V			1.5	60	
Ripple rejection	V_I= 9V to 19V, f= 120Hz	0°C to 125°C	59	75		dB
Output regulation	I_O= 5mA to 1.5A	25°C		14	120	mV
	I_O= 250mA to 750mA			4	60	
Output resistance	f= 1KHz	0°C to 125°C		0.019		Ω
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-0.8		mV/°C
Output noise voltage	f= 10 Hz to 100 KHz	25°C		45		μV
Dropout voltage	I_O= 1A	25°C		2.0		V
Bias current		25°C		5.7	8	mA
Bias current change	V_I= 8V to 25V	0°C to 125°C			1.3	
	I_O= 5mA to 1A				0.5	
Short-circuit output current		25°C		550		
Peak output current		25°C		2.2		A

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7808 electrical characteristics at specified virtual junction temperature, V_I= 14V, I_O= 500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7808			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	7.7	8	8.3	V
	I_O= 5mA to 1A, V_I= 10.5V to 23V, P≤15W	0°C to 125°C	7.6	8	8.4	
Input regulation	V_I= 10.5V to 25V	25°C		6	160	mV
	V_I= 11V to 17V			2	80	
Ripple rejection	V_I= 11.5V to 21.5V, f= 120Hz	0°C to 125°C	55	72		dB
Output regulation	I_O= 5mA to 1.5A	25°C		12	160	mV
	I_O= 250mA to 750mA			4	80	
Output resistance	f= 1KHz	0°C to 125°C		0.016		Ω
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-0.8		mV/°C
Output noise voltage	f= 10 Hz to 100 KHz	25°C		52		μV
Dropout voltage	I_O= 1A	25°C		2.0		V
Bias current		25°C		5.7	8	mA
Bias current change	V_I= 10.5V to 25V	0°C to 125°C			1	
	I_O= 5mA to 1A				0.5	
Short-circuit output current		25°C		450		
Peak output current		25°C		2.2		A

7885 electrical characteristics at specified virtual junction temperature, V_I= 15V, I_O= 500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7885			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	8.15	8.5	8.85	V
	I_O= 5mA to 1A, V_I= 11V to 23.5V, P≤15W	0°C to 125°C	8.1	8.5	8.9	
Input regulation	V_I= 10.5V to 25V	25°C		6	170	mV
	V_I= 11V to 17V			2	85	
Ripple rejection	V_I= 11.5V to 21.5V, f= 120Hz	0°C to 125°C	54	70		dB
Output regulation	I_O= 5mA to 1.5A	25°C		12	170	mV
	I_O= 250mA to 750mA			4	85	
Output resistance	f= 1KHz	0°C to 125°C		0.016		Ω
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-0.8		mV/°C
Output noise voltage	f= 10 Hz to 100 KHz	25°C		55		μV
Dropout voltage	I_O= 1A	25°C		2.0		V
Bias current		25°C		5.7	8	mA
Bias current change	V_I= 10.5V to 25V	0°C to 125°C			1	
	I_O= 5mA to 1A				0.5	
Short-circuit output current		25°C		450		
Peak output current		25°C		2.2		A

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7809 electrical characteristics at specified virtual junction temperature, V_I= 16V, I_O= 500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7809			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	8.65	9	9.35	V
	I_O= 5mA to 1A, V_I= 11.5V to 24V, P≤15W	0°C to 125°C	8.55	9	9.45	
Input regulation	V_I= 11.5V to 27V	25°C		7	180	mV
	V_I= 13V to 19V			2	90	
Ripple rejection	V_I= 12V to 22V, f= 120Hz	0°C to 125°C	55	70		dB
Output regulation	I_O= 5mA to 1.5A	25°C		12	180	mV
	I_O= 250mA to 750mA			4	90	
Output resistance	f= 1KHz	0°C to 125°C		0.018		Ω
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-1.0		mV/°C
Output noise voltage	f= 10 Hz to 100 KHz	25°C		60		μV
Dropout voltage	I_O= 1A	25°C		2.0		V
Bias current		25°C		5.7	8	mA
Bias current change	V_I= 11.5V to 27V	0°C to 125°C			1	
	I_O= 5mA to 1A				0.5	
Short-circuit output current		25°C		400		
Peak output current		25°C		2.2		A

7810 electrical characteristics at specified virtual junction temperature, V_I= 17V, I_O= 500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7810			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	9.6	10	10.4	V
	I_O= 5mA to 1A, V_I= 12.5V to 25V, P≤15W	0°C to 125°C	9.5	10	10.5	
Input regulation	V_I= 12.5V to 28V	25°C		7	200	mV
	V_I= 14V to 20V			2	100	
Ripple rejection	V_I= 13V to 23V, f= 120Hz	0°C to 125°C	55	71		dB
Output regulation	I_O= 5mA to 1.5A	25°C		12	200	mV
	I_O= 250mA to 750mA			4	100	
Output resistance	f= 1KHz	0°C to 125°C		0.018		Ω
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-1.0		mV/°C
Output noise voltage	f= 10 Hz to 100 KHz	25°C		70		μV
Dropout voltage	I_O= 1A	25°C		2.0		V
Bias current		25°C		5.7	8	mA
Bias current change	V_I= 12.5V to 28V	0°C to 125°C			1	
	I_O= 5mA to 1A				0.5	
Short-circuit output current		25°C		400		
Peak output current		25°C		2.2		A

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7812 electrical characteristics at specified virtual junction temperature, V_I= 19V, I_O= 500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7812			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	11.5	12	12.5	V
	I_O= 5mA to 1A, V_I= 14.5V to 27V, P≤15W	0°C to 125°C	11.4	12	12.6	
Input regulation	V_I= 14.5V to 30V	25°C		10	240	mV
	V_I= 16V to 22V			3	120	
Ripple rejection	V_I= 15V to 25V, f= 120Hz	0°C to 125°C	55	71		dB
Output regulation	I_O= 5mA to 1.5A	25°C		12	240	mV
	I_O= 250mA to 750mA			4	120	
Output resistance	f= 1KHz	0°C to 125°C		0.018		Ω
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-1.0		mV/°C
Output noise voltage	f= 10 Hz to 100 KHz	25°C		75		μV
Dropout voltage	I_O= 1A	25°C		2.0		V
Bias current		25°C		5.7	8	mA
Bias current change	V_I= 14.5V to 30V	0°C to 125°C			1	
	I_O= 5mA to 1A				0.5	
Short-circuit output current		25°C		350		
Peak output current		25°C		2.2		A

7815 electrical characteristics at specified virtual junction temperature, V_I= 23V, I_O= 500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7815			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	14.4	15	15.6	V
	I_O= 5mA to 1A, V_I= 17.5V to 30V, P≤15W	0°C to 125°C	14.25	15	15.75	
Input regulation	V_I= 17.5V to 30V	25°C		12	300	mV
	V_I= 20V to 26V			3	150	
Ripple rejection	V_I= 18.5V to 28.5V, f= 120Hz	0°C to 125°C	54	70		dB
Output regulation	I_O= 5mA to 1.5A	25°C		12	300	mV
	I_O= 250mA to 750mA			4	150	
Output resistance	f= 1KHz	0°C to 125°C		0.019		Ω
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-1.0		mV/°C
Output noise voltage	f= 10 Hz to 100 KHz	25°C		90		μV
Dropout voltage	I_O= 1A	25°C		2.0		V
Bias current		25°C		5.7	8	mA
Bias current change	V_I= 17.5V to 30V	0°C to 125°C			1	
	I_O= 5mA to 1A				0.5	
Short-circuit output current		25°C		230		
Peak output current		25°C		2.1		A

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7818 electrical characteristics at specified virtual junction temperature, V_I= 27V, I_O= 500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7818			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	17.3	18	18.7	V
	I_O= 5mA to 1A, V_I= 21V to 33V, P≤15W	0°C to 125°C	17.1	18	18.9	
Input regulation	V_I= 21V to 33V	25°C		15	360	mV
	V_I= 24V to 30V			5	180	
Ripple rejection	V_I= 22V to 32V, f= 120Hz	0°C to 125°C	53	69		dB
Output regulation	I_O= 5mA to 1.5A	25°C		12	360	mV
	I_O= 250mA to 750mA			4	180	
Output resistance	f= 1KHz	0°C to 125°C		0.022		Ω
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-1.0		mV/°C
Output noise voltage	f= 10 Hz to 100 KHz	25°C		110		μV
Dropout voltage	I_O= 1A	25°C		2.0		V
Bias current		25°C		5.8	8	mA
Bias current change	V_I= 21V to 33V	0°C to 125°C			1	
	I_O= 5mA to 1A				0.5	
Short-circuit output current		25°C		200		
Peak output current		25°C		2.1		A

7820 electrical characteristics at specified virtual junction temperature, V_I= 29V, I_O= 500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7820			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	19.2	20	20.8	V
	I_O= 5mA to 1A, V_I= 23V to 35V, P≤15W	0°C to 125°C	19	20	21	
Input regulation	V_I= 23V to 35V	25°C		18	400	mV
	V_I= 26V to 32V			7	200	
Ripple rejection	V_I= 24V to 34V, f= 120Hz	0°C to 125°C	51	66		dB
Output regulation	I_O= 5mA to 1.5A	25°C		15	400	mV
	I_O= 250mA to 750mA			7	200	
Output resistance	f= 1KHz	0°C to 125°C		0.027		Ω
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-1.3		mV/°C
Output noise voltage	f= 10 Hz to 100 KHz	25°C		150		μV
Dropout voltage	I_O= 1A	25°C		2.0		V
Bias current		25°C		5.8	8	mA
Bias current change	V_I= 23V to 35V	0°C to 125°C			1	
	I_O= 5mA to 1A				0.5	
Short-circuit output current		25°C		180		
Peak output current		25°C		2.1		A

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7824 electrical characteristics at specified virtual junction temperature, V_I= 33V, I_O= 500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7824 MIN	7824 TYP	7824 MAX	UNIT
Output voltage**		25°C	23	24	25	V
	I_O= 5mA to 1A, V_I= 27V to 38V, P≤15W	0°C to 125°C	22.8	24	25.2	
Input regulation	V_I= 27V to 38V	25°C		18	480	mV
	V_I= 30V to 36V			6	240	
Ripple rejection	V_I= 28V to 38V, f= 120Hz	0°C to 125°C	50	66		dB
Output regulation	I_O= 5mA to 1.5A	25°C		12	480	mV
	I_O= 250mA to 750mA			4	240	
Output resistance	f= 1KHz	0°C to 125°C		0.028		Ω
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-1.5		mV/°C
Output noise voltage	f= 10 Hz to 100 KHz	25°C		170		μV
Dropout voltage	I_O= 1A	25°C		2.0		V
Bias current		25°C		5.9	8	mA
Bias current change	V_I= 27V to 38V	0°C to 125°C			1	
	I_O= 5mA to 1A				0.5	
Short-circuit output current		25°C		150		
Peak output current		25°C		2.1		A

7827 electrical characteristics at specified virtual junction temperature, V_I= 36V, I_O= 500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7827 MIN	7827 TYP	7827 MAX	UNIT
Output voltage**		25°C	25.9	27	28.1	V
	I_O= 5mA to 1A, V_I= 30V to 40V, P≤15W	0°C to 125°C	25.7	27	28.3	
Input regulation	V_I= 30V to 40V	25°C		25	540	mV
	V_I= 33V to 39V			10	270	
Ripple rejection	V_I= 30V to 40V, f= 120Hz	0°C to 125°C	50	64		dB
Output regulation	I_O= 5mA to 1.5A	25°C		20	540	mV
	I_O= 250mA to 750mA			9	270	
Output resistance	f= 1KHz	0°C to 125°C		0.030		Ω
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-1.6		mV/°C
Output noise voltage	f= 10 Hz to 100 KHz	25°C		200		μV
Dropout voltage	I_O= 1A	25°C		2.0		V
Bias current		25°C		5.9	8	mA
Bias current change	V_I= 30V to 40V	0°C to 125°C			1	
	I_O= 5mA to 1A				0.5	
Short-circuit output current		25°C		120		
Peak output current		25°C		2.1		A

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TYPICAL APPLICATION

For a positive regulator, a 0.33-µF bypass capacitor should be used on the input terminals. While not necessary for stability, an output capacitor of 0.1µF may be used to improve the transient response of the regulator. These capacitors should be on or as near as possible to the regulator terminals. See Fig.1.

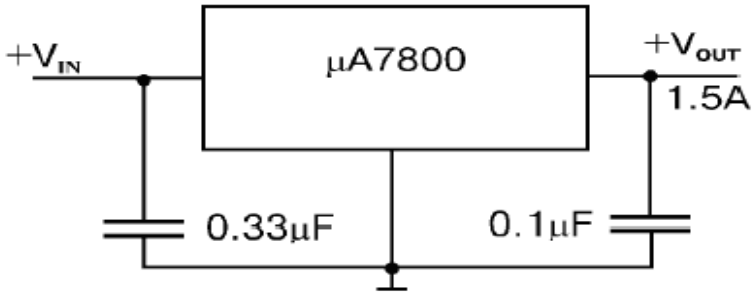
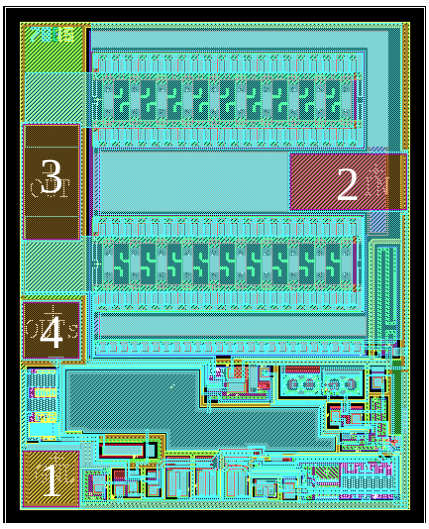


Fig. 1. Positive Regulator

Pad Location



Chip size: 1,27 x 1,57 mm

Wafer size: 100 mm
Wafer Thickness: 460±30µm (or 350±30µm, 280±30µm)
Top metal: AlSi
Backside metal: - (or Ti-Ni (V)-Ag)

Pad Location Coordinates

Pad N	Pad Name	X (µm)	Y (µm)	PAD Size, (µm)	
				W	H
1	Ground	140	140	170	170
2	Input	1040	1040	350	170
3	Output	140	1040	170	350
4	Output	140	590	170	170