

Positive-Voltage Regulators



Rev.1. Jan. 2010.



VSP MIKRON

78XX

- 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

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

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 thermal shutdown features of these regulators make them essentially immune to overload.

KC PACKAGE (TOP VIEW)



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

	78--	UNIT
Input voltage	7824, 7827	40
	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	V
	7806	8	
	7808	10.5	
	7885	10.5	
	7809	11.5	
	7810	12.5	
	7812	14.5	
	7815	17.5	
	7818	21	
	7820	23	
	7824	27	
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, $P \leq 15W$	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		4.2	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, $P \leq 15W$	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		4.3	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, $P \leq 15W$	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		4.3	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, $P \leq 15W$	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		4.3	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, $P \leq 15W$	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		4.3	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, $P \leq 15W$	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		4.3	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, $P \leq 15W$	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		4.3	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, $P \leq 15W$	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		4.3	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, $P_{\leq 15W}$	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		4.5	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, $P_{\leq 15W}$	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		4.5	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			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	23	24	25	V
	$I_O = 5mA$ to 1A, $V_I = 27V$ to 38V, $P_{\leq 15W}$	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		4.6	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			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	25.9	27	28.1	V
	$I_O = 5mA$ to 1A, $V_I = 30V$ to 40V, $P_{\leq 15W}$	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		4.8	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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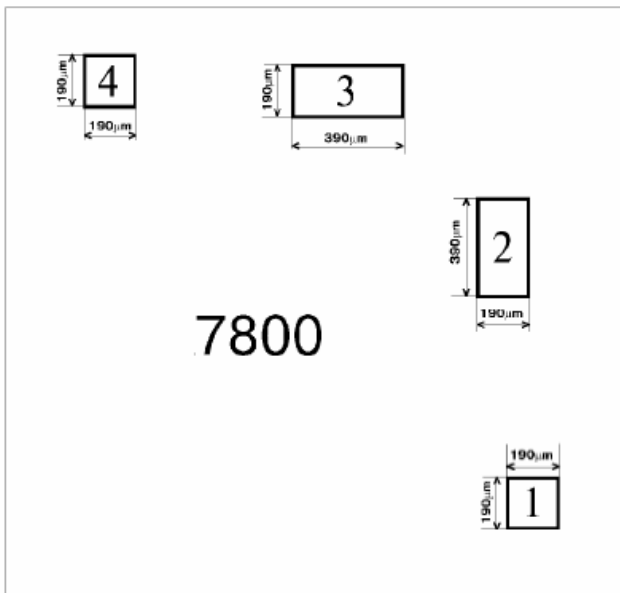
TYPICAL APPLICATION

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 0.1 μF 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



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

Pad №	Pad Name	X(μm)	Y(μm)
1	GROUND	1800	230
2	INPUT	1690	1010
3	OUTPUT	790	1880
4	OUTPUT	290	1810