

Positive-Voltage Regulators



Rev.2 Aug. 2012



VSP MIKRON

78MXXnd3

- 3-Terminal Regulators
- Output current up to 500mA
- Internal Thermal Overload Protection
- Internal Short-Circuit Limiting
- Output transistor safe operating area protection

Description

The 78MXXnd3 series of three terminal regulators are available in the TO-220 package with several fixed output voltages making it useful in a wide range of applications.

Nom. output voltage	Regulator
5V	78M05nd3
6V	78M06nd3
8V	78M08nd3
8.5V	78M85nd3
9V	78M09nd3
10V	78M10nd3
12V	78M12nd3
15V	78M15nd3
18V	78M18nd3
20V	78M20nd3
24V	78M24nd3
27V	78M27nd3

**KC PACKAGE
(TOP VIEW)**



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

	78M05nd3 thru 78M18nd3	78M24nd3 thru 78M27nd3	UNIT
Input voltage	35	40	V
Operating free-air, case, or virtual junction temperature range	0 to 150	0 to 150	°C
Storage temperature range	-65 to 150	-65 to 150	
Lead temperature 1.6 mm (1/16 inch) from case for 10 seconds	260	260	

Recommended operating condition

PARAMETR		MIN	MAX	UNIT
Input voltage, V_I	78M05nd3	7	25	V
	78M06nd3	8	25	
	78M08nd3	10.5	25	
	78M85nd3	10.5	25	
	78M09nd3	11.5	27	
	78M10nd3	12.5	28	
	78M12nd3	14.5	30	
	78M15nd3	17.5	30	
	78M18nd3	21	33	
	78M20nd3	23	36	
Output current, I_O	78M24nd3	27	38	A
	78M27nd3	30	40	
Operating virtual junction temperature, T_J		0	125	°C

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**78M05nd3 electrical characteristics at specified virtual junction temperature, $V_I=10V$, $I_O=350mA$
(unless otherwise noted)**

PARAMETER	TEST CONDITIONS*		78M05nd3			UNIT
			MIN	TYP	MAX	
Output voltage**	25°C		4.8	5	5.2	V
	$I_O=5mA$ to 350mA	0 to 125 °C	4.75	5	5.25	
Input regulation	$I_O=200mA$	$V_I=7V$ to 25V	25°C		100	mV
		$V_I=8V$ to 25V			50	
Ripple rejection	$V_I=8V$ to 18V, $f=120Hz$		25°C	62	80	dB
Output regulation	$I_O=5mA$ to 500mA		25°C		100	mV
	$I_O=5mA$ to 200mA				50	
Output noise voltage	$f=10Hz-100Hz$		25°C		40	µV
Dropout voltage			25°C		2	V
Bias current			25°C		4.8	mA
			125°C		7.5	
Bias current change	$V_I=7V$ to 25V		0 to 125 °C		1.0	
	$I_O=5mA$ to 350mA				0.5	

**78M06nd3 electrical characteristics at specified virtual junction temperature, $V_I=11V$, $I_O=350mA$
(unless otherwise noted)**

PARAMETER	TEST CONDITIONS*		78M06nd3			UNIT
			MIN	TYP	MAX	
Output voltage**	25°C		5.75	6	6.25	V
	$I_O=5mA$ to 350mA	0 to 125 °C	5.7	6	6.3	
Input regulation	$I_O=200mA$	$V_I=8V$ to 25V	25°C		100	mV
		$V_I=9V$ to 25V			50	
Ripple rejection	$V_I=9V$ to 19V, $f=120Hz$		25°C	62	80	dB
Output regulation	$I_O=5mA$ to 500mA		25°C		120	mV
	$I_O=5mA$ to 200mA				60	
Output noise voltage	$f=10Hz-100Hz$		25°C		45	µV
Dropout voltage			25°C		2	V
Bias current			25°C		4.8	mA
			125°C		7.5	
Bias current change	$V_I=8V$ to 25V		0 to 125 °C		1.0	
	$I_O=5mA$ to 350mA				0.5	

* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33µF capacitor across the input and a 0.1 µF capacitor across the output.

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**78M08nd3 electrical characteristics at specified virtual junction temperature, $V_I=14V$, $I_O=350mA$
(unless otherwise noted)**

PARAMETER	TEST CONDITIONS*		78M08nd3			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	7.7	8	8.3	V
	$I_O=5mA$ to 350mA $V_I=10.5V$ to 23V	0 to 125 °C	7.6	8	8.4	
Input regulation	$I_O=200mA$	$V_I=10.5V$ to 25V			150	mV
		$V_I=11V$ to 25V			75	
Ripple rejection	$V_I=11.5V$ to 21.5V, $f=120Hz$	25°C	62	80		dB
Output regulation	$I_O=5mA$ to 500mA	25°C			160	mV
	$I_O=5mA$ to 200mA				80	
Output noise voltage	$f=10Hz-100Hz$	25°C		52		µV
Dropout voltage		25°C		2		V
Bias current		25°C		4.8	8	mA
		125°C			7.5	
Bias current change	$V_I=10.5V$ to 25V	0 to 125 °C			1.0	
	$I_O=5mA$ to 350mA				0.5	

**78M85nd3 electrical characteristics at specified virtual junction temperature, $V_I=15.5V$, $I_O=350mA$
(unless otherwise noted)**

PARAMETER	TEST CONDITIONS*		78M85nd3			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	8.16	8.5	8.84	V
	$I_O=5mA$ to 350mA $V_I=10.5V$ to 23V	0 to 125 °C	8.07	8.5	8.93	
Input regulation	$I_O=200mA$	$V_I=10.5V$ to 25V			150	mV
		$V_I=11V$ to 25V			75	
Ripple rejection	$V_I=11.5V$ to 21.5V, $f=120Hz$	25°C	62	80		dB
Output regulation	$I_O=5mA$ to 500mA	25°C			160	mV
	$I_O=5mA$ to 200mA				80	
Output noise voltage	$f=10Hz-100Hz$	25°C		52		µV
Dropout voltage		25°C		2		V
Bias current		25°C		4.8	8	mA
		125°C			7.5	
Bias current change	$V_I=10.5V$ to 25V	0 to 125 °C			1.0	
	$I_O=5mA$ to 350mA				0.5	

* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33µF capacitor across the input and a 0.1 µF capacitor across the output.

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**78M09nd3 electrical characteristics at specified virtual junction temperature, $V_I=16.5V$, $I_O=350mA$
(unless otherwise noted)**

PARAMETER	TEST CONDITIONS*		78M09nd3			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	8.64	9	9.36	V
	$I_O=5mA$ to 350mA $V_I=11.5V$ to 25V	0 to 125 °C	8.55	9	9.45	
Input regulation	$I_O=200mA$	$V_I=11V$ to 27V	25°C		150	mV
		$V_I=11.5V$ to 27V			75	
Ripple rejection	$V_I=12V$ to 23.5V, $f=120Hz$	25°C	62	80		dB
Output regulation	$I_O=5mA$ to 500mA	25°C			180	mV
	$I_O=5mA$ to 200mA				90	
Output noise voltage	$f=10Hz-100Hz$	25°C		58		µV
Dropout voltage		25°C		2		V
Bias current		25°C		4.8	8	mA
		125°C			7.5	
Bias current change	$V_I=11V$ to 27V	0 to 125 °C			1.0	
	$I_O=5mA$ to 350mA				0.5	

**78M10nd3 electrical characteristics at specified virtual junction temperature, $V_I=17V$, $I_O=350mA$
(unless otherwise noted)**

PARAMETER	TEST CONDITIONS*		78M10nd3			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	9.6	10	10.4	V
	$I_O=5mA$ to 350mA $V_I=12.5V$ to 26V	0 to 125 °C	9.5	10	10.5	
Input regulation	$I_O=200mA$	$V_I=12V$ to 28V	25°C		150	mV
		$V_I=12.5V$ to 28V			75	
Ripple rejection	$V_I=13V$ to 23.5V, $f=120Hz$	25°C	62	80		dB
Output regulation	$I_O=5mA$ to 500mA	25°C			200	mV
	$I_O=5mA$ to 200mA				90	
Output noise voltage	$f=10Hz-100Hz$	25°C		62		µV
Dropout voltage		25°C		2		V
Bias current		25°C		4.8	8	mA
		125°C			7.5	
Bias current change	$V_I=12V$ to 28V	0 to 125 °C			1.0	
	$I_O=5mA$ to 350mA				0.5	

* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33µF capacitor across the input and a 0.1 µF capacitor across the output.

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78M12nd3 electrical characteristics at specified virtual junction temperature, $V_I=19V$, $I_O=350mA$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		78M12nd3			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	11.5	12	12.5	V
	$I_O=5mA$ to 350mA $V_I=14.5V$ to 27V	0 to 125 °C	11.4	12	12.6	
Input regulation	$I_O=200mA$	$V_I=14.5V$ to 30V			150	mV
		$V_I=16V$ to 30V			75	
Ripple rejection	$V_I=15V$ to 25V, $f=120Hz$	25°C	62	80		dB
Output regulation	$I_O=5mA$ to 500mA	25°C			240	mV
	$I_O=5mA$ to 200mA				120	
Output noise voltage	$f=10Hz-100Hz$	25°C		75		µV
Dropout voltage		25°C		2		V
Bias current		25°C		4.8	8	mA
		125°C			7.5	
Bias current change	$V_I=14.5V$ to 30V	0 to 125 °C			1.0	
	$I_O=5mA$ to 350mA				0.5	

78M15nd3 electrical characteristics at specified virtual junction temperature, $V_I=23V$, $I_O=350mA$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		78M15nd3			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	14.4	15	15.6	V
	$I_O=5mA$ to 350mA $V_I=17.5V$ to 30V	0 to 125 °C	14.25	15	15.75	
Input regulation	$I_O=200mA$	$V_I=17.5V$ to 30V			150	mV
		$V_I=20V$ to 30V			75	
Ripple rejection	$V_I=18.5V$ to 28.5V, $f=120Hz$	25°C	60	70		dB
Output regulation	$I_O=5mA$ to 500mA	25°C			300	mV
	$I_O=5mA$ to 200mA				150	
Output noise voltage	$f=10Hz-100Hz$	25°C		100		µV
Dropout voltage		25°C		2		V
Bias current		25°C		4.9	8	mA
		125°C			7.5	
Bias current change	$V_I=17.5V$ to 30V	0 to 125 °C			1.0	
	$I_O=5mA$ to 350mA				0.5	

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**78M18nd3 electrical characteristics at specified virtual junction temperature, $V_I=26V$, $I_O=350mA$
(unless otherwise noted)**

PARAMETER	TEST CONDITIONS*		78M18nd3			UNIT
			MIN	TYP	MAX	
Output voltage**	25°C		17.3	18	18.7	V
	$I_O=5mA$ to 350mA	0 to 125 °C	17.1	18	18.9	
Input regulation	$I_O=200mA$	$V_I=21.5V$ to 33V	25°C		150	mV
		$V_I=24.5V$ to 33V			75	
Ripple rejection	$V_I=22.5V$ to 32V, $f=120Hz$		25°C	60	70	dB
Output regulation	$I_O=5mA$ to 500mA		25°C		360	mV
	$I_O=5mA$ to 200mA				180	
Output noise voltage	$f=10Hz-100Hz$		25°C		100	µV
Dropout voltage			25°C		2	V
Bias current			25°C		5.7	mA
			125°C		7.5	
Bias current change	$V_I=21.5V$ to 33V		0 to 125 °C		1.0	
	$I_O=5mA$ to 350mA				0.5	

**78M20nd3 electrical characteristics at specified virtual junction temperature, $V_I=28V$, $I_O=350mA$
(unless otherwise noted)**

PARAMETER	TEST CONDITIONS*		78M20nd3			UNIT
			MIN	TYP	MAX	
Output voltage**	25°C		19.2	20	20.8	V
	$I_O=5mA$ to 350mA	0 to 125 °C	19	20	21	
Input regulation	$I_O=200mA$	$V_I=23.5V$ to 36V	25°C		150	mV
		$V_I=26.5V$ to 36V			75	
Ripple rejection	$V_I=24.5V$ to 35V, $f=120Hz$		25°C	55	65	dB
Output regulation	$I_O=5mA$ to 500mA		25°C		400	mV
	$I_O=5mA$ to 200mA				200	
Output noise voltage	$f=10Hz-100Hz$		25°C		120	µV
Dropout voltage			25°C		2	V
Bias current			25°C		4.9	mA
			125°C		7.5	
Bias current change	$V_I=23.5V$ to 36V		0 to 125 °C		1.0	
	$I_O=5mA$ to 350mA				0.5	

* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33µF capacitor across the input and a 0.1 µF capacitor across the output.

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**78M24nd3 electrical characteristics at specified virtual junction temperature, $V_I=31V$, $I_O=350mA$
(unless otherwise noted)**

PARAMETER	TEST CONDITIONS*		78M24nd3			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	23.04	24	24.96	V
	$I_O=5mA$ to 350mA $V_I=27V$ to 38V	0 to 125 °C	22.8	24	25.2	
Input regulation	$I_O=200mA$	$V_I=27.5V$ to 38V			150	mV
		$V_I=30V$ to 38V			75	
Ripple rejection	$V_I=28.5V$ to 37V, $f=120Hz$	25°C	55	65		dB
Output regulation	$I_O=5mA$ to 500mA	25°C			480	mV
	$I_O=5mA$ to 200mA				240	
Output noise voltage	$f=10Hz-100Hz$	25°C		140		µV
Dropout voltage		25°C		2		V
Bias current		25°C		4.9	8	mA
		125°C			7.5	
Bias current change	$V_I=27.5V$ to 38V	0 to 125 °C			1.0	
	$I_O=5mA$ to 350mA				0.5	

**78M27nd3 electrical characteristics at specified virtual junction temperature, $V_I=34V$, $I_O=350mA$
(unless otherwise noted)**

PARAMETER	TEST CONDITIONS*		78M27nd3			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	25.92	27	28.08	V
	$I_O=5mA$ to 350mA $V_I=30V$ to 40V	0 to 125 °C	25.65	27	28.35	
Input regulation	$I_O=200mA$	$V_I=30.5V$ to 40V			150	mV
		$V_I=34V$ to 40V			75	
Ripple rejection	$V_I=31V$ to 39V, $f=120Hz$	25°C	55	65		dB
Output regulation	$I_O=5mA$ to 500mA	25°C			540	mV
	$I_O=5mA$ to 200mA				270	
Output noise voltage	$f=10Hz-100Hz$	25°C		170		µV
Dropout voltage		25°C		2		V
Bias current		25°C		4.9	8	mA
		125°C			7.5	
Bias current change	$V_I=30.5V$ to 40V	0 to 125 °C			1.0	
	$I_O=5mA$ to 350mA				0.5	

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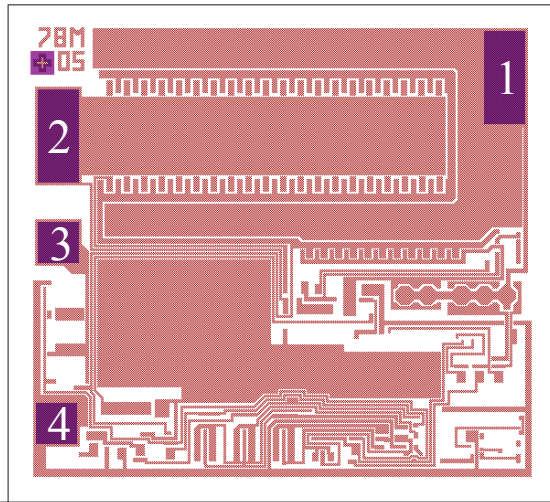
Positive-Voltage Regulators



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Pad Location



Chip size: 1.2 x 1.1 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 Number	PAD Name	PAD Coordinates (µm)		PAD Size, (µm)	
		X	Y	W	H
1	INPUT	1090	930	88	200
2	OUTPUT	110	800	88	200
3		110	570	88	88
4	GND	105	175	88	88