



DATA SHEET

16 JUNE 2003

No. 00011
REV 1-03

MIK78xx series

POSITIVE-VOLTAGE REGULATORS

REPLACEMENT of:

μ A78xx
 KA78xx
 LM78xx
 MC78xx

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GENERAL 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. In addition, they can be used with power-pass elements to make high-current voltage regulators. Each of these regulators can deliver up to 1.5 A of output current. The internal limiting and thermal shutdown features of these regulators make them essentially immune to overload.

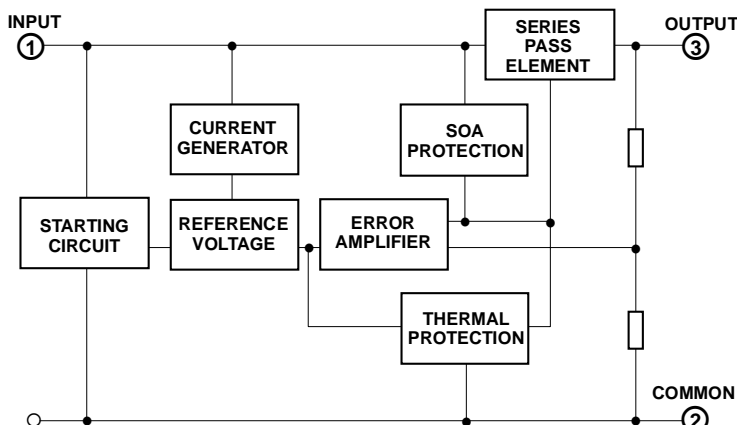
FEATURES

- 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



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INTERNAL BLOCK DIAGRAM



PIN DESCRIPTION

MIK78-xxCT	
TO-220-3	1 – INPUT 2 – COMMON 3 – OUTPUT TAB – COMMON
MIK78-xxCD2T	
TO-263-3	1 – INPUT 2 – COMMON 3 – OUTPUT TAB – COMMON

ABSOLUTE MAXIMUM RATINGS

Over operating free-air temperature range, unless otherwise noted.

SYMBOL	PARAMETER	MAXIMUM	UNIT
V_{IN}	Input voltage	MIK7824	40
		All others	35
P_D	Continuous total dissipation at 25 °C free-air temperature	2	W
	Continuous total dissipation at (or below) 25 °C case temperature	15	
T_A	Operating free-air temperature range	0 to 150	°C
T_C	Operating case temperature range		
T_J	Operating virtual junctions temperature range		
T_{STG}	Storage temperature range	-65 to 150	
T_L	Lead temperature 1.6 mm (1/16 inch) from case for 10 seconds	260	

NOTE:
 Stresses above those listed under «Absolute Maximum Ratings» may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions above those indicated in the operation sections of the specifications is not implied.

Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

NOTE: For operation above 25°C free-air or 90°C case temperature, refer to Figures 1 and 2. To avoid exceeding the design maximum virtual junction temperature, these ratings should not be exceeded. The built-in thermal overload protection may be activated at power levels slightly above or below the rated dissipation.

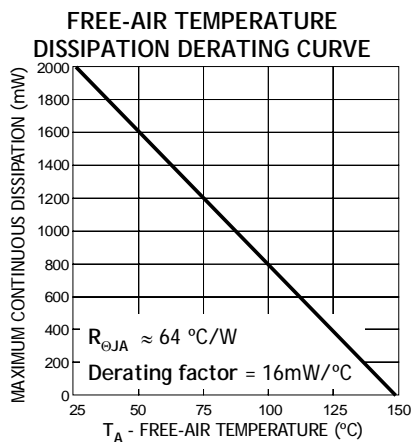


Fig. 1

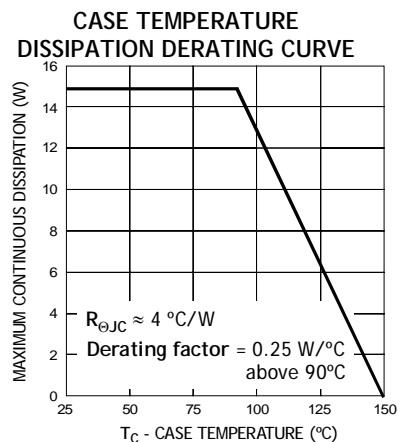


Fig. 2



RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	MIN	MAX	UNIT
V_{IN}	MIK7805	7.0	25.0	V
	MIK7806	8.0	25.0	
	MIK7808	10.5	25.0	
	MIK7809	11.5	27.0	
	MIK7810	12.5	28.0	
	MIK7812	14.5	30.0	
	MIK7815	17.5	30.0	
	MIK7818	21.0	33.0	
	MIK7824	27.0	38.0	
I_{OUT}	Output current		1.5	A
T_J	Operating virtual junction temperature	0	125	°C

ELECTRICAL CHARACTERISTICS

MIK7805

Electrical characteristics at specified virtual junction temperature, $V_{IN} = 10V$, $I_{OUT} = 500mA$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS*	MIN	TYP	MAX	UNIT	
Output voltage**	25°C	4.8	5	5.2	V	
	$I_{OUT} = 5mA$ to 1A, $V_{IN} = 7V$ to 20V, $P \leq 15W$	0°C to 125°C	4.75	5		5.25
Input regulation	$V_{IN} = 7V$ to 25V	25°C		3	100	mV
	$V_{IN} = 8V$ to 12V			1	50	
Ripple rejection	$V_{IN} = 8V$ to 18V, $f = 120Hz$	0°C to 125°C	62	78	dB	
Output regulation	$I_{OUT} = 5mA$ to 1.5A	25°C		15	100	mV
	$I_{OUT} = 250mA$ to 750mA			5	50	
Output resistance	$f = 1KHz$	0°C to 125°C		0.017	Ω	
Temperature coefficient of output voltage	$I_{OUT} = 5mA$	0°C to 125°C		-1.1	mV/°C	
Output noise voltage	$f = 10 Hz$ to 100 KHz	25°C		40	μV	
Dropout voltage	$I_{OUT} = 1A$	25°C		2.0	V	
Bias current		25°C		4.2	8	mA
Bias current change	$V_{IN} = 7V$ to 25V	0°C to 125°C			1.3	
	$I_{OUT} = 5mA$ to 1A				0.5	
Short-circuit output current		25°C		750		
Peak output current		25°C		2.2	A	

* 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.

** This specification applies only for dc power dissipation permitted by absolute maximum ratings.

**ELECTRICAL CHARACTERISTICS****MIK7806**Electrical characteristics at specified virtual junction temperature, $V_{IN} = 11V$, $I_{OUT} = 500mA$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS*	MIN	TYP	MAX	UNIT	
Output voltage**	25°C	5.75	6	6.25	V	
	$I_{OUT} = 5mA$ to 1A, $V_{IN} = 8V$ to 21V, $P \leq 15W$	0°C to 125°C	5.7	6		6.3
Input regulation	$V_{IN} = 8V$ to 25V	25°C		5	120	mV
	$V_{IN} = 9V$ to 13V			1.5	60	
Ripple rejection	$V_{IN} = 9V$ to 19V, $f = 120Hz$	0°C to 125°C	59	75		dB
Output regulation	$I_{OUT} = 5mA$ to 1.5A	25°C		14	120	mV
	$I_{OUT} = 250mA$ to 750mA			4	60	
Output resistance	$f = 1KHz$	0°C to 125°C		0.019		Ω
Temperature coefficient of output voltage	$I_{OUT} = 5mA$	0°C to 125°C		-0.8		mV/°C
Output noise voltage	$f = 10 Hz$ to 100 KHz	25°C		45		μV
Dropout voltage	$I_{OUT} = 1A$	25°C		2.0		V
Bias current		25°C		4.3	8	mA
Bias current change	$V_{IN} = 8V$ to 25V	0°C to 125°C			1.3	
	$I_{OUT} = 5mA$ to 1A				0.5	
Short-circuit output current		25°C		550		
Peak output current		25°C		2.2		A

ELECTRICAL CHARACTERISTICS**MIK7808**Electrical characteristics at specified virtual junction temperature, $V_{IN} = 14V$, $I_{OUT} = 500mA$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS*	MIN	TYP	MAX	UNIT	
Output voltage**	25°C	7.7	8	8.3	V	
	$I_{OUT} = 5mA$ to 1A, $V_{IN} = 10.5V$ to 23V, $P \leq 15W$	0°C to 125°C	7.6	8		8.4
Input regulation	$V_{IN} = 10.5V$ to 25V	25°C		6	160	mV
	$V_{IN} = 11V$ to 17V			2	80	
Ripple rejection	$V_{IN} = 11.5V$ to 21.5V, $f = 120Hz$	0°C to 125°C	55	72		dB
Output regulation	$I_{OUT} = 5mA$ to 1.5A	25°C		12	160	mV
	$I_{OUT} = 250mA$ to 750mA			4	80	
Output resistance	$f = 1KHz$	0°C to 125°C		0.016		Ω
Temperature coefficient of output voltage	$I_{OUT} = 5mA$	0°C to 125°C		-0.8		mV/°C
Output noise voltage	$f = 10 Hz$ to 100 KHz	25°C		52		μV
Dropout voltage	$I_{OUT} = 1A$	25°C		2.0		V
Bias current		25°C		4.3	8	mA
Bias current change	$V_{IN} = 10.5V$ to 25V	0°C to 125°C			1	
	$I_{OUT} = 5mA$ to 1A				0.5	
Short-circuit output current		25°C		450		
Peak output current		25°C		2.2		A

* 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.

** This specification applies only for dc power dissipation permitted by absolute maximum ratings.



ELECTRICAL CHARACTERISTICS

MIK7809

Electrical characteristics at specified virtual junction temperature, $V_{IN} = 16V$, $I_{OUT} = 500mA$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS*	MIN	TYP	MAX	UNIT
Output voltage**	25°C	8.65	9	9.35	V
	$I_{OUT} = 5mA$ to 1A, $V_{IN} = 11.5V$ to 24V, $P \leq 15W$	0°C to 125°C	8.55	9	
Input regulation	$V_{IN} = 11.5V$ to 27V	25°C	7	180	mV
	$V_{IN} = 13V$ to 19V		2	90	
Ripple rejection	$V_{IN} = 12V$ to 22V, $f = 120Hz$	0°C to 125°C	55	70	dB
Output regulation	$I_{OUT} = 5mA$ 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	$I_{OUT} = 5mA$	0°C to 125°C	-1.0		mV/°C
Output noise voltage	$f = 10 Hz$ to 100 KHz	25°C	60		μV
Dropout voltage	$I_{OUT} = 1A$	25°C	2.0		V
Bias current		25°C	4.3	8	mA
Bias current change	$V_{IN} = 11.5V$ to 27V	0°C to 125°C		1	
	$I_{OUT} = 5mA$ to 1A			0.5	
Short-circuit output current		25°C	400		
Peak output current		25°C	2.2		A

ELECTRICAL CHARACTERISTICS

MIK7810

Electrical characteristics at specified virtual junction temperature, $V_{IN} = 17V$, $I_{OUT} = 500mA$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS*	MIN	TYP	MAX	UNIT
Output voltage**	25°C	9.6	10	10.4	V
	$I_{OUT} = 5mA$ to 1A, $V_{IN} = 12.5V$ to 25V, $P \leq 15W$	0°C to 125°C	9.5	10	
Input regulation	$V_{IN} = 12.5V$ to 28V	25°C	7	200	mV
	$V_{IN} = 14V$ to 20V		2	100	
Ripple rejection	$V_{IN} = 13V$ to 23V, $f = 120Hz$	0°C to 125°C	55	71	dB
Output regulation	$I_{OUT} = 5mA$ to 1.5A	25°C	12	200	mV
	$I_{OUT} = 250mA$ to 750mA		4	100	
Output resistance	$f = 1KHz$	0°C to 125°C	0.018		Ω
Temperature coefficient of output voltage	$I_{OUT} = 5mA$	0°C to 125°C	-1.0		mV/°C
Output noise voltage	$f = 10 Hz$ to 100 KHz	25°C	70		μV
Dropout voltage	$I_{OUT} = 1A$	25°C	2.0		V
Bias current		25°C	4.3	8	mA
Bias current change	$V_{IN} = 12.5V$ to 28V	0°C to 125°C		1	
	$I_{OUT} = 5mA$ to 1A			0.5	
Short-circuit output current		25°C	400		
Peak output current		25°C	2.2		A

* 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.

** This specification applies only for dc power dissipation permitted by absolute maximum ratings.

**ELECTRICAL CHARACTERISTICS****MIK7812**Electrical characteristics at specified virtual junction temperature, $V_{IN} = 19V$, $I_{OUT} = 500mA$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS*	MIN	TYP	MAX	UNIT
Output voltage**	25°C	11.5	12	12.5	V
	$I_{OUT} = 5mA$ to 1A, $V_{IN} = 14.5V$ to 27V, $P \leq 15W$	0°C to 125°C	11.4	12	
Input regulation	$V_{IN} = 14.5V$ to 30V	25°C	10	240	mV
	$V_{IN} = 16V$ to 22V		3	120	
Ripple rejection	$V_{IN} = 15V$ to 25V, $f = 120Hz$	0°C to 125°C	55	71	dB
Output regulation	$I_{OUT} = 5mA$ to 1.5A	25°C	12	240	mV
	$I_{OUT} = 250mA$ to 750mA		4	120	
Output resistance	$f = 1KHz$	0°C to 125°C	0.018		Ω
Temperature coefficient of output voltage	$I_{OUT} = 5mA$	0°C to 125°C	-1.0		mV/°C
Output noise voltage	$f = 10 Hz$ to 100 KHz	25°C	75		μV
Dropout voltage	$I_{OUT} = 1A$	25°C	2.0		V
Bias current		25°C	4.3	8	mA
Bias current change	$V_{IN} = 14.5V$ to 30V	0°C to 125°C		1	
	$I_{OUT} = 5mA$ to 1A			0.5	
Short-circuit output current		25°C	350		
Peak output current		25°C	2.2		A

ELECTRICAL CHARACTERISTICS**MIK7815**Electrical characteristics at specified virtual junction temperature, $V_{IN} = 23V$, $I_{OUT} = 500mA$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS*	MIN	TYP	MAX	UNIT
Output voltage**	25°C	14.4	15	15.6	V
	$I_{OUT} = 5mA$ to 1A, $V_{IN} = 17.5V$ to 30V, $P \leq 15W$	0°C to 125°C	14.25	15	
Input regulation	$V_{IN} = 17.5V$ to 30V	25°C	12	300	mV
	$V_{IN} = 20V$ to 26V		3	150	
Ripple rejection	$V_{IN} = 18.5V$ to 28.5V, $f = 120Hz$	0°C to 125°C	54	70	dB
Output regulation	$I_{OUT} = 5mA$ to 1.5A	25°C	12	300	mV
	$I_{OUT} = 250mA$ to 750mA		4	150	
Output resistance	$f = 1KHz$	0°C to 125°C	0.019		Ω
Temperature coefficient of output voltage	$I_{OUT} = 5mA$	0°C to 125°C	-1.0		mV/°C
Output noise voltage	$f = 10 Hz$ to 100 KHz	25°C	90		μV
Dropout voltage	$I_{OUT} = 1A$	25°C	2.0		V
Bias current		25°C	4.3	8	mA
Bias current change	$V_{IN} = 17.5V$ to 30V	0°C to 125°C		1	
	$I_{OUT} = 5mA$ to 1A			0.5	
Short-circuit output current		25°C	230		
Peak output current		25°C	2.1		A

* 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.

** This specification applies only for dc power dissipation permitted by absolute maximum ratings.



ELECTRICAL CHARACTERISTICS

MIK7818

Electrical characteristics at specified virtual junction temperature, $V_{IN} = 27V$, $I_{OUT} = 500mA$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS*	MIN	TYP	MAX	UNIT
Output voltage**	25°C	17.3	18	18.7	V
	$I_{OUT} = 5mA$ to 1A, $V_{IN} = 21V$ to 33V, $P \leq 15W$	0°C to 125°C	17.1	18	
Input regulation	$V_{IN} = 21V$ to 33V	25°C	15	360	mV
	$V_{IN} = 24V$ to 30V		5	180	
Ripple rejection	$V_{IN} = 22V$ to 32V, $f = 120Hz$	0°C to 125°C	53	69	dB
Output regulation	$I_{OUT} = 5mA$ to 1.5A	25°C	12	360	mV
	$I_{OUT} = 250mA$ to 750mA		4	180	
Output resistance	$f = 1KHz$	0°C to 125°C	0.022		Ω
Temperature coefficient of output voltage	$I_{OUT} = 5mA$	0°C to 125°C	-1.0		mV/°C
Output noise voltage	$f = 10 Hz$ to 100 KHz	25°C	110		μV
Dropout voltage	$I_{OUT} = 1A$	25°C	2.0		V
Bias current		25°C	4.5	8	mA
Bias current change	$V_{IN} = 21V$ to 33V	0°C to 125°C		1	
	$I_{OUT} = 5mA$ to 1A			0.5	
Short-circuit output current		25°C	200		
Peak output current		25°C	2.1		A

ELECTRICAL CHARACTERISTICS

MIK7824

Electrical characteristics at specified virtual junction temperature, $V_{IN} = 33V$, $I_{OUT} = 500mA$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS*	MIN	TYP	MAX	UNIT
Output voltage**	25°C	23	24	25	V
	$I_{OUT} = 5mA$ to 1A, $V_{IN} = 27V$ to 38V, $P \leq 15W$	0°C to 125°C	22.8	24	
Input regulation	$V_{IN} = 27V$ to 38V	25°C	18	480	mV
	$V_{IN} = 30V$ to 36V		6	240	
Ripple rejection	$V_{IN} = 28V$ to 38V, $f = 120Hz$	0°C to 125°C	50	66	dB
Output regulation	$I_{OUT} = 5mA$ to 1.5A	25°C	12	480	mV
	$I_{OUT} = 250mA$ to 750mA		4	240	
Output resistance	$f = 1KHz$	0°C to 125°C	0.028		Ω
Temperature coefficient of output voltage	$I_{OUT} = 5mA$	0°C to 125°C	-1.5		mV/°C
Output noise voltage	$f = 10 Hz$ to 100 KHz	25°C	170		μV
Dropout voltage	$I_{OUT} = 1A$	25°C	2.0		V
Bias current		25°C	4.6	8	mA
Bias current change	$V_{IN} = 27V$ to 38V	0°C to 125°C		1	
	$I_{OUT} = 5mA$ to 1A			0.5	
Short-circuit output current		25°C	150		
Peak output current		25°C	2.1		A

* 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.

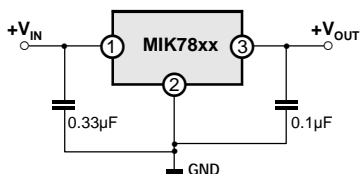
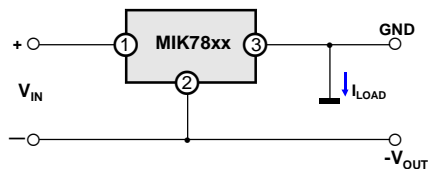
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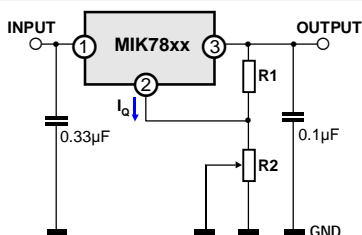
TYPICAL APPLICATIONS

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FIXED-OUTPUT REGULATOR

POSITIVE REGULATOR IN NEGATIVE CONFIGURATION
(V_{IN} MUST FLOAT)

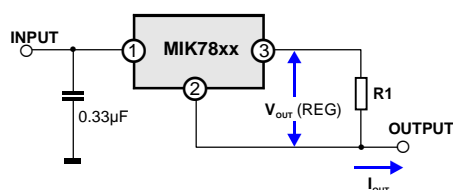
ADJUSTABLE-OUTPUT REGULATOR



$$V_{OUT} = V_{xx} + (V_{xx}/R1 + I_Q) \times R2$$

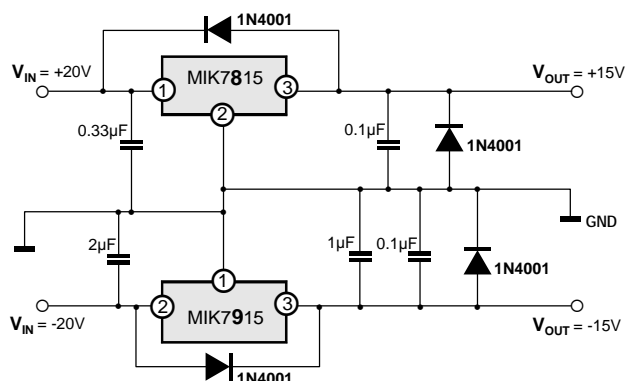
V_{xx} is the nominal output voltage of the fixed regulator

CURRENT REGULATOR

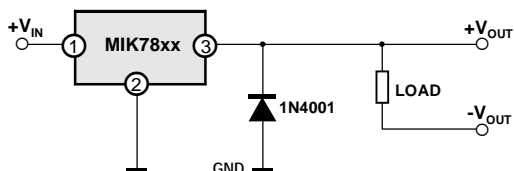


$$I_Q = (V_{OUT}/R1) + I_{OUT} \text{ BIAS CURRENT}$$

REGULATED DUAL SUPPLY

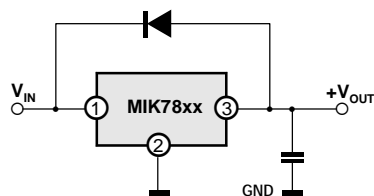


OUTPUT POLARITY-REVERSAL-PROTECTION CIRCUIT



In many cases, a regulator powers a load that is not connected to ground but, instead, is connected to a voltage source of opposite. In these cases, a clamp diode should be connected to the regulator output as shown in this figure. This protects the regulator from output polarity reversals during startup and short-circuit operation.

REVERSE-BIAS-PROTECTION CIRCUIT

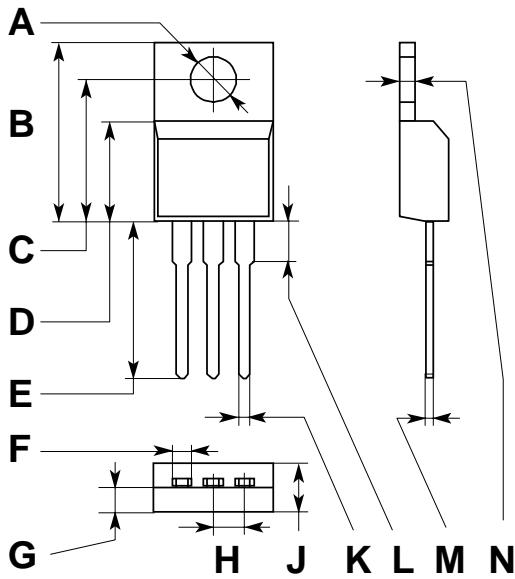


Occasionally, the input voltage to the regulator can collapse faster than the output voltage. This can occur when the input supply is crowbarred during an output overvoltage condition. If the output voltage is greater than approximately 7 V, the emitter-base junction of the series-pass element could break down. To prevent this, a diode shunt can be used as shown in this figure.



PHYSICAL DIMENSIONS AND MARKING DIAGRAMS

TO-220-3 PACKAGE



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	3.75	3.85	0.147	0.151
B	15.24	15.75	0.600	0.620
C	12.47	12.9	0.491	0.508
D	9.05	9.15	0.356	0.360
E	13.00	14.00	0.511	0.551
F	1.14	1.70	0.044	0.067
G	2.40	2.72	0.094	0.107
H	2.40	2.70	0.094	0.106
J	4.40	4.60	0.173	0.181
K	0.61	0.88	0.024	0.034
L	3.50	3.93	0.137	0.154
M	0.49	0.70	0.019	0.027
N	1.23	1.32	0.048	0.051

TO-220-3

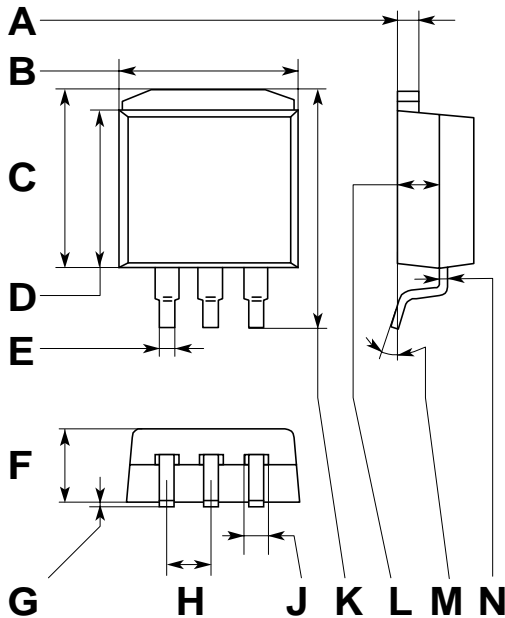
MARKING DIAGRAM



XX — output voltage (see table below)
 YY — Year
 WW — Work Week
 n — assembly location

XX	OUTPUT VOLTAGE	XX	OUTPUT VOLTAGE
05	5.0	12	12.0
06	6.0	15	15.0
08	8.0	18	18.0
09	9.0	24	24.0
10	10.0		

TO-263-3 PACKAGE



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.143	1.397	0.045	0.055
B	9.804	10.236	0.386	0.403
C	11.074	11.506	0.406	0.418
D	9.042	9.347	0.356	0.368
E	0.660	0.914	0.026	0.036
F	4.318	4.572	0.170	0.180
G	0.000	0.254	0.000	0.010
H	2.540 BSC		0.100 BSC	
J	1.295 REF		0.051 REF	
K	13.691	14.707	0.539	0.579
L	0.457	0.660	0.018	0.026
M	5° REF		5° REF	
N	2.235	2.591	0.088	0.102

TO-263-3

MARKING DIAGRAM



XX — output voltage (see table below)
 Y — Year
 WW — Work Week
 n — assembly location

XX	OUTPUT VOLTAGE	XX	OUTPUT VOLTAGE
05	5.0	12	12.0
06	6.0	15	15.0
08	8.0	18	18.0
09	9.0	24	24.0
10	10.0		



ORDERING INFORMATION

(THE FORM OF PACKING IS STIPULATED IN THE CONTRACT)

ORDERING NUMBER	OUTPUT VOLTAGE (V)	OPERATING TEMPERATURE (°C)	PACKAGE	SHIPPING
MIK 7805CT	5.0	0 ÷ 70	TO-220	50 Units/Rail
MIK 7806CT	6.0			
MIK 7808CT	8.0			
MIK 7809CT	9.0			
MIK 7810CT	10.0			
MIK 7812CT	12.0			
MIK 7815CT	15.0			
MIK 7818CT	18.0			
MIK 7824CT	24.0			
MIK 7805CD2T	5.0	0 ÷ 70	TO-263	50 Units/Rail, 800 Units/Reel
MIK 7806 CD2T	6.0			
MIK 7808 CD2T	8.0			
MIK 7809 CD2T	9.0			
MIK 7810 CD2T	10.0			
MIK 7812 CD2T	12.0			
MIK 7815 CD2T	15.0			
MIK 7818 CD2T	18.0			
MIK 7824 CD2T	24.0			

The information presented in this Data sheet is believed to be accurate and reliable. Application circuits shown are typical examples illustrating the operation of the device.

In the interest of product improvement, MIKRON reserves the right to change

specifications and data without notice and can assume no responsibility for the use of any information, devices and application circuits described herein. Reference to products of other manufacturers are solely for convenience and do not imply total equivalency of design, performance, or otherwise.

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