DATA SHEET
02 OCTOBER 2003

No. 00019
REV 1-03

REPLACEMENT OF:
CS 5205
AMC 7585
AMS 1084
B 1585
LM 1084
MIC 2950

MIK5205-xx series

5A LOW DROPOUT POSITIVE VOLTAGE REGULATOR

GENERAL DESCRIPTION

The MIK5205 series of positive adjustable and fixed regulators are designed to provide 5A with higher efficiency than currently available devices. All internal circuitry is designed to operate down to 1V input to output differential and the dropout voltage is fully specified as a function of load current. Dropout voltage of the device is 1V at light loads and rising to 1.15V at maximum output current. On-chip trimming adjusts the reference voltage to 1%.

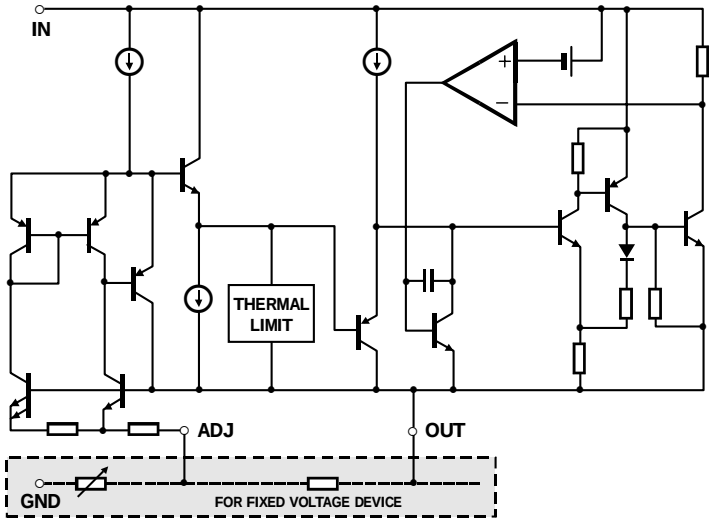
FEATURES

- Adjustable or Fixed Output
- Output Current of 5A
- Low Dropout, 1.15V at 5A Output Current
- 0.04% Line Regulation
- 0.08% Load Regulation
- 100% Thermal Limit Burn-In
- Fast Transient Response

APPLICATIONS

- High Efficiency Linear Regulators
- Post Regulators for Switching Supplies
- Microprocessor Supply
- Adjustable Power Supply

BLOCK DIAGRAM



PIN ASSIGNMENTS

MIK5205-xxT**, MIK5205**T

TO-220-3

TAB — V_{OUT}
1 — ADJ/GND
2 — V_{OUT}
3 — V_{IN}

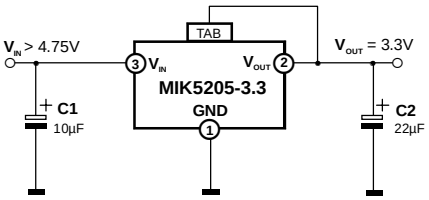
MIK5205-xxD2T**, MIK5205**D2T

TO-263-3

TAB — V_{OUT}
1 — ADJ/GND
2 — V_{OUT}
3 — V_{IN}

TYPICAL APPLICATION CIRCUIT

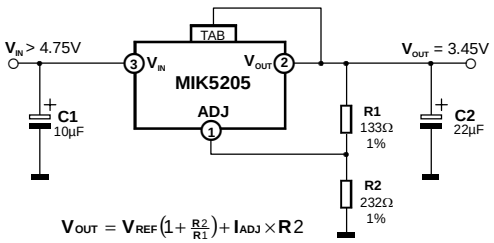
FIXED VOLTAGE REGULATOR



NOTES:

- C1 needed if device is far from filter capacitors
- C2 minimum value required for stability

ADJUSTABLE VOLTAGE REGULATOR



$$V_{OUT} = V_{REF}\left(1 + \frac{R2}{R1}\right) + I_{ADJ} \times R2$$

ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	MAXIMUM	UNIT
P_D	Power Dissipation	Internally Limited	W
V_{IN}	Input Voltage	7	V
T_J	Operating Junction Temperature Range		
	Control Section	0 to 125	°C
	Power Transistor	0 to 150	
T_{STG}	Storage Temperature	-65 to 150	°C
T_{LEAD}	Lead Temperature (Soldering, 10 sec)	300	°C

ELECTRICAL CHARACTERISTICS

Electrical Characteristics at I_{LOAD} = 0 mA and T_J = +25°C unless otherwise specified.

PARAMETER	DEVICE	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Reference Voltage (Note 1)	MIK5205	V_{IN} = 2.75V, I_{LOAD} = 10mA V_{IN} = 2.7V to 7V, I_{LOAD} = 10mA to 5A	☑	1.238 1.230	1.250 1.250	1.262 1.270	V
Output Voltage	MIK5205-1.5	V_{IN} = 4.0V V_{IN} = 3.0V, I_{LOAD} = 0mA to 5A	☑	1.485 1.475	1.500 1.500	1.515 1.525	V
	MIK5205-1.8	V_{IN} = 4.3V V_{IN} = 3.3V, I_{LOAD} = 0mA to 5A	☑	1.782 1.771	1.800 1.800	1.818 1.829	V
	MIK5205-2.5	V_{IN} = 5.0V V_{IN} = 4.0V, I_{LOAD} = 0mA to 5A	☑	2.475 2.460	2.500 2.500	2.525 2.540	V
	MIK5205-2.85	V_{IN} = 5.35V V_{IN} = 4.40V, I_{LOAD} = 0mA to 5A	☑	2.821 2.805	2.850 2.850	2.879 2.895	V
	MIK5205-3.0	V_{IN} = 5.5V V_{IN} = 4.5V, I_{LOAD} = 0mA to 5A	☑	2.970 2.950	3.000 3.000	3.030 3.050	V
	MIK5205-3.3	V_{IN} = 5.8V V_{IN} = 4.8V, I_{LOAD} = 0mA to 5A	☑	3.267 3.247	3.300 3.300	3.333 3.353	V
	MIK5205-3.5	V_{IN} = 6.0V V_{IN} = 5.0V, I_{LOAD} = 0mA to 5A	☑	3.465 3.445	3.500 3.500	3.535 3.555	V
	MIK5205-5.0	V_{IN} = 7.5V V_{IN} = 6.5V, I_{LOAD} = 0mA to 5A	☑	4.950 4.920	5.000 5.000	5.050 5.080	V
Line Regulation (Note 1)	All	I_{LOAD} = 10mA, (1.5V+ V_{OUT}) ≤ V_{IN} ≤ 7V	☑		0.04	0.2	%
Load Regulation (Note 1)	All	V_{IN} = V_{OUT} +2.5V, I_{LOAD} = 10mA to 5A	☑		0.08	0.4	%
Minimum Load Current (Note 1, 2)	MIK5205	V_{IN} = 5V	☑		5	10	mA
Ground Pin Current	MIK5205-1.5 / 1.8/ 2.5/ 2.85/ 3.0/ 3.3/ 3.5 / 5.0	V_{IN} = V_{OUT} +2.5V, I_{LOAD} = 10mA to 5A	☑		6	10	mA
Adjust Pin Current (Note 1)	MIK5205	V_{IN} = 2.75V, I_{LOAD} = 10mA	☑		50	120	µA
Current Limit (Note 1)	All	(V_{IN} - V_{OUT}) = 3V	☑	5.5	6.8		A
Ripple Rejection (Note 1)	All	V_{IN} = V_{OUT} + 2.5V, I_{LOAD} = 1.5A		60	80		dB
Thermal Regulation (Note 1)	MIK5205	T_A = 25°C, 30ms pulse			0.003		%/W
Dropout Voltage (Note 1, 3)	All	I_{LOAD} = 10mA I_{LOAD} = 5A	☑		1.00 1.15	1.15 1.30	V

The ☑ denotes the specifications which apply over the full temperature range.

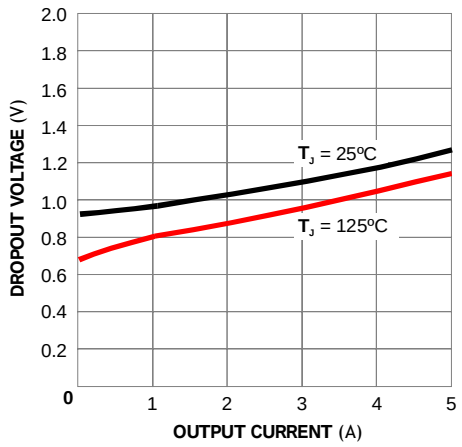
Note 1: For MIK5205 (adjustable) **Vadj** = 0V

Note 2: For the adjustable device the minimum load current is the minimum current required to maintain regulation. Normally the current in the resistor divider used to set the output voltage is selected to meet the minimum load current requirement.

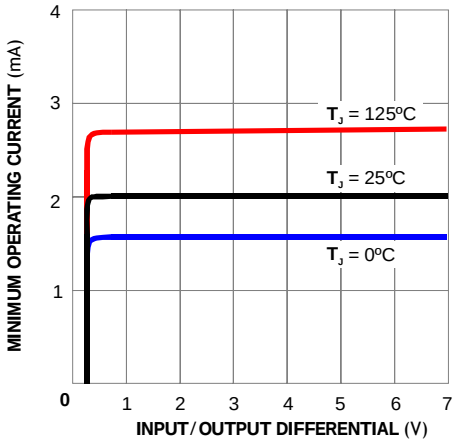
Note 3: The specification represent the minimum input/output voltage required to maintain 1% regulation.

TYPICAL CHARACTERISTICS

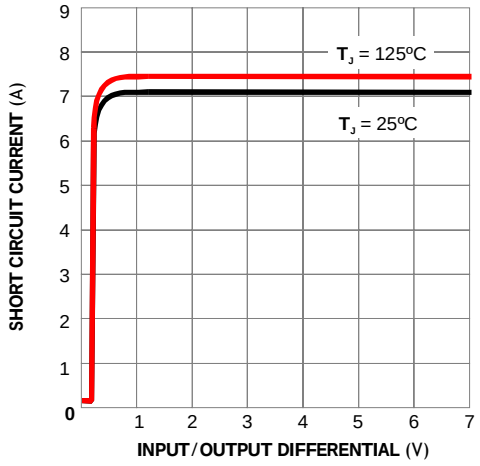
DROPOUT VOLTAGE (V_{IN} - V_{OUT})



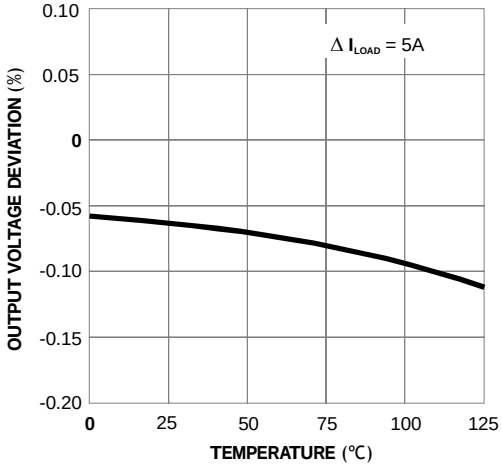
MINIMUM OPERATING CURRENT (ADJUSTABLE DEVICE)



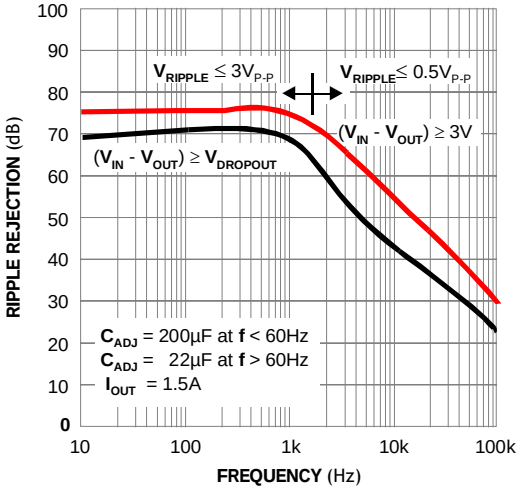
SHORT-CIRCUIT CURRENT



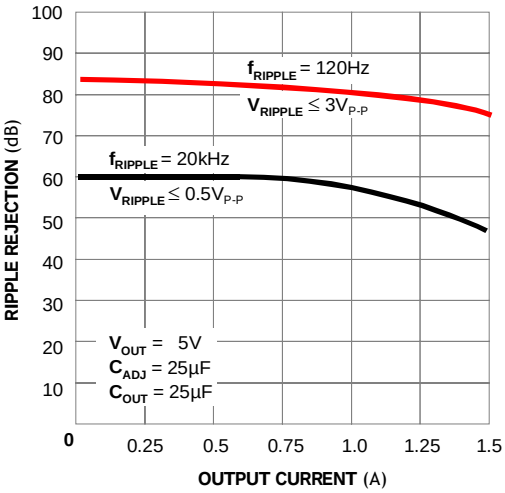
LOAD REGULATION



MIK5205 RIPPLE REJECTION

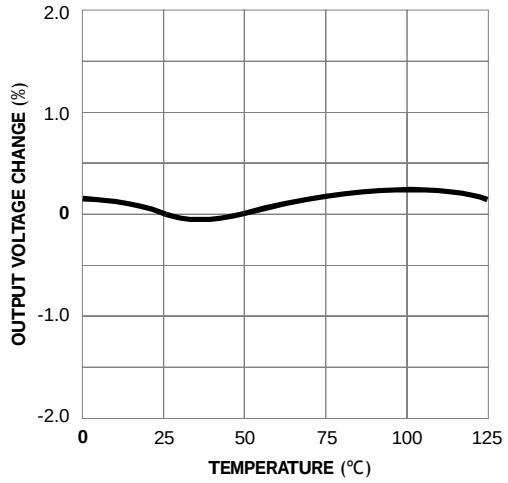


MIK5205 RIPPLE REJECTION versus CURRENT

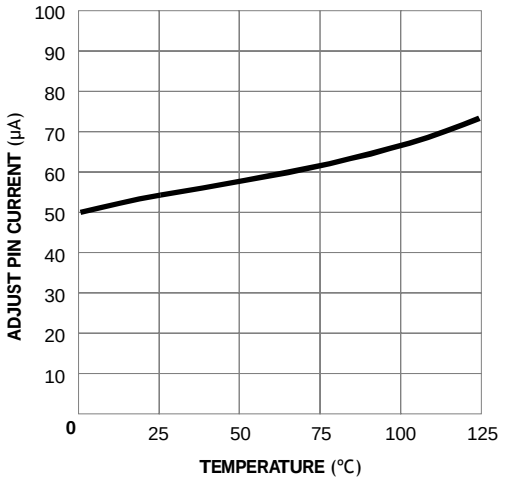


TYPICAL CHARACTERISTICS (CONTINUED)

TEMPERATURE STABILITY

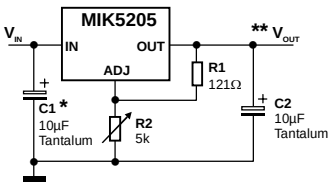


ADJUST PIN CURRENT



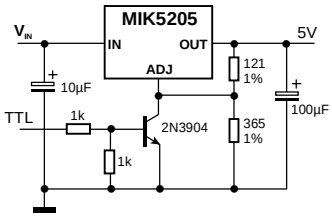
TYPICAL APPLICATIONS

1.2V to 5.5V ADJUSTABLE REGULATOR

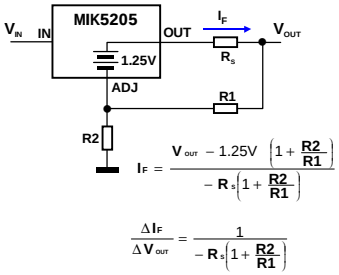


* NEEDED IF DEVICE IS FAR FROM FILTER CAPACITOR
** V_{OUT} = 1.25V x (1 + (R2/R1))

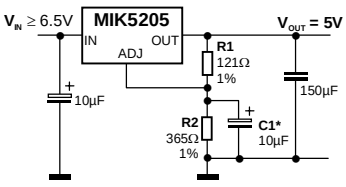
5V REGULATOR WITH SHUTDOWN



BATTERY CHARGER

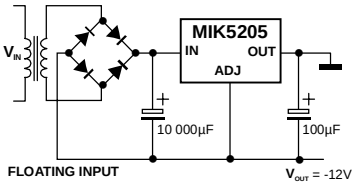


RIPPLE REJECTION ENHANCEMENT

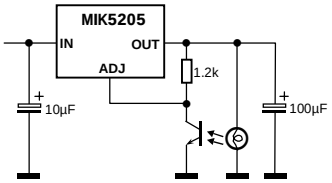


***C1** IMPROVES RIPPLE REJECTION. X_C SHOULD BE ≈R1 AT RIPPLE FREQUENCY

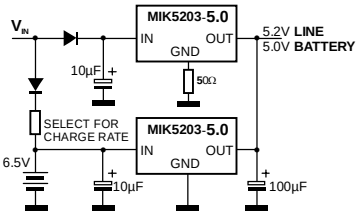
GENERATING NEGATIVE SUPPLY VOLTAGE



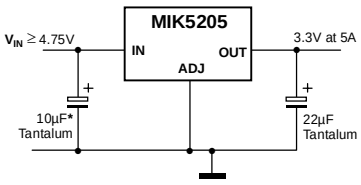
AUTOMATIC LIGHT CONTROL



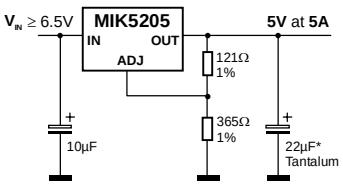
BATTERY BACKUP REGULATED SUPPLY



5V TO 3.3V, 5A REGULATOR

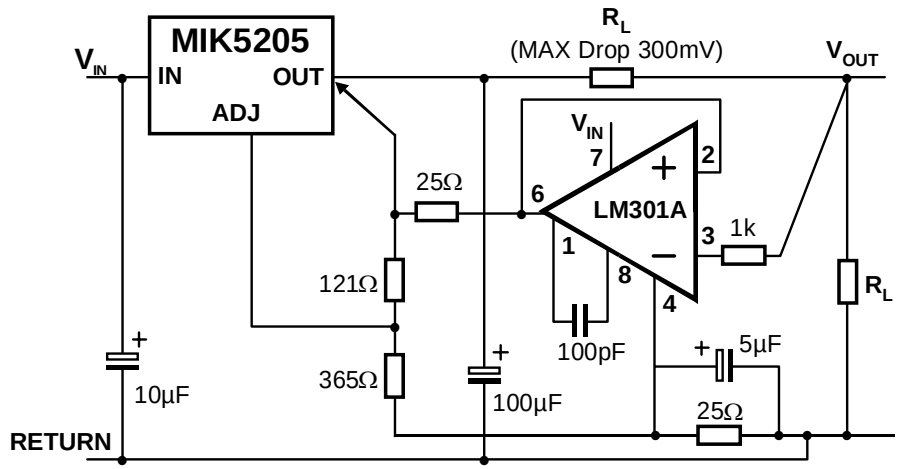


ADJUSTABLE 5V REGULATOR



TYPICAL APPLICATIONS (CONTINUED)

REMOTE SENSING



APPLICATION INFORMATION

The MIK5205 family of 3-terminal regulators are easy to use. They are protected against short circuit and thermal overloads. Thermal protection circuitry will shut down the regulator should the junction temperature exceed 170°C at the sense point. These regulators are pin compatible with older 3-terminal adjustable regulators, offer lower dropout voltage and more precise reference tolerance. Reference stability over temperature is improved over older types of regulators.

STABILITY

The MIK5205 family of regulators requires an output capacitor as part of the device frequency compensation. A minimum of 22µF of tantalum or 50µF of aluminum electrolytic is required. The ESR of the output capacitor should be less than 0.5Ω.

When using the MIK5205 adjustable device the adjust terminal can be bypassed to improve ripple rejection. When the adjust terminal is bypassed the required value of the output capacitor increases. The device will require an output capacitor of 22µF tantalum or 150µF aluminum electrolytic when the adjust pin is bypassed.
Normally, capacitor values on the order of 100µF are used in the output of many regulators to ensure good load transient response with large load current changes. Output capacitance can be increased without limit and larger values of output capacitance further improve stability and transient response.

PROTECTION DIODES

Diodes between input and output are not usually needed. Only with extremely large output capacitors, such as 1000µF and larger, and with the input pin instantaneously shorted to ground can damage occur. A crowbar circuit at the input of the MIK5205 in combination with a large output capacitor could generate currents large enough to cause damage. In this case a diode from output to input is recommended, as shown in Figure 1.

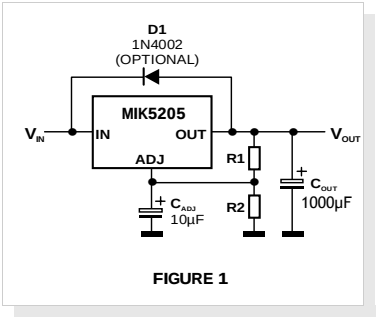


FIGURE 1

OUTPUT VOLTAGE

The MIK5205 develops a 1.25V reference voltage between the output and the adjust terminal (see Figure 2). By placing a resistor between these two terminals, a constant current is caused to flow through R1 and down through R2 to set the overall output voltage. Normally this current is chosen to be the specified minimum load current of 10mA. Because IADJ is very small and constant when compared to the current through R1, it represents a small error and can usually be ignored. For fixed voltage devices R1 and R2 are included in the device.

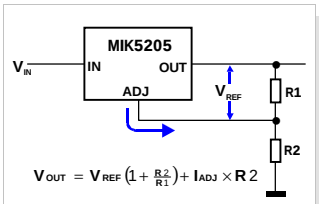


FIGURE 2. BASIC ADJUSTABLE REGULATOR

LOAD REGULATION

Because the MIK5205 is a 3-terminal device, it is not possible to provide true remote load sensing. Load regulation will be limited by the resistance of the wire connecting the regulator to the load. The data sheet specification for load regulation is measured at the output pin of the device. Negative side sensing is a true Kelvin connection, with the bottom of the output divider returned to the negative side of the load. Although it may not be immediately obvious, best load regulation is obtained when the top of the resistor divider (R1) is returned directly to the output pin of the device, not to the load. This is illustrated in Figure 3. Connected as shown, RP is not multiplied by the divider ratio. If R1 were connected to the load, the effective resistance between the regulator and the load would be:

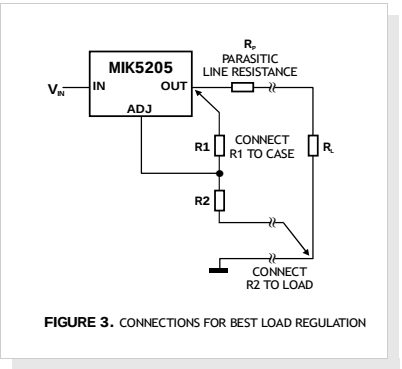


FIGURE 3. CONNECTIONS FOR BEST LOAD REGULATION

$$R_P \times \frac{R2 + R1}{R1},\ R_P = \text{Parasitic Line Resistance}$$

For fixed voltage devices the top of R1 is internally Kelvin connected, and the ground pin can be used for negative side sensing.

RIPPLE REJECTION

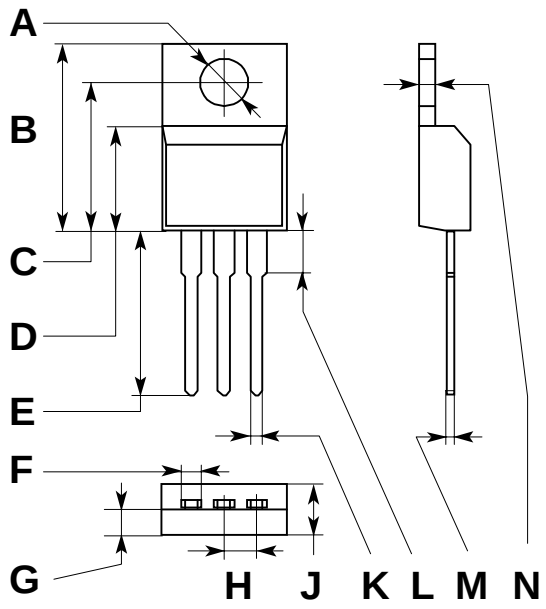
The curves for Ripple Rejection were generated using an adjustable device with the adjust pin bypassed. These curves will hold true for all values

of output voltage. For proper bypassing, and ripple rejection approaching the values shown, the impedance of the adjust pin capacitor, at the ripple frequency, should be < R1. R1 is normally in the range of 100Ω to 200Ω. The size of the required adjust pin capacitor is a function of the input ripple frequency. At 120Hz, with R1 = 100Ω, the adjust pin capacitor should be >13μF. At 10kHz only 0.16μF is needed.

For fixed voltage devices, and adjustable devices without an adjust pin capacitor, the output ripple will increase as the ratio of the output voltage to the reference voltage ($\mathbf{V_{OUT}/V_{REF}}$). For example, with the output voltage equal to 5V, the output ripple will be increased by the ratio of 5V/1.25V. It will increase by a factor of four. Ripple rejection will be degraded by 12dB from the value shown on the curve.

PHYSICAL DIMENSIONS AND MARKING DIAGRAMS

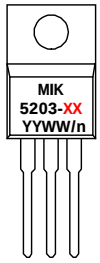
TO-220-3 PACKAGE



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

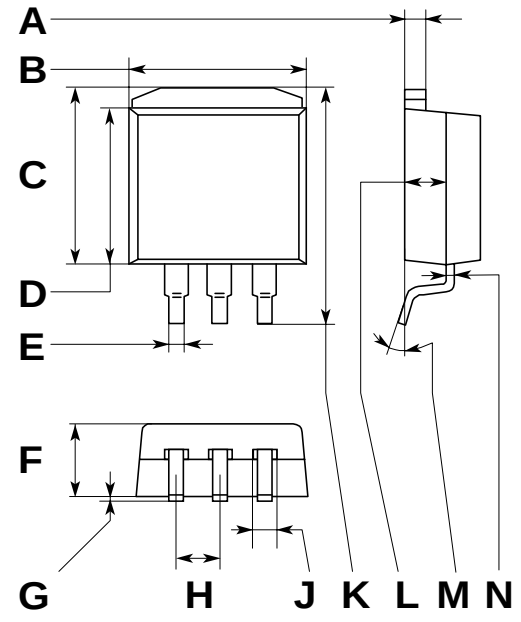
MARKING DIAGRAM



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

XX	OUTPUT VOLTAGE
Blank	Adjustable
15	1.5 V
18	1.8 V
25	2.5 V
28	2.85 V
3	3.0 V
33	3.3 V
35	3.5 V
5	5.0 V

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
Blank	Adjustable
15	1.5 V
18	1.8 V
25	2.5 V
28	2.85 V
3	3.0 V
33	3.3 V
35	3.5 V
5	5.0 V

ORDERING INFORMATION

ORDERING NUMBER	OUTPUT VOLTAGE	PACKAGE	OPERATING TEMPERATURE	SHIPPING
MIK 5205 **T**	Adjustable	TO-220-3	0°C to +70°C	50 units/Rail
MIK 5205-1.5 **T**	1.5 V			
MIK 5205-1.8 **T**	1.8 V			
MIK 5205-2.5 **T**	2.5 V			
MIK 5205-2.85 **T**	2.85 V			
MIK 5205-3.0 **T**	3.0 V			
MIK 5205-3.3 **T**	3.3 V			
MIK 5205-3.5 **T**	3.5 V			
MIK 5205-5.0 **T**	5.0 V			
MIK 5205 **D2T**	Adjustable	TO-263-3	0°C to +70°C	50 units/Rail & 800 units/Reel
MIK 5205-1.5 **D2T**	1.5 V			
MIK 5205-1.8 **D2T**	1.8 V			
MIK 5205-2.5 **D2T**	2.5 V			
MIK 5205-2.85 **D2T**	2.85 V			
MIK 5205-3.0 **D2T**	3.0 V			
MIK 5205-3.3 **D2T**	3.3 V			
MIK 5205-3.5 **D2T**	3.5 V			
MIK 5205-5.0 **D2T**	5.0 V			

NOTE: The form of packing is stipulated in the contract.

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