LDO Regulator Evaluation Board

MIC5203/05/06/07/16/19 LDO Regulators

General Description

This board can be used to evaluate several linear, low-dropout voltage regulators in the SOT-23-5 package. The board can accommodate any one of the following parts:

MIC5203
MIC5205
MIC5206
MIC5207
MIC5216
MIC5219

These regulators can be used to generate a well-regulated voltage from a higher, unregulated dc voltage. Since each regulator may have different features, this board has been designed to ease the evaluation of any of these features. A breadboarding area is also included so that further circuitry can be designed for evaluation with the regulator.

Requirements

The LDO evaluation board requires a power source with a voltage capability of 20V and at least 500mA of current. Several digital multimeters will be used to evaluate the different characteristics, as well as an oscilloscope to monitor input and output waveforms.

Circuit Description

The evaluation board contains a basic circuit with jumpers to connect different portions of the circuit depending on which device is being evaluated. The MIC5203 in the SOT-23-5 package is a simple LDO that only requires pins 1–3, and pin 5 to be used. Pin 4 is a no connect and it is not used. The fixed voltage versions of the MIC5205/5207/5219 have a noise bypass pin, which can be connected to the circuit for evaluation through a simple jumper. The MIC5205/5207/5219 adjustable parts give the user the option to set their own output voltage. By switching the appropriate jumper, the adjust resistors can be used to set the output voltage. The bypass capacitor can be used in conjunction with the adjust resistors to get a low-noise, adjustable output. Finally, the MIC5206/5216 LDOs have an error flag output that can be evaluated by using the appropriate jumper as well. The functionality of each of the jumpers is described in the Table 1.

The basic circuit contains an input capacitor, an output capacitor and several other components that can be connected through the jumpers.

Each device can be evaluated for the following characteristics: dropout voltage, ground current, and enable turn-on characteristics.

Ground Current

With JP2 open, an ammeter can be placed across the jumper to measure current flowing to ground. This places the meter in series with the ground pin. The meter should be highly accurate, preferably a 6½ digit meter or better so that the current can be measured reliably. The input and output voltages need to be monitored so that the device is not operating in dropout. The input should be 1V more positive than the output to measure standard ground current measurements at load. The output voltage will not be the nominal rated output voltage due to the impedance that is introduced into the ground lead. This is not important for the evaluation. The key aspect of this evaluation is the differential voltage from input to output. This can be measured by putting a DMM from input to output. JP2 need to be replaced to continue the evaluation. (JP1 should be closed for this evaluation. JP3/4/5 may be needed depending on the part number. JP6 can be left open on all circuits for this evaluation.)

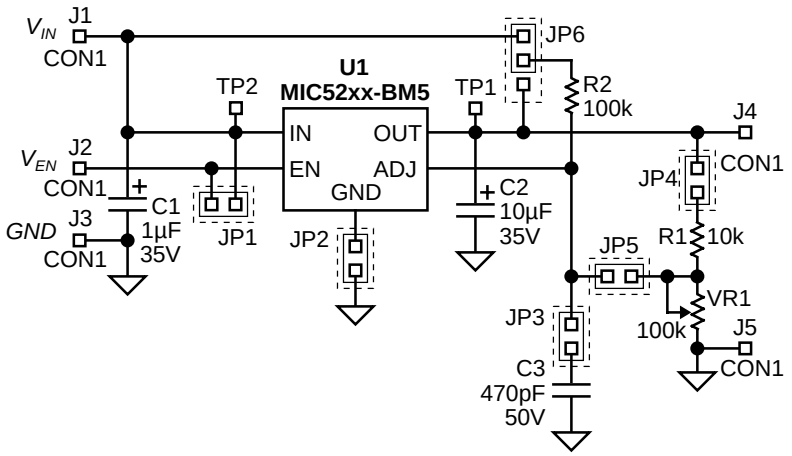


Figure 1. Evaluation Board Schematic

Jumper	Function
JP1	Used to tie V_{EN} to V_{IN}. When open, enable pin functionality can be evaluated.
JP2	Used to evaluate ground current. Either solder together or jumper for all other tests.
JP3	Used to connect bypass capacitor to pin 4. Do not use with MIC5206/5216/5203.
JP4	Used to connect adjust resistors to the output for evaluation of MIC5205/5207/5219 adjustable versions.
JP5	Used to connect adjust resistors to pin 4 for evaluation of 5205/5207/5219 adjustable versions.
JP6	Used to connect flag pull-up resistor for MIC5206/5216. Can be connected to V_{IN} or V_{OUT}.

Table 1.

Enable Characteristics

The enable pin characteristics can be determined by removing the jumper from JP1 and driving the enable pin with a power supply or a signal generator. Then, on an oscilloscope, the output voltage can be monitored relative to the enable voltage. JP1 can be replaced afterwards to do further measurements.

(JP2 must be closed and JP6 can be left open. JP3/4/5/6 may be open or closed depending on the part)

Dropout Voltage

Dropout voltage can be measured by using TP1 and TP2. These test points allow the voltage directly across the pass transistor to be monitored. DMMs can be used to monitor the input voltage relative to ground and the output voltage relative to ground, with a third DMM measuring directly across TP1 and TP2 to measure the dropout voltage. Dropout voltage is typically defined as the voltage at which the output falls 2% below the voltage measured at $V_{IN} = V_{OUT} + 1V$. In other words, make a measurement of the output voltage relative to ground when the voltage across the device (TP2-TP1) is 1V. Then, reduce the input voltage until the output voltage is 2% below the valued measured at that 1V differential. At this point, the voltage measured from TP2 to TP1 is the dropout voltage. (Close JP1/2 for this evaluation. JP3/4/5/6 can be left open, depending on the part.)

Error Flag

The error flag feature of the MIC5206/5216 can be evaluated by connecting jumper JP6 to either the input voltage or output voltage. The error output of these devices is an open collector output, therefore, it needs to be connected through a resistor to a high voltage. The output is active low. When there is a fault condition resulting in a low voltage output (low input voltage, or current limit), the transistor turns on and the collector is pulled to ground. The 100k resistor limits the current through the transistor. The resistor can be changed, but care must be taken not to damage the board traces when it is removed.

Adjustable Output Voltage

The board is equipped with a 10k resistor and a potentiometer so that an adjustable part can be evaluated for its output voltage accuracy. The output voltage is set for the MIC5205/5207/5219 through the following equation:

$$V_{OUT} = 1.242\left(1 + \frac{VR1}{R1}\right)$$

By connecting JP4 and JP5, the output will then be set to the desired voltage. The voltage is adjusted by changing VR1. Because VR1 is a 100k potentiometer, the output voltage is limited to 13.7V. If a higher output voltage is required, R1 can be lowered, taking care that the board is not damaged when the resistor is removed. The minimum recommended output voltage is 1.8V.

Noise Bypass Capacitor

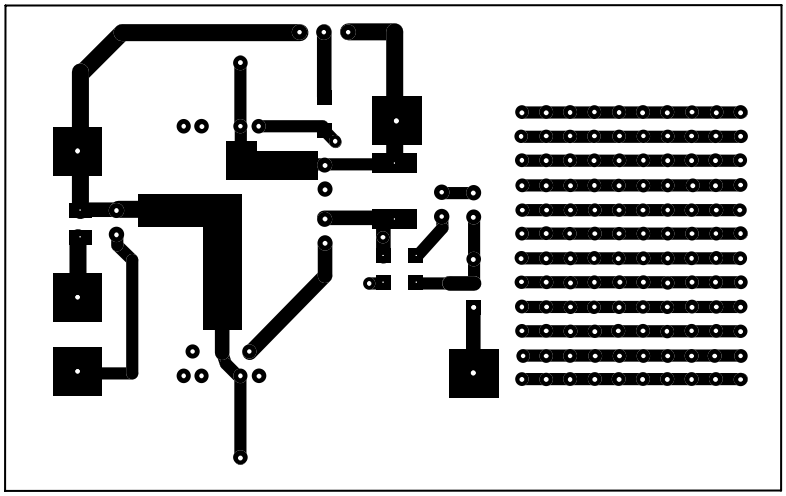
C3 is a 470pF, 50V NPO ceramic bypass capacitor for reducing noise on the MIC5205/5207/5219. JP3 connects this capacitor to the circuit so that the characteristics of those devices with the noise bypass capacitor attached can be evaluated.

An area for breadboarding is also included with this evaluation board so that additional testing can be performed. The holes are connected in horizontal rows for ease of use.

Parts List

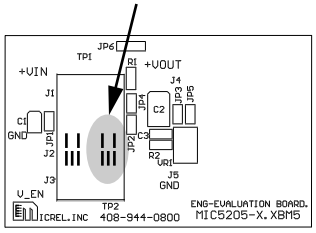
Reference	Vendor	Part Number	Description	Quantity
U1	Micrel	MIC5205 MIC5206 MIC5207 MIC5216 MIC5219	LDO linear regulator	1
C1	AVX	TAJA105K035R	1µF, 35V Tantalum	1
C2	AVX	TAJA106K035RBJ	10µF, 35V Tantalum	1
C3	Panasonic	PCC471CGCT-ND	470pF/50V ceramic	1
R1		1206-size resistor	10k 1% metal film	1
R2		1206-size resistor	100k 1% metal film	1
VR1		variable resistor	100k potentiometer	1

Printed Circuit Board Layouts



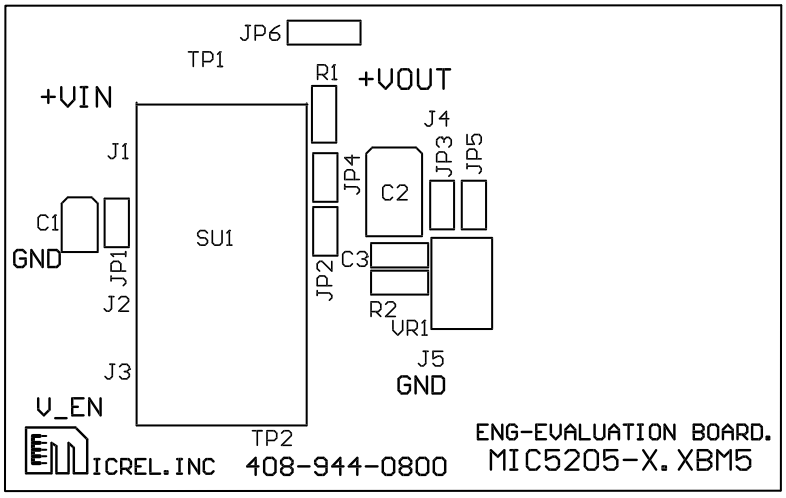
Component-Side Copper

Insert the device to be evaluated in the half of the dual socket nearest to jumper position JP2.

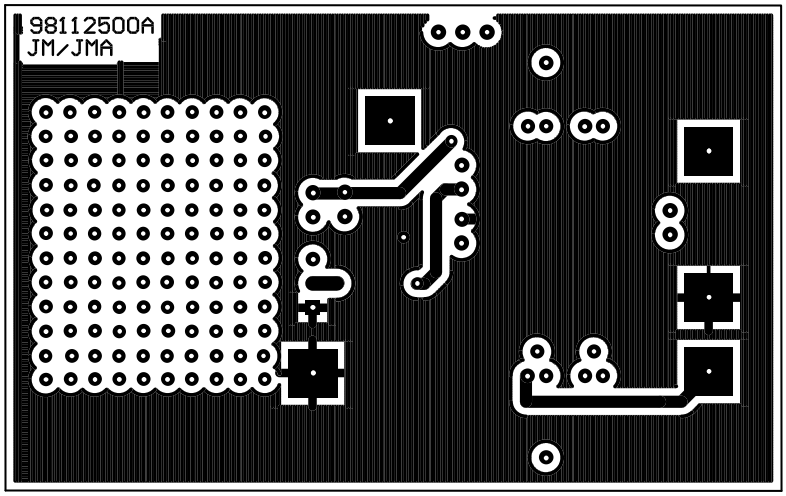


The half of the socket nearest to JP1 is not connected.

Figure 2. Active Socket



Component-Side Silk Screen



Solder-Side Copper

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