LP3878-ADJ Evaluation Board

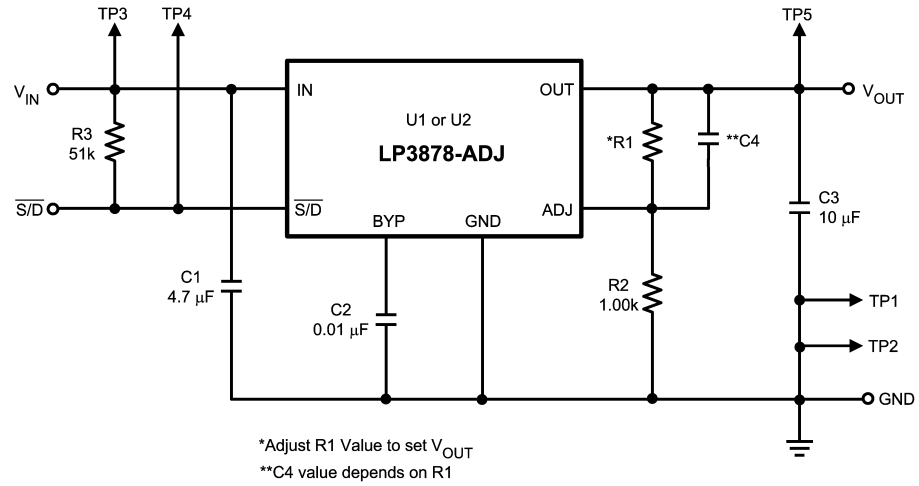
National Semiconductor
Application Note 1409
Chester Simpson
October 2005

Introduction

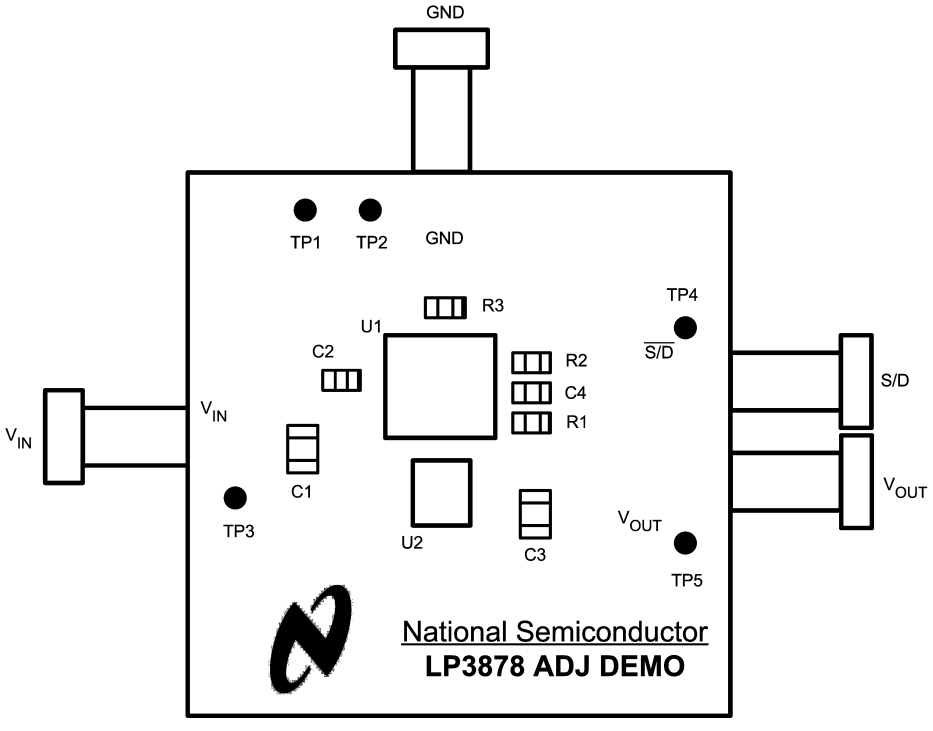
The LP3878-ADJ is an 800 mA low-dropout linear regulator whose output voltage can be externally set to any value between 1V and 5.5 V using two resistors. This application note gives information about the evaluation board supplied to demonstrate the function of this part.

Basic Application Circuit

The basic application circuit shown below provides the component designators used on the evaluation board.



Evaluation Board Basic Application Circuit



Evaluation Board Component Layout (Top View)

Setting the Output Voltage

The output voltage is set using the two external resistors R1 and R2:

$$V_{OUT} = V_{ADJ} \times (1 + R1/R2)$$

It can be assumed that V_{ADJ} = 1V.

R2 is required to be less than 5 kΩ for stability reasons. On these boards, R2 is 1.00 kΩ. Using these values for R2 and VADJ, the appropriate value for R1 can be calculated for any value of VOUT between 1V and 5.5V. The first quantity of boards built were set to 1.8V output using a 806Ω resistor for R1.

Selecting Compensation Capacitor (C4)

The function of C4 is "feedforward" compensation, which is to provide a zero in the loop gain which adds phase lead at the unity gain crossover frequency. The frequency of the zero is given by:

$$f_Z = 1/ (2 \times \pi \times R1 \times C4)$$

Bench testing was performed which showed the best range for the zero varied slightly based on the output voltage. For best setting time, it is recommended that C4 be selected such that:

$$(V_{OUT} > 2.5V) : 20kHz < f_Z < 100kHz$$

$$(V_{OUT} \leq 2.5V) : 50kHz < f_Z < 200kHz$$

NOTE: because C4 forms both a pole and zero, it should be made clear that the amount of beneficial phase gain which is possible reduces at lower output voltages. As the value of R1 is reduced, tha pole and zero become closer in frequency. At output voltages below about 1.5V, C4 has very little beneficial effect on phase margin (this topic is covered in detail on the LP3878-ADJ datasheet).

Component List

The first boards were built for a 1.8V output using the 8-lead LLP package. The component list below reflects this.

NOTE: higher voltage rated capacitors may be substituted, but only X5R or X7R dielectric types may be used.

PCB, LP3878-ADJ

U2: IC, LP3878SD-ADJ

TP1, TP2, TP3, TP4 TP5: test point terminal, NEWARK 97H6311

VIN CONNECTOR: banana jack (RED): DIGI-KEY 108-0902-001

VOUT CONNECTOR: banana jack (BLUE): DIGI-KEY 108-0910-001

GROUND CONNECTOR: banana jack (BLACK): DIGI-KEY 108-0903-001

$\overline{S/D}$ CONNECTOR: banana jack (YELLOW): DIGI-KEY 108-0907-001

R1: resistor, 0805 case, 806 Ω, 1%

R2: resistor, 0805 case, 1.00 kΩ, 1%

R3: resistor, 0805 case, 51 kΩ, 5%

C1: ceramic capacitor, 4.7 µF, Taiyo-Yuden #JMK316BJ475MD

C2: ceramic capacitor, 0805 case, 0.01 µF, 10V, X5R/X7R dielectric

C3: ceramic capacitor, 10 µF, 10V, Taiyo-Yuden # LMK325BJ106MN

C4: ceramic capacitor, 0805 case, 3300 pF, 10V, X5R/X7R dielectric

National Semiconductor
Americas Customer Support Center
Email: new.feedback@nsc.com
Tel: 1-800-272-9959

www.national.com

National Semiconductor
Europe Customer Support Center
Fax: +49 (0) 180-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 69 9508 6208
English Tel: +44 (0) 870 24 0 2171
Français Tel: +33 (0) 1 41 91 8790

National Semiconductor
Asia Pacific Customer Support Center
Email: ap.support@nsc.com

National Semiconductor
Japan Customer Support Center
Fax: 81-3-5639-7507
Email: jpn.feedback@nsc.com
Tel: 81-3-5639-7560