



MIC26901 Evaluation Board

28V, 9A Hyper Speed Control™
Synchronous DC/DC Buck Regulator

SuperSwitcher II™

General Description

The MIC26901 DC-DC regulator operates over an input supply range of 4.5V to 28V, and provides a regulated output at up to 9A of output current. The output voltage is adjustable to 0.8V with a typical accuracy of $\pm 1\%$ and the device operates at a switching frequency of 600kHz. The switching frequency remains fairly constant with changes in input voltage and output load.

Micrel's Hyper Speed Control™ architecture allows for ultra-fast transient response, while reducing the output capacitance. It also makes (High V_{IN})/(Low V_{OUT}) operation possible. The MIC26901 utilizes an adaptive T_{ON} ripple control architecture. An undervoltage lockout feature is provided to ensure proper operation under power-sag conditions. An internal soft-start feature is provided to reduce the inrush current. Foldback current limit and "hiccup" mode short-circuit protection and thermal shutdown ensures protection of the IC during fault conditions.

Note: This evaluation board is for 9A applications.

A datasheet and supporting documentation can be found on Micrel's web site at: www.micrel.com.

Requirements

The MIC26901 provides a 5V regulated output for input voltage V_{IN} , ranging from 5.5V to 28V. When $V_{IN} < 5.5V$, V_{DD} should be tied to PVIN pins to bypass the internal linear regulator by a jumper. The output load can either be an active or passive load.

Precautions

The evaluation board does not have reverse polarity protection. Applying a negative voltage to the V_{IN} terminal may damage the device. In addition, the maximum V_{IN} operating voltage of the MIC26901 evaluation board is 28V. Exceeding 29V on VIN could damage the device.

Getting Started

1. Connect an external supply to the VIN terminal. Apply the desired input voltage to the VIN and ground terminals of the evaluation board, paying careful attention to polarity and supply voltage. An ammeter may be placed between the input supply and the VIN terminal to the evaluation board. Ensure that the supply voltage is monitored at the VIN terminal. The ammeter and/or power lead resistance can reduce the voltage supplied to the input.
2. **Connect the load to the V_{OUT} and ground terminals.** The load can be either passive (resistive) or active (as in an electronic load). An ammeter can be placed between the load and the V_{OUT} terminal. Ensure that the output voltage is monitored at the V_{OUT} terminal. V_{OUT} can be set to 0.9V, 1.0V, 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, or 5.0V by a jumper. If a different voltage is needed, it can be adjusted by changing the feedback resistors. See "Output Voltage" section.
3. **Enable the MIC26901.** The EN pin is provided on the evaluation board. The output of the MIC26901 turns on when V_{DD} exceeds the UVLO threshold. Turn off the output of the MIC26901 by shorting the EN pin to ground. A connection on the board provides easy access to the enable pin.

Ordering Information

| Part Number | Description |
|----------------|---|
| MIC26901YJL EV | HSC 9A DC-DC Regulator Evaluation Board |

Hyper Speed Control is a trademark of Micrel, Inc
MLF and MicroLead Frame is a registered trademark of Amkor Technology, Inc.

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Output Voltage

The output voltage on the MIC26901 evaluation board is adjustable. It is set by adjusting the feedback resistors (R4 and one of R5, R6, R7, R8, R9, R10, R11, or R12) and can be calculated as follows as an example:

$$V_{\text{OUT}} = V_{\text{REF}} \times \left(1 + \frac{R4}{R7}\right)$$

where $V_{\text{REF}} = 0.8\text{V}$.

The output voltage above is set at the factory for a 1.2V output, but it can easily be changed by moving the jumper to a respective position to get an indicated voltage on the board. If a desired voltage is not shown on the board, it is easily modified by removing R4 and R7 and replacing them with the values that yield the desired output voltage.

Once R4 is selected, R7 can be calculated using:

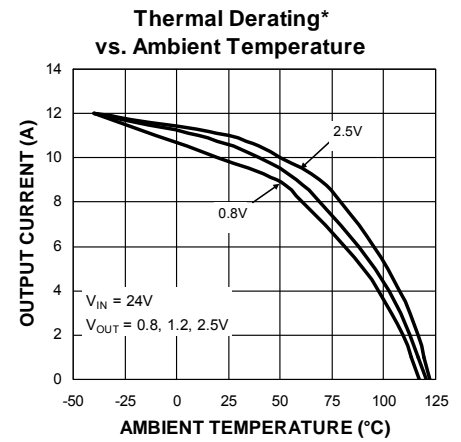
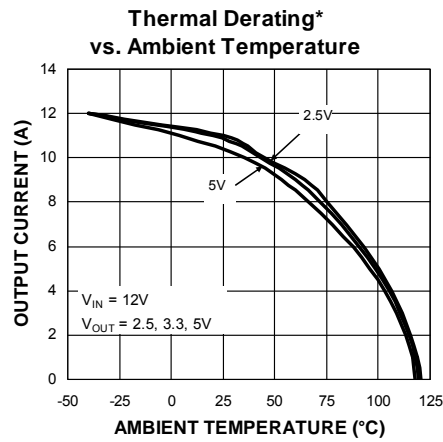
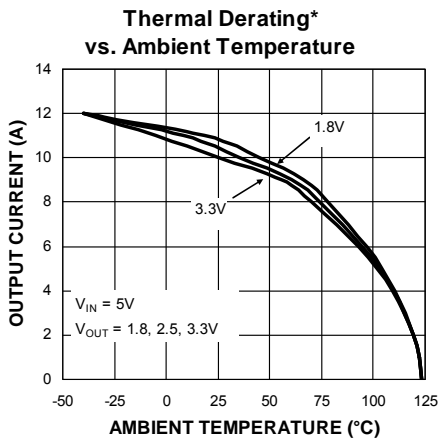
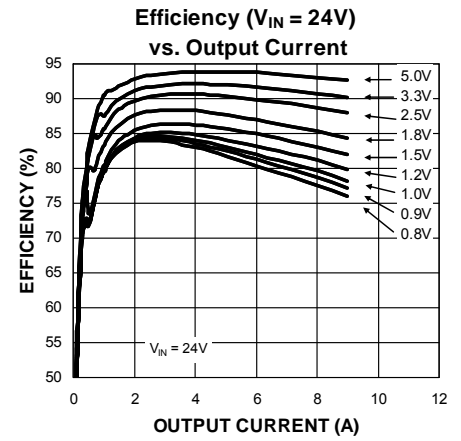
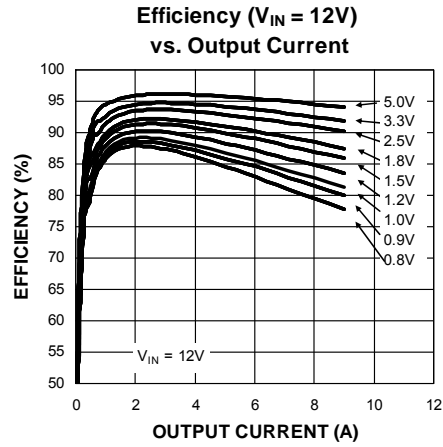
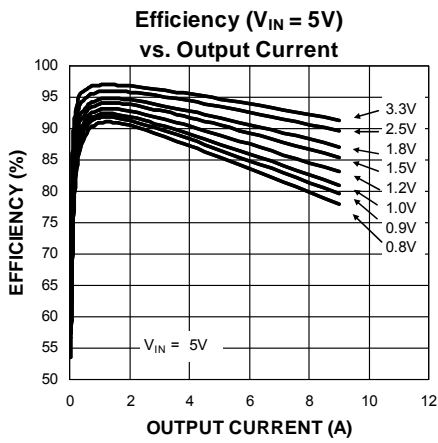
$$R7 = \frac{R4 \times V_{\text{REF}}}{V_{\text{OUT}} - V_{\text{REF}}}$$

For $V_{\text{REF}} = 0.8\text{V}$:

$$R7 = \frac{R4 \times 0.8\text{V}}{V_{\text{OUT}} - 0.8\text{V}}$$

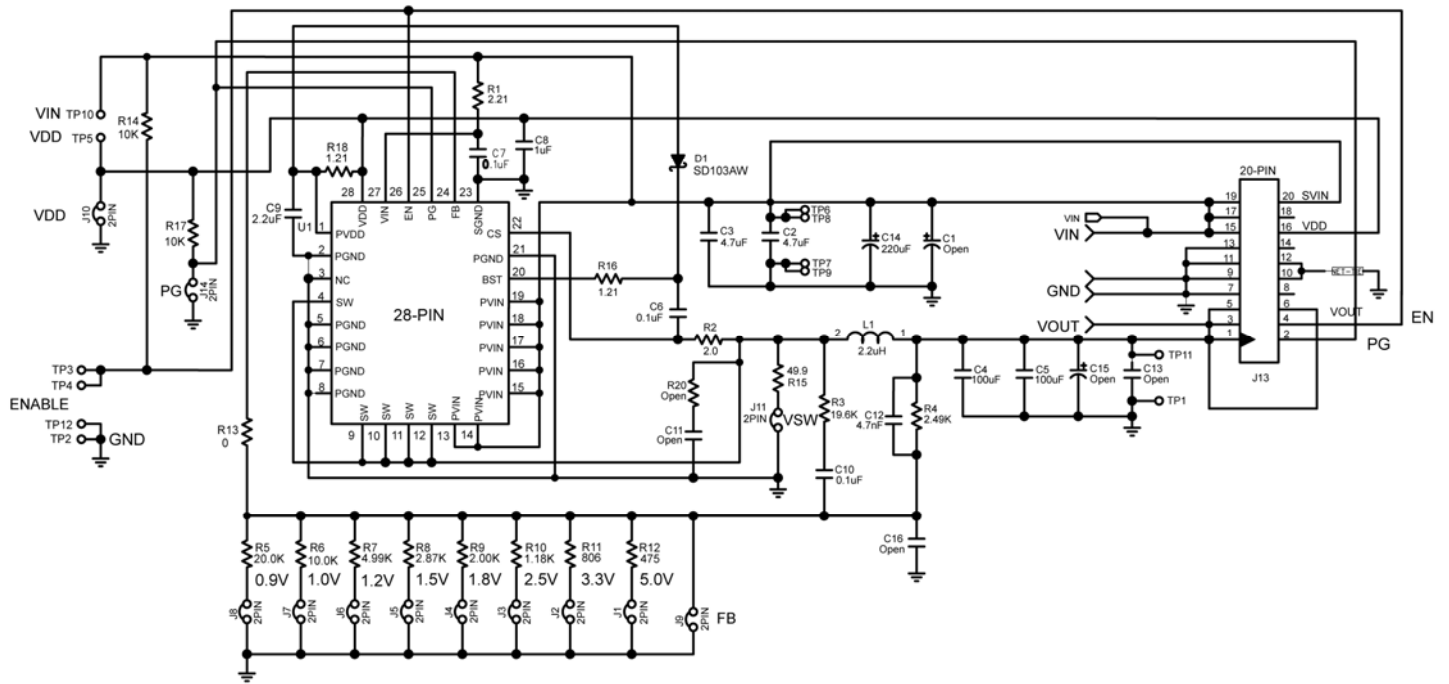
The output voltage should not be set to exceed 5V due to the 6.3V rating of the output capacitor and limitation on line regulation. Please refer to the "Setting Output Voltage" section of the MIC26901 datasheet for more information.

Evaluation Board Performance



Die Temperature* : The temperature measurement was taken at the hottest point on the MIC26901 case mounted on a 5 square inch 4 layer, 0.62", FR-4 PCB with 2oz finish copper weight per layer, see Thermal Measurement section. Actual results will depend upon the size of the PCB, ambient temperature and proximity to other heat emitting components.

Evaluation Board Schematic



Schematic of MIC26901 Evaluation Board
(J11, R13, R15 are for testing purposes)

Bill of Materials

| Item | Part Number | Manufacturer | Description | Qty |
|--------------|--------------------|--------------------------------|---|-----|
| C1 | Open | | | |
| C2, C3 | 12105C475KAZ2A | AVX ⁽¹⁾ | 4.7µF Ceramic Capacitor, X7R, Size 1210, 50V | 2 |
| | GRM32ER71H475KA88L | Murata ⁽²⁾ | | |
| | C3225X7R1H475K | TDK ⁽³⁾ | | |
| C13, C15 | Open | | | |
| C4, C5 | 12106D107MAT2A | AVX ⁽¹⁾ | 100µF Ceramic Capacitor, X5R, Size 1210, 6.3V | 3 |
| | GRM32ER60J107ME20L | Murata ⁽²⁾ | | |
| | C3225X5R0J107M | TDK ⁽³⁾ | | |
| C6, C7, C10 | 06035C104KAT2A | AVX ⁽¹⁾ | 0.1µF Ceramic Capacitor, X7R, Size 0603, 50V | 3 |
| | GRM188R71H104KA93D | Murata ⁽²⁾ | | |
| | C1608X7R1H104K | TDK ⁽³⁾ | | |
| C8 | 0603ZC105KAT2A | AVX ⁽¹⁾ | 1.0µF Ceramic Capacitor, X7R, Size 0603, 10V | 1 |
| | GRM188R71A105KA61D | Murata ⁽²⁾ | | |
| | C1608X7R1A105K | TDK ⁽³⁾ | | |
| C9 | 0603ZD225KAT2A | AVX ⁽¹⁾ | 2.2µF Ceramic Capacitor, X5R, Size 0603, 10V | 1 |
| | GRM188R61A225KE34D | Murata ⁽²⁾ | | |
| | C1608X5R1A225K | TDK ⁽³⁾ | | |
| C12 | 06035C472KAZ2A | AVX ⁽¹⁾ | 4.7nF Ceramic Capacitor, X7R, Size 0603, 50V | 1 |
| | GRM188R71H472K | Murata ⁽²⁾ | | |
| | C1608X7R1H472K | TDK ⁽³⁾ | | |
| C14 | B41851F7227M | EPCOS ⁽⁴⁾ | 220µF Aluminum Capacitor, 35V | 1 |
| C11, C16 | Open | | | |
| D1 | SD103AWS | MCC ⁽⁵⁾ | 40V, 350mA.Schottky Diode SOD323 | 1 |
| | SD103AWS-7 | Diodes Inc ⁽⁶⁾ | | |
| | SD103AWS | Vishay ⁽⁷⁾ | | |
| L1 | HCF1305-1R0-R | Cooper Bussmann ⁽⁸⁾ | 1.0µH Inductor, 21A Saturation Current | 1 |
| R1 | CRCW06032R21FKEA | Vishay Dale ⁽⁷⁾ | 2.21Ω Resistor, Size 0603, 1% | 1 |
| R2 | CRCW06032R00FKEA | Vishay Dale ⁽⁷⁾ | 2.00Ω Resistor, Size 0603, 1% | 1 |
| R3 | CRCW060319K6FKEA | Vishay Dale ⁽⁷⁾ | 19.6kΩ Resistor, Size 0603, 1% | 1 |
| R4 | CRCW06032K49FKEA | Vishay Dale ⁽⁷⁾ | 2.49kΩ Resistor, Size 0603, 1% | 1 |
| R5 | CRCW060320K0FKEA | Vishay Dale ⁽⁷⁾ | 20.0kΩ Resistor, Size 0603, 1% | 1 |
| R6, R14, R17 | CRCW060310K0FKEA | Vishay Dale ⁽⁷⁾ | 10.0kΩ Resistor, Size 0603, 1% | 3 |
| R7 | CRCW06034K99FKEA | Vishay Dale ⁽⁷⁾ | 4.99kΩ Resistor, Size 0603, 1% | 1 |
| R8 | CRCW06032K87FKEA | Vishay Dale ⁽⁷⁾ | 2.87kΩ Resistor, Size 0603, 1% | 1 |
| R9 | CRCW06032K006FKEA | Vishay Dale ⁽⁷⁾ | 2.00kΩ Resistor, Size 0603, 1% | 1 |
| R10 | CRCW06031K18FKEA | Vishay Dale ⁽⁷⁾ | 1.18kΩ Resistor, Size 0603, 1% | 1 |
| R11 | CRCW0603806RFKEA | Vishay Dale ⁽⁷⁾ | 806Ω Resistor, Size 0603, 1% | 1 |
| R12 | CRCW0603475RFKEA | Vishay Dale ⁽⁷⁾ | 475Ω Resistor, Size 0603, 1% | 1 |

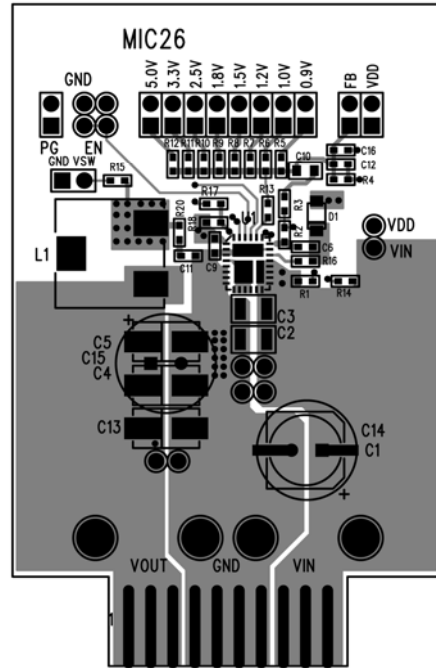
Bill of Materials (Continued)

| Item | Part Number | Manufacturer | Description | Qty |
|-----------|--------------------|-----------------------------------|--|----------|
| R13 | CRCW06030000FKEA | Vishay Dale ⁽⁷⁾ | 0Ω Resistor, Size 0603, 5% | 1 |
| R15 | CRCW060349R9FKEA | Vishay Dale ⁽⁷⁾ | 49.9Ω Resistor, Size 0603, 1% | 1 |
| R16, R18 | CRCW06031R21FKEA | Vishay Dale ⁽⁷⁾ | 1.21Ω Resistor, Size 0603, 1% | 2 |
| R20 | Open | | | |
| U1 | MIC26901YJL | Micrel, Inc.⁽⁹⁾ | 28V/9A Synchronous Buck DC-DC Regulator | 1 |

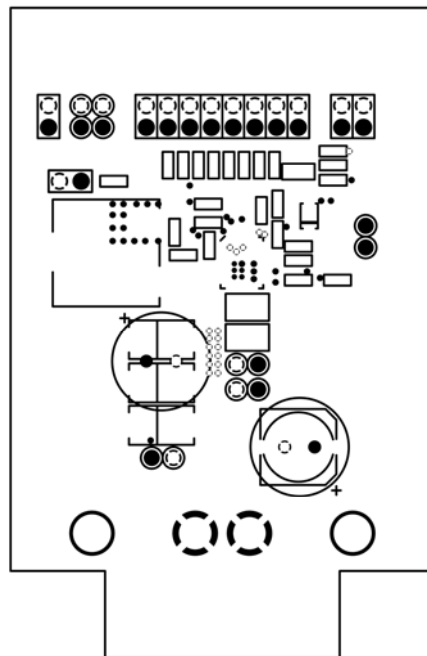
Notes:

1. AVX: www.avx.com.
2. Murata: www.murata.com
3. TDK: www.tdk.com.
4. EPCOS: www.epcos.com.
5. MCC: www.mcc.com.
6. Diode Inc.: www.diodes.com.
7. Vishay: www.vishay.com.
8. Cooper Bussmann: www.cooperbussmann.com
9. **Micrel, Inc.:** www.micrel.com

PCB Layout Recommendations

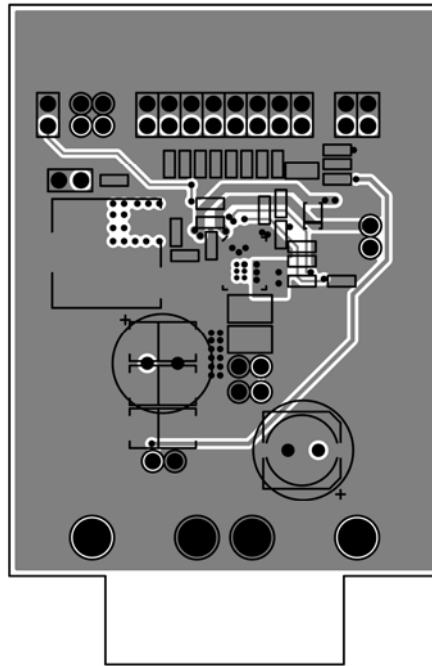


Top Layer

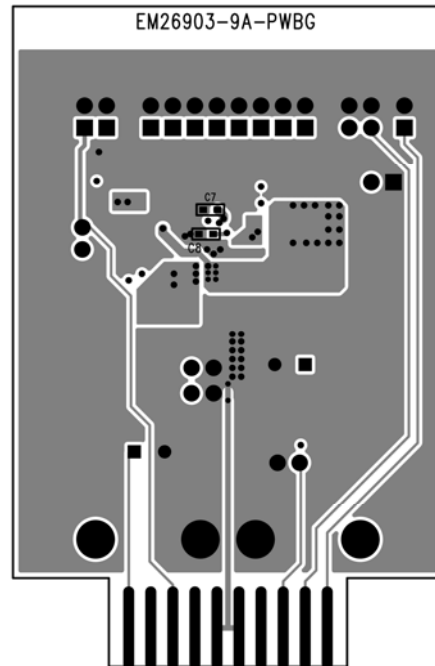


Mid-Layer 1 (Ground Plane)

PCB Layout Recommendations (Continued)



Mid-Layer 2



Bottom Layer

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