# MC3325

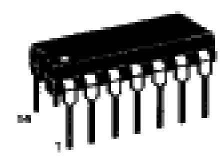
## Automotive Voltage Regulator

This device is designed for use in conjunction with an NPN Darlington transistor in a floating field alternator charging system.

- Overvoltage Protection
- Shut-Down on Loss of Battery Sense
- Selectable Temperature Coefficient
- Available in Chip Form for Hybrid Assembly

**AUTOMOTIVE VOLTAGE REGULATOR**

**SILICON MONOLITHIC INTEGRATED CIRCUIT**

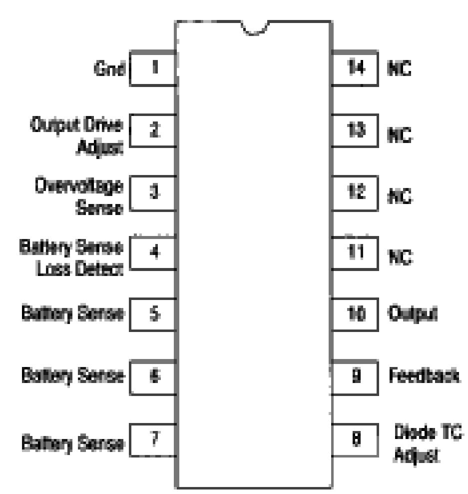


**P SUFFIX**
PLASTIC PACKAGE
CASE 646

### MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Current Into: Pins 5, 6, and 7 | $I_5$, $I_6$, or $I_7$ | 50 | mA |
| Pin 3 | $I_3$ | 20 | |
| Pin 4 | $I_4$ | 20 | |
| Pin 2 | $I_2$ | 120 | |
| Pin 8 | $I_8$ | 50 | |
| Pin 9 | $I_9$ | 50 | |
| Pin 10 | $I_{10}$ | 50 | |
| Junction Temperature | $T_J$ | 150 | °C |
| Operating Temperature Range | $T_A$ | –40 to +85 | °C |
| Storage Temperature Range | $T_{stg}$ | –65 to +150 | °C |

**PIN CONNECTIONS**

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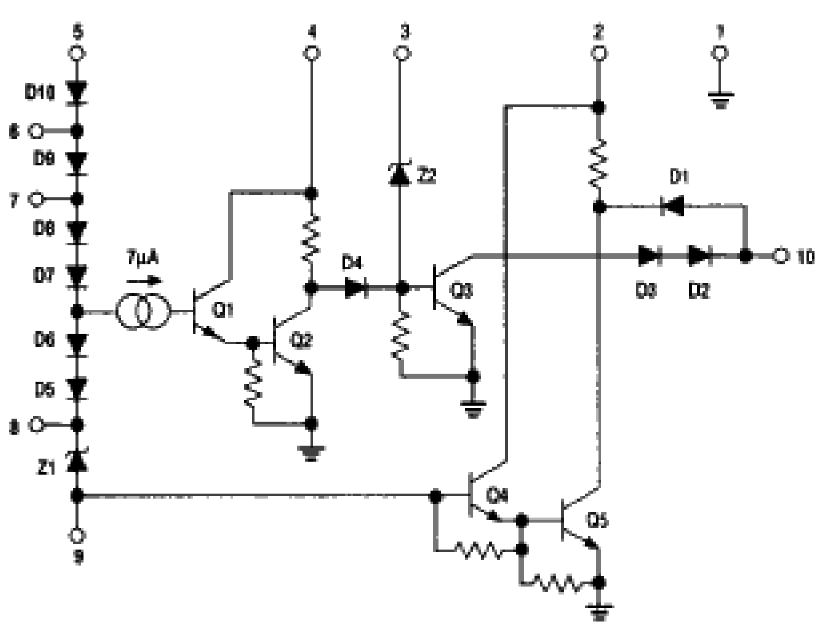
**Circuit Schematic**




### ORDERING INFORMATION

| Device | Temperature Range | Package |
|---|---|---|
| MC3325P | –40° to +85°C | Plastic DIP |

**ELECTRICAL CHARACTERICISTICS** ($T_A$ = 25°C, unless otherwise noted.)

| Characteristics | Figure | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|
| Diode TC Adjust: Threshold Voltage on Pin 8 | 1 | $V_8$ | 7.9 | 8.95 | V |
| Battery Sense | 1 | | | | V |
| Threshold Voltage on Pin 5 | | $V_5$ | 11.8 | 13.45 | |
| Threshold Voltage on Pin 6 | | $V_6$ | 11.1 | 12.75 | |
| Threshold Voltage on Pin 7 | | $V_7$ | 10.5 | 11.9 | |
| Battery Sense Loss Detect | 2 | | | | |
| Threshold Current Into Pin 4 | | $I_4$ | — | 600 | µA |
| Threshold Voltage at Pin 4 ($I_4 \le 400$ µA) | | $V_4$ | 1.3 | 1.7 | V |
| Overvoltage Sense | 2 | | | | |
| Threshold Current Into Pin 3 | | $I_3$ | — | 600 | µA |
| Threshold Voltage at Pin 3 ($I_3 \le 400$ µA) | | $V_3$ | 6.7 | 9.0 | V |
| Output Drive Adjust<br>Voltage Drop from Pin 2 to Pin 10 ($I_2$ = 10 mA) | 3 | $V_2$ | 1.9 | 2.4 | V |
| Low State Output Voltage at Pin 10<br>($I_3$ = 12 mA, $I_2$ = 120 mA) | 4 | $V_{10}$ | — | 0.7 | V |

## Test Circuits

**Figure 1**

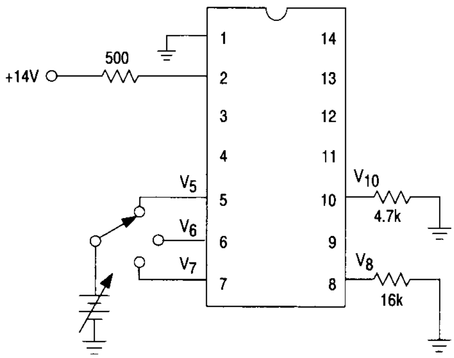



**Figure 2**

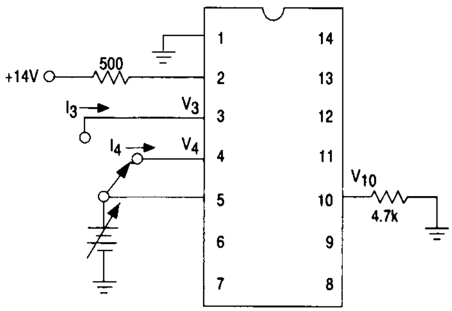



**Figure 3**

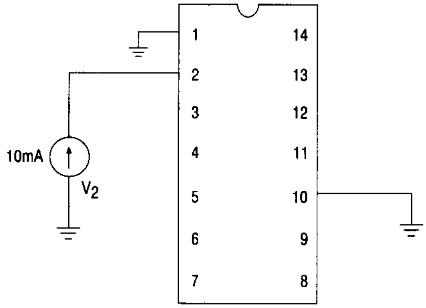
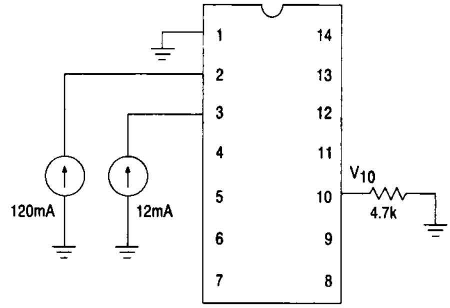



**Figure 4**

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## Applications Circuit Information

**R1** — Determines the temperature coefficient by setting the value of current in the diode string. As the value of R1 decreases, so does the effective TC. R1 should be chosen so that the current in the diode string is between 0.5 mA and 1.0 mA.

**R2** — This resistor determines the output drive current. Refer to specifications for the darlington driver and select the value for R2 that will provide enough drive to the output when the diode trio voltage is at a minimum.

$$I_{Drive} \cong \frac{V_{min} - 2.8\ V}{R2 + 50\ \Omega}$$

**R3** — Used as a current limiting resistor on Pin 3 in case of overvoltage at the diode trio. Voltage at Pin 3 will run approximately 7.5 V. R3 should be chosen so that the current ($I_3$) at maximum overvoltage is between 2.0 mA and 6.0 mA.

**R4** — Used as a current limiting resistor on Pin 4 in case of an open battery voltage sense load.

**R5** — This resistor determines the $V_{Reg}$ voltage as defined by the following equation:

$$V_{Reg} = \left(1 + \frac{R5}{R1}\right) 8.4 + \left(n + \frac{R5}{5.0\ k}\right)\ (0.7)$$

n = number of diodes used in diode string, ($4 \le n \le 6$)

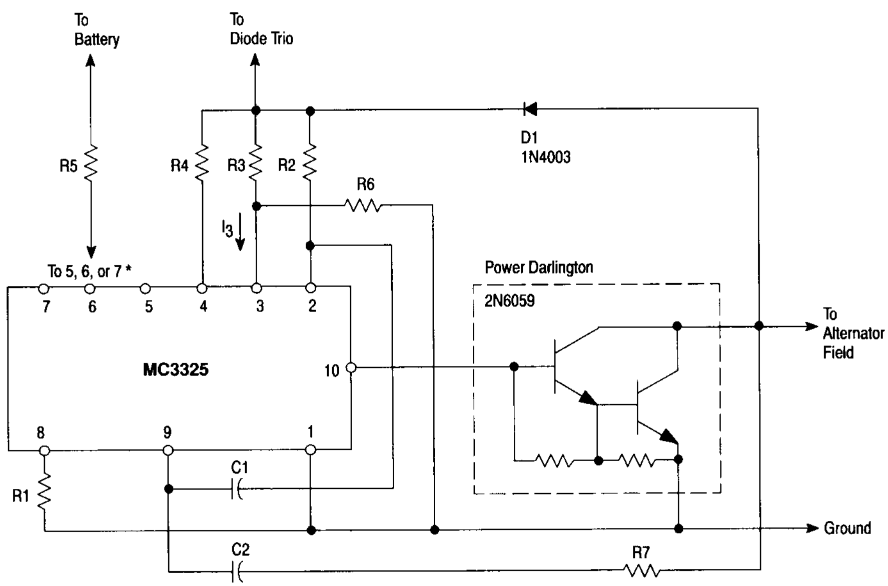
**R6** — This resistor in conjunction with R3 is used to set the threshold of overvoltage action.

$$\text{Threshold} \cong \frac{R3 + R6}{R6}\ (7.5)$$

**R7** — Used for compensation (approximately 3.0 kΩ).

**C1, C2** — Used for compensation (approximately 0.01 µF).

**Figure 5. Application Circuit**




*NOTE: The temperature coefficient of the battery voltage sense terminal is determined by the number of diodes used in the diode string (i.e., whether Pin 5, 6, or 7 is used). The approximate temperature coefficient for a diode at 1.0 mA is −2.0 mV/°C, and for a zener diode it is +3.0 mV/°C. Counting from ground (see circuit schematic) we have −2.0 mV for Q5, −2.0 mV for Q4, +3.0 mV for Z1, −8.0 mV for D5 thru D8, and an additional −2.0 mV each for D9 and D10 if used. The total temperature coefficient can be varied from approximately −9.0 mV/°C to −13 mV/°C depending on the number of the diodes in the diode string that are utilized.

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