MC33267

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Advance Information

Low Dropout Regulator

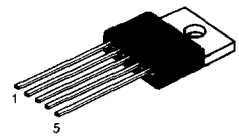
LOW DROPOUT REGULATOR with POWER-UP RESET

SILICON MONOLITHIC INTEGRATED CIRCUIT

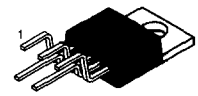
The MC33267 is a positive fixed 5.0 V regulator that is specifically designed to maintain proper voltage regulation with an extremely low input-to-output voltage differential. This device is capable of supplying output currents in excess of 500 mA and contains internal current limiting and thermal shutdown protection. Also featured is an on-chip power-up reset circuit that is ideally suited for use in microprocessor based systems. Whenever the regulator output voltage is below nominal, the reset output is held low. A programmable time delay is initiated after the regulator has reached its nominal level and upon timeout, the reset output is released.

Due to the low dropout voltage specifications, the MC33267 is ideally suited for use in battery powered industrial and consumer equipment where an extension of useful battery life is desirable. This device is contained in an economical five lead TO-220 type package.

- Low Input-to-Output Voltage Differential
- Output Current in Excess of 500 mA
- On-Chip Power-Up-Reset Circuit with Programmable Delay
- Internal Current Limiting with Thermal Shutdown
- Economical Five Lead TO-220 Type Package

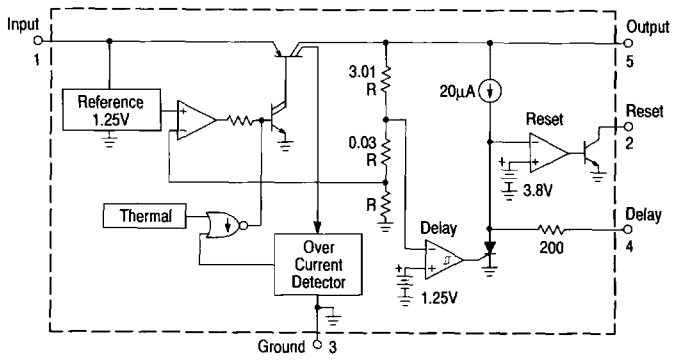


T SUFFIX
PLASTIC PACKAGE
CASE 314D

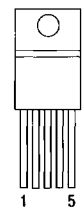


TV SUFFIX
PLASTIC PACKAGE
CASE 314B
(LEAD FORMED)

Simplified Block Diagram



PIN CONNECTIONS



Pin 1. V_{CC} Input
2. Reset
3. Ground
4. Delay
5. Output

(Heatsink surface connected to Pin 3)

ORDERING INFORMATION

Device	Temperature Range	Package
MC33267T	−40° to +105°C	Plastic Power
MC33267TV		Plastic Power

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Input Voltage Range	V_{in}	– 20 to + 40	Vdc
Delay Voltage Range	V_{DLYR}	– 0.3 to V_O	V
Delay Sink Current	$I_{DLY(sink)}$	25	mA
Reset Voltage Range	V_{RR}	– 0.3 to +15	V
Reset Sink Current	$I_{R(sink)}$	50	mA
Power Dissipation and Thermal Characteristics T/TV Suffix, Plastic Package, Case 314 T_A = 25°C Thermal Resistance Junction-to-Ambient T/TV Suffix, Plastic Package, Case 314 T_C = 90°C Thermal Resistance Junction-to-Case	 P_D θ_{JA} P_D θ_{JC}	 2.0 62.5 15 4.0	 W °C/W W °C/W
Operating Junction Temperature Range	T_J	– 40 to +150	°C
Storage Temperature Range	T_{stg}	– 55 to +150	°C

ELECTRICAL CHARACTERISTICS (V_{in} = 14.4 V, I_O = 5.0 mA, C_O = 100 µF, $C_{O(ESR)} \leq 0.3\ \Omega$, T_J = 25°C, Note 1, unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage (I_O = 5.0 mA to 500 mA, V_{in} = 6.0 V to 28 V) T_J = 25°C T_J = – 40° to +125°C	V_O	 4.95 4.9	 5.05 —	 5.15 5.2	V
Line Regulation (V_{in} = 6.0 V to 26 V)	Reg_{line}	—	3.0	50	mV
Load Regulation (I_O = 5.0 mA to 500 mA)	Reg_{load}	—	1.0	50	mV
Bias Current I_O = 0 mA I_O = 150 mA I_O = 500 mA I_O = 500 mA, V_{in} = 6.2 V	I_B	 — — — —	 12 22 100 120	 20 40 200 300	mA
Ripple Rejection (f = 120 Hz, V_{in} = 7.0 V to 17 V, I_O = 350 mA, C_O = 100 µF)	RR	 60	 80	 —	dB
Dropout Voltage (I_O = 500 mA)	$V_{in} - V_O$	—	0.58	0.8	V
Delay Comparator Threshold (V_O Decreasing)	$V_{th(DLY)}$	4.8	V_O – 0.15	V_O – 0.08	V
Delay Pin Source Current	$I_{DLY(source)}$	12	20	28	µA
Reset Comparator Threshold	$V_{th(R)}$	3.6	3.8	4.0	V
Reset Sink Saturation (I_{sink} = 10 mA)	$V_{CE(sat)}$	—	0.2	0.8	V
Reset Off-State Leakage (V_{CE} = 5.0 V)	$I_{R(leak)}$	—	0.3	10	µA

NOTE: 1. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient as possible.

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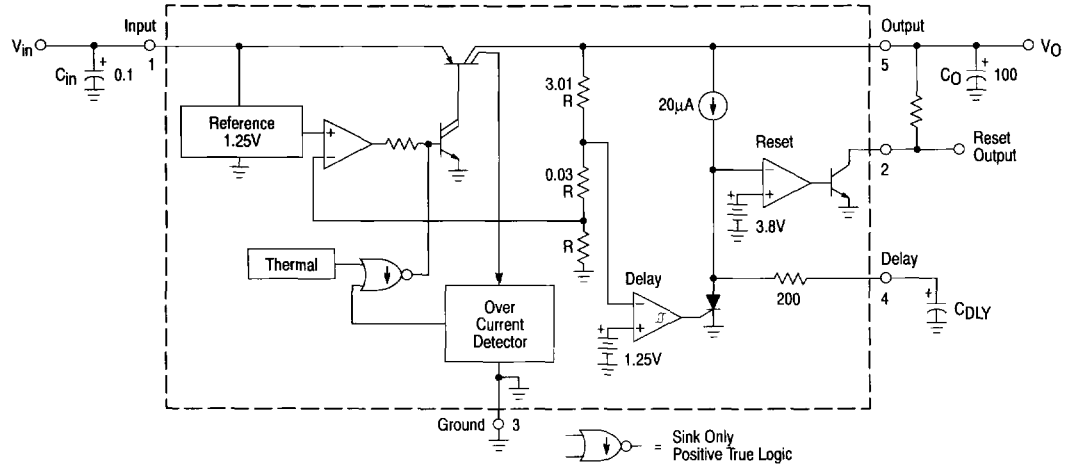
Figure 1. Typical Application Circuit



APPLICATION CIRCUIT INFORMATION

The MC33267 is a low dropout, positive fixed 5.0 V, 500 mA regulator. Protection features include output current limiting and thermal shutdown. System protection consists of an on-chip power-up microprocessor reset circuit.

A typical applications circuit is shown in Figure 1. The input bypass capacitor (C_{in}) is recommended if the regulator is located an appreciable distance (≥ 4″) from the supply input filter. This will reduce the circuit's sensitivity to the input line impedance at high frequencies.

These regulators are not internally compensated and thus require an external output capacitor (C_O) for stability. The recommended capacitance is 100 μF with an equivalent series resistance (ESR) of less than 0.3 Ω. A minimum capacitance of 33 μF with a maximum ESR of 3.0 Ω can be used in applications where space is a premium, however, these limits must be observed over the entire operating temperature range of the regulator circuit.

With economical electrolytic capacitors, cold temperature operation can pose a serious stability problem. As the electrolyte freezes, around − 30°C, the capacitance will decrease and the ESR will increase drastically, causing the circuit to oscillate. Quality electrolytic capacitors with extended temperature ranges of − 40°C to + 85°C and − 55°C to +105°C are readily available. It is suggested that oven testing of the entire circuit be performed with maximum load, minimum input voltage, and minimum ambient temperature.

Figure 2 shows the reset circuit timing relationship. Note that whenever the regulator's output is less than 4.9 V, the delay capacitor (C_{DLY}) is immediately discharged, and the reset output is held in a low state. As the regulator's output voltage increases beyond 4.97 V, the delay comparator will allow the 20 μA current source to charge C_{DLY}. The reset output will go to a high state when C_{DLY} crosses the 3.8 V threshold of the reset comparator. The reset delay time is controlled by the value selected for C_{DLY}. The required system reset time is governed by the microprocessor and usually a reset signal which lasts several machine cycles is sufficient.

Figure 2. Timing Waveforms

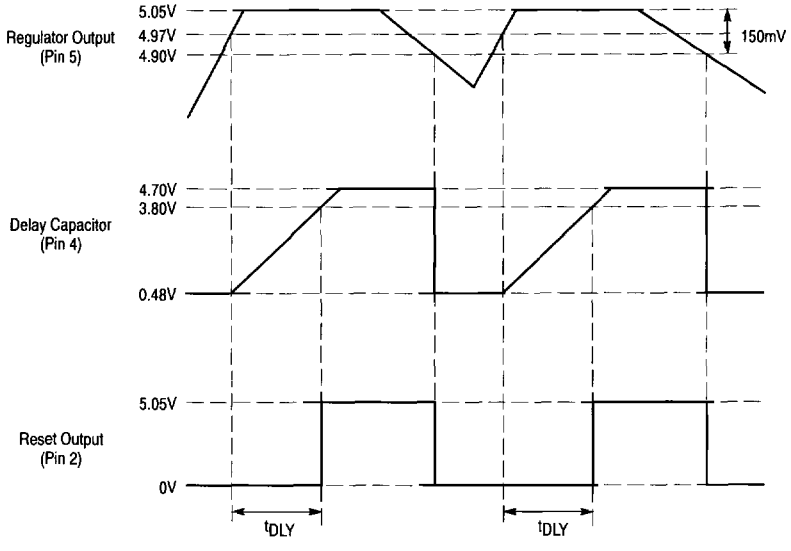


Figure 3. Reset Output versus Input Voltage

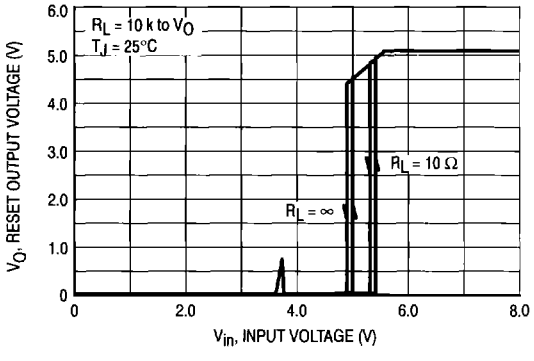


Figure 4. Output Voltage versus Input Voltage

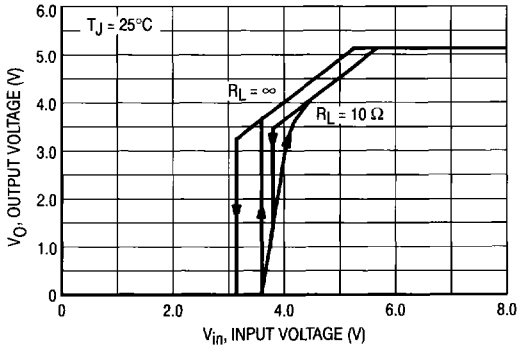


Figure 5. Dropout Voltage versus Output Current

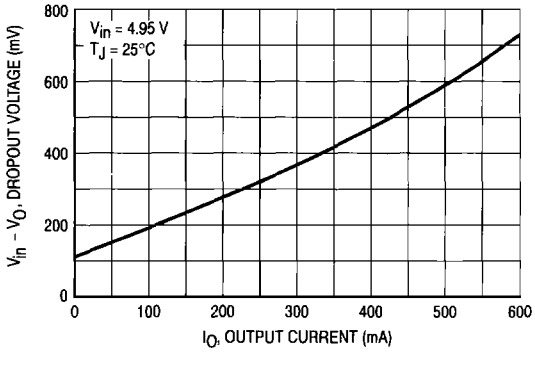


Figure 6. Bias Current versus Input Voltage