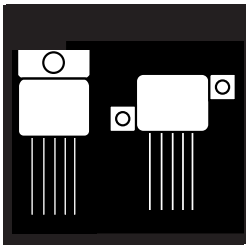
# STEP-DOWN SWITCHING VOLTAGE REGULATOR IN HERMETIC ISOLATED PACKAGE



**1.0 Amp, 5V, 12V, 15V And Adjustable Output Voltage Versions In MO-078 Metal Package**

## FEATURES

- Similar To Industry Standard LM1575
- Available in 5V, 12V, 15V, And Adjustable Versions
- 1.0 Amp Output
- Wide Input Voltage Range, 4V to 60V
- 53 kHz Fixed Frequency Internal Oscillator
- High Efficiency
- Hermetic Metal Packages

## DESCRIPTION

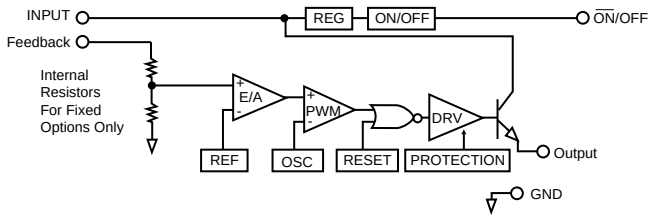
This series of regulators are monolithic integrated circuits designed for the active functions of a step down, buck or buck/boost regulator. It requires only four readily available standard components to complete the DC to DC converter design at 1 Amp. Current limiting and thermal shutdown features fully protect the device against overstress. The hermetic package is ideally suited for those critical environments requiring high reliability over a wide operating temperature range.

## ABSOLUTE MAXIMUM RATINGS @ $T_C$ = 25°C

Maximum Supply Voltage
- OM1575 . . . . . 45 V
- OMH1575 . . . . . 63 V

$\overline{ON}$/OFF Pin Input Voltage . . . . . -0.3 V V $V_{IN}$
Output Voltage To Ground (Steady State) . . . . . -1 V
Power Dissipation. . . . . Internally Limited
Operating Temperature Range . . . . . -55°C to + 150°C
Storage Temperature Range . . . . . -65°C to + 150°C
Thermal Resistance, $Rq_{JC}$ . . . . . 2.4°C/W
Lead Soldering Temperature (10 seconds). . . . . 260°C

## BLOCK DIAGRAM




3.3

## ELECTRICAL CHARACTERISTICS

Unless otherwise specified $V_{IN}$ = 12V for 5V and ADJ options; 25V for 12V; and 30V for 15V models; $V_{OUT}$ = 5V for ADJ, $I_O$ = 0.2A to 1A, $T_J$ = 25°C. $V_{IN}$ rated = 40V, and 60V for OMH Series.

| Parameter | Symbol | Test Conditions | | | Limits | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | $V_{IN}$ | $I_O$ | $T_J$ | MIN. | TYP. | MAX. | |
| OM1575-05 | $V_O$ | | 0.2A | | 4.95 | | 5.05 | |
| | | | | Over Temp. | 4.80 | | 5.20 | V |
| | | 8V to $V_{IN}$ Rated | | | 4.85 | | 5.15 | |
| OM1575-12 | $V_O$ | | 0.2A | | 11.88 | | 12.12 | |
| | | | | Over Temp. | 11.52 | | 12.48 | V |
| | | 15V to $V_{IN}$ Rated | | | 11.64 | | 12.36 | |
| OM1575-15 | $V_O$ | | 0.2A | | 14.85 | | 15.15 | |
| | | | | Over Temp. | 14.40 | | 15.60 | V |
| | | 18V to $V_{IN}$ Rated | | | 14.55 | | 15.45 | |
| Feedback Voltage | $V_{FB}$ | | 0.2A | | 1.217 | | 1.243 | |
| $V_{OUT}$ = 5V | | 8V to $V_{IN}$ Rated | | Over Temp. | 1.193 | | 1.267 | V |
| OM1575-A | | | | | 1.205 | | 1.255 | |
| Feedback Bias Current | $I_B$ | 12V | 0.2A | | | 50 | 100 | nA |
| | | | | Over Temp. | | | 500 | |
| Efficiency/Option | n | | | | | | | |
| 5 | | | 1A | | | 82 | | |
| 12 | | 15V | | | | 88 | | % |
| 15 | | 18V | | | | 90 | | |
| A $V_O$ = 5V | | 12V | | | | 82 | | |
| Switching Frequency | $F_{SX}$ | | | | 47 | 52 | 58 | kHz |
| | | | | Over Temp. | 43 | | 62 | |
| Saturation Voltage(1) | $V_{SAT}$ | | 1A | Over Temp. | | 0.9 | 1.2 | V |
| | | | | | | | 1.4 | |
| Maximum Duty Cycle (On)(3) | DC | | | | 93 | 98 | | % |
| Current Limit(1) | | | Peak Current | | 1.7 | 2.2 | 3.0 | A |
| Peak Current | $I_{CL}$ | | $T_{on}$ 3µsec | Over Temp. | 1.3 | | 3.2 | |
| Output Leakage Current(2) | | | | | | | | |
| Output = 0V | $I_L$ | $V_{IN}$ Rated | | | | | 2 | mA |
| Output = -1V | | | | | | 7.5 | 30 | |
| Quiescent Current (2) | $I_O$ | | | | | 5 | 10 | mA |
| | | | | Over Temp. | | | 12 | |
| Standby Quiescent | $I_{STBY}$ | | | | | 50 | 200 | µA |
| Current (On/Off Pin = 5V) | | | | Over Temp. | | | 500 | |
| On/Off Pin Logic | $V_{IH}$ | | | | | | | |
| Input Level | | | | | 2.2 | | | V |
| $V_{OUT}$ = 0V | | | | Over Temp. | 2.4 | 1.4 | | |
| $V_{OUT}$ = Option | $V_{IL}$ | | | | | | 1.0 | V |
| | | | | Over Temp. | | 1.2 | 0.8 | |
| On/Off Input Current | | | | | | | | |
| On/Off = 5V (Off) | $I_{IH}$ | | 0.2A | | | 12 | 30 | µA |
| On/Off = 5V (Off) | $I_{IL}$ | | | | | 0 | 10 | |

**Notes:** Over Temperature: -55°C to 150°C.

(1) Output sourcing current - resistive load, no inductor or capacitor.

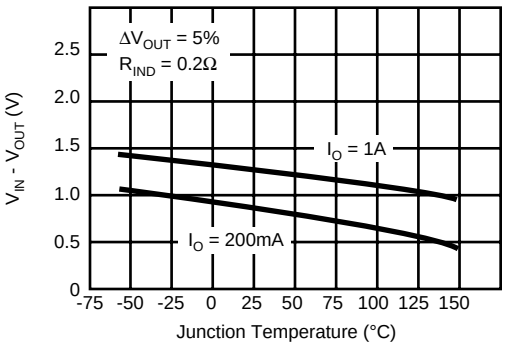
(2) Feedback = $V_O$ +1.0V.

(3) Feedback = 0V.

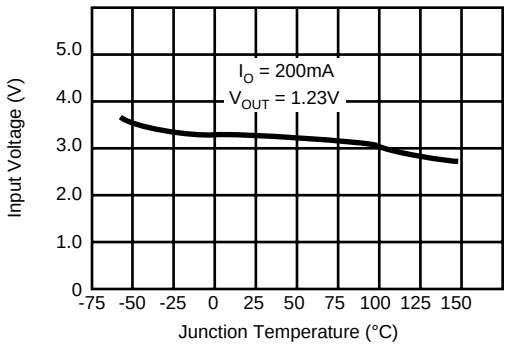
(4) Not all parameters are 100% tested during production. Consult the factory for more information.

# OPERATIONAL DATA

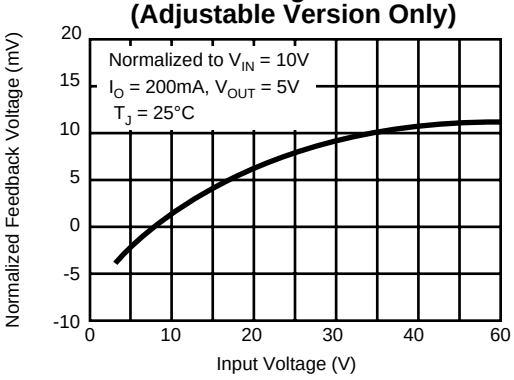
### Dropout Voltage



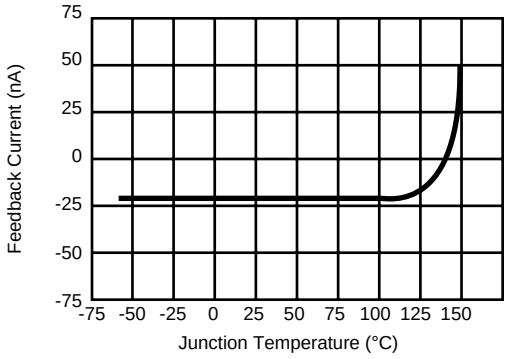

### Minimum Operating Voltage



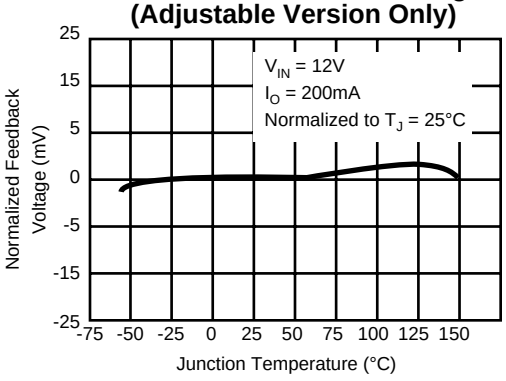

### Line Regulation (Adjustable Version Only)



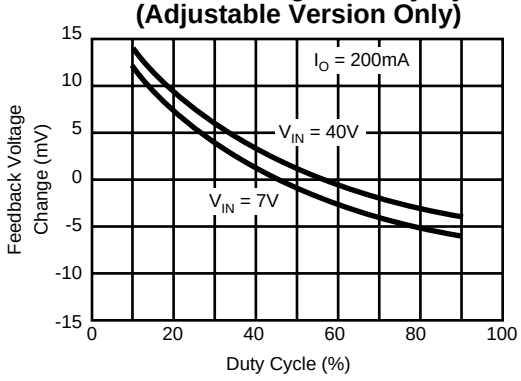

### Feedback Pin Current




### Normalized Feedback Voltage (Adjustable Version Only)




### Feedback Voltage vs Duty Cycle (Adjustable Version Only)

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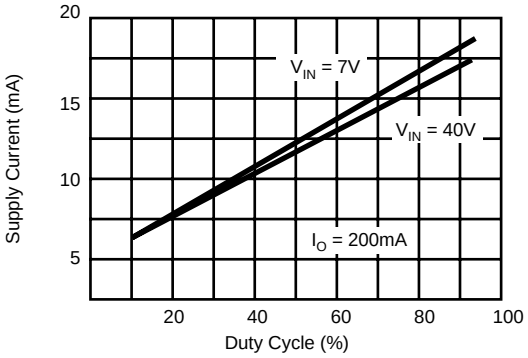
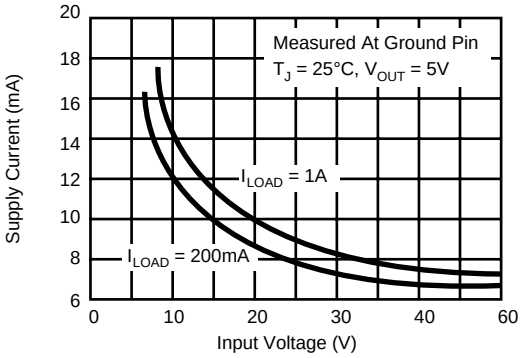
# OPERATIONAL DATA

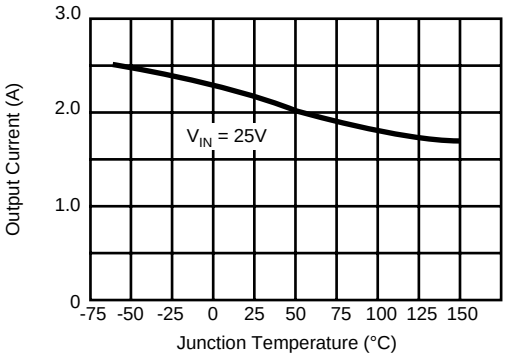
### Supply Current vs. Duty Cycle



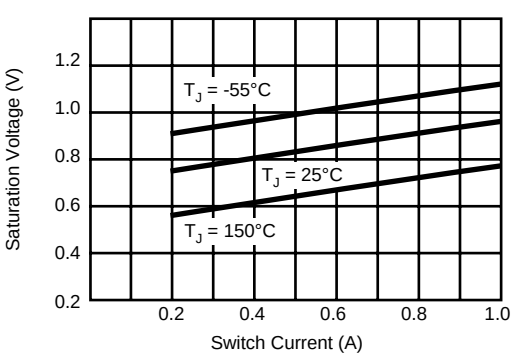

### Supply Current



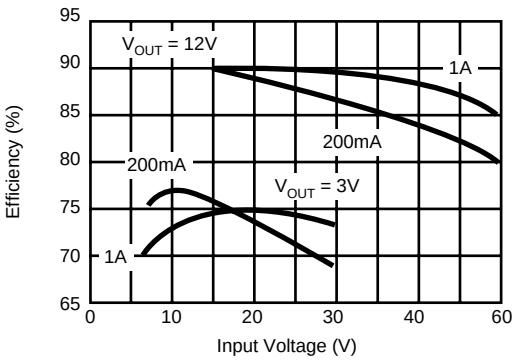

### Current Limit



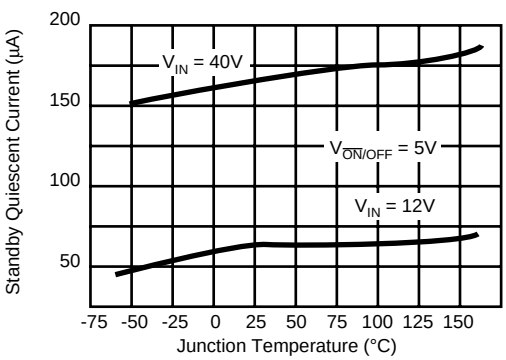

### Switch Saturation Voltage




### Efficiency




### Standby Quiescent Current




3.3

**Catch Diode**

If the output must be capable of a sustained short, the $I_F$ rating must be above 3A. The use of an ultra fast diode with soft recovery characteristics or a Schottky will be adequate. The major impact on Schottky versus an ultra fast is efficiency. Schottkys will provide approximately 4% to 5% improvement for output voltage below 12V, whereas above 12V the difference will become less significant. Breakdown rating must be in excess of $V_{IN}$ for margin.

**Input Capacitor**

The value shown will be adequate for most applications. Ripple voltage at the switching frequency is caused by the input capacitor supplying load current during the on time of the power switch. The use of a low ESR switching type capacitor will minimize ripple to an acceptable level.

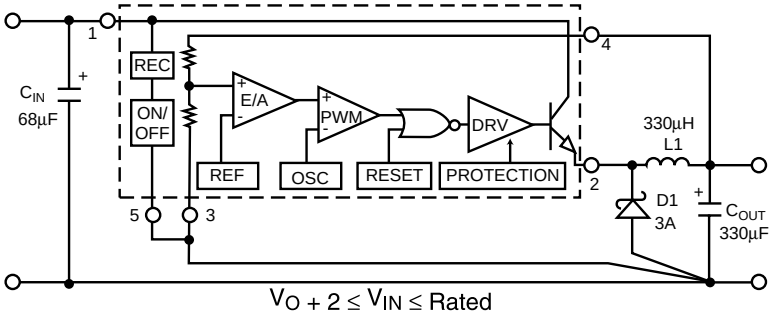
**Layout**

Use short connections with a central point ground to prevent improper operation caused by stray inductance and ground loops.

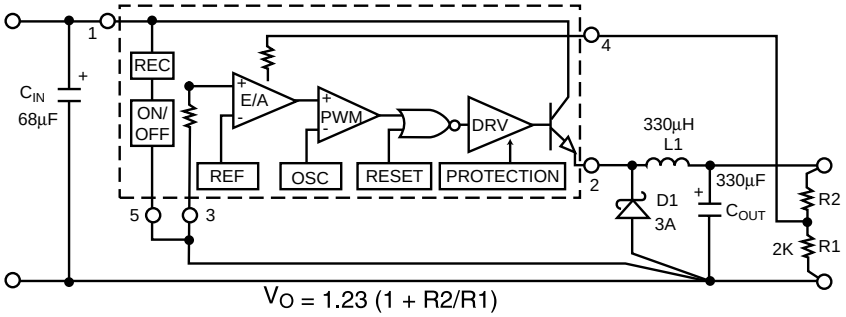
**Output Capacitor**

Ripple voltage on $V_{OUT}$ is directly related to the value of $C_{OUT}$ and the internal resistance ESR of $C_{OUT}$. Output noise can be lowered by increasing $C_{OUT}$ or by selecting a capacitor with a lower ESR. ESR must be approximately 0.07 or above to maintain stability, otherwise raise value of $C_{OUT}$.

**BUCK MODE FIXED VOLTAGE**




**BUCK MODE ADJUSTABLE VOLTAGE**

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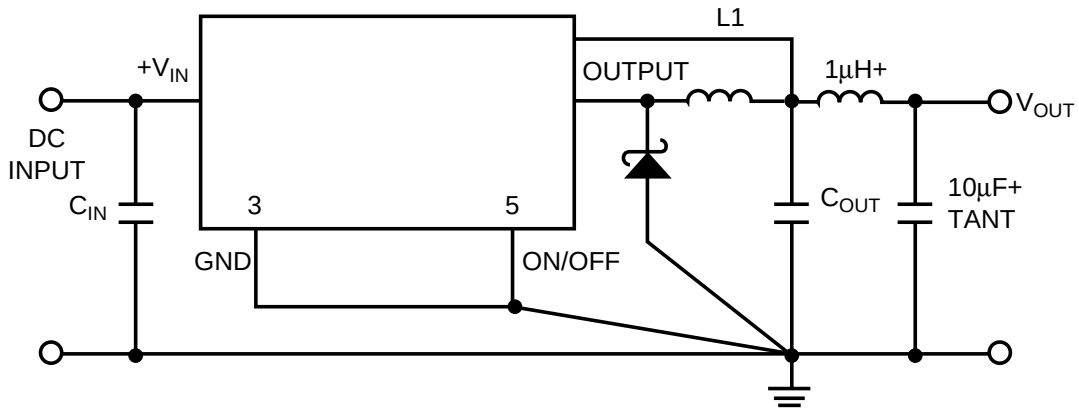
The above fixed and adjustable voltage selections will be adequate for most applications for output currents from 150mA to 1.0A. Applications of $V_{OUT}$ below 5V or above 24V may require component adjustment for maximum performance; please contact factory for application assistance.

**Switching Spikes**

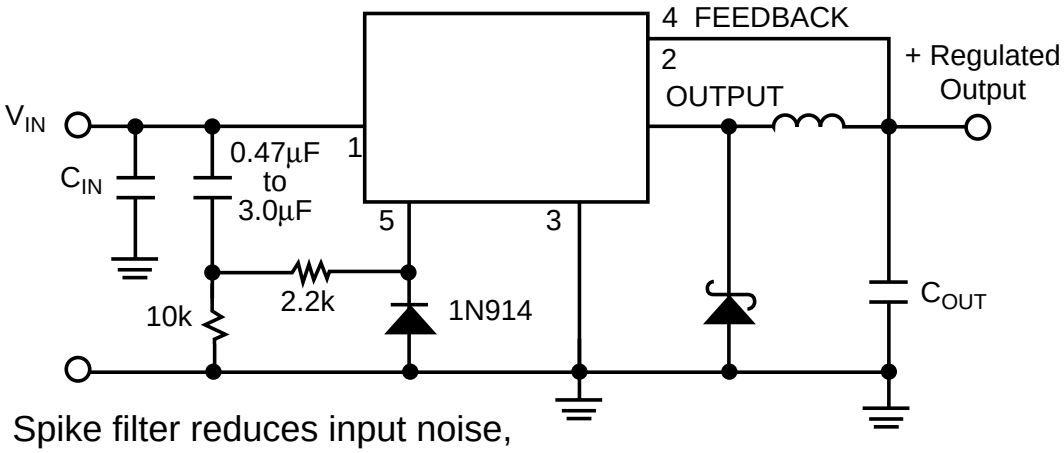
Switching spikes will also occur due to distributive capacitance across turns of the inductor when combined with output capacitor series inductance (ESL). Reduction to a level at or below the switching ripple can be achieved by using a post filter, as shown in the Switching Spike Reduction Schematic.

## SWITCHING SPIKE REDUCTION




**TYPICAL APPLICATION**

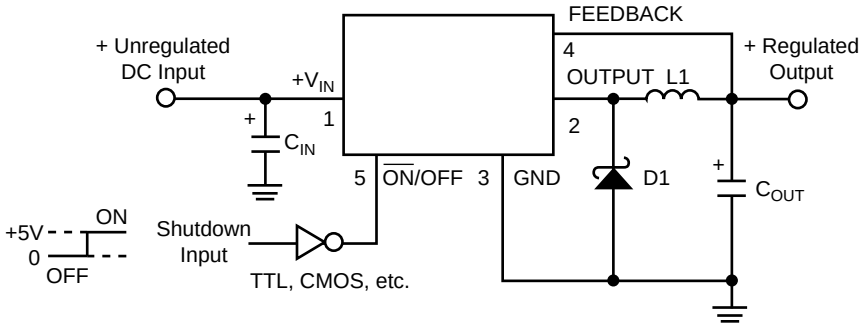
## TURN-ON DELAY WITH SPIKE FILTER

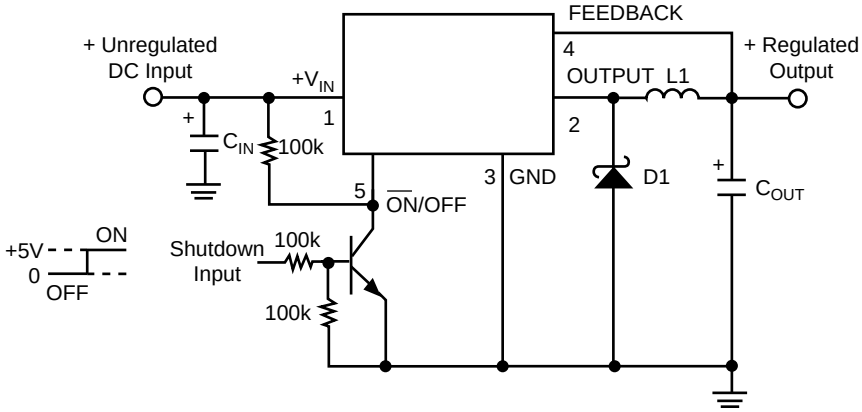



Spike filter reduces input noise, causing false triggering of delay.

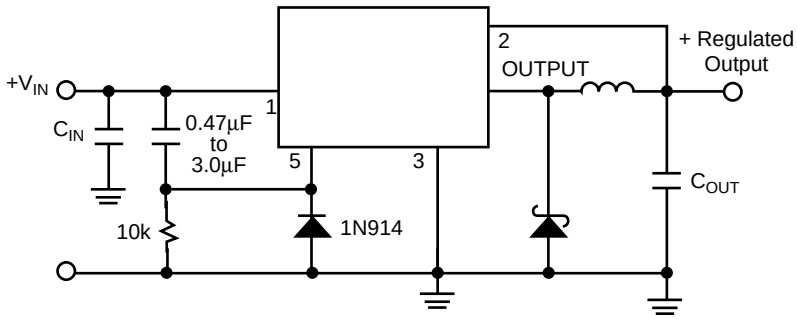
# TYPICAL APPLICATIONS

## TYPICAL BUCK SHUTDOWN




## TURN-ON DELAY

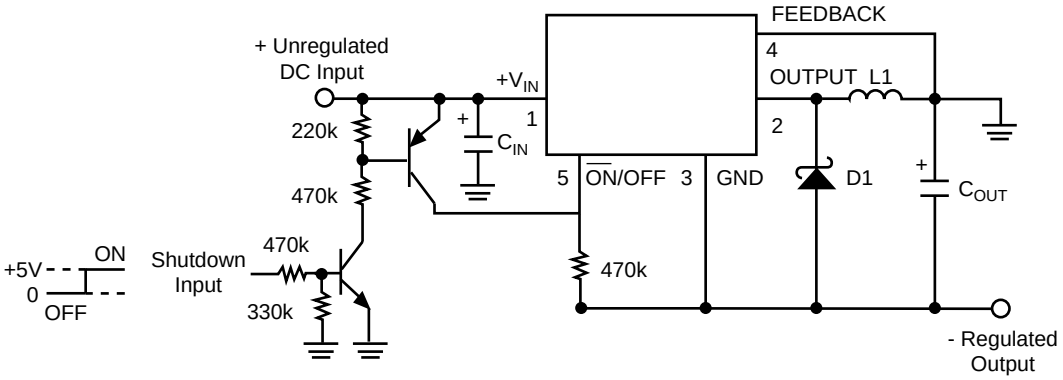


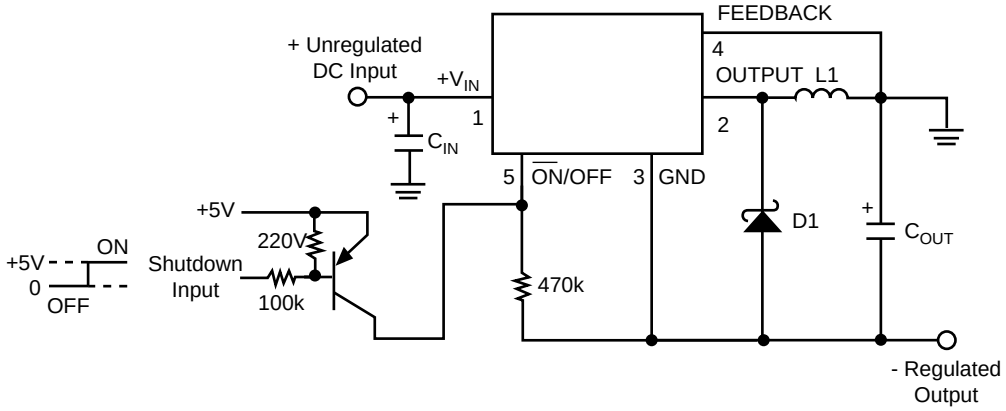

Circuit allows for $C_{IN}$ to be fully charged before start-up, provides $C_{IN}$ to supply hi-peak current instead of input supply.

3.3

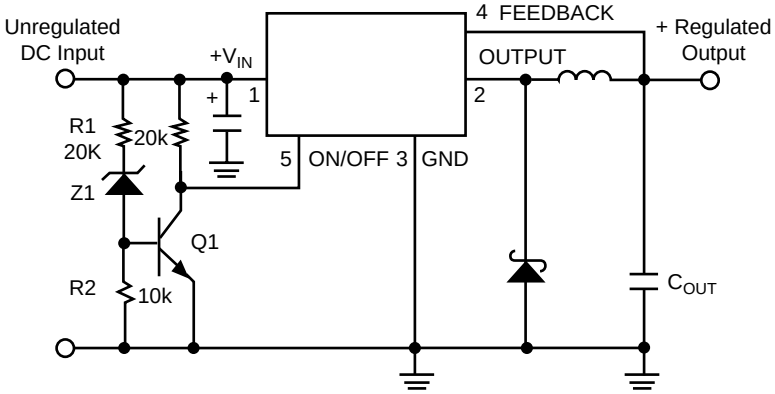
# TYPICAL APPLICATIONS

## INVERTING BUCK/BOOST SHUTDOWN




## UNDER VOLTAGE LOCKOUT

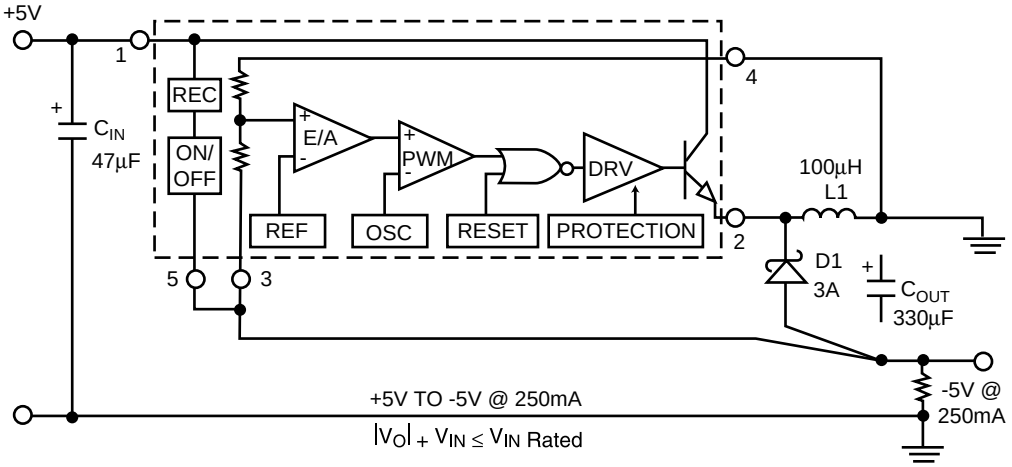


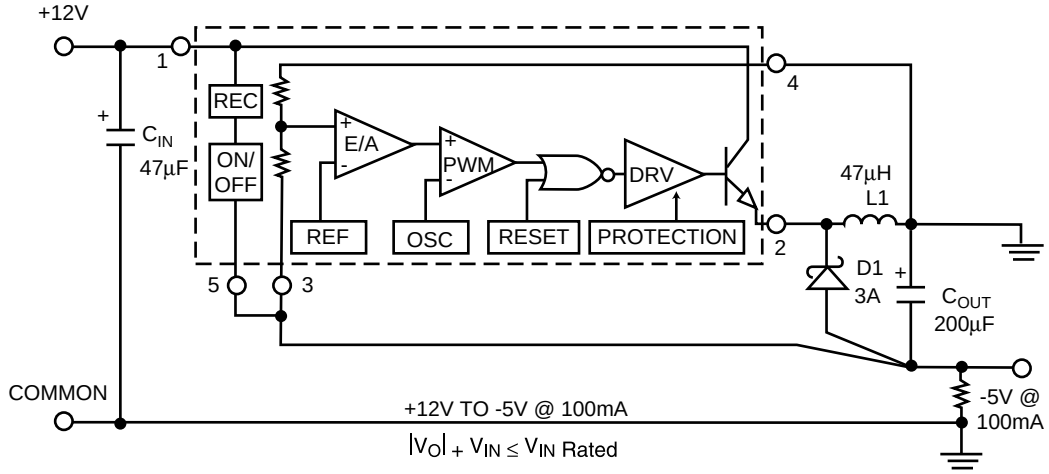

Regulator will be off until a $V_{IN}$ set point is reached.

$V_{O(ON)} \cong V_Z + 3V_{BE\ Q1}$

# TYPICAL APPLICATIONS

## INVERTING BUCK/BOOST




3.3

Inverting buck/boost operation is a different topology of operation than buck. This difference reduces the output current capability of the device, in that the inductor must supply all of the load current during the time the power switch is off: Maximum output current is approximately: $I_{OUT} @ 1.3/2 (1 + |V_O| / V_{IN})$

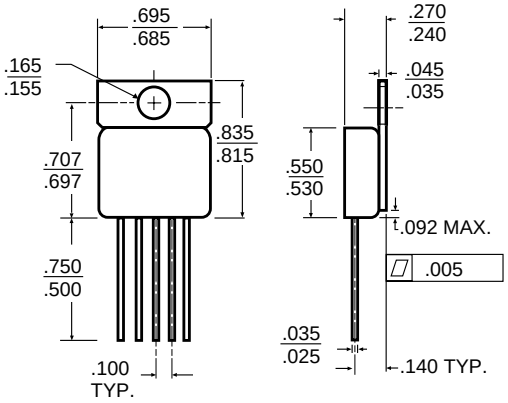
Component requirement stress is very similar to the buck with a few exceptions:

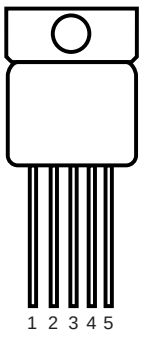
- Catch diode breakdown $V_{BR}$ must be greater than $V_{IN} + |V_{OUT}|$
- Input capacitor is larger due to the increased peak current during switch turn on. Power dissipation of the OM1575 is approximately: $P_D @ [|V_O| / (|V_O| + V_{IN})] I_O (1 + |V_O| / V_{IN})$

Please contact factory for additional assistance when using the buck/boost topology.

## MECHANICAL OUTLINE PIN CONNECTION

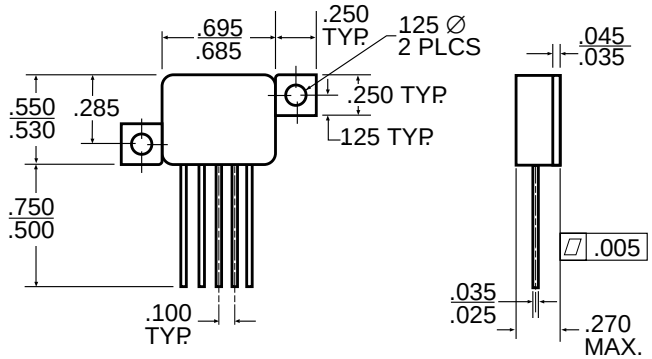
### MO-078 PACKAGE

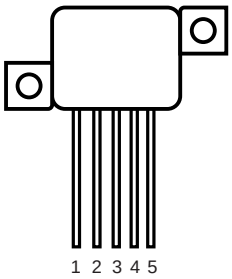



Pin 1: $V_{IN}$
Pin 2: OUT
Pin 3: GND
Pin 4: Feedback
Pin 5: $\overline{ON}$/OFF

### Z-TAB PACKAGE




Pin 1: $V_{IN}$
Pin 2: OUT
Pin 3: GND
Pin 4: Feedback
Pin 5: $\overline{ON}$/OFF



## ORDERING INFORMATION

**EXAMPLE: P/N OM 1575 - 05 SCM = 5 Volt, C5 Package With Screening**

| PART NUMBER | VOLTAGE LEVEL | CASE STYLE | SCREENING |
|---|---|---|---|
| OM1575 | 05 = 5 Volt | SC = MO-078 | Add “M” |
| OMH1575 | 12 = 12 Volt | SCZ = Z-Tab | for 883 |
| | 15 = 15 Volt | Both Packages | screening |
| | A = Adjustable | are Isolated | See section 3.2 |