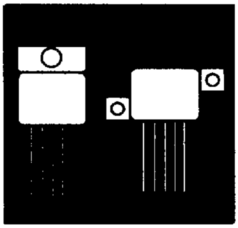
STEP-DOWN SWITCHING VOLTAGE REGULATOR IN HERMETIC ISOLATED PACKAGE



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 .... $-0.3\ V \leq V \leq V_{IN}$
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, $R\theta_{JC}$ .... 2.4°C/W
Lead Soldering Temperature (10 seconds) .... 260°C

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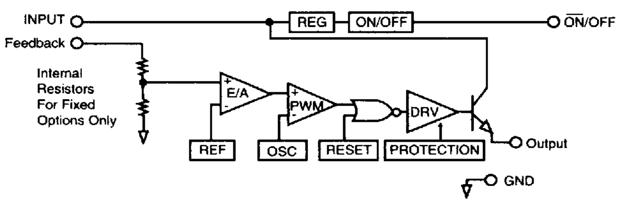
BLOCK DIAGRAM



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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}						1.2	
			1A	Over Temp.		0.9		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}		$T_{on} \leq 3\mu sec$	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.

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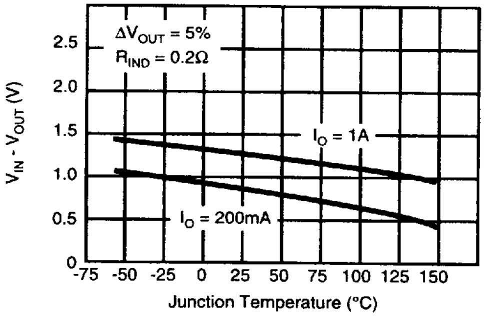
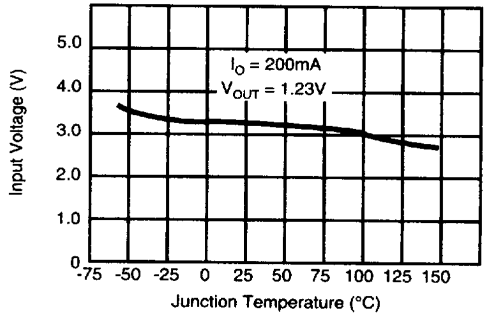
OPERATIONAL DATA

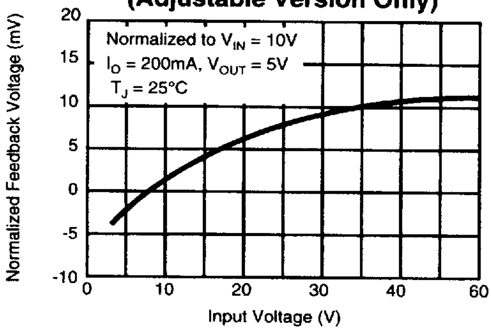
Dropout Voltage



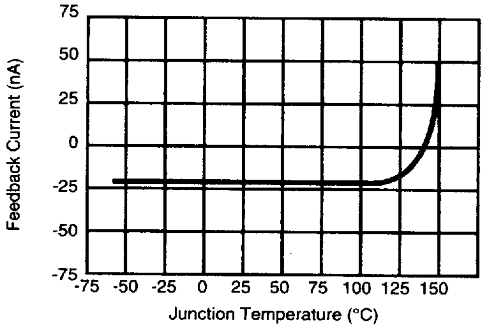
Minimum Operating Voltage



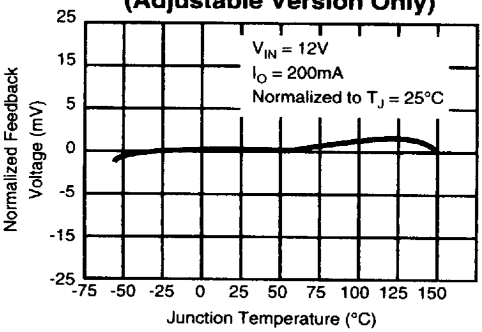
Line Regulation (Adjustable Version Only)



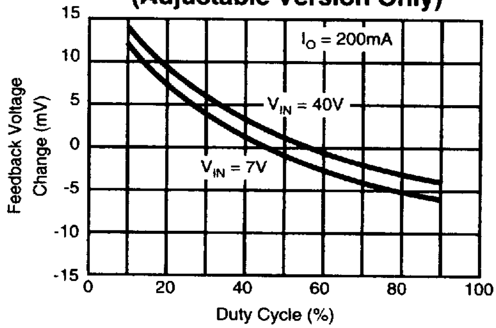
Feedback Pin Current



Normalized Feedback Voltage (Adjustable Version Only)



Feedback Voltage vs Duty Cycle (Adjustable Version Only)



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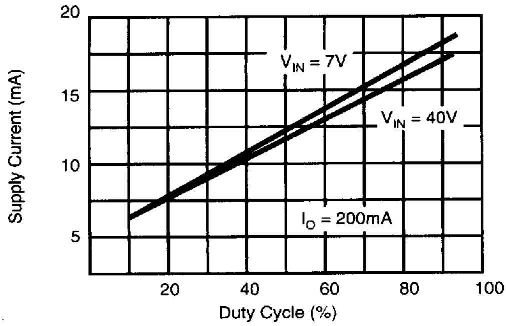
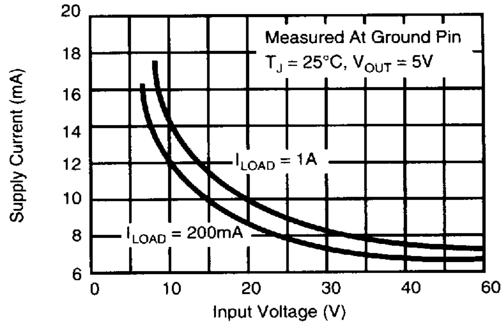
OPERATIONAL DATA

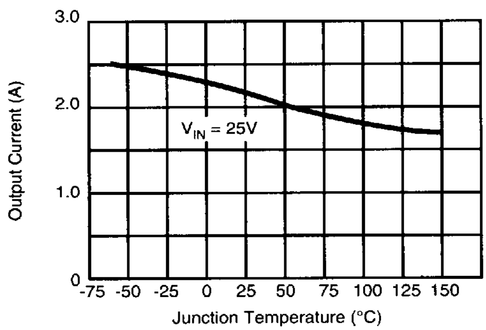
Supply Current vs. Duty Cycle



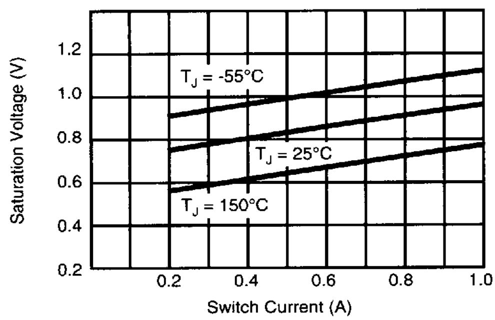
Supply Current



Current Limit



Switch Saturation Voltage



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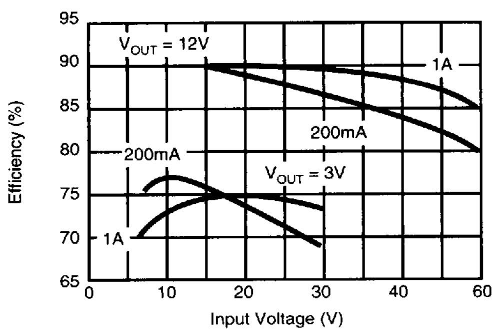
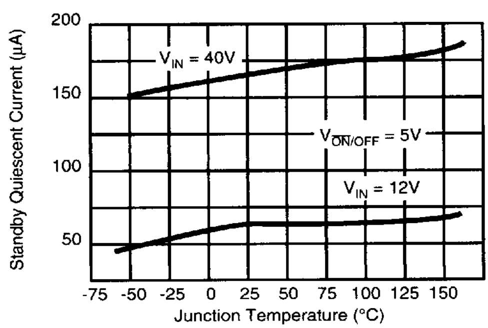
Efficiency



Standby Quiescent Current



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.

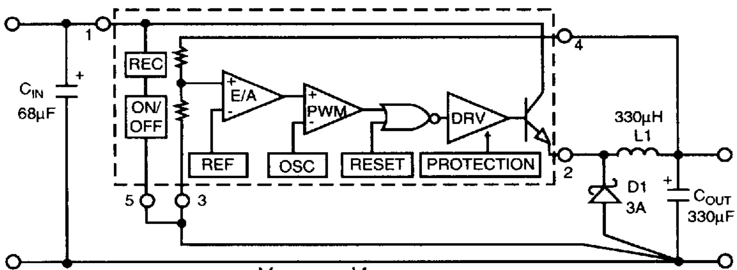
Layout

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

Output Capacitor

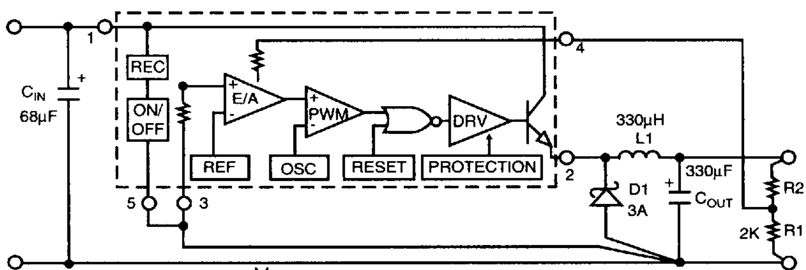
Ripple voltage on V_{OUT} is directly related to the value of C_{OUT} and the internal resistance ESR of C_{OUT}. Output noise can be lowered by increasing C_{OUT} or by selecting a capacitor with a lower ESR. ESR must be approximately 0.07Ω or above to maintain stability, otherwise raise value of C_{OUT}.

BUCK MODE FIXED VOLTAGE



$V_O + 2 \leq V_{IN} \leq$ Rated

BUCK MODE ADJUSTABLE VOLTAGE



$V_O = 1.23\ (1 + R2/R1)$

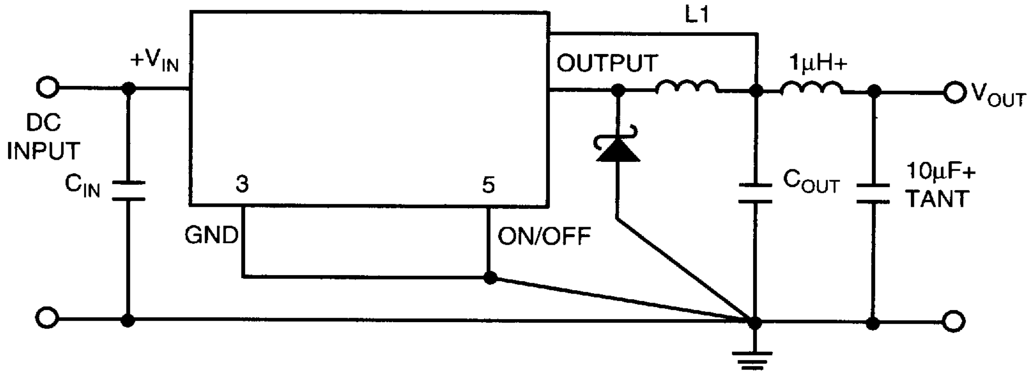
The above fixed and adjustable voltage selections will be adequate for most applications for output currents from 150mA to 1.0A. Applications of V_{OUT} below 5V or above 24V may require component adjustment for maximum performance; please contact factory for application assistance.

3.3

Switching Spikes

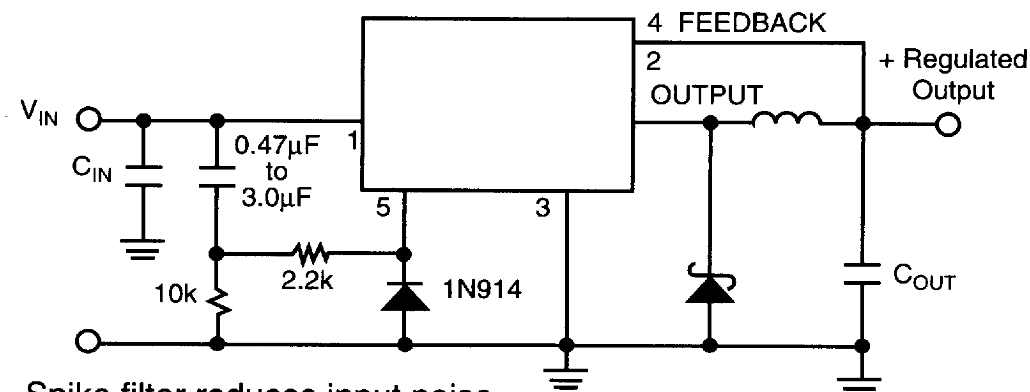
Switching spikes will also occur due to distributive capacitance across turns of the inductor when combined with output capacitor series inductance (ESL). Reduction to a level at or below the switching ripple can be achieved by using a post filter, as shown in the Switching Spike Reduction Schematic.

SWITCHING SPIKE REDUCTION



TYPICAL APPLICATION

TURN-ON DELAY WITH SPIKE FILTER



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

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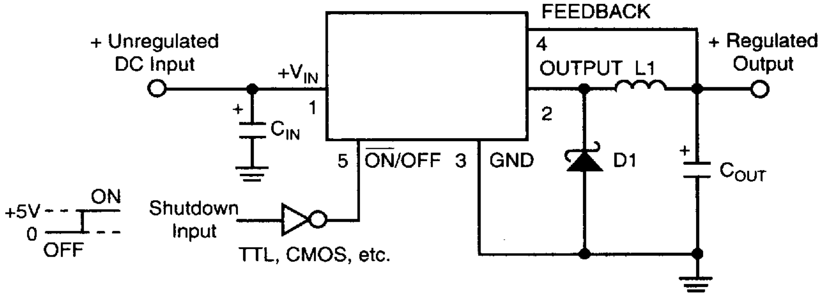
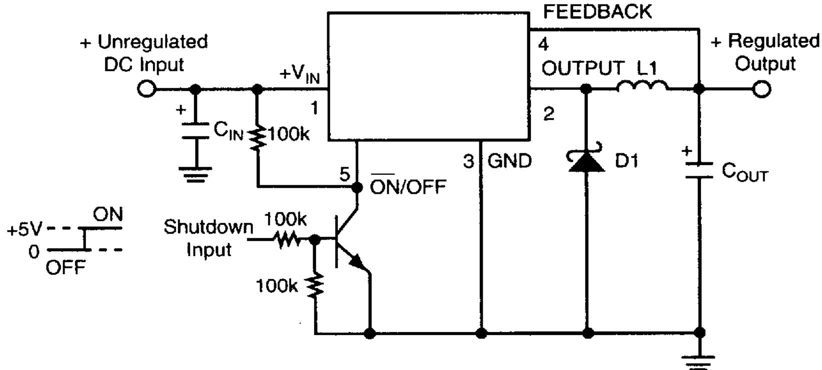
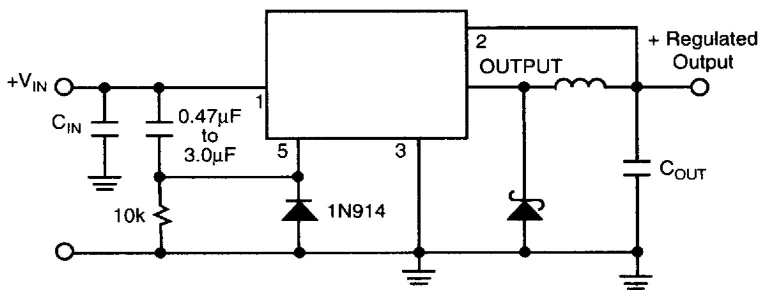
TYPICAL APPLICATIONS

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.

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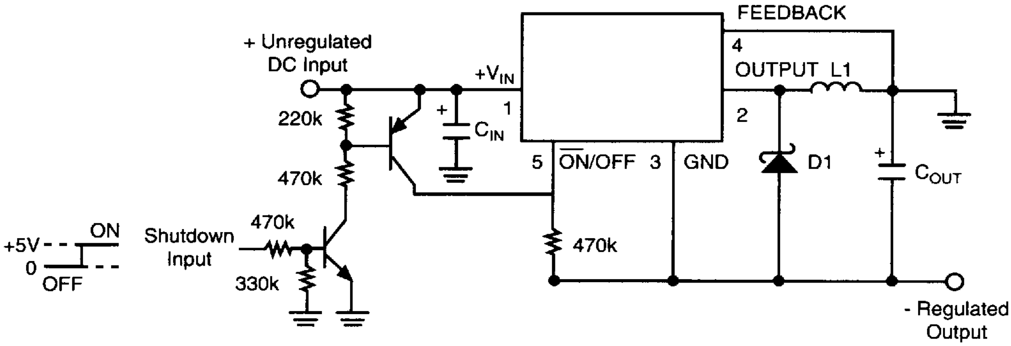
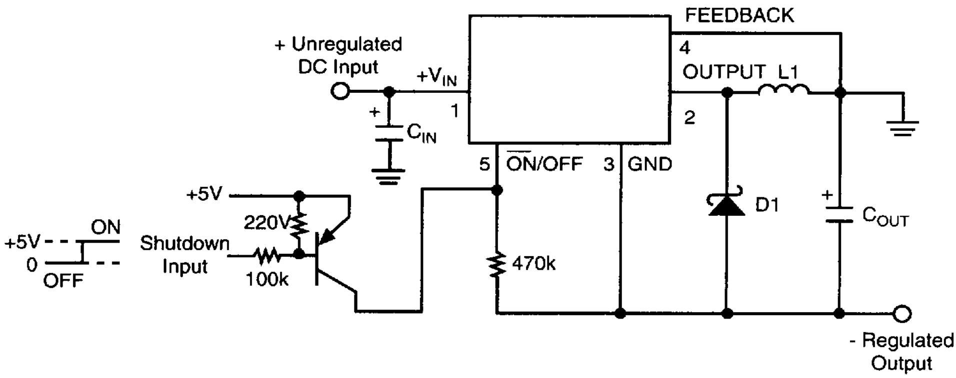
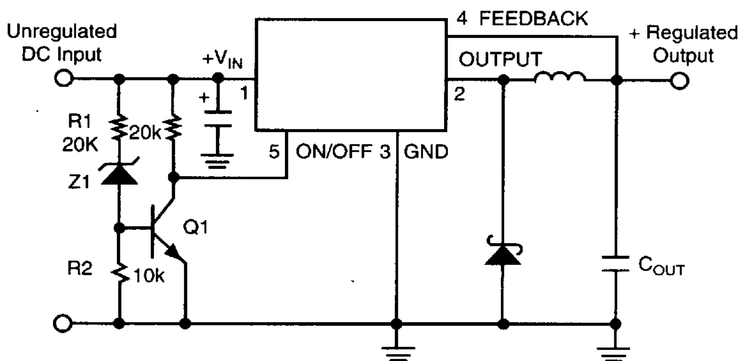
TYPICAL APPLICATIONS

INVERTING BUCK/BOOST SHUTDOWN





UNDER VOLTAGE LOCKOUT



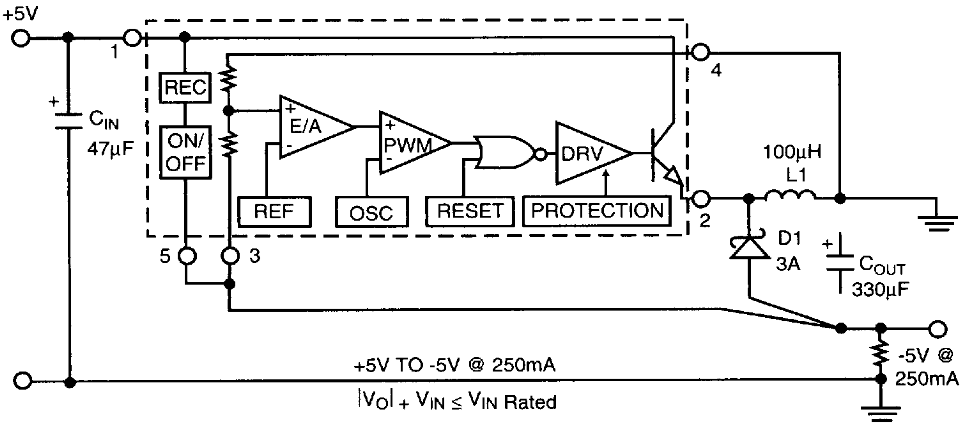
Regulator will be off until a V_{IN} set point is reached.

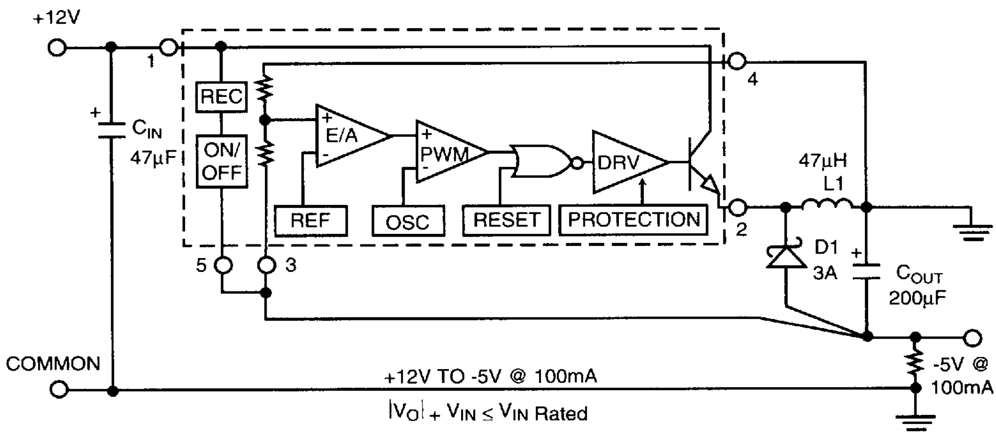
$V_{O(ON)} \cong V_Z + 3V_{BE\ Q1}$

3.3

TYPICAL APPLICATIONS

INVERTING BUCK/BOOST





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: $I_{OUT} \cong 1.3/2\ (1 + |V_O| / V_{IN})$

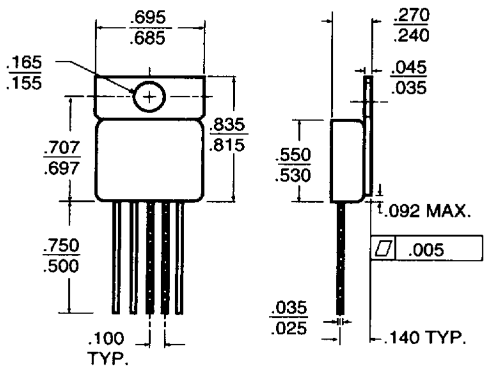
Component requirement stress is very similar to the buck with a few exceptions:

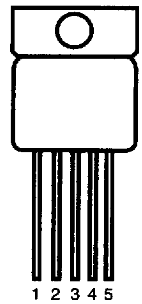
- Catch diode breakdown V_{BR} must be greater than $V_{IN} + |V_{OUT}|$
- Input capacitor is larger due to the increased peak current during switch turn on. Power dissipation of the OM1575 is approximately: $P_D \cong [\,|V_O| / (|V_O| + V_{IN})]\ I_O\ (1 + |V_O| / V_{IN})$

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

MECHANICAL OUTLINE / PIN CONNECTION

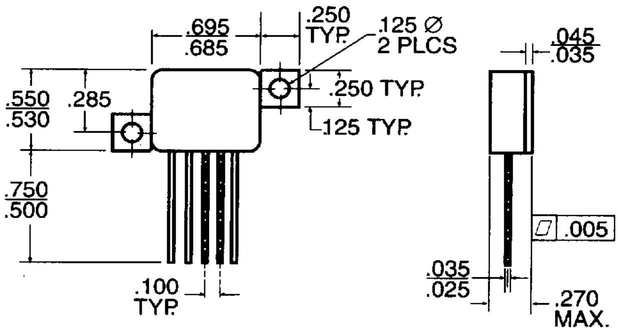
MO-078 PACKAGE

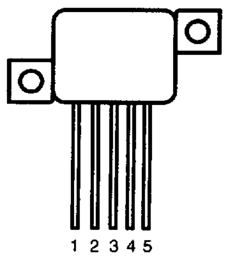




Pin 1: V_{IN}
Pin 2: OUT
Pin 3: GND
Pin 4: Feedback
Pin 5: $\overline{ON}$/OFF

Z-TAB PACKAGE





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

3.3

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

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