National Semiconductor

August 2004

LM1575/LM2575/LM2575HV
SIMPLE SWITCHER® 1A Step-Down Voltage Regulator

General Description

The LM2575 series of regulators are monolithic integrated circuits that provide all the active functions for a step-down (buck) switching regulator, capable of driving a 1A load with excellent line and load regulation. These devices are available in fixed output voltages of 3.3V, 5V, 12V, 15V, and an adjustable output version.

Requiring a minimum number of external components, these regulators are simple to use and include internal frequency compensation and a fixed-frequency oscillator.

The LM2575 series offers a high-efficiency replacement for popular three-terminal linear regulators. It substantially reduces the size of the heat sink, and in many cases no heat sink is required.

A standard series of inductors optimized for use with the LM2575 are available from several different manufacturers. This feature greatly simplifies the design of switch-mode power supplies.

Other features include a guaranteed ±4% tolerance on output voltage within specified input voltages and output load conditions, and ±10% on the oscillator frequency. External shutdown is included, featuring 50 µA (typical) standby current. The output switch includes cycle-by-cycle current limiting, as well as thermal shutdown for full protection under fault conditions.

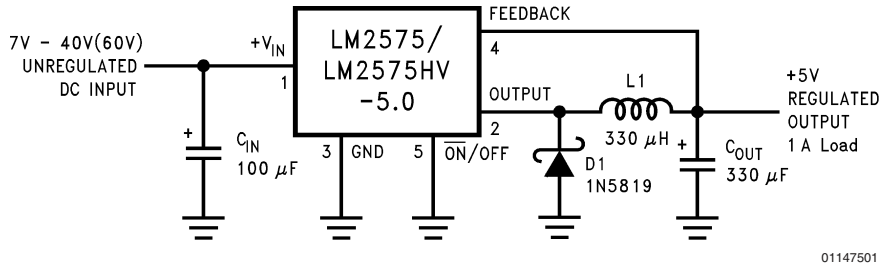
Features

- 3.3V, 5V, 12V, 15V, and adjustable output versions
- Adjustable version output voltage range, 1.23V to 37V (57V for HV version) ±4% max over line and load conditions
- Guaranteed 1A output current
- Wide input voltage range, 40V up to 60V for HV version
- Requires only 4 external components
- 52 kHz fixed frequency internal oscillator
- TTL shutdown capability, low power standby mode
- High efficiency
- Uses readily available standard inductors
- Thermal shutdown and current limit protection
- P^+ Product Enhancement tested

Applications

- Simple high-efficiency step-down (buck) regulator
- Efficient pre-regulator for linear regulators
- On-card switching regulators
- Positive to negative converter (Buck-Boost)

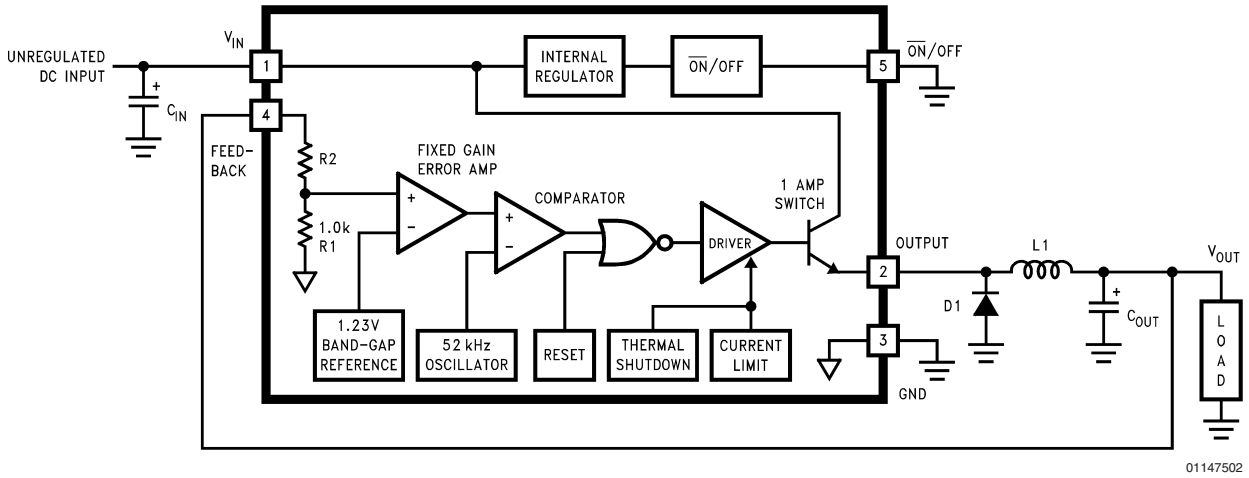
Typical Application (Fixed Output Voltage Versions)



Note: Pin numbers are for the TO-220 package.

SIMPLE SWITCHER® is a registered trademark of National Semiconductor Corporation.

Block Diagram and Typical Application



01147502

3.3V, R2 = 1.7k

5V, R2 = 3.1k

12V, R2 = 8.84k

15V, R2 = 11.3k

For ADJ. Version

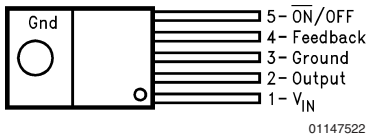
R1 = Open, R2 = 0Ω

Note: Pin numbers are for the TO-220 package.

FIGURE 1.

Connection Diagrams (XX indicates output voltage option. See Ordering Information table for complete part number.)

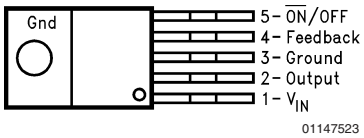
Straight Leads
5–Lead TO-220 (T)



01147522

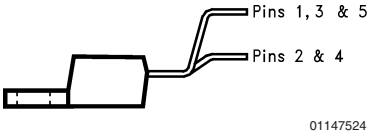
Top View
LM2575T-XX or LM2575HVT-XX
See NS Package Number T05A

Bent, Staggered Leads
5-Lead TO-220 (T)



01147523

Top View

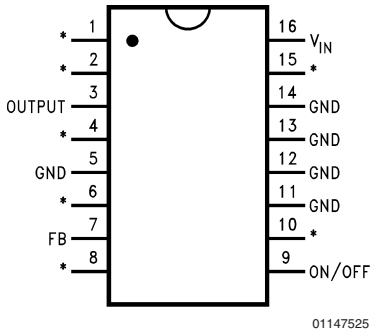


01147524

Side View
LM2575T-XX Flow LB03 or
LM2575HVT-XX Flow LB03
See NS Package Number T05D

Connection Diagrams (XX indicates output voltage option. See Ordering Information table for complete part number.) (Continued)

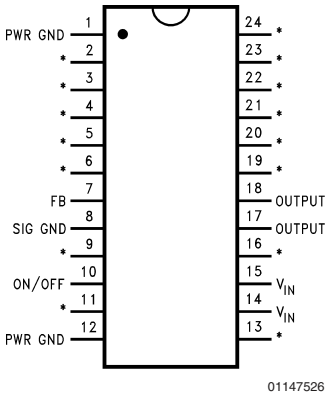
16–Lead DIP (N or J)



*No Internal Connection

Top View
LM2575N-XX or LM2575HVN-XX
See NS Package Number N16A
LM1575J-XX-QML
See NS Package Number J16A

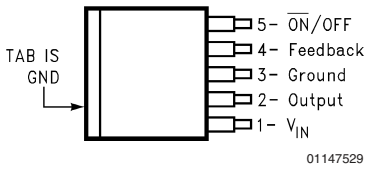
24-Lead Surface Mount (M)



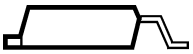
*No Internal Connection

Top View
LM2575M-XX or LM2575HVM-XX
See NS Package Number M24B

TO-263(S)
5-Lead Surface-Mount Package



Top View



Side View
LM2575S-XX or LM2575HVS-XX
See NS Package Number TS5B

Ordering Information

Package Type	NSC Package Number	Standard Voltage Rating (40V)	High Voltage Rating (60V)	Temperature Range
5-Lead TO-220 Straight Leads	T05A	LM2575T-3.3	LM2575HVT-3.3	
		LM2575T-5.0	LM2575HVT-5.0	
		LM2575T-12	LM2575HVT-12	
		LM2575T-15	LM2575HVT-15	
		LM2575T-ADJ	LM2575HVT-ADJ	
5-Lead TO-220 Bent and Staggered Leads	T05D	LM2575T-3.3 Flow LB03	LM2575HVT-3.3 Flow LB03	
		LM2575T-5.0 Flow LB03	LM2575HVT-5.0 Flow LB03	
		LM2575T-12 Flow LB03	LM2575HVT-12 Flow LB03	
		LM2575T-15 Flow LB03	LM2575HVT-15 Flow LB03	
		LM2575T-ADJ Flow LB03	LM2575HVT-ADJ Flow LB03	

Ordering Information (Continued)

Package Type	NSC Package Number	Standard Voltage Rating (40V)	High Voltage Rating (60V)	Temperature Range
16-Pin Molded DIP	N16A	LM2575N-5.0 LM2575N-12 LM2575N-15 LM2575N-ADJ	LM2575HVN-5.0 LM2575HVN-12 LM2575HVN-15 LM2575HVN-ADJ	$-40^{\circ}C \le T_J \le +125^{\circ}C$
24-Pin Surface Mount	M24B	LM2575M-5.0 LM2575M-12 LM2575M-15 LM2575M-ADJ	LM2575HVM-5.0 LM2575HVM-12 LM2575HVM-15 LM2575HVM-ADJ	
5-Lead TO-263 Surface Mount	TS5B	LM2575S-3.3 LM2575S-5.0 LM2575S-12 LM2575S-15 LM2575S-ADJ	LM2575HVS-3.3 LM2575HVS-5.0 LM2575HVS-12 LM2575HVS-15 LM2575HVS-ADJ	
16-Pin Ceramic DIP	J16A	LM1575J-3.3-QML LM1575J-5.0-QML LM1575J-12-QML LM1575J-15-QML LM1575J-ADJ-QML		$-55^{\circ}C \le T_J \le +150^{\circ}C$

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Maximum Supply Voltage	
LM1575/LM2575	45V
LM2575HV	63V
$\overline{ON}$ /OFF Pin Input Voltage	$-0.3V \le V \le +V_{IN}$
Output Voltage to Ground	
(Steady State)	−1V
Power Dissipation	Internally Limited
Storage Temperature Range	−65˚C to +150˚C
Maximum Junction Temperature	150˚C
Minimum ESD Rating	
(C = 100 pF, R = 1.5 kΩ)	2 kV
Lead Temperature	
(Soldering, 10 sec.)	260˚C

Operating Ratings

Temperature Range	
LM1575	$-55˚C \le T_J \le +150˚C$
LM2575/LM2575HV	$-40˚C \le T_J \le +125˚C$
Supply Voltage	
LM1575/LM2575	40V
LM2575HV	60V

LM1575-3.3, LM2575-3.3, LM2575HV-3.3 Electrical Characteristics

Specifications with standard type face are for T_J = 25˚C, and those with **boldface type** apply over **full Operating Temperature Range** .

Symbol	Parameter	Conditions	Typ	LM1575-3.3	LM2575-3.3 LM2575HV-3.3	Units (Limits)
				Limit (Note 2)	Limit (Note 3)	
SYSTEM PARAMETERS (Note 4) Test Circuit *Figure 2*						
V_{OUT}	Output Voltage	V_{IN} = 12V, I_{LOAD} = 0.2A	3.3			V
		Circuit of *Figure 2*		3.267	3.234	V(Min)
				3.333	3.366	V(Max)
V_{OUT}	Output Voltage	$4.75V \le V_{IN} \le 40V$, $0.2A \le I_{LOAD} \le 1A$	3.3			V
	LM1575/LM2575	Circuit of *Figure 2*		3.200/**3.168**	3.168/**3.135**	V(Min)
				3.400/**3.432**	3.432/**3.465**	V(Max)
V_{OUT}	Output Voltage	$4.75V \le V_{IN} \le 60V$, $0.2A \le I_{LOAD} \le 1A$	3.3			V
	LM2575HV	Circuit of *Figure 2*		3.200/**3.168**	3.168/**3.135**	V(Min)
				3.416/**3.450**	3.450/**3.482**	V(Max)
η	Efficiency	V_{IN} = 12V, I_{LOAD} = 1A	75			%

LM1575-5.0, LM2575-5.0, LM2575HV-5.0 Electrical Characteristics

Specifications with standard type face are for T_J = 25˚C, and those with **boldface type** apply over **full Operating Temperature Range**.

Symbol	Parameter	Conditions	Typ	LM1575-5.0	LM2575-5.0 LM2575HV-5.0	Units (Limits)
				Limit (Note 2)	Limit (Note 3)	
SYSTEM PARAMETERS (Note 4) Test Circuit *Figure 2*						
V_{OUT}	Output Voltage	V_{IN} = 12V, I_{LOAD} = 0.2A	5.0			V
		Circuit of *Figure 2*		4.950	4.900	V(Min)
				5.050	5.100	V(Max)
V_{OUT}	Output Voltage	$0.2A \le I_{LOAD} \le 1A$,	5.0			V
	LM1575/LM2575	$8V \le V_{IN} \le 40V$		4.850/**4.800**	4.800/**4.750**	V(Min)
		Circuit of *Figure 2*		5.150/**5.200**	5.200/**5.250**	V(Max)
V_{OUT}	Output Voltage	$0.2A \le I_{LOAD} \le 1A$,	5.0			V
	LM2575HV	$8V \le V_{IN} \le 60V$		4.850/**4.800**	4.800/**4.750**	V(Min)
		Circuit of *Figure 2*		5.175/**5.225**	5.225/**5.275**	V(Max)