Simple switcher 3A step-down Voltage regulator

General Description

The LM2576S-xxx-Y of regulators are monolithic integrated circuits that provide all the active functions for a step-down (buck) switching regulator, capable of driving 3A 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 afixed-frequency oscillator.

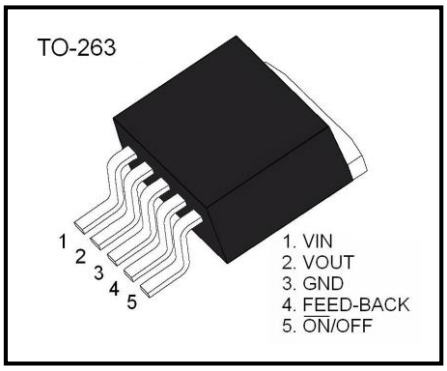
The LM2576S-xxx-Y offers a high-efficiency replacement for popular three-terminal linear regulators.It substantially reduces the size of the heatsink,and in some cases no heat sink is required.

A standard series of inductors optimized for use with the LM2576S-xxx-Y 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 with inspecified input voltages and output load conditions,and ±10% on the oscillator frequency.External shutdown is included,featuring 50µA(typical) standby current. The output switch includes cycle-by-cycle current limiting, as well as thermal shutdown for full protection under fault conditions.

Applications

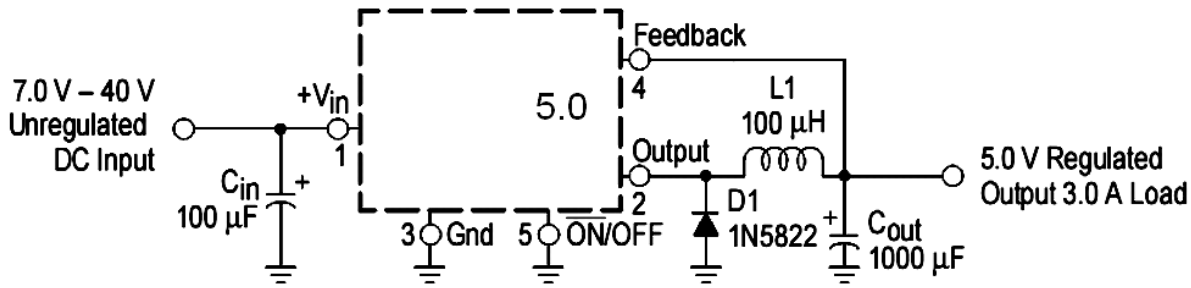
- Simple high-efficiency step-down(buck) regulator
- Efficient pre-regulator for linear regulators
- On-card switching regulators
- Positive to negative converter(Buck-Boost)



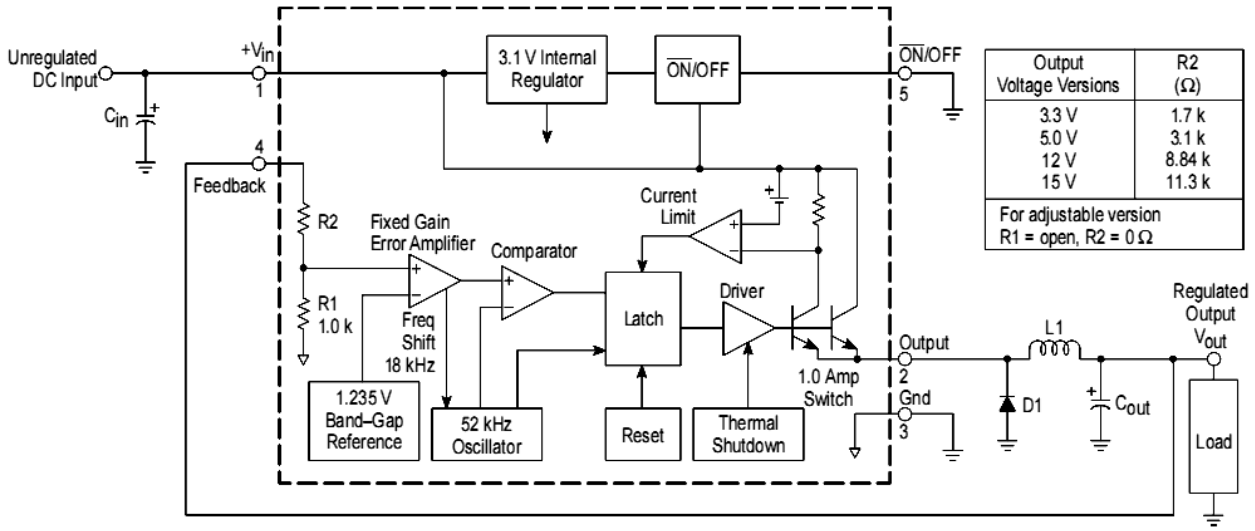
Features

- Guaranteed 3A output current
- Requiresonly 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

Typical Application (FixedOutputVoltage Versions)



Block Diagram and Typical Application



Absolute Maximum Ratings

Parameter	Symbol	Conditions	Ratings	Unit
Supply Voltage	V_{IN}		45	V
$\overline{ON}$/OFF Pin Input Voltage	$V_{\overline{ON}/OFF}$		-0.3 ~ V_{IN}	V
Output Voltage to Ground	V_{OG}	Steady State	-1	V
Power Dissipation	P_D		Internally Limited	W
Junction Temperature	T_j		-40 ~ 125	℃
Storage Temperature	T_{stg}		-65 ~ 150	℃
Minimum ESD Rating	V_{ESD}	C=100pF, R=1.5kΩ	2	kV
Lead Temperature	T_{LEAD}	Soldering,10 Seconds	260	℃

Notes: 1. External components such as the catch diode, inductor, input and output capacitors can affect switching regulator system performance.

2. Tested junction temperature range for the LM2576: T low = -40℃ Thigh= +125℃

Electrical Characteristics LM2576S-3.3-Y

Specification swith standard type face are for T_j =25℃

Parameter	Symbol	Conditions		Value			Unit
				Min	Typ	Max	
Output Voltage	V_{OUT}	V_{IN}=12V, I_{LOAD} =0.5A,		3.234	3.3	3.366	V
Output Voltage	V_{OUT}	6V ≤ V_{IN}≤ 40V, 0.5A ≤ I_{LOAD} ≤ 3A	T_j= 25℃	3.168	3.3	3.142	V
			T_j=-40~125℃	3.135	3.3	3.465	
Efficiency	η	V_{IN}=12V, I_{LOAD} =3.0A,			75		%

Electrical Characteristics LM2576S-5.0-Y

Specification swith standard type face are for T_j =25℃

Parameter	Symbol	Conditions		Value			Unit
				Min	Typ	Max	
Output Voltage	V_{OUT}	V_{IN}=12V, I_{LOAD} =0.5A,		4.9	5.0	5.1	V
Output Voltage	V_{OUT}	8V ≤ V_{IN}≤ 40V, 0.5A ≤ I_{LOAD} ≤ 3A	T_j= 25℃	4.8	5.0	5.2	V
			T_j=-40~125℃	4.75	5.0	5.25	
Efficiency	η	V_{IN}=12V, I_{LOAD} =3.0A,			77		%

Electrical Characteristics LM2576S-12-Y

Specification swith standard type face are for T_j =25℃

Parameter	Symbol	Conditions		Value			Unit
				Min	Typ	Max	
Output Voltage	V_{OUT}	V_{IN}=25V, I_{LOAD} =0.5A,		11.76	12	12.24	V
Output Voltage	V_{OUT}	15V ≤ V_{IN}≤ 40V, 0.5A ≤ I_{LOAD} ≤ 3A	T_j= 25℃	11.52	12	12.48	V
			T_j=-40~125℃	11.40	12	12.60	
Efficiency	η	V_{IN}=15V, I_{LOAD} =3.0A,			88		%

Electrical Characteristics LM2576S-15-Y

Specification swith standard type face are for T_j =25℃

Parameter	Symbol	Conditions		Value			Unit
				Min	Typ	Max	
Output Voltage	V_{OUT}	V_{IN}=25V, I_{LOAD} =0.5A,		14.70	15	15.30	V
Output Voltage	V_{OUT}	18V ≤ V_{IN}≤ 40V, 0.5A ≤ I_{LOAD} ≤ 3A	T_j= 25℃	14.40	15	15.60	V
			T_j=-40~125℃	14.52	15	15.75	
Efficiency	η	V_{IN}=18V, I_{LOAD} =3.0A,			88		%

Electrical Characteristics LM2576S-ADJ-Y

Specification swith standard type face are for T_j =25℃

Parameter	Symbol	Conditions		Value			Unit
				Min	Typ	Max	
Output Voltage	V_{OUT}	V_{IN}=12V, I_{LOAD} =0.5A, V_{OUT}=5V		1.217	1.23	1.243	V
Output Voltage	V_{OUT}	8V ≤ V_{IN}≤ 40V, 0.5A ≤ I_{LOAD} ≤ 3A V_{OUT}=5V	T_j= 25℃	1.193	1.23	1.267	V
			T_j=-40~125℃	1.180	1.23	1.280	
Efficiency	η	V_{IN}=12V, I_{LOAD} =3.0A, V_{OUT}=5V			77		%

All Output Voltage Versions Electrical Characteristics

V_{IN} =12V for the 3.3V,5V,and Adjustable version,V_{IN} =25V for the 12V version,and V_{IN} =30V for the 15V version. I_{LOAD} =500mA. Specification swith standard type face are for T_j =25˚C, unless other wises pecified,

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Feedback Bias Current	I_b	V_{OUT}=5V, Adjustable Only		50	100	nA
Oscillator Frequency	f_{OSC}	Note 3	47	52		kHz
Saturation Voltage	V_{sat}	I_{OUT} =3.0A		1.4	1.8	V
Max Duty Cycle (“on”)	DC	Note 5	93	98		%
Current Limit	I_{CL}	Note 3, 4	4.2	5.8	6.9	A
Output Leakage Current	I_L	Output = 0 V			2.0	mA
		Output = -1.0 V		7.5	30	
Quiescent Current	I_Q	Note 6		5	10	mA
Standby Quiescent Current	I_{stby}	$\overline{ON}$/OFF Pin=5.0V (off)		50	200	μA
$\overline{ON}$/OFF Pin Logic Input Level	V_{IH}	V_{OUT} = 0		1.4	2.2	V
$\overline{ON}$/OFF Pin Logic Input Level	V_{IL}	V_{OUT} = Nominal Output Voltage	1.0	1.2		V
$\overline{ON}$/OFF Pin Input Current	I_{IH}	$\overline{ON}$/OFF Pin=5.0V (“off”)	12		30	μA
$\overline{ON}$/OFF Pin Input Current	I_{IL}	$\overline{ON}$/OFF Pin=5.0V (“on”)	0		10	μA

Notes: 3. The oscillator frequency reduces to approximately 11 kHz in the event of an output short or an overload which causes the regulated output voltage to drop approximately 40% from the nominal output voltage. This self protection feature lowers the average dissipation of the IC by lowering the minimum duty cycle from 5% down to approximately 2%.

4. Output (Pin 2) sourcing current. No diode, inductor or capacitor connected to output pin.

5. Feedback (Pin 4) removed from output and connected to 0 V.

6 .Feedback (Pin 4) removed from output and connected to 12 V for the Adjustable, 3.3 V, and 5.0 V versions, and 25 V for the 12 V and 15 V versions, to force the output transistor “off”.

7 .Vin = 40 V.

Typical Characteristics

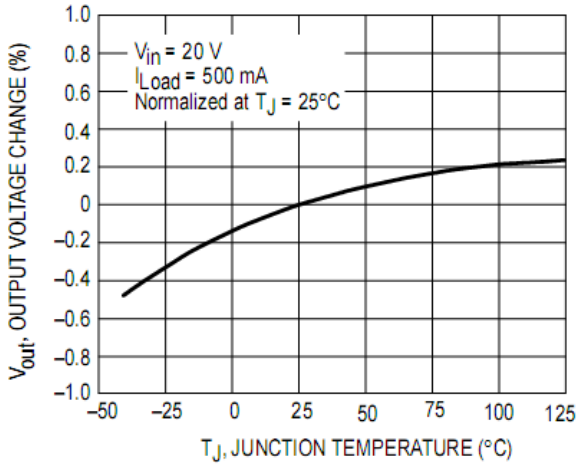


Figure 1. Normalized Output Voltage

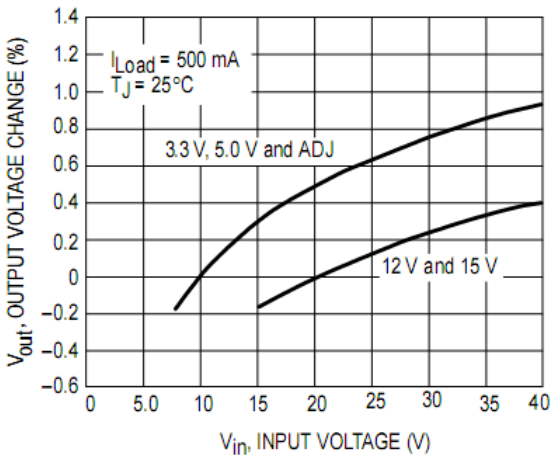


Figure 2. Line Regulation

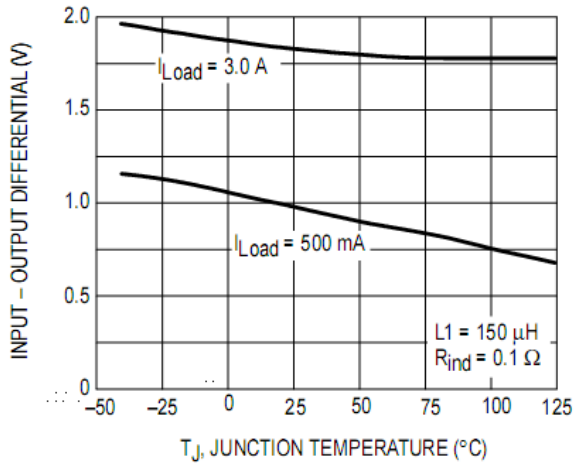


Figure 3. Dropout Voltage

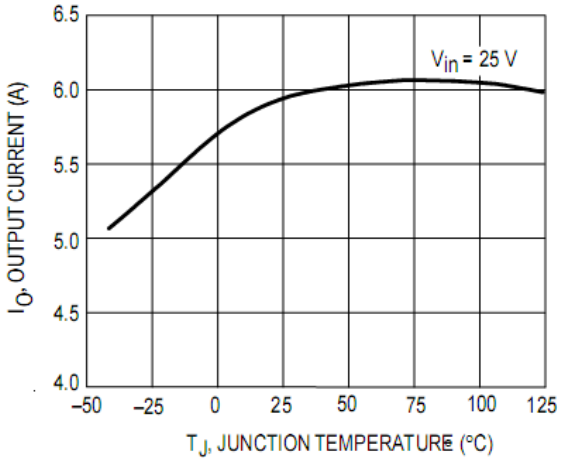


Figure 4. Current Limit

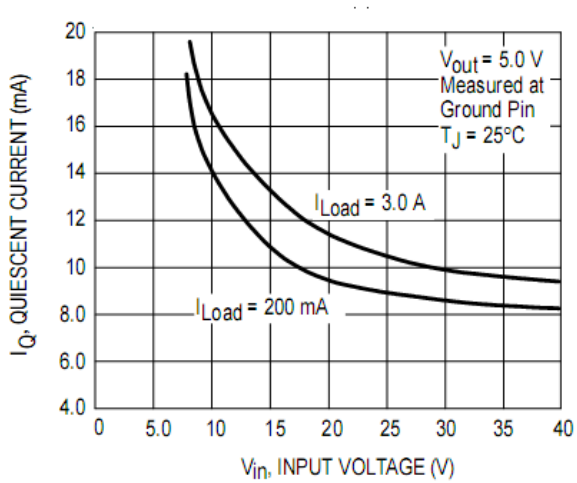


Figure 5. Quiescent Current

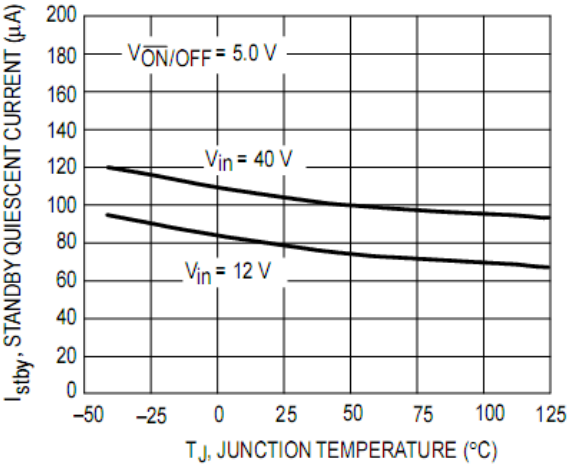


Figure 6. Standby Quiescent Current

Typical Characteristics

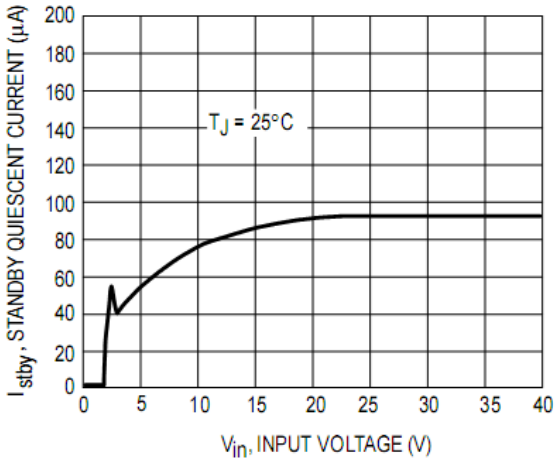


Figure 7. Standby Quiescent Current

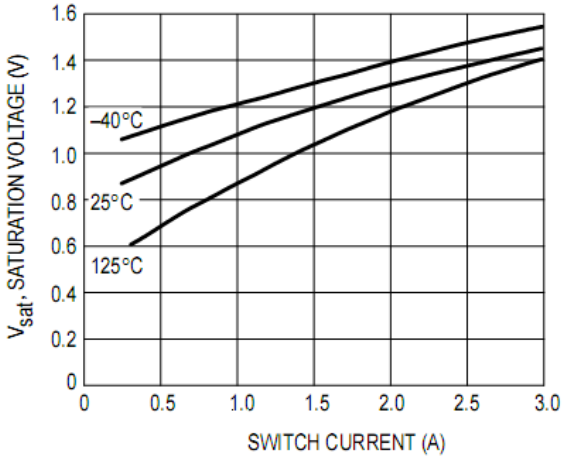


Figure 8. Switch Saturation Voltageon

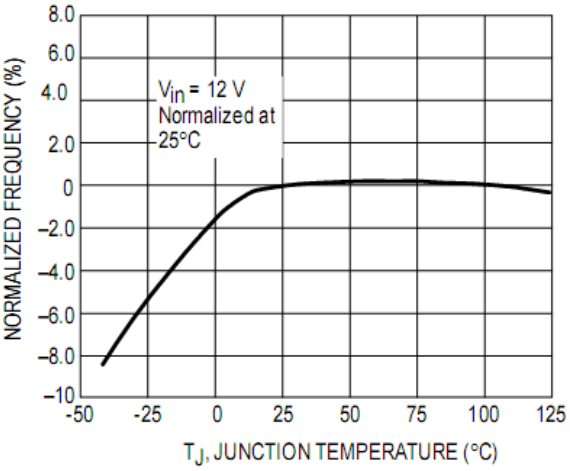


Figure 9. Oscillator Frequency

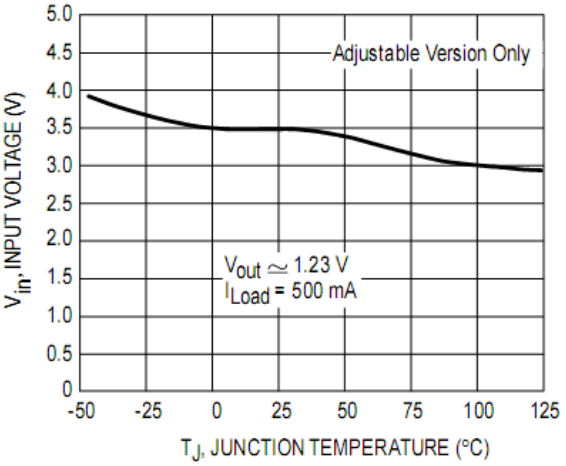


Figure 10. Minimum Operating Voltage

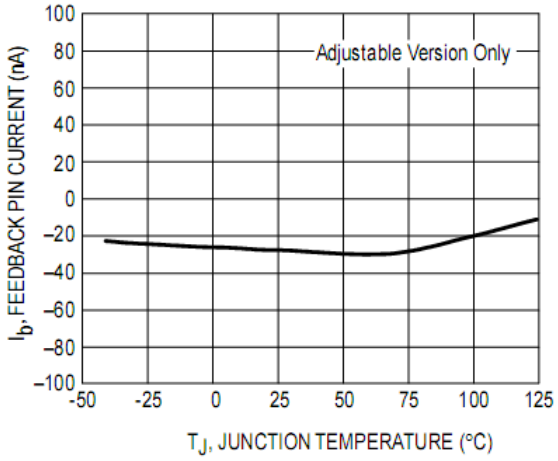
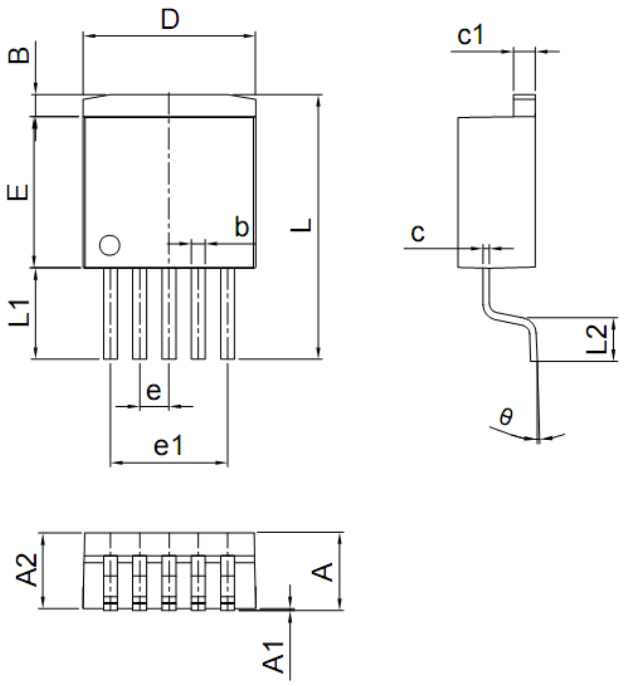


Figure 11. Feedback Pin Current

Package Dimensions



Dim	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.30	4.70	0.169	0.185
A1	0.00	0.15	0.000	0.006
A2	4.30	4.55	0.169	0.179
B	1.20	1.60	0.047	0.063
b	0.70	0.90	0.028	0.035
b1	1.20	1.50	0.047	0.059
c	0.30	0.60	0.012	0.024
c1	1.17	1.37	0.046	0.054
D	9.90	10.20	0.390	0.402
E	8.50	8.90	0.335	0.350
e	1.60	1.80	0.096	0.104
e1	6.40	7.20	0.252	0.283
L	14.60	15.00	0.575	0.590
L1	4.70	5.30	0.205	0.213
L2	2.30	2.60	0.091	0.110