General Description

The LM2596S regulator is monolithic integrated circuit ideally suited for easy and convenient design of a step−down switching regulator (buck converter). It is capable of driving a 3.0 A load with excellent line and load regulation. This device is available in adjustable output version and it is internally compensated to minimize the number of external components to simplify the power supply design.

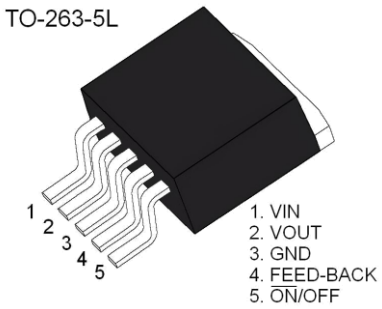
Since LM2596S converter is a switch-mode power supply, its efficiency is significantly higher in comparison with popular three−terminal linear regulators, especially with higher input voltages.

The LM2596S operates at a switching frequency of 150 kHz thus allowing smaller sized filter components than what would be needed with lower frequency switching regulators. Available in a standard 5-lead TO-263-5L package.

The other features include a guaranteed±4% tolerance on output voltage within specified input voltages and output load conditions, and±15% on the oscillator frequency. External shutdown is included, featuring 80μA (typical) standby current. Self protection features include switch cycle-by-cycle current limit for the output switch, as well as thermal shutdown for complete protection under fault conditions.

Applications

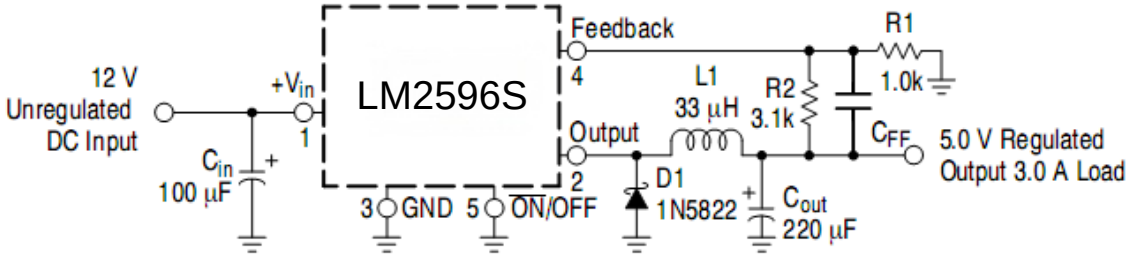
- Simple High-Efficiency Step-Down(Buck) Regulator
- Efficient Pre-Regulator for Linear Regulators
- On-Card Switching Regulators
- Positive to Negative Converter (Buck−Boost)
- Negative Step-Up Converters
- Power Supply for Battery Chargers



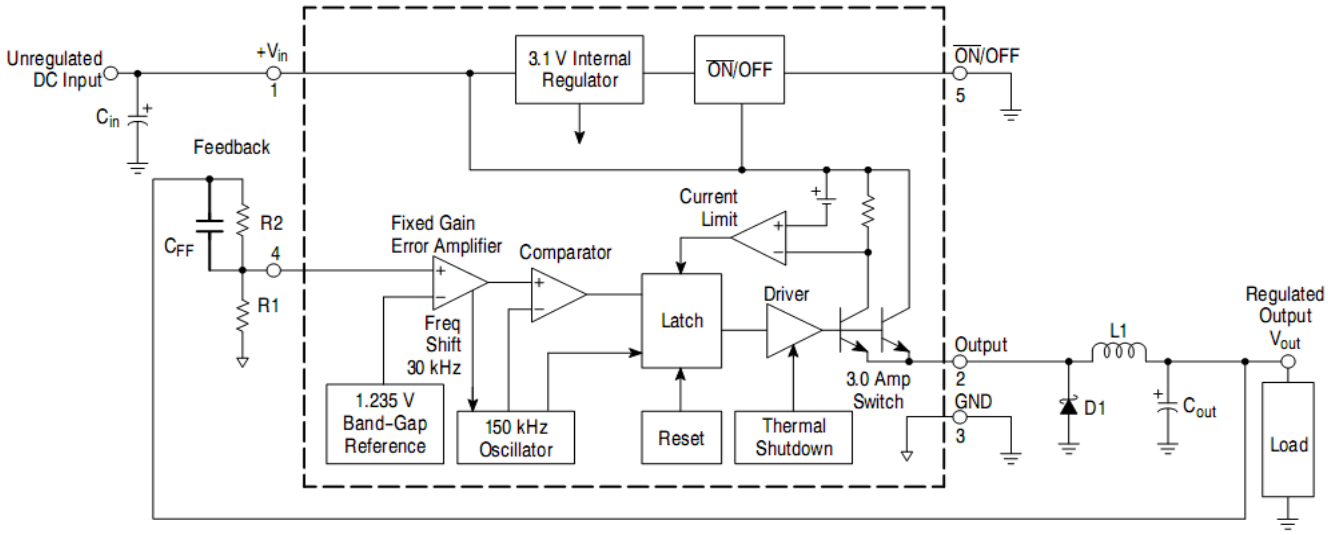
Features

- Adjustable Output Voltage Range 1.23 V -37 V
- Guaranteed 3.0 A Output Load Current
- Wide Input Voltage Range up to 40 V
- 150 kHz Fixed Frequency Internal Oscillator
- TTL Shutdown Capability
- Low Power Standby Mode, typ 80μA
- Thermal Shutdown and Current Limit Protection
- Internal Loop Compensation

Typical Application



Block Diagram and Typical Application



Absolute Maximum Ratings

Parameter	Symbol	Conditions	Ratings	Unit
Max Supply Voltage	V_{IN}		45	V
$\overline{ON}$/OFF Pin Input Voltage	$V_{\overline{ON}/OFF}$		-0.3 ~ +25	V
Feedback Pin Voltage	V_{FEED}		-0.3 ~ +25	V
Output Voltage to Ground	V_{OG}	Steady State	-1	V
Power Dissipation	P_D		Internally Limited	W
Junction Temperature	T_j		150	℃
Storage Temperature	T_{srg}		-65 ~ 150	℃
Minimum ESD Rating	V_{ESD}	C=100pF, R=1.5kΩ	2	kV

Pin Function Description

Pin	Symbol	Description
1	V_{IN}	This pin is the positive input supply for the LM2596 step-down switching regulator. In order to minimize voltage transi ents and to supply the switching currents needed by the regulator, a suitable input bypass capacitor must be present
2	Output	This is the emitter of the internal switch. The saturation voltage V sat of this output switch is typically 1.5 V. It should be kept in mind that the PCB area connected to this pin should be kept to a minimum in order to minimize coupling to sensitive circuitry.
3	GND	Circuit ground pin. See the information about the printed circuit board layout.
4	Feedback	This pin is the direct input of the error amplifier and the resistor network R2, R1 is connected externally to allow programming of the output voltage.
5	$V_{\overline{ON}/OFF}$	It allows the switching regulator circuit to be shut down using logic level signals, thus dropping the total input supply current to approximately 80μA. The threshold voltage is typically 1.6 V. Applying a voltage above this value (up to $+V_{in}$)) shuts the regulator off. If the voltage applied to this pin is lower than 1.6 V or if this pin is left open, the regulator will be in the “on” condition.

Electrical Characteristics (Specifications with standard type face are for T_j=25˚C)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Feedback Voltage	V_{FB}	V_{IN}=12V, I_{Load}=0.5A,V_{OUT}=5V			1.23		V
Feedback Voltage	V_{FB}	8V ≤ V_{IN}≤ 40V, 0.5A ≤ I_{Load} ≤ 3A V_{OUT} = 5V	T_j= 25℃	1.193		1.267	V
			T_j=-40~+125℃	1.18		1.28	
Efficiency	η	V_{IN}=12V, I_{Load} =3.0A,			73		%
Feedback Bias Current	I_D	V_{OUT} = 5V	T_j= 25℃		25	100	nA
			T_j=-40~+125℃			200	
Oscillator Frequency	f_{OSC}	T_j = 25℃		135	150	165	kHz
		T_j = -40 ~ +125℃		120	150	180	
Saturation Voltage	V_{sat}	I_{OUT} =3.0A	T_j = 25℃		1.5	1.8	V
			T_j=-40~+125℃			2.0	
Max Duty Cycle (“on”)	DC				95		%
Current Limit	I_{CL}	T_j = 25℃		4.2	5.6	6.9	A
		T_j = -40 ~ +125℃		3.5		7.5	
Output Leakage Current	I_L	Output = 0 V			0.5	2.0	mA
		Output = -1.0 V			6	20	
Quiescent Current	I_Q				5	10	mA
Standby Quiescent Current	I_{stby}	$\overline{ON}$/OFF Pin=5.0V (“off”)	T_j = 25℃		80	200	μA
			T_j=-40~+125℃			250	
$\overline{ON}$/OFF Pin Logic Input Level	V_{IH}	V_{OUT} = 0 Regulator off	T_j = 25℃	2.2			V
			T_j=-40~+125℃	2.4			
$\overline{ON}$/OFF Pin Logic Input Level	V_{IL}	V_{OUT} = Nominal Output Voltage Regulator on	T_j = 25℃			1.0	V
			T_j=-40~ +125℃			0.8	
$\overline{ON}$/OFF Pin Input Current	I_{IH}	$\overline{ON}$/OFF Pin=5.0V (Regulator off)			15	30	μA
$\overline{ON}$/OFF Pin Input Current	I_{IL}	$\overline{ON}$/OFF Pin=5.0V (Regulator on)			0.01	5.0	μA

Notes: 1. The oscillator frequency reduces to approximately 18 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%.

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

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

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

5 .Feedback (Pin 4) removed from output and connected to +12 V, to force the output transistor “off”.

6 .Vin = 40 V.

Typical Characteristics

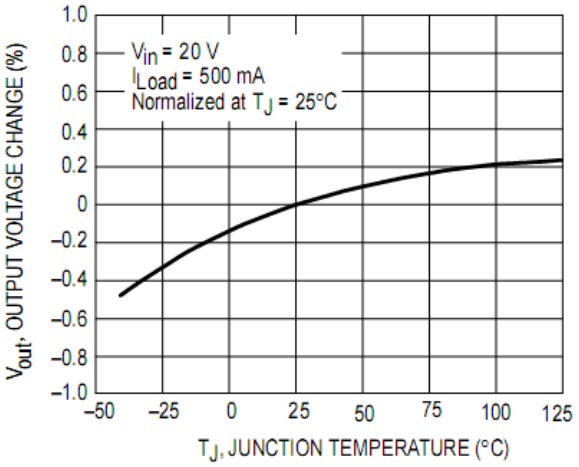


Figure 1. Normalized Output Voltage

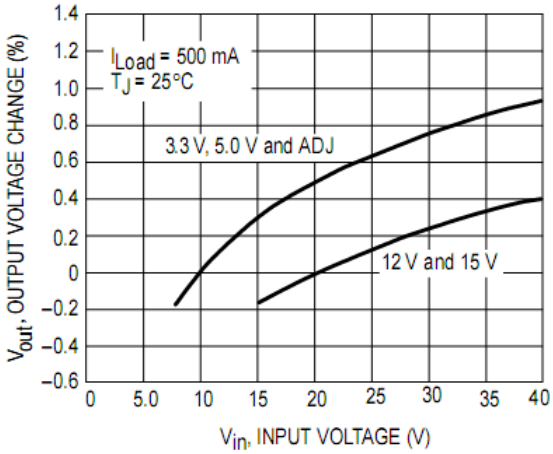


Figure 2. Line Regulation

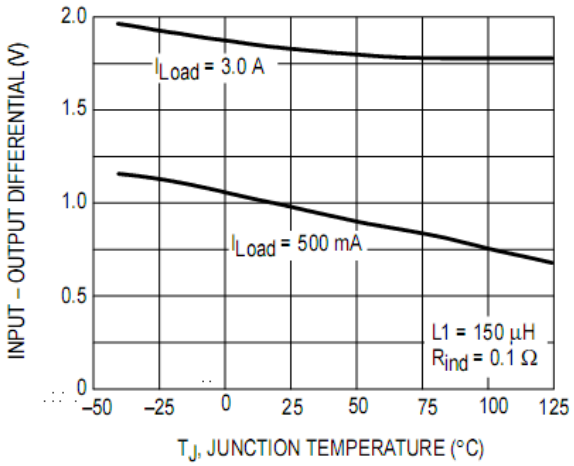


Figure 3. Dropout Voltage

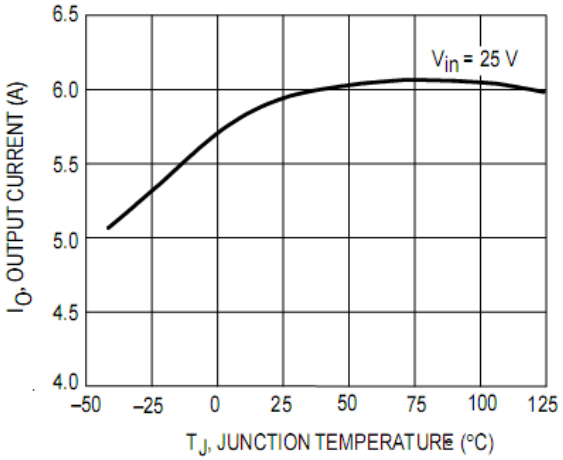


Figure 4. Current Limit

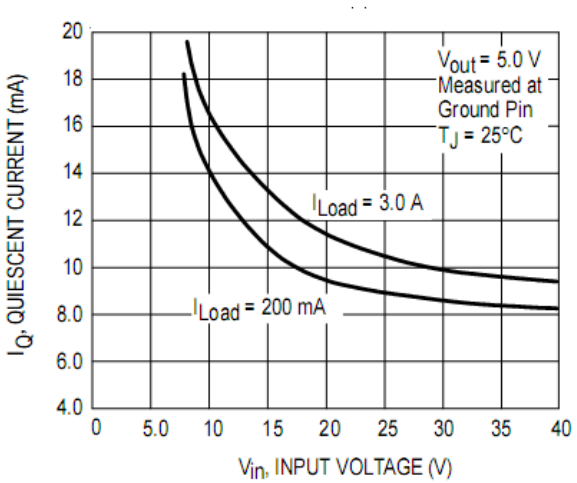


Figure 5. Quiescent Current

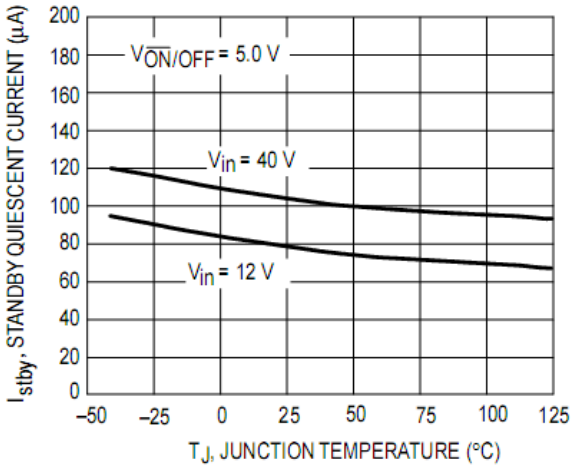


Figure 6. Standby Quiescent Current

Typical Characteristics

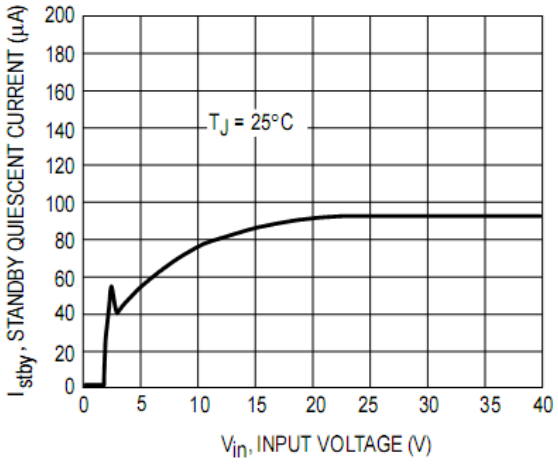


Figure 7. Standby Quiescent Current

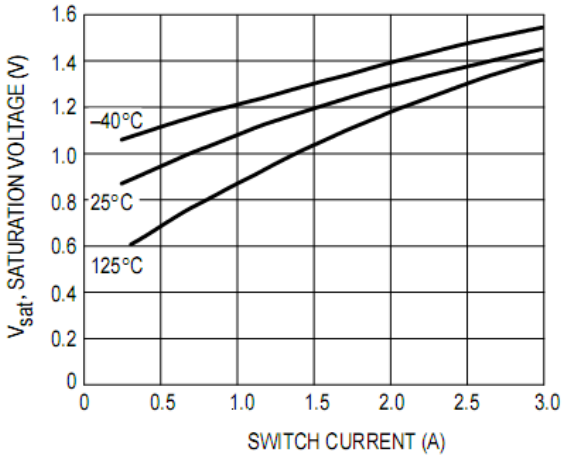


Figure 8. Switch Saturation Voltageon

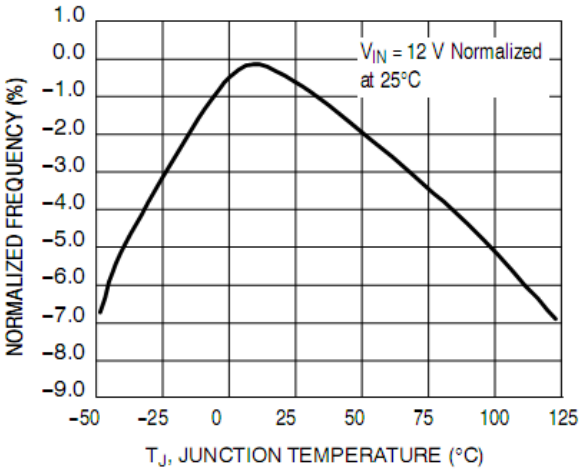


Figure 9. Switching Frequency

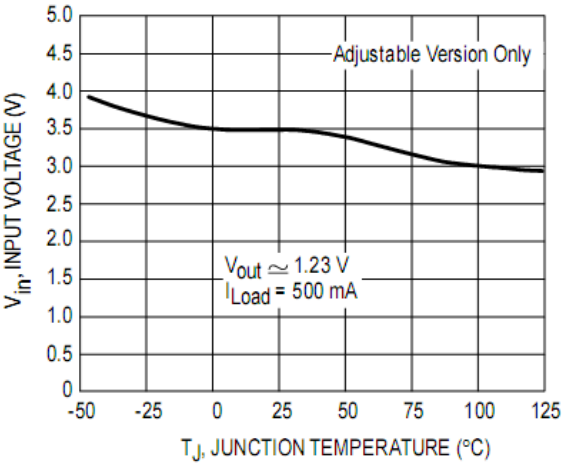


Figure 10. Minimum Operating Voltage

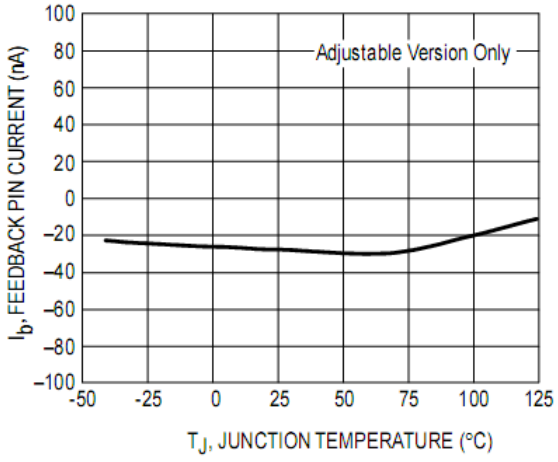
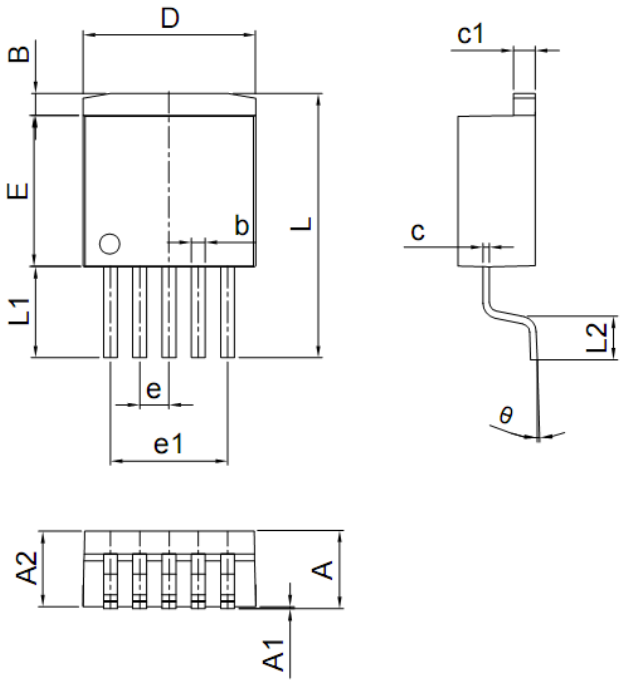


Figure 11. Feedback Pin Current

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