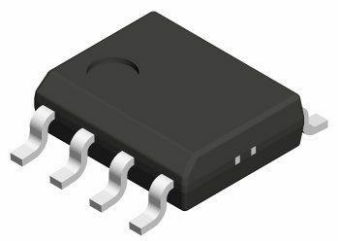
LM2594M-ADJ/X

Step-Down Voltage Regulator,
Power Converter, 150 kHz 0.5A, SOIC-8

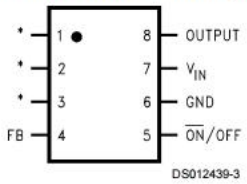
Features

- 3.3V, 5V, 12V, and adjustable output versions
- Adjustable version output voltage range, 1.2V to 37V (57V for the HV version) ±4% max over line and load conditions
- Available in 8-pin surface mount
- Guaranteed 0.5A output current
- Input voltage range up to 60V
- Requires only 4 external components
- 150 kHz fixed frequency internal oscillator
- TTL Shutdown capability
- Low power standby mode, IQ typically 85 µA
- High Efficiency
- Uses readily available standard inductors
- Thermal shutdown and current limit protection

SOIC-8



8-Lead Surface Mount (M)



Top View

Applications

- Simple high-efficiency step-down (buck) regulator
- Efficient pre-regulator for linear regulators
- On-card switching regulators
- Positive to Negative convertor

ON /OFF Pin Input Voltage	−0.3 ≤ V ≤ +25V
Feedback Pin Voltage	−0.3 ≤ V ≤+25V
Output Voltage to Ground (Steady State)	−1V
Power Dissipation	Internally limited
Storage Temperature Range	−65˚C to +150˚C
ESD Susceptibility	2 kV
Human Body Model	

Lead Temperature	
M8 Package	
Vapor Phase (60 sec.)	+215˚C
Infrared (15 sec.)	+220˚C
N Package (Soldering, 10 sec.)	+260˚C
Maximum Junction Temperature	+150˚C
Operating Conditions	
Temperature Range	−40˚C ≤ TJ +125˚C
Supply Voltage	4.5V to 40V

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Electrical Characteristics

Symbol	Parameter	Conditions	LM2594		Units (Limits)
			Typ	Limit	
SYSTEM PARAMETERS Test Circuit *Figure 1*					
V_{FB}	Feedback Voltage	4.5V ≤ V_{IN} ≤ V_{INmax}, 0.1A ≤ I_{LOAD} £ 0.5A V_{OUT} programmed for 3V. Circuit of *Figure 1*	1.230	1.193/**1.180** 1.267/**1.280**	V V(min) V(max)
	Efficiency	V_{IN} = 12V, I_{LOAD} = 0.5A	80		%
DEVICE PARAMETERS					
I_b	Feedback Bias Current	Adjustable Version Only, VFB = 1.3V	10	50/**100**	nA
f_O	Oscillator Frequency		150		kHz
				127/**110**	kHz(min)
				173/**173**	kHz(max)
VSAT	Saturation Voltage	I_{OUT} = 0.5A	0.9		V
				1.1/**1.2**	V(max)
DC	Max Duty Cycle (ON)		100		%
	Min Duty Cycle (OFF)		0		
ICL	Current Limit	Peak Current	0.8		A
				0.65/**0.58**	A(min)
				1.3/**1.4**	A(max)
I_L	Output Leakage Current	Output = 0V	2	50	µA(max) mA
		Output = −1V		15	mA(max)
I_Q	Quiescent Current		5		mA
				10	mA(max)
ISTBY	Standby Quiescent Current	ON/OFF pin = 5V (OFF)	85		µA
		LM2594M		200/**250**	µA(max)
		LM2594HV	140	250/**300**	µA(max)
qJA	Thermal Resistance	N Package, Junction to Ambient	95		˚C/W
		M Package, Junction to Ambient	150		
ON/OFF CONTROL Test Circuit *Figure 1*					
	ON /OFF Pin Logic Input Threshold Voltage		1.3		V
V_{IH}		Low (Regulator ON)		**0.6**	V(max)
V_{IL}		High (Regulator OFF)		**2.0**	V(min)
I_H	ON /OFF Pin Input Current	V_{LOGIC} = 2.5V (Regulator OFF)	5		µA
				15	µA(max)
I_L		V_{LOGIC} = 0.5V (Regulator ON)	0.02		µA
				5	µA(max)

Typical Performance Characteristics

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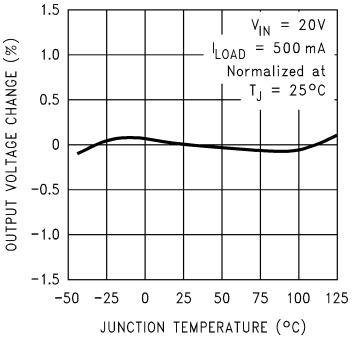
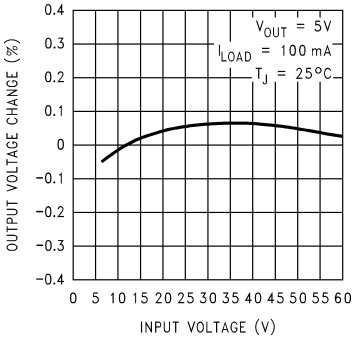
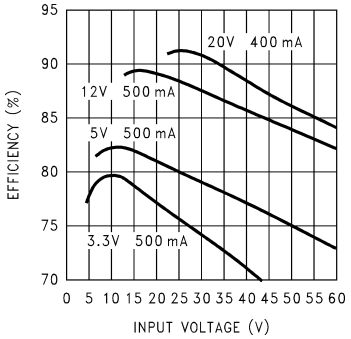
Normalized Output Voltage



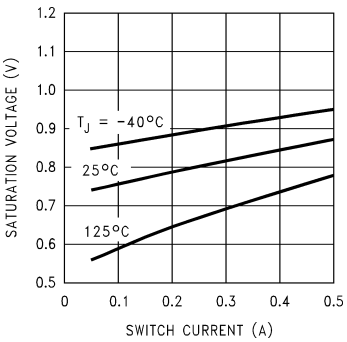
Line Regulation



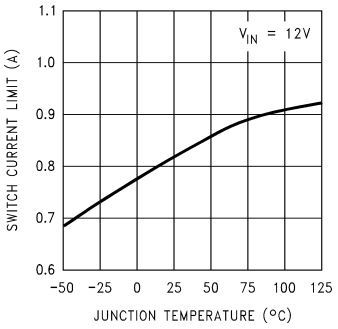
Efficiency



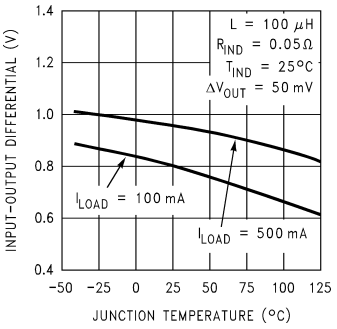
Switch Saturation Voltage



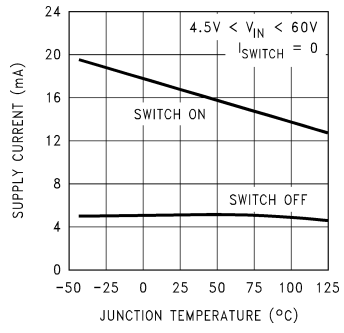
Switch Current Limit



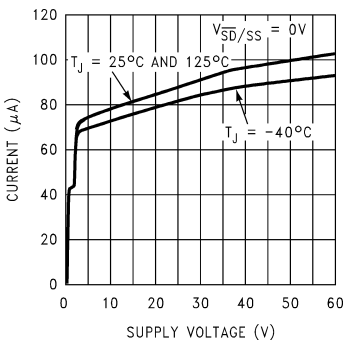
Dropout Voltage



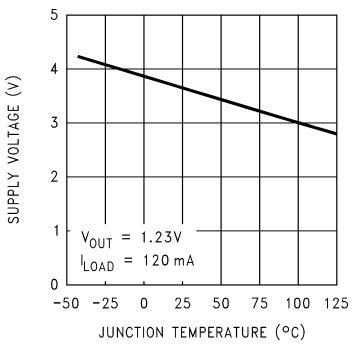
Quiescent Current



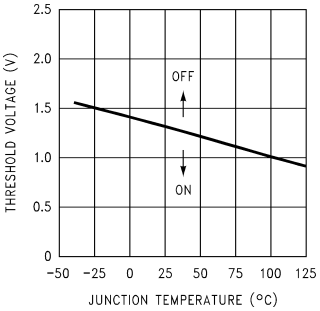
Standby Quiescent Current



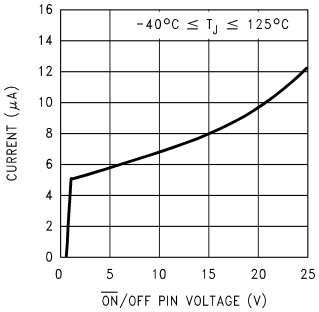
Minimum Operating Supply Voltage



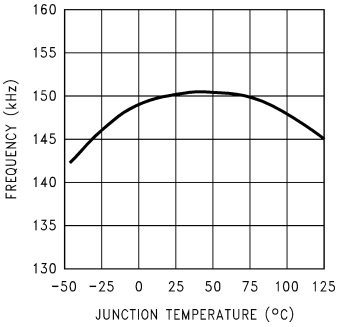
ON /OFF Threshold Voltage



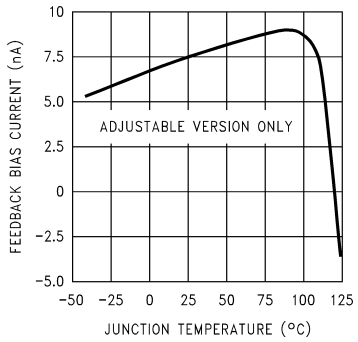
ON /OFF Pin Current (Sinking)



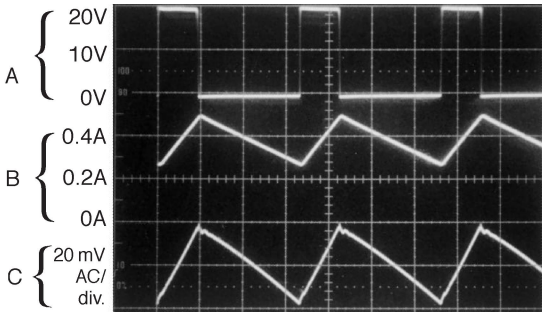
Switching Frequency



Feedback Pin Biais Current

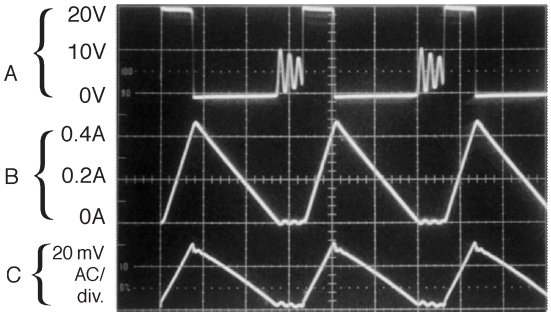


Continuous Mode Switching Waveforms
V_{IN} = 20V, V_{OUT} = 5V, I_{LOAD} = 400 mA
L = 100 µH, C_{OUT} = 120 µF, C_{OUT} ESR = 140 mΩ



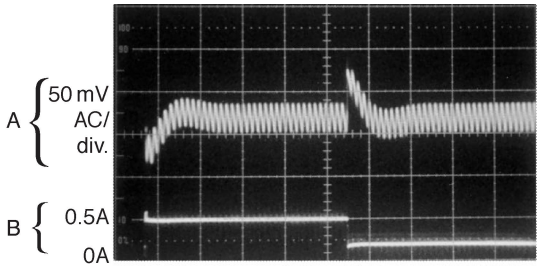
A: Output Pin Voltage, 10V/div.
B: Inductor Current 0.2A/div.
C: Output Ripple Voltage, 20 mV/div.
Horizontal Time Base: 2 µs/div.

Discontinuous Mode Switching Waveforms
V_{IN} = 20V, V_{OUT} = 5V, I_{LOAD} = 200 mA
L = 33 µH, C_{OUT} = 220 µF, C_{OUT} ESR = 60 mΩ



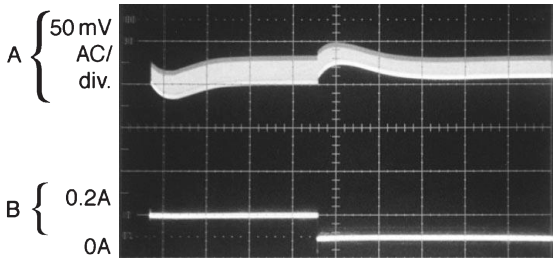
A: Output Pin Voltage, 10V/div.
B: Inductor Current 0.2A/div.
C: Output Ripple Voltage, 20 mV/div.
Horizontal Time Base: 2 µs/div.

Load Transient Response for Continuous Mode
V_{IN} = 20V, V_{OUT} = 5V, I_{LOAD} = 200 mA to 500 mA
L = 100 µH, C_{OUT} = 120 µF, C_{OUT} ESR = 140 mΩ



A: Output Voltage, 50 mV/div. (AC)
B: 200 mA to 500 mA Load Pulse
Horizontal Time Base: 50 µs/div.

Load Transient Response for Discontinuous Mode
V_{IN} = 20V, V_{OUT} = 5V, I_{LOAD} = 100 mA to 200 mA
L = 33 µH, C_{OUT} = 220 µF, C_{OUT} ESR = 60 mΩ



A: Output Voltage, 50 mV/div. (AC)
B: 100 mA to 200 mA Load Pulse
Horizontal Time Base: 200 µs/div.

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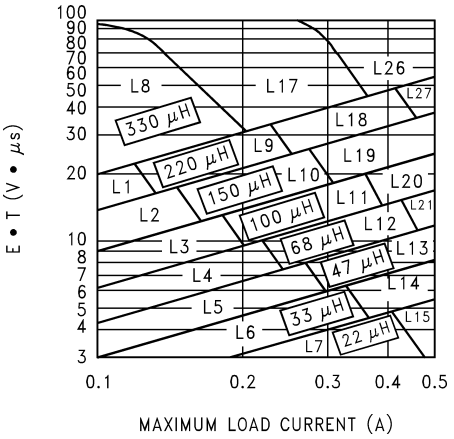
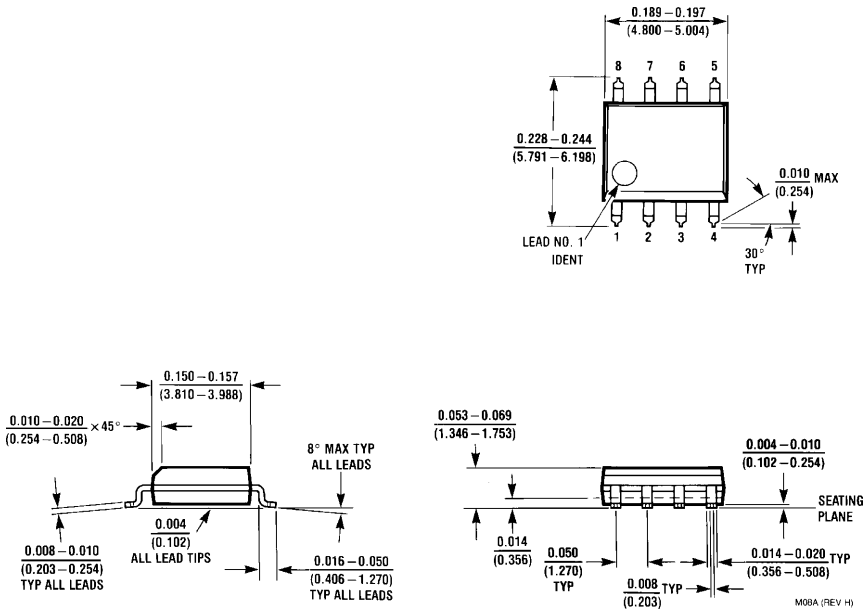
INDUCTOR VALUE SELECTION GUIDES (For Continuous Mode Operation)



Physical dimensions (inches (millimeters) unless otherwise noted)

8-Lead (0.150" Wide) Molded Small Outline Package



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