

LM2677 SIMPLE SWITCHER® High Efficiency 5A Step-Down Voltage Regulator with Sync

General Description

The LM2677 series of regulators are monolithic integrated circuits which provide all of the active functions for a step-down (buck) switching regulator capable of driving up to 5A loads with excellent line and load regulation characteristics. High efficiency (>90%) is obtained through the use of a low ON-resistance DMOS power switch. The series consists of fixed output voltages of 3.3V, 5V and 12V and an adjustable output version.

The SIMPLE SWITCHER concept provides for a complete design using a minimum number of external components. The switching clock frequency can be provided by an internal fixed frequency oscillator (260KHz) or from an externally provided clock in the range of 280KHz to 400KHz which allows the use of physically smaller sized components. A family of standard inductors for use with the LM2677 are available from several manufacturers to greatly simplify the design process. The external Sync clock provides direct and precise control of the output ripple frequency for consistent filtering or frequency spectrum positioning.

The LM2677 series also has built in thermal shutdown, current limiting and an ON/OFF control input that can power down the regulator to a low 50µA quiescent current standby condition. The output voltage is guaranteed to a ±2% tolerance.

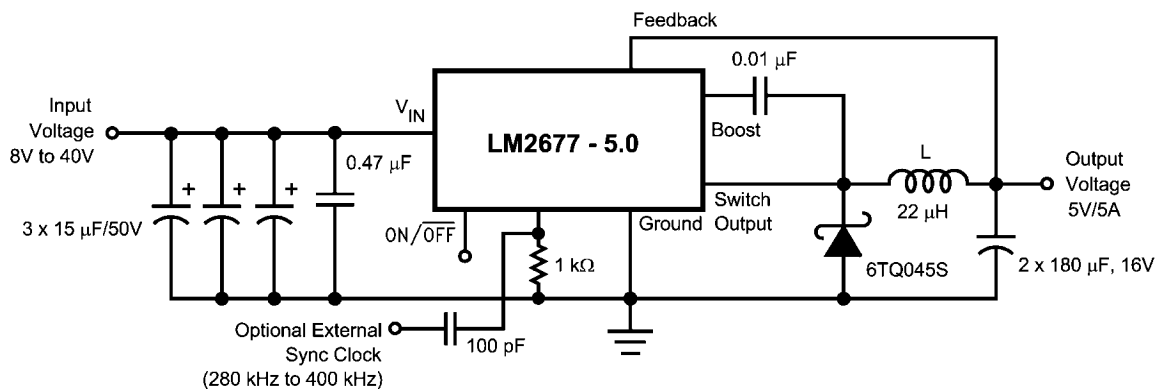
Features

- Efficiency up to 92%
- Simple and easy to design with (using off-the-shelf external components)
- 100 mΩ DMOS output switch
- 3.3V, 5V and 12V fixed output and adjustable (1.2V to 37V) versions
- 50µA standby current when switched OFF
- ±2% maximum output tolerance over full line and load conditions
- Wide input voltage range: 8V to 40V
- External Sync clock capability (280KHz to 400KHz)
- 260 KHz fixed frequency internal oscillator
- -40 to +125°C operating junction temperature range

Applications

- Simple to design, high efficiency (>90%) step-down switching regulators
- Efficient system pre-regulator for linear voltage regulators
- Battery chargers
- Communications and radio equipment regulator with synchronized clock frequency

Typical Application



10130103

Absolute Maximum Ratings (Note 1)

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

Input Supply Voltage	45V
ON/OFF Pin Voltage	-0.1V to 6V
Switch Voltage to Ground (Note 12)	-1V to V_{IN}
Boost Pin Voltage	$V_{SW} + 8V$
Feedback Pin Voltage	-0.3V to 14V
Power Dissipation	Internally Limited

ESD (Note 2)	2 kV
Storage Temperature Range	-65°C to 150°C
Soldering Temperature	
Wave	4 sec, 260°C
Infrared	10 sec, 240°C
Vapor Phase	75 sec, 219°C

Operating Ratings

Supply Voltage	8V to 40V
Junction Temperature Range (T_J)	-40°C to 125°C

Electrical Characteristics Limits appearing in **bold type face** apply over the entire junction temperature range of operation, -40°C to 125°C. Specifications appearing in normal type apply for $T_A = T_J = 25^\circ\text{C}$. Sync pin open circuited.

LM2677-3.3

Symbol	Parameter	Conditions	Typical (Note 3)	Min (Note 4)	Max (Note 4)	Units
V_{OUT}	Output Voltage	$V_{IN} = 8V$ to 40V, $100\text{mA} \leq I_{OUT} \leq 5A$	3.3	3.234/ 3.201	3.366/ 3.399	V
η	Efficiency	$V_{IN} = 12V$, $I_{LOAD} = 5A$	82			%

LM2677-5.0

Symbol	Parameter	Conditions	Typical (Note 3)	Min (Note 4)	Max (Note 4)	Units
V_{OUT}	Output Voltage	$V_{IN} = 8V$ to 40V, $100\text{mA} \leq I_{OUT} \leq 5A$	5.0	4.900/ 4.850	5.100/ 5.150	V
η	Efficiency	$V_{IN} = 12V$, $I_{LOAD} = 5A$	84			%

LM2677-12

Symbol	Parameter	Conditions	Typical (Note 3)	Min (Note 4)	Max (Note 4)	Units
V_{OUT}	Output Voltage	$V_{IN} = 15V$ to 40V, $100\text{mA} \leq I_{OUT} \leq 5A$	12	11.76/ 11.64	12.24/ 12.36	V
η	Efficiency	$V_{IN} = 24V$, $I_{LOAD} = 5A$	92			%

LM2677-ADJ

Symbol	Parameter	Conditions	Typ (Note 3)	Min (Note 4)	Max (Note 4)	Units
V_{FB}	Feedback Voltage	$V_{IN} = 8V$ to 40V, $100\text{mA} \leq I_{OUT} \leq 5A$ V_{OUT} Programmed for 5V	1.21	1.186/ 1.174	1.234/ 1.246	V
η	Efficiency	$V_{IN} = 12V$, $I_{LOAD} = 5A$	84			%

All Output Voltage Versions Electrical Characteristics

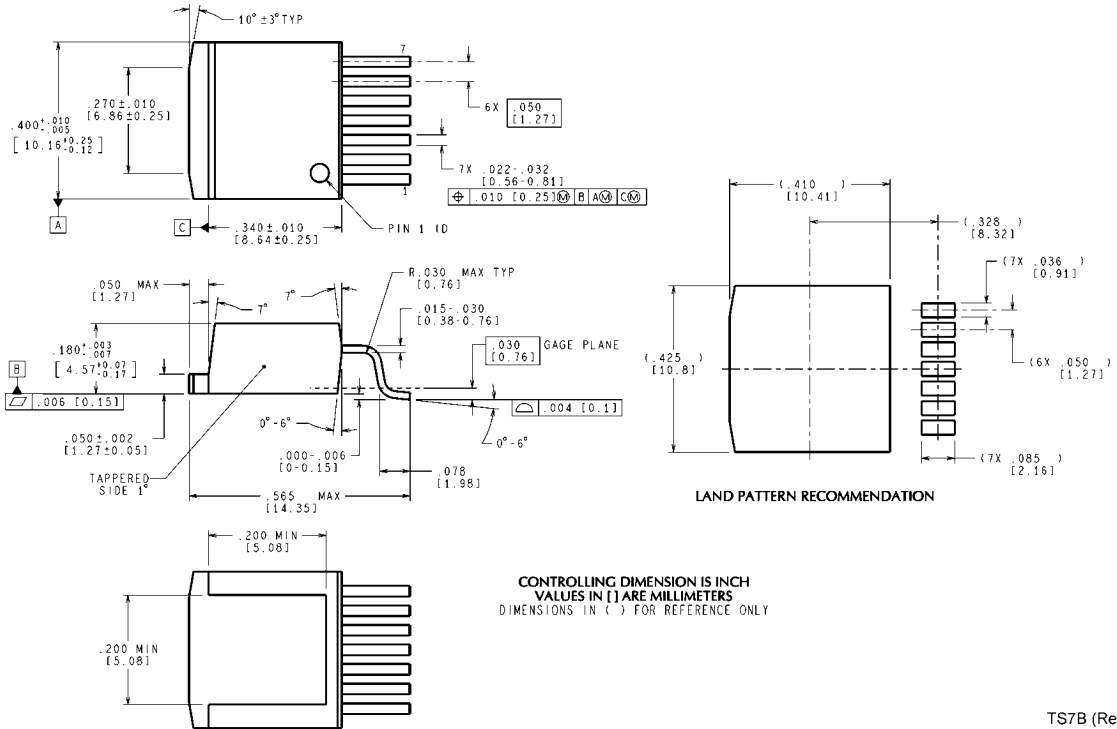
Limits appearing in **bold type face** apply over the entire junction temperature range of operation, -40°C to 125°C .

Specifications appearing in normal type apply for $T_A = T_J = 25^{\circ}\text{C}$. Unless otherwise specified $V_{IN}=12\text{V}$ for the 3.3V, 5V and Adjustable versions and $V_{IN}=24\text{V}$ for the 12V version, Sync pin open circuited..

Symbol	Parameter	Conditions	Typ	Min	Max	Units	
DEVICE PARAMETERS							
I_Q	Quiescent Current	$V_{FEEDBACK} = 8\text{V}$ For 3.3V, 5.0V, and ADJ Versions $V_{FEEDBACK} = 15\text{V}$ For 12V Versions	4.2		6	mA	
I_{STBY}	Standby Quiescent Current	ON/OFF Pin = 0V	50		100/150	μA	
I_{CL}	Current Limit		7	6.1/5.75	8.3/8.75	A	
I_L	Output Leakage Current	$V_{IN} = 40\text{V}$, ON/OFF Pin = 0V $V_{SWITCH} = 0\text{V}$	1		200	μA	
		$V_{SWITCH} = -1\text{V}$	6		15	mA	
$R_{DS(ON)}$	Switch On-Resistance	$I_{SWITCH} = 5\text{A}$	0.12		0.14/0.225	Ω	
f_O	Oscillator Frequency	Measured at Switch Pin	260	225	280	kHz	
D	Duty Cycle	Maximum Duty Cycle	91			%	
		Minimum Duty Cycle	0			%	
I_{BIAS}	Feedback Bias Current	$V_{FEEDBACK} = 1.3\text{V}$ ADJ Version Only	85			nA	
$V_{ON/OFF}$	ON/OFF Threshold Voltage		1.4	0.8	2.0	V	
$I_{ON/OFF}$	ON/OFF Input Current	ON/OFF Input = 0V	20		45	μA	
F_{SYNC}	Synchronization Frequency	$V_{SYNC}(\text{Pin } 5)=3.5\text{V}$, 50% Duty Cycle	400			KHz	
V_{SYNC}	SYNC Threshold Voltage		1.4			V	
θ_{JA}	Thermal Resistance	T Package, Junction to Ambient (Note 5)	65			$^{\circ}\text{C/W}$	
θ_{JA}		T Package, Junction to Ambient (Note 6)	45				
θ_{JC}		T Package, Junction to Case	2				
θ_{JA}		S Package, Junction to Ambient (Note 7)	56				
θ_{JA}		S Package, Junction to Ambient (Note 8)	35				
θ_{JA}		S Package, Junction to Ambient (Note 9)	26				
θ_{JC}		S Package, Junction to Case	2				
θ_{JA}		SD Package, Junction to Ambient (Note 10)	55				
θ_{JA}		SD Package, Junction to Ambient (Note 11)	29				
							++
							$^{\circ}\text{C/W}$

Note 1: Absolute Maximum Ratings are limits beyond which damage to the device may occur. Operating Ratings indicate conditions under which of the device is guaranteed. Operating Ratings do not imply guaranteed performance limits. For guaranteed performance limits and associated test condition, see the electrical Characteristics tables.

Physical Dimensions inches (millimeters) unless otherwise noted



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TO-263 Surface Mount Power Package
Order Number LM2677S-3.3, LM2677S-5.0,
LM2677S-12 or LM2677S-ADJ
NS Package Number TS7B

TS7B (Rev E)