National Semiconductor

MILITARY DATA SHEET

MNLM1577-X-15 REV 0A0

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SIMPLE SWITCHER STEP-UP VOLTAGE REGULATOR

General Description

The LM1577-15 is a monolithic integrated circuit that provides all of the power and control functions for set-up (boost), flyback, and forward converter switching regulators.

Requiring a minimum number of external components, this regulator is cost effective, and simple to use.

Included on the chip is a 3.0A NPN switch and its associated protection circuitry, consisting of current and thermal limiting, and undervoltage lockout. Other features include a 52kHz fixed-frequency oscillator that requires no external components, a soft start mode to reduce in-rush current during start-up and current mode control for improved rejection of input voltage and output load transients.

Industry Part Number

LM1577

NS Part Numbers

LM1577K-15/883 (*)
LM1577TH-15/883 (**)

Prime Die

LM1577D

Controlling Document

5962-9216801MXA*, QYA** REV A

Processing

MIL-STD-883, Method 5004

Quality Conformance Inspection

MIL-STD-883, Method 5005

Subgrp	Description	Temp (^{o}C)
1	Static tests at	+25
2	Static tests at	+125
3	Static tests at	-55
4	Dynamic tests at	+25
5	Dynamic tests at	+125
6	Dynamic tests at	-55
7	Functional tests at	+25
8A	Functional tests at	+125
8B	Functional tests at	-55
9	Switching tests at	+25
10	Switching tests at	+125
11	Switching tests at	-55

Features

- Requires few external components
- NPN output switches 3.0A, can stand off 65V
- Wide input voltage range: 3.5V to 40V
- Current-mode operation for improved transient response, line regulation, and current limit
- 52kHz internal oscillator
- Soft-start function reduces in-rush current during start-up
- Output switch protected by current limit, under-voltage lockout, and thermal shutdown

Applications

- Simple boost regulator
- Flyback and forward regulators
- Multiple-output regulator

(Absolute Maximum Ratings)

(Note 1)

Supply Voltage	45V
Output Switch Voltage	65V
Output Switch Current (Note 2)	6.0A
Power Dissipation	Internally Limited
Storage Temperature Range	-65 C to +150 C
Lead Temperature (Soldering, 10 seconds)	260 C
Maximum Junction Temperature	150 C
Thermal Resistance	
ThetaJA	
TO3 (Still Air)	38 C/W
TO3 (500LF/Min Air flow)	15.5 C/W
MD078 (Still Air)	57 C/W
MD078 (500LF/Min Air flow)	16 C/W
ThetaJC	
TO3	2.0 C/W
MD078	1.6 C/W
Minimum ESD Rating (Note 3)	2kV

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating ratings indicate conditions for which the device is intended to be functional, but device parameter specifications may not be guaranteed under these conditions. For guaranteed specifications and test conditions, see the Electrical Characteristics.

Note 2: Due to timing considerations of the LM1577 current limit circuit, output current cannot be internally limited when the LM1577 is used as a set-up regulator. To prevent damage to the switch, its current must be externally limited to 6.0A. However, output current is internally limited when the LM1577 is used as a flyback or forward converter regulator in accordance to the Application Hints.

Note 3: Human body model, 1.5K Ohm in series with 100pF.

Recommended Operating Conditions

Supply Voltage	$3.5V \leq Vin \leq 40V$
Output Switch Voltage	$0V \leq Vswitch \leq 60V$
Output Switch Current	$Iswitch \leq 3.0A$
Temperature Range	$-55\ C \leq TA \leq +125\ C$

Electrical Characteristics

DC: SYSTEM PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: Vin = 5V, Iswitch = 0

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Vout	Output Voltage	Vin = 5V to 12V, Iload = 100mA to 600mA			14.50	15.50	V	1
					14.25	15.75	V	2, 3
Delta Vout/Delta Vin	Line Regulation	Vin = 3.5V to 12V, Iload = 300mA				50	mV	1
						100	mV	2, 3
Delta Vout/Delta Load	Load Regulation	Vin = 5V, Iload = 100mA to 600mA				50	mV	1
						100	mV	2, 3

Electrical Characteristics

DC: DEVICE PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: Vin = 5V, Iswitch = 0

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Is	Input Supply Current	Vfeedback = 18V (Switch Off)				10.0	mA	1
						14.0	mA	2, 3
		Iswitch = 2.0A, Vcomp = 2.0V (Max Duty Cycle)				50	mA	1
						85	mA	2, 3
Vuv	Input Supply Undervoltage Lockout	Iswitch = 100mA			2.70	3.10	V	1
					2.65	3.15	V	2, 3
Vref	Output Reference Voltage	Measured at Feedback Pin, Vin = 3.5V to 40V, Vcomp = 1.0V			14.70	15.30	V	1
					14.55	15.45	V	2, 3
GM	Error Amp Transconductor	Icomp = -30uA to +30uA, Vcomp = 1.0V			170	420	uM	1
					110	500	uM	2, 3
Avol	Error Amp Voltage Gain	Vcomp = 1.1V to 1.6V, Rcomp = 1.0 M Ohm	1		40		V/V	1
			1		20		V/V	2, 3
	Error Amplifier Output Swing	Upper Limit Vfeedback = 12.0V			2.2	5.0	V	1
					2.0	5.0	V	2, 3
		Lower Limit Vfeedback = 18.0V				0.40	V	1
						0.55	V	2, 3
	Error Amplifier Output Current	Vfeedback = 12.0V to 18.0V, Vcomp = 1.0V			-300	-130	uA	1
					-400	-90	uA	2, 3
		Vfeedback = 12.0V to 18.0V, Vcomp=1.0V			130	300	uA	1
					90	400	uA	2, 3
Iss	Soft Start Current	Vfeedback = 12.0V, Vcomp = 0V			2.5	7.5	uA	1
					1.5	9.5	uA	2, 3
D	Maximum Duty Cycle	Vcomp = 1.5V, Iswitch = 100mA			93		%	1
					90		%	2, 3
Il	Switch Leakage Current	Vswitch = 65V, Vfeedback = 18.0V (Switch Off)			-1.0	300	uA	1
					-1.0	600	uA	2, 3
Vsat	Switch Saturation Voltage	Iswitch = 2.0A, Vcomp = 2.0V (Max Duty Cycle)				700	mV	1
						900	mV	2, 3
	NPN Switch Current Limit	Vcomp = 2.0V			3.7	5.3	A	1
					3.0	6.0	A	2, 3

Electrical Characteristics

AC: PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)
AC: Vin = 5V, Iswitch = 0

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
fo	Oscillator Frequency	Measured at Switch Pin, Iswitch = 100mA			48	56	KHz	4
					42	62	KHz	5, 6

Note 1: A 1.0 MOhm resistor is connected to the compensation pin (which is the error amplifier's output) to ensure accuracy in measuring Avol. In actual applications, this pins load resistance should be ≥ 10 MOhm, resulting in Avol that is typically twice the guaranteed minimum limit.