8A and 10A High Efficiency Switching Regulators

FEATURES

- Wide Input Voltage Range: 3.5V to 30V
- Low Quiescent Current: 7mA
- Internal 8A Switch (10A for LT1270A)
- Very Few External Parts Required
- Self-Protected Against Overloads
- Shutdown Mode Draws Only 100µA Supply Current
- Flyback-Regulated Mode Has Fully Floating Outputs
- Can be Externally Synchronized (See LT1072 Data Sheet)
- Comes in Standard 5-Pin TO-220 Package

APPLICATIONS

- High Efficiency Buck Converter
- PC Power Supply with Multiple Outputs
- Battery Upconverter
- Negative-to-Positive Converter

USER NOTE:

This data sheet is only intended to provide specifications, graphs and a general functional description of the LT1270A/LT1270. Application circuits are included to show the capability of the LT1270A/LT1270. A complete design manual (AN-19) should be obtained to assist in developing new designs. AN-19 contains a comprehensive discussion of both the LT1070 and the external components used with it, as well as complete formulas for calculating the values of these components. AN-19 can also be used for the LT1270A/LT1270 by factoring in the higher switch current rating and higher operating frequency.

A comprehensive CAD program called SwitcherCad is also available. Contact the local sales office in your area or the factory direct.

DESCRIPTION

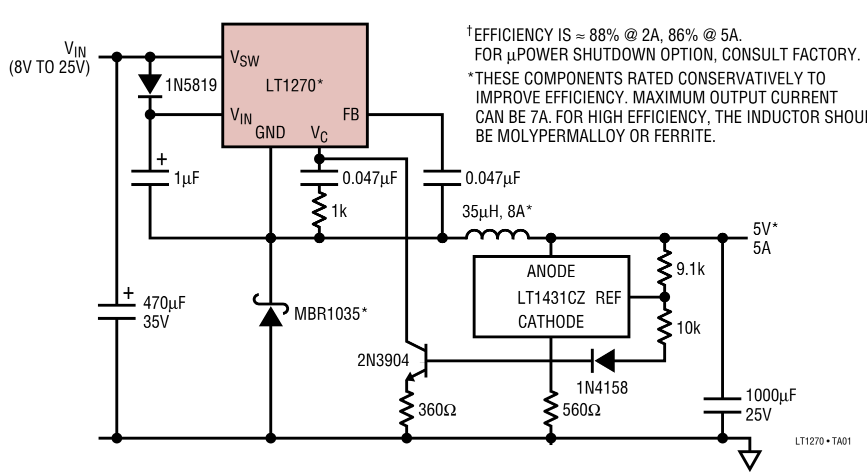
The LT1270A/LT1270 are monolithic high power switching regulators. Identical to the popular LT1070, except for switching frequency (60kHz) and higher switch current, they can be operated in all standard switching configurations including buck, boost, flyback, and inverting. A high current, high efficiency switch is included on the die along with all oscillator, control, and protection circuitry. Integration of all functions allows the LT1270A/LT1270 to be built in a standard TO-220 power package. This makes it extremely easy to use and provides "bust proof" operation similar to that obtained with 3-pin linear regulators.

The LT1270A/LT1270 operate with supply voltages from 3.5V to 30V, and draw only 7mA quiescent current. By utilizing current-mode switching techniques, they provide excellent AC and DC load and line regulation.

The LT1270A/LT1270 use adaptive anti-sat switch drive to allow very wide ranging load currents with no loss in efficiency. An externally activated shutdown mode reduces total supply current to 100µA typical for standby operation.

TYPICAL APPLICATION

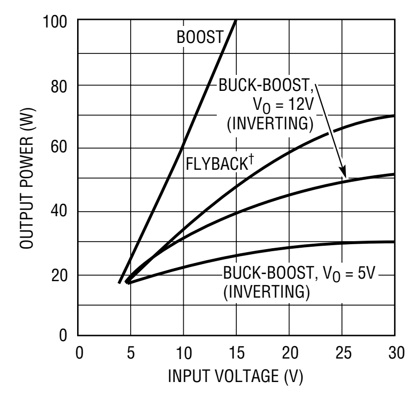
High Efficiency† Buck Converter



†EFFICIENCY IS ≈ 88% @ 2A, 86% @ 5A. FOR µPOWER SHUTDOWN OPTION, CONSULT FACTORY.

*THESE COMPONENTS RATED CONSERVATIVELY TO IMPROVE EFFICIENCY. MAXIMUM OUTPUT CURRENT CAN BE 7A. FOR HIGH EFFICIENCY, THE INDUCTOR SHOULD BE MOLYPERMALLOY OR FERRITE.

Maximum Output Power*



*MULTIPLY BY 1.2 FOR LT1270A. BUCK MODE OUTPUT POWER ≈ (7.5A)(V_{OUT})

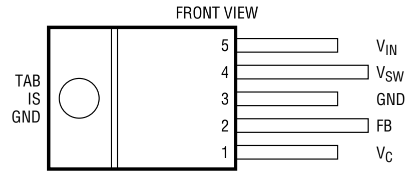
†TRANSFORMER TURNS RATIO MUST BE OPTIMUM TO ACHIEVE FULL POWER

ABSOLUTE MAXIMUM RATINGS

(Note 1)

Supply Voltage 30V
Switch Output Voltage 60V
Feedback Pin Voltage (Transient, 1ms) .... ±15V
Operating Junction Temperature Range
  LT1270AC/LT1270C (Oper.) .... 0°C to 125°C
  LT1270AC/LT1270C (Short-Ckt) .... 0°C to 140°C
Storage Temperature Range .... –65°c to 150°C
Lead Temperature (Soldering, 10 sec) .... 300°C

PACKAGE/ORDER INFORMATION



T PACKAGE
5-LEAD PLASTIC TO-220

$T_{JMAX} = 100°C$, $\theta_{JA} = 2°C/W$, $\theta_{JA} = 50°C/W$

ORDER PART NUMBER
LT1270CT LT1270ACT

Consult LTC Marketing for parts specified with wider operating temperature ranges.

ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range, otherwise specifications are at $T_A = 25°C$. $V_{IN} = 15V$, $V_C = 0.5V$, $V_{FB} = V_{REF}$, switch pin open, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
V_{REF}	Reference Voltage	Measured at Feedback Pin $V_C = 0.8V$	 ●	1.224 1.214	1.244 1.244	1.264 1.274	V V
I_B	Feedback Input Current	$V_{FB} = V_{REF}$			350	750 1100	nA nA
gm	Error Amplifier Transconductance	$\Delta I_C = \pm 25\mu A$	 ●	3000 2400	4400	6000 7000	µmho µmho
	Error Amplifier Source of Sink Current	$V_C = 1.5V$	 ●	150 120	200	350 400	µA µA
	Error Amplifier Clamp Voltage	Hi Clamp, $V_{FB} = 1V$ Lo Clamp, $V_{FB} = 1.5V$		1.80 0.25	 0.38	2.30 0.52	V V
	Reference Voltage Line Regulation	$3V \le V_{IN} \le V_{MAX}$, $V_C = 0.8V$	●			0.03	%/V
A_V	Error Amplifier Voltage Gain	$0.9V \le V_C \le 1.4V$		500	800		V/V
	Minimum Input Voltage		●		2.8	3.0	V
I_Q	Supply Current	$3V \le V_{IN} \le V_{MAX}$, $V_C = 0.6V$			7	10	mA
	Control Pin Threshold	Duty Cycle = 0	 ●	0.70 0.50	0.90	1.08 1.25	V V
	Normal/Flyback Threshold on Feedback Pin			0.40	0.45	0.54	V
V_{FB}	Flyback Reference Voltage	$I_{FB} = 50\mu A$	 ●	15.0 14.0	16.3	17.6 18.0	V V
V_{FB}	Change in Flyback Reference Voltage	$0.05 \le I_{FB} \le 1mA$		4.5	6.8	8.5	V
	Flyback Reference Voltage Line Regulation	$I_{FB} = 50\mu A$ $3V \le V_{IN} \le V_{MAX}$			0.01	0.03	%/V
	Flyback Amplifier Transconductance (gm)	$\Delta I_C = \pm 10\mu A$		150	300	650	µmho
	Flyback Amplifier Source and Sink Current	$V_C = 0.6V$ Source $I_{FB} = 50\mu A$ Sink	● ●	15 25	32 40	70 70	µA µA
BV	Output Switch Breakdown Voltage	$3V \le V_{IN} \le V_{MAX}$ $I_{SW} = 1.5mA$	●	60	75		V
V_{SAT}	Output Switch ON Resistance (Note 2, 4)	$T_J \le 100°C$ $T_J \le 125°C$			0.12	0.18 0.22	Ω Ω
	Control Voltage to Switch Current Transconductance				12		A/V
LIM	Switch Current Limit (LT1270) (Note 4)	Duty Cycle = 50%, $T_J \le 100°C$ Duty Cycle = 80%, $T_J \le 100°C$	● ●	8 6		16 14	A A

ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range, otherwise specifications are at T_A = 25°C. V_{IN} = 15V, V_C = 0.5V, V_{FB} = V_{REF}, switch pin open, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
I_{LIM}	Switch Current Limit (LT1270A) (Note 4)	Duty Cycle = 50%, $T_J \le$ 100°C Duty Cycle = 80%, $T_J \le$ 100°C	● ●	10.0 7.5		16.0 14.0	A A
$\frac{\Delta I_{IN}}{\Delta I_{SW}}$	Supply Current Increase During Switch-ON Time				25	40	mA/A
f	Switching Frequency		 ●	50 50	60	70 70	kHz kHz
DC_{MAX}	Maximum Switch Duty Cycle			80	92	95	%
	Flyback Sense Delay Time				1.5		µs
	Shutdown Mode Supply Current	$3V \le V_{IN} \le V_{MAX}$, V_C = 0.05V			100	400	µA
	Shutdown Mode Threshold Voltage	$3V \le V_{IN} \le V_{MAX}$	 ●	100 50	150	250 300	mV mV

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

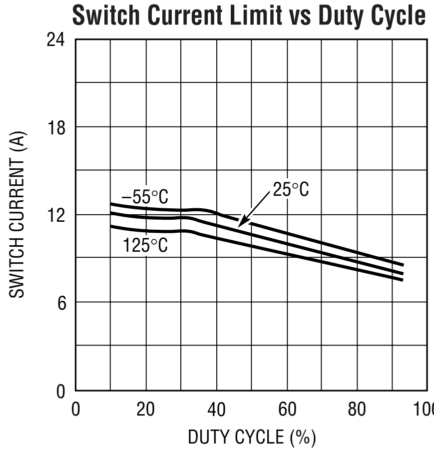
Note 2: Measured with V_C in Hi Clamp, V_{FB} = 0.8V.

Note 3: For duty cycles (DC) between 50% and 80%, minimum guaranteed switch current is given by I_{LIM} = 6.67 (1.7 – DC) for the LT1270 and I_{LIM} = 8.33 (1.7 – DC) for the LT1270A.

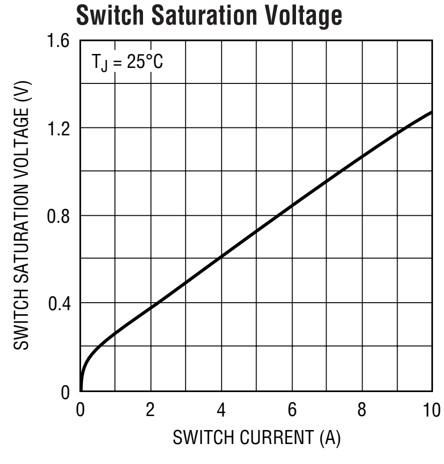
Note 4: Minimum current limit is reduced by 0.5A at 125°C. 100°C test limits are guaranteed by correlation to 125°C tests.

TYPICAL PERFORMANCE CHARACTERISTICS

Switch Current Limit vs Duty Cycle

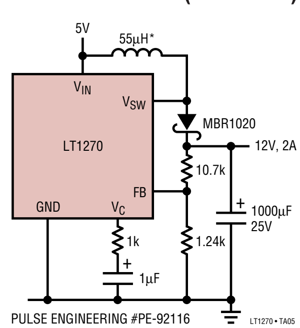


Switch Saturation Voltage



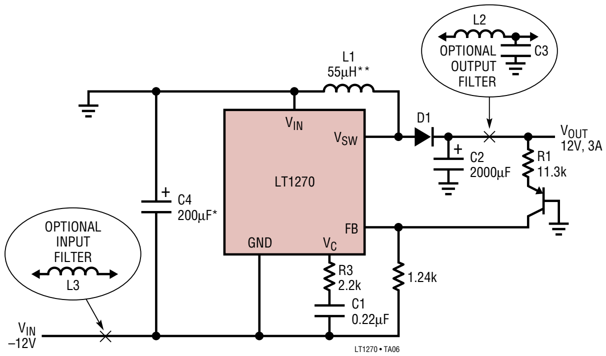
TYPICAL APPLICATIONS

Boost Converter (5V to 12V)



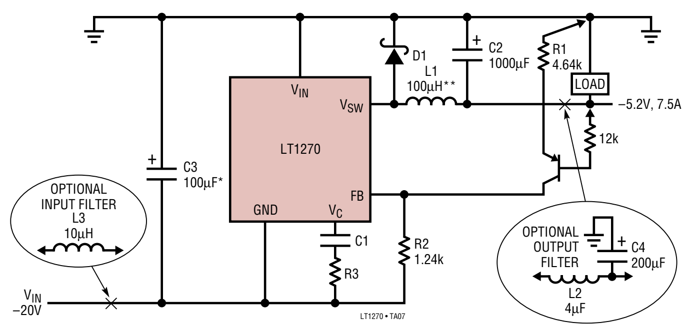
TYPICAL APPLICATIONS

Negative-to-Positive Buck-Boost Converter



*REQUIRED IF INPUT LEADS ≥ 2"
**PULSE ENGINEERING #PE-92116

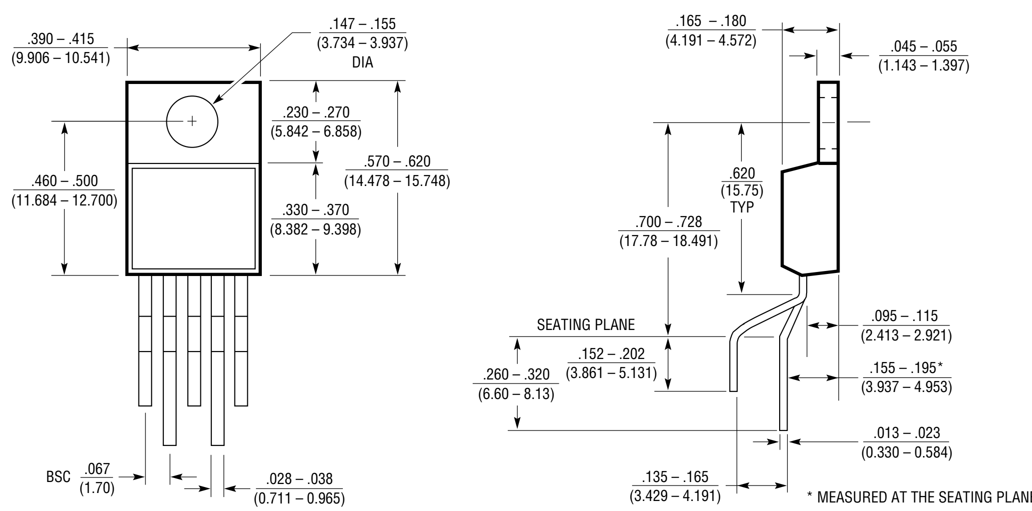
Negative Buck Converter



*REQUIRED IF INPUT LEADS ≥ 2"
**PULSE ENGINEERING #PE-92115

PACKAGE DESCRIPTION

T Package
5-Lead Plastic TO-220 (Standard)
(Reference LTC DWG # 05-08-1421)



* MEASURED AT THE SEATING PLANE
T5 (TO-220) 0801

RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LT1074/HV	4.4A (I_{OUT}), 100kHz, High Efficiency Step-Down DC/DC Converter	V_{IN}: 7.3V to 45/64V, V_{OUT} (min) = 2.21V, I_Q = 8.5mA, I_{SD} = 10μA, DD-5/7, TO220-5/7
LTC3414	4A (I_{OUT}), 4MHz, Synchronous Step-Down DC/DC Converter	V_{IN}: 2.3V to 5.5V, V_{OUT} (min) = 0.8V, I_Q = 64μA, I_{SD} <1μA, TSSOP20E
LT3430/LT3431	60V, 2.75A (I_{OUT}), 200/500kHz, High Efficiency Step-Down DC/DC Converter	V_{IN}: 5.5V to 60V, V_{OUT} (min) = 1.2V, I_Q = 2.5mA, I_{SD} = 30μA, TSSOP16E

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