5V Step-Down Switching Regulator

FEATURES

- Fixed 5V Output
- 2A On-Board Switch
- 100kHz Switching Frequency
- 2% Output Voltage Tolerance Over Temperature
- Greatly Improved Dynamic Behavior
- Available in Low Cost 5-Lead Package
- Only 9.5mA Quiescent Current
- Operates Up to 60V Input

APPLICATIONS

- 5V Output Buck Converter
- Tapped Inductor Buck Converter with 4A Output at 5V
- Positive-to-Negative Converter

DESCRIPTION

The LT1076-5 is a 2A fixed 5V output monolithic bipolar switching regulator which requires only a few external parts for normal operation. The power switch, all oscillator and control circuitry, all current limit components, and an output monitor are included on the chip. The topology is a classic positive "buck" configuration but several design innovations allow this device to be used as a positive-to-negative converter, a negative boost converter, and as a flyback converter. The switch output is specified to swing 40V below ground, allowing the LT1076-5 to drive a tapped inductor in the buck mode with output currents up to 4A.

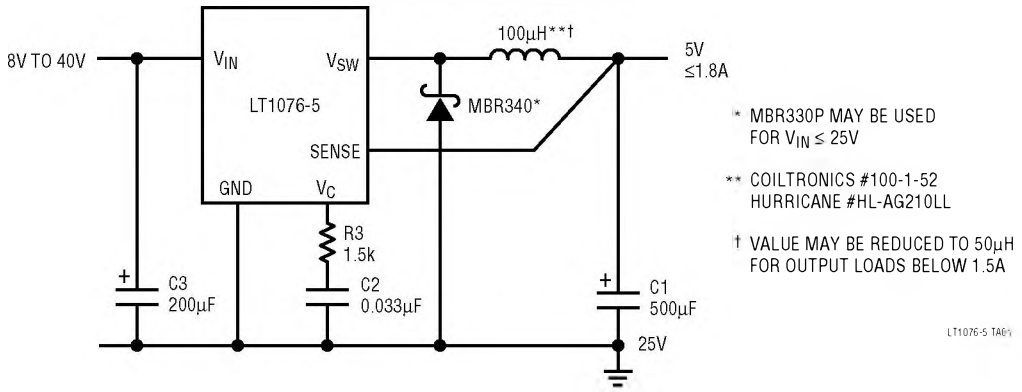
The LT1076-5 uses a true analog multiplier in the feedback loop. This makes the device respond nearly instantaneously to input voltage fluctuations and makes loop gain independent of input voltage. As a result, dynamic behavior of the regulator is significantly improved over previous designs.

On-chip pulse by pulse current limiting makes the LT1076-5 nearly bust-proof for output overloads or shorts. The input voltage range as a buck converter is 8V to 60V, but a self-boot feature allows input voltages as low as 5V in the inverting and boost configurations.

The LT1076-5 is available in a low cost 5-lead TO-220 package with frequency pre-set at 100kHz and current limit at 2.6A. See Application Note 44 for design details.

TYPICAL APPLICATION

Basic Positive Buck Converter



ABSOLUTE MAXIMUM RATINGS

Input Voltage
- LT1076-5 ..... 45V
- LT1076HV-5 ..... 64V

Switch Voltage with Respect to Input Voltage
- LT1076-5 ..... 64V
- LT1076HV-5 ..... 75V

Switch Voltage with Respect to Ground Pin (V_{SW} **Negative**)
- LT1076-5 (Note 5) 35V
- LT1076HV-5 (Note 5) 45V

Sense Pin Voltage ..... –2V, 10V

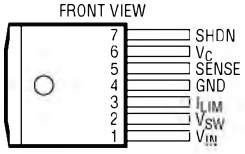
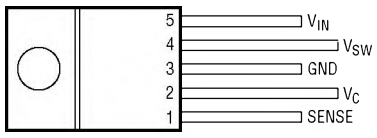
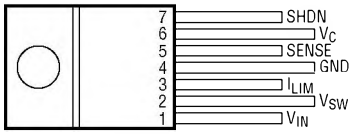
Maximum Operating Ambient Temperature Range
- LT1076C-5, LT1076HVC-5 ..... 0°C to 70°C
- LT1076I-5, LT1076HVI-5 ..... –40°C to 85°C

Maximum Operating Junction Temperature Range
- LT1076C-5, LT1076HVC-5 ..... 0°C to 125°C
- LT1076I-5, LT1076HVI-5 ..... –40°C to 125°C

Maximum Storage Temperature ..... –65°C to 150°C

Lead Temperature (Soldering, 10 sec) ..... 300°C

PACKAGE/ORDER INFORMATION

	ORDER PART NUMBER
FRONT VIEW  R PACKAGE 7-LEAD PLASTIC DD T_{JMAX} = 110°C θ WILL VARY FROM APPROXIMATELY 30°C/W WITH 2.8IN² OF 1 OZ COPPER TO 70°C/W WITH 0.20IN² OF 1 OZ COPPER	LT1076CR-5
FRONT VIEW  T PACKAGE 5-LEAD TO-220 FOR STRAIGHT LEADS, ORDER FLOW 06 T_{JMAX} = 110°C, θ_{JA} = 130°C/W	LT1076CT-5 LT1076HVCT-5 LT1076IT-5 LT1076HVIT-5
FRONT VIEW  Y PACKAGE 7-LEAD TO-220 T_{JMAX} = 110°C, θ_{JA} = 130°C/W	LT1076CY-5

Consult factory for Military grade parts.

ELECTRICAL CHARACTERISTICS

T_J = 25°C, V_{IN} = 25V, unless otherwise noted.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Switch "On" Voltage (Note 1)	I_{SW} = 0.5A I_{SW} = 2A	● ●			1.2 1.7	V V
Switch "Off" Leakage	V_{IN} = 25V, V_{SW} = 0 V_{IN} = V_{MAX}, V_{SW} = 0 (Note 6)				150 250	µA µA
Supply Current (Note 2)	V_{OUT} = 5.5V, V_{IN} ≤ 40V 40V < V_{IN} < 60V V_{SHDN} = 0.1V (Device Shutdown) (Note 8)	● ●		8.5 9.0 140	11 12 300	mA mA µA
Minimum Supply Voltage	Normal Mode Start-Up Mode (Note 3)	● ●		7.3 3.5	8.0 4.8	V V
Switch Current Limit (Note 4)	I_{LIM} = Open R_{LIM} = 10k (Note 9) R_{LIM} = 7k (Note 9)	●	2	2.6 1.8 1.2	3.2	A A A
Maximum Duty Cycle		●	85	90		%

ELECTRICAL CHARACTERISTICS $T_J = 25°C$, $V_{IN} = 25V$, unless otherwise noted.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Switching Frequency			90	100	110	kHz
	$T_J \leq 125°C$	●	85		120	kHz
	$V_{OUT} = V_{SENSE} = 0V$ (Note 4)			20		kHz
Switching Frequency Line Regulation	$8V \leq V_{IN} \leq V_{MAX}$ (Note 7)	●		0.03	0.1	%/V
Error Amplifier Voltage Gain (Note 7)	$1V \leq V_C \leq 4V$			2000		V/V
Error Amplifier Transconductance (Note 7)			3700	5000	8000	μmho
Error Amplifier Source and Sink Current	Source ($V_{SENSE} = 4.5V$)		100	140	225	μA
	Sink ($V_{SENSE} = 5.5V$)		0.7	1.0	1.6	mA
Sense Pin Divider Resistance			3	5	8	kΩ
Sense Voltage	$V_C = 2V$	●	4.85	5	5.15	V
Output Voltage Tolerance	V_{OUT} (Nominal) = 5V			±0.5	±2	%
	All Conditions of Input Voltage, Output Voltage, Temperature and Load Current	●		±1.0	±3	%
Output Voltage Line Regulation	$8V \leq V_{IN} \leq V_{MAX}$ (Note 6)	●		0.005	0.02	%/V
V_C Voltage at 0% Duty Cycle				1.5		V
	Over Temperature	●		–4.0		mV/°C
Multiplier Reference Voltage				24		V
Shutdown Pin Current	$V_{SHDN} = 5V$		5	10	20	μA
	$V_{SHDN} \leq V_{THRESHOLD}$ (≅ 2.5V)				50	μA
Shutdown Thresholds	Switch Duty Cycle = 0		2.2	2.45	2.7	V
	Fully Shut Down		0.1	0.30	0.5	V
Thermal Resistance Junction to Case					4	°C/W

The ● denotes specifications which apply over the full operating temperature range.

Note 1: To calculate maximum switch "on" voltage at currents between low and high conditions, a linear interpolation may be used.

Note 2: A sense pin voltage (V_{SENSE}) of 5.5V forces the V_C pin to its low clamp level and the switch duty cycle to zero. This approximates the zero load condition where duty cycle approaches zero.

Note 3: Total voltage from V_{IN} pin to ground pin must be ≥ 8V after start-up for proper regulation. For $T_A < 25°C$, limit = 5V.

Note 4: Switch frequency is internally scaled down when the sense pin voltage is less than 2.6V to avoid extremely short switch on times. During current limit testing, V_{SENSE} is adjusted to give a minimum switch on time of 1μs.

Note 5: Switch to input voltage limitation must also be observed.

Note 6: V_{MAX} = 40V for the LT1076-5 and 60V for the LT1076HV-5.

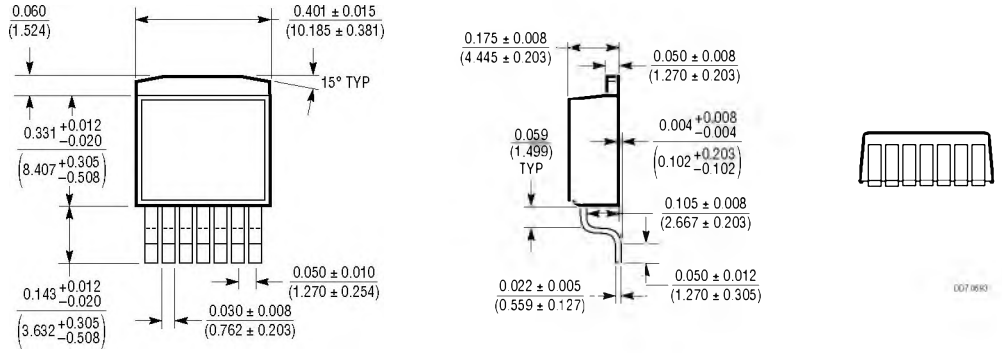
Note 7: Error amplifier voltage gain and transconductance are specified relative to the internal feedback node. To calculate gain and transconductance from the Sense pin (Output) to the V_C pin, multiply by 0.44.

Note 8: Does not include switch leakage.

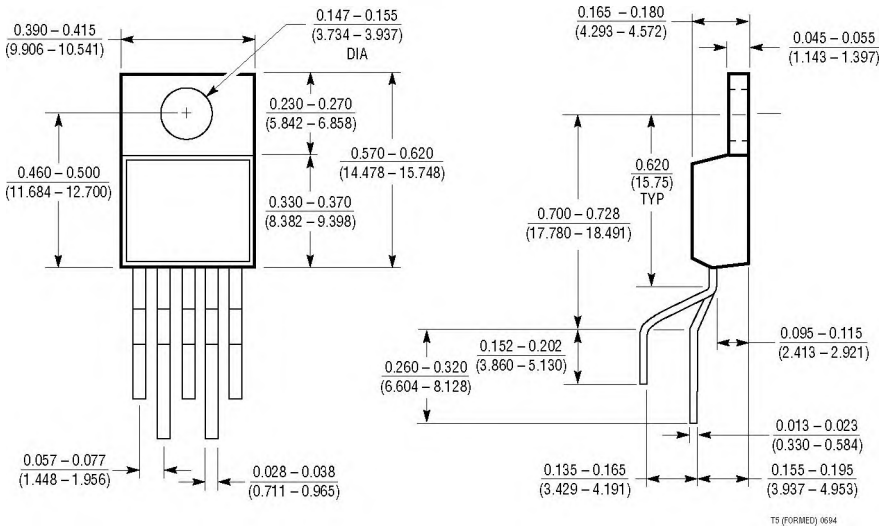
Note 9: $I_{LIM} \approx \frac{R_{LIM} - 1k}{5k}$

PACKAGE DESCRIPTION Dimensions in inches (millimeters) unless otherwise noted.

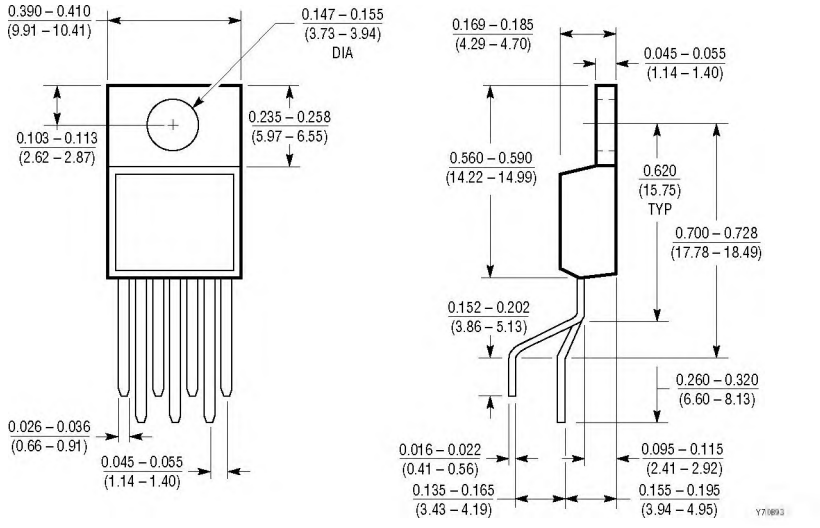
R Package, 7-Lead Plastic DD



T Package, 5-Lead TO-220



Y Package, 7-Lead TO-220



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