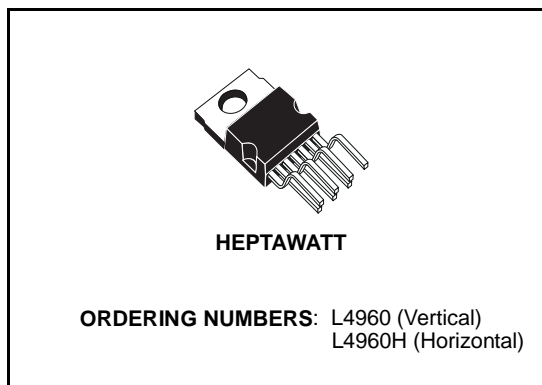


2.5A POWER SWITCHING REGULATOR

- 2.5A OUTPUT CURRENT
- 5.1V TO 40V OPUTPUT VOLTAGE RANGE
- PRECISE ($\pm 2\%$) ON-CHIP REFERENCE
- HIGH SWITCHING FREQUENCY
- VERY HIGH EFFICIENCY (UP TO 90%)
- VERY FEW EXTERNAL COMPONENTS
- SOFT START
- INTERNAL LIMITING CURRENT
- THERMAL SHUTDOWN



DESCRIPTION

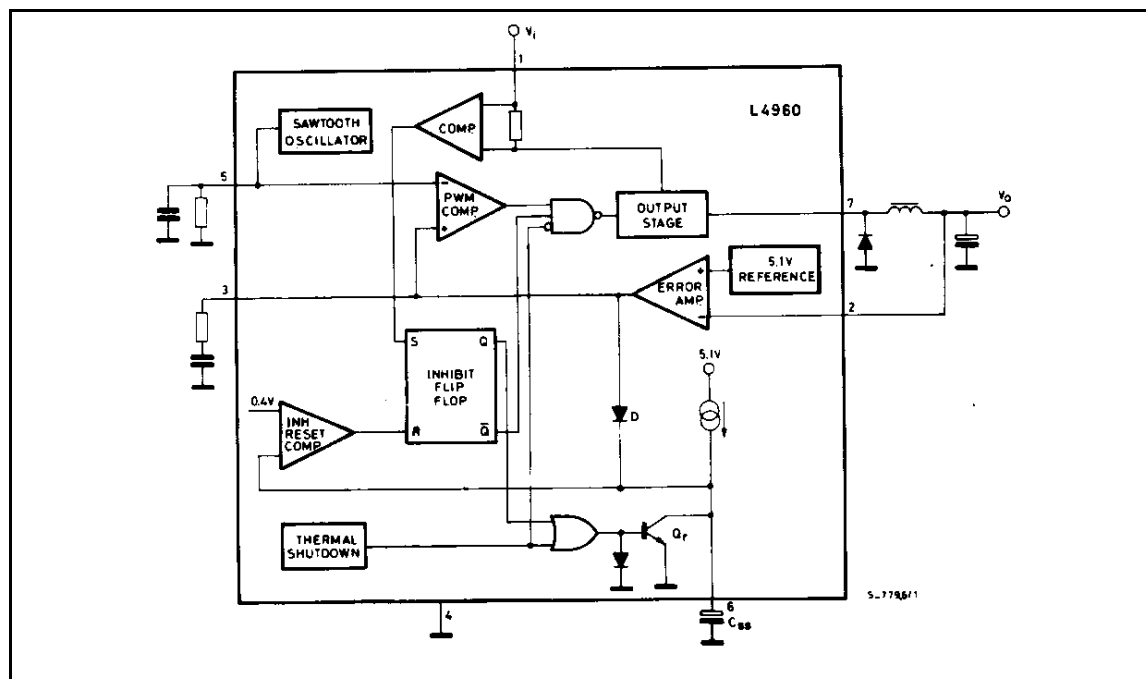
The L4960 is a monolithic power switching regulator delivering 2.5A at a voltage variable from 5V to 40V in step down configuration.

Features of the device include current limiting, soft start, thermal protection and 0 to 100% duty cycle for continuous operation mode.

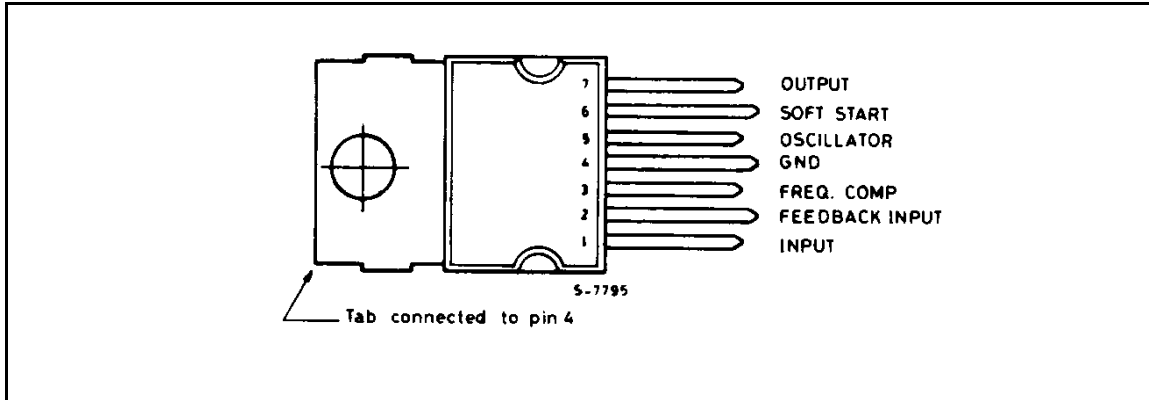
The L4960 is mounted in a Heptawatt plastic power package and requires very few external components.

Efficient operation at switching frequencies up to 150KHz allows a reduction in the size and cost of external filter components.

BLOCK DIAGRAM



PIN CONNECTION (Top view)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_1	Input voltage	50	V
$V_1 - V_7$	Input to output voltage difference	50	V
V_7	Negative output DC voltage	-1	V
	Negative output peak voltage at $t = 0.1\mu\text{s}$; $f = 100\text{KHz}$	-5	V
V_3, V_6	Voltage at pin 3 and 6	5.5	V
V_2	Voltage at pin 2	7	V
I_3	Pin 3 sink current	1	mA
I_5	Pin 5 source current	20	mA
P_{tot}	Power dissipation at $T_{\text{case}} \leq 90^\circ\text{C}$	15	W
T_j, T_{stg}	Junction and storage temperature	-40 to 150	$^\circ\text{C}$

PIN FUNCTIONS

N°	NAME	FUNCTION
1	SUPPLY VOLTAGE	Unregulated voltage input. An internal regulator powers the internal logic.
2	FEEDBACK INPUT	The feedback terminal of the regulation loop. The output is connected directly to this terminal for 5.1V operation; it is connected via a divider for higher voltages.
3	FREQUENCY COMPENSATION	A series RC network connected between this terminal and ground determines the regulation loop gain characteristics.
4	GROUND	Common ground terminal.
5	OSCILLATOR	A parallel RC network connected to this terminal determines the switching frequency.
6	SOFT START	Soft start time constant. A capacitor is connected between this terminal and ground to define the soft start time constant. This capacitor also determines the average short circuit output current.
7	OUTPUT	Regulator output.

THERMAL DATA

Symbol	Parameter	Value	Unit
$R_{th\ j-case}$	Thermal resistance junction-case	max	4 °C/W
$R_{th\ j-amb}$	Thermal resistance junction-ambient	max	50 °C/W

ELECTRICAL CHARACTERISTICS (Refer to the test circuit, $T_j = 25\text{ °C}$, $V_i = 35V$, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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DYNAMIC CHARACTERISTICS

V_o	Output voltage range	$V_i = 46V$ $I_o = 1A$	V_{ref}		40	V
V_i	Input voltage range	$V_o = V_{ref}$ to 36V $I_o = 2.5A$	9		46	V
ΔV_o	Line regulation	$V_i = 10V$ to 40V $V_o = V_{ref}$ $I_o = 1A$		15	50	mV
ΔV_o	Load regulation	$V_o = V_{ref}$ $I_o = 0.5A$ to 2A		10	30	mV
V_{ref}	Internal reference voltage (pin 2)	$V_i = 9V$ to 46V $I_o = 1A$	5	5.1	5.2	V
$\frac{\Delta V_{ref}}{\Delta T}$	Average temperature coefficient of refer voltage	$T_j = 0\text{ °C}$ to 125°C $I_o = 1A$		0.4		mV/°C
V_d	Dropout voltage	$I_o = 2A$		1.4	3	V
I_{om}	Maximum operating load current	$V_i = 9V$ to 46V $V_o = V_{ref}$ to 36V	2.5			A
I_{7L}	Current limiting threshold (pin 7)	$V_i = 9V$ to 46V $V_o = V_{ref}$ to 36V	3		4.5	A
I_{SH}	Input average current	$V_i = 46V$; output short-circuit		30	60	mA
η	Efficiency	$f = 100KHz$	$V_o = V_{ref}$		75	%
		$I_o = 2A$	$V_o = 12V$		85	%
SVR	Supply voltage ripple rejection	$\Delta V_i = 2V_{rms}$ ripple = 100Hz $V_o = V_{ref}$ $I_o = 1A$	50	56		dB
f	Switching frequency		85	100	115	KHz
$\frac{\Delta f}{\Delta V_i}$	Voltage stability of switching frequency	$V_i = 9V$ to 46V		0.5		%
$\frac{\Delta f}{\Delta T_j}$	Temperature stability of switching frequency	$T_j = 0\text{ °C}$ to 125°C		1		%
f_{max}	Maximum operating switching frequency	$V_o = V_{ref}$ $I_o = 2A$	120	150		KHz
T_{sd}	Thermal shutdown junction temperature			150		°C

L4960

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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DC CHARACTERISTICS

I_{1Q}	Quiescent drain current	100% duty cycle pins 5 and 7 open	$V_i = 46V$		30	40	mA
		0% duty cycle			15	20	mA
$-I_{7L}$	Output leakage current	0% duty cycle				1	mA

SOFT START

I_{6SO}	Source current		100	140	180	μA
I_{6SI}	Sink current		50	70	120	μA

ERROR AMPLIFIER

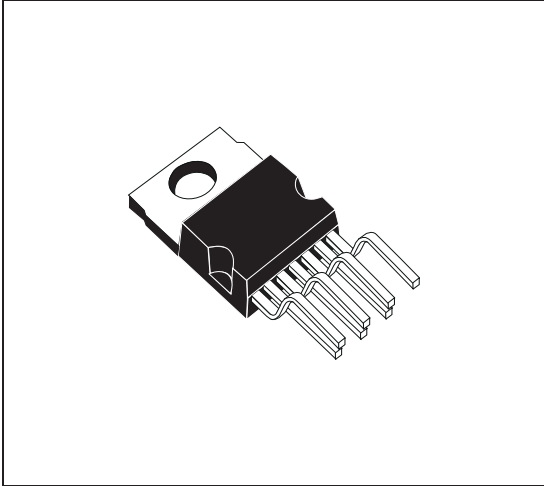
V_{3H}	High level output voltage	$V_2 = 4.7V$	$I_3 = 100\mu A$	3.5			V
V_{3L}	Low level output voltage	$V_2 = 5.3V$	$I_3 = 100\mu A$			0.5	V
I_{3SI}	Sink output current	$V_2 = 5.3V$		100	150		μA
$-I_{3SO}$	Source output current	$V_2 = 4.7V$		100	150		μA
I_2	Input bias current	$V_2 = 5.2V$			2	10	μA
G_v	DC open loop gain	$V_3 = 1V$ to $3V$		46	55		dB

OSCILLATOR

$-I_5$	Oscillator source current		5				mA
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DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			4.8			0.189
C			1.37			0.054
D	2.4		2.8	0.094		0.110
D1	1.2		1.35	0.047		0.053
E	0.35		0.55	0.014		0.022
E1	0.7		0.97	0.028		0.038
F	0.6		0.8	0.024		0.031
F1			0.9			0.035
G	2.34	2.54	2.74	0.095	0.100	0.105
G1	4.88	5.08	5.28	0.193	0.200	0.205
G2	7.42	7.62	7.82	0.295	0.300	0.307
H2			10.4			0.409
H3	10.05		10.4	0.396		0.409
L	16.7	16.9	17.1	0.657	0.668	0.673
L1		14.92			0.587	
L2	21.24	21.54	21.84	0.386	0.848	0.860
L3	22.27	22.52	22.77	0.877	0.891	0.896
L4			1.29			0.051
L5	2.6	2.8	3	0.102	0.110	0.118
L6	15.1	15.5	15.8	0.594	0.610	0.622
L7	6	6.35	6.6	0.236	0.250	0.260
L9		0.2			0.008	
M	2.55	2.8	3.05	0.100	0.110	0.120
M1	4.83	5.08	5.33	0.190	0.200	0.210
V4	40° (typ.)					
Dia	3.65		3.85	0.144		0.152

OUTLINE AND MECHANICAL DATA



Heptawatt V

