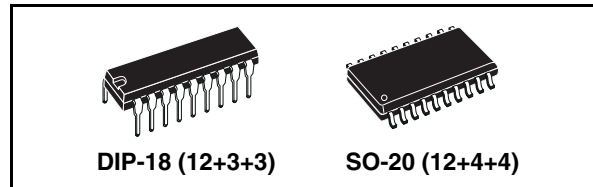


3.5A step down switching regulator

Features

- Up to 3.5A step down converter
- Operating input voltage from 8V to 55V
- 3.3V and 5.1V ($\pm 1\%$) fixed output, and adjustable outputs from:
 - 0.5V to 50V (3.3 type)
 - 5.1V to 50V (5.1 type)
- Frequency adjustable up to 300kHz
- Voltage feed forward
- Zero load current operation (min 1mA)
- Internal current limiting (pulse by pulse and HICCUP mode)
- Precise 5.1V (1.5%) reference voltage externally available
- Input/output synchronization function
- Inhibit for zero current consumption (100mA typ. at $V_{CC} = 24V$)
- Protection against feedback disconnection
- Thermal shutdown
- Output over voltage protection
- Soft start function

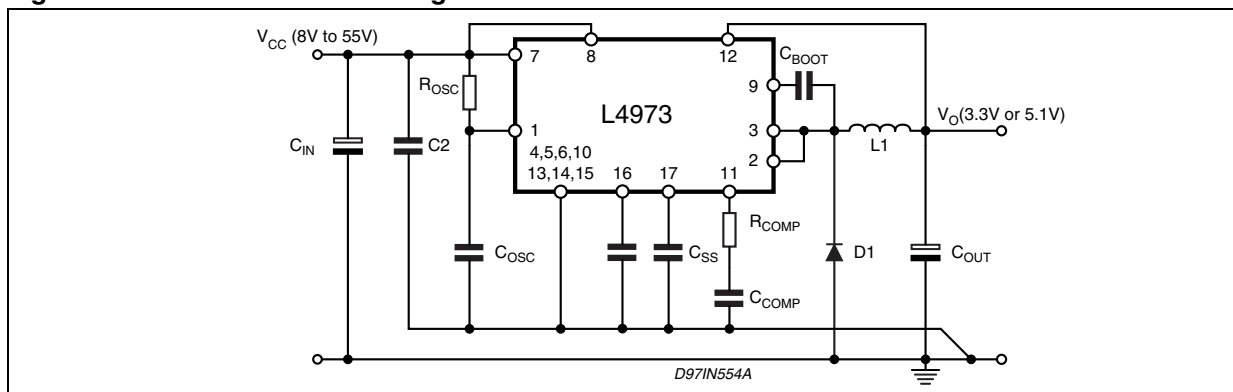


Description

The L4973 is a step down monolithic power switching regulator delivering 3.5A at fixed voltages of 3.3V or 5.1V and using a simple external divider output adjustable voltage up to 50V. Realized in BCD mixed technology, the device uses an internal power D-MOS transistor (with a typical $R_{DS(on)}$ of 0.15Ω) to obtain very high efficiency and very fast switching times. Switching frequency up to 300kHz are achievable (the maximum power dissipation of the packages must be observed).

A wide input voltage range between 8V to 55V and output voltages regulated from 3.3V to 40V cover the majority of the today applications. Features of this new generation of DC-DC converter includes pulse by pulse current limit, hiccup mode for output short circuit protection, voltage feed forward regulation, soft start, input/output synchronization, protection against feedback loop disconnection, inhibit for zero current consumption and thermal shutdown. Packages available are in plastic dual in line, DIP-18 (12+3+3) for standard assembly, and SO20 (12+4+4) for SMD assembly.

Figure 1. Internal schematic diagram



3 Electrical data

3.1 Maximum ratings

Table 2. Absolute maximum ratings

Symbol		Parameter	Value	Unit
DIP-18	SO-20			
V_7, V_8	V_9, V_8	Input voltage	58	V
V_2, V_3	V_2, V_3	Output DC voltage Output peak voltage at $t = 0.1\mu s$ $f = 200KHz$	-1 - 5	V V
I_2, I_3	I_2, I_3	Maximum output current	int. limit.	
V_9-V_8	$V_{10}-V_8$		14	V
V_9	V_{10}	Bootstrap voltage	70	V
V_{11}	V_{12}	Analog input voltage ($V_{CC} = 24V$)	12	V
V_{17}	V_{19}	Analog input voltage ($V_{CC} = 24V$)	13	V
V_{12}	V_{13}	($V_{CC} = 20V$)	6 -0.3	V V
V_{18}	V_{20}	($V_{CC} = 20V$)	5.5 0.3	V V
V_{10}	V_{11}	Inhibit	V_{CC} -0.3	V V
P_{tot}		DIP 12+3+3 Power dissipation a $T_{pins} \leq 90^\circ C$ ($T_A = 70^\circ C$ no copper area) ($T_A = 70^\circ C$ 4cm copper area on PCB)	5 1.3 2	W W W
		SO-20 Power dissipation a $T_{pins} = 90^\circ C$	4	W
T_J, T_{STG}		Junction and storage temperature	-40 to 150	$^\circ C$

3.2 Thermal data

Table 3. Thermal data

Symbol	Parameter	DIP-18	SO-20	Unit
R_{thJP}	Maximum thermal resistance junction-pin	12	15	$^\circ C/W$
R_{thJA}	Maximum thermal resistance junction-ambient	60 ⁽¹⁾	80 ⁽¹⁾	$^\circ C/W$

1. Package mounted on board

4 Electrical characteristics

Table 4. Electrical characteristics

(Refer to the test circuit, $V_{CC} = 24V$; $T_J = 25^\circ C$, $C_{OSC} = 2.7nF$; $R_{OSC} = 20K\Omega$; unless otherwise specified)

Symbol	Parameter	Test condition	Min	Typ	Max	Unit
Dynamic characteristics						
	Input Voltage Range ⁽¹⁾	$V_O = V_{REF}$ to 40V; $I_O = 3.5A$	(2)	8	55	V
	Output Voltage L4973V5.1	$I_O = 1A$		5.05	5.1	5.15 V
		$I_O = 0.5A$ to 3.5A $V_{CC} = 8V$ to 55V		5.00	5.1	5.20 V
		(2)	4.95	5.1	5.25	V
	Output Voltage L4973V3.3	$I_O = 1A$		3.326	3.36	3.393 V
		$I_O = 0.5A$ to 3.5A $V_{CC} = 8V$ to 40V		3.292	3.36	3.427 V
		(2)	3.26	3.36	3.46	V
	$R_{DS(on)}$	$V_{CC} = 10.5V$ $I_O = 3.5A$		0.15	0.22	Ω
		(2)			0.35	Ω
	Maximum Limiting Current	$V_{CC} = 8V$ to 55V	(2)	3.8	4.5	5.5 A
				4	4.5	5.5 A
η	Efficiency	$V_O = 5.1V$; $I_O = 3.5A$		90		%
		$V_O = 3.3V$; $I_O = 3.5A$		85		%
	Switching Frequency	(2)	90	100	110	KHz
	Supply Voltage Ripple Rejection	$V_i = V_{CC} + 2V_{RMS}$ $V_O = V_{ref}$; $I_O = 1A$; $f_{ripple} = 100Hz$	60			dB
Δf_{sw}	Switching Frequency Stability vs., Supply Voltage	$V_{CC} = 8V$ to 55V		2	5	%
Reference section						
	Reference Voltage	$I_{ref} = 0$ to 20mA; $V_{CC} = 8$ to 55V		5.025	5.1	5.175 V
		(2)	4.950	5.1	5.250	V
	Line Regulation	$I_{ref} = 0mA$; $V_{CC} = 8$ to 55V		5	10	mV
	Load Regulation	$V_{ref} = 0$ to 5mA; $V_{CC} = 0$ to 20mA		2	10	mV
				6	25	mV
	Short Circuit Current		30	65	100	mA

Table 4. Electrical characteristics (continued)

(Refer to the test circuit, $V_{CC} = 24V$; $T_J = 25^\circ C$, $C_{OSC} = 2.7nF$; $R_{OSC} = 20K\Omega$; unless otherwise specified)

Symbol	Parameter	Test condition	Min	Typ	Max	Unit
Soft start						
	Soft Start Charge Current		30	45	60	μA
	Soft Start Discharge Current		15	22	30	μA
Inhibit						
	High Level Voltage		(2)	3.0		V
	Low Level Voltage		(2)		0.8	V
	I _{source} High Level	V _{INH} = 3V	(2)	10	16	50 μA
	I _{source} Low Level	V _{INH} = 0.8V	(2)	10	15	50 μA
DC characteristics						
	Total Operating Quiescent Current	Duty Cycle = 50%		4	6	mA
	Quiescent Current	Duty Cycle = 0		2.7	4	mA
	Total stand-by quiescent current	V _{CC} = 24V; V _{INH} = 5V		100	200	μA
		V _{CC} = 55V; V _{INH} = 5V		150	300	μA
Error amplifier						
	High Level Output Voltage		11.0			V
	Low Level Output Voltage				0.65	V
	Source Bias Current		1	2	3	μA
	Source Output Current		200	300	600	μA
	Sink Output Current		200	300		μA
	Supply Voltage Ripple Rejection	V _{COMP} = V _{FB} C _{REF} = 4.7μF 1-5mA load current	60	80		dB
	DC Open Loop Gain	R _L = ∞	50	60		dB
	Transconductance	I _{comp} = -0.1 to 0.1mA; V _{comp} = 6V		2.5		mS
Oscillator section						
	Ramp valley		0.78	0.85	0.92	V

Table 4. Electrical characteristics (continued)

(Refer to the test circuit, $V_{CC} = 24V$; $T_J = 25^\circ C$, $C_{OSC} = 2.7nF$; $R_{OSC} = 20K\Omega$; unless otherwise specified)

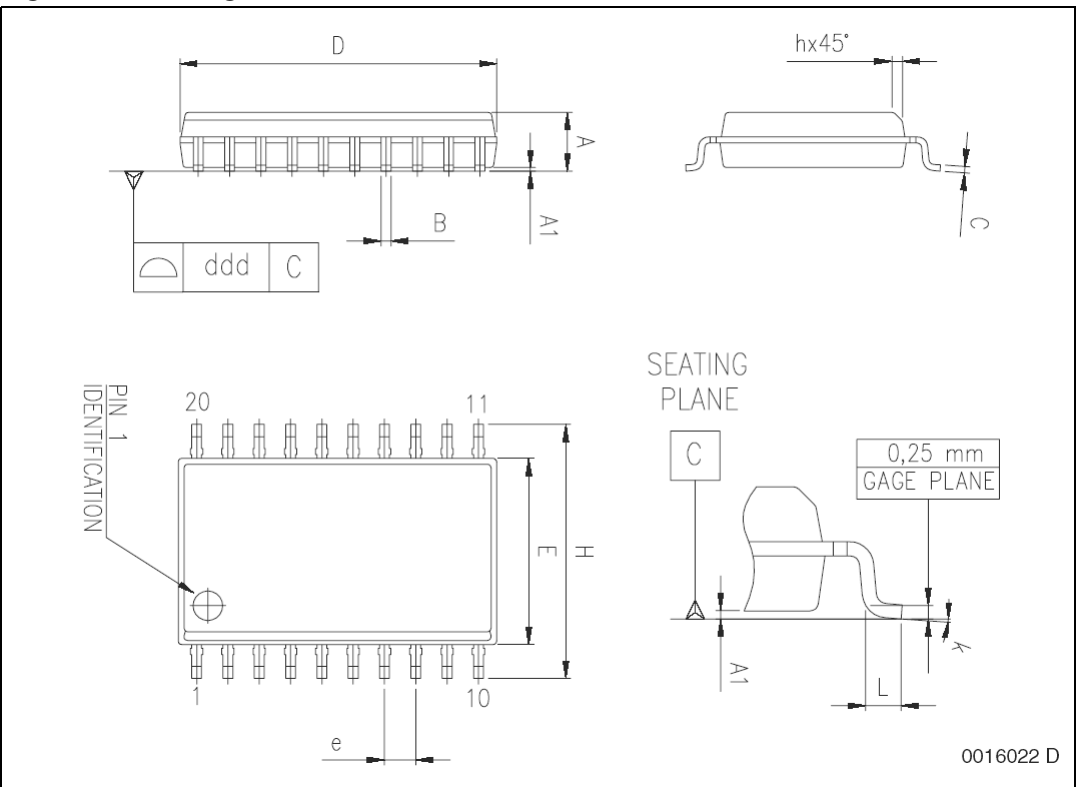
Symbol	Parameter	Test condition	Min	Typ	Max	Unit
	Ramp peak	$V_{CC} = 8V$ $V_{CC} = 55V$	1.9 9	2.1 9.6	2.3 10.2	V V
	Maximum Duty Cycle		95	97		%
	Maximum Frequency	Duty Cycle = 0%; $R_{OSC} = 13K\Omega$; $C_{OSC} = 820pF$;			300	KHz
Sync function						
	High Input Voltage	$V_{CC} = 8V$ to $55V$	3.5			V
	Low Input Voltage	$V_{CC} = 8V$ to $55V$			0.9	V
	Slave Sink Current		0.15	0.25	0.45	mA
	Master Output Amplitude	$I_{source} = 3mA$	4	4.5		V
	Output Pulse Width	no load, $V_{sync} = 4.5V$	0.20	0.35		μs

1. Pulse testing with a low duty cycle
2. Specifications referred to T_J from $-40^\circ C$ to $125^\circ C$.

Table 7. SO-20 mechanical data

Dim.	mm.			inch		
	Min	Typ	Max	Min	Typ	Max
A	2.35		2.65	0.093		0.104
A1	0.10		0.30	0.004		0.012
B	0.33		0.51	0.013		0.200
C	0.23		0.32	0.009		0.013
D (1)	12.60		13.00	0.496		0.512
E	7.40		7.60	0.291		0.299
e		1.27			0.050	
H	10.0		10.65	0.394		0.419
h	0.25		0.75	0.010		0.030
L	0.40		1.27	0.016		0.050
k	0° (min.), 8° (max.)					
ddd			0.10			0.004

Figure 46. Package dimensions



10 Order code

Table 8. Order code

Part number	Package	Packaging
L4973D3.3, E-L4973D3.3	SO-20	Tube
L4973D3.3-013TR, E-L4973D3.3-TR	SO-20	Tape and reel
L4973D5.1	SO-20	Tube
L4973D5.1-013TR	SO-20	Tape and reel
L4973V3.3, E-L4973V3.3	DIP-18	Tube
L4973V5.1, E-L4973V5.1	DIP-18	Tube