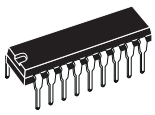
L4973

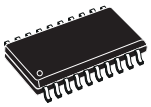
3.5A step down switching regulator

Features

- Up to 3.5A step down converter
- Operating input voltage from 8V to 55V
- 3.3V and 5.1V (±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



DIP-18 (12+3+3)

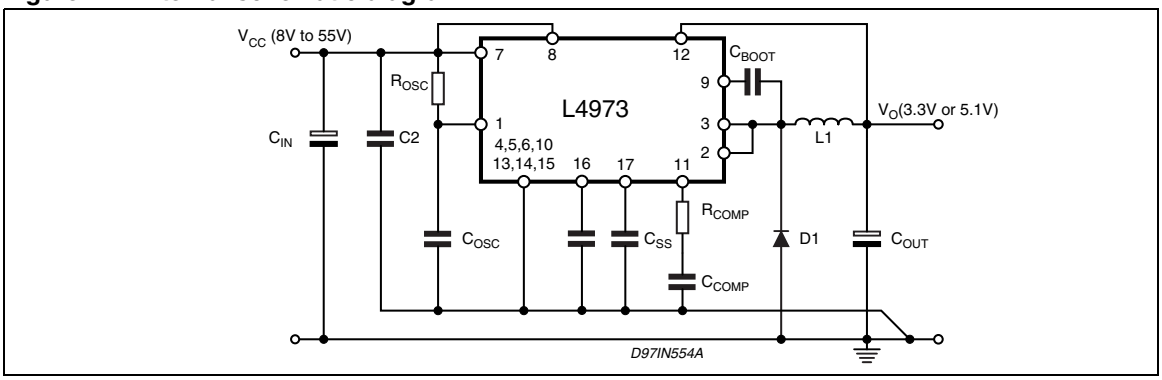


SO-20 (12+4+4)

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	S0-20			
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 = 0.1µs 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}	Analogs input voltage (V_{CC} = 24V)	12	V
V_{17}	V_{19}	Analogs 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 Tpins ≤ 90°C (T_A = 70°C no copper area) (T_A = 70°C 4cm copper area on PCB)	 5 1.3 2	 W W W
		SO-20 Power dissipation a T_{pins} = 90°C	 4	 W
T_J,T_{STG}		Junction and storage temperature	-40 to 150	°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	°C/W
R_{thJA}	Maximum thermal resistance junction-ambient	60 (1)	80 (1)	°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°C, C_{OSC} = 2.7nF; R_{OSC} = 20KΩ; 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 6	10 25	mV mV
	Short Circuit Current			30	65	100	mA

Table 4. Electrical characteristics (continued)
(Refer to the test circuit,V_{CC} = 24V; T_J = 25°C, C_{OSC} = 2.7nF; R_{OSC} = 20KΩ; 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} = VFB 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°C, C_{OSC} = 2.7nF; R_{OSC} = 20KΩ; unless otherwise specified)

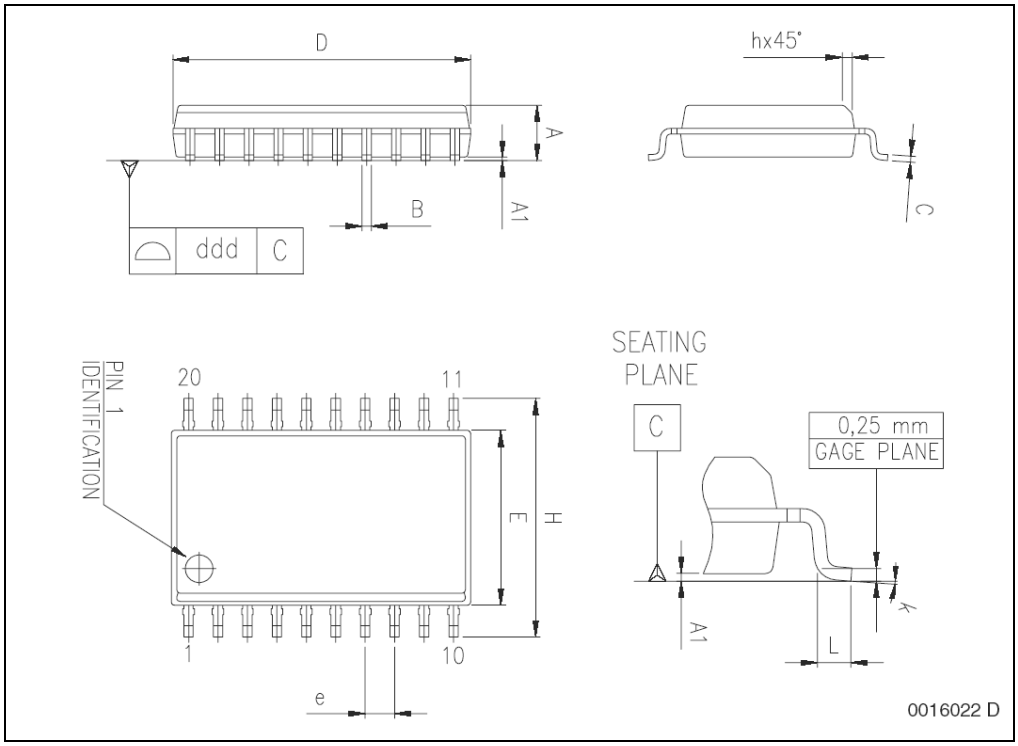
Symbol	Parameter	Test condition	Min	Typ	Max	Unit
	Ramp peak	V_{CC} = 8V V_{CC} = 55V	1.9 9	2.1 9.6	2.3 10.2	V V
	Maximum Duty Cycle		95	97		%
	Maximum Frequency	Duty Cycle = 0%; R_{OSC} =13KΩ; C_{OSC} = 820pF;			300	KHz
Sync function						
	High Input Voltage	V_{CC} = 8V to 55V	3.5			V
	Low Input Voltage	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°C to 125°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