SGS-THOMSON MICROELECTRONICS

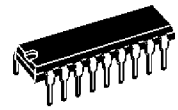
L4973V3 - L4973V5
L4973D3 - L4973D5

3.5A STEP DOWN SWITCHING REGULATOR

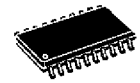
PRELIMINARY DATA

- UP TO 3.5A STEP DOWN CONVERTER
- OPERATING INPUT VOLTAGE FROM 8V TO 55V
- 3.3V AND 5.1V (+/-2%) FIXED OUTPUT VOLTAGES
- OUTPUT VOLTAGE ADJUSTABLE FROM: 0V TO 50V (L4973V3) 5.1V TO 50V (L4973V5)
- 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 (100µA Typ. at V_{CC} = 24V)
- PROTECTION AGAINST FEEDBACK DISCONNECTION

MULTIPOWER BCD TECHNOLOGY



POWERDIP (12+3+3)



SO20(12+4+4)

ORDERING NUMBERS:

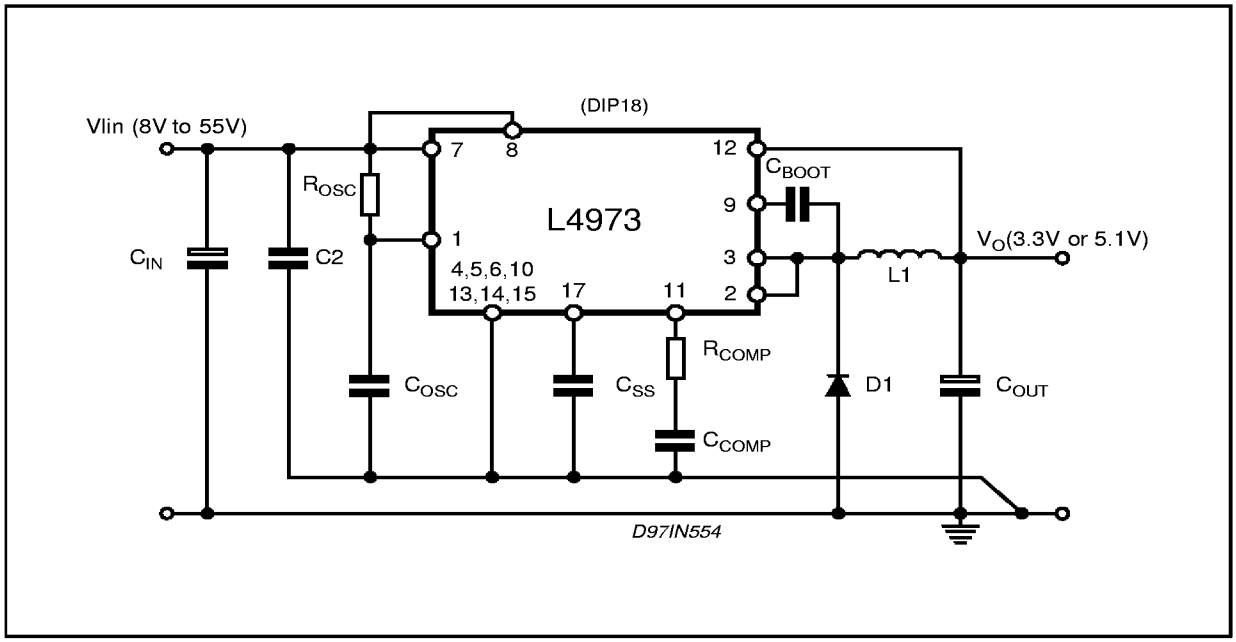
L4973V3	L4973D3
L4973V5	L4973D5

- THERMAL SHUTDOWN
- OUTPUT OVERVOLTAGE 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 5.1Vand using a simple external divider output adjustable voltage up to 50V.

TYPICAL APPLICATION CIRCUIT



Realized in BCD mixed technology, the device uses an internal power D-MOS transistor (with a typical Rdson of 0.15ohm) to obtain very high efficiency and very fast switching times.

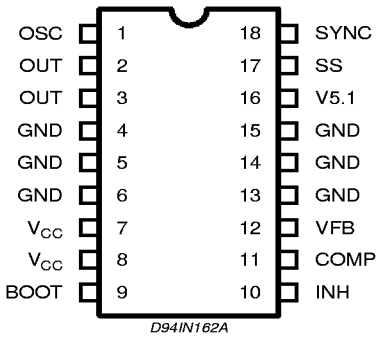
Switching frequency up to 300KHz are achievable (the maximum power dissipation of the packages must be observed).

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.

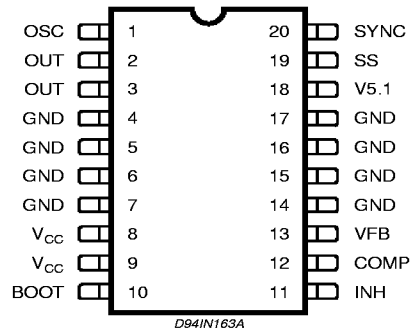
Features of this new generation of DC-DC converter includes pulse by pulse current limit, hiccup mode for output short circuit protection, voltage feed forward regulation, soft start, input/output synchronization, protection against feedback loop disconnection, inhibit for zero current consumption and thermal shutdown.

The proposed packages are in plastic dual in line, DIP-18 (12+3+3) for standard assembly, and SO20 (12+4+4) for SMD assembly.

PIN CONNECTIONS (Top view)

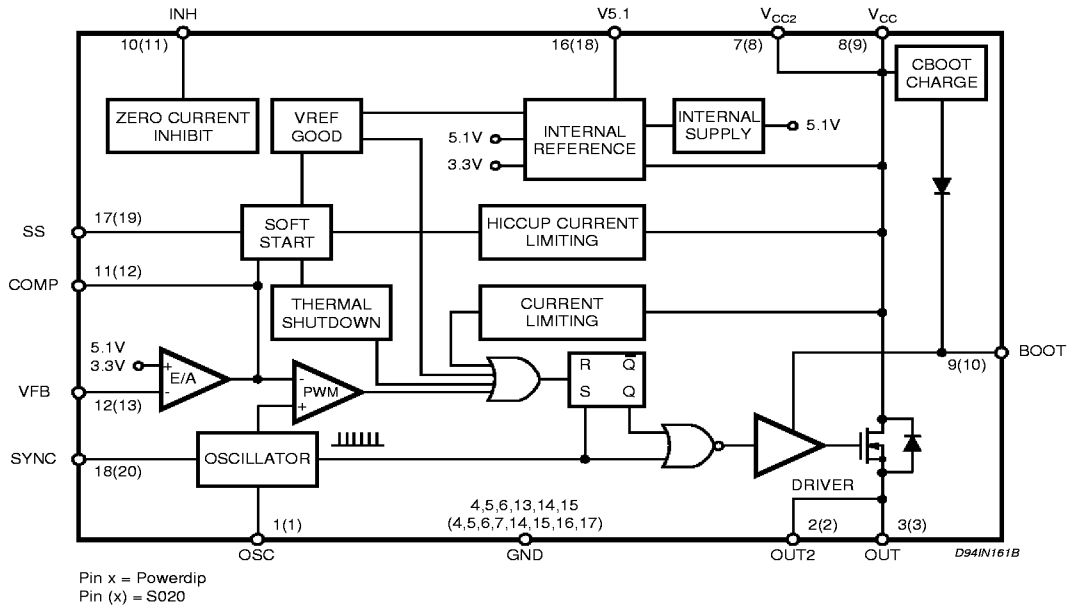


DIP18



SO20

BLOCK DIAGRAM



THERMAL DATA

Symbol	Parameter		DIP18	SO20	Unit
$R_{th(j\text{-}pin)}$	Thermal Resistance Junction to pin	Max.	12	15	°C/W
$R_{th(j\text{-}amb)}$	Thermal Resistance to Ambient	Max.	60 (*)	80 (*)	°C/W

(*) Package mounted on board.

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_{17}	V_{12}, V_{19}	Analogs input voltage (V_{CC} = 24V)		12	V
V_{12}	V_{13}	(V_{CC} = 24V)		6 -0.3	V V
V_{18}	V_{20}	(V_{CC} = 24V)		5.5 -0.3	V V
V_{10}, V_I	V_{11}, V_I	Inhibit		Vcc -0.6	V V
P_{tot}		Power dissipation a $T_{pins} \leq 90°C$ (T_{amb} = 70°C no copper area) (T_{amb} = 70°C 4cm copper area on PCB)	DIP-18	5 1.3 2	W W W
		Power dissipation a T_{pins} = 90°C	SO-20	4	W
T_J, T_{STG}		Junction and storage temperature		-40 to 150	°C

PIN FUNCTIONS

PIN DIP-18	PIN SO-20	NAME	DESCRIPTION
11	13	COMP	E/A output to be used for frequency compensation
10	11	INH	A logic signal (active high) disables the device (sleep mode operation). If not used it must be connected to GND; if floating the device is disabled.
9	10	BOOT	A capacitor connected between this pin and the output allows to drive the internal D-MOS.
18	20	SYNC	Input/Output synchronization.
7,8	8,9	Vcc	Not regulated DC input voltage
2,3	2,3	OUT	Stepdown regulator output.
12	12	VFB	Stepdown feedback input. Connecting directly this pin to the output 3.3V and 5.1V are obtained; a voltage divider is requested for higher output voltages. For voltage below 3.3V see note **
16	18	V5.1	Reference voltage externally available.
4,5,6 13,14,15	4,5,6,7 14,15,16,17	GND	Signal ground
1	1	OSC	An external resistor connected between the unregulated input voltage and Pin 1 and a capacitor connected from Pin 1 to ground fixes the switching frequency. (Line feed forward is automatically obtained)
17	19	SS	Soft start time constant. A capacitor connected between this terminal and ground determinates the soft start time.

ELECTRICAL CHARACTERISTICS (Refer to the test circuit, T_j = 25°C, C_{osc} = 1.2nF, R_{osc} = 47Kohm V_{cc} = 24V unless otherwise specified) ● = specifications referred to T_J from 0 to 125°C.

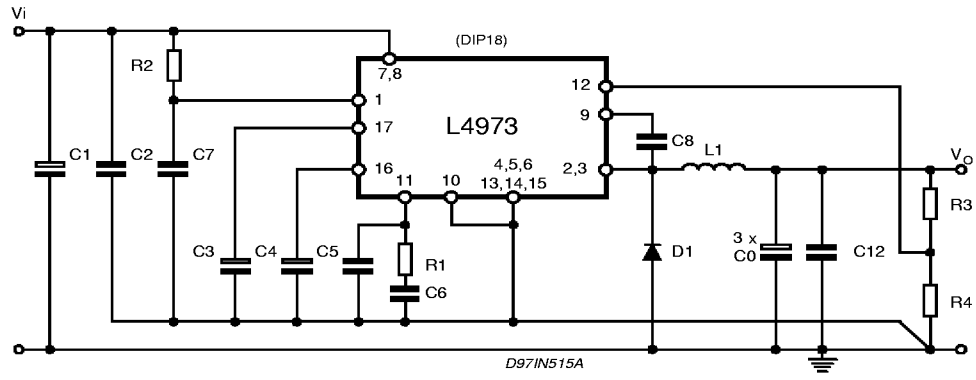
Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
DYNAMIC CHARACTERISTICS							
	Input Voltage range (*)	V_o = V_{REF} to 40V I_o = 3.5A	●	8		55	V
	Output Voltage L4973V5.1	I_O = 1A		5.05	5.1	5.15	V
		I_o = 0.5A to 3.5A V_{CC} = 8V to 55V		5.00	5.1	5.20	V
			●	4.95	5.1	5.25	V
	Output Voltage L4973V3.3	I_O = 1A		3.327	3.36	3.346	V
		I_o = 0.5A to 3.5A V_{CC} = 8V to 40V		3.292	3.36	3.427	V
			●	3.26	3.36	3.46	V
	R_{DSON}	V_{CC} = 10.5V, I_o = 3.5A			0.15	0.22	Ω
			●			0.35	Ω
	Maximum limiting current	V_{CC} = 8V to 55V	●	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		●	90	100	110	KHz
	Supply Voltage Ripple Rejection	V_i = V_{CC} + 2 VRMS 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			5.025	5.1	5.175	V
		I_{ref} = 0 to 20mA V_{cc} = 8V to 55V	●	4.950	5.1	5.250	V
	Line regulation	V_{cc} = 8V to 55V I_{ref} = 0 mA			5	10	mV
	Load regulation	I_{ref} = 0 to 5mA I_{ref} = 0 to 20mA			2 6	10 25	mV mV
	Short circuit current			30	65	100	mA
SOFT START							
	Soft start charge current			30	45	60	µA
	Soft start discharge current			15	22	30	µA
INHIBIT (not compatible with the 3.3V)							
	High level voltage		●	3.0			V
	Low level voltage		●			0.8	V
	I_{source} High level	V_{INH} = 3V	●	10	20	50	µA
	I_{source} Low level	V_{INH} = 0.8V	●	10	20	50	µA
DC CHARACTERISTICS							
	Total operating quiescent current	duty cycle = 50%			4	8	mA
	Quiescent current	duty cycle = 0			2.5	4.5	mA
	Total stand by quiescent current	Inhibit floating or V_{INH} = 5V V_{cc} = 24V V_{cc} = 55V			 100 150	 200 300	 µA µA
ERROR AMPLIFIER							
	High level output voltage			11.0			V
	Low level output Voltage					0.65	V
	Source Bias Current			1	2	3	µA

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
	Source output current			200	300	600	µA
	Sink output current			200	300		µA
	Supply voltage ripple rejection	V_{COMP} = VFB V_{CC} = 8V to 55V		60	80		dB
	DC open loop gain	$R_L = \infty$		50	60		dB
	Transconductance	I_{comp} =-0.1mAto0.1mA; V_{comp} = 6V			2.5		mS
OSCILLATOR SECTION							
	Ramp valley			0.78	0.85	0.92	V
	Ramp peak	V_{cc} = 8V		1.9	2.1	2.3	V
		V_{cc} = 55V		9	9.6	10.2	V
	Maximum duty cycle			95	97		%
	Maximum Frequency	Duty cycle = 0% R_{osc} = 20kΩ C_{osc} = 680pF				500	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, Vsync = 4.5V		0.20	0.35		µs

(*) Pulse testing with a low duty cycle.
(**) The maximum power dissipation of the packages must be observed.

APPLICATION CIRCUIT



C1=1000µF/63V
C2=220nF/63V
C3=470nF
C4=1µF/50V
C5=220pF
C6=22nF
C7=1.2nF
C8=220nF/63V
C9=100µF/40V
C0=100µF/40V(C10,C11,C12)
L1=150µH $K_{OOL\mu}$ 77310 - 40 Turns - 0.9mm
R1=9.1K
R2=43K
D1=GI SB560

L4973 V3.3

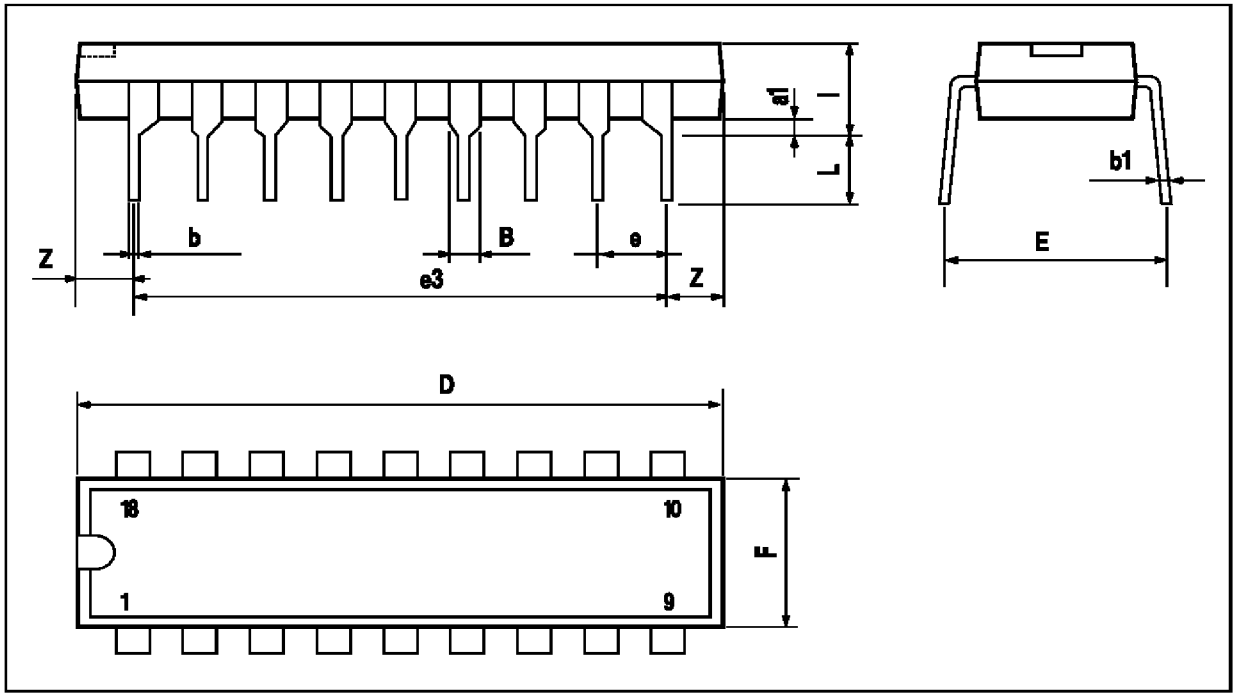
V_O(V)	R3(KΩ)	R4(KΩ)
3.3	0	
5.1	2.7	4.7
12	12	4.7
15	16	4.7
18	20	4.7
24	30	4.7

L4973 V5.1

V_O(V)	R3(KΩ)	R4(KΩ)
5.1	0	
12	6.2	4.7
15	9.1	4.7
18	12	4.7
24	18	4.7

POWERDIP 18 PACKAGE MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.85		1.40	0.033		0.055
b		0.50			0.020	
b1	0.38		0.50	0.015		0.020
D			24.80			0.976
E		8.80			0.346	
e		2.54			0.100	
e3		20.32			0.800	
F			7.10			0.280
I			5.10			0.201
L		3.30			0.130	
Z			2.54			0.100



SO20 PACKAGE MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			2.65			0.104
a1	0.1		0.3	0.004		0.012
a2			2.45			0.096
b	0.35		0.49	0.014		0.019
b1	0.23		0.32	0.009		0.013
C		0.5			0.020	
c1	45 (typ.)					
D	12.6		13.0	0.496		0.512
E	10		10.65	0.394		0.419
e		1.27			0.050	
e3		11.43			0.450	
F	7.4		7.6	0.291		0.299
L	0.5		1.27	0.020		0.050
M			0.75			0.030
S	8 (max.)