

2A STEP DOWN SWITCHING REGULATOR

1 Features

- UP TO 2A STEP DOWN CONVERTER
- OPERATING INPUT VOLTAGE FROM 8V TO 55V
- PRECISE 3.3V ($\pm 1\%$) INTERNAL REFERENCE VOLTAGE
- OUTPUT VOLTAGE ADJUSTABLE FROM 3.3V TO 50V
- SWITCHING FREQUENCY ADJUSTABLE UP TO 300KHz
- VOLTAGE FEEDFORWARD
- ZERO LOAD CURRENT OPERATION
- INTERNAL CURRENT LIMITING (PULSE-BYPULSE AND HICCUP MODE)
- INHIBIT FOR ZERO CURRENT CONSUMPTION
- PROTECTION AGAINST FEEDBACK DISCONNECTION
- THERMAL SHUTDOWN
- SOFT START FUNCTION

2 DESCRIPTION

The L4978 is a step down monolithic power switching regulator delivering 2A at a voltage between 3.3V and 50V (selected by a simple external divider). Realized in BCD mixed technology, the device uses an internal power D-MOS transistor (with a typical $R_{ds(on)}$ of 0.25Ω) to obtain very high

Figure 1. Packages



Table 1. Order Codes

Part Number	Package
L4978	DIP-8
L4978D	SO16
L4978D013TR	SO16 in Tape & Reel

efficiency and high switching speed.

A switching frequency up to 300KHz is 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 50V cover the majority of today's applications. Features of this new generations of DC-DC converter include pulse-by-pulse current limit, hiccup mode for short circuit protection, voltage feedforward regulation, soft-start, protection against feedback loop disconnection, inhibit for zero current consumption and thermal shutdown.

The device is available in plastic dual in line, DIP-8 for standard assembly, and SO16W for SMD assembly.

Figure 2. Typical Application Circuit

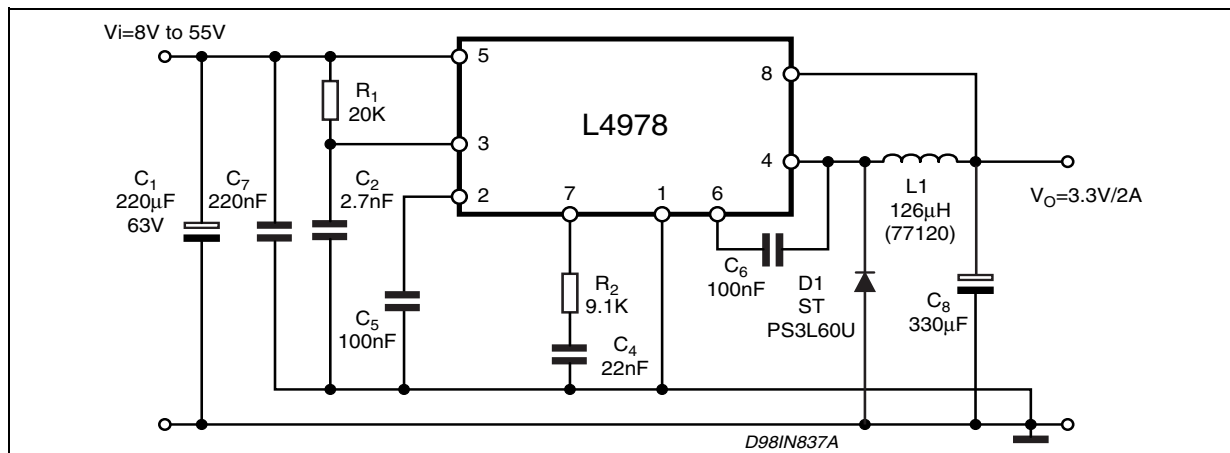


Table 3. Pin Description (continued)

N°	Pin	Name	Function
4	5, 6	OUT	Stepdown regulator output
5	11	V _{CC}	Unregulated DC input voltage
6	12	BOOT	A capacitor connected between this pin and OUT allows to drive the internal DMOS Transistors
7	13	COMP	E/A output to be used for frequency compensation
8	14	FB	Stepdown feedback input. Connecting directly to this pin results in an output voltage of 3.3V. An external resistive divider is required for higher output voltages.

(*) Pins 1, 7, 8, 9, 10, 15 and 16 are not internally, electrically connected to the die.

Table 4. Thermal Data

Symbol	Parameter	Minidip	SO16	Unit	
R _{th(j-amb)}	Thermal Resistance Junction to ambient	Max.	90 (*)	110 (*)	°C/W

(*) Package mounted on board.

Table 5. Absolute Maximum Ratings

Symbol		Parameter	Value	Unit
Minidip	SO16			
V ₅	V ₁₁	Input voltage	58	V
V ₄	V ₅ , V ₆	Output DC voltage Output peak voltage at t = 0.1ms f=200KHz	-1 -5	V V
I ₄	I ₅ , I ₆	Maximum output current	int. limit.	
V ₆ -V ₅	V ₁₂ -V ₁₁		14	V
V ₆	V ₁₂	Bootstrap voltage	70	V
V ₇	V ₁₃	Analogs input voltage (V _{CC} = 24V)	12	V
V ₂	V ₃	Analogs input voltage (V _{CC} = 24V)	13	V
V ₈	V ₁₄	(V _{CC} = 20V)	6 -0.3	V V
P _{tot}		Power dissipation a Tamb ≤ 60°C	DIP-8 SO16	W W
T _j , T _{stg}		Junction and storage temperature		-40 to 150 °C

Table 6. Electrical Characteristics

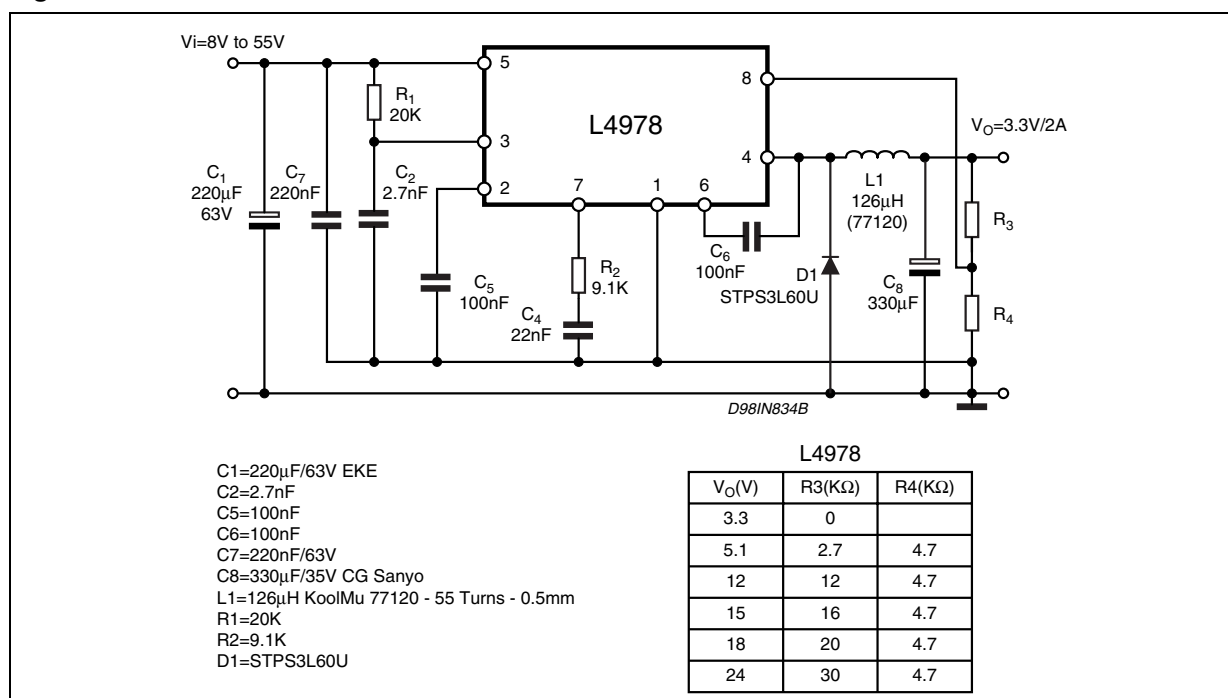
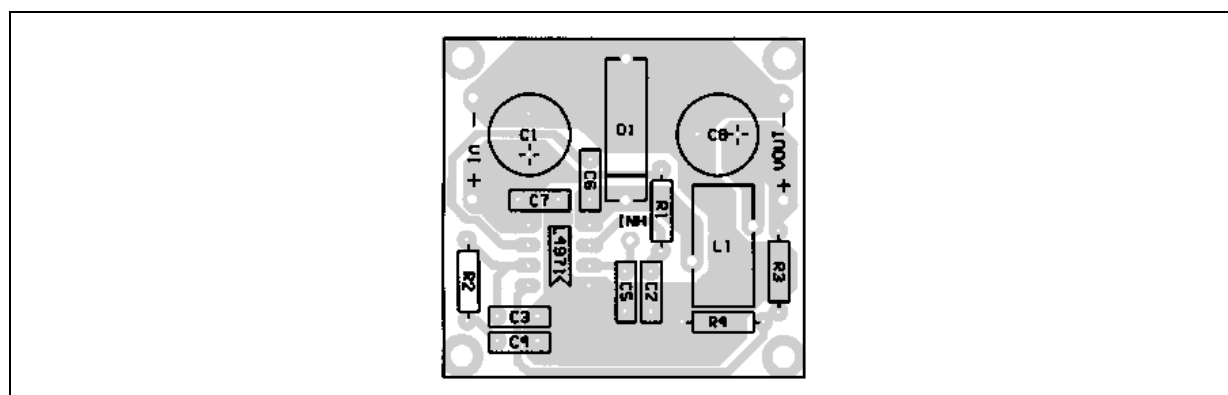
($T_j = 25^\circ\text{C}$, $C_{\text{OSC}} = 2.7\text{nF}$, $R_{\text{OSC}} = 20\text{k}\Omega$, $V_{\text{CC}} = 24\text{V}$, unless otherwise specified). "●" Specification Referred to T_j from 0 to 125°C

Symbol	Parameter	Test Condition		Min.	Typ.	Max.	Unit
DYNAMIC CHARACTERISTIC							
V _I	Operating input voltage range	V _O = 3.3 to 50V; I _O = 2A	●	8		55	V
V _O	Output voltage	I _O = 0.5A		3.33	3.36	3.39	V
		I _O = 0.2 to 2A		3.292	3.36	3.427	V
		V _{CC} = 8 to 55V	●	3.22	3.36	3.5	V
V _d	Dropout voltage	V _{CC} = 10V; I _O = 2A			0.58	0.733	V
			●			1.173	V
I _I	Maximum limiting current	V _{CC} = 8 to 55V	●	2.5	3	3.5	A
	Efficiency	V _O = 3.3V; I _O = 2A			87		%
f _s	Switching frequency		●	90	100	110	KHz
SVRR	Supply voltage ripple rejection	V _I = V _{CC} +2V _{RMS} ; V _O = V _{ref} ; I _O = 2.5A; f _{ripple} = 100Hz		60			dB
	Switching Frequency Stability vs. V _{CC}	V _{CC} = 8 to 55V			3	6	%
	Temp. stability of switching frequency	T _j = 0 to 125°C			4		%
SOFT START							
	Soft start charge current			30	40	50	μA
	Soft start discharge current			6	10	14	μA
INHIBIT							
V _{LL}	Low level voltage		●			0.9	V
I _{sLL}	Isorce Low level		●		5	15	μA
DC CHARACTERISTICS							
I _{qop}	Total operating quiescent current				4	6	mA
I _q	Quiescent current	Duty Cycle = 0; V _{FB} = 3.8V			2.5	3.5	mA
I _{qst-by}	Total stand-by quiescent current	V _{inh} < 0.9V			100	200	μA
		V _{CC} = 55V; V _{inh} <0.9V			150	300	μA
ERROR AMPLIFIER							
V _{FB}	Voltage Feedback Input			3.33	3.36	3.39	V
R _L	Line regulation	V _{CC} = 8 to 55V			5	10	mV
	Ref. voltage stability vs temperature		●		0.4		mV/°C
V _{oH}	High level output voltage	V _{FB} = 2.5V		10.3			V
V _{oL}	Low level output voltage	V _{FB} = 3.8V				0.65	V
I _{O source}	Source output current	V _{comp} = 6V; V _{FB} = 2.5V		180	220		μA
I _{O sink}	Sink output current	V _{comp} = 6V; V _{FB} = 3.8V		200	300		μA
I _b	Source bias current				2	3	μA
SVRR E/A	Supply voltage ripple rejection	V _{comp} = V _{FB} ; V _{CC} = 8 to 55V		60	80		dB
	DC open loop gain	R _L = ∞		50	57		dB
g _m	Transconductance	I _{comp} = -0.1 to 0.1mA V _{comp} = 6V			2.5		mS

Table 6. Electrical Characteristics

($T_j = 25^\circ\text{C}$, $C_{\text{OSC}} = 2.7\text{nF}$, $R_{\text{OSC}} = 20\text{k}\Omega$, $V_{\text{CC}} = 24\text{V}$, unless otherwise specified). "●" Specification Referred to T_j from 0 to 125°C

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
OSCILLATOR SECTION						
	Ramp Valley		0.78	0.85	0.92	V
	Ramp peak	$V_{\text{CC}} = 8\text{V}$	2	2.15	2.3	V
		$V_{\text{CC}} = 55\text{V}$	9	9.6	10.2	V
	Maximum duty cycle		95	97		%
	Maximum Frequency	Duty Cycle = 0% $R_{\text{OSC}} = 13\text{k}\Omega$, $C_{\text{OSC}} = 820\text{pF}$			300	kHz

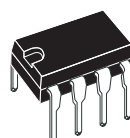
Figure 4. Test and evaluation board circuit.**Figure 5. PCB and component layout of the figure 4.**

3 Package Informations

Figure 29. DIP-8 Mechanical Data & Package Dimensions

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A		3.32			0.131	
a1	0.51			0.020		
B	1.15		1.65	0.045		0.065
b	0.356		0.55	0.014		0.022
b1	0.204		0.304	0.008		0.012
D			10.92			0.430
E	7.95		9.75	0.313		0.384
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			6.6			0.260
I			5.08			0.200
L	3.18		3.81	0.125		0.150
Z			1.52			0.060

OUTLINE AND MECHANICAL DATA



DIP-8

