DP4976A/4976B

***SIMPLE SWITCHER* 2A Step-Down Voltage Regulator & Operational Amplifier**

GENERAL DESCRIPTION

DP4976 is monolithic integrated circuits that provide all the active functions for a Step-Down(buck) switching regulator, capable of driving 2A load with Current Protection (OCP) and Over Voltage Protection (OVP) . In this case the OCP and OVP value can be changed with help external resistors.

DP4976 includes OCP and OVP- OpAmplifier, thereby reducing the size and cost for charger applications. it provides all the active functions for a step-down (buck) switching regulator and is capable of driving 2A load with excellent line and load regulation. It includes an internal frequency compensation components and a fixed-frequency oscillator. Among other features are a guaranteed ±4% tolerance on an output voltage within the specified input voltages and output load conditions, and ±10% - on the oscillator frequency. External shutdown is included, featuring 120 μA (typical) standby current.

The 4976 has OVP function. If Voltage of pin OVP overshoot 1.25v, OVP is happened and the circuit is OFF with Istb~120uA (typical). When Voltage of pin OVP fall down less 0.7v, the circuit is ON.

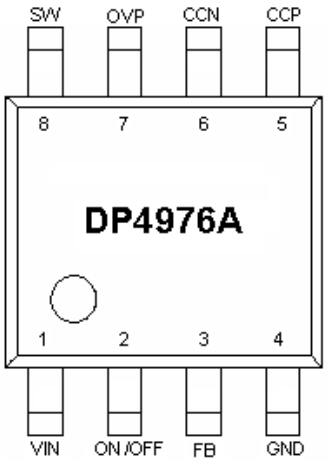
The output switch includes cycle-by-cycle current limiting and thermal shutdown elements for a full protection under fault conditions.

The high gain, internally frequency-compensated operational amplifiers were designed specifically to operate from a single power supply over a wide range of voltages.

These devices are available in fixed output voltage of 5V and an adjustable output version.

FEATURES

- Output voltage range, 1.23V to 37V ±4% max over line and load conditions
- Guaranteed 2A output current
- Wide input voltage range, 40V
- 52KHz fixed frequency oscillator
- TTL shutdown capability, low power standby mode
- High efficiency
- Thermal shutdown and current limit protection
- Low input offset voltage and offset current of OpAmp
- Internal frequency compensation of OpAmp

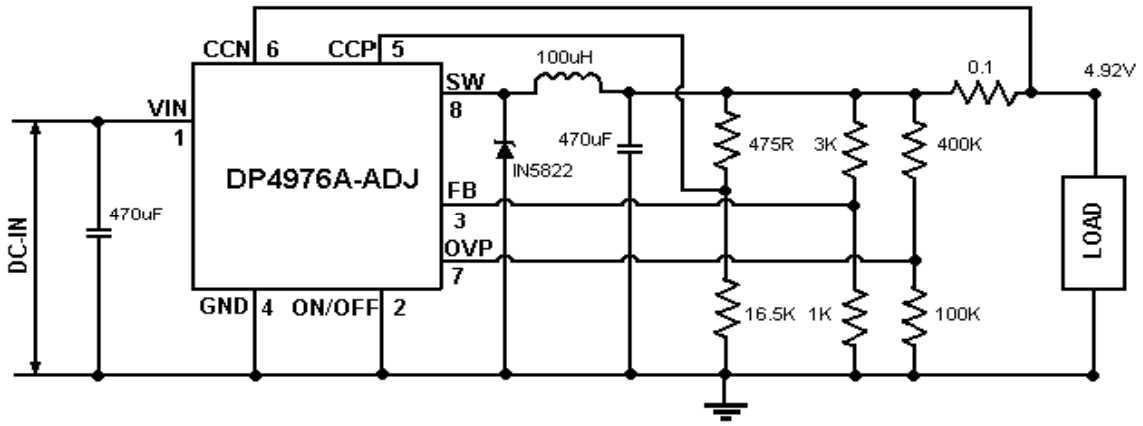


PACKAGE INFORMATION

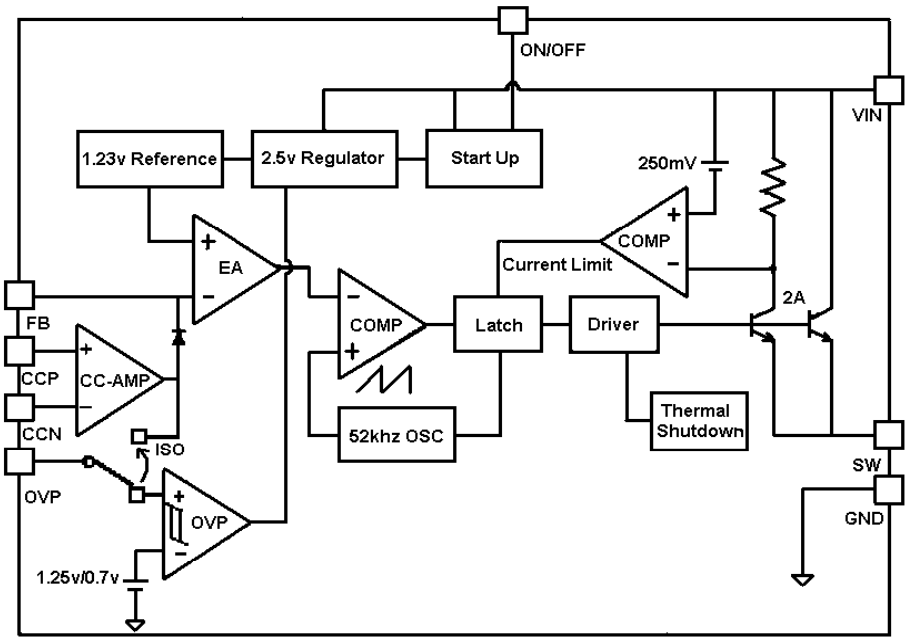
SOP-8 with Exposed PAD connection to Gnd on the bottom of Package

1 -- Vin
2 -- ON/OFF
3 -- FB
4 -- GND
5 -- CCP
6 -- CCN
7 -- OVP(4976A) , ISO(4976B)
8 -- SW

TYPICAL APPLICATION



BLOCK DIAGRAM



Note *1: There is the reserved PAD at output of Op Amplifier. It allows to connect to the pin OVP either input of OVP-comparator(Ver:A) or output of Op Amplifier(Ver: b) during packaging.

Absolute maximum ratings

Parameter	Symbol	Value
Maximum supply voltage	Vcc	45V
FB pin voltage	V_{FB}	-0.3V≤V≤+Vin+0.3V
ON/OFF pin voltage	Von/off	-0.3V≤V≤+Vin+0.3V
Output pin voltage	Vout	-1V≤V≤+Vin+0.3V
Maximum junction temperature	Tj max	150°C
Minimum ESD rating (C=100pF, R=1.5k)	ESD	2kV

Power dissipation	Pd	Internally-limited
Input differential voltage range	Vidr	45V
Input common mode voltage range	Vicr	-0.3V to 45V

Operating ratings

Supply voltage	5V to 40V
Temperature range	-40°C≤Tj≤+125°C

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, Vin=12V

Note: * denotes the specifications, which apply over full operating temperature range T_J = -40 to +125°C.

Symbol	Parameter	Conditions	Note	Min.	Typ.	Max.	Units
		4976 (Note 1, 9)					
SYSTEM PARAMETERS							
Vout	Vout 4976-ADJ	V_{IN}=12V, I_{LOAD}=0.5A Vout programmed for 5V		1.217	1.230	1.243	V
		7V≤V_{IN}≤40V, 0.5A≤I_{LOAD}≤2A Vout programmed for 5V	*	1.193 1.180	1.230	1.267 1.280	V
TOL	Tolerance of Vout 4976-ADJ	Vin= 10-30v, Iload=0.5-2A		-2		+2	%
η	Efficiency	V_{IN}=12V, I_{LOAD}=2A, Vout programmed for 5V			77		%
Vout	Vout 4976-5.0	V_{IN}=12V, I_{LOAD}=0.5A		4.90	5.00	5.10	V
		7V≤V_{IN}≤40V, 0.5A≤I_{LOAD}≤2A		4.80		5.20	V
			*	4.75		5.25	V
DEVICE PARAMETERS							
Ifb	Feedback bias current	Vout=5V Vfb=1.3V Vccn-Vccp=0.1V	*		50	100 500	nA
F0	Oscillator frequency	(Note 6)	* *	47 42	52	58 63	kHz
Vsat	Saturation voltage	Iout = 2A (Note 2)	*		1.1	1.25 1.35	V
DC	Max duty cycle (ON)	(Note 3)		93	98		%
I_{CL}	Current limit	Peak current (Notes 2, 6)	*	2.5 2.3	3.4	4.6 5.2	A
I_{OL}	Output leakage current	(Notes 4,5) Output = 0V Output =-1V			0.4 10	2 30	mA
	ON/OFF CONTROL						
V_{IH}	ON/OFF pin logic input level	Vout = 0V	*	2.2 2.4	1.4		V
V_{IL}		Vout = nominal output voltage	*		1.2	1.0 0.8	V
I_{IH}	ON/OFF pin input current	ON/OFF pin = 5V(OFF)			12	30	μA
I_{IL}		ON/OFF=0V(ON)			0	10	μA
OVP_H	High Voltage Threshold OVP pin	Note 7	 *	1.19 1.15	1.25	1.31 1.35	V
OVP_L	Low Voltage Threshold OVP pin	Note 7			0.7		V
Iovp	OVP pin input current	Vovp=1.3V	 *		50	100 500	nA
Operational Amplifier CC-AMP							
Vio	Input offset voltage	Vcc=5V to 40V Vic=0V Vfb=1.5V			4	11	mV
αVio	Average temperature coefficient of input offset voltage		*		10	15	uV/°C
αVio	Average temperature coefficient of input offset voltage		*		10		μV/°C
Iio	Input offset current	Vcm=0V	 *		8	100 300	nA

αIio	Average temperature coefficient of input offset current		*		20		pA/°C
Iib	Input bias current	Vcm=0V			-30	-500	nA
			*			-800	
Vicr	Common-mode input voltage range	Vcc=5V to 40V			0 to Vcc-1.5V		V
			*		0 to Vcc-2V		
Vfb_H	High level output voltage	R_L≥15k Vcc=40V Note 8		37.5	38		V
			*	37			
Vfb_L	Low level output Voltage	R_L≥10k			5	20	mV
			*			30	
CMRR	Common-mode rejection ratio	Vic=0V to Vcc-1.5V		60	80		dB
PSRR	Power Supply rejection ratio			60	90		dB
Io	Output Current	Vcc=12V, Vio=1V, Vfb=1.5V		-20	-30		mA
			*	-10			
Isc	Short-circuit output current to Gnd	Vfb=0V Vio=1V		-60	-40		mA
COMMON PARAMETERS							
I_Q	Quiescent Current	(Note 4) No-load OpAmp			5.5	11	mA
Istby	Standby quiescent current	ON/OFF Pin =5V(OFF) No-load OpAmp			120	330	uA

Note 1: External components such as the catch diode, inductor, input and output capacitors can affect switching regulator system performance.
Note 2: Output pin sourcing current. No diode, inductor or capacitor connected to output.
Note 3: Feedback pin removed from output and connected to 0V.
Note 4: Feedback pin removed from output and connected to +12V for the Adjustable, 3.3V and 5V, versions, and +25V for the 12V and 15V versions, to force the output transistor OFF.
Note 5: V_{IN} =40V
Note 6: The oscillator frequency reduces to approximately 11kHz in the event of an output short or an overload, which causes the regulated output voltage to drop approximately 40% from the nominal output voltage. This self-protection feature lowers the average power dissipation of the IC by lowering the minimum duty cycle from 5% down to approximately 2%.
Note 7: When Voltage of OVP pin >OVP_H, the circuit is OFF. When Voltage of OVP pin decrease less than OVP_L, the circuit is ON.
Note 8: R_L between FB and Gnd.
Note 9: Good use of the PC board's ground plane can help considerably to dissipate heat. The exposed pad on the bottom of the IC package must be soldered to a ground plane and that plane should extend out from beneath the IC to help dissipate the heat. The exposed pad is internally connected to the IC substrate.