Inv № 525

2C76K *SIMPLE SWITCHER* 2A Sep-Down Voltage Regulator & Operational Amplifier

Preliminary April 2009 -revised February 2010

GENERAL DESCRIPTION

Many chargers use the well-known device 2576 in conjunction with an operational amplifiers. This allows introducing an additional adjustment for the Over-Current Protection (OCP) and Over Voltage Protection (OVP). In this case the OCP and OVP value can be changed with help external resistors.
2C76K includes both devices – the 2576 and an OpAmplifier, thereby reducing the size and cost for charger applications.
The 2C76K are fabricated in 2 versions, which differ in stage assembly. The Version 1 are used for for charger applications, and the Version 2 are used for LED Drivers.
The 2C76K 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 2C76K 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.

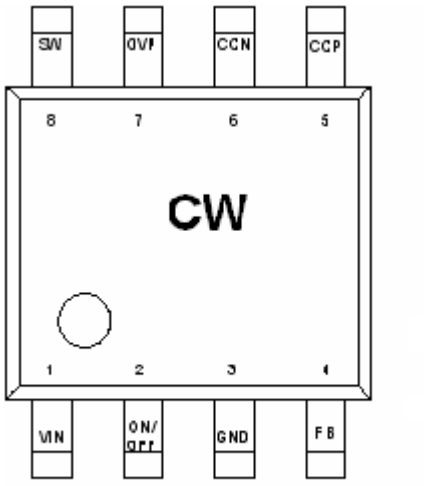
The high gain, internally frequency-compensated operational amplifiers were designed specifically to operate from a single power supply over a wide range of voltages.

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 - Gnd
4 – FB
5- CCP
6 – CCN
7 – OVP
8 – SW

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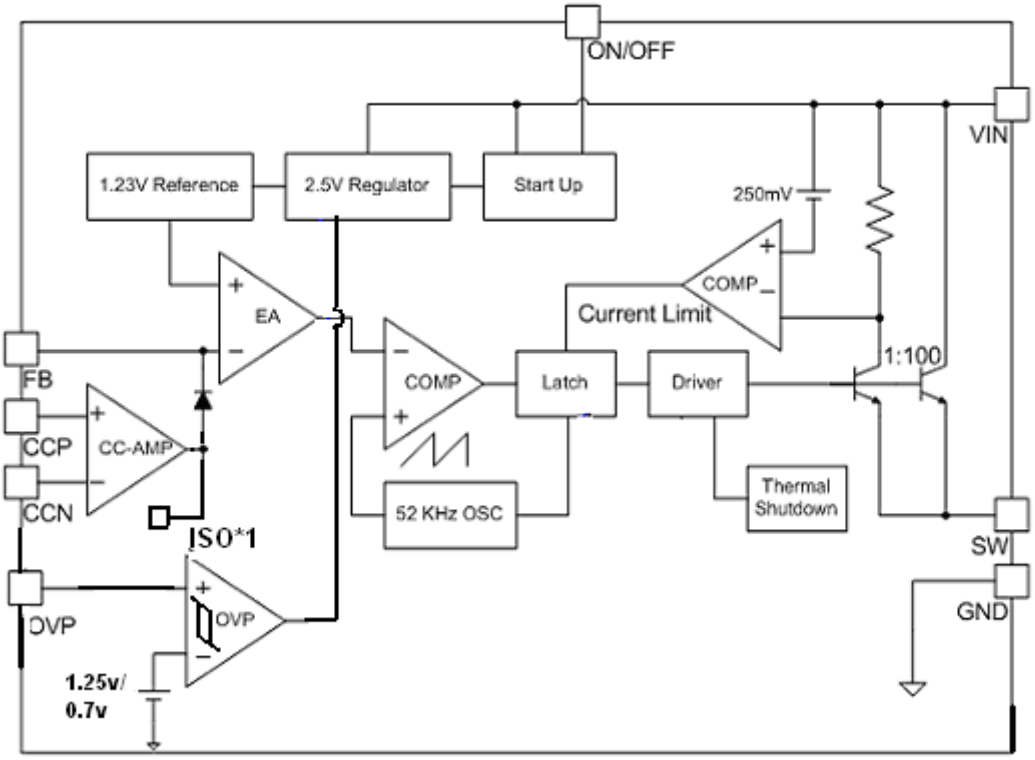
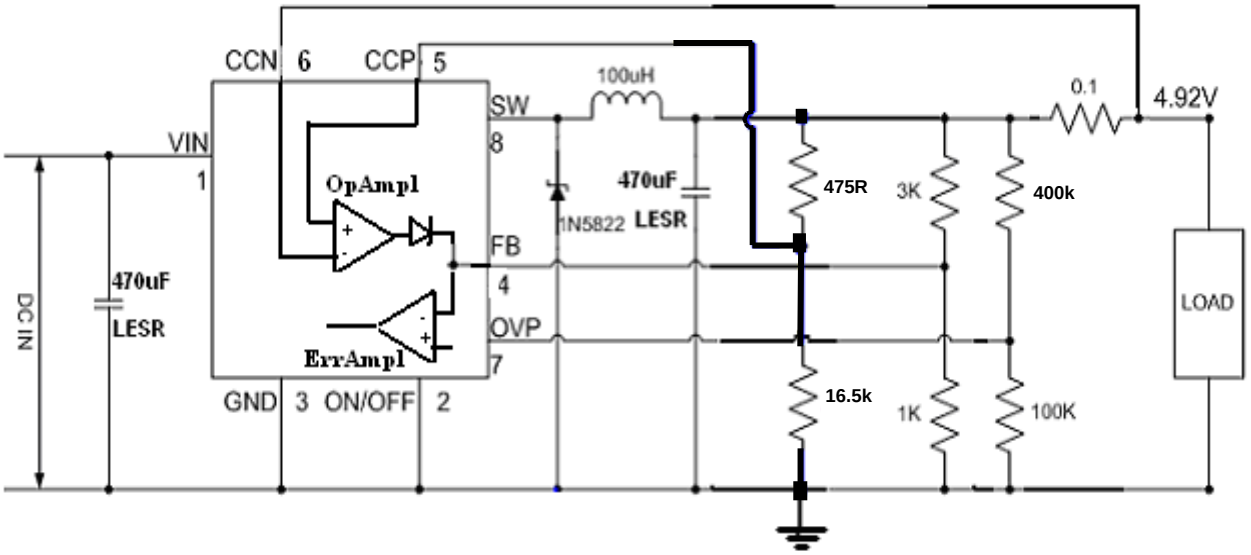
BLOCK DIAGRAM



Note *1: There is the reserved PAD ISO at output of Op Amplifier. It allows leave ISO open [**Version 1]** either connect ISO to the pin FB (shorting the diode) **[Version 2]** during packaging.

TYPICAL APPLICATION Version 1.



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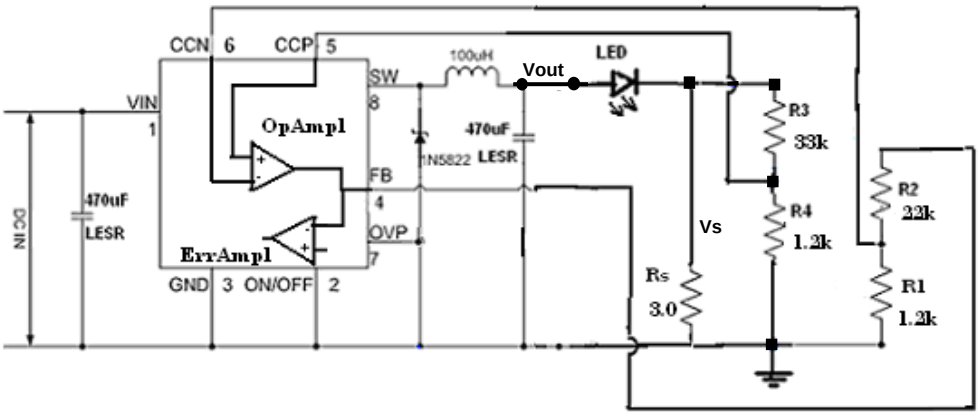
TYPICAL APPLICATION Version 2



Vfb~1.23v
Vccp=Vfb*R1/(R1+R2)
Vccn=Vccp
Vs=Vccn/R4*(R3+R4)

Absolute maximum ratings

Parameter	Symbol	Value
Maximum supply voltage	Vcc	45V
FB pin voltage	V_{FB}	-0.3V ≤ V ≤ +Vin
ON/OFF pin voltage	Von/off	-0.3V ≤ V ≤ +Vin
SW pin voltage	Vsw	-0.8V ≤ 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
		2576 (Note 1, 9)					
SYSTEM PARAMETERS							
Vout	Vout 2C76K-ADJ	V_{IN}=12V, I_{LOAD}=0.5A Vout programmed for 5V		1.215	1.230	1.245	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 2C76K-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 2C76K-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 =-0.8V			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		1.15	1.22	1.31	V
				*	1.11		1.35	
OVP_L	Low Voltage Threshold OVP pin		Note 7			0.74		V
Iovp	OVP pin input current		Vovp=1.3V			50	100	nA
				*			500	
Operational Amplifier CC-AMP								
Vio	Input offset voltage		Vcc=5V to 40V Vic=0V Vfb=1.5V			4	11	mV
				*		10	15	uV/°C
αVio	Average temperature coefficient of input offset voltage			*		10		µV/°C
Iio	Input offset current		Vcm=0V			8	100	nA
				*			300	
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 Vin-1.5V		60	80		dB
PSRR	Power Supply rejection ratio				60	90		dB
Io	Output Current		Vcc=12V, Vio=1V, Vfb=1.5V			-30	-20	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.

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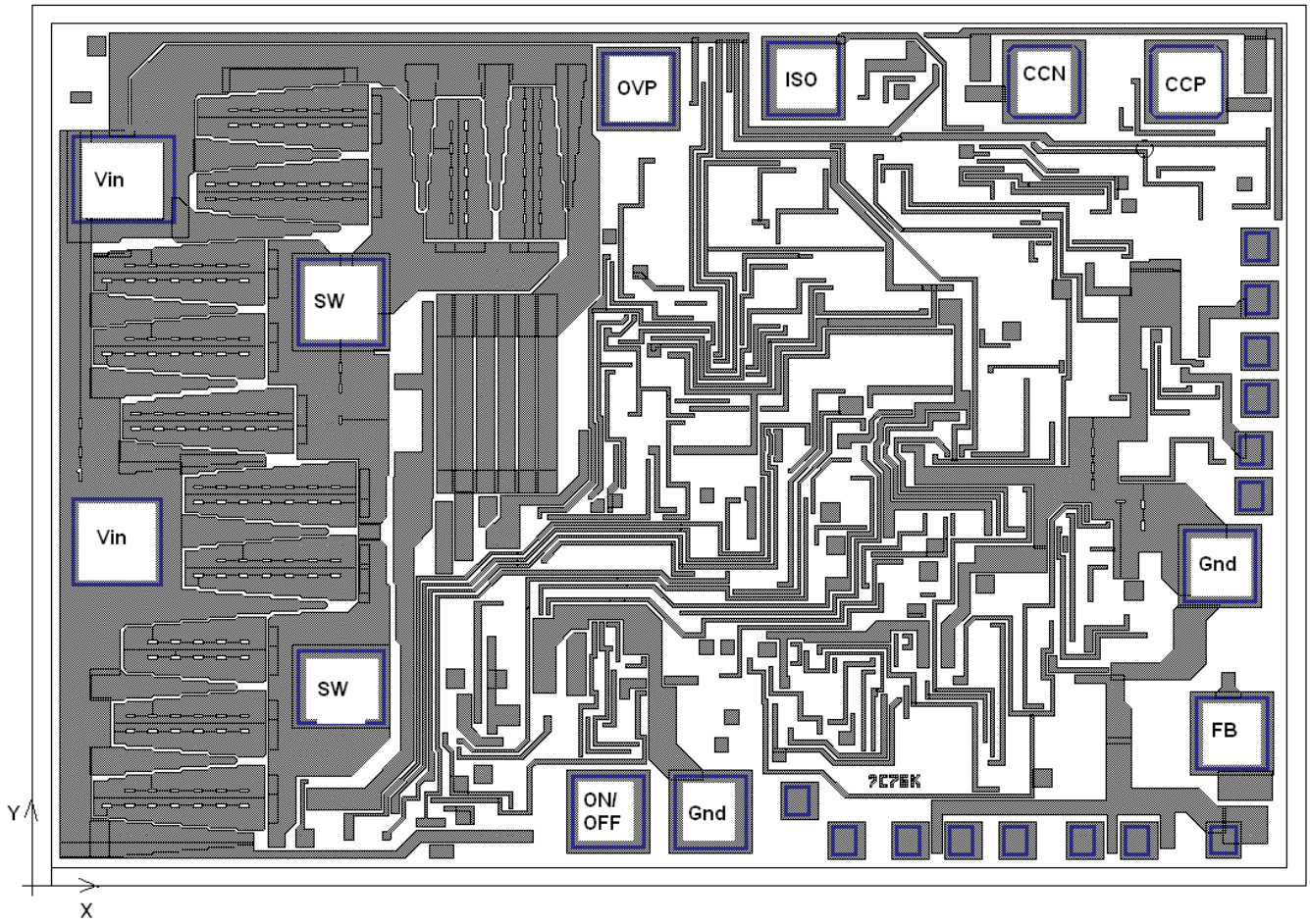
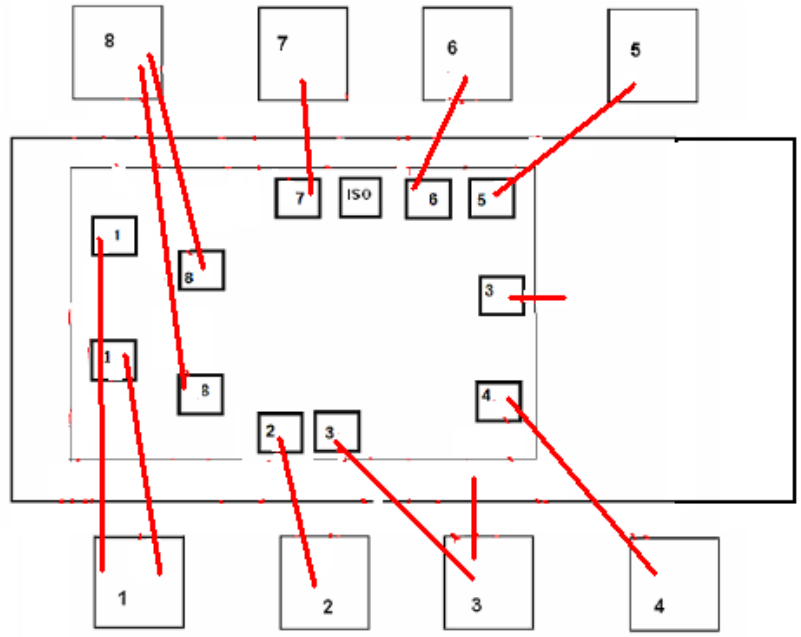


Chip Size=2.76*1.91mm^2

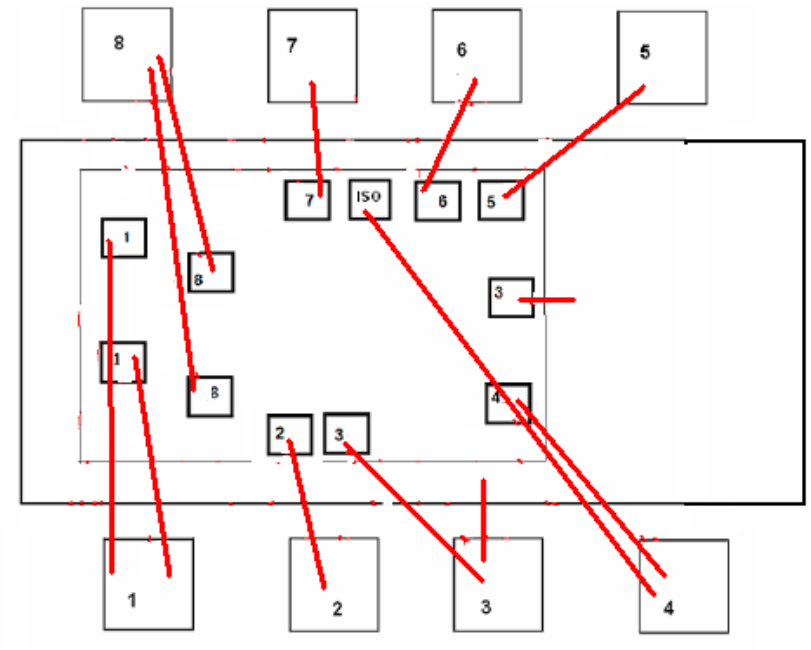
The PAD coordinates (um)

№ PAD	X	Y
1	183	746
1	201	1537
2	1248	160
3	1470	160
3	2575	692
4	2600	330
5	2502	1743
6	2195	1743
ISO	1672	1750
7	1312	1724
8	668	1266
8	668	432

BONDING DIAGRAM (SOP—8)



Version 1
Chip Size ~2.76*1.91mm^2
The package: SO-8
The wire diameters 50um



Version 2