

FEATURES

- Output voltage: 3.3V, 5V, 12V and adjustable output versions.
- Adjustable version output voltage range is within 1.23V to 37V.
- 52 kHz fixed switching frequency.
- Voltage mode non-synchronous PWM control.
- Thermal-shutdown and current-limit protection.
- On/Off shutdown control input.
- Short Circuit Protect (SCP).
- Wide output current – up to 2A.
- Low power standby mode.

GENERAL DESCRIPTION

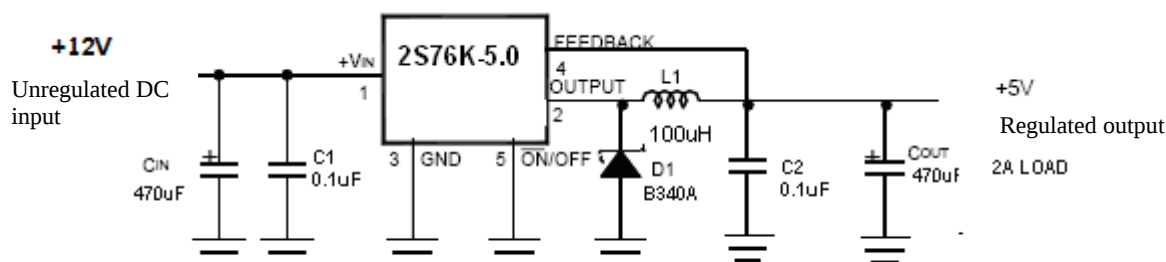
The 2S76K series are monolithic ICs designed for a step-down DC/DC converter, capable of driving 2A load without an additional transistor. It saves a board space. The external shutdown function is controlled by a logic level and then the circuit comes into the standby mode. The internal compensation makes the feedback control with good line and load regulation characteristics without an external design. Regarding the protection functions – the thermal shutdown prevents circuit damage during the overtemperature operation and the current limit is against overcurrent operation of the output switch. If the case for the current limiting occurs and V_{FB} is down by 40% of the nominal output voltage, the switching frequency shall be reduced.

The fixed output voltage version includes 3.3V, 5V, 12V devices, while the adjustable version voltages range from 1.23V to 37V. The chips are available in a standard 5-lead TO-220, TO-263 and 8-lead SOP package.

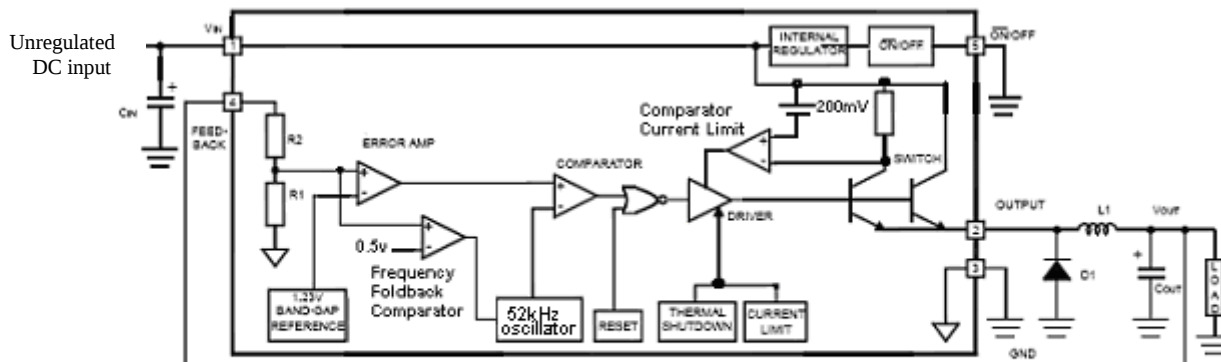
APPLICATIONS

- Simple high-efficiency step-down (buck) regulator
- Efficient pre-regulator for linear regulators
- On-card switching regulators
- Positive to negative converter (Buck-Boost)

TYPICAL APPLICATION (Fixed output voltage versions)



BLOCK DIAGRAM



For ADJ Version
R1 = Open, R2 = 0Ω

PIN ASSIGNMENT

For TO-220, TO-263:

- 1 - V_{IN}
- 2 - OUTPUT
- 3 - GND
- 4 - FB (Feedback)
- 5 - ON/OFF

For SOP-8 with exposed pad connection to GND on the bottom of package

- 1 - V_{IN}
- 2 - OUTPUT
- 3 - FB
- 4 - ON/OFF
- 5,6,7,8 - GND

**ABSOLUTE MAXIMUM RATING**

Characteristics	Symbol	Rating	Units
Maximum supply voltage	V_{IN}	45	V
ON/OFF Pin input voltage	$V_{ON/OFF}$	-0.3 to 40, $\leq V_{in}$	V
FB (Feedback) pin voltage	V_{FB}	-0.3 to 25, $\leq V_{in}$	V
Output voltage to GND	V_{OUT}	-1	V
Power dissipation	P_D	Internally limited	W
Minimum ESD rating HBM (C=100pF, R=1.5k)	ESD	2000	V
Storage temperature range	T_{ST}	-65°C to +150°C	°C
Maximum junction temperature	$T_{J,max}$	150°C	°C

OPERATING RATING

Temperature range	T_J	-40°C $\leq T_J \leq$ +125°C	°C
Supply voltage	V_{op}	4.5 to 40	V
I_{LOAD}	I_{LOAD}	$I_{LOAD} \leq 2.0$	A

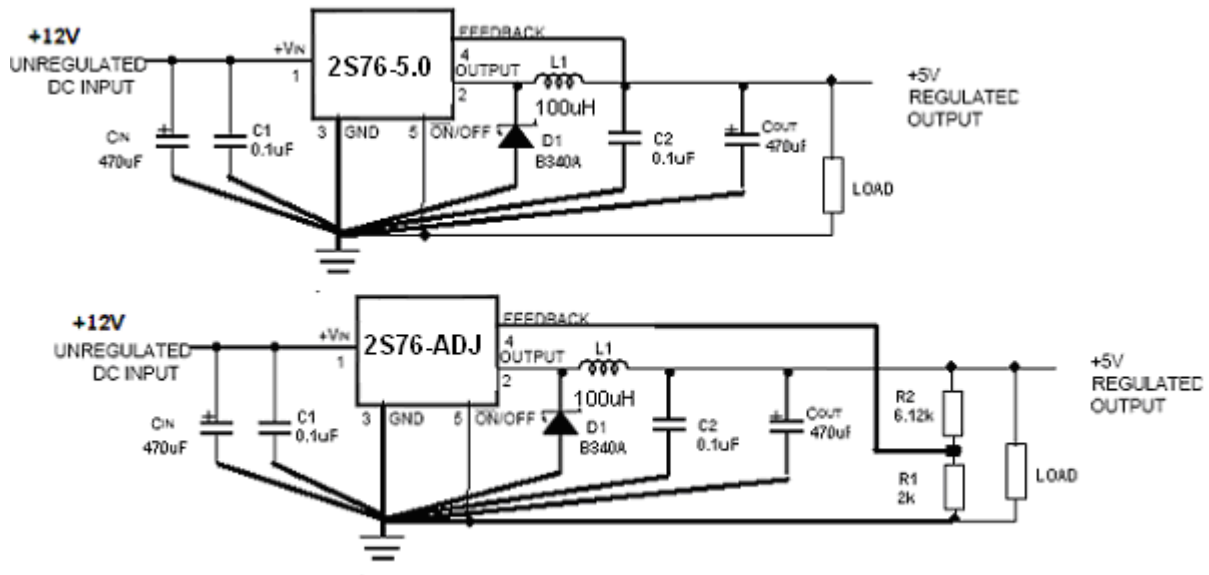
ELECTRICAL CHARACTERISTICS (Note 1)

Unless specified otherwise, $V_{IN}=12V$ for the 3.3V, 5V and adjustable versions, $V_{IN}=18V$ - for 12V version; $I_{LOAD}=0.2A$. The * denotes the specifications, which apply over full operating temperature range $T_J = -40$ to $+125^\circ C$.

SYMBOL	PARAMETER	CONDITIONS	*	Min	Typ	Max	Units
SYSTEM PARAMETERS Test Circuit Figure 1							
V_{OUT}	Output voltage 2S76K-3.3	$5.1V \leq V_{IN} \leq 40V$, $0.2A \leq I_{LOAD} \leq 2A$		3.168	3.3	3.432	V
			*	3.135		3.465	
	2S76K-5.0	$7V \leq V_{IN} \leq 40V$, $0.2A \leq I_{LOAD} \leq 2A$		4.800	5.00	5.200	V
			*	4.750		5.250	
	2S76K-12	$15V \leq V_{IN} \leq 40V$, $0.2A \leq I_{LOAD} \leq 2A$		11.52	12	12.48	V
			*	11.40		12.60	
	2S76K-ADJ	$7V \leq V_{IN} \leq 40V$, $0.2A \leq I_{LOAD} \leq 2A$ V_{OUT} programmed for 5V		1.193	1.230	1.267	V
			*	1.180		1.280	
	2S76K-A1	$7V \leq V_{IN} \leq 40V$, $0.5A \leq I_{LOAD} \leq 2A$ V_{OUT} programmed for 5V		1.205	1.242	1.279	V
			*	1.192		1.292	
TOL	Tolerance V_{OUT} 2S76K-ADJ, 2S76K-A1	$V_{IN}=10V$ to $30V$, $0.5A \leq I_{LOAD} \leq 2A$ $V_{OUT}=5V$		-2		2	%
η	Efficiency 2S76K-3.3	$V_{IN}=12V$, $I_{LOAD}=2A$			77		%
	2S76K-5.0	$V_{IN}=12V$, $I_{LOAD}=2A$			79		%
	2S76K-12	$V_{IN}=15V$, $I_{LOAD}=2A$			88		%
DEVICE PARAMETERS							
I_Q	Quiescent current	$V_{FB}=12V$ force driver off			5	8	mA
I_{FB}	Feedback bias current	$V_{FB}=1.3V$ (Adjustable version only)			-10	-50	nA
			*			-100	nA
I_{STB}	Shutdown supply current	$V_{ON/OFF}=5V$, $V_{IN}=40V$			100	200	μA
			*			250	μA
F_{OSC}	Oscillator frequency			47	52	58	kHz
			*	42		63	kHz
F_{SCP}	Oscillator frequency of Short Circuit Protect (SCP)	When $V_{OUT}<40\%$ from nominal			18		kHz
$DC_{(Max)}$	Max. duty cycle	$V_{FB}=0V$ force driver on	*		100		%
$DC_{(Min)}$	Min. duty cycle	$V_{FB}=12V$ force driver off	*		0		%
CL	Current limit	Peak current. No outside circuit. $V_{FB}=0V$		2.5	3.2	4.5	A
			*	2.3		4.9	A
V_{SAT}	Saturation voltage	$I_{OUT}=2A$. No outside circuit. $V_{FB}=0V$			1.2	1.4	V
			*		1.3	1.5	V
I_L	Output leakage current	$V_{OUT}=0V$. No outside circuit. $V_{FB}=12V$				-1	mA
I_{L1}	Output leakage current	$V_{OUT}=-1V$. No outside circuit. $V_{FB}=12V$				-30	mA
V_{IL}	ON/OFF input threshold voltage	Low (regulator ON)	*			0.6	V
V_{IH}		High (regulator OFF)	*	2.0			V
I_H	ON/OFF input current	$V_{ON/OFF}=2.5V$		-5	-0.1	5	μA

I_L	ON/OFF input current	$V_{ON/OFF}=0.5V$			0.01	-1	μA
Load reg.	Load regulation $\Delta V_{OUT}/V_{OUT}$	$I_{OUT}=0.2A$ to $2A$			0.5	1.2	%
T_{SD}	Thermal shutdown temperature	T_J	*		155		$^{\circ}C$

TEST CIRCUIT AND LAYOUT GUIDELINES



$$V_{OUT} = V_{REF} \left(1 + \frac{R_2}{R_1} \right)$$

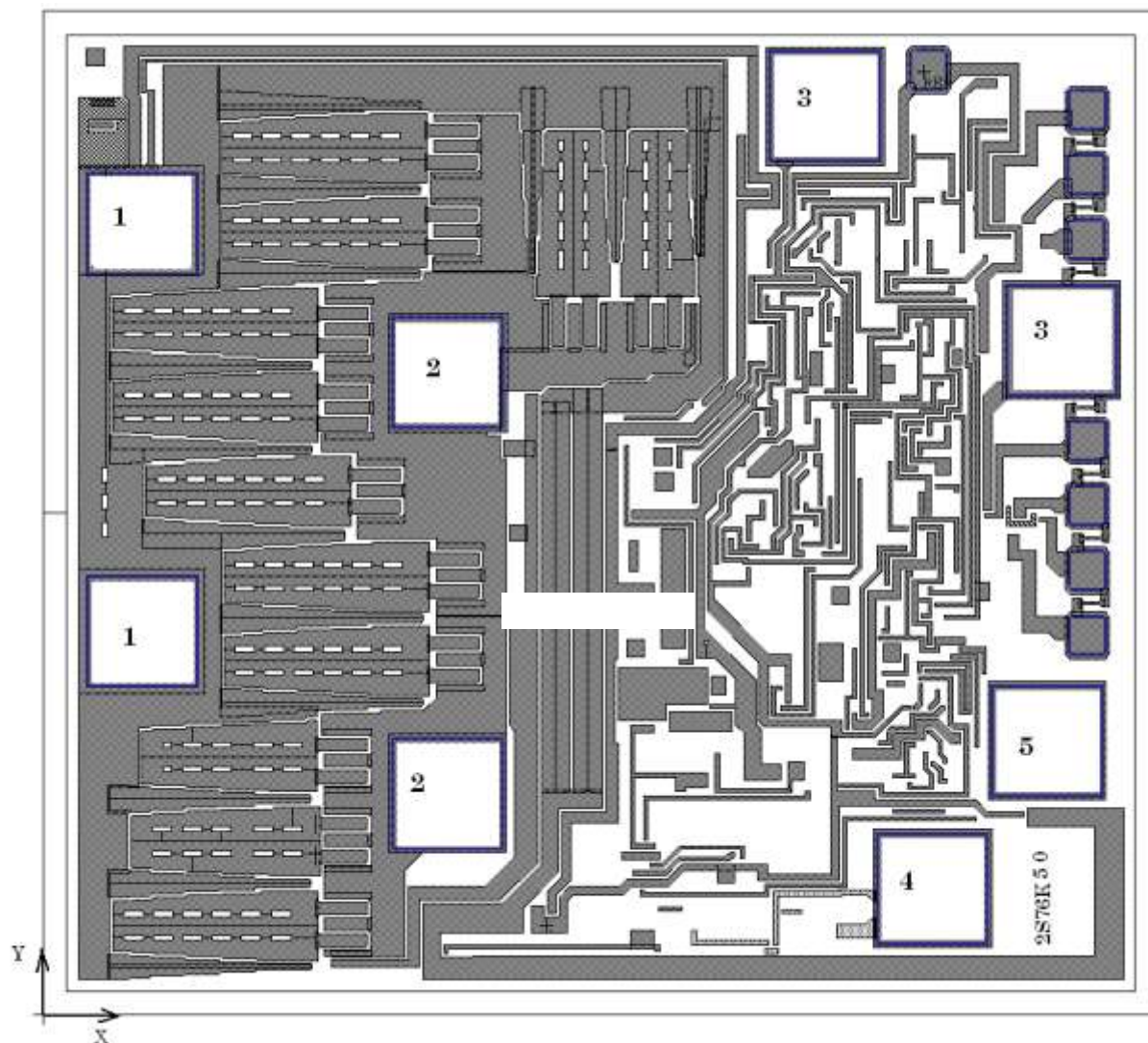
$$R_2 = R_1 \left(\frac{V_{OUT}}{V_{REF}} - 1 \right)$$

where $V_{REF} = 1.23V$, R_1 between 1k and 5k

FIGURE 1.

For minimal inductance and ground loops, the wires indicated by **heavy lines** should be wide printed circuit traces and should be kept as short as possible.

PAD LOCATION



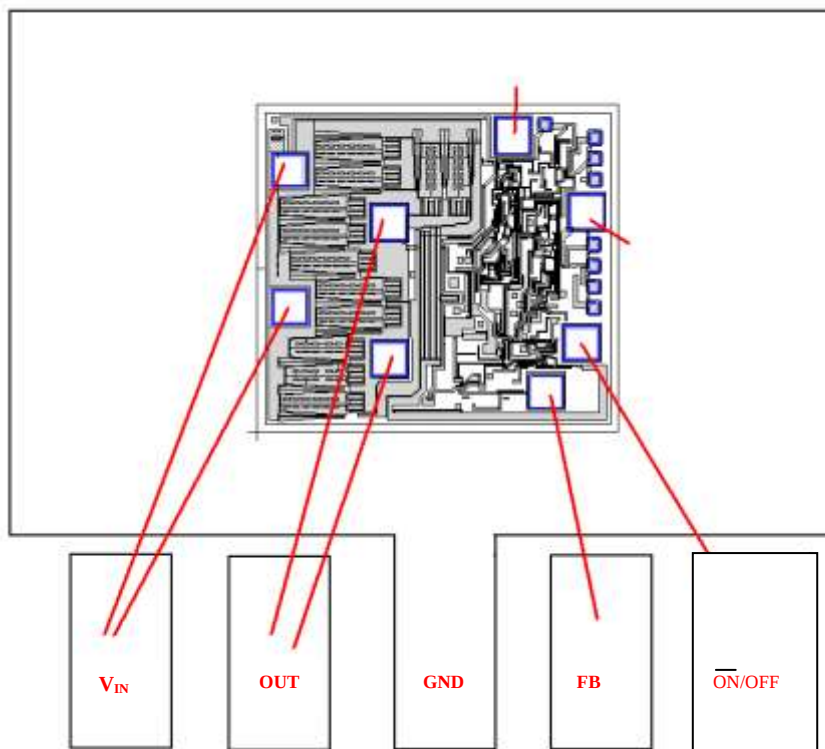
2S76K-XX

Chip size =1.89*1.70mm²

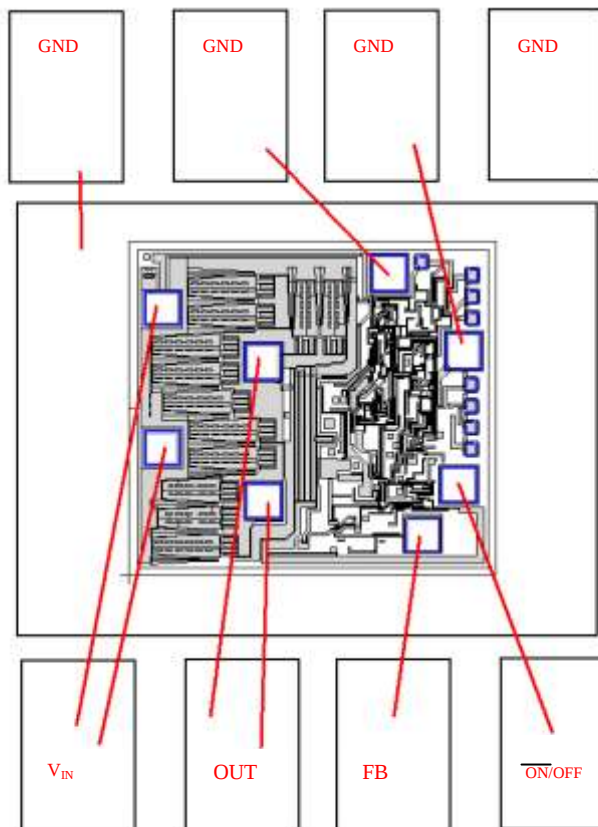
PAD LOCATION COORDINATES

Pad	Coordinates (μm)		Size(μm)
	X	Y	
1	177	651	190*190
1	177	1341	190*174
2	685	376	190*190
2	685	1089	190*190
3	1325	1541	190*190
3	1725	1143	190*190
4	1507	215	190*190
5	1700	465	190*190

BONDING DIAGRAM

**2S76K-XX**

Chip Size: 1.89*1.70mm². Package: TO-220, TO-263
The wire diameters 50μm

**2S76K-XX**

Chip size: 1.89*1.70mm². Package: SOP-8
The wire diameters 50μm