Inv № 413

3S76K-XX 52kHz 3A PWM Buck DC/DC Converter

November 2009

FEATURES

- Output voltage: 3.3V, 5V, 12V and adjustable output version 1.
- Adjustable version output voltage range, 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 input voltage 3A.
- Low power standby mode.

GENERAL DESCRIPTION

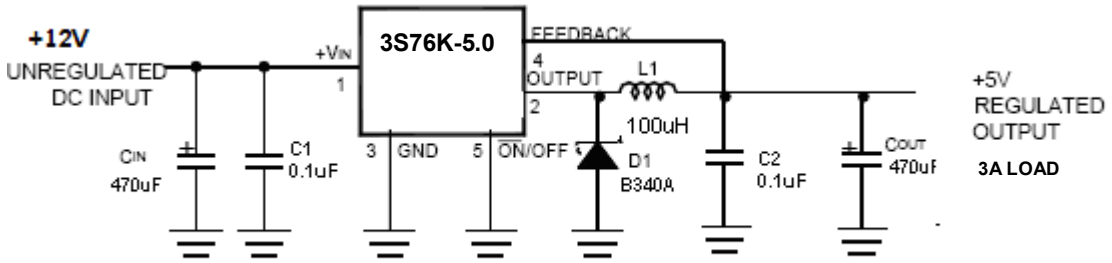
The 3S76K series are monolithic IC designed for a step-down DC/DC converter, and own the ability of driving 3A load without additional transistor. It saves board space. The external shutdown function can be controlled by logic level and then come into standby mode. The internal compensation makes feedback control having good line and load regulation without external design. Regarding protected function, thermal shutdown is to prevent over temperature operating from damage, and current limit is against over current operating of the output switch. If current limit function occurs and V_{FB} is down below 40% from the nominal output voltage, the switching frequency will be reduced.

The output version included fixed 3.3V, 5V, 12V, and an adjustable type. The chips are available in a standard 5-lead TO-220, TO-263 and 8-lead SOP package (for Iload ≤ 2A).

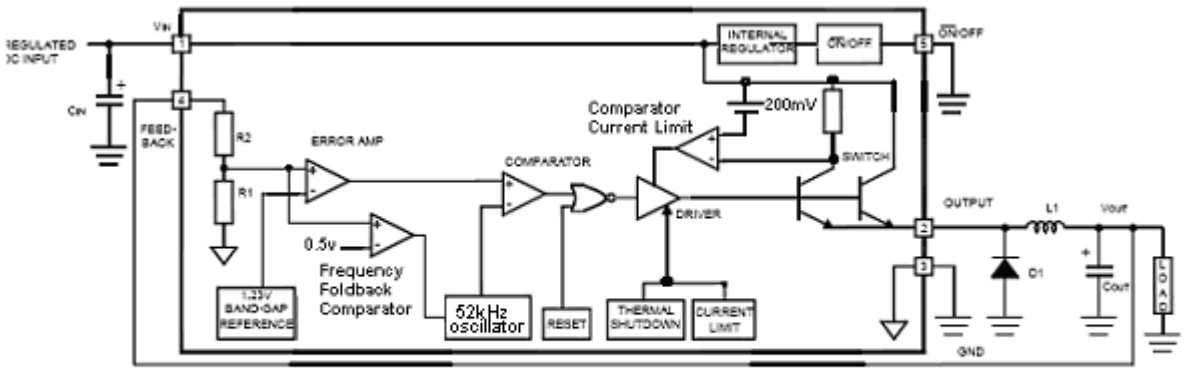
APPLICATIONS

- 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 – Vin
2 – OUTPUT
3 – GND
4 – FB
5 – ON/OFF

For SOP-8 with Exposed PAD connection to Gnd on the bottom of Package «Note:SOP-8 for Iload ≤ 2A

1 – Vin
2- OUTPUT
3- FB
4 – ON/OFF
5,6,7,8 – GND

ABSOLUTE MAXIMUM RATING

Characteristics	Symbol	Rating	Units
Maximum Supply Voltage	Vin	45	V
ON/OFF Pin Input Voltage	$V_{ON/OFF}$	-0.3 to 40, ≤ Vin	V
Feedback Pin Voltage	V_{FB}	-0.3 to 25, ≤ Vin	V
Output Voltage to Ground	V_{OUT}	-1	V
Power Dissipation	P_D	Internally limited	W
Minimum ESD Rating Human body model (C=100pF, R=1.5k)	ESD	2000	V
Storage Temperature Range	Tst	-65°C to +150°C	°C
Maximum Junction Temperature	Tj-max	150°C	°C

OPERATING RATING

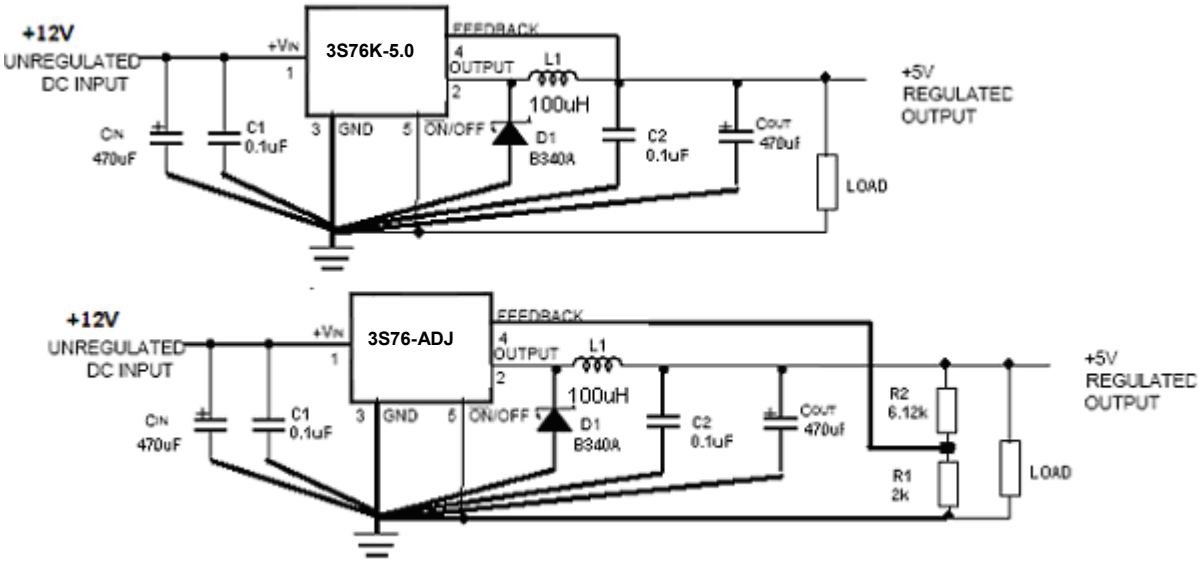
Temperature Range	Tj	-40°C ≤ Tj ≤ +125°C	°C
Supply Voltage	Vop	4.5 to 40	V
Iload	Iload	Iload ≤ 3	A

Electrical Characteristics (Note 1**).**
Unless otherwise specified, Vin=12v for the 3.3v, 5v and Adjustable versions, Vin=18v for 12v versions; Iload=0.3A.
The * denotes the specifications which apply over full operating temperature range T_J = -40…+125°C.

Symbol	Parameter	Conditions					Units
				Min	Typ	Max	
SYSTEM PARAMETERS	**Test Circuit** Figure 1						
V_{OUT}	Output Voltage 3S76K-3.3	5.6V ≤ V_{IN} ≤ 40V , 0.2A ≤ I_{LOAD} ≤ 3A	 *	3.168 3.135	3.3	3.432 3.465	V
	3S76K -5.0	8V ≤ V_{IN} ≤ 40V ,0.2A ≤ I_{LOAD} ≤ 3A	 *	4.800 4.750	5.00	5.200 5.250	V
	3S76K -12	15V ≤ V_{IN} ≤ 40V, 0.2A ≤ I_{LOAD} ≤ 3A	 *	11.52 11.40	12	12.48 12.60	V
	3S76K -ADJ	8V ≤ V_{IN} ≤ 40V , 0.2A ≤ I_{LOAD} ≤ 3A Vout programmed for 5v	 *	1.193 1.180	1.230	1.267 1.280	V
TOL	Tolerance Vout 3S76K -ADJ	Vin=10V to 30V, 0.5A ≤ I_{LOAD} ≤ 2A		-2		2	%
η	Efficiency 3S76K -3.3	V_{IN} =12V, I_{LOAD} =3A			77		%
	3S76K -5.0	V_{IN} =12V, I_{LOAD} =3A			79		%
	3S76K -12	V_{IN} =15V, I_{LOAD} =3A			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
Istb	Shutdown supply Current	$V_{ON/OFF}$=5v, Vin=40V			100	200	uA
			*			250	uA
Fosc	Oscillator Frequency			47	52	58	kHz
			*	42		63	kHz
Fscp	Oscillator Frequency of short circuit protect	When Vout<40% from nominal			18		kHz
DCmax	Max. Duty Cycle	V_{FB}=0V force driver on	*		100		%
DCmin	Min. Duty Cycle	V_{FB}=12V force driver off	*		0		%
CL	Current Limit 3S76K	Peak current. No outside circuit. V_{FB}=0V		3.7	5	6.9	A
			*	3.4		7.5	A
Vsat	Saturation Voltage 3S76K	Iout=3A. No outside circuit. V_{FB}=0V			1.4	1.6	V
			*		1.5	1.7	V
I_L	Output Leakage Current	Vout=0V. No outside circuit. V_{FB}=12V				-1	mA
I_{L1}	Output Leakage Current	Vout= -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	uA
I_L	ON/OFF input current	$V_{ON/OFF}$=0.5v			0.01	-1	uA
Load Reg	Load regulation ΔVout/Vout	Iout=0.2A to 3A			0.5	1.2	%
Tsd	Thermal shutdown Temp	Tj	*		155		°C

TEST CIRCUIT AND LAYOUT GUIDELINES



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

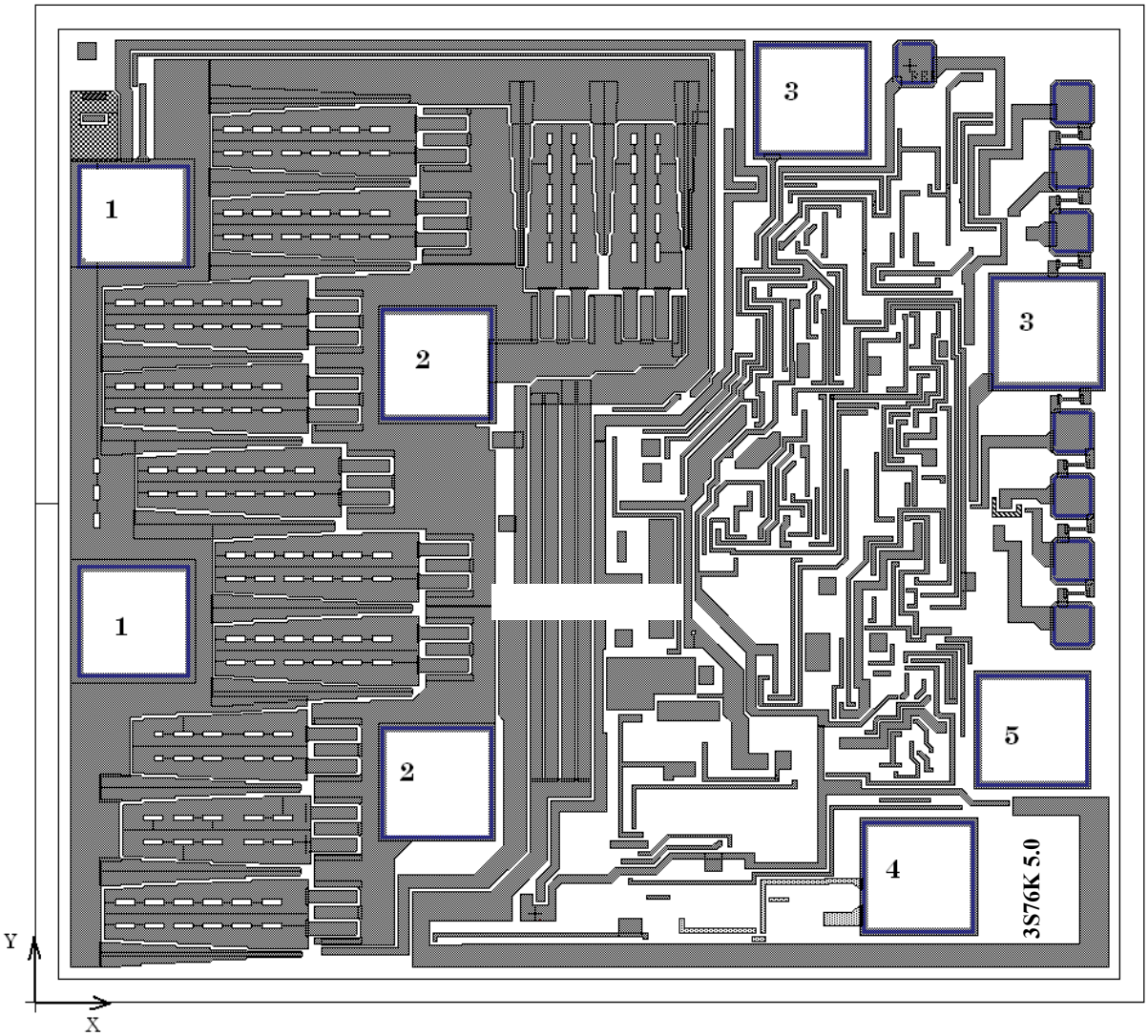
$$R_2 = R_1(\frac{V_{OUT}}{V_{REF}} - 1)$$

where V_{REF} = 1.23V, R1 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

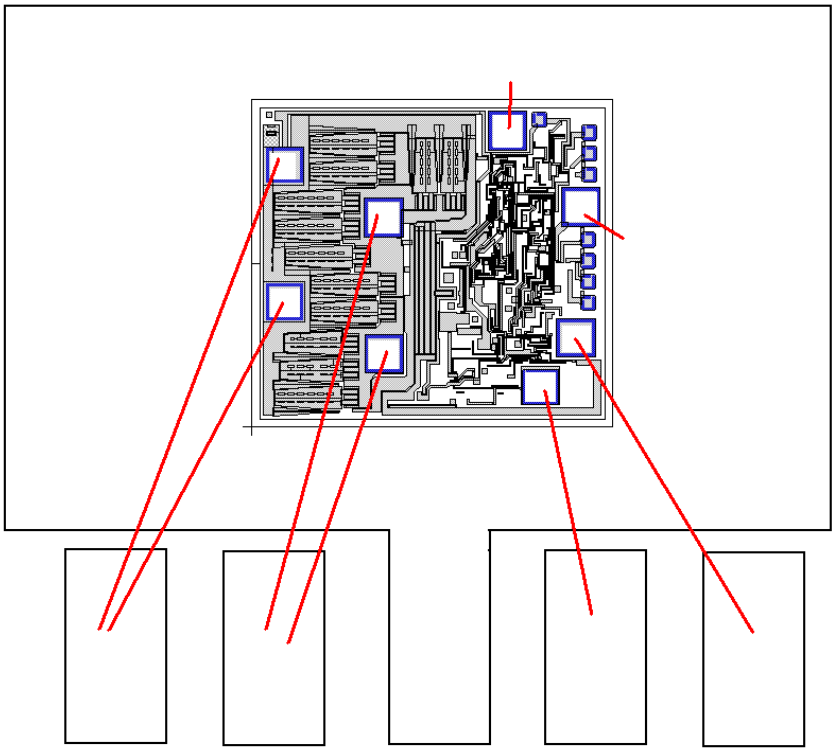


3S76K-XX Chip Size =1.89*1.70mm^2

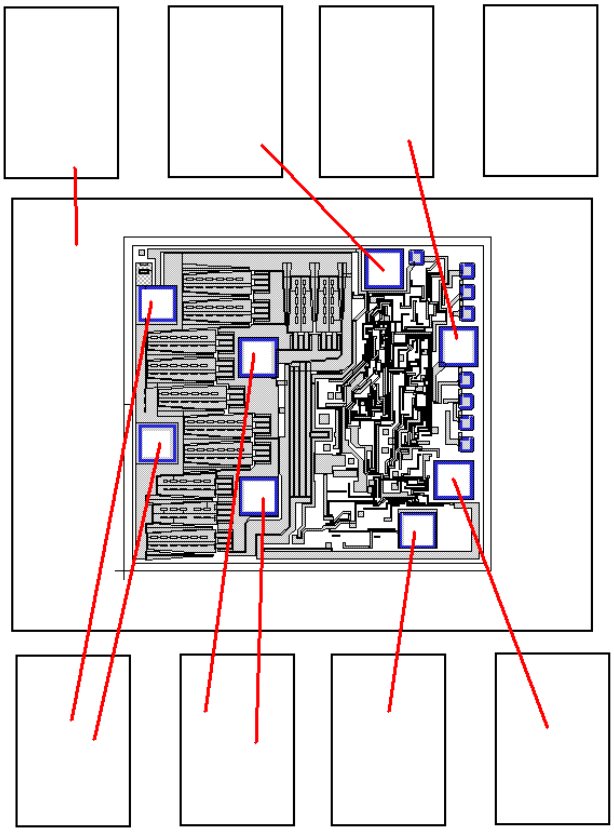
PAD LOCATION COORDINATES

PAD N	Coordinates (um)		PAD size (um)
	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



3S76K-XX
Chip Size : 1.87*1.70mm^2
Package: TO-220, TO-263
The wire diameters 75um



3S76K-XX Chip Size : 1.87*1.70mm^2
Package: SOP-8
The wire diameters 75um