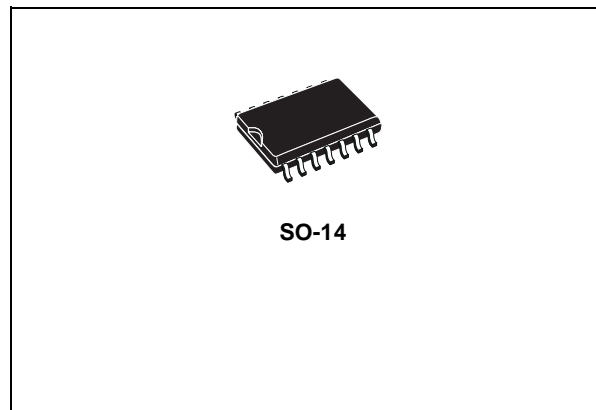
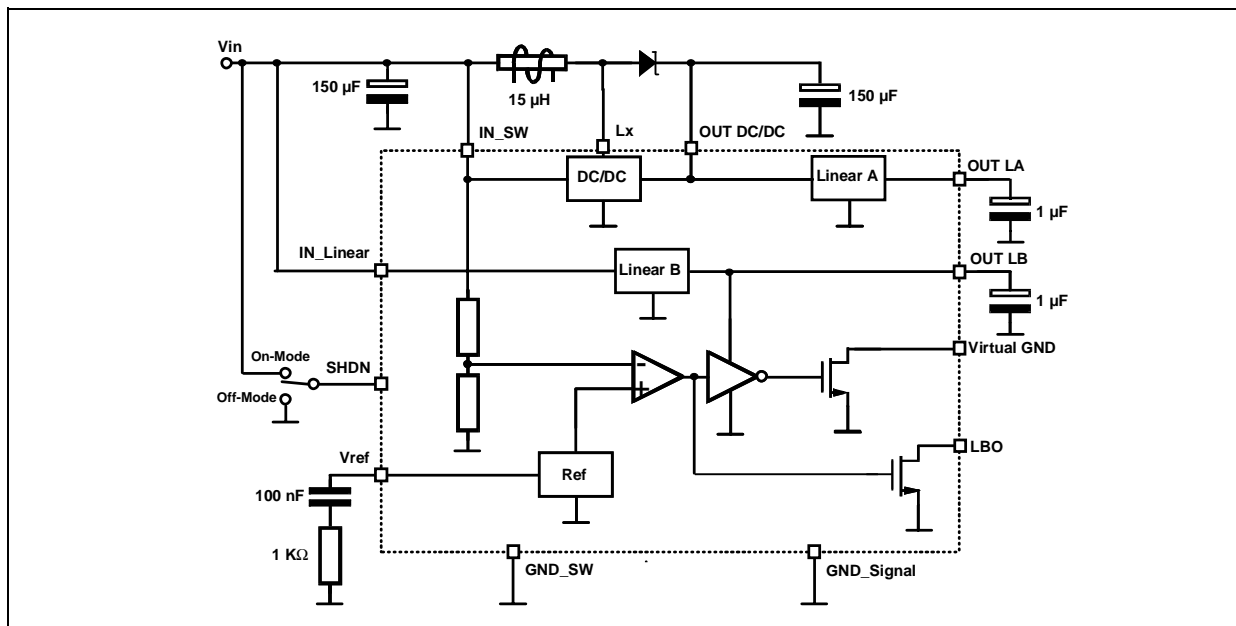


## TRIPLE VOLTAGE REGULATOR

- ONLY TWO CELL NEED AS INPUT
- THREE REGULATED OUTPUT
  - 1) HIGH EFFICIENCY PFM DC/DC CONVERTER 3.3V AT 200mA (87% EFFICIENCY)
  - 2) VERY LOW NOISE AND VERY LOW DROP  $V_{REG}$  (3V AT 20mA)
  - 3) VERY LOW NOISE AAND VERY LOW DROP  $V_{REG}$  (1.9V AT 20mA)
- LOGIC CONTROLLED ELECTRONIC SHUTDOWN
- LOW BATTERY DETECTOR
- VIRTUAL GND PIN
- TEMPERATURA RANGE: -40 TO 85°C



### SCHEMATIC DIAGRAM



## ST3M01

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### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>IN</sub>	DC Input Voltage (Both IN_Linear and IN_SW)	-0.3 to 7	V
V <sub>SHDN</sub>	Shutdown Input Voltage	-0.3 to V <sub>IN</sub> +0.3	V
V <sub>LX</sub>	Switch Voltage	-0.3 to 7	V
V <sub>LBO</sub>	Low Battery Output Voltage	-0.3 to 7	V
V <sub>virtual_GND</sub>	Virtual GND Output Voltage	-0.3 to 7	V
I <sub>LBO</sub>	Low Battery Output Maximum Current	30	mA
I <sub>virtual_GND</sub>	Virtual GND Output Maximum Current	30	mA
T <sub>stg</sub>	Storage Temperature Range	-65 to +150	°C
T <sub>op</sub>	Operating Junction Temperature Range	-40 to +85	°C

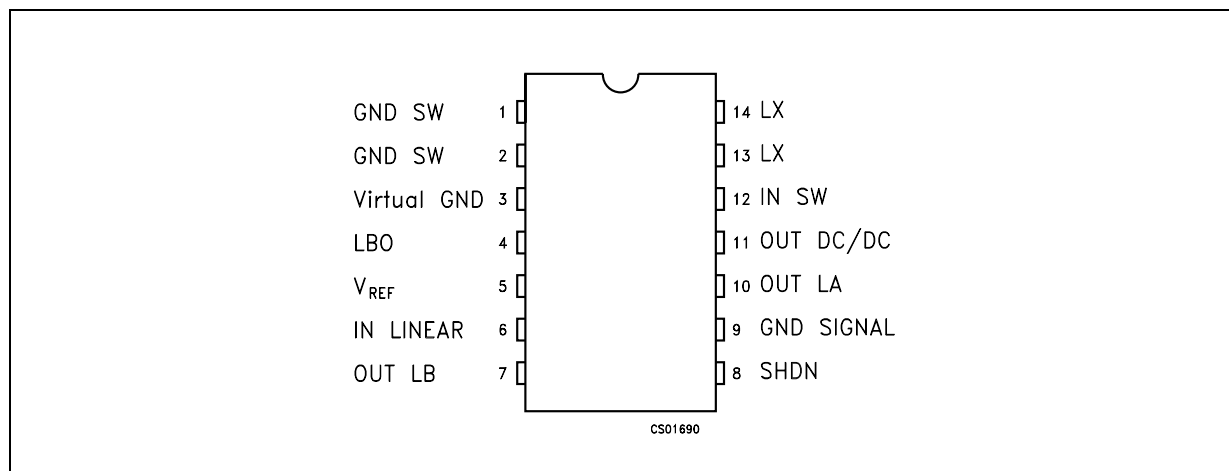
### THERMAL DATA

Symbol	Parameter	Value	Unit
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient (*)	160	°C/W

### ORDER CODES

Type	Package	Comment
ST3M01D	SO-14	50 parts per tube / 20 tube per box
ST3M01DTR	SO-14 (Tape & Reel)	2500 parts per reel

## CONNECTION DIAGRAM (top view)



## PIN DESCRIPTION

Pin N°	Symbol	Name and Function
1	GND SW	Switching Ground. Must be low impedance; solder directly to GND plane
2	GND SW	Switching Ground. Must be low impedance; solder directly to GND plane
3	Virtual GND	Virtual GND. Open Drain N-Channel MOSFET: must be high impedance when the Low Battery condition is detected.
4	LBO	Low Battery Output. Open Drain N-Channel MOSFET: sinks current when the input voltage drops below 2V typically.
5	V <sub>REF</sub>	Reference Voltage Output. Bypass with 0.1 μF to improve the linears V <sub>REF</sub> thermal noise performance.
6	IN Linear	Linear Input. Must be connected together with IN SW to the input supply.
7	OUT L <sub>B</sub>	Linear B Output port. 1.9V typically.
8	SHDN	Shutdown Input. Disables the SMPS and L <sub>A</sub> output, but the L <sub>B</sub> , the reference voltage and the low battery comparator remain active.
9	GND Signal	Signal GND. Must be connected together with the Switching Ground.
10	OUT L <sub>A</sub>	Linear A Output port. 3V typically.
11	OUT DC/DC	DC/DC Output Port: 3.3V typically.
12	IN SW	SMPS Input. Must be connected together with IN_Linear to the input supply.
13	LX	1.5A N-Channel Power MOSFET Drain.
14	LX	1.5A N-Channel Power MOSFET Drain.

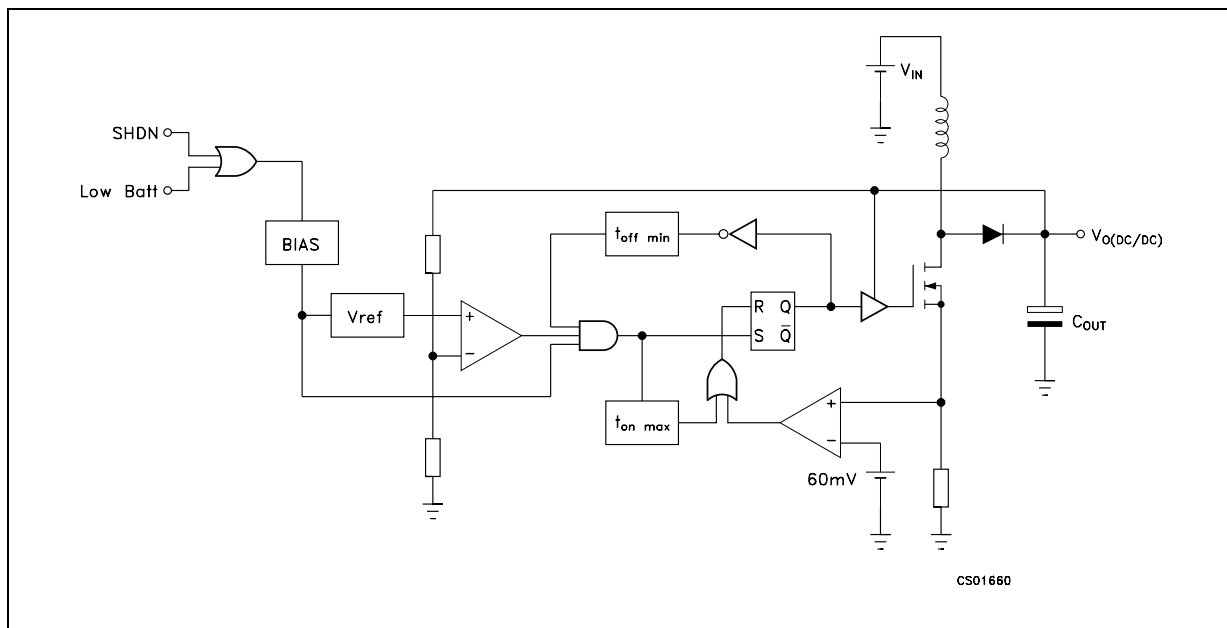
**ELECTRICAL CHARACTERISTICS** (Unless otherwise specified, please refer to the typical operating circuit of the pag 1 for the external components values and connections. Unless otherwise noted  $V_{SHDN}=HIGH$ )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_I$	Operating Input Voltage		1.9		3.3	V
$V_{O(DC/DC)}$	DC/DC Converter Output Voltage (Test Circuit A)	$2.24 < V_{IN} < 3.3V$ ; $0 < I_{O(DC/DC)} < 200mA$ ; $0 < I_{O(LA)} < 20mA$ ; $0 < I_{O(LB)} < 20mA$ ; $-40 < T_J < 85^\circ C$	3.2	3.3	3.415	V
$\eta$	DC/DC Converter Efficiency	$V_{IN}=2.4V$ ; $I_{O(DC/DC)}=100mA$ ; $I_{O(LA)}=0mA$ ; $I_{O(LB)}=0mA$ ; $T_J = 25^\circ C$		87		%
$V_{O(LA)}$	Linear A Output Voltage (Test Circuit A)	$2.24 < V_{IN} < 3.3V$ ; $0 < I_{O(DC/DC)} < 200mA$ ; $0 < I_{O(LA)} < 20mA$ ; $0 < I_{O(LB)} < 20mA$ ; $-40 < T_J < 85^\circ C$	2.93	3	3.09	V
$V_{O(LB)}$	Linear B Output Voltage (Test Circuit A)	$2.24 < V_{IN} < 3.3V$ ; $0 < I_{O(DC/DC)} < 200mA$ ; $0 < I_{O(LA)} < 20mA$ ; $0 < I_{O(LB)} < 20mA$ ; $-40 < T_J < 85^\circ C$	1.86	1.9	1.955	V
$e_{N(LA)}$	Linear A Thermal Output Noise Voltage (Note 2)	$V_{IN}=2.4V$ ; $V_{O(DC/DC)}=3.5V$ ; $I_{O(LA)}=20mA$ ; $10 < f < 80KHz$ ; $C_{O(LA)}=1\mu F$ ; $C_{REF}=0.1\mu F$ ; $T_J = 25^\circ C$		60		$\mu V_{rms}$
$e_{N(LB)}$	Linear B Thermal Output Noise Voltage (Note 2)	$V_{IN}=2.4V$ ; $V_{O(DC/DC)}=3.5V$ ; $I_{O(LB)}=20mA$ ; $10 < f < 80KHz$ ; $C_{O(LB)}=1\mu F$ ; $C_{REF}=0.1\mu F$ ; $T_J = 25^\circ C$		35		$\mu V_{rms}$
$I_{q(OFF)}$	Quiescent Current OFF Mode DC/DC & $L_A$ OFF $L_B$ ON (Test Circuit E)	$V_{IN}=3.3V$ ; No Load; $V_{SHDN}=LOW$ ; $T_J = 25^\circ C$		75		$\mu A$
$I_{q(OFF)}$	Quiescent Current OFF Mode (DC/DC & $L_A$ OFF $L_B$ ON) (Test Circuit F)	$V_{IN}=1.9V$ ; No Load; $V_{SHDN}=HIGH$ ; $T_J = 25^\circ C$		50		$\mu A$
$I_S(DC/DC)$	DC/DC Supply Current (Test Circuit B)	$V_{IN}=2.24V$ ; No Load; $T_J = 25^\circ C$		100		$\mu A$
$I_{q(LA)}$	Linear A Quiescent Current (Test Circuit C)	$V_{IN}=2.24V$ ; $V_{O(DC/DC)}=3.5V$ ; $I_{O(LA)}=10mA$ ; $T_J = 25^\circ C$		220		$\mu A$
$I_{q(LB)}$	Linear B Quiescent Current (Test Circuit C)	$V_{IN}=2.24V$ ; $V_{O(DC/DC)}=3.5V$ ; $I_{O(LB)}=10mA$ ; $T_J = 25^\circ C$		75		$\mu A$
$V_{BATT}$	Low Battery Detection Range	$V_{SHDN}=HIGH$ with falling edge	1.96	2	2.04	V
$V_{BATT(HYS)}$	Low Battery Detection Hysteresys			150	200	mV
$R_{ON(LBO)}$	LBO $R_{DS(ON)}$	$V_{IN}=1.9V$ ; $I_D=5mA$ ; $T_J = 25^\circ C$		10		$\Omega$
$V_{ih}$	Control Input Logic Low	$V_{IN}>2.24V$ ; $-40 < T_J < 85^\circ C$			0.4	V
$V_{il}$	Control Input Logic High	$V_{IN}>2.24V$ ; $-40 < T_J < 85^\circ C$	1.5			V
$T_{on}$	Timer On Response Time on DC/DC	$V_{IN}=2.4V$ ; $C_O=100\mu F$ ; $T_J = 25^\circ C$ $I_{O(DC/DC)}=200mA$ $V_{SHDN}=\text{from GND to } V_{SHDN(MAX)}$		0.6	9	ms
$R_{ON(V\_GND)}$	Virtual GND $R_{DS(ON)}$	$V_{IN}>2.24V$ ; $I_D=5mA$ ; $T_J = 25^\circ C$		10		$\Omega$

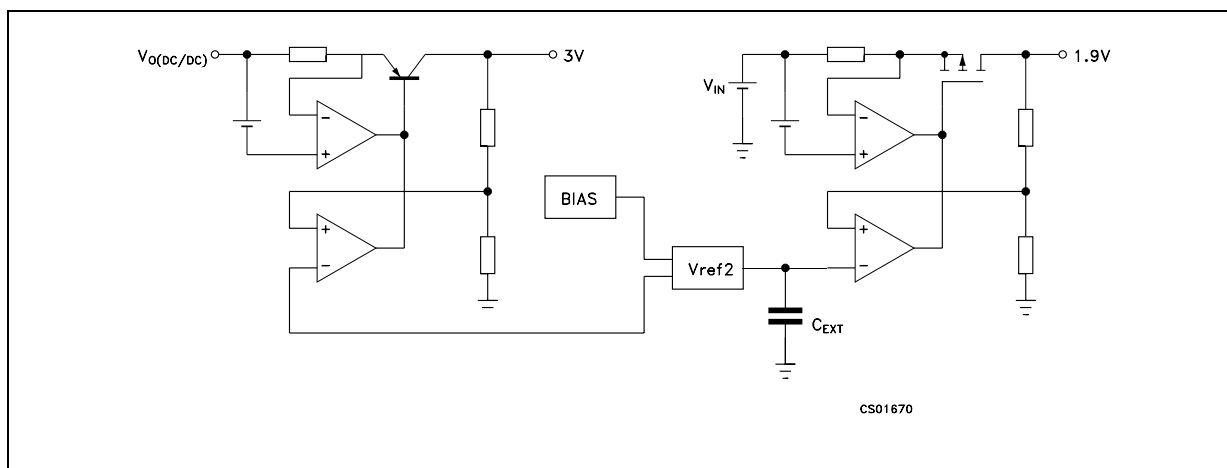
Note 1: For  $V_{IN} < 1.9V$  the  $V_{O(LB)}$  is out of regulation because of under dropout condition

Note 2:  $V_{O(DC/DC)} = 3.5V$  force for an external DC source to avoid switching noise

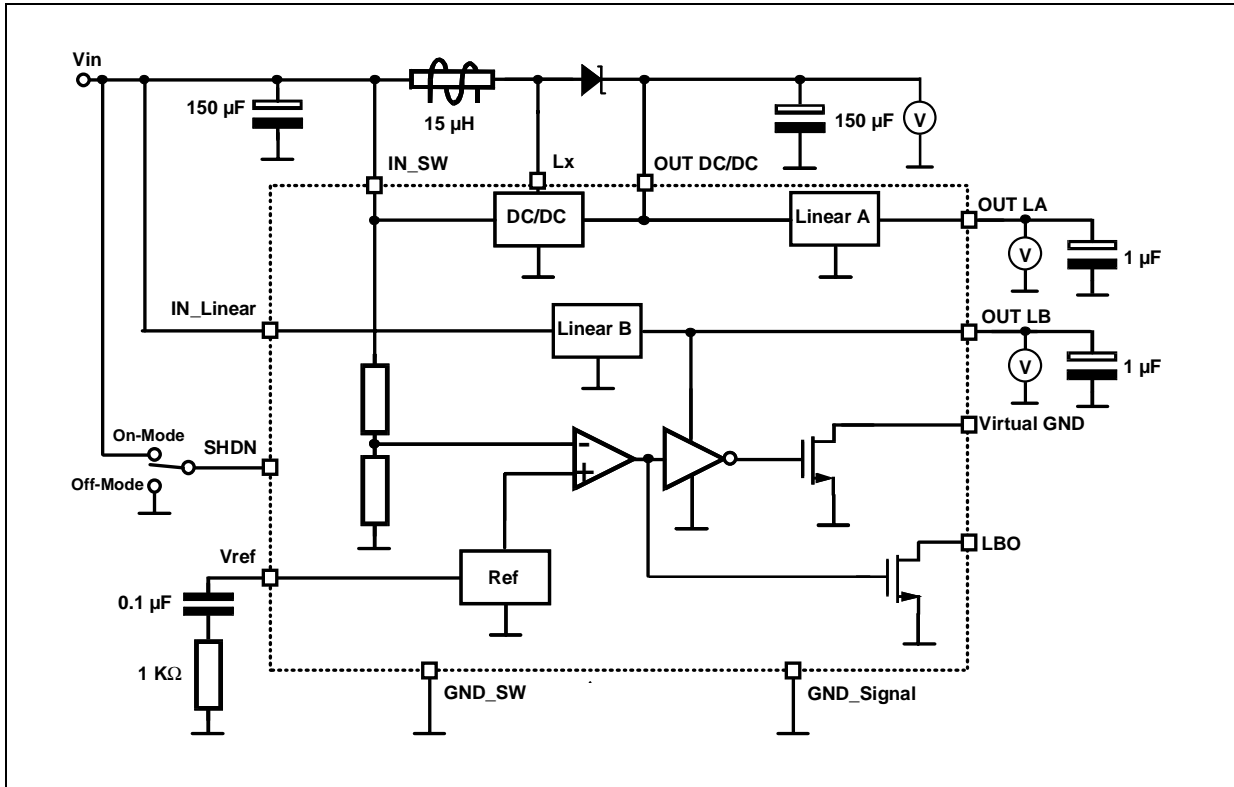
DC/DC CONVERTER BLOCK DIAGRAM



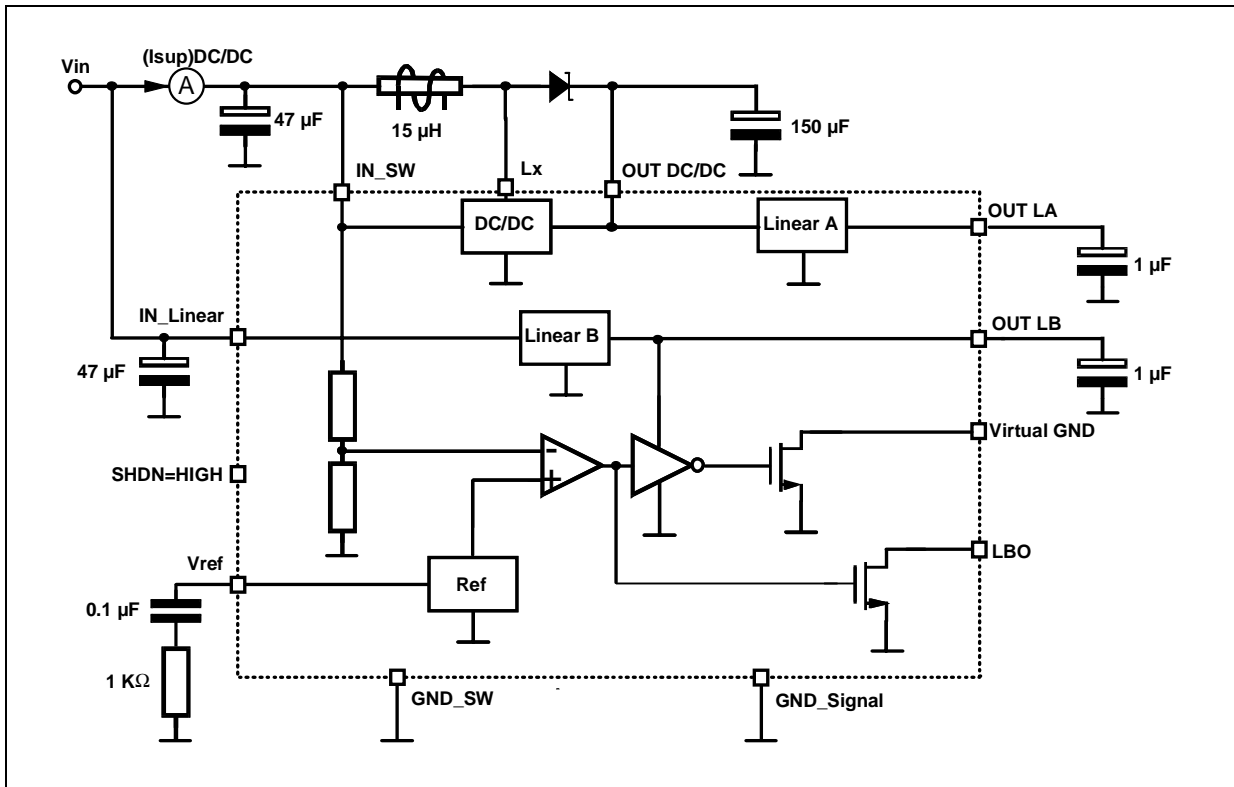
LINEAR VREG BLOCK DIAGRAM



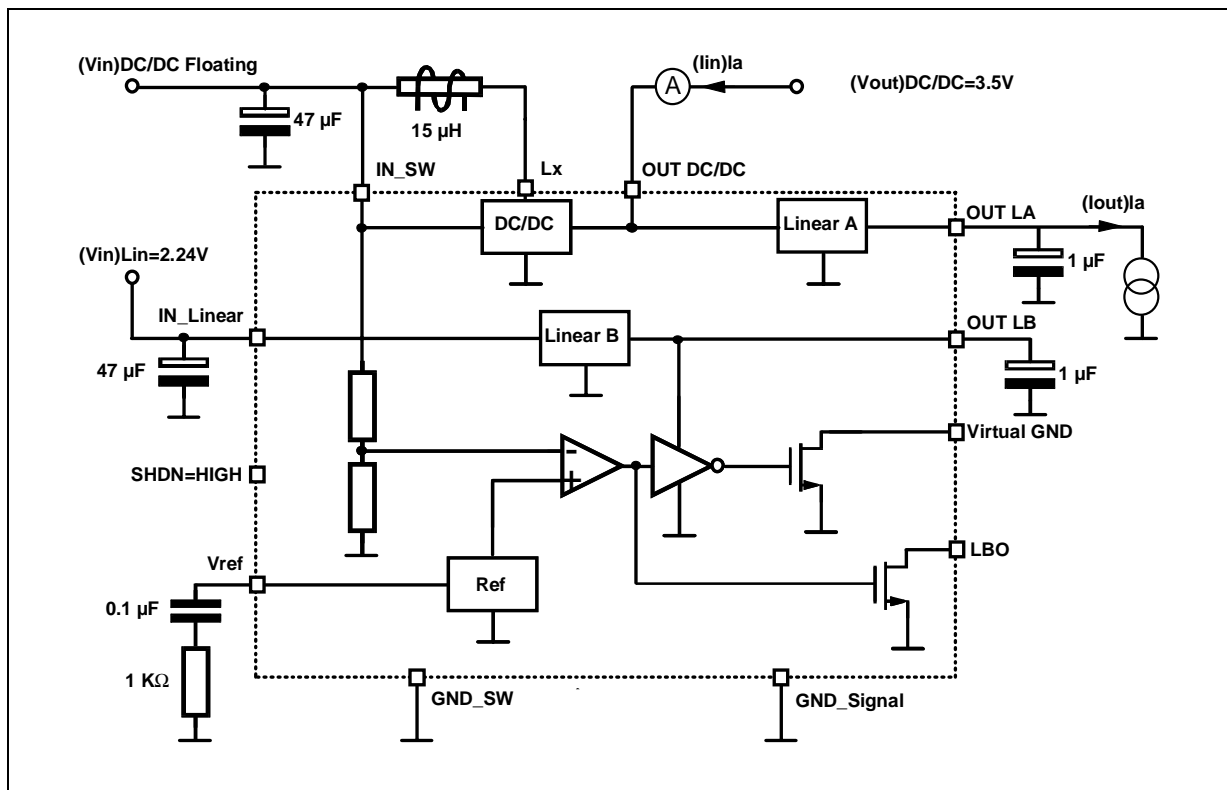
TEST CIRCUIT A



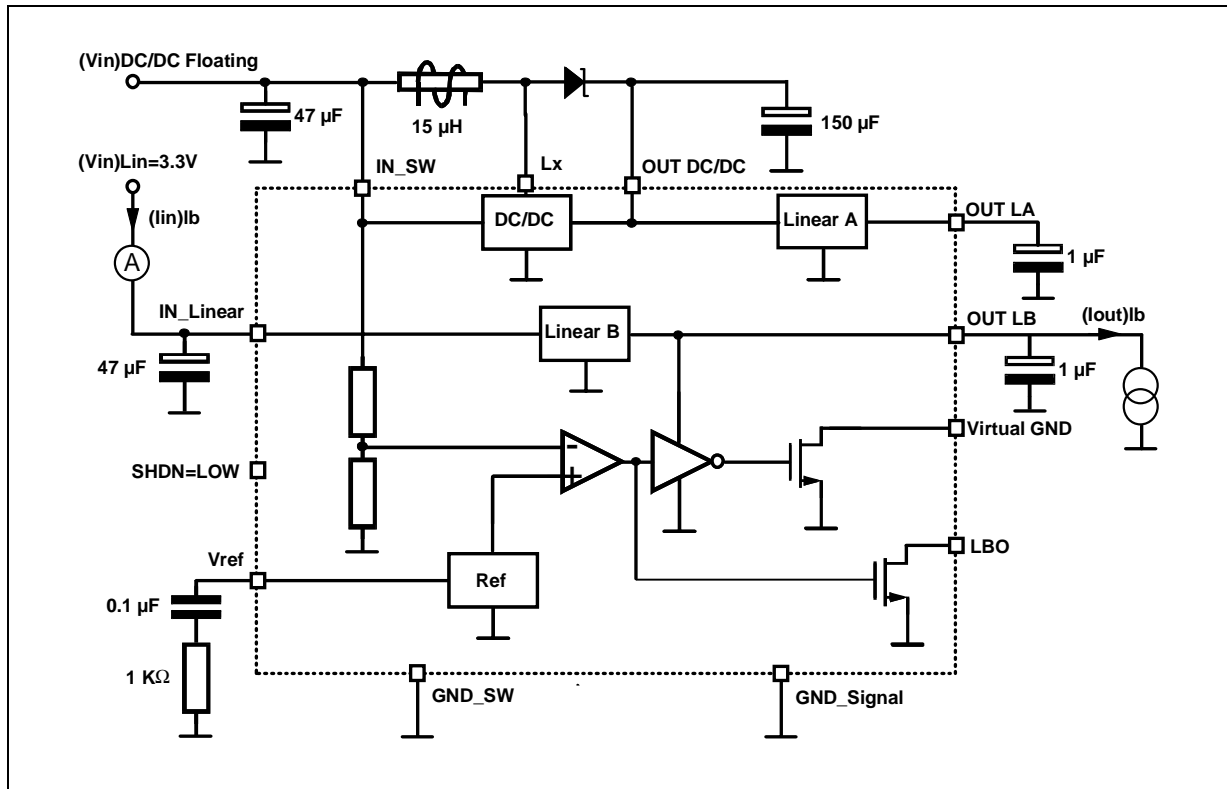
TEST CIRCUIT B



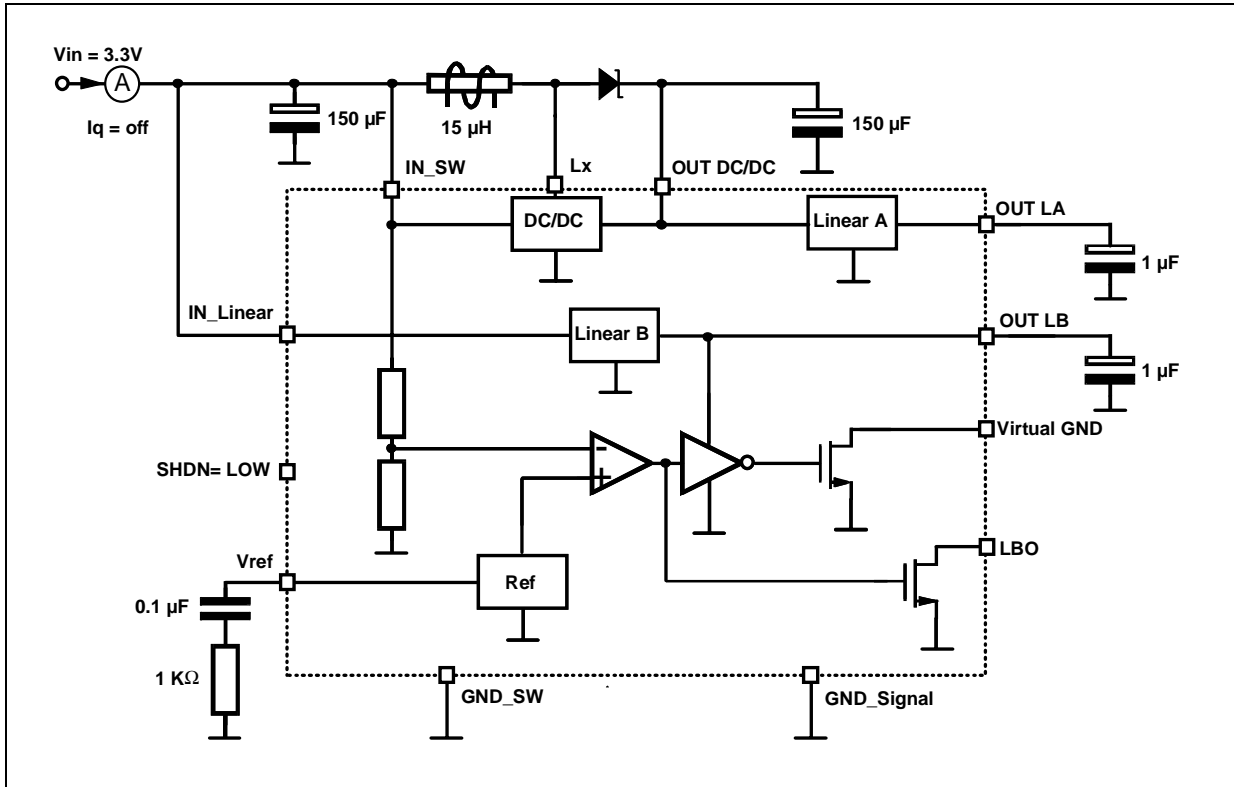
TEST CIRCUIT C  $(I_q)_{Ia} = (I_{in})_{Ia} - (I_{out})_{Ia}$



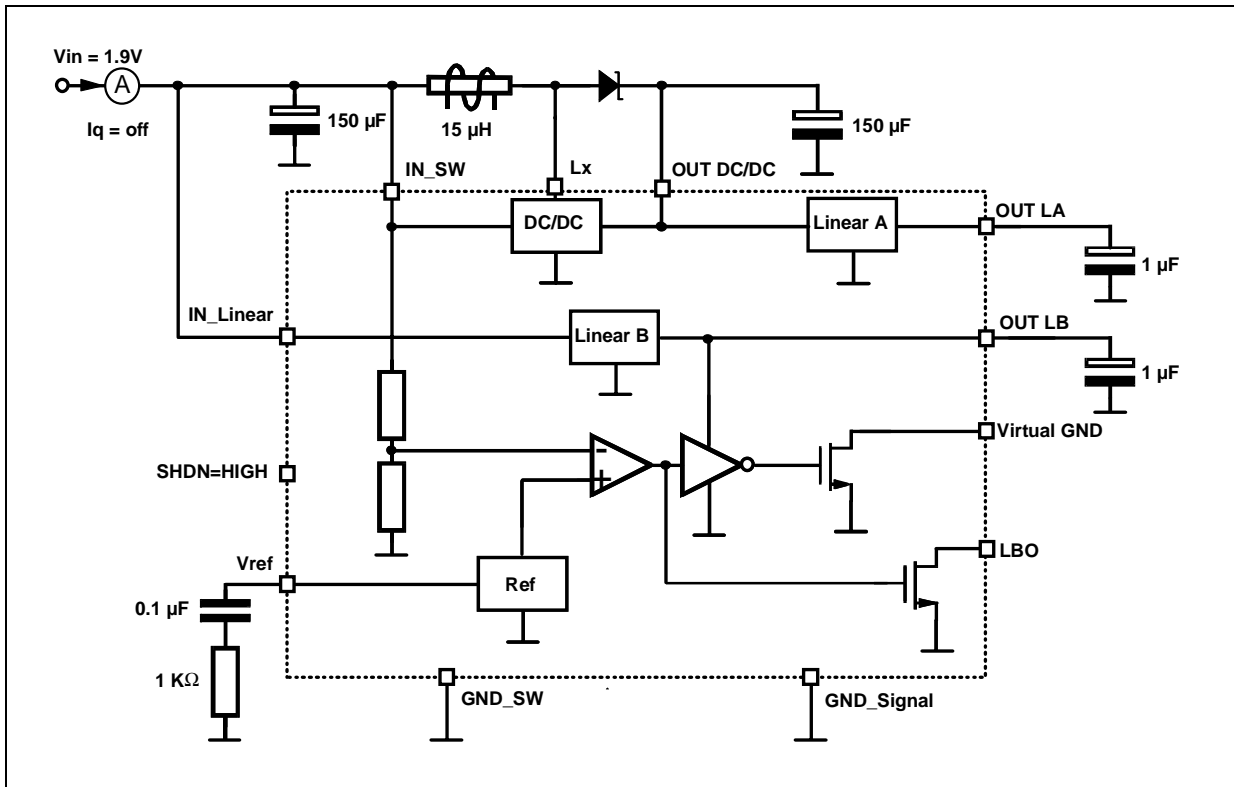
TEST CIRCUIT D  $(I_q)_{Ib} = (I_{in})_{Ib} - (I_{out})_{Ib}$



TEST CIRCUIT E

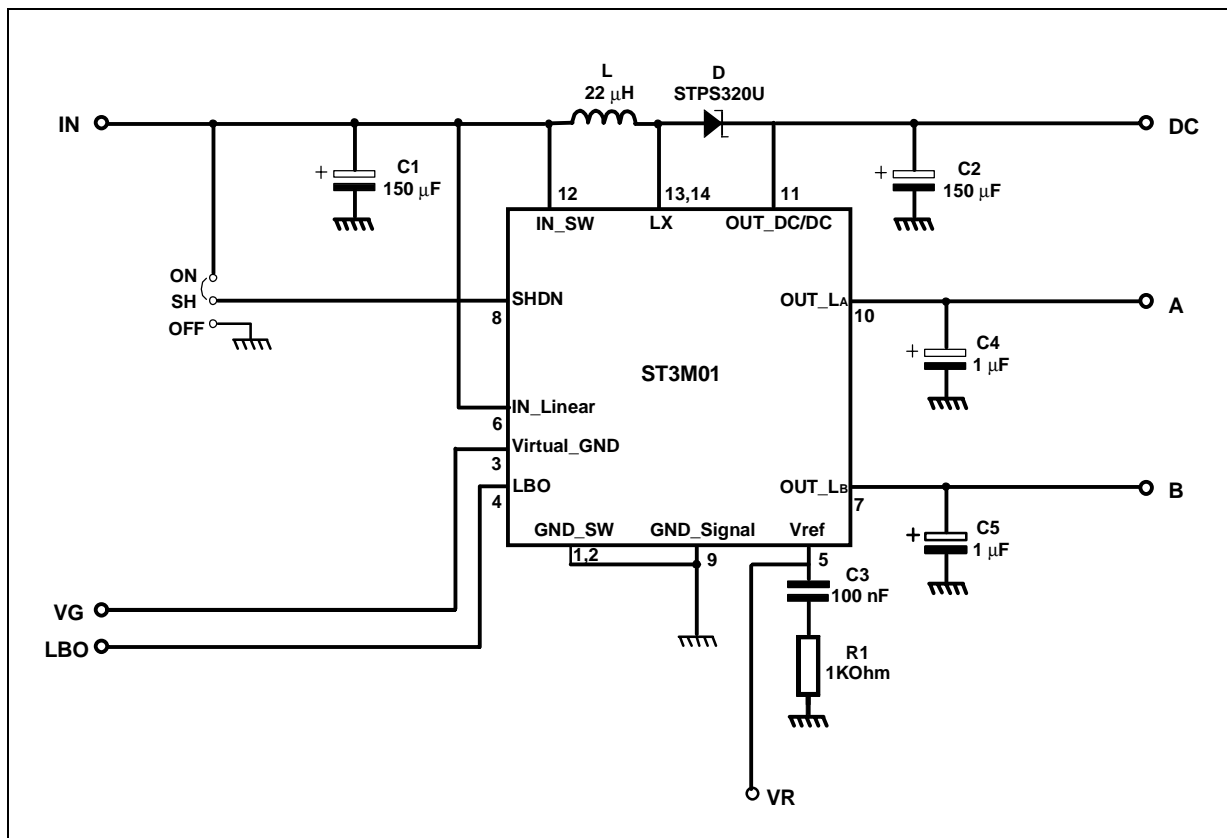


TEST CIRCUIT F

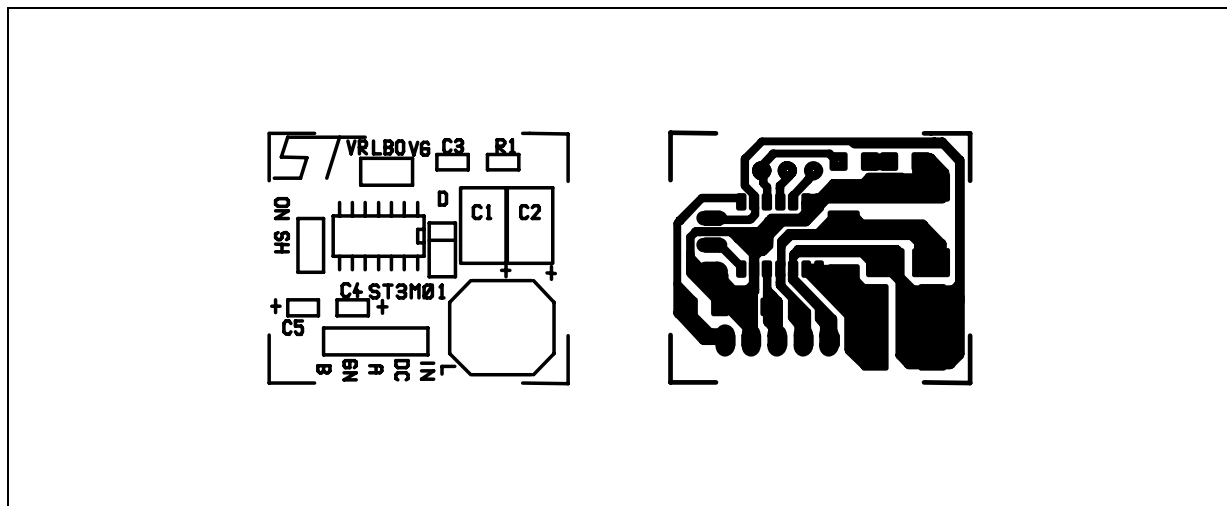




DEMOBOARD CIRCUIT

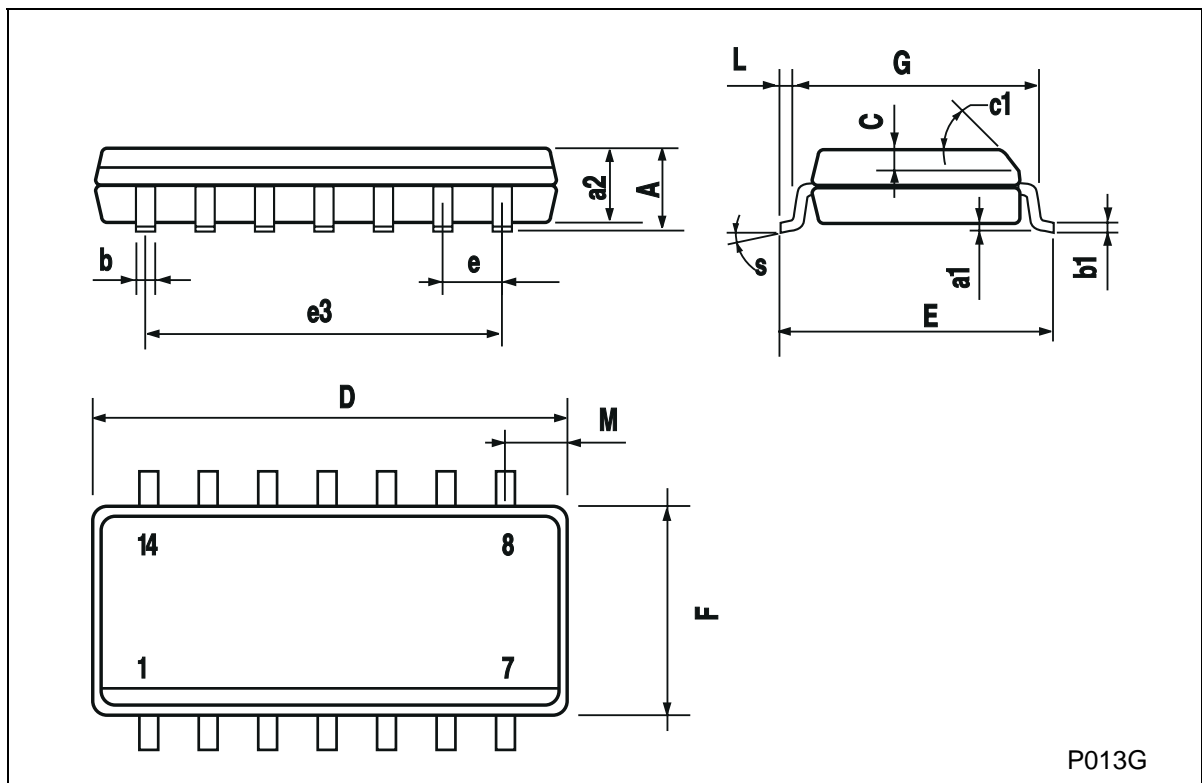


PC BOARD LAYOUT



## SO-14 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.003		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45 (typ.)					
D	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.68			0.026
S	8 (max.)					



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