Features

- Low start-up power supply voltage :1.4V(CH4)
- Wide supply voltage range from 1.8V to 7V (CH1~4)
- High speed operation is possible: Maximum 1 MHz
- Supports for down and up/down Zeta conversion (CH1)
- Supports for up, flyback and up/down SEPIC conversion (CH2,3,4)
- Totem-pole type output for MOSFET
- Built-in On/Off function
- Built-in Short-Circuit Protection

Applications

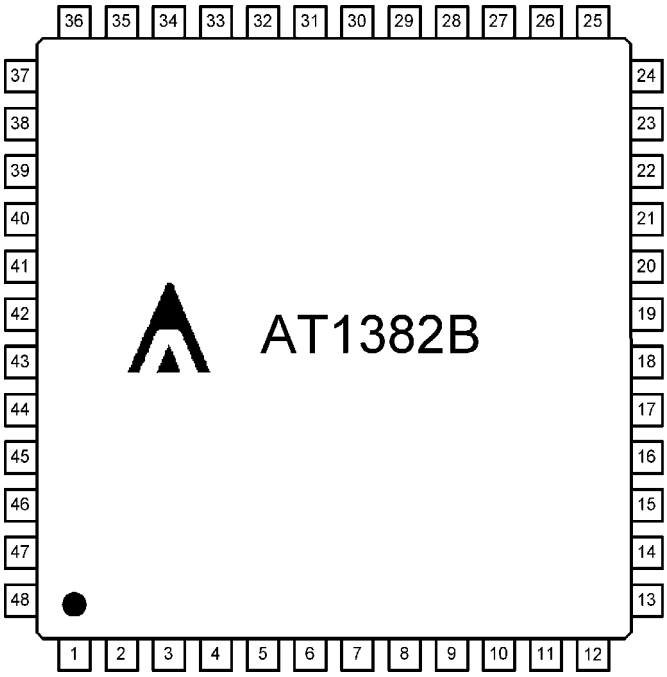
- Digital Cameras
- CCD Imaging Devices
- Camcorders

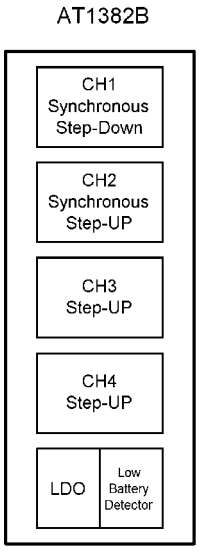
General Description

The AT1382B is a 4-channel PWM DC/DC control IC for low voltage applications with a soft start function and short circuit detection function. This IC is ideal for up conversion, down conversion, and up/down conversion (using a step-up/step-down Zeta(CH1) and SEPIC(CH2,3,4) system with free input and output settings). Four channels can be built in the LQFP48 package, each channel be controlled, and soft-start.

The AT1382B include one comparator to generate low-battery warning outputs. It also contains a gain block that can be used with an external P-channel MOSFET to make a low-dropout linear regulator.

Pin Assignment





Ordering Information

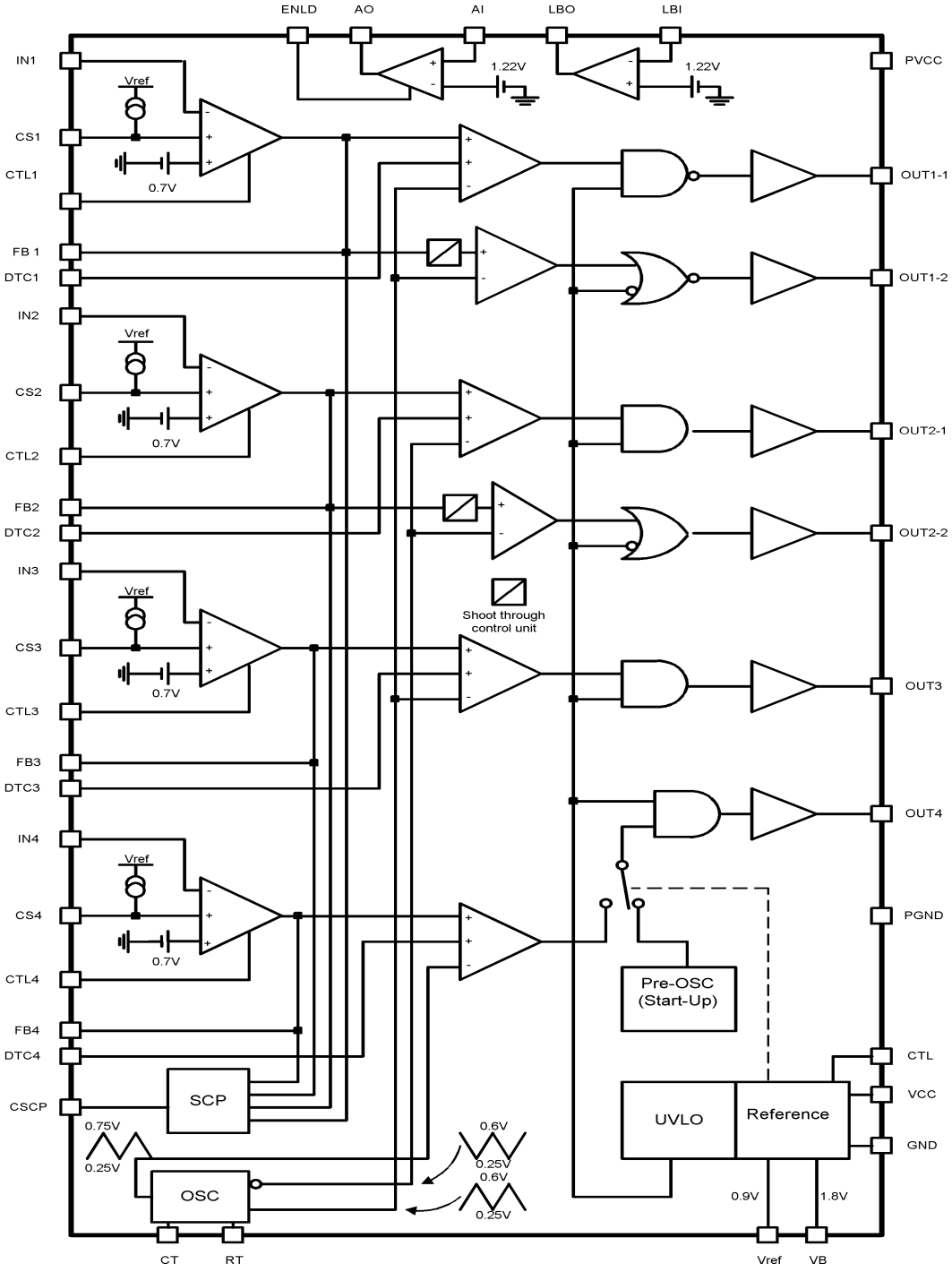
Part number	Package	Marking
AT1382B	LQFP48	AT1382BF

2F, No.10, Prosperity RD. II, Science-Based Industrial Park, Hsinchu 300,Taiwan, R.O.C.
Tel: 886-3-563-0878 WWW: http://www.aimtron.com.tw
Fax: 886-3-563-0879 Email: service@aimtron.com.tw

Pin Description

Pin No.	Pin name	I/O	Function
1	DTC4	I	CH4 Dead Time Control
2	FB4	O	CH4 Error Amplifier Output
3	IN4	I	CH4 Error Amplifier Inverted Input
4	CS4	-	CH4 Soft Start Setting Capacitor
5	CTL4	I	CH4 ON/OFF Control
6	DTC3	I	CH3 Dead Time Control
7	FB3	O	CH3 Error Amplifier Output
8	IN3	I	CH3 Error Amplifier Inverted Input
9	CS3	-	CH3 Soft Start Setting Capacitor
10	CTL3	I	CH3 ON/OFF Control
11	CSCP	-	Timer Latch Short-Circuit Detection Capacitor Input
12	VREF	O	Reference 0.9V Output
13	GND	P	Ground
14	GND	P	Ground
15	VBG	TEST	Reference Test Pin
16	VCC	P	Power Supply
17	VCC	P	Power Supply
18	POR	TEST	Pre-OSC Change to Main-OSC Indicator
19	RT	-	Oscillation Frequency Setting Resistor
20	CT	-	Oscillation Frequency Setting Capacitor
21	VB	O	Reference 1.8V Output
22	CTL	I	Power Supply Control
23	ENLD	I	Gain Block Enable Input
24	CT2	TEST	Triangular wave OSC Inverted output Test Pin
25	CTL2	I	CH2 ON/OFF Control
26	CS2	-	CH2 Soft Start Setting Capacitor
27	IN2	I	CH2 Error Amplifier Inverted Input
28	FB2	O	CH2 Error Amplifier Output
29	DTC2	I	CH2 Dead Time Control
30	CTL1	I	CH1 ON/OFF Control
31	CS1	-	CH1 Soft Start Setting Capacitor
32	IN1	I	CH1 Error Amplifier Inverted Input
33	FB1	O	CH1 Error Amplifier Output
34	DTC1	I	CH1 Dead Time Control
35	LBI	I	Low Battery Detected Input
36	LBO	O	Low Battery Indicator
37	AI	I	LDO Regulated Input
38	AO	O	LDO Drive Output
39	OUT1_1	O	CH1 Main Side Output
40	OUT1_2	O	CH1 Synchronous Rectifier Side Output
41	OUT2_1	O	CH2 Main Side Output
42	OUT2_2	O	CH2 Synchronous Rectifier Side Output
43	N.C.	-	
44	PVCC	P	Drive Output Block Power Supply
45	N.C.	-	
46	PGND	P	Drive Output Block Ground
47	OUT3	O	CH3 Output
48	OUT4	O	CH4 Output

Block Diagram



Absolute Maximum Ratings

Parameter	Symbol	Condition	Rating		Unit
			Min	Max	
Power supply voltage	Vcc	--	--	8	V
Output current	Io	Output pin	--	20	mA
Output peak current	Io	Output pin, Duty≦5%	--	200	mA
Power dissipation	P_D	Ta≦25℃ (LQFP-48P)	--	860	mW
Operation temperature	Topr	--	-30	85	℃
Storage temperature	Tstg	--	-55	125	℃

***Semiconductor devices can be permanently damaged by application of stress in excess of absolute ratings. Do not exceed these ratings.**

Recommended Operating Conditions

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
Startup power supply voltage	Vcc	CH4	1.4	--	7	V
Power supply voltage	Vcc	CH4	1.5	5.0	7	V
		CH1 to CH3	1.8	5.0	7	V
Reference voltage output current	I_{OR}	VREF pin	-1	--	0	mA
VB pin output current	I_B	VB pin	-0.5	--	0	mA
Input voltage	V_{IN}	IN1 to IN4 pins	0	--	Vcc-1.8	V
Control input voltage	V_{CTL}	CTL pin	0	--	7	V
Output current	Io	OUT pin (CH1 to CH3)	--	2	15	mA
		OUT pin (CH4)	1	2	15	mA
Oscillator	f_{OSC}	--	100	500	1000	kHz
Timing capacitor	C_T	--	47	100	560	pF
Timing resistor	R_T	--	8.2	18	100	kΩ
Soft start capacitor	Cs	CH1 to CH3	--	0.027	1.0	μF
	C_{+IN6}	CH4	--	0.47	1.0	μF
Short detection capacitor	C_{SCP}	--	--	0.1	1.0	μF
VB pin capacitor	C_{VB}	--	0.082	0.1	--	μF
Operating ambient temperature	Ta	--	-30	25	85	℃

Electrical Characteristics

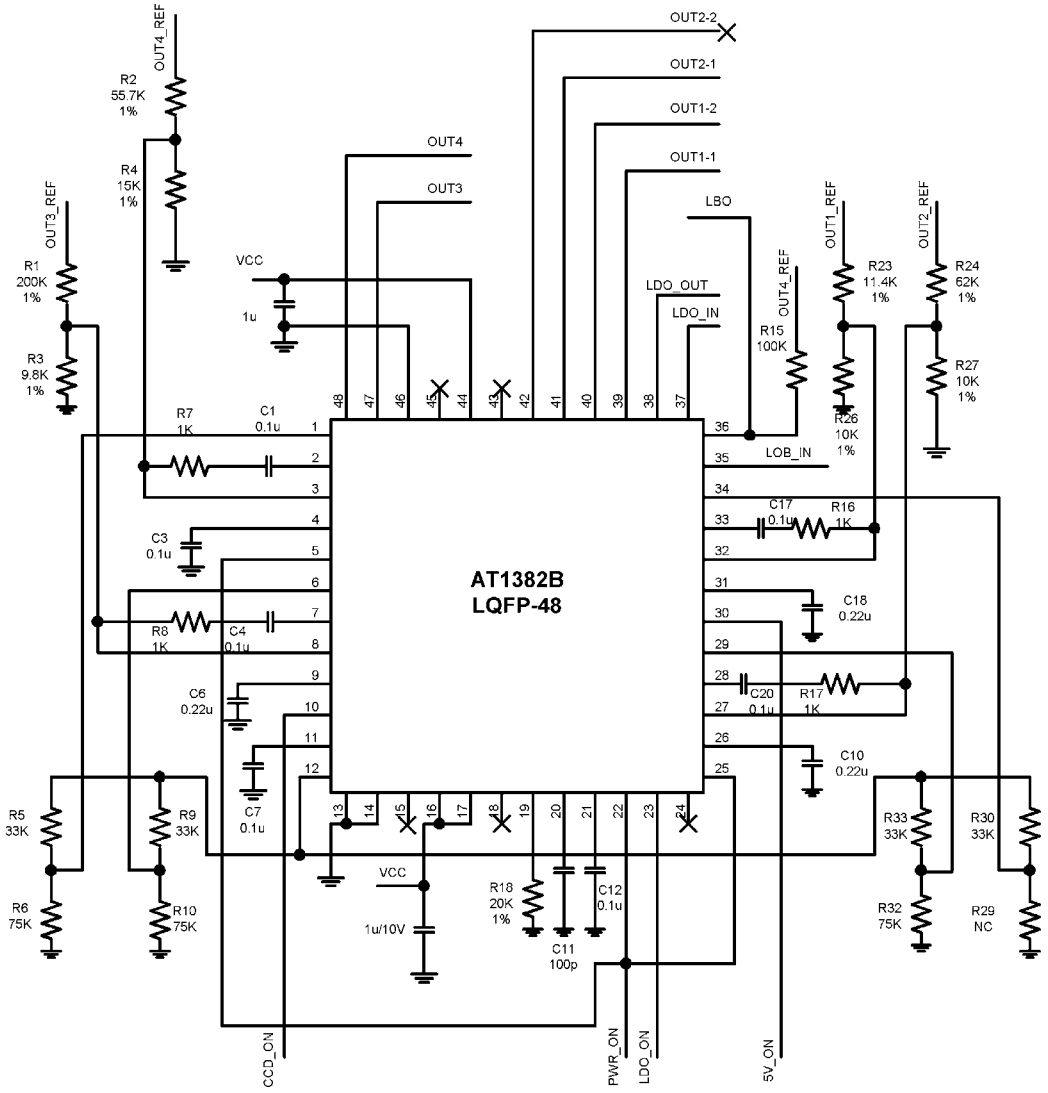
(Ta=25℃, VCC=PVCC=5V)

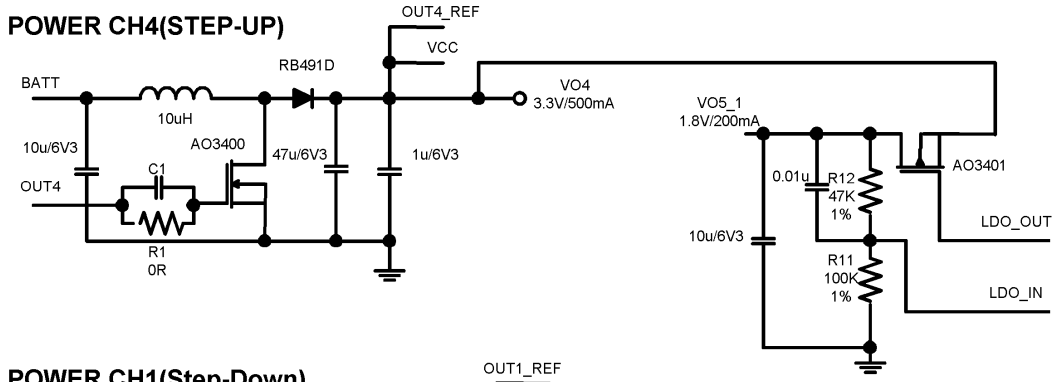
Parameter	Symbol	Condition	Measure result			Unit
			Min.	Typ.	Max.	
Reference voltage block [REF]						
Reference voltage	V_{REF}		0.88	0.90	0.92	V
Output voltage temperature stability	$\triangle V_{REF}$ /V_{REF}	Ta = -30℃ to 85℃	-	0.5	-	%
Input stability	Line	VCC=1.8V to 7V	-10	-	10	mV
Load stability	Load	VREF=0mA to –1mA	-10	-	10	mV
Shout circuit output current	I_{OSC}	VREF=0.7V	-20	-5	-1	mA
Under voltage lockout block [U.V.L.O]						
Threshold voltage(CH1~CH3)	V_{TH}		1.5	1.6	1.7	V
Hysteresis width(CH1~CH3)	V_H		-	0.2	-	V
Reset voltage(CH1~CH3)	V_{RST}		1.6	1.7	1.8	V
CH4 Pre-OSC change to Main-OSC threshold	V_{TH2}		-	1.7	-	V
Soft start block [CS]						
Input standby voltage	V_{STB}		-	50	100	mV
Charge current	I_{CS}		-6.0	-5.0	-4.0	μA
Short circuit detection block [SCP]						
Threshold voltage	V_{TH}		0.65	0.70	0.75	V
Input standby voltage	V_{STB}		-	50	100	mV
Input latch voltage	V_I		-	50	100	mV
Input source current	I_{CSCP}		-1.4	-1.0	-0.6	μA
Triangular wave oscillator block [OSC]						
Oscillator frequency	f_{OSC}	CT=100pF, RT=20kΩ	450	500	550	kHz
Frequency stability for voltage	△f /fdv	VCC=1.8V to 7V	-	1	10	%
Frequency stability for temperature	△f /fdt	Ta=-30℃ to 85℃	-	1	-	%

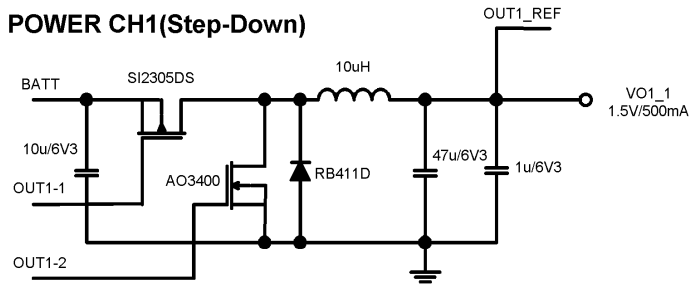
Parameter	Symbol	Condition	Measure result			Unit
			Min.	Typ.	Max.	
Error amplifier block [Error Amp](CH1~CH4)						
Threshold voltage	V_{TH}	FB=0.9V	0.69	0.70	0.71	V
V_T temperature stability	$\triangle V_T/V_T$	Ta = -30℃ to 85℃	-	0.5	-	%
Input bias current	I_B	IN=0V	-320	-80	-	nA
Voltage gain	A_V	DC	-	100	-	dB
Frequency bandwidth	BW	A_V=0dB	-	10	-	MHz
Output voltage	V_{OH}		1.3	1.4	-	V
	V_{OL}		-	50	200	mV
Output source current	I_{SOURCE}	FB=0.5V	-	-4.0	-1.0	mA
Output sink current	I_{SINK}	FB=0.5V	70	140	-	μA
Short detect comparator [SCP Comp]						
Threshold voltage	V_{TH}	CH1 to CH4	0.65	0.7	0.75	V
Input bias current	I_B	IN=0V	-320	-80	-	nA
PWM Comp. [PWM Comp]						
Threshold voltage(CH4)	V_{T0}	Duty = 0 %	0.25	0.3	-	V
	V_{Tmax}	Duty = 100 %	-	0.75	0.80	V
Threshold voltage(CH1~3)	V_{T0}	Duty = 0 %	0.20	0.25	-	
	V_{Tmax}	Duty = 100 %	-	0.65	0.70	
Input current	I_{DTC}	DTC=0.4V	-1.0	-0.3	-	μA
Output block (CH1,2) [Pin 39,41]						
Output source current	I_{SOURCE}	Duty≧95%, OUT=0V	-	-130	-80	mA
Output sink current	I_{SINK}	Duty≦5%, OUT=5V	65	100	-	mA
Output ON resistor	R_{OH}	OUT = -15mA	-	18	30	Ω
	R_{OL}	OUT = 15mA	-	16	25	Ω
Output block (CH1 to CH3) [Pin 40,42,47]						
Output source current	I_{SOURCE}	Duty≧95%, OUT=0V	-	-130	-80	mA
Output sink current	I_{SINK}	Duty≦5%, OUT=5V	65	100	-	mA
Output ON resistor	R_{OH}	OUT = -15mA	-	18	30	Ω
	R_{OL}	OUT = 15mA	-	16	25	Ω

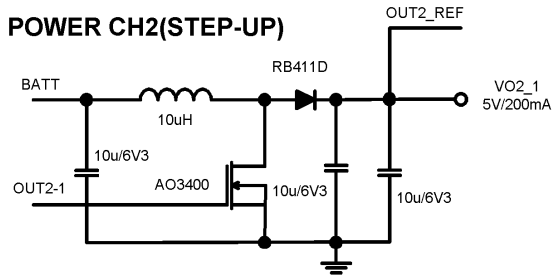
Parameter	Symbol	Condition	Measure result			Unit
			Min.	Typ	Max.	
Output block (CH4) [Pin 48]						
Output source current	I_{SOURCE}	Duty≧95%, OUT=0V	-	-260	-160	mA
Output sink current	I_{SINK}	Duty≦5%, OUT=5V	150	260	-	mA
Output ON resistor	R_{OH}	OUT = -15mA	-	9	15	Ω
	R_{OL}	OUT = 15mA	-	9	15	Ω
Control block [CTL]						
CTL input voltage	V_{IH}	Active mode	1.3	-	7	V
	V_{IL}	Standby mode	0	-	0.8	V
CTL1 to CTL4 input voltage	V_{IH}	Active mode	1.3	-	7	V
	V_{IL}	Standby mode	0	-	0.8	V
Input current	I_{CTL}	CTL = 5V	-	5	20	μA
Analog gain block [AO,AI]						
AI feedback regulation voltage		V_{AO}=V_{OUT}-1.22V	1.20	1.22	1.24	V
AI input common-mode range			-0.1	-	1.3	V
AI input current		V_{AI}=1.32V	-	-	100	nA
AI to AO voltage gain			70	100	140	V/V
AO output sink current		V_{AI}=1V, V_{AO}=2V	0.5	2.5	-	mA
AO output source current		V_{AI}=1.5V, V_{AO}=2V	0.5	2.5	-	mA
ENLD enable	V_{IH}	Active mode	1.2	-	7	V
ENLD disable	V_{IL}	Standby mode	0	-	0.8	V
Low battery detect block [LBI, LBO]						
LBI detect threshold			1.20	1.22	1.24	V
Detect Hysteresis			-50		+50	mV
LBO output voltage low		Isink=1mA	-	-	0.4	V
LBO output high leakage		V_{LBO}=5V	-	0.01	1	μA
General						
Standby current	Icss	CTL=0V	-	-	10	μA
	Icss(o)	CTL=0V	-	-	10	μA
Power supply current	Icc	CTL=CTL1=CTL2=CTL3=CTL4=ENLD="H"	-	3	6	mA

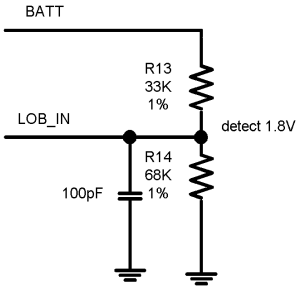
Typical Application

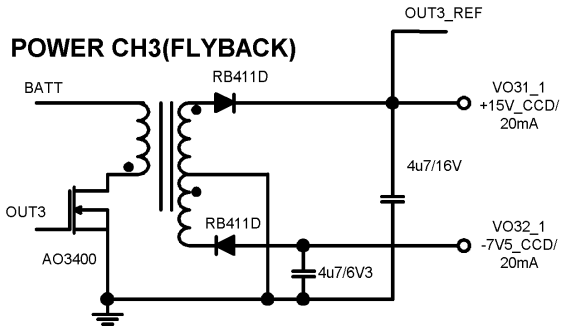



POWER CH4(STEP-UP)
OUT4_REF
VCC
RB491D
BATT
10uH
VO4
3.3V/500mA
VO5_1
1.8V/200mA
10u/6V3
AO3400
47u/6V3
1u/6V3
C1
OUT4
0.01u
R12
47K
1%
AO3401
LDO_OUT
R1
0R
10u/6V3
R11
100K
1%
LDO_IN


POWER CH1(Step-Down)
OUT1_REF
BATT
SI2305DS
10uH
VO1_1
1.5V/500mA
10u/6V3
AO3400
RB411D
47u/6V3
1u/6V3
OUT1-1
OUT1-2

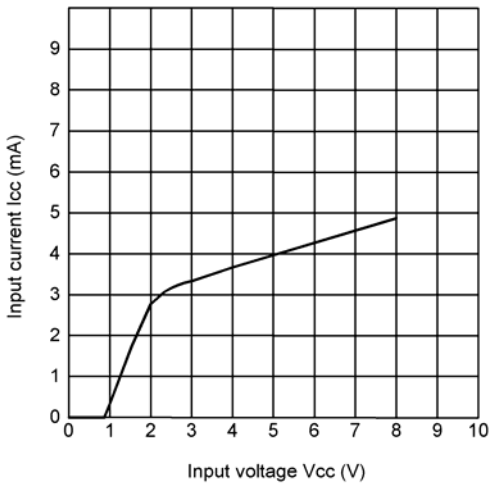

POWER CH2(STEP-UP)
OUT2_REF
RB411D
BATT
10uH
VO2_1
5V/200mA
10u/6V3
OUT2-1
AO3400
10u/6V3
10u/6V3


BATT
R13
33K
1%
LOB_IN
detect 1.8V
R14
68K
1%
100pF

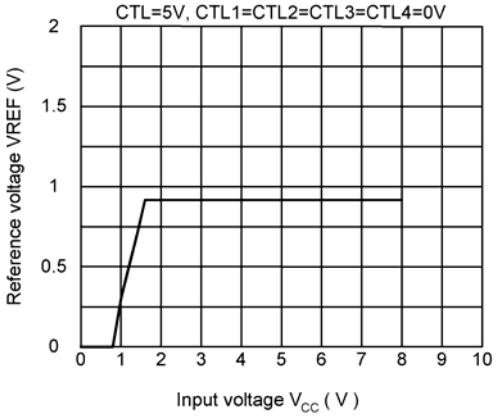

POWER CH3(FLYBACK)
OUT3_REF
RB411D
BATT
VO31_1
+15V_CCD/
20mA
4u7/16V
OUT3
RB411D
VO32_1
-7V5_CCD/
20mA
AO3400
4u7/6V3

Typical Characteristics

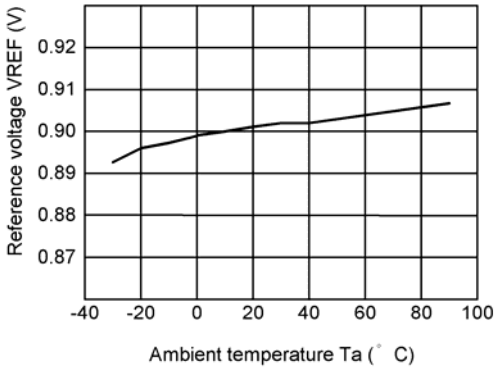
Input current vs. Input voltage
(CTL=5V, CTL1=CTL2=CTL3=CTL4=0V Ta = 25° C)



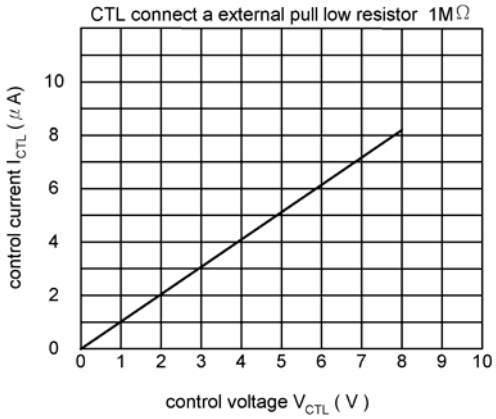
Reference voltage vs. Input voltage
Ta=25℃, Vref=0mA
CTL=5V, CTL1=CTL2=CTL3=CTL4=0V



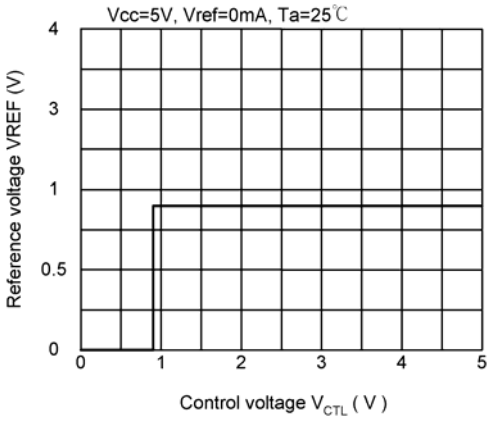
Reference voltage vs. Ambient temperature
Vcc=5V, Vref=0mA
CTL=5V, CTL1=CTL2=CTL3=CTL4=0V



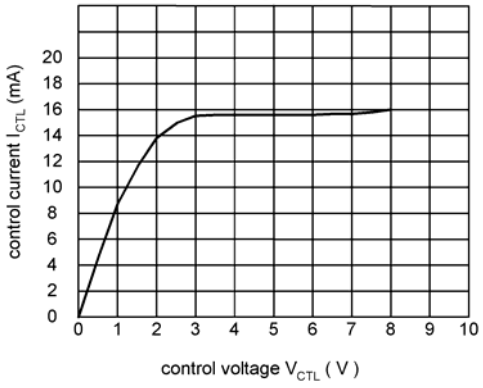
control voltage vs. control current (CTL)
Vcc=5V, Ta=25℃
CTL connect a external pull low resistor 1MΩ



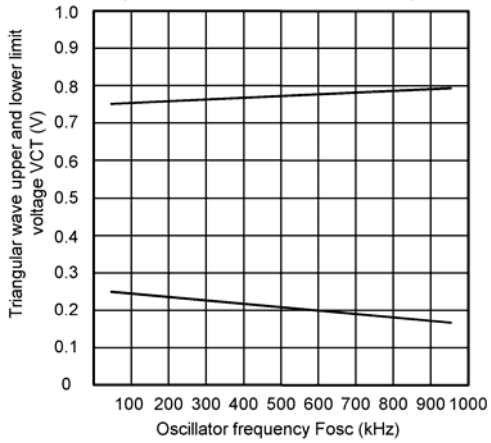
Reference voltage vs. control voltage
Vcc=5V, Vref=0mA, Ta=25℃



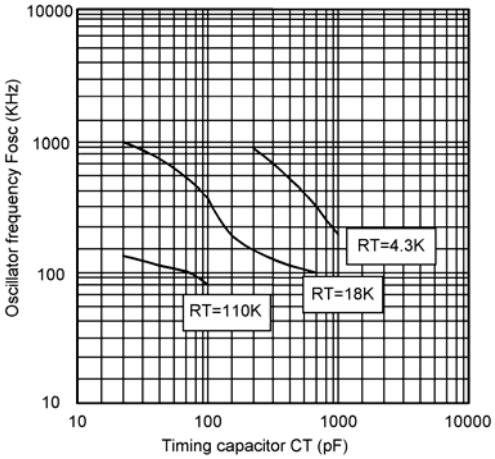
control voltage vs. control current (CTL1-CTL4)
Vcc=5V, Ta=25℃
CTL=CTL1=CTL2=CTL3=CTL4=5V



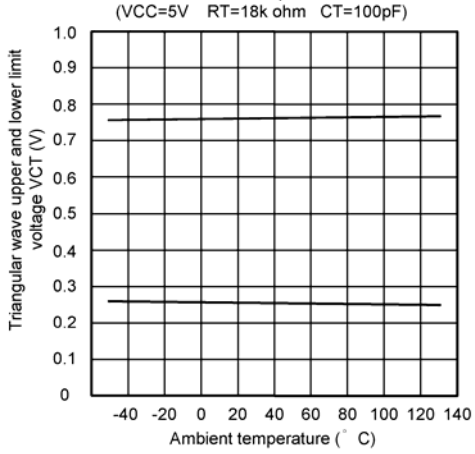
Triangular wave upper and lower limit voltage vs. Oscillator frequency
(VCC=5V RT=18k ohm Ta=25° C)



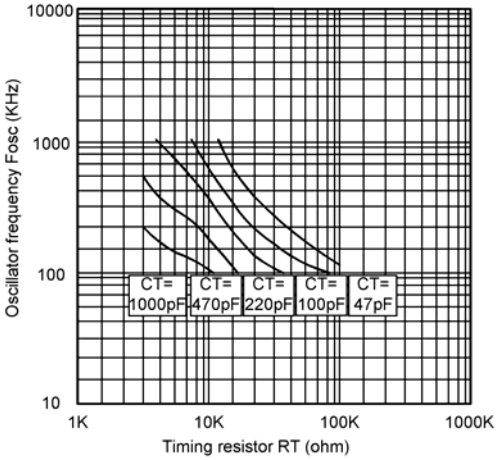
Oscillatro frequency vs. Timing capacitor
(VCC=5V Ta=25° C)



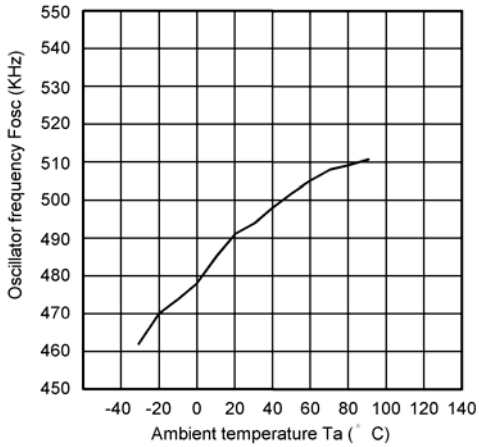
Triangular wave upper and lower limit voltage vs. Ambient temperature
(VCC=5V RT=18k ohm CT=100pF)



Oscillatro frequency vs. Timing capacitor
(VCC=5V Ta=25° C)

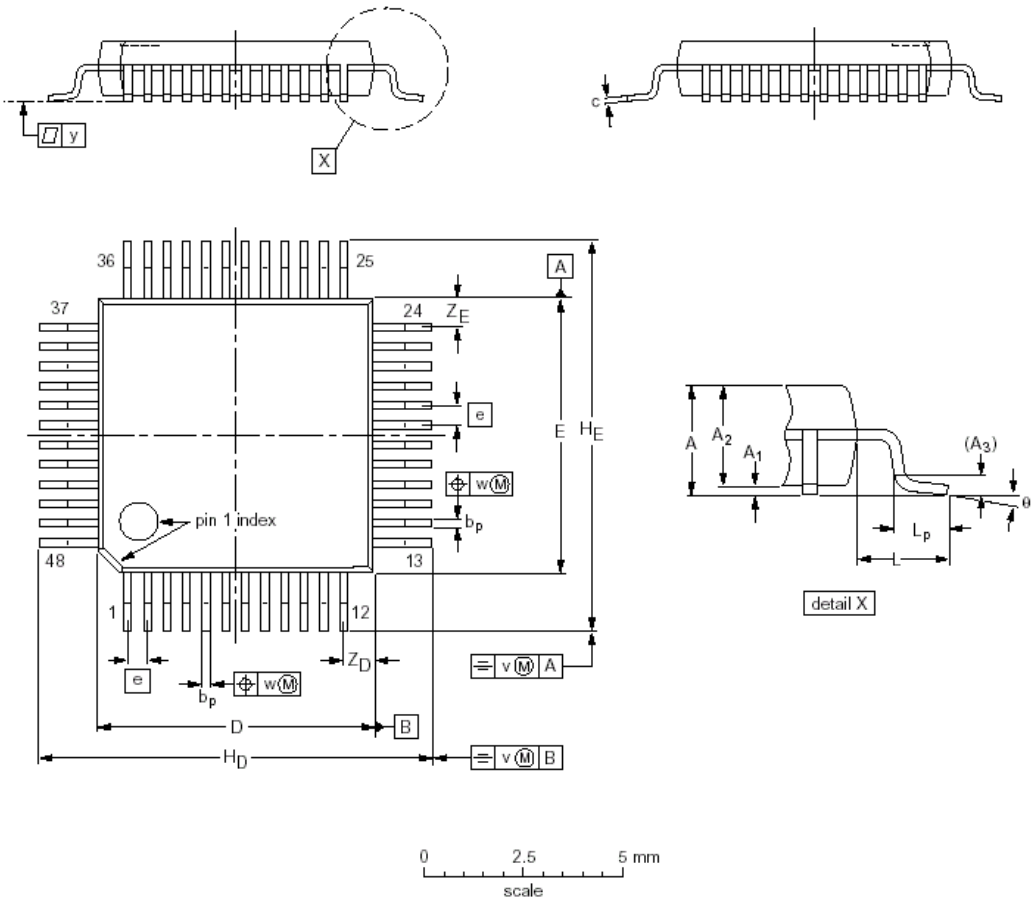


Oscillatro frequency vs. Ambient temperature
(VCC=5V RT=18k ohm CT=100pF
CTL=5V, CTL1=CTL2=CTL3=CTL4=0V)



Typical Characteristics

LQFP48

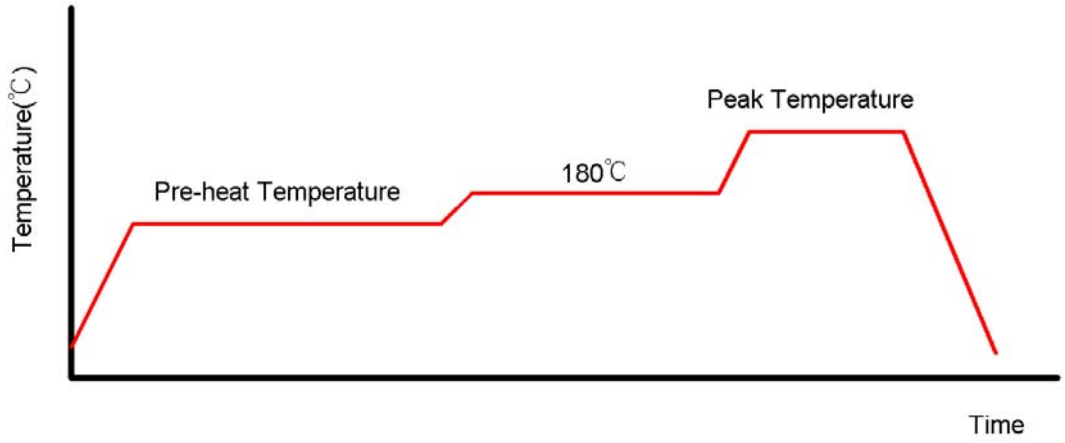


DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_D	H_E	L	L_p	v	w	y	$Z_D^{(1)}$	$Z_E^{(1)}$	θ
mm	1.60	0.20 0.05	1.45 1.35	0.25	0.27 0.17	0.18 0.12	7.1 6.9	7.1 6.9	0.5	9.15 8.85	9.15 8.85	1.0	0.75 0.45	0.2	0.12	0.1	0.95 0.55	0.95 0.55	7^o 0^o

Reflow Condition (IR/Convection or VPR Reflow)

Reference JEDEC Standard J-STD-020A



Classification Reflow Profiles

	Convection or IR/Convction	VPR
Average Heating Rate(180°C to peak)	5°C/second max.	10°C/second max.
Preheat Temperature(125±20°C)	120 seconds max.	
Temperature maintained above 180°C	10~150 seconds	
Time within 5°C of actual Peak Temperature	10~20 seconds	60 seconds
Peak Temperature Range(Note 1)	219~225°C or 235~240°C	219~225°C or 235~240°C
Cooling Rate	6°C /second max.	10°C/second max.
Time 25°C to Peak Temperature	6 minutes max.	

*1 The maximum peak temperatures for IR and VP reflow are depending on package dimensions.

Package Reflow Conditions

Pkg. Thickness ≥2.5mm and all bags	Pkg. Thickness <2.5mm and Pkg. Volume ≥350 mm^3	Pkg. Thickness <2.5mm and Pkg. Volume <350 mm^3
Convection 219~225℃		Convection 235~240℃
VPR 219~225℃		VPR 235~240℃
IR/Convection 219~225℃		IR/Convection 235~240℃