Voltage Regulator, Voltage Converter and Piezoelectric Horn Driver Product Specification

## **General Description**

The RE46C119 is intended for use in applications where low voltage regulation and a high voltage horn driver are required. The circuit features a voltage boost converter/regulator and driver circuit suitable for driving a piezoelectric horn. The horn enable pin activates the boost converter and horn driver circuit. Supply current is 6.5uA maximum when the boost regulator and horn driver are not in use. A 3V regulator is also provided for microprocessor voltage regulation. Low battery detection and signaling are also available. Interconnect pins are provided to allow communication in multiple unit environments. A power good pin monitors the status of the regulator output.

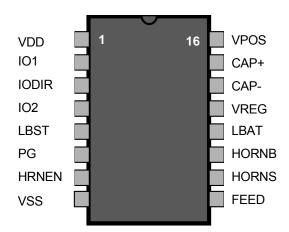
## **Applications**

Smoke detectors
CO Detectors
Personal Security Products
Electronic Games
Hand Held Instruments

## **Features**

- Low Quiescent Current
- 12V Boost Regulator
- Low Horn Driver Ron
- 3V Regulator, Other Options Available
- · Low Battery Detection Interface
- Power Good Circuit
- Device interconnection
- Available in DIP and SOIC packages
- Available in Standard Packaging or RoHS Compliant Pb Free Packaging

## **Pin Configuration**



# ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNITS
Supply Voltage	$V_{DD}$	12	V
Input Voltage Range Except FEED, IO1, IO2	$V_{in}$	$3$ to $V_{dd} + .3$	V
FEED Input Voltage Range	$V_{infd}$	-10 to +22	V
IO2 Input Voltage Range	$V_{io2}$	3 to VREG+.3	V
IO1 (as input) Voltage Range	$V_{io1}$	3 to $V_{dd}$ + 6	V
Input Current except FEED	l <sub>in</sub>	10	mA
Operating Temperature	$T_A$	-40 to 85	°C
Continuous Operating Current (Horn or VPOS)	I <sub>con</sub>	50	mA
Storage Temperature	$T_{STG}$	-55 to 125	°C
Maximum Junction Temperature	$T_J$	125	°C

Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only and operation at these conditions for extended periods may affect device reliability.

This product utilizes CMOS technology with static protection; however proper ESD prevention procedures should be used when handling this product. Damage can occur when exposed to extremely high static electrical charges.



## Electrical Characteristics at T<sub>A</sub>=27°C, Vdd=9V, Vss=0V (unless otherwise noted).

Parameter	Symbol	ool Conditions	Limits			
Parameter	Symbol	Conditions	MIN	TYP	MAX	UNITS
Supply Voltage	Vdd	Operating	6		12	V
Quiescent Supply Current	ldd1	HRNEN, LBST, IODIR, FEED, REGSEL=VSS, No Loads		4.7	6.5	uA
Supply Current	ldd2	LBST, IODIR, FEED =VSS HRNEN=VDD, No Loads		350		uA
	lin	All Inputs except FEED, Vin=VDD or VSS	-100		100	nA
Input Leakage	lihf	FEED=+22V		20	50	uA
	lilf	FEED=-10V	-50	-15		uA
Output Leakage	lout	PG = 5.0v			1.0	uA
Input Voltage Low	Vil	All Inputs except FEED			1	V
Input Voltage High	Vih	All Inputs Except FEED	2.3			V
	Vol1	HORNB or HORNS; lout=16mA;		.3	.5	V
Output Low Voltage	Vol2	IO2, lout=100uA; IODIR=Vil , IO1=Vil		.3	.5	V
	Vol3	PG, lout=5.0mA;		.5		V
Output High	Voh1	HORNB or HORNS; lout=-16mA	Vpos5	Vpos3		V
Voltage	Voh2	IO2, lout=-100uA; IODIR=Vil , IO1=Vih	Vreg5	Vreg3		V
VPOS RMS Output Voltage	$V_{vpos}$	VPOS; lout=-16mA; HRNEN=VDD		11.8	12.7	V
Charge pump Oscillator Frequency	CPf			150		kHz
Charge pump Power Efficiency	CPpe	VPOS; lout=-16mA, C1=1uF C2=10uF; Vdd=6.5v		85		%
Charge pump Voltage Efficiency	CPve	VPOS; No Loads, C1=1uF C2=10uF; Vdd=6.0v	95	99		%
Low Battery Interface	Lbv	LBAT; LBST=Vdd	.17 *Vdd	.2*Vdd	.23*Vdd	V
VREG Voltage	Vreg	VREG; lout<50mA; HRNEN=VSS	2.85	3	3.15	V
VREG Line Regulation	Vregln	VREG; Vdd=6V to 12V; VREG lout=10mA; HRNEN = VSS; Note 3			50	mV
VREG Load Regulation	Vregld	VREG; lout=0 to -50mA; HRNEN=VSS; Note 3			90	mV



## Electrical Characteristics at T<sub>A</sub>=27°C, Vdd=9V, Vss=0V (unless otherwise noted).

Parameter	Symbol	Conditions	Limits			
r ai ailletei	Syllibol	Conditions	MIN	TYP	MAX	UNITS
VREG Over Voltage Clamp	Vcl	lout>1mA; Note 2	3.7	4.0	4.3	V
VREG Over Voltage Clamp Current	lcl	VREG≥Vcl	0.5			mA
PG Trip Threshold	PGvtr	Vreg output rising	77	84	94	%Vreg
	PGvtf	Vreg output falling	72	80	88	%Vreg
PG Delay	PGtdly	Delay time with respect to PGvtr		500		usec
IO1 Output Current	IO1ih1	IODIR=Vil, IO1=Vdd-2V, Vdd=12V 25			60	UA
	IO1ih2	IODIR=Vil, IO1=17V, Vdd=12V			150	UA
	IO1ioh1	IODIR, IO2=Vih, Vdd=6.5V, IO1=4.5V	-4			mA
	IO1ioh2	IODIR, IO2=Vih, Vdd=12V, IO1=Vss			-16	mA
	IO1ioI1	IO dump current IODIR= Vih, IO2=Vil, IO1=1V	10	15		mA
IO1 Alarm Voltage	IO1vih	IODIR=Vil	3			V
	IO1vil	IODIR=Vil			1.5	V

Unless noted the limits at room temperature are guaranteed and 100% production tested. Limits over temperature are guaranteed but not 100% tested.

Note 2: In normal operation, the regulator will provide high-side current of up to 50mA, but current sinking capability is typically under 1uA. The overvoltage clamp, Vcl is intended to limit the voltage at VREG (output) when it is pulled up by an external source.

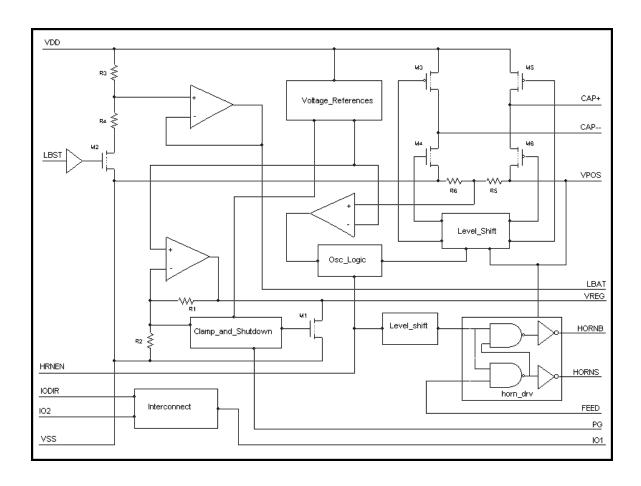
Note 3: Not 100% production tested but limits are guaranteed by design.

## **Interconnect Logic Truth Table**

IODIR	IO2 (pin 4)		IO1 (	pin 2)
(pin 3)	Input	Output	Input	Output
1	0			0
1	1			1
0		0	0	
0		1	1	



## **Functional Block Diagram**



Voltage Regulator, Voltage Converter and Piezoelectric Horn Driver Product Specification



## **PIN DESCRIPTIONS**

**VDD** (Pin 1, Input) - Connect to the positive terminal of the supply voltage for the voltage regulator, charge pump voltage converter and bi-directional Interconnect block.

**IO1** (Pin 2, Input/Output) - This bi-directional pin provides an interface to additional RE46C119 IO1 pins. This serves as a communication link between separate modules.

**IODIR** (Pin 3, Input) - This input provides control for the bi-directional pins IO1 and IO2.

**IO2** (Pin 4, Input/Output) - This bi-directional pin provides an interface to a TTL/CMOS I/O of an *u*P or ASIC. Refer to the interconnect logic truth table.

**LBST** (Pin 5, Input) - This input provides an enable or strobe control for the analog low battery detection function.

**PG** (Pin 6, Output) - This open drain NMOS output provides a status indication of when the VREG output is above or below a specified voltage level.

**HRNEN** (Pin 7, Input) - This input provides activation control for the charge pump boost regulator and horn driver outputs.

**VSS** (Pin 8, Input) - This power pin is connected to the negative terminal of the supply voltage.

**FEEDBACK** (Pin9, Input) - Horn driver input.

**HORNS** (Pin10, Output) - Horn output driver which provides VPOS to VSS output voltage swing for the piezoelectric horn.

**HORNB** (Pin11, Output) - Horn output driver which provides VPOS to VSS output voltage swing for the piezoelectric horn.

**LBAT** (Pin12, Output) - Analog output voltage that is proportional to the VDD supply and functions as a low battery detection output.

**VREG** (Pin13, Output) - Voltage regulator output, requires an external capacitor.

**VCAP-** (Pin14, I/O) - Negative terminal for the external charge pump boost (fly) capacitor.

**VCAP+** (Pin 15, I/O) - Positive terminal for the external charge pump boost (fly) capacitor.

**VPOS** (Pin 16, Output) - This output pin requires an external filter capacitor which supplies voltage for the horn driver outputs.

Voltage Regulator, Voltage Converter and Piezoelectric Horn Driver Product Specification



#### **Device Operation**

(Please refer to the functional block diagram)

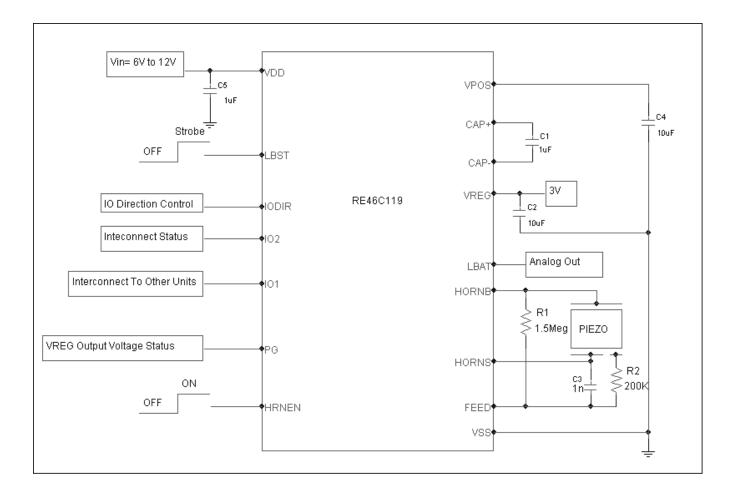
The RE46C119 consists of the following main functional blocks: band gap voltage reference, low drop-out voltage regulator (with over voltage clamp and power supply brownout protection), low battery detection, switched capacitor 12 volt boost regulator, horn driver and Interconnect logic.

When power is applied the band gap voltage reference and the voltage regulator output are initially enabled. The low battery detection, horn driver outputs and switched capacitor 12v boost regulator are enabled by TTL compatible positive logic control inputs.

When the HRNEN (Horn Enable) input is brought to a logic high level, the horn driver outputs as well as the 12v boost regulator become active. The 12v boost regulator supplies the horn driver outputs. The 12v boost regulator utilizes a charge pump to boost the Vdd supply input to a regulated 12-volt output. The charge pump consists of an internal oscillator that is controlled in a voltage comparator feedback configuration.

The low battery detection is enabled and strobed when the LBST input is brought to a logic high level. The LBAT output is a voltage follower amplifier whose input is determined by a resistor divider across the device supply rails.

## **Typical Application Circuit**



## **Application Notes:**

(See application circuit)

The efficiency of the switched capacitor charge pump regulator varies with the applied input voltage and the load current. The approximate voltage efficiency is given by:

Efficiency (%) = [VPOS/(2xVDD)]x100

Voltage Regulator, Voltage Converter and Piezoelectric Horn Driver Product Specification



## **Application Notes continued:**

(See application circuit)

### **Capacitor Selection:**

To achieve minimum output voltage ripple, the output capacitor  $C_4$  (for VPOS) should have a low ESR (Effective Series Resistance) value with leads kept as short as possible. Capacitors with long leads increase ripple voltage due to lead inductance.

Like all Low-Dropout Regulators, the RE46C119 requires an output capacitor connected between VREG (output) and VSS to stabilize the internal control loop. The recommended capacitance is 10uF. Capacitor values larger than 10uF are acceptable.

#### PCB Layout Suggestions:

Due to large transient currents flow in the  $V_{DD}$ ,  $V_{POS}$  and  $V_{SS}$  terminals, minimizing both input and output ripple is accomplished by placing capacitors as close as possible to the regulator using short direct circuit wiring or traces.

Voltage Regulator, Voltage Converter and Piezoelectric Horn Driver Product Specification



Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights.

#### Trademarks

The Microchip name and logo, the Microchip logo, Accuron, dsPIC, KEELOQ, KEELOQ logo, MPLAB, PIC, PICmicro, PICSTART, rfPIC, SmartShunt and UNI/O are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

FilterLab, Hampshire, Linear Active Thermistor, MXDEV, MXLAB, SEEVAL, SmartSensor and The Embedded Control Solutions Company are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Analog-for-the-Digital Age, Application Maestro, CodeGuard, dsPICDEM, dsPICDEM.net, dsPICworks, dsSPEAK, ECAN, ECONOMONITOR, FanSense, In-Circuit Serial Programming, ICSP, ICEPIC, Mindi, MiWi, MPASM, MPLAB Certified logo, MPLIB, MPLINK, mTouch, nanoWatt XLP, PICkit, PICDEM, PICDEM.net, PICtail, PIC<sup>32</sup> logo, PowerCal, PowerInfo, PowerMate, PowerTool, REAL ICE, rfLAB, Select Mode, Total Endurance, TSHARC, WiperLock and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

 $\ensuremath{\mathsf{SQTP}}$  is a service mark of Microchip Technology Incorporated in the U.S.A.

All other trademarks mentioned herein are property of their respective companies.

© 2009, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

Printed on recycled paper.

QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV

ISO/TS 16949:2002

Microchip received ISO/TS-16949:2002 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC® MCUs and dsPIC® DSCs, KEELOQ® code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.



OOO «ЛайфЭлектроникс" "LifeElectronics" LLC

ИНН 7805602321 КПП 780501001 P/C 40702810122510004610 ФАКБ "АБСОЛЮТ БАНК" (ЗАО) в г.Санкт-Петербурге К/С 3010181090000000703 БИК 044030703

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

#### Мы предлагаем:

- Конкурентоспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



Тел: +7 (812) 336 43 04 (многоканальный) Email: org@lifeelectronics.ru