



RE46C107

DC to DC Converter, Voltage Regulator and Piezoelectric Horn Driver
Product Specification

General Description

The RE46C107 is intended for use in 3V or 4.5V battery or battery-backed applications. The circuit features a DC-to-DC up-converter and driver circuit suitable for driving a piezoelectric horn. A selectable 3.0V or 3.3V regulator is also provided for microprocessor voltage regulation. An LED driver and low battery detection and signaling are also available.

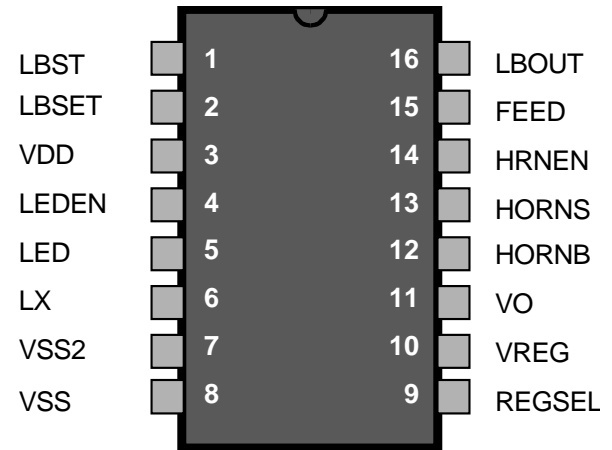
Applications

Smoke detectors
CO Detectors
Personal Security Products
Electronic Toys

Features

- Low Quiescent Current
- 10V Up Converter
- Low Horn Driver Ron
- Voltage Regulation to 3.0V or 3.3V
- Low Battery Detection
- Available in Standard Packaging or RoHS Compliant Pb Free Packaging

Pin Configuration



ABSOLUTE MAXIMUM RATINGS

PARAMETER

Supply Voltage

Input Voltage Range Except REGSEL & FEED

REGSEL Input Voltage Range

FEED Input Voltage Range

Input Current except FEED

Operating Temperature

Storage Temperature

Continuous Operating Current (HornS, HornB, Vreg, VO)

| SYMBOL | VALUE | UNITS |
|------------|-----------------------|-------|
| V_{DD} | 5 | V |
| V_{OUT} | 12 | V |
| V_{in} | -.3 to $V_{reg} + .3$ | V |
| V_{inrs} | -.3 to $V_{dd} + .3$ | V |
| V_{infd} | -10 to +22 | V |
| I_{in} | 10 | mA |
| T_A | 0 to 50 | °C |
| T_{STG} | -55 to 125 | °C |
| I_O | 40 | mA |

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 charge



PIN DESCRIPTIONS

| <u>PIN#</u> | <u>PIN NAME</u> | <u>DESCRIPTION</u> |
|-------------|-----------------|---|
| 1 | LBST | Logic input used to activate low battery detection circuitry. Input is designed to interface with circuitry supplied by Vreg, so input voltage levels will scale with the Vreg voltage. Input is disabled during brown-out. |
| 2 | LBSET | Internally connected to the low battery comparator input used to sense the Vdd voltage divider. The internal reference to which this node is compared is nominally 0.9V. Nominal internal resistance to Vdd is 400kohm. Nominal resistance to Vss is 240kohm. The resistance to Vss is changed to a nominal of 220kohm once a low battery condition is detected. External resistances can be added in parallel to adjust the low battery threshold voltage. |
| 3 | VDD | Connect to the positive supply voltage |
| 4 | LEDEN | Logic input used to enable the LED driver. Input is designed to interface with circuitry supplied by Vreg, so input voltage levels will scale with the Vreg voltage. LED driver is disabled during brown-out. |
| 5 | LED | Open drain NMOS output used to drive a visible LED. |
| 6 | LX | Open drain NMOS output used to drive the boost converter inductor. The inductor should be connected from this pin to the positive supply through a low resistance path. |
| 7 | VSS2 | Internally connected to the source of the NMOS device used to drive the boost converter inductor. Connect to the negative supply voltage through a low resistance path. |
| 8 | VSS | Connect to the negative supply voltage. |
| 9 | REGSEL | Logic input used to set the Vreg output voltage level. This input should always be tied to either Vdd or Vss. |
| 10 | VREG | Regulated output voltage. Nominal output is 3.3V for REGSEL=Vdd and 3.0V for REGSEL=Vss. |
| 11 | VO | Boosted voltage produced by DC-DC converter, typically 4V or 10V. |
| 12 | HORNB | This pin is connected to the metal electrode (B) of a piezoelectric transducer. |
| 13 | HORNS | HS is a complementary output to HB and connects to the ceramic electrode (S) of the piezoelectric transducer. |
| 14 | HRNEN | Logic input for horn enable designed to interface with circuitry supplied by Vreg. Input voltage levels will scale with the Vreg voltage. Horn is disabled during brown-out. |
| 15 | FEED | Usually connected to the feedback electrode of the piezoelectric horn through a current limiting resistor. If not used, this pin must be connected to Vss. |
| 16 | LBOUT | Logic output used to signal a low battery condition. Output pulls to Vreg when LBST is high and a low battery condition is detected. |

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Electrical Characteristics

Limits apply at $V_{dd}=3V$, $V_{ss}=V_{ss2}=0V$, $C_{reg}=10\mu F$, $C_{vo}=10\mu F$, $T_A=0^\circ C$ to $50^\circ C$, unless otherwise noted.
Typical values are at $T_A=27^\circ C$.

| Parameter | Symbol | Test Pin | Test Conditions | Limits | | | Units |
|--------------------------|---------|----------|--|--------------|--------------|------|---------|
| | | | | Min | Typ | Max | |
| Supply Voltage | Vdd | 3 | Operating | 2.0 | | 5.0 | V |
| Standby Supply Current | Iddstby | | Inputs low; LBSET open; No loads; DC-DC Running | | 20 | | μA |
| Quiescent Supply Current | Iddq | 3 | Inputs low; LBSET open; No loads; $V_O=5V$; $V_{Ix}=0.5V$ | | 7 | | μA |
| Quiescent Ivo | Ivoq | 10 | Same conditions as above for Iddq | | 9 | | μA |
| Input Leakage Low | Iil | 1, 4, 14 | LBST, LEDEN, HRNEN Inputs $V_{in}=V_{SS}$ | | | -100 | nA |
| | Iilrs | 9 | REGSEL Input $V_{in}=V_{SS}$ | | | -100 | nA |
| | Iilf | 15 | FEED=-10V; $V_O=10V$ | | -15 | -50 | μA |
| Input Leakage High | Iih | 1, 4, 14 | LBST, LEDEN, HRNEN Inputs $V_{in}=V_{reg}$ | | | 100 | nA |
| | Iihrs | 9 | REGSEL Input $V_{in}=V_{dd}$ | | | 100 | nA |
| | Iihf | 15 | FEED=+22V; $V_O=10V$ | | 20 | 50 | μA |
| Input Voltage Low | Vil | 1, 4, 14 | LBST, LEDEN, HRNEN Inputs | | | 1 | V |
| | Vilrs | 9 | REGSEL Input | | | 1 | V |
| | Vilf | 15 | FEED Input; $V_O=10V$ | | | 3 | V |
| Input Voltage High | Vih | 1, 4, 14 | LBST, LEDEN, HRNEN Inputs | $V_{reg}-.7$ | | | V |
| | Vihrs | 9 | REGSEL Input | 2.3 | | | V |
| | Vihf | 15 | FEED Input; $V_O=10V$ | 7 | | | V |
| Output Low Voltage | Vol1 | 12,13 | HORNB or HORNS; $I_{out}=16mA$; $V_{dd}=3V$; $V_O=10V$ | | .3 | .5 | V |
| | Vol2 | 5 | LED; $I_{out}=10mA$; $V_O=4V$ | | .3 | .5 | V |
| | Vol3 | 16 | LBOU; $I_{out}=100\mu A$; $V_{dd}=3V$ | | .3 | .5 | V |
| Output High Voltage | Voh1 | 12,13 | HORNB or HORNS; $V_O=10V$; $I_{out}=-16mA$; $HRNEN=V_{reg}$ | 9.5 | 9.7 | | V |
| | Voh3 | 16 | LBOU; $I_{out}=100\mu A$; $V_{dd}=2.1V$ | $V_{reg}-.5$ | $V_{reg}-.3$ | | V |
| VO Output Voltage | Vvo1 | 11 | $V_{dd}=3V$; $HRNEN=V_{reg}$; $I_{out}=10mA$ | | 10 | | V |
| | Vvo2 | 11 | $V_{dd}=3V$; $HRNEN=0V$; $I_{out}=10mA$ | | 4 | | V |

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Electrical Characteristics (continued)

Limits apply at $V_{dd}=3V$, $V_{ss}=V_{ss2}=0V$, $C_{reg}=10\mu F$, $C_{vo}=10\mu F$, $T_A=0^\circ C$ to $50^\circ C$, unless otherwise noted.
Typical values are at $T_A=27^\circ C$.

| Parameter | Symbol | Test Pin | Test Conditions | Limits | | | Units |
|--------------------------------|---------|----------|----------------------------------|--------|-----|------|-------|
| | | | | Min | Typ | Max | |
| VO Efficiency | Voeff1 | | Iload= 10mA, Vdd=3V; HRNEN=0V | | 85 | | % |
| | Voeff2 | | Iload=100uA; Vdd=3V; HRNEN=0V | | 75 | | % |
| Low Battery Threshold | Vlbat | 3 | LBST=Vreg | | 2.4 | | V |
| LBST to LBOU Propagation Delay | Tplh1b | 16 | Vdd=2.1; LBSET Cload=5pF | | 30 | | us |
| VREG Voltage | Vreg1 | 10 | Iout<20mA; REGSEL=Vdd | 3.1 | 3.3 | 3.5 | V |
| | Vreg2 | 10 | Iout<20mA; REGSEL=Vss | 2.8 | 3.0 | 3.2 | V |
| VREG Load Regulation | Vregld1 | 10 | Iout=0 to 20mA; HRNEN=Vreg | | 50 | | mV |
| | Vregld2 | 10 | Iout=0 to 20mA; HRNEN=0V | | 50 | | mV |
| Brownout Threshold | Vobvt | 11 | Falling edge of VO | | 3.6 | | V |
| VO-to-Brownout Margin | Vobvtm | 11 | Vv02 -Vobvt | 100 | 400 | | mV |
| Brownout Pull down | Ibt | 10 | VO=3.0V; Vreg=2.0V | 20 | 40 | | mA |
| VREG over voltage clamp | Vcl1 | 10 | REGSEL=Vdd | 3.75 | 4 | 4.25 | V |
| | Vcl2 | 10 | REGSEL=0V | 3.35 | 3.6 | 3.85 | V |

Notes on Electrical Characteristics:

1/ DC-DC converter in high boost mode (nominal VO=10V) can draw current pulses of greater than 1 Amp and is therefore very sensitive to series resistance. Critical components of this resistance are the inductor DC resistance, the internal resistance of the battery and the resistance in the connections from the inductor to the battery, from the inductor to the LX pin and from the Vss2 pin to the battery. In order to function properly under full load at Vdd=2V, the total of the inductor and interconnect resistances should not exceed 0.3 ohm. The internal battery resistance should be no more than 0.5 ohm and a low ESR capacitor of 10uF or more should be connected in parallel with the battery to average current draw over the boost converter cycle.

2/ In the Electrical Characteristics Table, wherever a specific VO value is listed under test conditions, the VO is forced externally with the inductor disconnected and the DC-DC converter is NOT running.

3/ The brown-out threshold voltage is the VO voltage at which the regulator and horn will be disabled. At VO voltages below the brown-out threshold Vreg will be pulled to Vss.

4/ In normal operation, the regulator will provide high-side current of up to 20mA, but current sinking capability is typically under 1uA. The overvoltage clamp is intended to limit the voltage at Vreg when it is pulled up by an external source.

5/ The limits shown are 100% tested at 25C only. Test limits are guard-banded based on temperature characterization to guarantee compliance at temperature extremes.

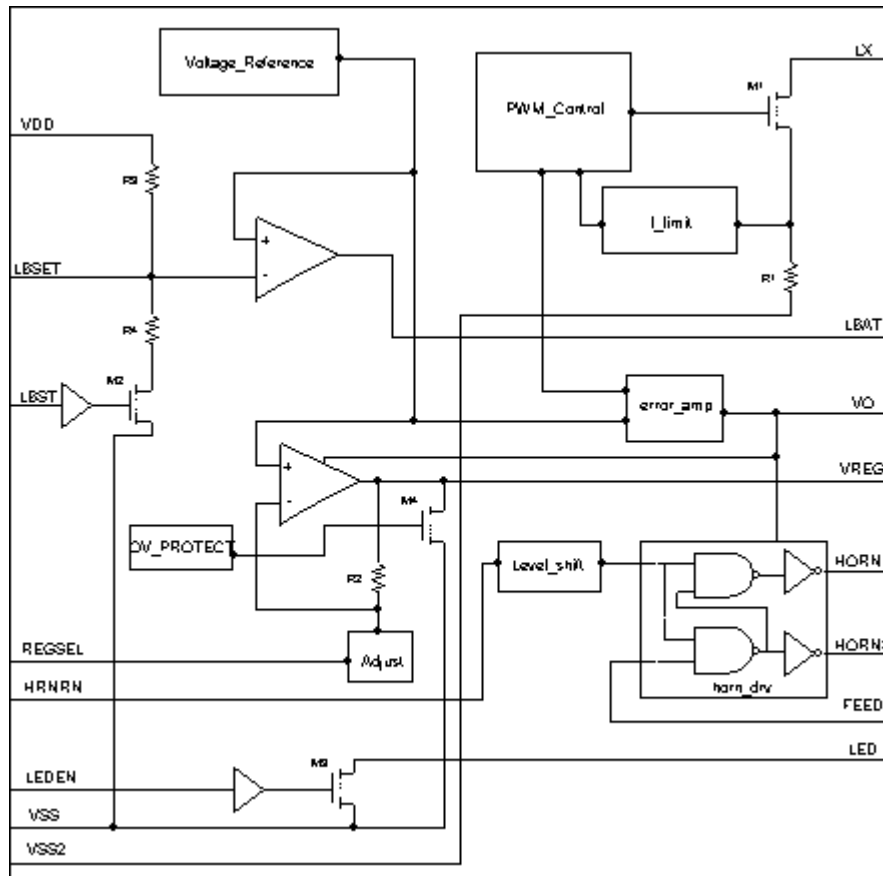
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Functional Block Diagram



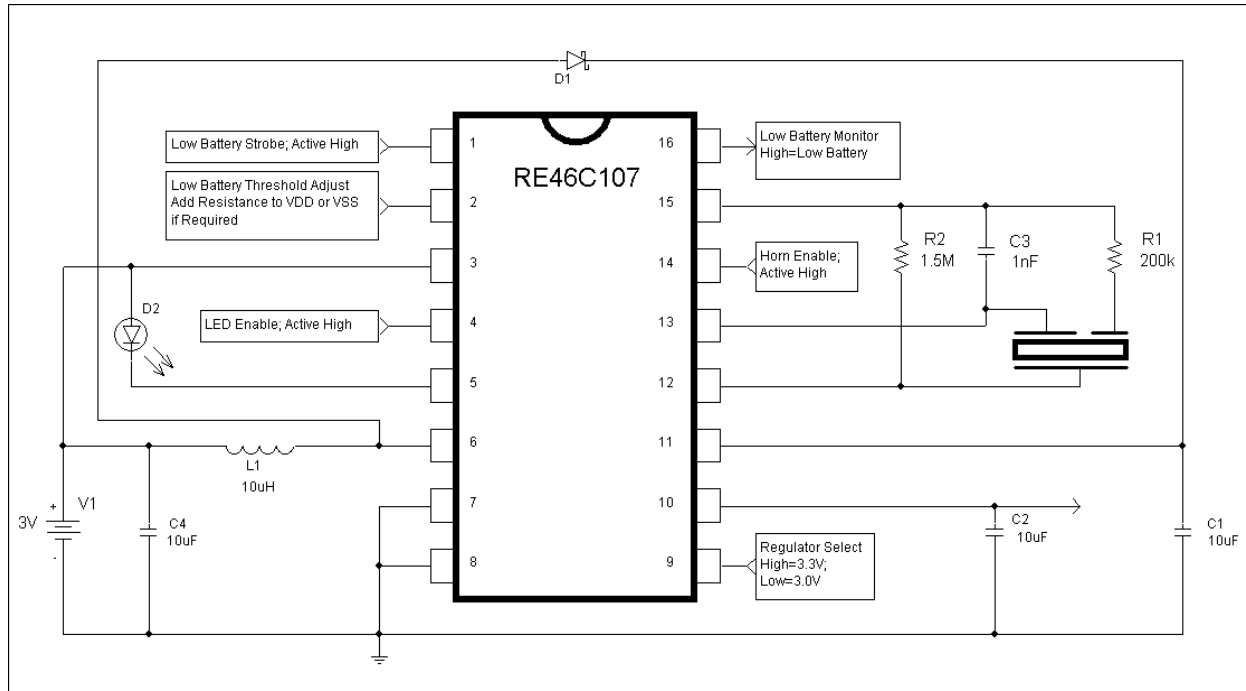
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Typical Application Circuit



Notes:

1/ Schottky diode D1 must have maximum peak current rating of at least 1.5A and for best results should have forward voltage spec of less than 0.5V at 1 Amp.

2/ Inductor L1 must have maximum peak current rating of at least 1.5A and for best results should have DC resistance of less than 0.3 ohm.

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