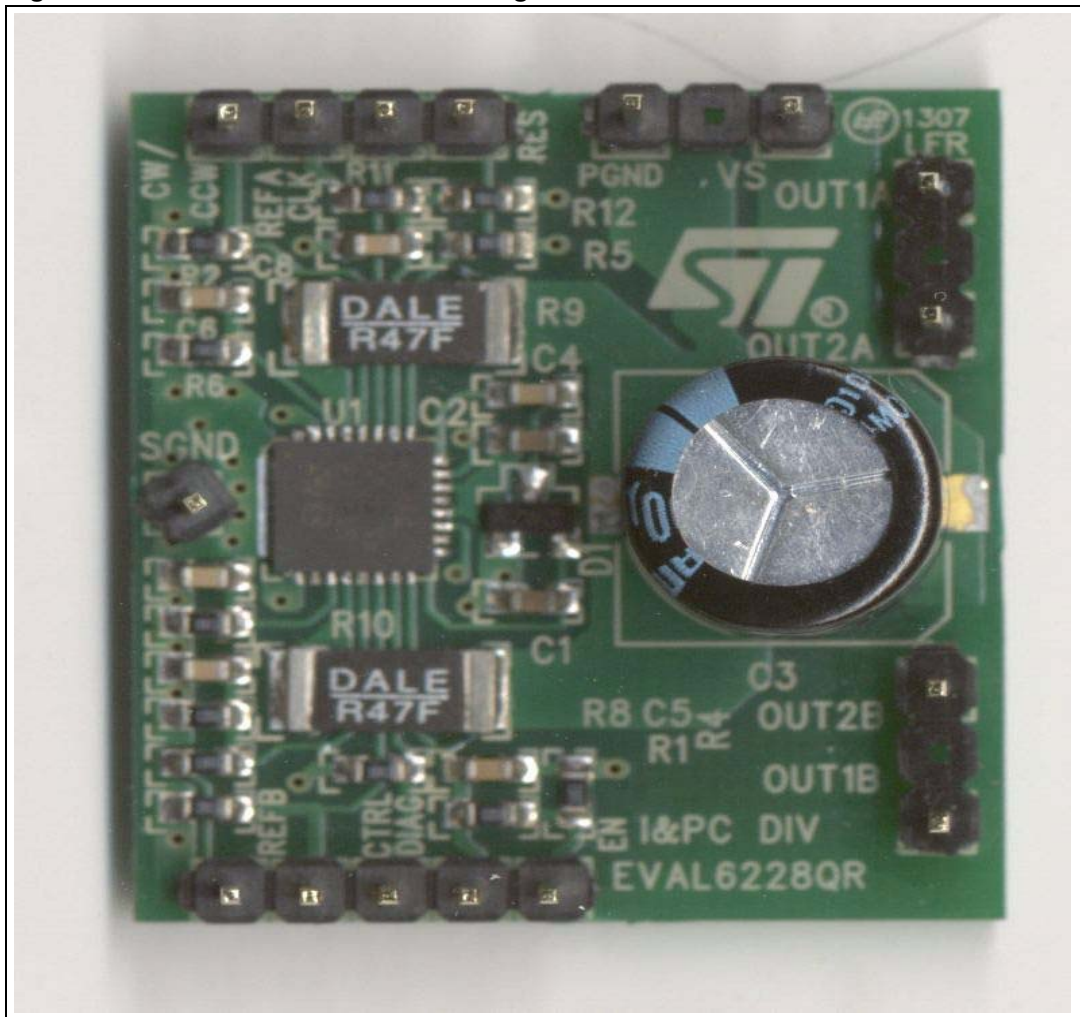


### EVAL6228QR reference design board

#### Introduction

This application note describes the evaluation board of the DMOS fully integrated stepper motor driver L6228Q. The board implements a typical application that can be used as a reference design to drive two-phase bipolar stepper motors with currents up to 1 A DC. Thanks to the small footprint of the L6228Q (QFN 5 x 5 mm, 32-lead) the PCB is very compact (27 x 32 mm).

Figure 1. EVAL6228QR reference design board

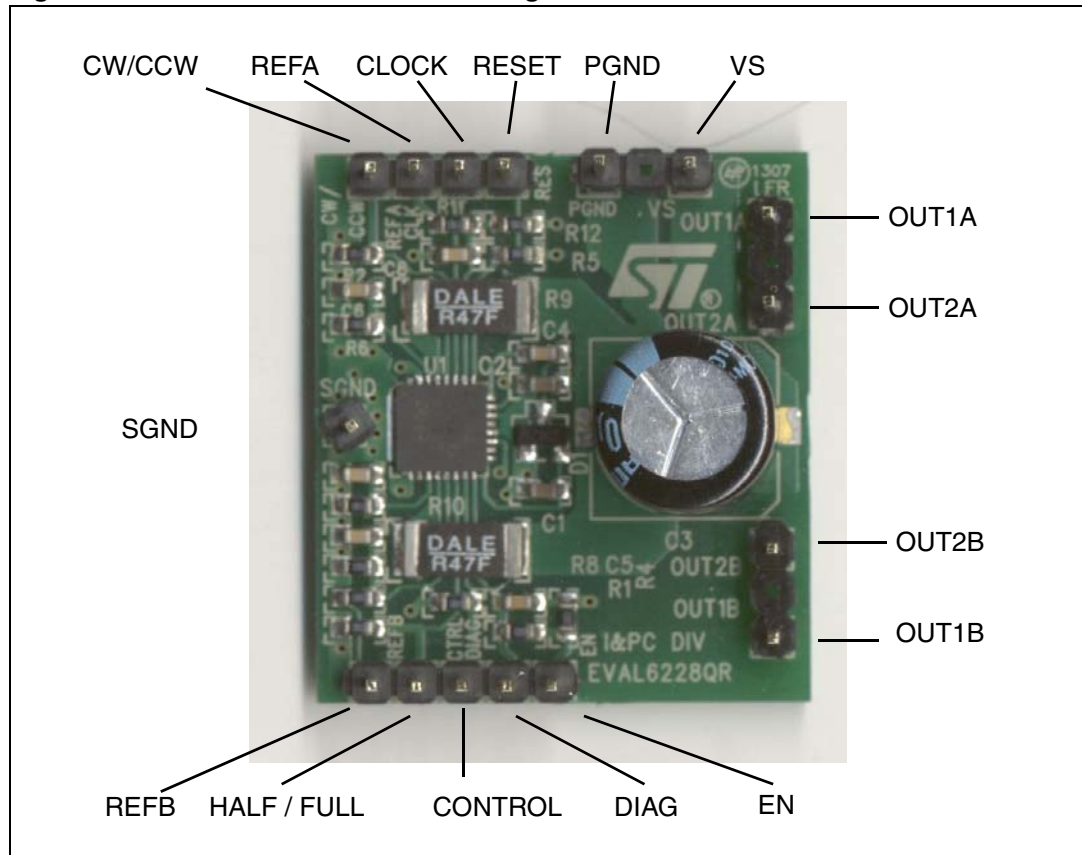


# 1 Demonstration board description

**Table 1. EVAL6228QR pin connections**

Name	Type	Function
VS	Power supply	Bridge A and bridge B power supply
PGND	Ground	Power ground terminal
CLOCK	Logic input	Step clock input
CW/CCW	Logic input	Selects the direction of the rotation (high = CW; low = CCW)
CONTROL	Logic input	Decay mode selector (high = SLOW decay; low = FAST decay)
HALF / FULL	Logic input	Step mode selector (high = half step; low = full step)
EN	Logic input / output	Chip enable (active high). When low, all power DMOSs are switched OFF (both bridge A and bridge B)
RESET	Logic input	Reset pin (active low). When low, the Phase Sequence Generator is reset to home state (state 1)
DIAG	Logic input	Diagnostic pin. When low, an overcurrent or overtemperature event is signaled
SGND	Ground	Signal ground terminal
REFA	Analog input	Bridge A current controller reference voltage
REFB	Analog input	Bridge B current controller reference voltage
OUT1A	Power output	Bridge A output 1
OUT2A	Power output	Bridge A output 2
OUT1B	Power output	Bridge B output 1
OUT2B	Power output	Bridge B output 2

Figure 2. EVAL6228QR reference design board



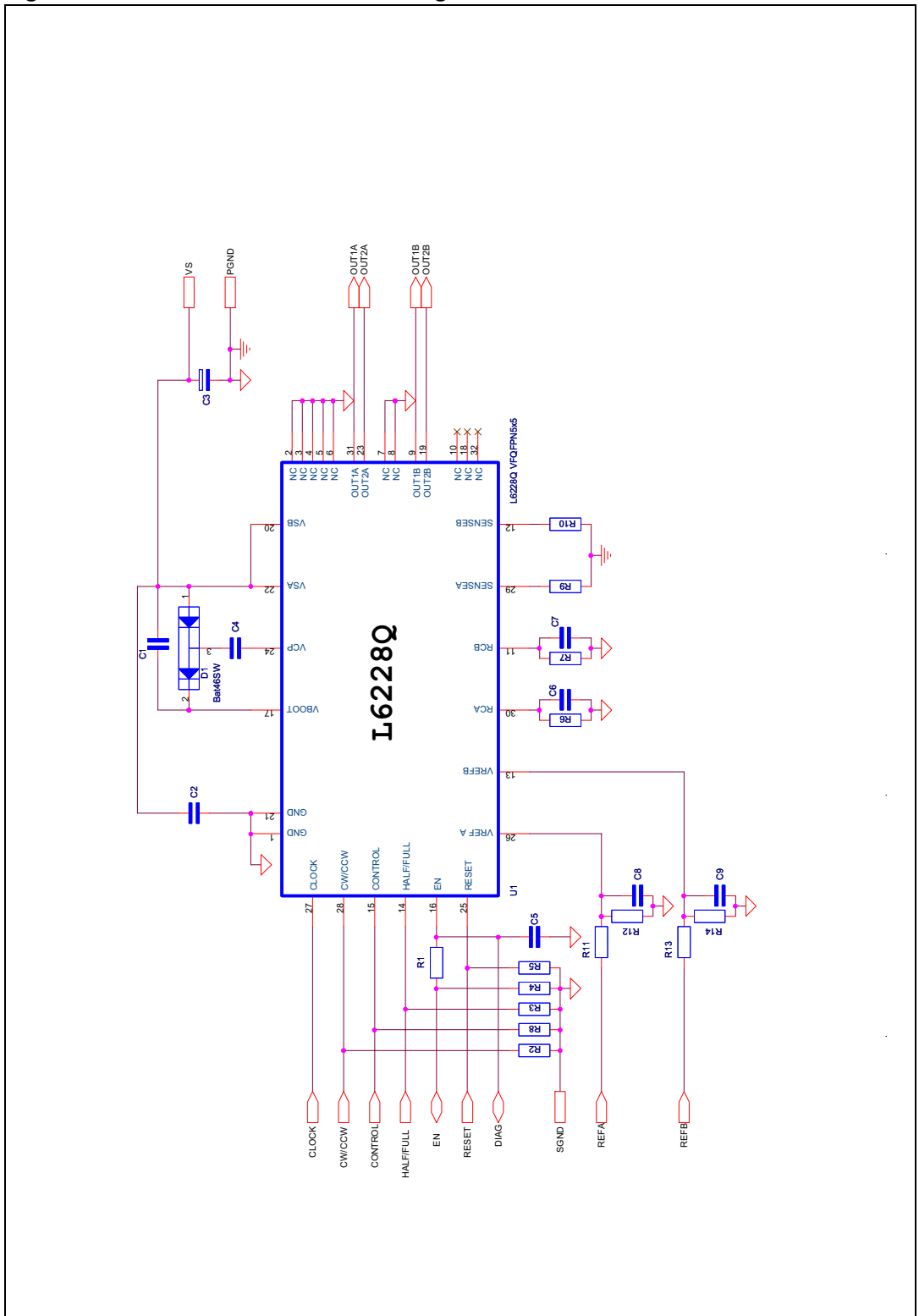
A step-clock input CLOCK is used to apply a clock signal which determines the progress of the internal state machine. It can be reset to its initial state by pulling down the RESET line. To perform the PWM current control an analog reference voltage should be provided to each channel of the driver.

A fixed reference voltage can be easily obtained through a resistive divider from an external voltage rail and GND (can be the one supplying the microcontroller or the rest of the application). Otherwise a very simple way to obtain a variable voltage without using a DAC is to low-pass filter a PWM output of a microcontroller. [Table 2](#) summarizes the electrical specification of the application, [Figure 3](#) shows the electrical schematic and [Table 3](#) gives the part list.

**Table 2. EVAL6228QR electrical specification (recommended values)**

Parameter	Value
Supply voltage range (VS)	8 V to 52 V DC
RMS output current rating (OUT x)	up to 1.4 A
Switching frequency	up to 100 kHz
Voltage reference range (REFA, REFB)	0 to +5 V
Input and enable voltage range	0 to +5 V
Operating temperature range	-25 °C to +125 °C
L6228Q thermal resistance junction to ambient	42 °C/W

Figure 3. EVAL6228QR reference design schematic



**Table 3. EVAL6228QR part list**

Part reference	Part value	Part description
C1	220 nF / 25 V	Capacitor
C2	220 nF / 63 V	Capacitor
C3	100 $\mu$ F / 63 V	Capacitor
C4	10 nF / 25 V	Capacitor
C5	5.6 nF	Capacitor
C6, C7	820 pF	Capacitor
C8, C9	220 nF	Capacitor
D1	BAT46SW	Diode
R1, R2, R3, R4, R5, R8	100 k $\Omega$ 5% 0.25 W	Resistor
R6, R7	100 k $\Omega$ 1% 0.25 W	Resistor
R9, R10	0.4 $\Omega$ 1 W	Resistor
R11, R13	20 k $\Omega$ 1% 0.25 W	Resistor
R12, R14	2 k $\Omega$ 1% 0.25 W	Resistor
U1	L6228Q	Stepper motor driver in VFQFPN5x5

The input lines CW/CCW, CONTROL, HALF / FULL, EN and RESET are connected to ground through a pull-down resistor which sets the low logic level as default. An external signal can be applied to change each input status.

D1, C1 and C4 constitute a charge pump circuit, which generates the supply voltage for the high-side integrated MOSFETs. Due to voltage and current switching at relatively high frequency, these components are connected through short paths in order to minimize induced noise on other circuitries.

R1 and C5 are used by the overcurrent protection integrated circuitry (disable time  $t_{DISABLE}$  is about 200  $\mu$ s and delay time  $t_{DELAY}$  about 1  $\mu$ s using the values in [Table 3](#)).

R6, C6 and R7, C7 are used to set the off-time  $t_{OFF}$  of the two PWM channels to about 50  $\mu$ s. The off-time should be adjusted according to the motor electrical characteristics and supply voltage by changing the R6, C6 and R7, C7 values.

R11, R12, C8 and R13, R14, C9 are low-pass filters which provide an external reference voltage through a PWM output of a microcontroller.

[Figure 4](#), [Figure 5](#) and [Figure 6](#) show the placement of the components and the layout of the two layers of the EVAL6228QR reference design board. A GND area has been used to improve the IC power dissipation.

Figure 4. EVAL6228QR component placement

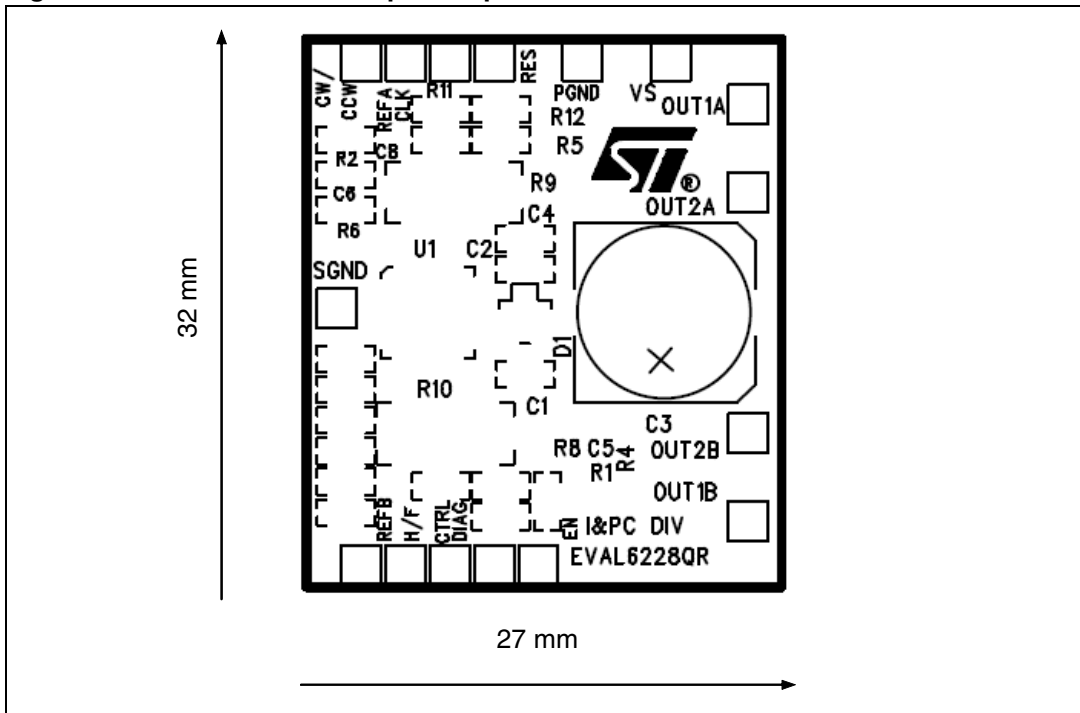


Figure 5. EVAL6228QR top layer layout

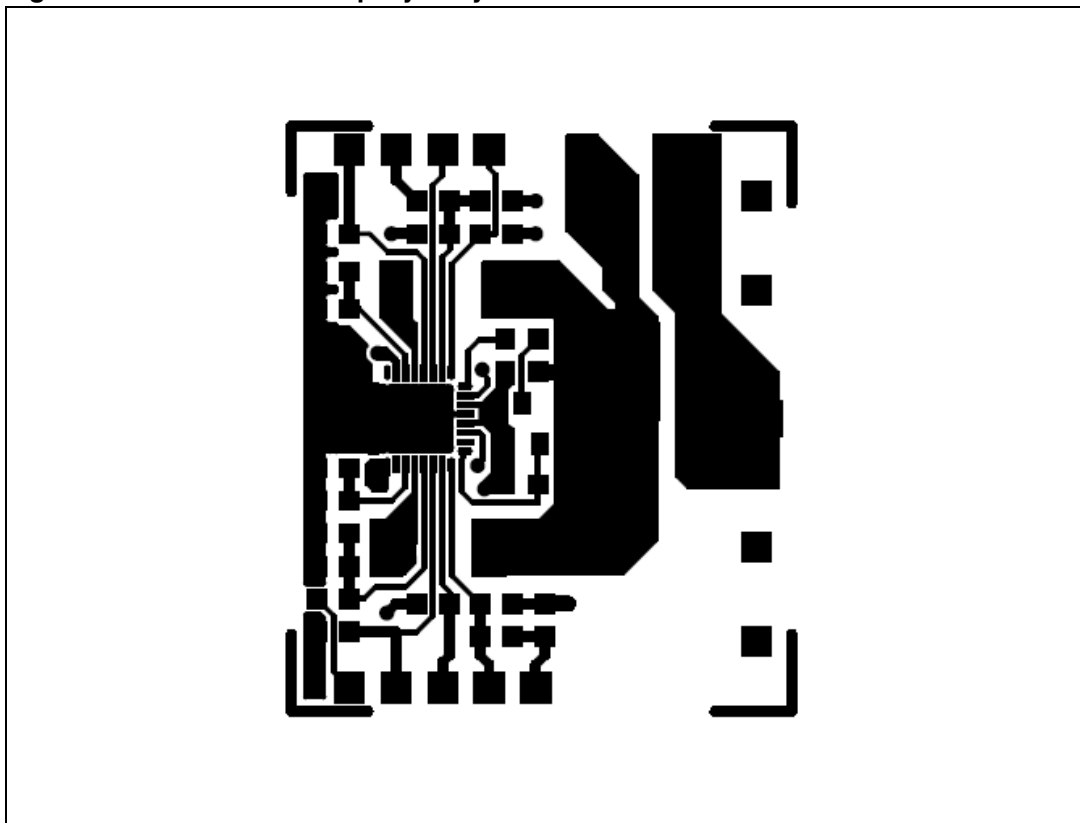
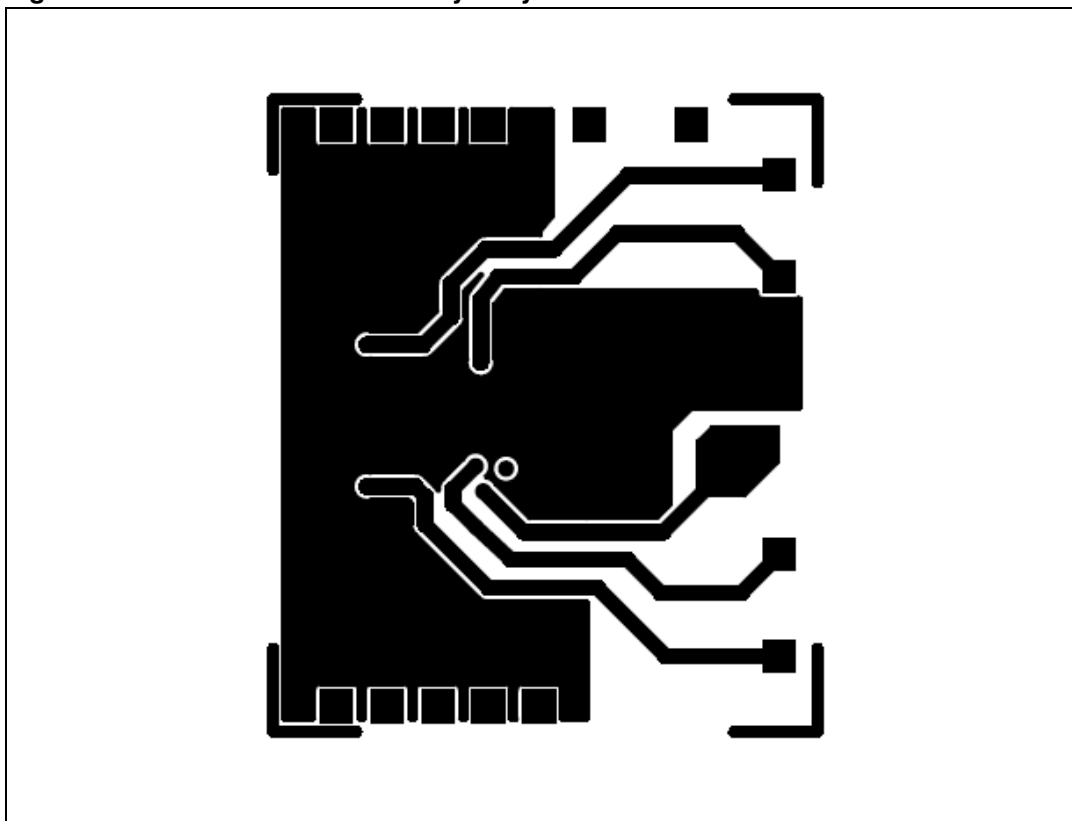


Figure 6. EVAL6228QR bottom layer layout





## 2 Revision history

**Table 4. Document revision history**

Date	Revision	Changes
06-Oct-2008	1	Initial release
28-Jan-2009	2	Updated value in <i>Table 2: EVAL6228QR electrical specification (recommended values) on page 4</i>

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