

EVAL6230QR demonstration board

Introduction

This application note describes the demonstration board of the DMOS driver for the three-phase brushless DC motor driver L6230Q. The board implements a typical application which can be used as a reference design to drive three-phase brushless DC motors with currents up to 1 A DC.

Thanks to the small footprint of the L6230Q (QFN 5x5 mm) the PCB is very compact (32x31 mm).

Figure 1. EVAL6230QR demonstration board

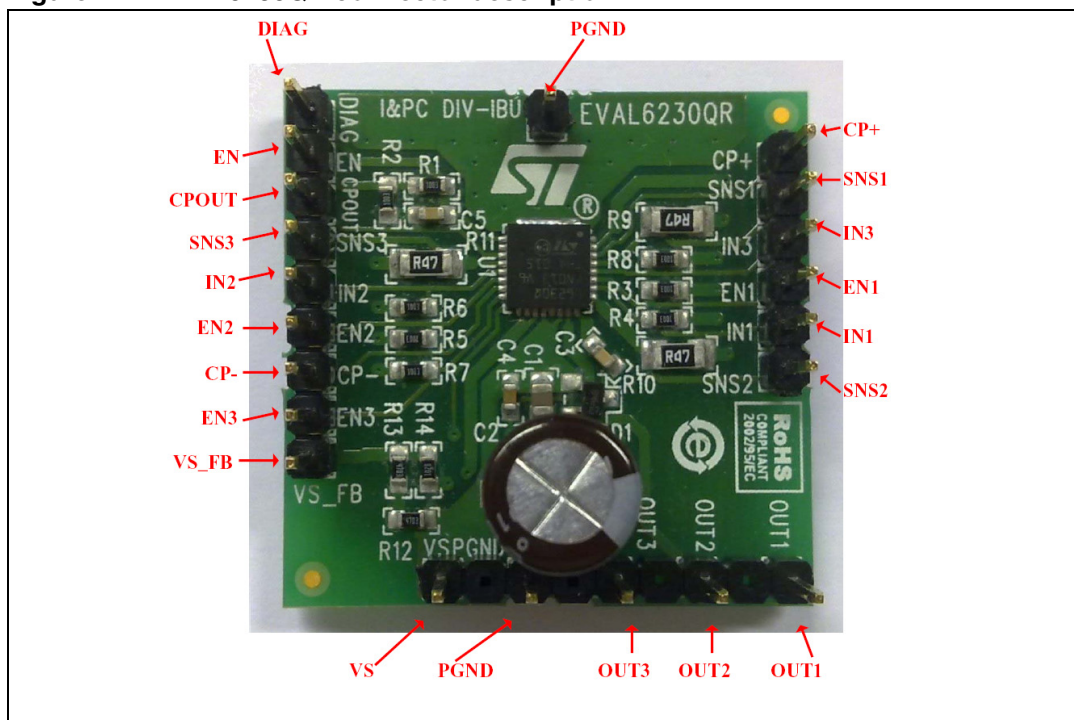


AM02583v1

1 Demonstration board description

Table 1. EVAL6230QR: pin connections

| Name | Type | Function |
|--------|-------------------|---|
| VS | Power supply | Power supply voltage. |
| PGND | Ground | Power ground terminal. |
| VS_FB | Analog output | Supply voltage feedback (1/115 divider ratio) |
| EN | Logic input | Chip enable (active 'H'). When 'L' switches OFF all power DMOS. |
| IN1 | Logic input | Logic input half bridge 1. |
| EN1 | Logic input | Enable input half bridge 1. |
| IN2 | Logic input | Logic input half bridge 2. |
| EN2 | Logic input | Enable input half bridge 2. |
| IN3 | Logic input | Logic input half bridge 3. |
| EN3 | Logic input | Enable input half bridge 3. |
| DIAG | Open-drain output | Diagnostic pin. When 'L' signals an overcurrent or overtemperature event. |
| CPOUT | Open-drain output | Open-drain output of internal comparator. |
| CP- | Analog input | Inverting input of internal comparator. |
| CP+ | Analog input | Non-inverting input of internal comparator. |
| SENSE1 | Analog output | Half bridge 1 source pin. |
| SENSE2 | Analog output | Half bridge 2 source pin. |
| SENSE3 | Analog output | Half bridge 3 source pin. |
| OUT1 | Power output | Output half bridge 1. |
| OUT2 | Power output | Output half bridge 2. |
| OUT3 | Power output | Output half bridge 3. |

Figure 2. EVAL6230QR connector description

The EN pin is chip enable (active high). The ENx pins enable the corresponding half-bridge. When low logic level is applied, the half bridge output is in high-impedance status (both high and low side MOS turned off).

The INx input pins drive the corresponding half bridge. When low logic level is applied, the low side MOS is switched on, whereas a high logic level turns on the high side MOS.

A general purpose comparator is integrated in the IC, its inputs and open-drain output are available on CP-, CP+, and CPOUT. It can be used for the current control or BEMF zero crossing detection (refer to the L6230; *DMOS driver for three-phase brushless DC motor*, datasheet for more details).

The power supply feedback and sensing signals are available for external conditioning, for example, to perform a field oriented control driving method.

[Table 2](#) summarizes the electrical specification of the application, [Figure 3](#) shows the electrical schematic and [Table 3](#) contains the parts list.

Table 2. EVAL6230QR: electrical specification (recommended values)

| Parameter | Value |
|---|-------------------|
| Supply voltage range (VS) | 8 to 52 Vdc |
| RMS output current rating (OUTx) | up to 1.4 A |
| Switching frequency | up to 100 kHz |
| Input and enable voltage range | 0 to +5 V |
| Comparator input voltage range | 0 to +5 V |
| Operating temperature range | -25 °C to +125 °C |
| L6230Q thermal resistance junction to ambient | 42 °C/W |

Figure 3. EVAL6230QR board schematic

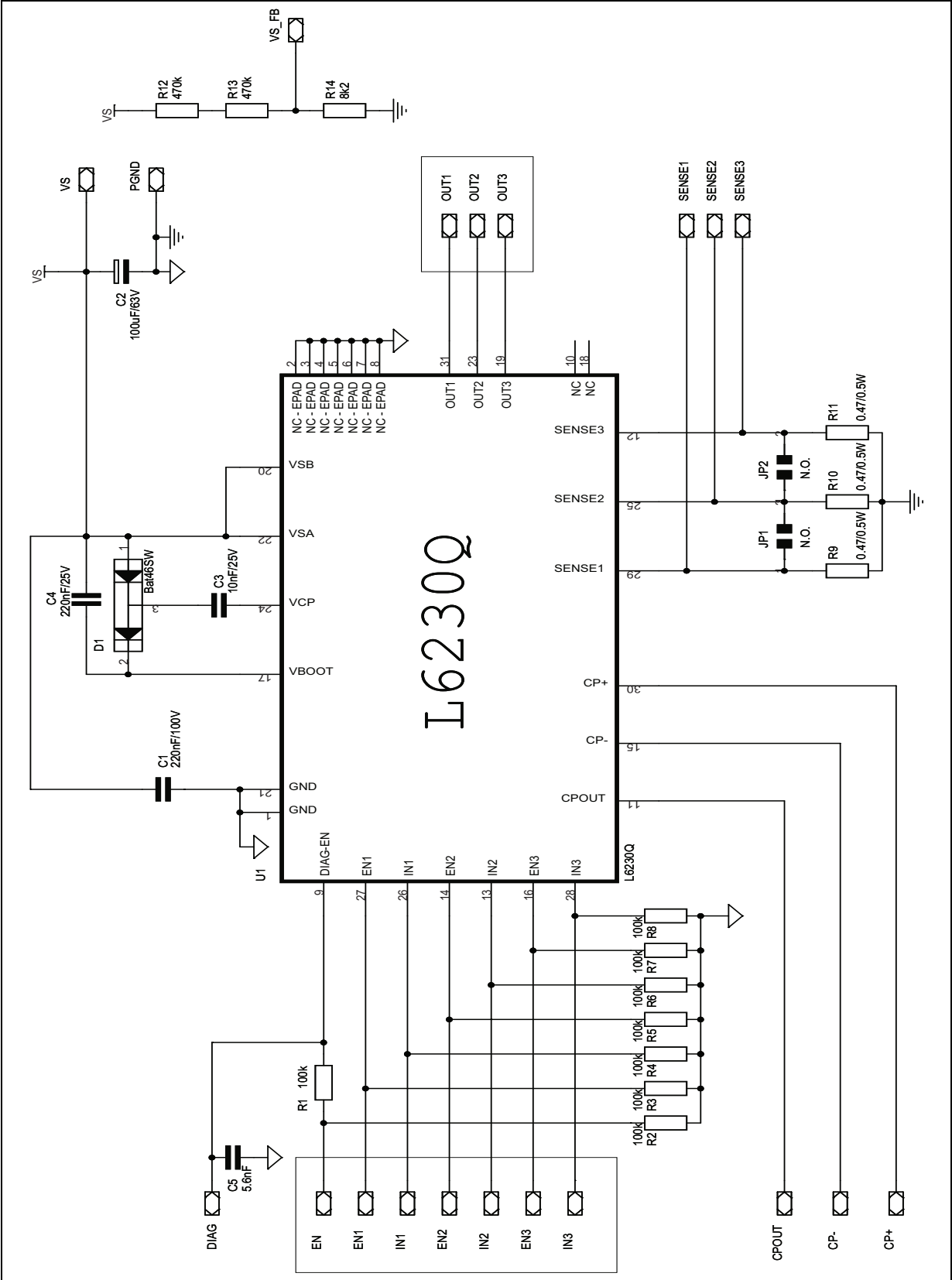


Table 3. EVAL6230QR parts list

| Part reference | Part value | Part description |
|----------------|---------------------------|--|
| C1 | 220 nF/100 V | Capacitor |
| C2 | 100 μ F/63 V | Capacitor |
| C3 | 10 nF/25 V | Capacitor |
| C4 | 220 nF/25 V | Capacitor |
| C5 | 5.6 nF | Capacitor |
| D1 | BAT46SW | Diodes |
| R1 ÷ R8 | 100 k Ω 5 % 0.25 W | Resistor |
| R9, R10, R11 | 0.47 Ω - 0.5 W | Resistor |
| R12, R13 | 470 k Ω 5 % 0.25 W | Resistor |
| R14 | 8.2 k Ω 5 % 0.25 W | Resistor |
| U1 | L6230Q | Three-phase BLDC motor driver in VFQFPN5x5 |

D1, C3, and C4 realize 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 together through short paths in order to minimize induced noise on other circuitries.

R2 and C5 are used by the overcurrent protection integrated circuitry to set the protection timings (disable time, t_{DISABLE} , is about 200 μ s and delay time, t_{DELAY} , is about 1 μ s with the values in [Table 3](#)).

[Figure 4](#), [Figure 5](#), and [Figure 6](#) show the component placement and the two layer layout of the EVAL6230QR demonstration board. A GND area has been used for the IC power dissipation.

Figure 4. EVAL6230QR component placement

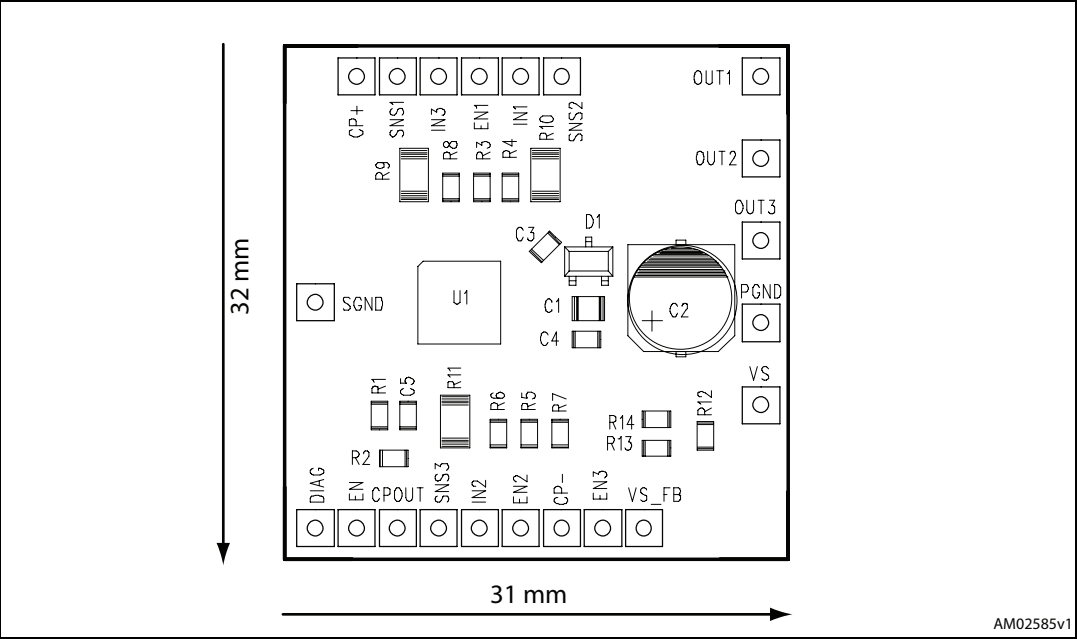


Figure 5. Top layer layout

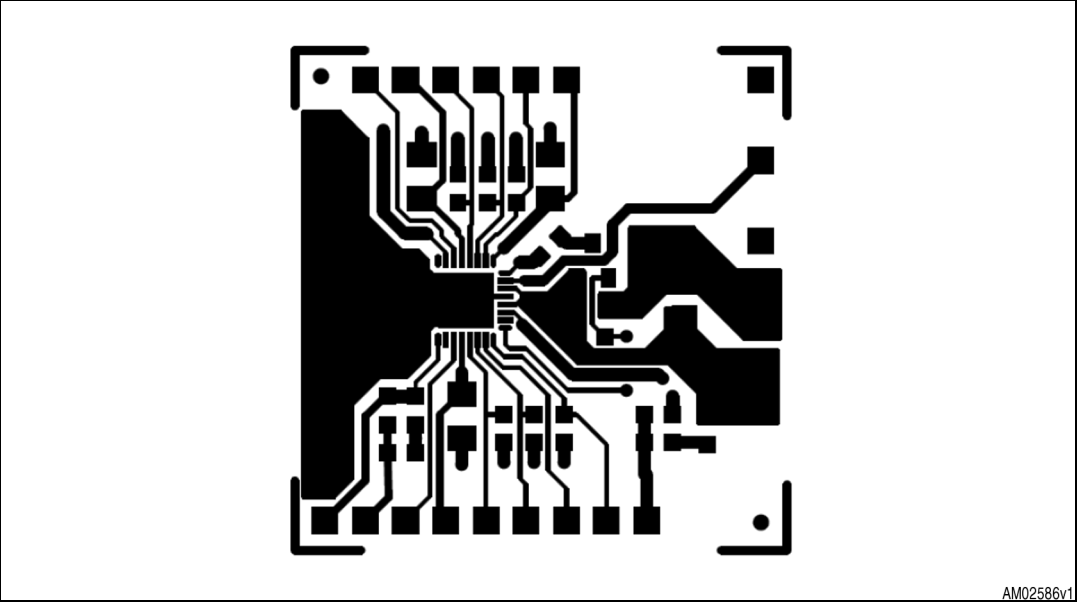
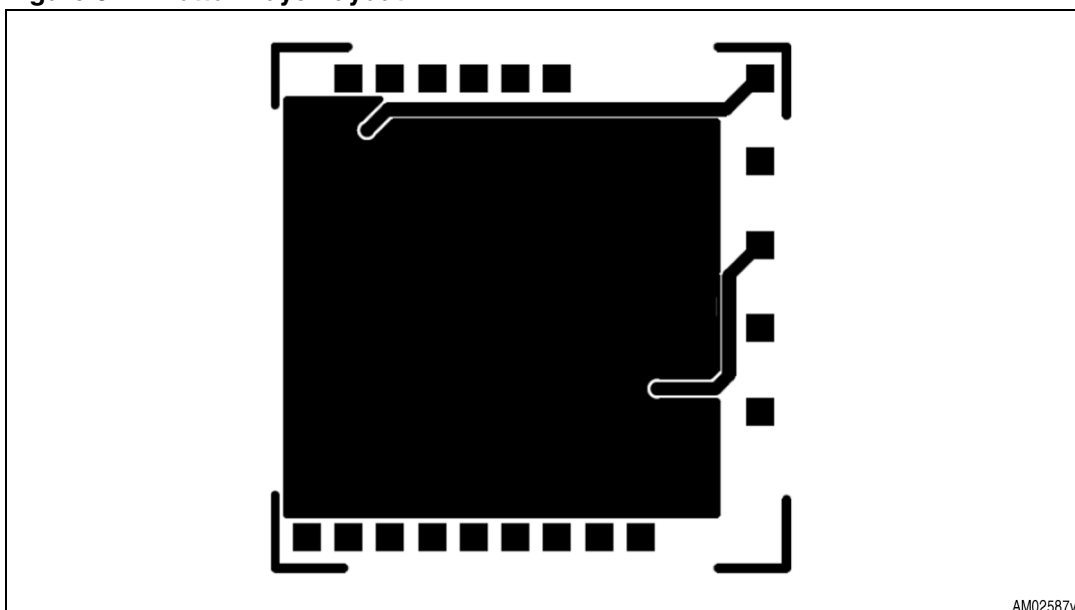


Figure 6. Bottom layer layout

2 Revision history

Table 4. Document revision history

| Date | Revision | Changes |
|-------------|----------|-----------------|
| 26-Nov-2010 | 1 | Initial release |

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2010 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[STMicroelectronics:](#)

[EVAL6230QR](#)