

## Q&A LV8968

Q: Can this IC work without a microcontroller as stand alone BLDC driver?

A: No, this Driver needs to be controlled via SPI with a microcontroller.

Q: For my microcontroller I need a higher current for VCC. What can I do to use a higher current from the LV8968? mA is not enough.

A: While the LV8968 can only deliver 50mA, an additional regulator with reference input can be used. For this extension the NCV8182C is a good example. It can use the VCC as reference voltage and drives up to 200mA load current. Using this method guarantees that the SPI voltage levels are compliant between the LV8968 and the microcontroller in use.

Q: Can I use the V3RO Regulator for external use?

A: The V3RO regulator is intended for internal use only. It is connected to V3RI for regulation feedback, where a decoupling capacitor should be placed for wide range stability.

Q: What is the maximum PWM output frequency?

A: The output frequency can be 50 KHz maximum.

Q: Can the LV8968 output a PWM with 100% duty cycle?

A: Because the LV8968 uses a bootstrap supply for the High side drivers, it cannot drive a DC level output (PWM dutycycle 100%). With an external Charge pump circuit, the 100% dutycycle can be achieved.

Refer to the Application note: <https://www.onsemi.com/pub/collateral/evbum2574-d.pdf>

Q: What is Drive 3 mode?

A: This mode is suitable for small microcontrollers which do not have 6 dedicated PWM control lines. IL(1-3) serve as enable signals for the phase drivers GH(1-3) and GL(1-3) while IH (1-3) serve as their PWM inputs. Connect the microcontroller's PWM line to IH(1-3) and the Phase select lines to individual IL inputs 1-3 respectively.

Q: Does this IC have three current sense amplifiers?

A: This IC has one current sense amplifier. The current measurement can be achieved with 3 external shunt resistors placed.

Refer to application note: <https://www.onsemi.com/pub/collateral/evbum2574-d.pdf>

Q: How to set the Wake pin?

A: The Wake pin, when set Low, together with the EN pin, brings the device in its sleep mode. When the Wake pin is high, the chip is in standby mode.

Q: How do I have to work with the PWMIN pin and RXD pin?

A: The PWMIN pin translates a VS level signal with a threshold of 40% and 60% VS. It outputs this digital signal at the RXD pin.

Q: What is VMCRES pin?

A: The PWMIN pin translates a VS level signal with a threshold of 40% and 60% VS. It outputs this digital signal at the RXD pin.

Q: How to set the BS Voltage?

A: In the case of a VCC undervoltage fault, Watchdog reset or thermal shutdown, VMCRES goes low. It can be used to interrupt or reset the microcontroller.

Q: How to set current sensing?

A: Single shunt current sensing can be implemented with the integrated high speed sense amplifier. It amplifies the voltage across IPS-ISO with a programmable gain defined by register CSGAIN. Access to this register is dynamic, allowing gain adjustment during motor operation. The offset is determined by CSOFEN relative to an internal reference which can be either 200mV for unidirectional current sensing or 1.5V for sensing current in both directions. The output of current sense amplifier appears on the ISO pin.

Current sensing amplifier ISO voltage is expressed with following formula:

$$V_{sen} = I_o * R_{shunt} (V)$$

$$V_{iso} = CSGAIN * V_{sen} + CSOFEN (V)$$

For example,  $R_{shunt} = 3.3 \text{ m}\Omega$ , Motor current  $I_o = 10 \text{ A}$ ,  $CSGAIN = 7.5$ ,  $CSOFEN = 1.5 \text{ V}$

$$V_{sen} = 10 * 3.3 = 0.033 \text{ V}$$

$V_{iso} = 7.5 * 0.033 + 1.5 = 0.2475 + 1.5 = 1.7475 \text{ V}$

Q: The power supply system VS, VDH and VGIN is described as having the following maximum absolute voltage 40V, there is a standard for ISO7632-2 5b 35V 400msec load dump. If the customer examines the load dump test. does LV8968 exceed 40V?

A: The maximum rating of the LV8968BB is 40V. so the 35V load dump test does not exceed 40V. But it is always good to use OVP (Overvoltage Protection) on the power supply lines.

Q: I have taken EN high, but no PWM occur in output drivers GH and GL.

A: Please confirm to communicate with MCU through SPI. If SPI is correct active and confirm to set up Register map.

Q: Can a Dead time be used for the FET driver switching?

A: A Dead time can be selected by register FDTI. It can be set from 0.2 $\mu$ s to 3.2 $\mu$ s. The FDTI value can be changed during motor operation. A fixed minimum dead time can be programmed by register FDTIFIM.

Q: Which protection functions does the LV8968 have?

A: The LV8968 has following protection functions:

FET short protection, Overcurrent shutoff, Thermal warning and shutdown, VS Under/Overvoltage protection, VCC undervoltage protection etc.

Q: What is the function of the DIAG pin?

A: The state of any internal diagnostics flag will bring the DIAG pin low, (Register MRDIAG0, MRDIAG1 show abnormal state). DIAG abnormal state polarity can be selected low or high by DIAGPOL register.

Q: How do I set the gate resistance of the FET(s).

A: The MOSFET gate resistance is determined by the total gate charge (Qg) of the FET gate and raising time (Trai) .

As the target raising time is set to 300ns, and Qg of the MOSFET is fixed, the gate resistor can be determined:

Rg: Gate resistor (ohm), VG: Gate supply voltage E.g 12(V), Ig: gate current (A)

Qg: Total gate charge of FET (nC), Trai: FET gate raising time.

$$I_g = Q_g / T_{rai}$$

$$R_g = V_G / I_g$$

For example:  $V_G = 12V$ ,  $Q_g = 33 \text{ nC}$ ,  $T_{rai} = 300 \text{ ns}$ .

$$I_g = 33 \text{ nC} / 300 \text{ ns} = 110 \text{ mA}$$

$$R_g = 12V / 110 \text{ mA} = 109,09 \text{ ohm}$$

Therefore, select for the gate resistor 110 ohm (E24).

The dead time must be higher than the FET gate off time.