



MPQ6526/MPQ6524/MPQ6523

Open Load Detection

Application Note

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ABSTRACT

The MPQ6526 family are multi-channel half-bridge driver, with full protection features include short-circuit protection, under-voltage protection, over temperature protection and open-load protection. The open load detection feature will be discussed in this application note.

CIRCUIT OVERVIEW

Open-load monitoring of MPQ6526, MPQ6524 and MPQ6523 is controlled by the OLD (open-load detection) bit, bit 13 of the input data register. The open-load monitoring circuit for each output driver is defined in Figure 1.

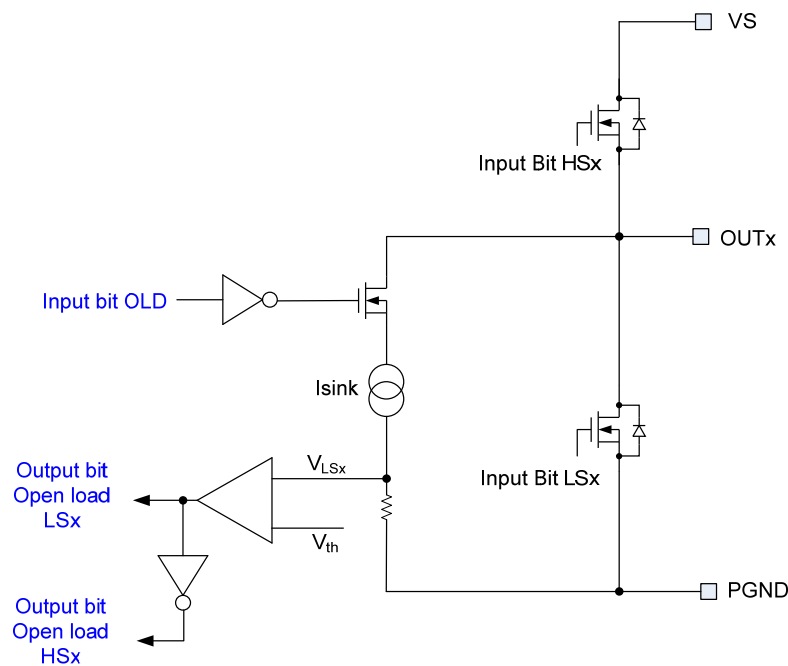


Figure 1: Open-load Detection Circuit

- When the OLD bit is set LOW, open-load detection is enabled. In this mode of operation, a pull-down current (I_{sink}) for each low-side switch (L_{Sx}) will be activated. An open-load condition is detected when the voltage (V_{LSx}) is lower than the open-load detection threshold for the output stage.
- When an open-load has been detected, the corresponding output bit LSx in the output data register will be set HIGH.
- When the OLD bit is set to HIGH, open-load detection function is disabled.

OPEN LOAD DETECTION FOR DIFFERENT LOAD CONFIGURATION

For different load configuration cases, the detailed open load detection solutions are provided in this application note.

1. Single-ended High-side Open-load

A high-side load as shown in Figure 2 can be directly monitored for an open-load condition. In this case, if the connected load is open, activating open-load detection ($OLD = 0$) will indicate a high-side open-load at the dedicated low-side output register (LSx) for the associated output ($OUTx$).

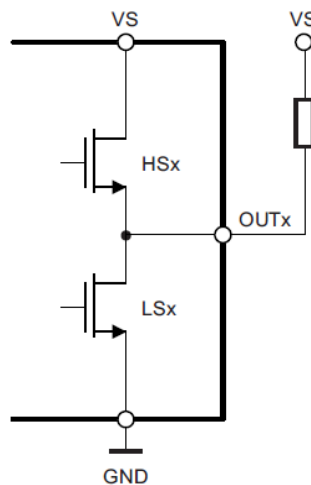


Figure 2: High-side Load Configuration

If $LSx = 1$, then the high-side load is open. Conversely, if $LSx = 0$, then the high-side load is properly connected.

2. Single-ended Low-side Open-load

A low-side load cannot be monitored for an open-load condition, as shown in Figure 3. In this case, regardless of the state of the load, open or closed, the result will be the same when activating open-load detection ($OLD = 0$). The corresponding $LSx = 0$ and $HSx = 1$ for the associated output ($OUTx$) in both instances.

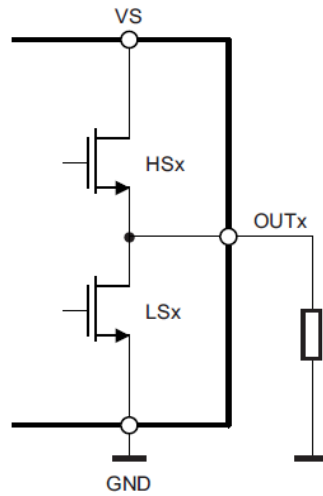


Figure 3: Low-side Load Configuration

3. H-bridge Configuration

An H-bridge configuration as shown in Figure 4 can be directly monitored for an open-load condition. Testing for this open-load is a two-step process. First, switch off all high-side (HSx/HSy) and low-side (LSx/LSy) drivers. The voltage at both clamps in this condition will be pulled-down. Next, with both low-side drivers off, switch on one high-side driver (HSx or HSy). Since the DC motor has a relatively low internal resistance, the voltage of the inactive high-side output should be at the same level as the activated high-side output. In the case of an open-load, the inactive low-side output register will report a “1” if the active high-side output is “0” (the inactive high-side output register will report a “0” if the active high-side output is “1”). Conversely, if the load is connected, both low-side outputs will report “0” (both high-side outputs will report “1”).

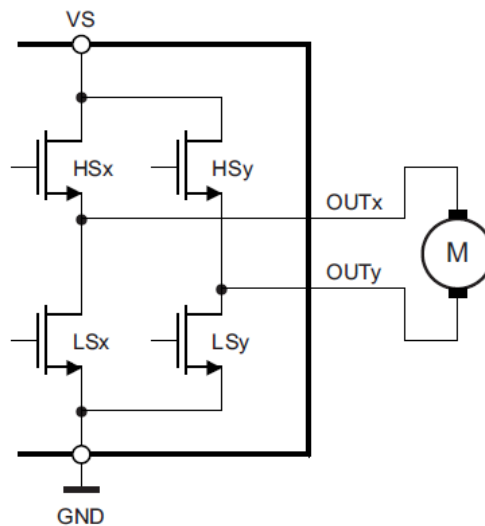


Figure 4: H-bridge Load Configuration

The register configuration to perform open-load test of the H-bridge is as follows:

- Step 1, program all drivers OFF
 - Input register command: OLD = 0, HSx = 0, LSx = 0, HSy = 0, LSy = 0
 - Output register result: LSx = 1, LSy = 1 indicates “Open-load” at LSx/LSy, which is expected
- Step 2, program HSy ON:
 - Input register command: OLD = 0, HSx = 0, LSx = 0, HSy = 1, LSy = 0
 - output register result: LSy=0, LSx=0 (or HSy = 1, HSx = 1) indicates “Motor connected”; LSy=0, LSx=1 (or HSy = 1, HSx = 0) indicates “Motor disconnected”

DESIGN SUMMARY

For MPQ6526 family, when the open-load detection bit (OLD) is set to low, open-load detection is enabled. In this mode, a pull-down current for each low-side switch is turned on. When an open-load has been detected, the corresponding output bit (LSx or HSx) in the output data register will report it. Please use this application note to test the open load for different load configurations.

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