



# MIC4605 Evaluation Board

## 85V Half-Bridge MOSFET Drivers with Adaptive Dead Time and Shoot-Through Protection

### General Description

The MIC4605 is an 85V half-bridge MOSFET driver that features adaptive-dead-time and shoot-through protection. The adaptive-dead-time circuitry actively monitors the half-bridge outputs to minimize the time between high-side and low-side MOSFET transitions, thus maximizing power efficiency. Anti-shoot-through circuitry prevents erroneous inputs and noise from turning both MOSFETs on at the same time. Additionally, the MIC4605's adjustable gate drive sets the gate drive voltage to VDD for optimal MOSFET  $R_{DS(ON)}$ , which minimizes power loss due to the MOSFET's  $R_{DS(ON)}$ .

### Requirements

At a minimum, the evaluation board requires a 5.5V to 16V power supply to power the VDD terminal (J1) of the MIC4605 and another supply (up to 85V) may be used to power the MOSFETs connected to the VIN terminal (J2). A pulse generator or the output of a PWM control IC may be connected to the HI and LI terminals (-1), or PWM single input (-2).

### Precautions

There is no reverse input protection on this board. When connecting the input sources, make sure that the correct polarity is observed.

Under extreme load conditions and with a high supply voltage (>48V) connected to the VIN terminal (J2), input transients can be quite large if long test leads are used. In such cases a 100 $\mu$ F, 100V electrolytic capacitor is needed across the VIN terminals to prevent overvoltage damage to the IC. This can be removed if a clean supply voltage on VIN is always guaranteed.

Datasheets and support documentation are available on Micrel's web site at: [www.micrel.com](http://www.micrel.com).

### Getting Started

1. **Connect VIN supply between the VIN and GND terminals and VDD supply between the VDD and GND terminals.**

Connect a supply between the VIN terminal (J2) and the GND terminal (J3), paying careful attention to polarity and supply range ( $VIN \leq 85V$ ). Do not apply power until Step 5.

Connect a supply between the VDD terminal (J1) and the GND terminal (J3), paying careful attention to polarity and supply range ( $5.5V \leq VDD < 16V$ ). Do not apply power until Step 5.

2. **Connect the TTL-compatible HI and LI inputs (-1), or the PWM single input (-2).**

Connect the HI input (JP2) and LI input (JP3) to a pulse generator or the output of a PWM control IC. Ensure that they are non-overlapping signals and are TTL compatible logic-levels. The PWM single input replaces the HI input (JP2) for the -2 option.

3. **Monitor inputs and outputs.**

Monitor the inputs HI (JP2) and LI (JP3) or PWM (JP2) and outputs HO (JP1) and LO (JP4) with an oscilloscope.

4. **Connect motor across HS and GND or connect HS to GND.**

The simplest way to observe the MIC4605 operation is to connect a motor across the HS terminal (J8) and GND (J9). Alternatively the HS terminal (J8) can be shorted to GND (J9) with the VIN supply turned OFF. DC and AC parameters can be easily measured in this configuration.

5. **Turn-on supplies and HI/LI inputs.**

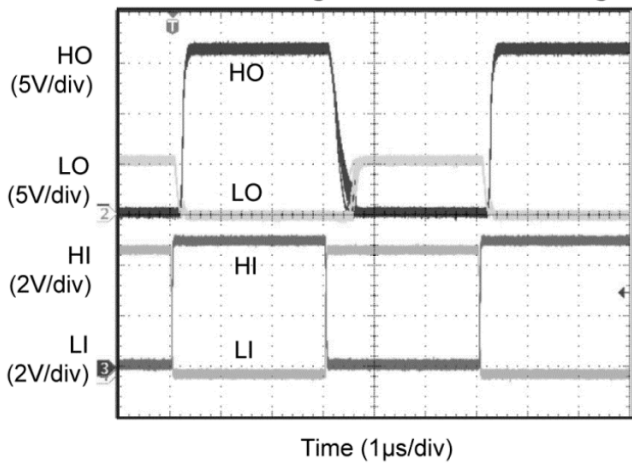
Turn-on the VDD power supply, followed by the VIN power supply. Turn on the HI and LI inputs (-1) or PWM single input (-2).

## Ordering Information

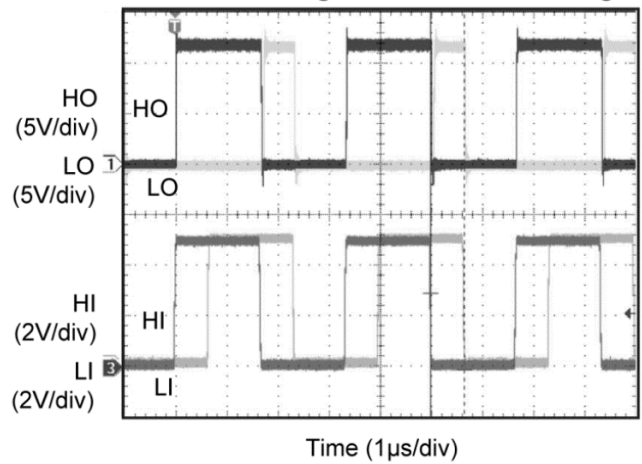
| Part Number     | Description  |
|-----------------|--|
| MIC4605-1YMT EV | Evaluation Board Featuring the MIC4605-1YMT Half-Bridge MOSFET Driver with Dual-TTL Inputs |
| MIC4605-2YMT EV | Evaluation Board Featuring the MIC4605-2YMT Half-Bridge MOSFET Driver with Dual-TTL Inputs |
| MIC4605-1YM EV  | Evaluation Board Featuring the MIC4605-1YM Half-Bridge MOSFET Driver with Single-PWM Input |
| MIC4605-2YM EV  | Evaluation Board Featuring the MIC4605-2YM Half-Bridge MOSFET Driver with Single-PWM Input |

## Evaluation Board Performance

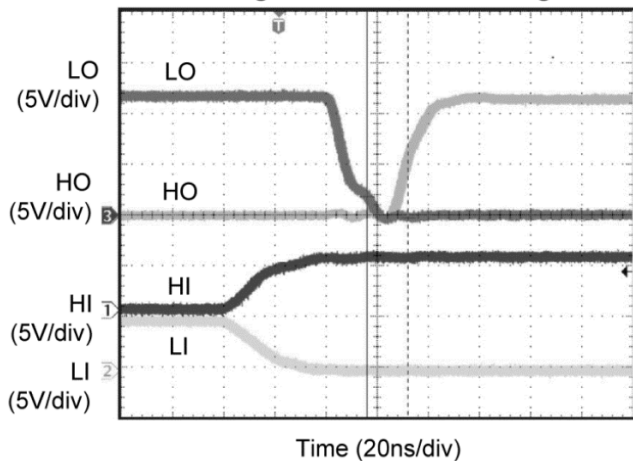
**MIC4605-1 166kHz Operation**  
Fan Load Showing LI, HI, LO, and HO Signals



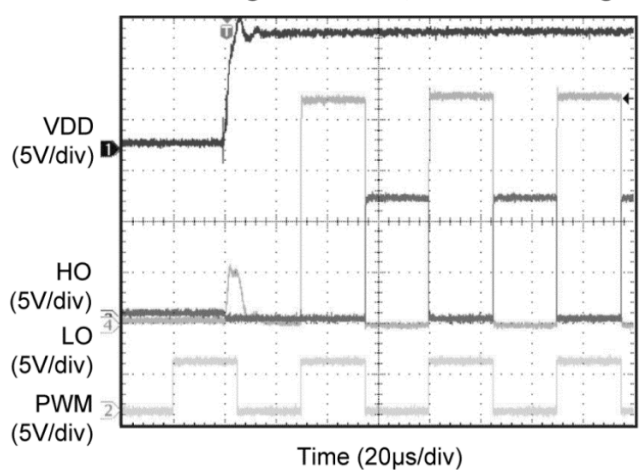
**MIC4605-1 166kHz Overlapping Inputs**  
Fan Load Showing LI, HI, LO, and HO Signals



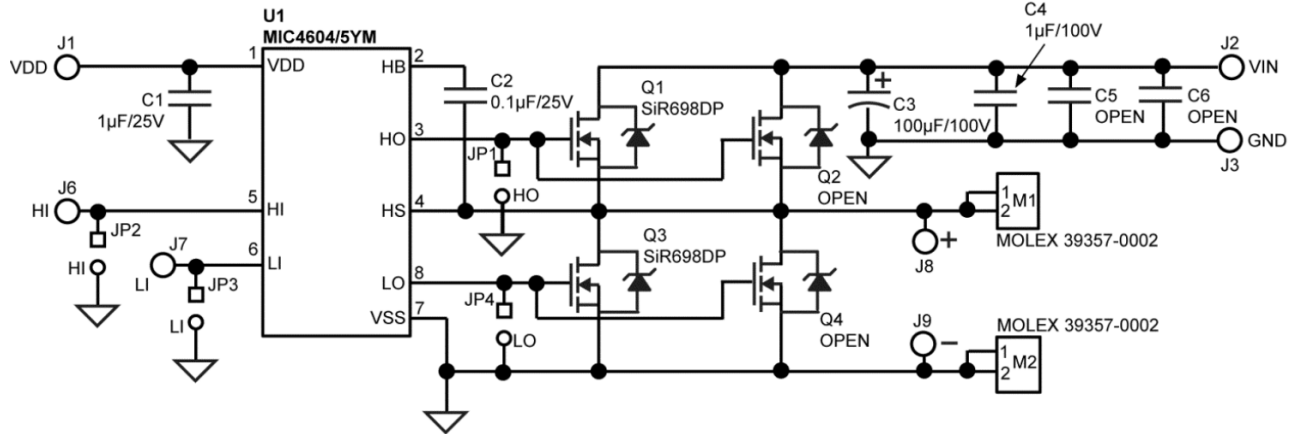
**MIC4605-1 Adaptive Dead Time (HS Ground)**  
Showing LI, HI, HO, and LO Signals



**MIC4605-2 VIN Turn-On (Hot Plug)**  
Fan Load Showing VDD, PWM, HO, and LO Signals



### Evaluation Board Schematic (MIC4605YM)



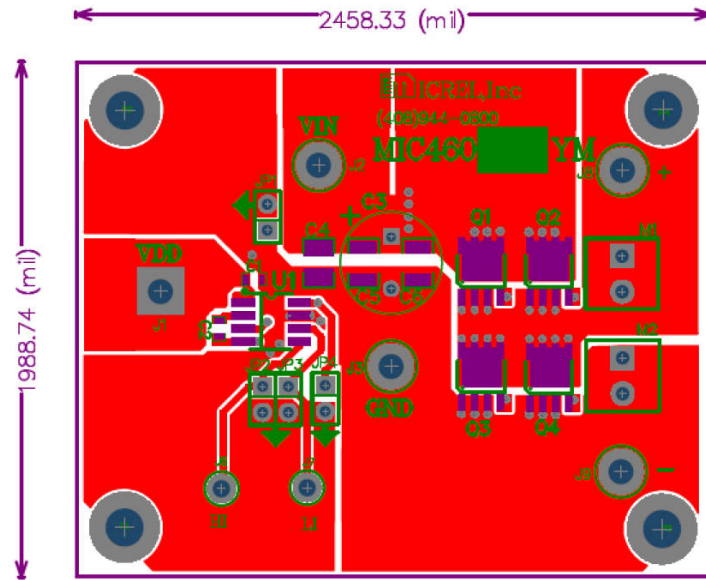
### Bill of Materials

| Item   | Part Number        | Manufacturer                | Description  | Qty. |
|--------|--------------------|-----------------------------|--|------|
| C1     | C1608X7R1E105K     | TDK <sup>(1)</sup>          | 1.0µF Ceramic Capacitor, 25V, X7R, Size 0603               | 1    |
|        | GRM188R71E105KA12D | Murata <sup>(2)</sup>       |  |      |
| C2     | C1608X7R1E104K     | TDK                         | 0.1µF Ceramic Capacitor, 25V, X7R, Size 0603               | 1    |
|        | 06033C104KAT2A     | AVX <sup>(3)</sup>          |  |      |
|        | GRM188R71E104KA01D | Murata                      |  |      |
| C3     | B41851-A9107-M008  | TDK                         | 100µF, 100V, Radial Electrolytic Capacitor                 | 1    |
| C4     | CGA5L2X7R2A105K    | TDK                         | 1.0µF Ceramic Capacitor, 100V, X7R, Size 1206              | 1    |
|        | 12061C105K4Z4A     | AVX                         |  |      |
|        | GRF31CR72A105KA01L | Murata                      |  |      |
| Q1, Q3 | AM7414NA           | Analog Power <sup>(4)</sup> | 100V , N-Channel MOSFET , SO8                              | 2    |
|        | SiR698DP-T1-GE3    | Vishay                      |  |      |
| U1     | MIC4605YM          | Micrel, Inc. <sup>(5)</sup> | 85V Half-Bridge MOSFET Drivers with 5.5V to 16V Gate Drive | 1    |

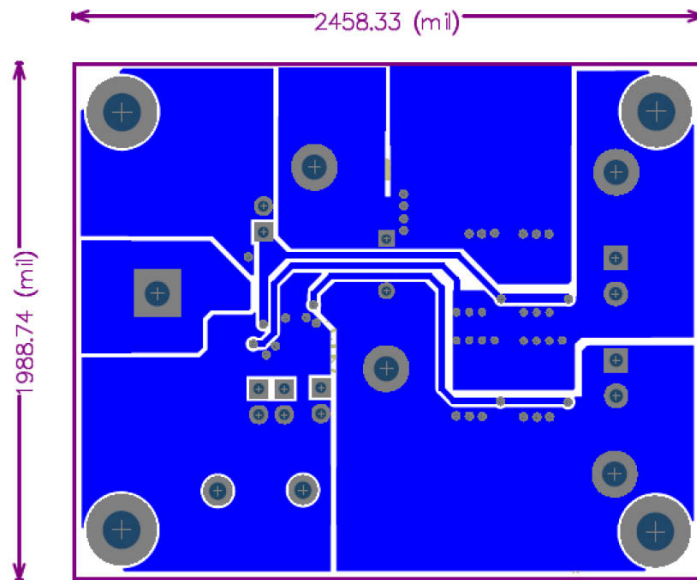
**Notes:**

1. TDK: [www.tdk.com](http://www.tdk.com).
2. Murata: [www.murata.com](http://www.murata.com).
3. AVX: [www.avx.com](http://www.avx.com).
4. Analog Power: [www.analogpowerinc.com](http://www.analogpowerinc.com).
5. Micrel, Inc.: [www.micrel.com](http://www.micrel.com).

### PCB Layout Recommendations (MIC4605YM)

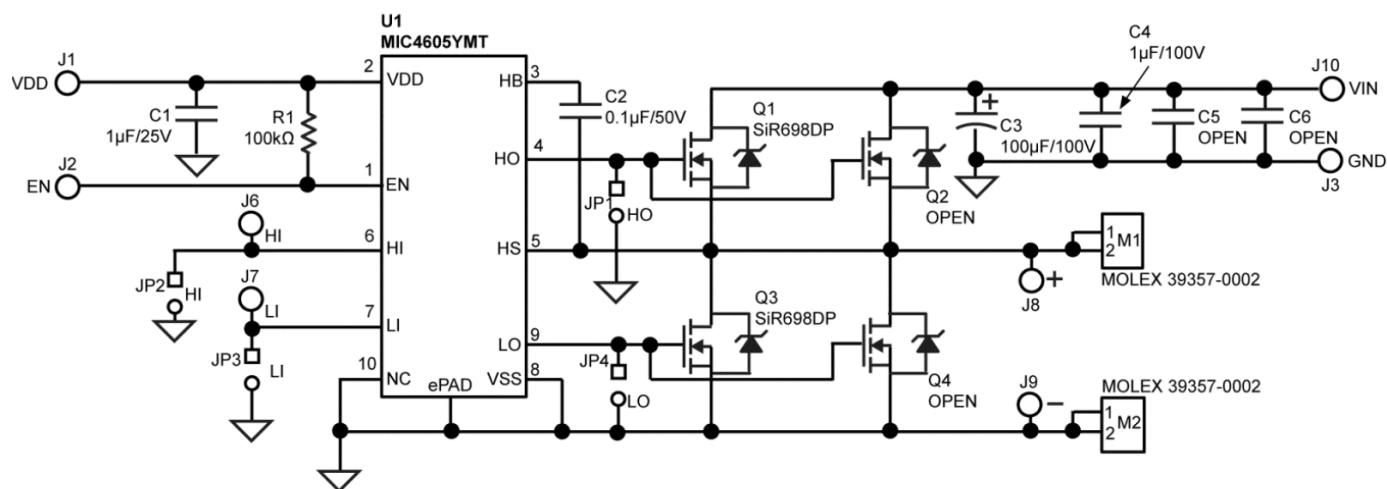


MIC4605YM Evaluation Board – Top Layer



MIC4605YM Evaluation Board – Bottom Layer

### Evaluation Board Schematic (MIC4605YMT)



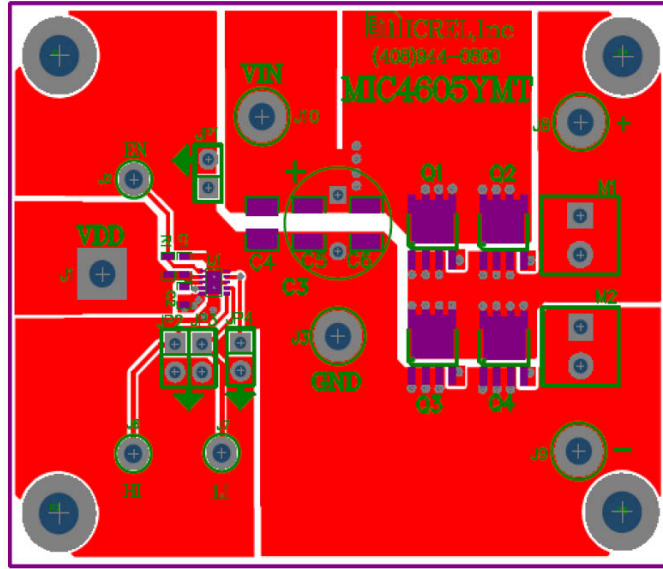
### Bill of Materials

| Item   | Part Number        | Manufacturer                 | Description  | Qty. |
|--------|--------------------|------------------------------|--|------|
| C1     | C1608X7R1E105K     | TDK <sup>(6)</sup>           | 1.0µF Ceramic Capacitor, 25V, X7R, Size 0603               | 1    |
|        | GRM188R71E105KA12D | Murata <sup>(7)</sup>        |  |      |
| C2     | C1608X7R1E104K     | TDK                          | 0.1µF Ceramic Capacitor, 25V, X7R, Size 0603               | 1    |
|        | 06033C104KAT2A     | AVX <sup>(8)</sup>           |  |      |
|        | GRM188R71E104KA01D | Murata                       |  |      |
| C3     | B41851-A9107-M008  | TDK                          | 100µF, 100V, Radial Electrolytic Capacitor                 | 1    |
| C4     | CGA5L2X7R2A105K    | TDK                          | 1.0µF Ceramic Capacitor, 100V, X7R, Size 1206              | 1    |
|        | 12061C105K4Z4A     | AVX                          |  |      |
|        | GRF31CR72A105KA01L | Murata                       |  |      |
| Q1, Q3 | AM7414NA           | Analog Power <sup>(9)</sup>  | 100V , N-Channel MOSFET , SO8                              | 2    |
|        | SiR698DP-T1-GE3    | Vishay                       |  |      |
| U1     | MIC4605YMT         | Micrel, Inc. <sup>(10)</sup> | 85V Half-Bridge MOSFET Drivers with 5.5V to 16V Gate Drive | 1    |

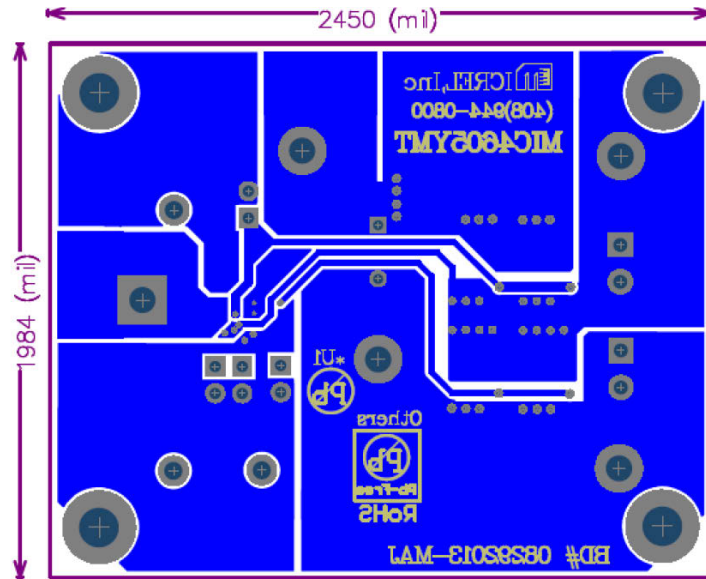
**Notes:**

- 6. TDK: [www.tdk.com](http://www.tdk.com).
- 7. Murata: [www.murata.com](http://www.murata.com).
- 8. AVX: [www.avx.com](http://www.avx.com).
- 9. Analog Power: [www.analogpowerinc.com](http://www.analogpowerinc.com).
- 10. Micrel, Inc.: [www.micrel.com](http://www.micrel.com).

### PCB Layout Recommendations (MIC4605YMT)



MIC4605YMT Evaluation Board – Top Layer



MIC4605YMT Evaluation Board – Bottom Layer

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