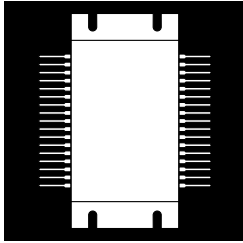


## 3 PHASE, LOW VOLTAGE, LOW $R_{DS(on)}$ , MOSFET BRIDGE CIRCUIT IN A PLASTIC PACKAGE



**Three Phase, 50 Volt, 15 To 45 Amp Bridge With Current And Temperature Sensing In A Low Profile Package**

### FEATURES

- Three Phase Power Switch Configuration
- Zener Gate Protection
- 10 Miliohm Shunt Resistor
- Linear Thermal Sensor
- Isolated Low Profile Package
- Output Currents Up To 45 Amps

### DESCRIPTION

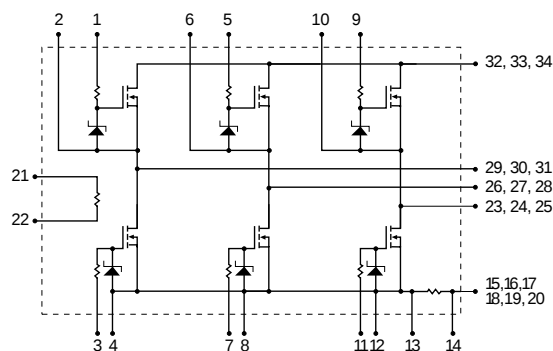
This series of MOSFET switches is configured in a 3 phase bridge with a common  $V_{DD}$  line, precision series shunt resistor in the source line, and a sensing element to monitor the substrate temperature. This device is ideally suited for Motor Control applications where size, performance, and efficiency are key.

2.1

### MAXIMUM RATINGS (@ 25°C)

| Part Number | $V_{DS}$ (Volts) | $R_{DS(on)}$ (m ) | $I_D$ (Amps) | Package |
|-------------|------------------|-------------------|--------------|---------|
| OMS305      | 50               | 100               | 15           | MP-3    |
| OMS305A     | 50               | 70                | 20           | MP-3    |
| OMS405      | 50               | 14                | 45           | MP-3    |

### SCHEMATIC



## OMS305, OMS305A, OMS405

### ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

| Parameter                               |                                              | OMS305 | OMS305A | OMS405 | Units                     |
|-----------------------------------------|----------------------------------------------|--------|---------|--------|---------------------------|
| $V_{DS}$                                | Drain-Source Voltage                         | 50     | 50      | 50     | V                         |
| $V_{DGR}$                               | Drain-Gate Voltage ( $R_{GS} = 1\text{ m}$ ) | 50     | 50      | 50     | V                         |
| $I_D @ T_C = 25^\circ\text{C}$          | Continuous Drain Current                     | 15     | 25      | 45     | A                         |
| $I_D @ T_C = 70^\circ\text{C}$          | Continuous Drain Current                     | 11     | 16      | 45     | A                         |
| $I_{DM}$                                | Pulsed Drain Current <sup>1</sup>            | 56     | 100     | 140    | A                         |
| $P_D @ T_C = 25^\circ\text{C}$          | Maximum Power Dissipation <sup>2</sup>       | 20     | 50      | 50     | W                         |
| $P_D @ T_C = 70^\circ\text{C}$          | Maximum Power Dissipation <sup>2</sup>       | 11     | 18      | 27     | W                         |
| Junction-To-Case Linear Derating Factor |                                              | 0.2    | 0.33    | 0.5    | W/ $^\circ\text{C}$       |
| Thermal Resistance Junction-To-Case     |                                              | 5.0    | 3.0     | 2.0    | $^\circ\text{C}/\text{W}$ |

**Note 1:** Pulse Test: Pulse width 300 sec. Duty Cycle 1.5%.

**Note 2:** Maximum Junction Temperature equal to  $125^\circ\text{C}$ .

### ELECTRICAL CHARACTERISTICS: OMS305 ( $T_C = 25^\circ$ unless otherwise specified)

| Characteristic | Symbol | Min. | Typ. | Max. | Unit |
|----------------|--------|------|------|------|------|
|----------------|--------|------|------|------|------|

#### OFF CHARACTERISTICS

|                                                                               |             |    |   |           |               |
|-------------------------------------------------------------------------------|-------------|----|---|-----------|---------------|
| Drain-Source Breakdown Voltage, $I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0$ | $V_{BRDSS}$ | 50 | - | -         | V             |
| Zero Gate Voltage Drain Current = $V_{GS}$ , $V_{DS} = \text{Max. Rat.}$      | $I_{DSS}$   | -  | - | 25.0      | $\mu\text{A}$ |
| $V_{DS} = \text{Max. Rat.} \times 0.8$ , $T_C = 70^\circ\text{C}$             |             | -  | - | 500.0     | $\mu\text{A}$ |
| Gate-Body Leakage, $V_{GS} = \pm 12\text{ V}$                                 | $I_{GSS}$   | -  | - | $\pm 500$ | nA            |

#### ON CHARACTERISTICS

|                                                                                    |              |     |   |     |   |
|------------------------------------------------------------------------------------|--------------|-----|---|-----|---|
| Gate-Threshold Voltage, $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$         | $V_{GSth}$   | 2.0 | - | 4.0 | V |
| Static Drain-Source On-Resistance, $V_{GS} = 10\text{ Vdc}$ , $I_D = 9.0\text{ A}$ | $R_{DS(on)}$ | -   | - | 0.1 |   |
| $T_C = 70^\circ\text{C}$                                                           |              | -   | - | 0.2 |   |
| On State Drain Current, $V_{DS} > I_{D(on)} \times R_{DS(on)}$ Max., $V_{GS} = 10$ | $I_{Don}$    | 15  | - | -   | A |

#### DYNAMIC CHARACTERISTICS

|                              |                                                                   |           |     |   |     |     |
|------------------------------|-------------------------------------------------------------------|-----------|-----|---|-----|-----|
| Forward Transconductance     | $V_{DS} > I_{D(on)} \times R_{DS(on)}$ Max., $I_D = 9.0\text{ A}$ | $g_{fs}$  | 3.0 | - | -   | mho |
| Input Capacitance            | $V_{DS} = 25\text{ V}$                                            | $C_{iss}$ | -   | - | 650 | pF  |
| Output Capacitance           | $V_{GS} = 0$                                                      | $C_{oss}$ | -   | - | 450 | pF  |
| Reverse Transfer Capacitance | $f = 1.0\text{ MHz}$                                              | $C_{rss}$ | -   | - | 280 | pF  |

#### SWITCHING CHARACTERISTICS

|                     |                                             |            |   |   |     |    |
|---------------------|---------------------------------------------|------------|---|---|-----|----|
| Turn-On Delay Time  | $V_{DS} = 30\text{ V}$ , $I_D = 3\text{ A}$ | $t_{don}$  | - | - | 30  | ns |
| Rise Time           | $R_{GS} = 50$ , $V_{GS} = 10\text{ V}$      | $t_r$      | - | - | 85  | ns |
| Turn-Off Delay Time |                                             | $t_{doff}$ | - | - | 90  | ns |
| Fall Time           |                                             | $t_f$      | - | - | 110 | ns |

#### SOURCE DRAIN DIODE CHARACTERISTICS

|                               |                                                               |             |   |      |     |               |
|-------------------------------|---------------------------------------------------------------|-------------|---|------|-----|---------------|
| Source - Drain Current        | $I_{SD} = 28\text{ A}$ , $V_{GS} = 0$                         | $I_{SD}$    | - | -    | 14  | A             |
| Source - Drain Current Pulsed |                                                               | $I_{SDM}^*$ | - | -    | 56  | A             |
| Forward On-Voltage            | $I_{SD} = 13\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{Sec}$ | $V_{SD}$    | - | -    | 1.8 | V             |
| Reverse Recovery Time         |                                                               | $t_{rr}$    | - | 120  | -   | ns            |
| Reverse Recovered Charge      |                                                               | $Q_{rr}$    | - | 0.15 | -   | $\mu\text{C}$ |

#### RESISTOR CHARACTERISTICS

|                                                                     |          |     |     |    |     |
|---------------------------------------------------------------------|----------|-----|-----|----|-----|
| Resistor Tolerance                                                  | $R_S$    | 9.0 | 10  | 11 | m   |
| Temperature Coefficient, $-40^\circ\text{C}$ to $+70^\circ\text{C}$ | $T_{cr}$ | -   | 100 | -  | ppm |

\* Indicates Pulse Test 300  $\mu\text{sec}$ , Duty Cycle 1.5%

## OMS305, OMS305A, OMS405

### ELECTRICAL CHARACTERISTICS: OMS305A (T<sub>C</sub> = 25° unless otherwise specified)

| Characteristic                                                                  | Symbol               | Min. | Typ. | Max. | Unit |
|---------------------------------------------------------------------------------|----------------------|------|------|------|------|
| <b>OFF CHARACTERISTICS</b>                                                      |                      |      |      |      |      |
| Drain-Source Breakdown Voltage, I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0    | V <sub>(BRDSS)</sub> | 50   | -    | -    | V    |
| Zero Gate Voltage Drain Current = V <sub>GS</sub> , V <sub>DS</sub> = Max. Rat. | I <sub>DSS</sub>     | -    | -    | 250  | μA   |
| V <sub>DS</sub> = Max. Rat. x 0.8, T <sub>C</sub> = 70°C                        |                      | -    | -    | 750  | μA   |
| Gate-Body Leakage, V <sub>GS</sub> = ±12 V                                      | I <sub>GSS</sub>     | -    | -    | ±500 | nA   |

### ON CHARACTERISTICS

|                                                                                                               |                     |     |   |      |   |
|---------------------------------------------------------------------------------------------------------------|---------------------|-----|---|------|---|
| Gate-Threshold Voltage, V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                           | V <sub>GS(th)</sub> | 2.0 | - | 4.0  | V |
| Static Drain-Source On-Resistance, V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 10 A                            | R <sub>DS(on)</sub> | -   | - | 0.07 |   |
| T <sub>C</sub> = 70°C                                                                                         |                     | -   | - | 0.14 |   |
| On State Drain Current, V <sub>DS</sub> > I <sub>D(on)</sub> X R <sub>DS(on)</sub> Max., V <sub>GS</sub> = 10 | I <sub>D(on)</sub>  | 20  | - | -    | A |

### DYNAMIC CHARACTERISTICS

|                              |                                                                                                                                                           |                  |     |      |   |     |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----|------|---|-----|
| Forward Transconductance     | V <sub>DS</sub> > I <sub>D(on)</sub> X R <sub>DS(on)</sub> Max., I <sub>D</sub> = 10 A,<br>V <sub>DS</sub> = 25 V,<br>V <sub>GS</sub> = 0,<br>f = 1.0 mHz | g <sub>fs</sub>  | 5.0 | -    | - | mho |
| Input Capacitance            |                                                                                                                                                           | C <sub>iss</sub> | -   | 1020 | - | pF  |
| Output Capacitance           |                                                                                                                                                           | C <sub>oss</sub> | -   | 500  | - | pF  |
| Reverse Transfer Capacitance |                                                                                                                                                           | C <sub>rss</sub> | -   | 120  | - | pF  |

### SWITCHING CHARACTERISTICS

|                     |                                                                                                                              |                     |   |   |    |    |
|---------------------|------------------------------------------------------------------------------------------------------------------------------|---------------------|---|---|----|----|
| Turn-On Delay Time  | V <sub>DD</sub> = 30 V, I <sub>D</sub> = 10 A,<br>R <sub>GS</sub> = 4.7 Ω, V <sub>GS</sub> = 10 V,<br>R <sub>L</sub> = 2.4 Ω | t <sub>d(on)</sub>  | - | - | 50 | ns |
| Rise Time           |                                                                                                                              | t <sub>r</sub>      | - | - | 75 | ns |
| Turn-Off Delay Time |                                                                                                                              | t <sub>d(off)</sub> | - | - | 50 | ns |
| Fall Time           |                                                                                                                              | t <sub>f</sub>      | - | - | 50 | ns |

### SOURCE DRAIN DIODE CHARACTERISTICS

|                                 |                                                                                               |                    |   |      |     |    |
|---------------------------------|-----------------------------------------------------------------------------------------------|--------------------|---|------|-----|----|
| Source - Drain Current          | I <sub>SD</sub> = 28 A, V <sub>GS</sub> = 0,<br>I <sub>SD</sub> = 13 A,<br>di/dt = 100 A/μSec | I <sub>SD</sub>    | - | -    | 25  | A  |
| Source - Drain Current (Pulsed) |                                                                                               | I <sub>SDM</sub> * | - | -    | 100 | A  |
| Forward On-Voltage              |                                                                                               | V <sub>SD</sub>    | - | -    | 2.4 | V  |
| Reverse Recovery Time           |                                                                                               | t <sub>rr</sub>    | - | 100  | -   | ns |
| Reverse Recovered Charge        |                                                                                               | Q <sub>rr</sub>    | - | 0.15 | -   | μC |

### RESISTOR CHARACTERISTICS

|                                         |                 |     |     |    |     |
|-----------------------------------------|-----------------|-----|-----|----|-----|
| Resistor Tolerance                      | R <sub>S</sub>  | 9.0 | 10  | 11 | m   |
| Temperature Coefficient, -40°C to +70°C | T <sub>cr</sub> | -   | 100 | -  | ppm |

\* Indicates Pulse Test 300 μsec, Duty Cycle 1.5%.

2.1

OMS305, OMS305A, OMS405

ELECTRICAL CHARACTERISTICS: OMS405 (T<sub>C</sub> = 25° unless otherwise specified)

| Characteristic                                                                                                                              | Symbol               | Min. | Typ. | Max. | Unit |
|---------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------|------|------|------|
| OFF CHARACTERISTICS                                                                                                                         |                      |      |      |      |      |
| Drain-Source Breakdown Voltage, I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0                                                                | V <sub>B(DDSS)</sub> | 50   | -    | -    | V    |
| Zero Gate Voltage Drain Current = V <sub>GS</sub> , V <sub>DS</sub> = Max. Rat.<br>V <sub>DS</sub> = Max. Rat. x 0.8, T <sub>C</sub> = 70°C | I <sub>DSS</sub>     | -    | -    | 250  | μA   |
|                                                                                                                                             |                      | -    | -    | 750  | μA   |
| Gate-Body Leakage, V <sub>GS</sub> = ±12 V                                                                                                  | I <sub>GSS</sub>     | -    | -    | ±100 | nA   |

ON CHARACTERISTICS

|                                                                                                               |                     |     |   |       |   |
|---------------------------------------------------------------------------------------------------------------|---------------------|-----|---|-------|---|
| Gate-Threshold Voltage, V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                           | V <sub>GS(th)</sub> | 2.0 | - | 4.0   | V |
| Static Drain-Source On-Resistance, V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 22.5 A<br>T <sub>C</sub> = 70°C | R <sub>DS(on)</sub> | -   | - | 0.016 |   |
|                                                                                                               |                     | -   | - | 0.028 |   |
| On State Drain Current, V <sub>DS</sub> > I <sub>D(on)</sub> X R <sub>DS(on)</sub> Max., V <sub>GS</sub> = 10 | I <sub>D(on)</sub>  | 45  | - | -     | A |

DYNAMIC CHARACTERISTICS

|                              |                                                                                                                                                           |                  |    |   |      |     |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----|---|------|-----|
| Forward Transconductance     | V <sub>DS</sub> > I <sub>D(on)</sub> X R <sub>DS(on)</sub> Max., I <sub>D</sub> = 40 A,<br>V <sub>DS</sub> = 25 V,<br>V <sub>GS</sub> = 0,<br>f = 1.0 mHz | g <sub>fs</sub>  | 25 | - | -    | mho |
| Input Capacitance            |                                                                                                                                                           | C <sub>iss</sub> | -  | - | 5200 | pF  |
| Output Capacitance           |                                                                                                                                                           | C <sub>oss</sub> | -  | - | 2300 | pF  |
| Reverse Transfer Capacitance |                                                                                                                                                           | C <sub>rss</sub> | -  | - | 600  | pF  |

SWITCHING CHARACTERISTICS

|                     |                                                                                                                           |                     |   |   |      |    |
|---------------------|---------------------------------------------------------------------------------------------------------------------------|---------------------|---|---|------|----|
| Turn-On Delay Time  | V <sub>DD</sub> = 30 V, I <sub>D</sub> = 45 A,<br>I <sub>D</sub> = 10 A,<br>R <sub>GS</sub> = 50 , V <sub>GS</sub> = 10 V | t <sub>d(on)</sub>  | - | - | 260  | ns |
| Rise Time           |                                                                                                                           | t <sub>r</sub>      | - | - | 1200 | ns |
| Turn-Off Delay Time |                                                                                                                           | t <sub>d(off)</sub> | - | - | 550  | ns |
| Fall Time           |                                                                                                                           | t <sub>f</sub>      | - | - | 420  | ns |

SOURCE DRAIN DIODE CHARACTERISTICS

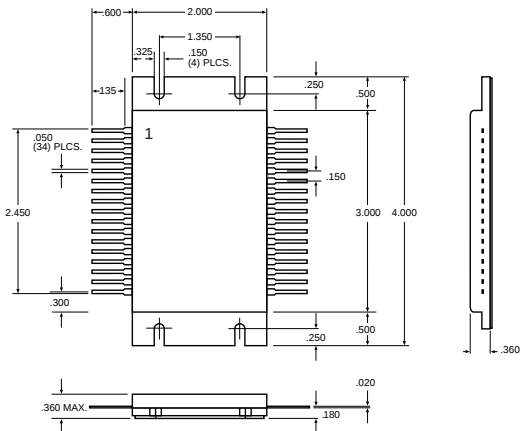
|                                 |                                                                                               |                    |   |      |     |    |
|---------------------------------|-----------------------------------------------------------------------------------------------|--------------------|---|------|-----|----|
| Source - Drain Current          | I <sub>SD</sub> = 45 A, V <sub>GS</sub> = 0,<br>I <sub>SD</sub> = 45 A,<br>di/dt = 100 A/μSec | I <sub>SD</sub>    | - | -    | 45  | A  |
| Source - Drain Current (Pulsed) |                                                                                               | I <sub>SDM</sub> * | - | -    | 150 | A  |
| Forward On-Voltage              |                                                                                               | V <sub>SD</sub>    | - | -    | 1.5 | V  |
| Reverse Recovery Time           |                                                                                               | t <sub>rr</sub>    | - | 120  | -   | ns |
| Reverse Recovered Charge        |                                                                                               | Q <sub>rr</sub>    | - | 0.45 | -   | μC |

RESISTOR CHARACTERISTICS

|                                         |                 |     |     |    |     |
|-----------------------------------------|-----------------|-----|-----|----|-----|
| Resistor Tolerance                      | R <sub>s</sub>  | 9.0 | 10  | 11 | m   |
| Temperature Coefficient, -40°C to +70°C | T <sub>cr</sub> | -   | 100 | -  | ppm |

\* Indicates Pulse Test 300 μsec, Duty Cycle 1.5%.

Mechanical Outline



|                     |                         |
|---------------------|-------------------------|
| Pin 1: Gate Q1      | Pin 34: V <sub>DD</sub> |
| Pin 2: Source Q1    | Pin 33: V <sub>DD</sub> |
| Pin 3: Gate Q2      | Pin 32: V <sub>DD</sub> |
| Pin 4: Source Q2    | Pin 31: Output Phase A  |
| Pin 5: Gate Q3      | Pin 30: Output Phase A  |
| Pin 6: Source Q3    | Pin 29: Output Phase A  |
| Pin 7: Gate Q4      | Pin 28: Output Phase B  |
| Pin 8: Source Q4    | Pin 17: Output Phase B  |
| Pin 9: Gate Q5      | Pin 26: Output Phase B  |
| Pin 10: Source Q5   | Pin 25: Output Phase C  |
| Pin 11: Gate Q6     | Pin 24: Output Phase C  |
| Pin 12: Source Q6   | Pin 23: Output Phase C  |
| Pin 13: +Sense Res. | Pin 22: +PTC            |
| Pin 14: -Sense Res. | Pin 21: -PTC            |
| Pin 15: Power GND   | Pin 20: Power GND       |
| Pin 16: Power GND   | Pin 19: Power GND       |
| Pin 17: Power GND   | Pin 18: Power GND       |

Contact factory for lead bending options.  
Mounting Recommendations: Maximum Mounting Torque: 3.0 mN. The module must be attached to a flat heat sink (flatness 100um maximum).