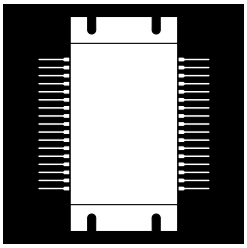
# 3 PHASE, LOW VOLTAGE, LOW $R_{DS(on)}$, MOSFET BRIDGE CIRCUIT IN A PLASTIC PACKAGE



**Three Phase, 250 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

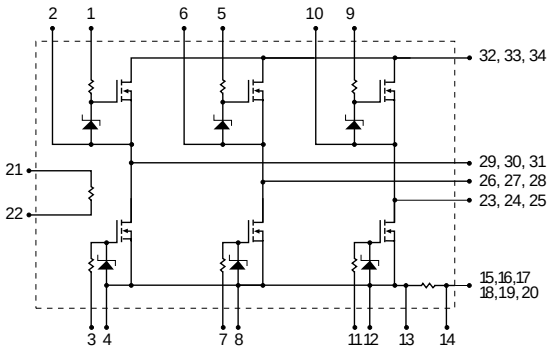
This series of MOSFET switches is configured in a 3 phase bridge with a common $V_{DD}$ line, precision series shunt resistor in the source line, and a sensing element to monitor the substrate temperature. This device is ideally suited for Motor Control applications where size, performance, and efficiency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

2.1

## MAXIMUM RATINGS (@ 25°C)

| Part Number | $V_{DS}$ (Volts) | $R_{DS(on)}$ (m ) | $I_D$ (Amps) | Package |
|---|---|---|---|---|
| OMS425 | 250 | 0.110 | 15 | MP-3 |
| OMS525 | 250 | 0.110 | 20 | MP-3 |
| OMS625 | 250 | 0.055 | 45 | MP-3 |

## SCHEMATIC



## ABSOLUTE MAXIMUM RATINGS ($T_C$ = 25°C unless otherwise noted)

| Parameter | | OMS425 | OMS525 | OMS625 | Units |
|---|---|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 250 | 250 | 250 | V |
| $V_{DGR}$ | Drain-Gate Voltage ($R_{GS}$ = 1 m ) | 250 | 250 | 250 | V |
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current | 15 | 20 | 45 | A |
| $I_D$ @ $T_C$ = 70°C | Continuous Drain Current | 15 | 16.6 | 38 | A |
| $I_{DM}$ | Pulsed Drain Current [1] | 56 | 69 | 80 | A |
| $P_D$ @ $T_C$ = 25°C | Maximum Power Dissipation [2] | 50 | 50 | 100 | W |
| $P_D$ @ $T_C$ = 70°C | Maximum Power Dissipation [2] | 27.5 | 27.5 | 55 | W |
| Junction-To-Case Linear Derating Factor | | 0.5 | 0.5 | 1.0 | W/°C |
| Thermal Resistance Junction-To-Case | | 2.0 | 2.0 | 1.0 | °C/W |

**Note 1:** Pulse Test: Pulse width 300 sec. Duty Cycle 1.5%.
**Note 2:** Maximum Junction Temperature equal to 125°C.

**ELECTRICAL CHARACTERISTICS: OMS425** ($T_C$ = 25° unless otherwise specified)

| Characteristic | | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain-Source Breakdown Voltage, $I_D$ = 250 µA, $V_{GS}$ = 0 | | $V_{BRDSS}$ | 250 | - | - | V |
| Zero Gate Voltage Drain Current = $V_{GS}$, $V_{DS}$ = Max. Rat. | | $I_{DSS}$ | - | - | 10 | µA |
| $V_{DS}$ = Max. Rat. x 0.8, $T_C$ = 70°C | | | - | - | 100 | µA |
| Gate-Body Leakage, $V_{GS}$ = ±12 V | | $I_{GSS}$ | - | - | ±500 | nA |
| **ON CHARACTERISTICS** | | | | | | |
| Gate-Threshold Voltage, $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | | $V_{GSth}$ | 2.0 | - | 4.0 | V |
| Static Drain-Source On-Resistance, $V_{GS}$ = 10 Vdc, $I_D$ = 9.0A | | $R_{DSon}$ | - | - | 0.11 | |
| $T_C$ = 70°C | | | - | - | 0.19 | |
| On State Drain Current, $V_{DS}$ > $I_{D(on)}$ X $R_{DS(on)}$ Max., $V_{GS}$ = 10 | | $I_{Don}$ | 15 | - | - | A |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Forward Transconductance | $V_{DS}$ > $I_{D(on)}$ X $R_{DS(on)}$ Max., $I_D$ = 11.5 A, | $g_{fs}$ | 11 | - | - | mho |
| Input Capacitance | $V_{DS}$ = 25 V, | $C_{iss}$ | - | - | 4340 | pF |
| Output Capacitance | $V_{GS}$ = 0, | $C_{oss}$ | - | - | 810 | pF |
| Reverse Transfer Capacitance | f = 1.0 mHz | $C_{rss}$ | - | - | 320 | pF |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| Turn-On Delay Time | | $t_{don}$ | - | - | 50 | ns |
| Rise Time | $V_{DD}$ = 125 V, $I_D$ = 15 A, | $t_r$ | - | - | 240 | ns |
| Turn-Off Delay Time | $R_{GS}$ = 9.1 , $V_{GS}$ = 10 V | $t_{doff}$ | - | - | 150 | ns |
| Fall Time | | $t_f$ | - | - | 182 | ns |
| **SOURCE DRAIN DIODE CHARACTERISTICS** | | | | | | |
| Source - Drain Current | | $I_{SD}$ | - | - | 15 | A |
| Source - Drain Current Pulsed | | $I_{SDM}$* | - | - | 56 | A |
| Forward On-Voltage | $I_{SD}$ = 15 A, $V_{GS}$ = 0, | $V_{SD}$ | - | - | 1.3 | V |
| Reverse Recovery Time | $I_{SD}$ = 15 A, di/dt = 100 A/µSec | $t_{rr}$ | - | 300 | - | ns |
| Reverse Recovered Charge | | $Q_{rr}$ | - | 3.5 | - | µC |
| **RESISTOR CHARACTERISTICS** | | | | | | |
| Resistor Tolerance | | $R_S$ | 9.0 | 10 | 11 | m |
| Temperature Coefficient, -40°C to +70°C | | $T_{cr}$ | - | 100 | - | ppm |

* Indicates Pulse Test 300 µsec, Duty Cycle 1.5%

**ELECTRICAL CHARACTERISTICS: OMS525** ($T_C$ = 25° unless otherwise specified)

| Characteristic | | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain-Source Breakdown Voltage, $I_D$ = 250 µA, $V_{GS}$ = 0 | | $V_{(BRDSS)}$ | 250 | - | - | V |
| Zero Gate Voltage Drain Current = $V_{GS}$, $V_{DS}$ = Max. Rat. | | $I_{DSS}$ | - | - | 1.0 | µA |
| $V_{DS}$ = Max. Rat. x 0.8, $T_C$ = 70°C | | | - | - | 100 | µA |
| Gate-Body Leakage, $V_{GS}$ = ±12 V | | $I_{GSS}$ | - | - | ±500 | nA |
| **ON CHARACTERISTICS** | | | | | | |
| Gate-Threshold Voltage, $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | | $V_{GS(th)}$ | 2.0 | - | 4.0 | V |
| Static Drain-Source On-Resistance, $V_{GS}$ = 10 Vdc, $I_D$ = 10 A | | $R_{DS(on)}$ | - | - | 0.11 | |
| $T_C$ = 70°C | | | - | - | 0.19 | |
| On State Drain Current, $V_{DS}$ > $I_{D(on)}$ X $R_{DS(on)}$ Max., $V_{GS}$ = 10 | | $I_{D(on)}$ | 20 | - | - | A |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Forward Transconductance | $V_{DS}$ > $I_{D(on)}$ X $R_{DS(on)}$ Max., $I_D$ = 11.5 A | $g_{fs}$ | 11 | - | - | mho |
| Input Capacitance | $V_{DS}$ = 25 V, | $C_{iss}$ | - | - | 4340 | pF |
| Output Capacitance | $V_{GS}$ = 0, | $C_{oss}$ | - | - | 810 | pF |
| Reverse Transfer Capacitance | f = 1.0 mHz | $C_{rss}$ | - | - | 320 | pF |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| Turn-On Delay Time, | | $t_{d(on)}$ | - | - | 50 | ns |
| Rise Time | $V_{DD}$ = 125 V, $I_D$ = 20 A, | $t_r$ | - | - | 250 | ns |
| Turn-Off Delay Time | $R_{GS}$ = 9.1 , $V_{GS}$ = 10 V | $t_{d(off)}$ | - | - | 180 | ns |
| Fall Time | | $t_f$ | - | - | 200 | ns |
| **SOURCE DRAIN DIODE CHARACTERISTICS** | | | | | | |
| Source - Drain Current | | $I_{SD}$ | - | - | 20 | A |
| Source - Drain Current (Pulsed) | $I_{SD}$ = 20 A, $V_{GS}$ = 0 | $I_{SDM}$* | | - | 100 | A |
| Forward On-Voltage | $I_{SD}$ = 20 A, | $V_{SD}$ | - | - | 1.3 | V |
| Reverse Recovery Time | di/dt = 100 A/µSec | $t_{rr}$ | - | 300 | - | ns |
| Reverse Recovered Charge | | $Q_{rr}$ | - | 3.5 | - | µC |
| **RESISTOR CHARACTERISTICS** | | | | | | |
| Resistor Tolerance | | $R_S$ | 9.0 | 10 | 11 | m |
| Temperature Coefficient, -40°C to +70°C | | $T_{cr}$ | - | 100 | - | ppm |

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

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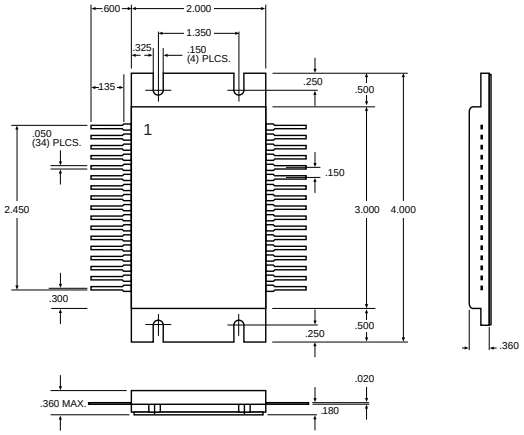
**ELECTRICAL CHARACTERISTICS: OMS625** ($T_C$ = 25° unless otherwise specified)

| Characteristic | | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain-Source Breakdown Voltage, $I_D$ = 250 µA, $V_{GS}$ = 0 | | $V_{(BRDSS}$ | 250 | - | - | V |
| Zero Gate Voltage Drain Current = $V_{GS}$, $V_{DS}$ = Max. Rat. | | $I_{DSS}$ | - | - | 10.5 | µA |
| $V_{DS}$ = Max. Rat. x 0.8, $T_C$ = 70°C | | | - | - | 1000 | µA |
| Gate-Body Leakage, $V_{GS}$ = ±12 V | | $I_{GSS}$ | - | - | ±1.0 | nA |
| **ON CHARACTERISTICS** | | | | | | |
| Gate-Threshold Voltage, $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | | $V_{GS(th)}$ | 2.0 | - | 4.0 | V |
| Static Drain-Source On-Resistance, $V_{GS}$ = 10 Vdc, $I_D$ = 22.5 A | | $R_{DS(on)}$ | - | - | 0.055 | |
| $T_C$ = 70°C | | | - | - | 0.1 | |
| On State Drain Current, $V_{DS}$ > $I_{D(on)}$ X $R_{DS(on)}$ Max., $V_{GS}$ = 10 | | $I_{D(on)}$ | 45 | - | - | A |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Forward Transconductance | $V_{DS}$ > $I_{D(on)}$ X $R_{DS(on)}$ Max., $I_D$ = 40 A | $g_{fs}$ | 22 | - | - | mho |
| Input Capacitance | $V_{DS}$ = 25 V, | $C_{iss}$ | - | - | 8680 | pF |
| Output Capacitance | $V_{GS}$ = 0, | $C_{oss}$ | - | - | 1620 | pF |
| Reverse Transfer Capacitance | f = 1.0 mHz | $C_{rss}$ | - | - | 640 | pF |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| Turn-On Delay Time | | $t_{d(on)}$ | - | - | 50 | ns |
| Rise Time | $V_{DD}$ = 125 V, $I_D$ = 45 A, | $t_r$ | - | - | 250 | ns |
| Turn-Off Delay Time | $R_{GS}$ = 9.1 , $V_{GS}$ = 10 V | $t_{d(off)}$ | - | - | 160 | ns |
| Fall Time | | $t_f$ | - | - | 200 | ns |
| **SOURCE DRAIN DIODE CHARACTERISTICS** | | | | | | |
| Source - Drain Current | | $I_{SD}$ | - | - | 45 | A |
| Source - Drain Current (Pulsed) | $I_{SD}$ = 45 A, $V_{GS}$ = 0, | $I_{SDM}$* | - | - | 150 | A |
| Forward On-Voltage | $I_{SD}$ = 45 A, | $V_{SD}$ | - | - | 1.3 | V |
| Reverse Recovery Time | di/dt = 100 A/µSec | $t_{rr}$ | - | 300 | - | ns |
| Reverse Recovered Charge | | $Q_{rr}$ | - | 7.0 | - | µC |
| **RESISTOR CHARACTERISTICS** | | | | | | |
| Resistor Tolerance | | $R_S$ | 9.0 | 10 | 11 | m |
| Temperature Coefficient, -40°C to +70°C | | $T_{cr}$ | - | 100 | - | ppm |

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



## Mechanical Outline




| | | | |
|---|---|---|---|
| Pin 1: | Gate Q1 | Pin 34: | $V_{DD}$ |
| Pin 2: | Source Q1 | Pin 33: | $V_{DD}$ |
| Pin 3: | Gate Q2 | Pin 32: | $V_{DD}$ |
| 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 |

Notes: •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 100mm maximum).