



# VM4001

## 40V N-Channel MOSFETs

### General Description

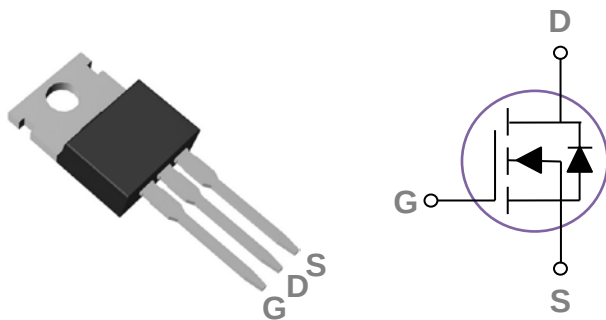
These N-Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency fast switching applications.

| BVDSS | RDS(ON) | ID   |
|-------|---------|------|
| 40V   | 2.4mΩ   | 170A |

### Features

- 40V, 170A,  $R_{DS(ON)} = 2.4m\Omega$  @  $V_{GS} = 10V$
- Improved  $dv/dt$  capability
- Fast switching
- Green Device Available

### TO220 Pin Configuration



### Applications

- Networking
- Load Switch
- LED applications
- Quick Charger

### Absolute Maximum Ratings $T_c=25^\circ\text{C}$ unless otherwise noted

| Symbol    | Parameter                                              | Rating     | Units               |
|-----------|--------------------------------------------------------|------------|---------------------|
| $V_{DS}$  | Drain-Source Voltage                                   | 40         | V                   |
| $V_{GS}$  | Gate-Source Voltage                                    | $\pm 20$   | V                   |
| $I_D$     | Drain Current – Continuous ( $T_c=25^\circ\text{C}$ )  | 170        | A                   |
|           | Drain Current – Continuous ( $T_c=100^\circ\text{C}$ ) | 109        | A                   |
| $I_{DM}$  | Drain Current – Pulsed <sup>1</sup>                    | 680        | A                   |
| EAS       | Single Pulse Avalanche Energy <sup>2</sup>             | 259        | mJ                  |
| IAS       | Single Pulse Avalanche Current <sup>2</sup>            | 72         | A                   |
| $P_D$     | Power Dissipation ( $T_c=25^\circ\text{C}$ )           | 151        | W                   |
|           | Power Dissipation – Derate above $25^\circ\text{C}$    | 1.2        | W/ $^\circ\text{C}$ |
| $T_{STG}$ | Storage Temperature Range                              | -55 to 150 | $^\circ\text{C}$    |
| $T_J$     | Operating Junction Temperature Range                   | -55 to 150 | $^\circ\text{C}$    |

### Thermal Characteristics

| Symbol          | Parameter                              | Typ. | Max. | Unit               |
|-----------------|----------------------------------------|------|------|--------------------|
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient | ---  | 62   | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case    | ---  | 0.83 | $^\circ\text{C/W}$ |

### Electrical Characteristics ( $T_J=25^\circ\text{C}$ , unless otherwise noted)



### Off Characteristics

| Symbol     | Parameter                      | Conditions                                     | Min. | Typ. | Max.      | Unit    |
|------------|--------------------------------|------------------------------------------------|------|------|-----------|---------|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}=0V$ , $I_D=250\mu A$                   | 40   | ---  | ---       | V       |
| $I_{DSS}$  | Drain-Source Leakage Current   | $V_{DS}=40V$ , $V_{GS}=0V$ , $T_J=25^\circ C$  | ---  | ---  | 1         | $\mu A$ |
|            |                                | $V_{DS}=32V$ , $V_{GS}=0V$ , $T_J=100^\circ C$ | ---  | ---  | 10        | $\mu A$ |
| $I_{GSS}$  | Gate-Source Leakage Current    | $V_{GS}=\pm 20V$ , $V_{DS}=0V$                 | ---  | ---  | $\pm 100$ | nA      |

### On Characteristics

|              |                                   |                                  |     |     |     |            |
|--------------|-----------------------------------|----------------------------------|-----|-----|-----|------------|
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}=10V$ , $I_D=20A$         | --- | 2   | 2.4 | m $\Omega$ |
|              |                                   | $V_{GS}=4.5V$ , $I_D=15A$        | --- | 2.9 | 3.8 | m $\Omega$ |
| $V_{GS(th)}$ | Gate Threshold Voltage            | $V_{GS}=V_{DS}$ , $I_D=250\mu A$ | 1.2 | 1.6 | 2.5 | V          |
| $g_{fs}$     | Forward Transconductance          | $V_{DS}=10V$ , $I_S=3A$          | --- | 9   | --- | S          |

### Dynamic and switching Characteristics

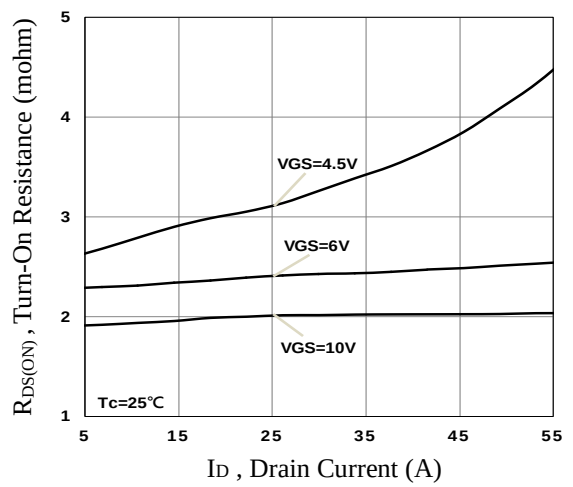
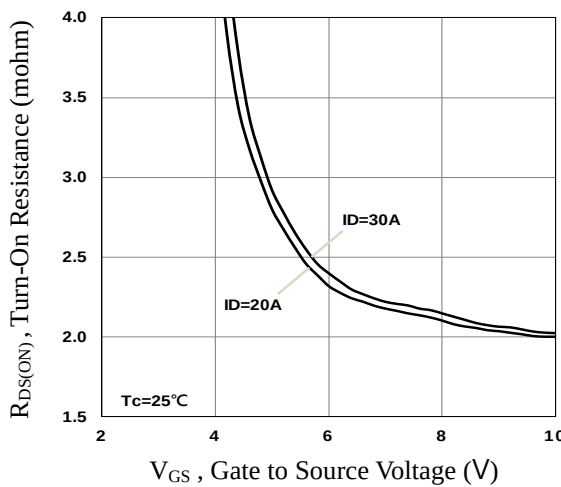
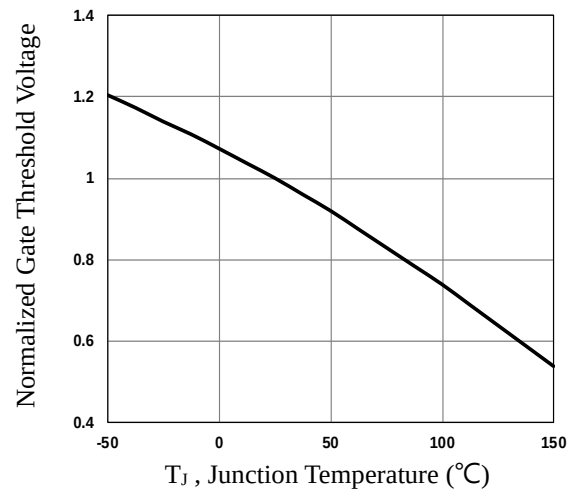
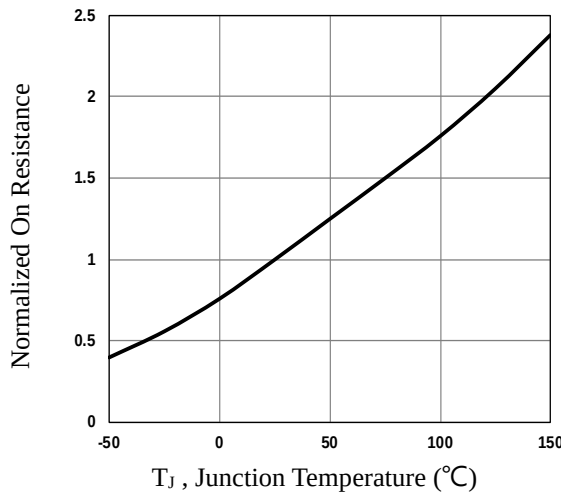
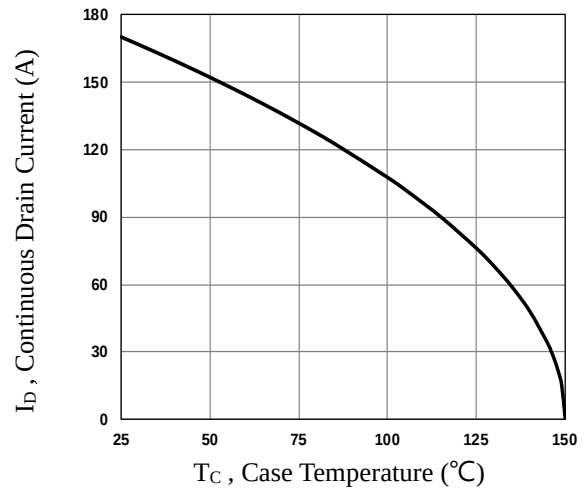
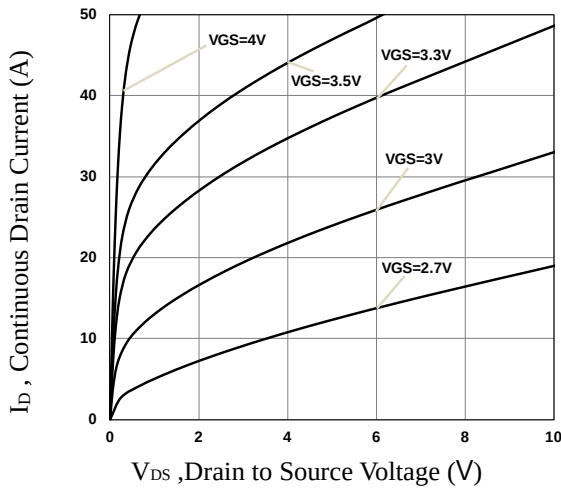
|              |                                     |                                                          |     |      |      |          |
|--------------|-------------------------------------|----------------------------------------------------------|-----|------|------|----------|
| $Q_g$        | Total Gate Charge <sup>3, 4</sup>   | $V_{DS}=20V$ , $V_{GS}=10V$ , $I_D=85A$                  | --- | 52   | 80   | nC       |
| $Q_{gs}$     | Gate-Source Charge <sup>3, 4</sup>  |                                                          | --- | 8.3  | 15   |          |
| $Q_{gd}$     | Gate-Drain Charge <sup>3, 4</sup>   |                                                          | --- | 14   | 21   |          |
| $T_{d(on)}$  | Turn-On Delay Time <sup>3, 4</sup>  | $V_{DD}=20V$ , $V_{GS}=10V$ , $R_G=6\Omega$<br>$I_D=85A$ | --- | 10   | 15   | ns       |
| $T_r$        | Rise Time <sup>3, 4</sup>           |                                                          | --- | 15   | 25   |          |
| $T_{d(off)}$ | Turn-Off Delay Time <sup>3, 4</sup> |                                                          | --- | 20   | 30   |          |
| $T_f$        | Fall Time <sup>3, 4</sup>           |                                                          | --- | 30   | 45   |          |
| $C_{iss}$    | Input Capacitance                   | $V_{DS}=20V$ , $V_{GS}=0V$ , $F=1MHz$                    | --- | 2950 | 4450 | pF       |
| $C_{oss}$    | Output Capacitance                  |                                                          | --- | 1100 | 1650 |          |
| $C_{rss}$    | Reverse Transfer Capacitance        |                                                          | --- | 58   | 90   |          |
| $R_g$        | Gate resistance                     | $V_{GS}=0V$ , $V_{DS}=0V$ , $F=1MHz$                     | --- | 0.9  | ---  | $\Omega$ |

### Drain-Source Diode Characteristics and Maximum Ratings

| Symbol   | Parameter                 | Conditions                                | Min. | Typ. | Max. | Unit |
|----------|---------------------------|-------------------------------------------|------|------|------|------|
| $I_S$    | Continuous Source Current | $V_G=V_D=0V$ , Force Current              | ---  | ---  | 170  | A    |
| $I_{SM}$ | Pulsed Source Current     |                                           | ---  | ---  | 340  | A    |
| $V_{SD}$ | Diode Forward Voltage     | $V_{GS}=0V$ , $I_S=1A$ , $T_J=25^\circ C$ | ---  | ---  | 1    | V    |
| $T_{rr}$ | Reverse Recovery Time     | $V_R=30V$ , $I_S=10A$                     | ---  | 70   | ---  | ns   |
| $Q_{rr}$ | Reverse Recovery Charge   | $di/dt=100A/\mu s$ , $T_J=25^\circ C$     | ---  | 100  | ---  | nC   |

Note :

1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2.  $V_{DD}=25V$ ,  $V_{GS}=10V$ ,  $L=0.1mH$ ,  $I_{AS}=72A$ ,  $R_G=25\Omega$ , Starting  $T_J=25^\circ C$ .
3. The data tested by pulsed, pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .
4. Essentially independent of operating temperature.



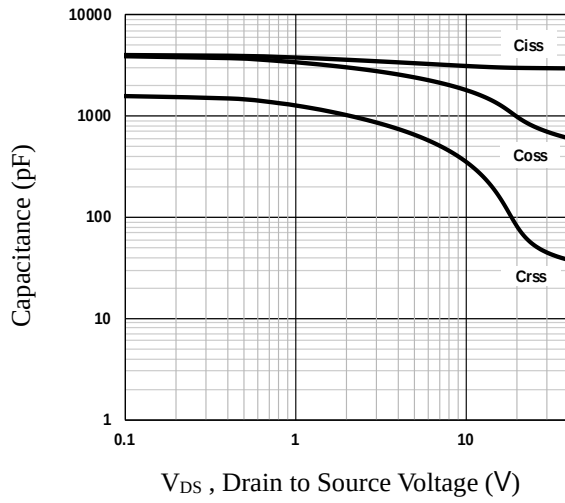


Fig.7 Capacitance Characteristics

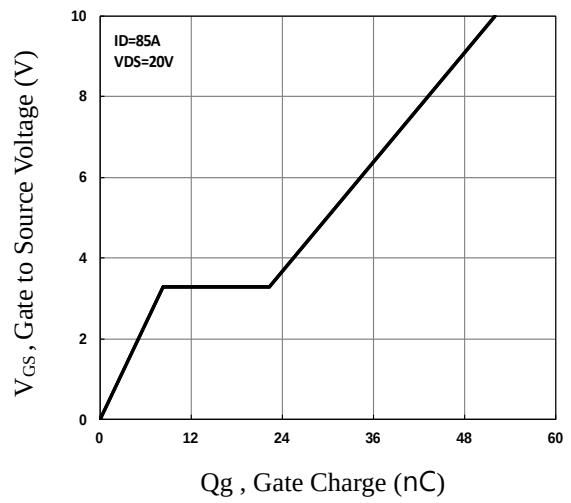


Fig.8 Gate Charge Characteristics

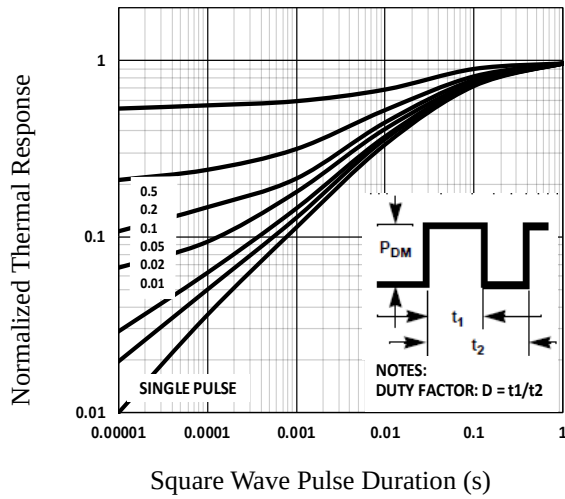


Fig.9 Normalized Transient Impedance

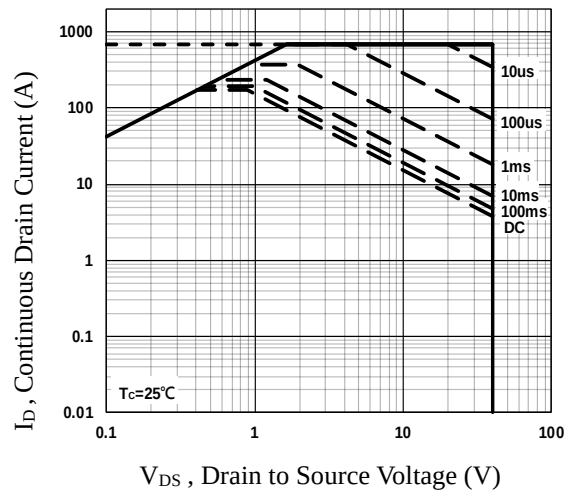


Fig.10 Maximum Safe Operation Area

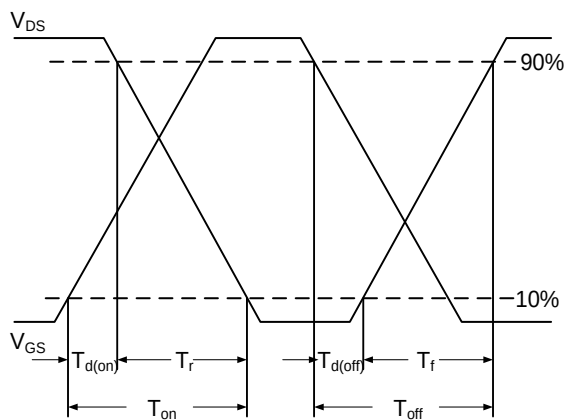


Fig.11 Switching Time Waveform

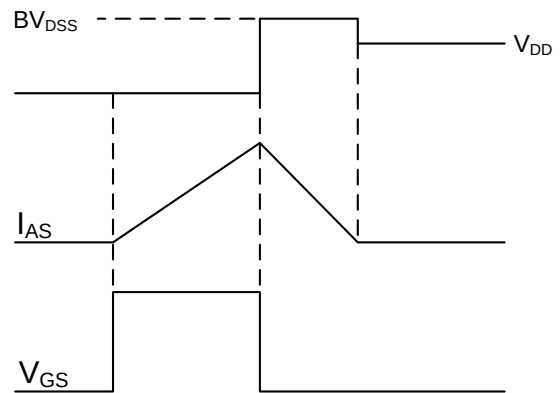
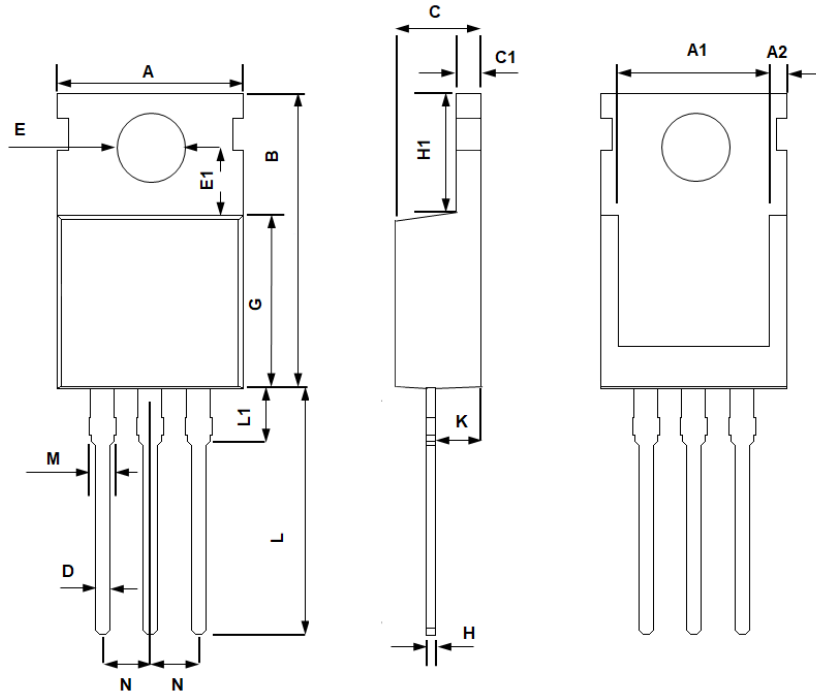


Fig.12 EAS Waveform



### TO220 PACKAGE INFORMATION



| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | MAX                       | MIN    | MAX                  | MIN   |
| A      | 10.400                    | 9.700  | 0.409                | 0.382 |
| A1     | 8.900                     | 7.400  | 0.350                | 0.291 |
| A2     | 1.400                     | 0.800  | 0.055                | 0.031 |
| B      | 16.500                    | 14.500 | 0.650                | 0.571 |
| C      | 4.750                     | 4.200  | 0.187                | 0.165 |
| C1     | 1.500                     | 1.100  | 0.059                | 0.043 |
| D      | 1.000                     | 0.600  | 0.039                | 0.024 |
| E      | 4.000                     | 3.300  | 0.157                | 0.130 |
| E1     | 3.800                     | 3.400  | 0.150                | 0.134 |
| G      | 9.400                     | 8.400  | 0.370                | 0.331 |
| H      | 0.600                     | 0.200  | 0.024                | 0.008 |
| H1     | 6.850                     | 6.200  | 0.270                | 0.244 |
| K      | 2.850                     | 2.100  | 0.112                | 0.083 |
| L      | 14.000                    | 12.500 | 0.551                | 0.492 |
| L1     | 4.000                     | 2.700  | 0.157                | 0.106 |
| M      | 1.750                     | 1.100  | 0.069                | 0.043 |
| N      | 2.640                     | 2.440  | 0.104                | 0.096 |



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## Contact Information

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