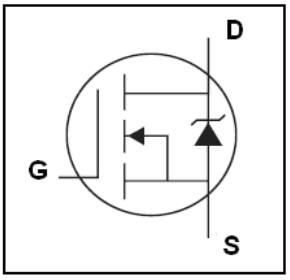
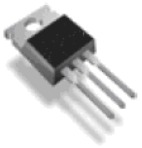
## Features

- ♦ Low On-Resistance
- ♦ Fast Switching
- ♦ 100% Avalanche Tested
- ♦ Repetitive Avalanche Allowed up to Tjmax
- ♦ Lead-Free, RoHS Compliant




| | |
|---|---|
| $V_{DSS}$ | 40V |
| $R_{DS(on)}$ | 1.8 mΩ |
| $I_D$ | 280A |



TO-220AB
VS40280AT

## Description

VS40280AT designed by the trench processing techniques to achieve extremely low on-resistance. Additional features of this design are a 175°C junction operating temperature, fast switching speed and improved repetitive avalanche rating . These features combine to make this design an extremely efficient and reliable device for use in Automotive applications and a wide variety of other applications.

## Absolute Maximum Ratings

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only;and functional operation of the device at these or any other condition beyond those indicated in the specifications is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions. Ambient temperature (TA) is 25°C, unless otherwise specified.

| | Parameter | | Rating | Unit |
|---|---|---|---|---|
| **Common Ratings ($T_C$=25°C Unless Otherwise Noted)** | | | | |
| $V_{GS}$ | Gate-Source Voltage | | ±20 | V |
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage | | 40 | V |
| $T_J$ | Maximum Junction Temperature | | 175 | °C |
| $T_{STG}$ | Storage Temperature Range | | -55 to 175 | °C |
| $I_S$ | Diode Continuous Forward Current① ③ | $T_C$=25°C | 280 | A |
| **Mounted on Large Heat Sink** | | | | |
| $I_{DM}$ | Pulse Drain Current Tested (Sillicon Limit) | $T_C$=25°C | 1120 | A |
| $I_D$ | Continuous Drain current@$V_{GS}$=10V (See Fig2) ③ | $T_C$=25°C | 280 | A |
| | | $T_C$=100°C | 200 | |
| $P_D$ | Maximum Power Dissipation | $T_C$=25°C | 350 | W |
| $R_{\theta JC}$ | Thermal Resistance-Junction to Case | | 0.78 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient | | 62.5 | °C/W |
| **Drain-Source Avalanche Ratings** | | | | |
| EAS | Avalanche Energy, Single Pulsed ② | | 1100 | mJ |

| Symbol | Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Static Electrical Characteristics @ $T_J$ = 25°C (unless otherwise stated)** | | | | | | |
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V $I_D$=250μA | 40 | -- | -- | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current(Tc=25℃) | $V_{DS}$=40V,$V_{GS}$=0V | -- | -- | 1 | μA |
| | Zero Gate Voltage Drain Current(Tc=125℃) | $V_{DS}$=40V,$V_{GS}$=0V | -- | -- | 100 | μA |
| $I_{GSS}$ | Gate-Body Leakage Current | $V_{GS}$=±20V,$V_{DS}$=0V | -- | -- | ±100 | nA |
| $V_{GS(TH)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$,$I_D$=250μA | 1 | 2 | 3 | V |
| $R_{DS(ON)}$ | Drain-Source On-State Resistance① | $V_{GS}$=10V, $I_D$=90A | -- | 1.8 | 2.5 | mΩ |
| gfs | Forward Transconductance | $V_{DS}$= 25V, $I_D$=90A | -- | 80 | -- | S |
| **Dynamic Electrical Characteristics @ $T_J$ = 25°C (unless otherwise stated)** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=20V,$V_{GS}$=0V, f=1MHz | -- | 6650 | -- | pF |
| $C_{oss}$ | Output Capacitance | | -- | 1100 | -- | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | -- | 445 | -- | pF |
| $Q_g$ | Total Gate Charge | $V_{DS}$=20V,$I_D$=30A, $V_{GS}$=10V | -- | 155 | -- | nC |
| $Q_{gs}$ | Gate-Source Charge | | -- | 35 | -- | nC |
| $Q_{gd}$ | Gate-Drain Charge | | -- | 56 | -- | nC |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD}$=20V, $I_D$=1A, $R_G$=6.8Ω, $V_{GS}$=10V $R_L$=30Ω, | -- | 39 | -- | nS |
| $t_r$ | Turn-on Rise Time | | -- | 35 | -- | nS |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 110 | -- | nS |
| $t_f$ | Turn-Off Fall Time | | -- | 63 | -- | nS |
| **Source- Drain Diode Characteristics@ $T_J$ = 25°C (unless otherwise stated)** | | | | | | |
| $I_{SD}$ | Source-drain current(Body Diode) ① | $T_C$=25℃ | -- | -- | 280 | A |
| $V_{SD}$ | Forward on voltage | $I_{SD}$=60A,$V_{GS}$=0V | -- | -- | 1.3 | V |
| $t_{rr}$ | Reverse Recovery Time | $T_j$=25℃,$I_{sd}$=30A, $V_{GS}$=0V di/dt=100A/μs | -- | 85 | -- | nS |
| $Q_{rr}$ | Reverse Recovery Charge | | | 125 | | nC |

NOTE:

①Pulse width ≤ 300μs; duty cycle≤ 2%.

② Limited by TJmax, starting TJ = 25°C, L = 0.25mH,RG = 25Ω, IAS = 98A, VGS =10V.

Part not recommended for use above this value

③Repetitive rating; pulse width limited by max. junction temperature.Package limit continuous current is 75A。

## Typical Characteristics

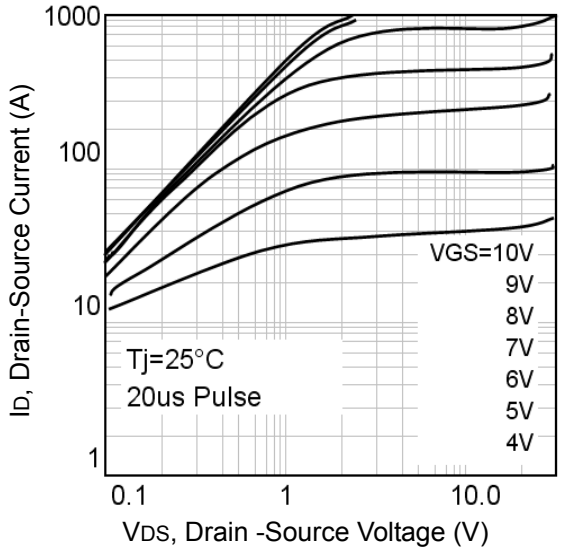



Fig1. Typical Output Characteristics

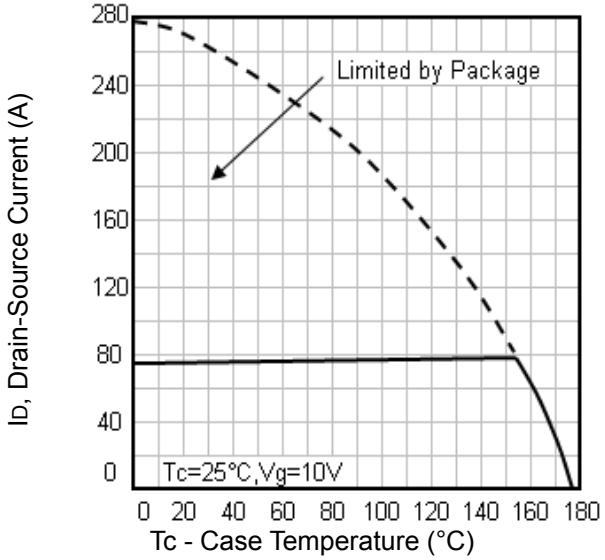



Fig2. Maximum Drain Current Vs.Case Temperature

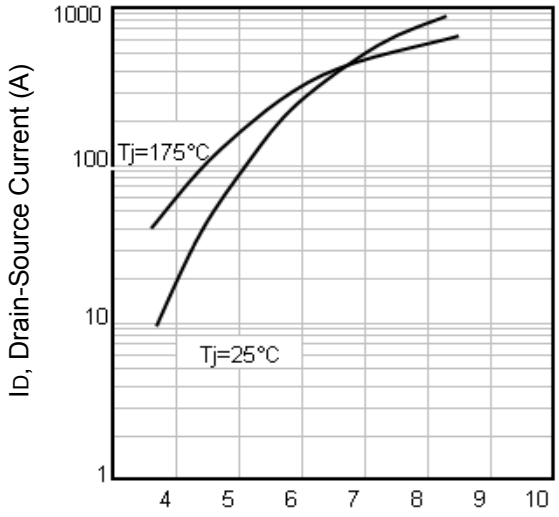



Fig3. Typical Transfer Characteristics

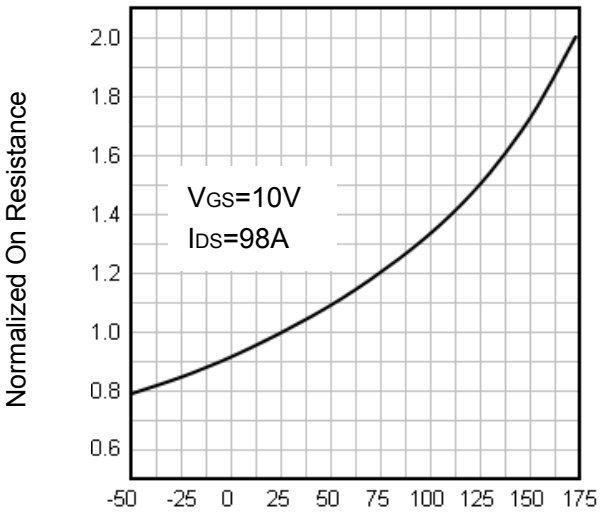



Fig4. Normalized On-Resistance Vs. Temperature

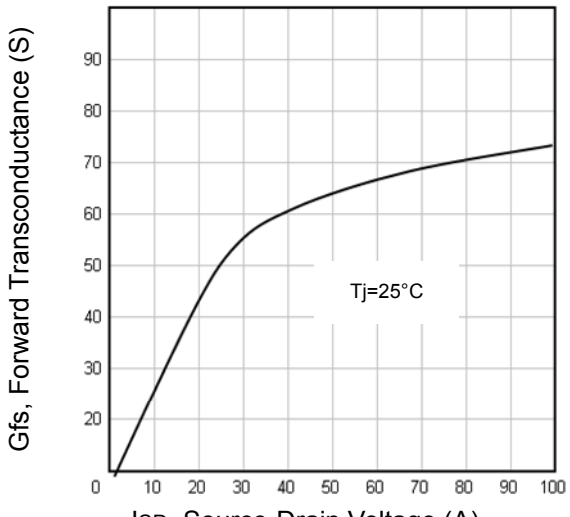



Fig5.Typical Forward Transconductance Vs. Drain Current

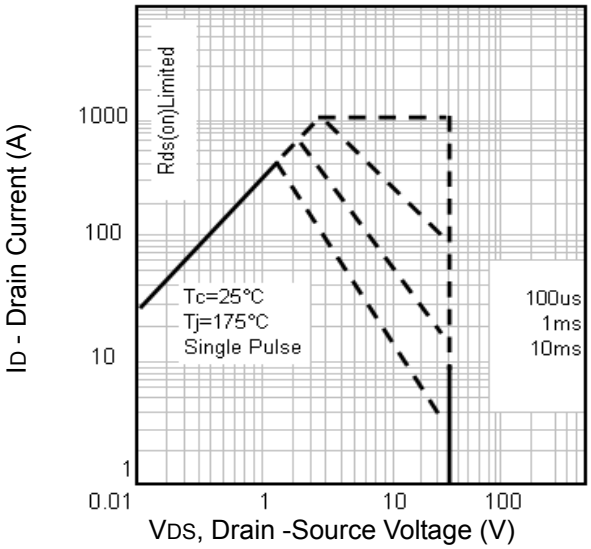



Fig6. Maximum Safe Operating Area

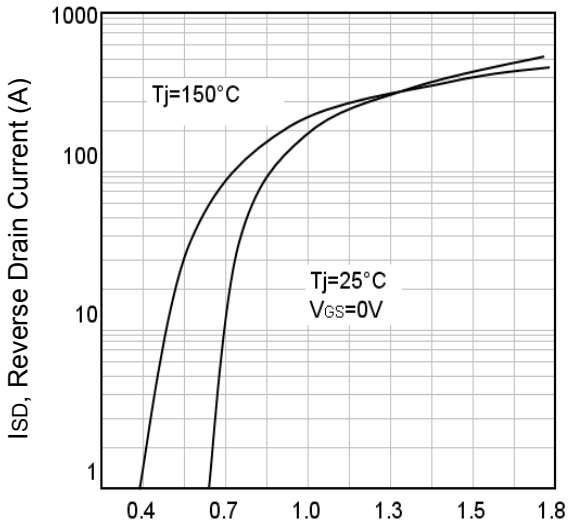



Fig7. Typical Source-Drain Diode Forward Voltage

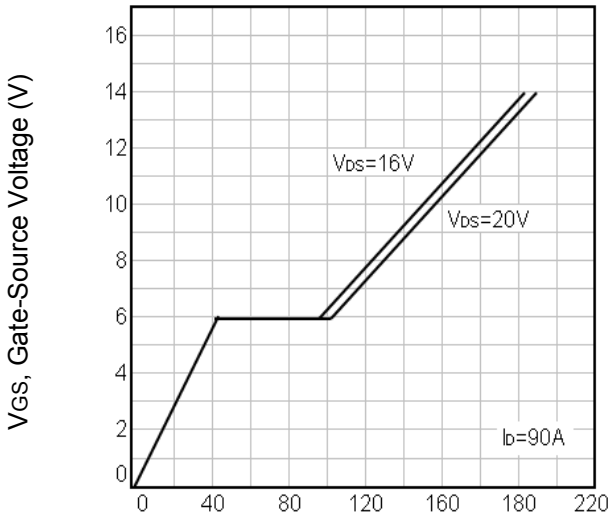



Fig8. Typical Gate Charge Vs.Gate-Source Voltage

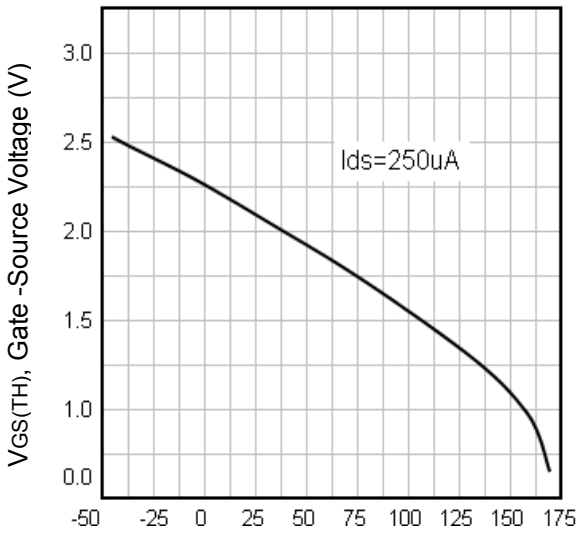



Fig9. Threshold Voltage Vs. Temperature

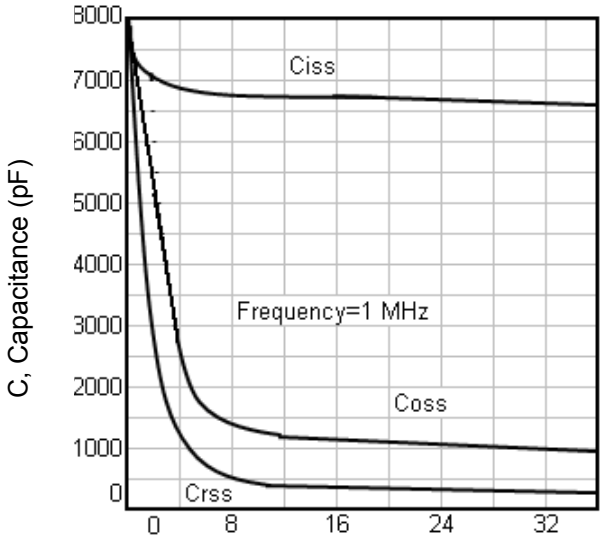



Fig10. Typical Capacitance Vs.Drain-Source Voltage

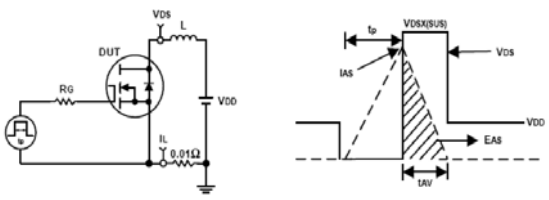



Fig11. Unclamped Inductive Test Circuit and waveforms

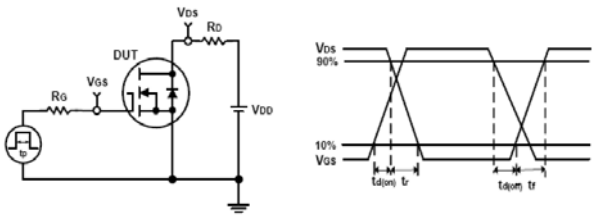
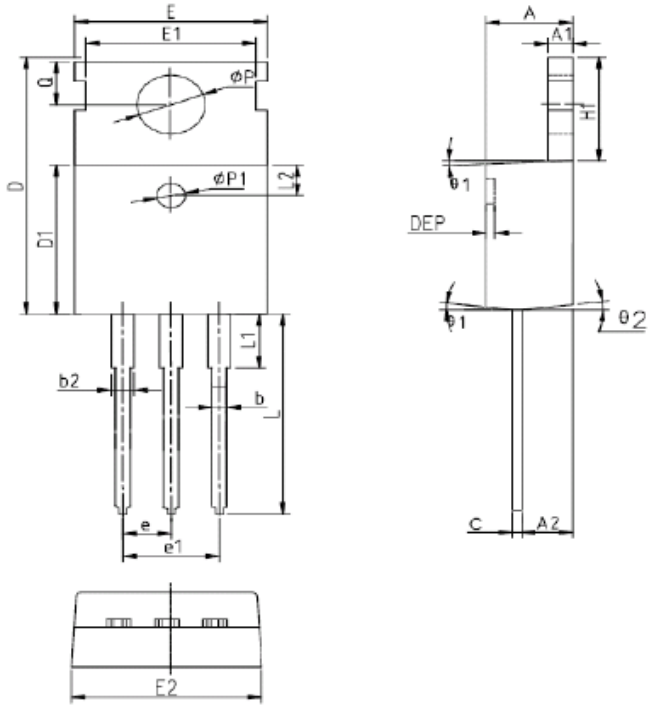



Fig12. Switching Time Test Circuit and waveforms

## TO-220 Package Outline




| SYMBOL | MM | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 4.40 | 4.57 | 4.70 |
| A1 | 1.27 | 1.30 | 1.33 |
| A2 | 2.35 | 2.40 | 2.50 |
| b | 0.77 | - | 0.90 |
| b2 | 1.23 | - | 1.36 |
| C | 0.48 | 0.50 | 0.52 |
| D | 15.40 | 15.60 | 15.80 |
| D1 | 9.00 | 9.10 | 9.20 |
| DEP | 0.05 | 0.10 | 0.20 |
| E | 9.70 | 9.90 | 10.10 |
| E1 | - | 8.70 | - |
| E2 | 9.80 | 10.00 | 10.20 |
| Øp1 | 1.40 | 1.50 | 1.60 |
| e | 2.54BSC | | |
| e1 | 5.08BSC | | |
| H1 | 6.40 | 6.50 | 6.60 |
| L | 12.75 | - | 13.17 |
| L1 | - | - | 3.95 |
| L2 | 2.50REF. | | |
| Øp | 3.57 | 3.60 | 3.63 |
| Q | 2.73 | 2.80 | 2.87 |
| θ1 | 5° | 7° | 9° |
| θ2 | 1° | 3° | 5° |

## Order Information

| Product | Marking | Package | Packaging | Min Unit Quantity |
|---|---|---|---|---|
| VS40280AT | VS40280AT | TO-220 | 50PCS/Tube | 1000PCS |

## Customer Service

**Sales and Service:**
sales@vgsemi.com
**Shen Zhen Vangaurd Semiconductor CO., LTD**
**TEL:** (86-755) -26902410
**FAX:** (86-755) -26907027
**WEB: www.vgsemi.com**