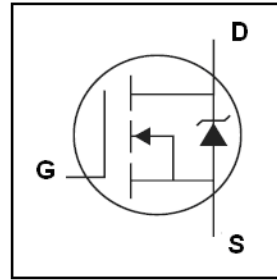


### Features

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

### Description

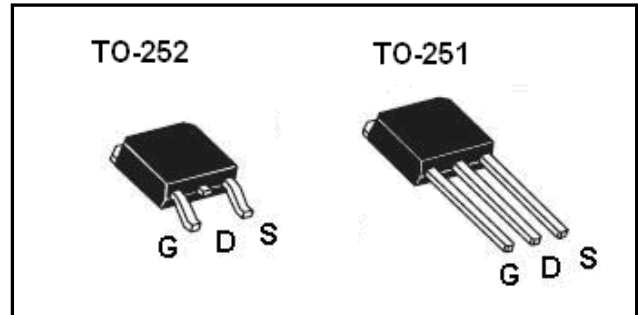
VS6038AD designed by the trench processing techniques to achieve extremely low on-resistance. Additional features of this design are a 175°C junction operating temperature, fast switching speed and improved repetitive avalanche rating. These features combine to make this design an extremely efficient and reliable device for use in Power applications and a wide variety of other supply applications.



$V_{DSS}$	60V
$R_{DS(on)}$	35 mΩ
$I_D$	25A

### 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.



Symbol	Parameter	Rating	Unit
<b>Common Ratings (Tc=25°C Unless Otherwise Noted)</b>			
V <sub>GS</sub>	Gate-Source Voltage	±20	V
V <sub>(BR)DSS</sub>	Drain-Source Breakdown Voltage	60	V
T <sub>J</sub>	Maximum Junction Temperature	175	°C
T <sub>STG</sub>	Storage Temperature Range	-55 to 175	°C
I <sub>S</sub>	Diode Continuous Forward Current	T <sub>C</sub> =25°C 25	A
<b>Mounted on Large Heat Sink</b>			
I <sub>DM</sub>	Pulse Drain Current Tested ①	T <sub>C</sub> =25°C 100	A
I <sub>D</sub>	Continuous Drain current@VGS=10V	T <sub>C</sub> =25°C 25	A
P <sub>D</sub>	Maximum Power Dissipation	T <sub>C</sub> =25°C 35	W
R <sub>θJC</sub>	Thermal Resistance-Junction to Case	3	°C/W
R <sub>θJA</sub>	Thermal Resistance Junction-Ambient	75	°C/W
<b>Drain-Source Avalanche Ratings</b>			
EAS	Avalanche Energy, Single Pulsed ②	38	mJ

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
<b>Static Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise stated)</b>						
V <sub>(BR)DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V I <sub>D</sub> =250μA	60	--	--	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current(Tc=25°C)	V <sub>DS</sub> =60V,V <sub>GS</sub> =0V	--	--	1	μA
	Zero Gate Voltage Drain Current(Tc=125°C)	V <sub>DS</sub> =60V,V <sub>GS</sub> =0V	--	--	100	μA
I <sub>GSS</sub>	Gate-Body Leakage Current	V <sub>GS</sub> =±16V,V <sub>DS</sub> =0V	--	--	±10	μA
V <sub>GS(TH)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =250μA	1.0	1.6	2.5	V
R <sub>DS(ON)</sub>	Drain-Source On-State Resistance <sup>③</sup>	V <sub>GS</sub> =10V, I <sub>D</sub> =16A	--	35	45	mΩ
R <sub>DS(ON)</sub>	Drain-Source On-State Resistance <sup>③</sup>	V <sub>GS</sub> =5V, I <sub>D</sub> =8A	--	38	55	mΩ
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> = 25V, I <sub>D</sub> =18A	--	25	--	S
<b>Dynamic Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise stated)</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =30V,V <sub>GS</sub> =0V, f=1MHz	--	650	--	pF
C <sub>oss</sub>	Output Capacitance		--	95	--	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	60	--	pF
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =30V,I <sub>D</sub> =18A, V <sub>GS</sub> =10V	--	20	--	nC
Q <sub>gs</sub>	Gate-Source Charge		--	7	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	5	--	nC
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DD</sub> =30V, I <sub>D</sub> =1A, R <sub>G</sub> =6.8Ω, V <sub>GS</sub> =10V	--	18	--	nS
t <sub>r</sub>	Turn-on Rise Time		--	15	--	nS
t <sub>d(off)</sub>	Turn-Off Delay Time		--	60	--	nS
t <sub>f</sub>	Turn-Off Fall Time		--	31	--	nS
<b>Source- Drain Diode Characteristics @ T<sub>J</sub> = 25°C (unless otherwise stated)</b>						
I <sub>SD</sub>	Source-drain current(Body Diode)	T <sub>c</sub> =25°C	--	--	25	A
V <sub>SD</sub>	Forward on voltage	I <sub>SD</sub> =20A,V <sub>GS</sub> =0V	--	--	1.3	V
t <sub>rr</sub>	Reverse Recovery Time	T <sub>J</sub> =25°C,I <sub>sd</sub> =20A, V <sub>GS</sub> =0V	--	65	--	nS
Q <sub>rr</sub>	Reverse Recovery Charge	di/dt=100A/μs		85		nC

**NOTE:**

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Limited by T<sub>Jmax</sub>, starting T<sub>J</sub> = 25°C, L = 0.3mH,R<sub>G</sub> = 25Ω, I<sub>AS</sub> = 16A, V<sub>GS</sub> = 10V. Part not recommended for use above this value
- ③ Pulse width ≤ 300μs; duty cycle ≤ 2%.

Typical Characteristics

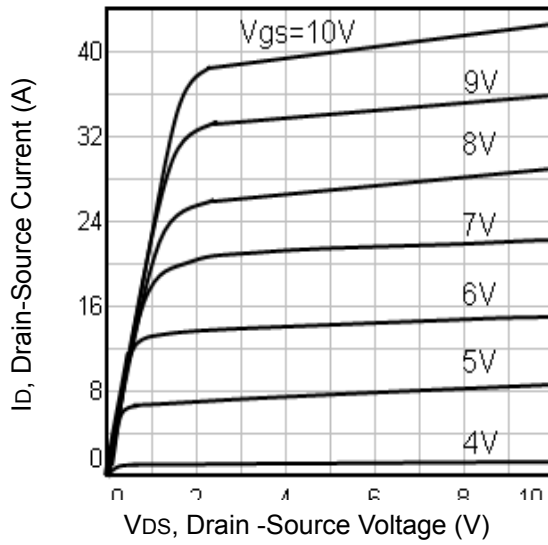


Fig1. Typical Output Characteristics

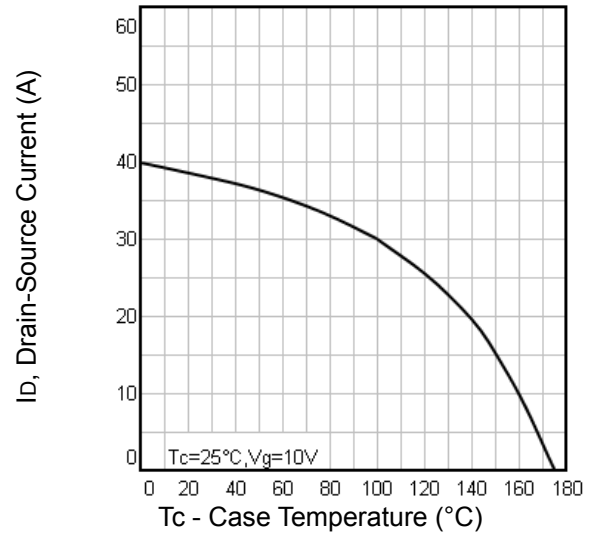


Fig2. Maximum Drain Current Vs. Case Temperature

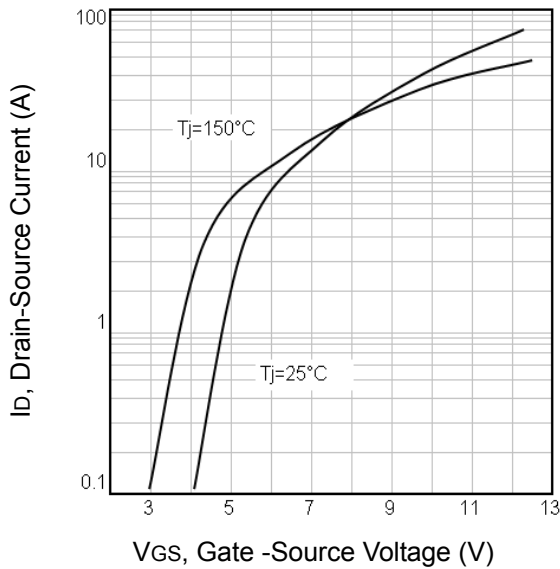


Fig3. Typical Transfer Characteristics

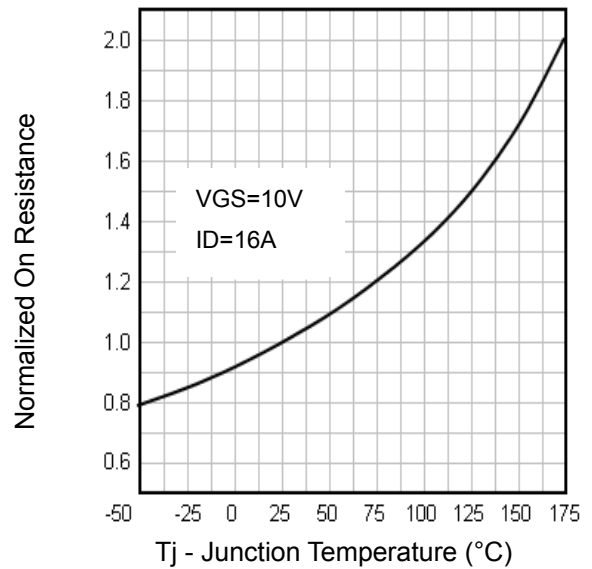


Fig4. Normalized On-Resistance Vs. Temperature

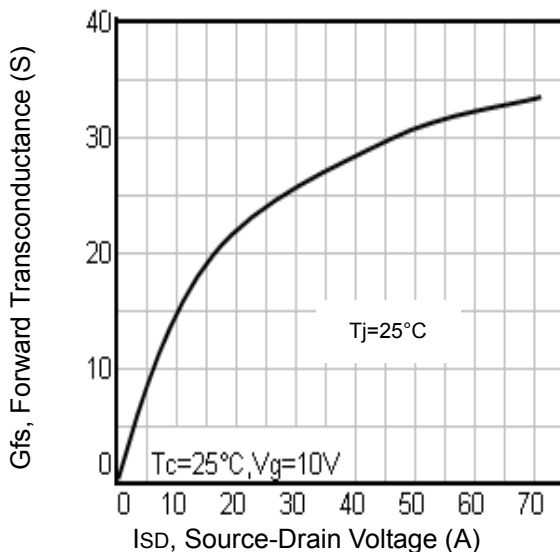


Fig5. Typical Forward Transconductance Vs. Drain Current

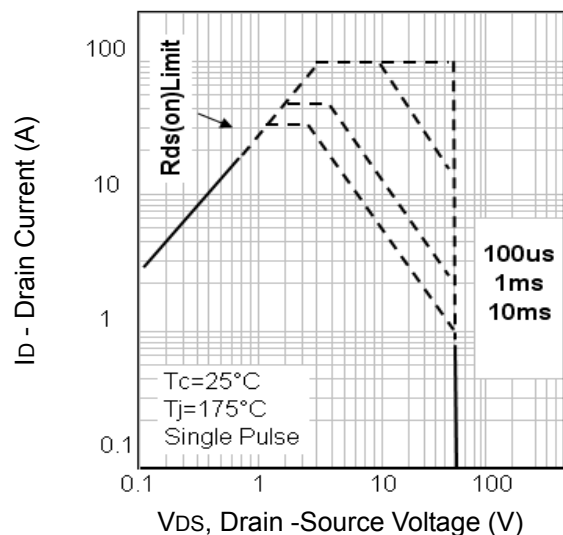


Fig6. Maximum Safe Operating Area

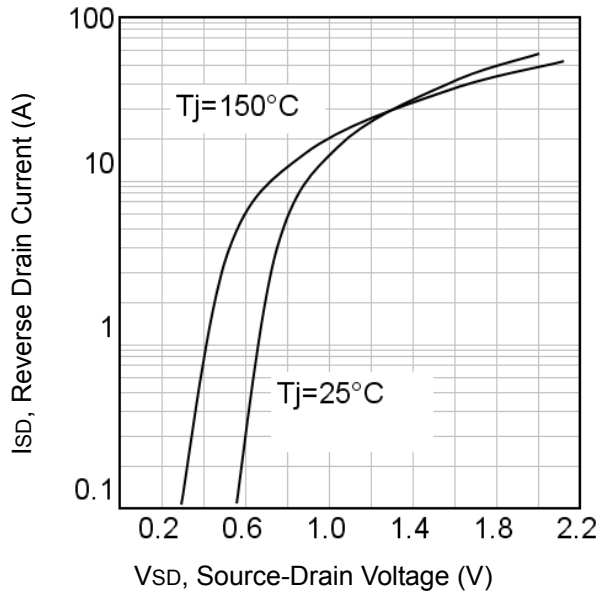


Fig7. Typical Source-Drain Diode Forward Voltage

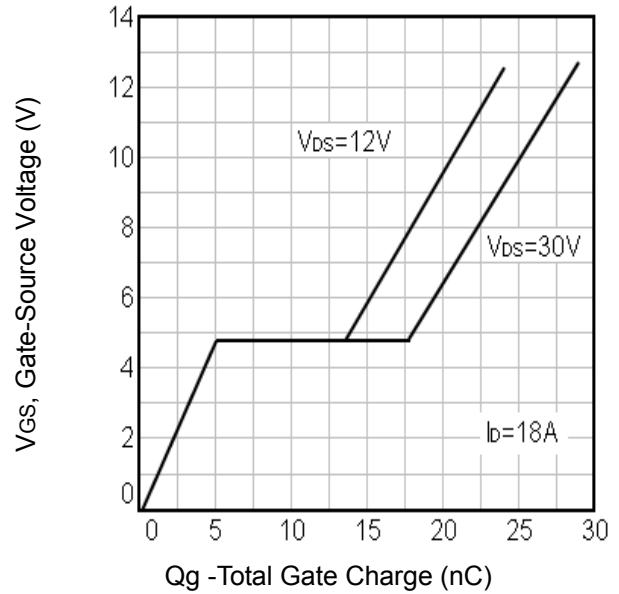


Fig8. Typical Gate Charge Vs. Gate-Source Voltage

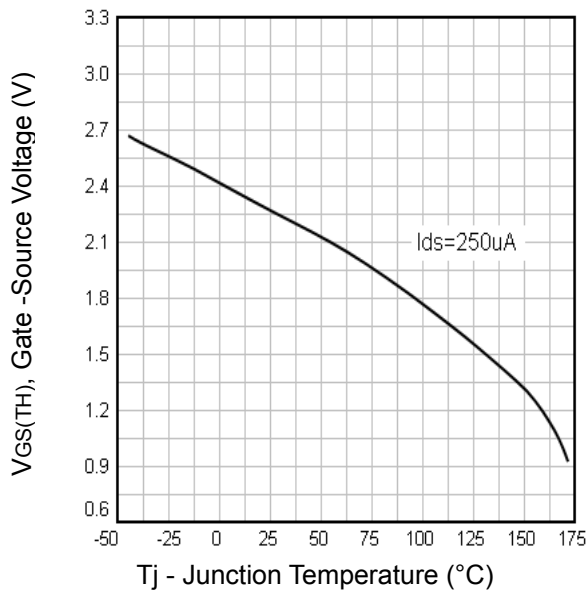


Fig9. Threshold Voltage Vs. Temperature

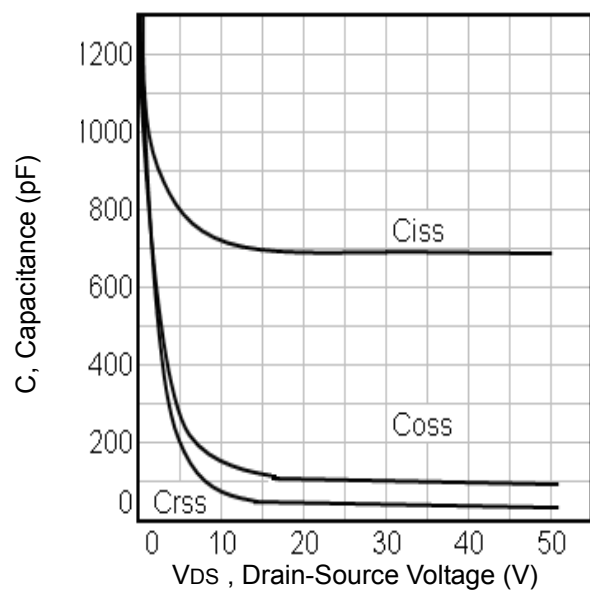


Fig10. Typical Capacitance Vs. Drain-Source Voltage

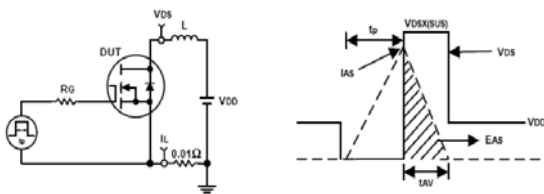


Fig11. Unclamped Inductive Test Circuit and waveforms

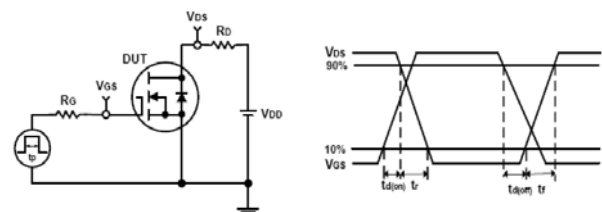
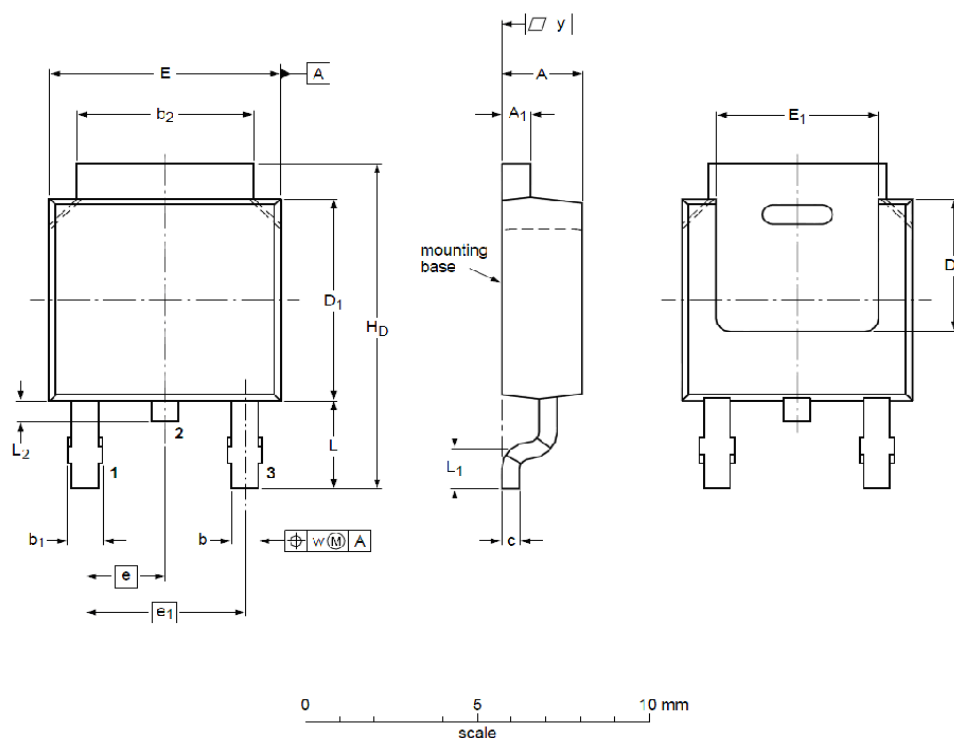


Fig12. Switching Time Test Circuit and waveforms

**TO-252 Package Outline Data**

**DIMENSIONS ( unit : mm )**

Symbol	Min	Typ	Max	Symbol	Min	Typ	Max
A	2.22	2.30	2.38	A <sub>1</sub>	0.46	0.58	0.93
b	0.71	0.79	0.89	b <sub>1</sub>	0.90	0.98	1.10
b <sub>2</sub>	5.00	5.30	5.46	c	0.20	0.40	0.56
D <sub>1</sub>	5.98	6.05	6.22	D <sub>2</sub>	--	4.00	--
E	6.47	6.60	6.73	E <sub>1</sub>	5.10	5.28	5.45
e	--	2.28	--	e <sub>1</sub>	--	4.57	--
H <sub>D</sub>	9.60	10.08	10.40	L	2.75	2.95	3.05
L <sub>1</sub>	--	0.50	--	L <sub>2</sub>	0.80	0.90	1.10
w	--	0.20	--	y	0.20	--	--

**Order Information**

Product	Marking	Package	Packaging	Min Unit Quantity
VS6038AD	6038AD	TO-252	2500/Reel	5000

**Customer Service**
**Sales and Service:**
[Sales@vgsemi.com](mailto:Sales@vgsemi.com)
**Vanguard Semiconductor CO., LTD**
**TEL:** (86-755) -26902410

**FAX:** (86-755) -26907027

**WEB:** [www.vgsemi.com](http://www.vgsemi.com)

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