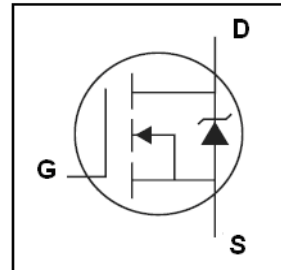


### Features

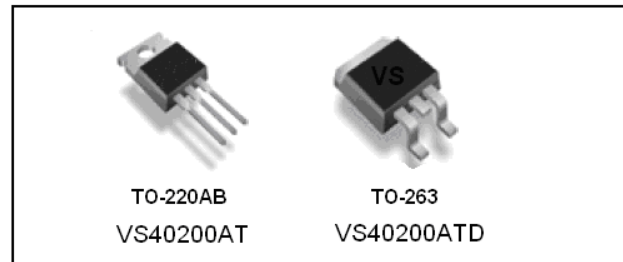
- ◆ Low On-Resistance
- ◆ Fast Switching
- ◆ 100% Avalanche Tested
- ◆ Repetitive Avalanche Allowed up to Tjmax
- ◆ Lead-Free, RoHS Compliant

### Description

VS40200AT/ATD 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.



$V_{DSS}$	40V
$R_{DS(on)}$	3 m $\Omega$
$I_D$	200A



### 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>			
$V_{GS}$	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 Current	$T_C = 25^\circ C$ 180	A
<b>Mounted on Large Heat Sink</b>			
$I_{DM}$	Pulse Drain Current Tested (Silicon Limit)	$T_C = 25^\circ C$ 800	A
$I_D$	Continuous Drain current@ $V_{GS}=10V$ (See Fig2)	$T_C = 25^\circ C$ 200	A
$P_D$	Maximum Power Dissipation	$T_C = 25^\circ C$ 300	W
$R_{\theta JC}$	Thermal Resistance-Junction to Case	0.78	°C/W
$R_{\theta JA}$	Thermal Resistance Junction-Ambient	62.5	°C/W
<b>Drain-Source Avalanche Ratings</b>			
EAS	Avalanche Energy, Single Pulsed ②	600	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	40	--	--	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current(Tc=25°C)	V <sub>DS</sub> =40V, V <sub>GS</sub> =0V	--	--	1	μA
	Zero Gate Voltage Drain Current(Tc=125°C)	V <sub>DS</sub> =40V, V <sub>GS</sub> =0V	--	--	100	μA
I <sub>GSS</sub>	Gate-Body Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	--	--	±100	nA
V <sub>GS(TH)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	1	2	3	V
R <sub>DS(ON)</sub>	Drain-Source On-State Resistance①	V <sub>GS</sub> =10V, I <sub>D</sub> =90A	--	3	4	mΩ
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> = 25V, I <sub>D</sub> =90A	--	80	--	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> =20V, V <sub>GS</sub> =0V, f=1MHz	--	4550	--	pF
C <sub>oss</sub>	Output Capacitance		--	810	--	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	245	--	pF
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =20V, I <sub>D</sub> =30A, V <sub>GS</sub> =10V	--	78	--	nC
Q <sub>gs</sub>	Gate-Source Charge		--	15	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	26	--	nC
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DD</sub> =20V, I <sub>D</sub> =1A, R <sub>G</sub> =6.8Ω, V <sub>GS</sub> =10V R <sub>L</sub> =30Ω,	--	19	--	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		--	33	--	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	--	--	180	A
I <sub>SDM</sub>	Pulsed Source-drain current(Body Diode)①		--	--	400	A
V <sub>SD</sub>	Forward on voltage	I <sub>SD</sub> =60A, 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> =30A, V <sub>GS</sub> =0V di/dt=100A/μs	--	55	--	nS
Q <sub>rr</sub>	Reverse Recovery Charge		--	95	--	nC

**NOTE:**

- ① Pulse width ≤ 300μs; duty cycle ≤ 2%.
- ② Limited by T<sub>Jmax</sub>, starting T<sub>J</sub> = 25°C, L = 0.125mH, R<sub>G</sub> = 25Ω, I<sub>AS</sub> = 68A, V<sub>GS</sub> = 10V.  
Part not recommended for use above this value
- ③ Repetitive rating; pulse width limited by max. junction temperature.

**Typical Characteristics**

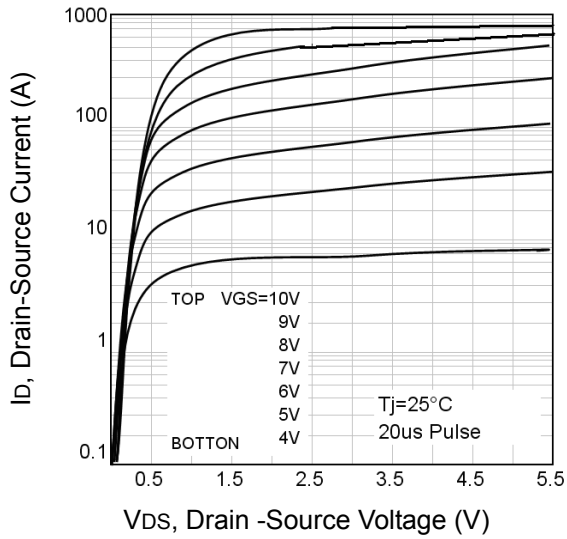


Fig1. Typical Output Characteristics

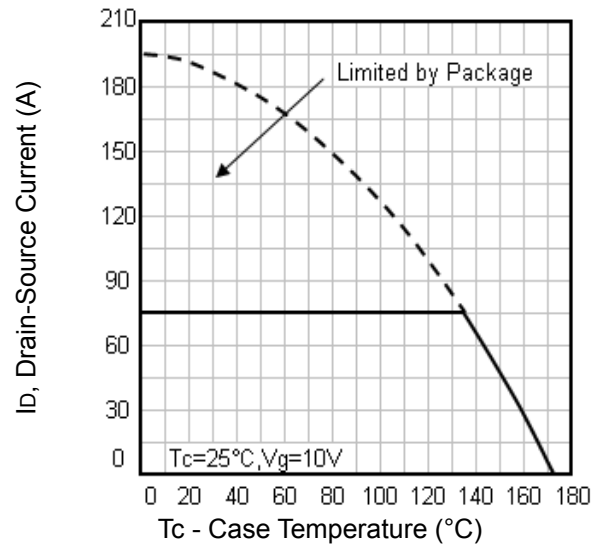


Fig2. Maximum Drain Current Vs. Case Temperature

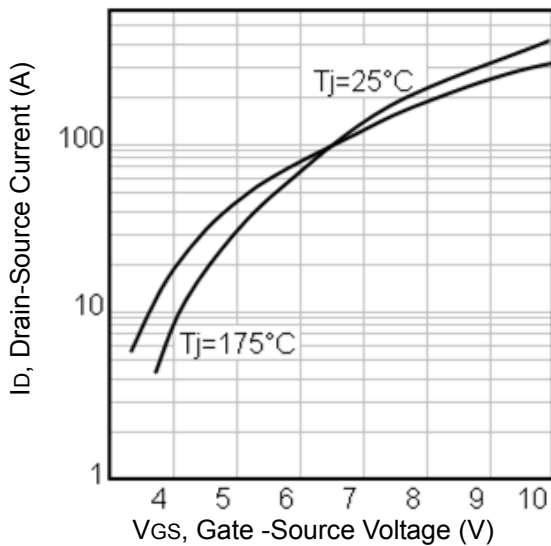


Fig3. Typical Transfer Characteristics

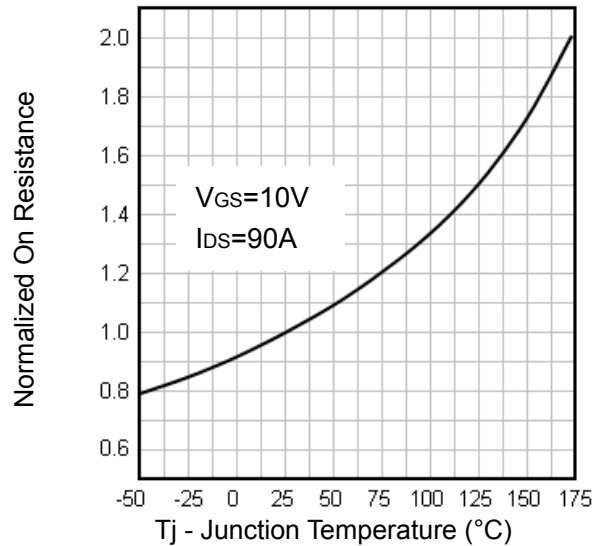


Fig4. Normalized On-Resistance Vs. Temperature

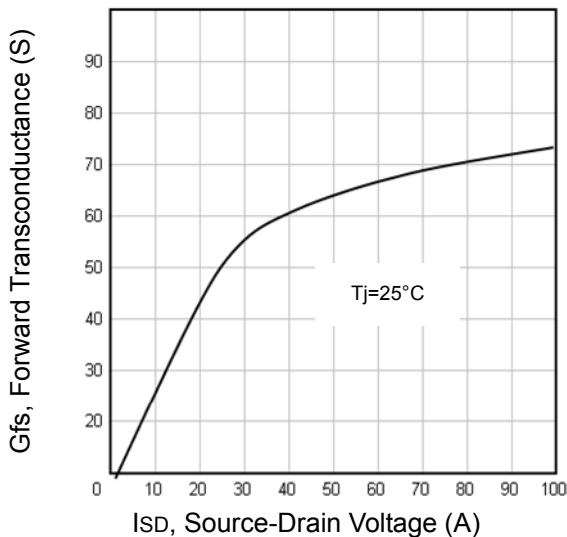


Fig5. Typical Forward Transconductance Vs. Drain Current

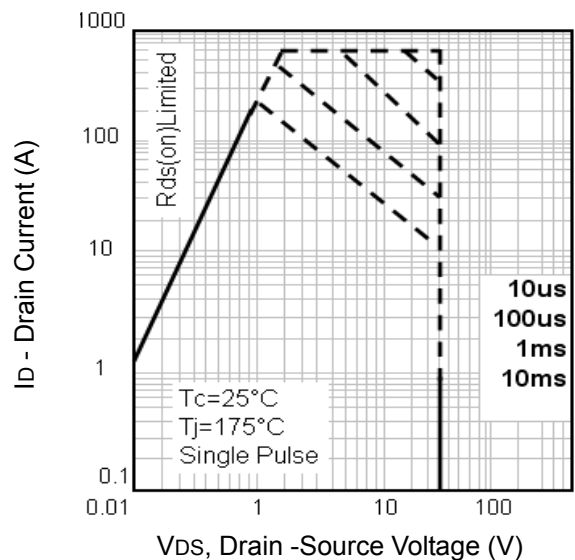


Fig6. Maximum Safe Operating Area

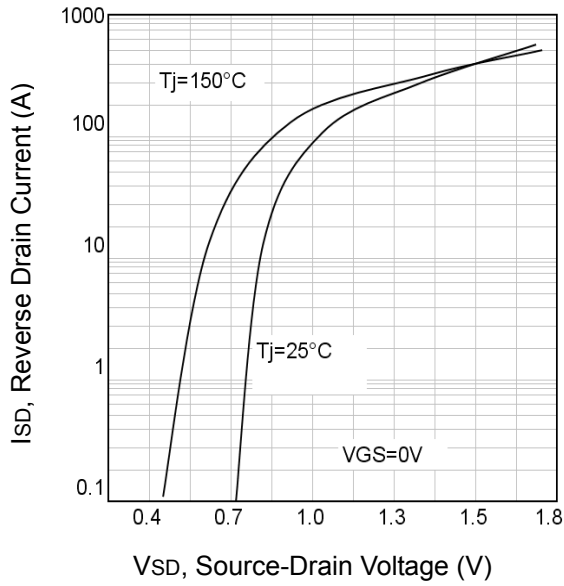


Fig7. Typical Source-Drain Diode Forward Voltage

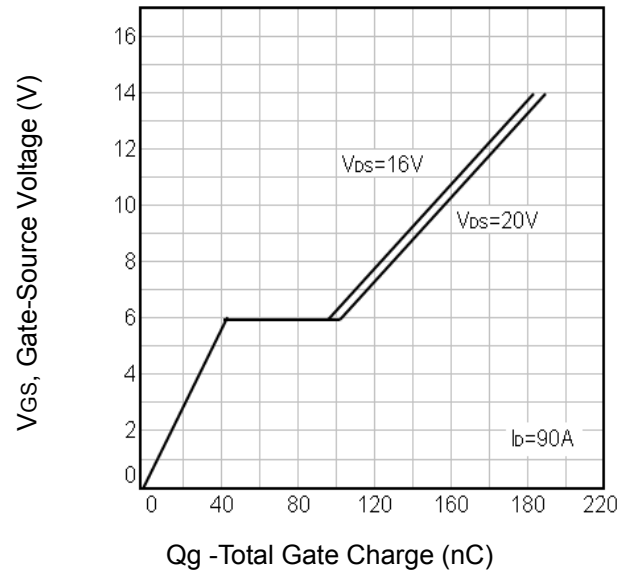


Fig8. Typical Gate Charge Vs. Gate-Source Voltage

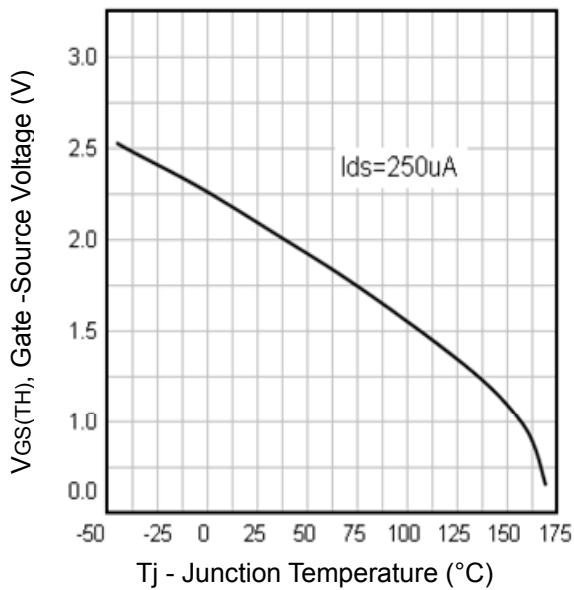


Fig9. Threshold Voltage Vs. Temperature

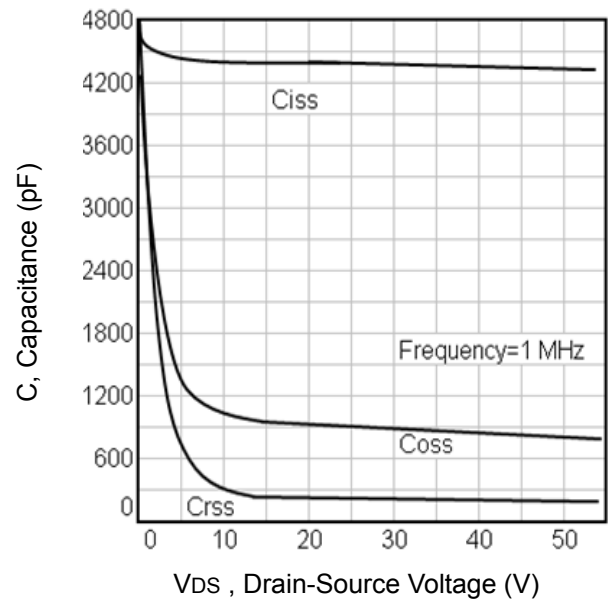


Fig10. Typical Capacitance Vs. Drain-Source Voltage

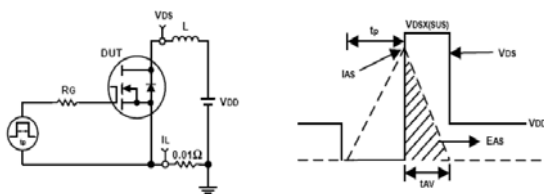


Fig11. Unclamped Inductive Test Circuit and waveforms

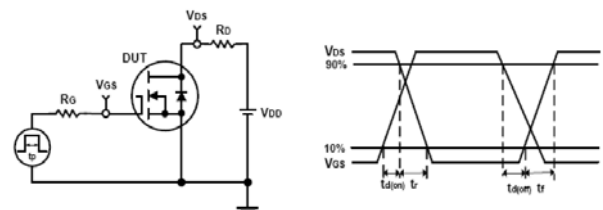
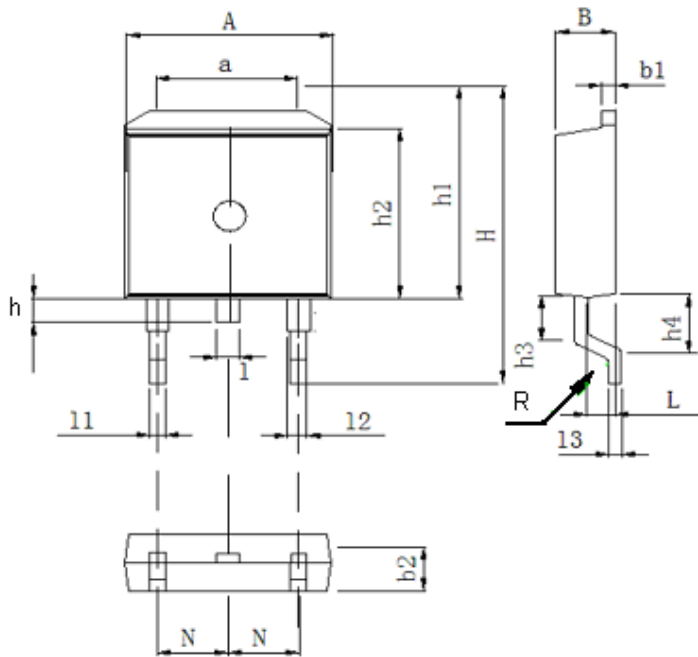


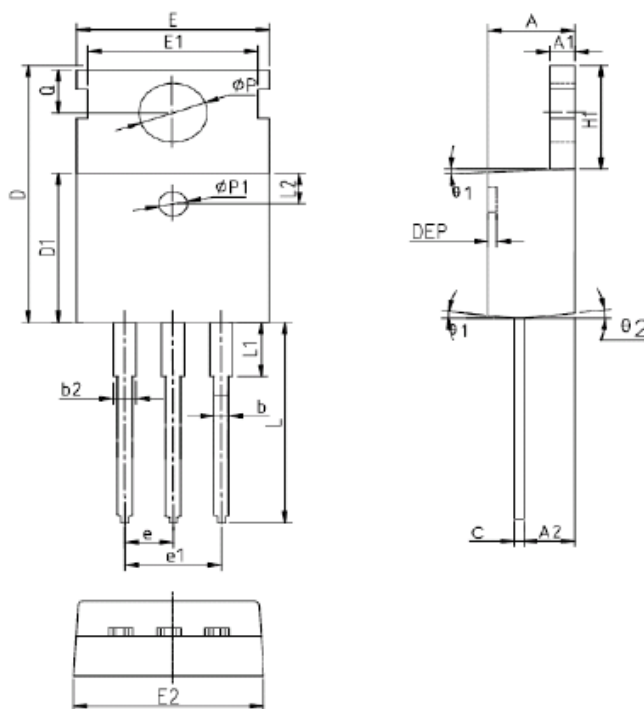
Fig12. Switching Time Test Circuit and waveforms

**TO-263 Package Outline**



DIM	MILLIMETERS
A	9.8±0.2
a	7.4±0.2
B	4.5±0.2
b1	1.3±0.05
b2	2.4±0.2
H	15.5±0.3
h	1.54±0.2
h1	10.5±0.2
h2	9.2±0.1
h3	1.54±0.2
h4	2.7±0.2
L	2.4±0.2
1	1.3±0.1
11	0.8±0.1
12	1.3±0.1
13	0.5±0.1
N	2.45

**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
θ 1	5°	7°	9°
θ 2	1°	3°	5°

## Order Information

Product	Marking	Package	Packaging	Min Unit Quantity
VS40200AT	VS40200AT	TO-220	50PCS/Tube	1000PCS
VS40200ATD	VS40200ATD	TO-263	50PCS/Tube	1000PCS

## Customer Service

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