

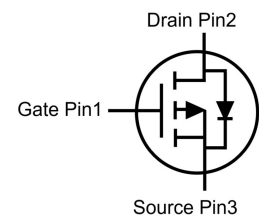
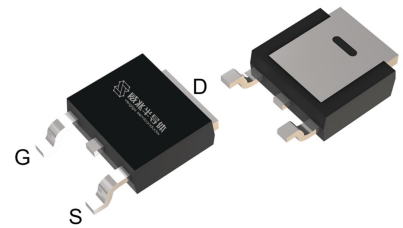
## Features

- P-Channel, -5V Logic Level Control
- Low on-resistance RDS(on) @ VGS=-4.5 V
- Fast Switching
- Enhancement mode
- 100% Avalanche Tested
- Pb-free lead plating; RoHS compliant



Part ID	Package Type	Marking	Packing
VS3510AD	TO-252	3510AD	2500PCS/Reel

$V_{DS}$	-30	V
$R_{DS(on),TYP@ V_{GS}=-10 V}$	10	mΩ
$R_{DS(on),TYP@ V_{GS}=-4.5V}$	18	mΩ
$I_D$	-50	A

**TO-252**


### Maximum ratings, at T<sub>A</sub>=25 °C, unless otherwise specified

Symbol	Parameter	Rating	Unit	
$V_{(BR)DSS}$	Drain-Source breakdown voltage	-30	V	
$V_{GS}$	Gate-Source voltage	±20	V	
$I_S$	Diode continuous forward current	$T_C = 25^\circ C$	-50	A
$I_D$	Continuous drain current @ $V_{GS} = -10V$	$T_C = 25^\circ C$	-50	A
		$T_C = 100^\circ C$	-36	A
$I_{DM}$	Pulse drain current tested ①	$T_C = 25^\circ C$	-200	A
$I_{DSM}$	Continuous drain current @ $V_{GS} = -10V$	$T_A = 25^\circ C$	-8	A
		$T_A = 70^\circ C$	-6	A
EAS	Avalanche energy, single pulsed ②	43	mJ	
$P_D$	Maximum power dissipation	$T_C = 25^\circ C$	52	W
$P_{DSM}$	Maximum power dissipation ③	$T_A = 25^\circ C$	1.25	W
MSL		Level 3		
$T_{STG} T_J$	Storage and Junction Temperature Range	-55 to 175	°C	
<b>Thermal Characteristics</b>				
$R_{\theta JC}$	Thermal Resistance-Junction to Case	2.9	°C/W	
$R_{\theta JA}$	Thermal Resistance Junction-Ambient	100	°C/W	

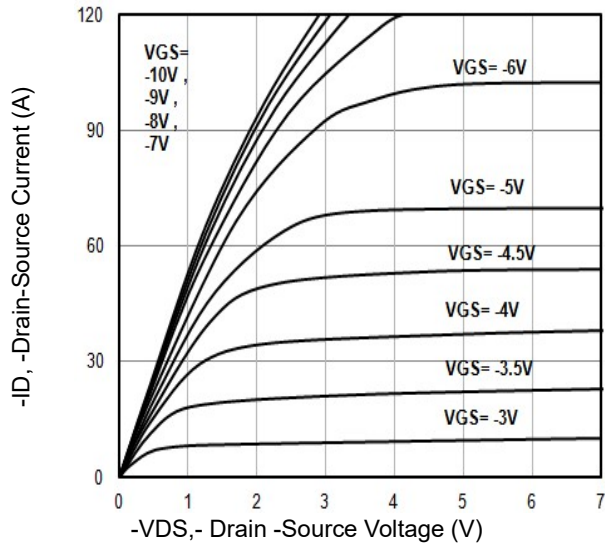
**Electrical Characteristics**

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	-30	--	--	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V	--	--	-1	μA
	Zero Gate Voltage Drain Current(T <sub>J</sub> =125°C)	V <sub>DS</sub> =-30V, 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	-1.3	-1.9	-2.4	V
R <sub>DS(ON)</sub>	Drain-Source On-State Resistance ④	V <sub>GS</sub> =-10V, I <sub>D</sub> =-20A	--	10	13	mΩ
R <sub>DS(ON)</sub>	Drain-Source On-State Resistance ④	V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-16A	--	18	23	mΩ
<b>Dynamic Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise stated)</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V, f=1MHz	--	2555	--	pF
C <sub>oss</sub>	Output Capacitance		--	290	--	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	200	--	pF
R <sub>g</sub>	Gate Resistance	f=1MHz		3.1		Ω
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =-15V, I <sub>D</sub> =-20A, V <sub>GS</sub> =-10V	--	44	--	nC
Q <sub>gs</sub>	Gate-Source Charge		--	8	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	9.8	--	nC
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DD</sub> =-15V, I <sub>D</sub> =-20A, R <sub>G</sub> =3.0Ω, V <sub>GS</sub> =-10V	--	10.6	--	ns
t <sub>r</sub>	Turn-on Rise Time		--	22	--	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	57	--	ns
t <sub>f</sub>	Turn-Off Fall Time		--	32	--	ns
<b>Source- Drain Diode Characteristics @ T<sub>J</sub> = 25°C (unless otherwise stated)</b>						
V <sub>SD</sub>	Forward on voltage	I <sub>SD</sub> =-20A, V <sub>GS</sub> =0V	--	-0.9	-1.2	V
t <sub>rr</sub>	Reverse Recovery Time	T <sub>J</sub> =25°C, I <sub>sd</sub> =-20A, V <sub>GS</sub> =0V	--	40	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge	di/dt=-100A/μs		49		nC

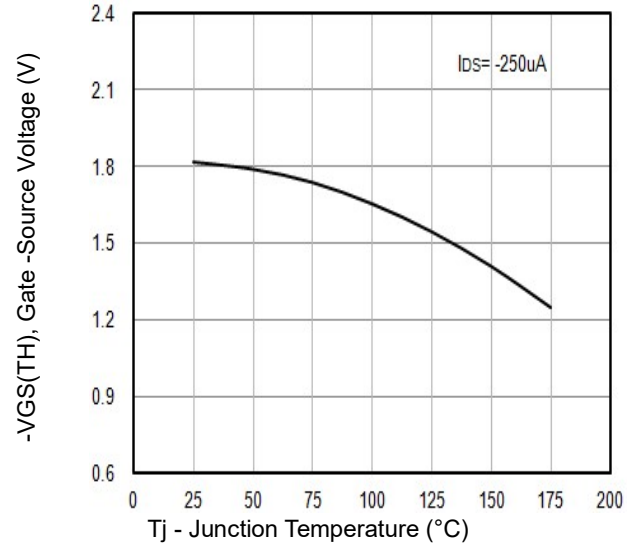
NOTE:

- 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 = 0.5mH, R<sub>G</sub> = 25Ω, I<sub>AS</sub> = -11A, V<sub>GS</sub> = -10V. Part not recommended for use above this value
- ③ The power dissipation P<sub>DSM</sub> is based on R<sub>θJA</sub> and the maximum allowed junction temperature of 150°C.
- ④ Pulse width ≤ 300μs; duty cycles ≤ 2%.

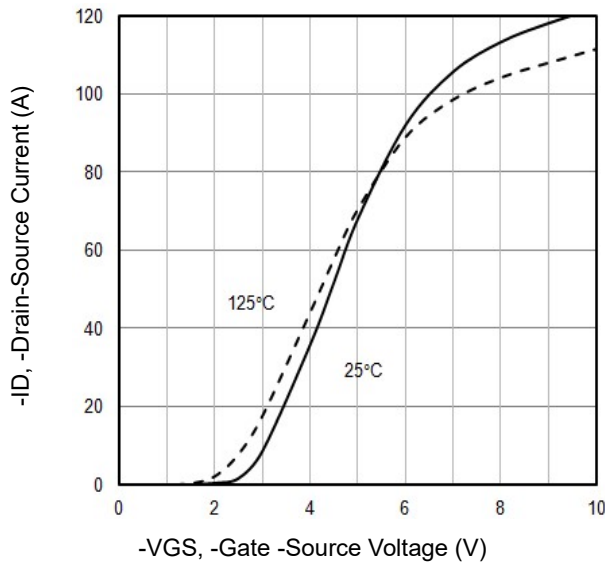
**Typical Characteristics**



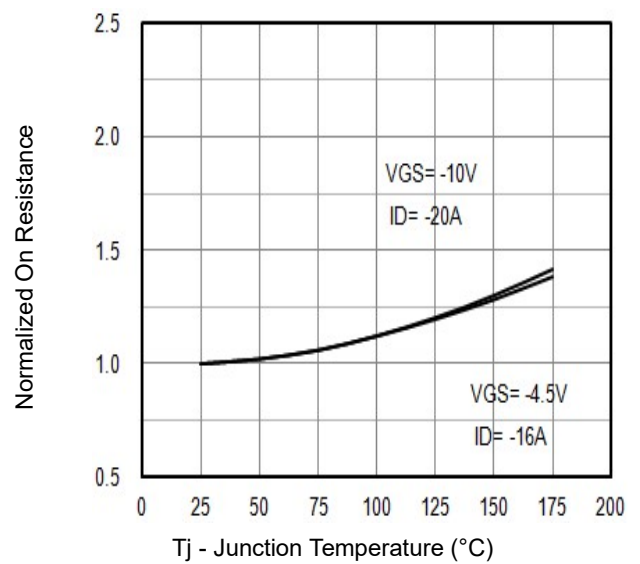
**Fig1.** Typical Output Characteristics



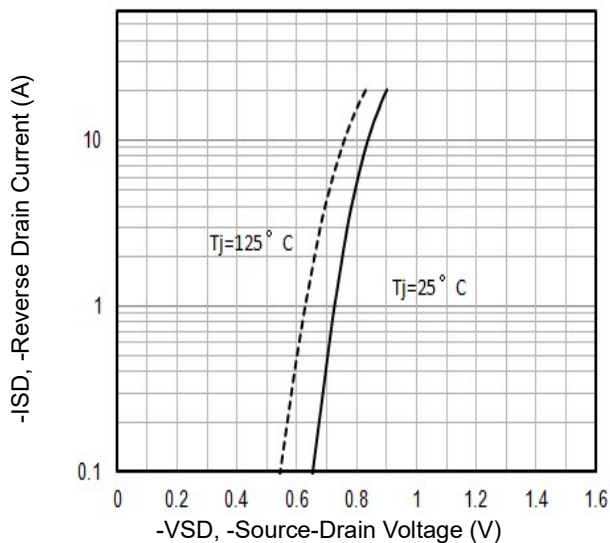
**Fig2.**  $-V_{GS(TH)}$  Gate-Source Voltage Vs.  $T_j$



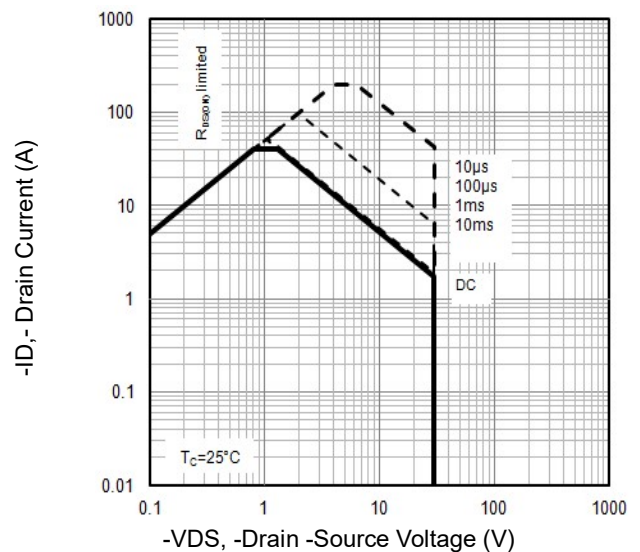
**Fig3.** Typical Transfer Characteristics



**Fig4.** Normalized On-Resistance Vs.  $T_j$

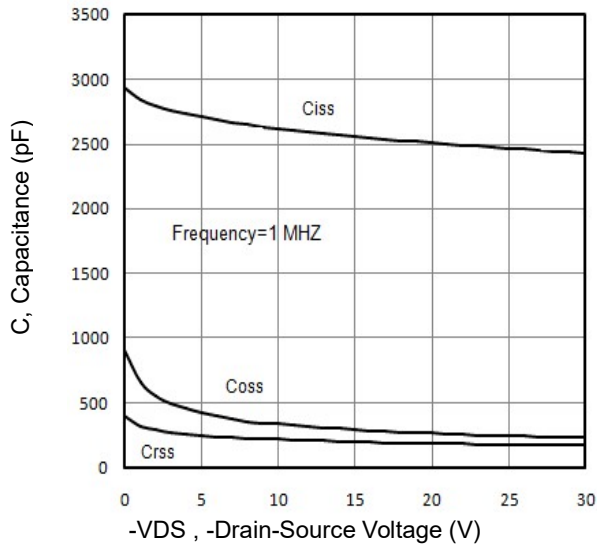


**Fig5.** Typical Source-Drain Diode Forward Voltage

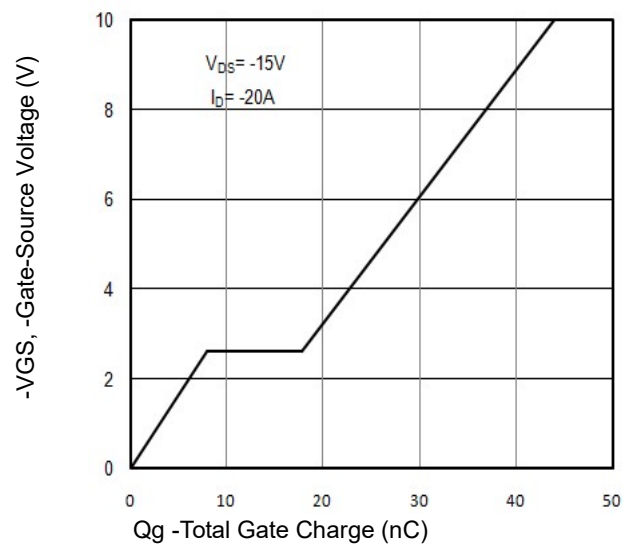


**Fig6.** Maximum Safe Operating Area

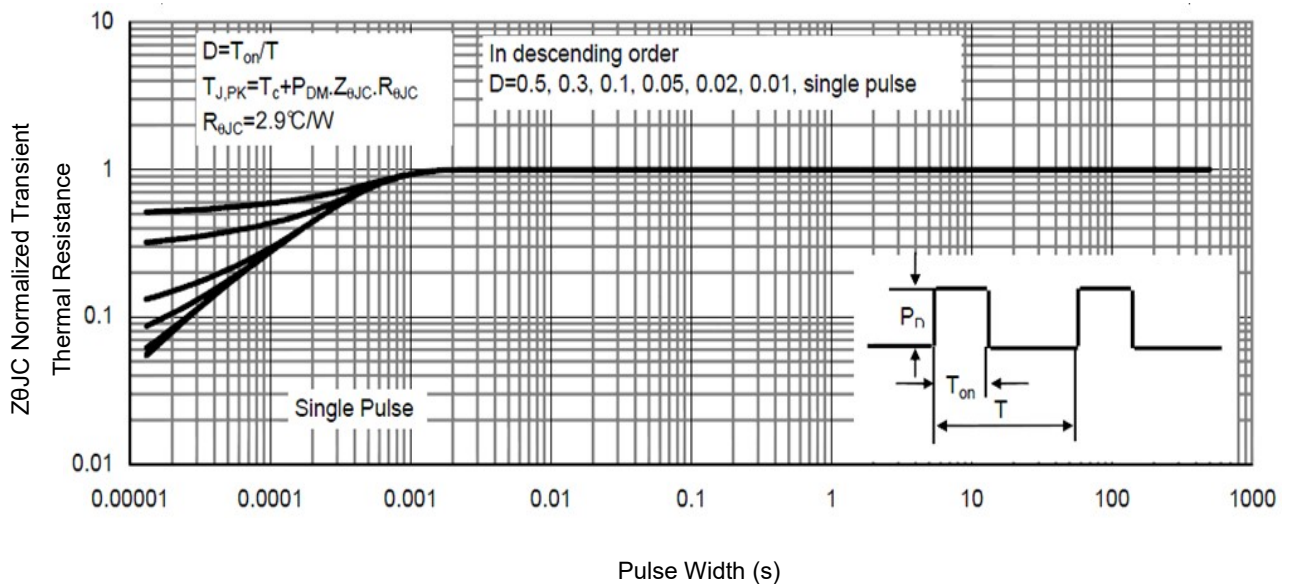
**Typical Characteristics**



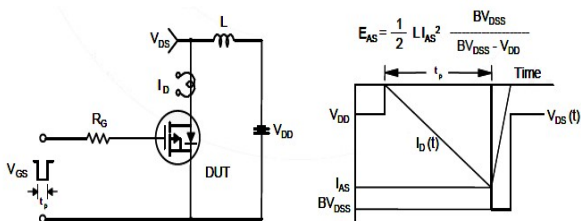
**Fig7.** Typical Capacitance Vs.Drain-Source Voltage



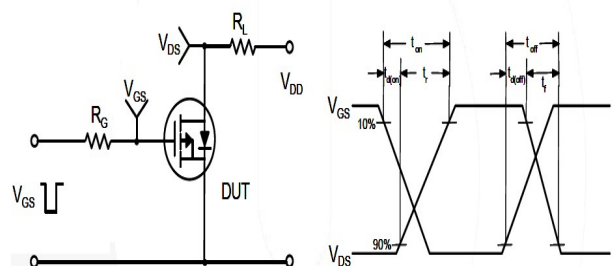
**Fig8.** Typical Gate Charge Vs.Gate-Source Voltage



**Fig9.** Normalized Maximum Transient Thermal Impedance

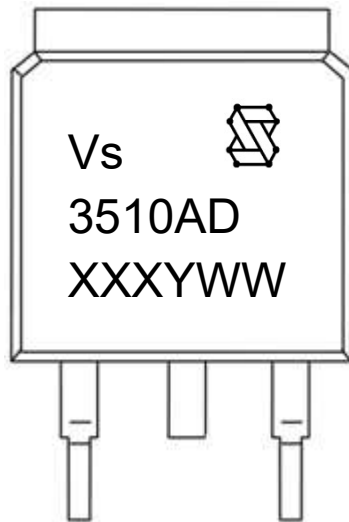


**Fig10.** Unclamped Inductive Test Circuit and Waveforms



**Fig11.** Switching Time Test Circuit and waveforms

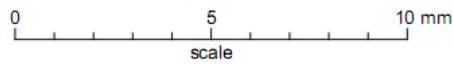
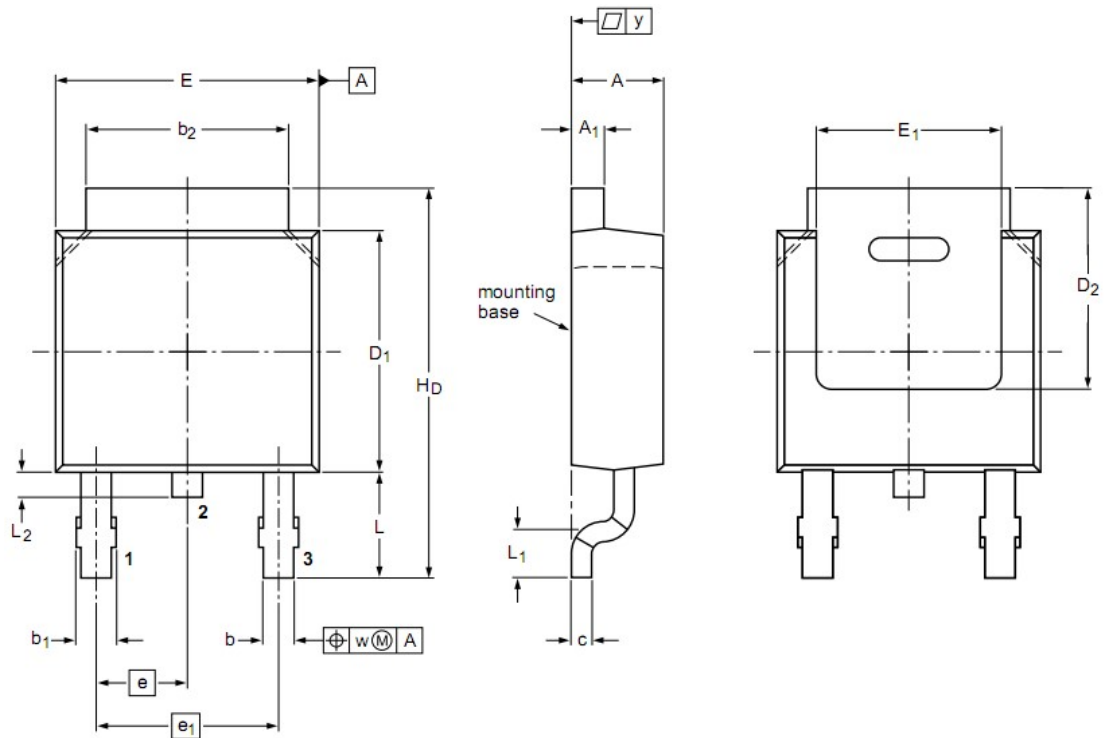
**Marking Information**



- 1st line: Vergiga Code (Vs) , Vergiga Logo
- 2nd line: Part Number (3510AD)
- 3rd line: Date code (XXXYWW)
  - XXX: Wafer Lot Number Code , code changed with Lot Number
  - Y: Year Code , refer to table below
  - WW: Week Code (01 to 53)

Code	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T
Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030

TO-252 Package Outline Data



Symbol	Dimensions (unit: mm)		
	Min	Typ	Max
A	2.20	2.30	2.38
A <sub>1</sub>	0.46	0.50	0.63
b	0.64	0.76	0.89
b <sub>1</sub>	0.77	0.85	1.14
b <sub>2</sub>	5.00	5.33	5.46
c	0.458	0.508	0.558
D <sub>1</sub>	5.98	6.10	6.223
D <sub>2</sub>	5.21	--	--
E	6.40	6.60	6.731
E <sub>1</sub>	4.40	--	--
e	2.286 BSC		
e <sub>1</sub>	--	4.57	--
H <sub>D</sub>	9.40	10.00	10.40
L	2.743 REF		
L <sub>1</sub>	1.40	1.52	1.77
L <sub>2</sub>	0.50	0.80	1.01
w	--	0.20	--
y	--	--	0.20

Notes:

1. Refer to JEDEC TO-252 variation AA
2. Dimension "E" does NOT include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.1524mm per side.
3. Dimension "D1" does NOT include interlead flash or protrusion. Interlead flash or protrusion shall not exceed 0.1524mm per end.

Customer Service

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