

## Features

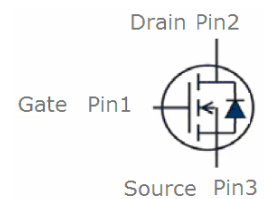
- N-Channel, 5V Logic Level Control
- Enhancement mode
- Low on-resistance @  $V_{GS}=4.5V$
- Fast Switching
- Pb-free lead plating; RoHS compliant



Part ID	Package Type	Marking	Tape and reel information
VSR090N10MS	SOT89	090N10	3000pcs/reel

$V_{DS}$	100	V
$R_{DS(on),typ@VGS=10V}$	70	m $\Omega$
$R_{DS(on),typ@VGS=4.5V}$	75	m $\Omega$
$I_D$	5	A

### SOT89



## Maximum ratings, at $T_j=25^\circ C$ , unless otherwise specified

Symbol	Parameter	Rating	Unit	
$V_{(BR)DSS}$	Drain-Source breakdown voltage	100	V	
$V_{GS}$	Gate-Source voltage	$\pm 20$	V	
$I_D$	Continuous drain current@ $V_{GS}=10V$	$T_C=25^\circ C$	5	A
		$T_A=70^\circ C$	3.2	A
$I_{DM}$	Pulse drain current tested ①	$T_C=25^\circ C$	20	A
$P_D$	Maximum power dissipation	$T_C=25^\circ C$	1.25	W
$I_S$	Diode Continuous Forward Current	$T_C=25^\circ C$	5	A
$T_J$	Maximum Junction Temperature	150	$^\circ C$	
$T_{STG}$	Storage and operating temperature range	-55 to 175	$^\circ C$	
<b>Thermal characteristics</b>				
$R_{\theta JA}$	Thermal Resistance Junction-Ambient	100	$^\circ C/W$	
$R_{\theta JC}$	Thermal Resistance-Junction to Case	15	$^\circ C/W$	

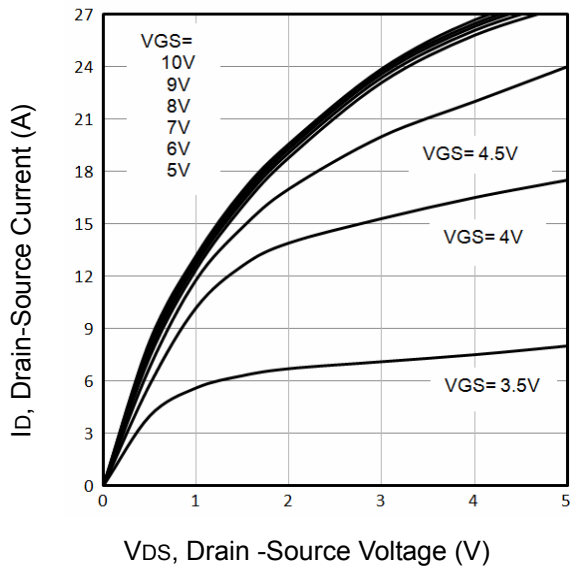
**Typical Electrical Characteristics**

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	100	--	--	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current(Tc=25°C)	V <sub>DS</sub> =100V, V <sub>GS</sub> =0V	--	--	1	μA
	Zero Gate Voltage Drain Current(Tc=125°C)	V <sub>DS</sub> =100V, 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	1.0	1.8	2.5	V
R <sub>DS(ON)</sub>	Drain-Source On-State Resistance②	V <sub>GS</sub> =10V, I <sub>D</sub> =5A	--	70	90	mΩ
R <sub>DS(ON)</sub>	Drain-Source On-State Resistance②	V <sub>GS</sub> =4.5V, I <sub>D</sub> =2A	--	75	100	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> =30V, V <sub>GS</sub> =0V, f=1MHz	--	435	--	pF
C <sub>oss</sub>	Output Capacitance		--	45	--	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	30	--	pF
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =50V, I <sub>D</sub> =1A, V <sub>GS</sub> =10V	--	9	--	nC
Q <sub>gs</sub>	Gate-Source Charge		--	1.7	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	1.6	--	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> =4.5V	--	6	--	nS
t <sub>r</sub>	Turn-on Rise Time		--	15	--	nS
t <sub>d(off)</sub>	Turn-Off Delay Time		--	16	--	nS
t <sub>f</sub>	Turn-Off Fall Time		--	10	--	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> =5A, V <sub>GS</sub> =0V	--	0.83	1.20	V
t <sub>rr</sub>	Reverse Recovery Time	T <sub>J</sub> =25°C, I <sub>sd</sub> =5A, V <sub>GS</sub> =0V di/dt=500A/μs	--	43	--	nS
Q <sub>rr</sub>	Reverse Recovery Charge		--	185	--	nC

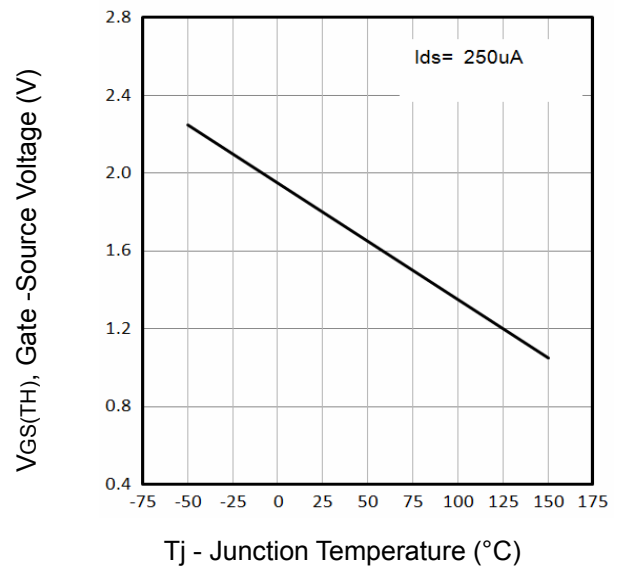
**NOTE:**

- ① Repetitive rating; pulse width limited by max. junction temperature
- ② Pulse width ≤ 300μs; duty cycles ≤ 2%.

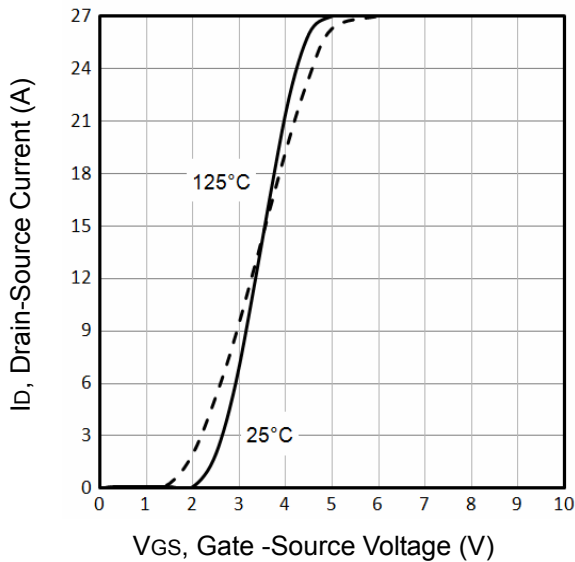
**Typical Characteristics**



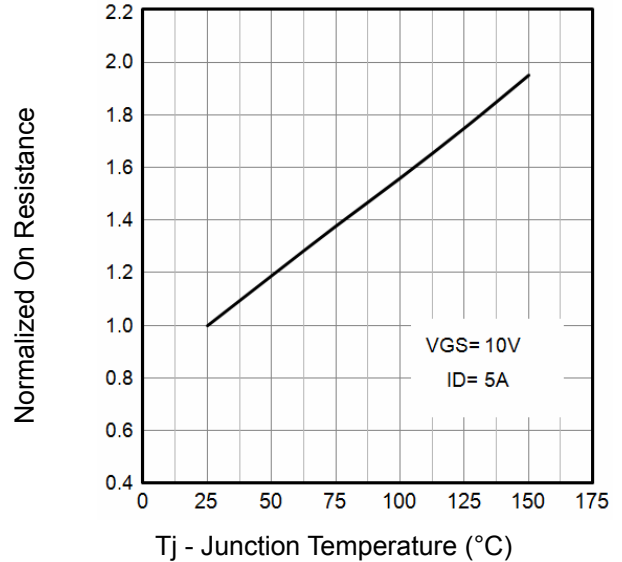
**Fig1.** Typical Output Characteristics



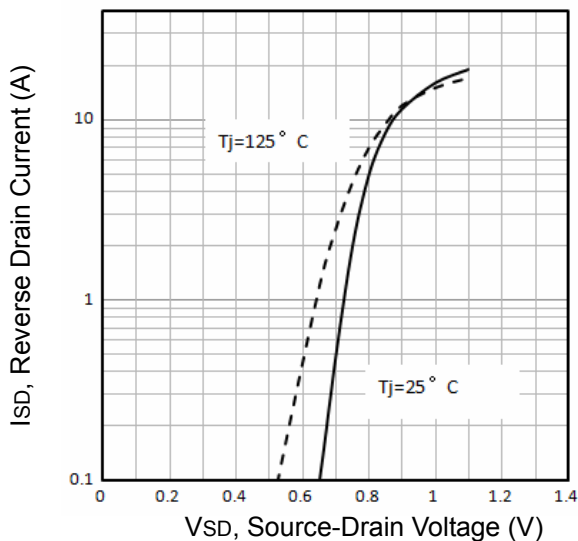
**Fig2.** Threshold Voltage Vs. Temperature



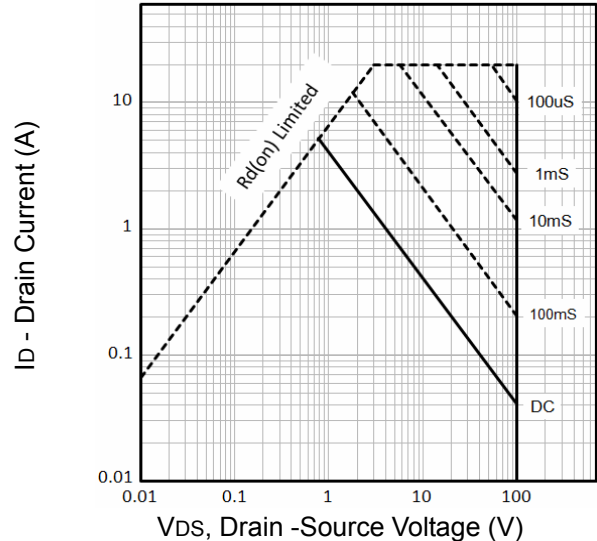
**Fig3.** Typical Transfer Characteristics



**Fig4.** Normalized On-Resistance Vs. Temperature

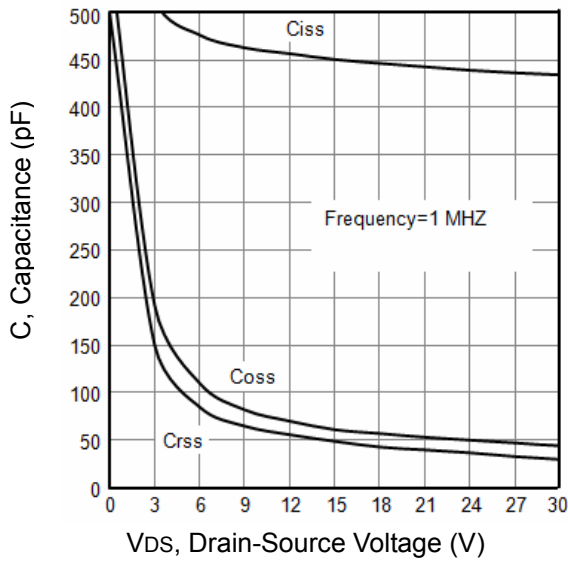


**Fig5.** Typical Source-Drain Diode Forward Voltage

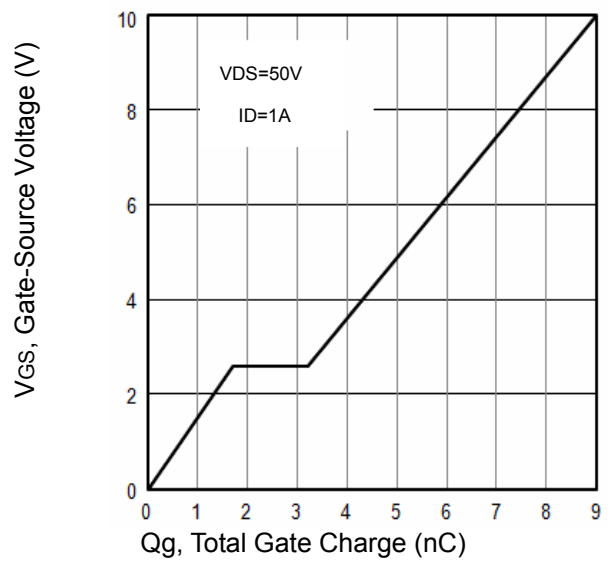


**Fig6.** Maximum Safe Operating Area

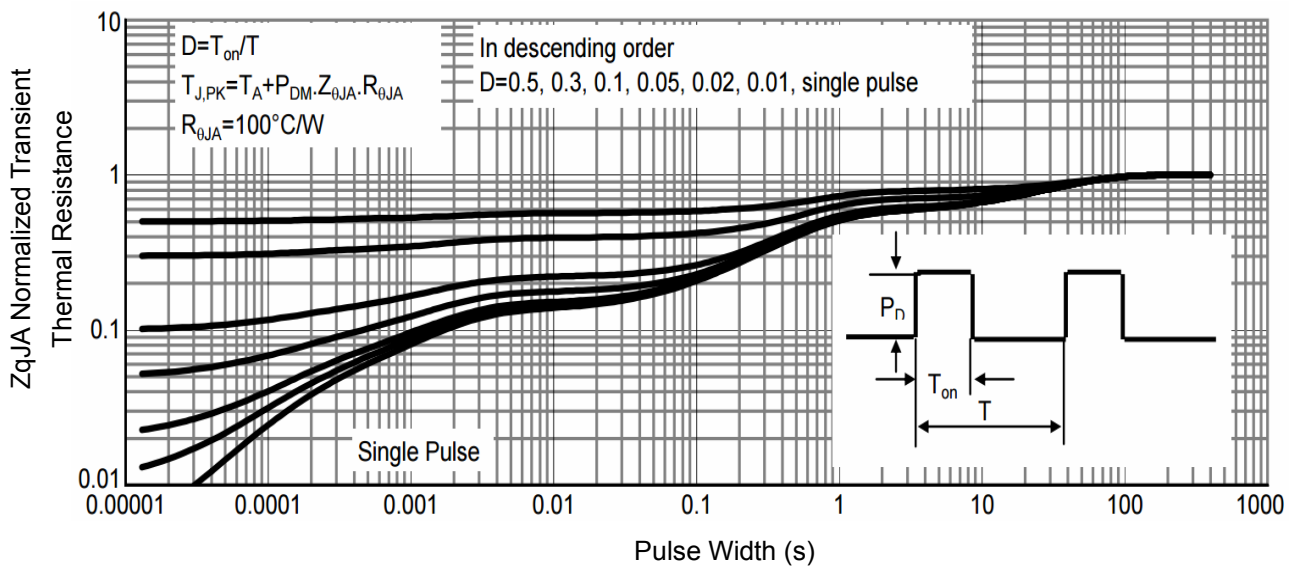
**Typical Characteristics**



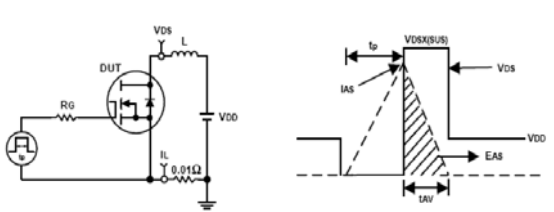
**Fig7.** Typical Capacitance Vs. Drain-Source



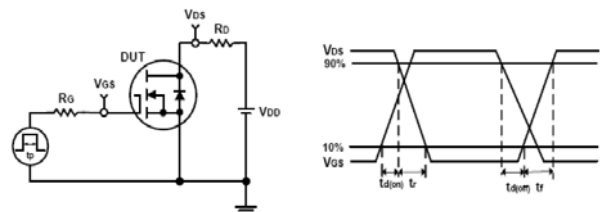
**Fig8.** Typical Gate Charge Vs. Gate-Source



**Fig9.** Normalized Maximum Transient Thermal

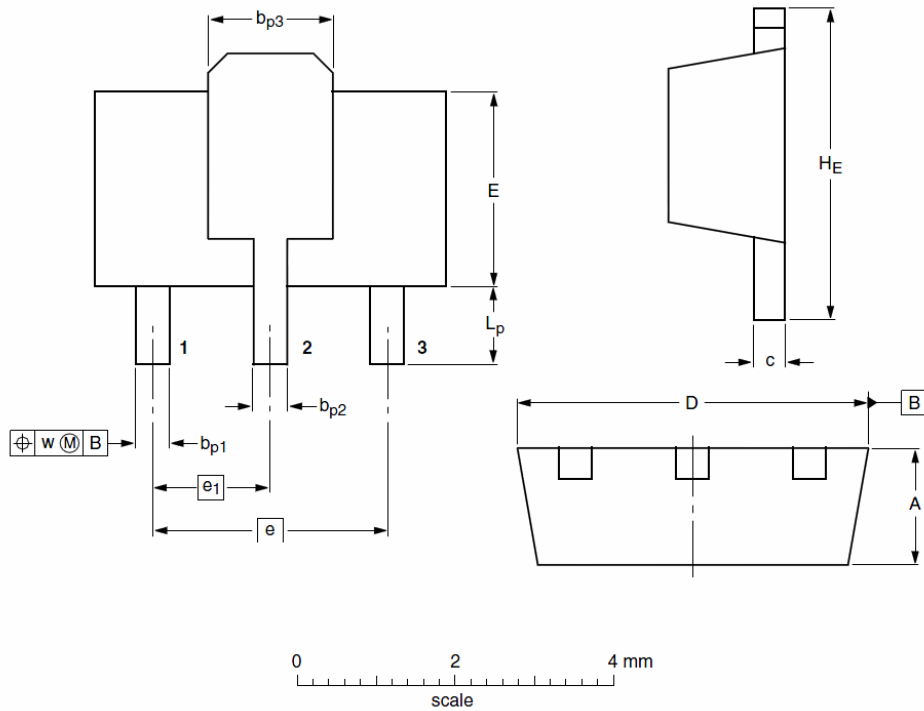


**Fig10.** Unclamped Inductive Test Circuit and waveforms



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

**SOT89 Package Outline Data**



**DIMENSIONS ( unit : mm )**

Symbol	Min	Typ	Max	Symbol	Min	Typ	Max
A	1.40	1.50	1.60	$b_{p1}$	0.35	0.43	0.48
$b_{p2}$	0.40	0.47	0.53	$b_{p3}$	1.40	1.68	1.80
c	0.23	0.35	0.44	D	4.40	4.48	4.60
E	2.40	2.51	2.60	e	--	3.00	--
$e_1$	--	1.50	--	$H_e$	3.75	4.08	4.25
$L_p$	0.80	0.90	1.20	w	--	0.13	--

**Customer Service**

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