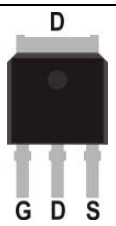
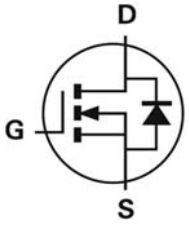
SG60N10VSI

60V N-Channel Power MOSFET

	TO-251VVS	
V_{DSS} , 60V $R_{DS(ON)}$, 13.5mΩ (max.) @ V_{GS}=10V $R_{DS(ON)}$, 16.5mΩ (max.) @ V_{GS}=4.5V I_D , 48A		

Description

The SG60N10SI uses advanced Trench technology and designs to provide excellent $R_{DS(ON)}$ with low gate charge. This device is suitable for use in PWM, load switching and general purpose applications.

Features

- Low On-Resistance
- Low Input Capacitance
- Low Miller Charge
- Low Input/Output Leakage
- Pb-free lead plating; RoHS compliant

Applications

- Motor / Body Load Control
- Automotive Systems
- Load Switch
- DC-DC converters and Off-line UPS

Ordering Information

Ordering Code	RoHS Status	Package	Package Code	Packing	Quantity
SG60N10VSI	Halogen-Free	TO-251VVS	VSI	Tube	75

Absolute Maximum Ratings (T_A=25°C unless otherwise noted)

Parameter		Symbol	Value	Unit
Drain-Source Voltage		V_{DS}	60	V
Gate-Source Voltage		V_{GS}	±20	V
Drain Current-Continuous Note 3	T_C=25°C	I_D	48	A
	T_C=100°C		48	A
Drain Current-Pulsed Note 1		I_{DM}	66	A
Avalanche Current		I_{AS}	28	A
Avalanche Energy, L=0.1mH		E_{AS}	39	mJ
Maximum Power Dissipation	T_C=25°C	P_D	114	W
	T_C=100°C		45	W
Storage Temperature Range		T_{STG}	-55 to +150	°C
Operating Junction Temperature Range		T_J	-55 to +150	°C

Thermal Resistance Ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Thermal Resistance, Junction-to-Ambient Note 2	$R_{\theta JA}$	Steady State	-	52.1	-	°C/W
Thermal Resistance, Junction-to-Case Note 2	$R_{\theta JC}$	Steady State	-	1.10	-	°C/W

Electrical Characteristics (T_J=25°C unless otherwise noted)

OFF CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V, I_{DS}=250μA	60	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=48V, V_{GS}=0V	-	-	1	μA
Gate-Body Leakage	I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA

ON CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Gate Threshold Voltage	$V_{GS(TH)}$	V_{DS}=V_{GS}, I_{DS}=250μA	1.2	-	2.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_{DS}=14A	-	-	13.5	mΩ
Drain-Source On-State Resistance		V_{GS}=4.5V, I_{DS}=7A	-	-	16.5	mΩ
Forward Transconductance Note 1	g_{fs}	V_{DS}=10V, I_D=15A	-	11	-	S

DYNAMIC CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Input Capacitance	C_{iss}	V_{DS}=30V, V_{GS}=0V, f=1MHz	-	2890	-	pF
Output Capacitance	C_{oss}		-	137	-	
Reverse Transfer Capacitance	C_{rss}		-	61	-	
Gate Resistance	R_g	V_{GS}=0V, V_{DS}=0V, f=1MHz	-	0.54	1	Ω

SWITCHING CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Turn-On Delay Time	$T_{d(on)}$	V_{DD}=30V, I_D=15A, V_{GS}=10V, Rg=3Ω	-	11.3	-	ns
Rise Time	t_r		-	30.4	-	
Turn-Off Delay Time	$T_{d(off)}$		-	25	-	
Fall Time	t_f		-	39.5	-	
Total Gate Charge	Q_g	V_{DS}=30V, I_{DS}=15A, V_{GS}=10V	-	41.8	-	nC
Gate to Source Gate Charge	Q_{gs}		-	12.3	-	
Gate to Drain “Miller” Charge	Q_{gd}		-	4.3	-	

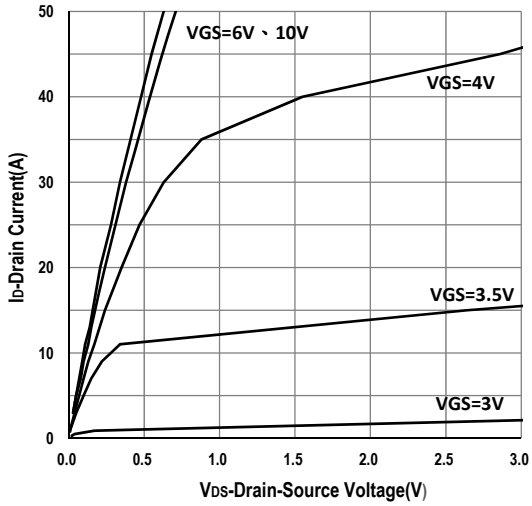
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Drain-Source Diode Forward Voltage	V_{SD}	V_{GS}=0V, I_S=10A	-	-	1.3	V
Body Diode Reverse Recovery Time	t_{rr}	V_{DS}=30V, I_F=12A, dI/dt=100A/μs	-	20	-	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	18	-	nC

Notes:

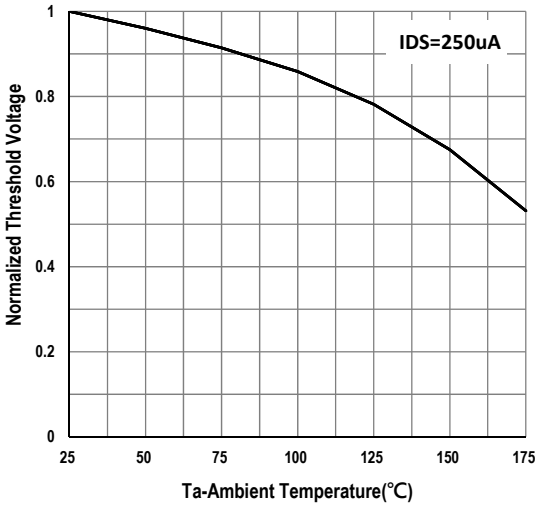
1. Pulse Test: Pulse Width ≤ 10ms, Duty Cycle ≤ 1%.
2. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design. $R_{\theta JA}$ shown below for single device operation on FR-4 in still air.
3. The maximum current rating is package limited.

Typical Operating Characteristics

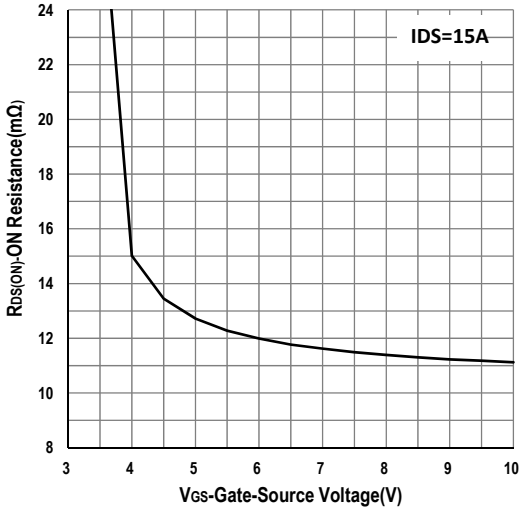
Output Characteristics



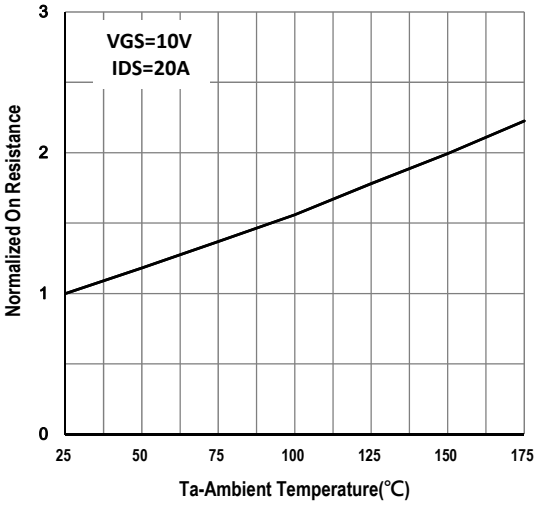
Gate Threshold Voltage



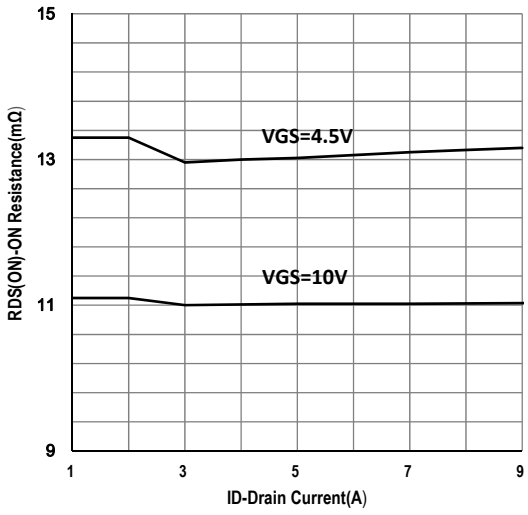
Gate-Source On Resistance



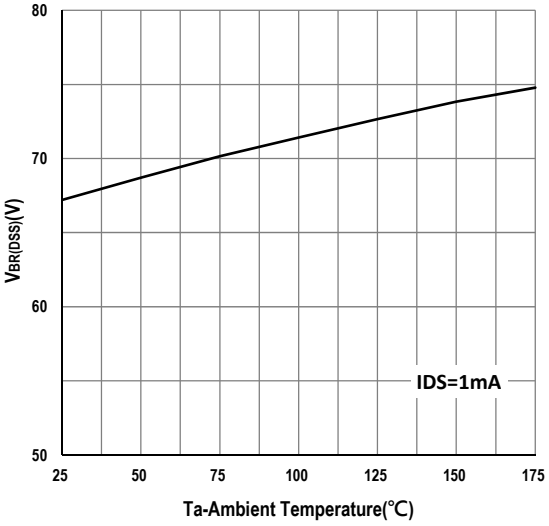
Drain-Source On Resistance



Drain-Source On Resistance

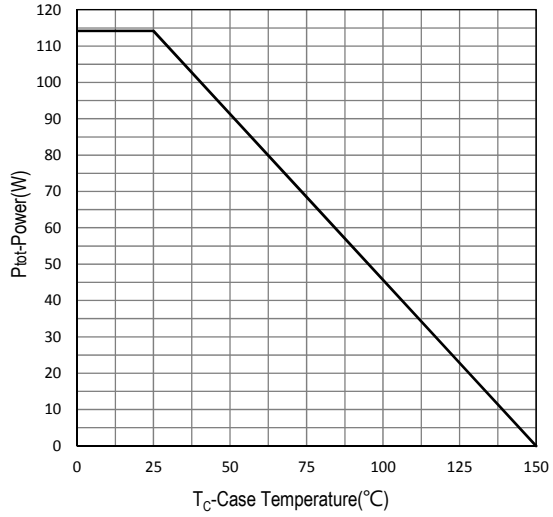


Drain-source Breakdown Voltage

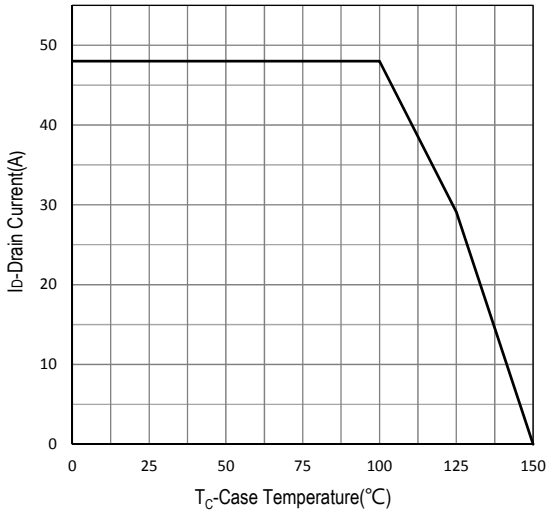


Typical Operating Characteristics (Cont.)

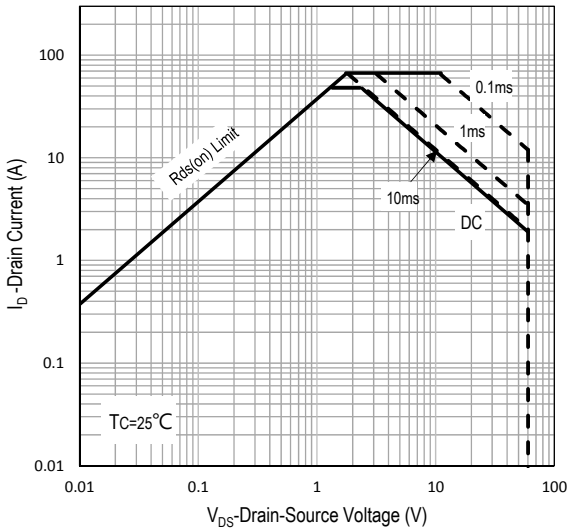
Power Dissipation



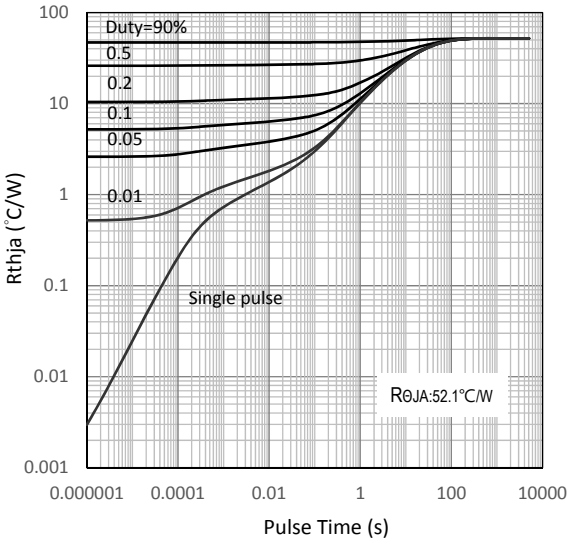
Drain Current



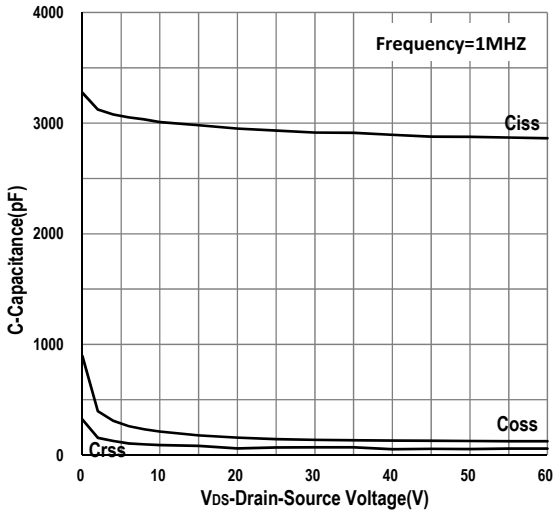
Safe Operation Area



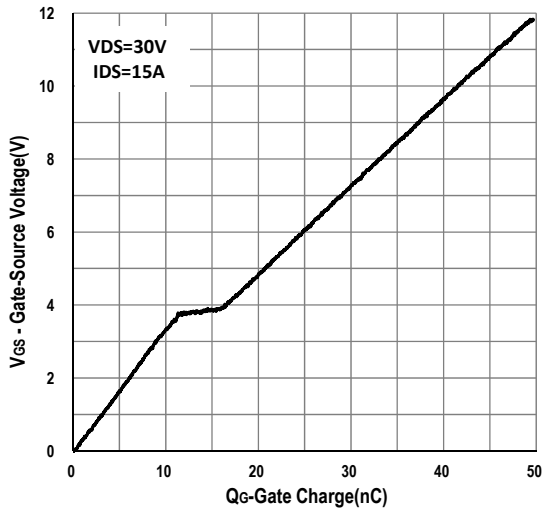
Transient Thermal Impedance



Capacitance



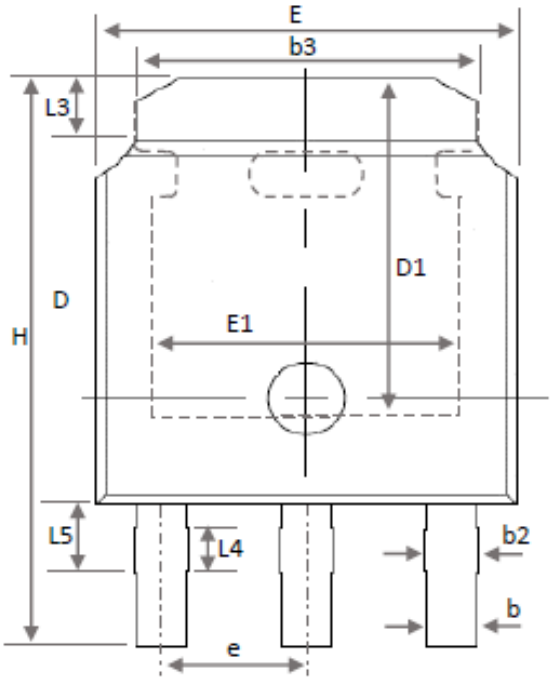
Gate Charge

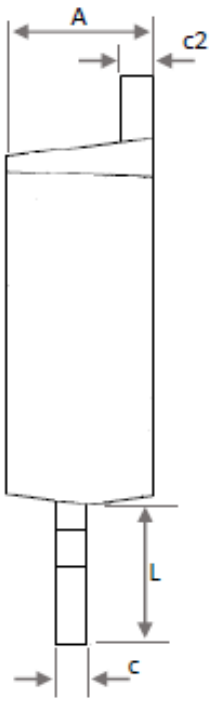


Marking Information

TO-251VVS (VSI)	Marking Rule
Laser Marking  	Line 1：Device SG60N10VSI Line 2：Date Code YYMMXXX YY：Year Code MM：Month Code XXX：Serial Number

Package of Dimension





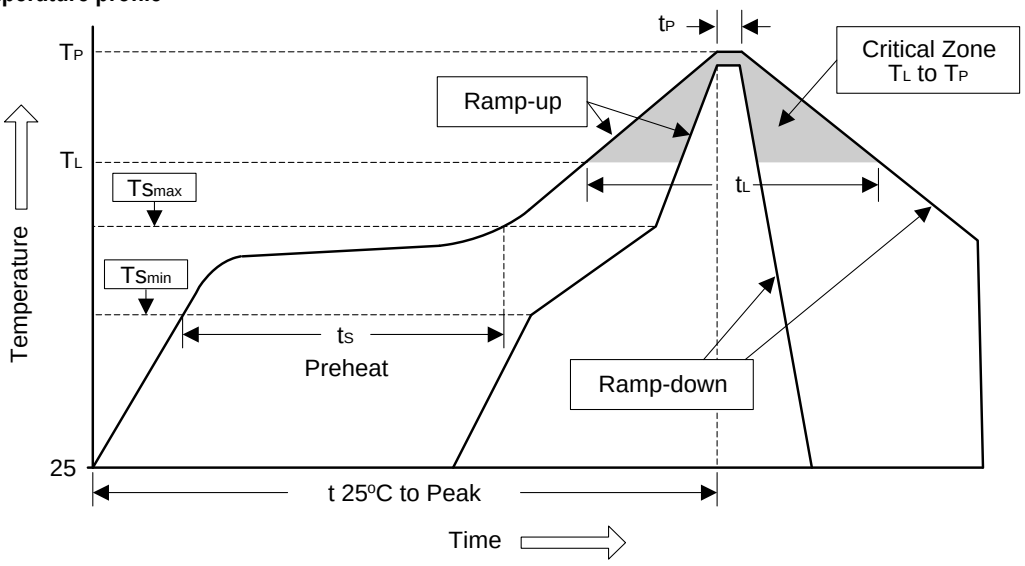
Symbol	Min	Nor	Max
E	6.40	6.60	6.73
L	2.20	2.35	2.50
L3	0.89	-	1.27
L4	0.70	0.70	0.70
L5	0.97	1.10	1.23
D	6.00	6.10	6.22
H	9.20	9.45	9.70
b	0.64	0.76	0.88
b2	0.77	0.84	1.00
b3	5.21	5.34	5.46
e	2.29	2.29	2.29
A	2.20	2.30	2.38
c	0.40	0.50	0.60
c2	0.40	0.50	0.60
D1	5.10	-	-
E1	4.40	-	-

1. All dimension are in millimeters.
2. Dimension does not include burrs and mold flash/protrusions.

Soldering Methods for Silicongear's Products

1. Storage environment: Temperature=10°C to 35°C Humidity=65%±15%
2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	<3°C/sec	<3°C/sec
Preheat - Temperature Min (Ts_{min}) - Temperature Max (Ts_{max}) - Time (min to max) (ts)	 100°C 150°C 60 to 120 sec	 150°C 200°C 60 to 180 sec
Tsmax to T_L - Ramp-up Rate	 <3°C/sec	 <3°C/sec
Time maintained above: - Temperature (T_L) - Time (t_L)	 183°C 60 to 150 sec	 217°C 60 to 150 sec
Peak Temperature (T_P)	240°C +0/-5°C	260°C +0/-5°C
Time within 5°C of actual Peak Temperature (t_P)	10 to 30 sec	20 to 40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25°C to Peak Temperature	<6 minutes	<8 minutes

3. Flow (wave) soldering (solder dipping)

Products	Peak Temperature	Dipping Time
Pb devices.	245°C ±5°C	5sec ±1sec
Pb-Free devices.	260°C +0/-5°C	5sec ±1sec

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