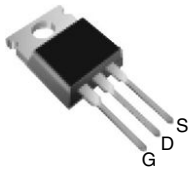
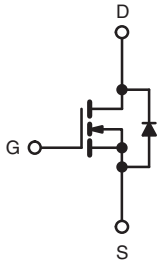
S Series Power MOSFET

PRODUCT SUMMARY		
V_{DS} at T_J max. (V)	650	
$R_{DS(on)}$ max. at 25 °C (Ω)	V_{GS} = 10 V	0.190
Q_g max. (nC)	98	
Q_{gs} (nC)	17	
Q_{gd} (nC)	25	
Configuration	Single	

TO-220AB





N-Channel MOSFET

FEATURES

- Generation One
- High E_{AR} Capability
- Lower Figure-of-Merit R_{on} x Q_g
- 100 % Avalanche Tested
- Ultra Low R_{on}
- dV/dt Ruggedness
- Ultra Low Gate Charge (Q_g)
- Compliant to RoHS Directive 2002/95/EC

Available

RoHS* COMPLIANT

Note

* Pb containing terminations are not RoHS compliant, exemptions may apply

APPLICATIONS

- PFC Power Supply Stages
- Hard Switching Topologies
- Solar Inverters
- UPS
- Motor Control
- Lighting
- Server Telecom

ORDERING INFORMATION	
Package	TO-220AB
Lead (Pb)-free	SiHP22N60S-E3

ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C, unless otherwise noted)

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			V_{DS}	600	V
Gate-Source Voltage			V_{GS}	± 20	
Gate-Source Voltage AC (f > 1 Hz)				30	
Continuous Drain Current	V_{GS} at 10 V	T_C = 25 °C	I_D	22	A
		T_C = 100 °C		13	
Pulsed Drain Current[a]			I_{DM}	65	
Linear Derating Factor		TO-220AB		2	W/°C
Single Pulse Avalanche Energy[b]			E_{AS}	690	mJ
Repetitive Avalanche Energy[a]			E_{AR}	25	
Maximum Power Dissipation		TO-220AB	P_D	250	W
Drain-Source Voltage Slope	T_J = 125 °C		dV/dt	37	V/ns
Reverse Diode dV/dt[d]				5.3	
Operating Junction and Storage Temperature Range			T_J, T_{stg}	- 55 to + 150	°C
Soldering Recommendations (Peak Temperature)[c]	for 10 s			300	

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature.
b. V_{DD} = 50 V, starting T_J = 25 °C, L = 28.2 mH, R_g = 25 Ω, I_{AS} = 7 A.
c. 1.6 mm from case.
d. $I_{SD} \leq I_D$, dI/dt = 100 A/µs, starting T_J = 25 °C.

THERMAL RESISTANCE RATINGS					
PARAMETER		**SYMBOL**	**TYP.**	**MAX.**	**UNIT**
Maximum Junction-to-Ambient	TO-220AB	R_{thJA}	-	62	°C/W
Maximum Junction-to-Case (Drain)	TO-220AB	R_{thJC}	-	0.5	

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 1 mA		600	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = 1 mA		-	0.70	-	V/°C
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA		2.0	-	4.0	V
Gate-Source Leakage	I_{GSS}	V_{GS} = ± 20 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 600 V, V_{GS} = 0 V		-	-	1	µA
		V_{DS} = 600 V, V_{GS} = 0 V, T_J = 150 °C		-	-	100	
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = 10 V	I_D = 11 A	-	0.160	0.190	Ω
Forward Transconductance[a]	g_{fs}	V_{DS} = 50 V, I_D = 13 A		-	9.4	-	S
Dynamic							
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1.0 MHz		-	2810	-	pF
Output Capacitance	C_{oss}			-	1480	-	
Reverse Transfer Capacitance	C_{rss}			-	33	-	
Effective Output Capacitance (Time Related)	$C_{oss\ eff.}$ (TR)[a]	V_{GS} = 0 V	V_{DS} = 0 V to 480 V	-	155	-	
Total Gate Charge	Q_g	V_{GS} = 10 V	I_D = 22 A, V_{DS} = 480 V	-	75	110	nC
Gate-Source Charge	Q_{gs}			-	17	-	
Gate-Drain Charge	Q_{gd}			-	25	-	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 380 V, I_D = 22 A, R_g = 9.1 Ω, V_{GS} = 10 V		-	24	50	ns
Rise Time	t_r			-	68	100	
Turn-Off Delay Time	$t_{d(off)}$			-	77	115	
Fall Time	t_f			-	59	90	
Gate Input Resistance	R_g	f = 1 MHz, open drain		-	0.65	-	Ω
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	22	A
Pulsed Diode Forward Current	I_{SM}			-	-	88	
Diode Forward Voltage	V_{SD}	T_J = 25 °C, I_S = 22 A, V_{GS} = 0 V		-	-	1.2	V
Reverse Recovery Time	t_{rr}	T_J = 25 °C, I_F = I_S, dI/dt = 100 A/µs, V_R = 25 V		-	462	690	ns
Reverse Recovery Charge	Q_{rr}			-	8.3	16	µC
Reverse Recovery Current	I_{RRM}			-	30	60	A

Note

a. $C_{oss\ eff.}$ (TR) is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS}.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

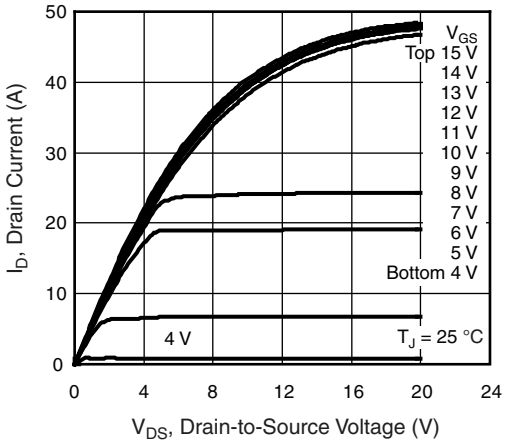


Fig. 1 - Typical Output Characteristics, T_J = 25 °C

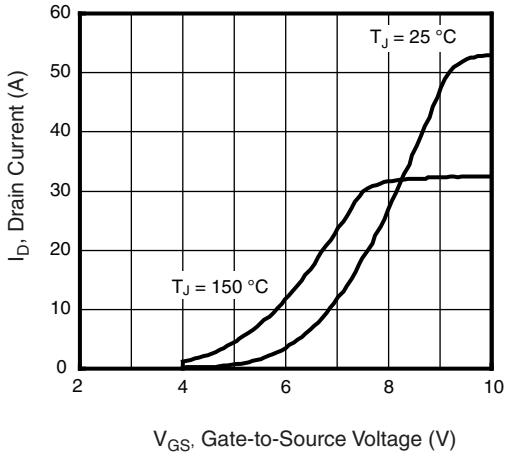


Fig. 3 - Typical Transfer Characteristics

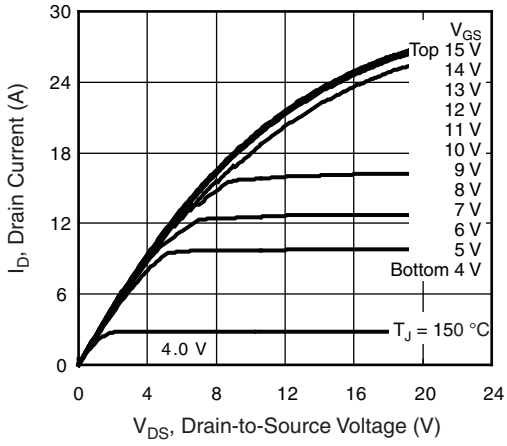


Fig. 2 - Typical Output Characteristics, T_J = 150 °C

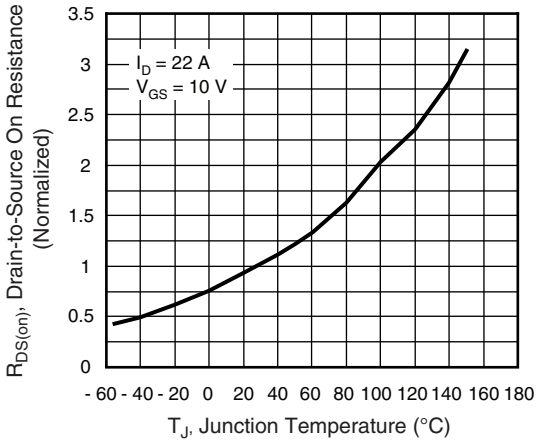


Fig. 4 - Normalized On-Resistance vs. Temperature

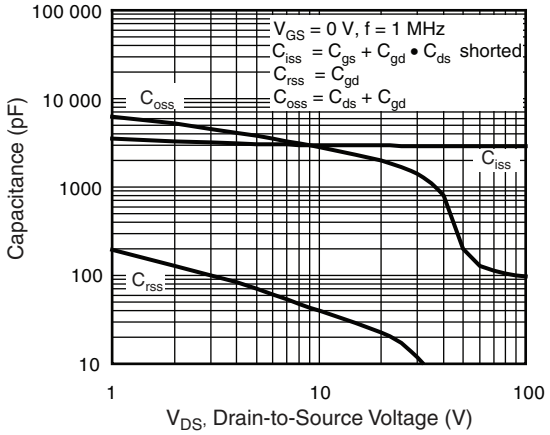


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

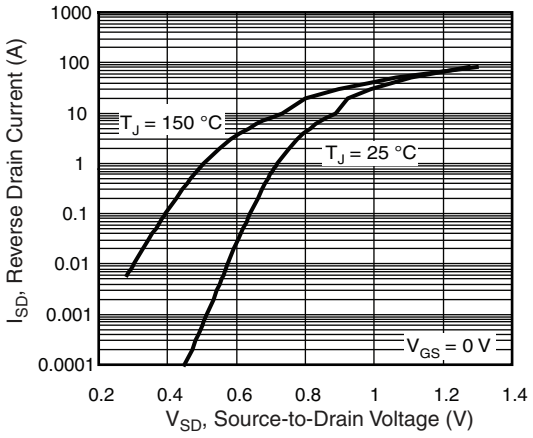


Fig. 7 - Typical Source-Drain Diode Forward Voltage

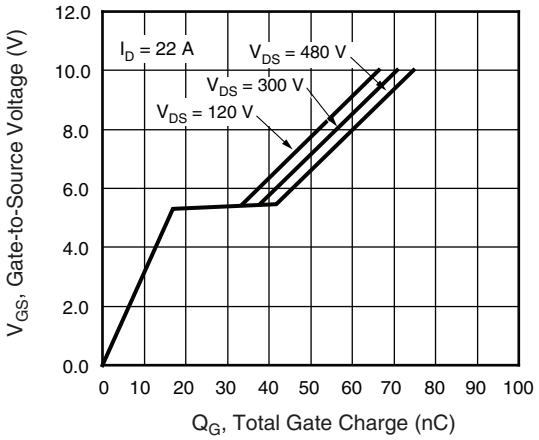


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

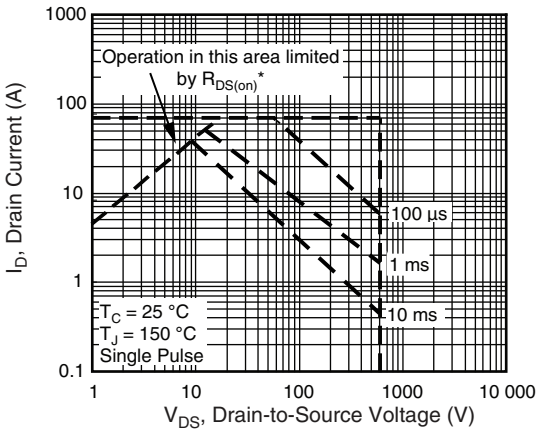


Fig. 8 - Maximum Safe Operating Area

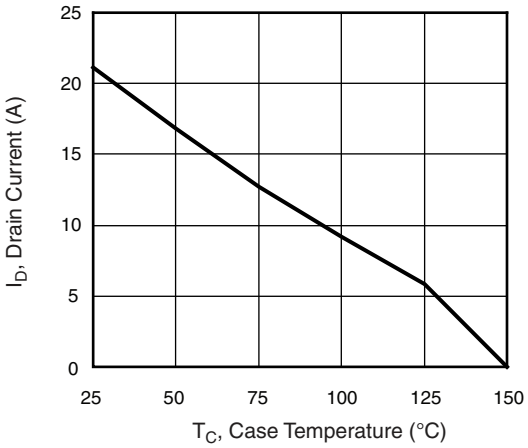


Fig. 9 - Maximum Drain Current vs. Case Temperature

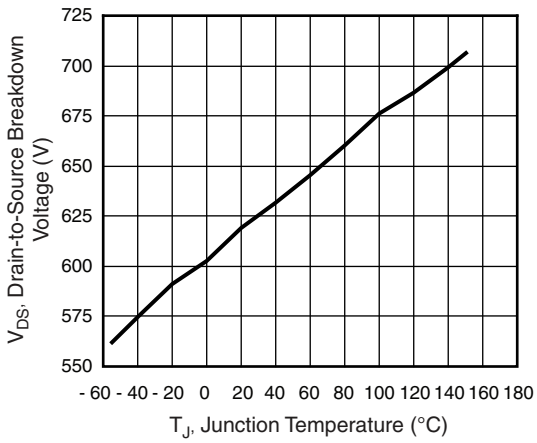


Fig. 10 - Drain-to-Source Breakdown Voltage

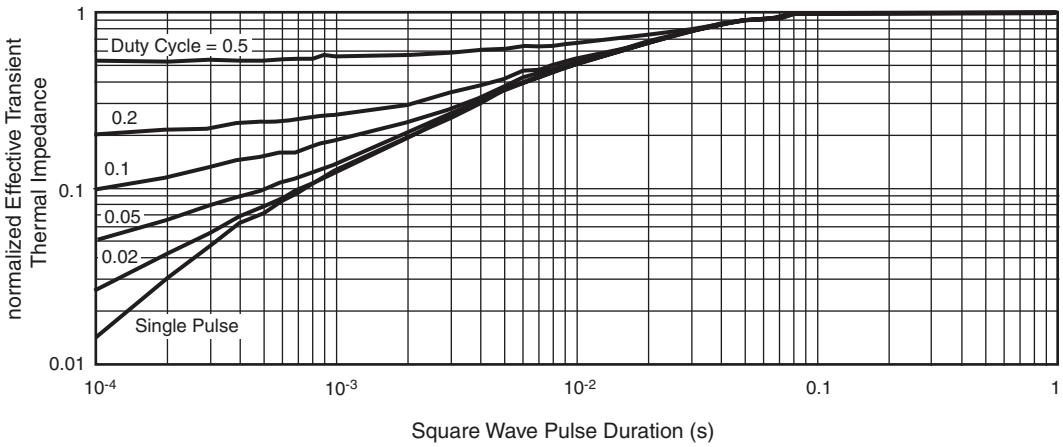


Fig. 11 - Normalized Thermal Transient Impedance, Junction-to-Case

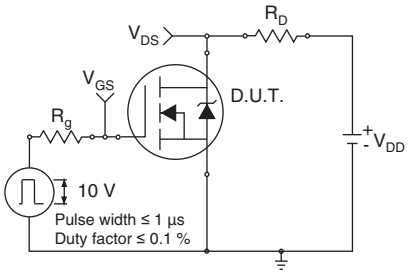


Fig. 11a - Switching Time Test Circuit

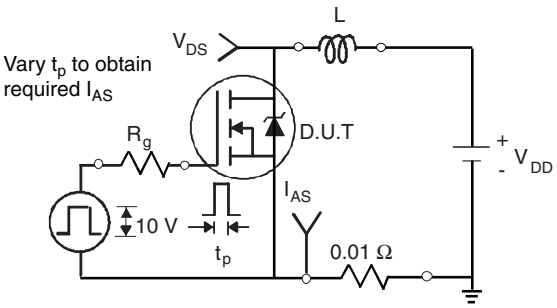


Fig. 12a - Unclamped Inductive Test Circuit

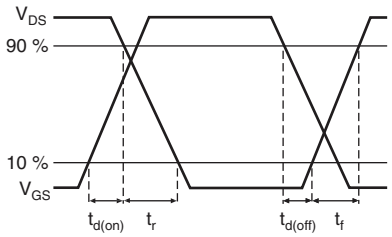


Fig. 11b - Switching Time Waveforms

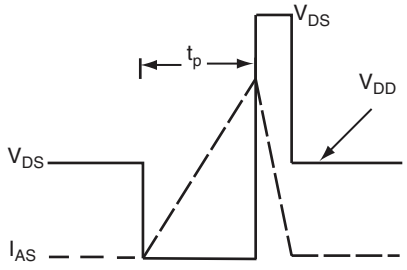


Fig. 12b - Unclamped Inductive Waveforms

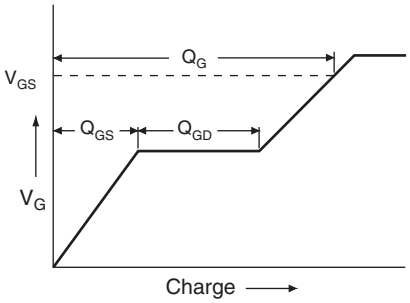


Fig. 13a - Basic Gate Charge Waveform

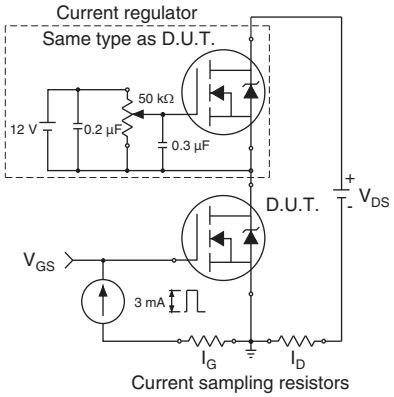
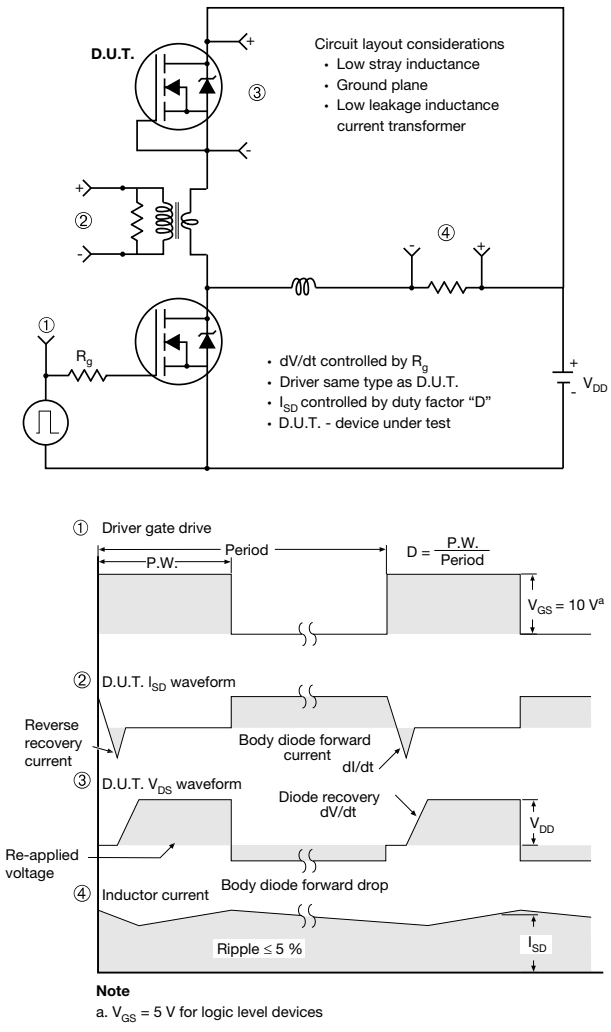


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



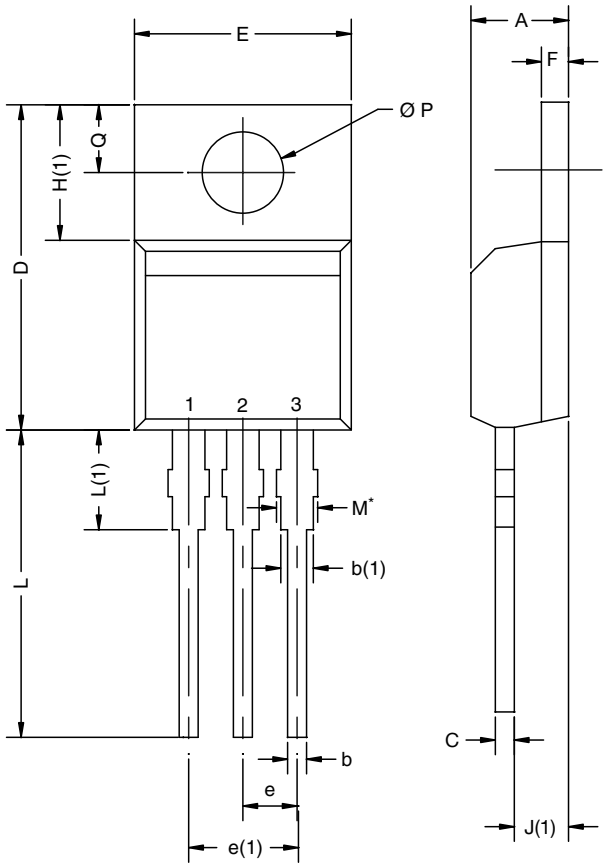
Note

a. V_{GS} = 5 V for logic level devices

Fig. 14 - For N-Channel

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?91373.

TO-220AB



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.09	6.48	0.240	0.255
J(1)	2.41	2.92	0.095	0.115
L	13.35	14.02	0.526	0.552
L(1)	3.32	3.82	0.131	0.150
Ø P	3.54	3.94	0.139	0.155
Q	2.60	3.00	0.102	0.118
ECN: T13-0724-Rev. O, 14-Oct-13 DWG: 5471				

Note

* M = 1.32 mm to 1.62 mm (dimension including protrusion) Heatsink hole for HVM

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