

S Series Power MOSFET


RoHS
COMPLIANT

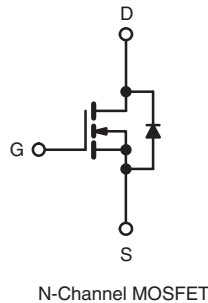
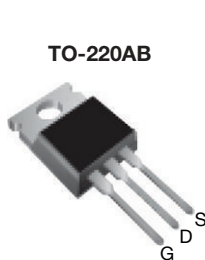
PRODUCT SUMMARY		
V_{DS} at T_J max. (V)	650	
$R_{DS(on)}$ max. at 25 °C (Ω)	$V_{GS} = 10$ V	0.190
Q_g max. (nC)	98	
Q_{gs} (nC)	17	
Q_{gd} (nC)	25	
Configuration	Single	

FEATURES

- Generation one
- High E_{AR} capability
- Lower figure-of-merit $R_{on} \times Q_g$
- 100 % avalanche tested
- Ultra low R_{on}
- dV/dt ruggedness
- Ultra low gate charge (Q_g)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

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}		± 30		
Continuous Drain Current	V_{GS} at 10 V	$T_C = 25$ °C	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

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 50$ V, starting $T_J = 25$ °C, $L = 28.2$ mH, $R_g = 25$ Ω , $I_{AS} = 7$ A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$, $dI/dt = 100$ A/ μ s, 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 ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$		600	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}, I_D = 1\text{ mA}$		-	0.70	-	V/°C
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		2.0	-	4.0	V
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 20\text{ V}$		-	-	± 100	nA
		$V_{GS} = \pm 30\text{ V}$		-	-	± 1	μA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$		-	-	1	μA
		$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$		-	-	100	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 11\text{ A}$	-	0.160	0.190	Ω
Forward Transconductance ^a	g_{fs}	$V_{DS} = 50\text{ V}, I_D = 13\text{ A}$		-	9.4	-	S
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}$		562	2810	5620	pF
Output Capacitance	C_{oss}			296	1480	2960	
Reverse Transfer Capacitance	C_{rss}			6.6	33	66	
Effective Output Capacitance (Time Related)	$C_{oss\text{ eff.}}(TR)^a$	$V_{GS} = 0\text{ V}$	$V_{DS} = 0\text{ V to } 480\text{ V}$	-	155	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$	$I_D = 22\text{ A}, V_{DS} = 480\text{ V}$	-	75	110	nC
Gate-Source Charge	Q_{gs}			-	17	-	
Gate-Drain Charge	Q_{gd}			-	25	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 380\text{ V}, I_D = 22\text{ A}, R_g = 9.1\text{ }\Omega, V_{GS} = 10\text{ V}$		-	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	$f = 1\text{ MHz}, \text{open drain}$		0.13	0.65	1.3	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}	$T_J = 25\text{ }^\circ\text{C}, I_S = 22\text{ A}, V_{GS} = 0\text{ V}$		-	-	1.2	V
Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = I_S, di/dt = 100\text{ A}/\mu\text{s}, V_R = 25\text{ V}$		-	462	690	ns
Reverse Recovery Charge	Q_{rr}			-	8.3	16	μC
Reverse Recovery Current	I_{RRM}			-	30	60	A

Note

a. $C_{oss\text{ eff.}}(TR)$ 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)

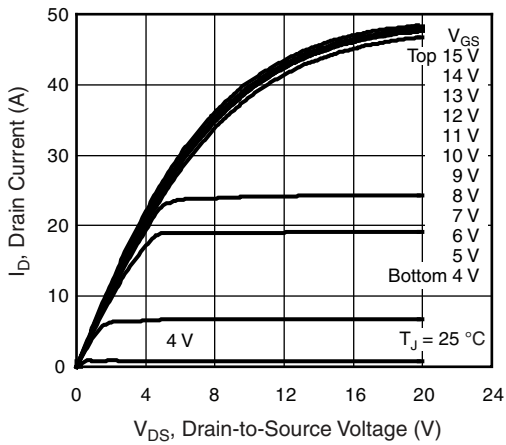


Fig. 1 - Typical Output Characteristics, $T_J = 25\text{ }^\circ\text{C}$

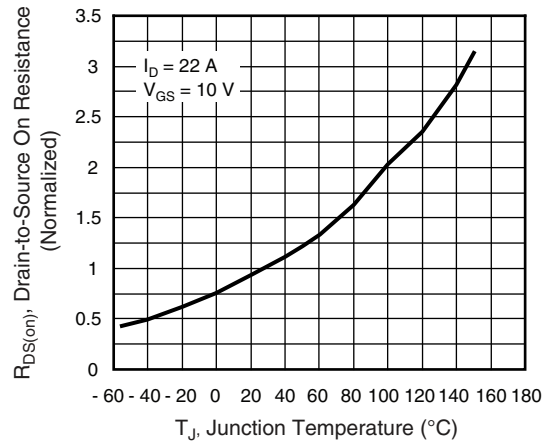


Fig. 4 - Normalized On-Resistance vs. Temperature

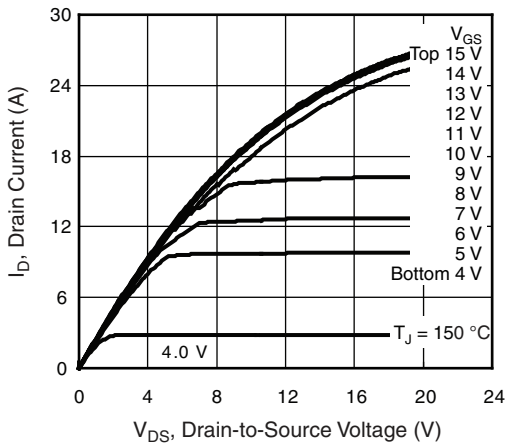


Fig. 2 - Typical Output Characteristics, $T_J = 150\text{ }^\circ\text{C}$

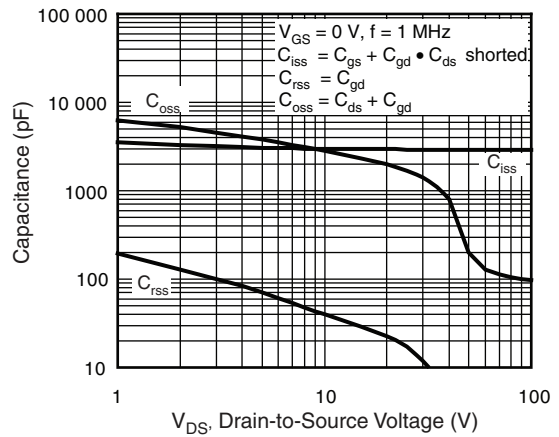


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

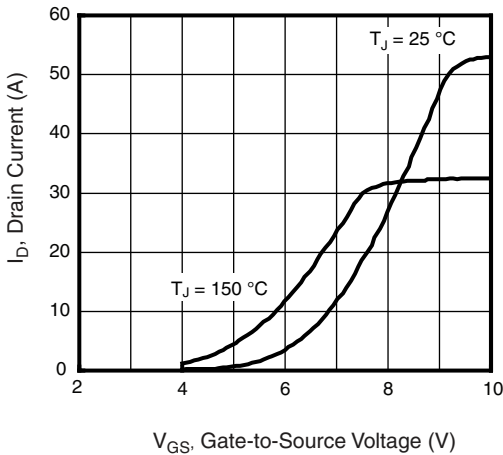


Fig. 3 - Typical Transfer Characteristics

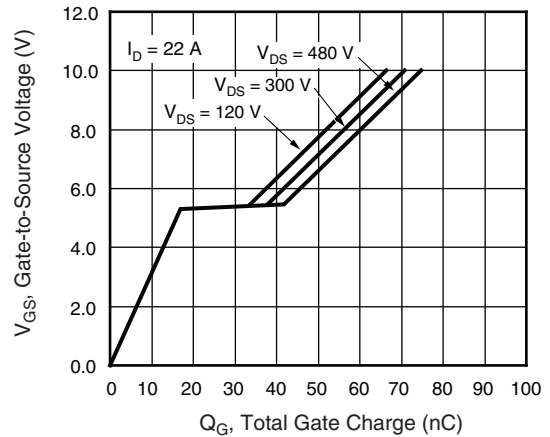


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

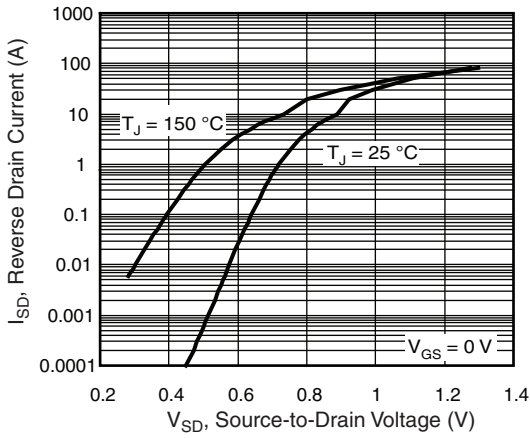


Fig. 7 - Typical Source-Drain Diode Forward Voltage

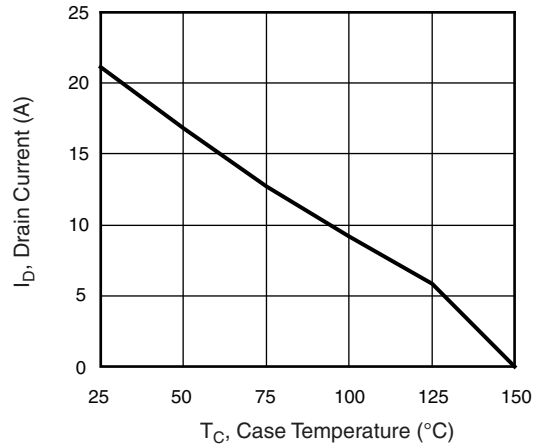


Fig. 9 - Maximum Drain Current vs. Case Temperature

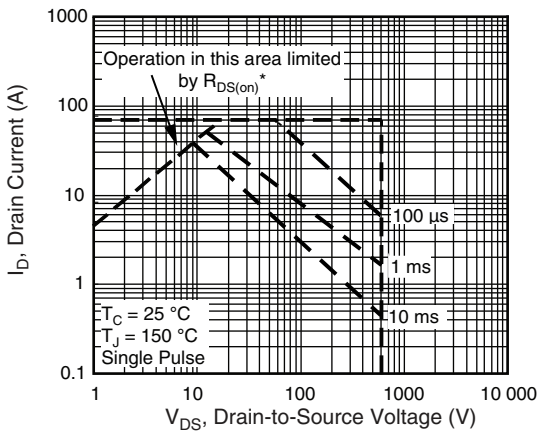


Fig. 8 - Maximum Safe Operating Area

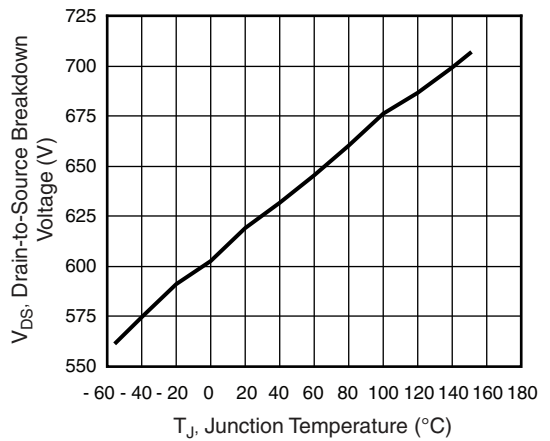


Fig. 10 - Drain-to-Source Breakdown Voltage

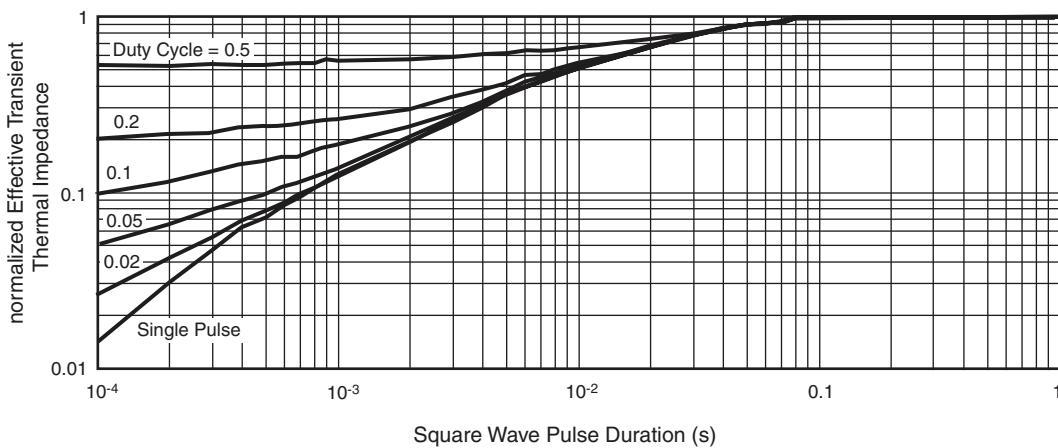


Fig. 11 - Normalized Thermal Transient Impedance, Junction-to-Case

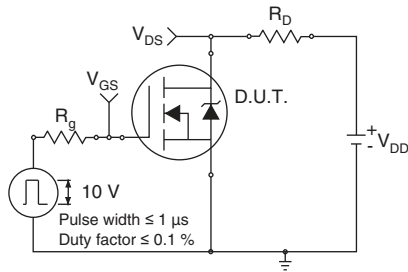


Fig. 12 - Switching Time Test Circuit

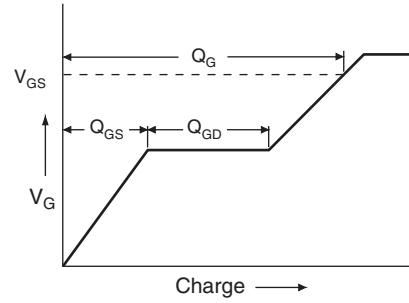


Fig. 16 - Basic Gate Charge Waveform

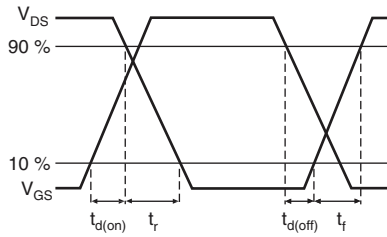


Fig. 13 - Switching Time Waveforms

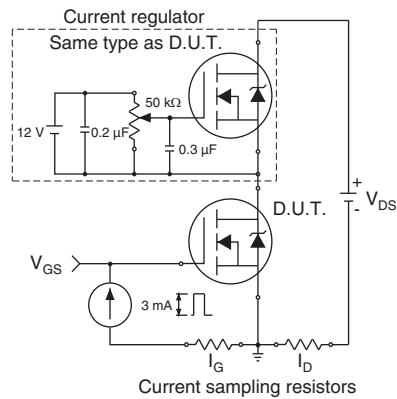


Fig. 17 - Gate Charge Test Circuit

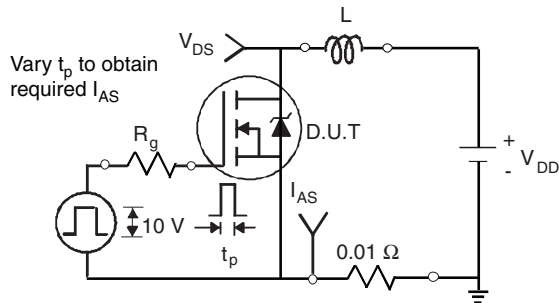


Fig. 14 - Unclamped Inductive Test Circuit

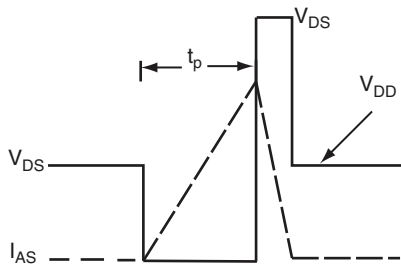
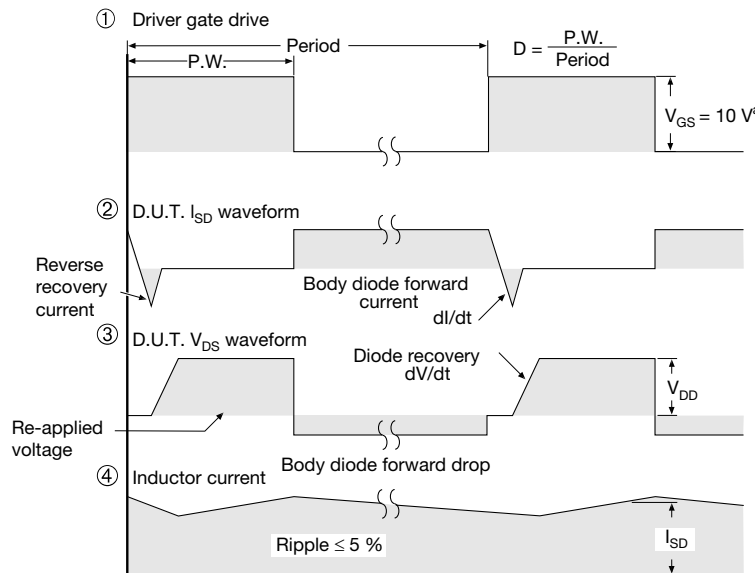
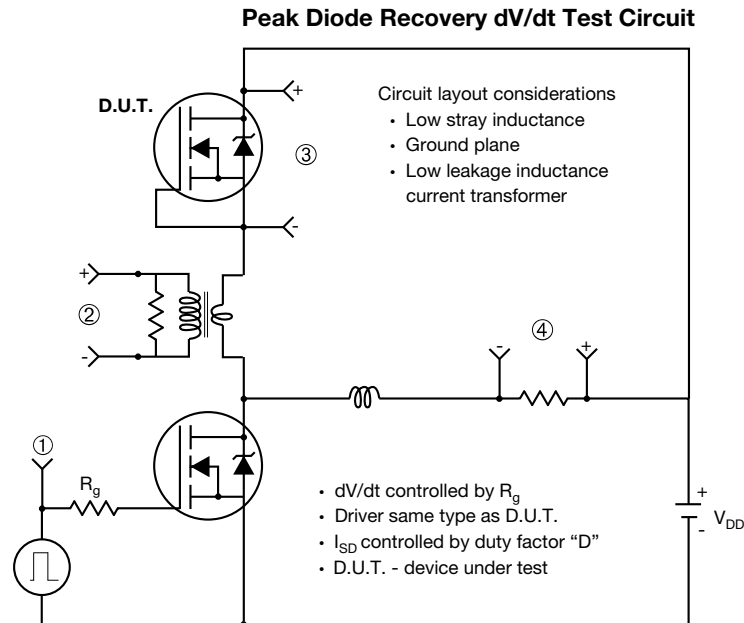


Fig. 15 - Unclamped Inductive Waveforms



Note

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

Fig. 18 - For N-Channel

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TO-220-1



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.14	4.70	0.163	0.185
b	0.69	1.02	0.027	0.040
b(1)	1.14	1.73	0.045	0.068
c	0.36	0.61	0.014	0.024
D	14.33	15.85	0.564	0.624
E	9.96	10.52	0.392	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	0.43	1.40	0.017	0.055
H(1)	6.10	6.48	0.240	0.255
J(1)	2.41	2.92	0.095	0.115
L	13.36	14.40	0.526	0.567
L(1)	3.33	4.04	0.131	0.159
$\varnothing P$	3.53	3.94	0.139	0.155
Q	2.59	3.00	0.102	0.118

ECN: X15-0003-Rev. A, 19-Jan-15
DWG: 6031

Notes

- M^* = 0.052 inches to 0.064 inches (dimension including protrusion), heatsink hole for HVM
- Outline conforms to JEDEC® outline TO-220AB with exception of dimension F



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