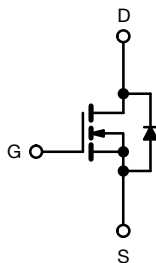
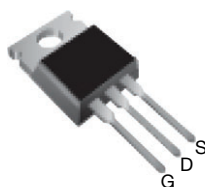


D Series Power MOSFET

TO-220AB


N-Channel MOSFET

PRODUCT SUMMARY

V_{DS} (V) at T_J max.	450	
$R_{DS(on)}$ max. (Ω) at 25 °C	$V_{GS} = 10$ V	1.0
Q_g max. (nC)	18	
Q_{gs} (nC)	3	
Q_{gd} (nC)	4	
Configuration	Single	

FEATURES

- Optimal design
 - Low area specific on-resistance
 - Low input capacitance (C_{iss})
 - Reduced capacitive switching losses
 - High body diode ruggedness
 - Avalanche energy rated (UIS)
- Optimal efficiency and operation
 - Low cost
 - Simple gate drive circuitry
 - Low figure-of-merit (FOM): $R_{on} \times Q_g$
 - Fast switching
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

APPLICATIONS

- Consumer electronics
 - Displays (LCD or plasma TV)
- Server and telecom power supplies
 - SMPS
- Industrial
 - Welding
 - Induction heating
- Motor drives
- Battery chargers



RoHS*
Available
HALOGEN
FREE
Available

ORDERING INFORMATION

Package	TO-220AB
Lead (Pb)-free	SiHP6N40D-E3
Lead (Pb)-free and halogen-free	SiHP6N40D-BE3
	SiHP6N40D-GE3

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

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	V_{DS}	400	V
Gate-source voltage	V_{GS}	± 30	
Gate-source voltage AC ($f > 1$ Hz)		30	
Continuous drain current ($T_J = 150$ °C)	I_D	6	A
		4	
Pulsed drain current ^a	I_{DM}	13	
Linear derating factor		0.8	W/°C
Single pulse avalanche energy ^b	E_{AS}	104	mJ
Maximum power dissipation	P_D	104	W
Operating junction and storage temperature range	T_J, T_{stg}	-55 to +150	°C
Drain-source voltage slope	dV/dt	24	V/ns
Reverse diode dV/dt ^d		0.48	
Soldering recommendations (peak temperature) ^c	For 10 s	300	°C

Notes

- Repetitive rating; pulse width limited by maximum junction temperature
- $V_{DD} = 50$ V, starting $T_J = 25$ °C, $L = 2.3$ mH, $R_g = 25$ Ω , $I_{AS} = 9.5$ A
- 1.6 mm from case
- $I_{SD} \leq I_D$, starting $T_J = 25$ °C

**THERMAL RESISTANCE RATINGS**

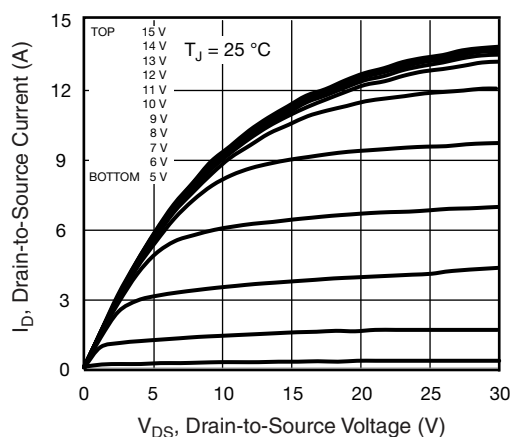
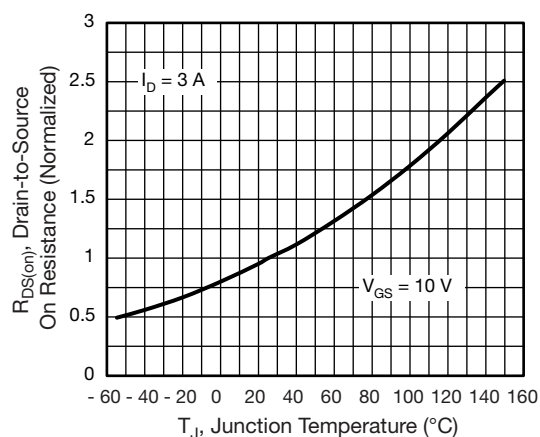
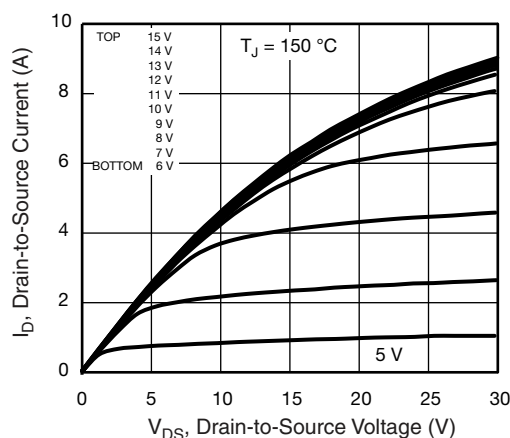
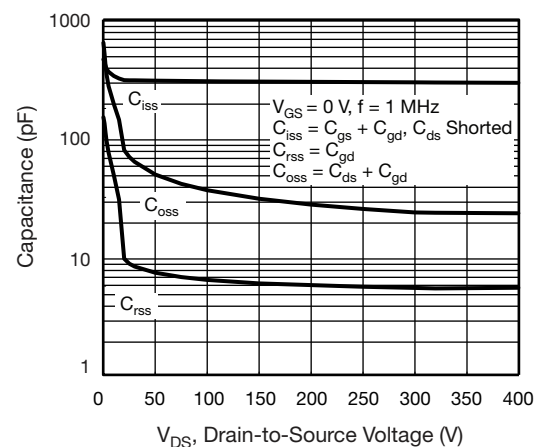
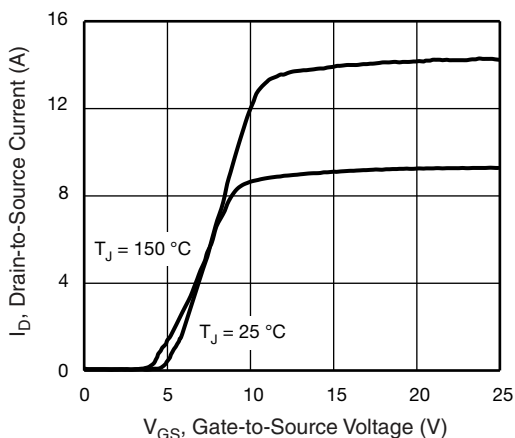
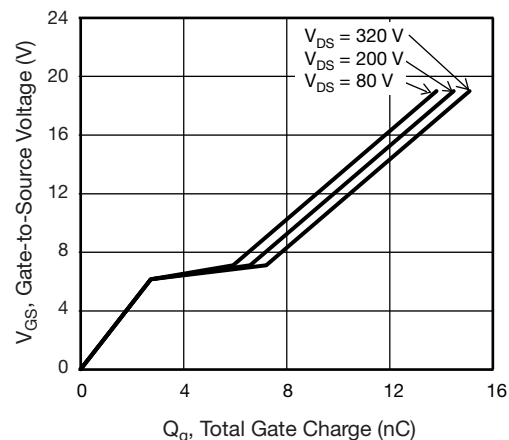
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	R_{thJA}	-	62	°C/W
Maximum junction-to-case (drain)	R_{thJC}	-	1.2	

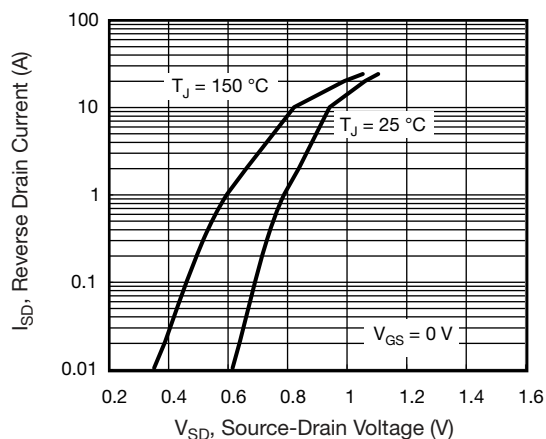
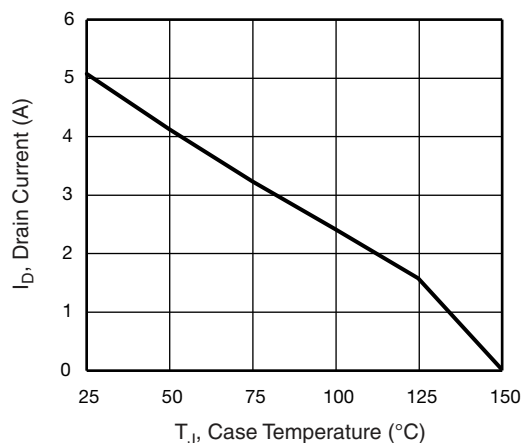
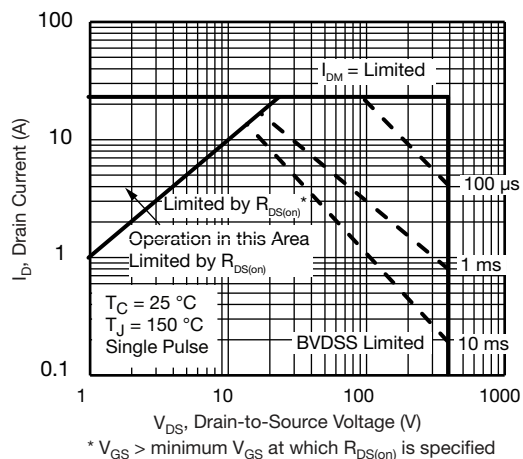
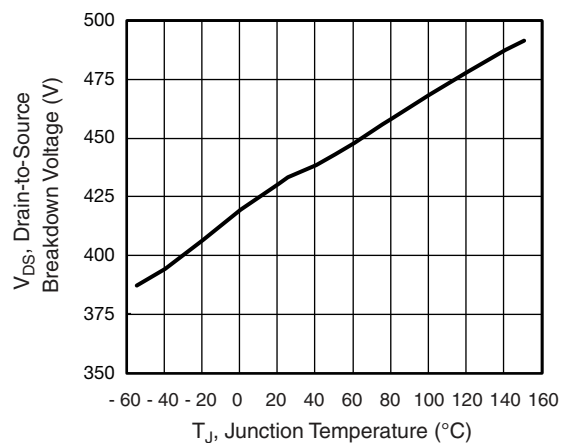
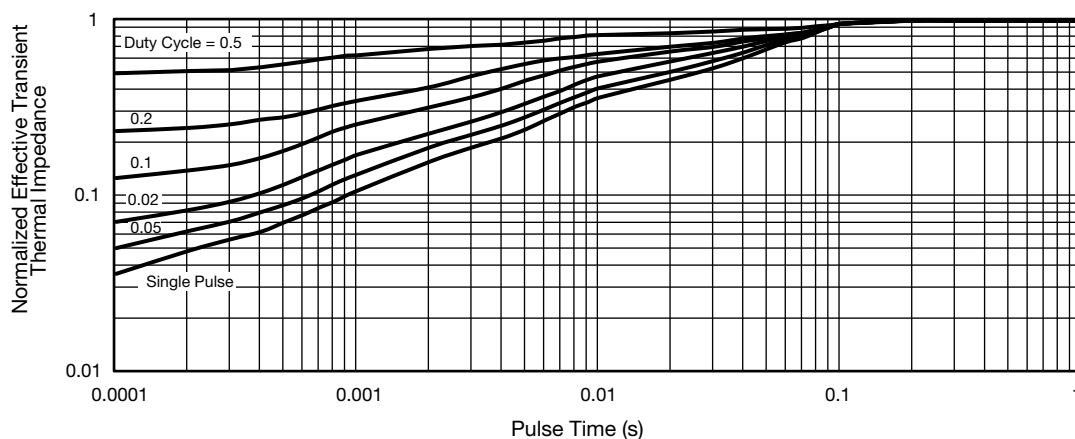
SPECIFICATIONS ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

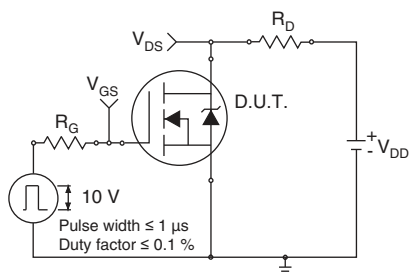
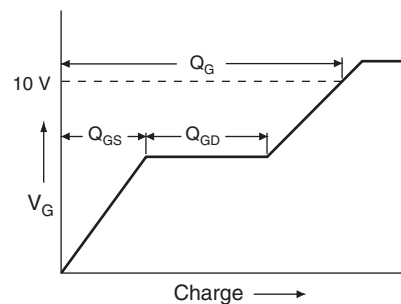
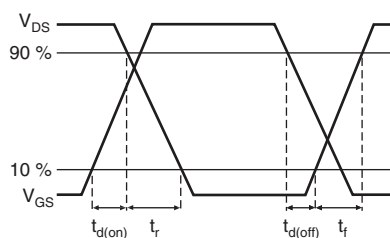
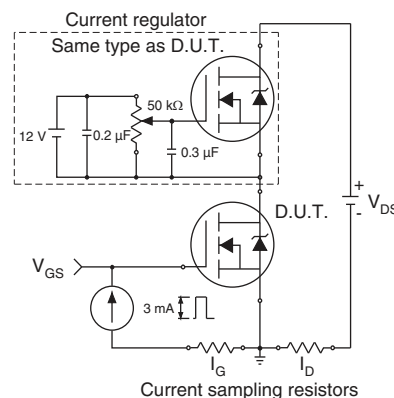
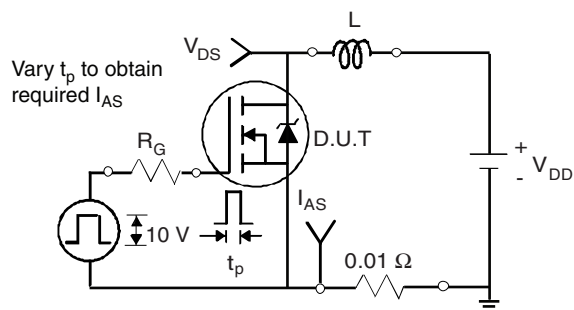
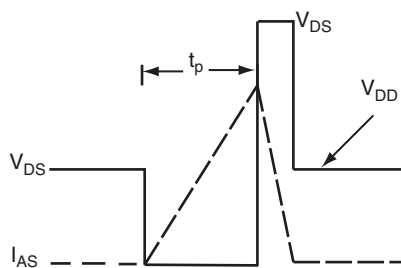
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-source breakdown voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA		400	-	-	V
V _{DS} temperature coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 250 μA		-	0.53	-	V/°C
Gate-source threshold Voltage (N)	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		3	-	5	V
Gate-source leakage	I _{GSS}	V _{GS} = ± 30 V		-	-	± 100	nA
Zero gate voltage drain current	I _{DSS}	V _{DS} = 400 V, V _{GS} = 0 V		-	-	1	μA
		V _{DS} = 320 V, V _{GS} = 0 V, T _J = 125 °C		-	-	10	
Drain-source on-state resistance	R _{DS(on)}	V _{GS} = 10 V	I _D = 3 A	-	0.85	1.0	Ω
Forward transconductance	g _{fs}	V _{DS} = 50 V, I _D = 3 A		-	1.7	-	S
Dynamic							
Input capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 100 V, f = 1 MHz		-	311	-	pF
Output capacitance	C _{oss}			-	38	-	
Reverse transfer capacitance	C _{rss}			-	7	-	
Effective output capacitance, energy related ^a	C _{o(er)}	V _{GS} = 0 V, V _{DS} = 0 V to 320 V		-	44	-	
Effective output capacitance, time related ^b	C _{o(tr)}			-	54	-	
Total gate charge	Q _g	V _{GS} = 10 V	I _D = 3 A, V _{DS} = 320 V	-	9	18	nC
Gate-source charge	Q _{gs}			-	3	-	
Gate-drain charge	Q _{gd}			-	4	-	
Turn-on delay time	t _{d(on)}	V _{DD} = 400 V, I _D = 3 A, V _{GS} = 10 V, R _g = 9.1 Ω		-	12	24	ns
Rise time	t _r			-	11	22	
Turn-off delay time	t _{d(off)}			-	14	28	
Fall time	t _f			-	8	16	
Gate input resistance	R _g	f = 1 MHz, open drain		1.0	1.9	3.8	Ω
Drain-Source Body Diode Characteristics							
Continuous source-drain diode current	I _S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	6	A
Pulsed diode forward current	I _{SM}			-	-	24	
Diode forward voltage	V _{SD}	T _J = 25 °C, I _S = 3 A, V _{GS} = 0 V		-	-	1.2	V
Reverse recovery time	t _{rr}	T _J = 25 °C, I _F = I _S = 3 A, dI/dt = 100 A/μs, V _R = 20 V		-	236	-	ns
Reverse recovery charge	Q _{rr}			-	1.1	-	μC
Reverse recovery current	I _{RRM}			-	9	-	A

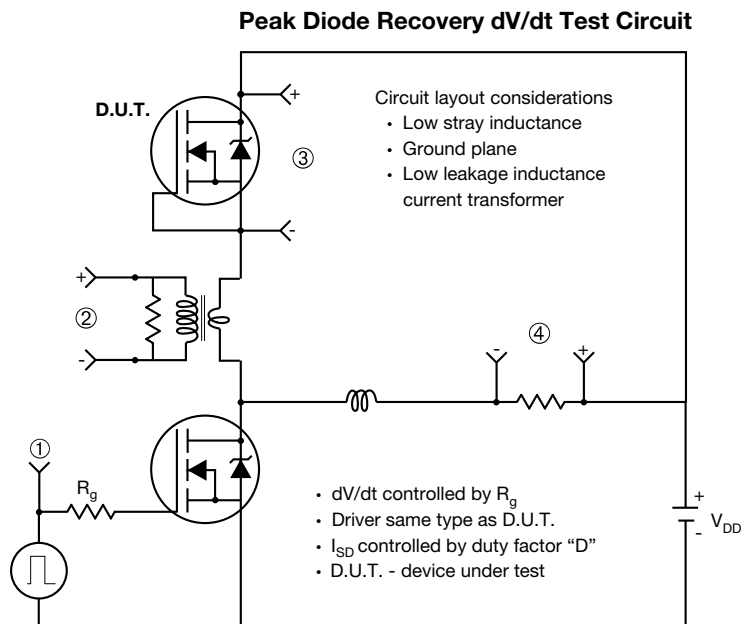
Notes

- a. $C_{oss(er)}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS}
b. $C_{oss(tr)}$ 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

Fig. 4 - Normalized On-Resistance vs. Temperature

Fig. 2 - Typical Output Characteristics

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 - Temperature vs. Drain-to-Source 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

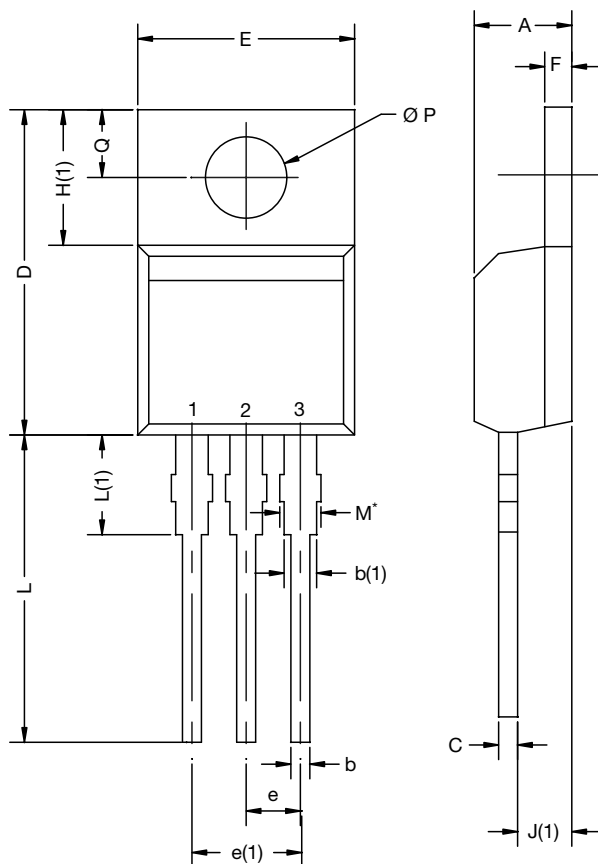

Note

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	4.24	4.65	0.167	0.183
b	0.69	1.02	0.027	0.040
b(1)	1.14	1.78	0.045	0.070
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	1.14	1.40	0.045	0.055
H(1)	6.10	6.71	0.240	0.264
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	2.54	3.00	0.100	0.118

ECN: E21-0621-Rev. D, 04-Nov-2021
DWG: 6031

Note

- M^* = 0.052 inches to 0.064 inches (dimension including protrusion), heatsink hole for HVM



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