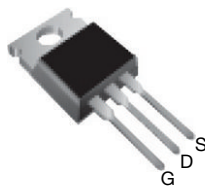


E Series Power MOSFET

TO-220AB


N-Channel MOSFET

FEATURES

- A specific on resistance ($m\Omega\text{-cm}^2$) reduction of 25 %
- Low figure-of-merit (FOM) $R_{DS(on)} \times Q_g$
- Low input capacitance (C_{iss})
- Reduced switching and conduction losses
- Ultra low gate charge (Q_g)
- Avalanche energy rated (UIS)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE
Available

APPLICATIONS

- Power factor correction power supplies (PFC)
- Hard switching PWM stages
- Computing
 - Switch mode power supplies (SMPS)
- Lighting
 - Light emitting diode (LED)
 - High intensity discharge (HID)
- Telecom
 - Server power supplies
- Renewable energy
 - Photovoltaic inverters
- Industrial
 - Welding
 - Induction heating
 - Motor drives
 - Battery chargers
 - Uninterruptable power supplies

PRODUCT SUMMARY

V_{DS} (V) at T_J max.	650	
$R_{DS(on)}$ typ. (Ω) at 25 °C	$V_{GS} = 10$ V	0.082
Q_g max. (nC)	132	
Q_{gs} (nC)	22	
Q_{gd} (nC)	46	
Configuration	Single	

ORDERING INFORMATION

Package	TO-220AB
Lead (Pb)-free and halogen-free	SiHP35N60E-BE3 ^a
	SiHP35N60E-GE3

Note

a. "-BE3" denotes alternate manufacturing location

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 ($T_J = 150\text{ }^{\circ}\text{C}$)	V_{GS} at 10 V	$T_C = 25\text{ }^{\circ}\text{C}$	I_D	32	A
		$T_C = 100\text{ }^{\circ}\text{C}$		20	
Pulsed drain current ^a			I_{DM}	80	
Linear derating factor				2	W/ $^{\circ}\text{C}$
Single pulse avalanche energy ^b			E_{AS}	691	mJ
Maximum power dissipation			P_D	250	W
Operating junction and storage temperature range			T_J, T_{stg}	-55 to +150	$^{\circ}\text{C}$
Drain-source voltage slope	$T_J = 125\text{ }^{\circ}\text{C}$		dV/dt	57	V/ns
Reverse diode dV/dt ^d				31	
Soldering recommendations (peak temperature) ^c	For 10 s			300	$^{\circ}\text{C}$

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature
 b. $V_{DD} = 140$ 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/ μ s, starting $T_J = 25$ °C

**THERMAL RESISTANCE RATINGS**

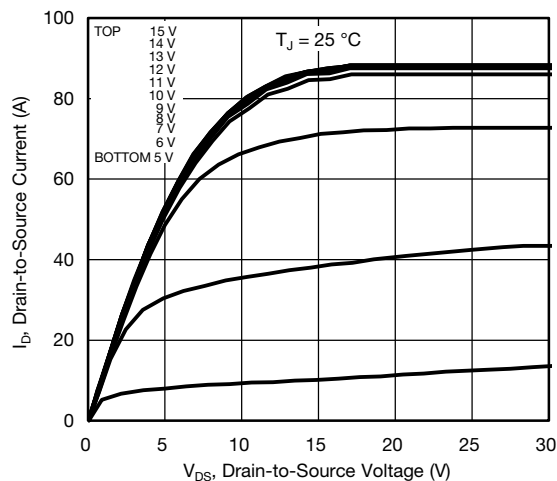
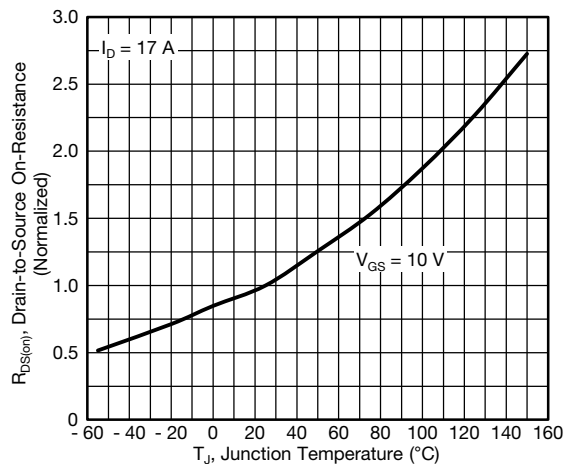
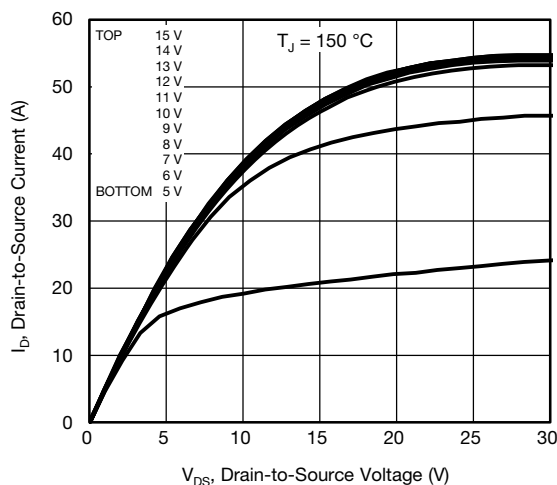
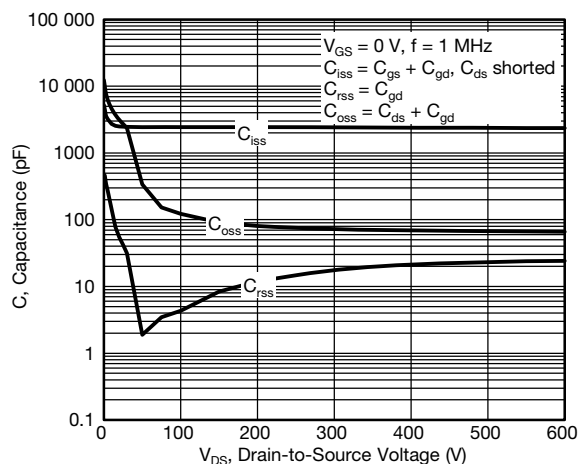
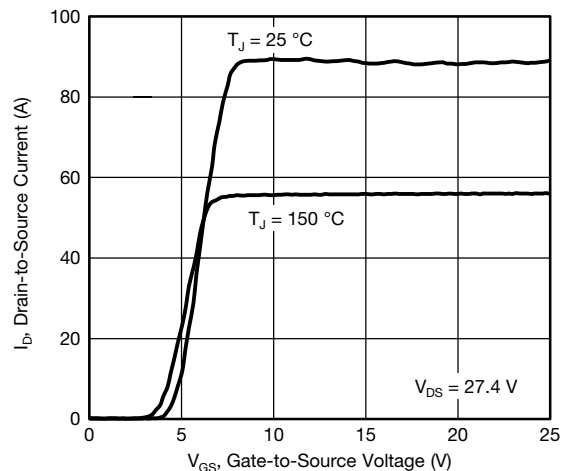
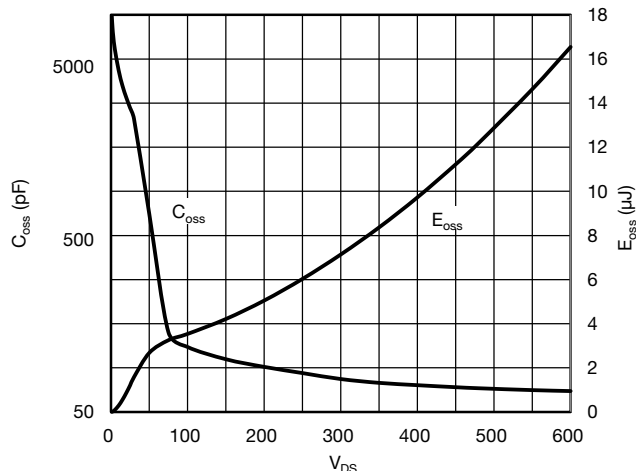
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	R_{thJA}	-	62	°C/W
Maximum junction-to-case (drain)	R_{thJC}	-	0.5	

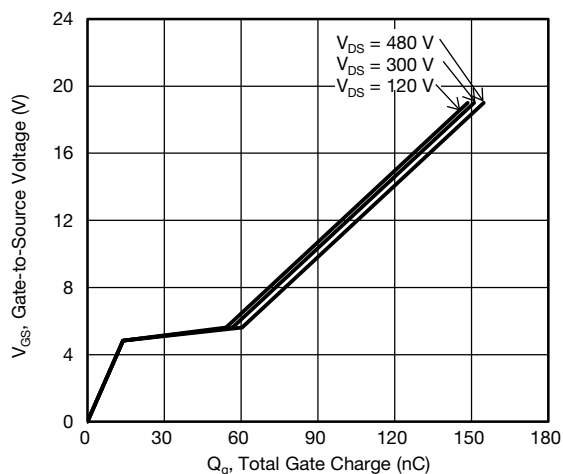
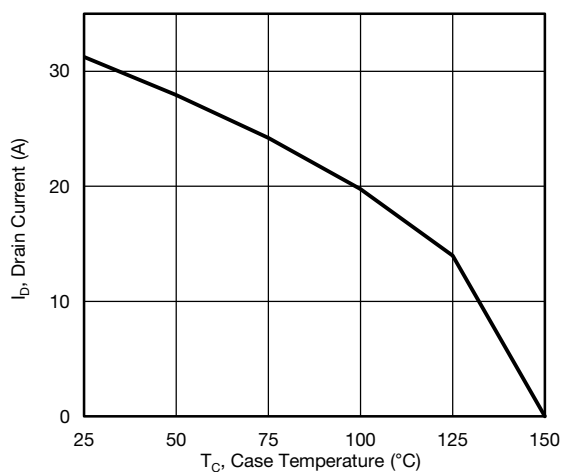
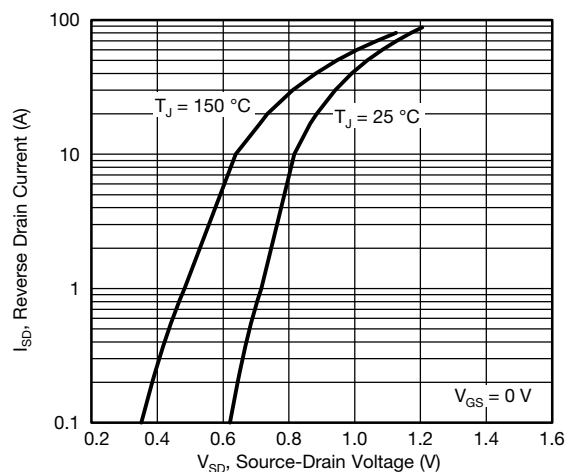
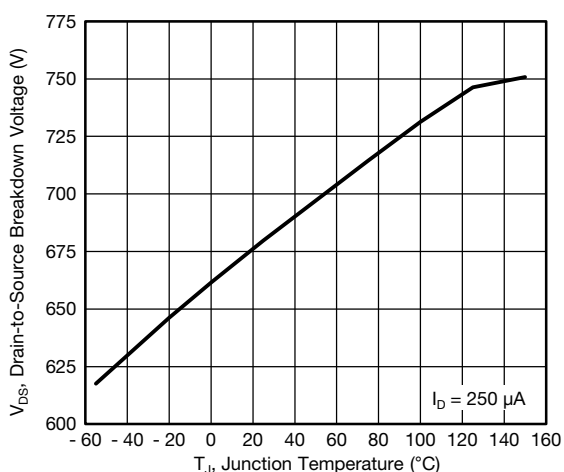
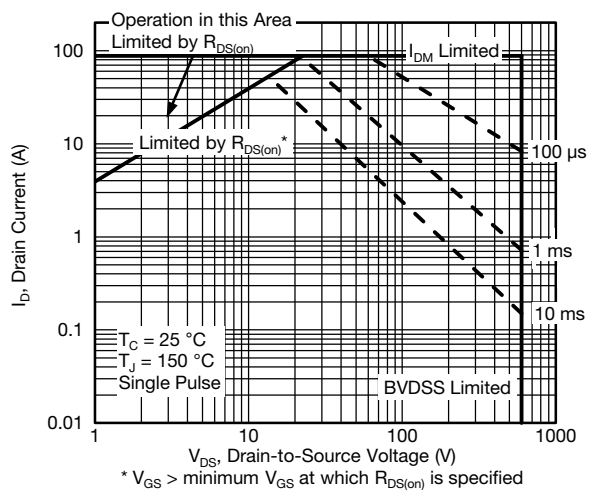
SPECIFICATIONS ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

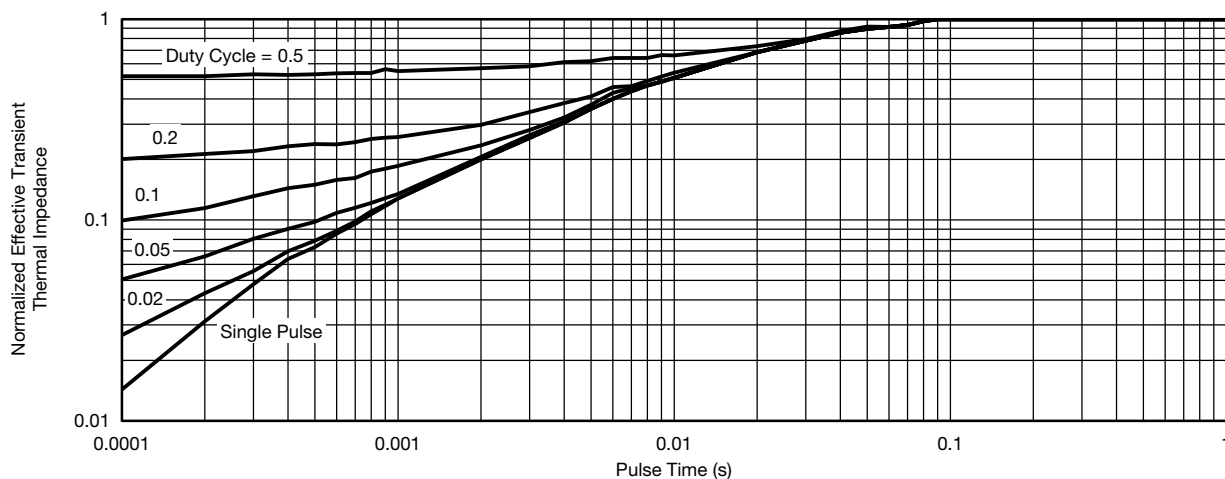
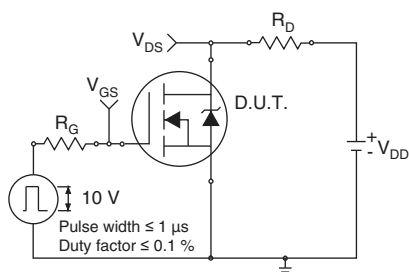
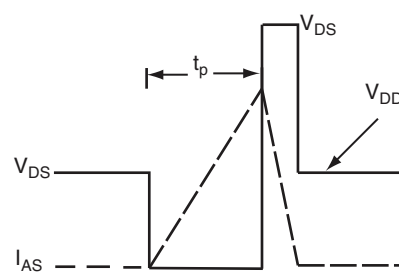
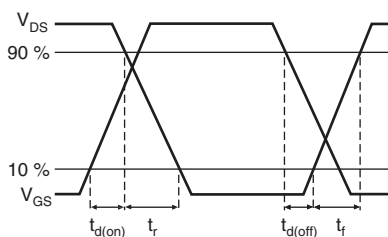
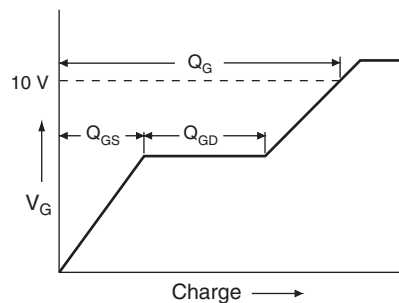
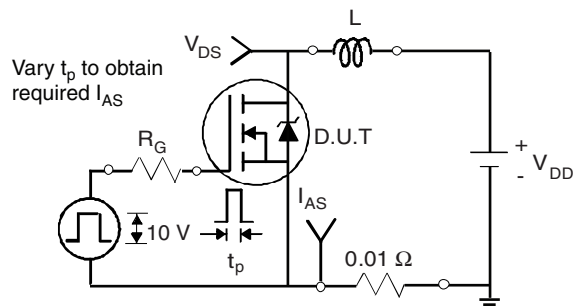
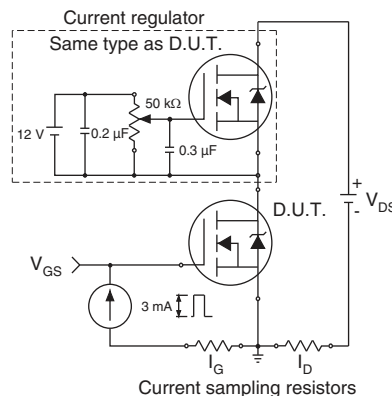
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-source breakdown voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA		600	-	-	V
V _{DS} temperature coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 1 mA		-	0.70	-	V/°C
Gate-source threshold Voltage (N)	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		2	-	4	V
Gate-source leakage	I _{GSS}	V _{GS} = ± 20 V		-	-	± 100	nA
		V _{GS} = ± 30 V		-	-	± 1	μA
Zero gate voltage drain current	I _{DSS}	V _{DS} = 600 V, V _{GS} = 0 V		-	-	1	μA
		V _{DS} = 480 V, V _{GS} = 0 V, T _J = 125 °C		-	-	25	
Drain-source on-state resistance	R _{DS(on)}	V _{GS} = 10 V	I _D = 17 A	-	0.082	0.094	Ω
Forward transconductance	g _{fs}	V _{DS} = 30 V, I _D = 17 A		-	13	-	S
Dynamic							
Input capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 100 V, f = 1 MHz		-	2760	-	pF
Output capacitance	C _{oss}			-	118	-	
Reverse transfer capacitance	C _{rss}			-	5	-	
Effective output capacitance, energy related ^a	C _{o(er)}	V _{DS} = 0 V to 480 V, V _{GS} = 0 V		-	118	-	
Effective output capacitance, time related ^b	C _{o(tr)}			-	429	-	
Total gate charge	Q _g	V _{GS} = 10 V	I _D = 17 A, V _{DS} = 480 V	-	88	132	nC
Gate-source charge	Q _{gs}			-	22	-	
Gate-drain charge	Q _{gd}			-	46	-	
Turn-on delay time	t _{d(on)}	V _{DD} = 480 V, I _D = 17 A, V _{GS} = 10 V, R _g = 9.1 Ω		-	29	58	ns
Rise time	t _r			-	61	92	
Turn-off delay time	t _{d(off)}			-	78	117	
Fall time	t _f			-	32	64	
Gate input resistance	R _g	f = 1 MHz, open drain		0.25	0.5	1	Ω
Drain-Source Body Diode Characteristics							
Continuous source-drain diode current	I _S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	32	A
Pulsed diode forward current	I _{SM}			-	-	80	
Diode forward voltage	V _{SD}	T _J = 25 °C, I _S = 17 A, V _{GS} = 0 V		-	0.9	1.2	V
Reverse recovery time	t _{rr}	T _J = 25 °C, I _F = I _S = 17 A, dI/dt = 100 A/μs, V _R = 25 V		-	455	910	ns
Reverse recovery charge	Q _{rr}			-	8	16	μC
Reverse recovery current	I _{RRM}			-	30	-	A

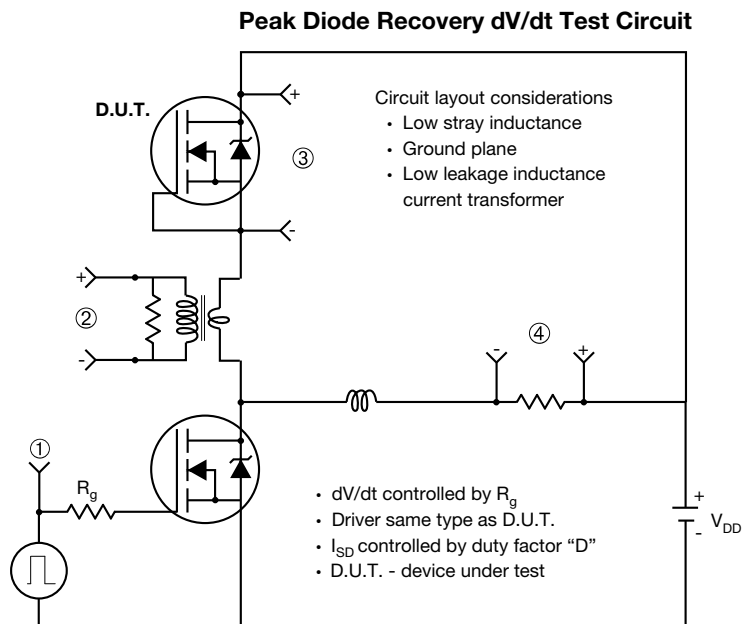
Notes

- 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_{DSS}
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_{DSS}

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 - C_{oss} and E_{oss} vs. V_{DS}


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

Fig. 10 - Maximum Drain Current vs. Case Temperature

Fig. 8 - Typical Source-Drain Diode Forward Voltage

Fig. 11 - Temperature vs. Drain-to-Source Voltage

Fig. 9 - Maximum Safe Operating Area


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case

Fig. 13 - Switching Time Test Circuit

Fig. 16 - Unclamped Inductive Waveforms

Fig. 14 - Switching Time Waveforms

Fig. 17 - Basic Gate Charge Waveform

Fig. 15 - Unclamped Inductive Test Circuit

Fig. 18 - Gate Charge Test Circuit


Note

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

Fig. 19 - For N-Channel

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