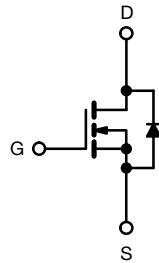
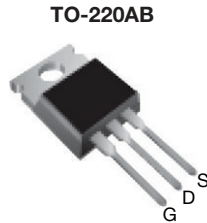


## E Series Power MOSFET With Fast Body Diode and Low Gate Charge



N-Channel MOSFET

**FEATURES**

- Reduced figure-of-merit (FOM):  $R_{on} \times Q_g$
- Fast body diode MOSFET using E series technology
- Reduced  $t_{rr}$ ,  $Q_{rr}$ , and  $I_{RRM}$
- Increased robustness due to low  $Q_{rr}$
- Low input capacitance ( $C_{iss}$ )
- Reduced switching and conduction losses
- Avalanche energy rated (UIS)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
 COMPLIANT  
 HALOGEN  
**FREE**  
 Available

PRODUCT SUMMARY		
$V_{DS}$ (V) at $T_J$ max.	650	
$R_{DS(on)}$ typ. ( $\Omega$ ) at 25 °C	$V_{GS} = 10$ V	0.127
$Q_g$ (Max.) (nC)	75	
$Q_{gs}$ (nC)	17	
$Q_{gd}$ (nC)	19	
Configuration	Single	

**APPLICATIONS**

- Telecommunications
  - Server and telecom power supplies
- Computing
  - ATX power supplies
- Industrial
  - Welding
  - Induction heating
  - Battery chargers
  - Uninterruptible power supplies (UPS)
- Renewable energy
  - String PV inverters

ORDERING INFORMATION	
Package	TO-220AB
Lead (Pb)-free and halogen-free	SiHP25N60EFL-BE3 <sup>a</sup>
	SiHP25N60EFL-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	$V_{GS}$		$\pm 30$	
Continuous drain current ( $T_J = 150$ °C)	$V_{GS}$ at 10 V	$T_C = 25$ °C	25	A
		$T_C = 100$ °C	16	
Pulsed drain current <sup>a</sup>	$I_{DM}$		61	
Linear derating factor			2	W/°C
Single pulse avalanche energy <sup>b</sup>	$E_{AS}$		353	mJ
Maximum power dissipation	$P_D$		250	W
Operating junction and storage temperature range	$T_J, T_{stg}$		-55 to +150	°C
Drain-source voltage slope	$T_J = 125$ °C		70	V/ns
Reverse diode dV/dt <sup>d</sup>	$dV/dt$		15	
Soldering recommendations (peak temperature) <sup>c</sup>	For 10 s		300	°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,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 5$  A  
 c. 1.6 mm from case



d.  $I_{SD} \leq I_D$ ,  $di/dt = 100 \text{ A}/\mu\text{s}$ , starting  $T_J = 25 \text{ }^\circ\text{C}$

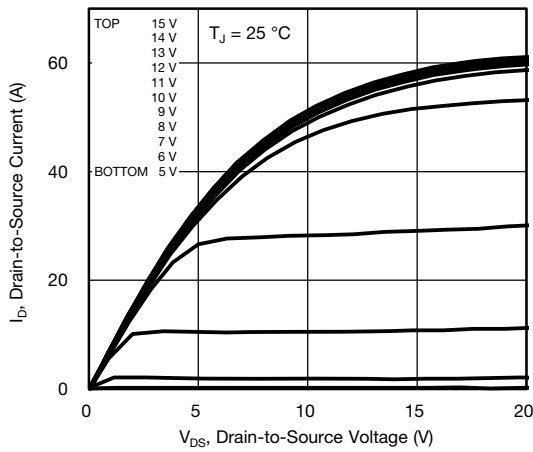
THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	$R_{thJA}$	-	62	°C/W
Maximum junction-to-case (drain)	$R_{thJC}$	-	0.5	

SPECIFICATIONS ( $T_J = 25 \text{ }^\circ\text{C}$ , unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
<b>Static</b>							
Drain-source breakdown voltage	$V_{DS}$	$V_{GS} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$		600	-	-	V
$V_{DS}$ temperature coefficient	$\Delta V_{DS}/T_J$	Reference to $25 \text{ }^\circ\text{C}$ , $I_D = 10 \text{ mA}$		-	0.69	-	V/°C
Gate-source threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = 250 \mu\text{A}$		3.0	-	5.0	V
Gate-source leakage	$I_{GSS}$	$V_{GS} = \pm 20 \text{ V}$		-	-	$\pm 100$	nA
		$V_{GS} = \pm 30 \text{ V}$		-	-	$\pm 1$	$\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 480 \text{ V}$ , $V_{GS} = 0 \text{ V}$		-	-	1	$\mu\text{A}$
		$V_{DS} = 480 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $T_J = 125 \text{ }^\circ\text{C}$		-	-	500	
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 10 \text{ V}$	$I_D = 12.5 \text{ A}$	-	0.127	0.146	$\Omega$
Forward transconductance	$g_{fs}$	$V_{DS} = 30 \text{ V}$ , $I_D = 12.5 \text{ A}$		-	11.3	-	S
<b>Dynamic</b>							
Input capacitance	$C_{iss}$	$V_{GS} = 0 \text{ V}$ , $V_{DS} = 100 \text{ V}$ , $f = 1 \text{ MHz}$		-	2274	-	pF
Output capacitance	$C_{oss}$			-	137	-	
Reverse transfer capacitance	$C_{rss}$			-	4	-	
Effective output capacitance, energy related <sup>a</sup>	$C_{o(er)}$			-	79	-	
Effective output capacitance, time related <sup>b</sup>	$C_{o(tr)}$	$V_{DS} = 0 \text{ V to } 480 \text{ V}$ , $V_{GS} = 0 \text{ V}$		-	330	-	
Total gate charge	$Q_g$	$V_{GS} = 10 \text{ V}$	$I_D = 12.5 \text{ A}$ , $V_{DS} = 480 \text{ V}$	-	50	75	nC
Gate-source charge	$Q_{gs}$			-	17	-	
Gate-drain charge	$Q_{gd}$			-	19	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 480 \text{ V}$ , $I_D = 12.5 \text{ A}$ , $R_g = 9.1 \Omega$ , $V_{GS} = 10 \text{ V}$		-	25	50	ns
Rise time	$t_r$			-	39	68	
Turn-off delay time	$t_{d(off)}$			-	47	94	
Fall time	$t_f$			-	21	42	
Gate input resistance	$R_g$	$f = 1 \text{ MHz}$ , open drain		0.4	0.7	1.4	$\Omega$
<b>Drain-Source Body Diode Characteristics</b>							
Continuous source-drain diode current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	25	A	
Pulsed diode forward current	$I_{SM}$		-	-	61		
Diode forward voltage	$V_{SD}$	$T_J = 25 \text{ }^\circ\text{C}$ , $I_S = 12.5 \text{ A}$ , $V_{GS} = 0 \text{ V}$		-	0.9	1.2	V
Reverse recovery time	$t_{rr}$	$T_J = 25 \text{ }^\circ\text{C}$ , $I_F = I_S = 12.5 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ , $V_R = 25 \text{ V}$		-	138	276	ns
Reverse recovery charge	$Q_{rr}$			-	0.8	1.6	$\mu\text{C}$
Reverse recovery current	$I_{RRM}$			-	11	-	A

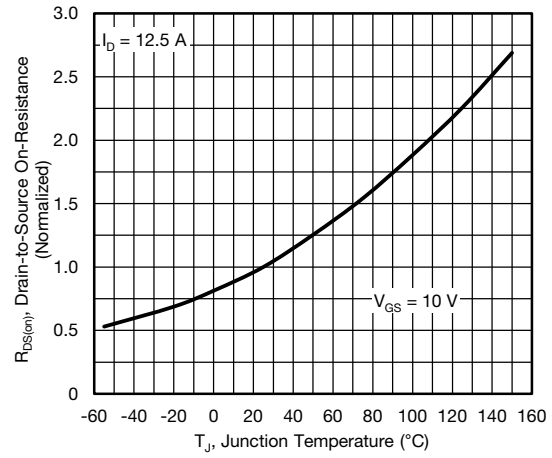
**Notes**

- 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 %  $V_{DSS}$

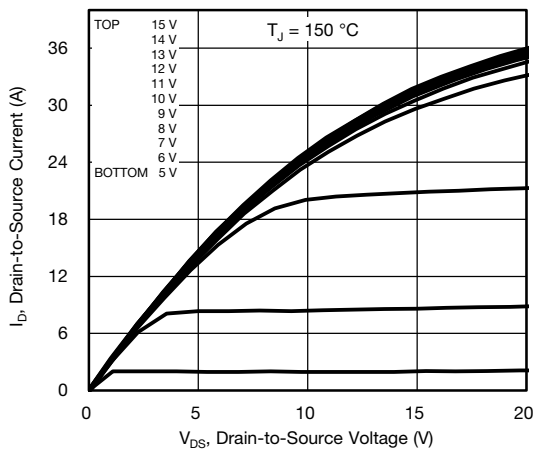
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



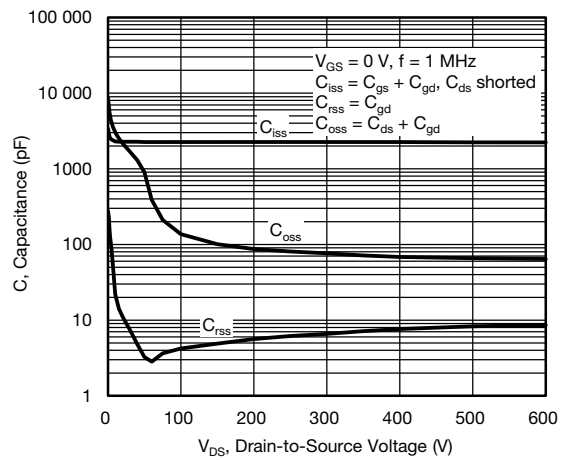
**Fig. 1 - Typical Output Characteristics**



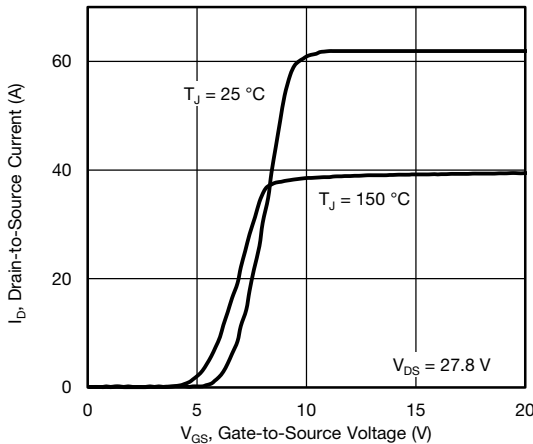
**Fig. 4 - Normalized On-Resistance vs. Temperature**



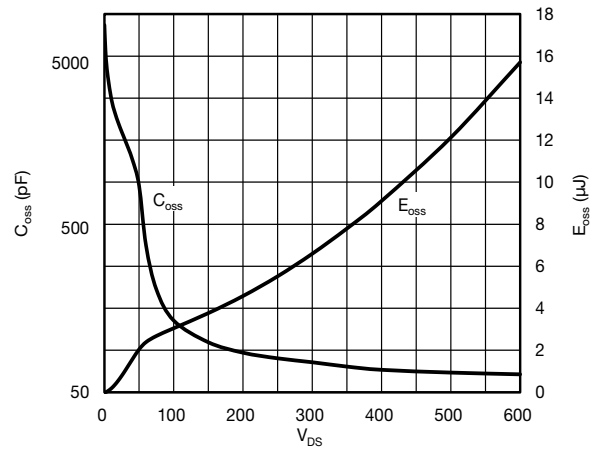
**Fig. 2 - Typical Output Characteristics**



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



**Fig. 3 - Typical Transfer Characteristics**



**Fig. 6 - Coss and Eoss vs. Vds**

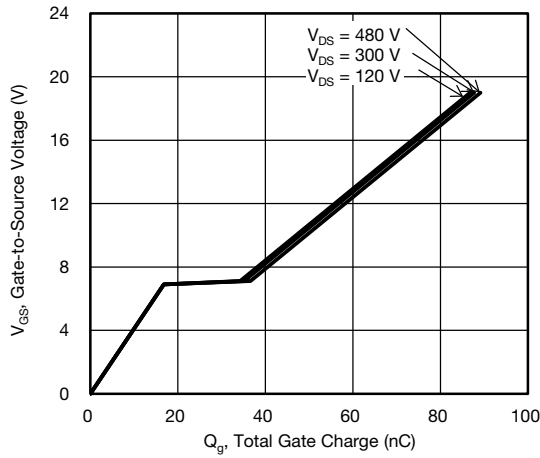


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

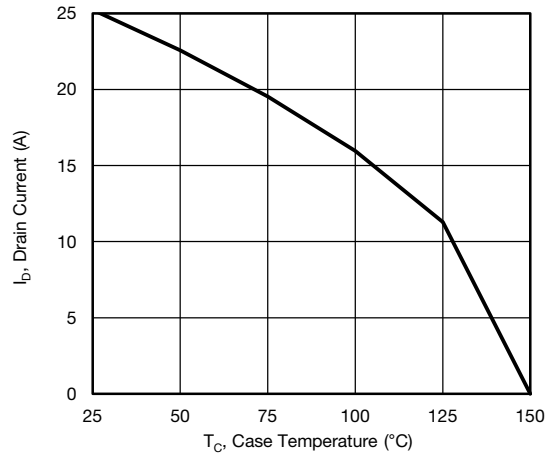


Fig. 10 - Maximum Drain Current vs. Case Temperature

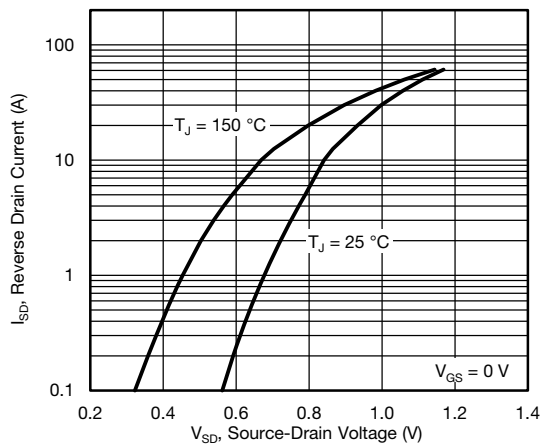


Fig. 8 - Typical Source-Drain Diode Forward Voltage

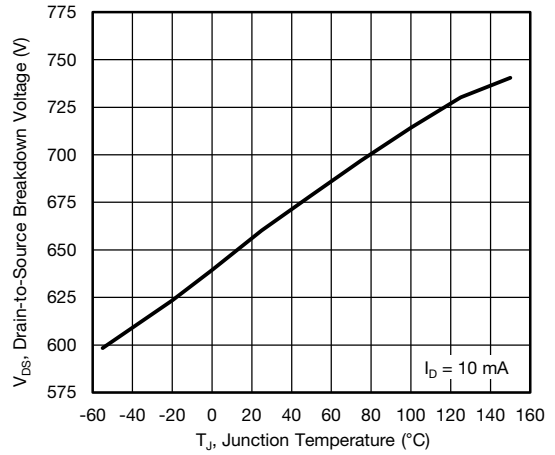


Fig. 11 - Typical Drain-to-Source Voltage vs. Temperature

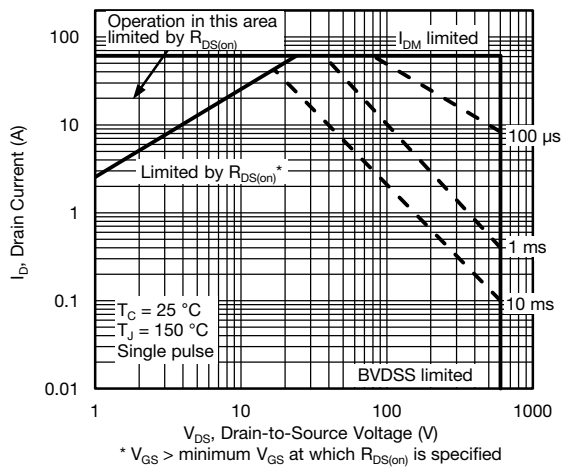


Fig. 9 - Maximum Safe Operating Area

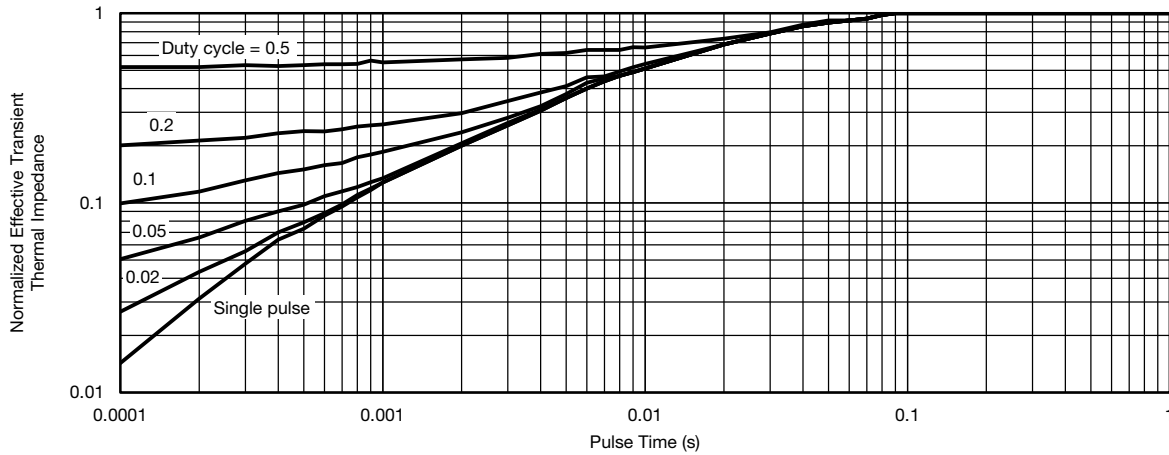


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case

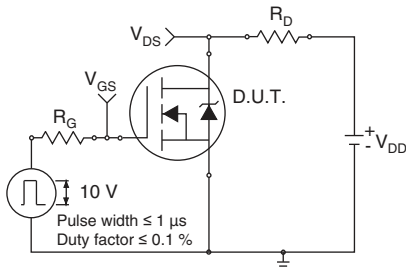


Fig. 13 - Switching Time Test Circuit

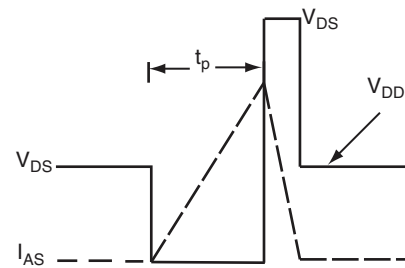


Fig. 16 - Unclamped Inductive Waveforms

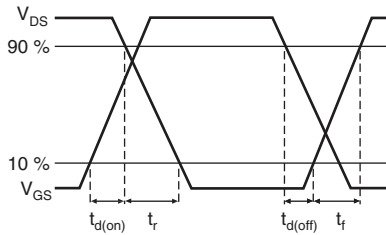


Fig. 14 - Switching Time Waveforms

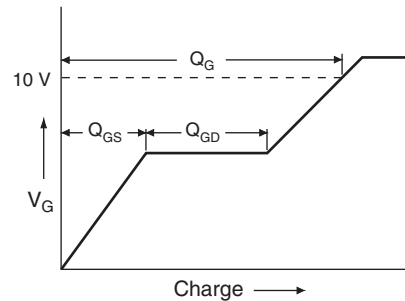


Fig. 17 - Basic Gate Charge Waveform

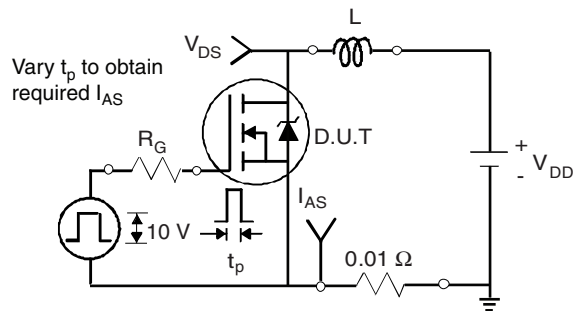


Fig. 15 - Unclamped Inductive Test Circuit

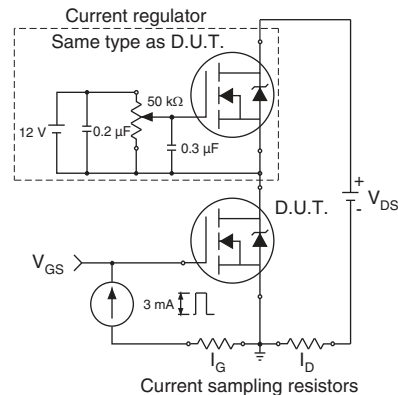
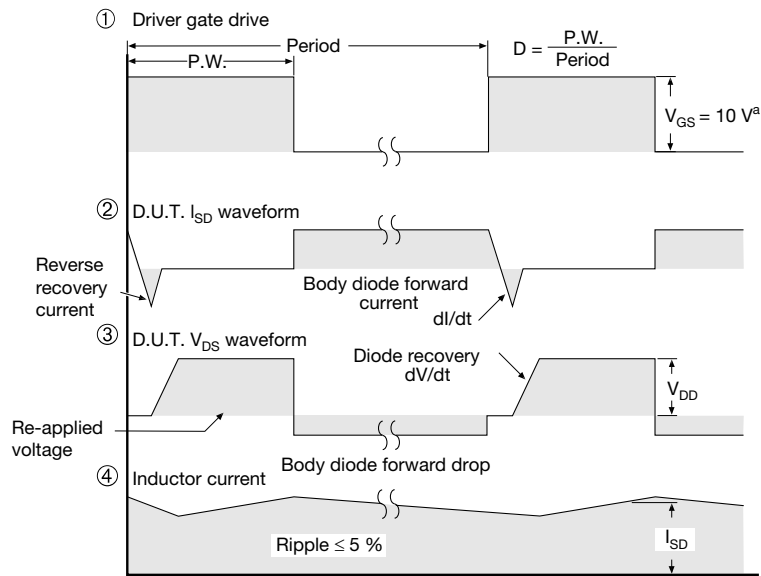
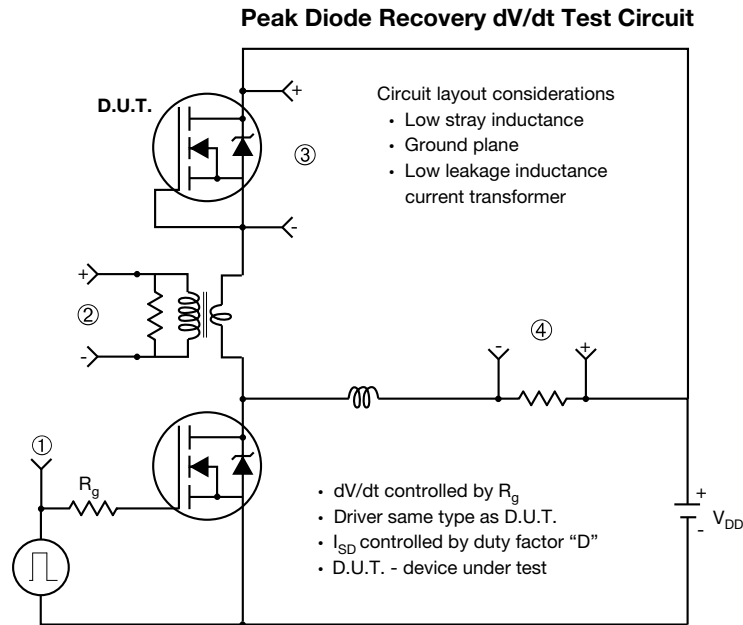


Fig. 18 - Gate Charge Test Circuit



**Note**

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

**Fig. 19 - For N-Channel**

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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
Ø 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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