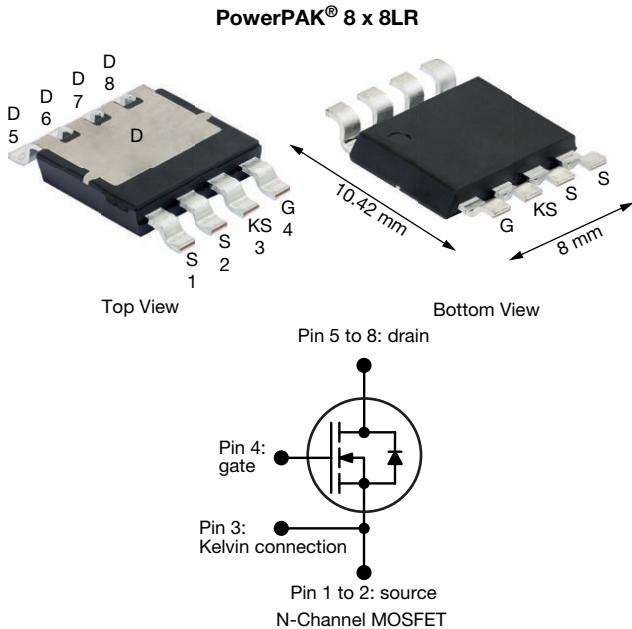


## EF Series Power MOSFET With Fast Body Diode



### FEATURES

- 4<sup>th</sup> generation E series technology
- Low figure of merit (FOM)  $R_{on} \times Q_g$
- Low effective capacitance ( $C_{o(er)}$ )
- 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

### APPLICATIONS

- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- Lighting
  - High-intensity discharge (HID)
  - Fluorescent ballast lighting
- Industrial
  - Welding
  - Induction heating
  - Motor drives
  - Battery chargers
  - Solar (PV inverters)

### PRODUCT SUMMARY

$V_{DS}$ (V) at $T_J$ max.	650	
$R_{DS(on)}$ typ. ( $\Omega$ ) at 25 °C	$V_{GS} = 10$ V	0.110
$Q_g$ max. (nC)	45	
$Q_{gs}$ (nC)	15	
$Q_{gd}$ (nC)	6	
Configuration	Single	

### ORDERING INFORMATION

Package	PowerPAK 8 x 8LR	
Lead (Pb)-free and halogen-free	SiHR120N60EF-T1GE3	

### 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	A
		$T_C = 100$ °C	
Pulsed drain current <sup>a</sup>	$I_{DM}$	46	
Linear derating factor		2.2	W/°C
Single pulse avalanche energy <sup>b</sup>	$E_{AS}$	144	mJ
Maximum power dissipation	$P_D$	278	W
Operating junction and storage temperature range	$T_J, T_{stg}$	-55 to +150	°C
Drain-source voltage slope	$dv/dt$	100	V/ns
		50	

#### Notes

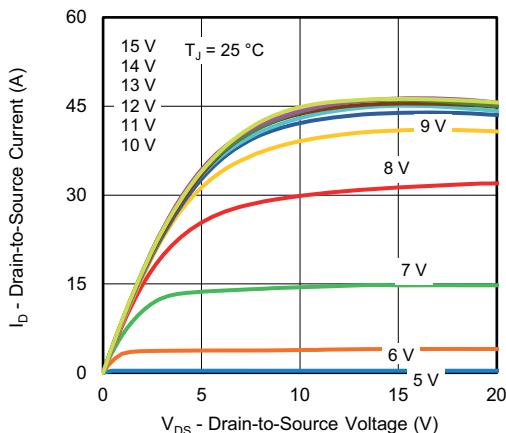
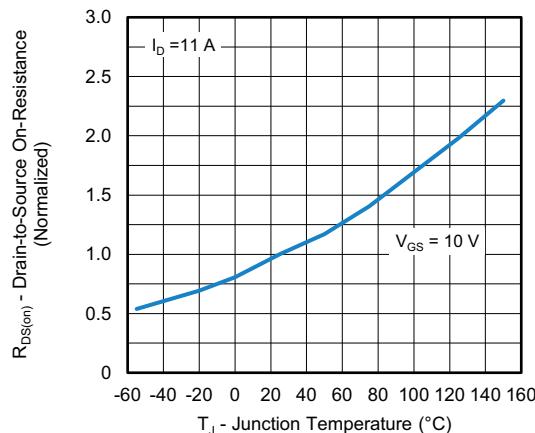
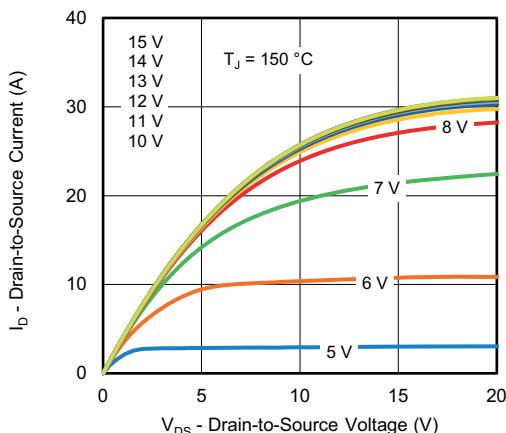
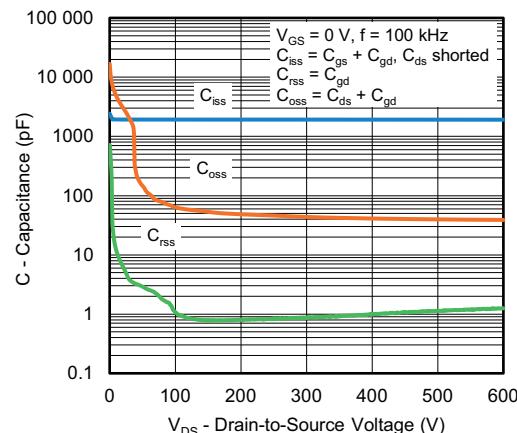
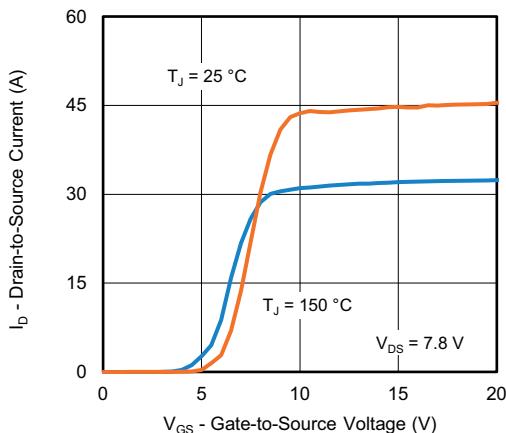
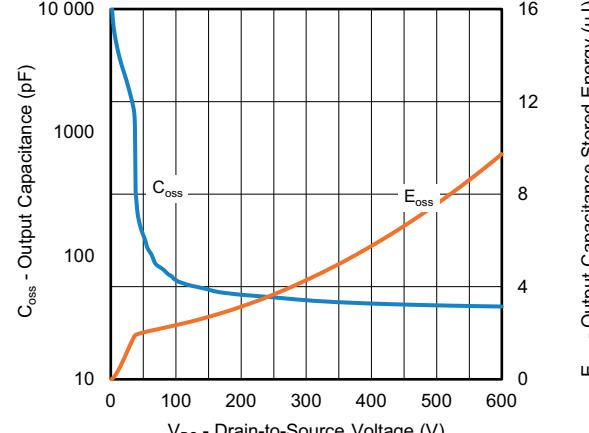
- Repetitive rating; pulse width limited by maximum junction temperature
- $V_{DD} = 120$  V, starting  $T_J = 25$  °C,  $L = 28.2$  mH,  $R_g = 25$  Ω,  $I_{AS} = 3.2$  A
- $I_{SD} \leq I_D$ ,  $di/dt = 100$  A/μs, starting  $T_J = 25$  °C

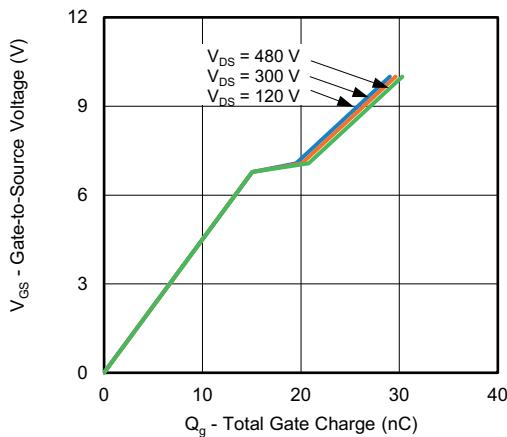
**THERMAL RESISTANCE RATINGS**

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	$R_{thJA}$	-	42	
Maximum junction-to-case (drain)	$R_{thJC}$	-	0.45	°C/W

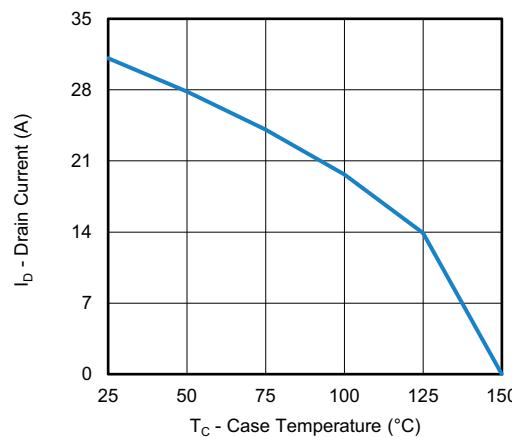
**SPECIFICATIONS (T<sub>J</sub> = 25 °C, unless otherwise noted)**

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
<b>Static</b>							
Drain-source breakdown voltage	$V_{DS}$	$V_{GS} = 0$ V, $I_D = 250$ μA		600	-	-	V
$V_{DS}$ temperature coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, $I_D = 1$ mA		-	0.52	-	V/°C
Gate-source threshold voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = 250$ μA		3.0	-	5.0	V
Gate-source leakage	$I_{GSS}$	$V_{GS} = \pm 20$ V		-	-	± 100	nA
		$V_{GS} = \pm 30$ V		-	-	± 1	μA
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 480$ V, $V_{GS} = 0$ V		-	-	1	μA
		$V_{DS} = 480$ V, $V_{GS} = 0$ V, $T_J = 125$ °C		-	-	2	mA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 10$ V	$I_D = 8$ A	-	0.110	0.125	Ω
Forward transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 8$ V, $I_D = 11$ A		-	10	-	S
<b>Dynamic</b>							
Input capacitance	$C_{iss}$	$V_{GS} = 0$ V, $V_{DS} = 100$ V, $f = 100$ kHz		-	1929	-	pF
Output capacitance	$C_{oss}$			-	67	-	
Reverse transfer capacitance	$C_{rss}$			-	1	-	
Effective output capacitance, energy related <sup>a</sup>	$C_{o(er)}$	$V_{DS} = 0$ V to 400 V, $V_{GS} = 0$ V		-	72	-	
Effective output capacitance, time related <sup>b</sup>	$C_{o(tr)}$			-	434	-	
Total gate charge	$Q_g$	$V_{GS} = 10$ V	$I_D = 11$ A, $V_{DS} = 480$ V	-	30	45	nC
Gate-source charge	$Q_{gs}$			-	15	-	
Gate-drain charge	$Q_{gd}$			-	6	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 480$ V, $I_D = 11$ A, $V_{GS} = 10$ V, $R_g = 9.1$ Ω		-	24	48	ns
Rise time	$t_r$			-	36	72	
Turn-off delay time	$t_{d(off)}$			-	31	62	
Fall time	$t_f$			-	20	40	
Gate input resistance	$R_g$	$f = 1$ MHz		0.3	0.7	1.4	Ω
<b>Drain-Source Body Diode Characteristics</b>							
Continuous source-drain diode current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode		-	-	31	A
Pulsed diode forward current	$I_{SM}$			-	-	46	
Diode forward voltage	$V_{SD}$	$T_J = 25$ °C, $I_S = 11$ A, $V_{GS} = 0$ V		-	-	1.2	V
Reverse recovery time	$t_{rr}$	$T_J = 25$ °C, $I_F = I_S = 11$ A, $di/dt = 100$ A/μs, $V_R = 400$ V		-	131	262	ns
Reverse recovery charge	$Q_{rr}$			-	0.6	1.2	μC
Reverse recovery current	$I_{RRM}$			-	7	-	A

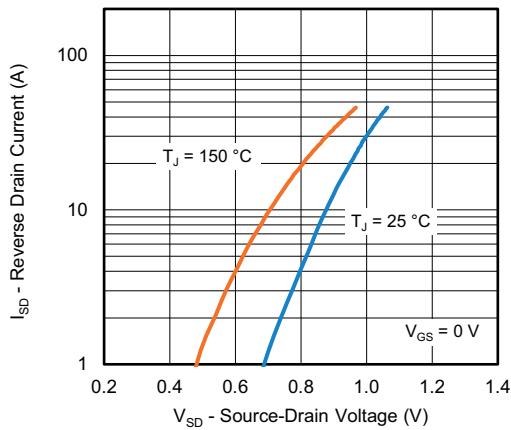
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**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.  $V_{DS}$**



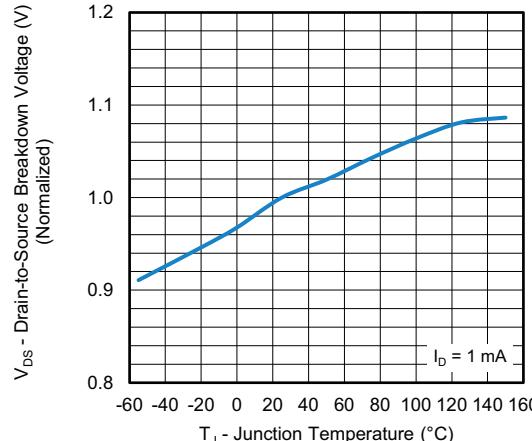
**Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage**



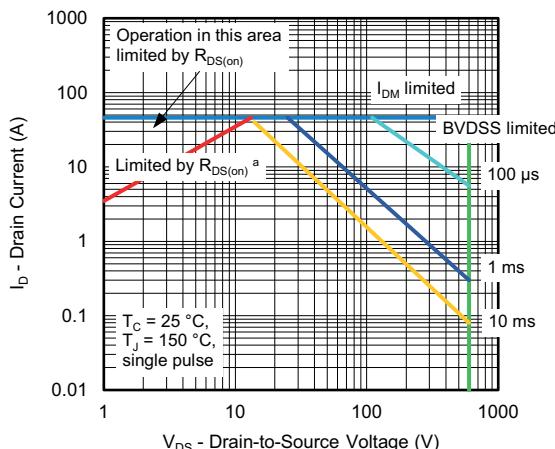
**Fig. 10 - Maximum Drain Current vs. Case Temperature**



**Fig. 8 - Typical Source-Drain Diode Forward Voltage**



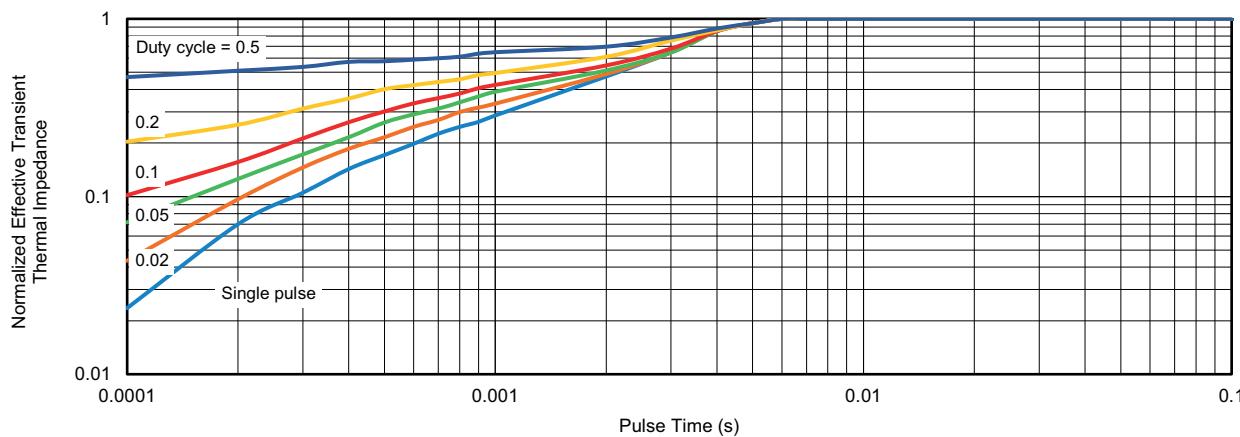
**Fig. 11 - Temperature vs. Drain-to-Source Voltage**



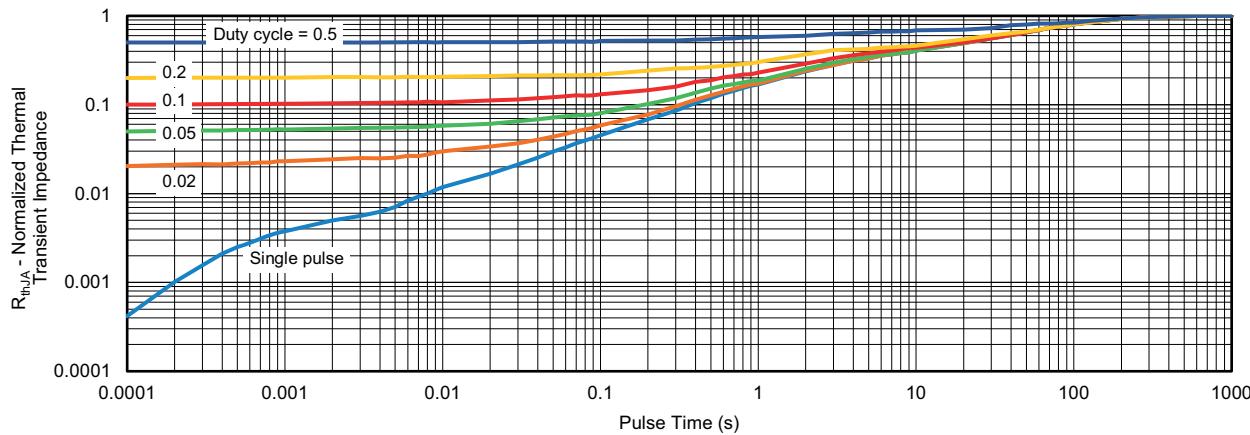
**Fig. 9 - Maximum Safe Operating Area**

**Note**

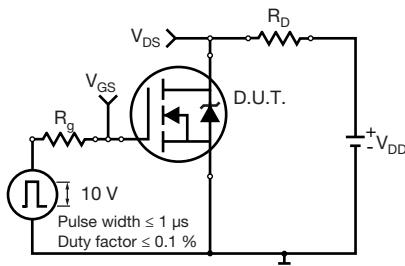
a.  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified



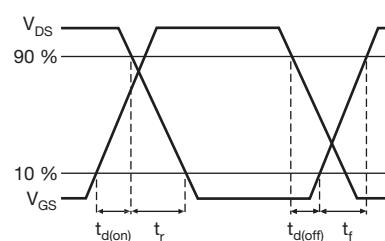
**Fig. 12 - Normalized Transient Thermal Impedance, Junction-to-Case**



**Fig. 13 - Normalized Transient Thermal Impedance, Junction-to-Ambient**



**Fig. 14 - Switching Time Test Circuit**



**Fig. 15 - Switching Time Waveforms**

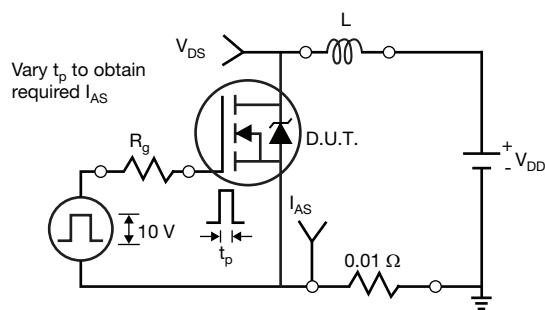


Fig. 16 - Unclamped Inductive Test Circuit

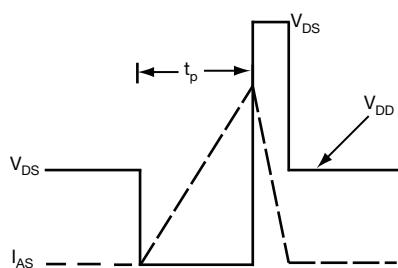


Fig. 17 - Unclamped Inductive Waveforms

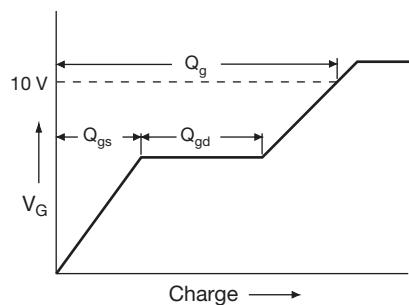


Fig. 18 - Basic Gate Charge Waveform

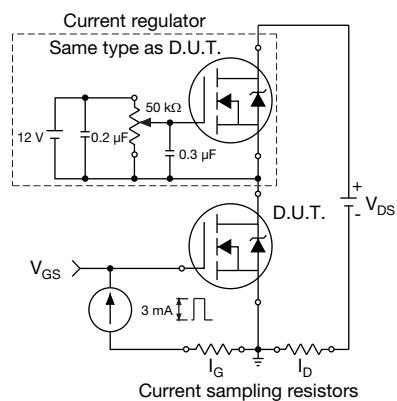
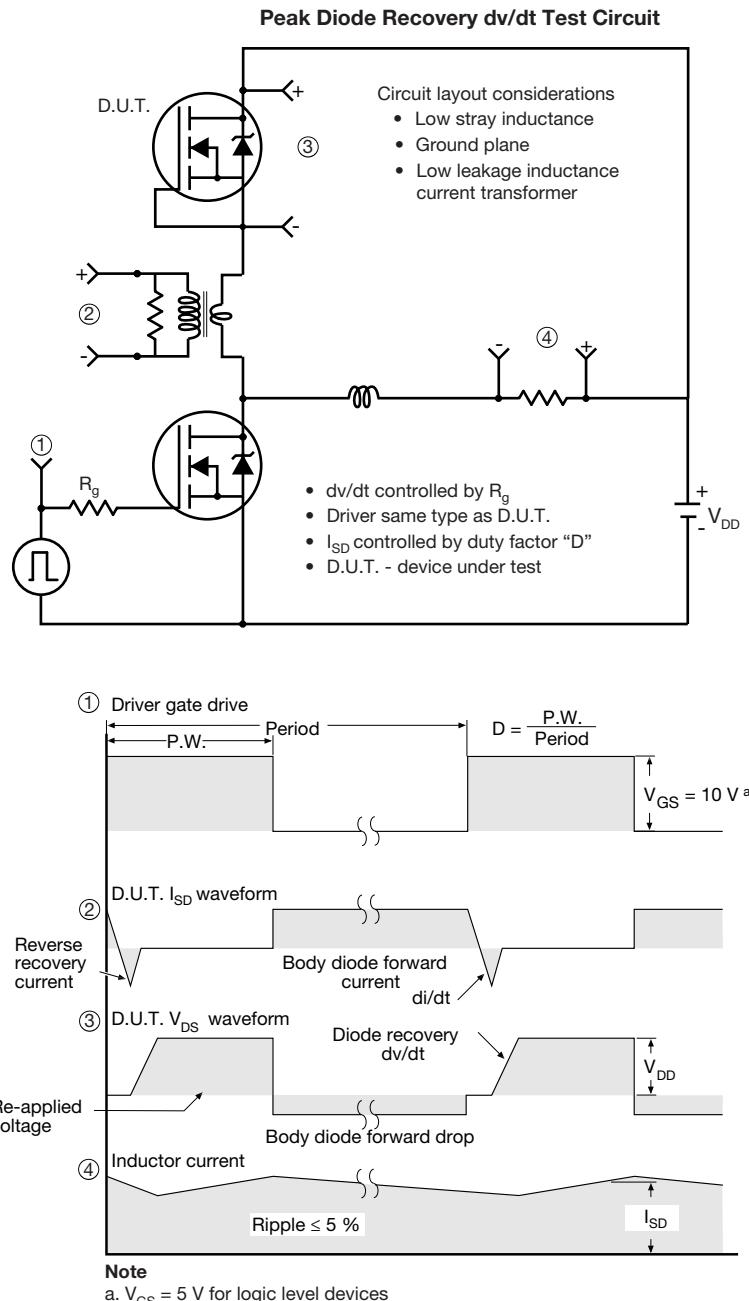


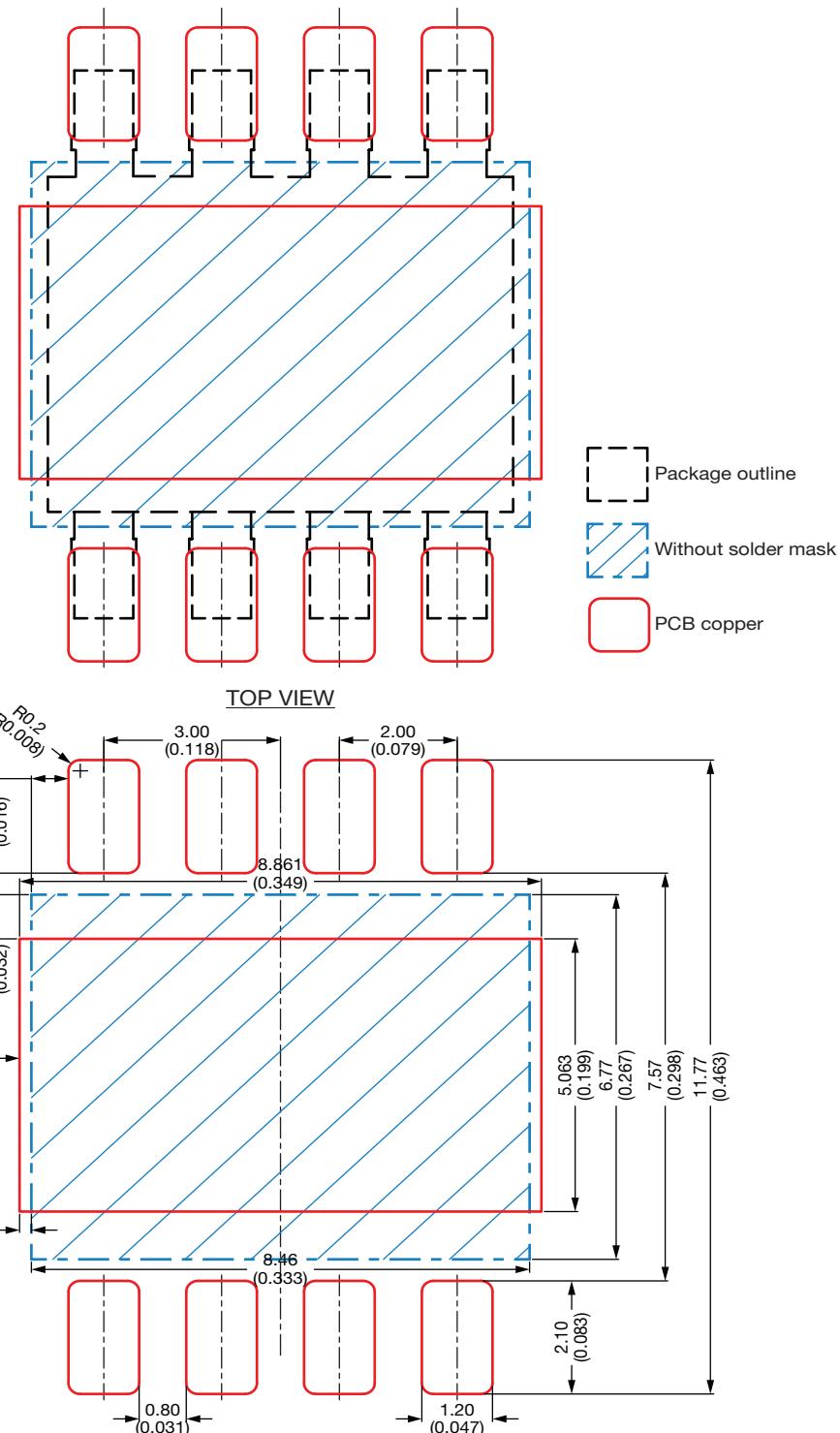
Fig. 19 - Gate Charge Test Circuit



**Fig. 20 - For N-Channel**

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## Recommended Land Pattern PowerPAK® 8 x 8LR


**Notes**

- This land pattern is for reference
- Proposed stencil thickness 200  $\mu\text{m}$
- All dimensions are in millimeter (inches)

ECN: S23-1106-Rev. A, 11-Dec-2023  
DWG: 3022

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