

## W15NK90Z-VB Datasheet

### Super Junction Power MOSFET

#### PRODUCT SUMMARY

$V_{DS}$ (V) at $T_J$ max.	900	
$R_{DS(on)}$ typ. ( $\Omega$ ) at 25 °C	$V_{GS} = 10\text{ V}$	0.27
$Q_g$ max. (nC)	122	
$Q_{gs}$ (nC)	14	
$Q_{gd}$ (nC)	23	
Configuration	Single	

#### FEATURES

- Low figure-of-merit (FOM)  $R_{on} \times Q_g$
- Low input capacitance ( $C_{iss}$ )
- Reduced switching and conduction losses
- Ultra low gate charge ( $Q_g$ )
- Avalanche energy rated (UIS)

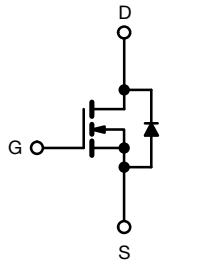
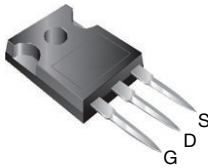


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COMPLIANT  
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#### APPLICATIONS

- 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
  - Renewable energy
  - Solar (PV inverters)

TO-247AC



N-Channel MOSFET

#### ABSOLUTE MAXIMUM RATINGS ( $T_C = 25\text{ °C}$ , unless otherwise noted)

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-source voltage			$V_{DS}$	900	V
Gate-source voltage			$V_{GS}$	$\pm 30$	
Continuous drain current ( $T_J = 150\text{ }^{\circ}\text{C}$ )	$V_{GS}$ at 10 V	$T_C = 25\text{ }^{\circ}\text{C}$	$I_D$	20	A
		$T_C = 100\text{ }^{\circ}\text{C}$		10	
Pulsed drain current <sup>a</sup>			$I_{DM}$	60	
Linear derating factor				1.7	W/ $^{\circ}\text{C}$
Single pulse avalanche energy <sup>b</sup>			$E_{AS}$	383	mJ
Maximum power dissipation			$P_D$	218	W
Operating junction and storage temperature range			$T_J, T_{stg}$	-55 to +150	$^{\circ}\text{C}$
Drain-source voltage slope	$T_J = 125\text{ }^{\circ}\text{C}$		$dV/dt$	70	V/ns
Reverse diode $dV/dt$ <sup>d</sup>		5.1			
Soldering recommendations (peak temperature) <sup>c</sup>	For 10 s			300	$^{\circ}\text{C}$


#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature
- $V_{DD} = 140\text{ V}$ , starting  $T_J = 25\text{ °C}$ ,  $L = 28.2\text{ mH}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 5.0\text{ A}$
- 1.6 mm from case
- $I_{SD} \leq I_D$ ,  $dI/dt = 100\text{ A}/\mu\text{s}$ , starting  $T_J = 25\text{ °C}$

**THERMAL RESISTANCE RATINGS**

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	$R_{thJA}$	-	62	°C/W
Maximum junction-to-case (drain)	$R_{thJC}$	-	0.6	

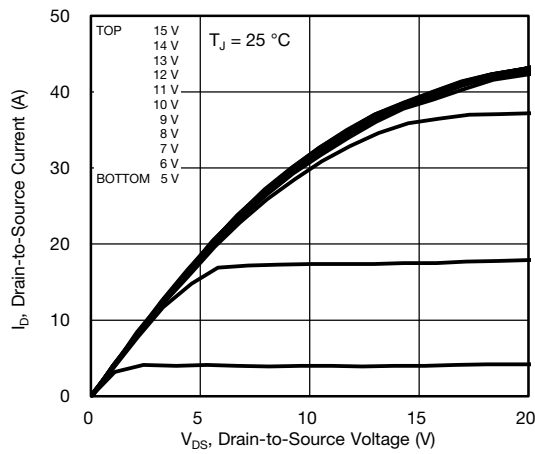
**SPECIFICATIONS** ( $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-source breakdown voltage	$V_{DS}$	$V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$		900	-	-	V
$V_{DS}$ temperature coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^{\circ}\text{C}$ , $I_D = 1\text{ mA}$		-	1.08	-	V/ $^{\circ}\text{C}$
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	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}$		-	-	$\pm 100$	nA
		$V_{GS} = \pm 30\text{ V}$		-	-	$\pm 1$	$\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 800\text{ V}$ , $V_{GS} = 0\text{ V}$		-	-	1	$\mu\text{A}$
		$V_{DS} = 640\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ }^{\circ}\text{C}$		-	-	10	
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 8.5\text{ A}$	-	0.27	-	$\Omega$
Forward transconductance	$g_{fs}$	$V_{DS} = 30\text{ V}$ , $I_D = 8.5\text{ A}$		-	8.7	-	S
Dynamic							
Input capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}$ , $V_{DS} = 100\text{ V}$ , $f = 1\text{ MHz}$		-	2408	-	pF
Output capacitance	$C_{oss}$			-	81	-	
Reverse transfer capacitance	$C_{rss}$			-	9	-	
Effective output capacitance, energy related <sup>a</sup>	$C_{o(er)}$	$V_{DS} = 0\text{ V to } 480\text{ V}$ , $V_{GS} = 0\text{ V}$		-	58	-	
Effective output capacitance, time related <sup>b</sup>	$C_{o(tr)}$			-	296	-	
Total gate charge	$Q_g$	$V_{GS} = 10\text{ V}$	$I_D = 8.5\text{ A}$ , $V_{DS} = 480\text{ V}$	-	61	122	nC
Gate-source charge	$Q_{gs}$			-	14	-	
Gate-drain charge	$Q_{gd}$			-	23	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 480\text{ V}$ , $I_D = 8.5\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_g = 9.1\text{ }\Omega$		-	22	44	ns
Rise time	$t_r$			-	24	48	
Turn-off delay time	$t_{d(off)}$			-	71	142	
Fall time	$t_f$			-	26	52	
Gate input resistance	$R_g$	$f = 1\text{ MHz}$ , open drain		0.3	0.7	1.4	$\Omega$
Drain-Source Body Diode Characteristics							
Continuous source-drain diode current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	15	A
Pulsed diode forward current	$I_{SM}$			-	-	45	
Diode forward voltage	$V_{SD}$	$T_J = 25\text{ }^{\circ}\text{C}$ , $I_S = 8.5\text{ A}$ , $V_{GS} = 0\text{ V}$		-	-	1.2	V
Reverse recovery time	$t_{rr}$	$T_J = 25\text{ }^{\circ}\text{C}$ , $I_F = I_S = 8.5\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 25\text{ V}$		-	416	832	ns
Reverse recovery charge	$Q_{rr}$			-	6.4	12.8	$\mu\text{C}$
Reverse recovery current	$I_{RRM}$			-	27	-	A

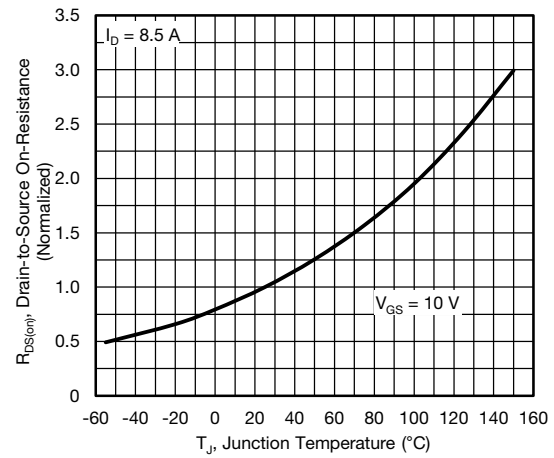
**Notes**

- 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 %  $V_{DSS}$

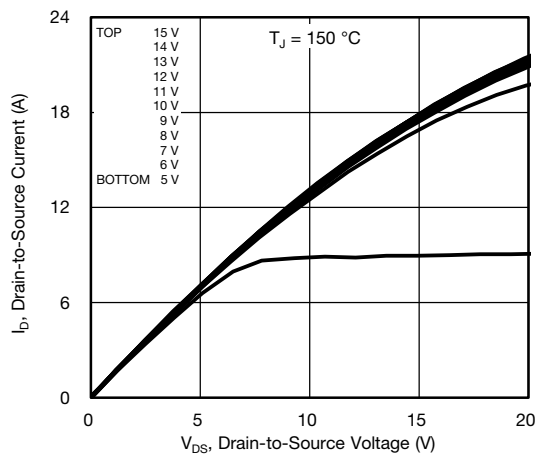
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



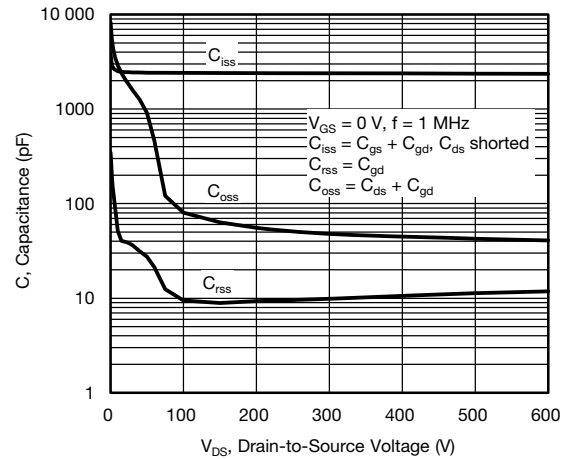
**Fig. 1 - Typical Output Characteristics**



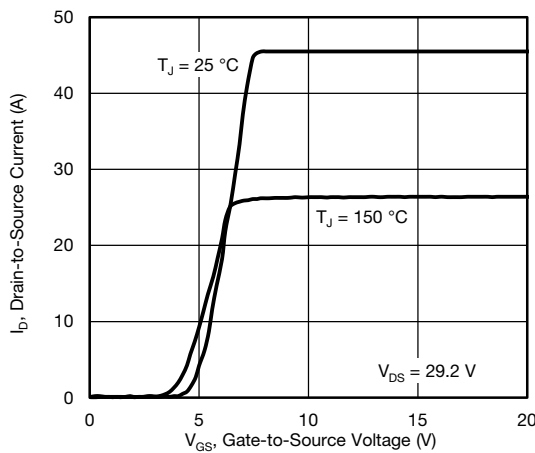
**Fig. 4 - Normalized On-Resistance vs. Temperature**



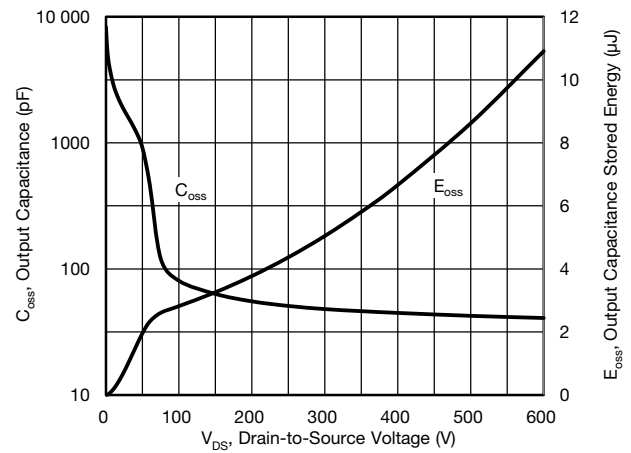
**Fig. 2 - Typical Output Characteristics**



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



**Fig. 3 - Typical Transfer Characteristics**



**Fig. 6 -  $C_{oss}$  and  $E_{oss}$  vs.  $V_{DS}$**

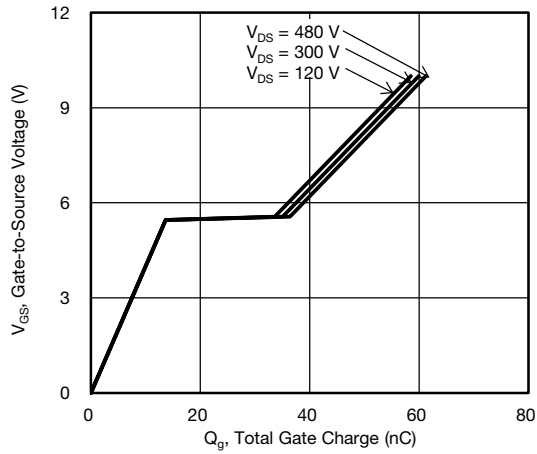


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

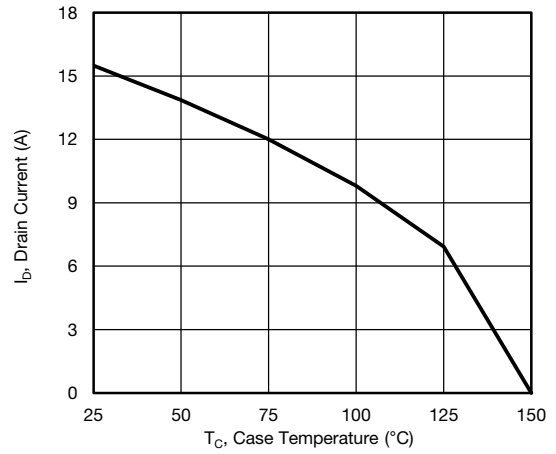


Fig. 10 - Maximum Drain Current vs. Case Temperature

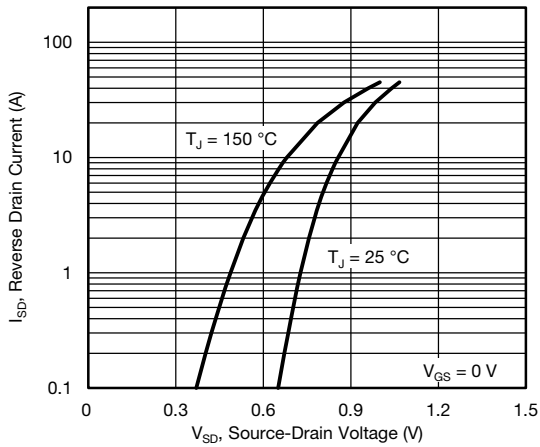


Fig. 8 - Typical Source-Drain Diode Forward Voltage

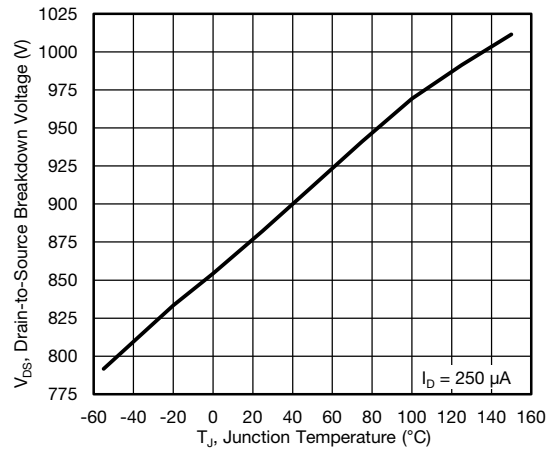


Fig. 11 - Temperature vs. Drain-to-Source Voltage

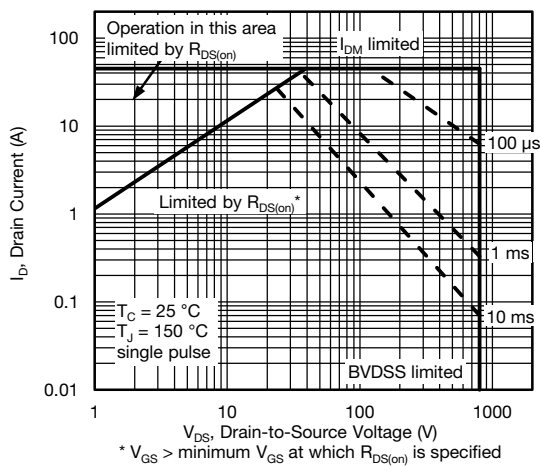
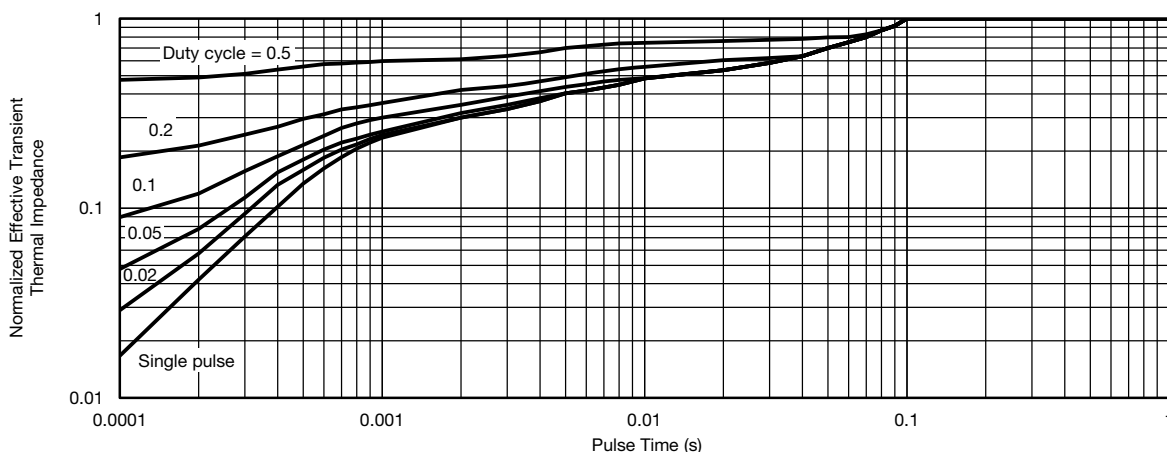
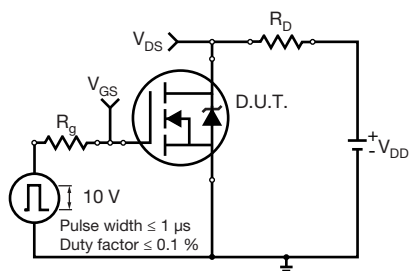


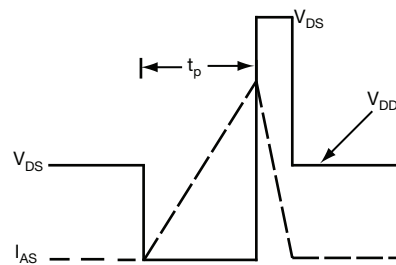
Fig. 9 - Maximum Safe Operating Area



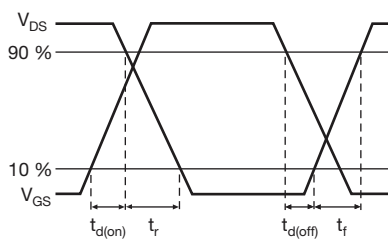
**Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case**



**Fig. 13 - Switching Time Test Circuit**



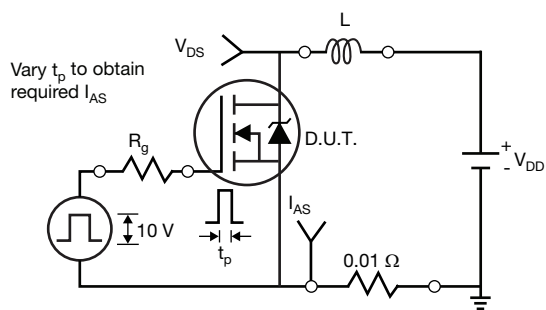
**Fig. 16 - Unclamped Inductive Waveforms**



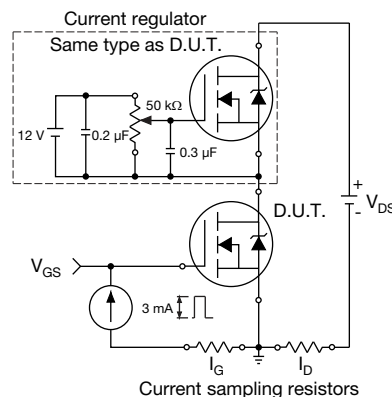
**Fig. 14 - Switching Time Waveforms**



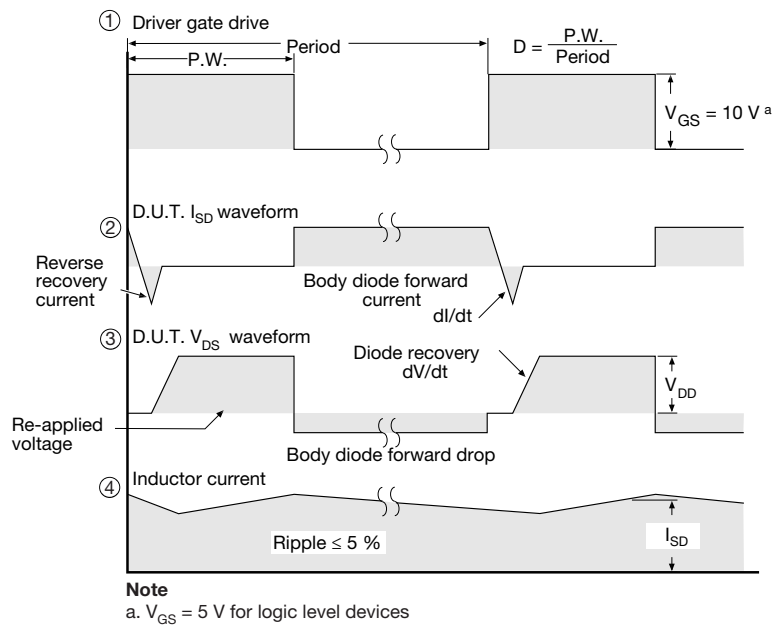
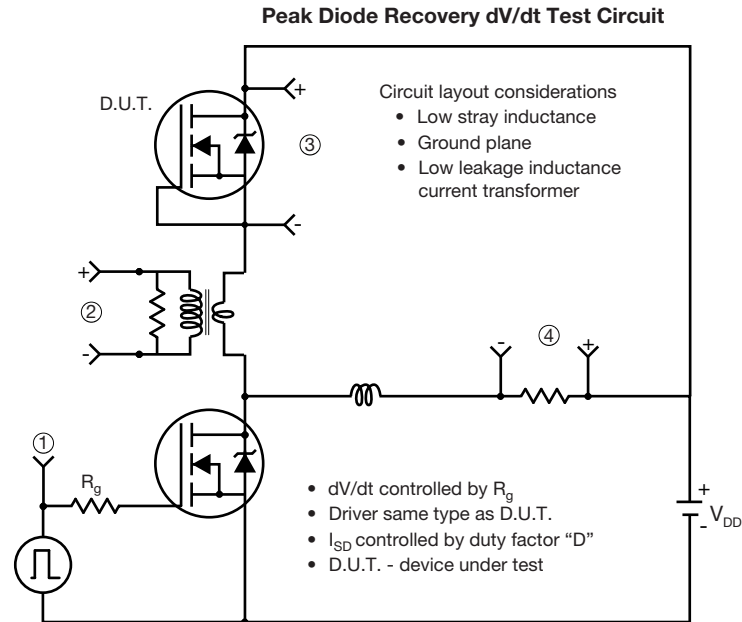
**Fig. 17 - Basic Gate Charge Waveform**



**Fig. 15 - Unclamped Inductive Test Circuit**



**Fig. 18 - Gate Charge Test Circuit**



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

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