

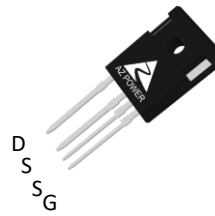
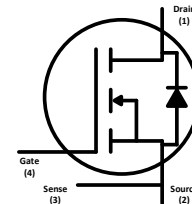
**Features:**

- 650V High Blocking Voltage
- Low On-Resistance
- High Speed Switching
- Easy to Parallel

**Benefits:**

- Increased frequency
- Minimal switching loss
- Higher Efficiency
- Low cooling requirement

Symbol	Value	Unit
$V_{DS}$	650	V
$I_{DS}$ ( $T_C=25^\circ\text{C}$ )	100	A
$R_{DSon}$	28	$\text{m}\Omega$

**Outline**

**Circuit**

**TO-247-4**
**Applications:**

- Switch Mode Power Supply
- High Voltage DC/DC Converters
- Solar Inverters
- Motor Drivers

**Maximum Ratings ( $T_C=25^\circ\text{C}$  unless otherwise specified)**

Symbol	Parameter	Value	Unit	Test Conditions
$V_{DSmax}$	Drain-Source Voltage	650	V	$V_{GS}=0\text{V}$ , $I_{DS}=100\mu\text{A}$
$V_{GSmax}$	Gate-Source Voltage	-10/+25	V	Absolute Maximum values
$V_{GSop}$	Gate-Source Voltage	-5/+20	V	Recommended operational values
$I_{DS}$	Continuous Drain Current	100 63	A	$V_{GS}=20\text{V}$ , $T_C=25^\circ\text{C}$ $V_{GS}=20\text{V}$ , $T_C=100^\circ\text{C}$
$I_{DS(pulse)}$	Pulsed Drain Current	160	A	Pulse width $t_p$ limited by $T_{Jmax}$
$P_D$	Power Dissipation	312	W	$T_C=25^\circ\text{C}$ , $T_J=150^\circ\text{C}$
$T_{J,max}$	Operating Junction Temperature	150	$^\circ\text{C}$	
$T_{stg}$	Storage Temperature Range	-55 to 150	$^\circ\text{C}$	

**Thermal characteristics**

Symbol	Parameter	Min.	Typ.	Max.	Unit
$R_{thJC}$	Thermal resistance		0.40		$^\circ\text{C}/\text{W}$

**Electrical Characteristics ( $T_c=25^\circ\text{C}$  unless otherwise specified)**

Symbol	Parameter	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	650			V	$V_{GS}=0V, I_{DS}=100\mu A$
$V_{GS(th)}$	Gate Threshold Voltage	1.4	2.0 1.3	2.4	V	$V_{DS}=V_{GS}, I_{DS}=13mA, T_J=25^\circ\text{C}$ $V_{DS}=V_{GS}, I_{DS}=13mA, T_J=150^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current		10	100	$\mu A$	$V_{DS}=650V, V_{GS}=0V$
$I_{GSS}$	Gate-Source Leakage Current			250	nA	$V_{GS}=20V, V_{DS}=0V$
$R_{Dson}$	Drain-Source On-State Resistance		28 32	32	m $\Omega$	$V_{GS}=20V, I_{DS}=55A, T_J=25^\circ\text{C}$ $V_{GS}=20V, I_{DS}=55A, T_J=150^\circ\text{C}$
$g_{fs}$	Transconductance		10.6		S	$V_{DS}=20V, I_{DS}=20A$
$R_{G,int}$	Internal Gate Resistance		1.2		$\Omega$	$f=1\text{ MHz}, V_{AC}=25mV$
$C_{ISS}$	Input Capacitance		6391		pF	$V_{DS}=600V, V_{GS}=0V$ $f=1\text{ MHz}, V_{AC}=25mV$
$C_{OSS}$	Output Capacitance		410			
$C_{RSS}$	Reverse Transfer Capacitance		37			
$E_{OSS}$	$C_{OSS}$ Stored Energy		77		$\mu J$	
$E_{on}$	Turn-On Switching Energy		386		$\mu J$	$V_{DD}=400V, V_{GS}=-5/20V, I_{DS}=55A,$ $R_{G(EXT)}=4.7\Omega, L=0.2mH$
$E_{off}$	Turn-off Switching Energy		183			
$t_{d(on)}$	Turn-On Delay Time		18		ns	$V_{DD}=400V, V_{GS}=-5/20V, I_{DS}=55A,$ $R_{G(EXT)}=4.7\Omega, R_L=7.27\Omega,$ Timing relative to $V_{DS}$
$t_r$	Rise Time		20			
$t_{d(off)}$	Turn-off Delay Time		51			
$t_f$	Fall Time		23			
$Q_{GS}$	Gate to Source Charge		40		nC	$V_{GS}=-5/20V, V_{DS}=400V, I_{DS}=55A$
$Q_{GD}$	Gate to Drain Charge		48			
$Q_G$	Total Gate Charge		218			

**Body Diode Characteristics**

Symbol	Parameter	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
$V_{SD}$	Diode Forward Voltage		4.6 3.9		V	$V_{GS}=-5V, I_{SD}=17A, T_J=25^\circ\text{C}$ $V_{GS}=-5V, I_{SD}=17A, T_J=150^\circ\text{C}$
$I_{SD}$	Continuous Diode Current		61		A	
$t_{rr}$	Reverse Recovery Time		86		ns	$V_{GS}=-5V, I_{SD}=55A, V_R=400V,$ $di/dt=1820A/\mu s$
$Q_{rr}$	Reverse Recovery Charge		225		nC	
$I_{rrm}$	Peak Reverse Recovery Current		16.3		A	

**Typical Performance**

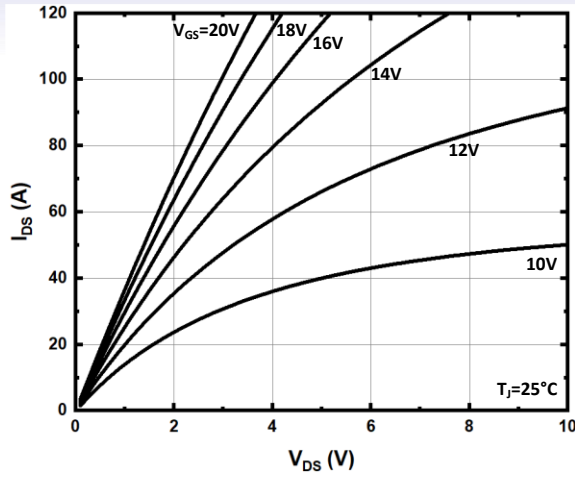


Fig. 1 Output Characteristics,  $T_j = 25^\circ\text{C}$

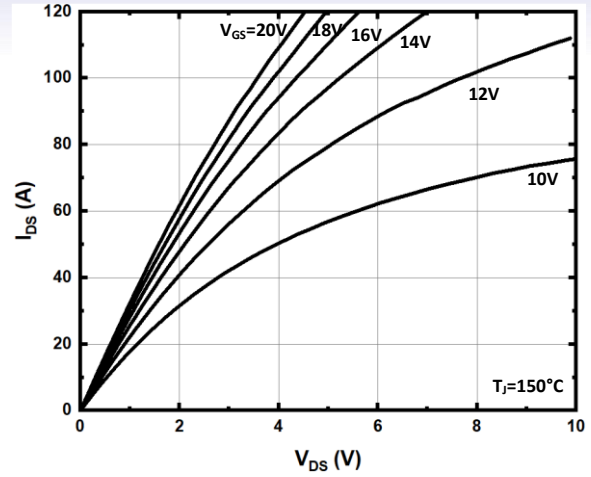


Fig. 2 Output Characteristics,  $T_j = 150^\circ\text{C}$

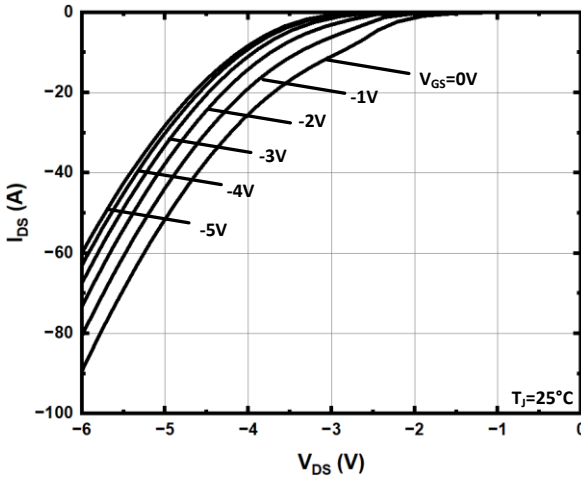


Fig. 3 Body Diode Characteristics,  $T_j = 25^\circ\text{C}$

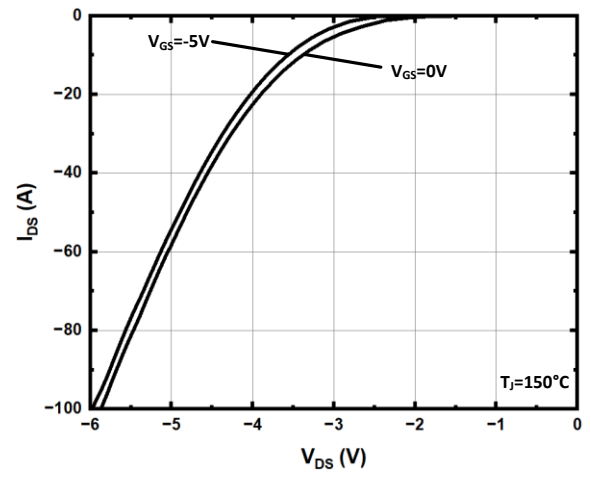


Fig. 4 Body Diode Characteristics,  $T_j = 150^\circ\text{C}$

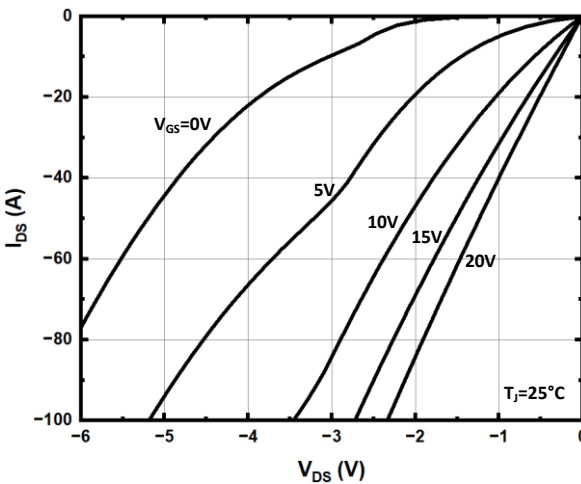


Fig. 5 3<sup>rd</sup> Quadrant Characteristics,  $T_j = 25^\circ\text{C}$

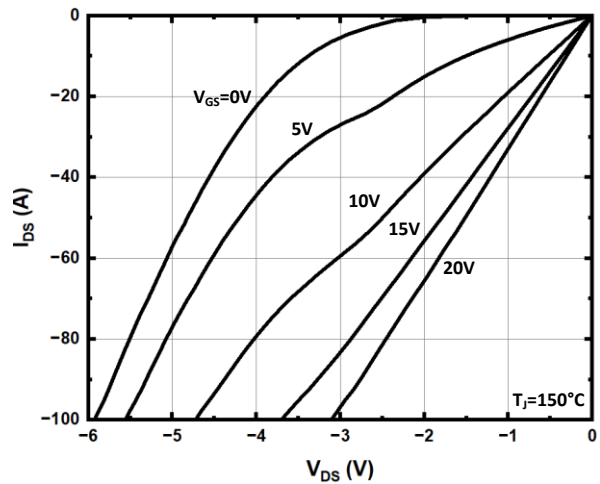
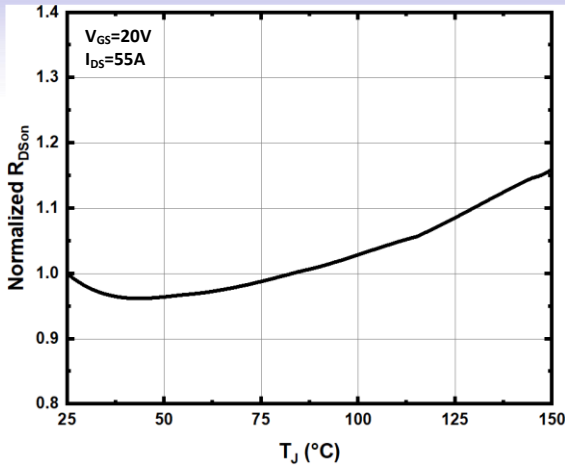
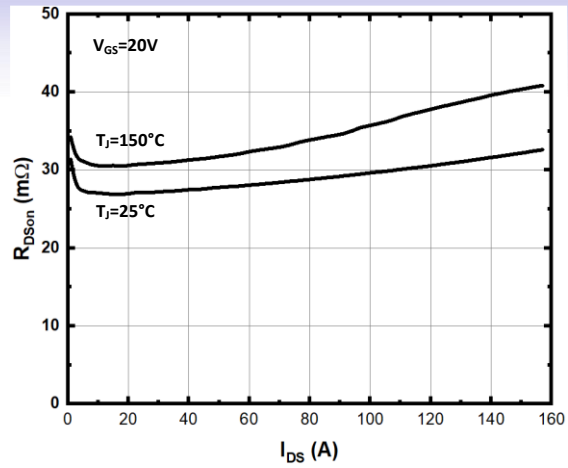


Fig. 6 3<sup>rd</sup> Quadrant Characteristics,  $T_j = 150^\circ\text{C}$

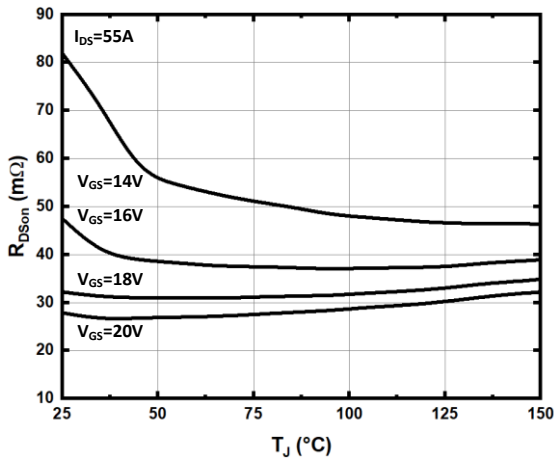
**Typical Performance**



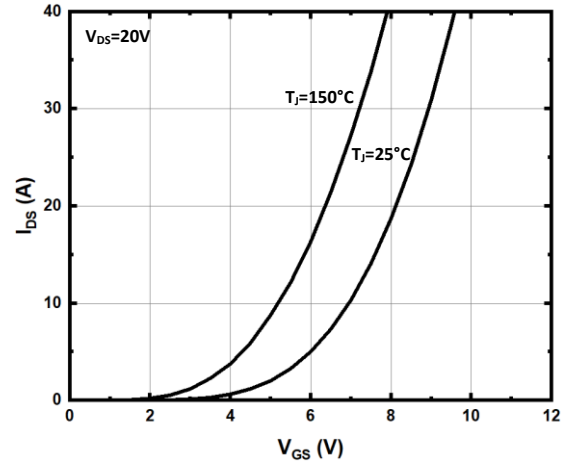
**Fig. 7 Normalized On-Resistance vs Temperature**



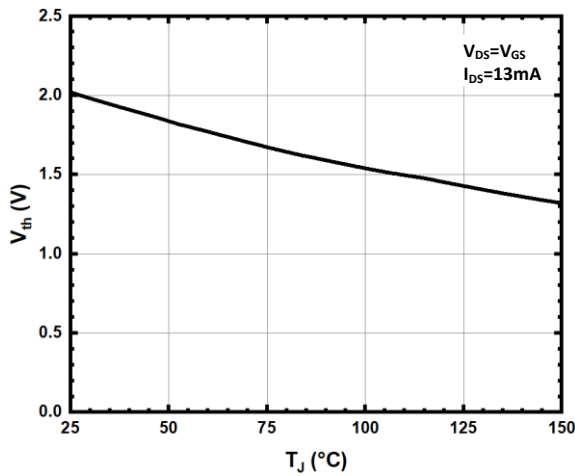
**Fig. 8 On-Resistance vs Drain Current**



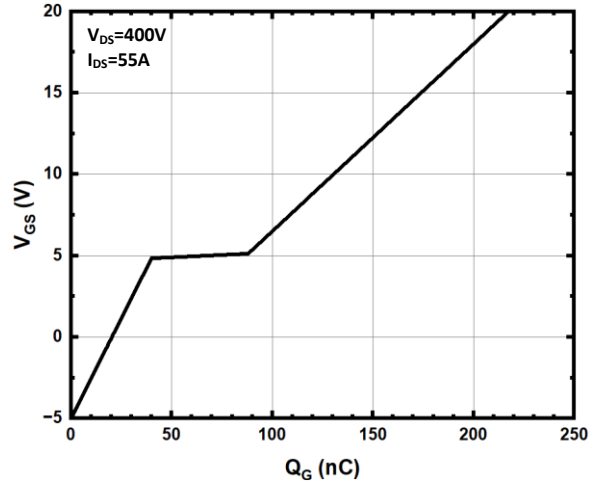
**Fig. 9 On-Resistance vs Temperature**



**Fig. 10 Transfer Characteristics**

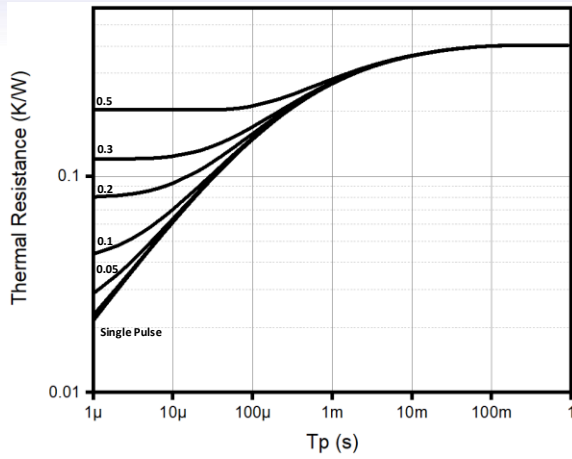


**Fig. 11 Threshold Voltage vs. Temperature**

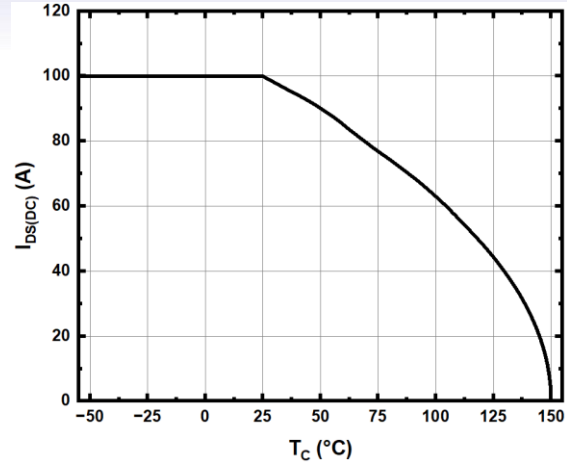


**Fig. 12 Gate Charge Characteristics**

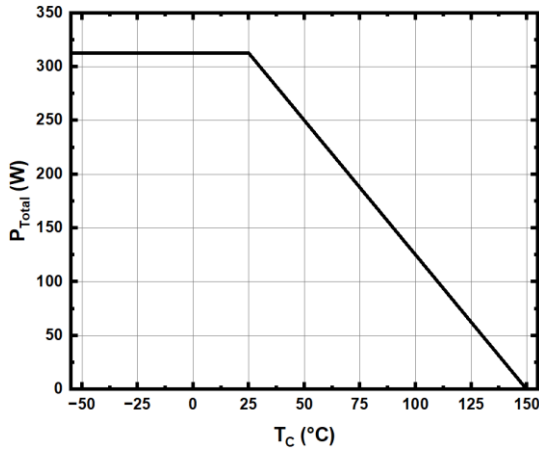
**Typical Performance**



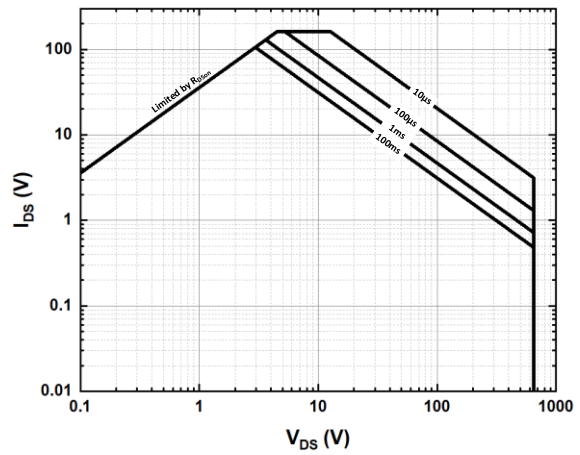
**Fig. 13 Transient Thermal Impedance**



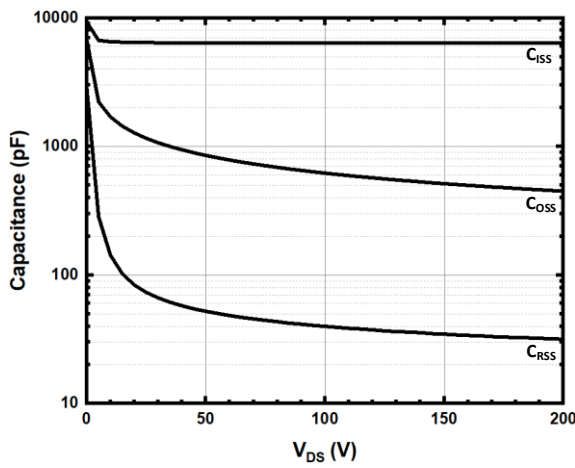
**Fig. 14 Continuous Drain Current Derating**



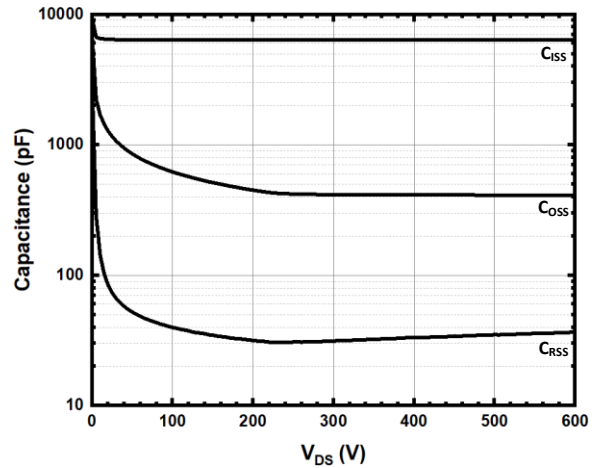
**Fig. 15 Power Derating**



**Fig. 16 Safe Operating Area**

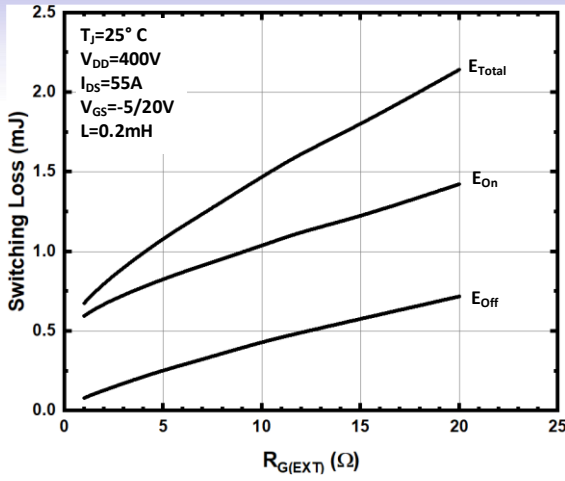


**Fig. 17 Capacitances vs V<sub>DS</sub> (200V)**

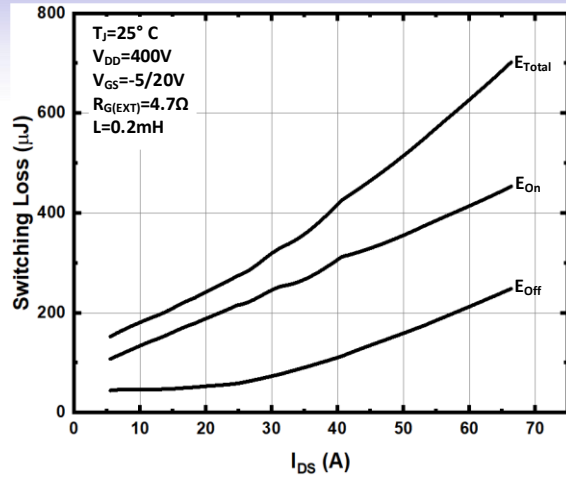


**Fig. 18 Capacitances vs V<sub>DS</sub> (600V)**

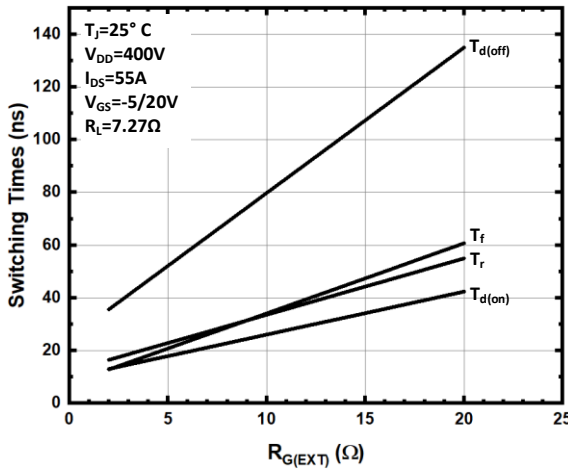
**Typical Performance**



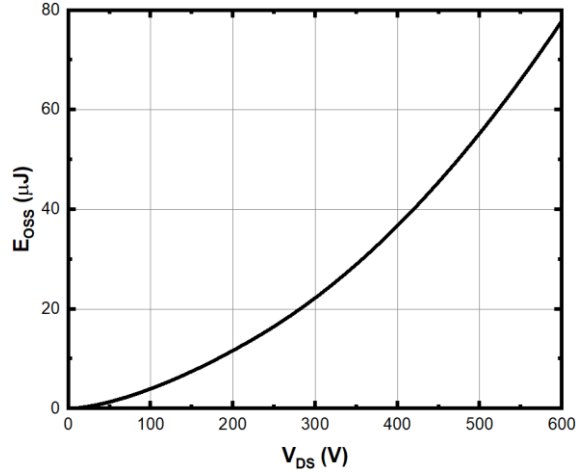
**Fig. 19 Switching Loss vs  $R_{G(EXT)}$  (400V)**



**Fig. 20 Switching Loss vs Drain Current (400V)**

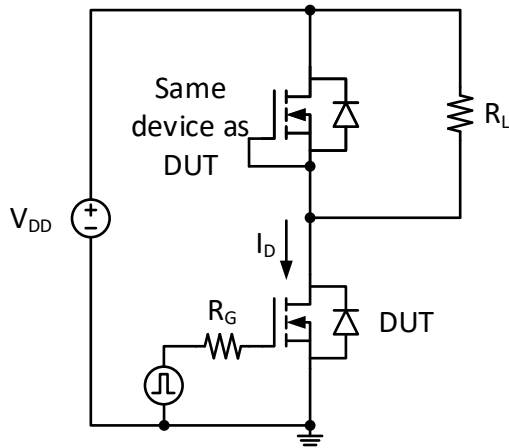


**Fig. 21 Switching Time vs  $R_{G(EXT)}$**

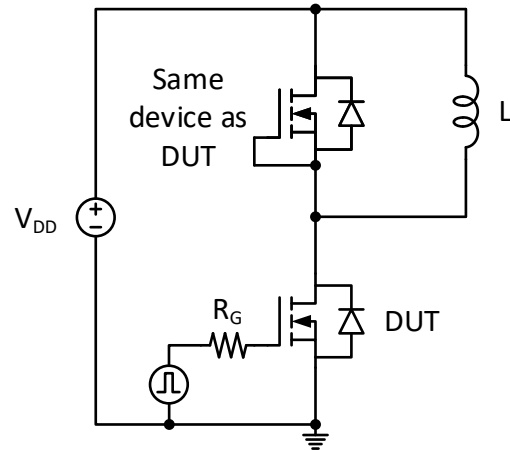


**Fig. 22 Output Capacitor Stored Energy**

**Methodologies**



**Fig. 23 Resistive Load Switching**



**Fig. 24 Clamped Inductive Switching**

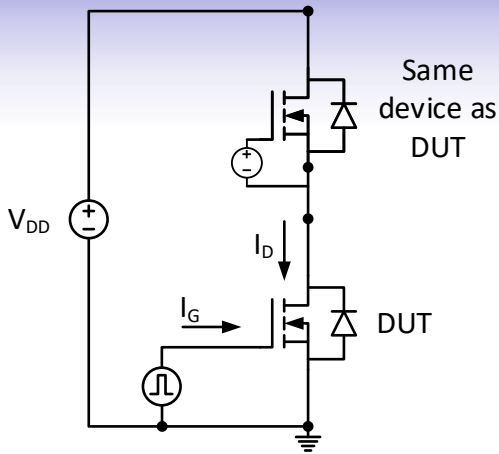


Fig. 25 Gate Charge

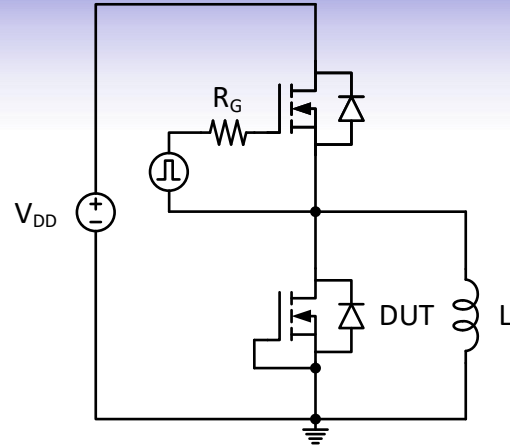


Fig. 26 Body Diode Reverse Recovery

**Definitions**

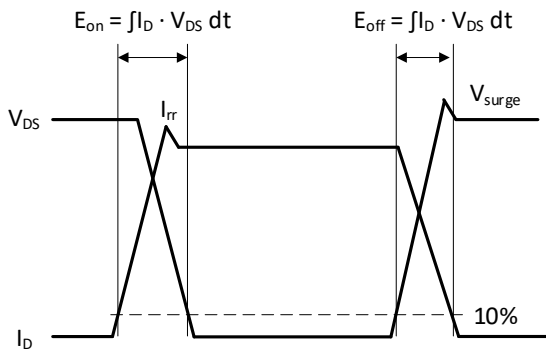


Fig. 27 Switching Losses

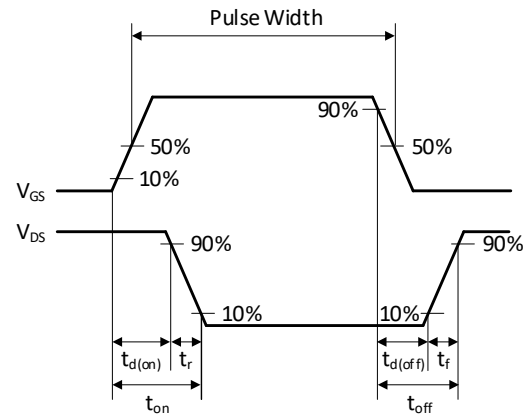


Fig. 28 Switching Times

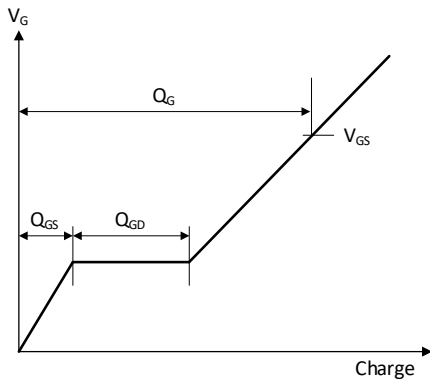


Fig. 29 Gate Charges

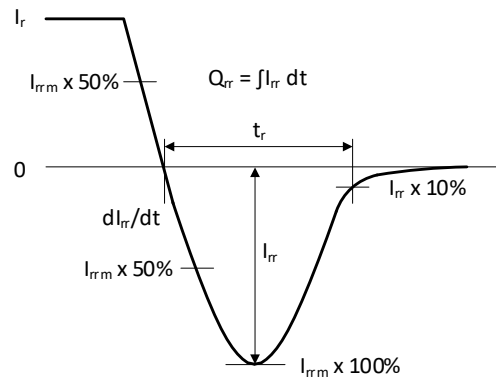


Fig. 30 Body Diode Reverse Recovery

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