

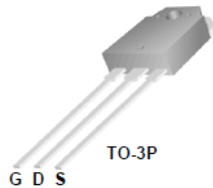


# TSA50N20MK

## 200V N-Channel MOSFET

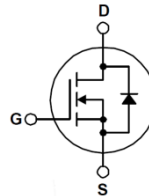
### General Description

This Power MOSFET is produced using Truesemi's advanced planar stripe DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switched mode power supplies, active power factor correction based on half bridge topology.



### Features

- 50A, 200V, Max.  $R_{DS(on)} = 0.038\Omega$  @  $V_{GS} = 10V$
- Low gate charge
- High ruggedness
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



### Absolute Maximum Ratings $T_J = 25^\circ C$ unless otherwise specified

Absolute Maximum Ratings $T_C = 25^\circ C$ , unless otherwise noted			
Parameter	Symbol	Value	Unit
Drain-Source Voltage (note1)	$V_{DSS}$	200	V
Continuous Drain Current	$I_D$	50	A
Pulsed Drain Current (note2)	$I_{DM}$	200	
Gate-Source Voltage	$V_{GSS}$	$\pm 20$	V
Single Pulse Avalanche Energy (note2)	$E_{AS}$	400	mJ
Power Dissipation ( $T_C = 25^\circ C$ )	$P_D$	34	W/ $^\circ C$
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55~+150	

### Thermal Resistance Characteristics

Thermal Resistance			
Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	$R_{thJC}$	0.5	$^\circ C/W$
Thermal Resistance, Junction-to-Ambient	$R_{thJA}$	45	

## Electrical Characteristics $T_J=25^\circ\text{C}$ unless otherwise specified

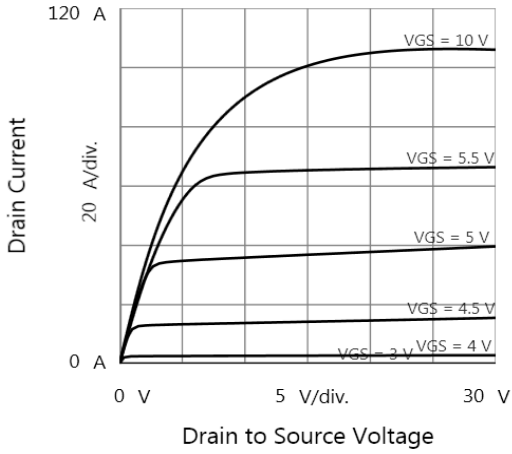
Specifications $T_J = 25^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu\text{A}$	200	--	--	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 200V, V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	1	$\mu\text{A}$
Gate-Source Leakage	$I_{GSS}$	$V_{GS} = \pm 20V, V_{DS} = 0V$	--	--	$\pm 100$	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	2	--	4	V
Drain-Source On-Resistance (Note4)	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 25A$	--	0.030	0.038	$\Omega$
<b>Dynamic</b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0V,$ $V_{DS} = 25V,$ $f = 1.0\text{MHz}$	--	3538	--	pF
Output Capacitance	$C_{oss}$		--	657	--	
Reverse Transfer Capacitance	$C_{rss}$		--	280	--	
Total Gate Charge	$Q_g$	$V_{DD} = 160V, I_D = 50A,$ $V_{GS} 0 \text{ to } 10V$	--	244	--	nC
Gate-Source Charge	$Q_{gs}$		--	16	--	
Gate-Drain Charge	$Q_{gd}$		--	144	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 100V, I_D = 50A,$ $V_{GS} = 10V, R_G = 25\Omega$	--	53	--	ns
Turn-on Rise Time	$t_r$		--	65	--	
Turn-off Delay Time	$t_{d(off)}$		--	689	--	
Turn-off Fall Time	$t_f$		--	230	--	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source Current	$I_{SD}$	Integral PN-diode in MOSFET	--	--	50	A
Pulsed Source Current	$I_{SM}$		--	--	200	
Body Forward Voltage	$V_{SD}$	$I_S = 20A, V_{GS} = 0V$	--	--	1.5	V
Reverse Recovery Time	$t_{rr}$	$V_{GS} = 0V, I_F = 10A,$ $di_F/dt = 100A/\mu\text{s}$	--	208	--	ns
Reverse Recovery Charge	$Q_{rr}$		--	2.04	--	$\mu\text{C}$

### NOTES:

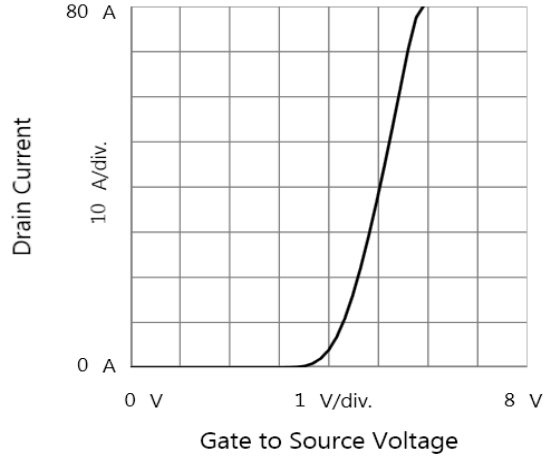
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $L = 10\text{mH}, V_{DD} = 50V, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3. Pulse Test: Pulse width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 1\%$

**Typical Characteristics**  $T_J = 25^\circ\text{C}$ , unless otherwise noted

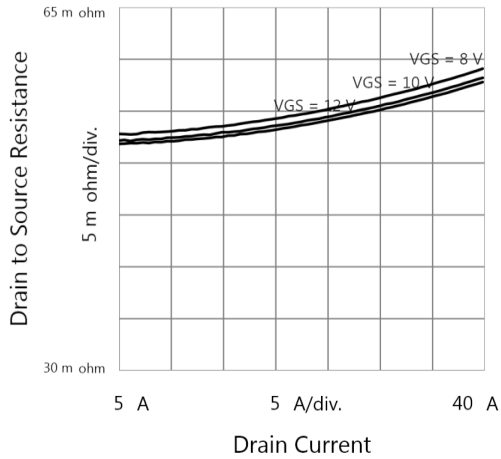
**Figure 1. Output Characteristics ( $T_J = 25^\circ\text{C}$ )**



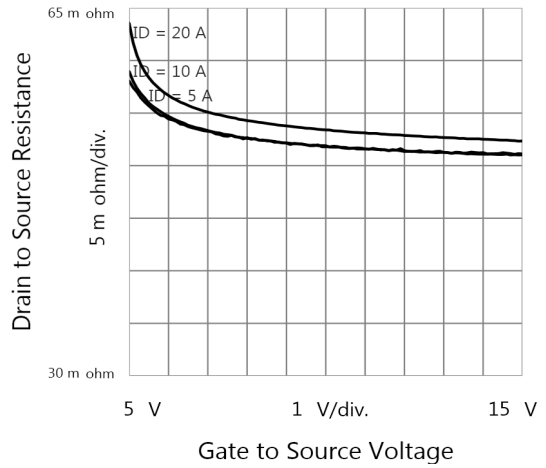
**Figure 2. Transfer Characteristics**



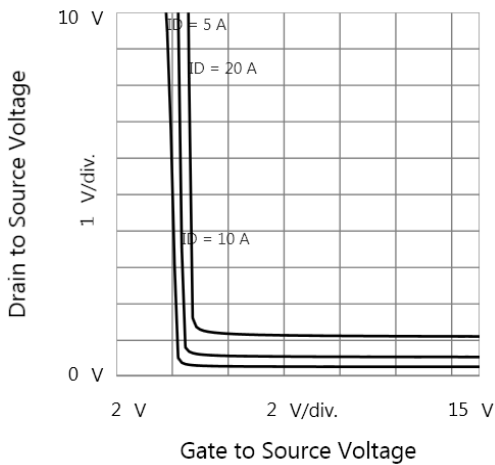
**Figure 3. Drain to Source Resistance vs. Drain Current**



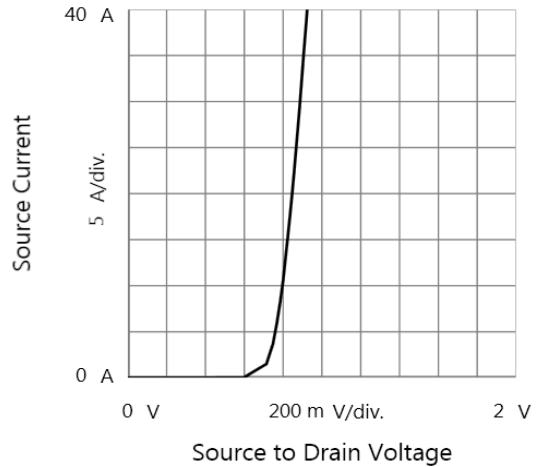
**Figure 4. Drain to Source Resistance vs. Gate to Source Voltage**



**Figure 5. Drain to Source Voltage vs. Gate to Source Voltage**



**Figure 6. Body Diode Forward Characteristics**



Typical Characteristics  $T_J = 25^\circ\text{C}$ , unless otherwise noted

Figure 7. Capacitance

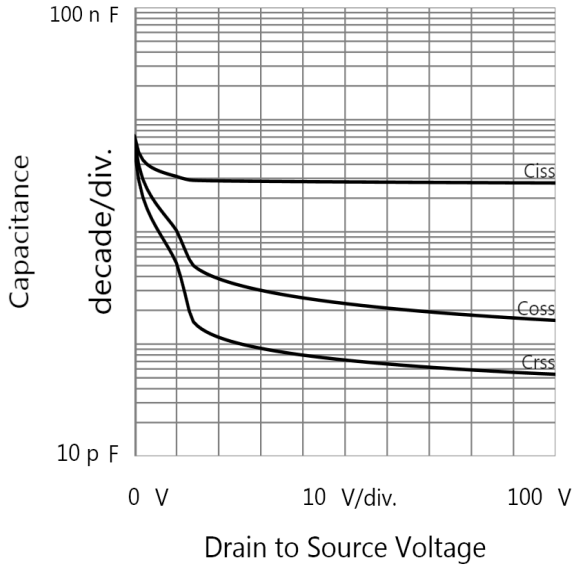


Figure 8. Gate Charge

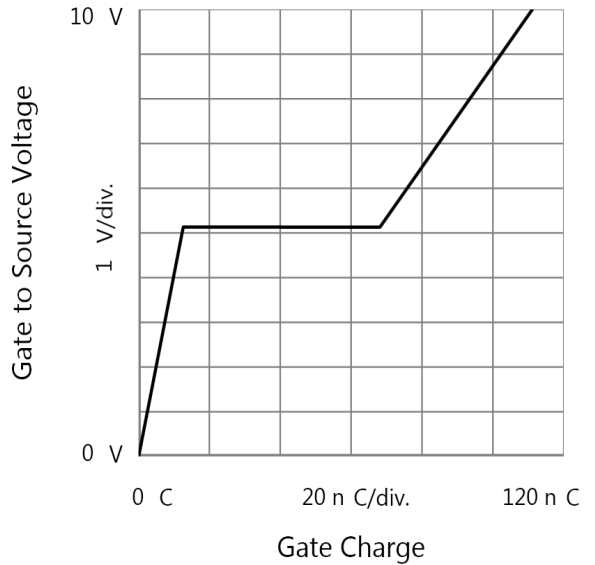


Figure 9. Transient Thermal Impedance TO-220F

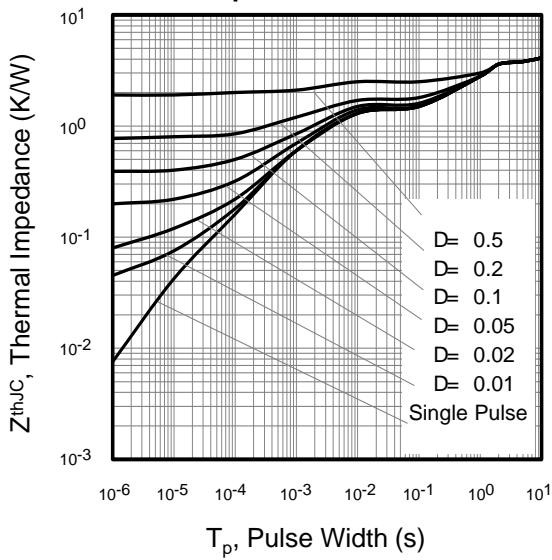
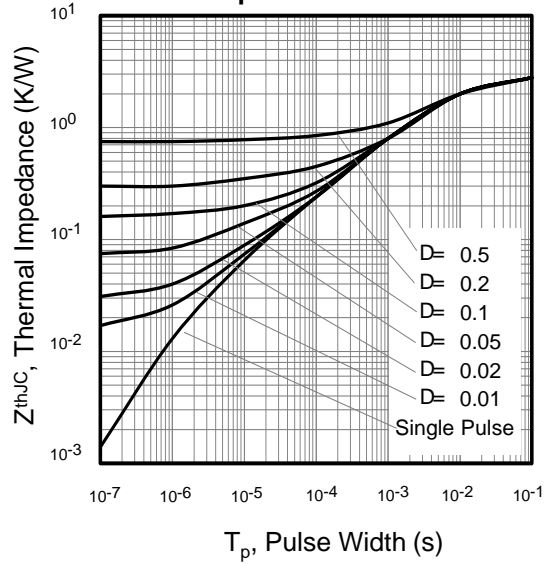


Figure 10. Transient Thermal Impedance TO-220



Typical Characteristics  $T_J = 25^\circ\text{C}$ , unless otherwise noted

Figure 1. Maximum Effective Thermal Impedance, Junction-to-Case

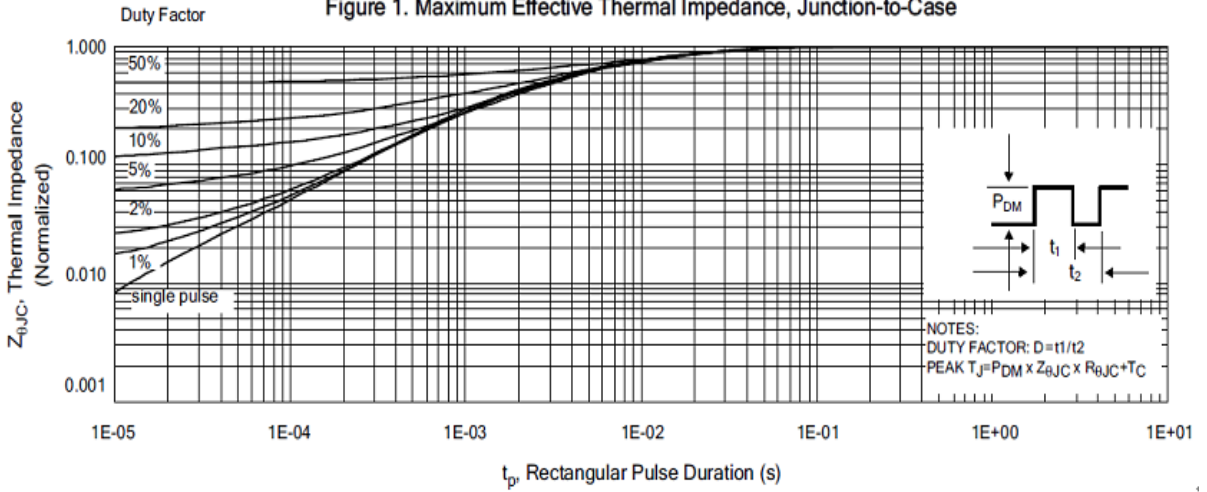


Figure 2. Maximum Power Dissipation vs Case Temperature

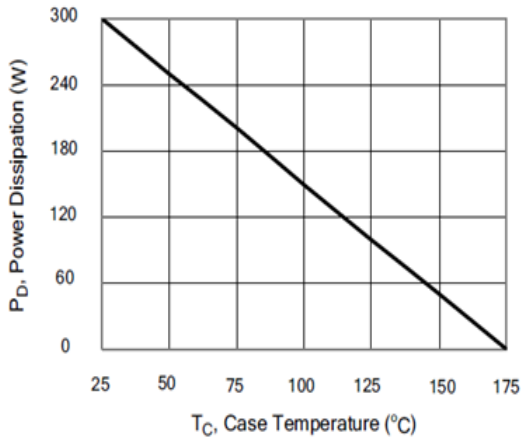


Figure 3. Maximum Continuous Drain Current vs Case Temperature

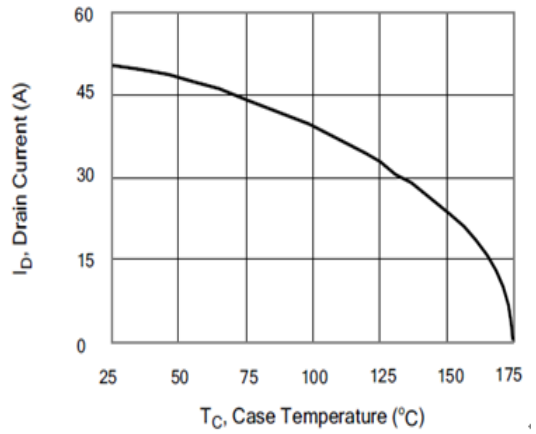


Figure 4. Typical Output Characteristics

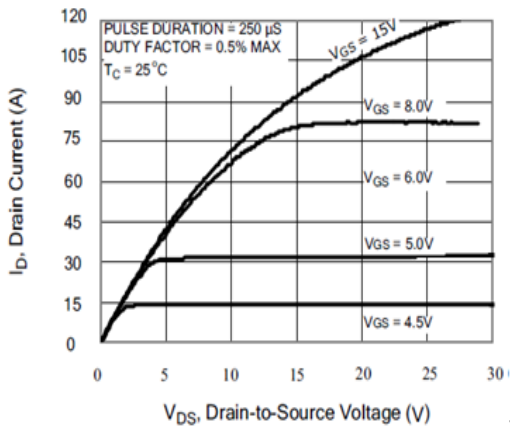
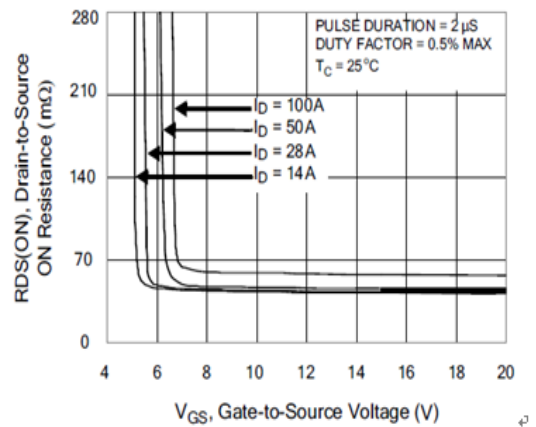


Figure 5. Typical Drain-to-Source ON Resistance vs Gate Voltage and Drain Current



Typical Characteristics  $T_J = 25^\circ\text{C}$ , unless

Figure 6. Maximum Peak Current Capability

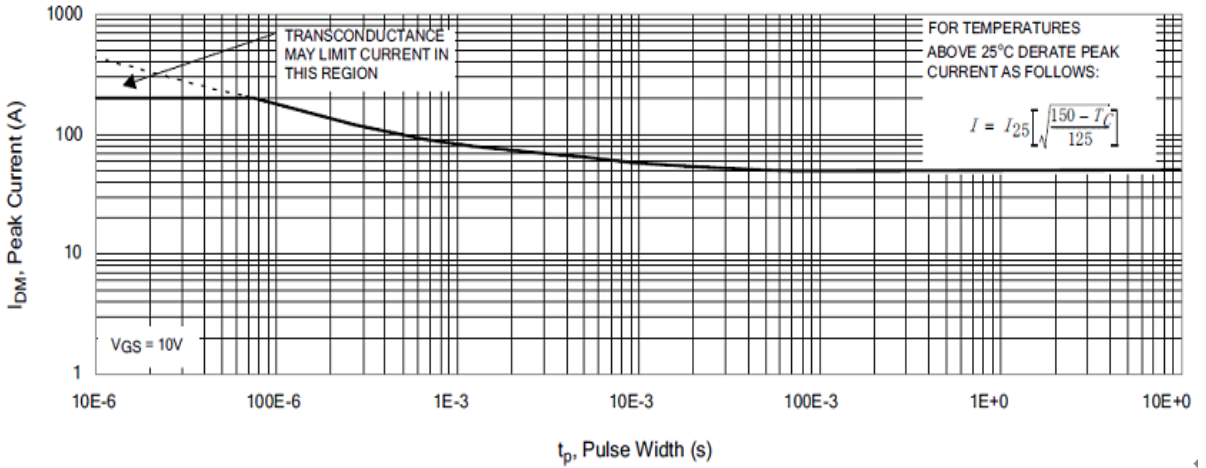


Figure 7. Typical Transfer Characteristics

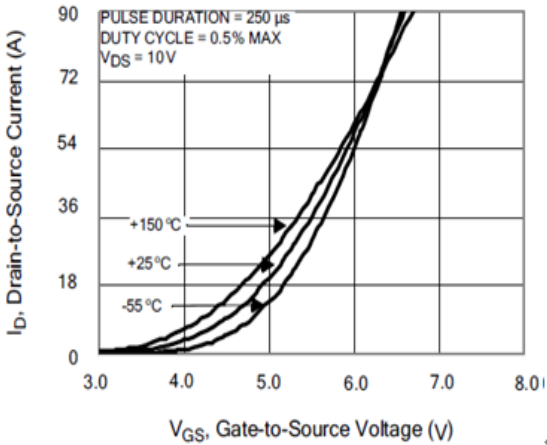


Figure 8. Unclamped Inductive Switching Capability

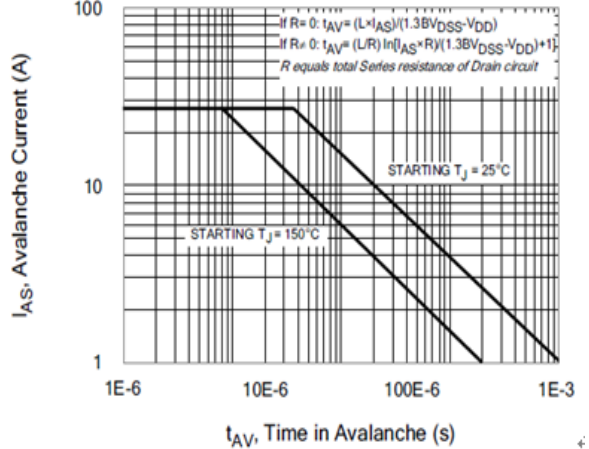


Figure 9. Typical Drain-to-Source ON Resistance vs Drain Current

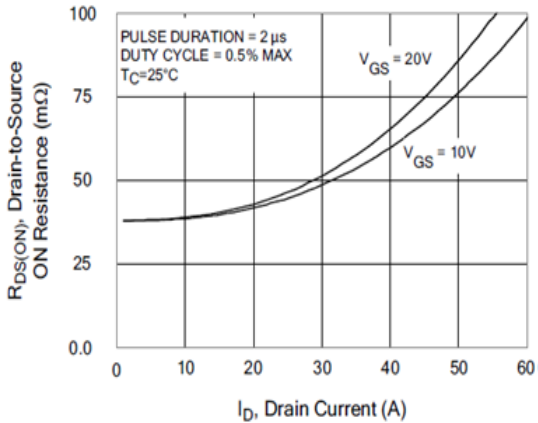


Figure 10. Typical Drain-to-Source ON Resistance vs Junction Temperature

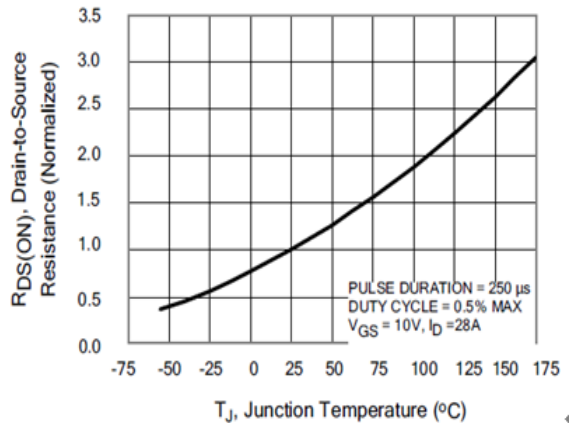


Figure 11. Typical Breakdown Voltage vs Junction Temperature

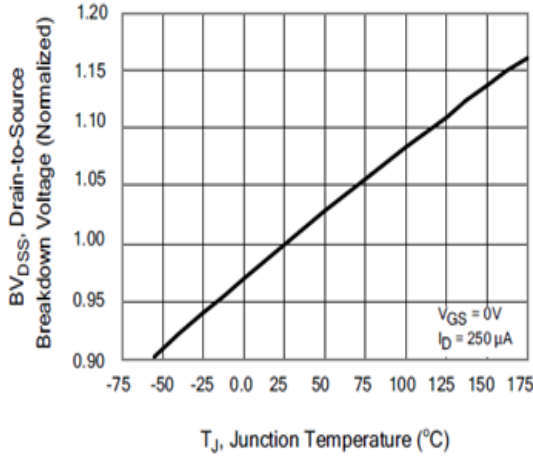


Figure 12. Typical Threshold Voltage vs Junction Temperature

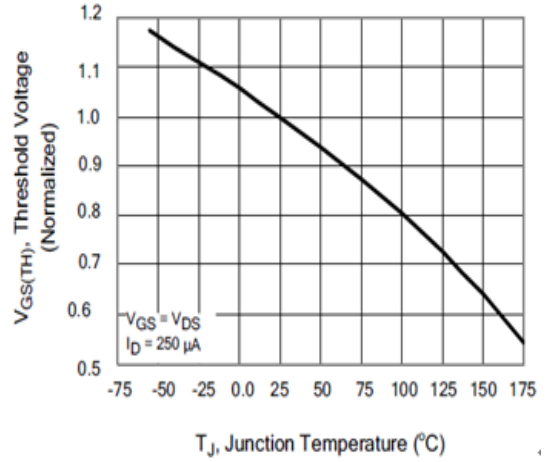


Figure 13. Maximum Forward Bias Safe Operating Area

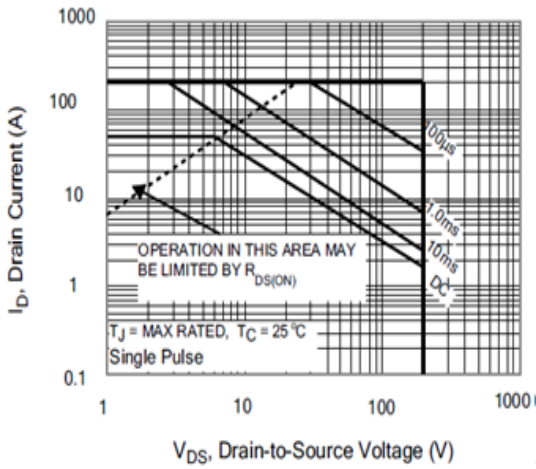


Figure 14. Capacitance vs Vds

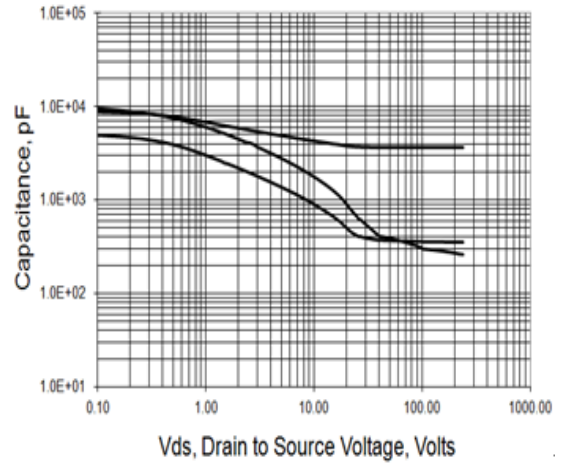


Figure 15. Typical Gate Charge

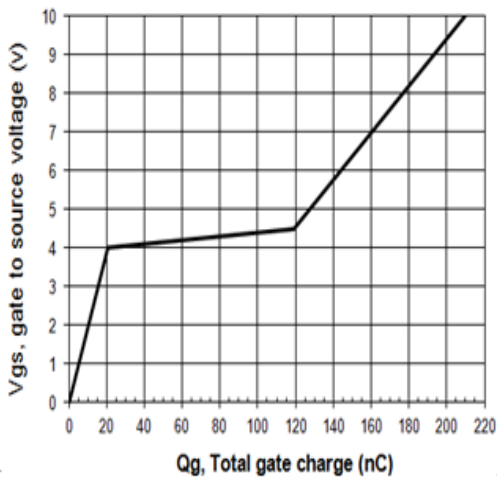
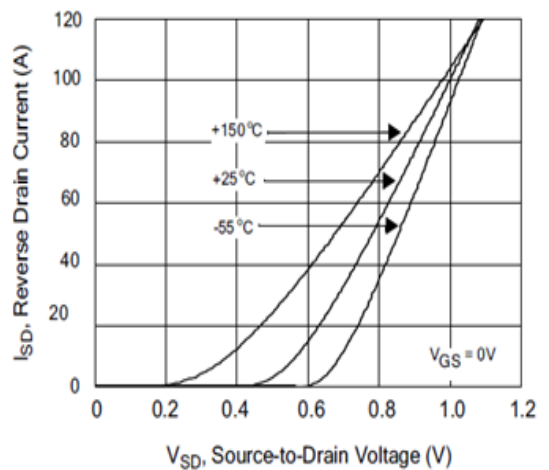
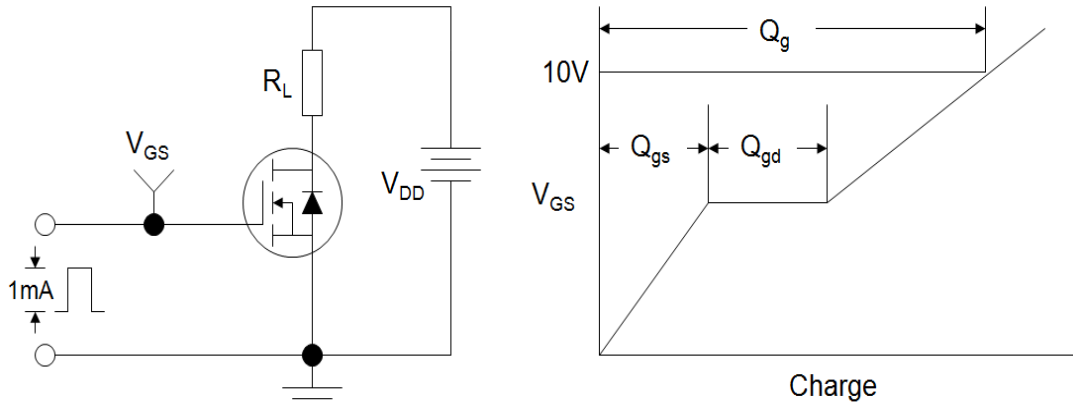


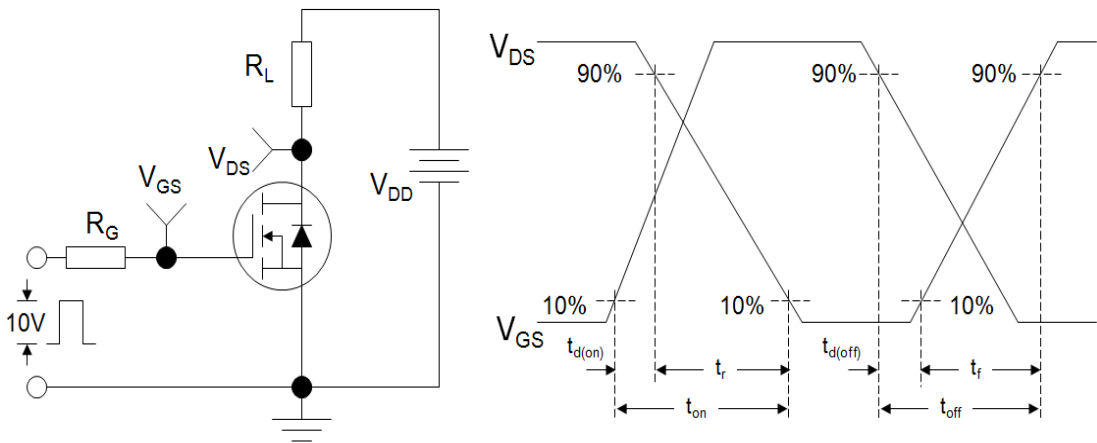
Figure 16. Typical Body Diode Transfer Characteristics



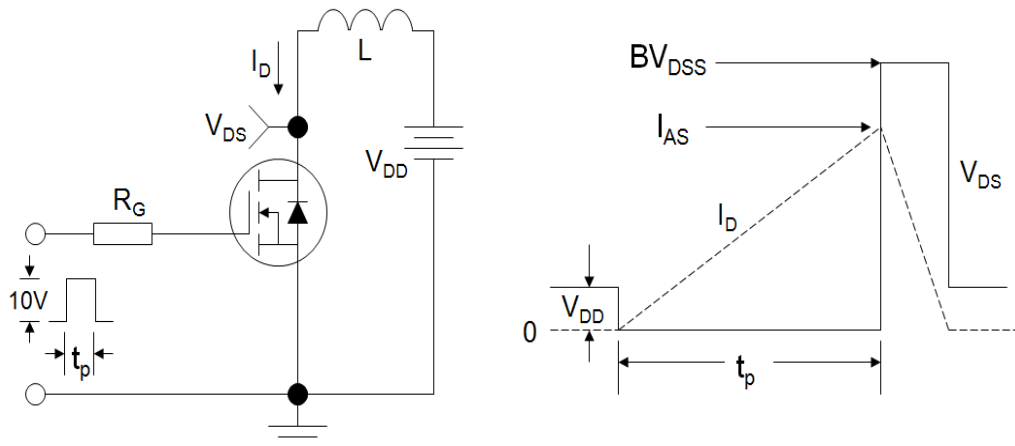
**Figure A: Gate Charge Test Circuit and**



**Figure B: Resistive Switching Test Circuit and Waveform**



**Figure C: Unclamped Inductive Switching Test Circuit and Waveform**





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