



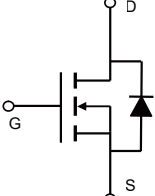


<p>Description</p> <p>The Power MOSFET is fabricated using the advanced planar VDMOS technology. The resulting device has low conduction resistance, superior switching performance and high avalanche energy.</p> <p>Features</p> <ul style="list-style-type: none"> ◆ Low $R_{DS(on)}$ ◆ Low gate charge (typ. $Q_g = 12.8 \text{ nC}$) ◆ 100% UIS tested ◆ RoHS compliant <p>Applications</p> <ul style="list-style-type: none"> ◆ Power factor correction. ◆ Switched mode power supplies. ◆ LED driver. 	<p>Product Summary</p> <table> <tr> <td>V_{DSS}</td> <td>500V</td> </tr> <tr> <td>I_D</td> <td>5A</td> </tr> <tr> <td>$R_{DS(on),max}$</td> <td>1.6Ω</td> </tr> <tr> <td>$Q_{g,typ}$</td> <td>12.8 nC</td> </tr> </table> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>TO-251</p> </div> <div style="text-align: center;">  <p>TO-252</p> </div> <div style="text-align: center;">  <p>TO-220F</p> </div> </div> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>TO-220C</p> </div> <div style="text-align: center;">  <p>Schematic</p> </div> </div>	V_{DSS}	500V	I_D	5A	$R_{DS(on),max}$	1.6 Ω	$Q_{g,typ}$	12.8 nC
V_{DSS}	500V								
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$Q_{g,typ}$	12.8 nC								

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	500	V
Continuous drain current ($T_c = 25^\circ\text{C}$)	I_D	5	A
($T_c = 100^\circ\text{C}$)		3.1	A
Pulsed drain current ¹⁾	I_{DM}	20	A
Gate-Source voltage	V_{GSS}	± 30	V
Avalanche energy, single pulse ²⁾	E_{AS}	210	mJ
Peak diode recovery dv/dt ³⁾	dv/dt	5	V/ns
Power Dissipation C TO-220F ($T_c = 25^\circ\text{C}$)	P_D	30	W
Derate above 25°C		0.24	W/ $^\circ\text{C}$
Power Dissipation C TO-220\TO-251\TO-252 ($T_c = 25^\circ\text{C}$)	P_D	75	W
Derate above 25°C		0.6	W/ $^\circ\text{C}$
Operating junction and storage temperature range	T_J, T_{STG}	-55 to +150	$^\circ\text{C}$
Continuous diode forward current	I_S	5	A
Diode pulse current	$I_{S,pulse}$	20	A

Thermal Characteristics

Parameter	Symbol	Value		Unit
		C TO-220F	C TO-220\TO-251\TO-252	
Thermal resistance, Junction-to-case	$R_{\theta JC}$	4.17	1.67	$^\circ\text{C/W}$
Thermal resistance, Junction-to-ambient	$R_{\theta JA}$	62.5	110	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device	Device Package	Marking	Units/Tube	Units/Reel
VSM5N50-T1	TO-251	VSM5N50-T1	50	
VSM5N50-T2	TO-252	VSM5N50-T2	50	
VSM5N50-TF	TO-220F	VSM5N50-TF		2500
VSM5N50-TC	TO-220C	VSM5N50-TC	72	

Electrical Characteristics
 $T_c = 25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Static characteristics						
Drain-source breakdown voltage	BV_{DSS}	$V_{GS}=0\text{ V}, I_D=0.25\text{ mA}$	500	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=0.25\text{ mA}$	2	-	4	V
Drain cut-off current	I_{DSS}	$V_{DS}=500\text{ V}, V_{GS}=0\text{ V},$ $T_j = 25^\circ\text{C}$ $T_j = 125^\circ\text{C}$	-	-	1	μA
Gate leakage current, Forward	I_{GSSF}	$V_{GS}=30\text{ V}, V_{DS}=0\text{ V}$	-	-	100	nA
Gate leakage current, Reverse	I_{GSSR}	$V_{GS}=-30\text{ V}, V_{DS}=0\text{ V}$	-	-	-100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=2.5\text{ A}$	-	1.35	1.60	Ω
Dynamic characteristics						
Input capacitance	C_{iss}	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$	-	537.5	-	pF
Output capacitance	C_{oss}		-	80.3	-	
Reverse transfer capacitance	C_{rss}		-	4	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 250\text{ V}, I_D = 5\text{ A}$ $R_G = 10\ \Omega, V_{GS}=15\text{ V}$	-	10.3	-	ns
Rise time	t_r		-	33.1	-	
Turn-off delay time	$t_{d(off)}$		-	29.4	-	
Fall time	t_f		-	13.2	-	
Gate charge characteristics						
Gate to source charge	Q_{gs}	$V_{DD}=400\text{ V}, I_D=5\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	3.9	-	nC
Gate to drain charge	Q_{gd}		-	4.6	-	
Gate charge total	Q_g		-	12.8	-	
Gate plateau voltage	$V_{plateau}$		-	5	-	V
Reverse diode characteristics						
Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=5\text{ A}$	-	-	1.5	V
Reverse recovery time	t_{rr}	$V_R=250\text{ V}, I_F=5\text{ A},$ $di/dt=100\text{ A}/\mu\text{s}$	-	319.2	-	ns
Reverse recovery charge	Q_{rr}		-	1.6	-	μC
Peak reverse recovery current	I_{rrm}		-	10.2	-	A

Notes:

- Pulse width limited by maximum junction temperature.
- $L=10\text{mH}, I_{AS} = 6.5\text{A},$ Starting $T_j = 25^\circ\text{C}.$
- $I_{SD} = 5\text{A}, di/dt \leq 100\text{A}/\mu\text{s}, V_{DD} \leq BV_{DS},$ Starting $T_j = 25^\circ\text{C}.$

Electrical Characteristics Diagrams

Figure 1. Typical Output Characteristics

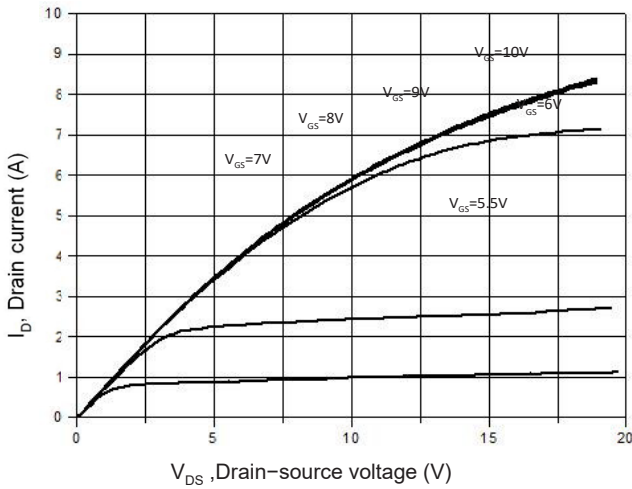


Figure 2. Transfer Characteristics

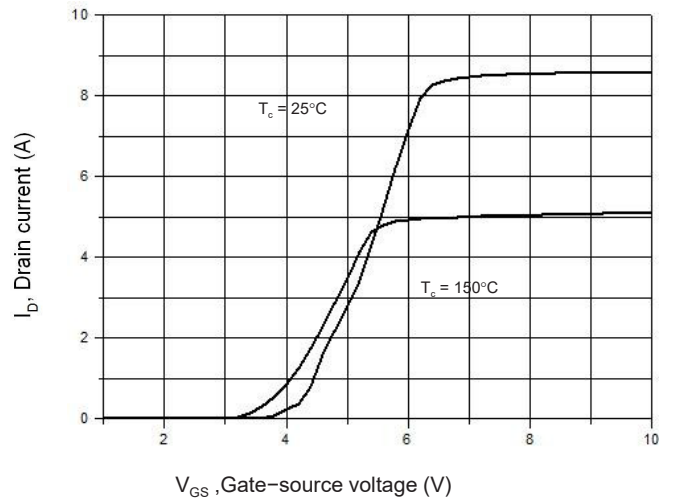


Figure 3. On-Resistance Variation vs. Drain Current

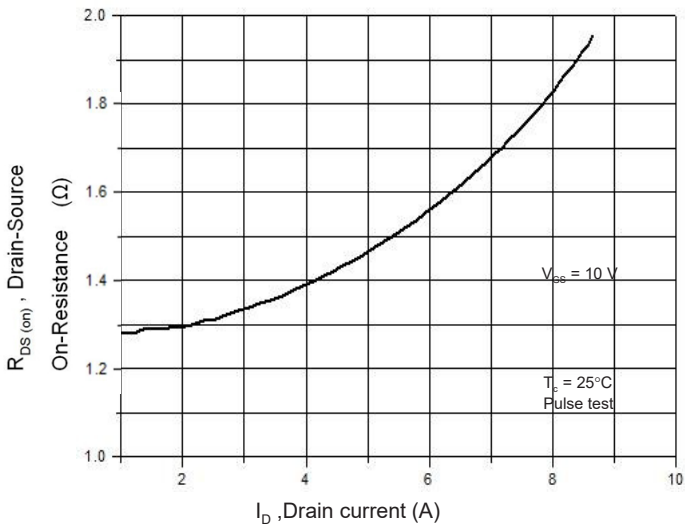


Figure 4. Threshold Voltage vs. Temperature

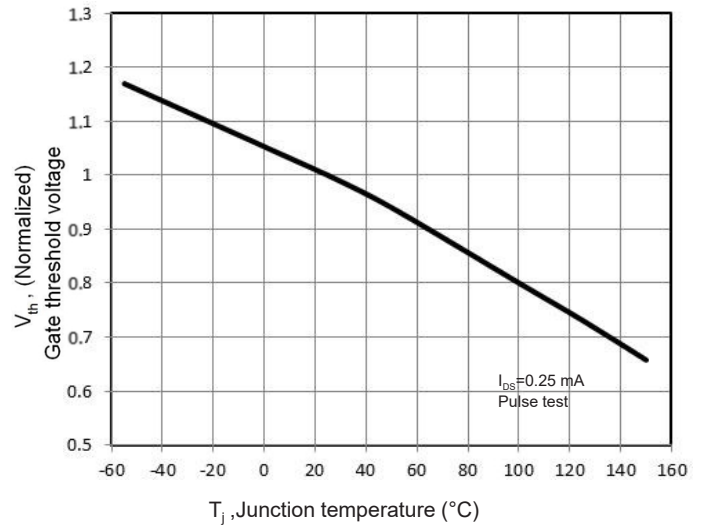


Figure 5. Breakdown Voltage vs. Temperature

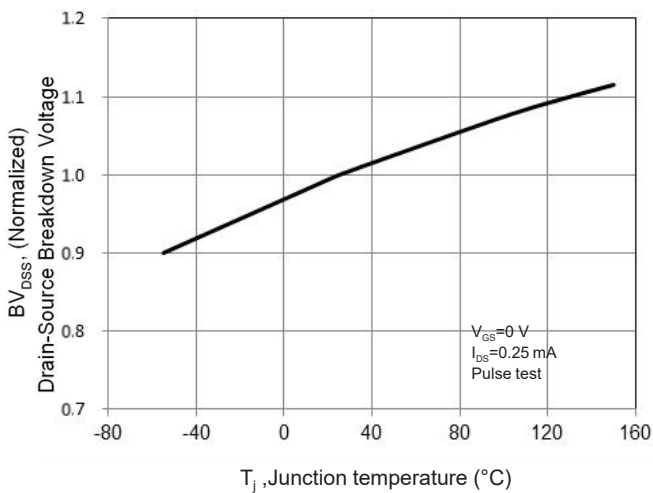


Figure 6. On-Resistance vs. Temperature

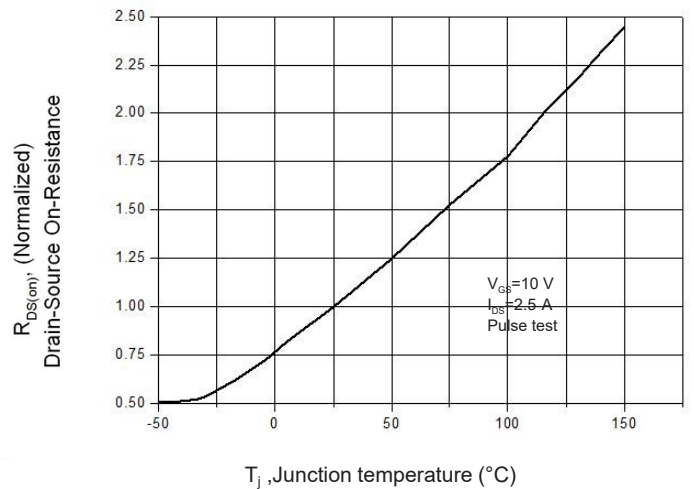


Figure 7. Capacitance Characteristics

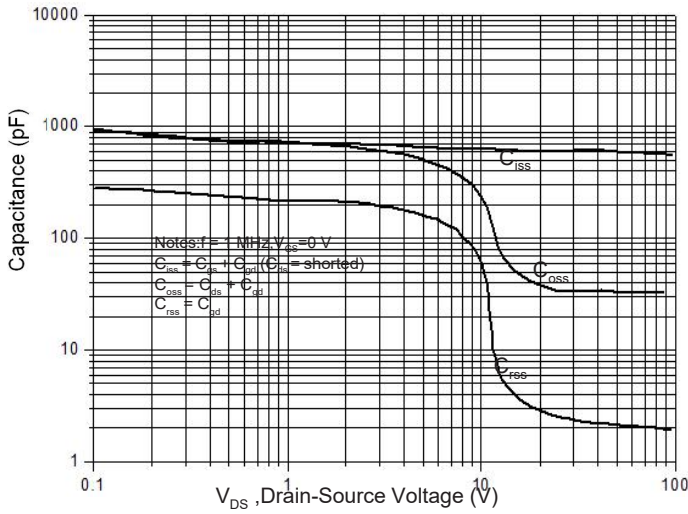


Figure 8. Gate Charge Characteristics

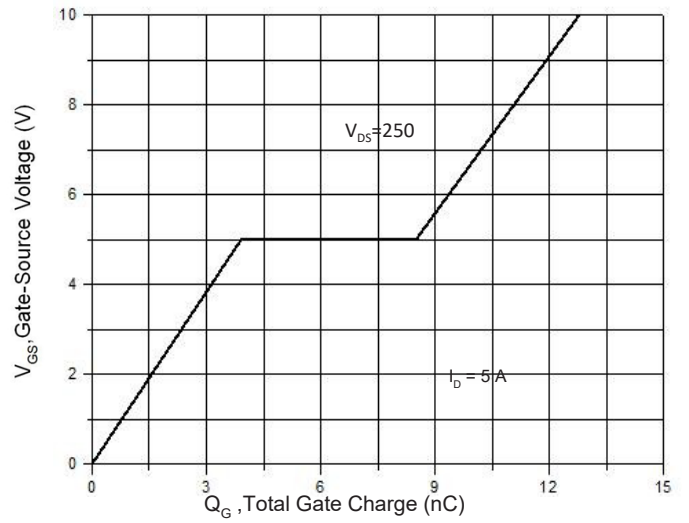


Figure 9. Maximum Safe Operating Area
C C TO-220F

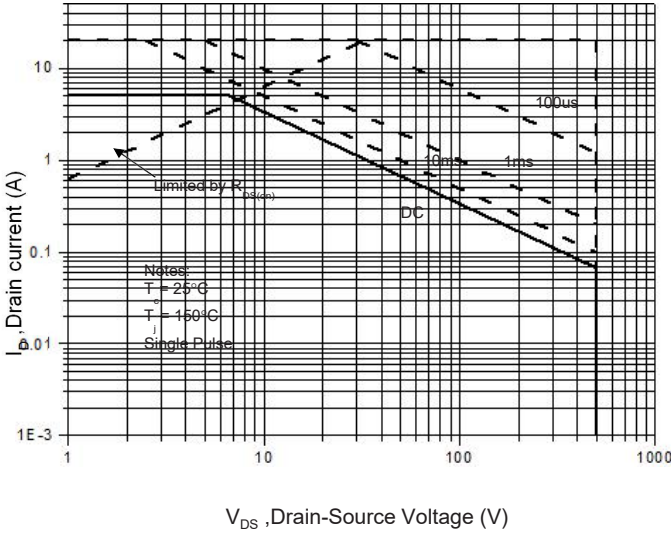


Figure 10. Maximum Safe Operating Area
C C TO-220/TO-251/TO-252

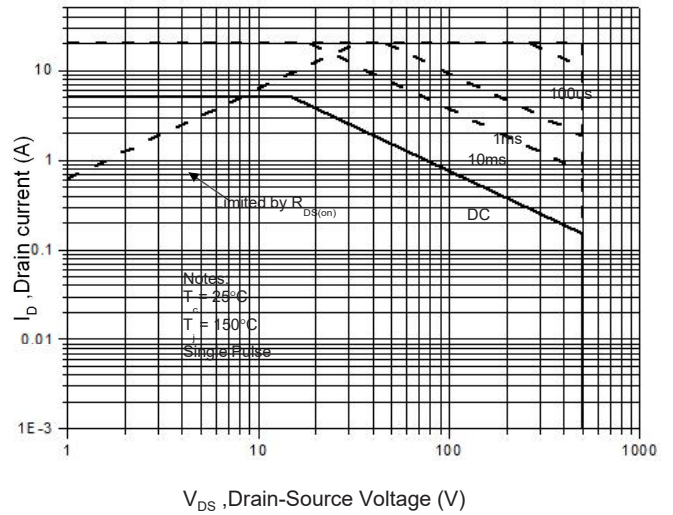


Figure 11. Power Dissipation vs. Temperature
C C TO-220F

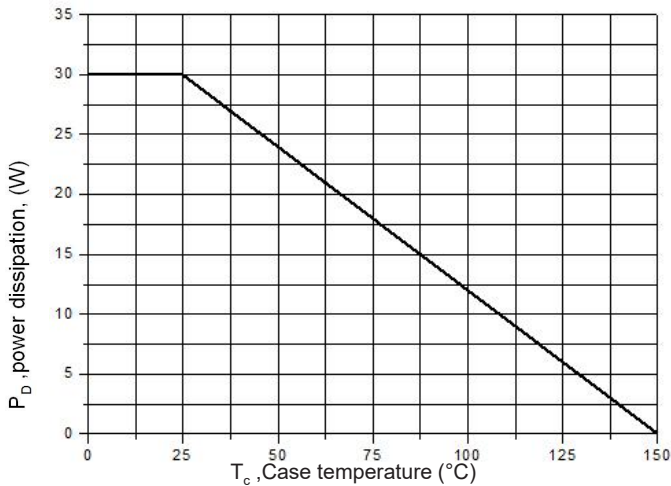


Figure 12. Power Dissipation vs. Temperature
C C TO-220/TO-251/TO-252

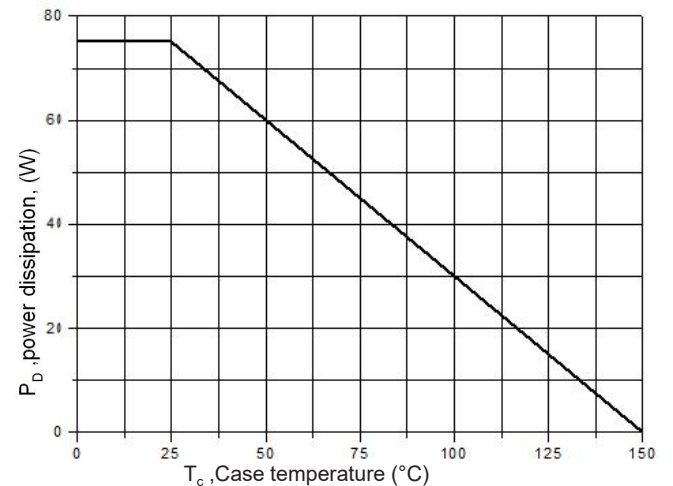


Figure 13. Continuous Drain Current vs. Temperature

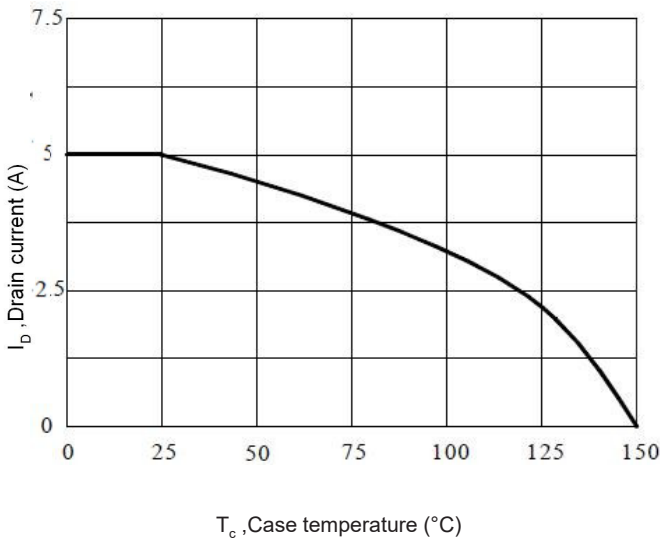
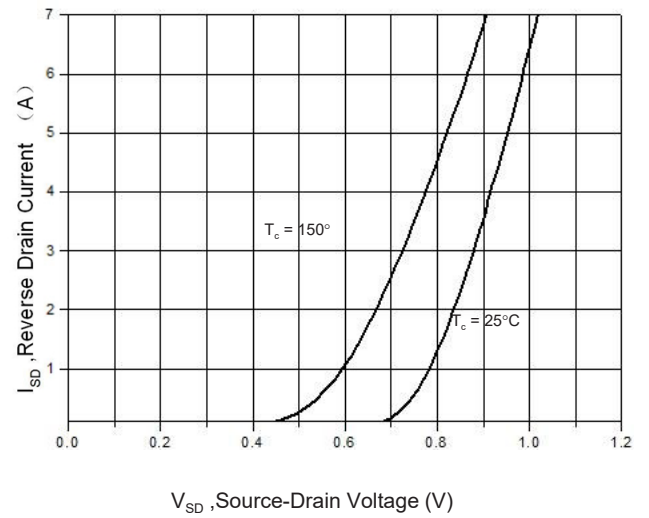
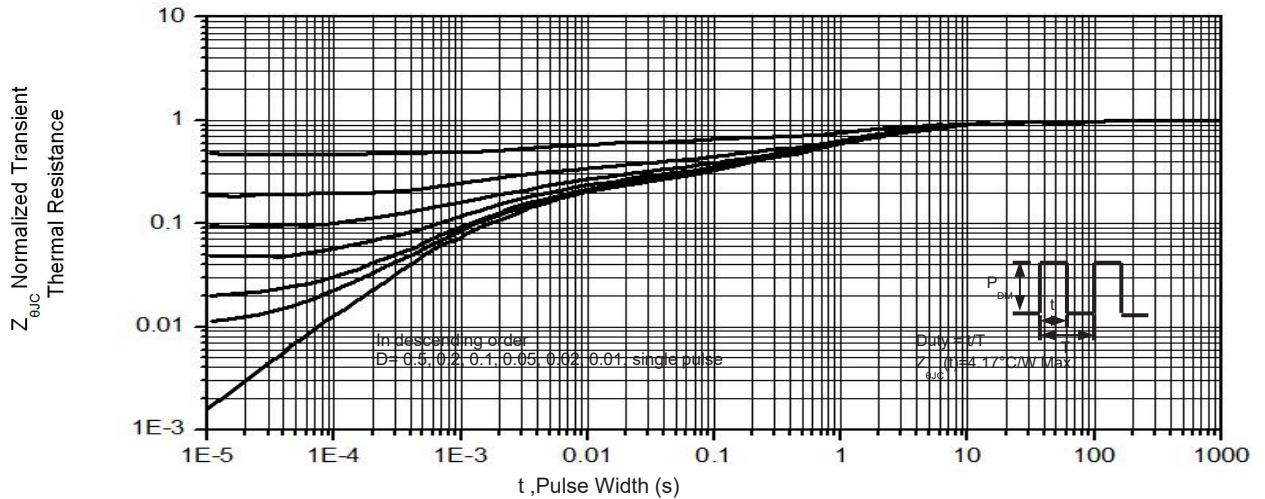
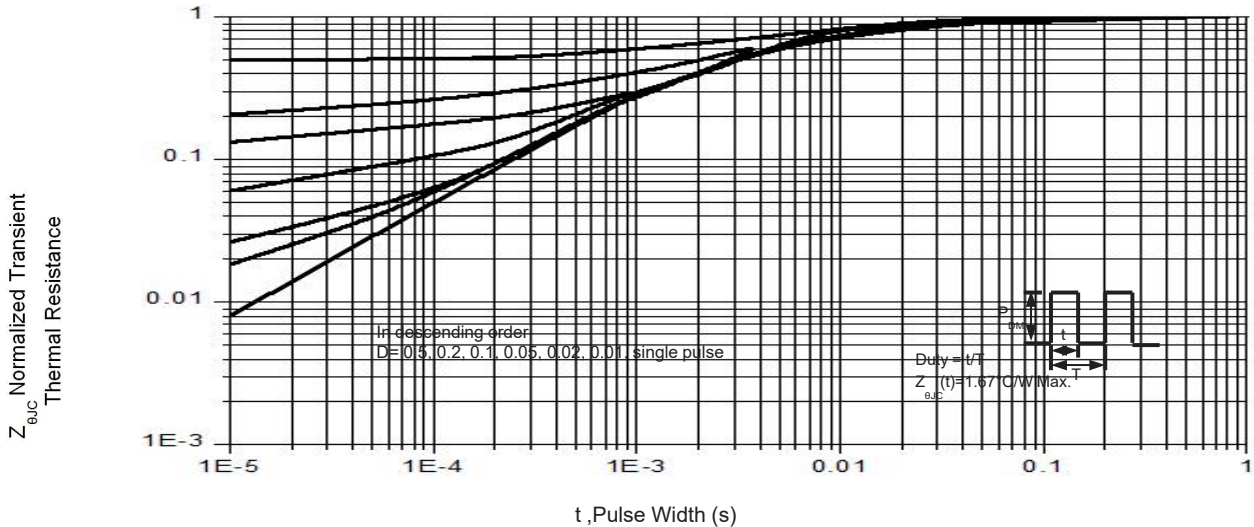
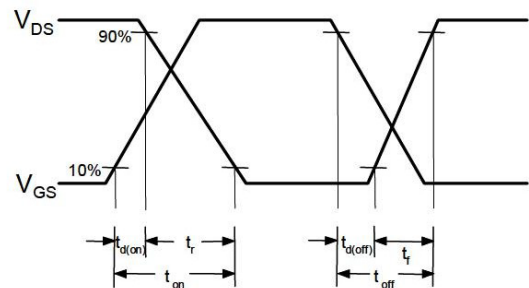
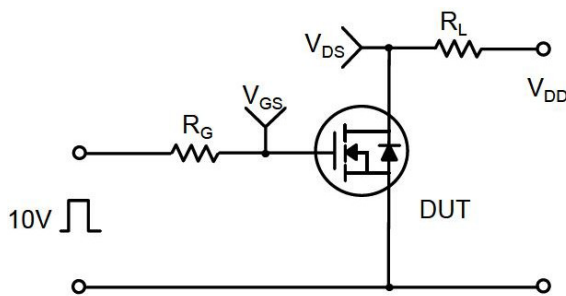
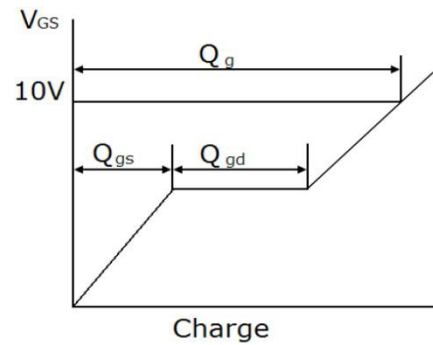
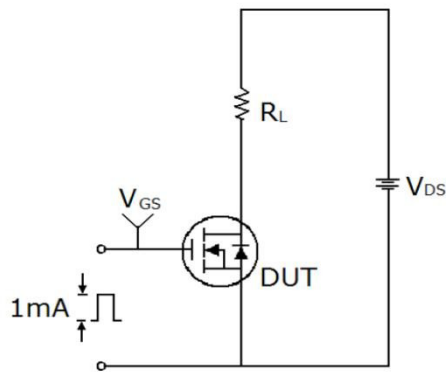


Figure 14. Body Diode Transfer Characteristics


 Figure 15 Transient Thermal Impedance, Junction to Case ζ TO-220F

 Figure 16. Transient Thermal Impedance, Junction to Case ζ TO-220/TO-251/TO-252


Gate Charge Test Circuit & Waveform

Unclamped Inductive Switching Test Circuit & Waveforms
