
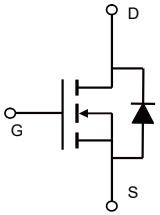


<p><b>Description</b></p> <p>The Power MOSFET is fabricated using the advanced planer <b>VDMOS</b> technology. The resulting device has low conduction resistance, superior switching performance and high avalanche energy.</p> <p><b>Features</b></p> <ul style="list-style-type: none"> <li>◆ Low <math>R_{DS(on)}</math></li> <li>◆ Low gate charge (typ. <math>Q_g = 33.2</math> nC)</li> <li>◆ 100% UIS tested</li> <li>◆ RoHS compliant</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>◆ Power factor correction.</li> <li>◆ Switched mode power supplies.</li> <li>◆ LED driver.</li> </ul>	<p><b>Product Summary</b></p> <table> <tr> <td><math>V_{DSS}</math></td> <td>500V</td> </tr> <tr> <td><math>I_D</math></td> <td>12A</td> </tr> <tr> <td><math>R_{DS(on),max}</math></td> <td>0.55<math>\Omega</math></td> </tr> <tr> <td><math>Q_{g,typ}</math></td> <td>33.2 nC</td> </tr> </table> <p><b>Pin Configuration</b></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>TO-220F</p> </div> <div style="text-align: center;">  <p>Schematic</p> </div> </div>	$V_{DSS}$	500V	$I_D$	12A	$R_{DS(on),max}$	0.55 $\Omega$	$Q_{g,typ}$	33.2 nC
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### Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	500	V
Continuous drain current ( $T_C = 25^\circ\text{C}$ ) ( $T_C = 100^\circ\text{C}$ )	$I_D$	12	A
		7.5	A
Pulsed drain current <sup>1)</sup>	$I_{DM}$	48	A
Gate-Source voltage	$V_{GSS}$	$\pm 30$	V
Avalanche energy, single pulse <sup>2)</sup>	$E_{AS}$	451	mJ
Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_D$	33	W
Operating junction and storage temperature range	$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$
Continuous diode forward current	$I_S$	12	A
Diode pulse current	$I_{S,pulse}$	48	A

### Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal resistance, Junction-to-case	$R_{\theta JC}$	3.8	$^\circ\text{C/W}$
Thermal resistance, Junction-to-ambient <sup>3)</sup>	$R_{\theta JA}$	60	$^\circ\text{C/W}$

### Package Marking and Ordering Information

Device	Device Package	Marking	Units/Tube
VSM12N50-TF	TO-220F	VSM12N50-TF	50

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

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
<b>Static characteristics</b>						
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	$I_{DSS}$	$V_{DS}=500\text{ V}, V_{GS}=0\text{ V},$ $T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	-	-	1 100	$\mu\text{A}$
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	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=6\text{ A}, T_j=25^\circ\text{C}$	-	0.46	0.55	$\Omega$
Gate resistance	$R_g$	$V_{GS}=0\text{ V}, V_{DS}=0\text{ V}, f=1\text{ MHz}$	-	2.7	-	$\Omega$
<b>Dynamic characteristics</b>						
Input capacitance	$C_{iss}$	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$	-	1612	-	$\mu\text{F}$
Output capacitance	$C_{oss}$		-	160	-	
Reverse transfer capacitance	$C_{rss}$		-	6	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 250\text{ V}, I_D = 6\text{ A}$ $R_G = 10\ \Omega, V_{GS}=15\text{ V}$	-	12.7	-	ns
Rise time	$t_r$		-	28.6	-	
Turn-off delay time	$t_{d(off)}$		-	74.3	-	
Fall time	$t_f$		-	11	-	
<b>Gate charge characteristics</b>						
Gate to source charge	$Q_{gs}$	$V_{DD}=400\text{ V}, I_D=6\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	7.8	-	nC
Gate to drain charge	$Q_{gd}$		-	12.8	-	
Gate charge total	$Q_g$		-	33.2	-	
Gate plateau voltage	$V_{plateau}$		-	5	-	V
<b>Reverse diode characteristics</b>						
Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=6\text{ A}$	-	-	1.5	V
Reverse recovery time	$t_{rr}$	$V_R=400\text{ V}, I_F=6\text{ A},$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	300.8	-	ns
Reverse recovery charge	$Q_{rr}$		-	2.2	-	$\mu\text{C}$
Peak reverse recovery current	$I_{rrm}$		-	14.4	-	A

**Notes:**

- Pulse width limited by maximum junction temperature.
- $V_{DD}=60\text{ V}, L=10\text{ mH}, I_{AS} = 9.5\text{ A}$ , Starting  $T_j= 25^\circ\text{C}$ .
- The value of  $R_{thJA}$  is measured by placing the device in a still air box which is one cubic foot.

**Electrical Characteristics Diagrams**

Figure 1. Typical Output Characteristics

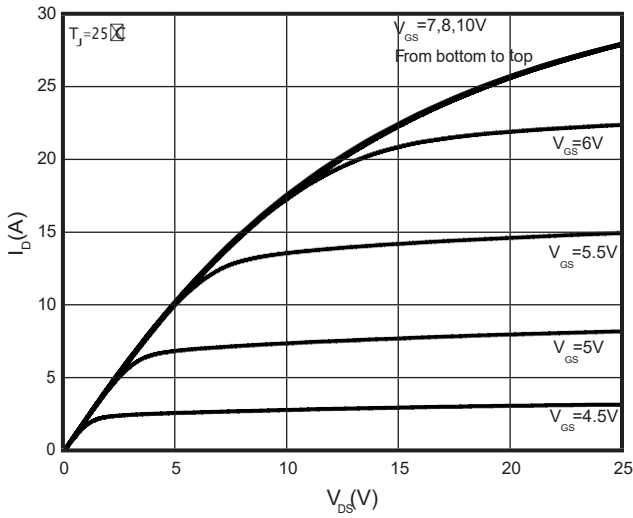


Figure 3. On-Resistance Variation vs. Drain Current

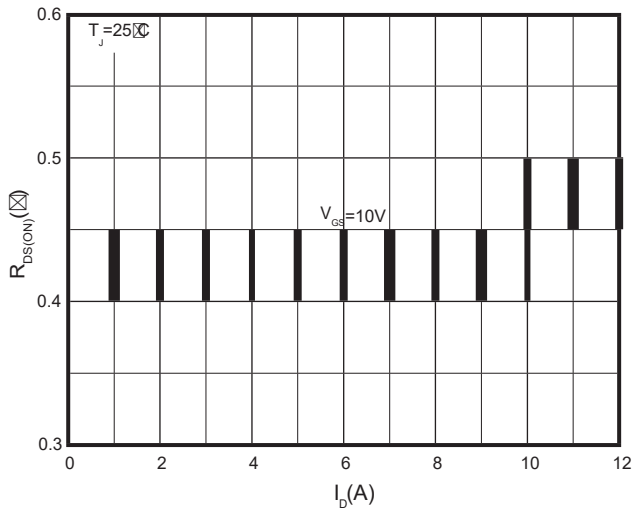


Figure 5. Breakdown Voltage vs. Temperature

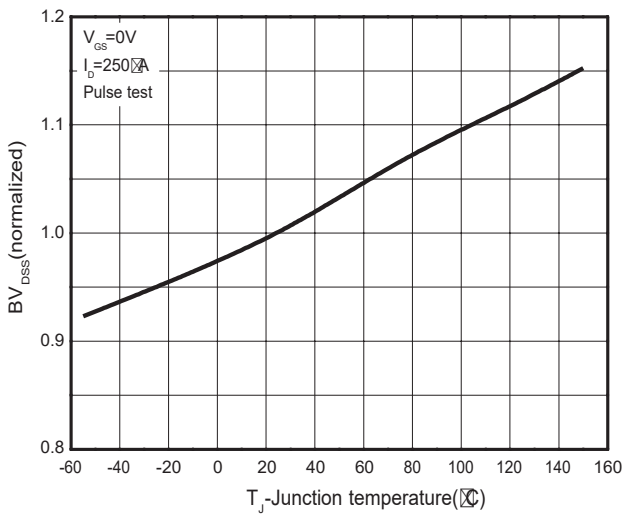


Figure 2. Transfer Characteristics

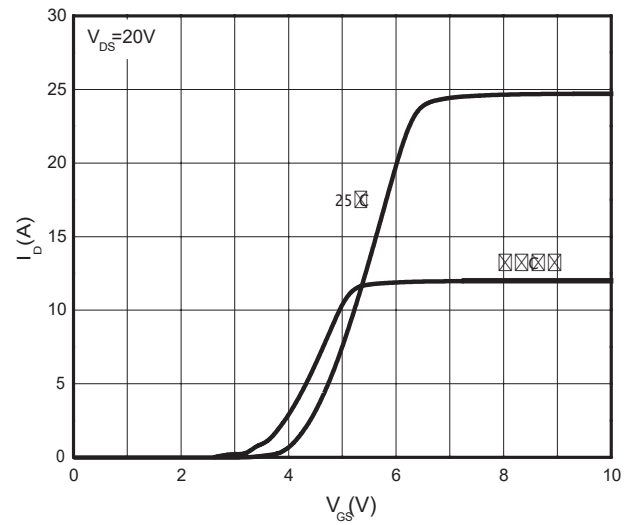


Figure 4. Threshold Voltage vs. Temperature

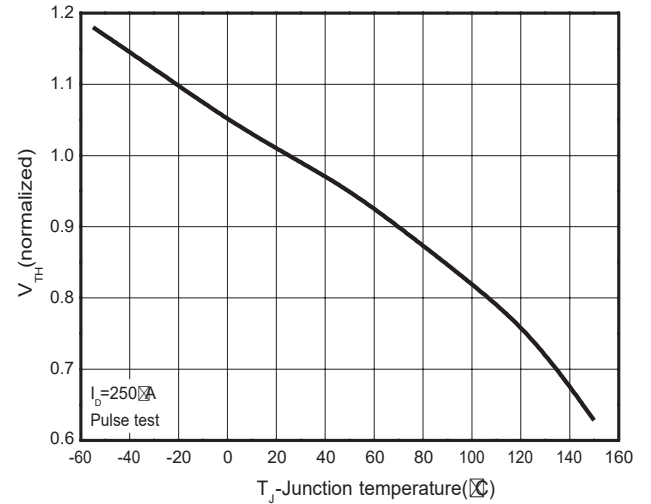


Figure 6. On-Resistance vs. Temperature

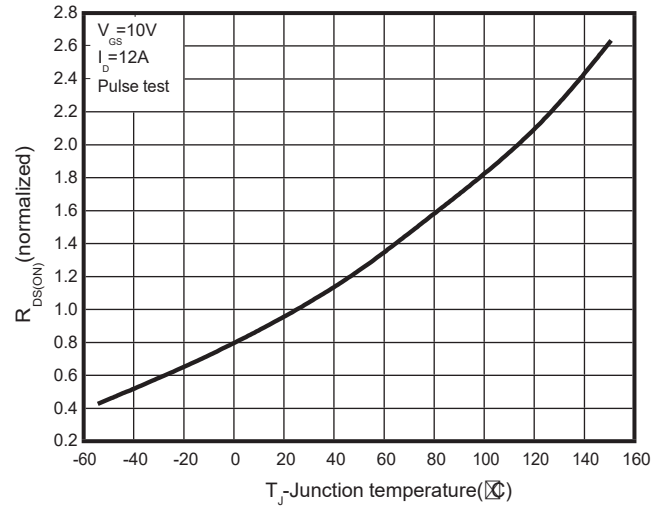


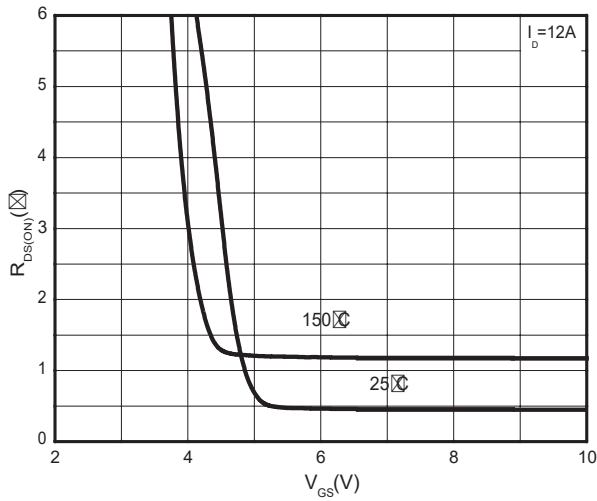
Figure 7.  $R_{ds(on)}$  vs. Gate Voltage


Figure 8. Body-Diode Characteristics

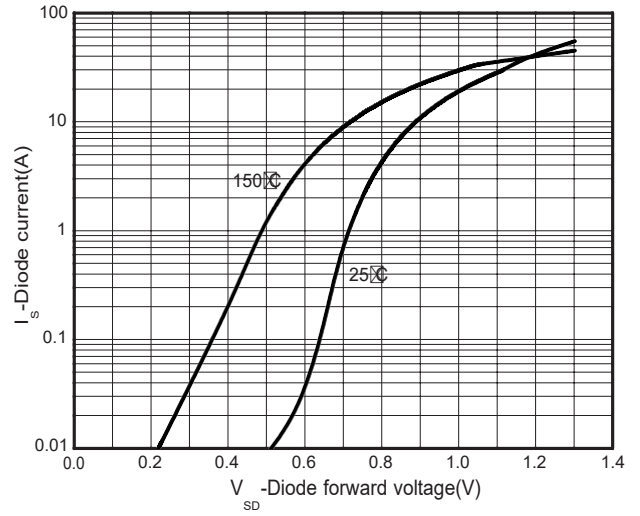


Figure 9. Capacitance Characteristics

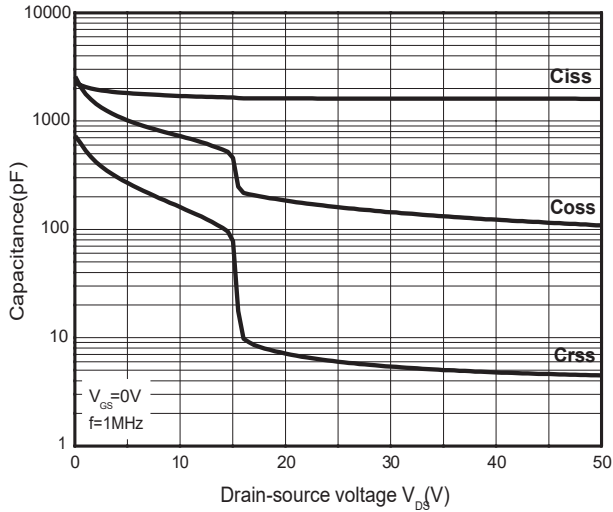


Figure 10. Gate Charge Characteristics

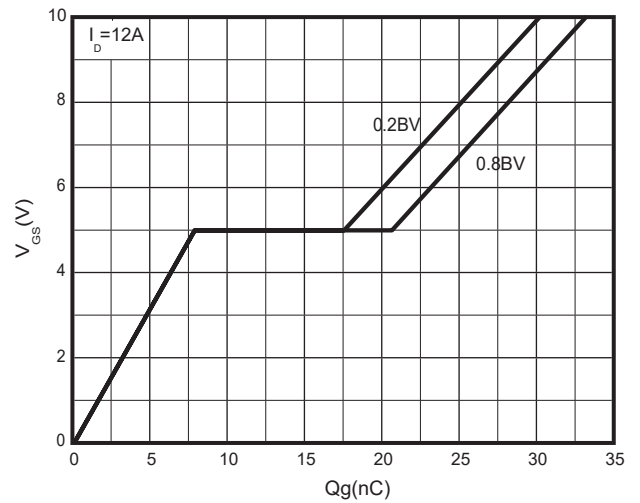


Figure 11. Power Dissipation vs. Temperature

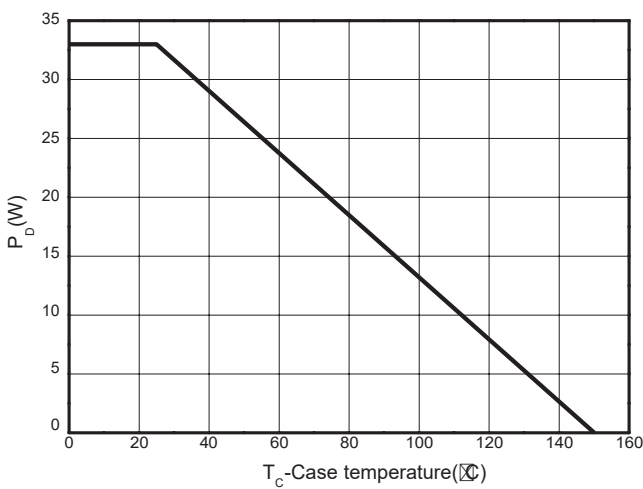


Figure 12. Continuous Drain Current vs. Temperature

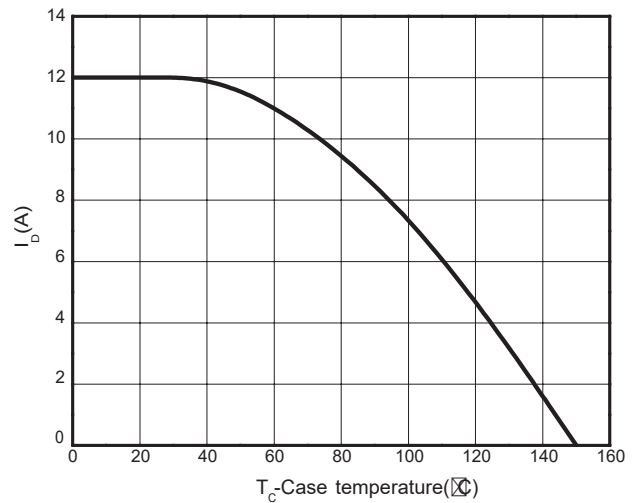


Figure 13: Safe Operating Area

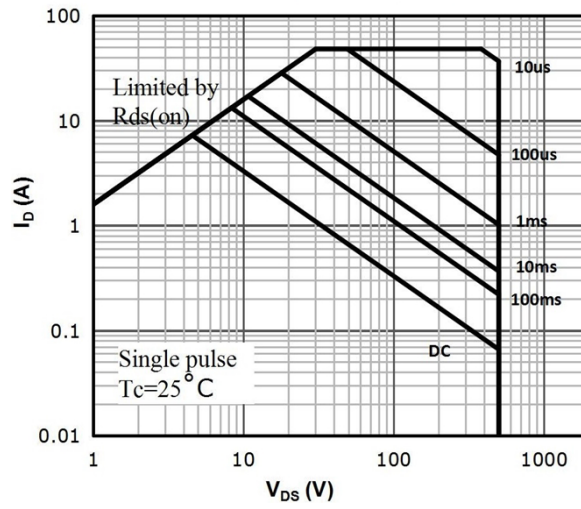
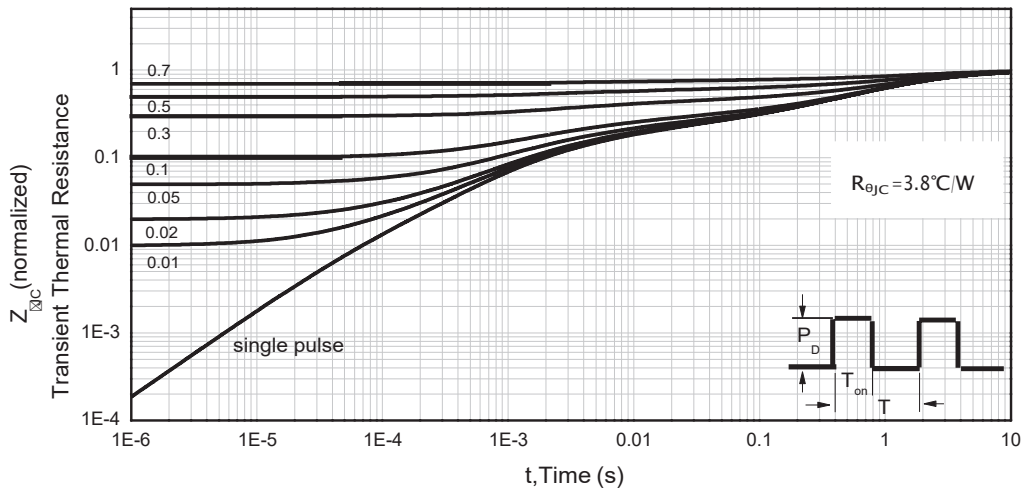
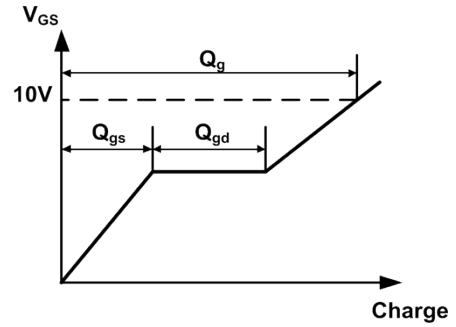
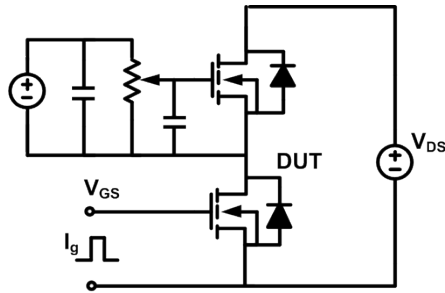
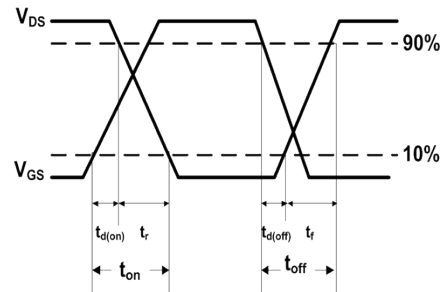
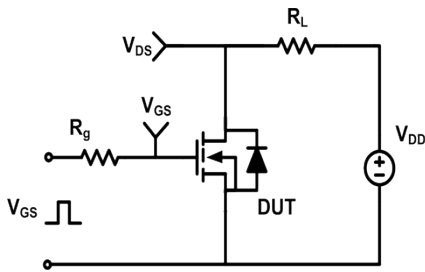
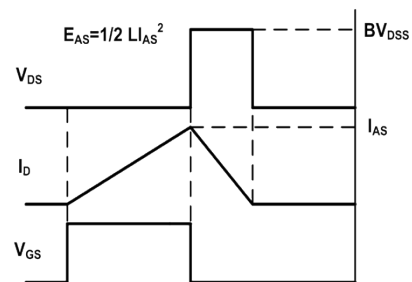
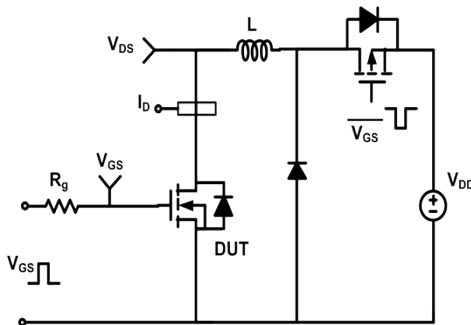


Figure 14. Transient Thermal Impedance, Junction to Case



**Test Circuit & Waveforms**
**Gate Charge Test Circuit & Waveform**

**Resistive Switching Test Circuit & Waveform**

**Unclamped Inductive Switching (UIS) Test Circuit & Waveform**

**Diode Recovery Test Circuit & Waveform**
