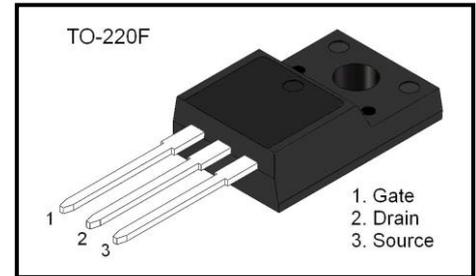
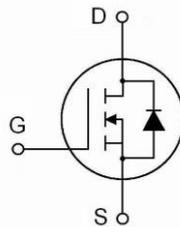


## General Description

The ZH10N65F is a high voltage power MOSFET designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristic. This power MOSFET is usually used in high speed switching applications including power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits

## Features

- $V_{DS}$  650V
- $I_D$  10A
- $R_{DS(ON)}$  ( $V_{GS} = 10V$ )  $<0.86\Omega$
- Fast Switching Capability
- Avalanche Energy Specified
- Improved dv/dt Capability, High Ruggedness



## Absolute Maximum Ratings (T<sub>C</sub> = 25°C unless otherwise specified)

Parameter		Symbol	Ratings	Units
Gate-Drain Voltage		$V_{DSS}$	650	V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	V
Continuous Drain Current	$T_A=25^\circ\text{C}$	$I_D$	10	A
	Pulsed (Note 2)	$I_{DM}$	38	
Power Dissipation		$P_D$	50	W
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	700	mJ
	Repetitive (Note 2)	$E_{AR}$	15.6	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Junction Temperature		$T_J$	150	$^\circ\text{C}$
Storage Temperature		$T_{STG}$	-55~155	$^\circ\text{C}$

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Repetitive Rating: Pulse width limited by maximum junction temperature

3.  $L = 14.2\text{mH}$ ,  $I_{AS} = 10\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$  Starting  $T_j = 25^\circ\text{C}$

4.  $I_{SD} \leq 9.5\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_j = 25^\circ\text{C}$

## Thermal Characteristic

Parameter	Symbol	Value	Units
Maximum Thermal Resistance, Junction-case	$R_{\theta JC}$	2.5	$^\circ\text{C}/\text{W}$
Maximum Thermal Resistance, Junction-Ambient	$R_{\theta JA}$	62.5	$^\circ\text{C}/\text{W}$

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

Parameter	Symbol	Test Conditions	Min.	Typ	Max.	Units
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=-250\mu A$	650			V
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D = 250\mu A$ , Referenced to $25^\circ\text{C}$		0.7		$V/^\circ\text{C}$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 650V, V_{GS} = 0V$			1	$\mu A$
Gate Leakage Current	Forward	$I_{GSS}$			100	nA
	Reverse				-100	nA
<b>On Characteristics</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	2.0		4.0	V
Drain-source On-Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 5A$		0.72	0.86	$\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS} = 10V, I_D = 5A$		8.0		S
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS} = 25V, V_{GS} = 0V$ , $f = 1.0\text{MHz}$		1570	2040	pF
Output Capacitance	$C_{oss}$			166	215	
Reverse Transfer Capacitance	$C_{rss}$			18	24	
<b>Switching Characteristics)</b>						
Turn-On Delay Time	$t_{d(on)}$	$V_{DS} = 325V, I_D = 10A$ $R_G = 25\Omega$ (Note 1, 2)		23	55	ns
Turn-on Rise Time	$t_r$			69	150	
Turn-Off elay Time	$t_{d(off)}$			144	300	
Turn-Off Fall	$t_f$			77	165	
Total Gate Charge	$Q_g$	$V_{DS} = 520V, I_D = 10A$ $V_{GS} = 10V$ (Note 1, 2)		44	57	nC
Gate-Source Charge	$Q_{gs}$			6.7		
Gate-Drain Charge	$Q_{gd}$			18.5		
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=10A$			1.4	V
Diode Forward Current	$I_S$	-			10	A
Pulsed Diode Forward Current	$I_{SM}$				38	A
Reverse Recovery Time	$t_{rr}$	$I_S = 10A, V_{GS} = 0V$ $di_f/dt = 100A/\mu s$ (Note 1)		420		ns
Reverse Recovery Charge	$Q_{rr}$			4.2		nC

Notes: 1. Pulse Test : Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ 

2. Essentially independent of operating temperature

Test Circuits and Waveforms

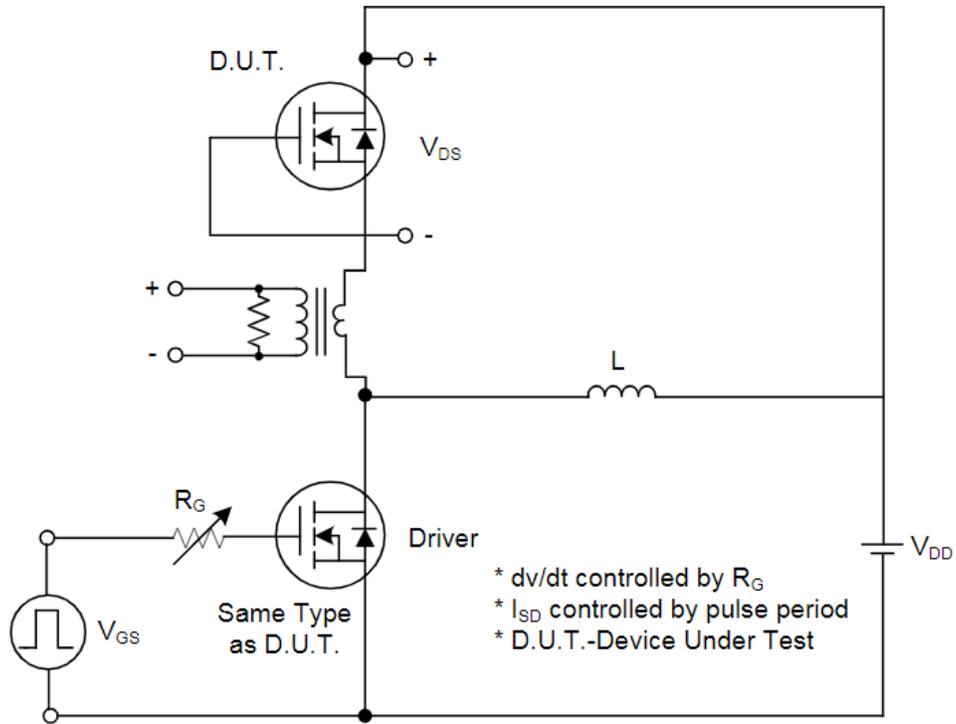


Figure 1. Peak Diode Recovery  $dv/dt$  Test Circuit

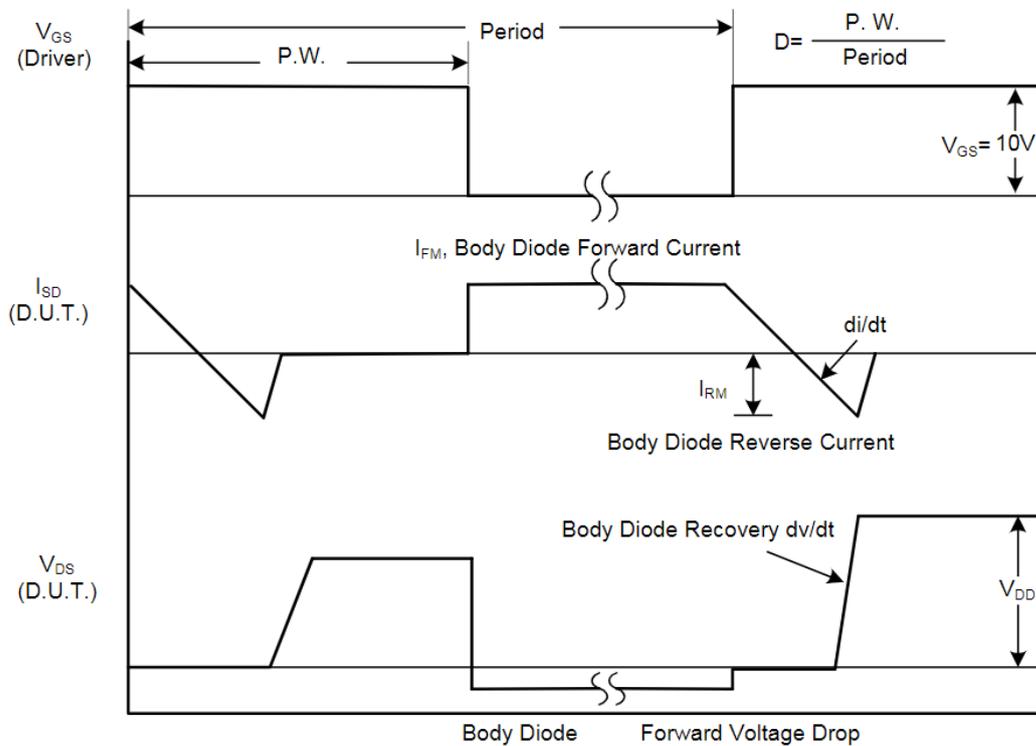


Figure 2. Peak Diode Recovery  $dv/dt$  Waveforms

Test Circuits and Waveforms

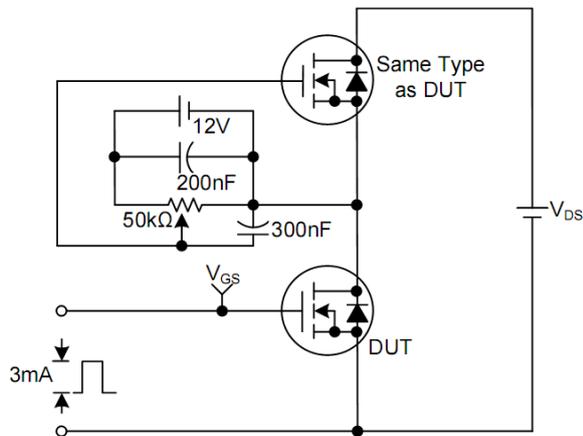


Figure 3. Gate Charge Test Circuit

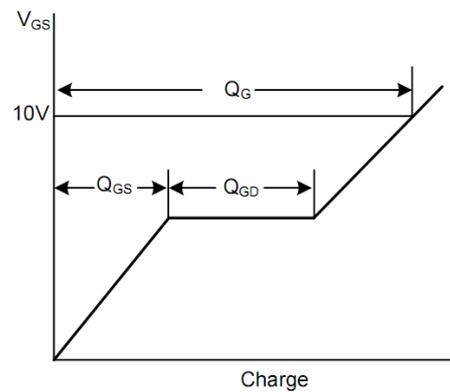


Figure 4. Gate Charge Waveforms

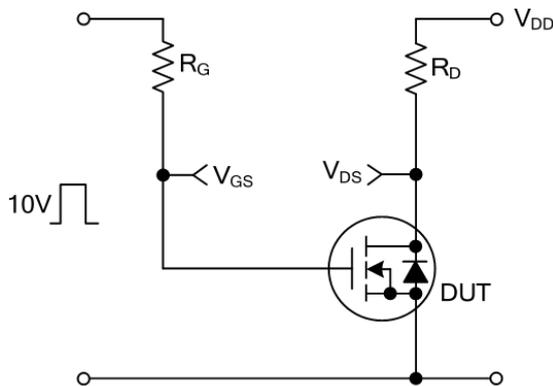


Figure 5. Resistive Switching Circuit

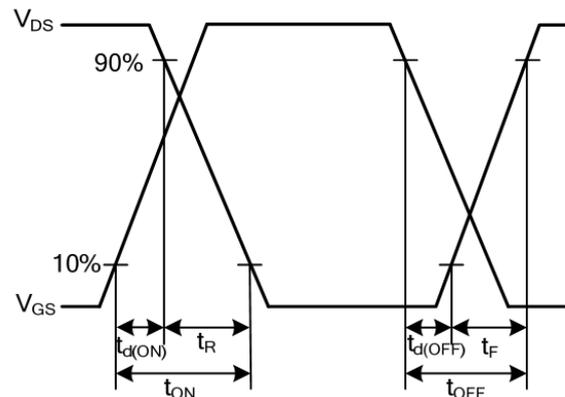


Figure 6. Resistive Switching Waveforms

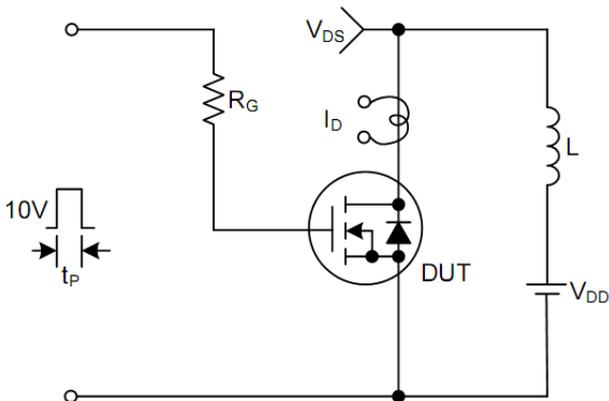


Figure 7. Unclamped Inductive Switching Test Circuit

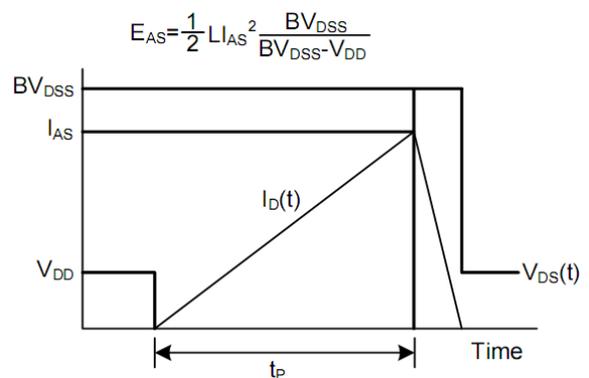


Figure 8. Unclamped Inductive Switching Waveforms

Typical Characteristics

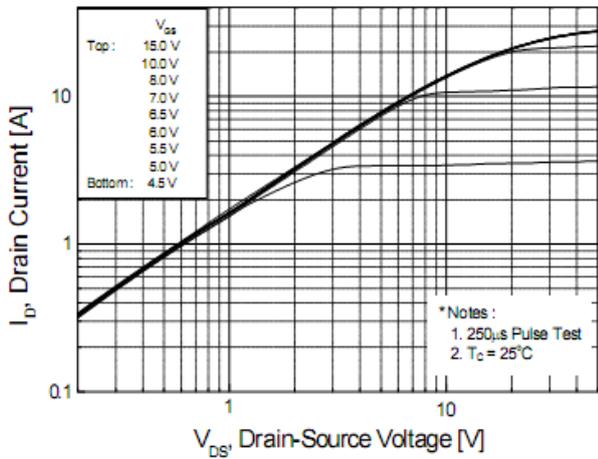


Figure 9. Output Characteristics

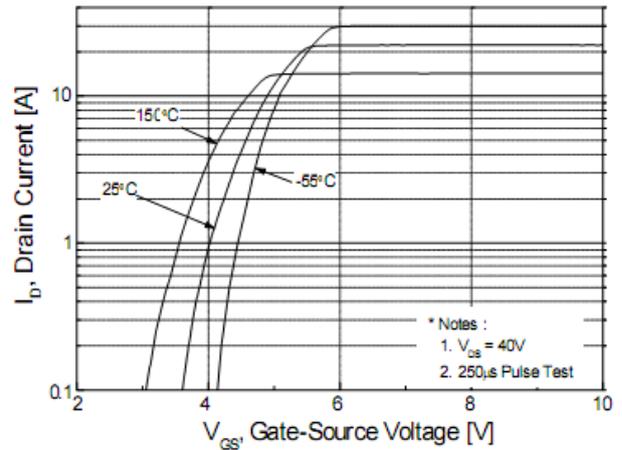


Figure 10. Transfer Characteristics

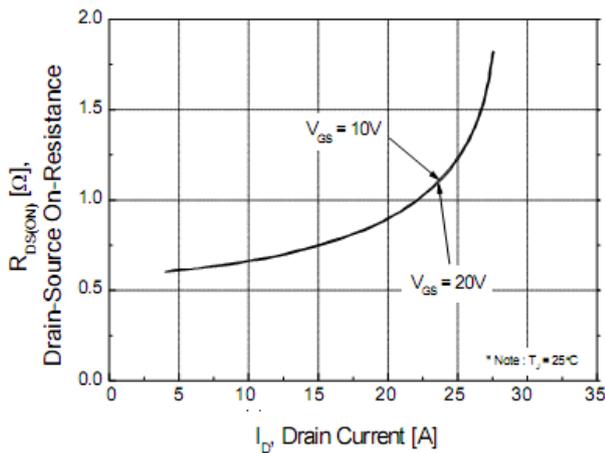


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

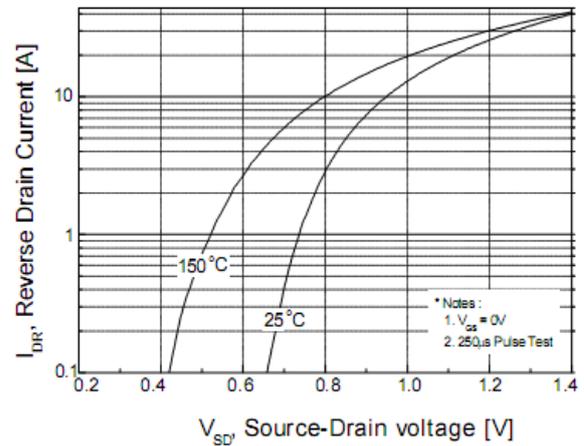


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

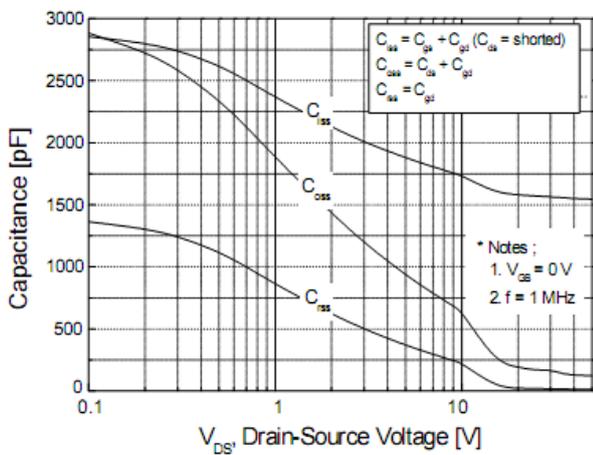


Figure 11. Capacitance Characteristics

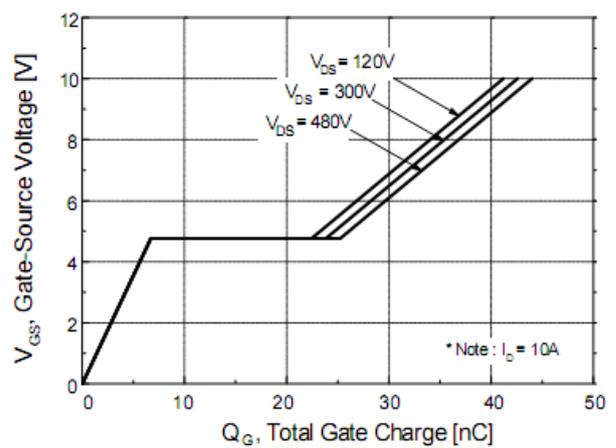


Figure 12. Gate Charge Characteristics

Typical Characteristics

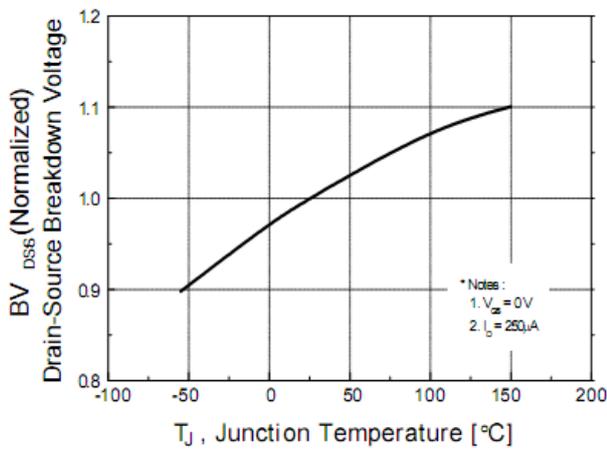


Figure 13. Breakdown Voltage Variation vs Temperature

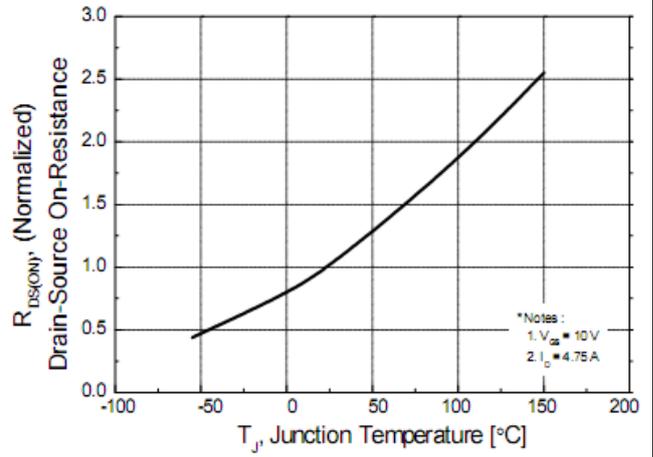


Figure 14. On-Resistance Variation vs Temperature

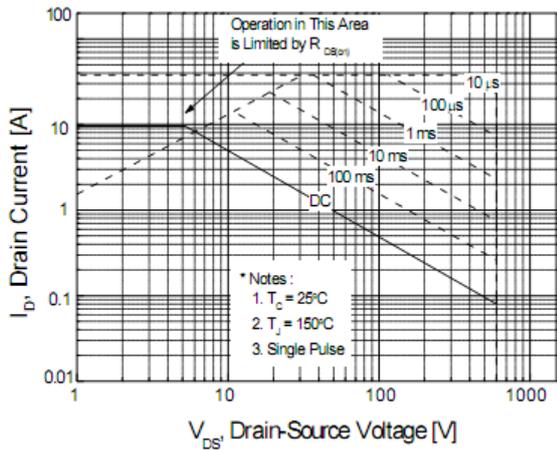


Figure 15. Safe Operating Area

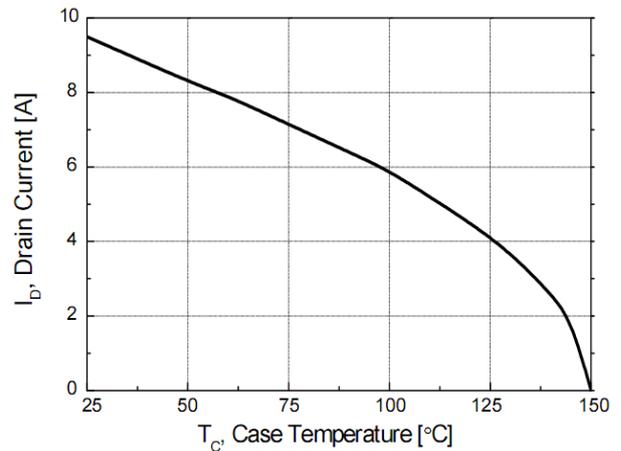


Figure 16. Maximum Drain Current vs Case Temperature

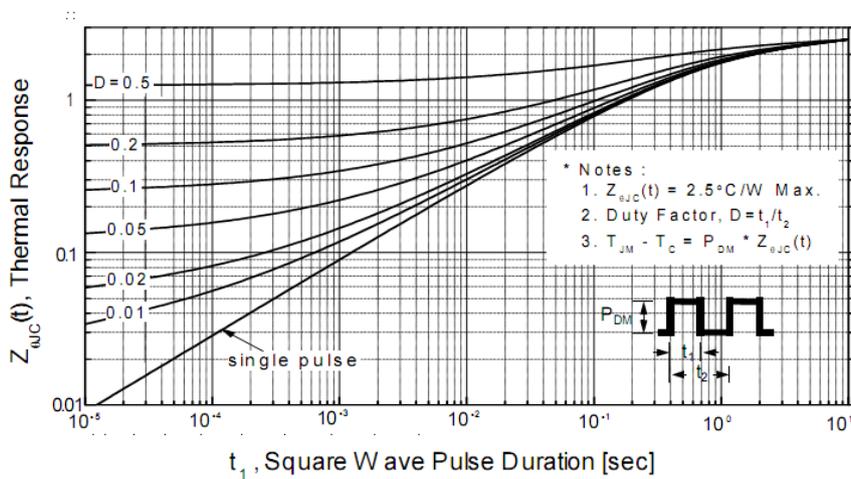


Figure 17. Transient Thermal Response Curve

Package Dimensions

Dim	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.50	4.90	0.177	0.193
A1	2.34	2.74	0.092	0.108
A2	2.66	2.86	0.105	0.113
b	0.75	0.85	0.030	0.033
b1	1.24	1.44	0.049	0.057
c	0.40	0.60	0.016	0.024
D	10.00	10.32	0.394	0.406
E	15.75	16.05	0.620	0.632
e	2.44	2.64	0.096	0.104
e1	4.88	5.28	0.192	0.208
F	3.10	3.5	0.122	0.138
L	12.90	13.50	0.508	0.531
L1	2.90	3.30	0.114	0.130
Φ	3.10	3.30	0.122	0.130