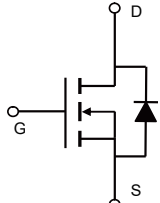## Description

The Power MOSFET is fabricated using the advanced planar VDMOS technology. The resulting device has low conduction resistance, superior switching performance and high avalance energy.

Features

◆ Low $R_{DS(on)}$

◆ Low gate charge (typ. Q_g =20.7nC)

◆ 100% UIS tested

◆ RoHS compliant

Applications

◆ Power faction correction.

◆ Switched mode power supplies.

◆ LED driver.

Product Summary

V_{DSS}	650V
I_D	7A
$R_{DS(on),max}$	1.4Ω
$Q_{g,typ}$	20.7nC

TO-220F   TO-220C

Schematic

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	650	V
Continuous drain current (T_C = 25°C)	I_D	7	A
(T_C = 100°C)		4.3	A
Pulsed drain current [1]	I_{DM}	28	A
Gate-Source voltage	V_{GSS}	±30	V
Avalanche energy, single pulse [2]	E_{AS}	352	mJ
Peak diode recovery dv/dt [3]	dv/dt	5	V/ns
Power Dissipation(C C C TO-220FT_C = 25°C)	P_D	39	W
Derate above 25°C		0.31	W/°C
Power Dissipation C C C TO-220(T_C = 25°C)		100	W
Derate above 25°C		0.8	W/°C
Operating junction and storage temperature range	T_J, T_{STG}	-55 to +150	°C
Continuous diode forward current	I_S	7	A
Diode pulse current	$I_{S,pulse}$	28	A

Thermal Characteristics

Parameter	Symbol	Value		Unit
		C C C TO-220F	C C C TO-220	
Thermal resistance, Junction-to-case	$R_{θJC}$	3.2	1.25	°C/W
Thermal resistance, Junction-to-ambient	$R_{θJA}$	62.5	110	°C/W

Package Marking and Ordering Information

Device	Device Package	Marking	Units/Tube	Units/Reel
VSM7N65-TF	TO-220F	VSM7N65-TF	50	
VSM7N65-TC	TO-220C	VSM7N65-TC	50	

Electrical Characteristics T_c = 25°C unless otherwise noted

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Static characteristics						
Drain-source breakdown voltage	BV_{DSS}	V_{GS}=0 V, I_D=250 uA	650	-	-	V
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=250 uA	2	-	4	V
Drain cut-off current	I_{DSS}	V_{DS}=650 V, V_{GS}=0 V, T_j = 25°C	-	-	1	µA
		T_j = 125°C	-	100		
Gate leakage current, Forward	I_{GSSF}	V_{GS}=30 V, V_{DS}=0 V	-	-	100	nA
Gate leakage current, Reverse	I_{GSSR}	V_{GS}=-30 V, V_{DS}=0 V	-	-	-100	nA
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS}=10 V, I_D=3.5 A	-	1.2	1.4	Ω
Dynamic characteristics						
Input capacitance	C_{iss}	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz	-	1090	-	pF
Output capacitance	C_{oss}		-	111	-	
Reverse transfer capacitance	C_{rss}		-	6.1	-	
Turn-on delay time	$t_{d(on)}$	V_{DD} = 325 V, I_D = 7 A, R_G = 10 Ω, V_{GS}=15 V	-	12.2	-	ns
Rise time	t_r		-	33.4	-	
Turn-off delay time	$t_{d(off)}$		-	53.6	-	
Fall time	t_f		-	15	-	
Gate charge characteristics						
Gate to source charge	Q_{gs}	V_{DD}=520 V, I_D=7 A, V_{GS}=0 to 10 V	-	5.7	-	nC
Gate to drain charge	Q_{gd}		-	7.2	-	
Gate charge total	Q_g		-	20.7	-	
Gate plateau voltage	$V_{plateau}$		-	5	-	V
Reverse diode characteristics						
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=7 A	-	0.85	1.5	V
Reverse recovery time	t_{rr}	V_R=325 V, I_F=7 A, dI_F/dt=100 A/µs	-	373.2	-	ns
Reverse recovery charge	Q_{rr}		-	2.1	-	µC
Peak reverse recovery current	I_{rrm}		-	15.7	-	A

Notes:

1. Pulse width limited by maximum junction temperature.

2. L=10mH, I_{AS} = 8.4A, Starting T_j= 25°C.

3. I_{SD} = 7A, di/dt≤100A/us, V_{DD}≤BV_{DS}, Starting T_j= 25°C.

Electrical Characteristics Diagrams

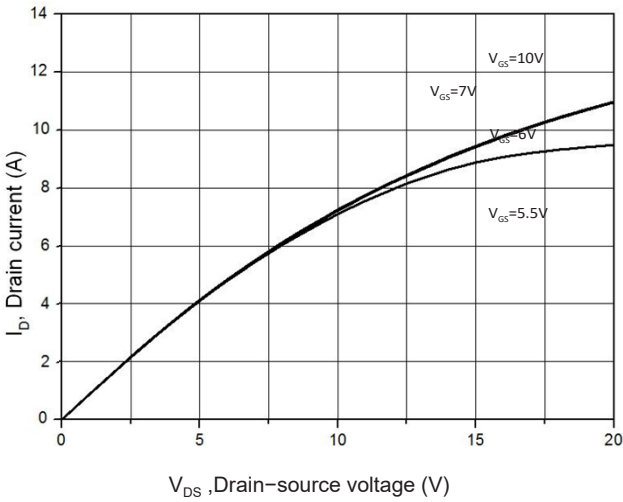Figure 1. Typical Output Characteristics
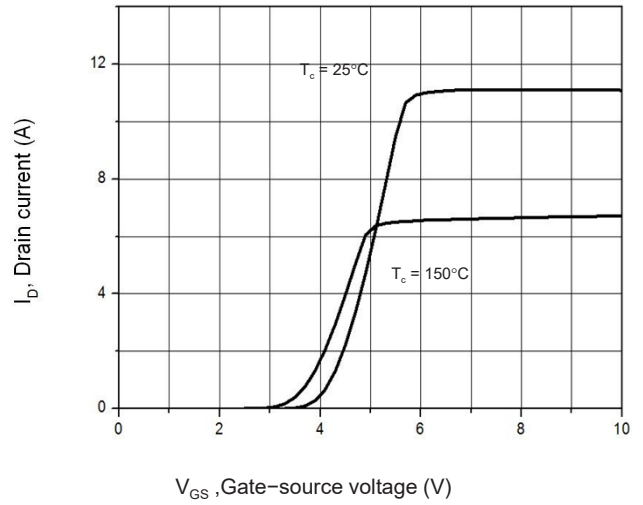

Figure 2. Transfer Characteristics

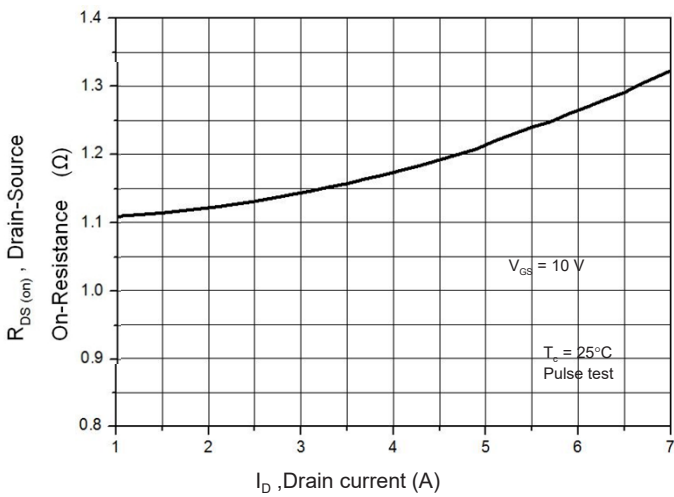Figure 3. On-Resistance Variation vs. Drain Current

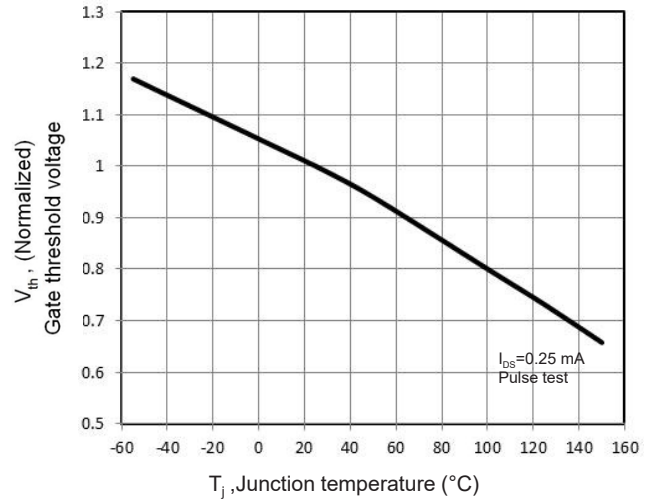Figure 4. Threshold Voltage vs. Temperature
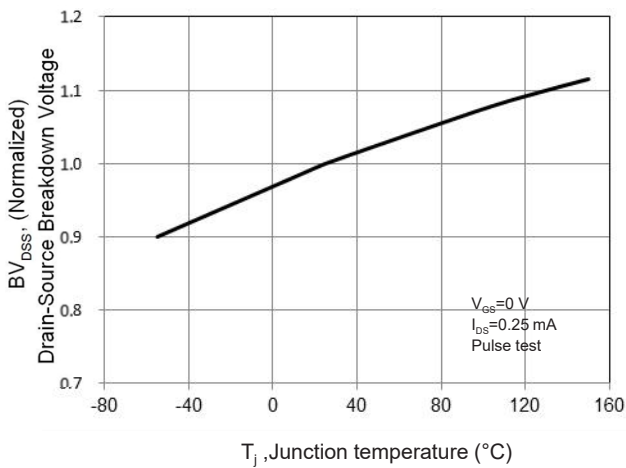

Figure 5. Breakdown Voltage vs. Temperature
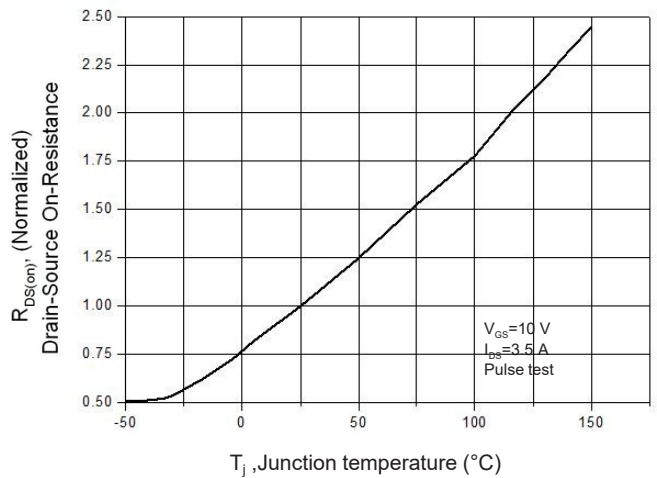

Figure 6. On-Resistance vs. Temperature

Figure 7. Capacitance Characteristics

Notes:f = 1 MHz,V_{GS}=0 V
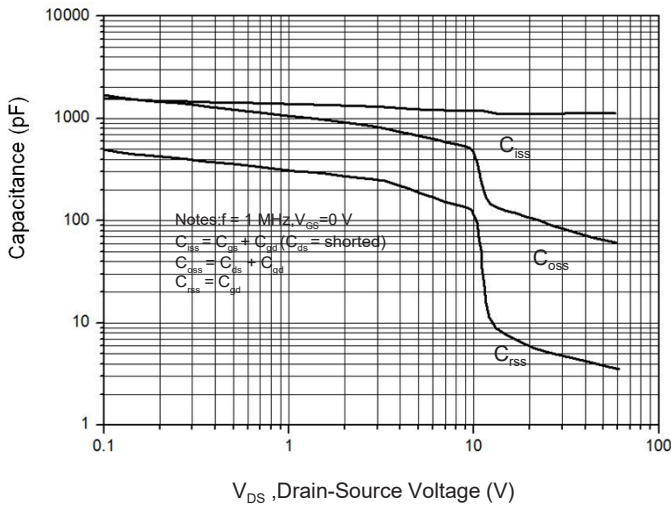C_{iss} = C_{gs} + C_{gd} (C_{ds} = shorted)
C_{oss} = C_{ds} + C_{gd}
C_{rss} = C_{gd}

C_{iss}

C_{oss}

C_{rss}

V_{DS} ,Drain-Source Voltage (V)

Figure 8. Gate Charge Characterist

V_{DS}=480V,

I_D = 7 A

Q_G ,Total Gate Charge (nC)
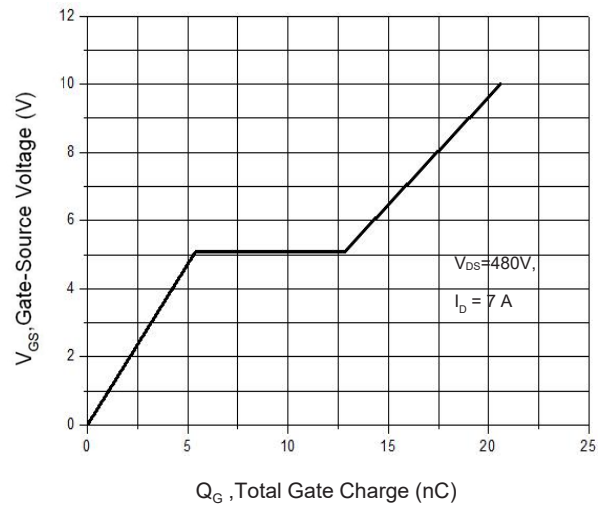
Figure 9. Maximum Safe Operating Area

C C TO-220F

100us

1ms

10ms

Limited by $R_{DS(on)}$

DC

Notes:
T_c = 25°C
T_j = 150°C

Single Pulse

V_{DS} ,Drain-Source Voltage (V)
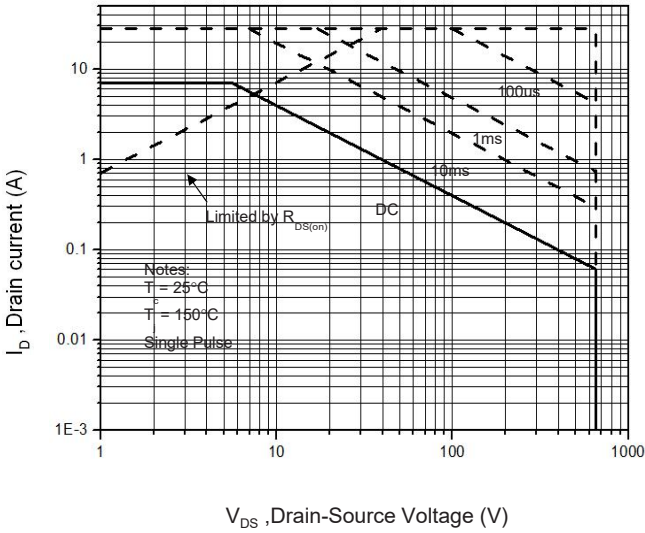
Figure 10. Maximum Safe Operating Area

C C TO-220

100us

1ms

10ms

Limited by $R_{DS(on)}$

DC

Notes:
T_c = 25°C
T_j = 150°C

Single Pulse

V_{DS} ,Drain-Source Voltage (V)
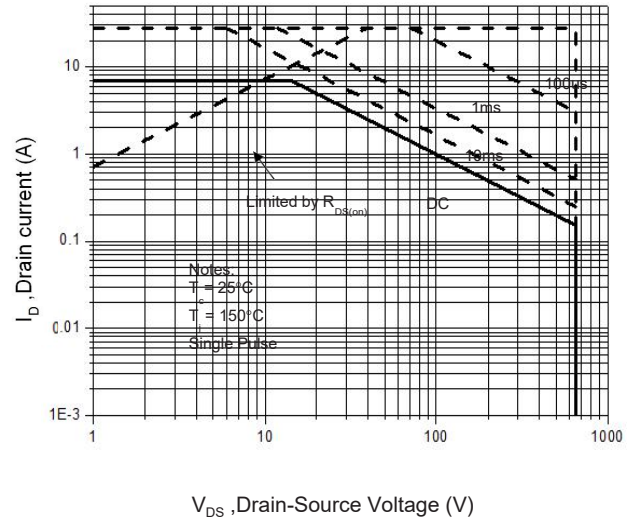
Figure 11. Power Dissipation vs. Temperature

C C TO-220F
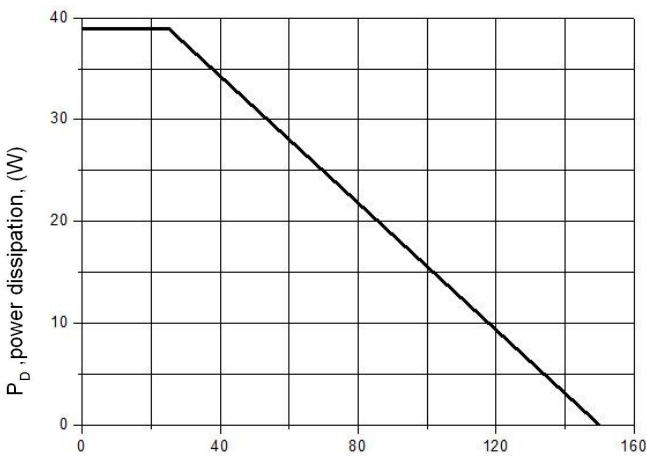
Figure 12. Power Dissipation vs. Temperature
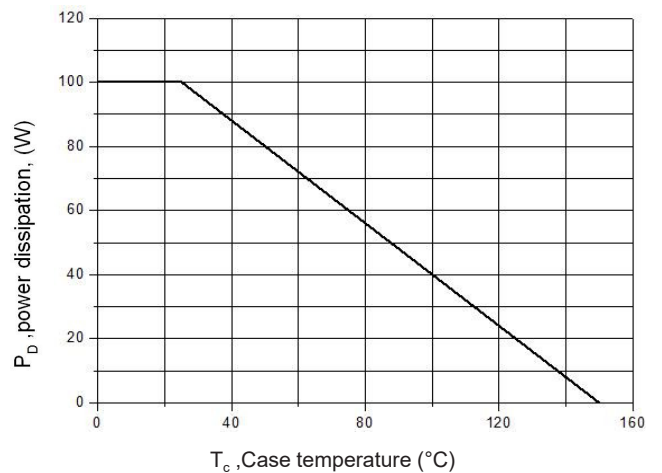
C C TO-220

T_c ,Case temperature (°C)
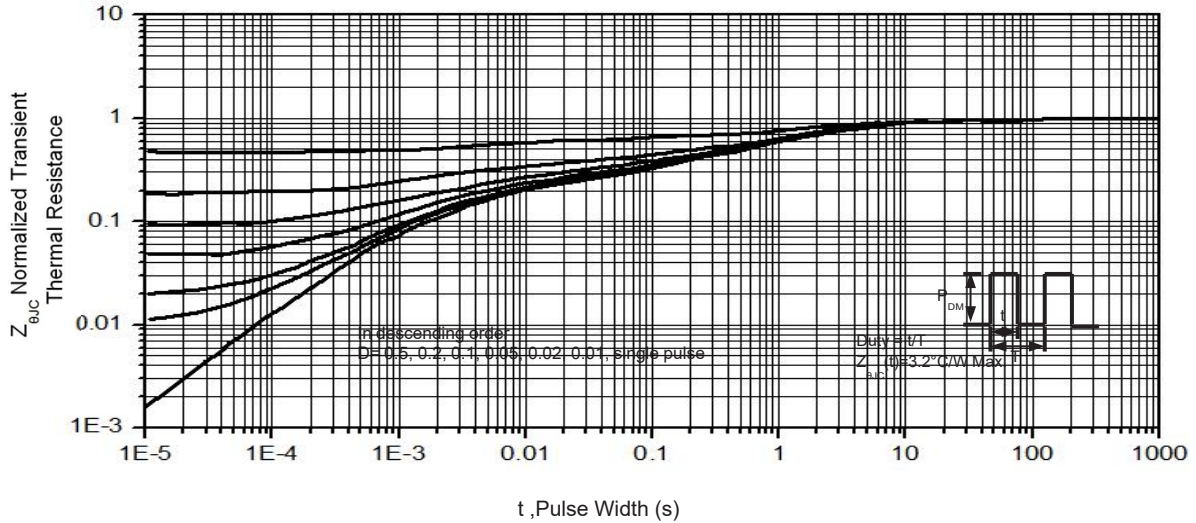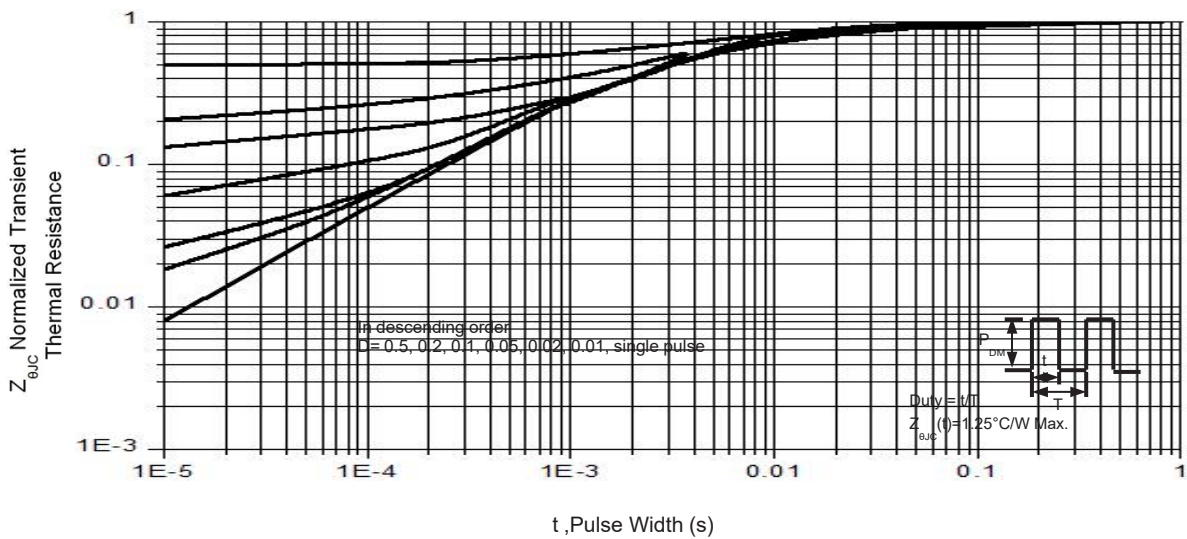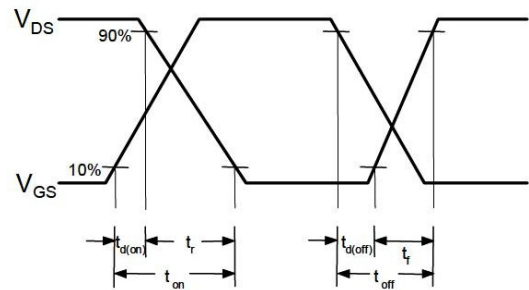
Figure 13. Continuous Drain Current vs. Temperature
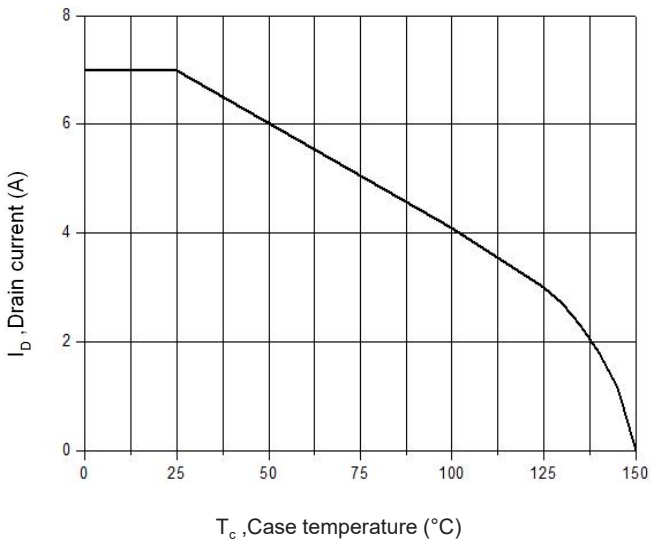
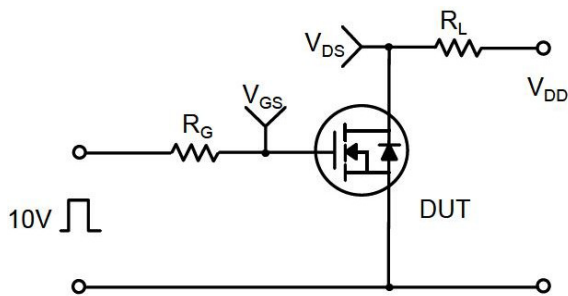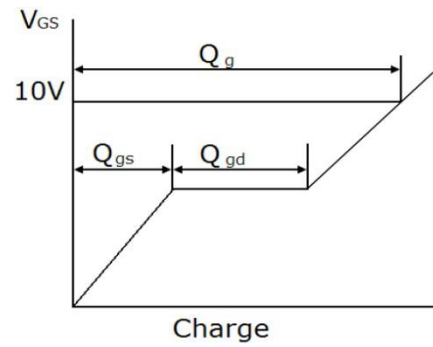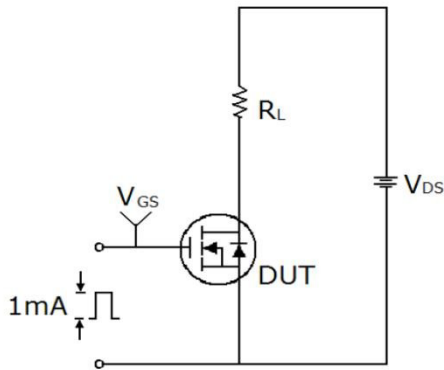Figure 14. Body Diode Transfer Characteristics
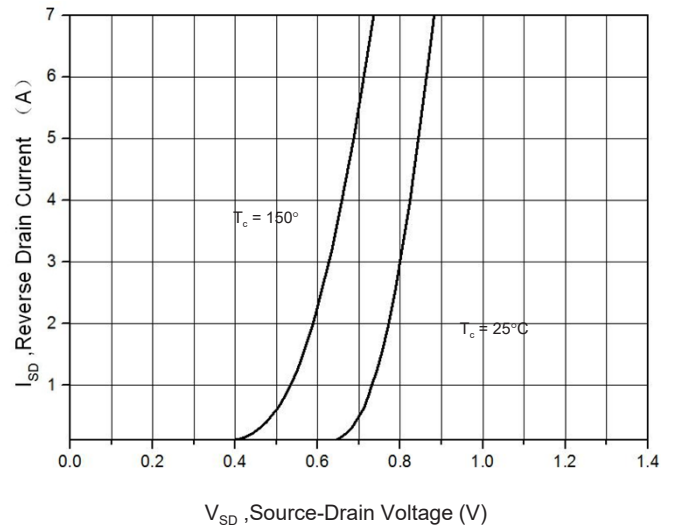
Figure 15 Transient Thermal Impendance,Junction to Case，TO-220F

Figure 16. Transient Thermal Impendance,Junction to Case，TO-220

t ,Pulse Width (s)

Gate Charge Test Circuit & Waveform

Unclamped Inductive Switching Test Circuit & Waveforms

$$E_{AR} = 1/2 \, LI_{AR}^{2}$$