



Features

- High Speed Switching with Low Capacitances
- High Blocking Voltage with Low On-Resistance
- Avalanche Ruggednes

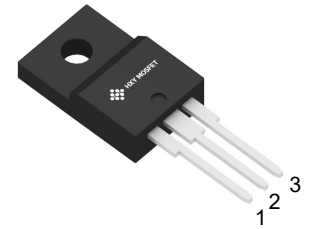
Applications

- Solar Inverters
- Switch Mode Power Supplies
- Battery Chargers
- High Voltage DC/DC Converters

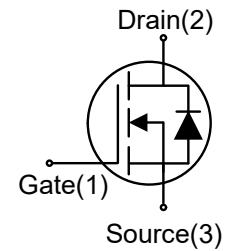


Package Marking and Ordering Information

Ordering Part Number	Package	Brand
NTPF110N65S3HF	TO-220F	HXY MOSFET



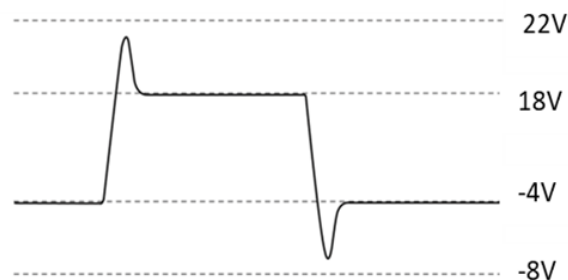
TO-220F



Maximum Ratings (T_c = 25°C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions
V _{DSmax}	Drain - Source Voltage	650	V	
V _{GSmax}	Gate - Source Voltage (dynamic)	-8/+22	V	
V _{GS}	Gate - Source Voltage	-4/+18	V	
I _D	Continuous Drain Current	24	A	T _C = 25°C
		13		T _C = 125°C
I _{D(pulse)}	Pulsed Drain Current	50	A	Pulse width t _p limited by T _{jmax}
P _D	Power Dissipation	95	W	T _C = 25°C
T _J , T _{stg}	Operating Junction and Storage Temperature	-55 to +175	°C	
I _S	Source current(Body Diode)	24	A	T _C = 25°C
		13		T _C = 125°C
E _{AS}	Avalanche energy, single pulse	265	mJ	L=10mH

•Example of acceptable V_{GS} waveform





Electrical Characteristics ($T_C = 25^\circ\text{C}$ unless other wise specified)

Symbol	Parameter	Value			Unit	Test Condition
		min.	typ.	max.		
Static Characteristics						
V _{(BR)DSS}	Drain-source breakdown voltage	650	-	-	V	V _{GS} =0V, I _D =100uA
V _{GS(th)}	Gate threshold voltage	2	3	4	V	V _{DS} =V _{GS} , I _D =2mA
I _{DSS}	Zero gate voltage drain current	-	1	5	μA	V _{DS} =650V, V _{GS} =0V T _C =25°C T _C =175°C
I _{GSS}	Gate-source leakage current	-		100	nA	V _{GS} =18V, V _{DS} =0V
R _{DS(on)}	Drain-source on-state resistance	-	110	140	mΩ	V _{GS} =18V, I _D =7A, T _J =25°C T _J =175°C
R _{DS(on)}	Drain-source on-state resistance	-	145	200	mΩ	V _{GS} =15V, I _D =7A, T _J =25°C T _J =175°C
Dynamic Characteristics						
C _{iss}	Input Capacitance	-	508.0	-	pF	V _{DS} = 400V V _{GS} = 0V T _J = 25°C V _{AC} =25mV f = 1MHz
C _{oss}	Output Capacitance	-	33.0	-		
C _{rss}	Reverse Transfer Capacitance	-	3.2	-		
Q _G	Gate Total Charge		30.5	-	nC	V _{DS} = 400V V _{GS} = 0/+18V I _D = 7A I _G =10mA
Q _{gs}	Gate-Source charge	-	2.55	-		
Q _{gd}	Gate-Drain charge	-	7.9	-		
E _{ON}	Turn-On Switching Energy	-	101	-	uJ	V _{DD} = 400V V _{GS} = -4/+18V I _D = 7A R _G = 5Ω L = 1mH T _J = 25°C
E _{OFF}	Turn-Off Switching Energy	-	23	-		
t _{d(on)}	Turn-on delay time	-	6.5	-	ns	
t _r	Rise time	-	3.1	-		
t _{d(off)}	Turn-off delay time	-	29.5	-		
t _f	Fall time	-	18.5	-		
R _G	Gate resistance	-	3.0	-	Ω	V _{AC} = 25mV, f=1MHz



Body Diode Characteristics

V_{SD}	Body Diode Forward Voltage	-	4.2	-	V	$V_{GS}=-4V, I_{SD}=3.5A,$ $T_J=25^{\circ}C$
		-	3.8	-		$V_{GS}=-4V, I_{SD}=3.5A,$ $T_J=175^{\circ}C$
t_{rr}	Reverse Recovery Time	-	42.2	-	ns	$V_R = 600V$ $I_D = 7A$ $di/dt = 1000A/\mu S$ $V_{GS} = -4V$ $T_J = 25^{\circ}C$
Q_{rr}	Reverse Recovery Charge	-	66	-	nC	
E_{REC}	Reverse Recovery Energy	-	14.74	-	uJ	
I_{rrm}	Peak Reverse Recovery Current	-	4.67	-	A	
t_A	Charge Time	-	20.8	-	ns	
t_B	DisCharge Time	-	21.4	-	ns	

Thermal Characteristics

Symbol	Parameter	Typ.	Unit	Test Conditions
R_{thJC}	Thermal Resistance from Junction to Case	1.55	$^{\circ}C/W$	
R_{thJA}	Thermal Resistance From Junction to Ambient	40		



Typical Performance

Fig 1. Output Characteristics ($T_J = -55^\circ\text{C}$)

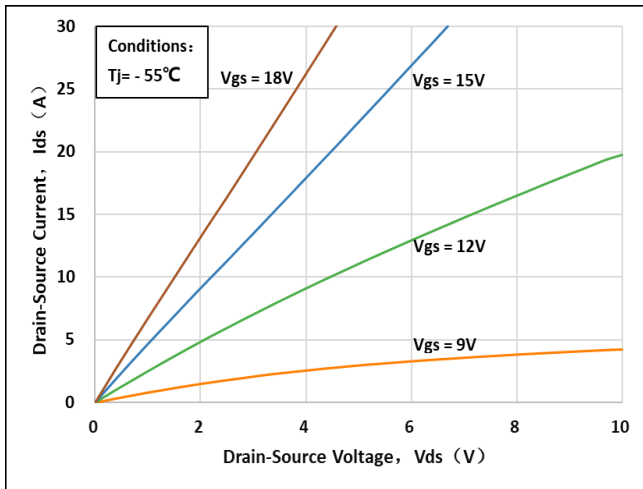


Fig 2. Output Characteristics ($T_J = 25^\circ\text{C}$)

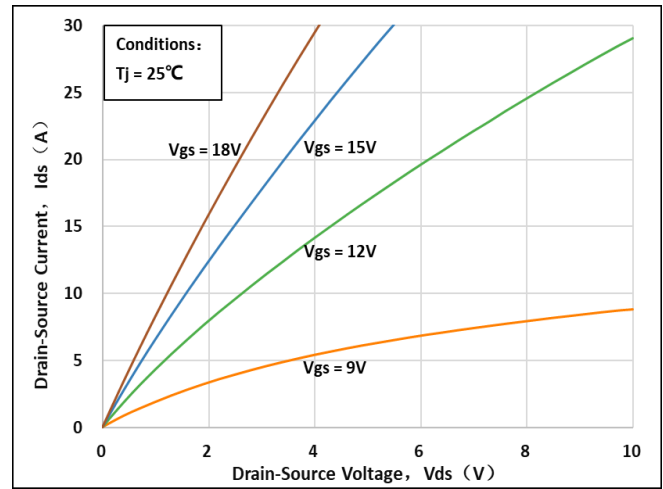


Fig 3. Output Characteristics ($T_J = 175^\circ\text{C}$)

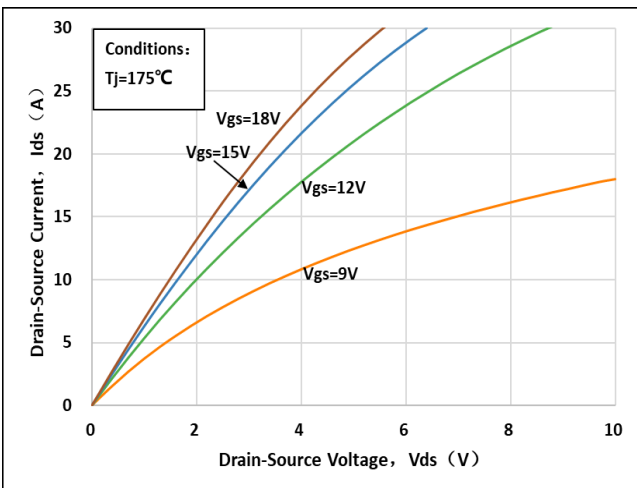


Fig 4: $R_{DS(on)}$ Vs I_{DS} Characteristics

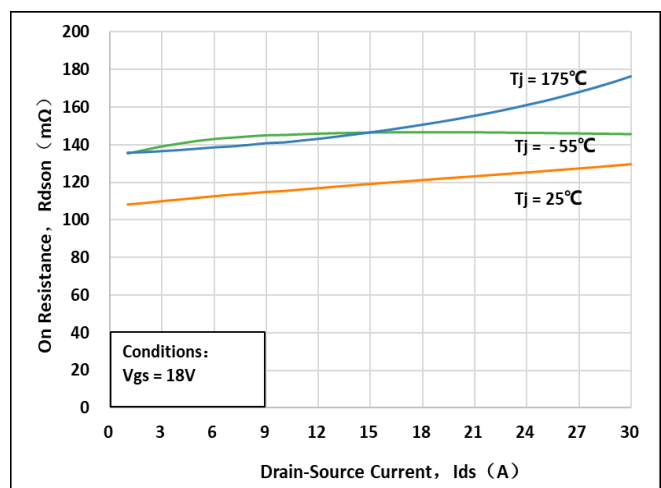


Fig 5: $R_{DS(on)}$ vs. Temperature

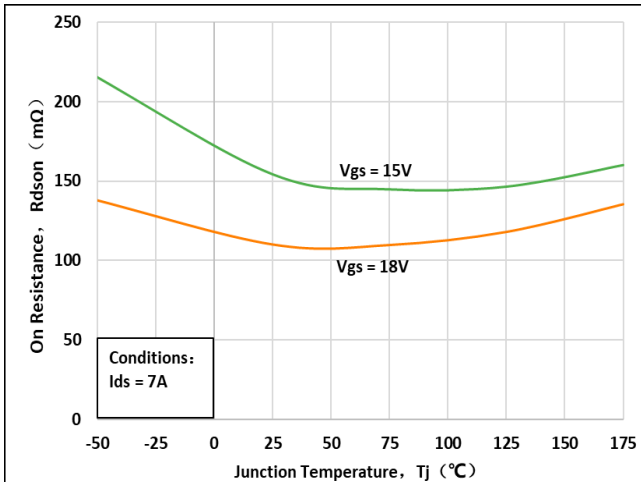


Fig 6: Transfer Characteristics

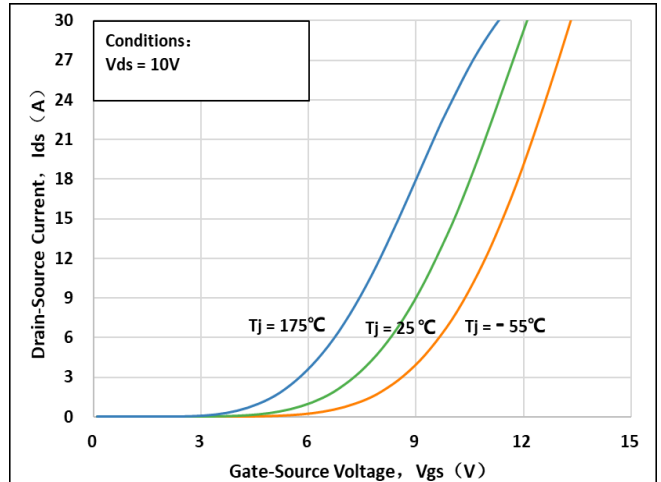




Fig 7: Body-diode Characteristics ($T_J = -55^\circ\text{C}$)

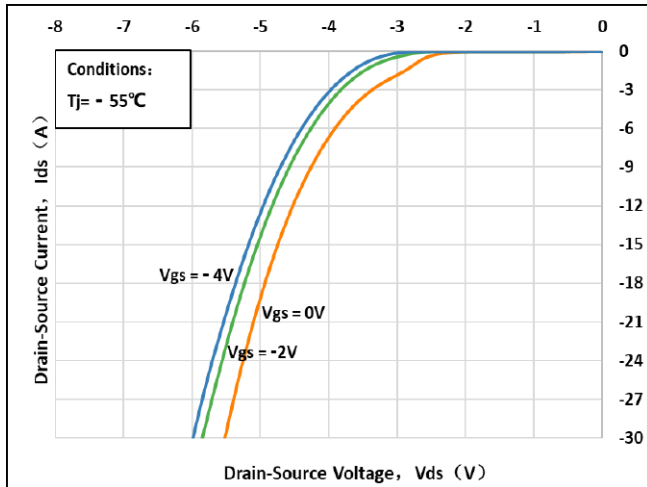


Fig 8: Body-diode Characteristics ($T_J = 25^\circ\text{C}$)

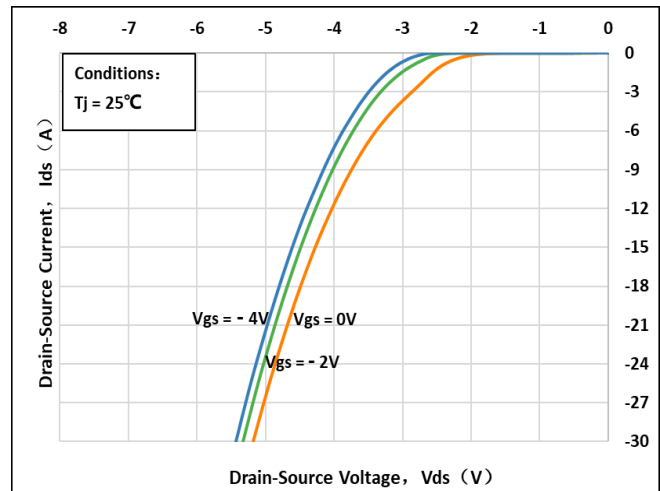


Fig 9: Body-diode Characteristics ($T_J = 175^\circ\text{C}$)

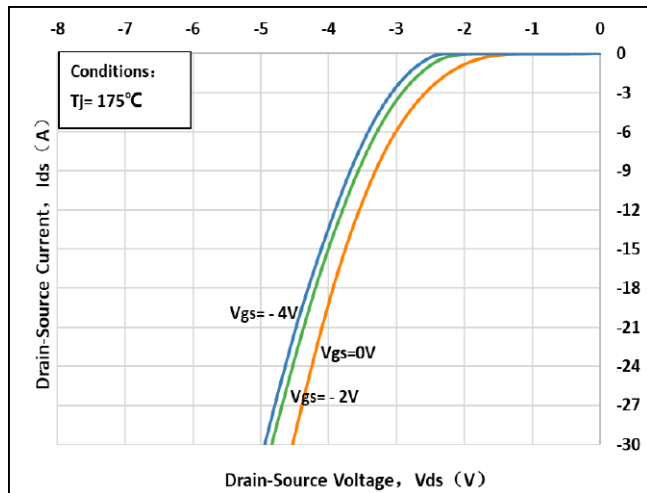


Fig 10: V_{TH} Vs T_J Temperature Characteristics

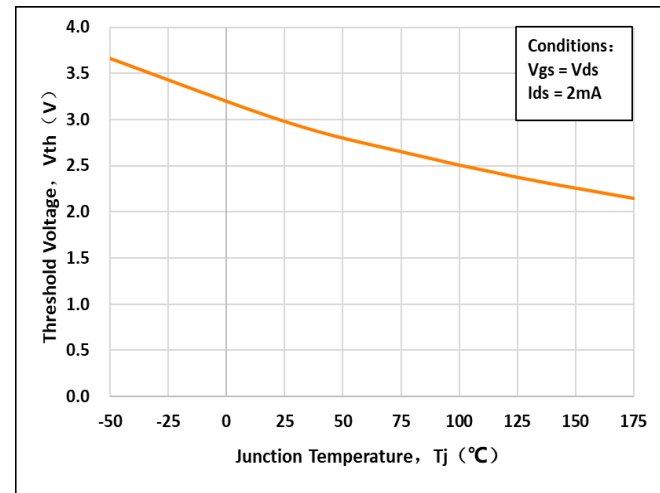


Fig 11: 3rd Quadrant Characteristics ($T_J = -55^\circ\text{C}$)

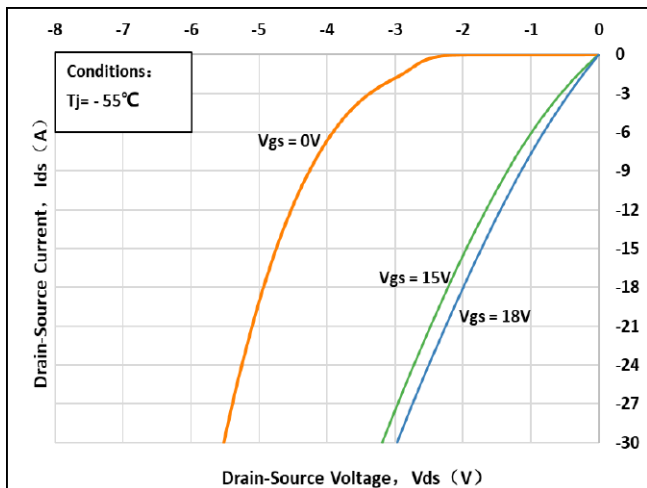


Fig 12: 3rd Quadrant Characteristics ($T_J = 25^\circ\text{C}$)

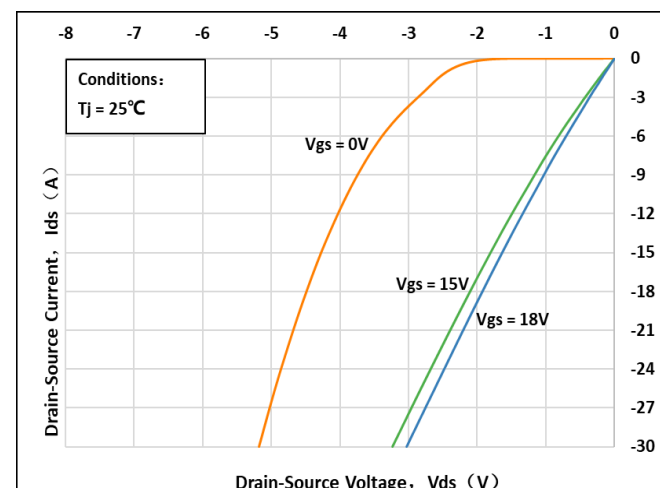




Fig 13: 3rd Quadrant Characteristics($T_J=175^{\circ}\text{C}$)

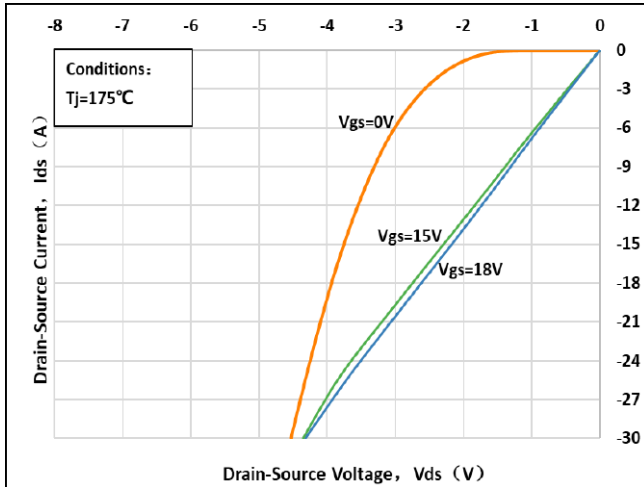


Fig 14: Gate Charge Characteristics

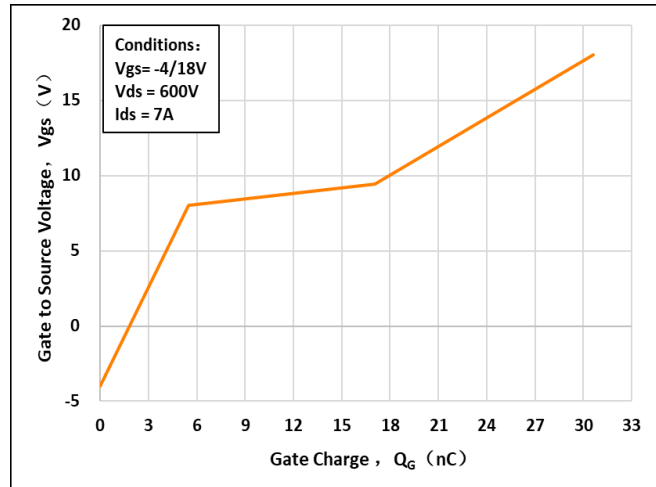


Fig 15: Drain Current vs. Case Temperature

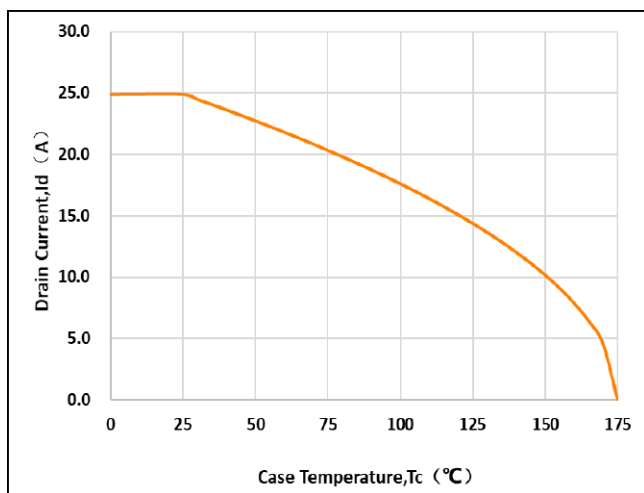


Fig 16: Safe Operating Area

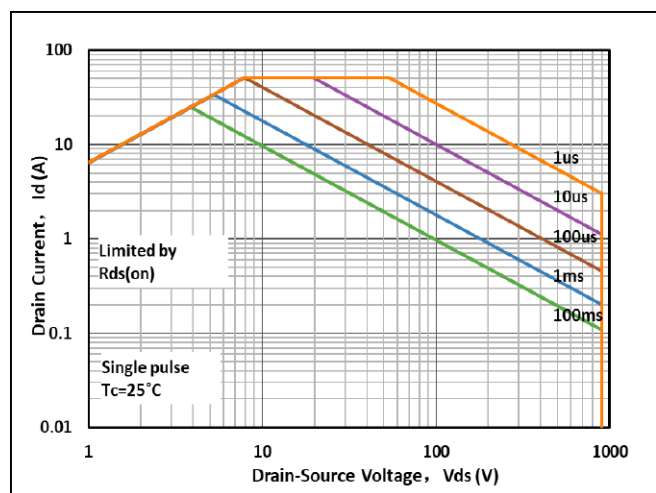


Fig 17: Capacitance Characteristics

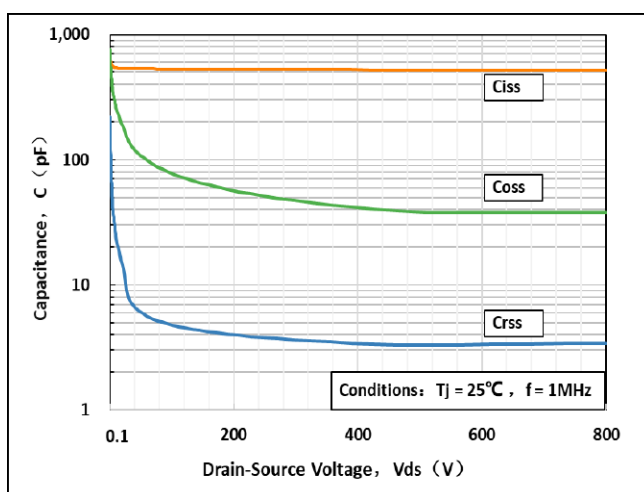
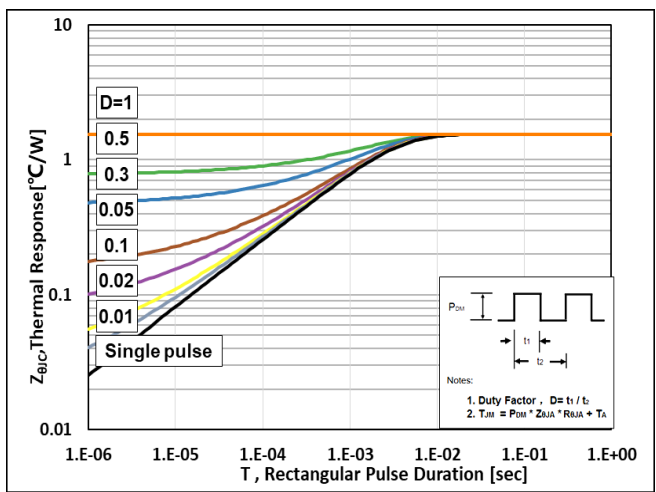


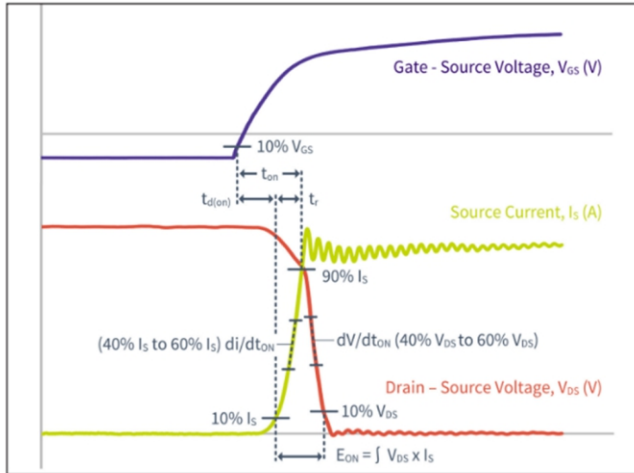
Fig 18: Transient Thermal Impedance



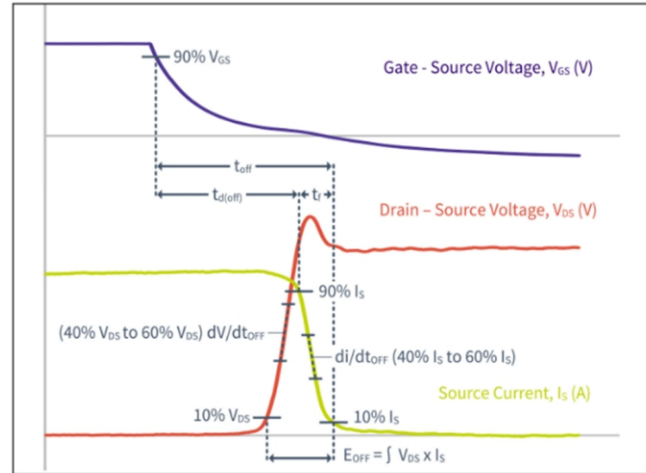


Test Circuit & Waveform

Figure A. Definition of switching times



Turn-on Transient Definitions



Turn-off Transient Definitions

Figure B. Dynamic test circuit

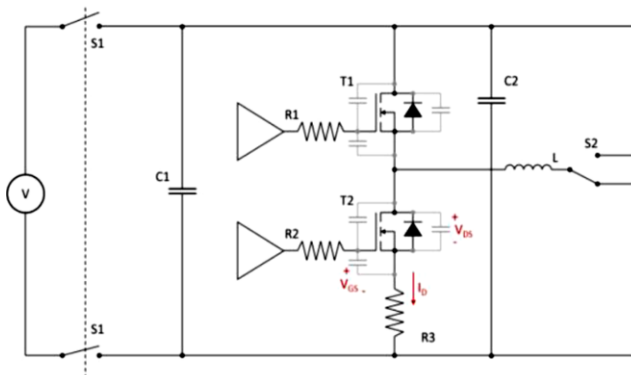
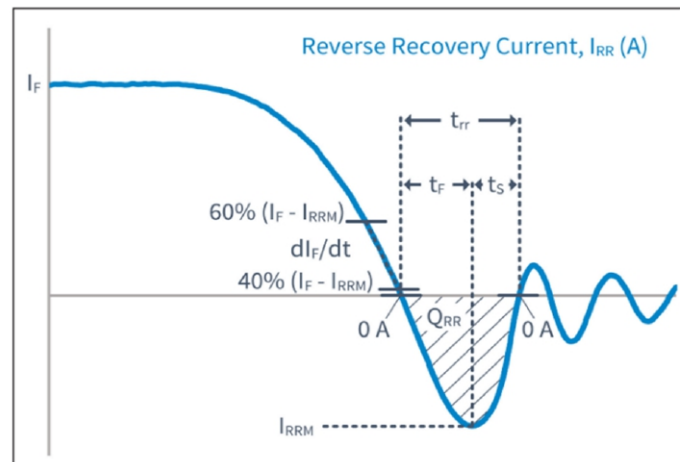


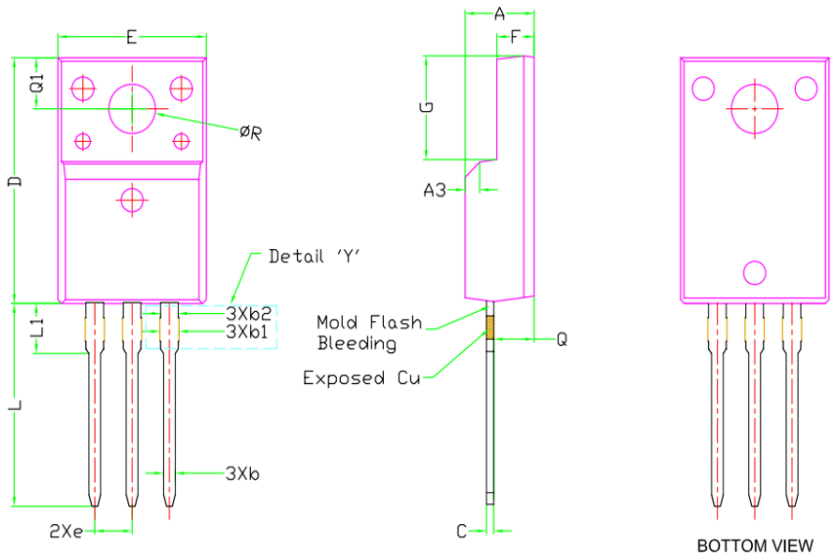
Figure C. Definition of body diodeswitching characteristics



Reverse Recovery Definitions



Package Dimensions
Package TO-220F



SYMBOL	DIMENSIONS		
	Min.	Nom.	Max.
A	4.60	4.70	4.80
b	0.70	0.80	0.91
b1	1.20	1.30	1.47
b2	1.10	1.20	1.30
C	0.45	0.50	0.63
D	15.80	15.87	15.97
e	2.54		
E	10.00	10.10	10.30
F	2.44	2.54	2.64
G	6.50	6.70	6.90
L	12.90	13.10	13.30
L1	3.13	3.23	3.33
Q	2.65	2.75	2.85
Q1	3.20	3.30	3.40
ϕR	3.08	3.18	3.28



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