

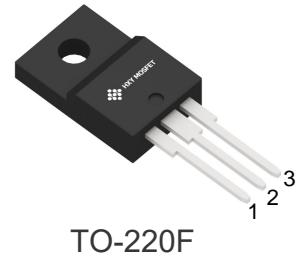


Features

- Wide bandgap SiC MOSFET technology
- Low On-Resistance with High Blocking Voltage
- Low Capacitances with High-Speed switching
- Low reverse recovery(Qrr)
- Halogen free, RoHS compliant

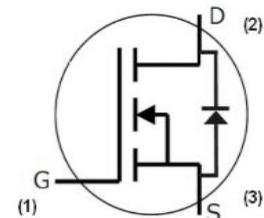
Benefits

- Reduce switching losses
- Increased system Switching Frequency
- Increased power density
- Reduction of heat sink requirements



Applications

- Switch mode power supplies
- Renewable energy
- On Board Charger
- High Voltage DC/DC Converters



Ordering Part Number	Package	Brand
STP5NK65ZFP	TO-220F	HXY MOSFET

Maximum Ratings ($T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Test conditions	Value	Unit	Note
V_{DSmax}	Drain-Source Voltage	$V_{GS} = 0\text{V}$, $I_D = 100\mu\text{A}$	650	V	
V_{GS}	Gate-Source voltage (transient)	$t_p \leq 500\text{ns}$, duty cycle $\leq 1\%$	-8/+20	V	
V_{GSop}	Recommend Gate-Source Voltage	Static	-4/+15	V	
EAS	Single pulse avalanche energy	$V_{DS}=650\text{V}$, $V_{DD}=50\text{V}$, $V_{GS}=15\text{V}$, $L=1\text{mH}$, $T_C=25^\circ\text{C}$	11	mJ	
I_D	Continuous Drain current	$V_{GS} = 18\text{V}$, $T_C = 25^\circ\text{C}$	3.9	A	Fig. 14
		$V_{GS} = 18\text{V}$, $T_C = 100^\circ\text{C}$	2.8		
$I_{D,pulse}$	Pulsed Drain Current	Pulse with t_p limited by T_{jmax}	4.44	A	
P_D	Power Dissipation	$T_C = 25^\circ\text{C}$, $T_j = 175^\circ\text{C}$	25.86	W	Fig. 16
T_j	Operating junction temperature		-55~175	°C	
T_{stg}	Storage temperature		-55~175	°C	



Thermal Characteristics

Symbol	Parameter	Value			Unit	Note
		Min.	Typ.	Max.		
$R_{th(jc)}$	Thermal resistance from Junction to Case		5.8		K/W	Fig. 15
$R_{th(ja)}$	Thermal resistance from Junction to Ambient		40		K/W	

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

Static Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
$V_{(BR)DSS}$	Drain-Source Breakdown voltage	$V_{GS} = 0\text{V}, I_D = 100\mu\text{A}$	650			V	
$V_{GS(th)}$	Gate Threshold voltage	$V_{GS} = V_{DS}, I_D = 0.2\text{mA}$		2.8		V	Fig. 9
		$V_{GS} = V_{DS}, I_D = 0.2\text{mA}, T_j = 175^\circ\text{C}$		2.0			
I_{GSS}	Gate-Source Leakage current	$V_{GS} = 15\text{V}, V_{DS} = 0\text{V}$			250	nA	
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 650\text{V}, V_{GS} = 0\text{V}, T_j = 25^\circ\text{C}$		1	50	μA	
$R_{DS(on)}$	Drain-Source On-state Resistance	$V_{GS} = 15\text{V}, I_D = 0.5\text{A}$ $V_{GS} = 18\text{V}, I_D = 0.5\text{A}$		530 410	690	$\text{m}\Omega$	Fig. 3, 4, 5
		$V_{GS} = 15\text{V}, I_D = 0.5\text{A}, T_j = 175^\circ\text{C}$ $V_{GS} = 18\text{V}, I_D = 0.5\text{A}, T_j = 175^\circ\text{C}$		550 500			
g_{fs}	Transconductance	$V_{DS} = 15\text{V}, I_D = 0.5\text{A}$		2.4		S	Fig. 6
		$V_{DS} = 15\text{V}, I_D = 0.5\text{A}, T_j = 175^\circ\text{C}$		1.9			



Gate Charge Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
Q_{GS}	Gate to Source Charge	$V_{DS} = 400V$ $I_D = 0.5A$ $V_{GS} = -4V/15V$		1.1		nC	Fig. 10
Q_{GD}	Gate to Drain Charge			2.7			
Q_G	Total Gate Charge			4.5			

AC Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
C_{iss}	Input Capacitance	$V_{GS} = 0V, V_{DS} = 600V$ $f = 1 MHz$ $V_{AC} = 25mV$		37.5		pF	Fig. 13
C_{oss}	Output Capacitance			11.5		pF	
C_{rss}	Reverse Transfer Capacitance			1.9		pF	
$R_{G(int)}$	Internal Gate Resistance	$f = 1 MHz, V_{AC} = 25mV$		15		Ω	

Reverse Diode Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
V_{SD}	Diode Forward Voltage	$V_{GS} = -4V, I_{SD} = 0.25A$		4.4		V	Fig. 7,8
		$V_{GS} = -4V, I_{SD} = 0.25A, T_j = 175^\circ C$		3.8			
I_S	Continuous Diode Forward Current	$V_{GS} = -4V, T_C = 25^\circ C$		3.6		A	
$I_{S,pulse}$	Diode pulse Current	$V_{GS} = -4V$, pulse width t_p limited by T_{jmax}		4.44		A	



Typical Performance

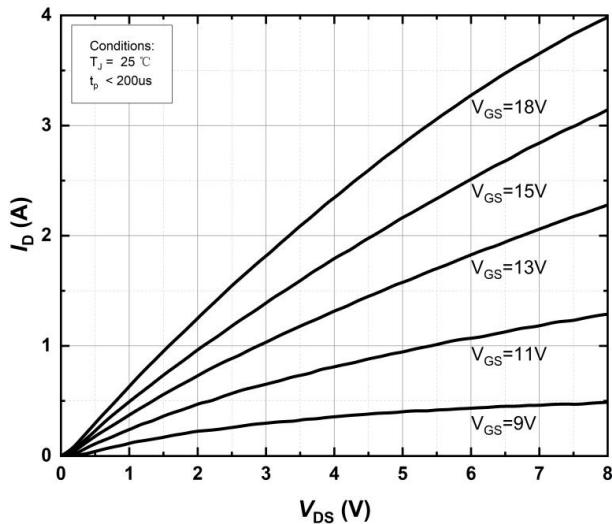


Figure 1. Output characteristics at $T_j=25^\circ\text{C}$

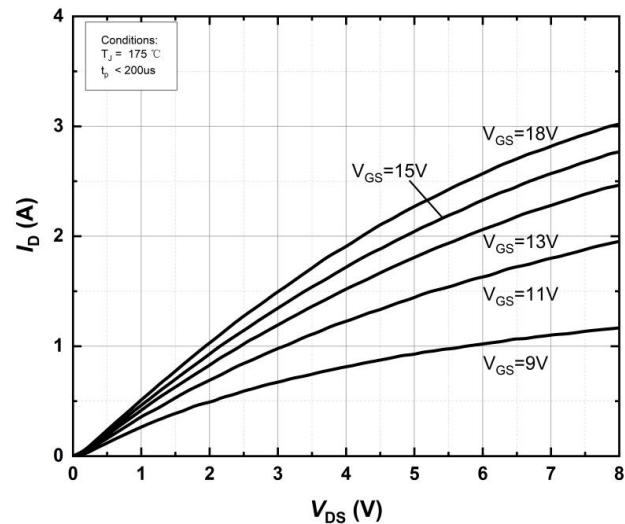


Figure 2. Output characteristics at $T_j=175^\circ\text{C}$

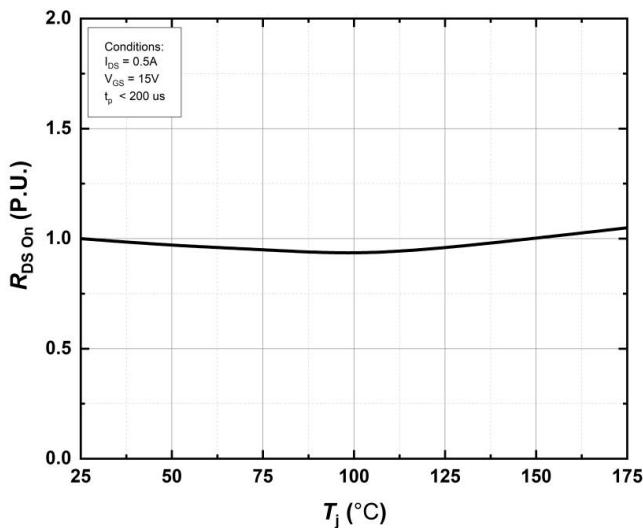


Figure 3. Normalized On-Resistance vs. Temperature

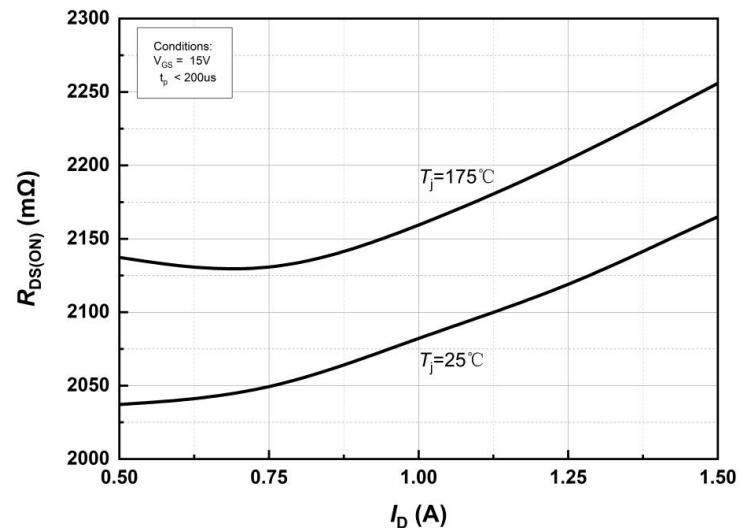


Figure 4. On-Resistance vs. Drain current for Various Temperature

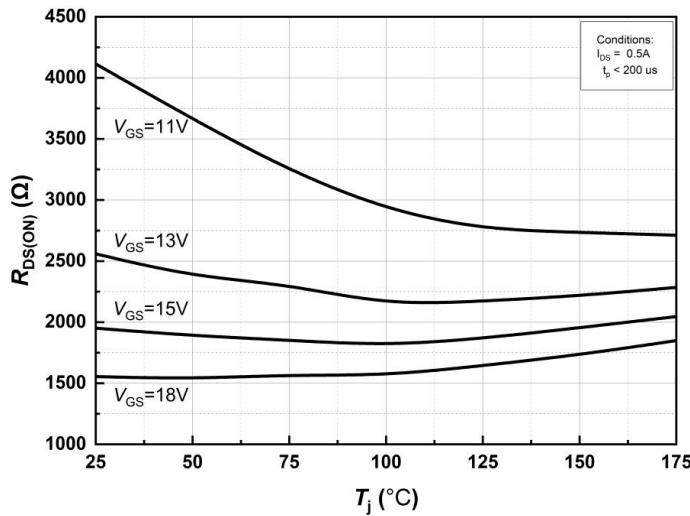


Figure 5. On-Resistance vs. Temperature for Various Gate Voltage

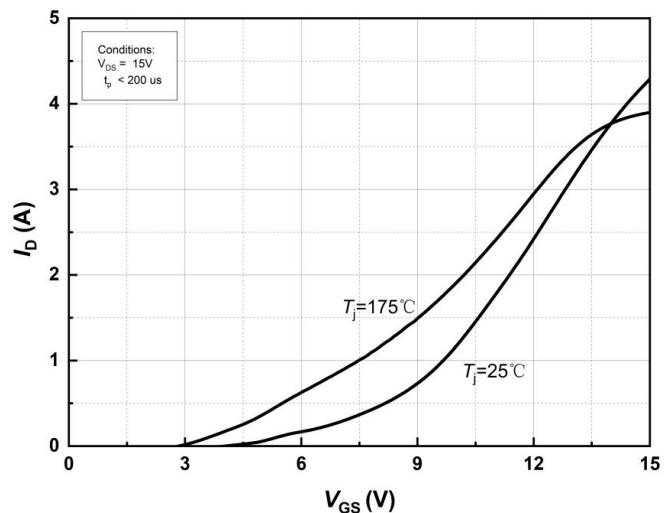


Figure 6. Transfer Characteristics for Various Junction Temperatures

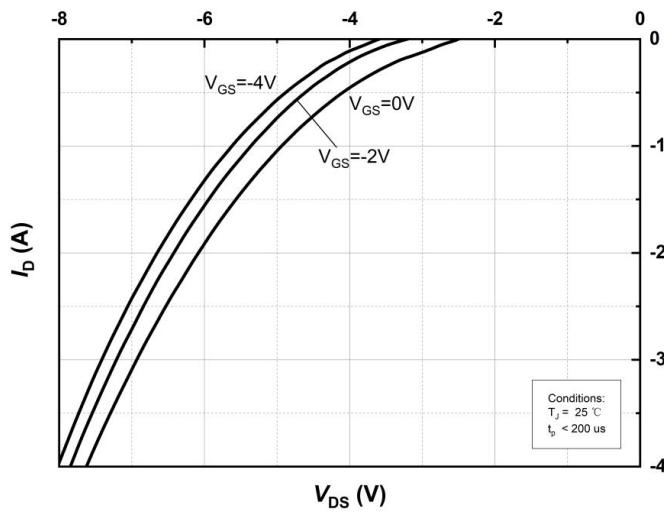


Figure 7. Body Diode Characteristics at $T_j=25^\circ\text{C}$

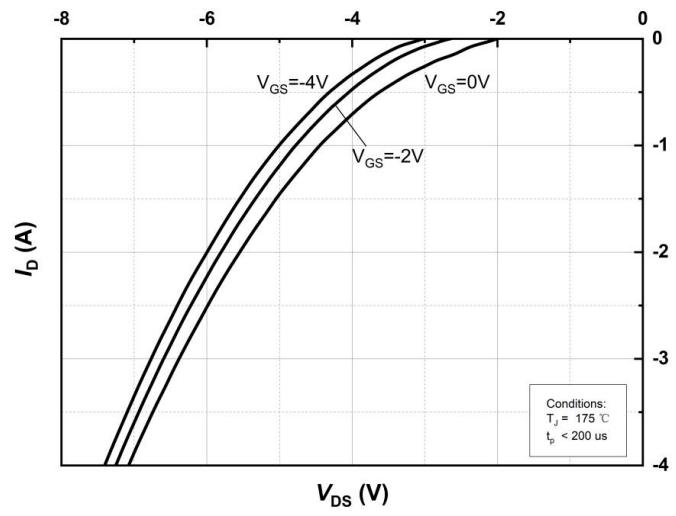


Figure 8. Body Diode Characteristics at $T_j=175^\circ\text{C}$

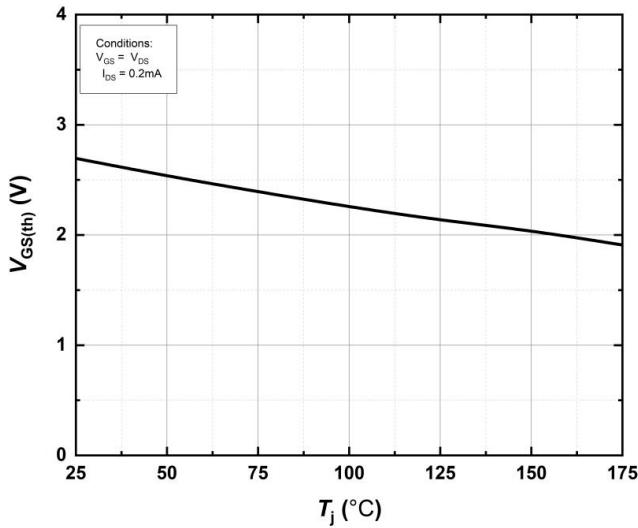


Figure 9. Threshold Voltage vs. Temperature

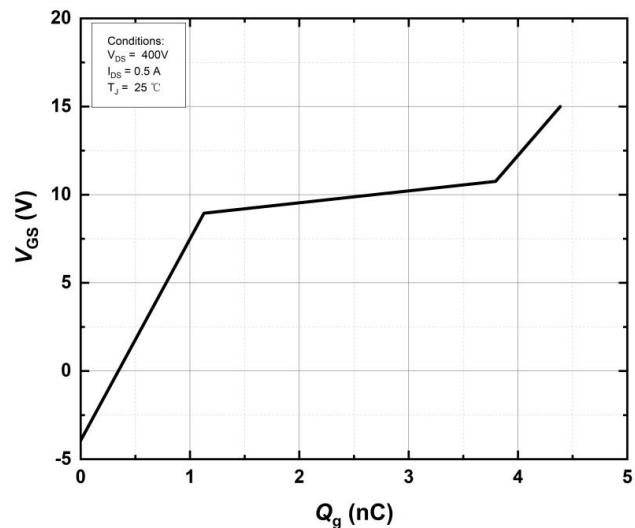


Figure 10 Gate Charge Characteristics

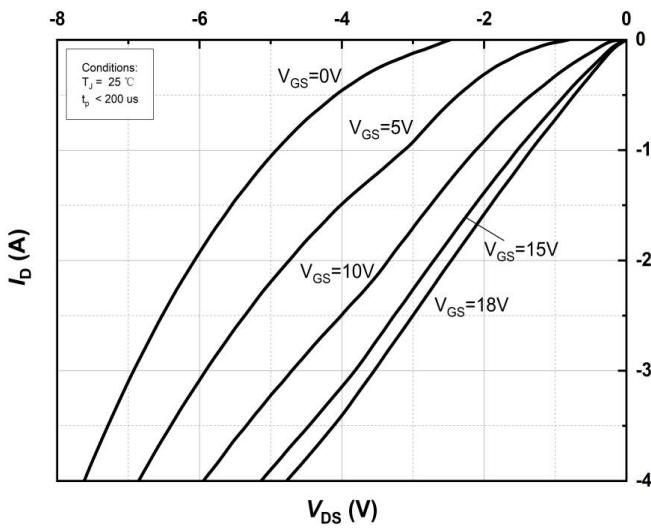


Figure 11. 3rd Quadrant Characteristic at $T_j=25^\circ\text{C}$

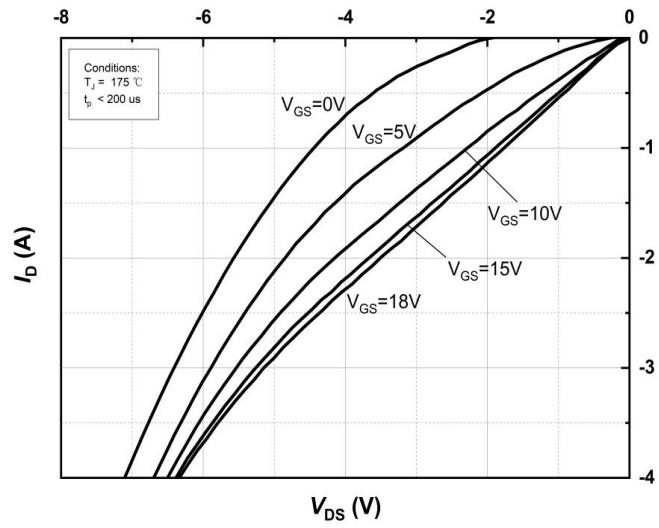


Figure 12. 3rd Quadrant Characteristic at $T_j=175^\circ\text{C}$

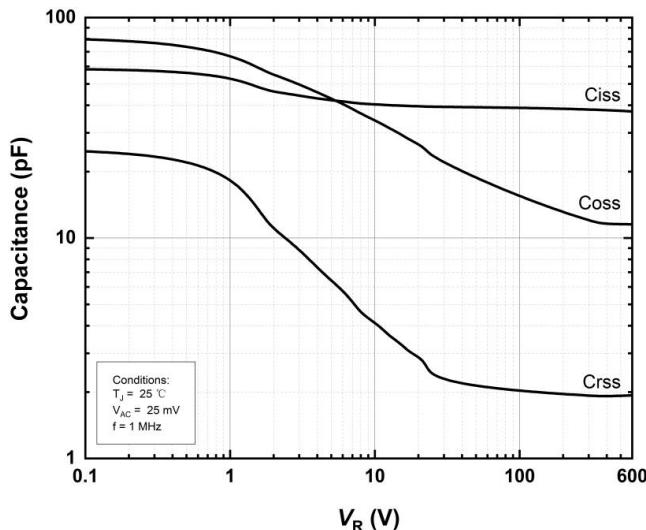


Figure 13. Capacitances vs. Drain-Source Voltage (0 – 600V)

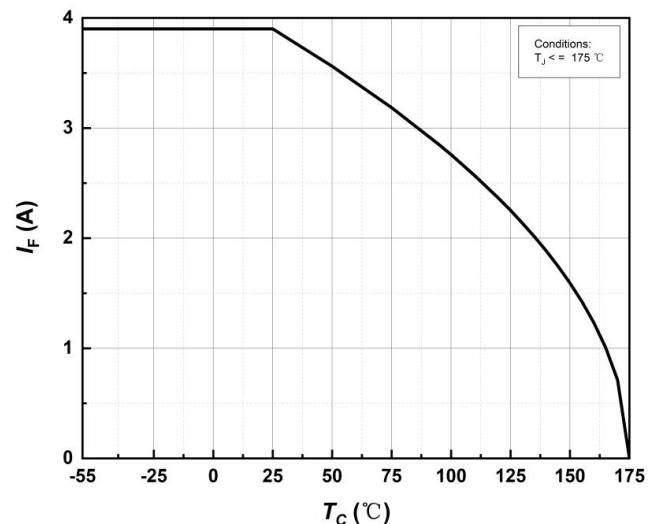


Figure 14. Continuous Drain Current Derating vs Case Temperature

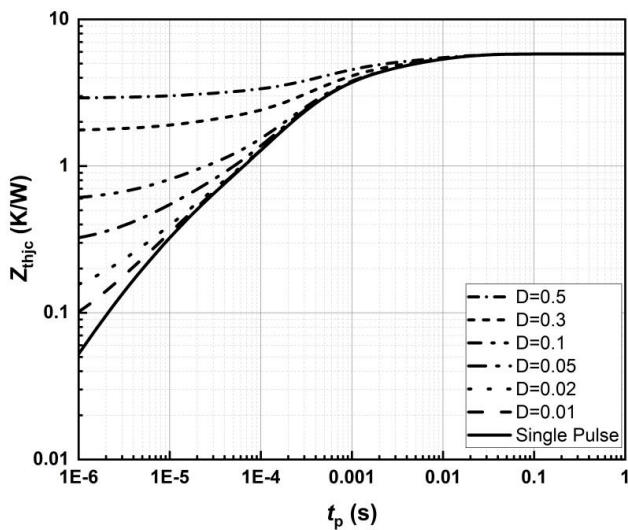


Figure 15. Transient Thermal Impedance (Junction – Case)

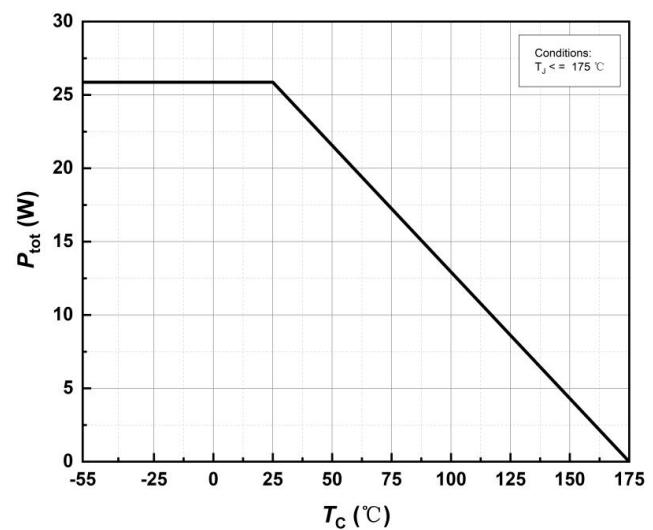


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

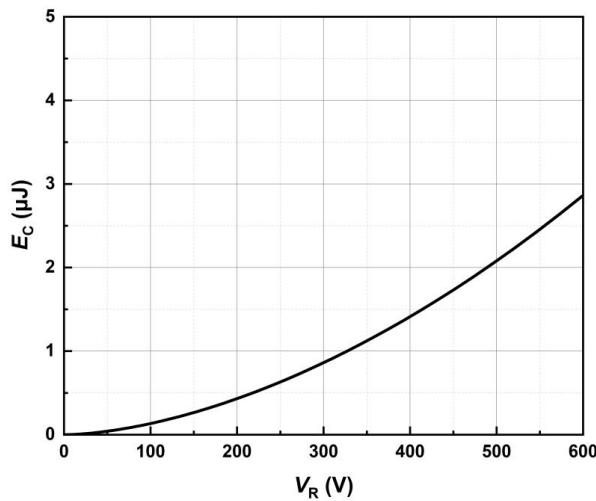


Figure 17. Output Capacitor Stored Energy

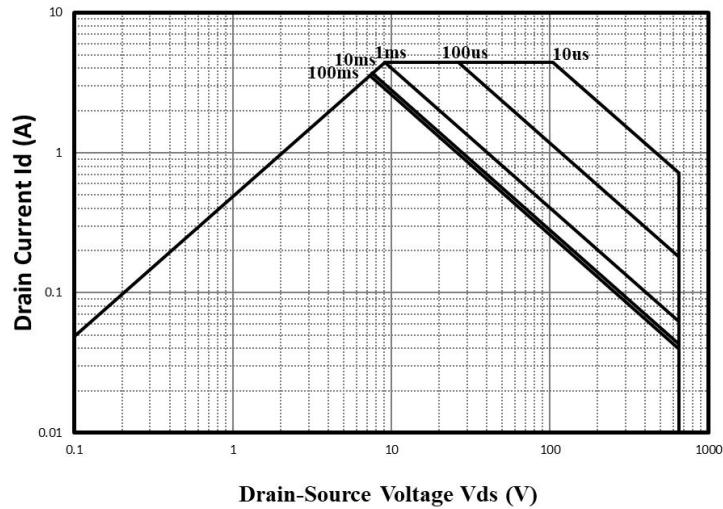
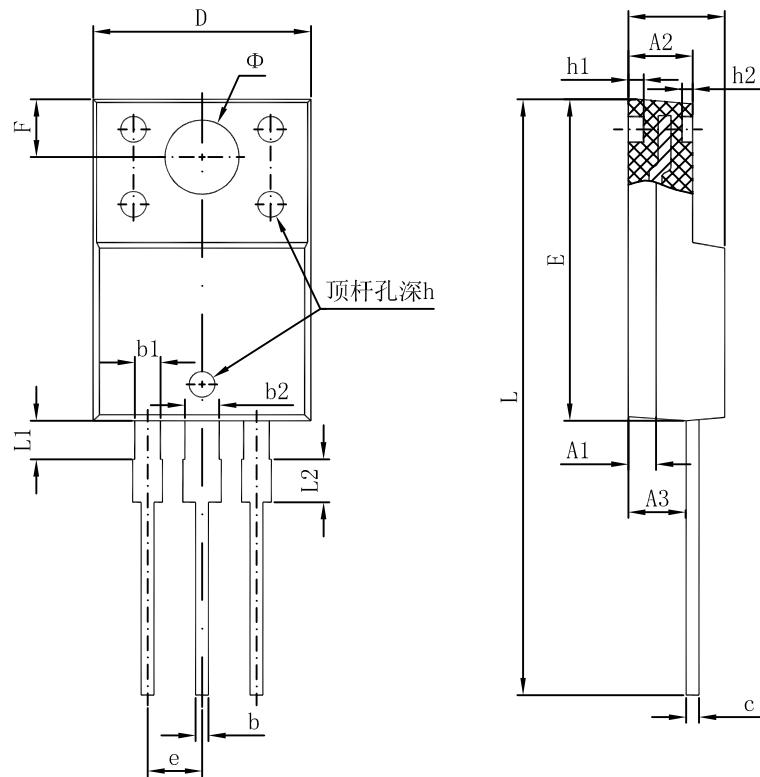


Figure 18. Safe Operating Area



Package Dimensions

Package TO-220F



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.300	4.700	0.169	0.185
A1	1.300	REF.	0.051	REF.
A2	2.800	3.200	0.110	0.126
A3	2.500	2.900	0.098	0.114
b	0.500	0.750	0.020	0.030
b1	1.100	1.350	0.043	0.053
b2	1.500	1.750	0.059	0.069
c	0.500	0.750	0.020	0.030
D	9.960	10.360	0.392	0.408
E	14.800	15.200	0.583	0.598
e	2.540 TYP.		0.100 TYP.	
F	2.700		REF. 0.106	
Φ	3.500		REF. 0.138	
h	0.000	0.300	0.000	0.012
h1	0.800		REF. 0.031	
h2	0.500		REF. 0.020	
L	28.000	28.400	1.102	1.118
L1	1.700	1.900	0.067	0.075
L2	1.900	2.100	0.075	0.083



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