



### Features

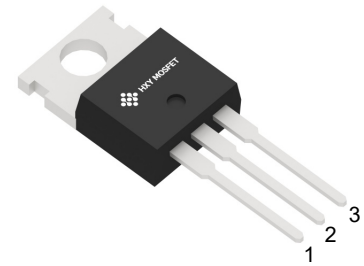
- Wide bandgap SiC MOSFET technology
- Low On-Resistance with High Blocking Voltage
- Low Capacitances with High-Speed switching
- Low reverse recovery(Qrr)
- Halogen free, RoHs compliant

### Benefits

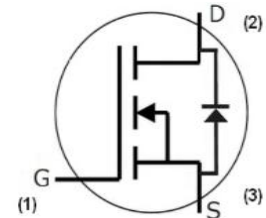
- Reduce switching losses
- Increased system Switching Frequency
- Increased power density
- Reduction of heat sink requirements

### Applications

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



TO-220C



Ordering Part Number	Package	Brand
MSJP20N65A-BP	TO-220C	HXY MOSFET

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

Symbol	Parameter	Test conditions	Value	Unit	Note
$V_{DSmax}$	Drain-Source Voltage	$V_{GS} = 0V, I_D = 100\mu A$	800	V	
$V_{GSmax}$	Gate-Source voltage	AC ( $f > 1\text{ Hz}$ )	-10/+25	V	
$V_{GSop}$	Recommend Gate-Source Voltage	Static	-4/+18 -4/+15	V	
$EAS$	Single pulse avalanche energy	$V_{DS}=800V, V_{DD}=50V, V_{GS}=10V, L=10mH, T_C=25^\circ C$	205	mJ	
$I_D$	Continuous Drain current	$V_{GS} = 18V, T_C = 25^\circ C$	20	A	Fig. 14
		$V_{GS} = 18V, T_C = 100^\circ C$	11		
$I_{D,pulse}$	Pulsed Drain Current	Pulse with $t_p$ limited by $T_{jmax}$	26	A	
$P_D$	Power Dissipation	$T_C = 25^\circ C, T_j = 175^\circ C$	83	W	Fig. 16
$T_j$	Operating junction temperature		-55~175	$^\circ C$	
$T_{stg}$	Storage temperature		-55~175	$^\circ C$	



### Thermal Characteristics

Symbol	Parameter	Value			Unit	Note
		Min.	Typ.	Max.		
$R_{th(jc)}$	Thermal resistance from Junction to Case		1.8		K/W	Fig. 15
$R_{th(ja)}$	Thermal resistance from Junction to Ambient		40		K/W	

### Electrical Characteristics (T<sub>c</sub> = 25°C unless other wise specified)

#### Static Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
$V_{(BR)DSS}$	Drain-Source Breakdown voltage	$V_{GS} = 0V, I_D = 100\mu A$	800			V	
$V_{GS(th)}$	Gate Threshold voltage	$V_{GS} = V_{DS}, I_D = 2.2mA$		3.0		V	Fig. 9
		$V_{GS} = V_{DS}, I_D = 2.2mA, T_J = 175^\circ C$		2.1			
$I_{GSS}$	Gate-Source Leakage current	$V_{GS} = 18V, V_{DS} = 0V$			250	nA	
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 800V, V_{GS} = 0V, T_J = 25^\circ C$		1	50	$\mu A$	
$R_{DS(on)}$	Drain-Source On-state Resistance	$V_{GS} = 15V, I_D = 5A$ $V_{GS} = 18V, I_D = 5A$		212 165	240	m $\Omega$	Fig. 3, 4, 5
		$V_{GS} = 15V, I_D = 5A, T_J = 175^\circ C$ $V_{GS} = 18V, I_D = 5A, T_J = 175^\circ C$		227 205			
$g_{fs}$	Transconductance	$V_{DS} = 18V, I_D = 5A$		5		S	Fig. 6
		$V_{DS} = 18V, I_D = 5A, T_J = 175^\circ C$		4			



### Gate Charge Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
$Q_{GS}$	Gate to Source Charge	$V_{DS} = 400V$ $I_D = 5A$ $V_{GS} = -4V/18V$		3.7		nC	Fig. 10
$Q_{GD}$	Gate to Drain Charge			7			
$Q_G$	Total Gate Charge			17.6			

### AC Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
$C_{iss}$	Input Capacitance	$V_{GS} = 0V, V_{DS} = 600V$ $f = 1\text{ MHz}$ $V_{AC} = 25mV$		361		pF	Fig. 13
$C_{oss}$	Output Capacitance			34		pF	
$C_{rss}$	Reverse Transfer Capacitance			3.5		pF	
$R_{G(int)}$	Internal Gate Resistance	$f = 1\text{ MHz}, V_{AC} = 25mV$		3.5		$\Omega$	

### Reverse Diode Characteristics

Symbol	Parameter	Test conditions	Value			Unit	Note
			Min.	Typ.	Max.		
$V_{SD}$	Diode Forward Voltage	$V_{GS} = -4V, I_{SD} = 2.5A$		3.8		V	Fig. 7,8
		$V_{GS} = -4V, I_{SD} = 2.5A, T_j = 175^\circ C$		3.4			
$I_S$	Continuous Diode Forward Current	$V_{GS} = -4V, T_C = 25^\circ C$		17		A	
$I_{S, pulse}$	Diode pulse Current	$V_{GS} = -4V, \text{pulse width } t_p \text{ limited by } T_{jmax}$		26		A	



### Typical Performance

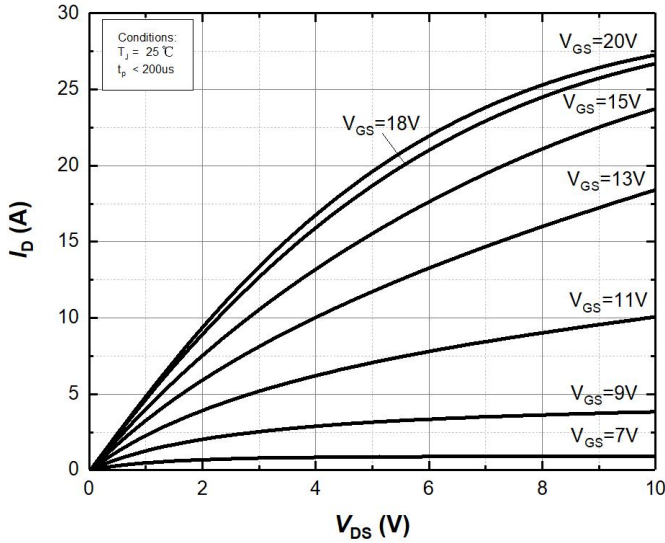


Figure 1. Output characteristics at  $T_j=25^\circ\text{C}$

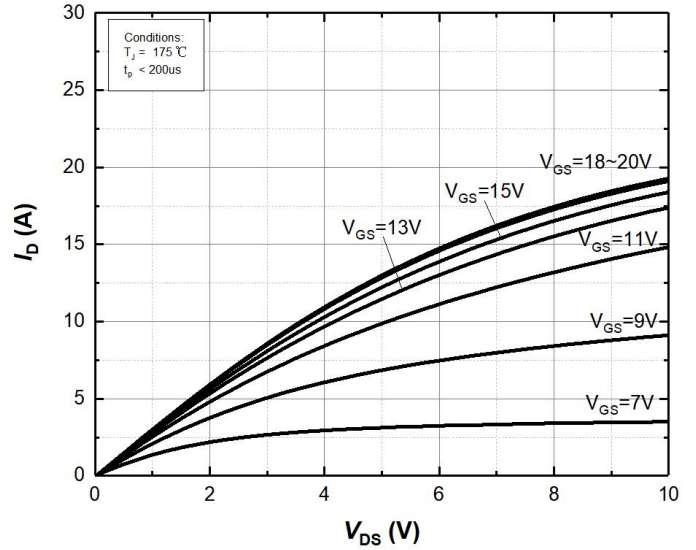


Figure 2. Output characteristics at  $T_j=175^\circ\text{C}$

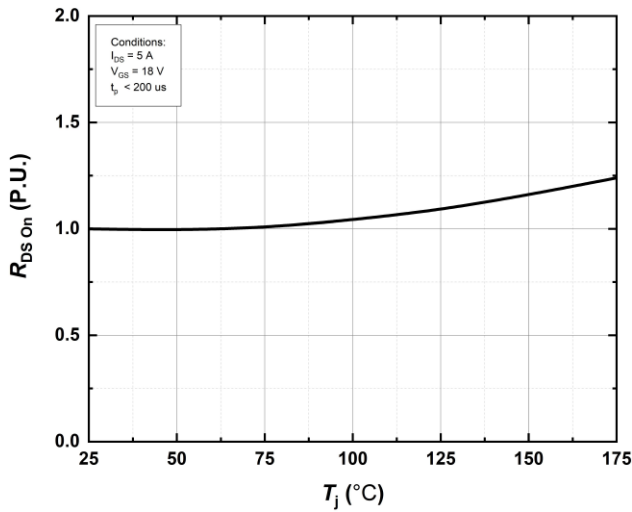


Figure 3. Normalized On-Resistance vs. Temperature

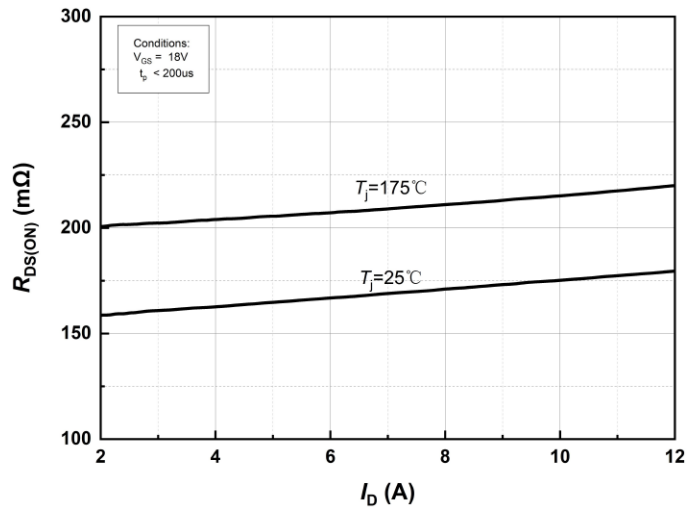


Figure 4. On-Resistance vs. Drain current for Various Temperature

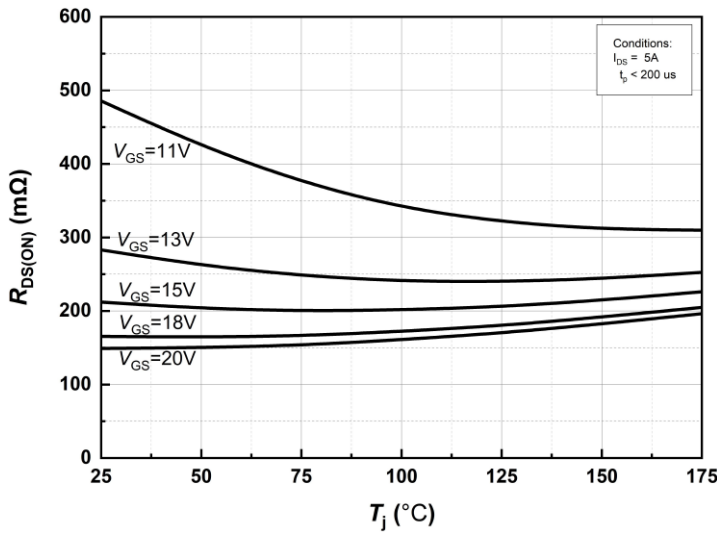


Figure 5. On-Resistance vs. Temperature for Various Gate Voltage

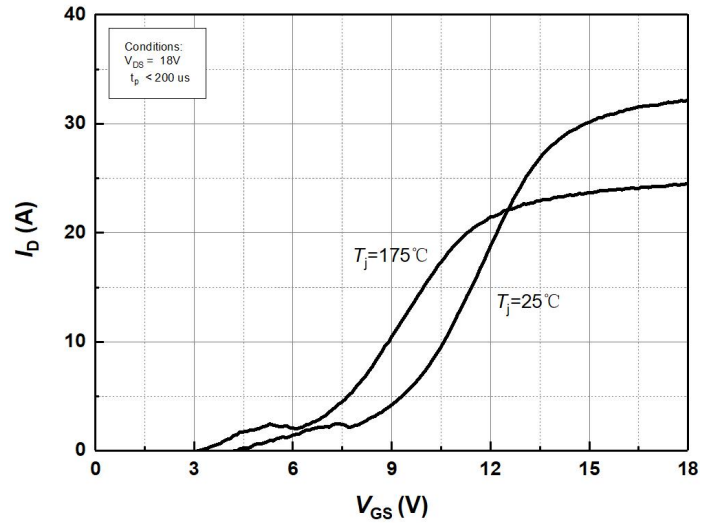


Figure 6. Transfer Characteristics for Various Junction Temperatures

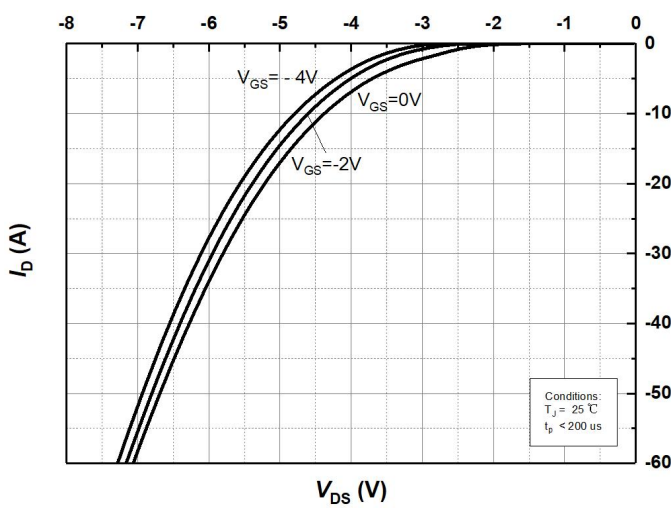


Figure 7. Body Diode Characteristics at Tj=25°C

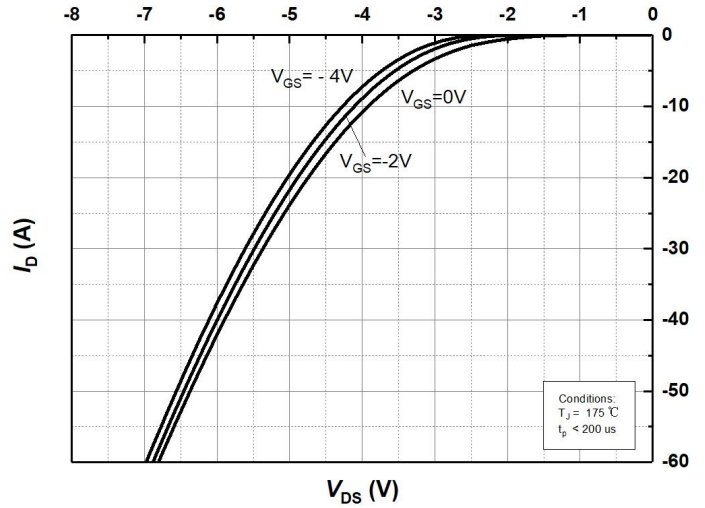


Figure 8. Body Diode Characteristics at Tj=175°C

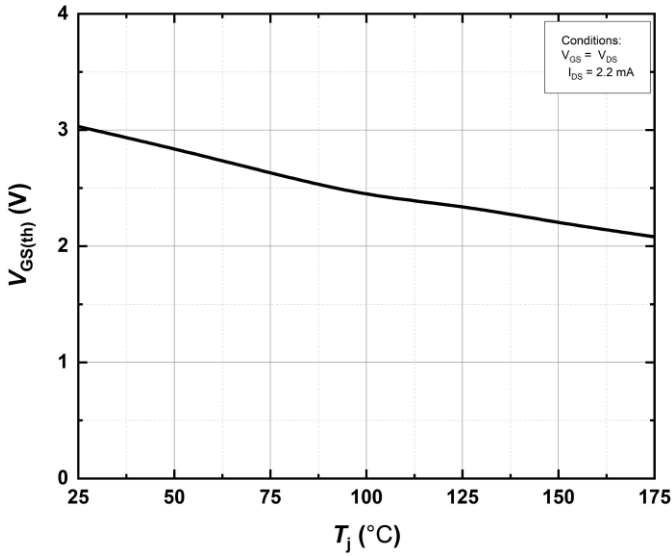


Figure 9. Threshold Voltage vs. Temperature

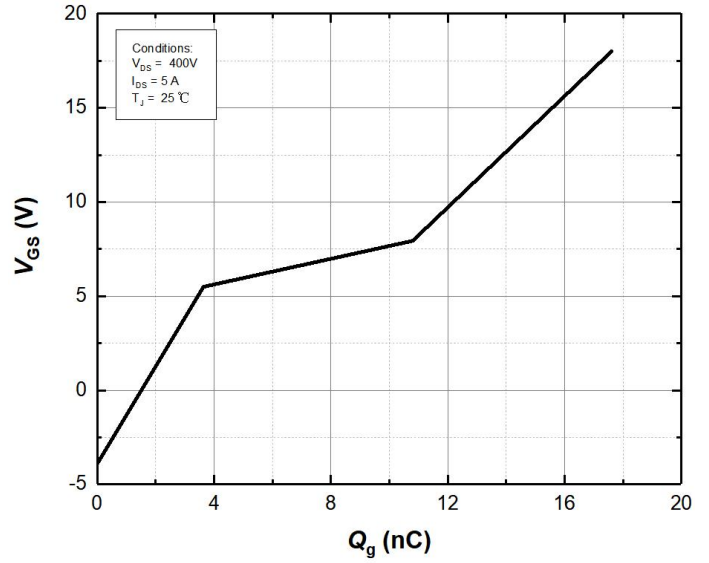


Figure 10 Gate Charge Characteristics

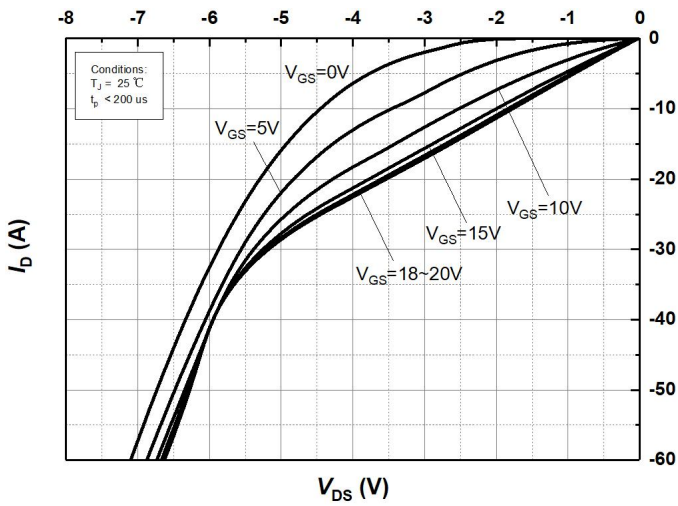


Figure 11. 3rd Quadrant Characteristic at  $T_j=25^\circ\text{C}$

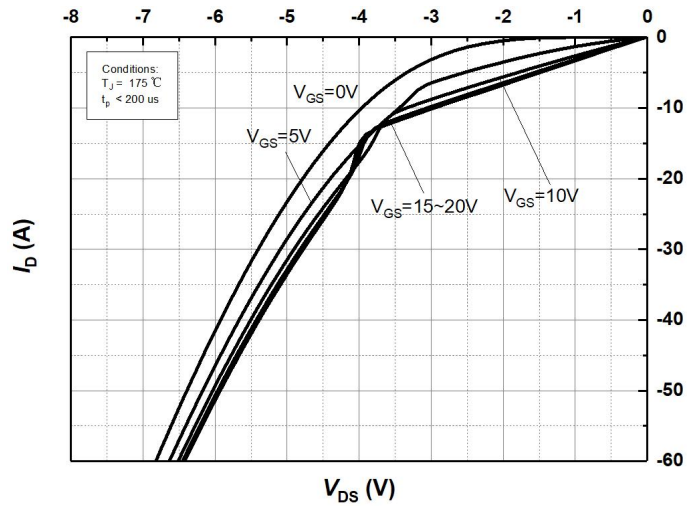


Figure 12. 3rd Quadrant Characteristic at  $T_j=175^\circ\text{C}$

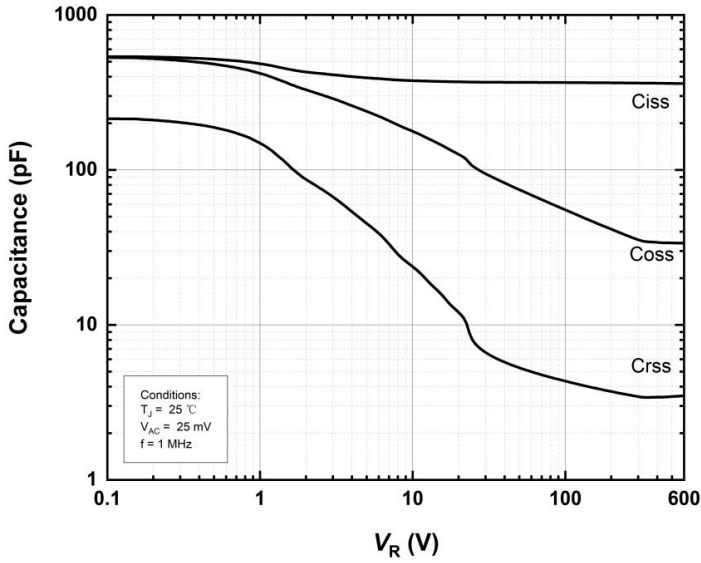


Figure 13. Capacitances vs. Drain-Source Voltage (0 – 600V)

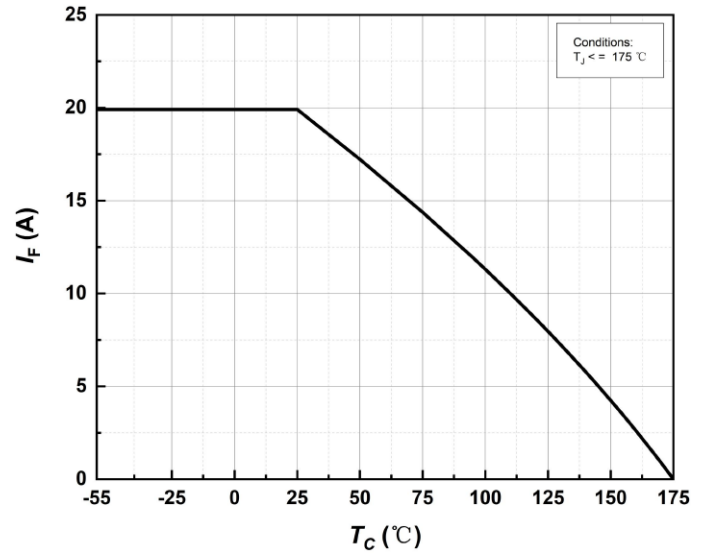


Figure 14. Continuous Drain Current Derating vs Case Temperature

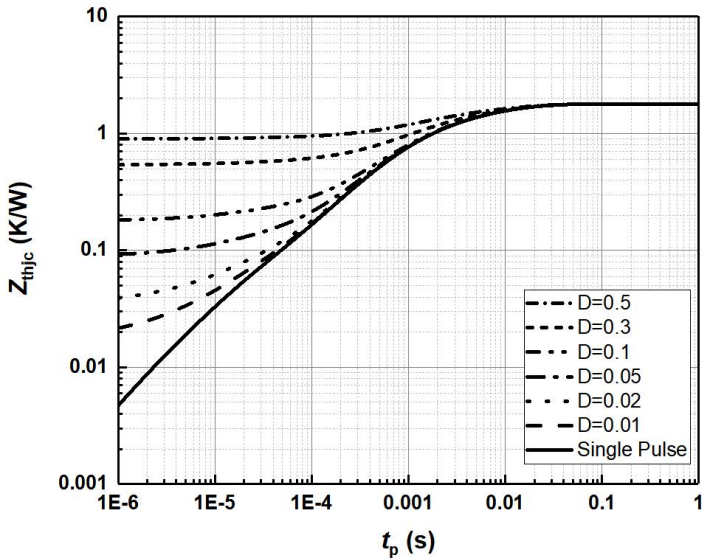


Figure 15. Transient Thermal Impedance (Junction – Case)

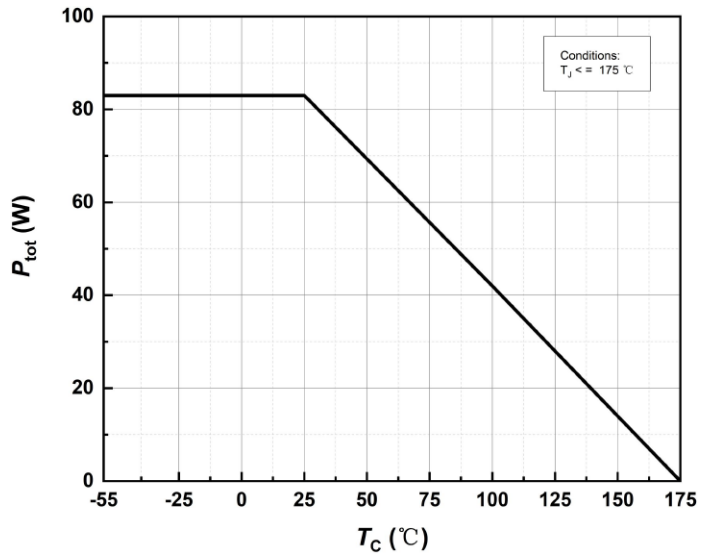


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

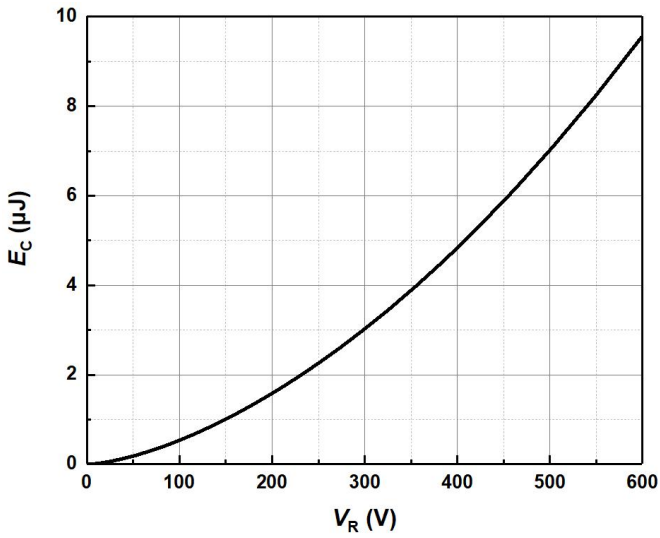


Figure 17. Output Capacitor Stored Energy

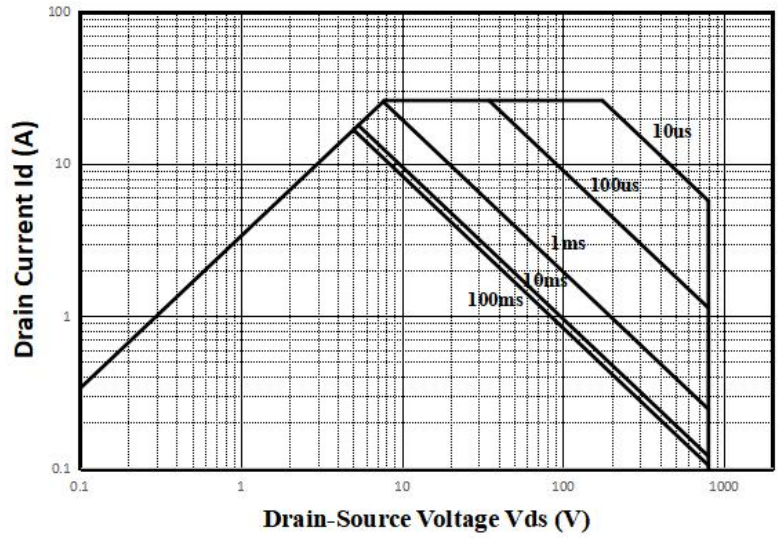


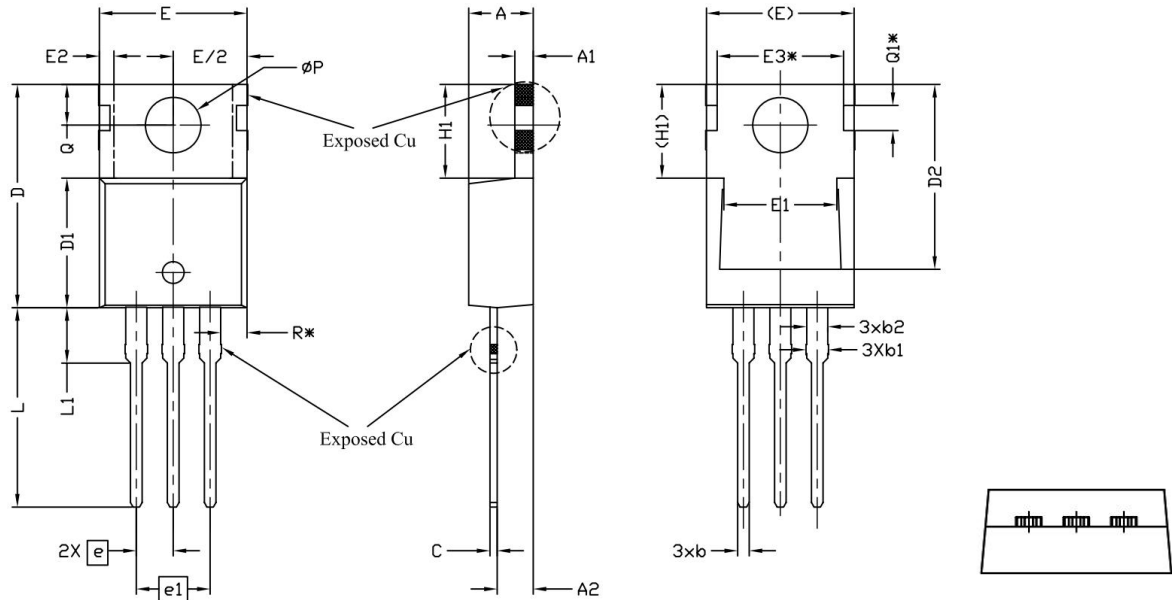
Figure 18. Safe Operating Area





## Package Dimensions

Package TO-220C



SYMBOL	DIMENSIONS			NOTES
	MIN.	NOM.	MAX.	
A	4.24	4.44	4.64	
A1	1.15	1.27	1.40	
A2	2.30	2.48	2.70	
b	0.70	0.80	0.90	
b1	1.20	1.55	1.75	
b2	1.20	1.45	1.70	
c	0.40	0.50	0.60	
D	14.70	15.37	16.00	4
D1	8.82	8.92	9.02	
D2	12.43	12.73	12.83	5
E	9.96	10.16	10.36	4,5
E1	6.86	7.77	8.89	5
E2	-	-	0.76	6
E3*	8.70REF.			
e	2.54BSC			
e1	5.08BSC			
H1	6.30	6.45	6.60	5,6
L	13.47	13.72	13.97	
L1	3.60	3.80	4.00	
ØP	3.75	3.84	3.93	
Q	2.60	2.80	3.00	
Q1*	1.73REF.			
R*	1.82REF.			



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