

## 1200V SiC MOSFET Power Module



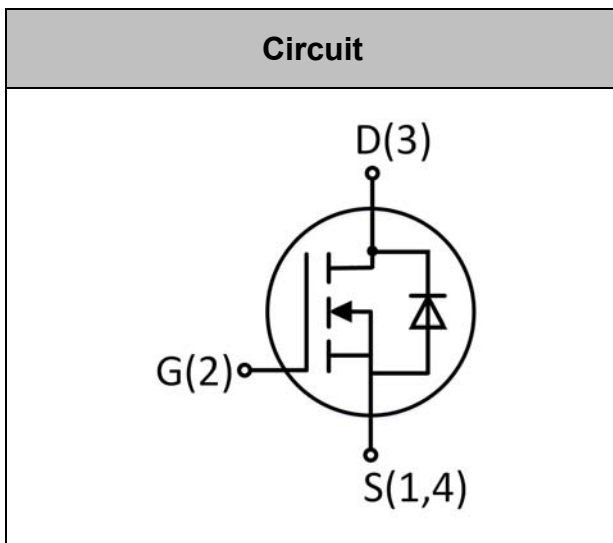
$V_{DS}$	1200V
$I_D$	53A
$R_{DS(on)}$	42m $\Omega$

### Applications

- Photovoltaic Inverter
- Battery Charger
- Server Power Supplies
- Energy Storage System

### Features

- Zero Turn-off Tail Current
- Normally-off N-channel MOSFET
- High Frequency Operation
- Low Switching Loss
- Low Inductance Screw Connectors
- Isolated Baseplate (SOT-227)



## ● MOSFET

Absolute Maximum Ratings (Per Position) ( $T_J=25^\circ\text{C}$  Unless Otherwise Specified)

Parameter	Symbol	Conditions	Value	Unit
Drain-Source Voltage	$V_{DS,max}$	$V_{GS}=0\text{ V}$ , $I_{DS}=100\mu\text{A}$	1200	V
Continuous Drain Current	$I_D$	$V_{GS}=20\text{V}$ , $T_C=25^\circ\text{C}$	53	A
		$V_{GS}=20\text{V}$ , $T_C=80^\circ\text{C}$	42	
Pulse Drain Current	$I_{D,pulse}$	Pulse width $t_p$ limited by $T_{J,max}$	223	A
Power Dissipation	$P_{D\_MOS}$	$T_C=25^\circ\text{C}$	223	W
Recommend Gate Source Voltage	$V_{GS,op}$	Static, recommended DC operating values	-5/20	V
Maximum Gate Source Voltage	$V_{GS,max}$	Absolute maximum values	-10/25	V
Max Junction Temperature	$T_{J,max}$		175	$^\circ\text{C}$



# MC40UZ12ST

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## ● MOSFET

Characteristic Values (Per Position) ( $T_J=25^\circ\text{C}$  Unless Otherwise Specified)

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=100\mu A$	1200			V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=40mA$	1.5	2.6	4.0	V
		$V_{DS}=V_{GS}, I_D=40mA, T_J=175^\circ\text{C}$		1.8		
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=1200V, V_{GS}=0V$		1	50	$\mu A$
Gate-Source Leakage Current	$I_{GSS}$	$V_{DS}=0V, V_{GS}=20V$			250	nA
Drain-Source On-Resistance	$R_{DS(on)}$	$I_D=30A, V_{GS}=20V$		42	52	m $\Omega$
		$I_D=30A, V_{GS}=20V, T_J=175^\circ\text{C}$		77		
Transconductance	$g_{fs}$	$V_{DS}=20V, I_D=30A$		16		S
		$V_{DS}=20V, I_D=30A, T_J=175^\circ\text{C}$		14.5		
Internal Gate Resistance	$R_{G(int.)}$	$f=1MHz, V_{AC}=25mV$		0.9		$\Omega$
Input Capacitance	$C_{iss}$	$V_{GS}=0V,$ $V_{DS}=800V,$ $f=1MHz,$ $V_{AC}=25mV$		4460		pF
Output Capacitance	$C_{oss}$			201		
Reverse Transfer Capacitance	$C_{rss}$			32.3		
$C_{oss}$ Stored Energy	$E_{oss}$			67		
Gate to Source Charge	$Q_{GS}$	$V_{DD}=800V,$ $V_{GS}=-5/20V,$ $I_D=30A$		42		nC
Gate to Drain Charge	$Q_{GD}$			91		
Total Gate Charge	$Q_G$			233		
Turn On Delay Time	$t_{d(on)}$	$V_{DD}=800V, V_{GS}=-5/20V,$ $I_D=30A, R_{G(ext)}=2.7\Omega,$ $L=100\mu H$		30		ns
Rise Time	$t_r$			27		
Turn Off Delay Time	$t_{d(off)}$			40		
Fall Time	$t_f$			21		
Turn-on Switching Energy	$E_{on}$			920		$\mu J$
Turn-off Switching Energy	$E_{off}$			191		
MOSFET Thermal Resistance, Junction to Case	$R_{thJC}$	JESD51-14		0.65		$^\circ\text{C/W}$



## ● Body Diode

Characteristic Values (Per Position) ( $T_J=25^\circ\text{C}$  Unless Otherwise Specified)

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Inverse Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_F=7.5A$		2.9		V
		$V_{GS}=0V, I_F=7.5A, T_J=175^\circ\text{C}$		2.6		
Continuous Diode Forward Current	$I_S$	$V_{GS}=0V, T_C=25^\circ\text{C}$		48		A
Reverse Recovery Time	$t_{rr}$	$V_{GS}=0V,$ $I_S=30A, V_R=400V,$ $di/dt=300A/\mu s$		144		ns
Reverse Recovery Charge	$Q_{rr}$			176		nC
Peak Reverse Recovery Current	$I_{rrm}$			7		A

## ● Module Characteristics

Parameter	Symbol	Conditions	Value	Unit
Isolation Breakdown Voltage	$V_{isol}$	AC, 50Hz (R.M.S), $t=3s$	3600	V
Operating Temperature	$T_{Jop}$		-55~175	$^\circ\text{C}$
Storage Temperature	$T_{stg}$		-55~175	$^\circ\text{C}$
Mounting Torque	M	Recommended (M4 screw)	1~1.5	Nm
Terminal Connection Torque		Recommended (M4 screw)	1~1.5	
Weight	W		29	g

## ● Typical Performance

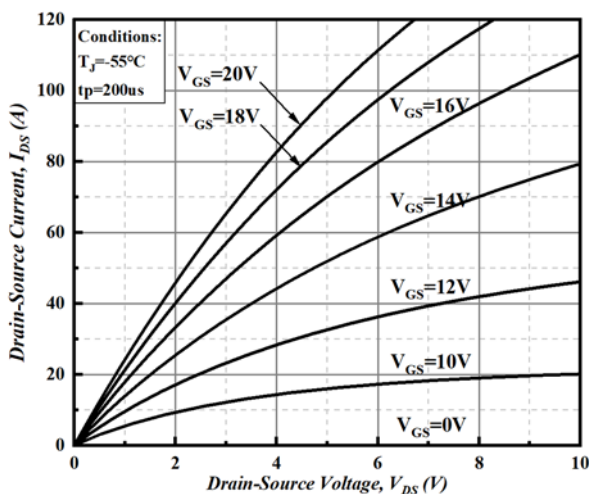


Figure 1. Output Characteristics  $T_J = -55^\circ\text{C}$

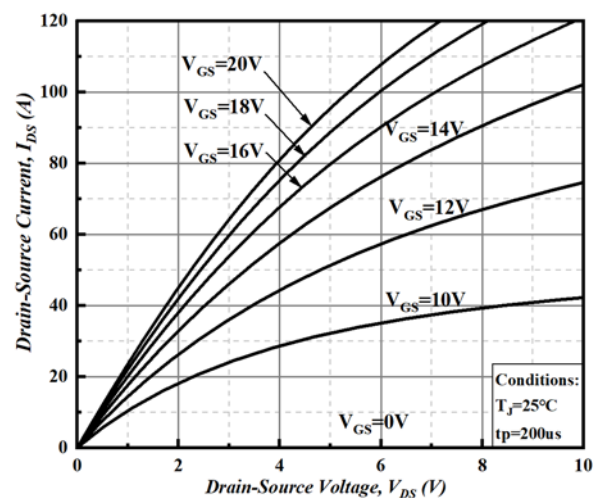


Figure 2. Output Characteristics  $T_J = 25^\circ\text{C}$

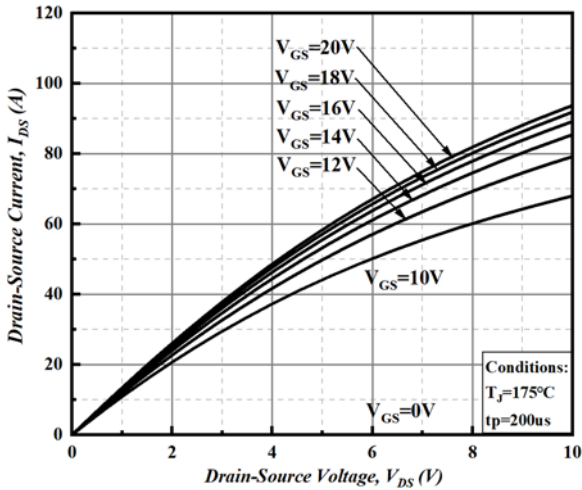


Figure 3. Output Characteristics  $T_J = 175^\circ\text{C}$

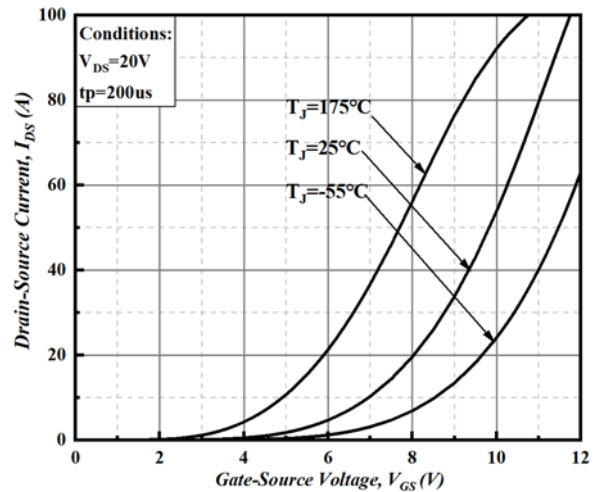


Figure 4. Transfer Characteristic for Various Junction Temperatures

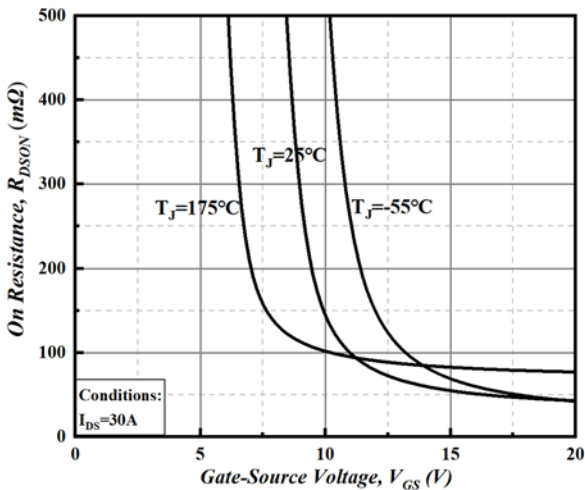


Figure 5. On-Resistance vs Gate Voltage For Various Junction Temperatures

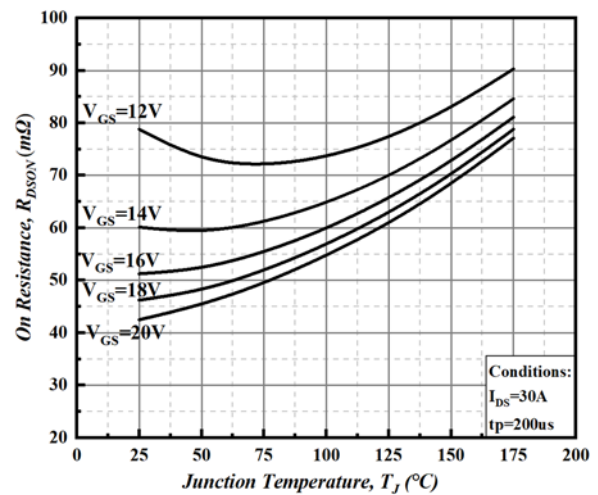


Figure 6. On-Resistance vs Temperature For Various Gate Voltage

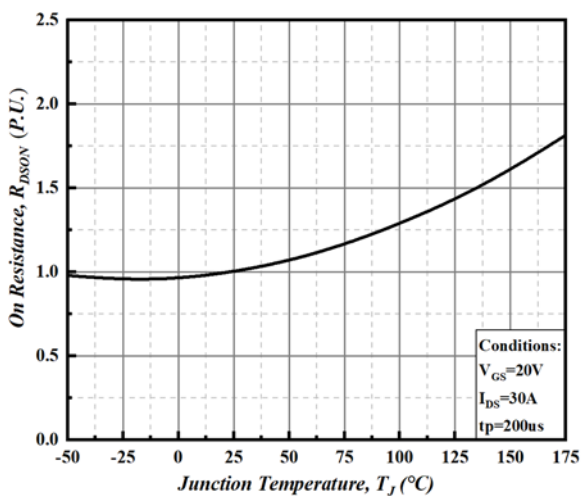


Figure 7. Normalized On-Resistance vs Temperature

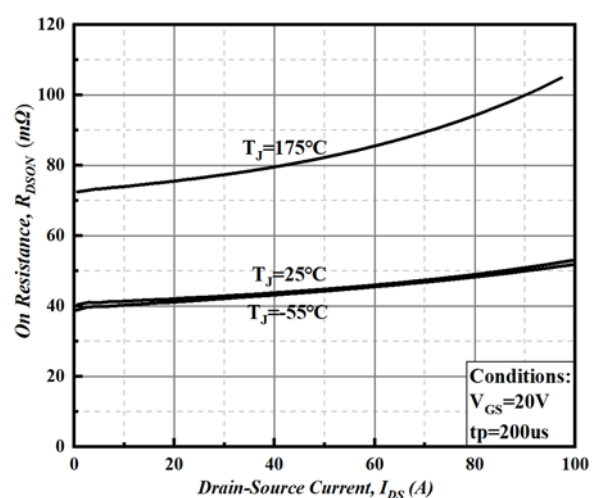


Figure 8. On-Resistance vs Drain Current



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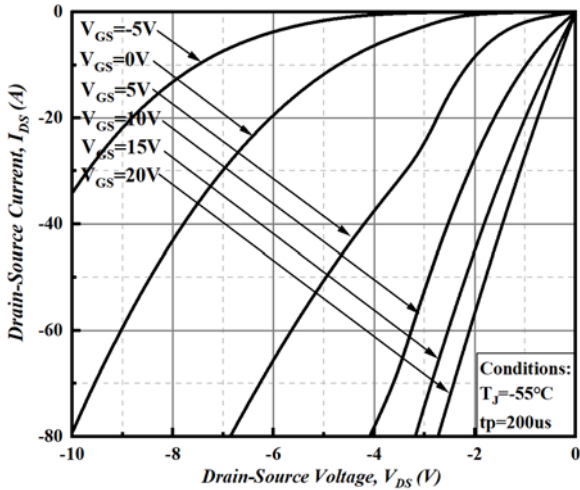


Figure 9. Body Diode Characteristic at  $T_J = -55^\circ\text{C}$

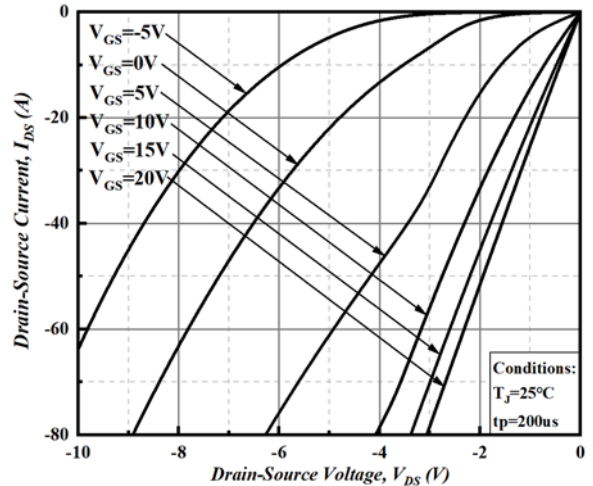


Figure 10. Body Diode Characteristic at  $T_J = 25^\circ\text{C}$

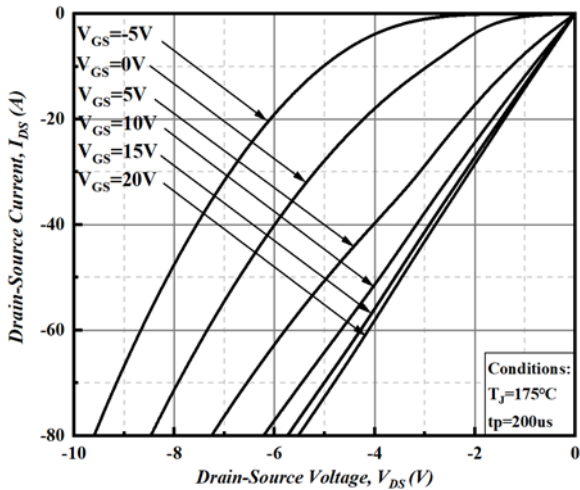


Figure 11. Body Diode Characteristic at  $T_J = 175^\circ\text{C}$

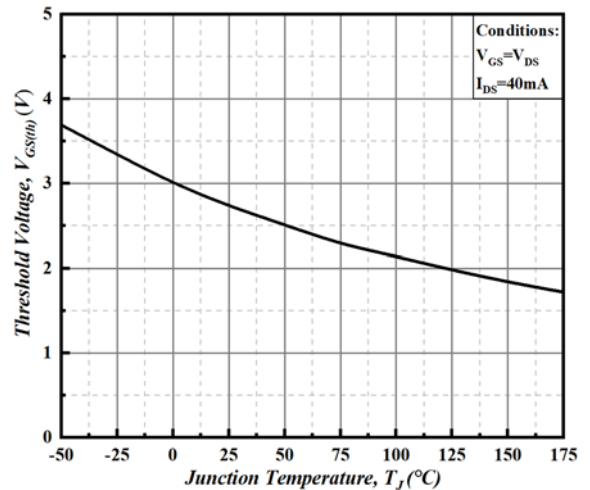


Figure 12. Threshold Voltage vs Temperature

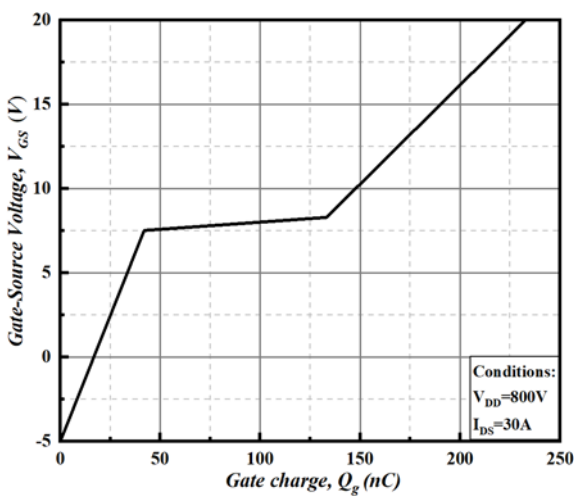


Figure 13. Gate Charge Characteristics

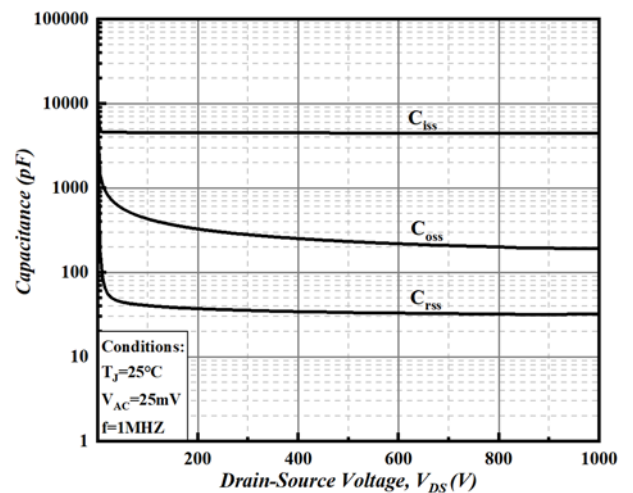


Figure 14. Capacitances vs Drain-Source Voltage (0 - 1000V)

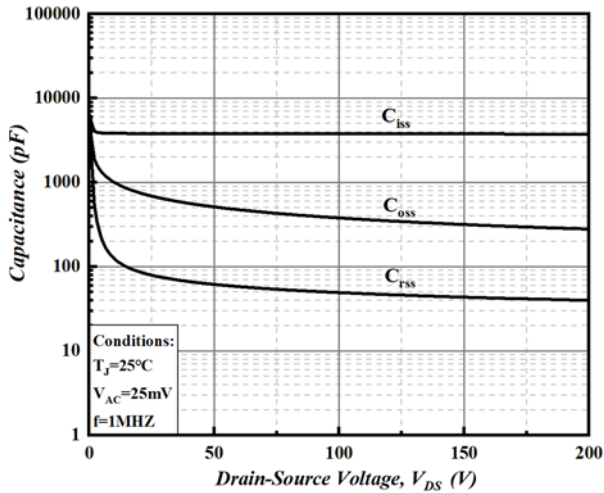


Figure 15. Capacitances vs Drain-Source Voltage (0 - 200V)

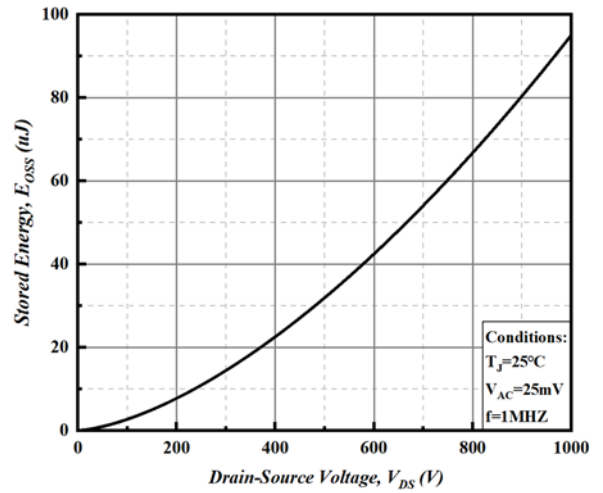


Figure 16. Output Capacitor Stored Energy

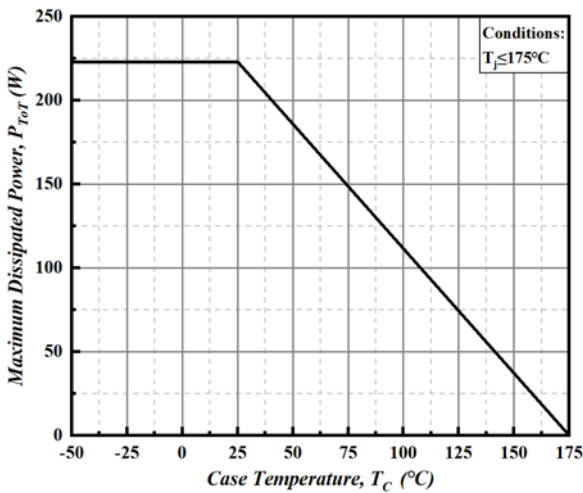


Figure 17. Maximum Power Dissipation Derating vs Case Temperature

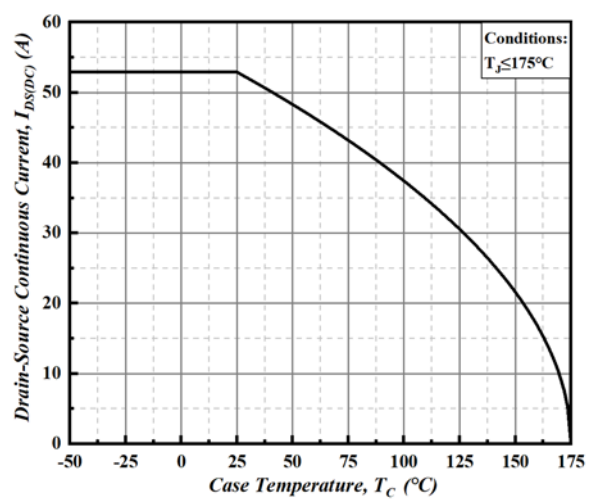


Figure 18. Continuous Drain Current vs Case Temperature

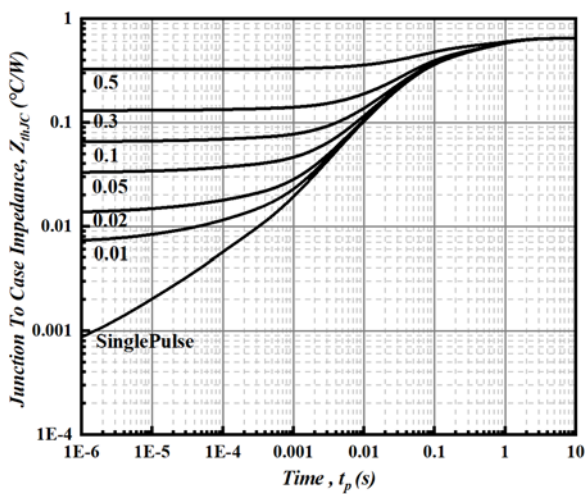


Figure 19. Transient Thermal impedance (Junction to Case)

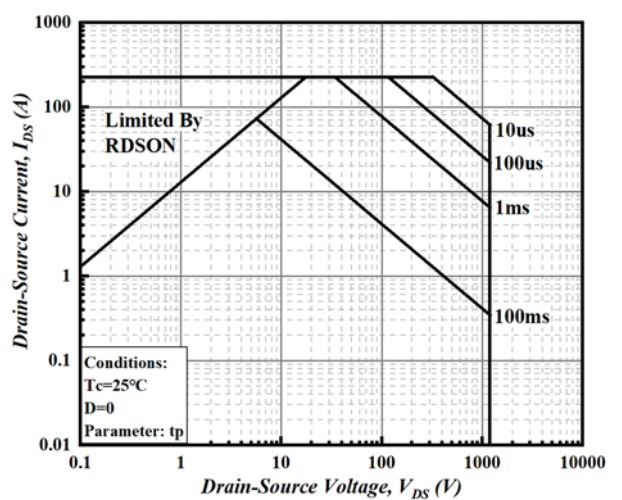
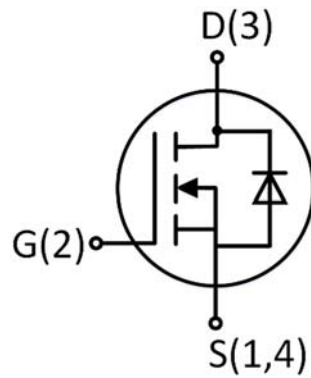


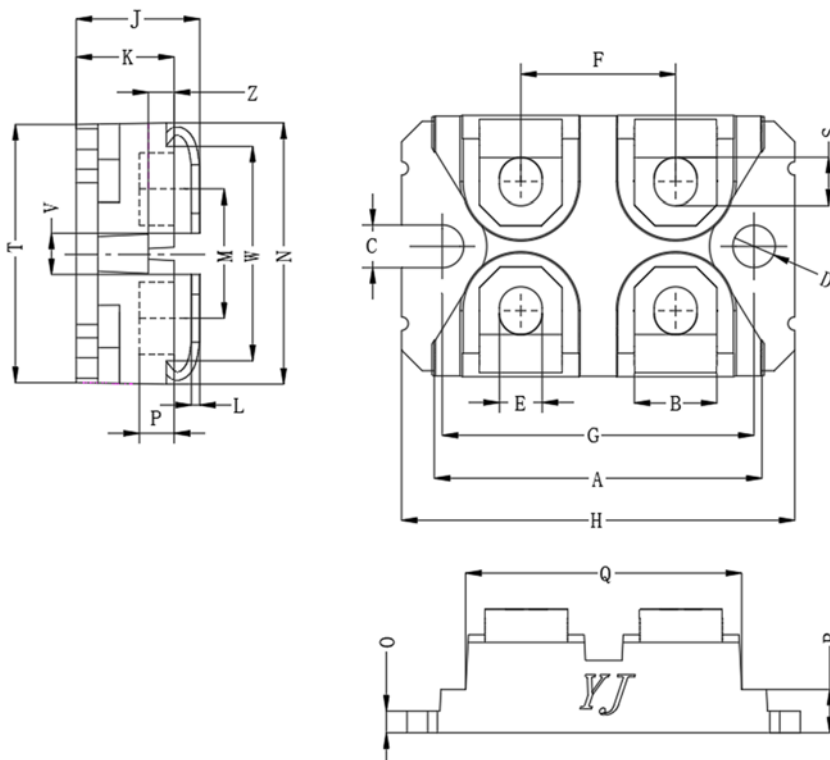
Figure 20. Safe Operating Area



● Schematic and Pin Out



● Package Dimensions (mm)



DIM	Millimeter	
	min	max
A	31.60	31.80
B	7.70	8.10
C	4.20	4.40
D	4.20	4.40
E	4.10	4.40
F	14.90	15.10
G	30.10	30.30
H	37.70	38.20
J	12.00	12.60
K	9.35	9.65
L	0.74	0.84
M	12.40	12.80
N	24.80	25.60
O	1.90	2.10
P	2.92	3.32
Q	26.60	27.00
R	3.80	4.20
S	4.95	5.45
T	23.70	24.30
V	3.50	5.50
W	20.55	20.85
Z	2.50	2.70



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