

MC20UZ12ST



1200V SiC MOSFET Power Module

V_{DS}	1200V
I_D	91A
$R_{DS(on)}$	22m Ω

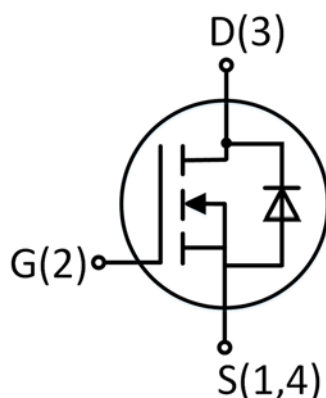
Applications

- 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)

Circuit



● 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	$V_{GS}=20\text{V}$, $T_C=25^{\circ}\text{C}$	91	A
		$V_{GS}=20\text{V}$, $T_C=80^{\circ}\text{C}$	72	
Pulse Drain Current	$I_{D,pulse}$	Pulse width t_p limited by $T_{J,max}$	320	A
Power Dissipation	P_{D_MOS}	$T_C=25^{\circ}\text{C}$	348	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	$^{\circ}\text{C}$

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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	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=200\mu A$	1200			V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=80mA$	1.5	2.8	4.0	V
		$V_{DS}=V_{GS}, I_D=80mA, T_J=175^{\circ}\text{C}$		1.8		
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=1200V, V_{GS}=0V$		1	100	μA
Gate-Source Leakage Current	I_{GSS}	$V_{DS}=0V, V_{GS}=20V$			250	nA
Drain-Source On-Resistance	$R_{DS(on)}$	$I_D=60A, V_{GS}=20V$		22	32	m Ω
		$I_D=60A, V_{GS}=20V, T_J=175^{\circ}\text{C}$		41		
Transconductance	g_{fs}	$V_{DS}=20V, I_D=60A$		32		S
		$V_{DS}=20V, I_D=60A, T_J=175^{\circ}\text{C}$		31.2		
Internal Gate Resistance	$R_{G(int.)}$	$f=1MHz, V_{AC}=25mV$		0.5		Ω
Input Capacitance	C_{iss}	$V_{GS}=0V,$ $V_{DS}=800V,$ $f=1MHz,$ $V_{AC}=25mV$		7560		pF
Output Capacitance	C_{oss}			286		
Reverse Transfer Capacitance	C_{rss}			26.9		
C_{oss} Stored Energy	E_{oss}			115		μJ
Gate to Source Charge	Q_{GS}	$V_{DD}=800V,$ $V_{GS}=-5/20V,$ $I_D=30A$		96		nC
Gate to Drain Charge	Q_{GD}			177		
Total Gate Charge	Q_G			463		
Turn On Delay Time	$t_{d(on)}$	$V_{DD}=800V, V_{GS}=-5/20V,$ $I_D=60A, R_{G(ext)}=2.7\Omega,$ $L=100\mu H$		33		ns
Rise Time	t_r			30		
Turn Off Delay Time	$t_{d(off)}$			44		
Fall Time	t_f			23		
Turn-on Switching Energy	E_{on}			2008		μJ
Turn-off Switching Energy	E_{off}			417		
MOSFET Thermal Resistance, Junction to Case	R_{thJC}	JESD51-14		0.41		$^{\circ}\text{C/W}$

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● 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}	$V_{GS}=0\text{V}$, $I_F=15\text{A}$		3.2		V
		$V_{GS}=0\text{V}$, $I_F=15\text{A}$, $T_J=175^\circ\text{C}$		2.7		
Continuous Diode Forward Current	I_S	$V_{GS}=0\text{V}$, $T_C=25^\circ\text{C}$		80		A
Reverse Recovery Time	t_{rr}	$V_{GS}=0\text{V}$, $I_S=60\text{A}$, $V_R=400\text{V}$, $di/dt=300\text{A}/\mu\text{s}$		157		ns
Reverse Recovery Charge	Q_{rr}			384		nC
Peak Reverse Recovery Current	I_{rrm}			15		A

● Module Characteristics

Parameter	Symbol	Conditions	Value	Unit
Isolation Breakdown Voltage	V_{isol}	AC, 50Hz (R.M.S), $t=3\text{s}$	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

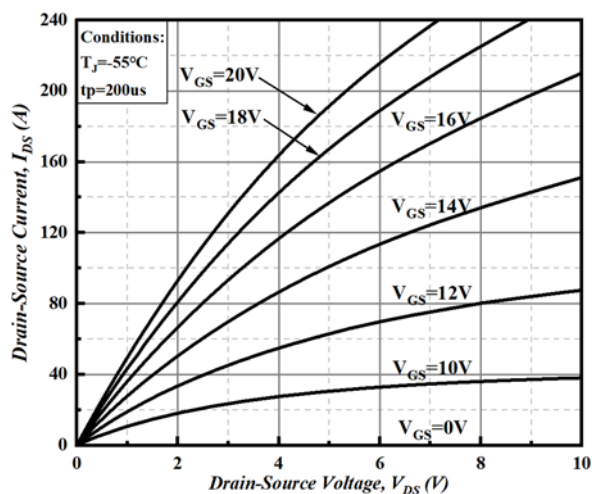


Figure 1. Output Characteristics $T_J = -55^\circ\text{C}$

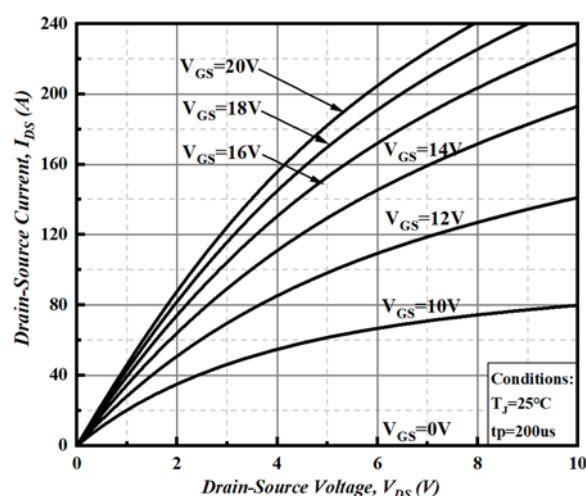


Figure 2. Output Characteristics $T_J = 25^\circ\text{C}$

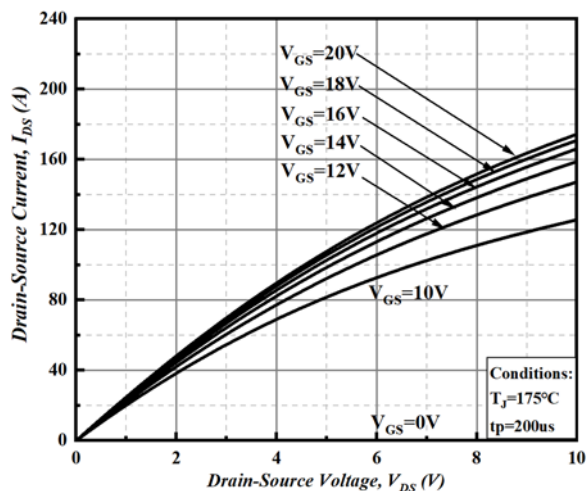


Figure 3. Output Characteristics $T_j = 175^\circ\text{C}$

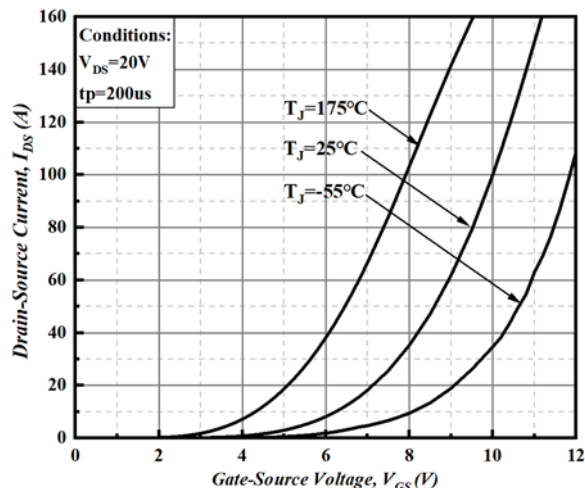


Figure 4. Transfer Characteristic for Various Junction Temperatures

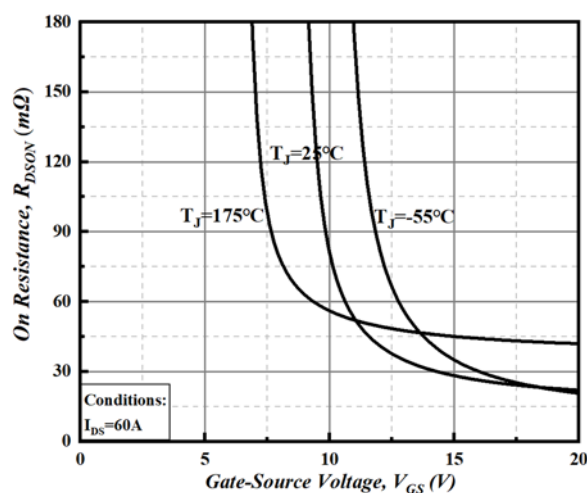


Figure 5. On-Resistance vs Gate Voltage For Various Junction Temperatures

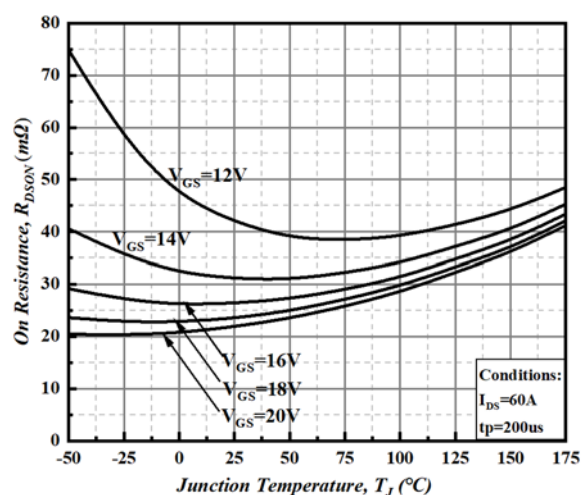


Figure 6. On-Resistance vs Temperature For Various Gate Voltage

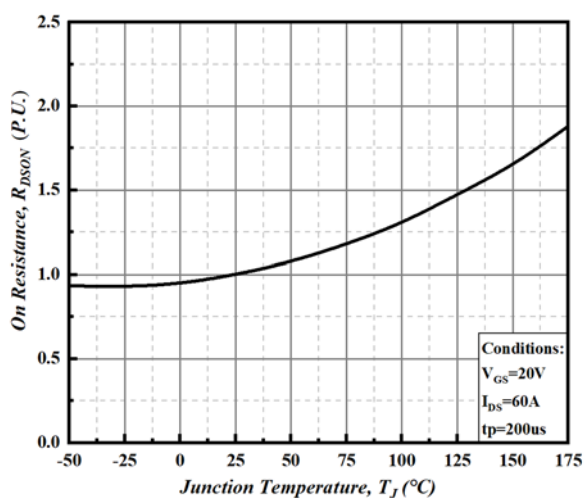


Figure 7. Normalized On-Resistance vs Temperature

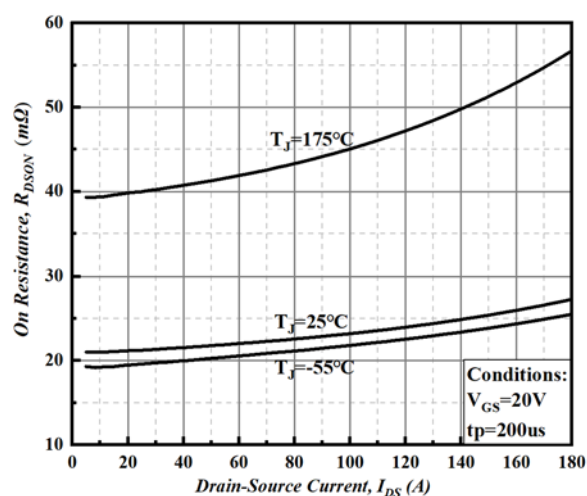


Figure 8. On-Resistance vs Drain Current

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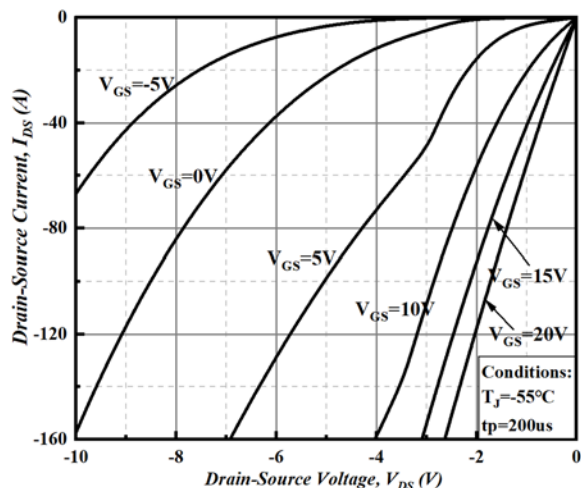


Figure 9. Body Diode Characteristic at $T_j = -55^\circ\text{C}$

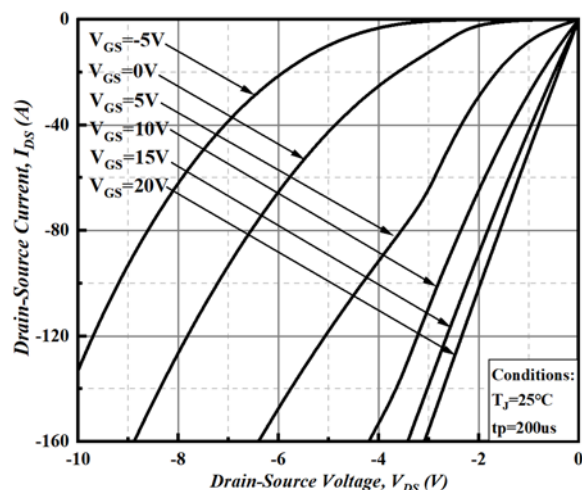


Figure 10. Body Diode Characteristic at $T_j = 25^\circ\text{C}$

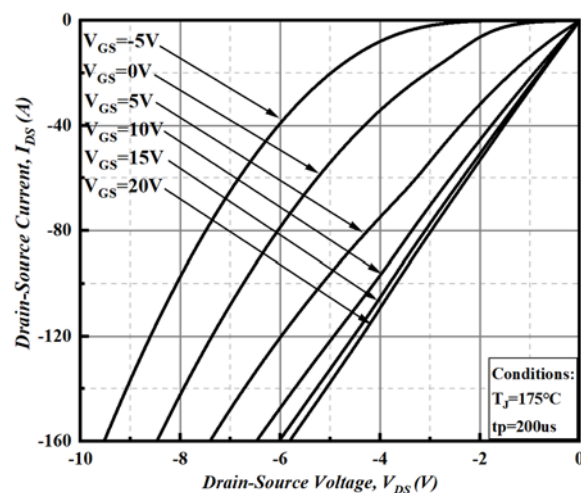


Figure 11. Body Diode Characteristic at $T_j = 175^\circ\text{C}$

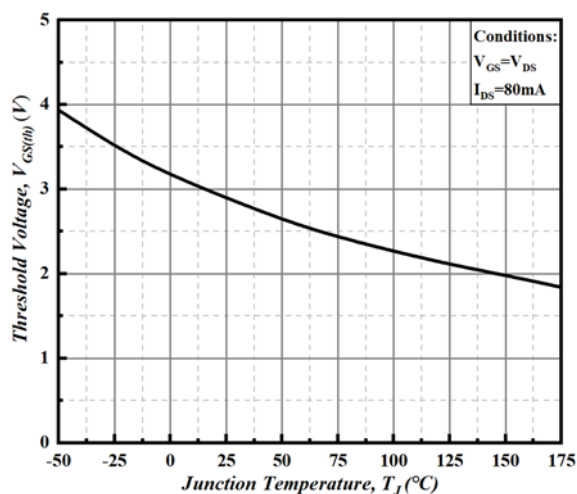


Figure 12. Threshold Voltage vs Temperature

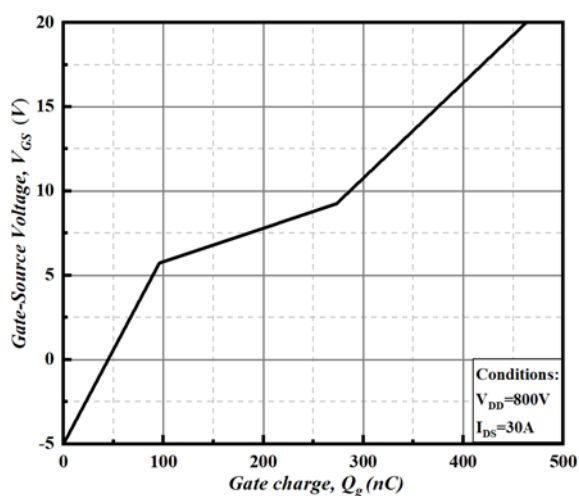


Figure 13. Gate Charge Characteristics

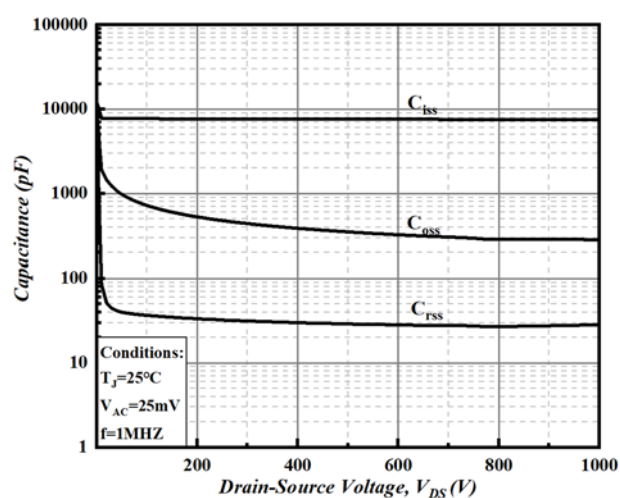


Figure 14. Capacitances vs Drain-Source Voltage (0 - 1000V)

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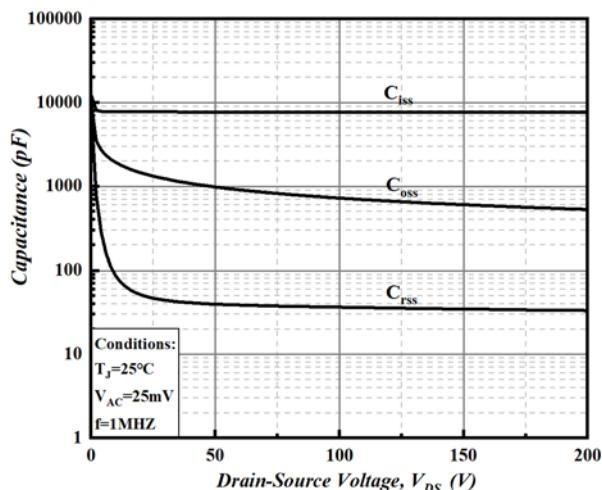


Figure 15. Capacitances vs Drain-Source Voltage (0 - 200V)

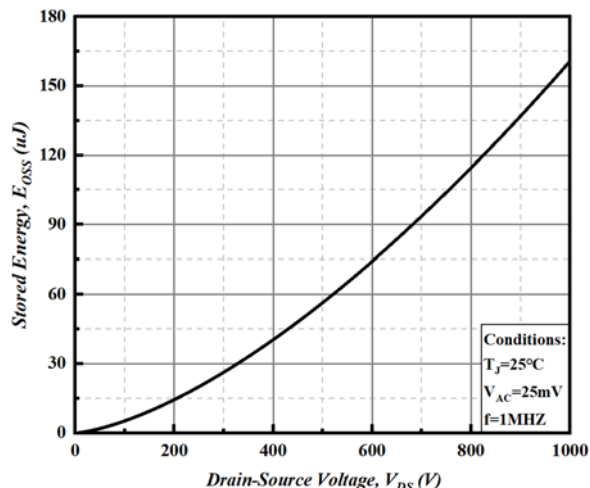


Figure 16. Output Capacitor Stored Energy

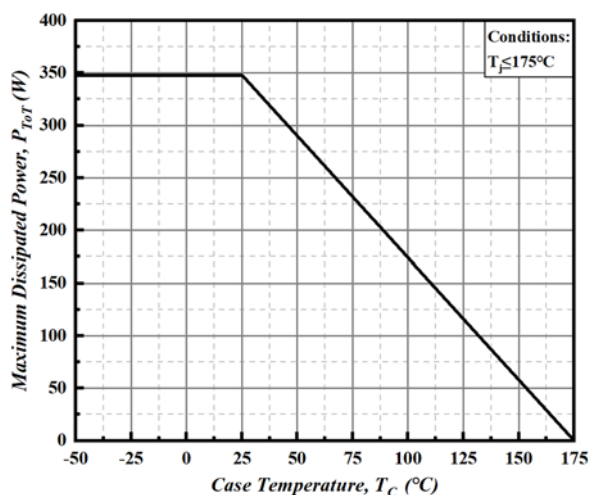


Figure 17. Maximum Power Dissipation Derating vs Case Temperature

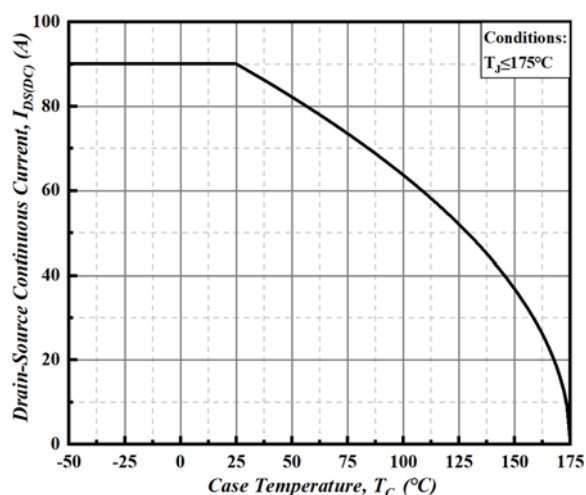


Figure 18. Continuous Drain Current vs Case Temperature

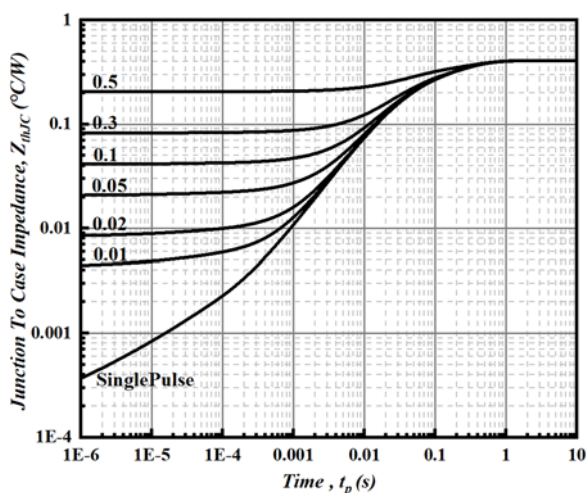


Figure 19. Transient Thermal impedance (Junction to Case)

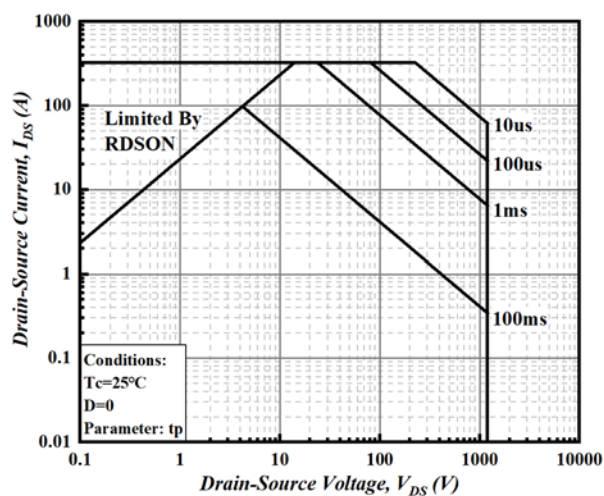
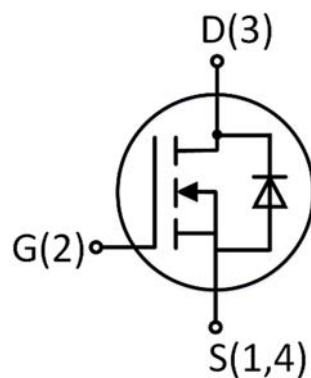


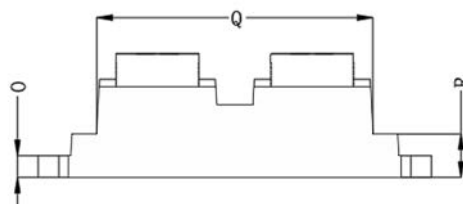
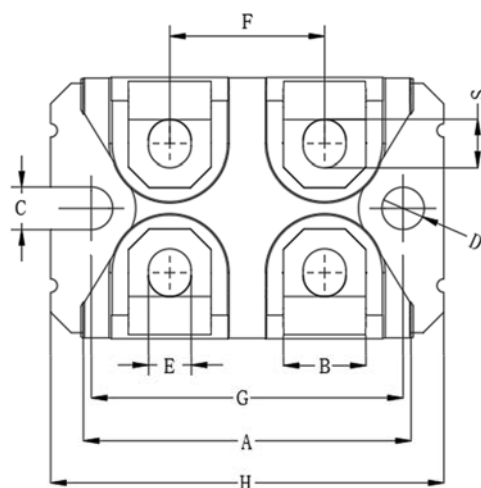
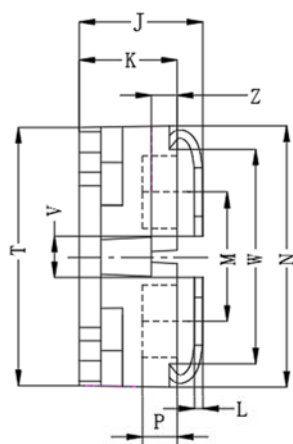
Figure 20. Safe Operating Area

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● 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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