

● General Description

This silicon carbide Power MOSFET device has been developed using ZMJ's advanced 1st generation SiC MOSFET technology. The device features a very low $R_{DS(on)}$ over the entire temperature range combined with low capacitances and very high switching operations. It improves application performance in frequency, energy efficiency, system size and weight reduction.

● Features

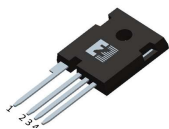
- High blocking voltage
- High speed switching with low capacitances
- Low $R_{DS(on)}$ to minimize conductive loss
- Low gate charge for fast switching
- Low thermal resistance
- 100% avalanche tested
- AEC-Q101 Qualified

● Application

- Motor drives
- On board charger
- DC-DC
- Auxiliary drives



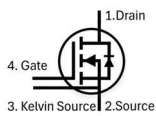
● Product Summary



TO-247-4

● Ordering Information

Part NO.	ZMCA020R120C4
Marking	ZMC020R120
Packing information	TUBE BULK
Basic ordering unit (pcs)	450


 $V_{DS}=1200V$
 $R_{DS(ON)}=19.4mR$
 $I_D=88A$


● Absolute Maximum Ratings ($T_A=25^{\circ}C$, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Max.	Unit
Drain-source voltage	V_{DS}		-	1200	V
Gate-source voltage ^①	V_{GS}	Transient Voltage	-10	25	V
	V_{GS}	Static Voltage	-10	24	V
Recommended turn on gate voltage	$V_{GS(on)}$		15	18	V
Recommended turn off gate voltage	$V_{GS(off)}$		-4	0	V
Continuous drain current	I_D	$V_{GS}=18V, T_C=25^{\circ}C$	-	88	A
	I_D	$V_{GS}=18V, T_C=75^{\circ}C$	-	72	A
	I_D	$V_{GS}=18V, T_C=100^{\circ}C$	-	62	A
Pulsed drain current	I_{DM}	Pulsed; $t_p \leq 10 \mu s; T_C = 25^{\circ}C$;	-	353	A

Total power dissipation	P_D	$T_C=25^{\circ}\text{C}$	-	357	W
Total power dissipation	P_D	$T_A=25^{\circ}\text{C}$	-	3.8	W
Operating junction temperature	T_J		-55	175	$^{\circ}\text{C}$
Storage temperature	T_{STG}		-55	175	$^{\circ}\text{C}$
Single pulse avalanche energy	E_{AS}	$L=0.5\text{mH}$, $V_{GS}=18\text{V}$, $R_g=25\Omega$,	-	1482	mJ

● Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}	-	-	0.42	$^{\circ}\text{C/W}$
Thermal resistance, junction - ambient	R_{thJA}	-	-	40	$^{\circ}\text{C/W}$
Soldering temperature	T_{sold}	-	-	260	$^{\circ}\text{C}$

● Electronic Characteristics ($T_J=25^{\circ}\text{C}$, unless otherwise specified)

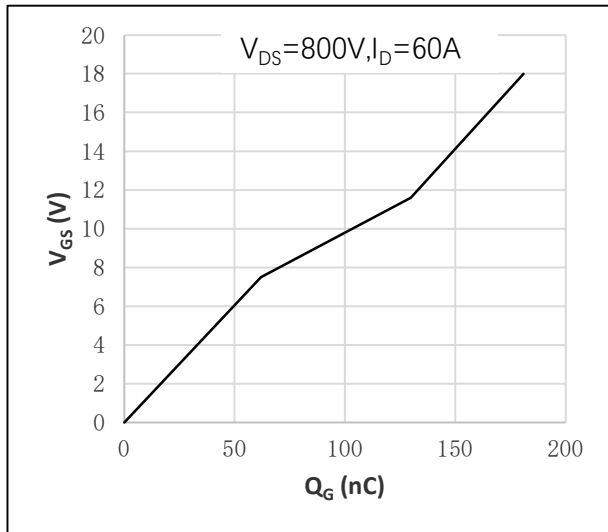
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	BV_{DSS}	$V_{GS}=0\text{V}$, $I_D=250\mu\text{A}$	1200	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}$, $I_D=5\text{mA}$	2	2.9	4	V
Drain-source leakage current	I_{DSS}	$V_{GS}=0\text{V}$, $V_{DS}=1200\text{V}$	-	-	10	μA
Gate- source leakage current	I_{GSS}	$V_{GS}=-10\text{V}$, $V_{DS}=0\text{V}$	-	-	-100	nA
		$V_{GS}=25\text{V}$, $V_{DS}=0\text{V}$	-	-	100	nA
Static drain-source on resistance	$R_{DS(ON)}$	$V_{GS}=18\text{V}$, $I_D=60\text{A}$, $T_J=25^{\circ}\text{C}$	-	19.4	23	m Ω
		$V_{GS}=18\text{V}$, $I_D=60\text{A}$, $T_J=175^{\circ}\text{C}$	-	38.2	-	m Ω
		$V_{GS}=15\text{V}$, $I_D=60\text{A}$, $T_J=25^{\circ}\text{C}$	-	25.1	-	m Ω
Forward transconductance	g_{FS}	$V_{DS}=10\text{V}$, $I_{SD}=60\text{A}$	-	47	-	S
Diode forward voltage	V_{FSD}	$V_{GS}=-4\text{V}$, $I_{SD}=60\text{A}$	-	4.2	5	V

● Dynamic characteristics ($T_J=25^{\circ}\text{C}$, unless otherwise specified)

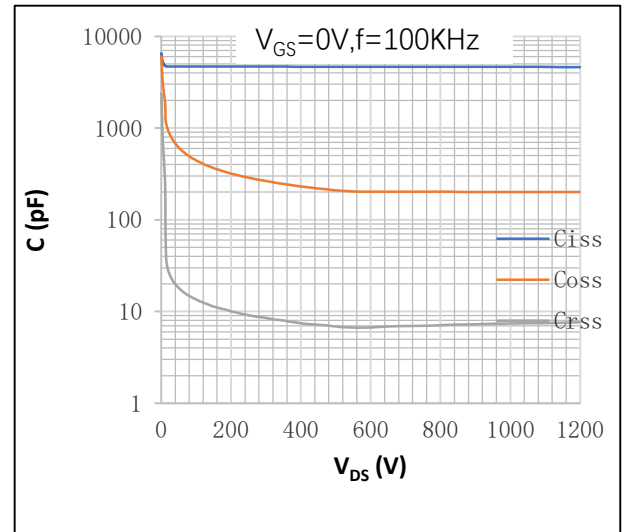
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	C_{iss}	$f=100\text{KHz}$, $V_{DS}=800\text{V}$, $V_{GS}=0\text{V}$	-	4711	-	pF
Output capacitance	C_{oss}		-	200	-	pF
Reverse transfer capacitance	C_{rss}		-	11	-	pF
Output charge	Q_{oss}	$f=100\text{KHz}$, $V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$ to 800V	-	266	-	nC
Coss stored energy	E_{oss}		-	74	-	μJ
Gate resistance	R_g	$f=1\text{MHz}$	-	1.8	-	Ω

Total gate charge	Q_g	$V_{DD} = 800V,$ $I_D = 60A,$ $V_{GS} = -4V/18V$	-	180.9	-	nC
Gate-source charge	Q_{gs}		-	62	-	nC
Gate-drain charge	Q_{gd}		-	67.9	-	nC
Turn-on delay time	$t_{D(on)}$	$V_{GS}=-4V/18V,$ $V_{DS}=800V,$ $R_G=1\Omega,$ $I_D=60A,$ $L=100\mu H$	-	20	-	ns
Turn-on rise time	t_r		-	8	-	ns
Turn-off delay time	$t_{D(off)}$		-	45	-	ns
Turn-off fall time	t_f		-	20	-	ns
Turn-on energy	E_{on}		-	465	-	uJ
Turn-off energy	E_{off}		-	138	-	uJ
Reverse recovery time	t_{rr}	$V_{DD}=800V, dI_S/dt =$ $100A/\mu s, I_S=60A$	-	21	-	ns
Reverse recovery charge	Q_{rr}		-	198	-	nC

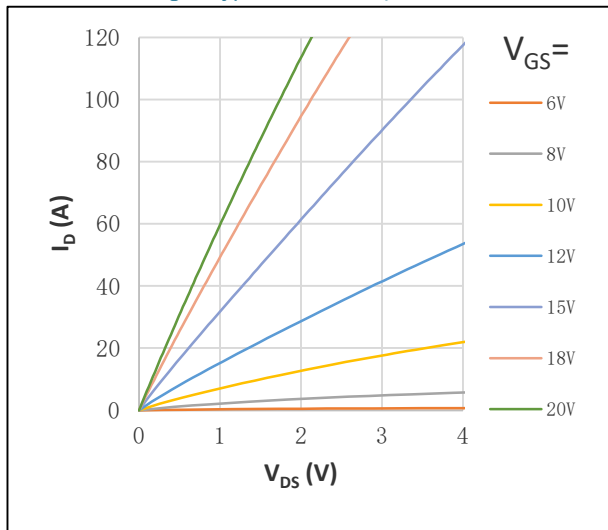
● Fig.1 Gate-source voltage as a function of gate charge; Typical values; $T_j=25^\circ\text{C}$



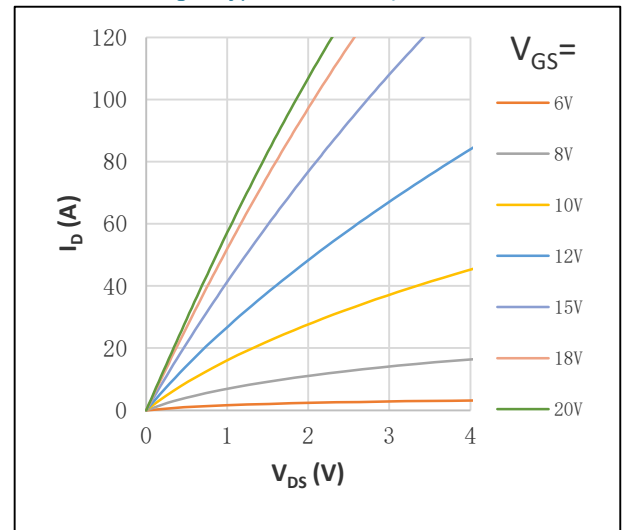
● Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage; Typical values; $T_j=25^\circ\text{C}$



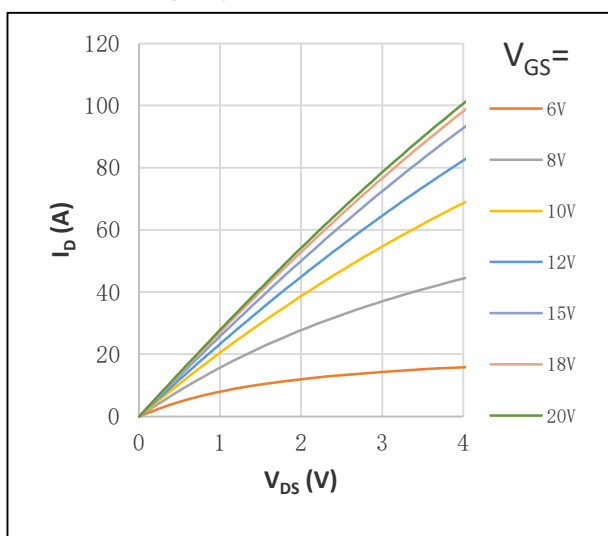
● Fig.3 Output characteristics: drain current as a function of drain-source voltage; Typical values; $T_j=-55^\circ\text{C}$



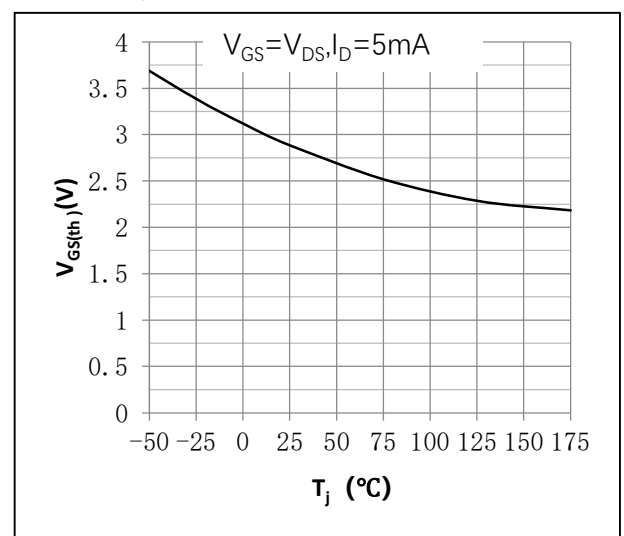
● Fig.4 Output characteristics: drain current as a function of drain-source voltage; Typical values; $T_j=25^\circ\text{C}$



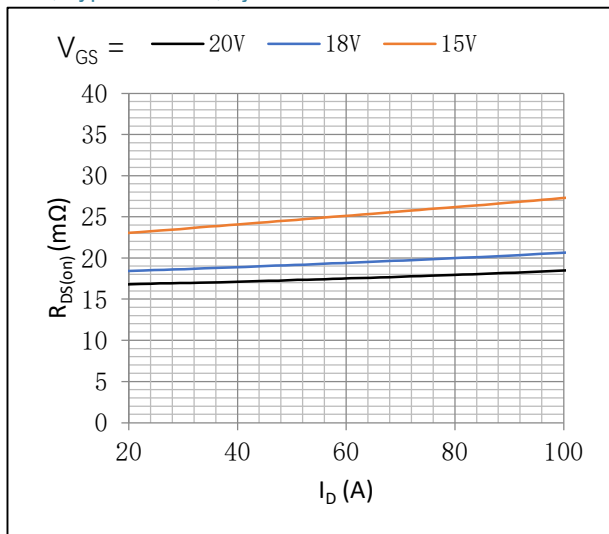
● Fig.5 Output characteristics: drain current as a function of drain-source voltage; Typical values; $T_j=175^\circ\text{C}$



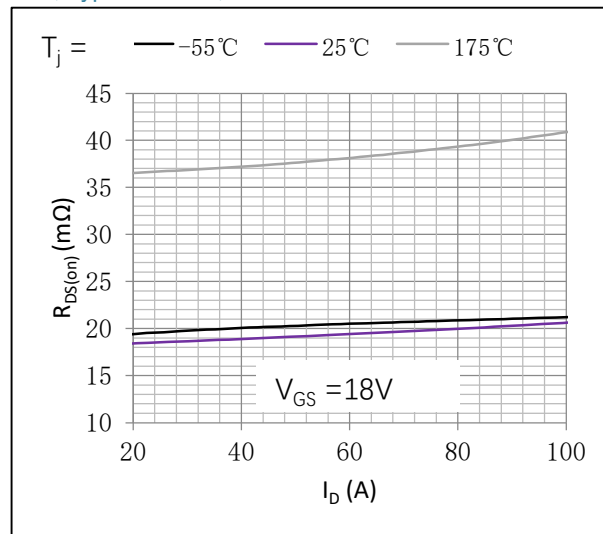
● Fig.6 Gate-source threshold voltage as a function of junction temperature; Typical values



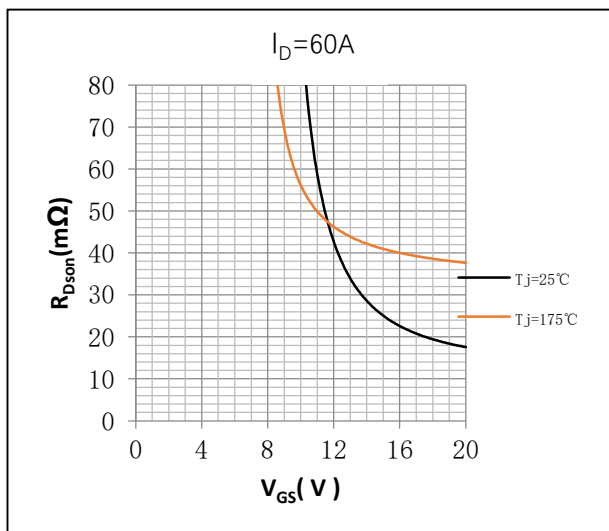
● Fig.7 Drain-source on-state resistance as a function of drain current; Typical values; $T_j=25^\circ\text{C}$



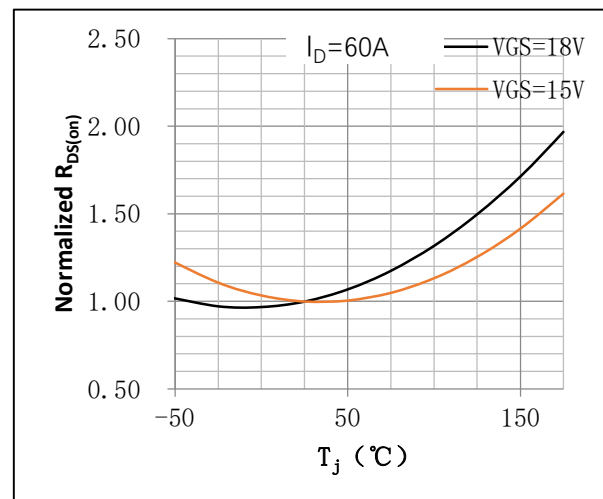
● Fig.8 Drain-source on-state resistance as a function of drain current; Typical values;



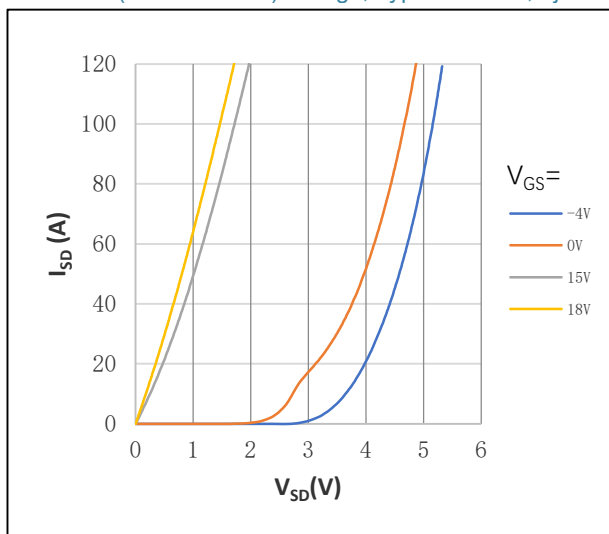
● Fig.9 Drain-source on-state resistance as a function of gate-source voltage; Typical values



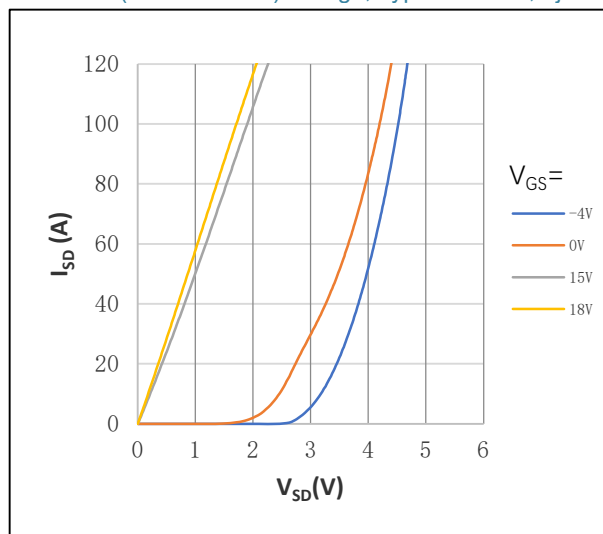
● Fig.10 Normalized drain-source on-state resistance factor as a function of junction temperature; Typical values Normalized On-Resistance = $R_{DS(on)}/R_{DS(on)}(25^\circ\text{C})$



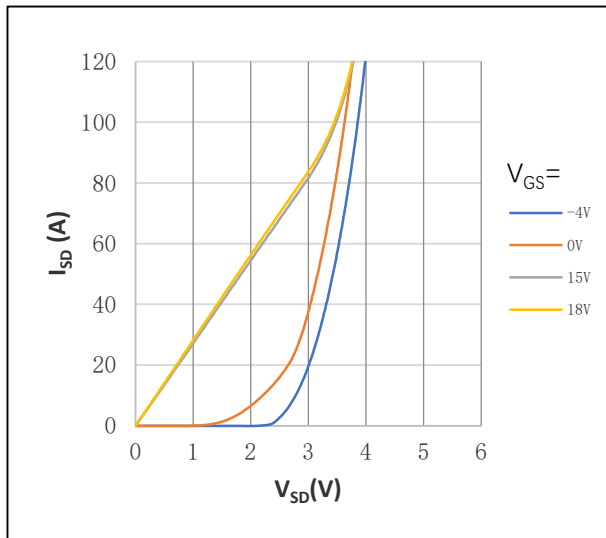
● Figure.11 Source (diode forward) current as a function of source-drain (diode forward) voltage; Typical values; $T_j=25^\circ\text{C}$



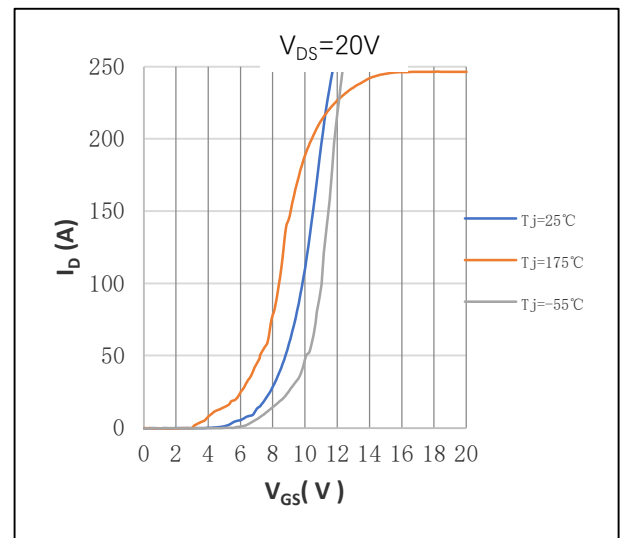
● Figure.12 Source (diode forward) current as a function of source-drain (diode forward) voltage; Typical values; $T_j=-55^\circ\text{C}$



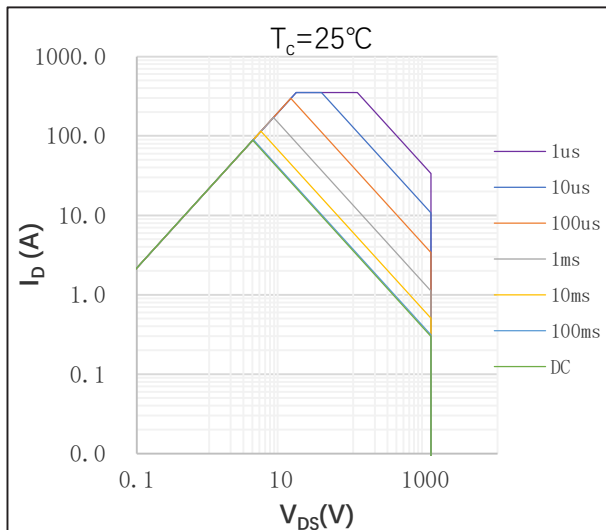
● Figure.13 Source (diode forward) current as a function of source-drain (diode forward) voltage; Typical values; $T_j=175^\circ\text{C}$



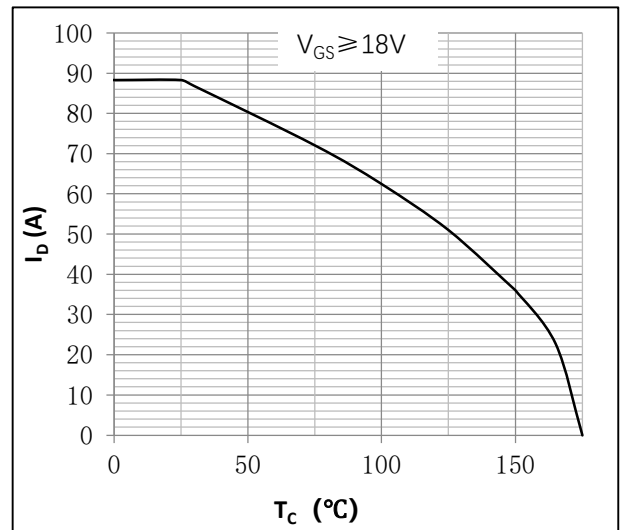
● Figure.14 Transfer characteristics: drain current as a function of gate-source voltage; Typical values



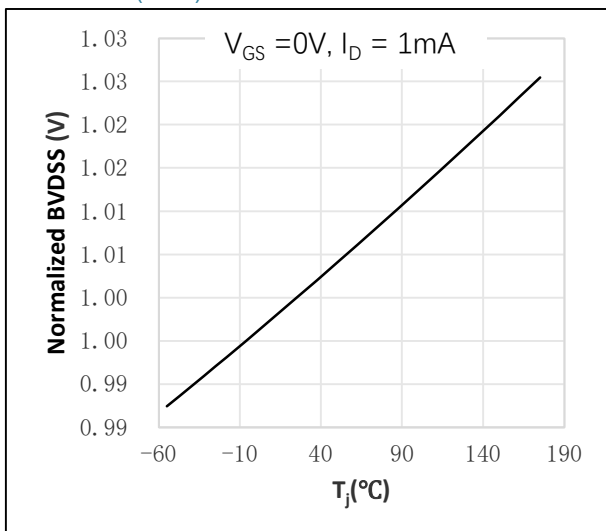
● Fig.15 Safe operating area: continuous and peak drain currents as a function of drain-source voltage; Calculative values



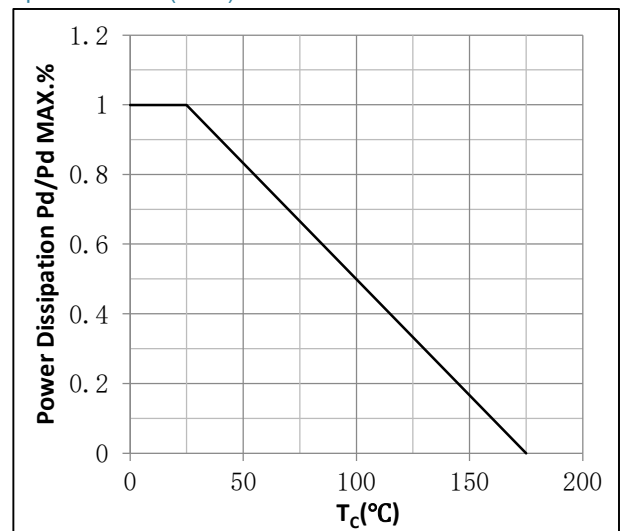
● Fig.16 Continuous drain current as a function of case temperature^①; Calculative values



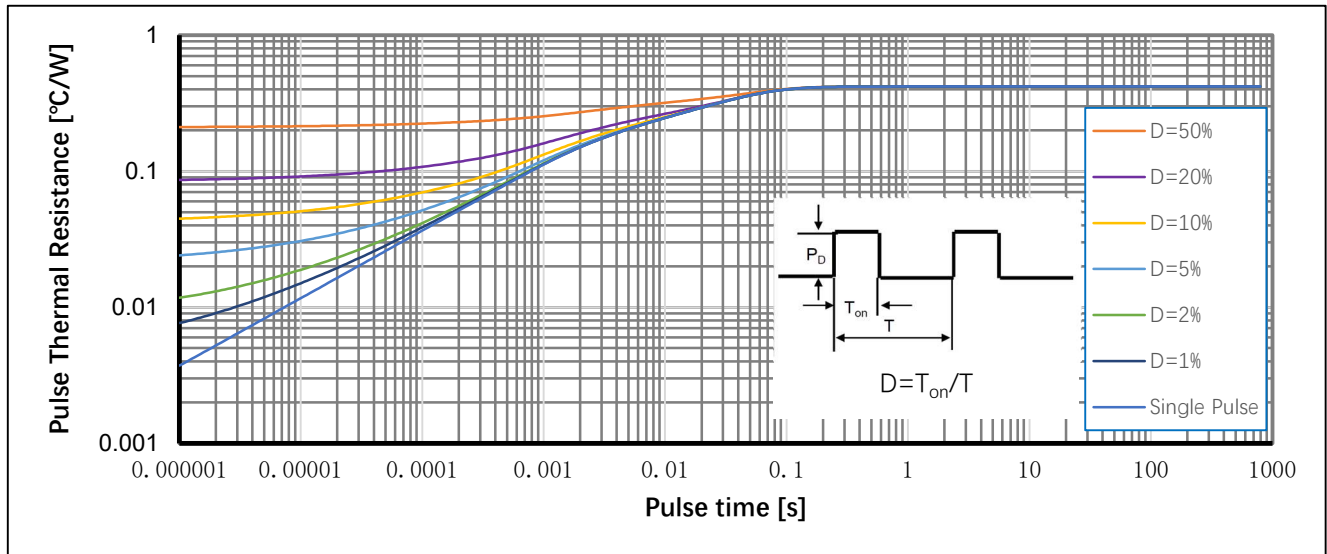
● Fig.17 Drain-source breakdown voltage as a function of junction temperature; Typical values Normalized $BV_{DSS} = BV_{DSS}/BV_{DSS}(25^\circ\text{C})$



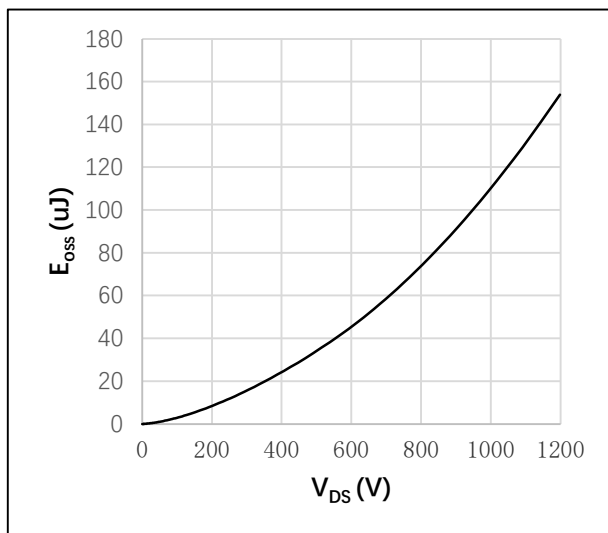
● Fig.18 Normalized total power dissipation as a function of case temperature; Calculative values Normalized Power Dissipation $= P_d/P_d(25^\circ\text{C})$



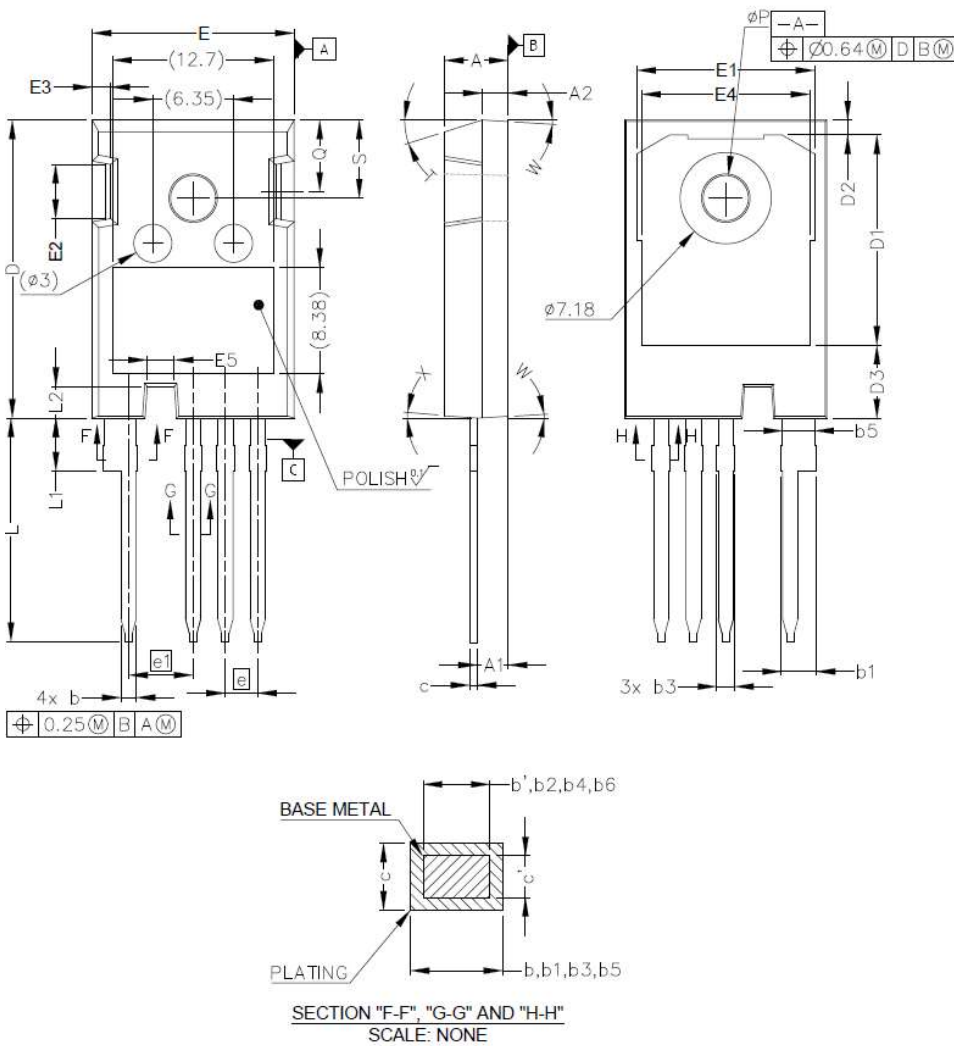
● Fig.19 Transient thermal impedance from junction to case as a function of pulse duration; max values



● Fig.20 Output capacitor stored energy as a function of drain-source voltage; Typical values; $T_j = 25^{\circ}\text{C}$



● Package Outline



SYMBOL	MILLIMETERS	
	MIN	MAX
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b'	1.07	1.28
b	1.07	1.33
b1	2.39	2.94
b2	2.39	2.84
b3	1.07	1.60
b4	1.07	1.50
b5	2.39	2.69
b6	2.39	2.64
c'	0.55	0.65
c	0.55	0.68
D	23.30	23.60
D1	16.25	17.65
D2	0.95	1.25
D3	5.55	6.15
E	15.75	16.13
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
E5	1.95	2.35
e	2.54 BSC	
e1	5.08 BSC	
N	4	
L	17.31	17.82
L1	3.97	4.37
L2	2.35	2.65
øP	3.51	3.65
Q	5.49	6.00
S	6.04	6.30
T	17.5° REF.	
W	3.5° REF.	
X	4° REF.	

● Note

① Practically the current will be limited by PCB, thermal design and operating temperature. $V_{GS}=18V$.

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● Revision History

Version	Date	Change
A	2025/9/9	New