

● General Description

It combines advanced trench MOSFET technology with a low resistance package to provide extremely low $R_{DS(ON)}$.

● Features

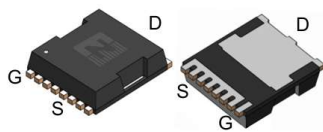
- Low $R_{DS(ON)}$ to minimize conductive loss
- Low Gate Charge for fast switching
- Low thermal resistance
- Wettable flank
- AEC-Q101 qualified

● Application

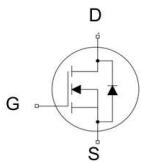
- BLDC motor driver
- DC-DC
- Load switch



● Product Summary



TOLL



$V_{DS}=40V$

$R_{DS(ON)}=0.55m\Omega$

$I_D=556A$



● Ordering Information

Part NO.	ZMSA005N04HR
Marking	ZMS005N04H
Packing information	REEL TAPE
Basic ordering unit (pcs)	2000

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

Parameter	Symbol	Conditions	Min.	Max.	Unit
Drain-source voltage	V_{DS}	$25^\circ C \leq T_J \leq 175^\circ C$	-	40	V
Gate-source voltage ^①	V_{GS}	DC; $-55^\circ C \leq T_J \leq 175^\circ C$	-20	20	V
Continuous drain current	I_D	$V_{GS}=10V, T_C=25^\circ C$	-	556	A
	I_D	$V_{GS}=10V, T_C=75^\circ C$	-	454	A
	I_D	$V_{GS}=10V, T_C=100^\circ C$	-	393	A
Pulsed drain current	I_{DM}	Pulsed; $t_p \leq 10 \mu s; T_C = 25^\circ C$;	-	2224	A
Diode continuous current	I_S	$V_{GS}=0V, T_C=25^\circ C$	-	288	A
Diode pulse current	$I_{S,pulse}$	Pulsed; $t_p \leq 10 \mu s; T_C = 25^\circ C$;	-	1152	A
Total power dissipation	P_D	$V_{GS} > 6V, T_C=25^\circ C$	-	375	W
Total power dissipation	P_D	$V_{GS} > 6V, T_A=25^\circ C$	-	3.8	W
Operating junction temperature	T_J		-55	175	$^\circ C$
Storage temperature	T_{STG}		-55	175	$^\circ C$

Single pulse avalanche energy	E_{AS}	$L=0.1\text{mH}$, $V_{GS}=10\text{V}$, $R_g=25\Omega$	-	756	mJ
Single pulse avalanche energy	E_{AS}	$L=0.5\text{mH}$, $V_{GS}=10\text{V}$, $R_g=25\Omega$	-	1314	mJ
ESD level (HBM)			CLASS 2		

● Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}	-	-	0.4	°C/W
Thermal resistance, junction - ambient	$R_{thJA}^{(2)}$	-	-	40	°C/W
Soldering temperature	T_{sold}	-	-	260	°C

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

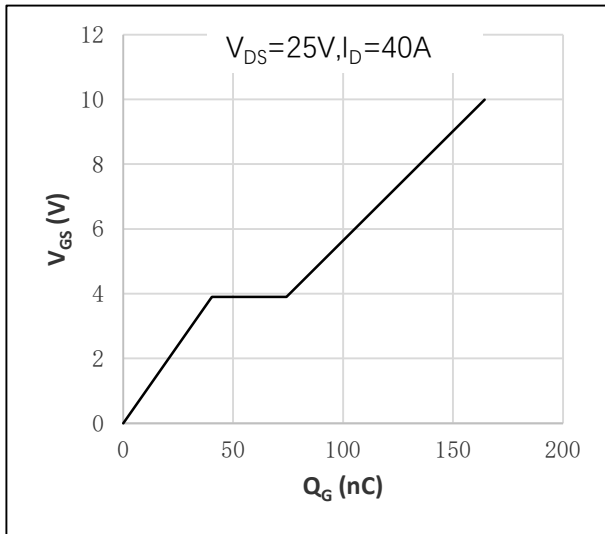
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	BV_{DSS}	$V_{GS}=0\text{V}$, $I_D=250\mu\text{A}$, $T_j=25^\circ\text{C}$	40	-	-	V
		$V_{GS}=0\text{V}$, $I_D=1\text{mA}$, $T_j=-55^\circ\text{C}$	38.4	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}$, $I_D=250\mu\text{A}$, $T_j=25^\circ\text{C}$	2	2.6	4	V
		$V_{GS}=V_{DS}$, $I_D=1\text{mA}$, $T_j=-55^\circ\text{C}$	-	-	4.7	V
		$V_{GS}=V_{DS}$, $I_D=1\text{mA}$, $T_j=175^\circ\text{C}$	1.1	-	-	V
Drain-source leakage current	I_{DSS}	$V_{GS}=0\text{V}$, $V_{DS}=40\text{V}$, $T_j=25^\circ\text{C}$	-	-	1	μA
		$V_{GS}=0\text{V}$, $V_{DS}=40\text{V}$, $T_j=175^\circ\text{C}$	-	-	500	μA
Gate- source leakage current	I_{GSS}	$V_{GS}=\pm 20\text{V}$, $V_{DS}=0\text{V}$	-	-	± 100	nA
Static drain-source on resistance	$R_{DS(ON)}$	$V_{GS}=10\text{V}$, $I_D=40\text{A}$, $T_j=25^\circ\text{C}$	-	0.55	0.69	m Ω
		$V_{GS}=10\text{V}$, $I_D=40\text{A}$, $T_j=175^\circ\text{C}$	-	0.97	-	m Ω
Forward transconductance	g_{FS}	$V_{DS}=5\text{V}$, $I_D=10\text{A}$	-	40	-	S
Diode forward voltage	V_{FSD}	$V_{GS}=0\text{V}$, $I_{SD}=40\text{A}$	-	0.8	1.3	V

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

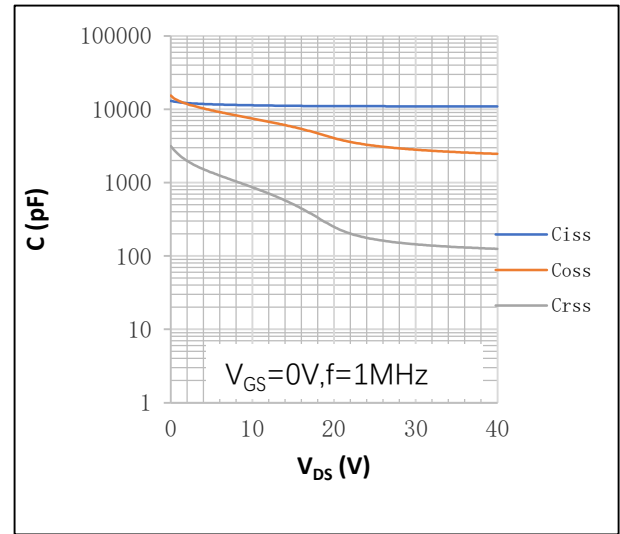
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	C_{iss}	$f=1\text{MHz}$, $V_{DS}=25\text{V}$, $V_{GS}=0\text{V}$	-	11051	-	pF
Output capacitance	C_{oss}		-	3192	-	pF
Reverse transfer capacitance	C_{rss}		-	169	-	pF
Gate resistance	R_g	$f=1\text{MHz}$	-	1.8	-	Ω
Total gate charge	Q_g	$V_{DD}=25\text{V}$, $I_D=40\text{A}$, $V_{GS}=10\text{V}$	-	164.3	-	nC
Gate-source charge	Q_{gs}		-	40.4	-	nC
Gate-drain charge	Q_{gd}		-	33.9	-	nC

Turn-on delay time	$t_{D(on)}$	$V_{GS}=10V, V_{DS}=25V,$ $R_G=3.3\Omega, I_D=40A$	-	65	-	ns
Turn-on rise time	t_r		-	31	-	ns
Turn-off delay time	$t_{D(off)}$		-	85	-	ns
Turn-off fall time	t_f		-	78	-	ns
Reverse recovery time	t_{rr}	$V_{DD}=25V, di_s/dt = 100A/\mu s,$ $I_S=40A$	-	97	-	ns
Reverse recovery charge	Q_{rr}		-	135	-	nC

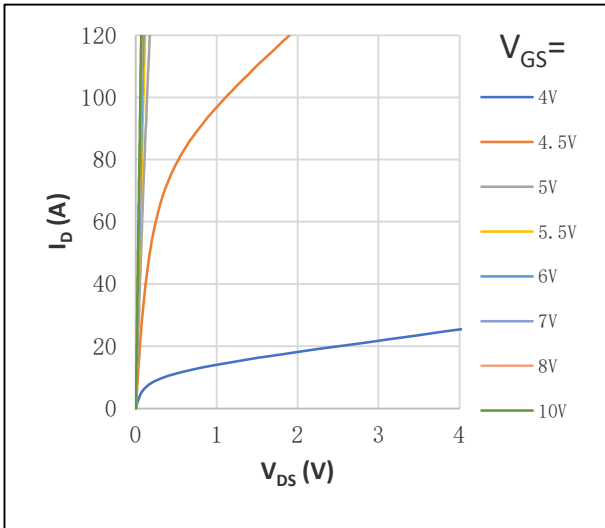
● Fig.1 Gate-source voltage as a function of gate charge; Typical values; $T_j=25^\circ\text{C}$



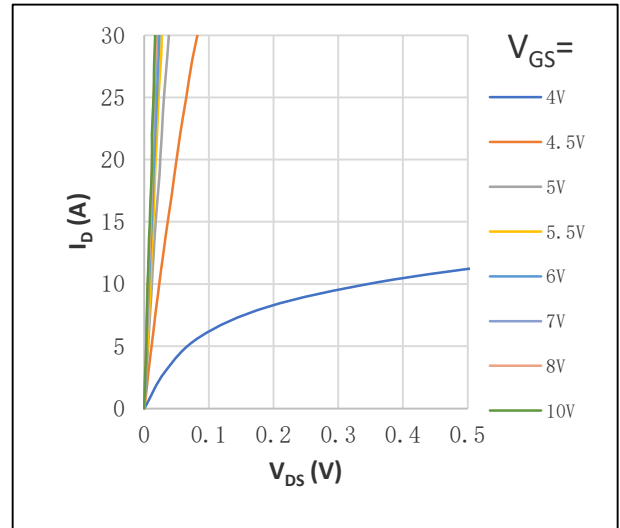
● Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage; Typical values; $T_j=25^\circ\text{C}$



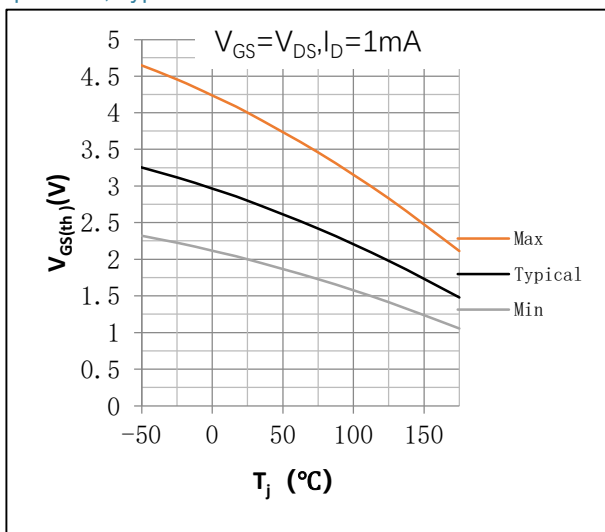
● Fig.3 Output characteristics: drain current as a function of drain-source voltage; Typical values; $T_j=25^\circ\text{C}$



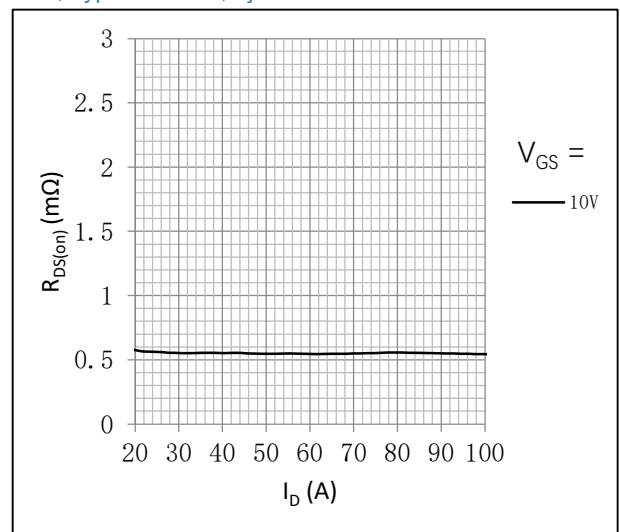
● Fig.4 Output characteristics: drain current as a function of drain-source voltage; Typical values: Expanded curve; $T_j=25^\circ\text{C}$



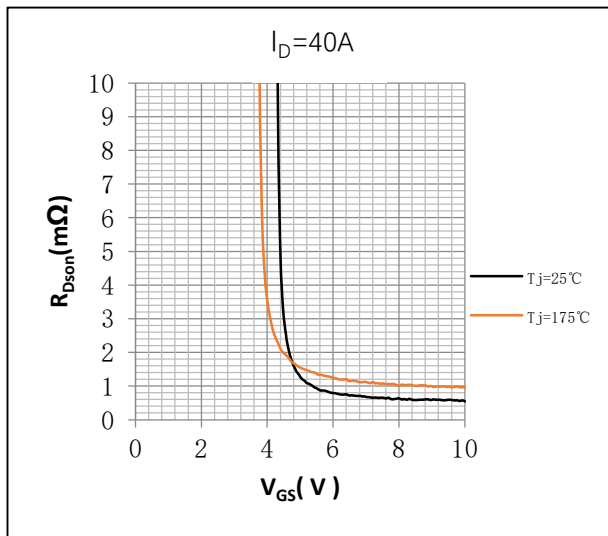
● Fig.5 Gate-source threshold voltage as a function of junction temperature; Typical/Min/Max values



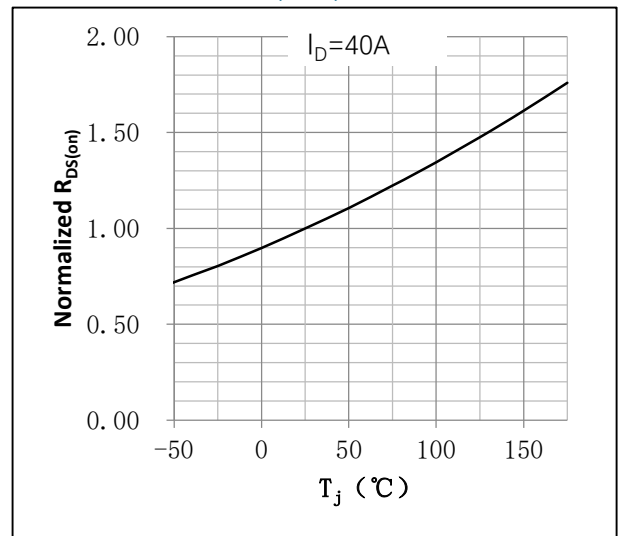
● Fig.6 Drain-source on-state resistance as a function of drain current; Typical values; $T_j=25^\circ\text{C}$



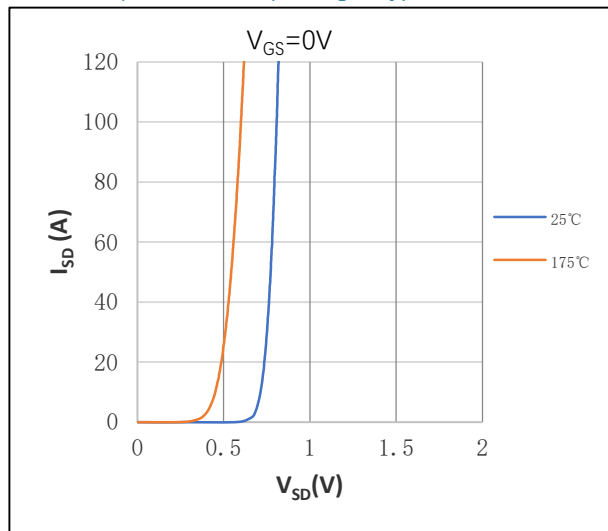
● Fig.7 Drain-source on-state resistance as a function of gate-source voltage; Typical values



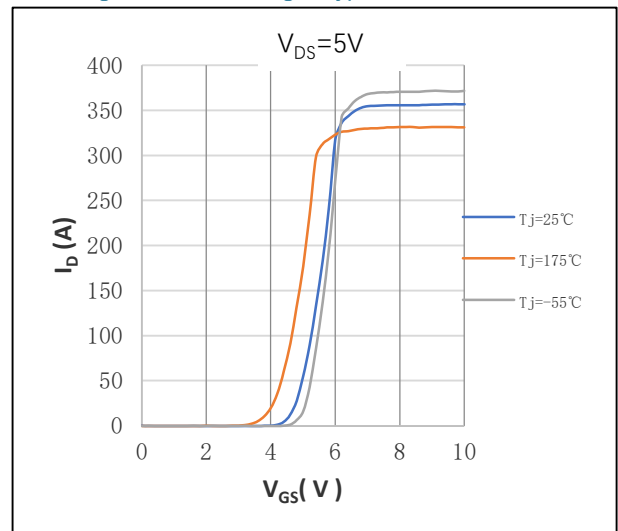
● Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature; Typical values Normalized On-Resistance = $R_{DS(on)}/R_{DS(on)}(25^{\circ}\text{C})$



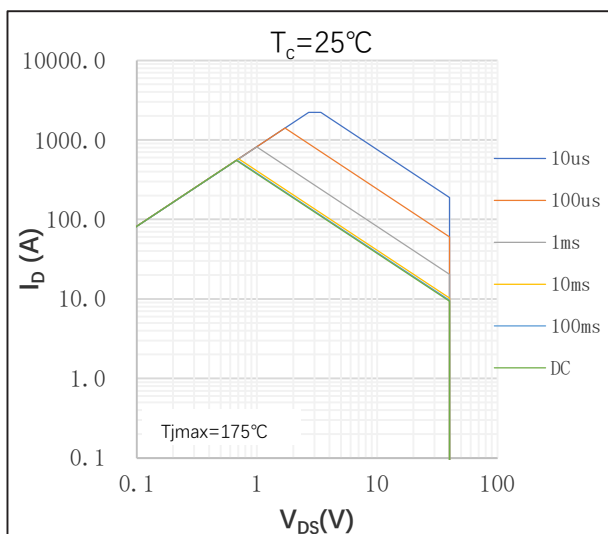
● Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage; Typical values



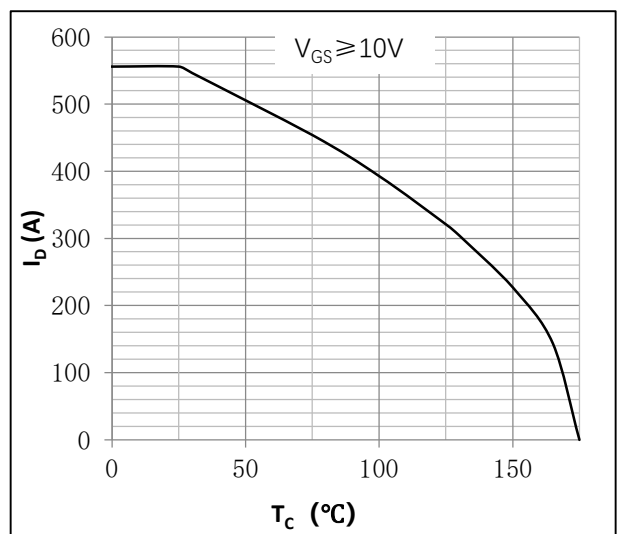
● Figure 10. Transfer characteristics: drain current as a function of gate-source voltage; Typical values



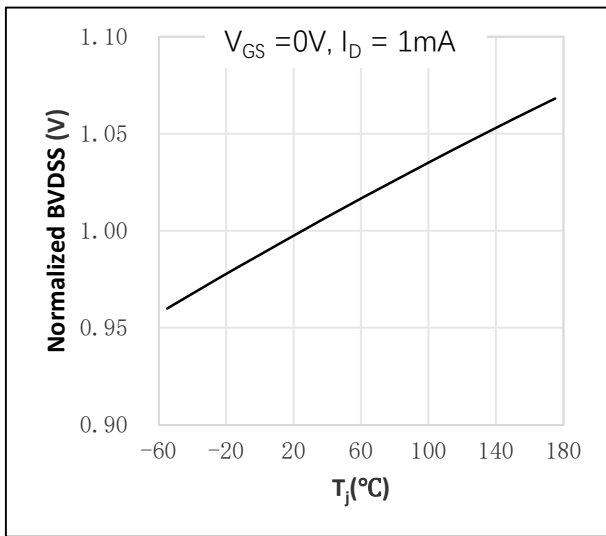
● Fig.11 Safe operating area: continuous and peak drain currents as a function of drain-source voltage; Calculative values



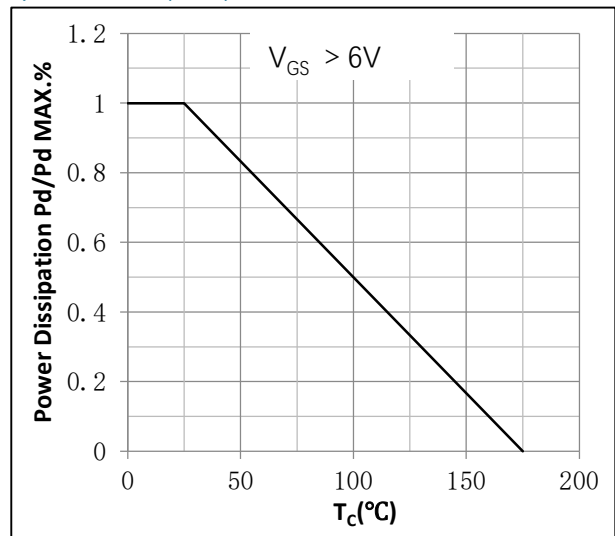
● Fig.12 Continuous drain current as a function of case temperature³; Calculative values



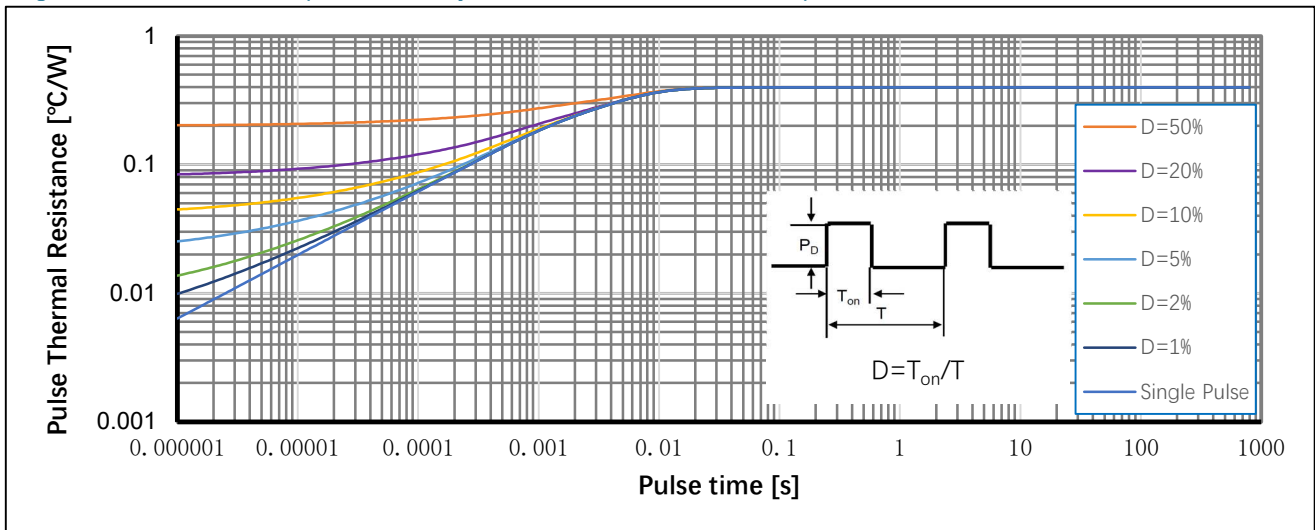
● Fig.13 Drain-source breakdown voltage as a function of junction temperature; Normalized values



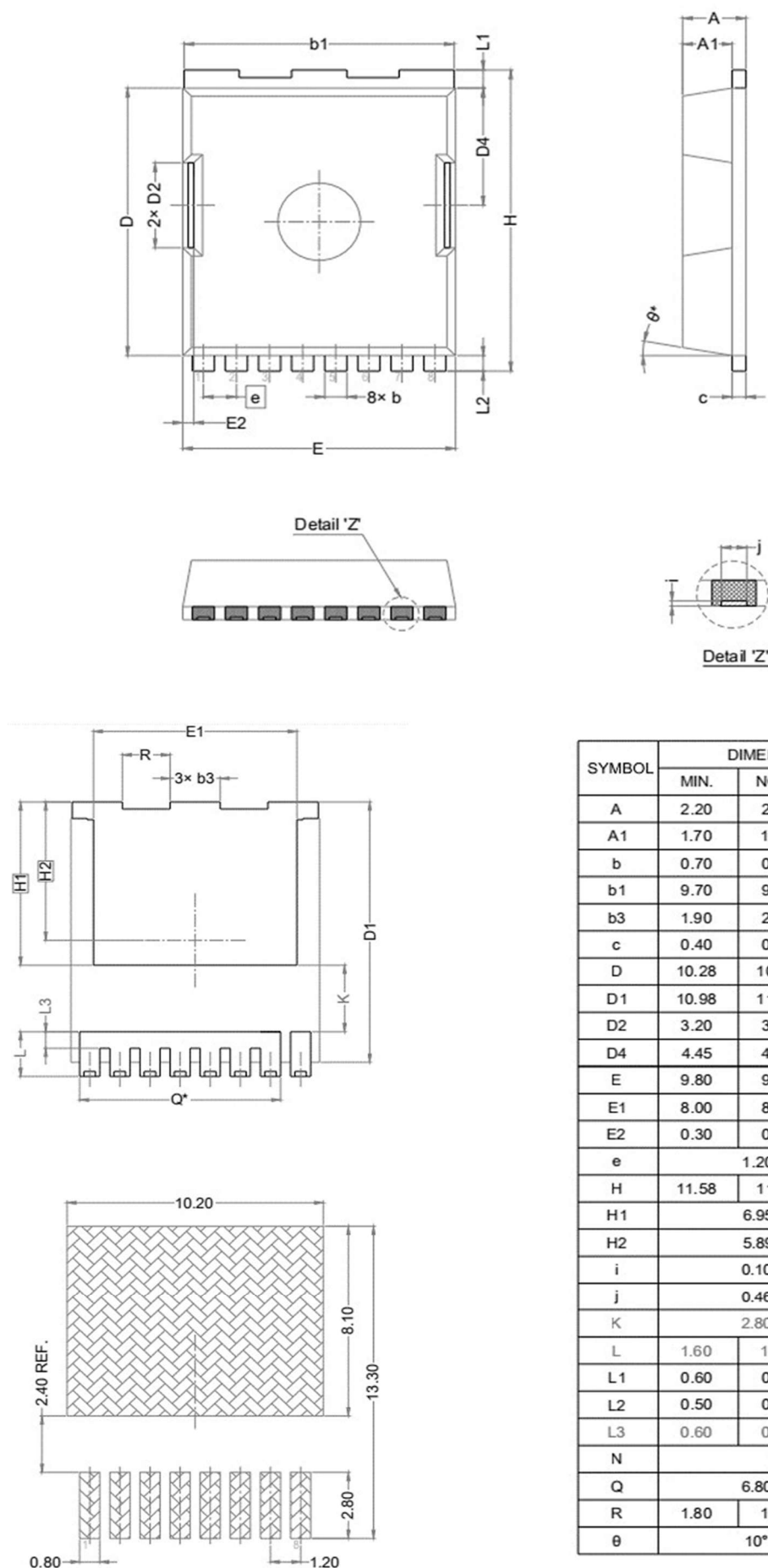
● Fig.14 Normalized total power dissipation as a function of case temperature; Calculative values Normalized Power Dissipation = $P_d/P_d(25^\circ C)$



● Fig.15 Transient thermal impedance from junction to case as a function of pulse duration; max values



● Package Outline



SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	2.20	2.30	2.40
A1	1.70	1.80	1.90
b	0.70	0.80	0.90
b1	9.70	9.80	9.90
b3	1.90	2.00	2.10
c	0.40	0.50	0.60
D	10.28	10.38	10.48
D1	10.98	11.08	11.18
D2	3.20	3.30	3.40
D4	4.45	4.55	4.65
E	9.80	9.90	10.00
E1	8.00	8.10	8.20
E2	0.30	0.40	0.50
e	1.20 BSC		
H	11.58	11.68	11.78
H1	6.95 BSC		
H2	5.89 BSC		
i	0.10 REF.		
j	0.46 REF.		
K	2.80 REF.		
L	1.60	1.90	2.10
L1	0.60	0.70	0.80
L2	0.50	0.60	0.70
L3	0.60	0.70	0.80
N	8		
Q	6.80 REF.		
R	1.80	1.90	2.00
θ	10° REF.		

● Note

- ① Pulse : $V_{GS}=+20V/-20V$, Duty cycle=50%, $T_j=175^{\circ}C$, $t=1000$ hours; For DC, the following test conditions can be passed: $V_{GS}=+20V/-10V$, $T_j=175^{\circ}C$, $t=1000$ hours;
- ② Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate;
- ③ Practically the current will be limited by PCB, thermal design and operating temperature. $V_{GS}=10V$.

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● Revision History

Version	Date	Change
A	2022/1/15	New
B	2022/9/10	1.Add Reach, HF figure 2.ID curve modified
C	2023/1/6	1.Correct dynamic characteristics 2.Correct symbol figure 3. Modify ID, EAS
C1	2023/3/30	Correct marking mistake
D	2023/12/18	Correct SOA
E	2024/11/6	RDSON modified
F	2025/8/17	Appy new datasheet format.