

● General Description

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

● Features

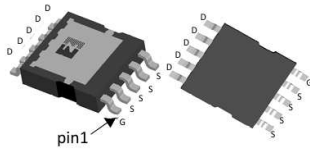
- Low $R_{DS(ON)}$ to minimize conductive loss
- Low Gate Charge for fast switching
- Low thermal resistance
- AEC-Q101 qualified

● Application

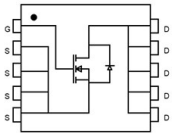
- BLDC motor driver
- DC-DC
- Load switch



● Product Summary



TCPAK 5*7



$V_{DS}=40V$

$R_{DS(ON)}=0.64mR$

$I_D=484A$



● Ordering Information

Part NO.	ZMSA006N04HTNC
Marking	06N04H
Packing information	REEL TAPE
Basic ordering unit (pcs)	2500

● 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	$V_{GS}=10V, T_C=25^{\circ}C$	-	484	A
	I_D	$V_{GS}=10V, T_C=75^{\circ}C$	-	395	A
	I_D	$V_{GS}=10V, T_C=100^{\circ}C$	-	342	A
Pulsed drain current	I_{DM}	Pulsed; $t_p \leq 10 \mu s; T_C = 25^{\circ}C$;	-	1936	A
Diode continuous current	I_S	$V_{GS}=0V, T_C=25^{\circ}C$	-	231	A
Diode pulse current	$I_{S,pulse}$	Pulsed; $t_p \leq 10 \mu s; T_C = 25^{\circ}C$;	-	924	A
Total power dissipation	P_D	$V_{GS} > 6V, T_C=25^{\circ}C$	-	300	W
Total power dissipation	P_D	$V_{GS} > 6V, T_A=25^{\circ}C$	-	5	W
Operating junction temperature	T_J		-55	175	$^{\circ}C$
Storage temperature	T_{STG}		-55	175	$^{\circ}C$
Single pulse avalanche energy	E_{AS}	$L=0.1mH, V_{GS}=10V, R_g=25\Omega$	-	476	mJ

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

● Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}	-	-	0.5	°C/W
Thermal resistance, junction - ambient	$R_{thJA}^{(2)}$	-	-	30	°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
		$V_{GS}=0\text{V}$, $I_D=1\text{mA}$, $T_j=-55^\circ\text{C}$	37.4	-	-	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
		$V_{GS}=V_{DS}$, $I_D=1\text{mA}$, $T_j=-55^\circ\text{C}$	-	-	4.6	V
		$V_{GS}=V_{DS}$, $I_D=1\text{mA}$, $T_j=175^\circ\text{C}$	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	$R_{DS(ON)}$	$V_{GS}=10\text{V}$, $I_D=40\text{A}$, $T_j=25^\circ\text{C}$	-	0.64	0.74	m Ω
		$V_{GS}=10\text{V}$, $I_D=40\text{A}$, $T_j=175^\circ\text{C}$	-	1.11	-	m Ω
Forward transconductance	g_{FS}	$V_{DS}=5\text{V}$, $I_D=10\text{A}$	-	24	-	S
Diode forward voltage	V_{FSD}	$V_{GS}=0\text{V}$, $I_{SD}=40\text{A}$	-	0.8	1.3	V

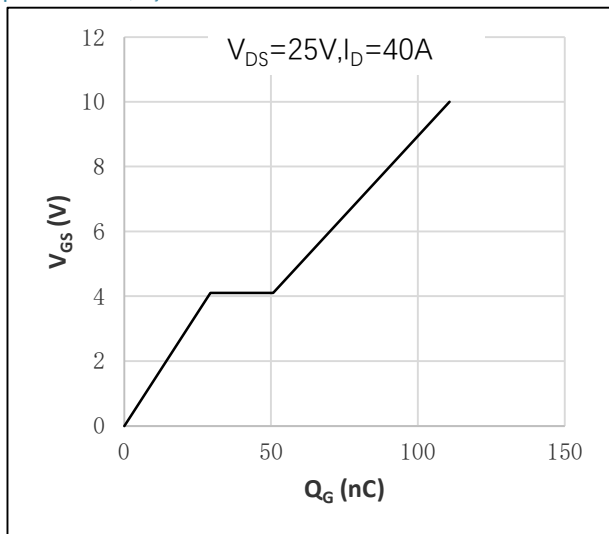
● Dynamic characteristics ($T_j=25^\circ\text{C}$, unless otherwise specified)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	C_{iss}	$f=1\text{MHz}$, $V_{DS}=25\text{V}$, $V_{GS}=0\text{V}$	-	7561	-	pF
Output capacitance	C_{oss}		-	2057	-	pF
Reverse transfer capacitance	C_{rss}		-	136	-	pF
Gate resistance	R_g	$f=1\text{MHz}$	-	1.5	-	Ω
Total gate charge	Q_g	$V_{DD}=25\text{V}$, $I_D=40\text{A}$, $V_{GS}=10\text{V}$	-	110.7	-	nC
Gate-source charge	Q_{gs}		-	29.4	-	nC
Gate-drain charge	Q_{gd}		-	21.4	-	nC

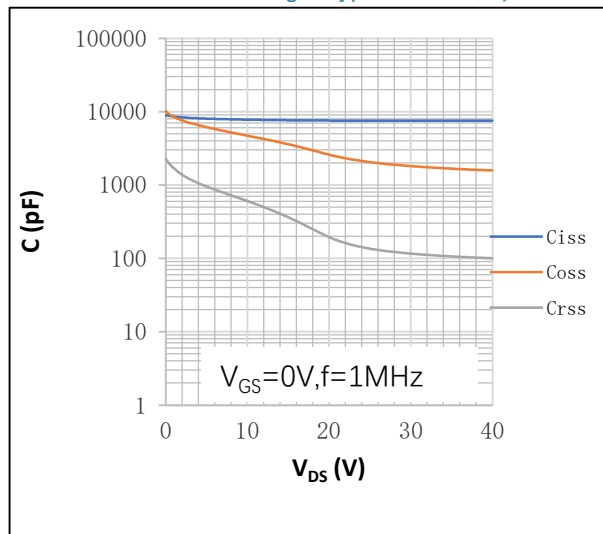
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Turn-on delay time	$t_{D(on)}$	$V_{GS}=10V, V_{DS}=25V,$ $R_G=3.3\Omega, I_D=40A$	-	16	-	ns
Turn-on rise time	t_r		-	11	-	ns
Turn-off delay time	$t_{D(off)}$		-	40	-	ns
Turn-off fall time	t_f		-	19	-	ns
Reverse recovery time	t_{rr}	$V_{DD}=25V, di_s/dt = 100A/\mu s,$ $I_S=40A$	-	72	-	ns
Reverse recovery charge	Q_{rr}		-	133	-	nC

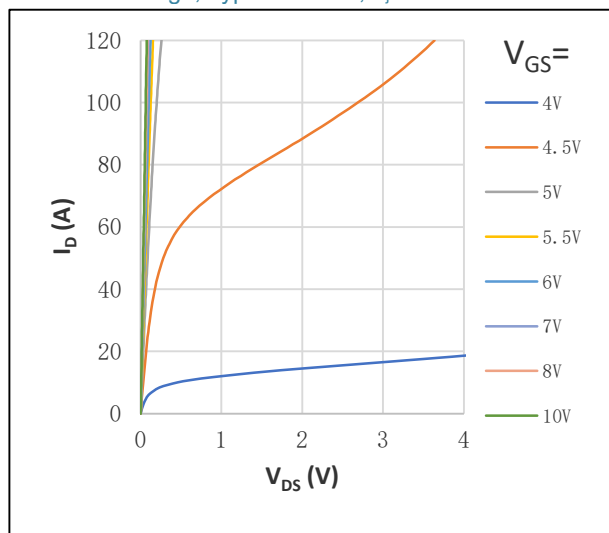
● Fig.1 Gate-source voltage as a function of gate charge; Typical values; $T_j=25^\circ\text{C}$



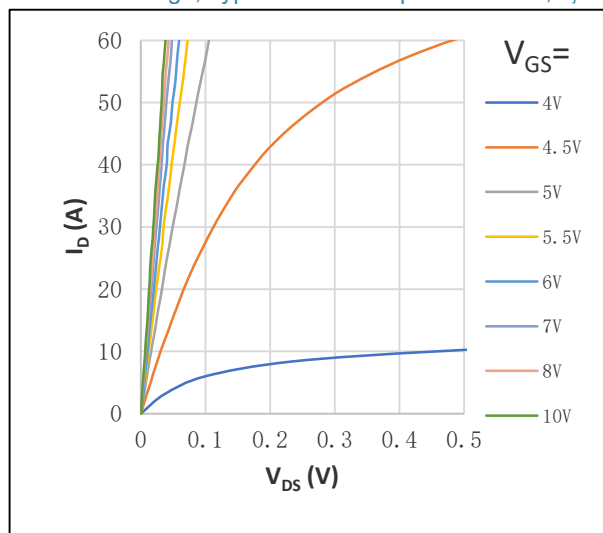
● Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage; Typical values; $T_j=25^\circ\text{C}$



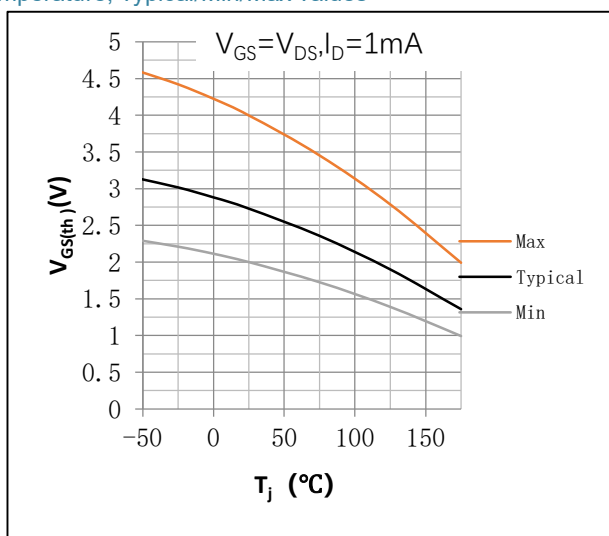
● Fig.3 Output characteristics: drain current as a function of drain-source voltage; Typical values; $T_j=25^\circ\text{C}$



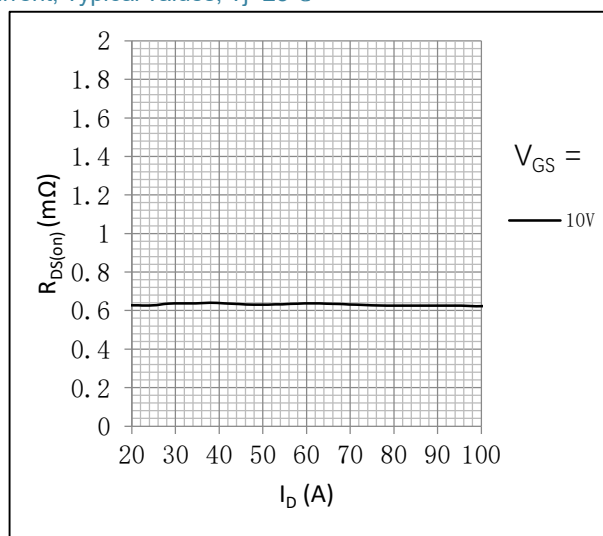
● Fig.4 Output characteristics: drain current as a function of drain-source voltage; Typical values: Expanded curve; $T_j=25^\circ\text{C}$



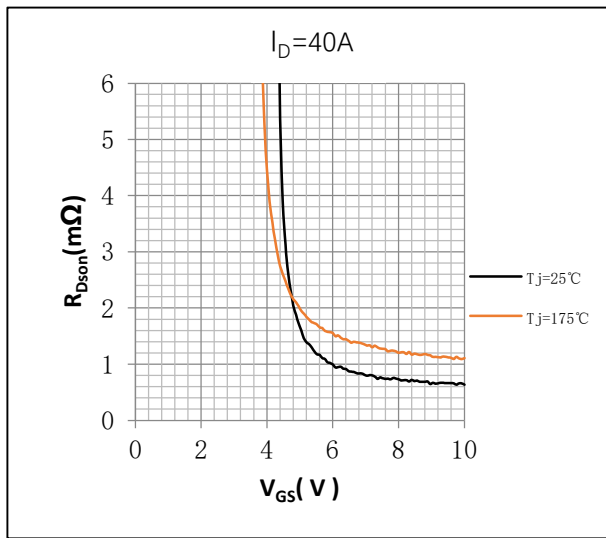
● Fig.5 Gate-source threshold voltage as a function of junction temperature; Typical/Min/Max values



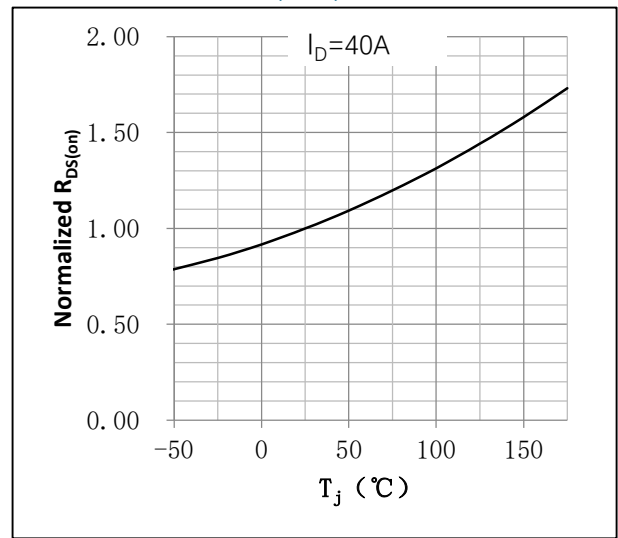
● Fig.6 Drain-source on-state resistance as a function of drain current; Typical values; $T_j=25^\circ\text{C}$



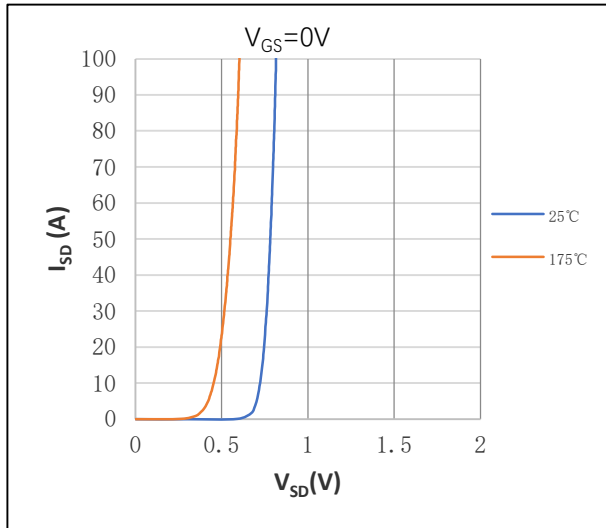
● Fig.7 Drain-source on-state resistance as a function of gate-source voltage; Typical values



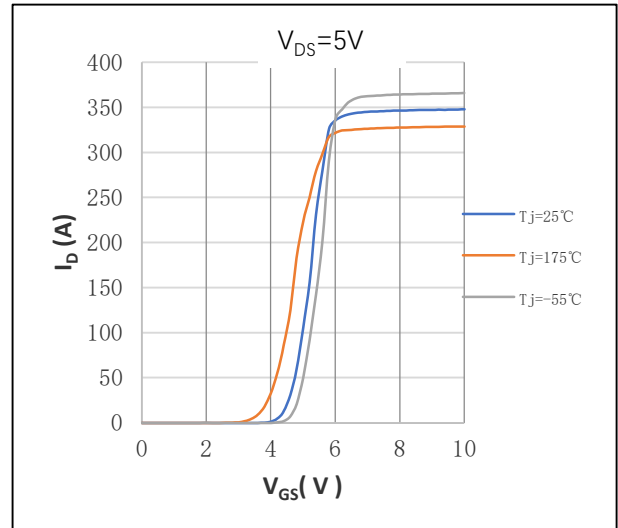
● Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature; Typical values Normalized On-Resistance= $R_{DS(on)}/R_{DS(on)}(25^{\circ}\text{C})$



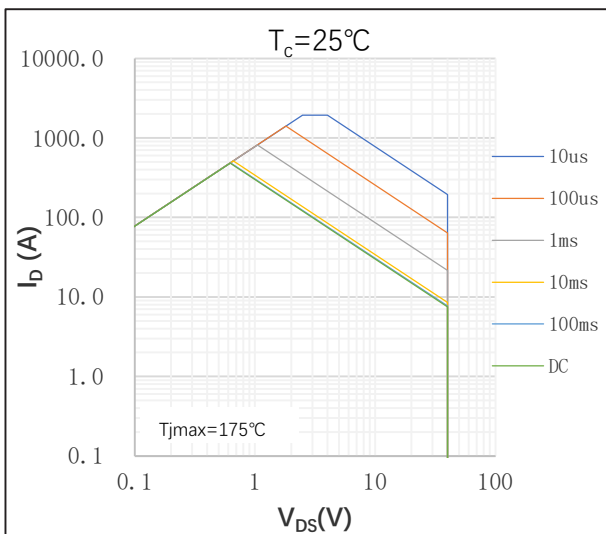
● Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage; Typical values



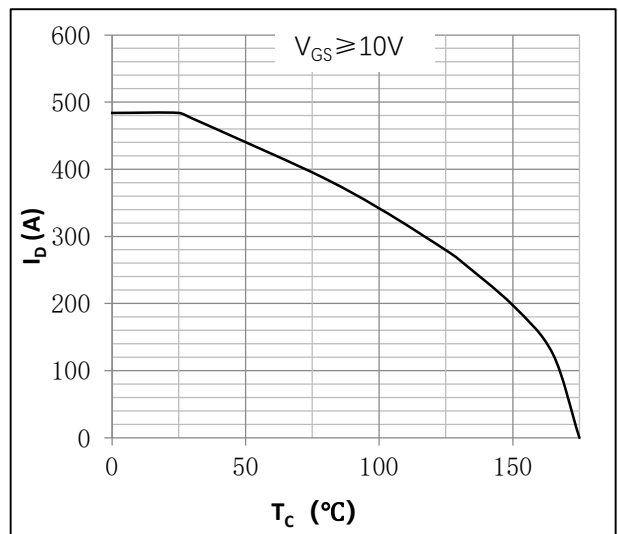
● Figure 10. Transfer characteristics: drain current as a function of gate-source voltage; Typical values



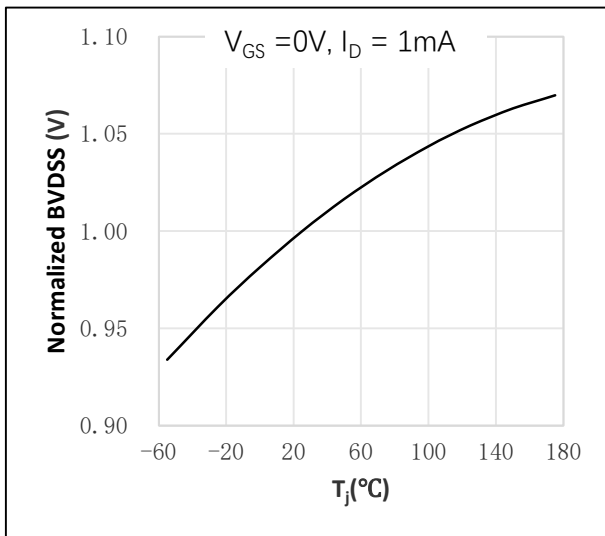
● Fig.11 Safe operating area: continuous and peak drain currents as a function of drain-source voltage; Calculative values



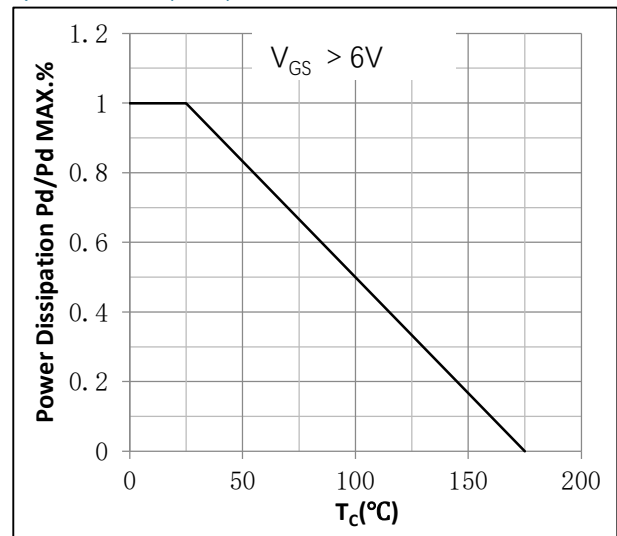
● Fig.12 Continuous drain current as a function of case temperature³; Calculative values



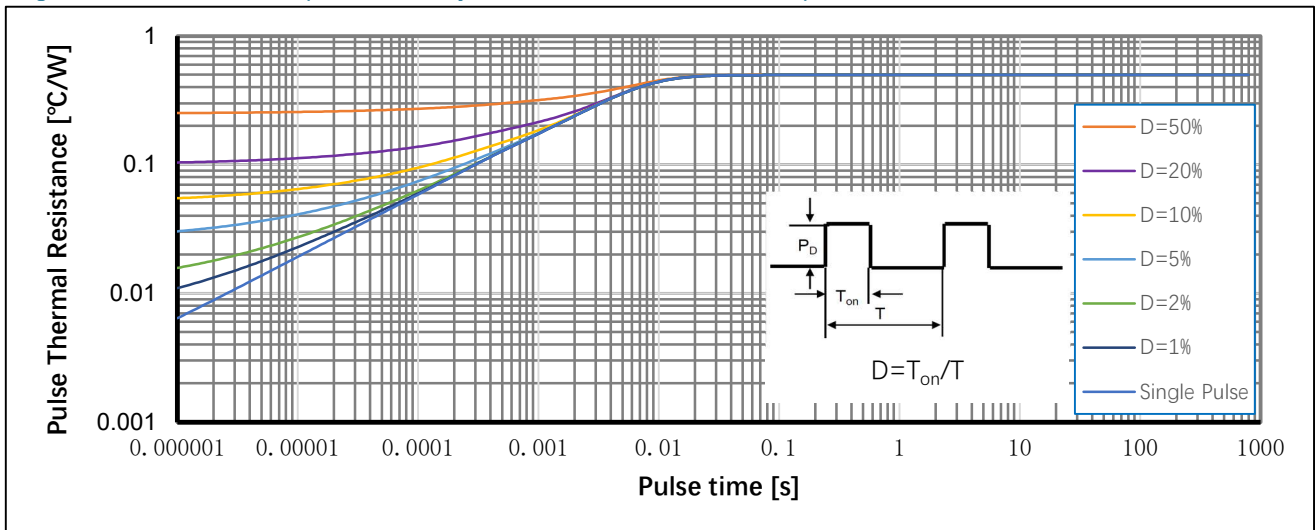
● Fig.13 Drain-source breakdown voltage as a function of junction temperature; Normalized values



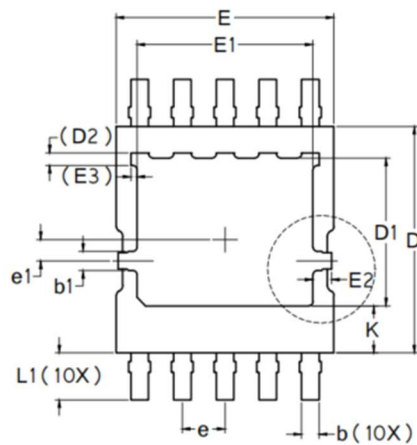
● Fig.14 Normalized total power dissipation as a function of case temperature; Calculative values Normalized Power Dissipation $= P_d / P_d(25^\circ C)$



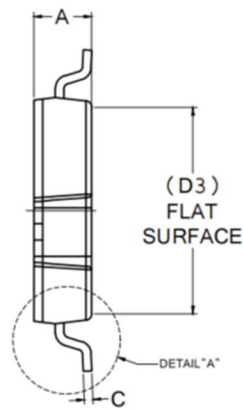
● Fig.15 Transient thermal impedance from junction to case as a function of pulse duration; max values



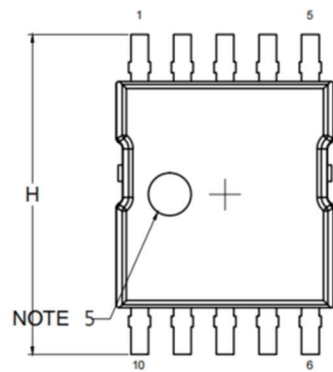
● Package Outline



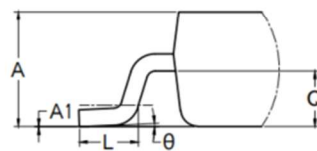
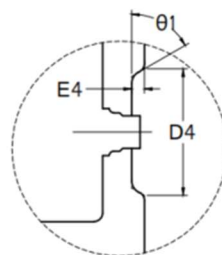
TOP VIEW



SIDE VIEW



BOTTOM VIEW


 DETAIL "A"
(2:1)

 DETAIL "B"
(2:1)

MILLIMETERS			
DIM	MIN	NOM	MAX
A	1.25	1.35	1.45
A1	-0.05	0	0.075
b	0.36	0.41	0.46
b1	0.30	0.45	0.50
c	0.16	0.20	0.26
D	5.20	5.30	5.40
D1	3.35	3.45	3.55
D2	0.29 REF		
D3	4.82 REF		
E	5.00	5.10	5.20
E1	4.02	4.12	4.22
E2	0.30	0.44	0.50
E3	0.14 REF		
e	1.00 BSC		
e1	0.50 BSC		
K	1.00	1.10	1.20
H	7.30	7.50	7.70
L	0.49	0.69	0.89
L1	0.90	1.10	1.30
Q	0.60	0.65	0.70
theta	0°	2.5°	5°
theta1	120° REF		
E4	0.15 REF		
D4	1.485 REF		
theta1	120° 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	2023/10/24	New
B	2024/4/16	Modify Ciss, Qg, and switch time.
C	2024/6/19	Modify package name as TCPAK5×7.
D	2024/9/24	Modify RDSON limit from 0.8 to 0.74.
E	2024/11/27	Modify basic ordering unit.
F	2026/8/26	Apply new datasheet format.