

Features

- Uses PingWei advanced PerfectMOS2 technology
- Extremely low on-resistance $R_{DS(on)}$
- Excellent $Q_g \times R_{DS(on)}$ product(FOM)
- Excellent Low Ciss
- Qualified according to AEC-Q101 criteria

Benefits

- High robustness and reliability
- Increases maximum current capability
- Low power loss, high power density
- Easy paralleling

Applications

- General automotive applications
- Motor Drivers
- Switching Voltage Regulators

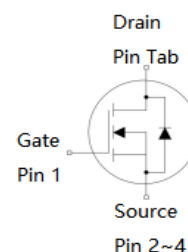
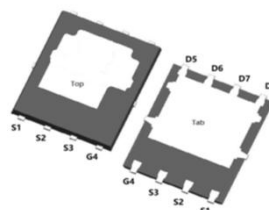


100% DVDS Tested
100% Avalanche Tested

Product Summary

V_{DS}	40V
$R_{DS(on)}@10V$ typ	1mΩ
I_D (Silicon limit)	271A

DFN5x6 Double Cooling

**Package Marking and Ordering Information**

Part #	Marking	Package	Packing	Reel Size	Tape Width	Qty
PWDC012N04ESQ	PW1204	DFN5x6Double Cooling	Tape&Reel	13 inches	12mm	5000pcs

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source voltage	V_{DS}	40	V
Continuous drain current	I_D	271	A
$T_C = 25^\circ\text{C}$ (Silicon limit)		192	
$T_C = 100^\circ\text{C}$ (Silicon limit)		150	
$T_C = 25^\circ\text{C}$ (Package limit)		37	
$T_a = 25^\circ\text{C}$ (Note1)			
Pulsed drain current ($T_C = 25^\circ\text{C}$)	$I_{D \text{ pulse}}$	600	A
Avalanche energy, single pulse ($L=0.3\text{mH}$)	E_{AS}	240	mJ
Gate-Source voltage	V_{GS}	± 20	V
Power dissipation	P_{tot}	150	W
$T_C = 25^\circ\text{C}$		2.7	
$T_a = 25^\circ\text{C}$ (Note1)			
Operating junction and storage temperature	T_j, T_{stg}	-55...+175	$^\circ\text{C}$
Soldering temperature, wave soldering only allowed at leads (1.6mm from case for 10s)	T_{sld}	260	$^\circ\text{C}$

Thermal Resistance

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		
Thermal resistance, junction – case.	RthJC	-	-	1.0	°C/W	-
Thermal resistance , Channel to Top Plate	Rth(ch-tp)	-	-	1.0	°C/W	Note2
Thermal resistance, junction - ambient	RthJA	-	-	55	°C/W	Note1

Electrical Characteristic (at Tj = 25 °C, unless otherwise specified)

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		

Static Characteristic

Drain-source breakdown voltage	BV _{DSS}	40	-	-	V	V _{GS} =0V, I _D =250uA
Gate threshold voltage	V _{GS(th)}	2.0	-	4.0	V	V _{DS} =V _{GS} , I _D =250uA
Zero gate voltage drain current	I _{DSS}	-	0.05	1	μA	V _{DS} =40V, V _{GS} =0V T _j =25°C T _j =150°C
Gate-source leakage current	I _{GSS}	-	±10	±100	nA	V _{GS} =±20V, V _{DS} =0V
Drain-source on-state resistance	R _{DS(on)}	-	1.0	1.2	mΩ	V _{GS} =10V, I _D =50A
Transconductance	g _{fs}	-	111	-	S	V _{DS} =5V, I _D =50A

Dynamic Characteristic

Input Capacitance	C _{iss}	-	4810	7215	pF	V _{GS} =0V, V _{DS} =20V, f=250KHz
Output Capacitance	C _{oss}	-	1655	2483		
Reverse Transfer Capacitance	C _{rss}	-	52	104		
Gate Total Charge	Q _G	-	66	132	nC	V _{DS} =20V, I _D =50A , V _{GS} =10V
Gate-Source charge	Q _{gs}	-	28	56		
Gate-Drain charge	Q _{gd}	-	8	16		
Turn-on delay time	t _{d(on)}	-	19	-	ns	V _{GS} =10V, V _{DD} =20V, R _G =1.6Ω, I _D =50A
Rise time	t _r	-	38	-		
Turn-off delay time	t _{d(off)}	-	43	-		
Fall time	t _f	-	21	-		
Gate resistance	R _G	-	2.6	-	Ω	V _{GS} =0V, V _{DS} =0V, f=1MHz

Body Diode Characteristic

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		
Body Diode Forward Voltage	V_{SD}	-	-	1.2	V	$V_{GS}=0V, I_{SD}=50A$
Body Diode Continuous Forward Current	I_S	-	-	150	A	TC = 25°C
Body Diode Pulsed Current	I_S pulse	-	-	600	A	TC = 25°C
Body Diode Reverse Recovery Time	t_{rr}	-	43	-	ns	$V_R=20V, I_F=50A,$ $dI/dt=100A/\mu s$
Body Diode Reverse Recovery Charge	Q_{rr}	-	23	-	nC	

Note1. 1 inch², 2oz single copper FR-4 PCB.

Note2. A maximum of the $z_{th}(ch-tp)$ measured at Pingwei's test environment is only used for reference. Be aware that the top-plate has the same electric potential as the sources; however, not intended for an Electrode.

Typical Performance Characteristics

Fig 1: Output Characteristics

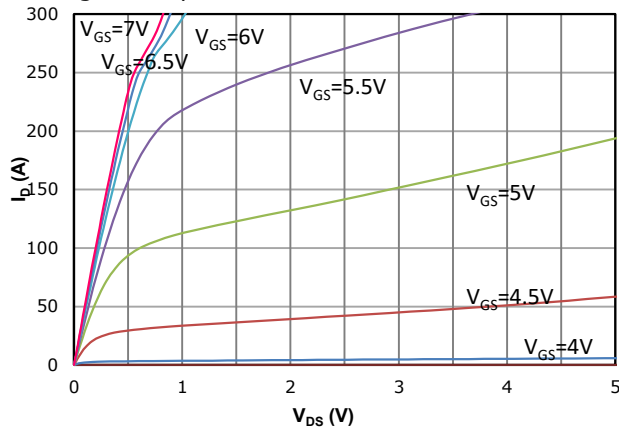


Fig 2: Transfer Characteristics

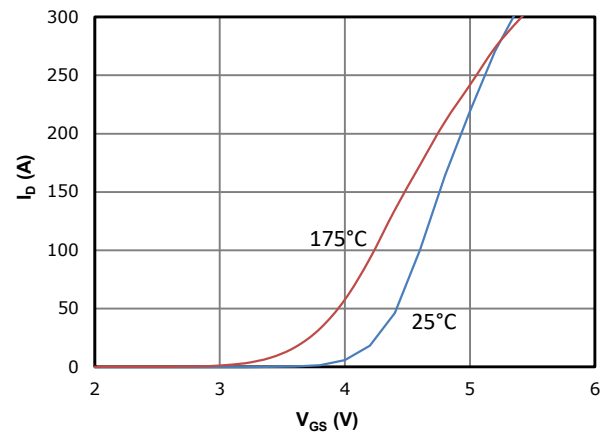


Fig 3: Rds(on) vs Drain Current and Gate Voltage

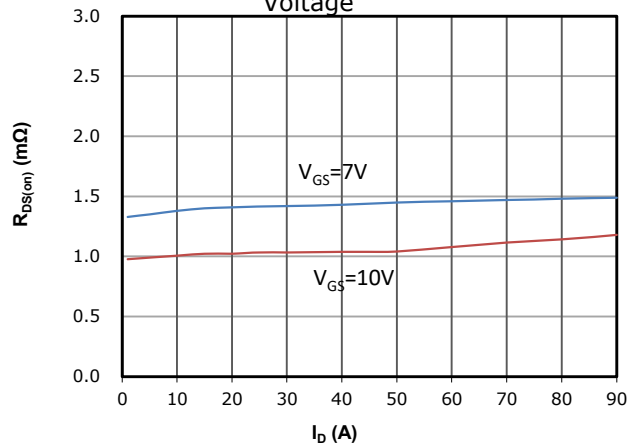


Fig 4: Rds(on) vs Gate Voltage

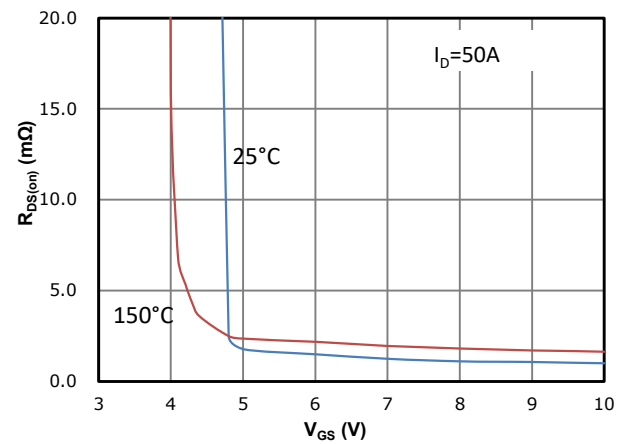


Fig 5: Rds(on) vs. Temperature

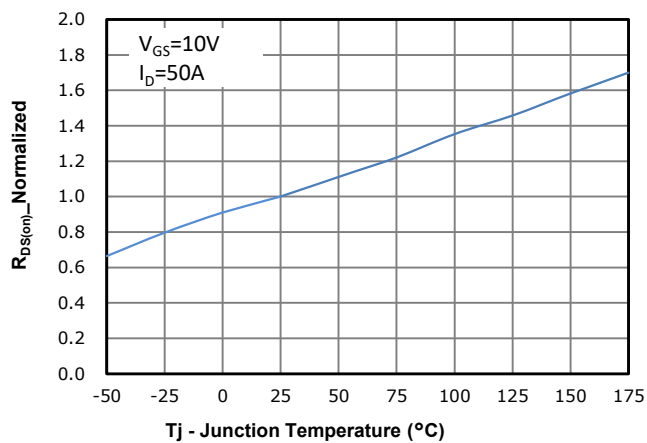


Fig 6: Vgs(th) vs. Temperature

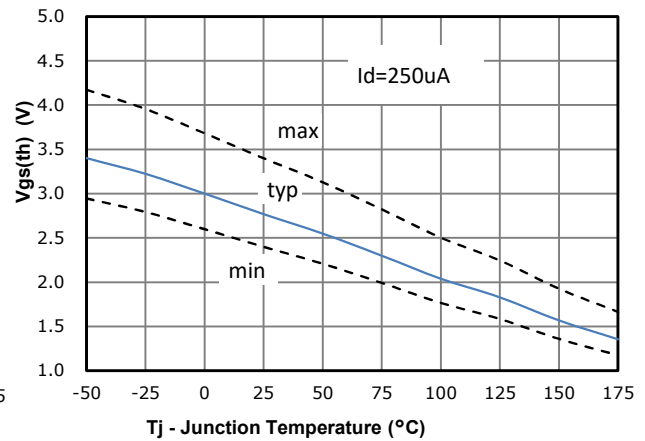


Fig 7: BVdss vs. Temperature

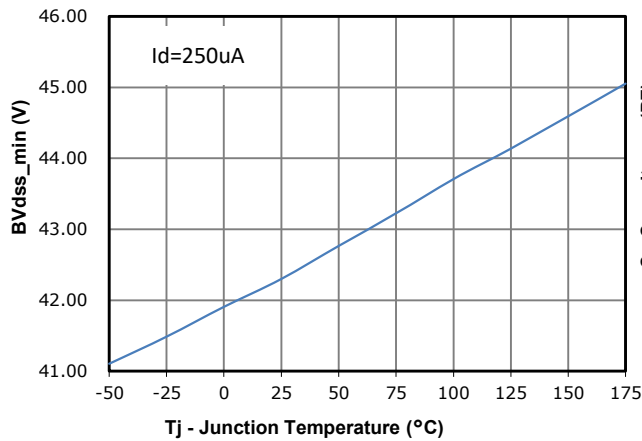


Fig 8: Capacitance Characteristics

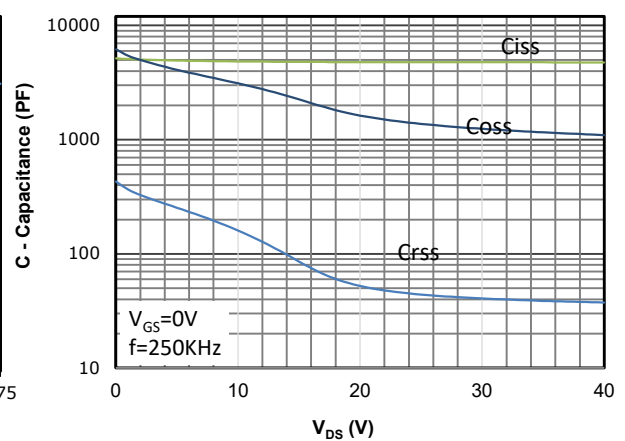


Fig 9: Gate Charge Characteristics

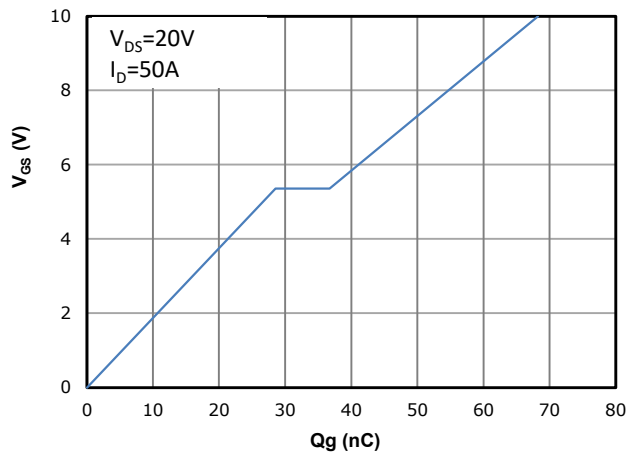


Fig 10: Body-diode Forward Characteristics

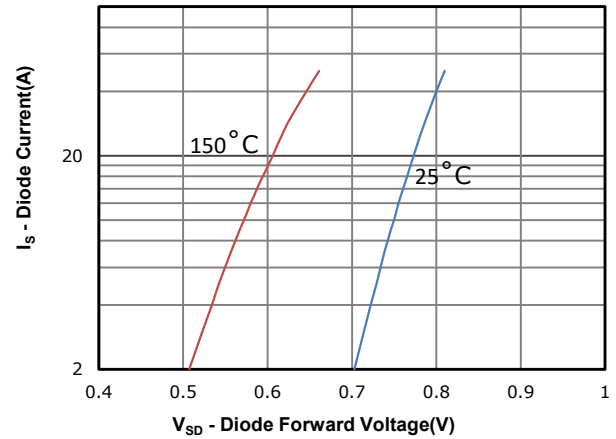


Fig 11: Power Dissipation

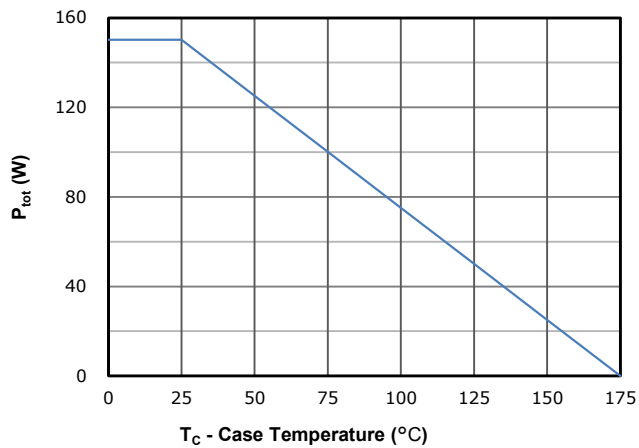


Fig 12: Drain Current Derating

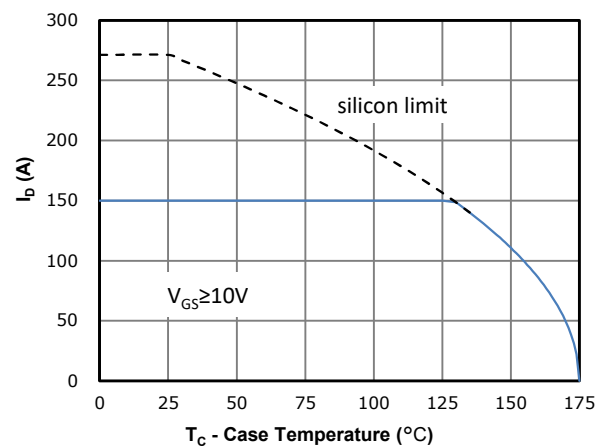


Fig 13: Safe Operating Area

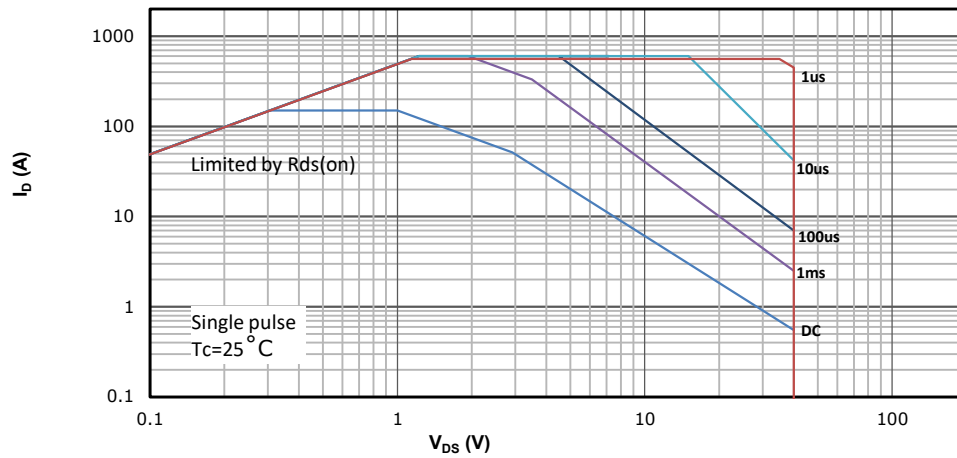
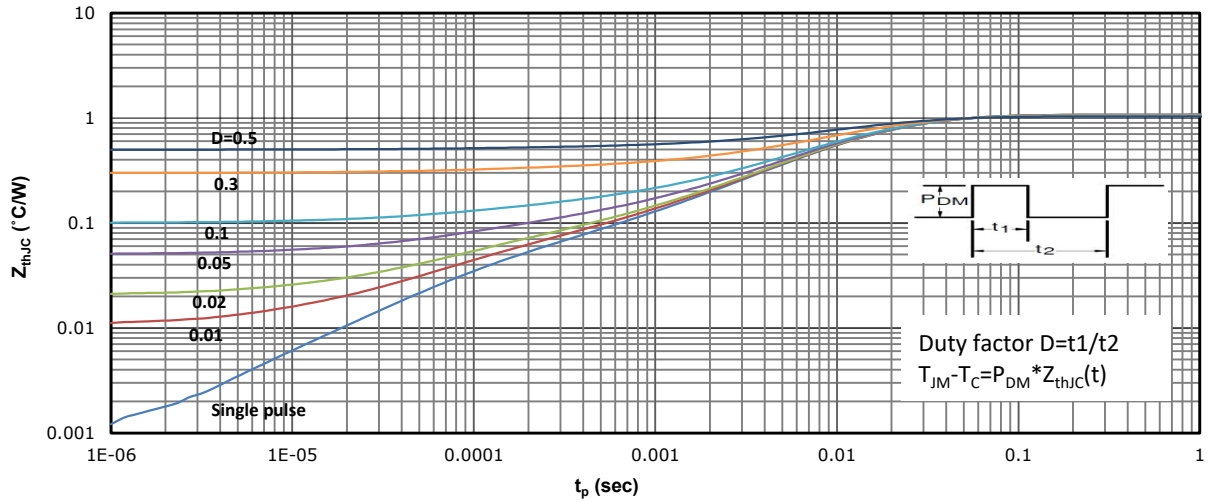
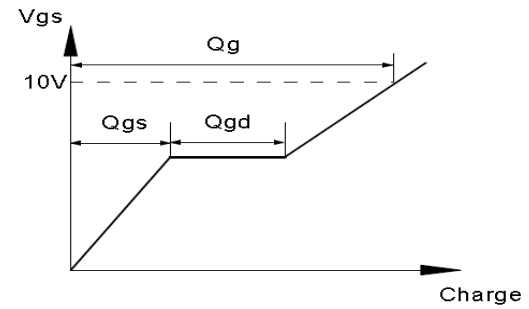
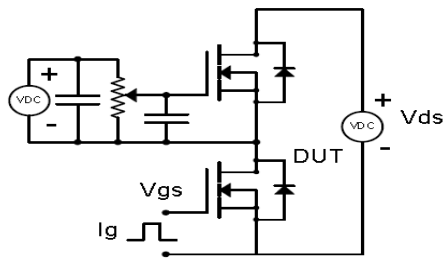


Fig 14: Max. Transient Thermal Impedance

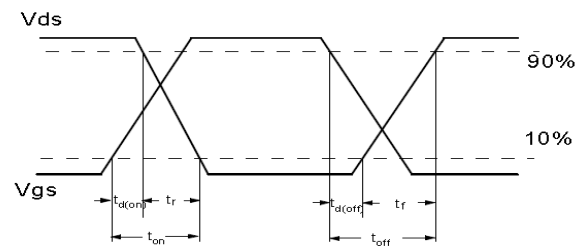
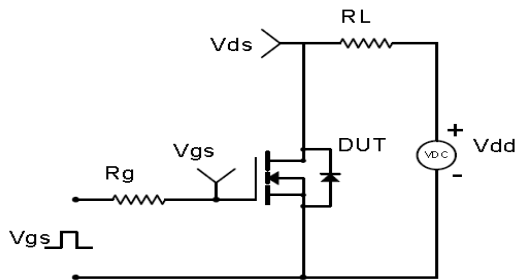


Test Circuit & Waveform

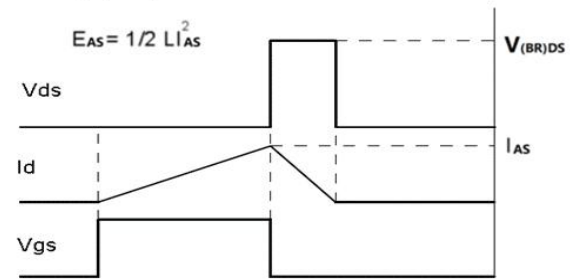
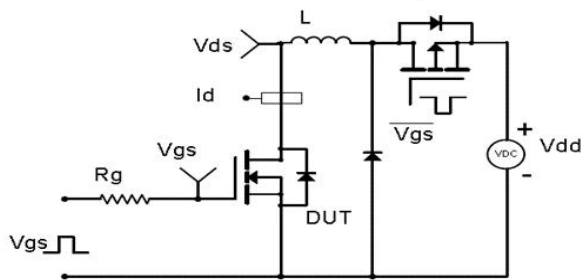
Gate Charge Test Circuit & Waveform



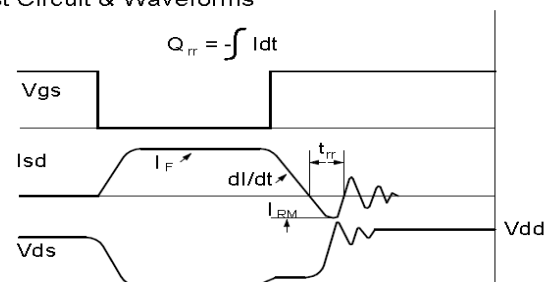
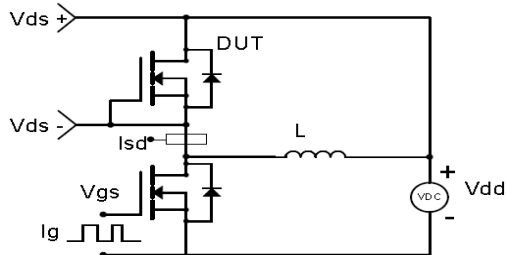
Resistive Switching Test Circuit & Waveforms

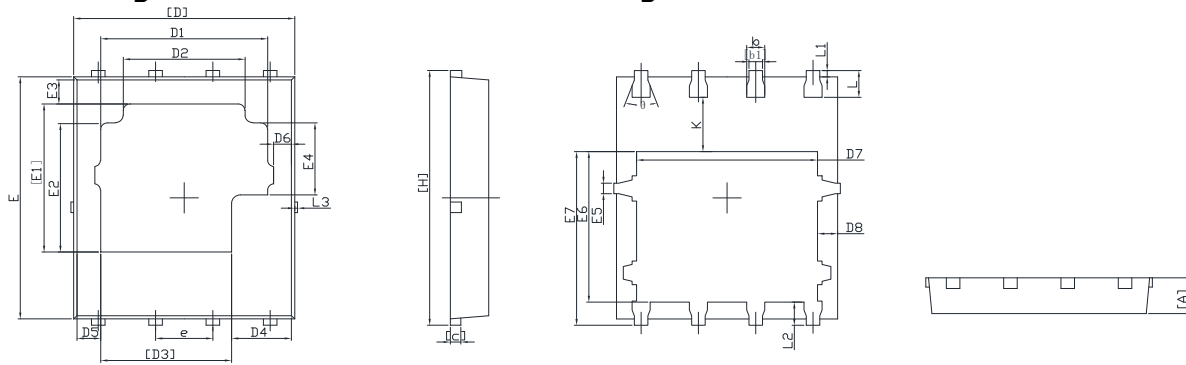


Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Package Outline: DFN5X6 Double Cooling

SYMBOL	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.75	0.95	0.030	0.037
b	0.30	0.50	0.012	0.020
b1	0.20	0.40	0.008	0.016
c	0.20	0.30	0.008	0.012
D	4.80	5.20	0.189	0.205
D1	3.45	3.95	0.136	0.156
D2	2.45	2.95	0.096	0.116
D3	2.65	3.15	0.104	0.124
D4	1.08	1.58	0.043	0.062
D5	0.28	0.78	0.011	0.031
D6	0.20	0.60	0.008	0.024
D7	3.81	4.21	0.150	0.166
D8	0.24	0.64	0.009	0.025
E	5.55	5.95	0.219	0.234
E1	3.27	3.77	0.129	0.148
E2	2.80	3.30	0.110	0.130
E3	0.32	0.82	0.013	0.032
E4	1.46	1.96	0.057	0.077
E5	0.15	0.45	0.006	0.018
E6	3.32	3.82	0.131	0.150
E7	3.875	4.375	0.153	0.172
e	1.27		0.050	
H	5.80	6.30	0.228	0.248
L	0.435	0.835	0.017	0.033
L1	0.05	0.25	0.002	0.010
L2	0.35	0.75	0.014	0.030
L3	-	0.85	-	0.033
K	1.09	1.49	0.043	0.059
θ	35°	45°	35°	45°

Revision History

Revision	Date	Major changes
1.0	2023/3/19	Release of Formal Version.
1.1	2023/6/1	Add the Rth(ch-tp) paramete.
1.2	2024/6/20	Update SOA/ID and Add ID/IDM@110°C.
1.3	2025/2/26	Correct Id,Rth,diagrams ,etc.
1.4	2025/11/18	Update Crss, pakage limit ID.

Disclaimer

Any and all semiconductor products have certain probability to fail or malfunction, which may result in personal injury, death or property damage. Customer are solely responsible for providing adequate safe measures when design their systems.

The product is not intended for use in applications that require extraordinary levels of quality and reliability, such as aviation/aerospace and life-support devices or systems.

Buyer is responsible for its products and applications using PingWei products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by PingWei.

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