CRMD0409C

40V Complementary Power MOSFET

Features

- Uses CRM(CQ) advanced Trench technology
- Extremely low on-resistance $R_{DS(on)}$
- Excellent Q_gx$R_{DS(on)}$ product(FOM)

Product Summary

Symbol	N-Ch	P-Ch
V_{DS}	40V	-40V
$R_{DS(on)\ typ.}$	10mΩ	28mΩ
I_D	21A	-21A

Applications

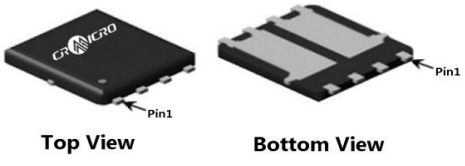
- Motor drive

100% DVDS Tested

100% Avalanche Tested

RoHS HF

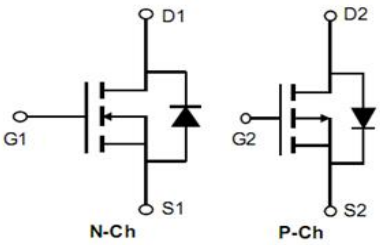
PDFN5x6D



Top View Bottom View



Top View



Package Marking and Ordering Information

Part #	Marking	Package	Packing	Reel Size	Tape Width	Qty
CRMD0409C	CRMD0409C	PDFN5x6D	Taping	N/A	N/A	4000pcs

Absolute Maximum Ratings

Parameter	Symbol	Maximum		Unit
		N-Ch	P-Ch	
Drain-source voltage	V_{DS}	40	-40	V
Continuous drain current T_C = 25°C (Silicon limit)	I_D	35	-21	A
Continuous drain current T_C = 25°C (Package limit)	I_D	21	-21	A
Pulsed drain current (T_C = 25°C, t_p limited by T_{jmax})	$I_{D\ pulse}$	84	-84	A
Avalanche energy, single pulse (L=0.5mH, Rg=25Ω)	E_{AS}	90	81	mJ
Gate-Source voltage	V_{GS}	±20	±20	V
Power dissipation (T_C = 25°C)	P_{tot}	24.1	24.1	W
Operating junction and storage temperature	T_j , T_{stg}	-55...+150		°C

Thermal Resistance

Parameter	Symbol	Typ	Max	Unit
Thermal resistance, junction – case.	R_{thJC}	3.7	5.2	°C/W
SMD version, device on PCB [1] Thermal resistance, junction – ambient(min. footprint)	R_{thJA}	68.4	82.1	°C/W

NOTE:
1.The value of RθJA is measured with the device mounted on 1in2 FR-4 board with 2oz. Copper, in a still air environment with TA =25°C. The value in any given application depends on the user's specific board design.

N-Channel 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	$V_{GS(th)}$	1	1.5	2.5	V	V_{DS}=V_{GS}, I_D=250uA
Zero gate voltage drain current	I_{DSS}	- -	0.08 -	1 5	μA	V_{DS}=40V, V_{GS}=0V Tj=25°C T_j=125°C
Gate-source leakage current	I_{GSS}	-	±10	±100	nA	V_{GS}=±20V, V_{DS}=0V
Drain-source on-state resistance	$R_{DS(on)}$	- -	12.0 10.0	16.0 12.0	mΩ	V_{GS}=4.5V, I_D=10A V_{GS}=10V, I_D=10A
Transconductance	g_{fs}	-	46.8	-	S	V_{DS}=10V, I_D=10A
Dynamic Characteristic						
Input Capacitance	C_{iss}	-	1585	-	pF	V_{GS}=0V, V_{DS}=40V, f=1MHz
Output Capacitance	C_{oss}	-	116	-		
Reverse Transfer Capacitance	C_{rss}	-	88	-		
Gate Total Charge	Q_G	-	35.8	-	nC	V_{GS}=10V, V_{DS}=40V, I_D=10A, f=1MHz
Gate-Source charge	Q_{gs}	-	6.6	-		
Gate-Drain charge	Q_{gd}	-	8.0	-		
Turn-on delay time	$t_{d(on)}$	-	8.6	-	ns	V_{GS}=10V, V_{DD}=20V, R_{G_ext}=2.7Ω, ID=10A
Rise time	t_r	-	28.4	-		
Turn-off delay time	$t_{d(off)}$	-	27.7	-		
Fall time	t_f	-	31.6	-		
Gate resistance	R_G	-	1.1	-	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}	-	0.82	1.2	V	V_{GS}=0V, I_{SD}=10A
Body Diode Reverse Recovery Time	t_{rr}	-	8.3	-	ns	I_F=10A, dI/dt=100A/μs
Body Diode Reverse Recovery Charge	Q_{rr}	-	0.65	-	nC	

N-Channel Typical Performance Characteristics

Fig 1: Output Characteristics

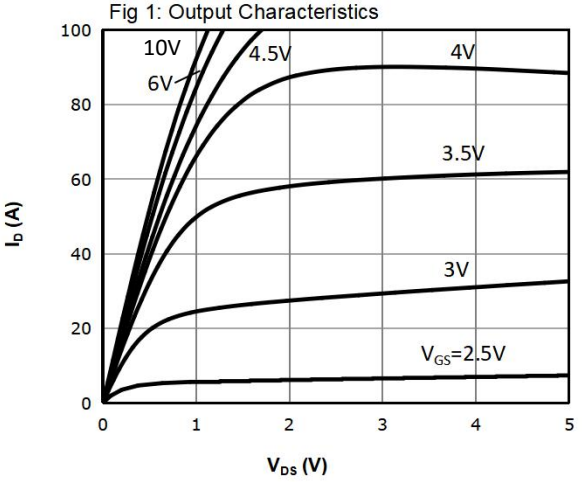


Fig 2: Transfer Characteristics

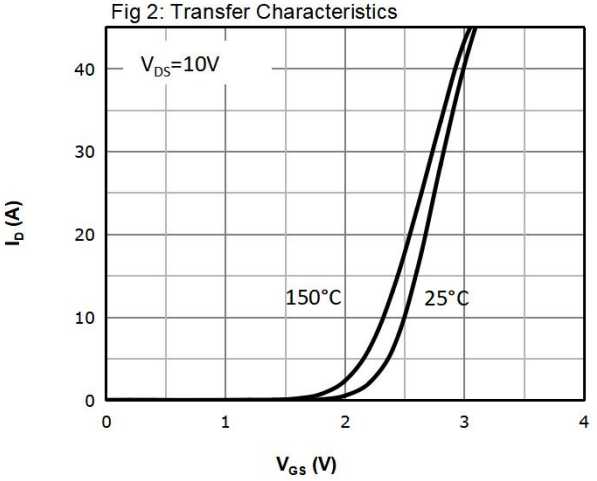


Fig 3: Rds(on) vs Drain Current and Gate Voltage

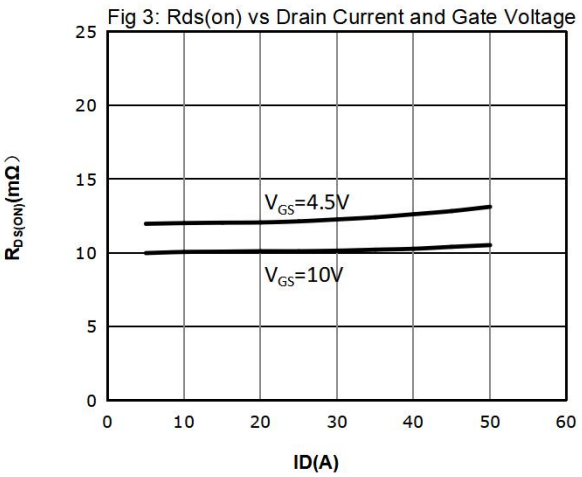


Fig 4: Rds(on) vs Gate Voltage

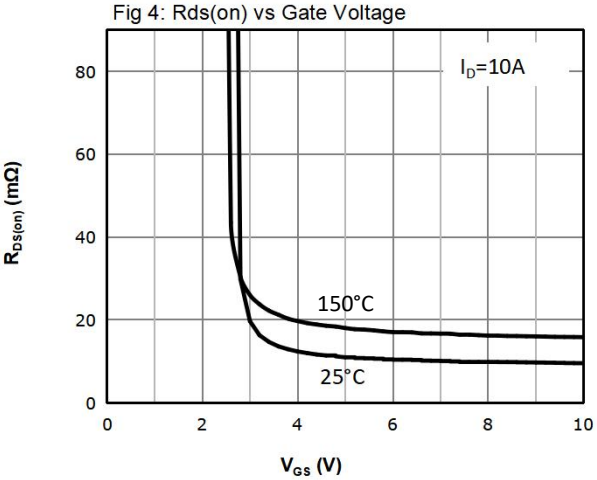


Fig 5: Rds(on) vs. Temperature

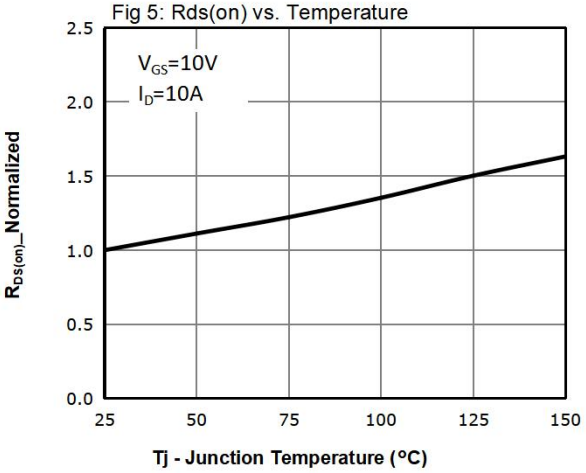


Fig 6: Capacitance Characteristics

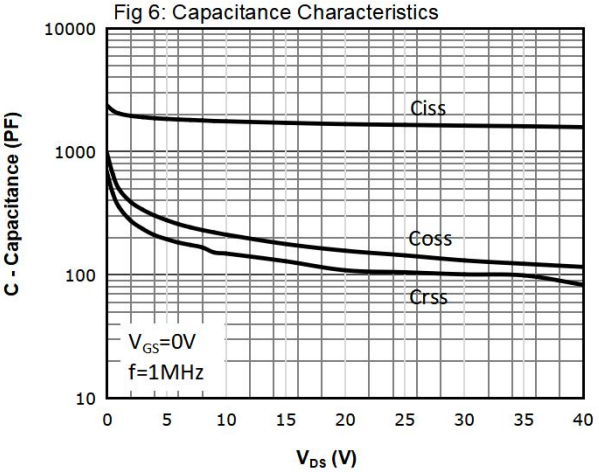


Fig 7: Gate Charge Characteristics

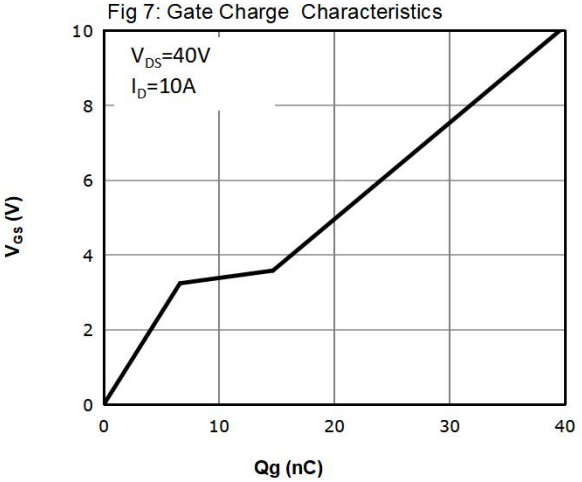


Fig 8: Body-diode Forward Characteristics

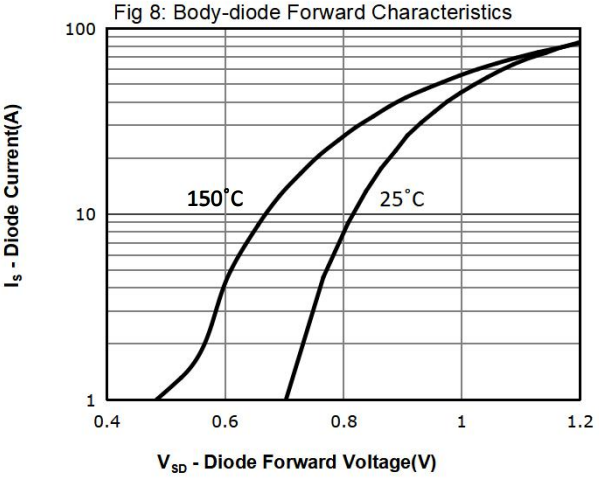


Fig 9: Safe Operating Area

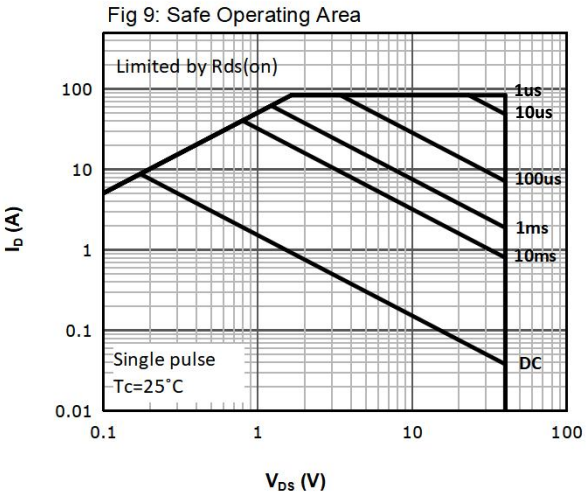
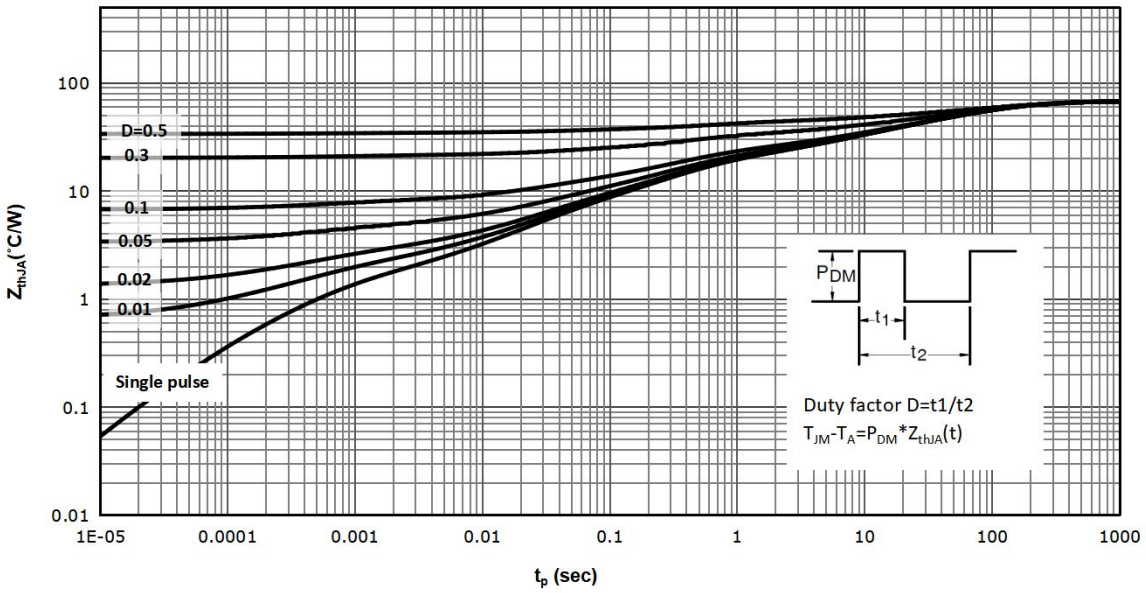


Fig 10: Max. Transient Thermal Impedance



P-Channel 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	$V_{GS(th)}$	-1	-1.8	-2.5	V	V_{DS}=V_{GS}, I_D=-250uA
Zero gate voltage drain current	I_{DSS}	- -	-0.08 -	-1 -5	μA	V_{DS}=-40V, V_{GS}=0V T_j=25°C T_j=125°C
Gate-source leakage current	I_{GSS}	-	±10	±100	nA	V_{GS}=±20V, V_{DS}=0V
Drain-source on-state resistance	$R_{DS(on)}$	- -	38.0 28.0	46.0 35.0	mΩ	V_{GS}=-4.5V, I_D=-10A V_{GS}=-10V, I_D=-10A
Transconductance	g_{fs}	-	23.8	-	S	V_{DS}=-10V, I_D=-10A
Dynamic Characteristic						
Input Capacitance	C_{iss}	-	1290	-	pF	V_{GS}=0V, V_{DS}=-40V, f=1MHz
Output Capacitance	C_{oss}	-	88	-		
Reverse Transfer Capacitance	C_{rss}	-	82	-		
Gate Total Charge	Q_G	-	26.2	-	nC	V_{GS}=-10V, V_{DS}=-40V, I_D=-10A, f=1MHz
Gate-Source charge	Q_{gs}	-	5.7	-		
Gate-Drain charge	Q_{gd}	-	5.4	-		
Turn-on delay time	$t_{d(on)}$	-	6.8	-	ns	V_{GS}=-10V, V_{DD}=-20V, R_{G_ext}=2.7Ω, ID=-10A
Rise time	t_r	-	31.4	-		
Turn-off delay time	$t_{d(off)}$	-	35	-		
Fall time	t_f	-	48	-		
Gate resistance	R_G	-	10.8	-	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}	-	-0.93	-1.2	V	V_{GS}=0V, I_{SD}=-10A
Body Diode Reverse Recovery Time	t_{rr}	-	18.7	-	ns	I_F=10A, dI/dt=100A/μs
Body Diode Reverse Recovery Charge	Q_{rr}	-	3.6	-	nC	

P-Channel Typical Performance Characteristics

Fig 1: Output Characteristics

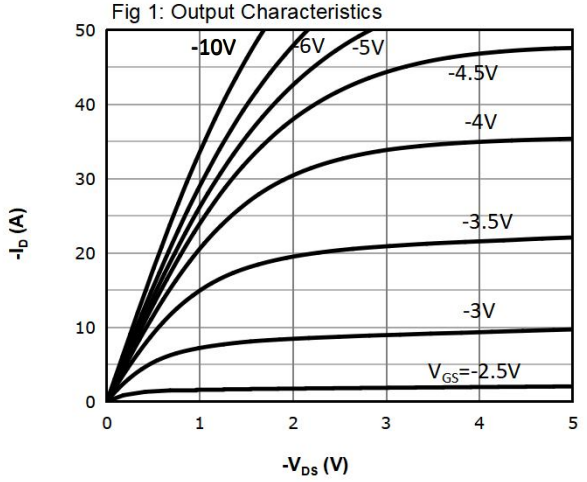


Fig 2: Transfer Characteristics

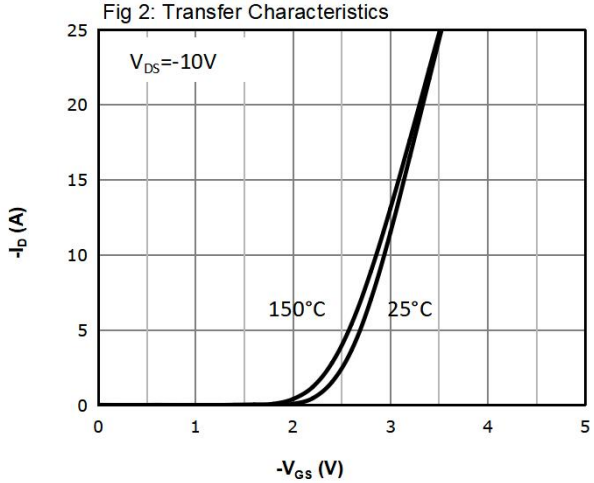


Fig 3: Rds(on) vs Drain Current and Gate Voltage

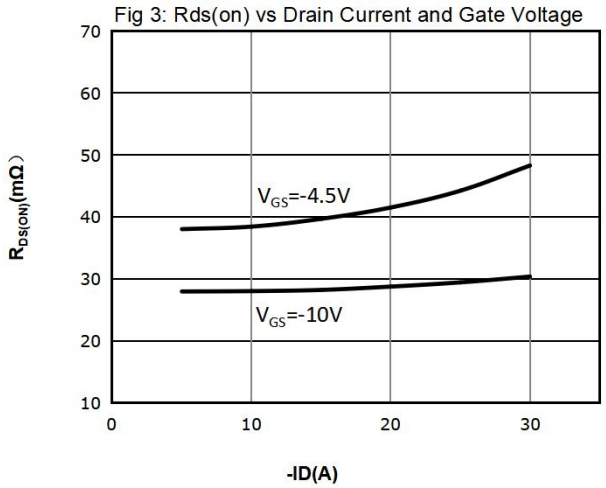


Fig 4: Rds(on) vs Gate Voltage

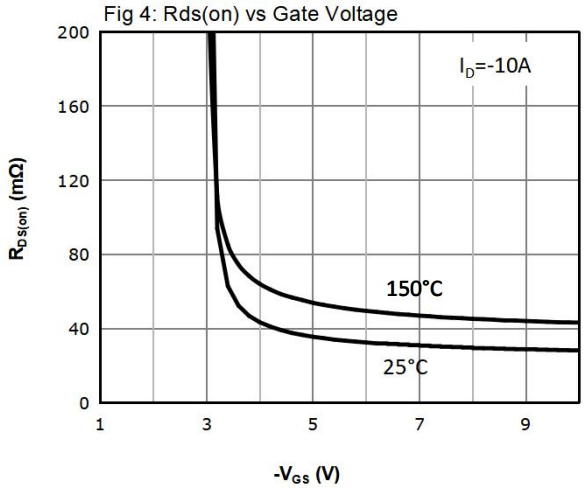


Fig 5: Rds(on) vs. Temperature

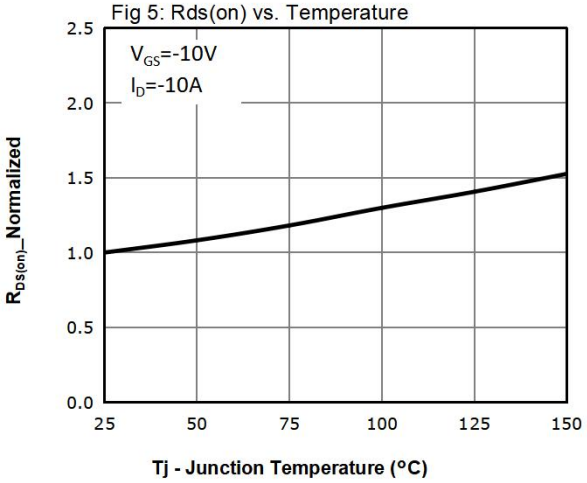


Fig 6: Capacitance Characteristics

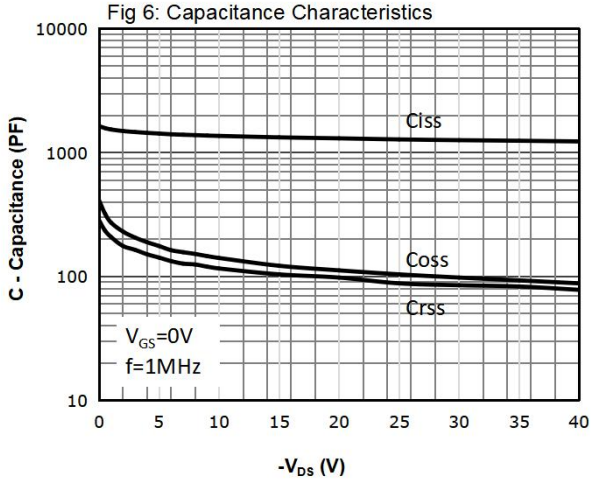


Fig 7: Gate Charge Characteristics

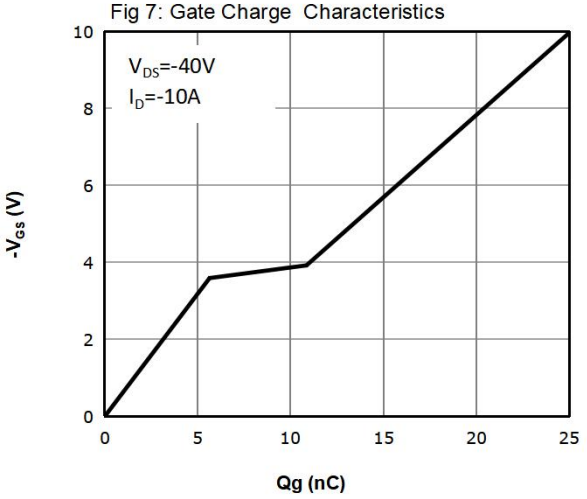


Fig 8: Body-diode Forward Characteristics

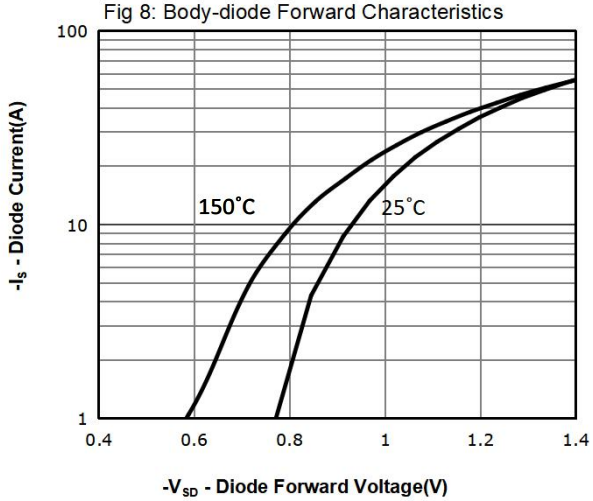


Fig 9: Safe Operating Area

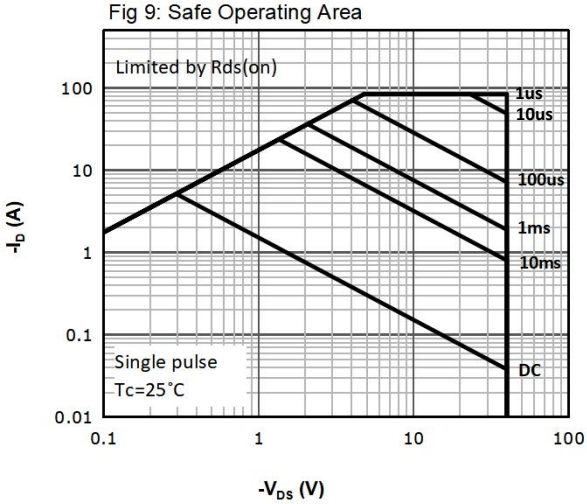
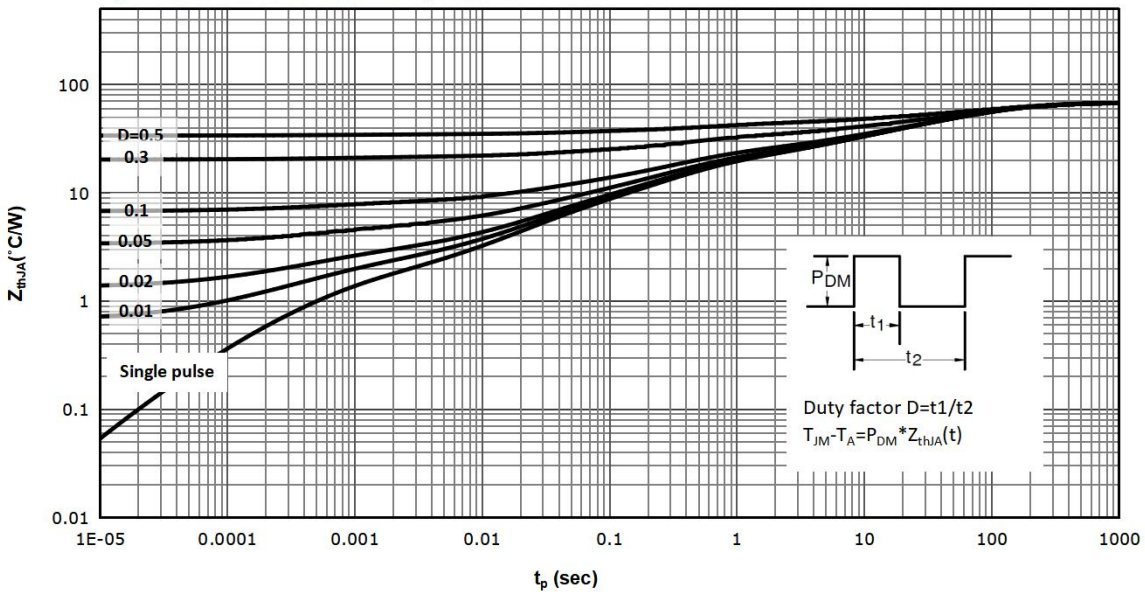
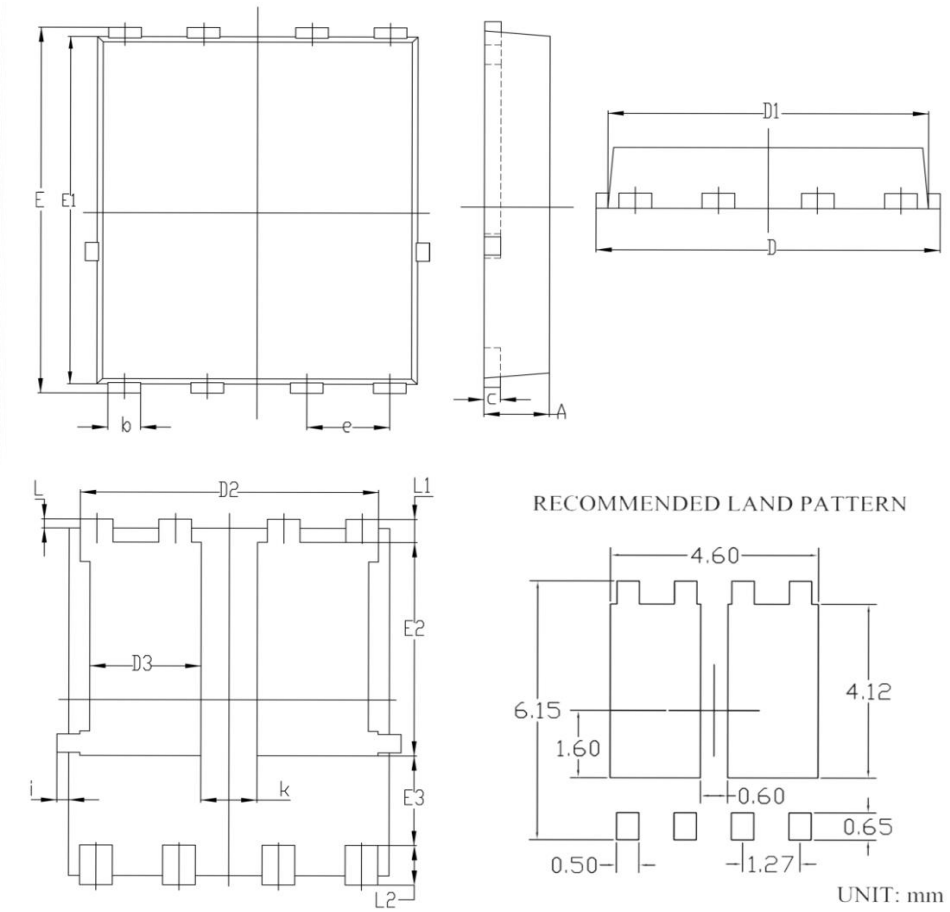


Fig 10: Max. Transient Thermal Impedance



Package Outline: PDFN5x6D



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.90	1.00	1.15	0.035	0.039	0.045
b	0.25	0.39	0.52	0.010	0.015	0.020
c	0.20	0.25	0.30	0.008	0.010	0.012
D	4.80	5.10	5.40	0.189	0.201	0.213
D1	4.80	4.90	5.00	0.189	0.193	0.197
D2	3.90	4.20	4.50	0.154	0.165	0.177
D3	1.50	1.70	1.90	0.059	0.067	0.075
E	5.90	6.05	6.20	0.232	0.238	0.244
E1	5.45	5.70	5.85	0.215	0.224	0.230
E2	3.30	3.50	3.80	0.130	0.138	0.150
E3	1.10	----	----	0.043	----	----
e	1.27 BSC			0.050 BSC		
L	0.05	0.15	0.25	0.002	0.006	0.010
L1	0.38	----	0.75	0.015	----	0.030
L2	0.38	----	0.75	0.015	----	0.030
i	----	----	0.18	----	----	0.007
k	0.50	----	----	0.020	----	----

NOTE

1.PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS.
MOLD FLASH AT THE NON-LEAD SIDES SHOULD BE LESS THAN 6 MILS EACH.

2.CONTROLLING DIMENSION IS MILLIMETER.
CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

Revision History

Revison	Date	Major changes
1.1	2023/1/5	Release of formal version

Disclaimer

Unless otherwise specified in the datasheet, the product is designed and qualified as a standard commercial product and is not intended for use in applications that require extraordinary levels of quality and reliability, such as automotive, aviation/aerospace and life-support devices or systems.

Any and all semicondutor 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.

This product is suitable for reflow soldering up to 260℃, not very suitable for wave soldering.
The reliability of this product is not guaranteed under specific conditions when accepted by customers.
CRM(CQ) reserves the right to improve product design, function and reliability without notice.