

如何正确理解 FRED 和 FRD 的特性参数

213022

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摘 要

FRD Fast Recovery Diode FRED(Fast Recovery Epitaxial Diode)
FRED

t_{rr} Q_r I_{RRM}

关键词 FRD FRED

如何正确理解 FRED 和 FRD 的特性参数

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摘要 FRD Fast Recovery Diode FRED(Fast Recovery Epitaxial Diode)
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关键词 FRD FRED

1. 前言

SCR MacMic MMF300Z060DK1 FRED
IGBT GTO MOSFET

2.1

1 MMF300Z060DK1 1 2
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[1~3]

Symbol	Parameter	Test Conditions	max	Unit
V_R	DC reverse voltage		600	V
V_{RRM}	Repetitive Reverse Voltage		600	V
$I_{F(AV)}$	Average Forward Current	$T_c=75^\circ\text{C}$, rec,d=0.5	95	A
$I_{F(RMS)}$	RMS Forward Current	$T_c=75^\circ\text{C}$	142	A

IRM

t_{rr}

FRD Fast Recovery Diode FRED(Fast Recovery Epitaxial Diode)

FRD

1 2 MMF300Z060DK1

FRED

V_R

$I_{F(AV)}$

P_{tot}

FRD FRED

T_j

V_R

MacMic

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FRD FRED

V_R [5]
5 10

V_{BR} V_R

V_R V_R

2. 各部分参数的理解

FRD FRED

Sym bol	Parame- ter	Test Conditions	max	Unit
I _{FSM}	Non-repeti- tive surge forward current	T _j =45 ; t=10ms(50Hz),sine	1200	A
		T _j =45 ; t=8.3ms(60Hz),sine	1300	A
		T _j =75 ; t=10ms(50Hz),sine	1080	A
		T _j =75 ; t=8.3ms(60Hz),sine	1170	A
I ² t	Rating for fusing	T _j =45 ; t=10ms(50Hz),sine	7200	A ² s
		T _j =45 ; t=8.3ms(60Hz),sine	7100	A ² s
		T _j =75 ; t=10ms(50Hz),sine	5800	A ² s
		T _j =75 ; t=8.3ms(60Hz),sine	5700	A ² s
T _J	Junction Temperature Range		-40 to +150	°C
T _{STG}	Storage Temperature Range		-40 to +125	°C
P _{tot}	Total power consumption		280	W
V _{isol}		50/60Hz,RMS t=1min	3000	V

V_{RRM}

MacMic V_{RRM} V_R V_{BR} MacMic FRD FRED V_{RWM}

I_{F(AV)} 25 75 MacMic 50% 15A 30A I_{F(AV)} 50% FRD FRED MacMic I_{F(RMS)} 25 75 I_{F(RMS)} I_{F(AV)} I_{F(RMS)} = I_{F(Peak)} √δ I_{F(Peak)} MacMic 50% 75 I_{FSM} T_J 8.3ms 10ms , T_J I_{FSM} I²t I²t

T_J -55
 +150 T_{STG}
 MMF300Z060DK1

$T_J=25$
 V_F I_F T_J
^[6] 3 V_F T_J
 125 T_C 25 I_F
 V_F

P_{tot}

$$P_{tot} = \frac{T_J - T_C}{R_{thjc}}$$

T_J

T_C
 R_{thjc}

V_{iso}

DCB(Direct Copper Bonding)

DCB

MacMic

DBC

AlN

DBC

Al₂O₃

MacMic

FRED

2 2

. 3 MMF300Z060DK1

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Unit
I_{RM}	Reverse Leakage Current	$V_R=600V$;	--	--	2	mA
		$V_R=480V$;	--	--	0.5	mA
		$V_R=480V$; $T_J=125^\circ C$			34	mA
V_F	Forward Voltage	$I_F=100A$;	--	--	1.36	V
		$I_F=100A$; $T_J=125^\circ C$			1.55	V
		$I_F=300A$;			2.05	V
		$I_F=300A$; $T_J=125^\circ C$			2.09	V

3

MacMic

FRED

MMF300Z060DK1

I_{RM}

V_R

MacMic

I_{RM}

$T_J=125$

2 3

.4 MMF300Z060DK1

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Unit
t_{rr}	Reverse Recovery Time	$I_F=100$ A $V_R=30$ 0V $di_F/dt=$ -200A/ μs	--	14	--	ns
		$T_J=100^\circ C$	--	250	300	ns

I_{RM}

4

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MMF300Z060DK1

FRED

FRD

FRED

FRED

FRD

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5us

FRD

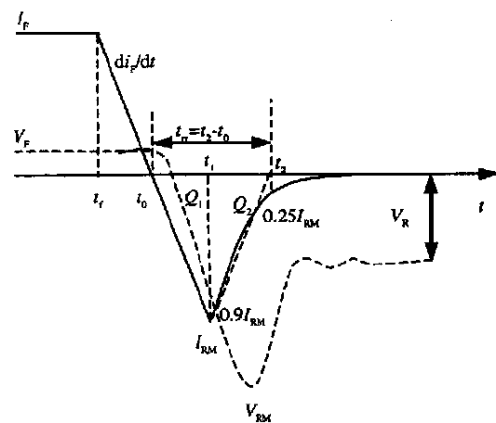
5us

MacMic

FRED

20ns

1

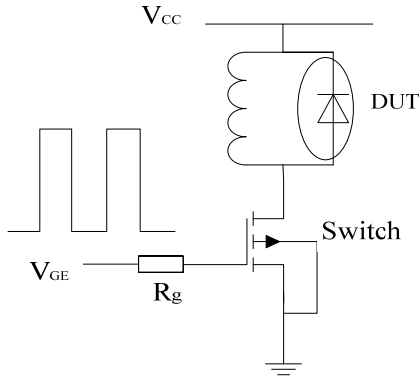


1.

2.4

.5 MMF300Z060DK1

Symbol	Parameter	Min	Typ	Max	Unit
$R_{\theta JC}$	Thermal Resistance Junction-to-Case	--	--	0.45	K/W



5 MacMic MMF300Z060DK1 FRED
 $R_{\theta JC}$

2.

1 4 t_{rr} $R_{\theta JC}$

t_2-t_0 I_{RRM} 0.25 I_{RRM} $R_{\theta JC}$

Q_{rr} dI_F/dt T_J V_{CC} t_{rr} $R_{\theta JA}$

I_F I_{RRM} Q_{rr} dI_F/dt MOSFET FRD FRED

2 I_{GBT} R_g R_g /

dI_F/dt V_{CC} V_R 80 25 /

50 125 150 /

T_J T_1 T_C I_F 2.5.1

t_{rr} 2.5.2 dI_F/dt

MMF300Z060DK1

Q_r dI_F/dt I_F

dI_F/dt Q_r

dI_F/dt I_F

Q_r 2.5.3

FRD FRED

I_{RRM} dI_F/dt

MMF300Z060DK1

I_{RM} di_F/dt
 I_F di_F/dt

I_{RRM}
 di_F/dt

参考文献

SIOD.

[1] . 1998 23(1):30~34

[2]

, 2003,37(2) 79~81

[3]

. 1997,1 85~87

[4]

. <http://www.macmicst.com/>.

[5] Muhannad H. Rashid

[M].

. 2004.

[6] GB/T 4023-1997.

2

. 1997

[7]

. 2001,38(3): 1~9

[8] N.Y.Y.shammas

. 2000,

1:22~28

作者简介:

1982 10 1

IGBT FRED

I_{RRM}
 2 5. 4

Q_r I_{RRM}

MMF300Z060DK1

0 150

I_{RRM}

3

Q_r

4.5

2 5. 5

t_{rr} di_F/dt

MacMic FRED

di_F/dt

t_{rr}

di_F/dt

I_F

t_{rr}

2 5. 6

/

V_{FR}

t_{FR}

di_F/dt

di_F/dt

V_{FR}

t_{FR}

2 5. 7

MacMic

$Z_{\theta JC}$

$Z_{\theta JC}$

2 5. 8 FRD FRED

TO 220

TO 247

MacMic

MMF300Z060DK1

FRED

FRED

3. 结论

FRD

FRED

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FRED

t_{rr} Q_{rr}

I_{RRM}