

FRED

Single Ultrafast Soft Recovery Diode

600A / 600V

FEATURES

- 175°C operating junction temperature
- Ultrafast soft recovery characteristics
- Low Q_{RR} and t_{rr}
- High frequency operation
- Very low forward voltage drop
- Designed and qualified for industrial level

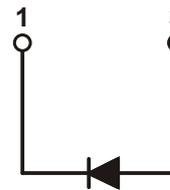
DESCRIPTION

The NKF600-60I FRED diode module series has been optimized to reduce losses and EMI/RFI in high frequency power conditioning system.

An extensive characterization of the recovery behavior for different values of current, temperature and di/dt simplifies the calculations of losses in the operating conditions. The softness of the recovery eliminates the need for a snubber in most applications.

TYPICAL APPLICATIONS

- High current switching power supplies
- Power converters
- Motor drives
- UPS
- Electrical welding machine
- Tele-communication power supply
- Freewheeling diode for IGBT


IAP (Insulated)


Single diode

PRODUCT SUMMARY

I_F Maximum	600A
V_R	600V
$I_{F(DC)}$ at T_C	600A @ 100°C
t_{rr} at 25°C	100nS

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNIT
Cathode to anode voltage, minimum	V_R		600	V
Continuous forward current	I_F	$T_C = 25^\circ\text{C}$	850	A
		$T_C = 100^\circ\text{C}$	600	
Single pulse forward surge current	I_{FSM}	Limited by junction temperature	5100	
Non-repetitive avalanche energy	E_{AS}	$L = 100\mu\text{H}$, duty cycle limited by maximum T_J	2.2	mJ
Maximum power dissipation	P_D	$T_C = 25^\circ\text{C}$	1350	W
		$T_C = 100^\circ\text{C}$	810	
Operating junction and storage temperature range	T_J, T_{Stg}		-40 to 175	°C

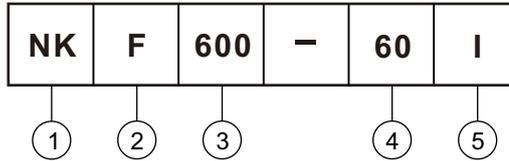
ELECTRICAL SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Cathode to anode breakdown voltage	V_{BR}	$I_R = 200\mu\text{A}$	600	-	-	V
Maximum forward voltage	V_{FM}	$I_F = 300\text{A}$	-	1.10	1.30	
		$I_F = 600\text{A}$	-	1.25	1.50	
		$I_F = 600\text{A}, T_J = 125\text{ }^\circ\text{C}$	-	-	1.25	
Maximum reverse leakage current	I_{RM}	$V_R = 600\text{V}, T_J = 25\text{ }^\circ\text{C}$	-	1.0	5.0	μA
		$V_R = 600\text{V}, T_J = 125\text{ }^\circ\text{C}$	-	0.5	2.0	mA
Maximum junction capacitance per leg	C_T	$V_R = 200\text{V}$	-	1200	1700	pF
Typical series inductance per leg	L_S	From top of terminal hole to mounting plane	-	7.0	-	nH
Maximum RMS insulation voltage	V_{INS}	50Hz	2500(1 min)	-	-	V

DYNAMIC RECOVERY CHARACTERISTICS ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Reverse recovery time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}$	$I_F = 0.5\text{A}, I_R = 1.0\text{A}, I_{RR} = 0.25\text{A}$	-	260	300	nS
		$T_J = 25\text{ }^\circ\text{C}$		-	100	-	
		$T_J = 125\text{ }^\circ\text{C}$		-	-	250	
Peak recovery current	I_{RRM}	$T_J = 25\text{ }^\circ\text{C}$	$I_F = 150\text{A}$ $di_F/dt = 1000\text{A}/\mu\text{s}$ $V_R = 300\text{V}$	-	55	-	A
		$T_J = 125\text{ }^\circ\text{C}$		-	115	-	
Reverse recovery charge	Q_{rr}	$T_J = 25\text{ }^\circ\text{C}$		-	-	4.5	μC
		$T_J = 125\text{ }^\circ\text{C}$		-	-	15.0	

THERMAL-MECHANICAL SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	
Maximum junction and storage temperature range	T_J, T_{Stg}	-40	-	175	$^\circ\text{C}$	
Thermal resistance, junction to case	R_{thJC}	-	-	0.07	$^\circ\text{C}/\text{W}$	
Thermal resistance, case to heatsink	R_{thCS}	-	0.035	-		
Weight		-	155 (5.47)	-	g(oz.)	
Mounting torque, M6		-	44.2 (5)	53.1 (6)	N·m (lbf · in)	
Terminal torque, M6		-	44.2 (5)	53.1 (6)		
Case style		INT-A-PAK (IAP)				

Ordering Information Tabel

Device code



- ① - Nell's power module
- ② - F for FRED Diode, single diode
- ③ - Maximum average forward current, 600 = 600A
- ④ - Voltage rating (60 = 600V)
- ⑤ - "I" for insulated type, IAP package

Fig.1 Typical forward voltage drop vs. instantaneous forward current

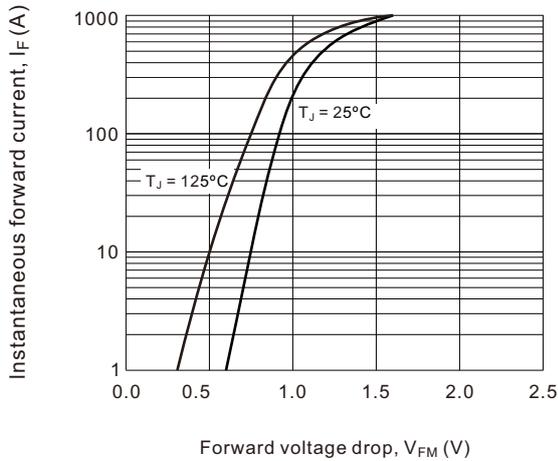


Fig.2 Typical reverse current vs reverse voltage

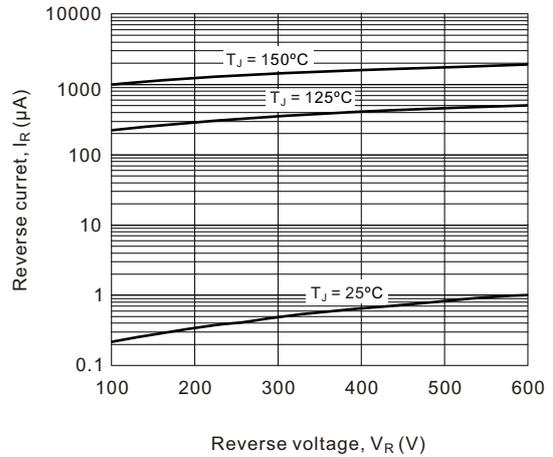


Fig.3 Maximum thermal impedance $R_{th(j-c)}$ characteristics

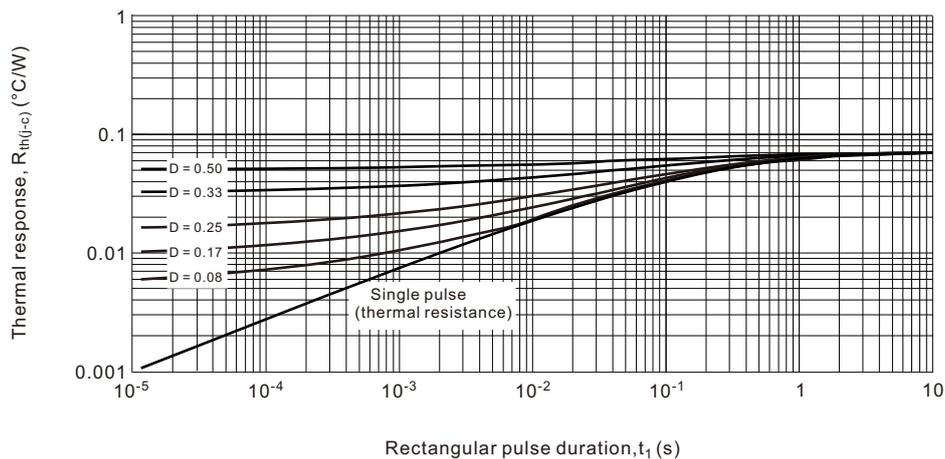


Fig.4 Typical junction capacitance vs. Reverse voltage

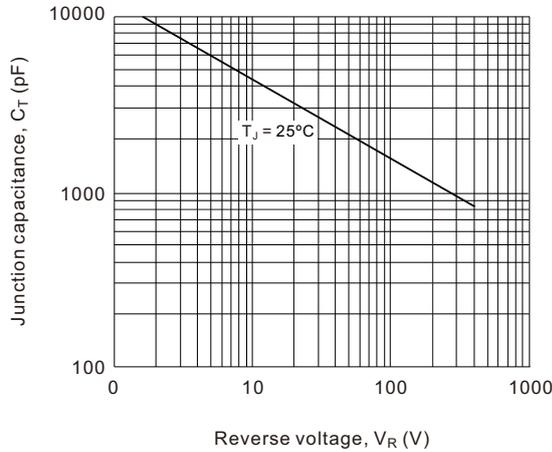


Fig.5 Maximum allowable case temperature vs. DC forward current

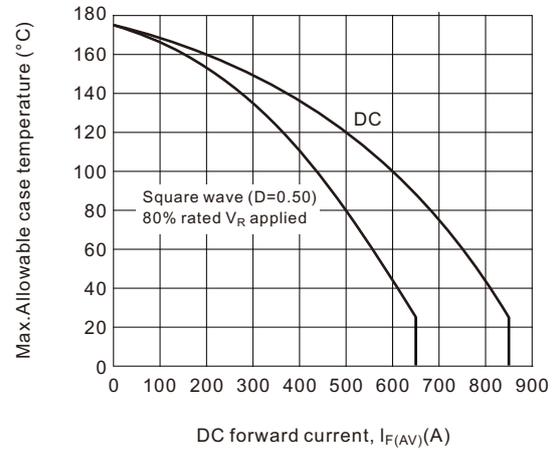


Fig.6 Typical reverse recovery time vs. di_F/dt

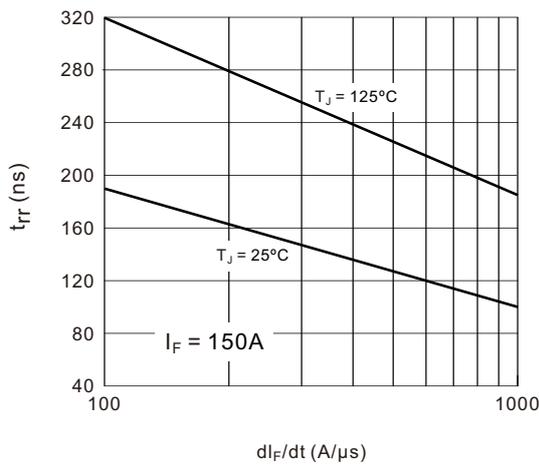


Fig.7 Reverse Recovery Parameter Test Circuit

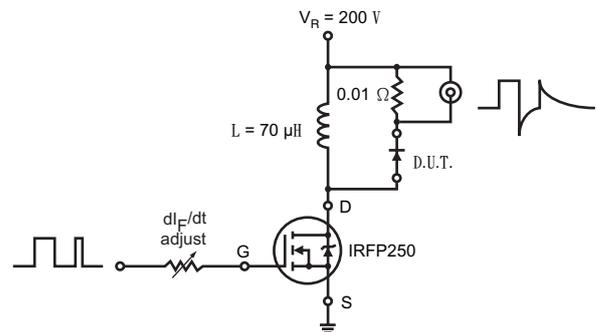
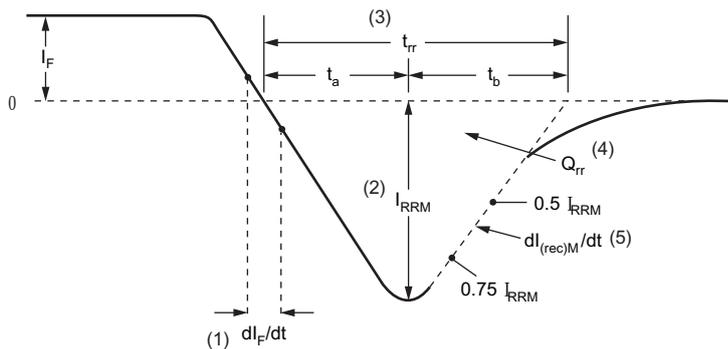


Fig.8 Reverse Recovery Waveform and Definitions



- (1) di_F/dt - rate of change of current through zero crossing
 - (2) I_{RRM} - peak reverse recovery current
 - (3) t_{rr} - reverse recovery time measured from zero crossing point of negative going i_F to point where a line passing through $0.75 I_{RRM}$ and $0.50 I_{RRM}$ extrapolated to zero current.
 - (4) Q_{rr} - area under curve defined by t_{rr} and I_{RRM}
- $$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$
- (5) $di_{(rec)M}/dt$ - peak rate of change of current during t_b portion of t_{rr}

Fig.9 Avalanche test circuit and waveforms

