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

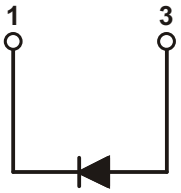
The NKF600-60I FRED diode module series has been optimized to reduce losses and EMI/RFI in high frequency power conditioning system.

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°C	850	A
		T_C = 100°C	600	
Single pulse forward surge current	I_{FSM}	Limited by junction temeperature	5100	
Non- repetitive avalanche energy	E_{AS}	L = 100μH, duty cycle limited by maximum T_J	2.2	mJ
Maximum power dissipation	P_D	T_C = 25°C	1350	W
		T_C=100°C	810	
Operating junction and storage temperature range	T_J,T_{Stg}		-40 to 175	°C

ELECTRICAL SPECIFICATIONS (T_J = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Cathode to anode breakdown voltage	V_{BR}	I_R = 200μA	600	-	-	V
Maximum forward voltage	V_{FM}	I_F= 300A	-	1.10	1.30	
		I_F= 600A	-	1.25	1.50	
		I_F= 600A, T_J = 125°C	-	-	1.25	
Maximum reverse leakage current	I_{RM}	V_R= 600V, T_J = 25°C	-	1.0	5.0	μA
		V_R= 600V, T_J = 125°C	-	0.5	2.0	mA
Maximum junction capacitance per leg	C_T	V_R = 200V	-	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 °C unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Reverse recovery time	t_{rr}	T_J = 25°C	I_F = 0.5A, I_R = 1.0A, I_{RR} = 0.25A	-	260	300	nS
		T_J = 25°C	I_F= 150A dI_F/dt = 1000A/μs V_R= 300V	-	100	-	
		T_J = 125°C		-	-	250	
Peak recovery current	I_{RRM}	T_J = 25°C		-	55	-	A
		T_J = 125°C		-	115	-	
Reverse recovery charge	Q_{rr}	T_J = 25°C		-	-	4.5	μC
		T_J = 125°C		-	-	15.0	

THERMAL-MECHANICAL SPECIFICATIONS (T_J = 25 °C unless otherwise specified)					
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Maximum junction and storage temperature range	T_J,T_{Stg}	-40	-	175	°C
Thermal resistance, junction to case	R_{thJC}	-	-	0.07	°C/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

NK	F	600	–	60	I
①	②	③		④	⑤

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

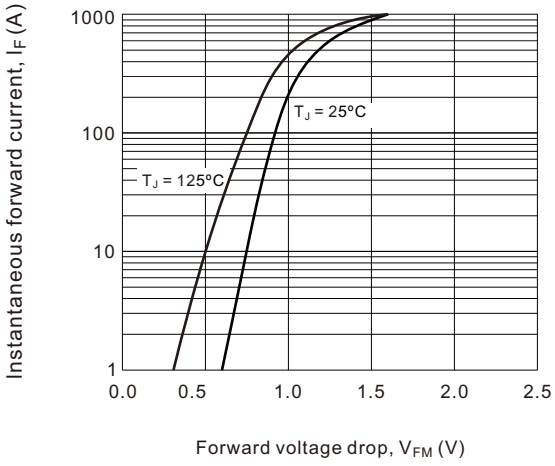


Fig.2 Typical reverse current vs reverse voltage

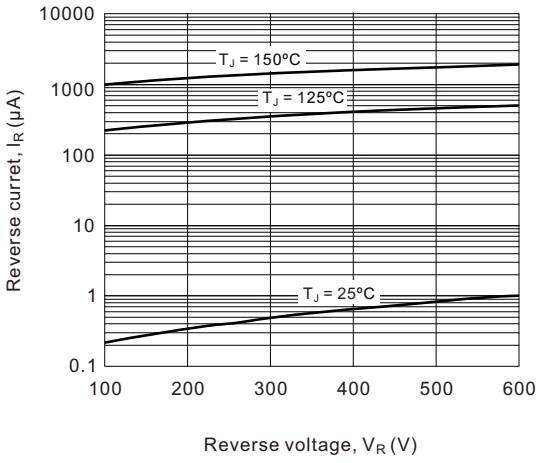


Fig.3 Maximum thermal impedance $R_{th(j-c)}$ characteristics

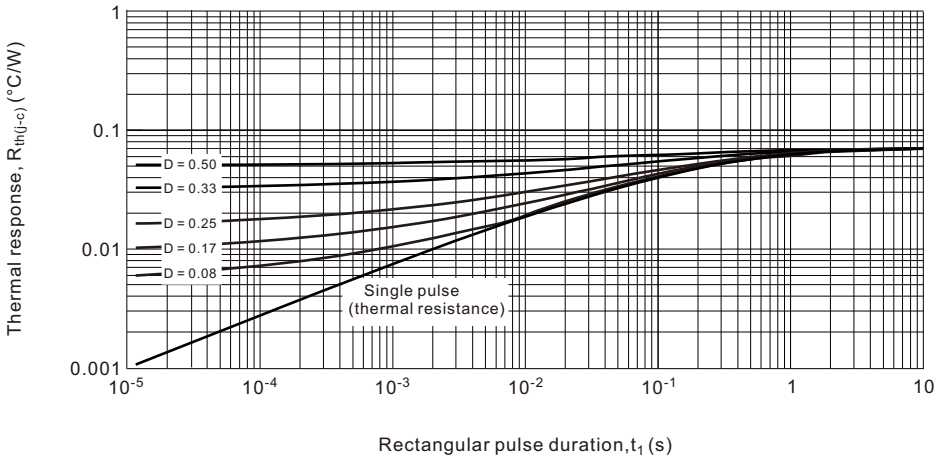


Fig.4 Typical junction capacitance vs. Reverse voltage

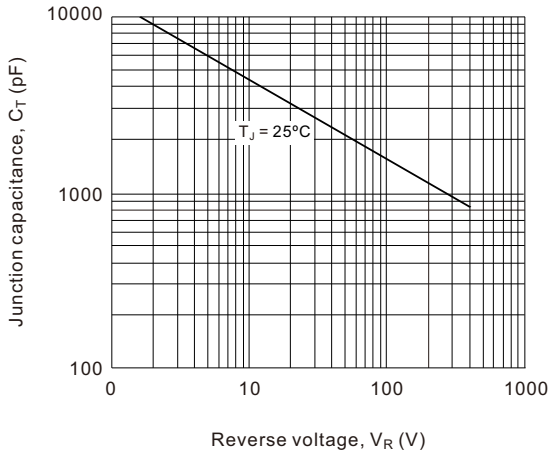


Fig.5 Maximum allowable case temperature vs. DC forward current

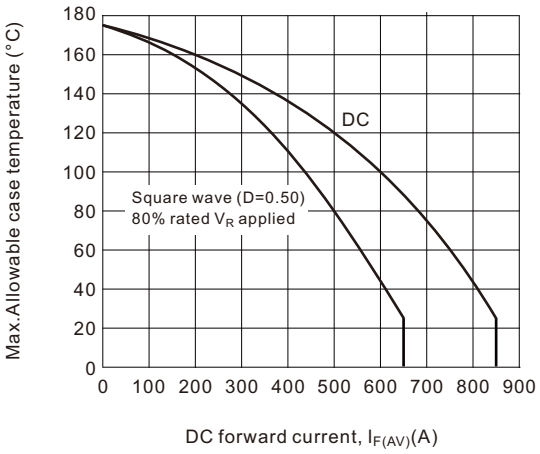


Fig.6 Typical reverse recovery time vs. dI_F/dt

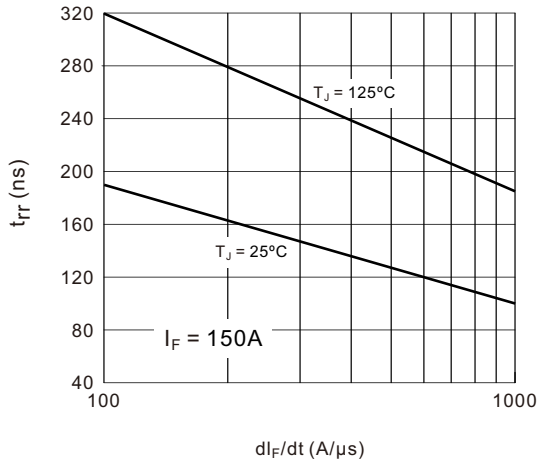


Fig.7 Reverse Recovery Parameter Test Circuit

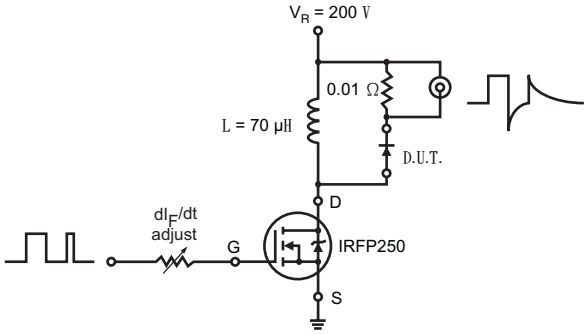
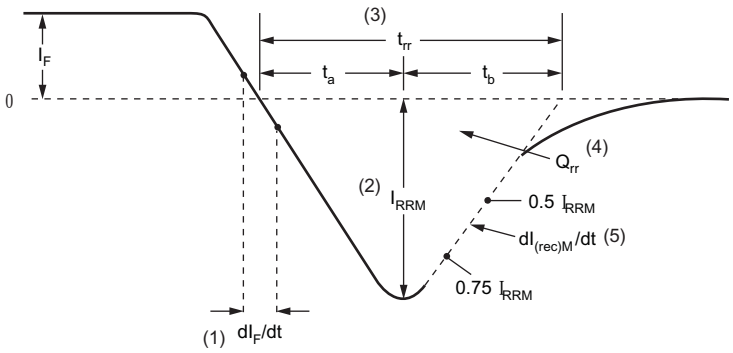


Fig.8 Reverse Recovery Waveform and Definitions



(1) dI_F/dt - rate of change of current through zero crossing

(2) I_{RRM} - peak reverse recovery current

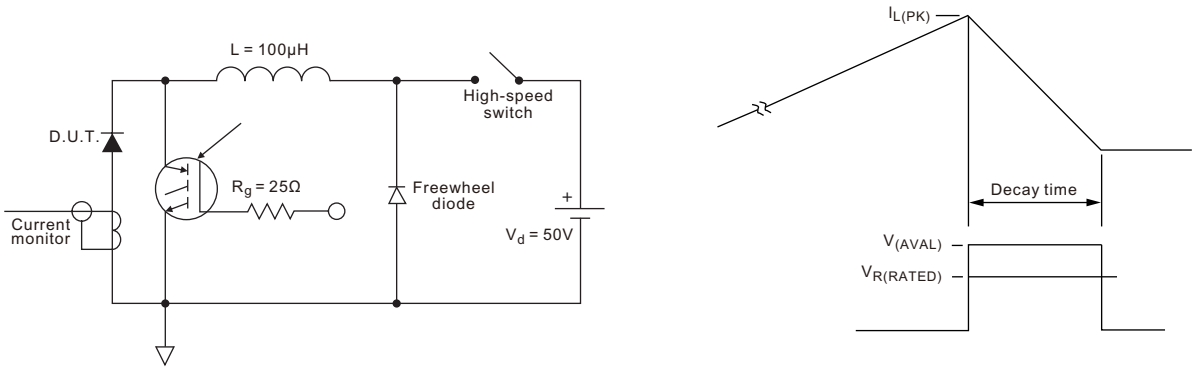
(3) t_{rr} - reverse recovery time measured from zero crossing point of negative going I_F to point where a line passing through 0.75 I_{RRM} and 0.50 I_{RRM} extrapolated to zero current.

(4) Q_{rr} - area under curve defined by t_{rr} and I_{RRM}

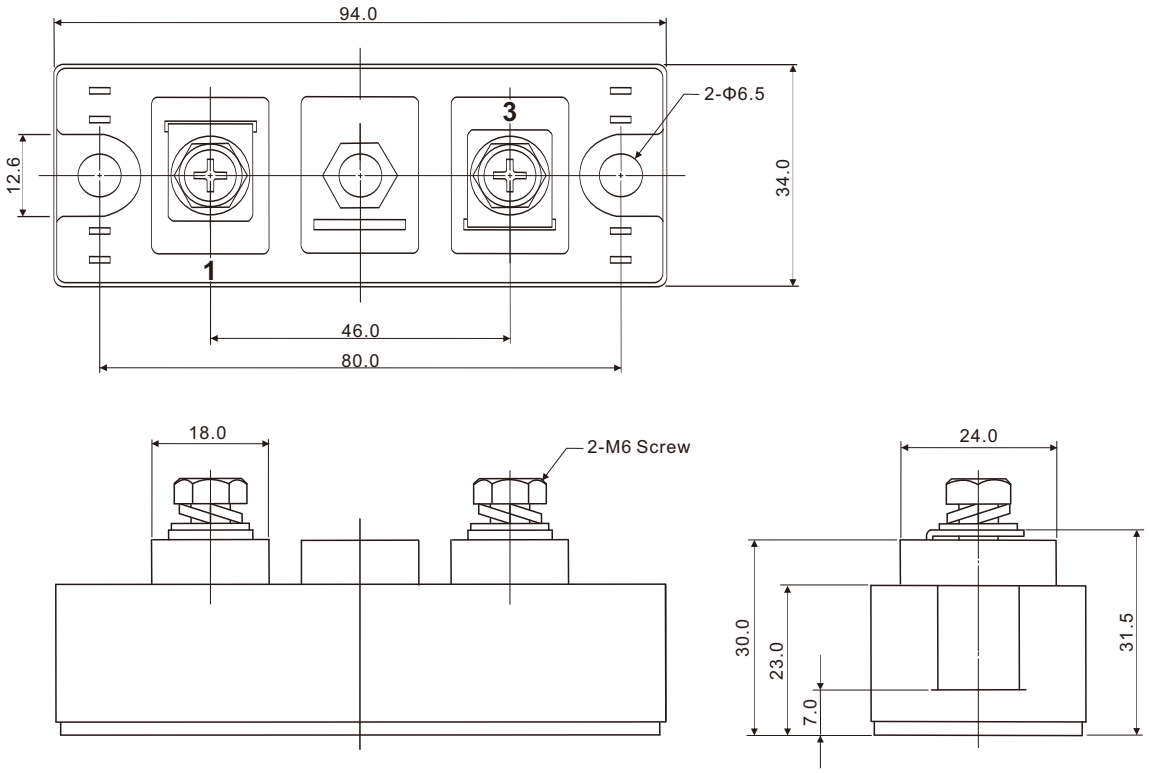
$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

(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



IAP (Insulated)



All dimensions in millimeters