

FRED

Ultrafast Soft Recovery Diode Module

600A / 600V (300Ax2 / 600V)

FEATURES

- Very low Q_{rr} and t_{rr}
- Lead (Pb)-free
- Designed and qualified for industrial level
- Reduced RFI and EMI
- Industrial standard package
- Planar FRED Chips
- 175°C Junction temperature

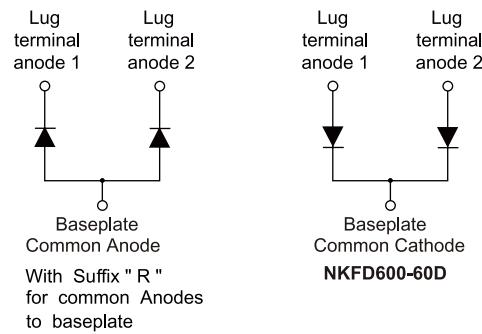
DESCRIPTION

FRED diodes are optimized to reduce losses and EMI/RFI in high frequency power conditioning systems.

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

- Power converters
- Motor drives
- Welders
- Switching power supplies
- Uninterruptible power supply (UPS)
- Power factor correction (PFC) circuit
- Inverter
- Choppers
- Battery chargers


Non-isolation


PRODUCT SUMMARY

$I_{F(AV)}$	600A
V_R	600V
$I_{F(DC)}$ at T_C	420A at 100 °C

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNIT
Cathode to anode voltage	V_R		600	V
Average forward current	$I_{F(AV)}$	$T_C = 25^\circ\text{C}$, per leg	690	A
		$T_C = 125^\circ\text{C}$ per device	600	
		per leg	300	
DC forward current	$I_{F(DC)}$	$T_C = 100^\circ\text{C}$	420	
Single pulse forward current	I_{FSM}	Limited by junction temperature, per leg	3000	
Non-repetitive avalanche energy	E_{AS}	$L = 100 \mu\text{H}$, duty cycle limited by maximum T_J	2.2	mJ
Maximum power dissipation per leg	P_D	$T_C = 25^\circ\text{C}$	1500	W
Operating junction and storage temperature range	T_J, T_{Stg}		- 55 to 175	°C

ELECTRICAL SPECIFICATIONS ($T_J = 25^\circ\text{C}$ unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Cathode to anode breakdown voltage	V_{BR}	$I_R = 100 \mu\text{A}$		600	-	-	
Maximum forward voltage	V_{FM}	$I_F = 300 \text{ A}$		-	1.25	1.40	V
		$I_F = 600 \text{ A}$		-	-	1.70	
		$I_F = 300 \text{ A}, T_J = 125^\circ\text{C}$		-	-	1.30	
Maximum reverse leakage current per leg	I_{RM}	$T_J = 125^\circ\text{C}, V_R = 600\text{V}$		-	0.3	2.5	mA
		$T_J = 25^\circ\text{C}, V_R = 600\text{V}$		-	1.0	10.0	μA
Junction capacitance	C_T	$V_R = 200\text{V}$		-	500	700	pF
Series inductance	L_S	From top of terminal hole to mounting plane		-	4.4	-	nH

DYNAMIC RECOVERY CHARACTERISTICS PER LEG ($T_J = 25^\circ\text{C}$ unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Reverse recovery time	t_{rr}	$I_F = 0.5\text{A}, I_R = 1.0\text{A}, I_{RR} = 0.25\text{A}$		-	160	180	ns
		$I_F = 1.0\text{A}, dI_F/dt = 200\text{A}/\mu\text{s}, V_R = 30\text{V}$		-	60	-	
		$T_J = 25^\circ\text{C}$		-	120	-	
		$T_J = 125^\circ\text{C}$		-	350	-	
Peak recovery current	I_{RRM}	$T_J = 25^\circ\text{C}$		-	16.5	-	A
		$T_J = 125^\circ\text{C}$		-	23	-	
Reverse recovery charge	Q_{rr}	$T_J = 25^\circ\text{C}$		-	-	2800	nC
		$T_J = 125^\circ\text{C}$		-	-	5800	

THERMAL AND MECHANICAL SPECIFICATIONS							
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT		
Maximum junction and storage temperature range	T_J, T_{stg}	-55	-	175	$^\circ\text{C}$		
Thermal resistance, junction to case per leg	R_{thJC}	-	-	0.10			
Thermal resistance, junction to case per module	R_{thJC}	-	-	0.05	$^\circ\text{C/W}$		
Typical thermal resistance, case to heatsink	R_{thCS}	-	0.08	-			
Weight		-	80 (2.82)	-	g (oz.)		
Mounting torque ⁽¹⁾ , M6		-	44.2 (5)	53.1 (6)	(N·m) lbf·in		
Terminal torque, M6		-	44.2 (5)	53.1 (6)			
Vertical pull		-	-	80	lbf·in		
2" lever pull		-	-	35			

Note

(1)Mounting surface must be smooth, flat, free of burrs or other protrusions. Apply a thin even film or thermal grease to mounting surface.

Gradually tighten each mounting bolt in 5 to 10 lbf. in steps until desired or maximum torque limits are reached.

Ordering Information Table

Device code

NK	F	D	600	-	60	R	D
1	2	3	4		5	6	7

- [1] - Nell's power module
- [2] - F for Ultrafast soft recovery diode (FRED)
- [3] - D for Dual Diodes
- [4] - Maximum average forward current, A
- [5] - Voltage rating (60 = 600V)
- [6] - None for common cathode configuration
"R" for common anode configuration
- [7] - Package type

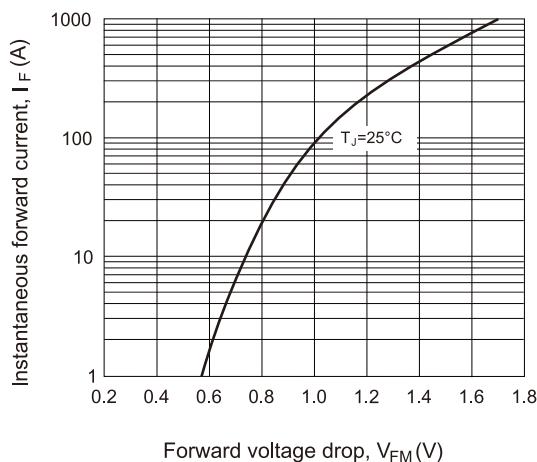
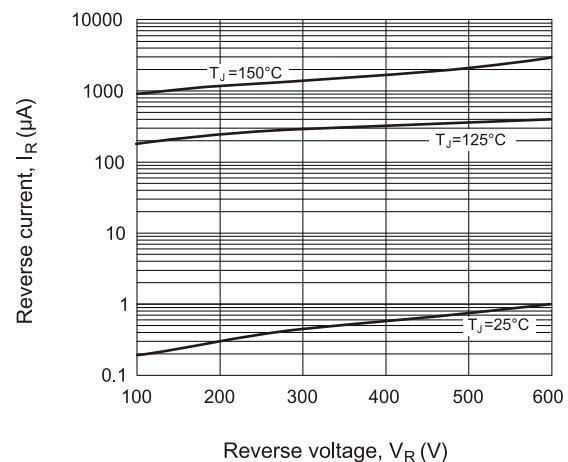
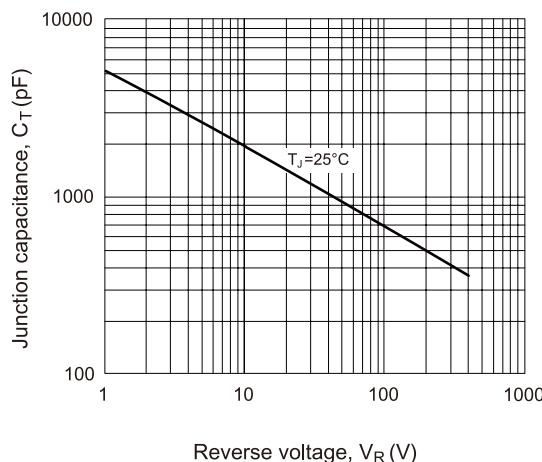
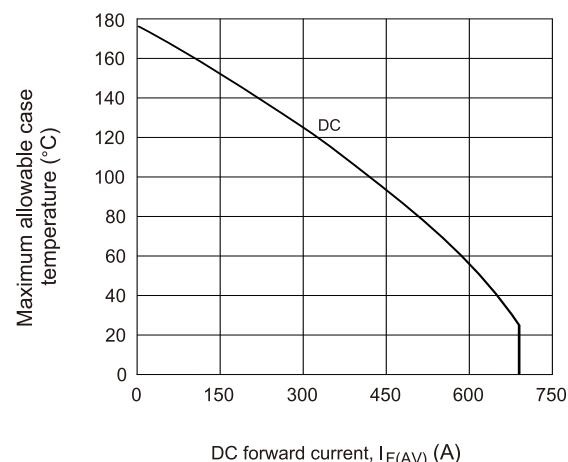
Fig.1 Typical forward voltage drop vs. Instantaneous forward current (per leg)

Fig.2 Typical reverse current vs. reverse voltage (per leg)

Fig.3 Typical junction capacitance vs. reverse voltage (per leg)

Fig.4 Maximum allowable case temperature vs. forward current (per leg)


Fig.5 Typical reverse recovery time vs. dI_F/dt (per leg)

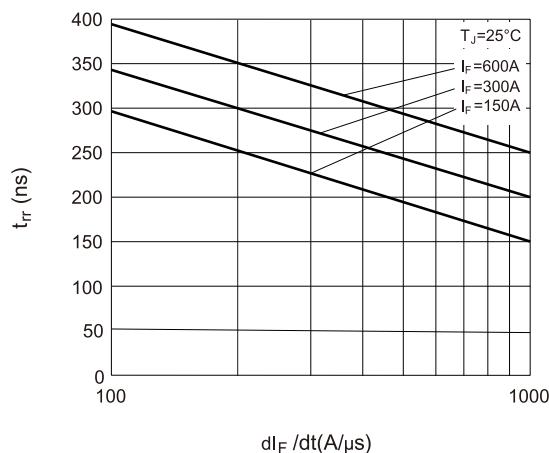


Fig.6 Maximum thermal impedance $R_{th(j-c)}$ characteristics (Per leg)

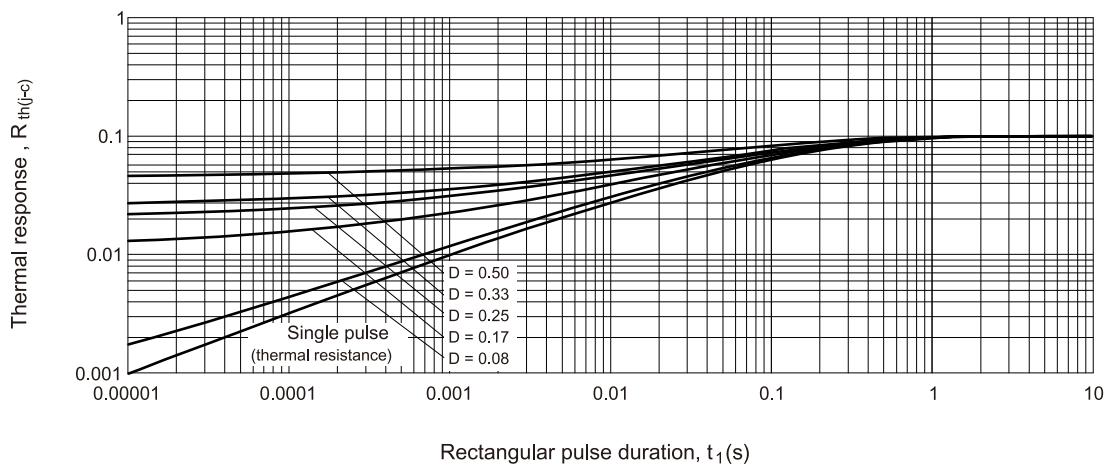


Fig.7 Reverse recovery parameter test circuit

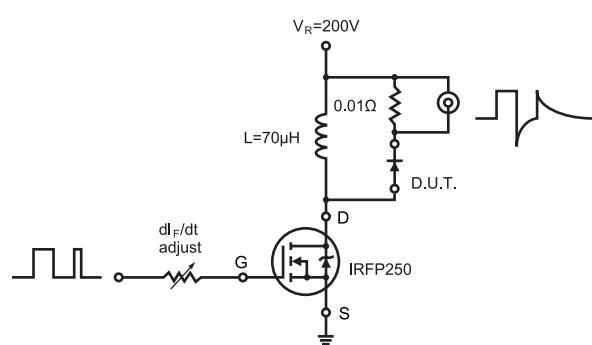
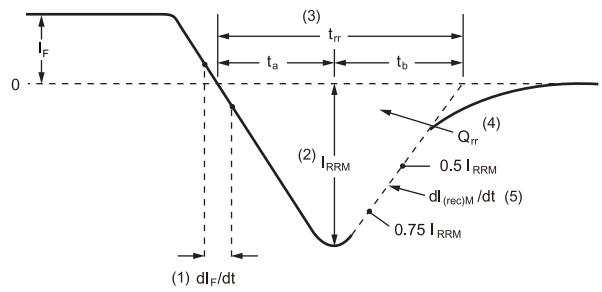


Fig.08 Reverse recovery waveform and definitions


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

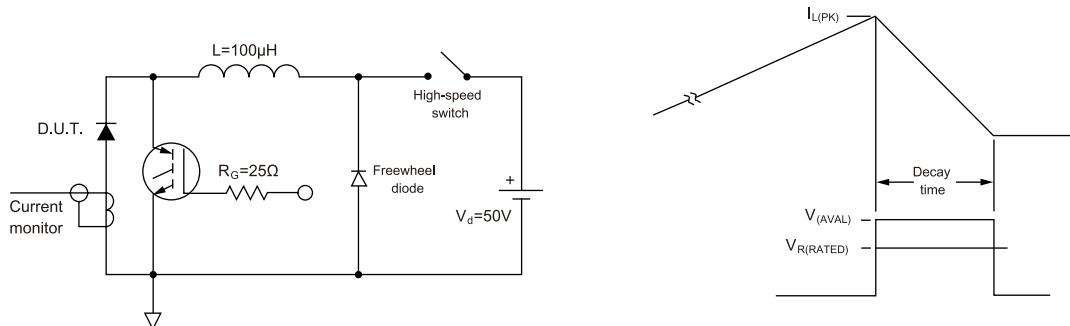
(4) Q_{rr} - area under curve defined by t_{rr} and I_{RRM}

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

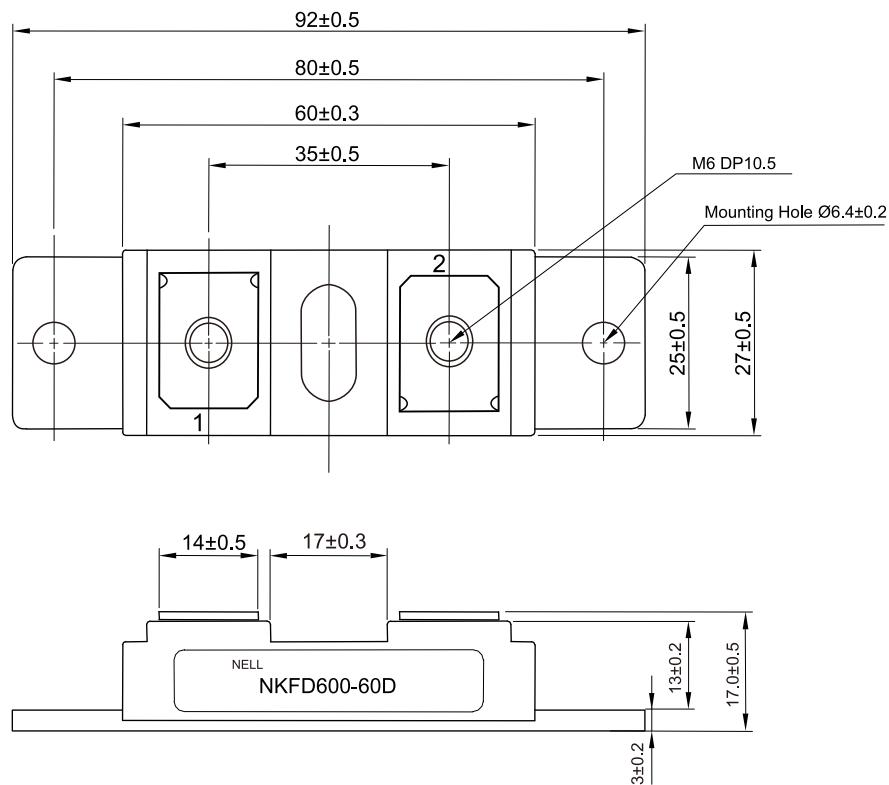
$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

(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.

(5) $dI_{(rec)M}/dt$ - peak rate of change of current during t_b portion of t_{rr}

Fig.09 Avalanche test circuit and waveforms


Package outline



All dimensions in millimeters