FRED
Ultrafast Soft Recovery Diode, 15 A

FEATURES

- Ultrafast and ultrasoft recovery
- Very low I_{RRM} and Q_{rr}
- Compliant to RoHS
- Designed and qualified for industrial level

BENEFITS

- Reduced RFI and EMI
- Reduced power loss in diode and switching transistor
- Higher frequency operation
- Reduced snubbing
- Reduced parts count

DESCRIPTION

HFA15PB60 is a state of the art ultrafast recovery diode. Employing the latest in epitaxial construction and advanced processing techniques it features a superb combination of characteristics which result in performance which is unsurpassed by any rectifier previously available. With basic ratings of 600V and 15 A continuous current, the HFA15PB60 is especially well suited for use as the companion diode for IGBTs and MOSFETs. In addition to ultrafast recovery time, the FRED product line features extremely low values of peak recovery current (I_{RRM}) and does not exhibit any tendency to "snap-off" during the t_b portion of recovery. The FRED features combine to offer designers a rectifier with lower noise and significantly lower switching losses in both the diode and the switching transistor. These FRED advantages can help to significantly reduce snubbing, component count and heatsink sizes. The FRED HFA15PB60 is ideally suited for applications in power supplies and power conversion systems (such as inverters), motor drives, and many other similar applications where high speed, high efficiency is needed.

TO-247 AC modified

Base
common
cathode

○ 2

○ 1   ○ 3
Cathode   Anode
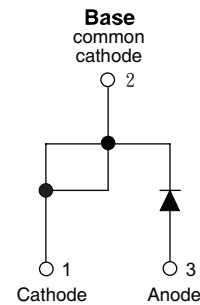
PRODUCT SUMMARY	
Package	TO-247AC modified (2 pins)
$I_{F(AV)}$	15A
V_R	600 V
V_F at I_F	1.7 V
t_{rr} (typ.)	19 ns
T_J max.	150ºC
Diode variation	Single die

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**VALUES**	**UNITS**
Cathode to anode voltage	V_R		600	V
Maximum continuous forward current	I_F	$T_C = 100$ ºC	15	
Single pulse forward current	I_{FSM}		150	A
Maximum repetitive forward current	I_{FRM}		60	
Maximum power dissipation	P_D	$T_C = 25$ ºC	74	W
		$T_C = 100$ ºC	29	
Operating junction and storage temperature range	T_J, T_{Stg}		- 55 to + 150	ºC

ELECTRICAL SPECIFICATIONS (T_J = 25 ºC unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Cathode to anode breakdown voltage	V_{BR}	I_R = 100 µA	600	-	-	V
Maximum forward voltage	V_{FM}	I_F = 15 A	-	1.55	1.7	
		I_F = 30 A	-	1.80	2.0	
		I_F = 15 A, T_J = 125 ºC	-	1.40	1.6	
Maximum reverse leakage current	I_{RM}	V_R = V_R rated	-	1.0	10	µA
		T_J = 125°C, V_R = V_R rated	-	400	1000	
Junction capacitance	C_T	V_R = 200V	-	25	50	pF
Series inductance	L_S	Measured lead to lead 5 mm from package body	-	12	-	nH

DYNAMIC RECOVERY CHARACTERISTICS PERLEG (T_J = 25 ºC unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS
Reverse recovery time	t_{rr}	I_F = 0.5A, I_R = 1.0A, I_{RR} = 250mA (RG#1 CKT)		-	22	30	ns
		I_F = 1.0 A, dI_F/dt = -200 A/µs, V_R =30 V, T_J = 25°C		-	19	-	
	t_{rr1}	T_J = 25 ºC	I_F= 15A dI_F/dt = -200 A/µs V_R = 200 V	-	42	60	
	t_{rr2}	T_J = 125 ºC		-	74	120	
Peak recovery current	I_{RRM1}	T_J = 25 ºC		-	4.0	6.0	A
	I_{RRM2}	T_J = 125 ºC		-	6.5	10	
Reverse recovery charge	Q_{rr1}	T_J = 25 ºC		-	80	180	nC
	Q_{rr2}	T_J = 125 ºC		-	220	600	
Peak rate of fall of recovery current during t_b	$dI_{(rec)M}/dt1$	T_J = 25 ºC		-	188	-	A/µs
	$dI_{(rec)M}/dt2$	T_J = 125 ºC		-	160	-	

THERMAL - MECHANICAL SPECIFICATIONS PER LEG

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Lead temperature	T_{lead}	0.063" from case (1.6 mm) for 10 s	–		300	°C
Junction to case, single leg conduction	R_{thJC}		-	-	1.7	K/W
Junction to case, both legs conducting			-	-	40	
Thermal resistance, junction to ambient	R_{thJA}	Typical socket mount	–		40	
Thermal resistance, case to heatsink	R_{thCS}	Mounting surface, flat, smooth and greased	-	0.25	-	
Weight			-	6.0	-	g
			-	0.21	-	oz.
Mounting torque			6.0 (5.0)	-	12 (10)	kgf . cm (lbf . in)
Marking device		Case style TO-247AC (JEDEC)		HFA15PA60		

Fig.1 **Maximum forward voltage drop vs**.
Instantaneous forward current

Instantaneous forward current (A), I_F

Forward voltage drop (V), V_{FM}

T_J = 150 °C
T_J = 125 °C
T_J = 25 °C
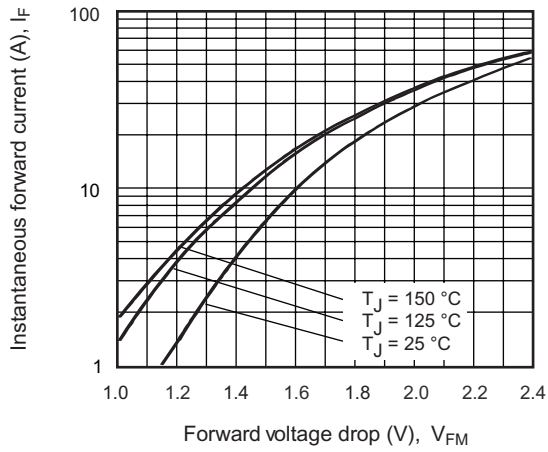
Fig.2 **Typical reverse current vs**. **reverse voltage**

Reverse current (µA), I_R

Reverse voltage (V), V_R

T_J = 150 °C
T_J = 125 °C
T_J = 25 °C
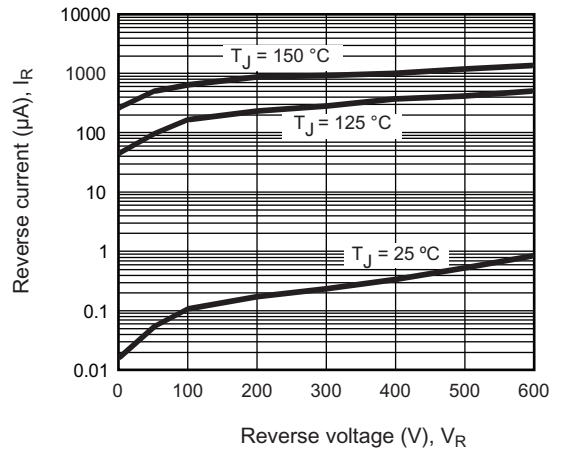
Fig.3 **Typical junction capacitance vs**. **reverse voltage**

Junction capacitance (pF), C_T

Reverse voltage (V), V_R

T_J = 25 °C
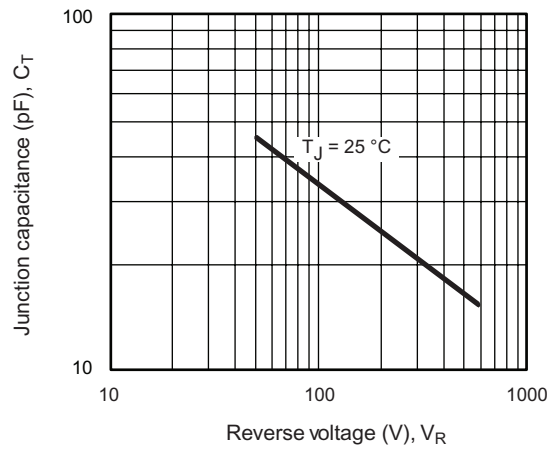
Fig.4 **Maximum thermal Impedance Z_{thJC} characteristics**

Thermal response, Z_{thJC}

Rectangular pulse duration (sec), t_1

D = 0.50
D = 0.20
D = 0.10
D = 0.05
D = 0.02
D = 0.01

Single pulse
(thermal response)

P_{DM}

t_1

t_2

Notes：

1. Duty factor D = t1/ t 2

2. Peak T = Pdm x ZthJC + Tc

Fig.5 **Typical reverse recovery time vs. dl$_F$/dt**
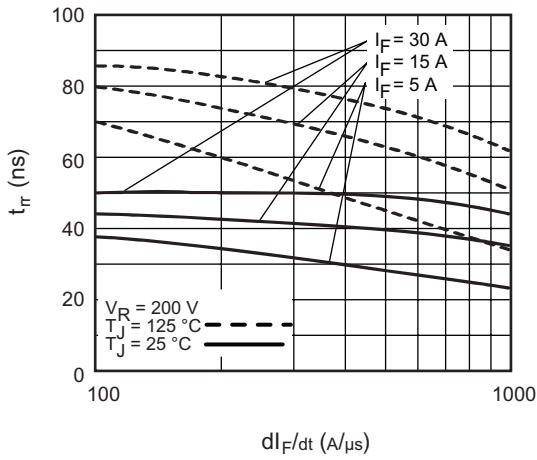

Fig.6 **Typical recovery current vs. dl$_F$/dt**
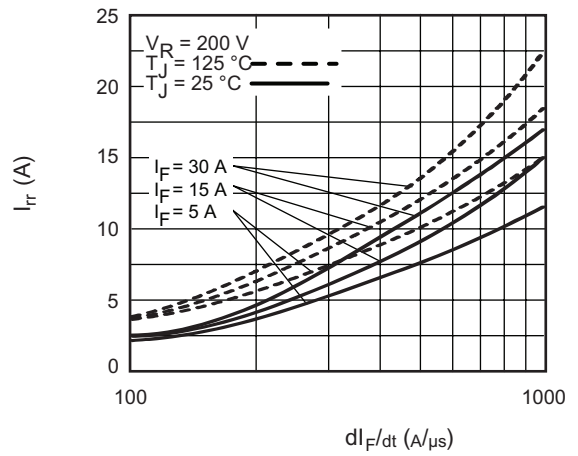

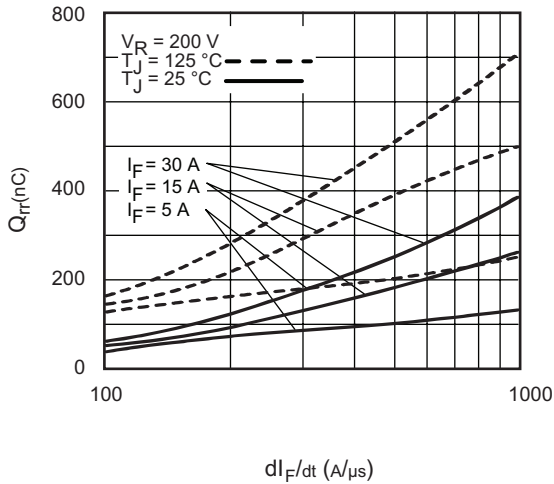Fig.7 **Typical Stored Charge vs. dl$_F$/dtl**

Fig.8 **Typical dl$_{(rec)M}$/dt vs. dl$_F$/dt**
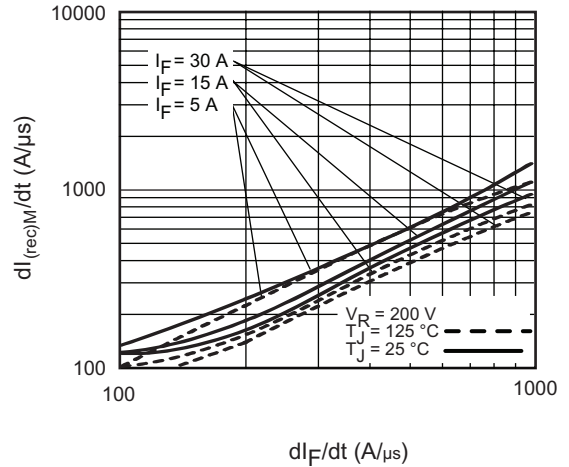
Fig.9 Reverse recovery parameter test circuit
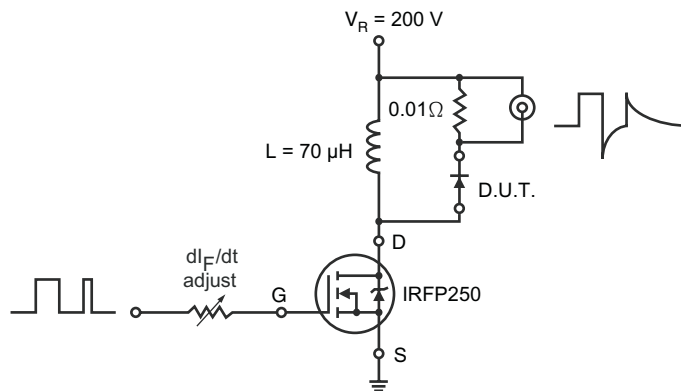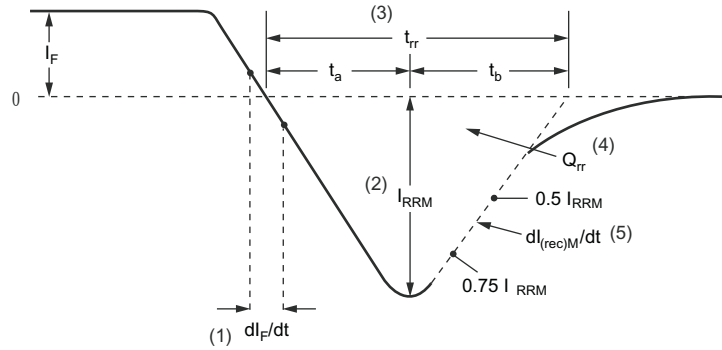
Nell High Power Products

Fig.10 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}

ORDERING INFORMATION TABLE

Device code	N	–	HFA	15	PB	60
	①		②	③	④	⑤

1	-	Nell Semiconductors product
2	-	FRED family
3	-	Current rating (15 =15A)
4	-	PB = TO-247AC modified
5	-	Voltage rating: (60 = 600 V)

Outine Table

N-HFA15PB60
2 pins

CATHODE TO BASE

2 CATHODE

1 CATHODE   3 ANODE

15.90 (0.626)
15.30 (0.602)

3.65 (0.144)
3.55 (0.139) DIA.

20.30 (0.800)
19.70 (0.775)

5.70 (0.225)
5.30 (0.208)

5.50 (0.217)
4.50 (0.177)
(2 PLCS.)

14.80 (0.583)
14.20 (0.559)

4.30 (0.170)
3.70 (0.145)

1.40 (0.056)
1.00 (0.039)

2.20 (0.087)
MAX.

10.94 (0.430)
10.86 (0.427)

5.30 (0.209)
4.70 (0.185)

2.5 (0.098)
1.5 (0.059)

2.40 (0.095)
MAX.

0.80 (0.032)
0.40 (0.213)

Conforms to JEDEC Outline TO-247AC (Modified)
Dimensions in millimeters and (inches)