FRED
Ultrafast Soft Recovery Diode, 16 A

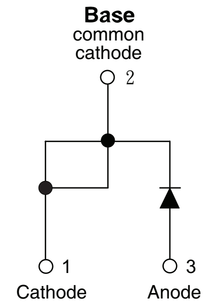
FEATURES

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

TO-247 AC modified

BENEFITS

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



DESCRIPTION

HFA16PB60 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 16 A continuous current, the HFA16PB60 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 (IRRM) and does not exhibit any tendency to “snap-off” during the tb 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 HFA16PB60 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.

PRODUCT SUMMARY	
Package	TO-247AC modified (2 pins)
$I_{F(AV)}$	16A
V_R	600 V
V_F at I_F	1.75 V
t_{rr} (typ.)	19 ns
T_J max.	150°C
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 °C	16	A
Single pulse forward current	I_{FSM}		150	
Maximum repetitive forward current	I_{FRM}		60	
Maximum power dissipation	P_D	T_C = 25 °C	74	W
		T_C = 100 °C	29	
Operating junction and storage temperature range	T_J, T_{Stg}		- 55 to + 150	°C

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 = 16 A	-	1.60	1.75	V
		I_F = 32 A	-	1.85	2.0	V
		I_F = 16 A, T_J = 125 ºC	-	1.45	1.65	V
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	µA
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	-	ns
	t_{rr1}	T_J = 25 ºC	I_F= 16A, dI_F/dt = -200 A/µs, V_R = 200 V	-	42	60	ns
	t_{rr2}	T_J = 125 ºC		-	74	120	ns
Peak recovery current	I_{RRM1}	T_J = 25 ºC		-	4.0	6.0	A
	I_{RRM2}	T_J = 125 ºC		-	6.5	10	A
Reverse recovery charge	Q_{rr1}	T_J = 25 ºC		-	80	180	nC
	Q_{rr2}	T_J = 125 ºC		-	220	600	nC
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	-	A/µs

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	R_{thJC}		-	-	40	K/W
Thermal resistance, junction to ambient	R_{thJA}	Typical socket mount	–		40	K/W
Thermal resistance, case to heatsink	R_{thCS}	Mounting surface, flat, smooth and greased	-	0.25	-	K/W
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)	HFA16PA60			

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

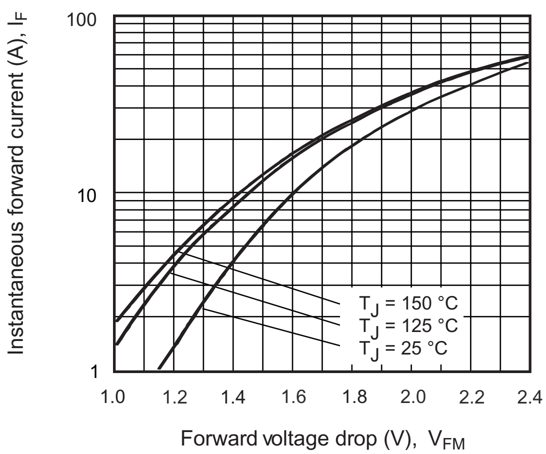


Fig.2 Typical reverse current vs. reverse voltage

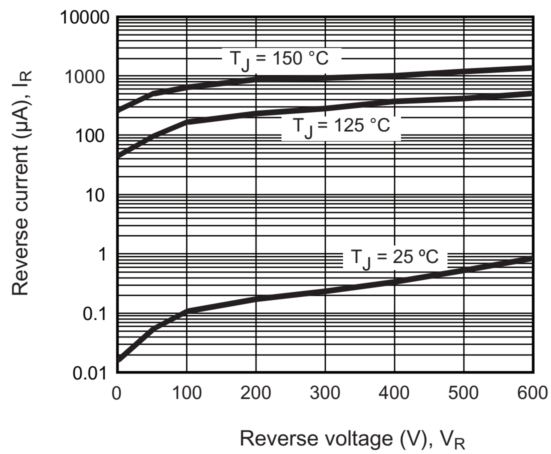


Fig.3 Typical junction capacitance vs. reverse voltage

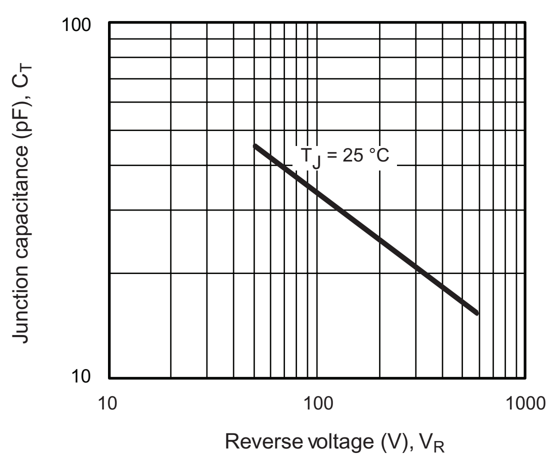


Fig.4 Maximum thermal Impedance Z_{thJC} characteristics

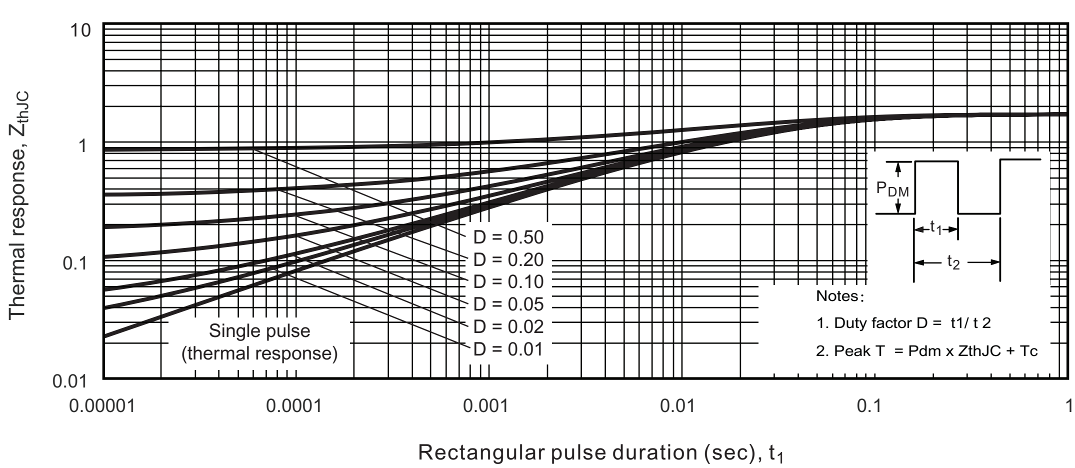


Fig.5 Typical reverse recovery time vs. dI_F/dt

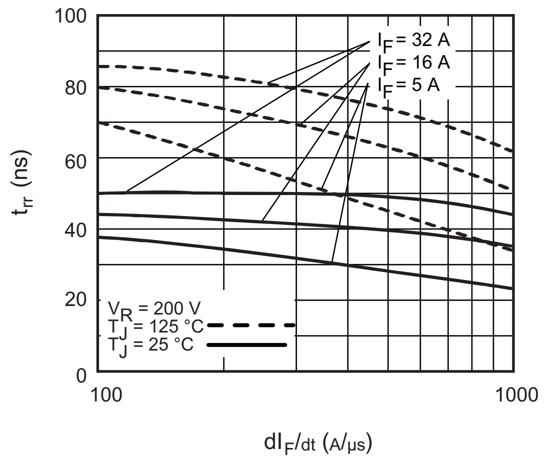


Fig.6 Typical recovery current vs. dI_F/dt

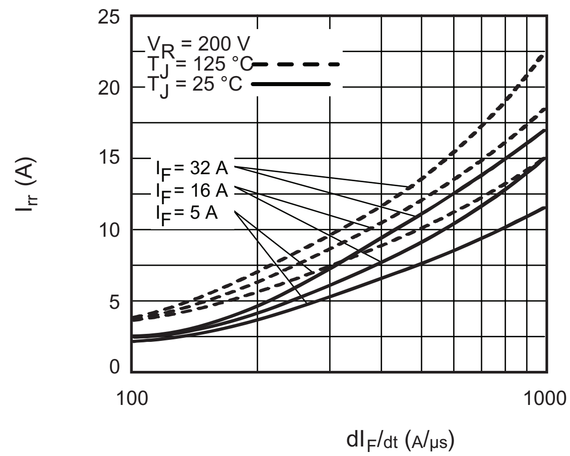


Fig.7 Typical Stored Charge vs. dI_F/dtl

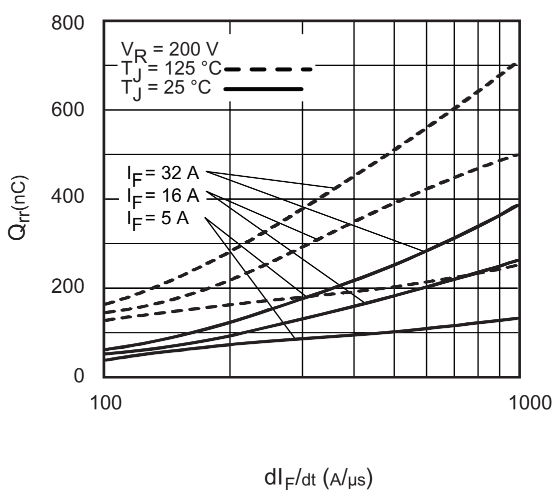


Fig.8 Typical $dI_{(rec)M}/dt$ vs. dI_F/dt

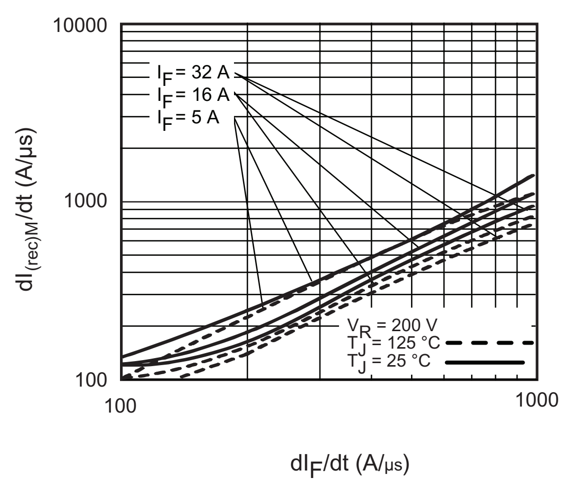


Fig.9 Reverse recovery parameter test circuit

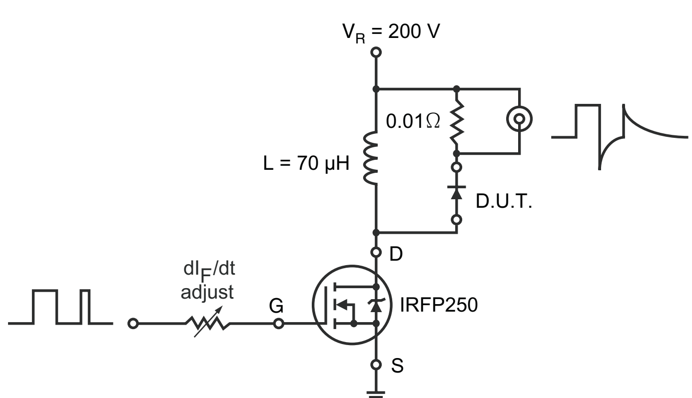
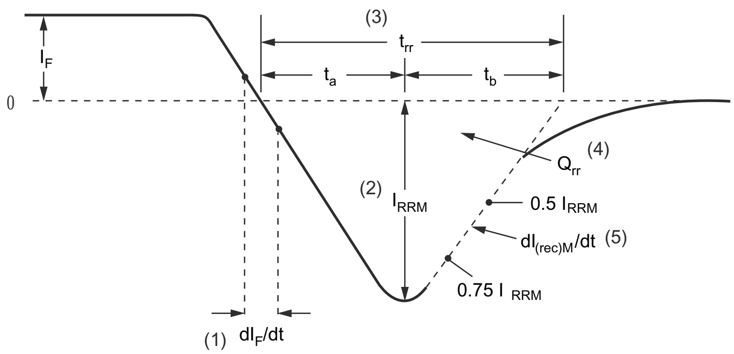


Fig.10 Reverse recovery waveform and definitions



(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}

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

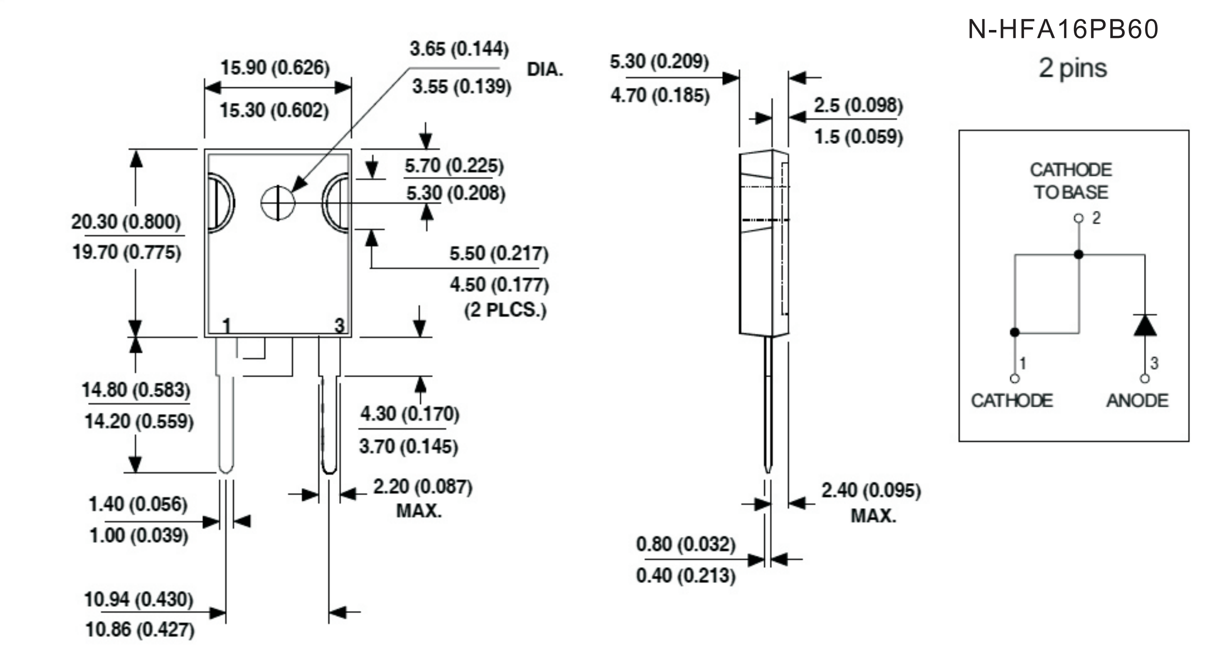
(5) $dI_{(rec)M}/dt$ - peak rate of change of current during t_b portion of t_{rr}

ORDERING INFORMATION TABLE

Device code	N	–	HFA	16	PB	60
	1		2	3	4	5

1 - Nell Semiconductors product
2 - FRED family
3 - Current rating (16 =16A)
4 - PB = TO-247AC modified
5 - Voltage rating: (60 = 600 V)

Outine Table



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