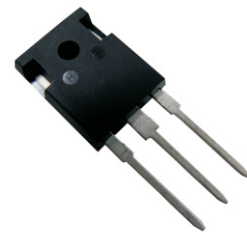


## FRED Ultrafast Soft Recovery Diode 2 x 15A / 400V

### FEATURES

- Ultrafast recovery time
- Very low leakage current
- Very low  $Q_{rr}$
- Specified at operating conditions
- Designed and qualified for industrial level
- Planar FRED Chip
- 175°C operating junction temperature



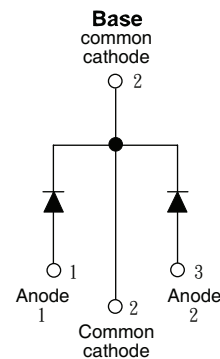
TO-247 AB

### BENEFITS

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

### DESCRIPTION

HFA30PA40C is a state of the art center tap 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 400V and 15A per leg continuous current, the HFA30PA40C 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 HFA30PA40C is ideally suited for applications in power conversion systems (such as inverters), motor drives, and many other similar applications where high speed, high efficiency is needed.



PRODUCT SUMMARY	
$V_R$	400 V
$V_F$ at 15A at 25 °C	1.3 V
$I_{F(AV)}$	2 x 15 A
$t_{rr}$ (typical)	19 ns
$T_J$ (maximum)	175 °C
$Q_{rr}$ (typical)	60 nC
$I_{RRM}$ (typical)	3.0 A

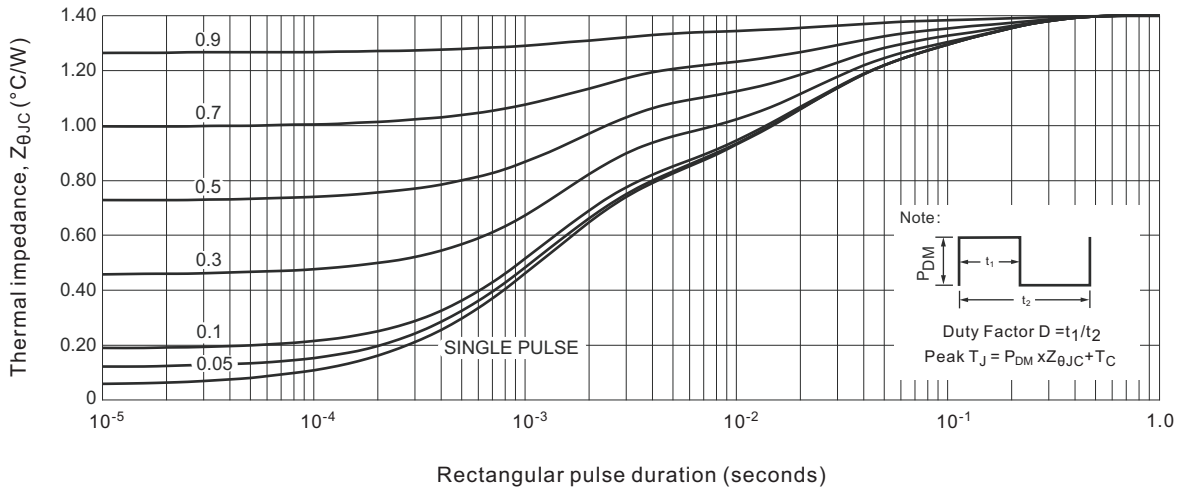
ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Cathode to anode voltage	$V_R$		400	V
Maximum continuous forward current	$I_F$	$T_C = 140\text{ °C}$	15	A
per leg			30	
per device			150	
Single pulse forward current	$I_{FSM}$		150	
Maximum repetitive forward current	$I_{FRM}$	$T_C = 140\text{ °C}$ , square wave, 20KHz	30	
Operating junction and storage temperature range	$T_J, T_{Stg}$		- 55 to + 175	°C

ELECTRICAL SPECIFICATIONS (T <sub>J</sub> = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Cathode to anode breakdown voltage	V <sub>BR</sub>	I <sub>R</sub> = 100 μA	400	-	-	V
Maximum forward voltage	V <sub>FM</sub>	I <sub>F</sub> = 15 A	-	1.15	1.3	
		I <sub>F</sub> = 30 A	-	-	1.6	
		I <sub>F</sub> = 15 A, T <sub>J</sub> = 125 °C	-	1.0	-	
Maximum reverse leakage current	I <sub>RM</sub>	V <sub>R</sub> = V <sub>R</sub> rated	-	0.5	10	μA
		T <sub>J</sub> = 125 °C, V <sub>R</sub> = V <sub>R</sub> rated	-	-	500	
Junction capacitance	C <sub>T</sub>	V <sub>R</sub> = 200V	-	33	50	pF
Series inductance	L <sub>S</sub>	Measured lead to lead 5 mm from package body	-	12	-	nH

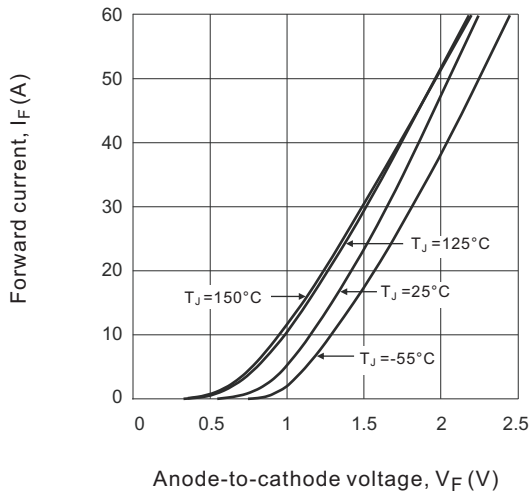
DYNAMIC RECOVERY CHARACTERISTICS PER LEG (T <sub>J</sub> = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 0.5A, I <sub>R</sub> = 1.0A, I <sub>RR</sub> = 0.25A (RG#1 CKT)	-	22	27	ns
		I <sub>F</sub> = 1.0 A, di <sub>F</sub> /dt = 100 A/μs, V <sub>R</sub> = 30 V, T <sub>J</sub> = 25 °C	-	19	-	
	t <sub>rr1</sub>	T <sub>J</sub> = 25 °C	-	35	60	
	t <sub>rr2</sub>	T <sub>J</sub> = 125 °C	-	95	120	
Peak recovery current	I <sub>RRM1</sub>	T <sub>J</sub> = 25 °C	-	3	6.0	A
	I <sub>RRM2</sub>	T <sub>J</sub> = 125 °C	-	6	10	
Reverse recovery charge	Q <sub>rr1</sub>	T <sub>J</sub> = 25 °C	-	60	180	nC
	Q <sub>rr2</sub>	T <sub>J</sub> = 125 °C	-	300	600	

THERMAL - MECHANICAL SPECIFICATIONS PER LEG						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Lead temperature	T <sub>lead</sub>	0.063" from case (1.6 mm) for 10 s	-	-	300	°C
Junction to case, single leg conduction	R <sub>thJC</sub>		-	-	1.40	K/W
Junction to case, both legs conducting			-	-	0.70	
Thermal resistance, junction to ambient	R <sub>thJA</sub>	Typical socket mount	-	-	40	
Thermal resistance, case to heatsink	R <sub>thCS</sub>	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-247AB (JEDEC)	HFA30PA40C			

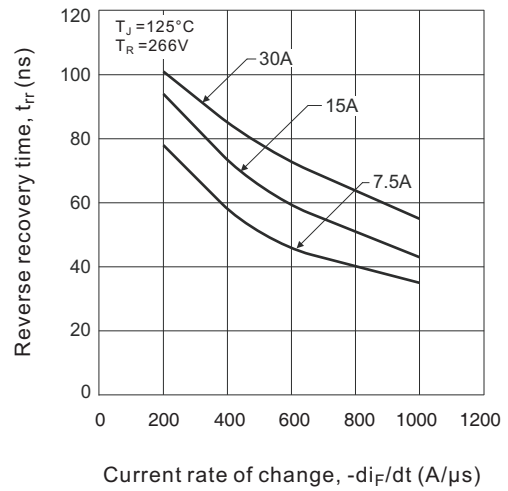
**Fig.1 Maximum effective transient thermal impedance, junction-to-case vs. pulse duration**



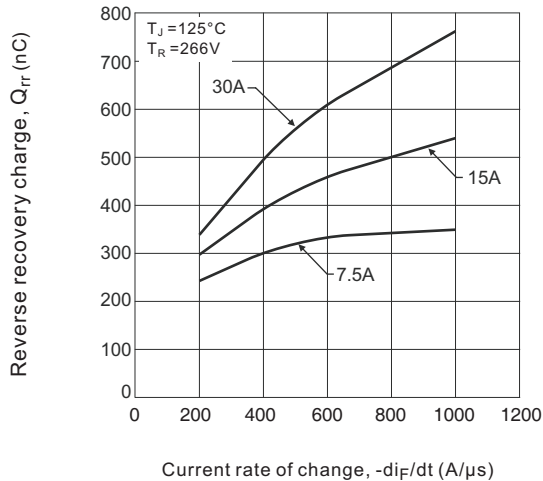
**Fig.2 Forward current vs. forward voltage**



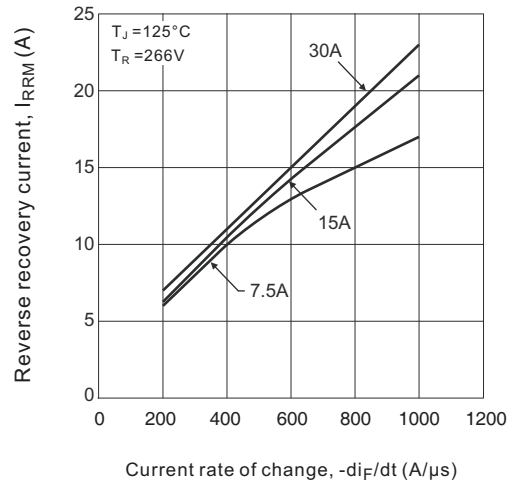
**Fig.3 Typical reverse recovery time vs. current rate of change**



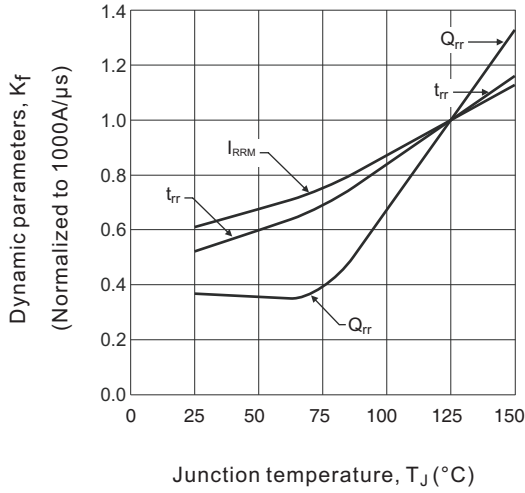
**Fig.4 Typical reverse recovery charge vs. current rate of change**



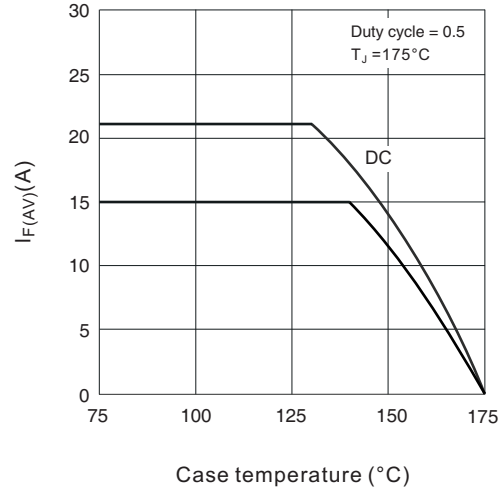
**Fig.5. Typical reverse recovery current vs. current rate of change**



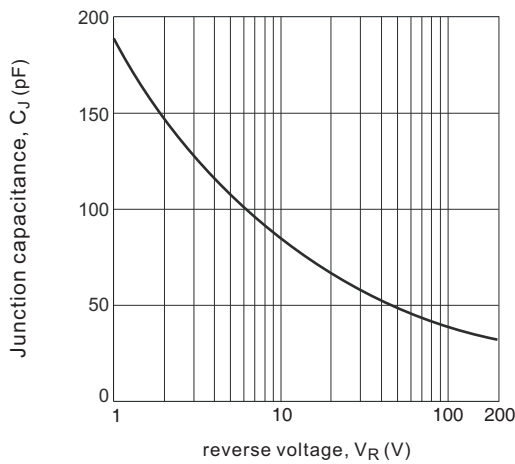
**Fig.6. Dynamic parameters vs. junction temperature**



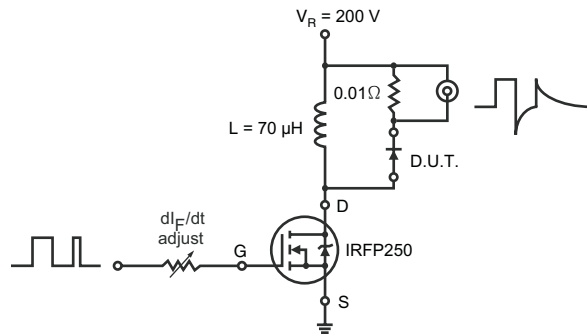
**Fig.7 Maximum average forward current vs. case temperature**



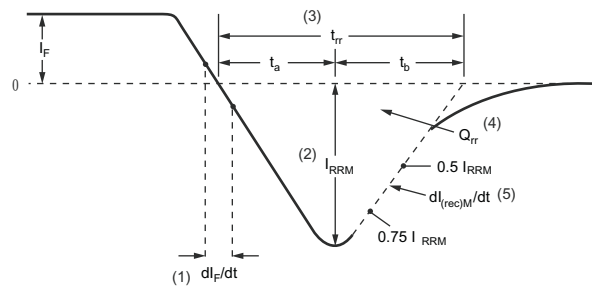
**Fig.8 Junction capacitance vs. reverse voltage**



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

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

## ORDERING INFORMATION TABLE

Device code	<b>HFA</b>	<b>30</b>	<b>PA</b>	<b>40</b>	<b>C</b>
	①	②	③	④	⑤

- ① - FRED family
- ② - Current rating (30 = 30 A, 15A x 2)
- ③ - Package outline (PA = TO-247, 3 pins)
- ④ - Voltage rating (40 = 400 V)
- ⑤ - Configuration (C = Center tap common cathode)

