

# FRED

## Ultrafast Soft Recovery Diode

### 30A/1200V



### FEATURES

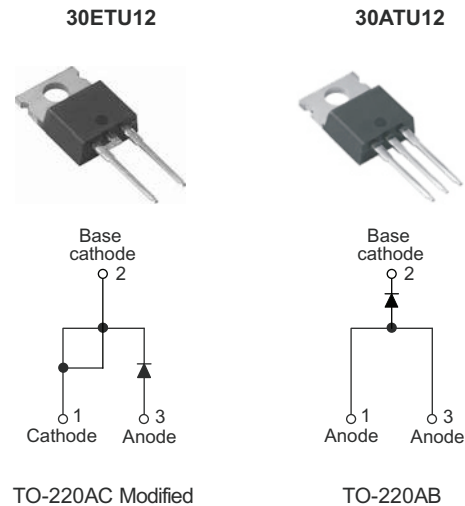
- Ultrafast recovery
- Ultrasoft recovery
- Ver low  $I_{RRM}$
- Ver low  $Q_{rr}$
- Compliant to RoHS
- Designed and qualified for industrial level
- Planar FRED Chip

### BENEFITS

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

### DESCRIPTION

30ETU12 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 1200V and 30A continuous current, the 30ETU12 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 30ETU12 is ideally suited for applications in power supplies and conversion systems (such as inverters), motor drives, and many other similar applications where high speed, high efficiency is needed.



PRODUCT SUMMARY	
$V_R$	1200 V
$V_F$ at 30A at 25 °C	2.35 V
$I_{F(AV)}$	30 A
$t_{rr}$ (typical)	38 ns
$T_J$ (maximum)	175 °C
$Q_{rr}$	545 nC

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Cathode to anode voltage	$V_R$		1200	V
Maximum continuous forward current	$I_F$	$T_C = 100\text{ °C}$	30	A
Single pulse forward current	$I_{FSM}$	$T_C = 25\text{ °C}$	280	
Maximum repetitive forward current	$I_{FRM}$		100	
Operating junction and storage temperature range	$T_J, T_{Stg}$		- 55 to 175	°C

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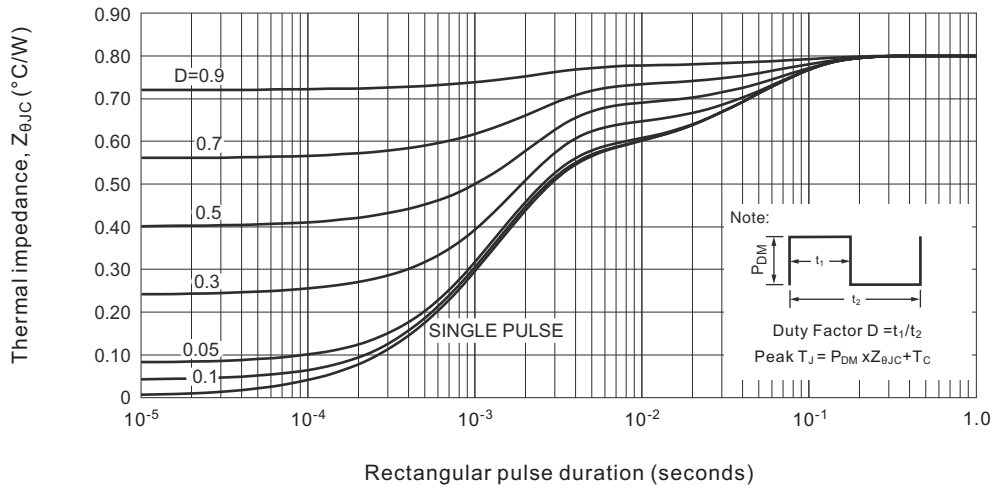
ELECTRICAL SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Cathode to anode breakdown voltage	$V_{BR}$	$I_R = 100\text{ }\mu\text{A}$	1200	-	-	V
Maximum forward voltage	$V_{FM}$	$I_F = 30\text{ A}$	-	1.95	2.35	
		$I_F = 60\text{ A}$	-	2.60	-	
Maximum reverse leakage current	$I_{RM}$	$V_R = V_R\text{ rated}$	-	1.0	10	$\mu\text{A}$
		$T_J = 150\text{ }^\circ\text{C}$ , $V_R = V_R\text{ rated}$	-	-	500	
Junction capacitance	$C_T$	$V_R = 200\text{ V}$	-	36	-	pF
Series inductance	$L_S$	Measured lead to lead 5 mm from package body	-	8	-	nH

DYNAMIC RECOVERY CHARACTERISTICS PERLEG ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS	
Reverse recovery time	$t_{rr}$	$I_F = 0.5\text{ A}$ , $I_R = 1.0\text{ A}$ , $I_{RR} = 0.25\text{ A}$ (RG#1 CKT)	-	52	60	ns	
		$I_F = 1.0\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$ , $T_J = 25\text{ }^\circ\text{C}$	-	38	-		
	$t_{rr1}$	$T_J = 25\text{ }^\circ\text{C}$	$I_F = 30\text{ A}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ $V_R = 800\text{ V}$	-	320		-
$t_{rr2}$	$T_J = 125\text{ }^\circ\text{C}$	-		435	-		
Peak recovery current	$I_{RRM1}$	$T_J = 25\text{ }^\circ\text{C}$		-	4	-	A
	$I_{RRM2}$	$T_J = 125\text{ }^\circ\text{C}$		-	9	-	
Reverse recovery charge	$Q_{rr1}$	$T_J = 25\text{ }^\circ\text{C}$		-	545	-	nC
	$Q_{rr2}$	$T_J = 125\text{ }^\circ\text{C}$		-	2100	-	

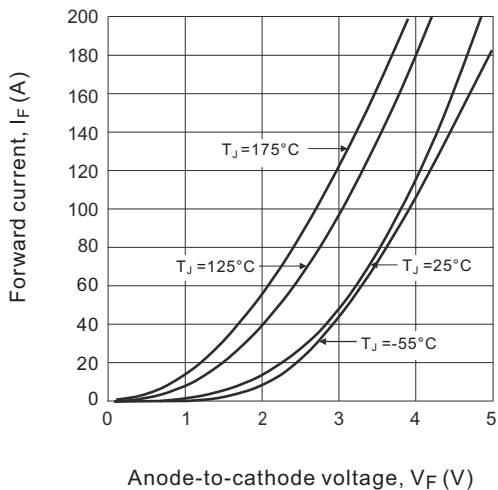
THERMAL - MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Lead temperature	$T_{lead}$	0.063" from case (1.6 mm) for 10 s	-	-	300	$^\circ\text{C}$
Thermal resistance, junction to case	$R_{thJC}$		-	0.5	0.8	K/W
Thermal resistance, junction to ambient	$R_{thJA}$	Typical socket mount	-	-	80	
Thermal resistance, case to heatsink	$R_{thCS}$	Mounting surface, flat, smooth and gered	-	0.4	-	
Weight			-	2	-	g
			-	0.07	-	oz.
Mounting torque			6 (5)	-	12 (10)	kgf . cm (lb . in)
Marking device		Case style TO-220AC Modified	30ETU12			
		Case style TO-220AB	30ATU12			

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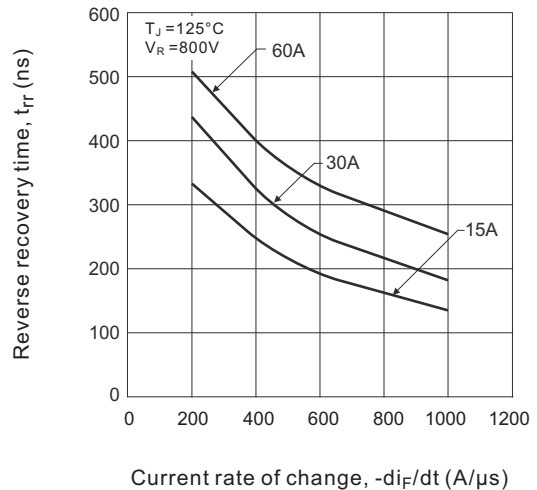
**Fig.1 Maximum effective transient thermal impedance, junction-to-case vs. pulse duration**



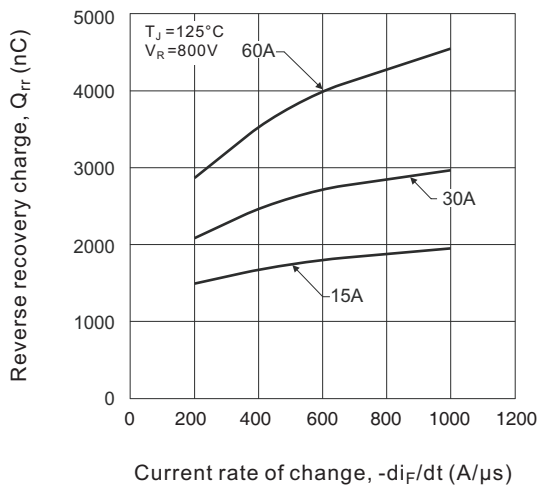
**Fig.2 Forward current vs. forward voltage**



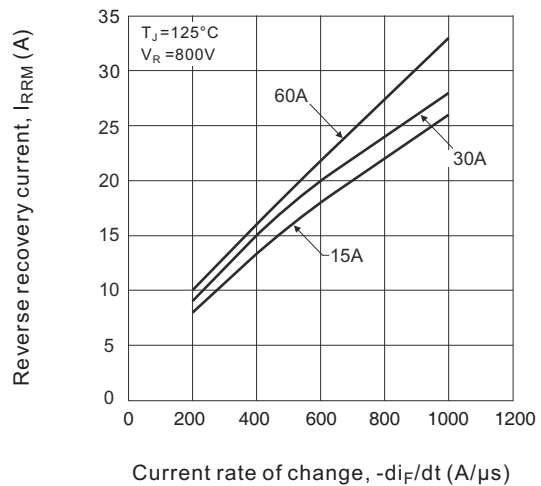
**Fig.3 Reverse recovery time vs. current rate of change**



**Fig.4 Reverse recovery charge vs. current rate of change**

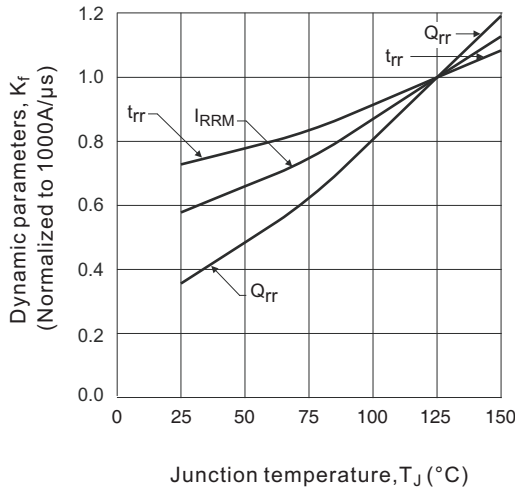


**Fig 5. Reverse recovery current vs. current rate of change**

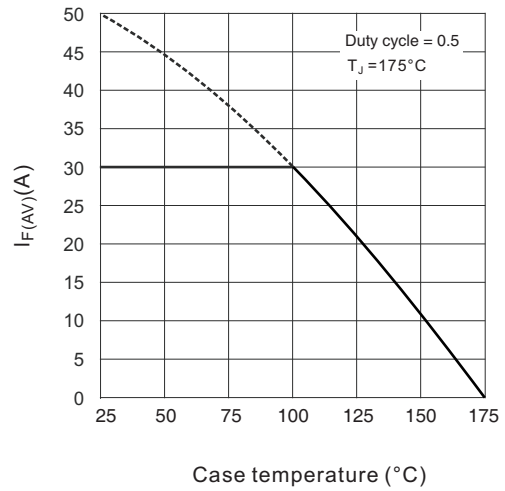


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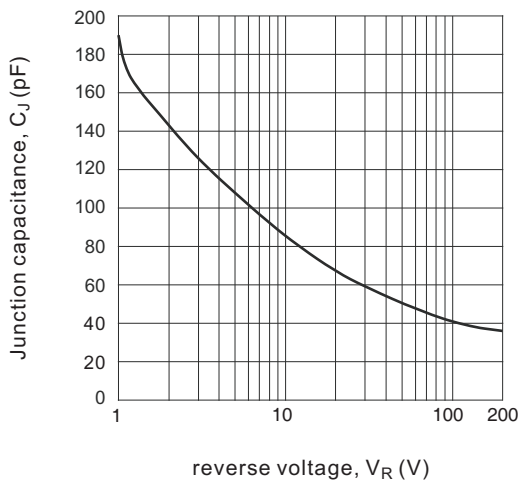
**Fig.6. Dynamic parameters vs. junction temperature**



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

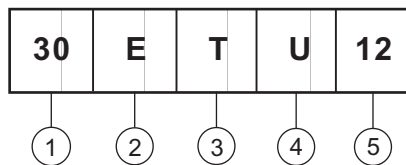


**Fig.8 Junction capacitance vs. reverse voltage**



### Ordering Information Table

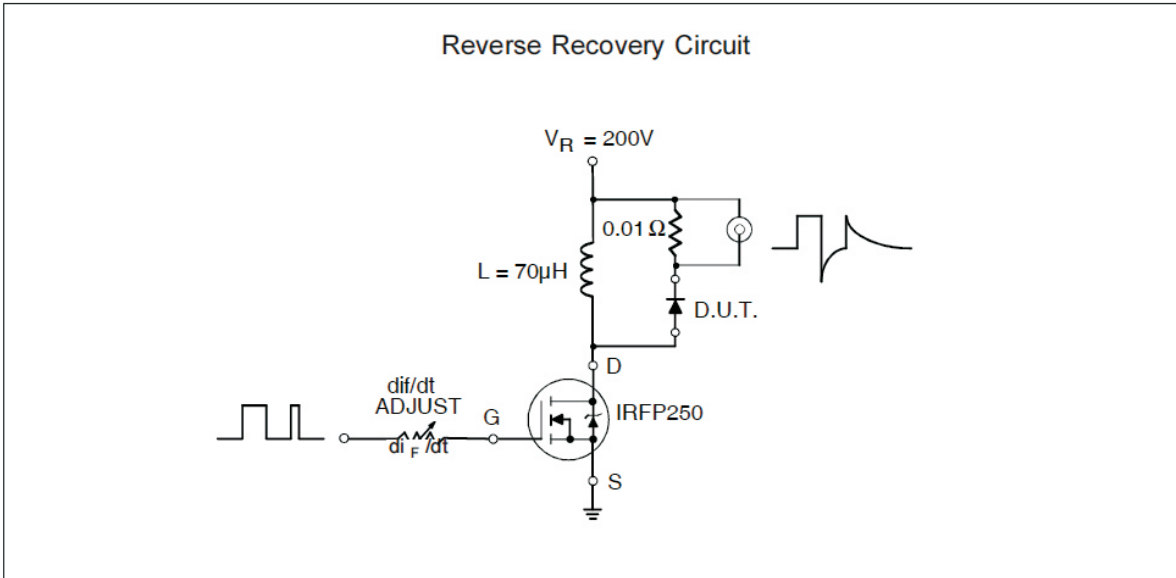
Device code



- 1 - Current rating (30 = 30A)
- 2 - Single Diode
- 3 - TO-220AB or TO-220AC Modified
- 4 - Ultrafast Recovery
- 5 - Voltage Rating (12 = 1200 V)

E = 2 pins  
A = 3 pins

Fig.9 Reverse recovery parameter test circuit



(3) Formula used:  $T_c = T_j - (P_d + P_{d_{REV}}) \times R_{thJC}$  ;

$P_d$  = Forward Power Loss =  $I_{F(AV)} \times V_{FM} @ (I_{F(AV)} / D)$  (see Fig. 6);

$P_{d_{REV}}$  = Inverse Power Loss =  $V_{R1} \times I_R (1 - D)$ ;  $I_R @ V_{R1} = 80\%$  rated  $V_R$

Fig.10 Reverse recovery waveform and definitions

