Bulletin PD-21080 08/05

International
IOR Rectifier

60EPU04PbF
60APU04PbF

Ultrafast Soft Recovery Diode

t_{rr} = 50ns (typ)
$I_{F(AV)}$ = 60Amp
V_R = 400V

Features
- Ultrafast Recovery
- 175°C Operating Junction Temperature
- Lead-Free ("PbF" suffix)

Benefits
- Reduced RFI and EMI
- Higher Frequency Operation
- Reduced Snubbing
- Reduced Parts Count

Description/ Applications

These diodes are optimized to reduce losses and EMI/ RFI in high frequency power conditioning systems. The softness of the recovery eliminates the need for a snubber in most applications. These devices are ideally suited for HF welding, power converters and other applications where switching losses are not significant portion of the total losses.

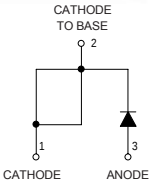
Absolute Maximum Ratings

	Parameters	Max	Units
V_R	Cathode to Anode Voltage	400	V
$I_{F(AV)}$	Continuous Forward Current, T_C = 127°C	60	A
I_{FSM}	Single Pulse Forward Current, T_C = 25°C	600	
I_{FRM} ①	Maximum Repetitive Forward Current	120	
T_J, T_{STG}	Operating Junction and Storage Temperatures	- 55 to 175	°C

① Square Wave, 20kHz

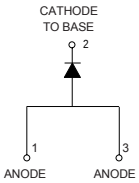
Case Styles

60EPU04PbF



TO-247AC (Modified)

60APU04PbF



TO-247AC

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameters	Min	Typ	Max	Units	Test Conditions
V_{BR}, V_r	Breakdown Voltage, Blocking Voltage	400	-	-	V	I_R = 100µA
V_F	Forward Voltage	-	1.05	1.25	V	I_F = 60A
		-	0.87	1.03	V	I_F = 60A, T_J = 175°C
		-	0.93	1.10	V	I_F = 60A, T_J = 125°C
I_R	Reverse Leakage Current	-	-	50	µA	V_R = V_R Rated
		-	-	2	mA	T_J = 150°C, V_R = V_R Rated
C_T	Junction Capacitance	-	50	-	pF	V_R = 400V
L_S	Series Inductance	-	3.5	-	nH	Measured lead to lead 5mm from package body

Dynamic Recovery Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameters	Min	Typ	Max	Units	Test Conditions	
t_{rr}	Reverse Recovery Time	-	50	60	ns	I_F = 1A, di_F/dt = 200A/µs, V_R = 30V	
		-	85	-		T_J = 25°C	I_F = 60A V_R = 200V di_F/dt = 200A/µs
		-	145	-		T_J = 125°C	
I_{RRM}	Peak Recovery Current	-	8.8	-	A	T_J = 25°C	
		-	15.4	-		T_J = 125°C	
Q_{rr}	Reverse Recovery Charge	-	375	-	nC	T_J = 25°C	
		-	1120	-		T_J = 125°C	

Thermal - Mechanical Characteristics

	Parameters	Min	Typ	Max	Units
R_{thJC}	Thermal Resistance, Junction to Case			0.70	K/W
R_{thCS} ②	Thermal Resistance, Case to Heatsink		0.2		
Wt	Weight		5.5		g
			0.2		(oz)
T	Mounting Torque	1.2 (10)		2.4 (20)	N*m (lbf.in)
	Marking Device	60EPU04, 60APU04			

② Mounting Surface, Flat, Smooth and Greased

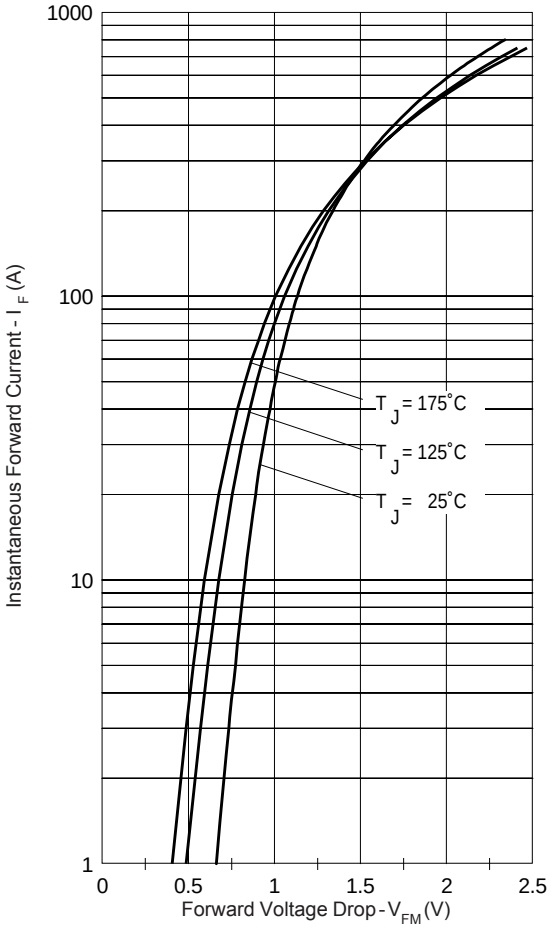


Fig. 1 - Typical Forward Voltage Drop Characteristics

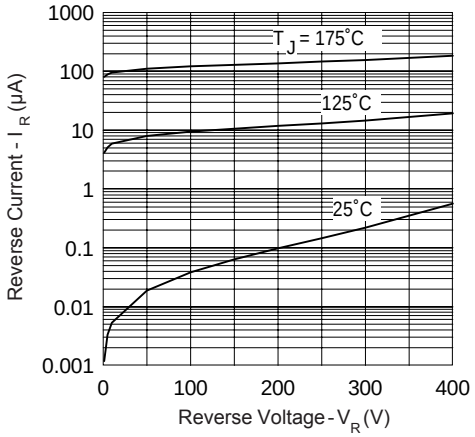


Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage

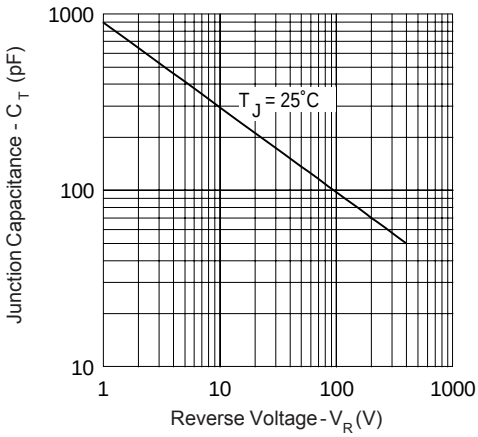


Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage

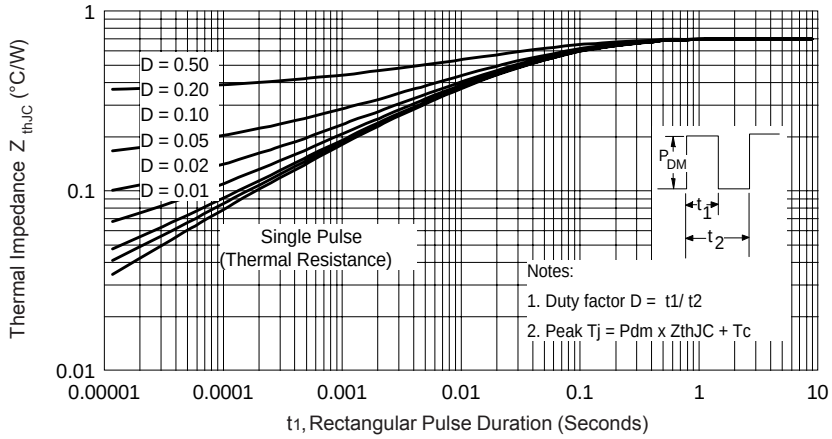


Fig. 4 - Max. Thermal Impedance Z_{thJC} Characteristics

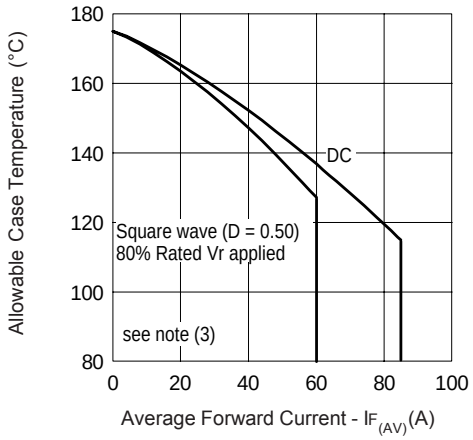


Fig. 5 - Max. Allowable Case Temperature Vs. Average Forward Current

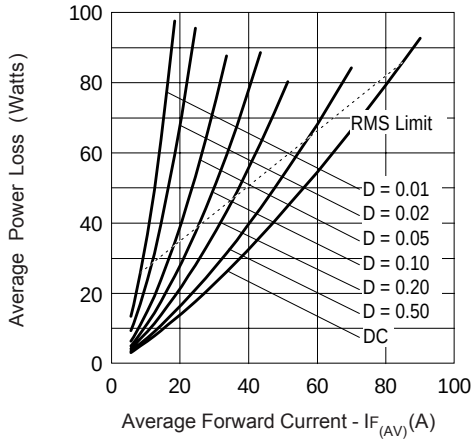


Fig. 6 - Forward Power Loss Characteristics

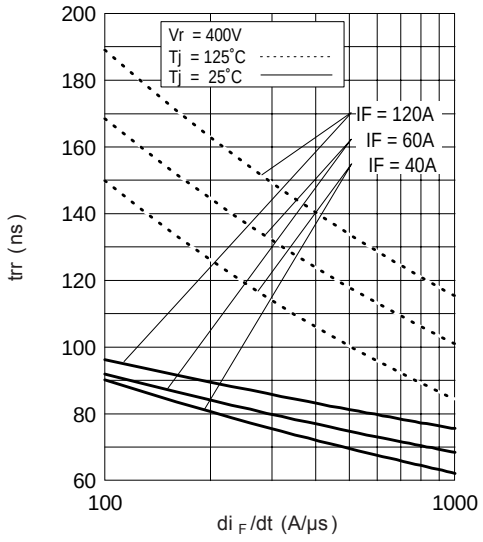


Fig. 7 - Typical Reverse Recovery time vs. di_F/dt

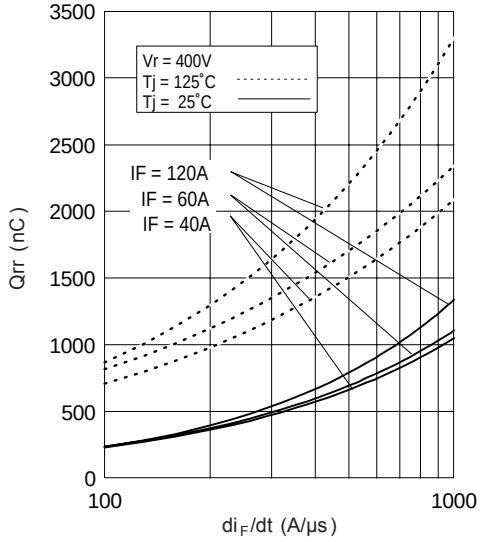


Fig. 8 - Typical Stored Charge vs. di_F/dt

(3) Formula used: $T_C = T_J - (Pd + Pd_{REV}) \times R_{thJC}$;
Pd = Forward Power Loss = $I_{F(AV)} \times V_{FM} @ (I_{F(AV)} / D)$ (see Fig. 6);
Pd_{REV} = Inverse Power Loss = $V_{R1} \times I_R (1 - D)$; $I_R @ V_{R1}$ = 80% rated V_R

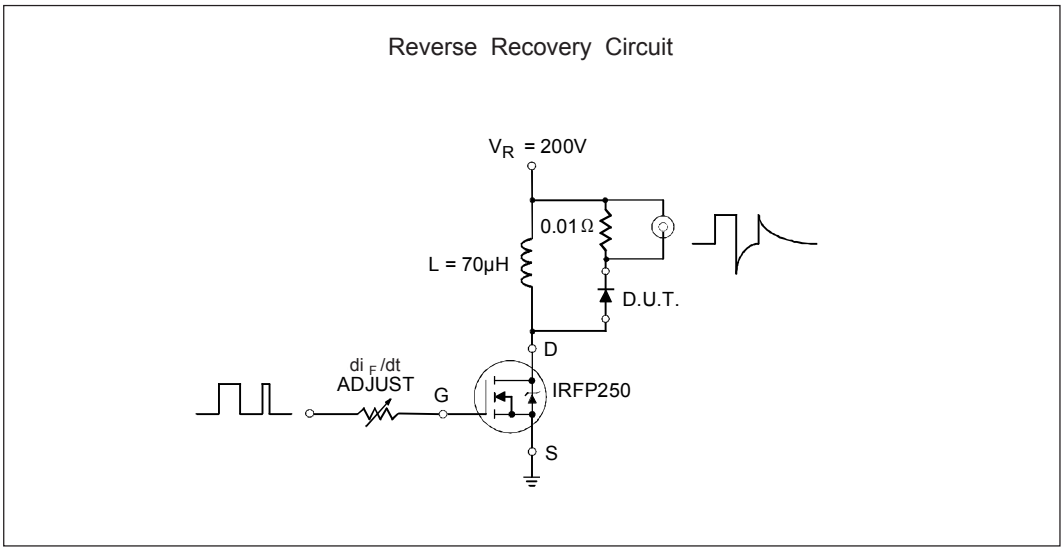
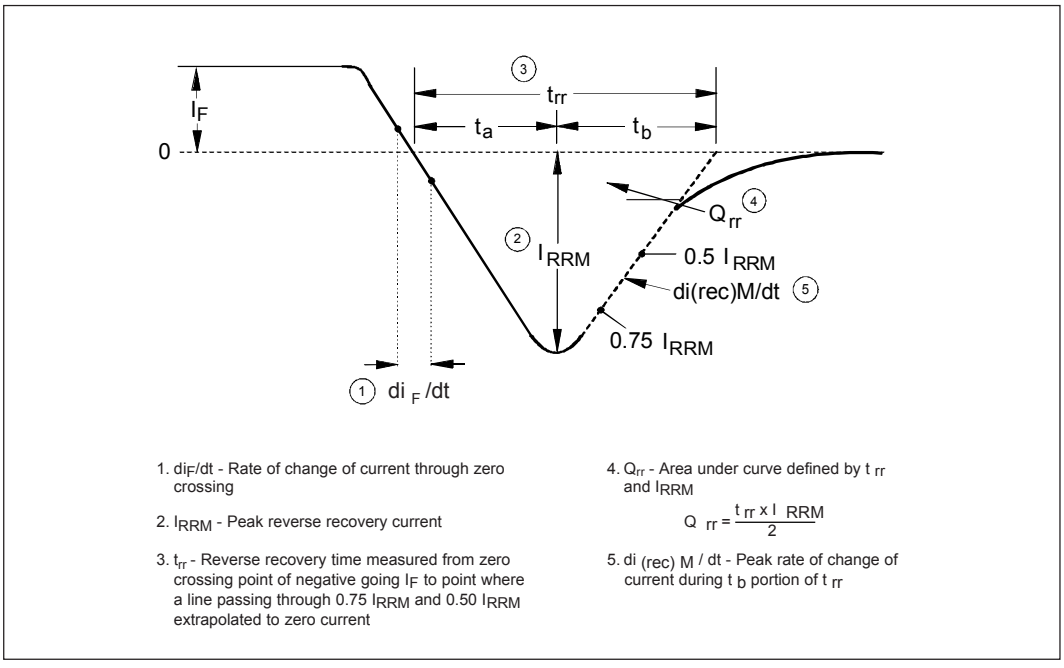


Fig. 9- Reverse Recovery Parameter Test Circuit



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}

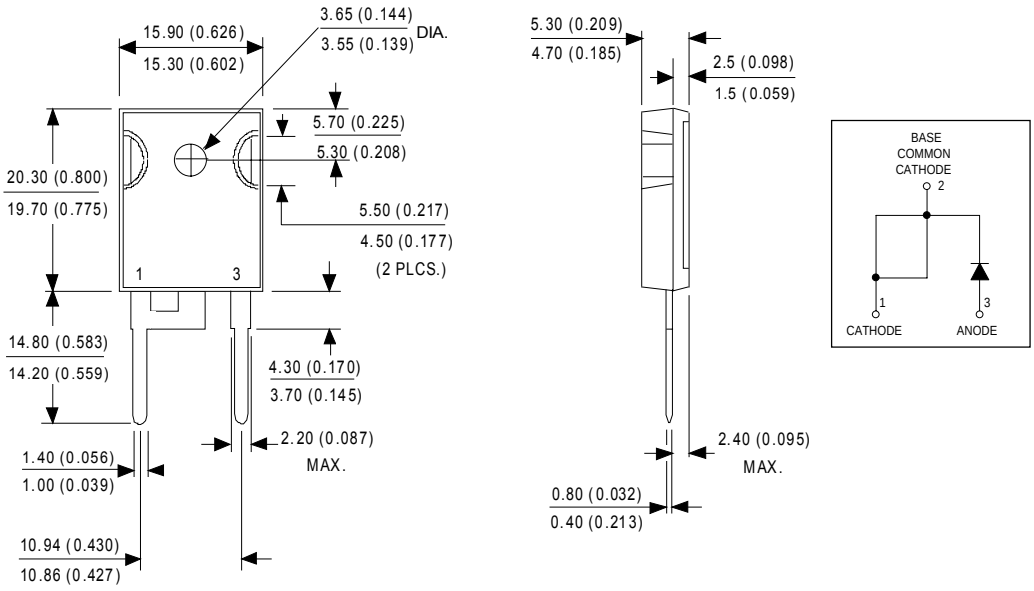
$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

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

Fig. 10 - Reverse Recovery Waveform and Definitions

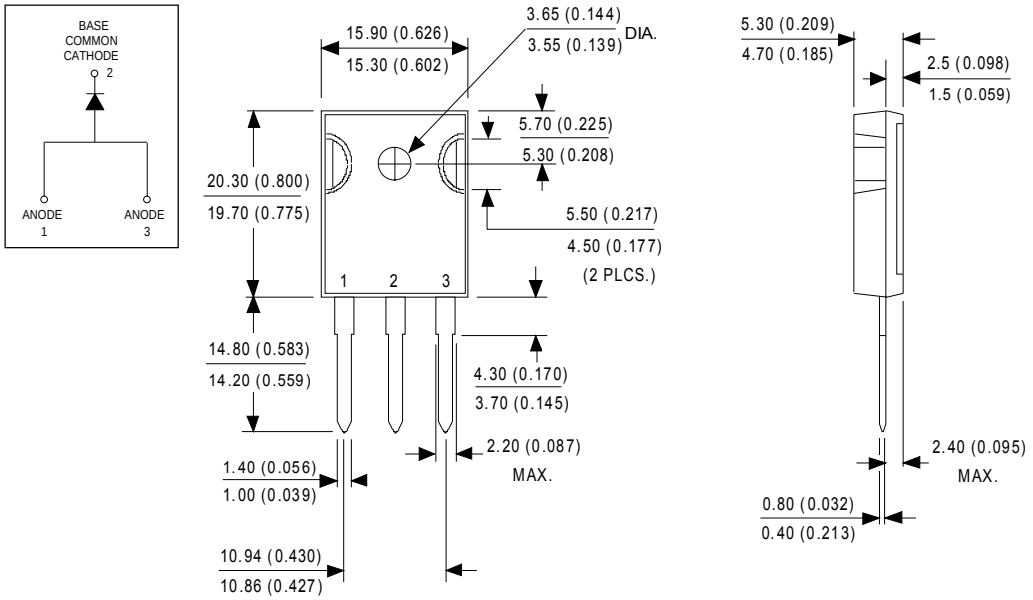
Outline Table

60EPU04PbF



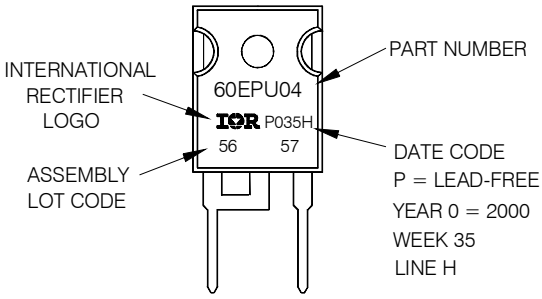
Dimensions in millimeters and inches

60APU04PbF

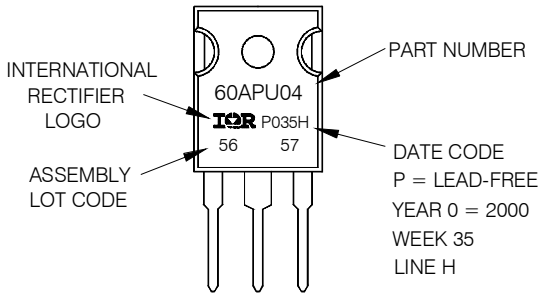


Marking Information

EXAMPLE: THIS IS A 60EPU04
WITH ASSEMBLY
LOT CODE 5657
ASSEMBLED ON WW 35, 2000
IN ASSEMBLY LINE "H"



EXAMPLE: THIS IS A 60APU04
WITH ASSEMBLY
LOT CODE 5657
ASSEMBLED ON WW 35, 2000
IN ASSEMBLY LINE "H"



Ordering Information Table

Device Code

60	E	P	U	04	PbF
1	2	3	4	5	6

1 - Current Rating (60 = 60A)

2 - Circuit Configuration:
E = Single Diode
A = Single Diode, 3 pins

3 - Package:
P = TO-247AC (Modified)

4 - Type of Silicon:
U = UltraFast Recovery

5 - Voltage Rating (04 = 400V)

6 - • none = Standard Production
• PbF = Lead-Free

Data and specifications subject to change without notice.
This product has been designed and qualified for Industrial Level and Lead-Free.
Qualification Standards can be found on IR's Web site.

International
IOR Rectifier

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08/05

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