Bulletin PD-20886 rev. A 10/06

International
IOR Rectifier

# 15ETH06PbF
# 15ETH06FPPbF

## Hyperfast Rectifier

### Features

- Hyperfastfast Recovery Time
- Low Forward Voltage Drop
- Low Leakage Current
- 175°C Operating Junction Temperature
- Single Die Center Tap Module
- UL E78996 approved
- Lead-Free ("PbF")

$t_{rr}$ = 22ns typ.
$I_{F(AV)}$ = 15Amp
$V_R$ = 600V

### Description/ Applications

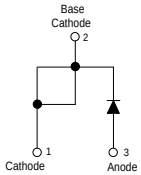
State of the art Hyperfast recovery rectifiers designed with optimized performance of forward voltage drop, Hyperfast recover time, and soft recovery.
The planar structure and the platinum doped life time control guarantee the best overall performance, ruggedness and reliability characteristics.
These devices are intended for use in PFC Boost stage in the AC-DC section of SMPS, inverters or as freewheeling diodes.
The IR extremely optimized stored charge and low recovery current minimize the switching losses and reduce over dissipation in the switching element and snubbers.

### Absolute Maximum Ratings

| | Parameters | Max | Units |
|---|---|---|---|
| $V_{RRM}$ | Peak Repetitive Reverse Voltage | 600 | V |
| $I_{F(AV)}$ | Average Rectified Forward Current @ $T_C$ = 140°C | 15 | A |
| | @ $T_C$ = 80°C (FULLPACK) | | |
| $I_{FSM}$ | Non Repetitive Peak Surge Current @ $T_J$ = 25°C | 120 | |
| | (FULLPACK) | 180 | |
| $I_{FM}$ | Peak Repetitive Forward Current | 30 | |
| $T_J$, $T_{STG}$ | Operating Junction and Storage Temperatures | - 65 to 175 | °C |

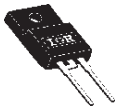
**Case Styles**

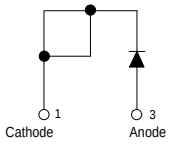
15ETH06PbF




TO-220AC

15ETH06FPPbF






TO-220 FULLPACK

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

| | Parameters | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $V_{BR}$, $V_r$ | Breakdown Voltage, Blocking Voltage | 600 | - | - | V | $I_R$ = 100µA |
| $V_F$ | Forward Voltage | - | 1.8 | 2.2 | V | $I_F$ = 15A, $T_J$ = 25°C |
| | | - | 1.3 | 1.6 | V | $I_F$ = 15A, $T_J$ = 150°C |
| $I_R$ | Reverse Leakage Current | - | 0.2 | 50 | µA | $V_R$ = $V_R$ Rated |
| | | - | 30 | 500 | µA | $T_J$ = 150°C, $V_R$ = $V_R$ Rated |
| $C_T$ | Junction Capacitance | - | 20 | - | pF | $V_R$ = 600V |
| $L_S$ | Series Inductance | - | 8.0 | - | nH | Measured lead to lead 5mm from package body |

## Dynamic Recovery Characteristics @ $T_C$ = 25°C (unless otherwise specified)

| | Parameters | Min | Typ | Max | Units | Test Conditions | |
|---|---|---|---|---|---|---|---|
| $t_{rr}$ | Reverse Recovery Time | - | 22 | 30 | ns | $I_F$ = 1A, $di_F/dt$ = 100A/µs, $V_R$ = 30V | |
| | | - | 28 | 35 | | $I_F$ = 15A, $di_F/dt$ = 100A/µs, $V_R$ = 30V | |
| | | | 29 | - | - | $T_J$ = 25°C | $I_F$ = 15A<br>$di_F/dt$ = 200A/µs<br>$V_R$ = 390V |
| | | - | 75 | - | | $T_J$ = 125°C | |
| $I_{RRM}$ | Peak Recovery Current | - | 3.5 | - | A | $T_J$ = 25°C | |
| | | - | 7 | - | | $T_J$ = 125°C | |
| $Q_{rr}$ | Reverse Recovery Charge | - | 57 | - | nC | $T_J$ = 25°C | |
| | | - | 300 | - | | $T_J$ = 125°C | |
| $t_{rr}$ | Reverse Recovery Time | - | 51 | - | ns | $T_J$ = 125°C | $I_F$ = 15A<br>$di_F/dt$ = 800A/µs<br>$V_R$ = 390V |
| $I_{RRM}$ | Peak Recovery Current | - | 20 | - | A | | |
| $Q_{rr}$ | Reverse Recovery Charge | - | 580 | - | nC | | |

## Thermal - Mechanical Characteristics

| | Parameters | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $T_J$ | Max. Junction Temperature Range | | - | - | 175 | °C |
| $T_{Stg}$ | Max. Storage Temperature Range | | - 65 | - | 175 | |
| $R_{thJC}$ | Thermal Resistance, Junction to Case | Per Leg | - | 1.0 | 1.3 | °C/W |
| | (Fullpack) | Per Leg | - | 3.0 | 3.5 | |
| $R_{thJA}$ ① | Thermal Resistance, Junction to Ambient | Per Leg | - | - | 70 | |
| $R_{thCS}$ ② | Thermal Resistance, Case to Heatsink | | - | 0.5 | - | |
| | Weight | | - | 2.0 | - | g |
| | | | - | 0.07 | - | (oz) |
| | Mounting Torque | | 6.0 | - | 12 | Kg-cm |
| | | | 5.0 | - | 10 | lbf.in |

① Typical Socket Mount
② Mounting Surface, Flat, Smooth and Greased

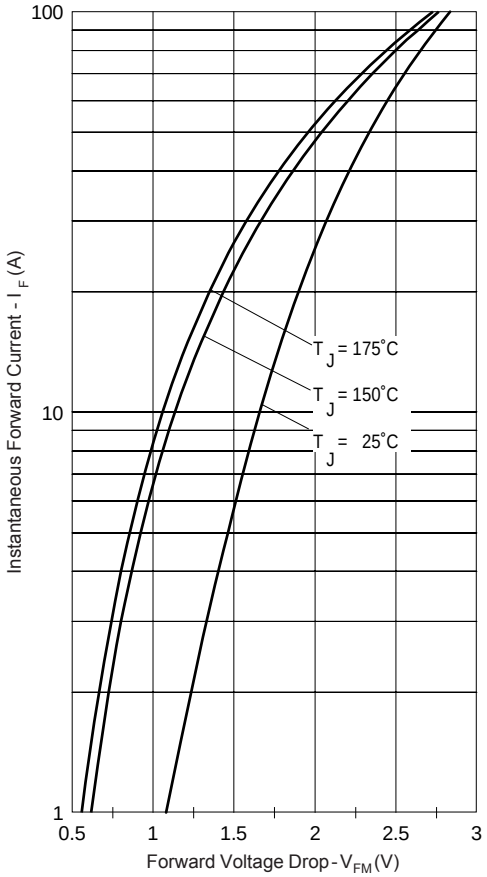



**Fig. 1 - Typical Forward Voltage Drop Characteristics**

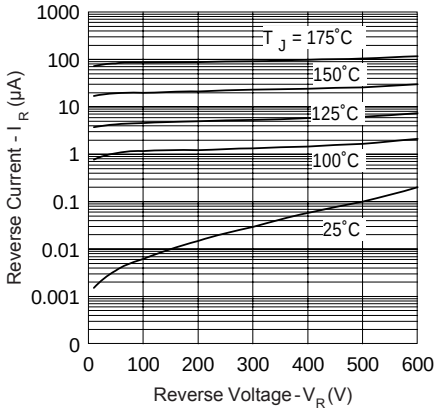



**Fig. 2 - Typical Values Of Reverse Current Vs. Reverse Voltage**

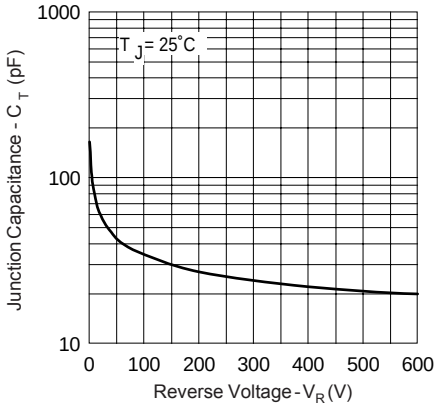



**Fig. 3 - Typical Junction Capacitance Vs. Reverse Voltage**

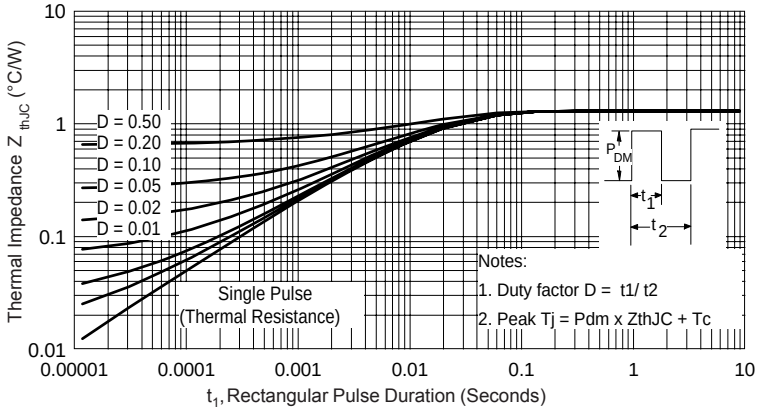



**Fig. 4 - Max. Thermal Impedance $Z_{thJC}$ Characteristics**

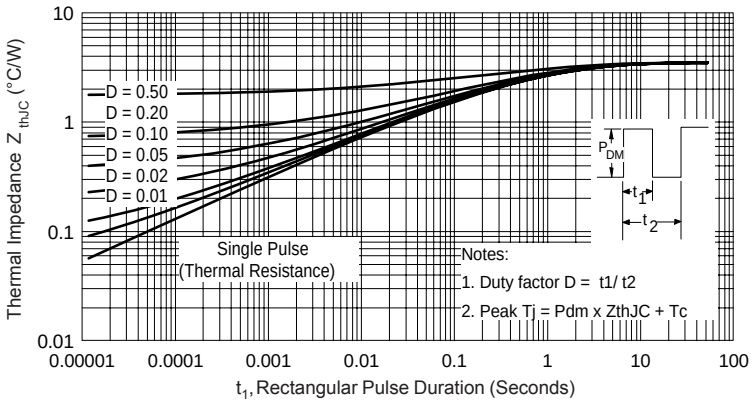



**Fig. 5 - Max. Thermal Impedance $Z_{thJC}$ Characteristics (FULLPACK)**

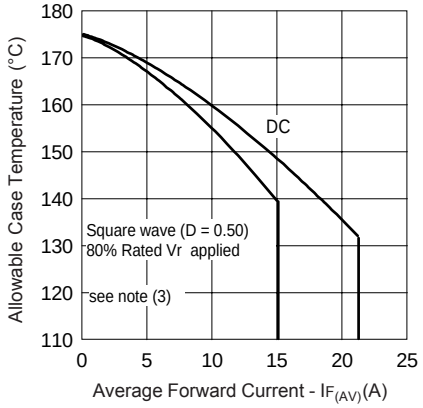



**Fig. 6 - Max. Allowable Case Temperature Vs. Average Forward Current**

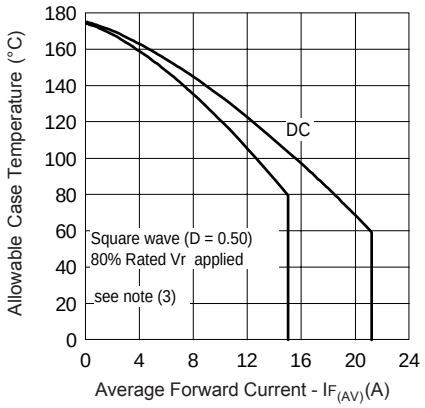



**Fig. 7 - Max. Allowable Case Temperature Vs. Average Forward Current (FULLPACK)**

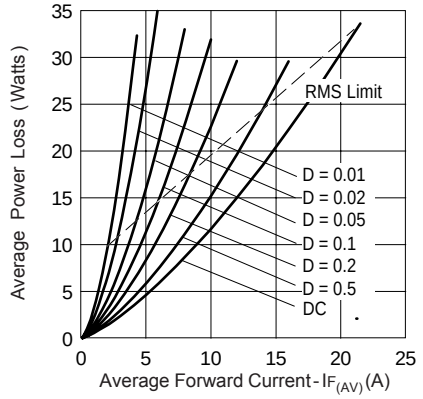



**Fig. 8 - Forward Power Loss Characteristics**

**(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. 8);
$Pd_{REV}$ = Inverse Power Loss = $V_{R1} \times I_R (1 - D)$;
$I_R @ V_{R1}$ = rated $V_R$

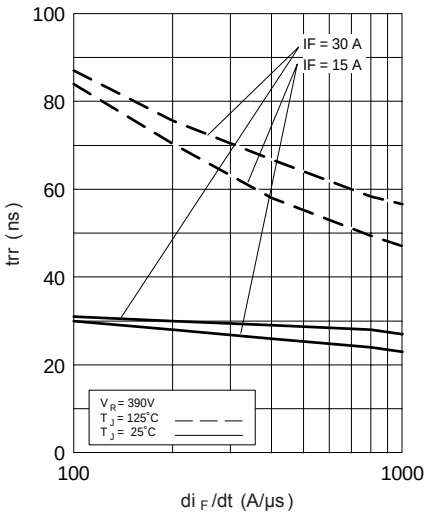



**Fig. 7 - Typical Reverse Recovery vs. $di_F/dt$**

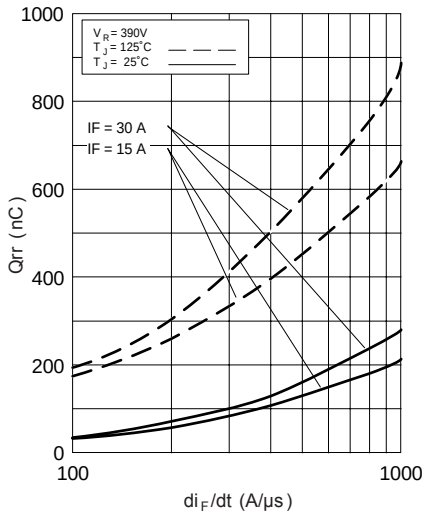



**Fig. 8 - Typical Stored Charge vs. $di_F/dt$**

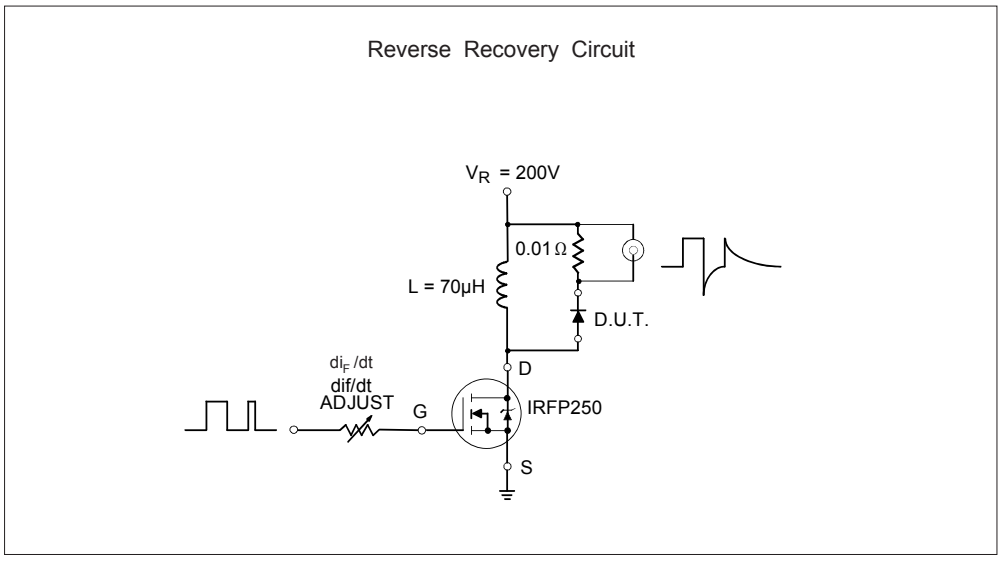
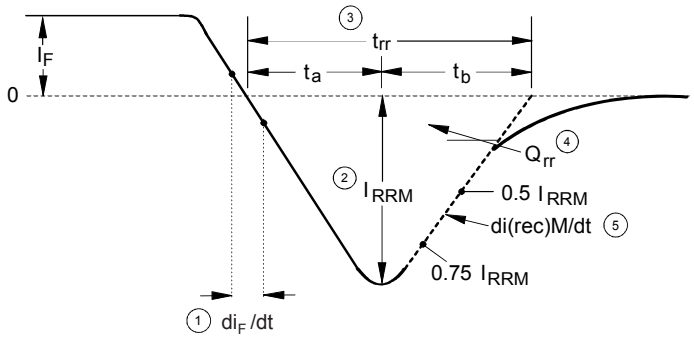



**Fig. 11- Reverse Recovery Parameter Test Circuit**



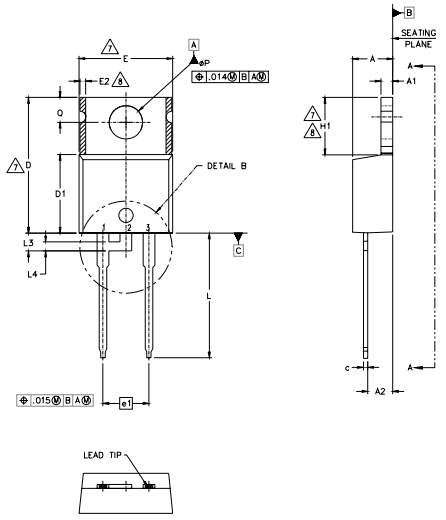

1. $di_F/dt$ - Rate of change of current through zero crossing
2. $I_{RRM}$ - Peak reverse recovery current
3. $t_{rr}$ - Reverse recovery time measured from zero crossing point of negative going $I_F$ to point where a line passing through 0.75 $I_{RRM}$ and 0.50 $I_{RRM}$ extrapolated to zero current
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. 12 - Reverse Recovery Waveform and Definitions**

## Outline Table



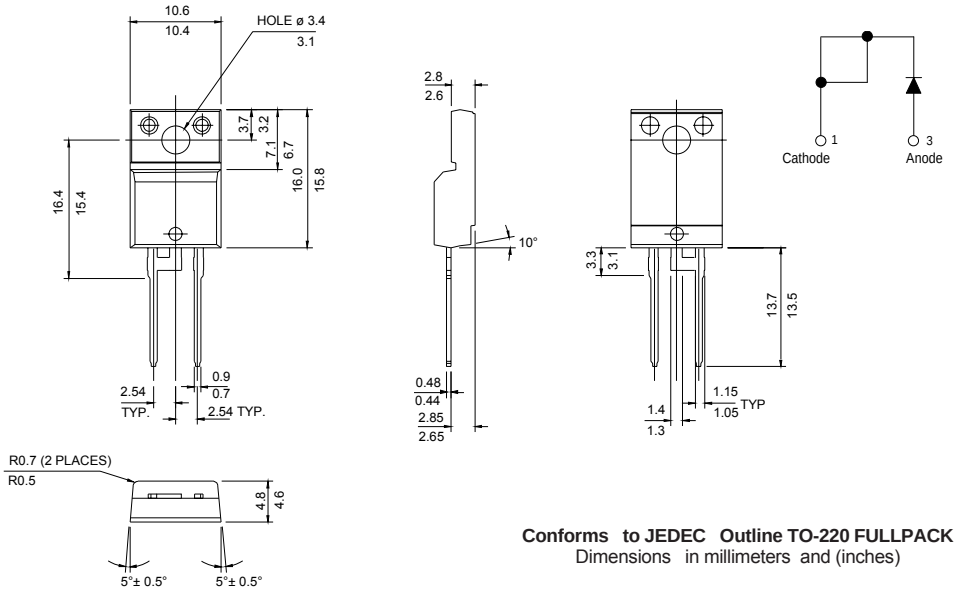

NOTES:
1.- DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M- 1994.
2.- DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
3.- LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
4.- DIMENSION D, D1 & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5.- DIMENSION b1, b3 & c1 APPLY TO BASE METAL ONLY.
6.- CONTROLLING DIMENSION : INCHES.
7.- THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,H1,D2 & E1
8.- DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED.
9.- OUTLINE CONFORMS TO JEDEC TO-220, D2 (min) WHERE DIMENSIONS ARE DERIVED FROM THE ACTUAL PACKAGE OUTLINE.

| SYMBOL | DIMENSIONS | | | | NOTES |
|---|---|---|---|---|---|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 3.56 | 4.83 | .140 | .190 | |
| A1 | 0.51 | 1.40 | .020 | .055 | |
| A2 | 2.03 | 2.92 | .080 | .115 | |
| b | 0.38 | 1.01 | .015 | .040 | |
| b1 | 0.38 | 0.97 | .015 | .038 | 5 |
| b2 | 1.14 | 1.78 | .045 | .070 | |
| b3 | 1.14 | 1.73 | .045 | .068 | 5 |
| c | 0.36 | 0.61 | .014 | .024 | |
| c1 | 0.36 | 0.56 | .014 | .022 | 5 |
| D | 14.22 | 16.51 | .560 | .650 | 4 |
| D1 | 8.38 | 9.02 | .330 | .355 | |
| D2 | 11.68 | 12.88 | .460 | .507 | 7 |
| E | 9.65 | 10.67 | .380 | .420 | 4,7 |
| E1 | 6.86 | 8.89 | .270 | .350 | 7 |
| E2 | – | 0.76 | – | .030 | 8 |
| e | 2.54 BSC | | .100 BSC | | |
| e1 | 5.08 BSC | | .200 BSC | | |
| H1 | 5.84 | 6.86 | .230 | .270 | 7,8 |
| L | 12.70 | 14.73 | .500 | .580 | |
| L1 | – | 6.35 | – | .250 | 3 |
| L3 | 1.78 | 2.13 | .070 | .084 | |
| L4 | 0.76 | 1.27 | .030 | .050 | 3 |
| øP | 3.53 | 3.73 | .139 | .147 | |
| Q | 2.54 | 3.05 | .100 | .120 | |

LEAD ASSIGNMENTS
DIODES
1+2.- CATHODE
3.- ANODE

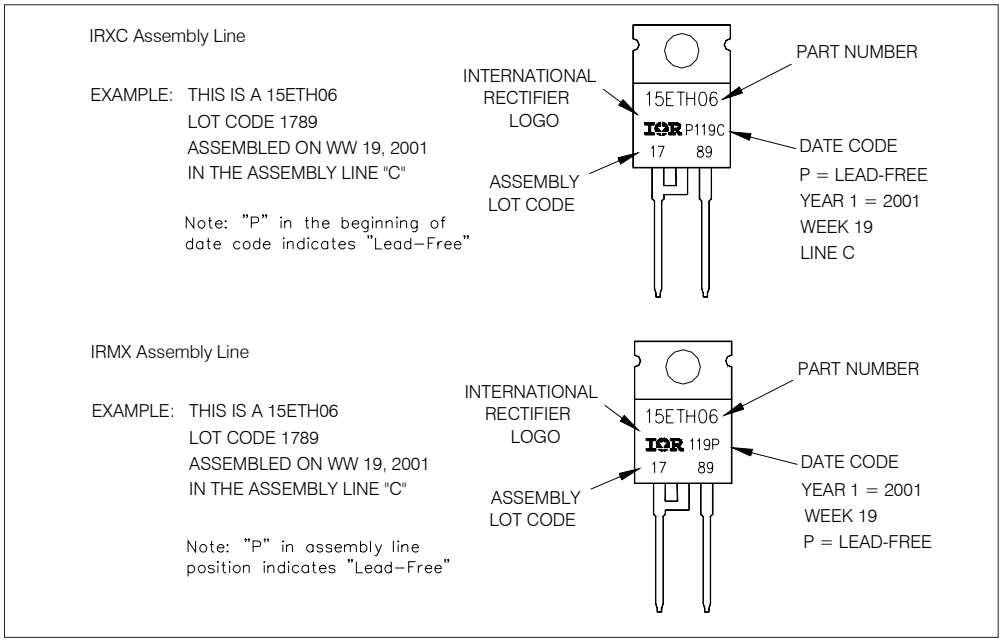
**Conforms to JEDEC Outline TO-220AC**
Dimensions in millimeters and (inches)

## Outline Table




**Conforms to JEDEC Outline TO-220 FULLPACK**
Dimensions in millimeters and (inches)

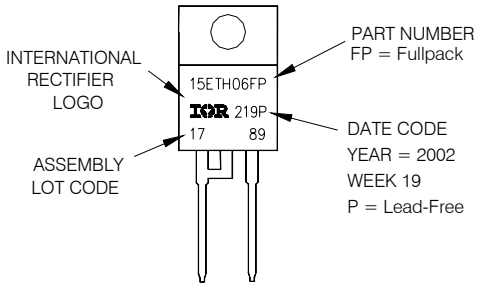
## Part Marking Information (TO-220)



## Part Marking Information (TO-220 FULL-PAK)

EXAMPLE: THIS IS A 15ETH06FP
LOT CODE 1789
ASSEMBLED ON WW 19, 2002
IN THE ASSEMBLY LINE "C"

Note: "P" in assembly line position indicates "Lead-Free"




## Ordering Information Table

**Device Code**

| 15 | E | T | H | 06 | FP | PbF |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

1 - Current Rating (15 = 15A)
2 - E = Single Diode
3 - T = TO-220, $D^2Pak$
4 - H = HyperFast Recovery
5 - Voltage Rating (06 = 600V)
6 - • none = TO-220AC
• FP = TO-220 FULLPACK
7 - • none = Standard Production
• PbF = Lead-Free

Tube Standard Pack Quantity: 50 pieces

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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12/06

# Notice

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