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# MBRB30H60CT-1G, MBR30H60CTG, MBRF30H60CTG, MBRB30H60CTT4G, NRVBB30H60CTT4G, MBRJ30H60CTG



ON Semiconductor®

<http://onsemi.com>

## SWITCHMODE Power Rectifier 60 V, 30 A

## SCHOTTKY BARRIER RECTIFIERS 30 AMPERES, 60 VOLTS

### Features and Benefits

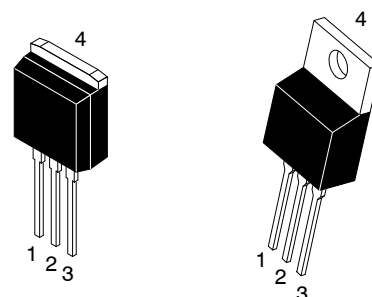
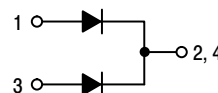
- Low Forward Voltage
- Low Power Loss/High Efficiency
- High Surge Capacity
- 175°C Operating Junction Temperature
- 30 A Total (15 A Per Diode Leg)
- Guard-Ring for Stress Protection
- AEC-Q101 Qualified and PPAP Capable
- NRVBB Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements
- These are Pb-Free Devices\*

### Applications

- Power Supply – Output Rectification
- Power Management
- Instrumentation

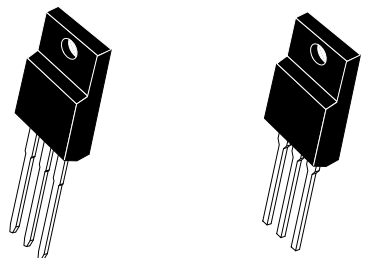
### Mechanical Characteristics:

- Case: Epoxy, Molded
- Epoxy Meets UL 94 V-0 @ 0.125 in
- Weight (Approximately): 1.5 Grams (I<sup>2</sup>PAK)  
1.7 Grams (D<sup>2</sup>PAK)  
1.9 Grams (TO-220 and TO-220FP)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes:  
260°C Max. for 10 Seconds



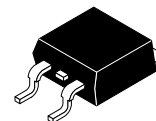
I<sup>2</sup>PAK (TO-262)  
CASE 418D  
PLASTIC  
STYLE 3

TO-220  
CASE 221A  
PLASTIC  
STYLE 6



TO-220  
CASE 221D  
STYLE 3

TO-220  
CASE 221AH



D<sup>2</sup>PAK  
CASE 418B

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

### ORDERING AND MARKING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

**MBRB30H60CT-1G, MBR30H60CTG, MBRF30H60CTG, MBRB30H60CTT4G,  
NRVBB30H60CTT4G, MBRJ30H60CTG**

**MAXIMUM RATINGS** (Per Diode Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	$V_{RRM}$ $V_{RWM}$ $V_R$	60	V
Average Rectified Forward Current (Rated $V_R$ , $T_C = 159^\circ\text{C}$ )	$I_{F(AV)}$	15	A
Peak Repetitive Forward Current (Rated $V_R$ , Square Wave, 20 kHz)	$I_{FRM}$	30	A
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	$I_{FSM}$	260	A
Operating Junction Temperature (Note 1)	$T_J$	-55 to +175	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to +175	$^\circ\text{C}$
Voltage Rate of Change (Rated $V_R$ )	dv/dt	10,000	V/ $\mu\text{s}$
Controlled Avalanche Energy (see test conditions in Figures 11 and 12)	$W_{AVAIL}$	350	mJ
ESD Ratings: Machine Model = C Human Body Model = 3B		> 400 > 8000	V

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. The heat generated must be less than the thermal conductivity from Junction-to-Ambient:  $dP_D/dT_J < 1/R_{\theta JA}$ .

**THERMAL CHARACTERISTICS**

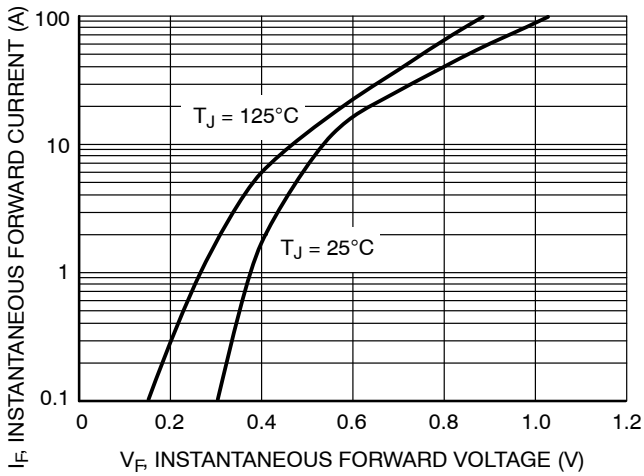
Characteristic	Symbol	Value	Unit
Maximum Thermal Resistance (MBRB30H60CT-1G and MBR30H60CTG) Junction-to-Case	$R_{\theta JC}$	2.0	$^\circ\text{C}/\text{W}$
Junction-to-Ambient (MBRF30H60CTG and MBRJ30H60CTG)	$R_{\theta JA}$	70	
Junction-to-Case (MBRB30H60CTT4G and NRVBB30H60CTT4G)	$R_{\theta JC}$	4.4	
Junction-to-Case	$R_{\theta JC}$	1.6	

**ELECTRICAL CHARACTERISTICS** (Per Diode Leg)

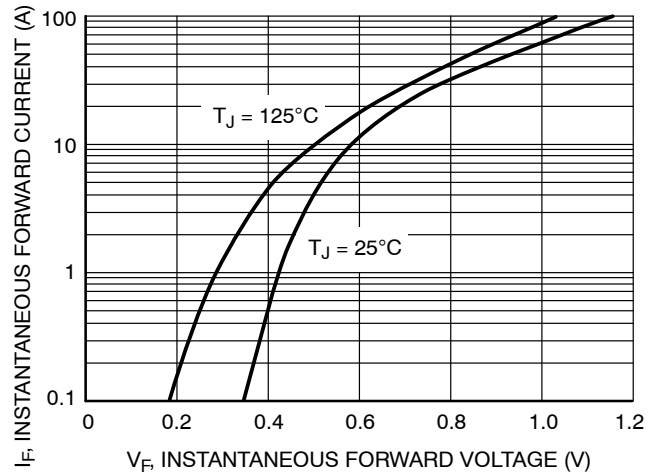
Characteristic	Symbol	Value	Unit
Maximum Instantaneous Forward Voltage (Note 2) ( $I_F = 15\text{ A}$ , $T_C = 25^\circ\text{C}$ ) ( $I_F = 15\text{ A}$ , $T_C = 125^\circ\text{C}$ ) ( $I_F = 30\text{ A}$ , $T_C = 25^\circ\text{C}$ ) ( $I_F = 30\text{ A}$ , $T_C = 125^\circ\text{C}$ )	$V_F$	0.62 0.56 0.78 0.71	V
Maximum Instantaneous Reverse Current (Note 2) (Rated DC Voltage, $T_C = 25^\circ\text{C}$ ) (Rated DC Voltage, $T_C = 125^\circ\text{C}$ )	$i_R$	0.3 45	mA

2. Pulse Test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

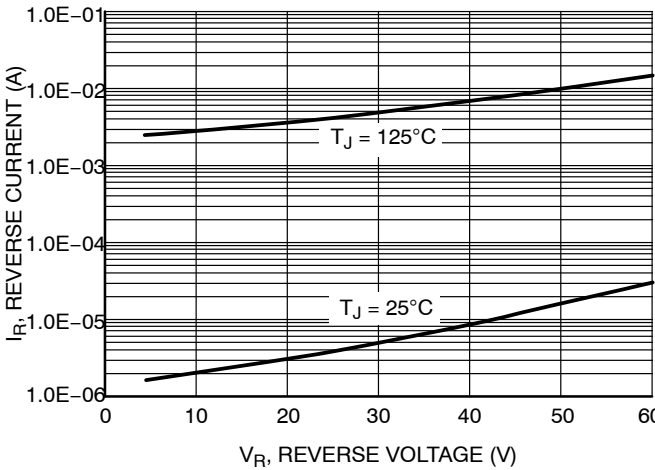
**MBRB30H60CT-1G, MBR30H60CTG, MBRF30H60CTG, MBRB30H60CTT4G,  
NRVBB30H60CTT4G, MBRJ30H60CTG**



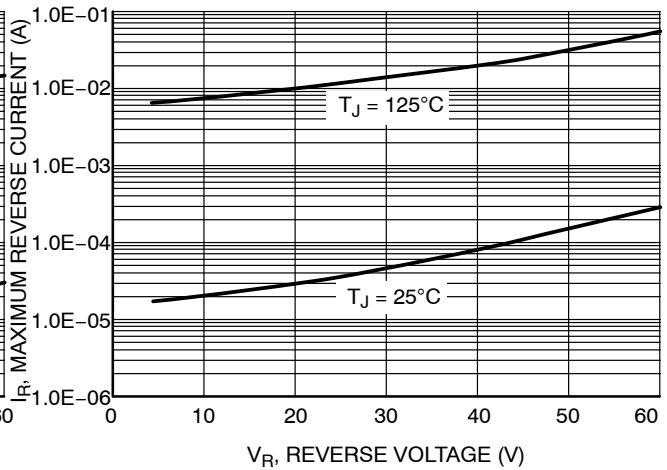
**Figure 1. Typical Forward Voltage**



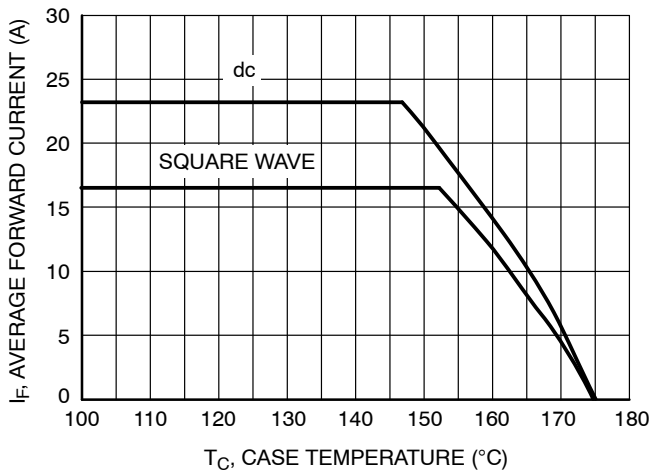
**Figure 2. Maximum Forward Voltage**



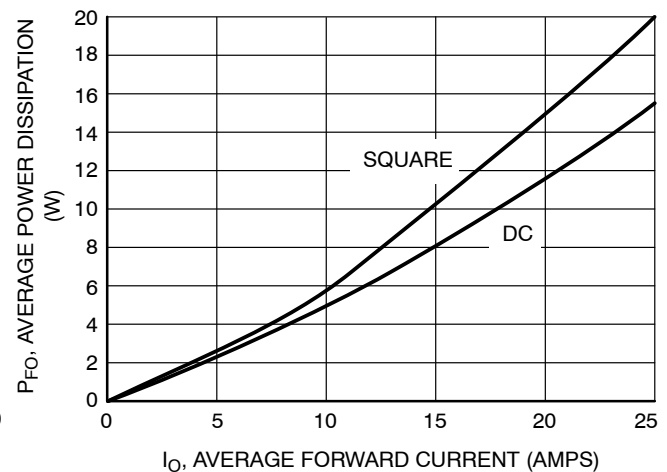
**Figure 3. Typical Reverse Current**



**Figure 4. Maximum Reverse Current**

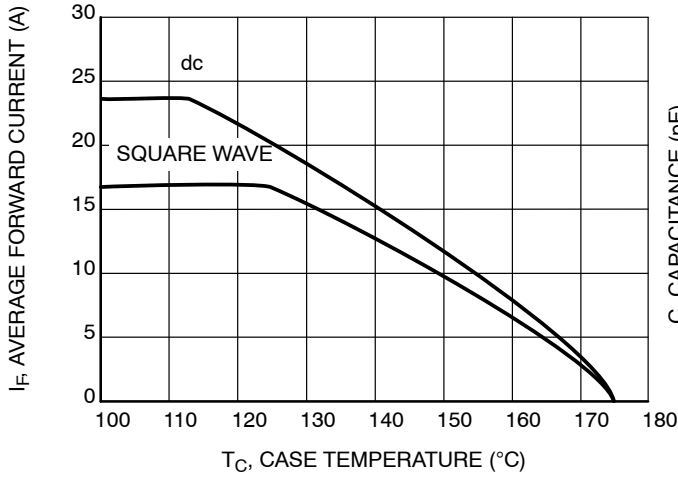


**Figure 5. Current Derating for  
MBRB30H60CT-1G, MBR30H60CTG,  
MBRB30H60CTT4G and NRVBB30H60CTT4G**

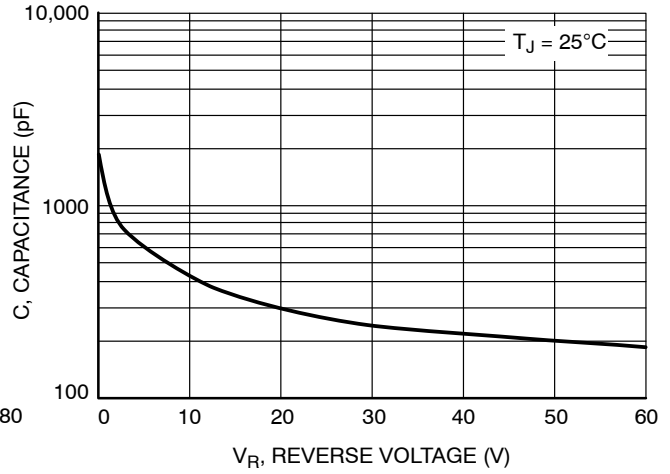


**Figure 6. Forward Power Dissipation**

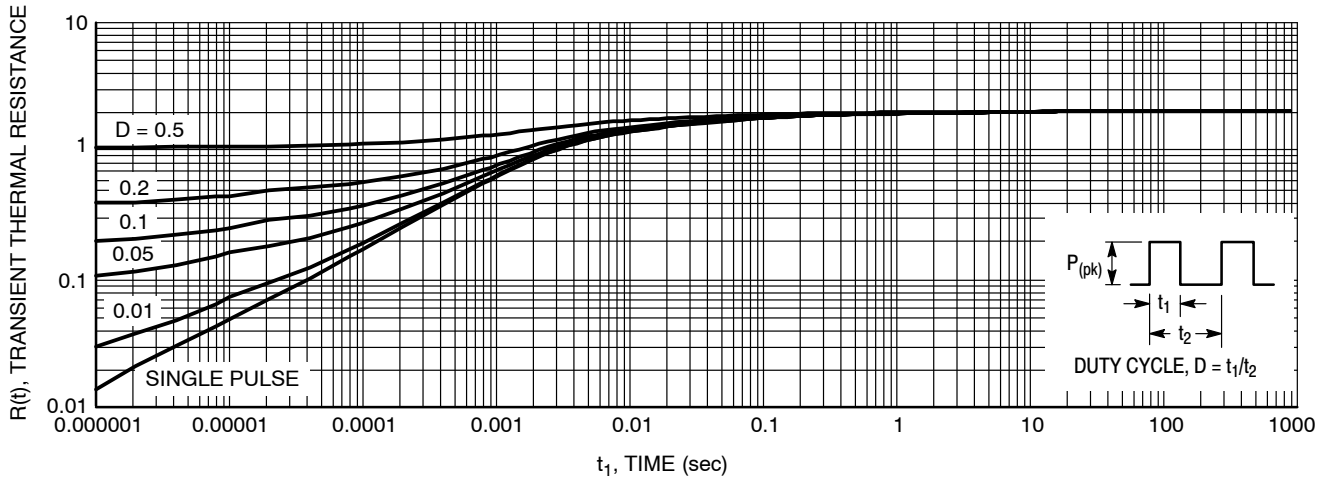
**MBRB30H60CT-1G, MBR30H60CTG, MBRF30H60CTG, MBRB30H60CTT4G,  
NRVBB30H60CTT4G, MBRJ30H60CTG**



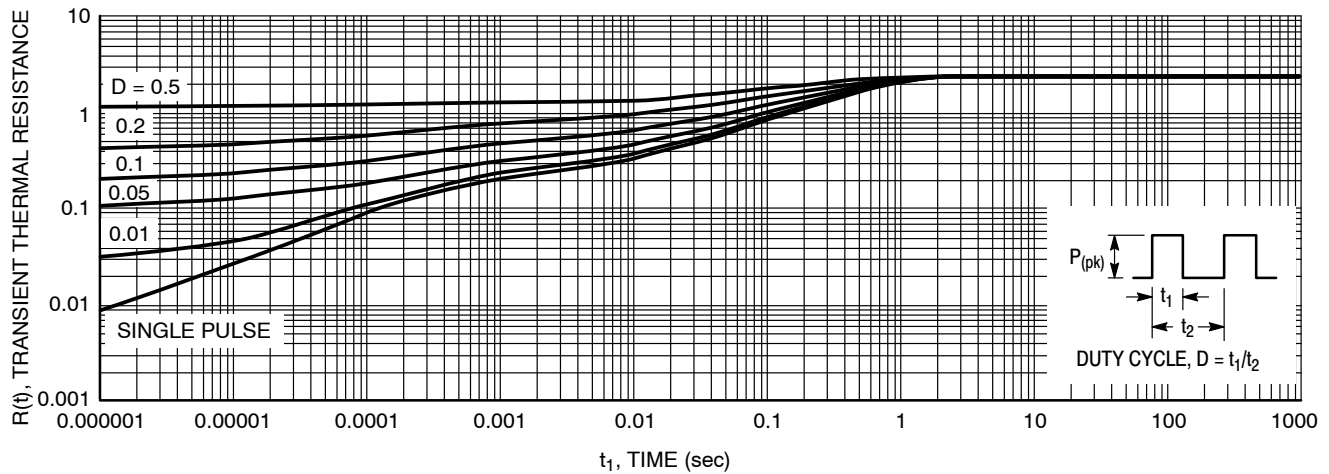
**Figure 8. Current Derating for  
MBRF30H60CTG and MBRJ30H60CTG**



**Figure 7. Capacitance**

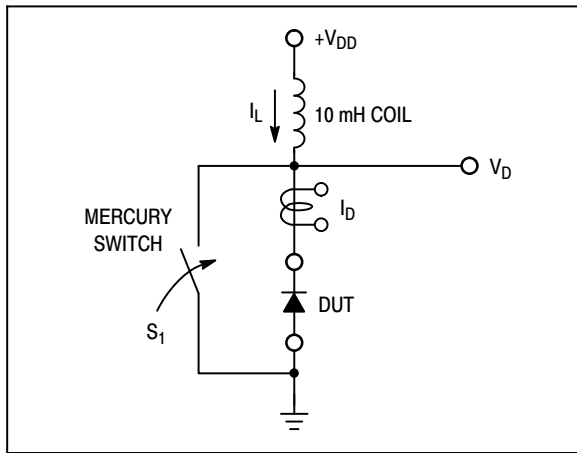


**Figure 9. Thermal Response Junction-to-Case for MBRB30H60CT-1G, MBR30H60CTG,  
MBRB30H60CTT4G and NRVBB30H60CTT4G**



**Figure 10. Thermal Response Junction-to-Case for MBRF30H60CTG and MBRJ30H60CTG**

**MBRB30H60CT-1G, MBR30H60CTG, MBRF30H60CTG, MBRB30H60CTT4G,  
NRVBB30H60CTT4G, MBRJ30H60CTG**

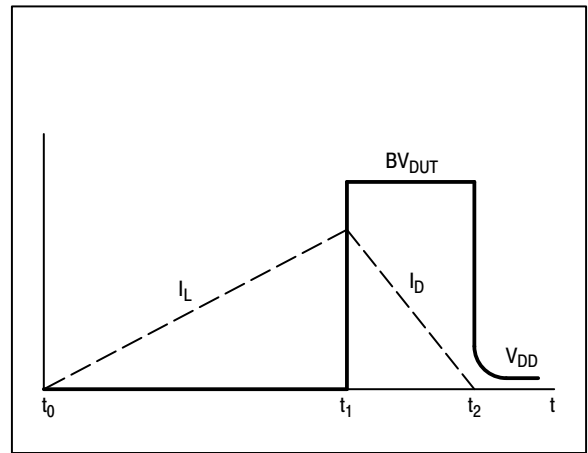


**Figure 11. Test Circuit**

The unclamped inductive switching circuit shown in Figure 11 was used to demonstrate the controlled avalanche capability of this device. A mercury switch was used instead of an electronic switch to simulate a noisy environment when the switch was being opened.

When  $S_1$  is closed at  $t_0$  the current in the inductor  $I_L$  ramps up linearly; and energy is stored in the coil. At  $t_1$  the switch is opened and the voltage across the diode under test begins to rise rapidly, due to  $di/dt$  effects, when this induced voltage reaches the breakdown voltage of the diode, it is clamped at  $BV_{DUT}$  and the diode begins to conduct the full load current which now starts to decay linearly through the diode, and goes to zero at  $t_2$ .

By solving the loop equation at the point in time when  $S_1$  is opened; and calculating the energy that is transferred to the diode it can be shown that the total energy transferred is equal to the energy stored in the inductor plus a finite amount of energy from the  $V_{DD}$  power supply while the diode is in breakdown (from  $t_1$  to  $t_2$ ) minus any losses due to finite component resistances. Assuming the component resistive



**Figure 12. Current-Voltage Waveforms**

elements are small Equation (1) approximates the total energy transferred to the diode. It can be seen from this equation that if the  $V_{DD}$  voltage is low compared to the breakdown voltage of the device, the amount of energy contributed by the supply during breakdown is small and the total energy can be assumed to be nearly equal to the energy stored in the coil during the time when  $S_1$  was closed, Equation (2).

**EQUATION (1):**

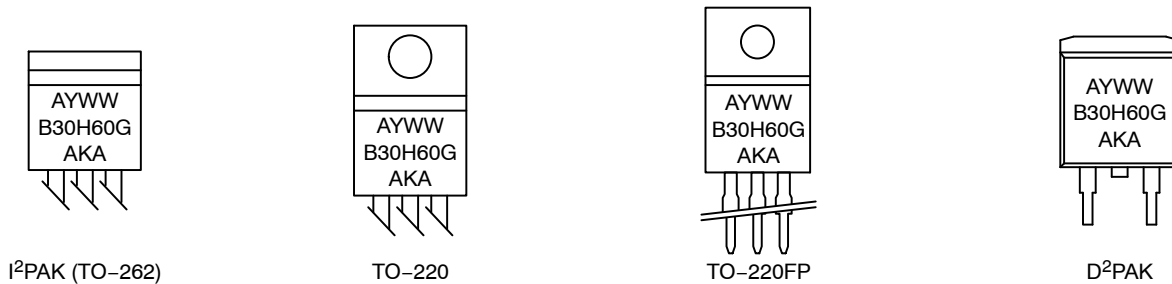
$$W_{AVAL} \approx \frac{1}{2} L I_{LPK}^2 \left( \frac{BV_{DUT}}{BV_{DUT} V_{DD}} \right)$$

**EQUATION (2):**

$$W_{AVAL} \approx \frac{1}{2} L I_{LPK}^2$$

**MBRB30H60CT-1G, MBR30H60CTG, MBRF30H60CTG, MBRB30H60CTT4G,  
NRVBB30H60CTT4G, MBRJ30H60CTG**

**MARKING DIAGRAMS**



B30H60 = Device Code  
 A = Assembly Location  
 Y = Year  
 WW = Work Week  
 G = Pb-Free Package  
 AKA = Polarity Designator

**ORDERING INFORMATION**

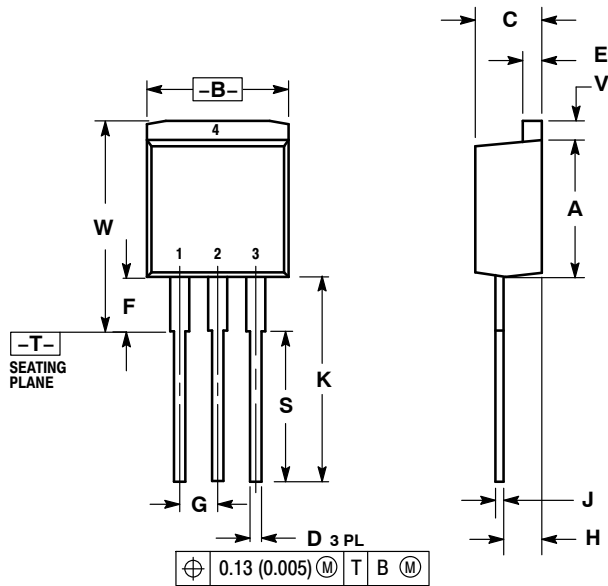
Device	Package	Shipping <sup>†</sup>
MBRB30H60CT-1G	TO-262 (Pb-Free)	50 Units / Rail
MBR30H60CTG	TO-220 (Pb-Free)	50 Units / Rail
MBRF30H60CTG	TO-220FP (Pb-Free)	50 Units / Rail
MBRB30H60CTT4G	D <sup>2</sup> PAK (Pb-Free)	800 / Tape & Reel
NRVBB30H60CTT4G	D <sup>2</sup> PAK (Pb-Free)	800 / Tape & Reel
MBRJ30H60CTG	TO-220FP (Pb-Free, Halogen Free)	50 Units / Rail

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

**MBRB30H60CT-1G, MBR30H60CTG, MBRF30H60CTG, MBRB30H60CTT4G,  
NRVBB30H60CTT4G, MBRJ30H60CTG**

**PACKAGE DIMENSIONS**

**I<sup>2</sup>PAK (TO-262)  
CASE 418D-01  
ISSUE D**

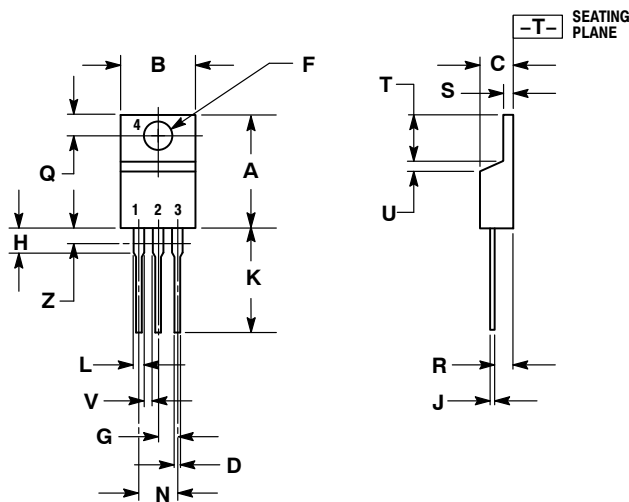


- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.335	0.380	8.51	9.65
B	0.380	0.406	9.65	10.31
C	0.160	0.185	4.06	4.70
D	0.026	0.035	0.66	0.89
E	0.045	0.055	1.14	1.40
F	0.122 REF		3.10 REF	
G	0.100 BSC		2.54 BSC	
H	0.094	0.110	2.39	2.79
J	0.013	0.025	0.33	0.64
K	0.500	0.562	12.70	14.27
S	0.390 REF		9.90 REF	
V	0.045	0.070	1.14	1.78
W	0.522	0.551	13.25	14.00

- STYLE 3:  
PIN 1. ANODE  
2. CATHODE  
3. ANODE  
4. CATHODE

**TO-220  
CASE 221A-09  
ISSUE AG**



- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.  
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.036	0.64	0.91
F	0.142	0.161	3.61	4.09
G	0.095	0.105	2.42	2.66
H	0.110	0.161	2.80	4.10
J	0.014	0.025	0.36	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

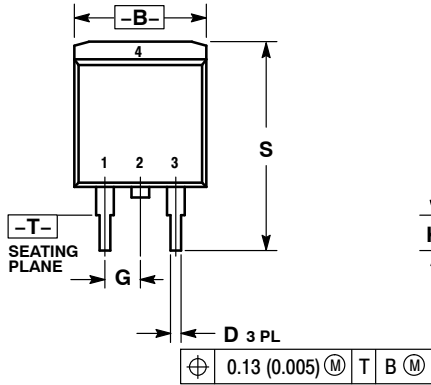
- STYLE 6:  
PIN 1. ANODE  
2. CATHODE  
3. ANODE  
4. CATHODE



**MBRB30H60CT-1G, MBR30H60CTG, MBRF30H60CTG, MBRB30H60CTT4G,  
NRVBB30H60CTT4G, MBRJ30H60CTG**

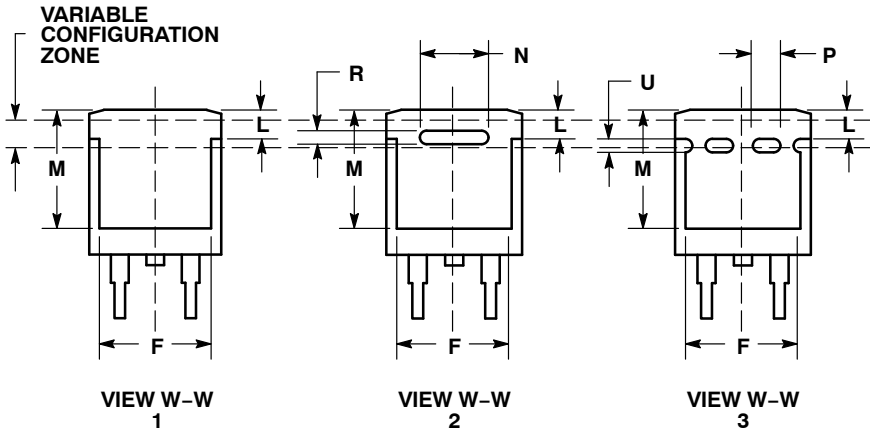
**PACKAGE DIMENSIONS**

**D<sup>2</sup>PAK 3**  
CASE 418B-04  
ISSUE K

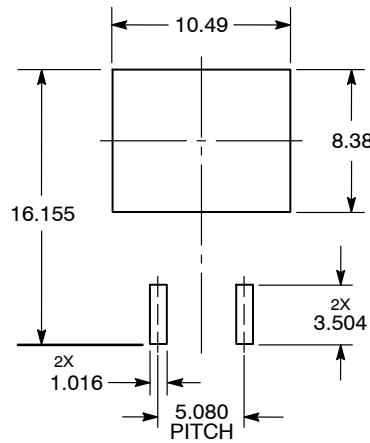


- NOTES:  
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
 2. CONTROLLING DIMENSION: INCH.  
 3. 418B-01 THRU 418B-03 OBSOLETE, NEW STANDARD 418B-04.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.340	0.380	8.64	9.65
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.83
D	0.020	0.035	0.51	0.89
E	0.045	0.055	1.14	1.40
F	0.310	0.350	7.87	8.89
G	0.100 BSC		2.54 BSC	
H	0.080	0.110	2.03	2.79
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
L	0.052	0.072	1.32	1.83
M	0.280	0.320	7.11	8.13
N	0.197 REF		5.00 REF	
P	0.079 REF		2.00 REF	
R	0.039 REF		0.99 REF	
S	0.575	0.625	14.60	15.88
V	0.045	0.055	1.14	1.40



**SOLDERING FOOTPRINT\***



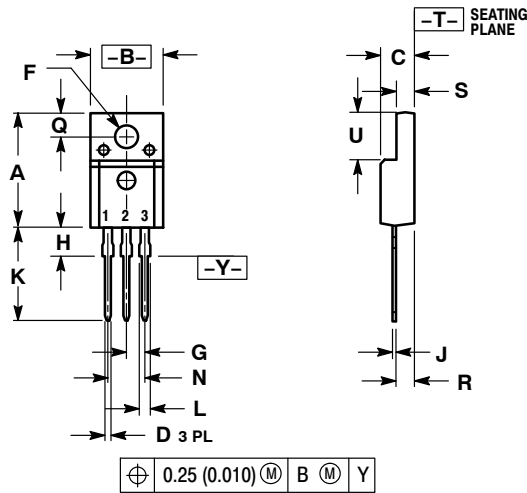
DIMENSIONS: MILLIMETERS

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

**MBRB30H60CT-1G, MBR30H60CTG, MBRF30H60CTG, MBRB30H60CTT4G,  
NRVBB30H60CTT4G, MBRJ30H60CTG**

**PACKAGE DIMENSIONS**

**TO-220 FULLPAK  
CASE 221D-03  
ISSUE K**

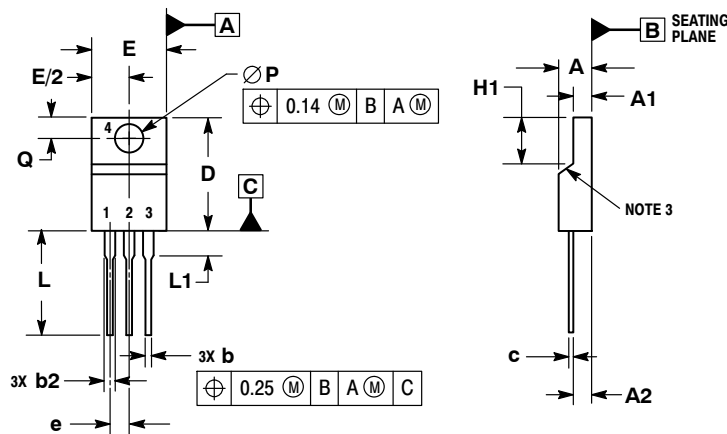


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH
  3. 221D-01 THRU 221D-02 OBSOLETE, NEW STANDARD 221D-03.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.617	0.635	15.67	16.12
B	0.392	0.419	9.96	10.63
C	0.177	0.193	4.50	4.90
D	0.024	0.039	0.60	1.00
F	0.116	0.129	2.95	3.28
G	0.100 BSC		2.54 BSC	
H	0.118	0.135	3.00	3.43
J	0.018	0.025	0.45	0.63
K	0.503	0.541	12.78	13.73
L	0.048	0.058	1.23	1.47
N	0.200 BSC		5.08 BSC	
Q	0.122	0.138	3.10	3.50
R	0.099	0.117	2.51	2.96
S	0.092	0.113	2.34	2.87
U	0.239	0.271	6.06	6.88

- STYLE 3:  
PIN 1. ANODE  
2. CATHODE  
3. ANODE

**TO-220 FULLPACK, 3-LEAD  
CASE 221AH  
ISSUE B**




- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. CONTOUR UNCONTROLLED IN THIS AREA.
  4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH AND GATE PROTRUSIONS. MOLD FLASH AND GATE PROTRUSIONS NOT TO EXCEED 0.13 PER SIDE. THESE DIMENSIONS ARE TO BE MEASURED AT OUTERMOST EXTREME OF THE PLASTIC BODY.
  5. DIMENSION b2 DOES NOT INCLUDE DAMBAR PROTRUSION. LEAD WIDTH INCLUDING PROTRUSION SHALL NOT EXCEED 2.00.

DIM	MILLIMETERS	
	MIN	MAX
A	4.30	4.70
A1	2.50	2.90
A2	2.50	2.70
b	0.54	0.84
b2	1.10	1.40
c	0.49	0.79
D	14.70	15.30
E	9.70	10.30
e	2.54 BSC	
H1	6.70	7.10
L	12.70	14.73
L1	---	2.80
P	3.00	3.40
Q	2.80	3.20

**MBRB30H60CT-1G, MBR30H60CTG, MBRF30H60CTG, MBRB30H60CTT4G,  
NRVBB30H60CTT4G, MBRJ30H60CTG**

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