# SWITCHMODE™ Power Rectifier 100 V, 20 A

#### **Features and Benefits**

- Low Forward Voltage: 0.64 V @ 125°C
- Low Power Loss/High Efficiency
- High Surge Capacity
- 175°C Operating Junction Temperature
- 20 A Total (10 A Per Diode Leg)
- Guard-Ring for Stress Protection
- Pb-Free Packages are Available

# **Applications**

- Power Supply Output Rectification
- Power Management
- Instrumentation

#### **Mechanical Characteristics:**

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

#### **MAXIMUM RATINGS**

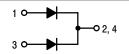
Please See the Table on the Following Page



# ON Semiconductor®

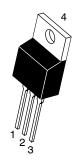
http://onsemi.com

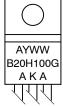
# SCHOTTKY BARRIER RECTIFIER 20 AMPERES, 100 VOLTS



TO-220AB CASE 221A

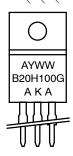
STYLE 6





MARKING DIAGRAMS







D<sup>2</sup>PAK CASE 418B STYLE 3



A = Assembly Location

Y = Year
WW = Work Week
B20H100 = Device Code
G = Pb-Free Device
AKA = Polarity Designator

#### **ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

## MAXIMUM RATINGS (Per Diode Leg)

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage		100	V
Average Rectified Forward Current (Rated $V_R$ ) $T_C = 162$ °C	I <sub>F(AV)</sub>	10	Α
Peak Repetitive Forward Current (Rated V <sub>R</sub> , Square Wave, 20 kHz) T <sub>C</sub> = 160°C	I <sub>FRM</sub>	20	Α
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I <sub>FSM</sub>	250	Α
Operating Junction Temperature (Note 1)	TJ	+175	°C
Storage Temperature	T <sub>stg</sub>	-65 to +175	°C
Voltage Rate of Change (Rated V <sub>R</sub> )	dv/dt	10,000	V/μs
Controlled Avalanche Energy (see test conditions in Figures 11 and 12)	W <sub>AVAL</sub>	200	mJ
ESD Ratings: Machine Model = C Human Body Model = 3B		> 400 > 8000	V

#### THERMAL CHARACTERISTICS

Maximum Thermal Resistance				°C/W	ĺ
(MBR20H100CT and MBRB20H100CT)	<ul><li>Junction-to-Case</li></ul>	$R_{ hetaJC}$	2.0		
	<ul><li>Junction-to-Ambient</li></ul>	$R_{ hetaJA}$	60		
(MBRF20H100CT)	<ul><li>Junction-to-Case</li></ul>	$R_{ heta JC}$	2.5		

# **ELECTRICAL CHARACTERISTICS** (Per Diode Leg)

Maximum Instantaneous Forward Voltage (Note 2)	VF		V
$(I_F = 10 \text{ A}, T_C = 25^{\circ}\text{C})$		0.77	
$(I_F = 10 \text{ A}, T_C = 125^{\circ}\text{C})$		0.64	
$(I_F = 20 \text{ A}, T_C = 25^{\circ}\text{C})$		0.88	
(I <sub>F</sub> = 20 A, T <sub>C</sub> = 125°C)		0.73	
Maximum Instantaneous Reverse Current (Note 2)	i <sub>R</sub>		mA
(Rated DC Voltage, T <sub>C</sub> = 125°C)		6.0	
(Rated DC Voltage, T <sub>C</sub> = 25°C)		0.0045	

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.

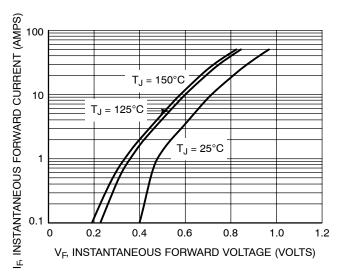
#### **DEVICE ORDERING INFORMATION**

Device Order Number	Package Type	Shipping <sup>†</sup>
MBR20H100CT	TO-220	50 Units / Rail
MBR20H100CTG	TO-220 (Pb-Free)	50 Units / Rail
MBRF20H100CTG	TO-220FP (Pb-Free)	50 Units / Rail
MBRB20H100CTT4G	D <sup>2</sup> PAK (Pb-Free)	800 / Tape & Reel

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

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

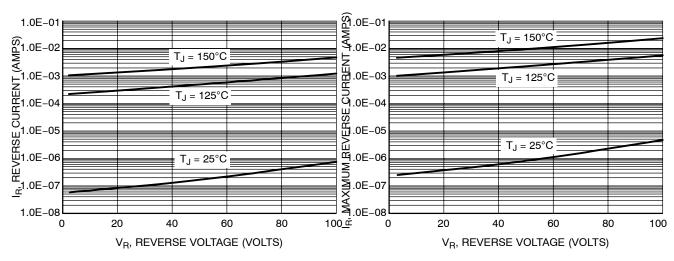
<sup>2.</sup> Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤[2.0%.



NATANTANEOUS FORWARD VOLTAGE (VOLTS)

Figure 1. Typical Forward Voltage

Figure 2. Maximum Forward Voltage



**Figure 3. Typical Reverse Current** 

Figure 4. Maximum Reverse Current

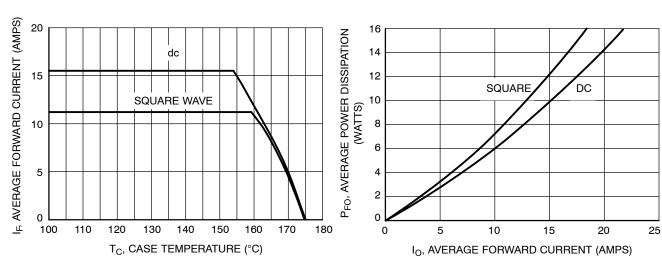


Figure 5. Current Derating

Figure 6. Forward Power Dissipation

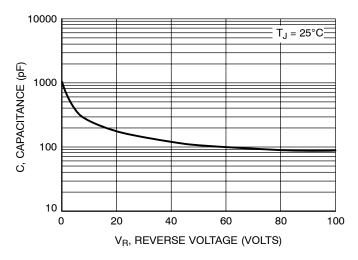


Figure 7. Capacitance

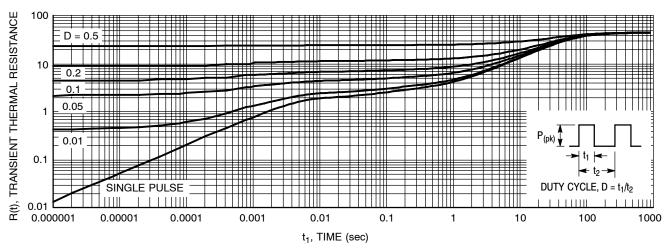


Figure 8. Thermal Response Junction-to-Ambient for MBR20H100CT and MBRB20H100CT

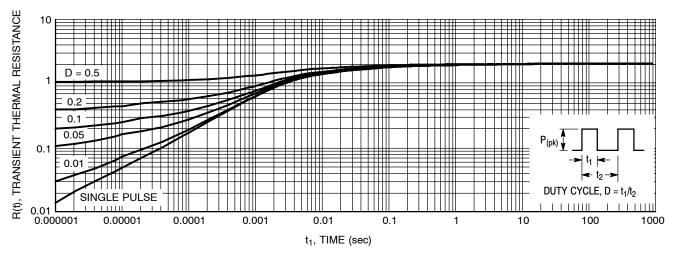


Figure 9. Thermal Response Junction-to-Case for MBR20H100CT and MBRB20H100CT

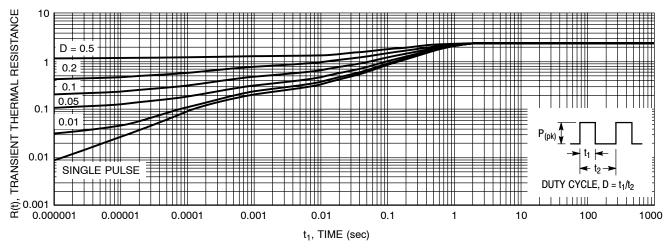


Figure 10. Thermal Response Junction-to-Case for MBRF20H100CT

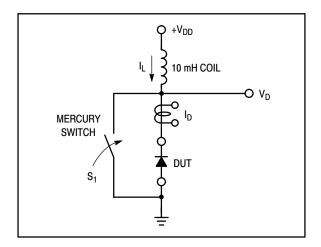


Figure 11. Test Circuit

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

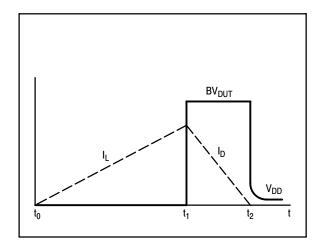


Figure 12. Current-Voltage Waveforms

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):**

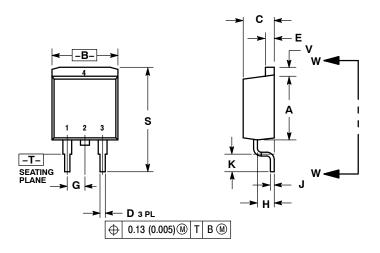
$$W_{AVAL} \approx \frac{1}{2}LI_{LPK}^{2} \left( \frac{BV_{DUT}}{BV_{DUT} - V_{DD}} \right)$$

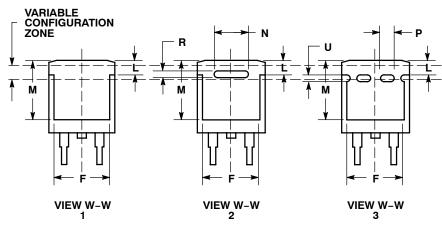
# **EQUATION (2):**

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

## **PACKAGE DIMENSIONS**

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



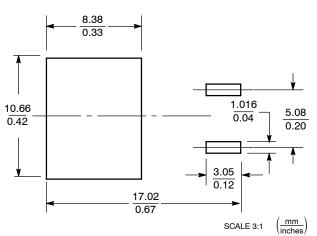


- NOTES:
  1. DIMENSIONING AND TOLERANCING
- PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. 418B-01 THRU 418B-03 OBSOLETE, NEW STANDARD 418B-04.

	INCHES		MILLIN	IETERS
DIM	MIN	MAX	MIN	MAX
Α	0.340	0.380	8.64	9.65
В	0.380	0.405	9.65	10.29
С	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
Н	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
М	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		REF	
S	0.575	0.625	14.60	15.88
V	0.045	0.055	1.14	1.40

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

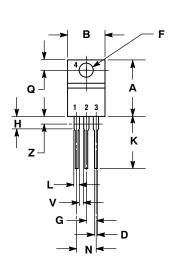
#### **SOLDERING FOOTPRINT\***

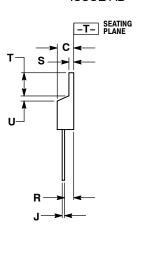


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

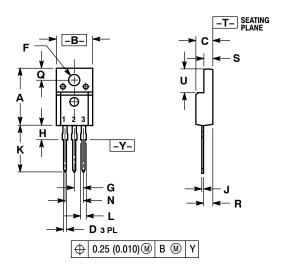
#### PACKAGE DIMENSIONS

TO-220 **PLASTIC** CASE 221A-09 **ISSUE AB** 





## TO-220 FULLPAK CASE 221D-03 **ISSUE G**



#### NOTES

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

	INCHES		IES MILLIMET	
DIM	MIN	MAX	MIN	MAX
Α	0.570	0.620	14.48	15.75
В	0.380	0.405	9.66	10.28
С	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
Н	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	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	0.020	0.055	0.508	1.39
Т	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
٧	0.045		1.15	
Z		0.080		2.04

STYLE 6:

ANODE PIN 1.

- CATHODE 2.
- ANODE
- CATHODE

#### NOTES

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

	INCHES		MILLIN	IETERS
DIM	MIN	MAX	MIN	MAX
Α	0.625	0.635	15.88	16.12
В	0.408	0.418	10.37	10.63
C	0.180	0.190	4.57	4.83
D	0.026	0.031	0.65	0.78
F	0.116	0.119	2.95	3.02
G	0.100 BSC		2.54 BSC	
Н	0.125	0.135	3.18	3.43
J	0.018	0.025	0.45	0.63
K	0.530	0.540	13.47	13.73
L	0.048	0.053	1.23	1.36
N	0.200 BSC		5.08 BSC	
Q	0.124	0.128	3.15	3.25
R	0.099	0.103	2.51	2.62
S	0.101	0.113	2.57	2.87
U	0.238	0.258	6.06	6.56

STYLE 3:

PIN 1. ANODE

- 2. CATHODE
- 3. ANODE

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