

# Breakover Diode Modules (BOD1)

 $V_{BO} = 1200 - 4200 \text{ V}$   
 $I_{AVM} = 0.2 - 1.25 \text{ A}$ 

Number of BODs	Types
2	IXBOD1-12R(D) ... IXBOD1-19R(D)
3	IXBOD1-20R(D) ... IXBOD1-32R(D)
4	IXBOD1-34R ... IXBOD1-42R



### Features / Advantages:

- Fast turn on
- Low temperature dependence
- Low leakage current

### Applications:

- High voltage circuit protection
- Transient voltage protection
- Trigger device
- Power pulse generators
- Lightning and arcing protection
- Energy discharge circuits
- Battery overvoltage protection
- Solar array protection

### Package: BOD-Package

- Industry standard outline
- RoHS compliant
- Epoxy meets UL 94V-0
- Soldering pins for PCB mounting
- Reduced weight

### Disclaimer Notice

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IXBOD1 several values				Ratings			
Symbol	Definitions	Conditions	min.	typ.	max.		
$I_D$	drain current	$V_D = 0.8 \cdot V_{BO}$ $T_{VJ} = 125^\circ\text{C}$			100	$\mu\text{A}$	
$I_{BO}$	breakover current	$T_{VJ} = 25^\circ\text{C}$			15	mA	
$I_H$	holding current	$T_{VJ} = 25^\circ\text{C}$			30	mA	
$V_H$	holding voltage	$T_{VJ} = 25^\circ\text{C}$	4		8	V	
$(di/dt)_C$	maximum pulsed source current	$V_D = V_{BO}; I_T = 80 \text{ A}; f = 50 \text{ Hz}$ $T_{VJ} = 125^\circ\text{C}$			200	A/ $\mu\text{s}$	
$t_q$	turn-off time	$V_D = 0.67 \cdot V_{BO}; V_R = 0 \text{ V}; I_T = 80 \text{ A}$ $T_{VJ} = 125^\circ\text{C}$ $dv/dt_{(lin.)} = 200 \text{ V}/\mu\text{s}; di/dt = -10 \text{ A}/\mu\text{s}$		150		$\mu\text{s}$	
$K_T$	temperature coefficient of $V_{BO}$				$2 \cdot 10^{-3}$	$\text{K}^{-1}$	
$K_P$	coefficient for energy per pulse $E_P$	(material constant)			700	K/Ws	

IXBOD1 - 12R... - 19R (2 Elements)				Ratings			
Symbol	Definitions	Conditions	min.	typ.	max.		
$V_{BO}$	breakover voltage	$V_{BO}(T_{VJ}) = V_{BO, 25^\circ\text{C}} [1 + K_T (T_{VJ} - 25^\circ\text{C})]$ IXBOD 1 -12R IXBOD 1 -13R IXBOD 1 -14R IXBOD 1 -15R IXBOD 1 -16R IXBOD 1 -17R IXBOD 1 -18R IXBOD 1 -19R	1150 1250 1350 1450 1550 1650 1750 1850	1200 1300 1400 1500 1600 1700 1800 1900	1250 1350 1450 1550 1650 1750 1850 1950	V V V V V V V V	
$I_{RMS}$	RMS current	$f = 50 \text{ Hz}$ $T_{amb} = 50^\circ\text{C}$ pins soldered to printed circuit (conductor 0.035x2mm)			2.0	A	
$I_{FAVM}$	maximum average forward current				1.25	A	
$I_{SM}$	maximum pulsed source current	$t_p = 0.1 \text{ ms};$ non repetitive $T_{amb} = 50^\circ\text{C}$			200	A	
$I^2t$	$I^2t$ value for fusing	$t_p = 0.1 \text{ ms}$ $T_{amb} = 50^\circ\text{C}$			2	$\text{A}^2\text{s}$	
$V_T$	forward voltage drop	$I_T = 5 \text{ A}$ $T_{VJ} = 125^\circ\text{C}$			3.4	V	
$V_{T0}$	threshold voltage	for power-loss calculation only			2.2	V	
$r_T$	slope resistance				0.24	$\Omega$	

IXBOD1 - 12RD... - 19RD (2 Elements)				Ratings			
Symbol	Definitions	Conditions	min.	typ.	max.		
$V_{BO}$	<i>breakover voltage</i>	$V_{BO}(T_{VJ}) = V_{BO, 25^{\circ}C} [1 + K_T (T_{VJ} - 25^{\circ}C)]$ IXBOD 1 -12RD IXBOD 1 -13RD IXBOD 1 -14RD IXBOD 1 -15RD IXBOD 1 -16RD IXBOD 1 -17RD IXBOD 1 -18RD IXBOD 1 -19RD					
			1150	1200	1250	V	
			1250	1300	1350	V	
			1350	1400	1450	V	
			1450	1500	1550	V	
			1550	1600	1650	V	
			1650	1700	1750	V	
			1750	1800	1850	V	
		1850	1900	1950	V		
$I_{RMS}$	<i>RMS current</i>	f = 50 Hz pins soldered to printed circuit (conductor 0.035x2mm)			0.3		A
$I_{FAVM}$	<i>maximum average forward current</i>				0.2		A
$I_{SM}$	<i>maximum pulsed source current</i>	$t_p = 0.1$ ms; non repetitive			50		A
$I^2t$	<i>I<sup>2</sup>t value for fusing</i>	$t_p = 0.1$ ms			0.125		A <sup>2</sup> s
$V_T$	<i>forward voltage drop</i>	$I_T = 5$ A			27		V
$V_{TO}$	<i>threshold voltage</i>	for power-loss calculation only			17.5		V
$r_T$	<i>slope resistance</i>				3		$\Omega$

IXBOD1 - 20R... - 32R (3 Elements)				Ratings			
Symbol	Definitions	Conditions	min.	typ.	max.		
$V_{BO}$	<i>breakover voltage</i>	$V_{BO}(T_{VJ}) = V_{BO, 25^{\circ}C} [1 + K_T (T_{VJ} - 25^{\circ}C)]$ IXBOD 1 -20R IXBOD 1 -21R IXBOD 1 -22R IXBOD 1 -23R IXBOD 1 -24R IXBOD 1 -25R IXBOD 1 -26R IXBOD 1 -28R IXBOD 1 -30R IXBOD 1 -32R					
			1950	2000	2050	V	
			2050	2100	2150	V	
			2150	2200	2250	V	
			2250	2300	2350	V	
			2350	2400	2450	V	
			2450	2500	2550	V	
			2500	2600	2700	V	
			2700	2800	2900	V	
			2900	3000	3100	V	
			3100	3200	3300	V	
$I_{RMS}$	<i>RMS current</i>	f = 50 Hz pins soldered to printed circuit (conductor 0.035x2mm)			1.4		A
$I_{FAVM}$	<i>maximum average forward current</i>				0.9		A
$I_{SM}$	<i>maximum pulsed source current</i>	$t_p = 0.1$ ms; non repetitive			200		A
$I^2t$	<i>I<sup>2</sup>t value for fusing</i>	$t_p = 0.1$ ms			2		A <sup>2</sup> s
$V_T$	<i>forward voltage drop</i>	$I_T = 5$ A			5.1		V
$V_{TO}$	<i>threshold voltage</i>	for power-loss calculation only			3.3		V
$r_T$	<i>slope resistance</i>				0.36		$\Omega$

IXBOD1 - 20RD... - 32RD (3 Elements)			Ratings			
Symbol	Definitions	Conditions	min.	typ.	max.	
$V_{BO}$	<i>breakover voltage</i>	$V_{BO}(T_{VJ}) = V_{BO, 25^{\circ}C} [1 + K_T (T_{VJ} - 25^{\circ}C)]$ IXBOD 1 -20RD IXBOD 1 -21RD IXBOD 1 -22RD IXBOD 1 -23RD IXBOD 1 -24RD IXBOD 1 -25RD IXBOD 1 -26RD IXBOD 1 -28RD IXBOD 1 -30RD IXBOD 1 -32RD				
			1950	2000	2050	V
			2050	2100	2150	V
			2150	2200	2250	V
			2250	2300	2350	V
			2350	2400	2450	V
			2450	2500	2550	V
			2500	2600	2700	V
			2700	2800	2900	V
			2900	3000	3100	V
3100	3200	3300	V			
$I_{RMS}$	<i>RMS current</i>	f = 50 Hz pins soldered to printed circuit (conductor 0.035x2mm)			0.3	A
$I_{FAVM}$	<i>maximum average forward current</i>				0.2	A
$I_{SM}$	<i>maximum pulsed source current</i>	$t_p = 0.1$ ms; non repetitive			50	A
$I^2t$	<i>I<sup>2</sup>t value for fusing</i>	$t_p = 0.1$ ms			0.125	A <sup>2</sup> s
$V_T$	<i>forward voltage drop</i>	$I_T = 5$ A			27	V
$V_{T0}$	<i>threshold voltage</i>	for power-loss calculation only			17.5	V
$r_T$	<i>slope resistance</i>				3	$\Omega$

IXBOD1 - 34... - 42R (4 Elements)			Ratings			
Symbol	Definitions	Conditions	min.	typ.	max.	
$V_{BO}$	<i>breakover voltage</i>	$V_{BO}(T_{VJ}) = V_{BO, 25^{\circ}C} [1 + K_T (T_{VJ} - 25^{\circ}C)]$ IXBOD 1 -34R IXBOD 1 -36R IXBOD 1 -38R IXBOD 1 -40R IXBOD 1 -42R				
			3300	3400	3500	V
			3500	3600	3700	V
			3700	3800	4000	V
			3900	4000	4100	V
			4100	4200	4300	V
$I_{RMS}$	<i>RMS current</i>	f = 50 Hz pins soldered to printed circuit (conductor 0.035x2mm)			1.1	A
$I_{FAVM}$	<i>maximum average forward current</i>				0.7	A
$I_{SM}$	<i>maximum pulsed source current</i>	$t_p = 0.1$ ms; non repetitive			200	A
$I^2t$	<i>I<sup>2</sup>t value for fusing</i>	$t_p = 0.1$ ms			2	A <sup>2</sup> s
$V_T$	<i>forward voltage drop</i>	$I_T = 5$ A			6.8	V
$V_{T0}$	<i>threshold voltage</i>	for power-loss calculation only			4.4	V
$r_T$	<i>slope resistance</i>				0.48	$\Omega$

Package FP-Case				Ratings			
Symbol	Definitions	Conditions	min.	typ.	max.		
$T_{amb}$	ambient temperature (cooling medium)		-40		125	°C	
$T_{stg}$	storage temperature		-40		125	°C	
$T_{vJM}$	maximum virtual junction temperature		-40		125	°C	
$R_{thJA}$	thermal resistance junction to ambient	natural convection			20	K/W	
		with air speed 2 m/s			16	K/W	
<b>Weight</b>				14		g	



### Outlines FP-case



Dimensions in mm (1 mm = 0.0394")



Ordering	Part Name	Marking on Product	Delivering Mode	Base Qty	Ordering Code
Standard	IXBOD 1 -12R	IXBOD 1 -12R	Box	20	468649
Standard	IXBOD 1 -12RD	IXBOD 1 -12RD	Box	20	472948
Standard	IXBOD 1 -13R	IXBOD 1 -13R	Box	20	468657
Standard	IXBOD 1 -13RD	IXBOD 1 -13RD	Box	20	472956
Standard	IXBOD 1 -14R	IXBOD 1 -14R	Box	20	468665
Standard	IXBOD 1 -14RD	IXBOD 1 -14RD	Box	20	472964
Standard	IXBOD 1 -15R	IXBOD 1 -15R	Box	20	468673
Standard	IXBOD 1 -15RD	IXBOD 1 -15RD	Box	20	472972
Standard	IXBOD 1 -16R	IXBOD 1 -16R	Box	20	468681
Standard	IXBOD 1 -16RD	IXBOD 1 -16RD	Box	20	472794
Standard	IXBOD 1 -17R	IXBOD 1 -17R	Box	20	468703
Standard	IXBOD 1 -17RD	IXBOD 1 -17RD	Box	20	472980
Standard	IXBOD 1 -18R	IXBOD 1 -18R	Box	20	468711
Standard	IXBOD 1 -18RD	IXBOD 1 -18RD	Box	20	472999
Standard	IXBOD 1 -19R	IXBOD 1 -19R	Box	20	468738
Standard	IXBOD 1 -19RD	IXBOD 1 -19RD	Box	20	473006
Standard	IXBOD 1 -20R	IXBOD 1 -20R	Box	20	468746
Standard	IXBOD 1 -20RD	IXBOD 1 -20RD	Box	20	473014
Standard	IXBOD 1 -21R	IXBOD 1 -21R	Box	20	468754
Standard	IXBOD 1 -21RD	IXBOD 1 -21RD	Box	20	473022
Standard	IXBOD 1 -22R	IXBOD 1 -22R	Box	20	468762
Standard	IXBOD 1 -22RD	IXBOD 1 -22RD	Box	20	473030
Standard	IXBOD 1 -23R	IXBOD 1 -23R	Box	20	468770
Standard	IXBOD 1 -23RD	IXBOD 1 -23RD	Box	20	472786
Standard	IXBOD 1 -24R	IXBOD 1 -24R	Box	20	468789
Standard	IXBOD 1 -24RD	IXBOD 1 -24RD	Box	20	473049
Standard	IXBOD 1 -25R	IXBOD 1 -25R	Box	20	468797
Standard	IXBOD 1 -25RD	IXBOD 1 -25RD	Box	20	473057
Standard	IXBOD 1 -26R	IXBOD 1 -26R	Box	20	468800
Standard	IXBOD 1 -26RD	IXBOD 1 -26RD	Box	20	473065
Standard	IXBOD 1 -28R	IXBOD 1 -28R	Box	20	468819
Standard	IXBOD 1 -28RD	IXBOD 1 -28RD	Box	20	473073
Standard	IXBOD 1 -30R	IXBOD 1 -30R	Box	20	468827
Standard	IXBOD 1 -30RD	IXBOD 1 -30RD	Box	20	473081
Standard	IXBOD 1 -32R	IXBOD 1 -32R	Box	20	468835
Standard	IXBOD 1 -32RD	IXBOD 1 -32RD	Box	20	473103
Standard	IXBOD 1 -34R	IXBOD 1 -34R	Box	20	468843
Standard	IXBOD 1 -36R	IXBOD 1 -36R	Box	20	468851
Standard	IXBOD 1 -38R	IXBOD 1 -38R	Box	20	468878
Standard	IXBOD 1 -40R	IXBOD 1 -40R	Box	20	468886
Standard	IXBOD 1 -42R	IXBOD 1 -42R	Box	20	468894

**Curves**



Fig. 1 Energy per pulse for single BOD element for trapezoidal wave current.  $E_p$  must be multiplied by number of elements for total energy

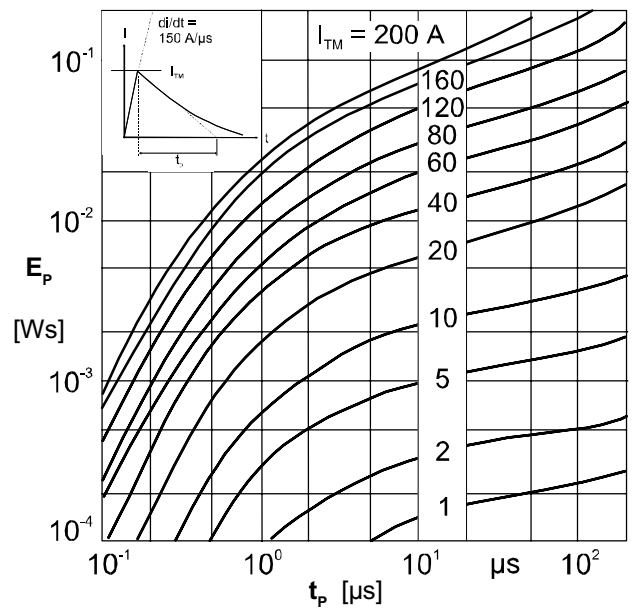


Fig. 2 Energy per pulse for single BOD element for exponentially decaying current pulse.  $E_p$  must be multiplied by number of elements for total energy

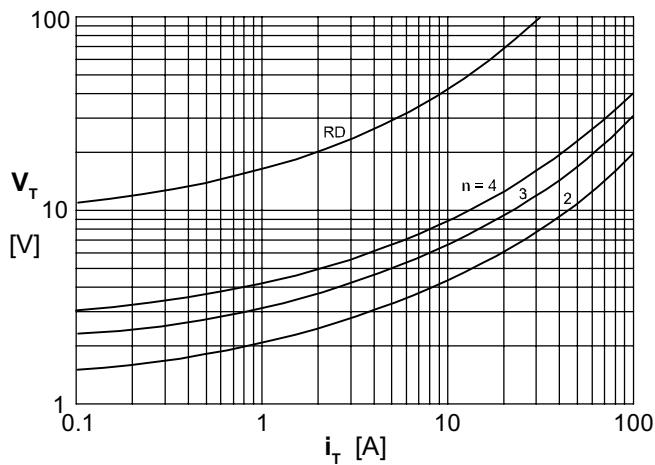


Fig. 3 On-state voltage at  $T_{vj} = 125^\circ\text{C}$

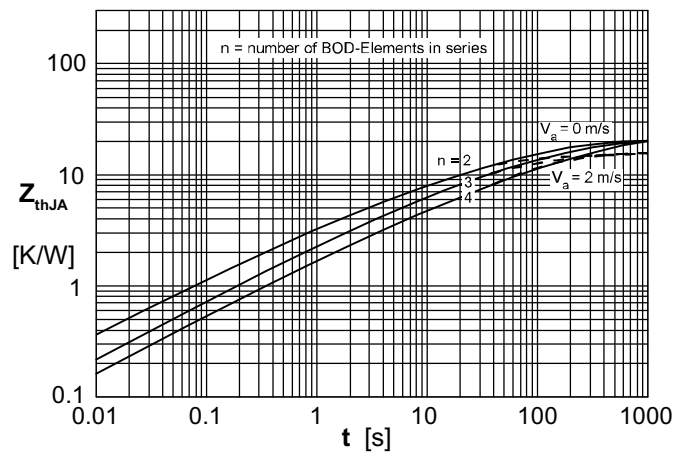


Fig. 4 Transient thermal resistance