



# High Voltage Standard Rectifier Module

$V_{RRM} = 2 \times 2000 \text{ V}$

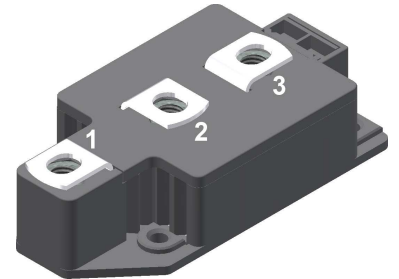
$I_{FAV} = 300 \text{ A}$

$V_F = 1 \text{ V}$

Phase leg

Part number

**MDD310-20N1**



Backside: isolated



### Features / Advantages:

- Package with DCB ceramic
- Improved temperature and power cycling
- Planar passivated chips
- Very low forward voltage drop
- Very low leakage current

### Applications:

- Diode for main rectification
- For single and three phase bridge configurations
- Supplies for DC power equipment
- Input rectifiers for PWM inverter
- Battery DC power supplies
- Field supply for DC motors

### Package: Y2

- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Height: 30 mm
- Base plate: DCB ceramic
- Reduced weight
- Advanced power cycling

### Disclaimer Notice

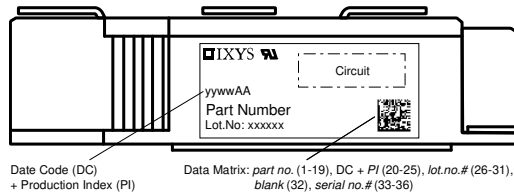
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Rectifier				Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit	
$V_{RSM}$	max. non-repetitive reverse blocking voltage				2100	V	
$V_{RRM}$	max. repetitive reverse blocking voltage				2000	V	
$I_R$	reverse current	$V_R = 2000\text{ V}$			1	mA	
		$V_R = 2000\text{ V}$			20	mA	
$V_F$	forward voltage drop	$I_F = 300\text{ A}$			1.13	V	
		$I_F = 600\text{ A}$			1.33	V	
		$I_F = 300\text{ A}$	$T_{VJ} = 125^\circ\text{C}$			1.00	V
		$I_F = 600\text{ A}$				1.29	V
$I_{FAV}$	average forward current	$T_C = 100^\circ\text{C}$			300	A	
$I_{F(RMS)}$	RMS forward current	180° sine			480	A	
$V_{F0}$	threshold voltage	} for power loss calculation only			0.75	V	
$r_F$	slope resistance				0.63	mΩ	
$R_{thJC}$	thermal resistance junction to case				0.13	K/W	
$R_{thCH}$	thermal resistance case to heatsink			0.04		K/W	
$P_{tot}$	total power dissipation				960	W	
$I_{FSM}$	max. forward surge current	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^\circ\text{C}$			11.5	kA
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			12.4	kA
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^\circ\text{C}$			9.78	kA
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			10.6	kA
$I^2t$	value for fusing	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^\circ\text{C}$			661.3	kA <sup>2</sup> s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			641.7	kA <sup>2</sup> s
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^\circ\text{C}$			477.8	kA <sup>2</sup> s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			463.5	kA <sup>2</sup> s
$C_J$	junction capacitance	$V_R = 700\text{ V}; f = 1\text{ MHz}$	$T_{VJ} = 25^\circ\text{C}$		288	pF	



Package Y2			Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit
$I_{RMS}$	RMS current	per terminal			600	A
$T_{VJ}$	virtual junction temperature		-40		150	°C
$T_{op}$	operation temperature		-40		125	°C
$T_{stg}$	storage temperature		-40		125	°C
<b>Weight</b>				254		g
$M_D$	mounting torque		2.5		5	Nm
$M_T$	terminal torque		12		15	Nm
$d_{Spp/App}$	creepage distance on surface   striking distance through air	terminal to terminal	13.0			mm
$d_{Spb/Apb}$		terminal to backside	13.0			mm
$V_{ISOL}$	isolation voltage	t = 1 second	3600			V
		t = 1 minute	3000			V



Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MDD310-20N1	MDD310-20N1	Box	2	470074

**Equivalent Circuits for Simulation**

\* on die level

$T_{VJ} = 150^{\circ}\text{C}$

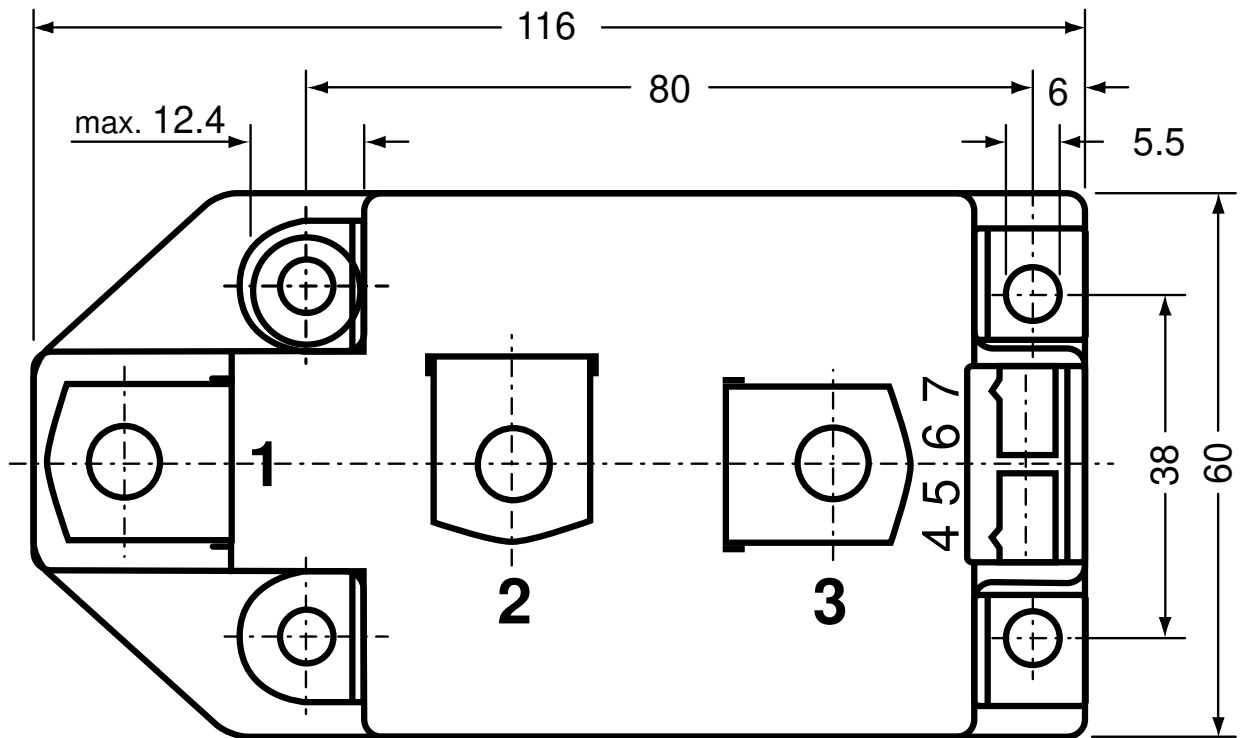
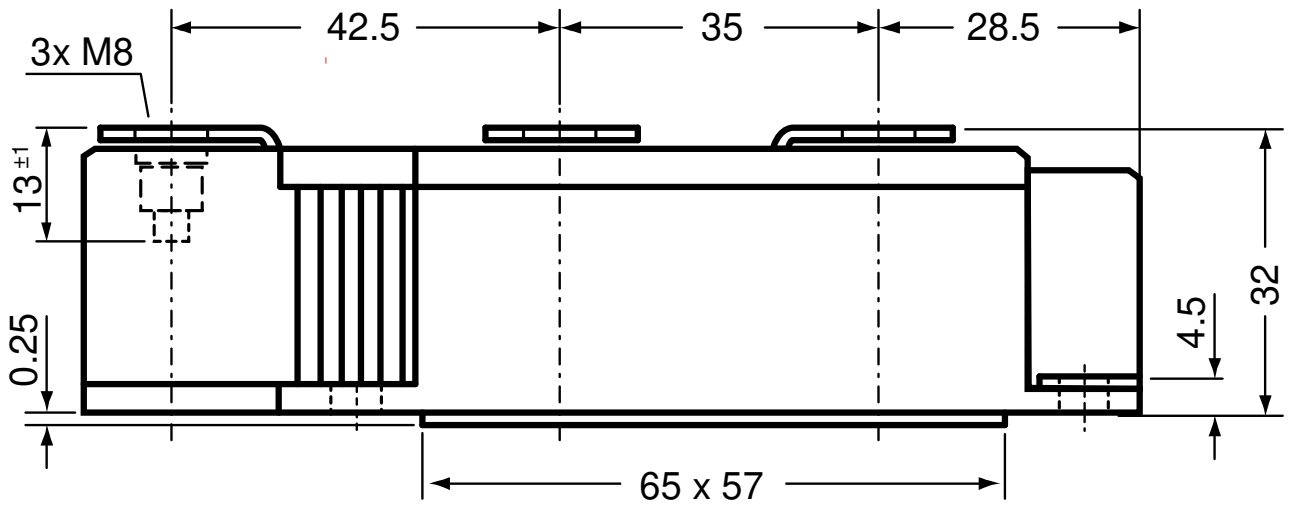


**Rectifier**

$V_{0\ max}$	threshold voltage	0.75	V
$R_{0\ max}$	slope resistance *	0.34	mΩ



Outlines Y2





**Rectifier**



Fig. 1 Surge overload current  
 $I_{FSM}$ : Crest value,  $t$ : duration

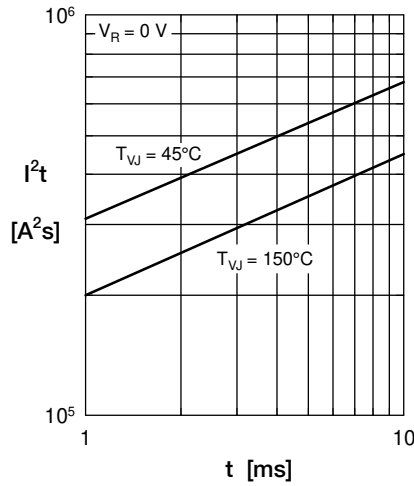


Fig. 2  $I^2t$  versus time (1-10 ms)



Fig. 3 Maximum forward current at case temperature



Fig. 4 Power dissipation versus forward current and ambient temperature (per diode)



Fig. 5 Single phase rectifier bridge: Power dissipation vs. direct output current and ambient temperature  $R$  = resistive load,  $L$  = inductive load



**Rectifier**

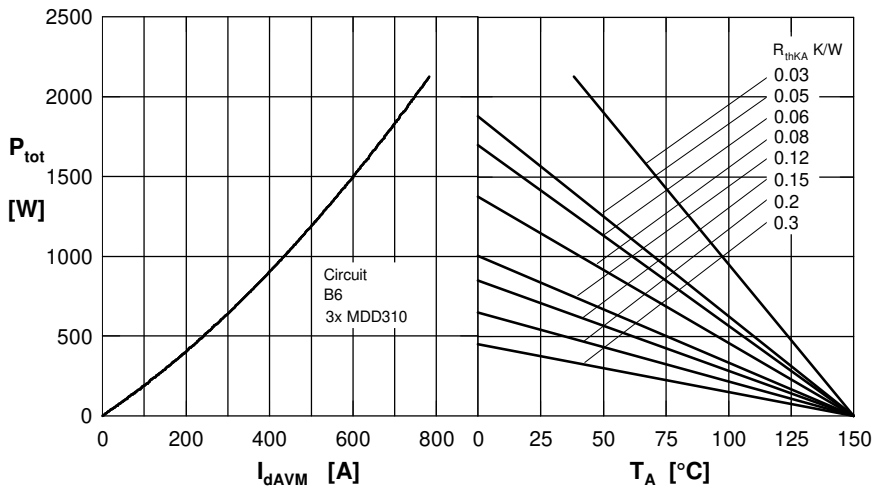


Fig.6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

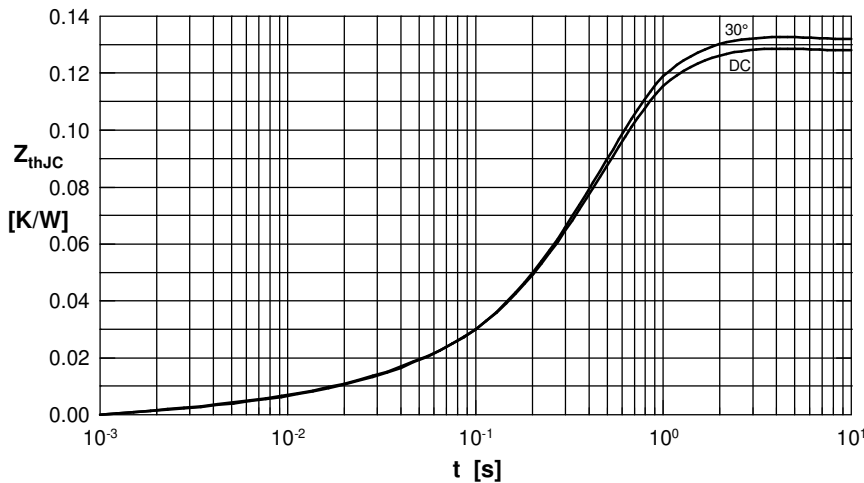


Fig. 7 Transient thermal impedance junction to case (per diode)

$R_{thJC}$  for various conduction angles  $d$ .

$d$	$R_{thJC}$ [K/W]
DC	0.129
180°	0.131
120°	0.132
60°	0.132
30°	0.133

Constants for  $Z_{thJC}$  calculation:

$i$	$R_{thi}$ [K/W]	$t_i$ [s]
1	0.0035	0.0099
2	0.0165	0.1680
3	0.1091	0.4560



Fig. 8 Transient thermal impedance junction to heatsink (per diode)

$R_{thJK}$  for various conduction angles  $d$ .

$d$	$R_{thJK}$ [K/W]
DC	0.169
180°	0.171
120°	0.172
60°	0.172
30°	0.173

Constants for  $Z_{thJK}$  calculation:

$i$	$R_{thi}$ (K/W)	$t_i$ (s)
1	0.0035	0.0099
2	0.0165	0.1680
3	0.1091	0.4560
4	0.0400	1.3600