

# High Voltage Standard Rectifier Module

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

$$I_{FAV} = 310 \text{ A}$$

$$V_F = 1,03 \text{ V}$$


Phase leg

Part number

**MDD312-20N1**



Backside: isolated

 E72873



## 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: Y1

- Isolation Voltage: 4800 V~
- Industry standard outline
- RoHS compliant
- Base plate: Copper internally DCB isolated
- Advanced power cycling

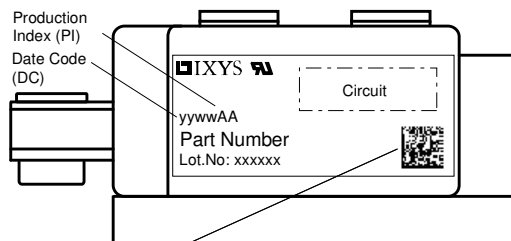
## Disclaimer Notice

Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at [www.littelfuse.com/disclaimer-electronics](http://www.littelfuse.com/disclaimer-electronics).

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	$V_R = 2000$ V		$T_{VJ} = 25^\circ\text{C}$		500	$\mu\text{A}$
		$V_R = 2000$ V		$T_{VJ} = 150^\circ\text{C}$		30	mA
$V_F$	forward voltage drop	$I_F = 300$ A		$T_{VJ} = 25^\circ\text{C}$		1,13	V
		$I_F = 600$ A				1,33	V
		$I_F = 300$ A		$T_{VJ} = 125^\circ\text{C}$		1,03	V
		$I_F = 600$ A				1,29	V
$I_{FAV}$	average forward current	$T_C = 100^\circ\text{C}$		$T_{VJ} = 150^\circ\text{C}$		310	A
$I_{F(RMS)}$	RMS forward current	180° sine	d = 0.5			520	A
$V_{F0}$	threshold voltage	} for power loss calculation only		$T_{VJ} = 150^\circ\text{C}$		0,80	V
$r_F$	slope resistance					0,6	m $\Omega$
$R_{thJC}$	thermal resistance junction to case					0,12	K/W
$R_{thCH}$	thermal resistance case to heatsink				0,04		K/W
$P_{tot}$	total power dissipation			$T_C = 25^\circ\text{C}$		1040	W
$I_{FSM}$	max. forward surge current	t = 10 ms; (50 Hz), sine		$T_{VJ} = 45^\circ\text{C}$		10,8	kA
		t = 8,3 ms; (60 Hz), sine		$V_R = 0$ V		11,7	kA
		t = 10 ms; (50 Hz), sine		$T_{VJ} = 150^\circ\text{C}$		9,18	kA
		t = 8,3 ms; (60 Hz), sine		$V_R = 0$ V		9,92	kA
$I^2t$	value for fusing	t = 10 ms; (50 Hz), sine		$T_{VJ} = 45^\circ\text{C}$		583,2	kA <sup>2</sup> s
		t = 8,3 ms; (60 Hz), sine		$V_R = 0$ V		566,1	kA <sup>2</sup> s
		t = 10 ms; (50 Hz), sine		$T_{VJ} = 150^\circ\text{C}$		421,4	kA <sup>2</sup> s
		t = 8,3 ms; (60 Hz), sine		$V_R = 0$ V		409,0	kA <sup>2</sup> s
$C_J$	junction capacitance	$V_R = 700$ V; f = 1 MHz		$T_{VJ} = 25^\circ\text{C}$		288	pF



Package Y1			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>				680		g
$M_D$	mounting torque		4,5		7	Nm
$M_T$	terminal torque		11		13	Nm
$d_{Spp/App}$	creepage distance on surface   striking distance through air	terminal to terminal	16,0			mm
$d_{Spb/Apb}$		terminal to backside	16,0			mm
$V_{ISOL}$	isolation voltage	t = 1 second	4800			V
		t = 1 minute	4000			V



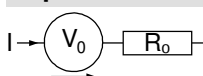
Data Matrix: part no. (1-19), DC + PI (20-25), lot.no.# (26-31), blank (32), serial no.# (33-36)

Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MDD312-20N1	MDD312-20N1	Box	3	467251

Similar Part	Package	Voltage class
MDD312-12N1	Y1-CU	1200
MDD312-14N1	Y1-CU	1400
MDD312-16N1	Y1-CU	1600
MDD312-18N1	Y1-CU	1800

MDD312-22N1	Y1-CU	2200
-------------	-------	------

**Equivalent Circuits for Simulation** \* on die level  $T_{VJ} = 150^{\circ}C$

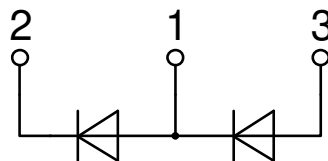
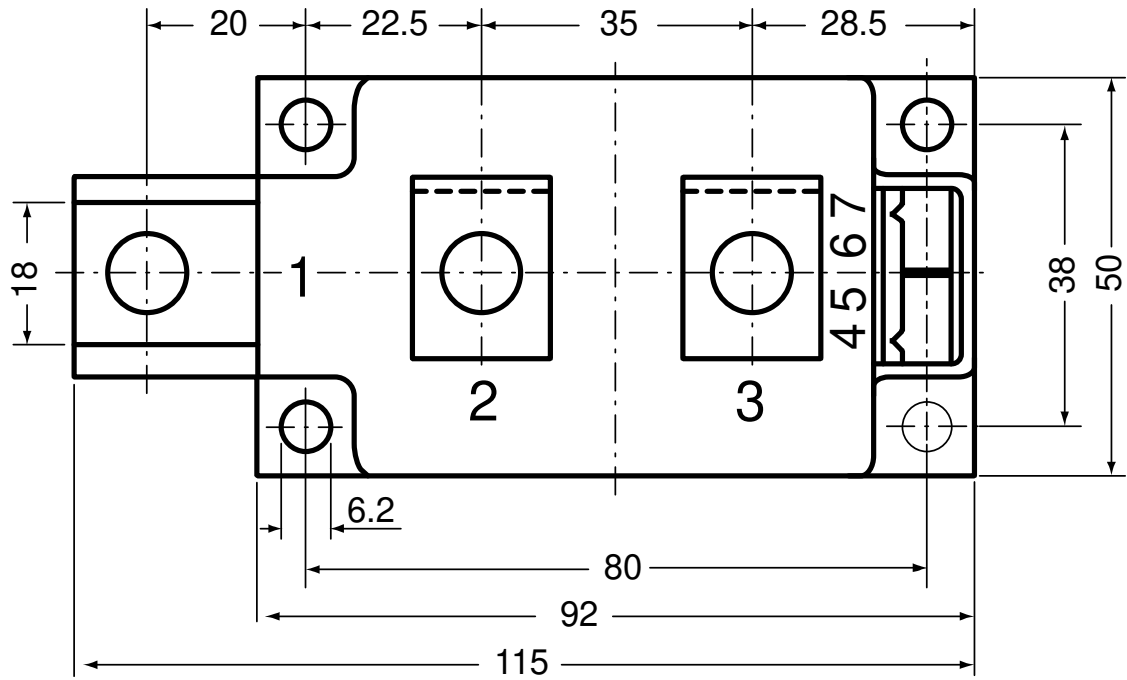
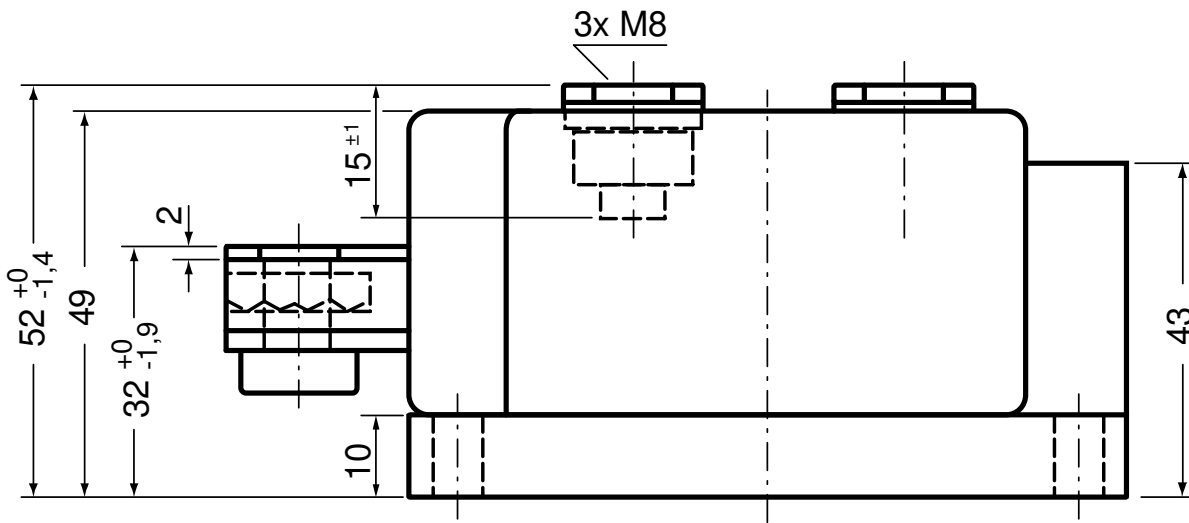


Rectifier

$V_{0\ max}$	threshold voltage	0,8	V
$R_{0\ max}$	slope resistance *	0,4	mΩ



Outlines Y1





**Rectifier**

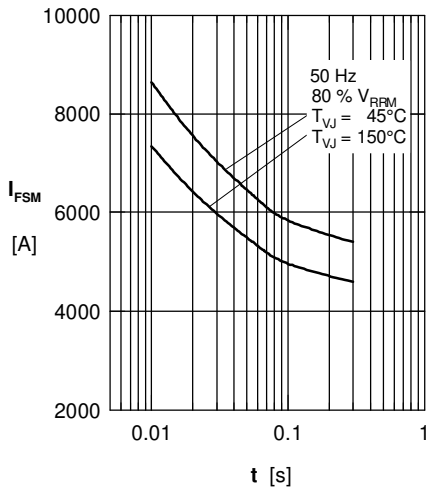


Fig. 1 Surge overload current  
 $I_{FSM}$ : Crest value,  $t$ : duration

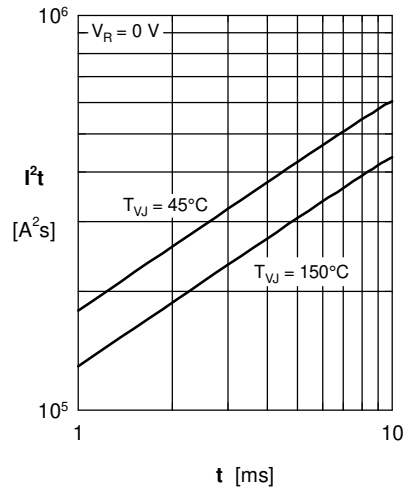


Fig. 2  $I^2t$  versus time (1-10 ms)

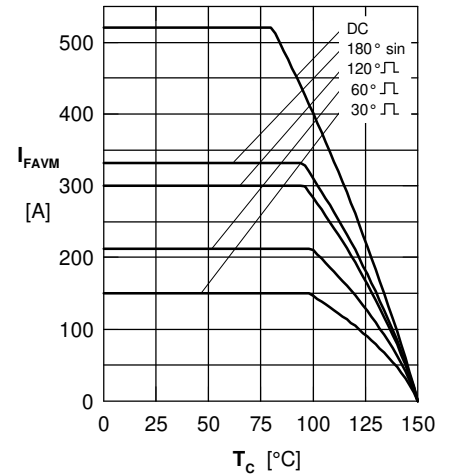


Fig. 3 Maximum forward current at case temperature

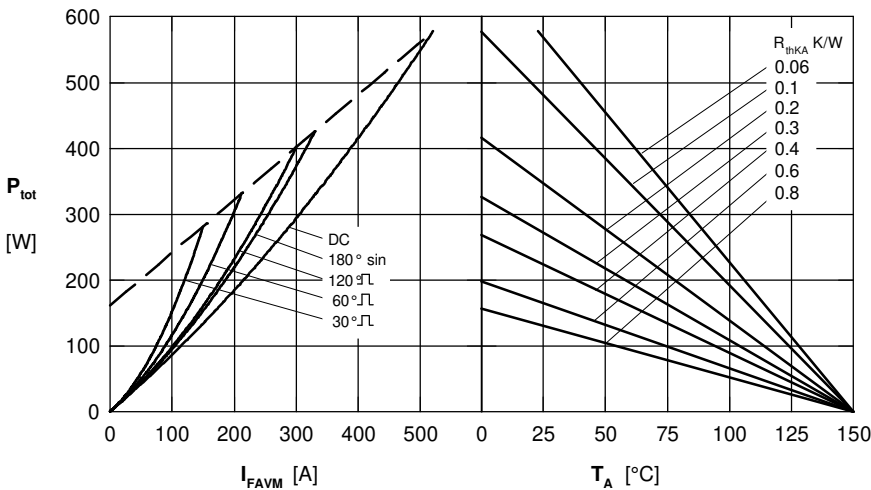


Fig. 4 Power dissipation vs. forward current & ambient temperature (per diode)

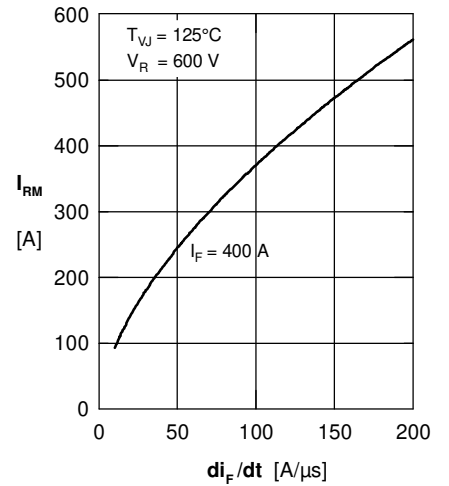


Fig. 5 Typ. peak reverse current

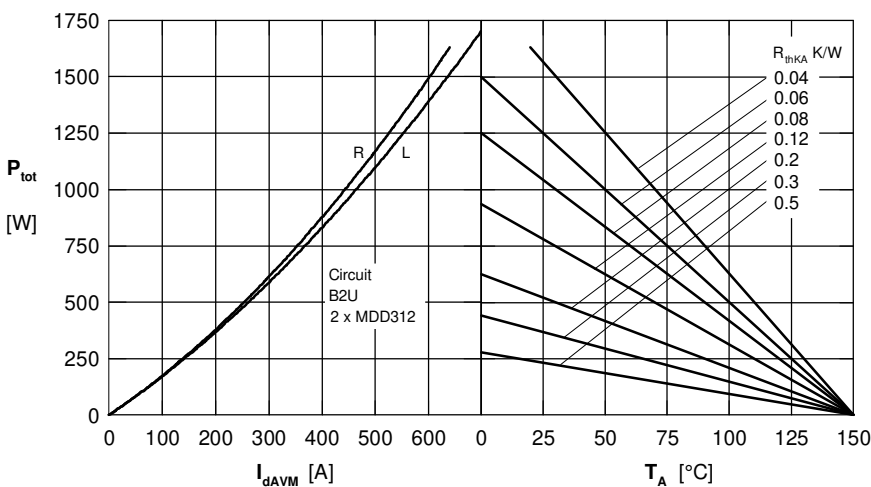


Fig. 6 Single phase rectifier bridge: Power dissipation vs. direct output current and ambient temperature  $R =$  resistive load,  $L =$  inductive load

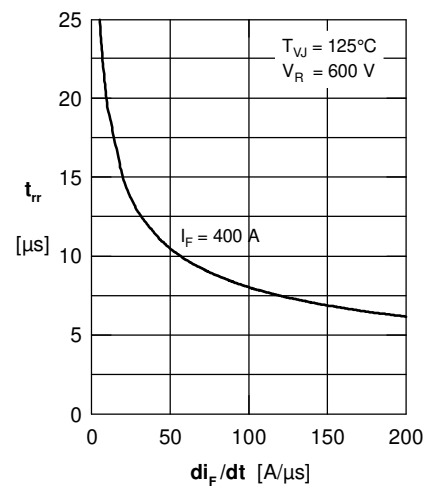


Fig. 7 Typ. recovery time  $t_{rr}$  versus  $-di_F/dt$



**Rectifier**



Fig. 8 Three phase rectifier bridge: Power dissipation vs. direct output current & ambient temperature



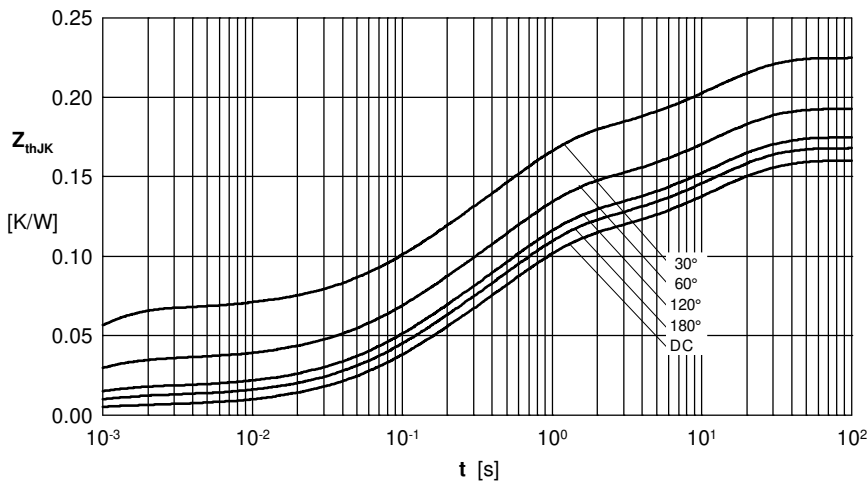
$R_{thJC}$  for various conduction angles  $d$ :

$d$	$R_{thJC}$ [K/W]
DC	0.120
180°	0.128
120°	0.135
60°	0.153
30°	0.185

Constants for  $Z_{thJC}$  calculation:

$i$	$R_{thi}$ (K/W)	$t_i$ (s)
1	0.0058	0.00054
2	0.0310	0.09800
3	0.0720	0.54000
4	0.0112	12.0000

Fig. 9 Transient thermal impedance junction to case (per diode)



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

$d$	$R_{thJK}$ [K/W]
DC	0.160
180°	0.168
120°	0.175
60°	0.193
30°	0.225

Constants for  $Z_{thJK}$  calculation:

$i$	$R_{thi}$ (K/W)	$t_i$ (s)
1	0.0058	0.00054
2	0.0310	0.09800
3	0.0720	0.54000
4	0.0112	12.0000
5	0.0400	12.0000

Fig. 10 Transient thermal impedance junction to heatsink (per diode)