



# Standard Rectifier Module

$V_{RRM} = 2 \times 1600 \text{ V}$

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

$V_F = 1.03 \text{ V}$

Phase leg

Part number

**MDD312-16N1**



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: 3600 V~
- Industry standard outline
- RoHS compliant
- Base plate: Copper internally DCB isolated
- Advanced power cycling

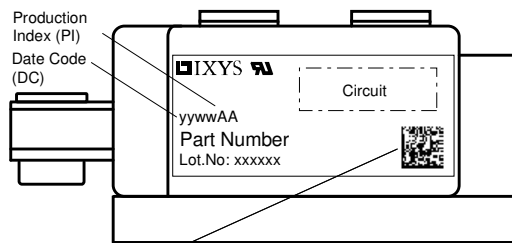
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Rectifier				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
$V_{RSM}$	max. non-repetitive reverse blocking voltage					1700	V
$V_{RRM}$	max. repetitive reverse blocking voltage					1600	V
$I_R$	reverse current	$V_R = 1600$ V		$T_{VJ} = 25^\circ\text{C}$		500	$\mu\text{A}$
		$V_R = 1600$ 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	$V_R = 400$ V; f = 1 MHz		$T_{VJ} = 25^\circ\text{C}$		381	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	3600			V
		t = 1 minute	3000			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	MDD312-16N1	MDD312-16N1	Box	3	463442

Similar Part	Package	Voltage class
MDD312-12N1	Y1-CU	1200
MDD312-14N1	Y1-CU	1400
MDD312-18N1	Y1-CU	1800
MDD312-20N1	Y1-CU	2000

MDD312-22N1	Y1-CU	2200
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**Equivalent Circuits for Simulation**

\* on die level

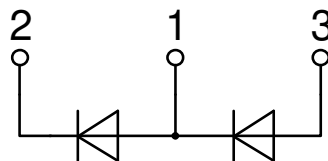
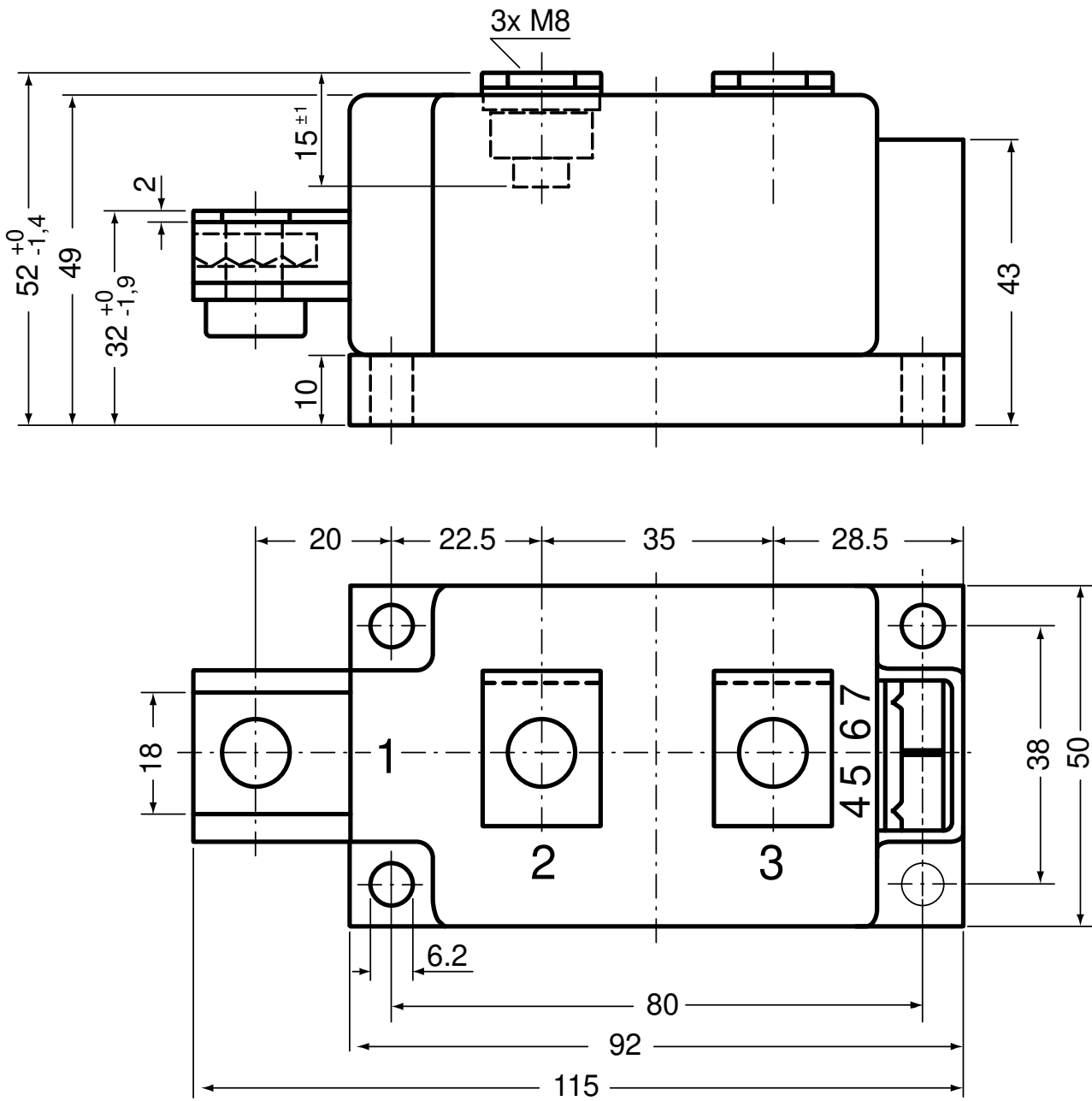
 $T_{VJ} = 150^{\circ}\text{C}$ 

**Rectifier**

$V_{0\ max}$	threshold voltage	0.8	V
$R_{0\ max}$	slope resistance *	0.4	mΩ



Outlines Y1





**Rectifier**

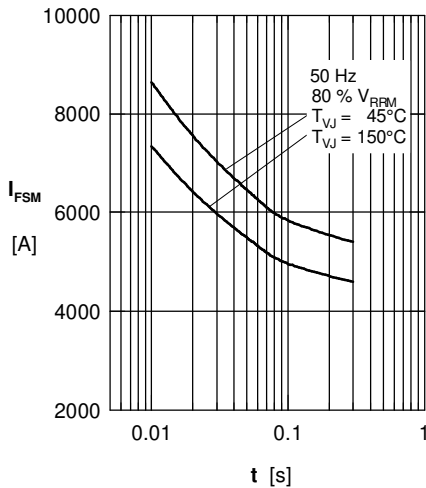


Fig. 1 Surge overload current  
 $I_{FSM}$ : Crest value,  $t$ : duration

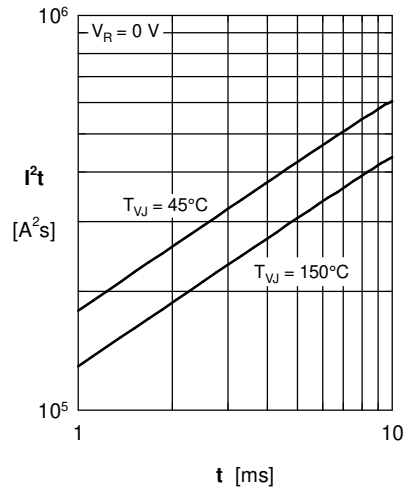


Fig. 2  $I^2t$  versus time (1-10 ms)

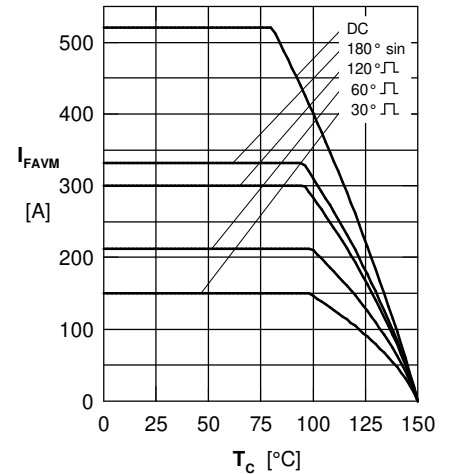


Fig. 3 Maximum forward current at case temperature

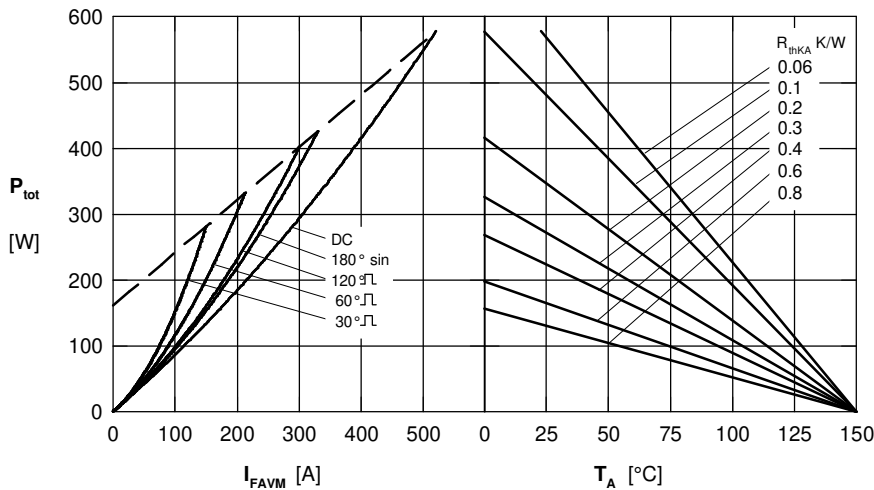


Fig. 4 Power dissipation vs. forward current & ambient temperature (per diode)

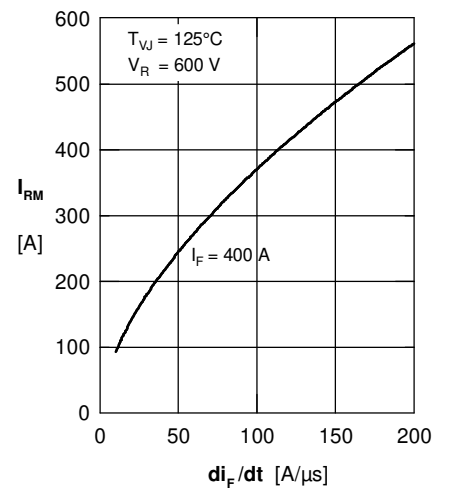


Fig. 5 Typ. peak reverse current

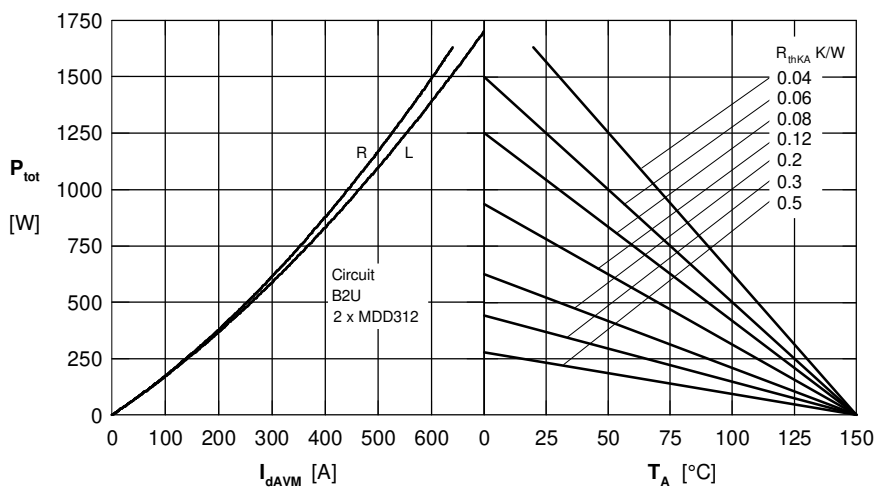


Fig. 6 Single phase rectifier bridge: Power dissipation vs. direct output current and ambient temperature  $R =$  resistive load,  $L =$  inductive load

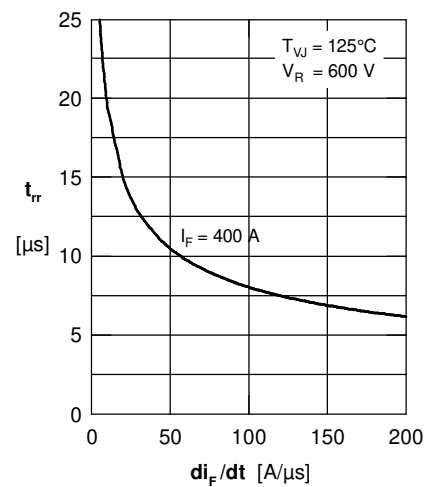


Fig. 7 Typ. recovery time  $t_{rr}$  versus  $-di_F/dt$



**Rectifier**

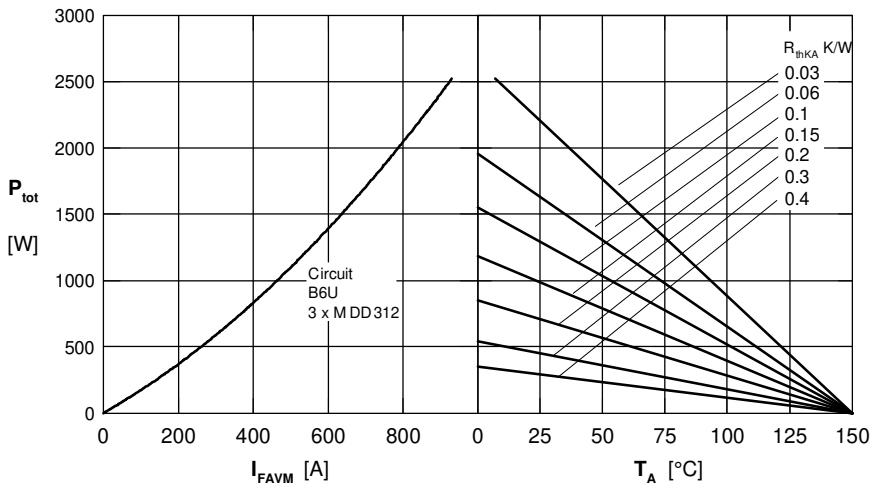
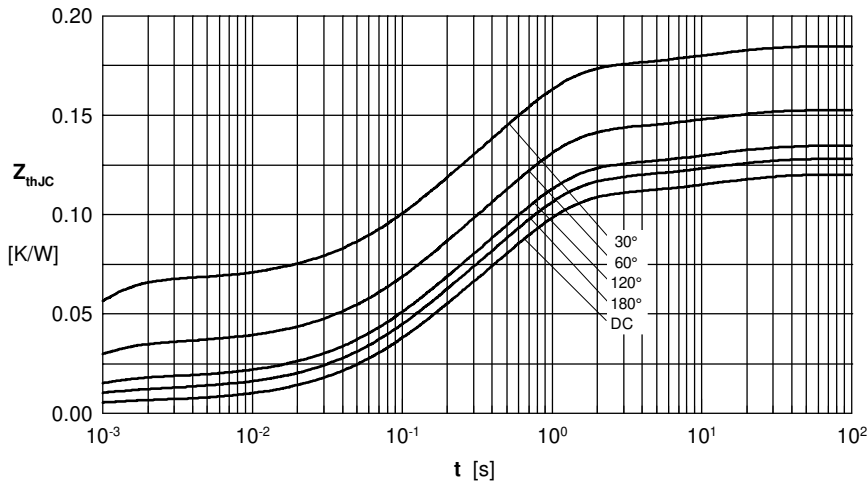


Fig. 8 Three phase rectifier bridge: Power dissipation vs. direct output current & ambient temperature



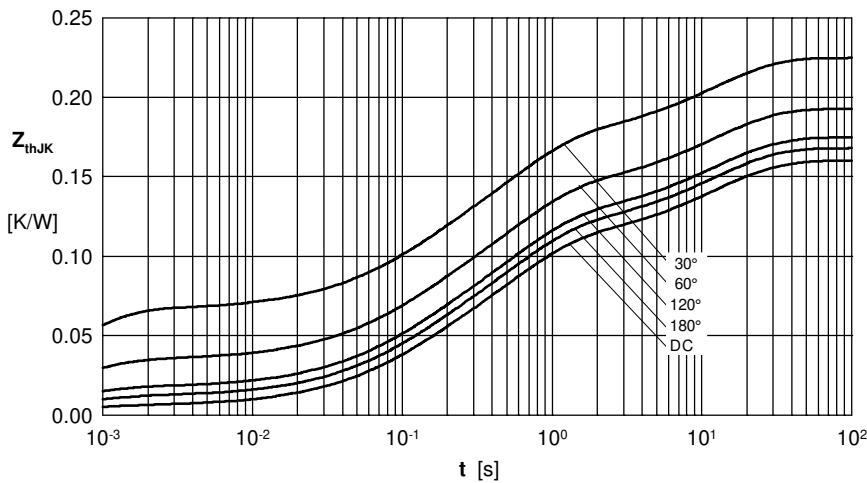
$R_{thJC}$  for various conduction angles  $d$ :

$d$	$R_{thJC}$ [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)