

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

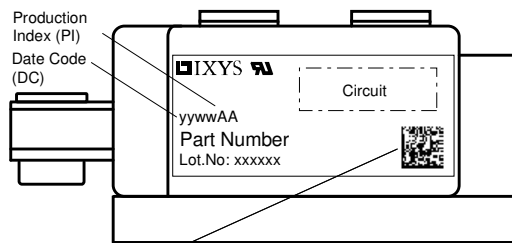
- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Base plate: Copper internally DCB isolated
- Advanced power cycling

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Rectifier				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
V_{RSM}	max. non-repetitive reverse blocking voltage					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	μA
		$V_R = 2000$ 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_{FO}	threshold voltage			$T_{VJ} = 150^\circ\text{C}$		0.80	V
r_F	slope resistance					0.6	m Ω
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 ² s
		t = 8,3 ms; (60 Hz), sine		$V_R = 0$ V		566.1	kA ² s
		t = 10 ms; (50 Hz), sine		$T_{VJ} = 150^\circ\text{C}$		421.4	kA ² s
		t = 8,3 ms; (60 Hz), sine		$V_R = 0$ V		409.0	kA ² 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
Weight				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	MDD312-20N1	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
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Equivalent Circuits for Simulation

* on die level

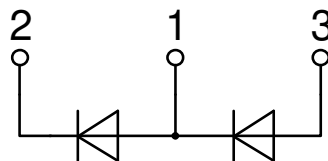
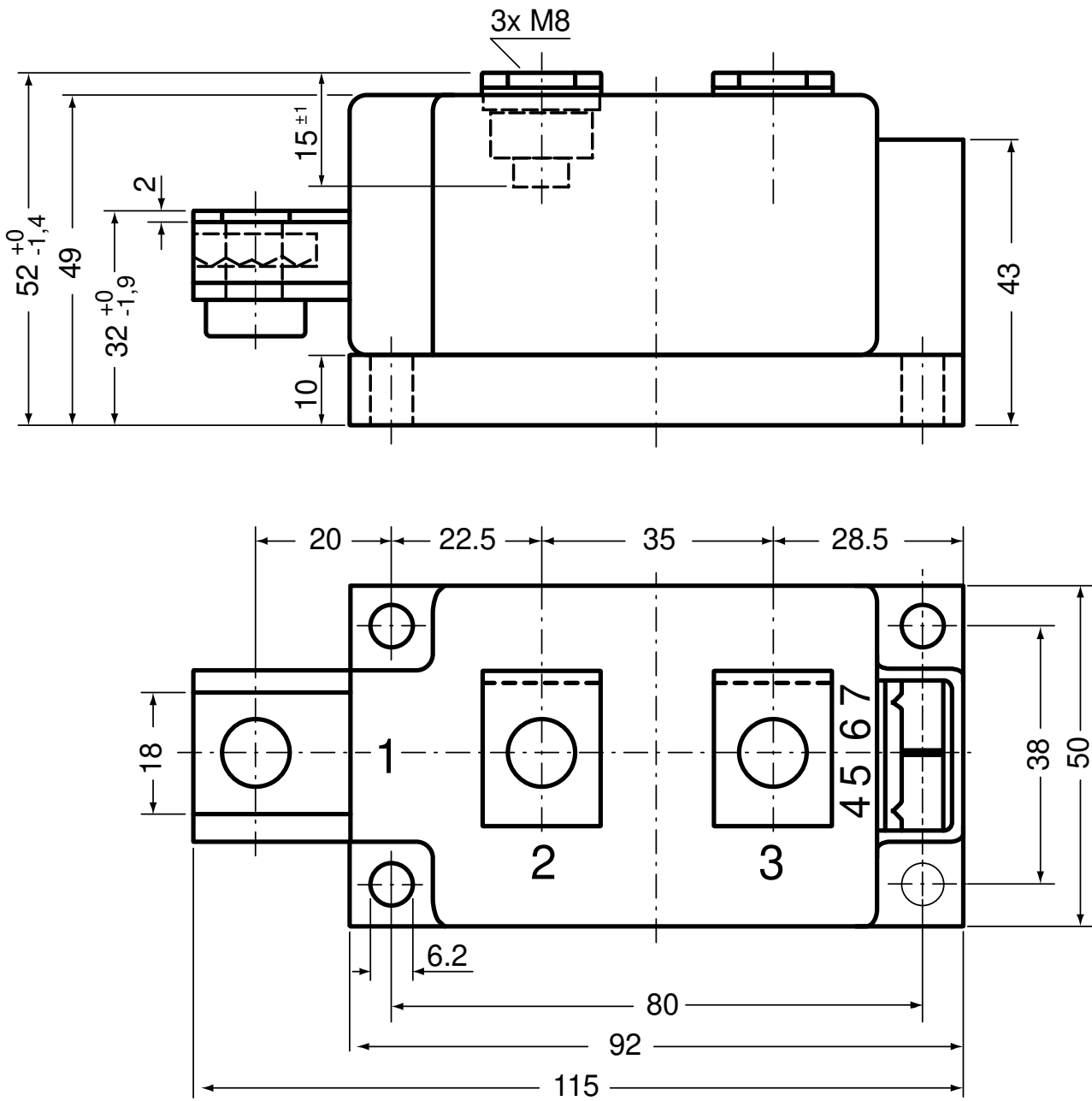
 $T_{VJ} = 150^{\circ}\text{C}$

Rectifier

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



Outlines Y1



Rectifier

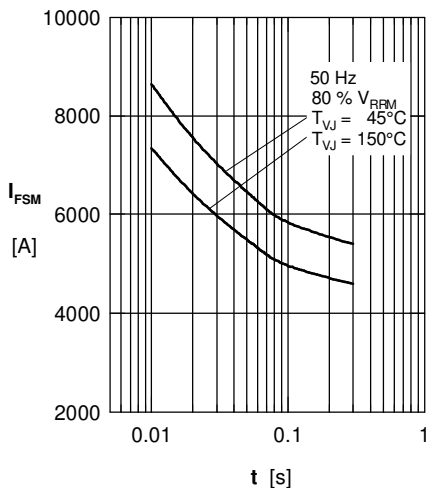


Fig. 1 Surge overload current
 I_{FSM} : Crest value, t : duration

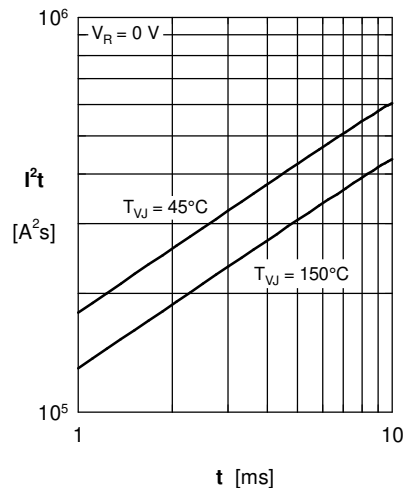


Fig. 2 I^2t versus time (1-10 ms)

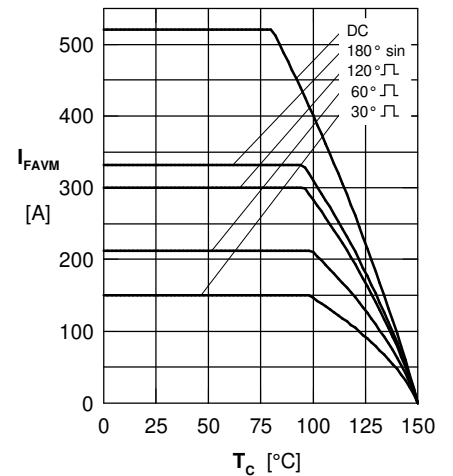


Fig. 3 Maximum forward current at case temperature

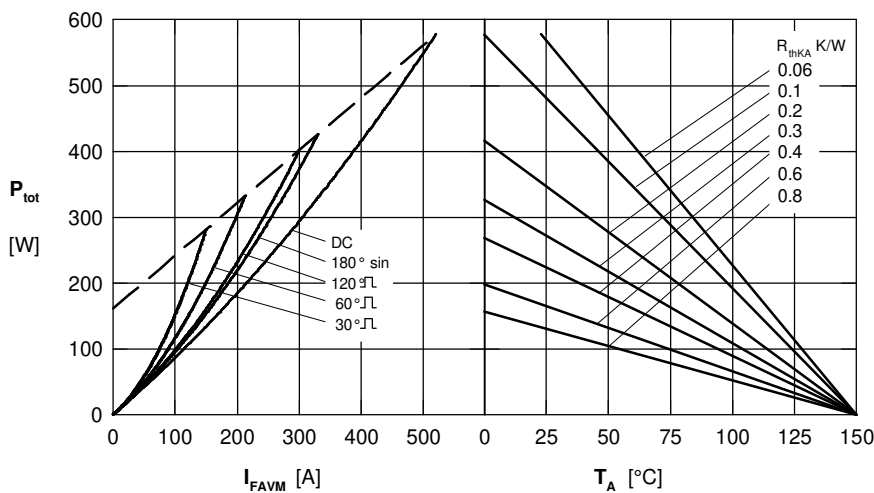


Fig. 4 Power dissipation vs. forward current & ambient temperature (per diode)

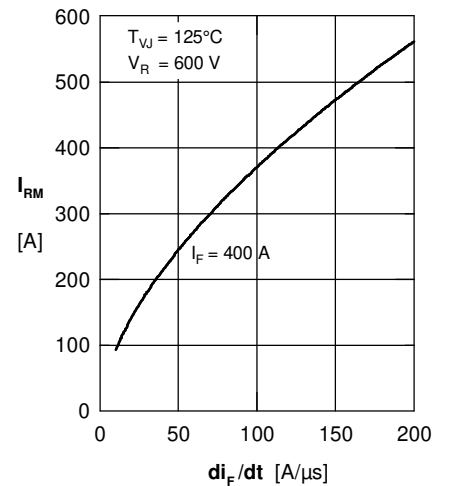


Fig. 5 Typ. peak reverse current

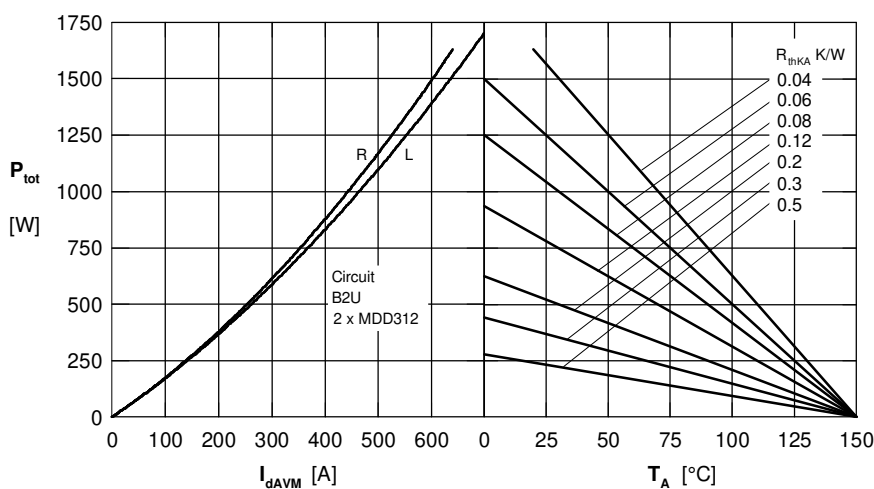


Fig. 6 Single phase rectifier bridge: Power dissipation vs. direct output current and ambient temperature $R =$ resistive load, $L =$ inductive load

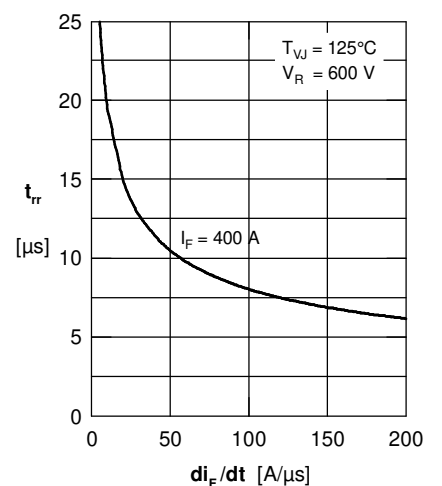


Fig. 7 Typ. recovery time t_{rr} versus $-di_F/dt$



Rectifier

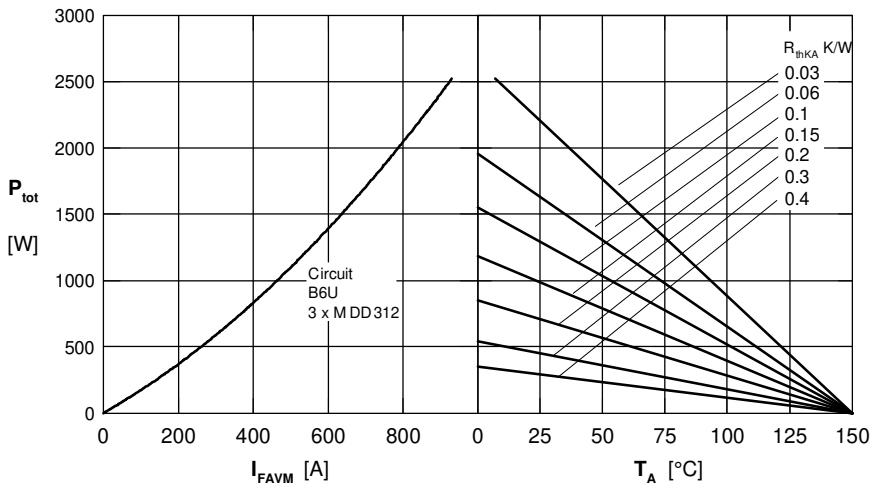
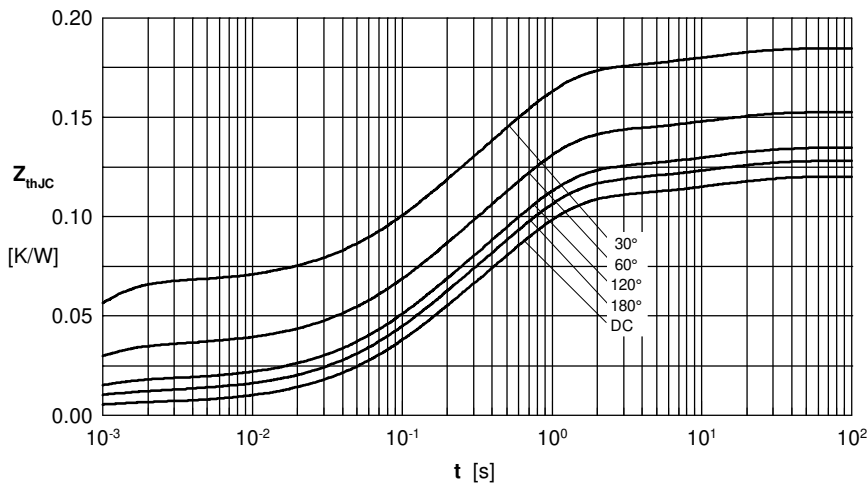


Fig. 8 Three phase rectifier bridge: Power dissipation vs. direct output current & ambient temperature



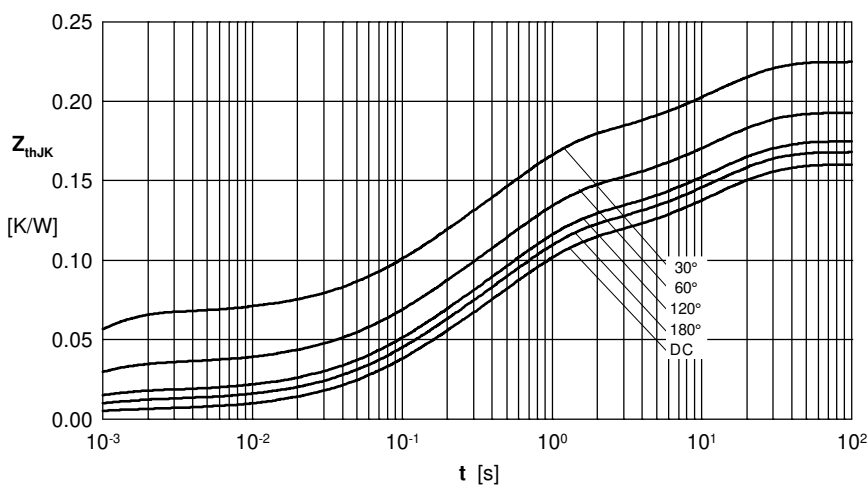
R_{thJC} for various conduction angles d :

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)