

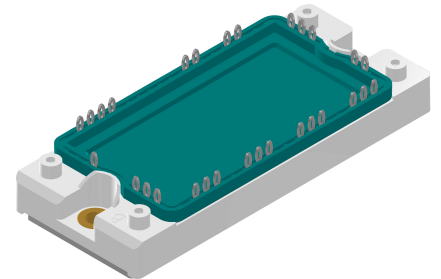
Standard Rectifier Module

| 3~ Rectifier | Brake Chopper |
|----------------------------|-------------------------------|
| $V_{RRM} = 1600 \text{ V}$ | $V_{CES} = 1200 \text{ V}$ |
| $I_{DAV} = 280 \text{ A}$ | $I_{C25} = 180 \text{ A}$ |
| $I_{FSM} = 1500 \text{ A}$ | $V_{CE(sat)} = 1.7 \text{ V}$ |

3~ Rectifier Bridge + Brake Unit + NTC

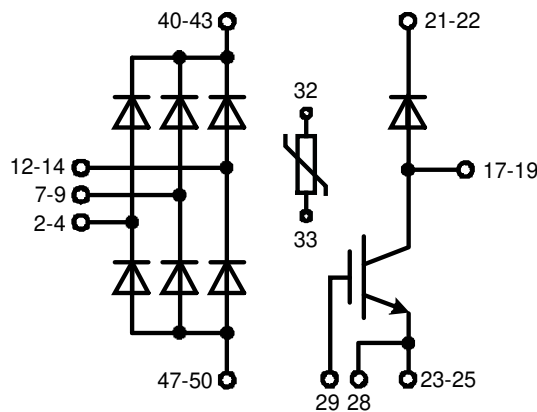
Part number

MDMA280UB1600PTED



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
- NTC
- X2PT - 2nd generation Xtreme light Punch Through
- Rugged X2PT design results in:
 - short circuit rated for 10 μsec .
 - very low gate charge
 - low EMI
 - square RBSOA @ 2x I_c
- Thin wafer technology combined with X2PT design results in a competitive low $V_{CE(sat)}$ and low thermal resistance

Applications:

- 3~ Rectifier with brake unit for drive inverters

Package: E2-Pack

- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- PressFit-Pins for PCB mounting
- Height: 17 mm
- Base plate: Copper internally DCB isolated
- Advanced power cycling
- Phase Change Material available

Disclaimer Notice

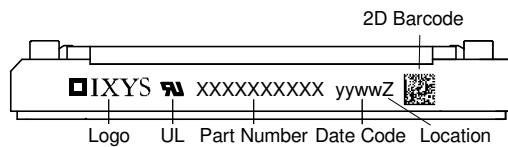
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| Rectifier | | | | Ratings | | | |
|------------|--|-----------------------------------|-------------|------------------------------|------|------|-------------------|
| Symbol | Definition | Conditions | | min. | typ. | max. | Unit |
| V_{RSM} | 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 | | $T_{VJ} = 25^\circ\text{C}$ | | 100 | μA |
| | | $V_R = 1600$ V | | $T_{VJ} = 150^\circ\text{C}$ | | 2 | mA |
| V_F | forward voltage drop | $I_F = 90$ A | | $T_{VJ} = 25^\circ\text{C}$ | | 1.23 | V |
| | | $I_F = 270$ A | | | | 1.75 | V |
| | | $I_F = 90$ A | | $T_{VJ} = 125^\circ\text{C}$ | | 1.18 | V |
| | | $I_F = 270$ A | | | | 1.87 | V |
| I_{DAV} | bridge output current | $T_C = 85^\circ\text{C}$ | rectangular | $T_{VJ} = 150^\circ\text{C}$ | | 280 | A |
| V_{F0} | threshold voltage | } for power loss calculation only | | $T_{VJ} = 150^\circ\text{C}$ | | 0.80 | V |
| r_F | slope resistance | | | | | 4.1 | m Ω |
| R_{thJC} | thermal resistance junction to case | | | | | 0.35 | K/W |
| R_{thCH} | thermal resistance case to heatsink | | | | 0.1 | | K/W |
| P_{tot} | total power dissipation | | | $T_C = 25^\circ\text{C}$ | | 355 | W |
| I_{FSM} | max. forward surge current | $t = 10$ ms; (50 Hz), sine | | $T_{VJ} = 45^\circ\text{C}$ | | 1.50 | kA |
| | | $t = 8,3$ ms; (60 Hz), sine | | $V_R = 0$ V | | 1.62 | kA |
| | | $t = 10$ ms; (50 Hz), sine | | $T_{VJ} = 150^\circ\text{C}$ | | 1.28 | kA |
| | | $t = 8,3$ ms; (60 Hz), sine | | $V_R = 0$ V | | 1.38 | kA |
| I^2t | value for fusing | $t = 10$ ms; (50 Hz), sine | | $T_{VJ} = 45^\circ\text{C}$ | | 11.3 | kA ² s |
| | | $t = 8,3$ ms; (60 Hz), sine | | $V_R = 0$ V | | 10.9 | kA ² s |
| | | $t = 10$ ms; (50 Hz), sine | | $T_{VJ} = 150^\circ\text{C}$ | | 8.13 | kA ² s |
| | | $t = 8,3$ ms; (60 Hz), sine | | $V_R = 0$ V | | 7.87 | kA ² s |
| C_J | junction capacitance | $V_R = 400$ V; $f = 1$ MHz | | $T_{VJ} = 25^\circ\text{C}$ | | 53 | pF |

| Brake IGBT + Diode | | | | Ratings | | | | |
|--------------------|--------------------------------------|--|------|---------|----------|---------------|------|---------------|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit | | |
| V_{CES} | collector emitter voltage | | | | 1200 | V | | |
| V_{GES} | max. DC gate voltage | | | | ± 20 | V | | |
| V_{GEM} | max. transient gate emitter voltage | | | | ± 30 | V | | |
| I_{C25} | collector current | | | | 180 | A | | |
| I_{C80} | | | | | 140 | A | | |
| P_{tot} | total power dissipation | | | | 500 | W | | |
| $V_{CE(sat)}$ | collector emitter saturation voltage | $I_C = 100 \text{ A}; V_{GE} = 15 \text{ V}$ | | | 1.7 | V | | |
| | | | | | 1.9 | V | | |
| $V_{GE(th)}$ | gate emitter threshold voltage | $I_C = 4 \text{ mA}; V_{GE} = V_{CE}$ | 6 | 6.8 | 7.5 | V | | |
| I_{CES} | collector emitter leakage current | $V_{CE} = V_{CES}; V_{GE} = 0 \text{ V}$ | | | 0.1 | mA | | |
| | | | | | 0.1 | mA | | |
| I_{GES} | gate emitter leakage current | $V_{GE} = \pm 20 \text{ V}$ | | | 500 | nA | | |
| $Q_{G(on)}$ | total gate charge | $V_{CE} = 600 \text{ V}; V_{GE} = 15 \text{ V}; I_C = 100 \text{ A}$ | | 340 | | nC | | |
| $t_{d(on)}$ | turn-on delay time | inductive load $V_{CE} = 600 \text{ V}; I_C = 100 \text{ A}$ $V_{GE} = \pm 15 \text{ V}; R_G = 6.8 \Omega$ | | | | | | |
| t_r | current rise time | | | | | | 230 | ns |
| $t_{d(off)}$ | turn-off delay time | | | | | | 70 | ns |
| t_f | current fall time | | | | | | 380 | ns |
| E_{on} | turn-on energy per pulse | | | | | | 230 | ns |
| E_{off} | turn-off energy per pulse | | | | | | 12.5 | mJ |
| | | 11.5 | mJ | | | | | |
| RBSOA | reverse bias safe operating area | $V_{GE} = \pm 15 \text{ V}; R_G = 6.8 \Omega$ | | | | | | |
| I_{CM} | | $V_{CEK} = 1200 \text{ V}$ | | | 300 | A | | |
| SCSOA | short circuit safe operating area | $V_{CEK} = 1200 \text{ V}$ | | | | | | |
| t_{SC} | short circuit duration | $V_{CE} = 720 \text{ V}; V_{GE} = \pm 15$ | | | 10 | μs | | |
| I_{SC} | short circuit current | $R_G = 6.8 \Omega$; non-repetitive | | | 450 | A | | |
| R_{thJC} | thermal resistance junction to case | | | | 0.25 | K/W | | |
| R_{thCH} | thermal resistance case to heatsink | | | | 0.10 | K/W | | |
| Brake Diode | | | | | | | | |
| V_{RRM} | max. repetitive reverse voltage | | | | 1200 | V | | |
| I_{F25} | forward current | | | | 88 | A | | |
| I_{F80} | | | | | 59 | A | | |
| V_F | forward voltage | $I_F = 60 \text{ A}$ | | | 2.20 | V | | |
| | | | | | 1.95 | V | | |
| I_R | reverse current | $V_R = V_{RRM}$ | | | 0.1 | mA | | |
| | | | | | 1.2 | mA | | |
| Q_{rr} | reverse recovery charge | $V_R = 600 \text{ V}$ $-di_f/dt = 1200 \text{ A}/\mu\text{s}$ $I_F = 60 \text{ A}; V_{GE} = 0 \text{ V}$ | | | | | | |
| I_{RM} | max. reverse recovery current | | | | | | 8 | μC |
| t_{rr} | reverse recovery time | | | | | | 60 | A |
| E_{rec} | reverse recovery energy | | | | | | 350 | ns |
| | | | | | 2.5 | mJ | | |
| R_{thJC} | thermal resistance junction to case | | | | 0.6 | K/W | | |
| R_{thCH} | thermal resistance case to heatsink | | | | 0.1 | K/W | | |



| Package E2-Pack | | Ratings | | | | |
|-----------------|--|---|------|------|------|------|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit |
| I_{RMS} | RMS current | per terminal | | | 30 | A |
| T_{VJ} | virtual junction temperature | | -40 | | 150 | °C |
| T_{op} | operation temperature | | -40 | | 125 | °C |
| T_{stg} | storage temperature | | -40 | | 125 | °C |
| Weight | | | | 176 | | g |
| M_D | mounting torque | | 3 | | 6 | Nm |
| $d_{Spp/App}$ | creepage distance on surface / striking distance through air | terminal to terminal | 6.0 | | | mm |
| $d_{Spb/Apb}$ | | terminal to backside | 12.0 | | | mm |
| V_{ISOL} | isolation voltage | t = 1 second 50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA | 3600 | | | V |
| | | t = 1 minute | 3000 | | | V |



Part description

- M = Module
- D = Diode
- M = Standard Rectifier
- A = (up to 1800V)
- 280 = Current Rating [A]
- UB = 3- Rectifier Bridge + Brake Unit
- 1600 = Reverse Voltage [V]
- PT = PressFit-Pin, Thermistor
- ED = E2-Pack
- = Hyphen
- PC = Phase Change Material

| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|-------------|----------------------|--------------------|---------------|----------|----------|
| Standard | MDMA280UB1600PTED | MDMA280UB1600PTED | Blister | 28 | 516613 |
| Alternative | MDMA280UB1600PTED-PC | MDMA280UB1600PTED | Blister | 28 | 515416 |

Temperature Sensor NTC

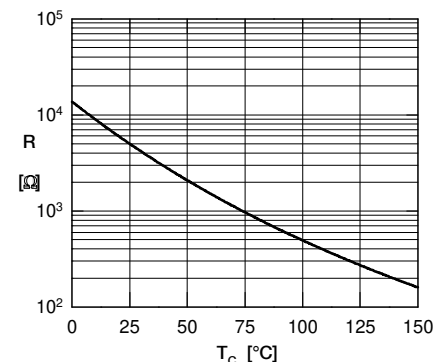
| Symbol | Definition | Conditions | min. | typ. | max. | Unit |
|-------------|-------------------------|---------------------|------|------|------|------------|
| R_{25} | resistance | $T_{VJ} = 25^\circ$ | 4.85 | 5 | 5.15 | k Ω |
| $B_{25/50}$ | temperature coefficient | | | 3375 | | K |

Equivalent Circuits for Simulation

* on die level

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

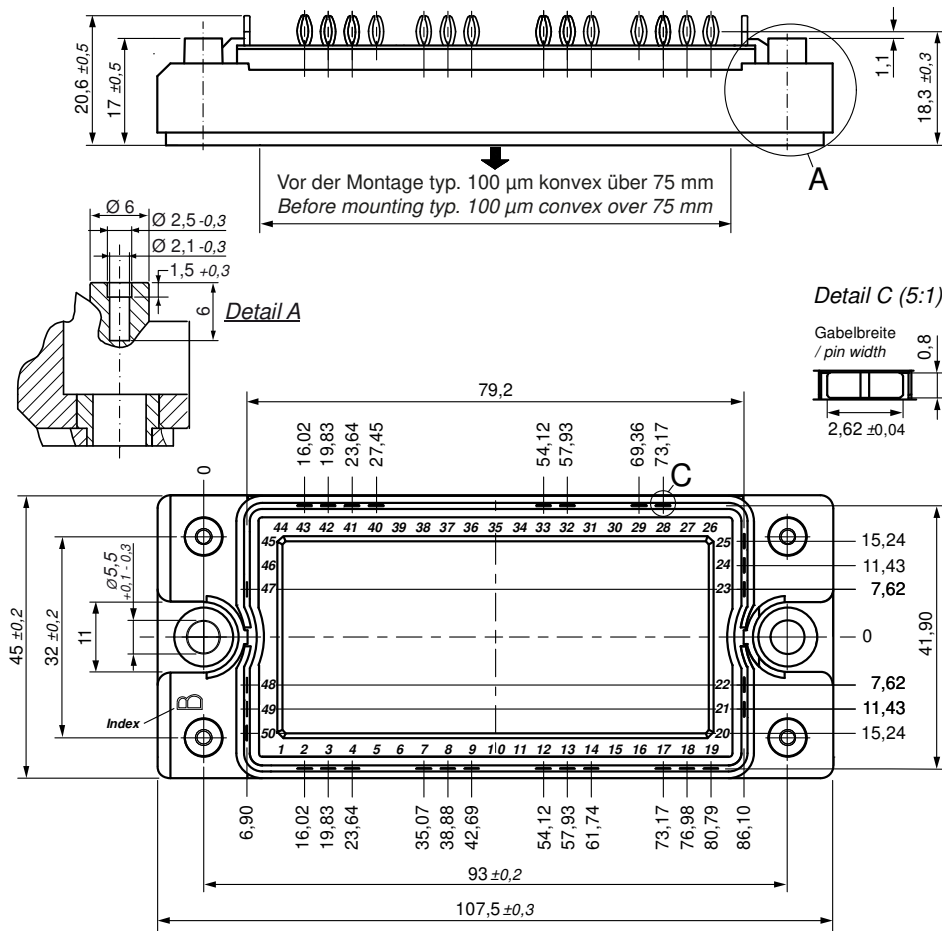
| | Rectifier | Brake Diode | |
|-------|--------------------|-------------|------------|
| V_0 | threshold voltage | 1.22 | V |
| R_0 | slope resistance * | 13 | m Ω |



Typ. NTC resistance vs. temperature



Outlines E2-Pack

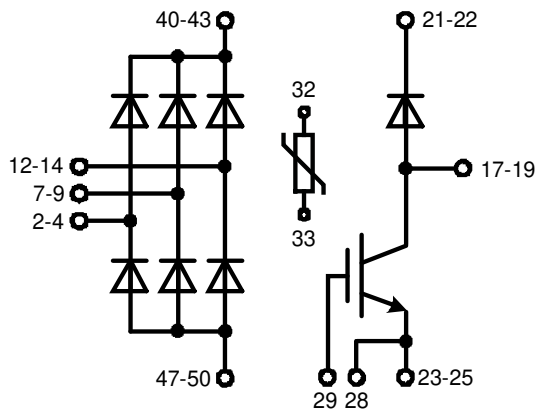


Bemerkung / Note:

- Nicht tolerierte Maße nach / Measure without tolerances according DIN ISO 2768-T1-m
- PCB-Lochmuster / PCB hole pattern: **see pin position**
- Toleranz Pin-Position und PCB-Lochmuster / Tolerance of pin position and PCB hole pattern: $\oplus 0.1$
- Bohrlochdurchmesser / Diameter of drill: $\varnothing 2.35$ mm
- Endlochdurchmesser / Diameter of plated holes: $\varnothing 2.14 - 2.29$ mm (Cu thickness in via typ. $50 \mu\text{m}$)
- Beschichtung / Plating: **chem. Sn max. $15 \mu\text{m}$**
- Einpresskraft / Insert Force: per terminal with a typ. insert speed of 7 mm/s: **typ. 90 N**
- Weitere Angaben / Further information: www.ixys.com **Application note IXAN0077**
- Montageanleitung / Mounting instruction: www.ixys.com **Application note IXAN0024**

Detail A: PCB-Montage / Mounting on PCB^L

- Empfohlene, selbstschneidende Schraube / Recommended, self-tapping screw: **EJOT PT®** (Größe / size: **K25**)^L
- Max. Schraubenlänge / Max. screw length: **PCB-Dicke / thickness + 6 mm** (max. Lochtiefe / hole depth)^L
- Empfohlenes Drehmoment / Recommended mounting torque: **1.5 Nm**



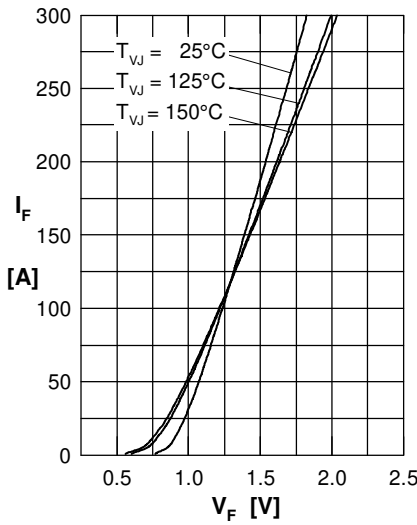
Rectifier


Fig. 1 Forward current versus voltage drop per diode

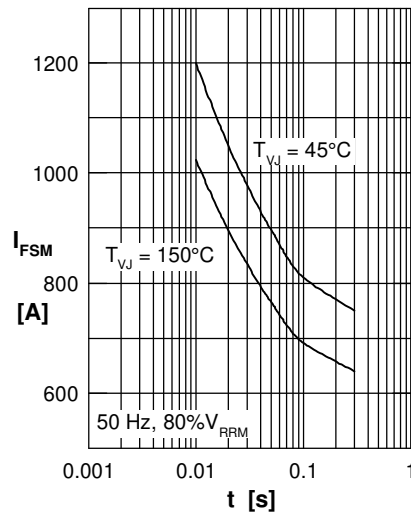


Fig. 2 Surge overload current vs. time per diode

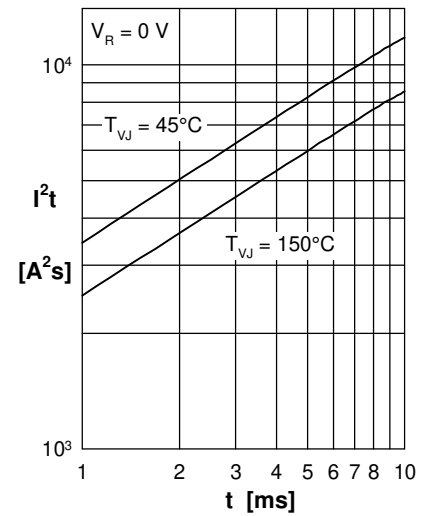
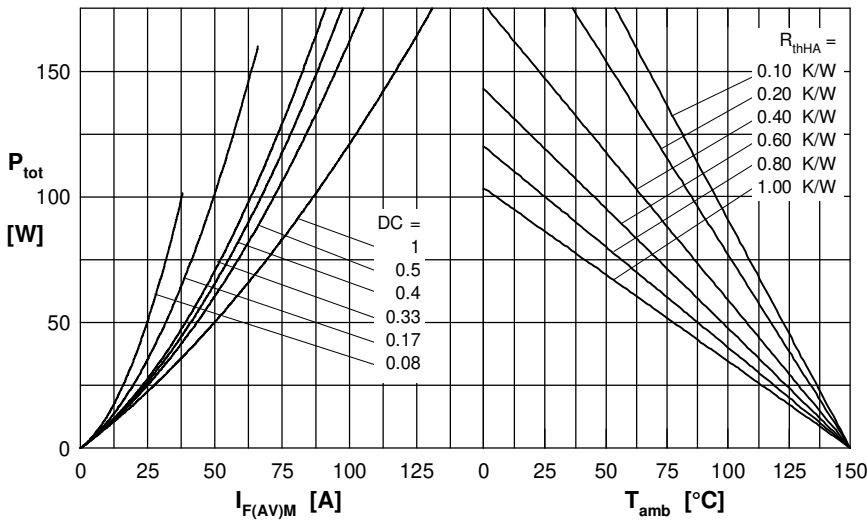

 Fig. 3 I^2t versus time per diode


Fig. 4 Power dissipation vs. forward current and ambient temperature per diode

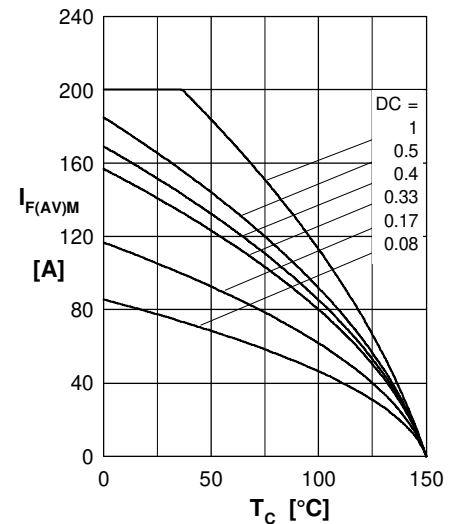


Fig. 5 Max. forward current vs. case temperature per diode

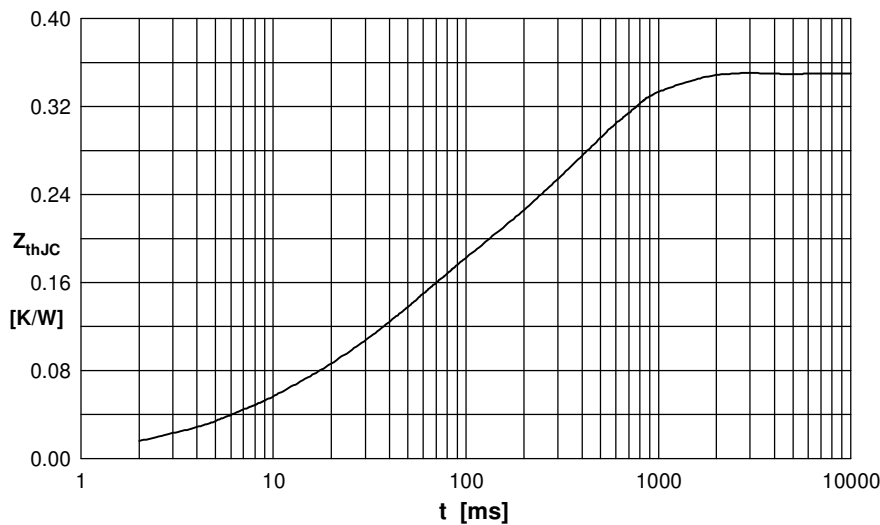


Fig. 6 Transient thermal impedance junction to case vs. time per diode

 Constants for Z_{thJC} calculation:

| i | R_{thi} (K/W) | t_i (s) |
|---|-----------------|-----------|
| 1 | 0.030 | 0.006 |
| 2 | 0.003 | 0.007 |
| 3 | 0.114 | 0.040 |
| 4 | 0.203 | 0.400 |