

flow PIM® 0+P, 600V, 10A

V23990-P370-\_01-PM

Version 0102



B: with PFC/ mit PFC

D: w/o PFC/ ohne PFC

**Maximum Ratings / Höchstzulässige Werte**  
at T<sub>J</sub>=25°C, unless otherwise specified

| Parameter                                                                  | Condition                                            | Symbol             | Value | Unit |
|----------------------------------------------------------------------------|------------------------------------------------------|--------------------|-------|------|
| <b>Input Rectifier Bridge</b>                                              |                                                      |                    |       |      |
| <b>Gleichrichter</b>                                                       |                                                      |                    |       |      |
| Repetitive peak reverse voltage<br>Periodische Rückw. Spitzensperrspannung |                                                      | VRRM               | 1600  | V    |
| Forward average current<br>Dauergrenzstrom                                 | sine T <sub>c</sub> =80°C<br>d=0.5                   | IFAV               | 25    | A    |
| Surge forward current<br>Stoßstrom Grenzwert                               | tp=10ms T <sub>J</sub> =25°C                         | IFSM               | 200   | A    |
| I <sup>2</sup> t-value<br>Grenzlastintegral                                | tp=10ms T <sub>J</sub> =25°C                         | I <sup>2</sup> t   | 200   | A²s  |
| Power dissipation per Diode<br>Verlustleistung pro Diode                   | T <sub>J</sub> =150°C T <sub>c</sub> =80°C           | P <sub>tot</sub>   | 44    | W    |
| <b>Transistor Inverter</b>                                                 |                                                      |                    |       |      |
| <b>Transistor Wechselrichter</b>                                           |                                                      |                    |       |      |
| Collector-emitter break down voltage<br>Kollektor-Emitter-Sperrspannung    |                                                      | VCE                | 600   | V    |
| DC collector current<br>Kollektor-Dauergleichstrom                         | T <sub>J</sub> =150°C T <sub>c</sub> =80°C           | I <sub>C</sub>     | 10    | A    |
| Repetitive peak collector current<br>Periodischer Kollektorspitzenstrom    | T <sub>J</sub> =150°C T <sub>c</sub> =80°C<br>tp=1ms | I <sub>Cpuls</sub> | 20    | A    |
| Power dissipation per IGBT<br>Verlustleistung pro IGBT                     | T <sub>J</sub> =150°C T <sub>c</sub> =80°C           | P <sub>tot</sub>   | 20    | W    |
| Gate-emitter peak voltage<br>Gate-Emitter-Spitzenspannung                  |                                                      | VGE                | ±20   | V    |
| <b>Diode Inverter</b>                                                      |                                                      |                    |       |      |
| <b>Diode Wechselrichter</b>                                                |                                                      |                    |       |      |
| DC forward current<br>Dauergleichstrom                                     | T <sub>J</sub> =150°C T <sub>c</sub> =80°C           | IF                 | 10    |      |
| Repetitive peak forward current<br>Periodischer Spitzenstrom               | T <sub>J</sub> =150°C T <sub>c</sub> =80°C<br>tp=1ms | IFRM               | 20    | A    |
| Power dissipation per Diode<br>Verlustleistung pro Diode                   | T <sub>J</sub> =150°C T <sub>c</sub> =80°C           | P <sub>tot</sub>   | 17    | W    |
| <b>PFC Transistor</b>                                                      |                                                      |                    |       |      |
| <b>PFC Transistor</b>                                                      |                                                      |                    |       |      |
| Drain to source breakdown voltage<br>Drai-Source Sperrspannung             |                                                      | Vbr                | 500   | V    |
| DC drain current<br>Drain-Dauergleichstrom                                 | T <sub>J</sub> =150°C T <sub>c</sub> =80°C           | I <sub>d</sub>     | 14    | A    |
| Pulsed drain current<br>Periodischer Drainstrom                            | T <sub>J</sub> =150°C T <sub>c</sub> =80°C<br>tp=1ms | I <sub>dpuls</sub> | 28    | A    |
| Power dissipation<br>Verlustleistung                                       | T <sub>J</sub> =150°C T <sub>c</sub> =80°C           | P <sub>tot</sub>   | 72    | W    |
| Gate-source peak voltage<br>Gate-Source-Spitzenspannung                    |                                                      | Vgs                | ±20   | V    |

| Parameter                                                                        | Condition                                                         | Symbol            | Value      | Unit            |
|----------------------------------------------------------------------------------|-------------------------------------------------------------------|-------------------|------------|-----------------|
| <b>PFC Diode (only preliminary data)</b>                                         |                                                                   |                   |            |                 |
| <b>PFC Diode (nur vorläufige Angabe)</b>                                         |                                                                   |                   |            |                 |
| DC forward current<br>Dauergleichstrom                                           | T <sub>j</sub> =150°C T <sub>c</sub> =80°C                        | I <sub>F</sub>    | 14         | A               |
| Repetitive peak forward current<br>Periodischer Spitzenstrom                     | T <sub>j</sub> =150°C T <sub>c</sub> =80°C<br>t <sub>p</sub> =1ms | I <sub>FRM</sub>  | 28         | A               |
| Power dissipation per Diode<br>Verlustleistung pro Diode                         | T <sub>j</sub> =150°C T <sub>c</sub> =80°C                        | P <sub>tot</sub>  | 30         | W               |
| <b>PFC Shunt</b>                                                                 |                                                                   |                   |            |                 |
| <b>PFC Shunt</b>                                                                 |                                                                   |                   |            |                 |
| DC forward current<br>Dauergleichstrom                                           |                                                                   | I <sub>F</sub>    | 11         | A               |
| Power dissipation per Shunt<br>Verlustleistung pro Shunt                         |                                                                   | P <sub>tot</sub>  | 3          | W               |
| <b>Low side Shunt</b>                                                            |                                                                   |                   |            |                 |
| <b>DC- Shunt</b>                                                                 |                                                                   |                   |            |                 |
| DC forward current<br>Dauergleichstrom                                           |                                                                   | I <sub>F</sub>    | 8          | A               |
| Power dissipation per Shunt<br>Verlustleistung pro Shunt                         |                                                                   | P <sub>tot</sub>  | 3          | W               |
| <b>PFC Capacitor</b>                                                             |                                                                   |                   |            |                 |
| <b>PFC Kondensator</b>                                                           |                                                                   |                   |            |                 |
| Max. DC voltage<br>Max. Gleichspannung                                           |                                                                   | U <sub>MAX</sub>  | 500        | V               |
| <b>NTC</b>                                                                       |                                                                   |                   | 22         | kΩ              |
| <b>Thermal properties</b>                                                        |                                                                   |                   |            |                 |
| <b>Thermische Eigenschaften</b>                                                  |                                                                   |                   |            |                 |
| max. Chip temperature<br>max. Chiptemperatur                                     |                                                                   | T <sub>jmax</sub> | 150        | °C              |
| Storage temperature<br>Lagertemperatur                                           |                                                                   | T <sub>stg</sub>  | -40...+125 | °C              |
| Operation temperature<br>Betriebstemperatur                                      |                                                                   | T <sub>op</sub>   | -40...+125 | °C              |
| Thermal resistance, chip to case<br>Wärmewiderstand Chip-Bodenplatte<br>per chip | Diode Rectifier                                                   | R <sub>thJC</sub> | 1,5        | K/W             |
|                                                                                  | Transistor Inverter                                               | R <sub>thJC</sub> | 1,9        | K/W             |
|                                                                                  | Diode Inverter                                                    | R <sub>thJC</sub> | 3,2        | K/W             |
|                                                                                  | Transistor PFC                                                    | R <sub>thJC</sub> | 1          | K/W             |
|                                                                                  | Diode PFC                                                         | R <sub>thJC</sub> | 2,3        | K/W             |
| <b>Insulation properties</b>                                                     |                                                                   |                   |            |                 |
| <b>Modulisolation</b>                                                            |                                                                   |                   |            |                 |
| Insulation test voltage<br>Isolationsspannung                                    | t=1min                                                            | V <sub>is</sub>   | 4000       | V <sub>dc</sub> |
| Creepage distance<br>Kriechstrecke                                               |                                                                   |                   | TBD        | mm              |
| Clearance<br>Luftstrecke                                                         |                                                                   |                   | TBD        | mm              |

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Characteristic values / Charakteristische Werte  
at T<sub>J</sub>=25°C, unless otherwise specified

| Parameter<br>FET Parameter | Symbol | Condition | T<br>(°C) | RG        | VGE        | VCE        | IF  | IC        | Value |      |      | Unit |
|----------------------------|--------|-----------|-----------|-----------|------------|------------|-----|-----------|-------|------|------|------|
|                            |        |           |           | RG<br>(Ω) | VGS<br>(V) | VDS<br>(V) | (A) | Id<br>(A) | min.  | typ. | max. |      |

**Input Rectifier Bridge****Gleichrichter**

|                                                                    |     |          |         |  |  |  |    |  |      |  |      |    |
|--------------------------------------------------------------------|-----|----------|---------|--|--|--|----|--|------|--|------|----|
| Forward voltage<br>Durchlaßspannung                                | VF  | TJ=25°C  |         |  |  |  | 10 |  | 0,95 |  |      | V  |
| Threshold voltage (for power loss calc. only)<br>Schleusenspannung | Vto | TJ=25°C  |         |  |  |  | 10 |  | 1,65 |  |      | V  |
| Slope resistance (for power loss calc. only)<br>Ersatzwiderstand   | rt  | TJ=25°C  |         |  |  |  | 10 |  | 0,74 |  |      | mΩ |
| Reverse current<br>Sperrstrom                                      | Ir  | VR=VRmax | TJ=25°C |  |  |  |    |  | 20   |  |      |    |
|                                                                    |     |          |         |  |  |  |    |  | 80   |  | 0,01 | mA |

**Transistor Inverter, inductive load****Transistor Wechselrichter**

|                                                                                        |          |                |          |    |    |     |  |      |     |      |      |     |
|----------------------------------------------------------------------------------------|----------|----------------|----------|----|----|-----|--|------|-----|------|------|-----|
| Gate emitter threshold voltage<br>Gate-Schwellenspannung                               | VGE(th)  | Vge=Vce        | TJ=25°C  |    |    |     |  | 300μ | 3   | 4    | 5    | V   |
| Collector-emitter saturation voltage<br>Kollektor-Emitter Sättigungsspannung           | VCE(sat) |                | TC=25°C  |    | 15 |     |  | 10,0 | 1,7 | 2    | 2,4  | V   |
| Collector-emitter cut-off current incl. FRED<br>Kollektor-Emitter Reststrom inkl. FRED | ICES     |                | TC=25°C  |    | 0  | 600 |  |      |     |      | 40   | μA  |
| Gate-emitter leakage current<br>Gate-Emitter Reststrom                                 | IGES     |                | TJ=25°C  |    | 20 | 0   |  |      |     |      | 100  | nA  |
| Turn-on delay time<br>Einschaltverzögerungszeit                                        | td(on)   | Rg(on)=Rg(off) | TJ=25°C  | 25 | 15 | 400 |  | 10,0 |     | 29   | 35   | ns  |
| Rise time<br>Anstiegszeit                                                              | tr       | Rg(on)=Rg(off) | TJ=25°C  | 25 | 15 | 400 |  | 10,0 |     | 21   | 25   | ns  |
| Turn-off delay time<br>Abschaltverzögerungszeit                                        | td(off)  | Rg(on)=Rg(off) | TJ=25°C  | 25 | 15 | 400 |  |      |     | 233  | 280  | ns  |
| Fall time<br>Fallzeit                                                                  | tf       | Rg(on)=Rg(off) | TJ=25°C  | 25 | 15 | 400 |  |      |     | 49   | 59   | ns  |
| Turn-on energy loss per pulse<br>Einschaltverlustenergie pro Puls                      | Eon      | Rg(on)=Rg(off) | TJ=125°C |    | 15 | 400 |  | 5,0  |     | 0,2  | 0,23 | mWs |
| Turn-off energy loss per pulse<br>Abschaltverlustenergie pro Puls                      | Eoff     | Rg(on)=Rg(off) | TJ=125°C |    | 25 | 400 |  | 5,0  |     | 0,17 | 0,22 | mWs |
| SC withstand time<br>Kurzschlußverhalten                                               | tSC      | @ 10*Ic(max)   | TJ=125°C |    |    |     |  |      |     |      | 10   | μs  |
| Input capacitance<br>Eingangskapazität                                                 | Cies     | f=1MHz         | TJ=25°C  |    |    |     |  |      |     | TBD  |      | nF  |
| Output capacitance<br>Ausgangskapazität                                                | Coss     | f=1MHz         | TJ=25°C  |    |    |     |  |      |     | TBD  |      | nF  |

**Diode Inverter****Diode Wechselrichter**

|                                                     |     |                   |          |  |  |     |    |  |      |  |  |    |
|-----------------------------------------------------|-----|-------------------|----------|--|--|-----|----|--|------|--|--|----|
| Diode forward voltage<br>Durchlaßspannung           | VF  | TJ=25°C           |          |  |  |     | 10 |  | 2,2  |  |  | V  |
| Peak reverse recovery current<br>Rückstromspitze    | IRM | dIF/dt=-200A/ms   | TJ=25°C  |  |  | 400 |    |  | 1,65 |  |  | A  |
| Reverse recovery time<br>Sperrverzögerungszeit      | trr | dIF/dt=-200A/ms   | TJ=125°C |  |  | 400 |    |  | 5    |  |  | ns |
| Reverse recovered charge<br>Sperrverzögerungsladung | Qrr | dIF/dt=200 A/msec | TJ=125°C |  |  | 400 |    |  | 55   |  |  | mC |

| Parameter                                                                 | Symbol            | Condition                    | T                   | RG  | VGE | VCE | IF  | IC    | Value |            |             | Unit |
|---------------------------------------------------------------------------|-------------------|------------------------------|---------------------|-----|-----|-----|-----|-------|-------|------------|-------------|------|
| FET Parameter                                                             |                   |                              | (°C)                | RG  | VGS | VDS | (A) | Id    | min.  | typ.       | max.        |      |
| Transistor PFC                                                            |                   |                              |                     |     |     |     |     |       |       |            |             |      |
| Static drain to source ON resistance<br>Statische drain-source Widerstand | Rds(on)           |                              | TJ=25°C             |     |     | 10  |     | 7,5   |       | 0,33       | 0,36        | Ω    |
| Gate threshold voltage<br>Gate Schwellenspannung                          | V(GS)th           | VDS=VGS<br>VDS=VGS, ID=250µA | TJ=25°C             |     |     |     |     | 3     | 4     | 5          |             | V    |
| Drain to Source breakdown voltage<br>Drain source Leckstrom               | V(BR)DSS          | ID=250µA                     | TJ=25°C             |     | 0   |     |     | 0,25m | 500   |            |             | V    |
| Drain to Source Leakage Current<br>Drain source Leckstrom                 | Igss              |                              | TJ=25°C             |     | 30  | 0   |     |       |       |            | 100         | nA   |
| Turn On Delay Time<br>Einschaltverzögerung                                | td(ON)            | VDD=250V                     | TJ=25°C             | 4,7 | 10  |     |     | 7,5   |       | 24         |             | ns   |
| Rise Time<br>Anstiegszeit                                                 | tr                | VDD=250V                     | TJ=25°C             | 4,7 | 10  |     |     | 7,5   |       | 14         |             | ns   |
| Turn off delay time<br>Abschaltverzögerung                                | td(OFF)           | VDD=400V                     | TJ=25°C             | 4,7 | 10  |     |     | 15,0  |       | 15         | 20          | ns   |
| Fall time<br>Abstiegszeit                                                 | tf                | VDD=400V                     | TJ=25°C             | 4,7 | 10  |     |     | 15,0  |       | 25         | 33          | ns   |
| Total gate charge<br>Gate Ladung                                          | Qg                | VDD=400V                     | TJ=25°C             |     | 10  |     |     | 15,0  |       | 60         | 80          | nC   |
| Gate to source charge<br>Gate source Ladung                               | Qgs               | VDD=400V                     | TJ=25°C             |     | 10  |     |     | 15,0  |       | 15         |             | nC   |
| Input capacitance<br>Eingangskapazität                                    | Ciss              | f=1MHz                       | TJ=25°C             |     | 0   | 25  |     |       |       | 2600       | 3400        | pF   |
| Output capacitance<br>Ausgangskapazität                                   | Coss              | f=1MHz                       | TJ=25°C             |     | 0   | 25  |     |       |       | 330        | 430         | pF   |
| Diode PFC                                                                 |                   |                              |                     |     |     |     |     |       |       |            |             |      |
| Forward voltage<br>Durchlaßspannung                                       | VF                |                              | TJ=25°C<br>TJ=125°C |     |     |     | 15  |       |       | 1,8<br>1,5 | 2,2<br>1,9  | V    |
| Breakdown voltage<br>Sperrspannung                                        | Vr                | Ir=100µA                     |                     |     |     |     |     |       |       |            | 600         | V    |
| Reverse leakage current<br>Leckstrom                                      | Irm               | Vr=Vr rated                  | TJ=25°C<br>TJ=125°C |     |     |     |     |       |       |            | 100<br>1000 | µA   |
| Reverse recovery time<br>Sperreverzögerungszeit                           | trr               | Vr=30V<br>dif/dt=50A/µs      | TJ=25°C<br>TJ=125°C |     |     | 15  |     |       |       | 29,4<br>90 |             | ns   |
| Peak recovery current<br>Rückstromspitze                                  | Irrm              | Vr=100V<br>dif/dt=100A/µs    | TJ=25°C<br>TJ=125°C |     |     | 15  |     |       |       | 3,5<br>5   |             | A    |
| Reverse recovery charge<br>Sperrverzögerungsladung                        | Qrr               | Vr=200V<br>dif/dt=200A/µs    | TJ=25°C<br>TJ=125°C |     |     | 15  |     |       |       | 57<br>275  |             | nC   |
| Peak rate of fall of recovery current<br>Sitzenteilheit von Rückstrom     | di(rec)max/<br>dt | Vr=200V<br>dif/dt=200A/µs    | TJ=25°C<br>TJ=125°C |     |     | 15  |     |       |       | TBD<br>800 |             | A/µs |
| NTC-Thermistor                                                            |                   |                              |                     |     |     |     |     |       |       |            |             |      |
| Rated resistance<br>Nennwiderstand                                        | R25               | Tol. ±5%                     | Tc=25°C             |     |     |     |     |       | 20,9  | 22         | 23,1        | kΩ   |
| Deviation of R100<br>Abweichung von R100                                  | DR/R              | R100=1503W                   | Tc=100°C            |     |     |     |     |       |       | 2,9        |             | %/K  |
| Power dissipation given Epcos-Typ<br>Verlustleistung Epcos-Typ angeben    | P                 |                              | Tc=25°C             |     |     |     |     |       |       |            | 210         | mW   |
| B-value<br>B-Wert                                                         | B(25/100)         | Tol. ±3%                     |                     |     |     |     |     |       |       | 3980       |             | K    |
| Shunts                                                                    |                   |                              |                     |     |     |     |     |       |       |            |             |      |
| Shuntwiderstände                                                          |                   |                              |                     |     |     |     |     |       |       |            |             |      |
| R1 value<br>R1 Wert                                                       | R                 | Tol. 1%                      | Tc=25°C             |     |     |     |     |       |       | 27         |             | mΩ   |
| Power dissipation<br>Verlustleistung                                      | P                 |                              | Tc=25°C             |     |     |     |     |       |       |            | 3           | W    |
| R2 value<br>R2 Wert                                                       | R                 | Tol. 1%                      | Tc=25°C             |     |     |     |     |       |       | 47         |             | mΩ   |
| Power dissipation<br>Verlustleistung                                      | P                 |                              | Tc=25°C             |     |     |     |     |       |       |            | 3           | W    |
| Capacitor                                                                 |                   |                              |                     |     |     |     |     |       |       |            |             |      |
| Kondensator                                                               |                   |                              |                     |     |     |     |     |       |       |            |             |      |
| C value<br>C Wert                                                         | C                 | Tol. 10%                     | Tc=25°C             |     |     |     |     |       |       | 100        |             | nF   |
| DC voltage<br>DC Spannung                                                 | Vdc               |                              | Tc=25°C             |     |     |     |     |       |       | 500        |             | V    |

Note: xxxx = measured values