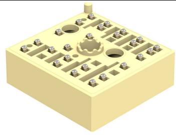
## MiniSKiiP® 1 PIM — 600 V / 6 A

### Features

- Solderless interconnection
- Trench Fieldstop IGBT3 technology

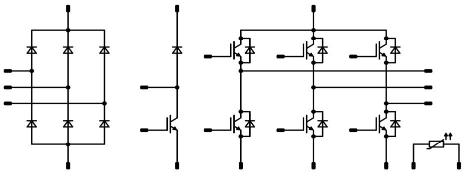
### MiniSKiiP® 1 housing



### Target Applications

- Industrial drives

### Schematic



### Types

- V23990-K201-A-PM

# Maximum Ratings

$T_j$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Condition | | Value | Unit |
|---|---|---|---|---|---|
| **Rectifier Diode** | | | | | |
| Repetitive peak reverse voltage | $V_{RRM}$ | | | 1600 | V |
| DC forward current | $I_{FAV}$ | $T_j = T_{jmax}$ | $T_s$ = 80 °C | 29 | A |
| Surge (non-repetitive) forward current | $I_{FSM}$ | $t_p$ = 10 ms<br>half sine wave | | 220 | A |
| $I^2t$-value | $I^2t$ | | | 240 | $A^2s$ |
| Power dissipation | $P_{tot}$ | $T_j = T_{jmax}$ | $T_s$ = 80 °C | 46 | W |
| Maximum Junction Temperature | $T_{jmax}$ | | | 150 | °C |
| **Inverter Switch / Brake Switch** | | | | | |
| Collector-emitter breakdown voltage | $V_{CE}$ | | | 600 | V |
| DC collector current | $I_C$ | $T_j = T_{jmax}$ | $T_s$ = 80 °C | 10 | A |
| Repetitive peak collector current | $I_{CRM}$ | $t_p$ limited by $T_{jmax}$ | | 18 | A |
| Power dissipation | $P_{tot}$ | $T_j = T_{jmax}$ | $T_s$ = 80 °C | 40 | W |
| Gate-emitter peak voltage | $V_{GE}$ | | | ±20 | V |
| Short circuit ratings | $t_{SC}$<br>$V_{CC}$ | $T_j \le$ 150 °C<br>$V_{GE}$ = 15 V | | 6<br>360 | μs<br>V |
| Maximum Junction Temperature | $T_{jmax}$ | | | 175 | °C |

# Maximum Ratings

$T_j$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Condition | | Value | Unit |
|---|---|---|---|---|---|
| **Inverter Diode / Brake Diode** | | | | | |
| Repetitive peak reverse voltage | $V_{RRM}$ | | | 600 | V |
| DC forward current | $I_F$ | $T_j = T_{jmax}$ | $T_s$ = 80 °C | 10 | A |
| Repetitive peak forward current | $I_{FRM}$ | $t_p$ limited by $T_{jmax}$ | | 20 | A |
| Power dissipation | $P_{tot}$ | $T_j = T_{jmax}$ | $T_s$ = 80 °C | 31 | W |
| Maximum Junction Temperature | $T_{jmax}$ | | | 175 | °C |
| **Thermal Properties** | | | | | |
| Storage temperature | $T_{stg}$ | | | -40…+125 | °C |
| Operation temperature under switching condition | $T_{op}$ | | | -40…+($T_{jmax}$ - 25) | °C |
| **Isolation Properties** | | | | | |
| Isolation voltage | $V_{is}$ | $t$ = 2 s | DC Test Voltage | 4000 | V |
| Creepage distance | | | | min 12,7 | mm |
| Clearance | | | | min 12,7 | mm |
| Comparative Tracking Index | CTI | | | >200 | |

# Characteristic Values

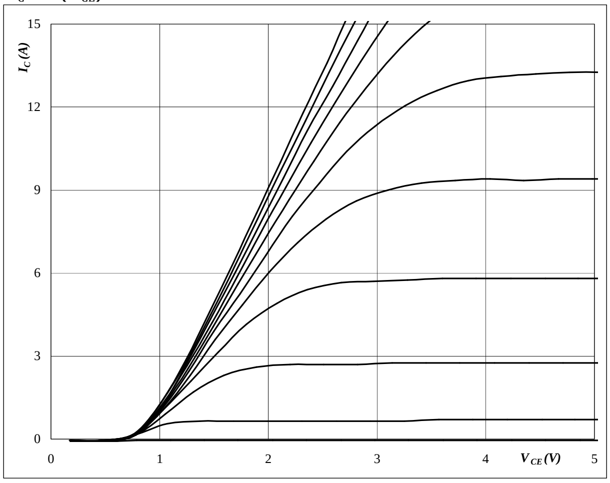
| Parameter | Symbol | Conditions | | | | | Value | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | $V_{GE}$ [V]<br>$V_{GS}$ [V] | $V_r$ [V]<br>$V_{CE}$ [V]<br>$V_{DS}$ [V] | $I_C$ [A]<br>$I_F$ [A]<br>$I_D$ [A] | $T_j$ [°C] | Min | Typ | Max | |
| **Rectifier Diode** | | | | | | | | | | |
| Forward voltage | $V_F$ | | | | 25 | 25<br>125 | | 1,51<br>1,42 | | V |
| Threshold voltage (for power loss calc. only) | $V_{to}$ | | | | 25 | 25<br>125 | | 0,86<br>0,79 | | V |
| Slope resistance (for power loss calc. only) | $r_t$ | | | | 25 | 25<br>125 | | 0,03<br>0,03 | | Ω |
| Reverse current | $I_r$ | | | 1500 | | 25 | | | 0,05 | mA |
| Thermal resistance junction to sink | $R_{th(j-s)}$ | Thermal grease thickness ≤ 50um λ = 1 W/mK | | | | | | 1,50 | | K/W |
| **Inverter Switch / Brake Switch** | | | | | | | | | | |
| Gate emitter threshold voltage | $V_{GE(th)}$ | $V_{CE} = V_{GE}$ | | | 0,0008 | 25 | 5 | 2,8 | 6,5 | V |
| Collector-emitter saturation voltage | $V_{CEsat}$ | | 15 | | 6 | 25<br>150 | 1,1 | 1,69<br>1,88 | 1,9 | V |
| Collector-emitter cut-off current incl. Diode | $I_{CES}$ | | 0 | 600 | | 25 | | | 0,0004 | mA |
| Gate-emitter leakage current | $I_{GES}$ | | 20 | 0 | | 25 | | | 300 | nA |
| Integrated Gate resistor | $R_{gint}$ | | | | | | | none | | Ω |
| Turn-on delay time | $t_{d(on)}$ | $R_{goff}$ = 32 Ω<br>$R_{gon}$ = 64 Ω | ±15 | 300 | 6 | 25<br>150 | | 21<br>20 | | ns |
| Rise time | $t_r$ | | | | | 25<br>150 | | 13<br>17 | | |
| Turn-off delay time | $t_{d(off)}$ | | | | | 25<br>150 | | 152<br>170 | | |
| Fall time | $t_f$ | | | | | 25<br>150 | | 98<br>103 | | |
| Turn-on energy loss | $E_{on}$ | | | | | 25<br>150 | | 0,155<br>0,209 | | mWs |
| Turn-off energy loss | $E_{off}$ | | | | | 25<br>150 | | 0,133<br>0,168 | | |
| Input capacitance | $C_{ies}$ | $f$ = 1 MHz | 0 | 25 | | 25 | | 380 | | pF |
| Output capacitance | $C_{oss}$ | | | | | | | 28 | | |
| Reverse transfer capacitance | $C_{rss}$ | | | | | | | 11 | | |
| Thermal resistance junction to sink | $R_{th(j-s)}$ | Thermal grease thickness ≤ 50um λ = 1 W/mK | | | | | | 2,40 | | K/W |
| **Inverter Diode / Brake Diode** | | | | | | | | | | |
| Diode forward voltage | $V_F$ | | | | 50 | 25<br>150 | | 1,34<br>1,34 | | V |
| Peak reverse recovery current | $I_{RRM}$ | $di_F/dt$ = tbd A/us | | | | 25<br>150 | | 5,97<br>6,97 | | A |
| Reverse recovery time | $t_{rr}$ | | | | | 25<br>150 | | 185<br>280 | | ns |
| Reverse recovered charge | $Q_{rr}$ | | | | | 25<br>150 | | 0,44<br>0,78 | | µC |
| Peak rate of fall of recovery current | $(di_{rf}/dt)_{max}$ | | | | | 25<br>150 | | 115<br>37 | | A/µs |
| Reverse recovered energy | $E_{rec}$ | | | | | 25<br>150 | | 0,082<br>0,154 | | mWs |
| Thermal resistance junction to sink | $R_{th(j-s)}$ | Thermal grease thickness ≤ 50um λ = 1 W/mK | | | | | | 3,00 | | K/W |
| **Thermistor** | | | | | | | | | | |
| Rated resistance | $R$ | | | | | 25 | | 1000 | | Ω |
| Deviation of $R_{100}$ | $\Delta_{R/R}$ | $R_{100}$ = 1670 Ω | | | | 100 | -3 | | 3 | % |
| $R_{100}$ | $R$ | | | | | 100 | | 1670 | | Ω |
| Power dissipation constant | | | | | | 25 | | | | mW/K |
| A-value | $B_{(25/50)}$ | | | | | 25 | | 7,635*10-3 | | 1/K |
| B-value | $B_{(25/100)}$ | | | | | 25 | | 1,731*10-5 | | 1/K² |
| Vincotech NTC Reference | | | | | | | | | E | |

# Inverter Switch / Brake Switch / Inverter Diode / Brake Diode

**figure 1.** **IGBT**

**Typical output characteristics**

$I_C = f(V_{CE})$



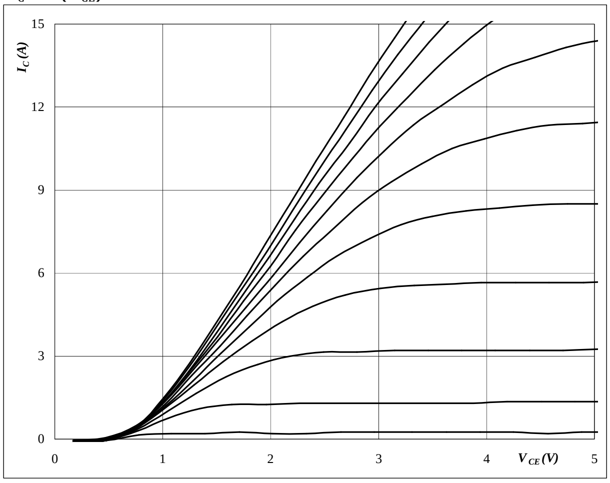

**At**

| | | |
|---|---|---|
| $t_p$ = | 250 | μs |
| $T_j$ = | 25 | °C |
| $V_{GE}$ from | 7 V to 17 V in steps of 1 V | |

**figure 2.** **IGBT**

**Typical output characteristics**

$I_C = f(V_{CE})$



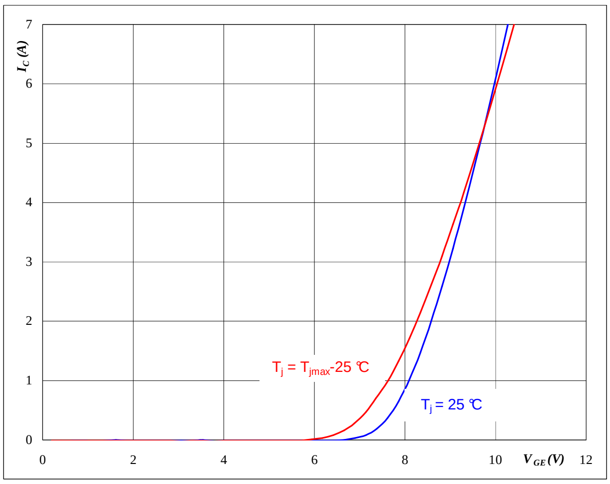

**At**

| | | |
|---|---|---|
| $t_p$ = | 250 | μs |
| $T_j$ = | 125 | °C |
| $V_{GE}$ from | 7 V to 17 V in steps of 1 V | |

**figure 3.** **IGBT**

**Typical transfer characteristics**

$I_C = f(V_{GE})$



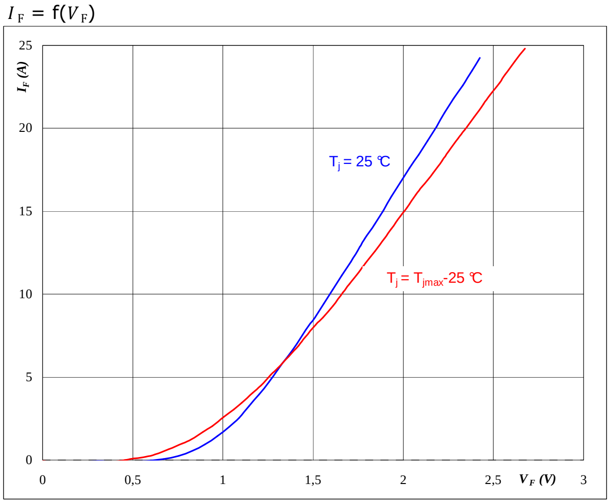

**At**

| | | |
|---|---|---|
| $t_p$ = | 250 | μs |
| $V_{CE}$ = | 10 | V |

**figure 4.** **FWD**

**Typical diode forward current as a function of forward voltage**

$I_F = f(V_F)$




**At**

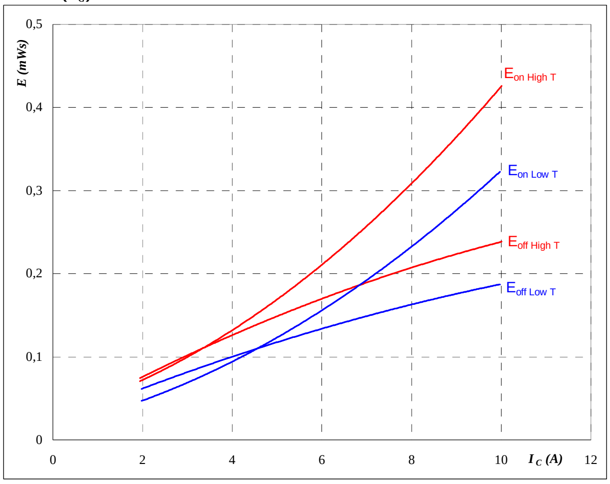
| | | |
|---|---|---|
| $t_p$ = | 250 | μs |

# Inverter Switch / Brake Switch / Inverter Diode / Brake Diode

**figure 5.** **IGBT**

**Typical switching energy losses as a function of collector current**

$E = f(I_C)$



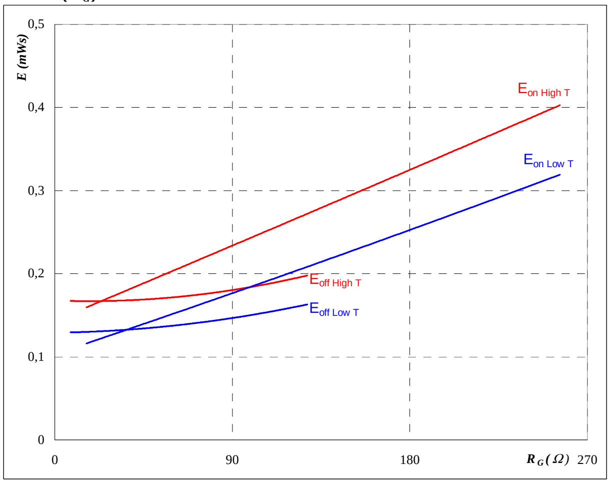

With an inductive load at

| | | |
|---|---|---|
| $T_j$ = | 25/125 | °C |
| $V_{CE}$ = | 300 | V |
| $V_{GE}$ = | 15 | V |
| $R_{gon}$ = | 64 | Ω |
| $R_{goff}$ = | 32 | Ω |

**figure 6.** **IGBT**

**Typical switching energy losses as a function of gate resistor**

$E = f(R_G)$



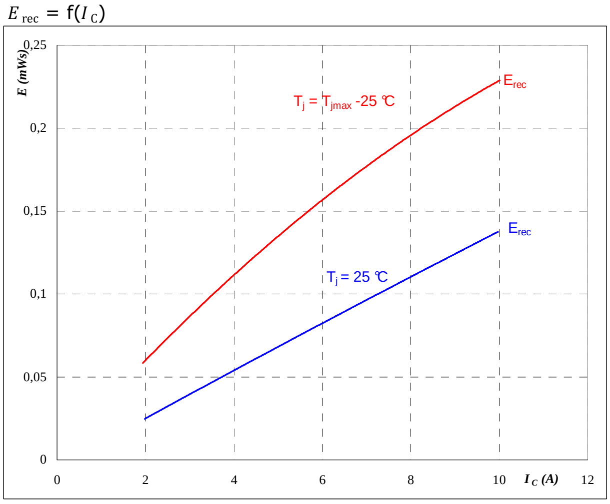

With an inductive load at

| | | |
|---|---|---|
| $T_j$ = | 25/125 | °C |
| $V_{CE}$ = | 300 | V |
| $V_{GE}$ = | 15 | V |
| $I_C$ = | 6 | A |

**figure 7.** **FWD**

**Typical reverse recovery energy loss as a function of collector current**

$E_{rec} = f(I_C)$



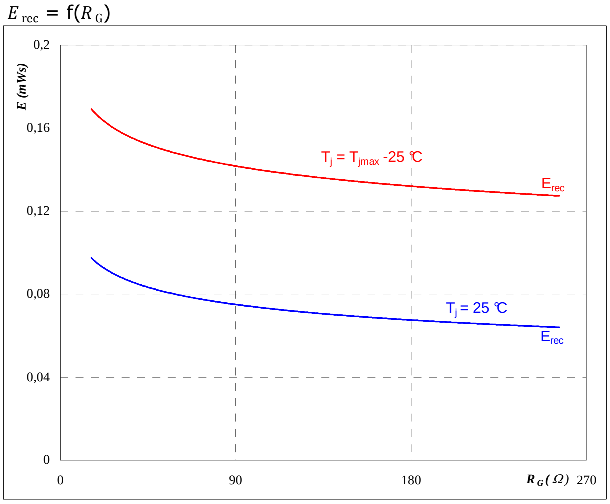

With an inductive load at

| | | |
|---|---|---|
| $T_j$ = | 25/125 | °C |
| $V_{CE}$ = | 300 | V |
| $V_{GE}$ = | 15 | V |
| $R_{gon}$ = | 64 | Ω |

**figure 8.** **FWD**

**Typical reverse recovery energy loss as a function of gate resistor**

$E_{rec} = f(R_G)$




With an inductive load at

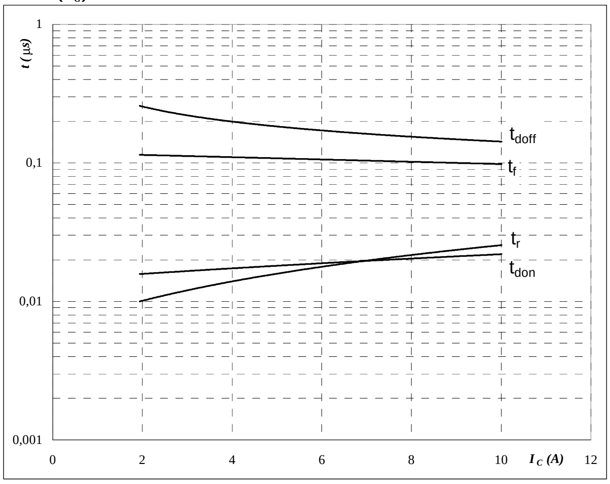
| | | |
|---|---|---|
| $T_j$ = | 25/125 | °C |
| $V_{CE}$ = | 300 | V |
| $V_{GE}$ = | 15 | V |
| $I_C$ = | 6 | A |

# Inverter Switch / Brake Switch / Inverter Diode / Brake Diode

**figure 9.** IGBT

**Typical switching times as a function of collector current**

$t = f(I_C)$



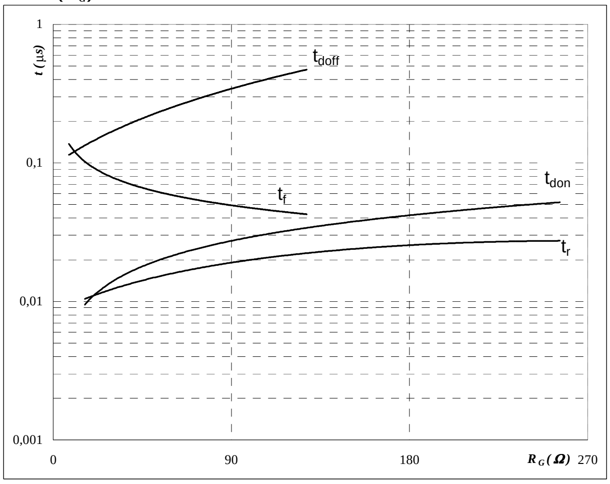

With an inductive load at

| | | |
|---|---|---|
| $T_j$ = | 125 | °C |
| $V_{CE}$ = | 300 | V |
| $V_{GE}$ = | 15 | V |
| $R_{gon}$ = | 64 | Ω |
| $R_{goff}$ = | 32 | Ω |

**figure 10.** IGBT

**Typical switching times as a function of gate resistor**

$t = f(R_G)$



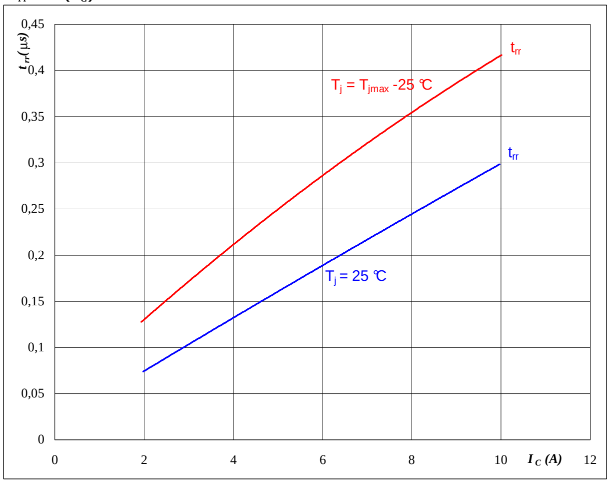

With an inductive load at

| | | |
|---|---|---|
| $T_j$ = | 125 | °C |
| $V_{CE}$ = | 300 | V |
| $V_{GE}$ = | 15 | V |
| $I_C$ = | 6 | A |

**figure 11.** FWD

**Typical reverse recovery time as a function of collector current**

$t_{rr} = f(I_C)$



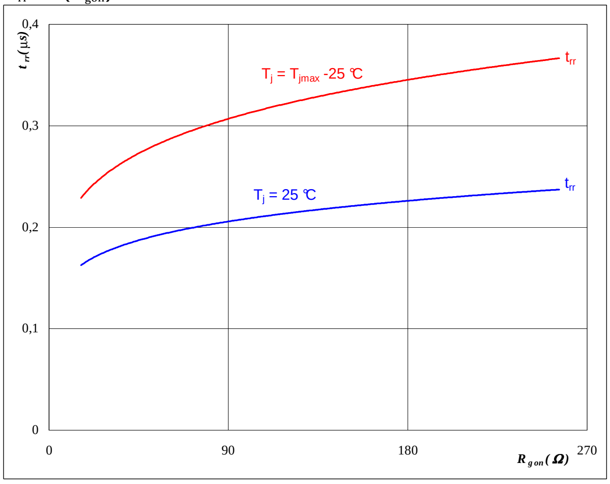

At

| | | |
|---|---|---|
| $T_j$ = | 25/125 | °C |
| $V_{CE}$ = | 300 | V |
| $V_{GE}$ = | 15 | V |
| $R_{gon}$ = | 64 | Ω |

**figure 12.** FWD

**Typical reverse recovery time as a function of IGBT turn on gate resistor**

$t_{rr} = f(R_{gon})$




At

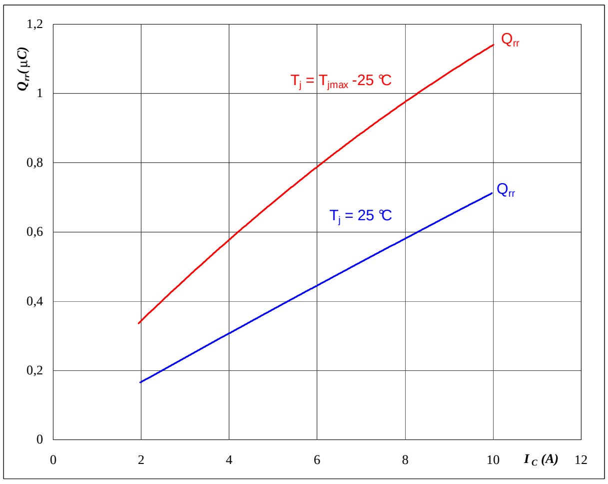
| | | |
|---|---|---|
| $T_j$ = | 25/125 | °C |
| $V_R$ = | 300 | V |
| $I_F$ = | 6 | A |
| $V_{GE}$ = | 15 | V |

# Inverter Switch / Brake Switch / Inverter Diode / Brake Diode

**figure 13.** **FWD**

**Typical reverse recovery charge as a function of collector current**

$Q_{rr} = f(I_C)$



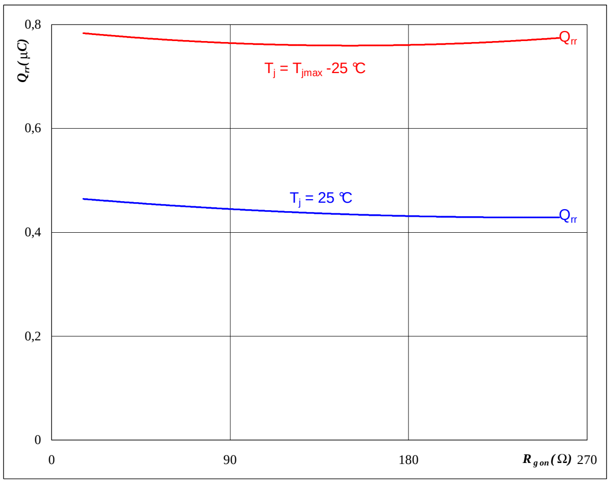

At

| | | |
|---|---|---|
| $T_j$ = | 25/125 | °C |
| $V_{CE}$ = | 300 | V |
| $V_{GE}$ = | 15 | V |
| $R_{gon}$ = | 64 | Ω |

**figure 14.** **FWD**

**Typical reverse recovery charge as a function of IGBT turn on gate resistor**

$Q_{rr} = f(R_{gon})$



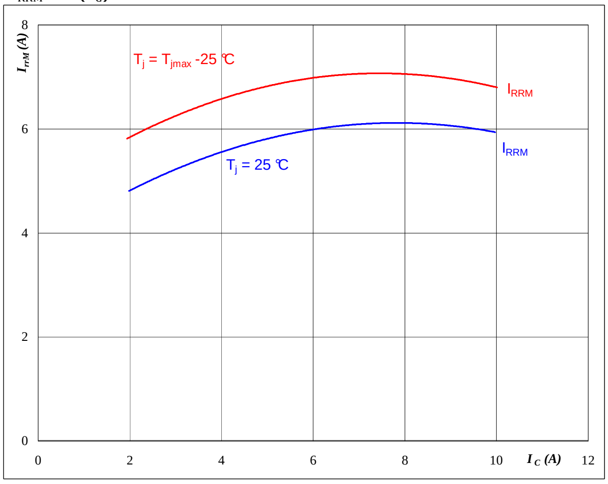

At

| | | |
|---|---|---|
| $T_j$ = | 25/125 | °C |
| $V_R$ = | 300 | V |
| $I_F$ = | 6 | A |
| $V_{GE}$ = | 15 | V |

**figure 15.** **FWD**

**Typical reverse recovery current as a function of collector current**

$I_{RRM} = f(I_C)$



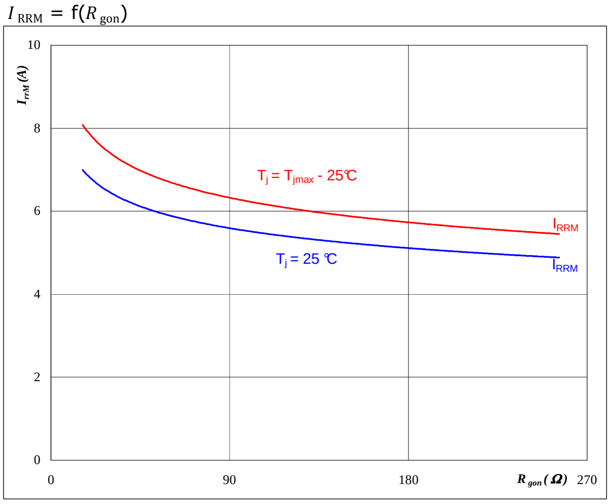

At

| | | |
|---|---|---|
| $T_j$ = | 25/125 | °C |
| $V_{CE}$ = | 300 | V |
| $V_{GE}$ = | 15 | V |
| $R_{gon}$ = | 64 | Ω |

**figure 16.** **FWD**

**Typical reverse recovery current as a function of IGBT turn on gate resistor**

$I_{RRM} = f(R_{gon})$




At

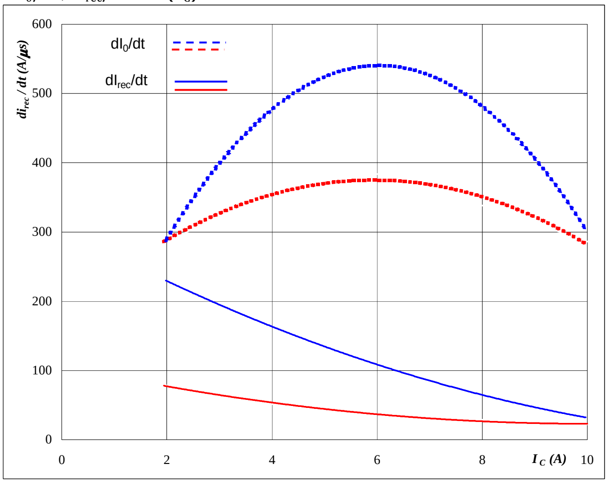
| | | |
|---|---|---|
| $T_j$ = | 25/125 | °C |
| $V_R$ = | 300 | V |
| $I_F$ = | 6 | A |
| $V_{GE}$ = | 15 | V |

# Inverter Switch / Brake Switch / Inverter Diode / Brake Diode

**figure 17.** **FWD**

**Typical rate of fall of forward and reverse recovery current as a function of collector current**

$dI_0/dt, dI_{rec}/dt = f(I_C)$



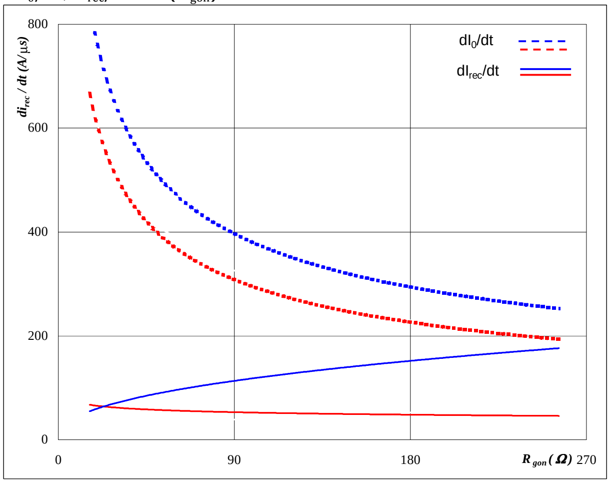

At

| | | |
|---|---|---|
| $T_j$ = | 25/125 | °C |
| $V_{CE}$ = | 300 | V |
| $V_{GE}$ = | 15 | V |
| $R_{gon}$ = | 64 | Ω |

**figure 18.** **FWD**

**Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor**

$dI_0/dt, dI_{rec}/dt = f(R_{gon})$



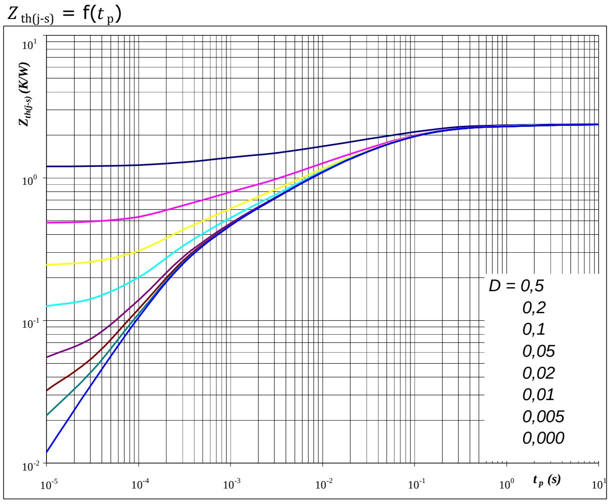

At

| | | |
|---|---|---|
| $T_j$ = | 25/125 | °C |
| $V_R$ = | 300 | V |
| $I_F$ = | 6 | A |
| $V_{GE}$ = | 15 | V |

**figure 19.** **IGBT**

**IGBT transient thermal impedance as a function of pulse width**

$Z_{th(j-s)} = f(t_p)$




At

| | | |
|---|---|---|
| $D$ = | $t_p / T$ | |
| $R_{th(j-s)}$ = | 2,40 | K/W |

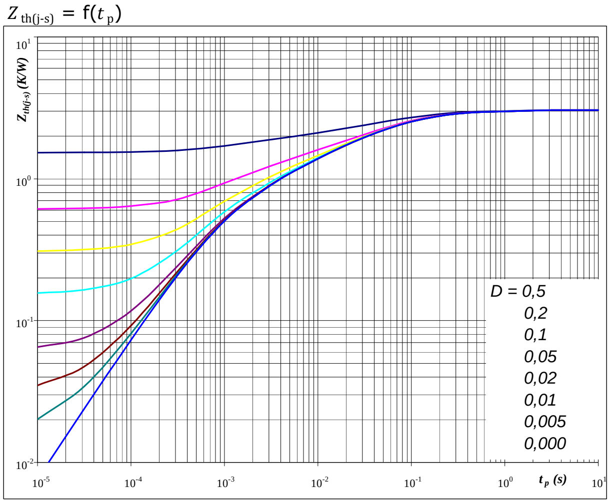
IGBT thermal model values

| $R$ (K/W) | Tau (s) |
|---|---|
| 8,29E-02 | 9,69E+00 |
| 1,83E-01 | 4,83E-01 |
| 8,23E-01 | 7,46E-02 |
| 5,86E-01 | 1,54E-02 |
| 4,26E-01 | 2,86E-03 |
| 2,99E-01 | 2,96E-04 |

**figure 20.** **FWD**

**FWD transient thermal impedance as a function of pulse width**

$Z_{th(j-s)} = f(t_p)$




At

| | | |
|---|---|---|
| $D$ = | $t_p / T$ | |
| $R_{th(j-s)}$ = | 3,00 | K/W |

FWD thermal model values

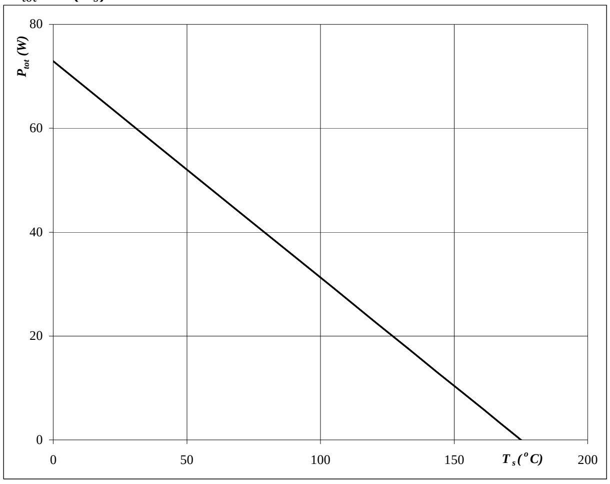
| $R$ (K/W) | Tau (s) |
|---|---|
| 1,66E-01 | 1,20E+00 |
| 8,73E-01 | 1,09E-01 |
| 9,47E-01 | 2,57E-02 |
| 5,64E-01 | 4,64E-03 |
| 5,02E-01 | 8,37E-04 |

# Inverter Switch / Brake Switch / Inverter Diode / Brake Diode

**figure 21.** **IGBT**

**Power dissipation as a function of heatsink temperature**

$P_{tot} = f(T_s)$



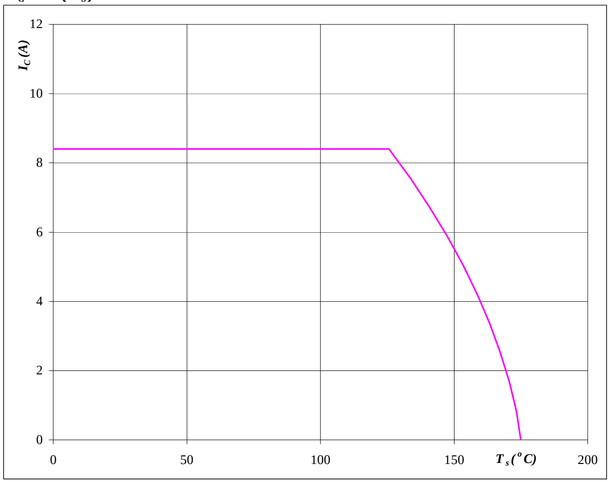

**At**

$T_j$ = 175 °C

**figure 22.** **IGBT**

**Collector current as a function of heatsink temperature**

$I_C = f(T_s)$




**At**

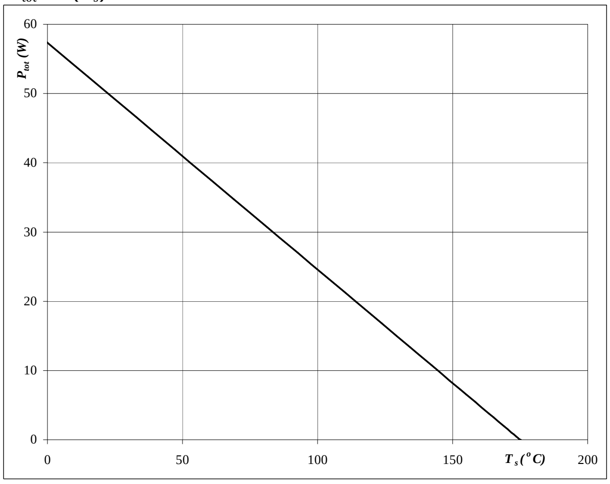
$T_j$ = 175 °C

$V_{GE}$ = 15 V

**figure 23.** **FWD**

**Power dissipation as a function of heatsink temperature**

$P_{tot} = f(T_s)$



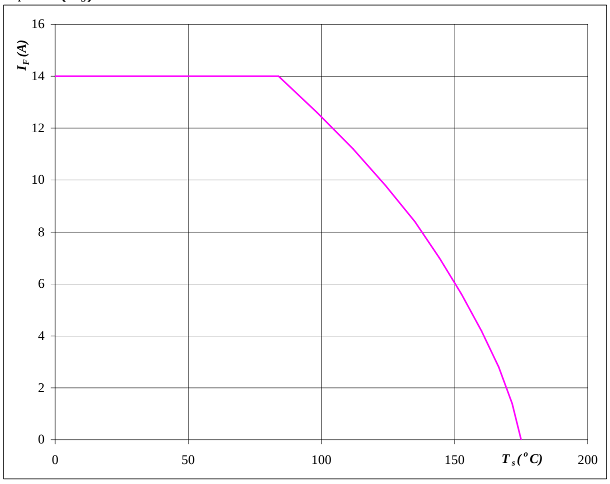

**At**

$T_j$ = 175 °C

**figure 24.** **FWD**

**Forward current as a function of heatsink temperature**

$I_F = f(T_s)$




**At**

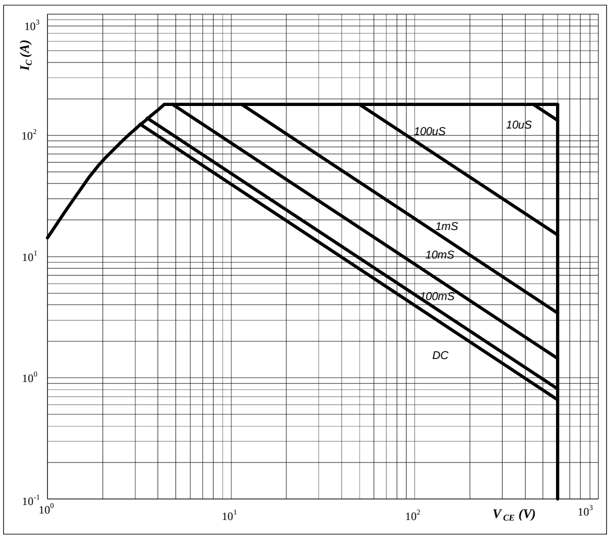
$T_j$ = 175 °C

# Inverter Switch / Brake Switch / Inverter Diode / Brake Diode

| figure 25. | IGBT |
|---|---|

**Safe operating area as a function of collector-emitter voltage**

$I_C = f(V_{CE})$



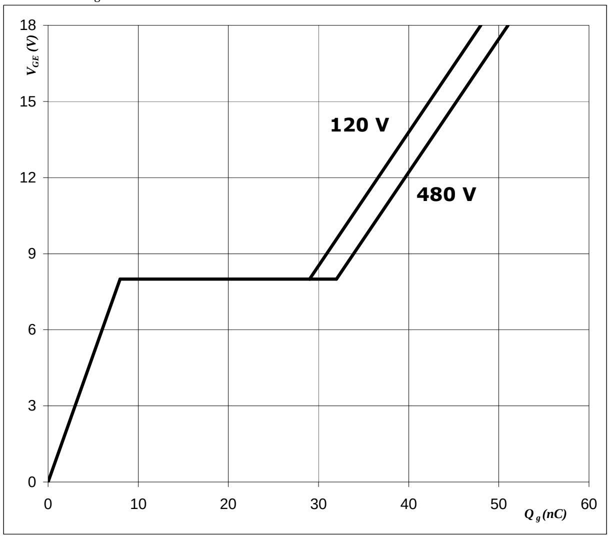

**At**

$D$ = single pulse
$T_s$ = 80 ºC
$V_{GE}$ = 15 V
$T_j$ = $T_{jmax}$

| figure 26. | IGBT |
|---|---|

**Gate voltage vs Gate charge**

$V_{GE} = f(Q_g)$




**At**

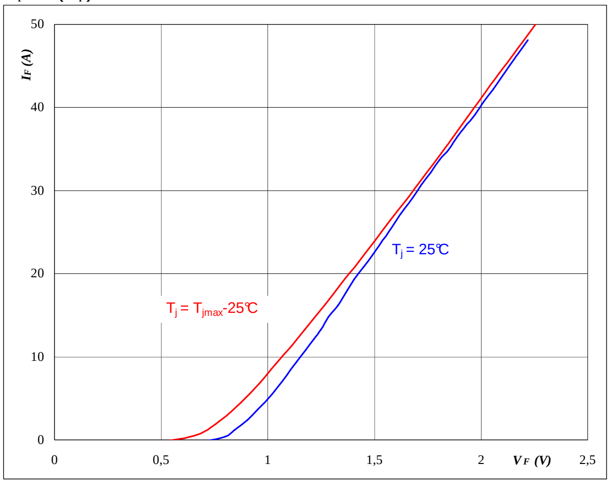
$I_C$ = 6 A

# Rectifier Diode

| figure 1. | Rectifier Diode |
| --- | --- |

**Typical diode forward current as a function of forward voltage**

$I_F = f(V_F)$



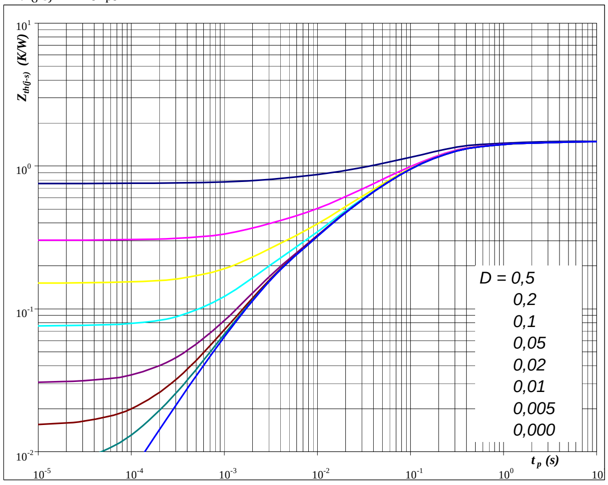

**At**

$t_p$ = 250 µs

| figure 2. | Rectifier Diode |
| --- | --- |

**Diode transient thermal impedance as a function of pulse width**

$Z_{th(j-s)} = f(t_p)$




**At**

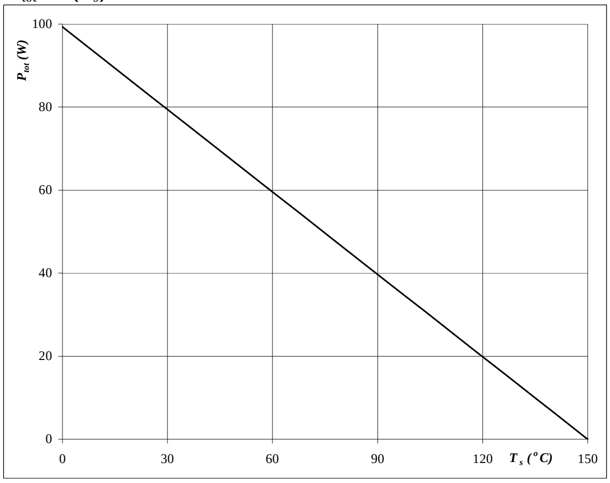
$D$ = $t_p / T$

$R_{th(j-s)}$ = 1,50 K/W

| figure 3. | Rectifier Diode |
| --- | --- |

**Power dissipation as a function of heatsink temperature**

$P_{tot} = f(T_s)$



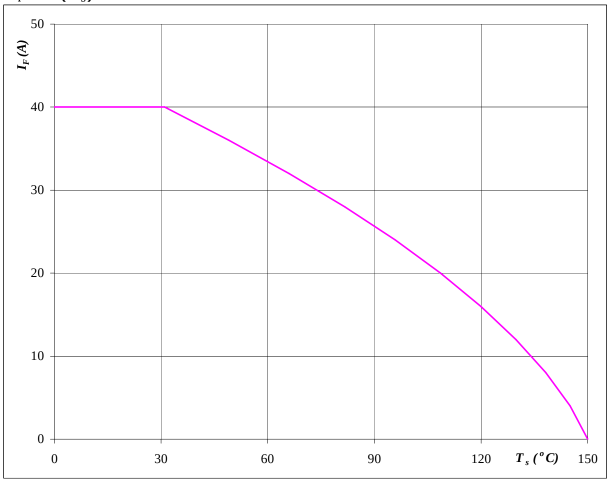

**At**

$T_j$ = 150 ºC

| figure 4. | Rectifier Diode |
| --- | --- |

**Forward current as a function of heatsink temperature**

$I_F = f(T_s)$




**At**

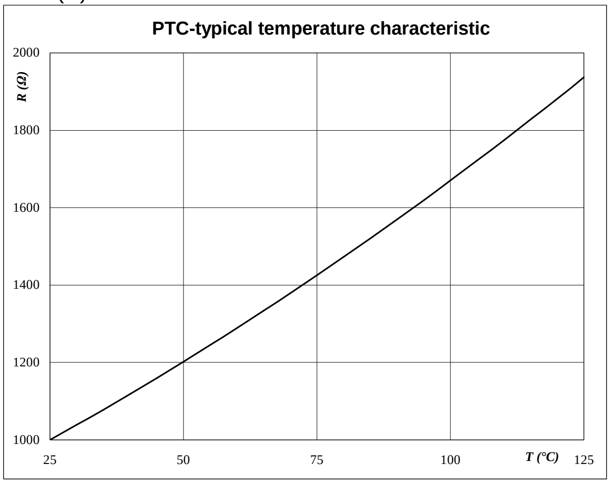
$T_j$ = 150 ºC

# Thermistor

**figure 1.** **Thermistor**

**Typical PTC characteristic**
**as a function of temperature**

$R = f(T)$



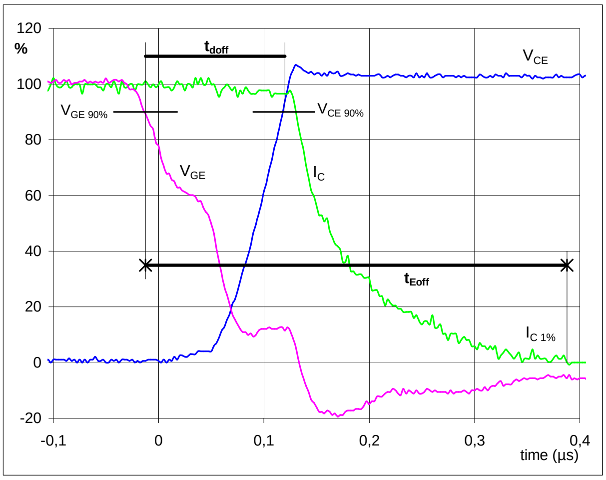
# Switching Definitions Output Inverter

**General conditions**

| | | |
|---|---|---|
| $T_j$ | = | 150 °C |
| $R_{gon}$ | = | 32 Ω |
| $R_{goff}$ | = | 17 Ω |

**figure 1.** **IGBT**

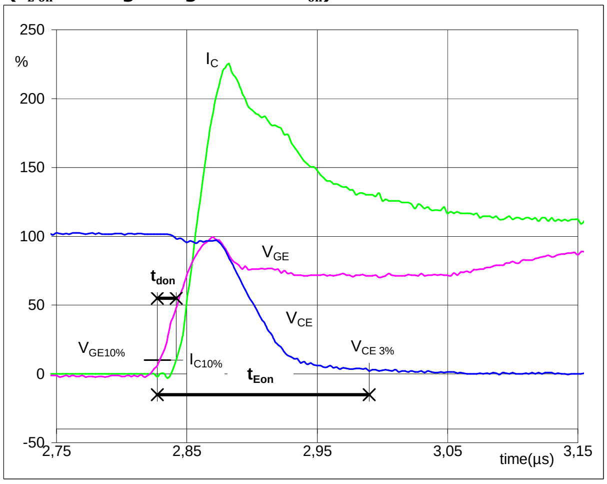
**Turn-off Switching Waveforms & definition of $t_{doff}$, $t_{Eoff}$**
**($t_{E\,off}$ = integrating time for $E_{off}$)**




| | | |
|---|---|---|
| $V_{GE}$ (0%) = | 0 | V |
| $V_{GE}$ (100%) = | 15 | V |
| $V_C$ (100%) = | 300 | V |
| $I_C$ (100%) = | 6 | A |
| $t_{doff}$ = | 0,13 | µs |
| $t_{E\,off}$ = | 0,40 | µs |

**figure 2.** **IGBT**

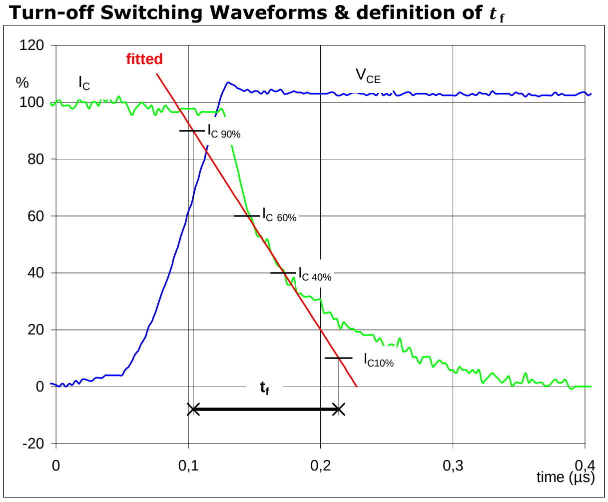
**Turn-on Switching Waveforms & definition of $t_{don}$, $t_{Eon}$**
**($t_{E\,on}$ = integrating time for $E_{on}$)**




| | | |
|---|---|---|
| $V_{GE}$ (0%) = | 0 | V |
| $V_{GE}$ (100%) = | 15 | V |
| $V_C$ (100%) = | 300 | V |
| $I_C$ (100%) = | 6 | A |
| $t_{don}$ = | 0,01 | µs |
| $t_{E\,on}$ = | 0,16 | µs |

**figure 3.** **IGBT**

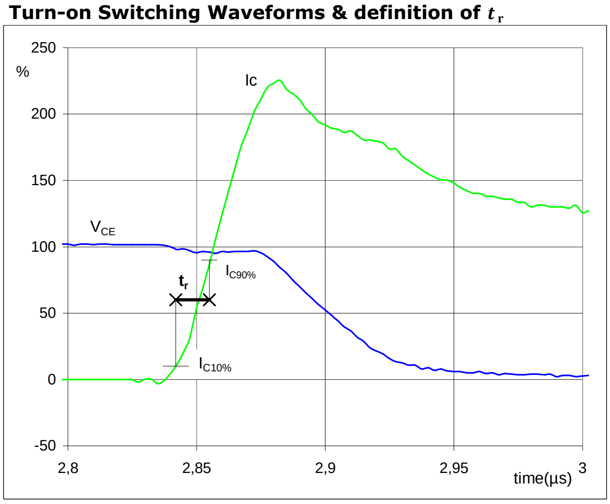
**Turn-off Switching Waveforms & definition of $t_f$**




| | | |
|---|---|---|
| $V_C$ (100%) = | 300 | V |
| $I_C$ (100%) = | 6 | A |
| $t_f$ = | 0,10 | µs |

**figure 4.** **IGBT**

**Turn-on Switching Waveforms & definition of $t_r$**

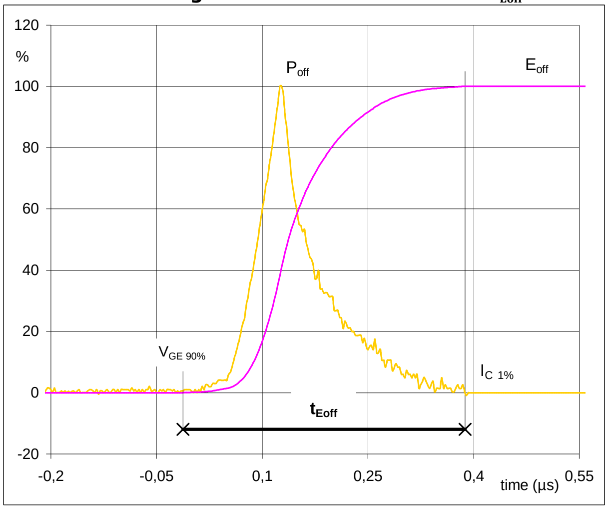



| | | |
|---|---|---|
| $V_C$ (100%) = | 300 | V |
| $I_C$ (100%) = | 6 | A |
| $t_r$ = | 0,01 | µs |

# Switching Definitions Output Inverter

**figure 5.** **IGBT**

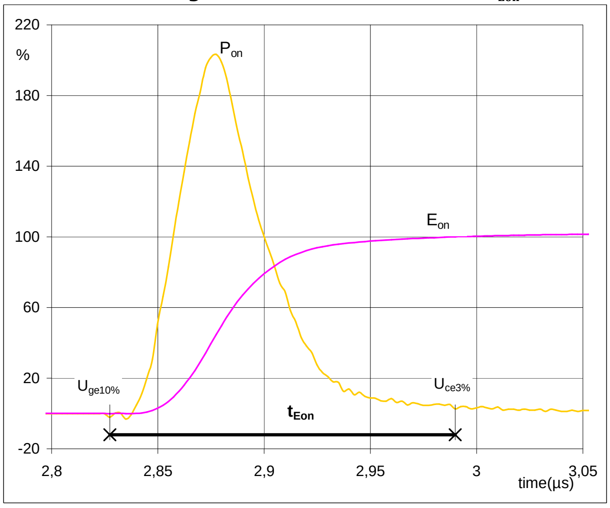
**Turn-off Switching Waveforms & definition of $t_{Eoff}$**




| | | |
|---|---|---|
| $P_{off}$ (100%) = | 1,80 | kW |
| $E_{off}$ (100%) = | 0,17 | mJ |
| $t_{E\,off}$ = | 0,40 | µs |

**figure 6.** **IGBT**

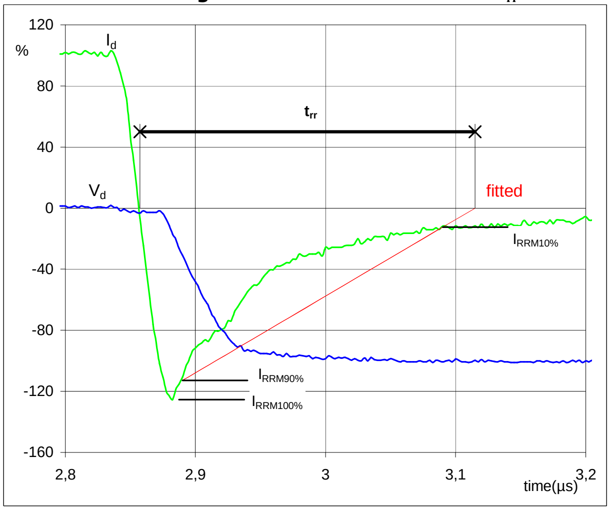
**Turn-on Switching Waveforms & definition of $t_{Eon}$**




| | | |
|---|---|---|
| $P_{on}$ (100%) = | 1,80 | kW |
| $E_{on}$ (100%) = | 0,18 | mJ |
| $t_{E\,on}$ = | 0,16 | µs |

**figure 7.** **IGBT**

**Turn-off Switching Waveforms & definition of $t_{rr}$**

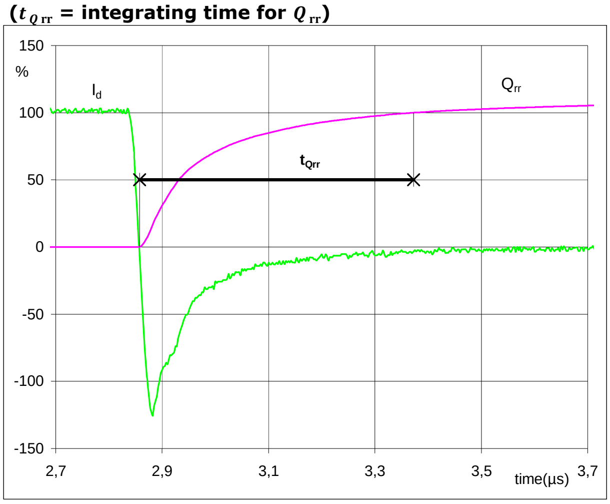



| | | |
|---|---|---|
| $V_d$ (100%) = | 300 | V |
| $I_d$ (100%) = | 6 | A |
| $I_{RRM}$ (100%) = | 7 | A |
| $t_{rr}$ = | 0,25 | µs |

# Switching Definitions Output Inverter

**figure 8.** **FWD**

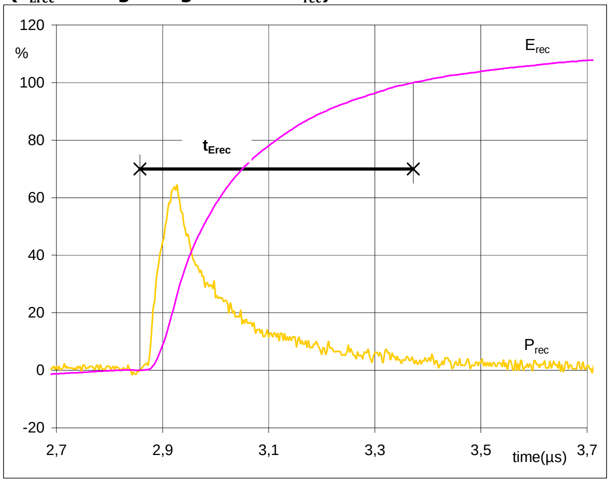
**Turn-on Switching Waveforms & definition of $t_{Qrr}$**
**($t_{Q\,rr}$ = integrating time for $Q_{rr}$)**




| | | |
|---|---|---|
| $I_d$ (100%) = | 6 | A |
| $Q_{rr}$ (100%) = | 0,77 | µC |
| $t_{Q\,rr}$ = | 0,51 | µs |

**figure 9.** **FWD**

**Turn-on Switching Waveforms & definition of $t_{Erec}$**
**($t_{Erec}$= integrating time for $E_{rec}$)**




| | | |
|---|---|---|
| $P_{rec}$ (100%) = | 1,80 | kW |
| $E_{rec}$ (100%) = | 0,16 | mJ |
| $t_{E\,rec}$ = | 0,51 | µs |

## Ordering Code & Marking

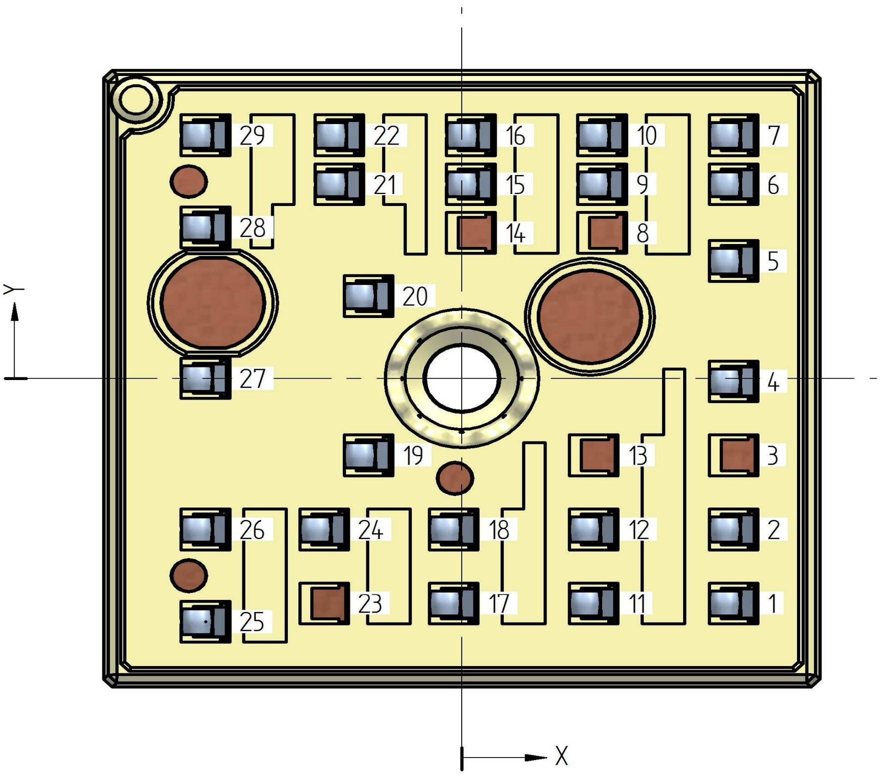
| Version | Ordering Code |
|---|---|
| with std lid (black V23990-K12-T-PM) | V23990-K201-A-/0A/-PM |
| with std lid (black V23990-K12-T-PM) and P12 | V23990-K201-A-/1A/-PM |
| with thin lid (white V23990-K13-T-PM) | V23990-K201-A-/0B/-PM |
| with thin lid (white V23990-K13-T-PM) and P12 | V23990-K201-A-/1B/-PM |


| | VIN | Date code | Name&Ver | UL | Lot | Serial |
|---|---|---|---|---|---|---|
| Text | VIN | WWYY | NNNNNNVV | UL | LLLLL | SSSS |

| | Type&Ver | Lot number | Serial | Date code | | |
|---|---|---|---|---|---|---|
| Datamatrix | TTTTTTTVV | LLLLL | SSSS | WWYY | | |

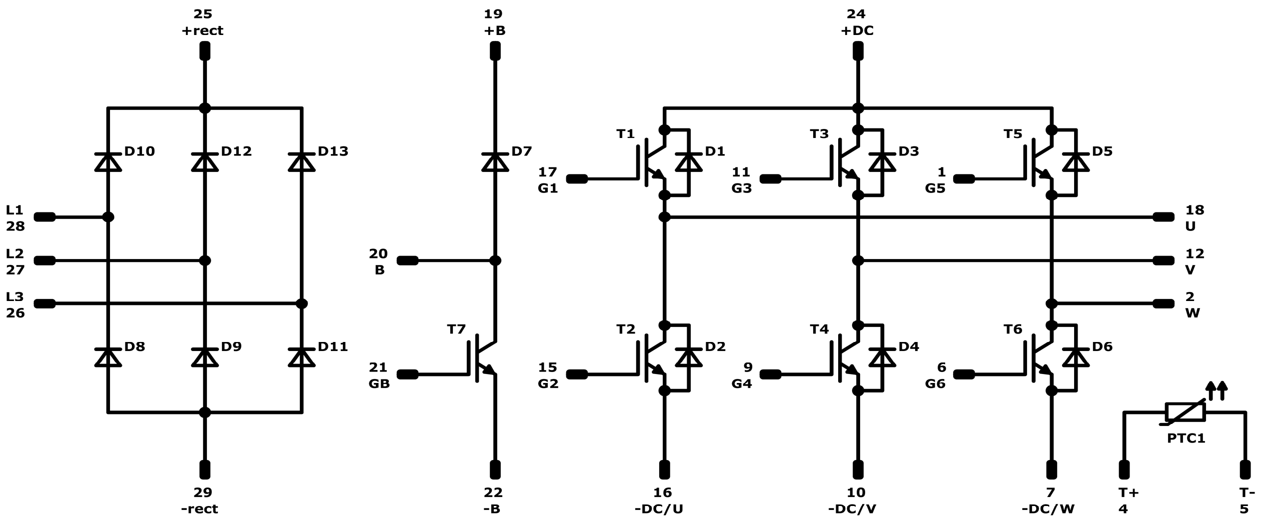
## Outline

| Pad table [mm] | | | |
|---|---|---|---|
| Pad | X | Y | Function |
| 1 | 15,93 | -14,6 | G5 |
| 2 | 15,93 | -9,8 | W |
| 3 | Not assembled | | |
| 4 | 15,93 | -0,2 | +T |
| 5 | 15,93 | 7,62 | -T |
| 6 | 15,93 | 12,62 | G6 |
| 7 | 15,93 | 15,8 | -DC/W |
| 8 | Not assembled | | |
| 9 | 8,23 | 12,62 | G4 |
| 10 | 8,23 | 15,8 | -DC/V |
| 11 | 7,73 | -14,6 | G3 |
| 12 | 7,73 | -9,8 | V |
| 13 | Not assembled | | |
| 14 | Not assembled | | |
| 15 | 0,53 | 12,62 | G2 |
| 16 | 0,53 | 15,8 | -DC/U |
| 17 | -0,47 | -14,6 | G1 |
| 18 | -0,47 | -9,8 | U |
| 19 | -5,47 | -5 | +B |
| 20 | -5,47 | 5,35 | B |
| 21 | -7,17 | 12,62 | GB |
| 22 | -7,17 | 15,8 | -B |
| 23 | Not assembled | | |
| 24 | -8,07 | -9,8 | +DC |
| 25 | -15,02 | -15,8 | +RECT |
| 26 | -15,02 | -9,8 | L3 |
| 27 | -15,02 | 0 | L2 |
| 28 | -15,02 | 9,8 | L1 |
| 29 | -15,02 | 15,8 | -RECT |




Pad positions refers to center point. For more informations on pad design please see package data.

## Pinout




## Identification

| ID | Component | Voltage | Current | Function | Comment |
|---|---|---|---|---|---|
| D8-D13 | Rectifier | 1600 V | 25 A | Rectifier Diode | |
| T1-T6 | IGBT | 600 V | 6 A | Inverter Switch | |
| D1-D6 | FWD | 600 V | 10 A | Inverter Diode | |
| T7 | IGBT | 600 V | 6 A | Brake Switch | |
| D7 | FWD | 600 V | 10 A | Brake Diode | |
| PTC1 | PTC | | | Thermistor | |

| Packaging instruction | | | | | |
|---|---|---|---|---|---|
| Standard packaging quantity (SPQ) | **120** | >SPQ | Standard | <SPQ | Sample |

| Handling instruction |
|---|
| Handling instructions for MiniSkiiP® 1 packages see vincotech.com website. |

| Package data |
|---|
| Package data for MiniSkiiP® 1 packages see vincotech.com website. |

| UL recognition and file number |
|---|
| This device is certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website. |

| Document No.: | Date: | Modification: | Pages |
|---|---|---|---|
| V23990-K201-A-D4-14 | 27 Jul. 2016 | | |