Vincotech

# V23990-P640-G09-PM
# V23990-P640-H09-PM

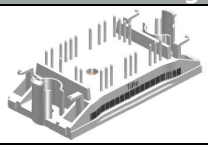
datasheet

## *flow* CON 0 — 1200 V / 75 A

### Features

- Input rectifier
- Optionally with brake chopper
- Vincotech clip-in housing

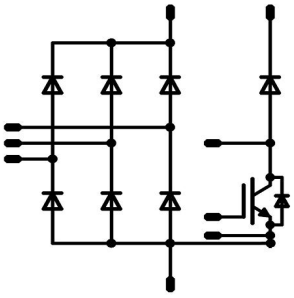
### *flow* 0 housing



### Target Applications

- Motor drives
- UPS

### Schematic



### Types

- V23990-P640-G09-PM with brake
- V23990-P640-H09-PM without brake

## Maximum Ratings

| Parameter | Symbol | Condition | | | Value | Unit |
|---|---|---|---|---|---|---|
| **Rectifier Diode** | | | | | | |
| Repetitive peak reverse voltage | $V_{RRM}$ | Tj=Tjmax | | | 1600 | V |
| Forward current per diode | $I_{FAV}$ | DC current | $T_j=T_j$max | $T_h$=80°C | 63 | A |
| Surge forward current | $I_{FSM}$ | $t_p$=10ms | half sine wave | $T_j$=45°C | 850 | A |
| $I^2t$-value | $I^2t$ | | | | 3610 | $A^2s$ |
| Power dissipation | $P_{tot}$ | $T_j=T_j$max | | $T_h$=80°C | 67 | W |
| Maximum junction temperature | $T_j$max | | | | 150 | °C |
| **Brake Switch** | | | | | | |
| Collector-emitter break down voltage | $V_{CE}$ | | | | 1200 | V |
| DC collector current | $I_C$ | $T_j=T_j$max | | $T_h$=80°C | 34 | A |
| Repetitive peak collector current | $I_{cpuls}$ | $t_p$ limited by $T_j$max | | | 105 | A |
| Power dissipation | $P_{tot}$ | $T_j=T_j$max | | $T_h$=80°C | 65 | W |
| Gate-emitter peak voltage | $V_{GE}$ | | | | ±20 | V |
| Short circuit ratings* | $t_{SC}$<br>$V_{CC}$ | $T_j$≤150°C<br>$V_{GE}$=15V | | | 10<br>900 | ms<br>V |
| Maximum junction temperature | $T_j$max | | | | 150 | °C |

* It is recommended to not exceed 1000 short circuit situations in the lifetime of the module and to allow at least 1s between short circuits

# Maximum Ratings

| Parameter | Symbol | Condition | | Value | Unit |
|---|---|---|---|---|---|
| **Brake Prot. Diode** | | | | | |
| Peak Repetitive Reverse Voltage | $V_{RRM}$ | | | 1200 | V |
| DC forward current | $I_F$ | $T_j=T_j$max | $T_h$=80°C | 6 | A |
| Repetitive peak forward current | $I_{FRM}$ | $t_p$ limited by $T_j$max | | 6 | A |
| Power dissipation | $P_{tot}$ | $T_j=T_j$max | $T_h$=80°C | 19 | W |
| Maximum junction temperature | $T_j$max | | | 150 | °C |
| **Brake Diode** | | | | | |
| Peak Repetitive Reverse Voltage | $V_{RRM}$ | | | 1200 | V |
| DC forward current | $I_F$ | $T_j=T_j$max | $T_h$=80°C | 23 | A |
| Repetitive peak forward current | $I_{FRM}$ | $t_p$ limited by $T_j$max | | 50 | A |
| Power dissipation | $P_{tot}$ | $T_j=T_j$max | $T_h$=80°C | 38 | W |
| Maximum junction temperature | $T_j$max | | | 150 | °C |
| **Thermal properties** | | | | | |
| Storage temperature | $T_{stg}$ | | | -40...+125 | °C |
| Operation temperature | $T_{op}$ | | | -40...+110 | °C |
| **Insulation properties** | | | | | |
| Insulation voltage | $V_{is}$ | t=2 s | DC voltage | 4000 | V |
| Creepage distance | | | | min 12.7 | mm |
| Clearance | | | | min 12.7 | mm |

## Characteristic Values

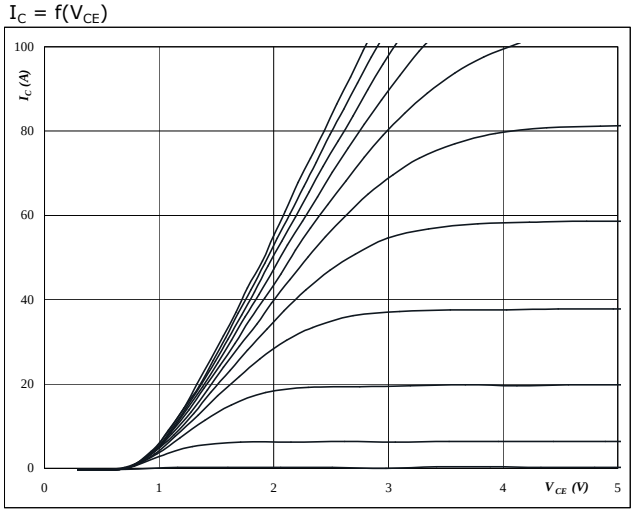
| Parameter | Symbol | Conditions | | | | | Value | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | $V_{GE}$(V) or $V_{GS}$(V) | $V_r$(V) or $V_{CE}$(V) or $V_{DS}$(V) | $I_C$(A) or $I_F$(A) or $I_D$(A) | T(°C) | Min | Typ | Max | |
| **Rectifier Diode** | | | | | | | | | | |
| Forward voltage | $V_F$ | | | | 75 | Tj=25°C<br>Tj=125°C | 1 | 1,17<br>1,13 | 1,5 | V |
| Threshold voltage (for power loss calc. only) | $V_{to}$ | | | | | Tj=25°C<br>Tj=125°C | | 0,91<br>0,78 | | V |
| Slope resistance (for power loss calc. only) | $r_t$ | | | | | Tj=25°C<br>Tj=125°C | | 3<br>5 | | mΩ |
| Reverse leakage current | $I_r$ | | | 1500 | | Tj=25°C<br>Tj=150°C | | | 0,5<br>1,5 | mA |
| Thermal resistance chip to heatsink | $R_{thJH}$ | Thermal grease<br>thickness ≤50um<br>λ= 1W/mK | | | | | | 1,04 | | K/W |
| **Brake Switch** | | | | | | | | | | |
| Gate emitter threshold voltage | $V_{GE(th)}$ | $V_{CE}$=$V_{GE}$ | | | 0,0015 | Tj=25°C<br>Tj=125°C | 5 | 5,8 | 6,5 | V |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | | 15 | | 35 | Tj=25°C<br>Tj=125°C | 1,3 | 1,69<br>1,88 | 2,2 | V |
| Collector-emitter cut-off | $I_{CES}$ | | 0 | 1200 | | Tj=25°C<br>Tj=125°C | | | 0,25 | mA |
| Gate-emitter leakage current | $I_{GES}$ | | 20 | 0 | | Tj=25°C<br>Tj=125°C | | | 650 | nA |
| Integrated Gate resistor | $R_{gint}$ | | | | | | | 6 | | Ω |
| Turn-on delay time | $t_{d(on)}$ | $R_{gon}$=32Ohm<br>$R_{goff}$=16Ohm | 15 | 600 | 35 | Tj=25°C<br>Tj=125°C | | 65 | | ns |
| Rise time | $t_r$ | | | | | Tj=25°C<br>Tj=125°C | | 26 | | ns |
| Turn-off delay time | $t_{d(off)}$ | | | | | Tj=25°C<br>Tj=125°C | | 673 | | ns |
| Fall time | $t_f$ | | | | | Tj=25°C<br>Tj=125°C | | 171 | | ns |
| Turn-on energy loss per pulse | $E_{on}$ | | | | | Tj=25°C<br>Tj=125°C | | 3,34 | | mWs |
| Turn-off energy loss per pulse | $E_{off}$ | | | | | Tj=25°C<br>Tj=125°C | | 3,99 | | mWs |
| Input capacitance | $C_{ies}$ | f=1MHz | 0 | 25 | | Tj=25°C | | 2,53 | | nF |
| Output capacitance | $C_{oss}$ | | | | | | | 0,132 | | nF |
| Reverse transfer capacitance | $C_{rss}$ | | | | | | | 0,115 | | nF |
| Gate charge | $Q_{Gate}$ | | 15 | 960 | 35 | Tj=25°C | | 203 | | nC |
| Thermal resistance chip to heatsink | $R_{thJH}$ | Thermal grease<br>thickness ≤50um<br>λ= 1W/mK | | | | | | 1,08 | | K/W |
| **Brake Prot. Diode** | | | | | | | | | | |
| Diode forward voltage | $V_F$ | | | | 3 | Tj=25°C<br>Tj=125°C | 1 | 1,61<br>1,56 | 2,3 | V |
| Reverse leakage current | $I_r$ | | | 1200 | | Tj=25°C<br>Tj=125°C | | | 250 | uA |
| Thermal resistance chip to heatsink | $R_{thJH}$ | Thermal grease<br>thickness ≤50um<br>λ= 1W/mK | | | | | | 3,62 | | K/W |
| **Brake Diode** | | | | | | | | | | |
| Diode forward voltage | $V_F$ | | | | 35 | Tj=25°C<br>Tj=125°C | 1 | 1,7<br>1,68 | 2,4 | V |
| Reverse leakage current | $I_r$ | | | 1200 | | Tj=25°C<br>Tj=125°C | | | 250 | mA |
| Peak reverse recovery current | $I_{RRM}$ | $R_{gon}$=32Ohm<br>$R_{goff}$=16Ohm | 15 | 600 | 35 | Tj=25°C<br>Tj=125°C | | 56,4 | | A |
| Reverse recovery time | $t_{rr}$ | | | | | Tj=25°C<br>Tj=125°C | | 279 | | ns |
| Reverse recovered charge | $Q_{rr}$ | | | | | Tj=25°C<br>Tj=125°C | | 5,15 | | mC |
| Peak rate of fall of reverse recovery current | $di(rec)max/dt$ | | | | | Tj=25°C<br>Tj=125°C | | 2460 | | A/ms |
| Reverse recovery energy | $E_{rec}$ | | | | | Tj=25°C<br>Tj=125°C | | 1,94 | | mWs |
| Thermal resistance chip to heatsink | $R_{thJH}$ | Thermal grease<br>thickness ≤50um<br>λ= 1W/mK | | | | | | 1,86 | | K/W |

# Brake

**Figure 1** Brake IGBT

**Typical output characteristics**

$I_C = f(V_{CE})$




At

$t_p$ = 250 µs

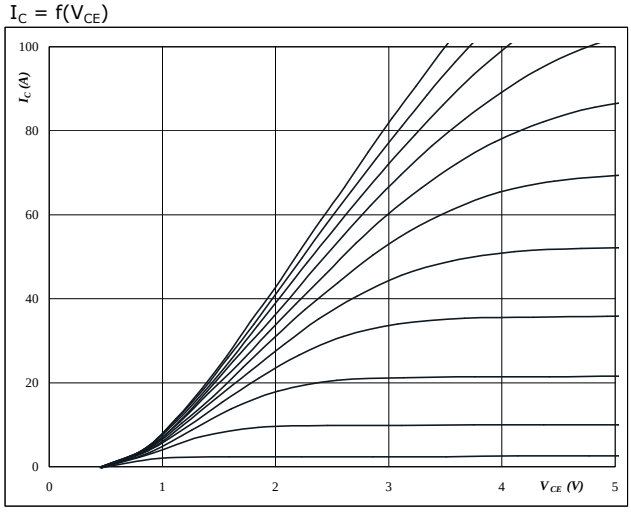
$T_j$ = 25 °C

VGE from 7 V to 17 V in steps of 1 V

**Figure 2** Brake IGBT

**Typical output characteristics**

$I_C = f(V_{CE})$




At

$t_p$ = 250 µs

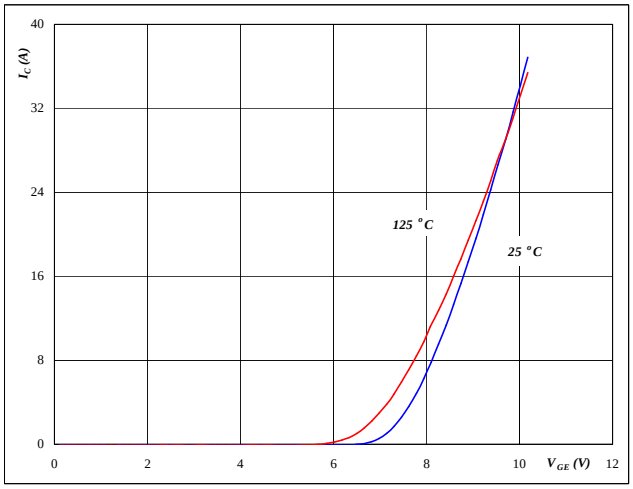
$T_j$ = 125 °C

VGE from 7 V to 17 V in steps of 1 V

**Figure 3** Brake IGBT

**Typical transfer characteristics**

$I_C = f(V_{GE})$




At

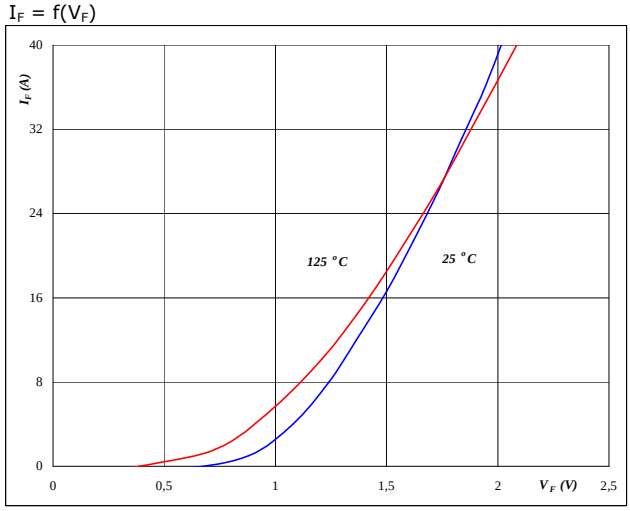
$t_p$ = 250 µs

$V_{CE}$ = 10 V

**Figure 4** Brake FWD

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

$I_F = f(V_F)$




At

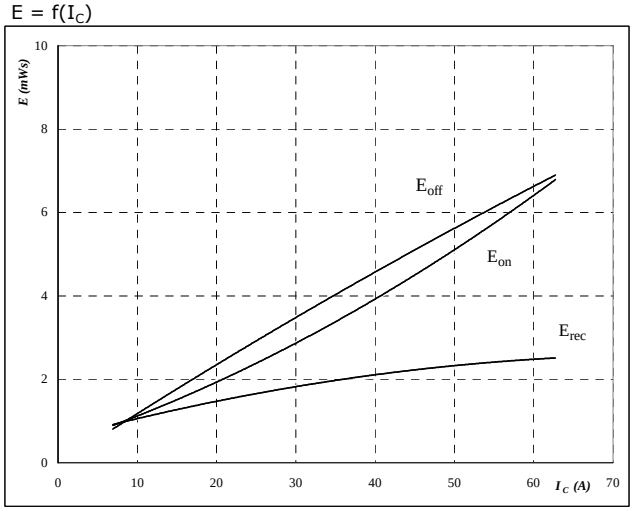
$t_p$ = 250 µs

# Brake

**Figure 5** Brake IGBT

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

E = f($I_C$)



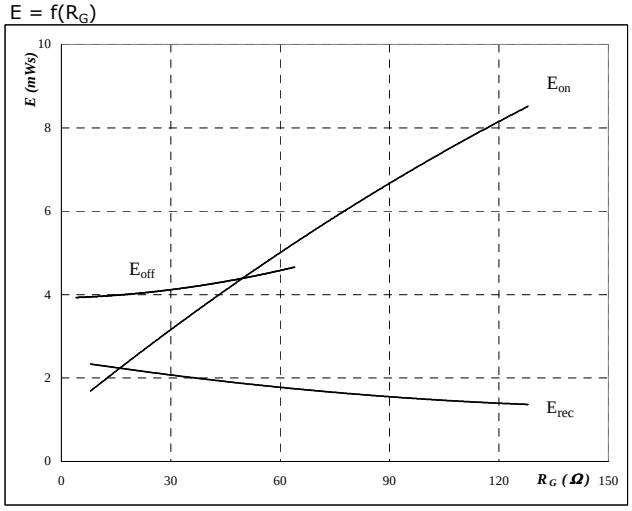

With an inductive load at

| | | |
|---|---|---|
| $T_j$ = | 125 | °C |
| $V_{CE}$ = | 600 | V |
| $V_{GE}$ = | 15 | V |
| $R_{gon}$ = | 32 | Ω |
| $R_{goff}$ = | 16 | Ω |

**Figure 6** Brake IGBT

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

E = f($R_G$)



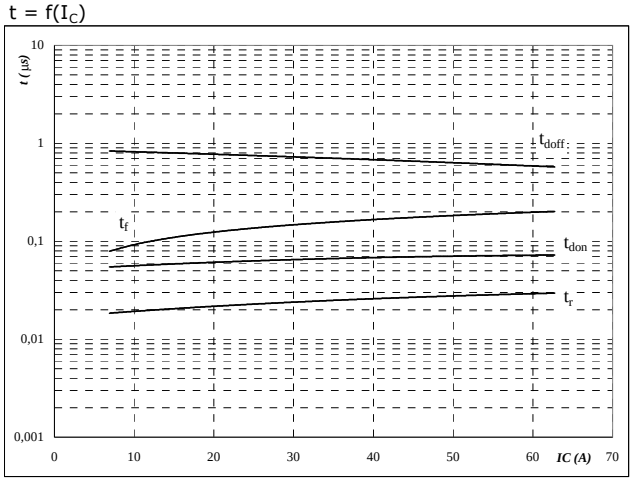

With an inductive load at

| | | |
|---|---|---|
| $T_j$ = | 125 | °C |
| $V_{CE}$ = | 600 | V |
| $V_{GE}$ = | 15 | V |
| $I_C$ = | 35 | A |

**Figure 7** Brake IGBT

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

t = f($I_C$)



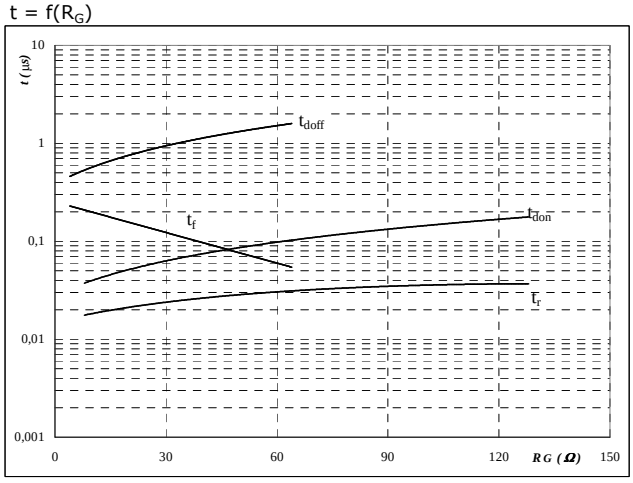

With an inductive load at

| | | |
|---|---|---|
| $T_j$ = | 125 | °C |
| $V_{CE}$ = | 600 | V |
| $V_{GE}$ = | 15 | V |
| $R_{gon}$ = | 32 | Ω |
| $R_{goff}$ = | 16 | Ω |

**Figure 8** Brake IGBT

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

t = f($R_G$)




With an inductive load at

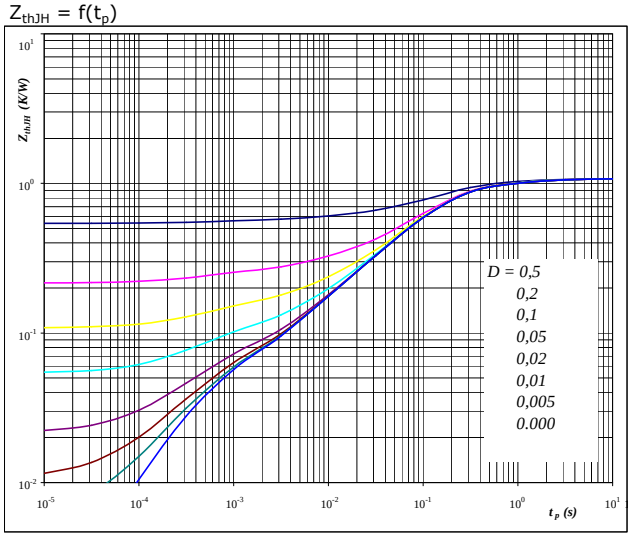
| | | |
|---|---|---|
| $T_j$ = | 125 | °C |
| $V_{CE}$ = | 600 | V |
| $V_{GE}$ = | 15 | V |
| $I_C$ = | 35 | A |

# Brake

**Figure 9** Brake IGBT

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

$Z_{thJH} = f(t_p)$




With

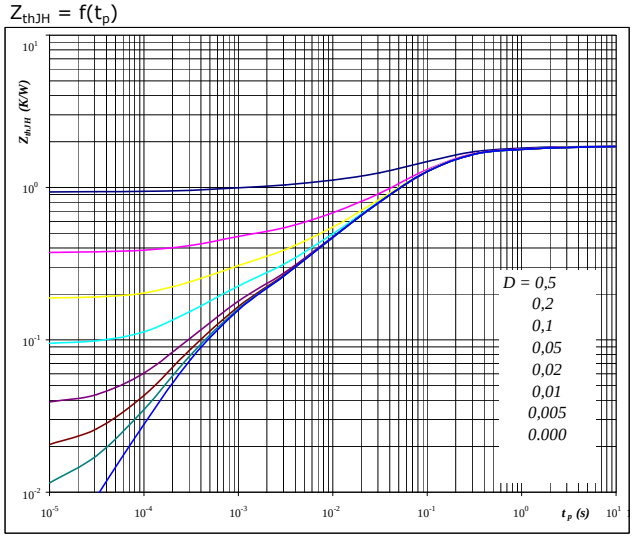
D = tp / T

$R_{thJH}$ = 1,08 K/W

**Figure 10** Brake FWD

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

$Z_{thJH} = f(t_p)$




With

D = tp / T

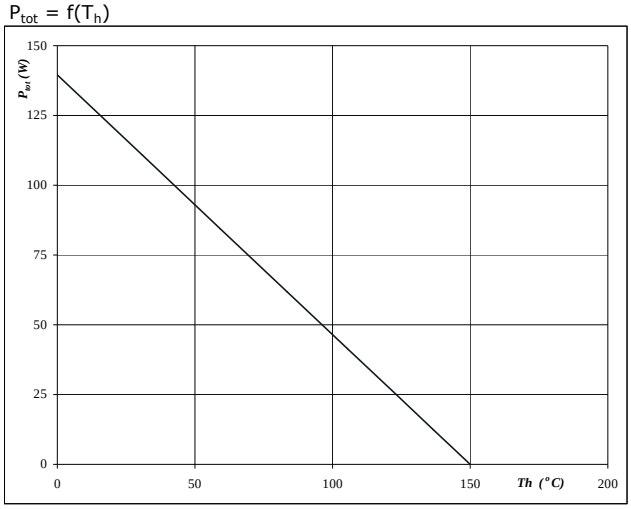
$R_{thJH}$ = 1,86 K/W

# Brake

**Figure 11** Brake IGBT

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

$P_{tot} = f(T_h)$



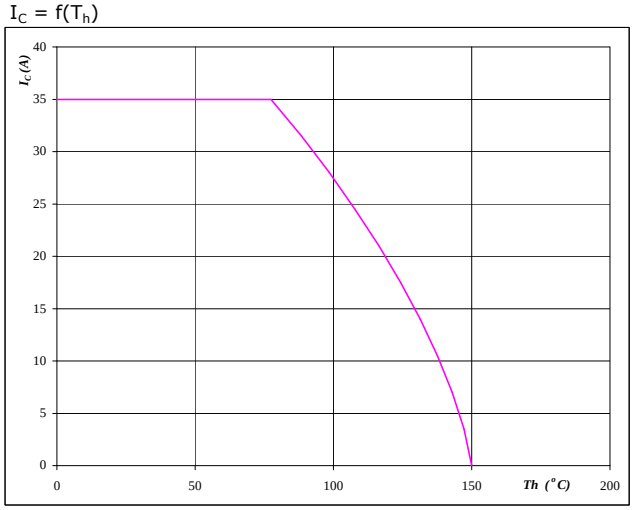

At

$T_j$ = 150 ºC

**Figure 12** Brake IGBT

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

$I_C = f(T_h)$




At

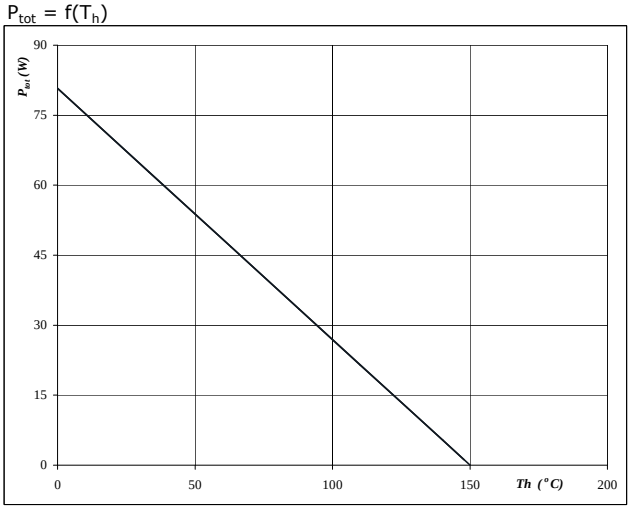
$T_j$ = 150 ºC

$V_{GE}$ = 15 V

**Figure 13** Brake FWD

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

$P_{tot} = f(T_h)$



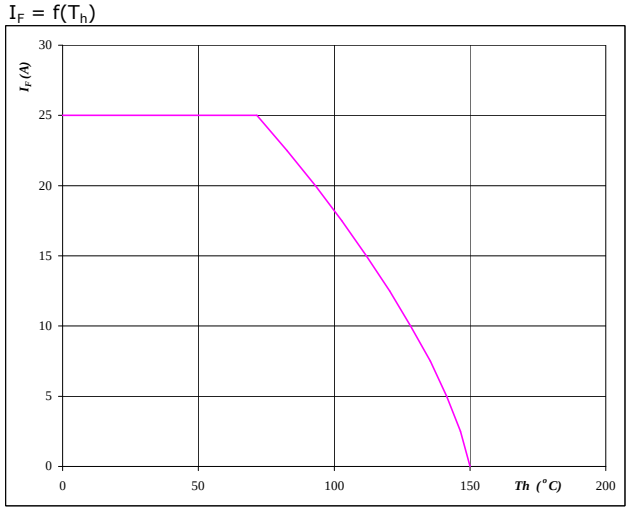

At

$T_j$ = 150 ºC

**Figure 14** Brake FWD

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

$I_F = f(T_h)$




At

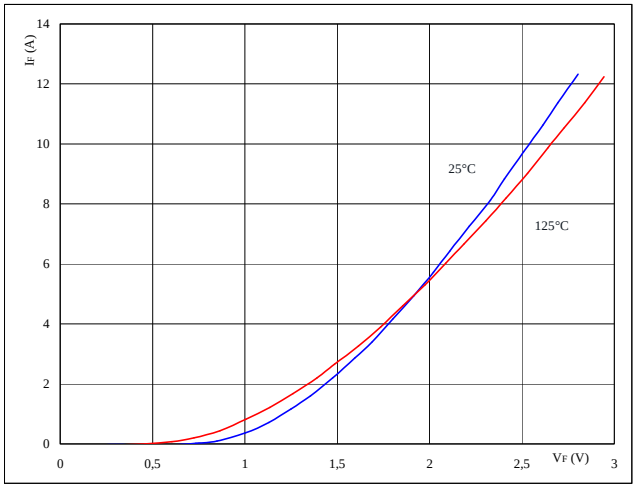
$T_j$ = 150 ºC

# Brake Prot. Diode

**Figure 1** Brake Prot. Diode

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

$I_F = f(V_F)$



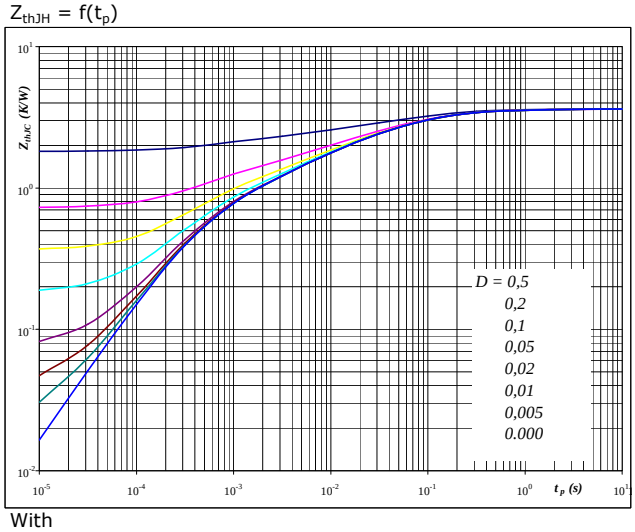

At

$t_p$ = 250 µs

**Figure 2** Brake Prot. Diode

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

$Z_{thJH} = f(t_p)$




With

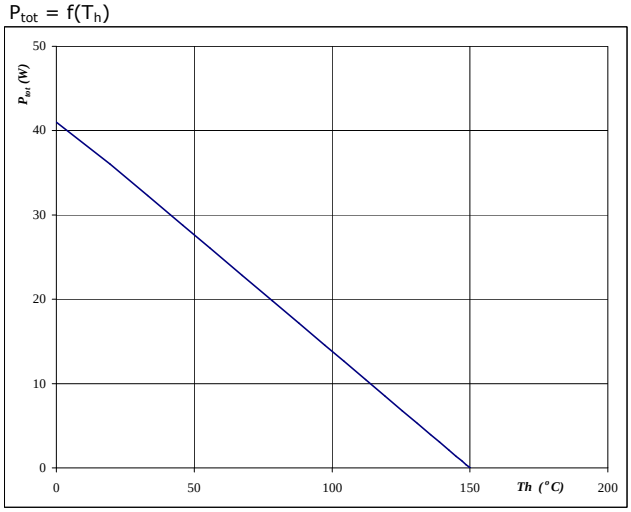
D = tp / T

$R_{thJH}$ = 3,62 K/W

**Figure 3** Brake Prot. Diode

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

$P_{tot} = f(T_h)$



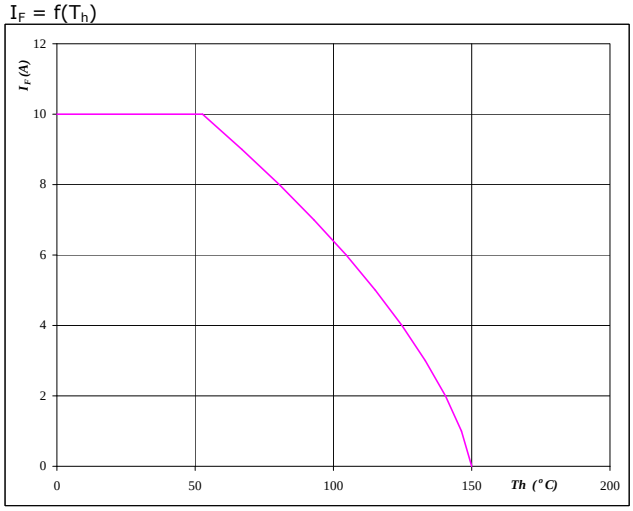

At

$T_j$ = 150 ºC

**Figure 4** Brake Prot. Diode

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

$I_F = f(T_h)$




At

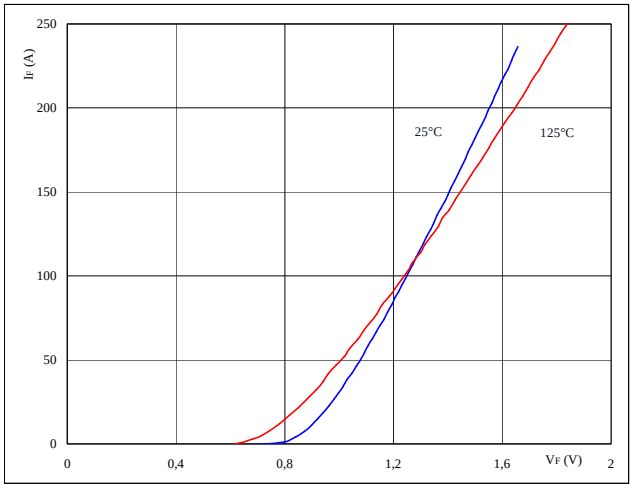
$T_j$ = 150 ºC

# Rectifier Bridge

**Figure 1** Rectifier diode

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

$I_F = f(V_F)$



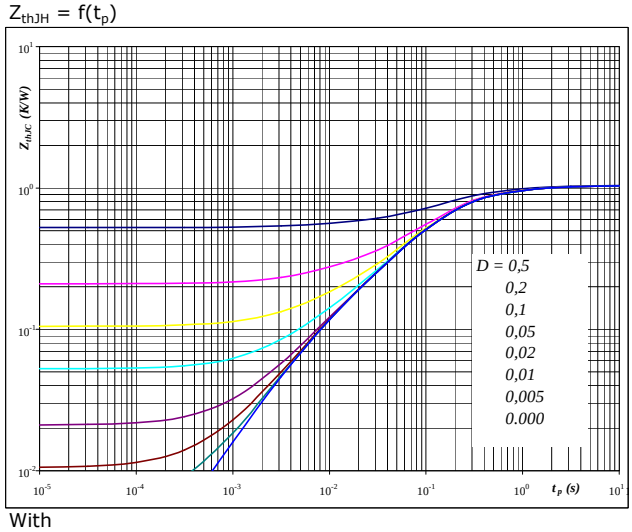

At

$t_p$ = 250 µs

**Figure 2** Rectifier diode

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

$Z_{thJH} = f(t_p)$




With

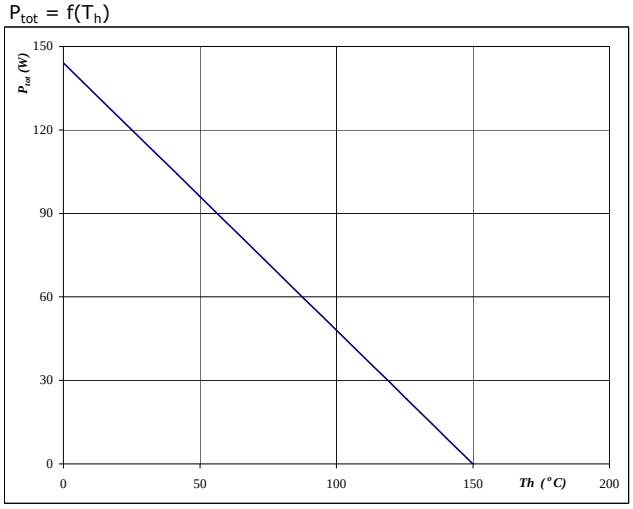
D = tp / T

$R_{thJH}$ = 1,04 K/W

**Figure 3** Rectifier diode

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

$P_{tot} = f(T_h)$



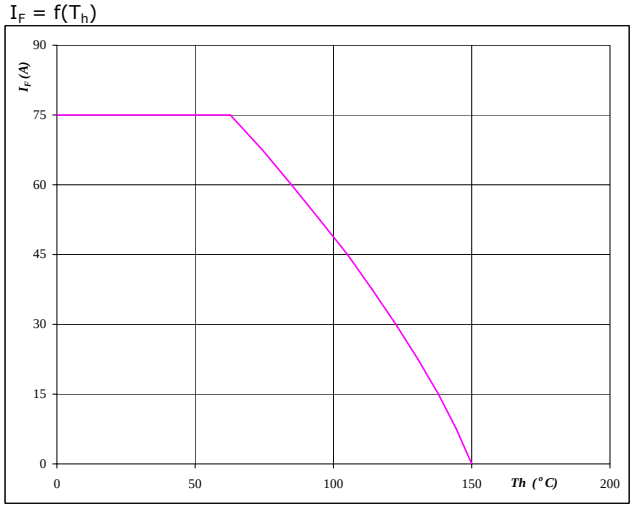

At

$T_j$ = 150 ºC

**Figure 4** Rectifier diode

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

$I_F = f(T_h)$




At

$T_j$ = 150 ºC

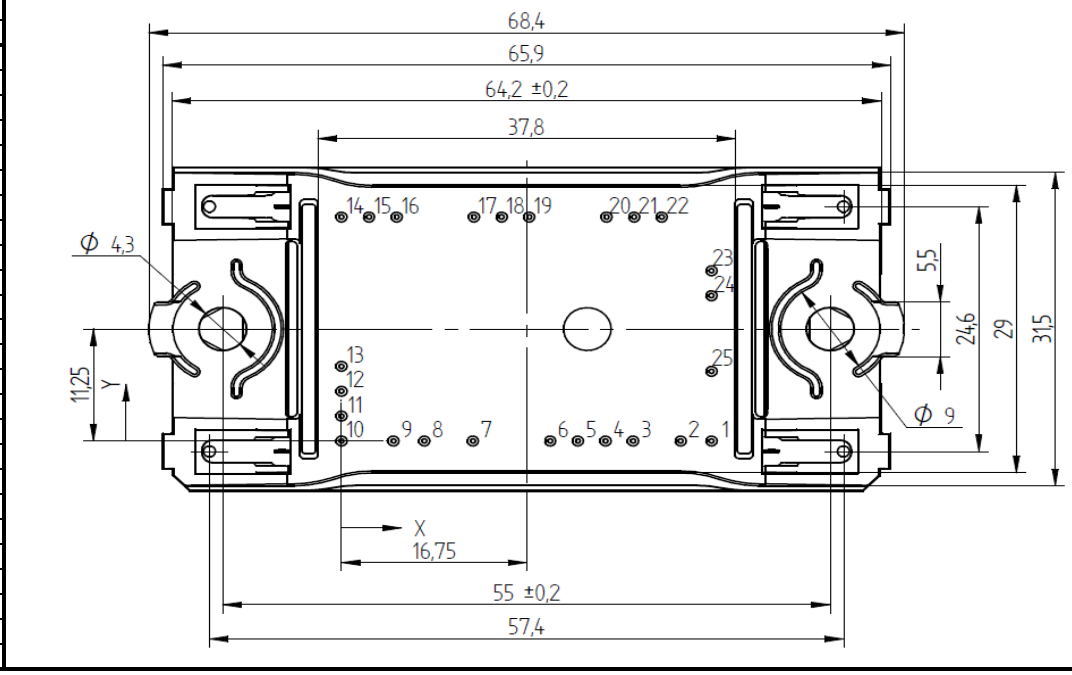
## Ordering Code & Marking

| Version | Ordering Code | in DataMatrix as | in packaging barcode as |
|---|---|---|---|
| With Brake | V23990-P640-G09-PM | P640G09 | P640G09 |
| Without Brake | V23990-P640-H09-PM | P640H09 | P640H09 |
| | | | |
| | | | |

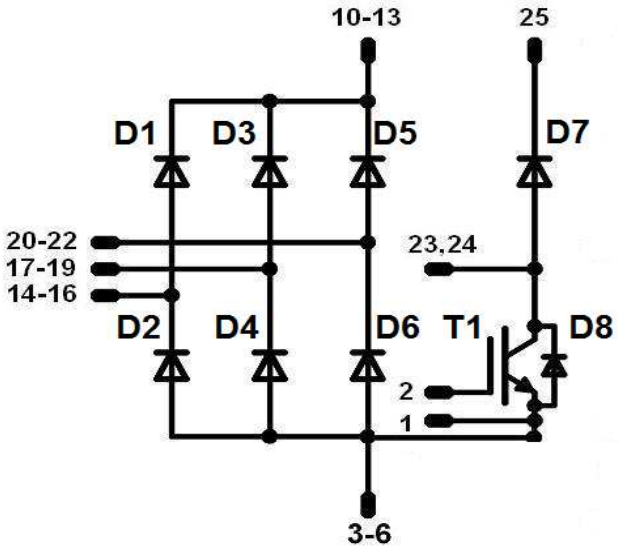

| | Name | Date code | UL & Vinco | Lot&Serial |
|---|---|---|---|---|
| Text | NNNNNNNNN | WWYY | UL Vinco | LLLLLSSSS |
| **Matrix** | **Name** | **Lot number** | **Serial** | **Date code** |
| | NNNNNNNNN | LLLLL | SSSS | WWYY |

## Outline

| Pin table | | |
|---|---|---|
| Pin | X | Y |
| 1 | 33,5 | 0 |
| 2 | 30,7 | 0 |
| 3 | 26,4 | 0 |
| 4 | 23,9 | 0 |
| 5 | 21,4 | 0 |
| 6 | 18,9 | 0 |
| 7 | 11,9 | 0 |
| 8 | 7,5 | 0 |
| 9 | 4,7 | 0 |
| 10 | 0 | 0 |
| 11 | 0 | 2,5 |
| 12 | 0 | 5 |
| 13 | 0 | 7,5 |
| 14 | 0 | 22,5 |
| 15 | 2,5 | 22,5 |
| 16 | 5 | 22,5 |
| 17 | 12 | 22,5 |
| 18 | 14,5 | 22,5 |
| 19 | 17 | 22,5 |
| 20 | 24 | 22,5 |
| 21 | 26,5 | 22,5 |
| 22 | 29 | 22,5 |
| 23 | 33,5 | 17,1 |
| 24 | 33,5 | 14,6 |
| 25 | 33,5 | 7 |




## Pinout




## Identification

| ID | Component | Voltage | Current | Function | Comment |
|---|---|---|---|---|---|
| D1-D6 | Rectifier | 1600V | 75 A | Rectifier Diode | |
| T1 | IGBT | 1200V | 35 A | Brake Switch | |
| D7 | FWD | 1200V | 35 A | Brake Diode | |
| D8 | FWD | 1200V | 3 A | Brake Port. Diode | |

| Packaging instruction | | | | | |
|---|---|---|---|---|---|
| Standard packaging quantity (SPQ) | 135 | >SPQ | Standard | <SPQ | Sample |

| Handling instruction |
|---|
| Handling instructions for *flow* 0 packages see vincotech.com website. |