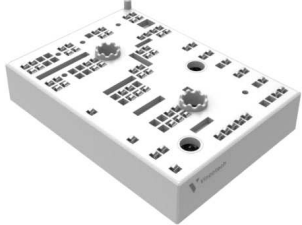
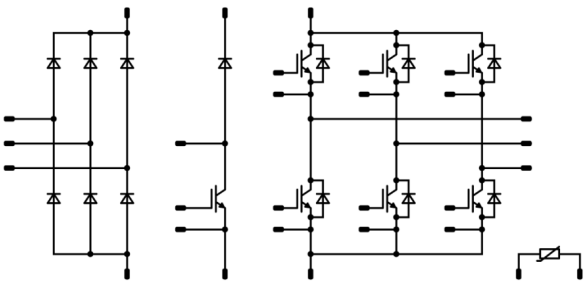




Vincotech

| MiniSKiP® PIM 3                                                                                                                                                                                                |  | 1200 V / 50 A                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------|
| <b>Features</b> <ul style="list-style-type: none"> <li>• IGBT M7 with low <math>V_{CEsat}</math> and improved EMC behavior</li> <li>• Solder-free spring contact technology</li> <li>• Built-in PTC</li> </ul> |  | <b>MiniSKiP® 3</b>  |
| <b>Target applications</b> <ul style="list-style-type: none"> <li>• Industrial Drives</li> </ul>                                                                                                               |  | <b>Schematic</b>    |
| <b>Types</b> <ul style="list-style-type: none"> <li>• 80-M312PMA050M7-K428A70</li> </ul>                                                                                                                       |  |                                                                                                        |

## Maximum Ratings

$T_j = 25\text{ °C}$ , unless otherwise specified

| Parameter                             | Symbol     | Condition                             | Value    | Unit |
|---------------------------------------|------------|---------------------------------------|----------|------|
| <b>Inverter Switch / Brake Switch</b> |            |                                       |          |      |
| Collector-emitter voltage             | $V_{CES}$  |                                       | 1200     | V    |
| Collector current                     | $I_C$      |                                       | 50       | A    |
| Repetitive peak collector current     | $I_{CRM}$  | $t_p$ limited by $T_{jmax}$           | 100      | A    |
| Total power dissipation               | $P_{tot}$  | $T_j = T_{jmax}$ $T_a = 80\text{ °C}$ | 153      | W    |
| Gate-emitter voltage                  | $V_{GES}$  |                                       | $\pm 20$ | V    |
| Maximum junction temperature          | $T_{jmax}$ |                                       | 175      | °C   |



Vincotech

## Maximum Ratings

$T_j = 25\text{ °C}$ , unless otherwise specified

| Parameter                           | Symbol     | Condition                             | Value | Unit |
|-------------------------------------|------------|---------------------------------------|-------|------|
| <b>Inverter Diode / Brake Diode</b> |            |                                       |       |      |
| Peak repetitive reverse voltage     | $V_{RRM}$  |                                       | 1200  | V    |
| Continuous (direct) forward current | $I_F$      |                                       | 50    | A    |
| Repetitive peak forward current     | $I_{FRM}$  | $t_p$ limited by $T_{jmax}$           | 100   | A    |
| Total power dissipation             | $P_{tot}$  | $T_j = T_{jmax}$ $T_s = 80\text{ °C}$ | 104   | W    |
| Maximum junction temperature        | $T_{jmax}$ |                                       | 175   | °C   |

## Rectifier Diode

|                                        |            |                                                   |      |                  |
|----------------------------------------|------------|---------------------------------------------------|------|------------------|
| Peak Repetitive Reverse Voltage        | $V_{RRM}$  |                                                   | 1600 | V                |
| Continuous (direct) forward current    | $I_F$      |                                                   | 50   | A                |
| Surge (non-repetitive) forward current | $I_{FSM}$  | 50 Hz Single Half Sine Wave $T_j = 150\text{ °C}$ | 490  | A                |
| Surge current capability               | $I_{st}$   | $t_p = 10\text{ ms}$                              | 1200 | A <sup>2</sup> s |
| Total power dissipation                | $P_{tot}$  | $T_j = T_{jmax}$ $T_s = 80\text{ °C}$             | 93   | W                |
| Maximum Junction Temperature           | $T_{jmax}$ |                                                   | 150  | °C               |

## Module Properties

### Thermal Properties

|                                                 |           |  |                           |    |
|-------------------------------------------------|-----------|--|---------------------------|----|
| Storage temperature                             | $T_{stg}$ |  | -40...+125                | °C |
| Operation temperature under switching condition | $T_{jop}$ |  | -40...( $T_{jmax} - 25$ ) | °C |

### Isolation Properties

|                            |            |                                                                 |       |    |
|----------------------------|------------|-----------------------------------------------------------------|-------|----|
| Isolation voltage          | $V_{isol}$ | DC Test Voltage* $t_p = 2\text{ s}$                             | 5500  | V  |
|                            |            | AC Voltage $t_p = 1\text{ min}$                                 | 2500  | V  |
| Creepage distance          |            | With std lid<br>For more informations see handling instructions | 6,3   | mm |
| Clearance                  |            | With std lid<br>For more informations see handling instructions | 6,3   | mm |
| Comparative Tracking Index | CTI        |                                                                 | > 200 |    |

\*100 % tested in production



Vincotech

## Characteristic Values

| Parameter | Symbol | Conditions |                              |                                           |                                     |            | Value |     |     | Unit |
|-----------|--------|------------|------------------------------|-------------------------------------------|-------------------------------------|------------|-------|-----|-----|------|
|           |        |            | $V_{GE}$ [V]<br>$V_{GS}$ [V] | $V_{CE}$ [V]<br>$V_{DS}$ [V]<br>$V_F$ [V] | $I_C$ [A]<br>$I_D$ [A]<br>$I_F$ [A] | $T_j$ [°C] | Min   | Typ | Max |      |

### Inverter Switch / Brake Switch

#### Static

|                                      |              |                   |    |      |       |                  |     |                      |     |    |
|--------------------------------------|--------------|-------------------|----|------|-------|------------------|-----|----------------------|-----|----|
| Gate-emitter threshold voltage       | $V_{GE(th)}$ | $V_{GE} = V_{CE}$ |    |      | 0,005 | 25               | 5,4 | 6                    | 6,6 | V  |
| Collector-emitter saturation voltage | $V_{CEsat}$  |                   | 15 |      | 50    | 25<br>125<br>150 |     | 1,55<br>1,77<br>1,83 | 1,9 | V  |
| Collector-emitter cut-off current    | $I_{CES}$    |                   | 0  | 1200 |       | 25               |     |                      | 90  | μA |
| Gate-emitter leakage current         | $I_{GES}$    |                   | 20 | 0    |       | 25               |     |                      | 500 | nA |
| Internal gate resistance             | $r_g$        |                   |    |      |       |                  |     | none                 |     | Ω  |
| Input capacitance                    | $C_{ies}$    |                   | 0  | 10   | 25    |                  |     | 10000                |     | pF |
| Output capacitance                   | $C_{oes}$    |                   |    |      |       |                  |     | 350                  |     |    |
| Reverse transfer capacitance         | $C_{res}$    |                   |    |      |       |                  |     | 130                  |     |    |
| Gate charge                          | $Q_g$        |                   | 15 | 600  | 50    | 25               |     | 410                  |     | nC |

#### Thermal

|                                     |               |                                                |  |  |  |  |  |      |  |     |
|-------------------------------------|---------------|------------------------------------------------|--|--|--|--|--|------|--|-----|
| Thermal resistance junction to sink | $R_{th(j-s)}$ | $\lambda_{paste} = 2,5 \text{ W/mK}$<br>(HPTP) |  |  |  |  |  | 0,62 |  | K/W |
|-------------------------------------|---------------|------------------------------------------------|--|--|--|--|--|------|--|-----|

#### Dynamic

|                             |              |                                                                                            |          |     |    |                  |  |                      |  |     |
|-----------------------------|--------------|--------------------------------------------------------------------------------------------|----------|-----|----|------------------|--|----------------------|--|-----|
| Turn-on delay time          | $t_{d(on)}$  | $R_{goff} = 8 \Omega$<br>$R_{gon} = 8 \Omega$                                              | $\pm 15$ | 600 | 48 | 25<br>125<br>150 |  | 176<br>176<br>190    |  | ns  |
| Rise time                   | $t_r$        |                                                                                            |          |     |    | 25<br>125<br>150 |  | 52<br>58<br>60       |  |     |
| Turn-off delay time         | $t_{d(off)}$ |                                                                                            |          |     |    | 25<br>125<br>150 |  | 206<br>229<br>241    |  |     |
| Fall time                   | $t_f$        |                                                                                            |          |     |    | 25<br>125<br>150 |  | 92<br>125<br>122     |  |     |
| Turn-on energy (per pulse)  | $E_{on}$     | $Q_{iFWD} = 4,9 \mu\text{C}$<br>$Q_{iFWD} = 7,1 \mu\text{C}$<br>$Q_{iFWD} = 8 \mu\text{C}$ |          |     |    | 25<br>125<br>150 |  | 4,82<br>6,38<br>6,25 |  | mWs |
| Turn-off energy (per pulse) | $E_{off}$    |                                                                                            |          |     |    | 25<br>125<br>150 |  | 2,98<br>4,25<br>5,03 |  |     |



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## Characteristic Values

| Parameter | Symbol | Conditions                   |                                           |                                     |            |  | Value |     |     | Unit |
|-----------|--------|------------------------------|-------------------------------------------|-------------------------------------|------------|--|-------|-----|-----|------|
|           |        | $V_{GE}$ [V]<br>$V_{GS}$ [V] | $V_{CE}$ [V]<br>$V_{DS}$ [V]<br>$V_F$ [V] | $I_C$ [A]<br>$I_D$ [A]<br>$I_F$ [A] | $T_j$ [°C] |  | Min   | Typ | Max |      |

### Inverter Diode / Brake Diode

#### Static

|                         |       |  |  |      |                  |  |  |                      |      |    |
|-------------------------|-------|--|--|------|------------------|--|--|----------------------|------|----|
| Forward voltage         | $V_F$ |  |  | 50   | 25<br>125<br>150 |  |  | 1,66<br>1,78<br>1,79 | 2,15 | V  |
| Reverse leakage current | $I_R$ |  |  | 1200 | 25               |  |  |                      | 50   | μA |

#### Thermal

|                                     |               |                                                |  |  |  |  |  |      |  |     |
|-------------------------------------|---------------|------------------------------------------------|--|--|--|--|--|------|--|-----|
| Thermal resistance junction to sink | $R_{th(j-s)}$ | $\lambda_{paste} = 2,5 \text{ W/mK}$<br>(HPTP) |  |  |  |  |  | 0,91 |  | K/W |
|-------------------------------------|---------------|------------------------------------------------|--|--|--|--|--|------|--|-----|

#### Dynamic

|                                       |                      |                                                                                                                   |          |     |    |                  |  |                      |  |      |
|---------------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------|----------|-----|----|------------------|--|----------------------|--|------|
| Peak recovery current                 | $I_{RRM}$            | $di/dt = 338 \text{ A/}\mu\text{s}$<br>$di/dt = 450 \text{ A/}\mu\text{s}$<br>$di/dt = 498 \text{ A/}\mu\text{s}$ | $\pm 15$ | 600 | 48 | 25<br>125<br>150 |  | 29<br>33<br>33       |  | A    |
| Reverse recovery time                 | $t_{rr}$             |                                                                                                                   |          |     |    | 25<br>125<br>150 |  | 339<br>435<br>511    |  | ns   |
| Recovered charge                      | $Q_r$                |                                                                                                                   |          |     |    | 25<br>125<br>150 |  | 4,93<br>7,08<br>8,04 |  | μC   |
| Reverse recovered energy              | $E_{rec}$            |                                                                                                                   |          |     |    | 25<br>125<br>150 |  | 1,79<br>2,59<br>3,33 |  | mWs  |
| Peak rate of fall of recovery current | $(di_{rr}/dt)_{max}$ |                                                                                                                   |          |     |    | 25<br>125<br>150 |  | 195<br>128<br>114    |  | A/μs |

### Rectifier Diode

#### Static

|                         |       |  |  |      |                  |  |  |                      |            |    |
|-------------------------|-------|--|--|------|------------------|--|--|----------------------|------------|----|
| Forward voltage         | $V_F$ |  |  | 50   | 25<br>125<br>150 |  |  | 1,14<br>1,08<br>1,07 | 1,8        | V  |
| Reverse leakage current | $I_r$ |  |  | 1600 | 25<br>145        |  |  |                      | 50<br>1100 | μA |

#### Thermal

|                                     |               |                                                |  |  |  |  |  |      |  |     |
|-------------------------------------|---------------|------------------------------------------------|--|--|--|--|--|------|--|-----|
| Thermal resistance junction to sink | $R_{th(j-s)}$ | $\lambda_{paste} = 2,5 \text{ W/mK}$<br>(HPTP) |  |  |  |  |  | 0,75 |  | K/W |
|-------------------------------------|---------------|------------------------------------------------|--|--|--|--|--|------|--|-----|



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# 80-M312PMA050M7-K428A70

datasheet

## Characteristic Values

| Parameter | Symbol | Conditions |                              |                                           |                                     |            | Value |     |     | Unit |
|-----------|--------|------------|------------------------------|-------------------------------------------|-------------------------------------|------------|-------|-----|-----|------|
|           |        |            | $V_{GE}$ [V]<br>$V_{GS}$ [V] | $V_{CE}$ [V]<br>$V_{DS}$ [V]<br>$V_F$ [V] | $I_C$ [A]<br>$I_D$ [A]<br>$I_F$ [A] | $T_j$ [°C] | Min   | Typ | Max |      |

### Thermistor

|                            |                |                         |  |  |  |     |    |                       |    |      |
|----------------------------|----------------|-------------------------|--|--|--|-----|----|-----------------------|----|------|
| Rated resistance           | $R$            |                         |  |  |  | 25  |    | 1                     |    | kΩ   |
| Deviation of $R_{100}$     | $\Delta_{R/R}$ | $R_{100} = 1670 \Omega$ |  |  |  | 100 | -2 |                       | +2 | %    |
| $R_{100}$                  | $R$            |                         |  |  |  | 100 |    | 1670                  |    | Ω    |
| Power dissipation constant |                |                         |  |  |  | 25  |    | 0,76                  |    | mW/K |
| A-value                    | $A_{(25/50)}$  |                         |  |  |  | 25  |    | $7,635 \cdot 10^{-3}$ |    | 1/K  |
| B-value                    | $B_{(25/100)}$ |                         |  |  |  | 25  |    | $1,731 \cdot 10^{-5}$ |    | 1/K² |
| Vincotech PTC Reference    |                |                         |  |  |  |     |    |                       | E  |      |



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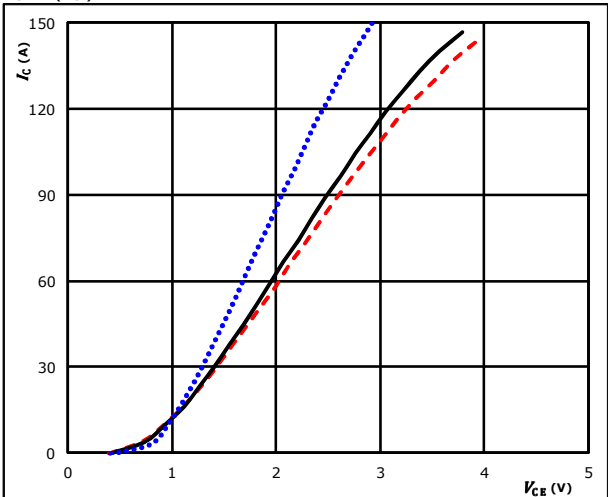
# 80-M312PMA050M7-K428A70 datasheet

## Inverter Switch / Brake Switch Characteristics

**figure 1.** IGBT

Typical transfer characteristics

$$I_C = f(V_{CE})$$

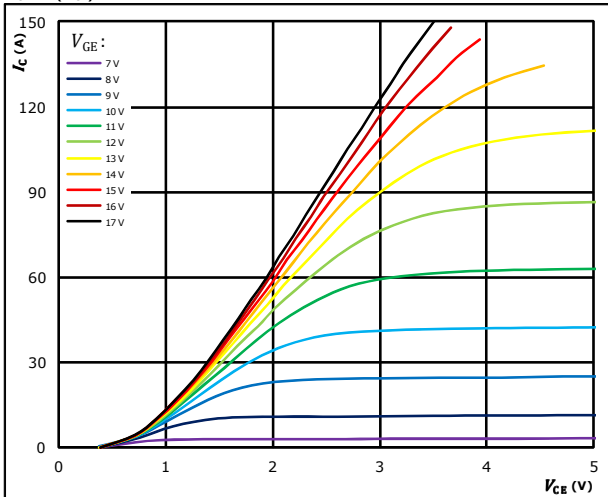


$t_p = 250$   $\mu$ s  
 $V_{GE} = 15$  V  
 $T_j$ : 25 °C (blue dotted), 125 °C (black solid), 150 °C (red dashed)

**figure 2.** IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

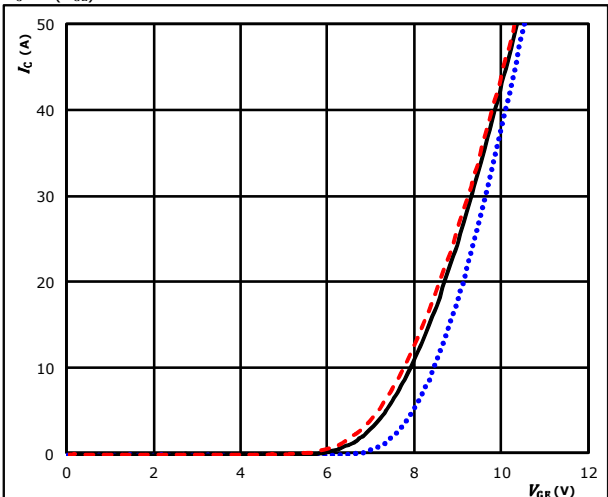


$t_p = 250$   $\mu$ s  
 $T_j = 150$  °C  
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

**figure 3.** IGBT

Typical transfer characteristics

$$I_C = f(V_{GE})$$

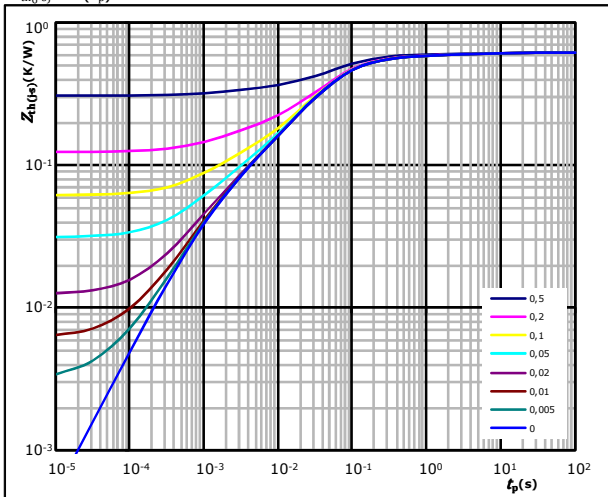


$t_p = 100$   $\mu$ s  
 $V_{CE} = 10$  V  
 $T_j$ : 25 °C (blue dotted), 125 °C (black solid), 150 °C (red dashed)

**figure 4.** IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,62$  K/W  
IGBT thermal model values  

| $R$ (K/W) | $\tau$ (s) |
|-----------|------------|
| 2,32E-02  | 4,64E+00   |
| 4,34E-02  | 3,95E-01   |
| 1,15E-01  | 7,05E-02   |
| 3,33E-01  | 2,36E-02   |
| 6,22E-02  | 4,58E-03   |
| 4,17E-02  | 7,04E-04   |
| 2,88E-03  | 3,40E-04   |



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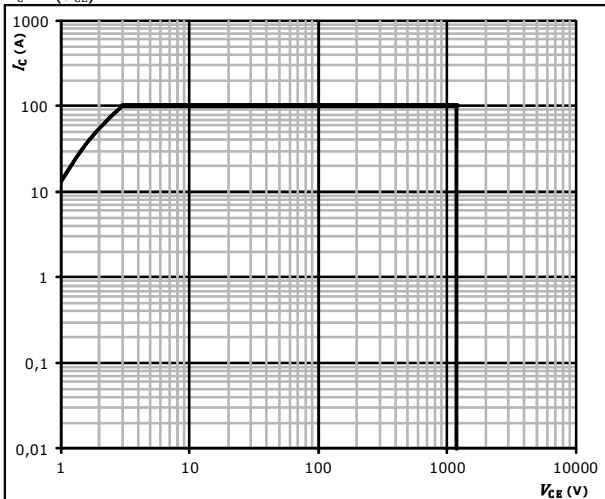
## Inverter Switch / Brake Switch Characteristics

**figure 5.**

IGBT

Safe operating area

$$I_C = f(V_{CE})$$



$D =$  single pulse  
 $T_s =$  80 °C  
 $V_{GE} =$   $\pm 15$  V  
 $T_j =$   $T_{jmax}$



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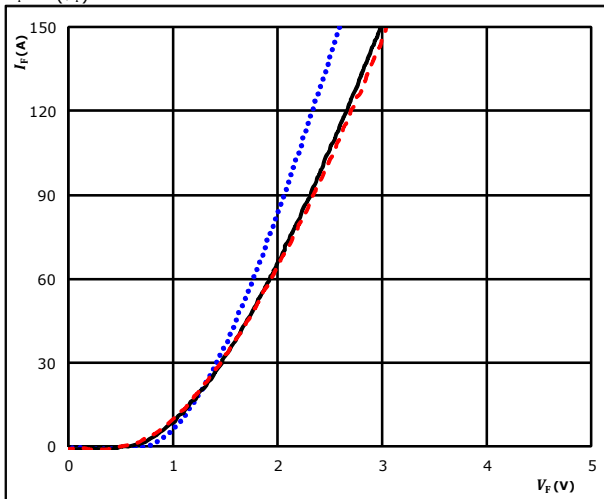
**80-M312PMA050M7-K428A70**  
datasheet

## Inverter Diode / Brake Diode Characteristics

**figure 1.** FWD

Typical forward characteristics

$$I_F = f(V_F)$$

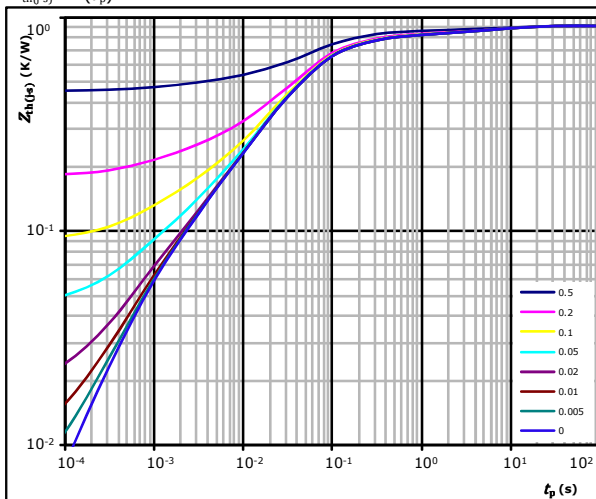


$t_p =$  250  $\mu$ s  
 $T_j$ : 25 °C (blue dotted line)  
125 °C (black solid line)  
150 °C (red dashed line)

**figure 2.** FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,91$  K/W

FWD thermal model values

| $R$ (K/W) | $\tau$ (s) |
|-----------|------------|
| 8,48E-02  | 5,83E+00   |
| 9,67E-02  | 3,26E-01   |
| 4,29E-01  | 4,85E-02   |
| 1,97E-01  | 1,77E-02   |
| 6,32E-02  | 2,88E-03   |
| 3,90E-02  | 5,73E-04   |

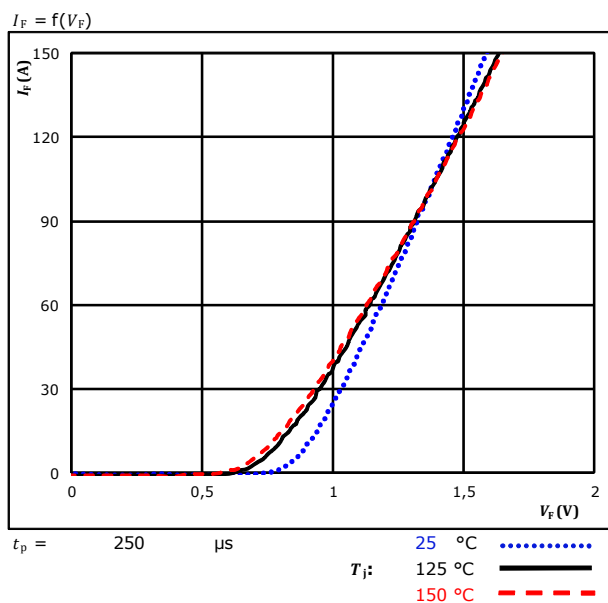


Vincotech

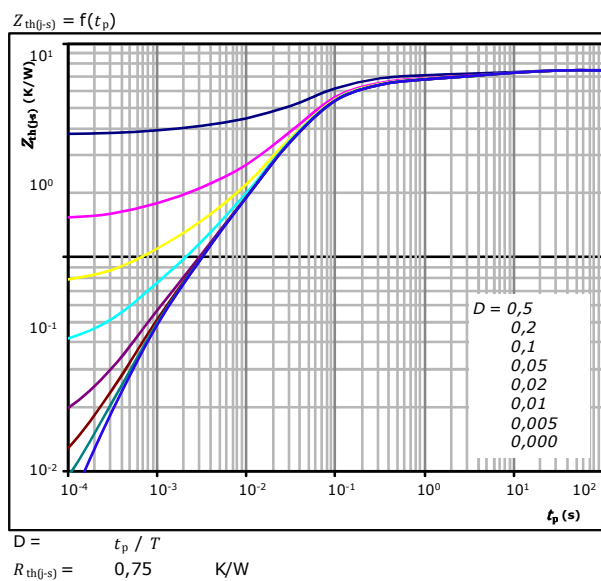
**80-M312PMA050M7-K428A70**  
datasheet

## Rectifier Diode Characteristics

**figure 1.** Rectifier Diode  
**Typical forward characteristics**



**figure 2.** Rectifier Diode  
**Transient thermal impedance as a function of pulse width**



Diode thermal model values

| $R$ (K/W) | $\tau$ (s) |
|-----------|------------|
| 6,99E-02  | 7,70E+00   |
| 7,97E-02  | 4,31E-01   |
| 3,54E-01  | 6,42E-02   |
| 1,62E-01  | 2,35E-02   |
| 5,21E-02  | 3,81E-03   |
| 3,21E-02  | 7,57E-04   |

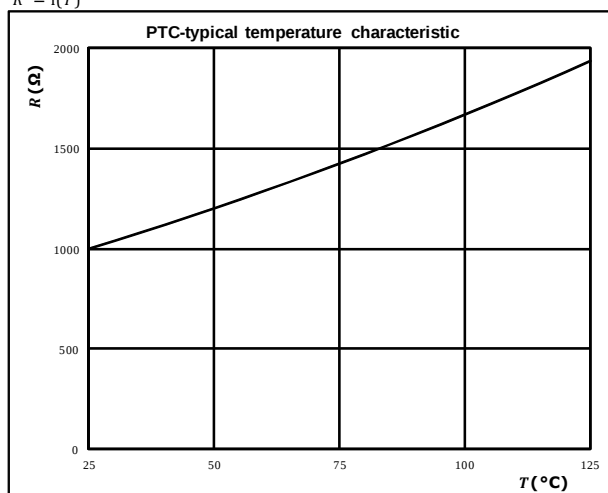


## PTC Characteristics

**figure 1.** Thermistor

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

$$R = f(T)$$





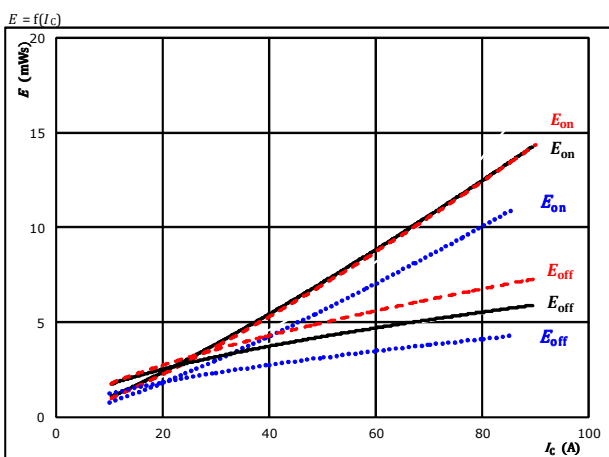
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datasheet

## Inverter / Brake Switching Characteristics

**figure 1.** IGBT

Typical switching energy losses as a function of collector current



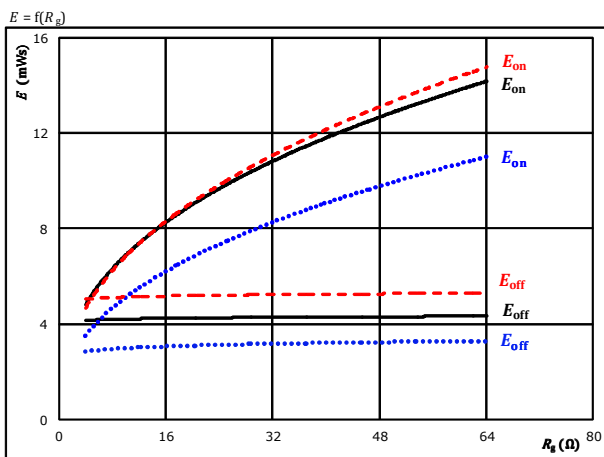
With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$   $\Omega$   
 $R_{goff} = 8$   $\Omega$

$T_J$ : 25 °C (blue dotted)  
125 °C (black solid)  
150 °C (red dashed)

**figure 2.** IGBT

Typical switching energy losses as a function of gate resistor



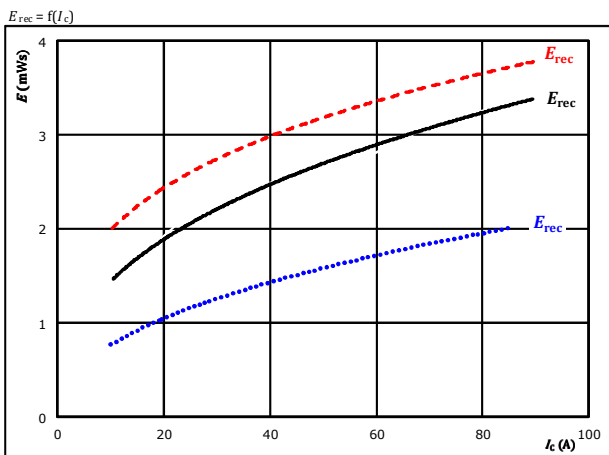
With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_C = 48$  A

$T_J$ : 25 °C (blue dotted)  
125 °C (black solid)  
150 °C (red dashed)

**figure 3.** FWD

Typical reverse recovered energy loss as a function of collector current



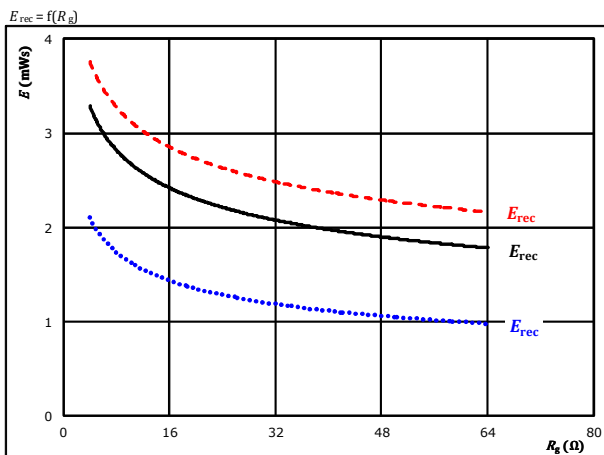
With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$   $\Omega$

$T_J$ : 25 °C (blue dotted)  
125 °C (black solid)  
150 °C (red dashed)

**figure 4.** FWD

Typical reverse recovered energy loss as a function of gate resistor



With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_C = 48$  A

$T_J$ : 25 °C (blue dotted)  
125 °C (black solid)  
150 °C (red dashed)



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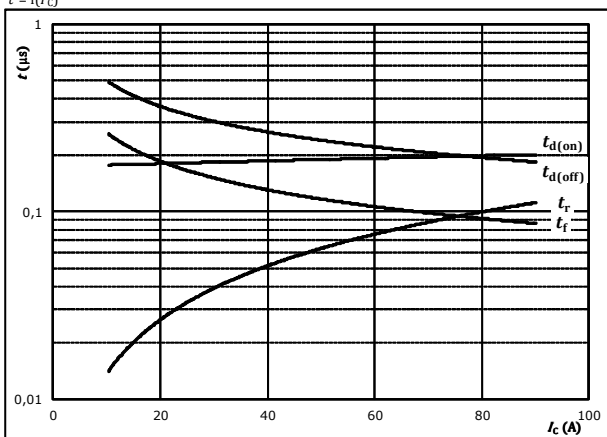
**80-M312PMA050M7-K428A70**  
datasheet

## Inverter / Brake Switching Characteristics

**figure 5.** IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



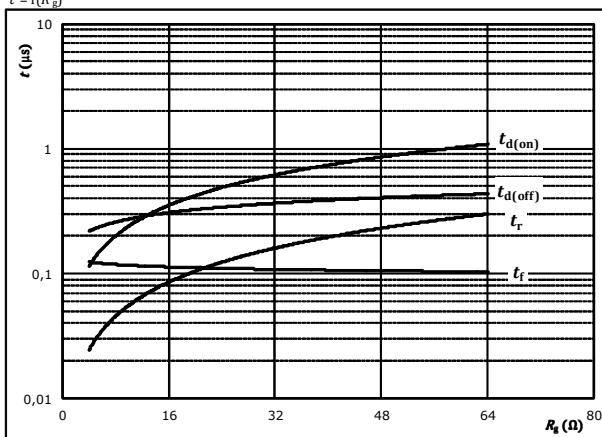
With an inductive load at

|                |     |    |
|----------------|-----|----|
| $T_j =$        | 150 | °C |
| $V_{CE} =$     | 600 | V  |
| $V_{GE} =$     | ±15 | V  |
| $R_{g(on)} =$  | 8   | Ω  |
| $R_{g(off)} =$ | 8   | Ω  |

**figure 6.** IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



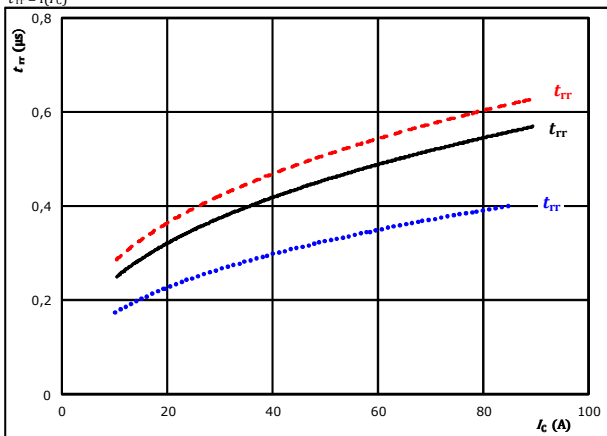
With an inductive load at

|            |     |    |
|------------|-----|----|
| $T_j =$    | 150 | °C |
| $V_{CE} =$ | 600 | V  |
| $V_{GE} =$ | ±15 | V  |
| $I_C =$    | 48  | A  |

**figure 7.** FWD

Typical reverse recovery time as a function of collector current

$$t_{rr} = f(I_C)$$

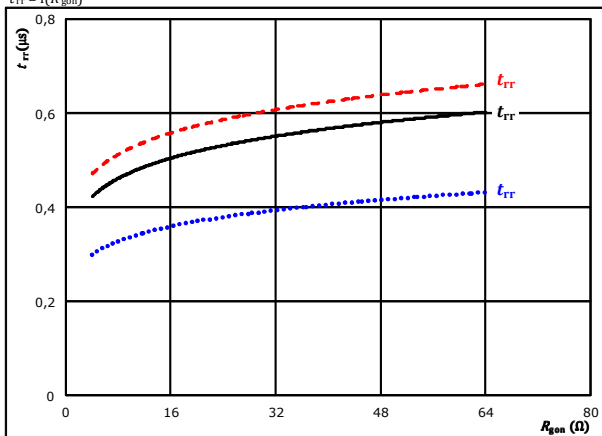


|    |               |     |   |         |        |       |
|----|---------------|-----|---|---------|--------|-------|
| At | $V_{CE} =$    | 600 | V | $T_j =$ | 25 °C  | ..... |
|    | $V_{GE} =$    | ±15 | V |         | 125 °C | ————  |
|    | $R_{g(on)} =$ | 8   | Ω |         | 150 °C | ----- |

**figure 8.** FWD

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

$$t_{rr} = f(R_{g(on)})$$



|    |            |     |   |         |        |       |
|----|------------|-----|---|---------|--------|-------|
| At | $V_{CE} =$ | 600 | V | $T_j =$ | 25 °C  | ..... |
|    | $V_{GE} =$ | ±15 | V |         | 125 °C | ————  |
|    | $I_C =$    | 48  | A |         | 150 °C | ----- |



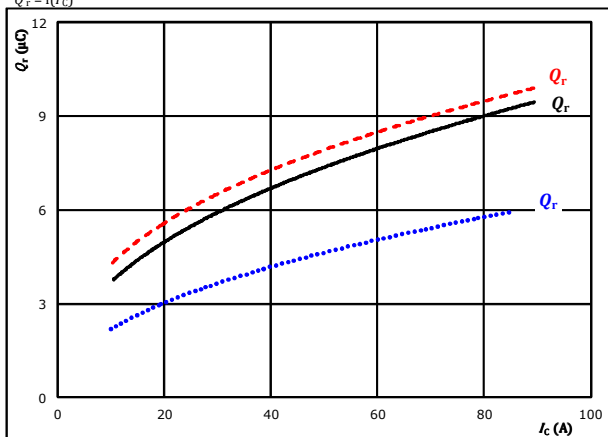
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## Inverter / Brake Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_C)$$

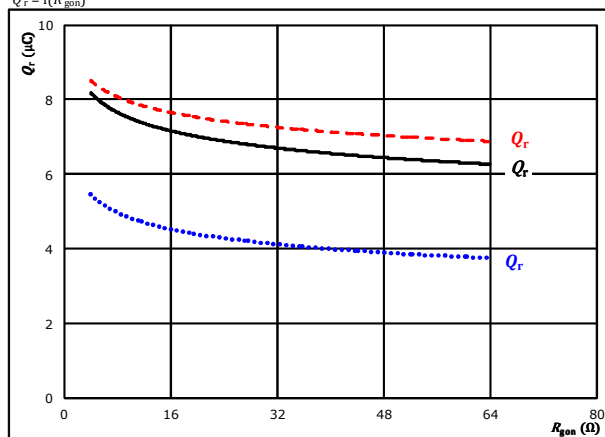


At  $V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$   $\Omega$   
 $T_j$ : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)

figure 10. FWD

Typical recovered charge as a function of IGBT turn on gate resistor

$$Q_r = f(R_{gon})$$

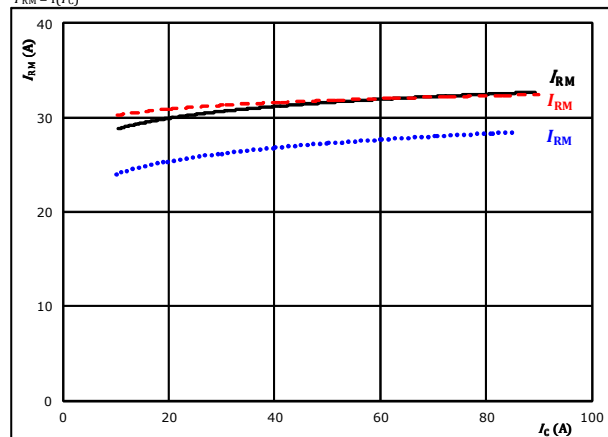


At  $V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_C = 48$  A  
 $T_j$ : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)

figure 11. FWD

Typical peak reverse recovery current as a function of collector current

$$I_{RM} = f(I_C)$$

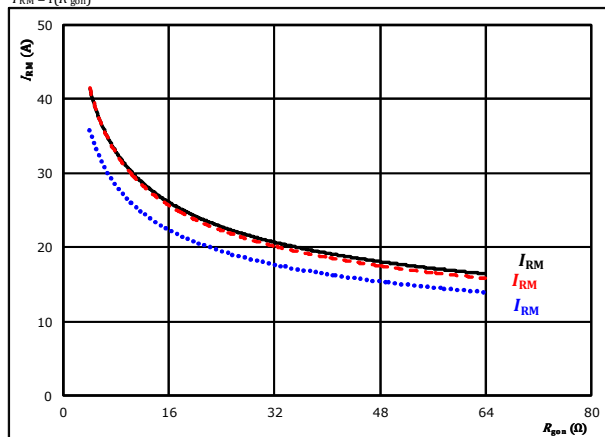


At  $V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$   $\Omega$   
 $T_j$ : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)

figure 12. FWD

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

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



At  $V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_C = 48$  A  
 $T_j$ : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)



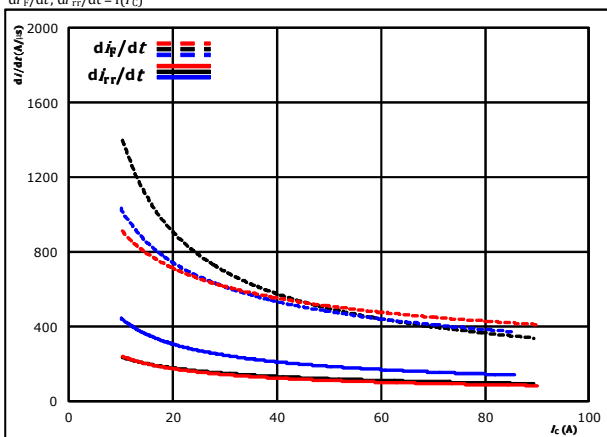
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## Inverter / Brake Switching Characteristics

figure 13. FWD

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

$$di_F/dt, di_{rr}/dt = f(I_C)$$

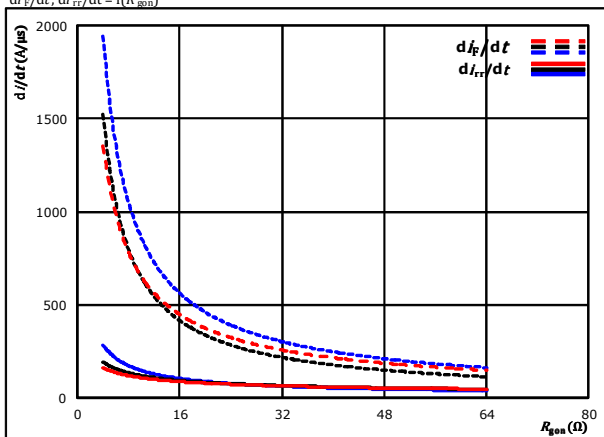


At  $V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{g0n} = 8$   $\Omega$   
 $T_j: 25$  °C  
 $125$  °C  
 $150$  °C

figure 14. FWD

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

$$di_F/dt, di_{rr}/dt = f(R_{g0n})$$

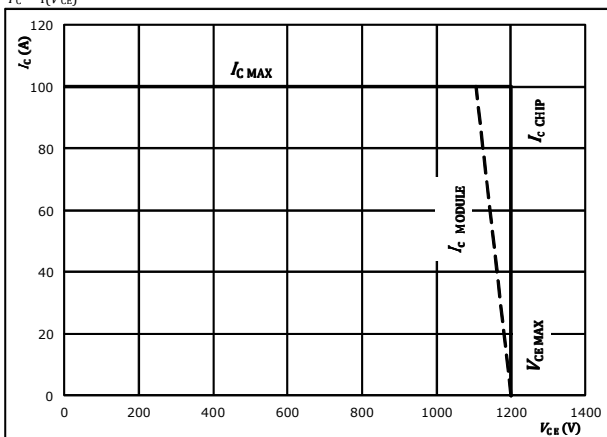


At  $V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_C = 48$  A  
 $T_j: 25$  °C  
 $125$  °C  
 $150$  °C

figure 15. IGBT

Reverse bias safe operating area

$$I_C = f(V_{CE})$$



At  $T_j = 175$  °C  
 $R_{g0n} = 8$   $\Omega$   
 $R_{g0ff} = 8$   $\Omega$



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**80-M312PMA050M7-K428A70**  
datasheet

## Inverter / Brake Switching Definitions

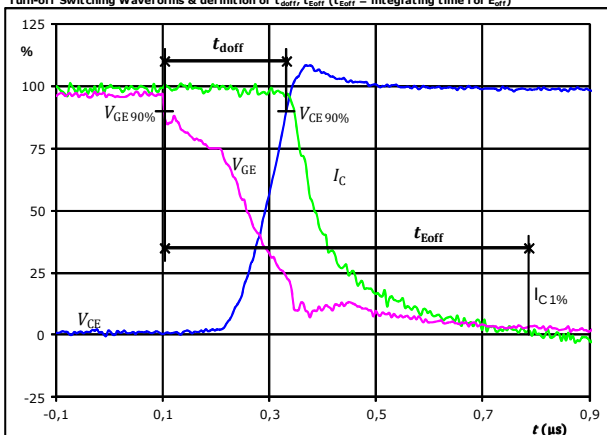
### General conditions

|            |   |            |
|------------|---|------------|
| $T_j$      | = | 125 °C     |
| $R_{gon}$  | = | 8 $\Omega$ |
| $R_{goff}$ | = | 8 $\Omega$ |

figure 1.

IGBT

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

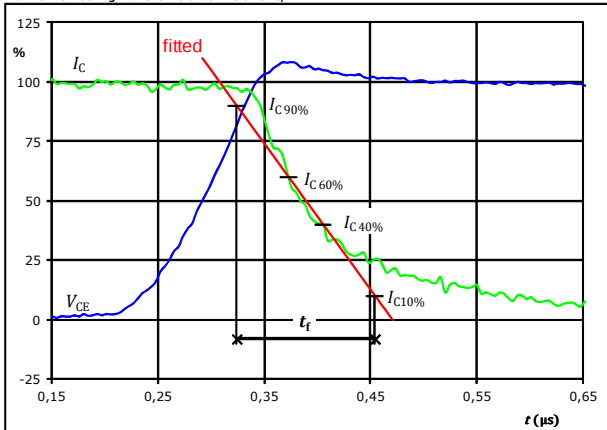


|                   |       |         |
|-------------------|-------|---------|
| $V_{GE}(0\%) =$   | -15   | V       |
| $V_{GE}(100\%) =$ | 15    | V       |
| $V_C(100\%) =$    | 600   | V       |
| $I_C(100\%) =$    | 51    | A       |
| $t_{doff} =$      | 0,229 | $\mu s$ |
| $t_{Eoff} =$      | 0,683 | $\mu s$ |

figure 3.

IGBT

Turn-off Switching Waveforms & definition of  $t_f$

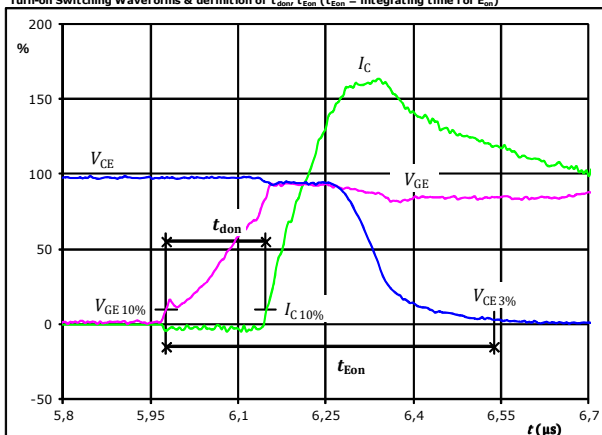


|                |       |         |
|----------------|-------|---------|
| $V_C(100\%) =$ | 600   | V       |
| $I_C(100\%) =$ | 51    | A       |
| $t_f =$        | 0,125 | $\mu s$ |

figure 2.

IGBT

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

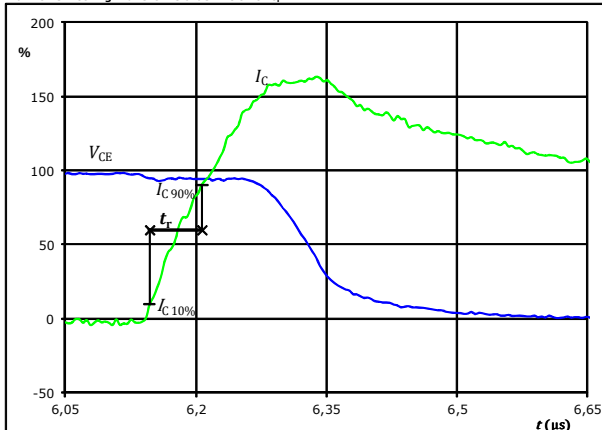


|                   |       |         |
|-------------------|-------|---------|
| $V_{GE}(0\%) =$   | -15   | V       |
| $V_{GE}(100\%) =$ | 15    | V       |
| $V_C(100\%) =$    | 600   | V       |
| $I_C(100\%) =$    | 51    | A       |
| $t_{don} =$       | 0,176 | $\mu s$ |
| $t_{Eon} =$       | 0,561 | $\mu s$ |

figure 4.

IGBT

Turn-on Switching Waveforms & definition of  $t_r$



|                |       |         |
|----------------|-------|---------|
| $V_C(100\%) =$ | 600   | V       |
| $I_C(100\%) =$ | 51    | A       |
| $t_r =$        | 0,058 | $\mu s$ |



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## Inverter / Brake Switching Characteristics

figure 5. IGBT

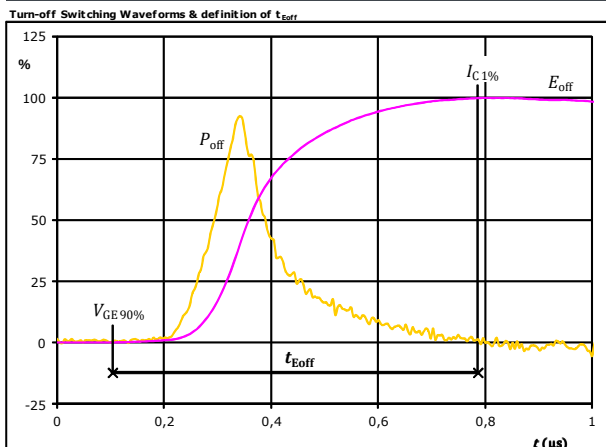


figure 6. IGBT

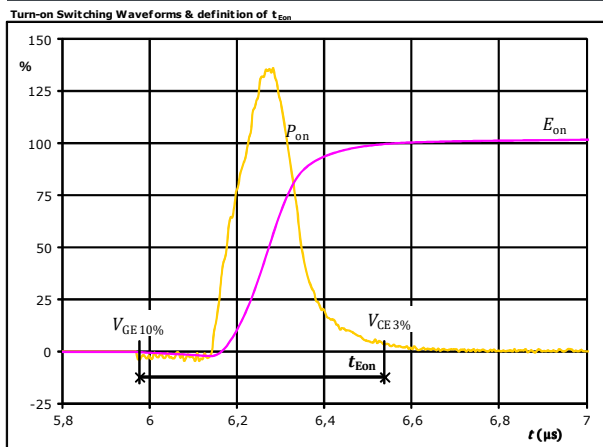
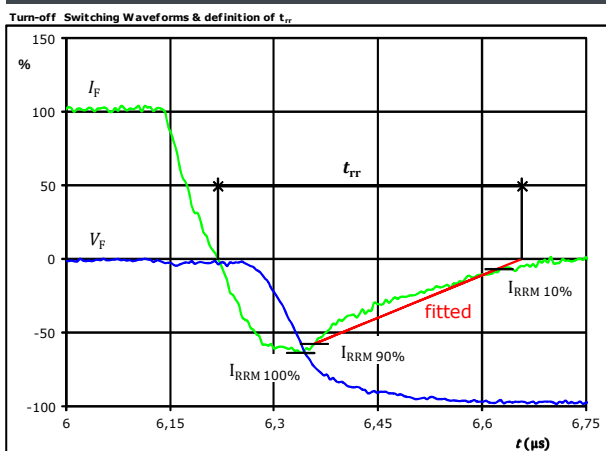


figure 7. FWD



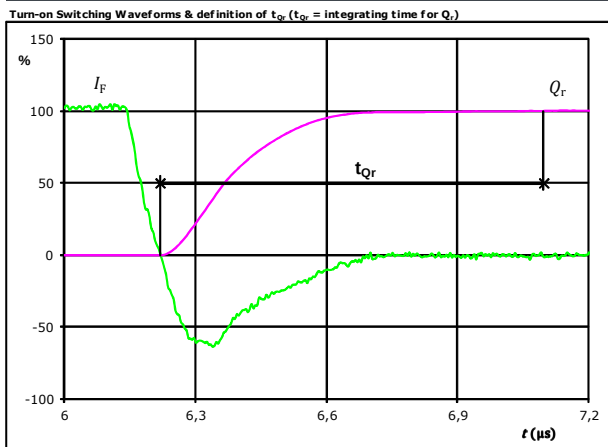


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**80-M312PMA050M7-K428A70**  
datasheet

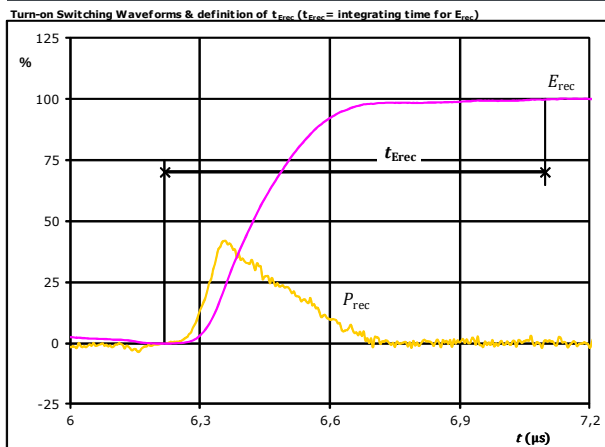
## Inverter / Brake Switching Characteristics

**figure 8.** FWD



$I_F$  (100%) = 51 A  
 $Q_r$  (100%) = 7,08  $\mu\text{C}$   
 $t_{Qr}$  = 0,88  $\mu\text{s}$

**figure 9.** FWD



$P_{rec}$  (100%) = 30,49 kW  
 $E_{rec}$  (100%) = 2,59 mJ  
 $t_{Erec}$  = 0,88  $\mu\text{s}$



# 80-M312PMA050M7-K428A70

datasheet

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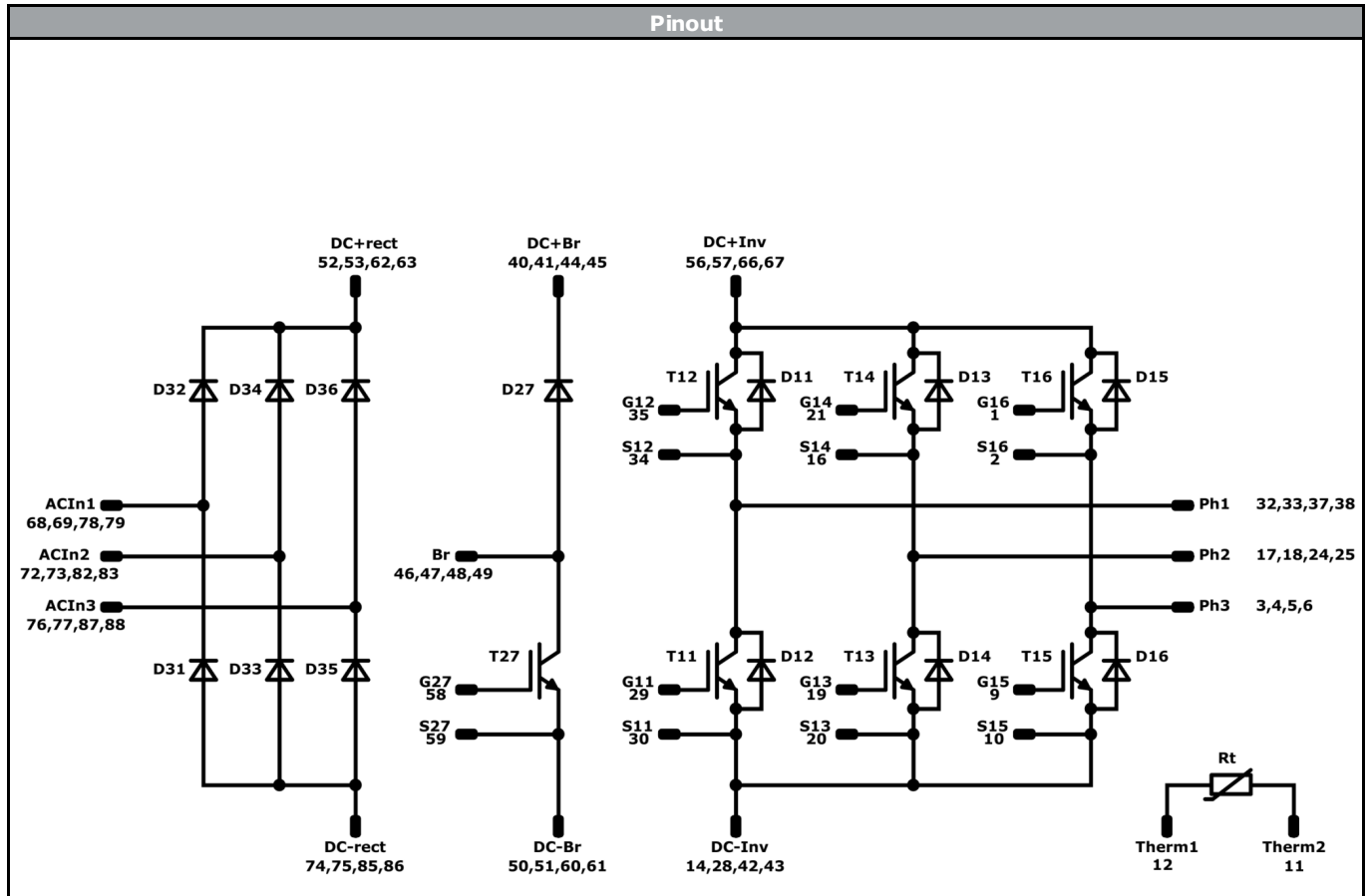
| Ordering Code & Marking                                                           |            |                        |                              |           |           |       |        |
|-----------------------------------------------------------------------------------|------------|------------------------|------------------------------|-----------|-----------|-------|--------|
| Version                                                                           |            |                        | Ordering Code                |           |           |       |        |
| With std lid (6.5mm height) + no thermal grease                                   |            |                        | 80-M312PMA050M7-K428A70-/0A/ |           |           |       |        |
| With thin lid (2.8mm height) + no thermal grease                                  |            |                        | 80-M312PMA050M7-K428A70-/0B/ |           |           |       |        |
| With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)      |            |                        | 80-M312PMA050M7-K428A70-/1A/ |           |           |       |        |
| With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)     |            |                        | 80-M312PMA050M7-K428A70-/1B/ |           |           |       |        |
| With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)   |            |                        | 80-M312PMA050M7-K428A70-/4A/ |           |           |       |        |
| With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)  |            |                        | 80-M312PMA050M7-K428A70-/4B/ |           |           |       |        |
| With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)     |            |                        | 80-M312PMA050M7-K428A70-/5A/ |           |           |       |        |
| With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)    |            |                        | 80-M312PMA050M7-K428A70-/5B/ |           |           |       |        |
|  | Text       | Name                   |                              | Date code | UL & VIN  | Lot   | Serial |
|                                                                                   |            | NN-NNNNNNNNNNNNNN-TTTT |                              | WVYY      | UL VIN    | LLLLL | SSSS   |
|                                                                                   | Datamatrix | Type&Ver               | Lot number                   | Serial    | Date code |       |        |
|                                                                                   | TTTTT      | LLLLL                  | SSSS                         | WVYY      |           |       |        |

| PCB pad table |               |        |          |     |               |       |          |
|---------------|---------------|--------|----------|-----|---------------|-------|----------|
| Pin           | X             | Y      | Function | Pin | X             | Y     | Function |
| 1             | 15,83         | -25,3  | G16      | 45  | -25,9         | 2,2   | DC+Br    |
| 2             | 15,83         | -6,4   | S16      | 46  | 10,82         | 8,74  | Br       |
| 3             | 15,83         | -3,2   | Ph3      | 47  | 10,82         | 11,94 | Br       |
| 4             | 15,83         | 0      | Ph3      | 48  | -32,82        | 8,74  | Br       |
| 5             | 15,83         | 3,2    | Ph3      | 49  | -32,82        | 11,94 | Br       |
| 6             | 15,83         | 6,4    | Ph3      | 50  | 4,32          | 22,1  | DC- Br   |
| 7             | Not assembled |        |          | 51  | 4,32          | 25,3  | DC- Br   |
| 8             |               |        |          | 52  | 3,42          | -25,3 | DC+rect  |
| 9             | 15,83         | 22,1   | G15      | 53  | 3,42          | -22,1 | DC+rect  |
| 10            | 15,83         | 25,3   | S15      | 54  | Not assembled |       |          |
| 11            | 8,13          | -25,3  | Therm2   | 55  |               |       |          |
| 12            | 8,13          | -22,1  | Therm1   | 56  | 3,42          | -9,3  | DC+Inv   |
| 13            | Not assembled |        |          | 57  | 3,42          | -6,1  | DC+Inv   |
| 14            | 8,13          | 25,3   | DC- Inv  | 58  | -39,32        | 15,7  | G27      |
| 15            | Not assembled |        |          | 59  | -39,32        | 18,9  | S27      |
| 16            | 41,82         | -12,18 | S14      | 60  | -39,32        | 22,1  | DC- Br   |
| 17            | 41,82         | -8,98  | Ph2      | 61  | -39,32        | 25,3  | DC- Br   |
| 18            | 41,82         | -5,79  | Ph2      | 62  | -40,22        | -25,3 | DC+rect  |
| 19            | 0,43          | 22,1   | G13      | 63  | -40,22        | -22,1 | DC+rect  |
| 20            | 0,43          | 25,3   | S13      | 64  | Not assembled |       |          |
| 21            | -1,07         | -25,3  | G14      | 65  |               |       |          |
| 22            | Not assembled |        |          | 66  | -40,22        | -9,3  | DC+Inv   |
| 23            |               |        |          | 67  | -40,22        | -6,09 | DC+Inv   |
| 24            | -1,82         | -8,98  | Ph2      | 68  | -10,18        | -25,3 | ACIn1    |
| 25            | -1,82         | -5,79  | Ph2      | 69  | -10,18        | -22,1 | ACIn1    |
| 26            | Not assembled |        |          | 70  | Not assembled |       |          |
| 27            |               |        |          | 71  |               |       |          |
| 28            | -7,27         | 25,3   | DC- Inv  | 72  | -10,18        | -9,5  | ACIn2    |
| 29            | -14,97        | 22,1   | G11      | 73  | -10,18        | -6,3  | ACIn2    |
| 30            | -14,97        | 25,3   | S11      | 74  | -10,18        | 6,3   | DC- rect |
| 31            | Not assembled |        |          | 75  | -10,18        | 9,5   | DC- rect |
| 32            | 23,95         | -11,82 | Ph1      | 76  | -10,18        | 22,1  | ACIn3    |
| 33            | 23,95         | -8,63  | Ph1      | 77  | -10,18        | 25,3  | ACIn3    |
| 34            | 23,95         | -5,42  | S12      | 78  | -53,82        | -25,3 | ACIn1    |
| 35            | -19,22        | -25,3  | G12      | 79  | -53,82        | -22,1 | ACIn1    |
| 36            | Not assembled |        |          | 80  | Not assembled |       |          |
| 37            | -19,7         | -11,82 | Ph1      | 81  |               |       |          |
| 38            | -19,7         | -8,62  | Ph1      | 82  | -53,82        | -9,5  | ACIn2    |
| 39            | Not assembled |        |          | 83  | -53,82        | -6,3  | ACIn2    |
| 40            | 17,74         | -1     | DC+Br    | 84  | Not assembled |       |          |
| 41            | 17,74         | 2,2    | DC+Br    | 85  | -53,82        | 6,3   | DC- rect |
| 42            | -22,67        | 22,1   | DC- Inv  | 86  | -53,82        | 9,5   | DC- rect |
| 43            | -22,67        | 25,3   | DC- Inv  | 87  | -53,82        | 22,1  | ACIn3    |
| 44            | -25,9         | -1     | DC+Br    | 88  | -53,82        | 25,3  | ACIn3    |

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



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| Identification               |           |         |         |                 |         |
|------------------------------|-----------|---------|---------|-----------------|---------|
| ID                           | Component | Voltage | Current | Function        | Comment |
| T11, T12, T13, T14, T15, T16 | IGBT      | 1200 V  | 50 A    | Inverter Switch |         |
| D11, D12, D13, D14, D15, D16 | FWD       | 1200 V  | 50 A    | Inverter Diode  |         |
| T27                          | IGBT      | 1200 V  | 50 A    | Brake Switch    |         |
| D27                          | FWD       | 1200 V  | 50 A    | Brake Diode     |         |
| D31, D32, D33, D34, D35, D36 | Rectifier | 1600 V  | 50 A    | Rectifier Diode |         |
| Rt                           | PTC       |         |         | Thermistor      |         |



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**80-M312PMA050M7-K428A70**  
datasheet

| Packaging instruction                |      |          |             |
|--------------------------------------|------|----------|-------------|
| Standard packaging quantity (SPQ) 48 | >SPQ | Standard | <SPQ Sample |

| Handling instruction                                                       |
|----------------------------------------------------------------------------|
| Handling instructions for MiniSkiiP® 3 packages see vincotech.com website. |

| Package data                                                      |
|-------------------------------------------------------------------|
| Package data for MiniSkiiP® 3 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 |
|-------------------------------|--------------|---------------------------------------|-------|
| 80-M312PMA050M7-K428A70-D3-14 | 12 Feb. 2019 | Inverter $V_{GE}$ condition corrected | 3     |

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