# 80-M3127PA150M7-K420E80
datasheet

**MiniSKiiP® 7PACK 3** **1200 V / 150 A**

## Topology features

- Brake+Inverter
- Kelvin Emitter for improved switching performance
- Temperature sensor

## Component features

- Easy paralleling
- Low turn-off losses
- Low collector emitter saturation voltage
- Positive temperature coefficient
- Short tail current
- Switching optimized for EMC

## Housing features

- Base isolation: $Al_2O_3$
- Easy assembly in one mounting step
- Flexible PCB design w/o pin holes
- Rugged solderless spring contacts

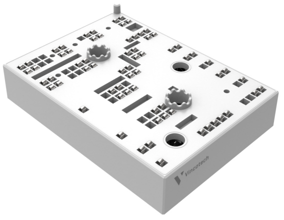
## Target applications

- Industrial Drives
- Servo Drives

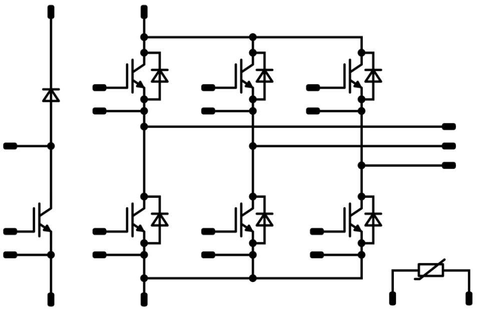
## Types

- 80-M3127PA150M7-K420E80

## MiniSKiiP® 3 16 mm housing



## Schematic



# Maximum Ratings

$T_j$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Conditions | | Value | Unit |
|---|---|---|---|---|---|
| **Inverter Switch** | | | | | |
| Collector-emitter voltage | $V_{CES}$ | | | 1200 | V |
| Collector current (DC current) | $I_C$ | $T_j = T_{jmax}$ | $T_s$ = 80 °C | 161 | A |
| Repetitive peak collector current | $I_{CRM}$ | $t_p$ limited by $T_{jmax}$ | | 300 | A |
| Total power dissipation | $P_{tot}$ | $T_j = T_{jmax}$ | $T_s$ = 80 °C | 317 | W |
| Gate-emitter voltage | $V_{GES}$ | | | ±20 | V |
| Short circuit ratings | $t_{SC}$ | $V_{GE}$ = 15 V, $V_{CC}$ = 800 V | $T_j$ = 150 °C | 9,5 | µs |
| Maximum junction temperature | $T_{jmax}$ | | | 175 | °C |
| **Inverter Diode** | | | | | |
| Peak repetitive reverse voltage | $V_{RRM}$ | | | 1200 | V |
| Forward current (DC current) | $I_F$ | $T_j = T_{jmax}$ | $T_s$ = 80 °C | 113 | A |
| Total power dissipation | $P_{tot}$ | $T_j = T_{jmax}$ | $T_s$ = 80 °C | 194 | W |
| Maximum junction temperature | $T_{jmax}$ | | | 175 | °C |
| **Brake Switch** | | | | | |
| Collector-emitter voltage | $V_{CES}$ | | | 1200 | V |
| Collector current (DC current) | $I_C$ | $T_j = T_{jmax}$ | $T_s$ = 80 °C | 161 | A |
| Repetitive peak collector current | $I_{CRM}$ | $t_p$ limited by $T_{jmax}$ | | 300 | A |
| Total power dissipation | $P_{tot}$ | $T_j = T_{jmax}$ | $T_s$ = 80 °C | 317 | W |
| Gate-emitter voltage | $V_{GES}$ | | | ±20 | V |
| Short circuit ratings | $t_{SC}$ | $V_{GE}$ = 15 V, $V_{CC}$ = 800 V | $T_j$ = 150 °C | 9,5 | µs |
| Maximum junction temperature | $T_{jmax}$ | | | 175 | °C |

# Maximum Ratings

$T_j$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Conditions | | Value | Unit |
|---|---|---|---|---|---|
| **Brake Diode** | | | | | |
| Peak repetitive reverse voltage | $V_{RRM}$ | | | 1200 | V |
| Forward current (DC current) | $I_F$ | $T_j = T_{jmax}$ | $T_s$ = 80 °C | 81 | A |
| Repetitive peak forward current | $I_{FRM}$ | $t_p$ limited by $T_{jmax}$ | | 200 | A |
| Total power dissipation | $P_{tot}$ | $T_j = T_{jmax}$ | $T_s$ = 80 °C | 149 | W |
| Maximum junction temperature | $T_{jmax}$ | | | 175 | °C |

## Module Properties

| Parameter | Symbol | Conditions | | Value | Unit |
|---|---|---|---|---|---|
| **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 s | 5500 | 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 | | | ≥ 600 | |

*100 % tested in production

# Characteristic Values

| Parameter | Symbol | Conditions | $V_{GE}$ [V] $V_{GS}$ [V] | $V_{CE}$ [V] $V_{DS}$ [V] $V_F$ [V] | $I_C$ [A] $I_D$ [A] $I_F$ [A] | $T_j$ [°C] | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| **Inverter Switch** | | | | | | | | | | |
| **Static** | | | | | | | | | | |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | | | 10 | 0,015 | 25 | 5,4 | 6 | 6,6 | V |
| Collector-emitter saturation voltage | $V_{CEsat}$ | | 15 | | 150 | 25<br>125<br>150 | | 1,58<br>1,8<br>1,86 | 1,85[1] | V |
| Collector-emitter cut-off current | $I_{CES}$ | | 0 | 1200 | | 25 | | | 100 | μA |
| Gate-emitter leakage current | $I_{GES}$ | | 20 | 0 | | 25 | | | 500 | nA |
| Internal gate resistance | $r_g$ | | | | | | | 3 | | Ω |
| Input capacitance | $C_{ies}$ | | 0 | 10 | | 25 | | 30000 | | pF |
| Output capacitance | $C_{oes}$ | | | | | | | 880 | | pF |
| Reverse transfer capacitance | $C_{res}$ | | | | | | | 320 | | pF |
| Gate charge | $Q_g$ | $V_{CC}$ = 600 V | 0/15 | | 150 | 25 | | 1000 | | nC |
| **Thermal** | | | | | | | | | | |
| Thermal resistance junction to sink[2] | $R_{th(j-s)}$ | $\lambda_{paste}$ = 2,5 W/mK (HPTP) | | | | | | 0,3 | | K/W |
| **Dynamic** | | | | | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $R_{gon}$ = 4 Ω<br>$R_{goff}$ = 4 Ω | ±15 | 600 | 150 | 25<br>125<br>150 | | 415,6<br>431,4<br>433 | | ns |
| Rise time | $t_r$ | | | | | 25<br>125<br>150 | | 95,4<br>109,8<br>113,8 | | ns |
| Turn-off delay time | $t_{d(off)}$ | | | | | 25<br>125<br>150 | | 300,2<br>339,6<br>345,8 | | ns |
| Fall time | $t_f$ | | | | | 25<br>125<br>150 | | 78,49<br>89,66<br>96,1 | | ns |
| Turn-on energy (per pulse) | $E_{on}$ | $Q_{rFWD}$=14,68 μC<br>$Q_{rFWD}$=22,62 μC<br>$Q_{rFWD}$=25,6 μC | | | | 25<br>125<br>150 | | 21,13<br>27,11<br>28,88 | | mWs |
| Turn-off energy (per pulse) | $E_{off}$ | | | | | 25<br>125<br>150 | | 9,81<br>13,01<br>14,02 | | mWs |

# Characteristic Values

| Parameter | Symbol | Conditions | $V_{GE}$ [V] $V_{GS}$ [V] | $V_{CE}$ [V] $V_{DS}$ [V] $V_F$ [V] | $I_C$ [A] $I_D$ [A] $I_F$ [A] | $T_j$ [°C] | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| **Inverter Diode** | | | | | | | | | | |
| **Static** | | | | | | | | | | |
| Forward voltage | $V_F$ | | | | 150 | 25<br>125<br>150 | | 1,79<br>1,9<br>1,9 | 2,1[1] | V |
| Reverse leakage current | $I_R$ | $V_r$ = 1200 V | | | | 25 | | | 40 | µA |
| **Thermal** | | | | | | | | | | |
| Thermal resistance junction to sink[2] | $R_{th(j-s)}$ | $\lambda_{paste}$ = 2,5 W/mK (HPTP) | | | | | | 0,49 | | K/W |
| **Dynamic** | | | | | | | | | | |
| Peak recovery current | $I_{RM}$ | d*i*/d*t*=1573 A/µs<br>d*i*/d*t*=980 A/µs<br>d*i*/d*t*=1114 A/µs | ±15 | 600 | 150 | 25<br>125<br>150 | | 63,36<br>71,74<br>74,12 | | A |
| Reverse recovery time | $t_{rr}$ | | | | | 25<br>125<br>150 | | 408,81<br>552,96<br>623,41 | | ns |
| Recovered charge | $Q_r$ | | | | | 25<br>125<br>150 | | 14,68<br>22,62<br>25,6 | | µC |
| Reverse recovered energy | $E_{rec}$ | | | | | 25<br>125<br>150 | | 4,97<br>8,08<br>9,18 | | mWs |
| Peak rate of fall of recovery current | $(di_{rf}/dt)_{max}$ | | | | | 25<br>125<br>150 | | 335,06<br>235,2<br>218,31 | | A/µs |

# Characteristic Values

| Parameter | Symbol | Conditions | $V_{GE}$ [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] | Values Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| **Brake Switch** | | | | | | | | | | |
| **Static** | | | | | | | | | | |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | | | 10 | 0,015 | 25 | 5,4 | 6 | 6,6 | V |
| Collector-emitter saturation voltage | $V_{CEsat}$ | | 15 | | 150 | 25<br>125<br>150 | | 1,58<br>1,8<br>1,86 | 1,85(1) | V |
| Collector-emitter cut-off current | $I_{CES}$ | | 0 | 1200 | | 25 | | | 100 | µA |
| Gate-emitter leakage current | $I_{GES}$ | | 20 | 0 | | 25 | | | 500 | nA |
| Internal gate resistance | $r_g$ | | | | | | | 3 | | Ω |
| Input capacitance | $C_{ies}$ | | | | | | | 30000 | | pF |
| Output capacitance | $C_{oes}$ | | 0 | 10 | | 25 | | 880 | | pF |
| Reverse transfer capacitance | $C_{res}$ | | | | | | | 320 | | pF |
| Gate charge | $Q_g$ | $V_{CC}$ = 600 V | 0/15 | | 150 | 25 | | 1000 | | nC |
| **Thermal** | | | | | | | | | | |
| Thermal resistance junction to sink(2) | $R_{th(j-s)}$ | $\lambda_{paste}$ = 2,5 W/mK (HPTP) | | | | | | 0,3 | | K/W |
| **Dynamic** | | | | | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | | | | | 25<br>125<br>150 | | 142<br>144<br>145 | | ns |
| Rise time | $t_r$ | $R_{gon}$ = 1 Ω<br>$R_{goff}$ = 1 Ω | | | | 25<br>125<br>150 | | 68<br>81<br>81 | | ns |
| Turn-off delay time | $t_{d(off)}$ | | | | | 25<br>125<br>150 | | 426<br>472<br>490 | | ns |
| Fall time | $t_f$ | | 0/15 | 700 | 147 | 25<br>125<br>150 | | 68,92<br>91,64<br>97,54 | | ns |
| Turn-on energy (per pulse) | $E_{on}$ | $Q_{rFWD}$=12,09 µC<br>$Q_{rFWD}$=18,33 µC<br>$Q_{rFWD}$=20,6 µC | | | | 25<br>125<br>150 | | 20,67<br>25,61<br>26,7 | | mWs |
| Turn-off energy (per pulse) | $E_{off}$ | | | | | 25<br>125<br>150 | | 10,6<br>14,07<br>14,91 | | mWs |

# Characteristic Values

| Parameter | Symbol | Conditions | $V_{GE}$ [V] $V_{GS}$ [V] | $V_{CE}$ [V] $V_{DS}$ [V] $V_F$ [V] | $I_C$ [A] $I_D$ [A] $I_F$ [A] | $T_j$ [°C] | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| **Brake Diode** | | | | | | | | | | |
| **Static** | | | | | | | | | | |
| Forward voltage | $V_F$ | | | | 100 | 25<br>125<br>150 | | 1,82<br>1,96<br>1,97 | 2,1(1) | V |
| Reverse leakage current | $I_R$ | $V_r$ = 1200 V | | | | 25 | | | 40 | µA |
| **Thermal** | | | | | | | | | | |
| Thermal resistance junction to sink(2) | $R_{th(j-s)}$ | $\lambda_{paste}$ = 2,5 W/mK (HPTP) | | | | | | 0,64 | | K/W |
| **Dynamic** | | | | | | | | | | |
| Peak recovery current | $I_{RM}$ | d*i*/d*t*=949 A/µs<br>d*i*/d*t*=863 A/µs<br>d*i*/d*t*=1320 A/µs | 0/15 | 700 | 147 | 25<br>125<br>150 | | 55,27<br>64<br>67,14 | | A |
| Reverse recovery time | $t_{rr}$ | | | | | 25<br>125<br>150 | | 359,46<br>463,66<br>516,02 | | ns |
| Recovered charge | $Q_r$ | | | | | 25<br>125<br>150 | | 12,09<br>18,33<br>20,6 | | µC |
| Reverse recovered energy | $E_{rec}$ | | | | | 25<br>125<br>150 | | 4,45<br>7,22<br>8,27 | | mWs |
| Peak rate of fall of recovery current | $(di_{rf}/dt)_{max}$ | | | | | 25<br>125<br>150 | | 350,37<br>227,05<br>211,77 | | A/µs |

# Characteristic Values

| Parameter | Symbol | Conditions | | | | | Values | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | $V_{GE}$ [V] $V_{GS}$ [V] | $V_{CE}$ [V] $V_{DS}$ [V] $V_F$ [V] | $I_C$ [A] $I_D$ [A] $I_F$ [A] | $T_j$ [°C] | Min | Typ | Max | |
| **Thermistor** | | | | | | | | | | |
| **Static** | | | | | | | | | | |
| Rated resistance | $R$ | | | | | 25 | | 1 | | kΩ |
| Deviation of R100 | $\Delta_{R/R}$ | $R_{100}$ = 1670 Ω | | | | 100 | -2 | | 2 | % |
| Maximum Current | $I_{max}$ | | | | | | | 3 | | mA |
| Power dissipation constant | $d$ | | | | | 25 | | 0,76 | | mW/K |
| A-value | $A$ | | | | | | | $7{,}635 \times 10^{-3}$ | | 1/K |
| B-value | $B$ | | | | | | | $1{,}73 \times 10^{-5}$ | | $1/K^2$ |
| Vincotech Thermistor Reference | | | | | | | | | E | |

(1) Value at chip level

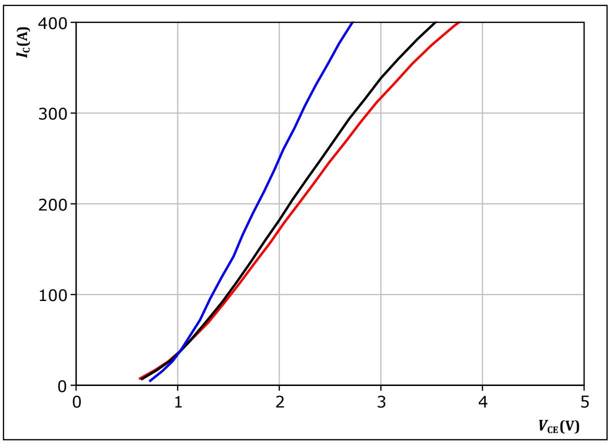
(2) Only valid with pre-applied Vincotech thermal interface material.

# Inverter Switch Characteristics

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

**Typical output characteristics**

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

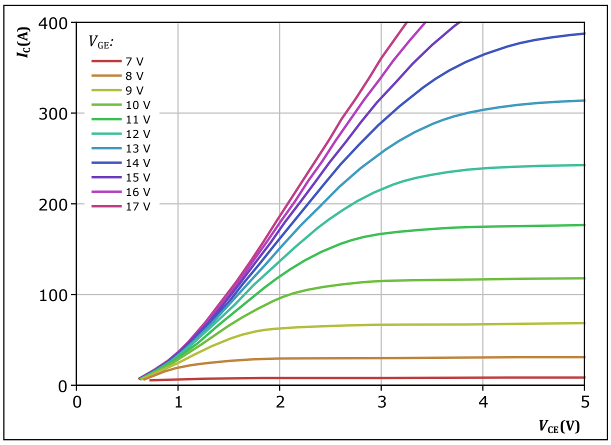



| | | | | |
|---|---|---|---|---|
| $t_p$ = | 250 | µs | | 25 °C |
| $V_{GE}$ = | 15 | V | $T_j$: | 125 °C |
| | | | | 150 °C |

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

**Typical output characteristics**

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



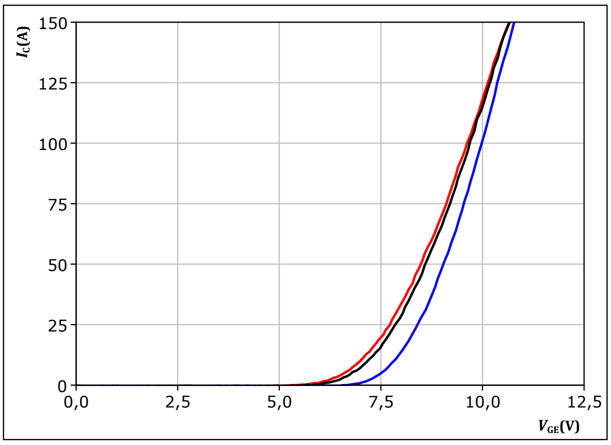

| | | |
|---|---|---|
| $t_p$ = | 250 | µs |
| $T_j$ = | 150 | °C |

$V_{GE}$ from 7 V to 17 V in steps of 1 V

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

**Typical transfer characteristics**

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

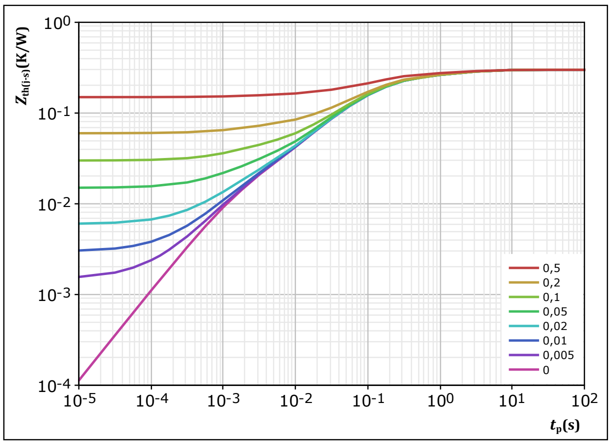



| | | | | |
|---|---|---|---|---|
| $t_p$ = | 250 | µs | | 25 °C |
| $V_{CE}$ = | 10 | V | $T_j$: | 125 °C |
| | | | | 150 °C |

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

**Transient thermal impedance as a function of pulse width**

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




| | | |
|---|---|---|
| $D$ = | $t_p$ / $T$ | |
| $R_{th(j-s)}$ = | 0,3 | K/W |

IGBT thermal model values

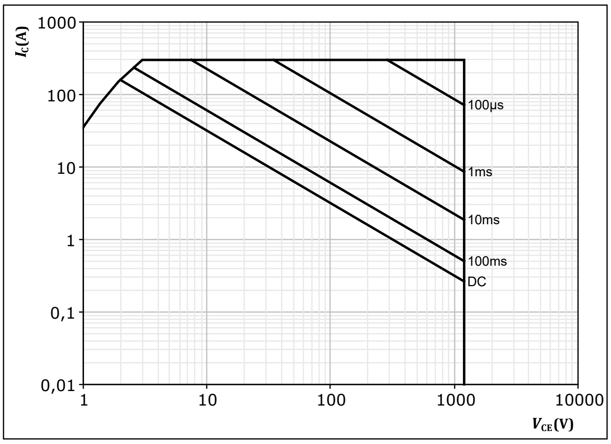
| $R$ (K/W) | $\tau$ (s) |
|---|---|
| 3,56E-02 | 2,96E+00 |
| 5,64E-02 | 6,04E-01 |
| 1,58E-01 | 1,03E-01 |
| 3,81E-02 | 2,02E-02 |
| 1,18E-02 | 1,52E-03 |

# Inverter Switch Characteristics

| figure 5. | IGBT |
|---|---|

**Safe operating area**

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

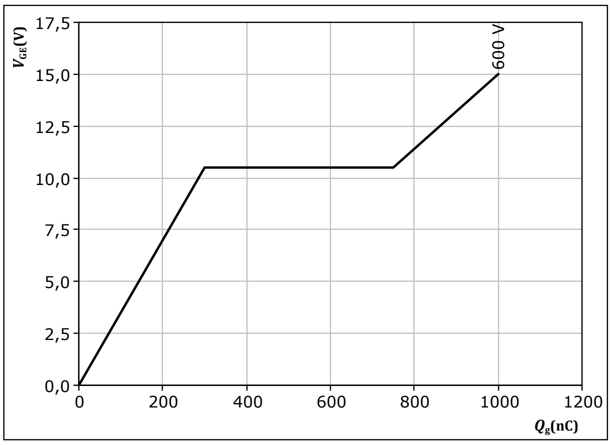



| | | |
|---|---|---|
| $D$ = | single pulse | |
| $T_s$ = | 80 | °C |
| $V_{GE}$ = | 15 | V |
| $T_j$ = | $T_{jmax}$ | |

| figure 6. | IGBT |
|---|---|

**Gate voltage vs gate charge**

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



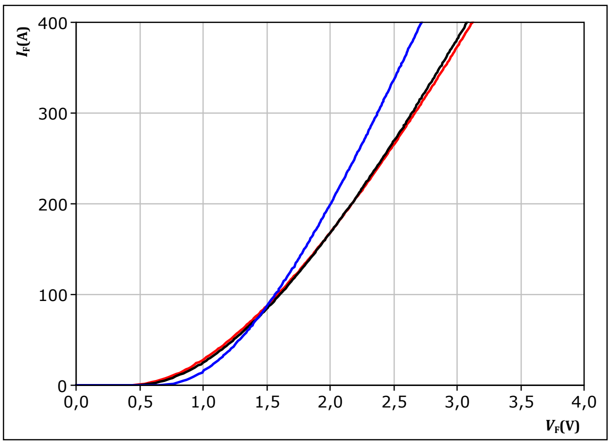

| | | |
|---|---|---|
| $I_C$ = | 150 | A |
| $T_j$ = | 25 | °C |

# Inverter Diode Characteristics

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

**Typical forward characteristics**

$I_F = f(V_F)$



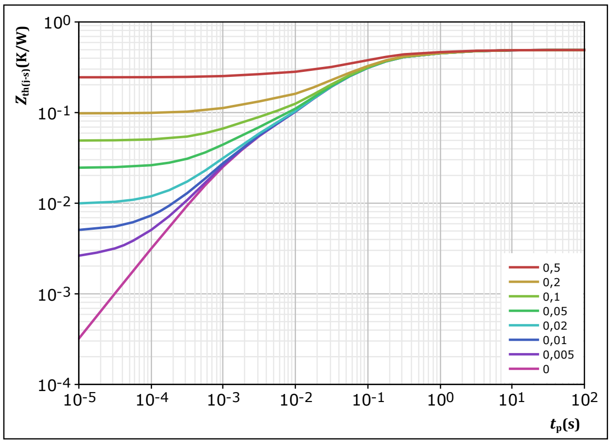

$t_p$ = 250 µs

$T_j$: 25 °C, 125 °C, 150 °C

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

**Transient thermal impedance as a function of pulse width**

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




$D$ = $t_p / T$

$R_{th(j-s)}$ = 0,49 K/W

FWD thermal model values

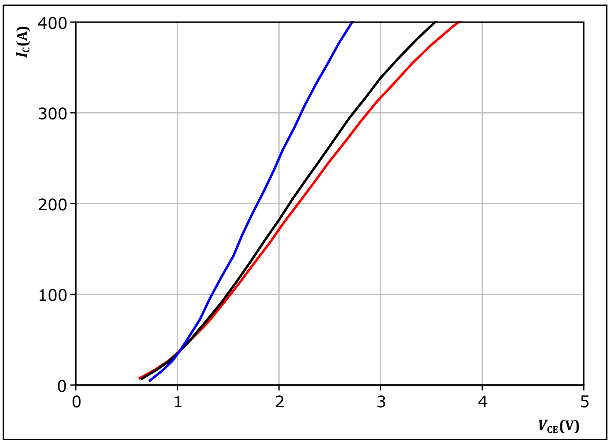
| $R$ (K/W) | $\tau$ (s) |
|---|---|
| 1,45E-02 | 6,66E+00 |
| 6,43E-02 | 1,13E+00 |
| 2,35E-01 | 1,21E-01 |
| 1,40E-01 | 2,42E-02 |
| 3,61E-02 | 1,48E-03 |

# Brake Switch Characteristics

**figure 9.** **IGBT**

**Typical output characteristics**

$I_C = f(V_{CE})$

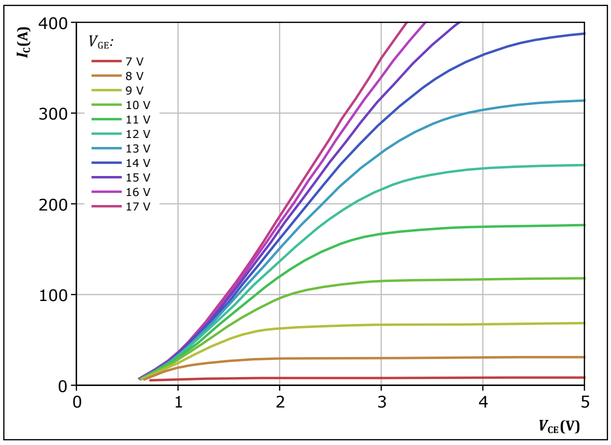



| | | | | |
|---|---|---|---|---|
| $t_p$ = | 250 | μs | | 25 °C |
| $V_{GE}$ = | 15 | V | $T_j$: | 125 °C |
| | | | | 150 °C |

**figure 10.** **IGBT**

**Typical output characteristics**

$I_C = f(V_{CE})$



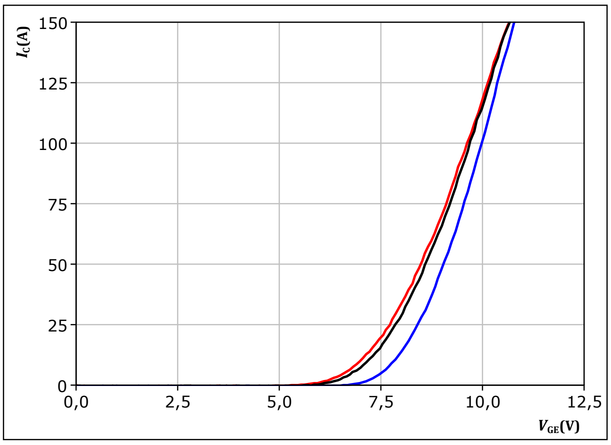

| | | |
|---|---|---|
| $t_p$ = | 250 | μs |
| $T_j$ = | 150 | °C |

$V_{GE}$ from 7 V to 17 V in steps of 1 V

**figure 11.** **IGBT**

**Typical transfer characteristics**

$I_C = f(V_{GE})$

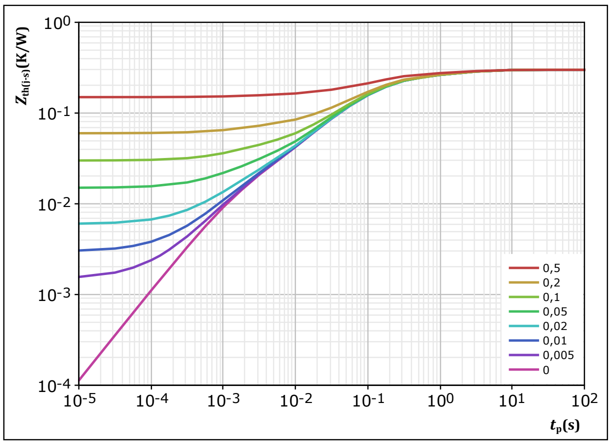



| | | | | |
|---|---|---|---|---|
| $t_p$ = | 250 | μs | | 25 °C |
| $V_{CE}$ = | 10 | V | $T_j$: | 125 °C |
| | | | | 150 °C |

**figure 12.** **IGBT**

**Transient thermal impedance as a function of pulse width**

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




| | | |
|---|---|---|
| $D$ = | $t_p$ / $T$ | |
| $R_{th(j-s)}$ = | 0,3 | K/W |

IGBT thermal model values

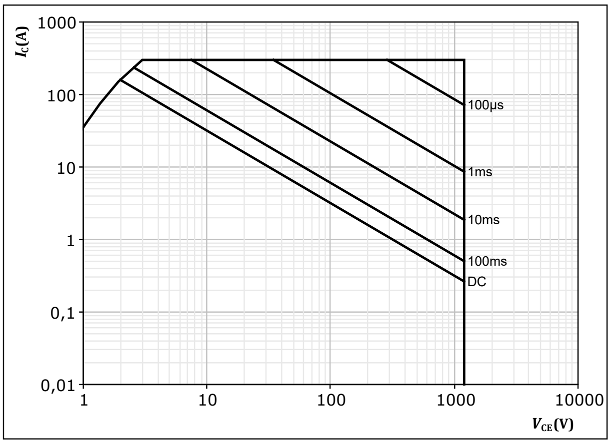
| $R$ (K/W) | $\tau$ (s) |
|---|---|
| 3,56E-02 | 2,96E+00 |
| 5,64E-02 | 6,04E-01 |
| 1,58E-01 | 1,03E-01 |
| 3,81E-02 | 2,02E-02 |
| 1,18E-02 | 1,52E-03 |

# Brake Switch Characteristics

**figure 13.** **IGBT**

**Safe operating area**

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

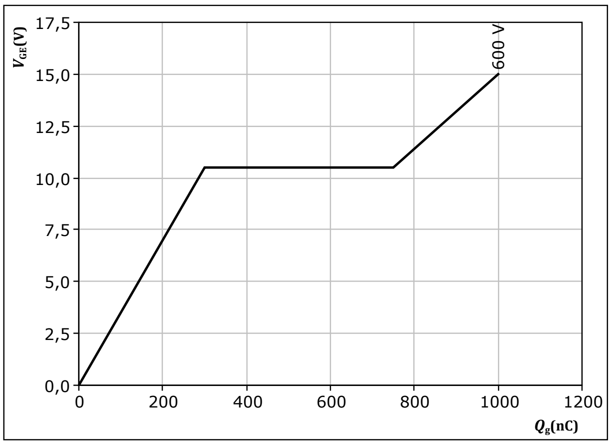



| | | |
|---|---|---|
| $D$ = | single pulse | |
| $T_s$ = | 80 | °C |
| $V_{GE}$ = | 15 | V |
| $T_j$ = | $T_{jmax}$ | |

**figure 14.** **IGBT**

**Gate voltage vs gate charge**

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



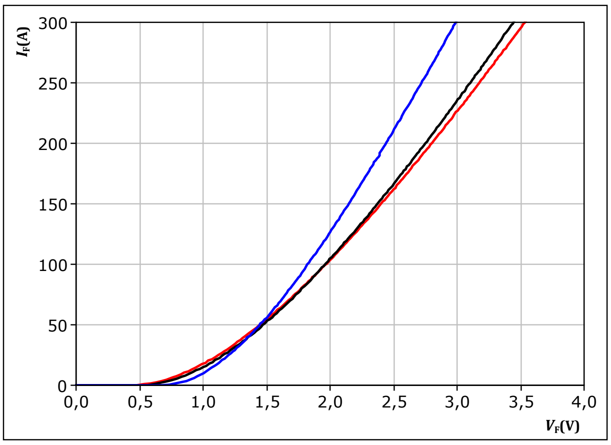

| | | |
|---|---|---|
| $I_C$ = | 150 | A |
| $T_j$ = | 25 | °C |

# Brake Diode Characteristics

**figure 15.** FWD

**Typical forward characteristics**

$I_F$ = f( $V_F$)



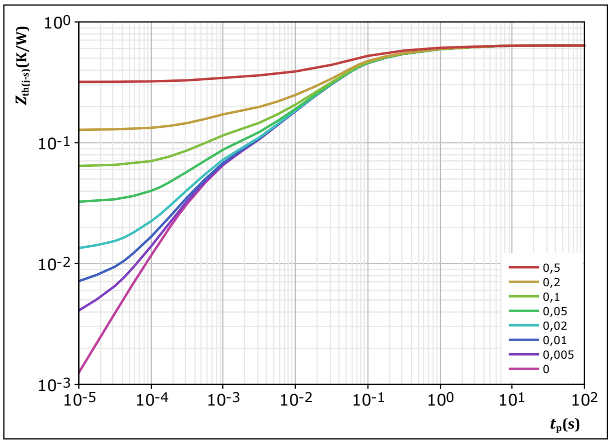

$t_p$ = 250 μs

$T_j$: 25 °C, 125 °C, 150 °C

**figure 16.** FWD

**Transient thermal impedance as a function of pulse width**

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




$D$ = $t_p$ / $T$

$R_{th(j-s)}$ = 0,638 K/W

FWD thermal model values

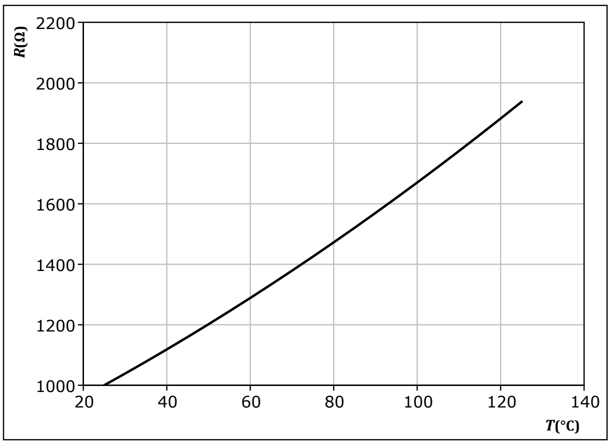
| R (K/W) | τ (s) |
|---|---|
| 5,39E-02 | 2,66E+00 |
| 1,18E-01 | 3,25E-01 |
| 3,25E-01 | 4,92E-02 |
| 8,49E-02 | 7,32E-03 |
| 5,61E-02 | 5,21E-04 |

# Thermistor Characteristics

| figure 17. | Thermistor |
|---|---|

**Typical PTC characteristic as function of temperature**

$R_T$ = f( $T$)

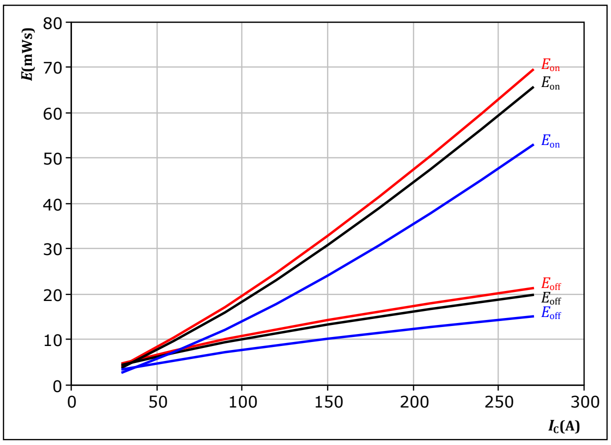


# Inverter Switching Characteristics

**figure 18.** **IGBT**

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

$E$ = f( $I_C$)



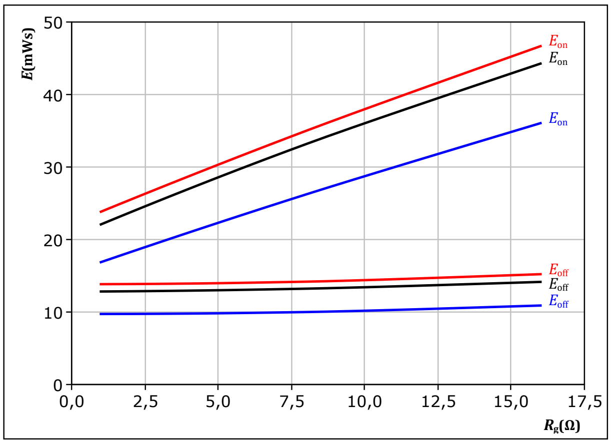

With an inductive load at

| | | | | |
|---|---|---|---|---|
| $V_{CE}$ = | 600 | V | $T_j$: | 25 °C |
| $V_{GE}$ = | ±15 | V | | 125 °C |
| $R_{gon}$ = | 4 | Ω | | 150 °C |
| $R_{goff}$ = | 4 | Ω | | |

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

**Typical switching energy losses as a function of IGBT turn on gate resistor**

$E$ = f( $R_g$)



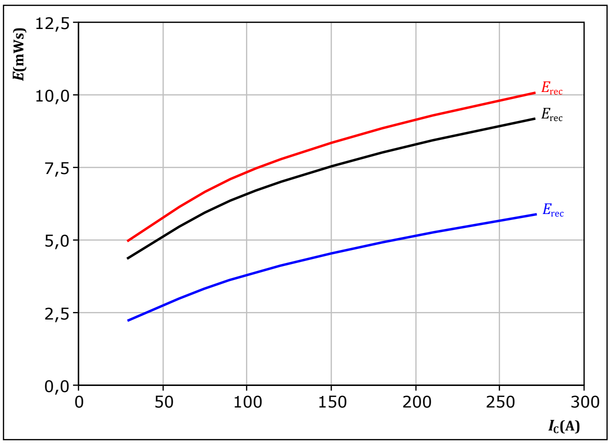

With an inductive load at

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

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

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

$E_{rec}$ = f( $I_C$)



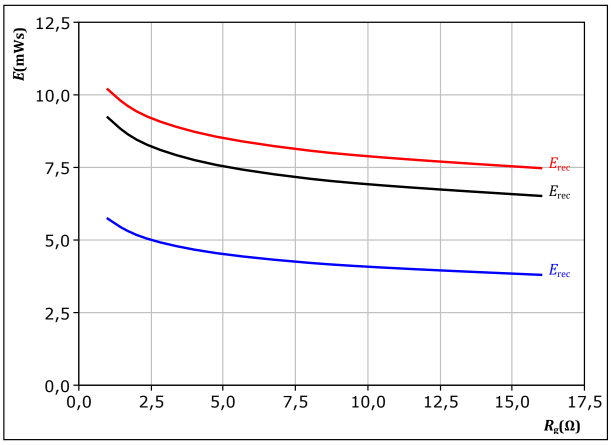

With an inductive load at

| | | | | |
|---|---|---|---|---|
| $V_{CE}$ = | 600 | V | $T_j$: | 25 °C |
| $V_{GE}$ = | ±15 | V | | 125 °C |
| $R_{gon}$ = | 4 | Ω | | 150 °C |

**figure 21.** **FWD**

**Typical reverse recovered energy loss as a function of IGBT turn on gate resistor**

$E_{rec}$ = f( $R_g$)




With an inductive load at

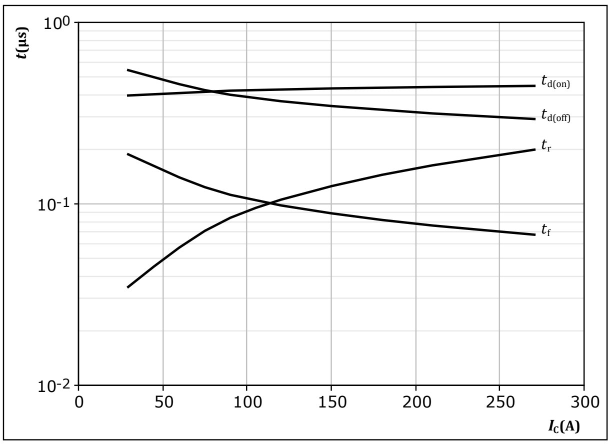
| | | | | |
|---|---|---|---|---|
| $V_{CE}$ = | 600 | V | $T_j$: | 25 °C |
| $V_{GE}$ = | ±15 | V | | 125 °C |
| $I_C$ = | 150 | A | | 150 °C |

# Inverter Switching Characteristics

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

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

$t$ = f( $I_C$ )



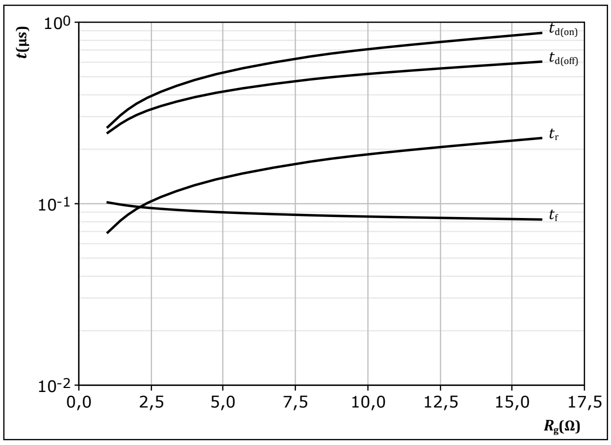

With an inductive load at

| | | |
|---|---|---|
| $T_j$ = | 150 | °C |
| $V_{CE}$ = | 600 | V |
| $V_{GE}$ = | ±15 | V |
| $R_{gon}$ = | 4 | Ω |
| $R_{goff}$ = | 4 | Ω |

**figure 23.** **IGBT**

**Typical switching times as a function of IGBT turn on gate resistor**

$t$ = f( $R_g$ )



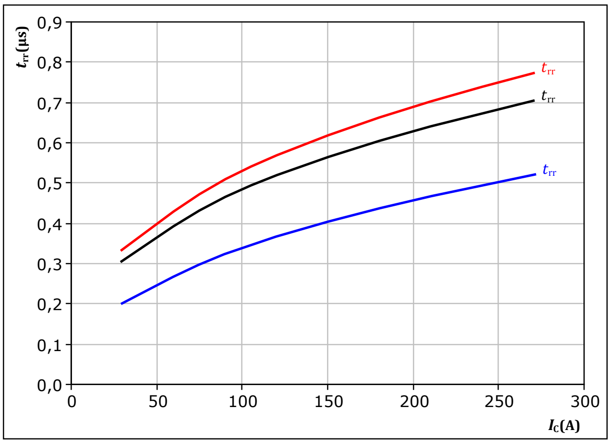

With an inductive load at

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

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

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

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




With an inductive load at

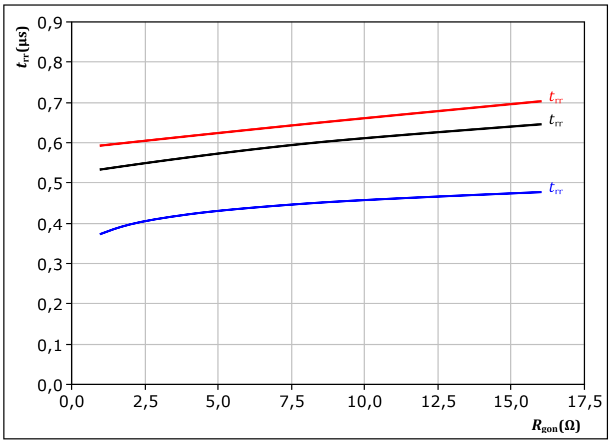
| | | |
|---|---|---|
| $V_{CE}$ = | 600 | V |
| $V_{GE}$ = | ±15 | V |
| $R_{gon}$ = | 4 | Ω |

$T_j$: 25 °C, 125 °C, 150 °C

**figure 25.** **FWD**

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

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




With an inductive load at

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

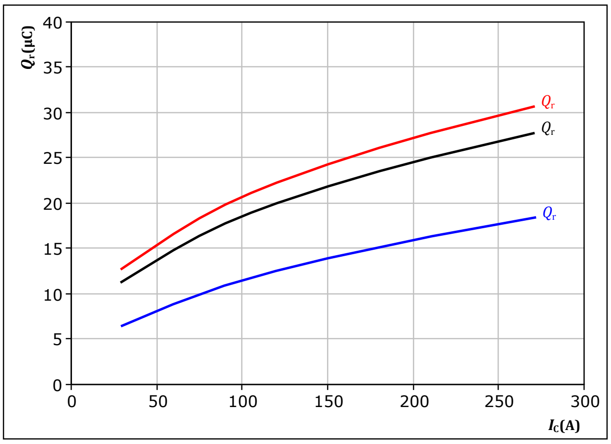
$T_j$: 25 °C, 125 °C, 150 °C

# Inverter Switching Characteristics

**figure 26.** **FWD**

**Typical recovered charge as a function of collector current**

$Q_r$ = f( $I_C$)



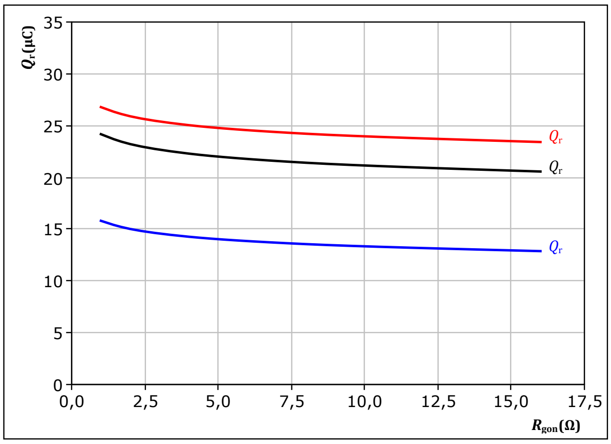

With an inductive load at

| | | | | |
|---|---|---|---|---|
| $V_{CE}$ = | 600 | V | $T_j$: | 25 °C |
| $V_{GE}$ = | ±15 | V | | 125 °C |
| $R_{gon}$ = | 4 | Ω | | 150 °C |

**figure 27.** **FWD**

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

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



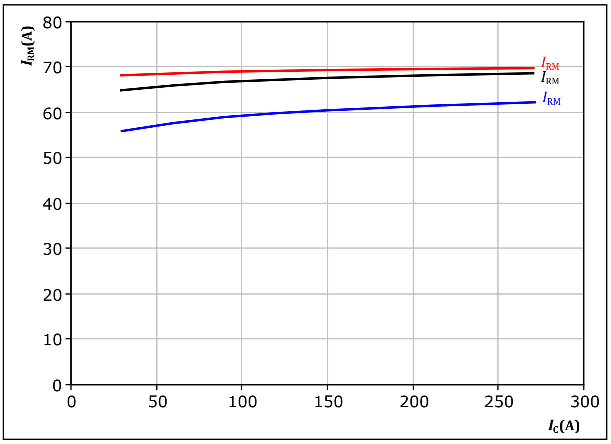

With an inductive load at

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

**figure 28.** **FWD**

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

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



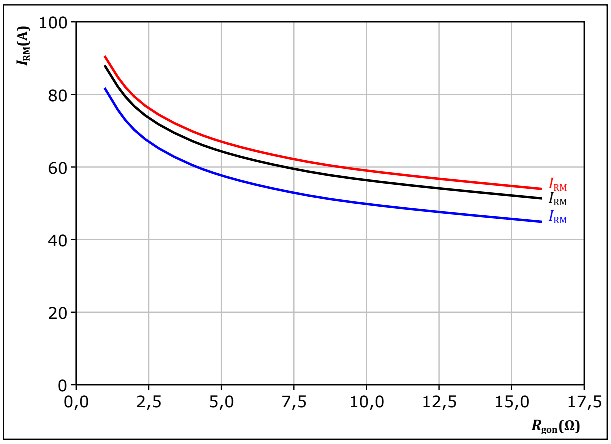

With an inductive load at

| | | | | |
|---|---|---|---|---|
| $V_{CE}$ = | 600 | V | $T_j$: | 25 °C |
| $V_{GE}$ = | ±15 | V | | 125 °C |
| $R_{gon}$ = | 4 | Ω | | 150 °C |

**figure 29.** **FWD**

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

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




With an inductive load at

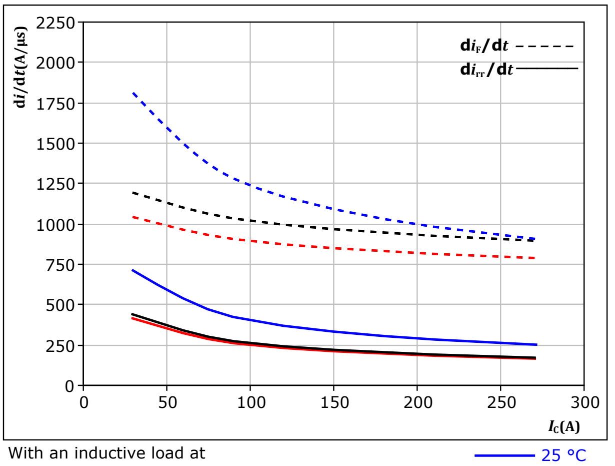
| | | | | |
|---|---|---|---|---|
| $V_{CE}$ = | 600 | V | $T_j$: | 25 °C |
| $V_{GE}$ = | ±15 | V | | 125 °C |
| $I_C$ = | 150 | A | | 150 °C |

# Inverter Switching Characteristics

**figure 30.** **FWD**

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

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



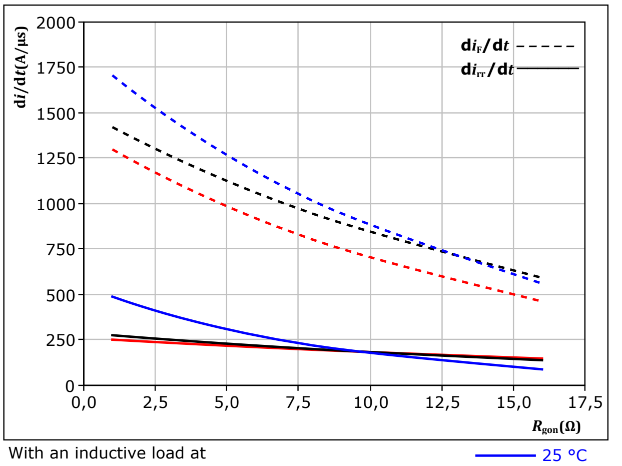

With an inductive load at

| | | | |
|---|---|---|---|
| $V_{CE}$ = | 600 | V | $T_j$: 25 °C |
| $V_{GE}$ = | ±15 | V | 125 °C |
| $R_{gon}$ = | 4 | Ω | 150 °C |

**figure 31.** **FWD**

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

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



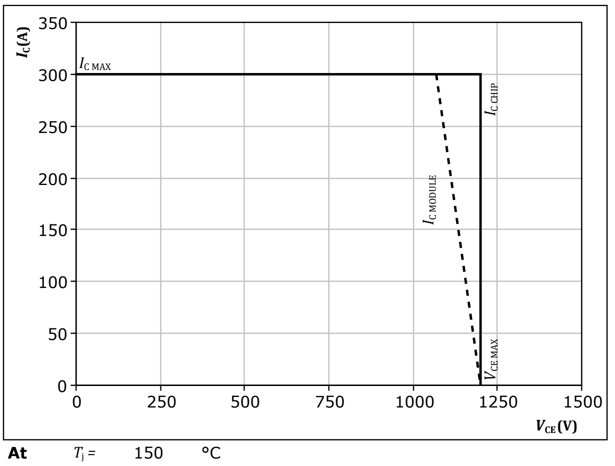

With an inductive load at

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

**figure 32.** **IGBT**

**Reverse bias safe operating area**

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



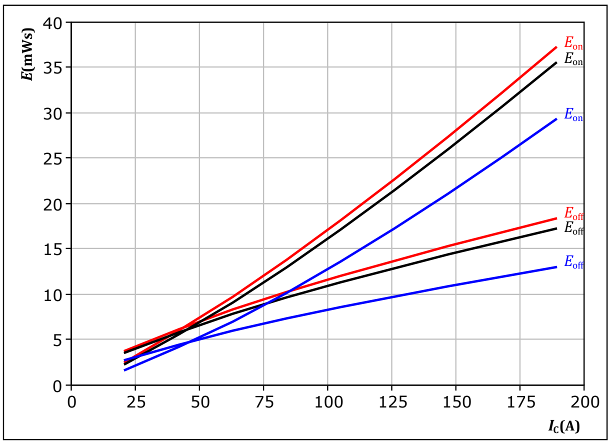

| | | | |
|---|---|---|---|
| **At** | $T_j$ = | 150 | °C |
| | $R_{gon}$ = | 4 | Ω |
| | $R_{goff}$ = | 4 | Ω |

# Brake Switching Characteristics

**figure 33.** **IGBT**

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

$E = f(I_C)$



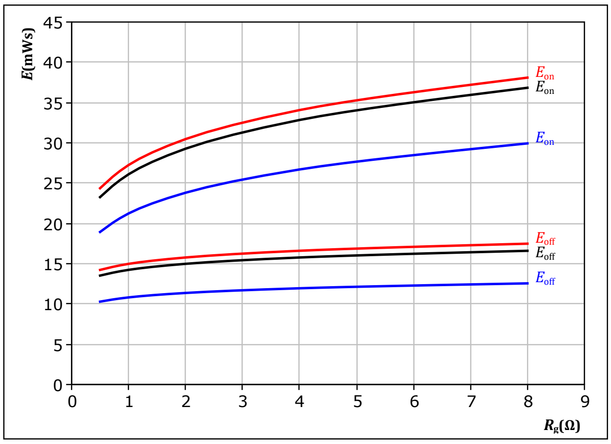

With an inductive load at

| | | | | |
|---|---|---|---|---|
| $V_{CE}$ = | 700 | V | $T_j$: | 25 °C |
| $V_{GE}$ = | 0/15 | V | | 125 °C |
| $R_{gon}$ = | 1 | Ω | | 150 °C |
| $R_{goff}$ = | 1 | Ω | | |

**figure 34.** **IGBT**

**Typical switching energy losses as a function of IGBT turn on gate resistor**

$E = f(R_g)$



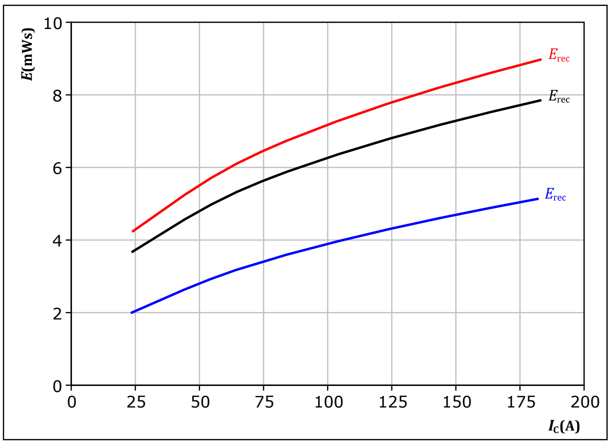

With an inductive load at

| | | | | |
|---|---|---|---|---|
| $V_{CE}$ = | 700 | V | $T_j$: | 25 °C |
| $V_{GE}$ = | 0/15 | V | | 125 °C |
| $I_C$ = | 147 | A | | 150 °C |

**figure 35.** **FWD**

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

$E_{rec} = f(I_C)$



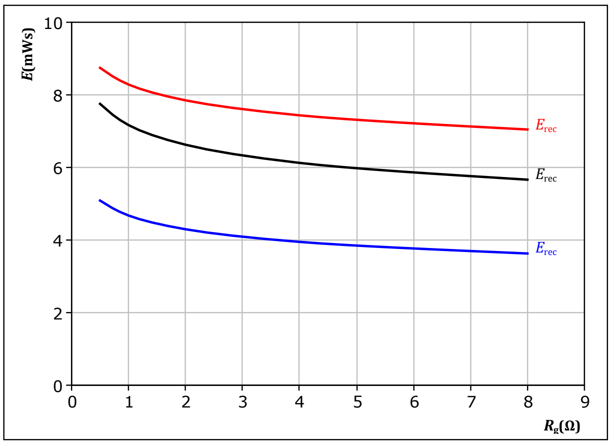

With an inductive load at

| | | | | |
|---|---|---|---|---|
| $V_{CE}$ = | 700 | V | $T_j$: | 25 °C |
| $V_{GE}$ = | 0/15 | V | | 125 °C |
| $R_{gon}$ = | 1 | Ω | | 150 °C |

**figure 36.** **FWD**

**Typical reverse recovered energy loss as a function of IGBT turn on gate resistor**

$E_{rec} = f(R_g)$




With an inductive load at

| | | | | |
|---|---|---|---|---|
| $V_{CE}$ = | 700 | V | $T_j$: | 25 °C |
| $V_{GE}$ = | 0/15 | V | | 125 °C |
| $I_C$ = | 147 | A | | 150 °C |

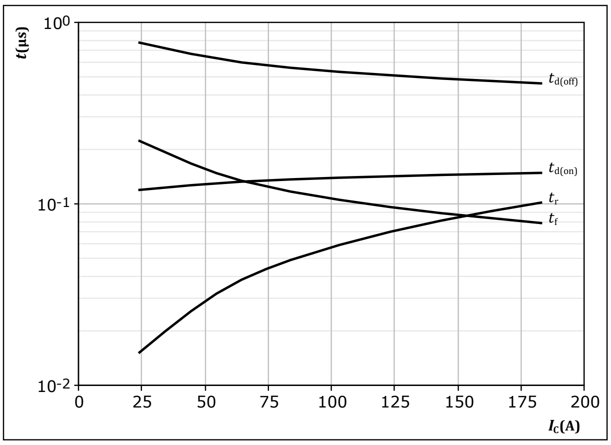
 

# Brake Switching Characteristics

**figure 37.** **IGBT**

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

$t$ = f( $I_C$)



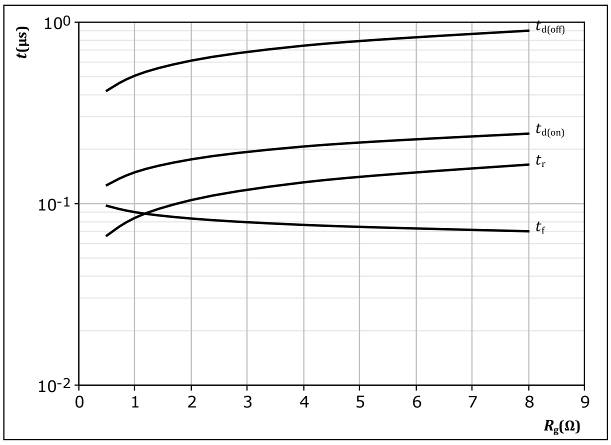

With an inductive load at

| | | |
|---|---|---|
| $T_j$ = | 150 | °C |
| $V_{CE}$ = | 700 | V |
| $V_{GE}$ = | 0/15 | V |
| $R_{gon}$ = | 1 | Ω |
| $R_{goff}$ = | 1 | Ω |

**figure 38.** **IGBT**

**Typical switching times as a function of IGBT turn on gate resistor**

$t$ = f( $R_g$)



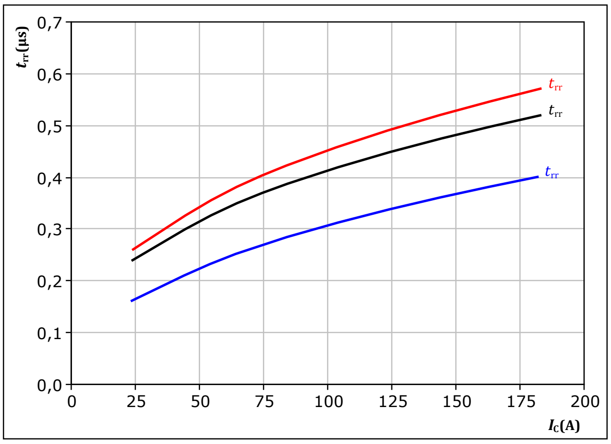

With an inductive load at

| | | |
|---|---|---|
| $T_j$ = | 150 | °C |
| $V_{CE}$ = | 700 | V |
| $V_{GE}$ = | 0/15 | V |
| $I_C$ = | 147 | A |

**figure 39.** **FWD**

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

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




With an inductive load at

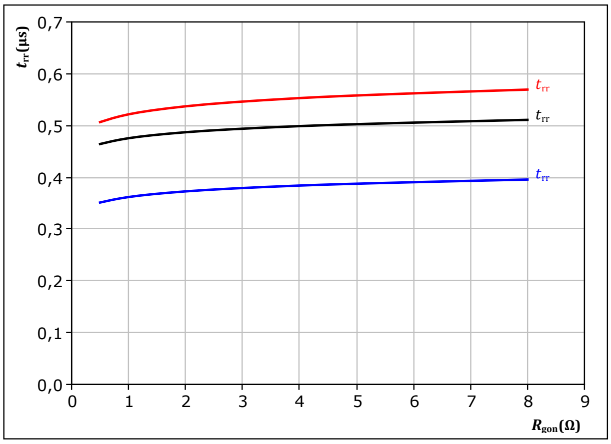
| | | |
|---|---|---|
| $V_{CE}$ = | 700 | V |
| $V_{GE}$ = | 0/15 | V |
| $R_{gon}$ = | 1 | Ω |

$T_j$: 25 °C, 125 °C, 150 °C

**figure 40.** **FWD**

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

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




With an inductive load at

| | | |
|---|---|---|
| $V_{CE}$ = | 700 | V |
| $V_{GE}$ = | 0/15 | V |
| $I_C$ = | 147 | A |

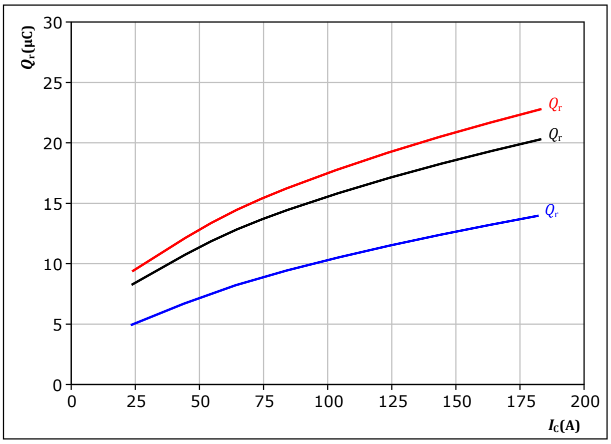
$T_j$: 25 °C, 125 °C, 150 °C

# Brake Switching Characteristics

**figure 41.** **FWD**

**Typical recovered charge as a function of collector current**

$Q_r$ = f( $I_C$)




With an inductive load at

$V_{CE}$ = 700 V

$V_{GE}$ = 0/15 V

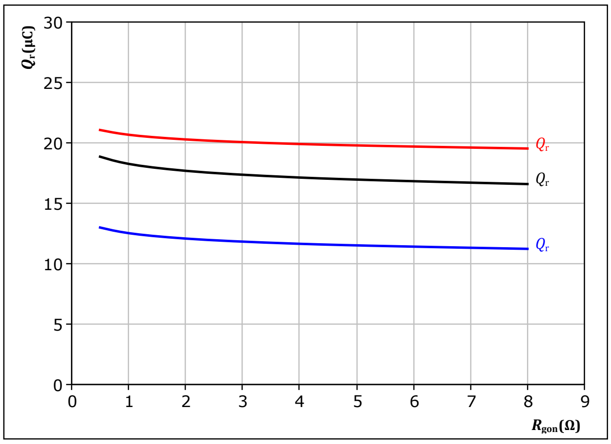
$R_{gon}$ = 1 Ω

$T_j$: 25 °C, 125 °C, 150 °C

**figure 42.** **FWD**

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

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




With an inductive load at

$V_{CE}$ = 700 V

$V_{GE}$ = 0/15 V

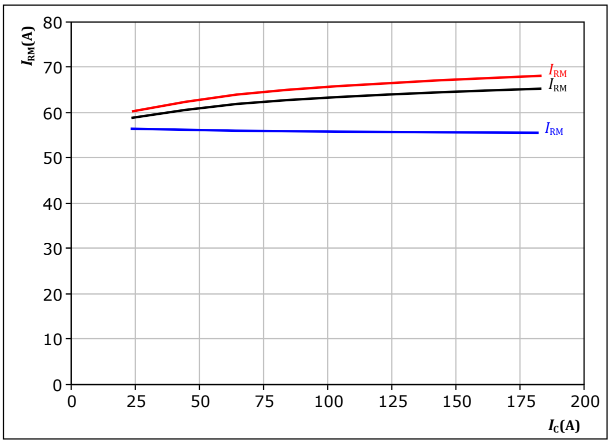
$I_C$ = 147 A

$T_j$: 25 °C, 125 °C, 150 °C

**figure 43.** **FWD**

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

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




With an inductive load at

$V_{CE}$ = 700 V

$V_{GE}$ = 0/15 V

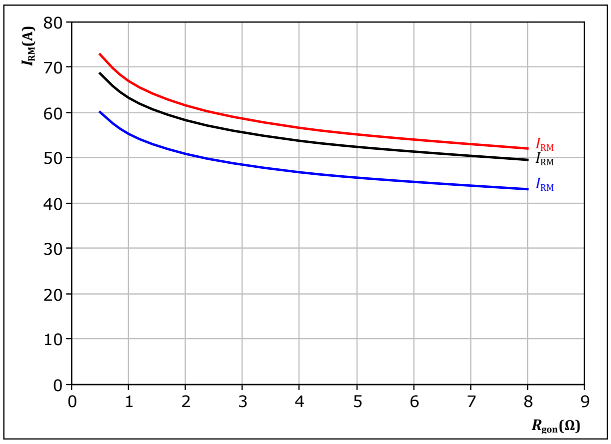
$R_{gon}$ = 1 Ω

$T_j$: 25 °C, 125 °C, 150 °C

**figure 44.** **FWD**

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

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




With an inductive load at

$V_{CE}$ = 700 V

$V_{GE}$ = 0/15 V

$I_C$ = 147 A

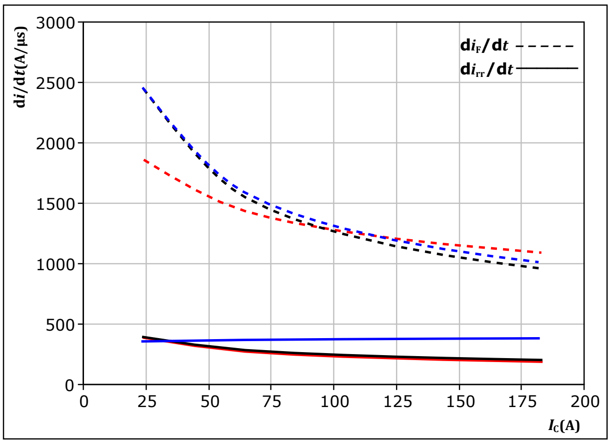
$T_j$: 25 °C, 125 °C, 150 °C

# Brake Switching Characteristics

**figure 45.** **FWD**

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

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



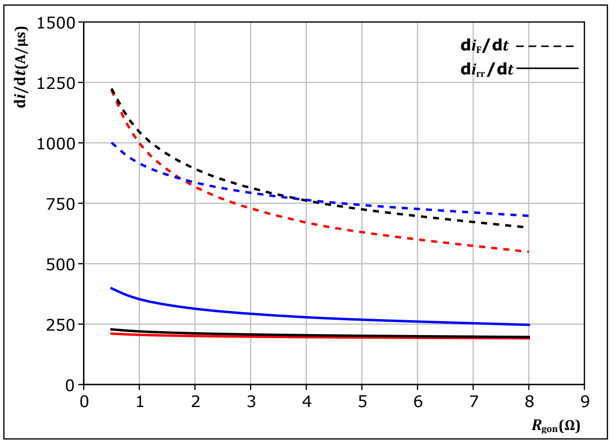

With an inductive load at

| | | | |
|---|---|---|---|
| $V_{CE}$ = | 700 | V | $T_j$: 25 °C |
| $V_{GE}$ = | 0/15 | V | 125 °C |
| $R_{gon}$ = | 1 | Ω | 150 °C |

**figure 46.** **FWD**

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

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



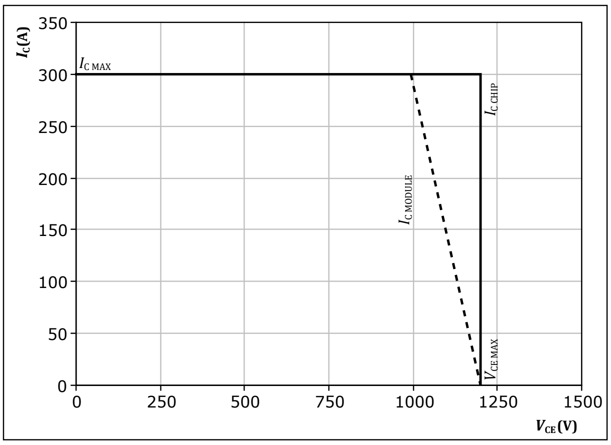

With an inductive load at

| | | | |
|---|---|---|---|
| $V_{CE}$ = | 700 | V | $T_j$: 25 °C |
| $V_{GE}$ = | 0/15 | V | 125 °C |
| $I_C$ = | 147 | A | 150 °C |

**figure 47.** **IGBT**

**Reverse bias safe operating area**

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




| | | | |
|---|---|---|---|
| **At** | $T_j$ = | 150 | °C |
| | $R_{gon}$ = | 1 | Ω |
| | $R_{goff}$ = | 1 | Ω |

# Switching Definitions

**figure 48.** **IGBT**

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

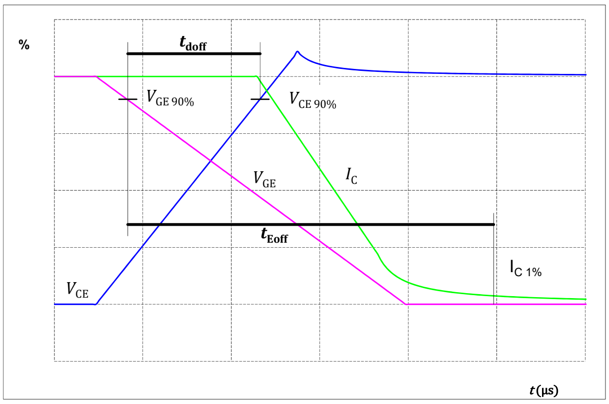



**figure 49.** **IGBT**

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

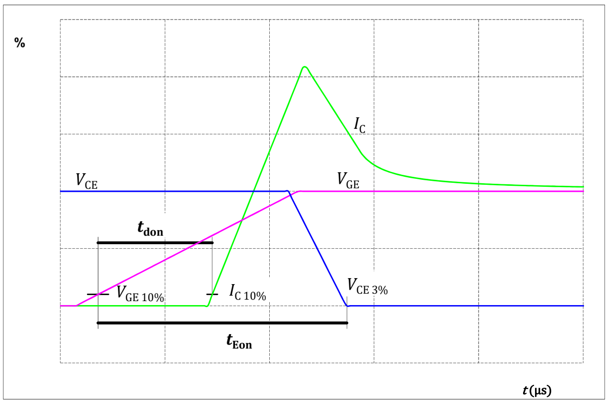



**figure 50.** **IGBT**

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

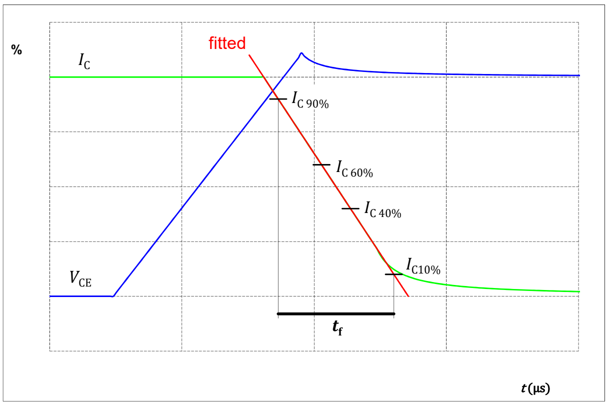
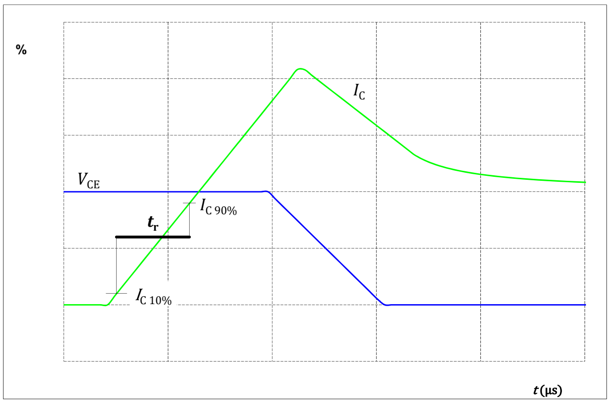



**figure 51.** **IGBT**

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



# Switching Definitions

**figure 52.** **FWD**

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

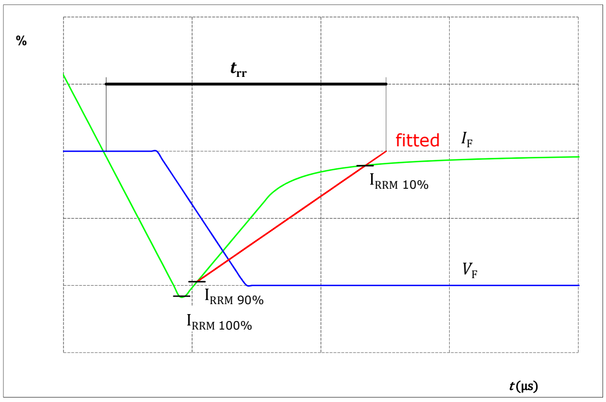
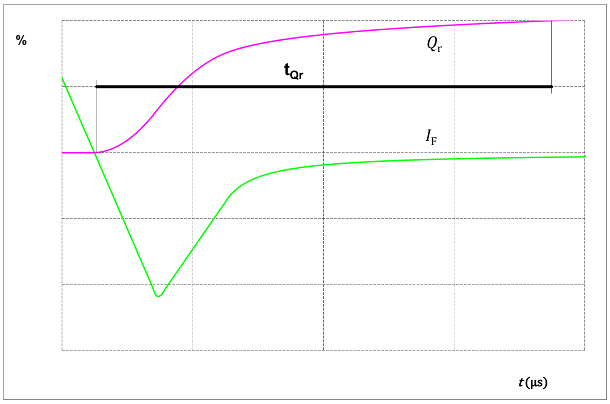



**figure 53.** **FWD**

**Turn-on Switching Waveforms & definition of $t_{Qr}$ ($t_{Qr}$ = integrating time for $Q_r$)**



## Ordering Code

| Version | Ordering Code |
|---|---|
| With std lid (6.5mm height) + no thermal grease | 80-M3127PA150M7-K420E80-/0A/ |
| With thin lid (2.8mm height) + no thermal grease | 80-M3127PA150M7-K420E80-/0B/ |
| With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based) | 80-M3127PA150M7-K420E80-/1A/ |
| With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based) | 80-M3127PA150M7-K420E80-/1B/ |
| With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free) | 80-M3127PA150M7-K420E80-/4A/ |
| With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free) | 80-M3127PA150M7-K420E80-/4B/ |
| With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based) | 80-M3127PA150M7-K420E80-/5A/ |
| With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based) | 80-M3127PA150M7-K420E80-/5B/ |

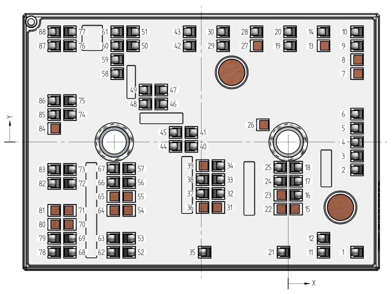
## Marking

| | Name | | Date code | UL & VIN | Lot | Serial |
|---|---|---|---|---|---|---|
| **Text** | NN-NNNNNNNNNNNNNN-TTTTTTVV | | WWYY | UL VIN | LLLLL | SSSS |
| | **Type&Ver** | **Lot number** | **Serial** | **Date code** | | |
| **Datamatrix** | TTTTTTTVV | LLLLL | SSSS | WWYY | | |

## Outline

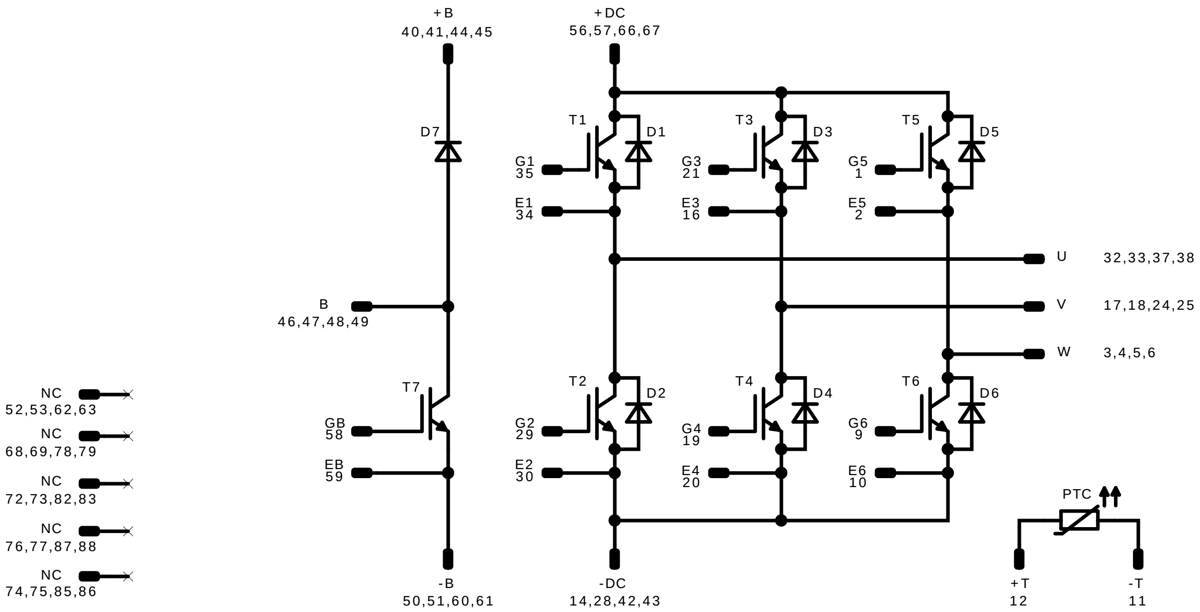
Pin table [mm]

| Pin | X | Y | Function | 45 | -25,9 | 2,2 | +B |
|---|---|---|---|---|---|---|---|
| 1 | 15,83 | -25,3 | G5 | 46 | -29,18 | 8,74 | B |
| 2 | 15,83 | -6,4 | E5 | 47 | -29,18 | 11,94 | B |
| 3 | 15,83 | -3,2 | W | 48 | -32,82 | 8,74 | B |
| 4 | 15,83 | 0 | W | 49 | -32,82 | 11,94 | B |
| 5 | 15,83 | 3,2 | W | 50 | -35,68 | 22,1 | -B |
| 6 | 15,83 | 6,4 | W | 51 | -35,68 | 25,3 | -B |
| 7 | not assembled | | | 52 | -36,58 | -25,3 | NC |
| 8 | not assembled | | | 53 | -36,58 | -22,1 | NC |
| 9 | 15,83 | 22,1 | G6 | 54 | not assembled | | |
| 10 | 15,83 | 25,3 | E6 | 55 | not assembled | | |
| 11 | 8,13 | -25,3 | -T | 56 | -36,58 | -9,3 | +DC |
| 12 | 8,13 | -22,1 | +T | 57 | -36,58 | -6,1 | +DC |
| 13 | not assembled | | | 58 | -39,32 | 15,7 | GB |
| 14 | 8,13 | 25,3 | -DC | 59 | -39,32 | 18,9 | EB |
| 15 | not assembled | | | 60 | -39,32 | 22,1 | -B |
| 16 | 1,82 | -12,18 | E3 | 61 | -39,32 | 25,3 | -B |
| 17 | 1,82 | -8,98 | V | 62 | -40,22 | -25,3 | NC |
| 18 | 1,82 | -5,79 | V | 63 | -40,22 | -22,1 | NC |
| 19 | 0,43 | 22,1 | G4 | 64 | not assembled | | |
| 20 | 0,43 | 25,3 | E4 | 65 | not assembled | | |
| 21 | -1,07 | -25,3 | G3 | 66 | -40,22 | -9,3 | +DC |
| 22 | not assembled | | | 67 | -40,22 | -6,09 | +DC |
| 23 | not assembled | | | 68 | -50,18 | -25,3 | NC |
| 24 | -1,82 | -8,98 | V | 69 | -50,18 | -22,1 | NC |
| 25 | -1,82 | -5,79 | V | 70 | not assembled | | |
| 26 | not assembled | | | 71 | not assembled | | |
| 27 | not assembled | | | 72 | -50,18 | -9,5 | NC |
| 28 | -7,27 | 25,3 | -DC | 73 | -50,18 | -6,3 | NC |
| 29 | -14,97 | 22,1 | G2 | 74 | -50,18 | 6,3 | NC |
| 30 | -14,97 | 25,3 | E2 | 75 | -50,18 | 9,5 | NC |
| 31 | not assembled | | | 76 | -50,18 | 22,1 | NC |
| 32 | -16,05 | -11,82 | U | 77 | -50,18 | 25,3 | NC |
| 33 | -16,05 | -8,63 | U | 78 | -53,82 | -25,3 | NC |
| 34 | -16,05 | -5,42 | E1 | 79 | -53,82 | -22,1 | NC |
| 35 | -19,22 | -25,3 | G1 | 80 | not assembled | | |
| 36 | not assembled | | | 81 | not assembled | | |
| 37 | -19,7 | -11,82 | U | 82 | -53,82 | -9,5 | NC |
| 38 | -19,7 | -8,62 | U | 83 | -53,82 | -6,3 | NC |
| 39 | not assembled | | | 84 | not assembled | | |
| 40 | -22,26 | -1 | +B | 85 | -53,82 | 6,3 | NC |
| 41 | -22,26 | 2,2 | +B | 86 | -53,82 | 9,5 | NC |
| 42 | -22,67 | 22,1 | -DC | 87 | -53,82 | 22,1 | NC |
| 43 | -22,67 | 25,3 | -DC | 88 | -53,82 | 25,3 | NC |
| 44 | -25,9 | -1 | +B | | | | |



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

## Pinout




## Identification

| ID | Component | Voltage | Current | Function | Comment |
|---|---|---|---|---|---|
| T2, T1, T4, T3, T6, T5 | IGBT | 1200 V | 150 A | Inverter Switch | |
| D1, D2, D3, D4, D5, D6 | FWD | 1200 V | 150 A | Inverter Diode | |
| T7 | IGBT | 1200 V | 150 A | Brake Switch | |
| D7 | FWD | 1200 V | 100 A | Brake Diode | |
| PTC1 | Thermistor | | | Thermistor | |

| 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. |

| Vincotech thermistor reference |
|---|
| See Vincotech thermistor reference table at vincotech.com website. |

| UL recognition and file number |
|---|
| This device is UL 1557 recognized under E192116 up to a junction temperature under switching condition $T_{j,op}$=150°C and up to 2500VAC/1min isolation voltage. For more information see vincotech.com website. |

| Document No.: | Date: | Modification: | Pages |
|---|---|---|---|
| 80-M3127PA150M7-K420E80-D1-14 | 5 Oct. 2025 | Initial Release | |