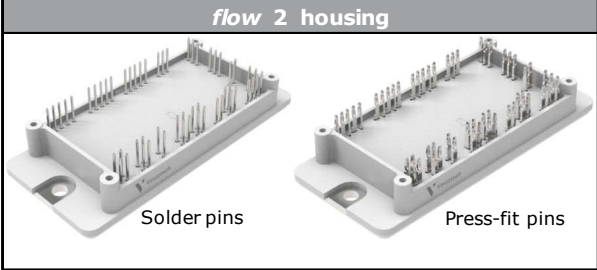
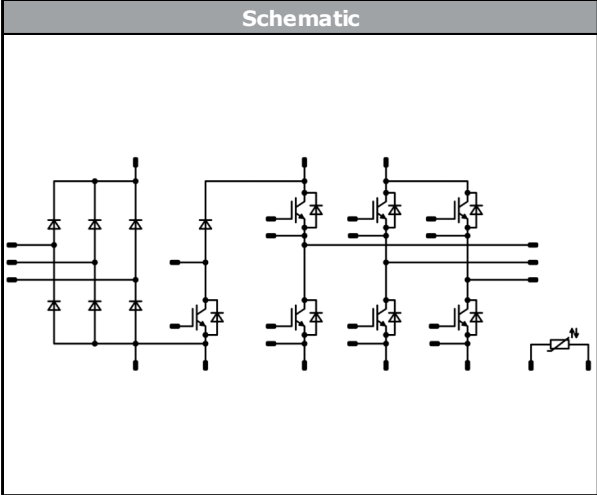




<i>flow PIM 2</i>	1200 V / 50 A
<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; background-color: #ccc; margin: 0;"><b>Features</b></p> <ul style="list-style-type: none"> <li>IGBT M7 with low <math>V_{CEsat}</math> and improved EMC behavior</li> <li>Open emitter configuration</li> <li>Compact and low inductive design</li> <li>Built-in NTC</li> </ul> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; background-color: #ccc; margin: 0;"><b>Target applications</b></p> <ul style="list-style-type: none"> <li>Industrial Drives</li> </ul> </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; background-color: #ccc; margin: 0;"><b>Types</b></p> <ul style="list-style-type: none"> <li>30-F212PMA050M7-L888A79</li> <li>30-P212PMA050M7-L888A79Y</li> </ul> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; background-color: #ccc; margin: 0;"><i>flow 2 housing</i></p>  <p style="text-align: center; margin: 0;">Solder pins      Press-fit pins</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; background-color: #ccc; margin: 0;"><b>Schematic</b></p>  </div>

## Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
<b>Rectifier Diode</b>				
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 $t_p = 8,3\text{ ms}$ $T_j = 150\text{ °C}$	490	A
Surge current capability	$I_{Pt}$		1200	$A^2s$
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	106	W
Maximum junction temperature	$T_{jmax}$		150	°C



Vincotech

## Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
<b>Inverter 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	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	162	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Maximum junction temperature	$T_{jmax}$		175	$^{\circ}\text{C}$

<b>Inverter 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	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	101	W
Maximum junction temperature	$T_{jmax}$		175	$^{\circ}\text{C}$

<b>Brake Switch</b>				
Collector-emitter voltage	$V_{CES}$		1200	V
Collector current	$I_C$		35	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	70	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	132	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Maximum junction temperature	$T_{jmax}$		175	$^{\circ}\text{C}$

<b>Brake Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		1200	V
Continuous (direct) forward current	$I_F$		25	A
Repetitive peak forward current	$I_{FRM}$	$T_j$ limited by $T_{jmax}$	50	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	62	W
Maximum junction temperature	$T_{jmax}$		175	$^{\circ}\text{C}$



## Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
<b>Brake Sw. Protection Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		1200	V
Continuous (direct) forward current	$I_F$		5	A
Repetitive peak forward current	$I_{FRM}$		10	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	34	W
Maximum junction temperature	$T_{jmax}$		175	°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* $t_p = 2\text{ s}$	6000	V
		AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance		Press-fit pins	min. 12,7	mm
		Solder pins		
Clearance		Press-fit pins	11,58	mm
		Solder pins	11,82	
Operation temperature under switching condition	CTI		> 200	

\*100% tested in production



## Characteristic Values

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

### Rectifier Diode

#### Static

Forward voltage	$V_F$			50	25 125 150		1,14 1,08 1,07	1,7		V
Reverse leakage current	$I_R$		1600		25 150			50 1100		μA

#### Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)					0,66			K/W
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## Characteristic Values

Parameter	Symbol	Conditions					Value			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		
<b>Inverter Switch</b>										
<b>Static</b>										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{CE}$			0,005	25	5,4	6	6,6	V
Collector-emitter saturation voltage	$V_{CEsat}$		15		50	25 125 150		1,55 1,77 1,83	1,9	V
Collector-emitter cut-off current	$I_{CES}$		0	1200		25			90	μA
Gate-emitter leakage current	$I_{GES}$		15	0		25			500	nA
Internal gate resistance	$r_g$							none		Ω
Input capacitance	$C_{ies}$							10000		pF
Output capacitance	$C_{oes}$		0	10		25		350		
Reverse transfer capacitance	$C_{res}$							130		
Gate charge	$Q_g$		15	600	50	25		410		nC
<b>Thermal</b>										
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,59		K/W
<b>Dynamic</b>										
Turn-on delay time	$t_{d(on)}$					25 125 150		176 176 190		ns
Rise time	$t_r$	$R_{goff} = 8$ Ω $R_{gon} = 8$ Ω				25 125 150		52 58 60		
Turn-off delay time	$t_{d(off)}$		±15	600	50	25 125 150		206 229 241		
Fall time	$t_f$					25 125 150		92 125 122		
Turn-on energy (per pulse)	$E_{on}$	$Q_{iFWD} = 4,9$ μC $Q_{iFWD} = 7,1$ μC $Q_{iFWD} = 8$ μC				25 125 150		4,82 6,38 6,25		
Turn-off energy (per pulse)	$E_{off}$					25 125 150		2,98 4,25 5,03		



## Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
		$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max		

### Inverter Diode

#### Static

Parameter	Symbol	$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Forward voltage	$V_F$			50	25 125 150		1,66 1,78 1,79	2,15	V
Reverse leakage current	$I_R$		1200		25 150			50	μA

#### Thermal

Parameter	Symbol	Conditions	Value	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)	0,94	K/W

#### Dynamic

Parameter	Symbol	$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Peak recovery current	$I_{RRM}$			50	25 125 150		29 33 33		A
Reverse recovery time	$t_{rr}$			50	25 125 150		339 435 511		ns
Recovered charge	$Q_r$			50	25 125 150		4,93 7,08 8,04		μC
Reverse recovered energy	$E_{rec}$			50	25 125 150		1,79 2,59 3,33		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$			50	25 125 150		195 128 114		A/μs



## Characteristic Values

Parameter	Symbol	Conditions					Value			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		
<b>Brake Switch</b>										
<b>Static</b>										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{CE}$			0,0035	25	5,4	6	6,6	V
Collector-emitter saturation voltage	$V_{CEsat}$		15		35	25 125 150		1,48 1,64 1,68	1,85	V
Collector-emitter cut-off current	$I_{CES}$		0	1200		25			80	μA
Gate-emitter leakage current	$I_{GES}$		20	0		25			500	nA
Internal gate resistance	$r_g$							none		Ω
Input capacitance	$C_{ies}$							7900		pF
Output capacitance	$C_{oes}$		0	10		25		270		
Reverse transfer capacitance	$C_{res}$							97		
Gate charge	$Q_g$		15	600	35	25		260		nC
<b>Thermal</b>										
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,72		K/W
<b>Dynamic</b>										
Turn-on delay time	$t_{d(on)}$					25 125 150		199 172 167		ns
Rise time	$t_r$	$R_{goff} = 16$ Ω $R_{gon} = 16$ Ω				25 125 150		111 109 110		
Turn-off delay time	$t_{d(off)}$		15/0	700	35	25 125 150		438 485 497		
Fall time	$t_f$					25 125 150		65 100 107		
Turn-on energy (per pulse)	$E_{on}$	$Q_{rFWD} = 2,8$ μC $Q_{rFWD} = 4,5$ μC $Q_{rFWD} = 5,1$ μC				25 125 150		4,87 5,85 6,10		
Turn-off energy (per pulse)	$E_{off}$					25 125 150		3,00 3,88 4,10		



## Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
		$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max		

### Brake Diode

#### Static

Parameter	Symbol	$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Forward voltage	$V_F$			25	25 125 150		1,63 1,70 1,69	2,1	V
Reverse leakage current	$I_R$		1200		25			35	μA

#### Thermal

Parameter	Symbol	$\lambda_{paste}$ = 3,4 W/mK (PSX)	$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$							1,54		K/W

#### Dynamic

Parameter	Symbol	$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Peak recovery current	$I_{RRM}$				25 125 150		18 20 20		A
Reverse recovery time	$t_{rr}$				25 125 150		269 397 449		ns
Recovered charge	$Q_r$	$di/dt = 310$ A/μs $di/dt = 311$ A/μs $di/dt = 260$ A/μs	15/0	700	35	25 125 150	2,81 4,53 5,09		μC
Reverse recovered energy	$E_{rec}$				25 125 150		1,12 1,92 2,21		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$				25 125 150		132 80 77		A/μs

### Brake Sw. Protection Diode

#### Static

Parameter	Symbol	$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Forward voltage	$V_F$			5	25 125 150		1,57 1,65 1,65	2,1	V
Reverse leakage current	$I_R$		1200		25			20	μA

#### Thermal

Parameter	Symbol	$\lambda_{paste}$ = 3,4 W/mK (PSX)	$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$							2,76		K/W





### Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
		$V_{GS}$ [V]	$V_{GE}$ [V]	$V_{DS}$ [V]	$I_D$ [A]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	

#### Thermistor

Rated resistance	$R$					25		22		kΩ
Deviation of $R_{100}$	$\Delta_{R/R}$	$R_{100} = 1484 \Omega$				100	-5		5	%
Power dissipation	$P$					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 1 \%$				25		3962		K
B-value	$B_{(25/100)}$	Tol. $\pm 1 \%$				25		4000		K
Vincotech NTC Reference									I	

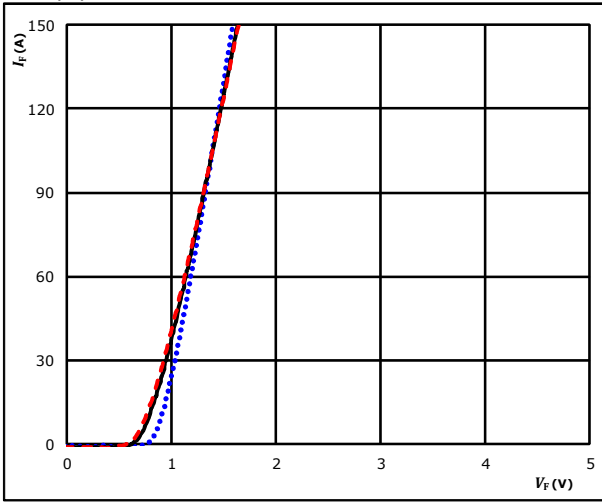


## Rectifier Diode Characteristics

**figure 1. Rectifier**

Typical forward characteristics

$$I_F = f(V_F)$$

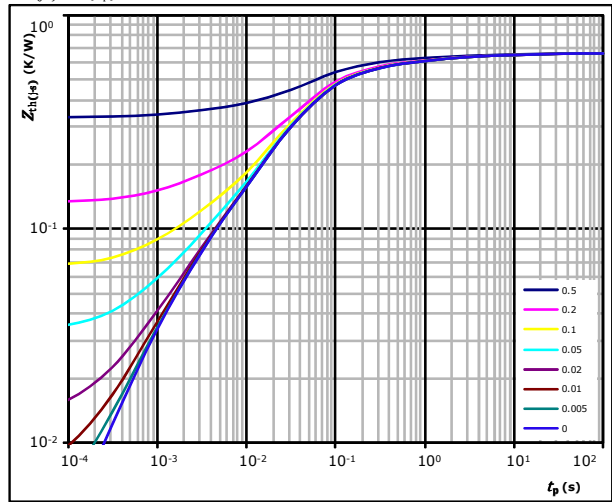


$t_p = 250 \mu s$   
 $T_j$ : 25 °C .....  
 125 °C ———  
 150 °C - - - -

**figure 2. Rectifier**

Transient thermal impedance as a function of pulse width

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



$$D = \frac{t_p}{T}$$

$$R_{th(j-s)} = 0,66 \text{ K/W}$$

Rectifier thermal model values

$R$ (K/W)	$\tau$ (s)
2,64E-02	1,18E+01
6,63E-02	1,18E+00
1,36E-01	1,65E-01
3,29E-01	4,29E-02
6,63E-02	1,04E-02
3,95E-02	1,49E-03

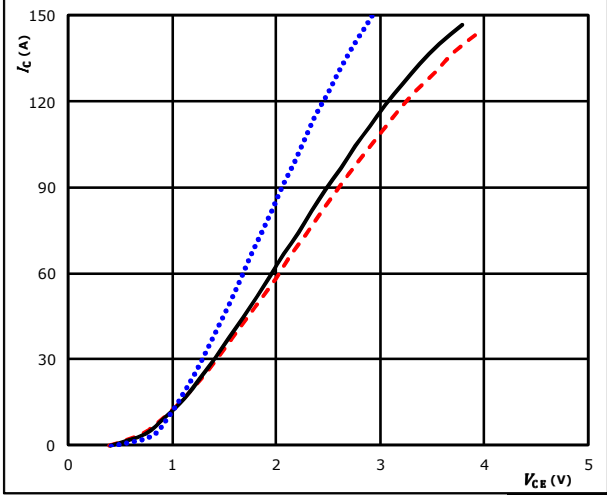


## Inverter Switch Characteristics

**figure 1.** IGBT

Typical output characteristics

$I_C = f(V_{CE})$

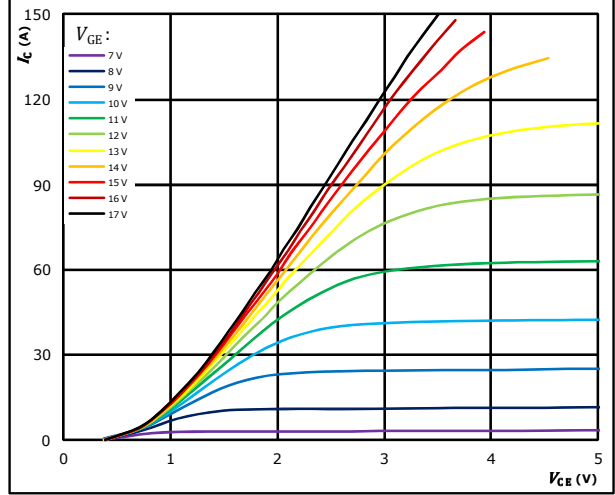


$t_p = 250 \mu s$        $T_j: 25 \text{ }^\circ C$       .....  
 $V_{GE} = 15 \text{ V}$        $T_j: 125 \text{ }^\circ C$       ———  
                                   $T_j: 150 \text{ }^\circ C$       - - - -

**figure 2.** IGBT

Typical output characteristics

$I_C = f(V_{CE})$

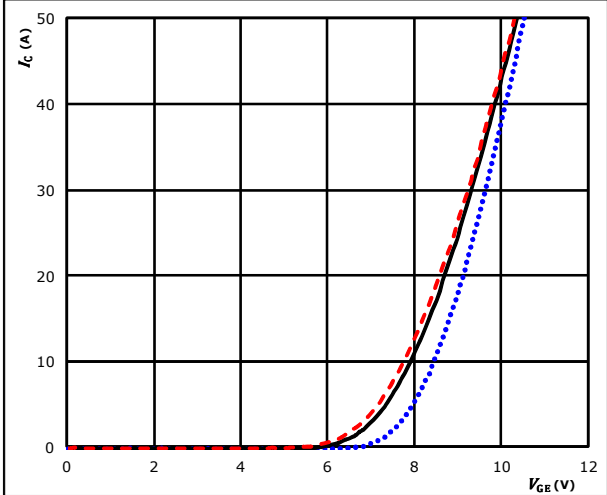


$t_p = 250 \mu s$        $T_j = 150 \text{ }^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

**figure 3.** IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

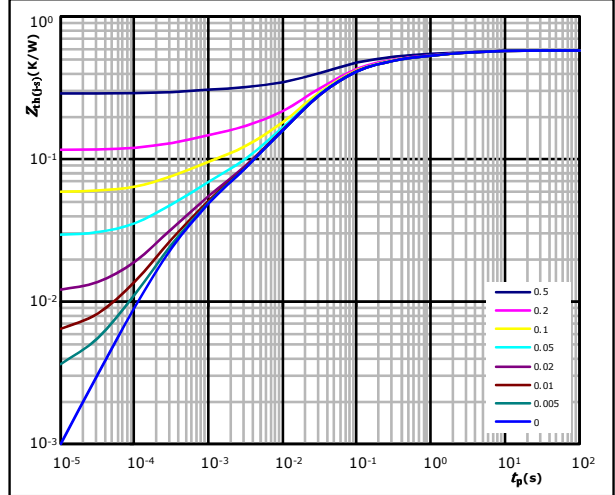


$t_p = 100 \mu s$        $T_j: 25 \text{ }^\circ C$       .....  
 $V_{CE} = 10 \text{ V}$        $T_j: 125 \text{ }^\circ C$       ———  
                                   $T_j: 150 \text{ }^\circ C$       - - - -

**figure 4.** IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,59 \text{ K/W}$

IGBT thermal model values

$R$ (K/W)	$\tau$ (s)
3,16E-02	4,80E+00
5,30E-02	1,05E+00
1,21E-01	1,71E-01
2,39E-01	4,01E-02
9,09E-02	1,21E-02
2,38E-02	1,71E-03
2,73E-02	3,65E-04

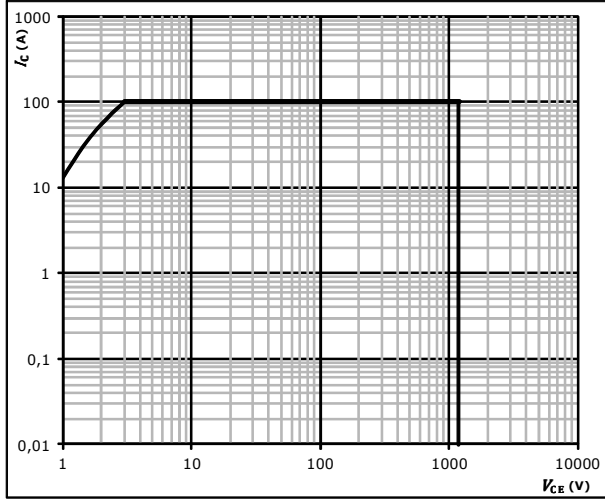


### Inverter Switch Characteristics

**figure 5. IGBT**

Safe operating area

$I_C = f(V_{CE})$



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

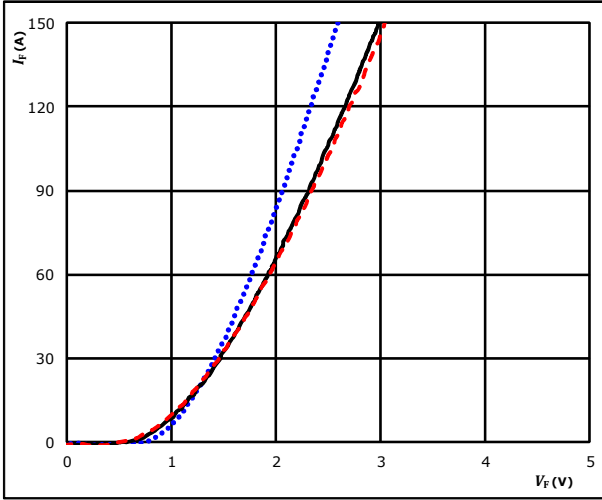


## Inverter Diode Characteristics

**figure 1.** FWD

Typical forward characteristics

$$I_F = f(V_F)$$

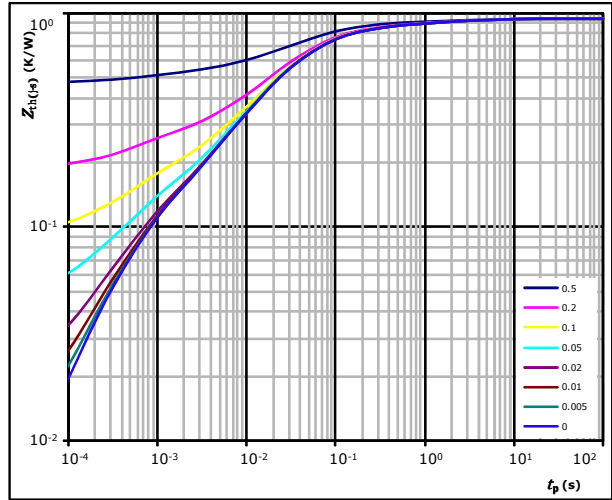


$t_p =$  250 μs  
 $T_j$ : 25 °C .....  
 125 °C ———  
 150 °C - - - -

**figure 2.** FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,94$  K/W

FWD thermal model values

$R$ (K/W)	$\tau$ (s)
5,03E-02	3,45E+00
8,14E-02	4,50E-01
2,71E-01	7,41E-02
3,67E-01	2,11E-02
9,51E-02	3,99E-03
7,76E-02	4,74E-04

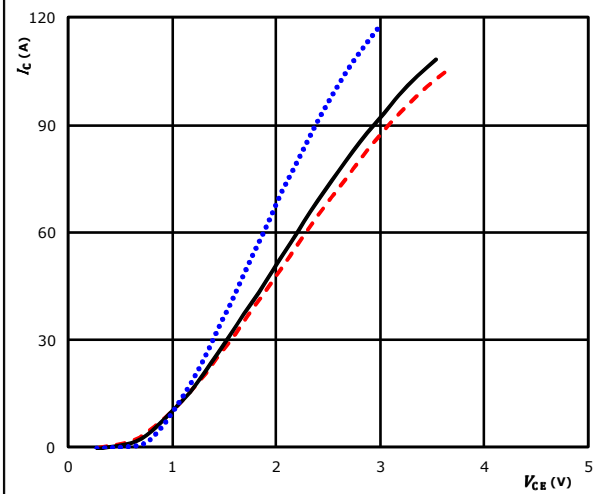


## Brake Switch Characteristics

**figure 1.** IGBT

Typical output characteristics

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

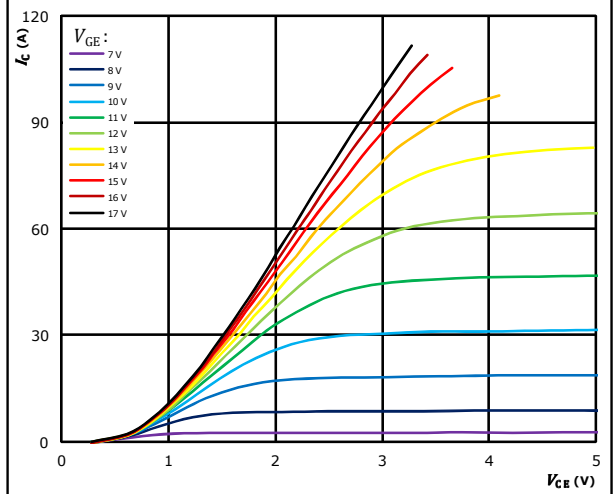


$t_p = 250 \mu\text{s}$   $T_j: 25 \text{ }^\circ\text{C}$  .....  
 $V_{GE} = 15 \text{ V}$   $T_j: 125 \text{ }^\circ\text{C}$  ———  
 $T_j: 150 \text{ }^\circ\text{C}$  - - - - -

**figure 2.** IGBT

Typical output characteristics

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

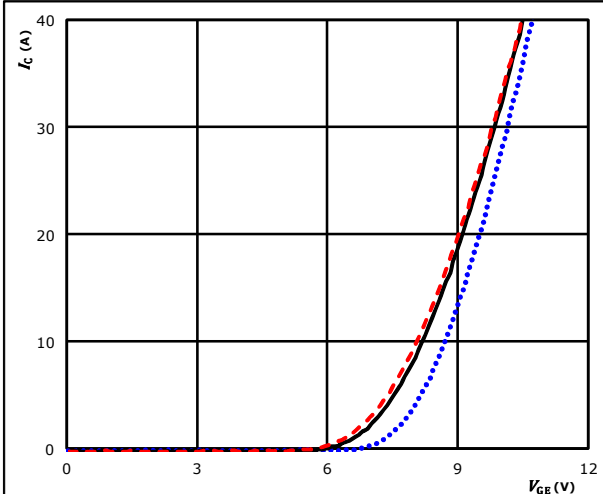


$t_p = 250 \mu\text{s}$   
 $T_j = 150 \text{ }^\circ\text{C}$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

**figure 3.** IGBT

Typical transfer characteristics

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

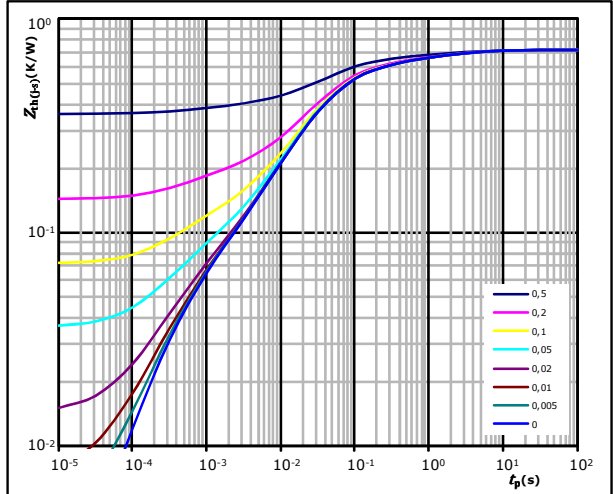


$t_p = 100 \mu\text{s}$   $T_j: 25 \text{ }^\circ\text{C}$  .....  
 $V_{CE} = 10 \text{ V}$   $T_j: 125 \text{ }^\circ\text{C}$  ———  
 $T_j: 150 \text{ }^\circ\text{C}$  - - - - -

**figure 4.** IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,72 \text{ K/W}$

IGBT thermal model values

$R$ (K/W)	$\tau$ (s)
3,93E-02	5,07E+00
7,23E-02	9,25E-01
1,28E-01	1,58E-01
3,10E-01	3,68E-02
1,08E-01	1,02E-02
3,17E-02	1,41E-03
3,18E-02	3,39E-04

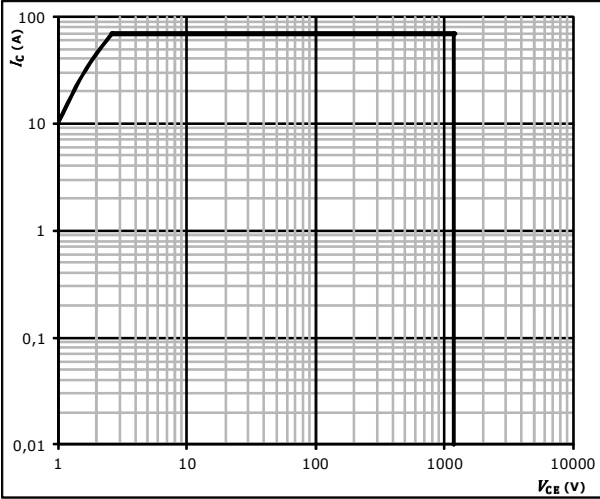


### Brake Switch Characteristics

**figure 5. IGBT**

Safe operating area

$I_C = f(V_{CE})$



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

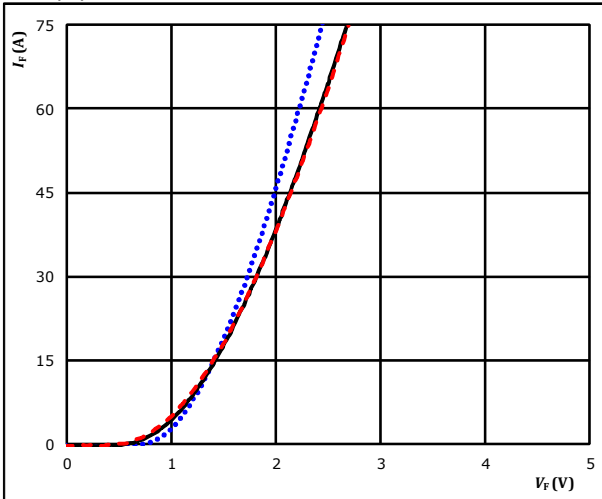


## Brake Diode Characteristics

**figure 1.** FWD

Typical forward characteristics

$$I_F = f(V_F)$$



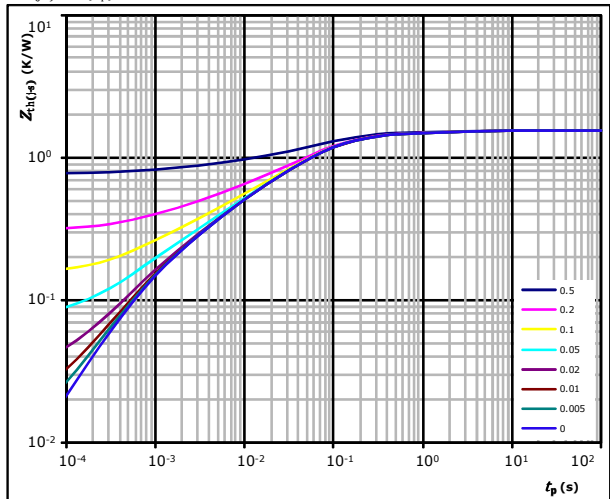
$t_p = 250 \mu s$

$T_j$ : 25 °C .....  
 125 °C ———  
 150 °C - - - -

**figure 2.** FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)} = 1,54 \text{ K/W}$

FWD thermal model values

$R$ (K/W)	$\tau$ (s)
4,69E-02	5,05E+00
1,06E-01	7,09E-01
5,57E-01	1,01E-01
4,68E-01	3,22E-02
2,35E-01	5,52E-03
8,77E-02	1,01E-03
4,01E-02	5,52E-04



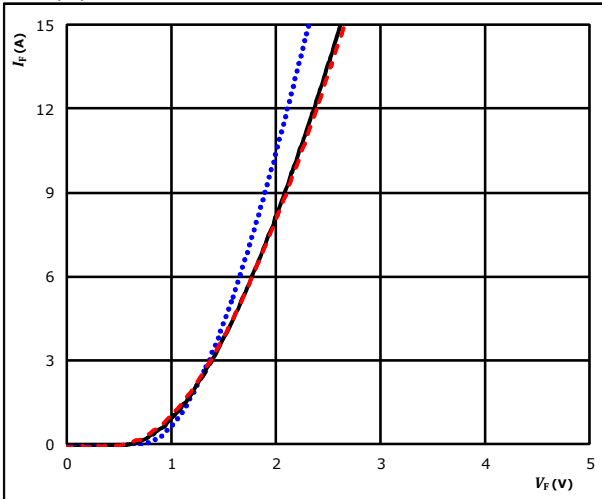


## Brake Sw. Protection Diode Characteristics

**figure 1.** FWD

Typical forward characteristics

$$I_F = f(V_F)$$

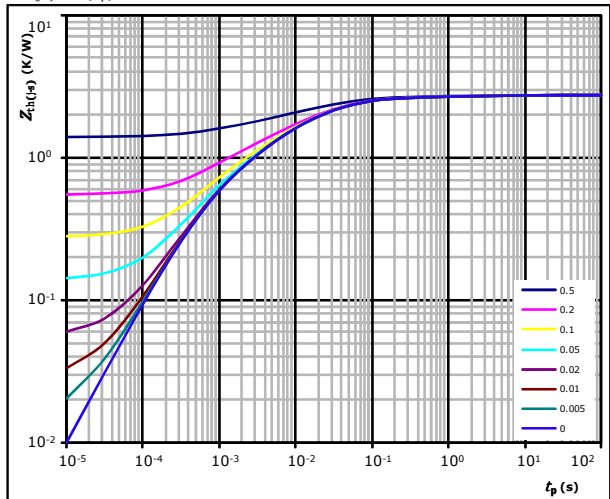


$t_p = 250 \mu s$   
 $T_j$ : 25 °C (blue dotted line)  
 125 °C (black solid line)  
 150 °C (red dashed line)

**figure 2.** FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 2,76 \text{ K/W}$   
 FWD thermal model values

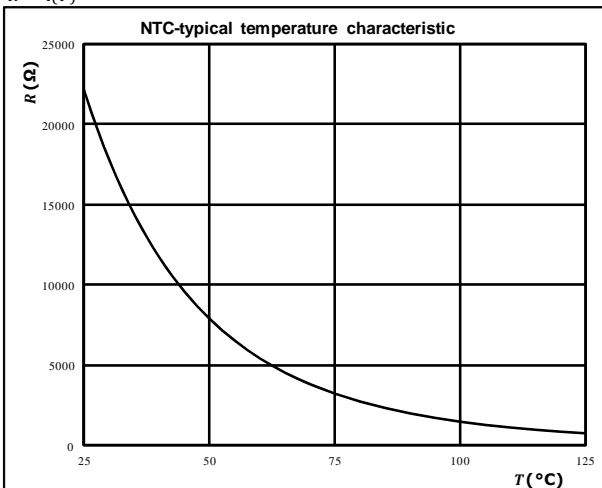
$R$ (K/W)	$\tau$ (s)
6,58E-02	4,81E+00
1,43E-01	3,47E-01
6,08E-01	4,61E-02
8,65E-01	1,40E-02
7,08E-01	2,91E-03
3,69E-01	5,42E-04

## Thermistor Characteristics

**figure 1.** Thermistor

Typical NTC characteristic as a function of temperature

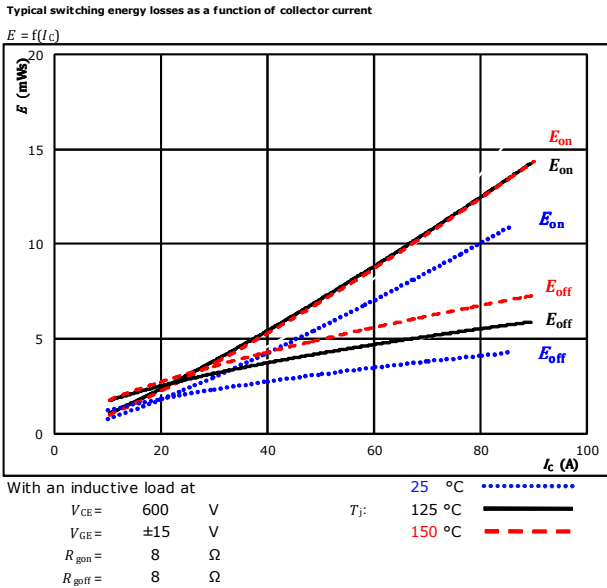
$$R = f(T)$$



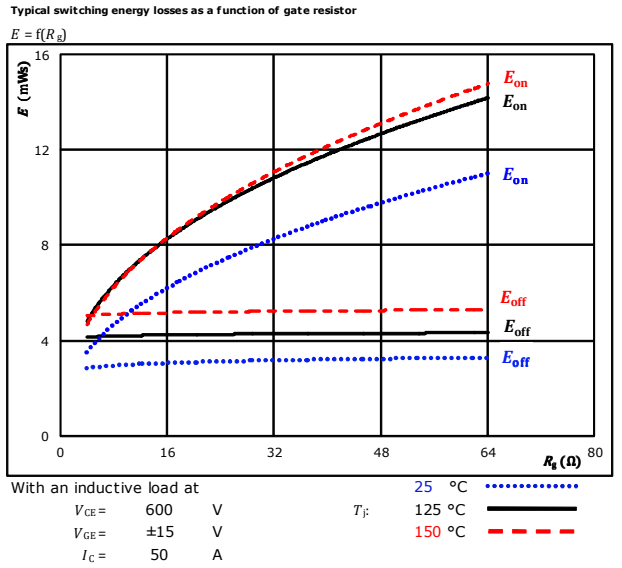


## Inverter Switching Characteristics

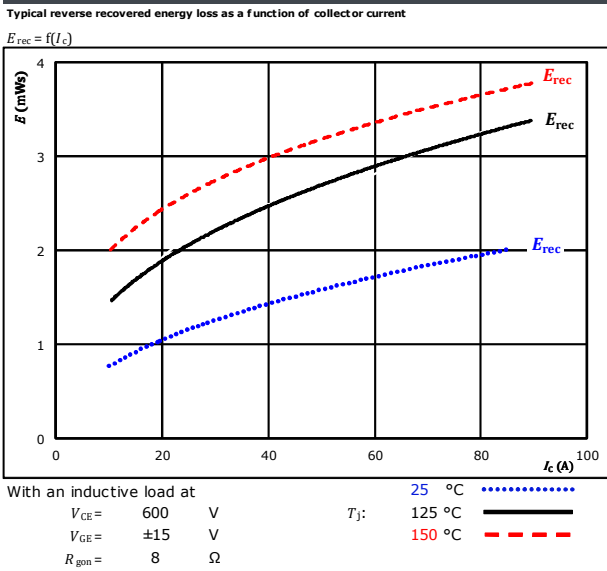
**figure 1.** IGBT



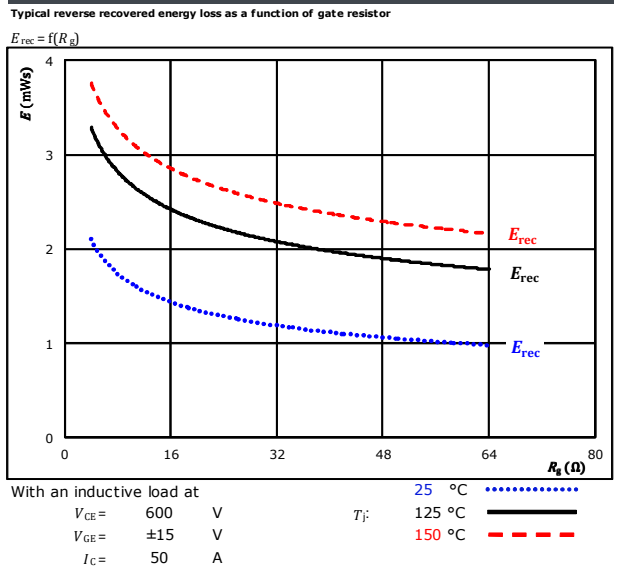
**figure 2.** IGBT



**figure 3.** FWD



**figure 4.** FWD



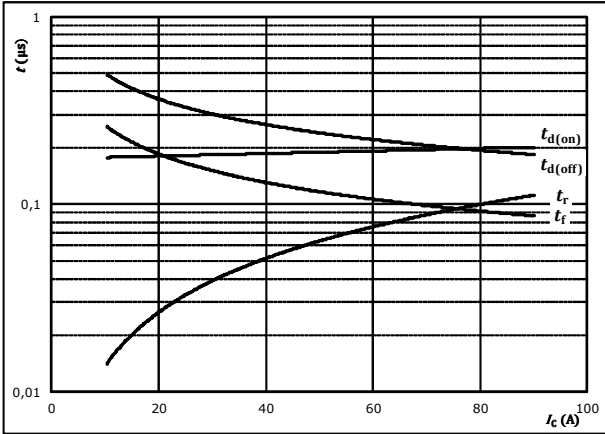


## Inverter Switching Characteristics

**figure 5.** IGBT

Typical switching times as a function of collector current

$$t = f(I_c)$$



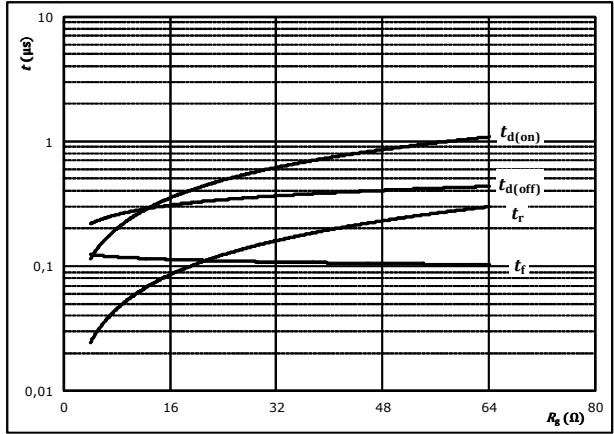
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	8	Ω
$R_{goff} =$	8	Ω

**figure 6.** IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



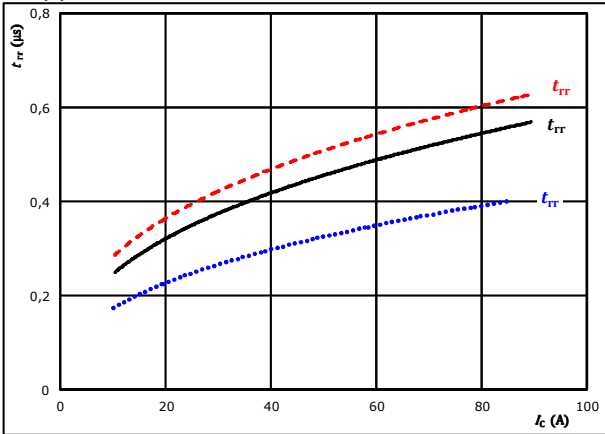
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$I_c =$	50	A

**figure 7.** FWD

Typical reverse recovery time as a function of collector current

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

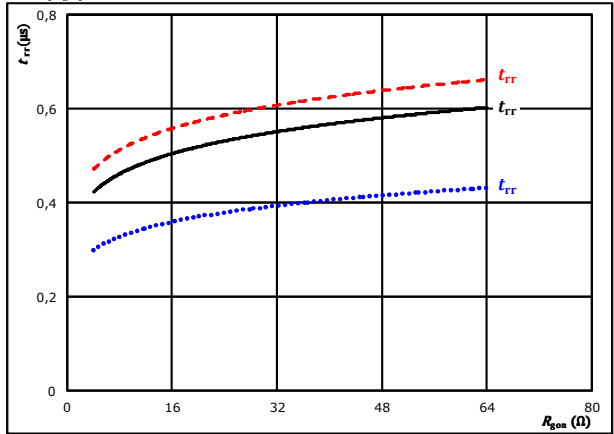


At	$V_{CE} =$	600	V	$T_j:$	25 °C	.....
	$V_{GE} =$	±15	V		125 °C	————
	$R_{gon} =$	8	Ω		150 °C	-----

**figure 8.** FWD

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

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



At	$V_{CE} =$	600	V	$T_j:$	25 °C	.....
	$V_{GE} =$	±15	V		125 °C	————
	$I_c =$	50	A		150 °C	-----

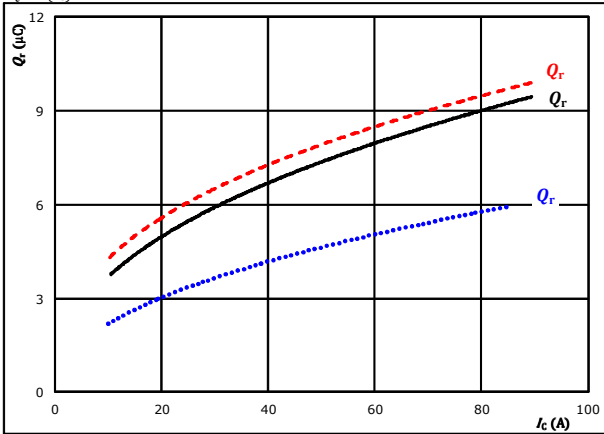


## Inverter Switching Characteristics

**figure 9.** FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

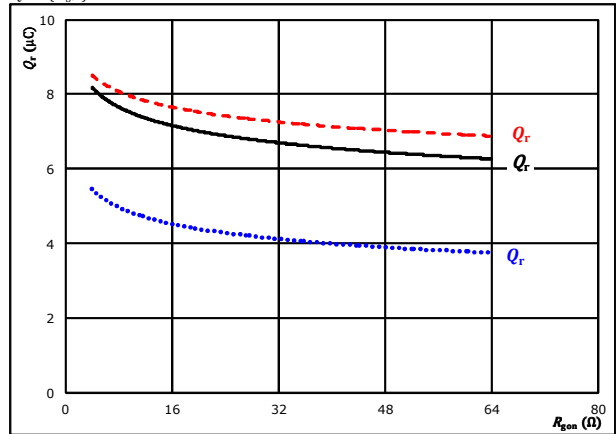


At  $V_{CE} = 600$  V  $T_j = 25$  °C .....  
 $V_{GE} = \pm 15$  V  $T_j = 125$  °C ———  
 $R_{gpn} = 8$  Ω  $T_j = 150$  °C - - - - -

**figure 10.** FWD

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

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

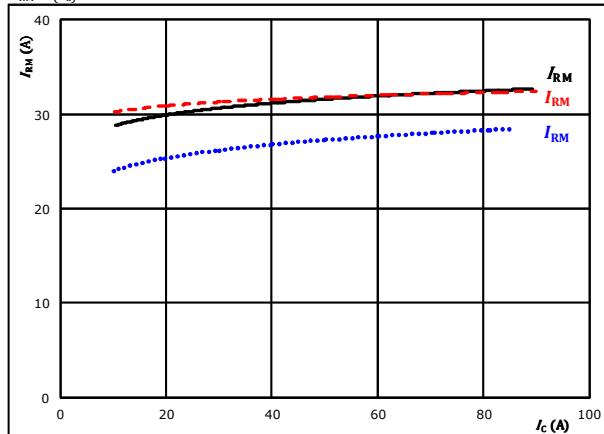


At  $V_{CE} = 600$  V  $T_j = 25$  °C .....  
 $V_{GE} = \pm 15$  V  $T_j = 125$  °C ———  
 $I_c = 50$  A  $T_j = 150$  °C - - - - -

**figure 11.** FWD

Typical peak reverse recovery current as a function of collector current

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

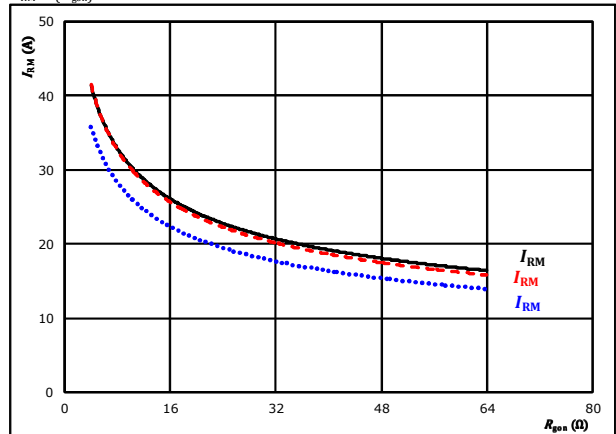


At  $V_{CE} = 600$  V  $T_j = 25$  °C .....  
 $V_{GE} = \pm 15$  V  $T_j = 125$  °C ———  
 $R_{gpn} = 8$  Ω  $T_j = 150$  °C - - - - -

**figure 12.** FWD

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

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



At  $V_{CE} = 600$  V  $T_j = 25$  °C .....  
 $V_{GE} = \pm 15$  V  $T_j = 125$  °C ———  
 $I_c = 50$  A  $T_j = 150$  °C - - - - -

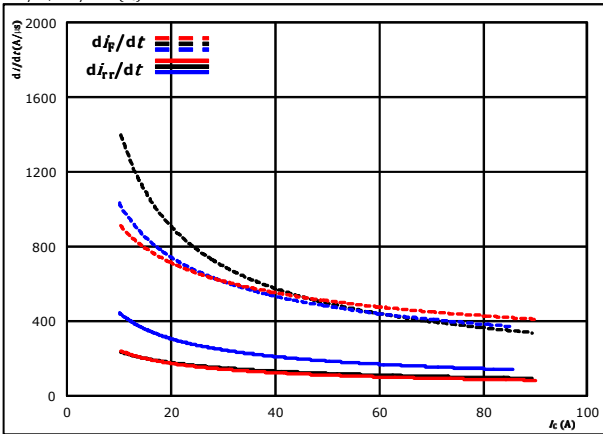


## Inverter Switching Characteristics

**figure 13.** FWD

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

$$di_f/dt, di_{rr}/dt = f(I_c)$$

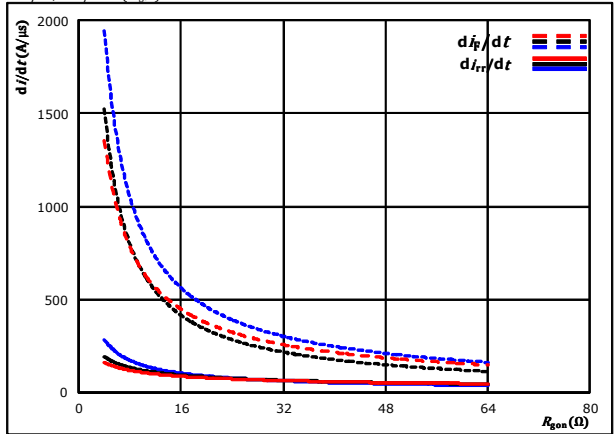


At  $V_{CE} = 600$  V  $T_j = 25$  °C (.....)  
 $V_{GE} = \pm 15$  V  $T_j = 125$  °C (—)  
 $R_{gpn} = 8$  Ω  $T_j = 150$  °C (---)

**figure 14.** FWD

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

$$di_f/dt, di_{rr}/dt = f(R_{gpn})$$

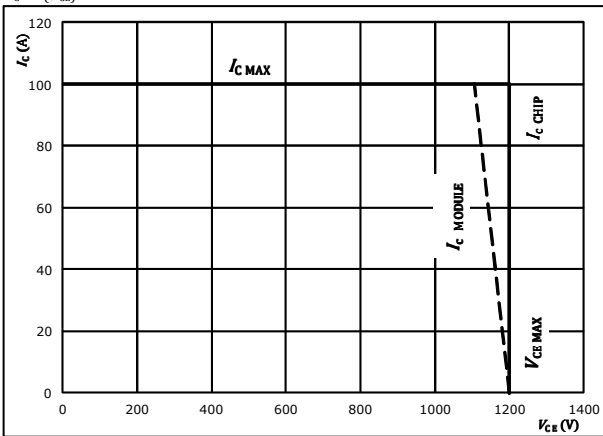


At  $V_{CE} = 600$  V  $T_j = 25$  °C (.....)  
 $V_{GE} = \pm 15$  V  $T_j = 125$  °C (—)  
 $I_c = 50$  A  $T_j = 150$  °C (---)

**figure 15.** IGBT

Reverse bias safe operating area

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



At  $T_j = 175$  °C  
 $R_{gpn} = 8$  Ω  
 $R_{goff} = 8$  Ω



Vincotech

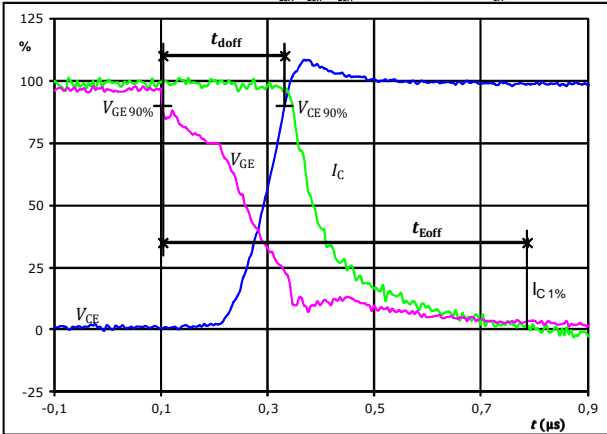
## Inverter Switching Definitions

**General conditions**

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

**figure 1.** IGBT

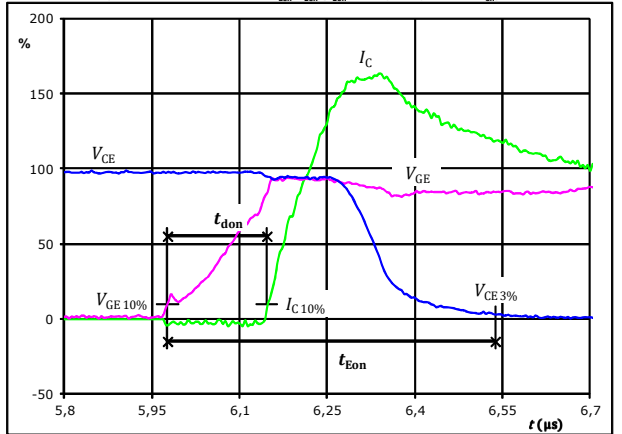
Turn-off Switching Waveforms & definition of  $t_{doff}$ ,  $t_{Eoff}$  ( $t_{Eoff}$  = integrating time for  $E_{off}$ )



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	600	V
$I_C(100\%) =$	50	A
$t_{doff} =$	0,229	$\mu s$
$t_{Eoff} =$	0,683	$\mu s$

**figure 2.** IGBT

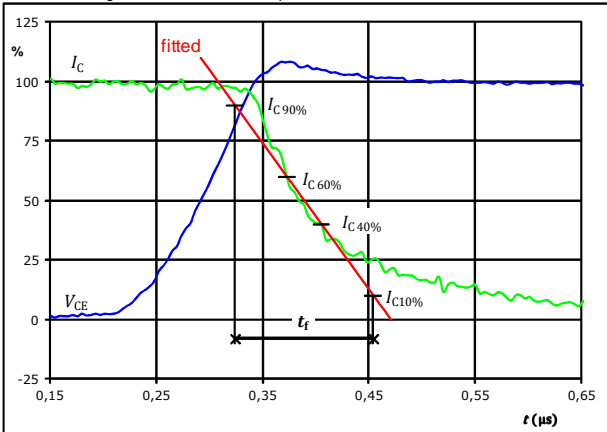
Turn-on Switching Waveforms & definition of  $t_{don}$ ,  $t_{Eon}$  ( $t_{Eon}$  = integrating time for  $E_{on}$ )



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	600	V
$I_C(100\%) =$	50	A
$t_{don} =$	0,176	$\mu s$
$t_{Eon} =$	0,561	$\mu s$

**figure 3.** IGBT

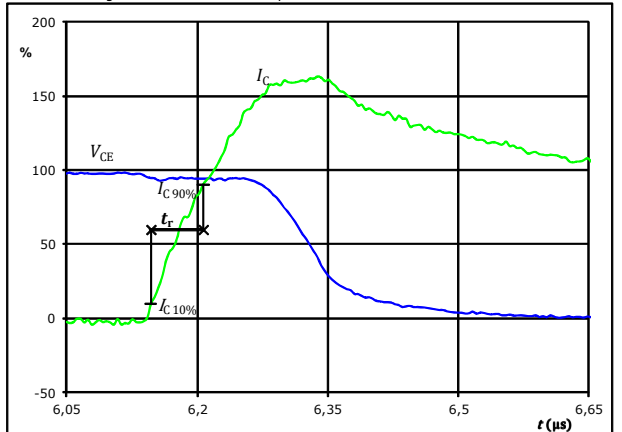
Turn-off Switching Waveforms & definition of  $t_f$



$V_C(100\%) =$	600	V
$I_C(100\%) =$	50	A
$t_f =$	0,125	$\mu s$

**figure 4.** IGBT

Turn-on Switching Waveforms & definition of  $t_r$



$V_C(100\%) =$	600	V
$I_C(100\%) =$	50	A
$t_r =$	0,058	$\mu s$

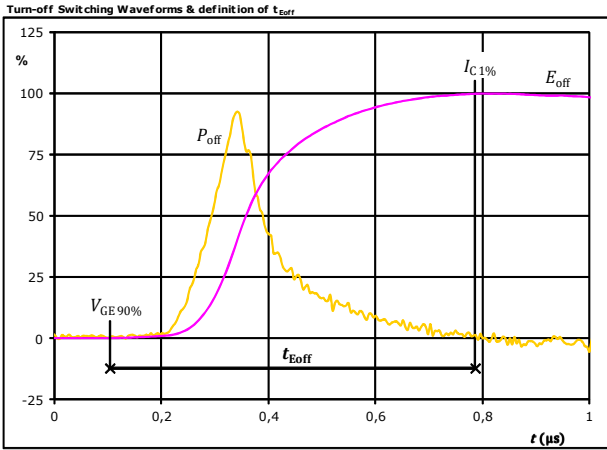


Vincotech

**30-F212PMA050M7-L888A79**  
**30-P212PMA050M7-L888A79Y**  
 datasheet

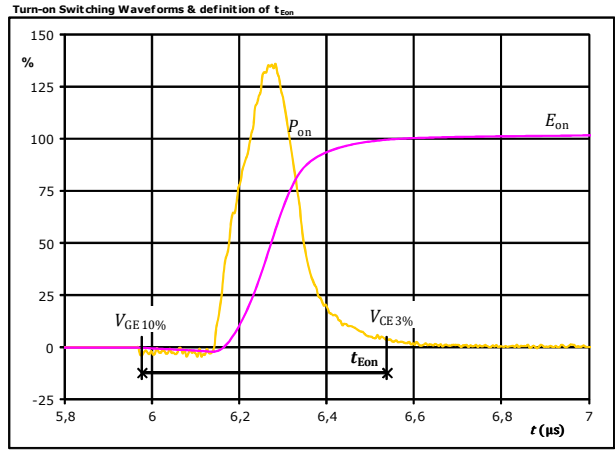
## Inverter Switching Characteristics

figure 5. IGBT



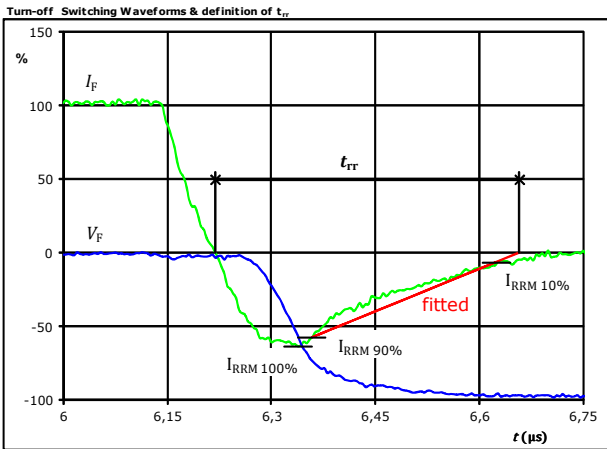
$P_{off}(100\%) = 30$  kW  
 $E_{off}(100\%) = 4,25$  mJ  
 $t_{Eoff} = 0,68$  μs

figure 6. IGBT



$P_{on}(100\%) = 30$  kW  
 $E_{on}(100\%) = 6,38$  mJ  
 $t_{Eon} = 0,56$  μs

figure 7. FWD

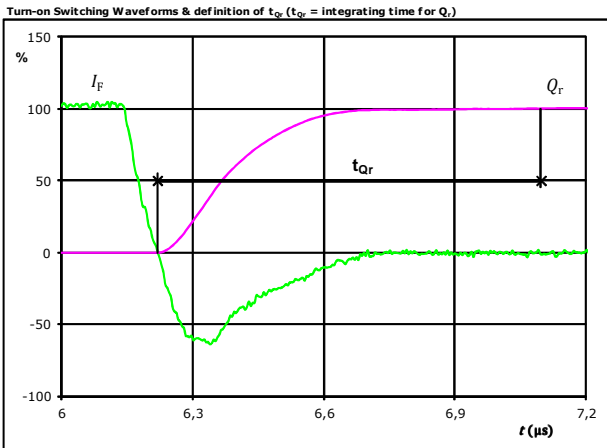


$V_F(100\%) = 600$  V  
 $I_F(100\%) = 50$  A  
 $I_{RRM}(100\%) = -33$  A  
 $t_{rr} = 0,435$  μs



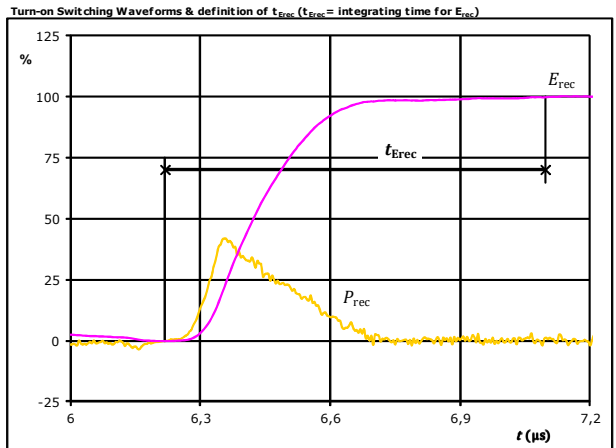
## Inverter Switching Characteristics

**figure 8.** FWD



$I_F$ (100%) =	50	A
$Q_r$ (100%) =	7,08	$\mu\text{C}$
$t_{Qr}$ =	0,88	$\mu\text{s}$

**figure 9.** FWD



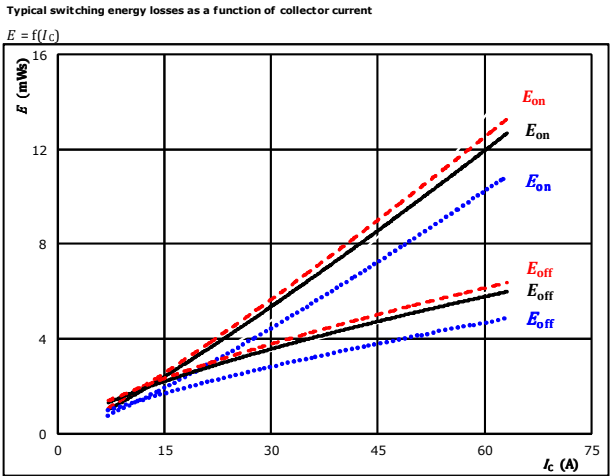
$P_{rec}$ (100%) =	30,00	kW
$E_{rec}$ (100%) =	2,59	mJ
$t_{Erec}$ =	0,88	$\mu\text{s}$





## Brake Switching Characteristics

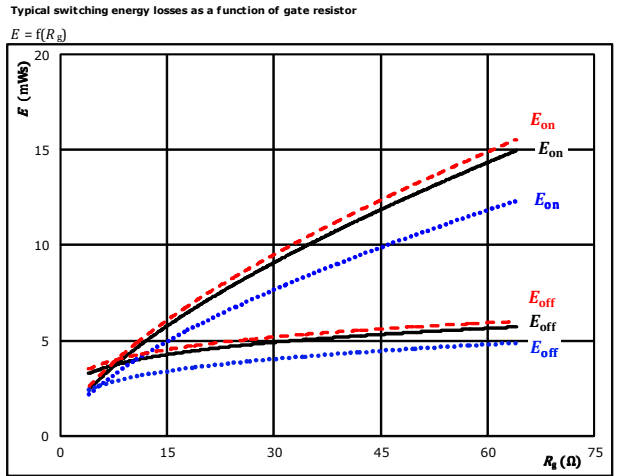
**figure 1.** IGBT



With an inductive load at

$V_{CE} = 700$ V	$T_j: 25$ °C	.....
$V_{GE} = 15/0$ V	$125$ °C	————
$R_{gon} = 16$ Ω	$150$ °C	-----
$R_{goff} = 16$ Ω		

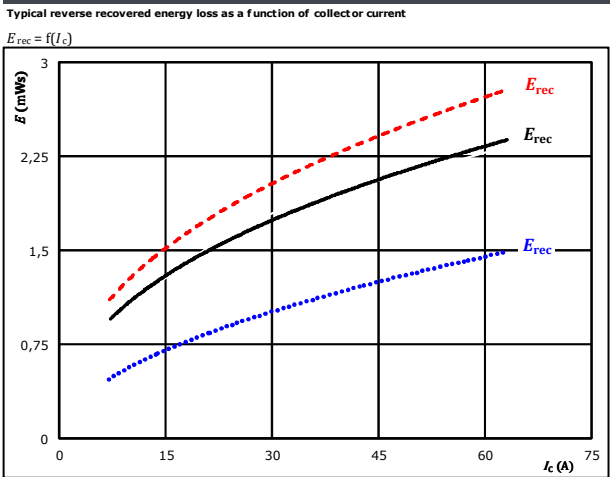
**figure 2.** IGBT



With an inductive load at

$V_{CE} = 700$ V	$T_j: 25$ °C	.....
$V_{GE} = 15/0$ V	$125$ °C	————
$I_c = 35$ A	$150$ °C	-----

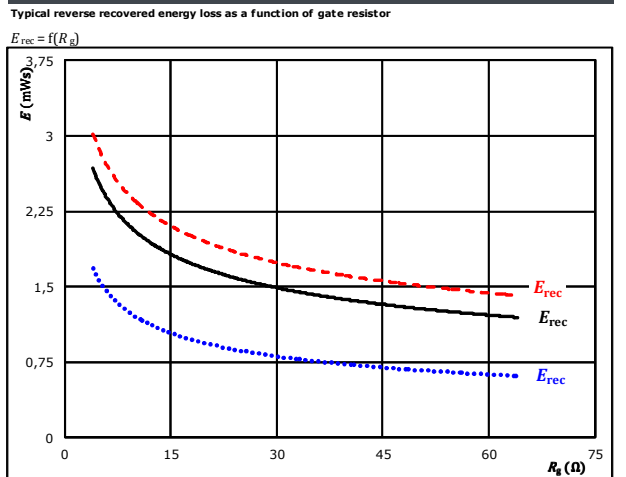
**figure 3.** FWD



With an inductive load at

$V_{CE} = 700$ V	$T_j: 25$ °C	.....
$V_{GE} = 15/0$ V	$125$ °C	————
$R_{gon} = 16$ Ω	$150$ °C	-----

**figure 4.** FWD



With an inductive load at

$V_{CE} = 700$ V	$T_j: 25$ °C	.....
$V_{GE} = 15/0$ V	$125$ °C	————
$I_c = 35$ A	$150$ °C	-----

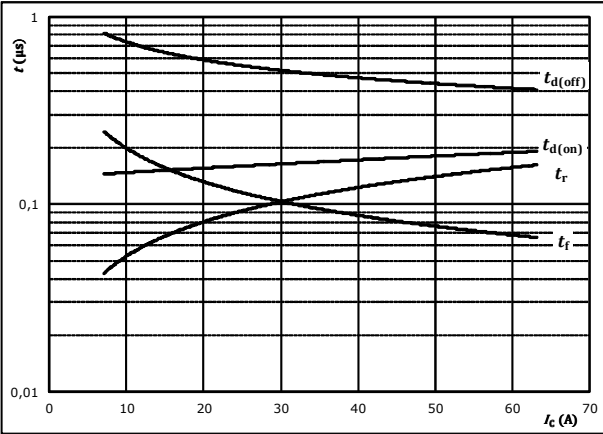


## Brake Switching Characteristics

**figure 5.** IGBT

Typical switching times as a function of collector current

$$t = f(I_c)$$



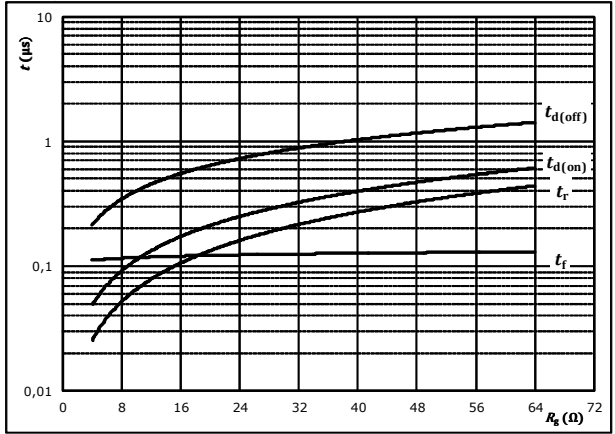
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	700	V
$V_{GE} =$	15/0	V
$R_{gon} =$	16	Ω
$R_{goff} =$	16	Ω

**figure 6.** IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



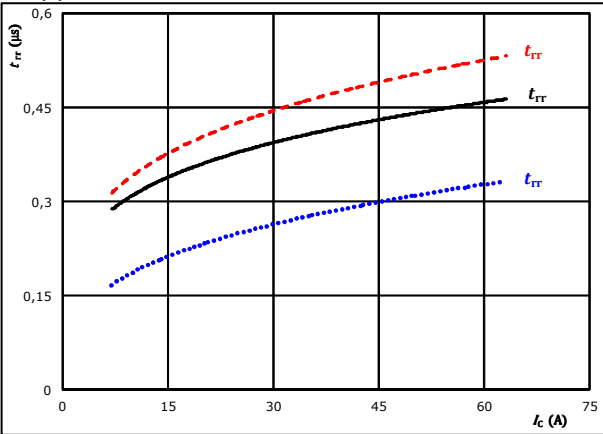
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	700	V
$V_{GE} =$	15/0	V
$I_c =$	35	A

**figure 7.** FWD

Typical reverse recovery time as a function of collector current

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

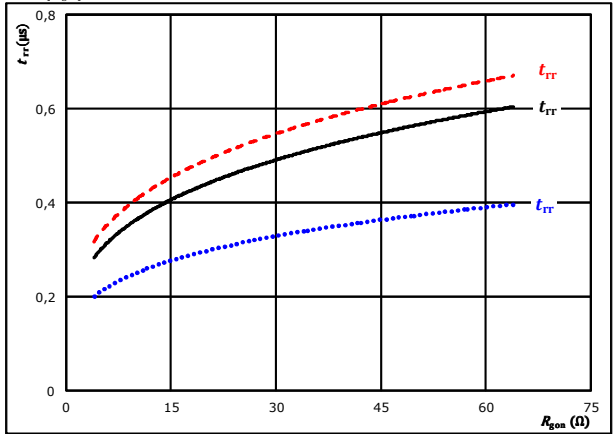


At	$V_{CE} =$	700	V	$T_j:$	25 °C	.....
	$V_{GE} =$	15/0	V		125 °C	————
	$R_{gon} =$	16	Ω		150 °C	- - - -

**figure 8.** FWD

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

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



At	$V_{CE} =$	700	V	$T_j:$	25 °C	.....
	$V_{GE} =$	15/0	V		125 °C	————
	$I_c =$	35	A		150 °C	- - - -

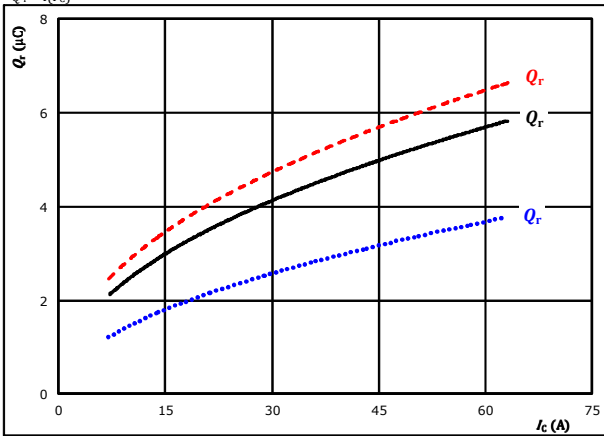


## Brake Switching Characteristics

**figure 9.** FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

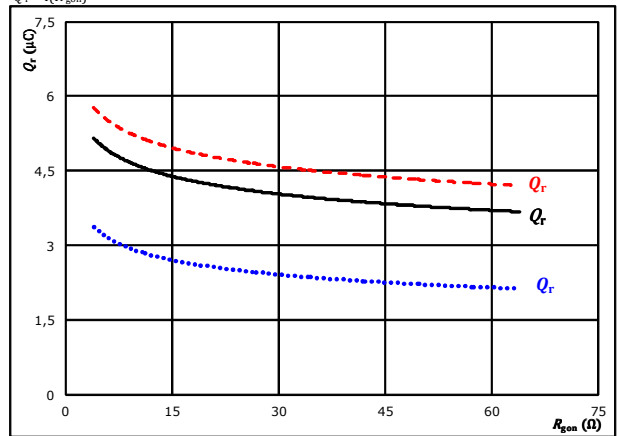


At  $V_{CE} = 700$  V  $T_j = 25$  °C .....  
 $V_{GE} = 15/0$  V  $T_j = 125$  °C ———  
 $R_{gpn} = 16$  Ω  $T_j = 150$  °C - - - - -

**figure 10.** FWD

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

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

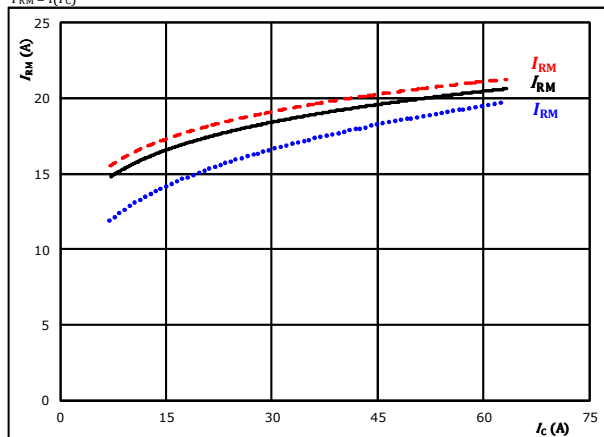


At  $V_{CE} = 700$  V  $T_j = 25$  °C .....  
 $V_{GE} = 15/0$  V  $T_j = 125$  °C ———  
 $I_c = 35$  A  $T_j = 150$  °C - - - - -

**figure 11.** FWD

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

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

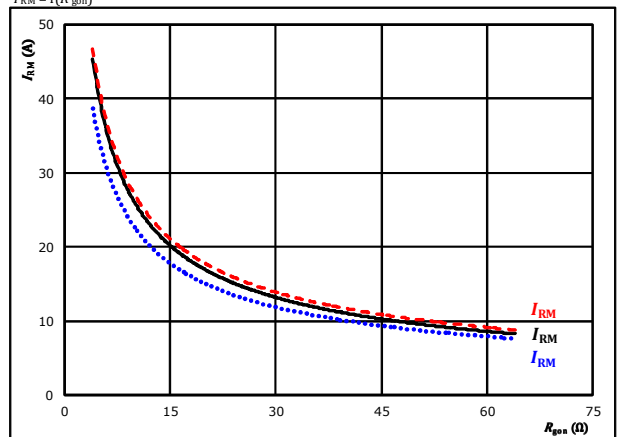


At  $V_{CE} = 700$  V  $T_j = 25$  °C .....  
 $V_{GE} = 15/0$  V  $T_j = 125$  °C ———  
 $R_{gpn} = 16$  Ω  $T_j = 150$  °C - - - - -

**figure 12.** FWD

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

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



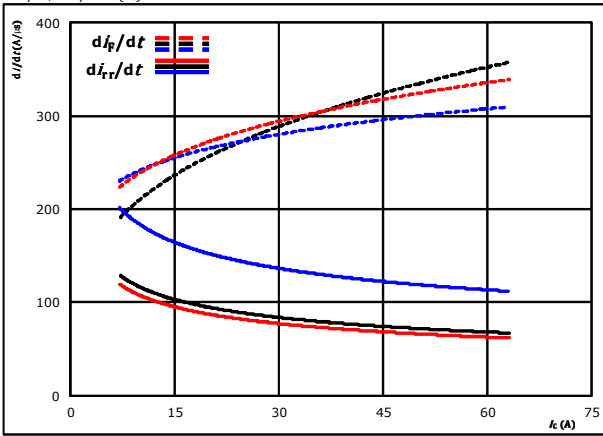
At  $V_{CE} = 700$  V  $T_j = 25$  °C .....  
 $V_{GE} = 15/0$  V  $T_j = 125$  °C ———  
 $I_c = 35$  A  $T_j = 150$  °C - - - - -



## Brake Switching Characteristics

**figure 13.** FWD

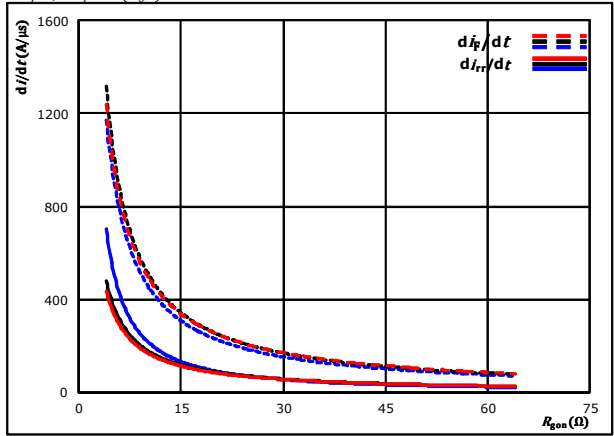
Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_f/dt, di_{rr}/dt = f(I_c)$



At  $V_{CE} = 700$  V  $T_j = 25$  °C .....  
 $V_{GE} = 15/0$  V  $T_j = 125$  °C ———  
 $R_{gpn} = 16$  Ω  $T_j = 150$  °C - - - - -

**figure 14.** FWD

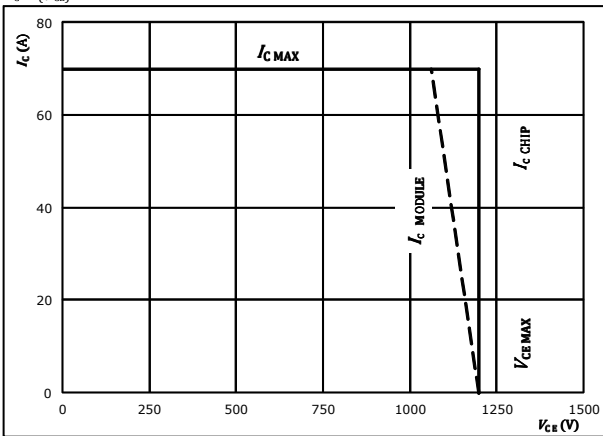
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor  
 $di_f/dt, di_{rr}/dt = f(R_{gpn})$



At  $V_{CE} = 700$  V  $T_j = 25$  °C .....  
 $V_{GE} = 15/0$  V  $T_j = 125$  °C ———  
 $I_c = 35$  A  $T_j = 150$  °C - - - - -

**figure 15.** IGBT

Reverse bias safe operating area  
 $I_c = f(V_{CE})$



At  $T_j = 175$  °C  
 $R_{gpn} = 16$  Ω  
 $R_{goff} = 16$  Ω



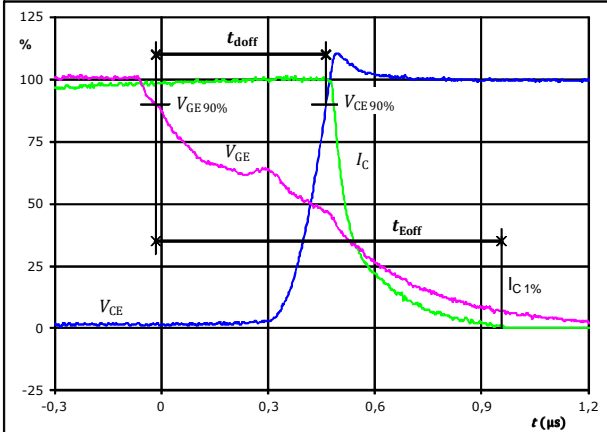
## Brake Switching Definitions

**General conditions**

$T_j$	=	125 °C
$R_{gon}$	=	16 $\Omega$
$R_{goff}$	=	16 $\Omega$

**figure 1.** IGBT

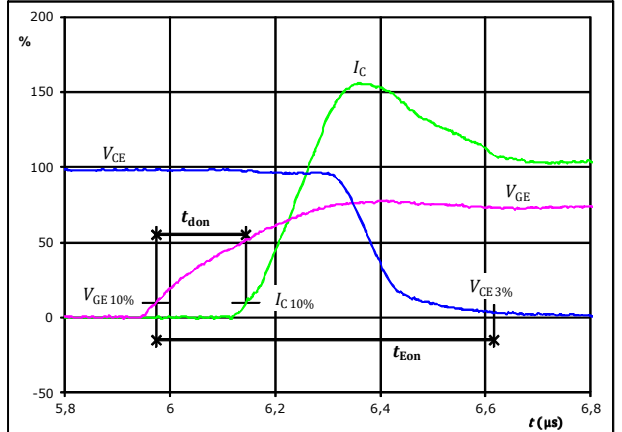
Turn-off Switching Waveforms & definition of  $t_{doff}$ ,  $t_{Eoff}$  ( $t_{Eoff}$  = integrating time for  $E_{off}$ )



$V_{CE}(0\%) =$	0	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	700	V
$I_C(100\%) =$	35	A
$t_{doff} =$	0,485	$\mu s$
$t_{Eoff} =$	0,973	$\mu s$

**figure 2.** IGBT

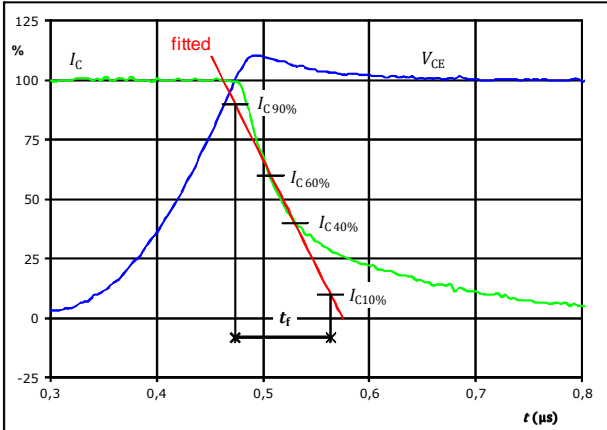
Turn-on Switching Waveforms & definition of  $t_{don}$ ,  $t_{Eon}$  ( $t_{Eon}$  = integrating time for  $E_{on}$ )



$V_{CE}(0\%) =$	0	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	700	V
$I_C(100\%) =$	35	A
$t_{don} =$	0,172	$\mu s$
$t_{Eon} =$	0,642	$\mu s$

**figure 3.** IGBT

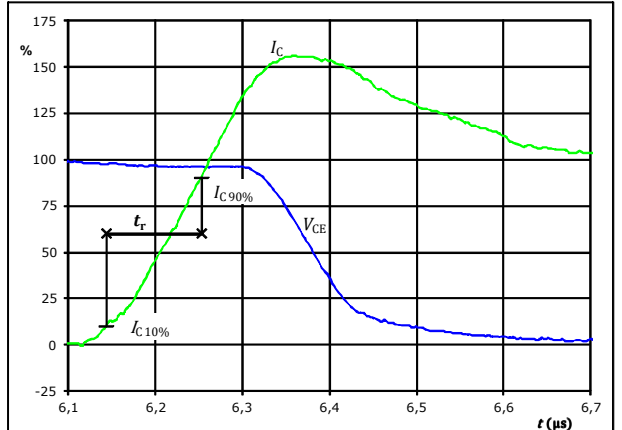
Turn-off Switching Waveforms & definition of  $t_f$



$V_C(100\%) =$	700	V
$I_C(100\%) =$	35	A
$t_f =$	0,100	$\mu s$

**figure 4.** IGBT

Turn-on Switching Waveforms & definition of  $t_r$



$V_C(100\%) =$	700	V
$I_C(100\%) =$	35	A
$t_r =$	0,109	$\mu s$

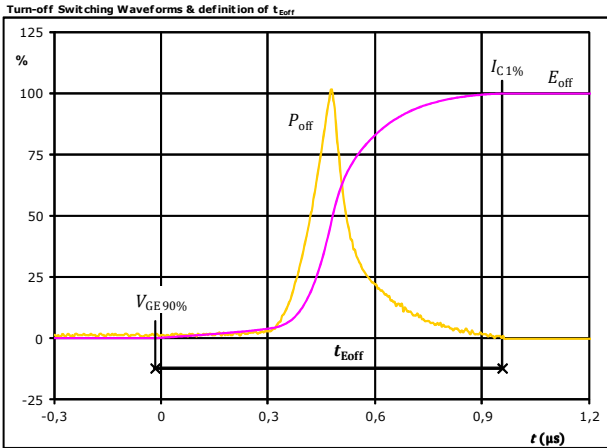


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**30-F212PMA050M7-L888A79**  
**30-P212PMA050M7-L888A79Y**  
 datasheet

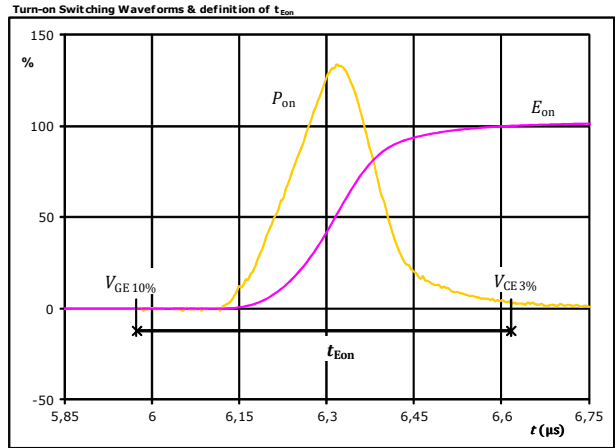
## Brake Switching Characteristics

figure 5. IGBT



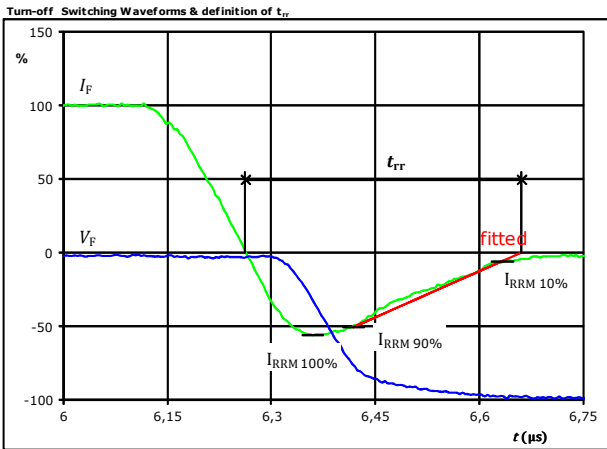
$P_{\text{off}}(100\%) = 24,56$  kW  
 $E_{\text{off}}(100\%) = 3,88$  mJ  
 $t_{\text{Eoff}} = 0,97$  µs

figure 6. IGBT



$P_{\text{on}}(100\%) = 24,56$  kW  
 $E_{\text{on}}(100\%) = 5,85$  mJ  
 $t_{\text{Eon}} = 0,64$  µs

figure 7. FWD

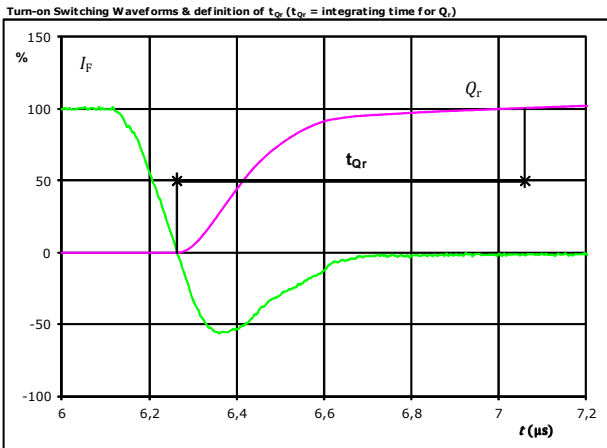


$V_F(100\%) = 700$  V  
 $I_F(100\%) = 35$  A  
 $I_{\text{RRM}}(100\%) = -20$  A  
 $t_{\text{rr}} = 0,397$  µs



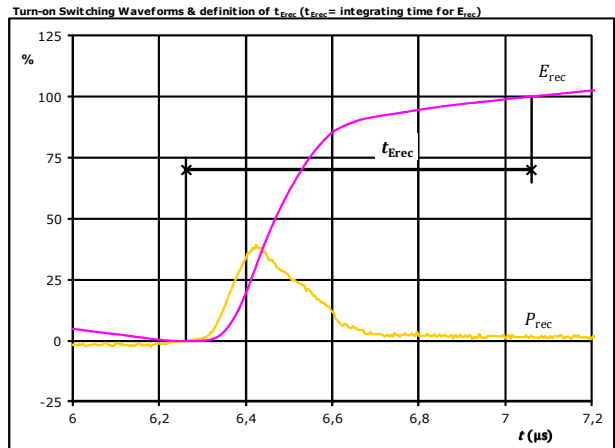
## Brake Switching Characteristics

**figure 8.** FWD



$I_F$ (100%) =	35	A
$Q_r$ (100%) =	4,53	$\mu\text{C}$
$t_{Qr}$ =	0,80	$\mu\text{s}$

**figure 9.** FWD



$P_{rec}$ (100%) =	24,56	kW
$E_{rec}$ (100%) =	1,92	mJ
$t_{Erec}$ =	0,80	$\mu\text{s}$



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datasheet

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Ordering Code & Marking						
Version			Ordering Code			
without thermal paste 17 mm housing with solder pins			30-F212PMA050M7-L888A79			
with thermal paste 17 mm housing with solder pins			30-F212PMA050M7-L888A79-/3/			
without thermal paste 17 mm housing with press-fit pins			30-P212PMA050M7-L888A79Y			
with thermal paste 17 mm housing with press-fit pins			30-P212PMA050M7-L888A79Y-/3/			
	Text	Name	Date code	UL & VIN	Lot	Serial
		NN-NNNNNNNNNNNNNN-TTTTITTV		WWYY	UL VIN	LLLLL
	Datamatrix	Type&Ver	Lot number	Serial	Date code	
TTTTITTV		LLLLL	SSSS	WWYY		

Outline							
Pin table							
Pin	X	Y	Function	Pin	X	Y	Function
1	71,2	0	DC-Rect	52	71,2	20,2	ACIn3
2	68,7	0	DC-Rect	53	71,2	12,8	Br
3	66,2	0	DC-Rect	54	68,7	12,8	Br
4	63,7	0	DC-Rect	55	71,2	5,6	G27
5	55,95	0	DC+Rect	56	71,2	2,8	DC-Br
6	53,45	0	DC+Rect	52	71,2	20,2	ACIn3
7	55,95	2,8	DC+Rect	53	71,2	12,8	Br
8	53,45	2,8	DC+Rect	54	68,7	12,8	Br
9	48,4	0	DC+Inv1	55	71,2	5,6	G27
10	45,9	0	DC+Inv1	56	71,2	2,8	DC-Br
11	38,9	0	S11				
12	36,1	0	DC-1				
13	38,9	2,8	G11				
14	36,1	2,8	DC-1				
15	31,3	0	DC-2				
16	28,5	0	S13				
17	31,3	2,8	DC-2				
18	28,5	2,8	G13				
19	19,3	0	Therm2				
20	19,3	2,8	Therm1				
21	12,3	0	DC+Inv2				
22	9,8	0	DC+Inv2				
23	12,3	2,8	DC+Inv2				
24	9,8	2,8	DC+Inv2				
25	2,8	0	S15				
26	0	0	DC-3				
27	2,8	2,8	G15				
28	0	2,8	DC-3				
29	0	37,2	Ph3				
30	2,5	37,2	Ph3				
31	5	37,2	Ph3				
32	7,8	37,2	S16				
33	10,6	37,2	G16				
34	18,45	37,2	G14				
35	21,25	37,2	S14				
36	24,05	37,2	Ph2				
37	26,55	37,2	Ph2				
38	29,05	37,2	Ph2				
39	36,1	37,2	Ph1				
40	38,6	37,2	Ph1				
41	41,1	37,2	Ph1				
42	43,9	37,2	S12				
43	46,7	37,2	G12				
44	53,7	37,2	ACIn1				
45	56,2	37,2	ACIn1				
46	58,7	37,2	ACIn1				
47	71,2	37,2	ACIn2				
48	71,2	34,7	ACIn2				
49	71,2	32,2	ACIn2				
50	71,2	25,2	ACIn3				
51	71,2	22,7	ACIn3				

**Solder pins**

**Press-fit pins**

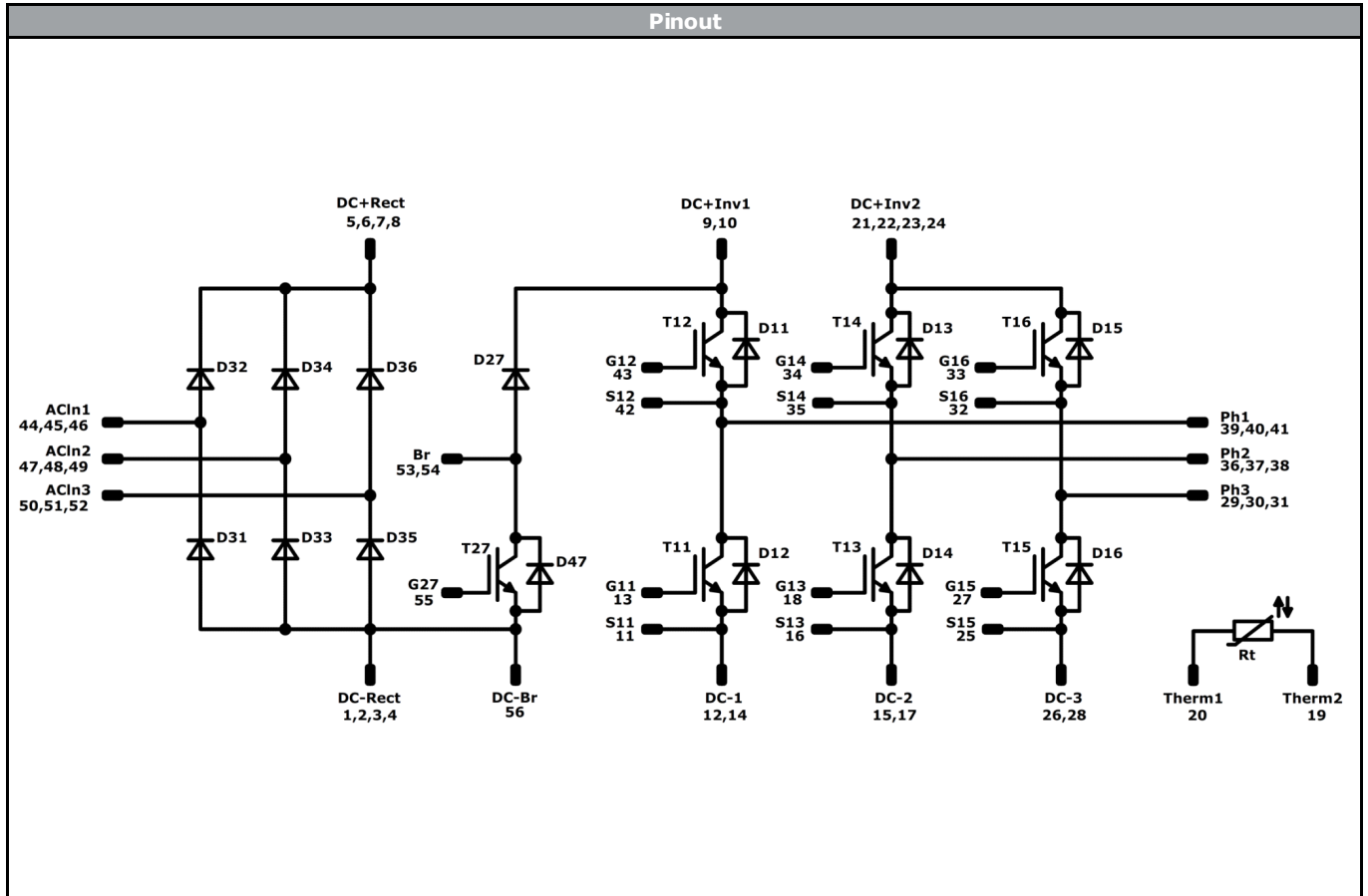
**Top View**

Tolerance of pinpositions: ±0.5mm at the end of pins  
Dimension of coordinate axis is only offset without tolerance





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<b>Identification</b>					
<b>ID</b>	<b>Component</b>	<b>Voltage</b>	<b>Current</b>	<b>Function</b>	<b>Comment</b>
D31, D32, D33, D34, D35, D36	Rectifier	1200 V	50 A	Rectifier Diode	
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	35 A	Brake Switch	
D27	FWD	1200 V	25 A	Brake Diode	
D47	Diode	1200 V	5 A	Brake Sw. Protection Diode	
Rt	NTC			Thermistor	




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Packaging instruction			
Standard packaging quantity (SPQ) 36	>SPQ	Standard	<SPQ Sample

Handling instruction
Handling instructions for <i>flow 2</i> packages see vincotech.com website.

Package data
Package data for <i>flow 2</i> 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
30-x212PMA050M7-L888A79x-D1-14	15 Dec. 2017		

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.