



Vincotech

# 30-F2166BA150RW-L267G09 datasheet

flowCON 2

1600 V / 150 A

## Features

- High Efficiency input rectifier
- Brake
- Complementary to flowPACK2

## Target applications

- Charging Stations
- Industrial Drives
- UPS
- Welding & Cutting

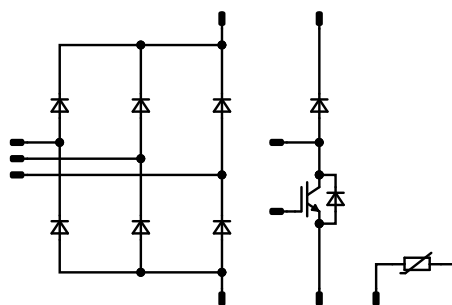
## Types

- 30-F2166BA150RW-L267G09

## flow 2 17 mm housing



## Schematic





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## Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
<b>Brake Switch</b>				
Collector-emitter voltage	$V_{CES}$		1200	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	114	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	300	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	291	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Short circuit ratings	$t_{SC}$	$V_{GE} = 15\text{ V}$ , $V_{CC} = 800\text{ V}$ $T_j = 150\text{ °C}$	10	$\mu s$
Maximum junction temperature	$T_{jmax}$		175	$^{\circ}\text{C}$

## Brake Diode

Peak repetitive reverse voltage	$V_{RRM}$		1200	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	49	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	100	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	94	W
Maximum junction temperature	$T_{jmax}$		150	$^{\circ}\text{C}$

## Brake Sw. Protection Diode

Peak repetitive reverse voltage	$V_{RRM}$		1200	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	17	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	15	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	38	W
Maximum junction temperature	$T_{jmax}$		150	$^{\circ}\text{C}$



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## Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
<b>Rectifier Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		1600	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	180	A
Surge (non-repetitive) forward current	$I_{FSM}$	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	1650	A
Surge current capability	$I^2t$		13600	A <sup>2</sup> s
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	218	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* $t_p = 2\text{ s}$	4000	V
Creepage distance			>12,7	mm
Clearance			>12,7	mm
Comparative Tracking Index	CTI		≥ 200	

\*100 % tested in production



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## 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	

### Brake Switch

#### Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0038	25	5,1	5,8	6,4	V
Collector-emitter saturation voltage	$V_{CEsat}$		15		100	25 125 150	1,53	1,94 2,23 2,31	1,97 <sup>(1)</sup>	V
Collector-emitter cut-off current	$I_{CES}$		0	1200		25			1,3	µA
Gate-emitter leakage current	$I_{GES}$		20	0		25			120	nA
Internal gate resistance	$r_g$							7,5		Ω
Input capacitance	$C_{ies}$	$f = 1 \text{ Mhz}$	0	25		25		6300		pF
Reverse transfer capacitance	$C_{res}$							270		pF
Gate charge	$Q_g$		15		0	25		800		nC

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						0,33		K/W
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#### Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 4 \Omega$ $R_{goff} = 4 \Omega$	0/15	600	100	25 125		53,6 55,2		ns
Rise time	$t_r$					25 125		34,8 37,6		ns
Turn-off delay time	$t_{d(off)}$					25 125		533,2 633,8		ns
Fall time	$t_f$					25 125		52,87 106,72		ns
Turn-on energy (per pulse)	$E_{on}$					25 125		7,14 9,51		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125		6,33 10,17		mWs



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## 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	

### Brake Diode

#### Static

Forward voltage	$V_F$				50	25 125	1,23	1,85 1,89	1,95 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_r = 1200$ V				25			27	μA

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,75		K/W
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#### Dynamic

Peak recovery current	$I_{RRM}$	$di/dt=3488$ A/μs $di/dt=2550$ A/μs	0/15	600	100	25 125		71,6 87,32		A
Reverse recovery time	$t_{rr}$					25 125		273,71 446,34		ns
Recovered charge	$Q_r$					25 125		8,75 15,44		μC
Reverse recovered energy	$E_{rec}$					25 125		3,56 6,59		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125		516,65 748,94		A/μs

### Brake Sw. Protection Diode

#### Static

Forward voltage	$V_F$				7,5	25 125	1,23	1,66 1,62	1,97 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_r = 1200$ V				25			27	μA

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,83		K/W
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## 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	

### Rectifier Diode

#### Static

Forward voltage	$V_F$				106	25 125		1,12 1,04	1,21 <sup>(1)</sup> 1,1 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_r = 1600$ V				25			100	μA

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,32		K/W
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### Thermistor

#### Static

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

<sup>(1)</sup> Value at chip level

<sup>(2)</sup> Only valid with pre-applied Vincotech thermal interface material.



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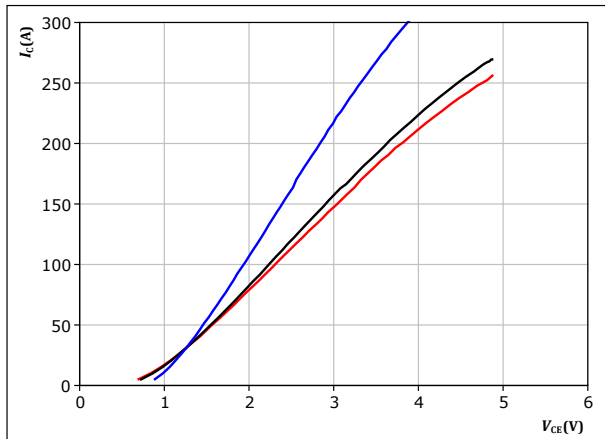
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## Brake Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

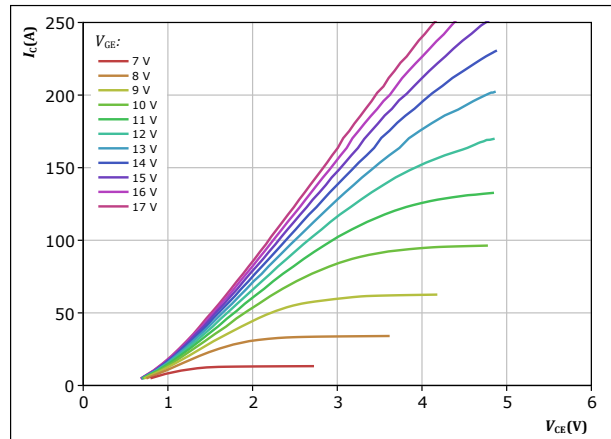


$t_p = 250 \mu s$   
 $V_{GE} = 15 V$   
 $T_j:$  25 °C, 125 °C, 150 °C

figure 2. IGBT

Typical output characteristics

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

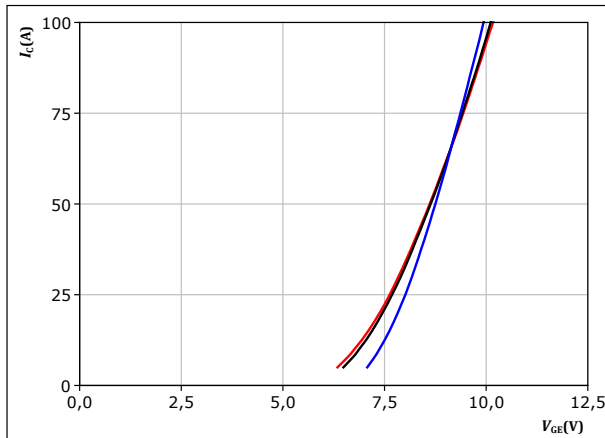


$t_p = 250 \mu s$   
 $T_j = 150 \text{ °C}$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

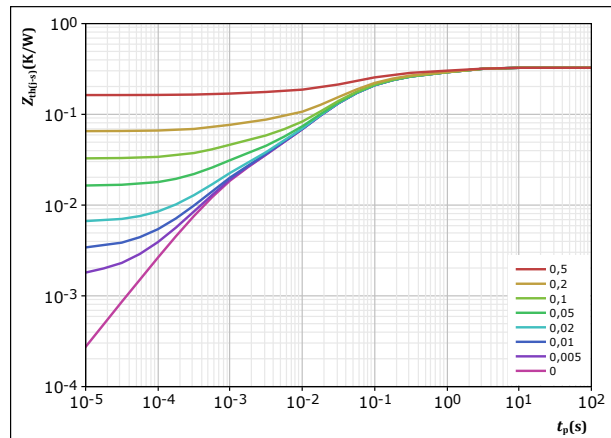


$t_p = 250 \mu s$   
 $V_{CE} = 10 V$   
 $T_j:$  25 °C, 125 °C, 150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T = 0,326 \text{ K/W}$   
IGBT thermal model values  

$R \text{ (K/W)}$	$\tau \text{ (s)}$
6,80E-02	1,50E+00
9,16E-02	1,41E-01
1,25E-01	3,64E-02
2,35E-02	1,13E-02
1,82E-02	8,50E-04



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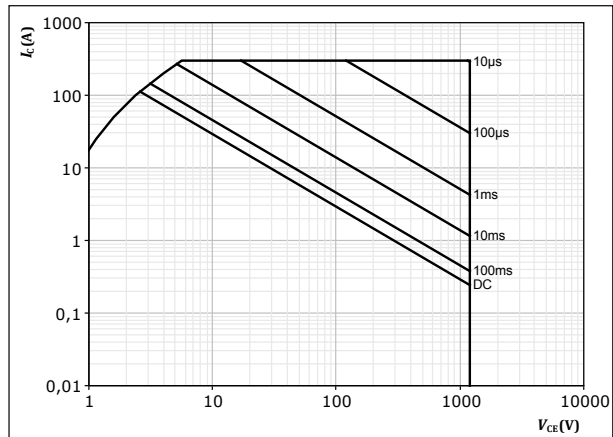
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datasheet

## Brake Switch Characteristics

**figure 5.** IGBT

Safe operating area

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



$D = \text{single pulse}$

$T_s = 80 \text{ } ^\circ\text{C}$   
 $V_{GE} = 15 \text{ V}$   
 $T_j = T_{jmax}$





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## Brake Diode Characteristics

figure 6. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

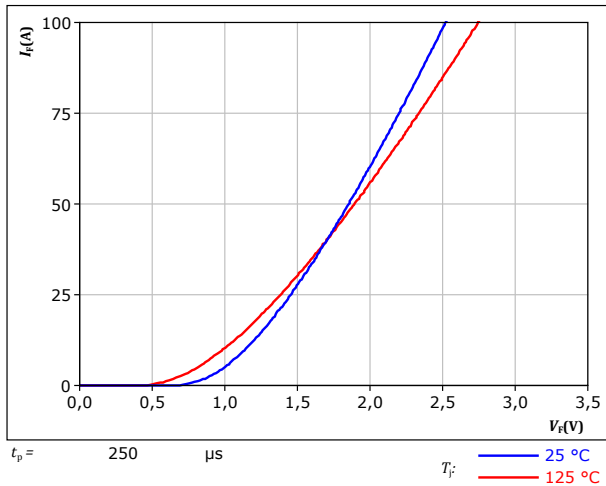
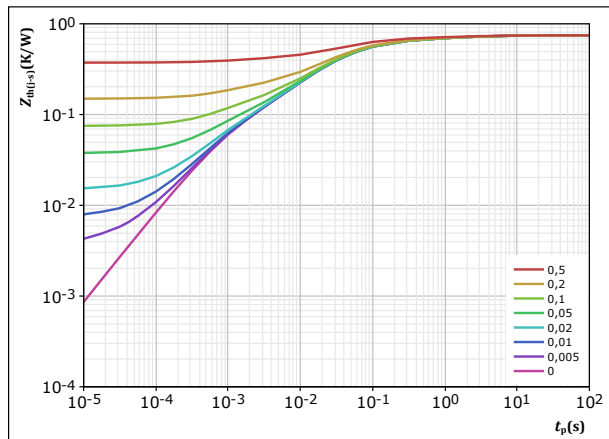


figure 7. FWD

Transient thermal impedance as a function of pulse width

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



$D =$	$t_p / T$	
$R_{th(j-s)} =$	0,746	K/W
FWD thermal model values		
$R$ (K/W)	$\tau$ (s)	
3,50E-02	5,35E+00	
7,36E-02	8,54E-01	
1,83E-01	1,14E-01	
3,18E-01	2,85E-02	
8,17E-02	7,22E-03	
5,49E-02	8,83E-04	



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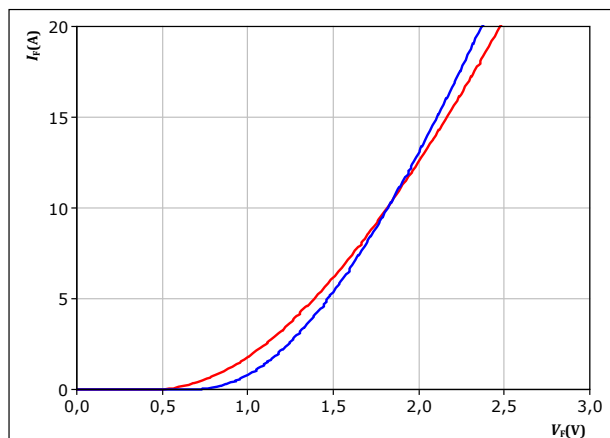
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## Brake Sw. Protection Diode Characteristics

figure 8. FWD

Typical forward characteristics

$$I_F = f(V_F)$$



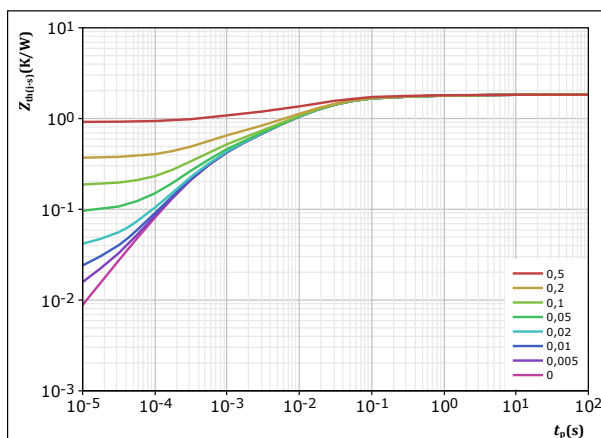
$t_p = 250 \mu s$

$T_j$ : — 25 °C  
— 125 °C

figure 9. FWD

Transient thermal impedance as a function of pulse width

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



$D =$	$t_p / T$	
$R_{th(j-s)} =$	1,833	K/W
FWD thermal model values		
$R$ (K/W)	$\tau$ (s)	
4,59E-02	4,62E+00	
1,15E-01	3,62E-01	
5,63E-01	3,63E-02	
6,02E-01	8,92E-03	
2,37E-01	1,88E-03	
2,71E-01	3,97E-04	



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## Rectifier Diode Characteristics

figure 10.

Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

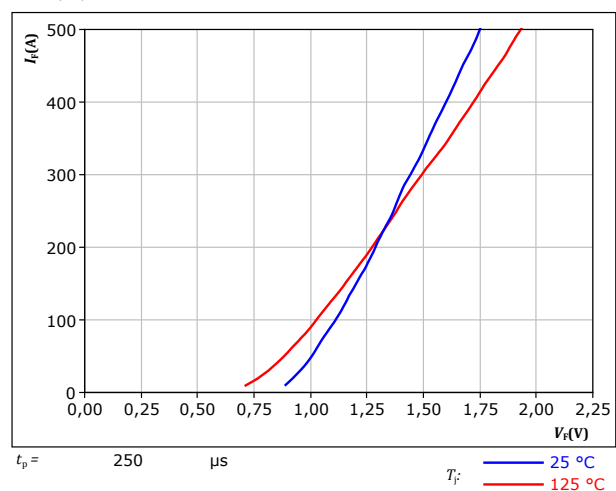
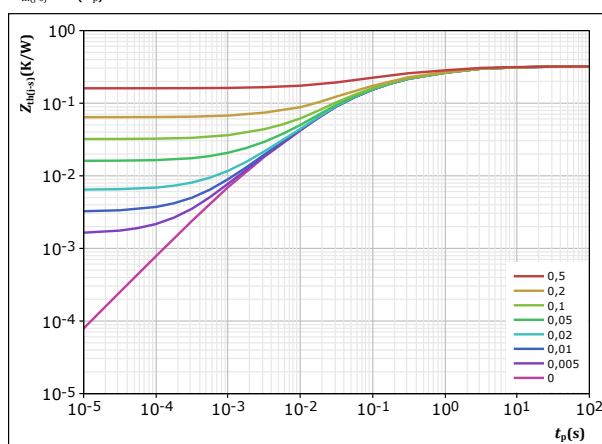


figure 11.

Rectifier

Transient thermal impedance as a function of pulse width

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



$D =$	$t_p / T$	
$R_{th(j-s)} =$	0,321	K/W
Rectifier thermal model values		
$R$ (K/W)	$\tau$ (s)	
2,12E-02	1,24E+01	
9,26E-02	1,14E+00	
1,22E-01	1,41E-01	
7,77E-02	2,51E-02	
7,59E-03	1,97E-03	



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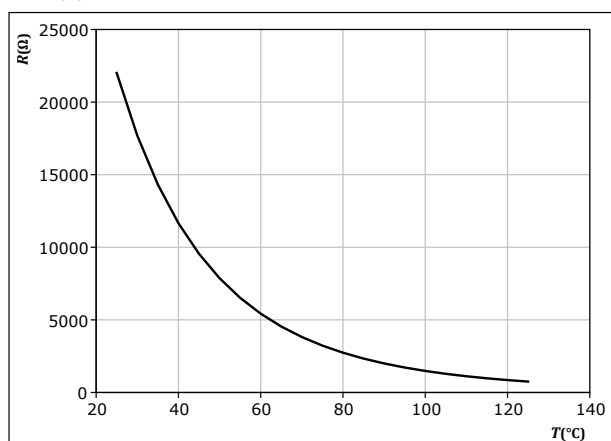
## Thermistor Characteristics

figure 12.

Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$





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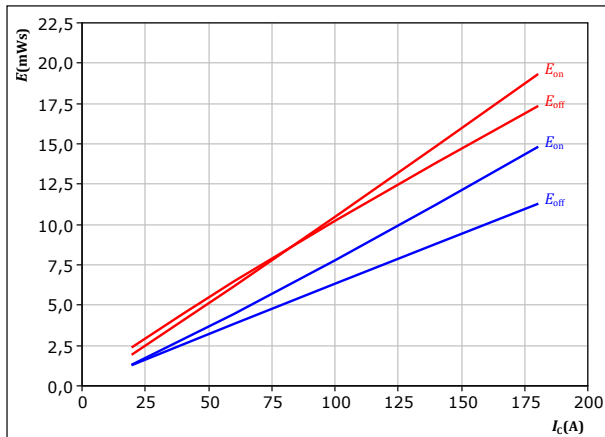
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## Brake Switching Characteristics

figure 13. IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$



With an inductive load at

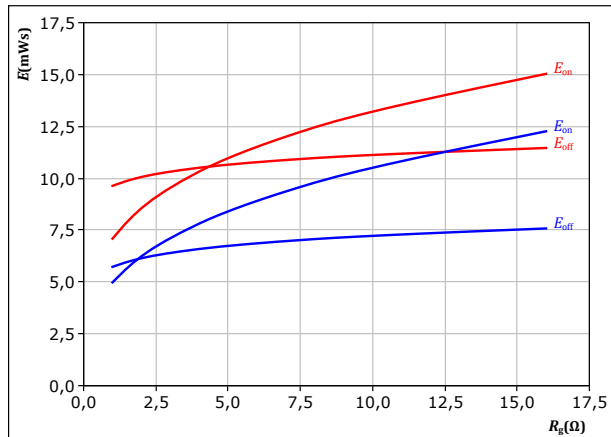
$V_{CE} = 600 \text{ V}$   
 $V_{GE} = 0/15 \text{ V}$   
 $R_{gon} = 4 \text{ } \Omega$   
 $R_{goff} = 4 \text{ } \Omega$

$T_j$ : — 25 °C  
— 125 °C

figure 14. IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$



With an inductive load at

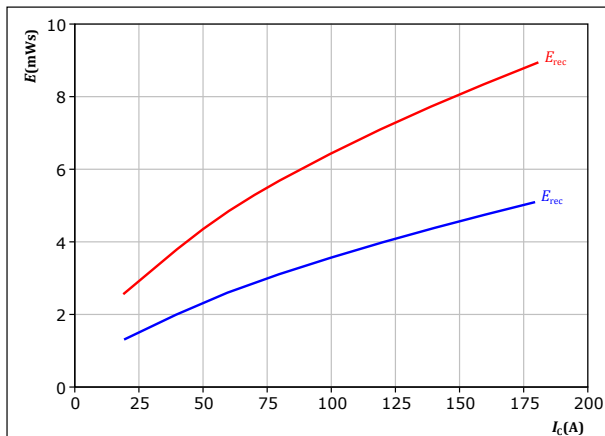
$V_{CE} = 600 \text{ V}$   
 $V_{GE} = 0/15 \text{ V}$   
 $I_C = 100 \text{ A}$

$T_j$ : — 25 °C  
— 125 °C

figure 15. FWD

Typical reverse recovered energy loss as a function of collector current

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



With an inductive load at

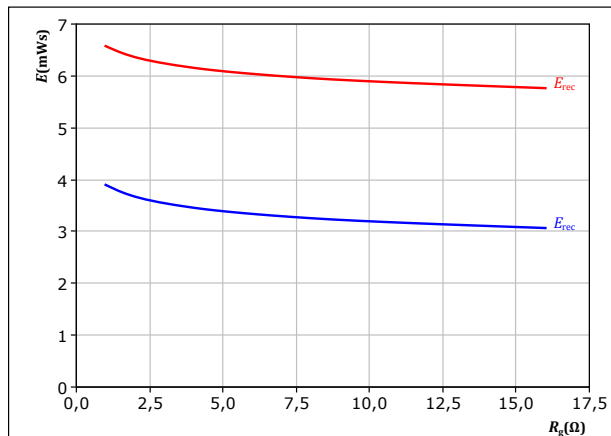
$V_{CE} = 600 \text{ V}$   
 $V_{GE} = 0/15 \text{ V}$   
 $R_{gon} = 4 \text{ } \Omega$

$T_j$ : — 25 °C  
— 125 °C

figure 16. FWD

Typical reverse recovered energy loss as a function of gate resistor

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



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = 0/15 \text{ V}$   
 $I_C = 100 \text{ A}$

$T_j$ : — 25 °C  
— 125 °C



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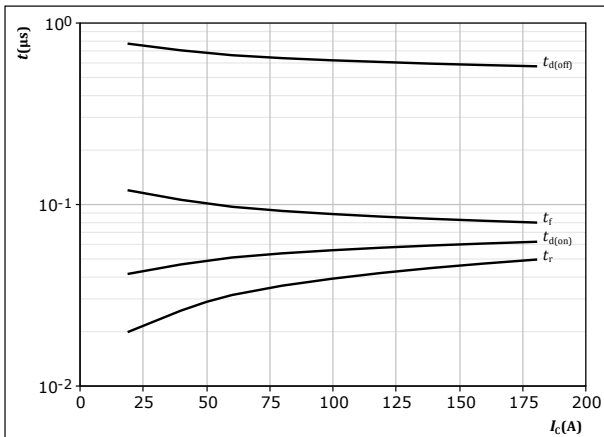
## Brake Switching Characteristics

figure 17.

IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



With an inductive load at

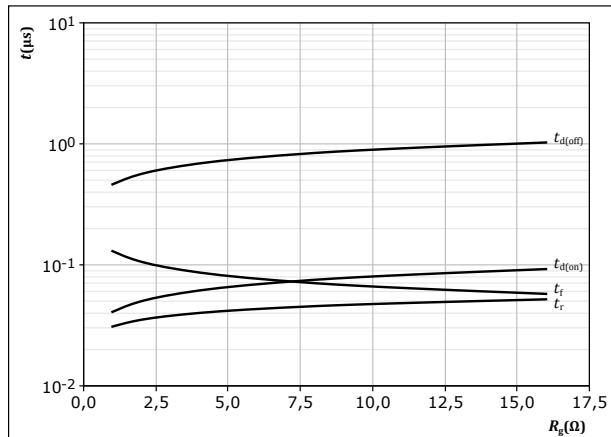
$T_j =$	125	°C
$V_{CE} =$	600	V
$V_{GE} =$	0/15	V
$R_{gon} =$	4	Ω
$R_{goff} =$	4	Ω

figure 18.

IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



With an inductive load at

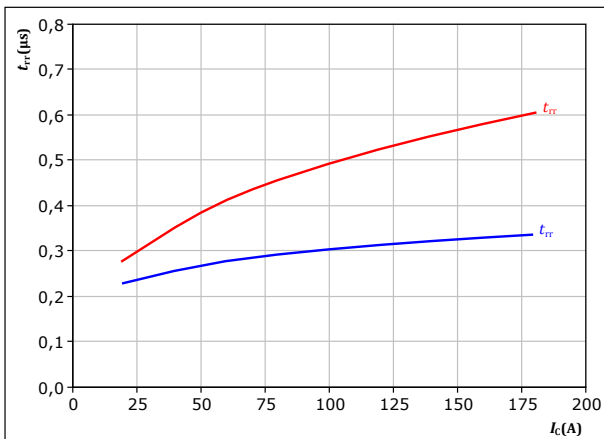
$T_j =$	125	°C
$V_{CE} =$	600	V
$V_{GE} =$	0/15	V
$I_C =$	100	A

figure 19.

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
$V_{GE} =$	0/15	V
$R_{gon} =$	4	Ω

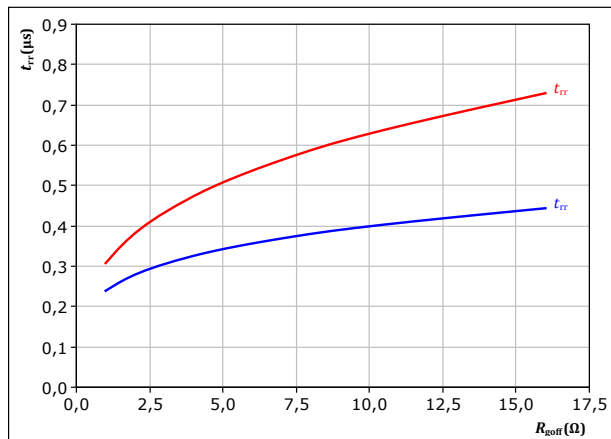
$T_j$ : — 25 °C  
— 125 °C

figure 20.

FWD

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

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



With an inductive load at

$V_{CE} =$	600	V
$V_{GE} =$	0/15	V
$I_C =$	100	A

$T_j$ : — 25 °C  
— 125 °C



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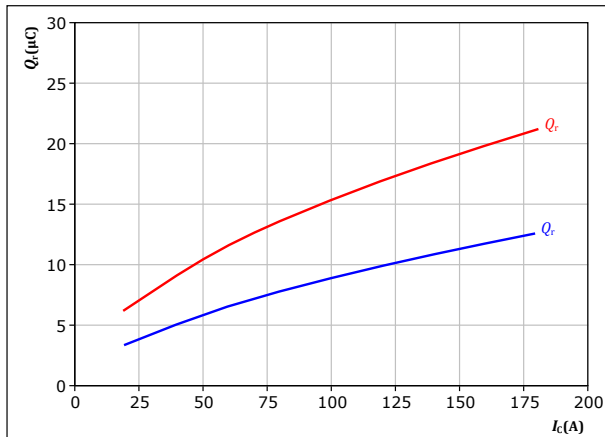
## Brake Switching Characteristics

figure 21.

FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = 0/15$  V  
 $R_{gon} = 4$  Ω

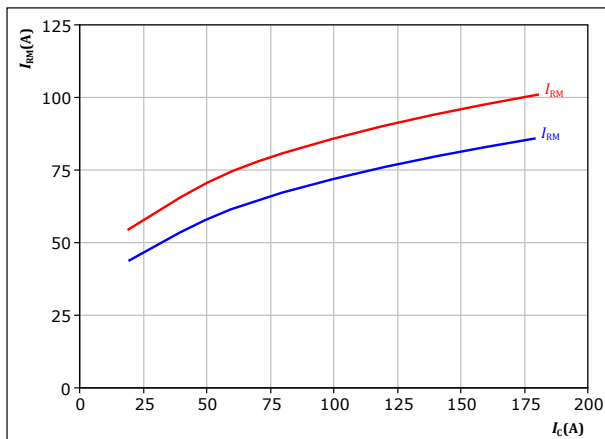
$T_j$ : — 25 °C  
— 125 °C

figure 23.

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  
 $V_{GE} = 0/15$  V  
 $R_{gon} = 4$  Ω

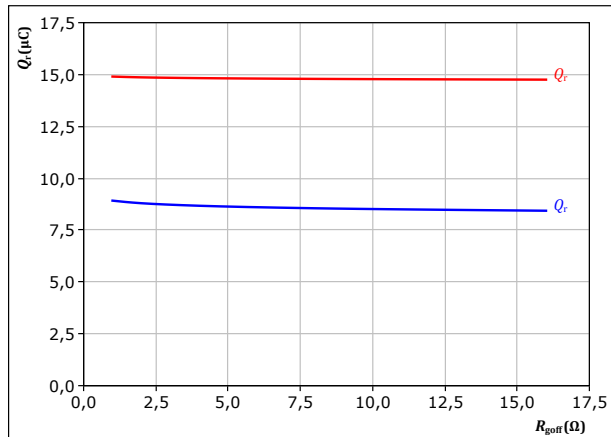
$T_j$ : — 25 °C  
— 125 °C

figure 22.

FWD

Typical recovered charge as a function of turn off gate resistor

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



With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = 0/15$  V  
 $I_c = 100$  A

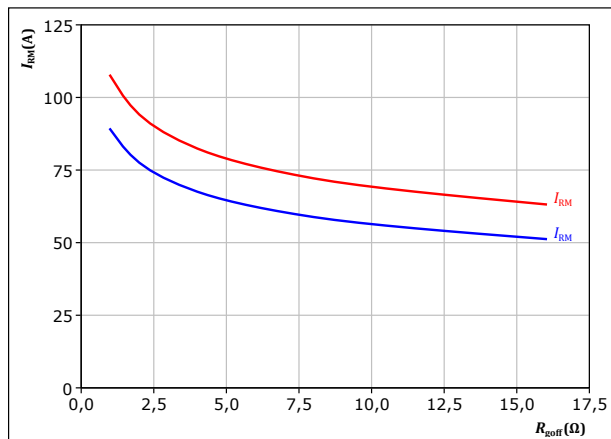
$T_j$ : — 25 °C  
— 125 °C

figure 24.

FWD

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

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



With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = 0/15$  V  
 $I_c = 100$  A

$T_j$ : — 25 °C  
— 125 °C



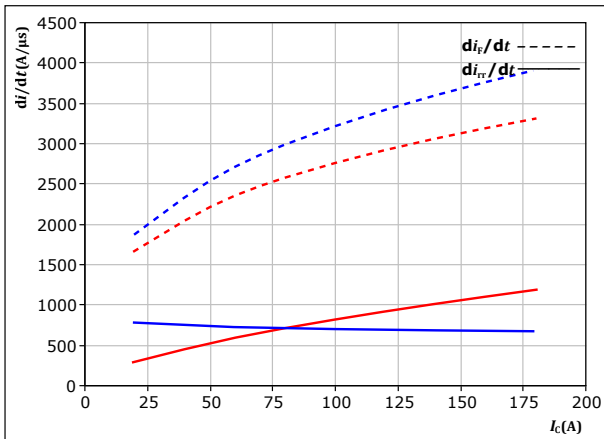
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## Brake Switching Characteristics

**figure 25.** FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_f/dt, di_r/dt = f(I_C)$



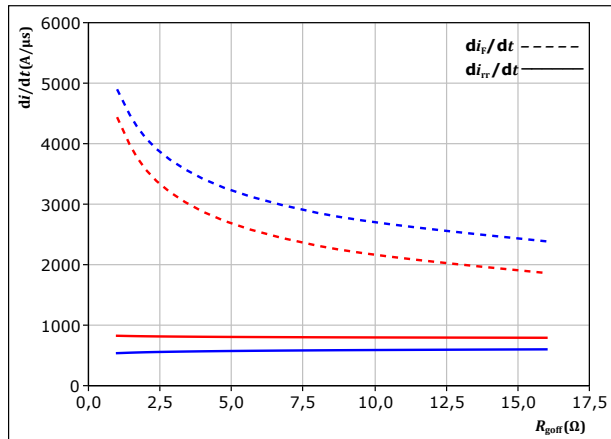
With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = 0/15$  V  
 $R_{goff} = 4$  Ω

$T_j$ : — 25 °C  
— 125 °C

**figure 26.** FWD

Typical rate of fall of forward and reverse recovery current as a function of turn off gate resistor  
 $di_f/dt, di_r/dt = f(R_{goff})$



With an inductive load at

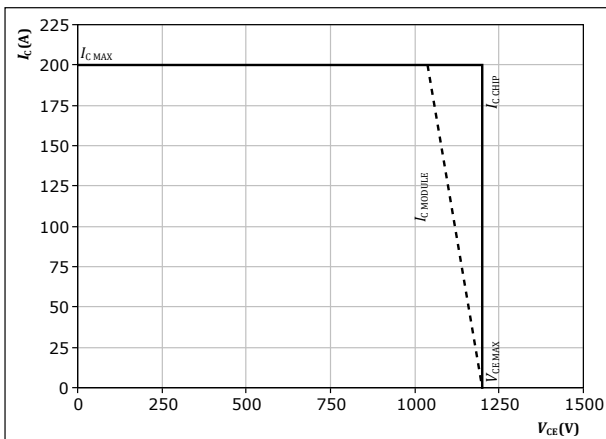
$V_{CE} = 600$  V  
 $V_{GE} = 0/15$  V  
 $I_C = 100$  A

$T_j$ : — 25 °C  
— 125 °C

**figure 27.** IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At  $T_j = 125$  °C  
 $R_{goff} = 4$  Ω  
 $R_{goff} = 4$  Ω





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## Brake Switching Definitions

figure 28. IGBT

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

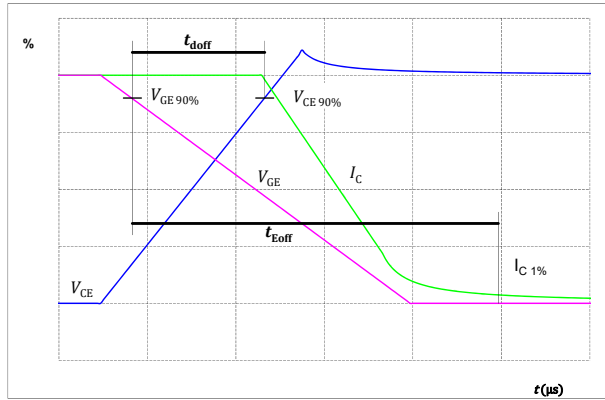


figure 29. IGBT

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

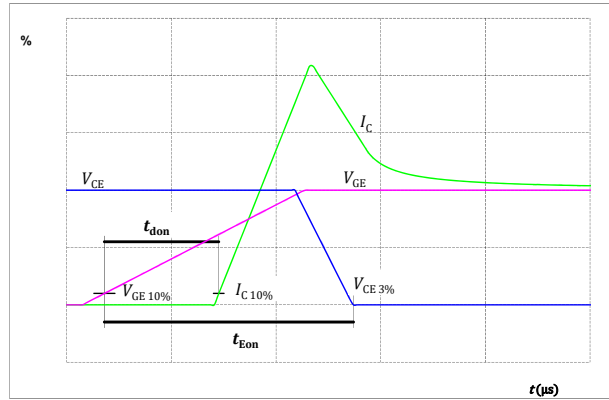


figure 30. IGBT

Turn-off Switching Waveforms & definition of  $t_f$

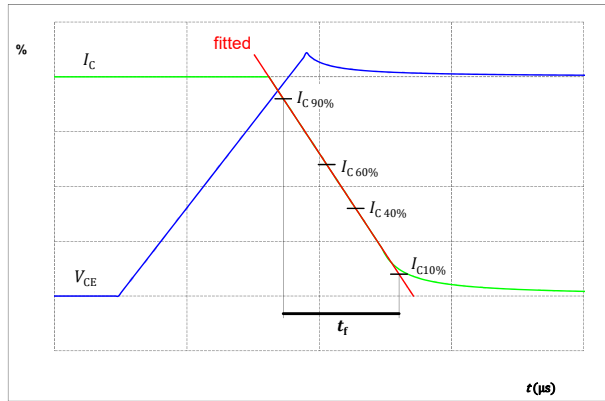
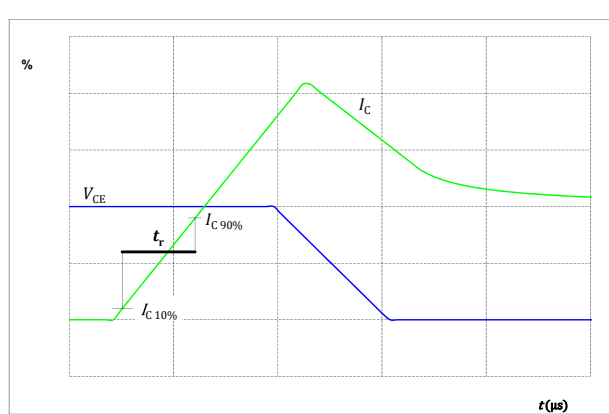


figure 31. IGBT

Turn-on Switching Waveforms & definition of  $t_r$





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## Brake Switching Definitions

figure 32.

FWD

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

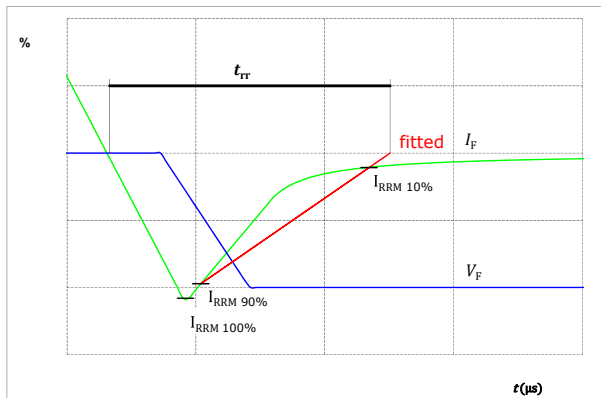
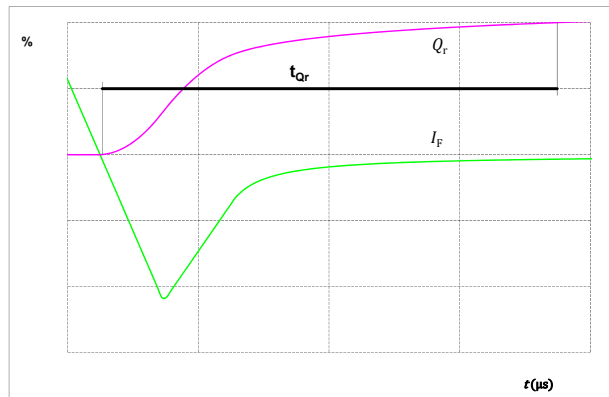


figure 33.

FWD


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





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Ordering Code	
Version	Ordering Code
Without thermal paste	30-F2166BA150RW-L267G09
With thermal paste (3,4 W/mK, PSX-P7)	30-F2166BA150RW-L267G09-/3/

Marking							
<div><div>NN-NNNNNNNNNNNNNN TTTTTUVVWVYV UL VIN LLLL SSSS</div><div></div></div>	Text	Name		Date code	UL & VIN	Lot	Serial
		NN-NNNNNNNNNNNNNN- TTTTTV		WWYV	UL VIN	LLLLL	SSSS
	Datamatrix	Type&Ver	Lot number	Serial	Date code		
		TTTTTTTV	LLLLL	SSSS	WWYV		

Outline							
Pin table [mm]							
Pin	X	Y	Function	26	9	20,1	R
1	70	0	BG	27	11,8	17,3	R
2	67	0	BS	28	11,8	20,1	R
3	49,8	0	NEG BUS	29	20,8	17,3	S
4	47	0	NEG BUS	30	20,8	20,1	S
5	47	2,8	NEG BUS	31	23,6	17,3	S
6	47	5,6	NEG BUS	32	23,6	20,1	S
7	2,8	0	NEG OUT	33	26,4	17,3	S
8	2,8	2,8	NEG OUT	34	26,4	20,1	S
9	2,8	5,6	NEG OUT	35	35,4	17,4	T
10	5,6	0	NEG OUT	36	35,4	20,2	T
11	0	0	NEG OUT	37	38,2	17,4	T
12	0	2,8	NEG OUT	38	38,2	20,2	T
13	0	5,6	NEG OUT	39	41	17,4	T
14	0	8,4	NEG OUT	40	41	20,2	T
15	0	27,6	POS OUT	41	47	30,4	POS BUS
16	0	30,4	POS OUT	42	47	33,2	POS BUS
17	0	33,2	POS OUT	43	47	36	POS BUS
18	0	36	POS OUT	44	61,6	22,85	BR
19	2,8	27,6	POS OUT	45	64,4	22,85	BR
20	2,8	30,4	POS OUT	46	67,2	22,85	BR
21	2,8	33,2	POS OUT	47	70	22,85	BR
22	2,8	36	POS OUT	48	64,2	36,55	NTC1
23	6,2	16,45	R	49	70,6	36,55	NTC2
24	6,2	19,25	R				
25	9	17,3	R				

The technical drawing consists of two parts: a side view at the top and a top view below it.

- Side View:** Shows the profile of the module. It has a base width of 200 mm. The height of the main body is 25 mm. There are several pins protruding from the top surface. A dimension of 10 mm is indicated for the distance between some of the pins.
- Top View:** Shows the rectangular footprint of the module, which is 200 mm wide and 100 mm deep. It features four mounting holes at the corners, each with a diameter of Ø 10 mm. Numerous smaller circular features represent individual pins or components, arranged in rows along the edges and in the center. A central feature is labeled with a downward arrow and the number 10.

Below the top view, there is a note: "Tolerance of positions: +0/-0.5 mm at the end of pin. Dimension of coordinate pins is only without tolerance."

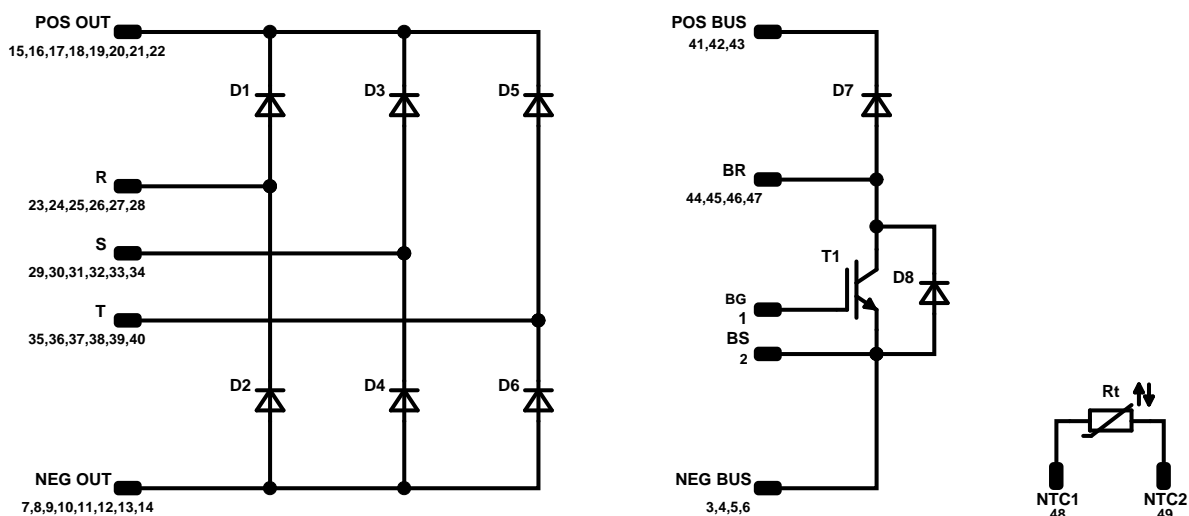


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## Pinout



## Identification

ID	Component	Voltage	Current	Function	Comment
T1	IGBT	1200 V	100 A	Brake Switch	
D7	FWD	1200 V	50 A	Brake Diode	
D8	FWD	1200 V	7,5 A	Brake Sw. Protection Diode	
D2, D1, D4, D3, D6, D5	Rectifier	1600 V	170 A	Rectifier Diode	
Rt	Thermistor			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.

Vincotech thermistor reference
See Vincotech thermistor reference table at 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-F2166BA150RW-L267G09-D5-14	28 Sep. 2021	New Datasheet format, module is unchanged Correct Characteristic Values of Brake Sw. Protection Diode	

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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.