Vincotech

30-F2166BA150RW-L267G09
datasheet

***flow*CON 2** | **1600 V / 150 A**

Features

- High Efficiency input rectifier
- Brake
- Complementary to *flow*PACK2

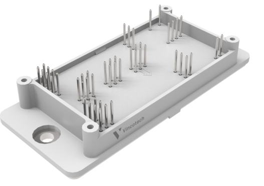
Target applications

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

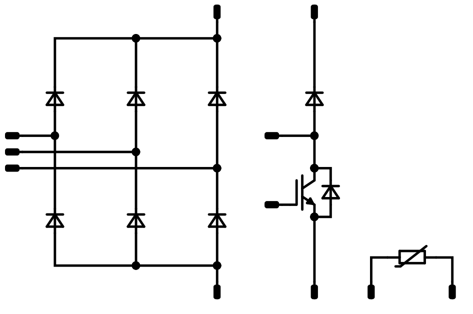
Types

- 30-F2166BA150RW-L267G09

flow 2 17 mm housing



Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Brake Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °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 °C	291	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	10	µs
Maximum junction temperature	T_{jmax}			175	°C
Brake Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °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 °C	94	W
Maximum junction temperature	T_{jmax}			150	°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 °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 °C	38	W
Maximum junction temperature	T_{jmax}			150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

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

*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
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(1)	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 Mhz	0	25		25		6300		pF
Reverse transfer capacitance	C_{res}	f = 1 Mhz	0	25		25		270		pF
Gate charge	Q_g		15		0	25		800		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,33		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	0/15	600	100	25 125		53,6 55,2		ns
Rise time	t_r	R_{gon} = 4 Ω R_{goff} = 4 Ω	0/15	600	100	25 125		34,8 37,6		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	0/15	600	100	25 125		533,2 633,8		ns
Fall time	t_f	R_{gon} = 4 Ω R_{goff} = 4 Ω	0/15	600	100	25 125		52,87 106,72		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=8,75 µC Q_{rFWD}=15,44 µC	0/15	600	100	25 125		7,14 9,51		mWs
Turn-off energy (per pulse)	E_{off}		0/15	600	100	25 125		6,33 10,17		mWs

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(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			27	μA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,75		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=3488 A/μs d*i*/d*t*=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	$(di_{rf}/dt)_{max}$					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(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			27	μA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,83		K/W

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(1) 1,1(1)	V
Reverse leakage current	I_R	V_r = 1600 V				25			100	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,32		K/W
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. ±1 %						3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %						4000		K
Vincotech Thermistor Reference									I	

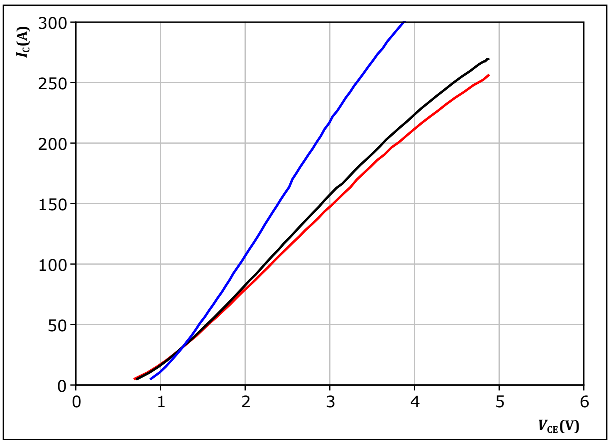
(1) Value at chip level
(2) Only valid with pre-applied Vincotech thermal interface material.

Brake Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

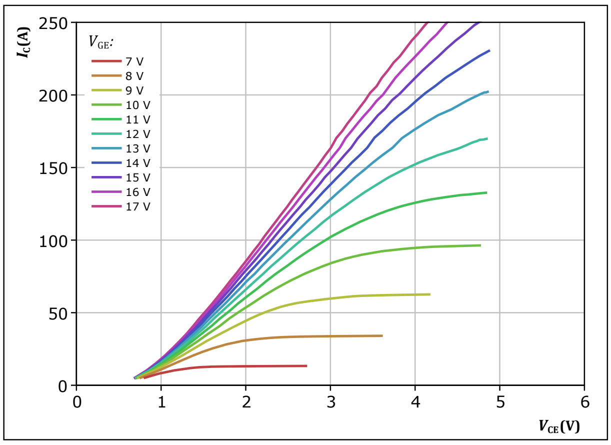


t_p = 250 µs
V_{GE} = 15 V
T_j: 25 °C, 125 °C, 150 °C

figure 2. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

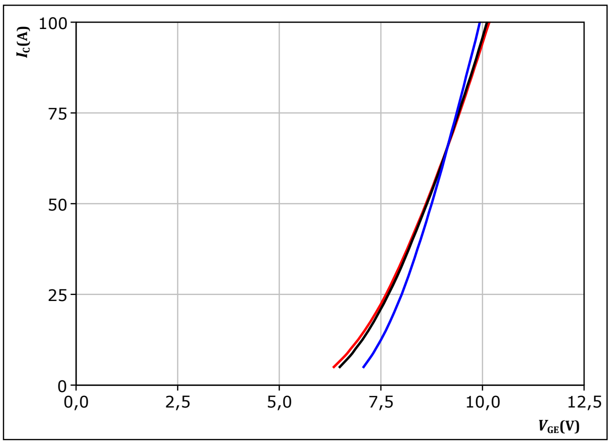


t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})

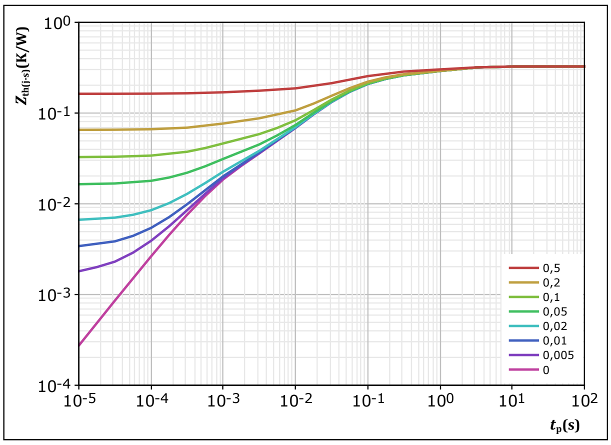


t_p = 250 µs
V_{CE} = 10 V
T_j: 25 °C, 125 °C, 150 °C

figure 4. **IGBT**

Transient thermal impedance as a function of pulse width

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



D = t_p / T
$R_{th(j-s)}$ = 0,326 K/W

IGBT thermal model values

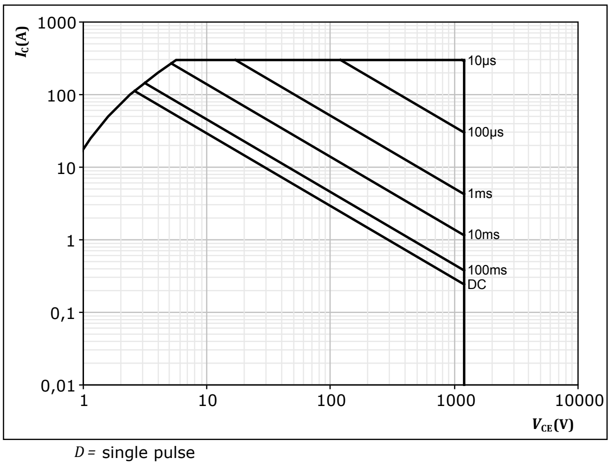
R (K/W)	τ (s)
6,80E-02	1,50E+00
9,16E-02	1,41E-01
1,25E-01	3,64E-02
2,35E-02	1,13E-02
1,82E-02	8,50E-04

Brake Switch Characteristics

figure 5.	**IGBT**

Safe operating area

I_C = f(V_{CE})



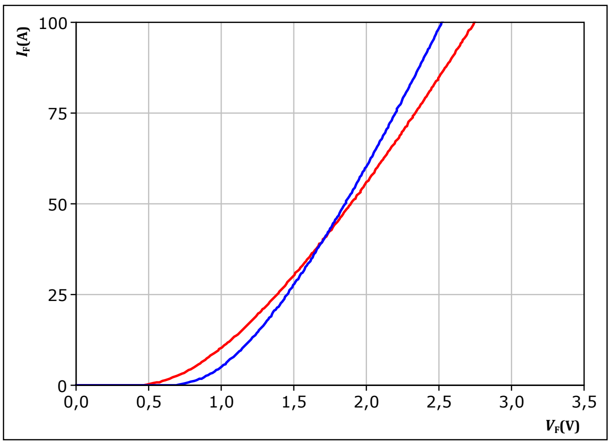
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Brake Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



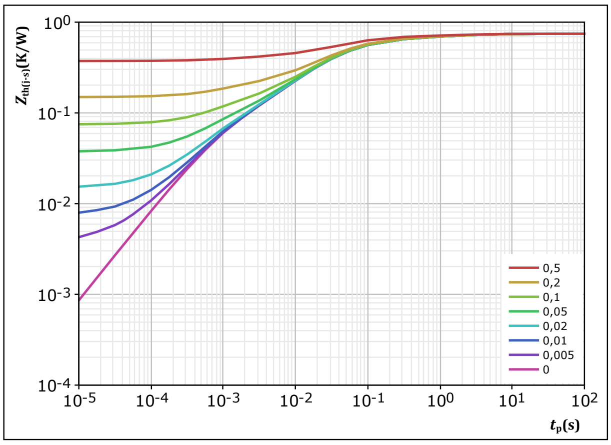
t_p = 250 µs

T_j: 25 °C, 125 °C

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

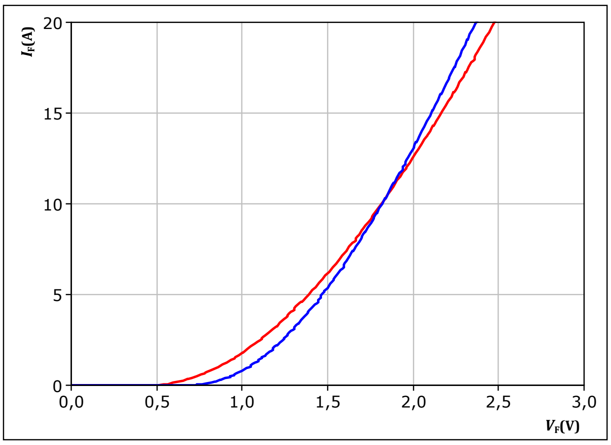
R (K/W)	τ (s)
3,50E-02	5,35E+00
7,36E-02	8,54E-01
1,83E-01	1,14E-01
3,18E-01	2,85E-02
8,17E-02	7,22E-03
5,49E-02	8,83E-04

Brake Sw. Protection Diode Characteristics

figure 8. FWD

Typical forward characteristics

$I_F = f(V_F)$



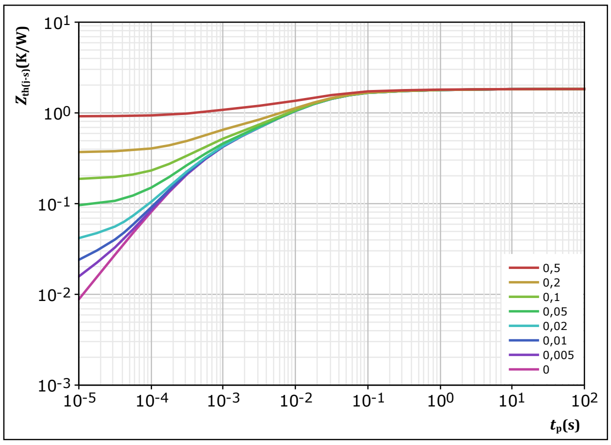
t_p = 250 μs

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

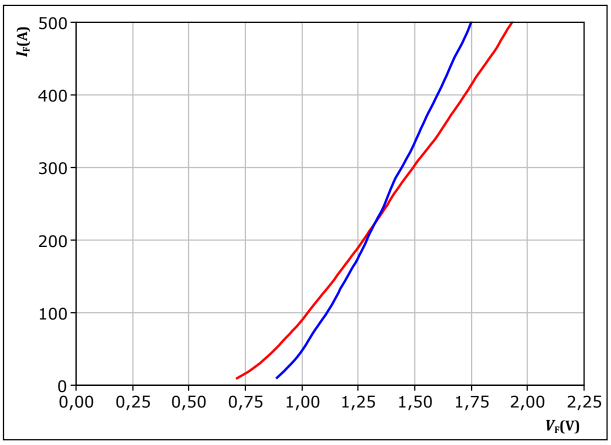
R (K/W)	τ (s)
4,59E-02	4,62E+00
1,15E-01	3,62E-01
5,63E-01	3,63E-02
6,02E-01	8,92E-03
2,37E-01	1,88E-03
2,71E-01	3,97E-04

Rectifier Diode Characteristics

figure 10. **Rectifier**

Typical forward characteristics

I_F = f(V_F)



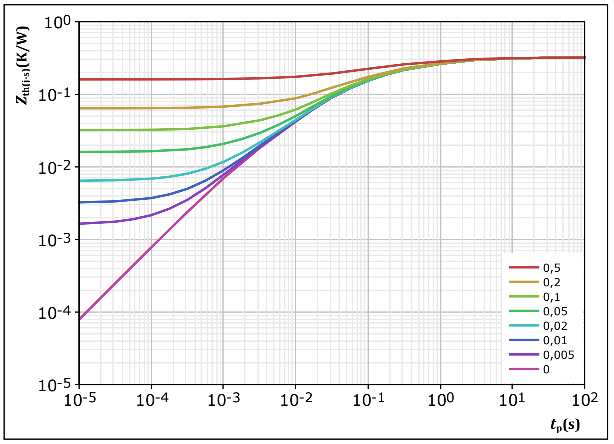
t_p = 250 µs

T_j: 25 °C, 125 °C

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

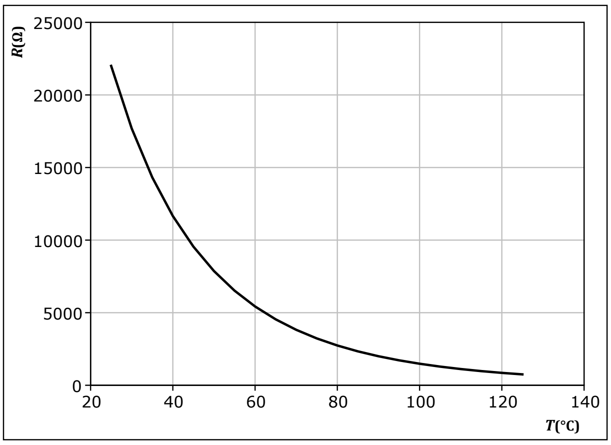
R (K/W)	τ (s)
2,12E-02	1,24E+01
9,26E-02	1,14E+00
1,22E-01	1,41E-01
7,77E-02	2,51E-02
7,59E-03	1,97E-03

Thermistor Characteristics

figure 12.	Thermistor

Typical NTC characteristic as function of temperature

R_T = f(T)

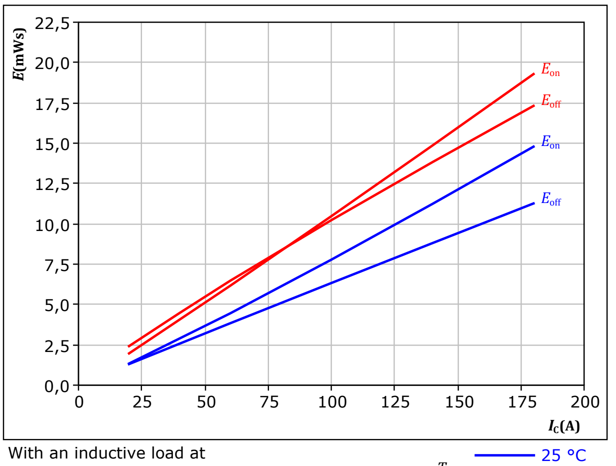


Brake Switching Characteristics

figure 13. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



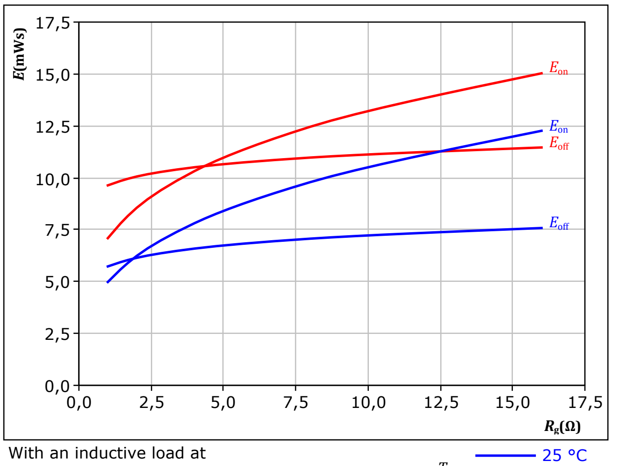
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		
R_{goff} =	4	Ω		

figure 14. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



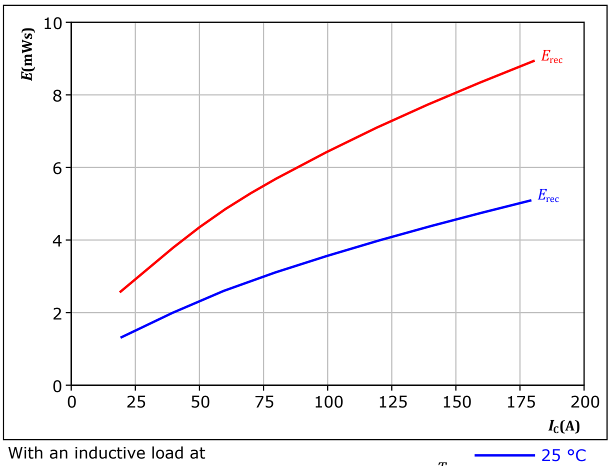
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	100	A		

figure 15. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



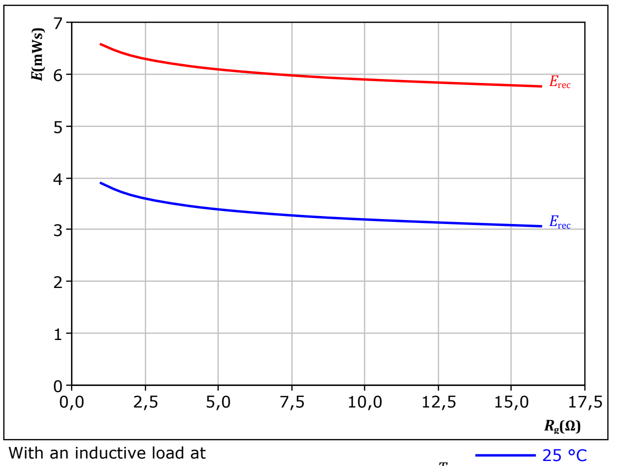
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		

figure 16. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

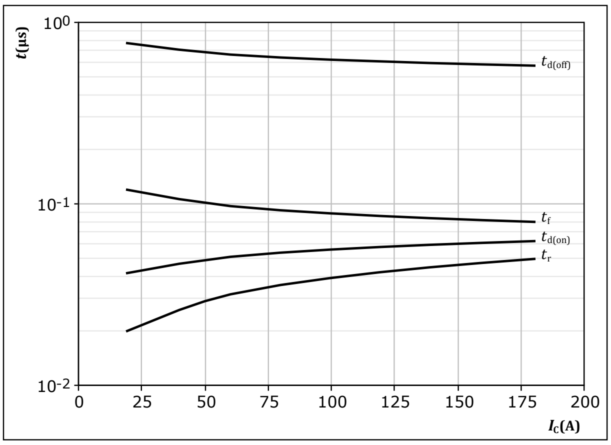
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	100	A		

Brake Switching Characteristics

figure 17. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



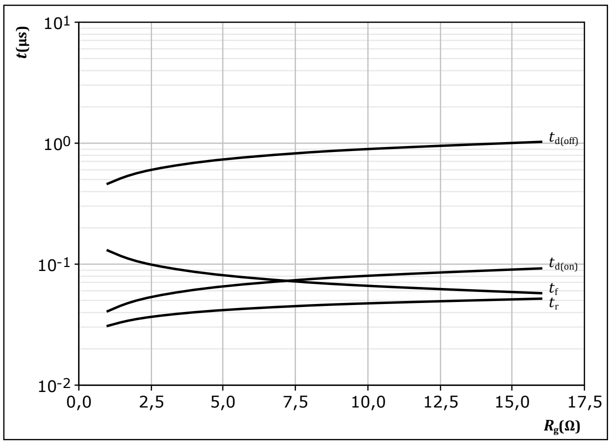
With an inductive load at

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)



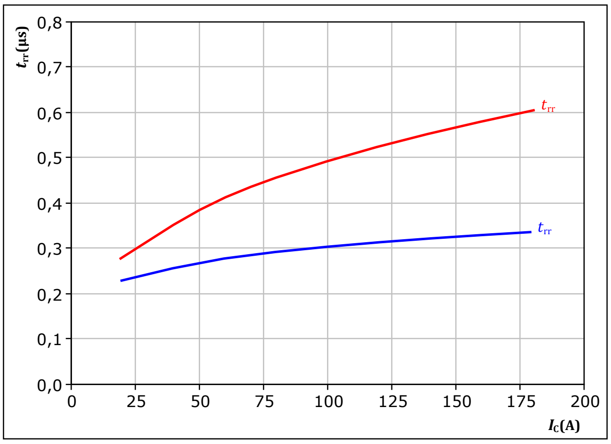
With an inductive load at

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

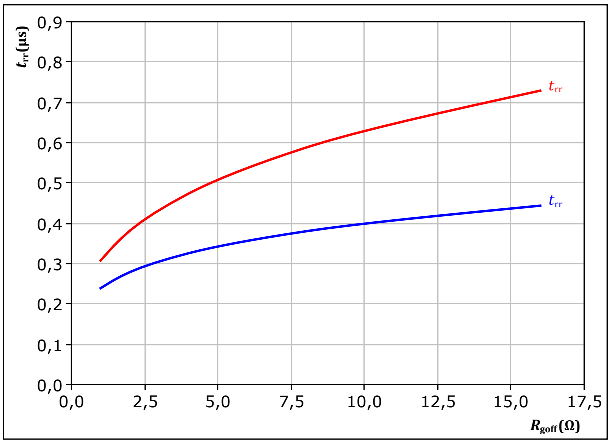
T_j: 25 °C / 125 °C

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

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

T_j: 25 °C / 125 °C

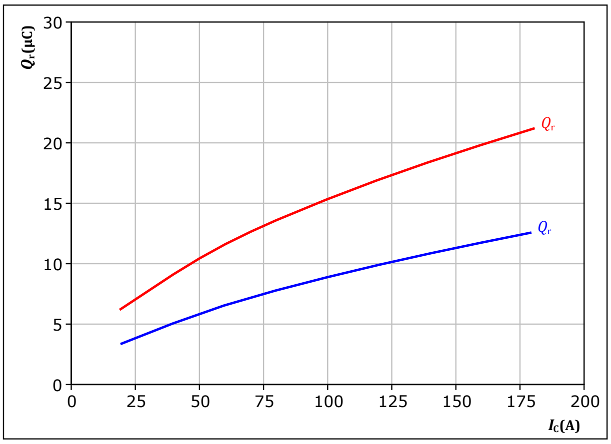
V_{CE} =	600	V
V_{GE} =	0/15	V
I_C =	100	A

Brake Switching Characteristics

figure 21. FWD

Typical recovered charge as a function of collector current

Q_r = f(I_C)



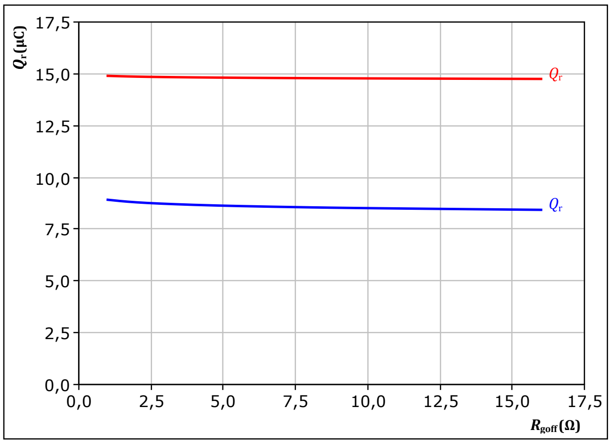
With an inductive load at

V_{CE} =	600	V	T_j: 25 °C
V_{GE} =	0/15	V	125 °C
R_{gon} =	4	Ω	

figure 22. FWD

Typical recovered charge as a function of turn off gate resistor

Q_r = f(R_{goff})



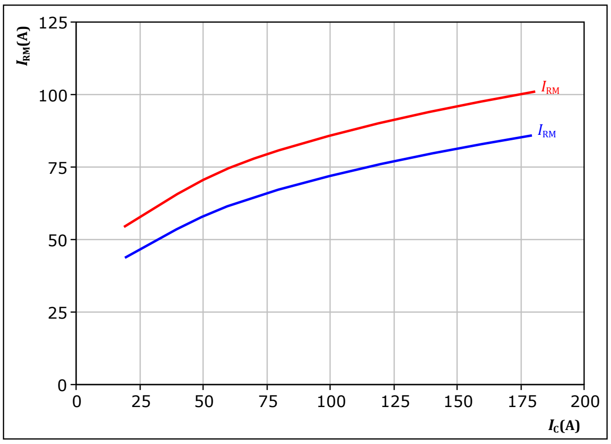
With an inductive load at

V_{CE} =	600	V	T_j: 25 °C
V_{GE} =	0/15	V	125 °C
I_C =	100	A	

figure 23. FWD

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



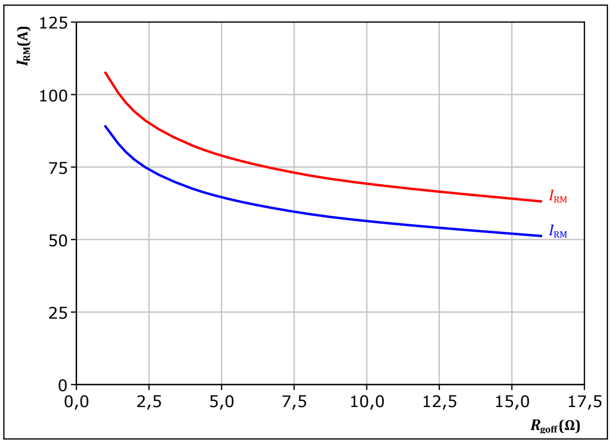
With an inductive load at

V_{CE} =	600	V	T_j: 25 °C
V_{GE} =	0/15	V	125 °C
R_{gon} =	4	Ω	

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

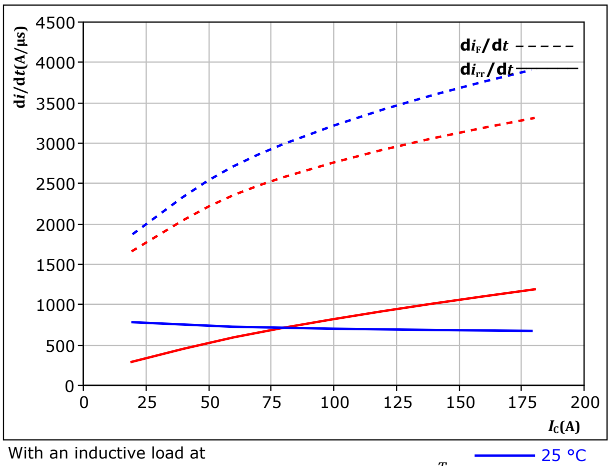
V_{CE} =	600	V	T_j: 25 °C
V_{GE} =	0/15	V	125 °C
I_C =	100	A	

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_{rr}/dt = f(I_C)



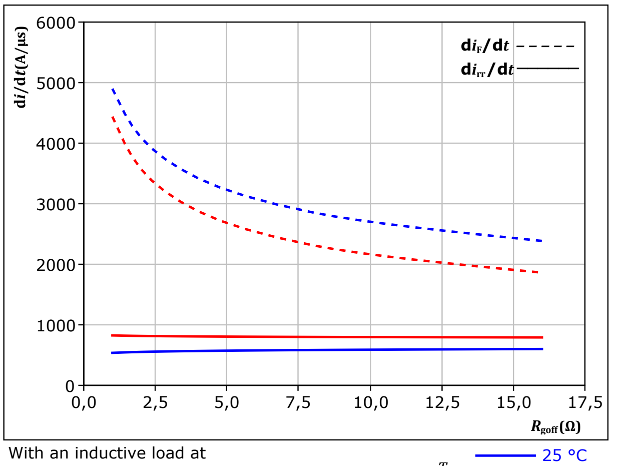
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	
V_{GE} =	0/15	V		125 °C	
R_{gon} =	4	Ω			

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_{rr}/dt = f(R_{goff})



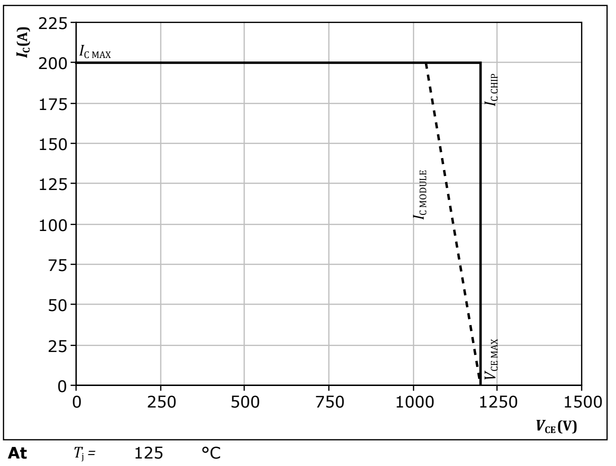
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	100	A		

figure 27. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



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

Brake Switching Definitions

figure 28.	IGBT

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

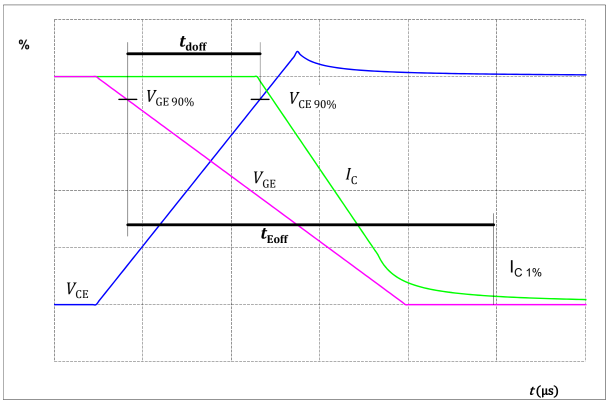


figure 29.	IGBT

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

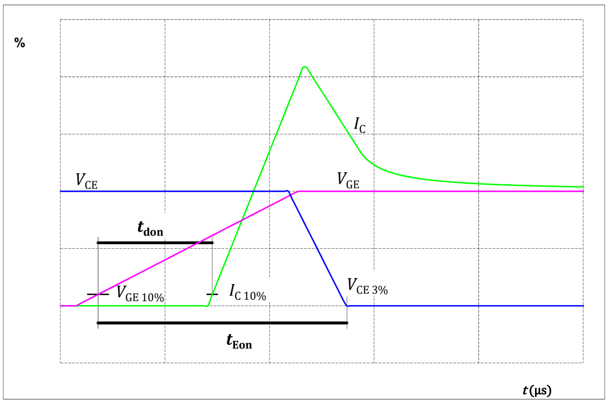


figure 30.	IGBT

Turn-off Switching Waveforms & definition of t_f

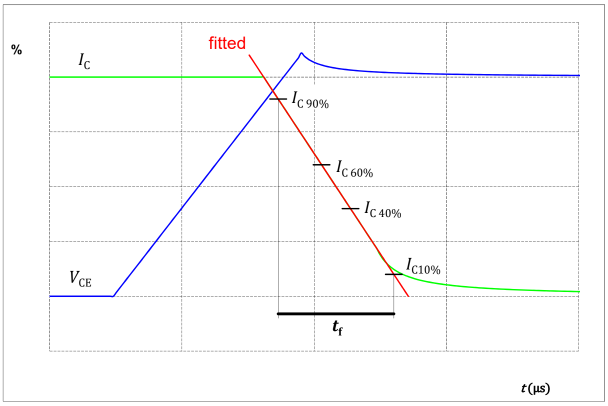
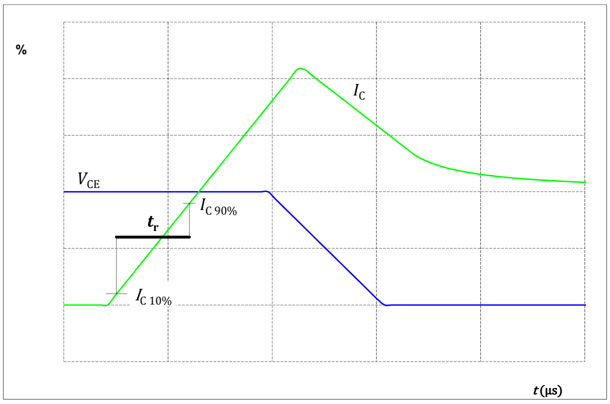


figure 31.	IGBT

Turn-on Switching Waveforms & definition of t_r



Brake Switching Definitions

figure 32. **FWD**

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

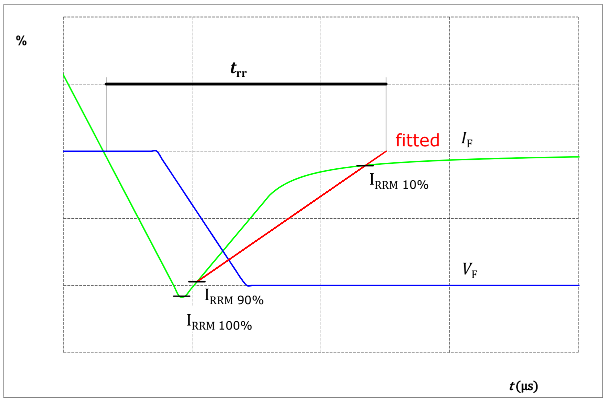
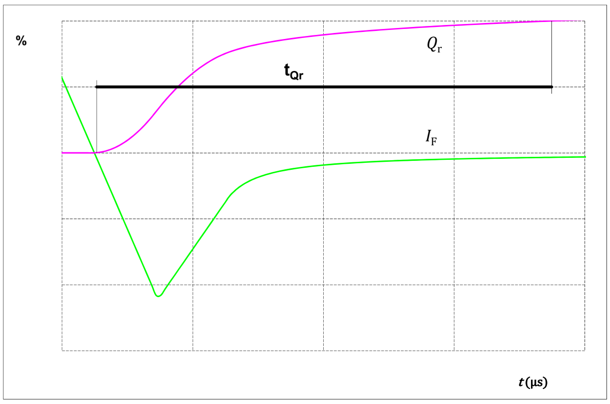


figure 33. **FWD**

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



Ordering Code

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

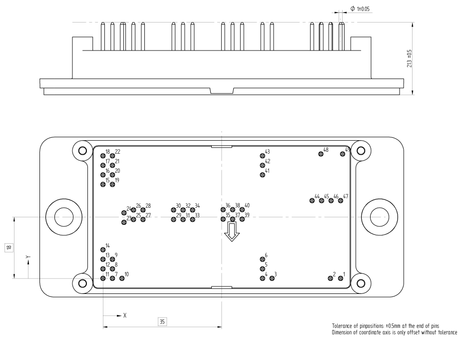
Marking

<table>
<tr><td rowspan="2">Text</td><td colspan="2">Name</td><td>Date code</td><td>UL & VIN</td><td>Lot</td><td>Serial</td></tr>
<tr><td colspan="2">NN-NNNNNNNNNNNNNN-TTTTTTVV</td><td>WWYY</td><td>UL VIN</td><td>LLLLL</td><td>SSSS</td></tr>
<tr><td rowspan="2">Datamatrix</td><td>Type&Ver</td><td>Lot number</td><td>Serial</td><td>Date code</td><td></td><td></td></tr>
<tr><td>TTTTTTTVV</td><td>LLLLL</td><td>SSSS</td><td>WWYY</td><td></td><td></td></tr>
</table>

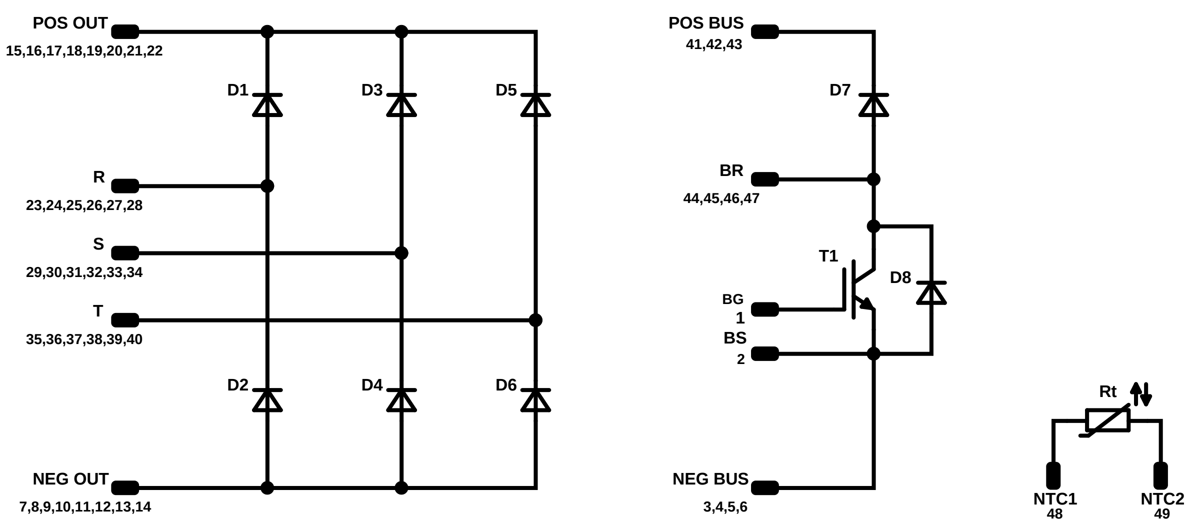
Outline

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				



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	

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

Handling instruction
Handling instructions for *flow* 2 packages see vincotech.com website.

Package data
Package data for *flow* 2 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	