Vincotech

80-M3166BA110JR-K469G70
datasheet

MiniSKiiP® CON 3 **1600 V / 110 A**

Topology features

- Brake Chopper
- Brake sense
- Common rectifier and Brake DC-
- Temperature sensor
- Three-phase Rectifier

Component features

- High inrush current capability

Housing features

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

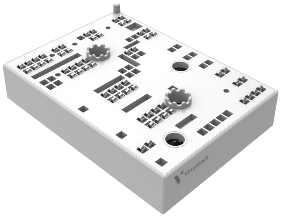
Target applications

- Embedded Drives
- Industrial Drives

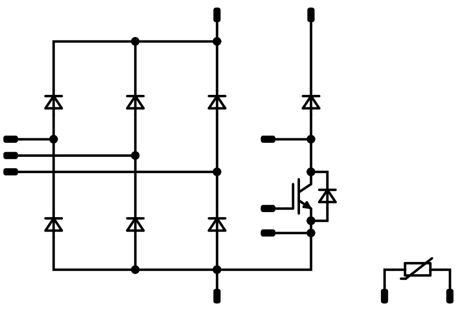
Types

- 80-M3166BA110JR-K469G70

MiniSKiiP® 3 16 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	161	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	317	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 800 V	T_j = 150 °C	9,5	µs
Maximum junction temperature	T_{jmax}			175	°C
Brake Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	113	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	194	W
Maximum junction temperature	T_{jmax}			175	°C
Brake 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	38	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		50	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	75	W
Maximum junction temperature	T_{jmax}			175	°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	151	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	1380	A
Surge current capability	I^2t	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	9520	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	182	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	5500	V
Creepage distance		With std lid For more informations see handling instructions		6,3	mm
Clearance		With std lid For more informations see handling instructions		6,3	mm
Comparative Tracking Index	CTI			≥ 600	

*100 % tested in production

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	$V_{GE(th)}$			10	0,015	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		150	25 125 150		1,58 1,8 1,86	1,85(1)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			100	µA
Gate-emitter leakage current	I_{GES}		20	0		25			500	nA
Internal gate resistance	r_g							3		Ω
Input capacitance	C_{ies}		0	10		25		30000		pF
Output capacitance	C_{oes}							880		pF
Reverse transfer capacitance	C_{res}							320		pF
Gate charge	Q_g	V_{CC} = 600 V	0/15		150	25		1000		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,3		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	0/15	700	150	25 125 150		177,01 173,1 170,72		ns
Rise time	t_r					25 125 150		97,68 109,61 114,04		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		554,93 621,16 639,56		ns
Fall time	t_f					25 125 150		53,76 73,91 79,17		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=11,36 µC Q_{rFWD}=18,67 µC Q_{rFWD}=21,08 µC				25 125 150		23,79 30,57 32,49		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		13,94 18,6 19,87		mWs

Characteristic Values

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Brake Diode										
Static										
Forward voltage	V_F				150	25 125 150		1,79 1,9 1,9	2,1(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			40	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,49		K/W
Dynamic										
Peak recovery current	I_{RM}	di/dt=1230 A/µs di/dt=1062 A/µs di/dt=994 A/µs	0/15	700	150	25 125 150		63,25 70,04 72,12		A
Reverse recovery time	t_{rr}					25 125 150		330,05 473,15 523,88		ns
Recovered charge	Q_r					25 125 150		11,36 18,67 21,08		µC
Reverse recovered energy	E_{rec}					25 125 150		3,9 6,93 7,92		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		345,7 256,82 236,83		A/µs

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Brake Sw. Protection Diode										
Static										
Forward voltage	V_F				25	25 125 150		1,63 1,7 1,69	2,1(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			35	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						1,26		K/W
Rectifier Diode										
Static										
Forward voltage	V_F				110	25 125		1,22 1,11	1,5(1)	V
Reverse leakage current	I_R	V_r = 1600 V				25 150			100 2000	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,38		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	
Thermistor										
Static										
Rated resistance	R					25		1		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1670 Ω				100	-2		2	%
Maximum Current	I_{max}							3		mA
Power dissipation constant	d					25		0,76		mW/K
A-value	A							$7{,}635 \times 10^{-3}$		1/K
B-value	B							$1{,}73 \times 10^{-5}$		$1/K^2$
Vincotech Thermistor Reference									E	

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

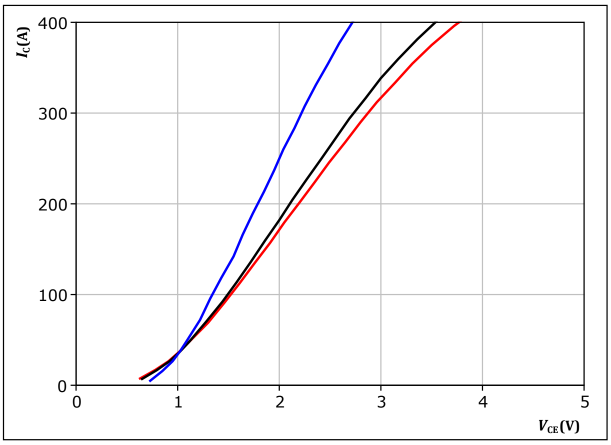
Vincotech

Brake Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

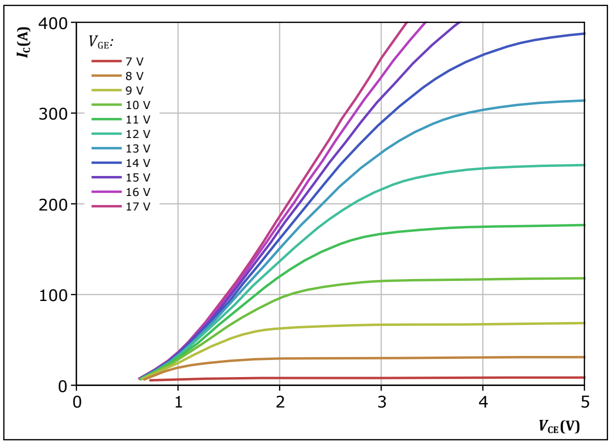


t_p = 250 µs
V_{GE} = 15 V
T_j: 25 °C, 125 °C, 150 °C

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

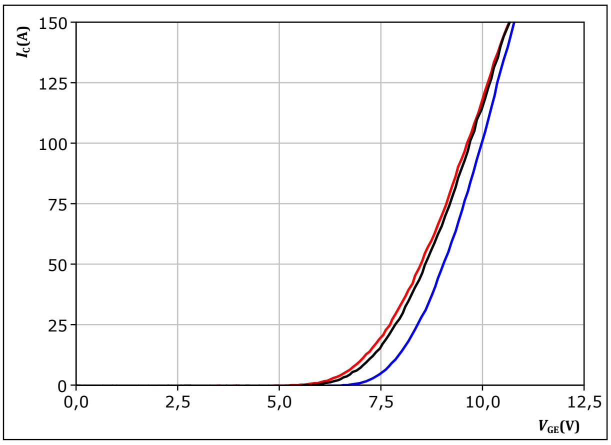


t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

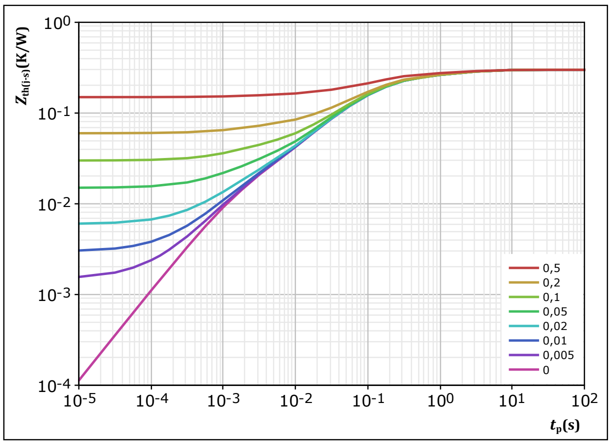


t_p = 250 µs
V_{CE} = 10 V
T_j: 25 °C, 125 °C, 150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



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

IGBT thermal model values

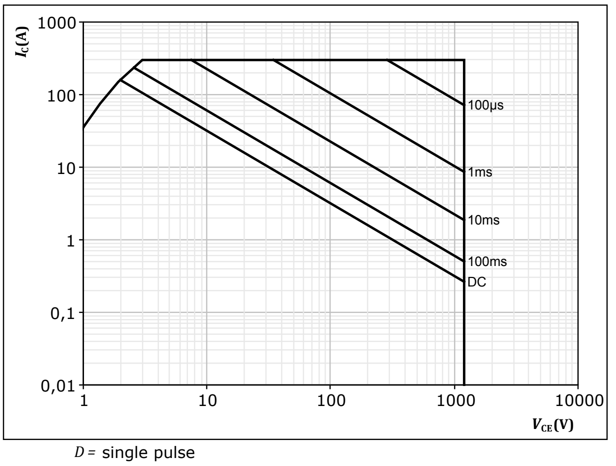
R (K/W)	τ (s)
3,56E-02	2,96E+00
5,64E-02	6,04E-01
1,58E-01	1,03E-01
3,81E-02	2,02E-02
1,18E-02	1,52E-03

Brake Switch Characteristics

figure 5. **IGBT**

Safe operating area

I_C = f(V_{CE})

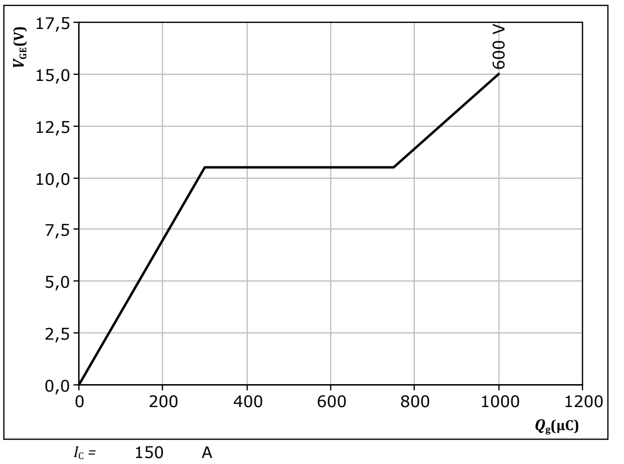


D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

figure 6. **IGBT**

Gate voltage vs gate charge

V_{GE} = f(Q_g)



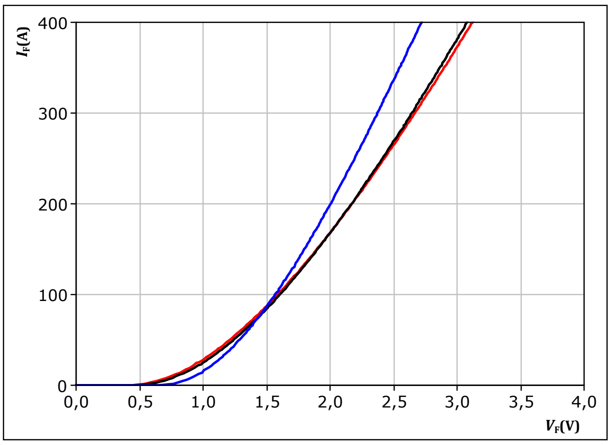
I_C =	150	A
T_j =	25	°C

Brake Diode Characteristics

figure 7. **FWD**

Typical forward characteristics

I_F = f(V_F)



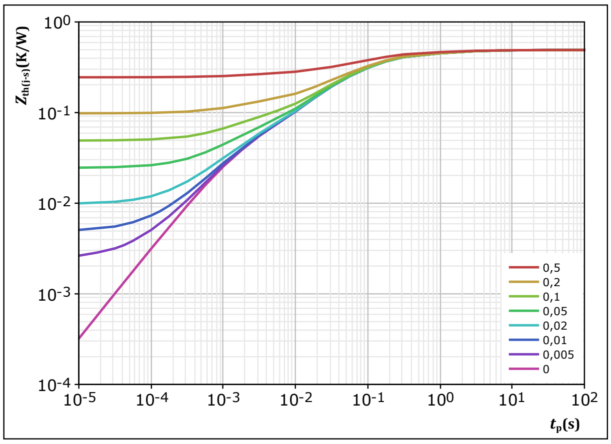
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 8. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

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

FWD thermal model values

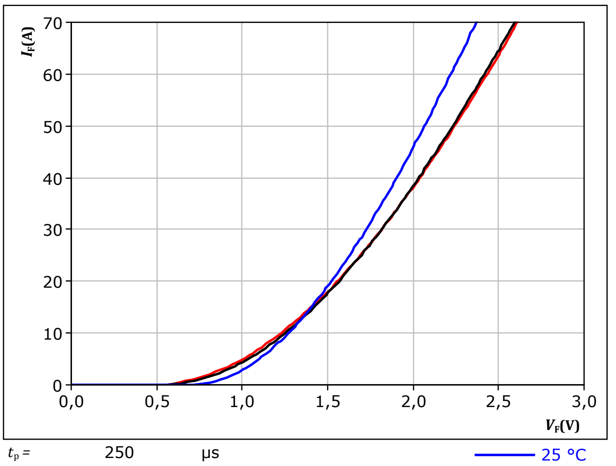
R (K/W)	τ (s)
1,45E-02	6,66E+00
6,43E-02	1,13E+00
2,35E-01	1,21E-01
1,40E-01	2,42E-02
3,61E-02	1,48E-03

Brake Sw. Protection Diode Characteristics

figure 9. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



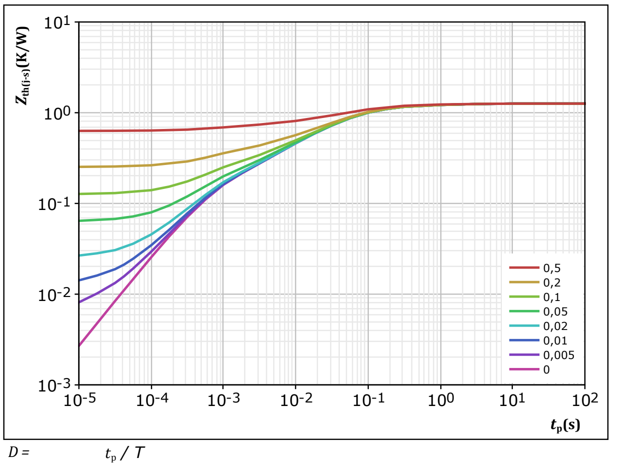
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 10. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,26 K/W

FWD thermal model values

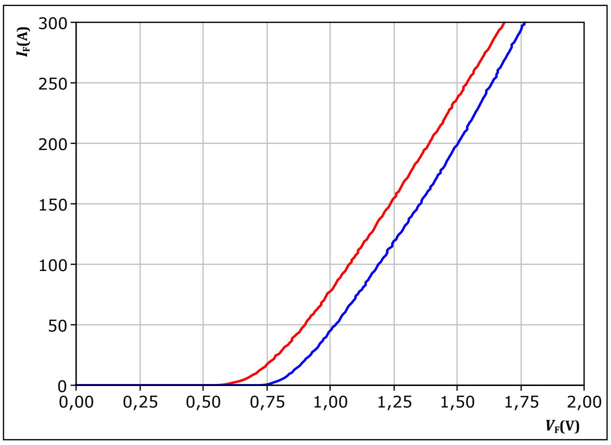
R (K/W)	τ (s)
7,18E-02	1,82E+00
2,80E-01	1,58E-01
5,13E-01	3,97E-02
2,46E-01	7,61E-03
1,49E-01	6,66E-04

Rectifier Diode Characteristics

figure 11. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



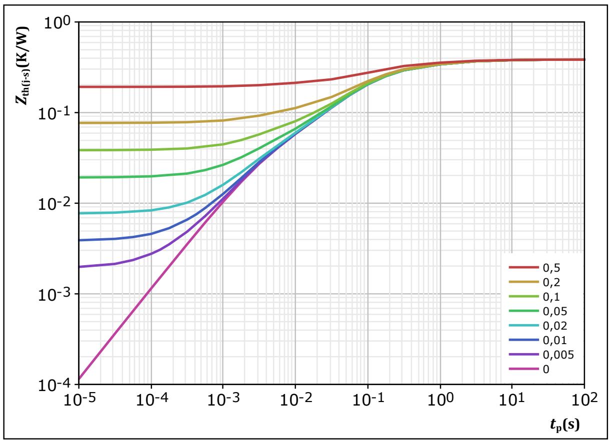
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 12. **Rectifier**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,384 K/W

Rectifier thermal model values

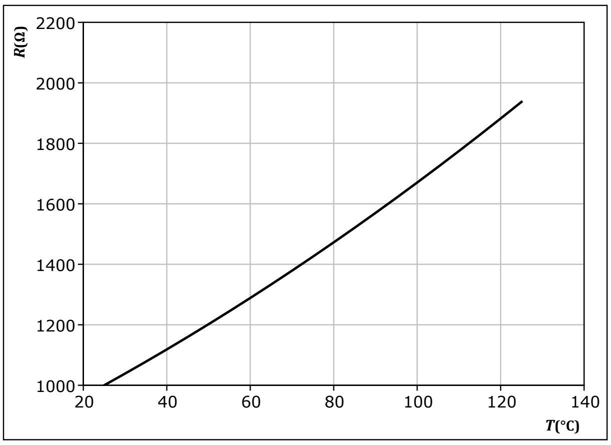
R (K/W)	τ (s)
1,76E-02	7,82E+00
7,08E-02	1,08E+00
1,73E-01	1,50E-01
9,54E-02	4,07E-02
2,70E-02	3,38E-03

Thermistor Characteristics

figure 13.	Thermistor

Typical PTC characteristic as function of temperature

$R_T = f(T)$

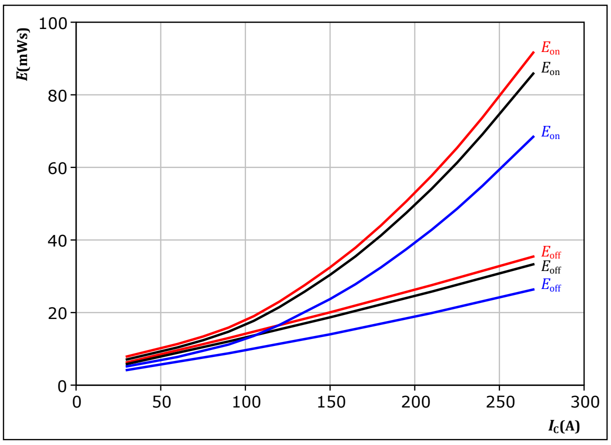


Brake Switching Characteristics

figure 14. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



With an inductive load at

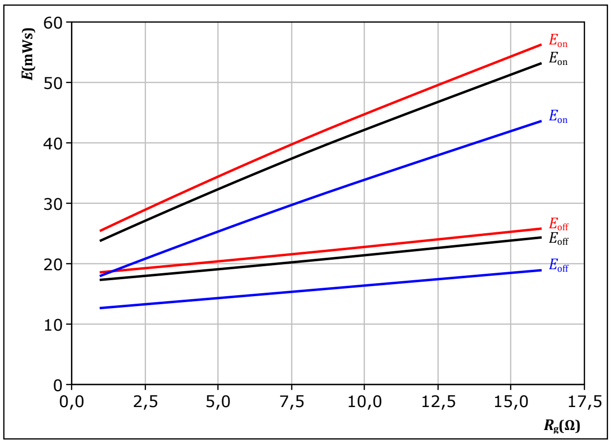
V_{CE} = 700 V
V_{GE} = 0/15 V
R_{gon} = 4 Ω
R_{goff} = 4 Ω

T_j: 25 °C, 125 °C, 150 °C

figure 15. **IGBT**

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

$E = f(R_g)$



With an inductive load at

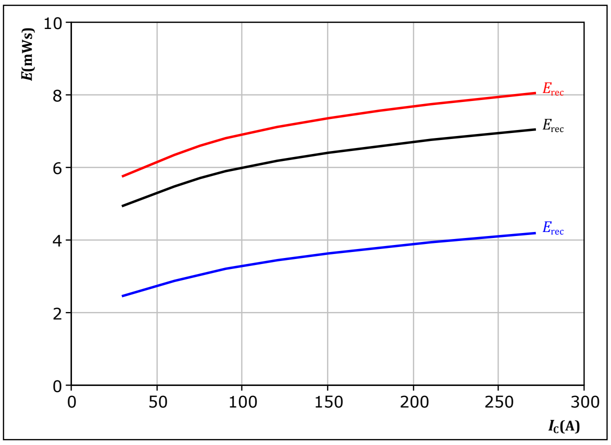
V_{CE} = 700 V
V_{GE} = 0/15 V
I_C = 150 A

T_j: 25 °C, 125 °C, 150 °C

figure 16. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



With an inductive load at

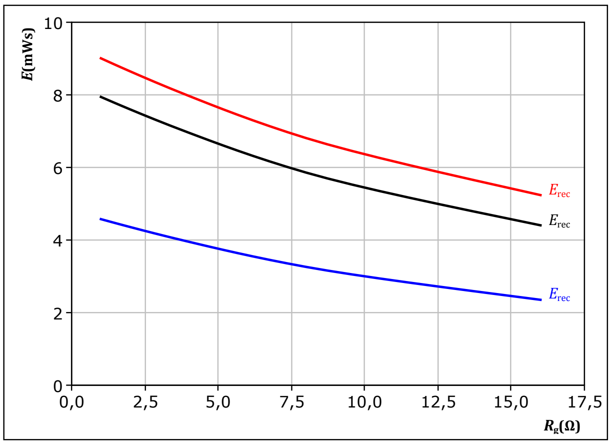
V_{CE} = 700 V
V_{GE} = 0/15 V
R_{gon} = 4 Ω

T_j: 25 °C, 125 °C, 150 °C

figure 17. **FWD**

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

$E_{rec} = f(R_g)$



With an inductive load at

V_{CE} = 700 V
V_{GE} = 0/15 V
I_C = 150 A

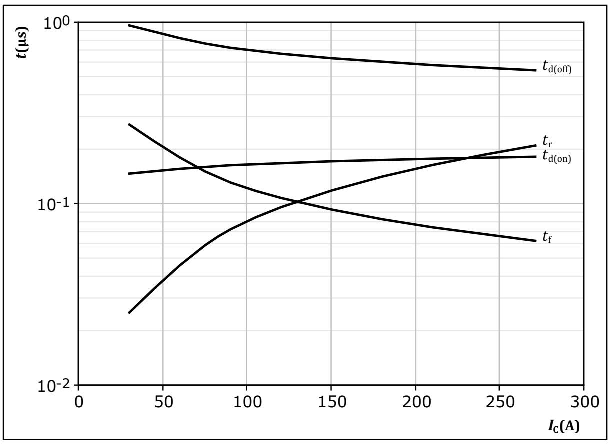
T_j: 25 °C, 125 °C, 150 °C

Brake Switching Characteristics

figure 18. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



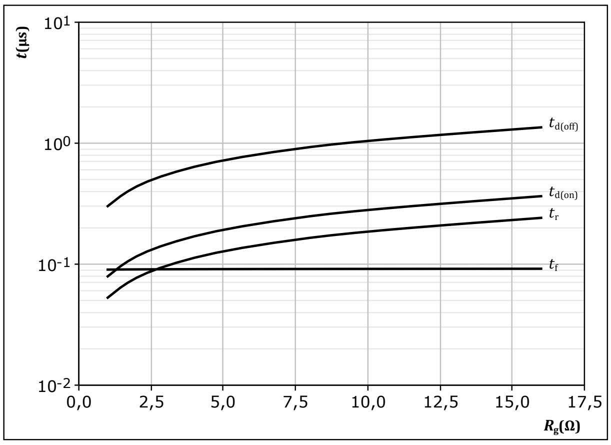
With an inductive load at

T_j =	150	°C
V_{CE} =	700	V
V_{GE} =	0/15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 19. **IGBT**

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

t = f(R_g)



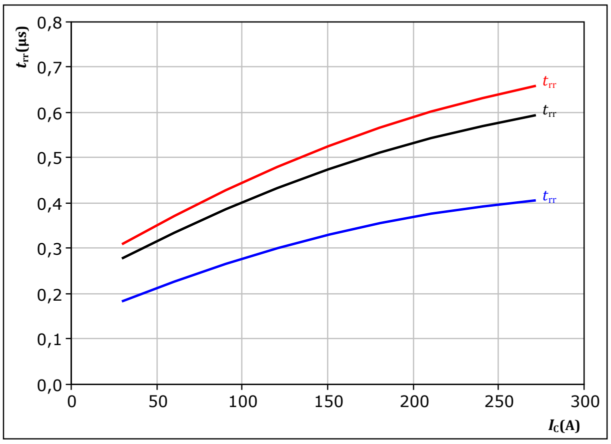
With an inductive load at

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

figure 20. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

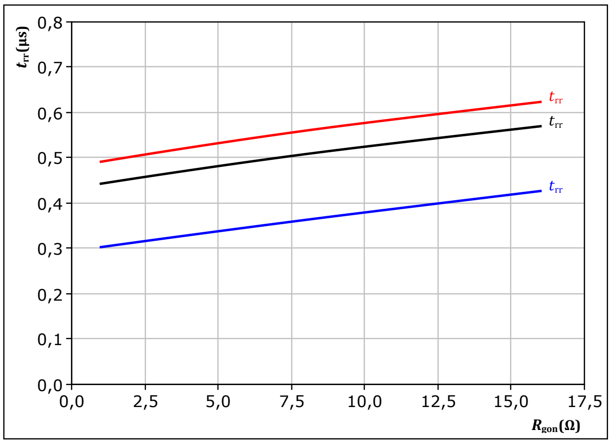
V_{CE} =	700	V
V_{GE} =	0/15	V
R_{gon} =	4	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 21. **FWD**

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

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



With an inductive load at

V_{CE} =	700	V
V_{GE} =	0/15	V
I_C =	150	A

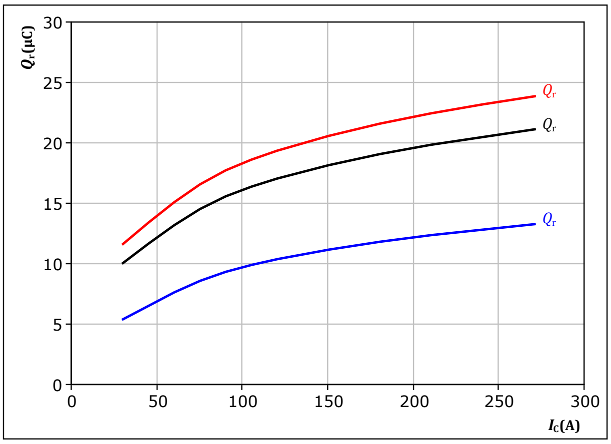
T_j: 25 °C, 125 °C, 150 °C

Brake Switching Characteristics

figure 22. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



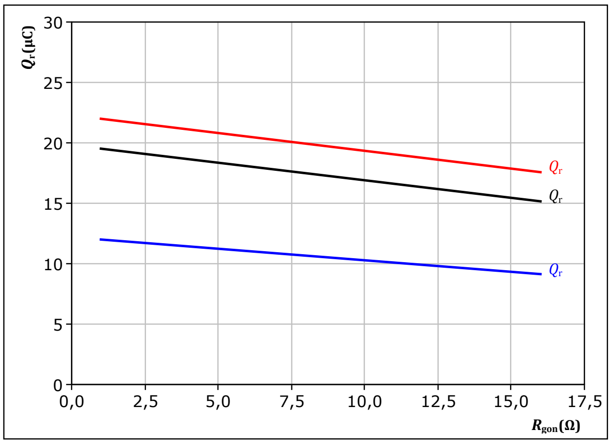
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 23. **FWD**

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

Q_r = f(R_{gon})



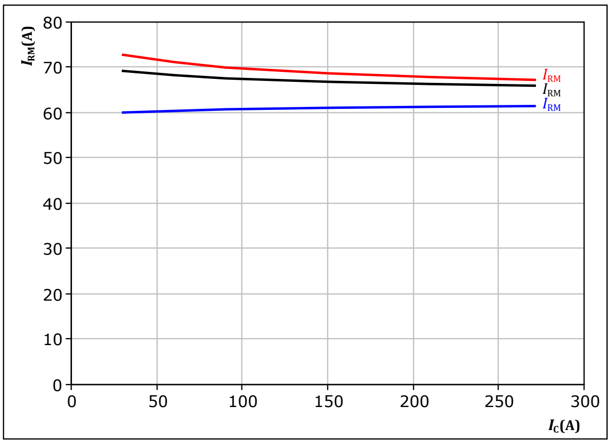
With an inductive load at

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

figure 24. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



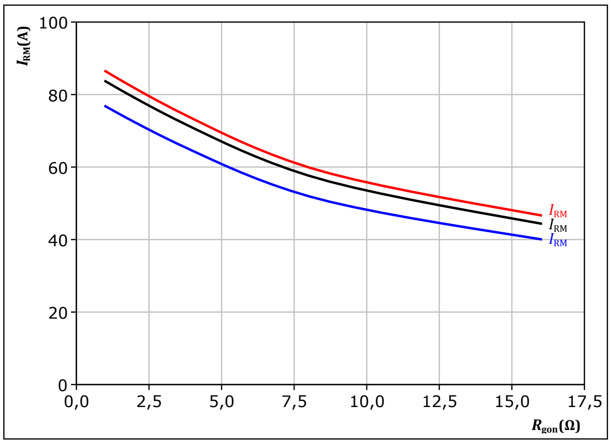
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 25. **FWD**

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

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



With an inductive load at

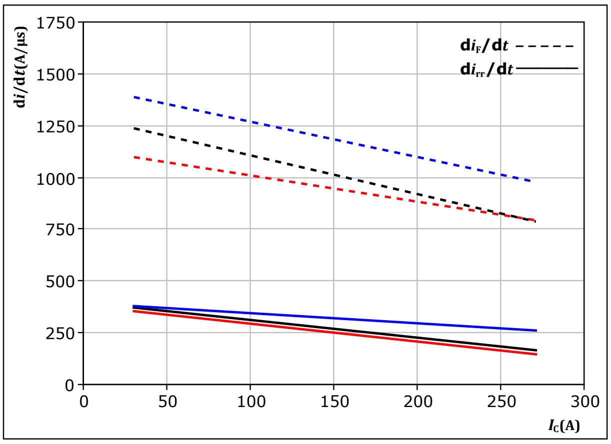
V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	150	A		150 °C

Brake Switching Characteristics

figure 26. **FWD**

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

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



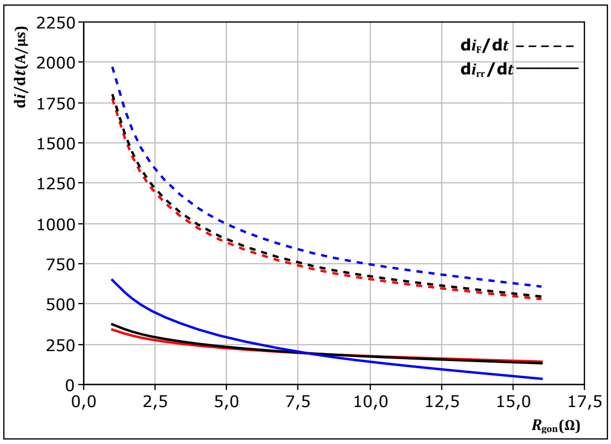
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 27. **FWD**

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

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



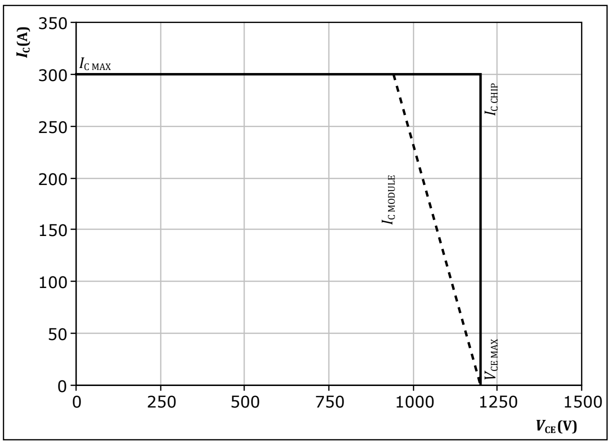
With an inductive load at

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

figure 28. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At	T_j =	150	°C
	R_{gon} =	4	Ω
	R_{goff} =	4	Ω

Brake Switching Definitions

figure 29. **IGBT**

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

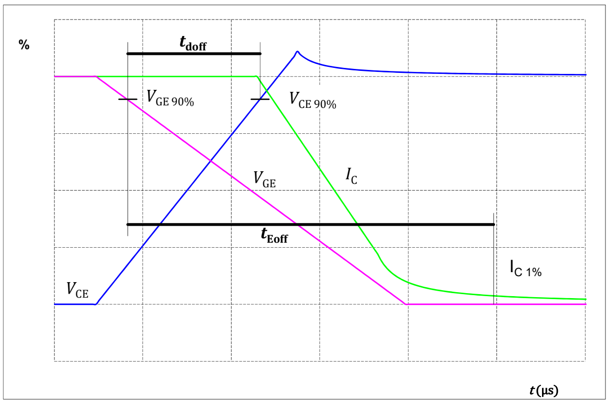


figure 30. **IGBT**

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

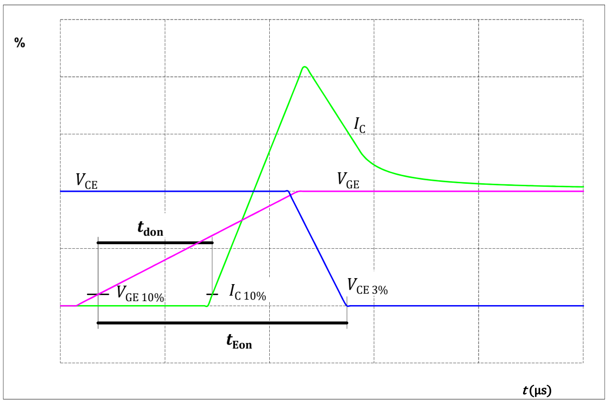


figure 31. **IGBT**

Turn-off Switching Waveforms & definition of t_f

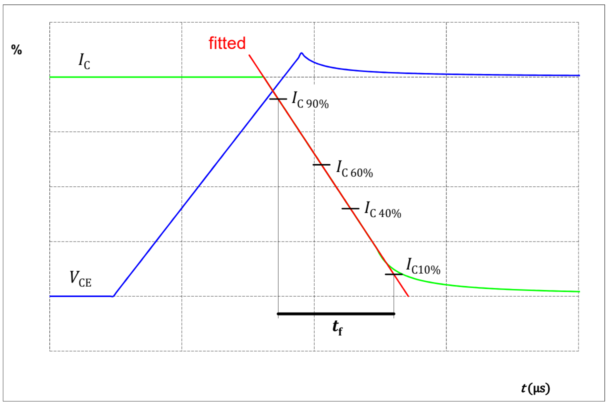
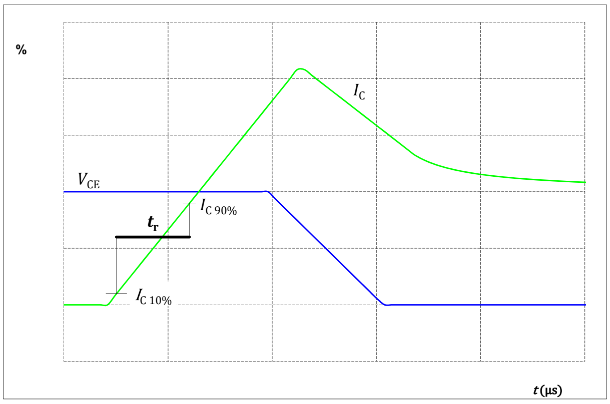


figure 32. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Brake Switching Definitions

figure 33. **FWD**

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

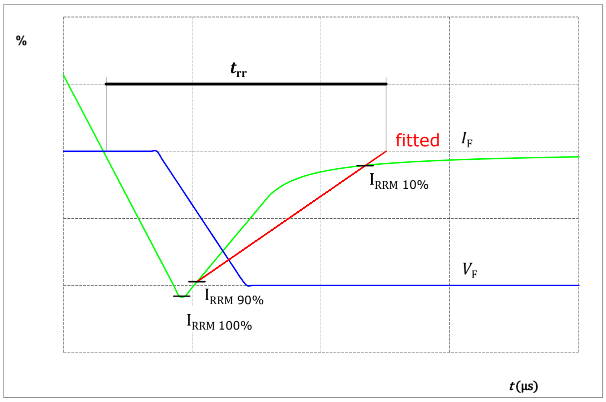
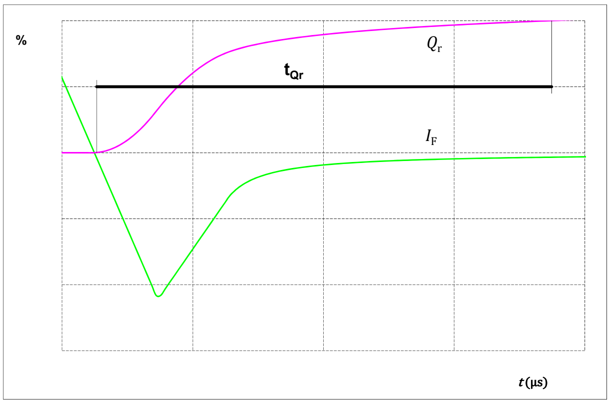


figure 34. **FWD**

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



Ordering Code

Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M3166BA110JR-K469G70-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M3166BA110JR-K469G70-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M3166BA110JR-K469G70-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M3166BA110JR-K469G70-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M3166BA110JR-K469G70-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M3166BA110JR-K469G70-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M3166BA110JR-K469G70-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M3166BA110JR-K469G70-/5B/

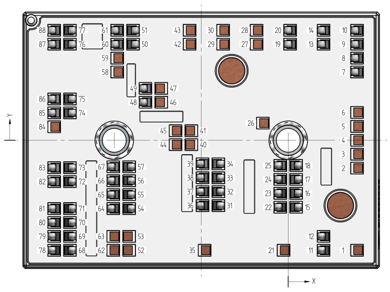
Marking

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

Outline

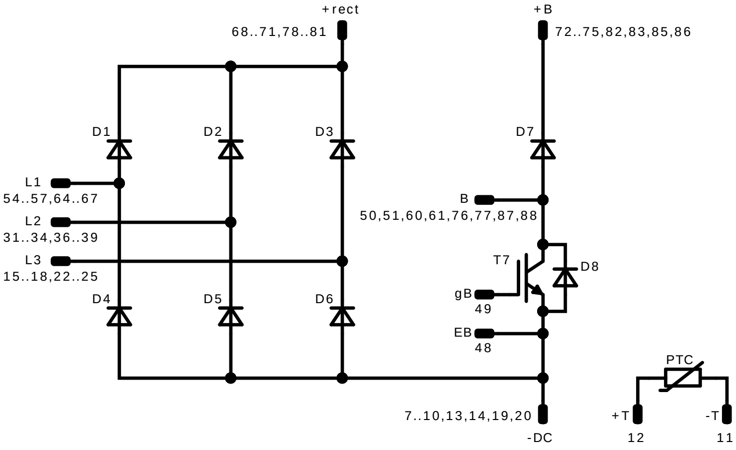
Pin table [mm]

Pin	X	Y	Function	Pin	X	Y	Function
				45	not assembled		
1	not assembled			46	not assembled		
2	not assembled			47	not assembled		
3	not assembled			48	-32,82	8,74	EB
4	not assembled			49	-32,82	11,94	gB
5	not assembled			50	-35,68	22,1	B
6	not assembled			51	-35,68	25,3	B
7	15,83	15,7	-DC	52	not assembled		
8	15,83	18,9	-DC	53	not assembled		
9	15,83	22,1	-DC	54	-36,58	-15,7	L1
10	15,83	25,3	-DC	55	-36,58	-12,5	L1
11	8,13	-25,3	-T	56	-36,58	-9,3	L1
12	8,13	-22,1	+T	57	-36,58	-6,1	L1
13	8,13	22,1	-DC	58	not assembled		
14	8,13	25,3	-DC	59	not assembled		
15	1,82	-15,38	L3	60	-39,32	22,1	B
16	1,82	-12,18	L3	61	-39,32	25,3	B
17	1,82	-8,98	L3	62	not assembled		
18	1,82	-5,79	L3	63	not assembled		
19	0,43	22,1	-DC	64	-40,22	-15,7	L1
20	0,43	25,3	-DC	65	-40,22	-12,5	L1
21	not assembled			66	-40,22	-9,3	L1
22	-1,82	-15,38	L3	67	-40,22	-6,09	L1
23	-1,82	-12,18	L3	68	-50,18	-25,3	+rect
24	-1,82	-8,98	L3	69	-50,18	-22,1	+rect
25	-1,82	-5,79	L3	70	-50,18	-18,9	+rect
26	not assembled			71	-50,18	-15,7	+rect
27	not assembled			72	-50,18	-9,5	+B
28	not assembled			73	-50,18	-6,3	+B
29	not assembled			74	-50,18	6,3	+B
30	not assembled			75	-50,18	9,5	+B
31	-16,05	-15,02	L2	76	-50,18	22,1	B
32	-16,05	-11,82	L2	77	-50,18	25,3	B
33	-16,05	-8,63	L2	78	-53,82	-25,3	+rect
34	-16,05	-5,42	L2	79	-53,82	-22,1	+rect
35	not assembled			80	-53,82	-18,9	+rect
36	-19,7	-15,02	L2	81	-53,82	-15,7	+rect
37	-19,7	-11,82	L2	82	-53,82	-9,5	+B
38	-19,7	-8,62	L2	83	-53,82	-6,3	+B
39	-19,7	-5,42	L2	84	not assembled		
40	not assembled			85	-53,82	6,3	+B
41	not assembled			86	-53,82	9,5	+B
42	not assembled			87	-53,82	22,1	B
43	not assembled			88	-53,82	25,3	B
44	not assembled						



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

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1	IGBT	1200 V	150 A	Brake Switch	
D7	FWD	1200 V	150 A	Brake Diode	
D8	FWD	1200 V	25 A	Brake Sw. Protection Diode	
D4, D1, D5, D2, D6, D3	Rectifier	1600 V	110 A	Rectifier Diode	
PTC	Thermistor			Thermistor	

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

Handling instruction
Handling instructions for MiniSKiiP® 3 packages see vincotech.com website.

Package data
Package data for MiniSKiiP® 3 packages see vincotech.com website.

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

UL recognition and file number
This device is certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
80-M3166BA110JR-K469G70-D1-14	7 Aug. 2022		