Vincotech

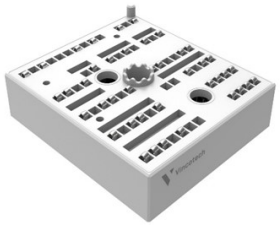
80-M212PMB035M7-K220A71
datasheet

MiniSKiiP® PIM 2 **1200 V / 35 A**

Features

- IGBT M7 with low V_{CEsat} and improved EMC behavior
- Open emitter configuration
- Solder-free spring contact technology
- Built-in PTC

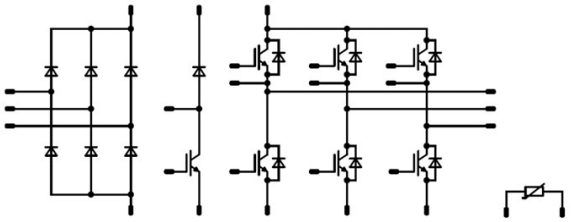
MiniSkiip® 2 housing



Target applications

- Industrial Drives

Schematic



Types

- 80-M212PMB035M7-K220A71

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Rectifier Diode				
Peak repetitive reverse voltage	V_{RRM}		1600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	49	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 150 °C	270	A
Surge current capability	I^2t		370	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	64	W
Maximum junction temperature	T_{jmax}		150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter / Brake Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	T_j = T_{jmax} T_s = 80 °C	49	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 °C	129	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V V_{cc} = 800 V T_j = 150 °C	9,5	µs
Maximum junction temperature	T_{jmax}		175	°C
Inverter / Brake Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	T_j = T_{jmax} T_s = 80 °C	45	A
Repetitive peak forward current	I_{FRM}		70	A
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	89	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 s	5500	V
		AC Voltage t_p = 1 min	2500	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		> 200	

*100 % tested in production

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	
Rectifier Diode										
Static										
Forward voltage	V_F				35	25 125		1,17 1,13	1,55	V
Reverse leakage current	I_R			1600		25			100	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						1,10		K/W

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	
Inverter / Brake Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,0035	25	5,4	6,0	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		35	25 125 150		1,48 1,64 1,68	2	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			120	µA
Gate-emitter leakage current	I_{GES}		20	0		25			500	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}		0	10		25		7900		pF
Output capacitance	C_{oes}							270		
Reverse transfer capacitance	C_{res}							97		
Gate charge	Q_g		15	600	35	25		260		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,73		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	35	25 125 150		124 122 121		ns
Rise time	t_r					25 125 150		14 17 18		
Turn-off delay time	$t_{d(off)}$					25 125 150		179 203 208		
Fall time	t_f					25 125 150		95 118 119		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 4,3 µC Q_{rFWD} = 6,2 µC Q_{rFWD} = 6,9 µC				25 125 150		1,45 1,92 2,09		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		2,40 3,17 3,42		

Characteristic Values

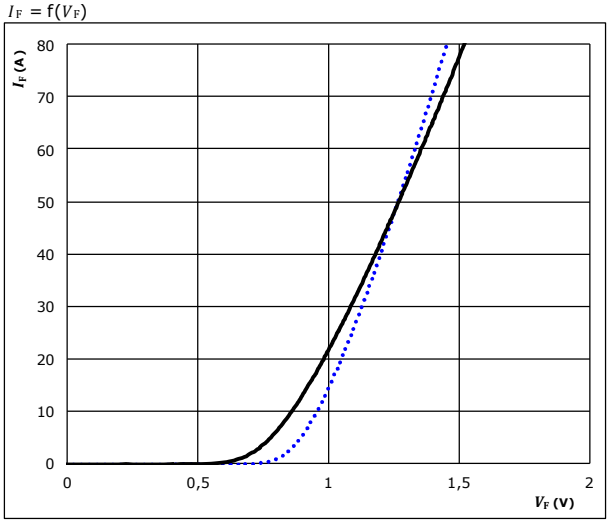
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter / Brake Diode										
Static										
Forward voltage	V_F				35	25 125 150		1,66 1,76 1,75	2,2	V
Reverse leakage current	I_R			1200		25			40	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						1,06		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 2681 A/µs di/dt = 2670 A/µs di/dt = 2690 A/µs	±15	600	35	25 125 150		77 76 77		A
Reverse recovery time	t_{rr}					25 125 150		157 284 311		ns
Recovered charge	Q_r					25 125 150		4,34 6,18 6,90		µC
Reverse recovered energy	E_{rec}					25 125 150		1,96 2,82 3,13		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		2734 2205 2101		A/µs
Thermistor										
Rated resistance	R					25		1		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1670 Ω				100	-2		+2	%
R_{100}	R					100		1670		Ω
Power dissipation constant						25		0,76		mW/K
A-value	$A_{(25/50)}$					25		$7,635*10^{-3}$		1/K
B-value	$B_{(25/100)}$					25		$1,731*10^{-5}$		1/K²
Vincotech PTC Reference									E	

Rectifier Diode Characteristics

figure 1. **Rectifier Diode**

Typical forward characteristics

$I_F = f(V_F)$



t_p = 250 µs

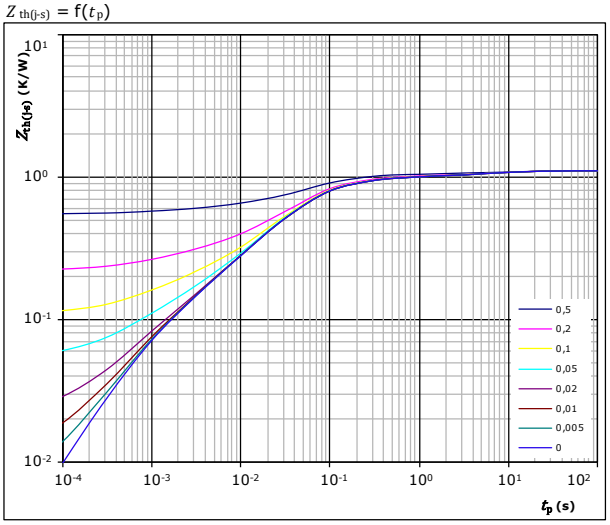
T_j: 25 °C

125 °C

figure 2. **Rectifier Diode**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,10 K/W

Diode thermal model values

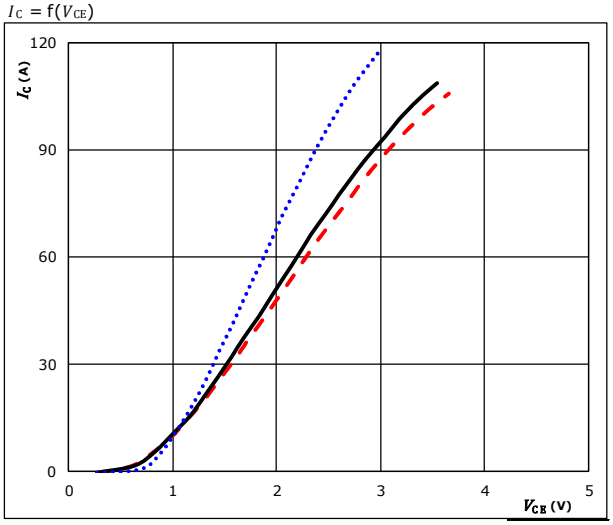
R (K/W)	τ (s)
1,03E-01	7,04E+00
1,17E-01	3,94E-01
5,19E-01	5,87E-02
2,38E-01	2,15E-02
7,64E-02	3,49E-03
4,71E-02	6,93E-04

Inverter / Brake Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

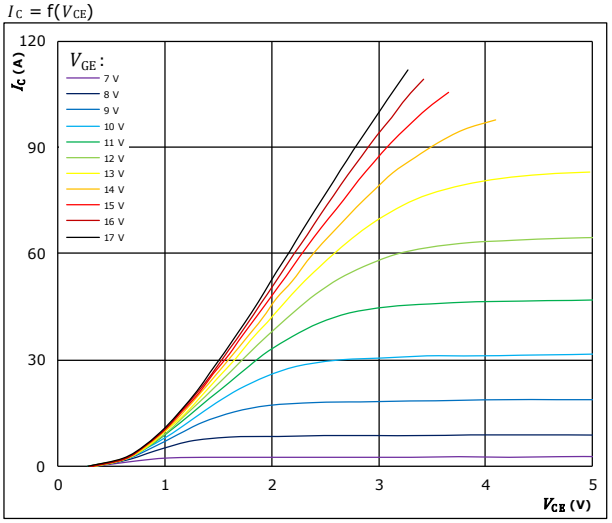


t_p =	250	µs		25 °C	
V_{GE} =	15	V	T_j:	125 °C	
				150 °C	

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

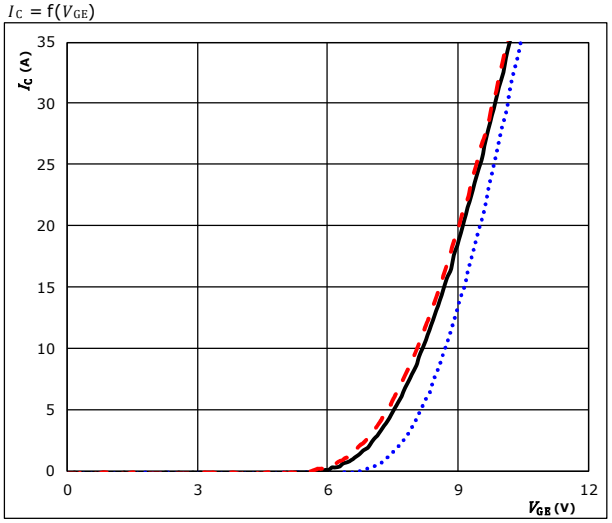


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

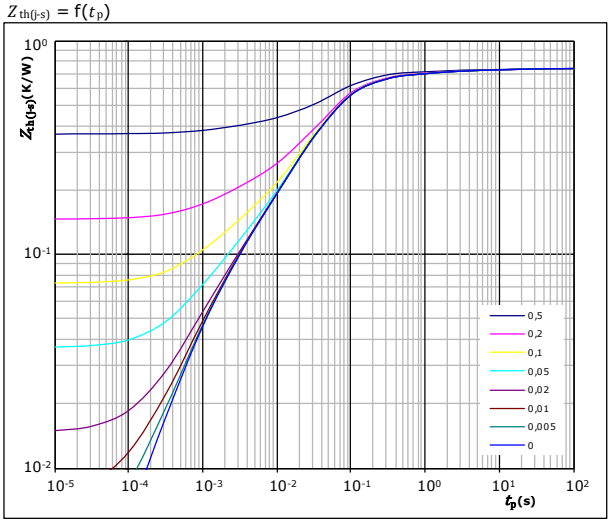


t_p =	100	µs		25 °C	
V_{CE} =	10	V	T_j:	125 °C	
				150 °C	

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,73	K/W

IGBT thermal model values

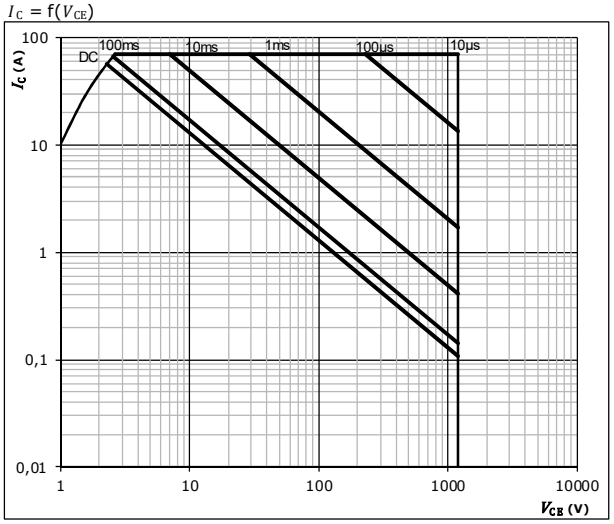
R (K/W)	τ (s)
2,73E-02	5,47E+00
5,12E-02	4,66E-01
1,36E-01	8,32E-02
3,93E-01	2,78E-02
7,33E-02	5,41E-03
4,92E-02	8,30E-04
3,39E-03	4,01E-04

Inverter / Brake Switch Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



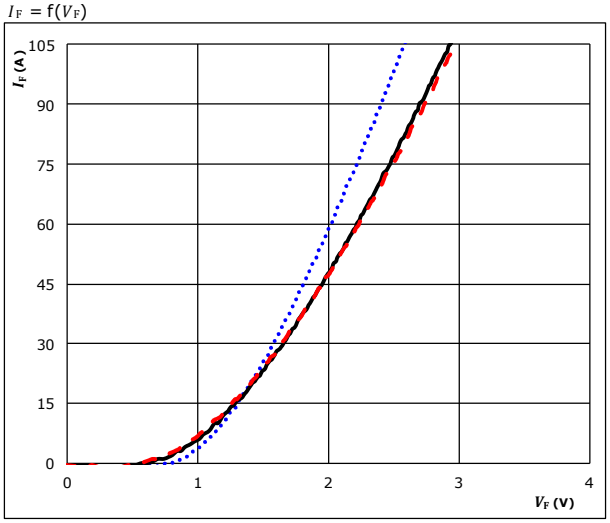
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Inverter / Brake Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



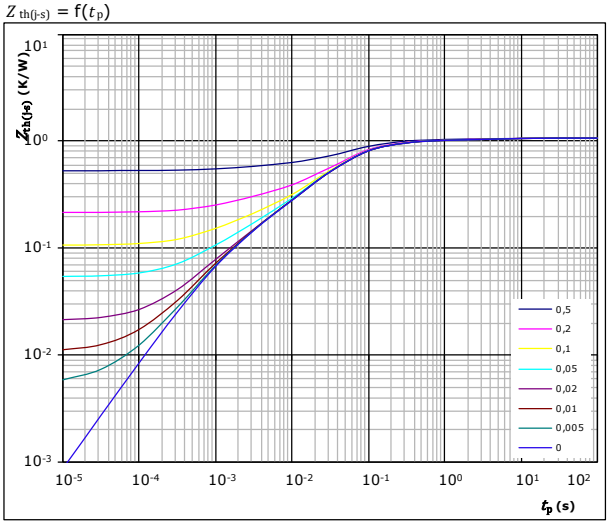
t_p = 250 µs

T_j: 25 °C
125 °C
150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,06 K/W

FWD thermal model values

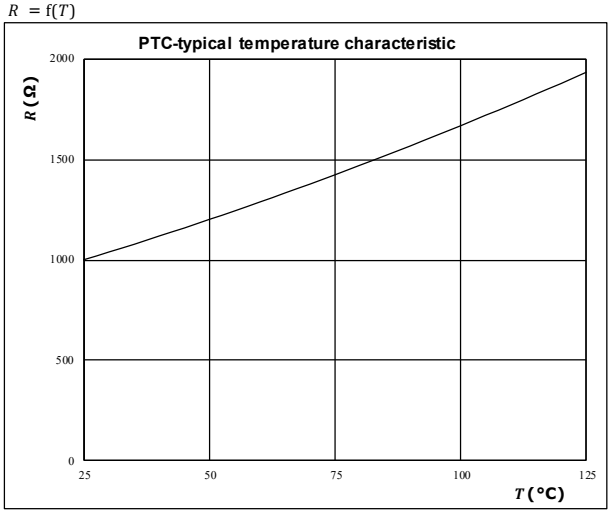
R (K/W)	τ (s)
3,96E-02	7,93E+00
7,42E-02	6,75E-01
1,97E-01	1,21E-01
5,70E-01	4,03E-02
1,06E-01	7,84E-03
7,13E-02	1,20E-03
4,92E-03	5,81E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical PTC characteristic
as a function of temperature

$R = f(T)$

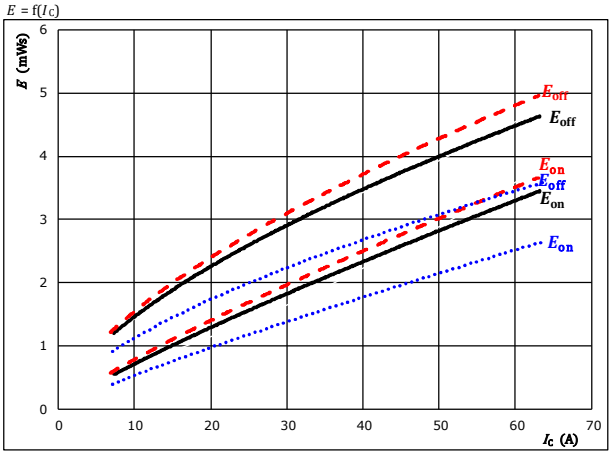


Inverter / Brake Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



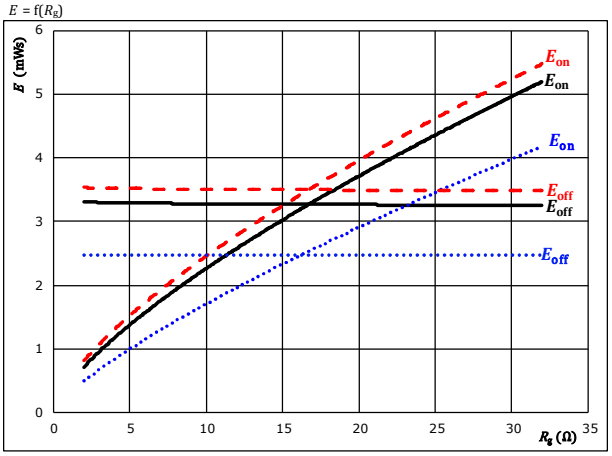
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C
R_{goff} =	8	Ω		

figure 2. IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



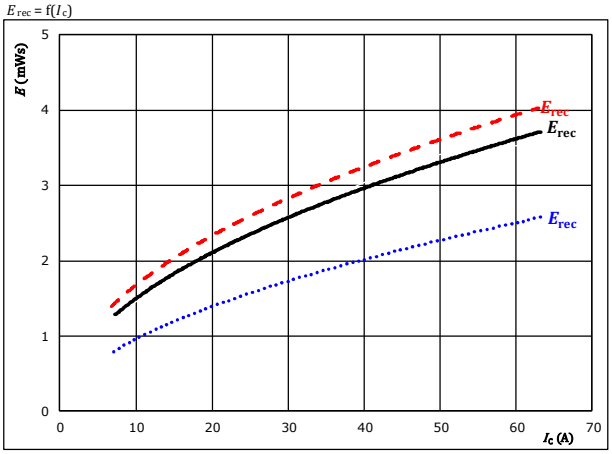
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	35	A		150 °C

figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_c)$



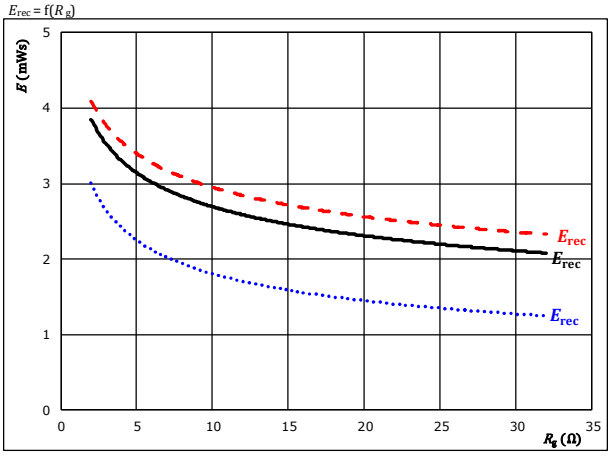
With an inductive load at

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

figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

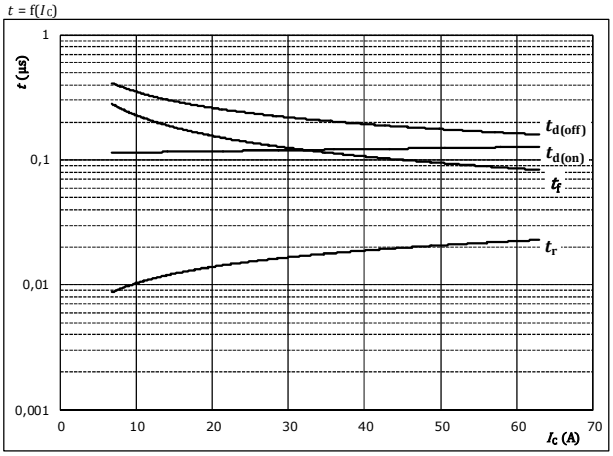
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	35	A		150 °C

Inverter / Brake Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



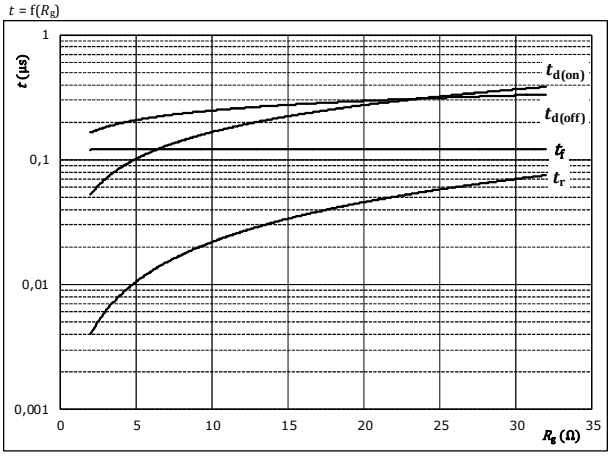
With an inductive load at

T_j =	150	°C
V_{CE} =	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

$t = f(R_g)$



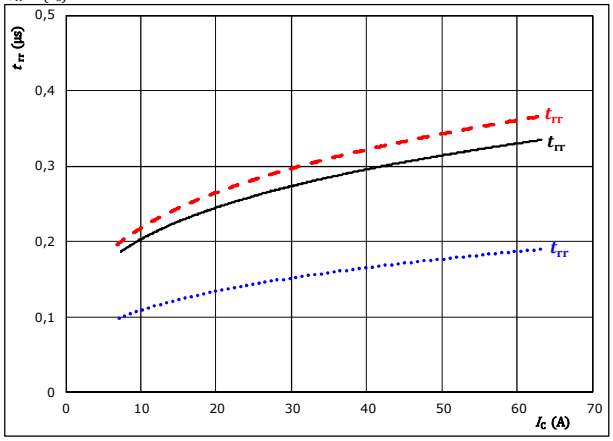
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	35	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

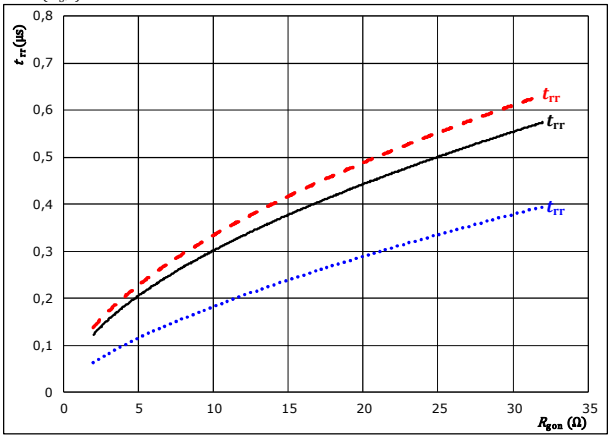


At					
V_{CE} =	600	V	T_j:	25 °C	
V_{GE} =	±15	V		125 °C	
R_{gon} =	8	Ω		150 °C	

figure 8. **FWD**

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

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



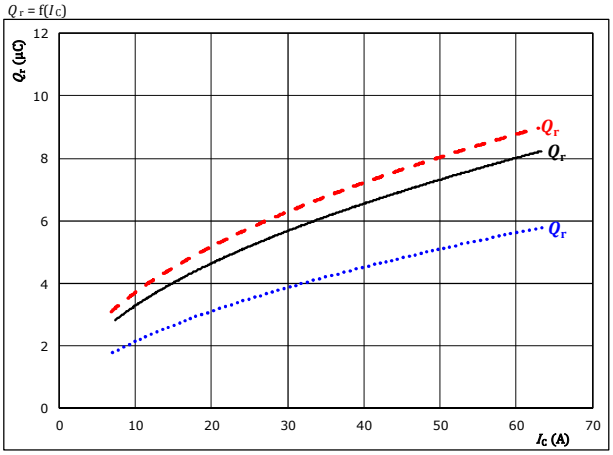
At					
V_{CE} =	600	V	T_j:	25 °C	
V_{GE} =	±15	V		125 °C	
I_C =	35	A		150 °C	

Inverter / Brake Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

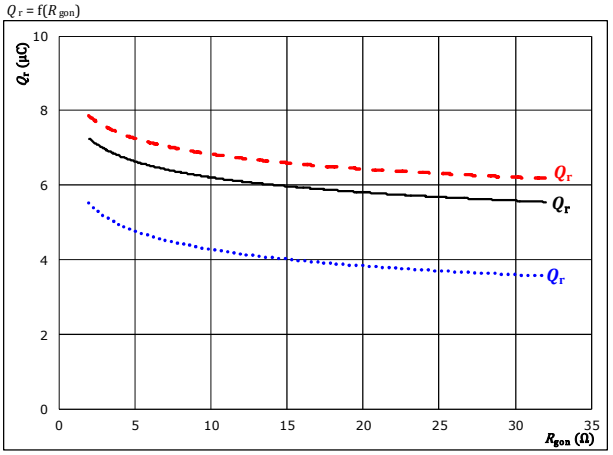


At					
V_{CE} =	600	V		25 °C	
V_{GE} =	±15	V	T_j:	125 °C	
R_{gon} =	8	Ω		150 °C	

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

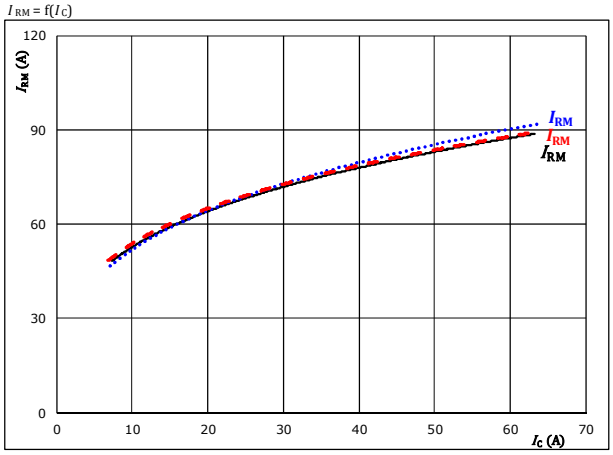


At					
V_{CE}=	600	V		25 °C	
V_{GE} =	±15	V	T_j:	125 °C	
I_C=	35	A		150 °C	

figure 11. **FWD**

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

$I_{RM} = f(I_C)$

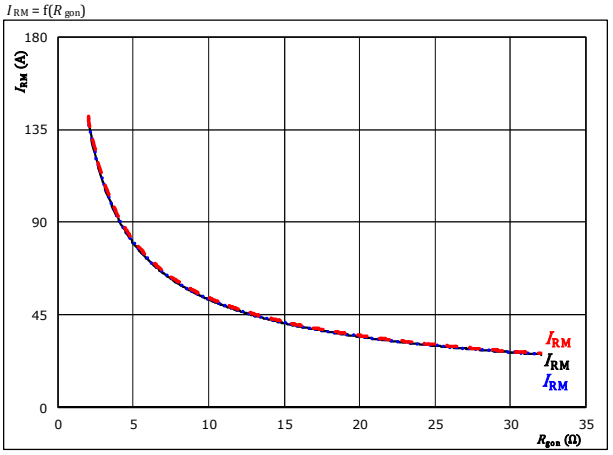


At					
V_{CE}:	600	V		25 °C	
V_{GE} =	±15	V	T_j:	125 °C	
R_{gon} =	8	Ω		150 °C	

figure 12. **FWD**

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

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



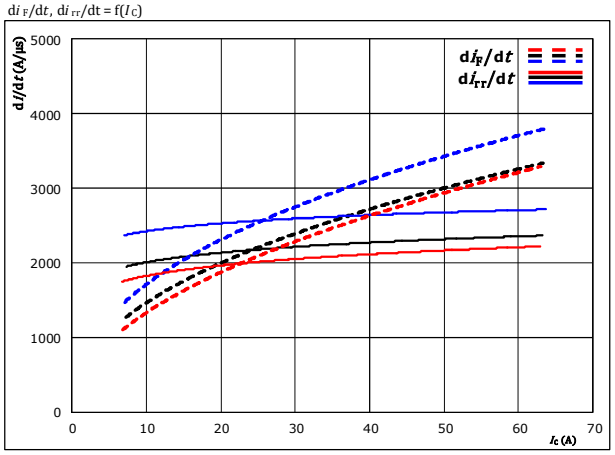
At					
V_{CE} =	600	V		25 °C	
V_{GE} =	±15	V	T_j:	125 °C	
I_C =	35	A		150 °C	

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

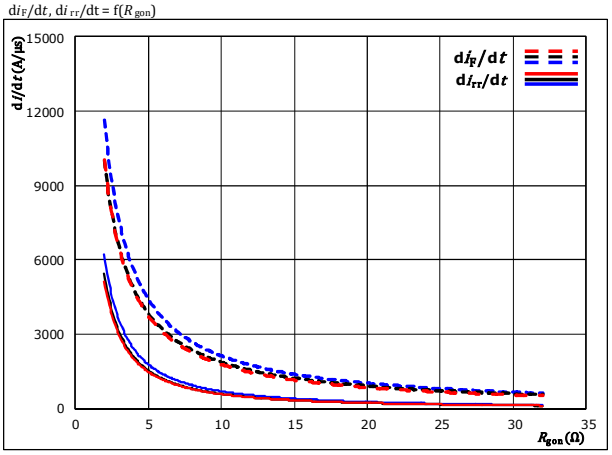


At						
V_{CE} =	600	V		25	°C	·····
V_{GE} =	±15	V	T_j:	125	°C	———
R_{gon} =	8	Ω		150	°C	– – – –

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

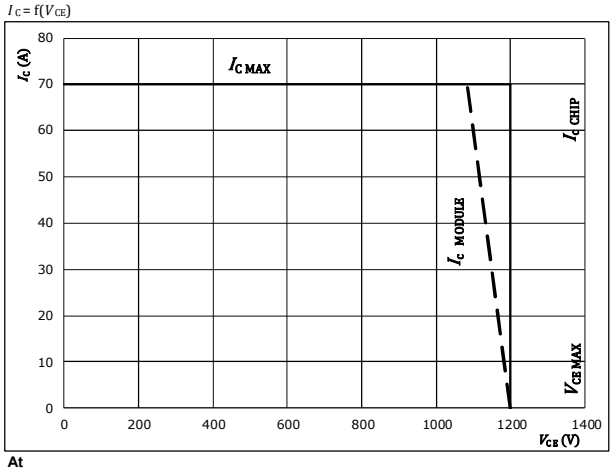


At						
V_{CE} =	600	V		25	°C	·····
V_{GE} =	±15	V	T_j:	125	°C	———
I_C =	35	A		150	°C	– – – –

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	125	°C
R_{gon} =	8	Ω
R_{goff} =	8	Ω

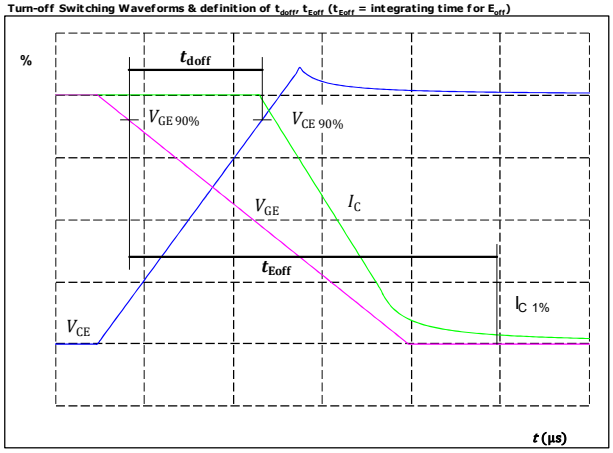
Inverter / Brake Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

figure 1. IGBT

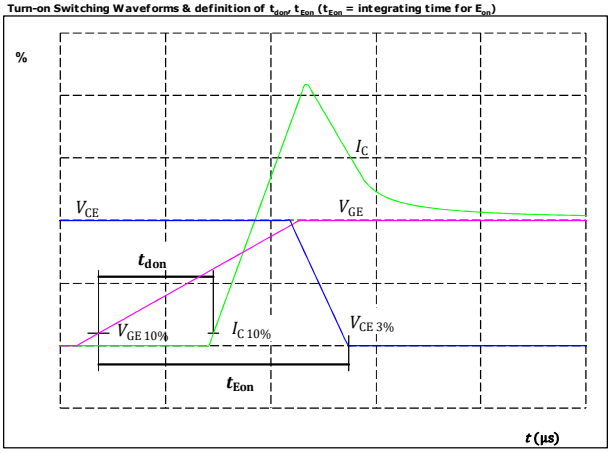
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	35	A
t_{doff} =	203	ns

figure 2. IGBT

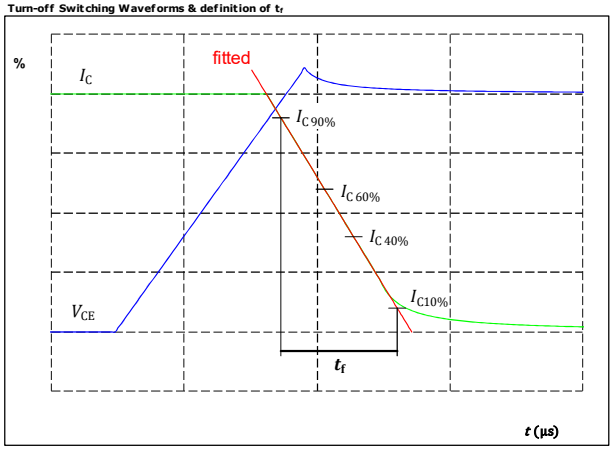
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	35	A
t_{don} =	122	ns

figure 3. IGBT

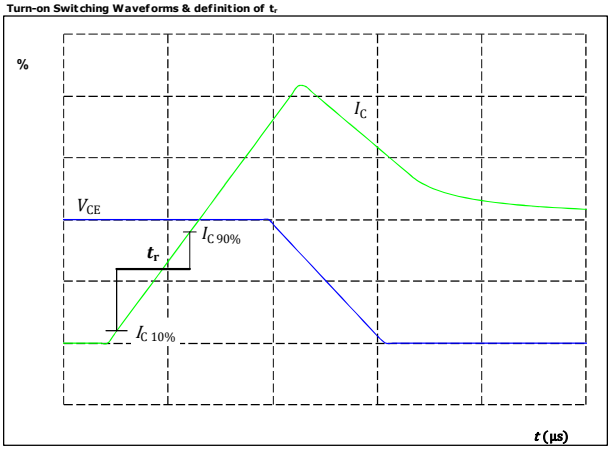
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	35	A
t_f =	118	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

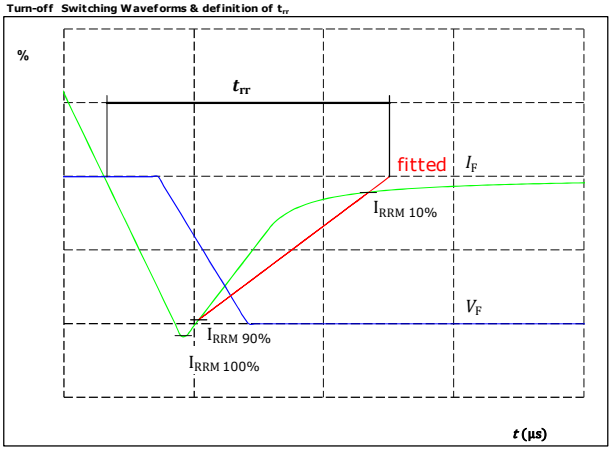


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	35	A
t_r =	17	ns

Inverter / Brake Switching Characteristics

figure 5. **FWD**

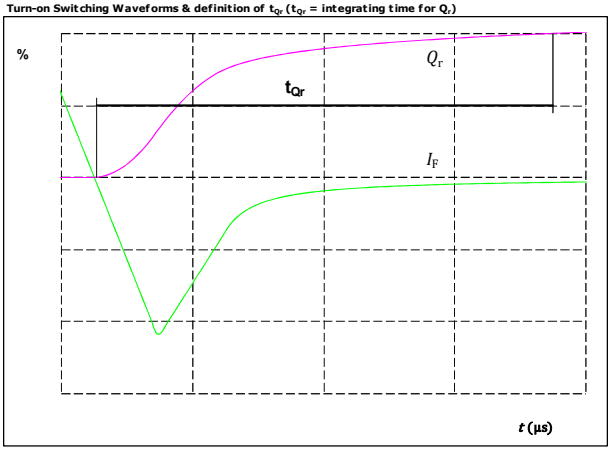
Turn-off Switching Waveforms & definition of t_{rr}



$V_F(100\%)$ =	600	V
$I_F(100\%)$ =	35	A
$I_{RRM}(100\%)$ =	76	A
t_{rr} =	284	ns

figure 6. **FWD**

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



$I_F(100\%)$ =	35	A
$Q_r(100\%)$ =	6,18	µC

Vincotech

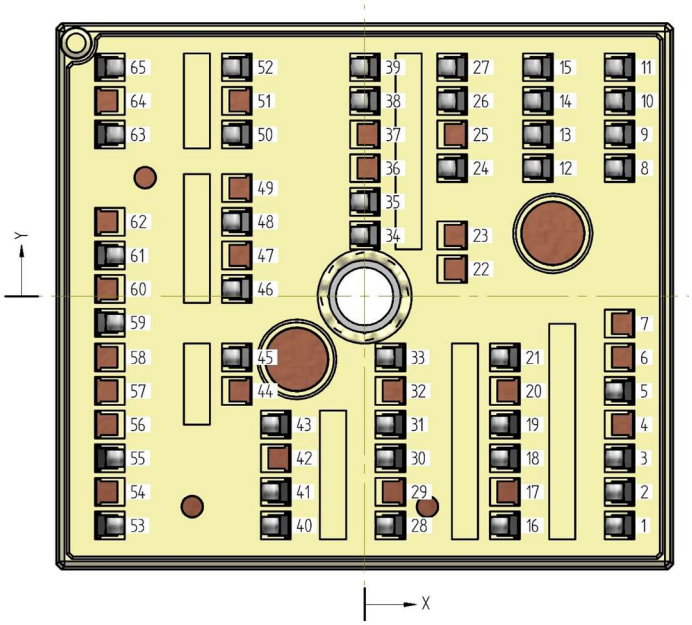
Ordering Code & Marking

Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M212PMB035M7-K220A71-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M212PMB035M7-K220A71-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M212PMB035M7-K220A71-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M212PMB035M7-K220A71-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M212PMB035M7-K220A71-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M212PMB035M7-K220A71-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M212PMB035M7-K220A71-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M212PMB035M7-K220A71-/5B/

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

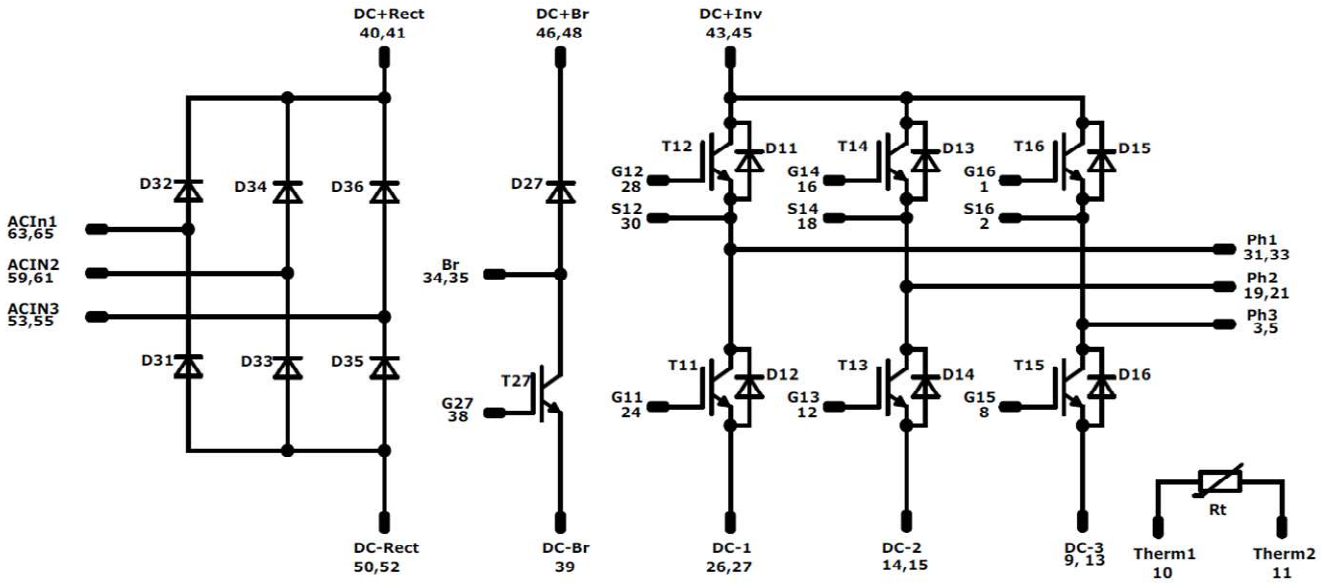
Outline

PCB pad table				PCB pad table			
Pin	X	Y	Function	Pin	X	Y	Function
1	24,38	-21,8	G16	48	-12,22	7,1	DC+Br
2	24,38	-18,6	S16	49	Not assembled		
3	24,38	-15,4	Ph3	50	-12,22	15,4	DC-Rect
4	Not assembled			51	Not assembled		
5	24,38	-9	Ph3	52	-12,22	21,8	DC-Rect
6	Not assembled			53	-24,38	-21,8	ACIn3
7	Not assembled			54	Not assembled		
8	24,38	12,2	G15	55	-24,38	-15,4	ACIn3
9	24,38	15,4	DC-3	56	Not assembled		
10	24,38	18,6	Therm1	57	Not assembled		
11	24,38	21,8	Therm2	58	Not assembled		
12	16,58	12,2	G13	59	-24,38	-2,5	ACIn2
13	16,58	15,4	DC-3	60	Not assembled		
14	16,58	18,6	DC-2	61	-24,38	3,9	ACIn2
15	16,58	21,8	DC-2	62	Not assembled		
16	13,42	-21,8	G14	63	-24,38	15,4	ACIn1
17	Not assembled			64	Not assembled		
18	13,42	-15,4	S14	65	-24,38	21,8	ACIn1
19	13,42	-12,2	Ph2				
20	Not assembled						
21	13,42	-5,8	Ph2				
22	Not assembled						
23	Not assembled						
24	8,38	12,2	G11				
25	Not assembled						
26	8,38	18,6	DC-1				
27	8,38	21,8	DC-1				
28	2,46	-21,8	G12				
29	Not assembled						
30	2,46	-15,4	S12				
31	2,46	-12,2	Ph1				
32	Not assembled						
33	2,46	-5,8	Ph1				
34	-0,01	5,85	Br				
35	-0,01	9,05	Br				
36	Not assembled						
37	Not assembled						
38	-0,01	18,65	G27				
39	0,03	21,8	DC-Br				
40	-8,5	-21,8	DC+Rect				
41	-8,5	-18,6	DC+Rect				
42	Not assembled						
43	-8,5	-12,2	DC+Inv				
44	Not assembled						
45	-12,22	-5,8	DC+Inv				
46	-12,22	0,7	DC+Br				
47	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
D31, D32, D33, D34, D35, D36	Rectifier	1600 V	35 A	Rectifier Diode	
T11, T12, T13, T14, T15, T16	IGBT	1200 V	35 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	35 A	Inverter Diode	
T27	IGBT	1200 V	35 A	Brake Switch	
D27	FWD	1200 V	35 A	Brake Diode	
Rt	PTC			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 72	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for MiniSkiiP® 2 packages see vincotech.com website.

Package data
Package data for MiniSkiiP® 2 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
80-M212PMB035M7-K220A71-D3-14	29 Sep. 2020	Correction of PCB pad table	16