Vincotech

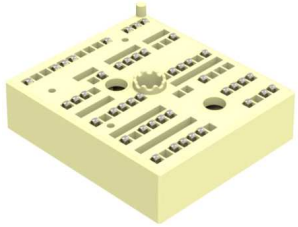
80-M212WPB025SC-K388F
datasheet

MiniSKiiP PACK 2 — **1200 V / 25 A**

Features

- Twin sixpack configuration for 4Q inverters
- Trench IGBT4 Technology
- Solderless spring contact mounting system

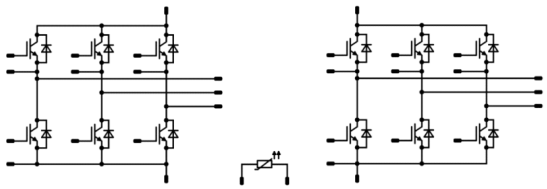
MiniSkiip 2 housing



Target applications

- Industrial Drives

Schematic



Types

- 80-M212WPB025SC-K388F

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	T_j = T_{jmax} T_s = 80 °C	33	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	75	A
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	95	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150°C V_{GE} = 15V	10 800	µs V
Maximum Junction Temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	27	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms	T_j = 150 °C	100	A
Surge current capability	I^2t			50	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	69	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				min. 12,7	mm
Clearance				min. 12,7	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	
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,00085	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		25	25 125 150	1,6	1,96 2,22 2,28	2,2	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			62,5	µA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f= 1 MHz	0	25		25		1450		pF
Reverse transfer capacitance	C_{res}							50		
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness ≤ 50 µm λ = 1 W/mK						1,00		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 16 Ω R_{gon} = 16 Ω	±15	600	25	25 150		71 72		ns
Rise time	t_r					25 150		32 36		
Turn-off delay time	$t_{d(off)}$					25 150		199 270		
Fall time	t_f					25 150		90 135		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 1,5 µC Q_{rFWD} = 3,9 µC				25 150		1,607 2,462		mWs
Turn-off energy (per pulse)	E_{off}					25 150		1,527 2,498		

Characteristic Values

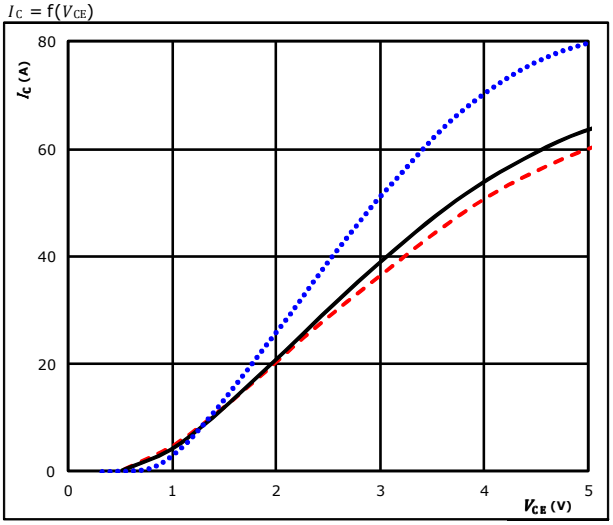
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Diode										
Static										
Forward voltage	V_F				25	25 150	1	2,47 2,49	2,8	V
Reverse leakage current	I_r			1200		25 150			60 3300	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness ≤ 50 µm λ = 1 W/mK						1,37		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 690 A/µs di/dt = 578 A/µs	±15	600	25	25 150		12 17		A
Reverse recovery time	t_{rr}					25 150		278 580		ns
Recovered charge	Q_r					25 150		1,549 3,882		µC
Reverse recovered energy	E_{rec}					25 150		0,607 1,631		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		111 89		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	

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

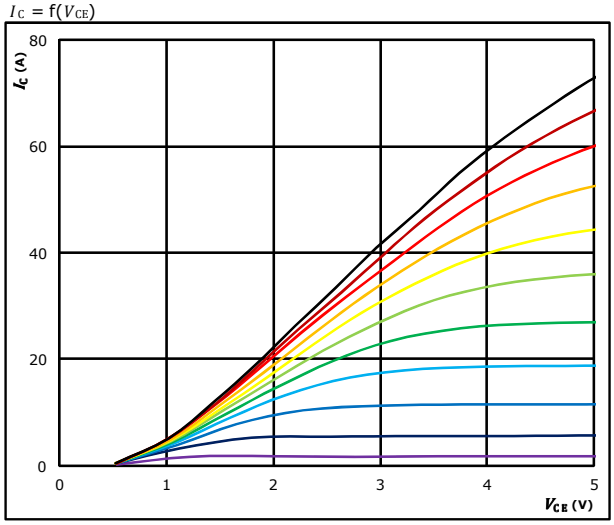


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

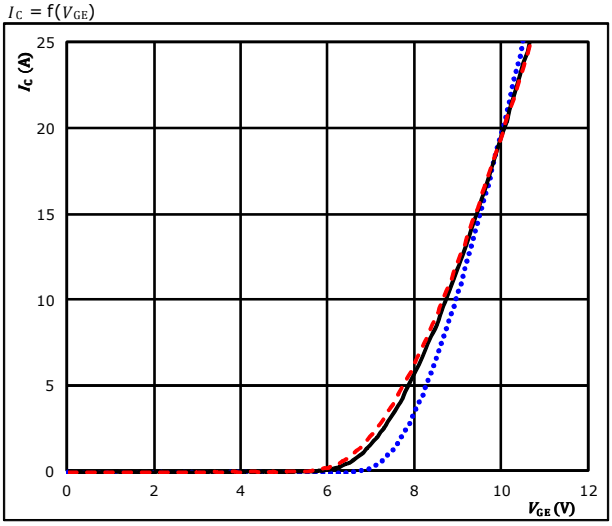


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

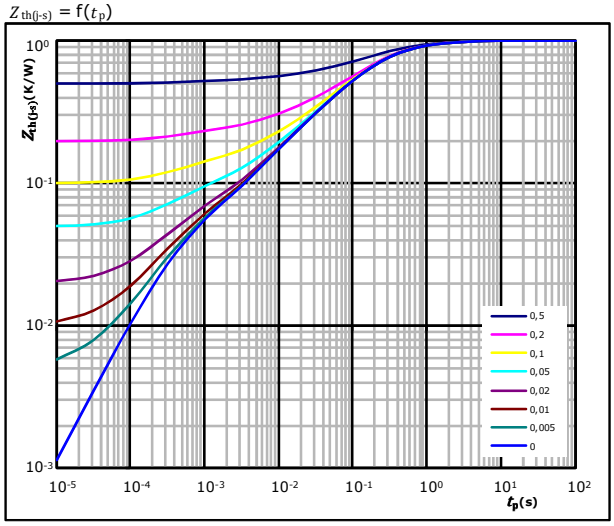


t_p =	100	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 4. **IGBT**

Transient Thermal Impedance as function of Pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,00	K/W

IGBT thermal model values

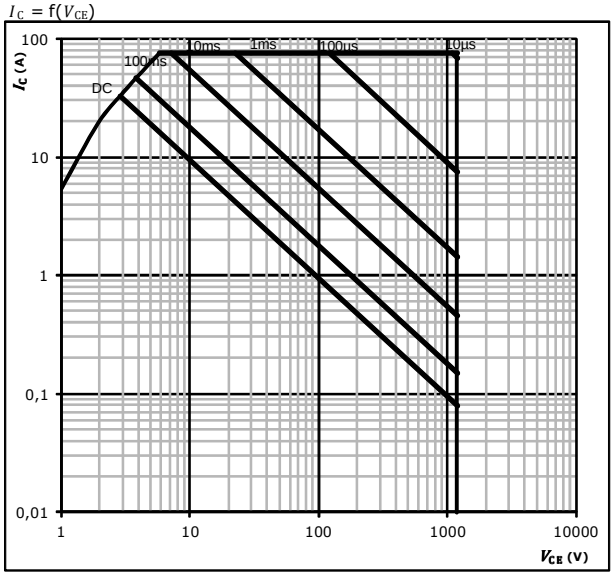
R (K/W)	τ (s)
4,33E-02	3,72E+00
2,16E-01	6,10E-01
4,68E-01	1,52E-01
1,79E-01	2,85E-02
5,59E-02	4,38E-03
3,78E-02	4,07E-04

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



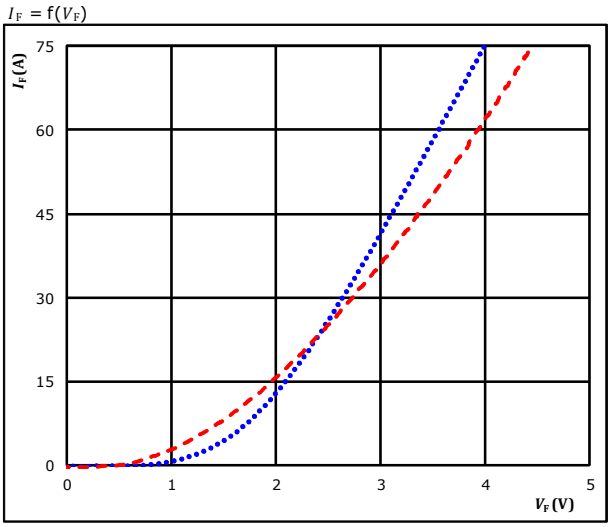
At

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

Inverter Diode Characteristics

figure 1. **FWD**

Typical forward characteristics



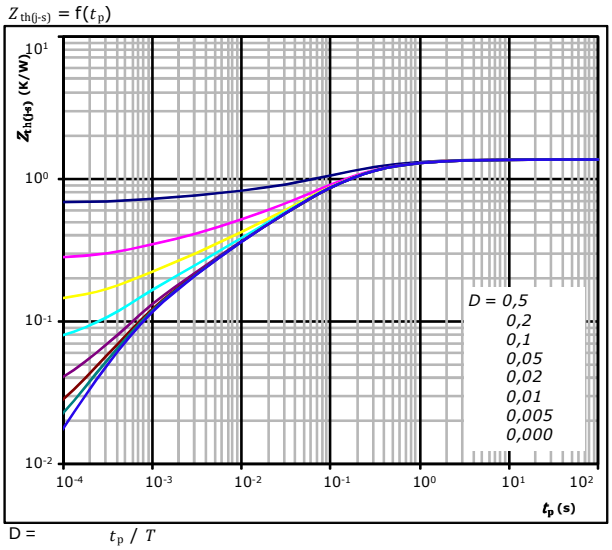
t_p = 250 µs

T_j: 25 °C

150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width



D = t_p / T

$R_{th(j-s)}$ = 1,37 K/W

FWD thermal model values

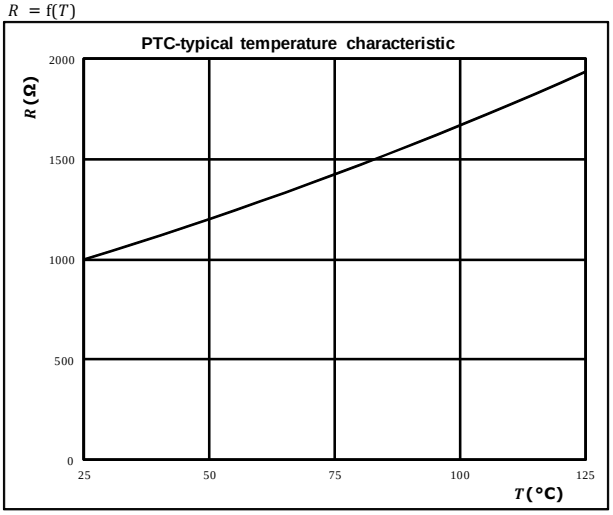
R (K/W)	τ (s)
2,62E-02	9,28E+00
2,01E-01	7,62E-01
5,69E-01	1,47E-01
3,29E-01	2,99E-02
1,55E-01	4,40E-03
8,83E-02	6,49E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical PTC characteristic as a function of temperature

$R = f(T)$

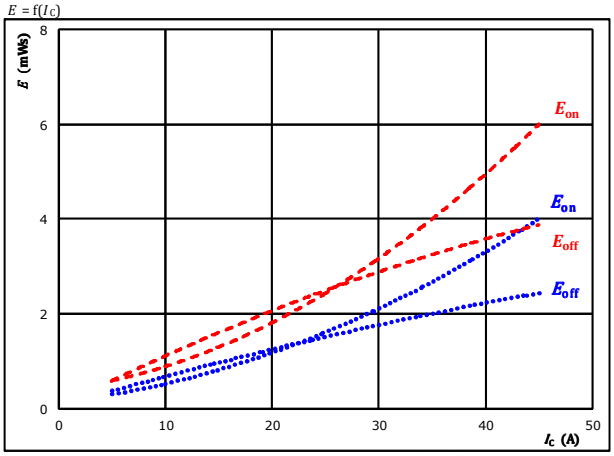


Inverter Switching Characteristics

Figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



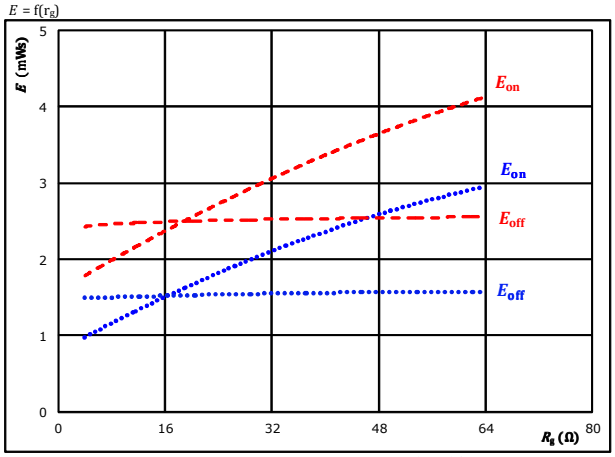
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C
R_{goff} =	16	Ω		

Figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(r_G)$



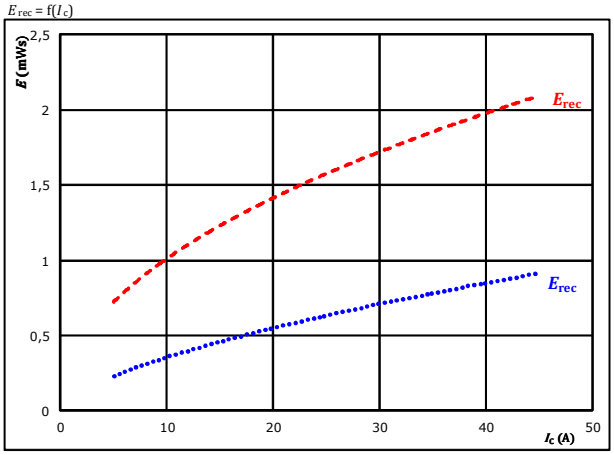
With an inductive load at

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

Figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



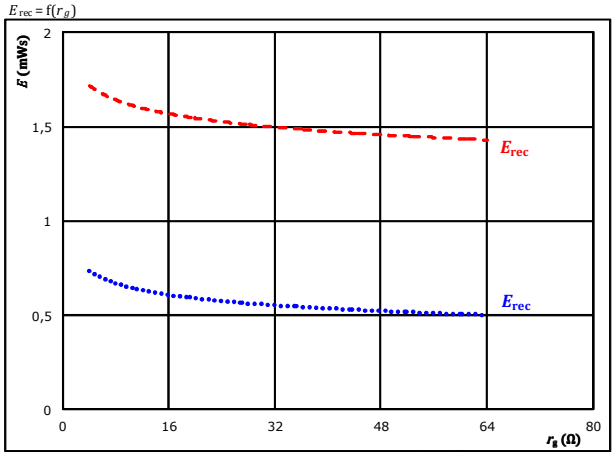
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	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

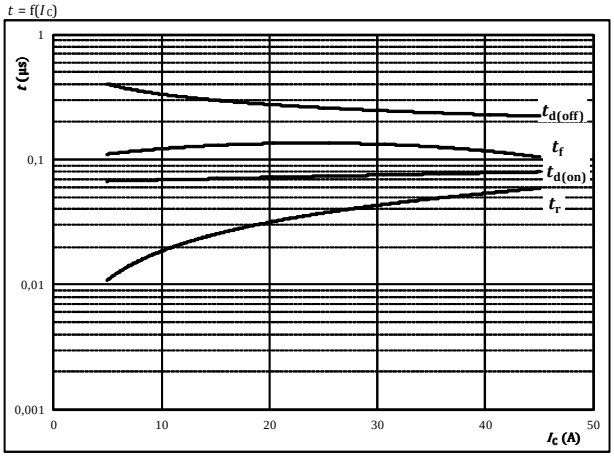
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	25	A		150 °C

Inverter Switching Characteristics

Figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



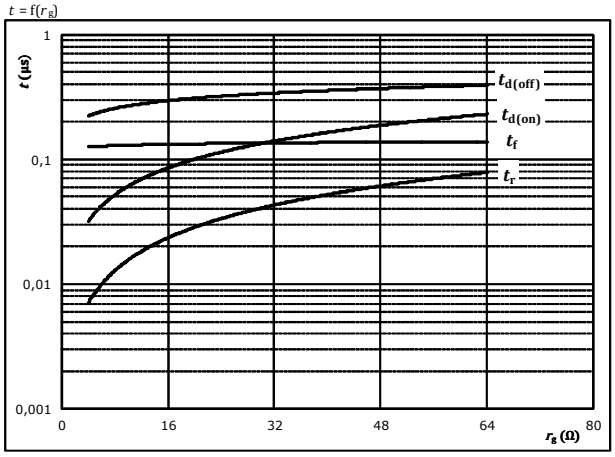
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

Figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(r_g)$



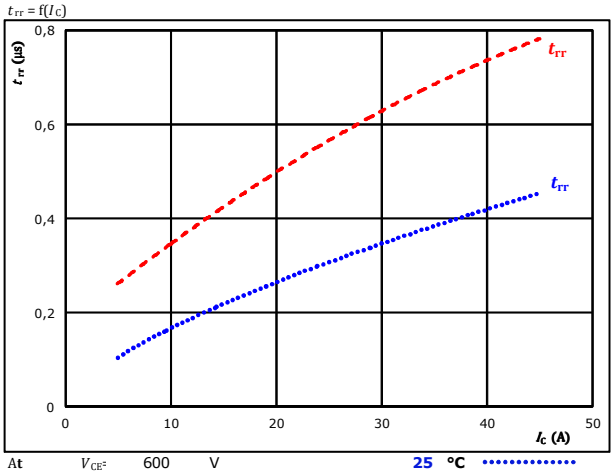
With an inductive load at

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

Figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

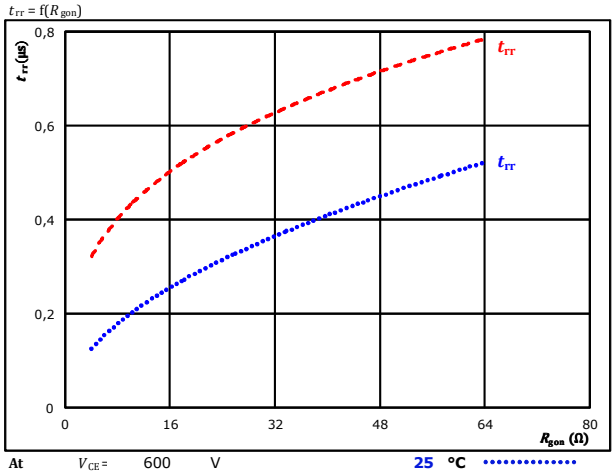


At	V_{CE} =	600	V		25 °C
	V_{GE} =	±15	V	T_j:	125 °C
	R_{gon} =	16	Ω		150 °C

Figure 8. **FWD**

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

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



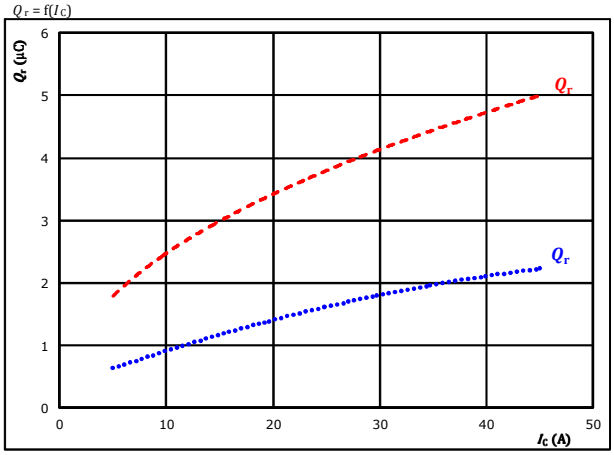
At	V_{CE} =	600	V		25 °C
	V_{GE} =	±15	V	T_j:	125 °C
	I_C =	25	A		150 °C

Inverter Switching Characteristics

Figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

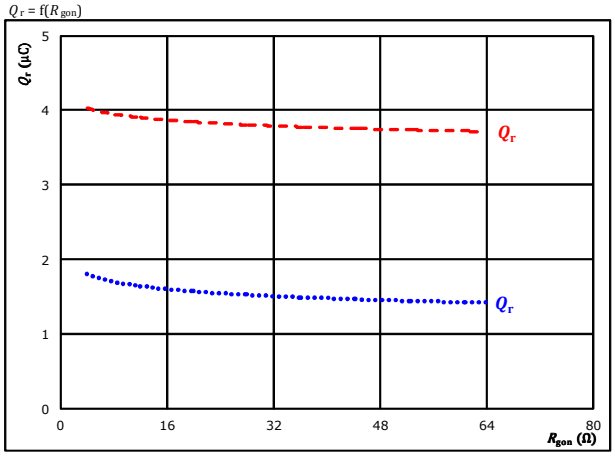


At	V_{CE} =	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	16	Ω		150 °C	

Figure 10. **FWD**

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

$Q_r = f(R_{gon})$

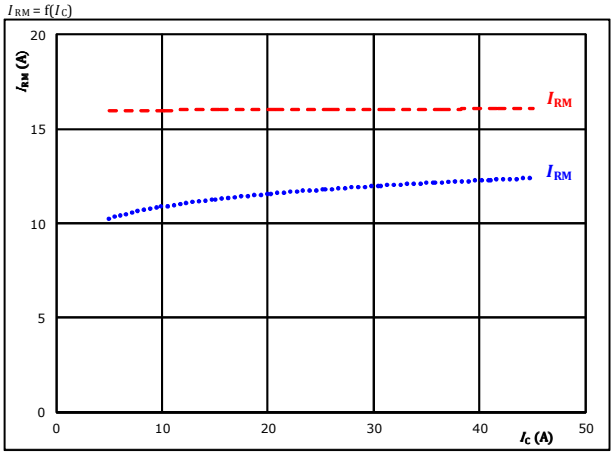


At	V_{CE}=	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C=	25	A		150 °C	

Figure 11. **FWD**

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

$I_{RM} = f(I_C)$

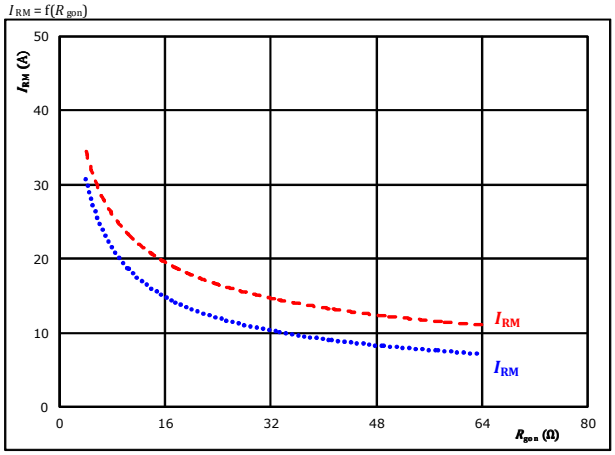


At	V_{CE}:	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	16	Ω		150 °C	

Figure 12. **FWD**

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

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



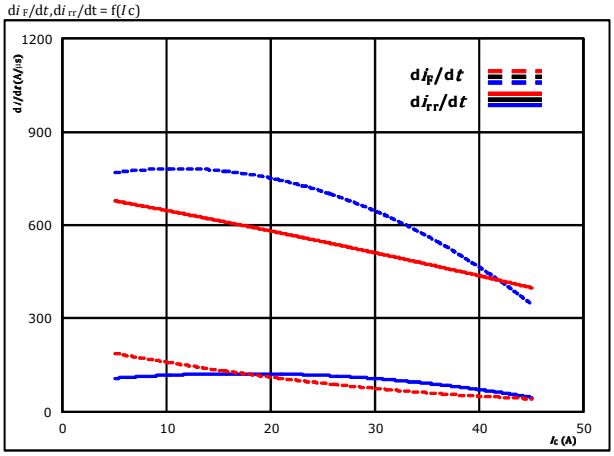
At	V_{CE} =	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C =	25	A		150 °C	

Inverter Switching Characteristics

Figure 13. **FWD**

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

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

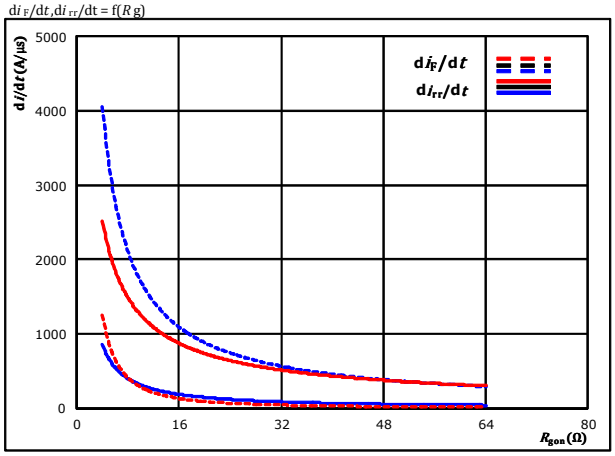


At	V_{CE} =	600	V		
	V_{GE} =	±15	V	T_j:	25 ℃
	R_{gon} =	16	Ω		125 ℃
					150 ℃

Figure 14. **FWD**

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

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

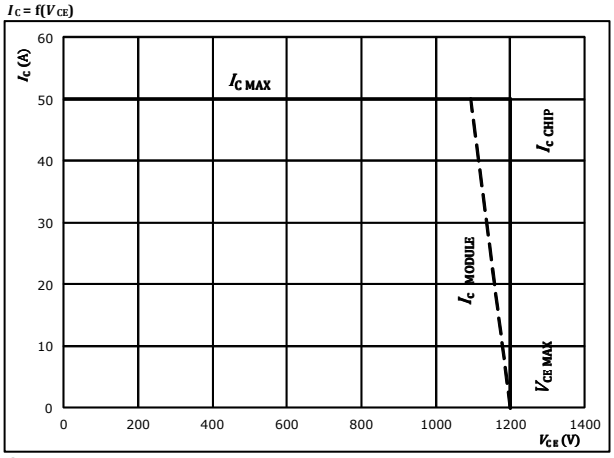


At	V_{CE} =	600	V
	V_{GE} =	±15	V
	I_C =	25	A

Figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	175	°C	
R_{gon} =	16	Ω	
R_{goff} =	16	Ω	

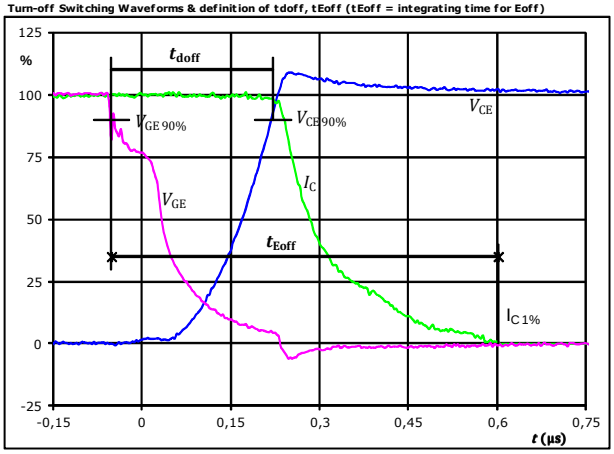
Inverter Switching Definitions

General conditions

T_j	=	**150 °C**
R_{gon}	=	**16 Ω**
R_{goff}	=	**16 Ω**

Figure 1. IGBT

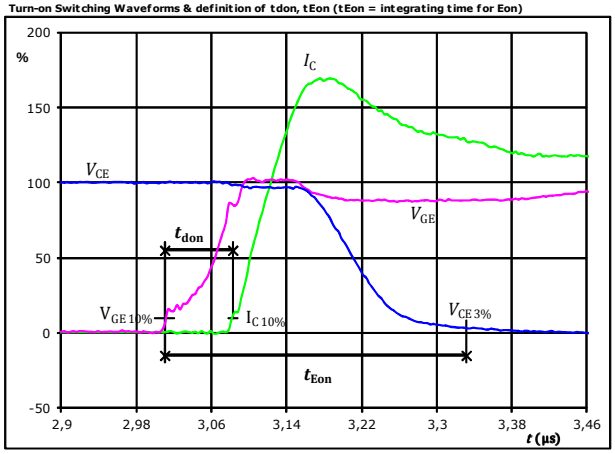
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	25	A
t_{doff} =	0,270	µs
t_{Eoff} =	0,653	µs

Figure 2. IGBT

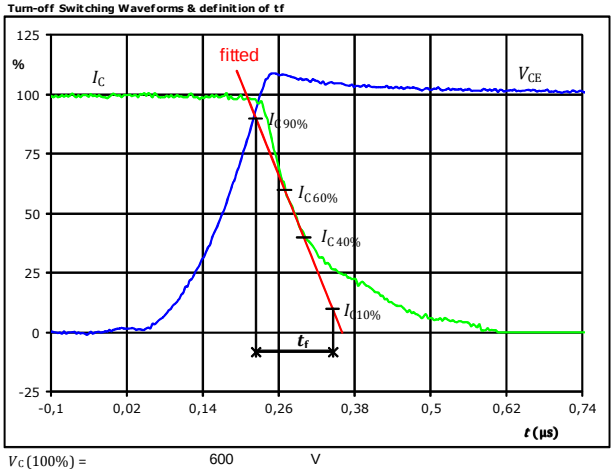
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	25	A
t_{don} =	0,072	µs
t_{Eon} =	0,321	µs

Figure 3. IGBT

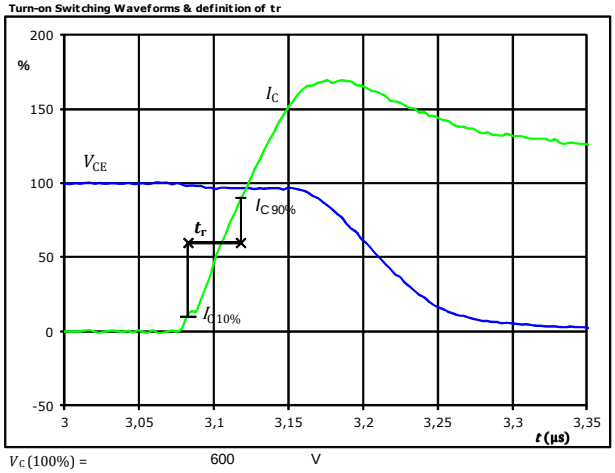
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	25	A
t_f =	0,135	µs

Figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

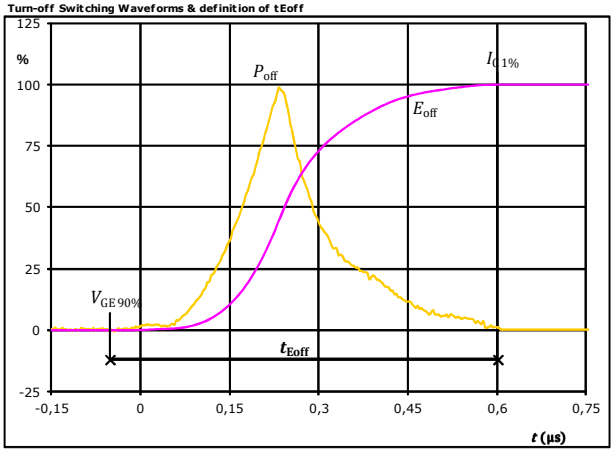


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	25	A
t_r =	0,036	µs

Inverter Switching Characteristics

Figure 5. **IGBT**

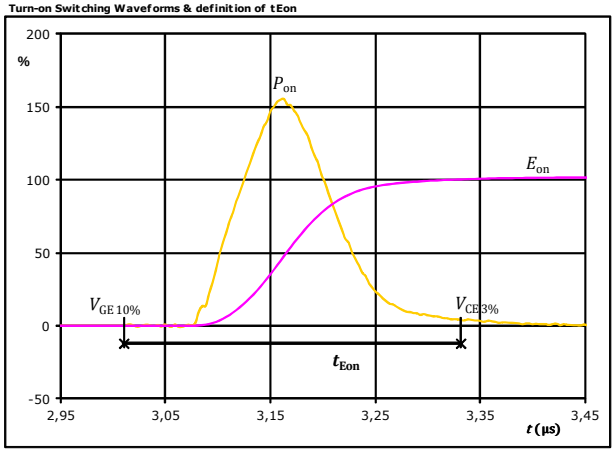
Turn-off Switching Waveforms & definition of tEoff



$P_{off}(100\%)$ =	15,03	kW
$E_{off}(100\%)$ =	2,50	mJ
t_{Eoff} =	0,65	µs

Figure 6. **IGBT**

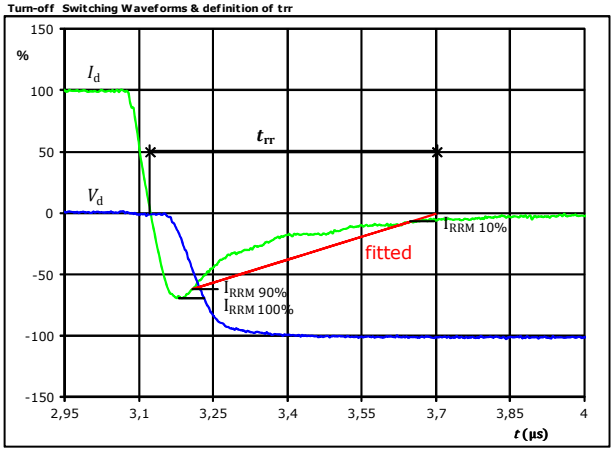
Turn-on Switching Waveforms & definition of tEon



$P_{on}(100\%)$ =	15,03	kW
$E_{on}(100\%)$ =	2,46	mJ
t_{Eon} =	0,321	µs

Figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

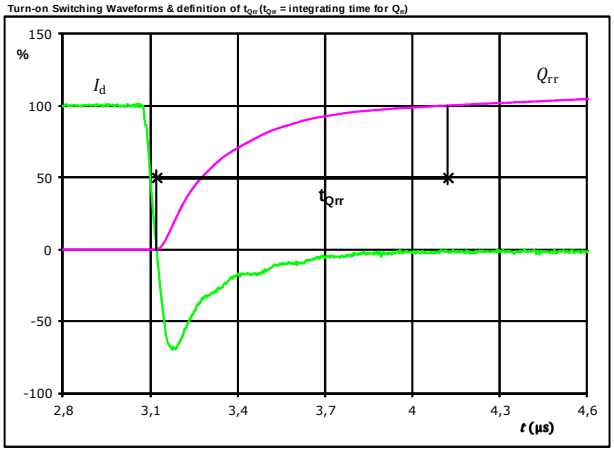


$V_d(100\%)$ =	600	V
$I_d(100\%)$ =	25	A
$I_{RRM}(100\%)$ =	-17	A
t_{rr} =	0,580	µs

Inverter Switching Characteristics

Figure 8. **FWD**

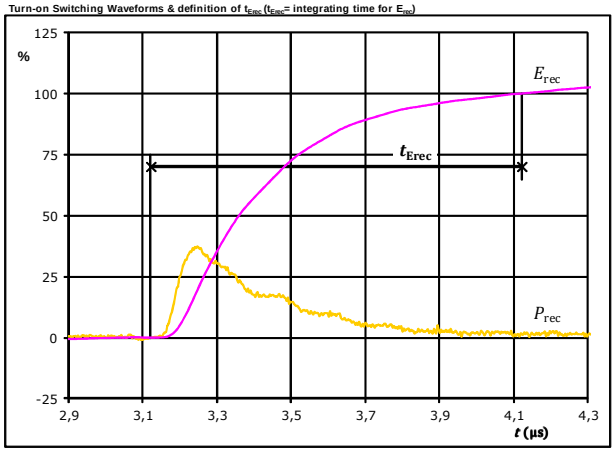
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	25	A
Q_{rr} (100%) =	3,88	µC
t_{Qrr} =	1,00	µs

Figure 9. **FWD**

Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	15,03	kW
E_{rec} (100%) =	1,63	mJ
t_{Erec} =	1,00	µs

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Ordering Code & Marking

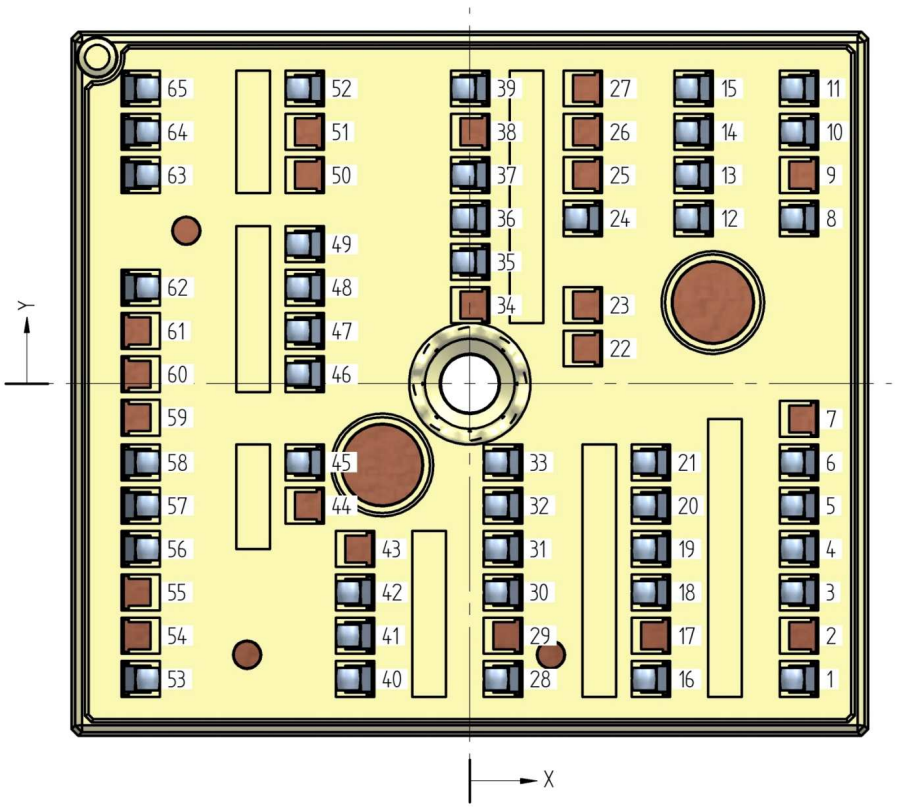
Version	Ordering Code
with std lid (black V23990-K22-T-2-PM) with thermal paste	80-M212WPB025SC-K388F-/1A/
with thin lid (white V23990-K23-T-3-PM) with thermal paste	80-M212WPB025SC-K388F-/1B/

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

Outline

PCB pad table			
Pin	X	Y	Function
1	24,38	-21,8	DC+2
2	Not assembled		
3	24,38	-15,4	G26
4	24,38	-12,2	S26
5	24,38	-9	Ph23
6	24,38	-5,8	Ph23
7	Not assembled		
8	24,38	12,2	G25
9	Not assembled		
10	24,38	18,6	Therm1
11	24,38	21,8	Therm2
12	16,58	12,2	G23
13	16,58	15,4	Se2
14	16,58	18,6	DC-2
15	16,58	21,8	DC-2
16	13,42	-21,8	DC+2
17	Not assembled		
18	13,42	-15,4	G24
19	13,42	-12,2	S24
20	13,42	-9	Ph22
21	13,42	-5,8	Ph22
22	Not assembled		
23	Not assembled		
24	8,38	12,2	G21
25	Not assembled		
26	Not assembled		
27	Not assembled		
28	2,46	-21,8	DC+2
29	Not assembled		
30	2,46	-15,4	G22
31	2,46	-12,2	S22
32	2,46	-9	Ph21
33	2,46	-5,8	Ph21
34	Not assembled		
35	0,03	9	Se1
36	0,03	12,2	DC-1
37	0,03	15,4	DC-1
38	Not assembled		
39	0,03	21,8	G13
40	-8,5	-21,8	S12
41	-8,5	-18,6	Ph11
42	-8,5	-15,4	Ph11
43	Not assembled		
44	Not assembled		
45	-12,22	-5,8	G11
46	-12,22	0,7	G14
47	-12,22	3,9	S14
48	-12,22	7,1	Ph12
49	-12,22	10,3	Ph12
50	Not assembled		
51	Not assembled		

PCB pad table			
Pin	X	Y	Function
52	-12,22	21,8	G15
53	-24,38	-21,8	G12
54	Not assembled		
55	Not assembled		
56	-24,38	-12,2	DC+1
57	-24,38	-9	DC+1
58	-24,38	-5,8	DC+1
59	Not assembled		
60	Not assembled		
61	Not assembled		
62	-24,38	7,1	G16
63	-24,38	15,4	S16
64	-24,38	18,6	Ph13
65	-24,38	21,8	Ph13



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

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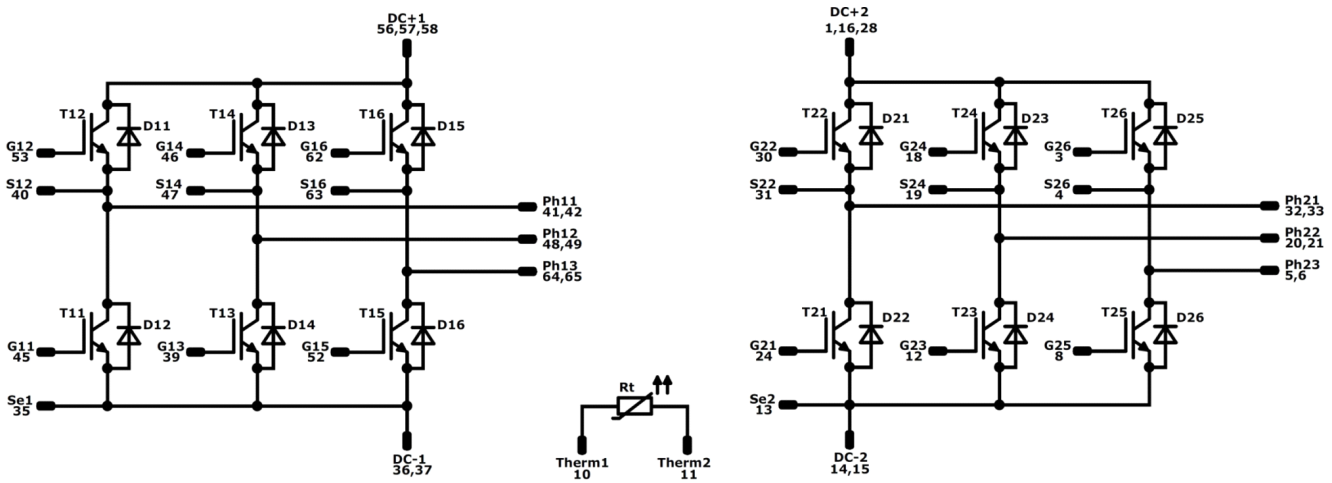
Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11 , T12 , T13 T14 , T15 , T16 T21 , T22 , T23 T24 , T25 , T26	IGBT	1200 V	25 A	Inverter Switch	
D11 , D12 , D13 D14 , D15 , D16 D21 , D22 , D23 D24 , D25 , D26	FWD	1200 V	25 A	Inverter Diode	
Rt	Thermistor			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-M212WPB025SC-K388F-D2-14	04 Sep. 2017	New ordering option added	16