



MiniSKiiP® PACK 3

1200 V / 200 A

Topology features

- Inverter
- Kelvin Emitter for improved switching performance
- Temperature sensor

Component features

- Easy paralleling
- Low turn-off losses
- Low collector emitter saturation voltage
- Positive temperature coefficient
- Short tail current
- Switching optimized for EMC

Housing features

- Base isolation: Si₃N₄
- Easy assembly in one mounting step
- Flexible PCB design w/o pin holes
- Rugged solderless spring contacts

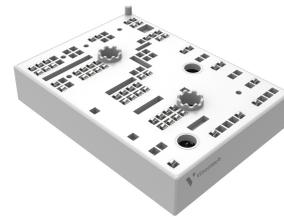
Target applications

- Industrial Drives

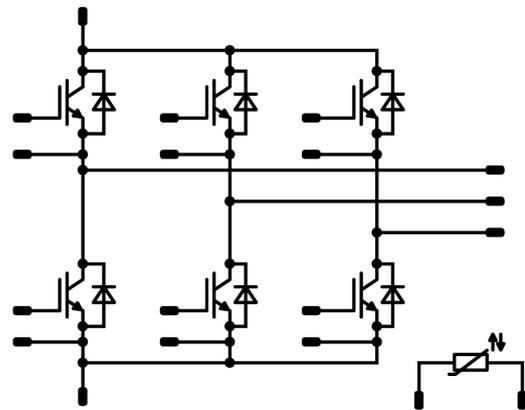
Types

- 80-M3126PA200M701-K820F72

MiniSKiiP® 3 16 mm housing



Schematic





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Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	222	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	400	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	464	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$, $V_{CC} = 800\text{ V}$ $T_j = 150\text{ °C}$	9,5	μs
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

Inverter Diode

Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	184	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	400	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	363	W
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

Module Properties

Thermal Properties

Storage temperature	T_{stg}		-40...+125	$^{\circ}\text{C}$
Operation temperature under switching condition	T_{jop}		-40...+($T_{jmax} - 25$)	$^{\circ}\text{C}$

Isolation Properties

Isolation voltage	V_{isol}	DC Test Voltage* $t_p = 2\text{ s}$	5500	V
Isolation voltage	V'_{isol}	AC Voltage $t_p = 1\text{ min}$	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		≥ 600	

*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		

Inverter Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$		10	0,02	25	5,4	6	6,6	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	15		200	25 125 150		1,69 1,88 1,93	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						2		Ω
Input capacitance	C_{ies}						37000		pF
Output capacitance	C_{oes}	0	10		25		1100		pF
Reverse transfer capacitance	C_{res}						420		pF
Gate charge	Q_g	$V_{CC} = 600$ V	0/15		200	25		1200	nC

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 2,5$ W/mK (HPTP)					0,2		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		481,4 495,2 499,2	ns
Rise time	t_r	$R_{gon} = 4$ Ω $R_{goff} = 4$ Ω				25 125 150		165,6 180,2 187,6	ns
Turn-off delay time	$t_{d(off)}$		±15	600	200	25 125 150		335 369,2 378	ns
Fall time	t_f					25 125 150		66,21 84,66 89,83	ns
Turn-on energy (per pulse)	E_{on}	$Q_{tFWD} = 17,29$ μC $Q_{tFWD} = 27,14$ μC $Q_{tFWD} = 30,48$ μC				25 125 150		40,56 50,21 53,76	mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		11,9 16,08 17,33	mWs



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80-M3126PA200M701-K820F72
datasheet

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		
Inverter Diode										
Static										
Forward voltage	V_F			200	25 125 150		1,86 1,99 1,98	2,1 ⁽¹⁾		V
Reverse leakage current	I_R	$V_r = 1200$ V			25			40		μA
Thermal										
Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 2,5$ W/mK (HPTP)					0,26			K/W
Dynamic										
Peak recovery current	I_{RM}	$di/dt=787$ A/μs $di/dt=929$ A/μs $di/dt=579$ A/μs	±15	600	200	25		59,57		A
Reverse recovery time	t_{rr}					125		71,22		
						150		75,12		
						25		455,84		
Recovered charge	Q_r					125		606,46		
						150		666,84		
		25		17,29						
Reverse recovered energy	E_{rec}	125		27,14						
		150		30,48						
		25		5,22						
Peak rate of fall of recovery current	$(di_r/dt)_{max}$	125		8,57						
		150		9,68						
		25		408,74						
						125		251,18		A/μs
						150		221,58		



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Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
		V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	V_{CE} [V]	T_j [°C]	Min	Typ	Max	

Thermistor

Static

Rated resistance	R					25		1		kΩ
Deviation of R100	$A_{R/R}$	$R_{100} = 1670 \Omega$				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.

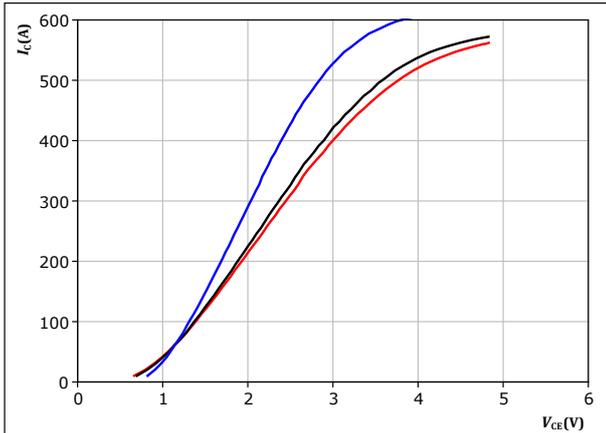


Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

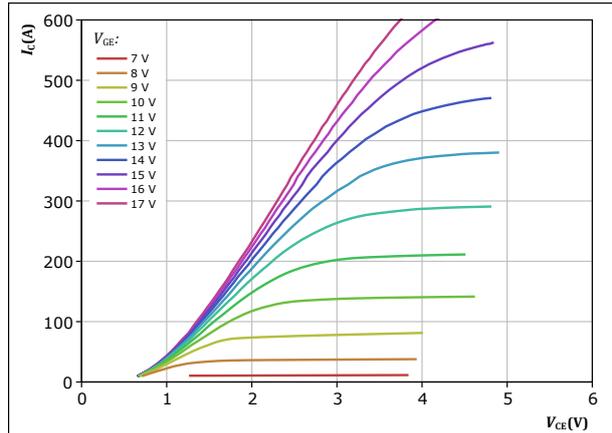


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j:$ 25 °C, 125 °C, 150 °C

figure 2. IGBT

Typical output characteristics

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

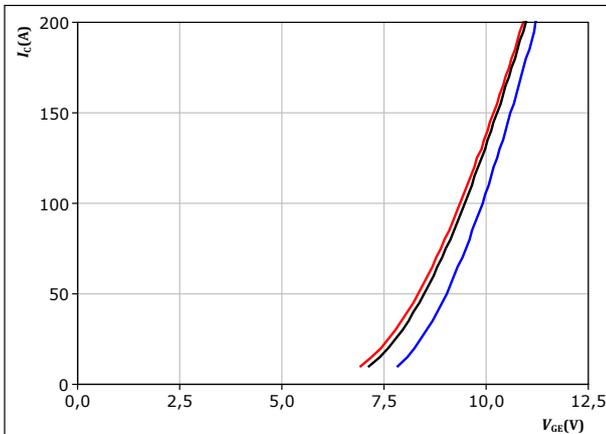


$t_p = 250 \mu s$
 $T_j = 150 \text{ }^\circ\text{C}$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

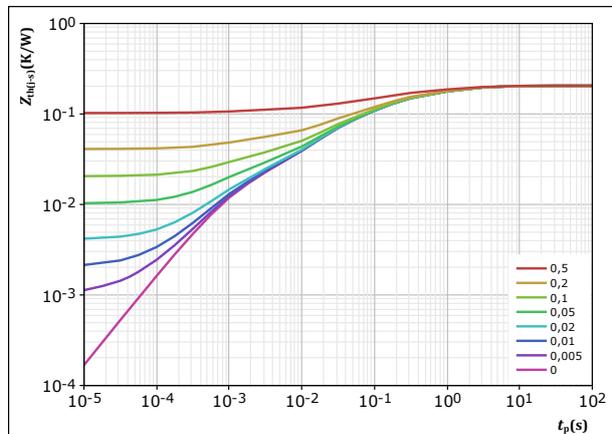


$t_p = 250 \mu s$
 $V_{CE} = 10 V$
 $T_j:$ 25 °C, 125 °C, 150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 0,205 \text{ K/W}$
 IGBT thermal model values

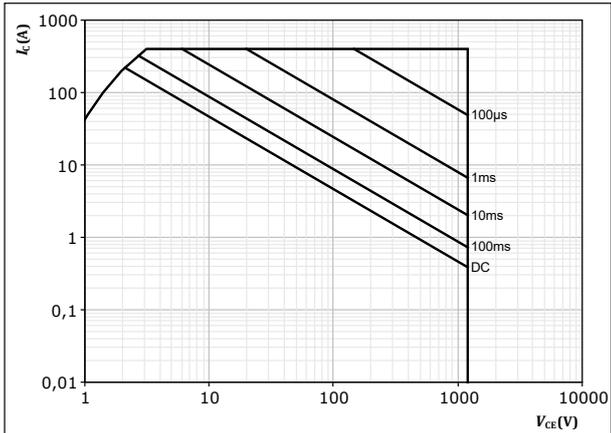
R (K/W)	τ (s)
2,22E-02	3,01E+00
4,32E-02	7,42E-01
7,78E-02	1,33E-01
4,70E-02	2,06E-02
1,48E-02	1,06E-03



Inverter Switch Characteristics

figure 5. IGBT

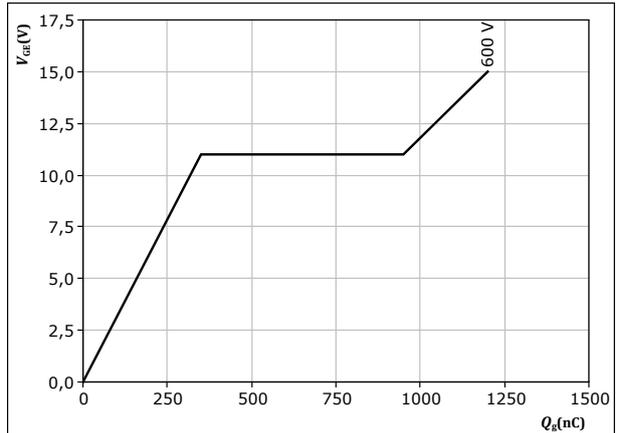
Safe operating area
 $I_C = f(V_{CE})$



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

figure 6. IGBT

Gate voltage vs gate charge
 $V_{GE} = f(Q_g)$



$I_C = 200 \text{ A}$
 $T_j = 25 \text{ } ^\circ\text{C}$



Inverter Diode Characteristics

figure 7. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

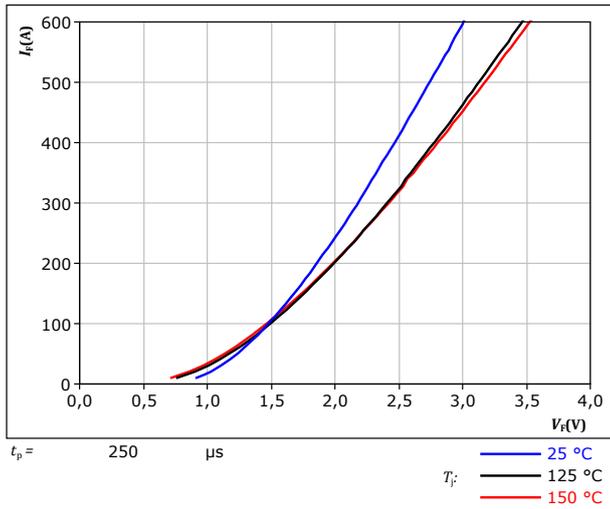
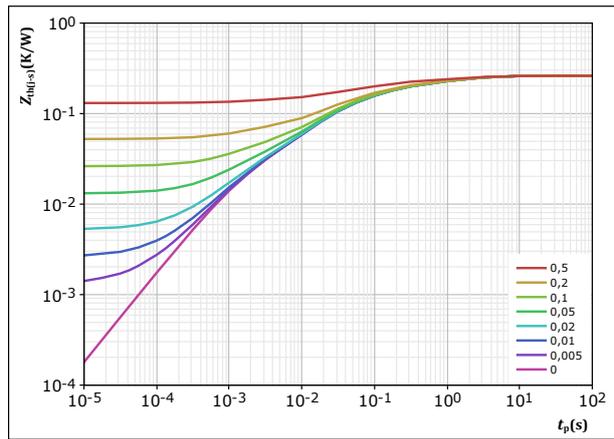


figure 8. FWD

Transient thermal impedance as a function of pulse width

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



$D = \frac{t_p}{T}$
 $R_{th(j-s)} = 0,262 \text{ K/W}$
 FWD thermal model values

R (K/W)	τ (s)
2,59E-02	3,52E+00
5,41E-02	7,32E-01
9,10E-02	9,39E-02
7,28E-02	1,84E-02
1,80E-02	1,39E-03

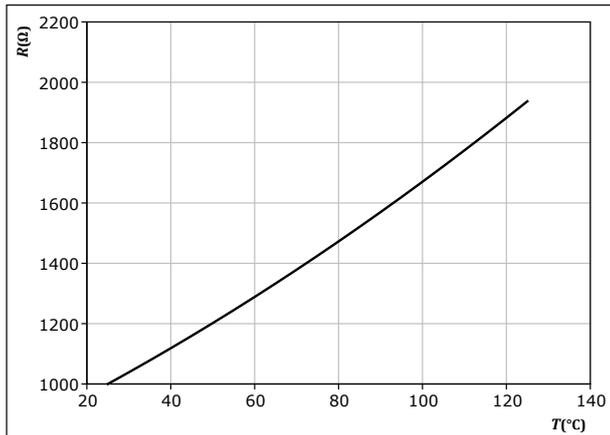


Thermistor Characteristics

figure 9. Thermistor

Typical PTC characteristic as function of temperature

$$R_T = f(T)$$

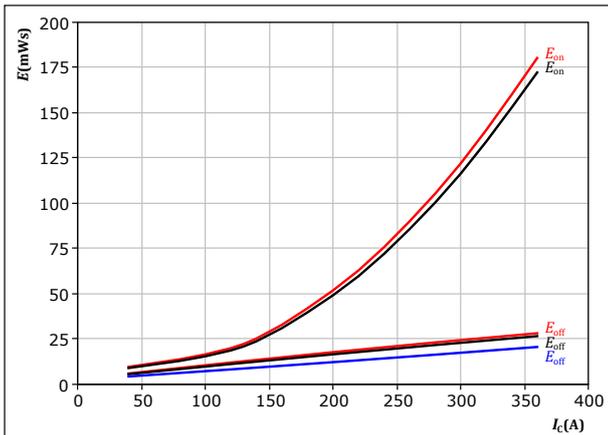




Inverter Switching Characteristics

figure 10. IGBT

Typical switching energy losses as a function of collector current
 $E = f(I_c)$

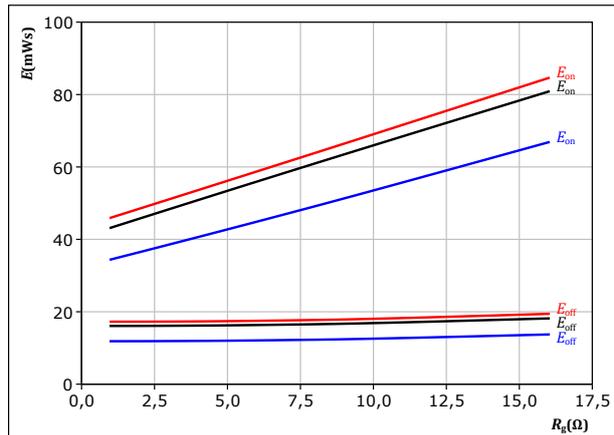


With an inductive load at
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 4 \ \Omega$
 $R_{goff} = 4 \ \Omega$

T_j : — 25 °C
 — 125 °C
 — 150 °C

figure 11. IGBT

Typical switching energy losses as a function of IGBT turn on gate resistor
 $E = f(R_g)$

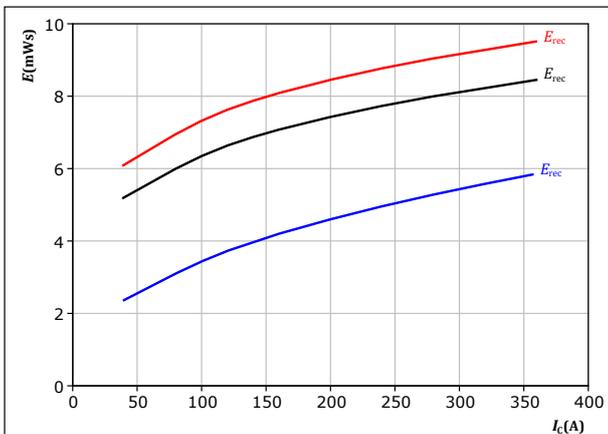


With an inductive load at
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 200 \text{ A}$

T_j : — 25 °C
 — 125 °C
 — 150 °C

figure 12. FWD

Typical reverse recovered energy loss as a function of collector current
 $E_{rec} = f(I_c)$

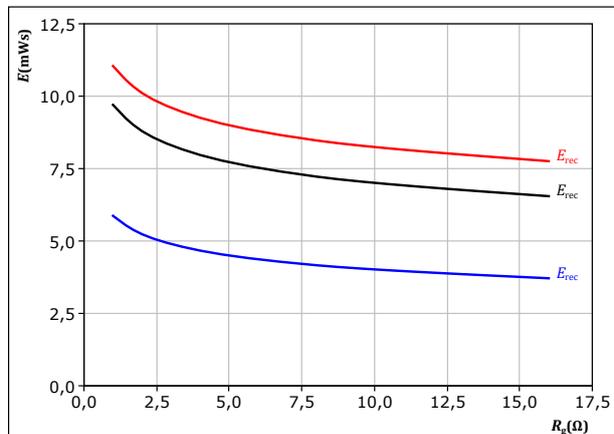


With an inductive load at
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 4 \ \Omega$

T_j : — 25 °C
 — 125 °C
 — 150 °C

figure 13. 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
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 200 \text{ A}$

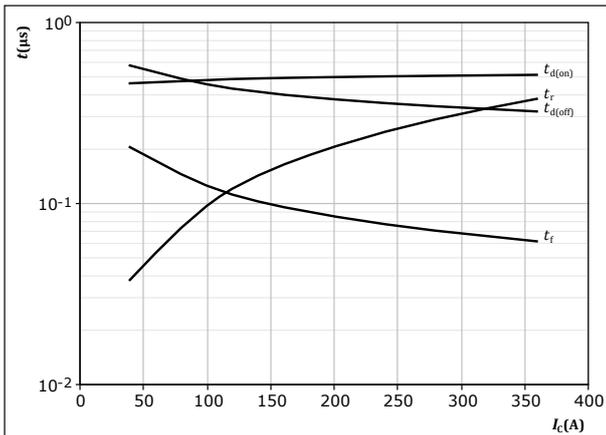
T_j : — 25 °C
 — 125 °C
 — 150 °C



Inverter Switching Characteristics

figure 14. IGBT

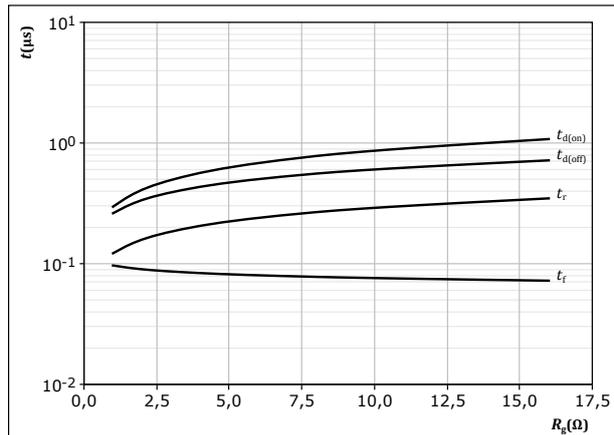
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 150$ °C
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω
 $R_{goff} = 4$ Ω

figure 15. IGBT

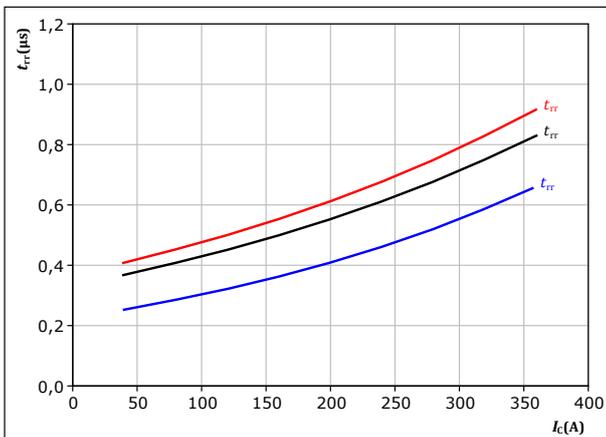
Typical switching times as a function of IGBT turn on gate resistor
 $t = f(R_g)$



With an inductive load at
 $T_j = 150$ °C
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 200$ A

figure 16. FWD

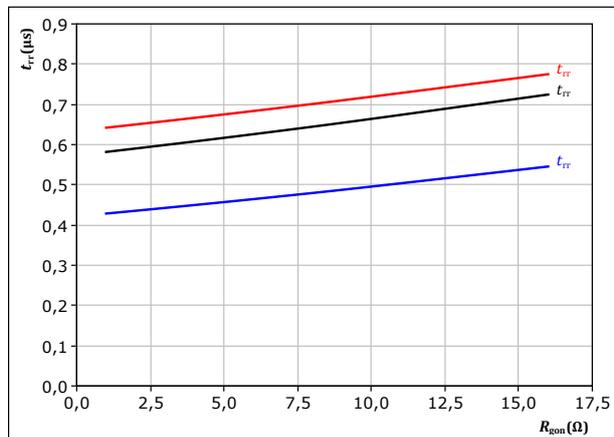
Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω
 T_j : — 25 °C
— 125 °C
— 150 °C

figure 17. FWD

Typical reverse recovery time as a function of IGBT turn on gate resistor
 $t_{rr} = f(R_{gon})$



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 200$ A
 T_j : — 25 °C
— 125 °C
— 150 °C

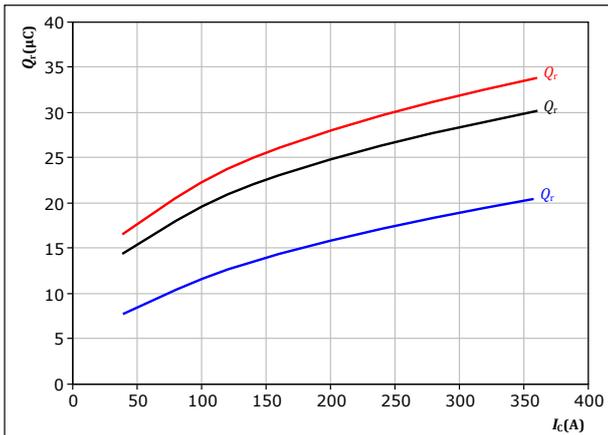


Inverter Switching Characteristics

figure 18. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



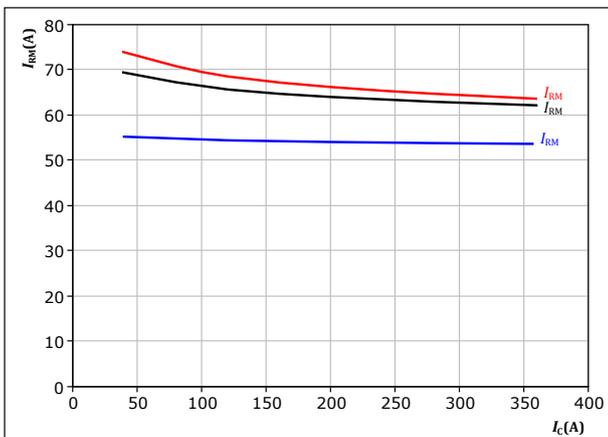
With an inductive load at

$V_{CE} =$	600	V	$T_j:$	25 °C
$V_{GE} =$	±15	V		125 °C
$R_{gon} =$	4	Ω		150 °C

figure 20. FWD

Typical peak reverse recovery current as a function of collector current

$$I_{RM} = f(I_c)$$



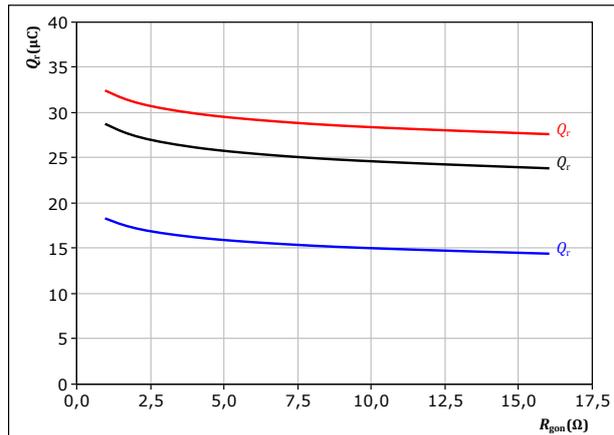
With an inductive load at

$V_{CE} =$	600	V	$T_j:$	25 °C
$V_{GE} =$	±15	V		125 °C
$R_{gon} =$	4	Ω		150 °C

figure 19. FWD

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

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



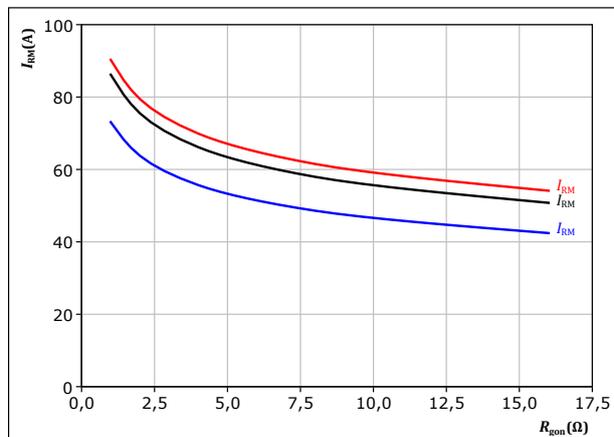
With an inductive load at

$V_{CE} =$	600	V	$T_j:$	25 °C
$V_{GE} =$	±15	V		125 °C
$I_c =$	200	A		150 °C

figure 21. 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

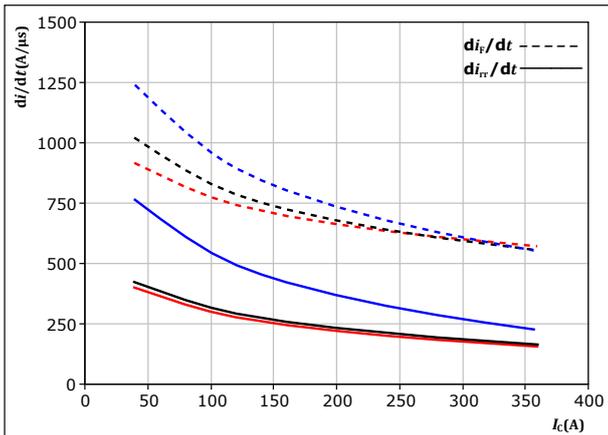
$V_{CE} =$	600	V	$T_j:$	25 °C
$V_{GE} =$	±15	V		125 °C
$I_c =$	200	A		150 °C



Inverter Switching Characteristics

figure 22. FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_{rr}/dt = f(I_c)$

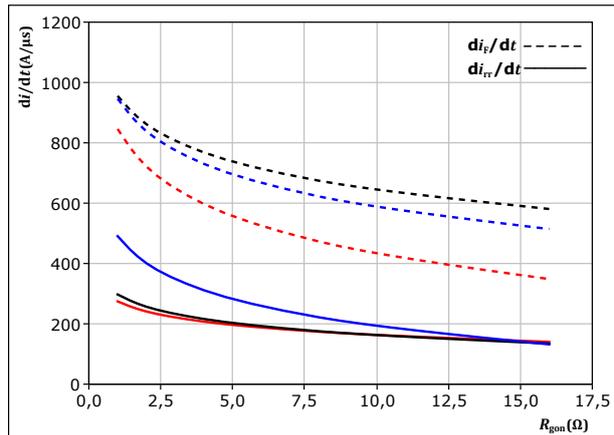


With an inductive load at

$V_{CE} =$	600	V	$T_j:$	25 °C
$V_{GE} =$	±15	V		125 °C
$R_{gon} =$	4	Ω		150 °C

figure 23. FWD

Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor
 $di_f/dt, di_{rr}/dt = f(R_{gon})$

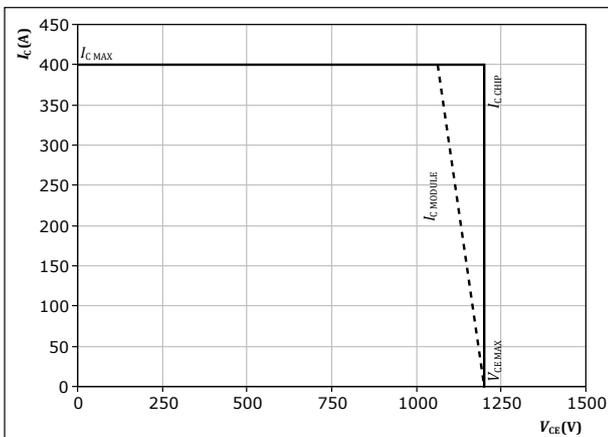


With an inductive load at

$V_{CE} =$	600	V	$T_j:$	25 °C
$V_{GE} =$	±15	V		125 °C
$I_c =$	200	A		150 °C

figure 24. IGBT

Reverse bias safe operating area
 $I_c = f(V_{CE})$



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



Inverter Switching Definitions

figure 25. IGBT

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

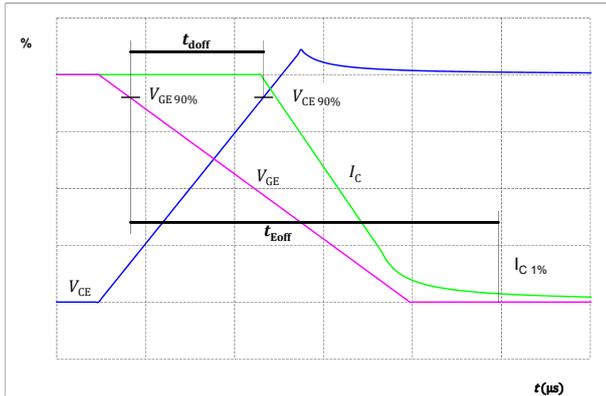


figure 26. IGBT

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

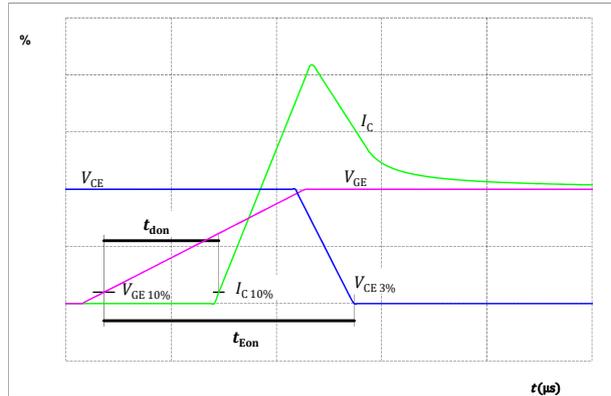


figure 27. IGBT

Turn-off Switching Waveforms & definition of t_f

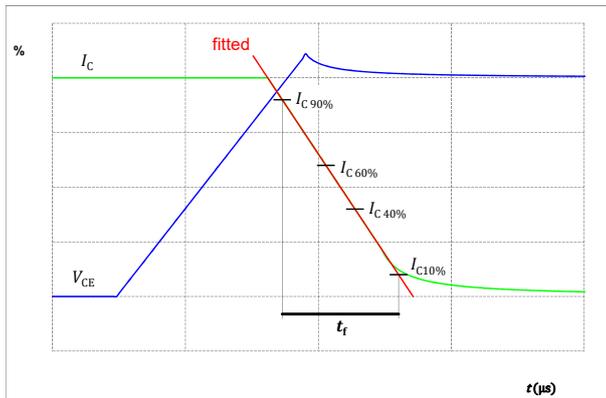
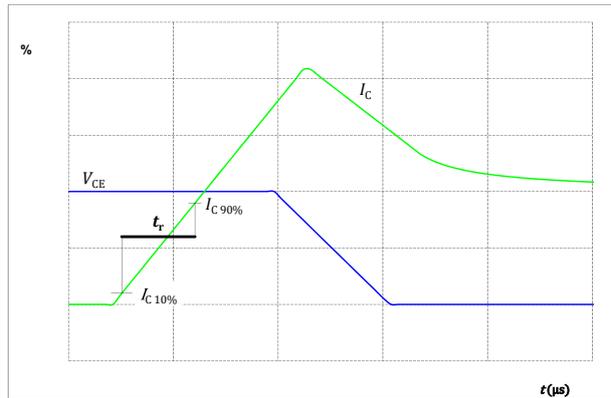


figure 28. IGBT

Turn-on Switching Waveforms & definition of t_r





Inverter Switching Definitions

figure 29. FWD

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

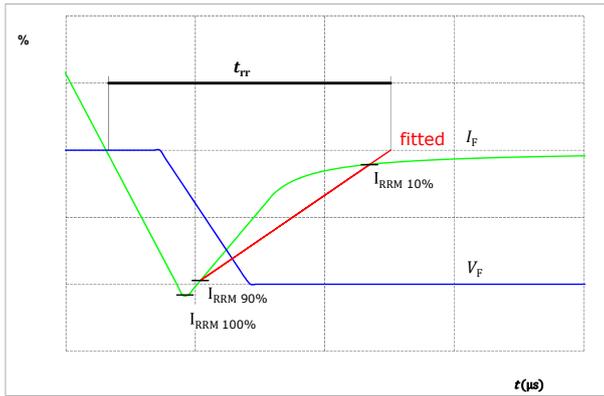
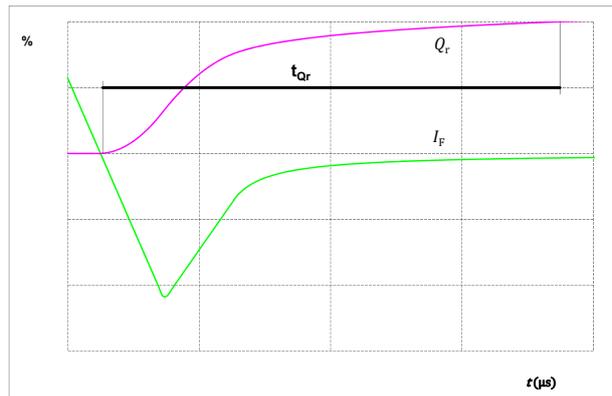


figure 30. FWD

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



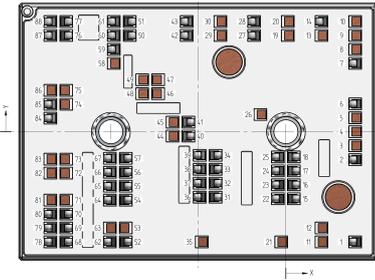


Vincotech

Ordering Code	
Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M3126PA200M701-K820F72-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M3126PA200M701-K820F72-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M3126PA200M701-K820F72-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M3126PA200M701-K820F72-/1B/
With std lid (6.5mm height) + thermal grease (3,4 W/mK, PSX-P7, silicone-free)	80-M3126PA200M701-K820F72-/3A/
With thin lid (2.8mm height) + thermal grease (3,4 W/mK, PSX-P7, silicone-free)	80-M3126PA200M701-K820F72-/3B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M3126PA200M701-K820F72-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M3126PA200M701-K820F72-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M3126PA200M701-K820F72-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M3126PA200M701-K820F72-/5B/

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

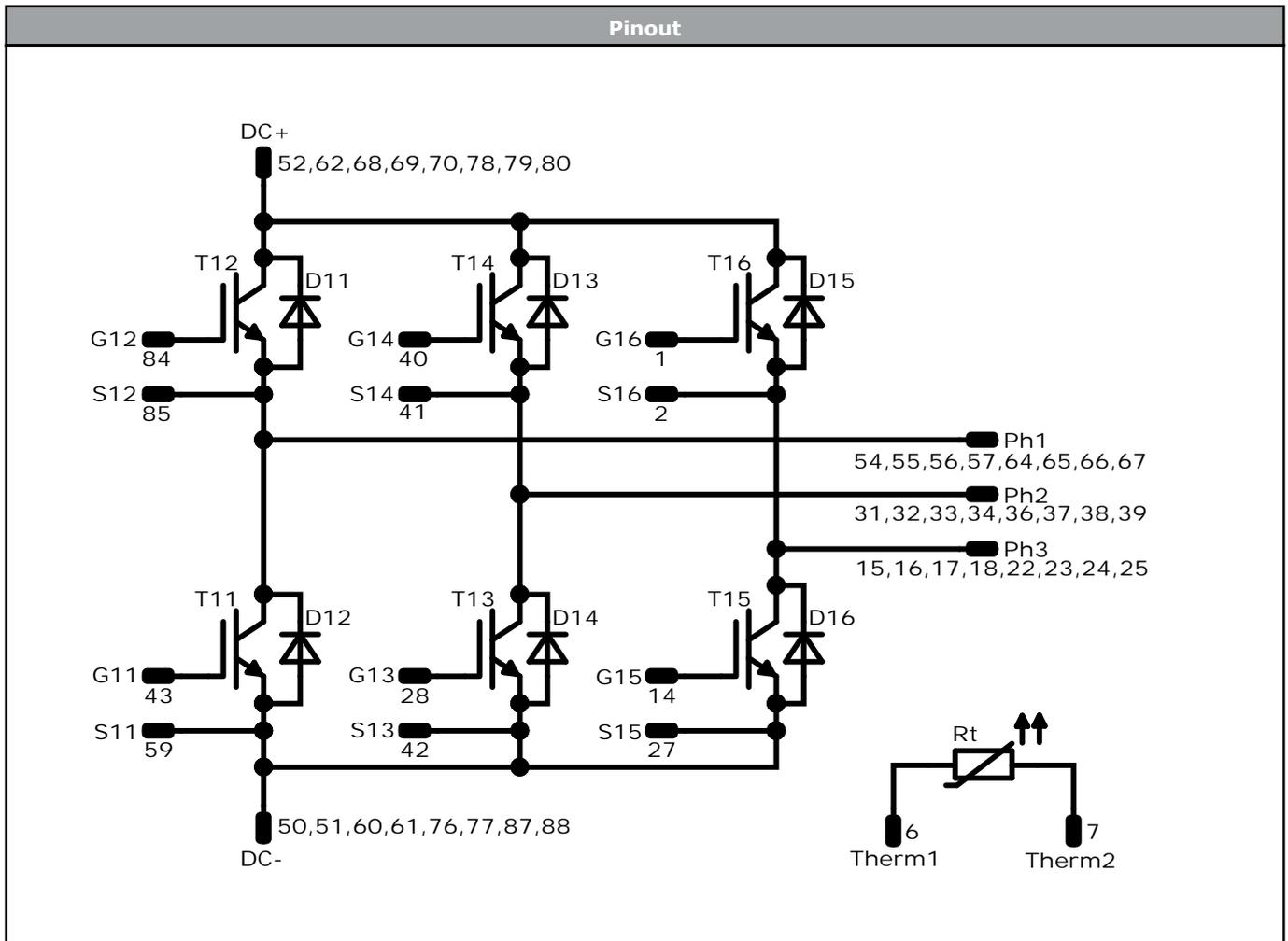
Outline									
Pin table [mm]									
Pin	X	Y	Function	45	not assembled				
1	15,83	-25,3	G16	46	not assembled				
2	15,83	-6,4	S16	47	not assembled				
3	not assembled			48	not assembled				
4	not assembled			49	not assembled				
5	not assembled			50	-35,68	22,1	DC-		
6	15,83	6,4	Therm1	51	-35,68	25,3	DC-		
7	15,83	15,7	Therm2	52	-36,58	-25,3	DC+		
8	not assembled			53	not assembled				
9	not assembled			54	-36,58	-15,7	Ph1		
10	not assembled			55	-36,58	-12,5	Ph1		
11	not assembled			56	-36,58	-9,3	Ph1		
12	not assembled			57	-36,58	-6,1	Ph1		
13	not assembled			58	not assembled				
14	8,13	25,3	G15	59	-39,32	18,9	S11		
15	1,82	-15,38	Ph3	60	-39,32	22,1	DC-		
16	1,82	-12,18	Ph3	61	-39,32	25,3	DC-		
17	1,82	-8,98	Ph3	62	-40,22	-25,3	DC+		
18	1,82	-5,79	Ph3	63	not assembled				
19	not assembled			64	-40,22	-15,7	Ph1		
20	not assembled			65	-40,22	-12,5	Ph1		
21	not assembled			66	-40,22	-9,3	Ph1		
22	-1,82	-15,38	Ph3	67	-40,22	-6,09	Ph1		
23	-1,82	-12,18	Ph3	68	-50,18	-25,3	DC+		
24	-1,82	-8,98	Ph3	69	-50,18	-22,1	DC+		
25	-1,82	-5,79	Ph3	70	-50,18	-18,9	DC+		
26	not assembled			71	not assembled				
27	-7,27	22,1	S15	72	not assembled				
28	-7,27	25,3	G13	73	not assembled				
29	not assembled			74	not assembled				
30	not assembled			75	not assembled				
31	-16,05	-15,02	Ph2	76	-50,18	22,1	DC-		
32	-16,05	-11,82	Ph2	77	-50,18	25,3	DC-		
33	-16,05	-8,63	Ph2	78	-53,82	-25,3	DC+		
34	-16,05	-5,42	Ph2	79	-53,82	-22,1	DC+		
35	not assembled			80	-53,82	-18,9	DC+		
36	-19,7	-15,02	Ph2	81	not assembled				
37	-19,7	-11,82	Ph2	82	not assembled				
38	-19,7	-8,62	Ph2	83	not assembled				
39	-19,7	-5,42	Ph2	84	-53,82	3,1	G12		
40	-22,26	-1	G14	85	-53,82	6,3	S12		
41	-22,26	2,2	S14	86	not assembled				
42	-22,67	22,1	S13	87	-53,82	22,1	DC-		
43	-22,67	25,3	G11	88	-53,82	25,3	DC-		
44	not assembled								



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



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Identification					
ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	200 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	200 A	Inverter Diode	
Rt	Thermistor			Thermistor	



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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-M3126PA200M701-K820F72-D1-14	22 Sep. 2023		

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