Vincotech

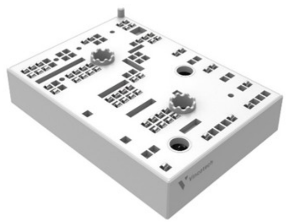
80-M3126PA150SH01-K430F43
datasheet

MiniSKiiP® PACK 3	1200 V / 150 A

Features

- Trench Fieldstop High Speed IGBT4 Technology
- Solder-free spring contact Technology
- Integrated temperature sensor
- Si_3N_4 substrate for enhanced thermal performance

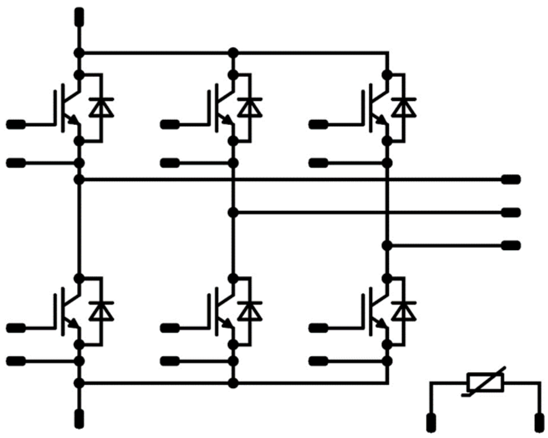
MiniSkiip® 3 housing



Target applications

- Embedded Drives
- Industrial Drives

Schematic



Types

- 80-M3126PA150SH01-K430F43

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	168	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	450	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	501	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V Vcc = 800 V T_j = 150 °C	10	µs
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	143	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 150 °C	900	A
Surge current capability	I^2t	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 150 °C	4050	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	297	W
Maximum junction temperature	T_{jmax}		175	°C

Module Properties

Thermal Properties

Parameter	Symbol	Condition	Value	Unit
Storage temperature	T_{stg}		-40…+125	°C
Operation temperature under switching condition	T_{jop}		-40…(T_{jmax} - 25)	°C

Isolation Properties

Parameter	Symbol	Condition	Value	Unit
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	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
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0052	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		150	25 125 150	1,78	2,19 2,54 2,65	2,42	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			20	μA
Gate-emitter leakage current	I_{GES}		20	0		25			240	nA
Internal gate resistance	r_g							5		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		8800		pF
Reverse transfer capacitance	C_{res}							470		
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,19		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	150	25 125 150		158 168 171		ns
Rise time	t_r					25 125 150		65 70 70		
Turn-off delay time	$t_{d(off)}$					25 125 150		237 300 315		
Fall time	t_f					25 125 150		28 69 82		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 8,2 μC Q_{rFWD} = 19,4 μC Q_{rFWD} = 23 μC				25 125 150		19,45 26,71 29,21		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		6,08 10,20 11,29		

Characteristic Values

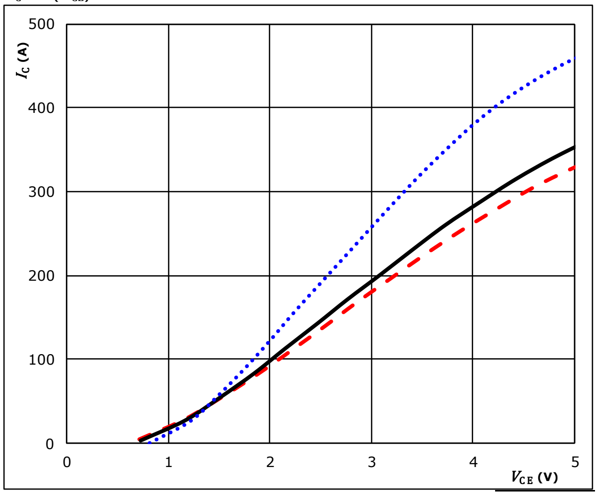
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Diode										
Static										
Forward voltage	V_F				150	25 125 150		2,21 2,27 2,19	2,46	V
Reverse leakage current	I_R			1200		25 150			180 28000	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,32		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 820 A/µs di/dt = 894 A/µs di/dt = 944 A/µs	±15	600	150	25 125 150		41 55 60		A
Reverse recovery time	t_{rr}					25 125 150		361 612 711		ns
Recovered charge	Q_r					25 125 150		8,21 19,42 23,00		µC
Reverse recovered energy	E_{rec}					25 125 150		2,56 6,69 7,83		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		144 148 143		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

$I_C = f(V_{CE})$

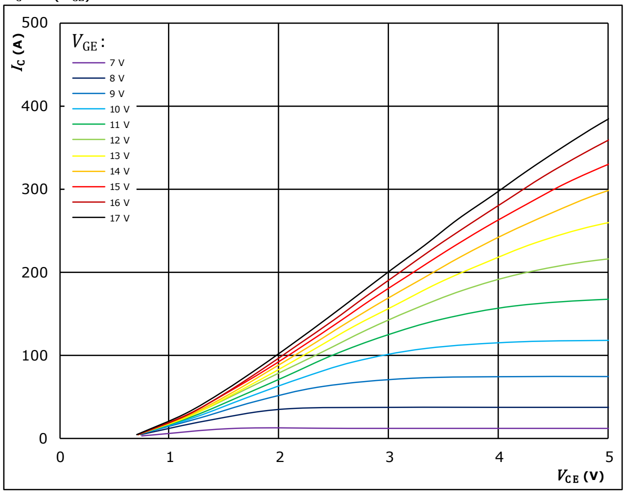


t_p =	250	µs		25 °C	dotted blue
V_{GE} =	15	V	T_j:	125 °C	solid black
				150 °C	dashed red

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

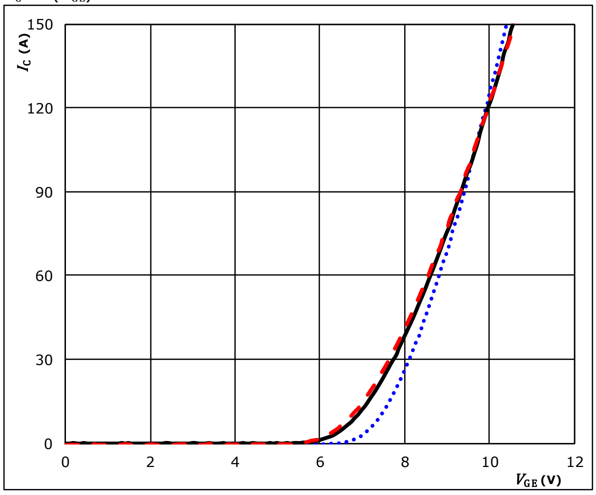


t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

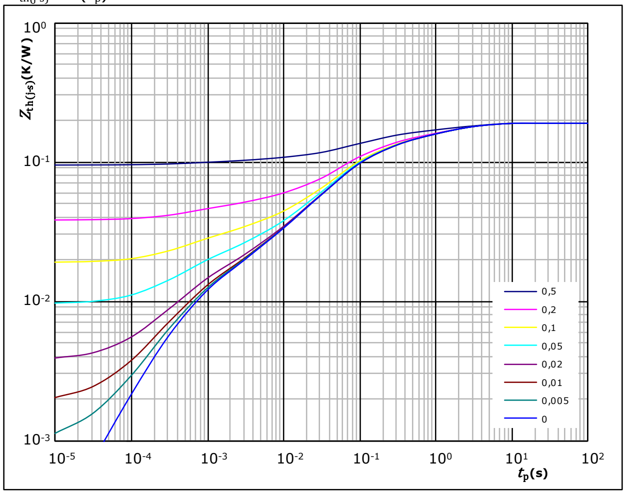


t_p =	100	µs		25 °C	dotted blue
V_{CE} =	10	V	T_j:	125 °C	solid black
				150 °C	dashed red

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T
$R_{th(j-s)}$ = 0,19 K/W

IGBT thermal model values

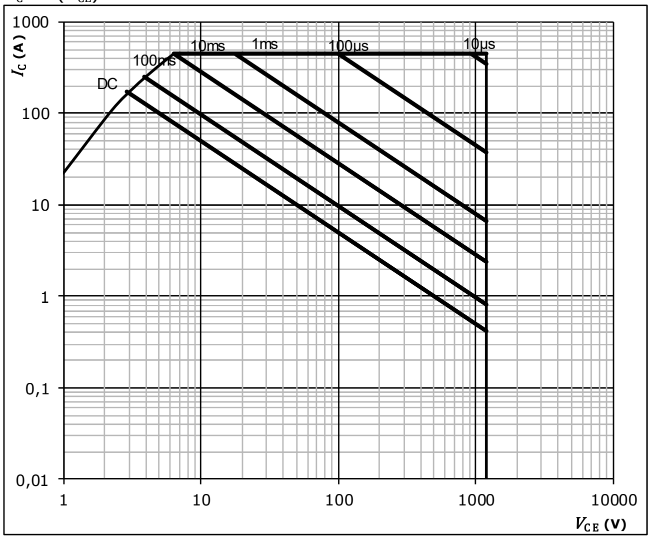
R (K/W)	τ (s)
4,60E-02	2,08E+00
3,85E-02	3,68E-01
7,14E-02	7,51E-02
1,54E-02	2,46E-02
9,56E-03	3,29E-03
8,81E-03	4,80E-04

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



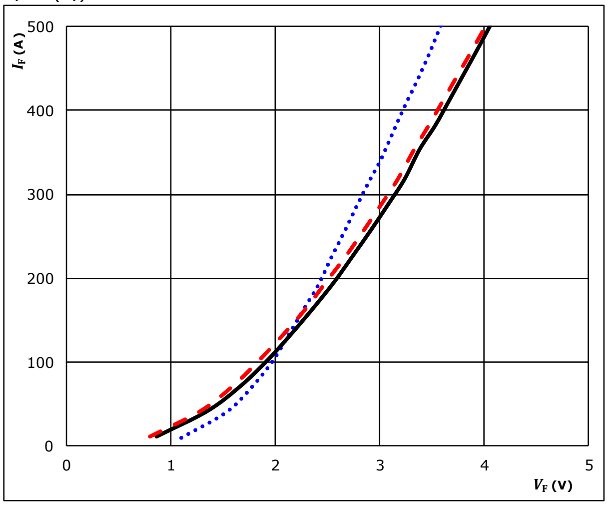
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Inverter Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



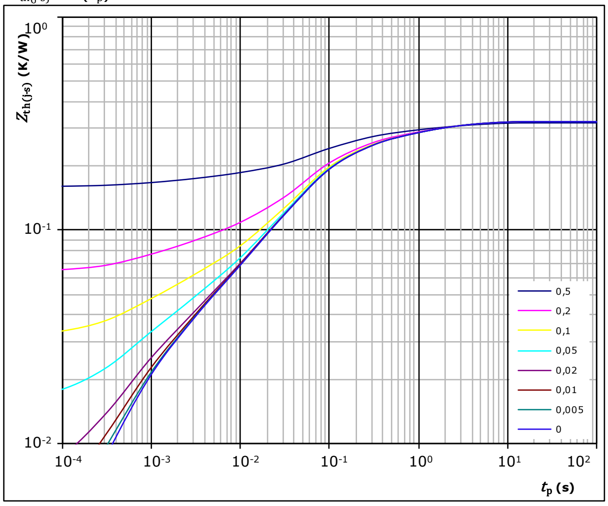
t_p = 250 µs

T_j: 25 °C ; 125 °C ; 150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j\text{-}s)}$ = 0,32 K/W

FWD thermal model values

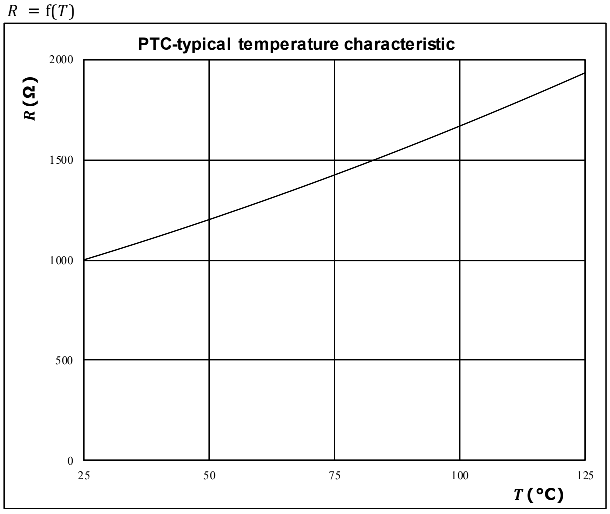
R (K/W)	τ (s)
3,41E-02	2,90E+00
4,33E-02	7,45E-01
8,48E-02	1,59E-01
1,17E-01	4,42E-02
2,41E-02	3,98E-03
1,62E-02	7,03E-04

PTC Characteristics

figure 1. **Thermistor**

Typical PTC characteristic as a function of temperature

$R = f(T)$

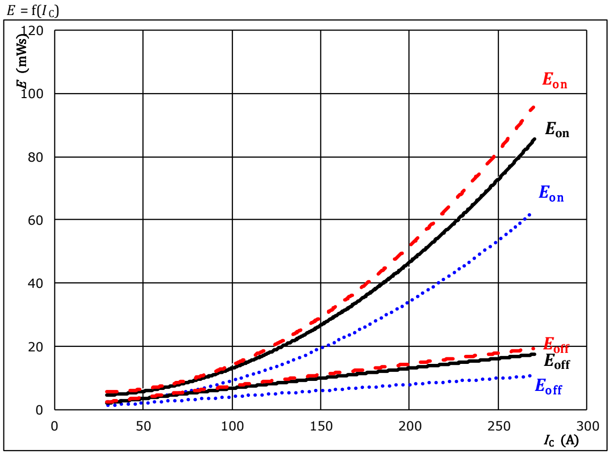


Inverter Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



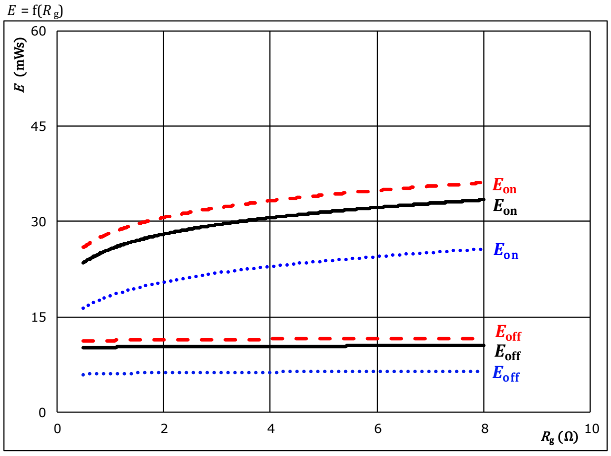
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	2	Ω		150 °C	dashed
R_{goff} =	2	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



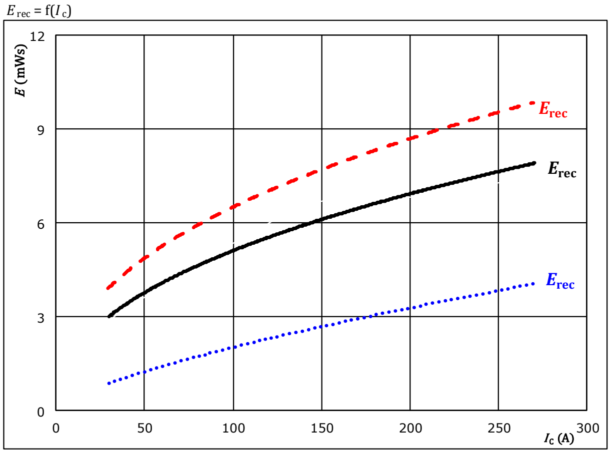
With an inductive load at

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

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



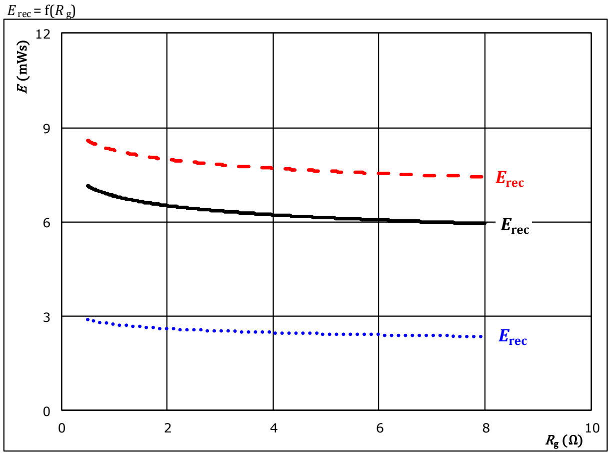
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	2	Ω		150 °C	dashed

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

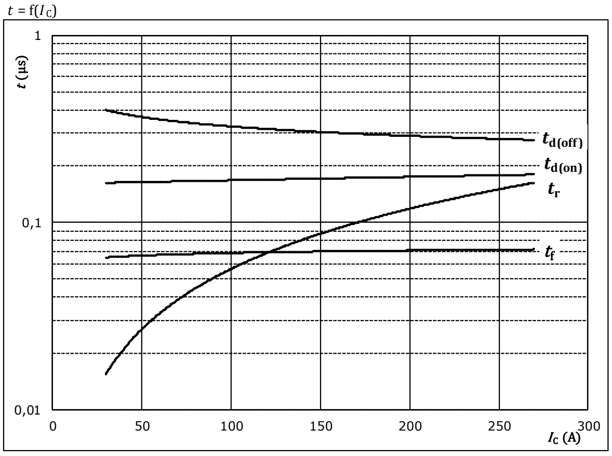
V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C =	150	A		150 °C	dashed

Inverter Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



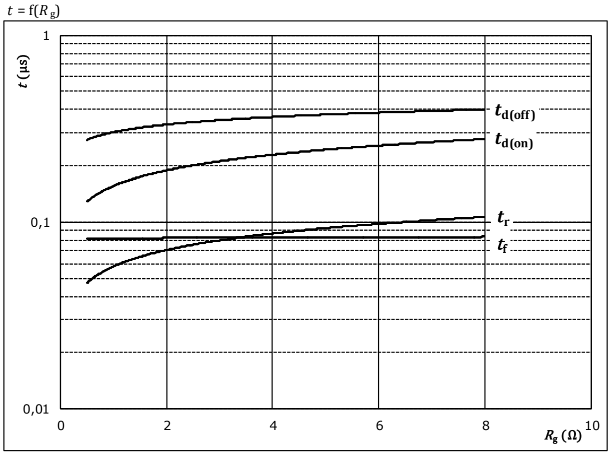
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



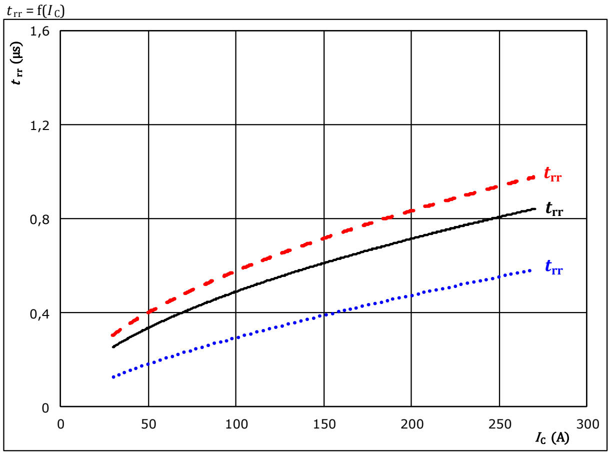
With an inductive load at

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

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



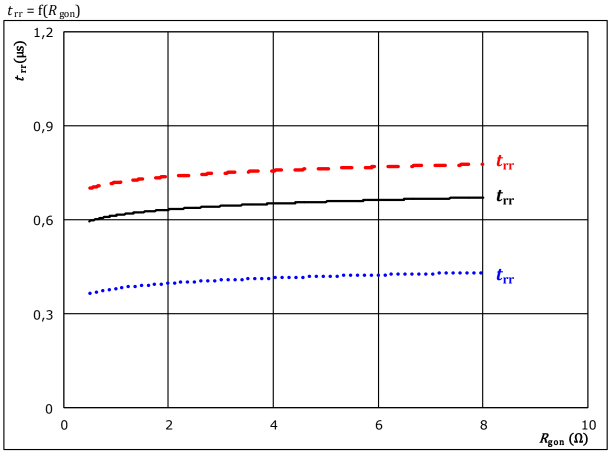
With an inductive load at

V_{CE}=	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	2	Ω		150 °C	dashed

figure 8. **FWD**

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

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



With an inductive load at

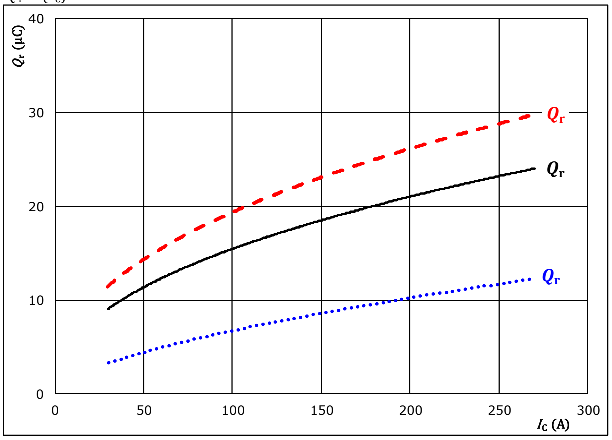
V_{CE}=	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C =	150	A		150 °C	dashed

Inverter Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



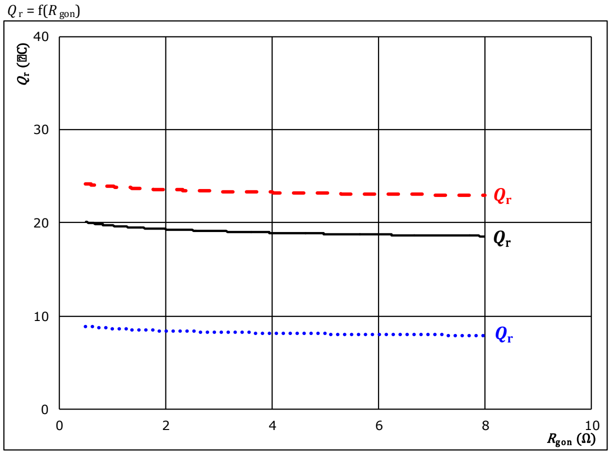
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	2	Ω		150 °C	dashed

figure 10. **FWD**

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

$Q_r = f(R_{gon})$



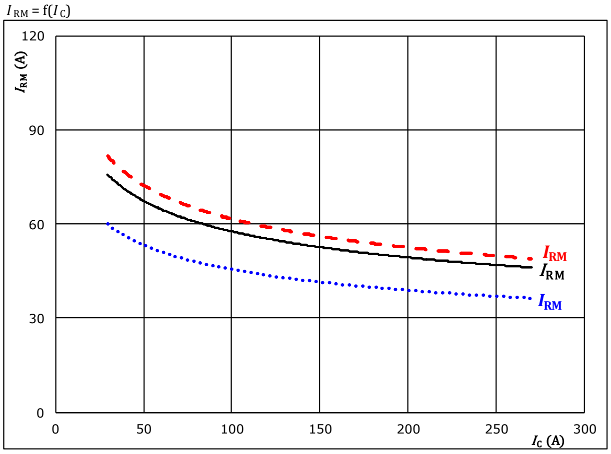
With an inductive load at

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

figure 11. **FWD**

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

$I_{RM} = f(I_C)$



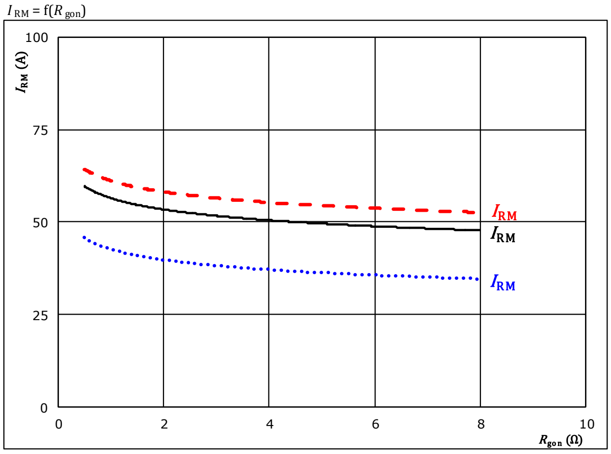
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	2	Ω		150 °C	dashed

figure 12. **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

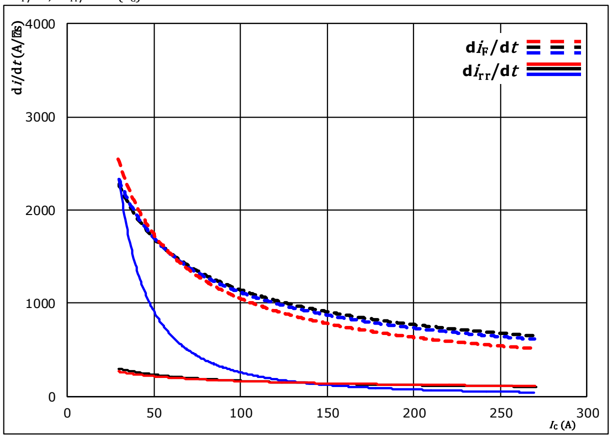
V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C =	150	A		150 °C	dashed

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



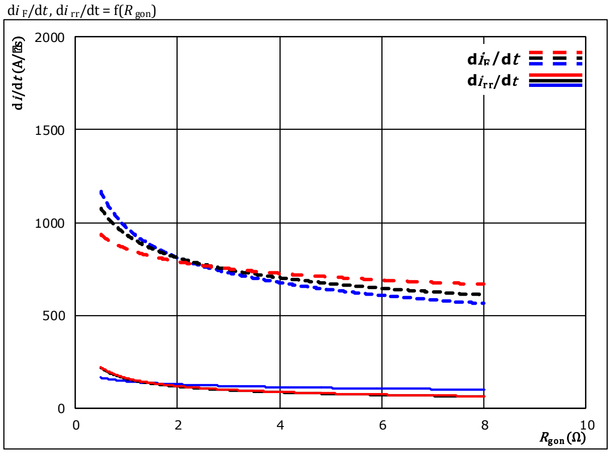
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	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, $di_{rr}/dt = f(R_{gon})$



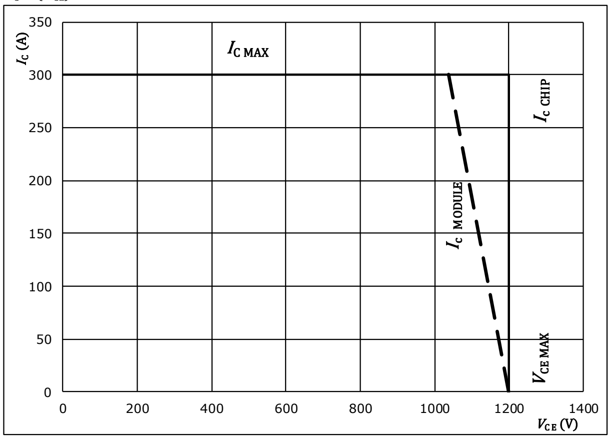
With an inductive load at

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

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	125	°C
R_{gon} =	2	Ω
R_{goff} =	2	Ω

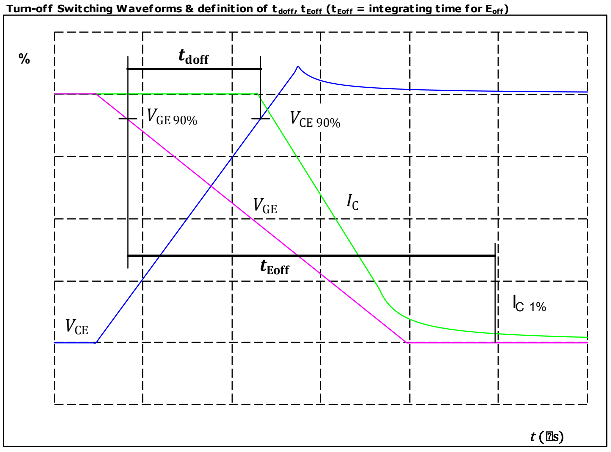
Inverter Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	2 Ω
R_{goff}	=	2 Ω

figure 1. **IGBT**

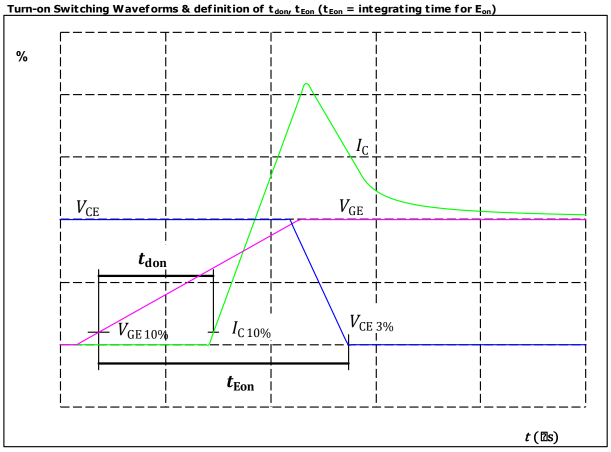
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	150	A
t_{doff} =	300	ns

figure 2. **IGBT**

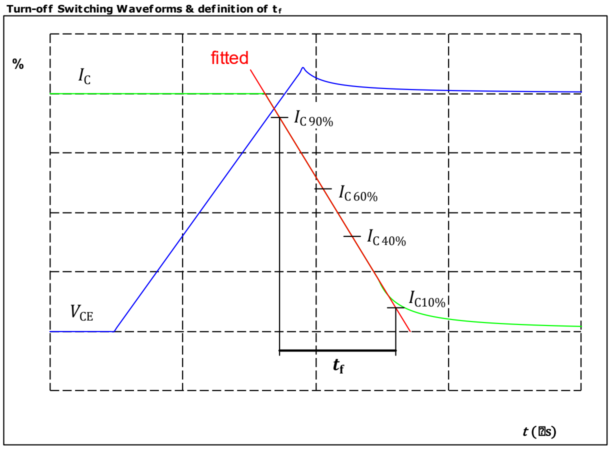
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	150	A
t_{don} =	168	ns

figure 3. **IGBT**

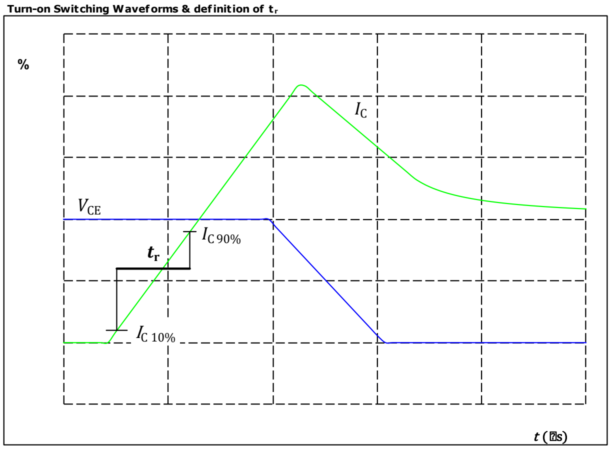
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	150	A
t_f =	69	ns

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

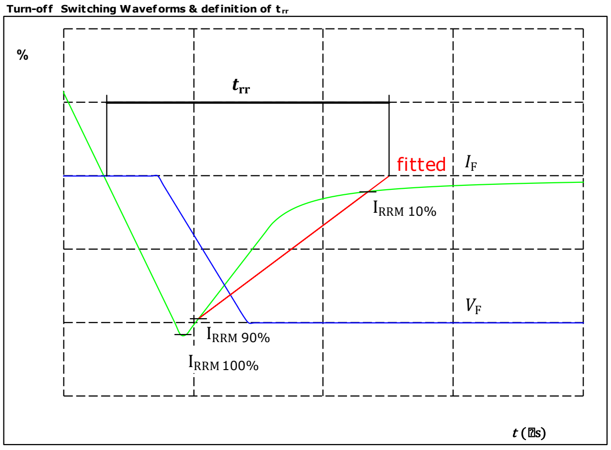


V_C (100%) =	600	V
I_C (100%) =	150	A
t_r =	70	ns

Inverter Switching Characteristics

figure 5.	FWD

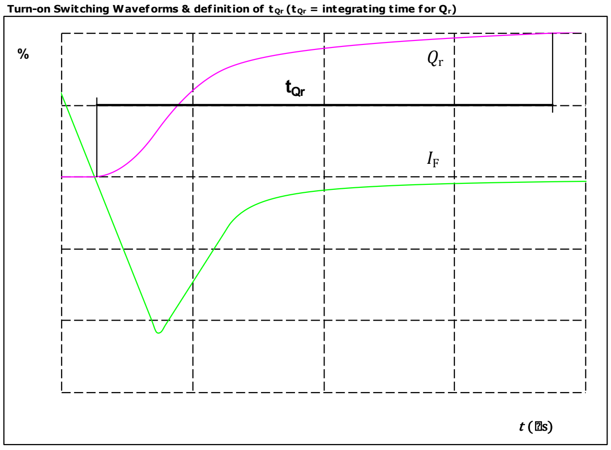
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	600	V
I_F (100%) =	150	A
I_{RRM} (100%) =	55	A
t_{rr} =	612	ns

figure 6.	FWD

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



I_F (100%) =	150	A
Q_r (100%) =	19,42	μC

80-M3126PA150SH01-K430F43
datasheet

Vincotech

Ordering Code & Marking

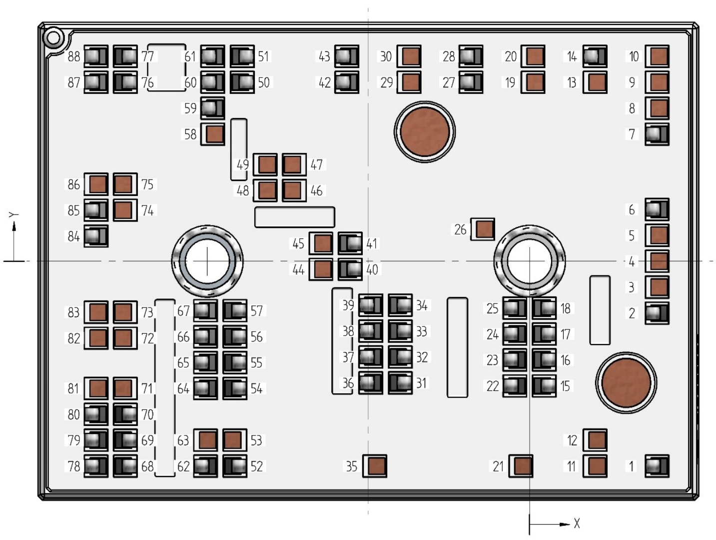
Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M3126PA150SH01-K430F43-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M3126PA150SH01-K430F43-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M3126PA150SH01-K430F43-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M3126PA150SH01-K430F43-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M3126PA150SH01-K430F43-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M3126PA150SH01-K430F43-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M3126PA150SH01-K430F43-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M3126PA150SH01-K430F43-/5B/

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

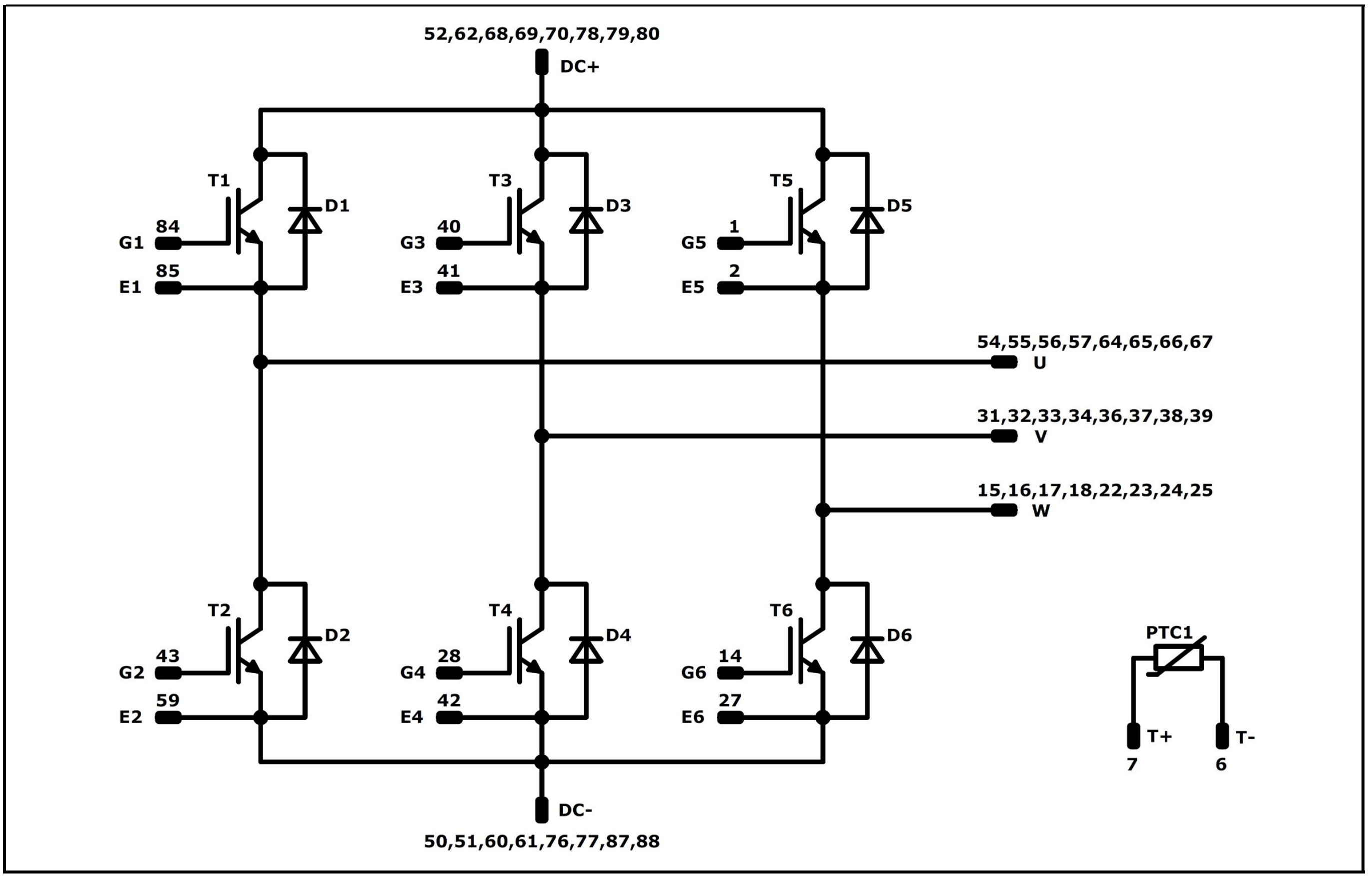
Outline

Pin	X	Y	Function	Pin	X	Y	Function
1	15,83	-25,3	G5	48	Not assembled		
2	15,83	-6,4	E5	49	Not assembled		
3	Not assembled			50	-35,68	22,1	-DC
4	Not assembled			51	-35,68	25,3	-DC
5	Not assembled			52	-36,58	-25,3	+DC
6	15,83	6,4	-T	53	Not assembled		
7	15,83	15,7	+T	54	-36,58	-15,7	U
8	Not assembled			55	-36,58	-12,5	U
9	Not assembled			56	-36,58	-9,3	U
10	Not assembled			57	-36,58	-6,1	U
11	Not assembled			58	Not assembled		
12	Not assembled			59	-39,32	18,9	E2
13	Not assembled			60	-39,32	22,1	-DC
14	8,13	25,3	G6	61	-39,32	25,3	-DC
15	1,82	-15,38	W	62	-40,22	-25,3	+DC
16	1,82	-12,18	W	63	Not assembled		
17	1,82	-8,98	W	64	-40,22	-15,7	U
18	1,82	-5,79	W	65	-40,22	-12,5	U
19	Not assembled			66	-40,22	-9,3	U
20	Not assembled			67	-40,22	-6,09	U
21	Not assembled			68	-50,18	-25,3	+DC
22	-1,82	-15,38	W	69	-50,18	-22,1	+DC
23	-1,82	-12,18	W	70	-50,18	-18,9	+DC
24	-1,82	-8,98	W	71	Not assembled		
25	-1,82	-5,79	W	72	Not assembled		
26	Not assembled			73	Not assembled		
27	-7,27	22,1	E6	74	Not assembled		
28	-7,27	25,3	G4	75	Not assembled		
29	Not assembled			76	-50,18	22,1	-DC
30	Not assembled			77	-50,18	25,3	-DC
31	-16,05	-15,02	V	78	-53,82	-25,3	+DC
32	-16,05	-11,82	V	79	-53,82	-22,1	+DC
33	-16,05	-8,63	V	80	-53,82	-18,9	+DC
34	-16,05	-5,42	V	81	Not assembled		
35	Not assembled			82	Not assembled		
36	-19,7	-15,02	V	83	Not assembled		
37	-19,7	-11,82	V	84	-53,82	3,1	G1
38	-19,7	-8,62	V	85	-53,82	6,3	E1
39	-19,7	-5,42	V	86	Not assembled		
40	-22,26	-1	G3	87	-53,82	22,1	-DC
41	-22,26	2,2	E3	88	-53,82	25,3	-DC
42	-22,67	22,1	E4				
43	-22,67	25,3	G2				
44	Not assembled						
45	Not assembled						
46	Not assembled						
47	Not assembled						

(Both halves of the pin table are headed "PCB pad table".)



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



Identification					
ID	**Component**	**Voltage**	**Current**	**Function**	**Comment**
T1, T2, T3, T4, T5, T6	IGBT	1200 V	150 A	Inverter Switch	
D1, D2, D3, D4, D5, D6	FWD	1200 V	150 A	Inverter Diode	
PTC1	PTC			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.

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-M3126PA150SH01-K430F43-D1-14	30 May. 2019		