



MiniSKiiP PIM 0

600 V / 6 A

Topology features

- Open Emitter configuration
- Temperature sensor
- Converter+Inverter

Component features

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

Housing features

- Base isolation: Al₂O₃
- Easy assembly in one mounting step
- Flexible PCB design w/o pin holes
- Rugged solderless spring contacts

Extra features

- Equivalent: SKiiP 01NAC066V3

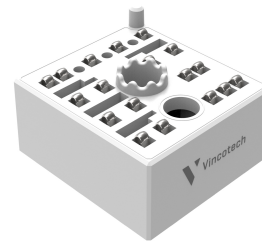
Target applications

- Industrial Drives
- Embedded Drives

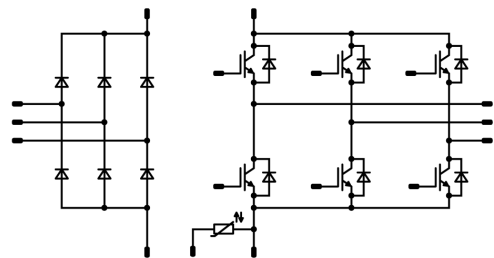
Types

- 80-M006PNB006SA-K614C

MiniSKiiP® 0 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}		600	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s \leq 80\text{ °C}$	18 ⁽¹⁾	A
Repetitive peak collector current	I_{CRM}	i_p limited by T_{jmax}	18	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	36	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	i_{SC}	$V_{GE} = 15\text{ V}$, $V_{CC} = 360\text{ V}$ $T_j = 150\text{ °C}$	6	μs
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

⁽¹⁾ limited by I_{CRM}

Inverter Diode

Peak repetitive reverse voltage	V_{RRM}		600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	16	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	35	W
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

Rectifier Diode

Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	32	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	150	A
Surge current capability	I^2t		112	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	51	W
Maximum junction temperature	T_{jmax}		150	$^{\circ}\text{C}$



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80-M006PNB006SA-K614C
datasheet

Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
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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* $t_p = 2\text{ s}$	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		≥ 200	

*100 % tested in production



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80-M006PNB006SA-K614C
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 Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			9E-05	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		6	25 150	1,1	1,6 1,83	1,9 ⁽²⁾	V
Collector-emitter cut-off current	I_{CES}		0	600		25			0,4	μA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}							368		pF
Output capacitance	C_{oes}	$f = 1$ Mhz	0	25		25		28		pF
Reverse transfer capacitance	C_{res}							11		pF

Thermal

Thermal resistance junction to sink ⁽³⁾	$R_{th(j-s)}$	$\lambda_{paste} = 2,5$ W/mK (HPTP)						2,68		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 64$ Ω $R_{goff} = 64$ Ω	±15	300	6	25		105		ns
Rise time	t_r					150		102,4		ns
						25		21,8		ns
Turn-off delay time	$t_{d(off)}$					150		142,2		ns
						25		163,6		ns
Fall time	t_f					25		102,74		ns
						150		132,43		ns
Turn-on energy (per pulse)	E_{on}	$Q_{trWD} = 0,324$ μC		25		0,15		mWs		
		$Q_{trWD} = 0,775$ μC		150		0,225		mWs		
Turn-off energy (per pulse)	E_{off}			25		0,145		mWs		
				150		0,193		mWs		



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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 Diode

Static

Forward voltage	V_F				7	25 150		1,48 1,45	1,65 ⁽²⁾	V
Reverse leakage current	I_R	$V_r = 600$ V				25			100	μA

Thermal

Thermal resistance junction to sink ⁽³⁾	$R_{th(j-s)}$	$\lambda_{paste} = 2,5$ W/mK (HPTP)						2,72		K/W
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Dynamic

Peak recovery current	I_{RM}	$di/dt=219$ A/μs $di/dt=191$ A/μs	±15	300	6	25 150		3,92 5,82		A
Reverse recovery time	t_{rr}					25 150		182,68 288,1		ns
Recovered charge	Q_r					25 150		0,324 0,775		μC
Reverse recovered energy	E_{rec}					25 150		0,059 0,156		mWs
Peak rate of fall of recovery current	$(di/dt)_{max}$					25		44,63		A/μs
						150		57,36		

Rectifier Diode

Static

Forward voltage	V_F				8	25 125		1,05 0,976	1,21 ⁽²⁾ 1,1 ⁽²⁾	V
Reverse leakage current	I_R	$V_r = 1600$ V				25			100	μA

Thermal

Thermal resistance junction to sink ⁽³⁾	$R_{th(j-s)}$	$\lambda_{paste} = 2,5$ W/mK (HPTP)						1,37		K/W
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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	

⁽²⁾ Value at chip level

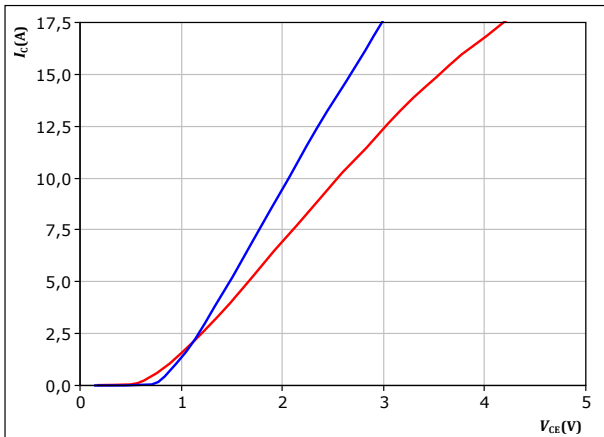
⁽³⁾ Only valid with pre-applied Vincotech thermal interface material.



Inverter Switch Characteristics

figure 1. IGBT

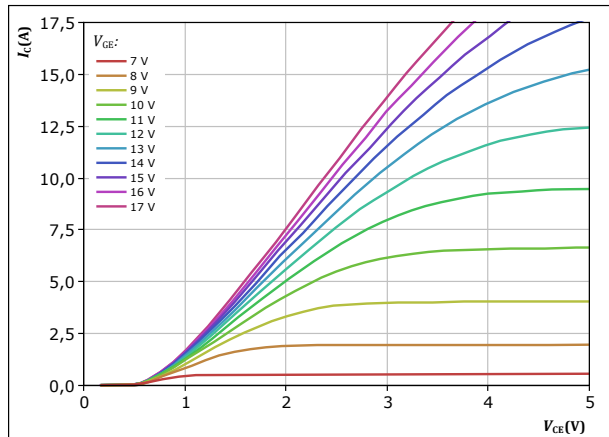
Typical output characteristics
 $I_C = f(V_{CE})$



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

figure 2. IGBT

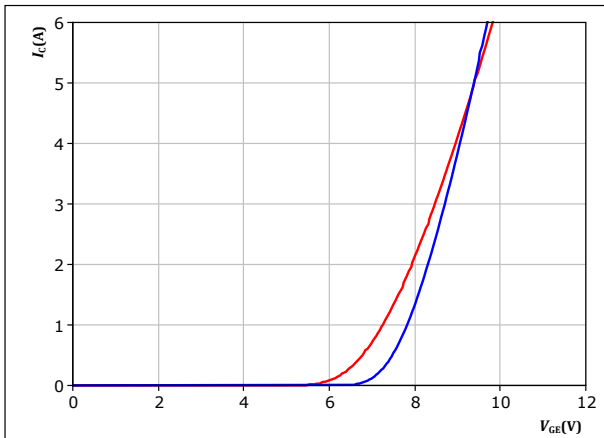
Typical output characteristics
 $I_C = f(V_{CE})$



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

figure 3. IGBT

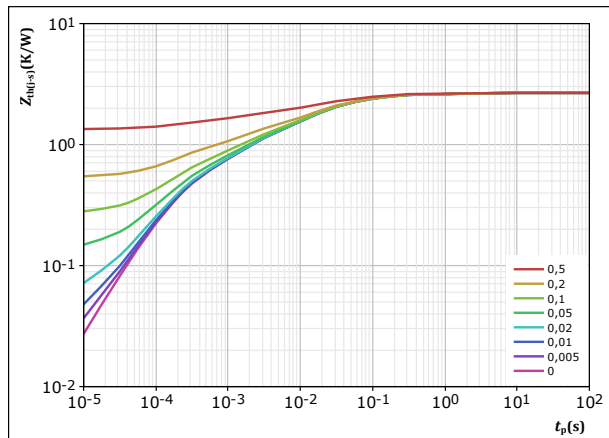
Typical transfer characteristics
 $I_C = f(V_{GE})$



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

figure 4. IGBT

Transient thermal impedance as a function of pulse width
 $Z_{th(j-s)} = f(t_p)$



$D = t_p / T$
 $R_{th(j-s)} = 2,675 \text{ K/W}$
IGBT thermal model values

R (K/W)	τ (s)
1,05E-01	1,91E+00
6,02E-01	8,23E-02
9,70E-01	1,43E-02
5,78E-01	1,57E-03
4,21E-01	1,79E-04

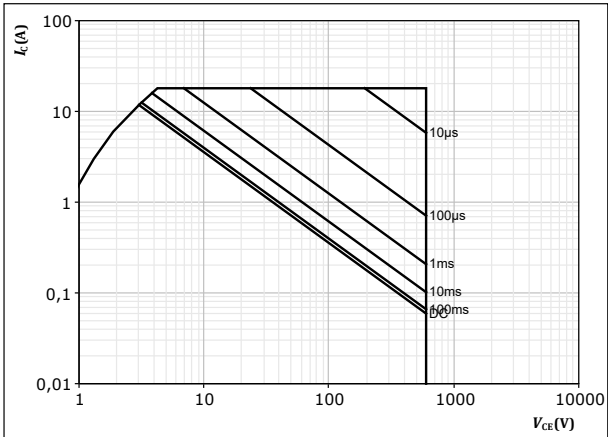


Inverter Switch Characteristics

figure 5. IGBT

Safe operating area

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



$D =$ single pulse

$T_s = 80$ °C

$V_{CE} = 15$ V

$T_j = T_{jmax}$

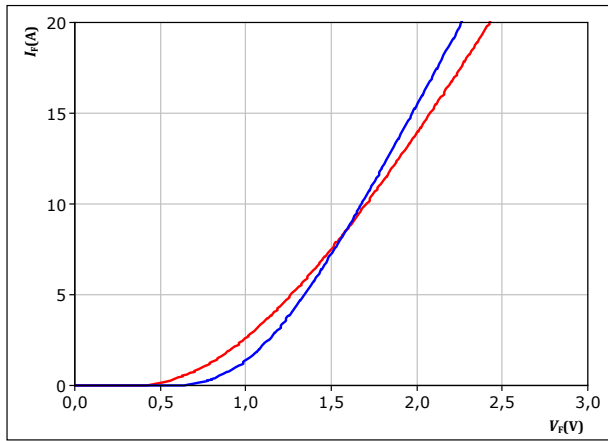


Inverter Diode Characteristics

figure 6. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

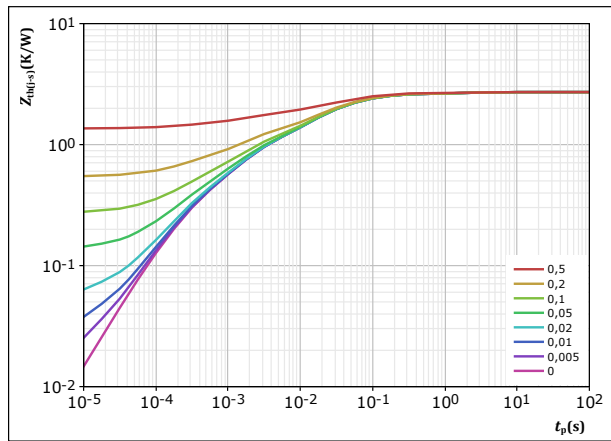


$t_p = 250 \mu s$
 T_j : — 25 °C
 — 150 °C

figure 7. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 2,716 \text{ K/W}$
 FWD thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
1,15E-01	1,90E+00
6,02E-01	8,69E-02
1,14E+00	1,92E-02
6,40E-01	1,68E-03
2,20E-01	2,10E-04



Rectifier Diode Characteristics

figure 8. Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

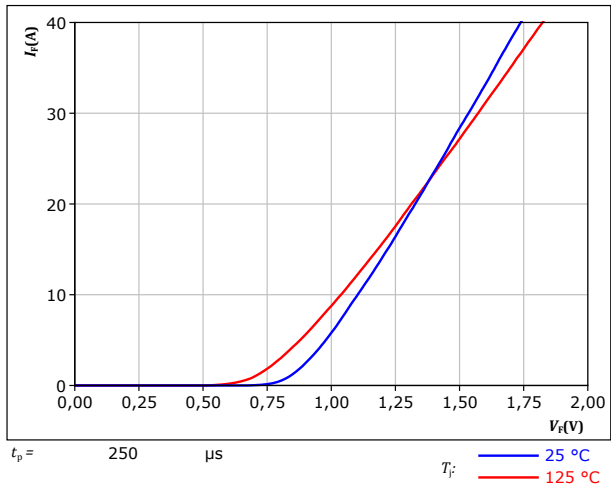
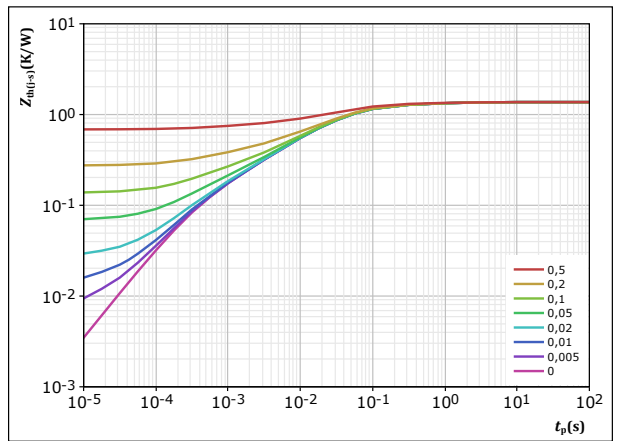


figure 9. Rectifier

Transient thermal impedance as a function of pulse width

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



$D =$ t_p / T
 $R_{th(j-s)} =$ 1,371 K/W
 Rectifier thermal model values

R (K/W)	τ (s)
6,75E-02	1,56E+00
1,34E-01	2,41E-01
6,34E-01	4,40E-02
3,25E-01	9,85E-03
1,24E-01	2,12E-03
8,71E-02	3,56E-04

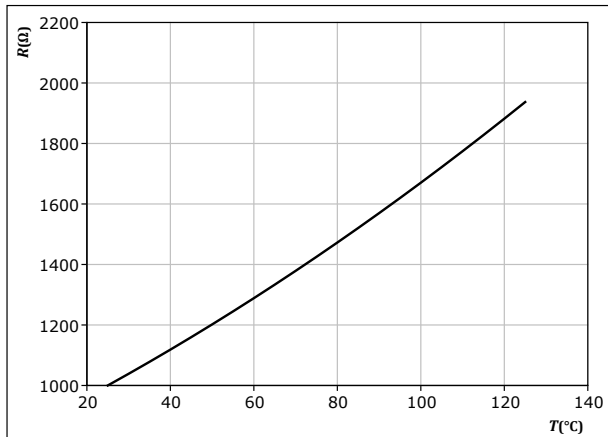


Thermistor Characteristics

figure 10. Thermistor

Typical PTC characteristic as function of temperature

$$R_T = f(T)$$

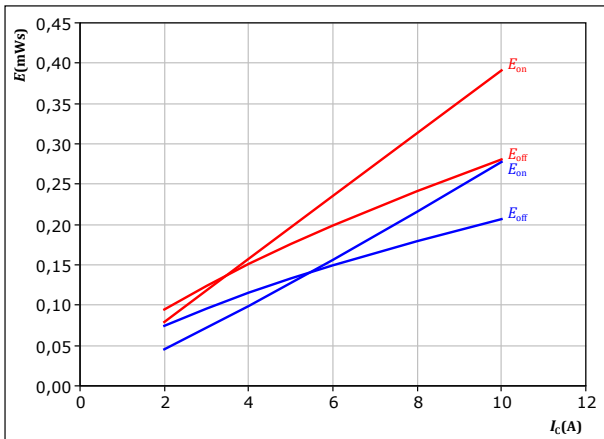




Inverter Switching Characteristics

figure 11. IGBT

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



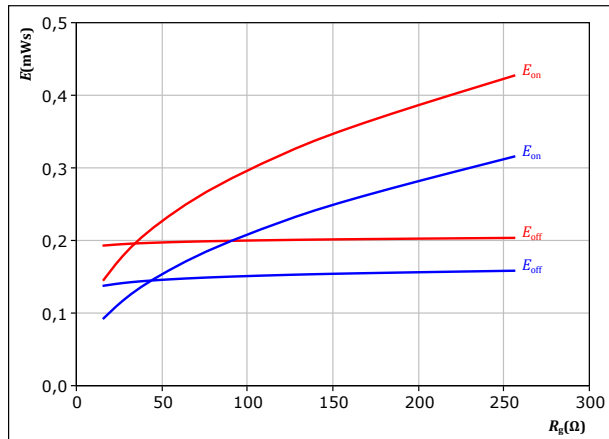
With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 64$ Ω
 $R_{goff} = 64$ Ω

T_j : — 25 °C
— 150 °C

figure 12. IGBT

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



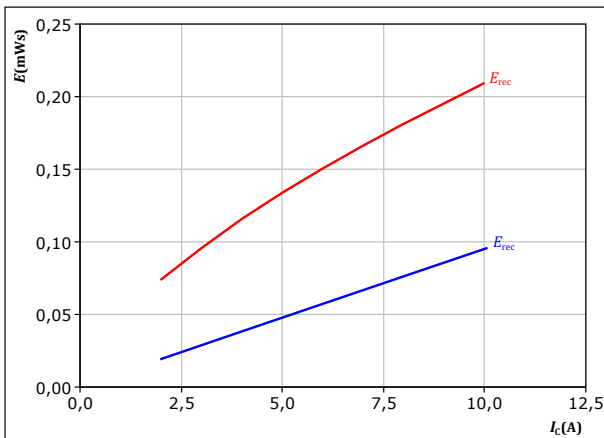
With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_c = 6$ A

T_j : — 25 °C
— 150 °C

figure 13. FWD

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



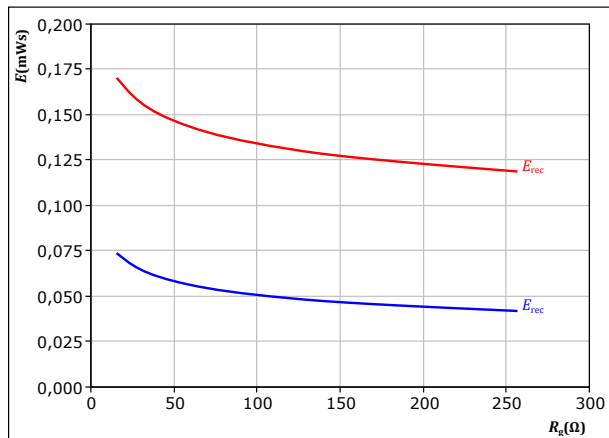
With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 64$ Ω

T_j : — 25 °C
— 150 °C

figure 14. 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

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_c = 6$ A

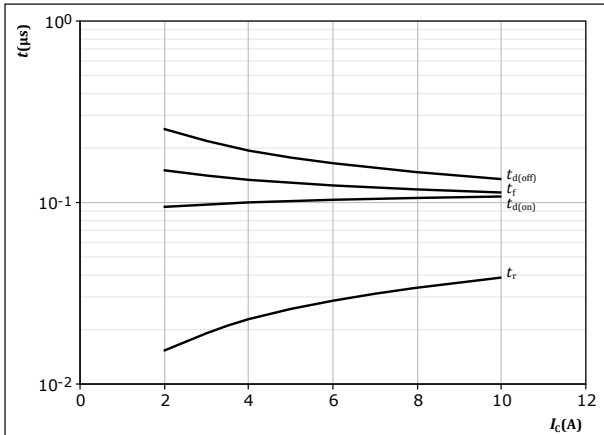
T_j : — 25 °C
— 150 °C



Inverter Switching Characteristics

figure 15. IGBT

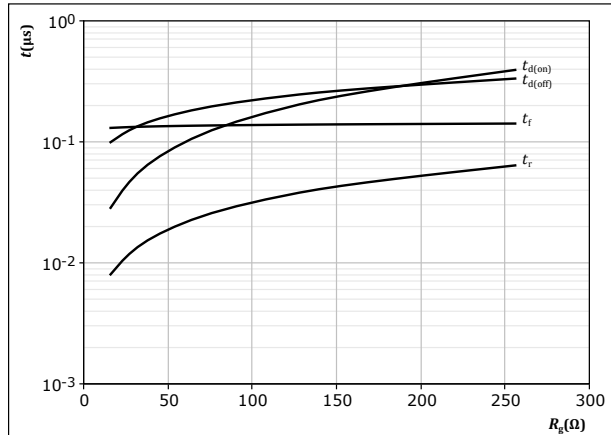
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 150 \text{ }^\circ\text{C}$
 $V_{CE} = 300 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 64 \text{ } \Omega$
 $R_{goff} = 64 \text{ } \Omega$

figure 16. IGBT

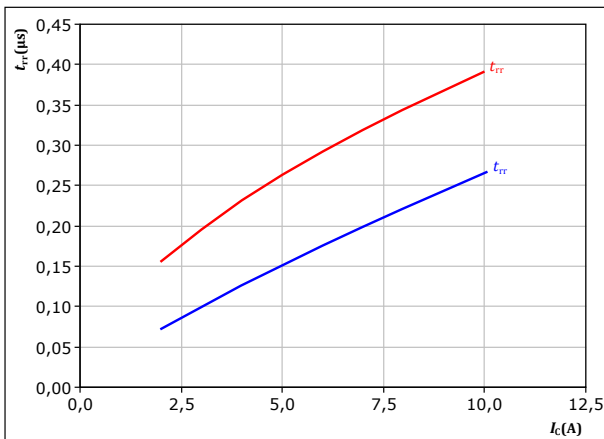
Typical switching times as a function of IGBT turn on gate resistor
 $t = f(R_g)$



With an inductive load at
 $T_j = 150 \text{ }^\circ\text{C}$
 $V_{CE} = 300 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 6 \text{ A}$

figure 17. FWD

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

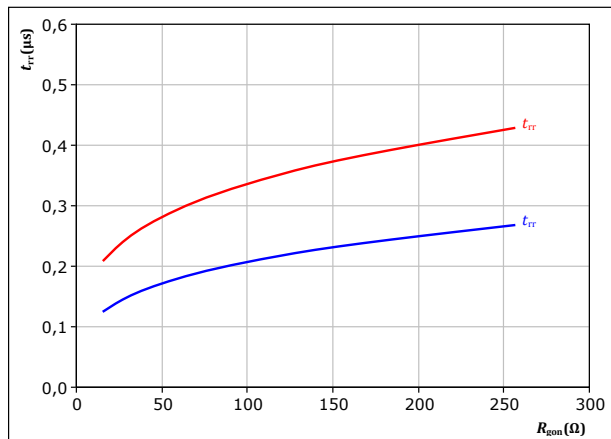


With an inductive load at
 $V_{CE} = 300 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 64 \text{ } \Omega$

T_j : — 25 °C
 — 150 °C

figure 18. FWD

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



With an inductive load at
 $V_{CE} = 300 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 6 \text{ A}$

T_j : — 25 °C
 — 150 °C

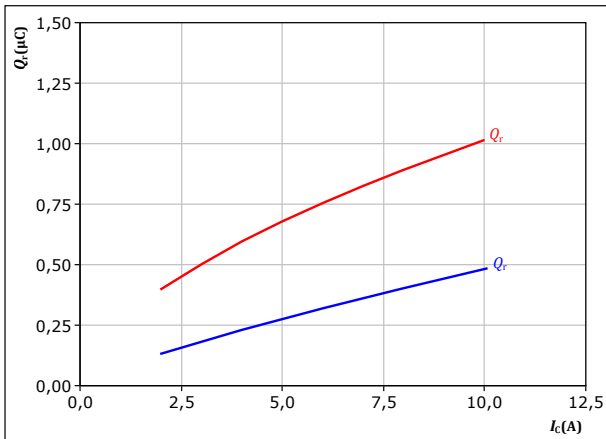


Inverter Switching Characteristics

figure 19. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

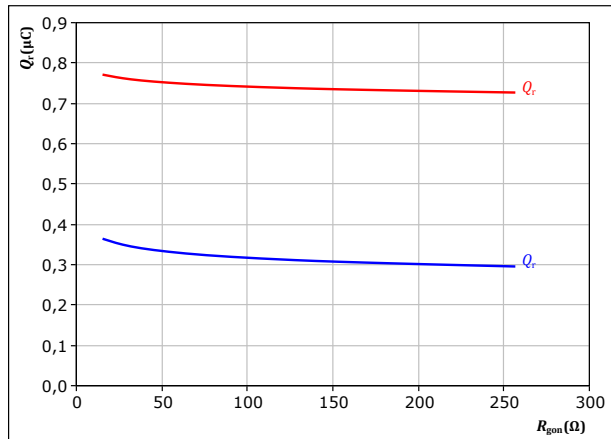
$V_{CE} = 300 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 64 \ \Omega$

T_j : — 25 °C
— 150 °C

figure 20. FWD

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

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



With an inductive load at

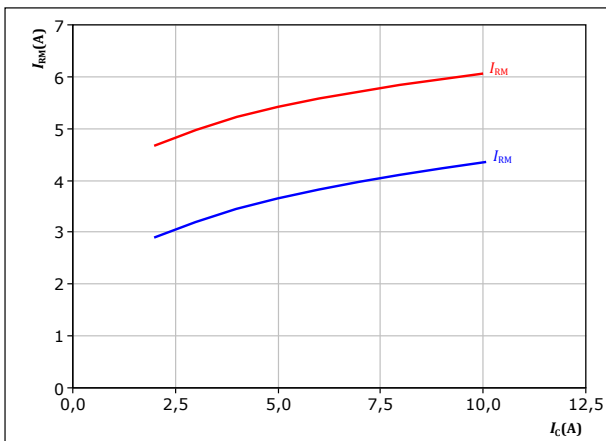
$V_{CE} = 300 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 6 \text{ A}$

T_j : — 25 °C
— 150 °C

figure 21. FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

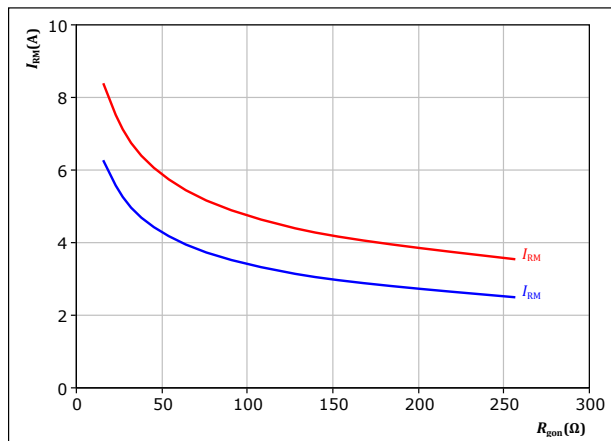
$V_{CE} = 300 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 64 \ \Omega$

T_j : — 25 °C
— 150 °C

figure 22. 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

$V_{CE} = 300 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 6 \text{ A}$

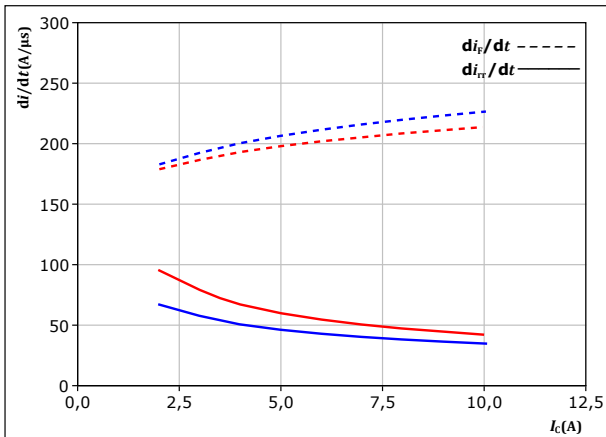
T_j : — 25 °C
— 150 °C



Inverter Switching Characteristics

figure 23. FWD

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

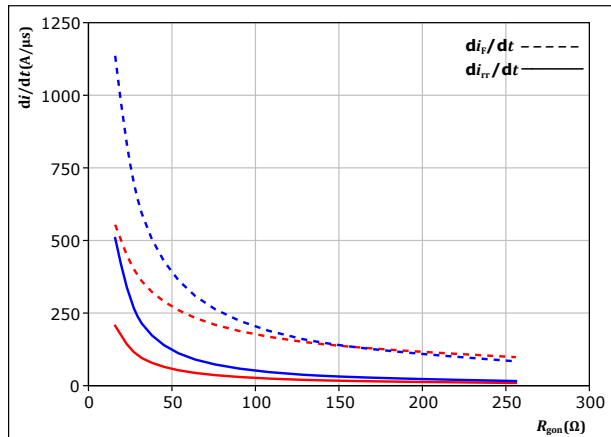


With an inductive load at
 $V_{CE} = 300 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 64 \ \Omega$

T_j : — 25 °C
 — 150 °C

figure 24. FWD

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

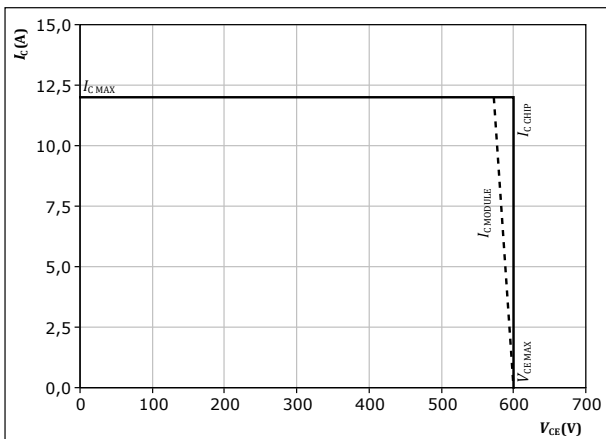


With an inductive load at
 $V_{CE} = 300 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 6 \text{ A}$

T_j : — 25 °C
 — 150 °C

figure 25. IGBT

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



At $T_j = 150 \text{ °C}$
 $R_{gon} = 64 \ \Omega$
 $R_{goff} = 64 \ \Omega$



Inverter Switching Definitions

figure 26. IGBT
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff} (t_{Eoff} = integrating time for E_{off})

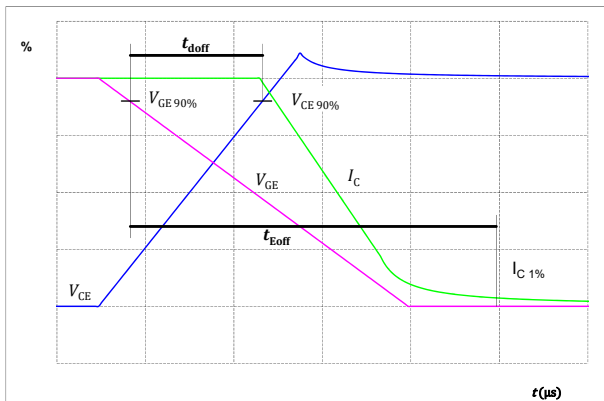


figure 27. IGBT
Turn-on Switching Waveforms & definition of t_{don} , t_{Eon} (t_{Eon} = integrating time for E_{on})

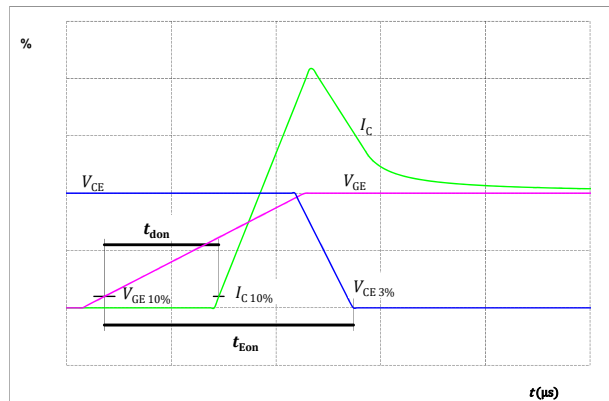


figure 28. IGBT
Turn-off Switching Waveforms & definition of t_f

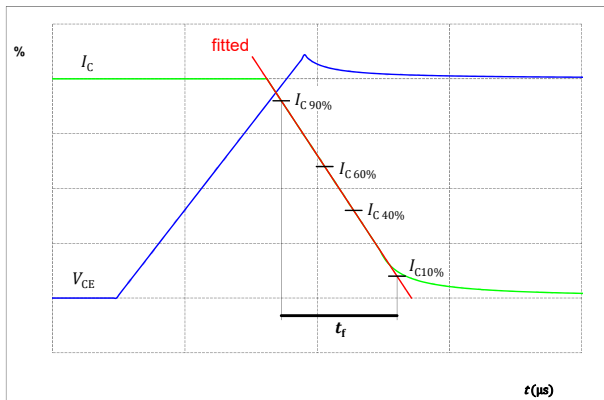
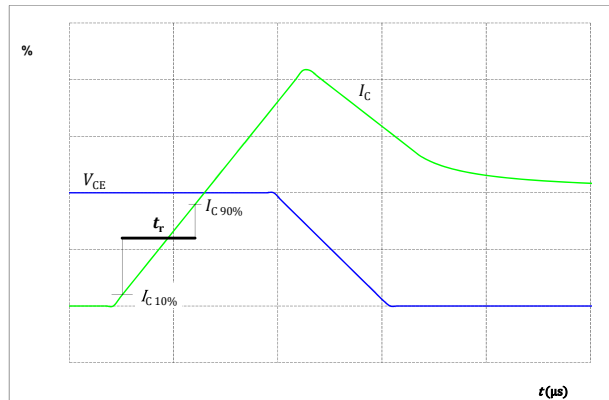


figure 29. IGBT
Turn-on Switching Waveforms & definition of t_r





Inverter Switching Definitions

figure 30. FWD

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

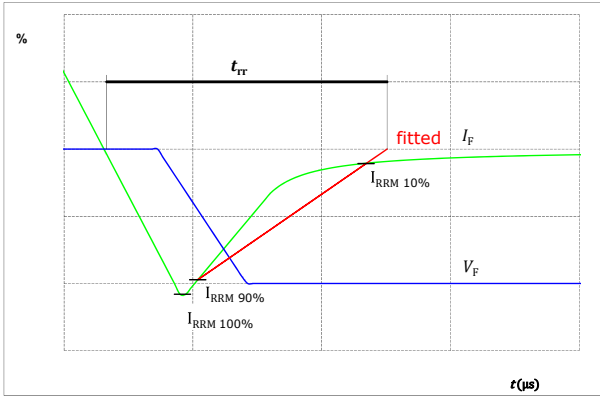
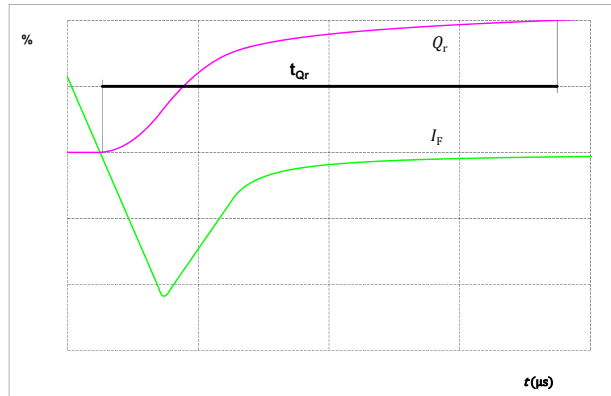


figure 31. FWD

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-M006PNB006SA-K614C-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M006PNB006SA-K614C-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M006PNB006SA-K614C-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M006PNB006SA-K614C-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M006PNB006SA-K614C-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M006PNB006SA-K614C-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M006PNB006SA-K614C-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M006PNB006SA-K614C-/5B/

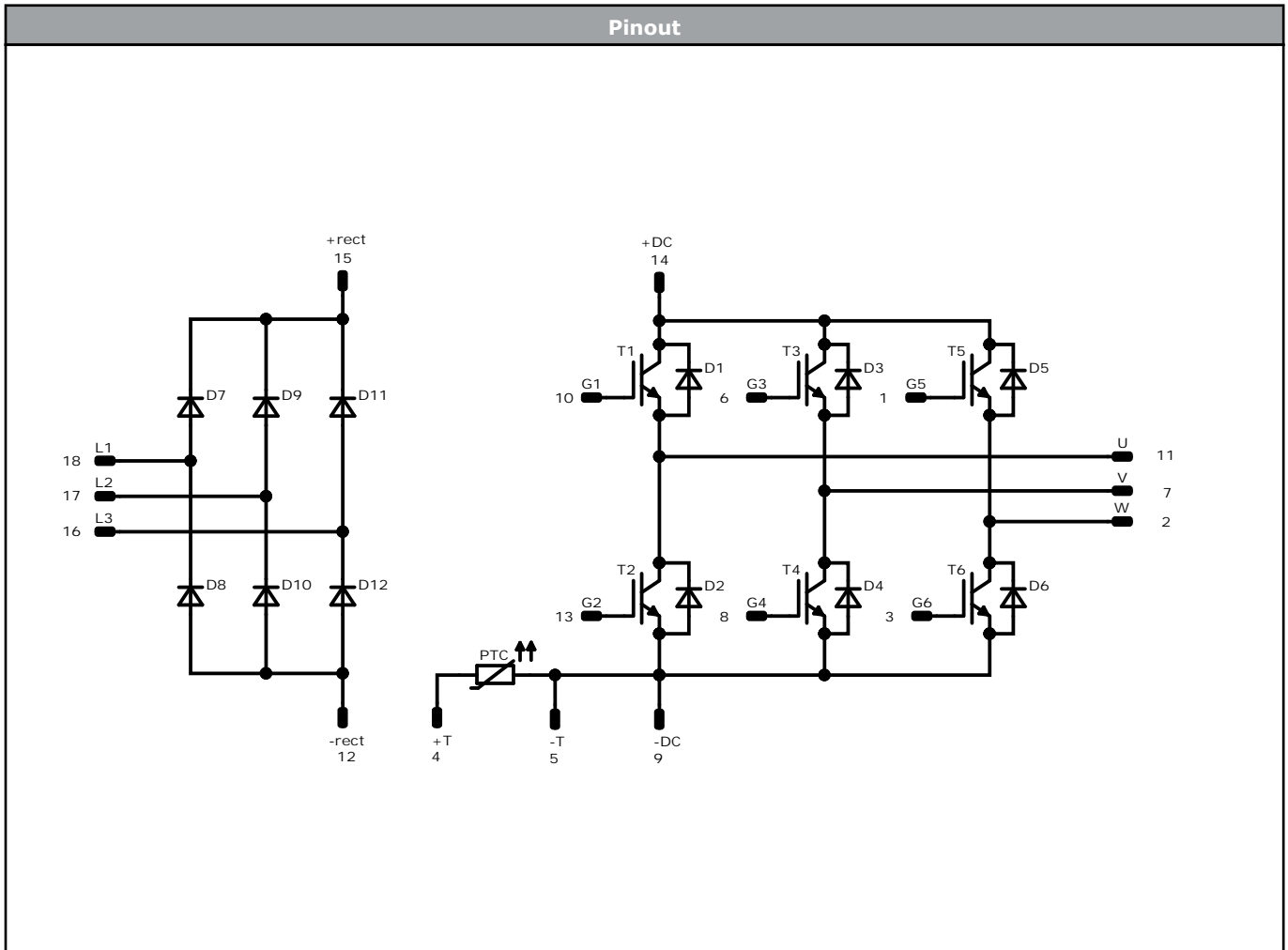
Marking						
Text	Name		Type&Ver	Date code	VIN & Lot	Serial&UL
		NN-NNNNNNNNNNNNNNNN		TTTTTTTVV	WWYY	VIN LLLLL
Datamatrix		Type&Ver	Lot number	Serial	Date code	
	TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline				
Pin table [mm]				
Pin	X	Y	Function	
1	11,93	-11,5	G5	
2	11,93	-6,9	W	
3	11,93	4,71	G6	
4	11,93	8,3	+T	
5	11,93	11,5	-T	
6	4,33	-11,5	G3	
7	4,33	-5,8	V	
8	4,33	6,95	G4	
9	4,33	10,15	-DC	
10	-3,27	-11,5	G1	
11	-3,27	-5,8	U	
12	-3,27	5,5	-RECT	
13	-3,27	11,5	G2	
14	-11,07	-11,5	+DC	
15	-11,07	-8,3	+RECT	
16	-11,07	-1,68	L3	
17	-11,07	4,93	L2	
18	-11,07	11,5	L1	

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
T2, T1, T4, T3, T6, T5	IGBT	600 V	6 A	Inverter Switch	
D1, D2, D3, D4, D5, D6	FWD	600 V	10 A	Inverter Diode	
D8, D7, D10, D9, D12, D11	Rectifier	1600 V	14 A	Rectifier Diode	
PTC	Thermistor			Thermistor	




Packaging instruction				
Standard packaging quantity (SPQ) 198	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for MiniSKiiP® 0 packages see vincotech.com website.

Package data
Package data for MiniSKiiP® 0 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-M006PNB006SA-K614C-D4-14	31 Aug. 2023	Rectifier diode, surge (non-repetitive) forward current Introduce Rth values with HPTP New Datasheet format, module is unchanged Separate datasheet	

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1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.