80-M006PNB010SA-K615C
datasheet

MiniSKiiP PIM 0 | **600 V / 10 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: Al_2O_3
- Easy assembly in one mounting step
- Flexible PCB design w/o pin holes
- Rugged solderless spring contacts

Extra features

- Equivalent: SKiiP 02NAC066V3

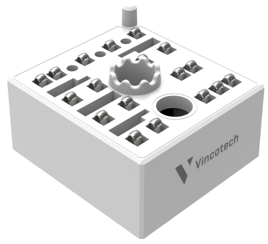
Target applications

- Industrial Drives
- Embedded Drives

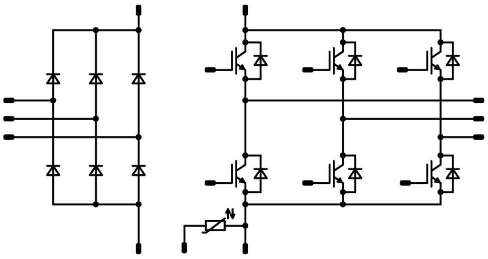
Types

- 80-M006PNB010SA-K615C

MiniSKiiP® 0 16 mm housing



Schematic



Maximum Ratings

T_j = 25 °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 = 80 °C	17	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	44	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 360 V	T_j = 150 °C	6	μs
Maximum junction temperature	T_{jmax}			175	°C
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	23	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	95	A
Surge current capability	I^2t			45	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	45	W
Maximum junction temperature	T_{jmax}			175	°C
Rectifier Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	32	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	150	A
Surge current capability	I^2t			112	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	51	W
Maximum junction temperature	T_{jmax}			150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
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
Isolation voltage	V_{isol}	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]	Values Min	Typ	Max	Unit
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00015	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		10	25 150	1,1	1,64 1,89	1,9(1)	V
Collector-emitter cut-off current	I_{CES}		0	600		25			0,6	µA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		551		pF
Output capacitance	C_{oes}							40		pF
Reverse transfer capacitance	C_{res}							17		pF
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						2,14		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 32 Ω R_{goff} = 32 Ω	±15	300	10	25 150		89,8 90,6		ns
Rise time	t_r					25 150		22 24,8		ns
Turn-off delay time	$t_{d(off)}$					25 150		133,4 155,6		ns
Fall time	t_f					25 150		119,52 144,28		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,655 µC Q_{rFWD}=1,46 µC				25 150		0,261 0,382		mWs
Turn-off energy (per pulse)	E_{off}					25 150		0,255 0,343		mWs

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				20	25 150		1,78 1,8	2,3[(1)]	V
Reverse leakage current	I_R	V_r = 600 V				25			100	µA
Thermal										
Thermal resistance junction to sink[(2)]	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						2,13		K/W
Dynamic										
Peak recovery current	I_{RM}	di/dt=266 A/µs di/dt=305 A/µs	±15	300	10	25 150		6,77 9,87		A
Reverse recovery time	t_{rr}					25 150		233,11 351,48		ns
Recovered charge	Q_r					25 150		0,655 1,46		µC
Reverse recovered energy	E_{rec}					25 150		0,128 0,305		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		104,52 109,07		A/µs
Rectifier Diode										
Static										
Forward voltage	V_F				8	25 125		1,05 0,976	1,21[(1)] 1,1[(1)]	V
Reverse leakage current	I_R	V_r = 1600 V				25			100	µA
Thermal										
Thermal resistance junction to sink[(2)]	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						1,37		K/W

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	
Thermistor										
Static										
Rated resistance	R					25		1		kΩ
Deviation of R100	$\Delta_{R/R}$	R_{100} = 1670 Ω				100	-2		2	%
Maximum Current	I_{max}							3		mA
Power dissipation constant	d					25		0,76		mW/K
A-value	A							$7,635x10^{-3}$		1/K
B-value	B							$1,73x10^{-5}$		$1/K^2$
Vincotech Thermistor Reference									E	

(1) Value at chip level
(2) Only valid with pre-applied Vincotech thermal interface material.

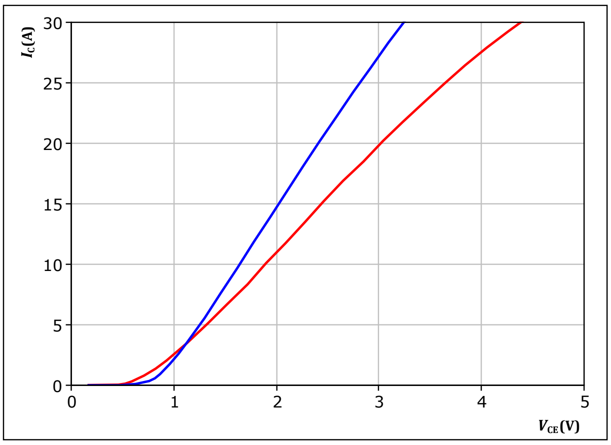
80-M006PNB010SA-K615C
datasheet

Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

I_C = f(V_{CE})

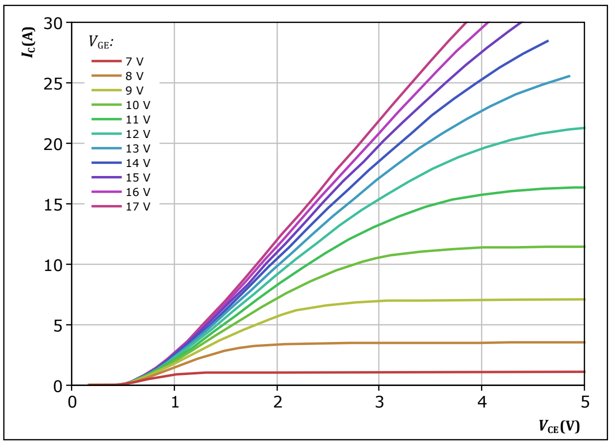


t_p =	250	μs	
V_{GE} =	15	V	
T_j:	25 °C	150 °C	

figure 2. IGBT

Typical output characteristics

I_C = f(V_{CE})



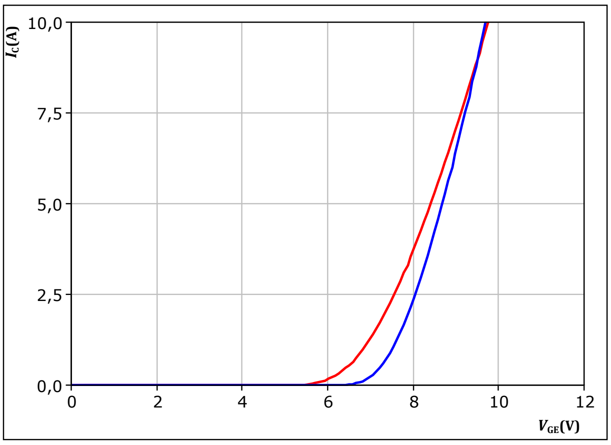
t_p =	250	μs
T_j =	150	°C

V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

I_C = f(V_{GE})

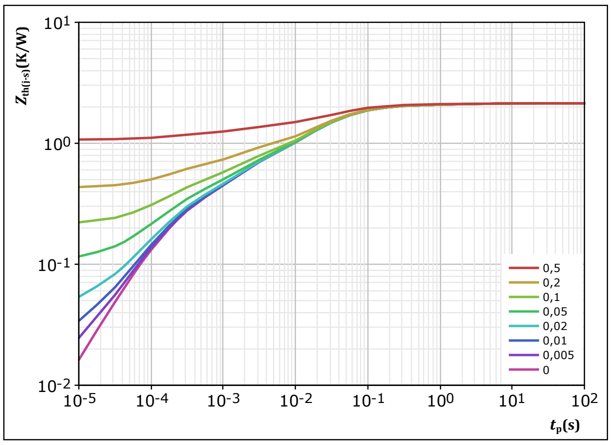


t_p =	250	μs	
V_{CE} =	10	V	
T_j:	25 °C	150 °C	

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	2,14	K/W

IGBT thermal model values

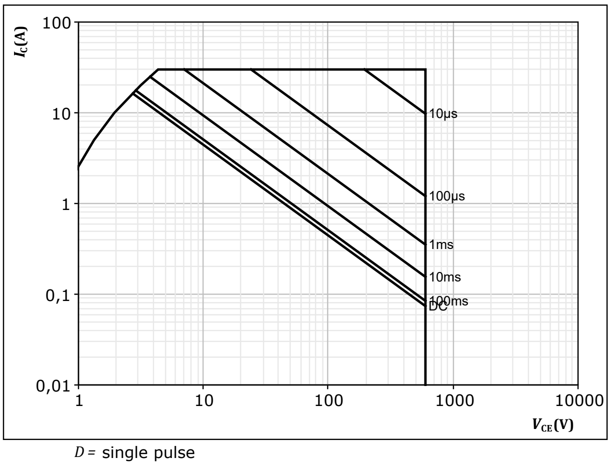
R (K/W)	τ (s)
7,66E-02	2,68E+00
3,77E-01	1,31E-01
1,06E+00	2,36E-02
3,93E-01	1,75E-03
2,33E-01	1,67E-04

Inverter Switch Characteristics

figure 5.	IGBT

Safe operating area

$I_C = f(V_{CE})$



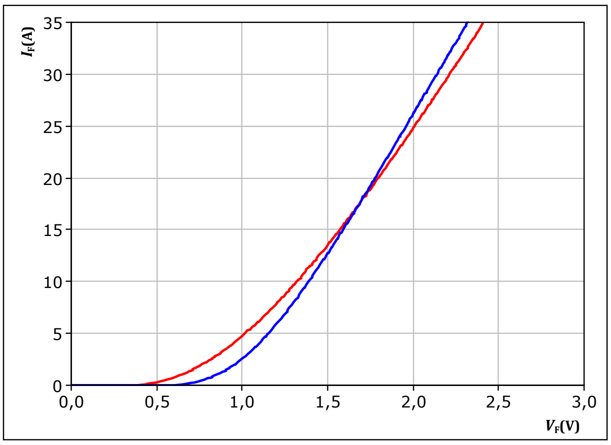
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Inverter Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



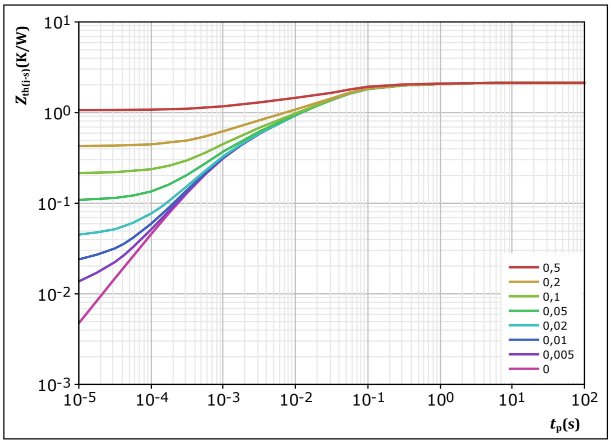
t_p = 250 μs

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

$R_{th(j-s)}$ = 2,129 K/W

FWD thermal model values

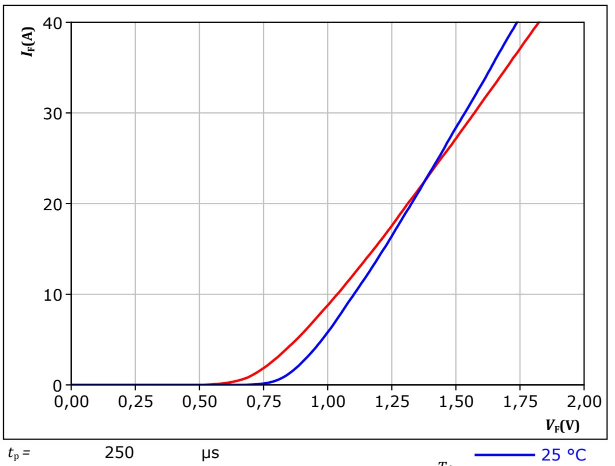
R (K/W)	τ (s)
1,15E-01	1,68E+00
2,75E-01	1,56E-01
1,07E+00	3,32E-02
4,14E-01	3,99E-03
2,60E-01	7,65E-04

Rectifier Diode Characteristics

figure 8. **Rectifier**

Typical forward characteristics

I_F = f(V_F)



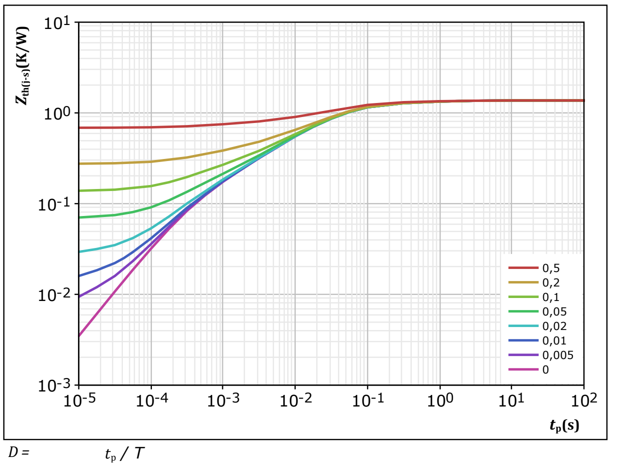
t_p = 250 µs

T_j: 25 °C, 125 °C

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

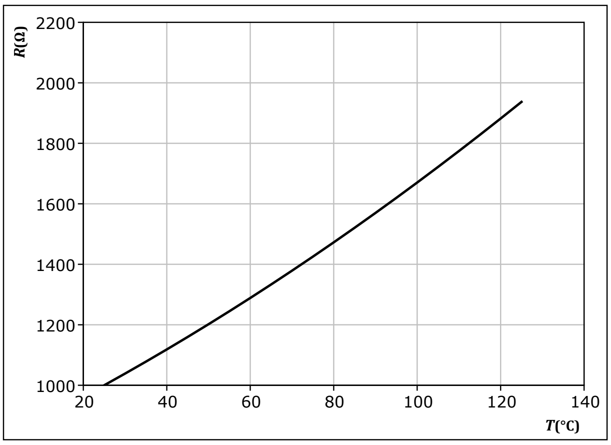
R (K/W)	τ (s)
6,75E-02	1,56E+00
1,34E-01	2,41E-01
6,34E-01	4,40E-02
3,25E-01	9,85E-03
1,24E-01	2,12E-03
8,71E-02	3,56E-04

Thermistor Characteristics

figure 10.	Thermistor

Typical PTC characteristic as function of temperature

$R_T = f(T)$

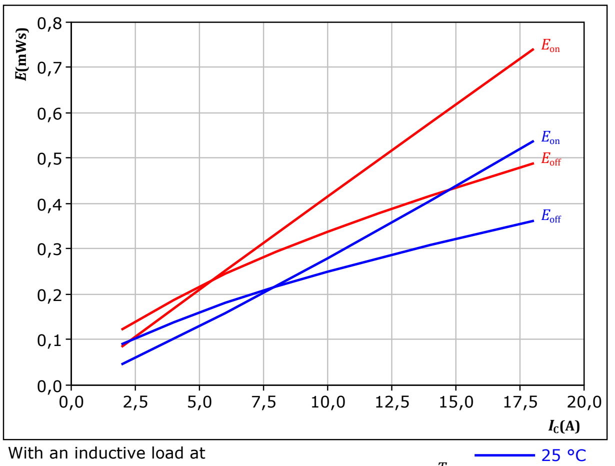


Inverter Switching Characteristics

figure 11. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



With an inductive load at

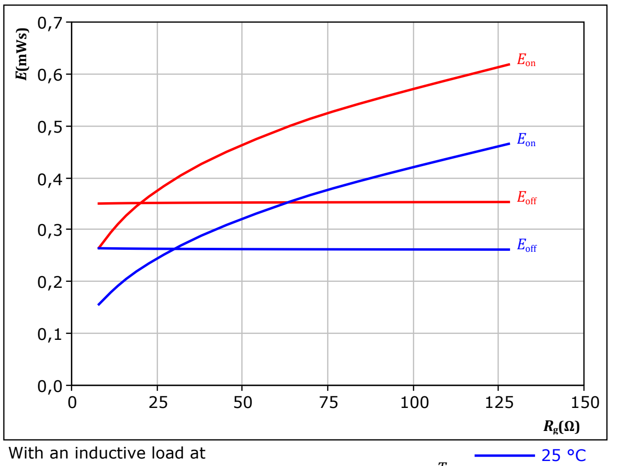
V_{CE} =	300	V	
V_{GE} =	±15	V	
R_{gon} =	32	Ω	
R_{goff} =	32	Ω	

T_j: 25 °C (blue), 150 °C (red)

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

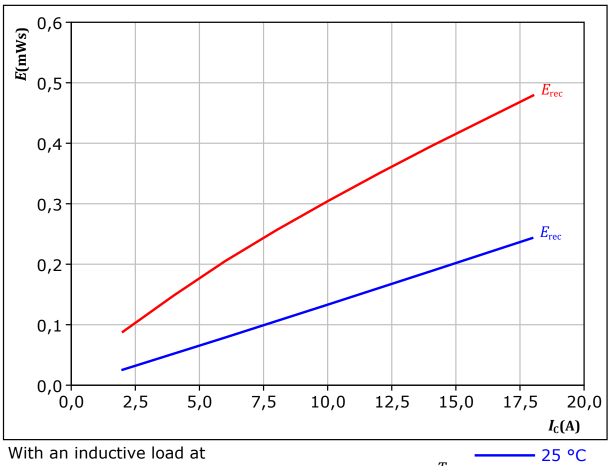
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	10	A

T_j: 25 °C (blue), 150 °C (red)

figure 13. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



With an inductive load at

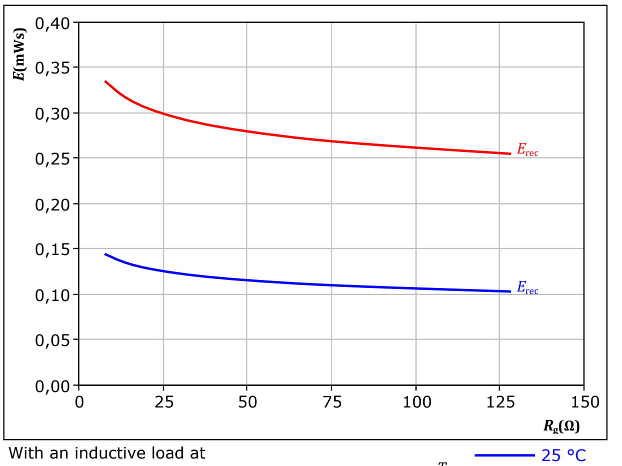
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

T_j: 25 °C (blue), 150 °C (red)

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} =	±15	V
I_C =	10	A

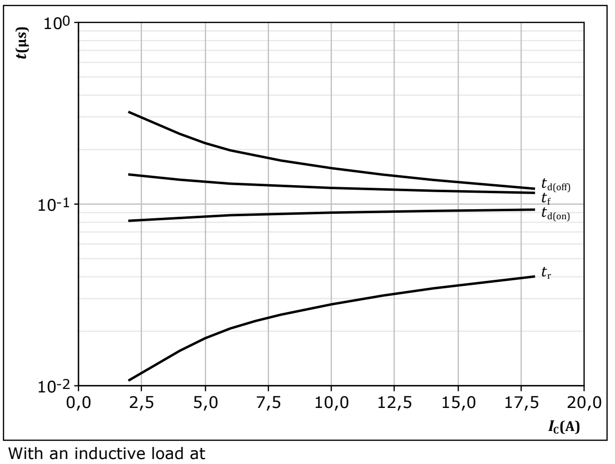
T_j: 25 °C (blue), 150 °C (red)

Inverter Switching Characteristics

figure 15. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



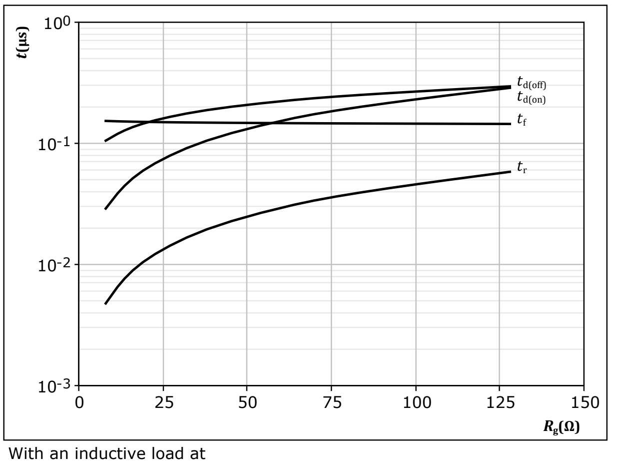
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

figure 16. **IGBT**

Typical switching times as a function of IGBT turn on gate resistor

$t = f(R_g)$



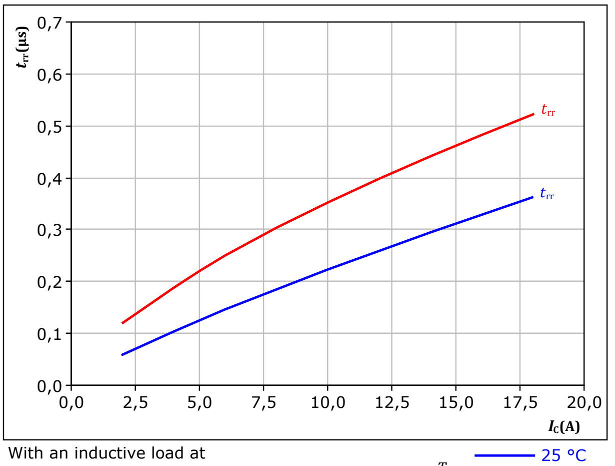
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	10	A

figure 17. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



With an inductive load at

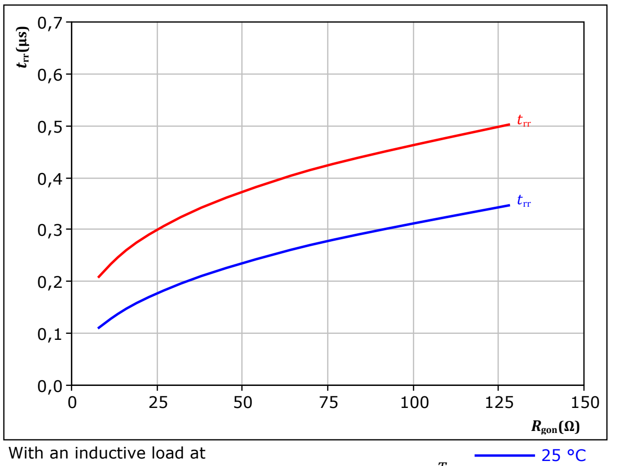
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

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	V
V_{GE} =	±15	V
I_C =	10	A

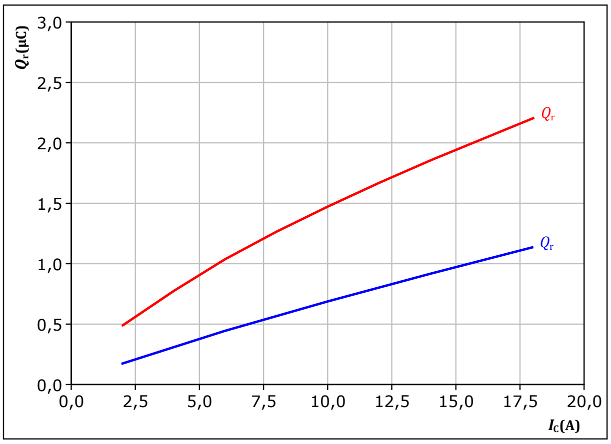
T_j: 25 °C, 150 °C

Inverter Switching Characteristics

figure 19. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



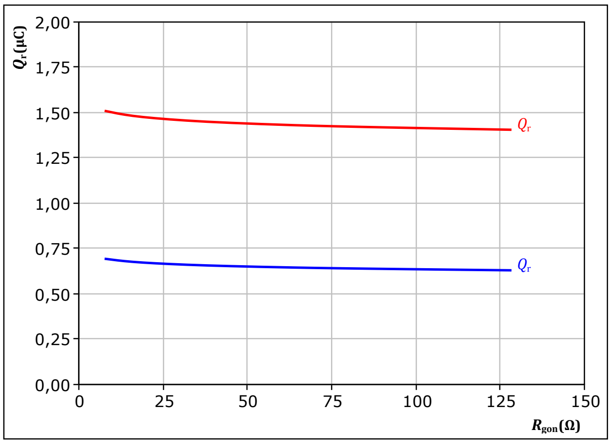
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	
V_{GE} =	±15	V		150 °C	
R_{gon} =	32	Ω			

figure 20. **FWD**

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

Q_r = f(R_{gon})



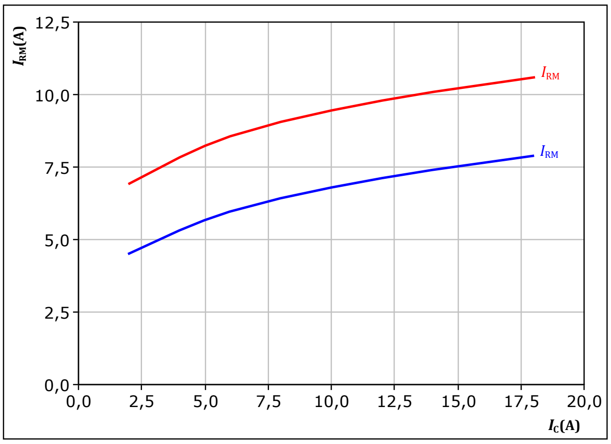
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	
V_{GE} =	±15	V		150 °C	
I_C =	10	A			

figure 21. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



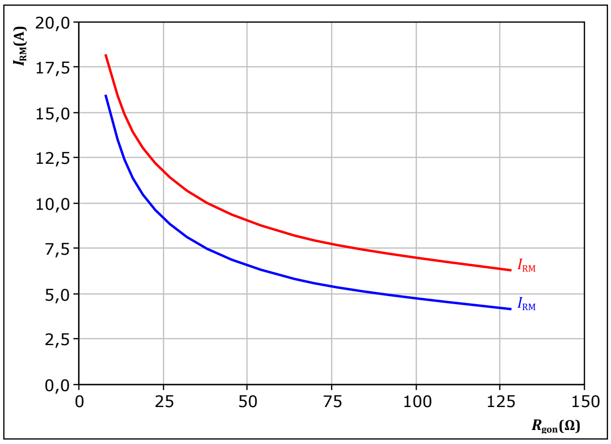
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	
V_{GE} =	±15	V		150 °C	
R_{gon} =	32	Ω			

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

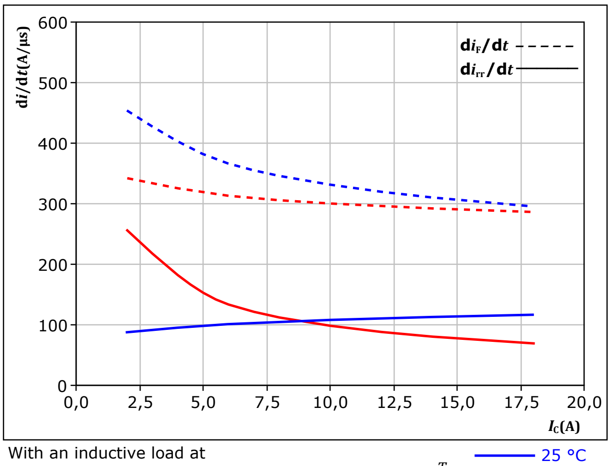
V_{CE} =	300	V	T_j:	25 °C	
V_{GE} =	±15	V		150 °C	
I_C =	10	A			

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

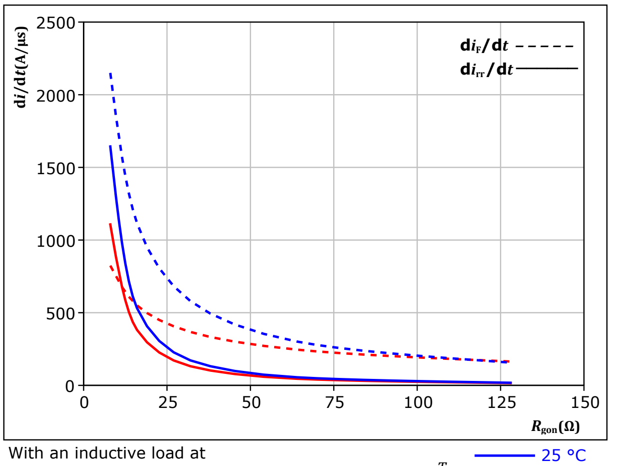
T_j: 25 °C, 150 °C

V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

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

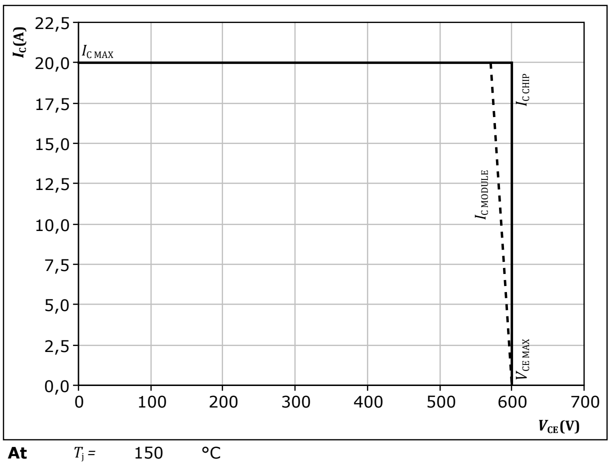
T_j: 25 °C, 150 °C

V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	10	A

figure 25. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At

T_j =	150	°C
R_{gon} =	32	Ω
R_{goff} =	32	Ω

Inverter Switching Definitions

figure 26. **IGBT**

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

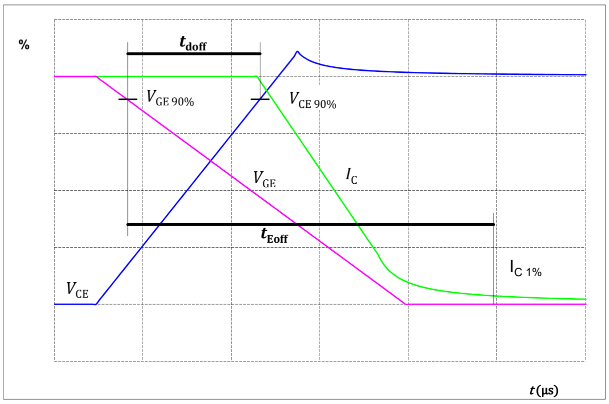


figure 27. **IGBT**

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

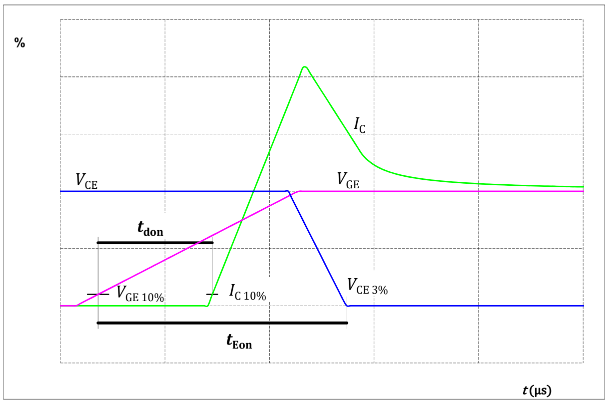


figure 28. **IGBT**

Turn-off Switching Waveforms & definition of t_f

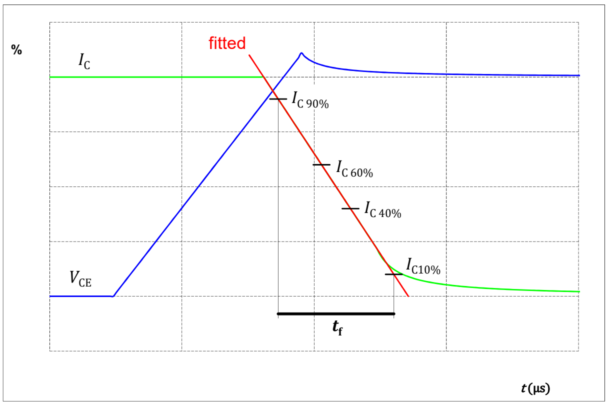
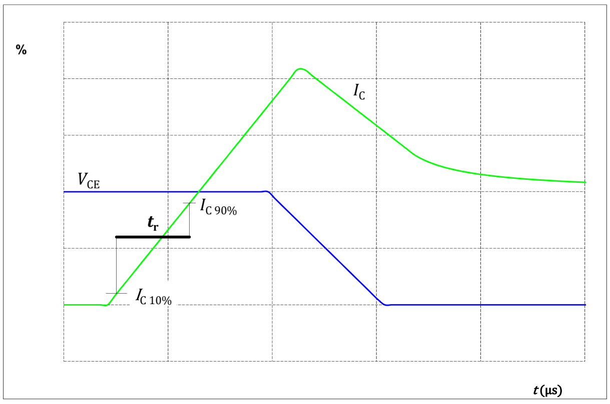


figure 29. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Inverter Switching Definitions

figure 30. **FWD**

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

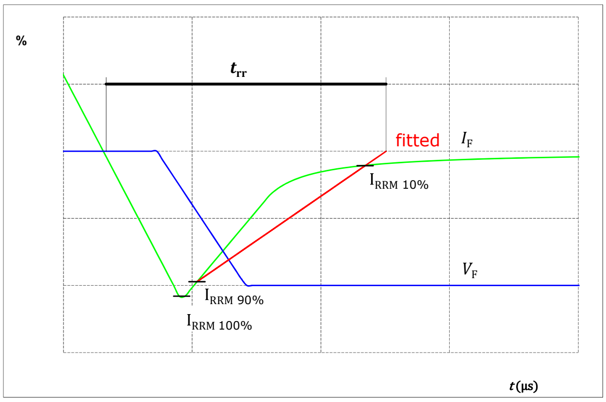
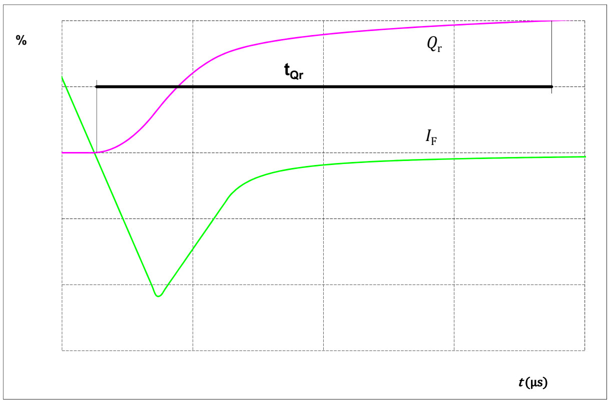


figure 31. **FWD**

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

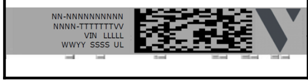


80-M006PNB010SA-K615C
datasheet

Ordering Code

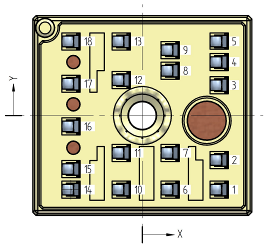
Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M006PNB010SA-K615C-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M006PNB010SA-K615C-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M006PNB010SA-K615C-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M006PNB010SA-K615C-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M006PNB010SA-K615C-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M006PNB010SA-K615C-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M006PNB010SA-K615C-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M006PNB010SA-K615C-/5B/

Marking

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

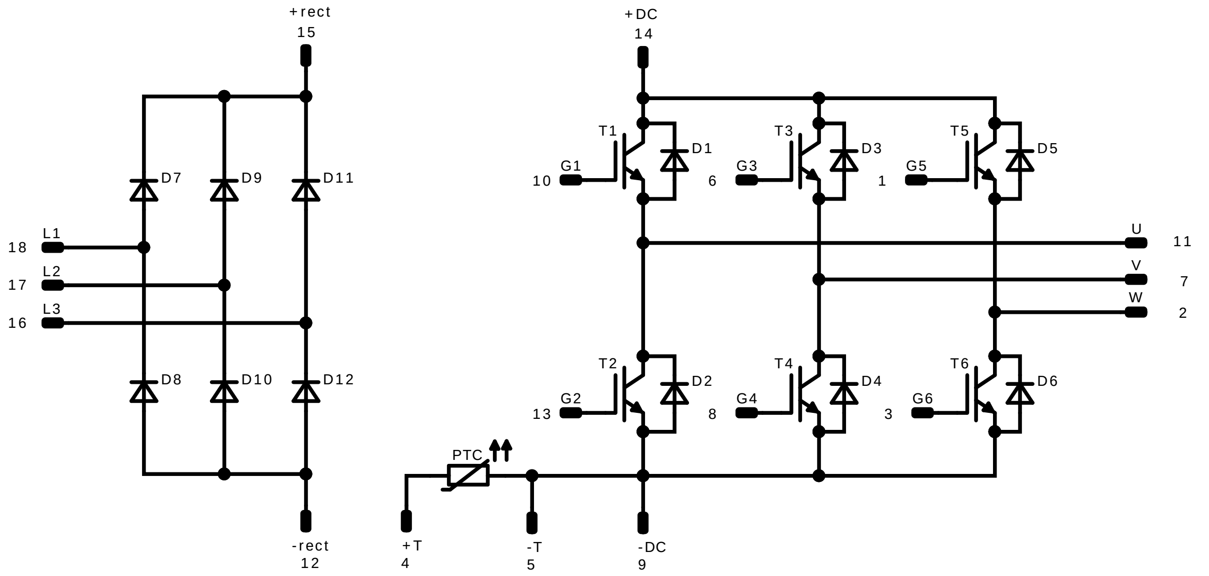
Outline

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

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T2, T1, T4, T3, T6, T5	IGBT	600 V	10 A	Inverter Switch	
D1, D2, D3, D4, D5, D6	FWD	600 V	20 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-M006PNB010SA-K615C-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	