80-M012PNA010M7-K619C71
datasheet

MiniSKiiP PIM 0 | **1200 V / 10 A**

Topology features

- Converter+Inverter
- 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: Al_2O_3
- Easy assembly in one mounting step
- Flexible PCB design w/o pin holes
- Rugged solderless spring contacts

Extra features

- Equivalent: SKiiP 03NAC12T4V1

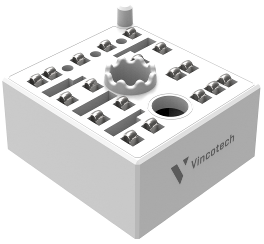
Target applications

- Industrial Drives

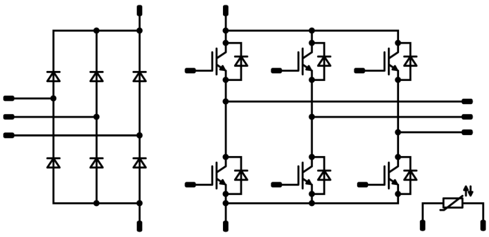
Types

- 80-M012PNA010M7-K619C71

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}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s <= 80 °C	20 (1)	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	67	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 800 V	T_j = 150 °C	9,5	µs
Maximum junction temperature	T_{jmax}			175	°C

(1) limited by I_{CRM}

Parameter	Symbol	Conditions		Value	Unit
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s <= 80 °C	20 (2)	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	53	W
Maximum junction temperature	T_{jmax}			175	°C

(2) limited by I_{FRM}

Parameter	Symbol	Conditions		Value	Unit
Rectifier Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	37	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

80-M012PNA010M7-K619C71
datasheet

Vincotech

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	$V_{GE(th)}$			10	0,001	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		10	25 125 150		1,66 1,9 1,96	2,1(3)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			35	µA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}		0	10		25		2000		pF
Output capacitance	C_{oes}		0	10		25		86		pF
Reverse transfer capacitance	C_{res}		0	10		25		23		pF
Gate charge	Q_g	V_{CC} = 600 V	0/15		10	25		80		nC
Thermal										
Thermal resistance junction to sink(4)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						1,41		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 32 Ω R_{goff} = 32 Ω	±15	600	10	25 125 150		127,8 125,6 123,4		ns
Rise time	t_r	R_{gon} = 32 Ω R_{goff} = 32 Ω	±15	600	10	25 125 150		29 32,2 33,8		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 32 Ω R_{goff} = 32 Ω	±15	600	10	25 125 150		145,2 179,2 182		ns
Fall time	t_f	R_{gon} = 32 Ω R_{goff} = 32 Ω	±15	600	10	25 125 150		98,1 107,57 116,71		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=1,09 µC Q_{rFWD}=1,66 µC Q_{rFWD}=1,81 µC	±15	600	10	25 125 150		0,883 1,12 1,19		mWs
Turn-off energy (per pulse)	E_{off}		±15	600	10	25 125 150		0,656 0,86 0,908		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				10	25 125 150		1,61 1,69 1,7	1,9(3)	V
Reverse leakage current	I_R	V_r = 1200 V				25			25	μA
Thermal										
Thermal resistance junction to sink(4)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						1,8		K/W
Dynamic										
Peak recovery current	I_{RM}	di/dt=278 A/μs di/dt=270 A/μs di/dt=272 A/μs	±15	600	10	25 125 150		8,67 9,25 9,34		A
Reverse recovery time	t_{rr}					25 125 150		254,4 372,9 409		ns
Recovered charge	Q_r					25 125 150		1,09 1,66 1,81		μC
Reverse recovered energy	E_{rec}					25 125 150		0,374 0,62 0,68		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		84,75 53,58 49,28		A/μs

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	
Rectifier Diode										
Static										
Forward voltage	V_F				8	25 125		0,996 0,907	1,21(3) 1,1(3)	V
Reverse leakage current	I_R	V_r = 1600 V				25			100	µA
Thermal										
Thermal resistance junction to sink(4)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						1,37		K/W
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							$7{,}635\times10^{-3}$		1/K
B-value	B							$1{,}73\times10^{-5}$		$1/K^2$
Vincotech Thermistor Reference									E	

(3) Value at chip level

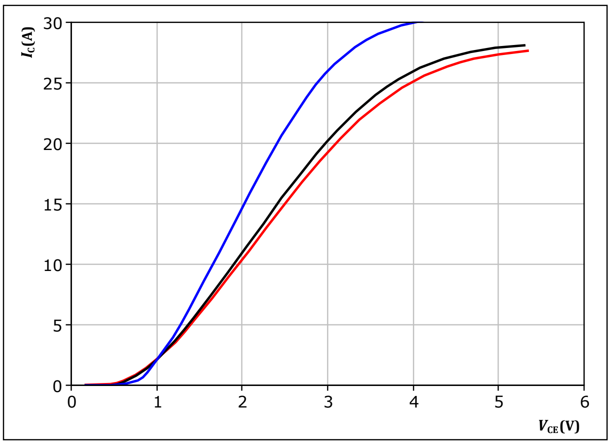
(4) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

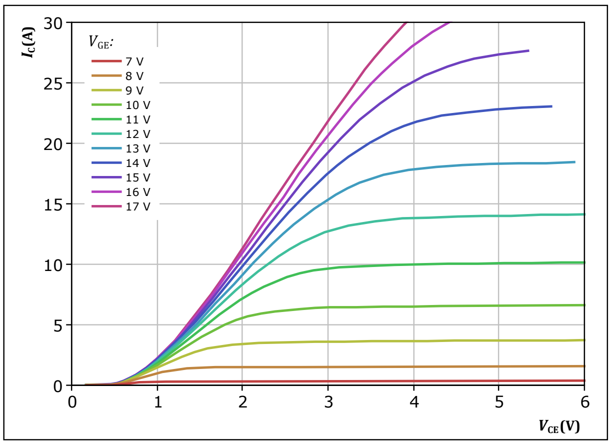


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



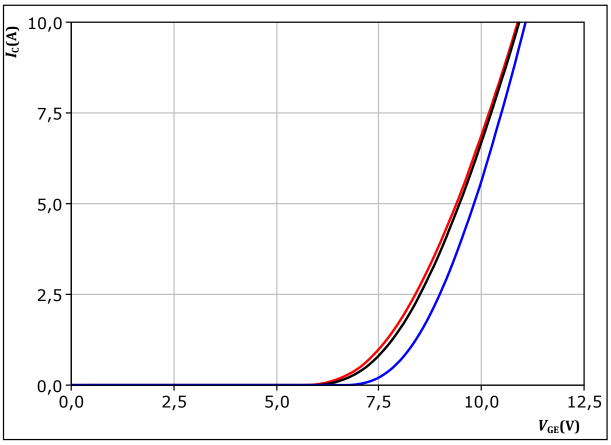
t_p =	250	µs
T_j =	150	°C

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

figure 3. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})

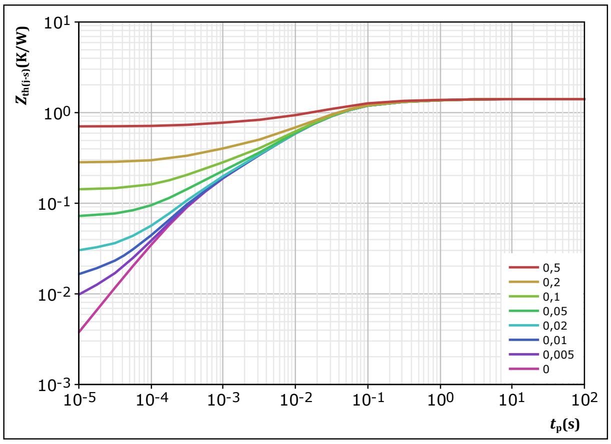


t_p =	250	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 4. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,409	K/W

IGBT thermal model values

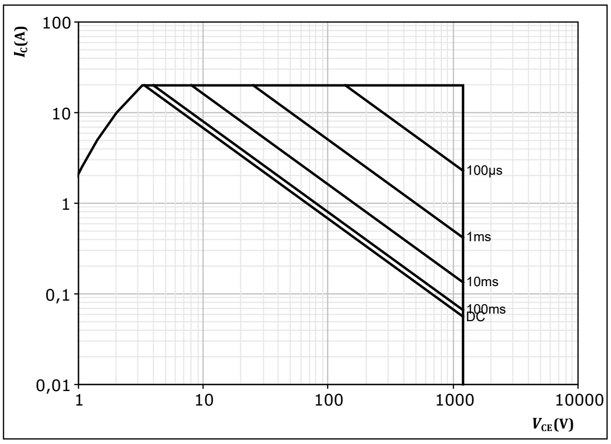
R (K/W)	τ (s)
7,86E-02	1,46E+00
1,33E-01	2,21E-01
5,83E-01	4,32E-02
3,51E-01	1,14E-02
1,57E-01	2,77E-03
1,06E-01	3,80E-04

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area

I_C = f(V_{CE})

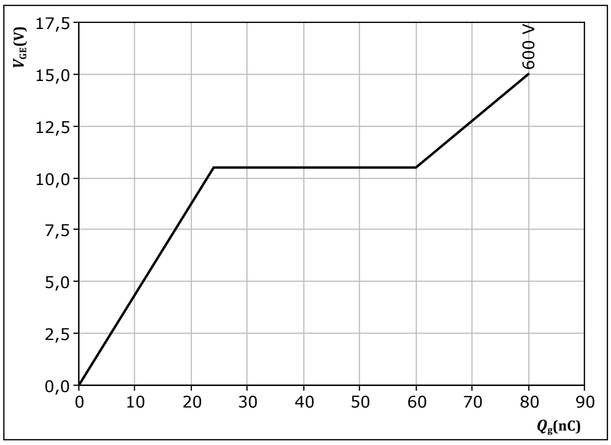


D = single pulse
T_s = 80 °C
V_{GE} = 15 V
T_j = T_{jmax}

figure 6. **IGBT**

Gate voltage vs gate charge

V_{GE} = f(Q_g)



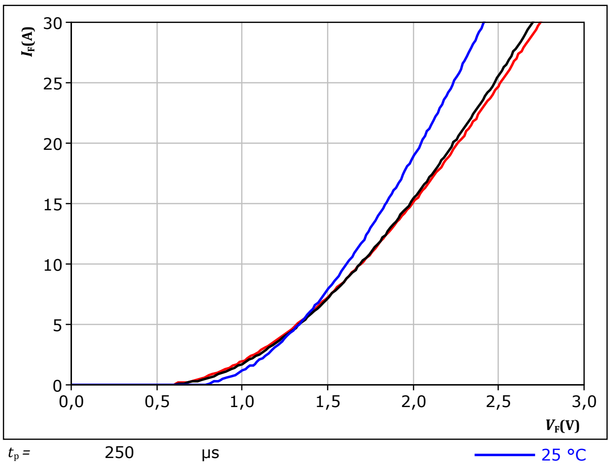
I_C = 10 A
T_j = 25 °C

Inverter Diode Characteristics

figure 7. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



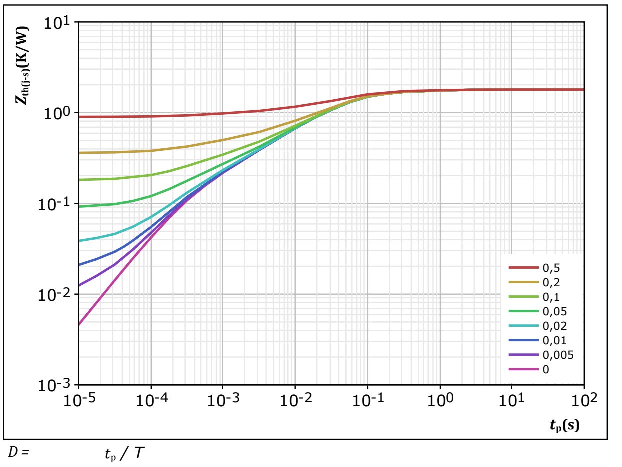
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 8. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,796 K/W

FWD thermal model values

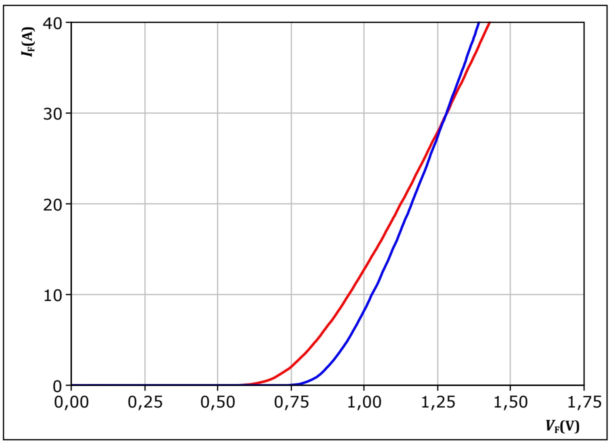
R (K/W)	τ (s)
9,72E-02	1,09E+00
2,38E-01	1,57E-01
9,04E-01	4,18E-02
3,13E-01	8,00E-03
1,25E-01	2,16E-03
1,19E-01	3,44E-04

Rectifier Diode Characteristics

figure 9. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



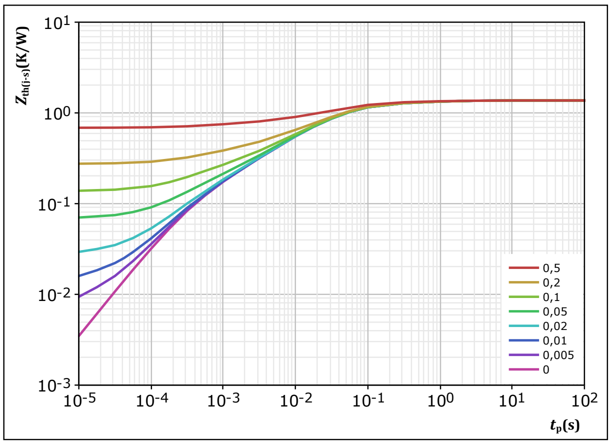
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 10. **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

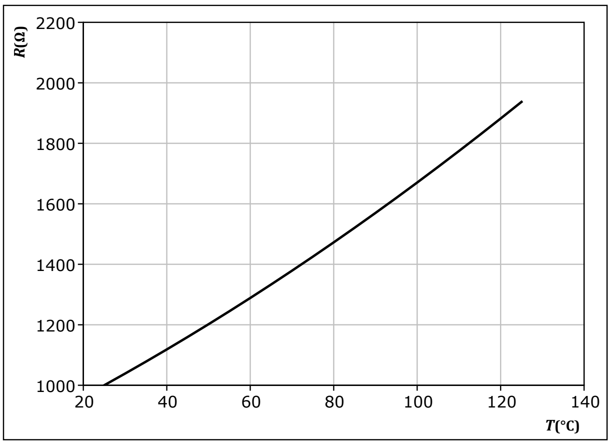
R (K/W)	τ (s)
6,75E-02	1,56E+00
1,34E-01	2,41E-01
6,34E-01	4,40E-02
3,25E-01	9,85E-03
1,24E-01	2,12E-03
8,71E-02	3,56E-04

Thermistor Characteristics

figure 11.	Thermistor

Typical PTC characteristic as function of temperature

R_T = f(T)

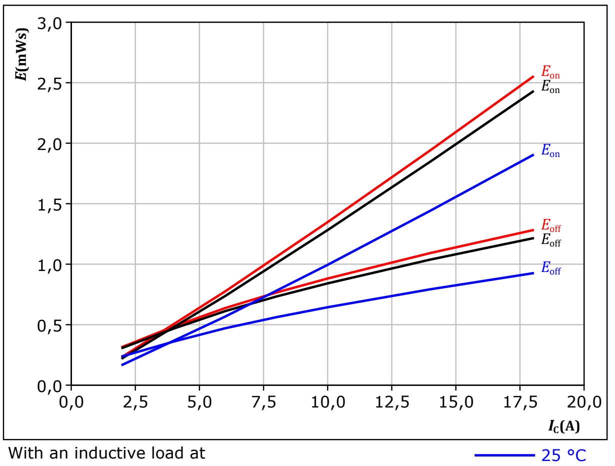


Inverter Switching Characteristics

figure 12. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



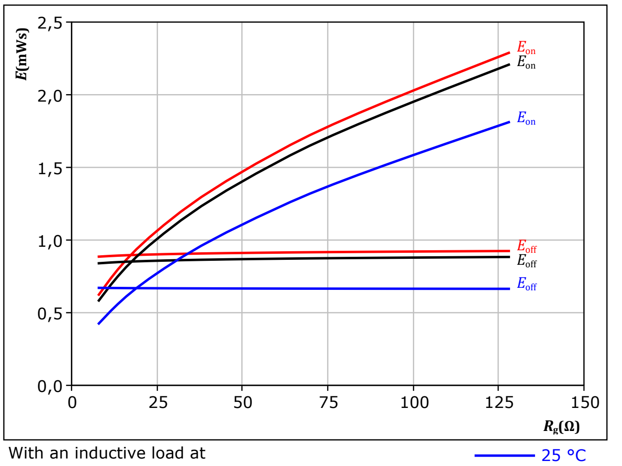
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	32	Ω		150 °C
R_{goff} =	32	Ω		

figure 13. **IGBT**

Typical switching energy losses as a function of IGBT turn on gate resistor

$E = f(R_g)$



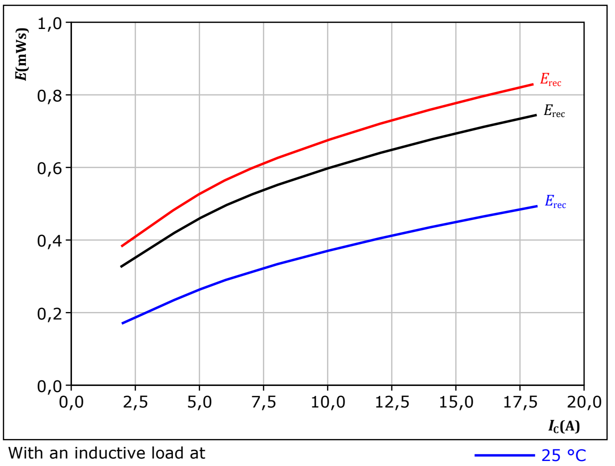
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	10	A		150 °C

figure 14. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



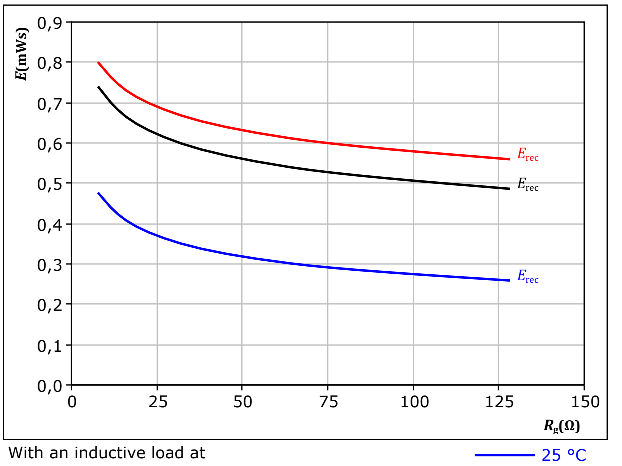
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	32	Ω		150 °C

figure 15. **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

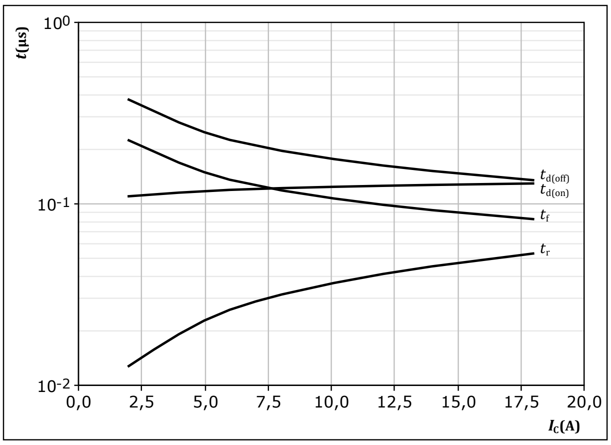
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	10	A		150 °C

Inverter Switching Characteristics

figure 16. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



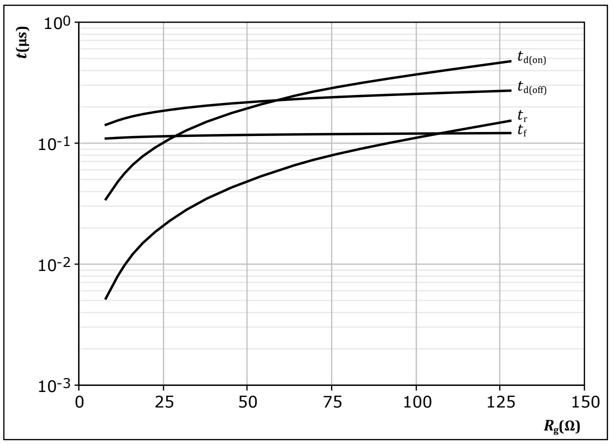
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

figure 17. **IGBT**

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

t = f(R_g)



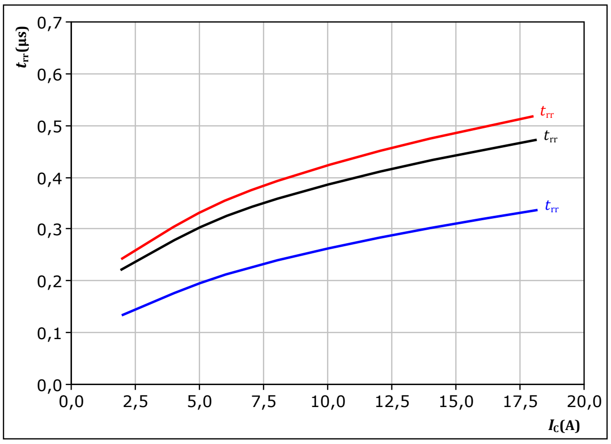
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	10	A

figure 18. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

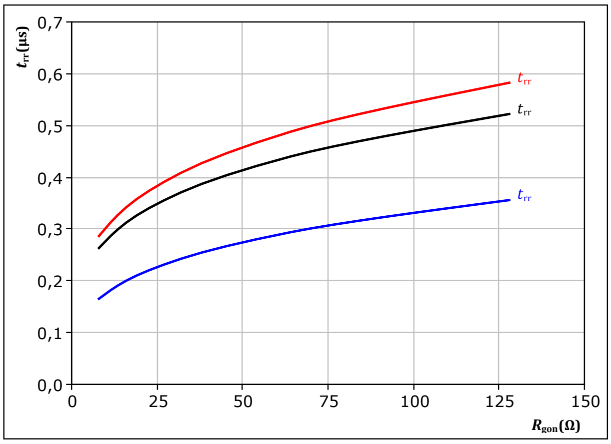
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 19. **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} =	±15	V
I_C =	10	A

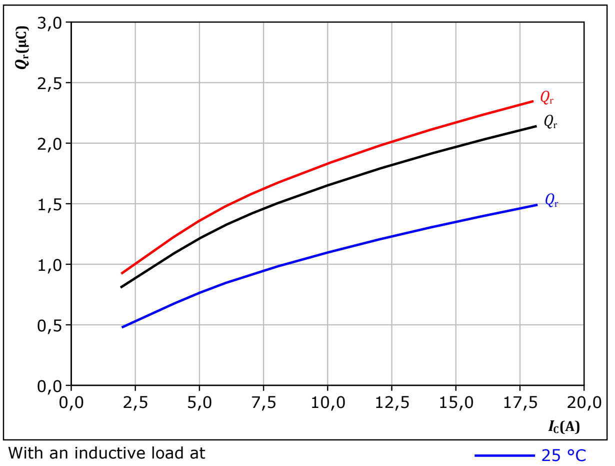
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 20. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



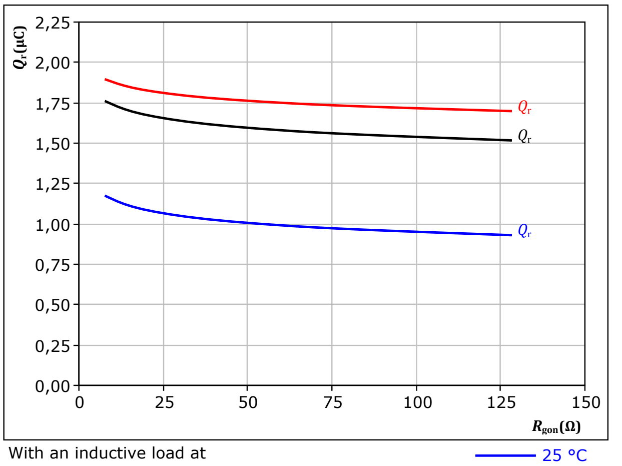
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	32	Ω		150 °C

figure 21. **FWD**

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

Q_r = f(R_{gon})



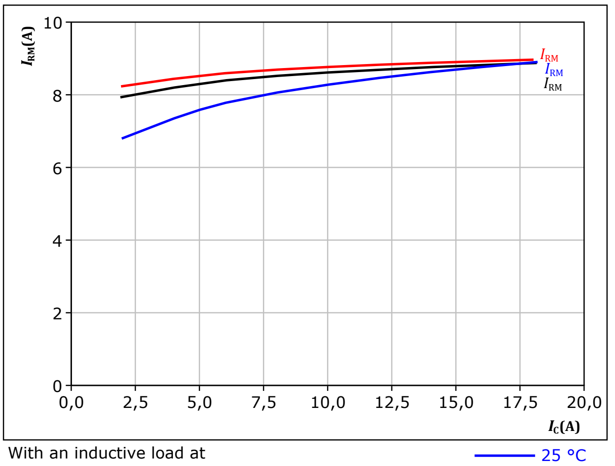
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	10	A		150 °C

figure 22. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



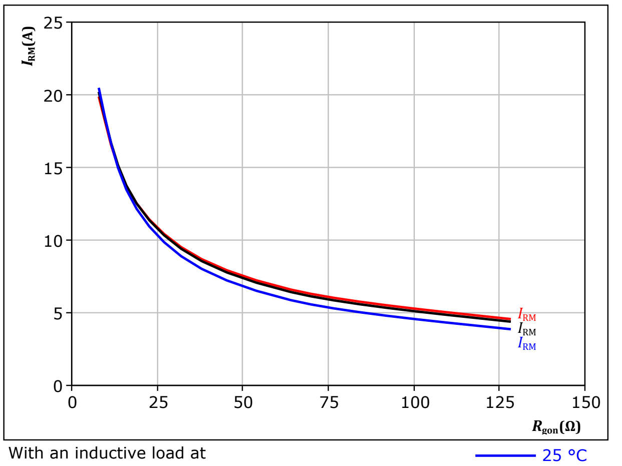
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	32	Ω		150 °C

figure 23. **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

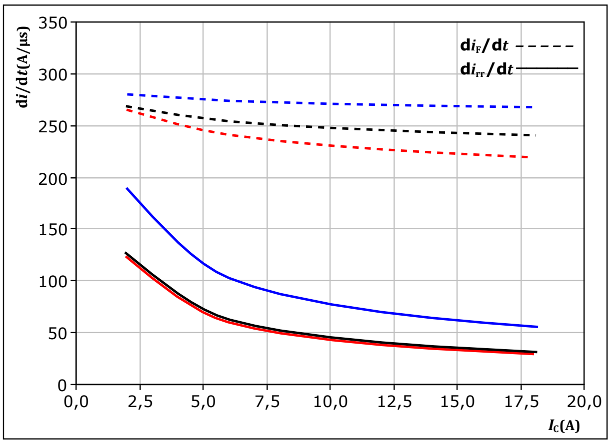
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	10	A		150 °C

Inverter Switching Characteristics

figure 24. **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)



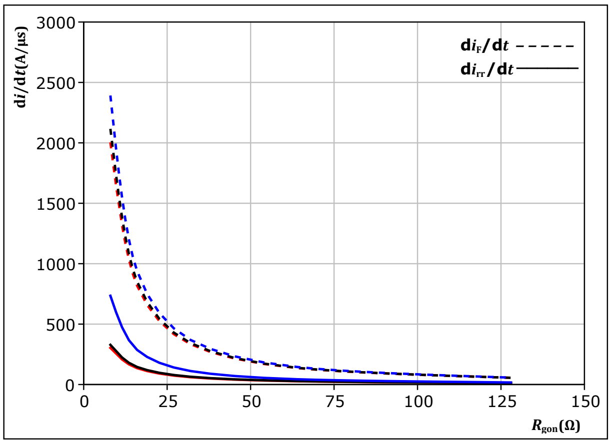
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	32	Ω		150 °C

figure 25. **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})



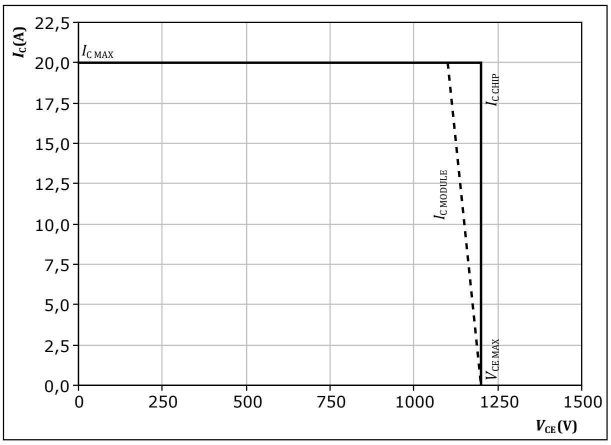
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	10	A		150 °C

figure 26. **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 27. **IGBT**

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

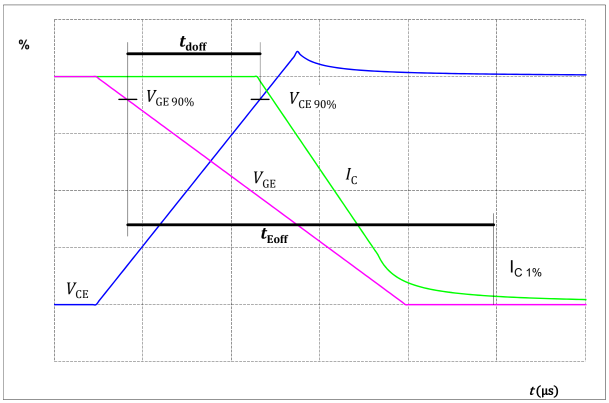


figure 28. **IGBT**

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

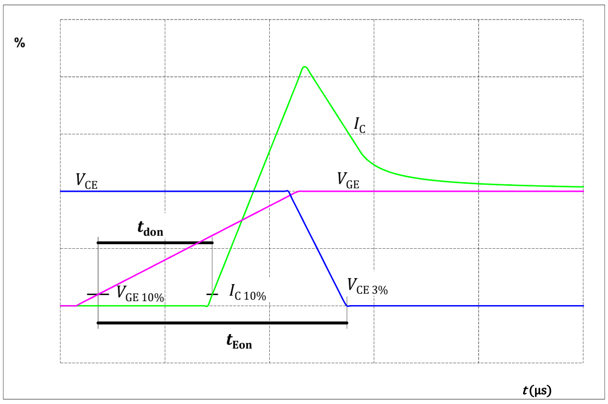


figure 29. **IGBT**

Turn-off Switching Waveforms & definition of t_f

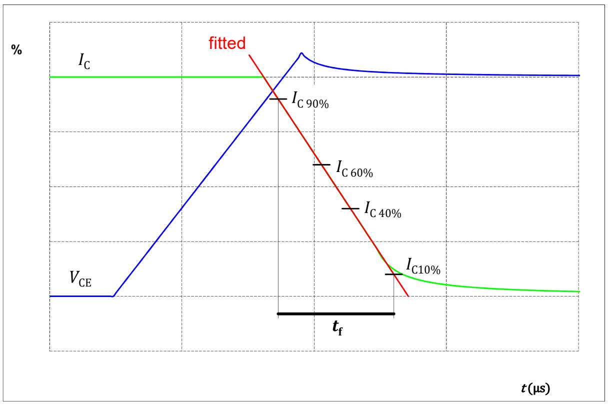
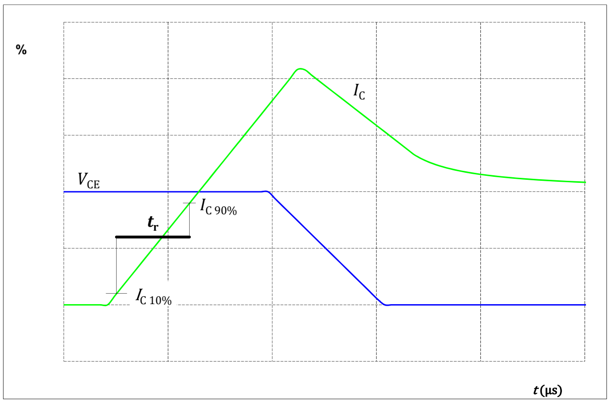


figure 30. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Inverter Switching Definitions

figure 31.	FWD

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

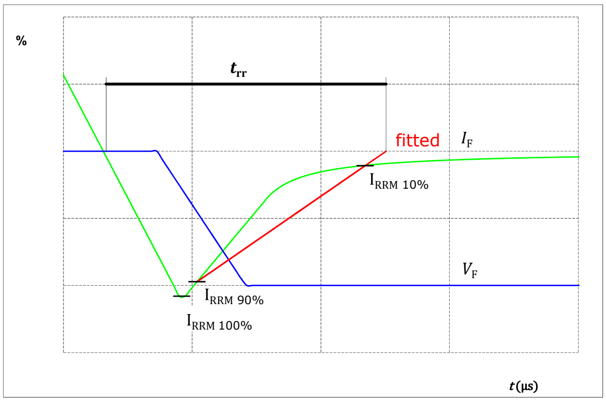
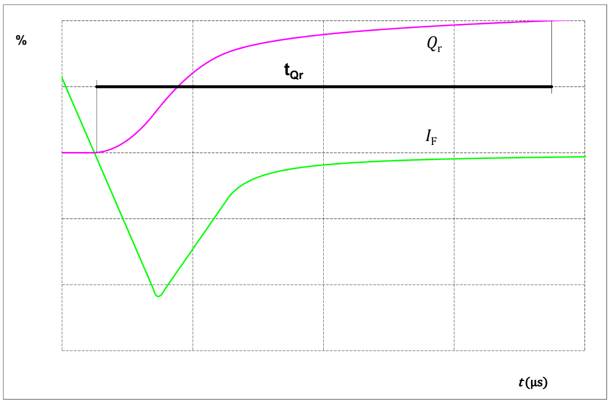


figure 32.	FWD

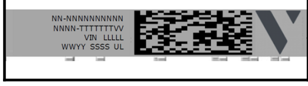
Turn-on Switching Waveforms & definition of t_{Qr} **(**t_{Qr} **= integrating time for** Q_r**)**



Ordering Code

Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M012PNA010M7-K619C71-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M012PNA010M7-K619C71-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M012PNA010M7-K619C71-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M012PNA010M7-K619C71-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M012PNA010M7-K619C71-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M012PNA010M7-K619C71-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M012PNA010M7-K619C71-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M012PNA010M7-K619C71-/5B/

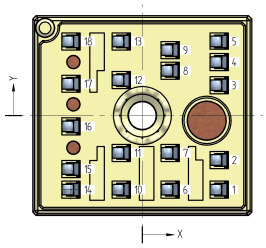
Marking



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

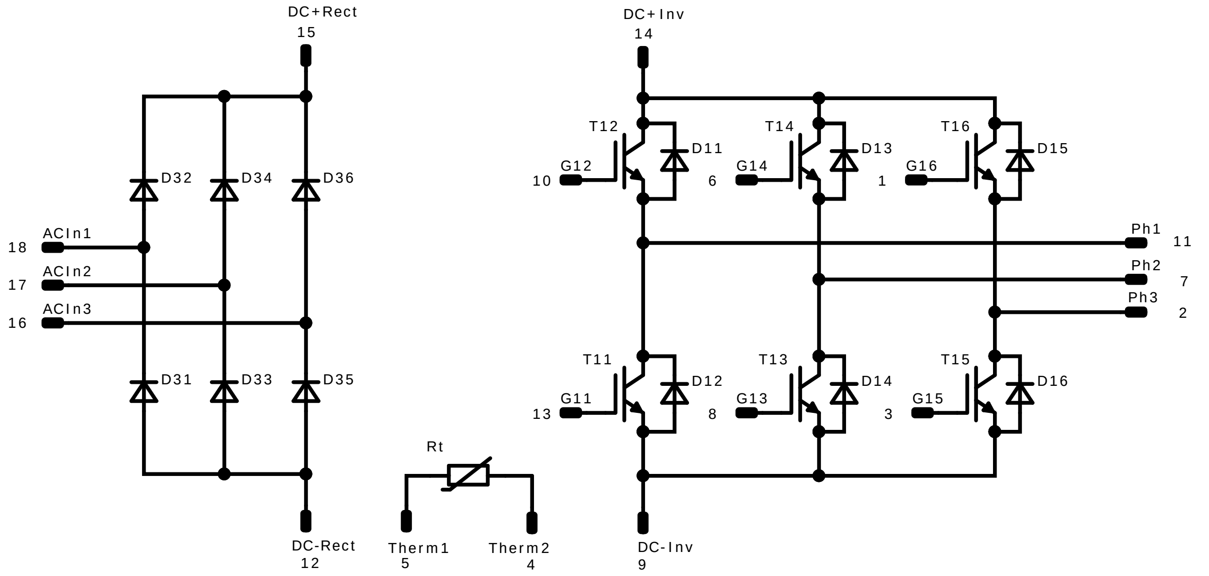
Outline

Pin table [mm]			
Pin	X	Y	Function
1	11,93	-11,5	G16
2	11,93	-6,9	Ph3
3	11,93	4,71	G15
4	11,93	8,3	Therm2
5	11,93	11,5	Therm1
6	4,33	-11,5	G14
7	4,33	-5,8	Ph2
8	4,33	6,95	G13
9	4,33	10,15	DC-Inv
10	-3,27	-11,5	G12
11	-3,27	-5,8	Ph1
12	-3,27	5,5	DC-Rect
13	-3,27	11,5	G11
14	-11,07	-11,5	DC+Inv
15	-11,07	-8,3	DC+Rect
16	-11,07	-1,68	ACIn3
17	-11,07	4,93	ACIn2
18	-11,07	11,5	ACIn1



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

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	10 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	10 A	Inverter Diode	
D31, D32, D33, D34, D35, D36	Rectifier	1600 V	14 A	Rectifier Diode	
Rt	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-M012PNA010M7-K619C71-D2-14	29 Apr. 2022	Correction of Zth curves	
80-M012PNA010M7-K619C71-D3-14	10 Aug. 2023	Rectifier diode, surge (non-repetitive) forward current	