80-M3126PB200M702-K860F70
datasheet

MiniSKiiP PACK 3 | **1200 V / 200 A**

Topology features

- Inverter
- Kelvin Emitter for improved switching performance
- Open Emitter configuration
- 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

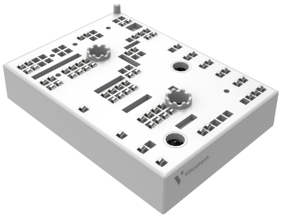
Target applications

- Embedded Drives
- Industrial Drives

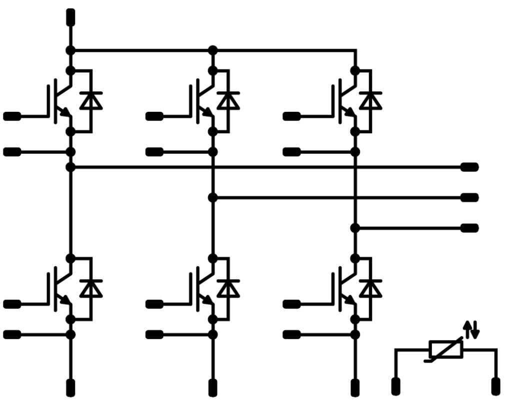
Types

- 80-M3126PB200M702-K860F70

MiniSKiiP® 3 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	198	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 °C	392	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
Inverter Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ T_s = 80 °C	113	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	194	W
Maximum junction temperature	T_{jmax}		175	°C
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		≥ 600	

*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	$V_{GE(th)}$			10	0,02	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		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}		0	10		25		37000		pF
Output capacitance	C_{oes}							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)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,24		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	±15	600	200	25 125 150		446,1 453,24 455,15		ns
Rise time	t_r					25 125 150		91,51 106,79 111,66		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		301,28 336,72 346,68		ns
Fall time	t_f					25 125 150		70,87 94,01 97,32		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=12,01 µC Q_{rFWD}=19,09 µC Q_{rFWD}=21,38 µC				25 125 150		22,79 30,06 32,19		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		14,59 19,76 21,07		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				150	25 125 150		1,79 1,9 1,89	2,1(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			40	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,49		K/W
Dynamic										
Peak recovery current	I_{RM}	d*i*/d*t*=1954 A/µs d*i*/d*t*=1619 A/µs d*i*/d*t*=1581 A/µs	±15	600	200	25 125 150		89,81 90,96 92,47		A
Reverse recovery time	t_{rr}					25 125 150		317,14 479,41 523,82		ns
Recovered charge	Q_r					25 125 150		12,01 19,09 21,38		µC
Reverse recovered energy	E_{rec}					25 125 150		3,88 6,5 7,33		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		436,9 306,48 311,42		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	
Thermistor										
Static										
Rated resistance	R					25		5		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 499 Ω				100	3,2		3,3	%
Power dissipation	P					25		130		mW
Power dissipation constant	d					25		1,3		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %						3380		K
Vincotech Thermistor Reference									V	

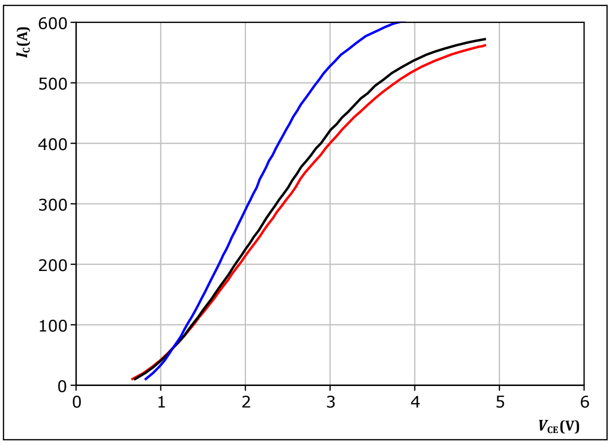
(1) Value at chip level
(2) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$



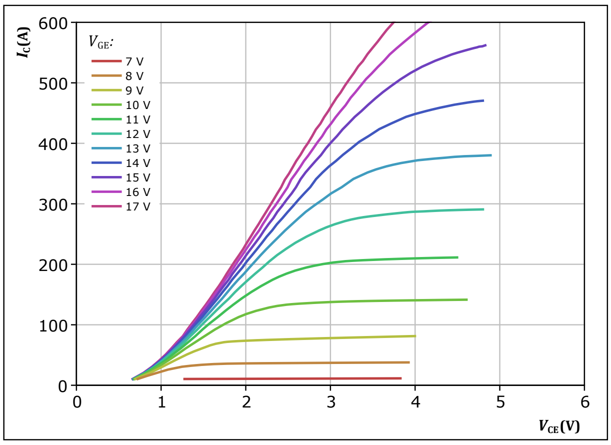
t_p =	250	µs
V_{GE} =	15	V

T_j: 25 °C, 125 °C, 150 °C

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$



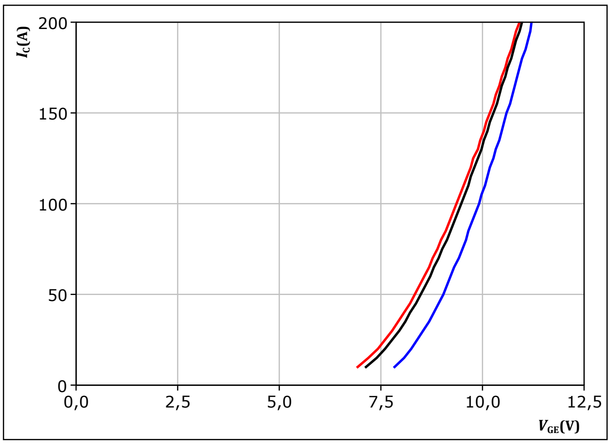
t_p =	250	µs
T_j =	150	°C

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

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



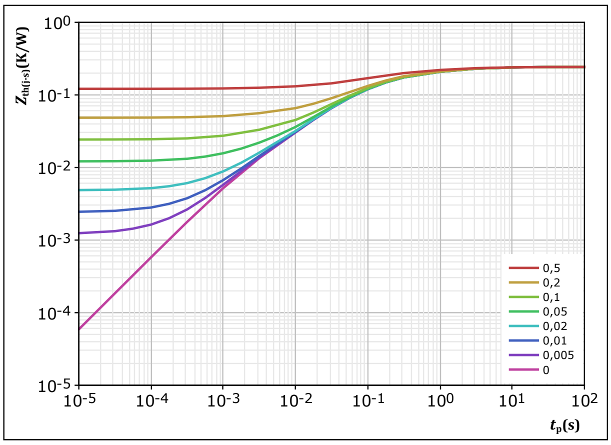
t_p =	250	µs
V_{CE} =	10	V

T_j: 25 °C, 125 °C, 150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,243 K/W

IGBT thermal model values

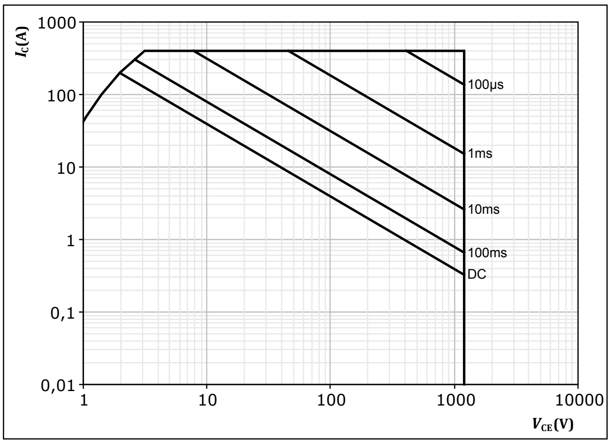
R (K/W)	τ (s)
1,22E-02	8,07E+00
5,19E-02	1,24E+00
1,10E-01	1,65E-01
6,11E-02	3,27E-02
7,54E-03	2,30E-03

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area

I_C = f(V_{CE})

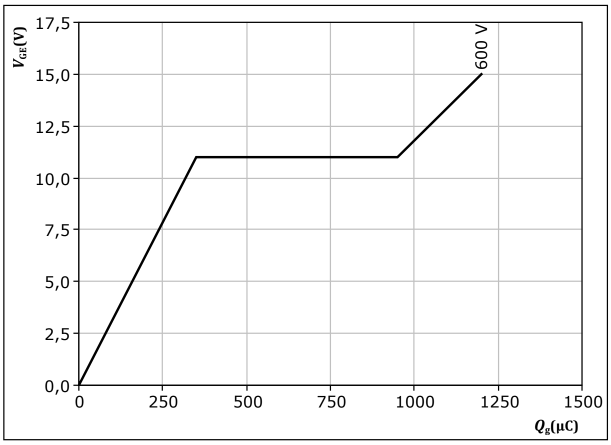


D = single pulse
T_s = 80 °C
V_{GE} = 15 V
T_j = T_{jmax}

figure 6. **IGBT**

Gate voltage vs gate charge

V_{GE} = f(Q_g)



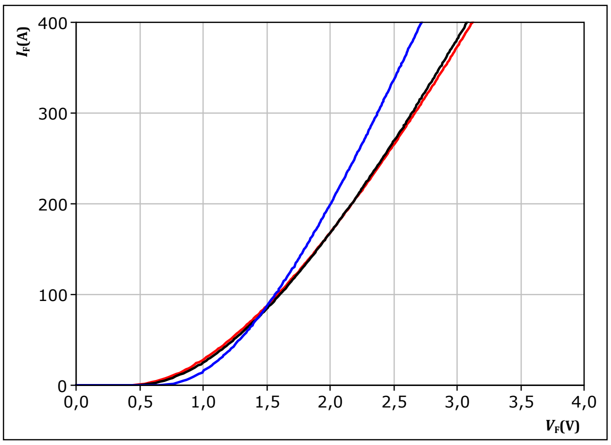
I_C = 200 A
T_j = 25 °C

Inverter Diode Characteristics

figure 7. **FWD**

Typical forward characteristics

I_F = f(V_F)



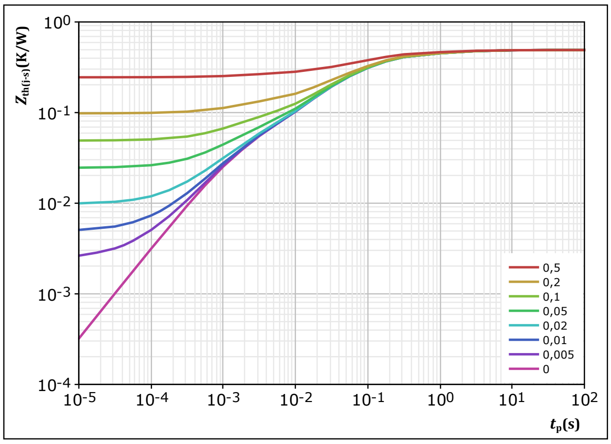
t_p = 250 µs

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

$R_{th(j-s)}$ = 0,49 K/W

FWD thermal model values

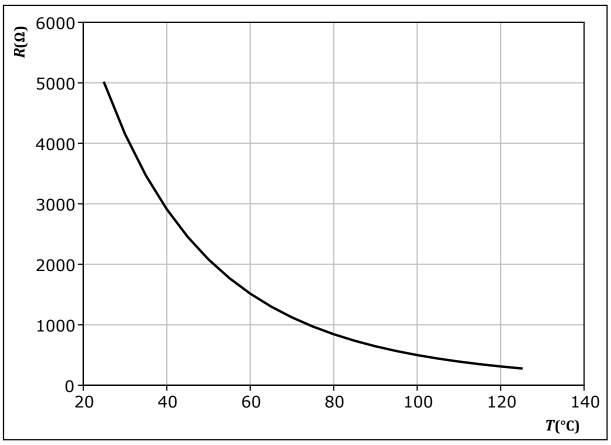
R (K/W)	τ (s)
1,45E-02	6,66E+00
6,43E-02	1,13E+00
2,35E-01	1,21E-01
1,40E-01	2,42E-02
3,61E-02	1,48E-03

Thermistor Characteristics

figure 9. **Thermistor**

Typical NTC characteristic as function of temperature

R_T = f(T)

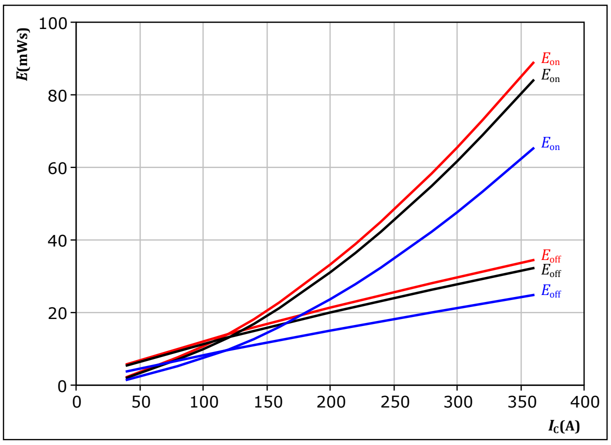


Inverter Switching Characteristics

figure 10. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



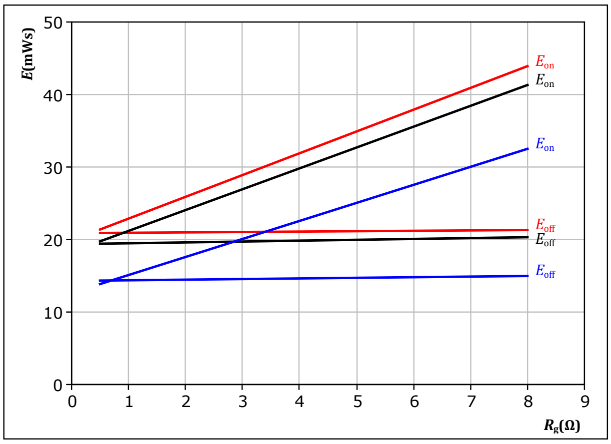
With an inductive load at

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

figure 11. **IGBT**

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

$E = f(R_g)$



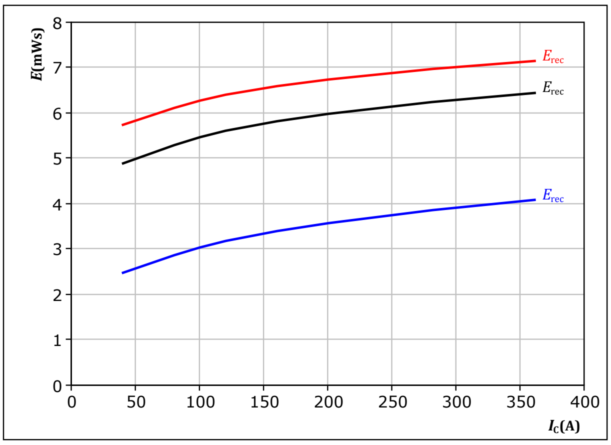
With an inductive load at

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

figure 12. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



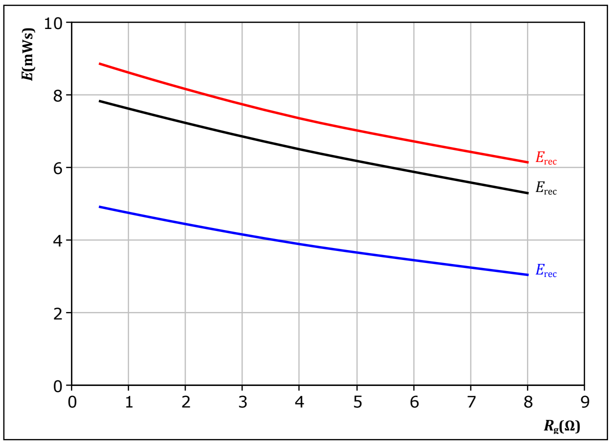
With an inductive load at

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

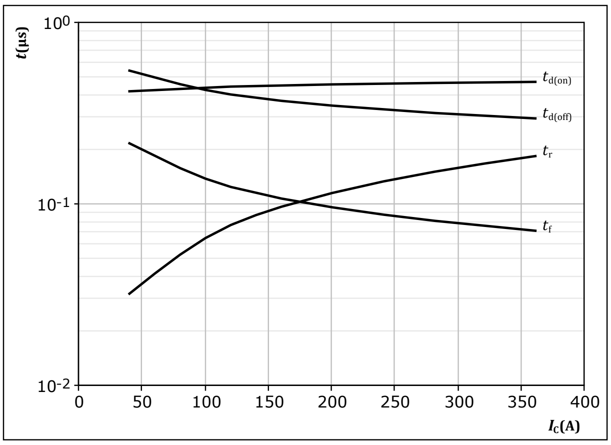
			T_j:	
V_{CE} =	600	V		25 °C
V_{GE} =	±15	V		125 °C
I_C =	200	A		150 °C

Inverter Switching Characteristics

figure 14. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



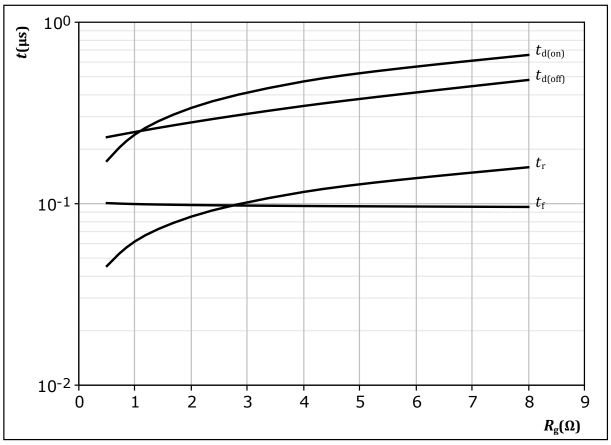
With an inductive load at

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

$t = f(R_g)$



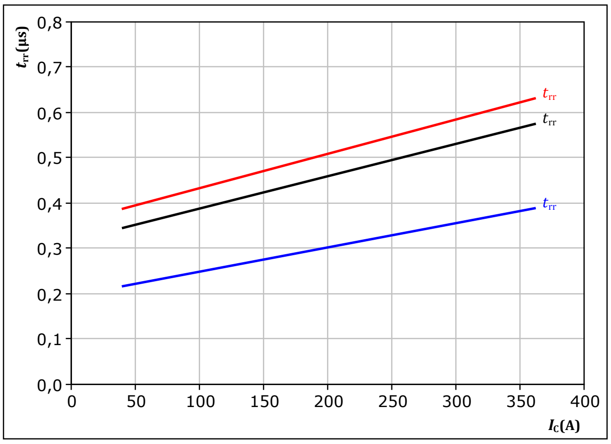
With an inductive load at

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

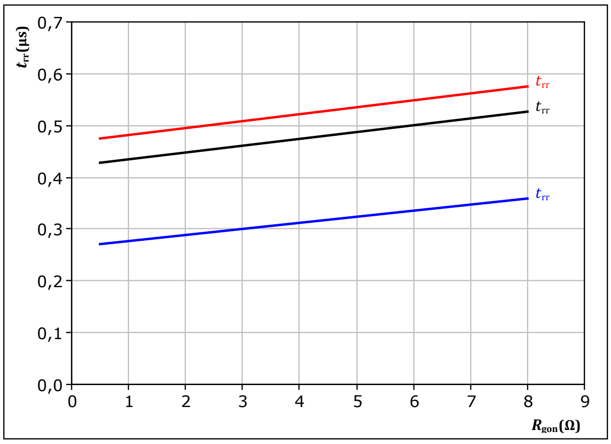
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

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} =	±15	V
I_C =	200	A

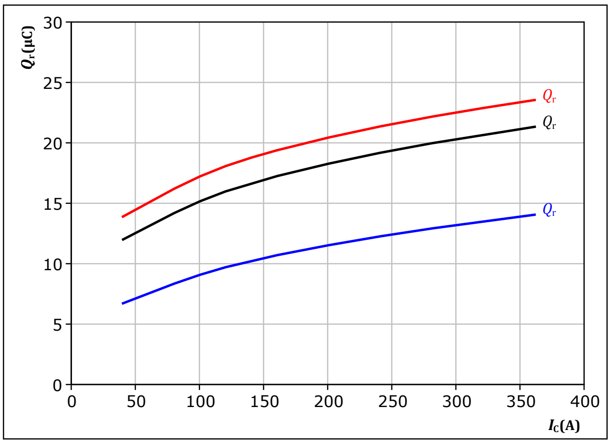
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 18. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



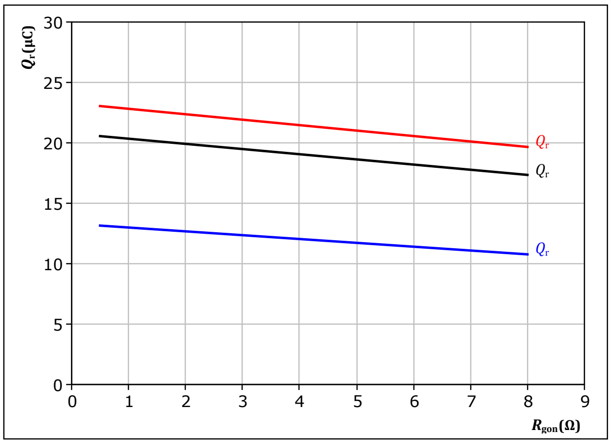
With an inductive load at

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

figure 19. **FWD**

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

Q_r = f(R_{gon})



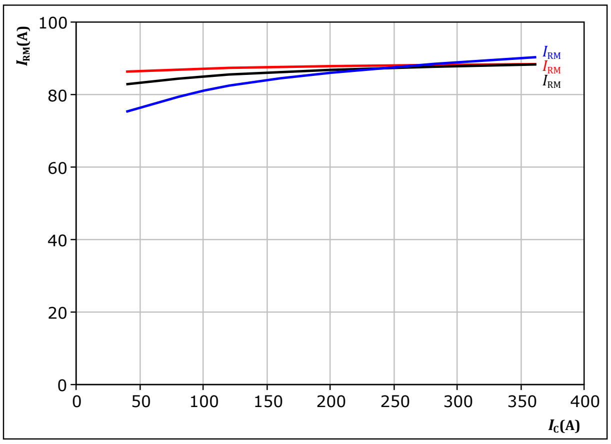
With an inductive load at

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

figure 20. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



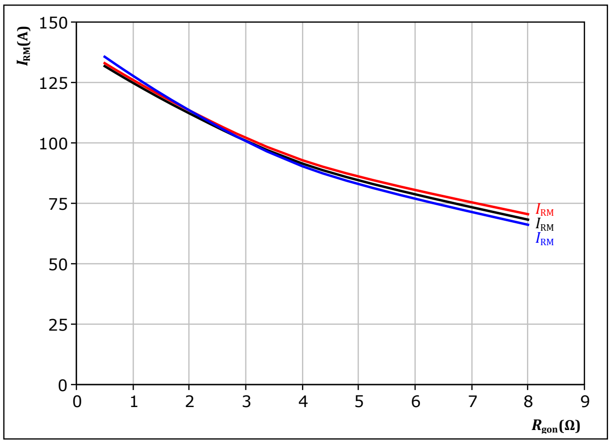
With an inductive load at

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

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

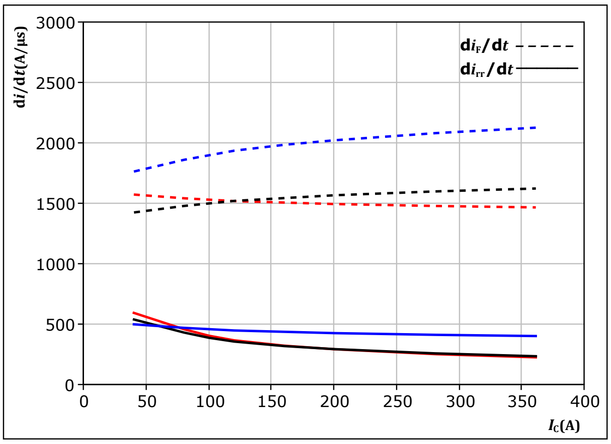
V_{CE} =	600	V	T_j: 25 °C / 125 °C / 150 °C
V_{GE} =	±15	V	
I_C =	200	A	

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)



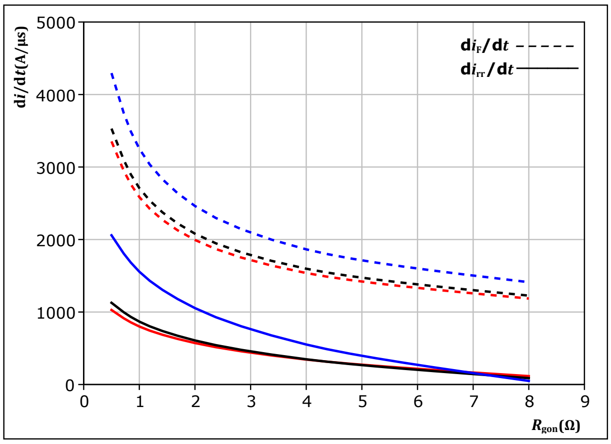
With an inductive load at

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})



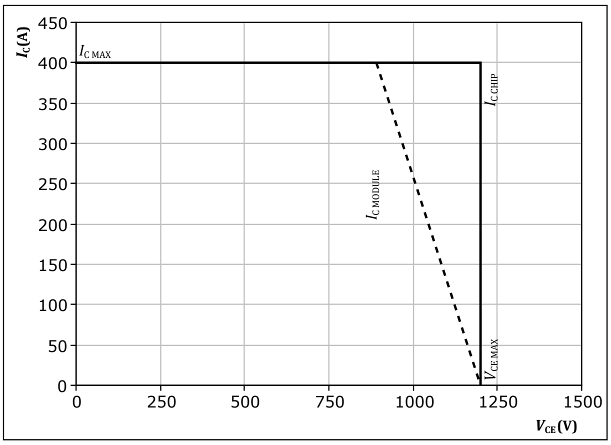
With an inductive load at

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_{tEoff} = integrating time for E_{off})

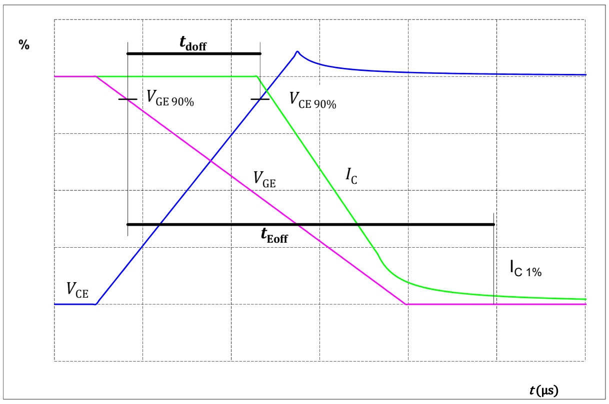


figure 26.	**IGBT**

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

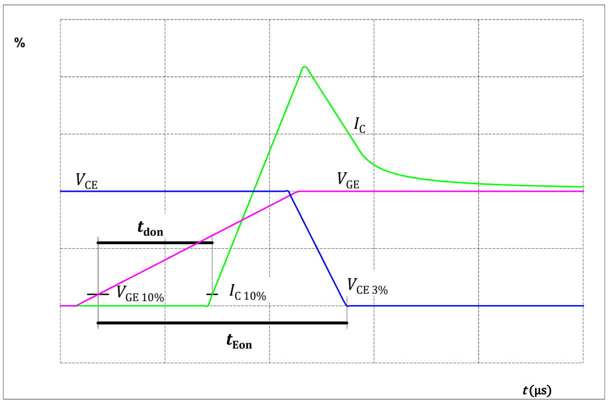


figure 27.	**IGBT**

Turn-off Switching Waveforms & definition of t_f

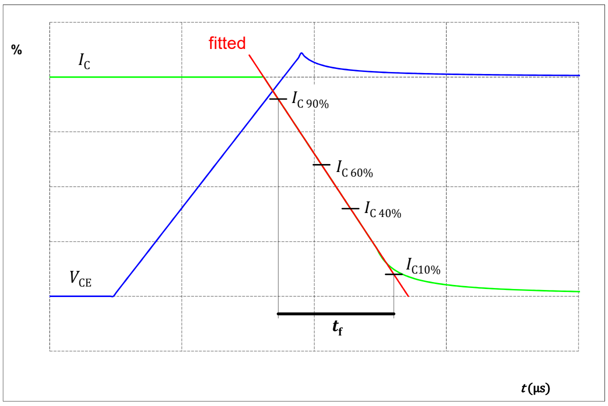
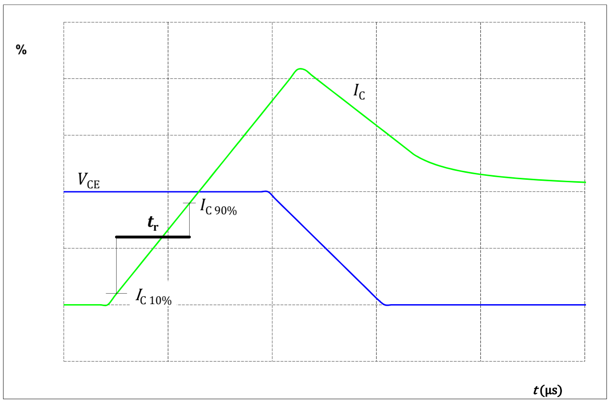


figure 28.	**IGBT**

Turn-on Switching Waveforms & definition of t_r



Inverter Switching Definitions

figure 29. **FWD**

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

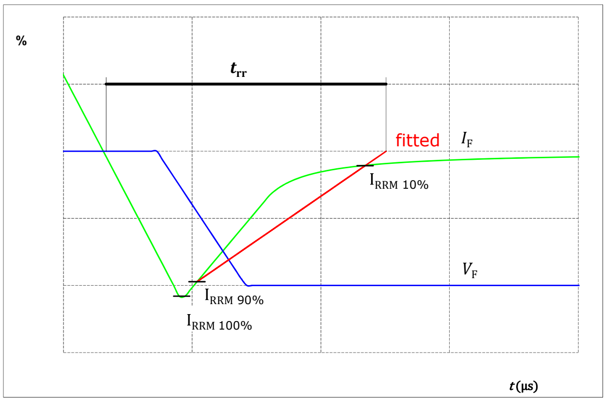
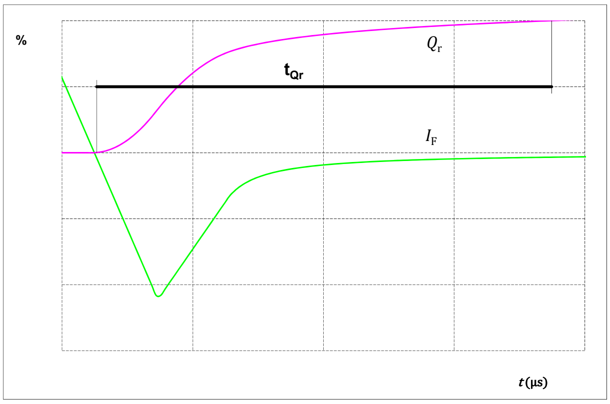


figure 30. **FWD**

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



Ordering Code

Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M3126PB200M702-K860F70-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M3126PB200M702-K860F70-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M3126PB200M702-K860F70-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M3126PB200M702-K860F70-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M3126PB200M702-K860F70-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M3126PB200M702-K860F70-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M3126PB200M702-K860F70-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M3126PB200M702-K860F70-/5B/

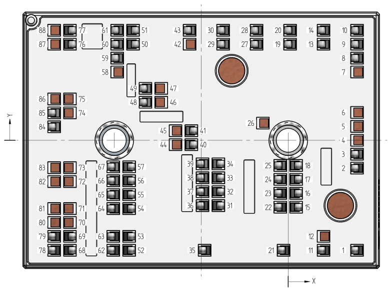
Marking

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

Outline

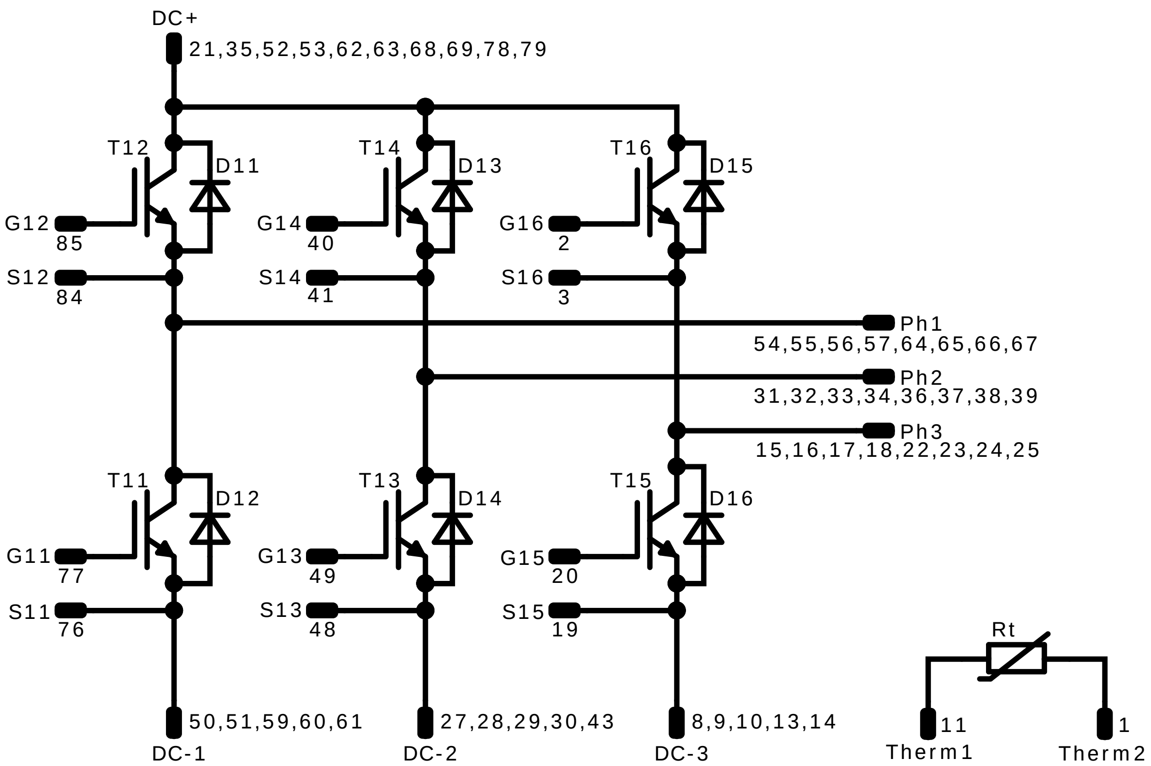
Pin table [mm]

Pin	X	Y	Function	Pin	X	Y	Function
				45	not assembled		
1	15,83	-25,3	Therm2	46	not assembled		
2	15,83	-6,4	G16	47	not assembled		
3	15,83	-3,2	S16	48	-32,82	8,74	S13
4	not assembled			49	-32,82	11,94	G13
5	not assembled			50	-35,68	22,1	DC-1
6	not assembled			51	-35,68	25,3	DC-1
7	not assembled			52	-36,58	-25,3	DC+
8	15,83	18,9	DC-3	53	-36,58	-22,1	DC+
9	15,83	22,1	DC-3	54	-36,58	-15,7	Ph1
10	15,83	25,3	DC-3	55	-36,58	-12,5	Ph1
11	8,13	-25,3	Therm1	56	-36,58	-9,3	Ph1
12	not assembled			57	-36,58	-6,1	Ph1
13	8,13	22,1	DC-3	58	not assembled		
14	8,13	25,3	DC-3	59	-39,32	18,9	DC-1
15	1,82	-15,38	Ph3	60	-39,32	22,1	DC-1
16	1,82	-12,18	Ph3	61	-39,32	25,3	DC-1
17	1,82	-8,98	Ph3	62	-40,22	-25,3	DC+
18	1,82	-5,79	Ph3	63	-40,22	-22,1	DC+
19	0,43	22,1	S15	64	-40,22	-15,7	Ph1
20	0,43	25,3	G15	65	-40,22	-12,5	Ph1
21	-1,07	-25,3	DC+	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	not assembled		
26	not assembled			71	not assembled		
27	-7,27	22,1	DC-2	72	not assembled		
28	-7,27	25,3	DC-2	73	not assembled		
29	-14,97	22,1	DC-2	74	not assembled		
30	-14,97	25,3	DC-2	75	not assembled		
31	-16,05	-15,02	Ph2	76	-50,18	22,1	S11
32	-16,05	-11,82	Ph2	77	-50,18	25,3	G11
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	-19,22	-25,3	DC+	80	not assembled		
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	S12
40	-22,26	-1	G14	85	-53,82	6,3	G12
41	-22,26	2,2	S14	86	not assembled		
42	not assembled			87	not assembled		
43	-22,67	25,3	DC-2	88	not assembled		
44	not assembled						



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	200 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	150 A	Inverter Diode	
Rt	Thermistor			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.

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-M3126PB200M702-K860F70-D3-14	15 Jun. 2022	Change of Inverter Diode New calculation method for Ic/If	