80-M2122PA200SC02-K709F45

datasheet

MiniSKiiP® DUAL 2 — **1200 V / 200 A**

Topology features

- Half Bridge
- Temperature sensor

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
- Half-Bridge configuration
- Rugged solderless spring contacts

Extra features

- Equivalent: SKiiP 26GB12T4V1
- SiC FWD

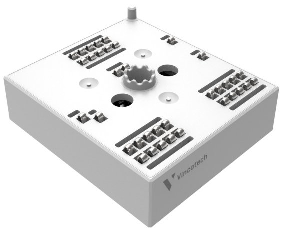
Target applications

- Elevator Drives

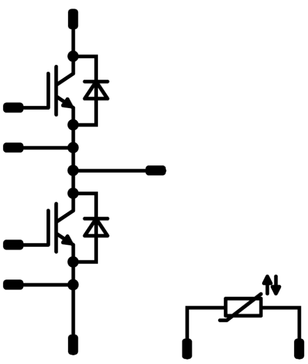
Types

- 80-M2122PA200SC02-K709F45

MiniSKiiP® 2 16 mm housing



Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Half-Bridge Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	227	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		600	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	577	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	10	µs
Maximum junction temperature	T_{jmax}			175	°C
Half-Bridge Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	126	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	715	A
Surge current capability	I^2t			2550	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	271	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]	Values Min	Values Typ	Values Max	Unit
Half-Bridge Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0076	25	5,1	5,8	6,4	V
Collector-emitter saturation voltage	V_{CEsat}		15		200	25 125 150	1,53	1,94 2,23 2,31	1,97(1)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			2,6	µA
Gate-emitter leakage current	I_{GES}		20	0		25			240	nA
Internal gate resistance	r_g							3,75		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		12600		pF
Reverse transfer capacitance	C_{res}							540		pF
Gate charge	Q_g		±15		0	25		1600		nC
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,16		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	200	25 125 150		182,24 195,33 198,94		ns
Rise time	t_r					25 125 150		41,83 46,12 47,52		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		290,88 373,7 396,96		ns
Fall time	t_f					25 125 150		76,37 153,96 182,41		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,476 µC Q_{rFWD}=0,465 µC Q_{rFWD}=0,472 µC				25 125 150		7,24 8,63 9,03		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		13,67 21,62 24,32		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	
Half-Bridge Diode										
Static										
Forward voltage	V_F				100	25 125 150		1,44 1,71 1,81	1,6(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25 150		1 70	400	µA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,35		K/W
Dynamic										
Peak recovery current	I_{RM}	d*i*/d*t*=5519 A/µs d*i*/d*t*=4604 A/µs d*i*/d*t*=5077 A/µs	±15	600	200	25 125 150		38,35 36,61 36,5		A
Reverse recovery time	t_{rr}					25 125 150		20,27 20,86 21,15		ns
Recovered charge	Q_r					25 125 150		0,476 0,465 0,472		µC
Reverse recovered energy	E_{rec}					25 125 150		0,1 0,09 0,091		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		5412,74 4396,46 4846,03		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 R100	$\Delta_{R/R}$	R_{100} = 493 Ω				100	-5		5	%
Power dissipation	P							245		mW
Power dissipation constant	d					25		1,4		mW/K
B-value	$B_{(25/50)}$	Tol. ±2 %						3375		K
B-value	$B_{(25/100)}$	Tol. ±2 %						3437		K
Vincotech Thermistor Reference									K	

(1) Value at chip level

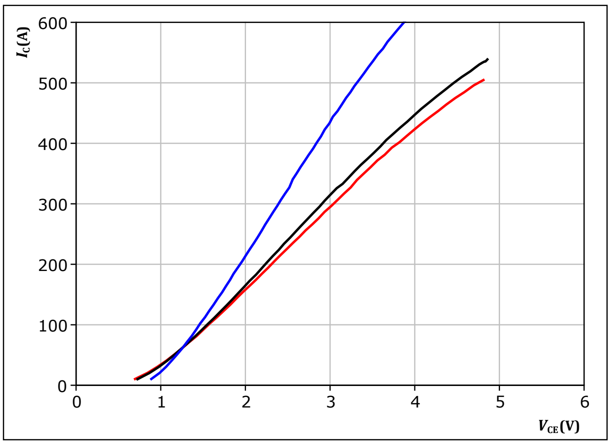
(2) Only valid with pre-applied Vincotech thermal interface material.

Half-Bridge Switch Characteristics

figure 1. IGBT

Typical output characteristics

I_C = f(V_{CE})

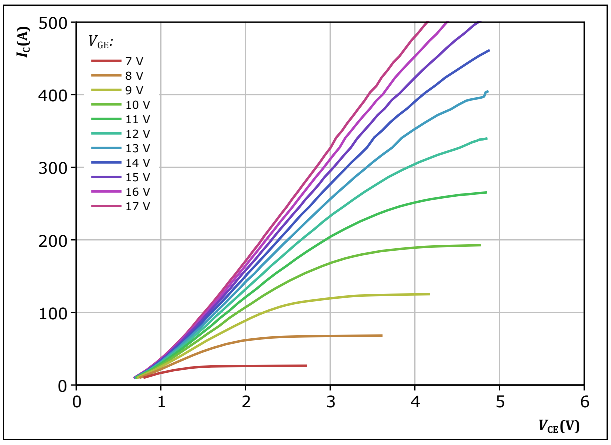


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 2. IGBT

Typical output characteristics

I_C = f(V_{CE})



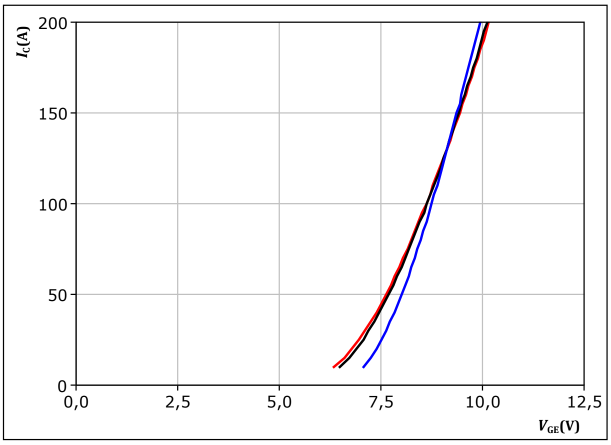
t_p =	250	µs
T_j =	150	°C

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

figure 3. IGBT

Typical transfer characteristics

I_C = f(V_{GE})

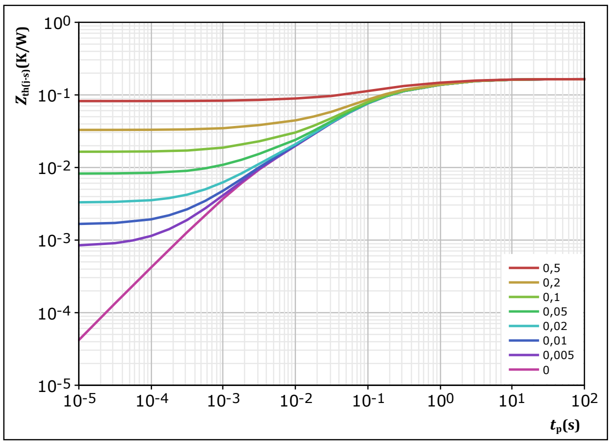


t_p =	250	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j\text{-}s)}$ =	0,165	K/W

IGBT thermal model values

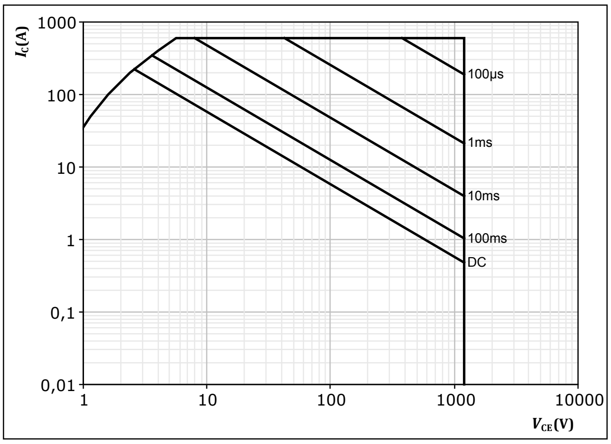
R (K/W)	τ (s)
6,52E-03	1,00E+01
4,19E-02	1,42E+00
6,98E-02	1,78E-01
3,95E-02	3,90E-02
7,01E-03	2,49E-03

Half-Bridge Switch Characteristics

figure 5. **IGBT**

Safe operating area

I_C = f(V_{CE})



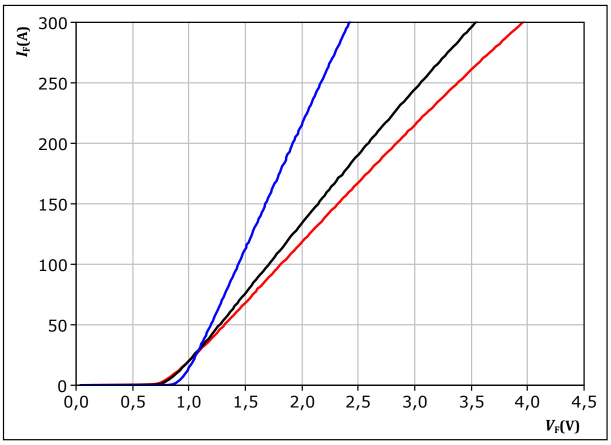
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Half-Bridge Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



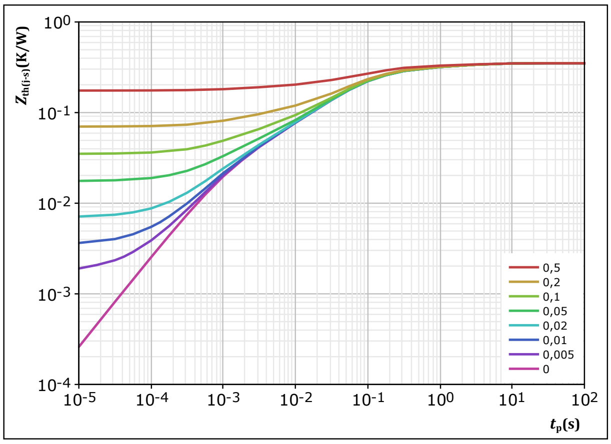
t_p = 250 µs

T_j: 25 °C, 125 °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

$R_{th(j-s)}$ = 0,35 K/W

FWD thermal model values

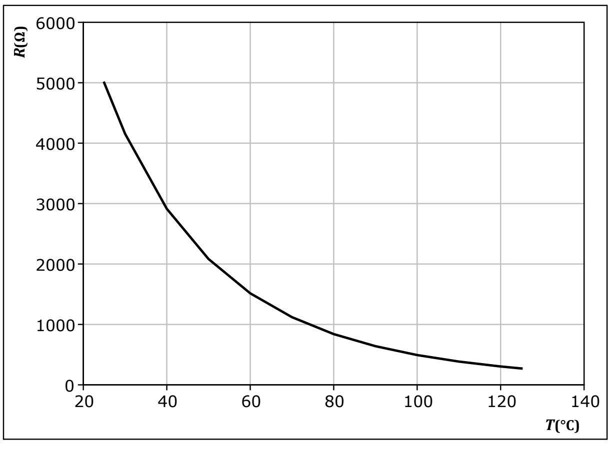
R (K/W)	τ (s)
3,62E-02	2,93E+00
5,68E-02	4,35E-01
1,87E-01	7,34E-02
4,80E-02	1,04E-02
2,25E-02	1,20E-03

Thermistor Characteristics

figure 8.	Thermistor

Typical NTC characteristic as function of temperature

$R_T = f(T)$

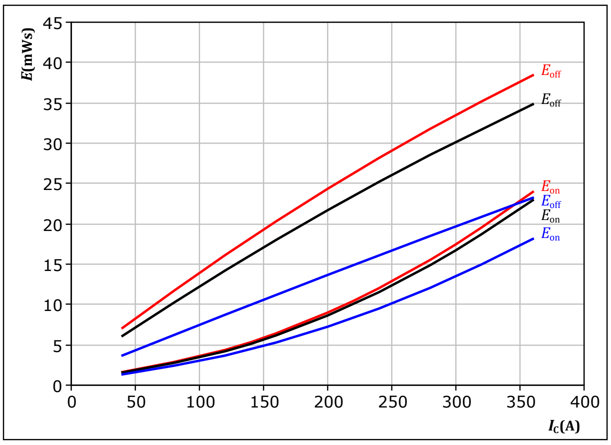


Half-Bridge Switching Characteristics

figure 9. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



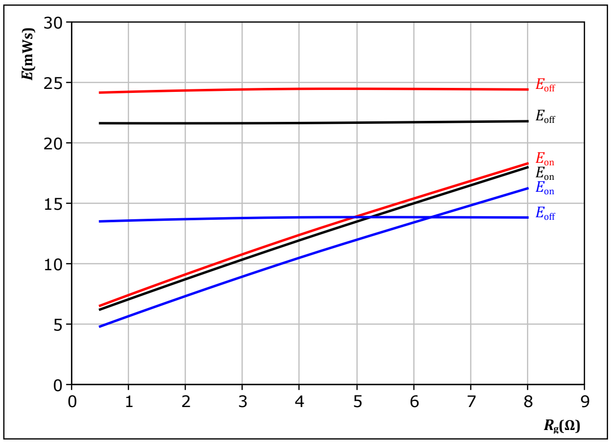
With an inductive load at

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

figure 10. **IGBT**

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

$E = f(R_g)$



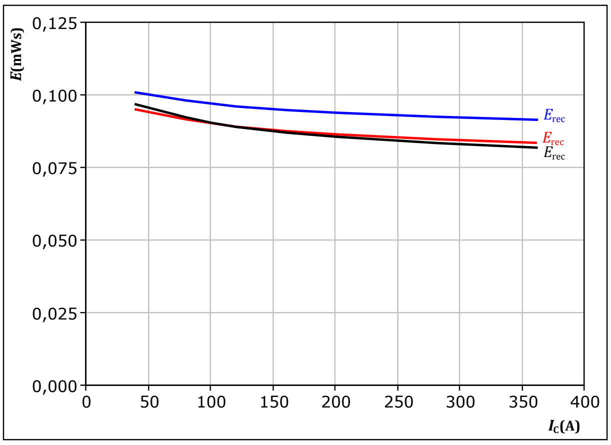
With an inductive load at

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

figure 11. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



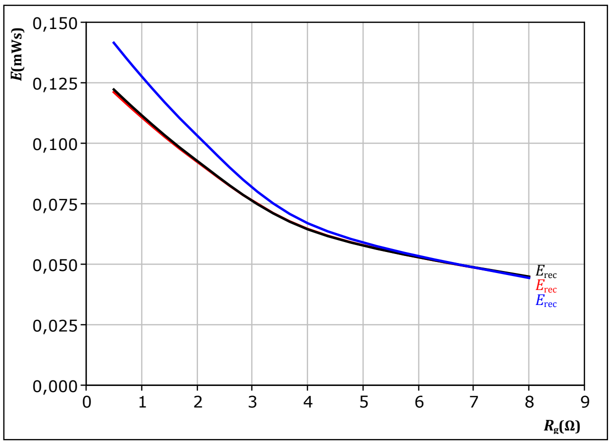
With an inductive load at

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

figure 12. **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

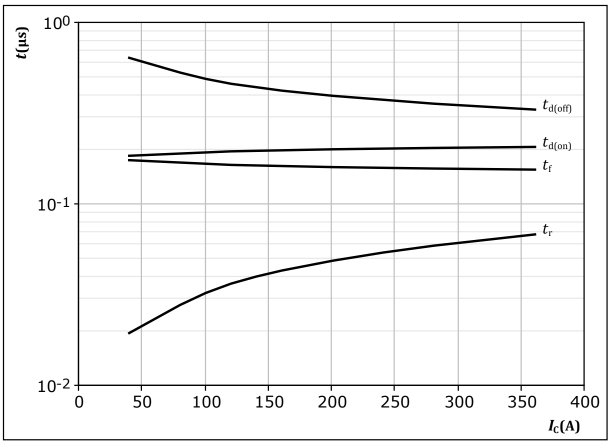
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	200	A		150 °C

Half-Bridge Switching Characteristics

figure 13. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



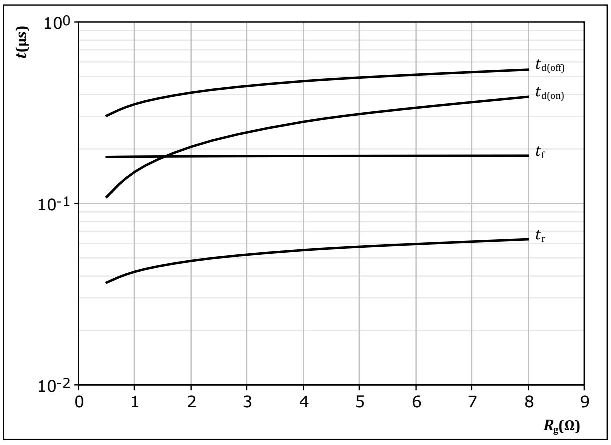
With an inductive load at

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

figure 14. **IGBT**

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

t = f(R_g)



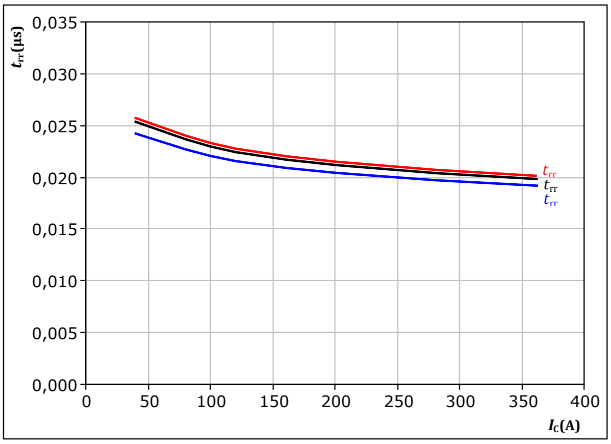
With an inductive load at

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

figure 15. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

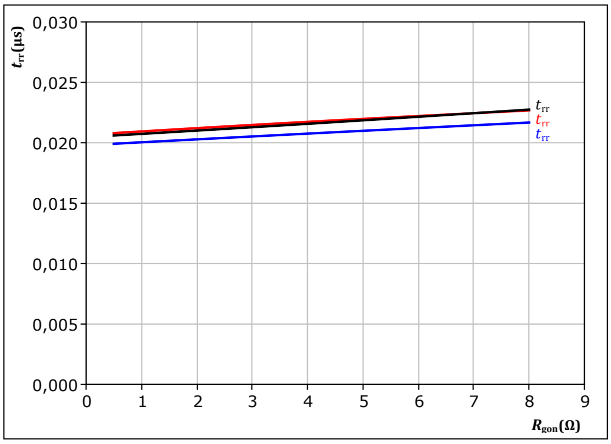
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

T_j: 25 °C / 125 °C / 150 °C

figure 16. **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

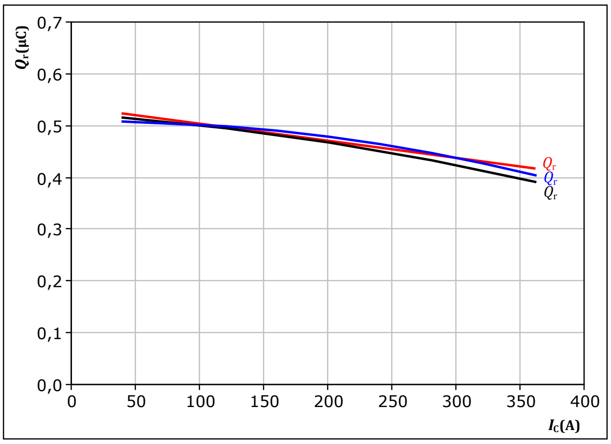
T_j: 25 °C / 125 °C / 150 °C

Half-Bridge Switching Characteristics

figure 17. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



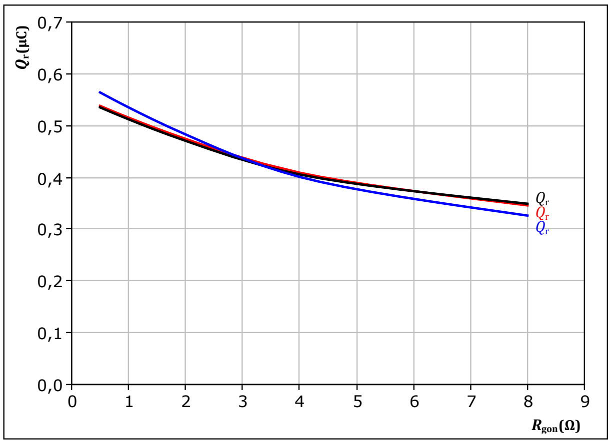
With an inductive load at

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

figure 18. **FWD**

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

Q_r = f(R_{gon})



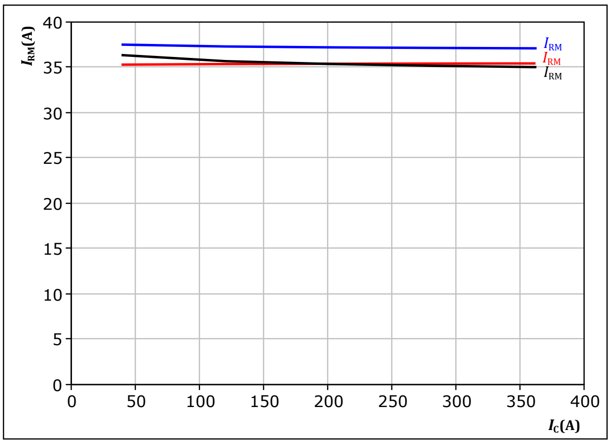
With an inductive load at

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

figure 19. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



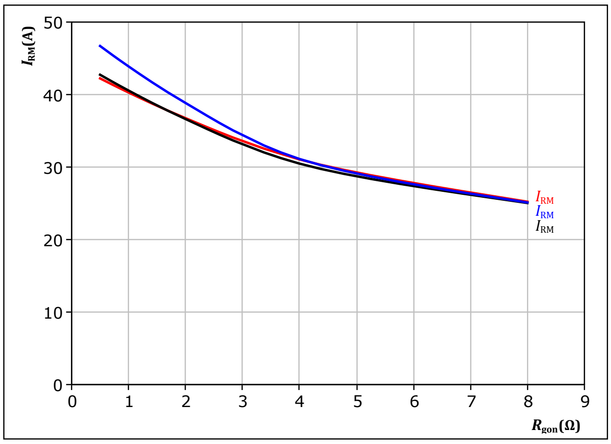
With an inductive load at

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

figure 20. **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

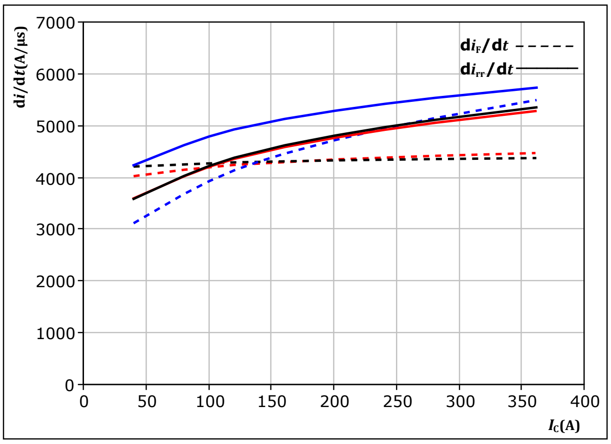
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	200	A		150 °C

Half-Bridge Switching Characteristics

figure 21. **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)



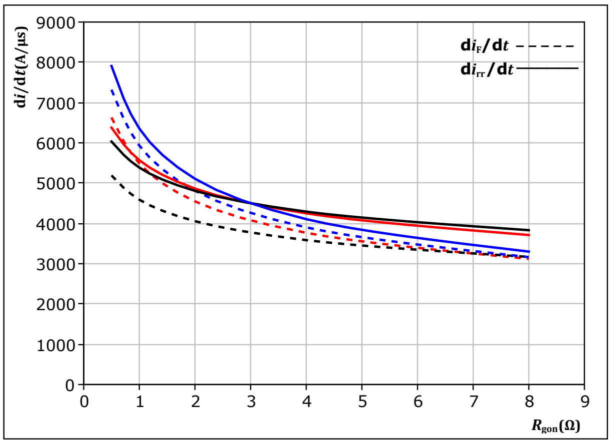
With an inductive load at

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

figure 22. **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})



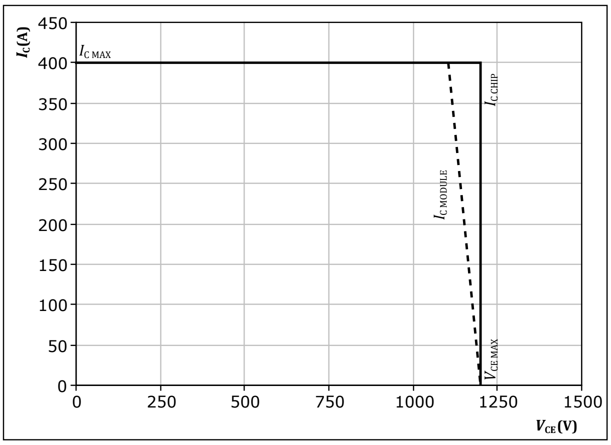
With an inductive load at

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

figure 23. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At	T_j =	150	°C
	R_{gon} =	2	Ω
	R_{goff} =	2	Ω

Half-Bridge Switching Definitions

figure 24. **IGBT**

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

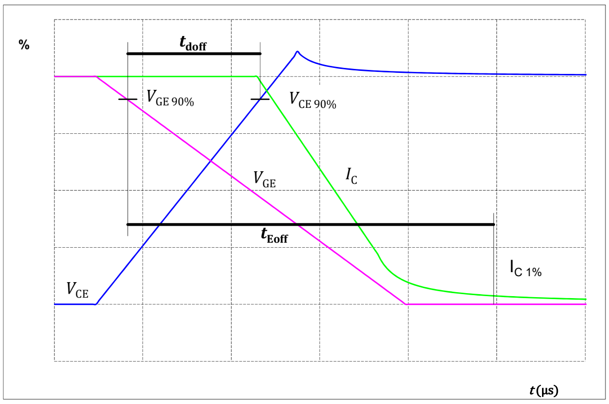


figure 25. **IGBT**

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

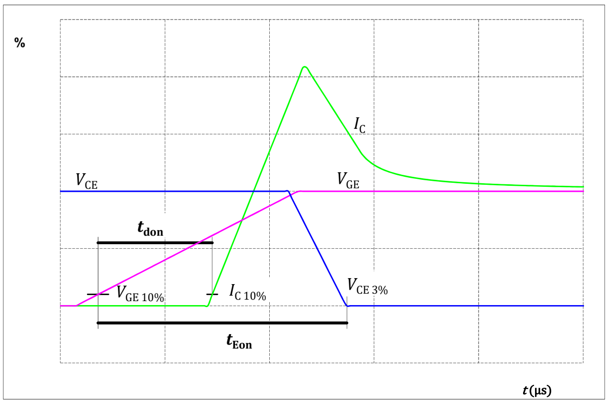


figure 26. **IGBT**

Turn-off Switching Waveforms & definition of t_f

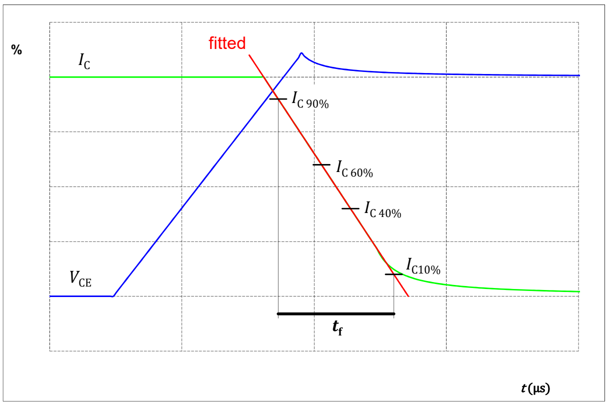
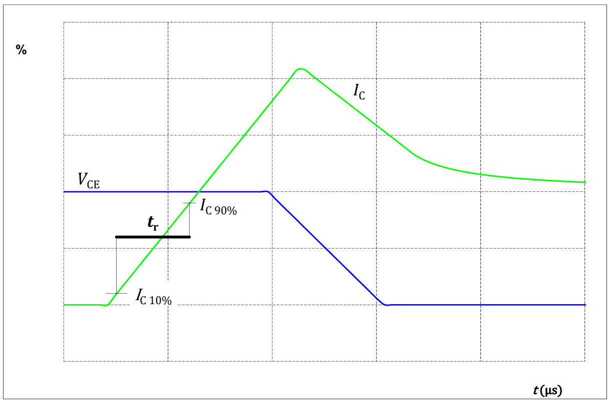


figure 27. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Half-Bridge Switching Definitions

figure 28. **FWD**

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

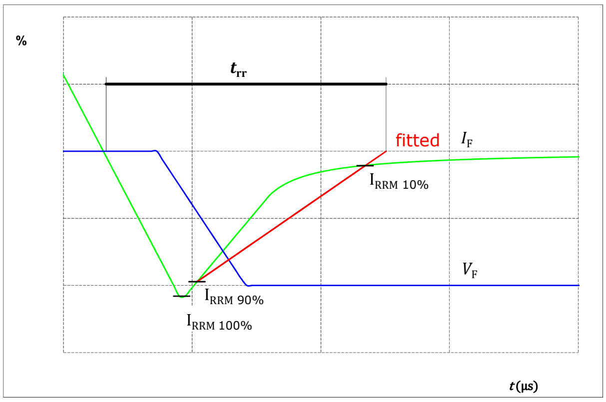
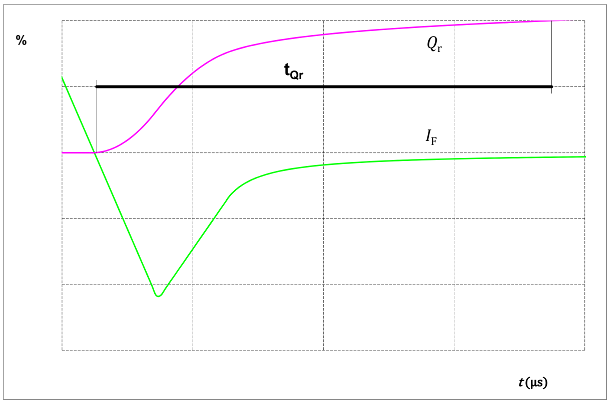


figure 29. **FWD**

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



Ordering Code

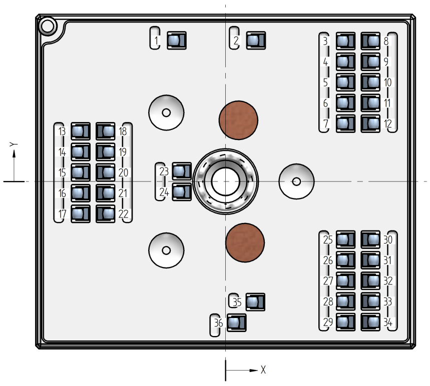
Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M2122PA200SC02-K709F45-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M2122PA200SC02-K709F45-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M2122PA200SC02-K709F45-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M2122PA200SC02-K709F45-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M2122PA200SC02-K709F45-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M2122PA200SC02-K709F45-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M2122PA200SC02-K709F45-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M2122PA200SC02-K709F45-/5B/

Marking

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		

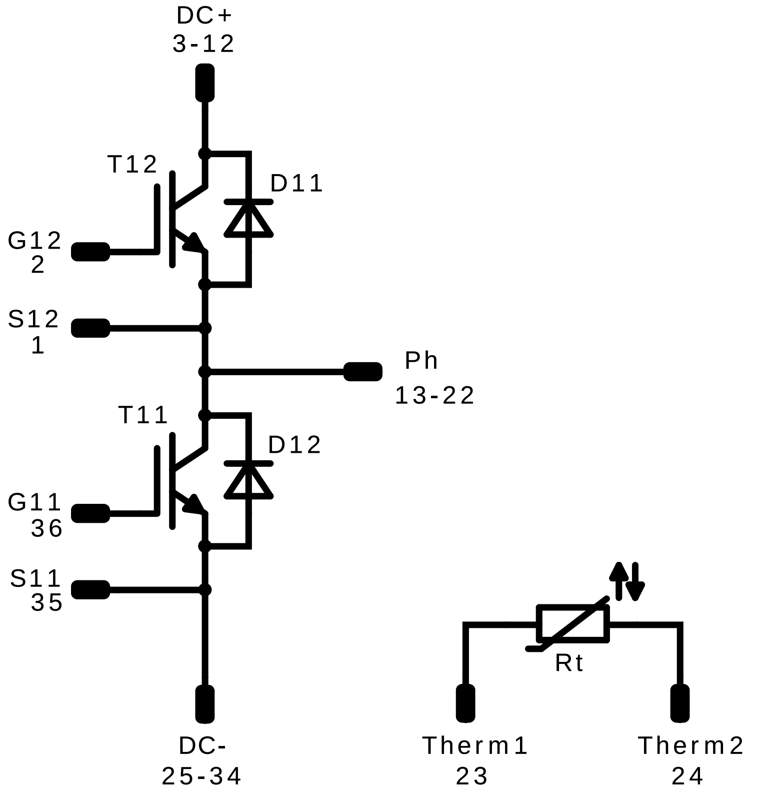
Outline

Pin table [mm]			
Pin	X	Y	Function
1	-7,6	21,9	S12
2	4,7	21,9	G12
3	18,6	21,8	DC+
4	18,6	18,6	DC+
5	18,6	15,4	DC+
6	18,6	12,2	DC+
7	18,6	9	DC+
8	22,5	21,8	DC+
9	22,5	18,6	DC+
10	22,5	15,4	DC+
11	22,5	12,2	DC+
12	22,5	9	DC+
13	-22,5	7,8	Ph
14	-22,5	4,6	Ph
15	-22,5	1,4	Ph
16	-22,5	-1,8	Ph
17	-22,5	-5	Ph
18	-18,6	7,8	Ph
19	-18,6	4,6	Ph
20	-18,6	1,4	Ph
21	-18,6	-1,8	Ph
22	-18,6	-5	Ph
23	-6,8	1,6	Therm1
24	-6,8	-1,6	Therm2
25	18,6	-9	DC-
26	18,6	-12,2	DC-
27	18,6	-15,4	DC-
28	18,6	-18,6	DC-
29	18,6	-21,8	DC-
30	22,5	-9	DC-
31	22,5	-12,2	DC-
32	22,5	-15,4	DC-
33	22,5	-18,6	DC-
34	22,5	-21,8	DC-
35	4,6	-18,7	S11
36	1,7	-21,9	G11



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	IGBT	1200 V	200 A	Half-Bridge Switch	
D11, D12	FWD	1200 V	100 A	Half-Bridge Diode	
Rt	Thermistor			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 72	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for MiniSKiiP® 2 packages see vincotech.com website.

Package data
Package data for MiniSKiiP® 2 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-M2122PA200SC02-K709F45-D2-14	31 Jul. 2023	Optimized position of Half-Bridge Diode	