80-M2122PA150SC-K708F40
datasheet

Vincotech

MiniSKiip®DUAL 2 | **1200 V / 150 A**

Features

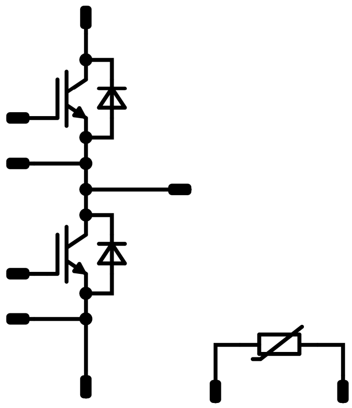
- Half-Bridge topology
- Trench IGBT and CAL diode chip technology
- Integrated NTC sensor
- Solderless spring contact mountig system

MiniSkiip®2 housing

Target applications

- Charging Stations
- Industrial Drives
- Solar Inverters
- UPS
- Welding & Cutting

Schematic



Types

- 80-M2122PA150SC-K708F40

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Half-Bridge Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C		150	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	450	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	453	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

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Half-Bridge Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	139	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms	T_j = 150 °C	860	A
Surge current capability	I^2t	50 Hz Single Half Sine Wave t_p = 10 ms	T_j = 150 °C	3700	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	291	W
Maximum junction temperature	T_{jmax}			175	°C

Module Properties

Thermal Properties

Parameter	Symbol	Condition		Value	Unit
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{jop}			-40…(T_{jmax} - 25)	°C

Isolation Properties

Parameter	Symbol	Condition		Value	Unit
Isolation voltage	V_{isol}	DC Test Voltage*	t_p = 2 s	5500	V
		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]	Min	Typ	Max	Unit
Half-Bridge Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0052	25	5,2	5,8	6,4	V
Collector-emitter saturation voltage	V_{CEsat}		15		150	25 125 150	1,58	1,83 2,12 2,19	2,07	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			2	µA
Gate-emitter leakage current	I_{GES}		20	0		25			240	nA
Internal gate resistance	r_g							5		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		8600		pF
Reverse transfer capacitance	C_{res}							320		
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,21		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	150	25 125 150		169 180 182		ns
Rise time	t_r					25 125 150		31 35 38		
Turn-off delay time	$t_{d(off)}$					25 125 150		285 355 377		
Fall time	t_f					25 125 150		56 130 159		
Turn-on energy (per pulse)*	E_{on}	Q_{rFWD} = 9,4 µC Q_{rFWD} = 19,5 µC Q_{rFWD} = 23,3 µC				25 125 150		9,06 13,97 15,83		mWs
Turn-off energy (per pulse)*	E_{off}					25 125 150		8,77 13,54 15,40		

* Ls = 12 nH

Characteristic Values

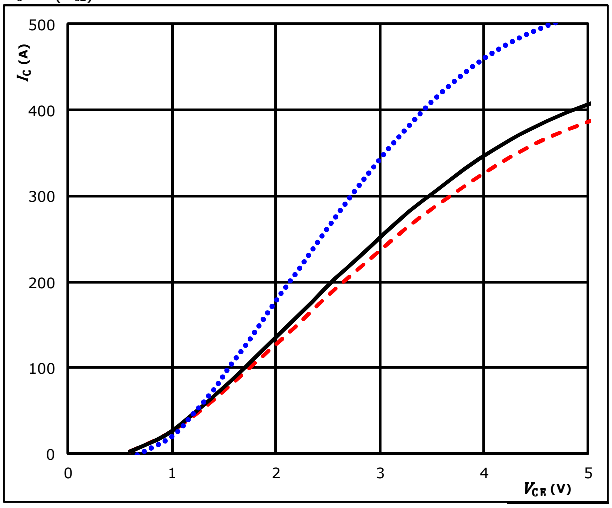
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Half-Bridge Diode										
Static										
Forward voltage	V_F				150	25 125 150		2,22 2,30 2,23	2,49	V
Reverse leakage current	I_R			1200		25 150			240 28000	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,33		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 5861 A/µs di/dt = 4745 A/µs di/dt = 4340 A/µs	±15	600	150	25 125 150		133 156 168		A
Reverse recovery time	t_{rr}					25 125 150		212 391 429		ns
Recovered charge	Q_r					25 125 150		9,37 19,55 23,33		µC
Reverse recovered energy	E_{rec}					25 125 150		3,25 7,11 8,45		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		5536 3331 2909		A/µs
Thermistor										
Rated resistance	R					25		5		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 493 Ω				100	-5		+5	%
Power dissipation	P					25		245		mW
Power dissipation constant						25		1,4		mW/K
B-value	$B_{(25/50)}$	Tol. ±2 %				25		3375		K
B-value	$B_{(25/100)}$	Tol. ±2 %				25		3437		K
Vincotech NTC Reference									K	

Half-Bridge Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



t_p = 250 µs

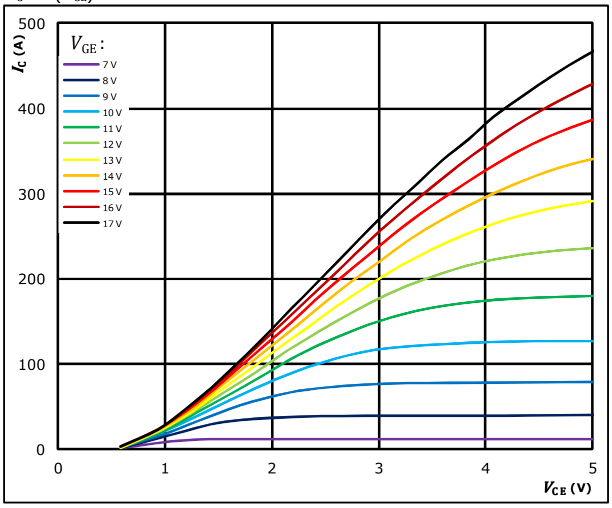
V_{GE} = 15 V

T_j: 25 °C, 125 °C, 150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



t_p = 250 µs

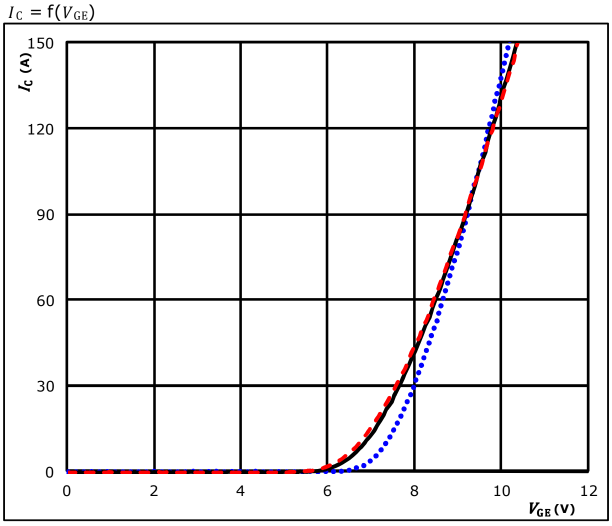
T_j = 150 °C

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 = 100 µs

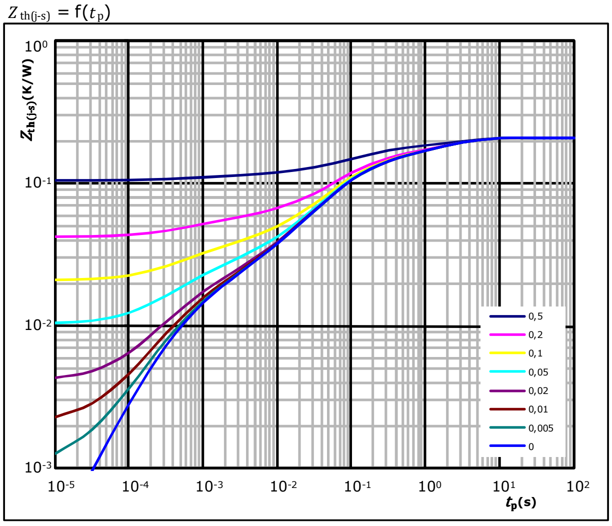
V_{CE} = 10 V

T_j: 25 °C, 125 °C, 150 °C

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,21 K/W

IGBT thermal model values

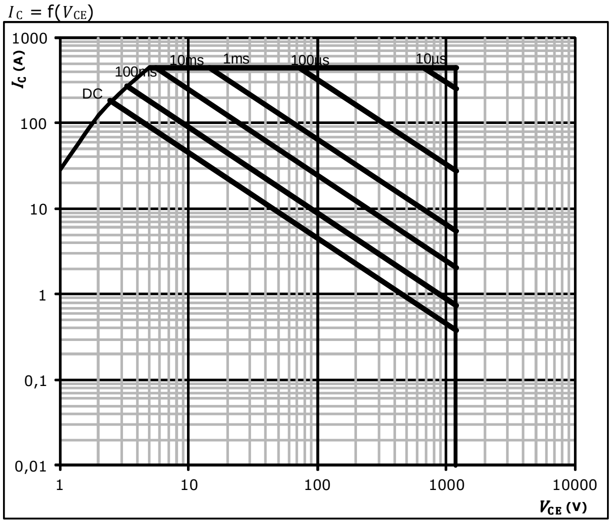
R (K/W)	τ (s)
5,76E-02	2,91E+00
4,18E-02	3,82E-01
8,02E-02	8,51E-02
1,35E-02	1,20E-02
9,50E-03	1,62E-03
7,18E-03	4,17E-04

Half-Bridge Switch Characteristics

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



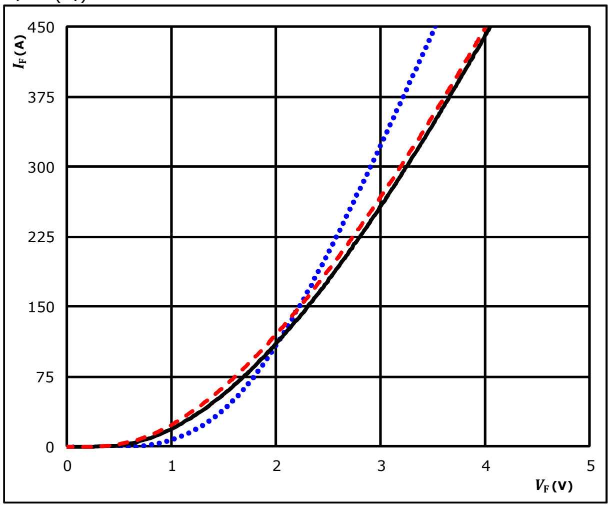
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Half-Bridge Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



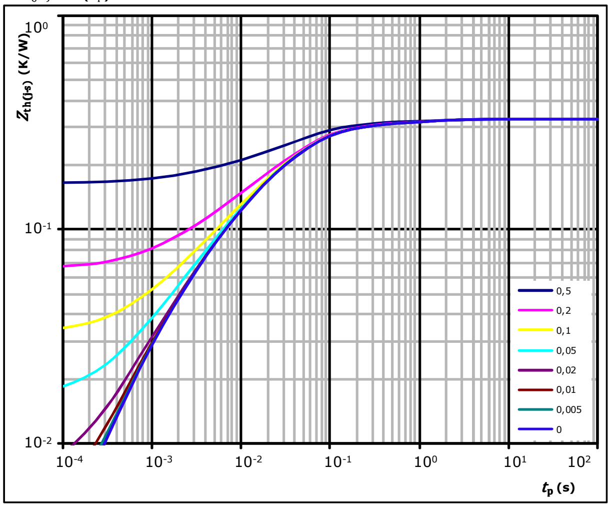
t_p = 250 μs

T_j: 25 °C
125 °C
150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,33 K/W

FWD thermal model values

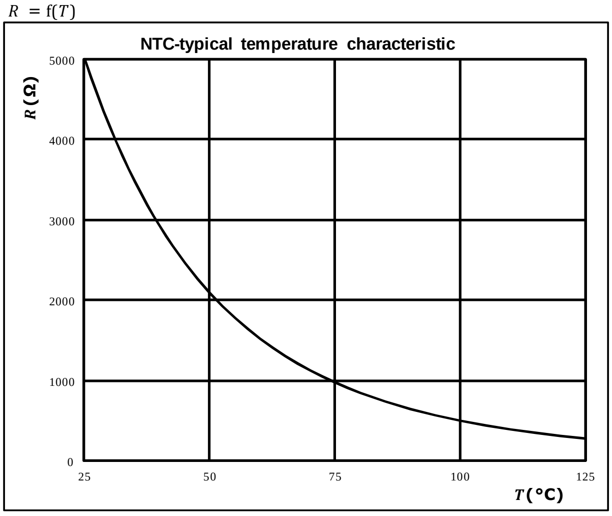
R (K/W)	τ (s)
2,08E-02	2,80E-01
5,00E-02	3,25E-02
1,60E-01	8,01E-03
7,22E-02	1,53E-03
2,11E-02	2,84E-04
3,02E-03	1,60E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic as a function of temperature

$R = f(T)$

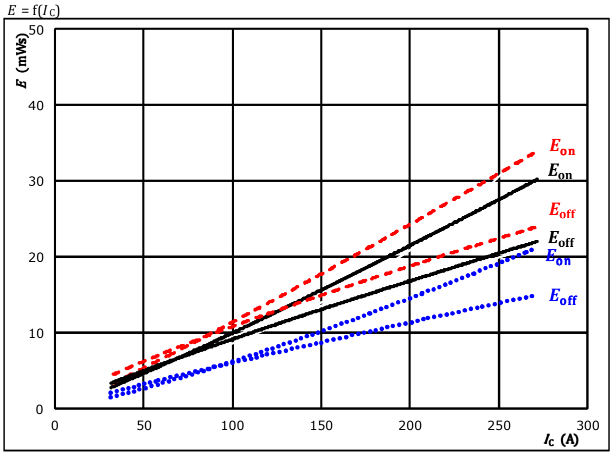


Half-Bridge Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



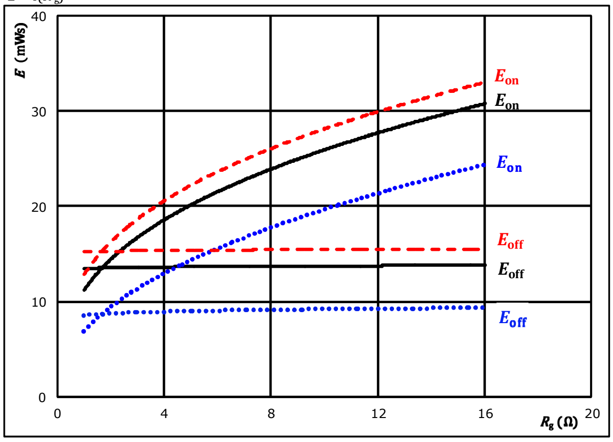
With an inductive load at

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

figure 2. IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



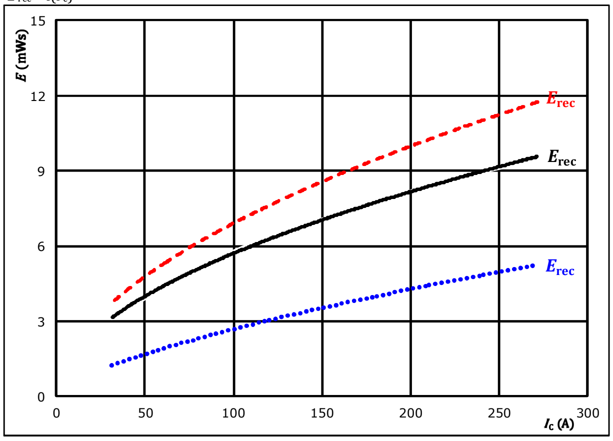
With an inductive load at

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

figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



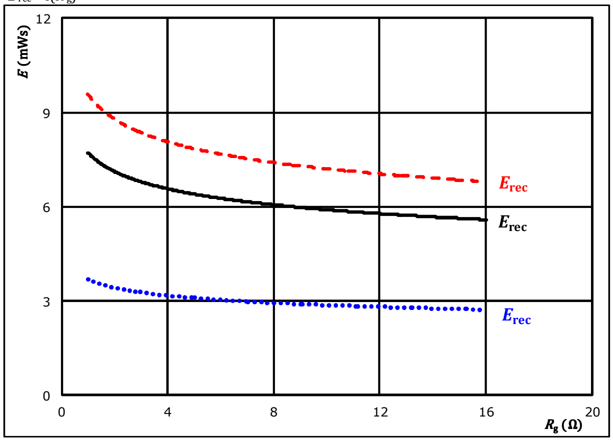
With an inductive load at

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

figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

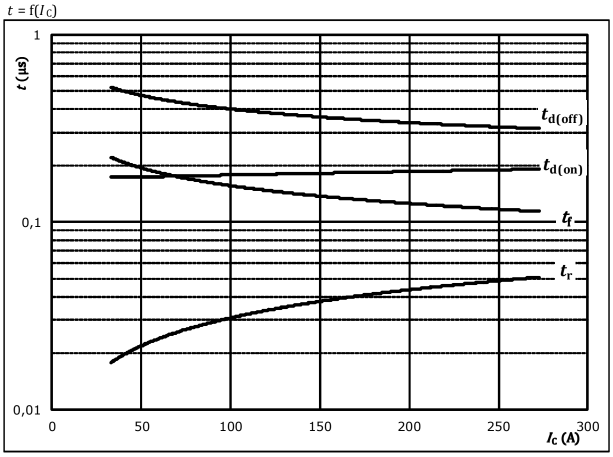
V_{CE} = 600 V
V_{GE} = ±15 V
I_C = 150 A
T_j: 25 °C, 125 °C, 150 °C

Half-Bridge Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



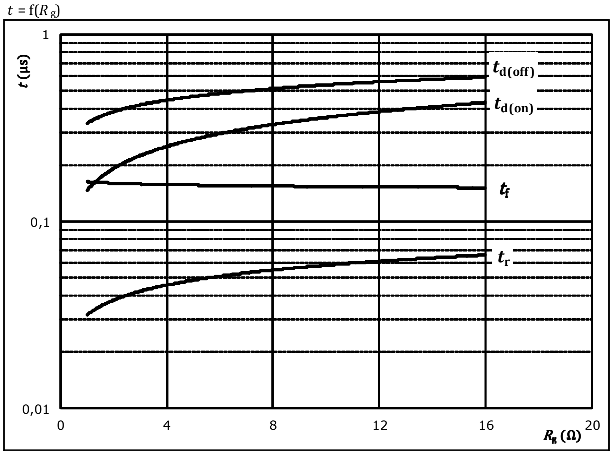
With an inductive load at

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

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



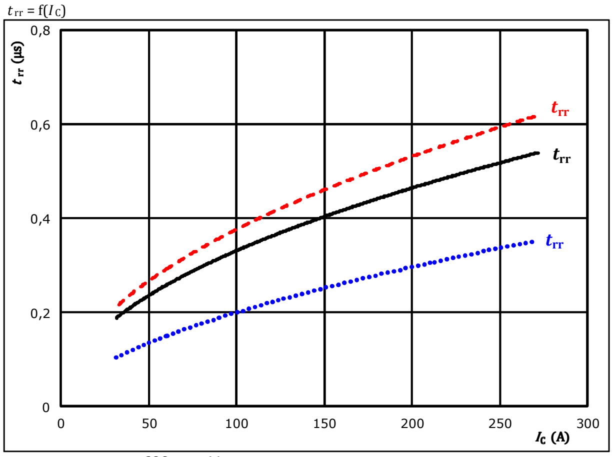
With an inductive load at

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

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

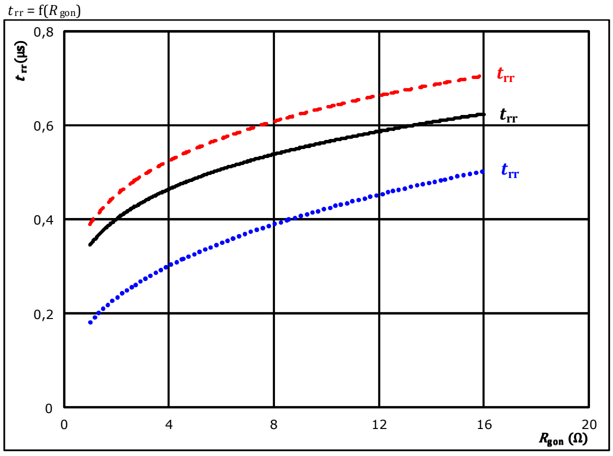


At						
V_{CE} =	600	V		T_j:	25 °C	dotted
V_{GE} =	±15	V			125 °C	solid
R_{gon} =	2	Ω			150 °C	dashed

figure 8. **FWD**

Typical reverse recovery time as a function of IGBT turn on gate resistor

$t_{rr} = f(R_{gon})$



At						
V_{CE} =	600	V		T_j:	25 °C	dotted
V_{GE} =	±15	V			125 °C	solid
I_C =	150	A			150 °C	dashed

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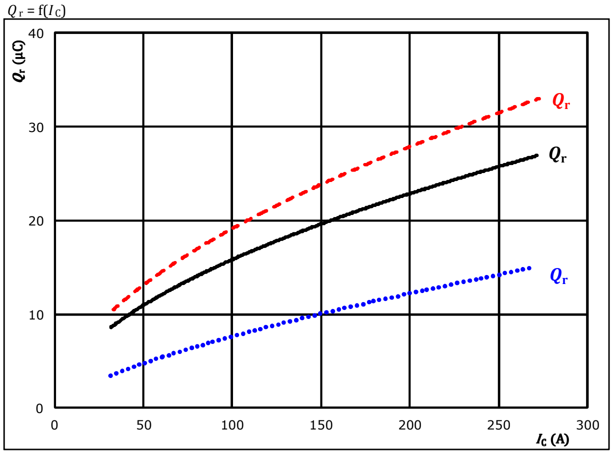
Half-Bridge Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

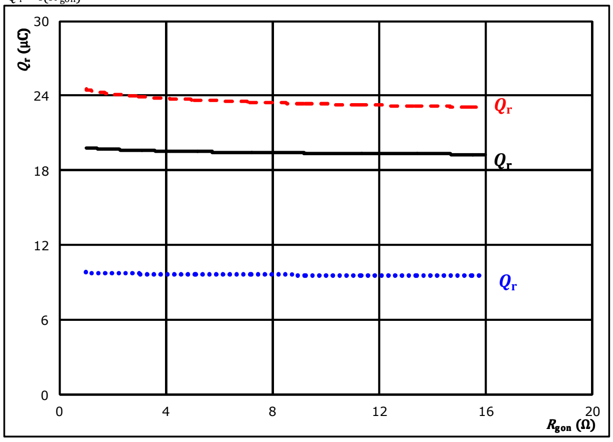


At					
V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	2	Ω		150 °C	dashed

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

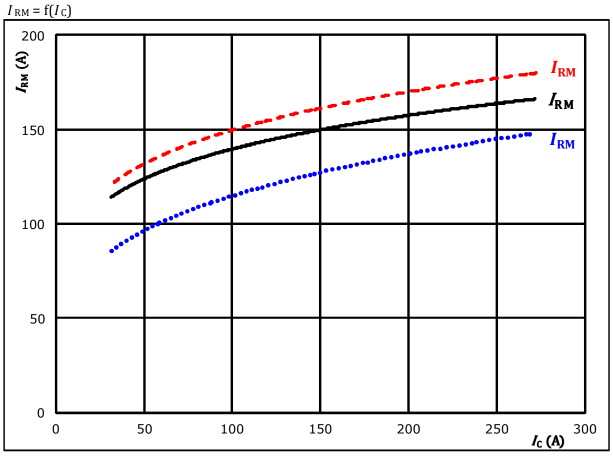


At					
V_{CE}=	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C=	150	A		150 °C	dashed

figure 11. **FWD**

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

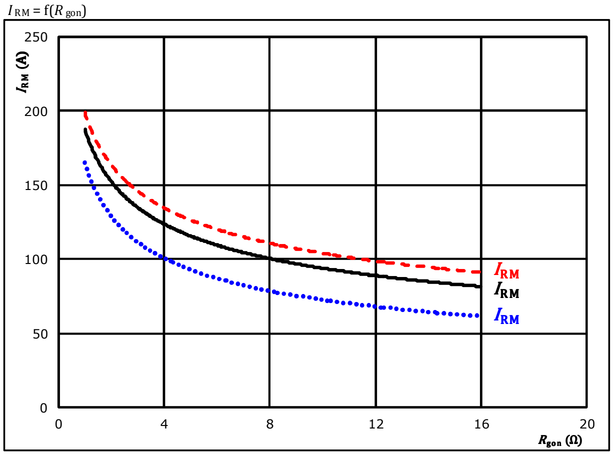


At					
V_{CE}:	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	2	Ω		150 °C	dashed

figure 12. **FWD**

Typical peak reverse recovery current as a function of IGBT turn on gate resistor

$I_{RM} = f(R_{gon})$



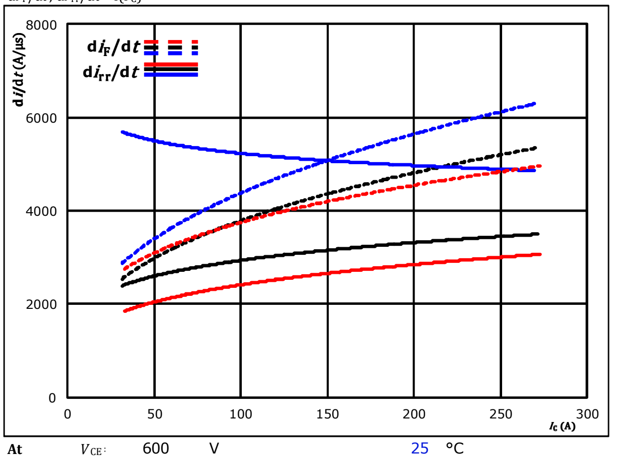
At					
V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C =	150	A		150 °C	dashed

Half-Bridge Switching Characteristics

figure 13. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of collector current

$di_F/dt,\ di_{rr}/dt = f(I_C)$

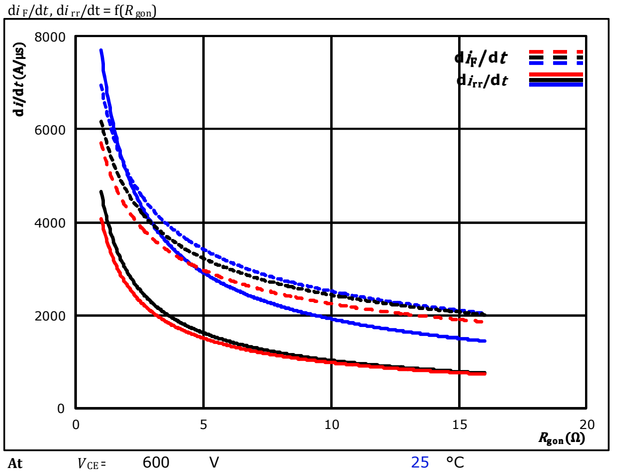


At				
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 14. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor

$di_F/dt,\ di_{rr}/dt = f(R_{gon})$

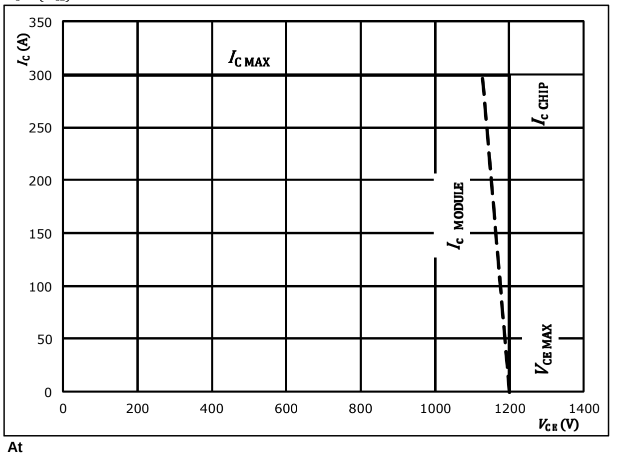


At				
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	150	A		150 °C

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At		
T_j =	125	°C
R_{gon} =	2	Ω
R_{goff} =	2	Ω

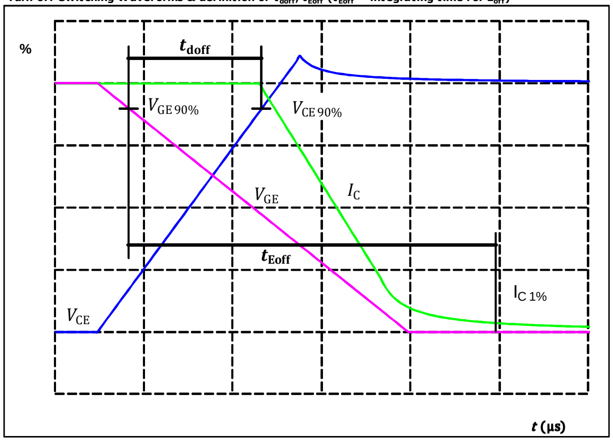
Half-Bridge Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	2 Ω
R_{goff}	=	2 Ω

figure 1. IGBT

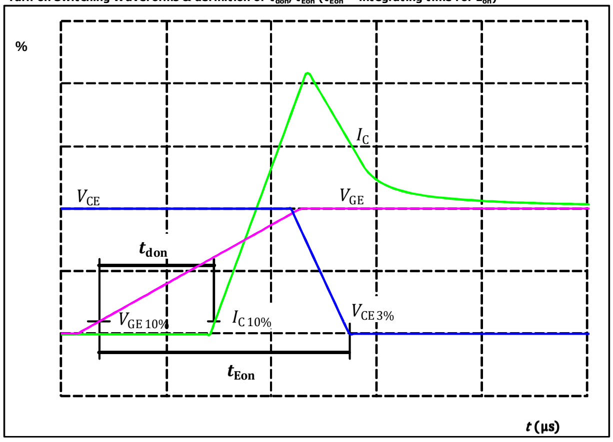
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	150	A
t_{doff} =	355	ns

figure 2. IGBT

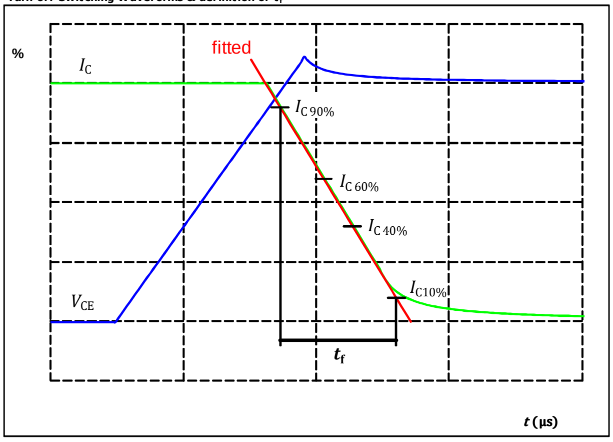
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	150	A
t_{don} =	180	ns

figure 3. IGBT

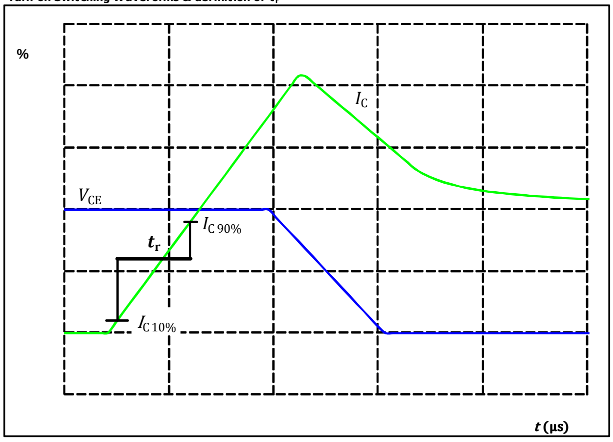
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	150	A
t_f =	130	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

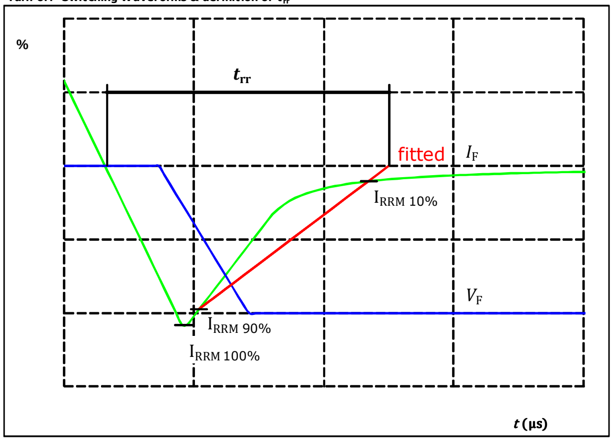


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	150	A
t_r =	35	ns

Half-Bridge Switching Characteristics

figure 5. FWD

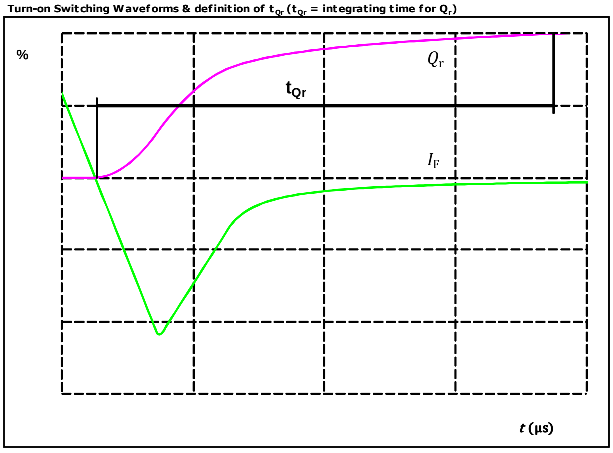
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	600	V
I_F (100%) =	150	A
I_{RRM} (100%) =	156	A
t_{rr} =	391	ns

figure 6. FWD

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



I_F (100%) =	150	A
Q_r (100%) =	19,55	μC

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Ordering Code & Marking

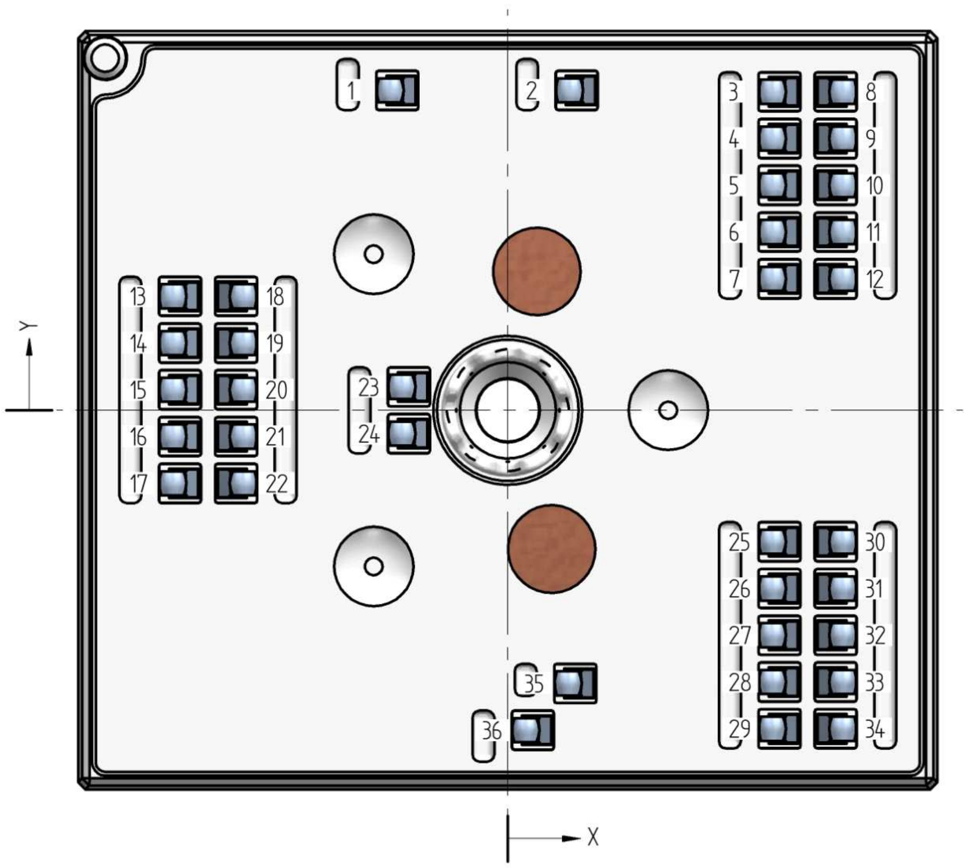
Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M2122PA150SC-K708F40-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M2122PA150SC-K708F40-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M2122PA150SC-K708F40-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M2122PA150SC-K708F40-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M2122PA150SC-K708F40-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M2122PA150SC-K708F40-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M2122PA150SC-K708F40-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M2122PA150SC-K708F40-/5B/

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

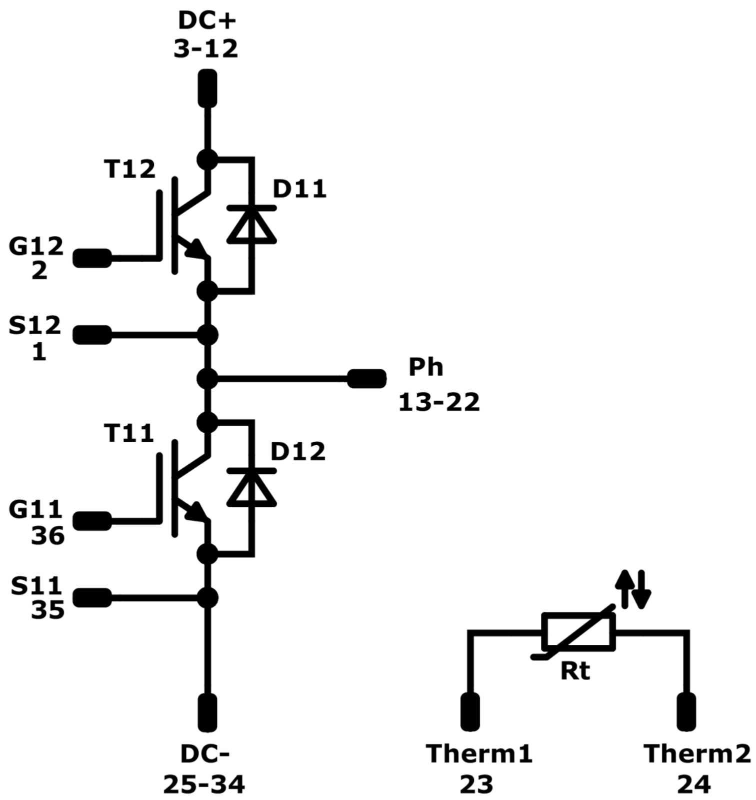
PCB pad table

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	150 A	Half-Bridge Switch	
D11 , D12	FWD	1200 V	150 A	Half-Bridge Diode	
Rt	NTC			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.

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-M2122PA150SC-K708F40-D2-14	30 May. 2018	Thermal interface changed to HPTP	All