Vincotech

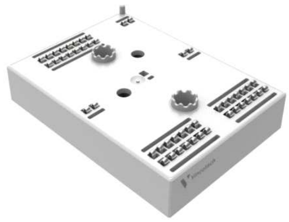
80-M3122PA400SC-K830F40
datasheet

MiniSKiiP® DUAL 3 | **1200 V / 400 A**

Features

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

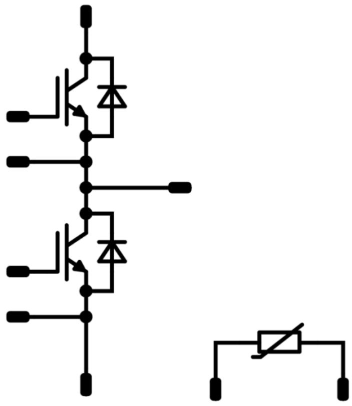
MiniSkiip® 3 housing



Target applications

- Industrial Drives
- Power Supply
- Solar Inverters
- UPS

Schematic



Types

- 80-M3122PA400SC-K830F40

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Half-Bridge Switch - Lo side / Half-Bridge Switch - Hi side				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C		400	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	1200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	1106	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 - Lo side / Half-Bridge Diode - Hi side					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	309	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms	T_j = 150 °C	2200	A
Surge current capability	I^2t	50 Hz Single Half Sine Wave t_p = 10 ms	T_j = 150 °C	24208	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	634	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
Isolation voltage	V_{isol}	AC Voltage	t_p = 1 min	2500	V
Creepage distance		With std lid For more information see handling instructions		6,3	mm
Clearance		With std lid For more information 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 - Lo side / Half-Bridge Switch - Hi side										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0152	25	5,1	5,8	6,4	V
Collector-emitter saturation voltage	V_{CEsat}		15		400	25 125 150	1,53	1,93 2,22 2,30	1,97	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			5,2	µA
Gate-emitter leakage current	I_{GES}		20	0		25			480	nA
Internal gate resistance	r_g							1,875		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		25200		pF
Reverse transfer capacitance	C_{res}							1080		
Gate charge	Q_g		15	none		25		3200		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,09		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	400	25 125 150		265 279 280		ns
Rise time	t_r					25 125 150		51 55 59		
Turn-off delay time	$t_{d(off)}$					25 125 150		374 451 472		
Fall time	t_f					25 125 150		51 102 129		
Turn-on energy (per pulse)*	E_{on}	Q_{rFWD} = 23,6 µC Q_{rFWD} = 51,7 µC Q_{rFWD} = 62,7 µC				25 125 150		27,46 38,59 42,92		mWs
Turn-off energy (per pulse)*	E_{off}					25 125 150		25,17 39,49 44,32		

* Ls = 14 nH

Characteristic Values

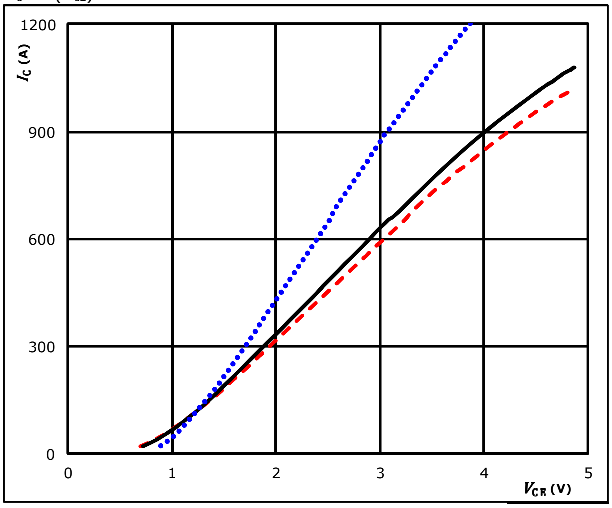
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Half-Bridge Diode - Lo side / Half-Bridge Diode - Hi side										
Static										
Forward voltage	V_F				400	25 125 150		2,34 2,47 2,40	2,52	V
Reverse leakage current	I_R			1200		25 150			480 70800	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,15		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 7742 A/µs di/dt = 7633 A/µs di/dt = 7094 A/µs	±15	600	400	25 125 150		277 349 377		A
Reverse recovery time	t_{rr}					25 125 150		264 463 507		ns
Recovered charge	Q_r					25 125 150		23,64 51,72 62,67		µC
Reverse recovered energy	E_{rec}					25 125 150		8,30 19,82 23,87		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		8528 6150 5660		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 - Lo side / Half-Bridge Switch - Hi side Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

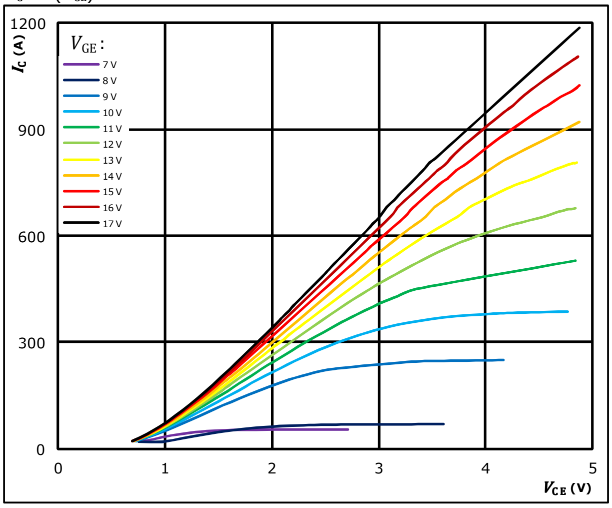


t_p =	250	µs		25 °C	··········
V_{GE} =	15	V	T_j:	125 °C	——
				150 °C	– – –

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



t_p = 250 µs

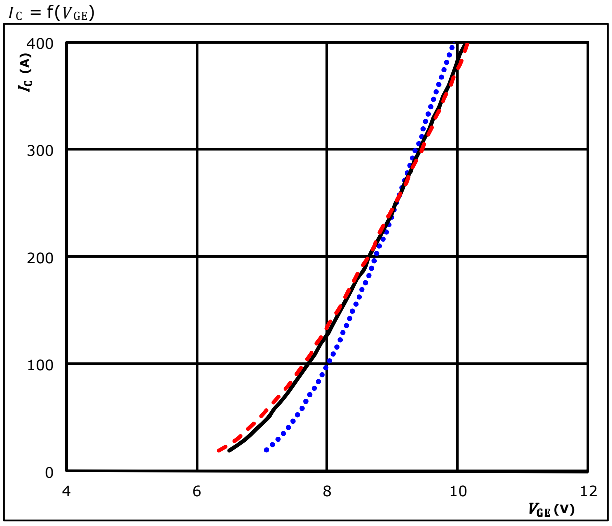
T_j = 125 °C

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

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

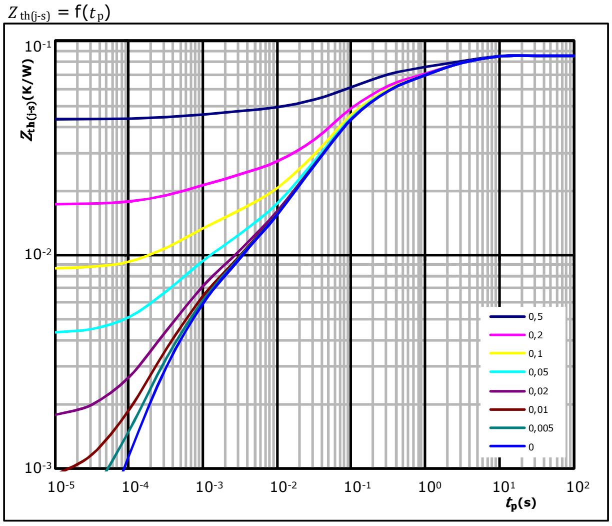


t_p =	100	µs		25 °C	··········
V_{CE} =	10	V	T_j:	125 °C	——
				150 °C	– – –

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 0,09 K/W

IGBT thermal model values

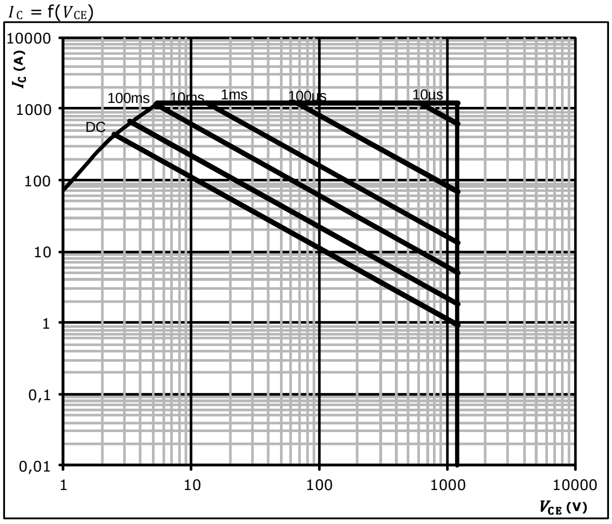
R (K/W)	τ (s)
2,36E-02	1,19E+00
1,71E-02	1,56E-01
3,28E-02	3,48E-02
5,52E-03	4,93E-03
3,89E-03	6,63E-04
2,94E-03	1,71E-04

Half-Bridge Switch - Lo side / Half-Bridge Switch - Hi side Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



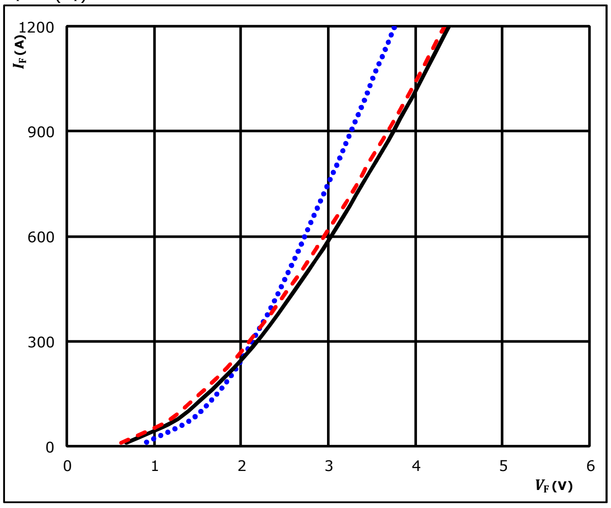
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Half-Bridge Diode - Lo side / Half-Bridge Diode - Hi side Characteristics

figure 1. FWD

Typical forward characteristics

$I_F = f(V_F)$



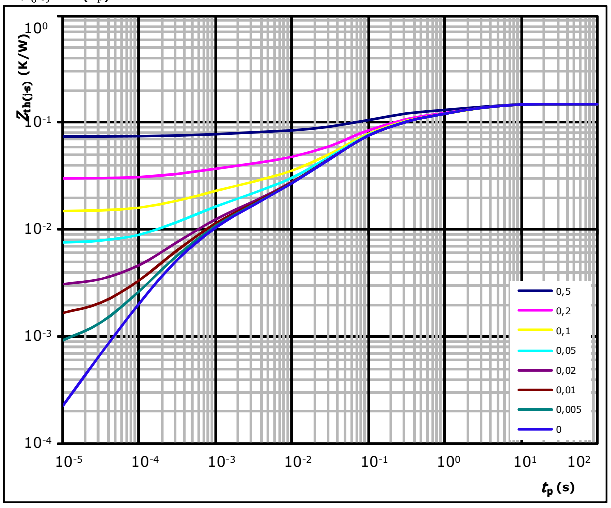
t_p = 250 µs

T_j: 25 °C; 125 °C; 150 °C

figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,15 K/W

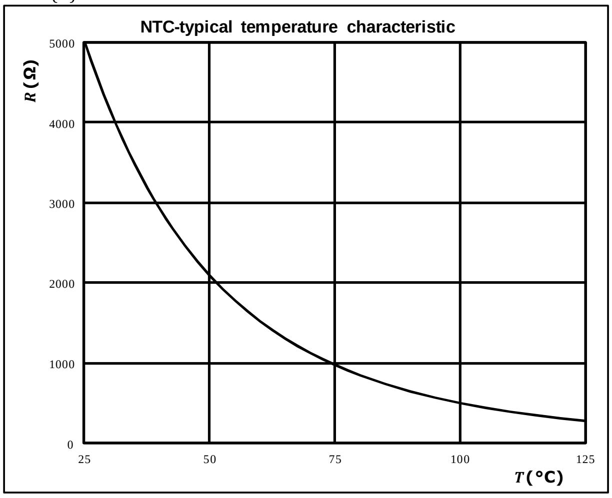
FWD thermal model values

R (K/W)	τ (s)
4,11E-02	2,08E+00
2,99E-02	2,73E-01
5,73E-02	6,08E-02
9,63E-03	8,60E-03
6,79E-03	1,16E-03
5,13E-03	2,98E-04

Thermistor Characteristics

figure 1.	Thermistor

Typical NTC characteristic
as a function of temperature
$R = f(T)$

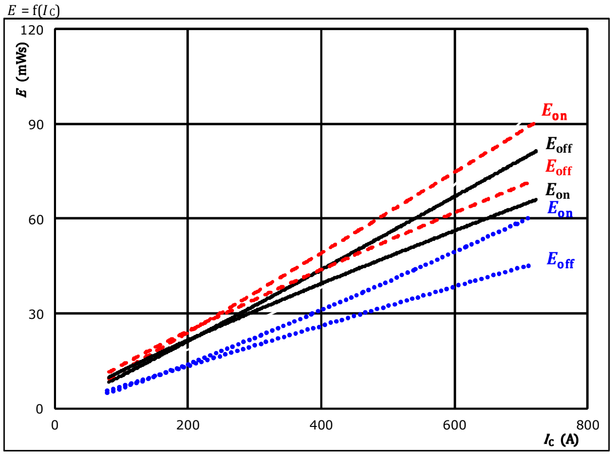


Half-Bridge Switch - Lo side / Half-Bridge Switch - Hi side Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



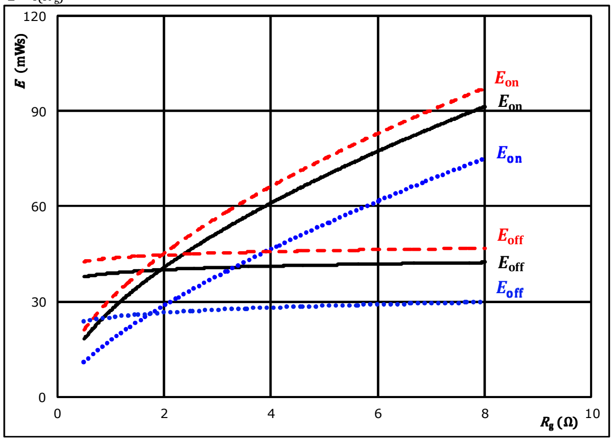
With an inductive load at

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

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



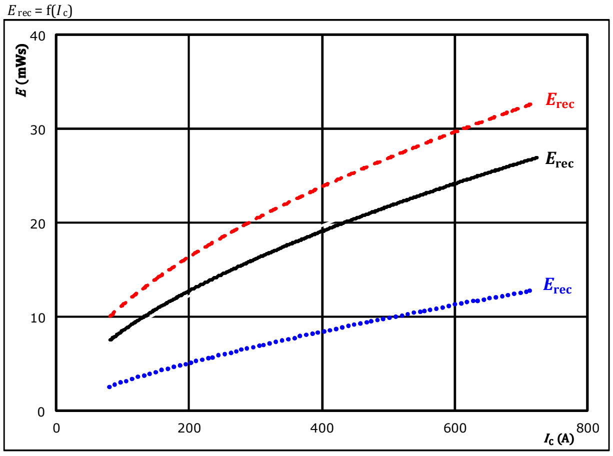
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	400	A		150 °C

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_c)$



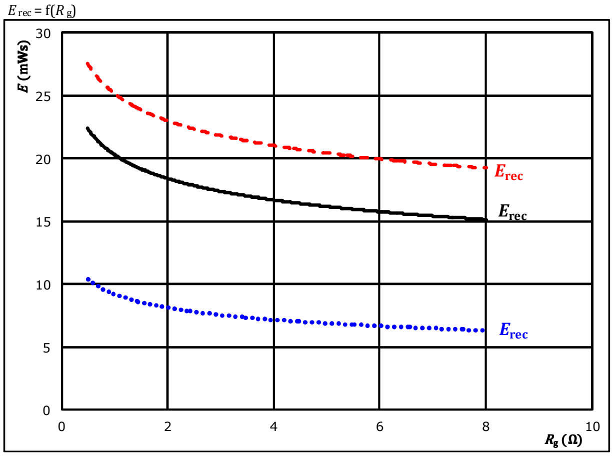
With an inductive load at

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

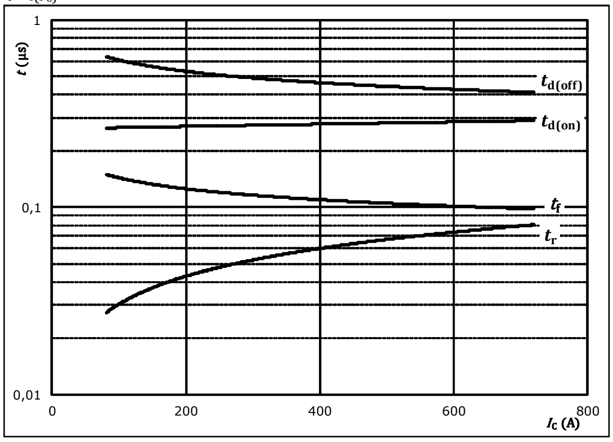
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	400	A		150 °C

Half-Bridge Switch - Lo side / Half-Bridge Switch - Hi side Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



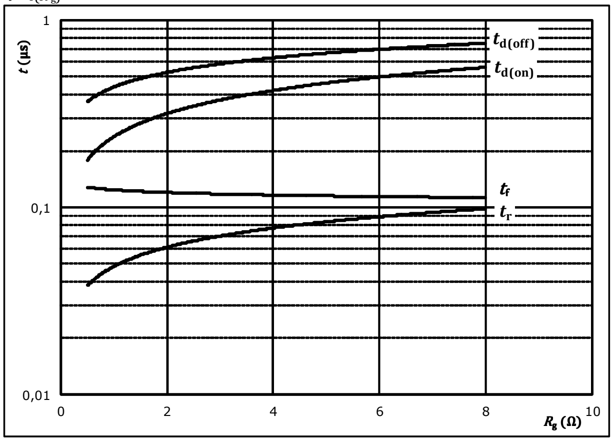
With an inductive load at

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

$t = f(R_g)$



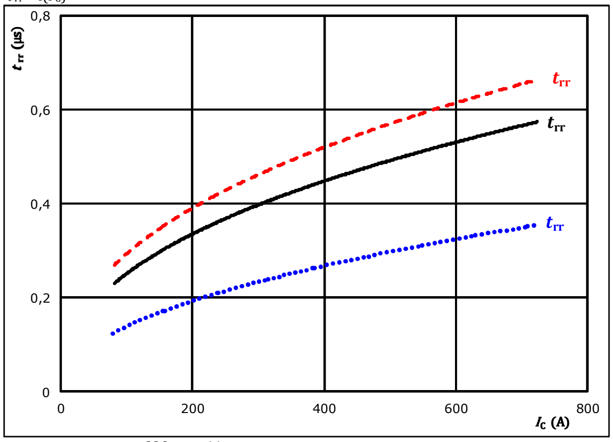
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	400	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

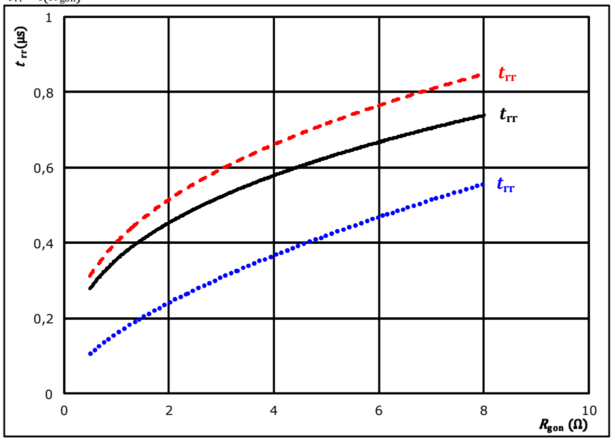


At						
V_{CE}=	600	V			25 °C	··············
V_{GE} =	±15	V		T_j:	125 °C	———
R_{gon} =	2	Ω			150 °C	— — —

figure 8. **FWD**

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

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



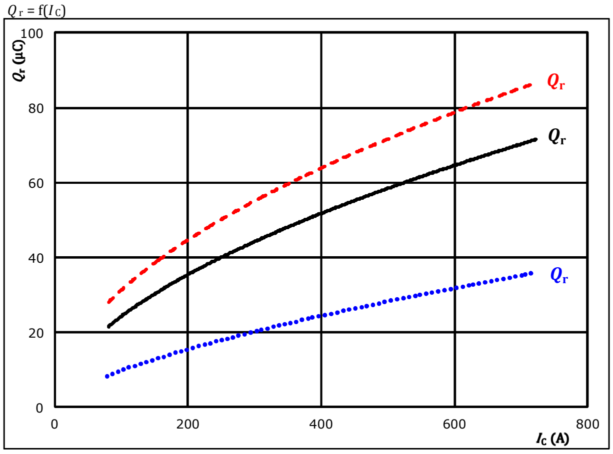
At						
V_{CE} =	600	V			25 °C	··············
V_{GE} =	±15	V		T_j:	125 °C	———
I_C =	400	A			150 °C	— — —

Half-Bridge Switch - Lo side / Half-Bridge Switch - Hi side Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

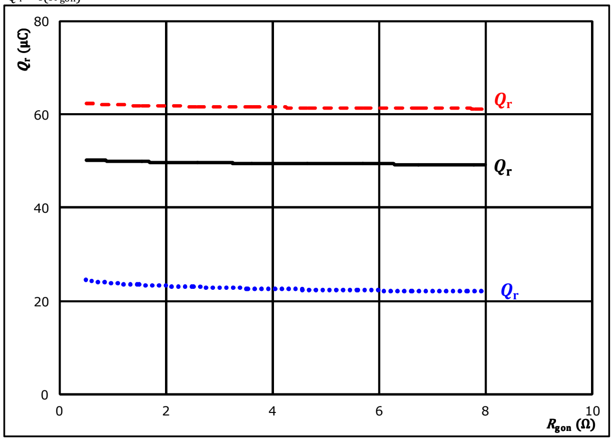


At					
V_{CE} =	600	V		25 °C	dotted
V_{GE} =	±15	V	T_j:	125 °C	solid
R_{gon} =	2	Ω		150 °C	dashed

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

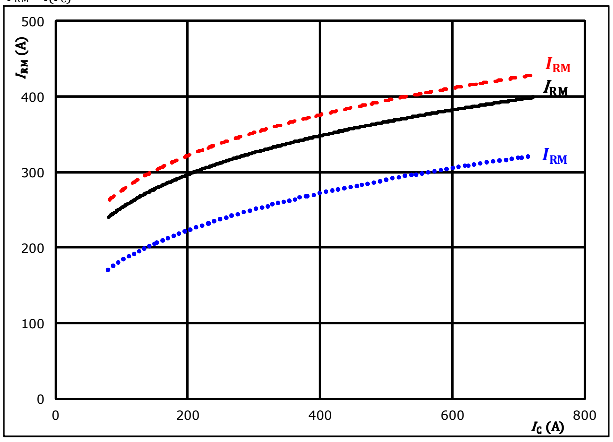


At					
V_{CE}=	600	V		25 °C	dotted
V_{GE} =	±15	V	T_j:	125 °C	solid
I_C=	400	A		150 °C	dashed

figure 11. **FWD**

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

$I_{RM} = f(I_C)$

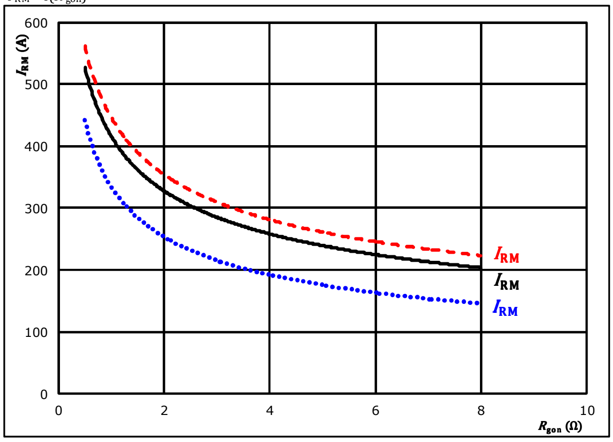


At					
V_{CE} =	600	V		25 °C	dotted
V_{GE} =	±15	V	T_j:	125 °C	solid
R_{gon} =	2	Ω		150 °C	dashed

figure 12. **FWD**

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

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



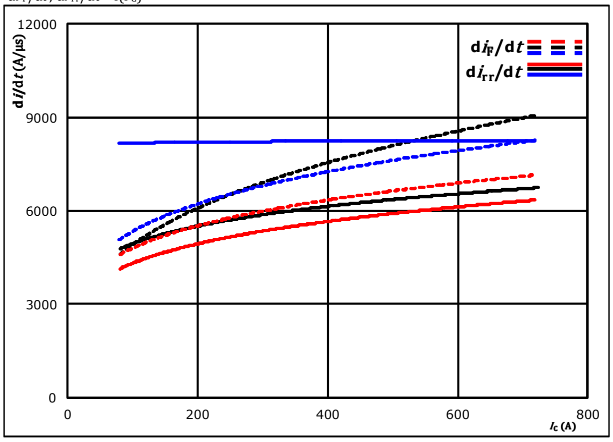
At					
V_{CE} =	600	V		25 °C	dotted
V_{GE} =	±15	V	T_j:	125 °C	solid
I_C =	400	A		150 °C	dashed

Half-Bridge Switch - Lo side / Half-Bridge Switch - Hi side Switching Characteristics

figure 13. **FWD**

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

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

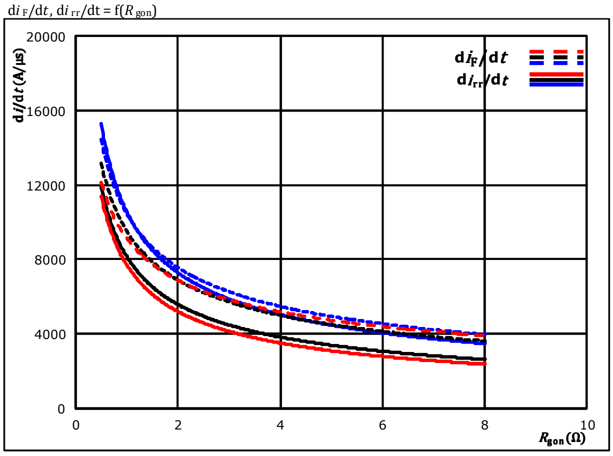


At					
V_{CE} =	600	V		25	°C
V_{GE} =	±15	V	T_j:	125	°C
R_{gon} =	2	Ω		150	°C

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

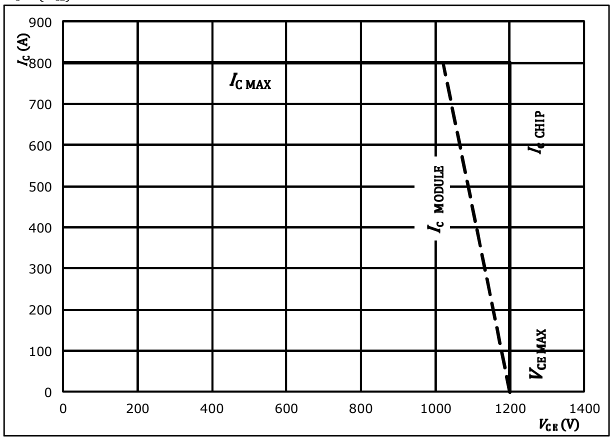


At					
V_{CE} =	600	V		25	°C
V_{GE} =	±15	V	T_j:	125	°C
I_C =	400	A		150	°C

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

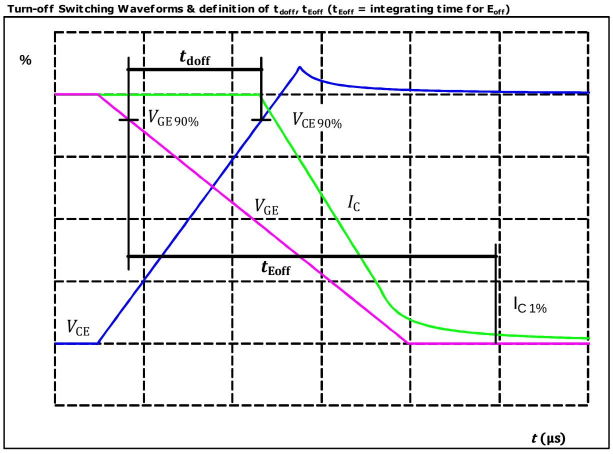
Half-Bridge Switch - Lo side / Half-Bridge Switch - Hi side Switching Definitions

General conditions

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

figure 1. **IGBT**

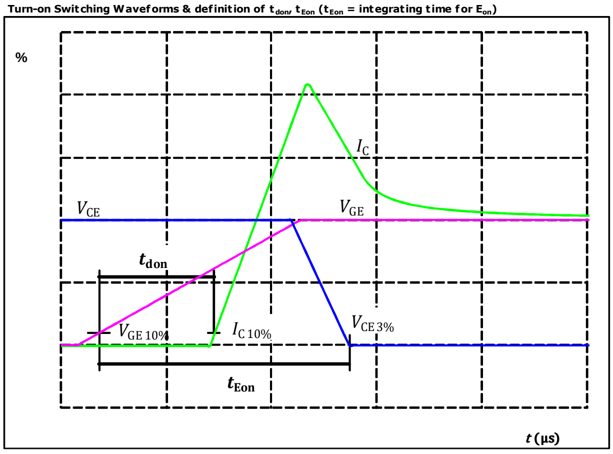
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	400	A
t_{doff} =	451	ns

figure 2. **IGBT**

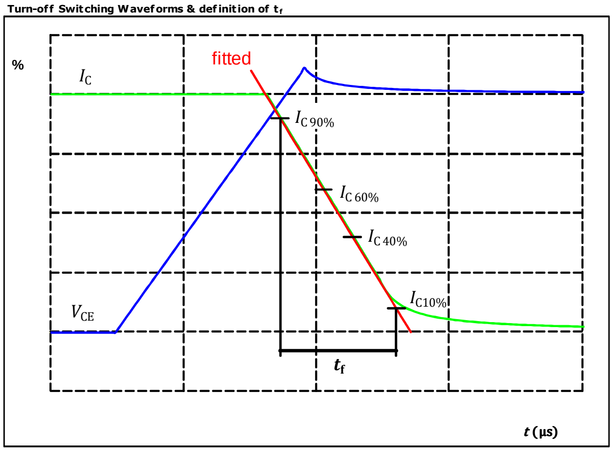
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	400	A
t_{don} =	279	ns

figure 3. **IGBT**

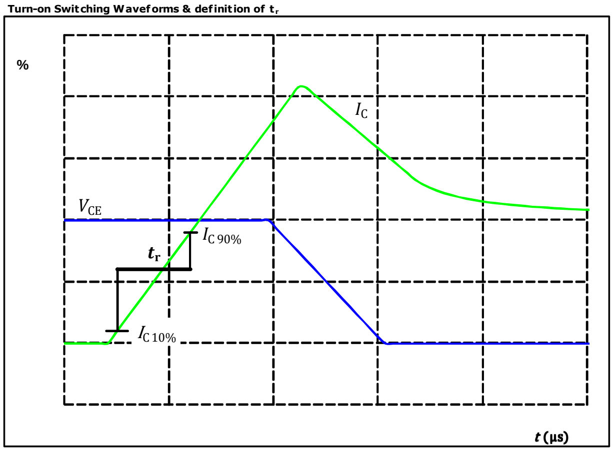
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	400	A
t_f =	102	ns

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

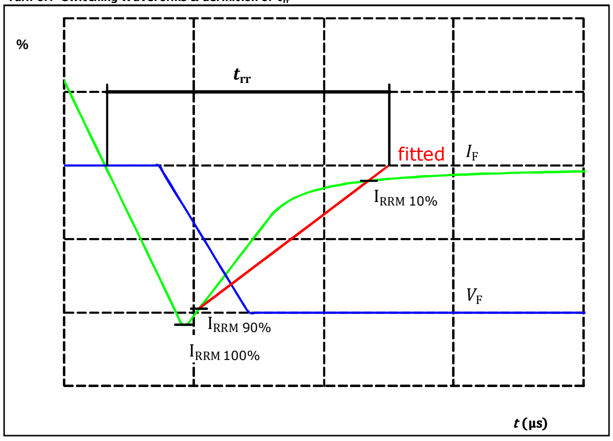


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	400	A
t_r =	55	ns

Half-Bridge Switch - Lo side / Half-Bridge Switch - Hi side Switching Definitions

figure 5. **FWD**

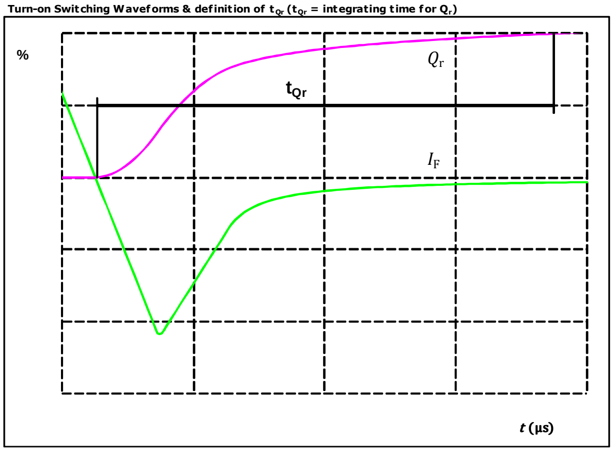
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	600	V
I_F (100%) =	400	A
I_{RRM} (100%) =	349	A
t_{rr} =	463	ns

figure 6. **FWD**

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



I_F (100%) =	400	A
Q_r (100%) =	51,72	µC

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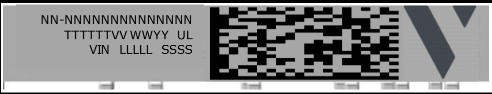
Ordering Code & Marking

Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M3122PA400SC-K830F40-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M3122PA400SC-K830F40-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M3122PA400SC-K830F40-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M3122PA400SC-K830F40-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M3122PA400SC-K830F40-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M3122PA400SC-K830F40-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M3122PA400SC-K830F40-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M3122PA400SC-K830F40-/5B/

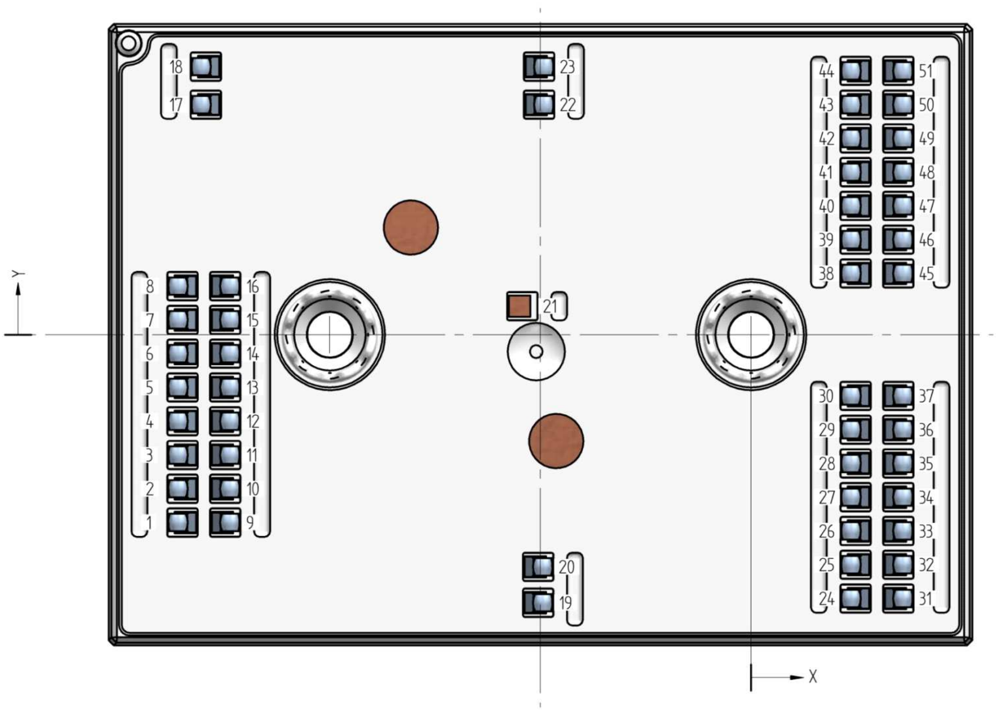


Text	Name		Date code	UL & VIN	Lot	Serial
	NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTTVV	LLLLL	SSSS	WWYY		

Outline

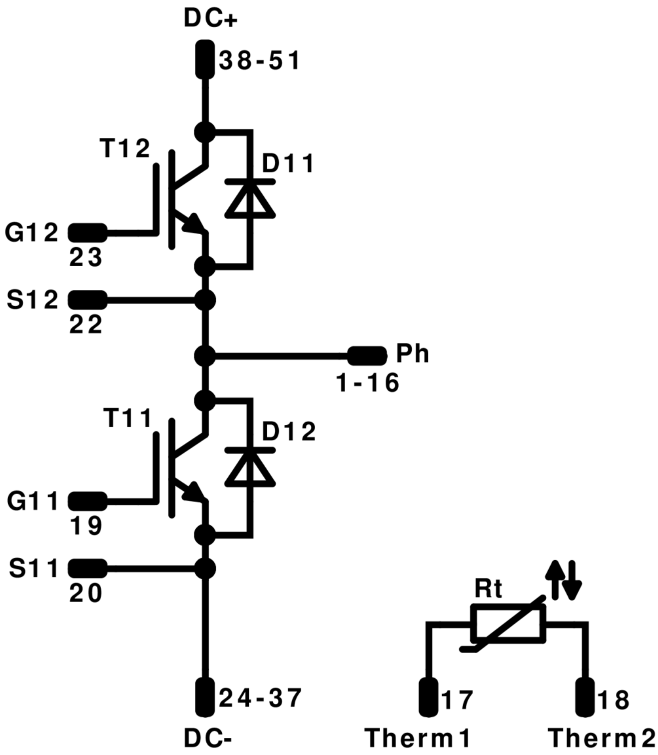
PCB pad table

Pin	X	Y	Function	Pin	X	Y	Function
1	-54	-18	Ph	47	14	12,2	+DC
2	-54	-15	Ph	48	14	15,4	+DC
3	-54	-11	Ph	49	14	18,6	+DC
4	-54	-8,2	Ph	50	14	21,8	+DC
5	-54	-5	Ph	51	14	25	+DC
6	-54	-1,8	Ph				
7	-54	1,4	Ph				
8	-54	4,6	Ph				
9	-50	-18	Ph				
10	-50	-15	Ph				
11	-50	-11	Ph				
12	-50	-8,2	Ph				
13	-50	-5	Ph				
14	-50	-1,8	Ph				
15	-50	1,4	Ph				
16	-50	4,6	Ph				
17	-52	21,8	Therm1				
18	-52	25,4	Therm2				
19	-20	-25	G11				
20	-20	-22	S11				
21	Not assembled						
22	-20	21,8	S12				
23	-20	25,4	G12				
24	9,95	-25	-DC				
25	9,95	-22	-DC				
26	9,95	-19	-DC				
27	9,95	-15	-DC				
28	9,95	-12	-DC				
29	9,95	-9	-DC				
30	9,95	-5,8	-DC				
31	14	-25	-DC				
32	14	-22	-DC				
33	14	-19	-DC				
34	14	-15	-DC				
35	14	-12	-DC				
36	14	-9	-DC				
37	14	-5,8	-DC				
38	9,95	5,8	+DC				
39	9,95	9	+DC				
40	9,95	12,2	+DC				
41	9,95	15,4	+DC				
42	9,95	18,6	+DC				
43	9,95	21,8	+DC				
44	9,95	25	+DC				
45	14	5,8	+DC				
46	14	9	+DC				



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	IGBT	1200 V	400 A	Half-Bridge Switch - Lo side	
D12	FWD	1200 V	400 A	Half-Bridge Diode - Lo side	
T12	IGBT	1200 V	400 A	Half-Bridge Switch - Hi side	
D11	FWD	1200 V	400 A	Half-Bridge Diode - Hi side	
Rt	NTC			Thermistor	

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80-M3122PA400SC-K830F40
datasheet

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.

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-M3122PA400SC-K830F40-D2-14	29 May. 2018	Dynamic condition added	3