80-M3122PA400M7-K830F70
datasheet

Vincotech

MiniSKiiP®DUAL 3 **1200 V / 400 A**

Features

- IGBT M7 technology with low V_{CEsat} and improved EMC behavior
- Solder-free spring contact technology
- Standard MiniSKiiP package sizes
- Built-in NTC

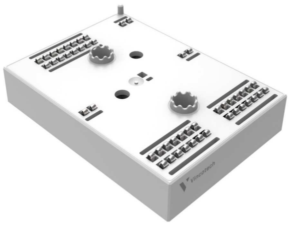
Target applications

- Industrial Drives
- Power Supply
- Solar Inverters
- UPS

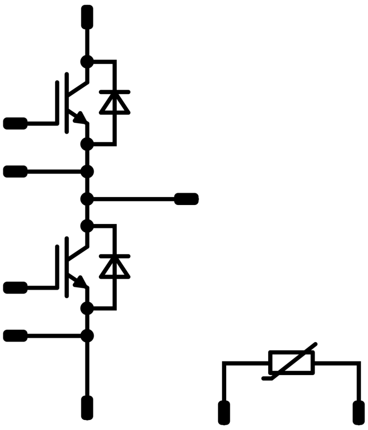
Types

- 80-M3122PA400M7-K830F70

MiniSkiip®3 housing



Schematic



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		400	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	800	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	883	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

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	309	A
Repetitive peak forward current	I_{FRM}			800	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	536	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	$V_{GE(th)}$			10	0,04	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		400	25 125 150		1,53 1,70 1,75	1,85	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			400	µA
Gate-emitter leakage current	I_{GES}		20	0		25			2000	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}		0	10		25		84000		pF
Output capacitance	C_{oes}		0	10		25		2800		pF
Reverse transfer capacitance	C_{res}		0	10		25		1120		pF
Gate charge	Q_g		15	600	400	25		2800		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,11		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	400	25 125 150		369 366 367		ns
Rise time	t_r	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	400	25 125 150		41 49 48		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	400	25 125 150		339 367 373		ns
Fall time	t_f	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	400	25 125 150		72 91 97		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 41,5 µC Q_{rFWD} = 62,9 µC Q_{rFWD} = 71,6 µC	±15	600	400	25 125 150		26,330 36,739 39,055		mWs
Turn-off energy (per pulse)	E_{off}		±15	600	400	25 125 150		27,404 35,132 37,854		mWs

Characteristic Values

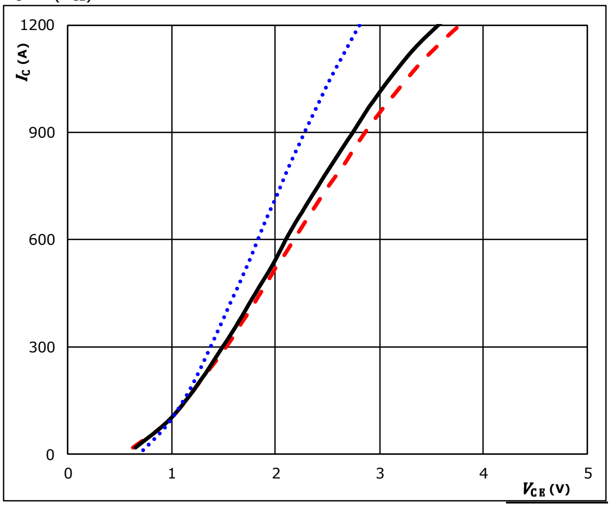
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Half-Bridge Diode										
Static										
Forward voltage	V_F				400	25 125 150		1,82 1,96 1,97	2,1	V
Reverse leakage current	I_R			1200		25			160	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,18		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 10059 A/µs di/dt = 9788 A/µs di/dt = 8678 A/µs	±15	600	400	25 125 150		377 393 405		A
Reverse recovery time	t_{rr}					25 125 150		274 420 458		ns
Recovered charge	Q_r					25 125 150		41,481 62,920 71,623		µC
Reverse recovered energy	E_{rec}					25 125 150		15,817 24,249 27,871		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		5015 3117 3230		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

$I_C = f(V_{CE})$

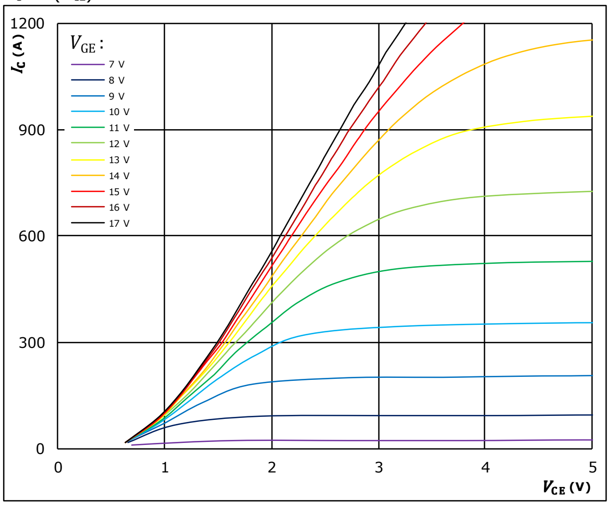


t_p =	250	µs		25 °C	dotted
V_{GE} =	15	V	T_j:	125 °C	solid
				150 °C	dashed

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



t_p = 250 µs

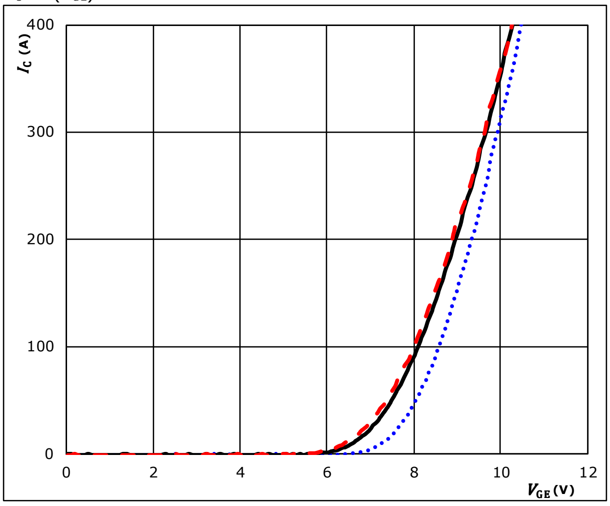
T_j = 150 °C

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

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

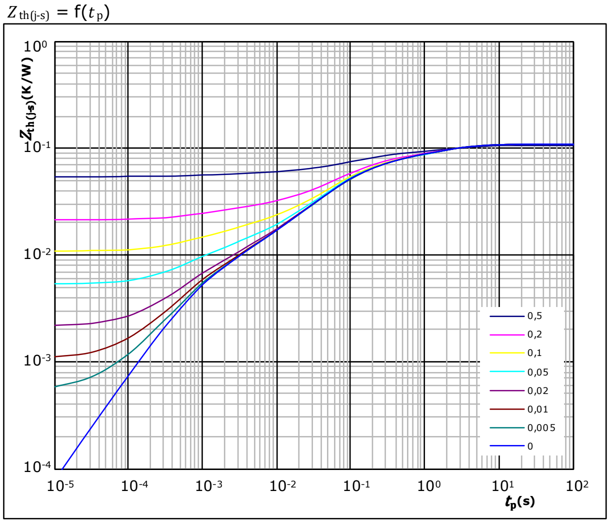


t_p =	100	µs		25 °C	dotted
V_{CE} =	10	V	T_j:	125 °C	solid
				150 °C	dashed

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T

$R_{th(j-s)}$ = 0,11 K/W

IGBT thermal model values

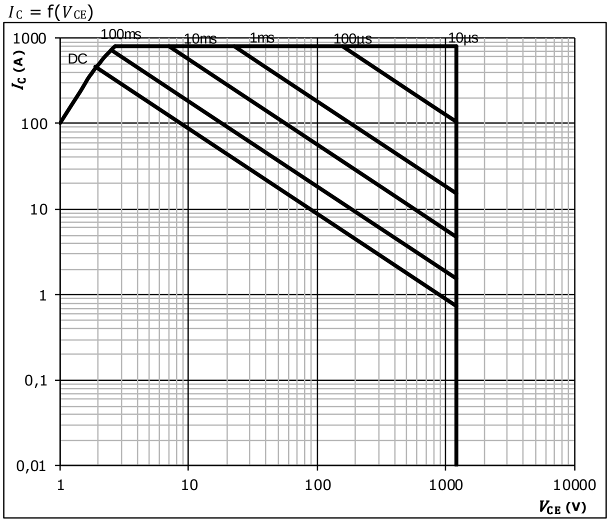
R (K/W)	τ (s)
2,25E-02	1,75E+00
1,79E-02	4,84E-01
3,26E-02	8,77E-02
2,34E-02	3,02E-02
5,79E-03	4,31E-03
5,38E-03	5,52E-04

Half-Bridge Switch Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



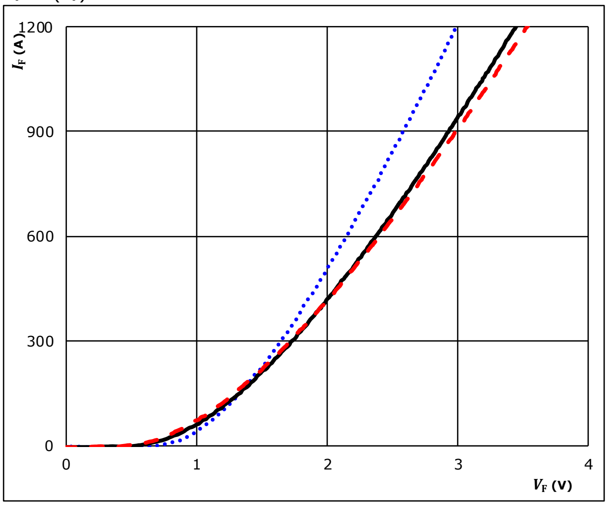
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Half-Bridge Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$

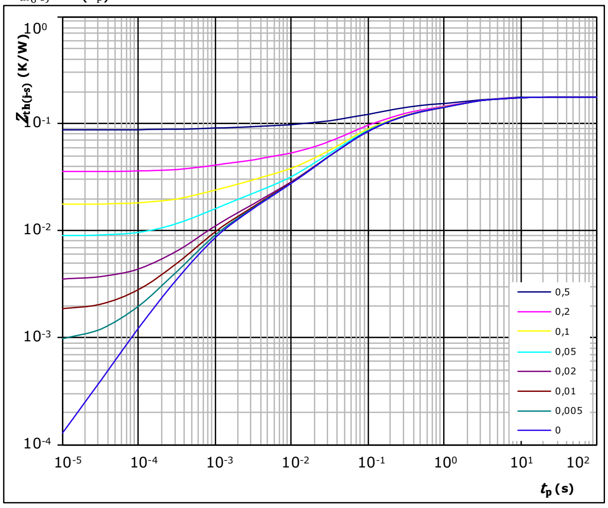


t_p =	250	μs	T_j:	25 °C
				125 °C
				150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 0,18 K/W

FWD thermal model values

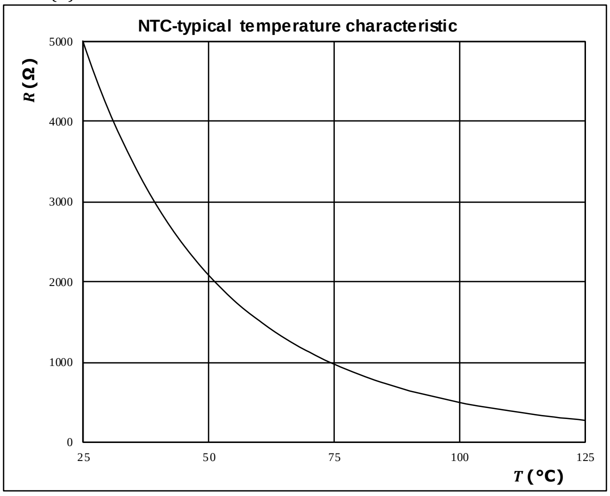
R (K/W)	τ (s)
3,71E-02	2,88E+00
2,94E-02	7,97E-01
5,37E-02	1,44E-01
3,85E-02	4,98E-02
9,53E-03	7,10E-03
8,86E-03	9,10E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic as a function of temperature

$R = f(T)$

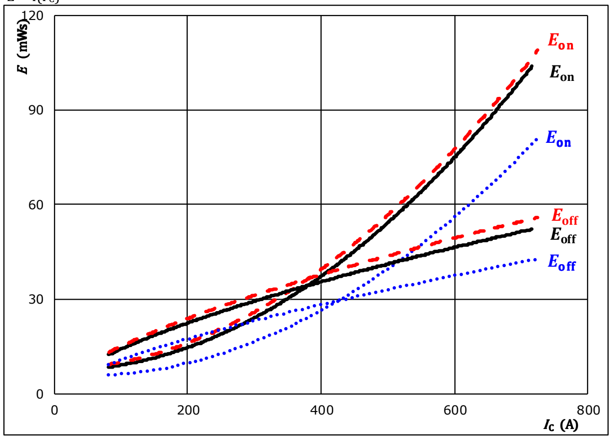


Half-Bridge Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



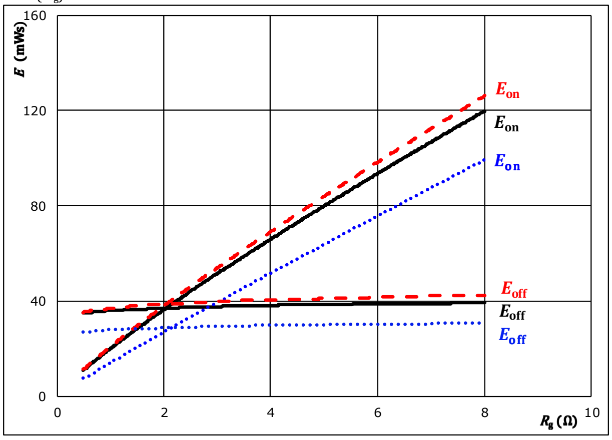
With an inductive load at

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

figure 2. IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



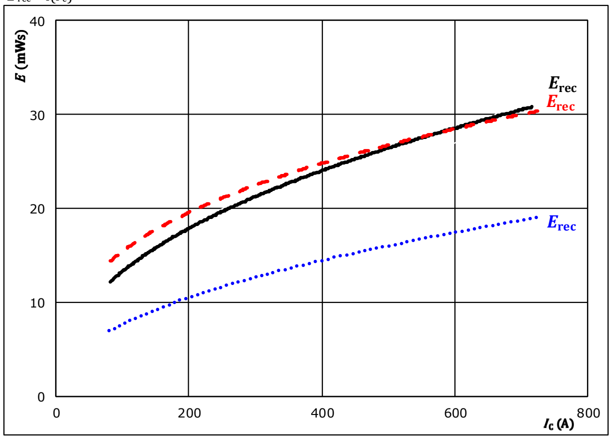
With an inductive load at

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

figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



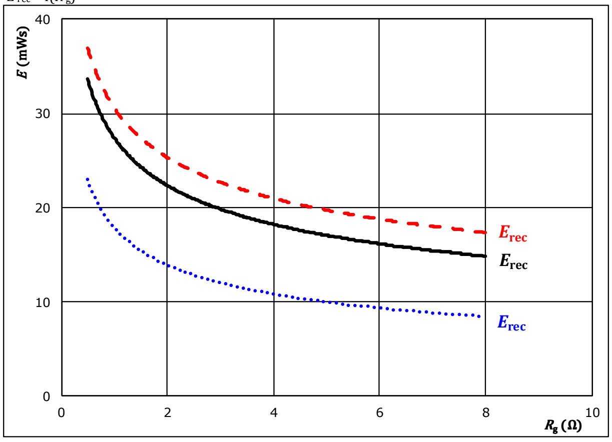
With an inductive load at

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

figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

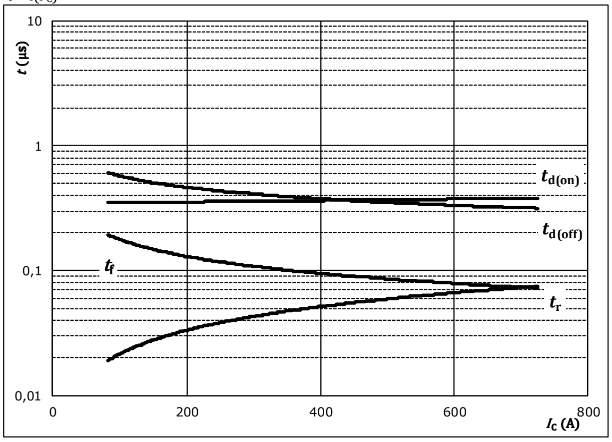
V_{CE} =	600	V	T_j:	25 °C (dotted)
V_{GE} =	±15	V		125 °C (solid)
I_C =	400	A		150 °C (dashed)

Half-Bridge Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



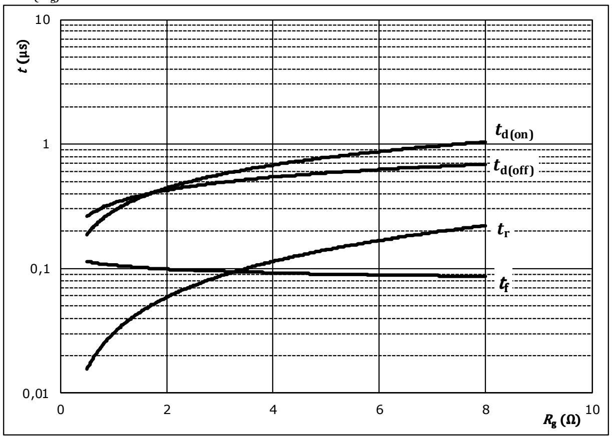
With an inductive load at

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

$t = f(R_g)$



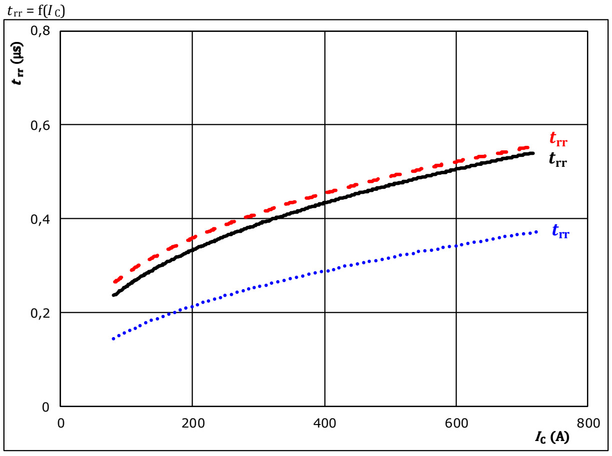
With an inductive load at

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

figure 7. FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



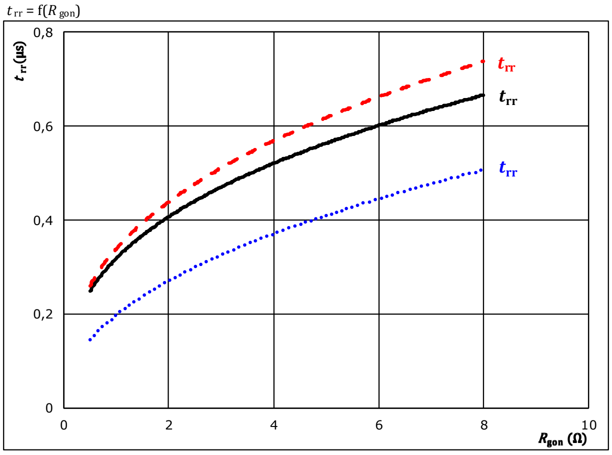
With an inductive load at

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

figure 8. FWD

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

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



With an inductive load at

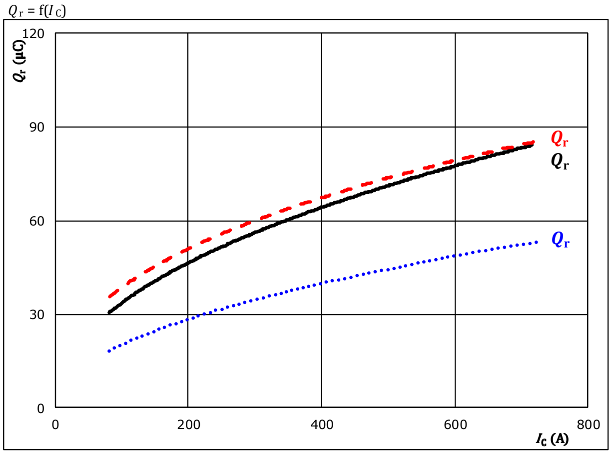
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	400	A		150 °C

Half-Bridge Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



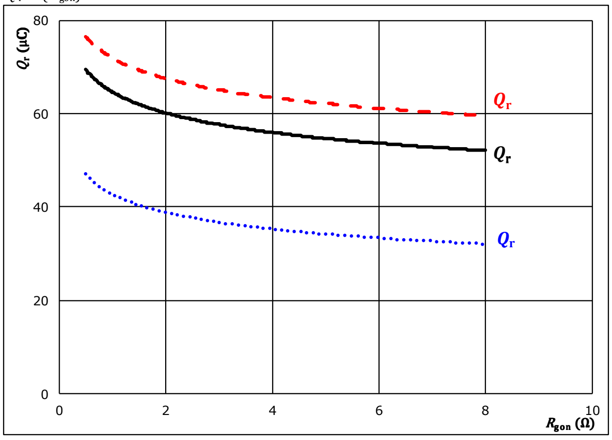
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	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

$Q_r = f(R_{gon})$



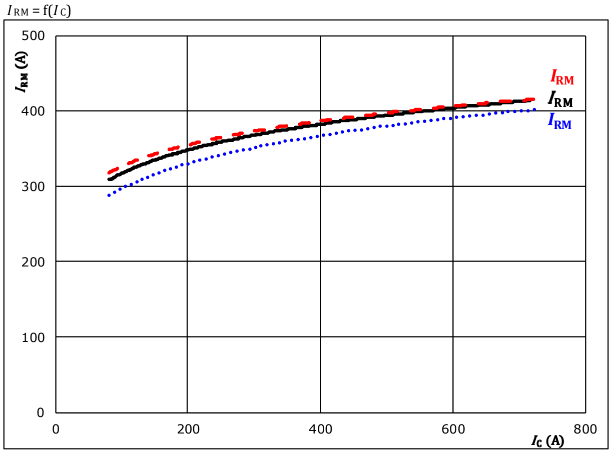
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		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

$I_{RM} = f(I_C)$



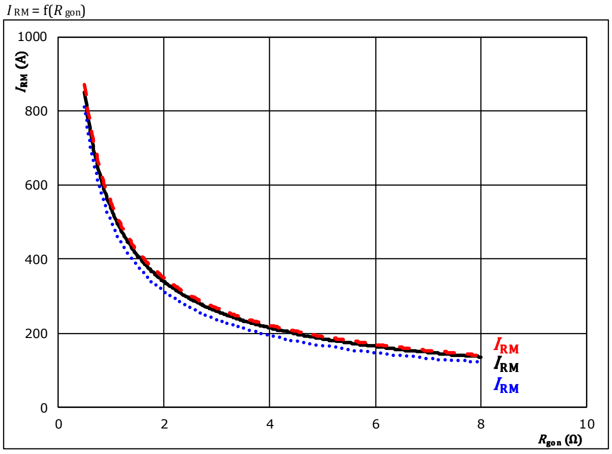
With an inductive load at

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

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



With an inductive load at

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

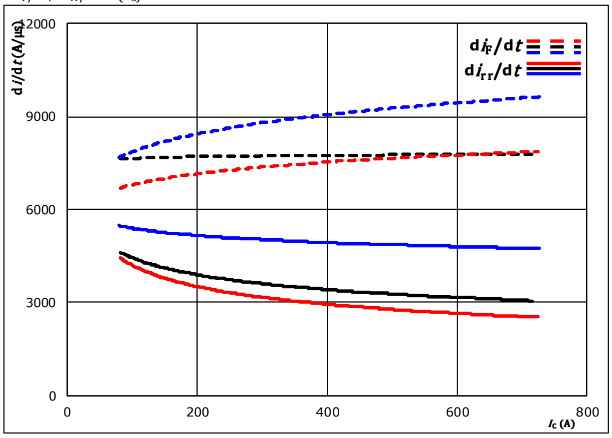
Vincotech

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



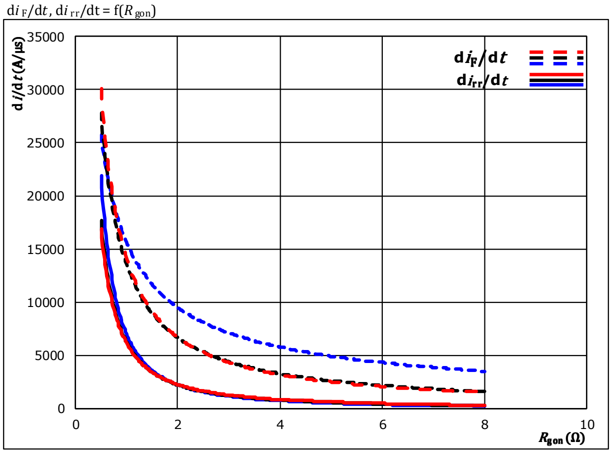
With an inductive load at

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

figure 14. FWD

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

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



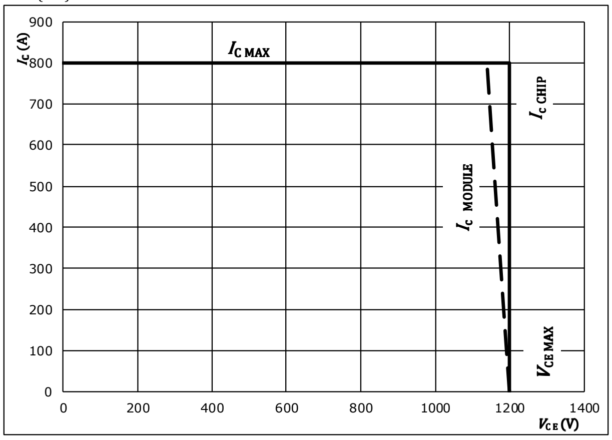
With an inductive load at

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

figure 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

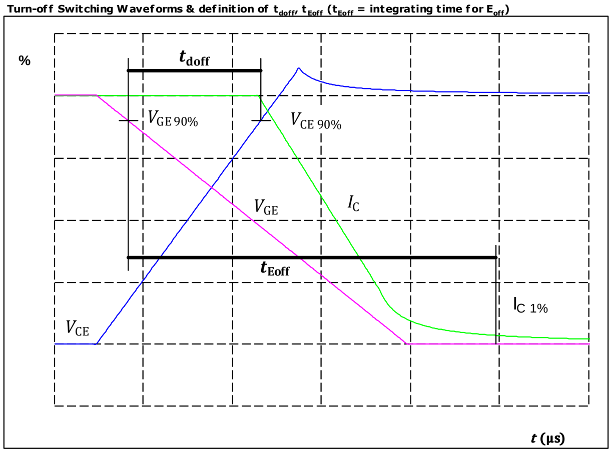
Half-Bridge Switching Definitions

General conditions

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

figure 1. **IGBT**

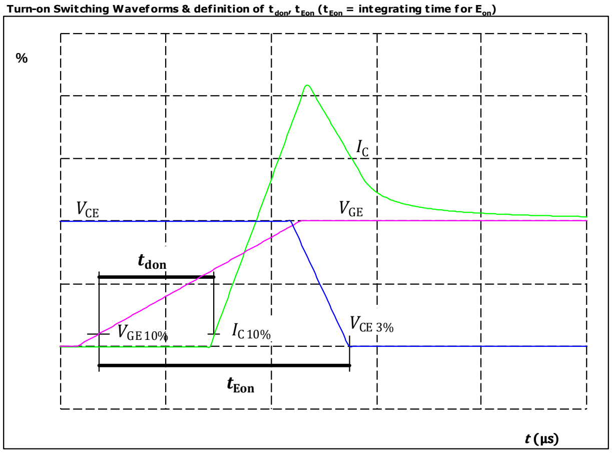
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	400	A
t_{doff} =	367	ns

figure 2. **IGBT**

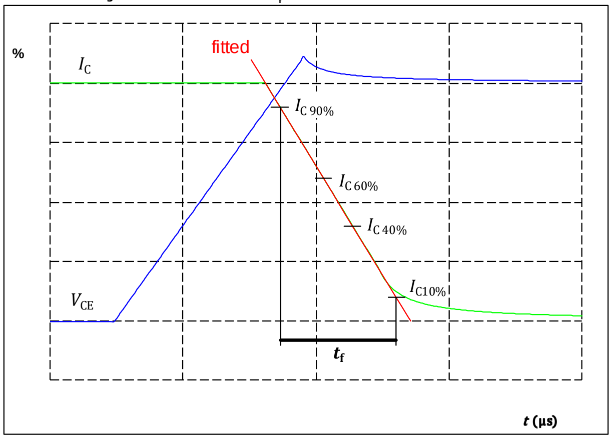
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	400	A
t_{don} =	366	ns

figure 3. **IGBT**

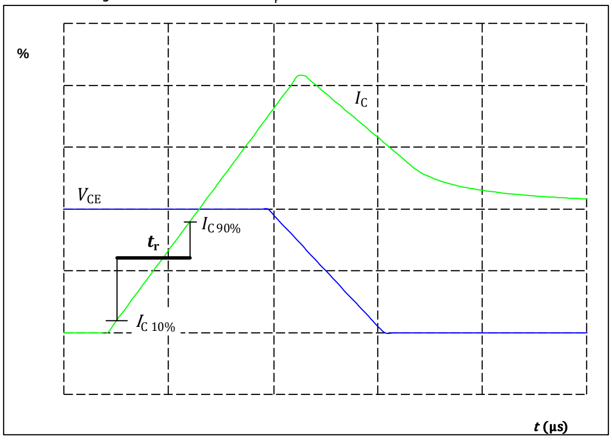
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	400	A
t_f =	91	ns

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

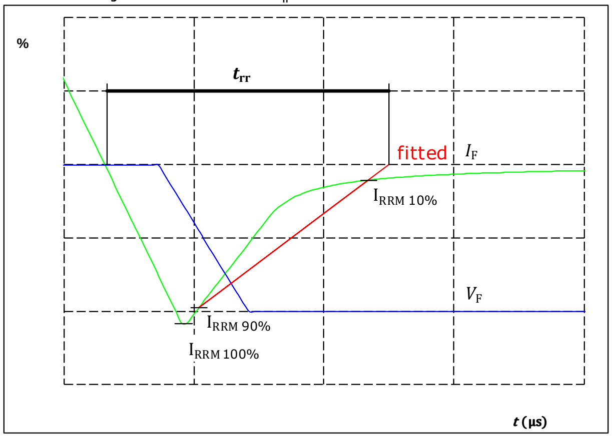


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	400	A
t_r =	49	ns

Half-Bridge Switching Characteristics

figure 5. FWD

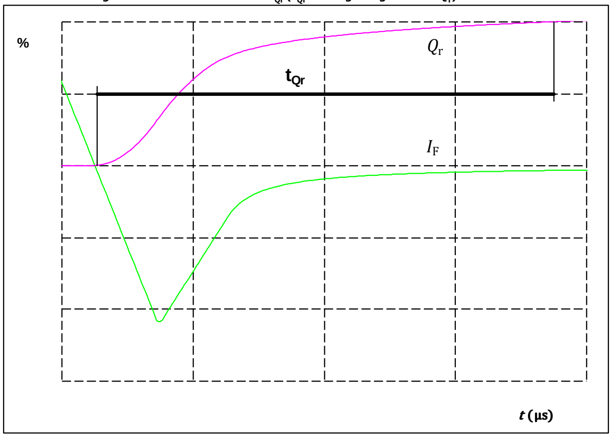
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	600	V
I_F (100%) =	400	A
I_{RRM} (100%) =	393	A
t_{rr} =	420	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%) =	62,92	µC

Ordering Code & Marking

Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M3122PA400M7-K830F70-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M3122PA400M7-K830F70-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M3122PA400M7-K830F70-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M3122PA400M7-K830F70-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M3122PA400M7-K830F70-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M3122PA400M7-K830F70-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M3122PA400M7-K830F70-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M3122PA400M7-K830F70-/5B/

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

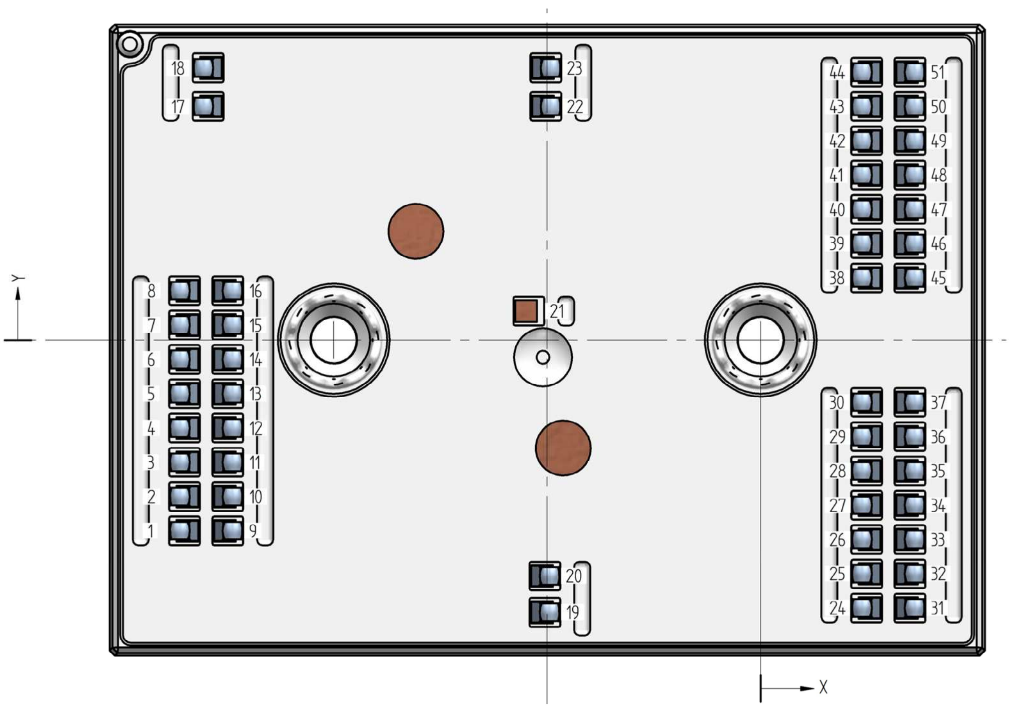
Outline

PCB pad table

Pin	X	Y	Function
1	-53,95	-17,8	Ph
2	-53,95	-14,6	Ph
3	-53,95	-11,4	Ph
4	-53,95	-8,2	Ph
5	-53,95	-5	Ph
6	-53,95	-1,8	Ph
7	-53,95	1,4	Ph
8	-53,95	4,6	Ph
9	-49,95	-17,8	Ph
10	-49,95	-14,6	Ph
11	-49,95	-11,4	Ph
12	-49,95	-8,2	Ph
13	-49,95	-5	Ph
14	-49,95	-1,8	Ph
15	-49,95	1,4	Ph
16	-49,95	4,6	Ph
17	-51,75	21,8	Therm1
18	-51,75	25,4	Therm2
19	-20,25	-25,4	G11
20	-20,25	-22	S11
21	Not assembled		
22	-20,15	21,8	S12
23	-20,15	25,4	G12
24	9,95	-25	-DC
25	9,95	-21,8	-DC
26	9,95	-18,6	-DC
27	9,95	-15,4	-DC
28	9,95	-12,2	-DC
29	9,95	-9	-DC
30	9,95	-5,8	-DC
31	13,95	-25	-DC
32	13,95	-21,8	-DC
33	13,95	-18,6	-DC
34	13,95	-15,4	-DC
35	13,95	-12,2	-DC
36	13,95	-9	-DC
37	13,95	-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	13,95	5,8	+DC
46	13,95	9	+DC
47	13,95	12,2	+DC

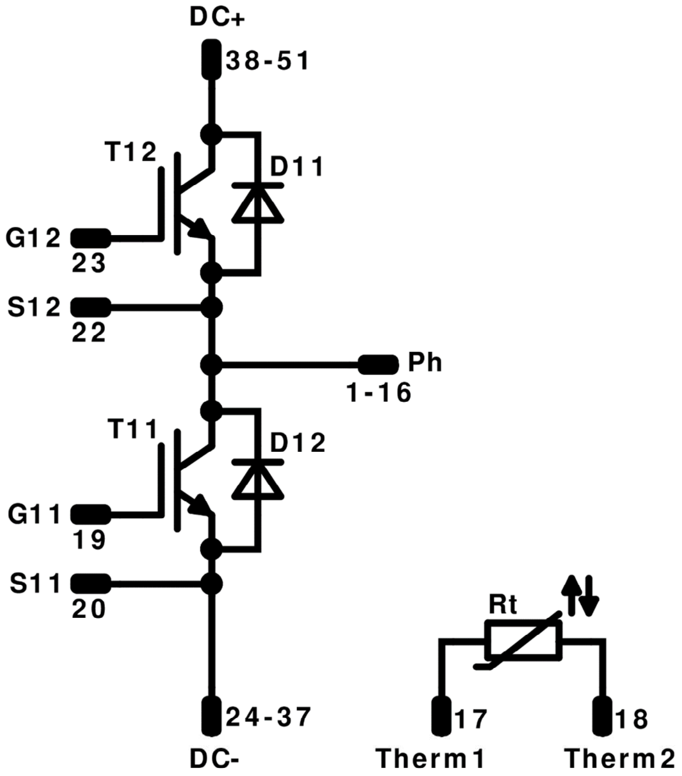
PCB pad table

Pin	X	Y	Function
48	13,95	15,4	+DC
49	13,95	18,6	+DC
50	13,95	21,8	+DC
51	13,95	25	+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, T12	IGBT	1200 V	400 A	Half-Bridge Switch	
D11, D12	FWD	1200 V	400 A	Half-Bridge Diode	
Rt	NTC			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.

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-M3122PA400M7-K830F70-D1-14	08 Nov. 2018		

DISCLAIMER

The information, specifications, procedures, methods and recommendations herein (together "information") are presented by Vincotech to reader in good faith, are believed to be accurate and reliable, but may well be incomplete and/or not applicable to all conditions or situations that may exist or occur. Vincotech reserves the right to make any changes without further notice to any products to improve reliability, function or design. No representation, guarantee or warranty is made to reader as to the accuracy, reliability or completeness of said information or that the application or use of any of the same will avoid hazards, accidents, losses, damages or injury of any kind to persons or property or that the same will not infringe third parties rights or give desired results. It is reader's sole responsibility to test and determine the suitability of the information and the product for reader's intended use.

LIFE SUPPORT POLICY
Vincotech products are not authorised for use as critical components in life support devices or systems without the express written approval of Vincotech.
As used herein:
1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.