Vincotech

80-M3072PA300SC-K836F30
datasheet

MiniSKiip® DUAL 3 | **650 V / 300 A**

Features

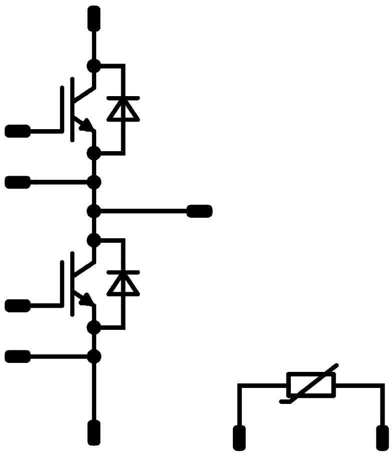
- Half-bridge topology
- Trench IGBT and CAL diode chip technology
- Integrated NTC sensor
- Solderless spring contact mounting system

MiniSkiip® 3 housing

Target applications

- Industrial Drives
- Power Supply
- Solar Inverters
- UPS

Schematic



Types

- 80-M3072PA300SC-K836F30

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Half-Bridge Switch - Lo side / Hi side					
Collector-emitter voltage	V_{CES}			650	V
Collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	283	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		900	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	459	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \leq$ 150 °C V_{GE} = 15 V		6 360	μs V
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 / Hi side					
Peak repetitive reverse voltage	V_{RRM}			650	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	271	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms	T_j = 150 °C	2200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	392	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]	Value Min	Typ	Max	Unit
Half-Bridge Switch - Lo side / Hi side										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0048	25	5,1	5,8	6,4	V
Collector-emitter saturation voltage	V_{CEsat}		15		300	25 125 150		1,46 1,59 1,62	1,9	V
Collector-emitter cut-off current	I_{CES}		0	650		25			15,2	µA
Gate-emitter leakage current	I_{GES}		20	0		25			1200	nA
Internal gate resistance	r_g							1		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		18480		pF
Reverse transfer capacitance	C_{res}							548		
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	350	300	25 125 150		232 240 241		ns
Rise time	t_r					25 125 150		40 43 44		
Turn-off delay time	$t_{d(off)}$					25 125 150		330 356 359		
Fall time	t_f					25 125 150		40 52 69		
Turn-on energy (per pulse)*	E_{on}	Q_{rFWD} = 11,9 µC Q_{rFWD} = 22 µC Q_{rFWD} = 27,5 µC				25 125 150		6,446 8,198 9,620		mWs
Turn-off energy (per pulse)*	E_{off}					25 125 150		7,479 9,971 10,81		

* Ls = 14 nH

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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 / Hi side										
Static										
Forward voltage	V_F				300	25 125 150		1,51 1,56 1,53		V
Reverse leakage current	I_R			650		25 150			240 68000	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,24		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 8358 A/µs di/dt = 8085 A/µs di/dt = 6700 A/µs	±15	350	300	25 125 150		278 336 361		A
Reverse recovery time	t_{rr}					25 125 150		64 136 149		ns
Recovered charge	Q_r					25 125 150		11,87 22,02 27,49		µC
Reverse recovered energy	E_{rec}					25 125 150		2,154 4,499 5,698		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		10333 9642 8389		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	

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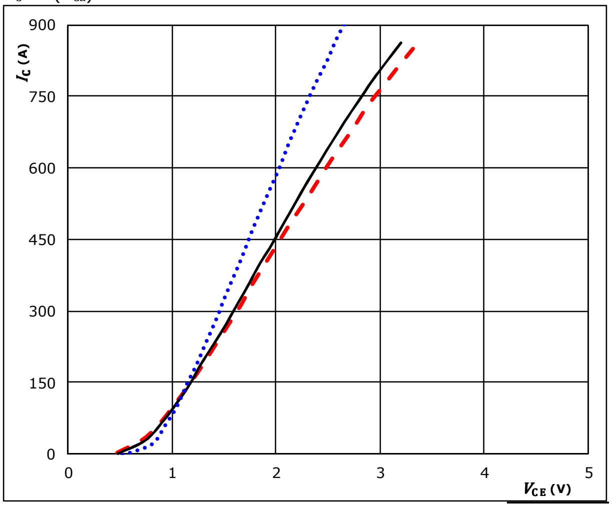
Half-Bridge Switch - Lo side / Hi side Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

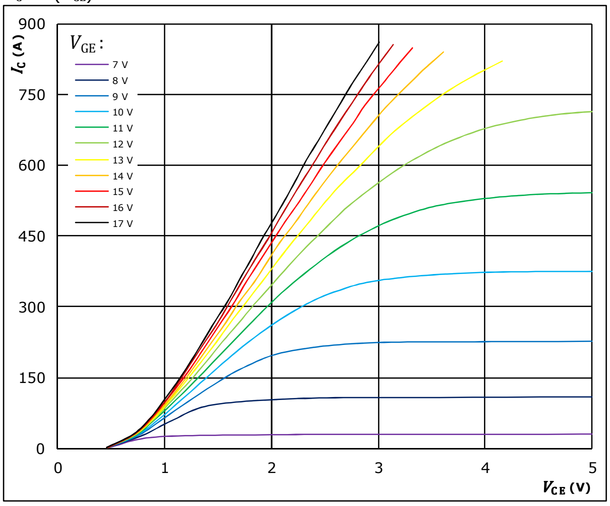


t_p =	250	µs		25 °C	············
V_{GE} =	15	V	T_j:	125 °C	———
				150 °C	– – – –

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



t_p = 250 µs

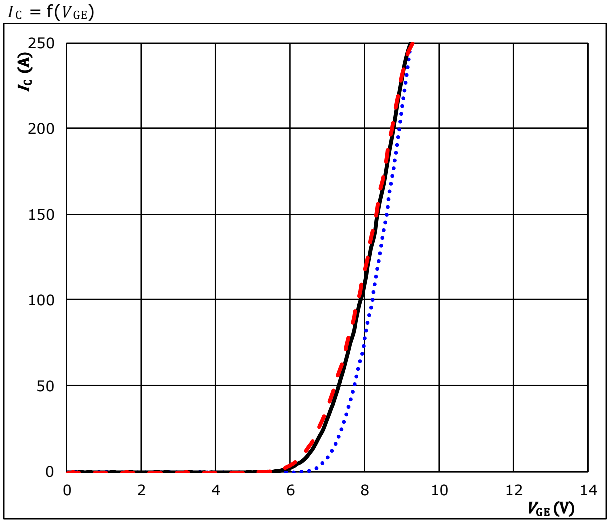
T_j = 150 °C

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

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

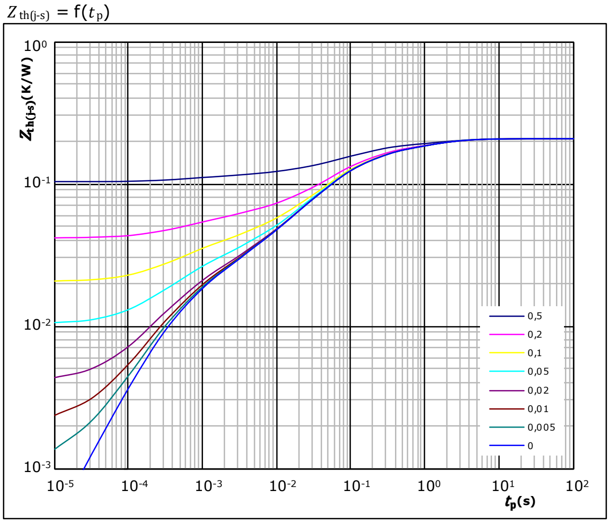


t_p =	100	µs		25 °C	············
V_{CE} =	10	V	T_j:	125 °C	———
				150 °C	– – – –

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T

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

IGBT thermal model values

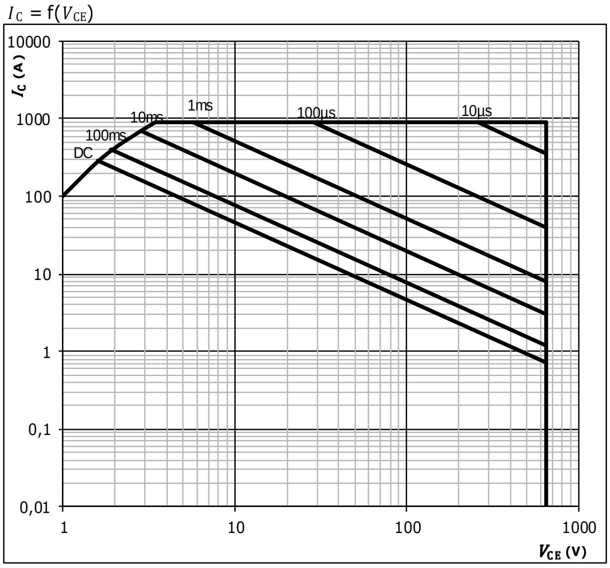
R (K/W)	τ (s)
3,75E-02	1,38E+00
3,79E-02	2,60E-01
8,77E-02	5,77E-02
2,09E-02	1,10E-02
1,20E-02	1,52E-03
1,11E-02	3,00E-04

Half-Bridge Switch - Lo side / 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}	

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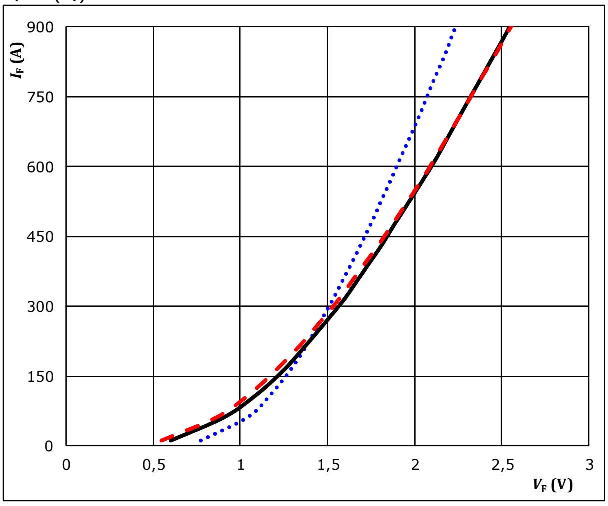
Half-Bridge Diode - Lo side / Hi side Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



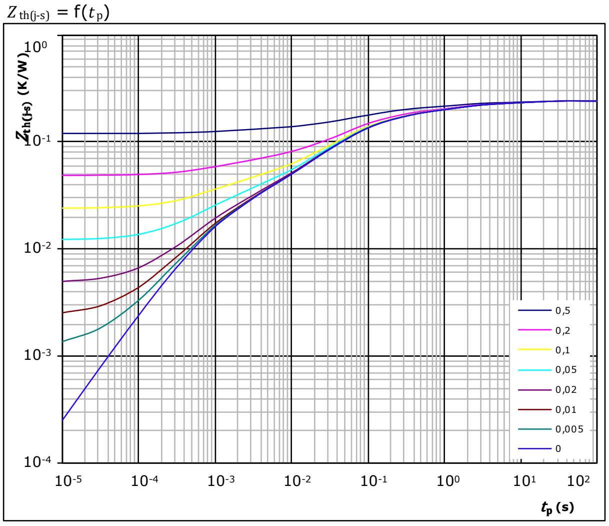
t_p = 250 µs

T_j: 25 °C; 125 °C; 150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j\text{-}s)} =$ 0,24 K/W

FWD thermal model values

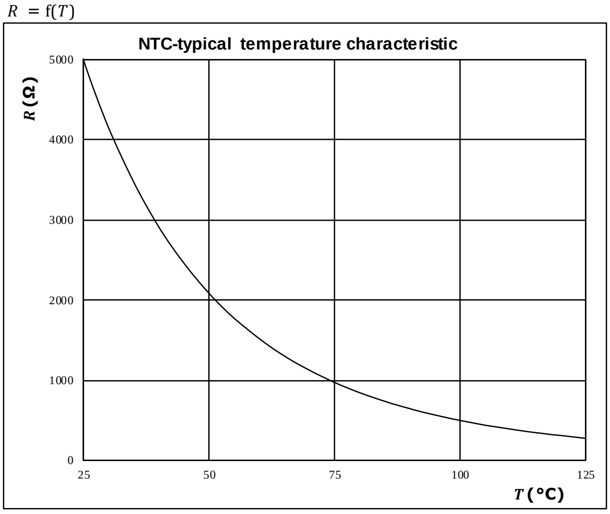
R (K/W)	τ (s)
2,40E-02	8,42E+00
4,53E-02	1,05E+00
4,48E-02	1,82E-01
8,94E-02	4,91E-02
2,01E-02	7,96E-03
1,62E-02	1,00E-03
2,70E-03	3,64E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic
as a function of temperature

$R = f(T)$

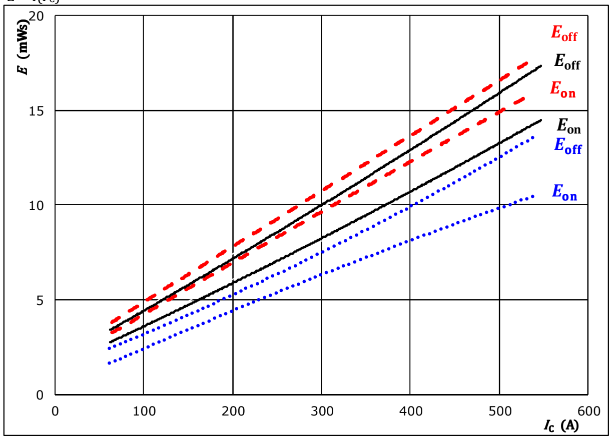


Half-Bridge Switch Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



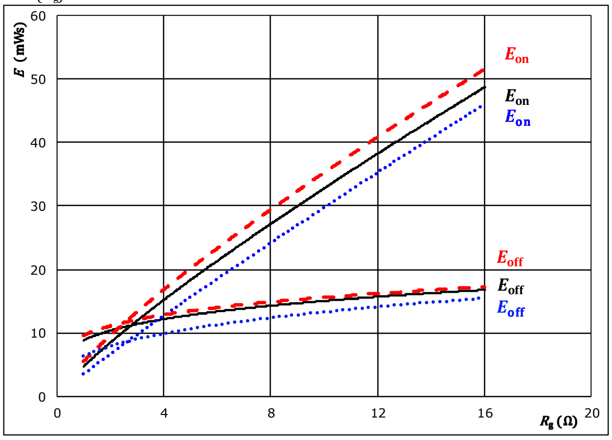
With an inductive load at

V_{CE} =	350	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

$E = f(R_g)$



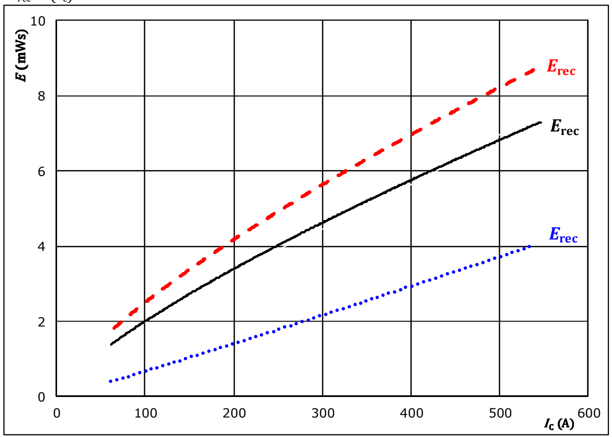
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C =	300	A		150 °C	dashed

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



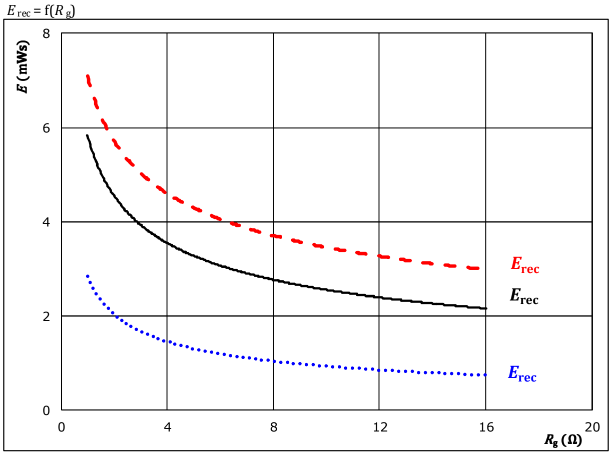
With an inductive load at

V_{CE} =	350	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

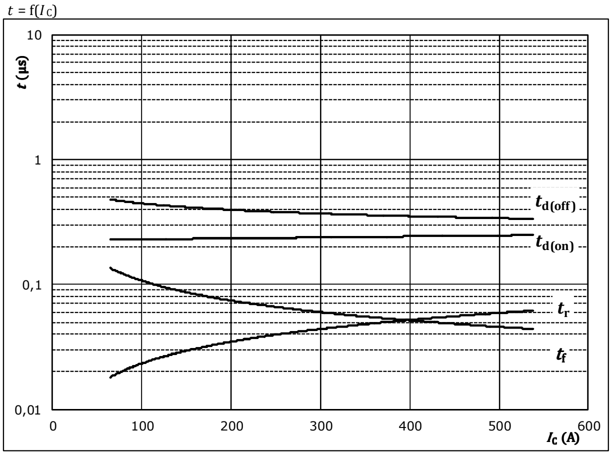
V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C =	300	A		150 °C	dashed

Half-Bridge Switch Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



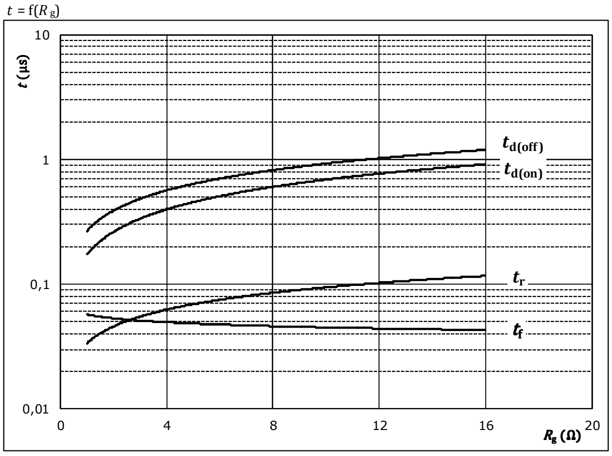
With an inductive load at

T_j =	150	°C
V_{CE} =	350	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

$t = f(R_g)$



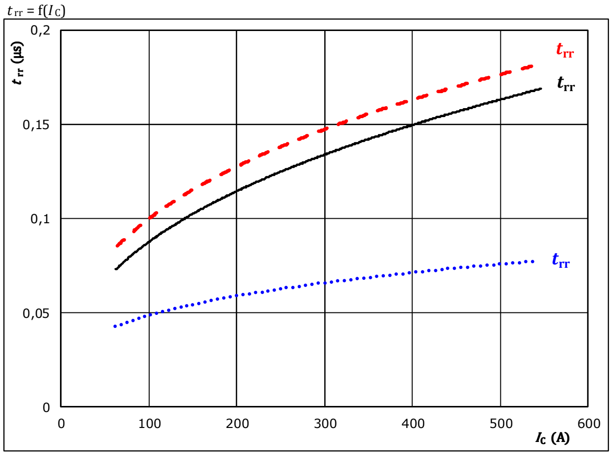
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	300	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

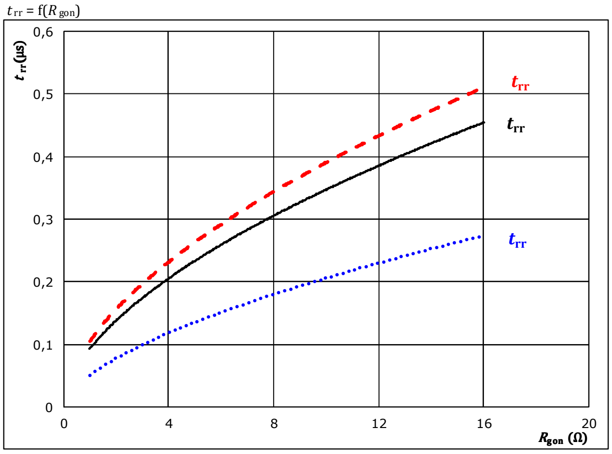


At					
V_{CE}=	350	V		25 °C	···········
V_{GE} =	±15	V	T_j:	125 °C	———
R_{gon} =	2	Ω		150 °C	– – –

figure 8. **FWD**

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

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



At					
V_{CE} =	350	V		25 °C	···········
V_{GE} =	±15	V	T_j:	125 °C	———
I_C =	300	A		150 °C	– – –

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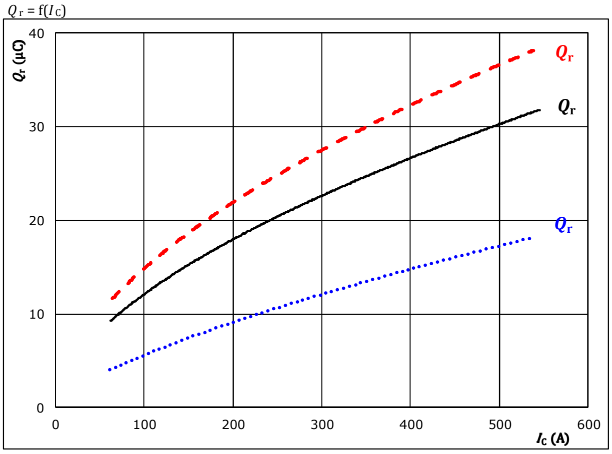
Half-Bridge Switch Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

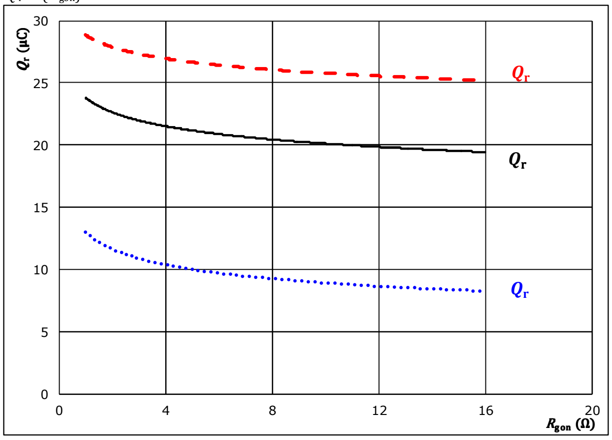


At					
V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	2	Ω		150 °C	dashed

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

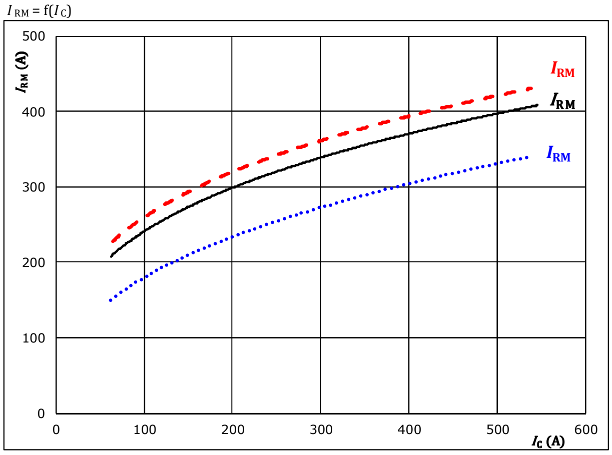


At					
V_{CE}=	350	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C=	300	A		150 °C	dashed

figure 11. **FWD**

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

$I_{RM} = f(I_C)$

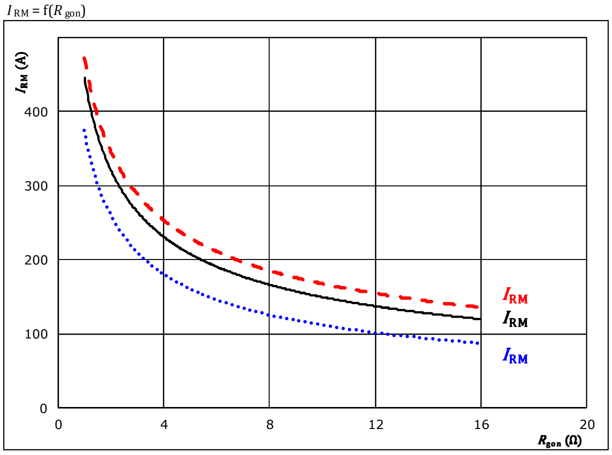


At					
V_{CE}:	350	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	2	Ω		150 °C	dashed

figure 12. **FWD**

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

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



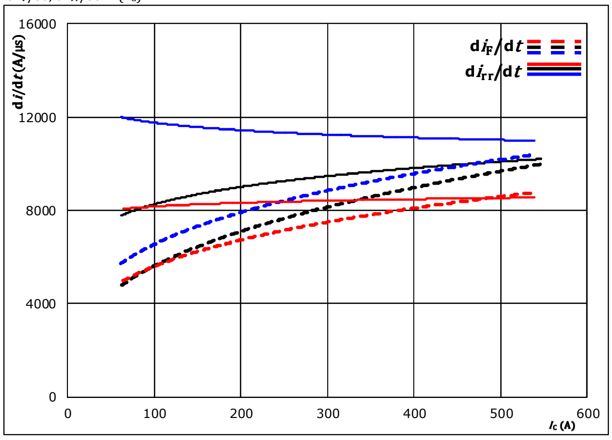
At					
V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C =	300	A		150 °C	dashed

Half-Bridge Switch Switching Characteristics

figure 13. **FWD**

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

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

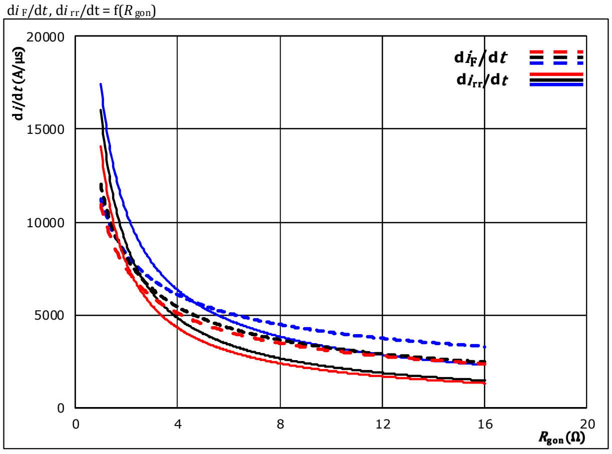


At				
V_{CE} =	350	V		25 °C
V_{GE} =	±15	V	T_j:	125 °C
R_{gon} =	2	Ω		150 °C

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

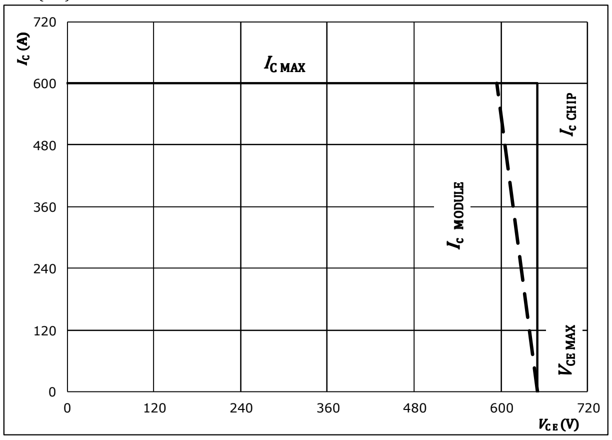


At				
V_{CE} =	350	V		25 °C
V_{GE} =	±15	V	T_j:	125 °C
I_C=	300	A		150 °C

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



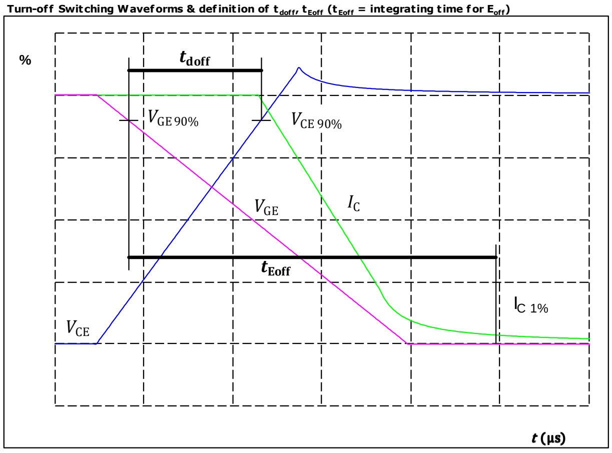
At		
T_j =	175	°C
R_{gon} =	2	Ω
R_{goff} =	2	Ω

Half-Bridge Switch Switching Definitions

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

figure 1. IGBT

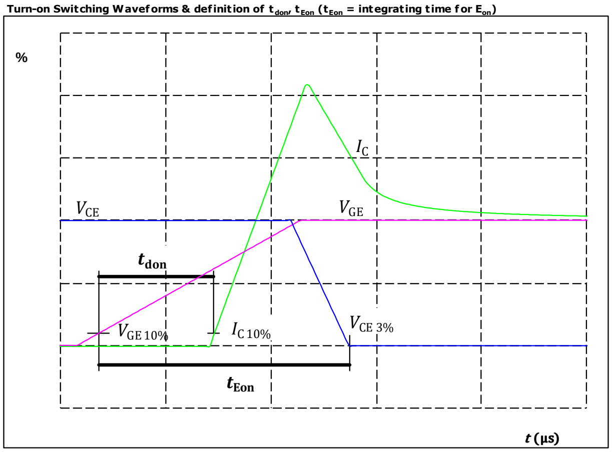
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	300	A
t_{doff} =	356	ns

figure 2. IGBT

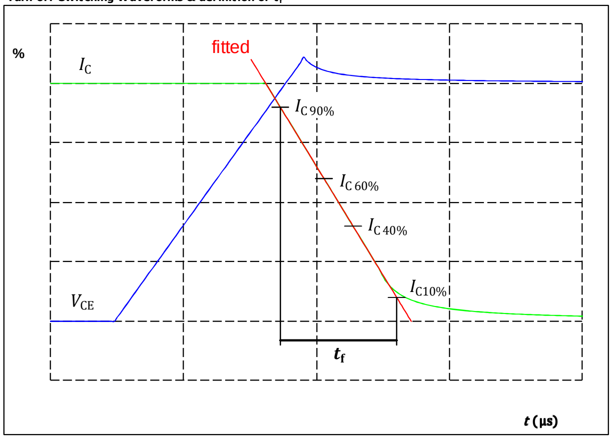
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	300	A
t_{don} =	240	ns

figure 3. IGBT

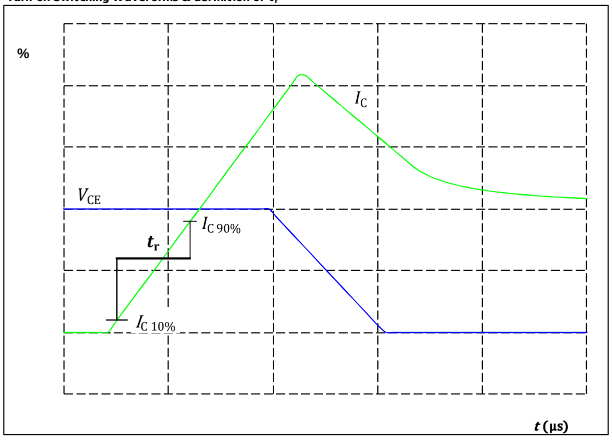
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	300	A
t_f =	52	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

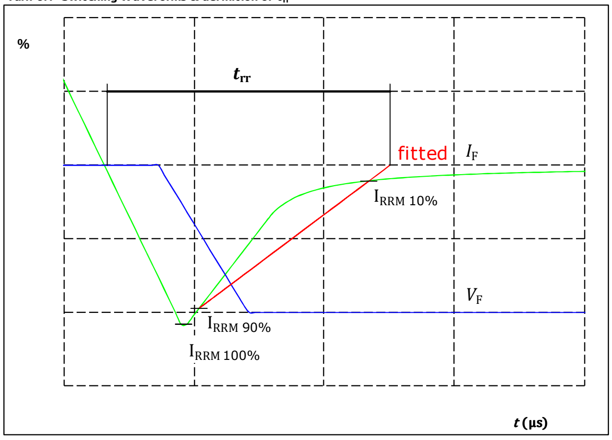


$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	300	A
t_r =	43	ns

Half-Bridge Switch Switching Characteristics

figure 5.	FWD

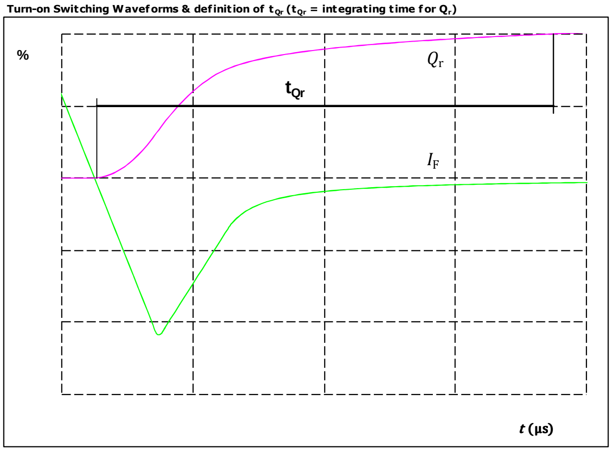
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	350	V
I_F (100%) =	300	A
I_{RRM} (100%) =	336	A
t_{rr} =	136	ns

figure 6.	FWD

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



I_F (100%) =	300	A
Q_r (100%) =	22,02	µC

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Ordering Code & Marking

Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M3072PA300SC-K836F30-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M3072PA300SC-K836F30-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M3072PA300SC-K836F30-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M3072PA300SC-K836F30-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M3072PA300SC-K836F30-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M3072PA300SC-K836F30-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M3072PA300SC-K836F30-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M3072PA300SC-K836F30-/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		

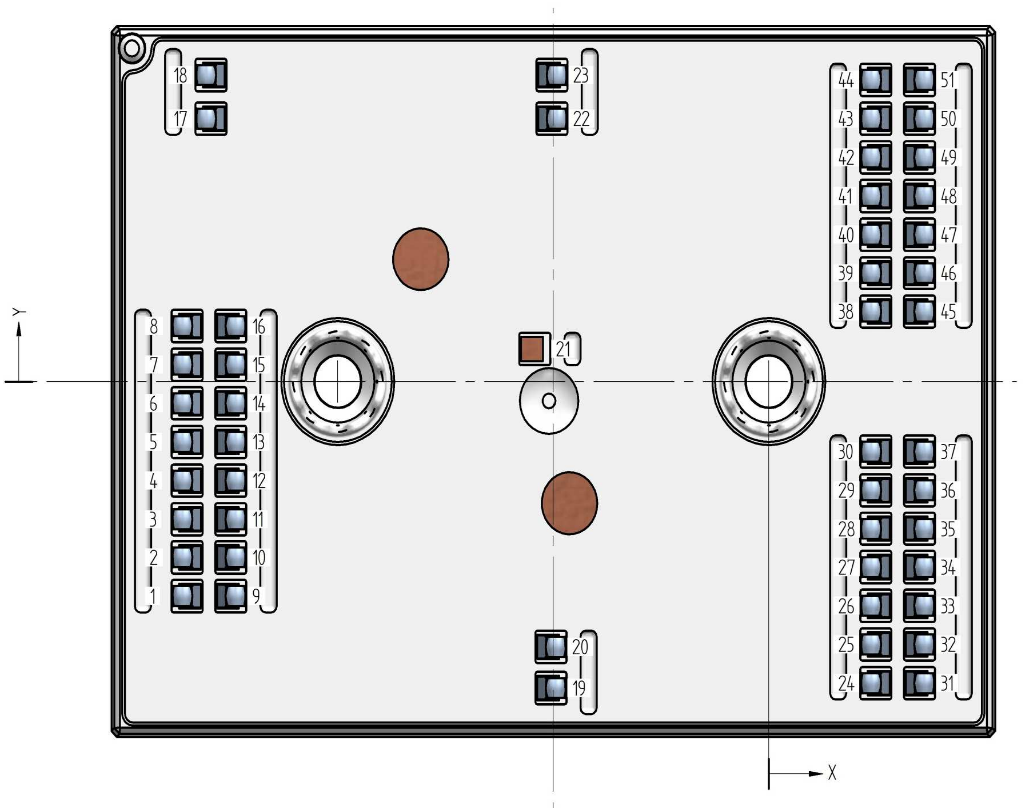
Outline

PCB pad table

Pin	X	Y	Function
1	-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

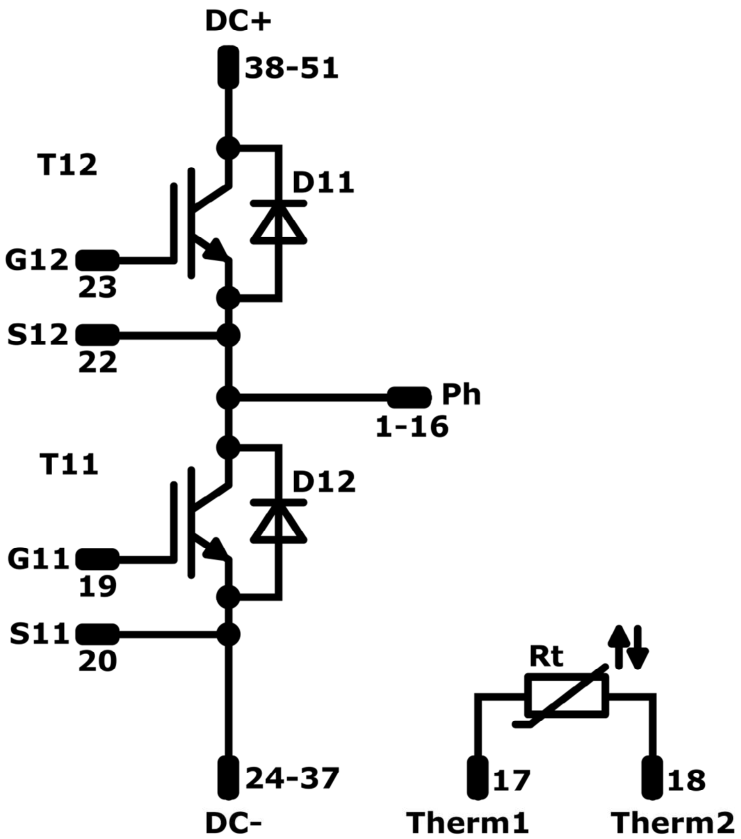
PCB pad table

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	650 V	300 A	Half-Bridge Switch - Lo side / Hi side	
D11, D12	FWD	650 V	300 A	Half-Bridge Diode - Lo side / Hi side	
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.

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-M3072PA300SC-K836F30-D2-14	25 May. 2018		