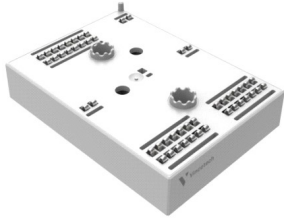
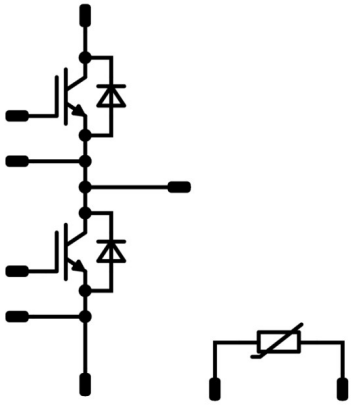




Vincotech

MiniSKiP® DUAL 3	1200 V / 400 A
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">Features</div> <ul style="list-style-type: none"> Half-bridge topology Trench IGBT and CAL diode chip technology Integrated NTC sensor Solderless spring contact mounting system 	<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">MiniSKiP® 3 housing</div> 
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">Target applications</div> <ul style="list-style-type: none"> Industrial Drives Power Supply Solar Inverters UPS 	<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">Schematic</div> 
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">Types</div> <ul style="list-style-type: none"> 80-M3122PA400SC-K830F40 	

Maximum Ratings

$T_j = 25\text{ °C}$, 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	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	436	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	1200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	1106	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$ $V_{CE} = 800\text{ V}$ $T_j = 150\text{ °C}$	10	µs
Maximum junction temperature	T_{jmax}		175	°C



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Maximum Ratings

$T_j = 25\text{ °C}$, 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	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	309	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	2200	A
Surge current capability	I^2t		24208	A ² s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	634	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* $t_p = 2\text{ s}$	5500	V
		AC Voltage $t_p = 1\text{ min}$	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



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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 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}								25200		pF
Reverse transfer capacitance	C_{res}	$f = 1$ Mhz	0	25		25			1080		
Gate charge	Q_g		15	none			25		3200		nC

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 2,5$ W/mK (HPTP)							0,09		K/W
-------------------------------------	---------------	----------------------------------------	--	--	--	--	--	--	------	--	-----

Dynamic

Turn-on delay time	$t_{d(on)}$						25 125 150		265 279 280		ns
Rise time	t_r	$R_{gon} = 2$ Ω $R_{goff} = 2$ Ω					25 125 150		51 55 59		
Turn-off delay time	$t_{d(off)}$						25 125 150		374 451 472		
Fall time	t_f		±15	600	400		25 125 150		51 102 129		
Turn-on energy (per pulse)*	E_{on}	$Q_{t-FWD} = 23,6$ µC $Q_{t-FWD} = 51,7$ µC $Q_{t-FWD} = 62,7$ µC					25 125 150		27,46 38,59 42,92		
Turn-off energy (per pulse)*	E_{off}						25 125 150		25,17 39,49 44,32		

* $L_s = 14$ nH



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Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
		V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max		

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

Static

Parameter	Symbol	V_{GS} [V]	V_{DS} [V]	I_D [A]	I_F [A]	T_j [°C]	Min	Typ	Max	Unit
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	μ A

Thermal

Parameter	Symbol	Conditions	Value	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 2,5$ W/mK (HPTP)	0,15	K/W

Dynamic

Parameter	Symbol	di/dt	V_{GS} [V]	V_{DS} [V]	I_D [A]	I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Peak recovery current	I_{RRM}						25 125 150		277 349 377		A
Reverse recovery time	t_{rr}						25 125 150		264 463 507		ns
Recovered charge	Q_r	$di/dt = 7742$ A/ μ s $di/dt = 7633$ A/ μ s $di/dt = 7094$ A/ μ s	± 15	600	400		25 125 150		23,64 51,72 62,67		μ C
Reverse recovered energy	E_{rec}						25 125 150		8,30 19,82 23,87		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$						25 125 150		8528 6150 5660		A/ μ s

Thermistor

Parameter	Symbol	Value	T_j [°C]	Min	Typ	Max	Unit
Rated resistance	R		25		5		k Ω
Deviation of R_{100}	$\Delta_{R/R}$	$R_{100} = 493 \Omega$	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	

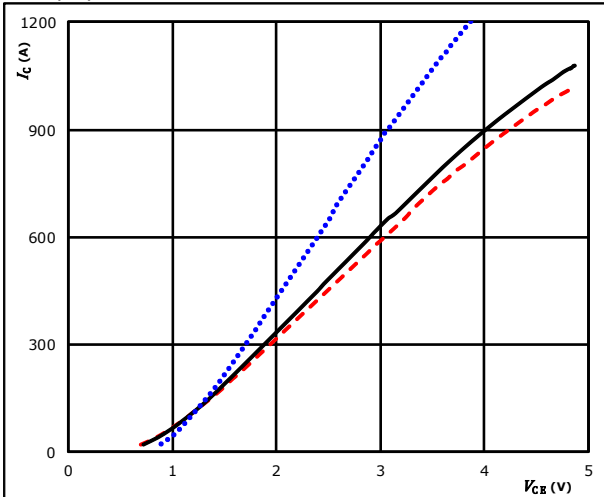


Half-Bridge Switch - Lo side / Half-Bridge Switch - Hi side Characteristics

figure 1. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

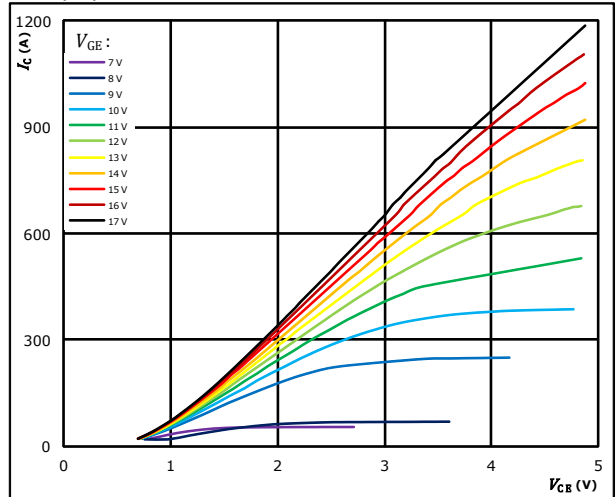


$t_p = 250 \mu\text{s}$
 $V_{GE} = 15 \text{ V}$
 $T_j: 25 \text{ }^\circ\text{C}$ (blue dotted)
 $125 \text{ }^\circ\text{C}$ (black solid)
 $150 \text{ }^\circ\text{C}$ (red dashed)

figure 2. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

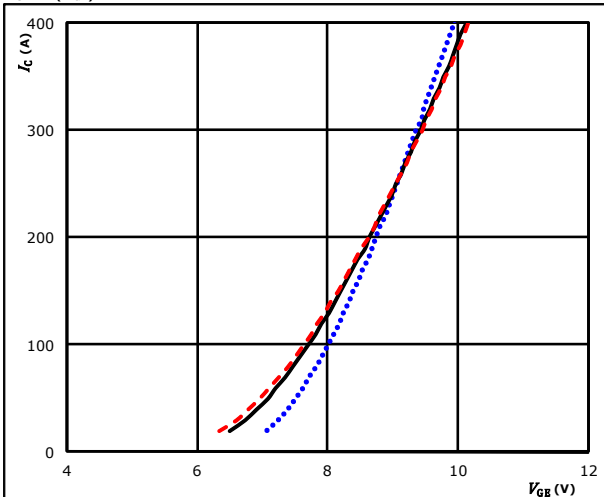


$t_p = 250 \mu\text{s}$
 $T_j = 125 \text{ }^\circ\text{C}$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$$I_C = f(V_{GE})$$

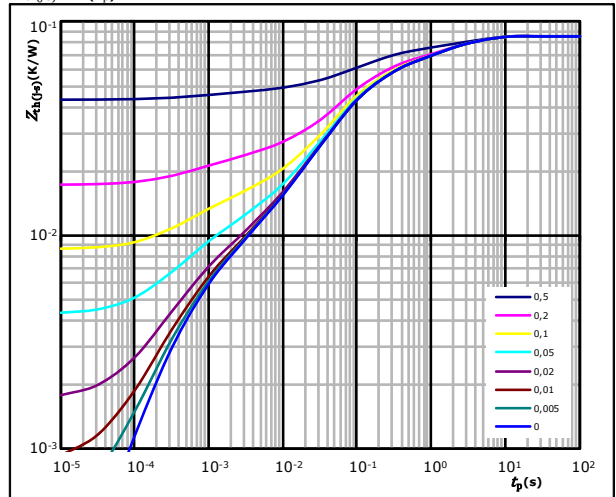


$t_p = 100 \mu\text{s}$
 $V_{CE} = 10 \text{ V}$
 $T_j: 25 \text{ }^\circ\text{C}$ (blue dotted)
 $125 \text{ }^\circ\text{C}$ (black solid)
 $150 \text{ }^\circ\text{C}$ (red dashed)

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



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



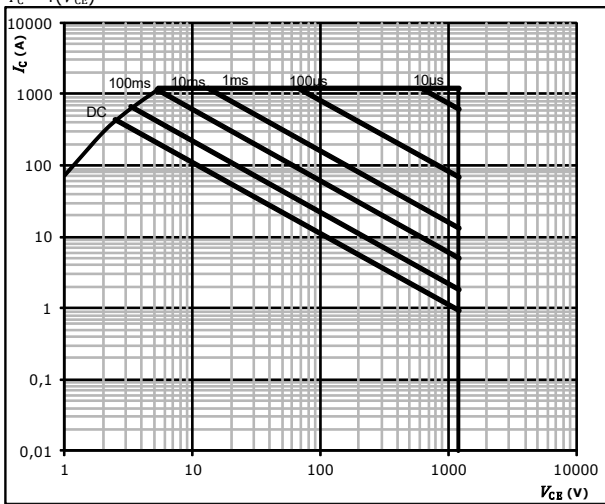
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Half-Bridge Switch - Lo side / Half-Bridge Switch - Hi side Characteristics

figure 5. IGBT

Safe operating area

$$I_C = f(V_{CE})$$



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



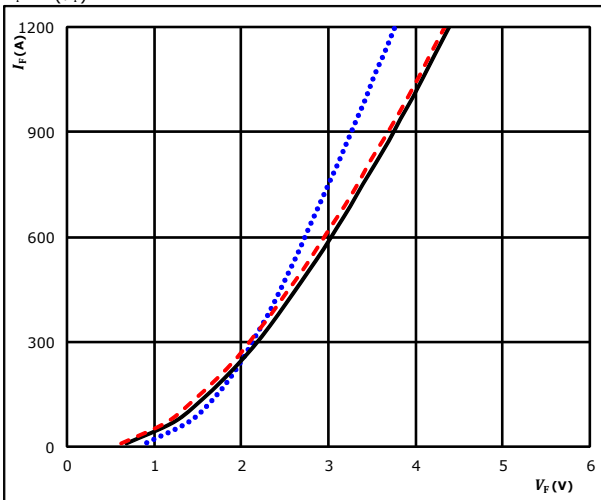
Vincotech

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

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

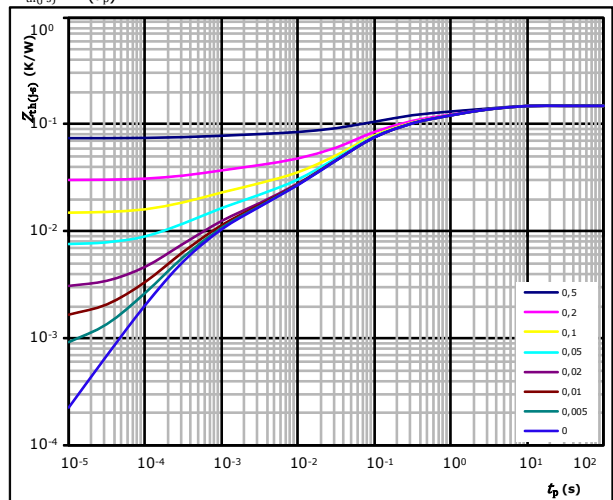


$t_p = 250 \mu s$
 T_j : 25 °C (blue dotted), 125 °C (black solid), 150 °C (red dashed)

figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 0,15 \text{ K/W}$

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

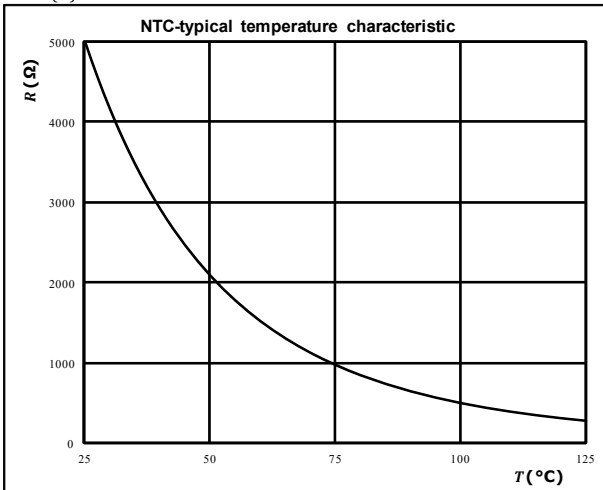


Thermistor Characteristics

figure 1. Thermistor

**Typical NTC characteristic
as a function of temperature**

$$R = f(T)$$

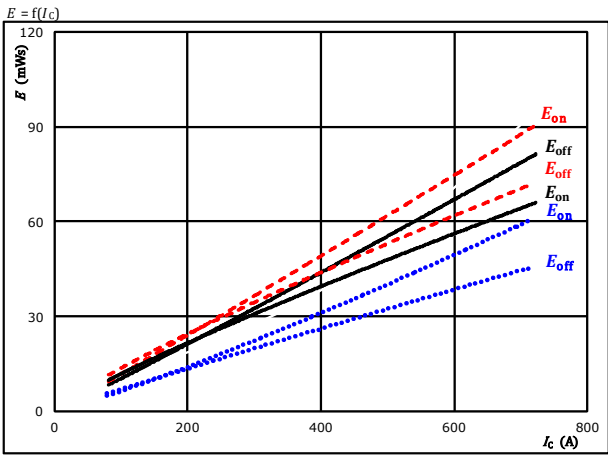




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Half-Bridge Switch - Lo side / Half-Bridge Switch - Hi side Switching Characteristics

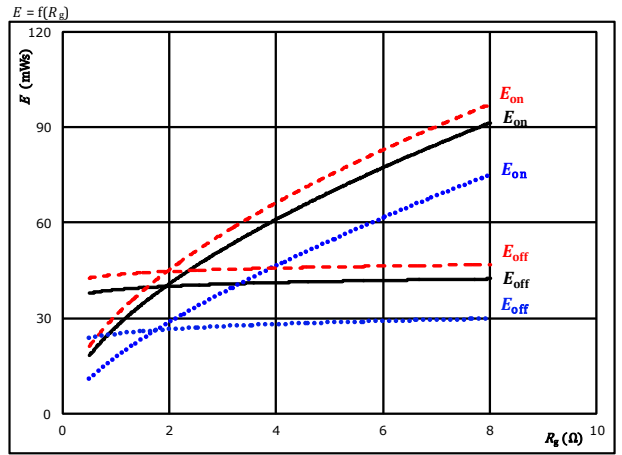
figure 1. IGBT
Typical switching energy losses as a function of collector current



With an inductive load at

$V_{CE} = 600$ V	$T_j = 25$ °C
$V_{GE} = \pm 15$ V	$T_j = 125$ °C	————
$R_{g\text{on}} = 2$ Ω	$T_j = 150$ °C	-----
$R_{g\text{off}} = 2$ Ω		

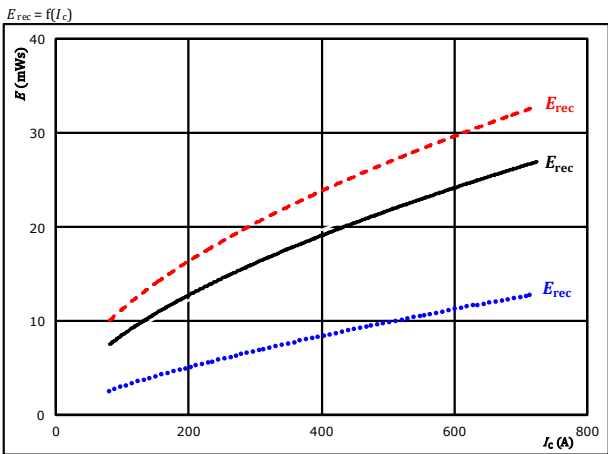
figure 2. IGBT
Typical switching energy losses as a function of gate resistor



With an inductive load at

$V_{CE} = 600$ V	$T_j = 25$ °C
$V_{GE} = \pm 15$ V	$T_j = 125$ °C	————
$I_C = 400$ A	$T_j = 150$ °C	-----

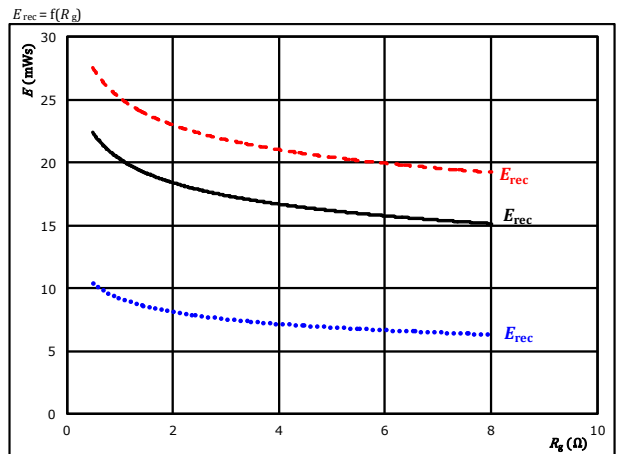
figure 3. FWD
Typical reverse recovered energy loss as a function of collector current



With an inductive load at

$V_{CE} = 600$ V	$T_j = 25$ °C
$V_{GE} = \pm 15$ V	$T_j = 125$ °C	————
$R_{g\text{on}} = 2$ Ω	$T_j = 150$ °C	-----

figure 4. FWD
Typical reverse recovered energy loss as a function of gate resistor



With an inductive load at

$V_{CE} = 600$ V	$T_j = 25$ °C
$V_{GE} = \pm 15$ V	$T_j = 125$ °C	————
$I_C = 400$ A	$T_j = 150$ °C	-----

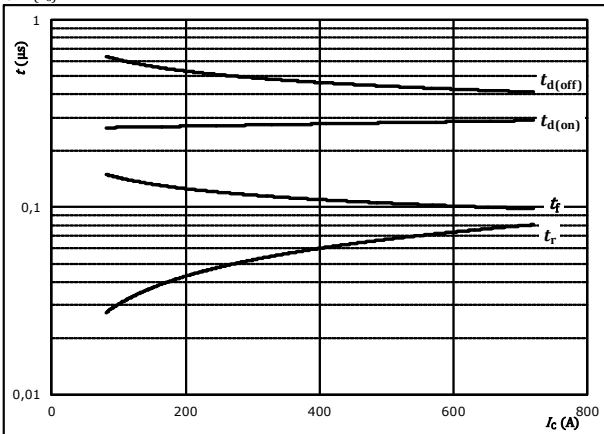


Half-Bridge Switch - Lo side / Half-Bridge Switch - Hi side Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$$t = f(I_c)$$



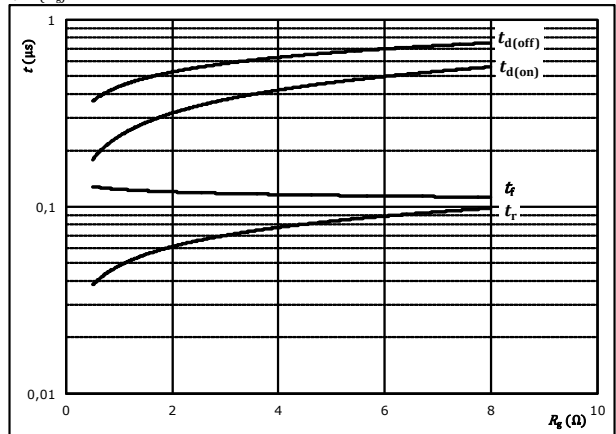
With an inductive load at

$T_j =$	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

$$t = f(R_g)$$



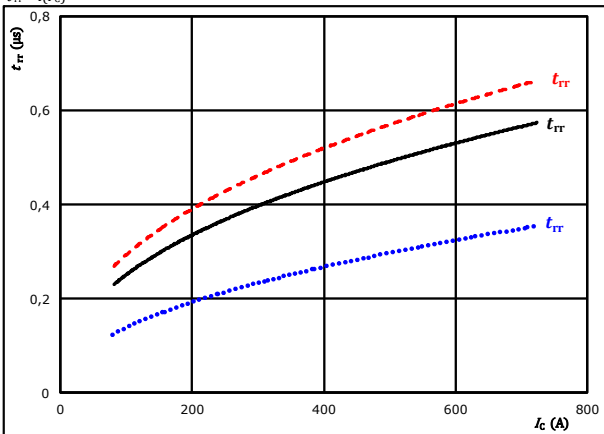
With an inductive load at

$T_j =$	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

$$t_{rr} = f(I_c)$$

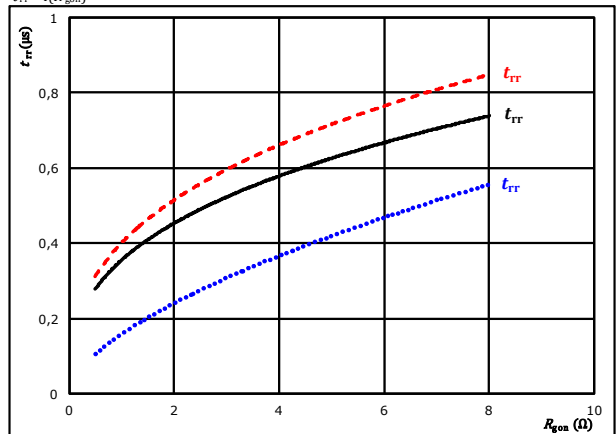


At	$V_{CE} =$	600	V	$T_j:$	25 °C
	$V_{GE} =$	±15	V		125 °C	————
	$R_{gon} =$	2	Ω		150 °C	- - - -

figure 8. FWD

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

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



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

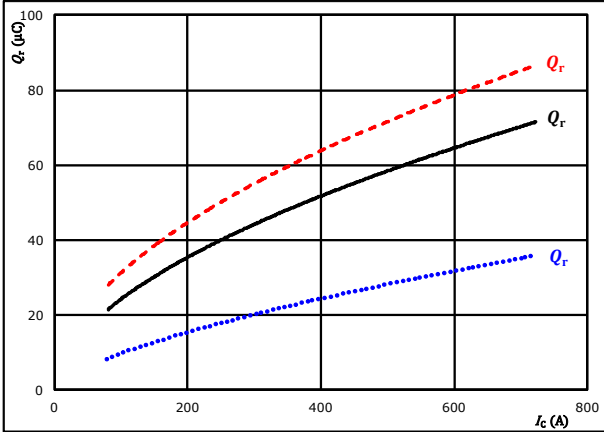


Half-Bridge Switch - Lo side / Half-Bridge Switch - Hi side Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

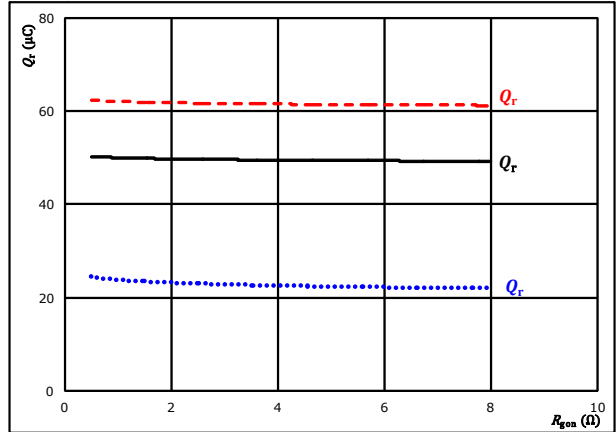


At $V_{CE} = 600$ V $T_j = 25$ °C $R_{g(on)} = 2$ Ω
 $V_{GE} = \pm 15$ V $T_j = 125$ °C
 $T_j = 150$ °C

figure 10. FWD

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

$$Q_r = f(R_{g(on)})$$

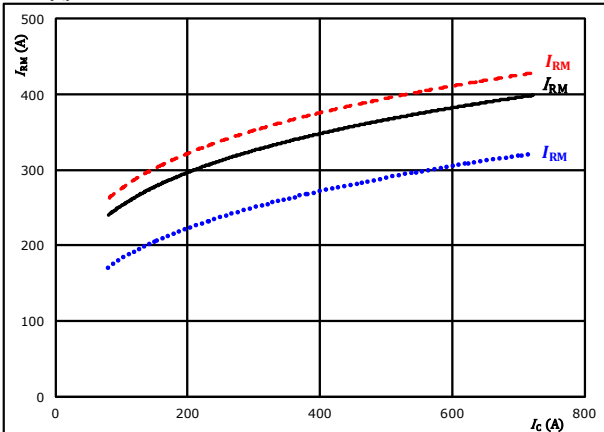


At $V_{CE} = 600$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C
 $I_c = 400$ A $T_j = 150$ °C

figure 11. FWD

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

$$I_{RM} = f(I_c)$$

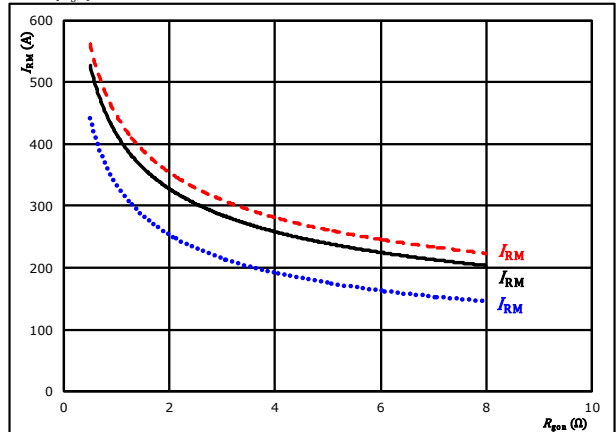


At $V_{CE} = 600$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C
 $R_{g(on)} = 2$ Ω $T_j = 150$ °C

figure 12. FWD

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

$$I_{RM} = f(R_{g(on)})$$



At $V_{CE} = 600$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C
 $I_c = 400$ A $T_j = 150$ °C

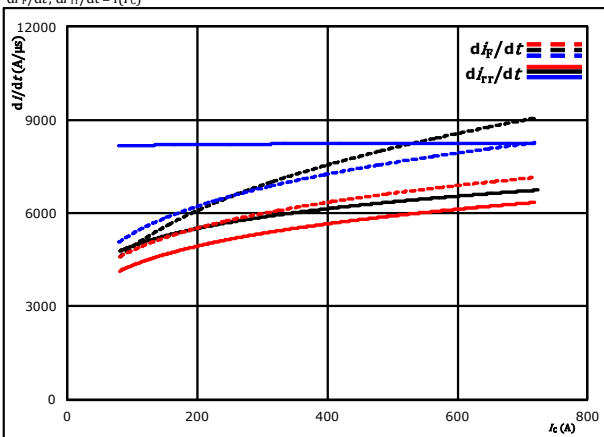


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Half-Bridge Switch - Lo side / Half-Bridge Switch - Hi side Switching Characteristics

figure 13. FWD

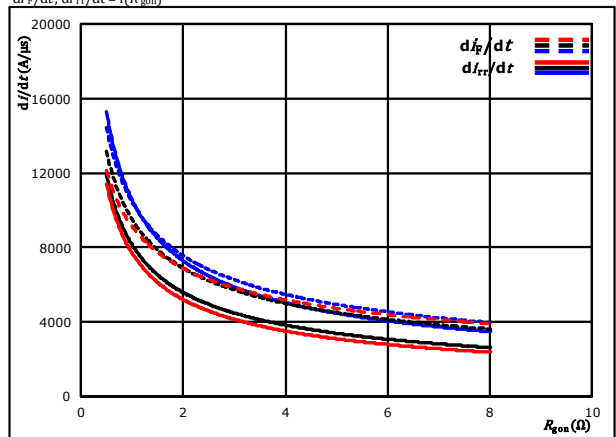
Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_F/dt, di_{rr}/dt = f(I_C)$



At $V_{CE} = 600$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C
 $R_{g(on)} = 2$ Ω $T_j = 150$ °C

figure 14. FWD

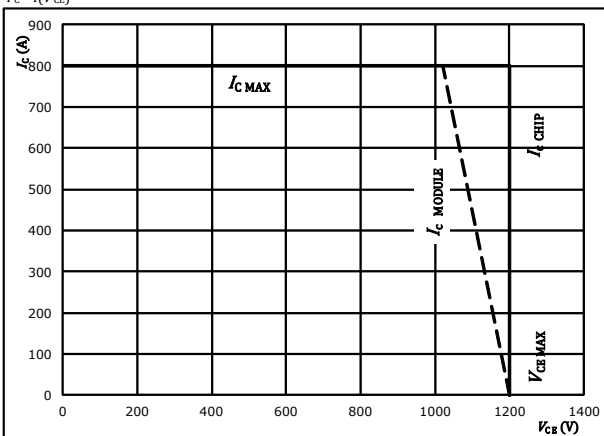
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
 $di_F/dt, di_{rr}/dt = f(R_{g(on)})$



At $V_{CE} = 600$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C
 $I_C = 400$ A $T_j = 150$ °C

figure 15. IGBT

Reverse bias safe operating area
 $I_C = f(V_{CE})$



At $T_j = 125$ °C
 $R_{g(on)} = 2$ Ω
 $R_{g(off)} = 2$ Ω

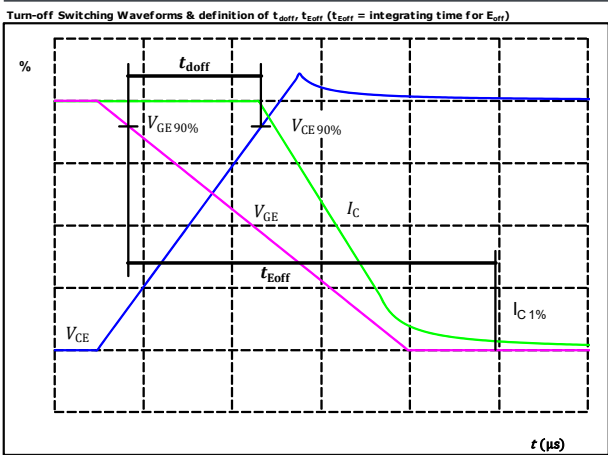


Half-Bridge Switch - Lo side / Half-Bridge Switch - Hi side Switching Definitions

General conditions

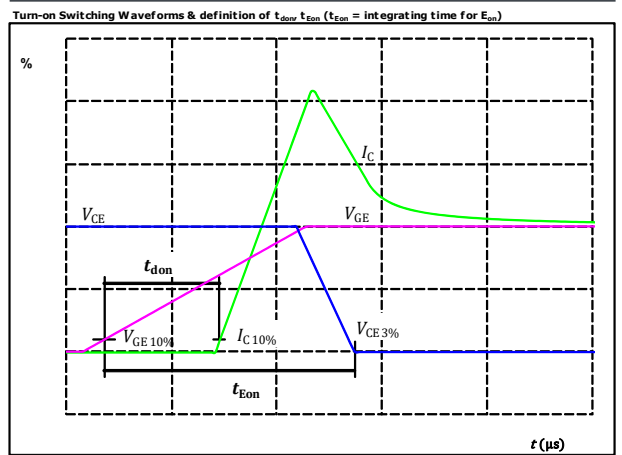
T_j	=	125 °C
R_{gon}	=	2 Ω
R_{goff}	=	2 Ω

figure 1. IGBT



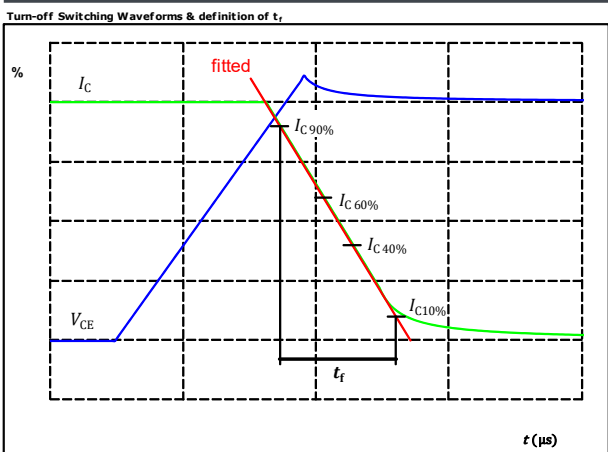
$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	600	V
$I_C(100\%) =$	400	A
$t_{doff} =$	451	ns

figure 2. IGBT



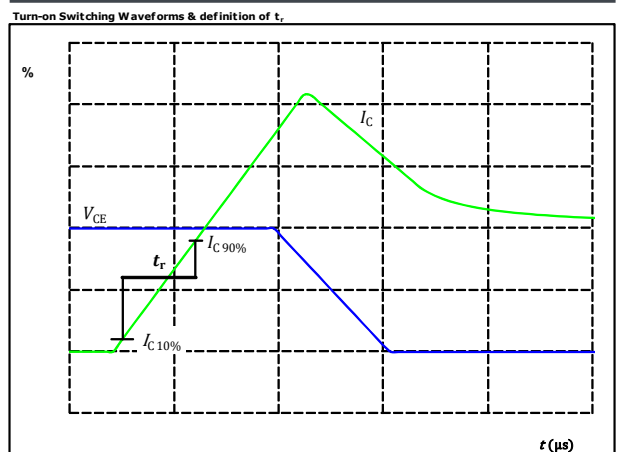
$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	600	V
$I_C(100\%) =$	400	A
$t_{don} =$	279	ns

figure 3. IGBT



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

figure 4. IGBT



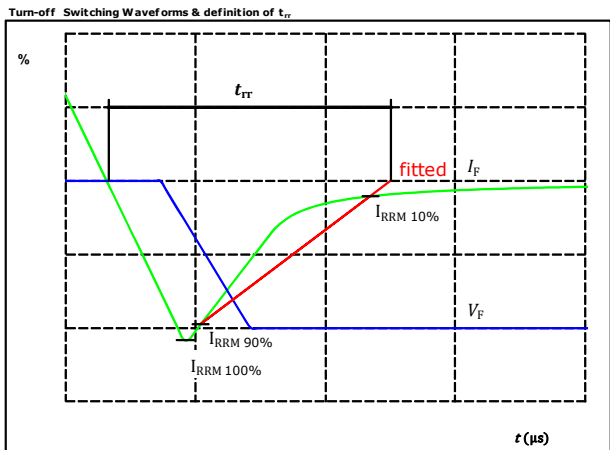
$V_C(100\%) =$	600	V
$I_C(100\%) =$	400	A
$t_r =$	55	ns



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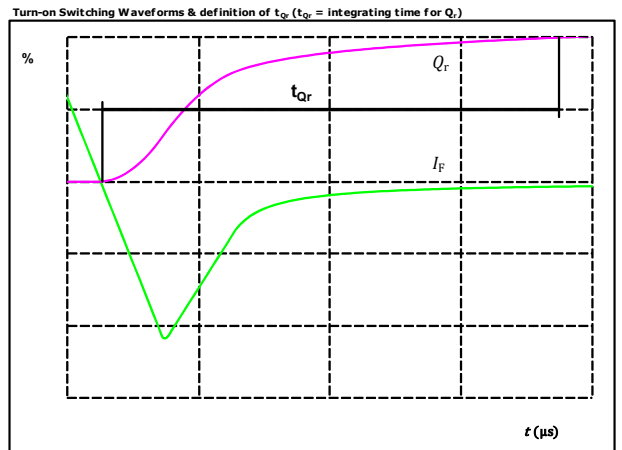
Half-Bridge Switch - Lo side / Half-Bridge Switch - Hi side Switching Definitions

figure 5. FWD



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


figure 6. FWD

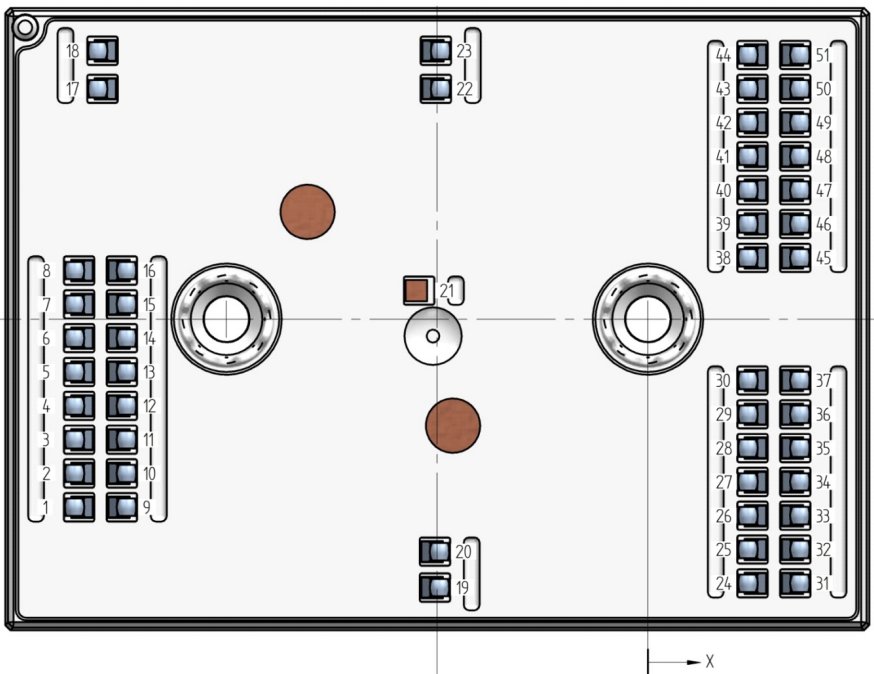


$I_F(100\%) =$	400	A
$Q_r(100\%) =$	51,72	μC



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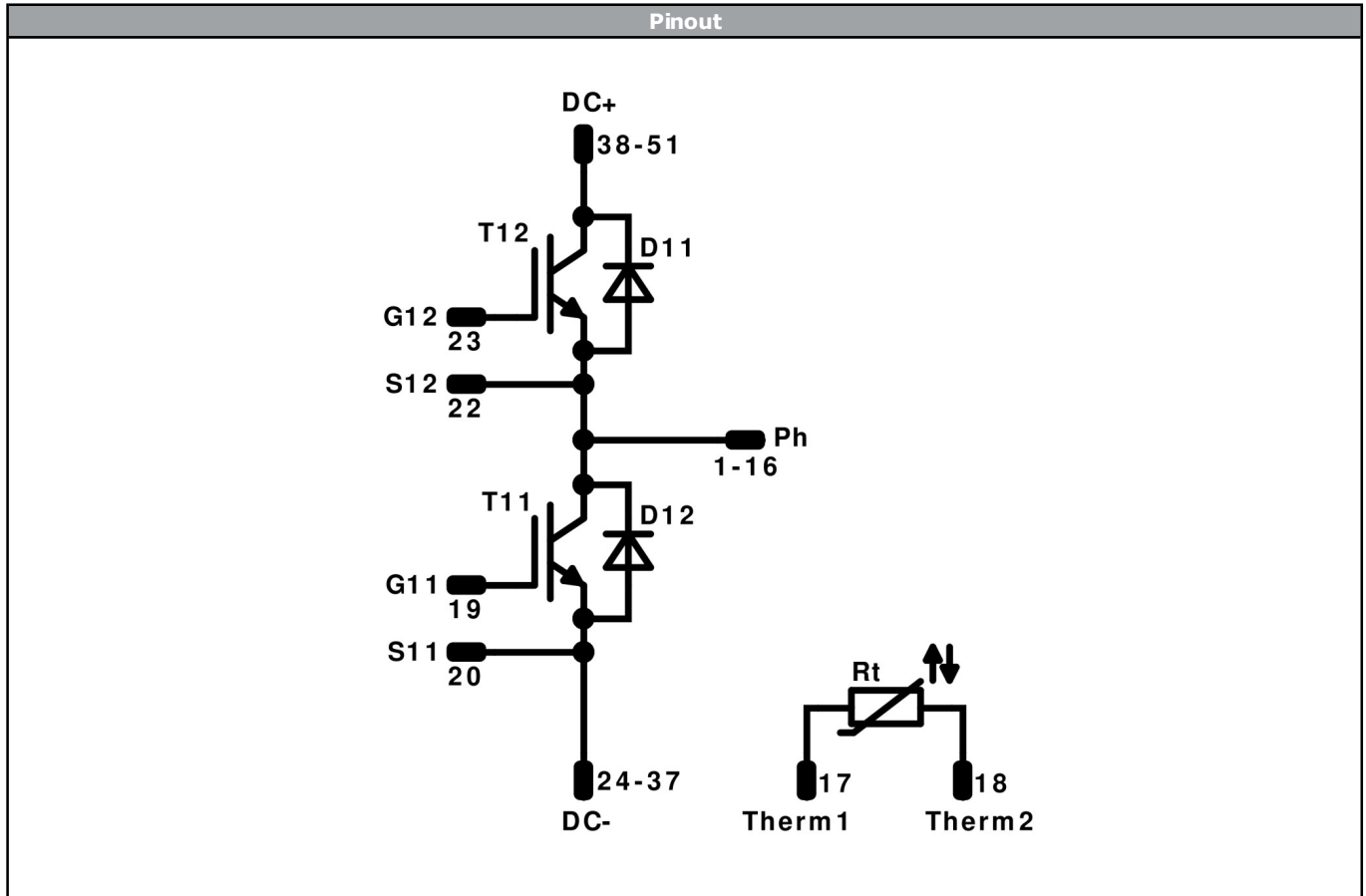
Ordering Code & Marking						
Version			Ordering Code			
With std lid (6.5mm height) + no thermal grease			80-M3122PA400SC-K830F40-/0A/			
With thin lid (2.8mm height) + no thermal grease			80-M3122PA400SC-K830F40-/0B/			
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)			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/			
 NN-NNNNNNNNNNNNNN TTTTITVW WYYY UL VIN LLLLL SSSS	Text	Name	Date code	UL & VIN	Lot	Serial
	Datamatrix	NN-NNNNNNNNNNNNNN- TTTTITVW Type&Ver TTTTITVW Lot number LLLLL	W W Y Y	UL VIN	LLLLL	SSSS

PCB pad table								Outline	
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



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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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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-D3-14	08 Mar. 2019	Correction of I _c /I _f values	1,2

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