80-M2126PA050M7-K718F70
datasheet

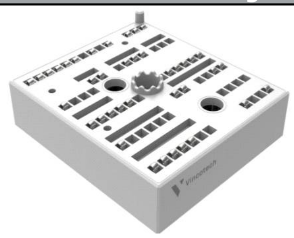
Vincotech

MiniSKiiP® PACK 2	1200 V / 50 A

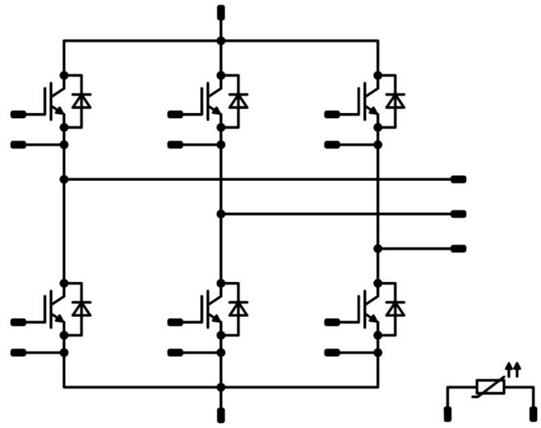
Features

- IGBT M7 with low V_{CEsat} and improved EMC bahavior
- Sloder-free spring contact technology
- Bultin PTC

MiniSKiiP® housing



Schematic



Target applications

- Industrial Drives

Types

- 80-M2126PA050M7-K718F70

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C		50	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	100	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	153	W
Gate-emitter voltage	V_{GES}		±20	V
Maximum junction temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F		50	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	100	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	104	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 s	5500	V
		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
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,005	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	25 125 150		1,55 1,77 1,83	1,9	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			90	µA
Gate-emitter leakage current	I_{GES}		15	0		25			500	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	10	0	10		25		10000		pF
Output capacitance	C_{oes}							350		
Reverse transfer capacitance	C_{res}							130		
Gate charge	Q_g		15	600	50	25		410		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,62		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 8 Ω R_{gon} = 8 Ω	±15	600	48	25 125 150		176 176 190		ns
Rise time	t_r					25 125 150		52 58 60		
Turn-off delay time	$t_{d(off)}$					25 125 150		206 229 241		
Fall time	t_f					25 125 150		92 123 122		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 4,59 µC Q_{rFWD} = 7,1 µC Q_{rFWD} = 8 µC				25 125 150		4,82 6,38 6,25		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		2,98 4,25 5,03		

Characteristic Values

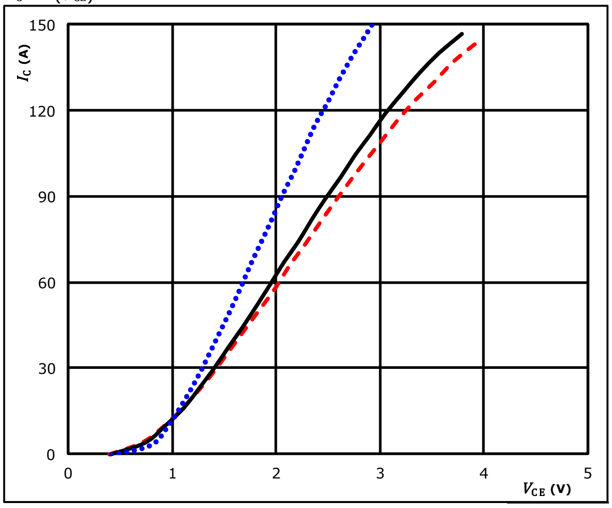
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Diode										
Static										
Forward voltage	V_F				50	25 125 150		1,66 1,78 1,79	2,15	V
Reverse leakage current	I_R			1200		25			50	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,91		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 388 A/µs di/dt = 450 A/µs di/dt = 498 A/µs	±15	600	48	25 125 150		29 33 33		A
Reverse recovery time	t_{rr}					25 125 150		339 435 511		ns
Recovered charge	Q_r					25 125 150		4,93 7,08 8,04		µC
Reverse recovered energy	E_{rec}					25 125 150		1,79 2,59 3,33		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		195 128 114		A/µs
Thermistor										
Rated resistance	R					25		1		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1670 Ω				100	-2		+2	%
R_{100}	R					100		1670		Ω
Power dissipation constant						25		0,76		mW/K
A-value	$A_{(25/50)}$					25		$7,635 \cdot 10^{-3}$		1/K
B-value	$B_{(25/100)}$					25		$1,731 \cdot 10^{-5}$		1/K²
Vincotech PTC Reference									E	

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

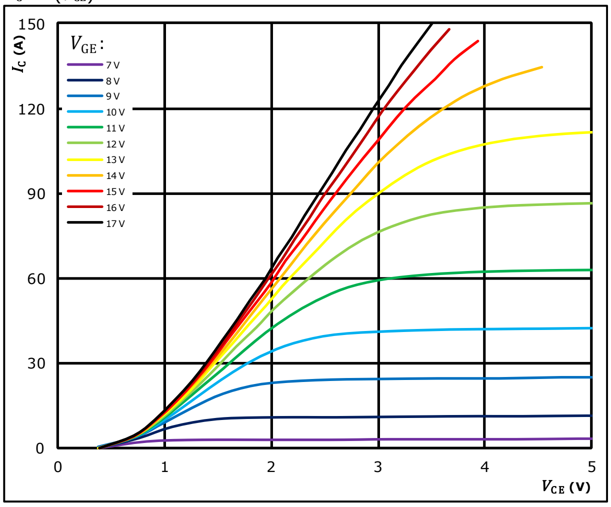


t_p =	250	µs		25 °C	············
V_{GE} =	15	V	T_j:	125 °C	——
				150 °C	– – –

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



t_p = 250 µs

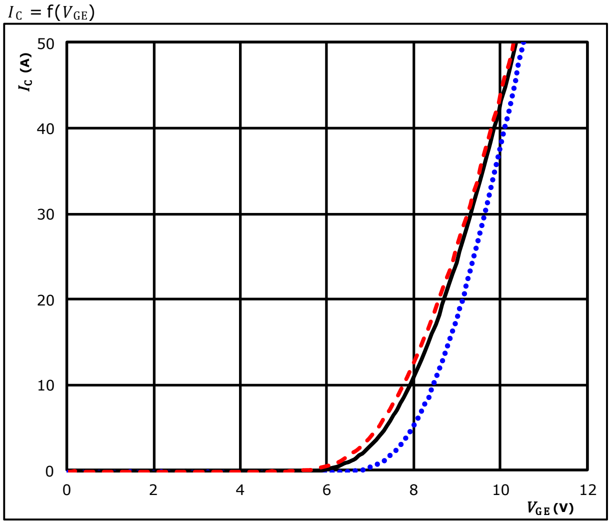
T_j = 150 °C

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

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

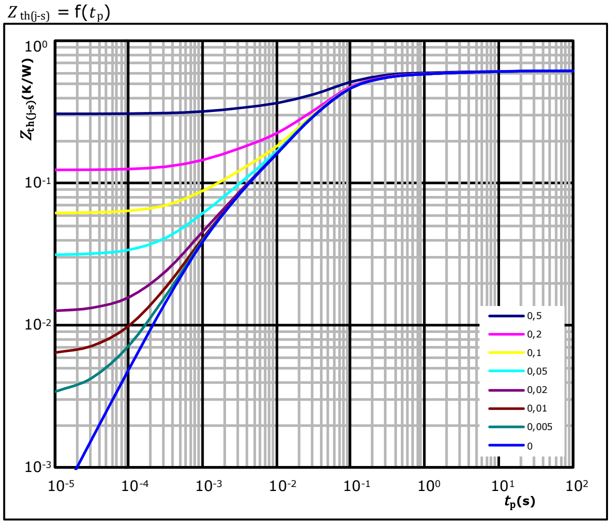


t_p =	100	µs		25 °C	············
V_{CE} =	10	V	T_j:	125 °C	——
				150 °C	– – –

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T

$R_{th(j-s)}$ = 0,62 K/W

IGBT thermal model values

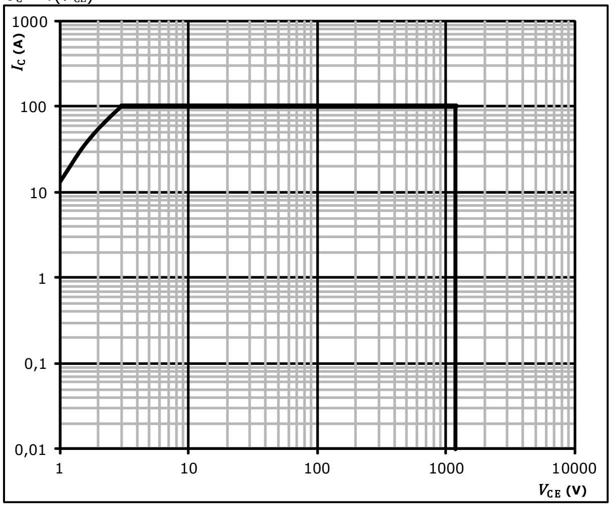
R (K/W)	τ (s)
2,32E-02	4,64E+00
4,34E-02	3,95E-01
1,15E-01	7,05E-02
3,33E-01	2,36E-02
6,22E-02	4,58E-03
4,17E-02	7,04E-04
2,88E-03	3,40E-04

Inverter Switch Characteristics

figure 5.	IGBT

Safe operating area

$I_C = f(V_{CE})$



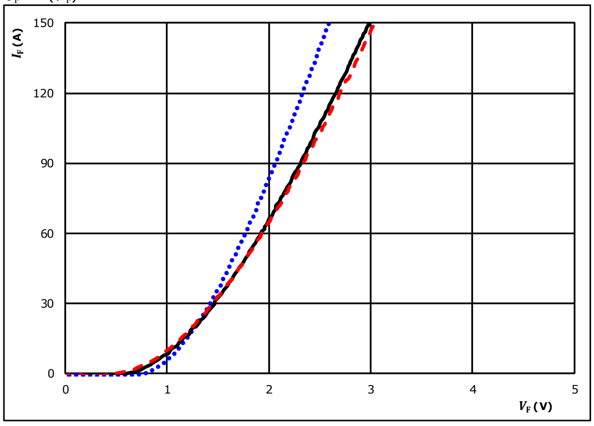
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Inverter Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

I_F = f(V_F)



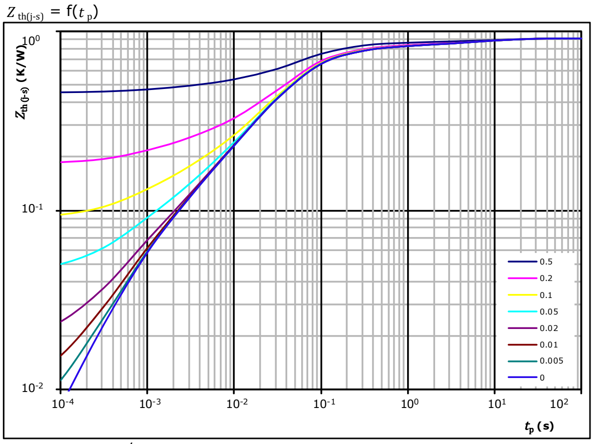
t_p = 250 µs

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

$R_{th(j-s)}$ = 0,91 K/W

FWD thermal model values

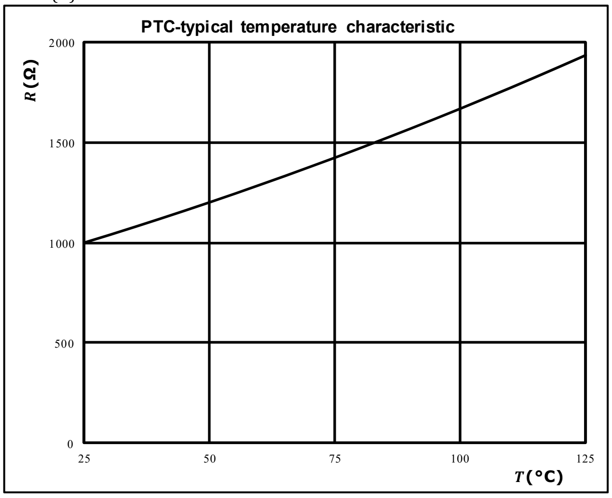
R (K/W)	τ (s)
8,48E-02	5,83E+00
9,67E-02	3,26E-01
4,29E-01	4,85E-02
1,97E-01	1,77E-02
6,32E-02	2,88E-03
3,90E-02	5,73E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical PTC characteristic as a function of temperature

R = f(T)

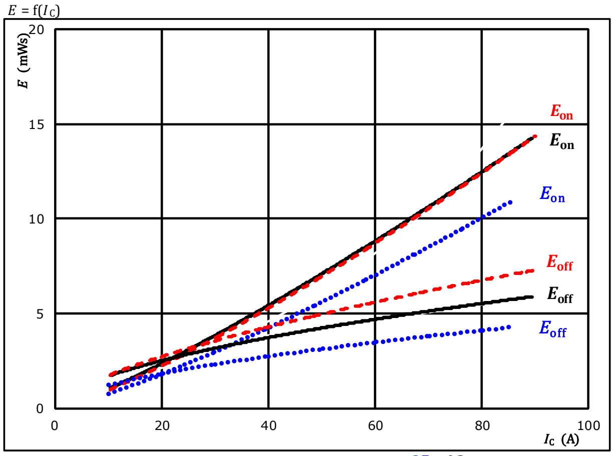


Inverter Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



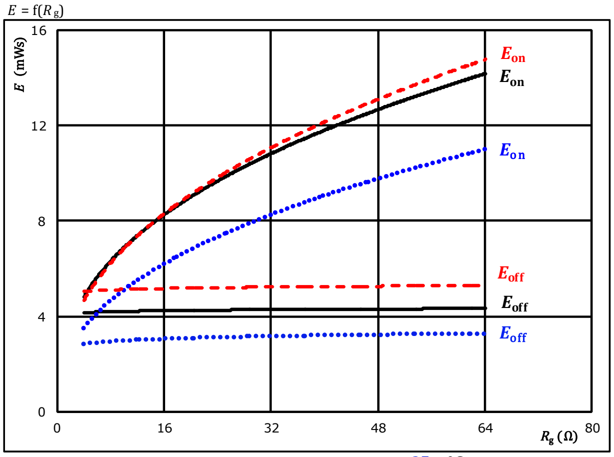
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C (dotted)
V_{GE} =	±15	V		125 °C (solid)
R_{gon} =	8	Ω		150 °C (dashed)
R_{goff} =	8	Ω		

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



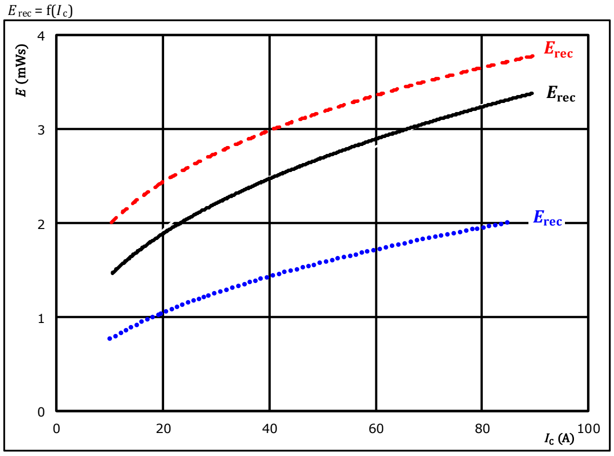
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C (dotted)
V_{GE} =	±15	V		125 °C (solid)
I_C =	48	A		150 °C (dashed)

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_c)$



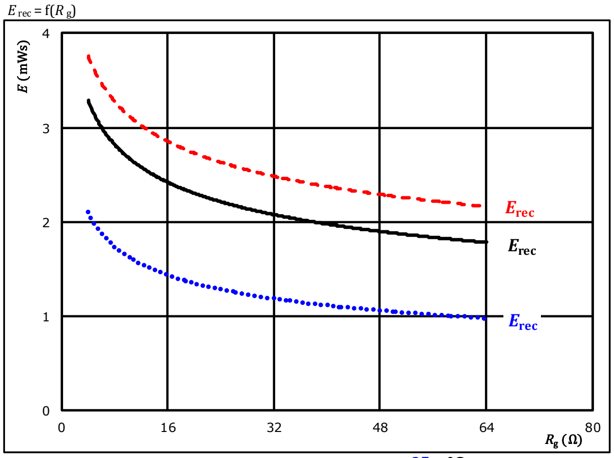
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C (dotted)
V_{GE} =	±15	V		125 °C (solid)
R_{gon} =	8	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

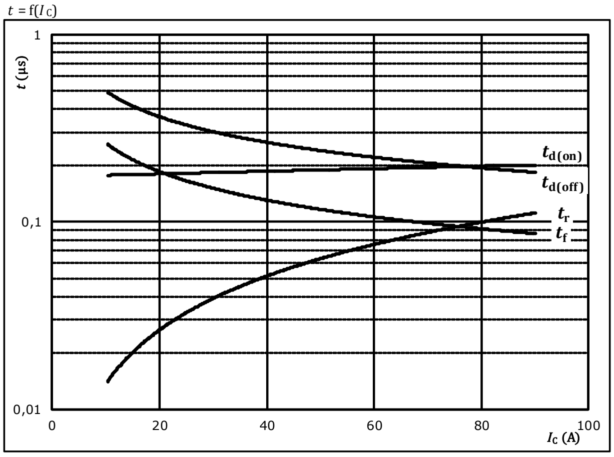
V_{CE} =	600	V	T_j:	25 °C (dotted)
V_{GE} =	±15	V		125 °C (solid)
I_C =	48	A		150 °C (dashed)

Inverter Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



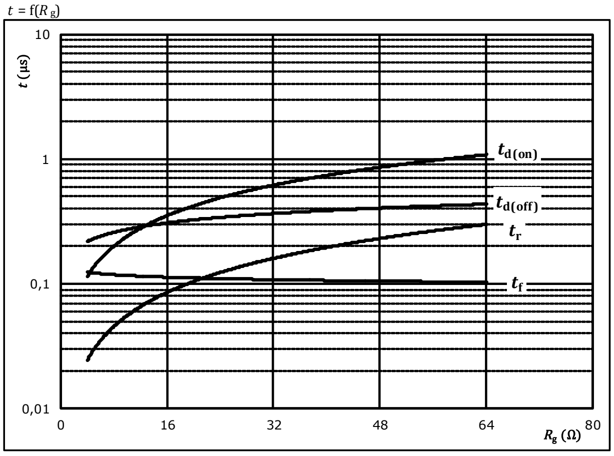
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



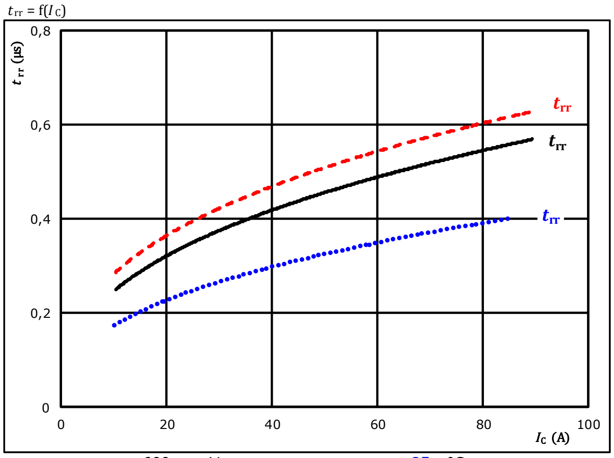
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	48	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

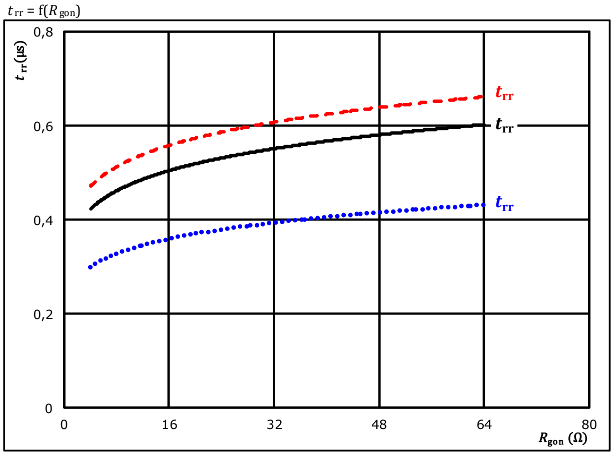


At					
V_{CE} =	600	V		25 °C	···········
V_{GE} =	±15	V	T_j:	125 °C	———
R_{gon} =	8	Ω		150 °C	– – –

figure 8. **FWD**

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

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



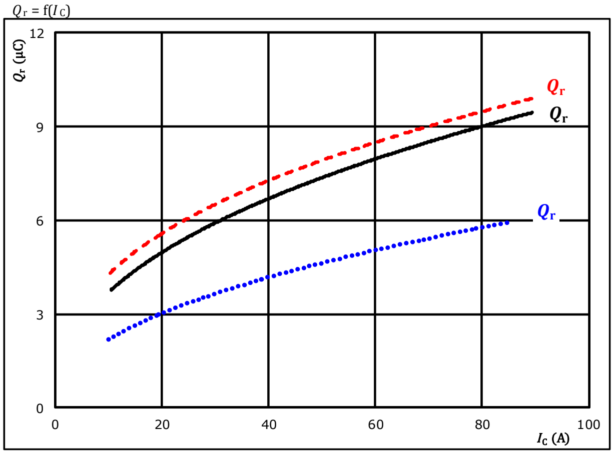
At					
V_{CE} =	600	V		25 °C	···········
V_{GE} =	±15	V	T_j:	125 °C	———
I_C =	48	A		150 °C	– – –

Inverter Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

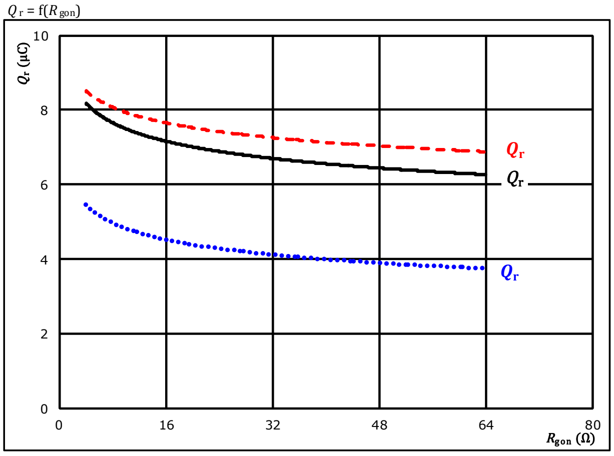


At						
	V_{CE} =	600	V	T_j:	25 °C	dotted
	V_{GE} =	±15	V		125 °C	solid
	R_{gon} =	8	Ω		150 °C	dashed

figure 10. FWD

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

$Q_r = f(R_{gon})$

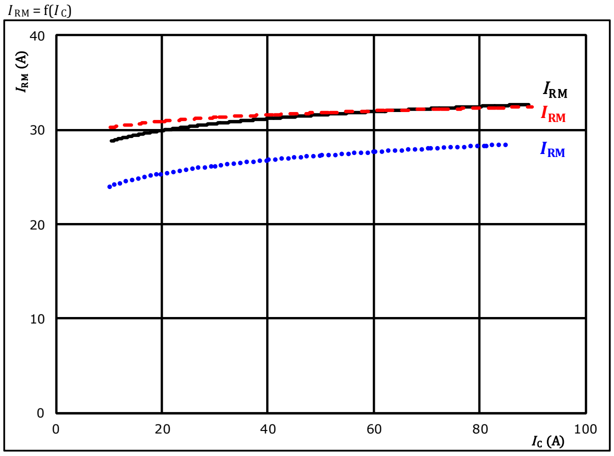


At						
	V_{CE} =	600	V	T_j:	25 °C	dotted
	V_{GE} =	±15	V		125 °C	solid
	I_C =	48	A		150 °C	dashed

figure 11. FWD

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

$I_{RM} = f(I_C)$

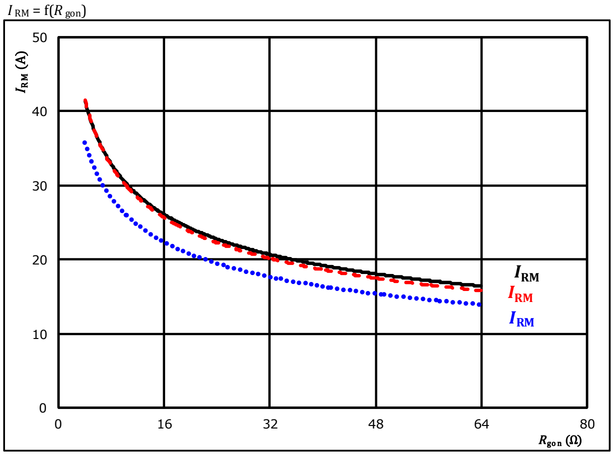


At						
	V_{CE} :	600	V	T_j:	25 °C	dotted
	V_{GE} =	±15	V		125 °C	solid
	R_{gon} =	8	Ω		150 °C	dashed

figure 12. FWD

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

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



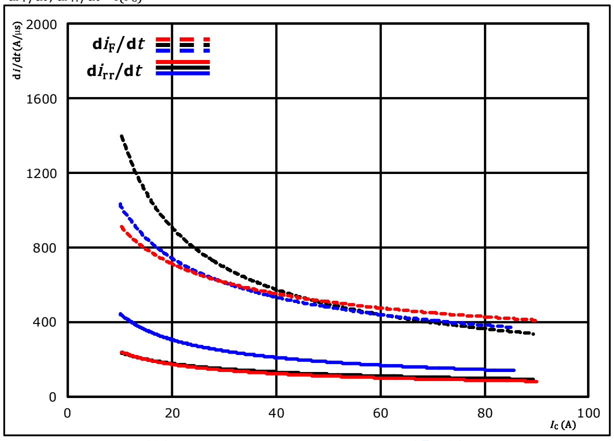
At						
	V_{CE} =	600	V	T_j:	25 °C	dotted
	V_{GE} =	±15	V		125 °C	solid
	I_C =	48	A		150 °C	dashed

Inverter 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)

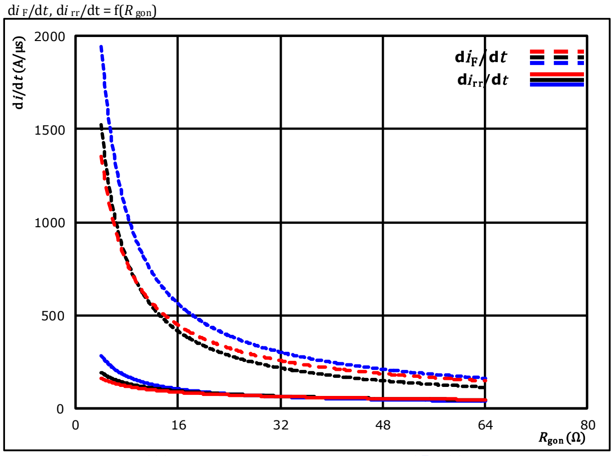


At					
V_{CE} =	600	V		25	°C
V_{GE} =	±15	V	T_j:	125	°C
R_{gon} =	8	Ω		150	°C

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})

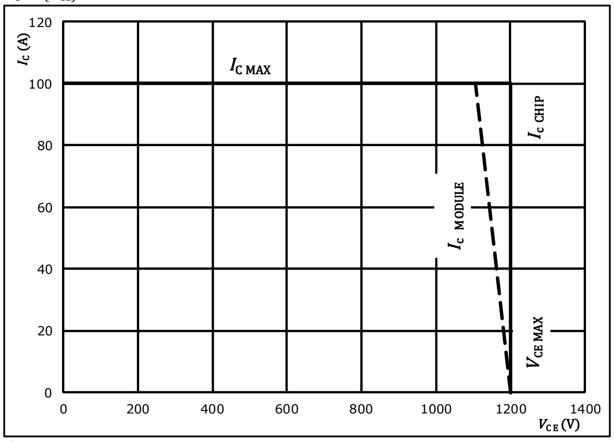


At					
V_{CE} =	600	V		25	°C
V_{GE} =	±15	V	T_j:	125	°C
I_C=	48	A		150	°C

figure 15. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At		
T_j =	175	°C
R_{gon} =	8	Ω
R_{goff} =	8	Ω

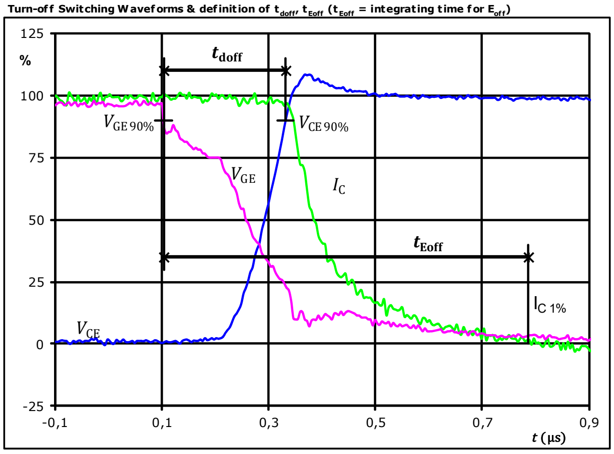
Inverter Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

figure 1. IGBT

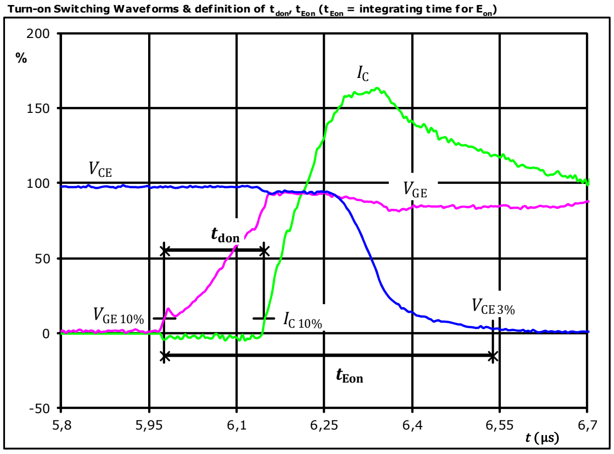
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	51	A
t_{doff} =	0,229	µs
t_{Eoff} =	0,683	µs

figure 2. IGBT

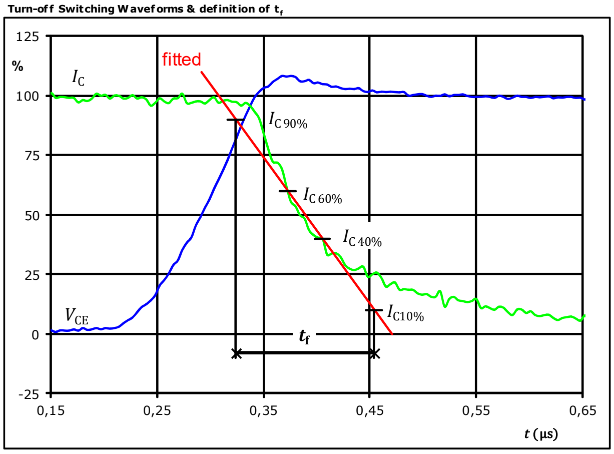
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	51	A
t_{don} =	0,176	µs
t_{Eon} =	0,561	µs

figure 3. IGBT

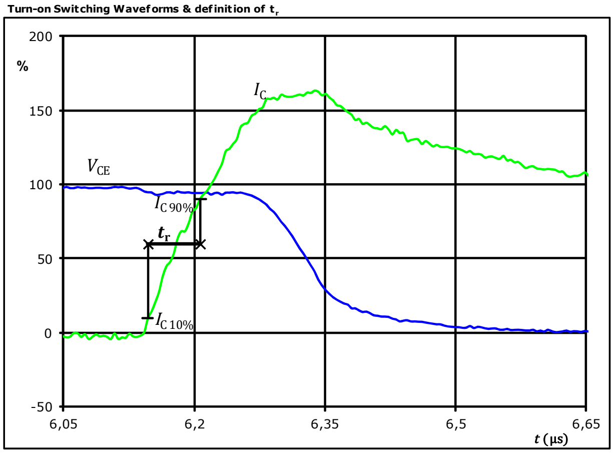
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	51	A
t_f =	0,125	µs

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

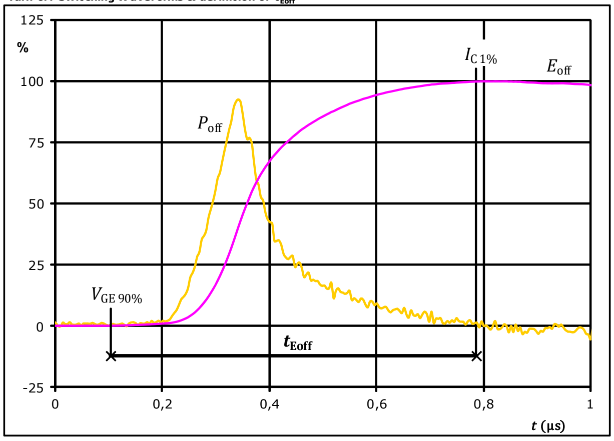


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	51	A
t_r =	0,058	µs

Inverter Switching Characteristics

figure 5. **IGBT**

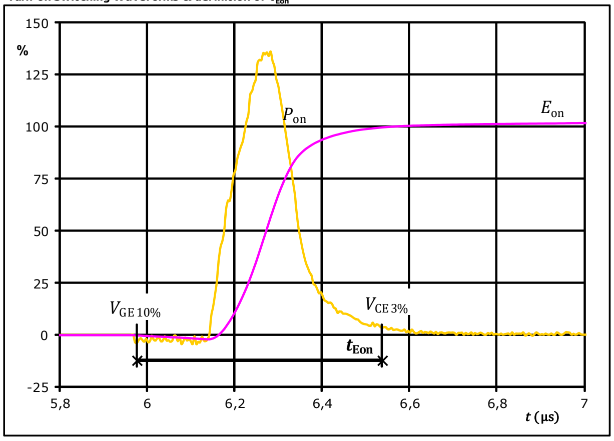
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	30,49	kW
E_{off} (100%) =	4,25	mJ
t_{Eoff} =	0,68	µs

figure 6. **IGBT**

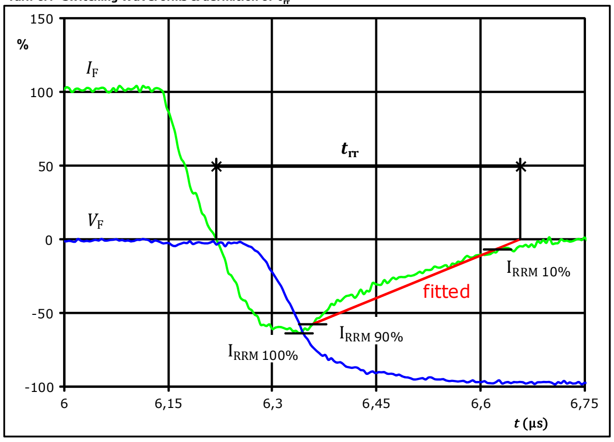
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	30,49	kW
E_{on} (100%) =	6,38	mJ
t_{Eon} =	0,56	µs

figure 7. **FWD**

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

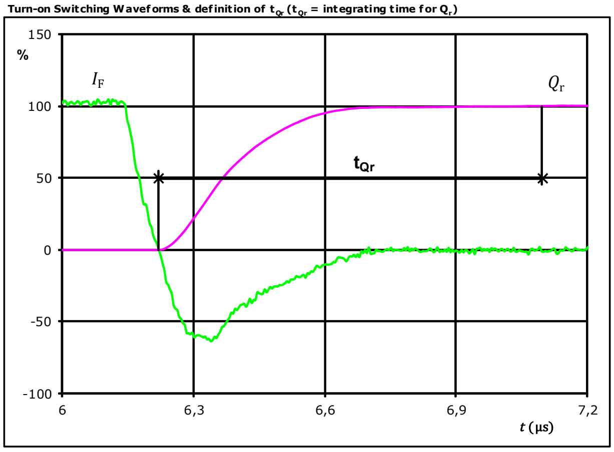


V_F (100%) =	600	V
I_F (100%) =	51	A
I_{RRM} (100%) =	-33	A
t_{rr} =	0,435	µs

Inverter Switching Characteristics

figure 8. **FWD**

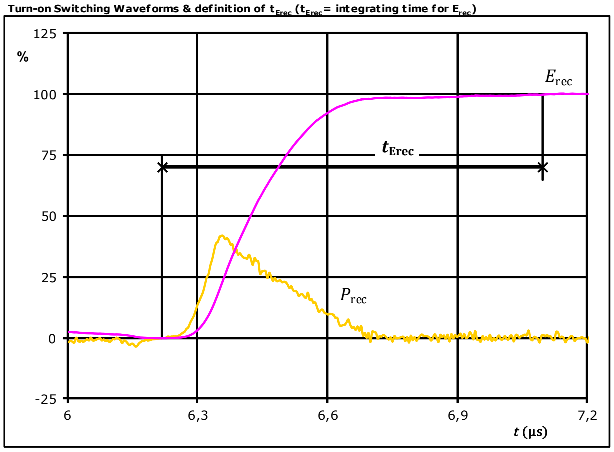
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	51	A
Q_r (100%) =	7,08	µC
t_{Qr} =	0,88	µs

figure 9. **FWD**

Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec} = integrating time for E_{rec})



P_{rec} (100%) =	30,49	kW
E_{rec} (100%) =	2,59	mJ
t_{Erec} =	0,88	µs

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Ordering Code & Marking

Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M2126PA050M7-K718F70-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M2126PA050M7-K718F70-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M2126PA050M7-K718F70-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M2126PA050M7-K718F70-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M2126PA050M7-K718F70-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M2126PA050M7-K718F70-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M2126PA050M7-K718F70-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M2126PA050M7-K718F70-/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		

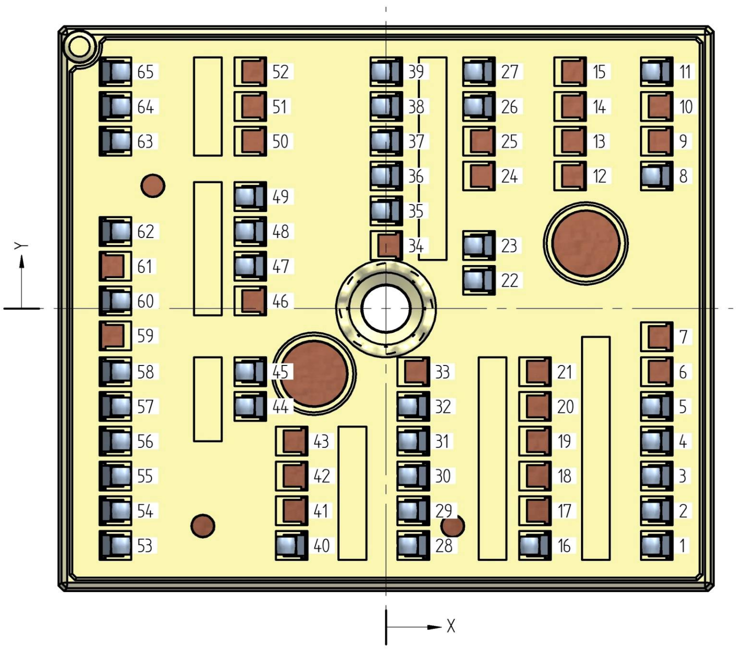
Outline

PCB pad table

Pin	X	Y	Function
1	24,38	-21,8	DC+123
2	24,38	-18,6	DC+123
3	24,38	-15,4	DC+123
4	24,38	-12,2	DC+123
5	24,38	-9	DC+123
6	Not assembled		
7			
8	24,38	12,2	Therm1
9	Not assembled		
10			
11	24,38	21,8	Therm2
12	Not assembled		
13			
14			
15			
16	13,42	-21,8	G16
17	Not assembled		
18			
19			
20			
21			
22	8,38	2,6	S14
23	8,38	5,8	G14
24	Not assembled		
25			
26	8,38	18,6	S12
27	8,38	21,8	G12
28	2,46	-21,8	S16
29	2,46	-18,6	Ph3
30	2,46	-15,4	Ph3
31	2,46	-12,2	Ph3
32	2,46	-9	Ph3
33	Not assembled		
34			
35	0,03	9	Ph1
36	0,03	12,2	Ph1
37	0,03	15,4	Ph1
38	0,03	18,6	Ph1
39	0,03	21,8	Ph1
40	-8,5	-21,8	Ph3
41	Not assembled		
42			
43			
44	-12,22	-9	Ph2
45	-12,22	-5,8	Ph2
46	Not assembled		
47	-12,22	3,9	Ph2
48	-12,22	7,1	Ph2

PCB pad table

Pin	X	Y	Function
49	-12,22	10,3	Ph2
50	Not assembled		
51			
52			
53	-24,38	-21,8	G15
54	-24,38	-18,6	S15
55	-24,38	-15,4	DC-123
56	-24,38	-12,2	DC-123
57	-24,38	-9	DC-123
58	-24,38	-5,8	S13
59	Not assembled		
60	-24,38	0,7	G13
61	Not assembled		
62	-24,38	7,1	DC-123
63	-24,38	15,4	DC-123
64	-24,38	18,6	S11
65	-24,38	21,8	G11



Pad positions refers to center point. For more informations on pad design please see package data

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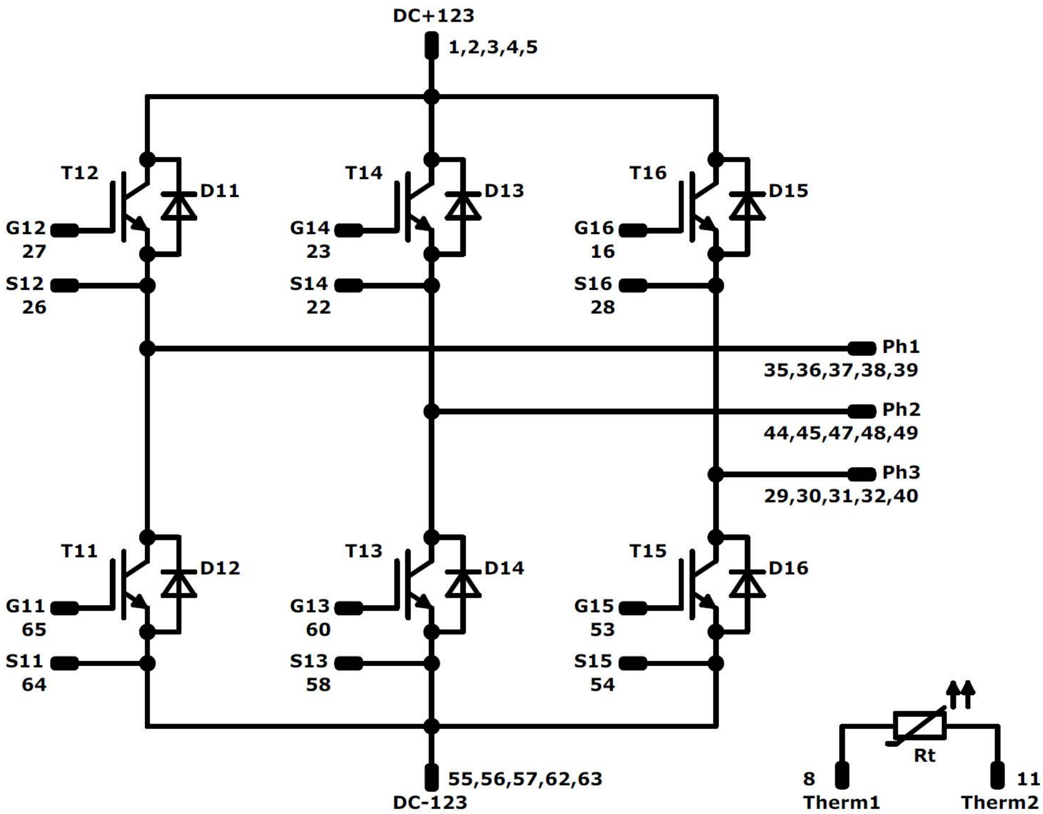
Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	50 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	50 A	Inverter Diode	
Rt	PTC			Thermistor	

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80-M2126PA050M7-K718F70
datasheet

Packaging instruction				
Standard packaging quantity (SPQ) 100	>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-M2126PA050M7-K718F70-D1-14	25 Nov. 2017		