Vincotech

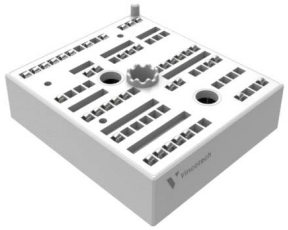
80-M2126PA035M7-K717F70
datasheet

MiniSKiiP®PACK 2 — **1200 V / 35 A**

Features

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

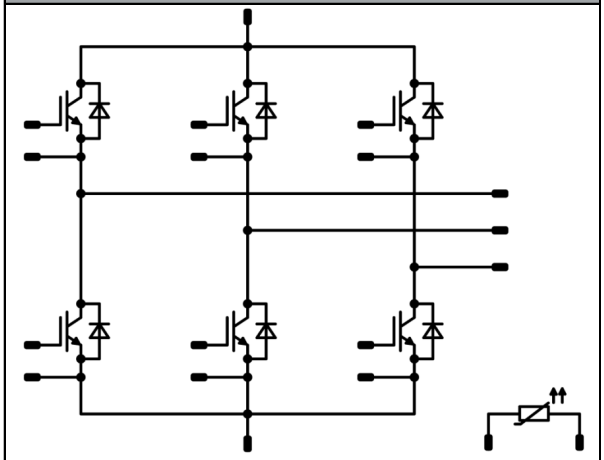
MiniSkiiP® 2 housing



Target applications

- Industrial Drives

Schematic



Types

- 80-M2126PA035M7-K717F70

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		35	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	70	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	129	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		35	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	70	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	77	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					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 Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0035	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		35	25 125 150		1,48 1,64 1,68	1,75	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			80	µA
Gate-emitter leakage current	I_{GES}		20	0		25			500	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	10	0	10		25		8000		pF
Output capacitance	C_{oes}							280		
Reverse transfer capacitance	C_{res}							95		
Gate charge	Q_g		15	600	35	25		300		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,73		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 8 Ω R_{gon} = 8 Ω	±15	600	35	25 125 150		124 122 121		ns
Rise time	t_r					25 125 150		14 17 18		
Turn-off delay time	$t_{d(off)}$					25 125 150		179 203 208		
Fall time	t_f					25 125 150		95 118 119		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 4,3 µC Q_{rFWD} = 6,2 µC Q_{rFWD} = 6,9 µC				25 125 150		1,45 1,92 2,09		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		2,40 3,17 3,42		

Characteristic Values

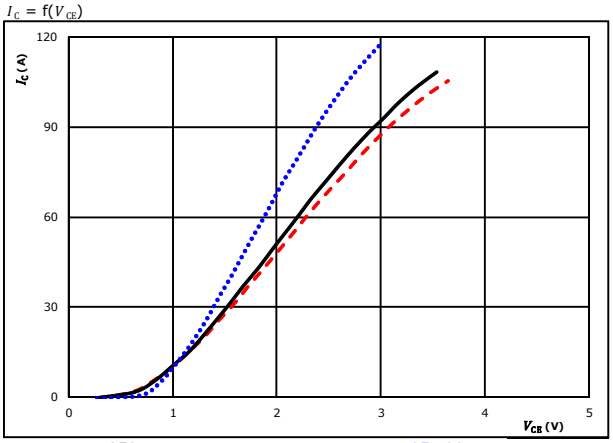
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Diode										
Static										
Forward voltage	V_F				35	25 125 150		1,66 1,76 1,75	2,1	V
Reverse leakage current	I_R			1200		25			40	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						1,24		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 2681 A/µs di/dt = 2670 A/µs di/dt = 2690 A/µs	±15	600	35	25 125 150		77 76 77		A
Reverse recovery time	t_{rr}					25 125 150		157 284 311		ns
Recovered charge	Q_r					25 125 150		4,34 6,18 6,90		µC
Reverse recovered energy	E_{rec}					25 125 150		1,96 2,82 3,13		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		2734 2205 2101		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		$7,635*10^{-3}$		1/K
B-value	$B_{(25/100)}$					25		$1,731*10^{-5}$		1/K²
Vincotech PTC Reference									E	

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

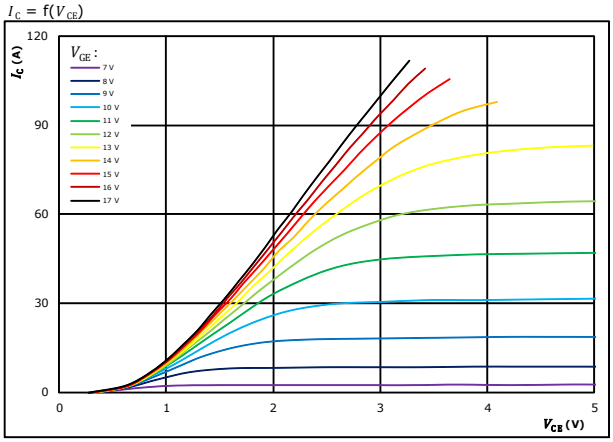


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

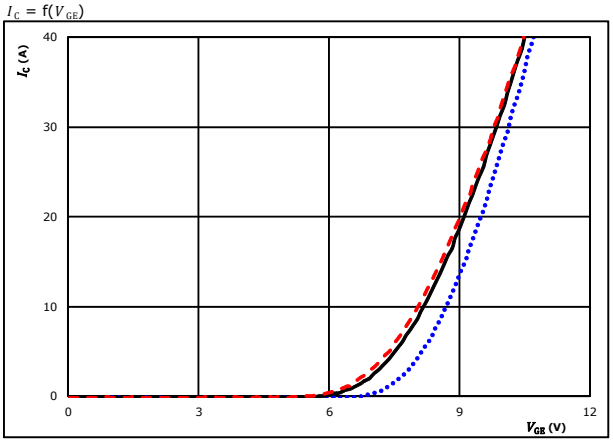


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

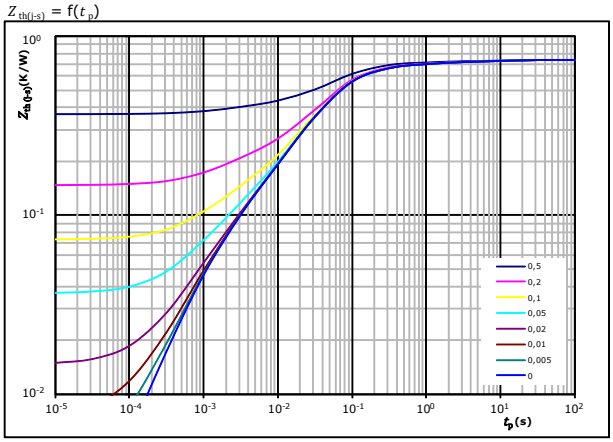


t_p =	100	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,73	K/W

IGBT thermal model values

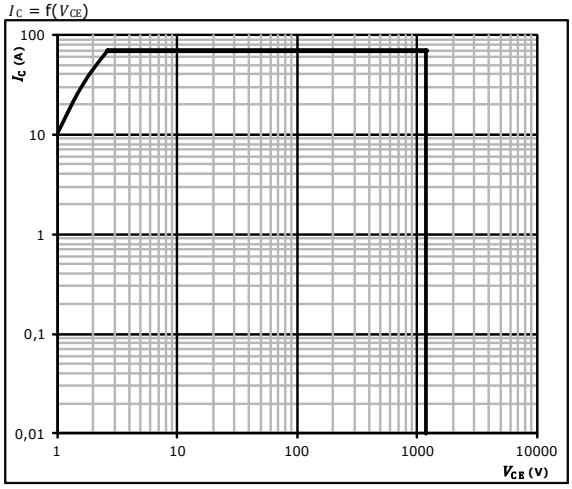
R (K/W)	τ (s)
2,73E-02	5,47E+00
5,12E-02	4,66E-01
1,36E-01	8,32E-02
3,93E-01	2,78E-02
7,33E-02	5,41E-03
4,92E-02	8,30E-04
3,39E-03	4,01E-04

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



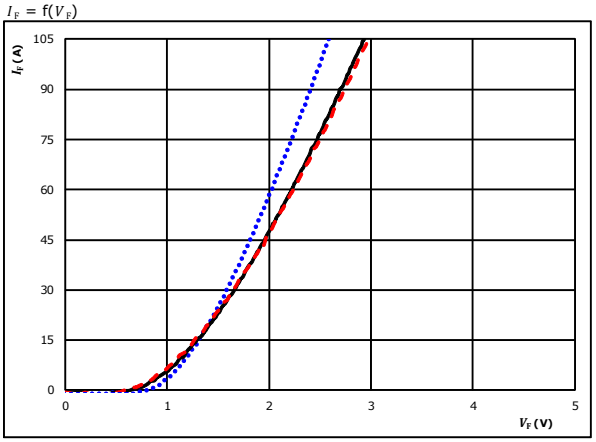
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Inverter Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



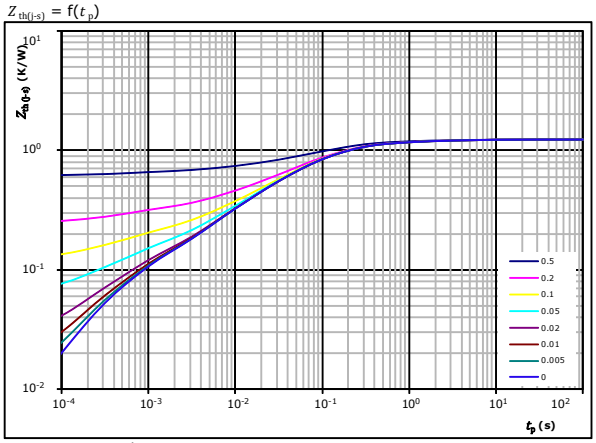
t_p = 250 µs

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

$R_{th(j-s)}$ = 1,24 K/W

FWD thermal model values

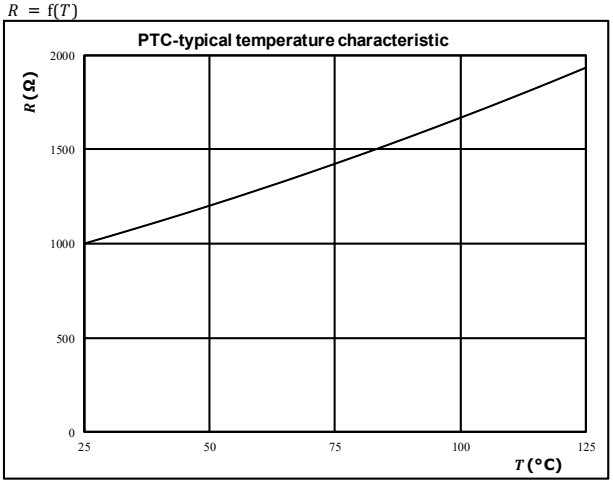
R (K/W)	τ (s)
5,40E-02	3,36E+00
1,45E-01	4,86E-01
5,42E-01	9,83E-02
3,02E-01	2,38E-02
1,17E-01	4,48E-03
7,51E-02	3,80E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical PTC characteristic
as a function of temperature

$R = f(T)$

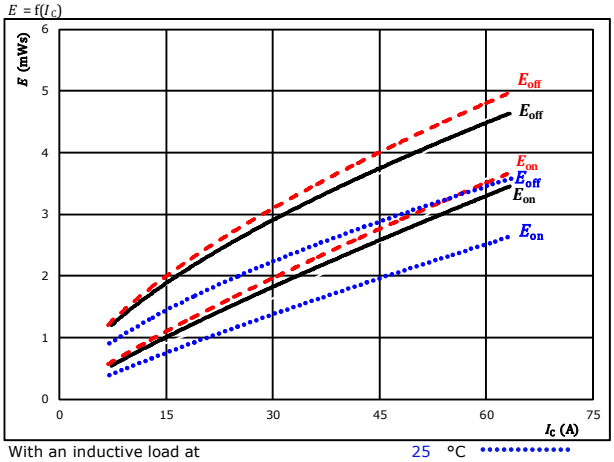


Inverter Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



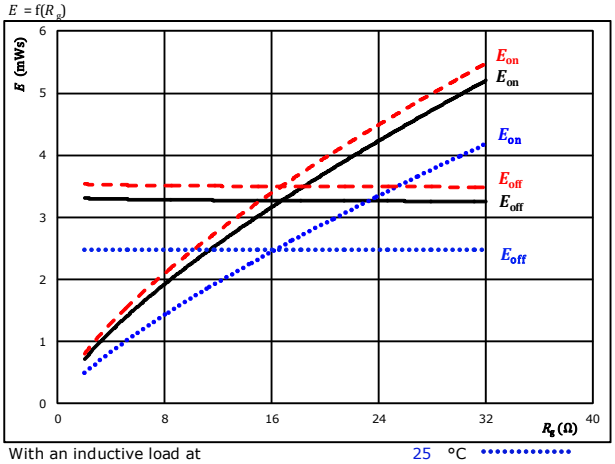
With an inductive load at

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

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



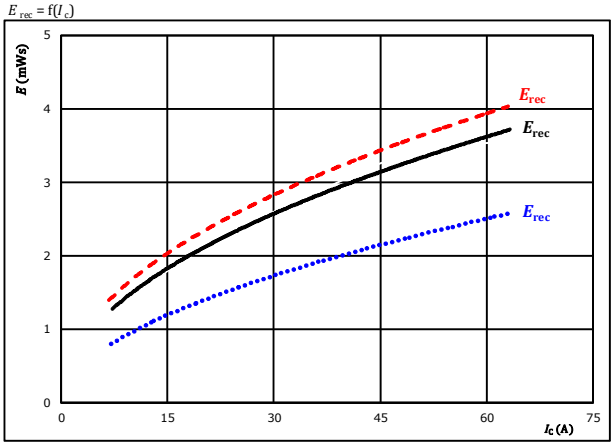
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	
V_{GE} =	±15	V		125 °C	
I_C =	35	A		150 °C	

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



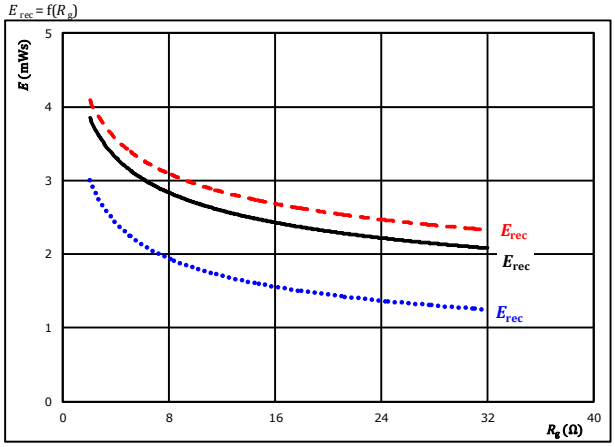
With an inductive load at

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

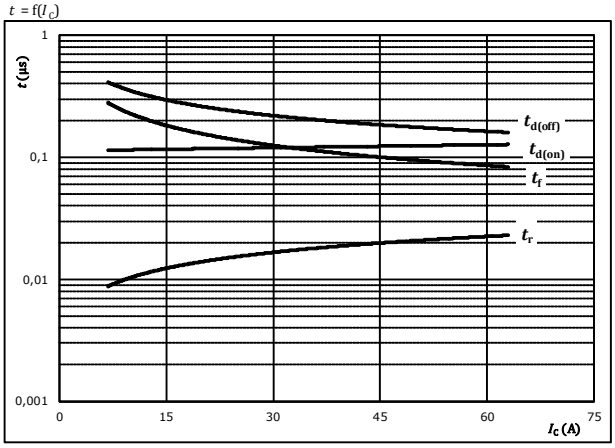
V_{CE} =	600	V	T_j:	25 °C	
V_{GE} =	±15	V		125 °C	
I_C =	35	A		150 °C	

Inverter Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



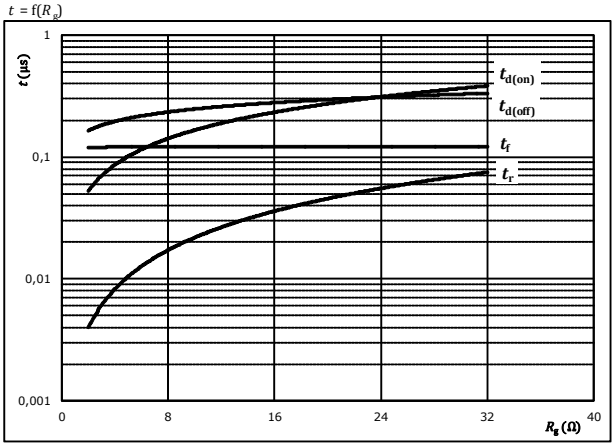
With an inductive load at

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

$t = f(R_g)$



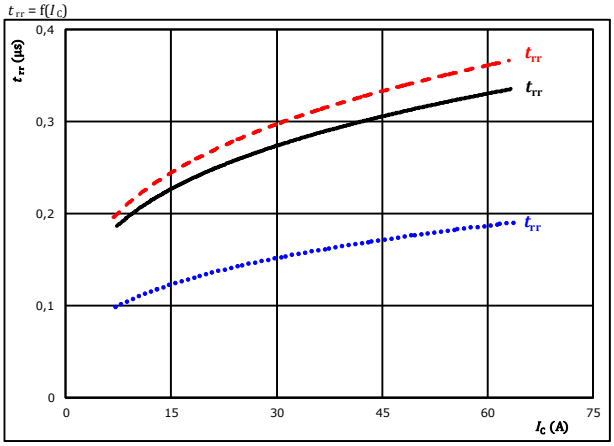
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	35	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



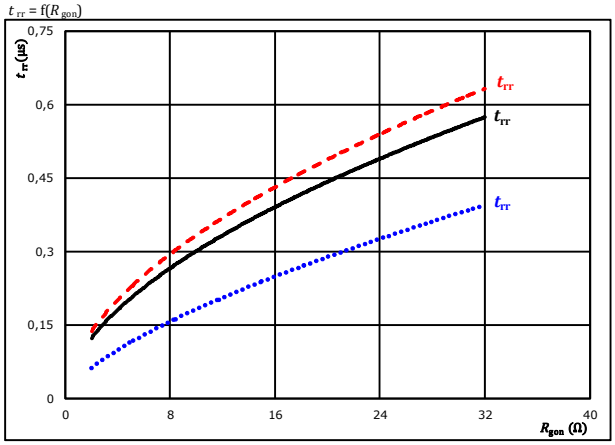
At

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

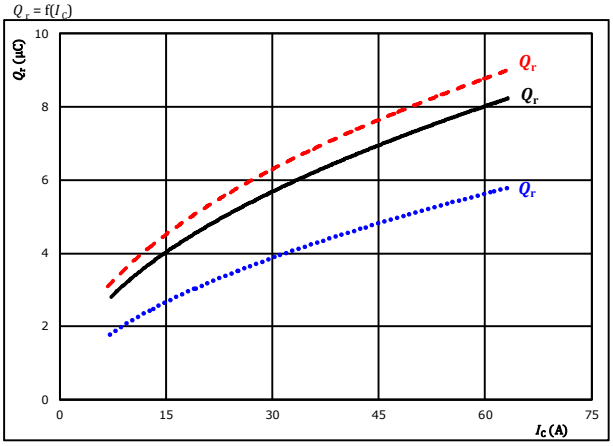
V_{CE}:	600	V		25	°C
V_{GE} =	±15	V	T_j:	125	°C
I_C =	35	A		150	°C

Inverter Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

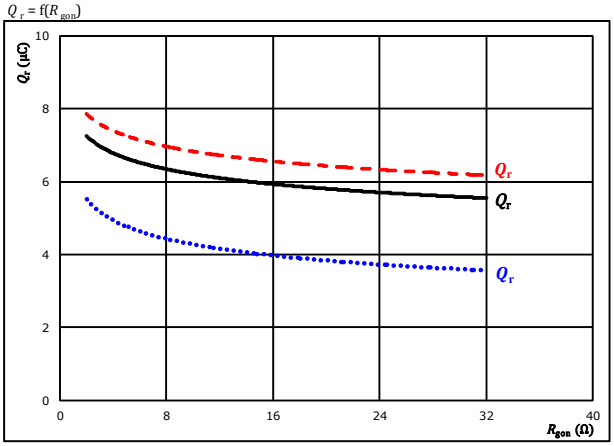


At					
V_{CE}:	600	V		25 °C	•••••••••••••
V_{GE} =	±15	V	T_j:	125 °C	———
R_{gon} =	8	Ω		150 °C	– – – –

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

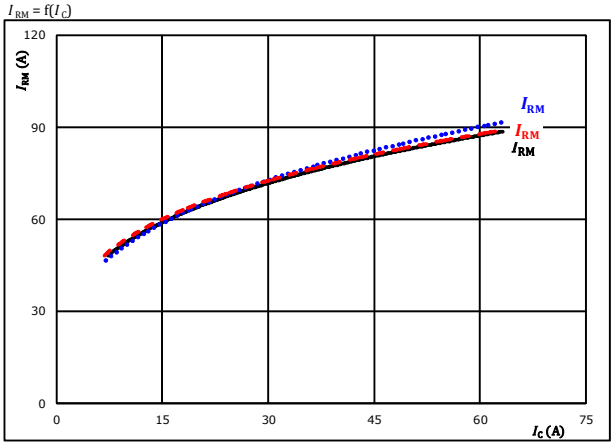


At					
V_{CE}:	600	V		25 °C	•••••••••••••
V_{GE} =	±15	V	T_j:	125 °C	———
I_C =	35	A		150 °C	– – – –

figure 11. **FWD**

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

$I_{RM} = f(I_C)$

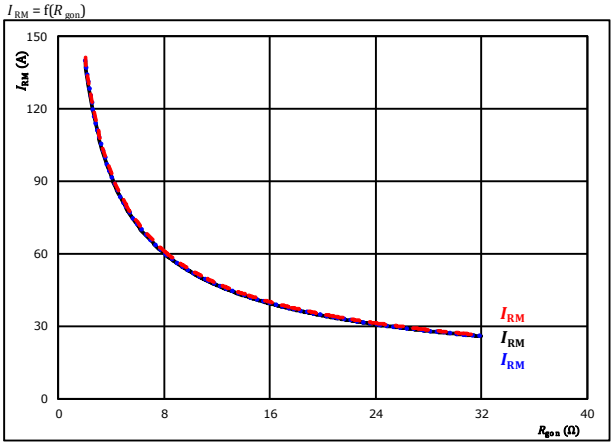


At					
V_{CE}	600	V		25 °C	•••••••••••••
V_{GE} =	±15	V	T_j:	125 °C	———
R_{gon} =	8	Ω		150 °C	– – – –

figure 12. **FWD**

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

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



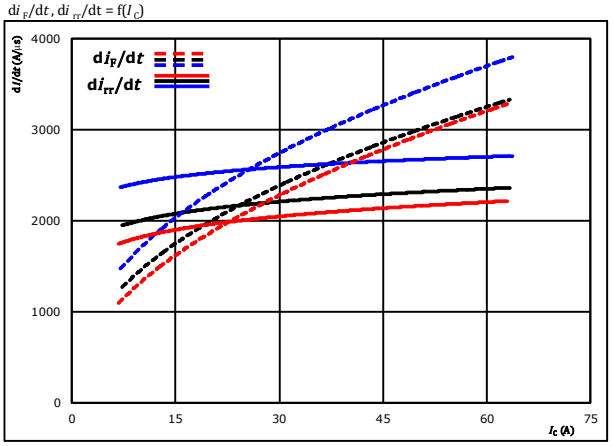
At					
V_{CE}:	600	V		25 °C	•••••••••••••
V_{GE} =	±15	V	T_j:	125 °C	———
I_C =	35	A		150 °C	– – – –

Inverter Switching Characteristics

figure 13. **FWD**

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

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

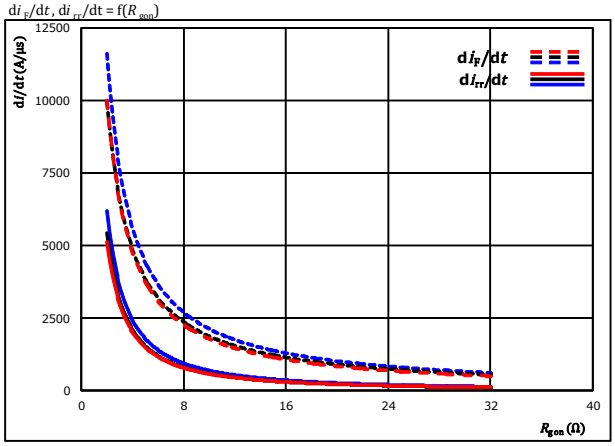


At					
	V_{CE}	600	V		
	V_{GE} =	±15	V	T_j:	25 °C, 125 °C, 150 °C
	R_{gon} =	8	Ω		

figure 14. **FWD**

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

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

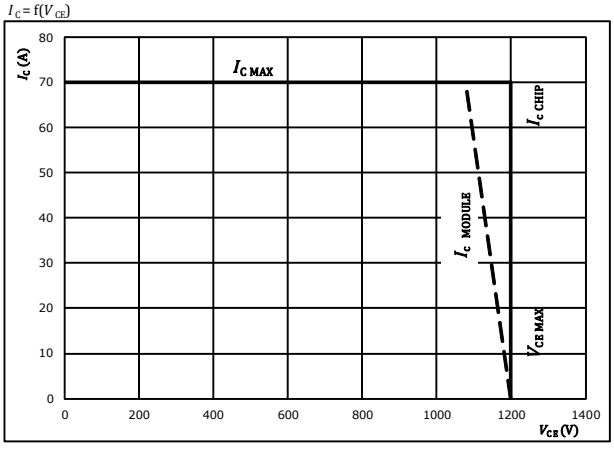


At					
	V_{CE}:	600	V		
	V_{GE} =	±15	V	T_j:	25 °C, 125 °C, 150 °C
	I_C=	35	A		

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

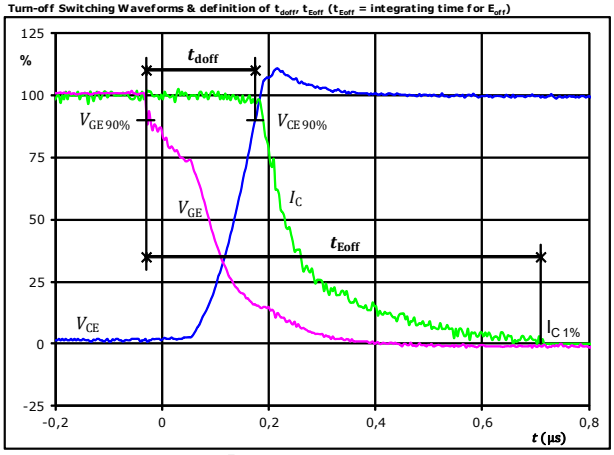
Inverter Switching Definitions

General conditions

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

figure 1. **IGBT**

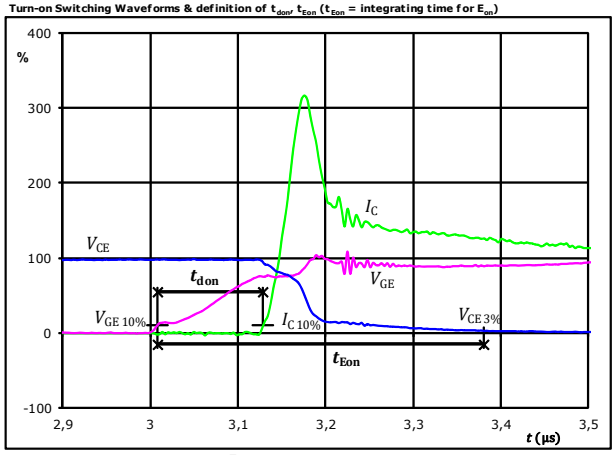
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	35	A
t_{doff} =	0,203	µs
t_{Eoff} =	0,739	µs

figure 2. **IGBT**

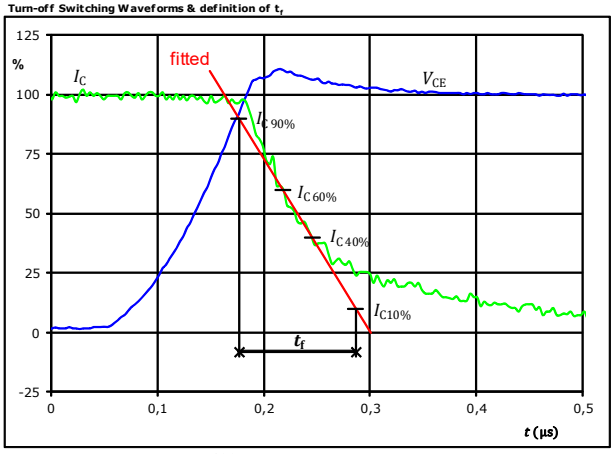
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	35	A
t_{don} =	0,122	µs
t_{Eon} =	0,372	µs

figure 3. **IGBT**

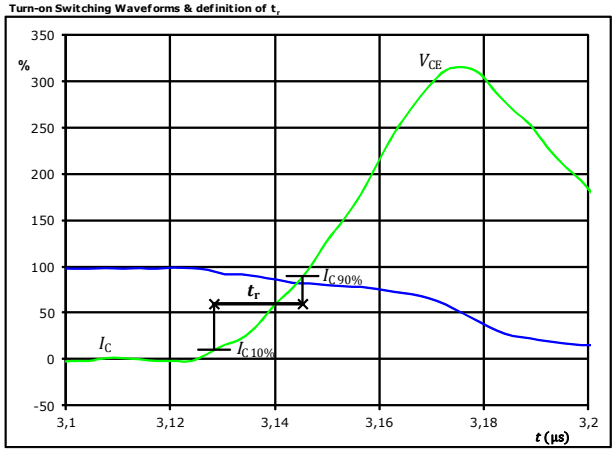
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	35	A
t_f =	0,118	µs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

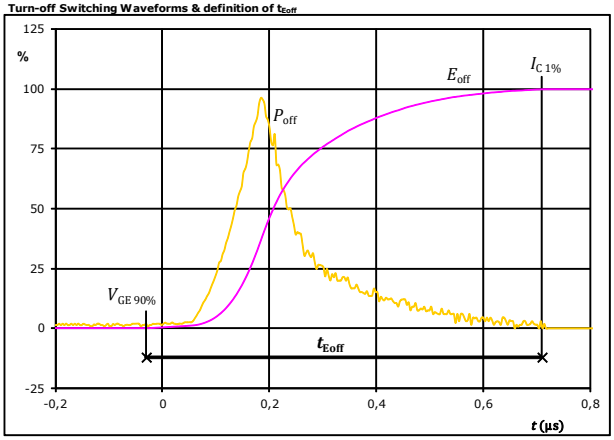


V_C (100%) =	600	V
I_C (100%) =	35	A
t_r =	0,017	µs

Inverter Switching Characteristics

figure 5. **IGBT**

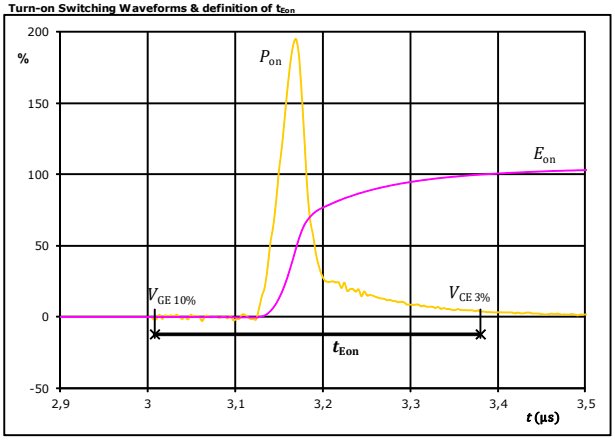
Turn-off Switching Waveforms & definition of t_{Eoff}



$P_{off}(100\%)$ =	20,99	kW
$E_{off}(100\%)$ =	3,17	mJ
t_{Eoff} =	0,74	µs

figure 6. **IGBT**

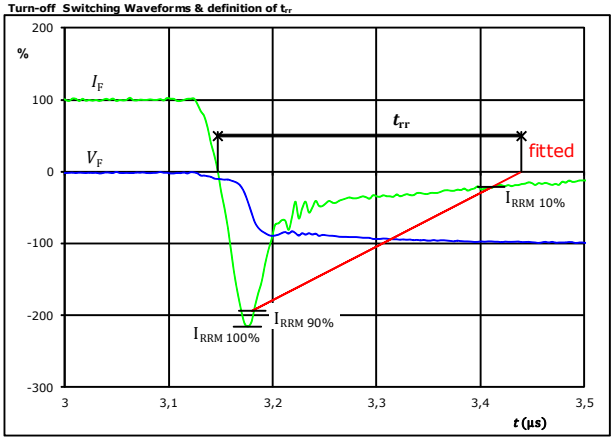
Turn-on Switching Waveforms & definition of t_{Eon}



$P_{on}(100\%)$ =	20,99	kW
$E_{on}(100\%)$ =	1,92	mJ
t_{Eon} =	0,37	µs

figure 7. **FWD**

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

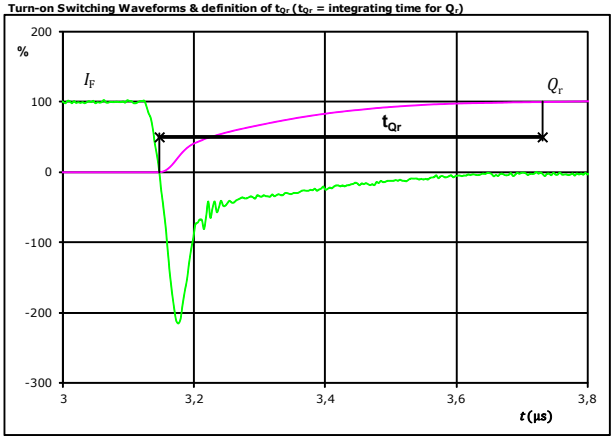


$V_F(100\%)$ =	600	V
$I_F(100\%)$ =	35	A
$I_{RRM}(100\%)$ =	-76	A
t_{rr} =	0,284	µs

Inverter Switching Characteristics

figure 8. **FWD**

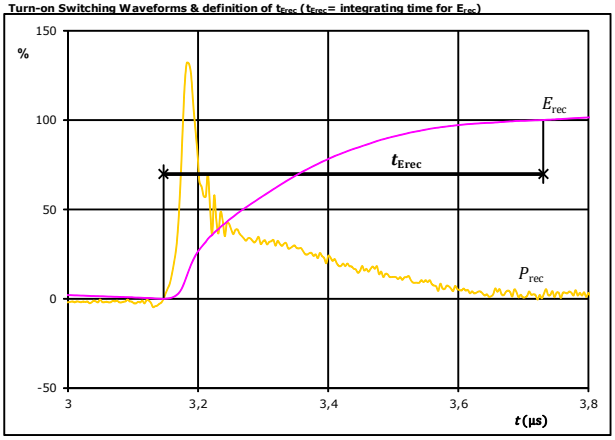
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	35	A
Q_r (100%) =	6,18	µC
t_{Qr} =	0,58	µs

figure 9. **FWD**

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



P_{rec} (100%) =	20,99	kW
E_{rec} (100%) =	2,82	mJ
t_{Erec} =	0,58	µs

Ordering Code & Marking

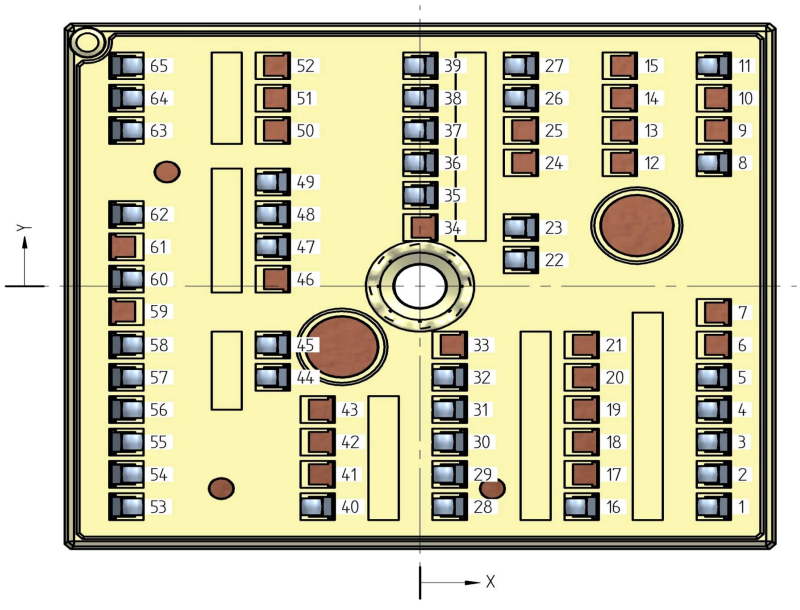
Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M2126PA035M7-K717F70-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M2126PA035M7-K717F70-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M2126PA035M7-K717F70-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M2126PA035M7-K717F70-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M2126PA035M7-K717F70-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M2126PA035M7-K717F70-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M2126PA035M7-K717F70-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M2126PA035M7-K717F70-/5B/

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

Outline

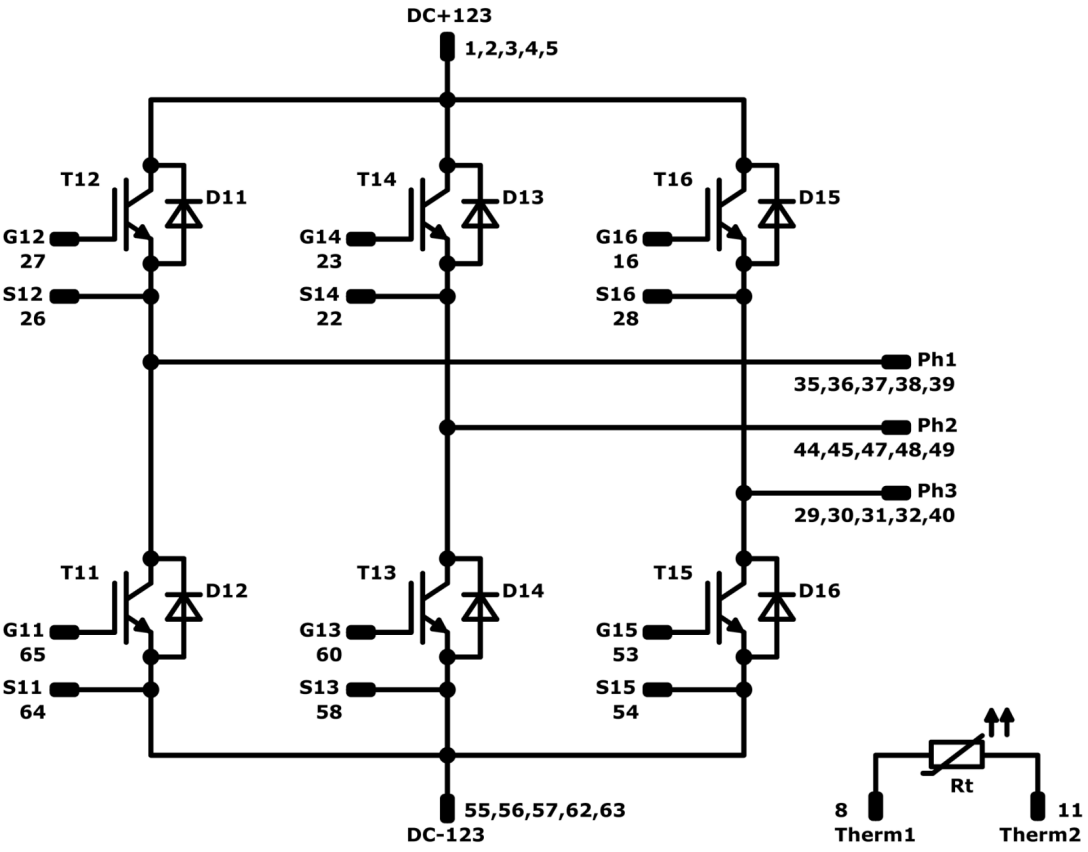
PCB pad table

Pin	X	Y	Function	Pin	X	Y	Function
1	24,38	-21,8	DC+123	48	-12,22	7,1	Ph2
2	24,38	-18,6	DC+123	49	-12,22	10,3	Ph2
3	24,38	-15,4	DC+123	50	Not assembled		
4	24,38	-12,2	DC+123	51			
5	24,38	-9	DC+123	52			
6	Not assembled			53	-24,38	-21,8	G15
7				54	-24,38	-18,6	S15
8	24,38	12,2	Therm1	55	-24,38	-15,4	DC-123
9	Not assembled			56	-24,38	-12,2	DC-123
10				57	-24,38	-9	DC-123
11	24,38	21,8	Therm2	58	-24,38	-5,8	S13
12	Not assembled			59	Not assembled		
13				60	-24,38	0,7	G13
14				61	Not assembled		
15				62	-24,38	7,1	DC-123
16	13,42	-21,8	G16	63	-24,38	15,4	DC-123
17	Not assembled			64	-24,38	18,6	S11
18				65	-24,38	21,8	G11
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				



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, T13, T14, T15, T16	IGBT	1200 V	35 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	35 A	Inverter Diode	
Rt	PTC			Thermistor	

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-M2126PA035M7-K717F70-D1-14	25 Nov. 2017		