Vincotech

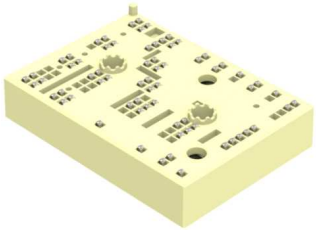
80-M312PMA100M7-K420A70
datasheet

MiniSkiiP®PIM 3 **1200 V / 100 A**

Features

- IGBT Mitsubishi gen 7 technology with low V_{CEsat} and improved EMC behavior
- Solder-free spring contact technology

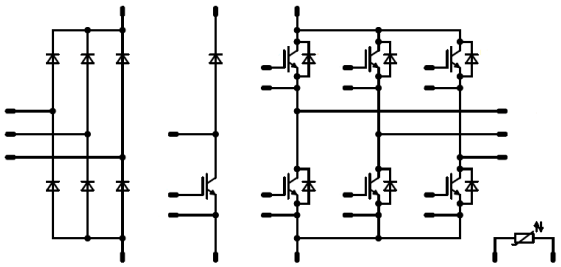
MiniSkiiP® 3 housing



Target applications

- Industrial Drives

Schematic



Types

- 80-M312PMA100M7-K420A70

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter / Brake Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ T_s = 80 °C	92	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	178	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 / Brake Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	72	A
Repetitive peak forward current	I_{FRM}			200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	121	W
Maximum junction temperature	T_{jmax}			175	°C
Rectifier Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	106	A
Surge (non-repetitive) forward current	I_{FSM}	t_p = 10 ms, sin 180°	T_j = 150 °C	890	A
Surge current capability	I^2t			3960	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	156	W
Maximum Junction Temperature	T_{jmax}			150	°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	4000	V
Creepage distance				min. 12,7	mm
Clearance				min. 12,7	mm
Comparative Tracking Index	CTI			> 200	

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 / Brake Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,01	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		100	25 125 150		1,61 1,82 1,91	2,05	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			110	µA
Gate-emitter leakage current	I_{GES}		20	0		25			500	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}		0	10		25		21000		pF
Output capacitance	C_{oes}							700		
Reverse transfer capacitance	C_{res}							280		
Gate charge	Q_g		15	600	100	25		650		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness ≤ 50 µm λ = 1 W/mK						0,53		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 2 Ω R_{gon} = 2 Ω	±15	600	100	25 125 150		118 118 118		ns
Rise time	t_r					25 125 150		10 12 13		
Turn-off delay time	$t_{d(off)}$					25 125 150		174 200 206		
Fall time	t_f					25 125 150		83 96 107		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 11,6 µC Q_{rFWD} = 17,3 µC Q_{rFWD} = 19,2 µC				25 125 150		3,255 4,868 5,368		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		6,605 8,774 9,490		

Characteristic Values

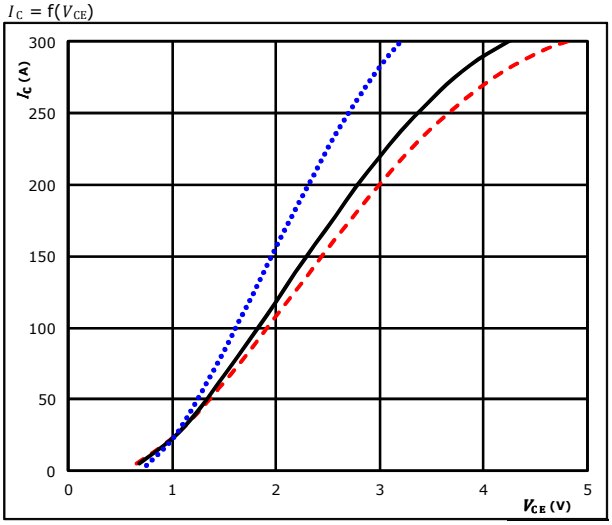
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter / Brake Diode										
Static										
Forward voltage	V_F				100	25 125 150		1,82 1,96 1,97	2,1	V
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness ≤ 50 µm λ = 1 W/mK						0,79		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 9387 A/µs di/dt = 7872 A/µs di/dt = 8350 A/µs	±15	600	100	25 125 150		178 166 165		A
Reverse recovery time	t_{rr}					25 125 150		149 312 339		ns
Recovered charge	Q_r					25 125 150		11,601 17,270 19,181		µC
Reverse recovered energy	E_{rec}					25 125 150		5,138 7,753 8,588		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		4044 2649 2147		A/µs
Rectifier Diode										
Static										
Forward voltage	V_F				75	25 125		1,10 1,05	1,8	V
Reverse leakage current	I_r			1600		25 145			50 1100	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,45		K/W
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 / Brake Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

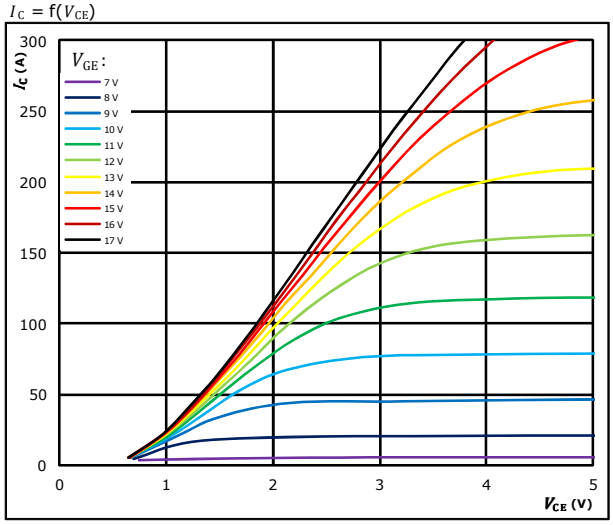


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

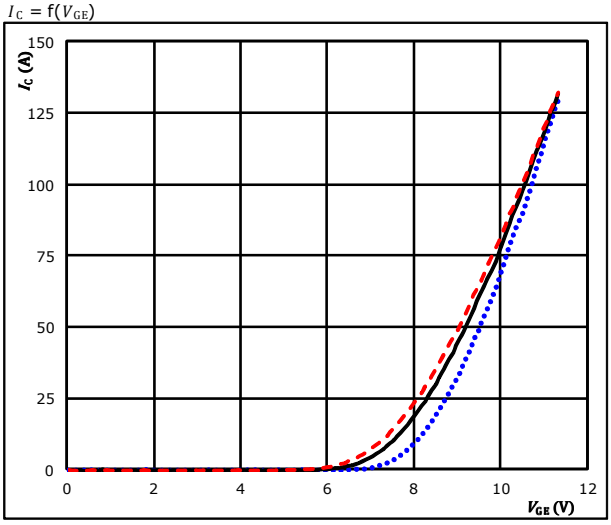


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

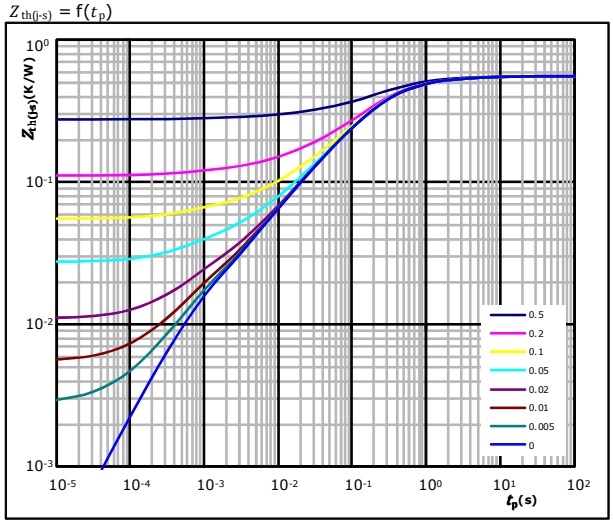


t_p =	100	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,56	K/W

IGBT thermal model values

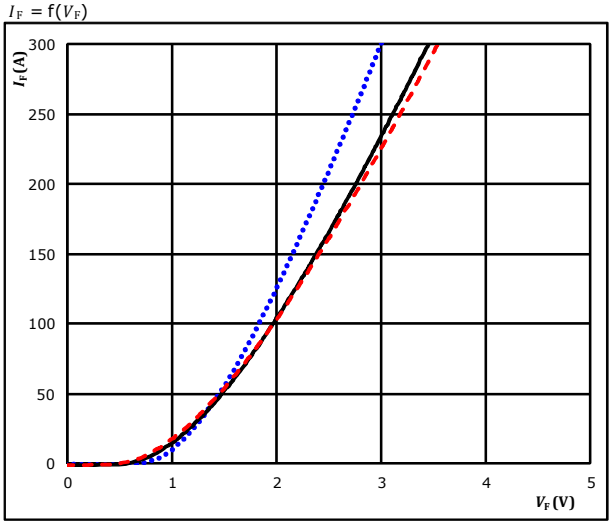
R (K/W)	τ (s)
3,45E-02	4,54E+00
9,61E-02	9,24E-01
2,83E-01	2,14E-01
9,09E-02	6,06E-02
4,22E-02	1,07E-02
1,30E-02	7,43E-04

Inverter / Brake Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



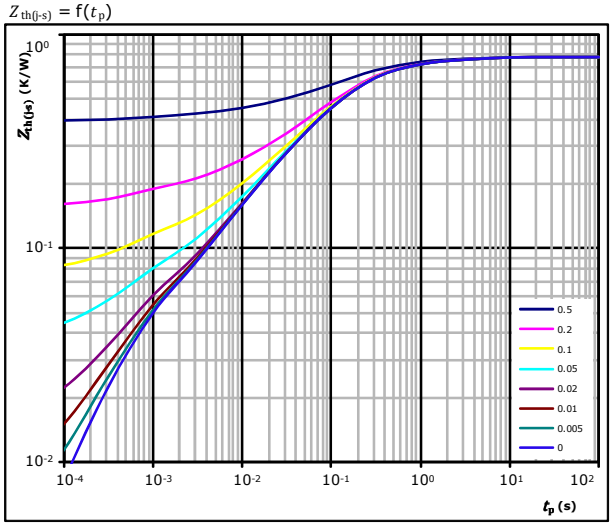
t_p = 250 µs

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

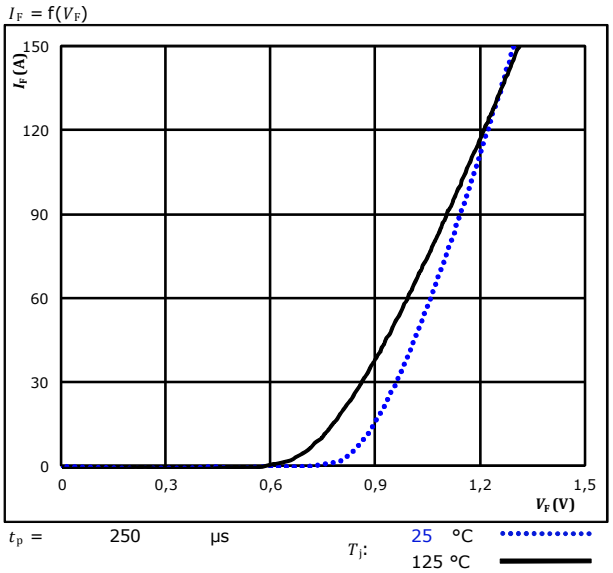
$R_{th(j-s)}$ = 0,79 K/W

FWD thermal model values

R (K/W)	τ (s)
4,05E-02	4,23E+00
8,85E-02	8,35E-01
3,44E-01	1,77E-01
1,91E-01	4,34E-02
8,21E-02	7,68E-03
4,03E-02	5,72E-04

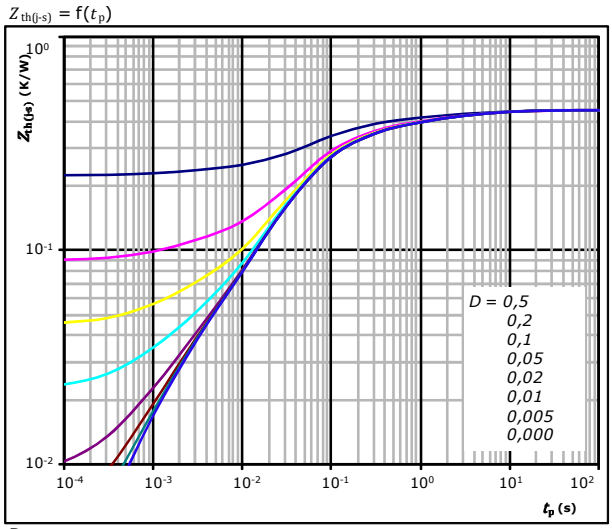
Rectifier Diode Characteristics

figure 1. **Rectifier Diode**
Typical forward characteristics



t_p = 250 µs
T_j: 25 °C
125 °C

figure 2. **Rectifier Diode**
Transient thermal impedance as a function of pulse width



D = t_p / T
$R_{th(j-s)}$ = 0,45 K/W

Diode thermal model values

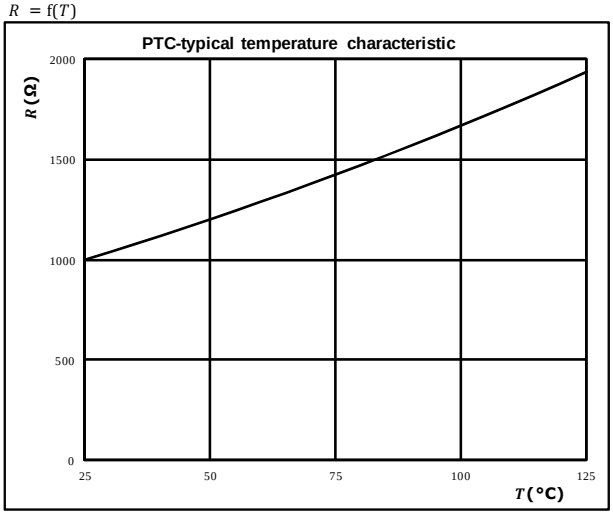
R (K/W)	τ (s)
3,06E-02	7,38E+00
5,87E-02	1,30E+00
1,21E-01	1,90E-01
2,00E-01	4,49E-02
2,12E-02	9,83E-03
1,85E-02	1,38E-03

Thermistor Characteristics

figure 1. **Thermistor**

Typical PTC characteristic as a function of temperature

$R = f(T)$

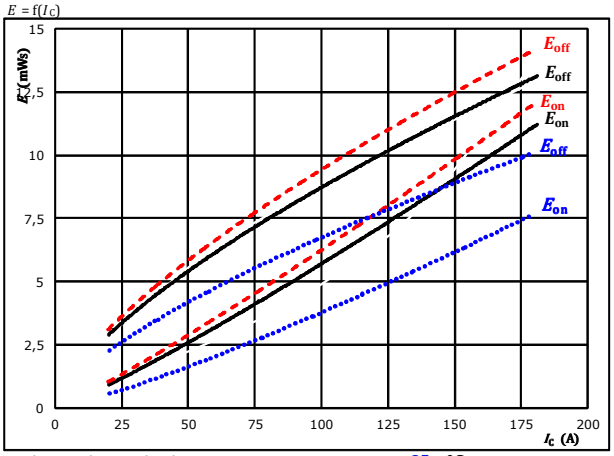


Inverter / Brake Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



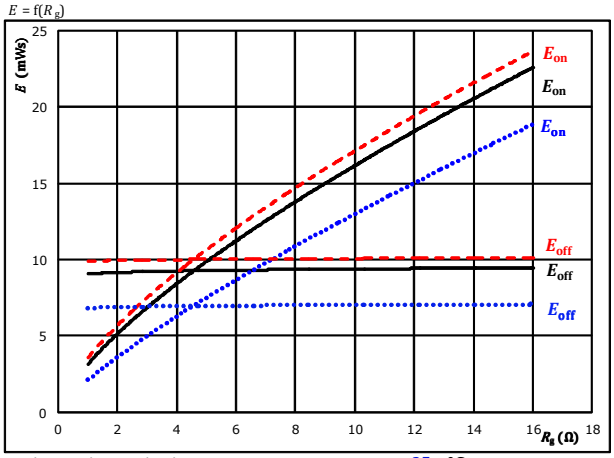
With an inductive load at

V_{CE} =	600	V	T_J:	25 °C	·····
V_{GE} =	±15	V		125 °C	———
R_{gon} =	2	Ω		150 °C	– – –
R_{goff} =	2	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



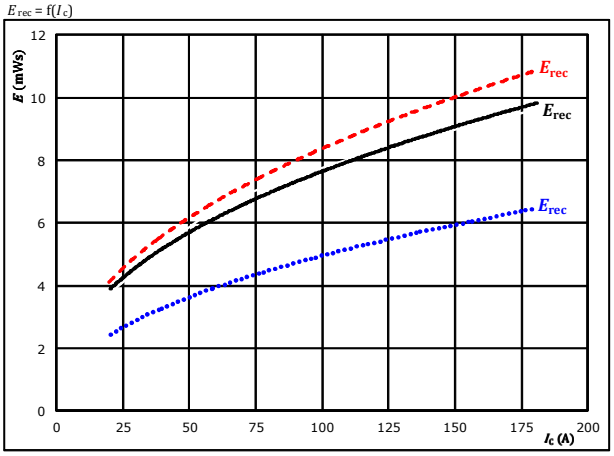
With an inductive load at

V_{CE} =	600	V	T_J:	25 °C	·····
V_{GE} =	±15	V		125 °C	———
I_C =	100	A		150 °C	– – –

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



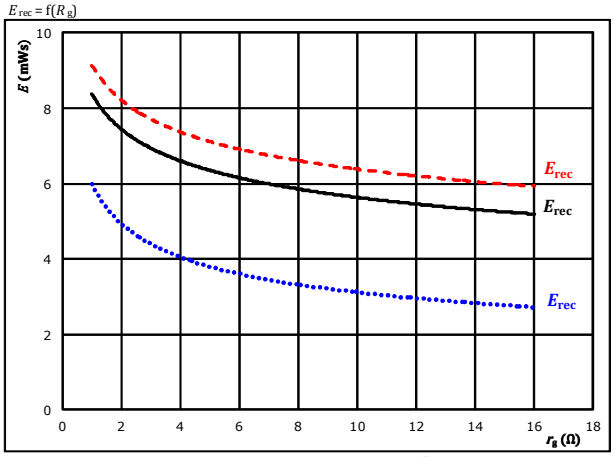
With an inductive load at

V_{CE} =	600	V	T_J:	25 °C	·····
V_{GE} =	±15	V		125 °C	———
R_{gon} =	2	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

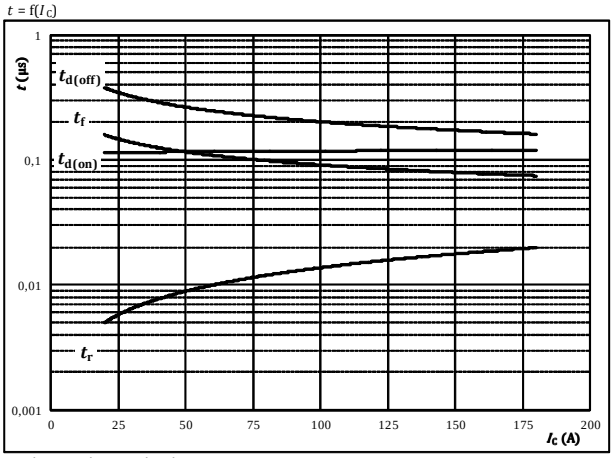
V_{CE} =	600	V	T_J:	25 °C	·····
V_{GE} =	±15	V		125 °C	———
I_C =	100	A		150 °C	– – –

Inverter / Brake Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



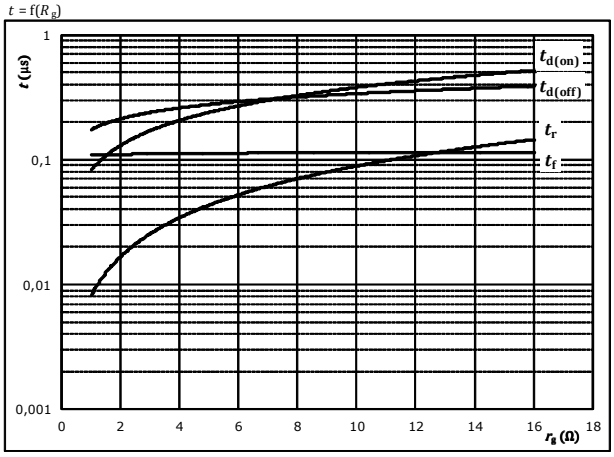
With an inductive load at

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

$t = f(R_g)$



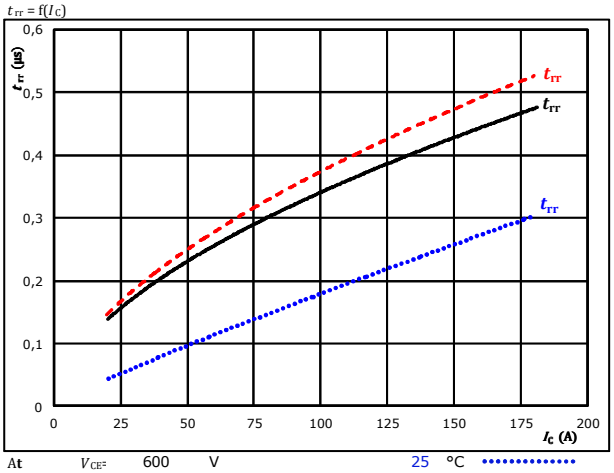
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	100	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

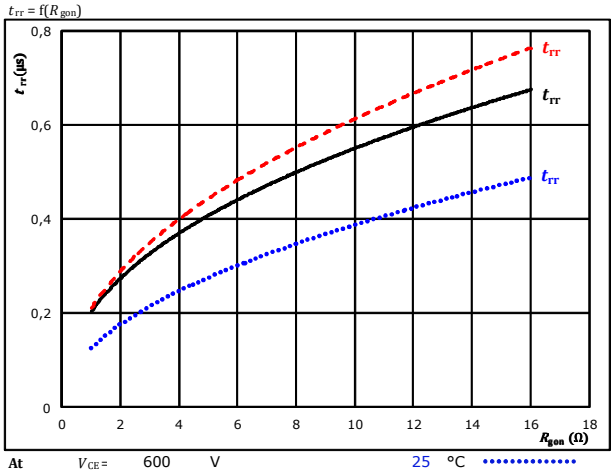


At	V_{CE}=	600	V		25 °C
	V_{GE} =	±15	V	T_j:	125 °C
	R_{gon} =	2	Ω		150 °C

figure 8. **FWD**

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

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



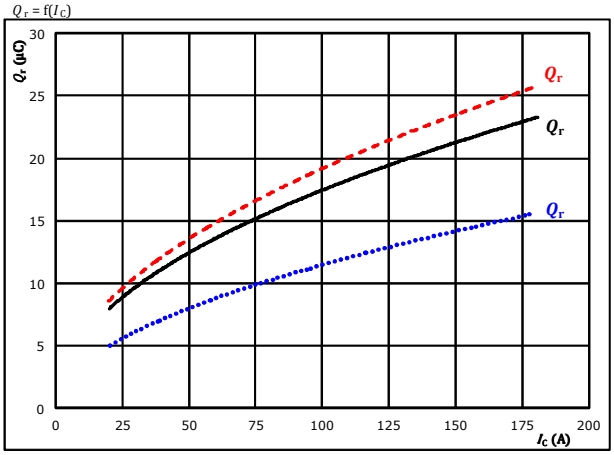
At	V_{CE} =	600	V		25 °C
	V_{GE} =	±15	V	T_j:	125 °C
	I_C =	100	A		150 °C

Inverter / Brake Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

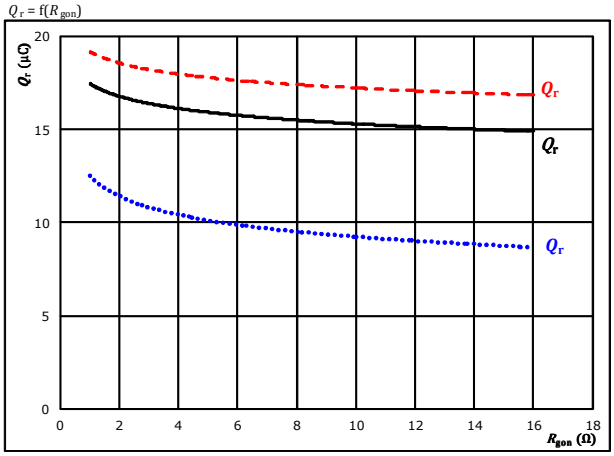


At						
	V_{CE} =	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	2	Ω		150 °C	

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

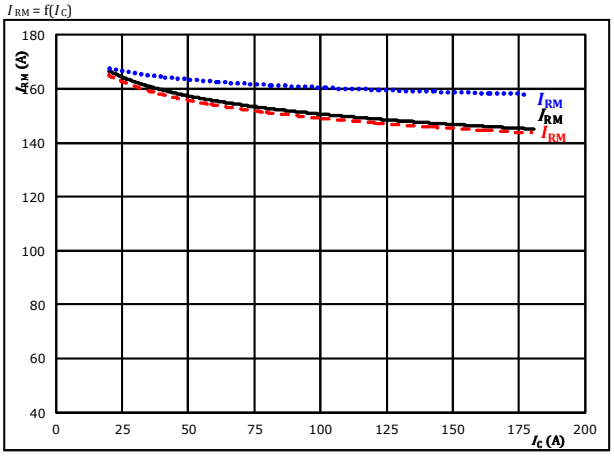


At						
	V_{CE}=	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C=	100	A		150 °C	

figure 11. **FWD**

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

$I_{RM} = f(I_C)$

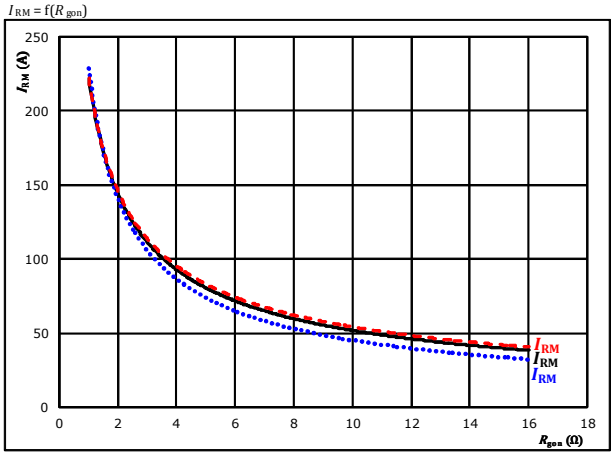


At						
	V_{CE}:	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	2	Ω		150 °C	

figure 12. **FWD**

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

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



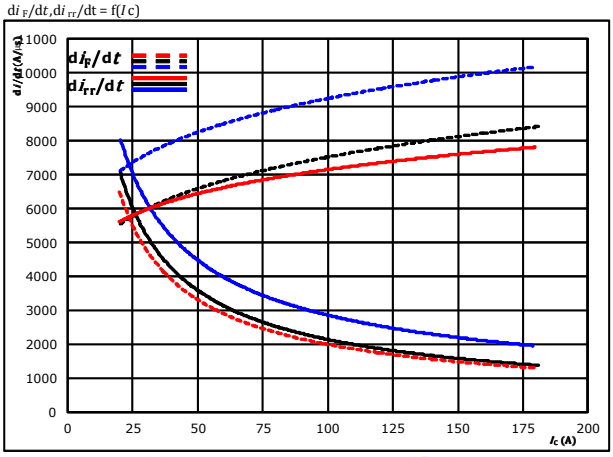
At						
	V_{CE} =	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C =	100	A		150 °C	

Inverter / Brake Switching Characteristics

figure 13. **FWD**

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

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

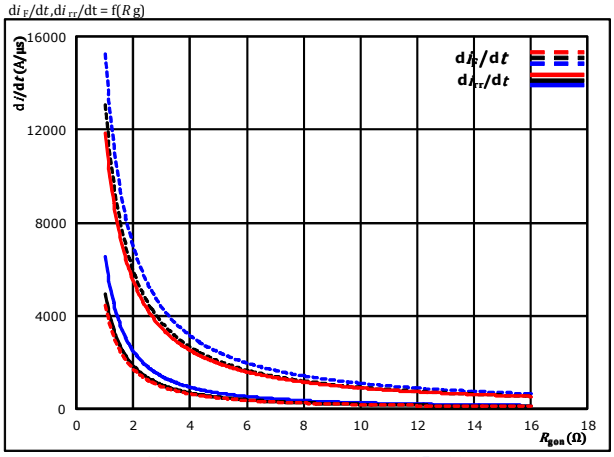


At						
V_{CE} =	600	V		25	°C	
V_{GE} =	±15	V	T_j:	125	°C	
R_{gon} =	2	Ω		150	°C	

figure 14. **FWD**

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

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

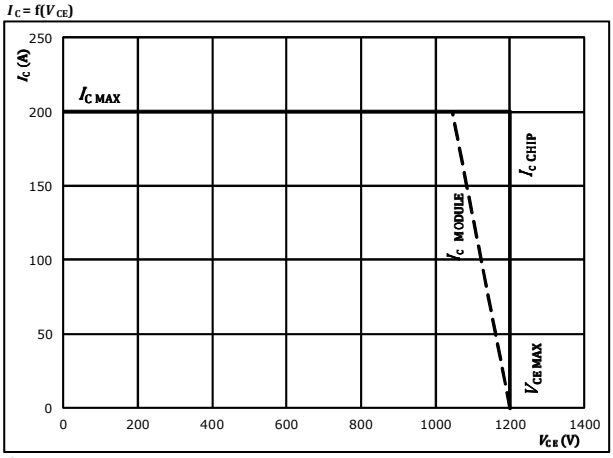


At						
V_{CE} =	600	V		25	°C	
V_{GE} =	±15	V	T_j:	125	°C	
I_C=	100	A		150	°C	

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

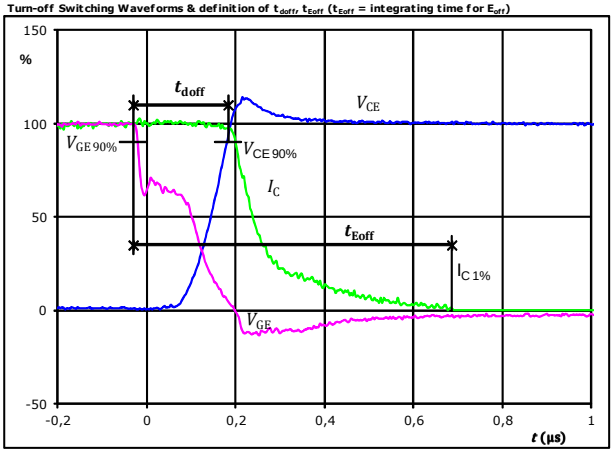
Inverter / Brake Switching Definitions

General conditions

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

figure 1. **IGBT**

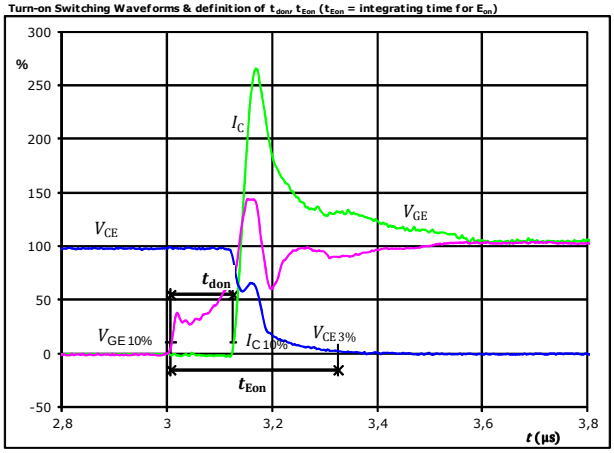
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	100	A
t_{doff} =	0,200	µs
t_{Eoff} =	0,717	µs

figure 2. **IGBT**

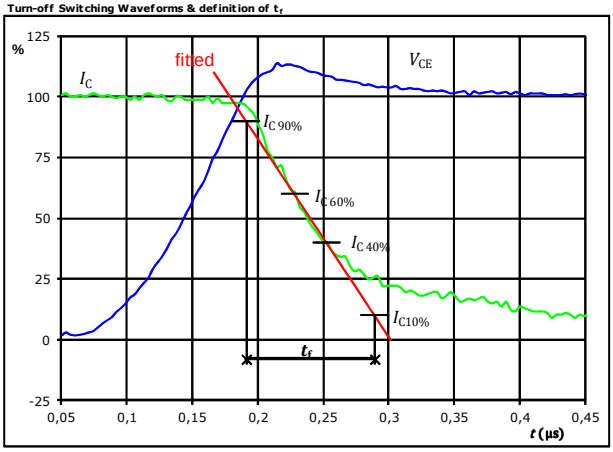
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	100	A
t_{don} =	0,118	µs
t_{Eon} =	0,318	µs

figure 3. **IGBT**

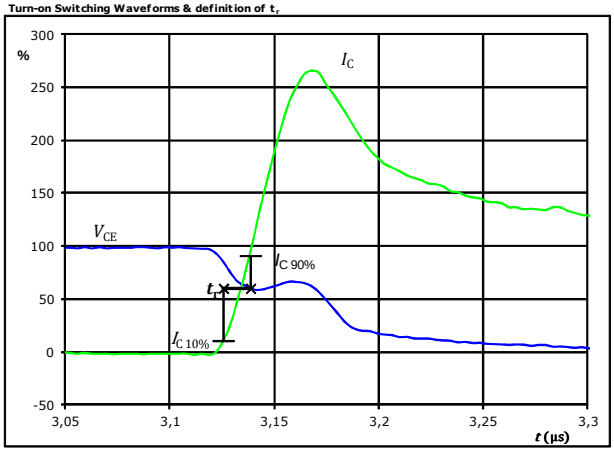
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	100	A
t_f =	0,096	µs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

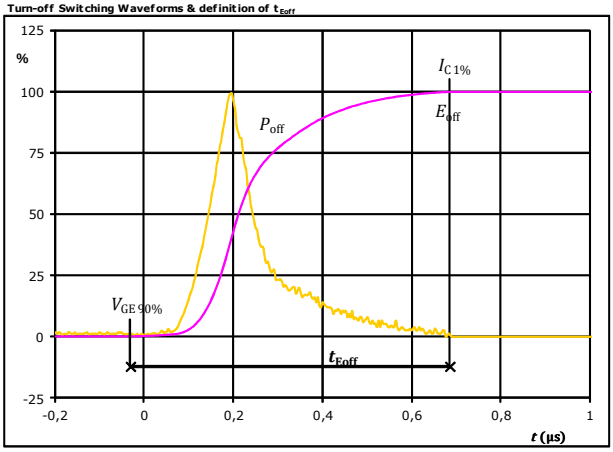


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	100	A
t_r =	0,012	µs

Inverter / Brake Switching Characteristics

figure 5. **IGBT**

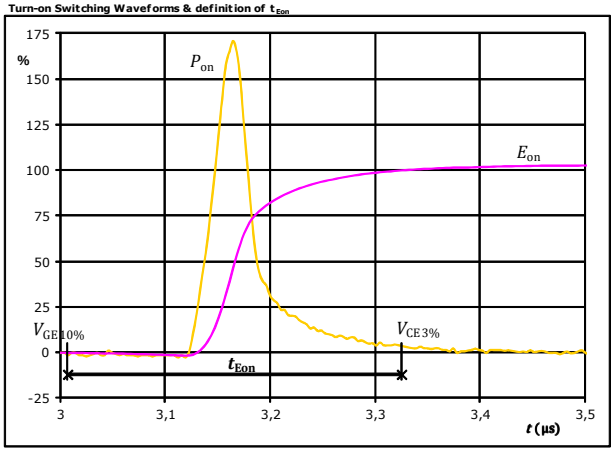
Turn-off Switching Waveforms & definition of t_{Eoff}



$P_{off}(100\%) =$	59,87	kW
$E_{off}(100\%) =$	8,77	mJ
$t_{Eoff} =$	0,72	µs

figure 6. **IGBT**

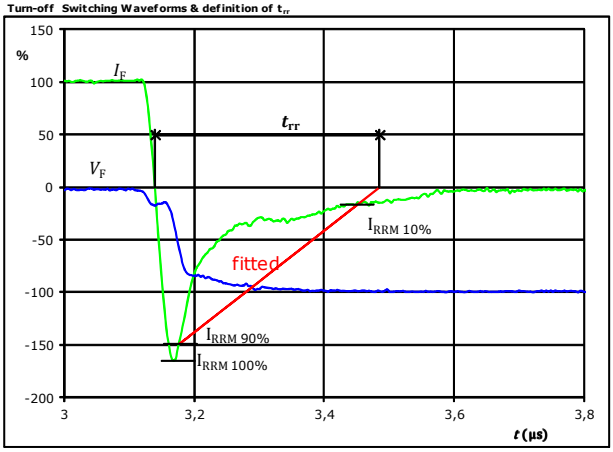
Turn-on Switching Waveforms & definition of t_{Eon}



$P_{on}(100\%) =$	59,87	kW
$E_{on}(100\%) =$	4,87	mJ
$t_{Eon} =$	0,32	µs

figure 7. **FWD**

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

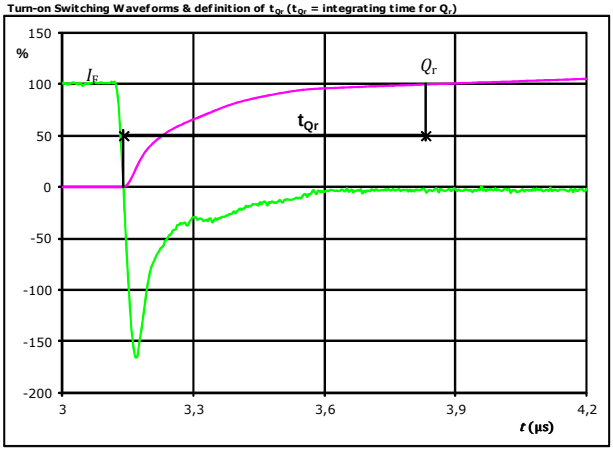


$V_F(100\%) =$	600	V
$I_F(100\%) =$	100	A
$I_{RRM}(100\%) =$	-166	A
$t_{rr} =$	0,312	µs

Inverter / Brake Switching Characteristics

figure 8. **FWD**

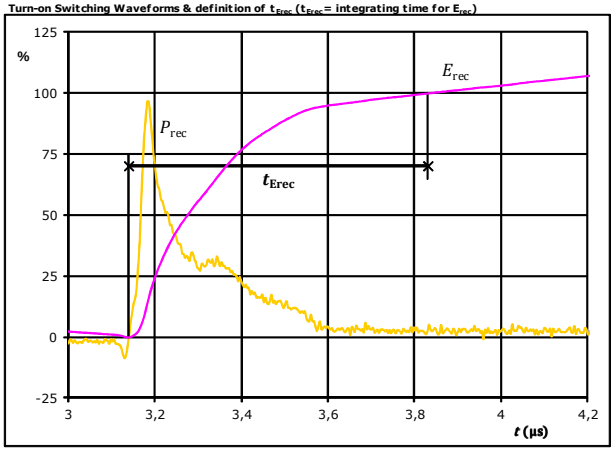
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	100	A
Q_r (100%) =	17,27	µC
t_{Qr} =	0,69	µs

figure 9. **FWD**

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



P_{rec} (100%) =	59,87	kW
E_{rec} (100%) =	7,75	mJ
t_{Erec} =	0,69	µs

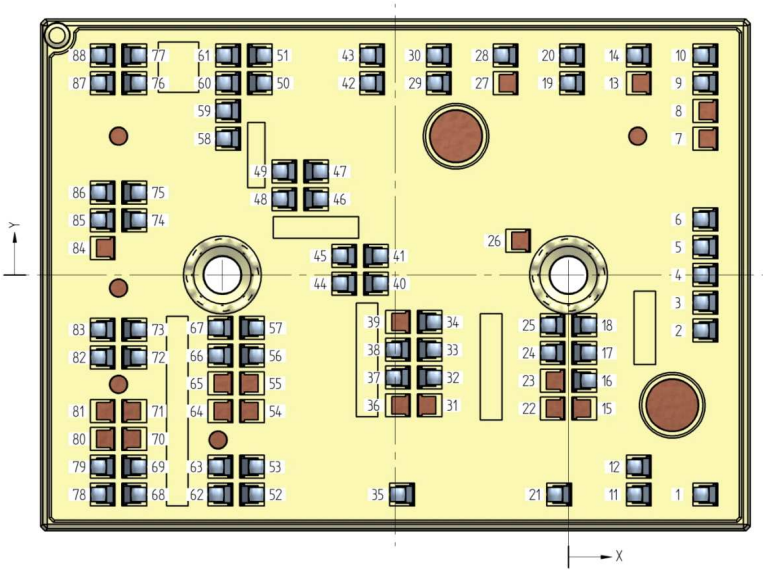
Ordering Code & Marking

Version	Ordering Code
without thermal paste	80-M312PMA100M7-K420A70
with thermal paste with std lid (black V23990-K32-T-2-PM)	80-M312PMA100M7-K420A70-/1A/

	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		

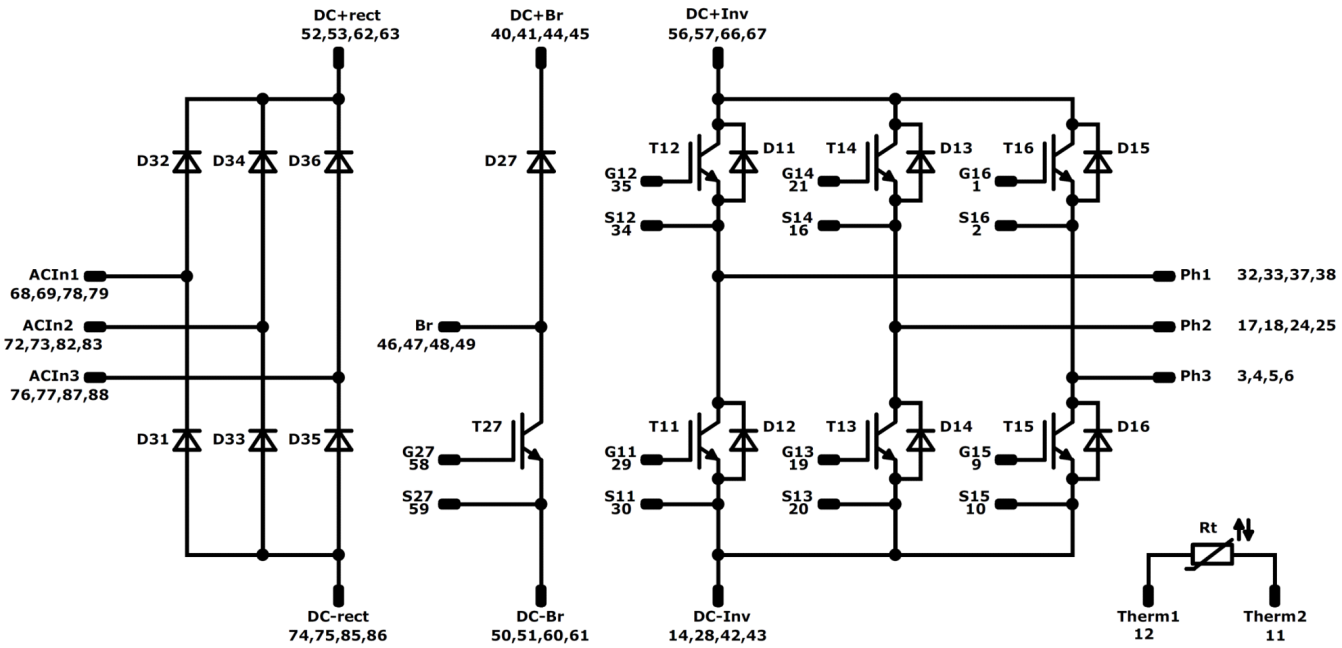
Outline

PCB pad table [mm]				PCB pad table [mm]			
Pin	X	Y	Function	Pin	X	Y	Function
1	15,83	-25,3	G16	45	-25,9	2,2	DC+Br
2	15,83	-6,4	S16	46	10,82	8,74	Br
3	15,83	-3,2	Ph3	47	10,82	11,94	Br
4	15,83	0	Ph3	48	-32,82	8,74	Br
5	15,83	3,2	Ph3	49	-32,82	11,94	Br
6	15,83	6,4	Ph3	50	4,32	22,1	DC-Br
7	Not assembled			51	4,32	25,3	DC-Br
8	Not assembled			52	3,42	-25,3	DC+rect
9	15,83	22,1	G15	53	3,42	-22,1	DC+rect
10	15,83	25,3	S15	54	Not assembled		
11	8,13	-25,3	Therm2	55	Not assembled		
12	8,13	-22,1	Therm1	56	3,42	-9,3	DC+Inv
13	Not assembled			57	3,42	-6,1	DC+Inv
14	8,13	25,3	DC-Inv	58	-39,32	15,7	G27
15	Not assembled			59	-39,32	18,9	S27
16	41,82	-12,18	S14	60	-39,32	22,1	DC-Br
17	41,82	-8,98	Ph2	61	-39,32	25,3	DC-Br
18	41,82	-5,79	Ph2	62	-40,22	-25,3	DC+rect
19	0,43	22,1	G13	63	-40,22	-22,1	DC+rect
20	0,43	25,3	S13	64	Not assembled		
21	-1,07	-25,3	G14	65	Not assembled		
22	Not assembled			66	-40,22	-9,3	DC+Inv
23	Not assembled			67	-40,22	-6,09	DC+Inv
24	-1,82	-8,98	Ph2	68	-10,18	-25,3	ACIn1
25	-1,82	-5,79	Ph2	69	-10,18	-22,1	ACIn1
26	Not assembled			70	Not assembled		
27	Not assembled			71	Not assembled		
28	-7,27	25,3	DC-Inv	72	-10,18	-9,5	ACIn2
29	-14,97	22,1	G11	73	-10,18	-6,3	ACIn2
30	-14,97	25,3	S11	74	-10,18	6,3	DC-rect
31	Not assembled			75	-10,18	9,5	DC-rect
32	23,95	-11,82	Ph1	76	-10,18	22,1	ACIn3
33	23,95	-8,63	Ph1	77	-10,18	25,3	ACIn3
34	23,95	-5,42	S12	78	-53,82	-25,3	ACIn1
35	-19,22	-25,3	G12	79	-53,82	-22,1	ACIn1
36	Not assembled			80	Not assembled		
37	-19,7	-11,82	Ph1	81	Not assembled		
38	-19,7	-8,62	Ph1	82	-53,82	-9,5	ACIn2
39	Not assembled			83	-53,82	-6,3	ACIn2
40	17,74	-1	DC+Br	84	Not assembled		
41	17,74	2,2	DC+Br	85	-53,82	6,3	DC-rect
42	-22,67	22,1	DC-Inv	86	-53,82	9,5	DC-rect
43	-22,67	25,3	DC-Inv	87	-53,82	22,1	ACIn3
44	-25,9	-1	DC+Br	88	-53,82	25,3	ACIn3



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

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11,T12,T13 T14,T15,T16	IGBT	1200 V	100 A	Inverter	
D11,D12,D13 D14,D15,D16	FWD	1200 V	100 A	Inverter/Brake Diode	
T27	IGBT	1200 V	100 A	Brake Switch	
D27	FWD	1200 V	100 A	Brake Diode	
D31,D32,D33 D34,D35,D36	Diode	1600 V	75 A	Rectifier Diode	
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-M312PMA100M7-K420A70-D1-14	22 Mar. 2017		