Vincotech

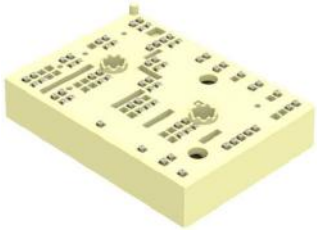
80-M312PMA075M7-K429A70
datasheet

MiniSkiiP®PIM 3 **1200 V / 75 A**

Features

- IGBT M7 with low with low V_{CEsat} and improved EMC behavior
- Solder-free spring contact technology
- Built-in PTC

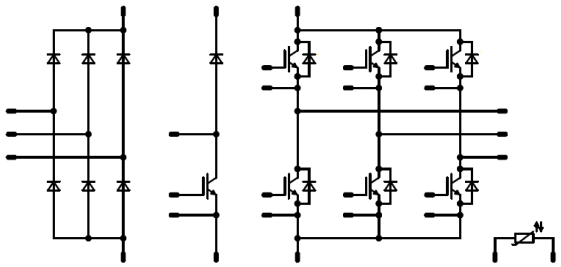
MiniSkiiP® 3 housing



Target applications

- Industrial Drives

Schematic



Types

- 80-M312PMA075M7-K429A70

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		75	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	150	A
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	196	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	83	A
Repetitive peak forward current	I_{FRM}		200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	149	W
Maximum junction temperature	T_{jmax}		175	°C
Rectifier Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1600	V
Continuous (direct) forward current	I_F		50	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 150 °C	490	A
Surge current capability	I^2t		1200	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	93	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	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					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	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0075	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		75	25 125 150		1,55 1,70 1,75	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							4		Ω
Input capacitance	C_{ies}		0	10		25		16000		pF
Output capacitance	C_{oes}							480		
Reverse transfer capacitance	C_{res}							190		
Gate charge	Q_g		15	600	75	25		490		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,49		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 2 Ω R_{gon} = 2 Ω	±15	600	75	25 125 150		197 208 212		ns
Rise time	t_r					25 125 150		29 38 39		
Turn-off delay time	$t_{d(off)}$					25 125 150		203 233 242		
Fall time	t_f					25 125 150		86 113 111		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 8,5 µC Q_{rFWD} = 13,4 µC Q_{rFWD} = 15,3 µC				25 125 150		5,559 7,819 8,496		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		5,076 6,804 7,285		

Characteristic Values

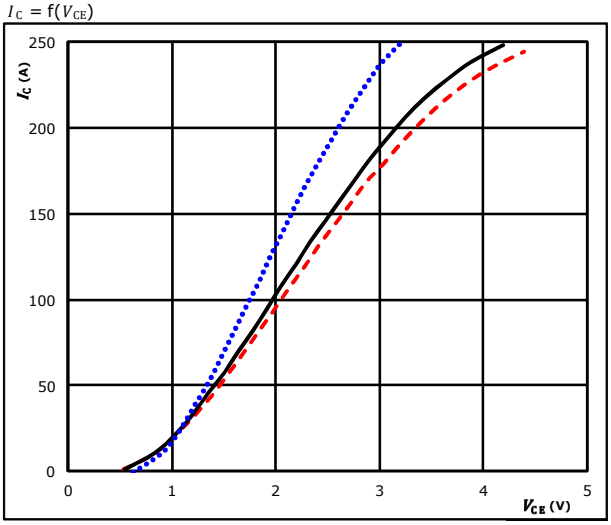
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter / Brake Diode										
Static										
Forward voltage	V_F				100	25 125 150		1,82 1,96 1,97	2,1	V
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,64		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 2268 A/µs di/dt = 1969 A/µs di/dt = 1970 A/µs	±15	600	75	25 125 150		75 77 78		A
Reverse recovery time	t_{rr}					25 125 150		278 432 459		ns
Recovered charge	Q_r					25 125 150		8,539 13,394 15,308		µC
Reverse recovered energy	E_{rec}					25 125 150		3,195 5,193 5,995		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		802 614 544		A/µs
Rectifier Diode										
Static										
Forward voltage	V_F				50	25 125 150		1,14 1,08 1,07	1,21	V
Reverse leakage current	I_r			1600		25 145			50 1100	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,75		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

$I_C = f(V_{CE})$

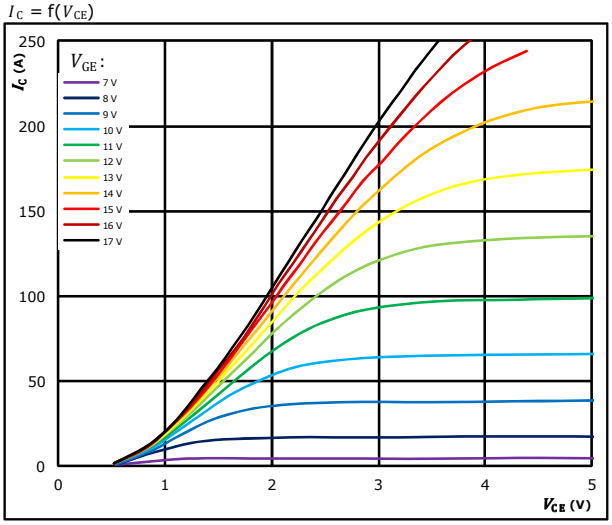


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

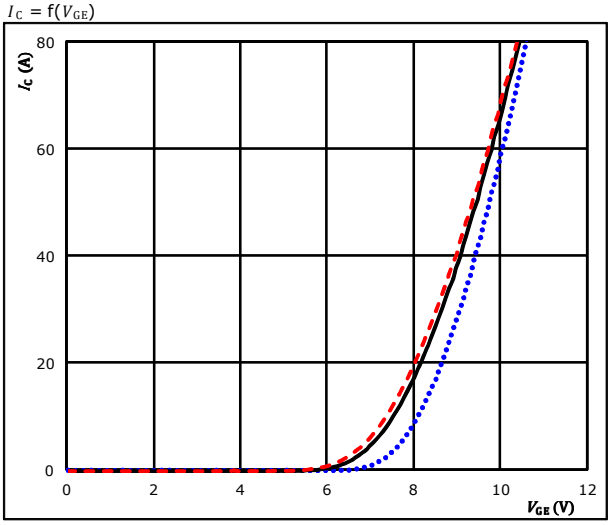


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

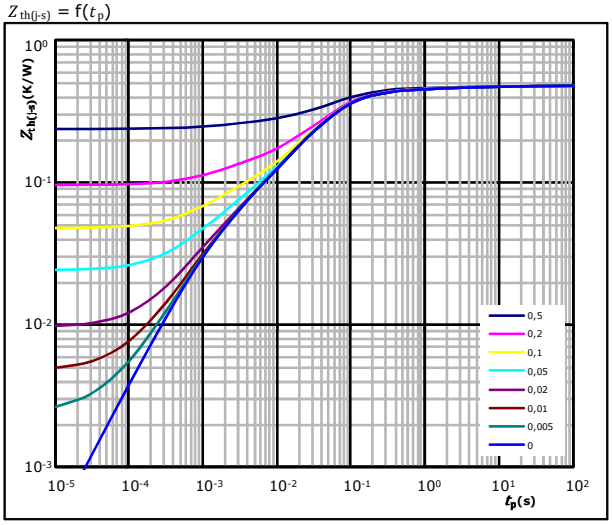


t_p =	100	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,49	K/W

IGBT thermal model values

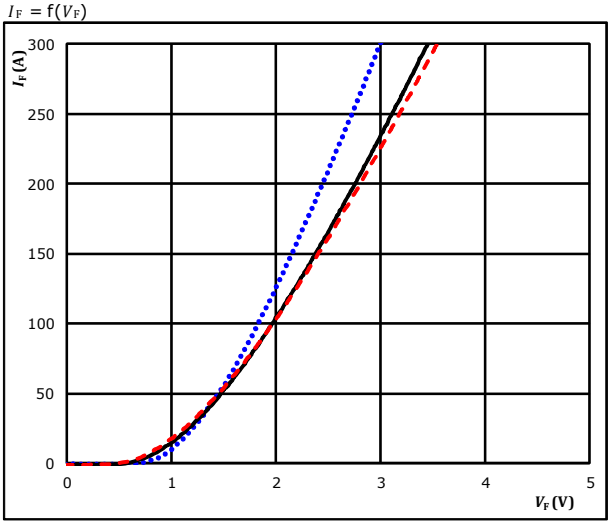
R (K/W)	τ (s)
1,81E-02	3,62E+00
3,38E-02	3,08E-01
8,98E-02	5,50E-02
2,60E-01	1,84E-02
4,85E-02	3,57E-03
3,25E-02	5,49E-04
2,24E-03	2,65E-04

Inverter / Brake Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



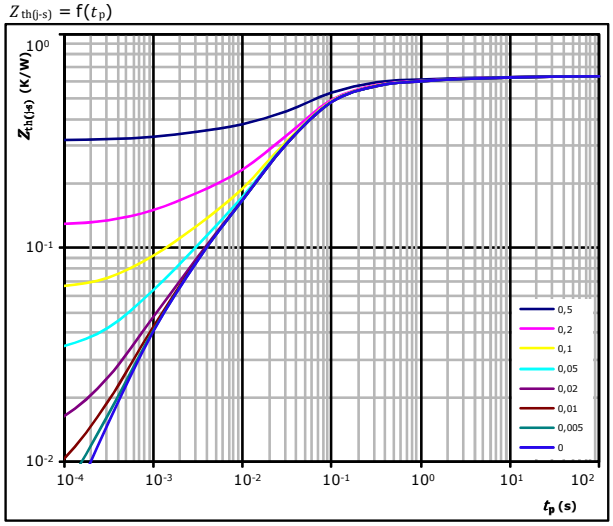
t_p = 250 µs

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

$R_{th(j-s)}$ = 0,64 K/W

FWD thermal model values

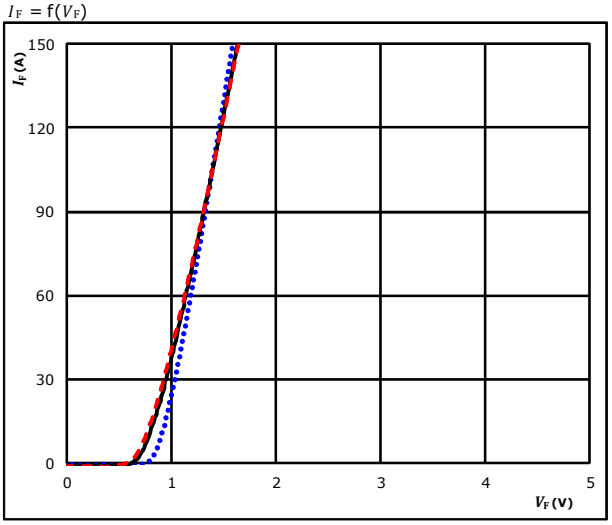
R (K/W)	τ (s)
2,37E-02	4,76E+00
4,45E-02	4,05E-01
1,18E-01	7,23E-02
3,42E-01	2,42E-02
6,37E-02	4,70E-03
4,28E-02	7,22E-04
2,95E-03	3,48E-04

Rectifier Diode Characteristics

figure 1. **Rectifer**

Typical forward characteristics

$I_F = f(V_F)$



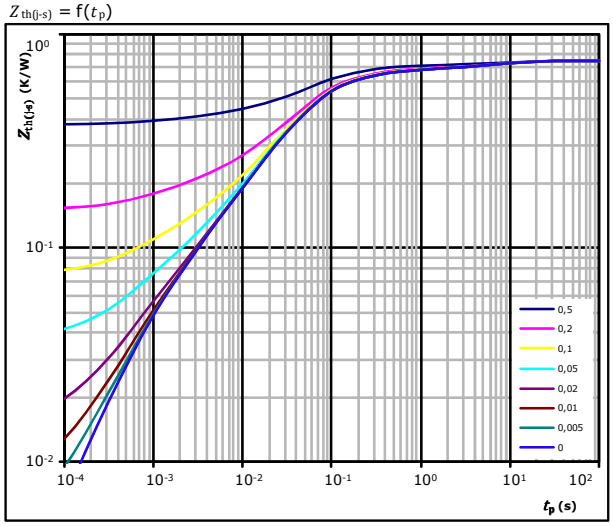
t_p = 250 µs

T_j: 25 °C
125 °C
150 °C

figure 2. **Rectifer**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,75 K/W

Rectifer thermal model values

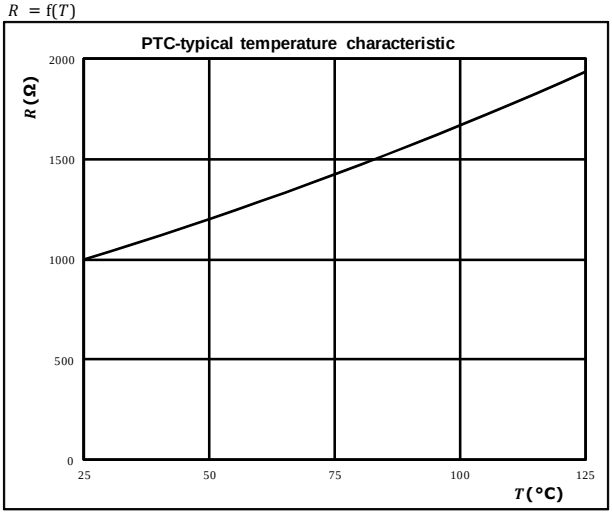
R (K/W)	τ (s)
6,99E-02	4,80E+00
7,97E-02	2,69E-01
3,54E-01	4,00E-02
1,62E-01	1,46E-02
5,21E-02	2,38E-03
3,21E-02	4,72E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical PTC characteristic as a function of temperature

$R = f(T)$

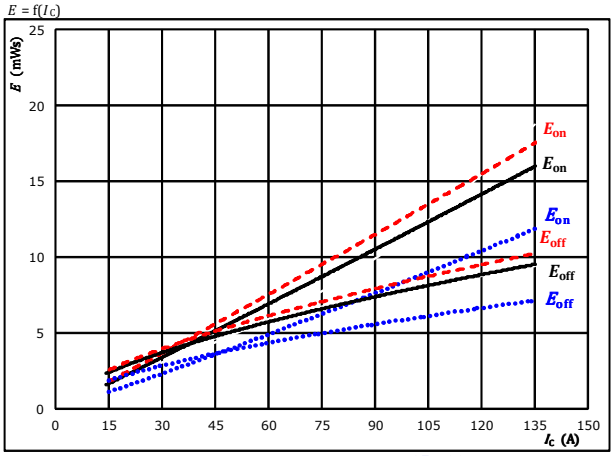


Inverter / Brake Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



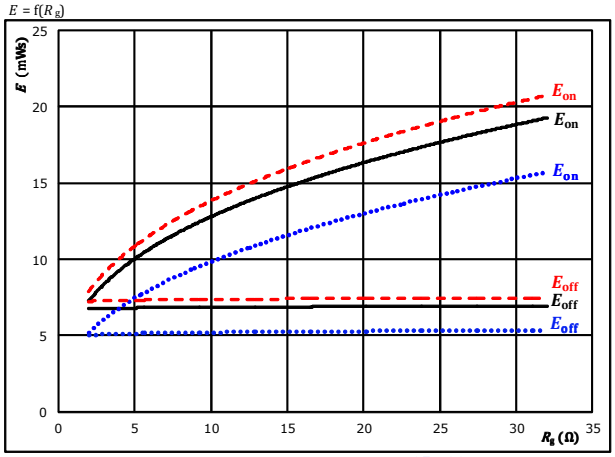
With an inductive load at

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

$E = f(R_g)$



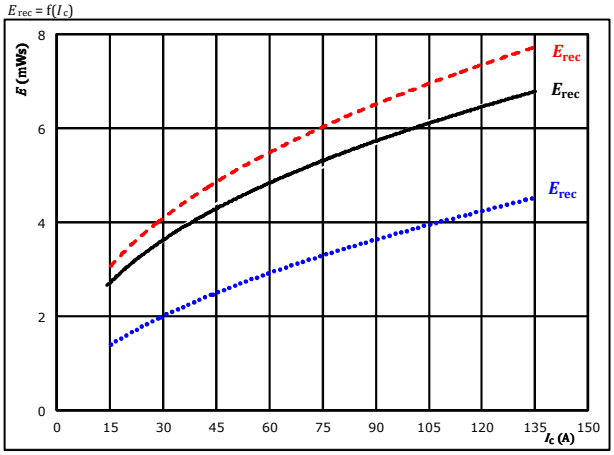
With an inductive load at

V_{CE} =	600	V	T_J:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	75	A		150 °C

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



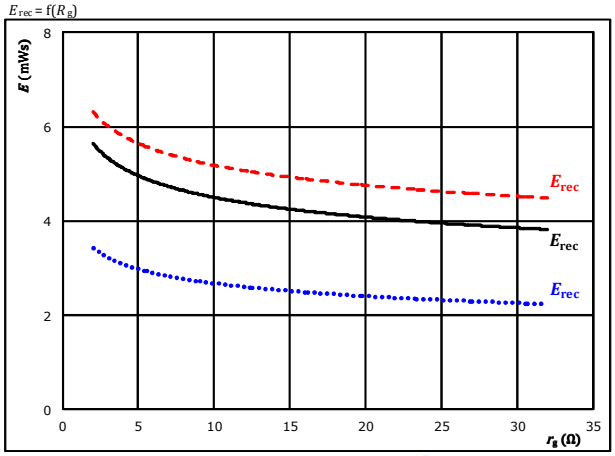
With an inductive load at

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

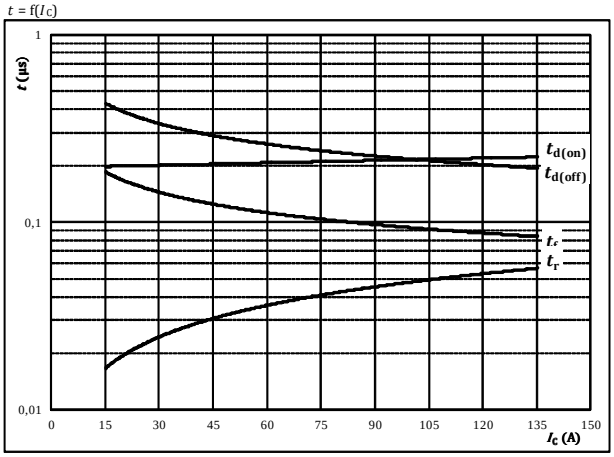
V_{CE} =	600	V	T_J:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	75	A		150 °C

Inverter / Brake Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



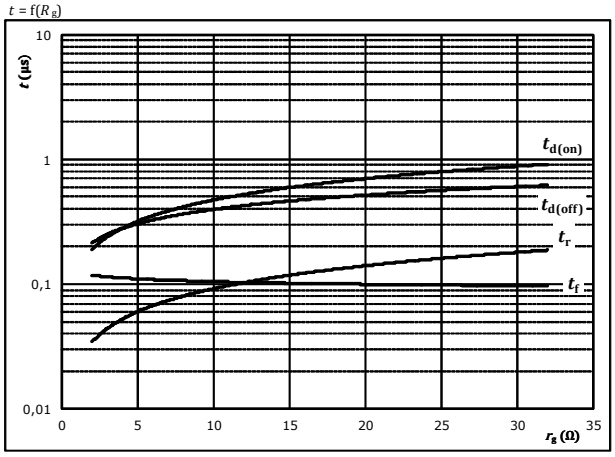
With an inductive load at

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

$t = f(R_g)$



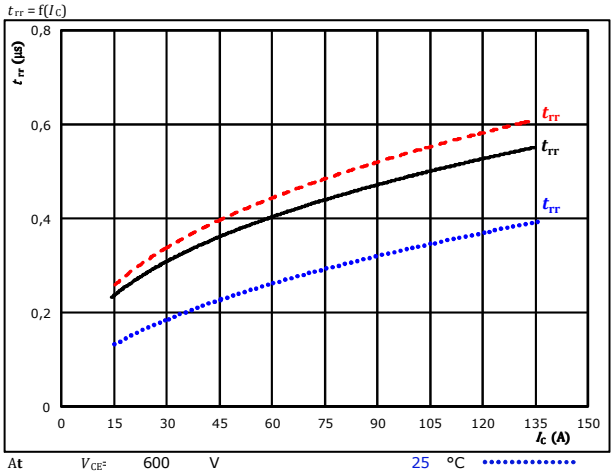
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	75	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



At

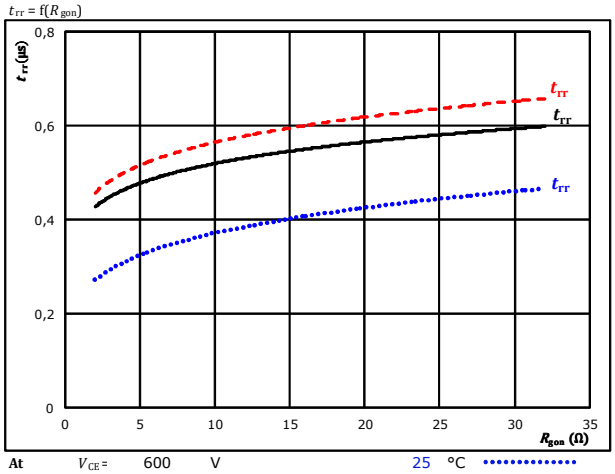
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

T_j: 25 °C, 125 °C, 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
V_{GE} =	±15	V
I_C =	75	A

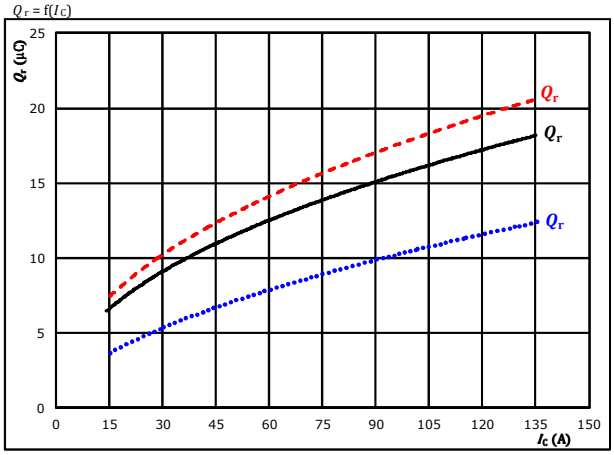
T_j: 25 °C, 125 °C, 150 °C

Inverter / Brake Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

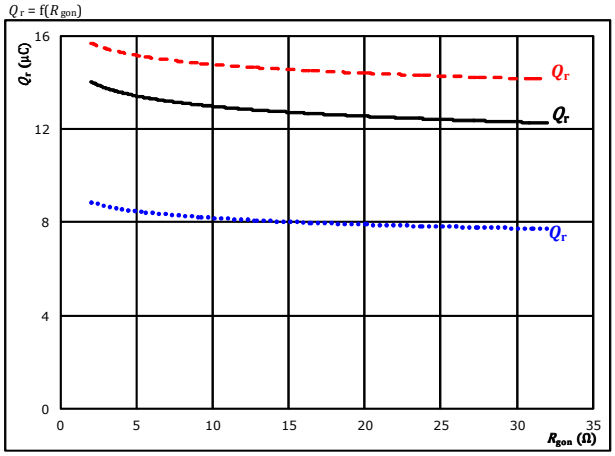


At						
	V_{CE} =	600	V		25 °C	•••••••••••••••
	V_{GE} =	±15	V	T_j:	125 °C	———
	R_{gon} =	2	Ω		150 °C	– – – –

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

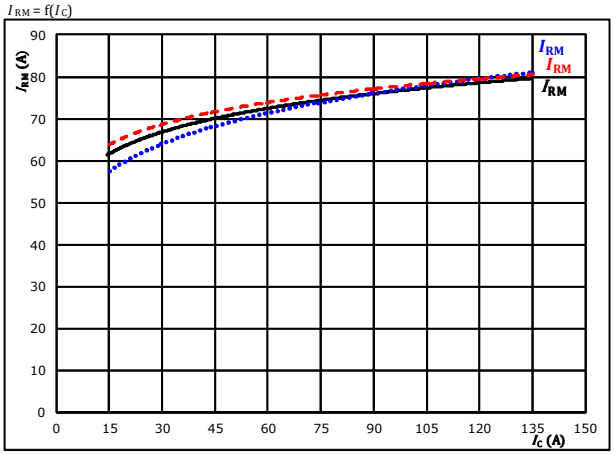


At						
	V_{CE}=	600	V		25 °C	•••••••••••••••
	V_{GE} =	±15	V	T_j:	125 °C	———
	I_C=	75	A		150 °C	– – – –

figure 11. **FWD**

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

$I_{RM} = f(I_C)$

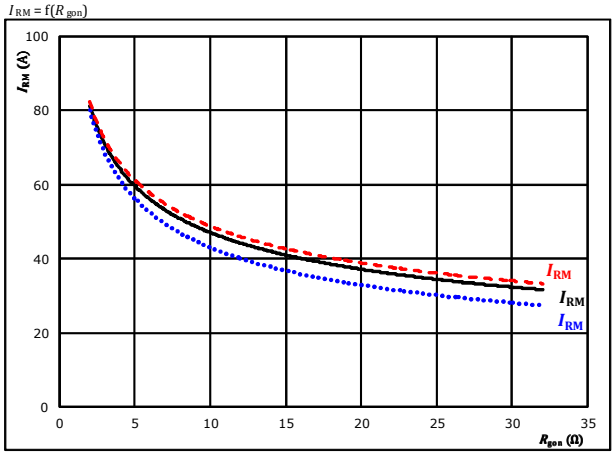


At						
	V_{CE}:	600	V		25 °C	•••••••••••••••
	V_{GE} =	±15	V	T_j:	125 °C	———
	R_{gon} =	2	Ω		150 °C	– – – –

figure 12. **FWD**

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

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



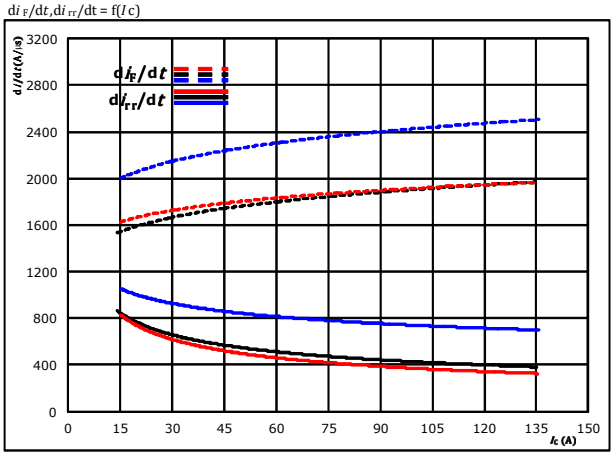
At						
	V_{CE} =	600	V		25 °C	•••••••••••••••
	V_{GE} =	±15	V	T_j:	125 °C	———
	I_C =	75	A		150 °C	– – – –

Inverter / Brake Switching Characteristics

figure 13. **FWD**

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

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

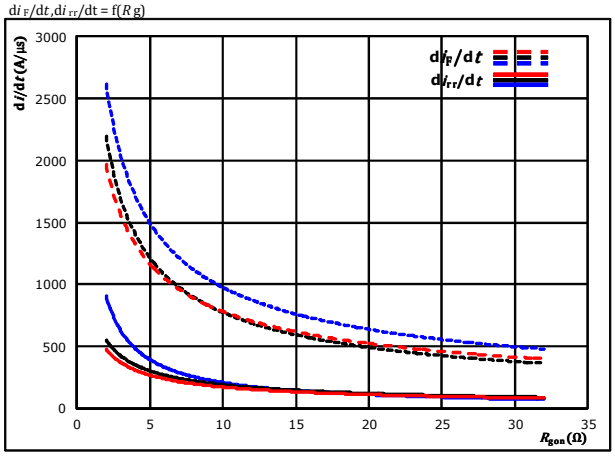


At						
V_{CE} =	600	V	T_j:	25 °C	•••••••••••••••
V_{GE} =	±15	V		125 °C	———
R_{gon} =	2	Ω		150 °C	– – – –

figure 14. **FWD**

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

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

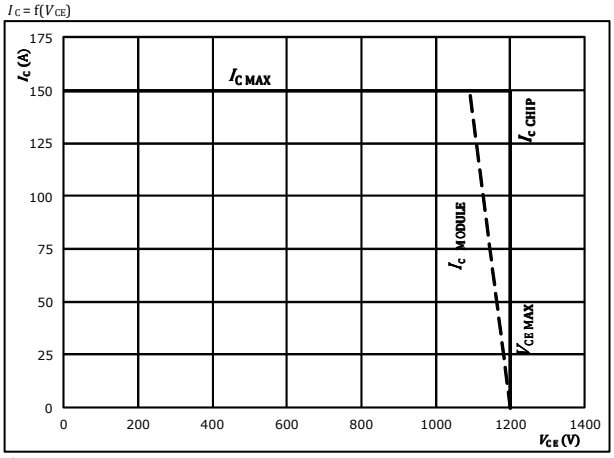


At						
V_{CE} =	600	V	T_j:	25 °C	•••••••••••••••
V_{GE} =	±15	V		125 °C	———
I_C =	75	A		150 °C	– – – –

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

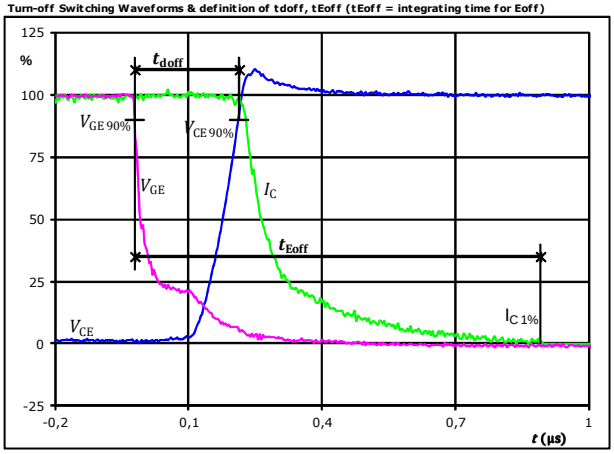
Inverter / Brake Switching Definitions

General conditions

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

figure 1. **IGBT**

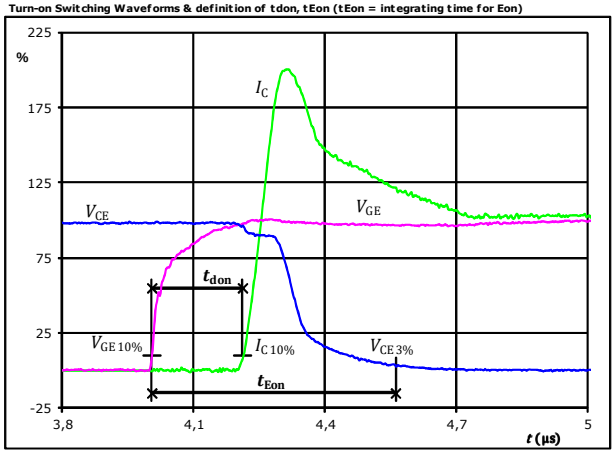
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	76	A
t_{doff} =	0,233	µs
t_{Eoff} =	0,913	µs

figure 2. **IGBT**

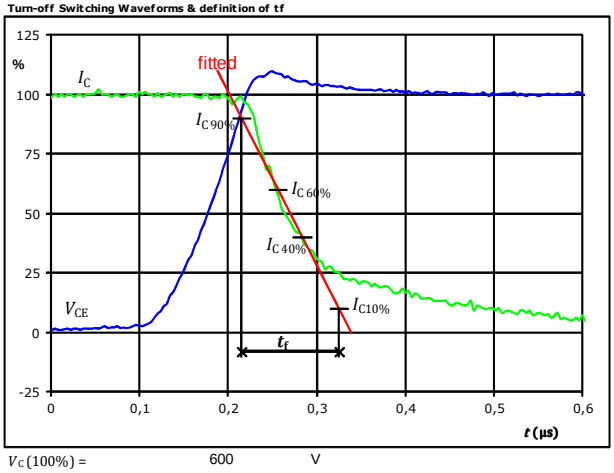
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	76	A
t_{don} =	0,208	µs
t_{Eon} =	0,556	µs

figure 3. **IGBT**

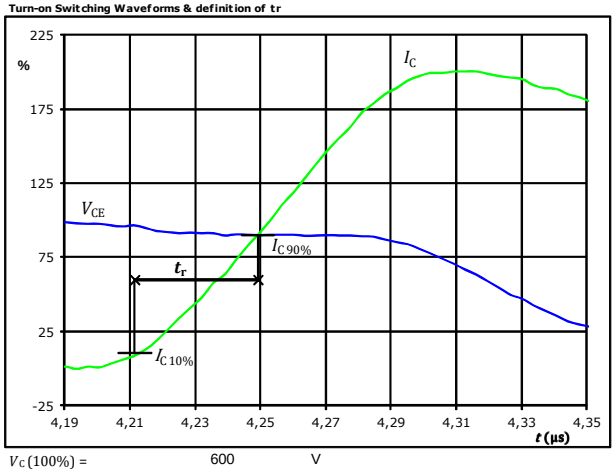
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	76	A
t_f =	0,113	µs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of tr

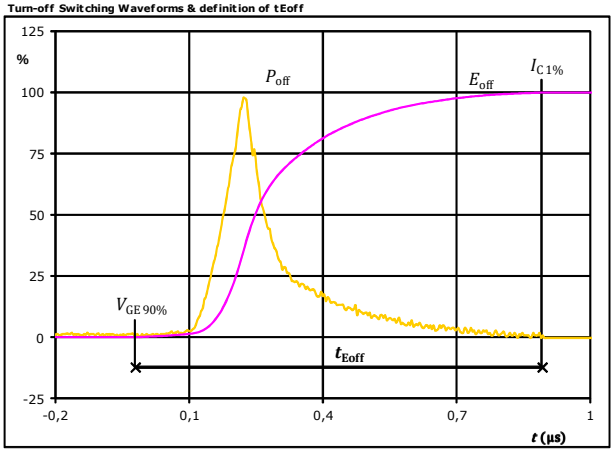


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	76	A
t_r =	0,038	µs

Inverter / Brake Switching Characteristics

figure 5. **IGBT**

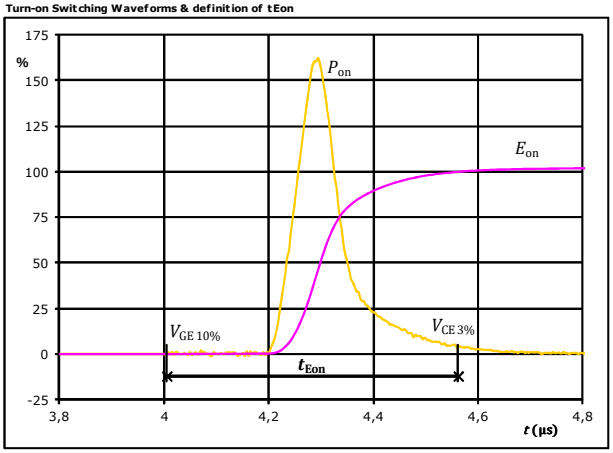
Turn-off Switching Waveforms & definition of tEoff



$P_{off}(100\%)$ =	45,36	kW
$E_{off}(100\%)$ =	6,80	mJ
t_{Eoff} =	0,91	µs

figure 6. **IGBT**

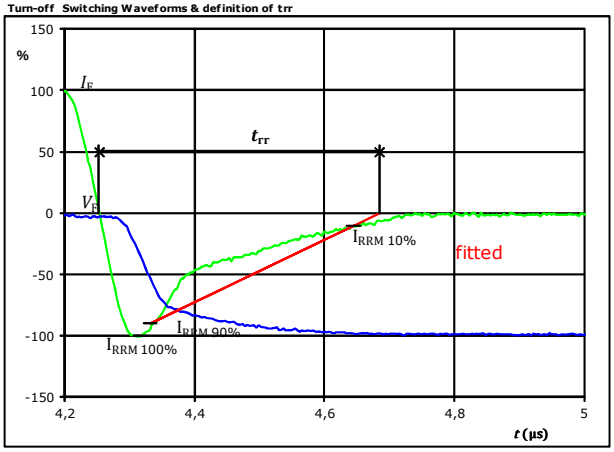
Turn-on Switching Waveforms & definition of tEon



$P_{on}(100\%)$ =	45,36	kW
$E_{on}(100\%)$ =	7,82	mJ
t_{Eon} =	0,56	µs

figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

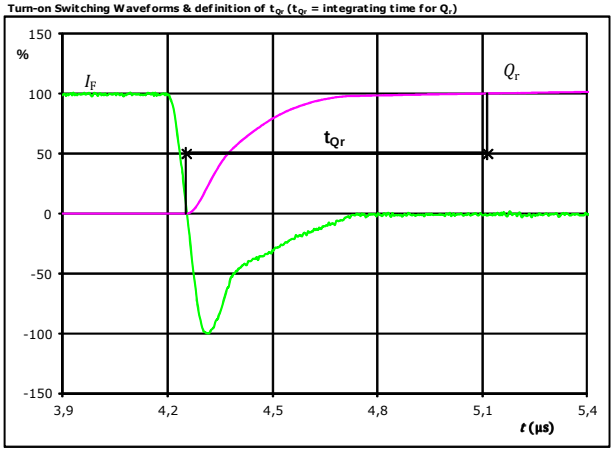


$V_F(100\%)$ =	600	V
$I_F(100\%)$ =	76	A
$I_{RRM}(100\%)$ =	-77	A
t_{rr} =	0,432	µs

Inverter / Brake Switching Characteristics

figure 8. **FWD**

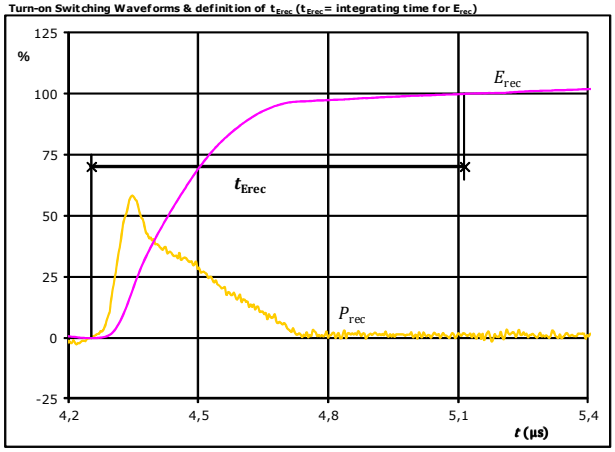
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	76	A
Q_r (100%) =	13,39	µC
t_{Qr} =	0,86	µs

figure 9. **FWD**

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



P_{rec} (100%) =	45,36	kW
E_{rec} (100%) =	5,19	mJ
t_{Erec} =	0,86	µs

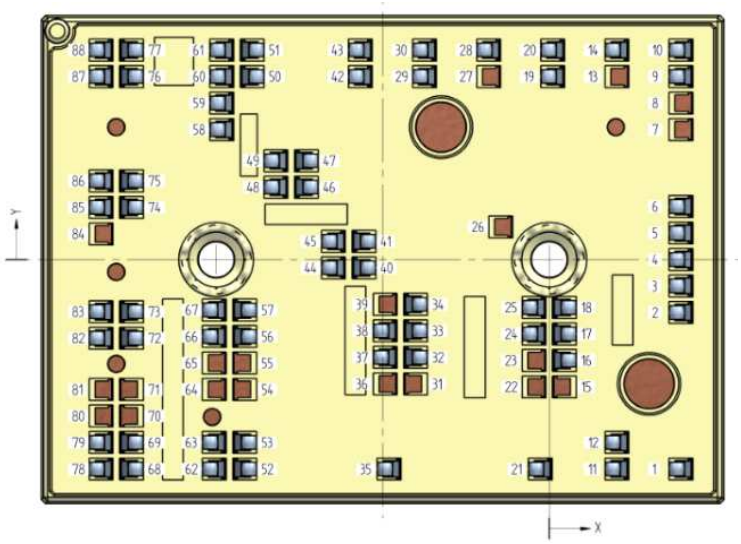
Ordering Code & Marking

Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M312PMA075M7-K429A70-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M312PMA075M7-K429A70-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M312PMA075M7-K429A70-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M312PMA075M7-K429A70-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M312PMA075M7-K429A70-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M312PMA075M7-K429A70-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M312PMA075M7-K429A70-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M312PMA075M7-K429A70-/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		

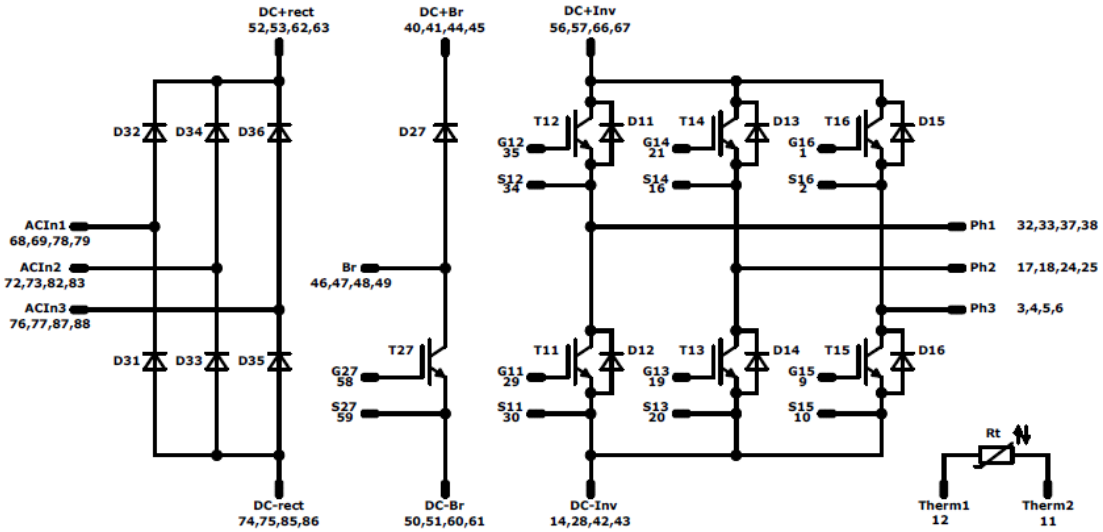
Outline

PCB pad table [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 data.

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11,T12,T13 T14,T15,T16	IGBT	1200 V	75 A	Inverter Switch	
D11,D12,D13 D14,D15,D16	FWD	1200 V	100 A	Inverter Diode	
T27	IGBT	1200 V	75 A	Brake Switch	
D27	FWD	1200 V	100 A	Brake Diode	
D31,D32,D33 D34,D35,D36	Diode	1600 V	50 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-M312PMA075M7-K429A70-D2-14	20 Dec. 2017		