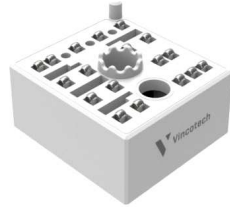
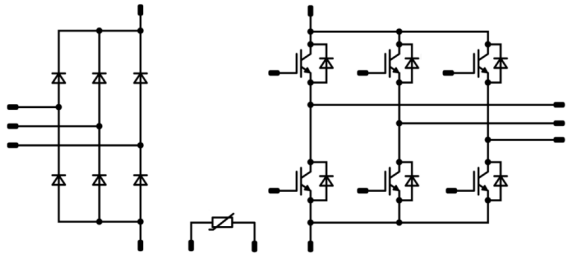




Vincotech

80-M012PNA010M7-K619C71 datasheet

MiniSkiiP® PIM 0		1200 V / 10 A
Features • IGBT M7 with low V_{CEsat} and improved EMC behavior • Solder-free spring contact technology • Built in PTC		MiniSkiiP® 0 housing 
Target applications • Industrial Drives		Schematic 
Types • 80-M012PNA010M7-K619C71		

Maximum Ratings

$T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Rectifier Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	35	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave $T_j = 150\text{ °C}$ $t_p = 10\text{ ms}$	200	A
Surge current capability	I^2t		200	A ² s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	51	W
Maximum Junction Temperature	T_{jmax}		150	°C



Vincotech

Maximum Ratings

$T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	14	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	67	W
Gate-emitter voltage	V_{GES}		± 20	V
Maximum junction temperature	T_{jmax}		175	°C

Inverter Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	14	A
Repetitive peak forward current	I_{FRM}		20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	53	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



Vincotech

80-M012PNA010M7-K619C71

datasheet

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	

Rectifier Diode

Static

Forward voltage	V_F				25	25 125		1,22 1,21	1,75	V
Reverse leakage current	I_r			1600		25 145			50 1100	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 2,5 \text{ W/mK}$ (HPTP)						1,37		K/W
-------------------------------------	---------------	--	--	--	--	--	--	------	--	-----



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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	

Inverter Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,001	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		10	25 125 150		1,66 1,90 1,96	1,95	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			55	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			2000		pF
Output capacitance	C_{oes}							86		
Reverse transfer capacitance	C_{res}							23		
Gate charge	Q_g		15	600	10	25		80		nC

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 2,5 \text{ W/mK}$ (HPTP)						1,41		K/W
-------------------------------------	---------------	--	--	--	--	--	--	------	--	-----

Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{goff} = 32 \Omega$ $R_{gon} = 32 \Omega$	± 15	600	10	25 125 150		128 126 123		ns
Rise time	t_r					25 125 150		29 32 34		
Turn-off delay time	$t_{d(off)}$					25 125 150		145 179 182		
Fall time	t_f					25 125 150		98 108 117		
Turn-on energy (per pulse)	E_{on}					25 125 150		0,883 1,125 1,189		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,656 0,860 0,908		



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80-M012PNA010M7-K619C71

datasheet

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				10	25 125 150		1,61 1,69 1,69	2,1	V
Reverse leakage current	I_R			1200		25			25	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 2,5 \text{ W/mK}$ (HPTP)						1,80		K/W
-------------------------------------	---------------	--	--	--	--	--	--	------	--	-----

Dynamic

Peak recovery current	I_{RRM}	$di/dt = 278 \text{ A/}\mu\text{s}$ $di/dt = 270 \text{ A/}\mu\text{s}$ $di/dt = 272 \text{ A/}\mu\text{s}$	± 15	600	10	25 125 150		9 9 9		A
Reverse recovery time	t_{rr}					25 125 150		254 373 409		ns
Recovered charge	Q_r					25 125 150		1,088 1,664 1,808		μC
Reverse recovered energy	E_{rec}					25 125 150		0,374 0,620 0,680		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		85 54 49		A/μs

Thermistor

Rated resistance	R					25		1		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	$R_{100} = 1670 \Omega$				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	



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80-M012PNA010M7-K619C71 datasheet

Rectifier Diode Characteristics

figure 1. FWD
Typical forward characteristics

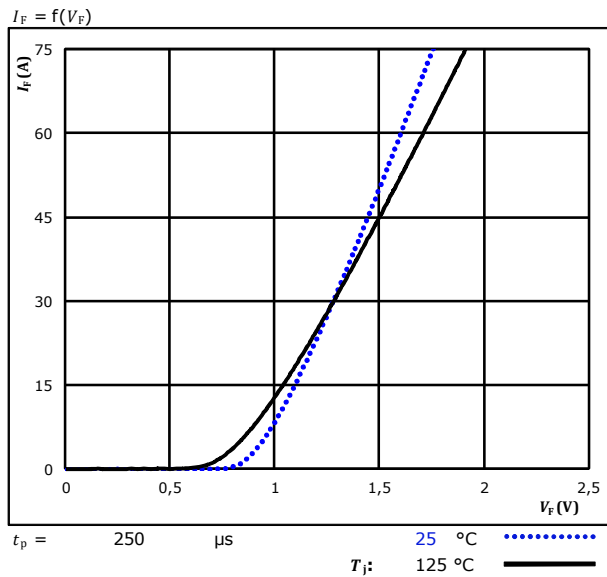
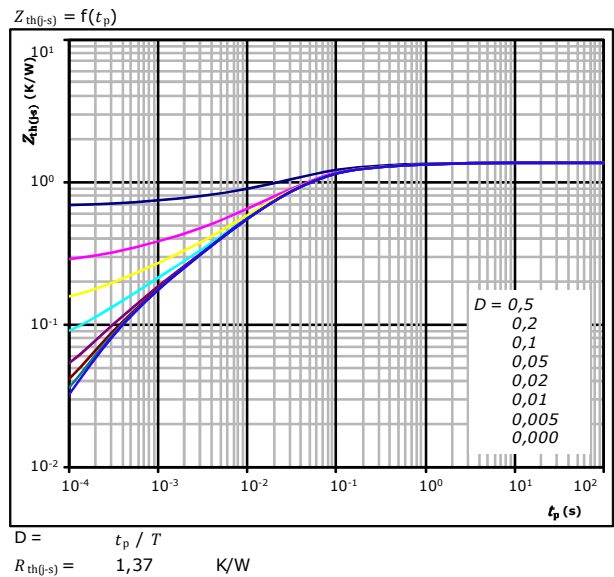


figure 2. FWD
Transient thermal impedance as a function of pulse width



Diode thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
6,75E-02	1,56E+00
1,34E-01	2,41E-01
6,34E-01	4,40E-02
3,25E-01	9,85E-03
1,24E-01	2,12E-03
8,72E-02	3,56E-04
8,72E-02	3,56E-04



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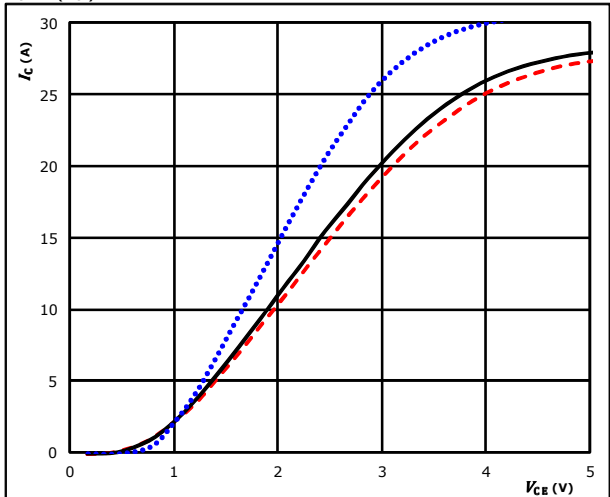
80-M012PNA010M7-K619C71
datasheet

Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

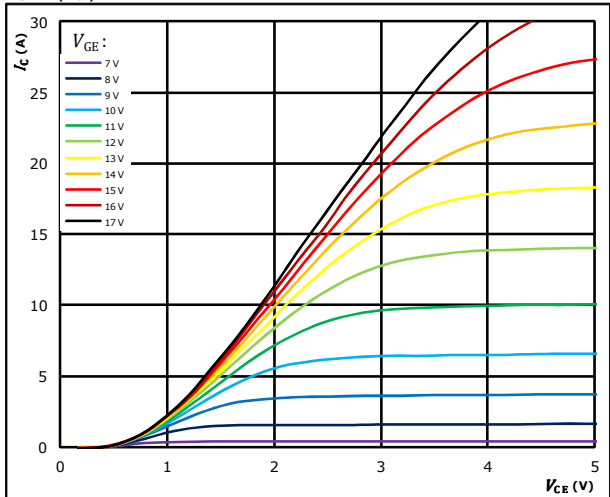


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j: 25 \text{ } ^\circ C$ (blue dotted line)
 $125 \text{ } ^\circ C$ (black solid line)
 $150 \text{ } ^\circ C$ (red dashed line)

figure 2. IGBT

Typical output characteristics

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

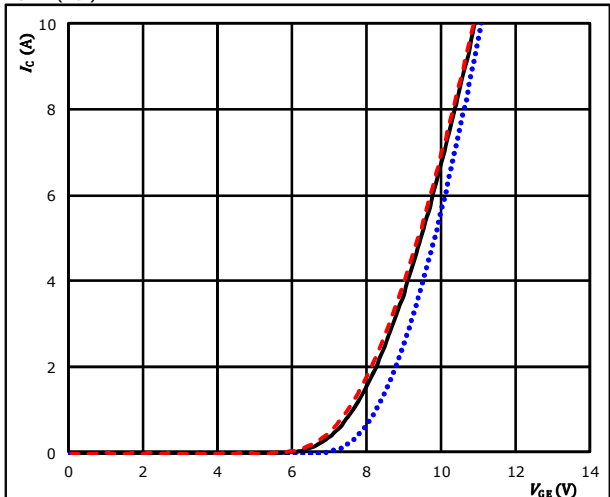


$t_p = 250 \mu s$
 $T_j = 150 \text{ } ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

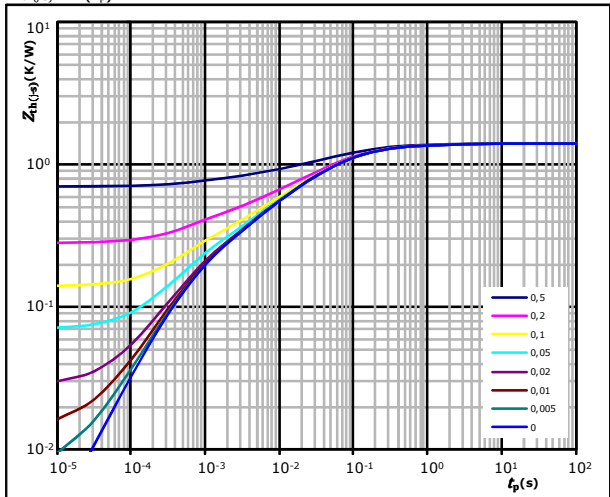


$t_p = 100 \mu s$
 $V_{CE} = 10 V$
 $T_j: 25 \text{ } ^\circ C$ (blue dotted line)
 $125 \text{ } ^\circ C$ (black solid line)
 $150 \text{ } ^\circ C$ (red dashed line)

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$
 $R_{th(j-s)} = 1,41 \text{ K/W}$
IGBT thermal model values

R (K/W)	τ (s)
6,61E-02	1,89E+00
1,81E-01	2,00E-01
5,32E-01	4,93E-02
3,21E-01	1,08E-02
1,59E-01	2,58E-03
1,49E-01	4,46E-04



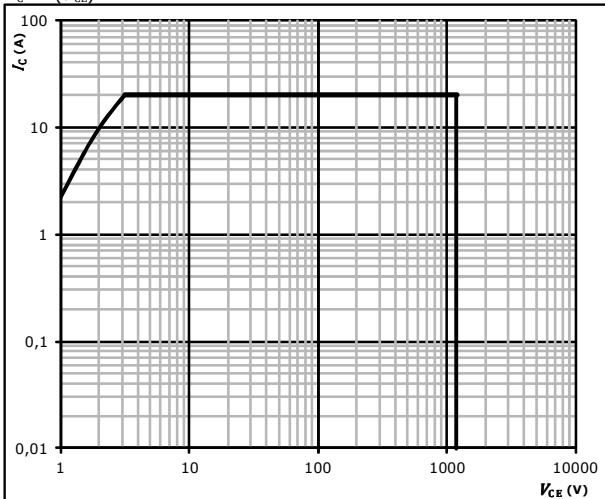
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Inverter Switch Characteristics

figure 5. IGBT

Safe operating area

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



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



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Inverter Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

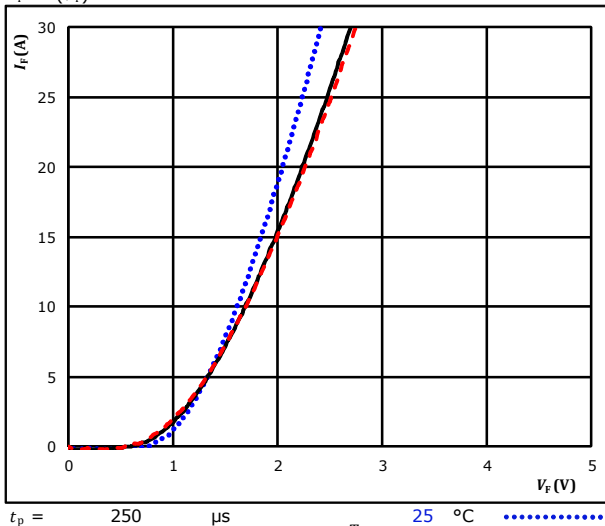
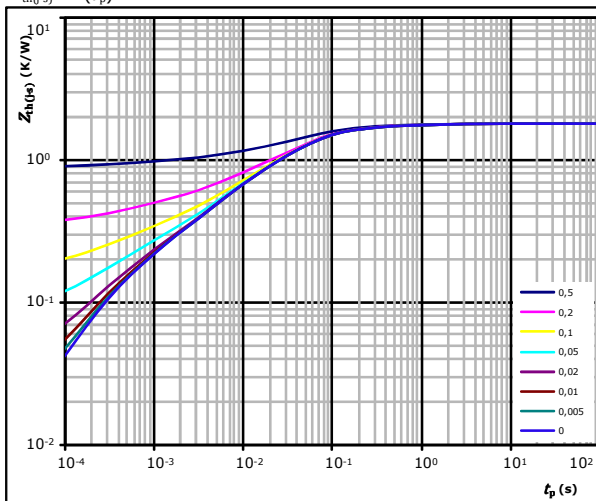


figure 2. FWD

Transient thermal impedance as a function of pulse width

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



FWD thermal model values

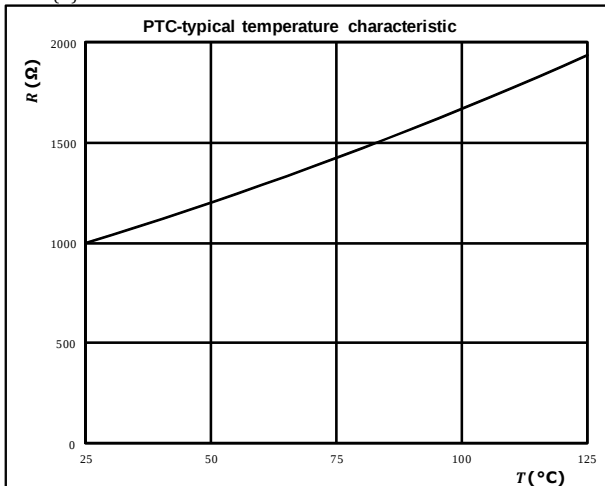
$R \text{ (K/W)}$	$\tau \text{ (s)}$
9,72E-02	1,16E+00
2,38E-01	1,67E-01
9,04E-01	4,46E-02
3,13E-01	8,53E-03
1,25E-01	2,30E-03
1,19E-01	3,66E-04

Thermistor Characteristics

figure 1. Thermistor

Typical PTC characteristic
as a function of temperature

$$R = f(T)$$



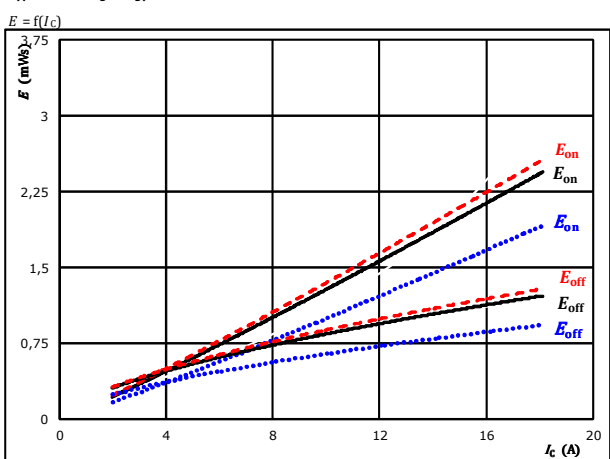


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Inverter Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current



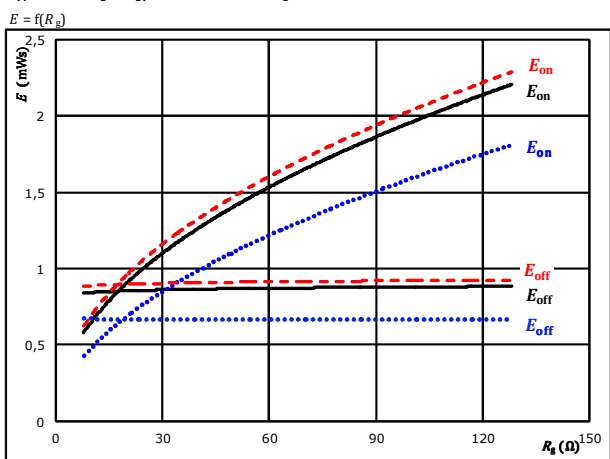
With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω
 $R_{goff} = 32$ Ω

T_J : 25 °C (dotted blue)
125 °C (solid black)
150 °C (dashed red)

figure 2. IGBT

Typical switching energy losses as a function of gate resistor



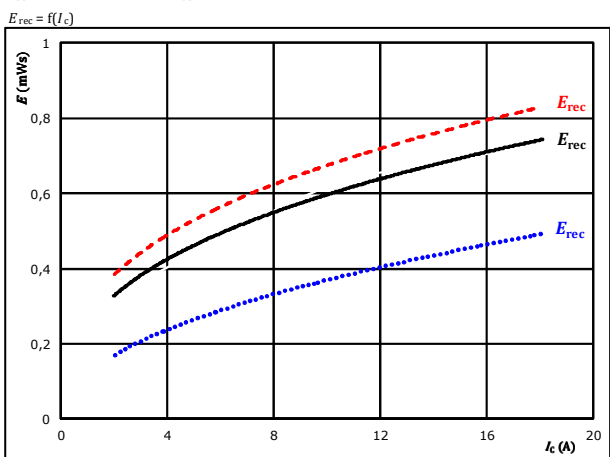
With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 10$ A

T_J : 25 °C (dotted blue)
125 °C (solid black)
150 °C (dashed red)

figure 3. FWD

Typical reverse recovered energy loss as a function of collector current



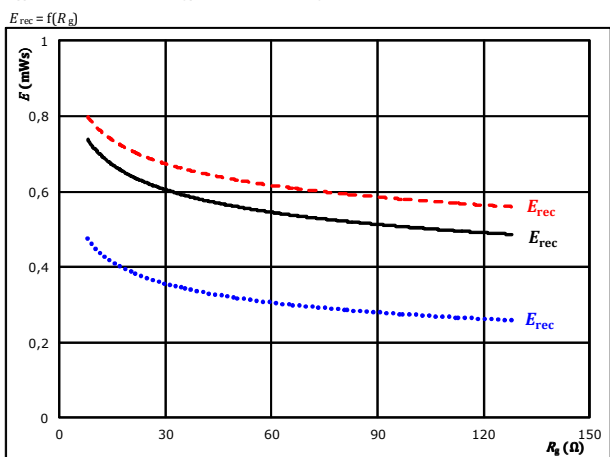
With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω

T_J : 25 °C (dotted blue)
125 °C (solid black)
150 °C (dashed red)

figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor



With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 10$ A

T_J : 25 °C (dotted blue)
125 °C (solid black)
150 °C (dashed red)



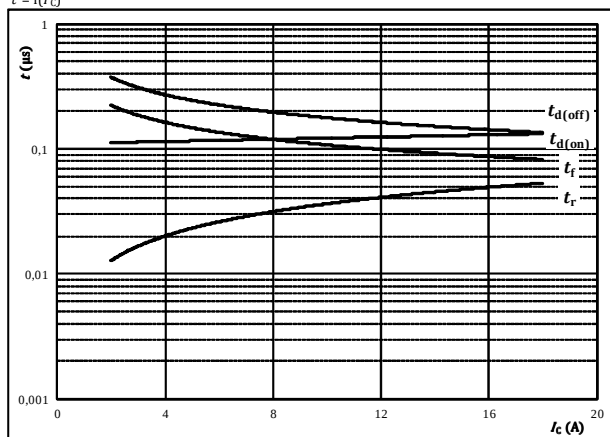
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Inverter Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



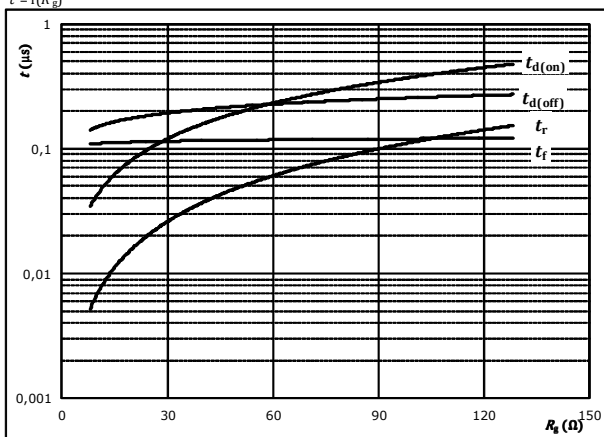
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	32	Ω
$R_{goff} =$	32	Ω

figure 6. IGBT

Typical switching times as a function of gate resistor

$t = f(R_g)$



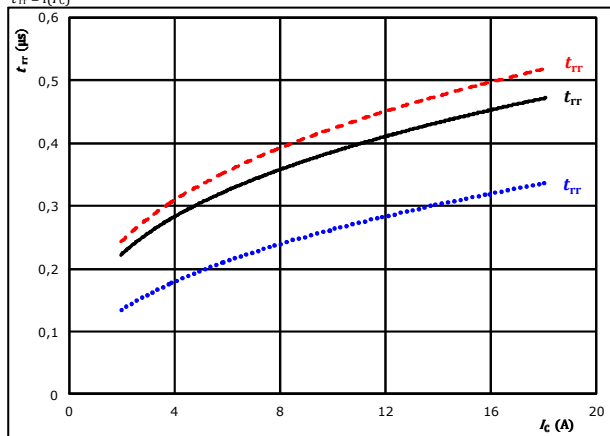
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$I_C =$	10	A

figure 7. FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

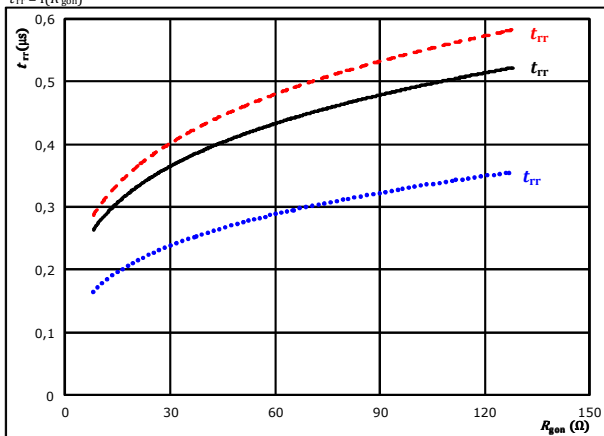


At	$V_{CE} =$	600	V	$T_j:$	25 °C	
	$V_{GE} =$	±15	V		125 °C	————
	$R_{gon} =$	32	Ω		150 °C	-----

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	————
	$I_C =$	10	A		150 °C	-----



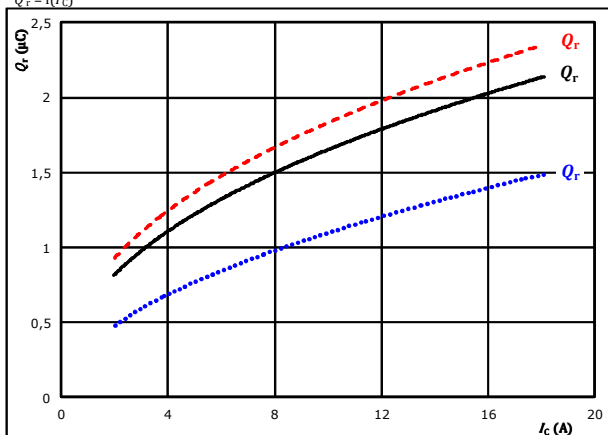
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Inverter Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_C)$$

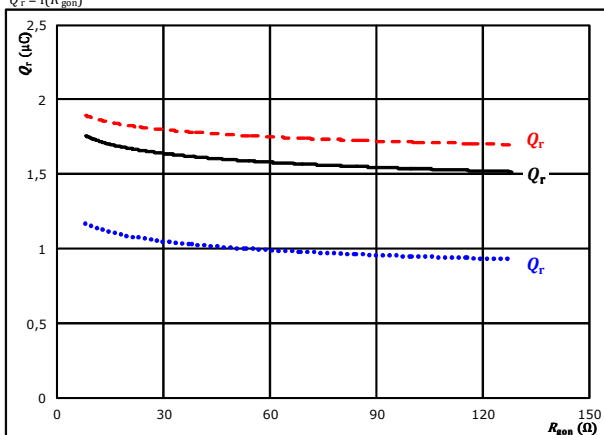


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω
 T_j : 25 °C
125 °C ———
150 °C - - - - -

figure 10. FWD

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

$$Q_r = f(R_{gon})$$

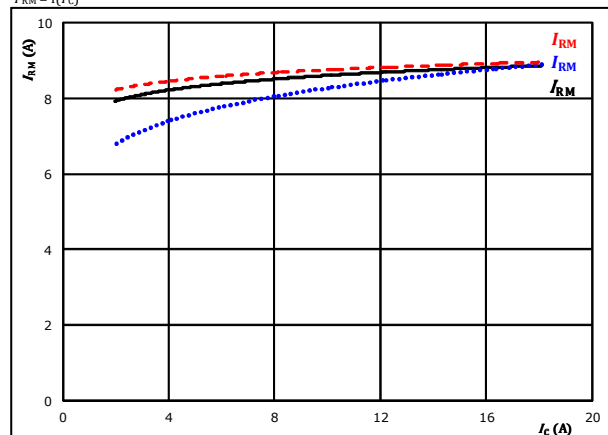


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 10$ A
 T_j : 25 °C
125 °C ———
150 °C - - - - -

figure 11. FWD

Typical peak reverse recovery current as a function of collector current

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

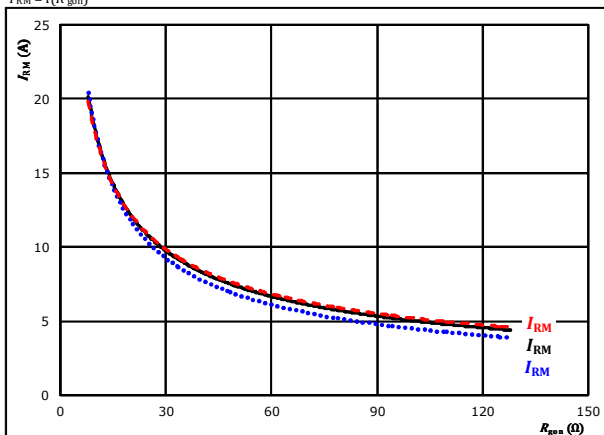


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω
 T_j : 25 °C
125 °C ———
150 °C - - - - -

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
 $V_{GE} = \pm 15$ V
 $I_C = 10$ A
 T_j : 25 °C
125 °C ———
150 °C - - - - -



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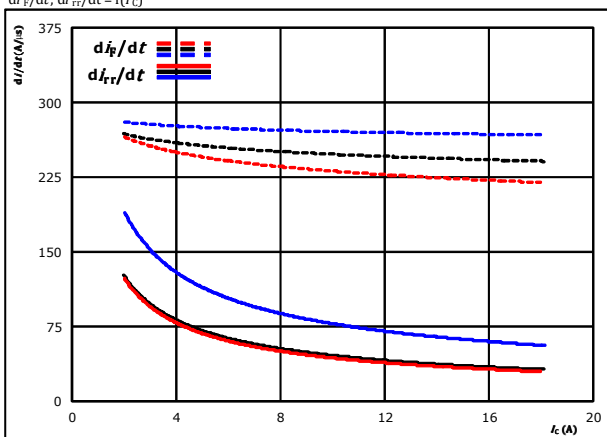
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datasheet

Inverter Switching Characteristics

figure 13. FWD

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

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

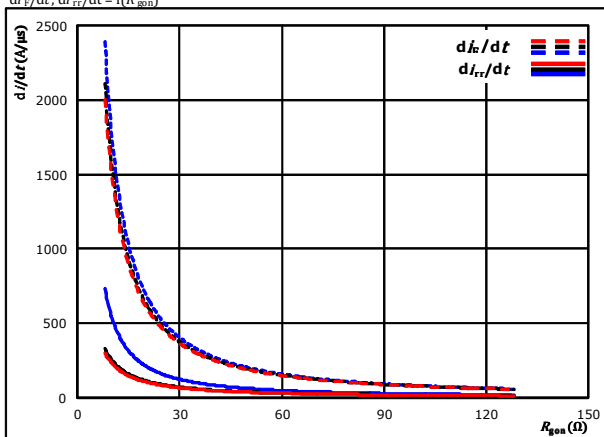


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{g0n} = 32$ Ω
 $T_j = 25$ °C
 125 °C
 150 °C

figure 14. FWD

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

$$di_f/dt, di_{rr}/dt = f(R_{g0n})$$

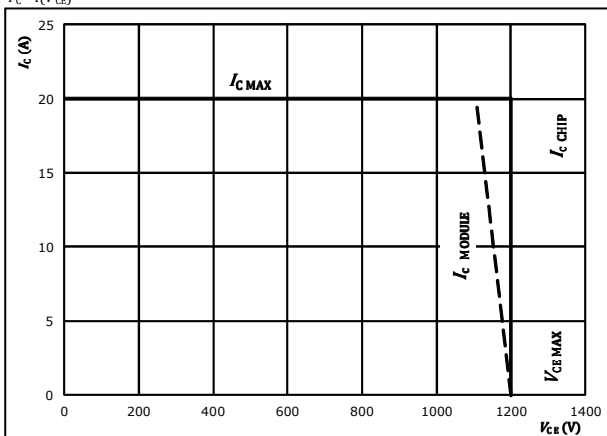


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 10$ A
 $T_j = 25$ °C
 125 °C
 150 °C

figure 15. IGBT

Reverse bias safe operating area

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



At $T_j = 175$ °C
 $R_{g0n} = 32$ Ω
 $R_{g0ff} = 32$ Ω



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datasheet

Inverter Switching Definitions

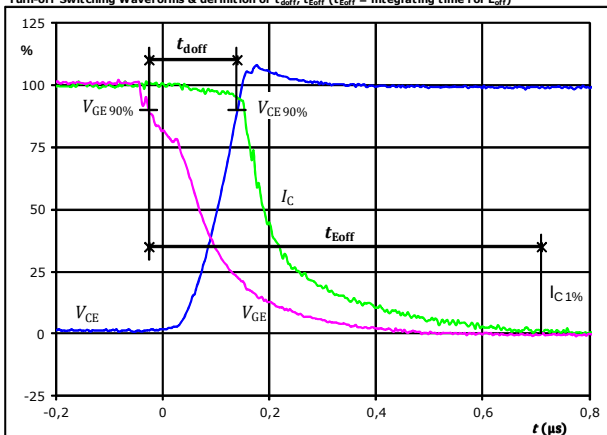
General conditions

T_j	=	125 °C
R_{gon}	=	32 Ω
R_{goff}	=	32 Ω

figure 1.

IGBT

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

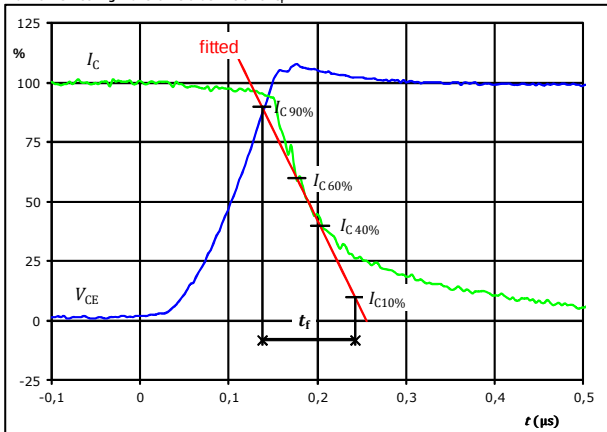


$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	600	V
$I_C(100\%) =$	10	A
$t_{doff} =$	0,179	μs
$t_{Eoff} =$	0,736	μs

figure 3.

IGBT

Turn-off Switching Waveforms & definition of t_f

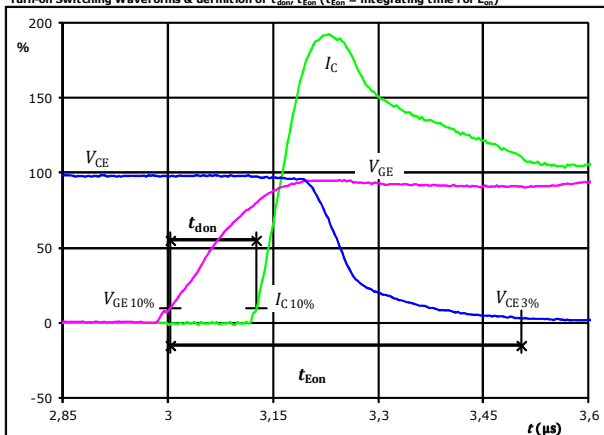


$V_C(100\%) =$	600	V
$I_C(100\%) =$	10	A
$t_f =$	0,108	μs

figure 2.

IGBT

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

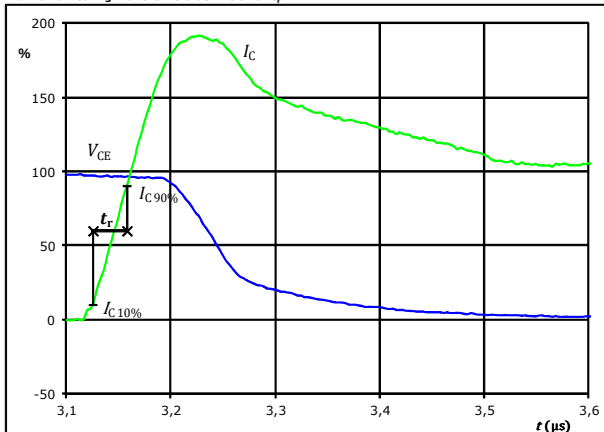


$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	600	V
$I_C(100\%) =$	10	A
$t_{don} =$	0,126	μs
$t_{Eon} =$	0,501	μs

figure 4.

IGBT

Turn-on Switching Waveforms & definition of t_r



$V_C(100\%) =$	600	V
$I_C(100\%) =$	10	A
$t_r =$	0,032	μs



Vincotech

Inverter Switching Characteristics

figure 5. IGBT

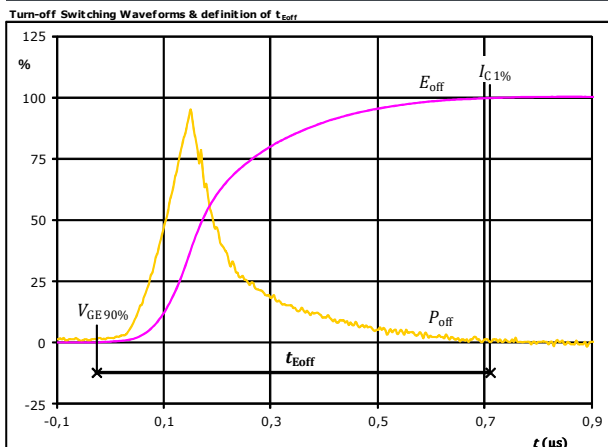


figure 6. IGBT

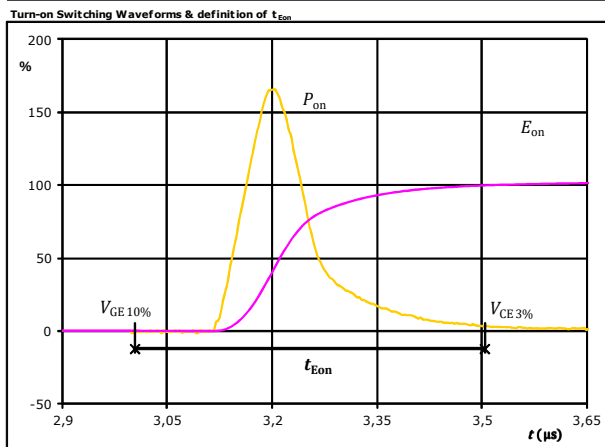
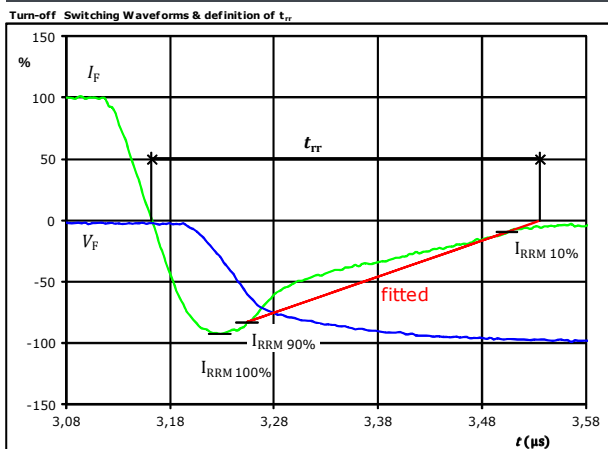


figure 7. FWD





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Inverter Switching Characteristics

figure 8. FWD

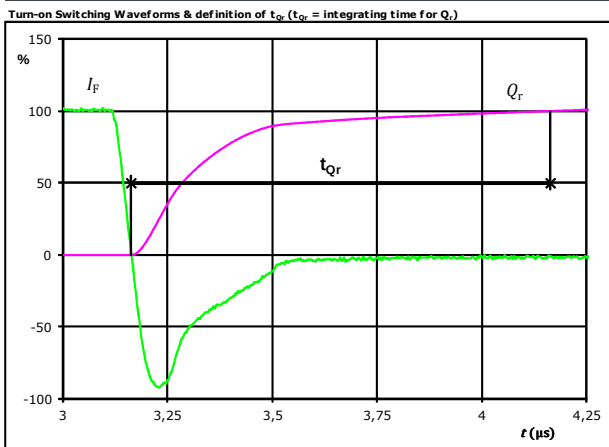
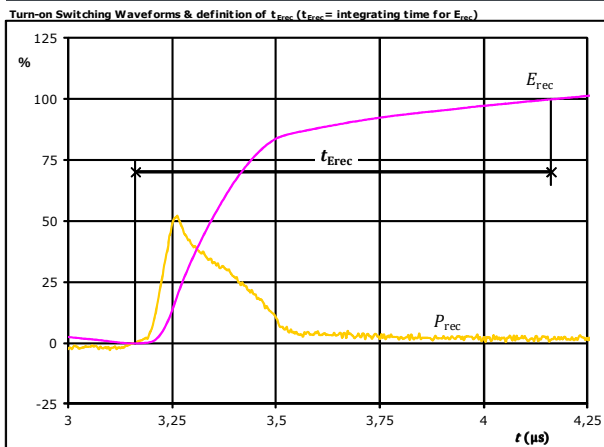


figure 9. FWD





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Ordering Code & Marking								
Version				Ordering Code				
With std lid (6.5mm height) + no thermal grease				80-M012PNA010M7-K619C71-/0A/				
With thin lid (2.8mm height) + no thermal grease				80-M012PNA010M7-K619C71-/0B/				
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)				80-M012PNA010M7-K619C71-/1A/				
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)				80-M012PNA010M7-K619C71-/1B/				
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)				80-M012PNA010M7-K619C71-/4A/				
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)				80-M012PNA010M7-K619C71-/4B/				
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)				80-M012PNA010M7-K619C71-/5A/				
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)				80-M012PNA010M7-K619C71-/5B/				
NN-NNNNNNNNNN NNNN-TTTTTTWW VIN LLLLL WWYY SSSS UL 		Text	Name		Type&Ver	Date code	VIN & Lot	Serial&UL
			NN-NNNNNNNNNNNNNNNN		TTTTTTTVV	WWYY	VIN LLLLL	SSSS UL
		Datamatrix	Type&Ver	Lot number	Serial	Date code		
TTTTTTTW	LLLLL		SSSS	WWYY				

Outline

PCB pad table

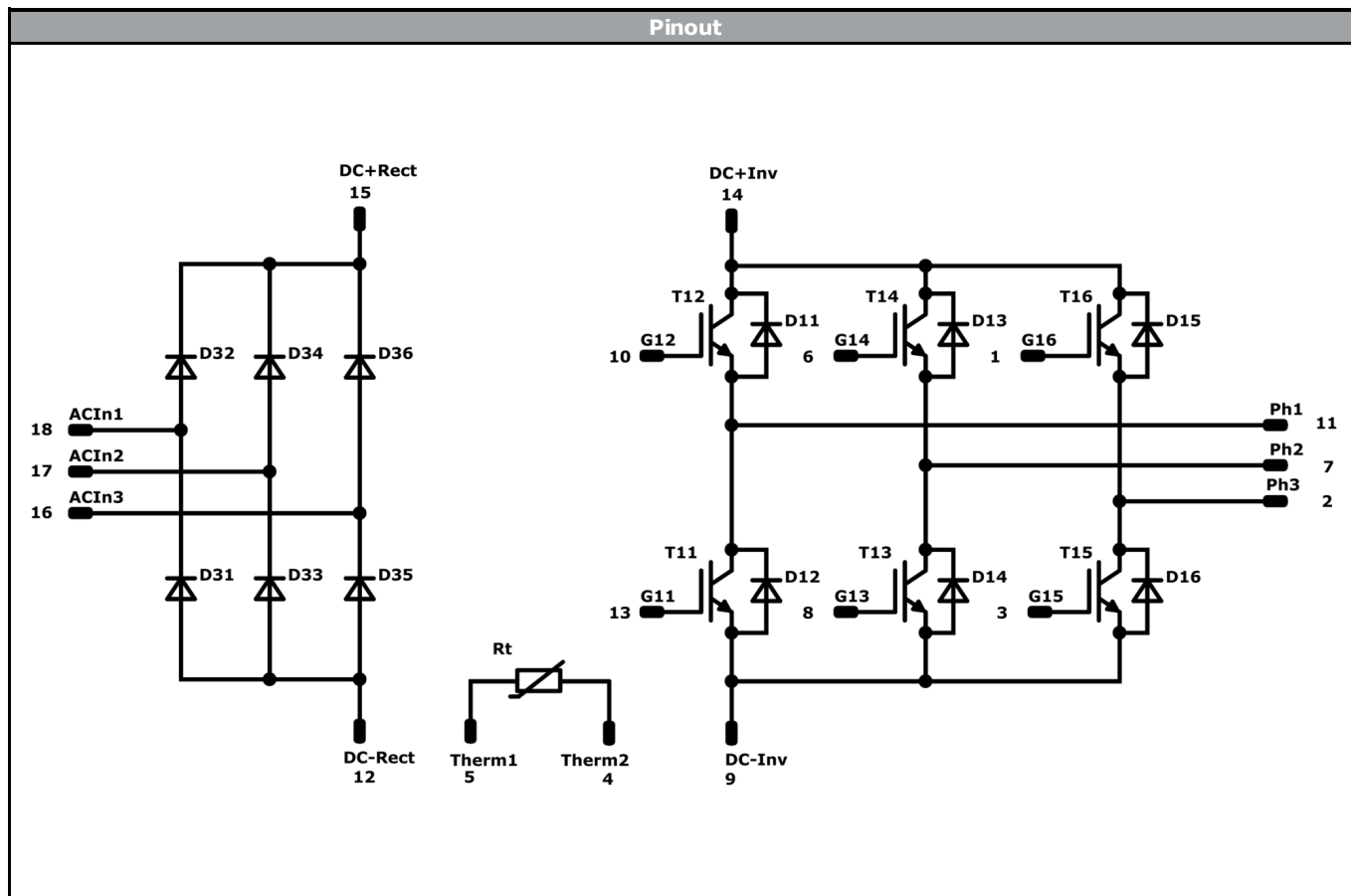
Pin	X	Y	Function
1	11,93	-11,5	G16
2	11,93	-6,9	Ph3
3	11,93	4,71	G15
4	11,93	8,3	Therm2
5	11,93	11,5	Therm1
6	4,33	-11,5	G14
7	4,33	-5,8	Ph2
8	4,33	6,95	G13
9	4,33	10,15	DC-Inv
10	-3,27	-11,5	G12
11	-3,27	-5,8	Ph1
12	-3,27	5,5	DC-Rect
13	-3,27	11,5	G11
14	-11,07	-11,5	DC+Inv
15	-11,07	-8,3	DC+Rect
16	-11,07	-1,68	ACIn3
17	-11,07	4,93	ACIn2
18	-11,07	11,5	ACIn1

The image shows a top-down view of a rectangular package with a yellow interior and a dark brown border. The package is oriented with a coordinate system where the Y-axis points upwards and the X-axis points to the right. The origin (0,0) is located at the center of a large circular feature on the right side of the package. Eight pins are arranged around the perimeter, numbered 1 through 8. Pins 1, 2, 3, and 4 are on the right side, while pins 5, 6, 7, and 8 are on the left side. The pins are represented by small blue rectangles with black outlines. The package also features several circular features: a large central circle, a smaller circle at the top center, and a small circle at the bottom center. The package is labeled with 'X' and 'Y' axes and a coordinate system.

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
D31-D36	Rectifier	1600 V	25 A	Rectifier Diode	
T11-T16	IGBT	1200 V	10 A	Inverter Switch	
D11-D16	FWD	1200 V	10 A	Inverter Diode	
Rt	NTC			Thermistor	



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Packaging instruction			
Standard packaging quantity (SPQ) 198	>SPQ	Standard	<SPQ Sample

Handling instruction
Handling instructions for MiniSkiiP® 0 packages see vincotech.com website.

Package data
Package data for MiniSkiiP® 0 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-M012PNA010M7-K619C71-D1-14	06 Nov. 2017		

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.