Vincotech

V23990-P623-F/F04-PM

preliminary datasheet

fast PACK 0 H 2nd gen — 600V / 60A

Features

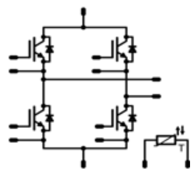
- Ultra fast switching frequency of up to 250kHz
- Clip-in PCB mounting

flow 0 housing

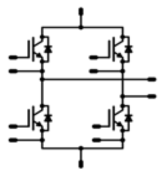
Target Applications

- Distributed Power Generation
- Welding

Schematic



P623-F04



P623-F

Types

- V23990-P623-F-PM without NTC
- V23990-P623-F04-PM with NTC

Maximum Ratings

Parameter	Symbol	Condition		Value	Unit
Transistor H-bridge (IGBT)					
Collector-emitter break down voltage	V_{CE}			600	V
DC collector current	I_C	T_j=$T_j$max	T_h=80°C T_c=80°C	35 47	A
Repetitive peak collector current	I_{cpuls}	tp limited by $T_j$max		224	A
Power dissipation per IGBT	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	93 140	W
Gate-emitter peak voltage	V_{GE}			±20	V
SC withstand time*	t_{SC}	Tj≤125°C VCC=600V VGE=15V		10	µs
Maximum junction temperature	$T_j$max			150	°C

* It is recommended to not exceed 1000 short circuit situations in the lifetime of the module and to allow at least 1s between short circuits

Parameter	Symbol	Condition		Value	Unit
Diode H-bridge					
DC forward current	I_F	T_j=$T_j$max	T_h=80°C T_c=80°C	34 47	A
Repetitive peak forward current	I_{FRM}	tp limited by $T_j$max		150	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	47 71	W
Maximum junction temperature	$T_j$max			150	°C

V23990-P623-F/F04-PM
preliminary datasheet

Maximum Ratings

Parameter	Symbol	Condition	Value	Unit
Thermal properties				
Storage temperature	T_{stg}		-40…+125	°C
Operation temperature	T_{op}		-40…+125	°C
Insulation properties				
Insulation voltage	V_{is}	t=1min	4000	Vdc
Creepage distance			min 12,7	mm
Clearance			min 12,7	mm

Characteristic Values

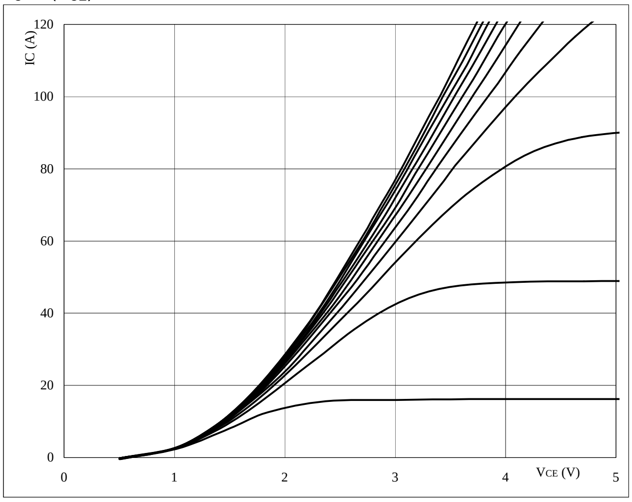
Parameter	Symbol	Conditions					Value			Unit
			V_{GE}(V) or V_{GS}(V)	V_r(V) or V_{CE}(V) or V_{DS}(V)	I_C(A) or I_F(A) or I_D(A)	T(C°)	Min	Typ	Max	
Transistor H-bridge (IGBT)										
Gate emitter threshold voltage	$V_{GE(th)}$	VGE=VCE			0,0006	Tj=25°C Tj=125°C	3	4	5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		60	Tj=25°C Tj=125°C		2,65 3,1	3,7	V
Collector-emitter cut-off	I_{CES}		0	600		Tj=25°C Tj=125°C			0,35	mA
Gate-emitter leakage current	I_{GES}		30	0		Tj=25°C Tj=125°C			300	nA
Integrated Gate resistor	R_{gint}					Tj=25°C Tj=125°C		-		Ohm
Turn-on delay time	$t_{d(on)}$	Rgoff=2 Ω Rgon=4 Ω	15/0	400	60	Tj=25°C Tj=125°C		 18		ns
Rise time	t_r					Tj=25°C Tj=125°C		 15,7		ns
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=125°C		 205,8		ns
Fall time	t_f					Tj=25°C Tj=125°C		 11,7		ns
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		 1,11		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		 0,97		mWs
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C Tj=125°C		3		nF
Output capacitance	C_{oss}					Tj=25°C Tj=125°C		0,3		nF
Reverse transfer capacitance	C_{rss}					Tj=25°C Tj=125°C		0,18		nF
Gate charge	Q_{Gate}		15	400	60	Tj=25°C Tj=125°C		 329		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 0,61 W/mK						0,76		K/W
Thermal resistance chip to case per chip	R_{thJC}							nA		K/W
Diode H-bridge										
Diode forward voltage	V_F				60	Tj=25°C Tj=125°C		1,6 1,55	2,3	V
Peak reverse recovery current	I_{RM}	Rgon=4 Ω dI0/dt=5250 A/us	15	400	60	Tj=25°C Tj=125°C		 100,3		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		 126,1		ns
Reverse recovery charge	Q_{rr}					Tj=25°C Tj=125°C		 4,49		μC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 0,61 W/mK						1,49		K/W
Thermal resistance chip to case per chip	R_{thJC}							nA		K/W
NTC Thermistor										
Rated resistance	R_{25}					Tj=25°C		22		kOhm
Deviation of R100	$D_{R/R}$	R100=1503Ω				Tc=100°C		2,9		%/K
Power dissipation given Epcos-Type	P					Tj=25°C		210		mW
B-value	$B_{(25/100)}$	Tol. ±3%				Tj=25°C		3980		K

Output Inverter

Figure 1 Output Inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



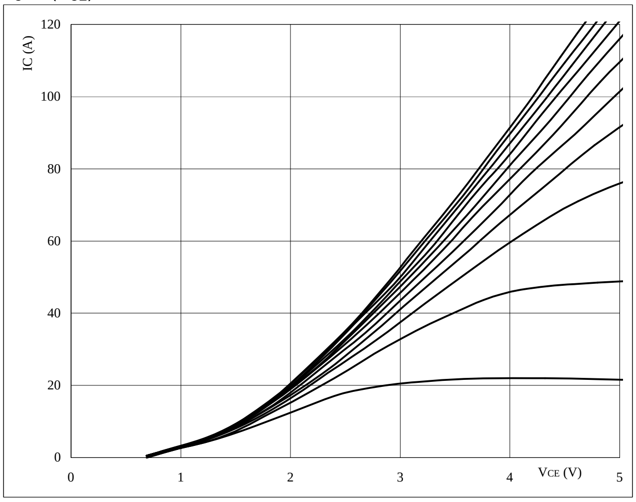
At

t_p = 250 µs
T_j = 25 °C
VGE from 6V to 16V in steps of 1V

Figure 3 Output Inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



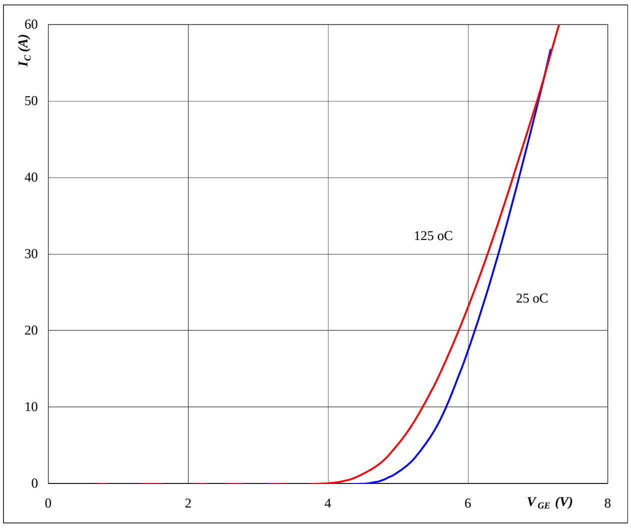
At

t_p = 250 µs
T_j = 125 °C
VGE from 6V to 16V in steps of 1V

Figure 4 Output Inverter IGBT

Typical transfer characteristics

$I_c = f(V_{GE})$



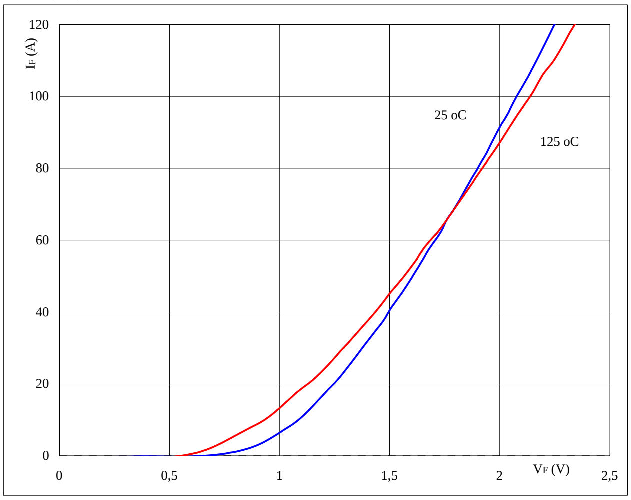
At

t_p = 250 µs
V_{CE} = 10 V

Figure 4 Output Inverter FRED

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

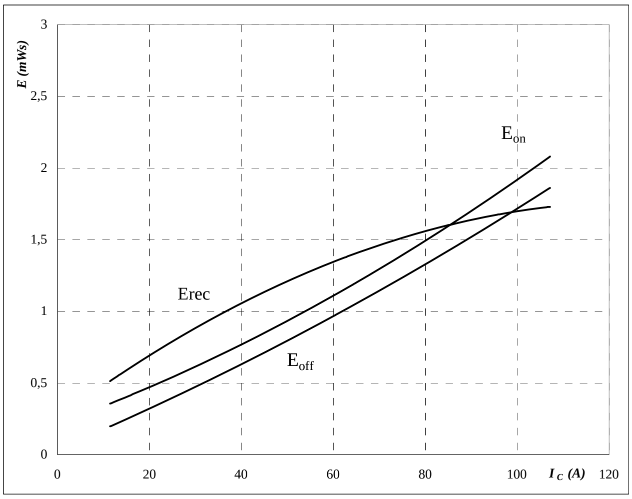
t_p = 250 µs

Output Inverter

Figure 5 Output Inverter IGBT

Typical switching energy losses as a function of collector current

E = f(I_c)



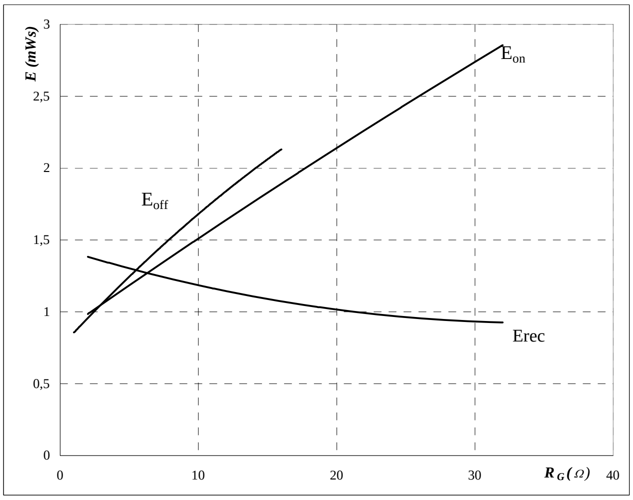
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	15	V
R_{gon} =	4	Ω
R_{goff} =	2	Ω

Figure 6 Output Inverter IGBT

Typical switching energy losses as a function of gate resistor

E = f(R_G)



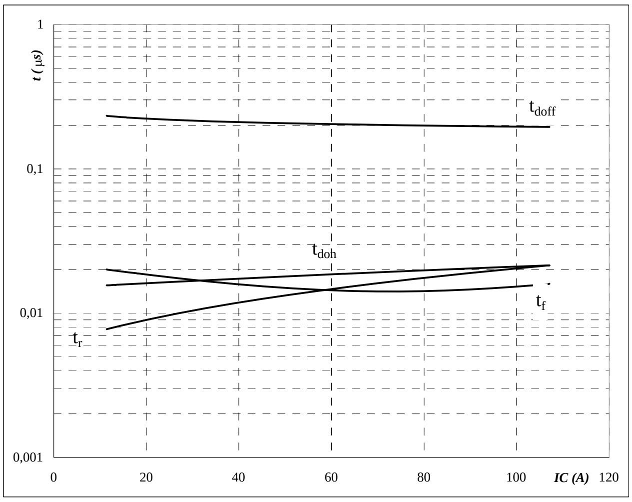
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	15	V
I_C =	60	A

Figure 7 Output Inverter IGBT

Typical switching times as a function of collector current

t = f(I_C)



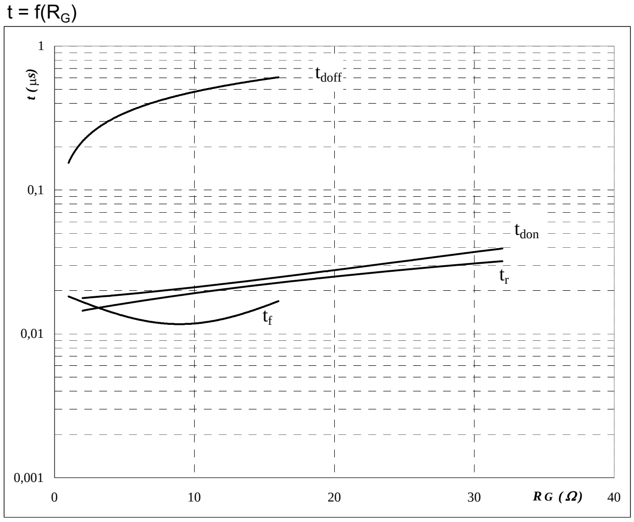
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	15	V
R_{gon} =	4	Ω
R_{goff} =	2	Ω

Figure 8 Output Inverter IGBT

Typical switching times as a function of gate resistor

t = f(R_G)



With an inductive load at

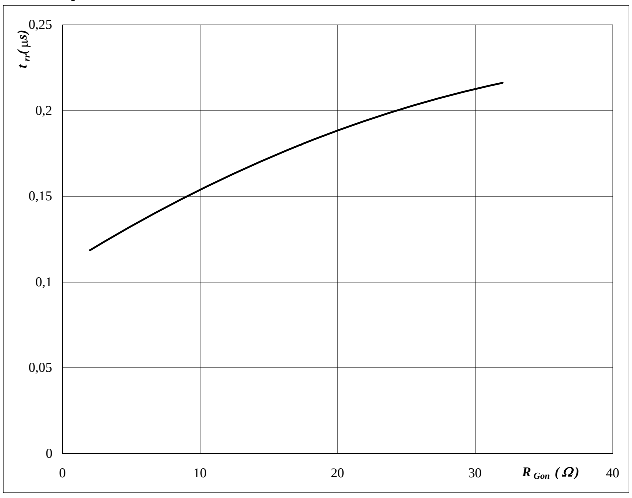
T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	15	V
I_C =	60	A

Output Inverter

Figure 9 Output Inverter FRED

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

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



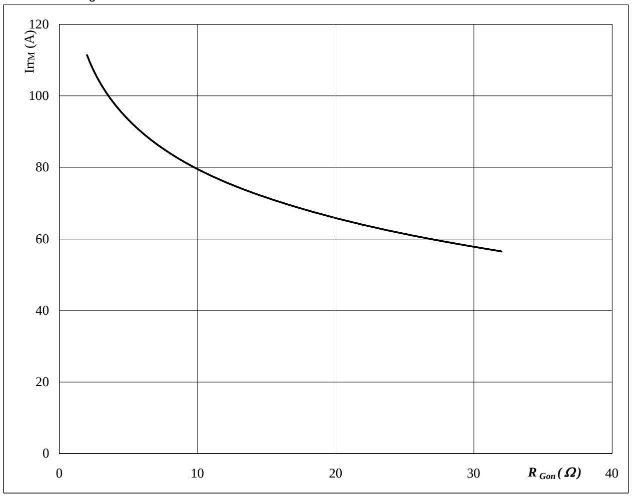
At

T_j =	125	°C
V_R =	400	V
I_F =	60	A
V_{GE} =	15	V

Figure 10 Output Inverter FRED

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

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



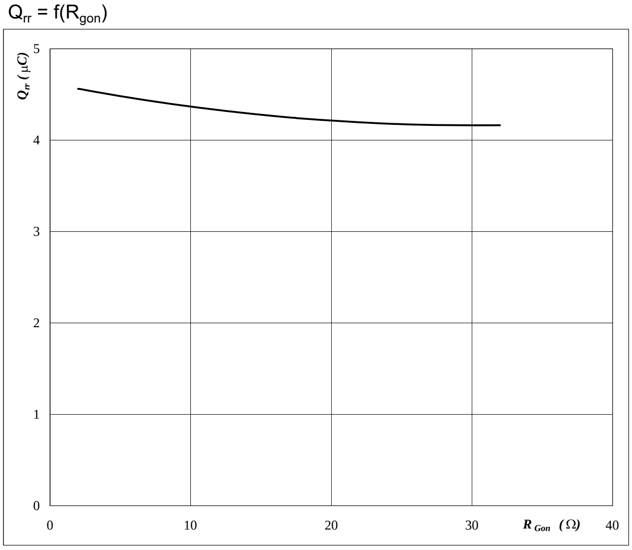
At

T_j =	125	°C
V_R =	400	V
I_F =	60	A
V_{GE} =	15	V

Figure 11 Output Inverter FRED

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

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



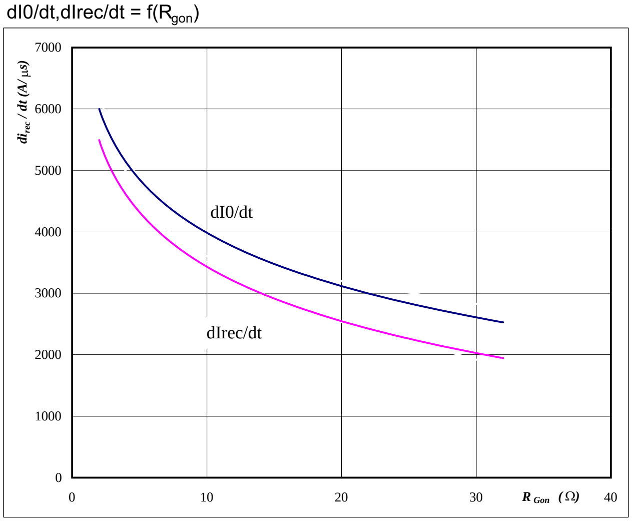
At

T_j =	125	°C
V_R =	400	V
I_F =	60	A
V_{GE} =	15	V

Figure 12 Output Inverter FRED

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

$dI0/dt, dIrec/dt = f(R_{gon})$



At

T_j =	125	°C
V_R =	400	V
I_F =	60	A
V_{GE} =	15	V

V23990-P623-F/F04-PM

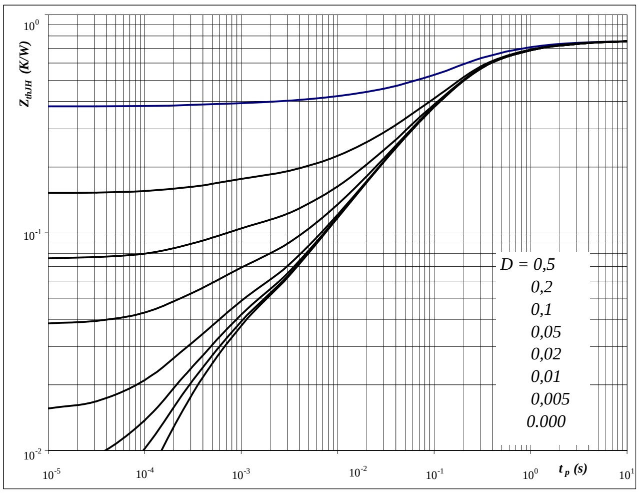
preliminary datasheet

Output Inverter

Figure 13

IGBT transient thermal impedance
as a function of pulse width

$Z_{thJH} = f(tp)$



With

D = tp / T

R_{thJH} = 0,76 K/W

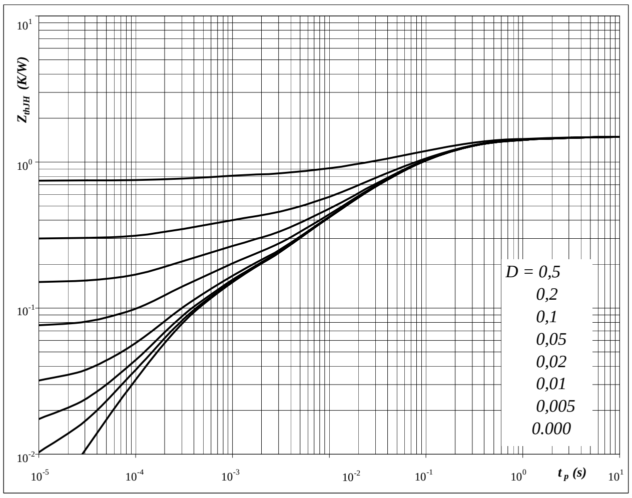
IGBT thermal model values

R (C/W)	Tau (s)
0,04	4,9E+00
0,13	8,8E-01
0,41	1,7E-01
0,12	3,0E-02
0,03	4,9E-03
0,03	4,3E-04

Figure 14

FRED transient thermal impedance
as a function of pulse width

$Z_{thJH} = f(tp)$



With

D = tp / T

R_{thJH} = 1,49 K/W

FRED thermal model values

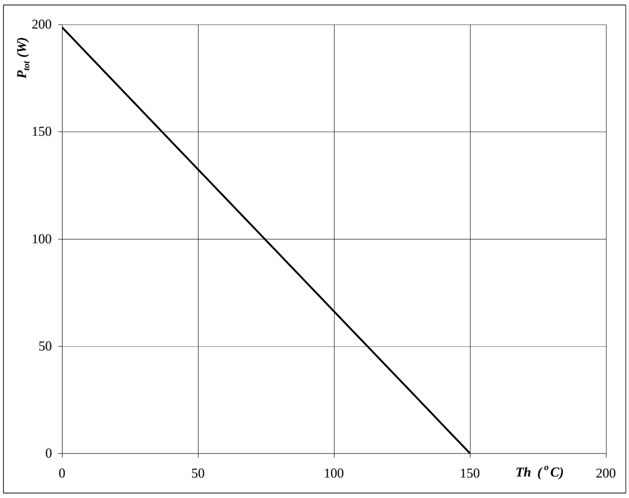
R (C/W)	Tau (s)
0,06	3,8E+00
0,20	5,1E-01
0,62	1,1E-01
0,39	2,2E-02
0,12	3,8E-03
0,10	3,3E-04

Output Inverter

Figure 15 Output Inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

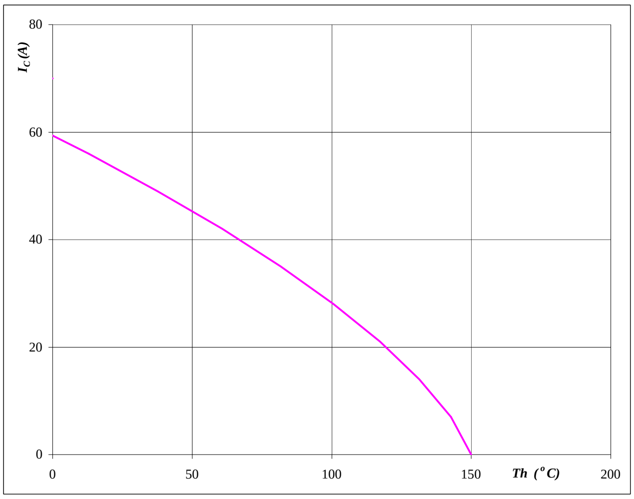


At
T_j = 150 °C

Figure 16 Output Inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$

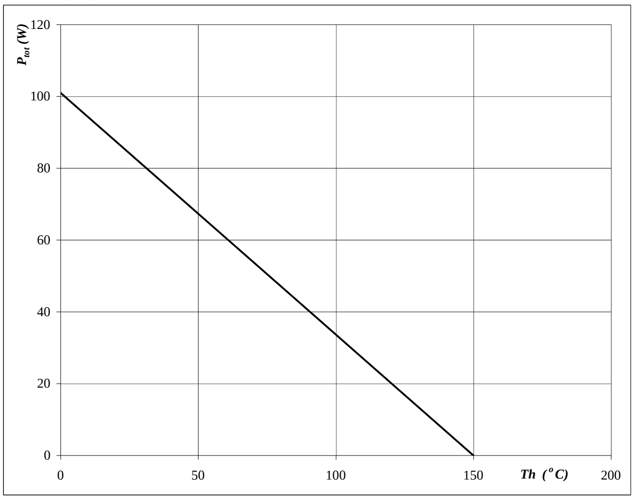


At
T_j = 150 °C
V_{GE} = 15 V

Figure 17 Output Inverter FRED

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

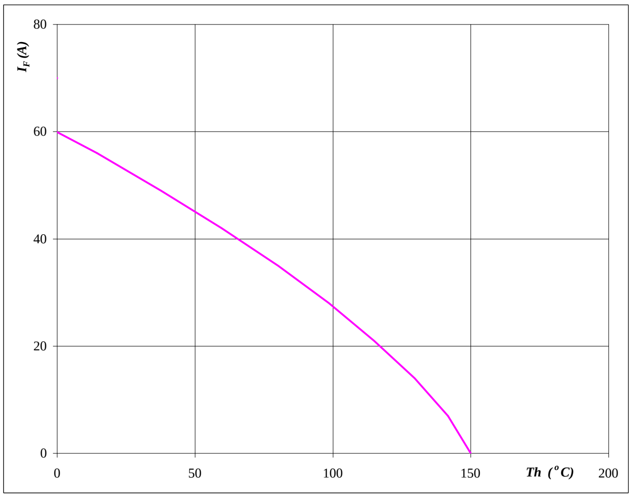


At
T_j = 150 °C

Figure 18 Output Inverter FRED

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At
T_j = 150 °C

Switching Definitions Output Inverter

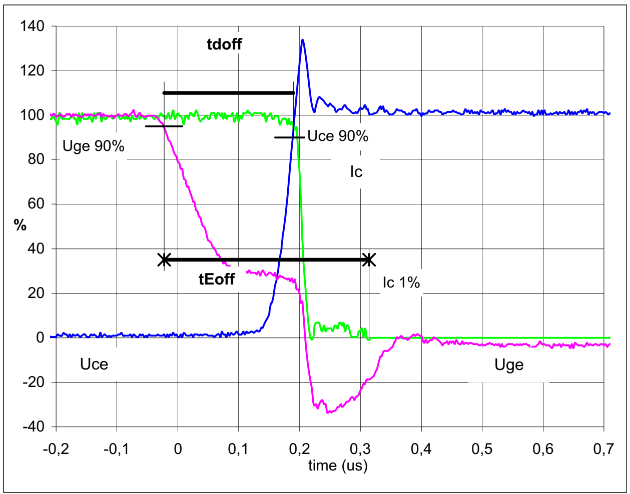
General conditions

T_j	=	125 °C
R_{gon}	=	4 Ω
R_{goff}	=	2 Ω

Figure 1 Output Inverter IGBT

Turn-off Switching Waveforms & definition of tdoff, tEoff

(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) = 0 V

V_{GE} (100%) = 15 V

V_C (100%) = 400 V

I_C (100%) = 60 A

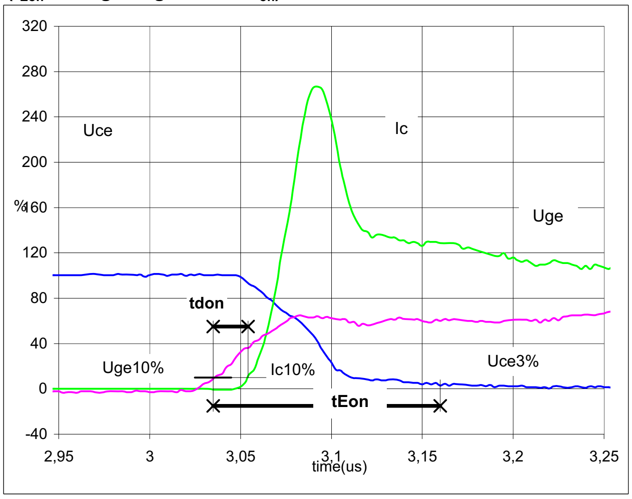
t_{doff} = 0,21 µs

t_{Eoff} = 0,34 µs

Figure 2 Output Inverter IGBT

Turn-on Switching Waveforms & definition of tdon, tEon

(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) = 0 V

V_{GE} (100%) = 15 V

V_C (100%) = 400 V

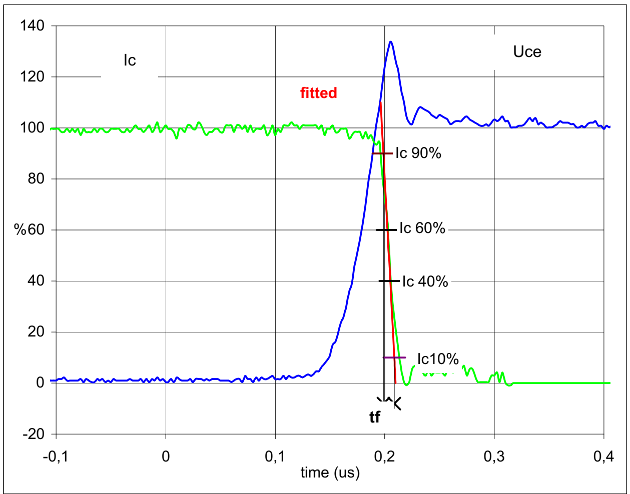
I_C (100%) = 60 A

t_{don} = 0,02 µs

t_{Eon} = 0,12 µs

Figure 3 Output Inverter IGBT

Turn-off Switching Waveforms & definition of t_f



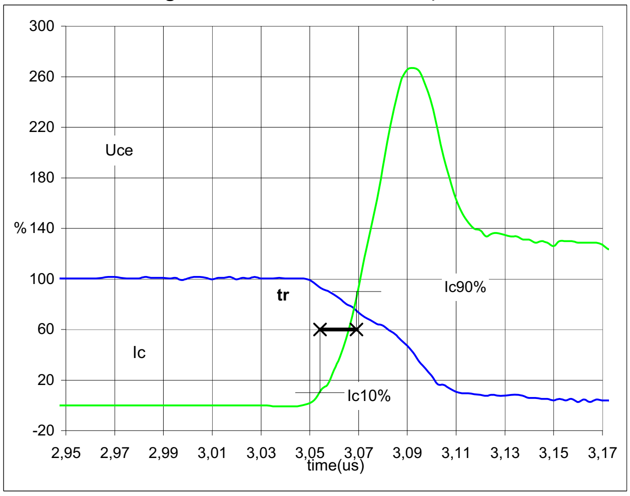
V_C (100%) = 400 V

I_C (100%) = 60 A

t_f = 0,012 µs

Figure 4 Output Inverter IGBT

Turn-on Switching Waveforms & definition of t_r



V_C (100%) = 400 V

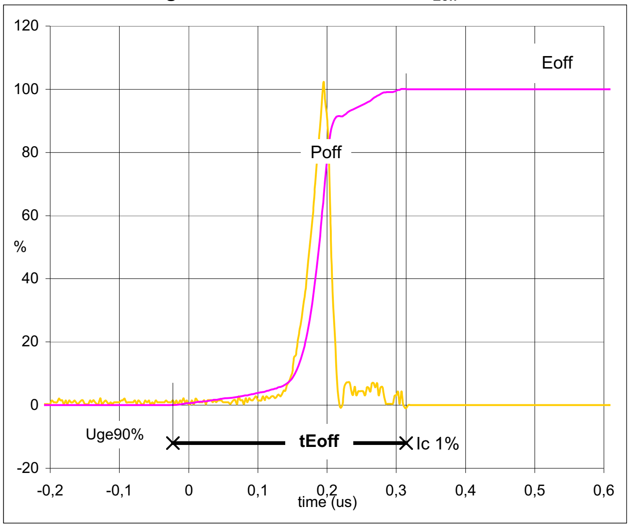
I_C (100%) = 60 A

t_r = 0,016 µs

Switching Definitions Output Inverter

Figure 5 Output Inverter IGBT

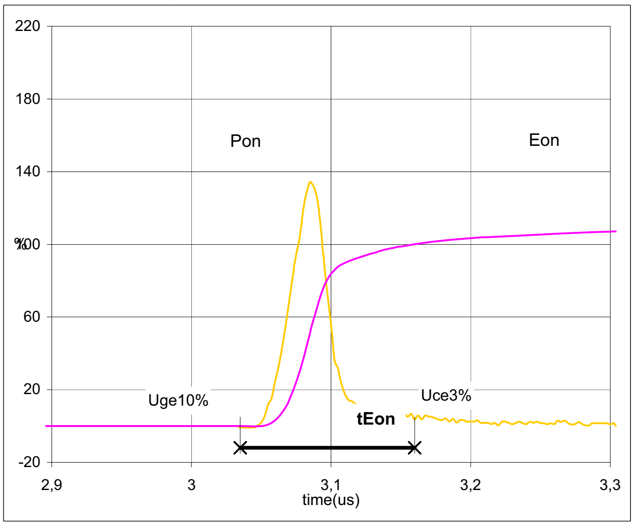
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	23,88	kW
E_{off} (100%) =	0,97	mJ
t_{Eoff} =	0,34	μs

Figure 6 Output Inverter IGBT

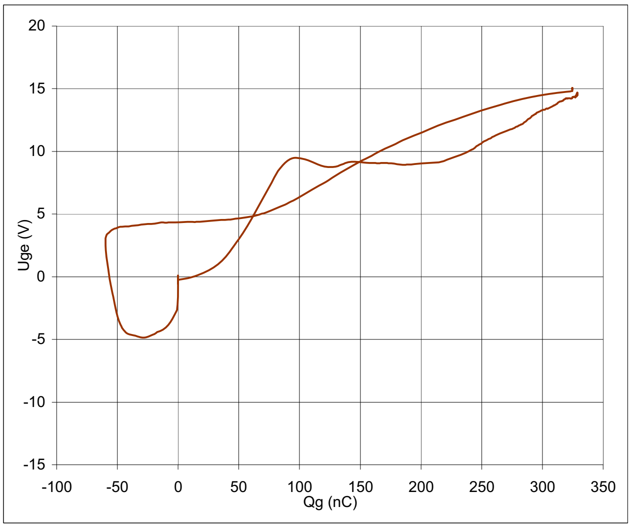
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	23,9	kW
E_{on} (100%) =	1,11	mJ
t_{Eon} =	0,12	μs

Figure 7 Output Inverter IGBT

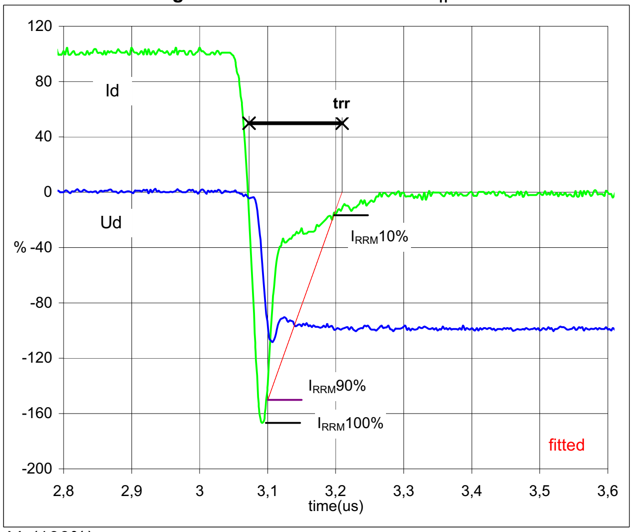
Gate voltage vs Gate charge



V_{GEoff} =	0	V
V_{GEon} =	15	V
V_C (100%) =	400	V
I_C (100%) =	60	A
Q_g =	328,7	nC

Figure 8 Output Inverter FRED

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



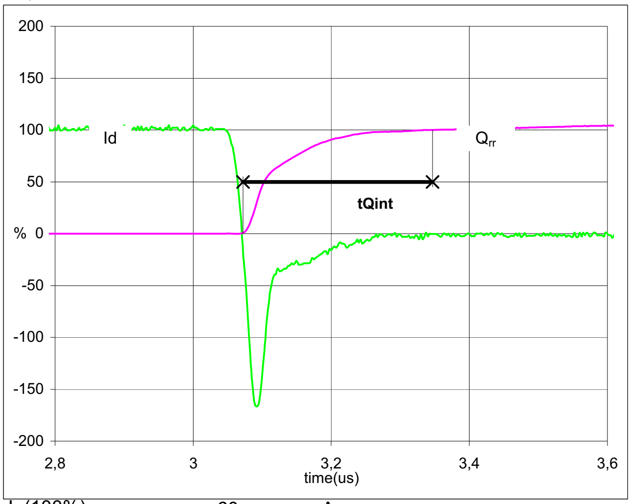
V_d (100%) =	400	V
I_d (100%) =	60	A
I_{RRM} (100%) =	100	A
t_{rr} =	0,13	μs

V23990-P623-F/F04-PM
preliminary datasheet

Switching Definitions Output Inverter

Figure 9 Output Inverter FRED

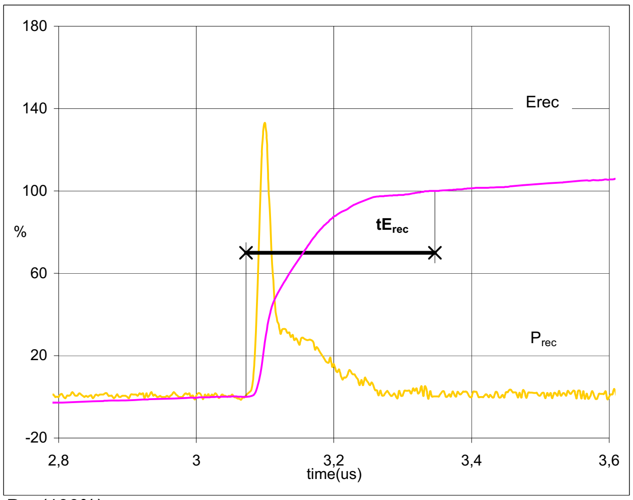
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	60	A
Q_{rr} (100%) =	4,49	μC
t_{Qint} =	0,27	μs

Figure 10 Output Inverter FRED

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

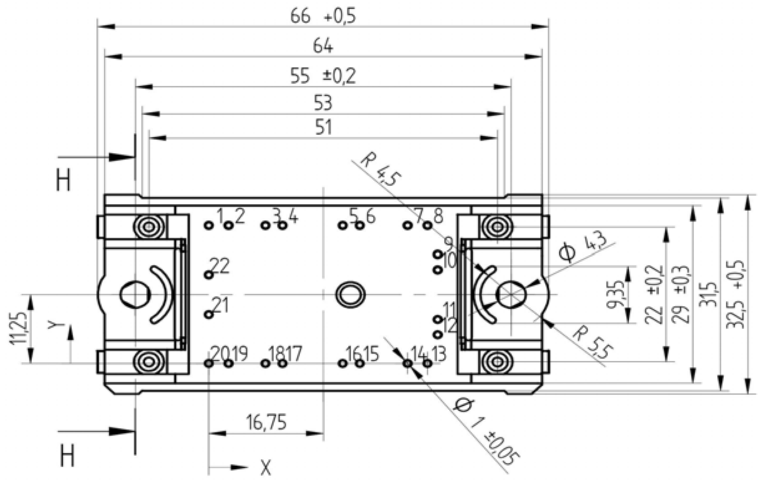


P_{rec} (100%) =	24	kW
E_{rec} (100%) =	1,32	mJ
t_{Erec} =	0,27	μs

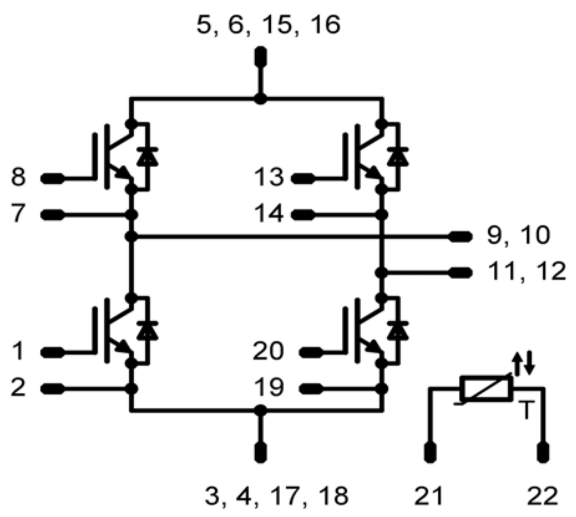
Package Outline and Pinout

Outline

Pin Table		
Pin	X	Y
1	0	22,5
2	2,9	22,5
3	8,3	22,5
4	10,8	22,5
5	19,6	22,5
6	22,1	22,5
7	29,1	22,5
8	32	22,5
9	33,5	17,8
10	33,5	15,3
11	33,5	7,2
12	33,5	4,7
13	32	0
14	29,1	0
15	22,1	0
16	19,6	0
17	10,8	0
18	8,3	0
19	2,9	0
20	0	0
21	0	8
22	0	14,5



Pinout



PRODUCT STATUS DEFINITIONS

Datasheet Status	Product Status	Definition
Target	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice. The data contained is exclusively intended for technically trained staff.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data may be published at a later date. Vincotech reserves the right to make changes at any time without notice in order to improve design. The data contained is exclusively intended for technically trained staff.
Final	Full Production	This datasheet contains final specifications. Vincotech reserves the right to make changes at any time without notice in order to improve design. The data contained is exclusively intended for technically trained staff.

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For tested values please contact Vincotech.
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As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.

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.