Vincotech

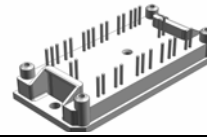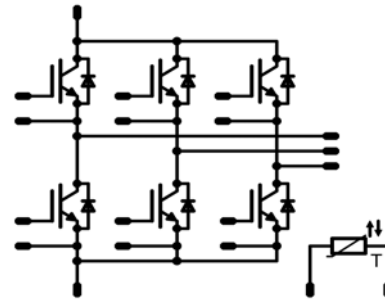| flowPACK 1 3rd gen	600V/100A

Features

- Compact flow1 housing
- Trench Fieldstop IGBT3 Technology
- Compact and Low Inductance Design
- AIN substrate for improved performance
- Built-in NTC

Target Applications

- Motor Drive
- Power Generation
- UPS

Types

- V23990-P825-F

flow1 housing

Schematic

Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Transistor					
Collector-emitter break down voltage	V_{CE}			600	V
DC collector current	I_C	$T_j=T_j max$	$T_h=80°C$ $T_c=80°C$	100	A
Repetitive peak collector current	I_{Cpulse}	t_p limited by $T_j max$		300	A
Power dissipation per IGBT	P_{tot}	$T_j=T_j max$	$T_h=80°C$ $T_c=80°C$	190	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j≤150°C$ $V_{GE}=15V$		6 360	µs V
Maximum Junction Temperature	$T_j max$			175	°C
Inverter Diode					
Peak Repetitive Reverse Voltage	V_{RRM}	$T_j=25°C$		600	V
DC forward current	I_F	$T_j=T_j max$	$T_h=80°C$ $T_c=80°C$	94	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j max$		300	A
Power dissipation per Diode	P_{tot}	$T_j=T_j max$	$T_h=80°C$ $T_c=80°C$	139	W
Maximum Junction Temperature	$T_j max$			175	°C

Maximum Ratings

Tj=25°C, unless otherwise specified

| Parameter	Symbol	Condition	Value	Unit
Thermal Properties				
Storage temperature	T_{stg}		-40…+125	°C
Operation temperature under switching condition	T_{op}		-40…+150	°C
Insulation Properties				
Insulation voltage	V_{is}	t=2 s DC voltage	4000	V
Creepage distance			min 12,7	mm
Clearance			min 12,7	mm

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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_j	Min	Typ	Max	
Inverter Transistor									
Gate emitter threshold voltage	$V_{GE(th)}$	VCE=VGE		0,0016	Tj=25°C Tj=150°C	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	15		100	Tj=25°C Tj=150°C	1,1	1,54 1,76	2,25	V
Collector-emitter cut-off current incl. Diode	I_{CES}	0	600		Tj=25°C Tj=150°C			0,66	mA
Gate-emitter leakage current	I_{GES}	20	0		Tj=25°C Tj=150°C			650	nA
Integrated Gate resistor	R_{gint}						2		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=4 Ω Rgon=4 Ω	±15	300	100	Tj=25°C Tj=150°C	151 157		ns
Rise time	t_r					Tj=25°C Tj=150°C	19 25		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=150°C	205 232		
Fall time	t_f					Tj=25°C Tj=150°C	89 101		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C	1,34 2,00		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C	2,35 3,11		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		6160		pF
Output capacitance	C_{oss}						384		
Reverse transfer capacitance	C_{rss}						183		
Gate charge	Q_{Gate}	Vcc=480V	±15		100	Tj=25°C		625		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal foil thickness=76um Kunze foil KU-ALF5					0,50		K/W
Inverter Diode									
Diode forward voltage	V_F			100	Tj=25°C Tj=150°C	1,2	1,65 1,53	2,4	V
Peak reverse recovery current	I_{RRM}	Rgon=4 Ω	±15	300	100	Tj=25°C Tj=150°C	97 117		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C	140 292		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=150°C	4,87 10,01		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=150°C	6149 3433		A/µs
Reverse recovered energy	Erec					Tj=25°C Tj=150°C	1,03 2,25		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal foil thickness=76um Kunze foil KU-ALF5					0,68		K/W
Thermistor									
Rated resistance	R_{25}	Tol. ±5%			Tj=25°C	4,2	4,7	5,8	kΩ
Deviation of R100	$D_{R/R}$	R100=435Ω			Tc=100°C		2,6		%/K
Power dissipation given Epcos-Typ	P				Tj=25°C		210		mW
B-value	$B_{(25/100)}$	Tol. ±3%			Tj=25°C		3530		K

Output Inverter

Figure 1	Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$

At
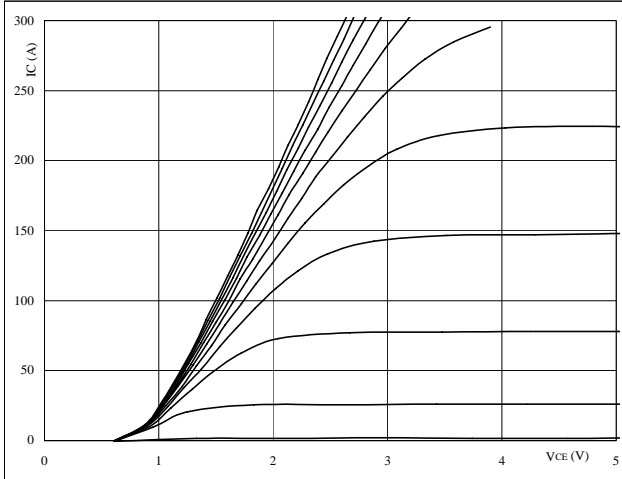
t_p =	250	µs
T_j =	25	°C

VGE from 7 V to 17 V in steps of 1 V

Figure 2	Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$

At
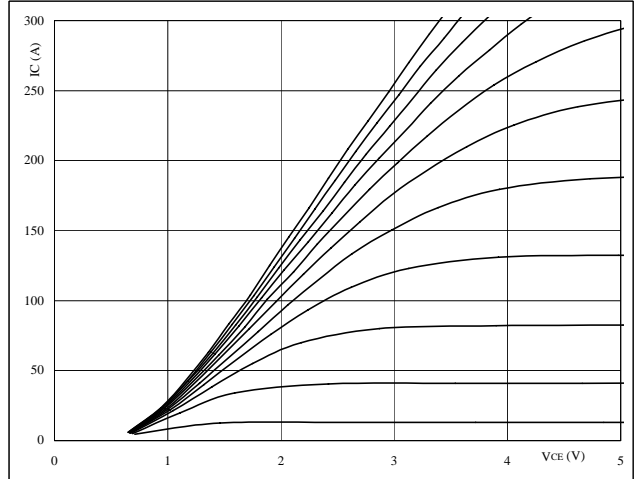
t_p =	250	µs
T_j =	150	°C

VGE from 7 V to 17 V in steps of 1 V

Figure 3	Output inverter IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

$T_j = T_{j_{max}}-25°C$

$T_j = 25°C$

At
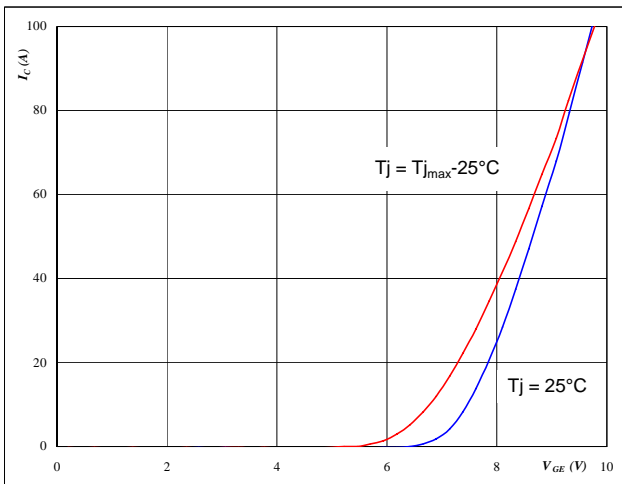
t_p =	250	µs
V_{CE} =	10	V

Figure 4	Output inverter FRED

**Typical diode forward current as
a function of forward voltage**

$I_F = f(V_F)$
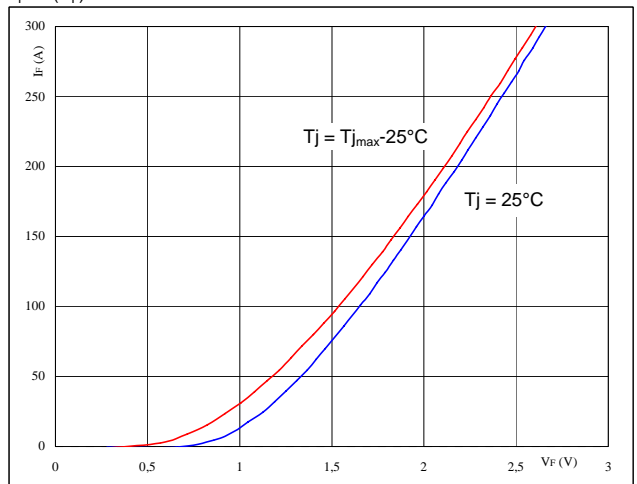
$T_j = T_{j_{max}}-25°C$

$T_j = 25°C$

At

t_p =	250	µs

Output Inverter

Figure 5	Output inverter IGBT

Typical switching energy losses
as a function of collector current
$E = f(I_c)$
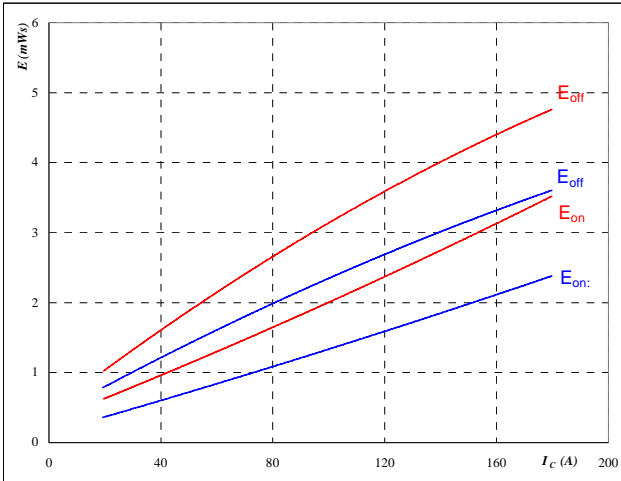
With an inductive load at

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 6	Output inverter IGBT

Typical switching energy losses
as a function of gate resistor
$E = f(R_G)$
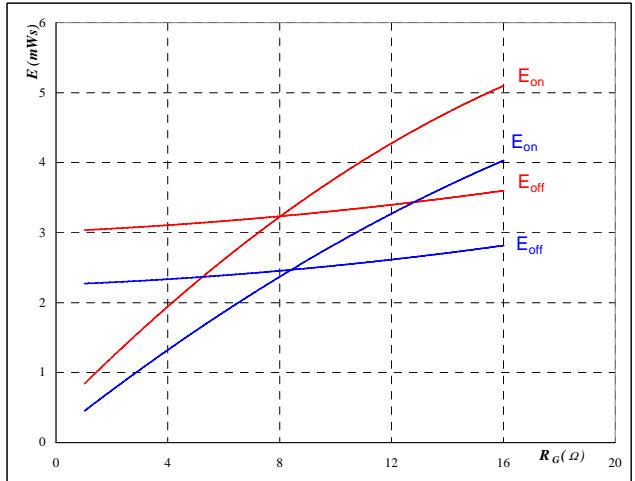
With an inductive load at

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	100	A

Figure 7	Output inverter IGBT

Typical reverse recovery energy loss
as a function of collector current
$E_{rec} = f(I_c)$
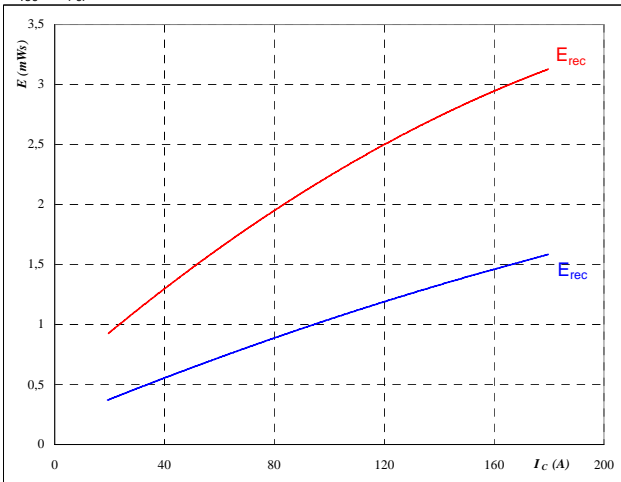
With an inductive load at

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 8	Output inverter IGBT

Typical reverse recovery energy loss
as a function of gate resistor
$Erec = f(R_G)$
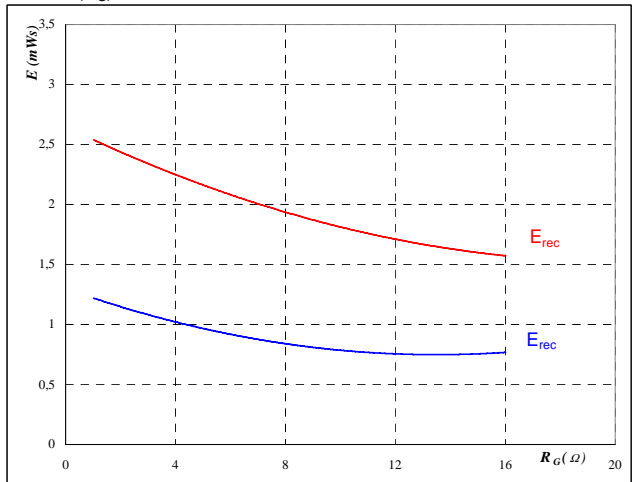
With an inductive load at

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	100	A

Output Inverter

Figure 9	Output inverter IGBT

Typical switching times as a function of collector current

$t = f(I_C)$
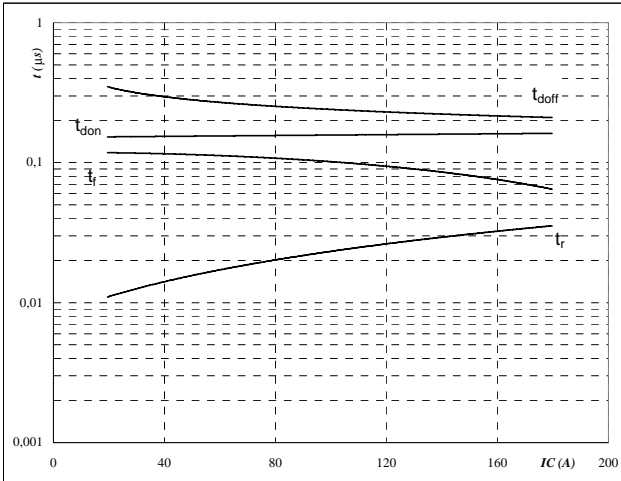
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10	Output inverter IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$
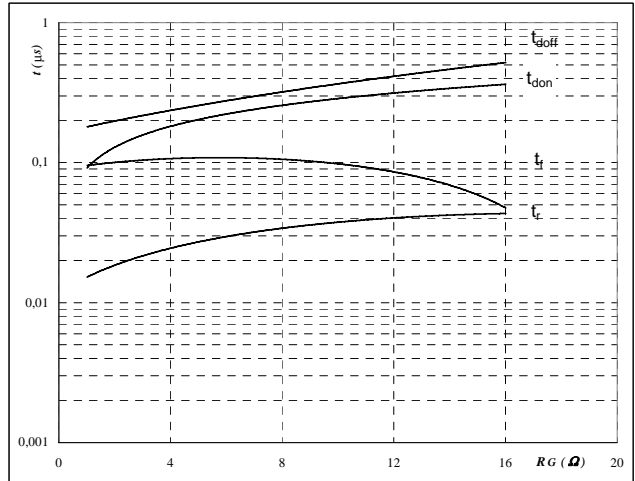
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	100	A

Figure 11	Output inverter FRED

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

At

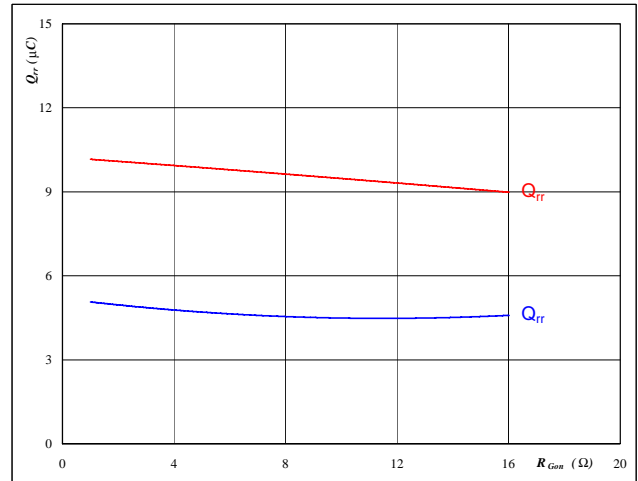|		
T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
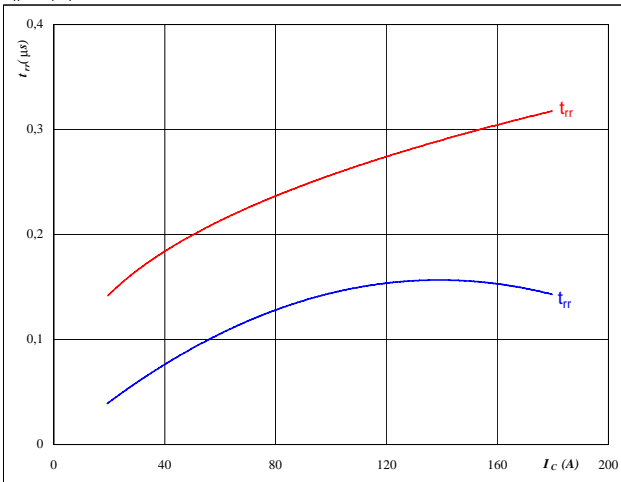
Figure 12	Output inverter FRED

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

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

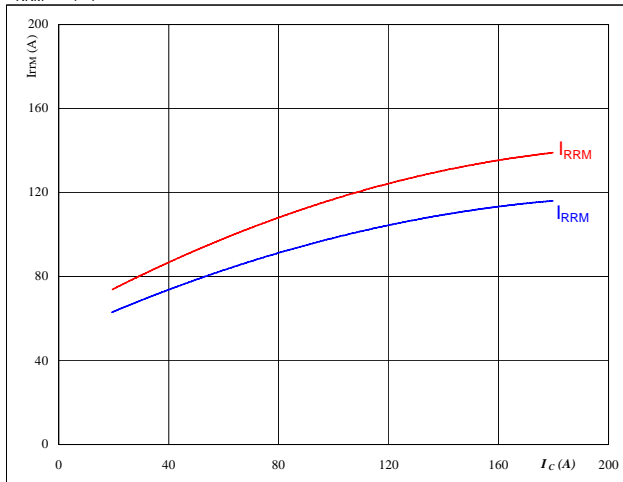**At**
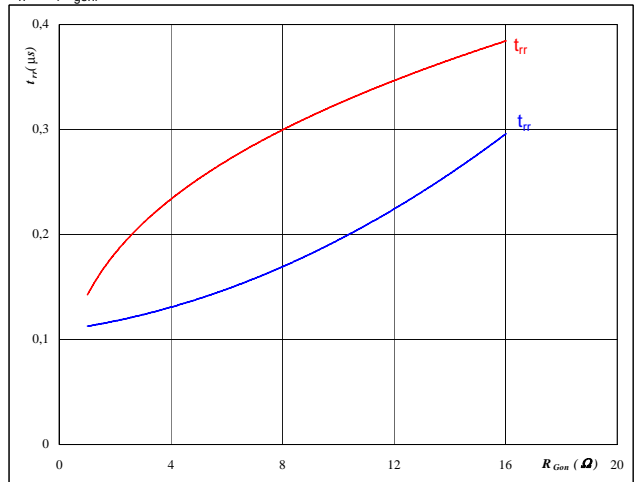
T_j =	25/150	°C
V_R =	300	V
I_F =	100	A
V_{GE} =	±15	V

Output Inverter

Figure 13	Output inverter FRED

**Typical reverse recovery charge as a
function of collector current**
$Q_{rr} = f(Ic)$

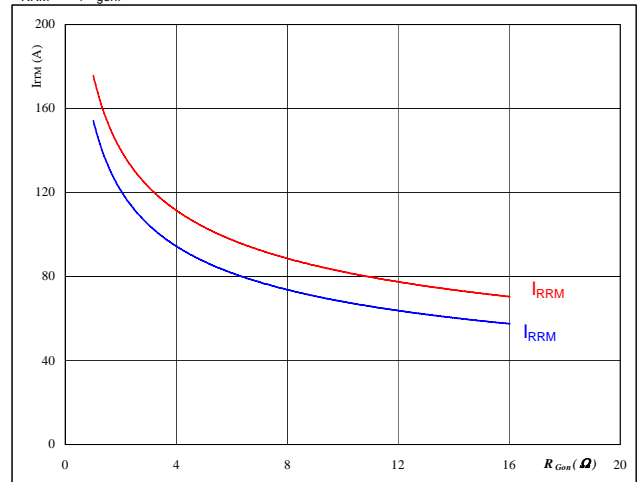**At**
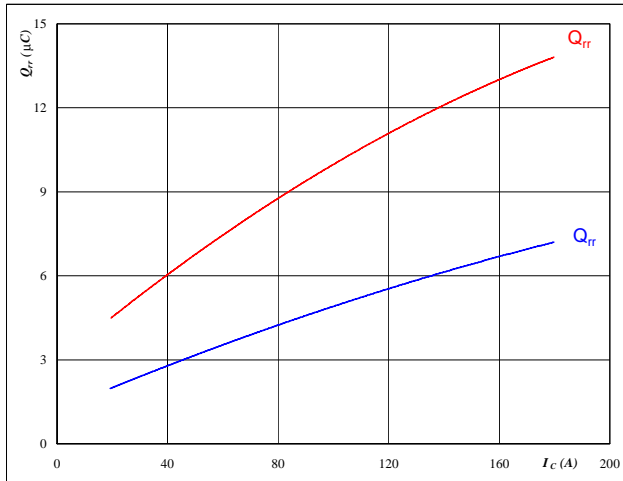
T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 14	Output inverter FRED

**Typical reverse recovery charge as a
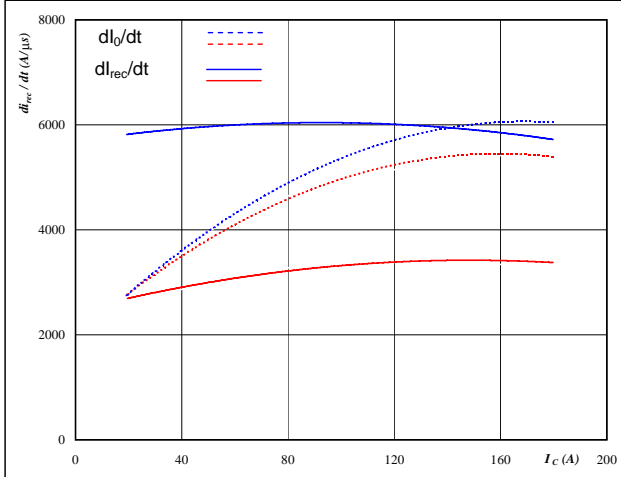function of IGBT turn on gate resistor**
$Q_{rr} = f(R_{gon})$

At

T_j =	25/150	°C
V_R =	300	V
I_F =	100	A
V_{GE} =	±15	V

Figure 15	Output inverter FRED

**Typical reverse recovery current as a
function of collector current**
$I_{RRM} = f(Ic)$

At

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 16	Output inverter FRED

**Typical reverse recovery current as a
function of IGBT turn on gate resistor**
$I_{RRM} = f(R_{gon})$

At

T_j =	25/150	°C
V_R =	300	V
I_F =	100	A
V_{GE} =	±15	V

Output Inverter

Figure 17	Output inverter FRED

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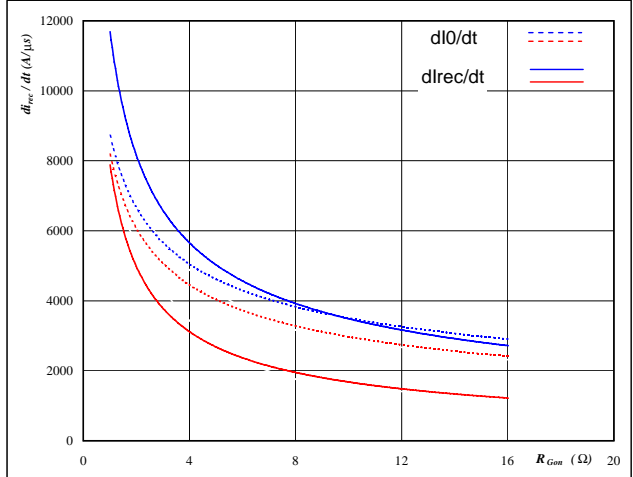function of collector current**

$dI0/dt, dIrec/dt = f(Ic)$

At

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 18	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 =	25/150	°C
V_R =	300	V
I_F =	100	A
V_{GE} =	±15	V

Figure 19	Output inverter IGBT

**IGBT transient thermal impedance
as a function of pulse width**
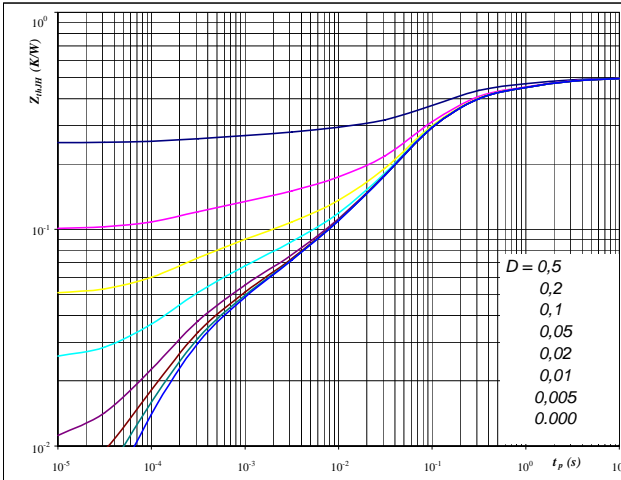
$Z_{thJH} = f(t_p)$

At

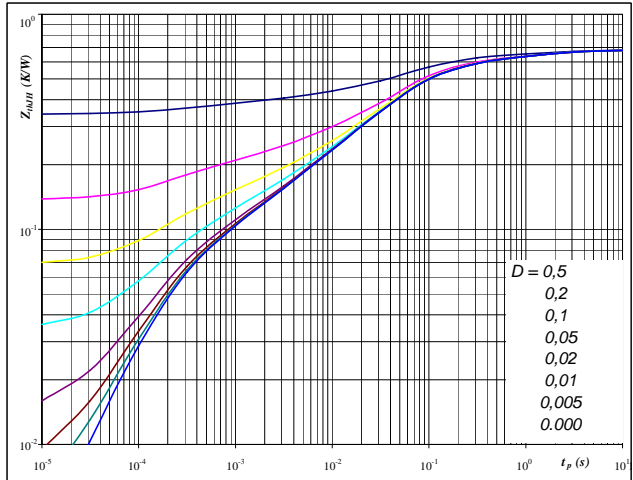|		
D =	tp / T	
R_{thJH} =	0,50	K/W

IGBT thermal model values

R (C/W)	Tau (s)
0,02	1,0E+01
0,08	1,3E+00
0,17	1,6E-01
0,16	5,7E-02
0,03	5,3E-03
0,02	7,6E-04
0,02	1,6E-04

Figure 20	Output inverter FRED

**FRED transient thermal impedance
as a function of pulse width**

$Z_{thJH} = f(t_p)$

At

D =	tp / T	
R_{thJH} =	0,68	K/W

FRED thermal model values
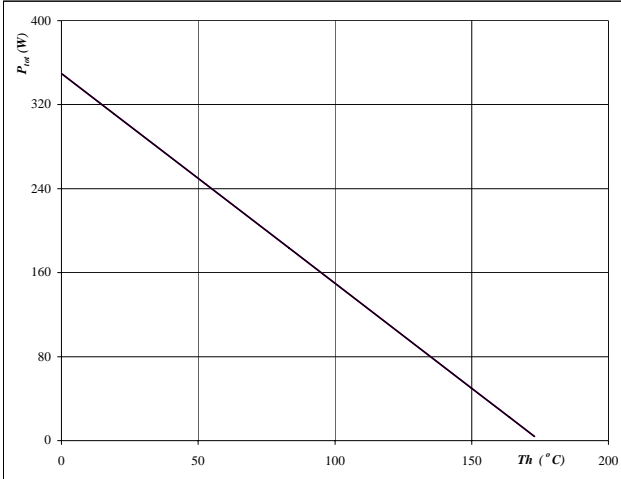
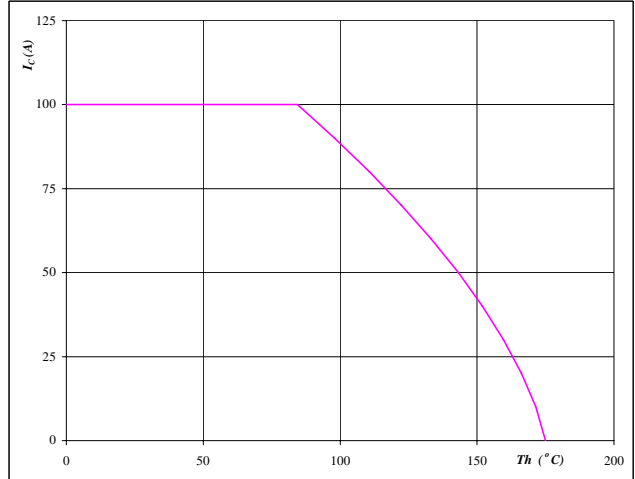| R (C/W)	Tau (s)
0,02	1,0E+01
0,08	1,3E+00
0,13	1,6E-01
0,27	4,3E-02
0,08	6,0E-03
0,05	9,5E-04
0,05	1,9E-04

Output Inverter

Figure 21	Output inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

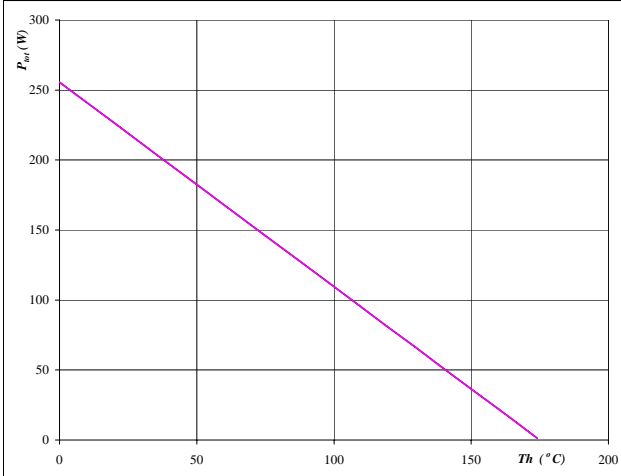**At**

$T_j = $ 175 °C

Figure 22	Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$

At

$T_j = $ 175 °C

$V_{GE} = $ 15 V

Figure 23	Output inverter FRED

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

At

$T_j = $ 175 °C

Figure 24	Output inverter FRED

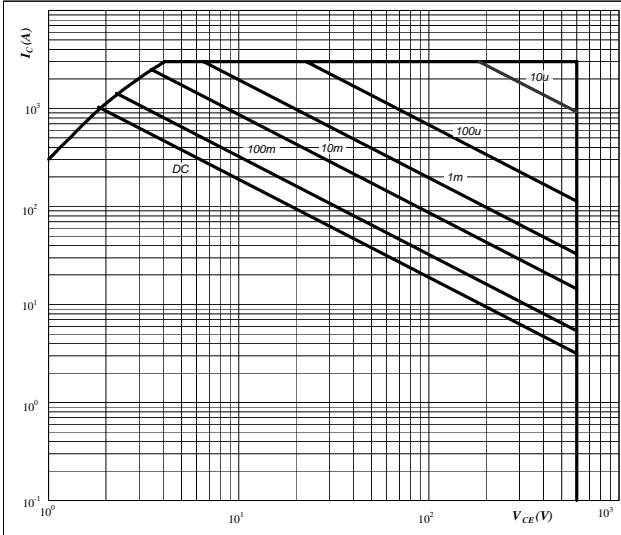**Forward current as a function of heatsink temperature**

$I_F = f(T_h)$
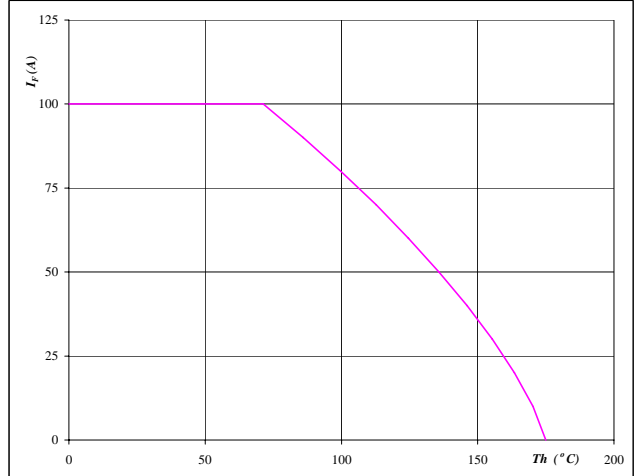
At

$T_j = $ 175 °C

Output Inverter

| Figure 25 | Output inverter IGBT |

Safe operating area as a function of collector-emitter voltage
$I_C = f(V_{CE})$

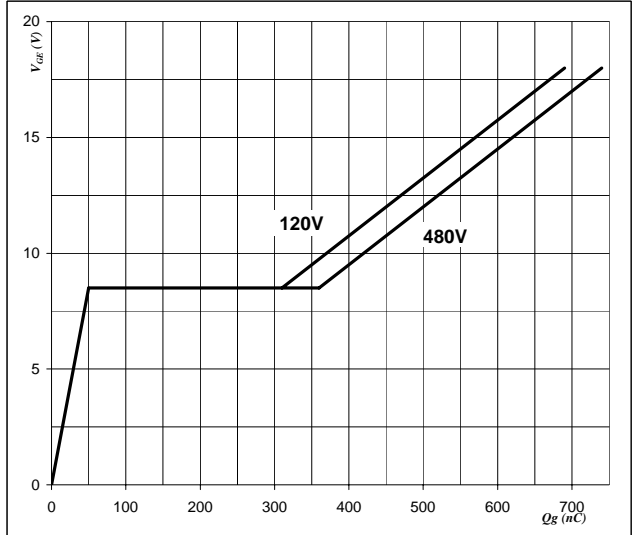**At**

D =	single pulse	
Th =	80	ºC
V_{GE} =	±15	V
Tj =	T_{jmax}	ºC

| Figure 26 | Output inverter IGBT |

Gate voltage vs Gate charge

$V_{GE} = f(Qg)$

At

I_C =	100	A

![Vincotech]

Thermistor

Figure 1	Thermistor

Typical NTC characteristic
as a function of temperature
$R_T = f(T)$

NTC-typical temperature characteristic
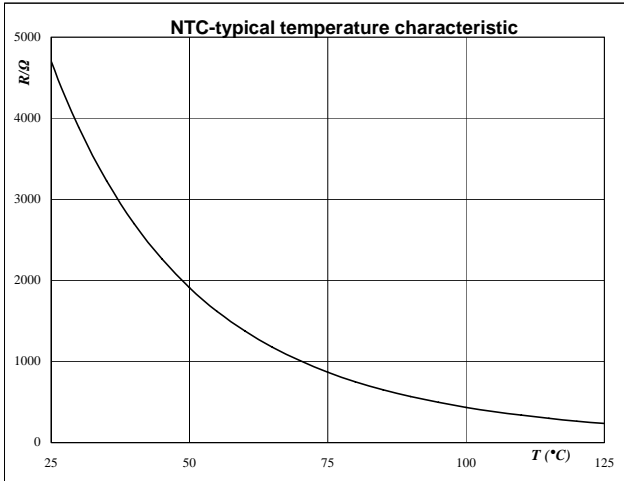
Switching Definitions Output Inverter

General conditions

T_j	=	150 °C
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

Figure 1 — Output inverter IGBT

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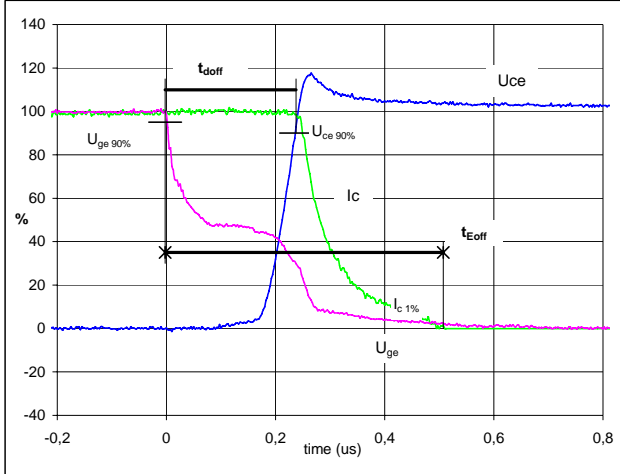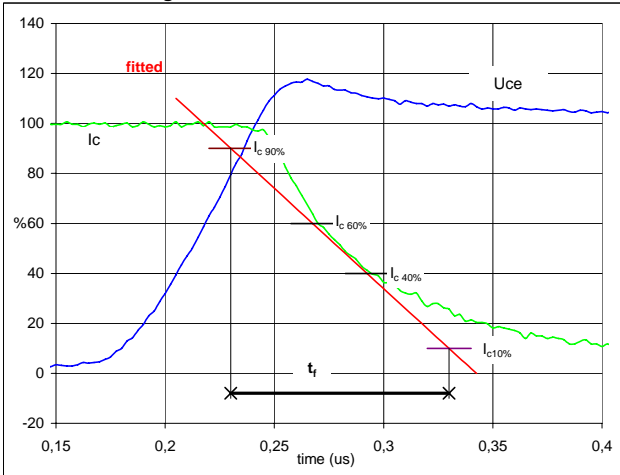

V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	99	A
t_{doff} =	0,23	µs
t_{Eoff} =	0,51	µs

Figure 2 — Output inverter IGBT

Turn-on Switching Waveforms & definition of tdon, tEon
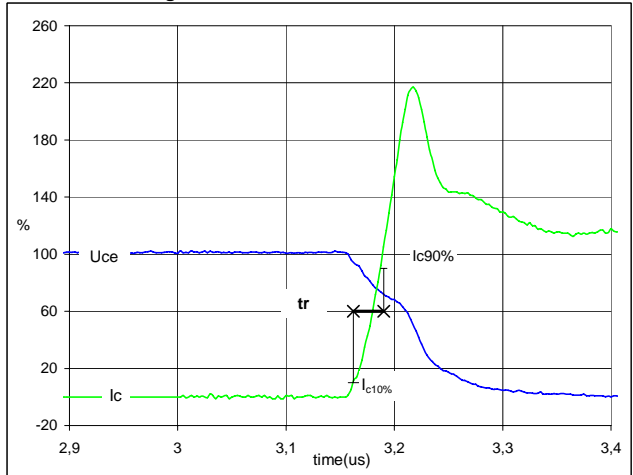**(t_{Eon} = integrating time for E_{on})**
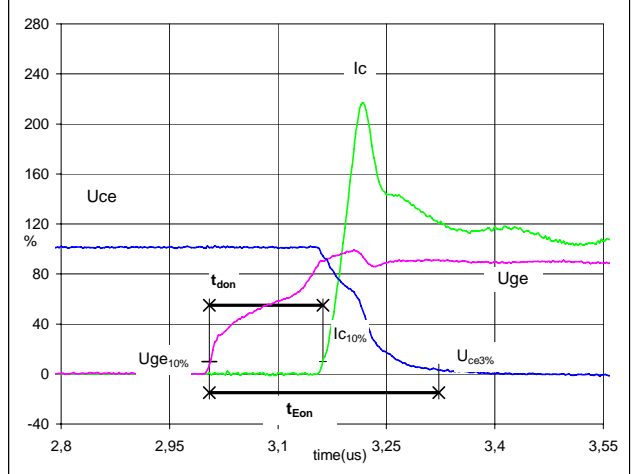
V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	99	A
t_{don} =	0,16	µs
t_{Eon} =	0,32	µs

Figure 3 — Output inverter IGBT

Turn-off Switching Waveforms & definition of t_f

V_C (100%) =	300	V
I_C (100%) =	99	A
t_f =	0,10	µs

Figure 4 — Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

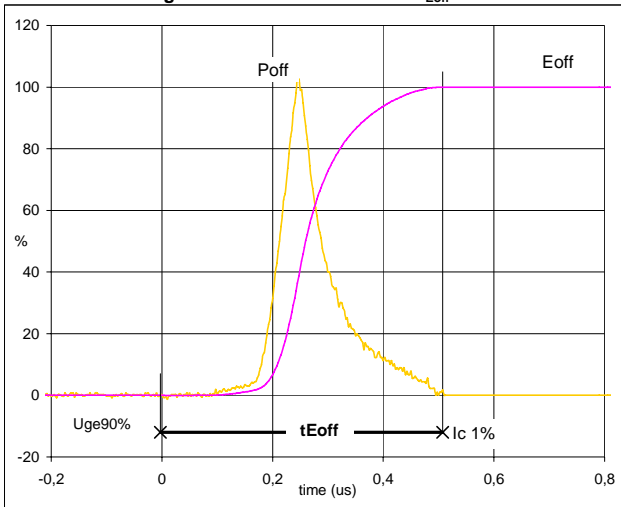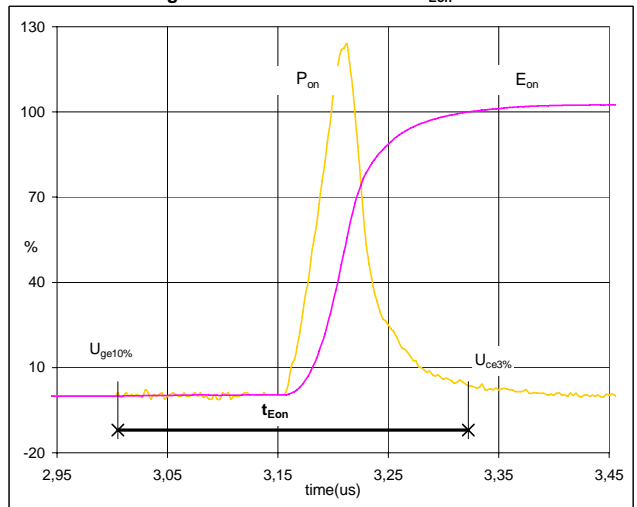|		
V_C (100%) =	300	V
I_C (100%) =	99	A
t_r =	0,03	µs

Switching Definitions Output Inverter

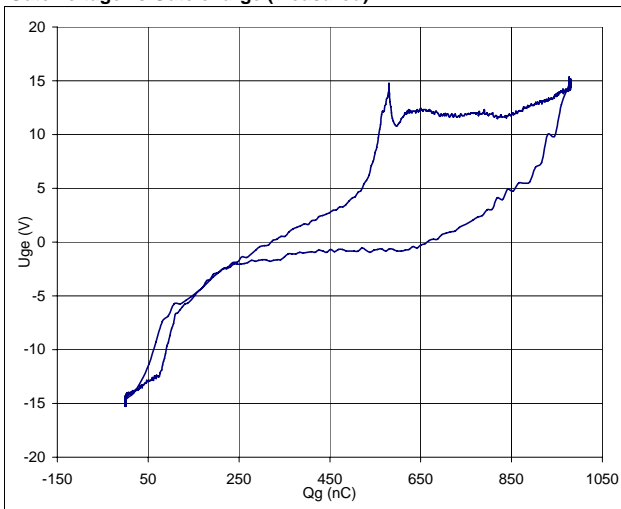| Figure 5	Output inverter IGBT

Turn-off Switching Waveforms & definition of t$_{Eoff}$

P$_{off}$ (100%) =	29,79	kW
E$_{off}$ (100%) =	3,11	mJ
t$_{Eoff}$ =	0,51	µs

Figure 6	Output inverter IGBT

Turn-on Switching Waveforms & definition of t$_{Eon}$

P$_{on}$ (100%) =	29,79	kW
E$_{on}$ (100%) =	2,00	mJ
t$_{Eon}$ =	0,32	µs

Figure 7	Output inverter FRED

Gate voltage vs Gate charge (measured)

V$_{GEoff}$ =	-15	V
V$_{GEon}$ =	15	V
V$_C$ (100%) =	300	V
I$_C$ (100%) =	99	A
Q$_g$ =	979,79	nC

Figure 8	Output inverter IGBT

Turn-off Switching Waveforms & definition of t$_{rr}$
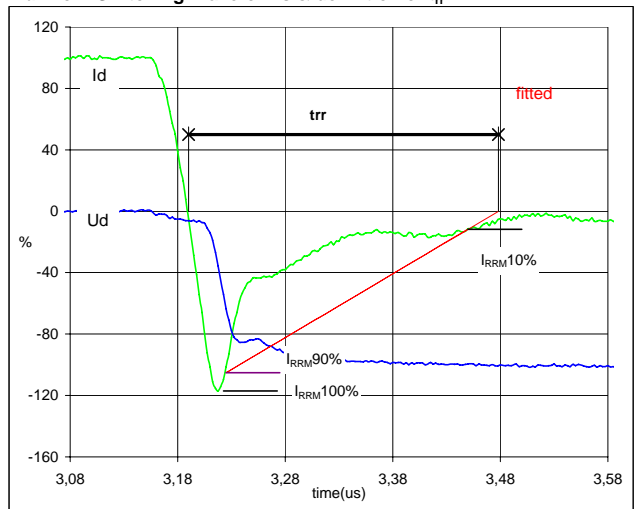
V$_d$ (100%) =	300	V
I$_d$ (100%) =	99	A
I$_{RRM}$ (100%) =	-117	A
t$_{rr}$ =	0,29	µs

Switching Definitions Output Inverter

Figure 9	Output inverter FRED

Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})
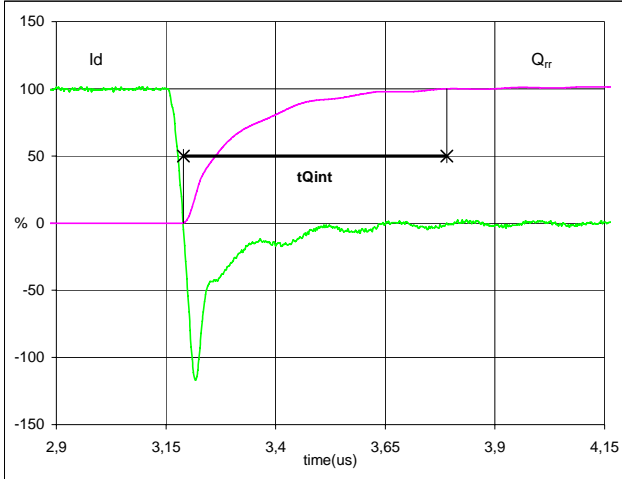
I_d (100%) =	99	A
Q_{rr} (100%) =	10,01	µC
t_{Qint} =	0,60	µs

Figure 10	Output inverter FRED

Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec}= integrating time for E_{rec})
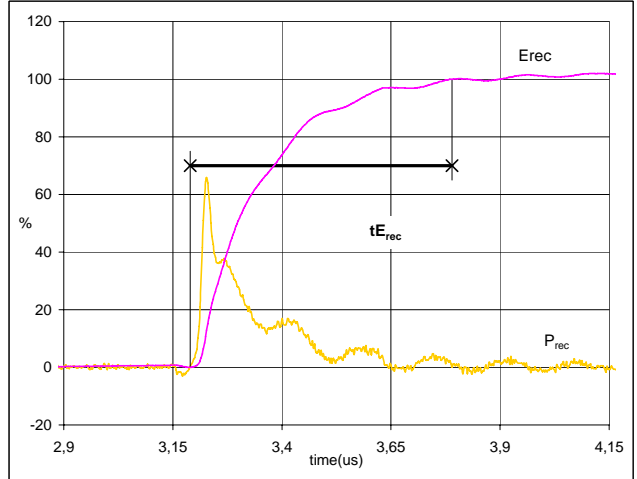
P_{rec} (100%) =	29,79	kW
E_{rec} (100%) =	2,25	mJ
t_{Erec} =	0,60	µs

Package Outline and Pinout

Outline

Pin Table

Pin	X	Y	Pin	X	Y	Pin	X	Y	Pin	X	Y
1	52,6	0	9	12,2	0	17	5,4	28,6	25	39,7	28,6
2	49,9	0	10	9,2	0	18	9,6	28,6	26	42,7	28,6
3	42,65	0	11	2,7	0	19	12,6	28,6	27	47,2	28,6
4	39,65	0	12	0	0	20	19,6	28,6	28	49,9	28,6
5	35,15	0	13	0	14,65	21	22,3	28,6	29	52,6	28,6
6	28,4	0	14	2,7	14,65	22	25	28,6	30	52,6	14,65
7	24	0	15	0	28,6	23	29,7	28,6	31	49,9	14,65
8	21	0	16	2,7	28,6	24	32,7	28,6			

Pinout
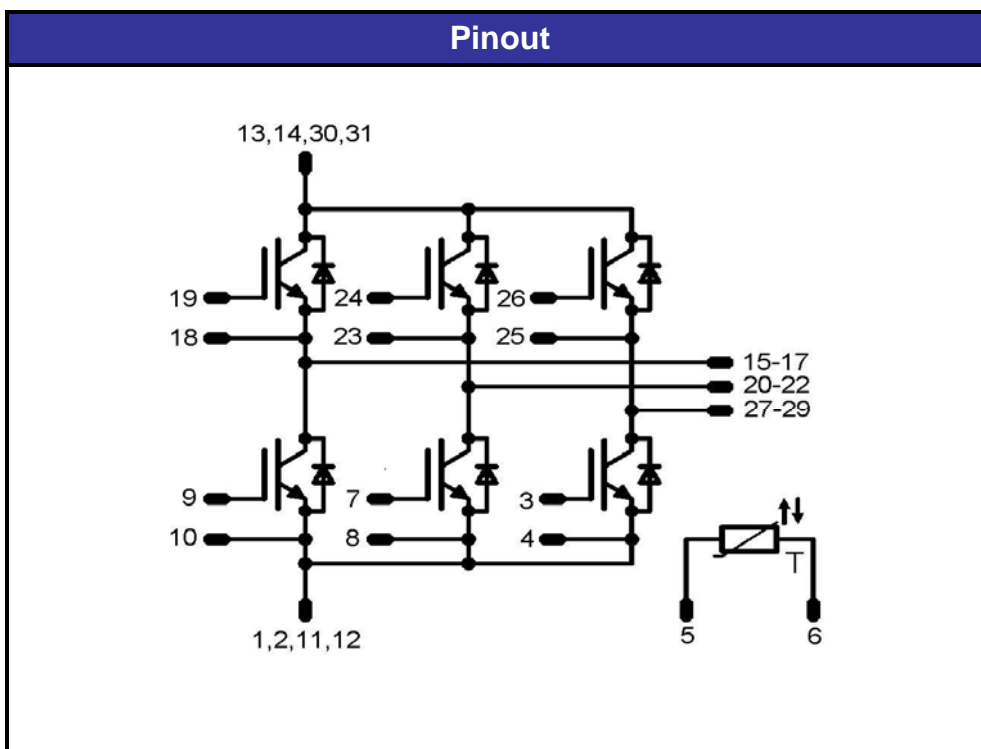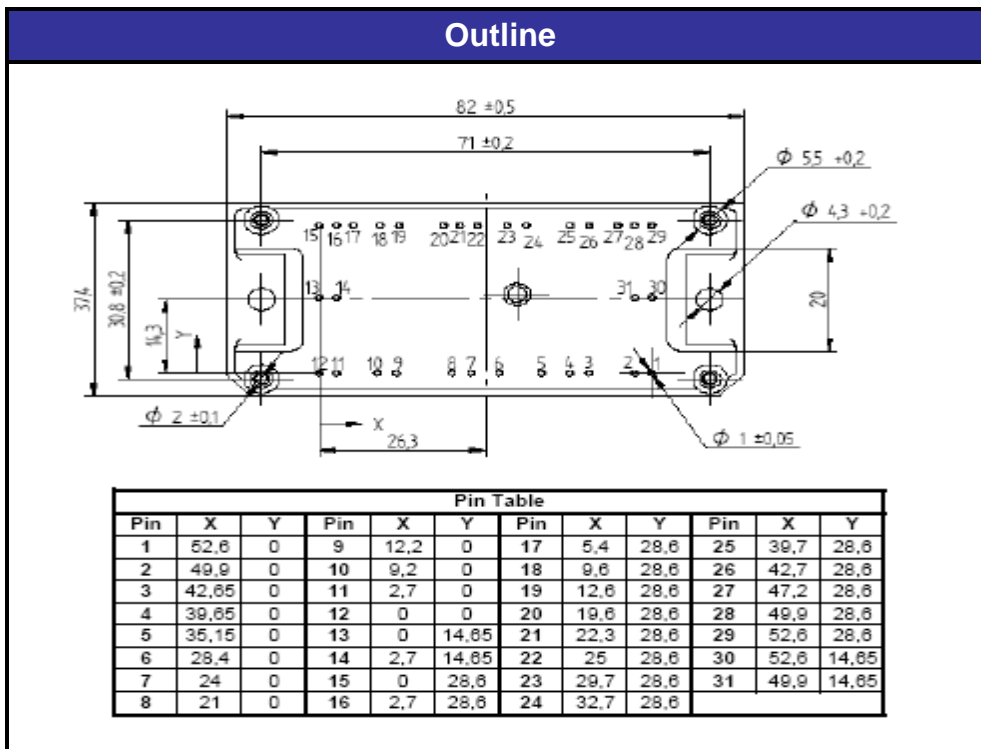
PRODUCT STATUS DEFINITIONS

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.