Vincotech

flowPHASE0	1200V/100A

Features

- Trench Fieldstop IGBT[4] technology
- 2-clip housing in 12mm and 17mm height
- Compact and low inductance design
- AIN substrate for improved performance

flow0 housing

Target Applications

- Motor Drive
- UPS

Schematic

Types

- FZ122PA100SC01
- F0122PA100SC01
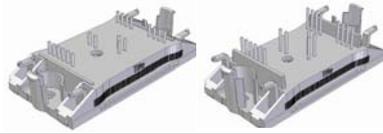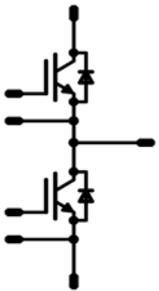
Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Transistor					
Collector-emitter break down voltage	V_{CE}			1200	V
DC collector current	I_C	$T_j=T_j$max	T_h=80°C	111	A
			T_c=80°C	142	
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	297	W
			T_c=80°C	450	
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC}	T_j≤150°C		10	µs
	V_{CC}	V_{GE}=15V		800	V
Maximum Junction Temperature	$T_j$max			175	°C
Inverter Diode					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25°C		1200	V
DC forward current	I_F	$T_j=T_j$max	T_h=80°C	103	A
			T_c=80°C	130	
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		200	A
Power dissipation per Diode	P_{tot}	$T_j=T_j$max	T_h=80°C	187	W
			T_c=80°C	284	
Maximum Junction Temperature	$T_j$max			175	°C

Revision: 1

Maximum Ratings

T_j=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…+(Tjmax - 25)	°C
Insulation Properties				
Insulation voltage	V_{is}	t=2s DC voltage	4000	V
Creepage distance			min 12,7	mm
Clearance			min 12,7	mm

Vincotech

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	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0036	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	1,5	1,95 2,39	2,3	V
Collector-emitter cut-off current incl. Diode	I_{CES}	0	1200			Tj=25°C Tj=150°C			0,035	mA
Gate-emitter leakage current	I_{GES}	20	0			Tj=25°C Tj=150°C			700	nA
Integrated Gate resistor	R_{gint}							7,5		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=4 Ω Rgon=4 Ω	±15	600	100	Tj=25°C Tj=150°C		193 210		ns
Rise time	t_r					Tj=25°C Tj=150°C		32 42		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=150°C		299 383		
Fall time	t_f					Tj=25°C Tj=150°C		75 110		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C		8,09 12,46		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C		5,35 8,47		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		6150		pF
Output capacitance	C_{oss}							405		
Reverse transfer capacitance	C_{rss}							345		
Gate charge	Q_{Gate}	±15				Tj=25°C		386		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal foil thickness=76um Kunze foil KU-ALF5						0,32		K/W
Thermal resistance chip to case per chip	R_{thJC}									
Inverter Diode									
Diode forward voltage	V_F			50		Tj=25°C Tj=150°C	1	1,81 1,77	2,3	V
Peak reverse recovery current	I_{RRM}	Rgon=4 Ω	±15	600	100	Tj=25°C Tj=150°C		98,18 113,5		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		283,4 454,7		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=150°C		8,93 18,06		µC
Peak rate of fall of recovery current	di(rec)max/dt					Tj=25°C Tj=150°C		3254 1038		A/µs
Reverse recovered energy	Erec					Tj=25°C Tj=150°C		3,1 6,56		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal foil thickness=76um Kunze foil KU-ALF5						0,51		K/W
Thermal resistance chip to case per chip	R_{thJC}									

Revision: 1

Output Inverter

Figure 1   Output inverter IGBT
Typical output characteristics
$I_C = f(V_{CE})$
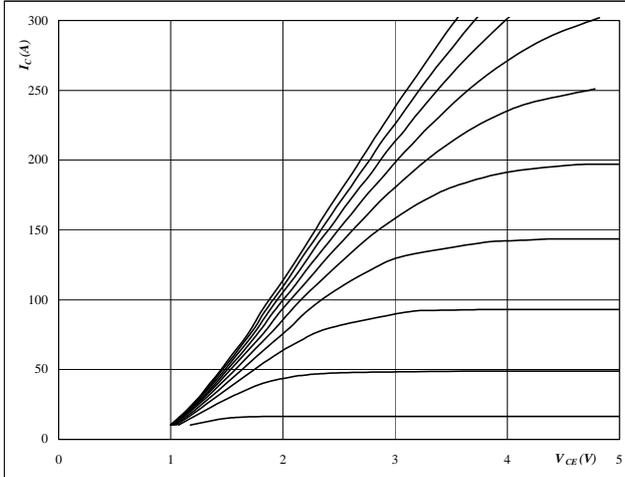
**At**
$t_p =$ 350   µs
$T_j =$ 25   °C
V_{GE} from   7 V to 17 V in steps of 1 V

Figure 2   Output inverter IGBT
**Typical output characteristics**
$I_C = f(V_{CE})$
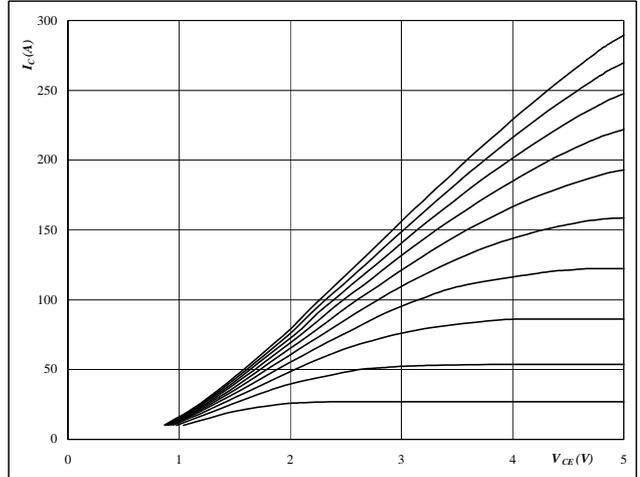
At
$t_p =$ 350   µs
$T_j =$ 150   °C
V_{GE} from   7 V to 17 V in steps of 1 V

Figure 3   Output inverter IGBT
Typical transfer characteristics
$I_C = f(V_{GE})$
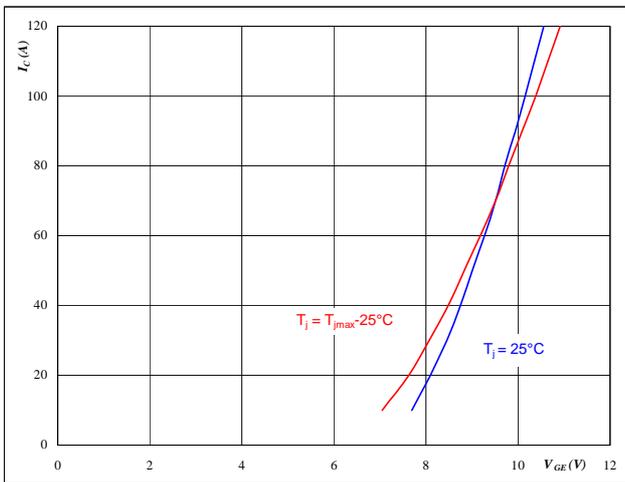
At
$t_p =$ 350   µs
$V_{CE} =$ 10   V

Figure 4   Output inverter FRED
**Typical diode forward current as
a function of forward voltage**
$I_F = f(V_F)$
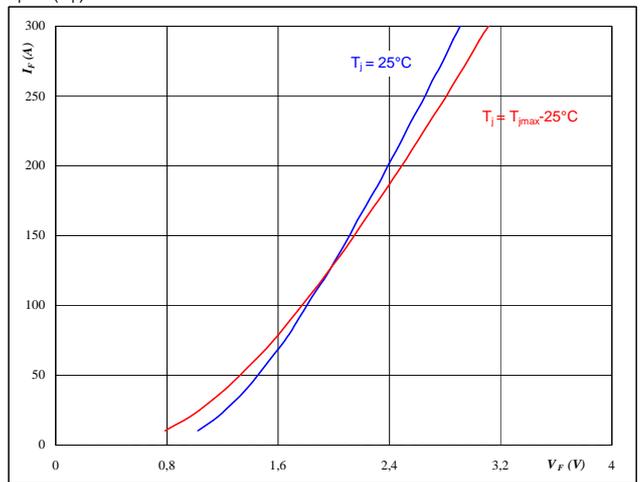
At
$t_p =$ 350   µs

Output Inverter

Figure 5   Output inverter IGBT

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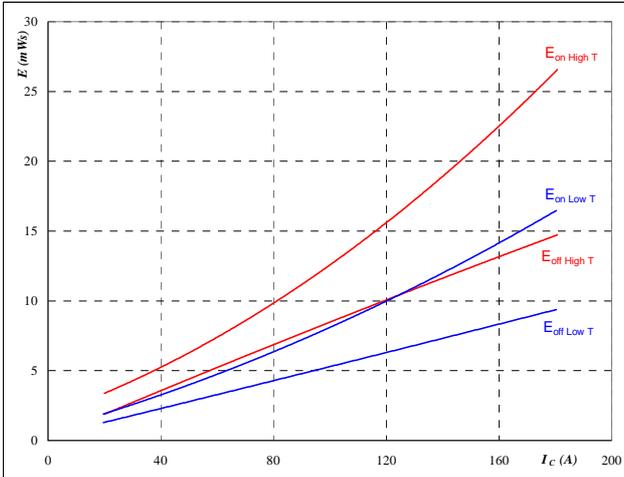
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	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**
$E = f(R_G)$
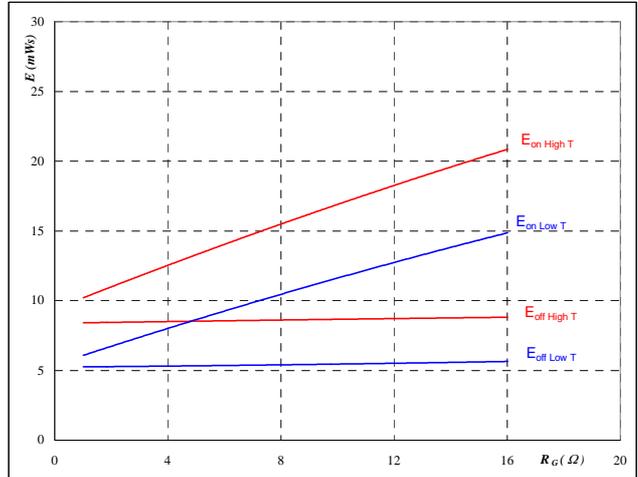
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	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**
$E_{rec} = f(I_C)$
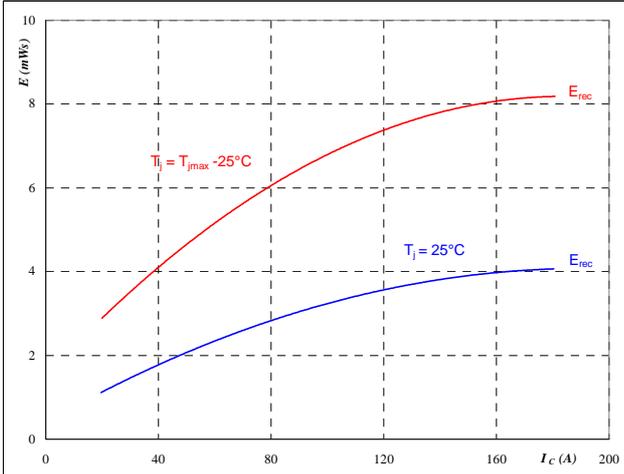
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	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
$E_{rec} = f(R_G)$
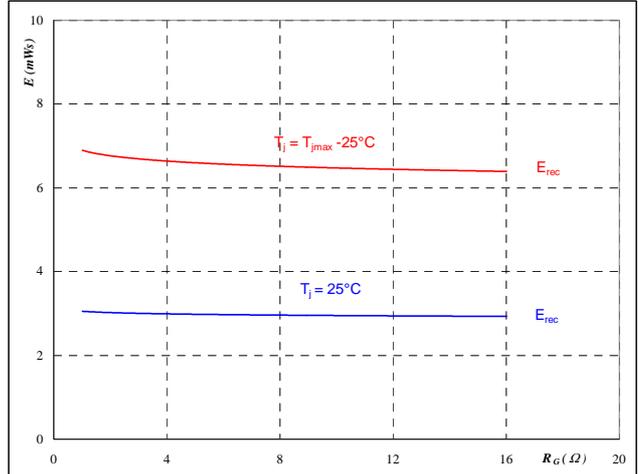
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	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

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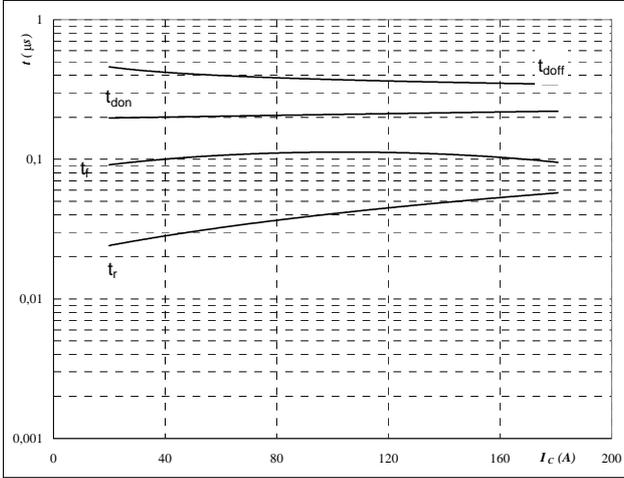
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	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

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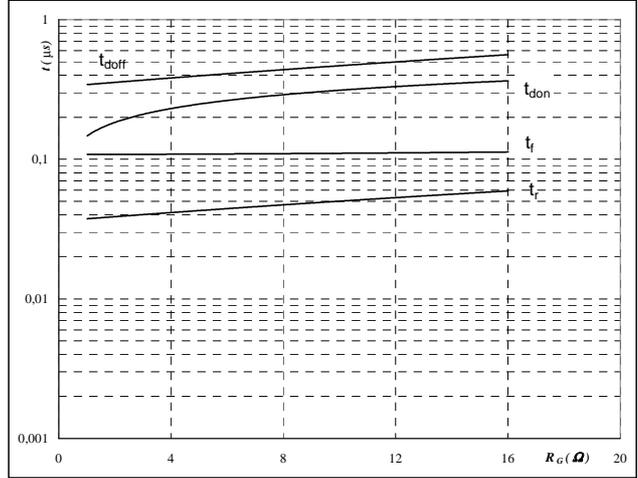
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	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
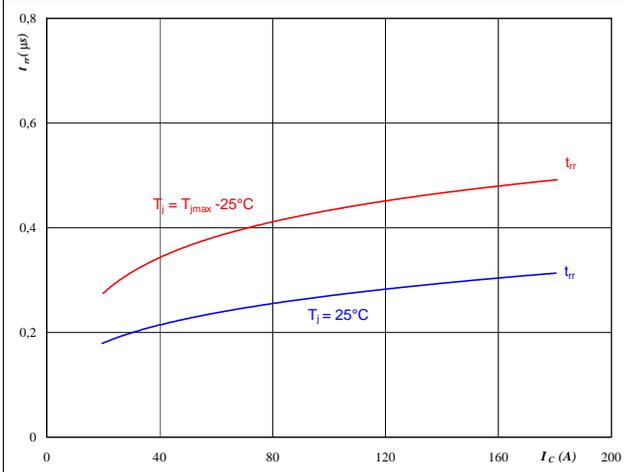
$T_j =$	25/150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	4	Ω

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
$V_R =$	600	V
$I_F =$	100	A
$V_{GE} =$	±15	V

Revision: 1

Output Inverter

Figure 13	Output inverter FRED

**Typical reverse recovery charge as a
function of collector current**

$Q_{rr} = f(I_C)$

At
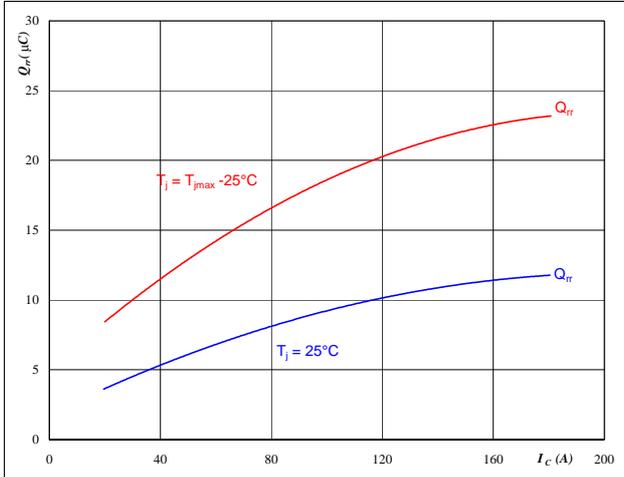
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 14	Output inverter FRED

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

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

At
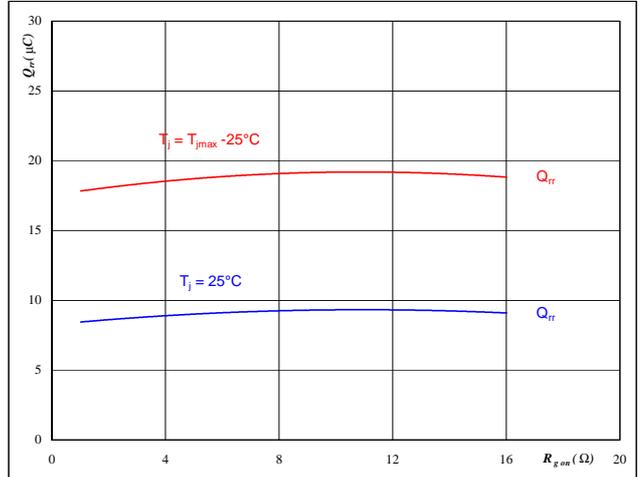
T_j =	25/150	°C
V_R =	600	V
I_F =	100	A
V_{GE} =	±15	V

Figure 15	Output inverter FRED

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

$I_{RRM} = f(I_C)$

At
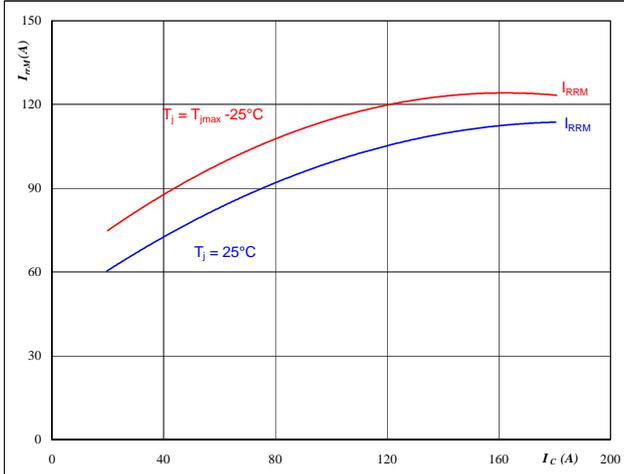
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 16	Output inverter FRED

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

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

At
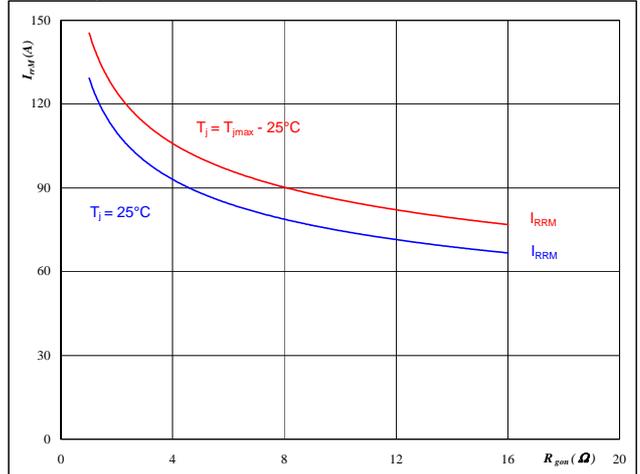
T_j =	25/150	°C
V_R =	600	V
I_F =	100	A
V_{GE} =	±15	V

Output Inverter

Figure 17	Output inverter FRED

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

$dI_0/dt, dI_{rec}/dt = f(I_C)$

At
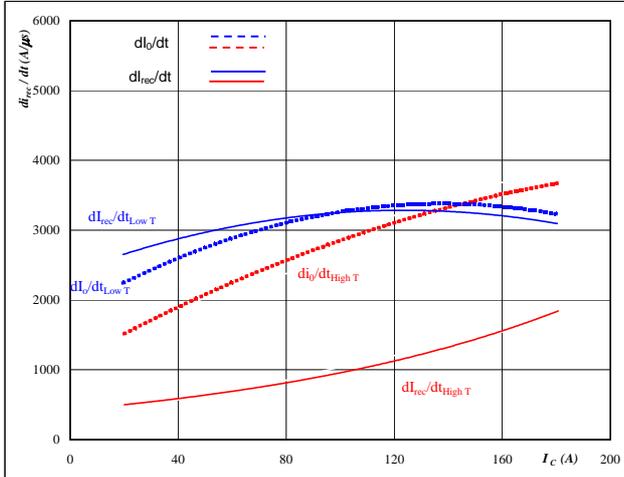
| $T_j =$	25/150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	4	Ω

Figure 18	Output inverter FRED

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

$dI_0/dt, dI_{rec}/dt = f(R_{gon})$

At
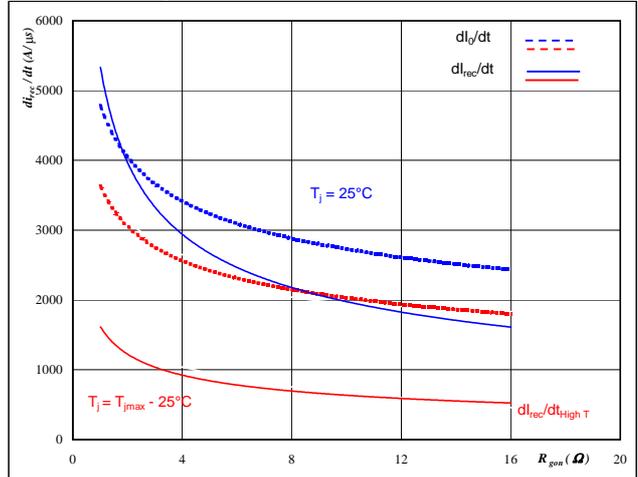
$T_j =$	25/150	°C
$V_R =$	600	V
$I_F =$	100	A
$V_{GE} =$	±15	V

Figure 19	Output inverter IGBT

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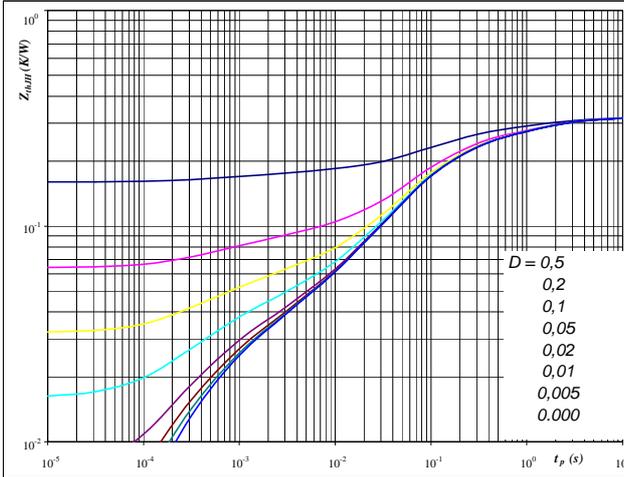
$Z_{thJH} = f(t_p)$

At

D =	t_p / T	
$R_{thJH} =$	0,32	K/W

IGBT thermal model values

R (C/W)	Tau (s)
0,03	4,4E+00
0,06	9,7E-01
0,11	1,5E-01
0,08	4,2E-02
0,02	2,5E-03
0,02	3,5E-04

Figure 20	Output inverter FRED

FRED transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$
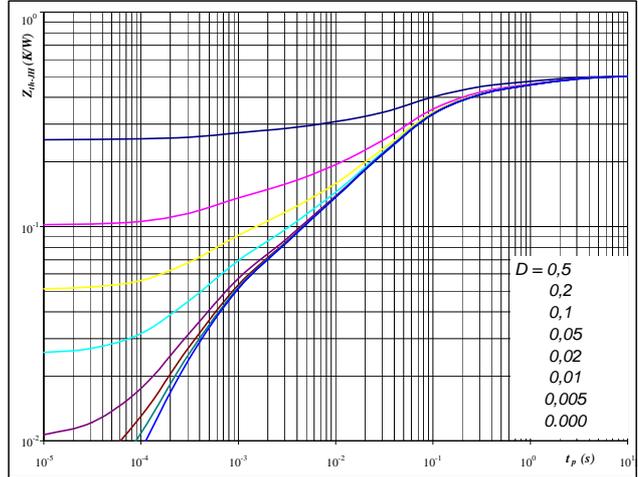
At

D =	t_p / T	
$R_{thJH} =$	0,51	K/W

FRED thermal model values

R (C/W)	Tau (s)
0,02	9,2E+00
0,08	1,2E+00
0,14	1,5E-01
0,18	3,9E-02
0,05	4,2E-03
0,04	5,1E-04

Output Inverter

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

At
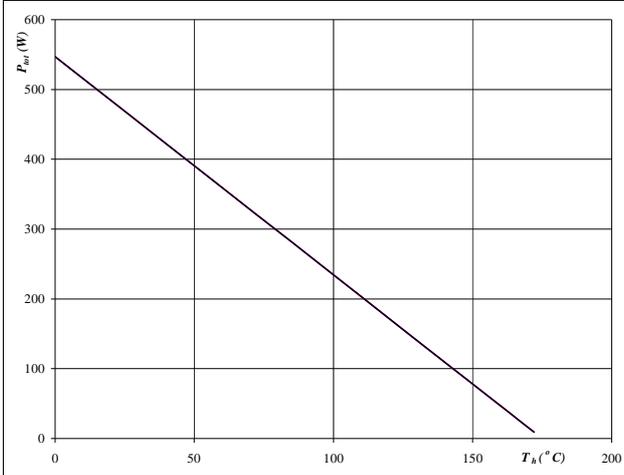
T_j =	175	°C

— single heating
— overall heating

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

$I_C = f(T_h)$
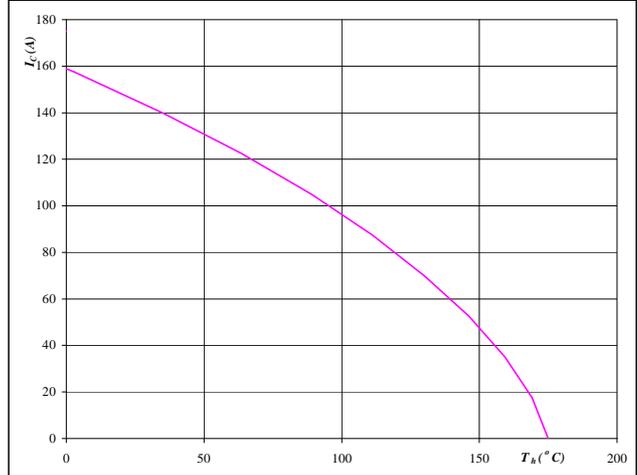
At

T_j =	175	°C
V_{GE} =	15	V

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

At
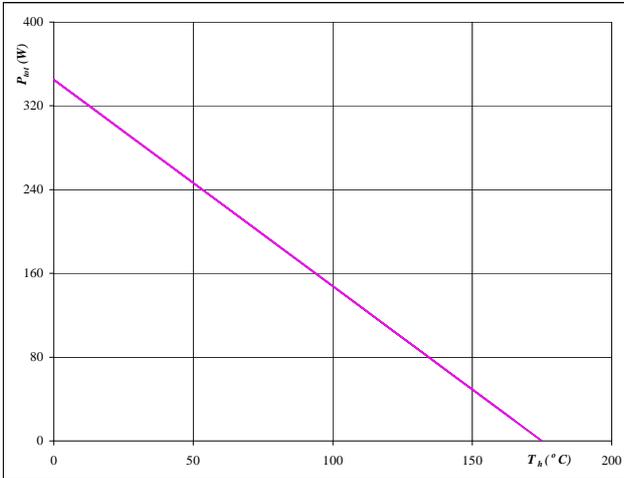
T_j =	175	°C

— single heating
— overall heating

Forward current as a function of heatsink temperature

$I_F = f(T_h)$
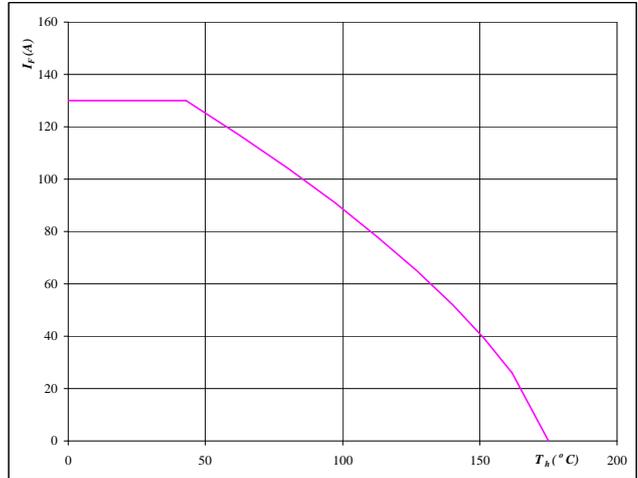
At

T_j =	175	°C

Output Inverter

Figure 25	Output inverter IGBT

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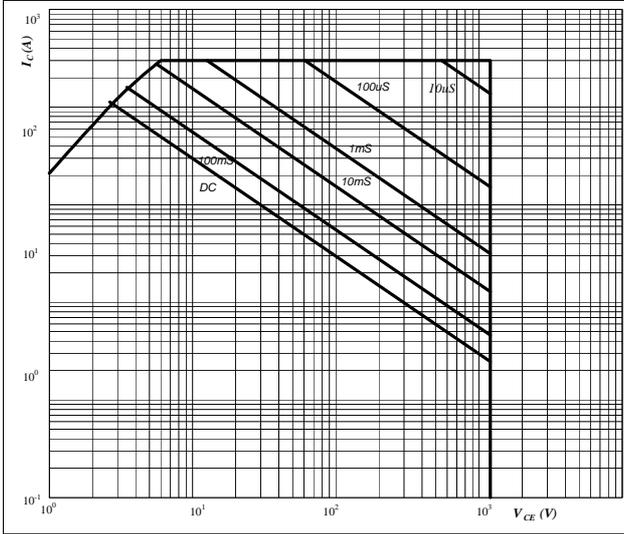
At

D = single pulse
T_h = 80 ºC
V_{GE} = ±15 V
T_j = T_{jmax} ºC

Figure 26	Output inverter IGBT

Gate voltage vs Gate charge

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

At

I_C = 100 A

Revision: 1
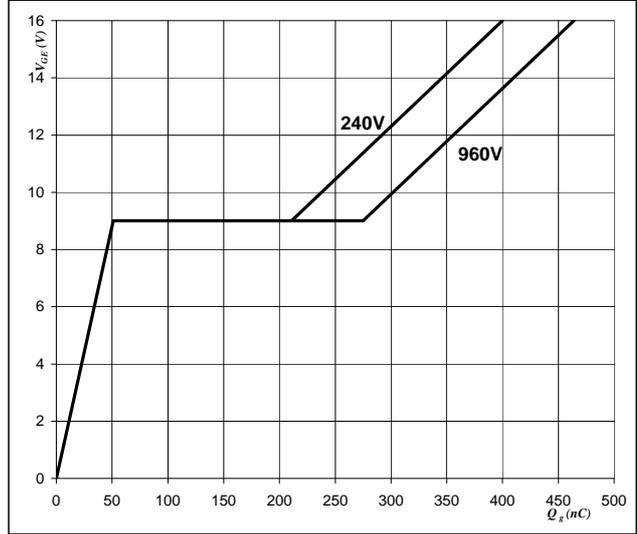
Switching Definitions Output Inverter

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 t_{doff}, t_{Eoff}
**(t_{Eoff} = integrating time for E_{off})**
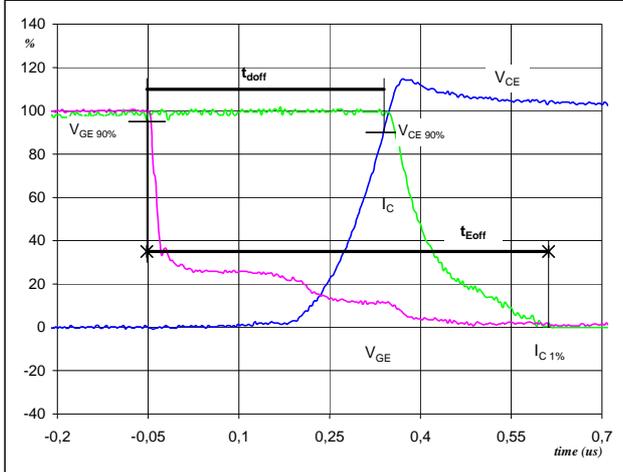
V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	99	A
t_{doff} =	0,38	µs
t_{Eoff} =	0,66	µs

Figure 2 — Output inverter IGBT

Turn-on Switching Waveforms & definition of tdon, t_{Eon}
(t_{Eon} = integrating time for E_{on})
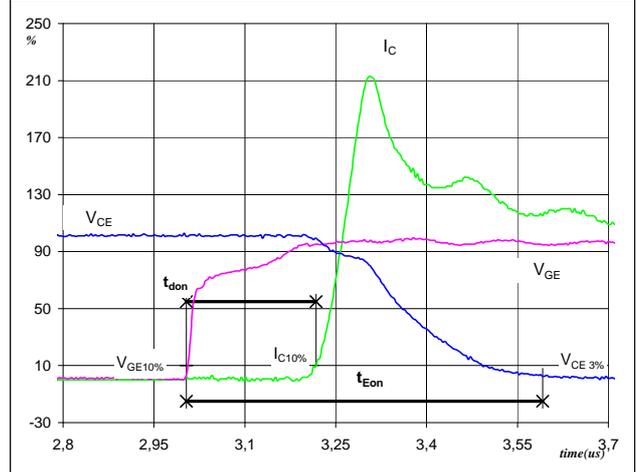
V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	99	A
t_{don} =	0,21	µs
t_{Eon} =	0,59	µs

Figure 3 — Output inverter IGBT

Turn-off Switching Waveforms & definition of t_f
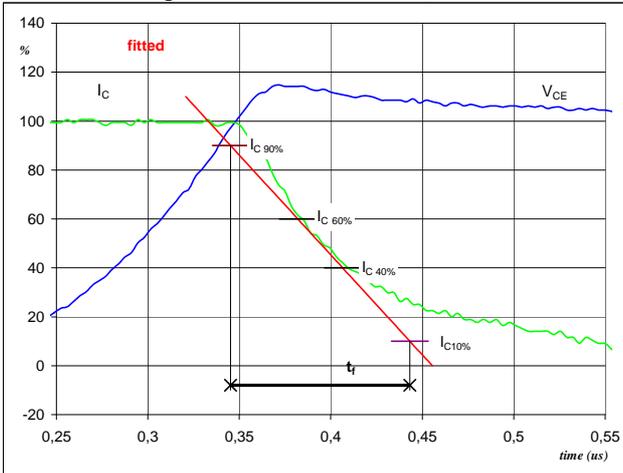
V_C (100%) =	600	V
I_C (100%) =	99	A
t_f =	0,11	µs

Figure 4 — Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r
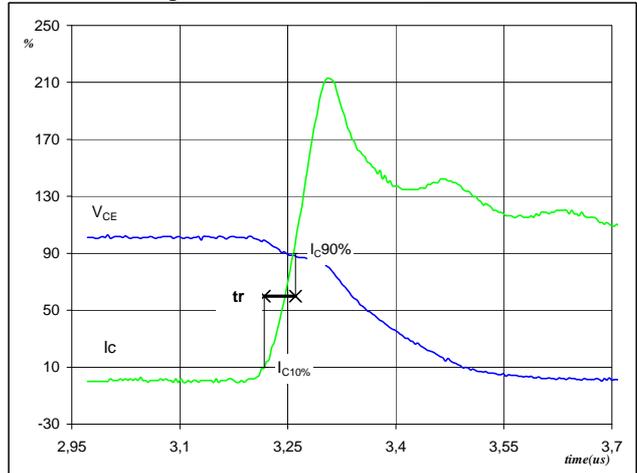
V_C (100%) =	600	V
I_C (100%) =	99	A
t_r =	0,04	µs

Revision: 1

Switching Definitions Output Inverter

Figure 5	Output inverter IGBT

Turn-off Switching Waveforms & definition of t_{Eoff}
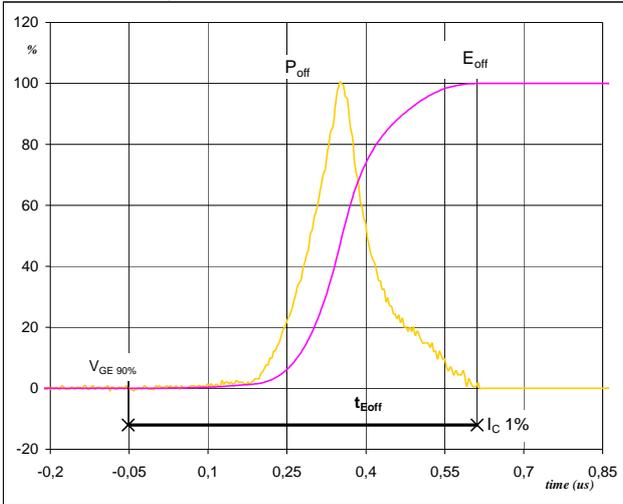
P_{off} (100%) =	59,42	kW
E_{off} (100%) =	8,45	mJ
t_{Eoff} =	0,66	µs

Figure 6	Output inverter IGBT

Turn-on Switching Waveforms & definition of t_{Eon}
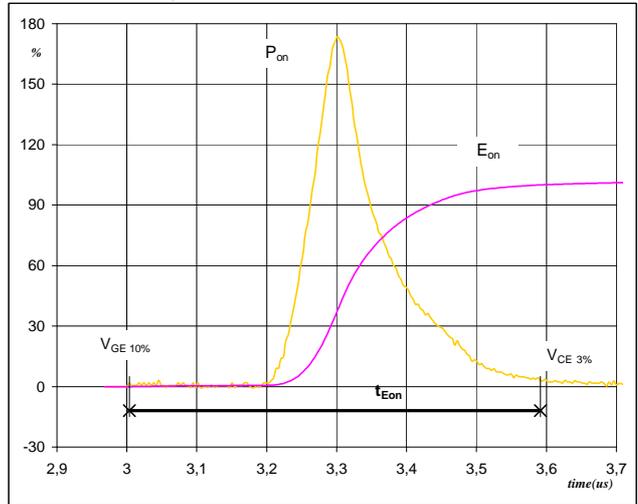
P_{on} (100%) =	59,42	kW
E_{on} (100%) =	12,38	mJ
t_{Eon} =	0,59	µs

Figure 7	Output inverter FRED

Gate voltage vs Gate charge (measured)
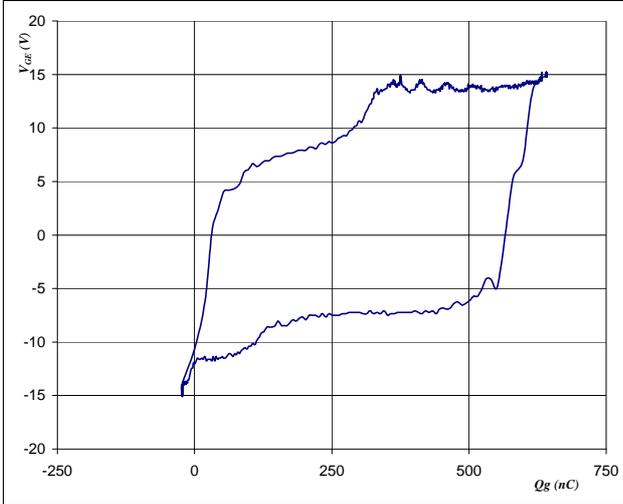
V_{GEoff} =	-15	V
V_{GEon} =	15	V
V_C (100%) =	600	V
I_C (100%) =	99	A
Q_g =	6433,37	nC

Figure 8	Output inverter IGBT

Turn-off Switching Waveforms & definition of t_{rr}
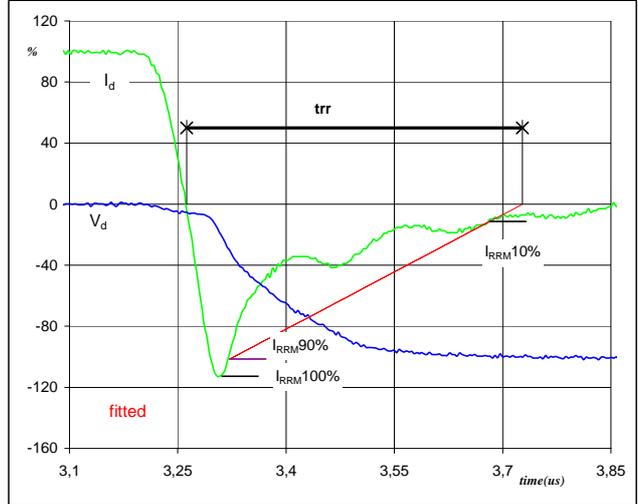
|		
V_d (100%) =	600	V
I_d (100%) =	99	A
I_{RRM} (100%) =	-113	A
t_{rr} =	0,46	µs

Switching Definitions Output Inverter

Figure 9	Output inverter FRED

Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})
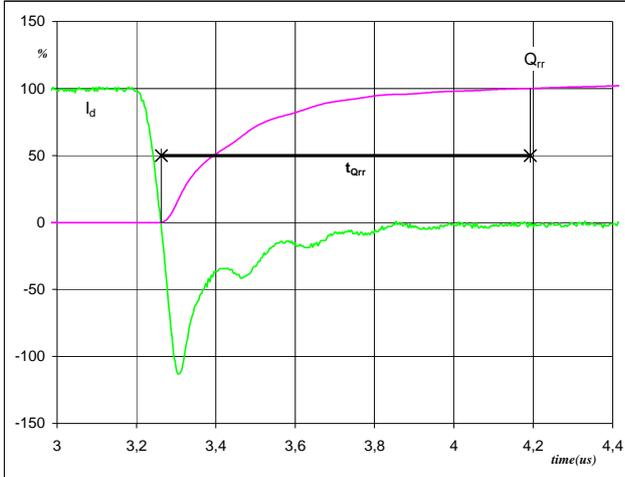
I_d (100%) =	99	A
Q_{rr} (100%) =	18,12	µC
t_{Qrr} =	0,93	µs

Figure 10	Output inverter FRED

Turn-on Switching Waveforms & definition of t_{Erec}
**(t_{Erec}= integrating time for E_{rec})**
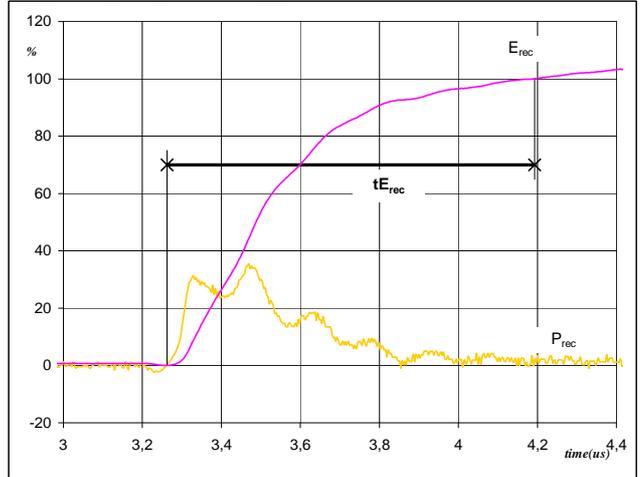
P_{rec} (100%) =	59,42	kW
E_{rec} (100%) =	6,60	mJ
t_{Erec} =	0,93	µs

Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	10-FZ122PA100SC01-P999F18	P999F18	P999F18
without thermal paste 17mm housing	10-F0122PA100SC01-P999F19	P999F19	P999F19

Outline

Pin table		
Pin	X	Y
1	0	0
2	0	2,3
3	0	4,6
4	0	6,9
5	0	15,6
6	0	17,9
7	0	20,2
8	0	22,5
9	13,85	16,45
10	16,75	16,45
11	33,5	11,5
12	33,5	9,2
13	33,5	6,9
14	33,5	4,6
15	33,5	2,3
16	33,5	0
17	13,85	13,55
18	19,55	4,95
19	19,55	7,85
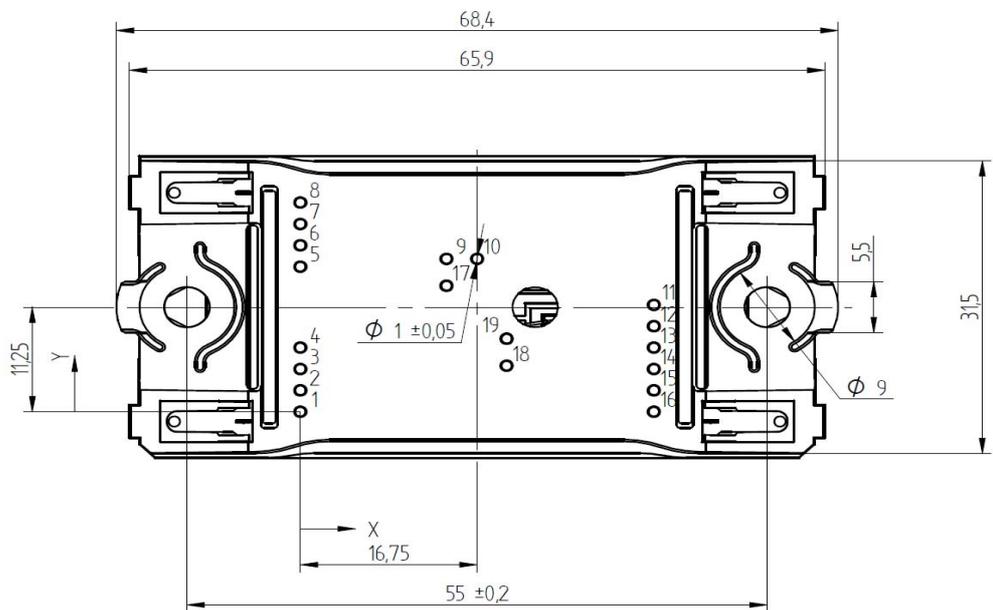
Pinout
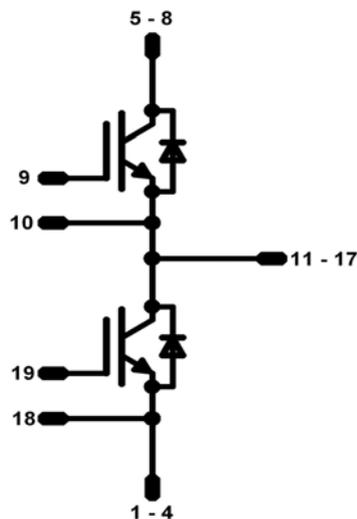
PRODUCT STATUS DEFINITIONS

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.