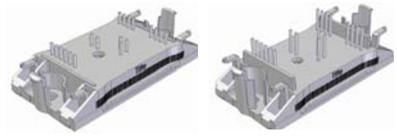
flowPHASE0 **600V/150A**

Features

- Trench Fieldstop IGBT[3] technology
- 2-clip housing in 12mm and 17mm height
- Compact and low inductance design
- AlN substrate for improved performance

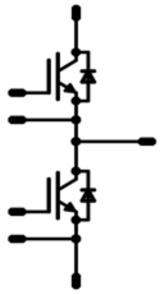
flow0 housing



Target Applications

- Motor Drive
- UPS

Schematic



Types

- FZ062PA150SA01
- F0062PA150SA01

Maximum Ratings

T_j=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	142 183	A
Repetitive peak collector current	I_{Cpulse}	t_p limited by $T_j$max		450	A
Power dissipation per IGBT	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	264 400	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	120 150	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		450	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	174 264	W
Maximum Junction Temperature	$T_j$max			175	°C

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

Characteristic Values

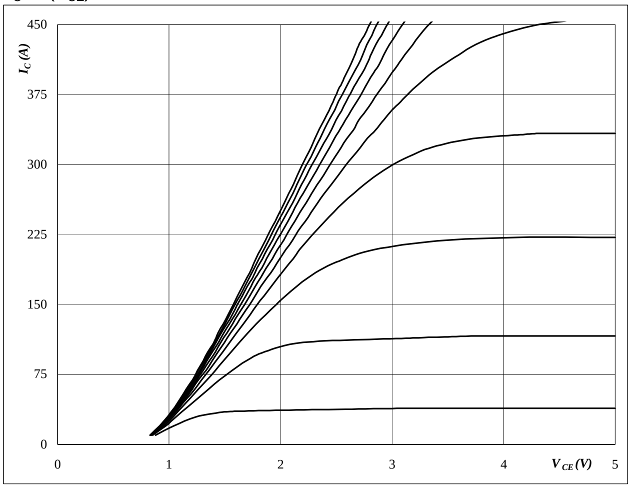
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Inverter Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0024	Tj=25°C Tj=150°C	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		150	Tj=25°C Tj=150°C	1	1,61 1,87	2,2	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		Tj=25°C Tj=150°C			0,96	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=150°C			700	nA
Integrated Gate resistor	R_{gint}							2		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=4 Ω Rgon=4 Ω	±15	300	150	Tj=25°C Tj=150°C		231 241		ns
Rise time	t_r					Tj=25°C Tj=150°C		32 37		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=150°C		296 329		
Fall time	t_f					Tj=25°C Tj=150°C		81 95		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C		2,03 3		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C		3,88 5,21		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		9240		pF
Output capacitance	C_{oss}							576		
Reverse transfer capacitance	C_{rss}							274		
Gate charge	Q_{Gate}		±15			Tj=25°C		930		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal foil thickness=76um Kunze foil KU-ALF5						0,36		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	1,71 1,6	2,2	V
Peak reverse recovery current	I_{RRM}	Rgon=4 Ω	±15	300	150	Tj=25°C Tj=150°C		123,92 161,1		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		108,8 273,1		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=150°C		7,37 15,35		μC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=150°C		2262 2417		A/μs
Reverse recovered energy	Erec					Tj=25°C Tj=150°C		1,62 3,48		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal foil thickness=76um Kunze foil KU-ALF5						0,55		K/W
Thermal resistance chip to case per chip	R_{thJC}									

Output Inverter

Figure 1	Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



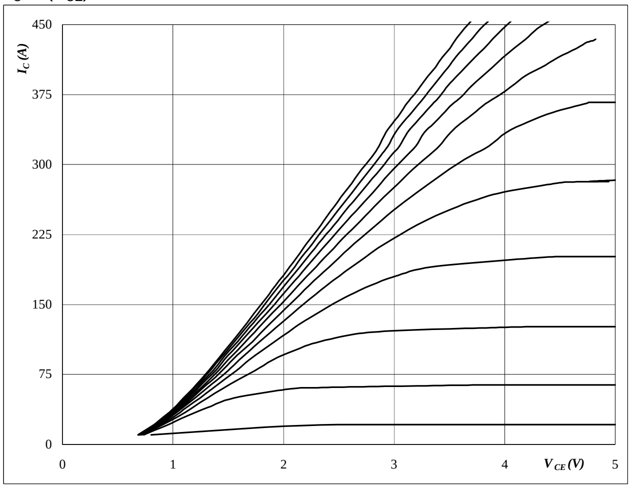
At

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

$I_C = f(V_{CE})$



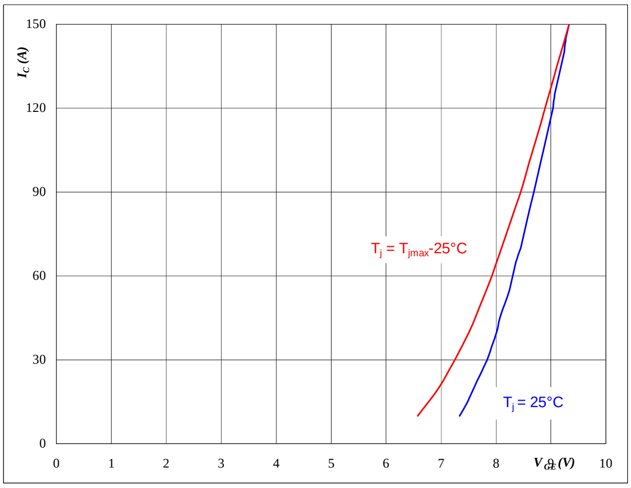
At

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

$I_C = f(V_{GE})$



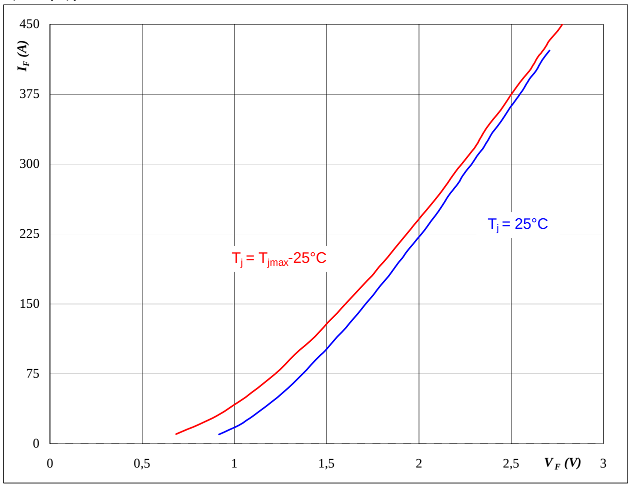
At

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

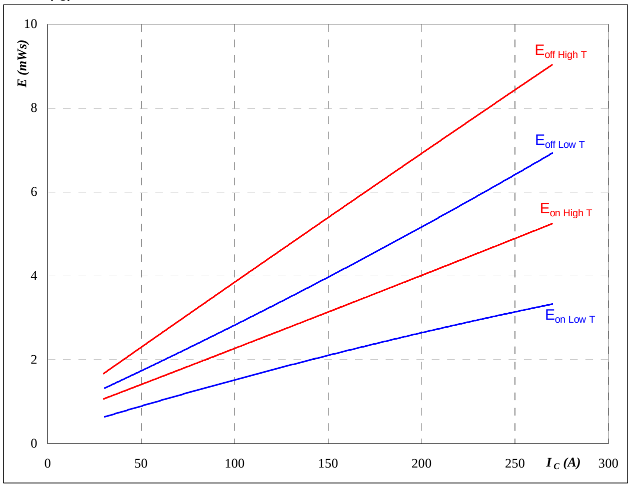
t_p =	350	µs

Output Inverter

Figure 5 Output inverter IGBT

Typical switching energy losses
as a function of collector current

E = f(I_C)



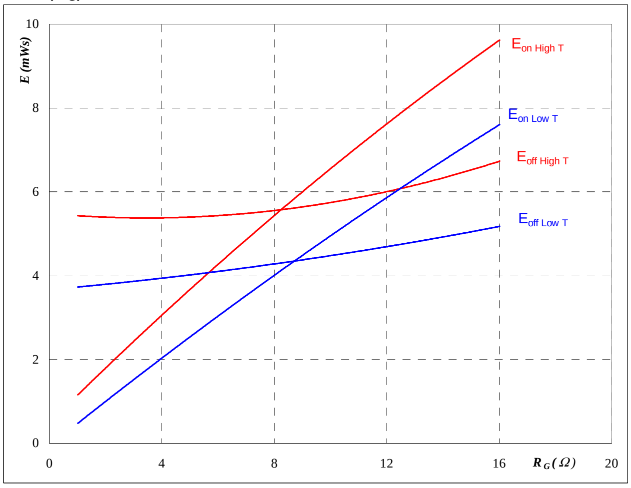
With an inductive load at

T_j =	25/150	°C
V_{CE} =	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)



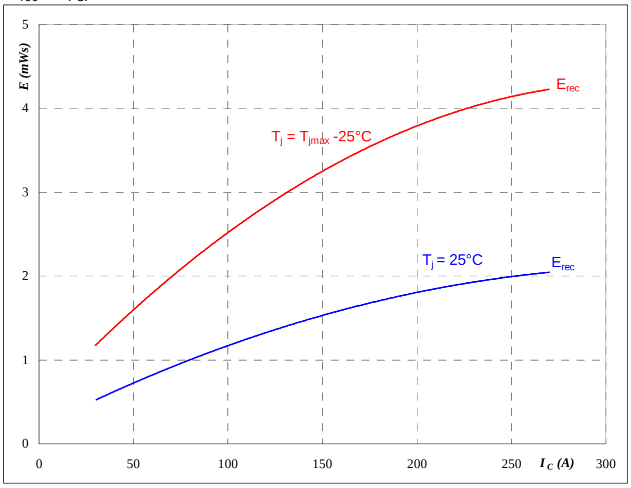
With an inductive load at

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

Figure 7 Output inverter IGBT

Typical reverse recovery energy loss
as a function of collector current

E_{rec} = f(I_C)



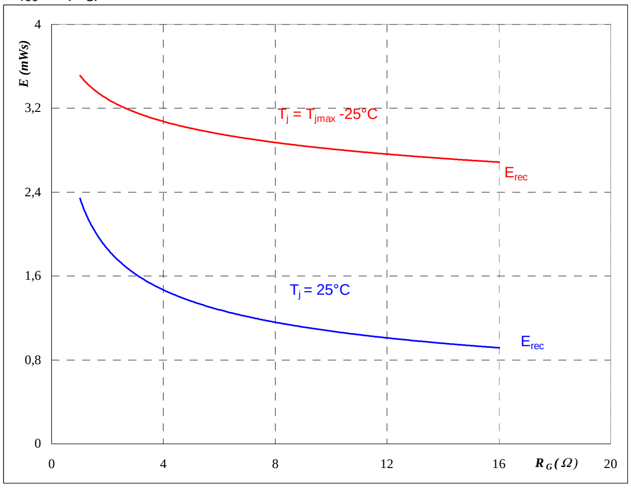
With an inductive load at

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

E_{rec} = f(R_G)



With an inductive load at

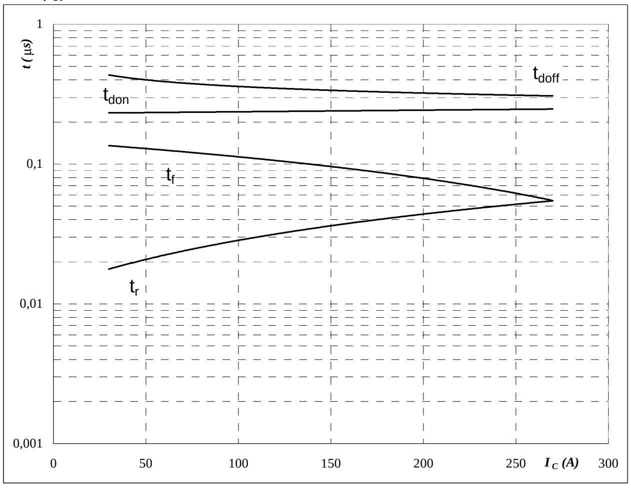
T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	150	A

Output Inverter

Figure 9 Output inverter IGBT

Typical switching times as a function of collector current

t = f(I_C)



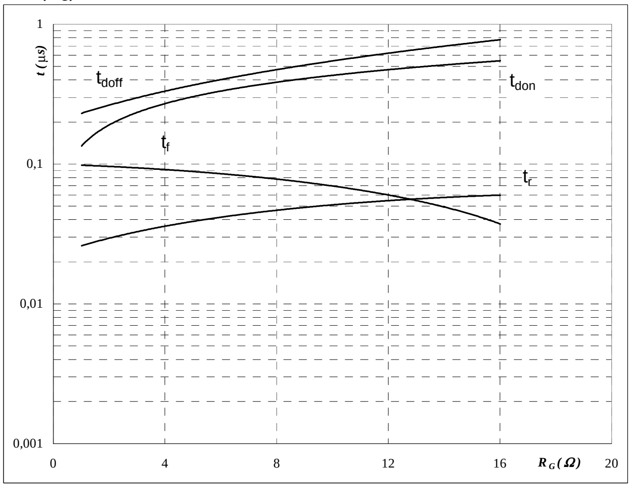
With an inductive load at

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)



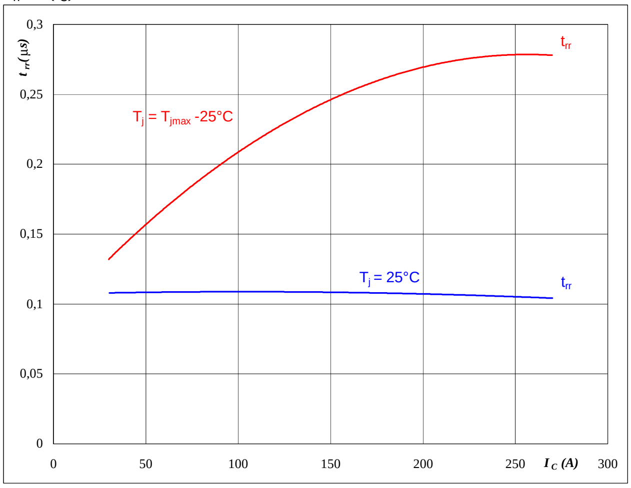
With an inductive load at

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

Figure 11 Output inverter FRED

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



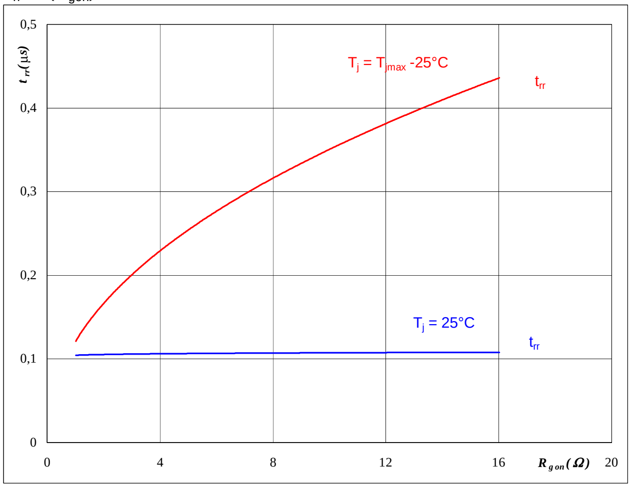
At

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

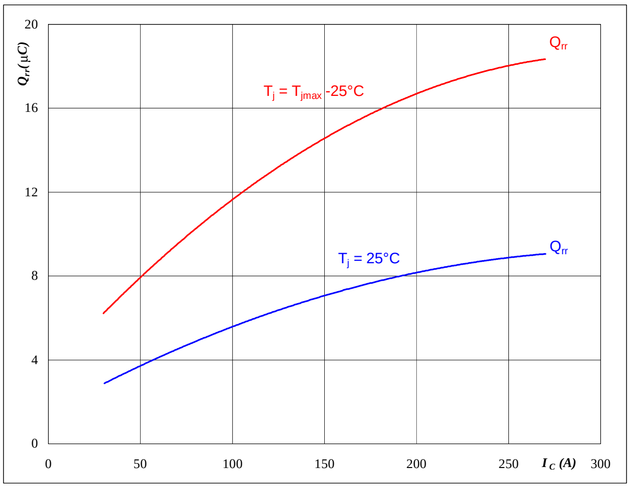
T_j =	25/150	°C
V_R =	300	V
I_F =	150	A
V_{GE} =	±15	V

Output Inverter

Figure 13 Output inverter FRED

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$

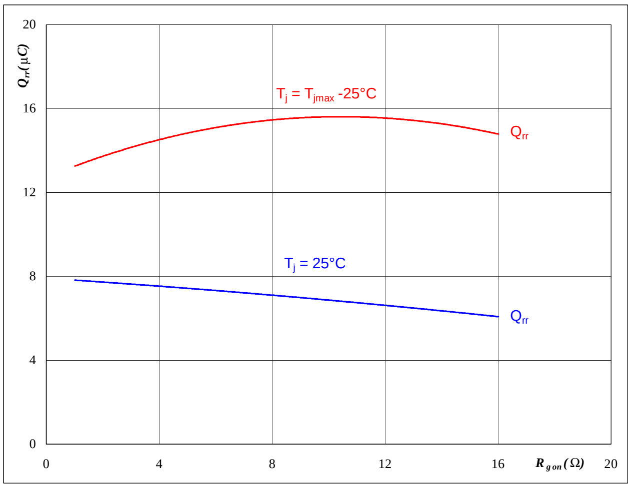


At		
T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 14 Output inverter FRED

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

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

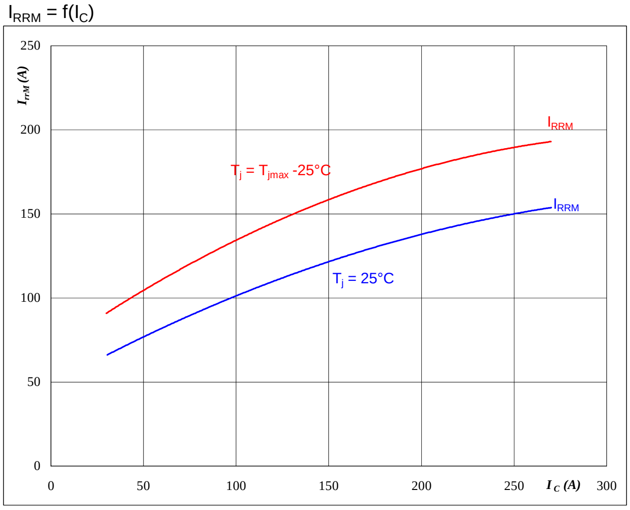


At		
T_j =	25/150	°C
V_R =	300	V
I_F =	150	A
V_{GE} =	±15	V

Figure 15 Output inverter FRED

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$

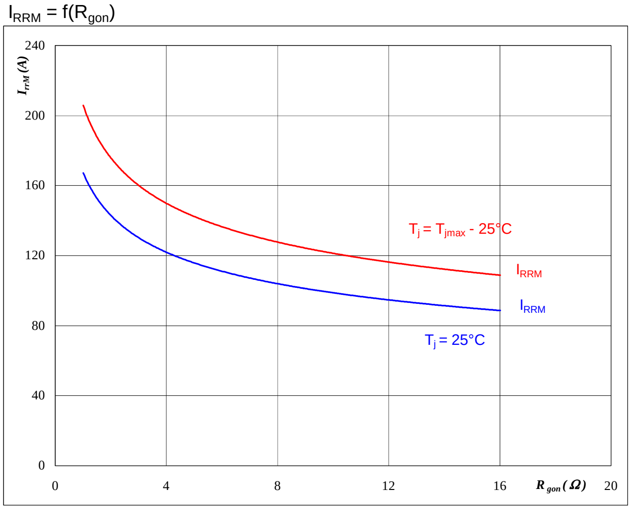


At		
T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 16 Output inverter FRED

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

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



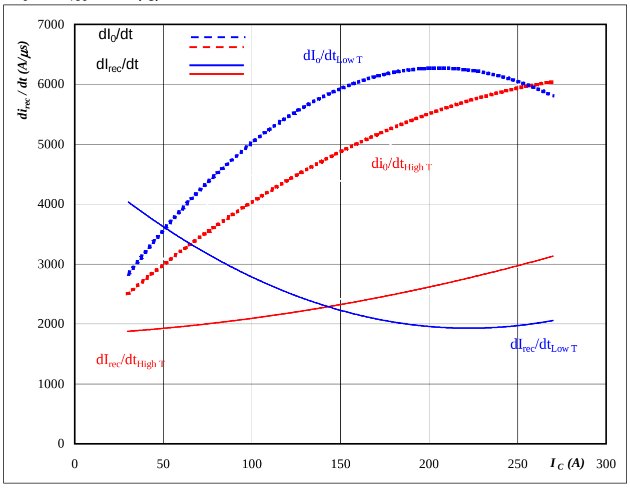
At		
T_j =	25/150	°C
V_R =	300	V
I_F =	150	A
V_{GE} =	±15	V

Output Inverter

Figure 17 — Output inverter FRED

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

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



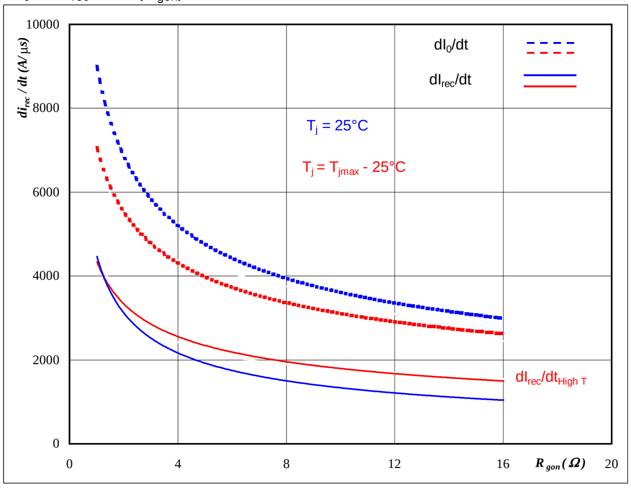
At

T_j =	25/150	°C
V_{CE} =	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

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



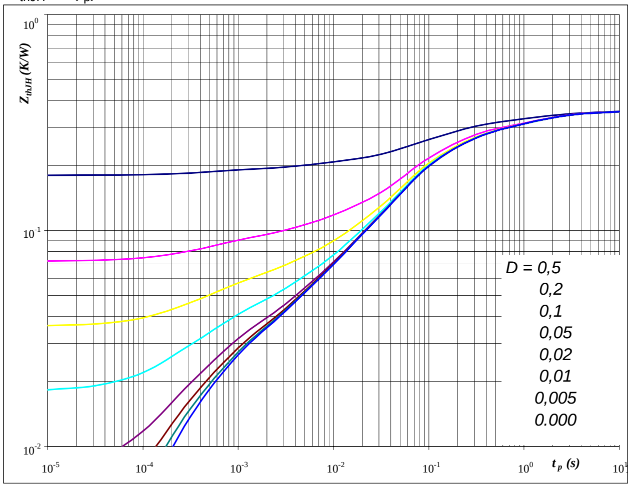
At

T_j =	25/150	°C
V_R =	300	V
I_F =	150	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} =	0,36	K/W

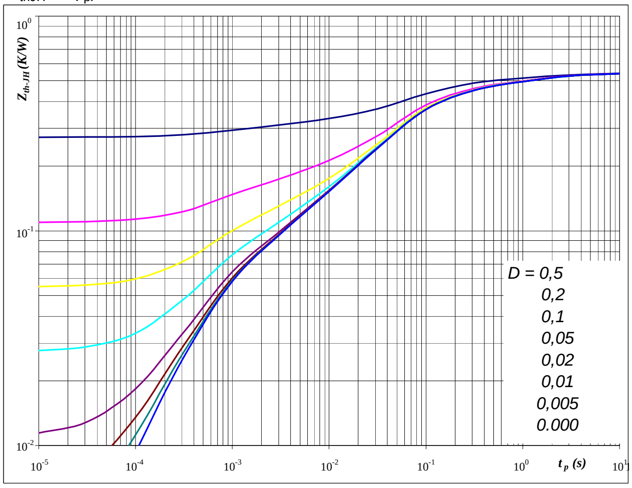
IGBT thermal model values

R (C/W)	Tau (s)
0,01	9,7E+00
0,08	1,3E+00
0,11	1,7E-01
0,12	4,9E-02
0,02	3,6E-03
0,02	3,8E-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} =	0,55	K/W

FRED thermal model values

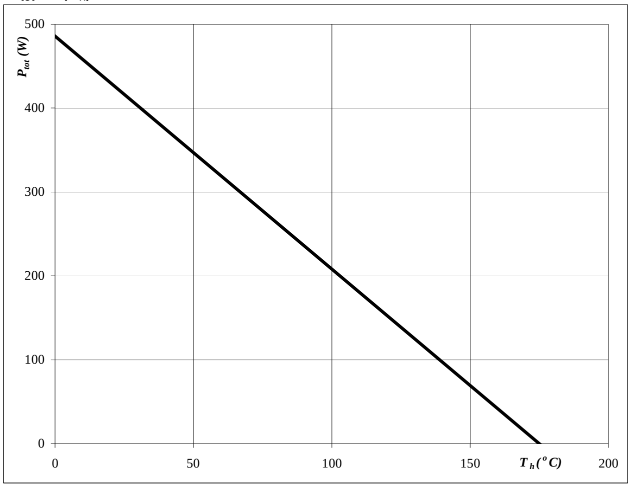
R (C/W)	Tau (s)
0,02	9,9E+00
0,07	1,3E+00
0,11	1,9E-01
0,23	5,0E-02
0,06	5,8E-03
0,06	6,7E-04

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

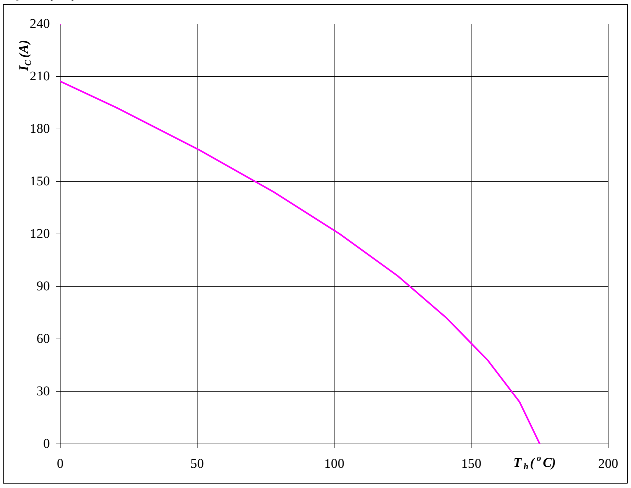
single heating

overall heating

Figure 22 Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

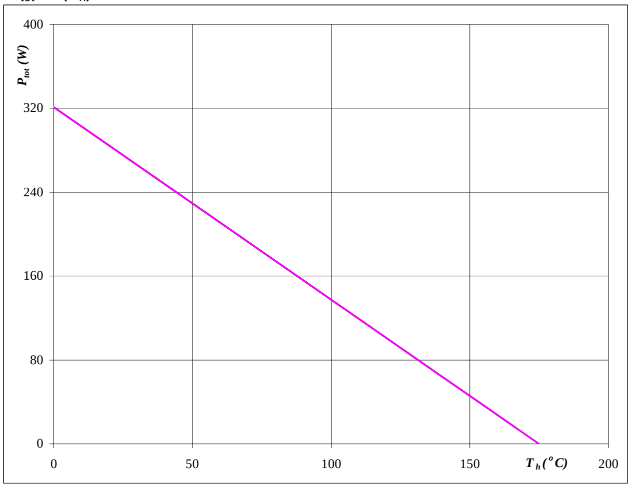
T_j = 175 °C

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

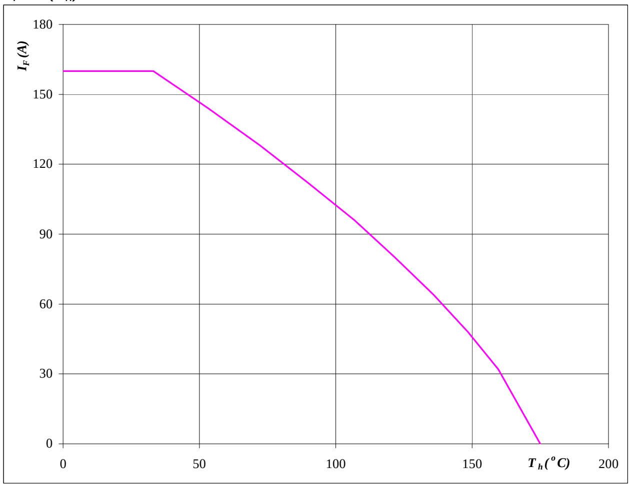
single heating

overall heating

Figure 24 Output inverter FRED

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

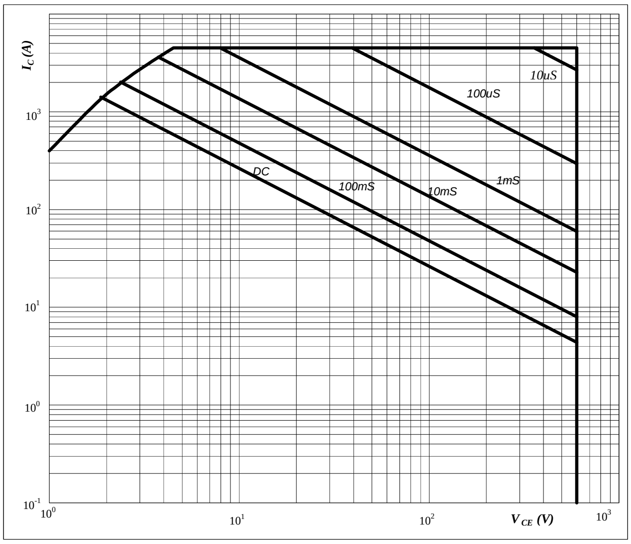
T_j = 175 °C

Output Inverter

Figure 25 Output inverter IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



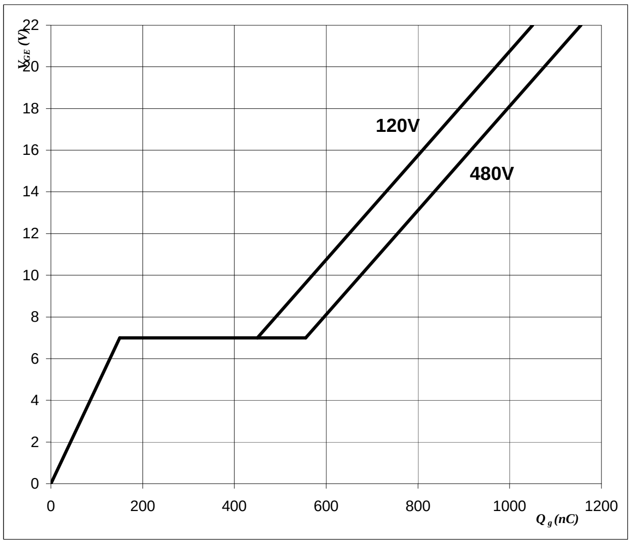
At

D =	single pulse	
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 =	150	A

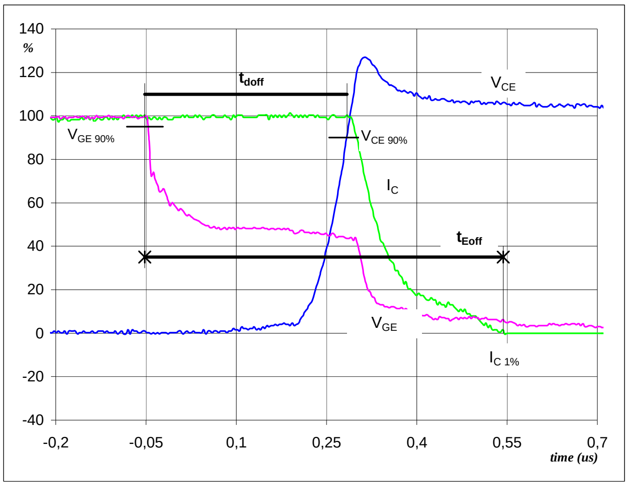
Switching Definitions Output Inverter

General conditions

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

Figure 1 Output inverter IGBT

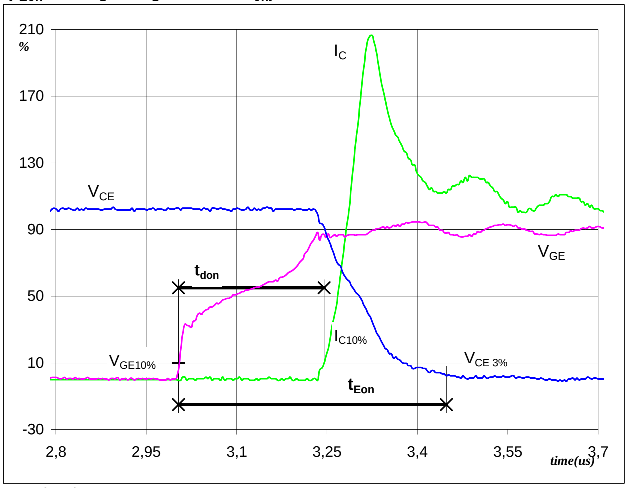
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	150	A
t_{doff} =	0,33	µs
t_{Eoff} =	0,60	µs

Figure 2 Output inverter IGBT

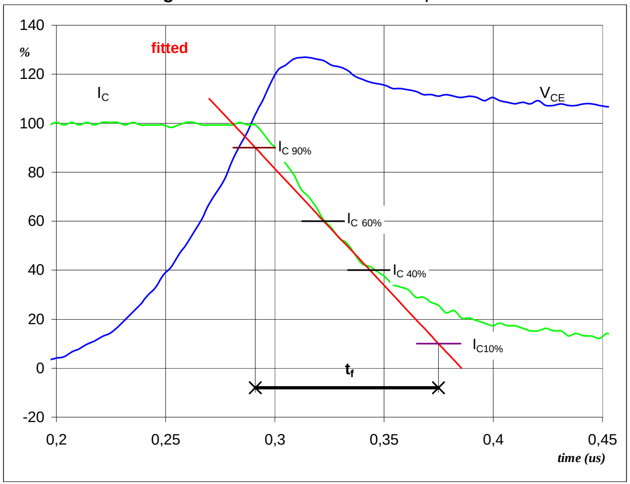
Turn-on Switching Waveforms & definition of tdon, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	150	A
t_{don} =	0,24	µs
t_{Eon} =	0,44	µs

Figure 3 Output inverter IGBT

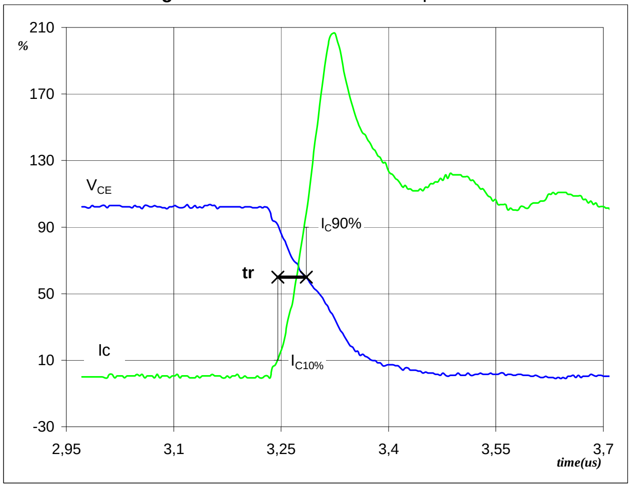
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	300	V
I_C (100%) =	150	A
t_f =	0,09	µs

Figure 4 Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

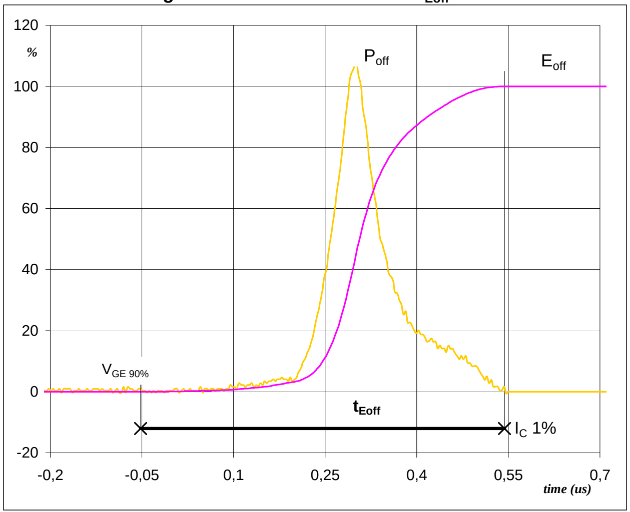


V_C (100%) =	300	V
I_C (100%) =	150	A
t_r =	0,04	µs

Switching Definitions Output Inverter

Figure 5 Output inverter IGBT

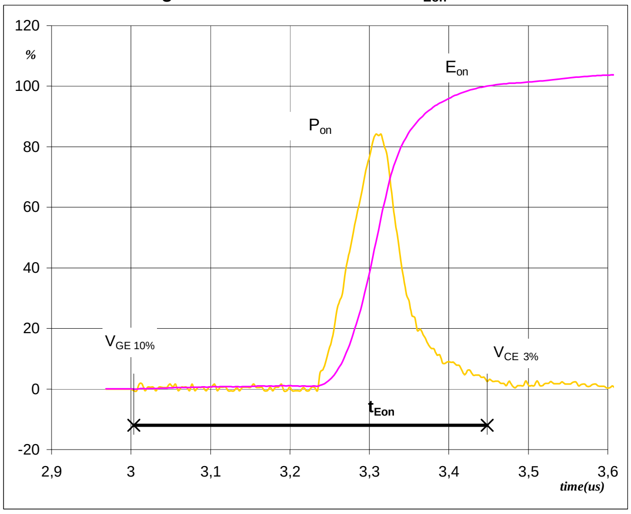
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	45,00	kW
E_{off} (100%) =	5,23	mJ
t_{Eoff} =	0,60	µs

Figure 6 Output inverter IGBT

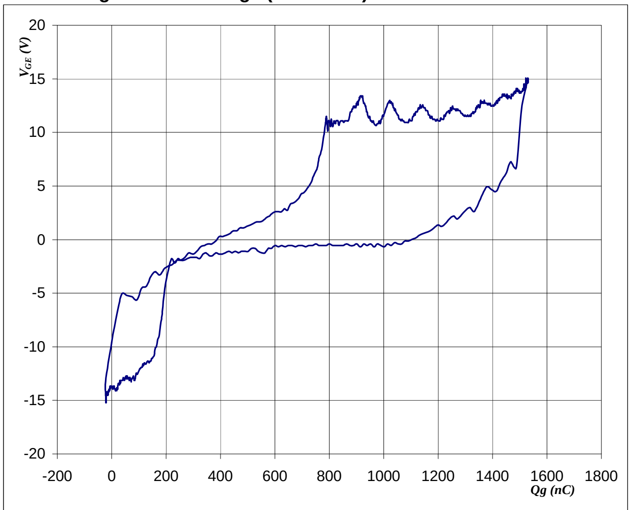
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	45,00	kW
E_{on} (100%) =	3,02	mJ
t_{Eon} =	0,44	µs

Figure 7 Output inverter FRED

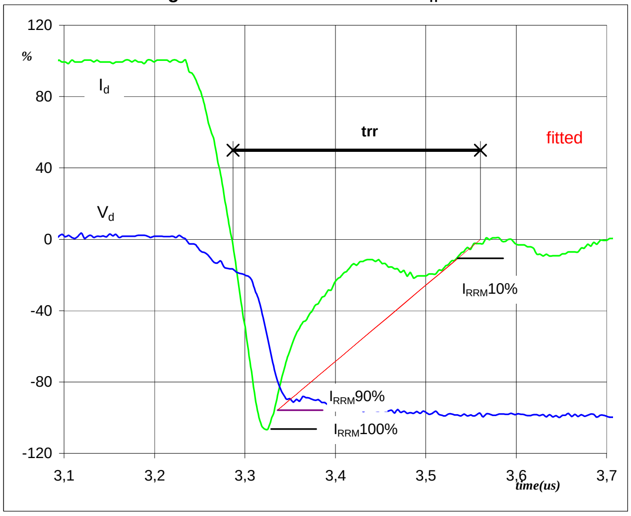
Gate voltage vs Gate charge (measured)



V_{GEoff} =	-15	V
V_{GEon} =	15	V
V_C (100%) =	300	V
I_C (100%) =	150	A
Q_g =	5363,18	nC

Figure 8 Output inverter IGBT

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

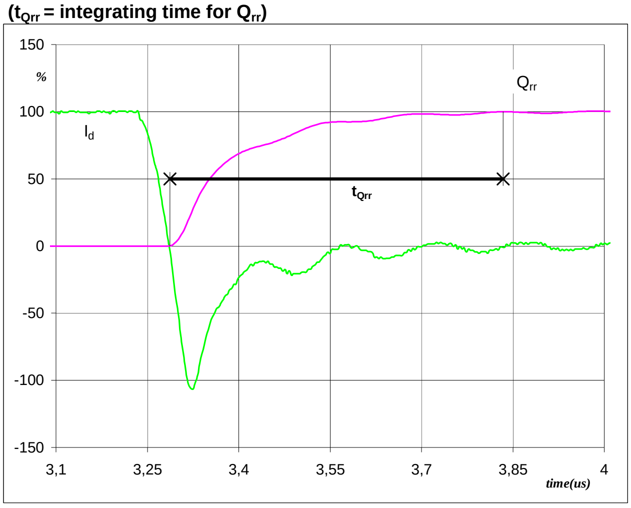


V_d (100%) =	300	V
I_d (100%) =	150	A
I_{RRM} (100%) =	-161	A
t_{rr} =	0,16	µs

Switching Definitions Output Inverter

Figure 9 Output inverter FRED

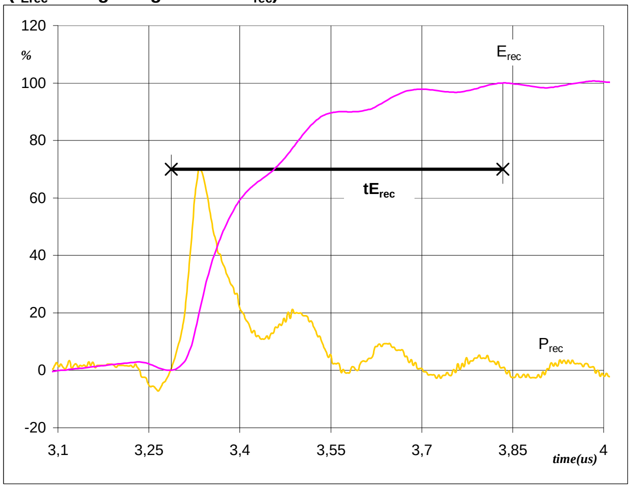
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	150	A
Q_{rr} (100%) =	13,55	μC
t_{Qrr} =	0,55	μs

Figure 10 Output inverter FRED

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



P_{rec} (100%) =	45,00	kW
E_{rec} (100%) =	2,95	mJ
t_{Erec} =	0,55	μs

Ordering Code and Marking - Outline - Pinout

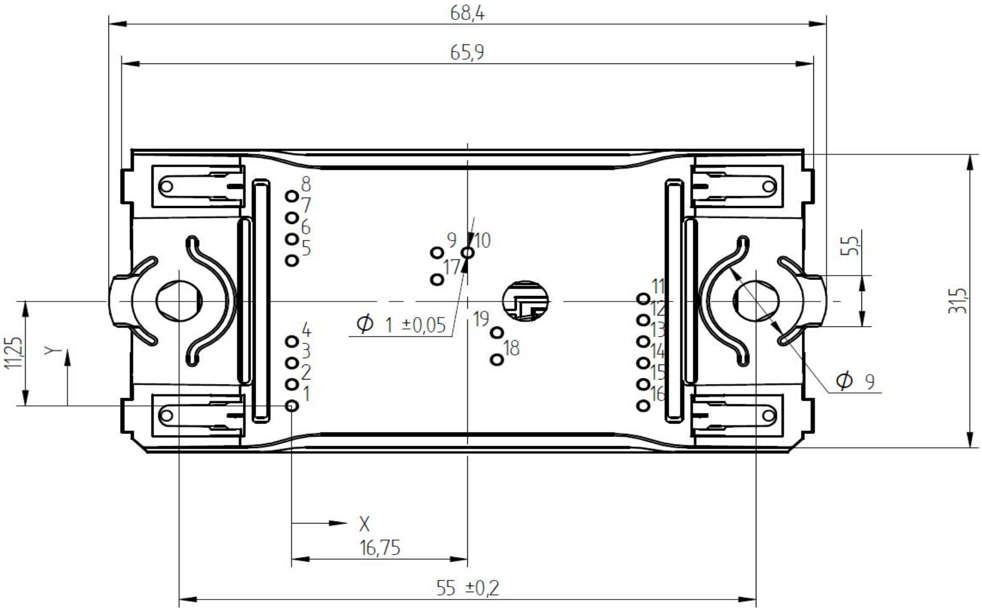
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	10-FZ062PA150SA01-P995F18	P995F18	P995F18
without thermal paste 17mm housing	10-F0062PA150SA01-P995F19	P995F19	P995F19

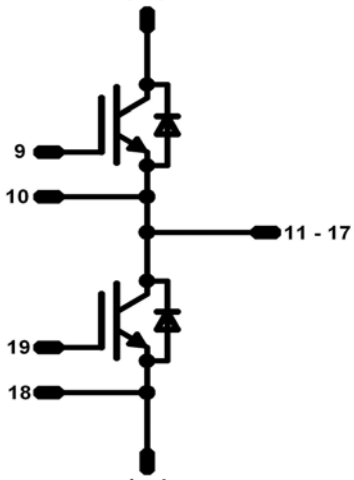
Outline

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.
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