V23990-P820-F-PM

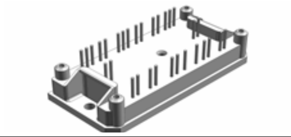
preliminary datasheet

flowPACK 1 3rd gen — **1200V/75A**

Features

- Compact flow1 housing
- Trench Fieldstop IGBT4 Technology
- Compact and Low Inductance Design
- AlN substrate for improved performance
- Built-in NTC

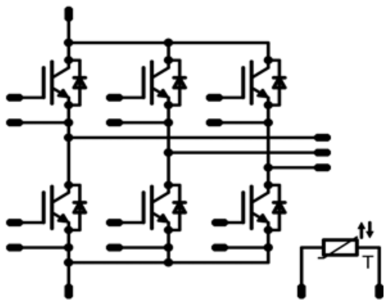
flow1 housing



Target Applications

- Motor Drive
- Power Generation
- UPS

Schematic



Types

- V23990-P820-F

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 T_c=80°C	75	A
Repetitive peak collector current	I_{Cpulse}	t_p limited by $T_j max$	T_h=80°C T_c=80°C	225	A
Power dissipation per IGBT	P_{tot}	$T_j=T_j max$	T_h=80°C T_c=80°C	212	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \leq 150$°C V_{GE}=15V		10 800	μs 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 T_c=80°C	75	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j max$	T_h=80°C T_c=80°C	150	A
Power dissipation per Diode	P_{tot}	$T_j=T_j max$	T_h=80°C T_c=80°C	163	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=1min	4000	V_{DC}
Creepage distance			min 12,7	mm
Clearance			min 12,7	mm

Characteristic Values

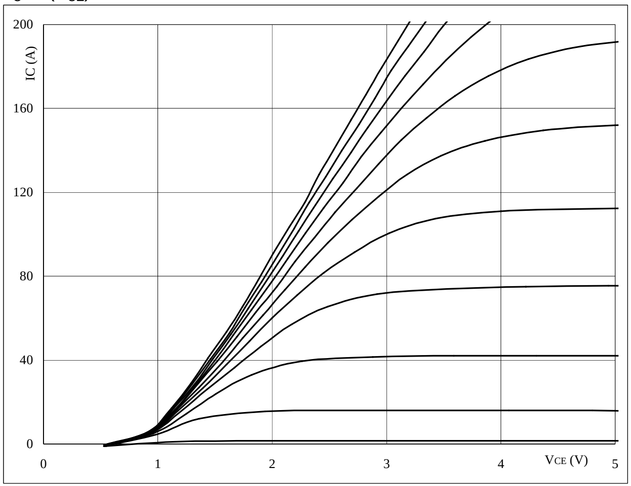
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Inverter Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	VCE=VGE			0,0024	Tj=25°C Tj=150°C	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		75	Tj=25°C Tj=150°C	1,6	1,92 2,39	2,4	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	1200		Tj=25°C Tj=150°C			0,025	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=150°C			650	nA
Integrated Gate resistor	R_{gint}							10		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=4 Ω Rgon=4 Ω	±15	600	75	Tj=25°C Tj=150°C		165 183		ns
Rise time	t_r					Tj=25°C Tj=150°C		27 35		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=150°C		271 351		
Fall time	t_f					Tj=25°C Tj=150°C		83 115		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C		6,16 9,44		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C		4,02 6,48		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		4400		pF
Output capacitance	C_{oss}							290		
Reverse transfer capacitance	C_{rss}							235		
Gate charge	Q_{Gate}	Vcc=960V	±15		75	Tj=25°C		375		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal foil thickness=76um Kunze foil KU-ALF5						0,45		K/W
Inverter Diode										
Diode forward voltage	V_F				75	Tj=25°C Tj=150°C	1,4	1,75 1,71	2,5	V
Peak reverse recovery current	I_{RRM}	Rgon=4 Ω	±15	600	75	Tj=25°C Tj=150°C		69 76		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		316 499		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=150°C		7,26 14,26		μC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=150°C		2373 371		A/μs
Reverse recovered energy	Erec					Tj=25°C Tj=150°C		2,61 5,34		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal foil thickness=76um Kunze foil KU-ALF5						0,58		K/W
Thermistor										
Rated resistance	R_{25}	Tol. ±5%				Tj=25°C	4,46	4,7	4,94	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

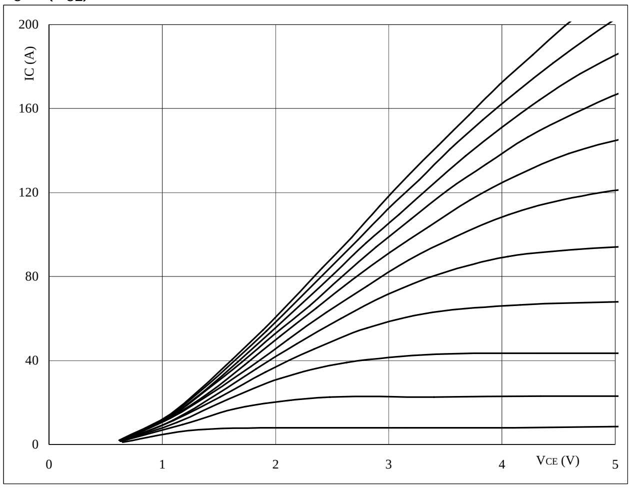
t_p =	250	μs
T_j =	25	°C

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

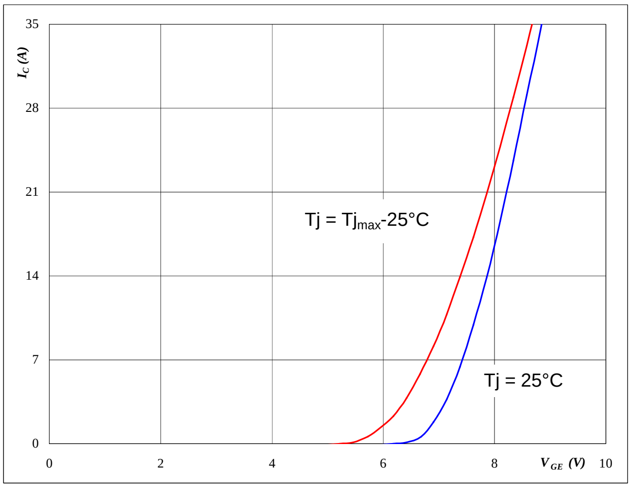
t_p =	250	μs
T_j =	150	°C

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

Figure 3 Output inverter IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



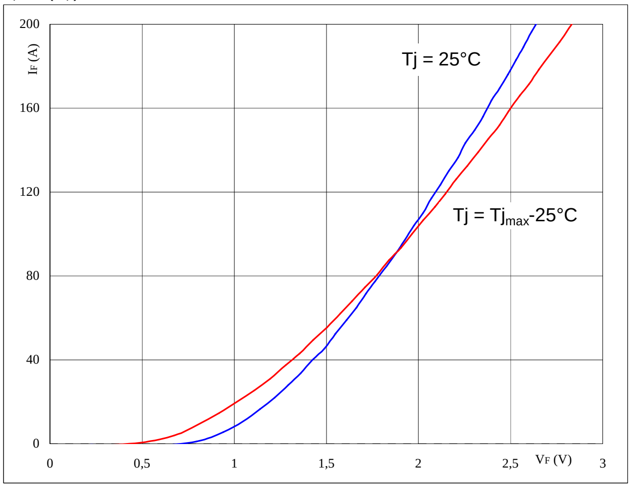
At

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

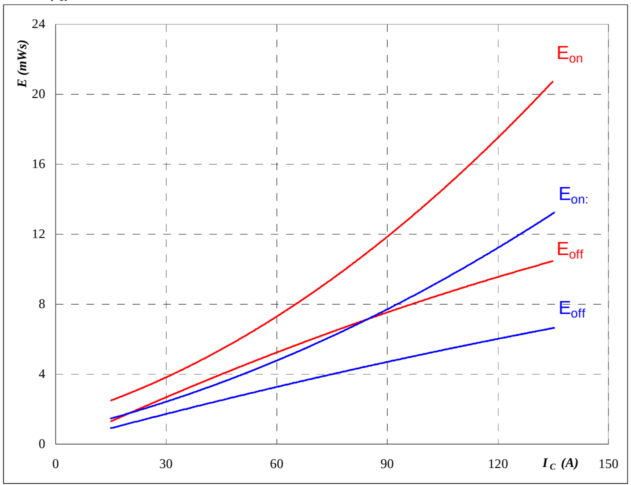
t_p =	250	μs

Output Inverter

Figure 5 Output inverter IGBT

Typical switching energy losses as a function of collector current

$E = f(I_c)$



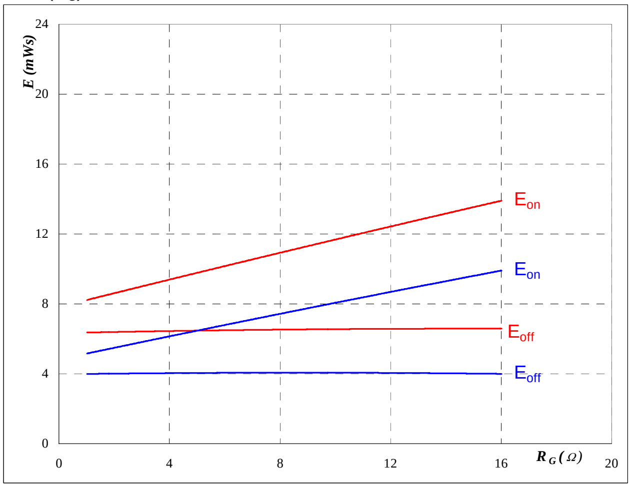
With an inductive load at

T_j =	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

$E = f(R_G)$



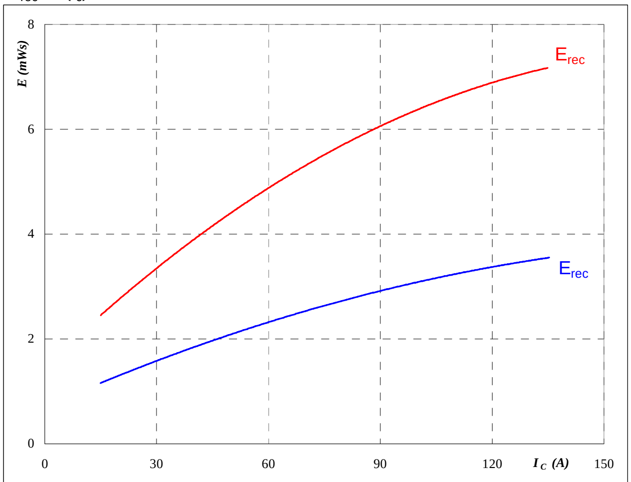
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	75	A

Figure 7 Output inverter IGBT

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_c)$



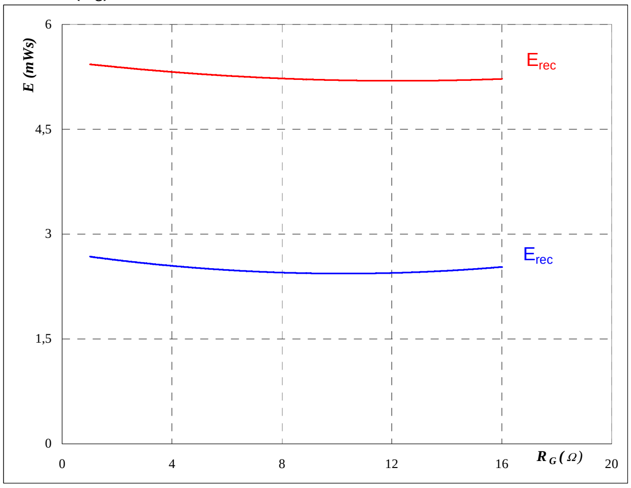
With an inductive load at

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

$Erec = f(R_G)$



With an inductive load at

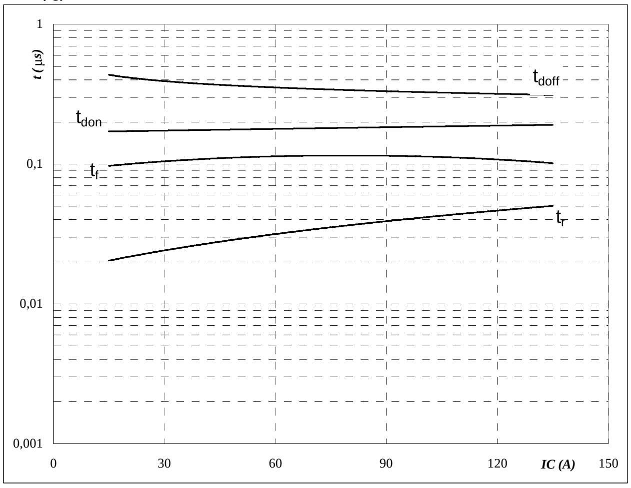
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	75	A

Output Inverter

Figure 9 Output inverter IGBT

Typical switching times as a function of collector current

t = f(I_C)



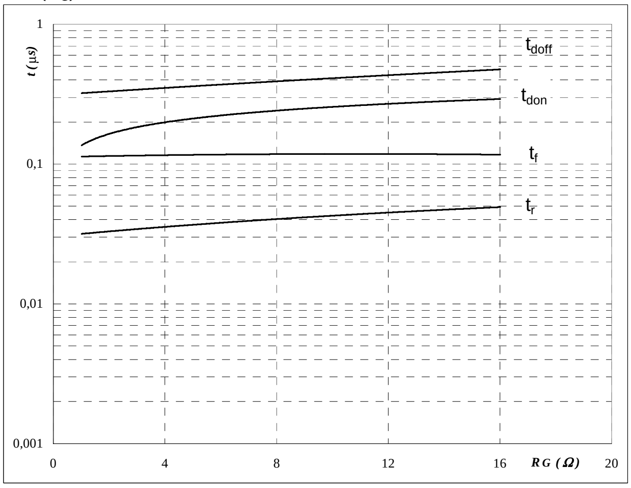
With an inductive load at

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)



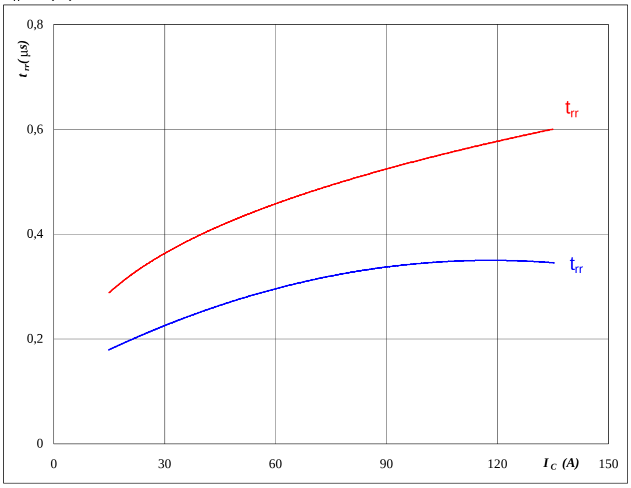
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	75	A

Figure 11 Output inverter FRED

Typical reverse recovery time as a function of collector current

t_{rr} = f(Ic)



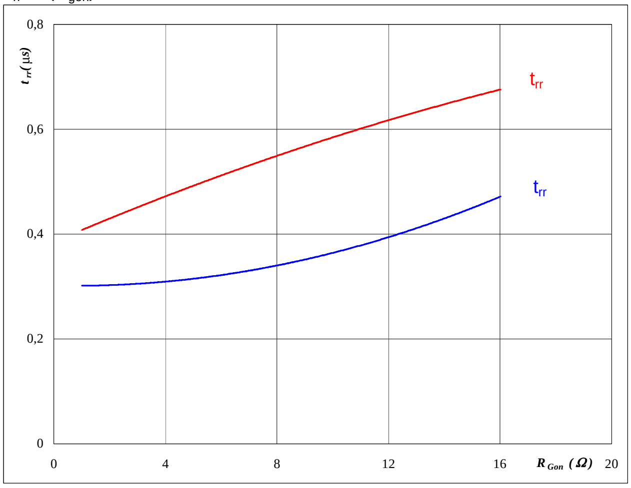
At

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

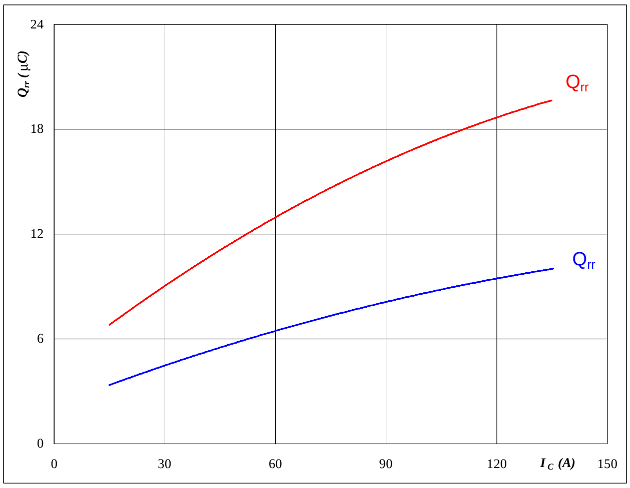
T_j =	25/150	°C
V_R =	600	V
I_F =	75	A
V_{GE} =	±15	V

Output Inverter

Figure 13 Output inverter FRED

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(Ic)$



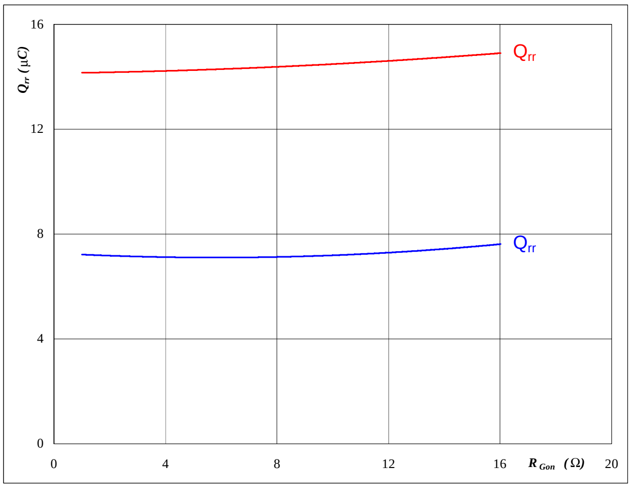
At

T_j =	25/150	°C
V_{CE} =	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

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



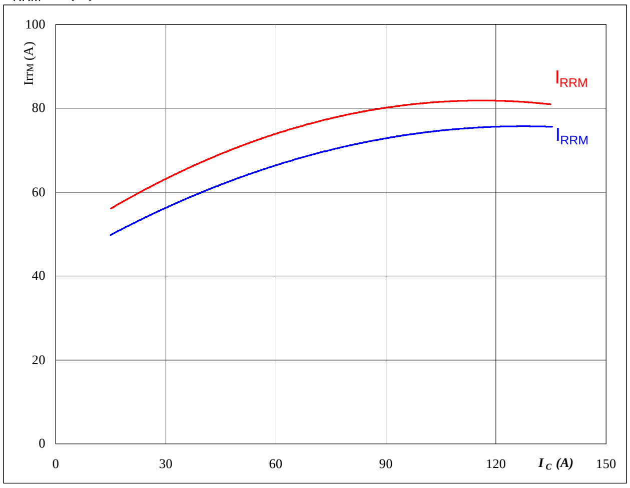
At

T_j =	25/150	°C
V_R =	600	V
I_F =	75	A
V_{GE} =	±15	V

Figure 15 Output inverter FRED

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(Ic)$



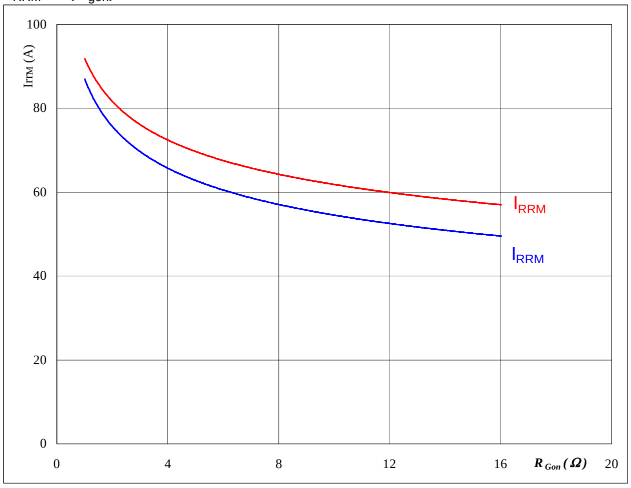
At

T_j =	25/150	°C
V_{CE} =	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

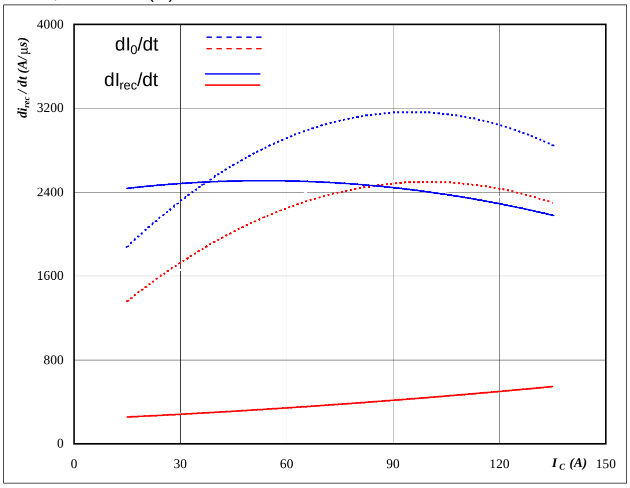
T_j =	25/150	°C
V_R =	600	V
I_F =	75	A
V_{GE} =	±15	V

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)



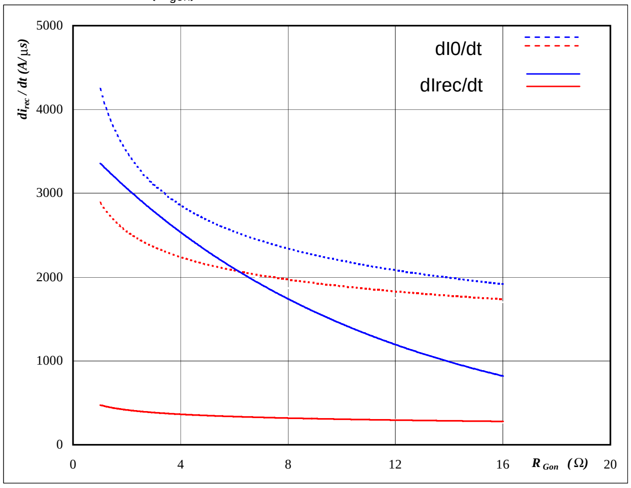
At

T_j =	25/150	°C
V_{CE} =	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

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



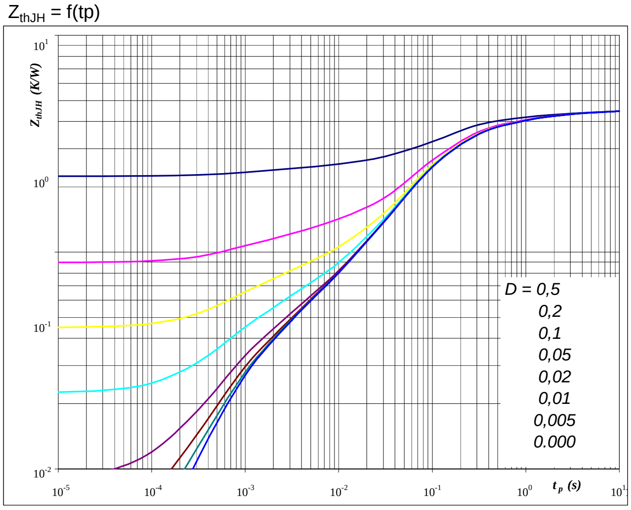
At

T_j =	25/150	°C
V_R =	600	V
I_F =	75	A
V_{GE} =	±15	V

Figure 19 Output inverter IGBT

IGBT transient thermal impedance as a function of pulse width

Z_{thJH} = f(tp)



At

D =	tp / T	
R_{thJH} =	0,45	K/W

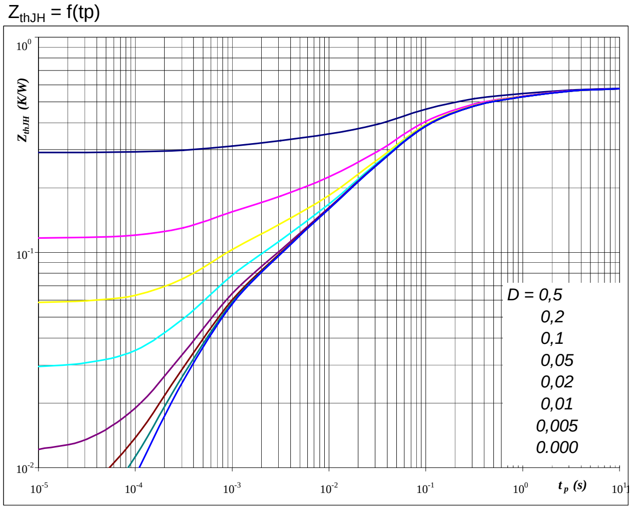
IGBT thermal model values

R (C/W)	Tau (s)
0,05	2,4E+00
0,10	3,9E-01
0,24	8,4E-02
0,03	7,0E-03
0,03	8,5E-04

Figure 20 Output inverter FRED

FRED transient thermal impedance as a function of pulse width

Z_{thJH} = f(tp)



At

D =	tp / T	
R_{thJH} =	0,58	K/W

FRED thermal model values

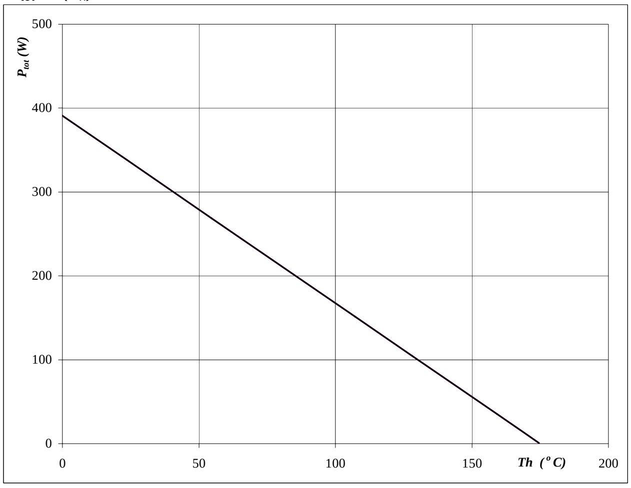
R (C/W)	Tau (s)
0,02	9,6E+00
0,08	1,2E+00
0,15	1,7E-01
0,22	4,3E-02
0,06	5,4E-03
0,05	6,7E-04

Output Inverter

Figure 21 Output inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



At

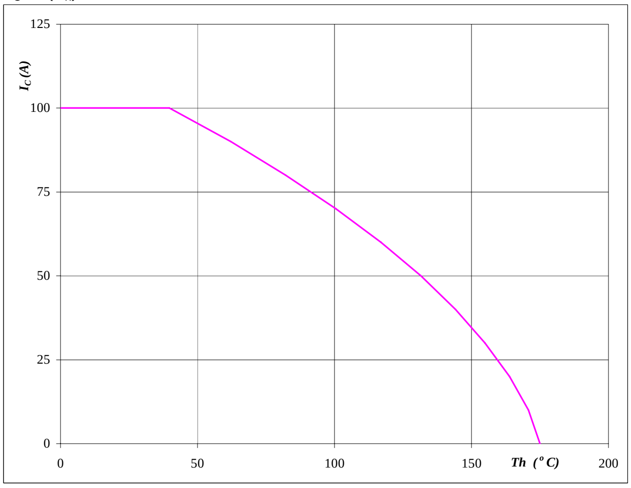
T_j =	175	°C

single heating
overall heating

Figure 22 Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



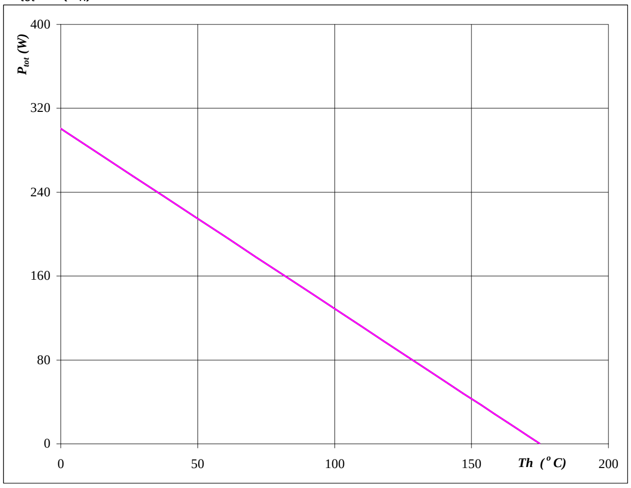
At

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

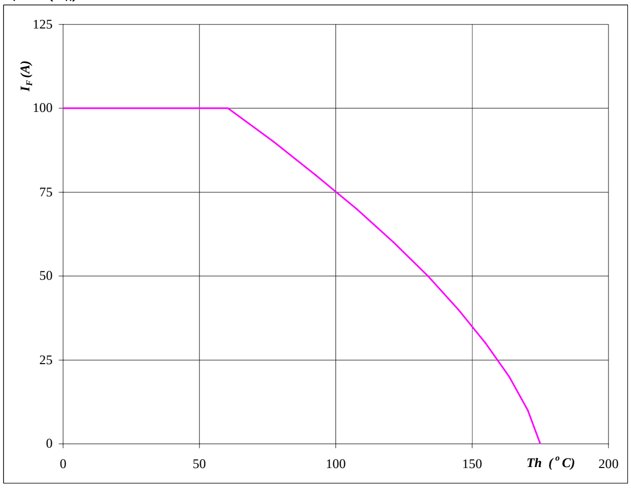
T_j =	175	°C

single heating
overall heating

Figure 24 Output inverter FRED

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

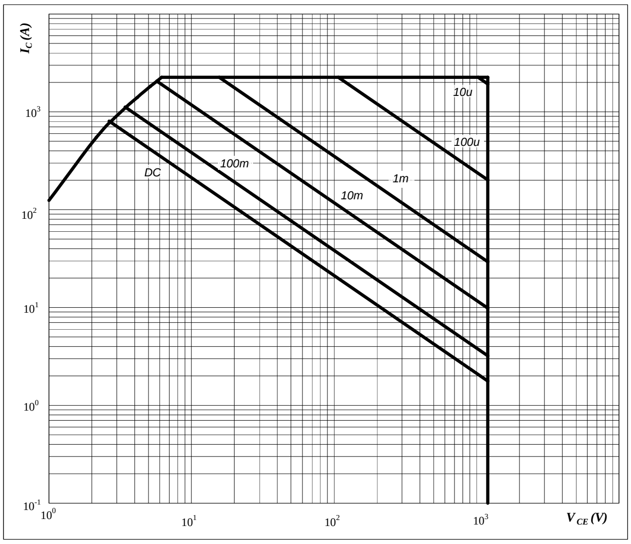
T_j =	175	°C

Output Inverter

Figure 25	Output inverter IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



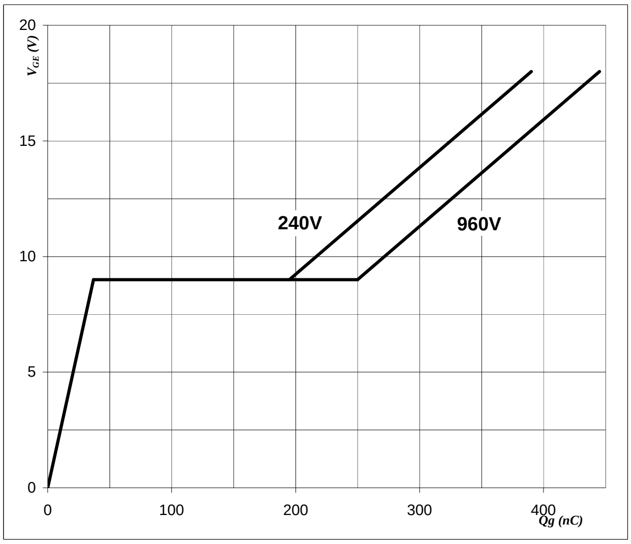
At

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

Figure 26	Output inverter IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Qg)$



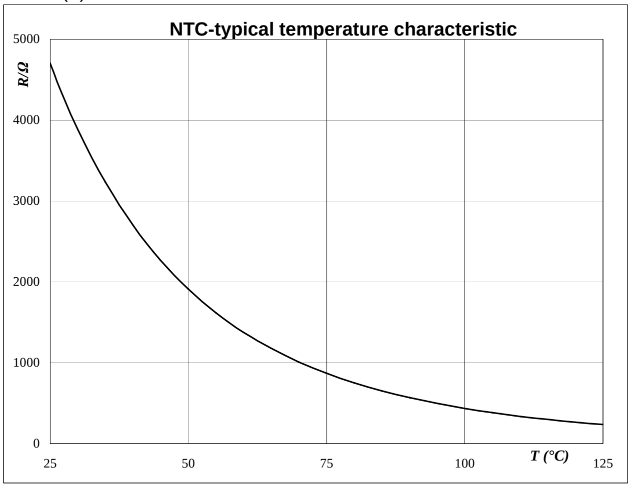
At

I_C =	75	A

Thermistor

Figure 1	Thermistor

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



Vincotech

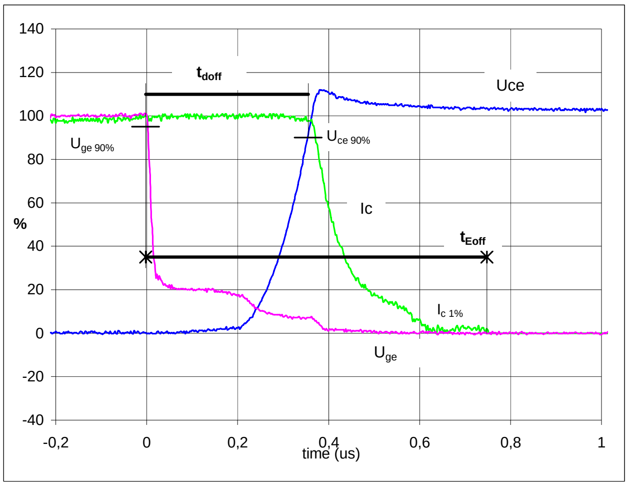
Switching Definitions Output Inverter

General conditions

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

Figure 1 — Output inverter IGBT

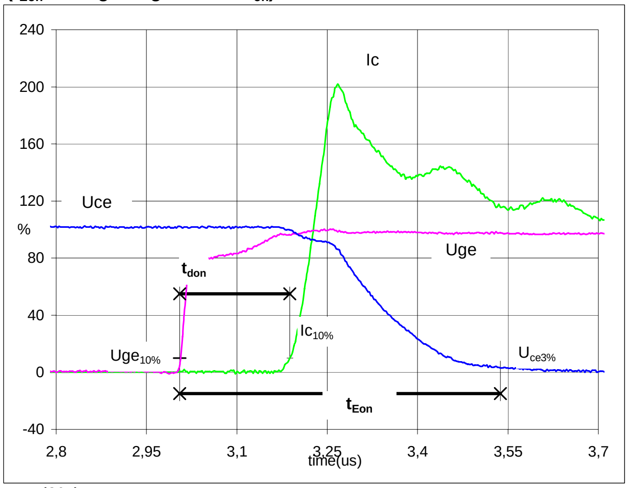
Turn-off Switching Waveforms & definition of tdoff, tEoff
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	75	A
t_{doff} =	0,35	µs
t_{Eoff} =	0,75	µs

Figure 2 — Output inverter IGBT

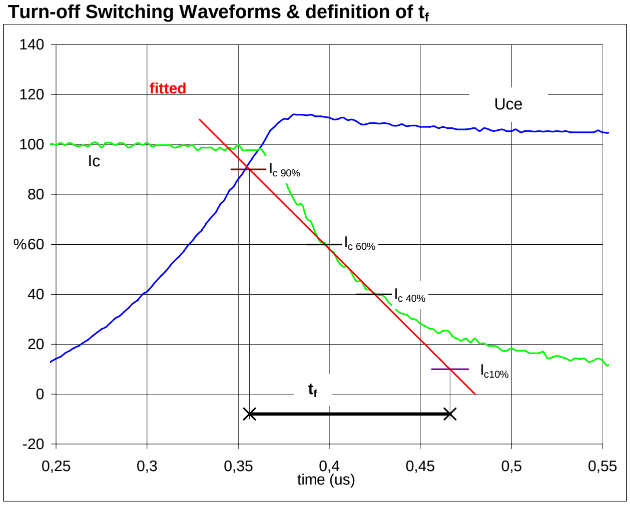
Turn-on Switching Waveforms & definition of tdon, tEon
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	75	A
t_{don} =	0,18	µs
t_{Eon} =	0,53	µs

Figure 3 — Output inverter IGBT

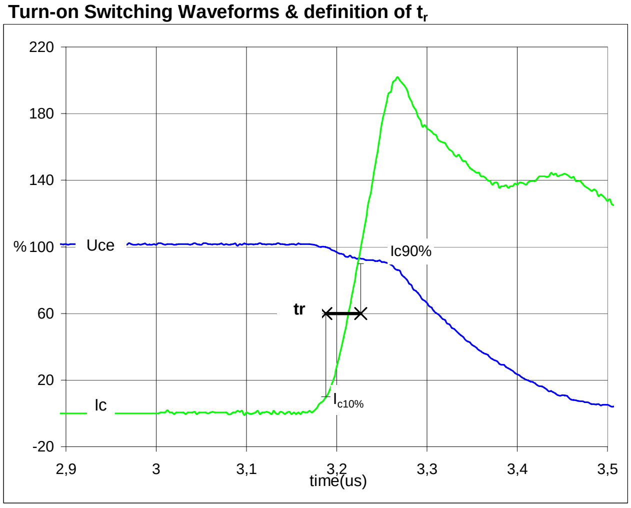
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	75	A
t_f =	0,12	µs

Figure 4 — Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

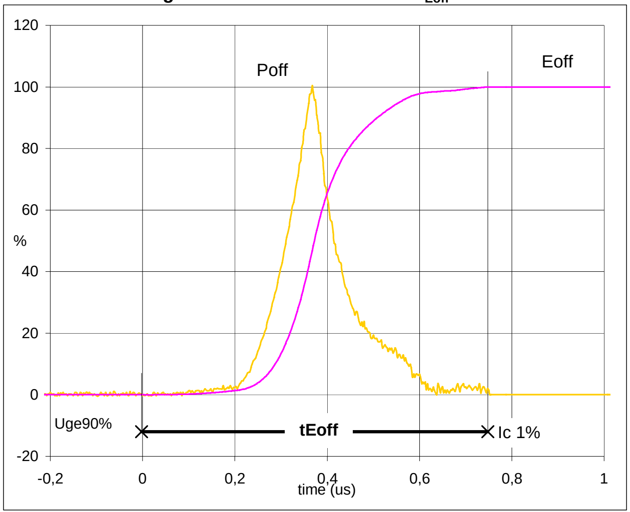


V_C (100%) =	600	V
I_C (100%) =	75	A
t_r =	0,04	µs

Switching Definitions Output Inverter

Figure 5 Output inverter IGBT

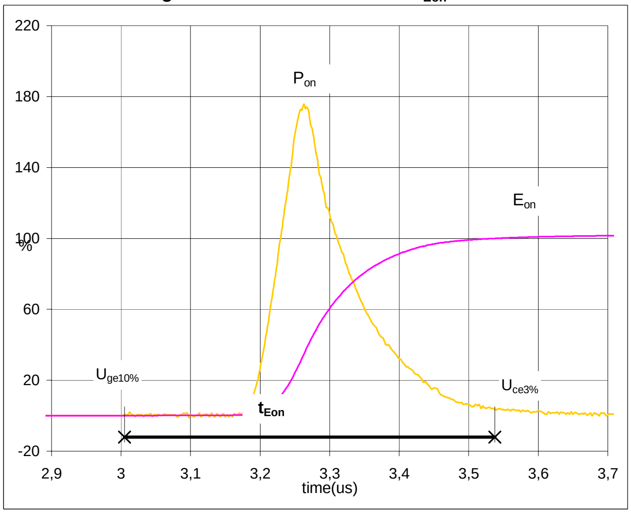
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	45,22	kW
E_{off} (100%) =	6,48	mJ
t_{Eoff} =	0,75	µs

Figure 6 Output inverter IGBT

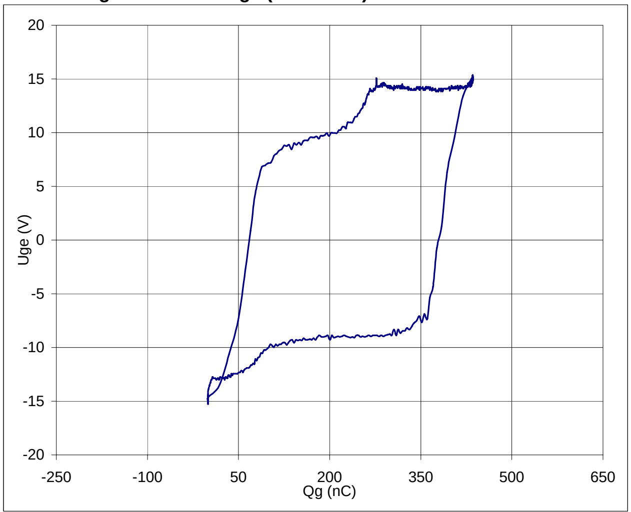
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	45,22	kW
E_{on} (100%) =	9,44	mJ
t_{Eon} =	0,53	µs

Figure 7 Output inverter FRED

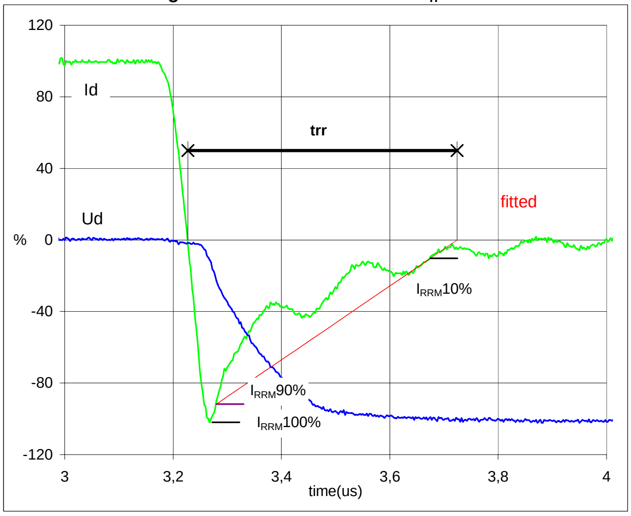
Gate voltage vs Gate charge (measured)



V_{GEoff} =	-15	V
V_{GEon} =	15	V
V_C (100%) =	600	V
I_C (100%) =	75	A
Q_g =	435,75	nC

Figure 8 Output inverter IGBT

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

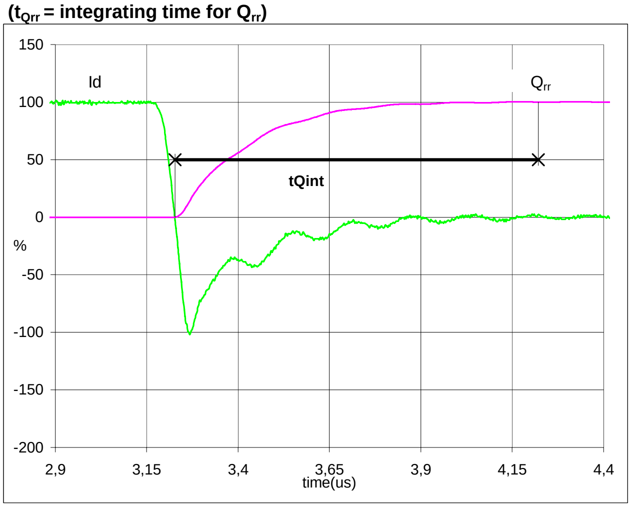


V_d (100%) =	600	V
I_d (100%) =	75	A
I_{RRM} (100%) =	-76	A
t_{rr} =	0,50	µs

Switching Definitions Output Inverter

Figure 9 Output inverter FRED

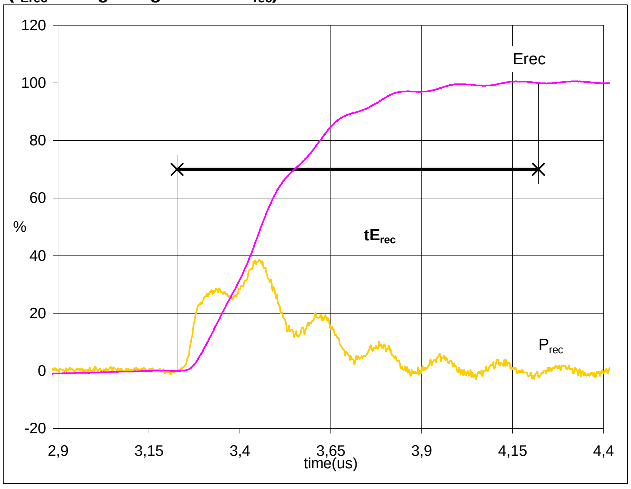
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	75	A
Q_{rr} (100%) =	14,26	µC
t_{Qint} =	0,99	µs

Figure 10 Output inverter FRED

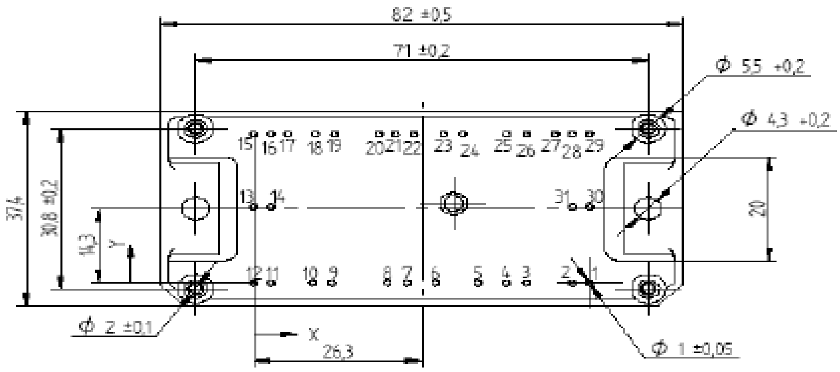
Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	45,22	kW
E_{rec} (100%) =	5,34	mJ
t_{Erec} =	0,99	µs

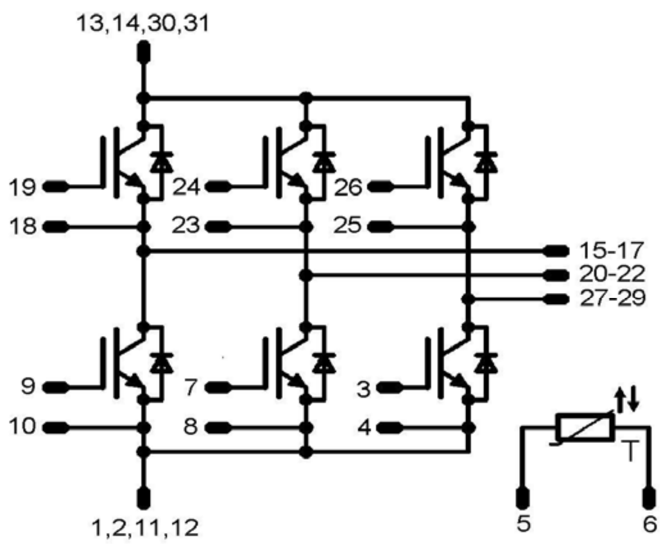
Package Outline and Pinout

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



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Datasheet Status	Product Status	Definition
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