V23990-P823-F10-PM

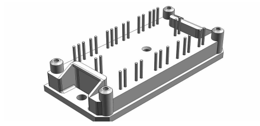
datasheet

***flow* PACK 1 3rd gen** — **600 V / 50 A**

Features

- Compact flow1 housing
- Compact and Low Inductance Design
- Built-in NTC

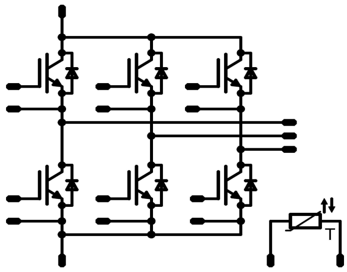
flow1 housing



Target Applications

- Motor Drive
- Power Generation
- UPS

Schematic



Types

- V23990-P823-F10-PM

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	$T_j=T_jmax$	T_h=80°C T_c=80°C	44	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_jmax	T_h=80°C T_c=80°C	150	A
Power dissipation	P_{tot}	$T_j=T_jmax$	T_h=80°C T_c=80°C	77	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_{jmax}			175	°C
Inverter Diode					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25°C		600	V
DC forward current	I_F	$T_j=T_jmax$	T_h=80°C T_c=80°C	40	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_jmax	T_h=80°C T_c=80°C	100	A
Power dissipation	P_{tot}	$T_j=T_jmax$	T_h=80°C T_c=80°C	57	W
Maximum Junction Temperature	T_{jmax}			175	°C
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

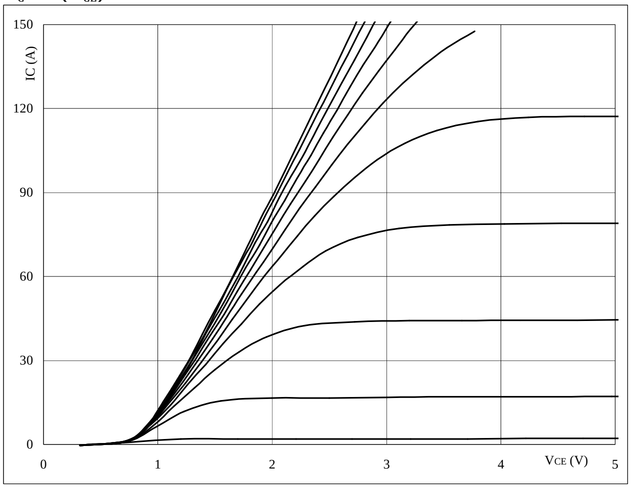
Parameter	Symbol	Conditions	V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	Unit
Inverter Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	VCE=VGE			0,0008	Tj=25°C Tj=150°C	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	Tj=25°C Tj=150°C	1,1	1,56 1,79	2,1	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		Tj=25°C Tj=150°C			0,35	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=150°C			650	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=8 Ω Rgon=8 Ω	±15	300	50	Tj=25°C Tj=150°C		106 98		ns
Rise time	t_r					Tj=25°C Tj=150°C		19 16		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=150°C		150 173		
Fall time	t_f					Tj=25°C Tj=150°C		89 115		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C		0,50 0,75		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C		1,18 1,63		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		3140		pF
Output capacitance	C_{oss}							200		
Reverse transfer capacitance	C_{rss}							93		
Gate charge	Q_G	Vcc=480	±15		50	Tj=25°C		310		nC
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						1,24		K/W
Inverter Diode										
Diode forward voltage	V_F				50	Tj=25°C Tj=150°C	1,2	1,63 1,60	2,1	V
Peak reverse recovery current	I_{RRM}	Rgon=8 Ω	±15	300	50	Tj=25°C Tj=150°C		28 79		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		144 147		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=150°C		1,91 4,71		nC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					Tj=25°C Tj=150°C		1357 4135		A/μs
Reverse recovered energy	E_{rec}					Tj=25°C Tj=150°C		0,55 1,09		mWs
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						1,65		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

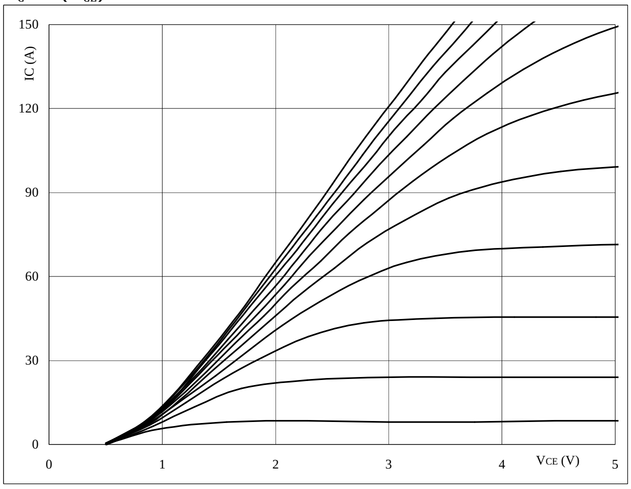
T_j = 25 °C

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

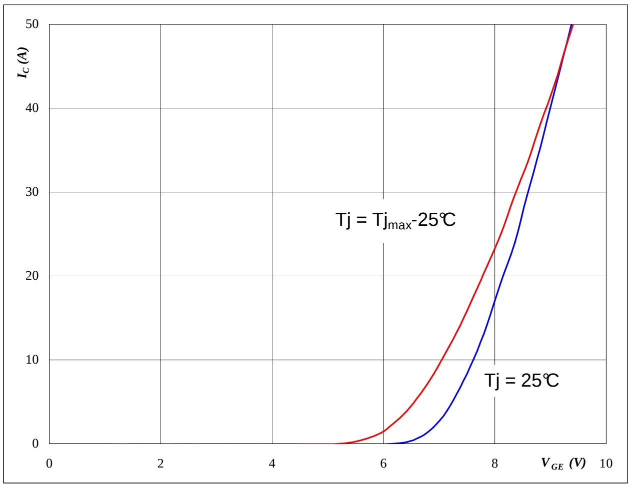
T_j = 150 °C

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

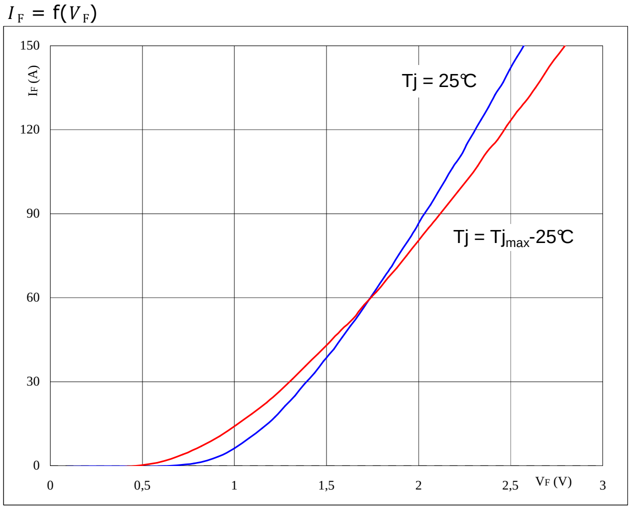
t_p = 250 µs

V_{CE} = 10 V

Figure 4 Output inverter FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

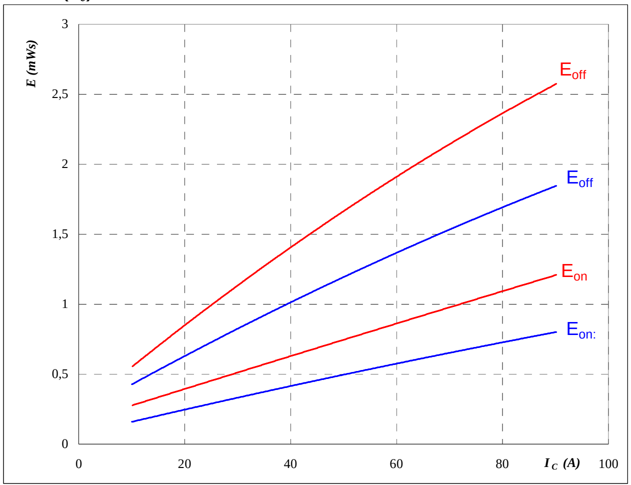
t_p = 250 µs

Output Inverter

Figure 5 Output inverter IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



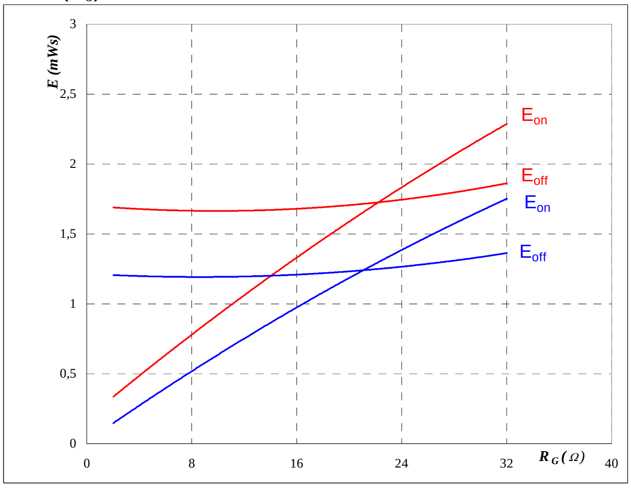
With an inductive load at

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 6 Output inverter IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



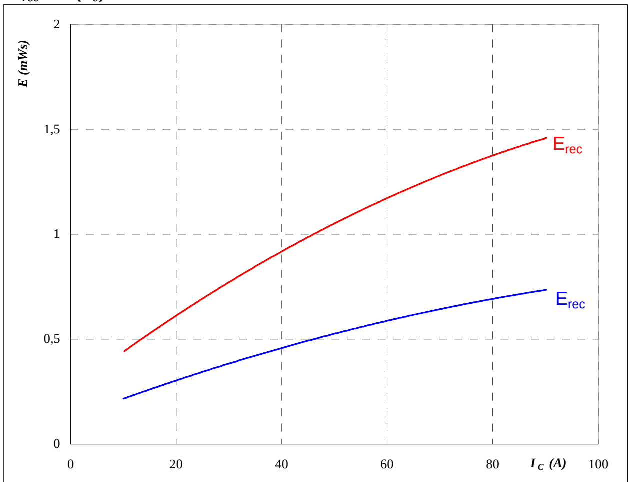
With an inductive load at

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	50	A

Figure 7 Output inverter IGBT

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



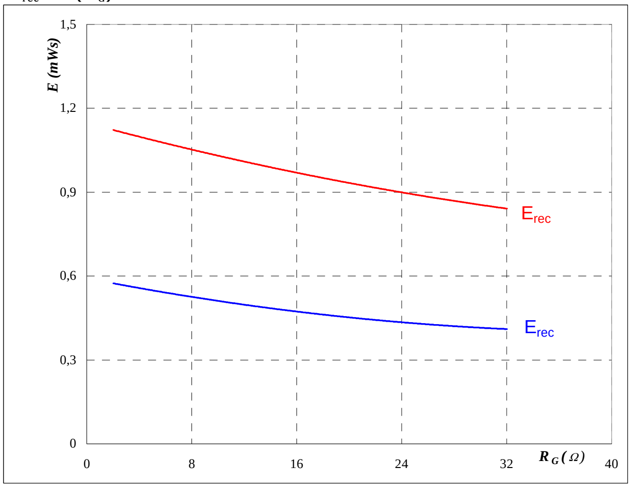
With an inductive load at

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	8	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

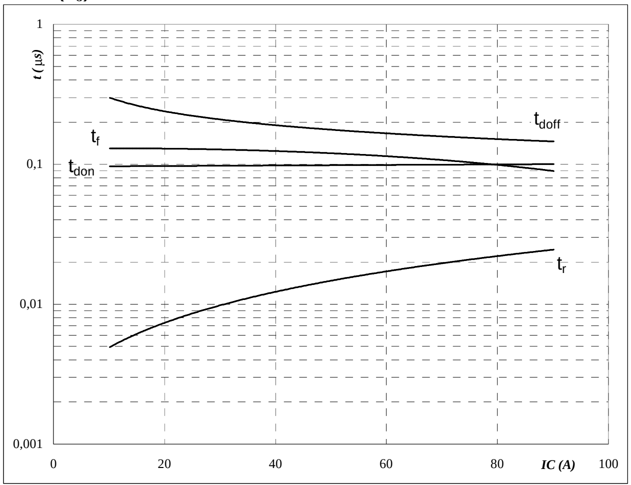
T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	50	A

Output Inverter

Figure 9 Output inverter IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



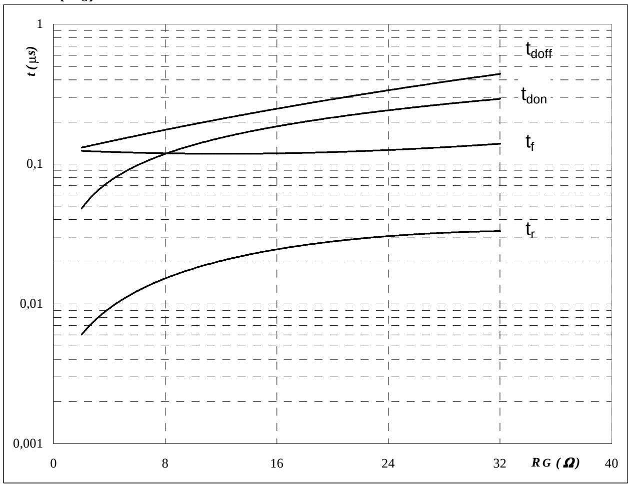
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 10 Output inverter IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



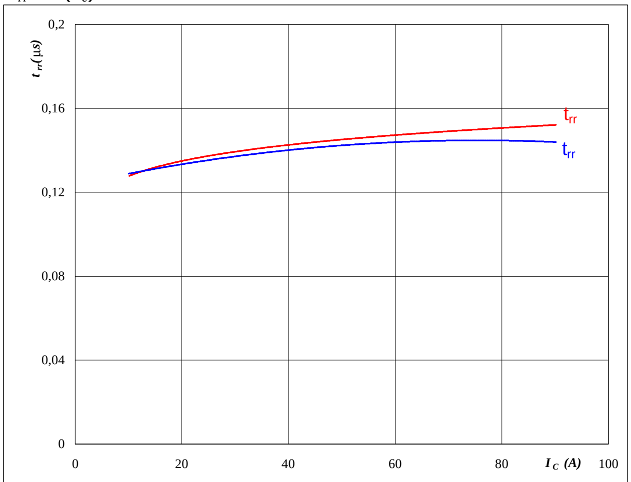
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	50	A

Figure 11 Output inverter FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



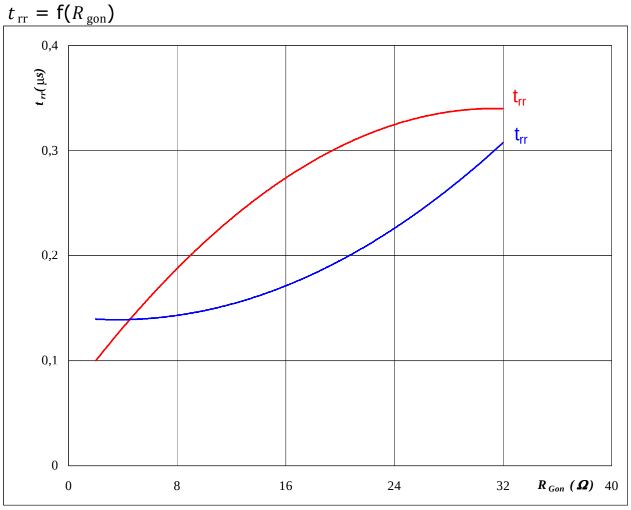
At

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 12 Output inverter FWD

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

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



At

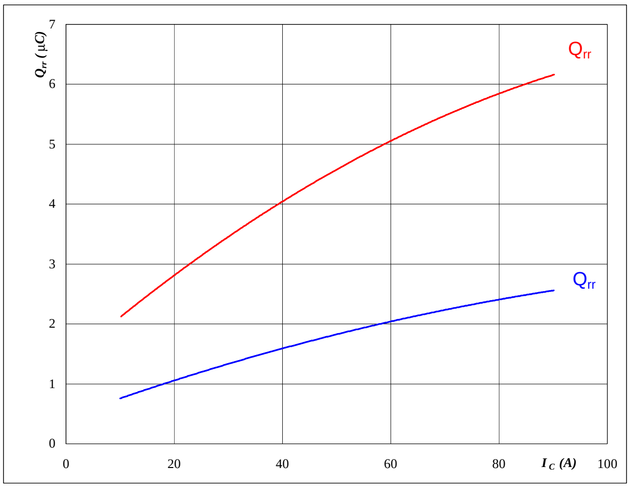
T_j =	25/150	°C
V_R =	300	V
I_F =	50	A
V_{GE} =	±15	V

Output Inverter

Figure 13 Output inverter FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_c)$



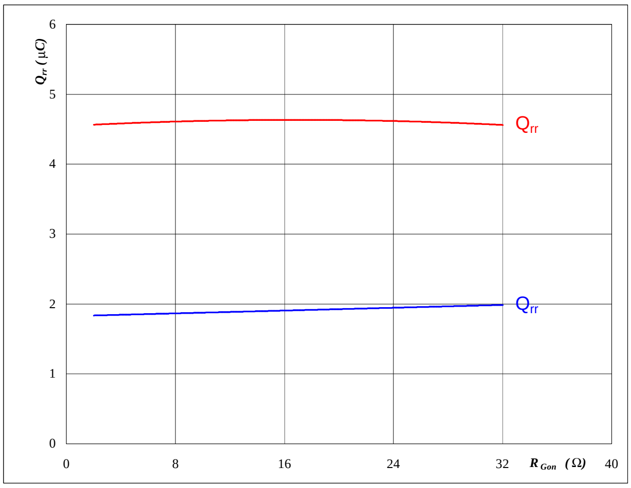
At

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 14 Output inverter FWD

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

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



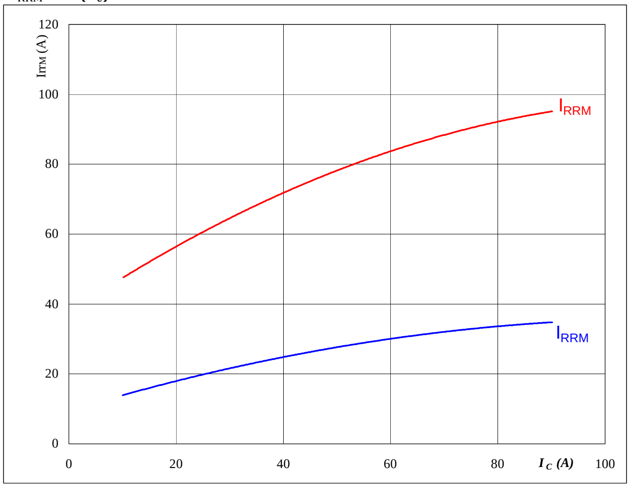
At

T_j =	25/150	°C
V_R =	300	V
I_F =	50	A
V_{GE} =	±15	V

Figure 15 Output inverter FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_c)$



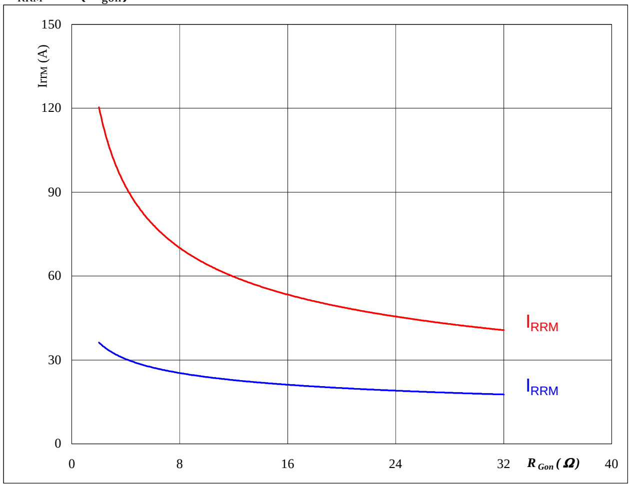
At

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 16 Output inverter FWD

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

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



At

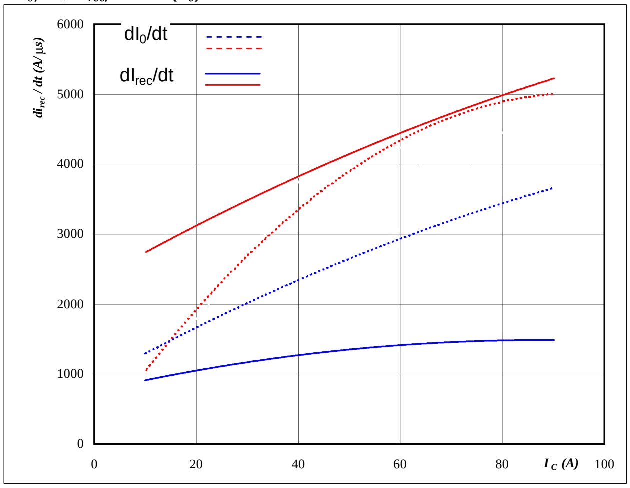
T_j =	25/150	°C
V_R =	300	V
I_F =	50	A
V_{GE} =	±15	V

Output Inverter

Figure 17 Output inverter FWD

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

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



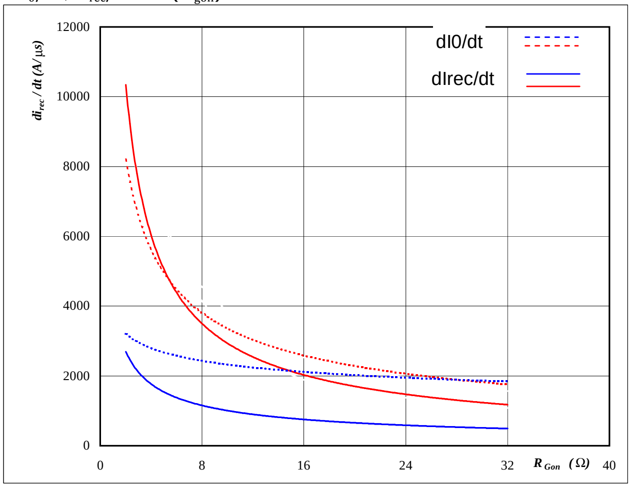
At

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 18 Output inverter FWD

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

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



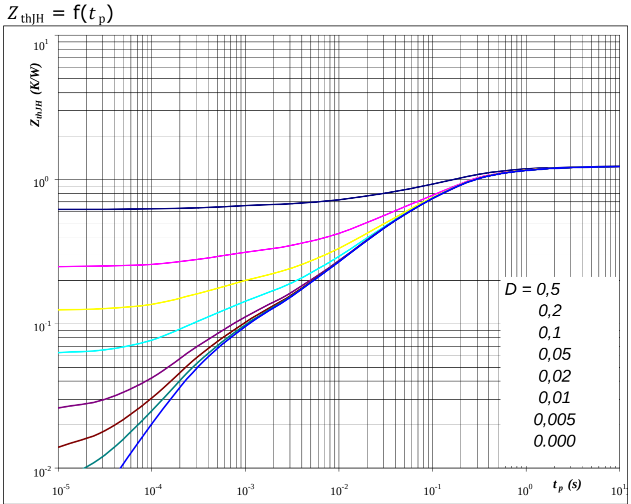
At

T_j =	25/150	°C
V_R =	300	V
I_F =	50	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} =	1,24	K/W

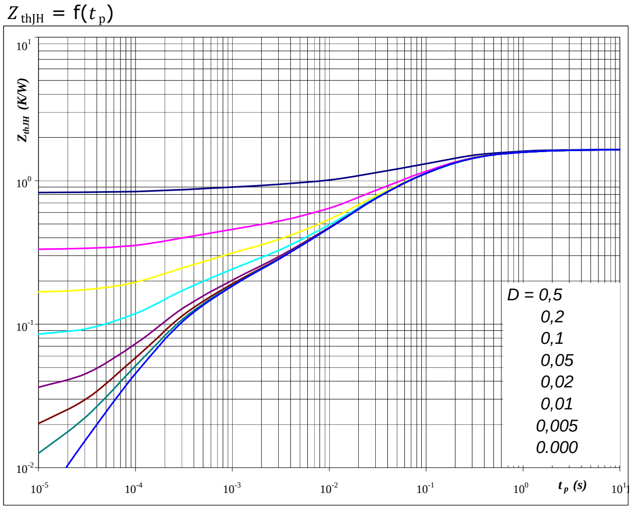
IGBT thermal model values

R (K/W)	Tau (s)
0,02	1,3E+01
0,10	1,7E+00
0,30	3,0E-01
0,49	9,8E-02
0,23	1,6E-02
0,04	2,2E-03
0,06	3,4E-04

Figure 20 Output inverter FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	1,65	K/W

FWD thermal model values

R (K/W)	Tau (s)
0,02	1,5E+01
0,09	1,7E+00
0,27	3,1E-01
0,72	8,9E-02
0,36	1,4E-02
0,09	1,3E-03
0,10	2,4E-04

Vincotech

V23990-P823-F10-PM
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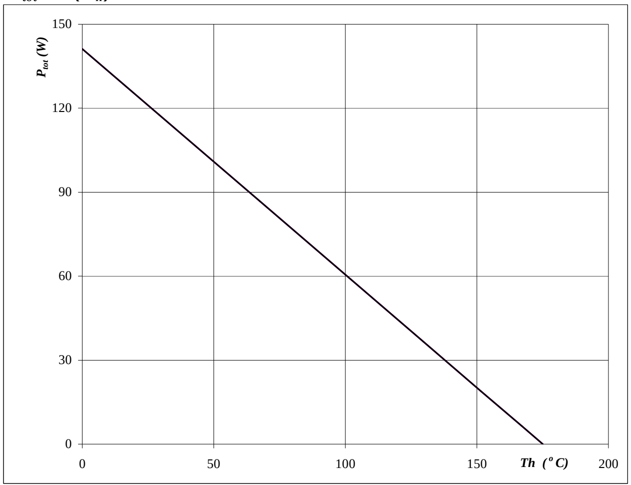
Output Inverter

Figure 21 Output inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



At

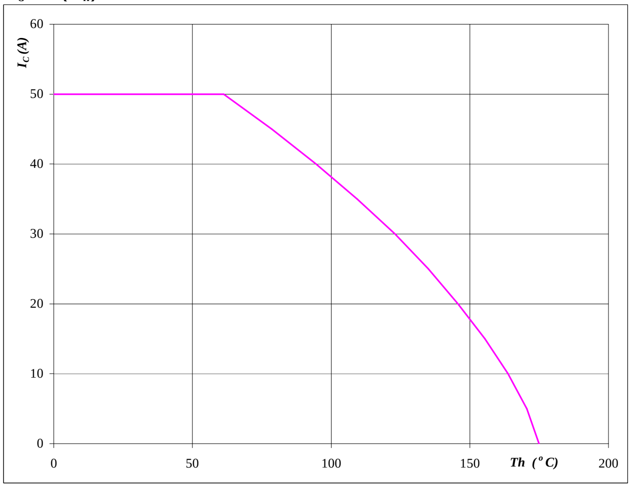
T_j = 175 °C

single heating
overall heating

Figure 22 Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

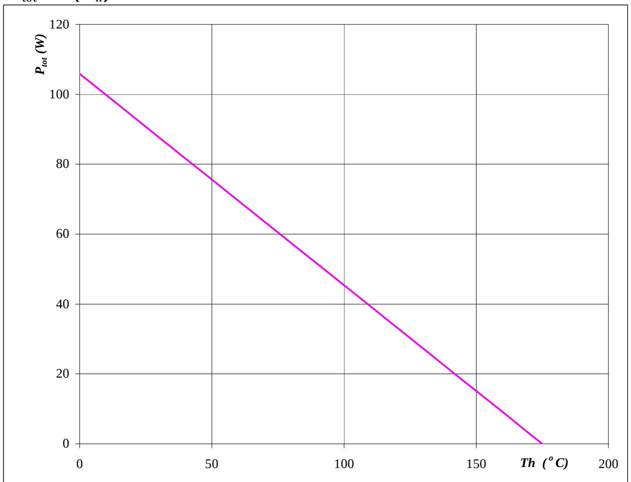
T_j = 175 °C

V_{GE} = 15 V

Figure 23 Output inverter FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



At

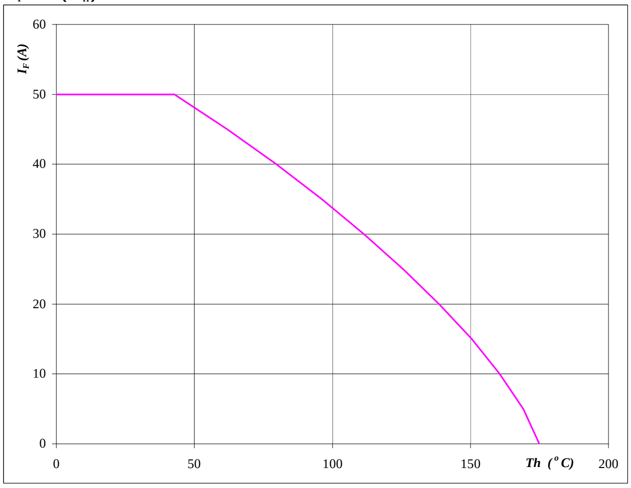
T_j = 175 °C

single heating
overall heating

Figure 24 Output inverter FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

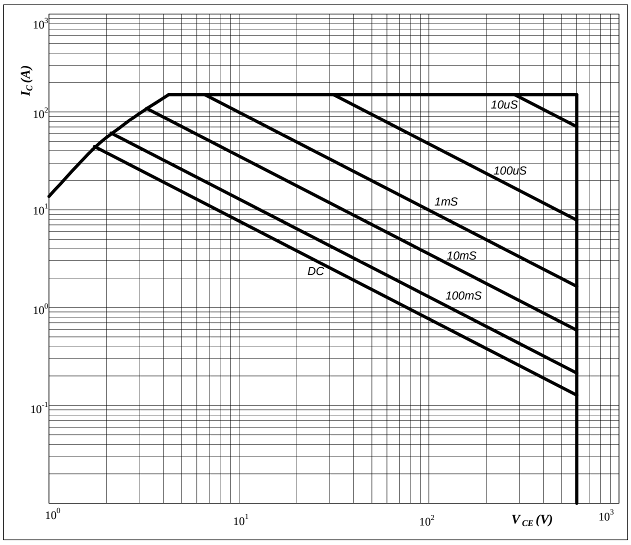
T_j = 175 °C

Output Inverter

Figure 25	Output inverter IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



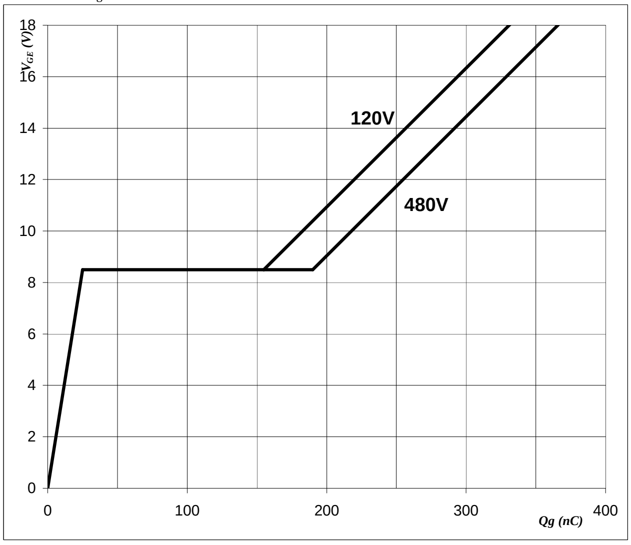
At

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

$V_{GE} = f(Q_g)$



At

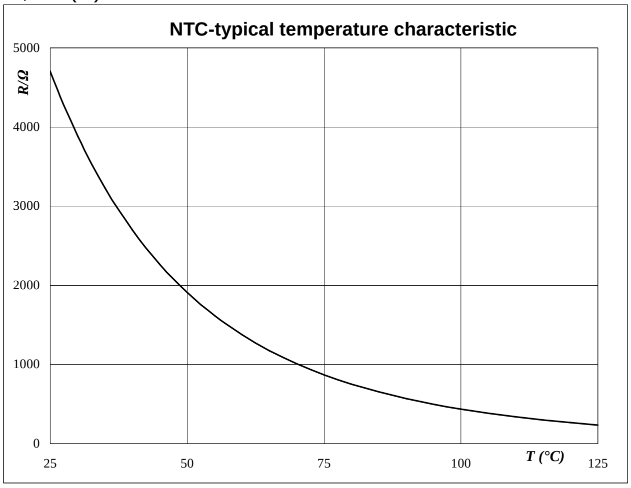
I_C =	50	A

Thermistor

Figure 1	Thermistor

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$



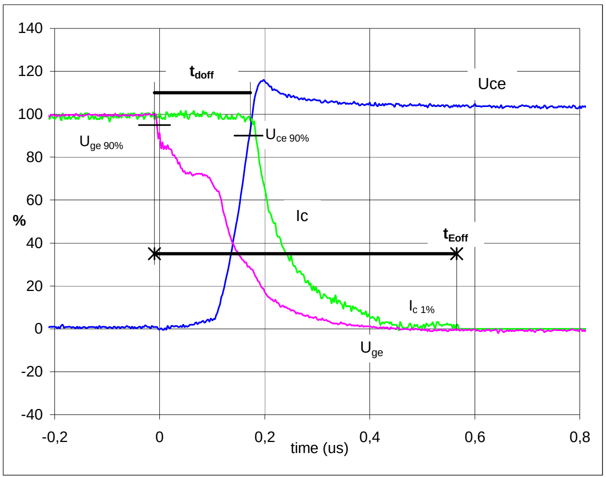
Switching Definitions Output Inverter

General conditions

T_j	=	150 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

Figure 1 Output inverter IGBT

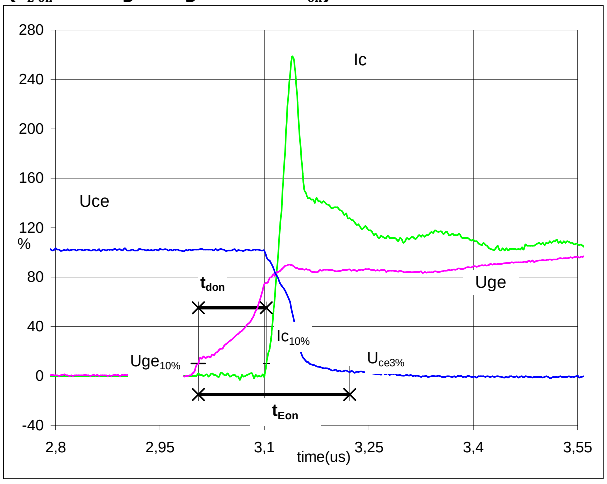
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	50	A
t_{doff} =	0,17	μs
$t_{E\,off}$ =	0,58	μs

Figure 2 Output inverter IGBT

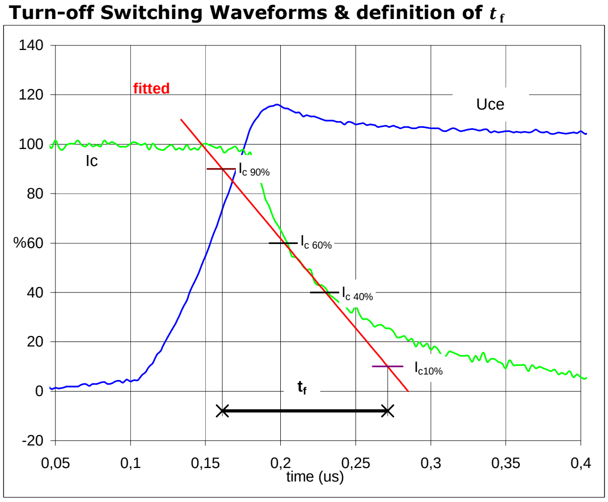
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	50	A
t_{don} =	0,10	μs
$t_{E\,on}$ =	0,22	μs

Figure 3 Output inverter IGBT

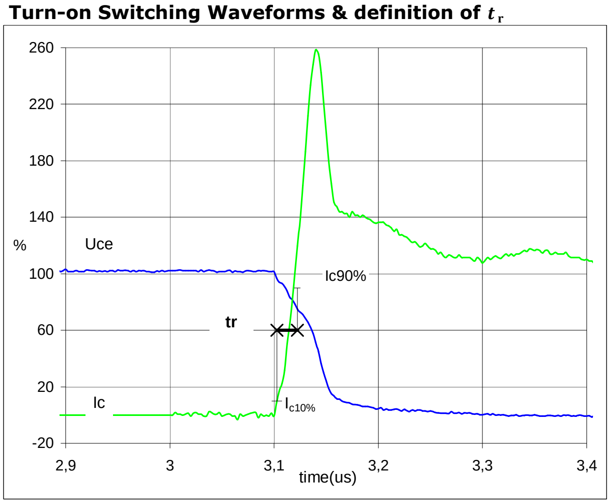
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	300	V
I_C (100%) =	50	A
t_f =	0,12	μs

Figure 4 Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r



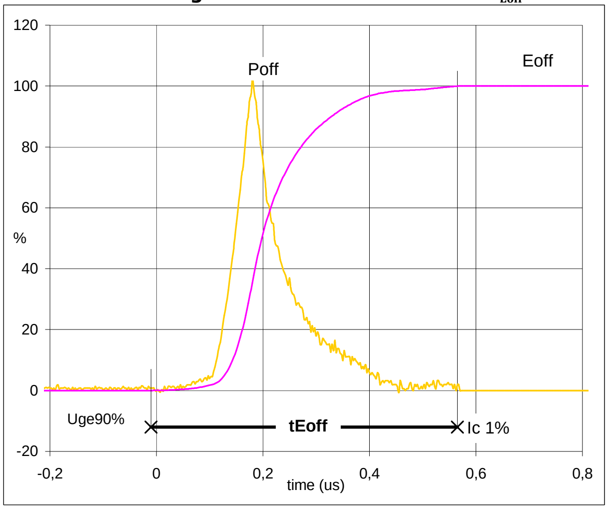
V_C (100%) =	300	V
I_C (100%) =	50	A
t_r =	0,02	μs

Vincotech

Switching Definitions Output Inverter

Figure 5 Output inverter IGBT

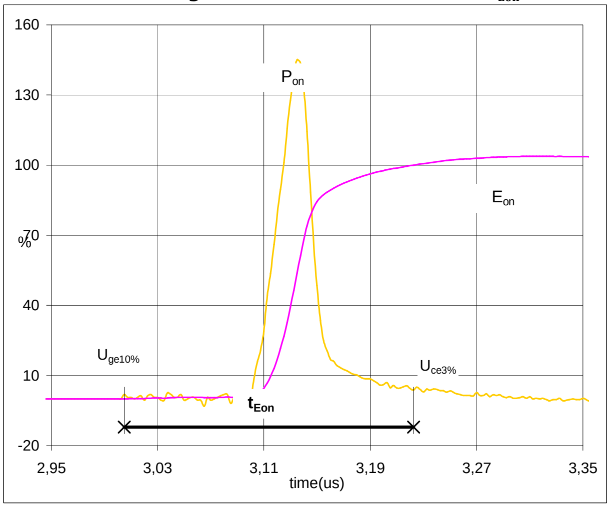
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	15,03	kW
E_{off} (100%) =	1,63	mJ
$t_{E\,off}$ =	0,58	μs

Figure 6 Output inverter IGBT

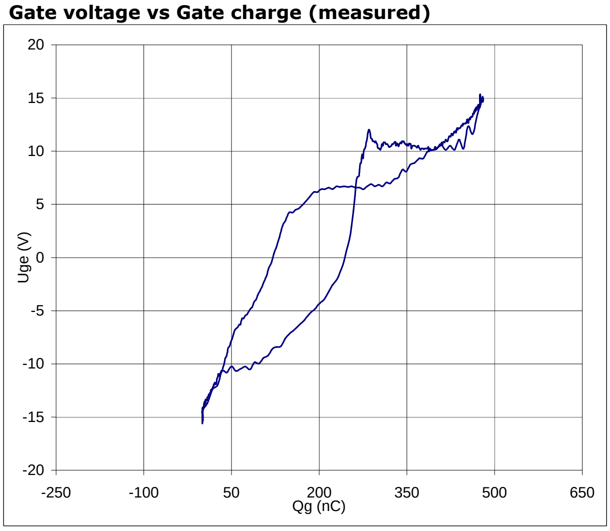
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	15,03	kW
E_{on} (100%) =	0,75	mJ
$t_{E\,on}$ =	0,22	μs

Figure 7 Output inverter FRED

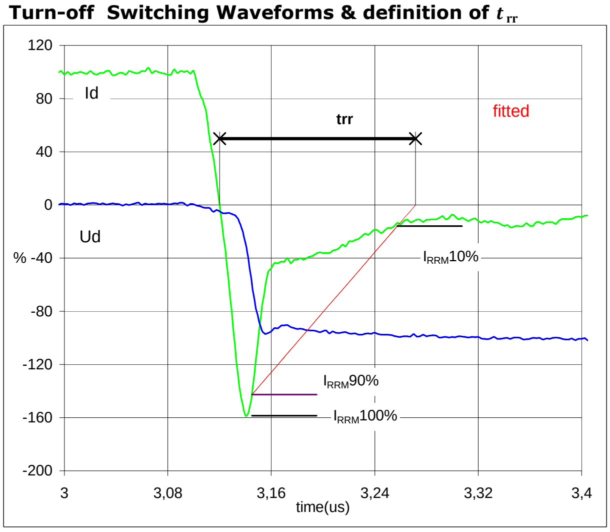
Gate voltage vs Gate charge (measured)



$V_{GE\,off}$ =	-15	V
$V_{GE\,on}$ =	15	V
V_C (100%) =	300	V
I_C (100%) =	50	A
Q_g =	479,76	nC

Figure 8 Output inverter IGBT

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

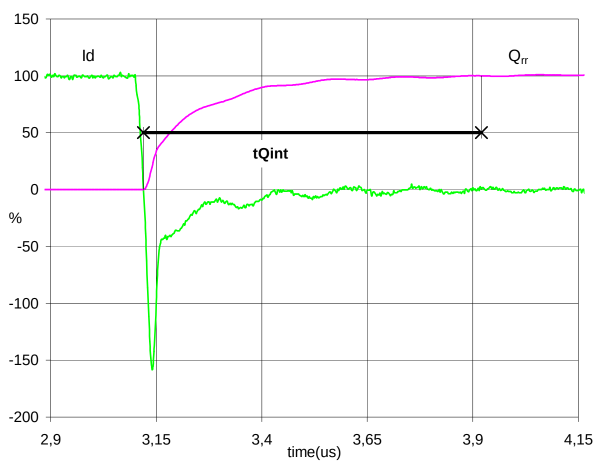


V_d (100%) =	300	V
I_d (100%) =	50	A
I_{RRM} (100%) =	-79	A
t_{rr} =	0,15	μs

Switching Definitions Output Inverter

Figure 9	Output inverter FRED

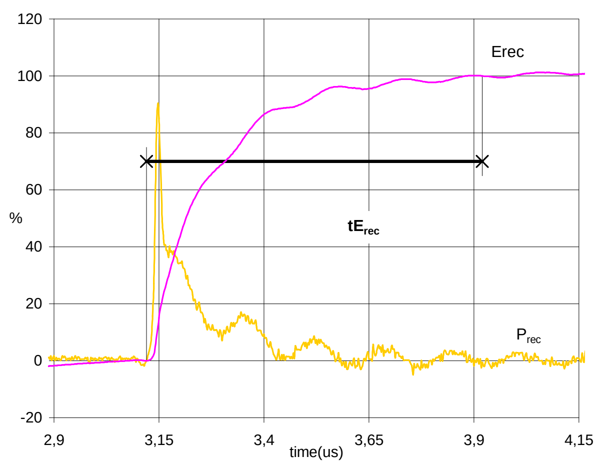
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	50	A
Q_{rr} (100%) =	4,71	μC
t_{Qint} =	0,80	μs

Figure 10	Output inverter FRED

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



P_{rec} (100%) =	15,03	kW
E_{rec} (100%) =	1,09	mJ
$t_{E\,rec}$ =	0,80	μs

Ordering Code and Marking - Outline - Pinout

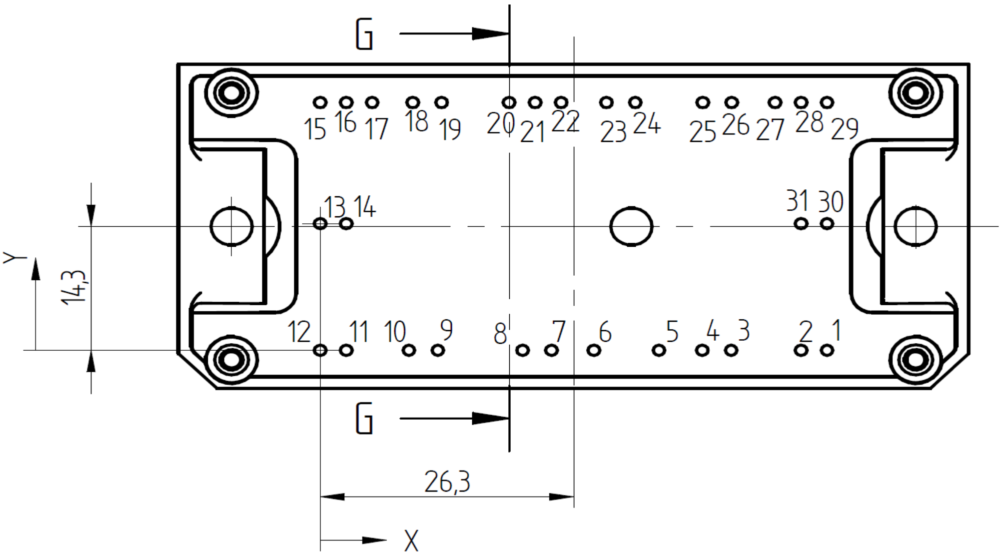
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 17mm housing	V23990-P823-F10-PM	P823-F10	P823-F10

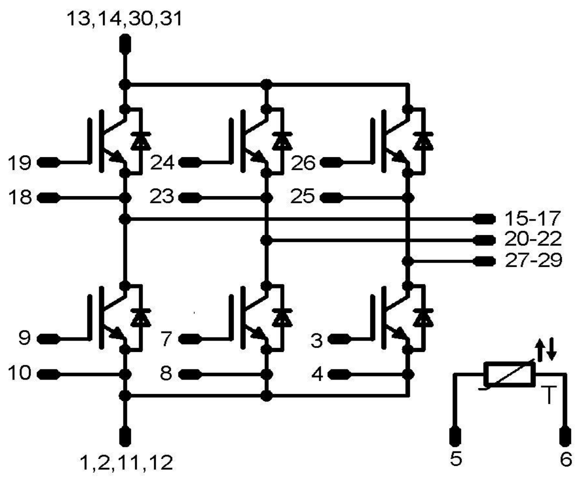
Outline

Pin table

Pin	X	Y
1	52,6	0
2	49,9	0
3	42,65	0
4	39,65	0
5	35,15	2,8
6	28,4	0
7	24	2,8
8	21	0
9	12,2	0
10	9,2	0
11	2,7	0
12	0	0
13	0	14,65
14	2,7	14,65
15	0	28,6
16	2,7	28,6
17	5,4	28,6
18	9,6	28,6
19	12,6	28,6
20	19,6	28,6
21	22,3	28,6
22	25	28,6
23	29,7	28,6
24	32,7	28,6
25	39,7	28,6
26	42,7	28,6
27	42,2	28,6
28	49,9	28,6
29	52,6	28,6
30	52,6	14,56
31	49,9	14,56



Pinout



Packaging instruction					
Standard packaging quantity (SPQ)	100	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 1 packages see vincotech.com website.

Package data
Package data for *flow* 1 packages see vincotech.com website.

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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.