Vincotech

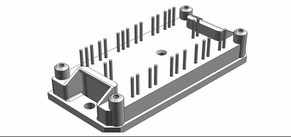
V23990-P825-F10-PM
datasheet

flow **PACK 1 3rd gen** — **600 V / 100 A**

Features

- Compact *flow* 1 housing
- Compact and Low Inductance Design
- Built-in NTC

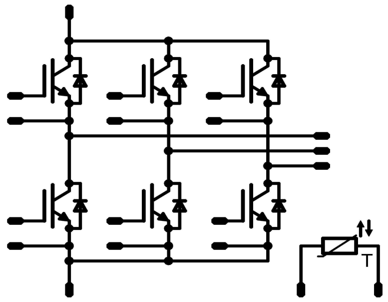
flow 1 housing



Target Applications

- Motor Drive
- Power Generation
- UPS

Schematic



Types

- V23990-P825-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=$T_j$max	T_h=80°C T_c=80°C	70	A
Repetitive peak collector current	I_{Cpulse}	t_p limited by $T_j$max	T_h=80°C T_c=80°C	300	A
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	107	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}			600	V
DC forward current	I_F	T_j=$T_j$max	T_h=80°C T_c=80°C	59	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max	T_h=80°C T_c=80°C	300	A
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	72	W
Maximum Junction Temperature	$T_j$max			175	°C
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+150	°C

Maximum Ratings

Tj=25℃, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Insulation Properties				
Insulation voltage	V_{is}	t=1min	4000	V_{DC}
Creepage distance			min 12,7	mm
Clearance			min 12,7	mm

Characteristic Values

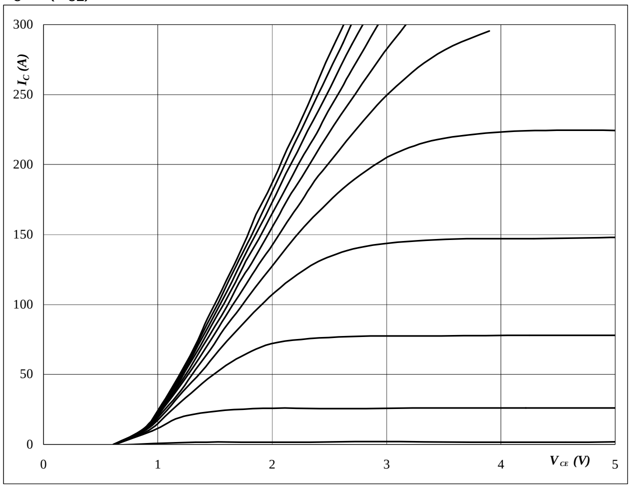
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Inverter Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	VCE=VGE			0,0016	Tj=25℃ Tj=150℃	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		100	Tj=25℃ Tj=150℃	1,1	1,54 1,76	2,25	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		Tj=25℃ Tj=150℃			0,66	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25℃ Tj=150℃			650	nA
Integrated Gate resistor	R_{gint}							2		Ω
Turn-on delay time	$t_{d(on)}$					Tj=25℃ Tj=150℃		151 157		
Rise time	t_r					Tj=25℃ Tj=150℃		19 25		ns
Turn-off delay time	$t_{d(off)}$	Rgoff=4 Ω Rgon=4 Ω	±15	300	100	Tj=25℃ Tj=150℃		205 232		
Fall time	t_f					Tj=25℃ Tj=150℃		89 101		
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=150℃		1,34 2,00		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=150℃		2,35 3,11		
Input capacitance	C_{ies}							6160		
Output capacitance	C_{oss}	f=1MHz	0	25		Tj=25℃		384		pF
Reverse transfer capacitance	C_{rss}							183		
Gate charge	Q_{Gate}	Vcc=480V	±15		100	Tj=25℃		625		nC
Thermal resistance chip to heatsink	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,89		K/W
Inverter Diode										
Diode forward voltage	V_F				100	Tj=25℃ Tj=150℃	1,2	1,65 1,53	2,4	V
Peak reverse recovery current	I_{RRM}					Tj=25℃ Tj=150℃		97 117		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=150℃		140 292		ns
Reverse recovered charge	Q_{rr}	Rgon=4 Ω	±15	300	100	Tj=25℃ Tj=150℃		4,87 10,01		nC
Peak rate of fall of recovery current	$di_{(rec)}max$ /dt					Tj=25℃ Tj=150℃		6149 3433		A/µs
Reverse recovered energy	E_{rec}					Tj=25℃ Tj=150℃		1,03 2,25		mWs
Thermal resistance chip to heatsink	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,31		K/W
Thermistor										
Rated resistance	R					Tj=25°C		4,7		kΩ
Deviation of R100	ΔR/R	R100=401 Ω				Tj=100°C	-12,4		12,4	%
Power dissipation	P					Tj=25°C		210		mW
Power dissipation constant						Tj=25°C		3,5		mW/K
B-value	B(25/50)					Tj=25°C		3590		K
B-value	B(25/100)					Tj=25°C		3650		K
Vincotech NTC Reference									D	

Output Inverter

Figure 1 Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

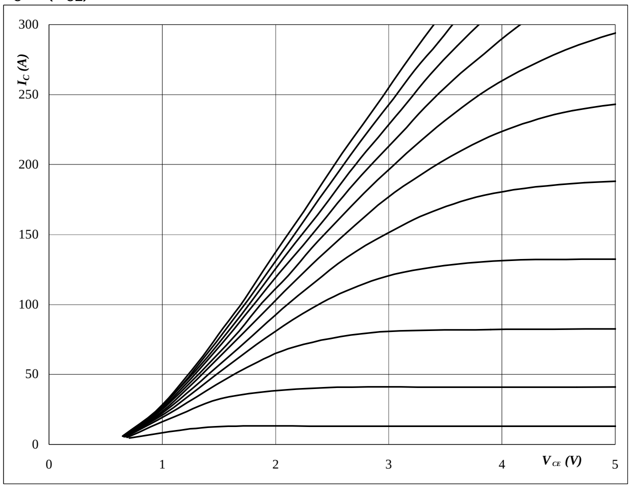
T_j = 25 ℃

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

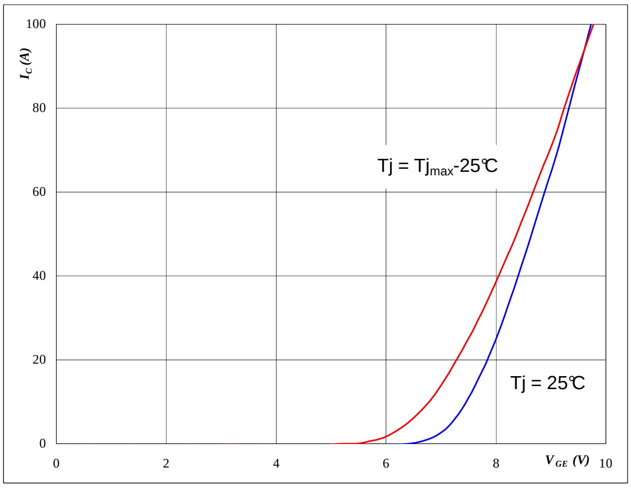
T_j = 150 ℃

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

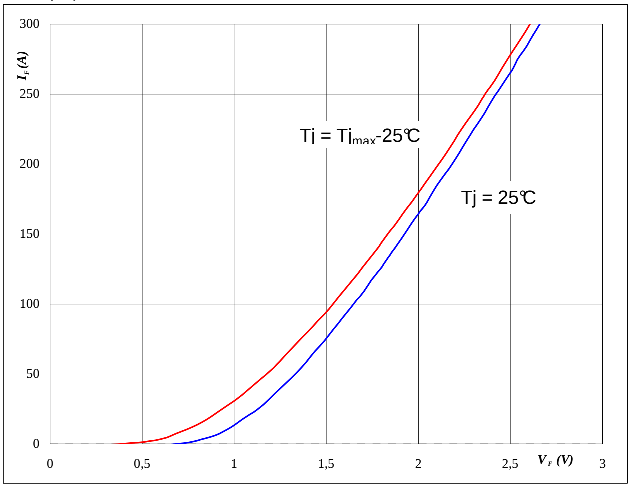
t_p = 250 µs

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

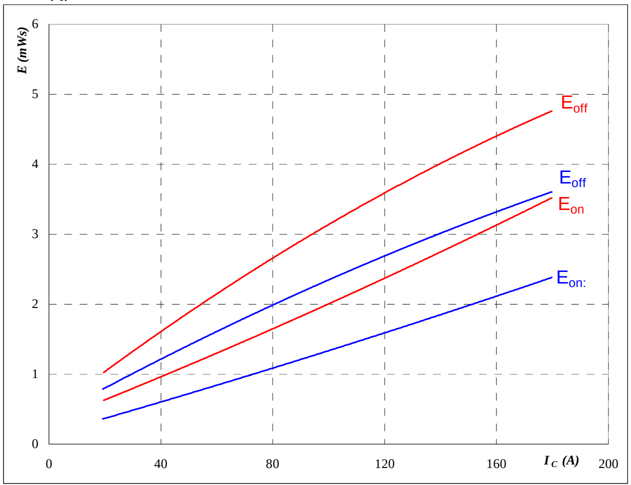
Vincotech

Output Inverter

Figure 5 Output inverter IGBT

Typical switching energy losses as a function of collector current

$E = f(I_c)$



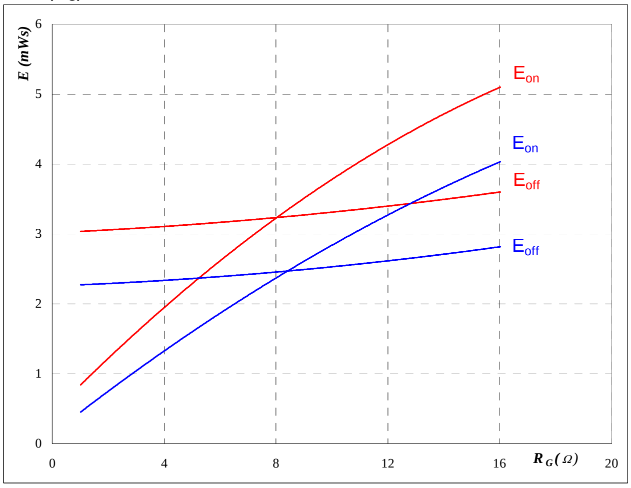
With an inductive load at

T_j =	25/150	℃
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

$E = f(R_G)$



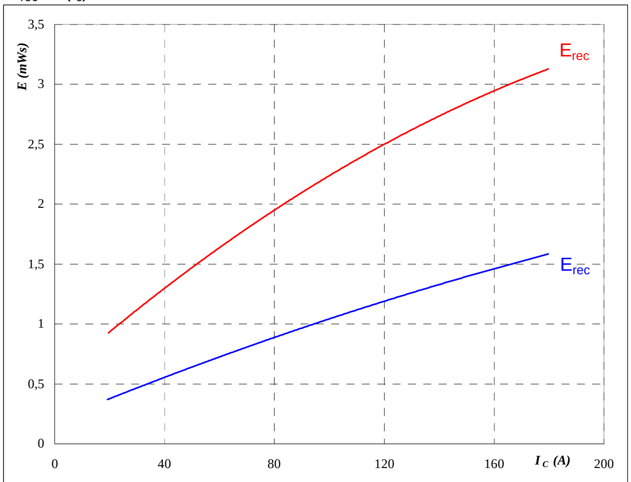
With an inductive load at

T_j =	25/150	℃
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

$E_{rec} = f(I_c)$



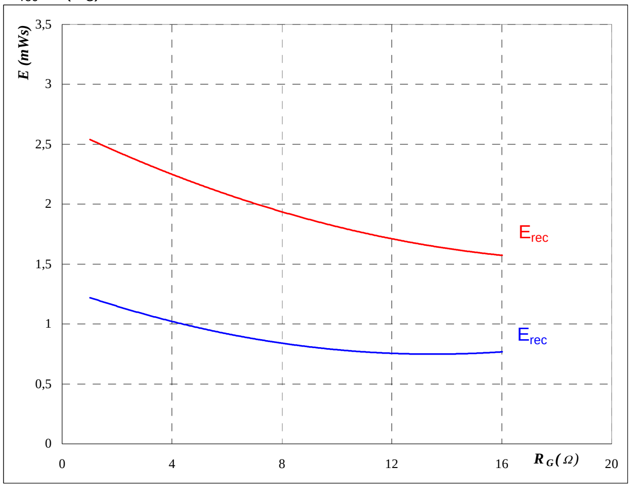
With an inductive load at

T_j =	25/150	℃
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

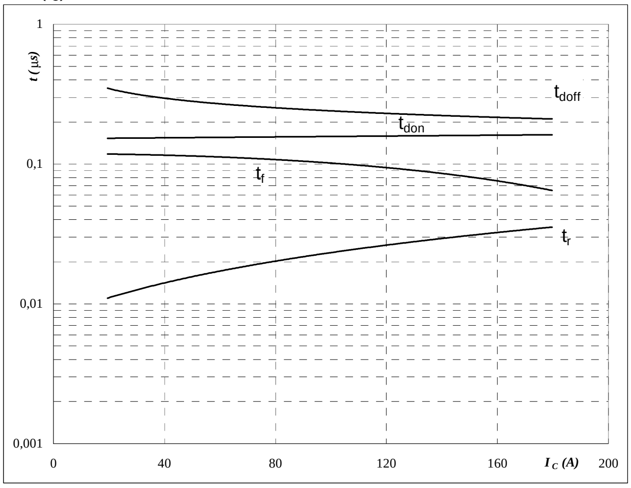
T_j =	25/150	℃
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	100	A

Output Inverter

Figure 9 Output inverter IGBT

Typical switching times as a function of collector current

t = f(I_C)



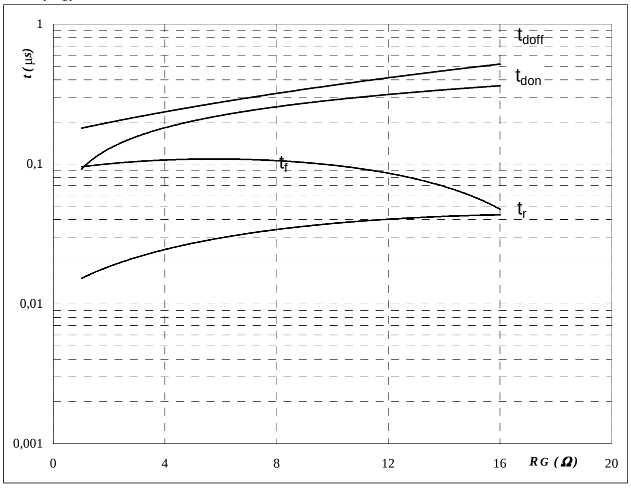
With an inductive load at

T_j =	150	℃
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)



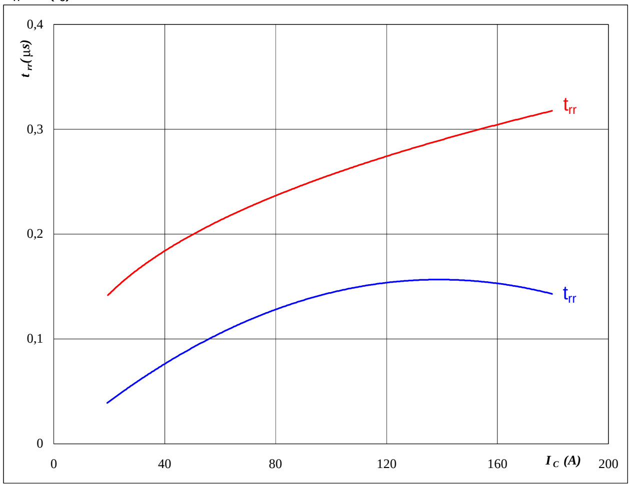
With an inductive load at

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

Figure 11 Output inverter FWD

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_c)



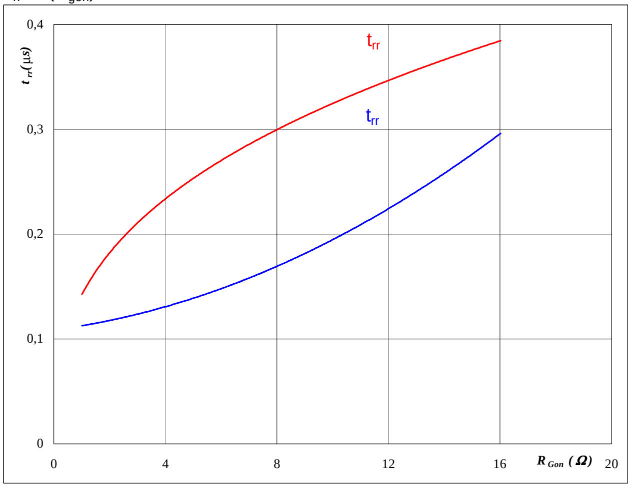
At

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

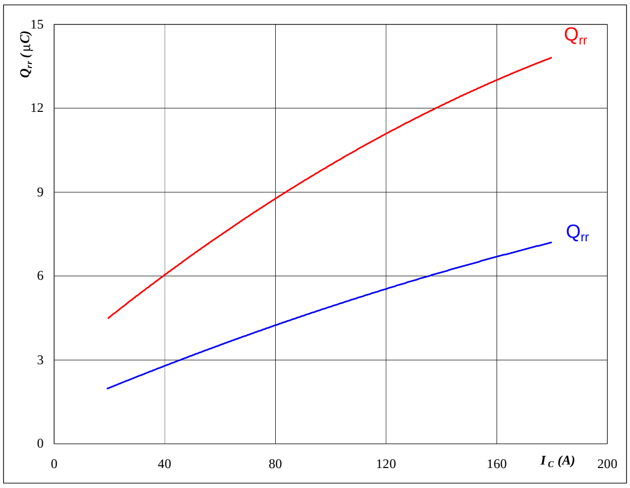
T_j =	25/150	℃
V_R =	300	V
I_F =	100	A
V_{GE} =	±15	V

Output Inverter

Figure 13	Output inverter FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(Ic)$



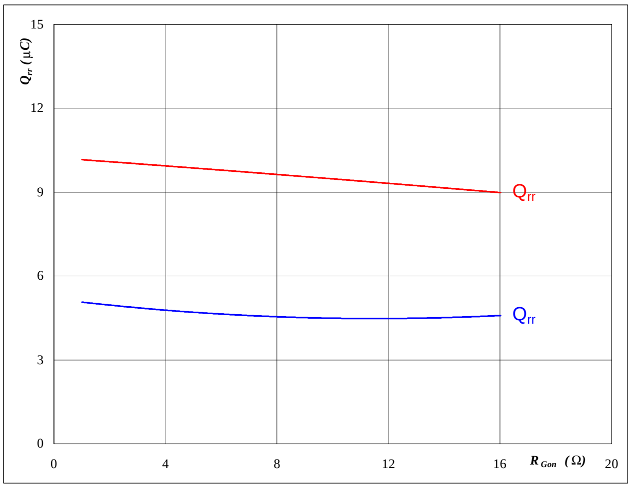
At

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

Figure 14	Output inverter FWD

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

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



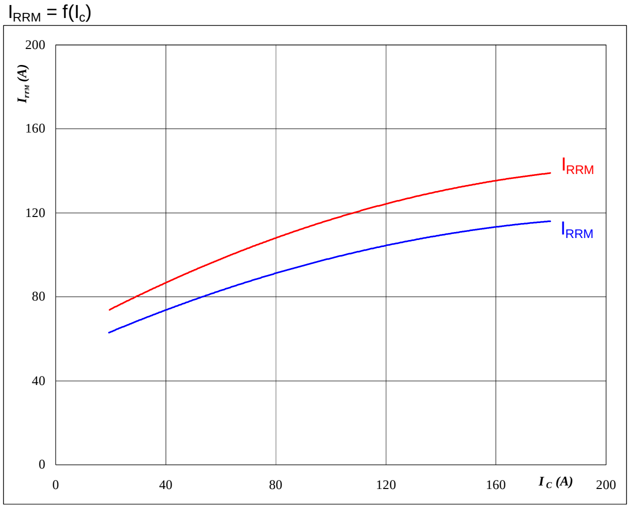
At

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

Figure 15	Output inverter FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_c)$



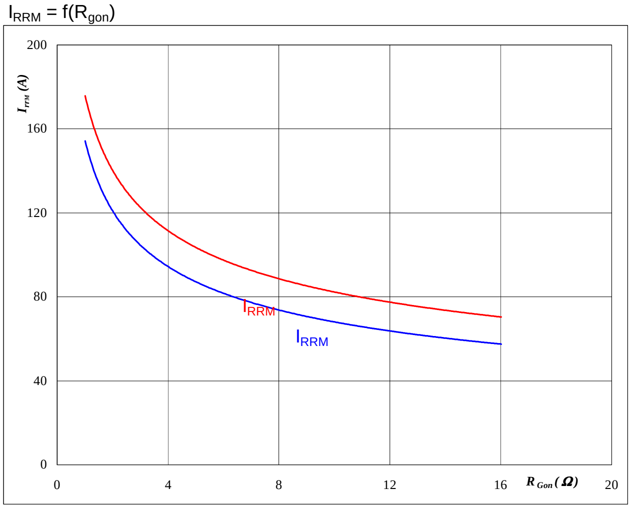
At

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

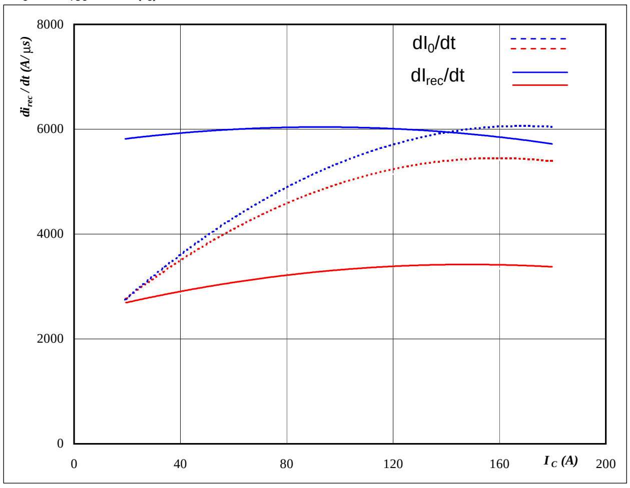
T_j =	25/150	℃
V_R =	300	V
I_F =	100	A
V_{GE} =	±15	V

Output Inverter

Figure 17 Output inverter FWD

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

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



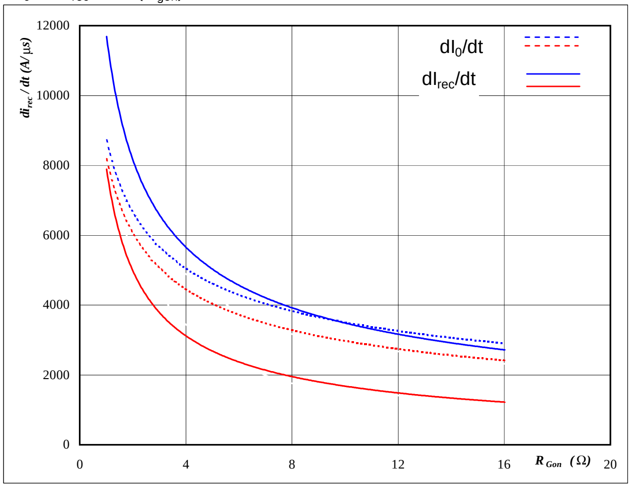
At

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

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



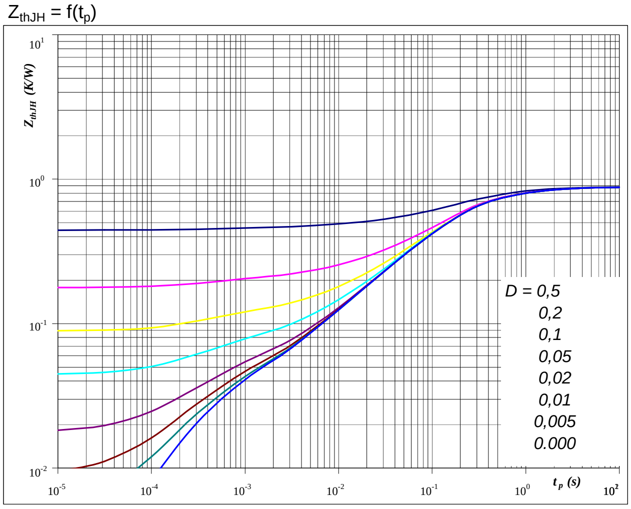
At

T_j =	25/150	℃
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} =	0,89	K/W

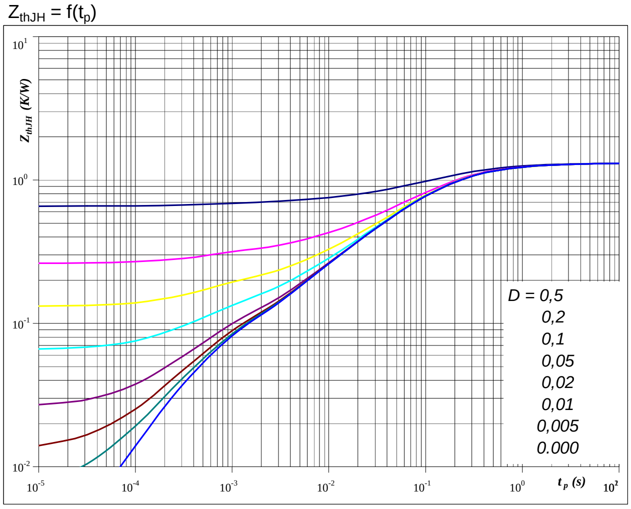
IGBT thermal model values

R (K/W)	Tau (s)
0,03	9,9E+00
0,15	1,1E+00
0,51	1,9E-01
0,14	3,2E-02
0,03	4,7E-03
0,03	3,9E-04

Figure 20 Output inverter FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	tp / T	
R_{thJH} =	1,31	K/W

FWD thermal model values

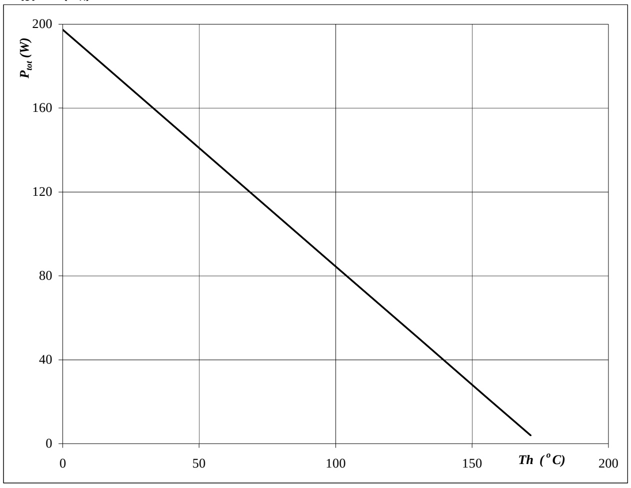
R (K/W)	Tau (s)
0,02	9,9E+00
0,15	1,2E+00
0,59	1,8E-01
0,35	4,7E-02
0,13	8,1E-03
0,07	5,3E-04

Output Inverter

Figure 21 Output inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



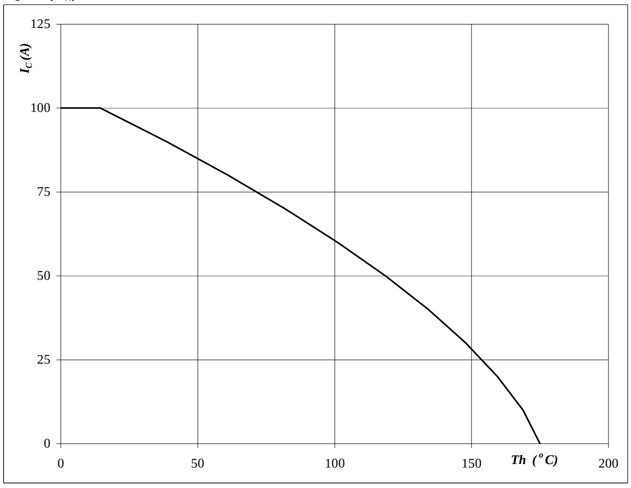
At

T_j = 175 ℃

Figure 22 Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

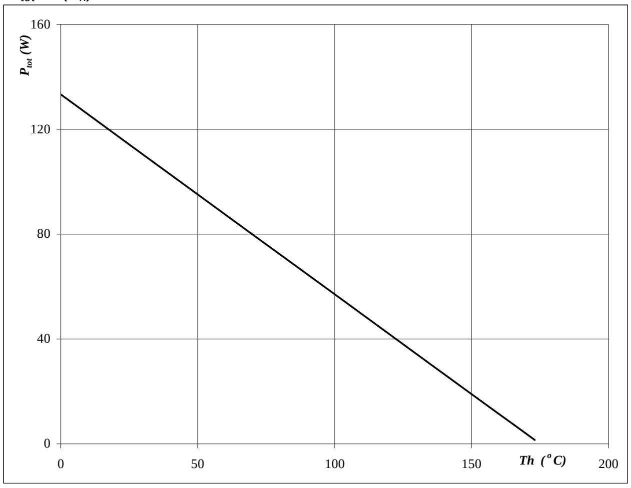
T_j = 175 ℃

V_{GE} = 15 V

Figure 23 Output inverter FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



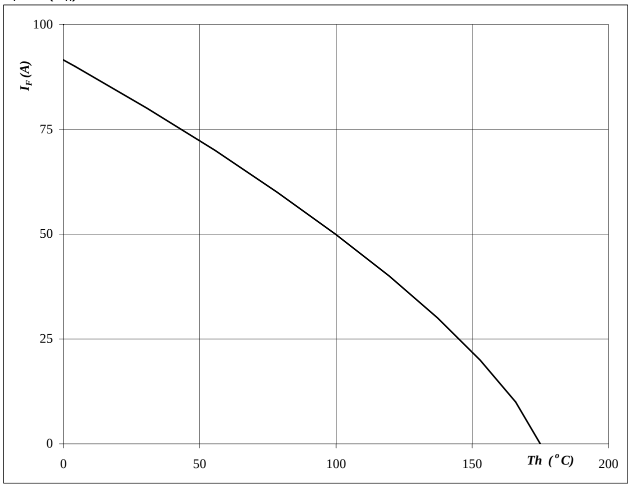
At

T_j = 175 ℃

Figure 24 Output inverter FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

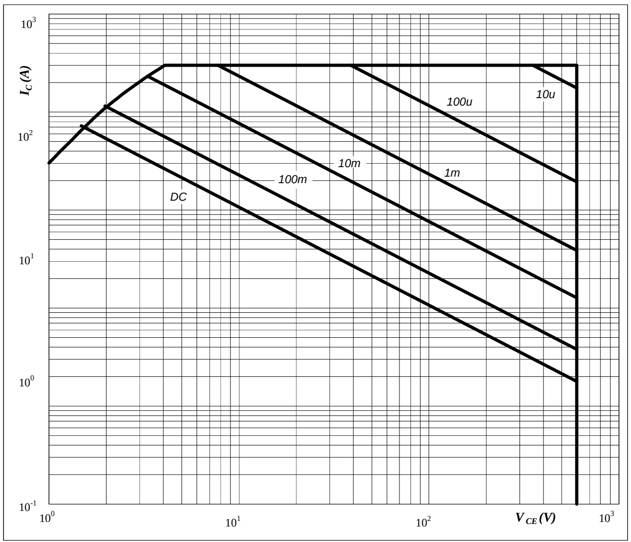
T_j = 175 ℃

Output Inverter

Figure 25	Output inverter IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



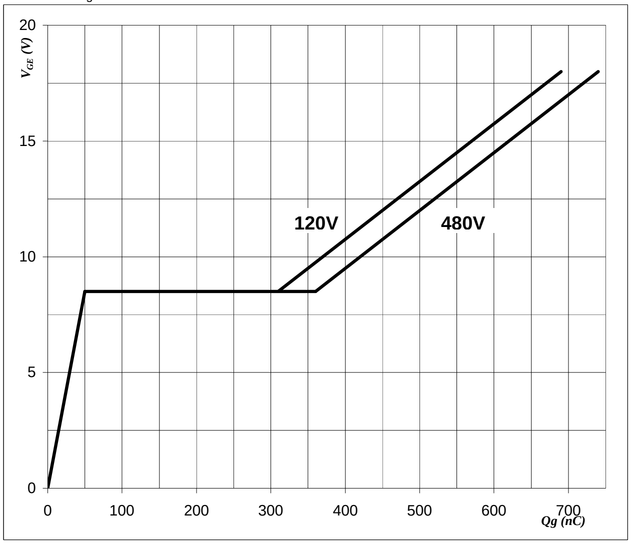
At

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

Figure 26	Output inverter IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



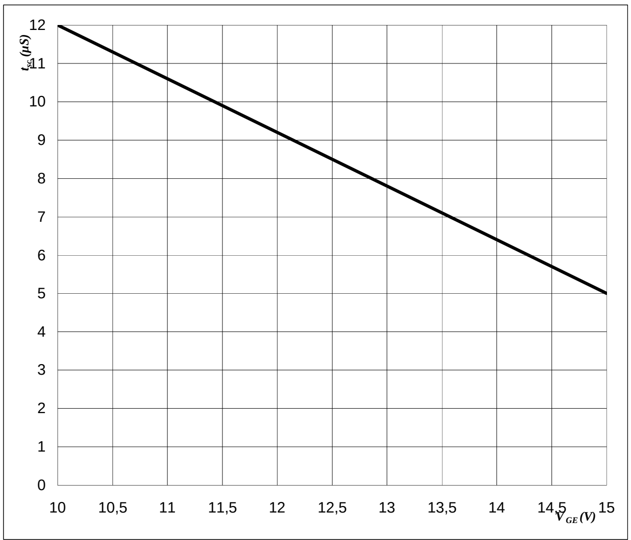
At

I_C =	100	A

Figure 27	Output inverter IGBT

Short circuit withstand time as a function of gate-emitter voltage

$t_{sc} = f(V_{GE})$



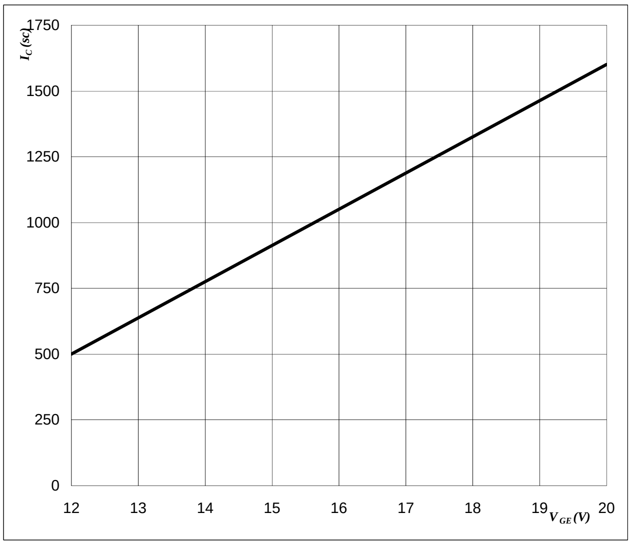
At

V_{CE} =	600	V
T_j ≤	150	ºC

Figure 28	Output inverter IGBT

Typical short circuit collector current as a function of gate-emitter voltage

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



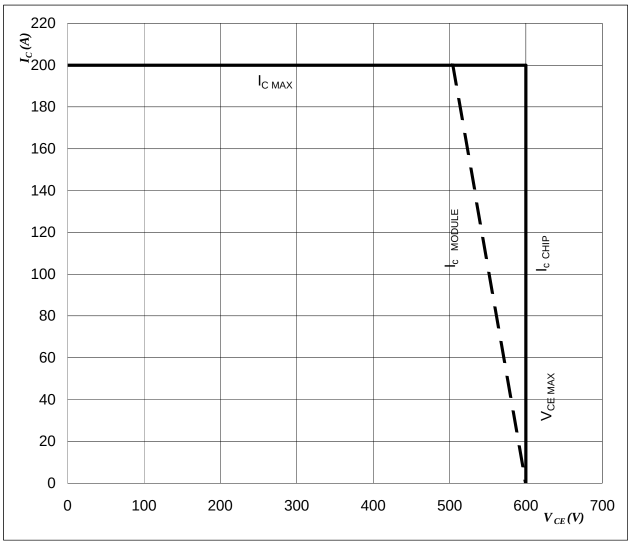
At

V_{CE} ≤	400	V
T_j ≤	150	ºC

Figure 29 IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

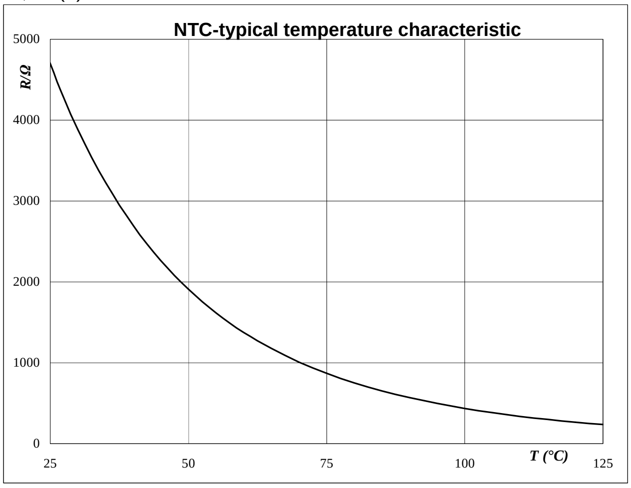
T_j = T_{jmax}-25 ºC

Switching mode : 3phase SPWM

Thermistor

Figure 1	Thermistor

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



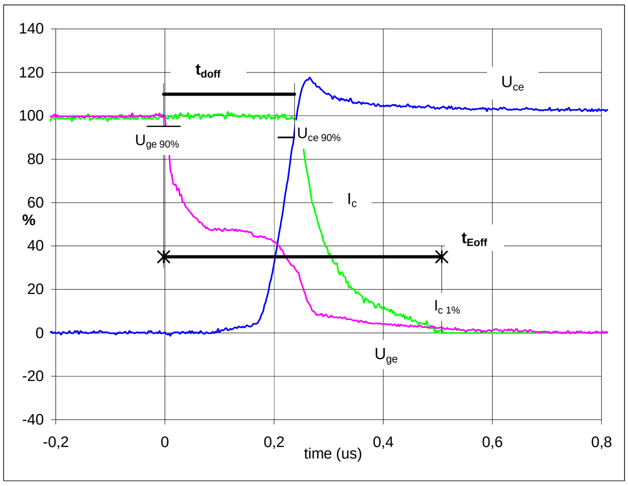
Switching Definitions Output Inverter

General conditions

T_j	=	150 ℃
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

Figure 1 Output inverter IGBT

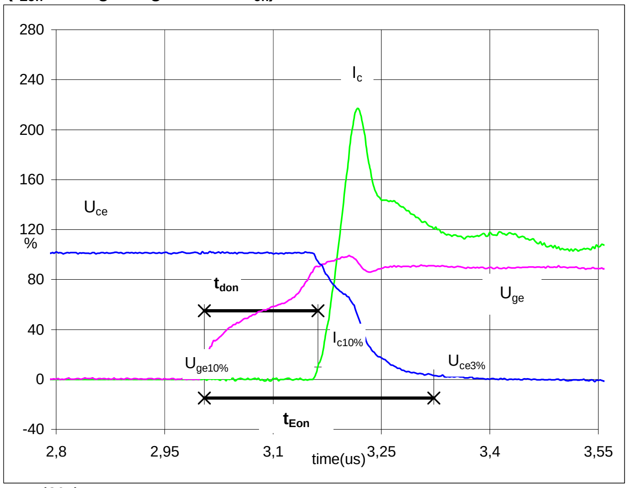
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



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

Figure 2 Output inverter IGBT

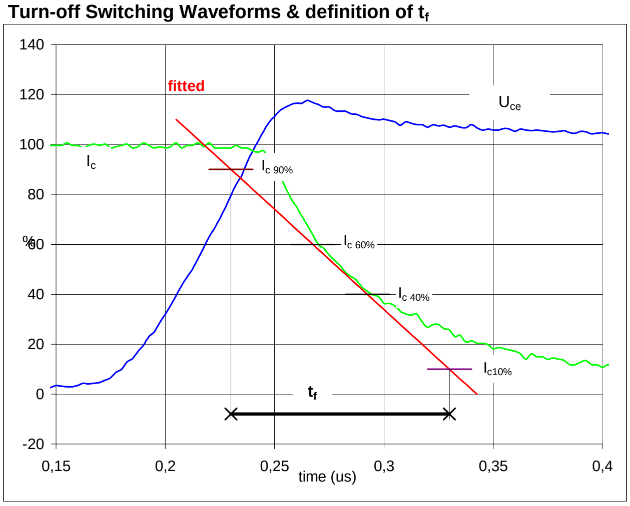
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	99	A
t_{don} =	0,16	µs
t_{Eon} =	0,32	µs

Figure 3 Output inverter IGBT

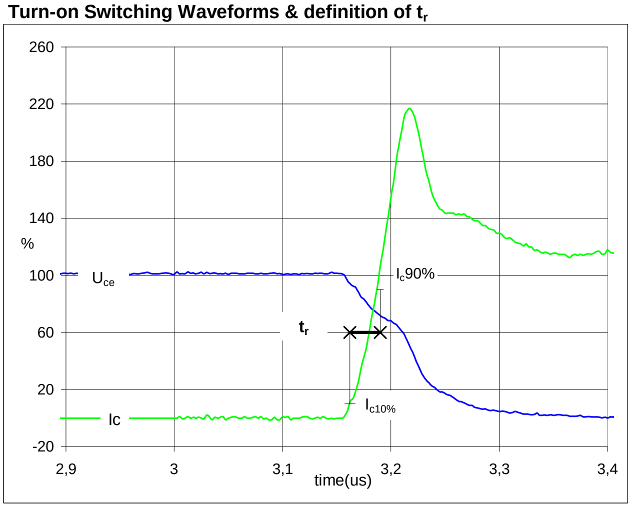
Turn-off Switching Waveforms & definition of t_f



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

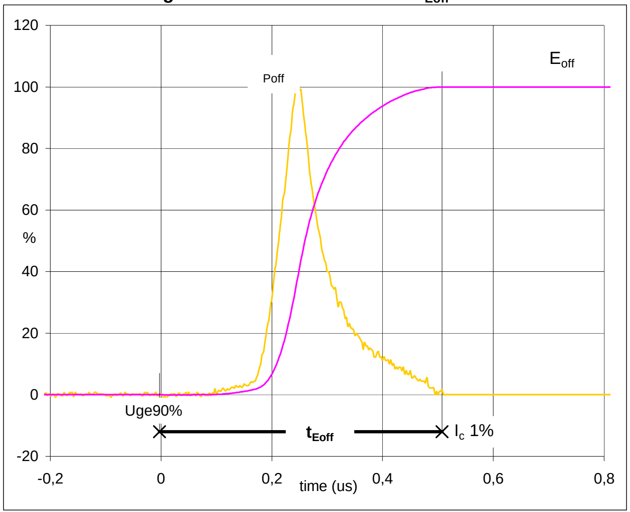


V_C (100%) =	300	V
I_C (100%) =	99	A
t_r =	0,03	µs

Switching Definitions Output Inverter

Figure 5 Output inverter IGBT

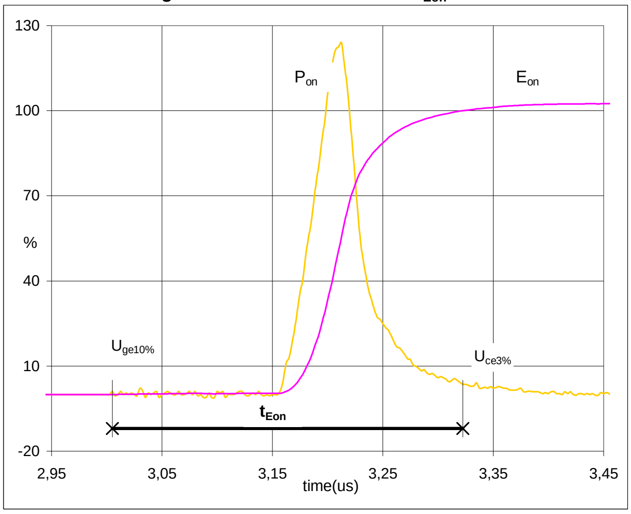
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	29,79	kW
E_{off} (100%) =	3,11	mJ
t_{Eoff} =	0,51	μs

Figure 6 Output inverter IGBT

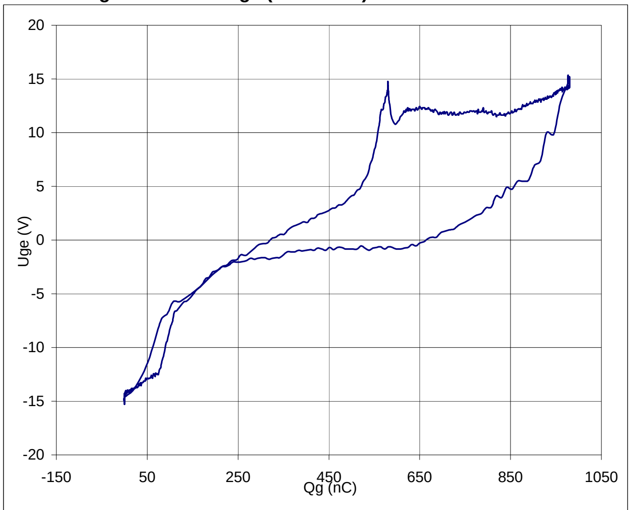
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	29,79	kW
E_{on} (100%) =	2,00	mJ
t_{Eon} =	0,32	μs

Figure 7 Output inverter FWD

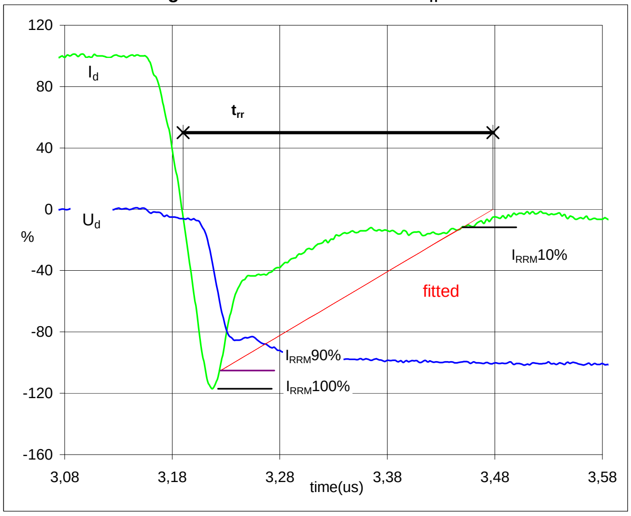
Gate voltage vs Gate charge (measured)



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}

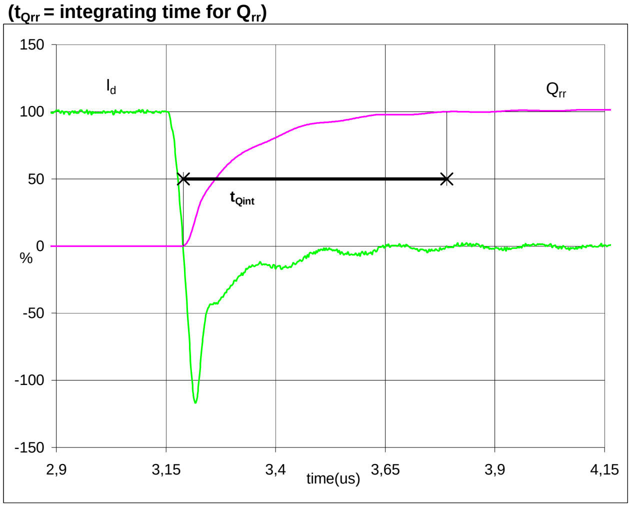


V_d (100%) =	300	V
I_d (100%) =	99	A
I_{RRM} (100%) =	-117	A
t_{rr} =	0,29	μs

Switching Definitions Output Inverter

Figure 9 Output inverter FWD

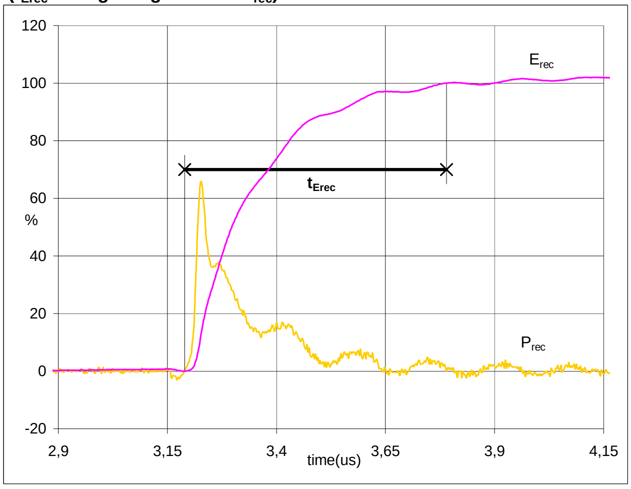
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	99	A
Q_{rr} (100%) =	10,01	μC
t_{Qint} =	0,60	μs

Figure 10 Output inverter FWD

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

Ordering Code and Marking - Outline - Pinout

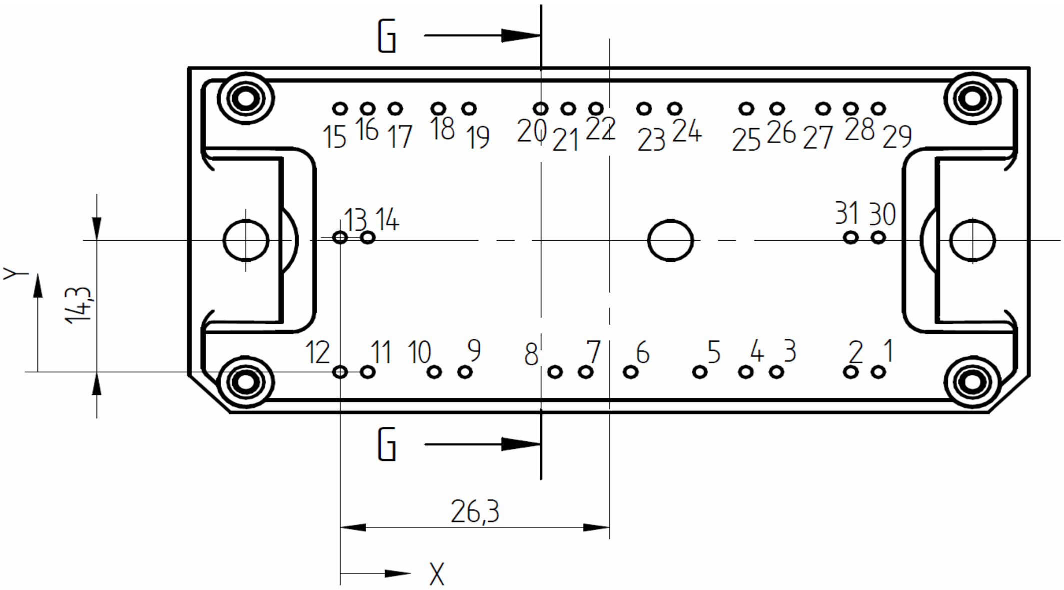
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 17mm housing	V23990-P825-F10-PM	P825-F10	P825-F10

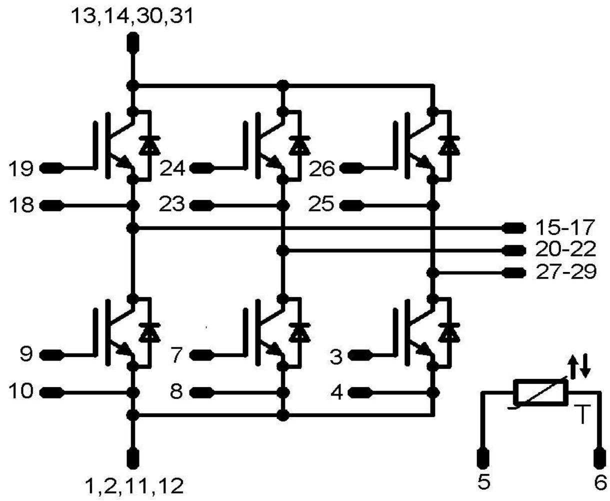
Outline

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



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