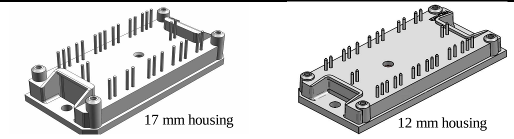
flow PACK 1 3rd gen — 1200 V / 50 A

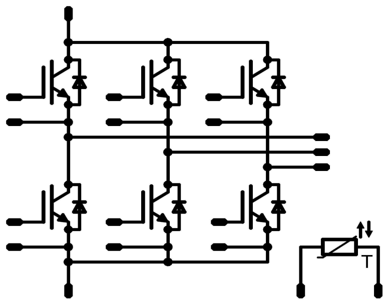
Features
- Compact *flow* 1 housing
- Trench Fieldstop IGBT4 Technology
- Compact and Low Inductance Design
- Built-in NTC

flow 1 housing



Target Applications
- Motor Drive
- Power Generation
- UPS

Schematic



Types
- V23990-P829-F10-PM
- V23990-P829-F108-PM

Maximum Ratings

T_j=25℃, 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℃ T_c=80℃	45	A
Repetitive peak collector current	I_{Cpulse}	t_p limited by $T_j$max	150	A
Power dissipation	P_{tot}	$T_j=T_j$max T_h=80℃ T_c=80℃	103	W
Gate-emitter peak voltage	V_{GE}		±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150℃ V_{GE}=15V	10 800	µs V
Maximum Junction Temperature	$T_j$max		175	℃
Inverter Diode				
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25℃	1200	V
DC forward current	I_F	$T_j=T_j$max T_h=80℃ T_c=80℃	44	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max	100	A
Power dissipation	P_{tot}	$T_j=T_j$max T_h=80℃ T_c=80℃	76	W
Maximum Junction Temperature	$T_j$max		175	℃
Thermal Properties				
Storage temperature	T_{stg}		-40…+125	℃
Operation temperature under switching condition	T_{op}		-40…+150	℃

Maximum Ratings

Tj=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Insulation Properties					
Insulation voltage	V_{is}	t=2s	DC voltage	4000	V
Creepage distance				min 12,7	mm
Clearance			17 mm housing 12 mm housing	min 12,7 min 8,06	mm

Characteristic Values

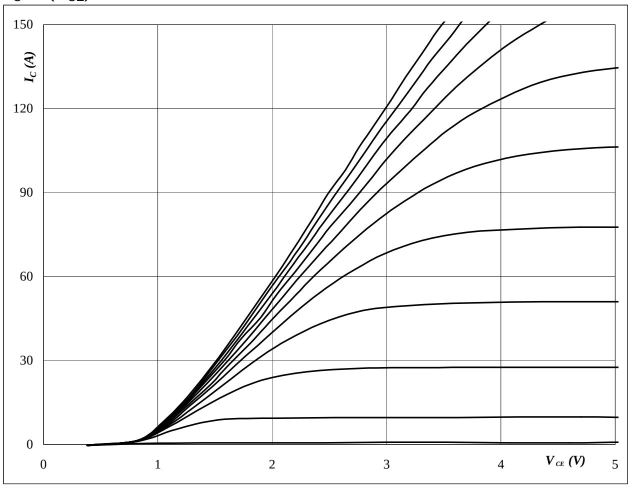
Parameter	Symbol	Conditions	V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	Unit
Inverter Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	VCE=VGE			0,0017	Tj=25℃ Tj=150℃	5,00	5,80	6,50	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		50	Tj=25℃ Tj=150℃	1,60	1,93 2,35	2,30	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	1200		Tj=25℃ Tj=150℃			0,02	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25℃ Tj=150℃			650	nA
Integrated Gate resistor	R_{gint}							4		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=8 Ω Rgon=8 Ω	±15	600	50	Tj=25℃ Tj=150℃		96 101		ns
Rise time	t_r					Tj=25℃ Tj=150℃		17 24		
Turn-off delay time	$t_{d(off)}$					Tj=25℃ Tj=150℃		214 281		
Fall time	t_f					Tj=25℃ Tj=150℃		87 122		
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=150℃		2,70 4,21		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=150℃		2,74 4,53		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25℃		2770		pF
Output capacitance	C_{oss}							205		
Reverse transfer capacitance	C_{rss}							160		
Gate charge	Q_{Gate}	Vcc=960	±15		50	Tj=25℃		240		nC
Thermal resistance chip to heatsink	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,92		K/W
Inverter Diode										
Diode forward voltage	V_F				50	Tj=25℃ Tj=150℃	1,4	1,83 1,80	2,3	V
Peak reverse recovery current	I_{RRM}	Rgon=8 Ω	±15	600	50	Tj=25℃ Tj=150℃		81 85		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=150℃		139 316		ns
Reverse recovered charge	Q_{rr}					Tj=25℃ Tj=150℃		4,80 9,71		nC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25℃ Tj=150℃		4803 1209		A/µs
Reverse recovered energy	Erec					Tj=25℃ Tj=150℃		1,79 3,97		mWs
Thermal resistance chip to heatsink	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,26		K/W
Thermistor										
Rated resistance	R					Tj=25ºC		4,7		kΩ
Deviation of R100	ΔR/R	R100=401 Ω				Tj=100ºC	-12,4		12,4	%
Power dissipation	P					Tj=25ºC		210		mW
Power dissipation constant						Tj=25ºC		3,5		mW/K
B-value	B(25/50)					Tj=25ºC		3590		K
B-value	B(25/100)					Tj=25ºC		3650		K
Vincotech NTC Reference									D	

Output Inverter

Figure 1 Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

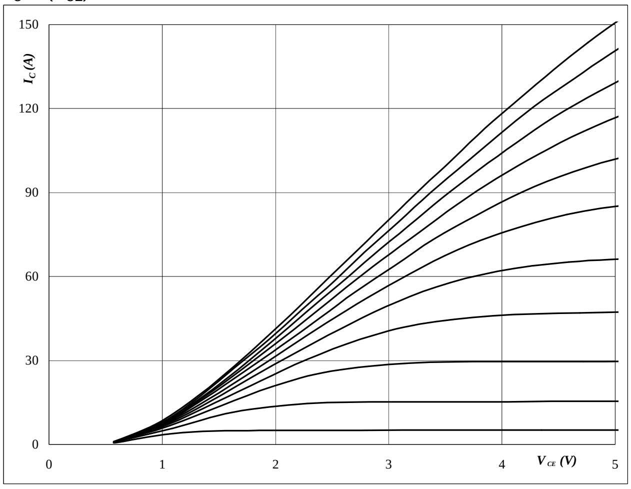
t_p =	250	µs
T_j =	25	℃

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

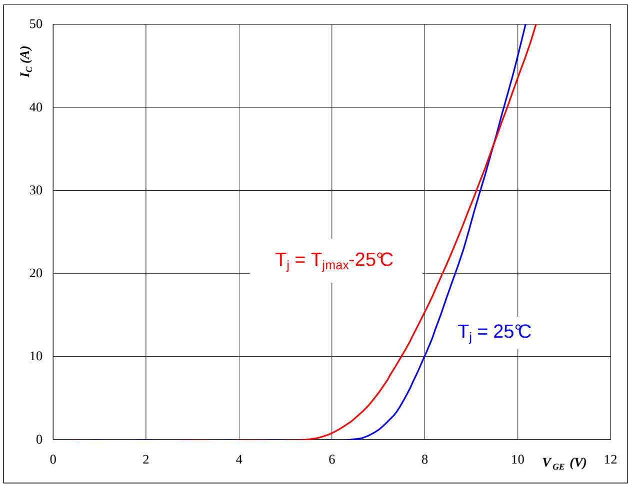
t_p =	250	µs
T_j =	150	℃

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

Figure 3 Output inverter IGBT

Typical transfer characteristics

$Ic = f(V_{GE})$



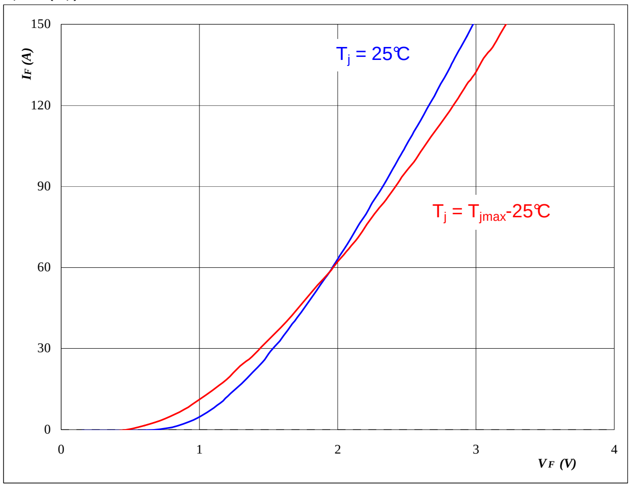
At

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

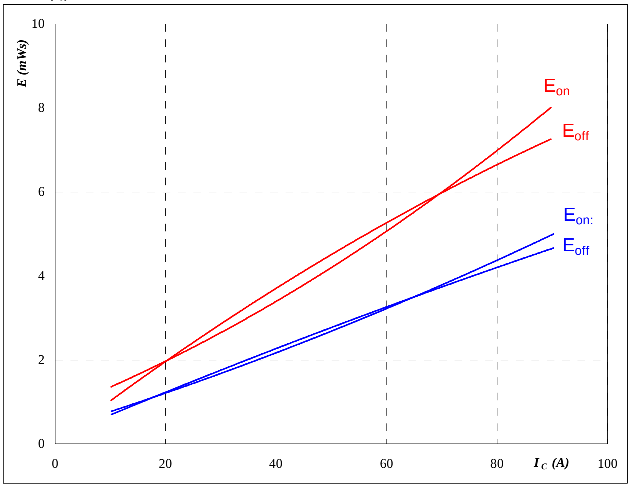
t_p =	250	µs

Output Inverter

Figure 5 Output inverter IGBT

Typical switching energy losses as a function of collector current

E = f(I_c)



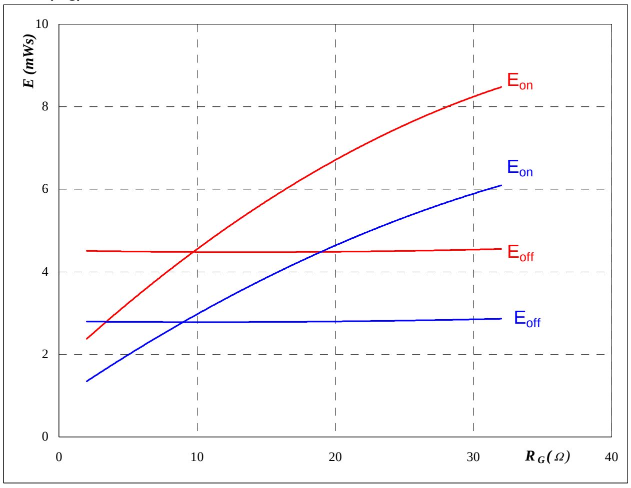
With an inductive load at

T_j =	25/150	℃
V_{CE} =	600	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)



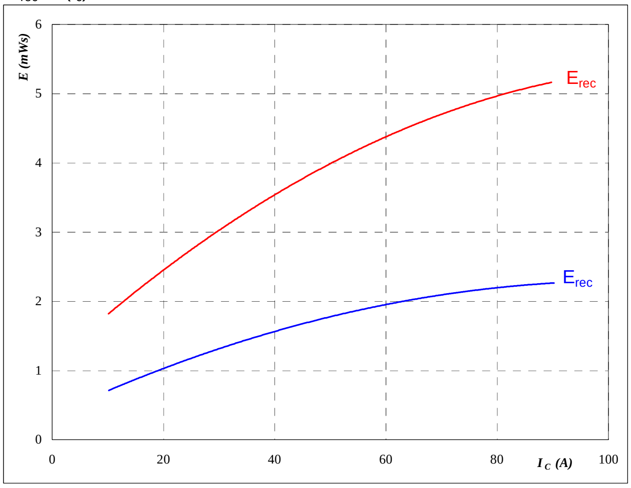
With an inductive load at

T_j =	25/150	℃
V_{CE} =	600	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)



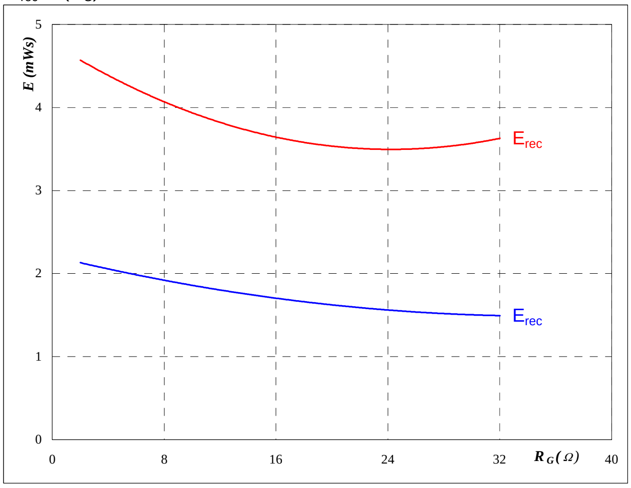
With an inductive load at

T_j =	25/150	℃
V_{CE} =	600	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

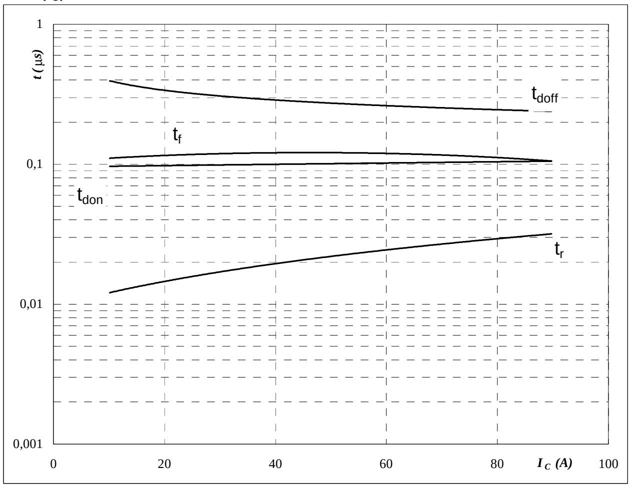
T_j =	25/150	℃
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	50	A

Output Inverter

Figure 9	Output inverter IGBT

Typical switching times as a function of collector current

t = f(I_C)



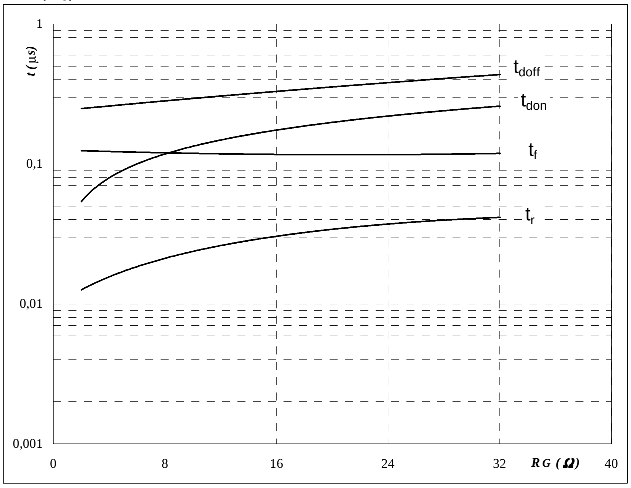
With an inductive load at

T_j =	150	℃
V_{CE} =	600	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)



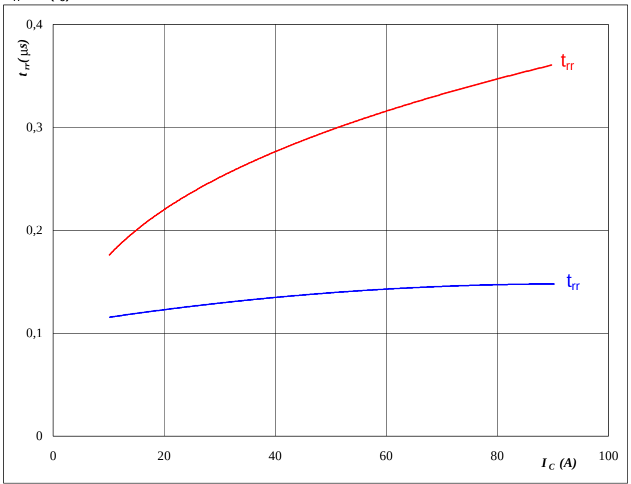
With an inductive load at

T_j =	150	℃
V_{CE} =	600	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)



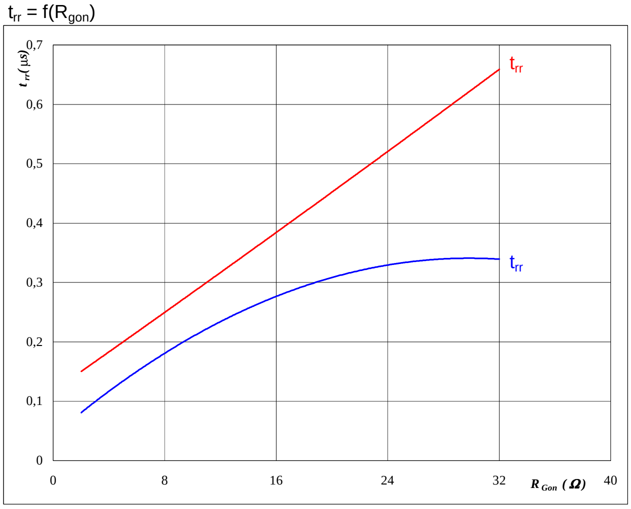
At

T_j =	25/150	℃
V_{CE} =	600	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

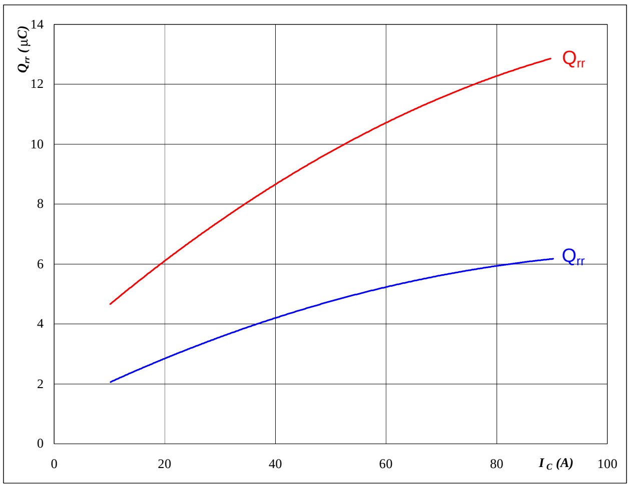
T_j =	25/150	℃
V_R =	600	V
I_F =	50	A
V_{GE} =	±15	V

Output Inverter

Figure 13 Output inverter FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_c)$



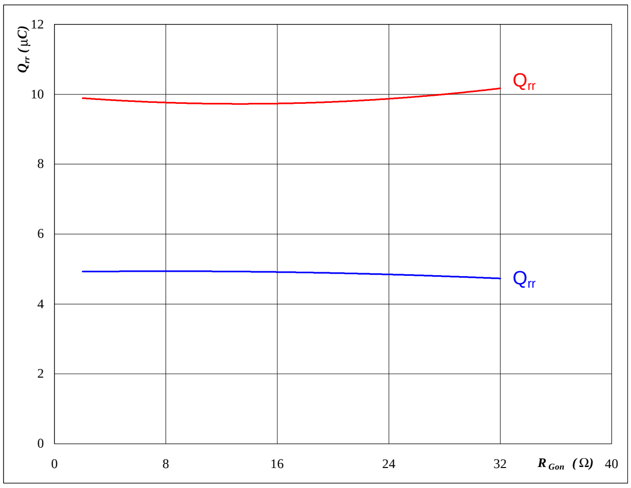
At

T_j =	25/150	℃
V_{CE} =	600	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

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



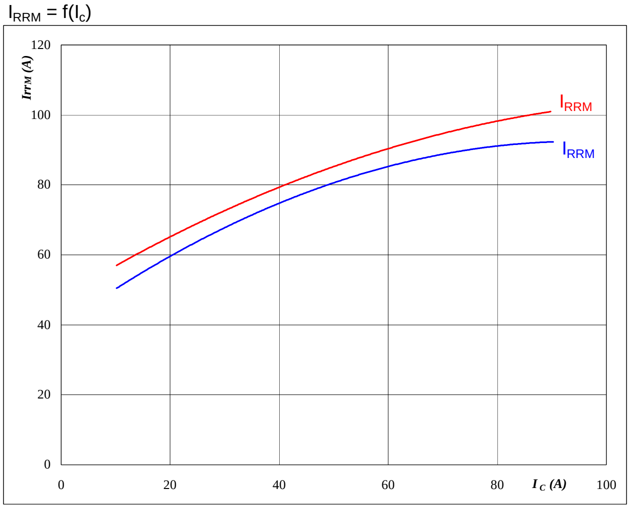
At

T_j =	25/150	℃
V_R =	600	V
I_F =	50	A
V_{GE} =	±15	V

Figure 15 Output inverter FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_c)$



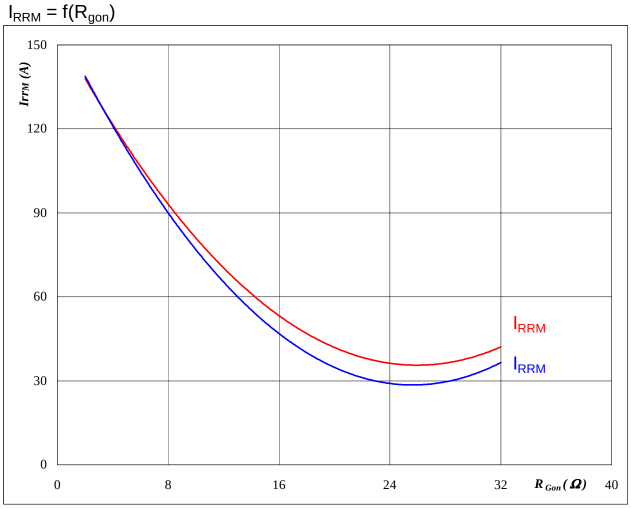
At

T_j =	25/150	℃
V_{CE} =	600	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

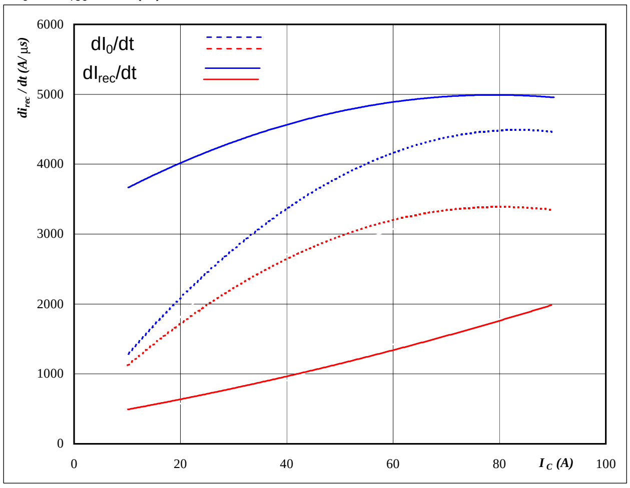
T_j =	25/150	℃
V_R =	600	V
I_F =	50	A
V_{GE} =	±15	V

Output Inverter

Figure 17 Output inverter FWD

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

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



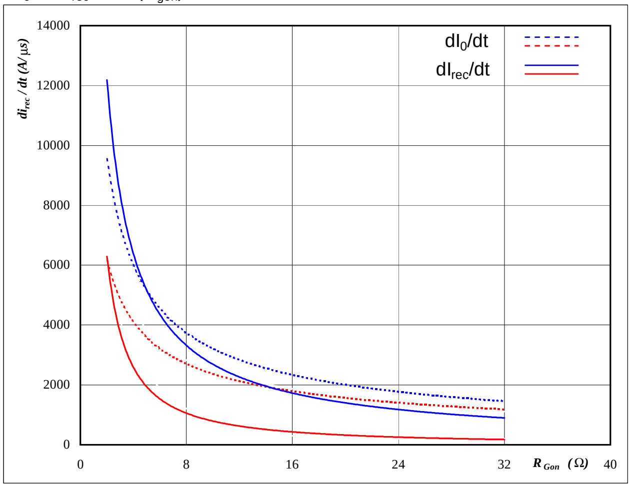
At

T_j =	25/150	℃
V_{CE} =	600	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

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



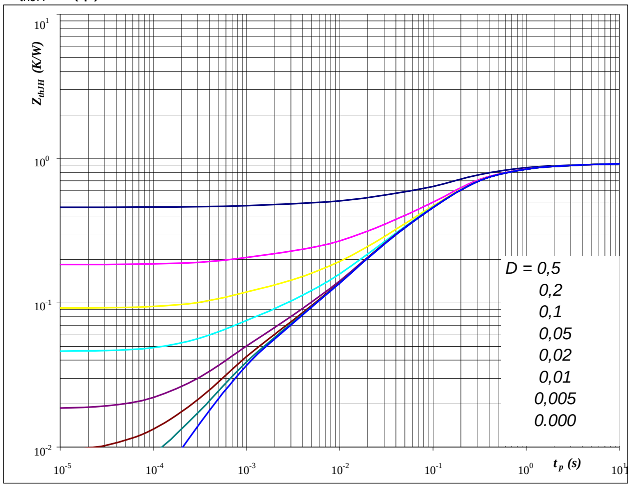
At

T_j =	25/150	℃
V_R =	600	V
I_F =	50	A
V_{GE} =	±15	V

Figure 19 Output inverter IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(tp)$



At

D =	tp / T	
R_{thJH} =	0,92	K/W

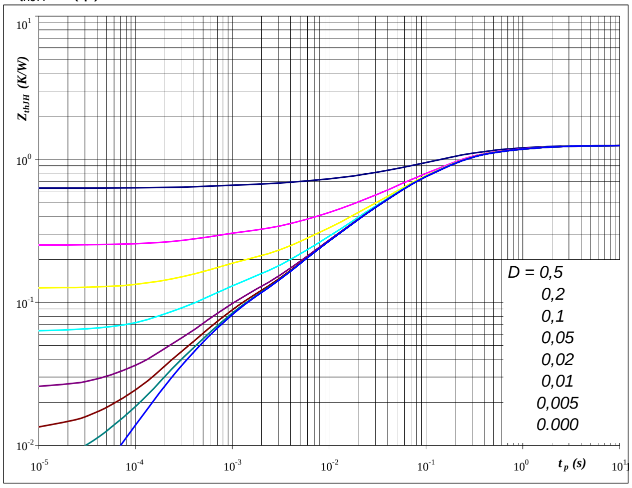
IGBT thermal model values

R (K/W)	Tau (s)
0,07	2,9E+00
0,24	4,7E-01
0,45	1,2E-01
0,12	1,5E-02
0,04	9,2E-04

Figure 20 Output inverter FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(tp)$



At

D =	tp / T	
R_{thJH} =	1,26	K/W

FWD thermal model values

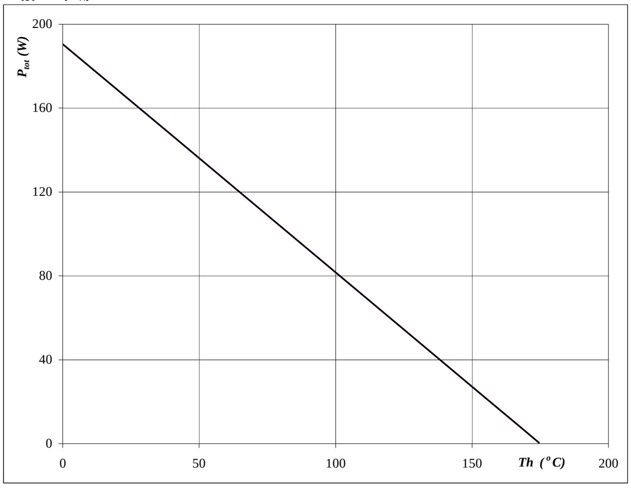
R (K/W)	Tau (s)
0,02	1,3E+01
0,14	1,1E+00
0,62	1,6E-01
0,29	3,5E-02
0,12	6,7E-03
0,06	5,2E-04

Output Inverter

Figure 21 Output inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



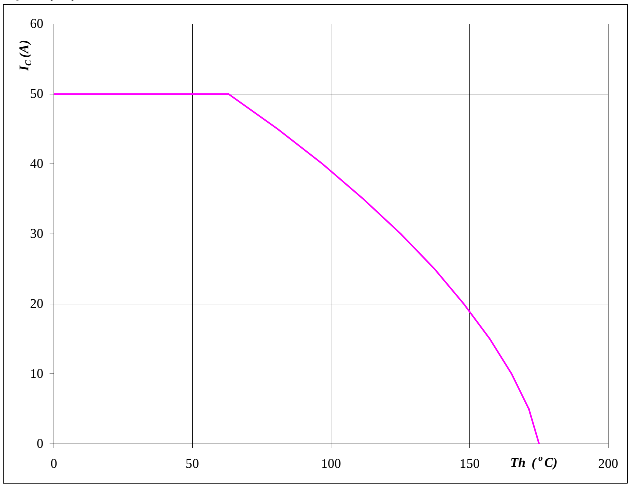
At

T_j = 175 ℃

Figure 22 Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

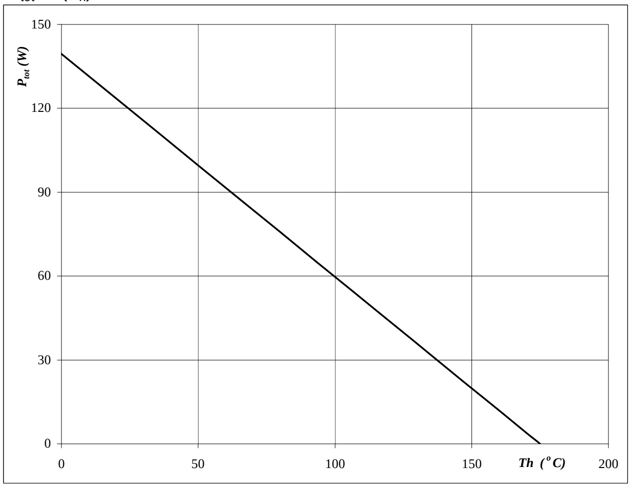
T_j = 175 ℃

V_{GE} = 15 V

Figure 23 Output inverter FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



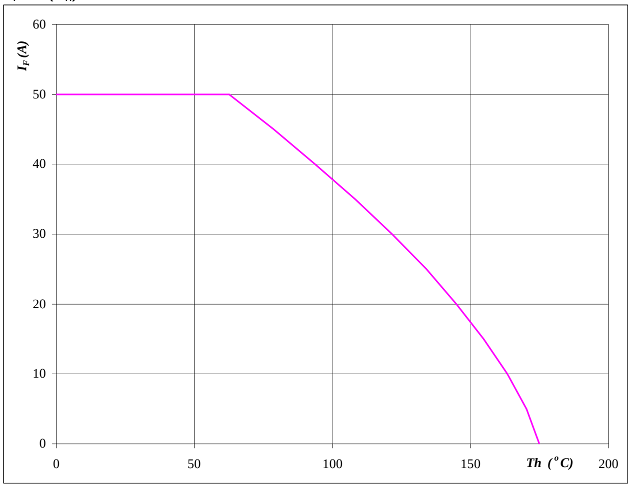
At

T_j = 175 ℃

Figure 24 Output inverter FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

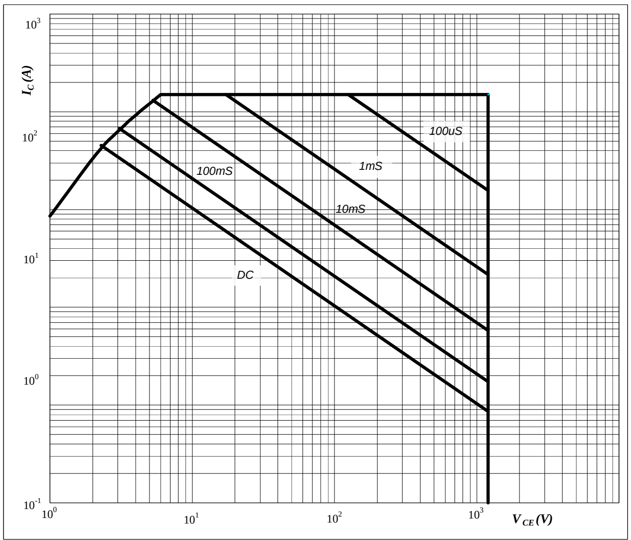
T_j = 175 ℃

Output Inverter

Figure 25	Output inverter IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



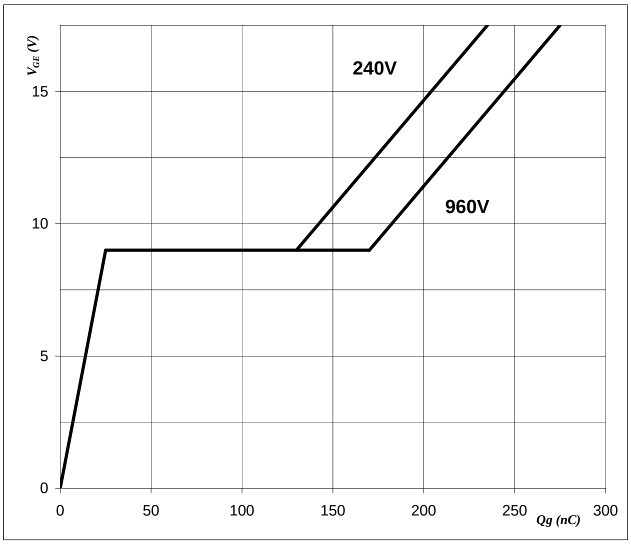
At

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

Figure 26	Output inverter IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Qg)$



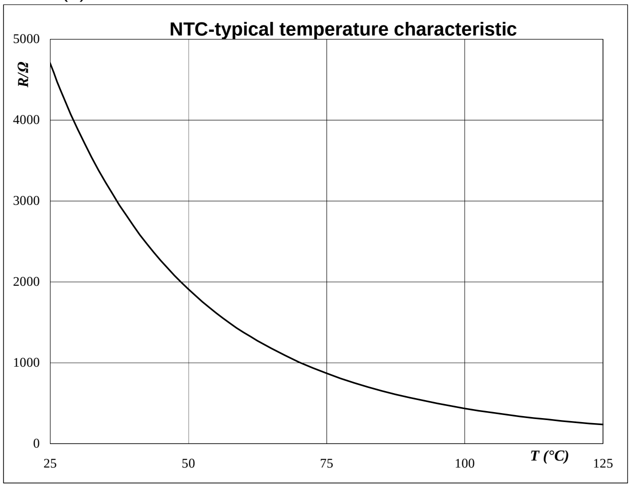
At

I_C =	50	A

Thermistor

Figure 1 Thermistor

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



Switching Definitions Output Inverter

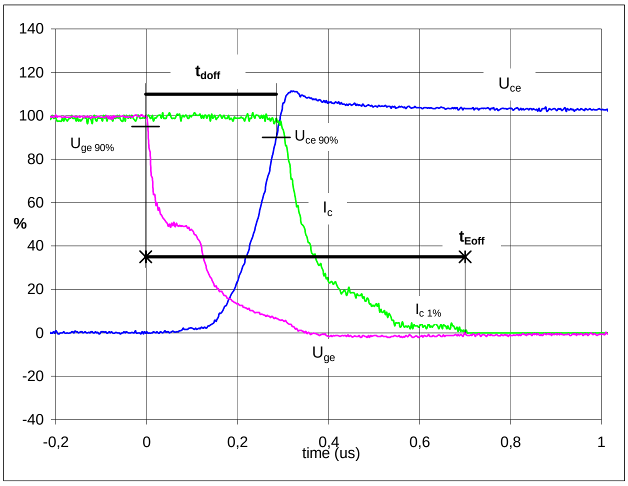
General conditions

T_j	=	150 ℃
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

Figure 1 Output inverter IGBT

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

(t_{Eoff} = integrating time for E_{off})

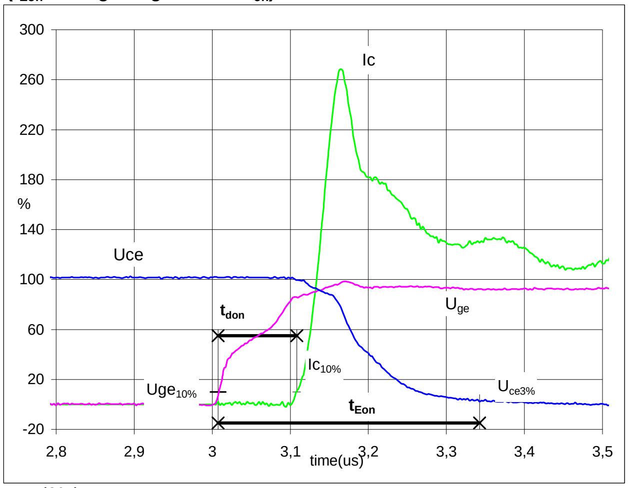


V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	50	A
t_{doff} =	0,28	µs
t_{Eoff} =	0,70	µs

Figure 2 Output inverter IGBT

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

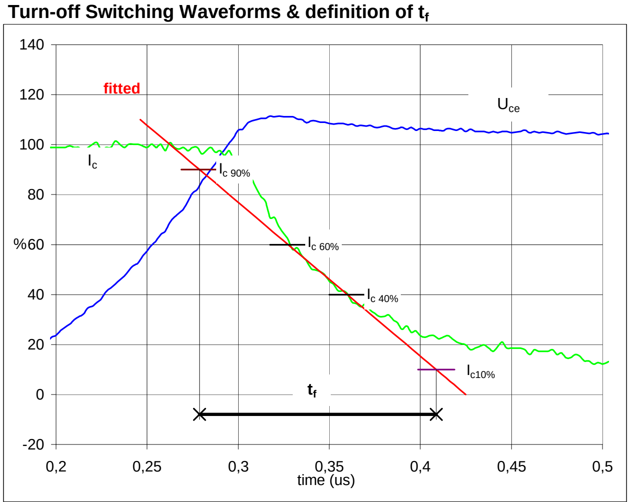
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	50	A
t_{don} =	0,10	µs
t_{Eon} =	0,33	µs

Figure 3 Output inverter IGBT

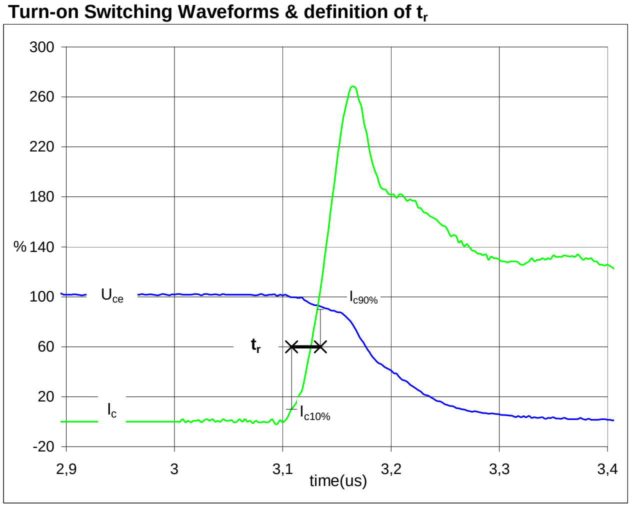
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	50	A
t_f =	0,12	µs

Figure 4 Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

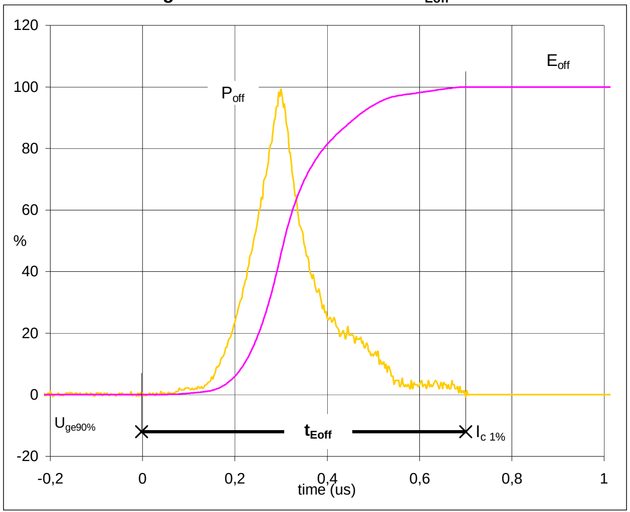


V_C (100%) =	600	V
I_C (100%) =	50	A
t_r =	0,02	µs

Switching Definitions Output Inverter

Figure 5 Output inverter IGBT

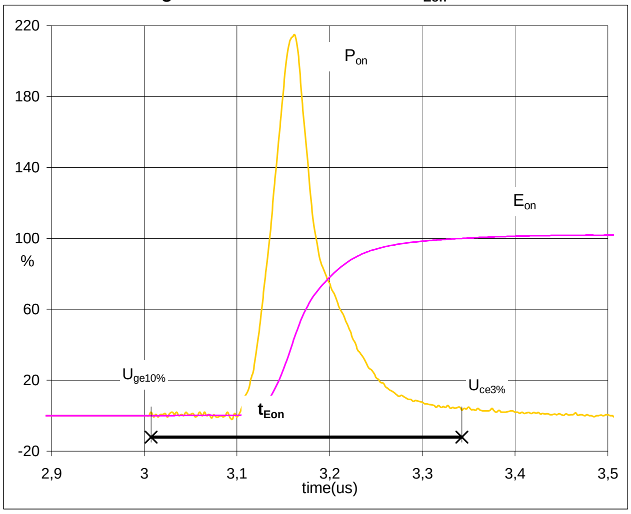
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	30,10	kW
E_{off} (100%) =	4,53	mJ
t_{Eoff} =	0,70	μs

Figure 6 Output inverter IGBT

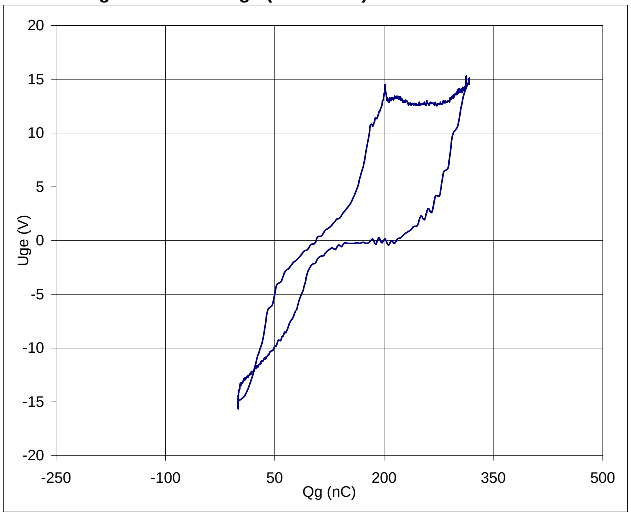
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	30,10	kW
E_{on} (100%) =	4,21	mJ
t_{Eon} =	0,33	μs

Figure 7 Output inverter FWD

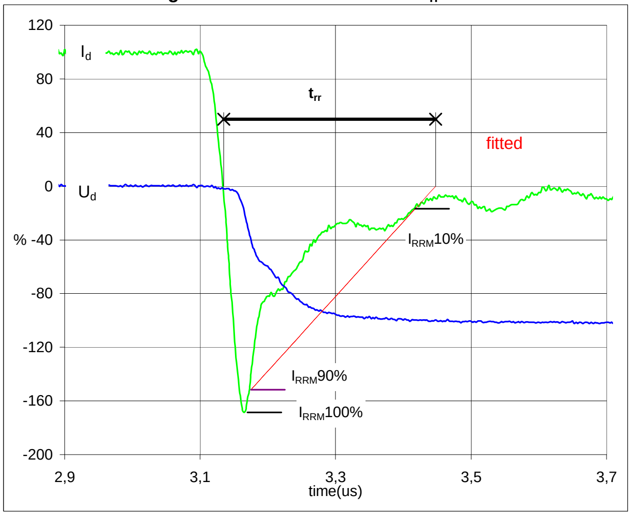
Gate voltage vs Gate charge (measured)



V_{GEoff} =	-15	V
V_{GEon} =	15	V
V_C (100%) =	600	V
I_C (100%) =	50	A
Q_g =	317	nC

Figure 8 Output inverter IGBT

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

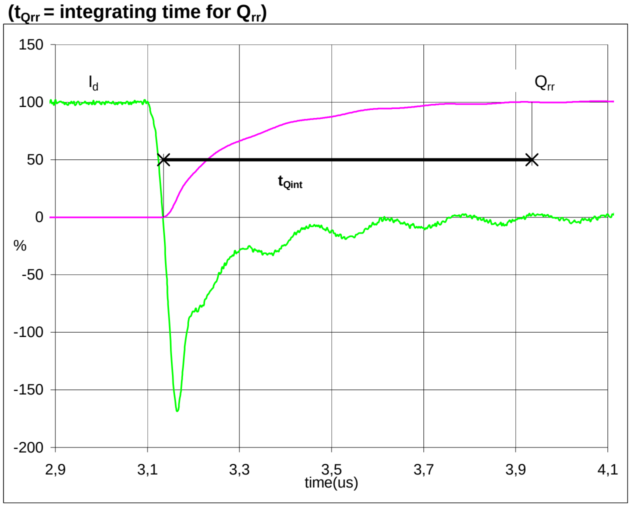


V_d (100%) =	600	V
I_d (100%) =	50	A
I_{RRM} (100%) =	-85	A
t_{rr} =	0,32	μs

Switching Definitions Output Inverter

Figure 9	Output inverter FWD

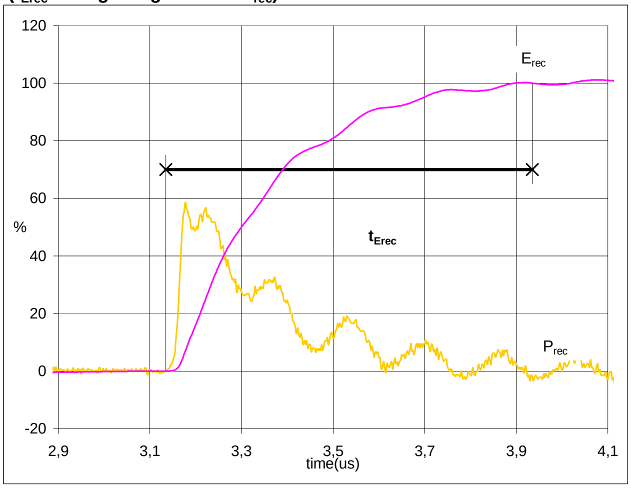
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	50	A
Q_{rr} (100%) =	9,71	µC
t_{Qint} =	0,80	µs

Figure 10	Output inverter FWD

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



P_{rec} (100%) =	30,10	kW
E_{rec} (100%) =	3,97	mJ
t_{Erec} =	0,80	µs

Ordering Code and Marking - Outline - Pinout

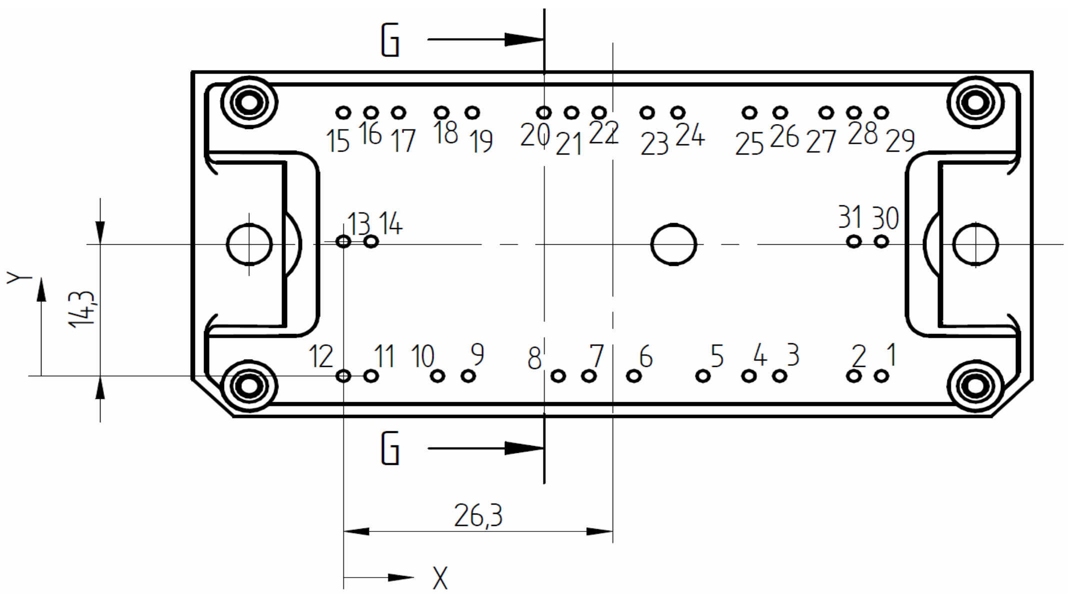
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 17mm housing	V23990-P829-F10-PM	P829F10	P829-F10
without thermal paste 12mm housing	V23990-P829-F108-PM	P829F108	P829-F108

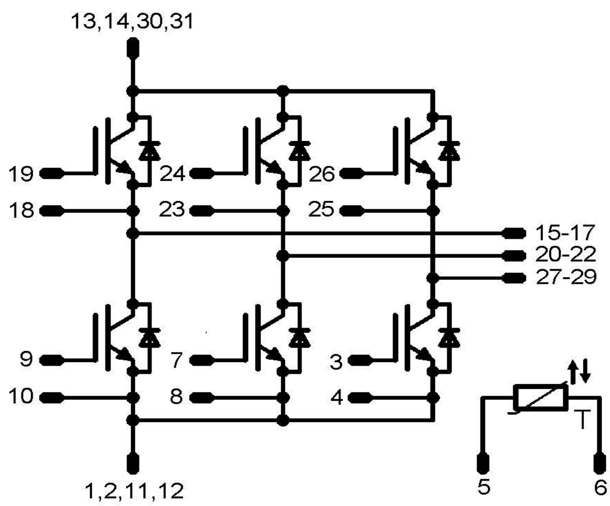
Outline

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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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.