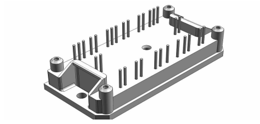
Vincotech

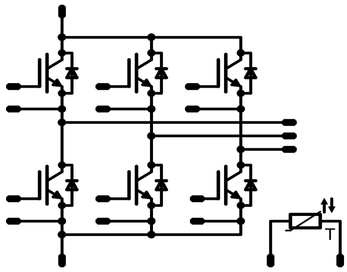
V23990-P824-F10-PM
datasheet

flow **PACK 1 3rd gen**	**600 V / 75 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-P824-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	59	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_j$max	T_h=80°C T_c=80°C	225	A
Power dissipation	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	94	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	$T_j=T_j$max	T_h=80°C T_c=80°C	48	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	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	69	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

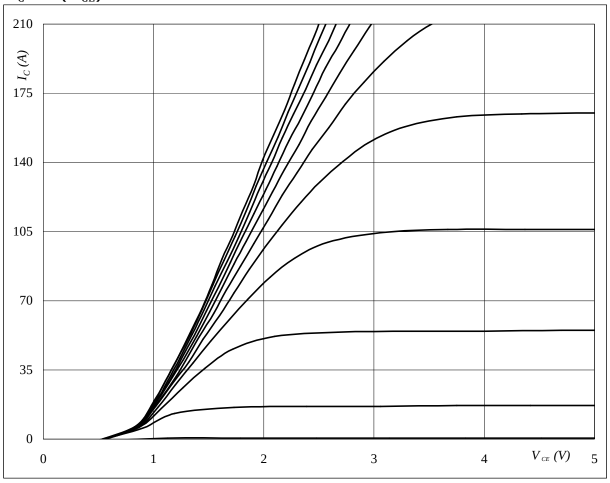
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Inverter Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	VCE=VGE			0,0012	Tj=25°C Tj=150°C	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		75	Tj=25°C Tj=150°C	1,1	1,54 1,79	2,2	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		Tj=25°C Tj=150°C			0,5	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=150°C			650	nA
Integrated Gate resistor	R_{gint}							4		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=4 Ω Rgon=4 Ω	±15	300	75	Tj=25°C Tj=150°C		160 162		ns
Rise time	t_r					Tj=25°C Tj=150°C		21 26		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=150°C		208 242		
Fall time	t_f					Tj=25°C Tj=150°C		105 118		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C		1,08 1,60		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C		1,99 2,76		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		4620		pF
Output capacitance	C_{oss}							288		
Reverse transfer capacitance	C_{rss}							137		
Gate charge	Q_G	Vcc=480V	±15		75	Tj=25°C		470		nC
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						1,01		K/W
Inverter Diode										
Diode forward voltage	V_F				75	Tj=25°C Tj=150°C	1,2	1,79 1,75	2,2	V
Peak reverse recovery current	I_{RRM}	Rgon=4 Ω	±15	300	75	Tj=25°C Tj=150°C		58 88		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		133 169		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=150°C		2,23 6,83		nC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					Tj=25°C Tj=150°C		3338 3540		A/μs
Reverse recovered energy	E_{rec}					Tj=25°C Tj=150°C		0,51 1,50		mWs
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						1,38		K/W
Thermistor										
Rated resistance	R					Tj=25°C		4,7		kΩ
Deviation of R100	$\Delta_{R/R}$	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

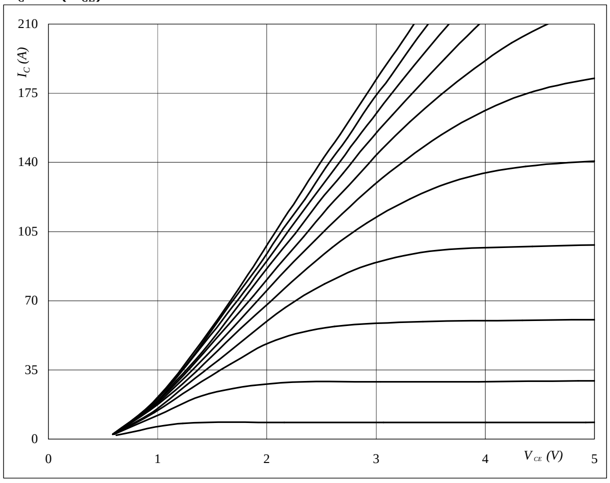
t_p =	250	µs
T_j =	25	°C

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

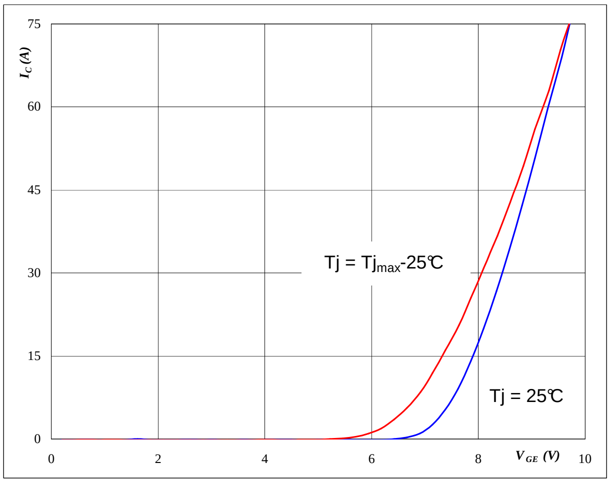
t_p =	250	µs
T_j =	150	°C

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

Figure 3 Output inverter IGBT

Typical transfer characteristics

$I_c = f(V_{GE})$



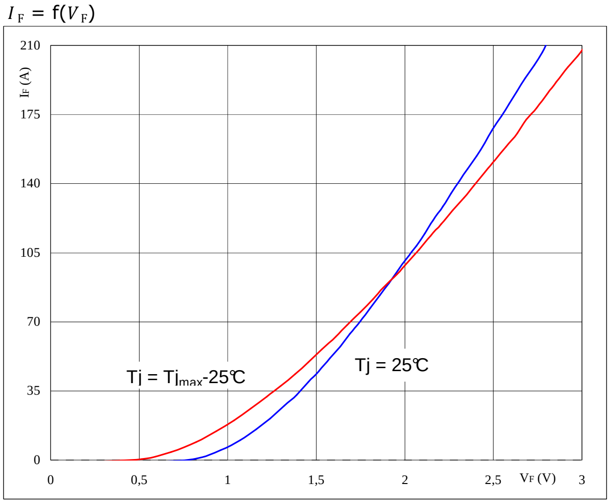
At

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

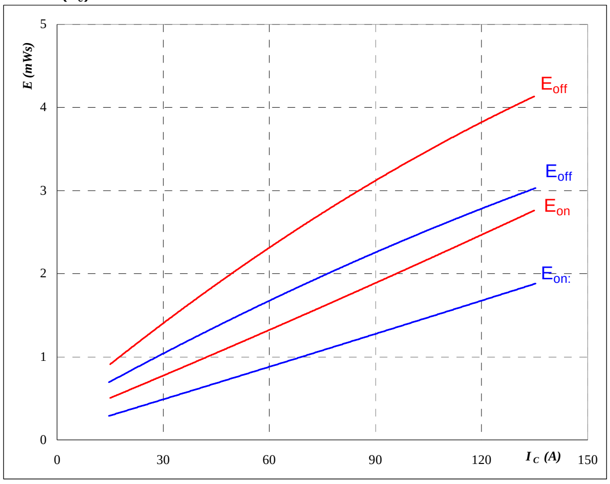
t_p =	250	µs

Output Inverter

Figure 5 Output inverter IGBT

Typical switching energy losses as a function of collector current

$E = f(I_c)$



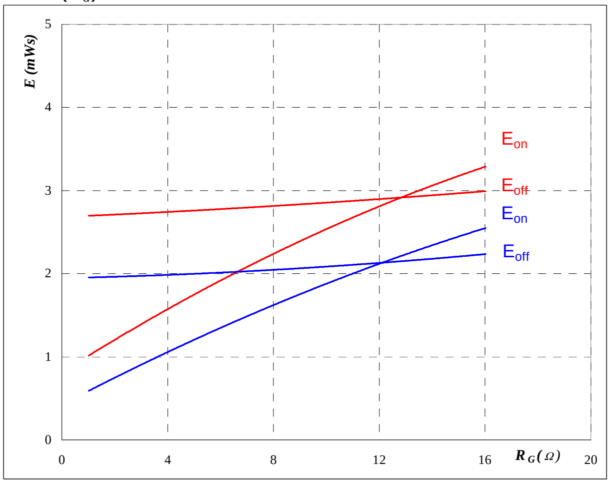
With an inductive load at

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

Figure 6 Output inverter IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



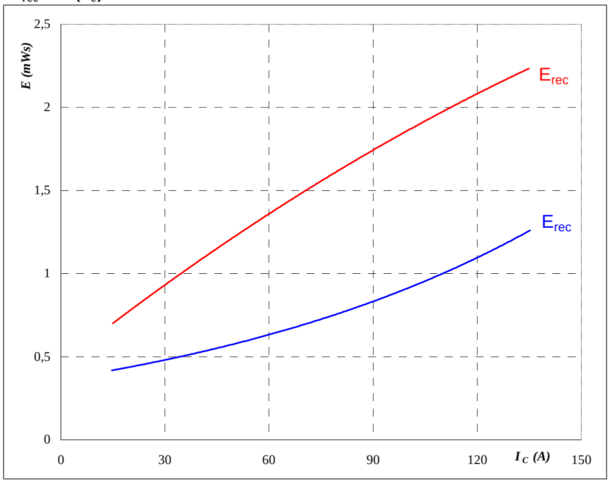
With an inductive load at

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	75	A

Figure 7 Output inverter IGBT

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_c)$



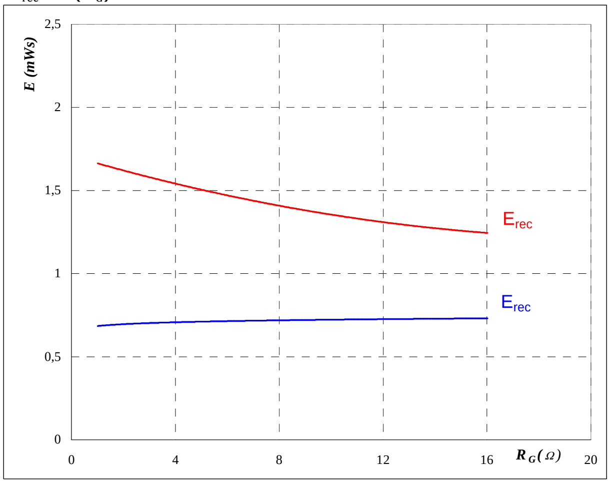
With an inductive load at

T_j =	25/150	°C
V_{CE} =	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

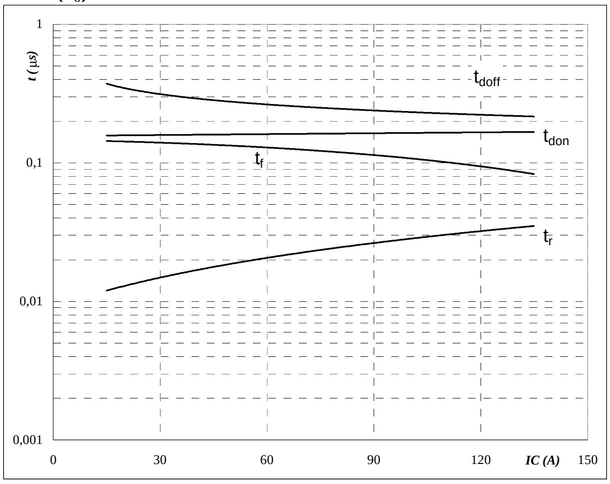
T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	75	A

Output Inverter

Figure 9	Output inverter IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



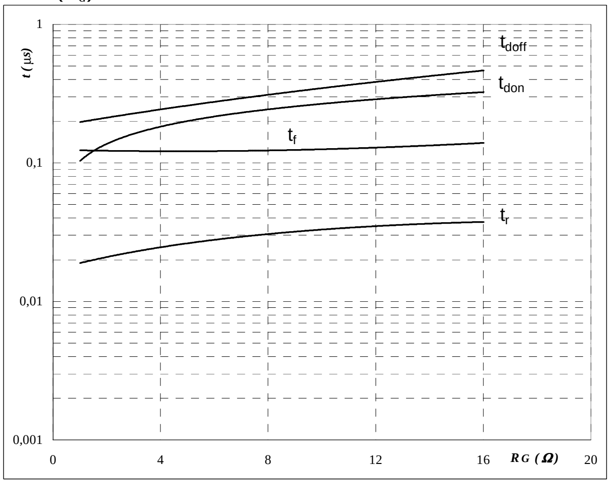
With an inductive load at

T_j =	150	°C
V_{CE} =	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

$t = f(R_G)$



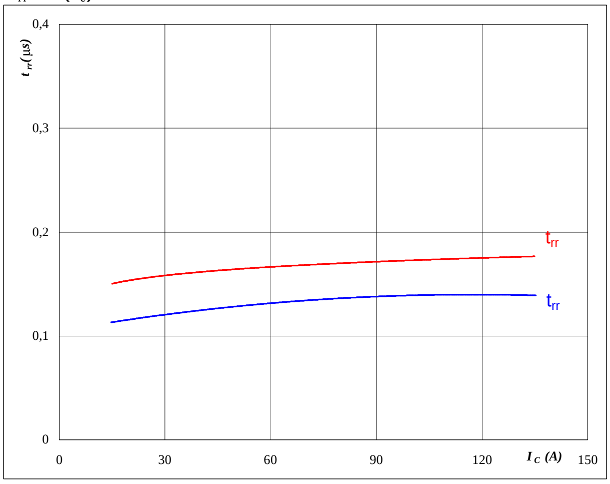
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	75	A

Figure 11	Output inverter FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



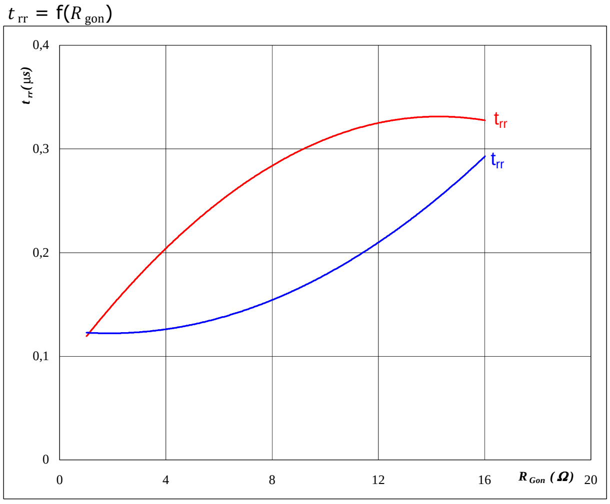
At

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

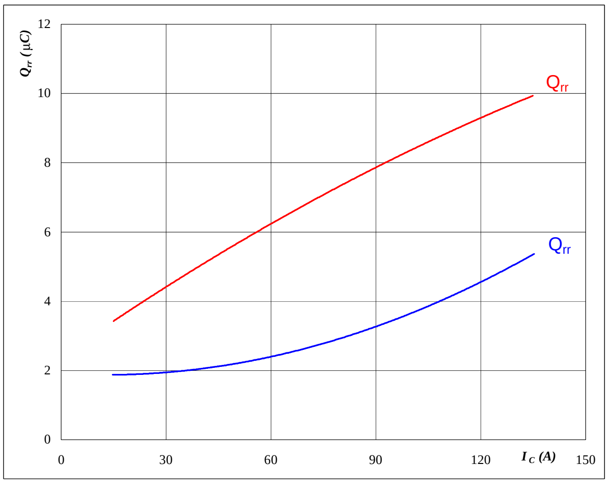
T_j =	25/150	°C
V_R =	300	V
I_F =	75	A
V_{GE} =	±15	V

Output Inverter

Figure 13 Output inverter FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_c)$



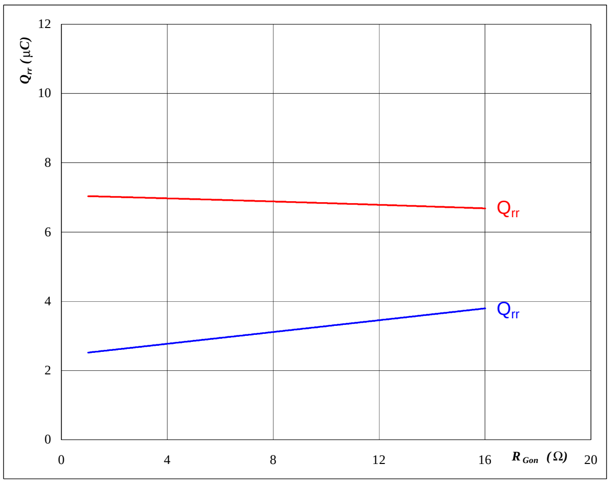
At

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

Figure 14 Output inverter FWD

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

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



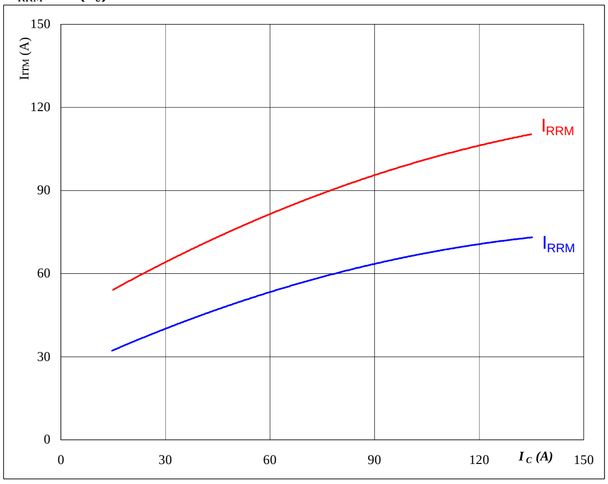
At

T_j =	25/150	°C
V_R =	300	V
I_F =	75	A
V_{GE} =	±15	V

Figure 15 Output inverter FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_c)$



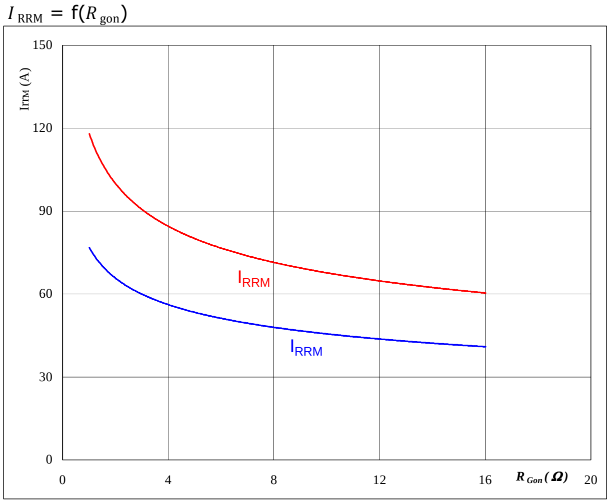
At

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

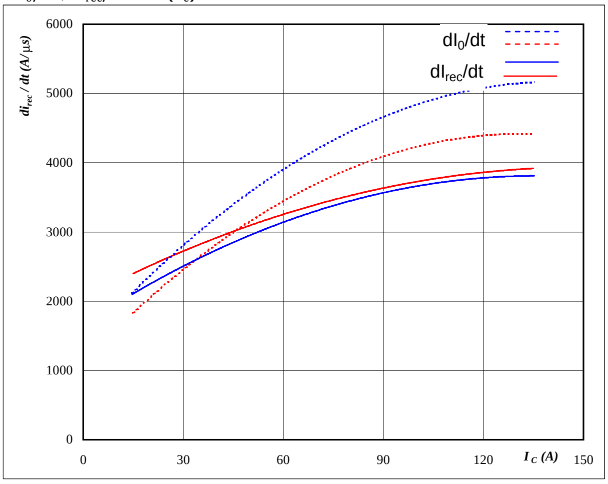
T_j =	25/150	°C
V_R =	300	V
I_F =	75	A
V_{GE} =	±15	V

Output Inverter

Figure 17 Output inverter FWD

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

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



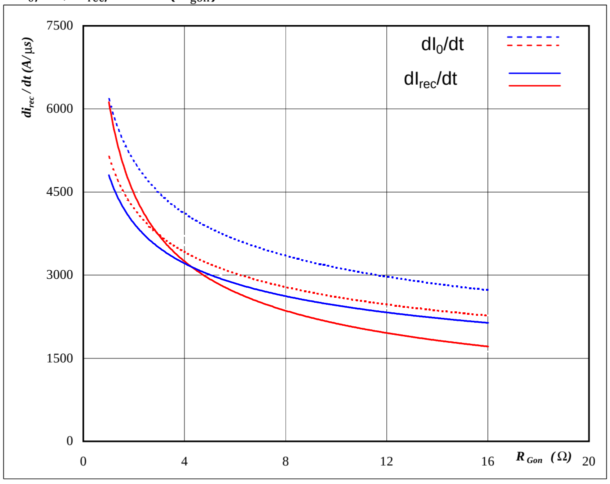
At

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

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



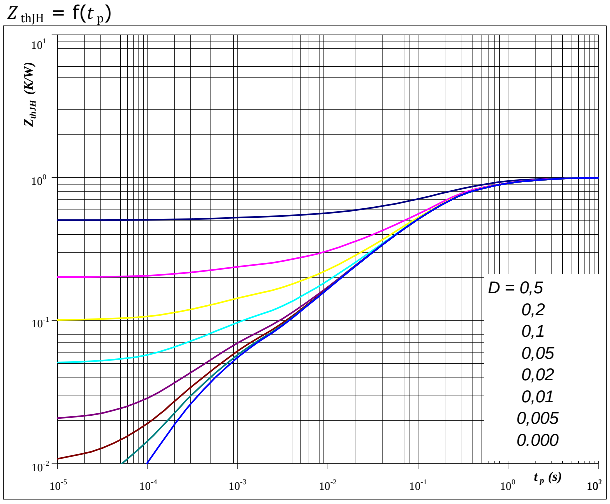
At

T_j =	25/150	°C
V_R =	300	V
I_F =	75	A
V_{GE} =	±15	V

Figure 19 Output inverter IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	1,01	K/W

IGBT thermal model values

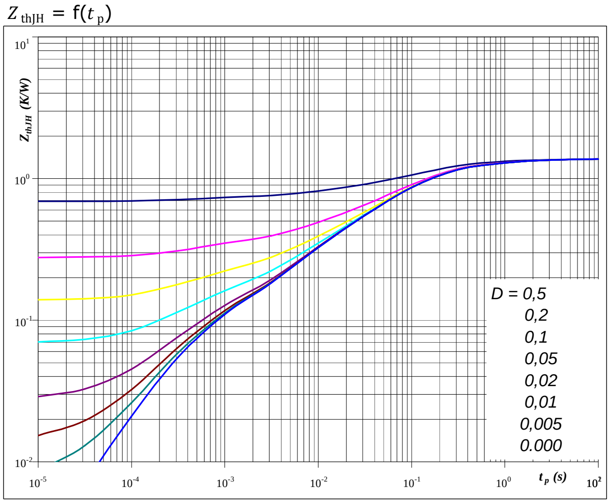
R (K/W)	Tau (s)
0,03	9,8E+00
0,16	1,1E+00
0,54	1,8E-01
0,18	3,3E-02
0,06	5,8E-03
0,04	4,6E-04

R (K/W)

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} =	1,38	K/W

FWD thermal model values

R (K/W)	Tau (s)
0,03	9,9E+00
0,17	1,0E+00
0,64	1,4E-01
0,31	3,3E-02
0,15	6,2E-03
0,08	4,2E-04

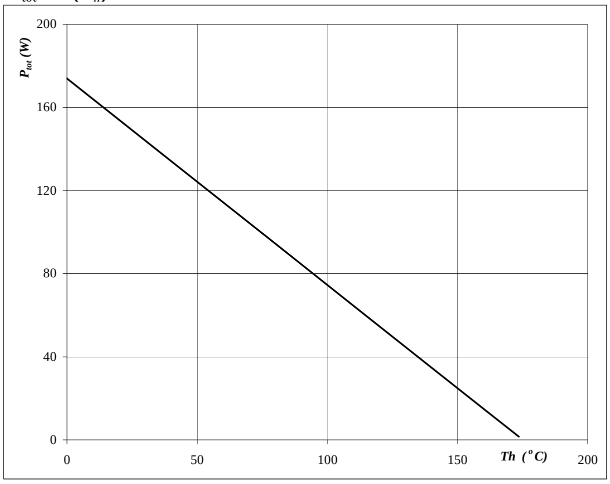
R (K/W)

Output Inverter

Figure 21 Output inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



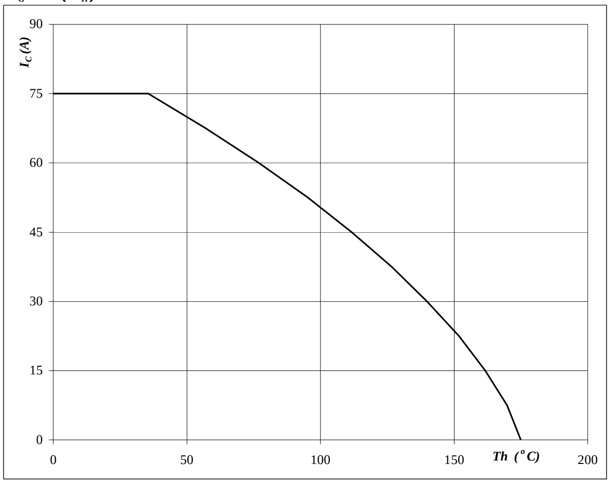
At

T_j = 175 °C

Figure 22 Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

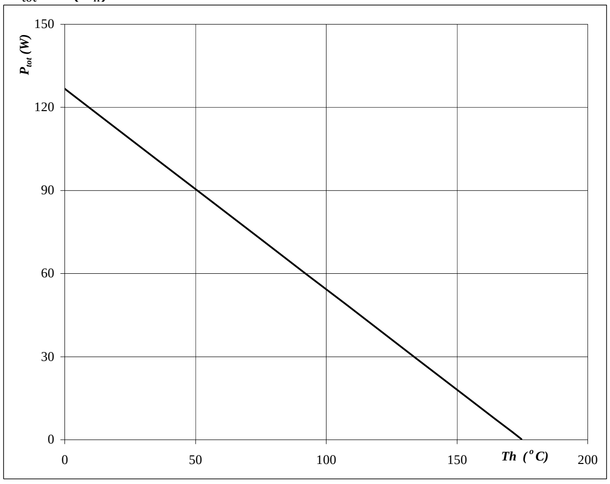
T_j = 175 °C

V_{GE} = 15 V

Figure 23 Output inverter FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



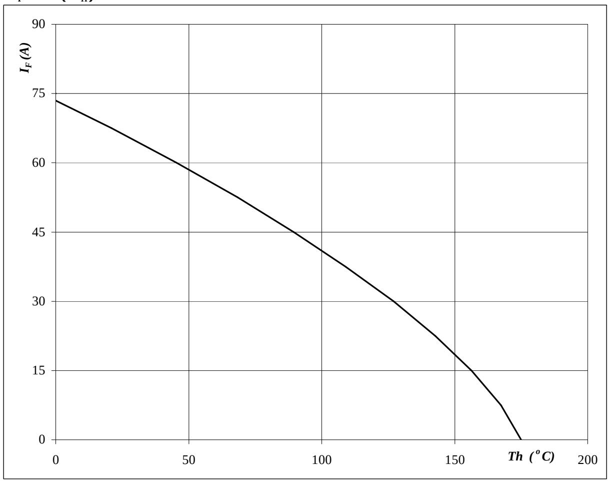
At

T_j = 175 °C

Figure 24 Output inverter FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

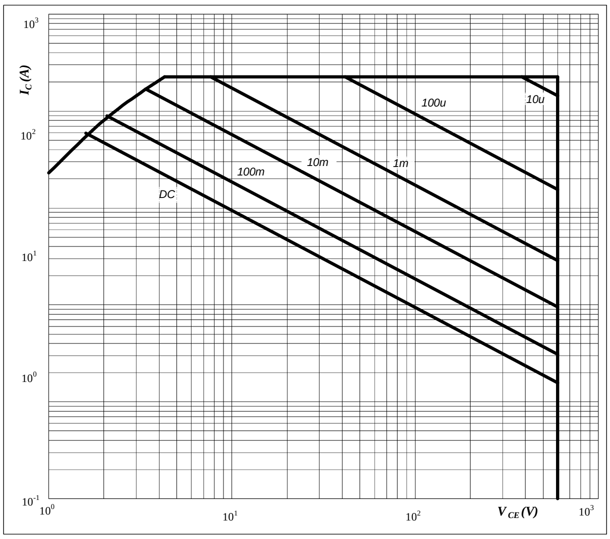
T_j = 175 °C

Output Inverter

Figure 25	Output inverter IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



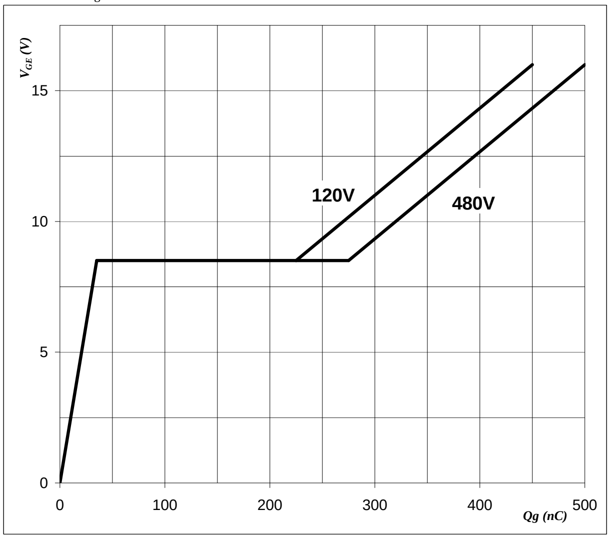
At

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

$V_{GE} = f(Q_g)$



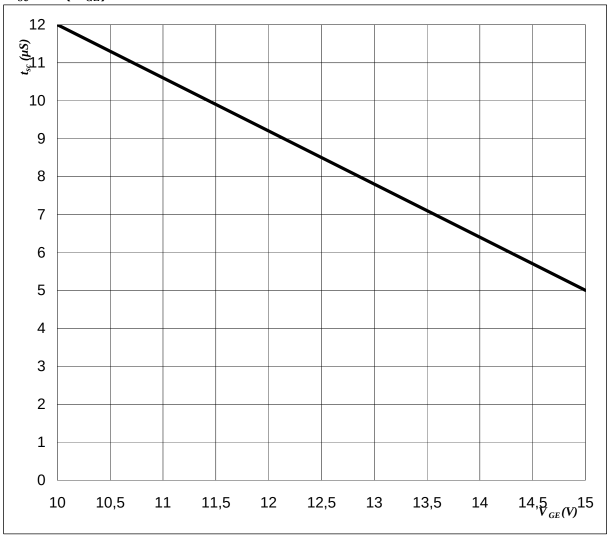
At

I_C =	75	A

Figure 27	Output inverter IGBT

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

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



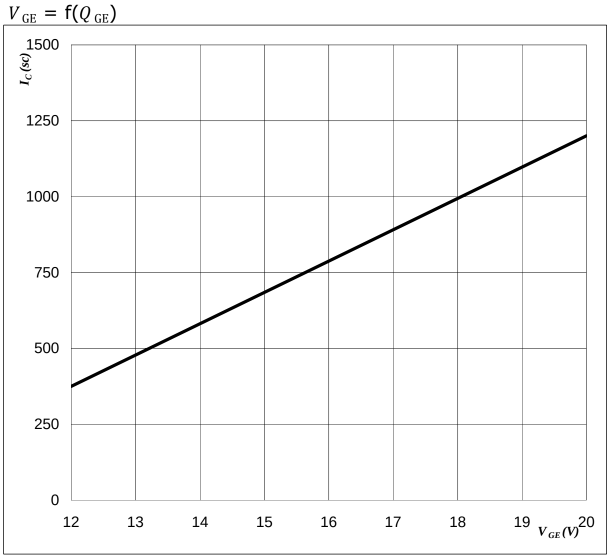
At

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

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



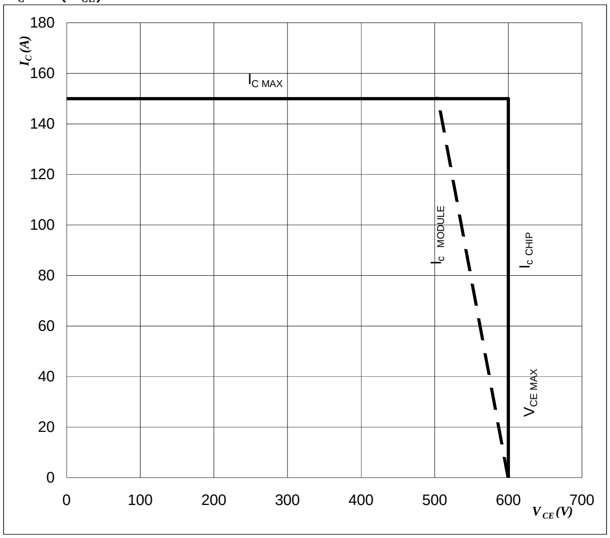
At

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

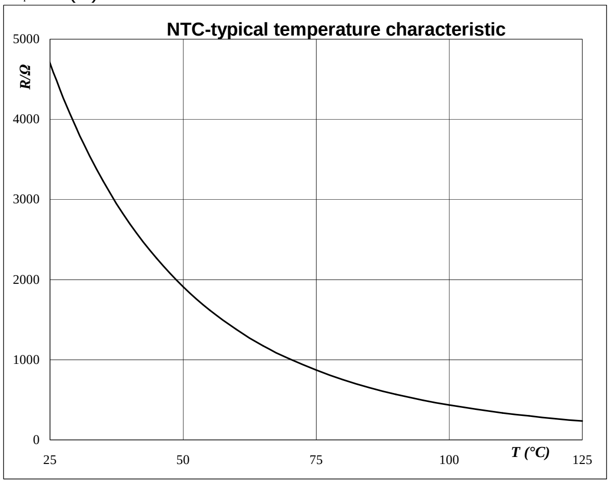
Switching mode : 3phase SPWM

Thermistor

Figure 1	Thermistor

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$



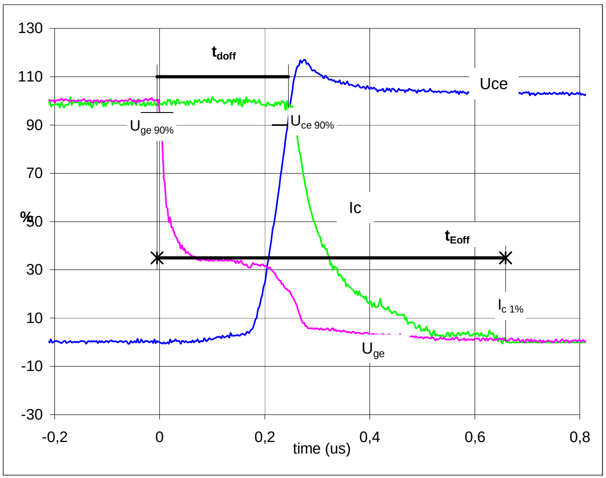
Switching Definitions Output Inverter

General conditions

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

Figure 1 Output inverter IGBT

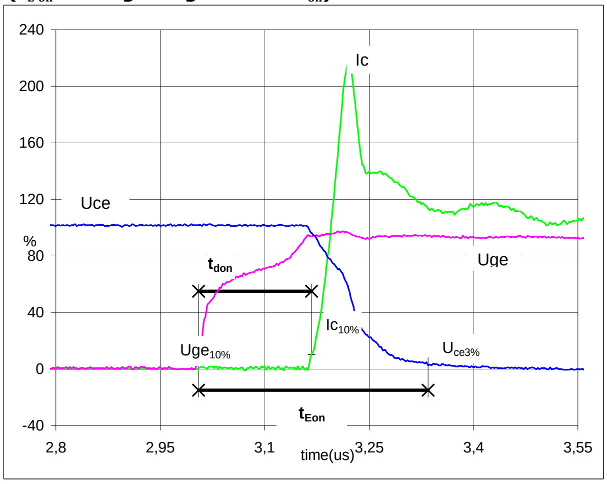
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	75	A
t_{doff} =	0,24	µs
$t_{E\,off}$ =	0,66	µs

Figure 2 Output inverter IGBT

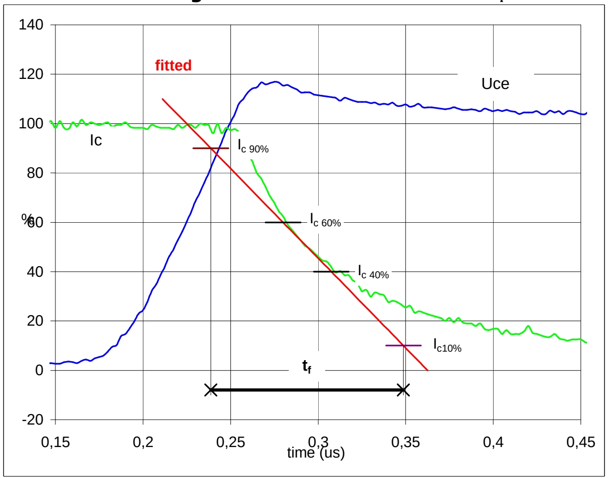
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	75	A
t_{don} =	0,16	µs
$t_{E\,on}$ =	0,33	µs

Figure 3 Output inverter IGBT

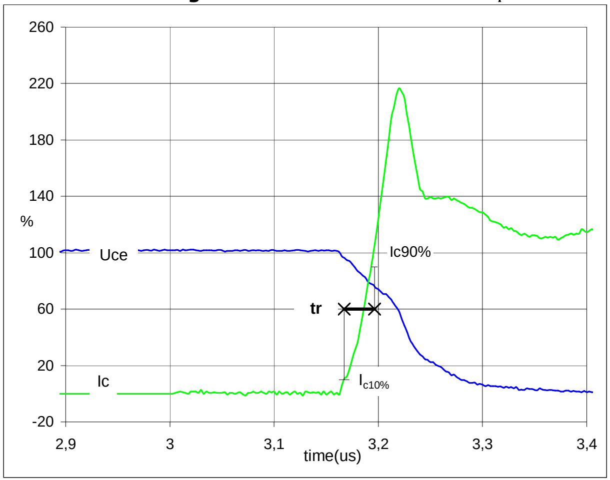
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	300	V
I_C (100%) =	75	A
t_f =	0,12	µs

Figure 4 Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

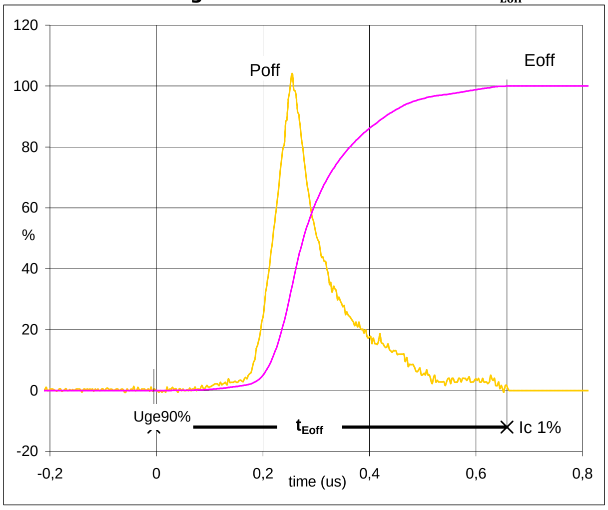


V_C (100%) =	300	V
I_C (100%) =	75	A
t_r =	0,03	µs

Switching Definitions Output Inverter

Figure 5 Output inverter IGBT

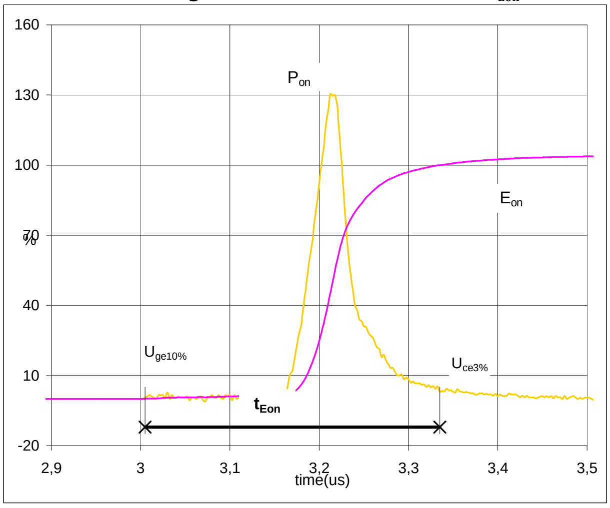
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	22,54	kW
E_{off} (100%) =	2,76	mJ
$t_{E\,off}$ =	0,66	µs

Figure 6 Output inverter IGBT

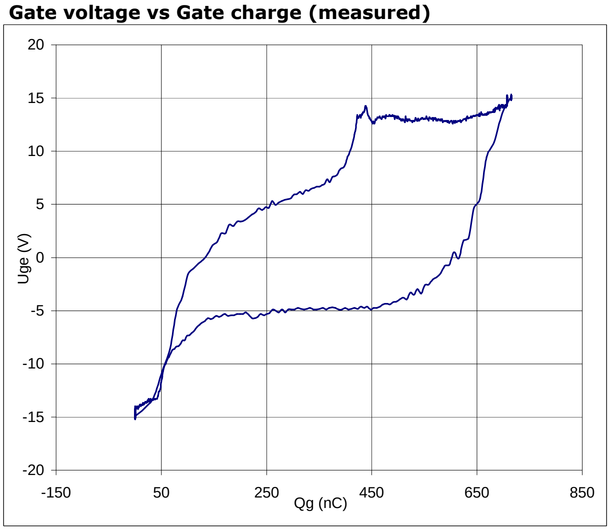
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	22,54	kW
E_{on} (100%) =	1,60	mJ
$t_{E\,on}$ =	0,33	µs

Figure 7 Output inverter FWD

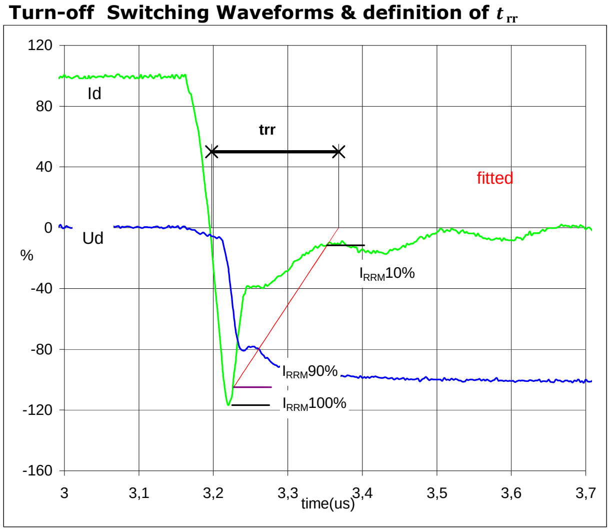
Gate voltage vs Gate charge (measured)



$V_{GE\,off}$ =	-15	V
$V_{GE\,on}$ =	15	V
V_{C} (100%) =	300	V
I_{C} (100%) =	75	A
Q_{g} =	715,15	nC

Figure 8 Output inverter IGBT

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

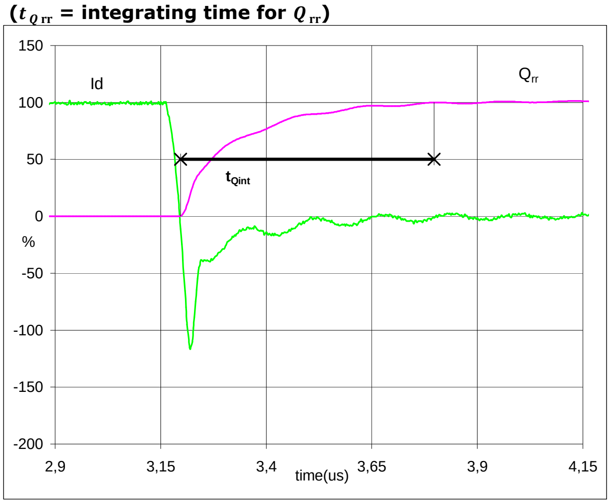


V_{d} (100%) =	300	V
I_{d} (100%) =	75	A
I_{RRM} (100%) =	-88	A
t_{rr} =	0,17	µs

Switching Definitions Output Inverter

Figure 9	Output inverter FWD

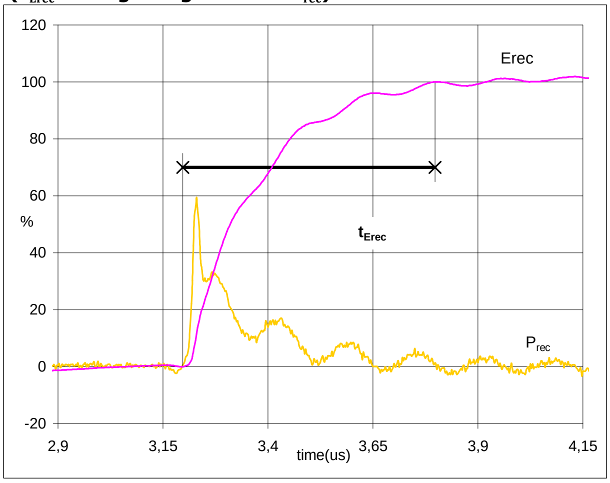
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	75	A
Q_{rr} (100%) =	6,83	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%) =	22,54	kW
E_{rec} (100%) =	1,50	mJ
$t_{E\,rec}$ =	0,60	µs

Ordering Code and Marking - Outline - Pinout

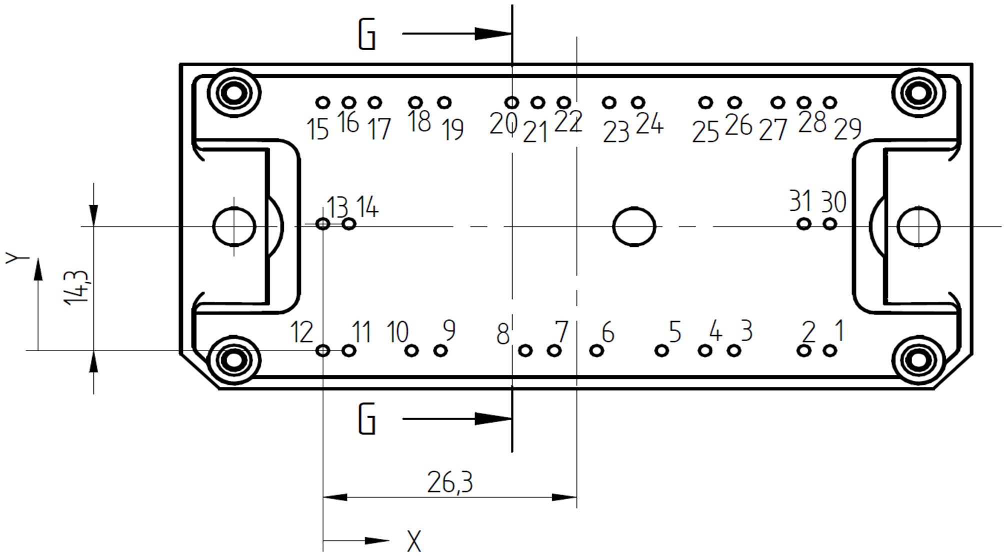
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 17mm housing	V23990-P824-F10-PM	P824-F10	P824-F10

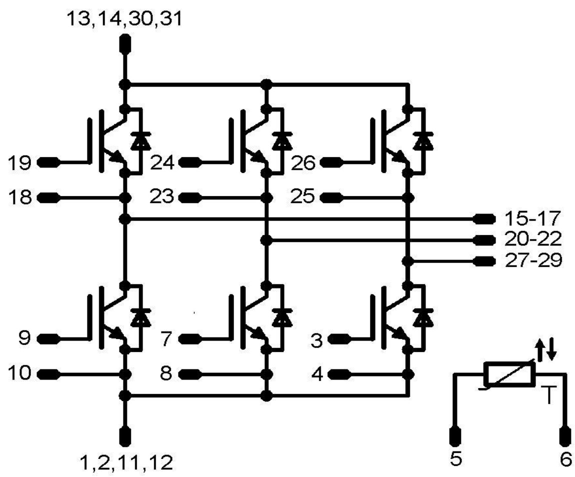
Outline

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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