flowPIM0 3rd Gen 1200V/15A

Features

- 2 Clips housing in 12 and 17mm height
- Trench Fieldstop Technology IGBT4
- Optional w/o BRC

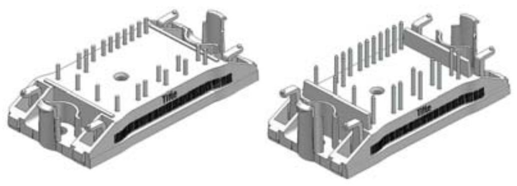
Target Applications

- Industrial Drives
- Embedded Generation

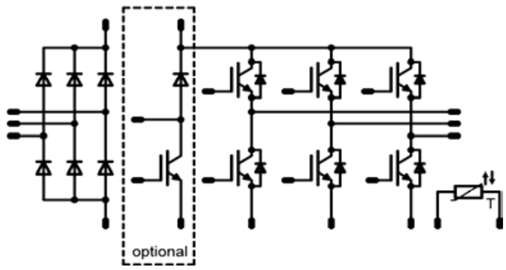
Types

- V23990-P840-A48-PM 12mm height
- V23990-P840-A49-PM 17mm height
- V23990-P840-C48-PM 12mm height; w/o BRC
- V23990-P840-C49-PM 17mm height; w/o BRC

flow0 Housing



Schematics



Maximum Ratings

Tj=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Input Rectifier Doide					
Repetitive peak reverse voltage	V_{RRM}			1600	V
Forward current per diode	I_{FAV}	DC current	T_h=80℃ T_c=80℃	28	A
Surge forward current	I_{FSM}	t_p=10ms		220	A
I2t-value	I^2t			240	A2s
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	33	W
Maximum Junction Temperature	T_{jmax}			150	℃
Transistor Inverter					
Collector-emitter voltage	V_{CE}			1200	V
DC collector current	I_C	T_j=$T_j$max	T_h=80℃ T_c=80℃	19	A
Repetitive peak collector current	I_{Cpuls}	tp limited by $T_j$max		45	A
Power dissipation per IGBT	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	52	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC}	T_j≤150℃		10	μs
	V_{CC}	V_{GE}=15V		800	V
Maximum Junction Temperature	T_{jmax}			175	℃

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Diode Inverter				
Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
DC forward current	I_F	$T_j=T_j$max T_h=80°C T_c=80°C	18	A
Repetitive peak forward current	I_{FRM}	tp limited by $T_j$max	30	A
Power dissipation per Diode	P_{tot}	$T_j=T_j$max T_h=80°C T_c=80°C	38	W
Maximum Junction Temperature	T_{jmax}		175	°C
Transistor BRC				
Collector-emitter voltage	V_{CE}		1200	V
DC collector current	I_C	$T_j=T_j$max T_h=80°C T_c=80°C	12	A
Repetitive peak collector current	I_{cpuls}	tp limited by $T_j$max T_h=80°C	24	A
Power dissipation per IGBT	P_{tot}	$T_j=T_j$max T_h=80°C T_c=80°C	40	W
Gate-emitter peak voltage	V_{GE}		±20	V
Short circuit ratings	t_{SC}	T_j≤150°C	10	μs
	V_{CC}	V_{GE}=15V	800	V
Maximum Junction Temperature	T_{jmax}		175	°C
Diode BRC				
Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
DC forward current	I_F	$T_j=T_j$max T_h=80°C T_c=80°C	10	A
Repetitive peak forward current	I_{FRM}	tp limited by $T_j$max T_h=80°C	15	A
Power dissipation per Diode	P_{tot}	$T_j=T_j$max T_h=80°C T_c=80°C	22	W
Maximum Junction Temperature	T_{jmax}		150	°C
Thermal properties				
Storage temperature	T_{stg}		-40…+125	°C
Operation temperature	T_{jop}		-40…+150	°C
Insulation properties				
Insulation voltage	V_{is}	t=2s DC voltage	4000	V
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(℃)	Min	Typ	Max	
Input Rectifier Diode										
Forward voltage	V_F				30	Tj=25℃ Tj=125℃	1	1,22 1,19	1,9	V
Threshold voltage (for power loss calc. only)	V_{to}				30	Tj=25℃ Tj=125℃		0,93 0,81		V
Slope resistance (for power loss calc. only)	r_t					Tj=25℃ Tj=125℃		0,010 0,013		Ω
Reverse current	I_r			1600		Tj=25℃ Tj=150℃			0,1	mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,16		K/W
Transistor Inverter										
Gate emitter threshold voltage	$V_{GE(th)}$	VCE=VGE			0,0005	Tj=25℃ Tj=125℃	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$				15	Tj=25℃ Tj=125℃		1,94 2,26		V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	1200		Tj=25℃ Tj=125℃			0,01	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25℃ Tj=125℃			200	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	Rgon=16 Ohm Rgoff=16 Ohm	±15	600	15	Tj=25℃ Tj=125℃		60		ns
Rise time	t_r					Tj=25℃ Tj=125℃		19		ns
Turn-off delay time	$t_{d(off)}$					Tj=25℃ Tj=125℃		239		ns
Fall time	t_f					Tj=25℃ Tj=125℃		106		ns
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=125℃		1,25		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=125℃		1,24		mWs
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25℃		1000		pF
Output capacitance	C_{oss}							100		pF
Reverse transfer capacitance	C_{rss}							56		pF
Gate charge	Q_{Gate}	Vcc=960V	±15		15	Tj=25℃		93		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,83		K/W
Diode Inverter										
Diode forward voltage	V_F				10	Tj=25℃ Tj=125℃	1,35	1,90 1,91	2,35	V
Reverse leakage current	I_{rm}			1200		Tj=25℃ Tj=125℃		2,7		mA
Peak reverse recovery current	I_{RRM}	Rgon=16 Ohm	±15	600	15	Tj=25℃ Tj=125℃		16		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=125℃		433		ns
Reverse recovered charge	Q_{rr}					Tj=25℃ Tj=125℃		2,75		uC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25℃ Tj=125℃		109		A/ms
Reverse recovered energy	Erec					Tj=25℃ Tj=125℃		1,16		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,52		K/W

Characteristic Values

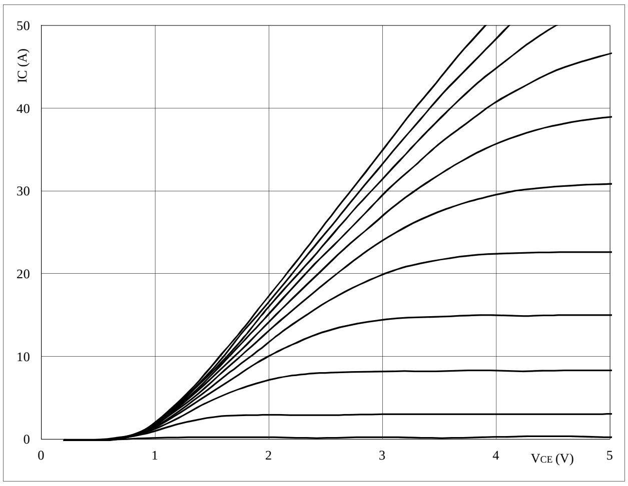
Parameter	Symbol	Conditions	V_{GE}(V) or V_{GS}(V)	V_r(V) or V_{CE}(V) or V_{DS}(V)	I_C(A) or I_F(A) or I_D(A)	T(℃)	Min	Typ	Max	Unit
Transistor BRC										
Gate emitter threshold voltage	$V_{GE(th)}$	VCE=VGE			0,0003	Tj=25℃ Tj=125℃	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$				8	Tj=25℃ Tj=125℃	1,6	1,87 2,22	2,1	V
Collector-emitter cut-off	I_{CES}		0	1200		Tj=25℃ Tj=125℃			0,05	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25℃ Tj=125℃			200	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	Rgon=32Ohm Rgoff=32Ohm	15	600	8	Tj=25℃ Tj=125℃		 72		ns
Rise time	t_r					Tj=25℃ Tj=125℃		 24		ns
Turn-off delay time	$t_{d(off)}$					Tj=25℃ Tj=125℃		 228		ns
Fall time	t_f					Tj=25℃ Tj=125℃		 104		ns
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=125℃		 0,71		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=125℃		 0,62		mWs
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25℃		490		pF
Output capacitance	C_{oss}							50		pF
Reverse transfer capacitance	C_{rss}							30		pF
Gate charge	Q_{Gate}	Vcc=960V	±15		8	Tj=25℃		50		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,36		K/W
Diode BRC										
Diode forward voltage	V_F				7,5	Tj=25℃ Tj=125℃	0,8	1,67 1,61	2,2	V
Reverse leakage current	I_r			1200		Tj=25℃ Tj=125℃			250	mA
Peak reverse recovery current	I_{RRM}	Rgon=32Ohm	15	600	8	Tj=25℃ Tj=125℃		 10		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=125℃		 427		ns
Reverse recovered charge	Q_{rr}					Tj=25℃ Tj=125℃		 1,64		mC
Peak rate of fall of recovery current	di(rec)max/dt					Tj=25℃ Tj=125℃		 73		A/ms
Reverse recovery energy	E_{rec}					Tj=25℃ Tj=125℃		 0,69		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						3,15		K/W
Thermistor										
Rated resistance	R_{25}	Tol. ±13%				Tj=25℃	19,1	22	24,9	kΩ
	R_{100}	Tol. ±5%				Tj=100℃	1411	1486	1560	
Power dissipation given Epcos-Typ	P					Tj=25℃		210		mW
B-value	$B_{(25/100)}$	Tol. ±3%				Tj=25℃		4000		K

Output Inverter

Figure 1 Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

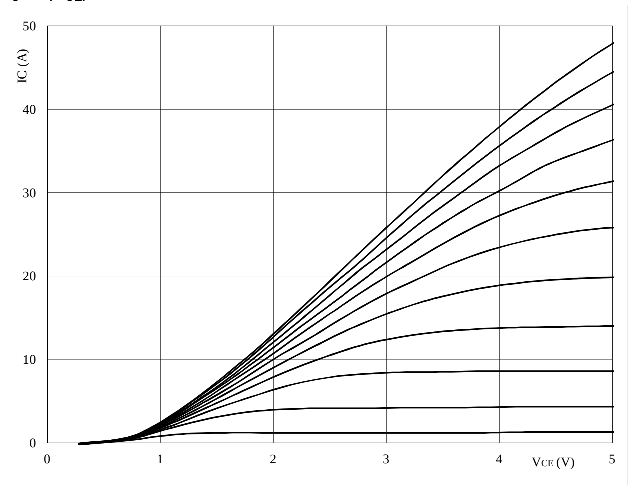
t_p =	250	µs
T_j =	25	℃

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

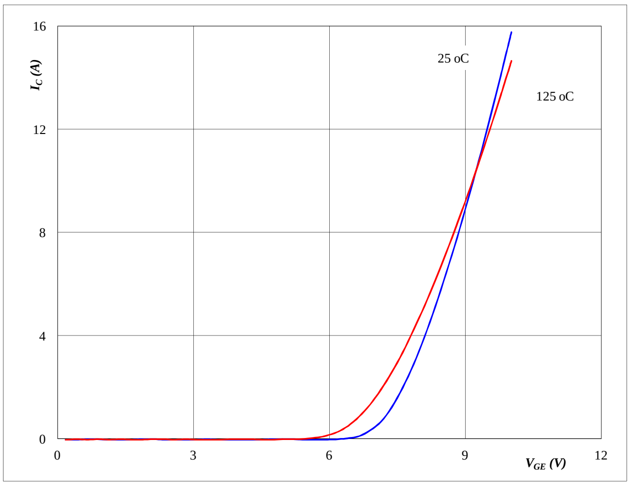
t_p =	250	µs
T_j =	125	℃

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

Figure 3 Output inverter IGBT

Typical transfer characteristics

$Ic = f(V_{GE})$



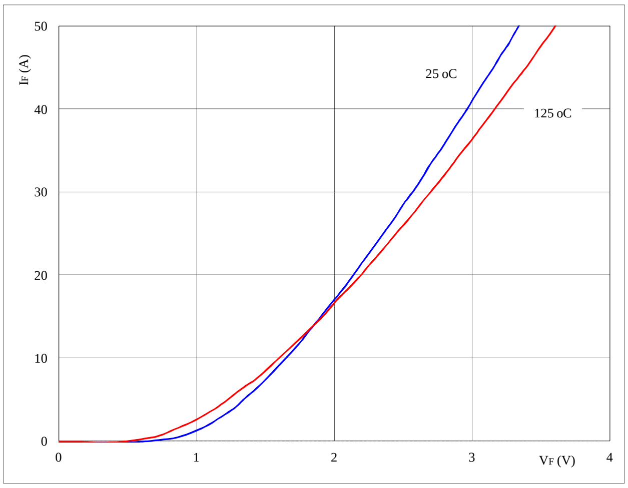
At

t_p =	250	µs
V_{CE} =	10	V

Figure 4 Output inverter FRED

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

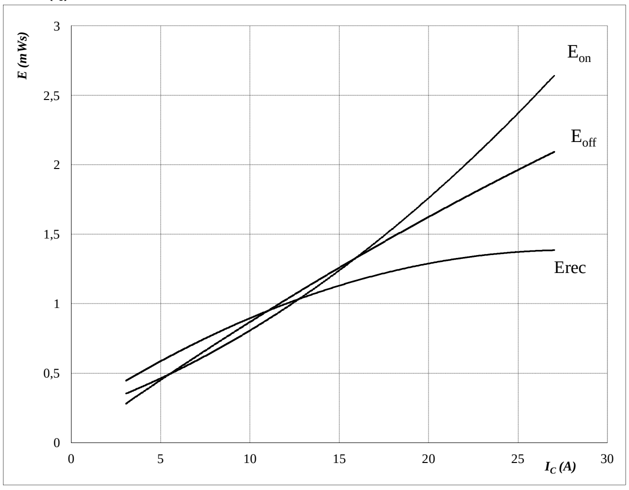
t_p =	250	µs

Output Inverter

Figure 5 Output inverter IGBT

Typical switching energy losses as a function of collector current

E = f(I_C)



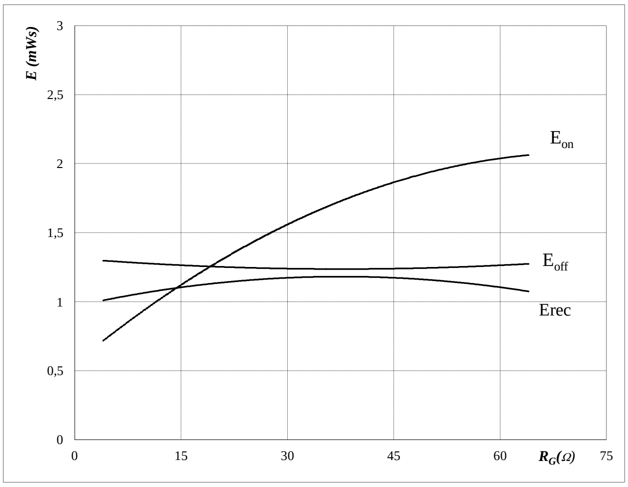
With an inductive load at

T_j =	125	℃
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

Figure 6 Output inverter IGBT

Typical switching energy losses as a function of gate resistor

E = f(R_G)



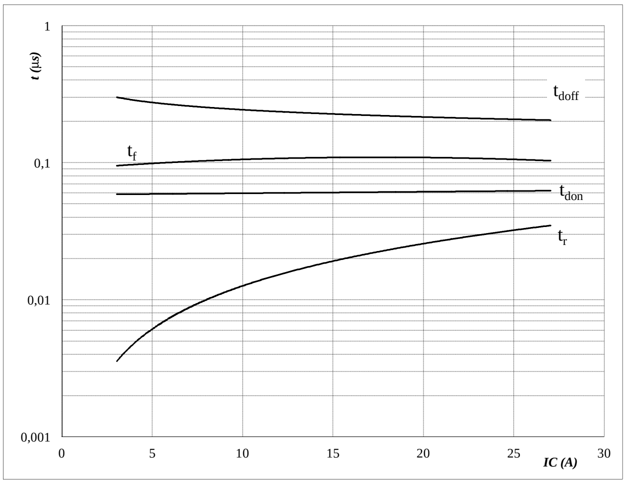
With an inductive load at

T_j =	125	℃
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	15	A

Figure 7 Output inverter IGBT

Typical switching times as a function of collector current

t = f(I_C)



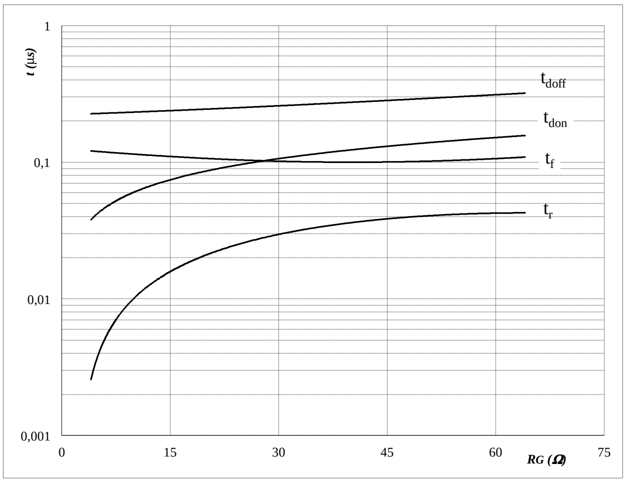
With an inductive load at

T_j =	125	℃
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

Figure 8 Output inverter IGBT

Typical switching times as a function of gate resistor

t = f(R_G)



With an inductive load at

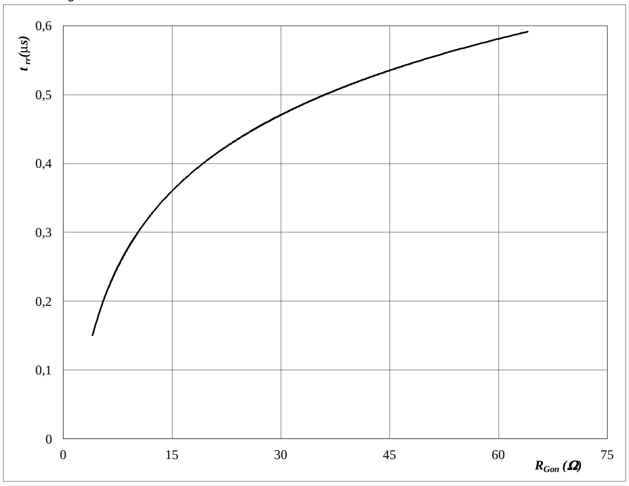
T_j =	125	℃
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	15	A

Output Inverter

Figure 9 Output inverter FRED diode

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

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



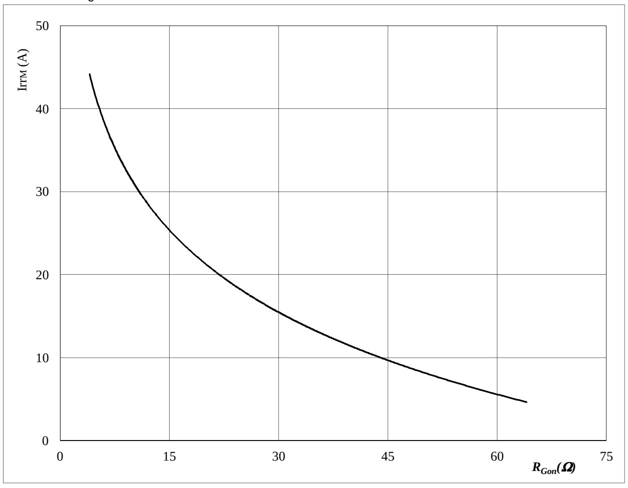
At

T_j =	125	°C
V_R =	600	V
I_F =	15	A
V_{GE} =	±15	V

Figure 10 Output inverter FRED diode

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

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



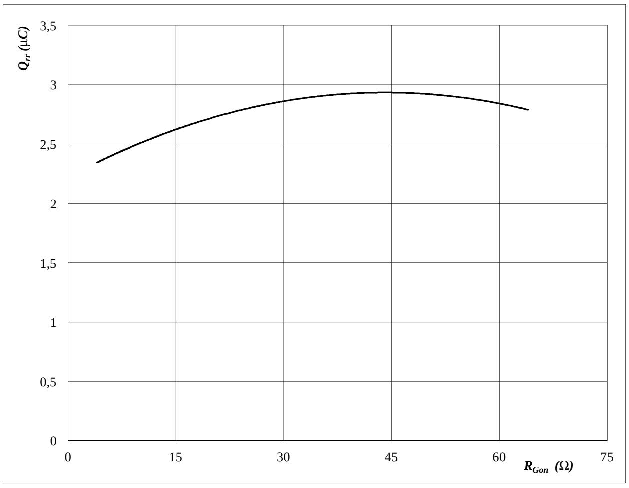
At

T_j =	125	°C
V_R =	600	V
I_F =	15	A
V_{GE} =	±15	V

Figure 11 Output inverter FRED diode

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

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



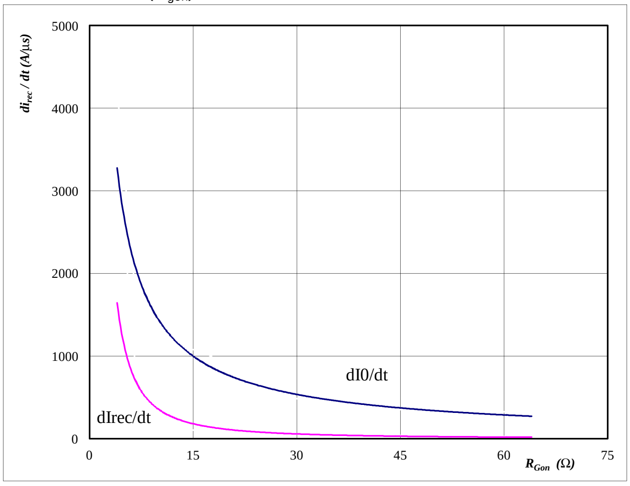
At

T_j =	125	°C
V_R =	600	V
I_F =	15	A
V_{GE} =	±15	V

Figure 12 Output inverter FRED diode

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

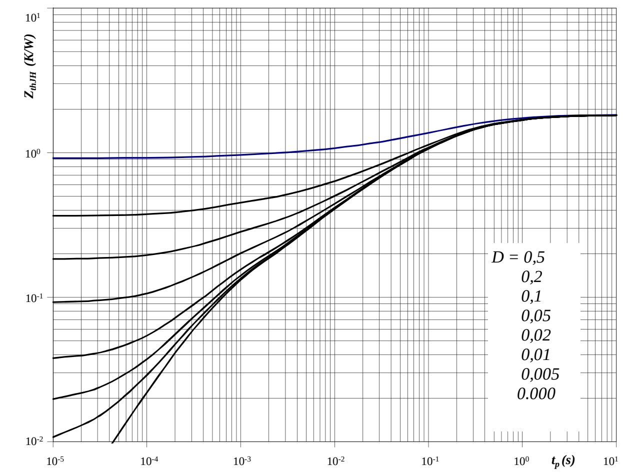
T_j =	125	°C
V_R =	600	V
I_F =	15	A
V_{GE} =	±15	V

Output Inverter

Figure 13

IGBT transient thermal impedance
as a function of pulse width

$Z_{thJH} = f(tp)$



With

D = tp / T

R_{thJH} = 1,83 K/W

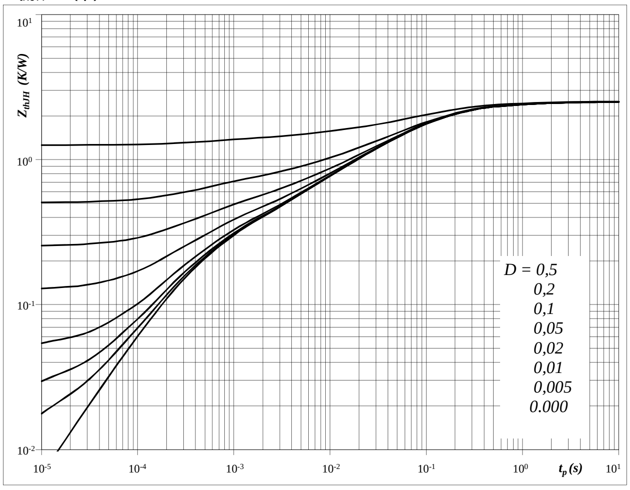
IGBT thermal model values

R (C/W)	Tau (s)
0,06	5,6E+00
0,28	8,7E-01
0,77	1,7E-01
0,42	3,4E-02
0,19	6,2E-03
0,10	5,5E-04

Figure 14

FRED transient thermal impedance
as a function of pulse width

$Z_{thJH} = f(tp)$



With

D = tp / T

R_{thJH} = 2,52 K/W

FRED thermal model values

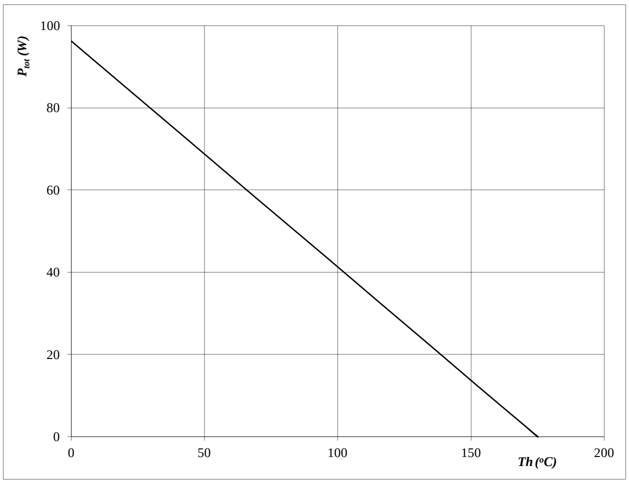
R (C/W)	Tau (s)
0,05	9,6E+00
0,26	8,2E-01
1,04	1,2E-01
0,69	2,6E-02
0,27	3,4E-03
0,21	3,8E-04

Output Inverter

Figure 15 Output inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

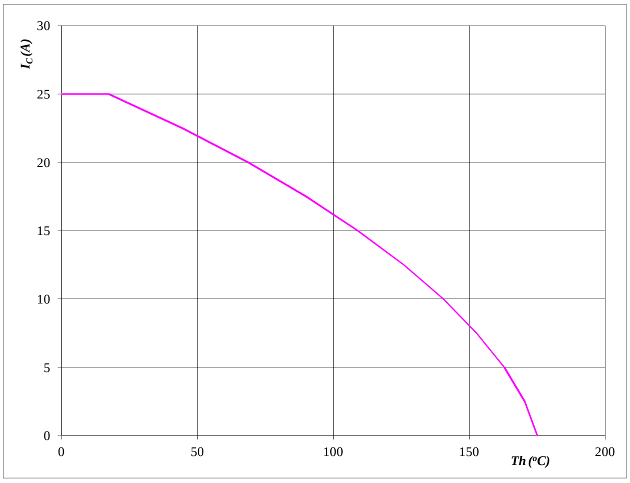


At
$T_j =$ 175 ℃

Figure 16 Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$

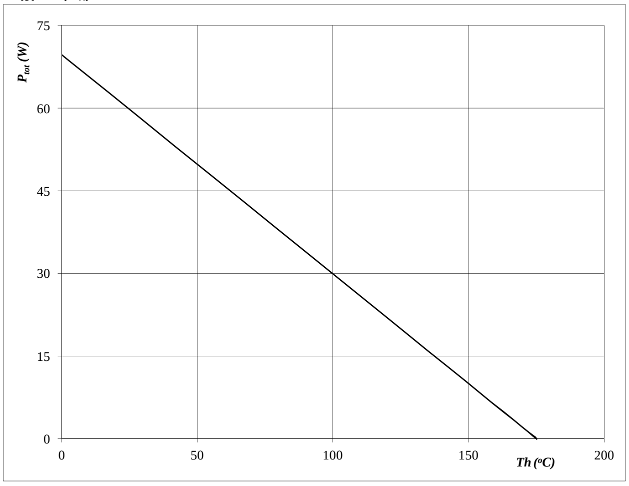


At
$T_j =$ 175 ℃
$V_{GE} =$ 15 V

Figure 17 Output inverter FRED

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

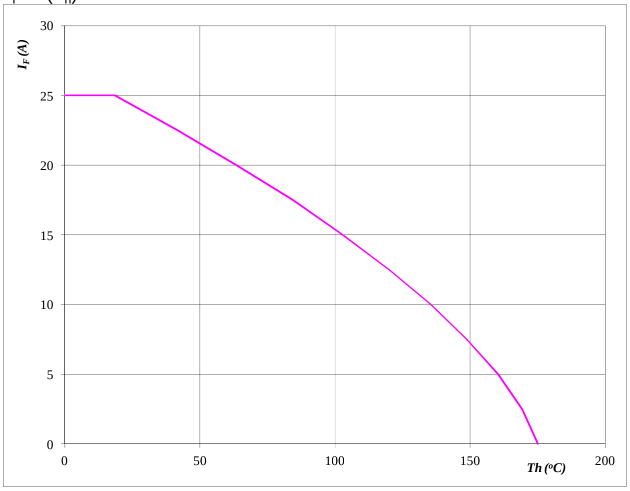


At
$T_j =$ 175 ℃

Figure 18 Output inverter FRED

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



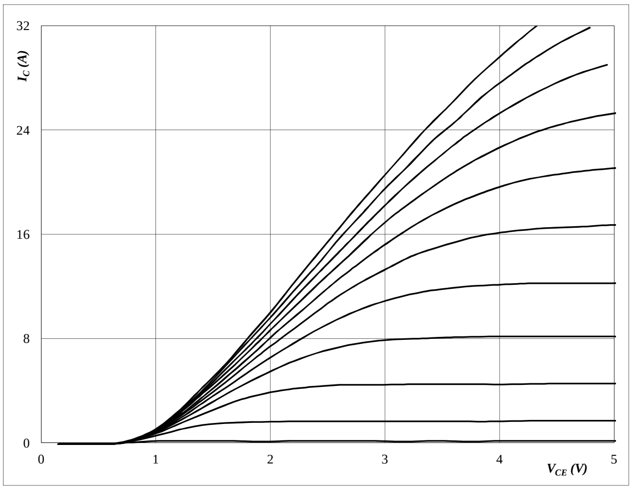
At
$T_j =$ 175 ℃

Brake

Figure 1 Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

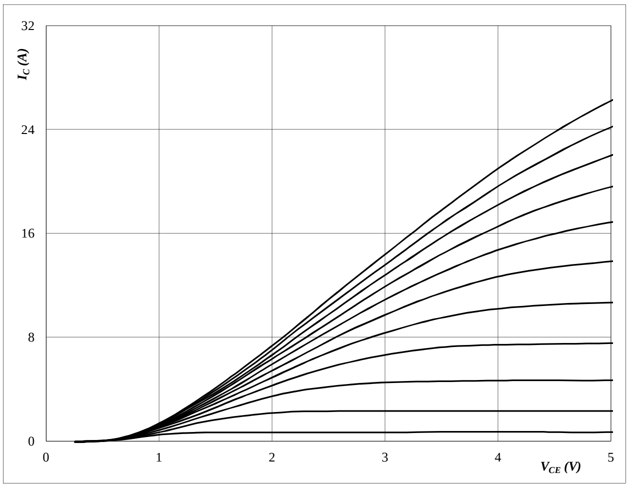
t_p =	250	µs
T_j =	25	°C

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

Figure 2 Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

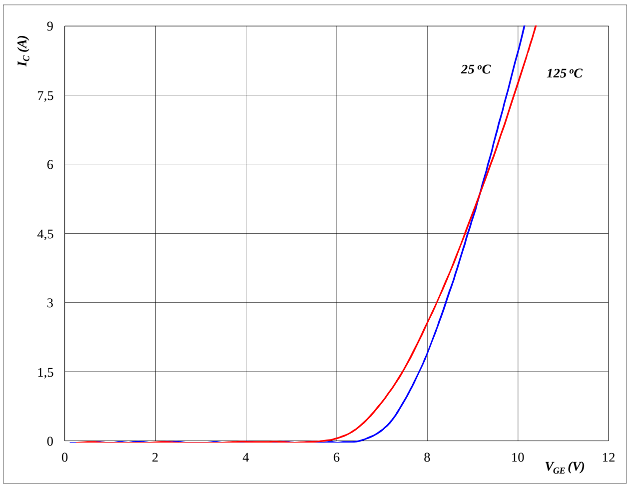
t_p =	250	µs
T_j =	125	°C

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

Figure 3 Brake IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



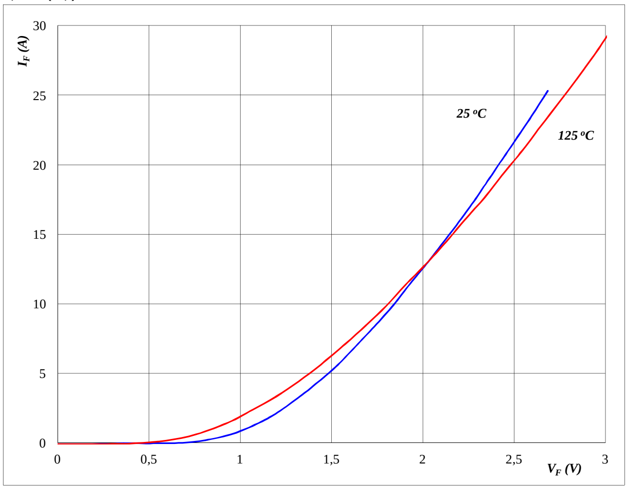
At

t_p =	250	µs
V_{CE} =	10	V

Figure 4 Brake FRED

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

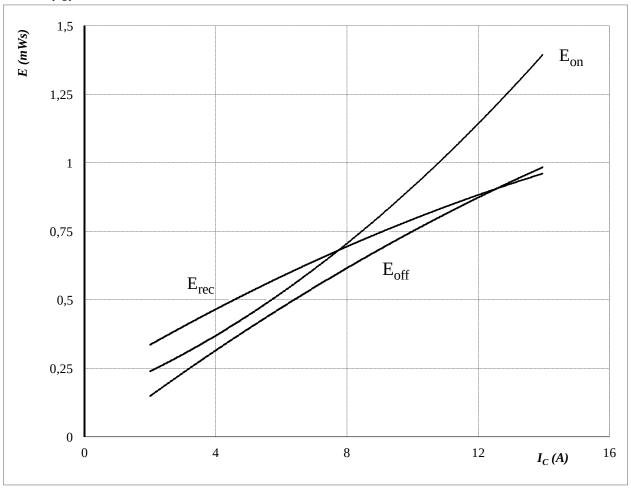
t_p =	250	µs

Brake

Figure 5 Brake IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



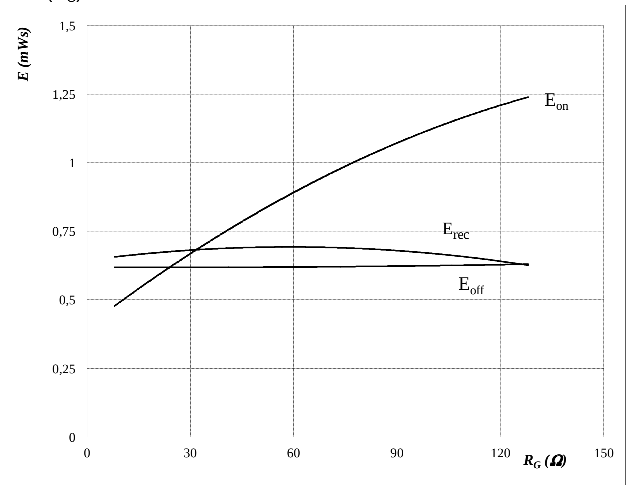
With an inductive load at

T_j =	125	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

Figure 6 Brake IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



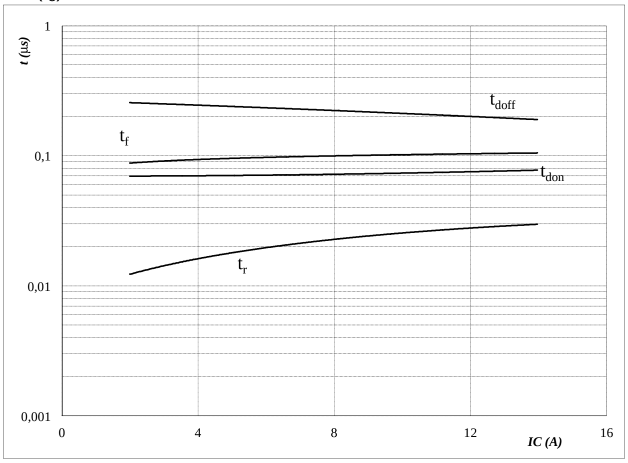
With an inductive load at

T_j =	125	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	8	A

Figure 7 Brake IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



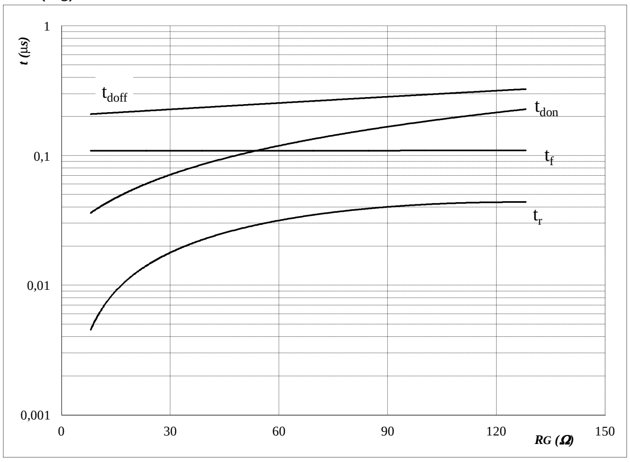
With an inductive load at

T_j =	125	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

Figure 8 Brake IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



With an inductive load at

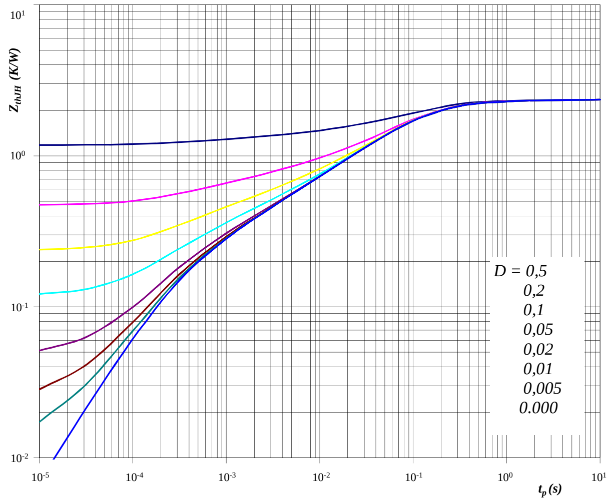
T_j =	125	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	8	A

Brake

Figure 9

IGBT transient thermal impedance
as a function of pulse width

$Z_{thJH} = f(t_p)$

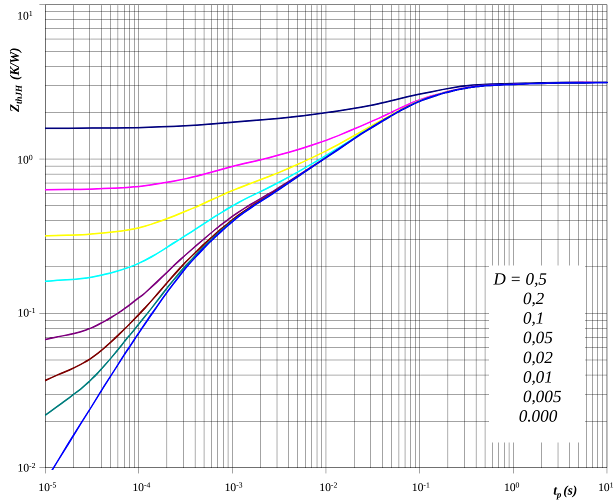


With
D = tp / T
R_{thJH} = 2,36 K/W

Figure 10

FRED transient thermal impedance
as a function of pulse width

$Z_{thJH} = f(t_p)$



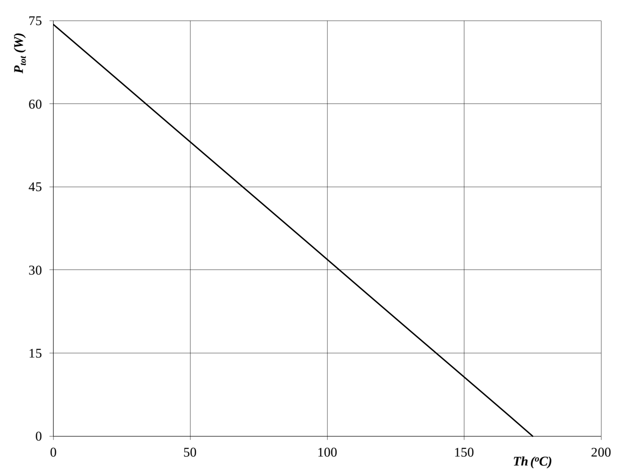
With
D = tp / T
R_{thJH} = 3,15 K/W

Brake

Figure 11 Brake IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



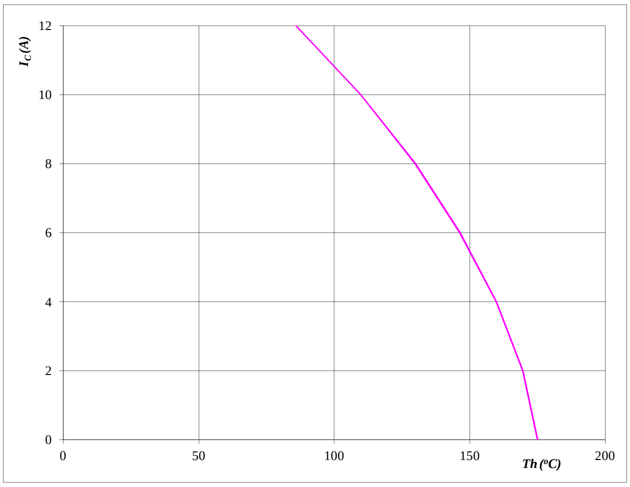
At

T_j = 175 ºC

Figure 12 Brake IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

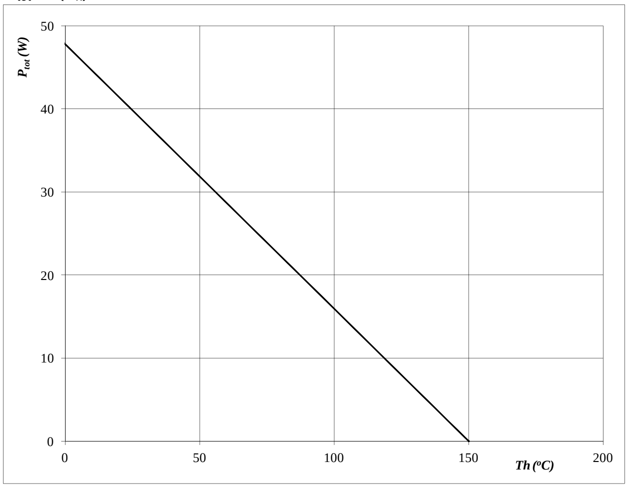
T_j = 175 ºC

V_{GE} = 15 V

Figure 13 Brake FRED

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



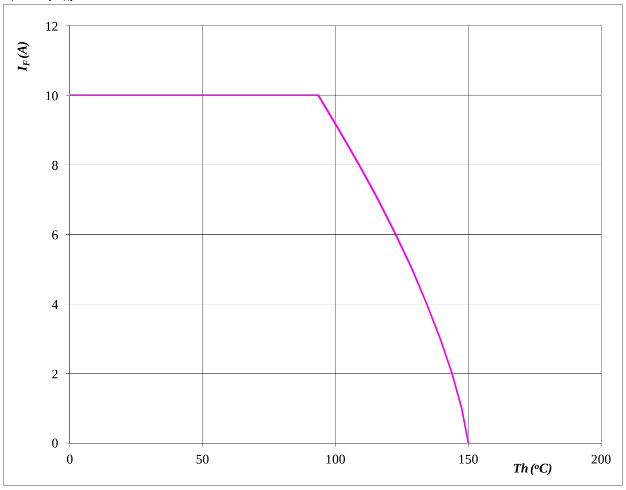
At

T_j = 150 ºC

Figure 14 Brake FRED

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

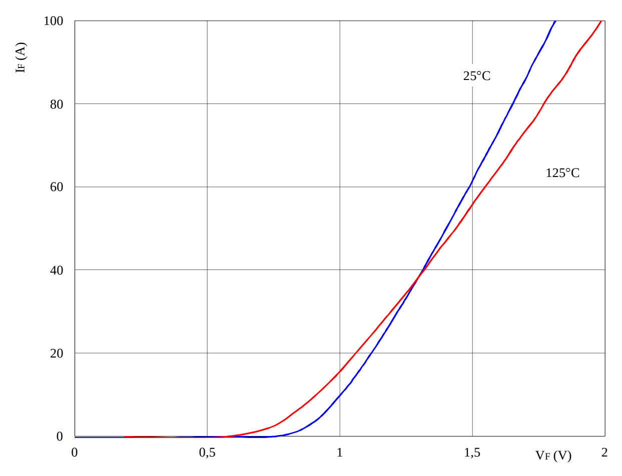
T_j = 150 ºC

Input Rectifier Bridge

Figure 1 Rectifier diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



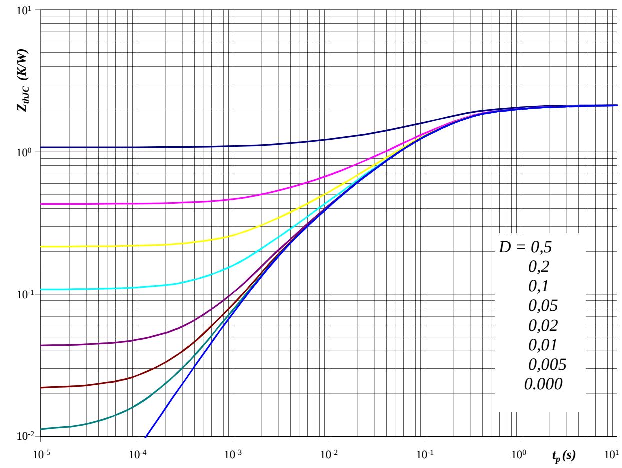
At

t_p = 250 µs

Figure 2 Rectifier diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



With

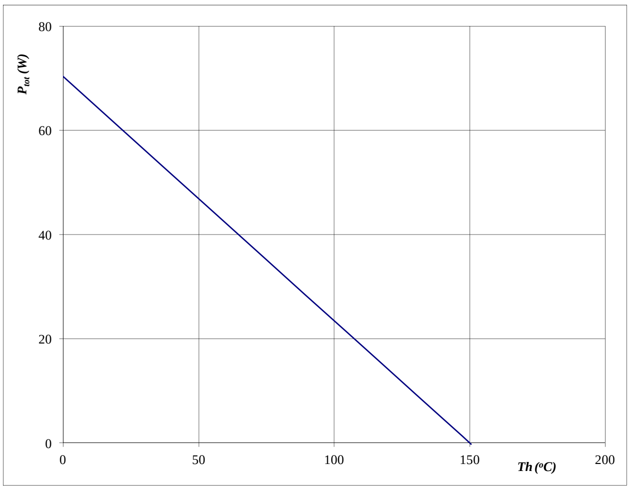
D = tp / T

R_{thJH} = 2,16 K/W

Figure 3 Rectifier diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



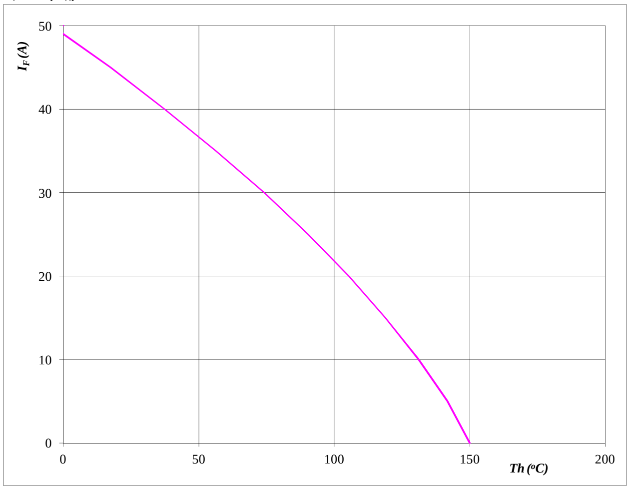
At

T_j = 150 ºC

Figure 4 Rectifier diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

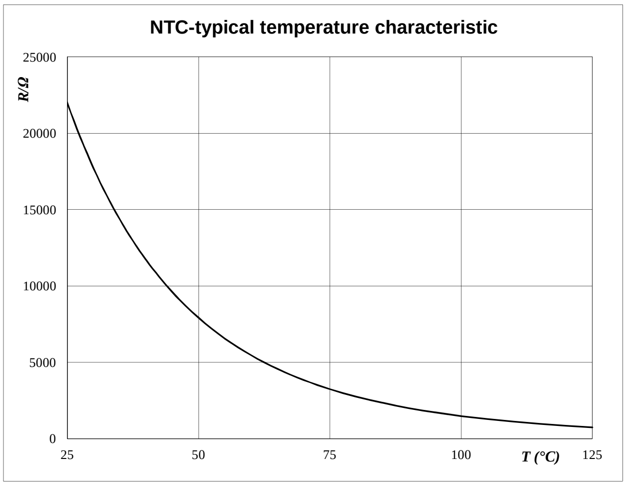
T_j = 150 ºC

Thermistor

Figure 1 Thermistor

Typical NTC characteristic
as a function of temperature

R_T = f (T)



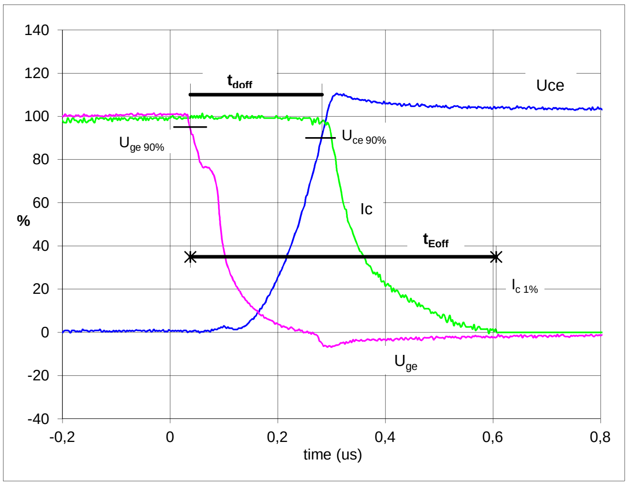
Switching Definitions Output Inverter

General conditions

T_j	=	125 °C
R_{gon}	=	16 Ω
R_{goff}	=	19 Ω

Figure 1 Output inverter IGBT

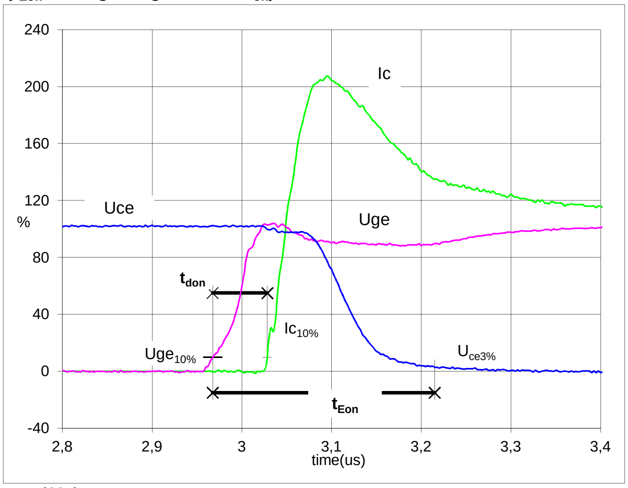
Turn-off Switching Waveforms & definition of tdoff, tEoff
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	15	A
t_{doff} =	0,24	μs
t_{Eoff} =	0,57	μs

Figure 2 Output inverter IGBT

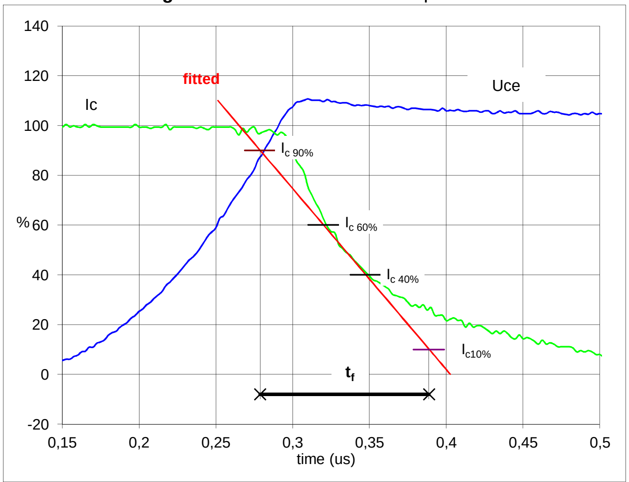
Turn-on Switching Waveforms & definition of tdon, tEon
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	15	A
t_{don} =	0,06	μs
t_{Eon} =	0,25	μs

Figure 3 Output inverter IGBT

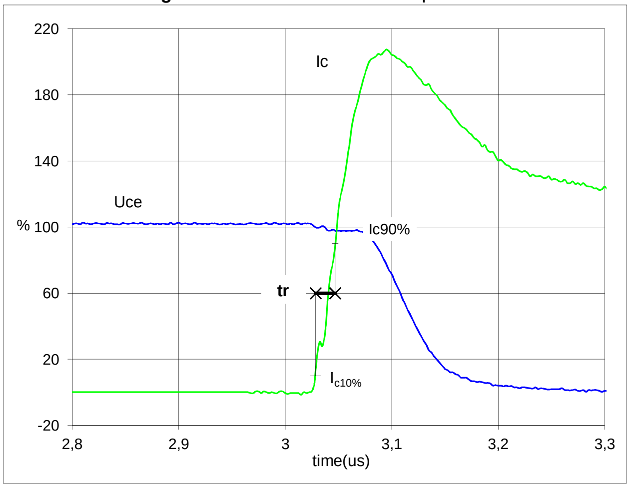
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	15	A
t_f =	0,106	μs

Figure 4 Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

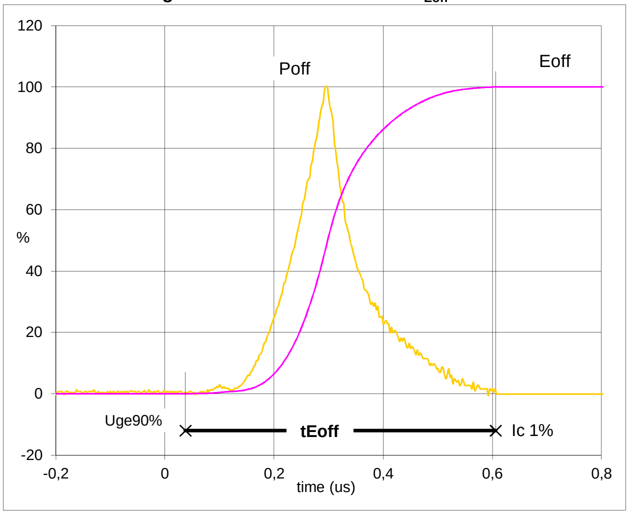


V_C (100%) =	600	V
I_C (100%) =	15	A
t_r =	0,019	μs

Switching Definitions Output Inverter

Figure 5 Output inverter IGBT

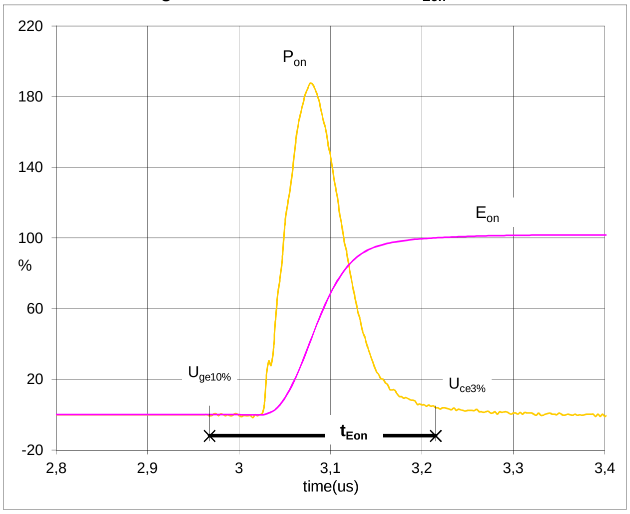
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	9,00	kW
E_{off} (100%) =	1,24	mJ
t_{Eoff} =	0,57	µs

Figure 6 Output inverter IGBT

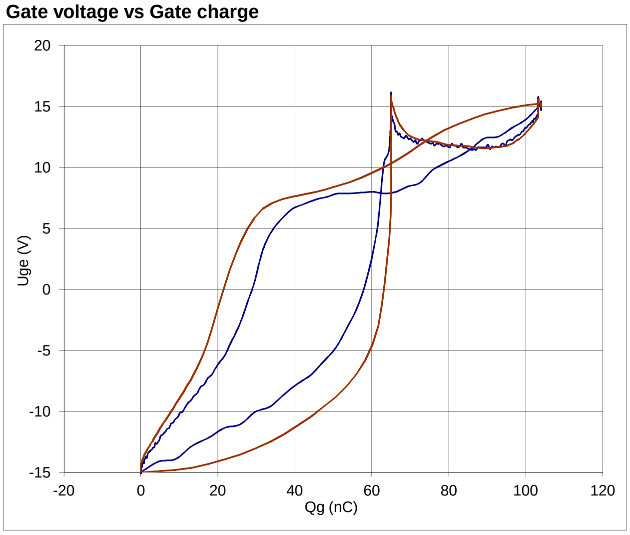
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	9,00	kW
E_{on} (100%) =	1,25	mJ
t_{Eon} =	0,25	µs

Figure 7 Output inverter IGBT

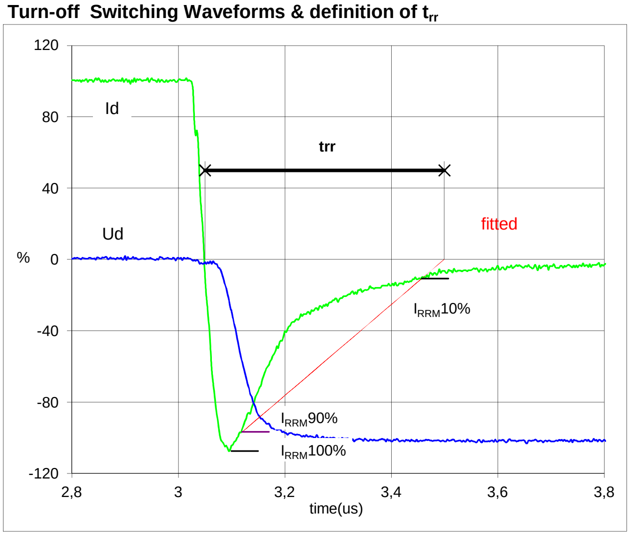
Gate voltage vs Gate charge



V_{GEoff} =	-15	V
V_{GEon} =	15	V
V_C (100%) =	600	V
I_C (100%) =	15	A
Q_g =	104,04	nC

Figure 8 Output inverter FRED

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

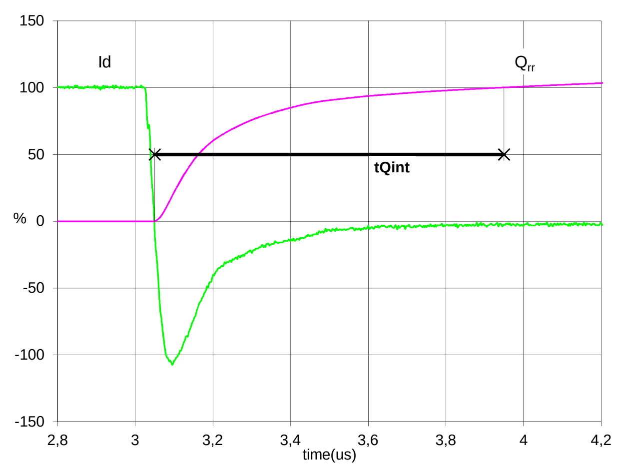


V_d (100%) =	600	V
I_d (100%) =	15	A
I_{RRM} (100%) =	-16	A
t_{rr} =	0,43	µs

Switching Definitions Output Inverter

Figure 9 Output inverter FRED

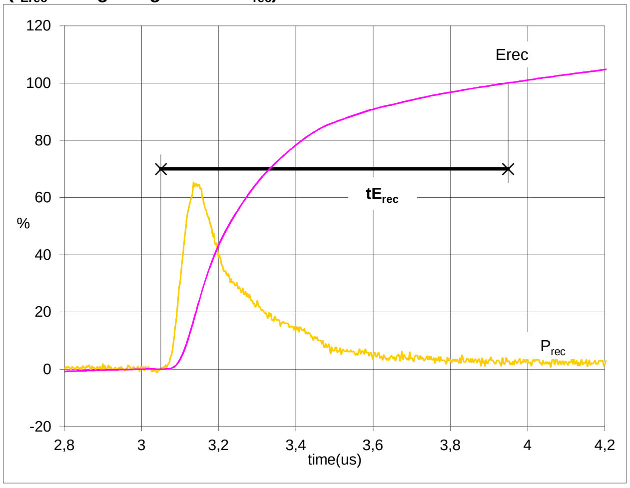
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	15	A
Q_{rr} (100%) =	2,75	µC
t_{Qint} =	0,90	µs

Figure 10 Output inverter FRED

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

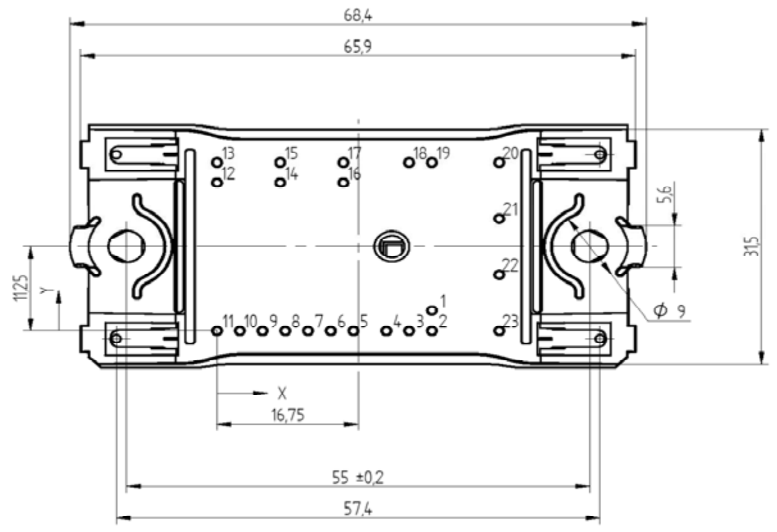


P_{rec} (100%) =	9,00	kW
E_{rec} (100%) =	1,157	mJ
t_{Erec} =	0,90	µs

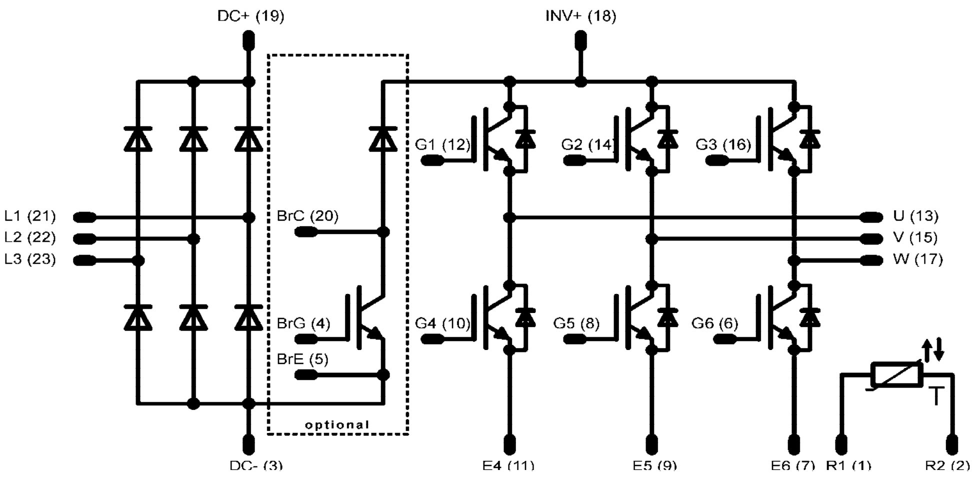
Package Outline and Pinout

Outline

Pin table		
Pin	X	Y
1	25,5	2,7
2	25,5	0
3	22,8	0
4	20,1	0
5	16,2	0
6	13,5	0
7	10,8	0
8	8,1	0
9	5,4	0
10	2,7	0
11	0	0
12	0	19,8
13	0	22,5
14	7,5	19,8
15	7,5	22,5
16	15	19,8
17	15	22,5
18	22,8	22,5
19	25,5	22,5
20	33,5	22,5
21	33,5	15
22	33,5	7,5
23	33,5	0



Pinout



PRODUCT STATUS DEFINITIONS

Datasheet Status	Product Status	Definition
Target	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice. The data contained is exclusively intended for technically trained staff.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data may be published at a later date. Vincotech reserves the right to make changes at any time without notice in order to improve design. The data contained is exclusively intended for technically trained staff.
Final	Full Production	This datasheet contains final specifications. Vincotech reserves the right to make changes at any time without notice in order to improve design. The data contained is exclusively intended for technically trained staff.

DISCLAIMER

Vincotech reserves the right to make changes without further notice to any products herein to improve reliability, function or design. Vincotech does not assume any liability arising out of the application or use of any product or circuit described herein; neither does it convey any license under its patent rights, nor the rights of others.

LIFE SUPPORT POLICY

Vincotech products are not authorised for use as critical components in life support devices or systems without the express written approval of Vincotech.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.
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.