MiniSKiiP® 3 PIM — 1200V / 50A

Features

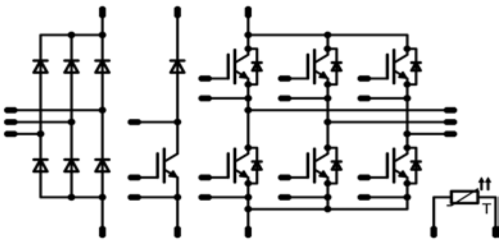
- Solderless interconnection
- Trench Fieldstop IGBT4 technology

MiniSKiiP® 3 housing

Target Applications

- Industrial Drives

Schematic



Types

- V23990-K428-A40-PM

Maximum Ratings

T_j=25℃, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Input Rectifier Diode				
Repetitive peak reverse voltage	V_{RRM}		1600	V
DC forward current	I_{FAV}	$T_j=T_j max$ T_h=80℃	50	A
Surge forward current	I_{FSM}	t_p=10ms T_j=25℃	450	A
I^2t-value	I^2t		1020	A^2s
Power dissipation per Diode	P_{tot}	$T_j=T_j max$ T_h=80℃	62	W
Maximum Junction Temperature	$T_j max$		150	℃
Inverter Transistor				
Collector-emitter break down voltage	V_{CE}		1200	V
DC collector current	I_C	$T_j=T_j max$ T_h=80℃	40	A
Repetitive peak collector current	I_{Cpulse}	t_p limited by $T_j max$	150	A
Power dissipation per IGBT	P_{tot}	$T_j=T_j max$ T_h=80℃	88	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	℃

Maximum Ratings

T_j=25℃, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter Diode				
Repetitive peak reverse voltage	V_{RRM}		1200	V
DC forward current	I_F	T_j=$T_j$max T_h=80℃	35	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max	335	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max T_h=80℃	66	W
Maximum Junction Temperature	$T_j$max		175	℃
Brake Transistor				
Collector-emitter break down voltage	V_{CE}		1200	V
DC collector current	I_C	T_j=$T_j$max T_h=80℃	45	A
Repetitive peak collector current	I_{Cpuls}	t_p limited by $T_j$max	150	A
Power dissipation per IGBT	P_{tot}	T_j=$T_j$max T_h=80℃	101	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	℃
Brake Diode				
Repetitive peak reverse voltage	V_{RRM}		1200	V
DC forward current	I_F	T_j=$T_j$max T_h=80℃	38	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max	335	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max T_h=80℃	70	W
Maximum Junction Temperature	$T_j$max		175	℃
Thermal Properties				
Storage temperature	T_{stg}		-40…+125	℃
Operation temperature under switching condition	T_{op}		-40…+(Tjmax - 25)	℃
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	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	Value Min	Value Typ	Value Max	Unit
Input Rectifier Diode										
Forward voltage	V_F				35	Tj=25℃ Tj=125℃	0,8	1,03 0,93	1,35	V
Threshold voltage (for power loss calc. only)	V_{to}					Tj=25℃ Tj=125℃		0,9 0,74		V
Slope resistance (for power loss calc. only)	r_t					Tj=25℃ Tj=125℃		0,004 0,006		Ω
Reverse current	I_r			1500		Tj=25℃ Tj=125℃			0,1 1,1	mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50µm λ=1W/mK						1,14		K/W
Thermal resistance chip to case per chip	R_{thJC}							N/A		
Inverter Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0017	Tj=25℃ Tj=150℃	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		50	Tj=25℃ Tj=150℃	1,6	1,91 2,39	2,4	V
Collector-emitter cut-off current incl. Diode	I_{CES}			1200		Tj=25℃ Tj=150℃			0,06	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25℃ Tj=150℃			600	nA
Integrated Gate resistor	R_{gint}							4		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=8Ω Rgon=8Ω	±15	600	50	Tj=25℃ Tj=150℃		106 111		ns
Rise time	t_r					Tj=25℃ Tj=150℃		18 25		
Turn-off delay time	$t_{d(off)}$					Tj=25℃ Tj=150℃		228 298		
Fall time	t_f					Tj=25℃ Tj=150℃		84 125		
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=150℃		2,66 4,46		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=150℃		2,78 4,58		
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}		±15			Tj=25℃		380		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50µm λ=1W/mK						1,09		K/W
Thermal resistance chip to case per chip	R_{thJC}							N/A		
Inverter Diode										
Diode forward voltage	V_F				50	Tj=25℃ Tj=150℃	1,5	2,19 2,21	2,9	V
Peak reverse recovery current	I_{RRM}	Rgon=8Ω	±15	600	50	Tj=25℃ Tj=150℃		61,3 70,7		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=150℃		144 312		ns
Reverse recovered charge	Q_{rr}					Tj=25℃ Tj=150℃		3,74 8,8		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25℃ Tj=150℃		3494 950		A/µs
Reverse recovered energy	Erec					Tj=25℃ Tj=150℃		1,38 3,48		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50µm λ=1W/mK						1,44		K/W
Thermal resistance chip to case per chip	R_{thJC}							N/A		

Characteristic Values

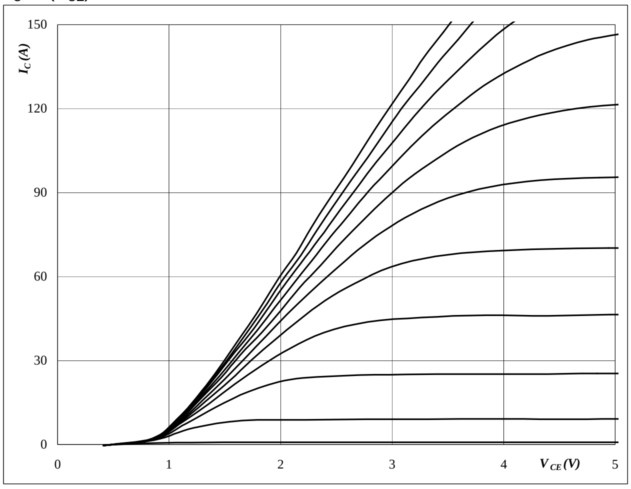
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Brake Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0017	Tj=25℃ Tj=150℃	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		50	Tj=25℃ Tj=150℃	1,6	1,85 2,28	2,4	V
Collector-emitter cut-off incl diode	I_{CES}			1200		Tj=25℃ Tj=150℃			0,06	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25℃ Tj=150℃			600	nA
Integrated Gate resistor	R_{gint}							4		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=8Ω Rgon=8Ω	±15	600	50	Tj=25℃ Tj=150℃		105 111		ns
Rise time	t_r					Tj=25℃ Tj=150℃		18 31		
Turn-off delay time	$t_{d(off)}$					Tj=25℃ Tj=150℃		223 295		
Fall time	t_f					Tj=25℃ Tj=150℃		87 132		
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=150℃		2,63 5,57		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=150℃		2,68 4,59		
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}		±15			Tj=25℃		380		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50µm λ=1W/mK						0,94		K/W
Thermal resistance chip to case per chip	R_{thJC}							N/A		
Brake Diode										
Diode forward voltage	V_F				50	Tj=25℃ Tj=150℃	1,5	2,12 2,1	2,9	V
Reverse leakage current	I_r			1200		Tj=25℃ Tj=150℃			60 5100	µA
Peak reverse recovery current	I_{RRM}	Rgon=8Ω	±15	600	50	Tj=25℃ Tj=150℃		60,6 40,3		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=150℃		145 560		ns
Reverse recovered charge	Q_{rr}					Tj=25℃ Tj=150℃		3,61 8,54		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25℃ Tj=150℃		3649 154		A/µs
Reverse recovery energy	E_{rec}					Tj=25℃ Tj=150℃		1,31 3,32		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50µm λ=1W/mK						1,36		K/W
Thermal resistance chip to case per chip	R_{thJC}							N/A		
Thermistor										
Rated resistance	R					T=25℃		1000		Ω
Deviation of R100	ΔR/R	R100=1670 Ω				T=100℃	-3		3	%
R100	P					T=100℃		1670,313		Ω
Power dissipation constant						T=25℃				mW/K
A-value	B(25/50)	Tol. %				T=25℃		7,635*10-3		1/K
B-value	B(25/100)	Tol. %				T=25℃		1,731*10-5		1/K²
Vincotech NTC Reference									E	

Output Inverter

Figure 1 Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

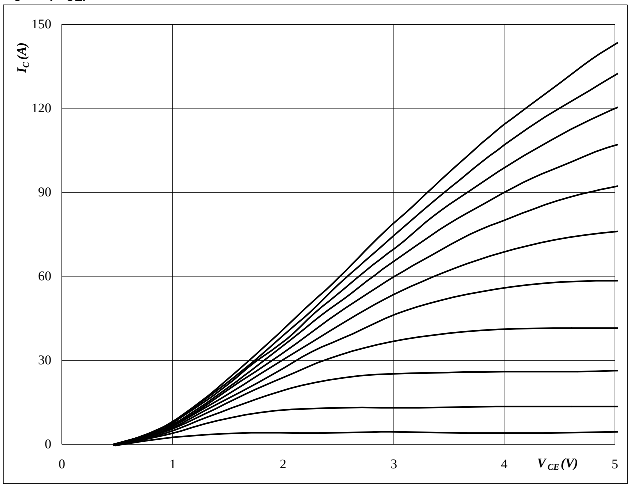
T_j = 25 ℃

V_{GE} 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

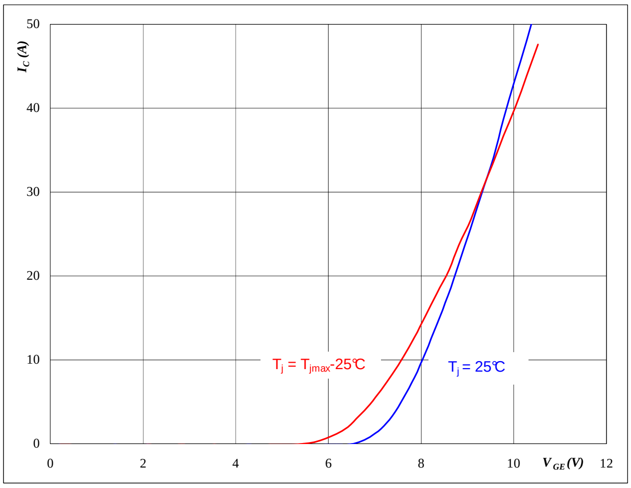
T_j = 150 ℃

V_{GE} 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

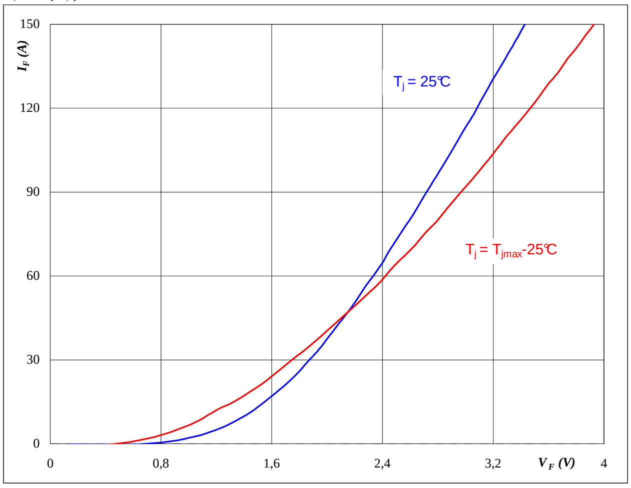
t_p = 250 µs

V_{CE} = 10 V

Figure 4 Output inverter FRED

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

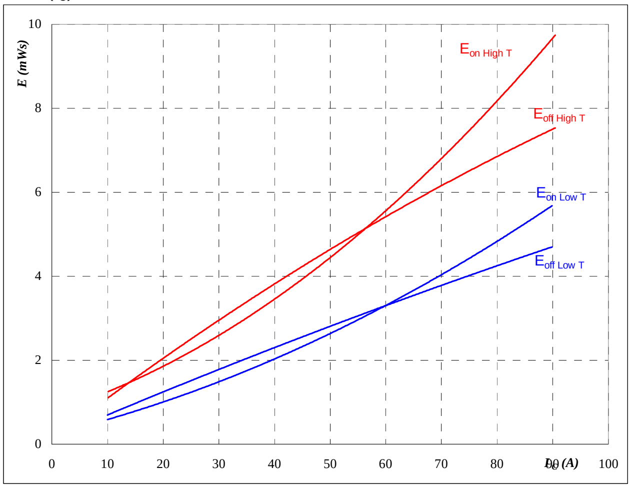
t_p = 250 µs

Output Inverter

Figure 5 Output inverter IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



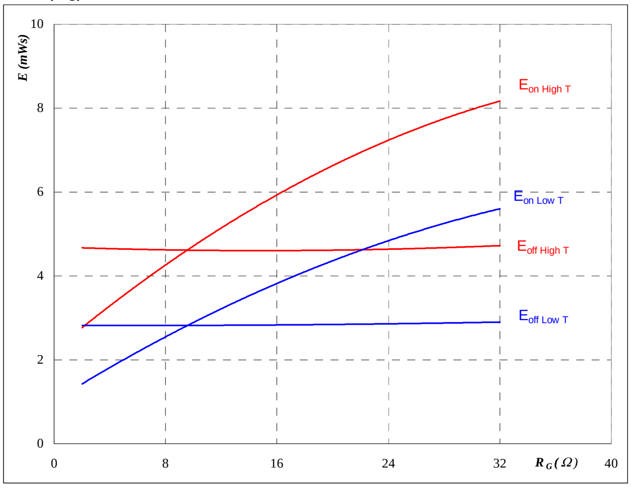
With an inductive load at

T_j =	25/150	°C
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

$E = f(R_G)$



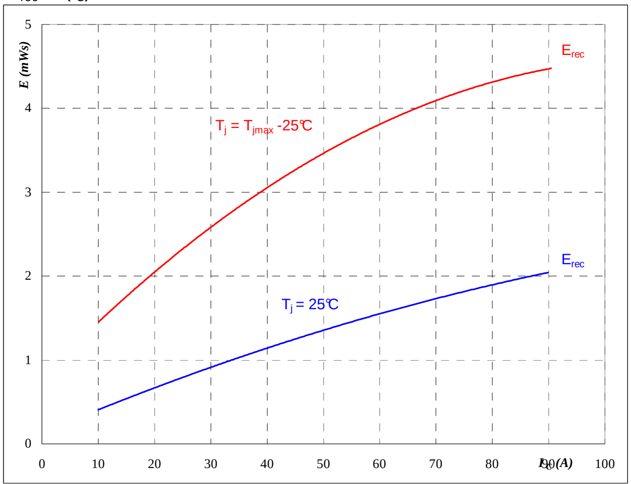
With an inductive load at

T_j =	25/150	°C
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

$E_{rec} = f(I_C)$



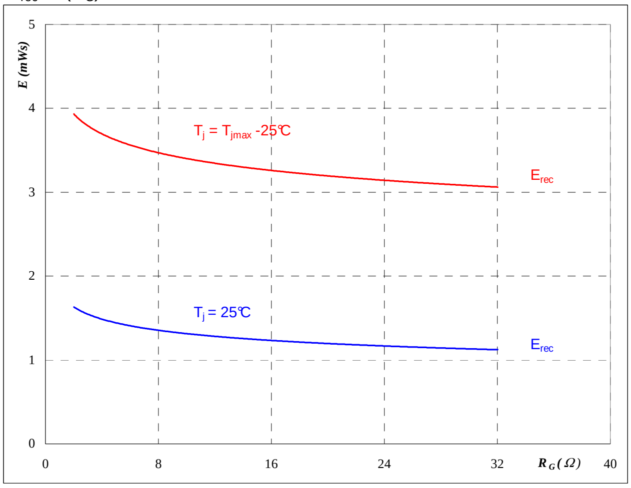
With an inductive load at

T_j =	25/150	°C
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

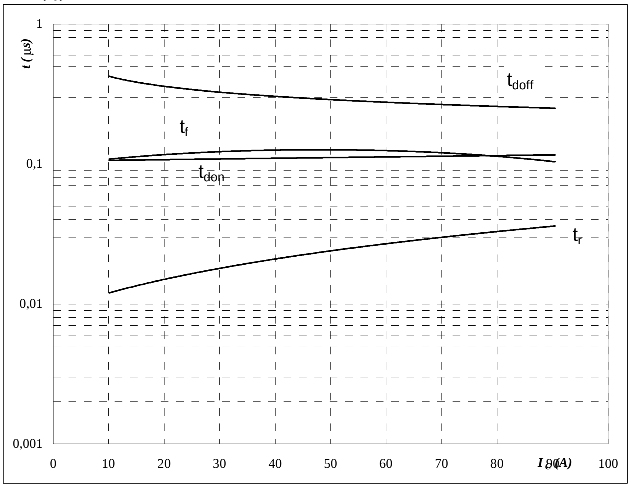
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	50	A

Output Inverter

Figure 9 Output inverter IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



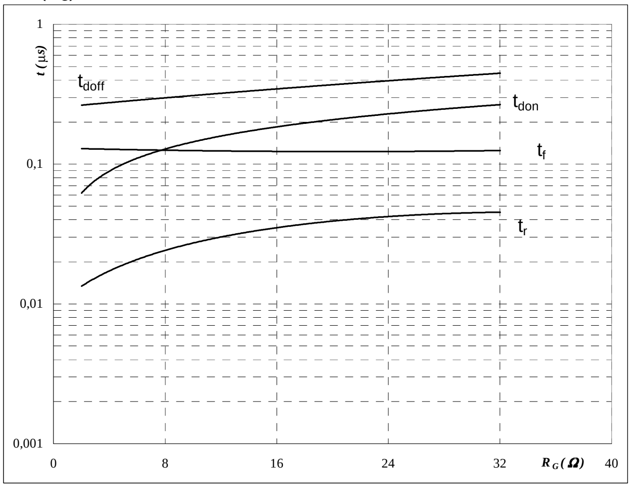
With an inductive load at

T_j =	150	°C
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

$t = f(R_G)$



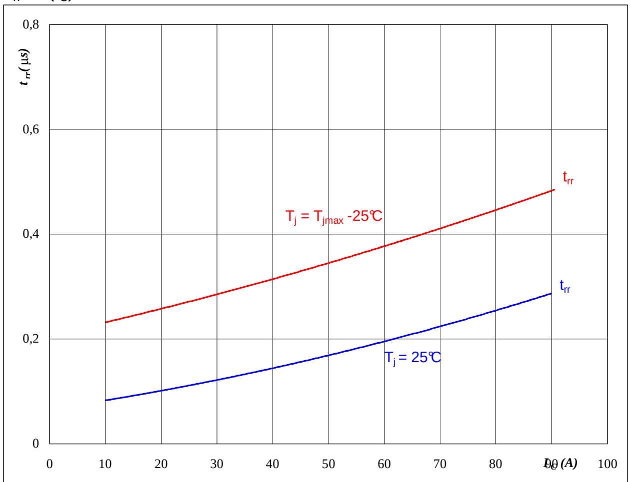
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	50	A

Figure 11 Output inverter FRED

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



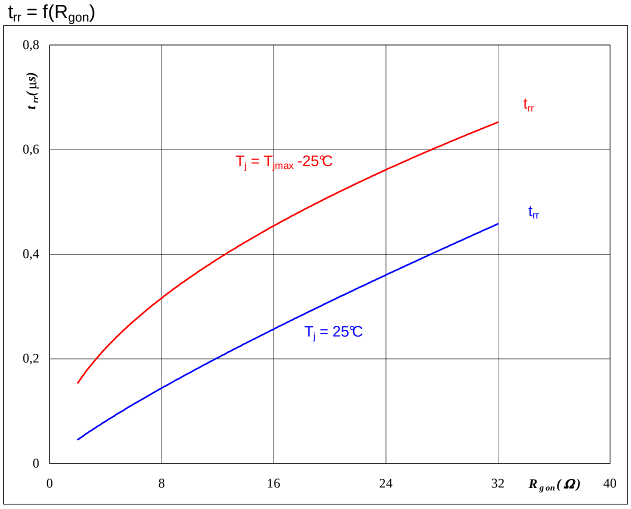
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 12 Output inverter FRED

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

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



At

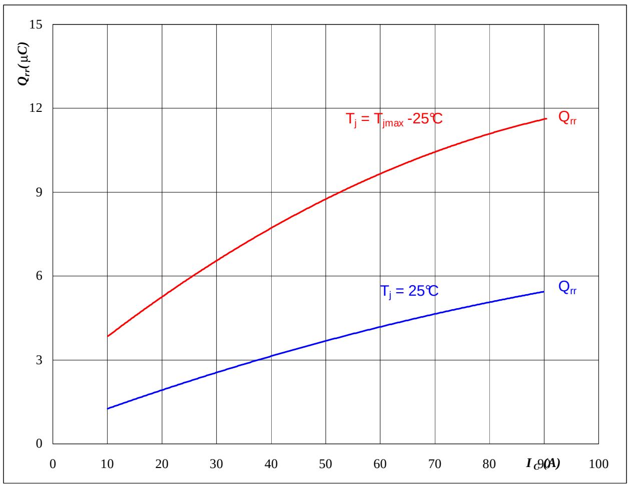
T_j =	25/150	°C
V_R =	600	V
I_F =	50	A
V_{GE} =	±15	V

Output Inverter

Figure 13 Output inverter FRED

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



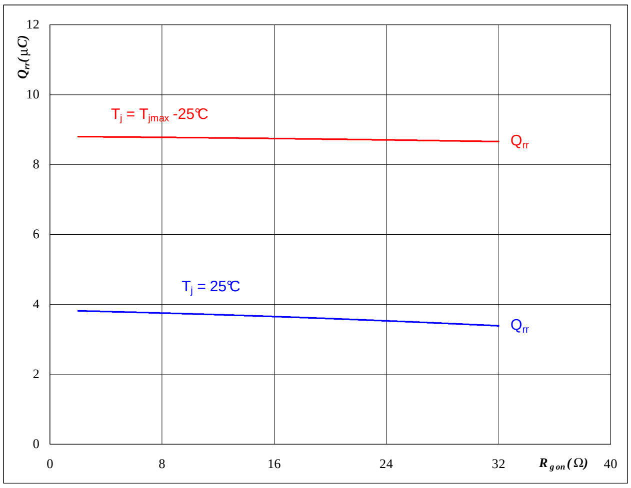
At

T_j =	25/150	℃
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 14 Output inverter FRED

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

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



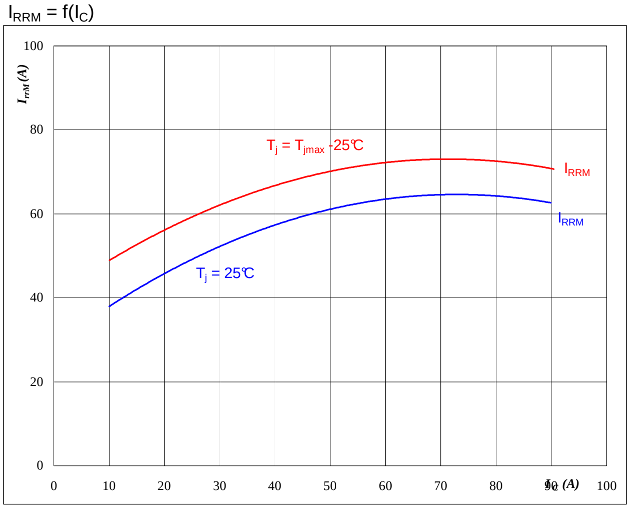
At

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

Figure 15 Output inverter FRED

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



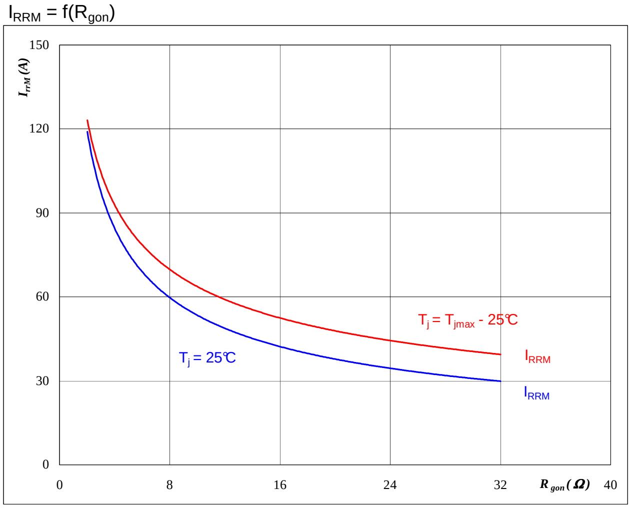
At

T_j =	25/150	℃
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 16 Output inverter FRED

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

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



At

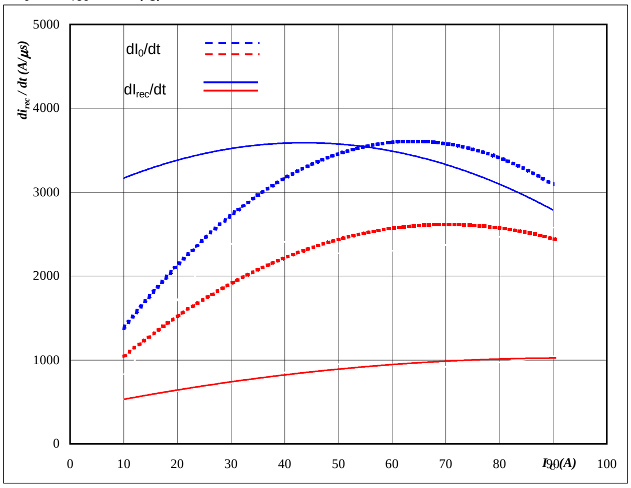
T_j =	25/150	℃
V_R =	600	V
I_F =	50	A
V_{GE} =	±15	V

Output Inverter

Figure 17 Output inverter FRED

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

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



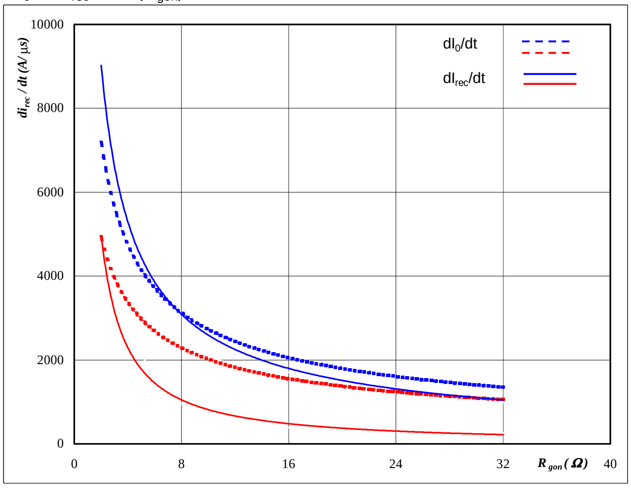
At

T_j =	25/150	℃
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 18 Output inverter FRED

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

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



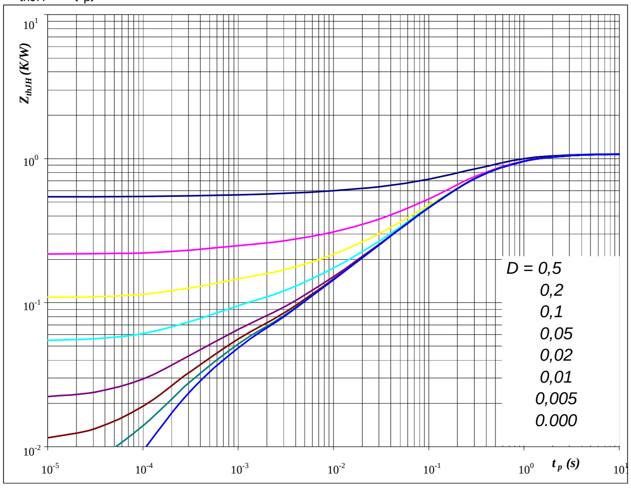
At

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

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	1,09	K/W

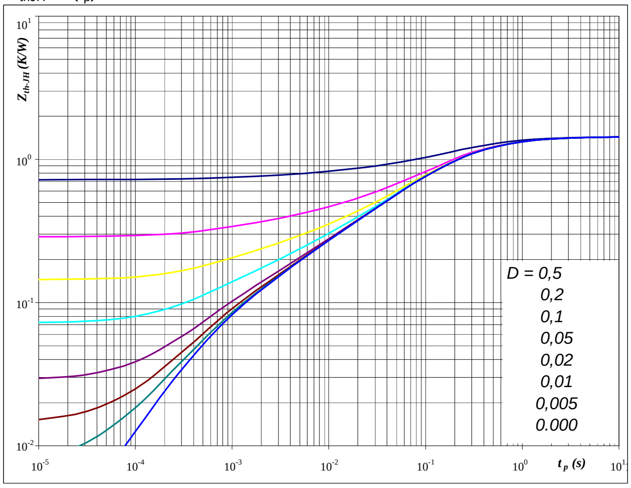
IGBT thermal model values

R (C/W)	Tau (s)
0,04	9,5E+00
0,23	1,0E+00
0,58	2,3E-01
0,15	3,4E-02
0,05	4,3E-03
0,03	4,0E-04

Figure 20 Output inverter FRED

FRED transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	1,44	K/W

FRED thermal model values

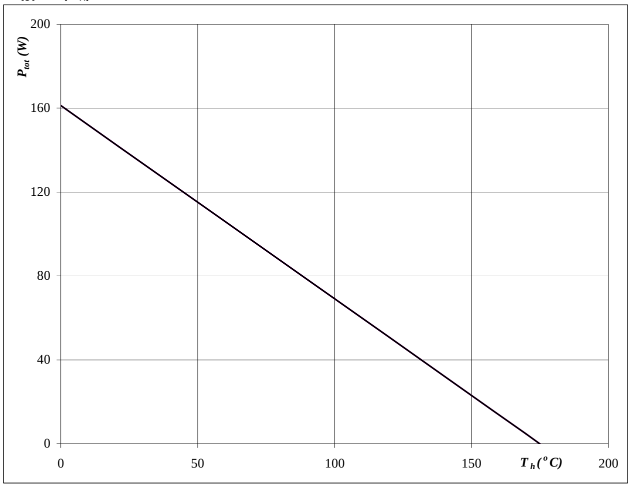
R (C/W)	Tau (s)
0,03	9,7E+00
0,26	9,0E-01
0,72	1,8E-01
0,27	3,1E-02
0,11	4,0E-03
0,05	5,8E-04

Output Inverter

Figure 21 Output inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



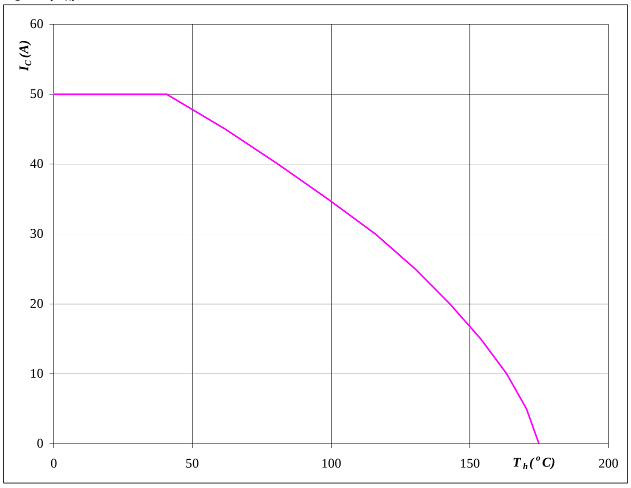
At

T_j = 175 ℃

Figure 22 Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

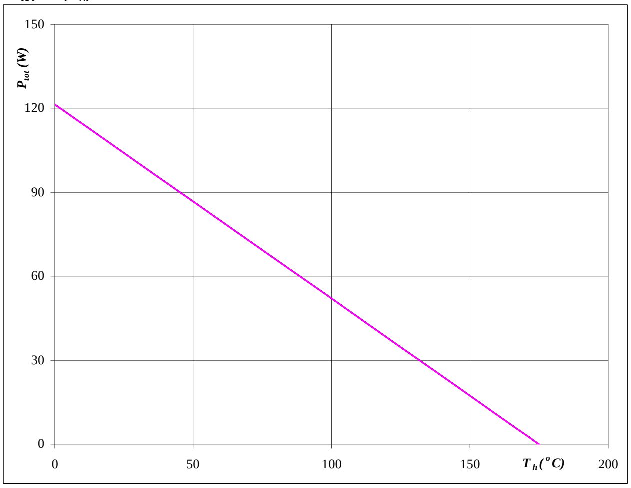
T_j = 175 ℃

V_{GE} = 15 V

Figure 23 Output inverter FRED

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



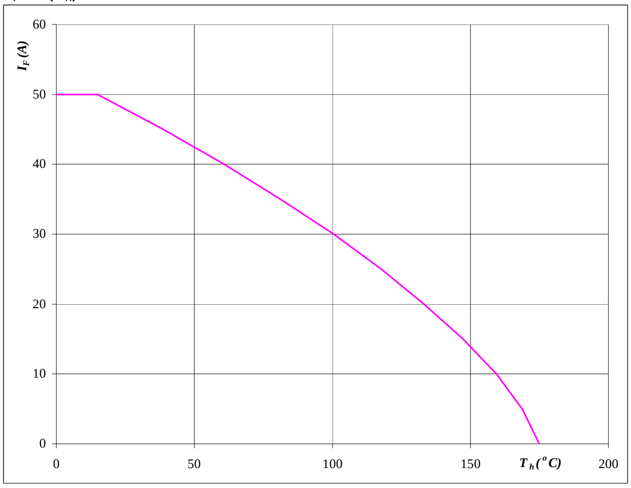
At

T_j = 175 ℃

Figure 24 Output inverter FRED

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

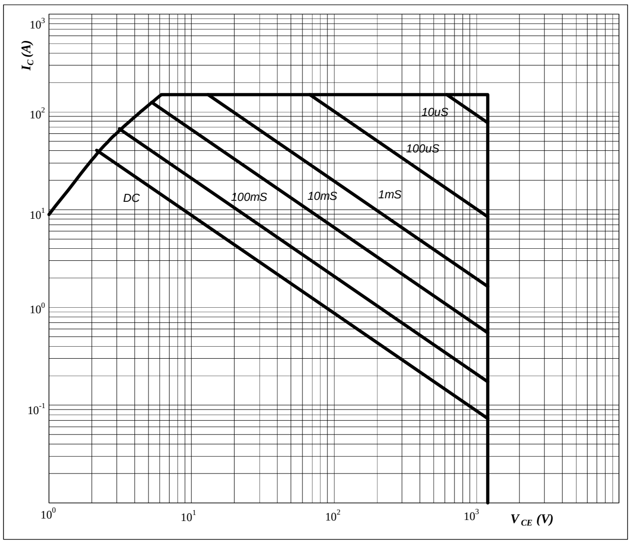
T_j = 175 ℃

Output Inverter

Figure 25 Output inverter IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



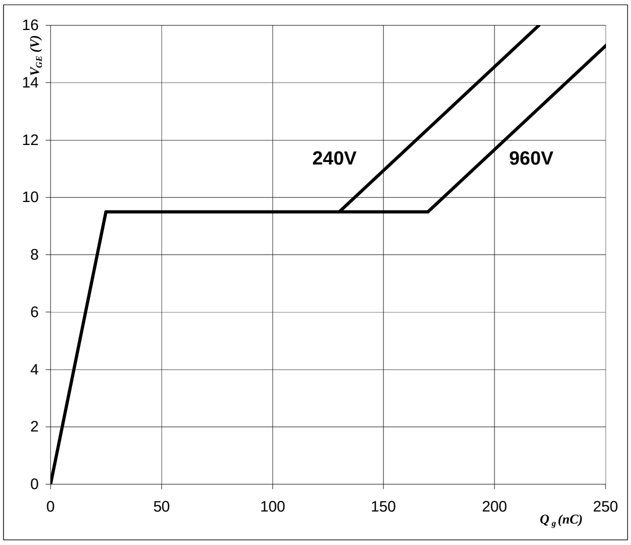
At

D =	single pulse	
T_h =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	ºC

Figure 26 Output inverter IGBT

Gate voltage vs Gate charge

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



At

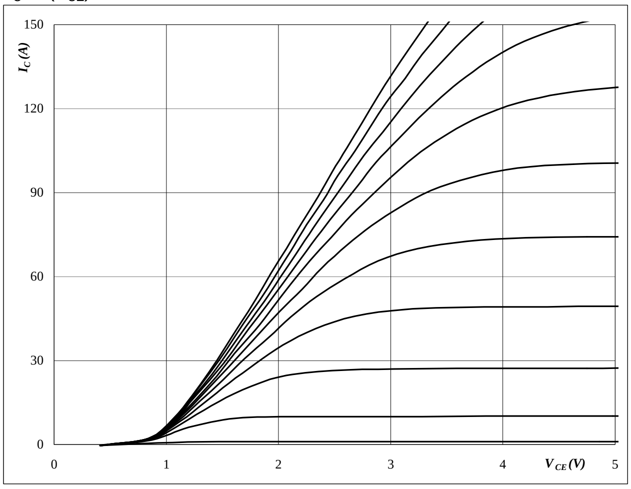
I_C =	50	A

Brake

Figure 1 Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 μs

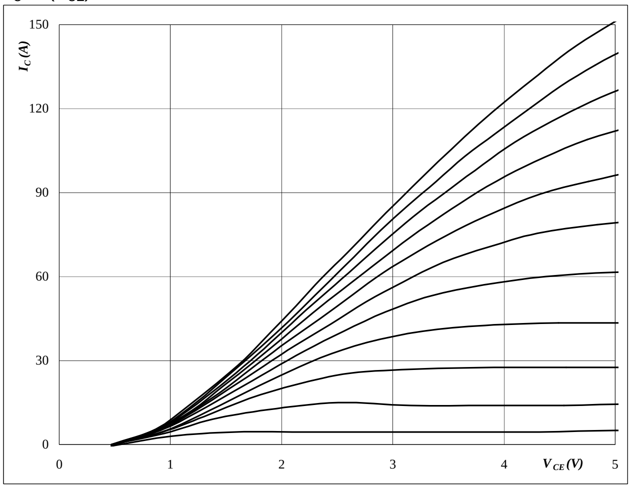
T_j = 25 °C

V_{GE} 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

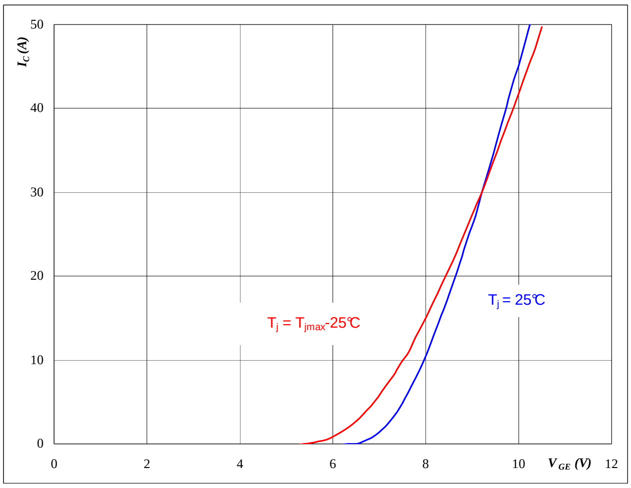
T_j = 150 °C

V_{GE} from 7 V to 17 V in steps of 1 V

Figure 3 Brake IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



At

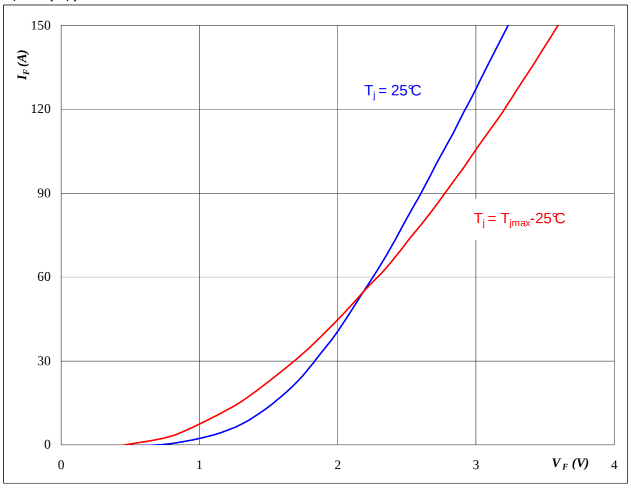
t_p = 250 μs

V_{CE} = 10 V

Figure 4 Brake FRED

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

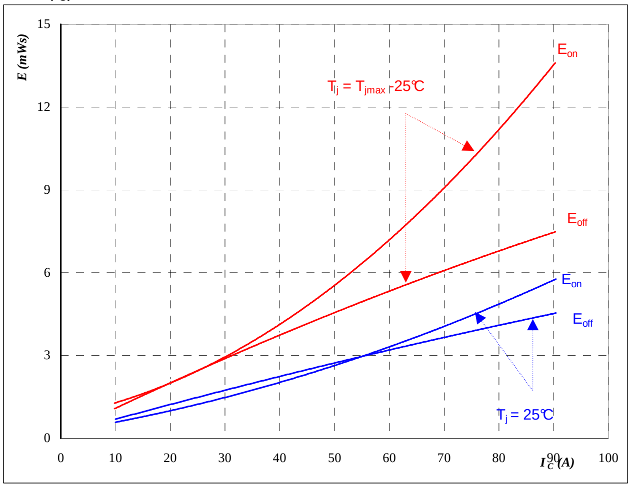
t_p = 250 μs

Brake

Figure 5 Brake IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



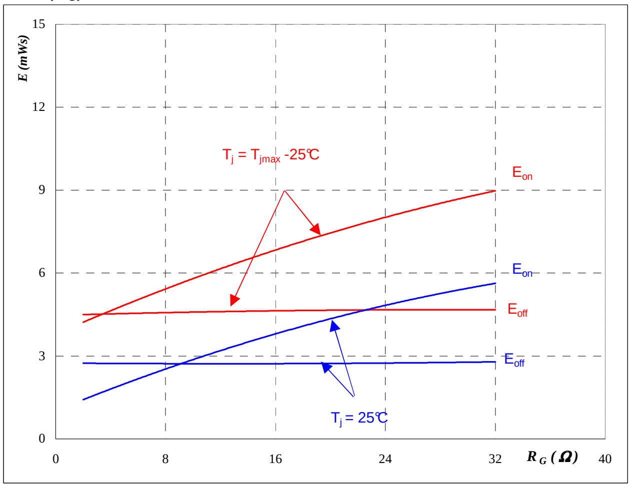
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 6 Brake IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



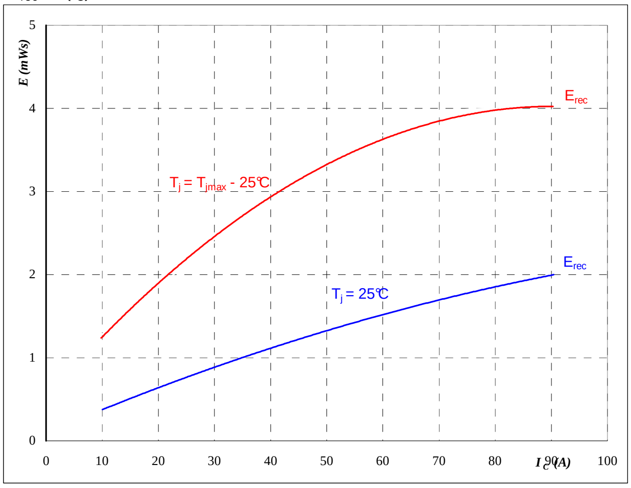
With an inductive load at

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

Figure 7 Brake IGBT

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



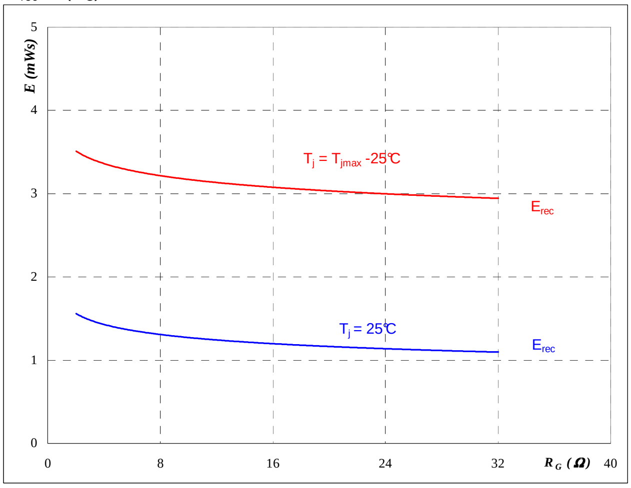
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 8 Brake IGBT

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

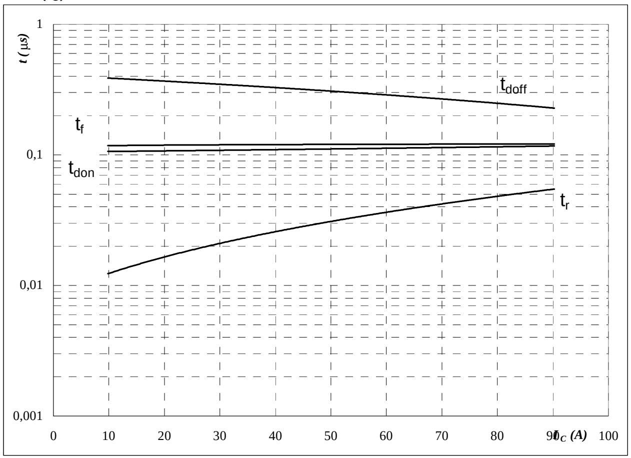
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	50	A

Brake

Figure 9 Brake IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



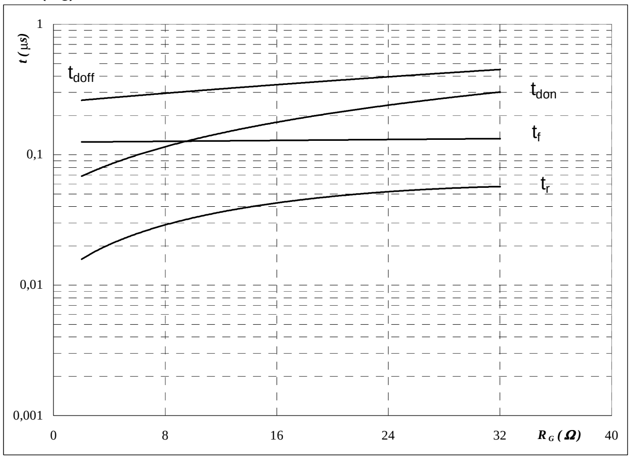
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 10 Brake IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



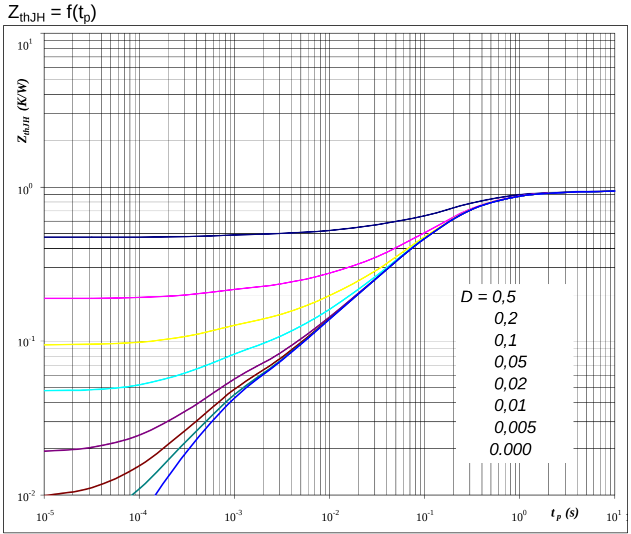
With an inductive load at

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

Figure 11 Brake IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



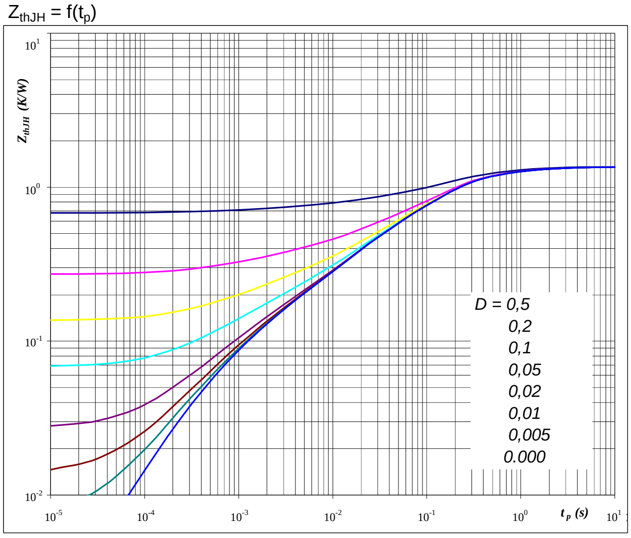
At

D =	tp / T	
R_{thJH} =	0,94	K/W

Figure 12 Brake FRED

FRED transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

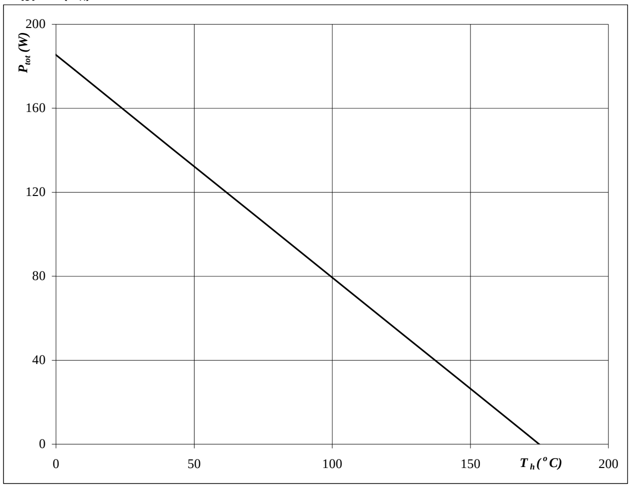
D =	tp / T	
R_{thJH} =	1,36	K/W

Brake

Figure 13 Brake IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



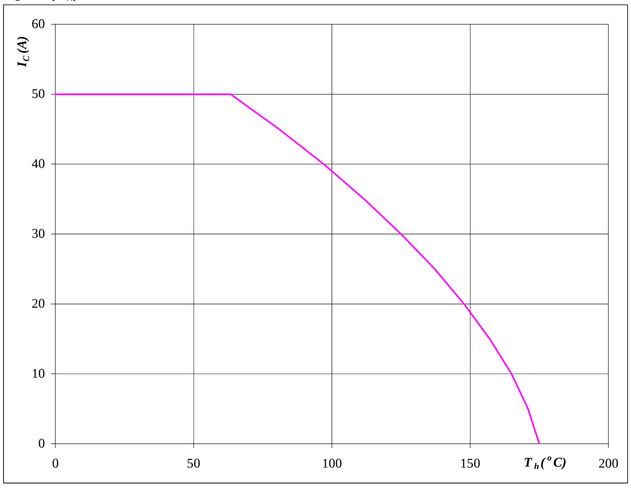
At

T_j = 175 ºC

Figure 14 Brake IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

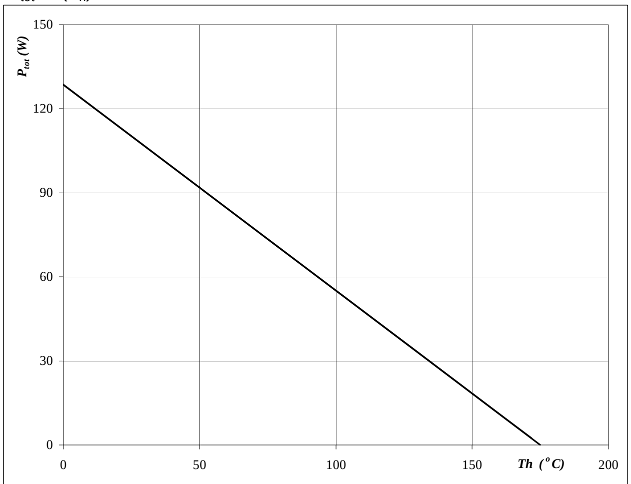
T_j = 175 ºC

V_{GE} = 15 V

Figure 15 Brake FRED

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



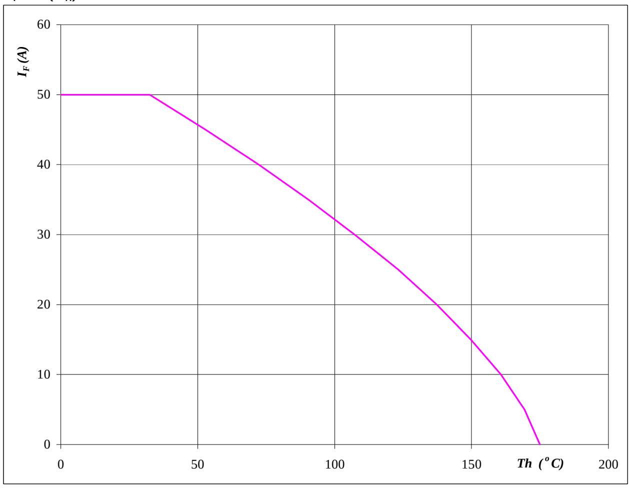
At

T_j = 175 ºC

Figure 16 Brake FRED

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

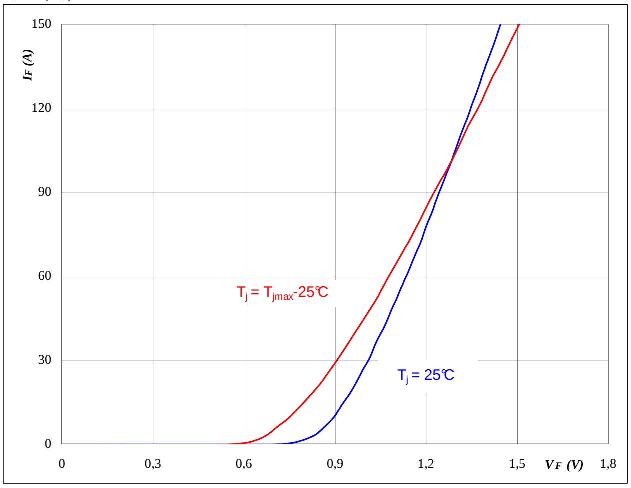
T_j = 175 ºC

Input Rectifier Bridge

Figure 1 Rectifier diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



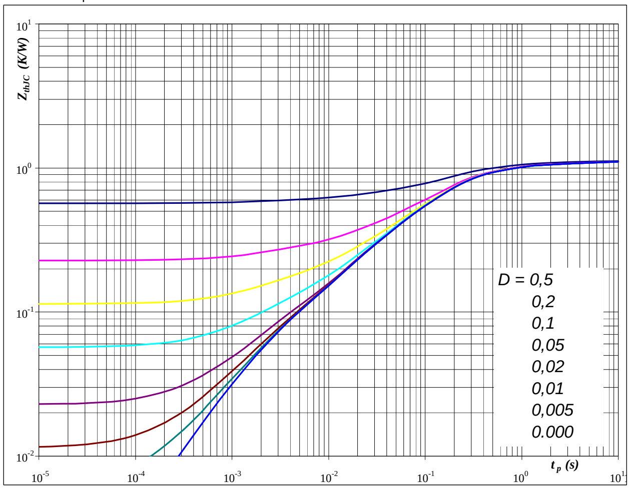
At

t_p =	250	μs

Figure 2 Rectifier diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



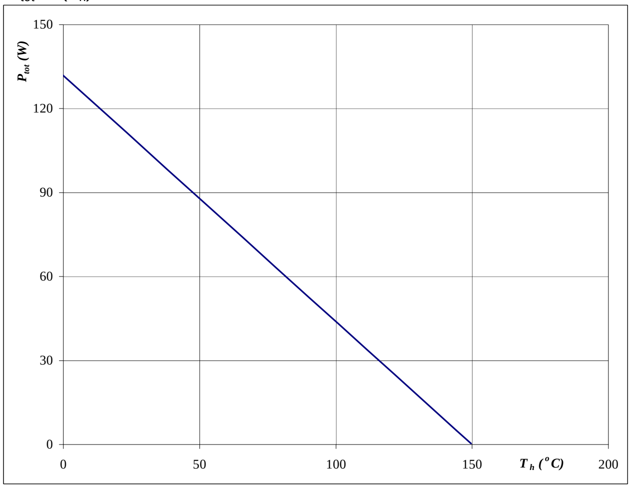
At

D =	t_p / T	
R_{thJH} =	1,138	K/W

Figure 3 Rectifier diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



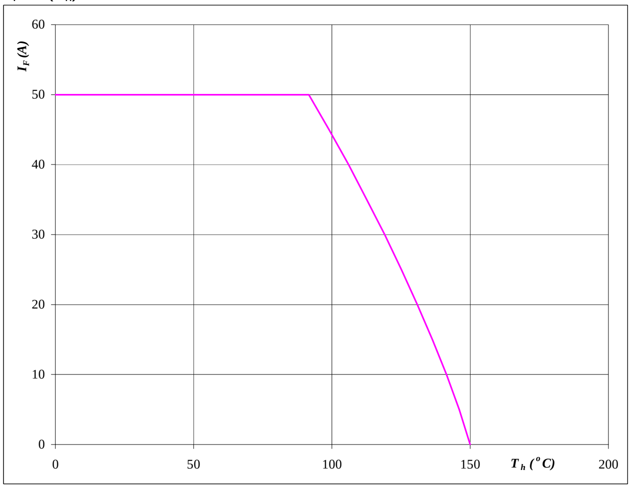
At

T_j =	150	ºC

Figure 4 Rectifier diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



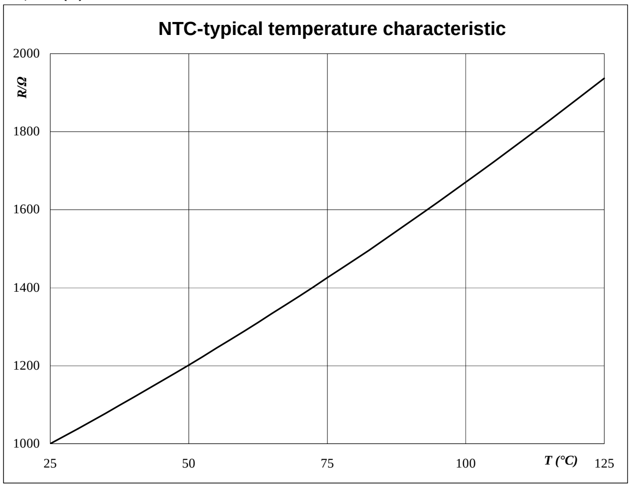
At

T_j =	150	ºC

Thermistor

Figure 1	Thermistor

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



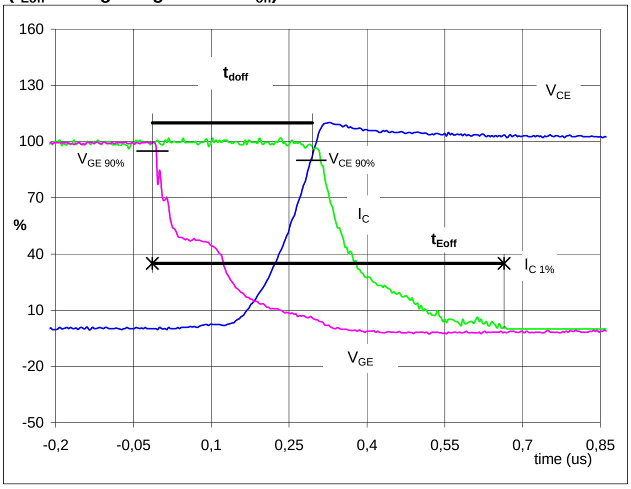
Switching Definitions Output Inverter

General conditions

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

Figure 1 Output inverter IGBT

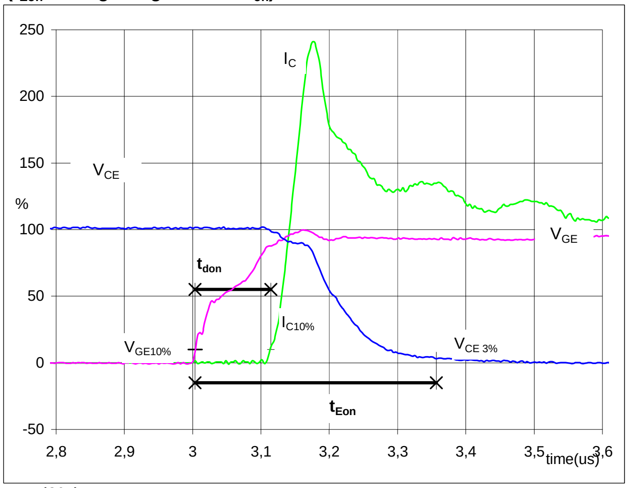
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	50	A
t_{doff} =	0,30	µs
t_{Eoff} =	0,68	µs

Figure 2 Output inverter IGBT

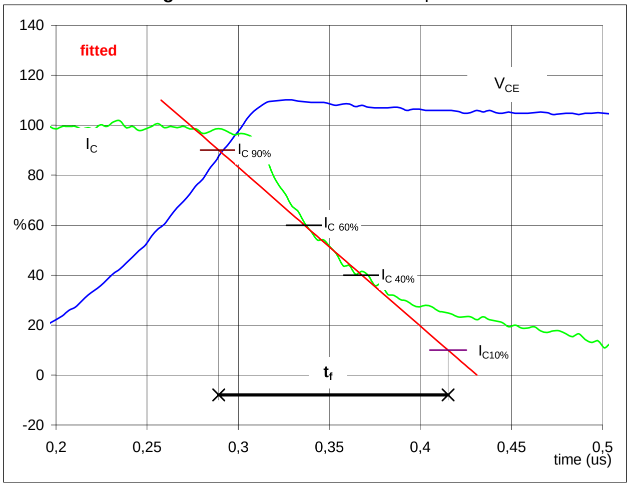
Turn-on Switching Waveforms & definition of tdon, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	50	A
t_{don} =	0,11	µs
t_{Eon} =	0,35	µs

Figure 3 Output inverter IGBT

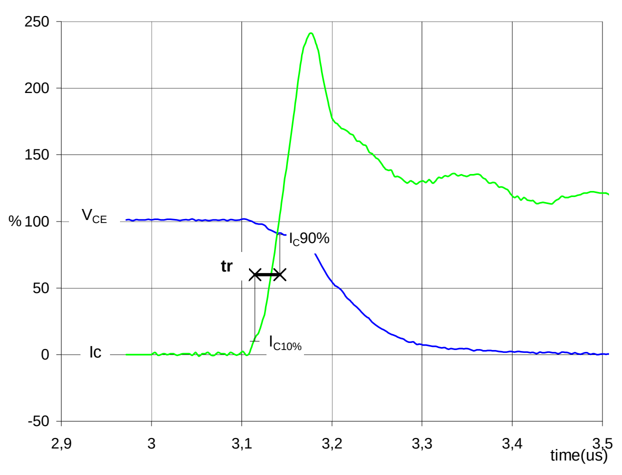
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	50	A
t_f =	0,13	µs

Figure 4 Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

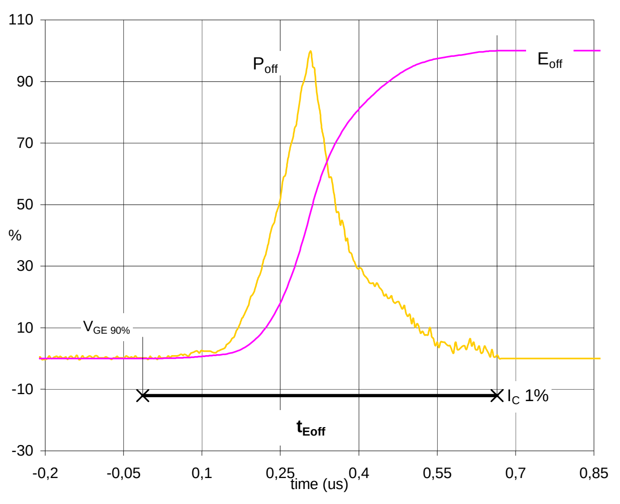


V_C (100%) =	600	V
I_C (100%) =	50	A
t_r =	0,03	µs

Switching Definitions Output Inverter

Figure 5 Output inverter IGBT

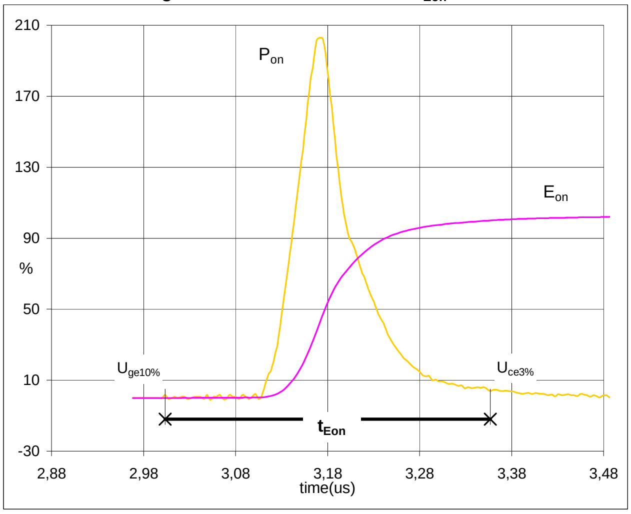
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	29,95	kW
E_{off} (100%) =	4,58	mJ
t_{Eoff} =	0,68	μs

Figure 6 Output inverter IGBT

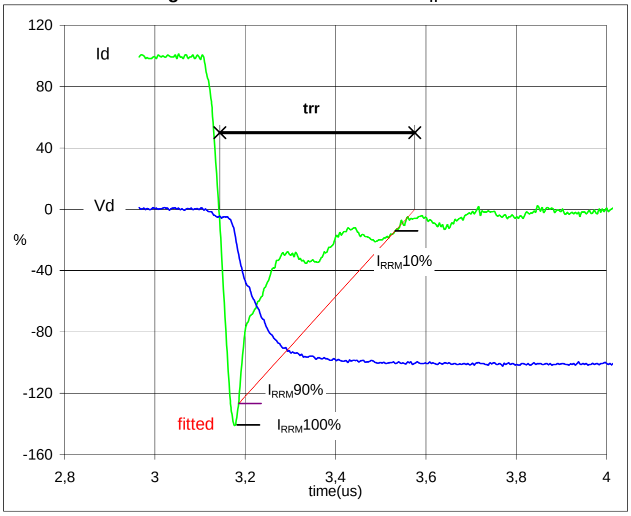
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	29,95	kW
E_{on} (100%) =	4,46	mJ
t_{Eon} =	0,35	μs

Figure 78 Output inverter IGBT

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

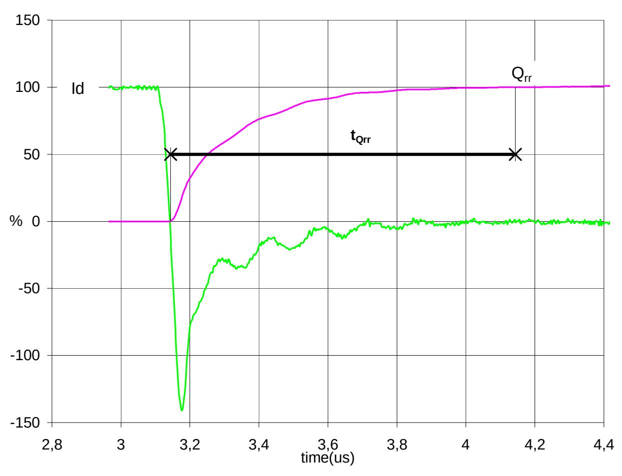


V_d (100%) =	600	V
I_d (100%) =	50	A
I_{RRM} (100%) =	-71	A
t_{rr} =	0,31	μs

Switching Definitions Output Inverter

Figure 8 Output inverter FRED

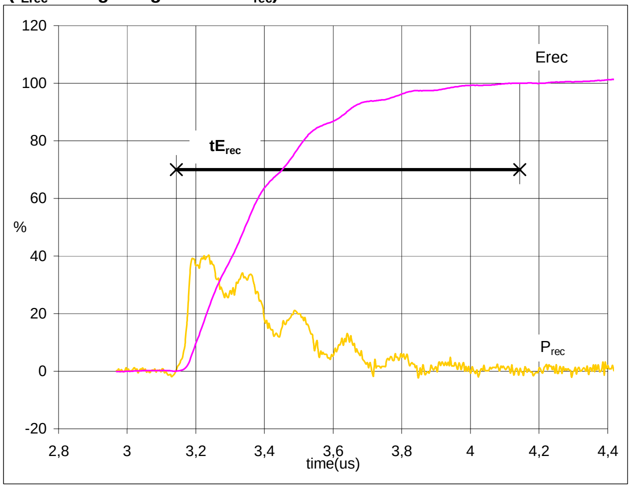
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	50	A
Q_{rr} (100%) =	8,80	µC
t_{Qrr} =	1,00	µs

Figure 9 Output inverter FRED

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



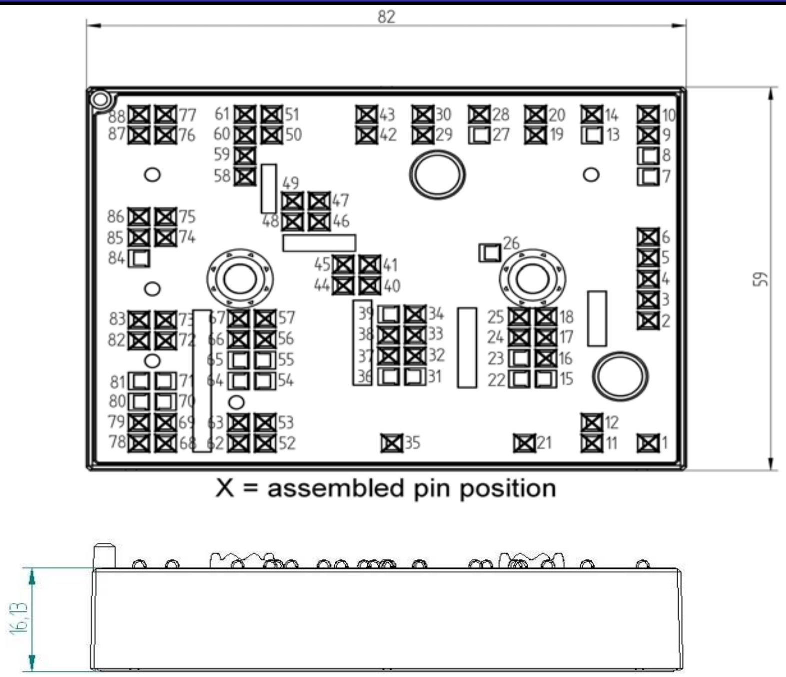
P_{rec} (100%) =	29,95	kW
E_{rec} (100%) =	3,48	mJ
t_{Erec} =	1,00	µs

Ordering Code and Marking - Outline - Pinout

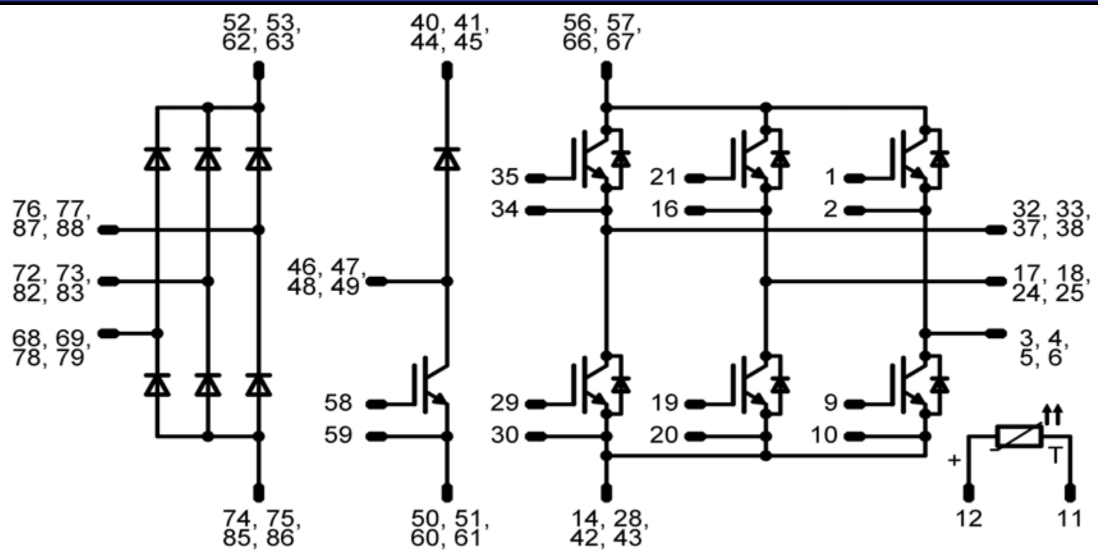
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
with std lid (black V23990-K12-T-PM)	V23990-K428-A40-/0A/-PM	K428A40	K428A40-/0A/
with std lid (black V23990-K12-T-PM) and P12	V23990-K428-A40-/1A/-PM	K428A40	K428A40-/1A/
with thin lid (white V23990-K13-T-PM)	V23990-K428-A40-/0B/-PM	K428A40	K428A40-/0B/
with thin lid (white V23990-K13-T-PM) and P12	V23990-K428-A40-/1B/-PM	K428A40	K428A40-/1B/

Outline



Pinout



DISCLAIMER

The information given in this datasheet describes the type of component and does not represent assured characteristics. For tested values please contact Vincotech.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.