flow2 **1200V/75A**

Features

- 3~rectifier,BRC,Inverter, NTC
- Very Compact housing, easy to route
- Mitsubishi IGBT and FWD

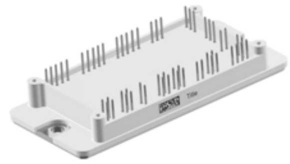
Target Applications

- Motor Drives
- Power Generation

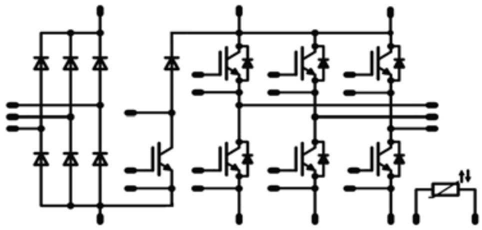
Types

- V23990-P769-A50

flow2



Schematic



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℃ T_c=80℃	92 100	A
Surge forward current	I_{FSM}	t_p=10ms	T_j=25℃	890	A
I2t-value	I^2t			3960	A^2s
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	126 191	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℃ T_c=80℃	83 106	A
Pulsed collector current	I_{Cpulse}	t_p limited by $T_j$max		150	A
Turn off safe operating area		VCE ≤ 1200V, Tj ≤ Top max		150	A
Power dissipation per IGBT	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	204 309	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150℃ V_{GE}=15V		10 850	µs V
Maximum Junction Temperature	$T_j$max			175	℃

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Diode					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25°C		1200	V
DC forward current	I_F	$T_j=T_j$max	T_h=80°C T_c=80°C	79 102	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		150	A
Power dissipation per Diode	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	159 242	W
Maximum Junction Temperature	$T_j$max			175	°C
Brake Transistor					
Collector-emitter break down voltage	V_{CE}			1200	V
DC collector current	I_C	$T_j=T_j$max	T_h=80°C T_c=80°C	60 78	A
Pulsed collector current	I_{Cpuls}	t_p limited by $T_j$max		100	A
Turn off safe operating area		VCE ≤ 1200V, Tj ≤ Top max		100	A
Power dissipation per IGBT	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	150 228	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150°C V_{GE}=15V		10 850	μs V
Maximum Junction Temperature	$T_j$max			175	°C
Brake Inverse Diode					
Peak Repetitive Reverse Voltage	V_{RRM}	T_c=25°C		1200	V
DC forward current	I_F	$T_j=T_j$max	T_h=80°C T_c=80°C	16 16	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		20	A
Brake Inverse Diode	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	69 98	W
Maximum Junction Temperature	$T_j$max			175	°C
Brake Diode					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25°C		1200	V
DC forward current	I_F	$T_j=T_j$max	T_h=80°C T_c=80°C	28 37	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		50	A
Power dissipation per Diode	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	72 109	W
Maximum Junction Temperature	$T_j$max			175	°C

Maximum Ratings

T_j=25℃, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
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
Comparative tracking index	CTI		>200	

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	
Input Rectifier Diode										
Forward voltage	V_F				75	Tj=25°C Tj=125°C	1	1,24 1,26	1,8	V
Threshold voltage (for power loss calc. only)	V_{to}				75	Tj=25°C Tj=125°C		0,89 0,73		V
Slope resistance (for power loss calc. only)	r_t				75	Tj=25°C Tj=125°C		5 7		mΩ
Reverse current	I_r			1500		Tj=25°C Tj=125°C			0,1	mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						0,56		K/W
Thermal resistance chip to heatsink per chip	R_{thJC}							0,37		
Inverter Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0075	Tj=25°C Tj=150°C	5,4	6	6,6	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		75	Tj=25°C Tj=150°C	1,4	1,84 2,22	2,2	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	1200		Tj=25°C Tj=150°C			300	µA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=150°C			500	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=4 Ω Rgon=4 Ω	±15	600	75	Tj=25°C Tj=150°C		60 60		ns
Rise time	t_r					Tj=25°C Tj=150°C		6 8		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=150°C		134 188		
Fall time	t_f					Tj=25°C Tj=150°C		66 94		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C		2,08 3,46		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C		3,54 6,31		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		7500		pF
Output capacitance	C_{oss}							1500		
Reverse transfer capacitance	C_{rss}							130		
Gate charge	Q_{Gate}		±15			Tj=25°C		175		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						0,47		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,31		
Inverter Diode										
Diode forward voltage	V_F				75	Tj=25°C Tj=150°C	1,4	1,77 1,9	2,2	V
Peak reverse recovery current	I_{RRM}	Rgoff=4 Ω	±15	600	75	Tj=25°C Tj=150°C		160 164,8		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		114,9 160,2		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=150°C		9,94 18,79		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=150°C		8310 4137		A/µs
Reverse recovered energy	Erec					Tj=25°C Tj=150°C		4,78 9,32		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						0,60		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,39		

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
Brake Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$		10	0,005	Tj=25℃ Tj=150℃	5,4	6	6,6	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		50	Tj=25℃ Tj=150℃	1,4	1,77 2,12	2,3	V
Collector-emitter cut-off incl diode	I_{CES}		0	1200		Tj=25℃ Tj=150℃			300	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25℃ Tj=150℃			500	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=8 Ω Rgon=8 Ω	±15	600	50	Tj=25℃ Tj=150℃		60 60,8		ns
Rise time	t_r					Tj=25℃ Tj=150℃		9,8 12,6		
Turn-off delay time	$t_{d(off)}$					Tj=25℃ Tj=150℃		124 176		
Fall time	t_f					Tj=25℃ Tj=150℃		47 80		
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=150℃		1,79 2,8		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=150℃		2,37 4,04		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25℃		5000		pF
Output capacitance	C_{oss}							1000		
Reverse transfer capacitance	C_{rss}							80		
Gate charge	Q_{Gate}		15	600	50	Tj=25℃		117		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						0,63		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,42		
Brake Inverse Diode										
Diode forward voltage	V_F				10	Tj=25℃ Tj=150℃	1,2	1,80 1,76	2,2	V
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						1,38		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,91		
Brake Diode										
Diode forward voltage	V_F				25	Tj=25℃ Tj=150℃	1	2,24 2,36	2,9	V
Reverse leakage current	I_r			1200		Tj=25℃ Tj=150℃			60	μA
Peak reverse recovery current	I_{RRM}	Rgoff=8 Ω Rgoff=8 Ω	±15	600	50	Tj=25℃ Tj=150℃		58 59,8		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=150℃		119 276		ns
Reverse recovered charge	Q_{rr}					Tj=25℃ Tj=150℃		3,4 3,4		μC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25℃ Tj=150℃		2926 1546		A/μs
Reverse recovery energy	E_{rec}					Tj=25℃ Tj=150℃		1,42 2,86		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						1,32		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,87		
Thermistor										
Rated resistance	R					T=25℃		21511		Ω
Deviation of R100	ΔR/R	R100=1486 Ω				T=25℃	-4,5		+4,5	%
Power dissipation	P					T=25℃		210		mW
Power dissipation constant						T=25℃		3,5		mW/K
B-value	$B_{(25/50)}$					T=25℃		3884		K
B-value	$B_{(25/100)}$					T=25℃		3964		K
Vincotech NTC Reference									F	

Characteristic Values

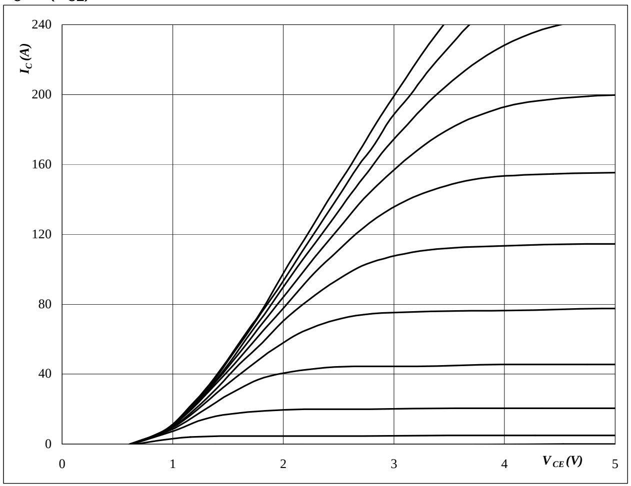
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Module Properties										
Thermal resistance, case to heatsink	R_{thCH}							tbd.		K/W
Module stray inductance	L_{sCE}							5		nH
Chip module lead resistance, terminals -chip	$R_{cc'1+EE'}$							tbd.		mΩ
Mounting torque	M						3,8	4	4,2	Nm
Terminal connection torque	M						6,7	7	7,4	Nm
Weight	G							tbd.		g

Output Inverter

Figure 1 Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



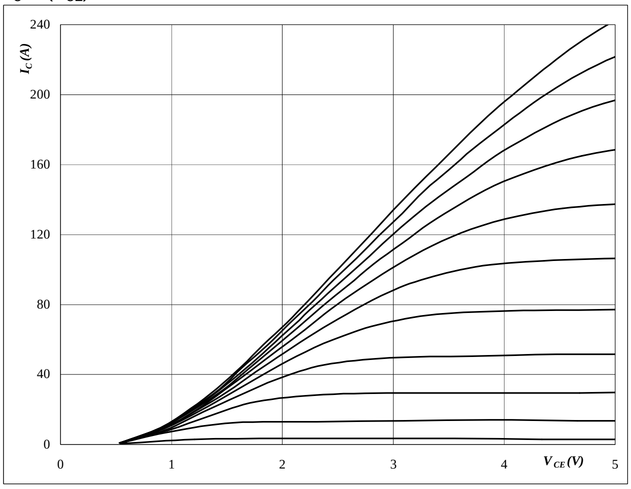
At

t_p =	250	µs
T_j =	25	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 2 Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



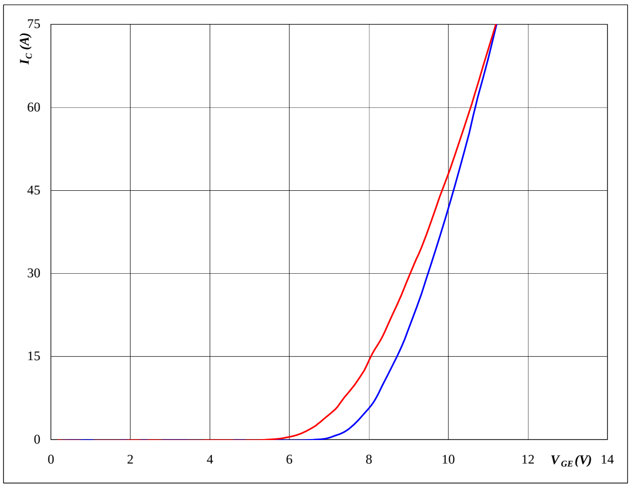
At

t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 3 Output inverter IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



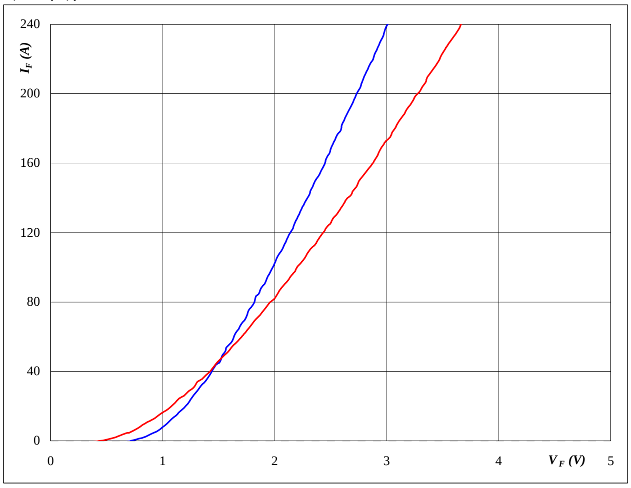
At

T_j =	25/150	°C
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

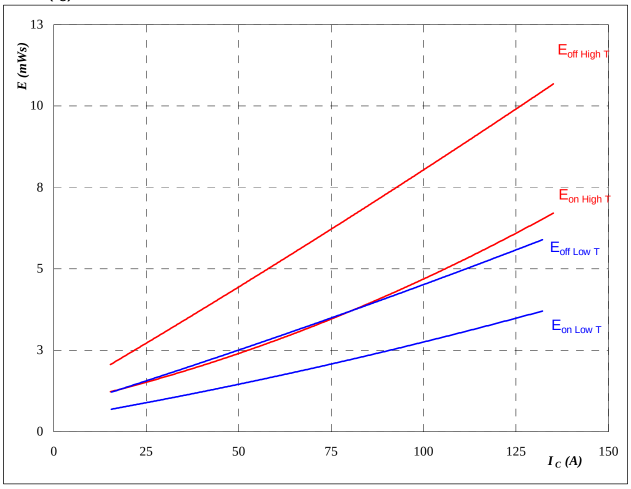
t_p =	250	µs

Output Inverter

Figure 5	Output inverter IGBT

Typical switching energy losses
as a function of collector current

E = f(I_C)



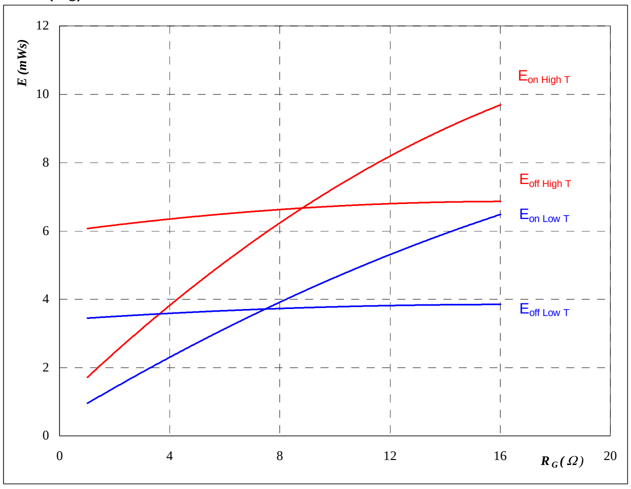
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	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)



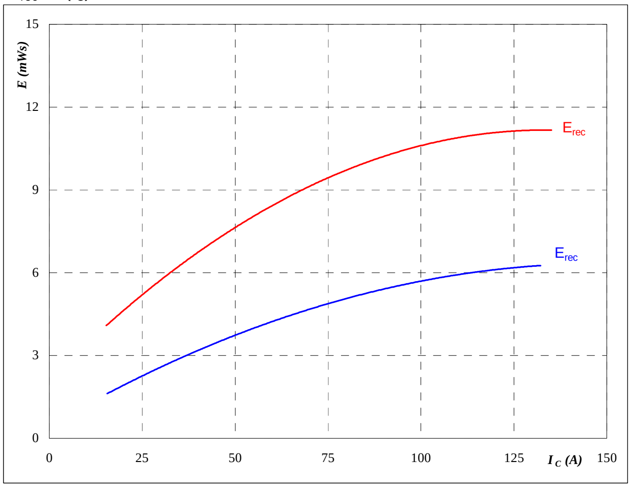
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	75	A

Figure 7	Output inverter FWD

Typical reverse recovery energy loss
as a function of collector current

E_{rec} = f(I_C)



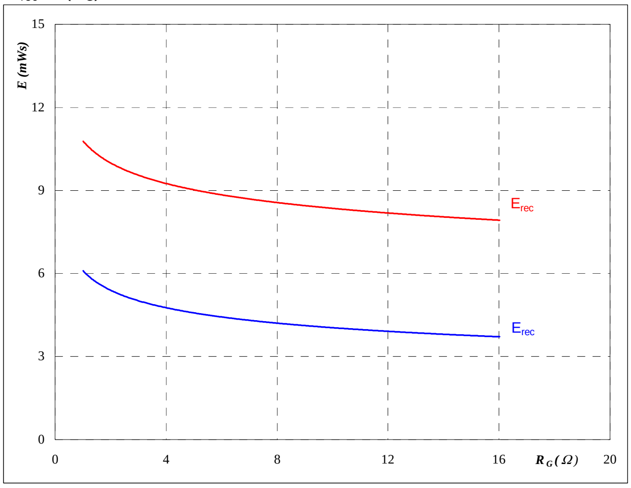
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 8	Output inverter FWD

Typical reverse recovery energy loss
as a function of gate resistor

E_{rec} = f(R_G)



With an inductive load at

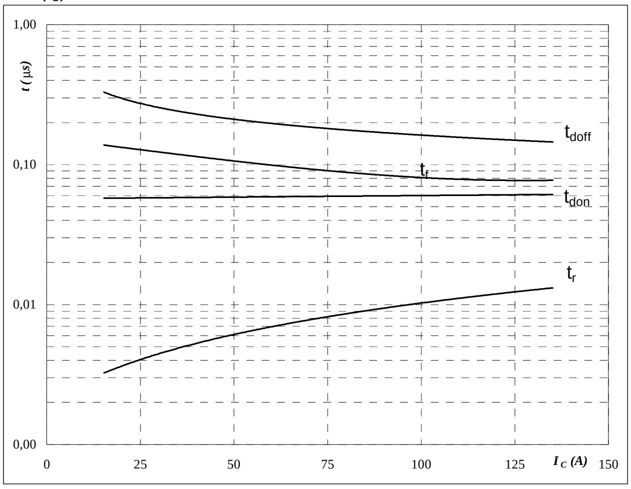
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	75	A

Output Inverter

Figure 9 Output inverter IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



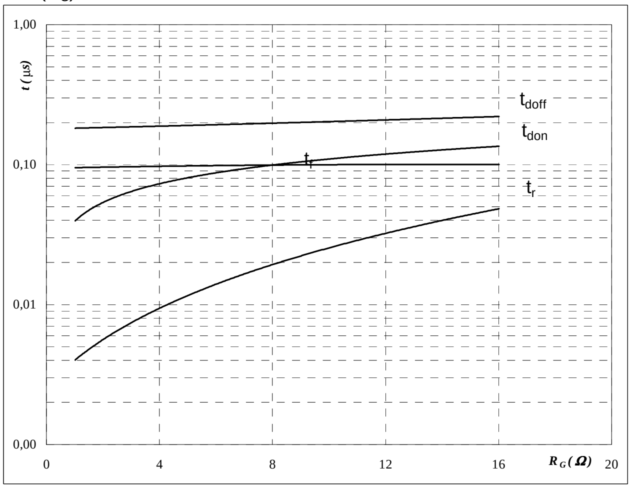
With an inductive load at

T_j =	150	℃
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10 Output inverter IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



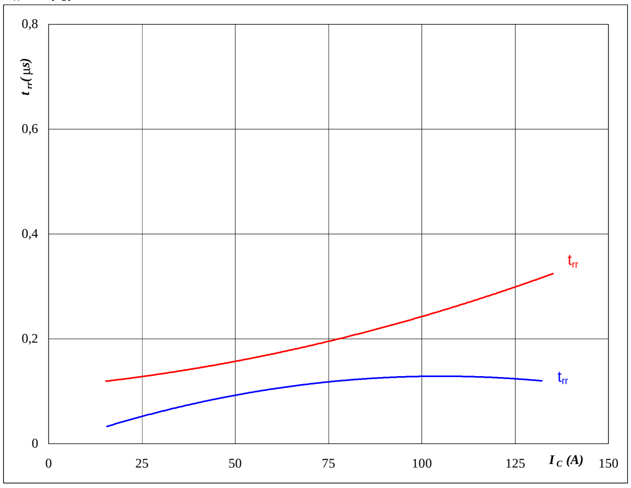
With an inductive load at

T_j =	150	℃
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	75	A

Figure 11 Output inverter FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



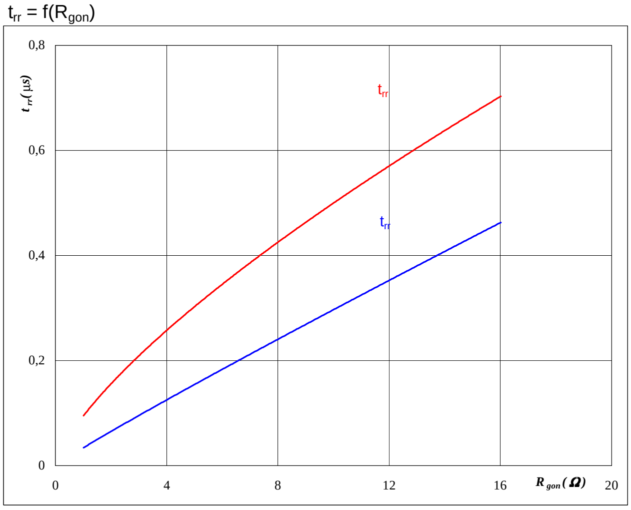
At

T_j =	25/150	℃
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 12 Output inverter FWD

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

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



At

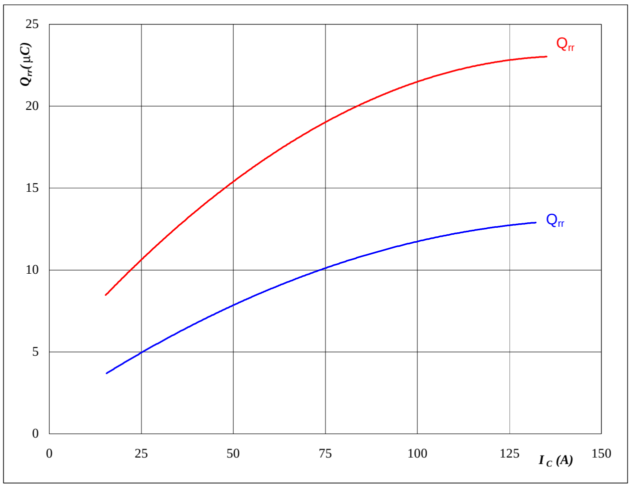
T_j =	25/150	℃
V_R =	600	V
I_F =	75	A
V_{GE} =	±15	V

Output Inverter

Figure 13 Output inverter FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



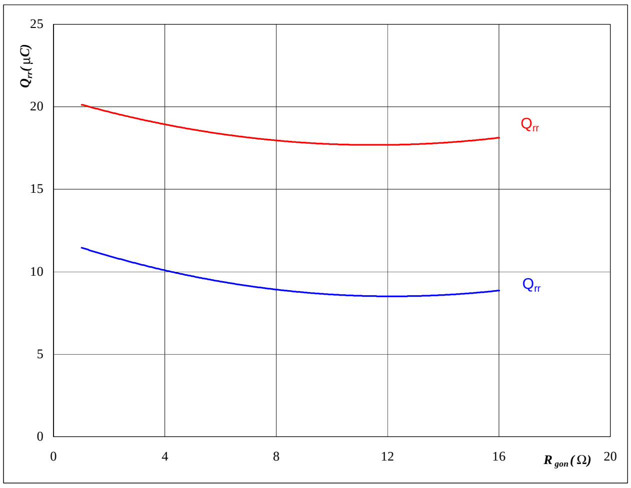
At

T_j =	25/150	°C
V_{CE} =	600	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

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



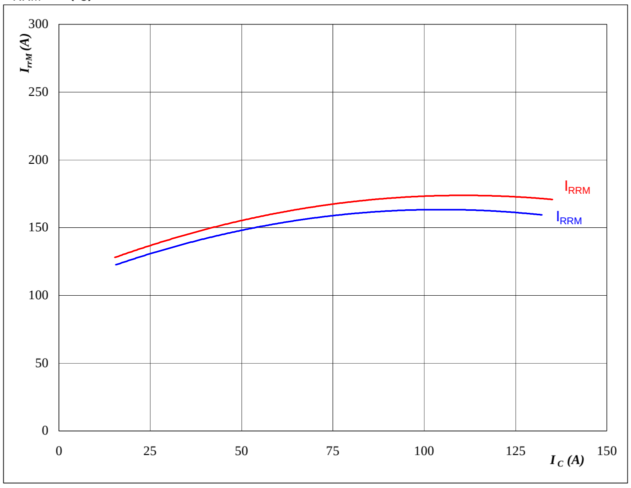
At

T_j =	25/150	°C
V_R =	600	V
I_F =	75	A
V_{GE} =	±15	V

Figure 15 Output inverter FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



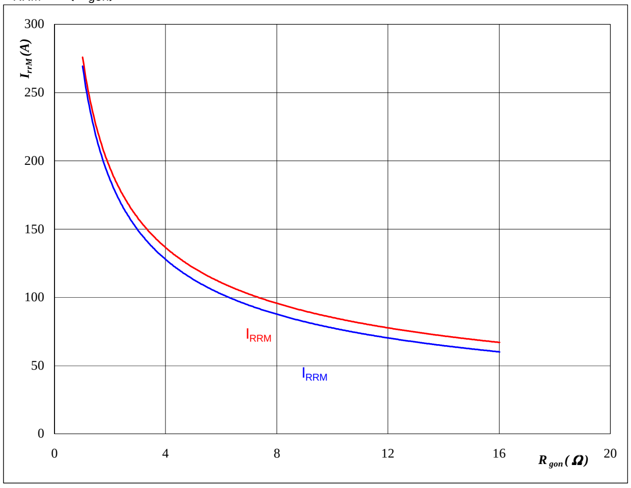
At

T_j =	25/150	°C
V_{CE} =	600	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

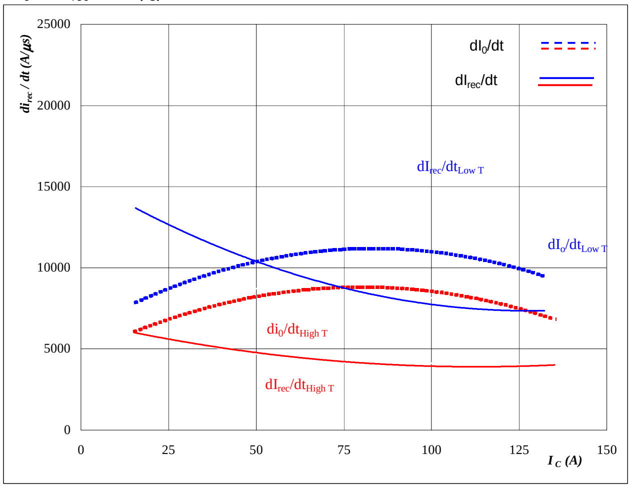
T_j =	25/150	°C
V_R =	600	V
I_F =	75	A
V_{GE} =	±15	V

Output Inverter

Figure 17	Output inverter FWD

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

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



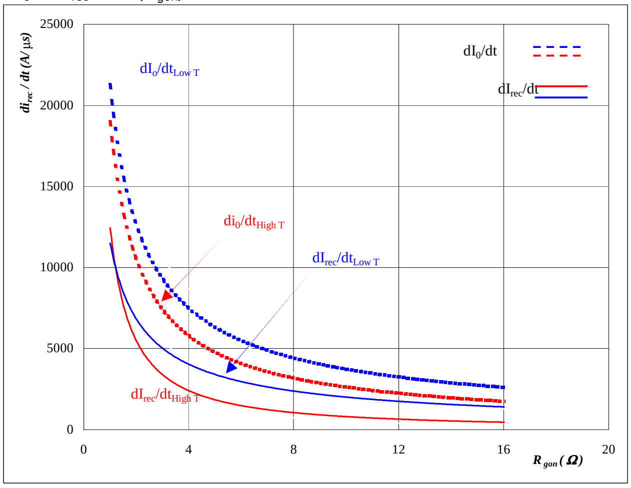
At

T_j =	25/150	℃
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 18	Output inverter FWD

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

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



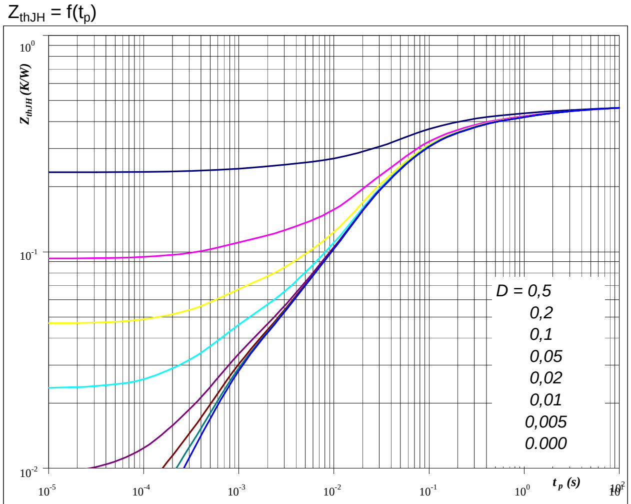
At

T_j =	25/150	℃
V_R =	600	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} =	0,47	K/W	RthJH =	0,45	K/W

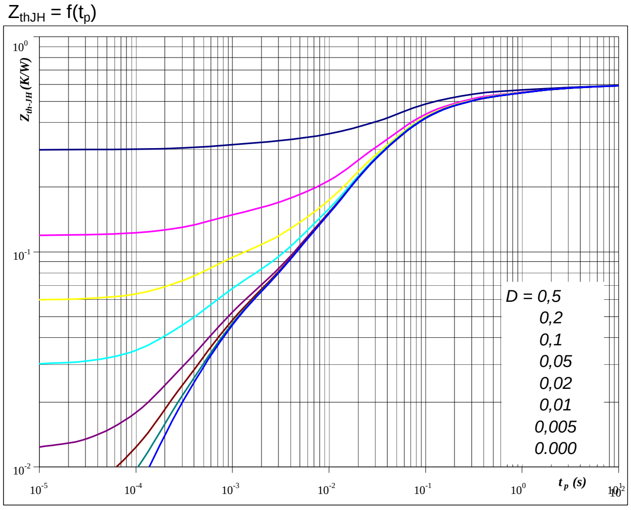
IGBT thermal model values

Thermal grease R (C/W)	Thermal grease Tau (s)	Phase change interface R (C/W)	Phase change interface Tau (s)
0,04	3,6E+00	0,04	3,5E+00
0,06	7,0E-01	0,06	6,8E-01
0,13	1,3E-01	0,12	1,2E-01
0,18	3,3E-02	0,18	3,2E-02
0,03	8,1E-03	0,03	7,9E-03
0,03	7,8E-04	0,02	7,5E-04

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} =	0,60	K/W	RthJH =	0,58	K/W

FWD thermal model values

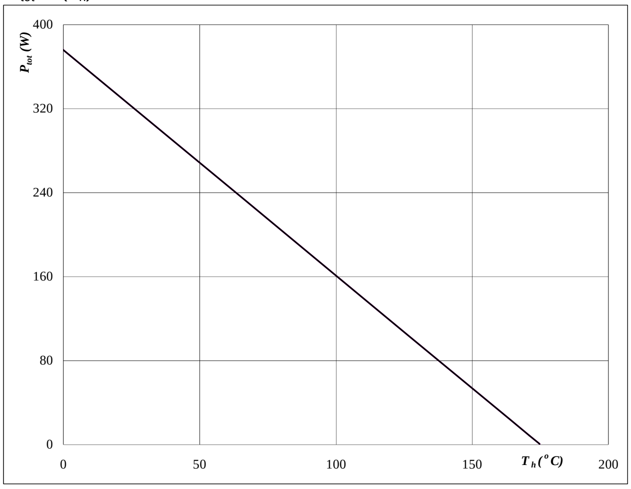
Thermal grease R (C/W)	Thermal grease Tau (s)	Phase change interface R (C/W)	Phase change interface Tau (s)
0,04	3,9E+00	0,04	3,8E+00
0,07	6,6E-01	0,06	6,4E-01
0,17	1,1E-01	0,17	1,1E-01
0,25	3,0E-02	0,24	2,9E-02
0,03	4,4E-03	0,03	4,3E-03
0,03	5,5E-04	0,03	5,4E-04

Output Inverter

Figure 21 Output inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



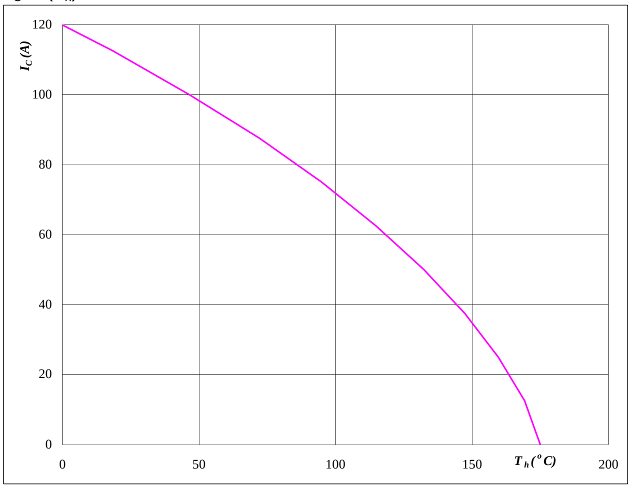
At

T_j = 175 °C

Figure 22 Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

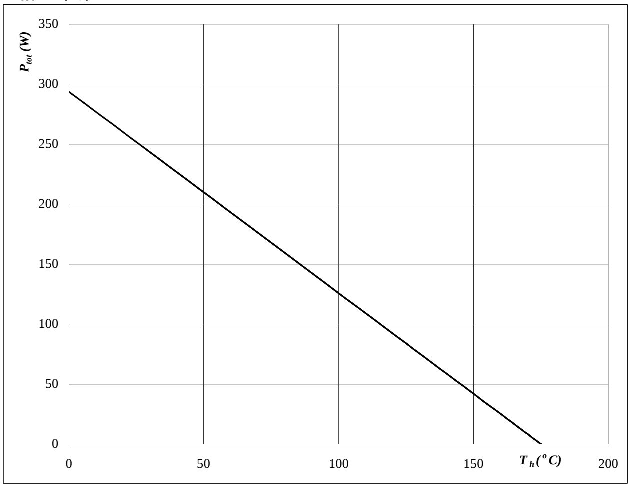
T_j = 175 °C

V_{GE} = 15 V

Figure 23 Output inverter FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



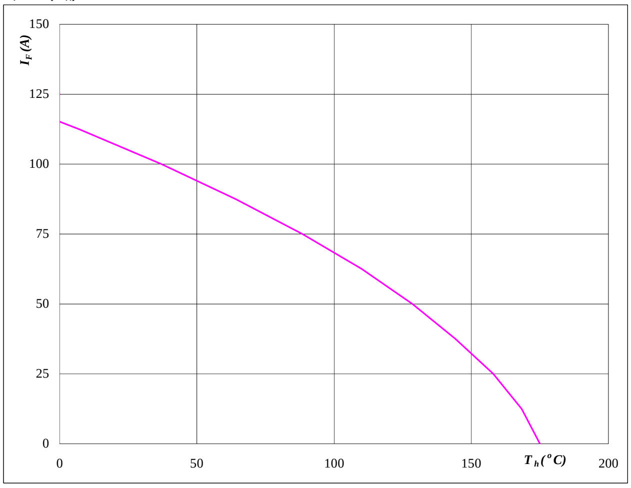
At

T_j = 175 °C

Figure 24 Output inverter FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

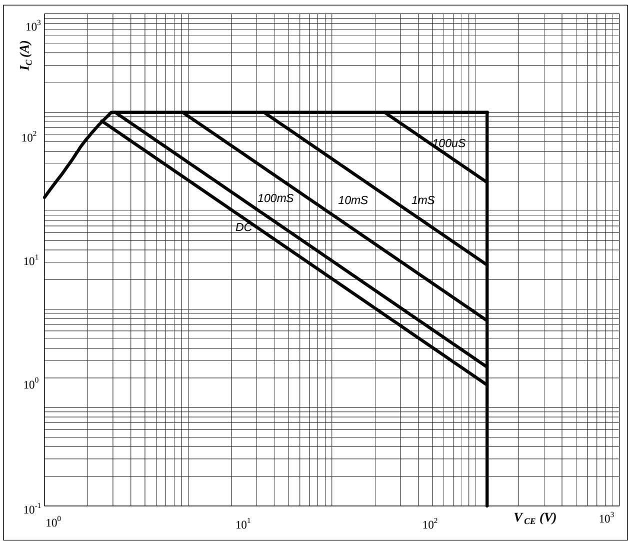
T_j = 175 °C

Output Inverter

Figure 25 Output inverter IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



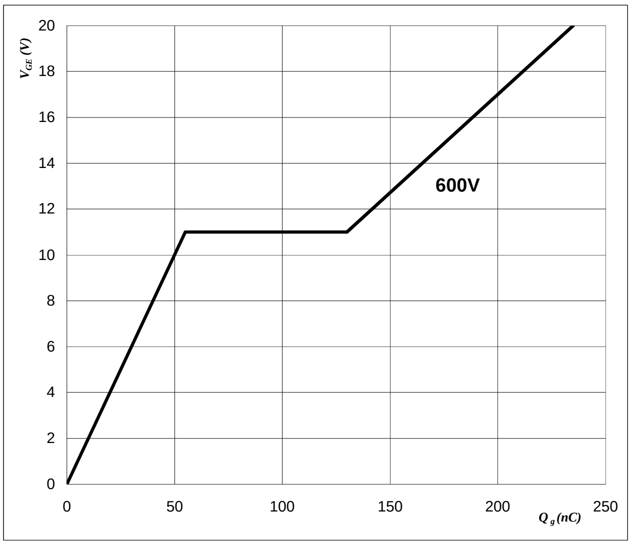
At

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

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



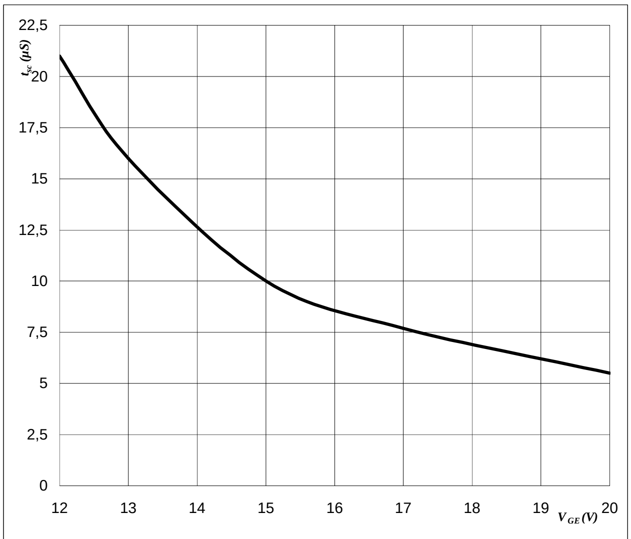
At

I_C =	75	A

Figure 27 Output inverter IGBT

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

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



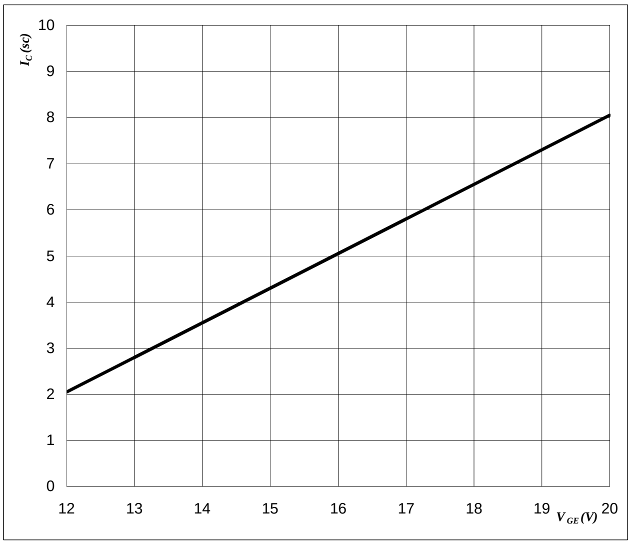
At

V_{CE} =	1200	V
T_j ≤	175	ºC

Figure 28 Output inverter IGBT

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

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



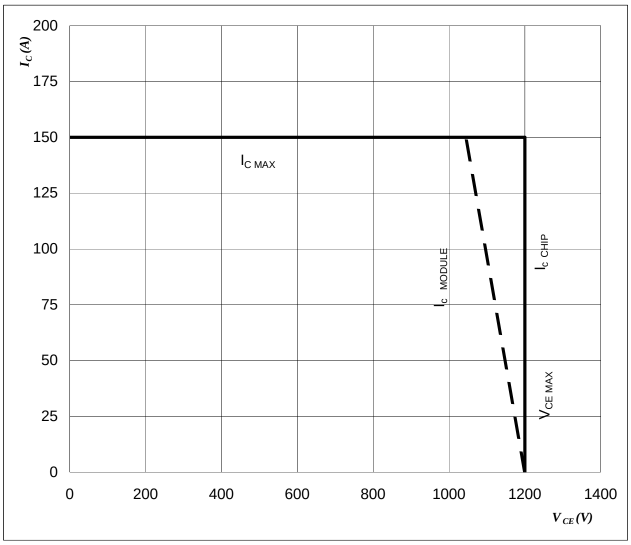
At

V_{CE} ≤	1200	V
T_j =	175	ºC

Figure 29	IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

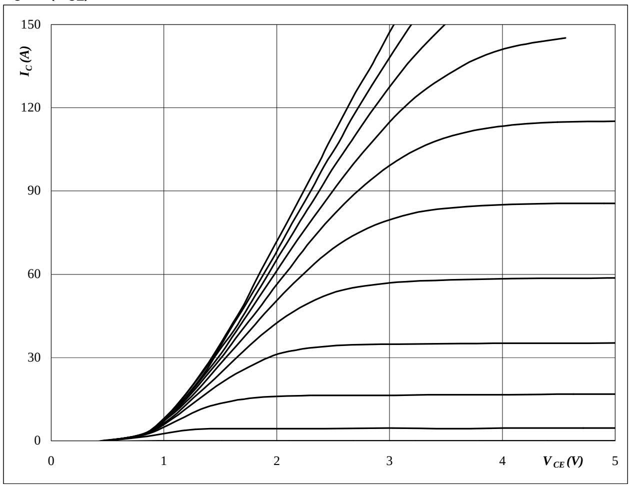
T_j =	150 ℃
Rgon =	4 Ω
Rgoff =	4 Ω

Brake

Figure 1	Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$



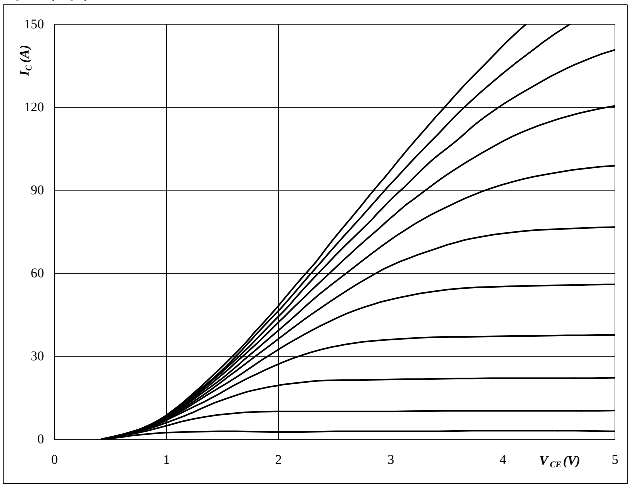
At

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

$I_C = f(V_{CE})$



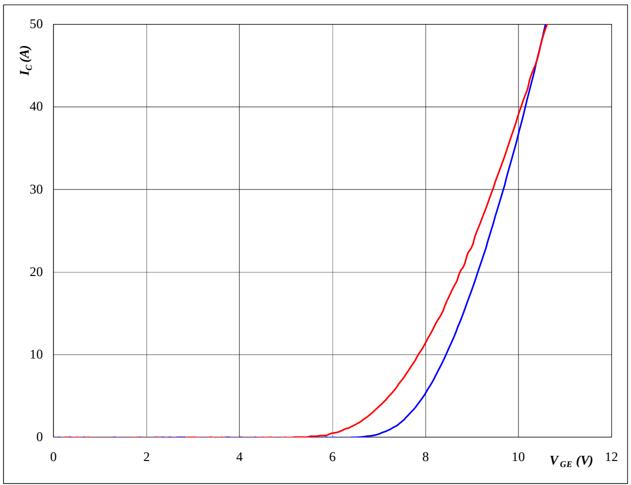
At

t_p =	250	μs
T_j =	149	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 3	Brake IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



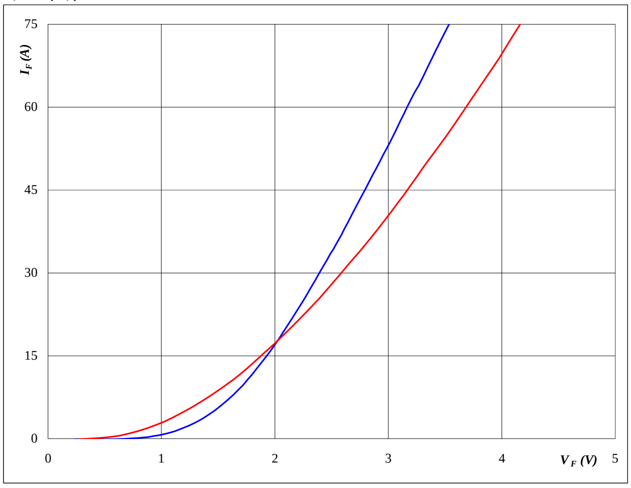
At

T_j =	25/150	°C
t_p =	250	μs
V_{CE} =	10	V

Figure 4	Brake FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

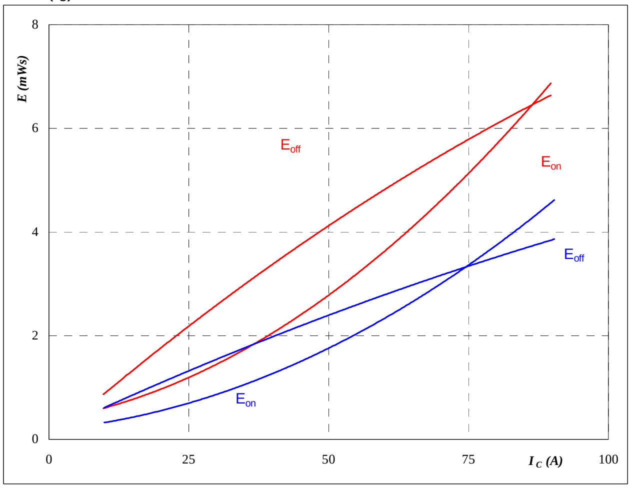
t_p =	250	μs

Brake

Figure 5 Brake IGBT

Typical switching energy losses
as a function of collector current

E = f(I_C)



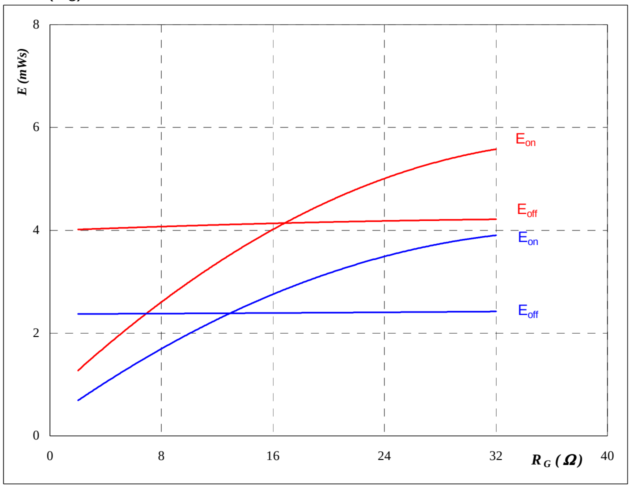
With an inductive load at

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)



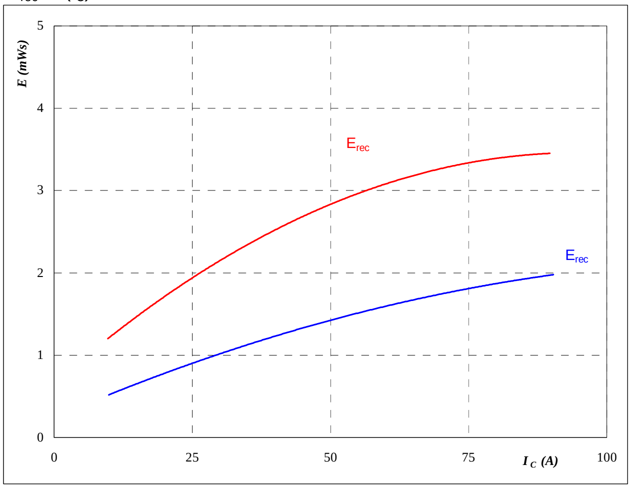
With an inductive load at

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

Figure 7 Brake FWD

Typical reverse recovery energy loss
as a function of collector current

E_{rec} = f(I_C)



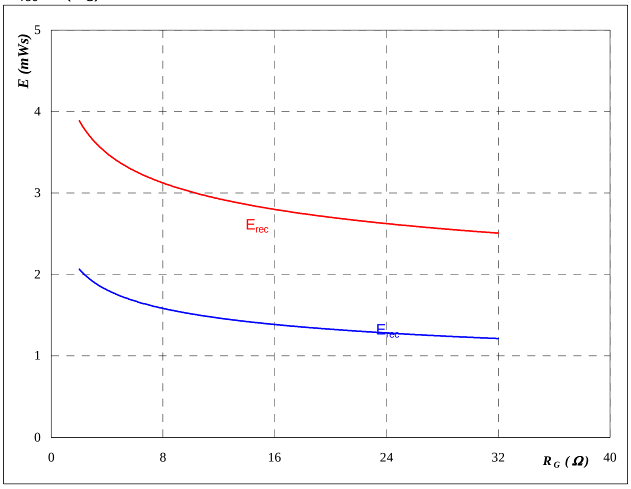
With an inductive load at

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

Figure 8 Brake FWD

Typical reverse recovery energy loss
as a function of gate resistor

E_{rec} = f(R_G)



With an inductive load at

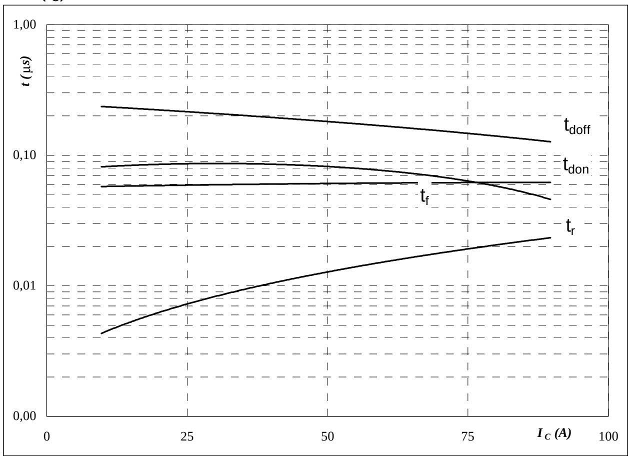
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	50	A

Brake

Figure 9 — Brake IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



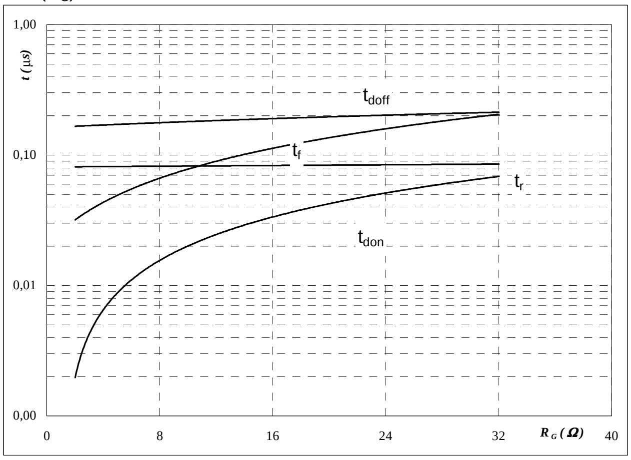
With an inductive load at

T_j =	150	℃
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

$t = f(R_G)$



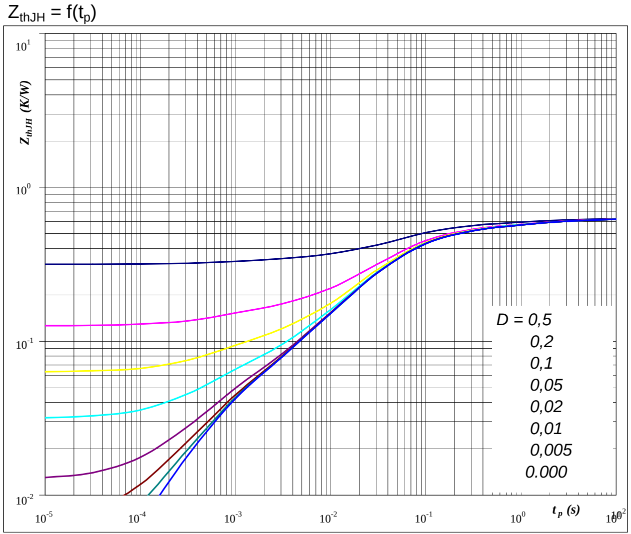
With an inductive load at

T_j =	150	℃
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

$Z_{thJH} = f(t_p)$

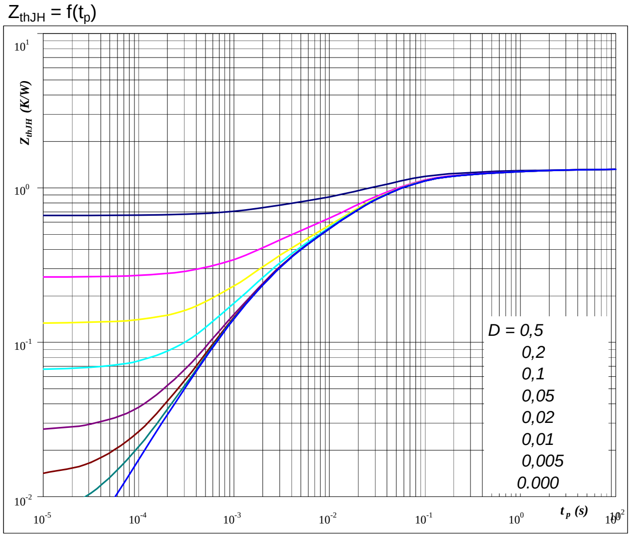


At		D =	tp / T		
Thermal grease			Phase change interface		
R_{thJH} =	0,631	K/W	R_{thJH} =	0,61	K/W

Figure 12 — Brake FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



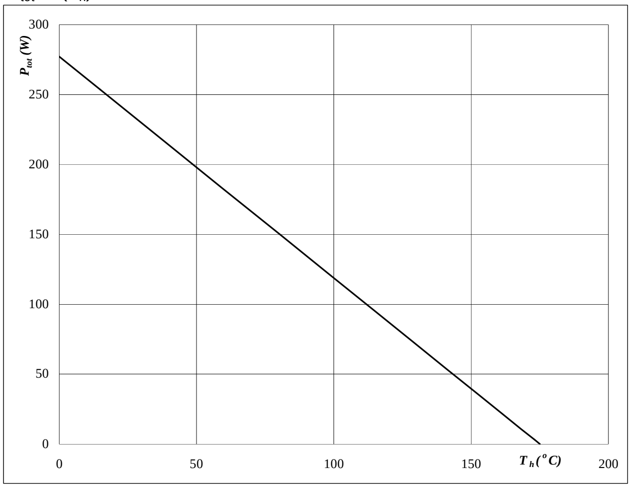
At		D =	tp / T		
Thermal grease			Phase change interface		
R_{thJH} =	1,32	K/W	R_{thJH} =	1,28	K/W

Brake

Figure 13 Brake IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



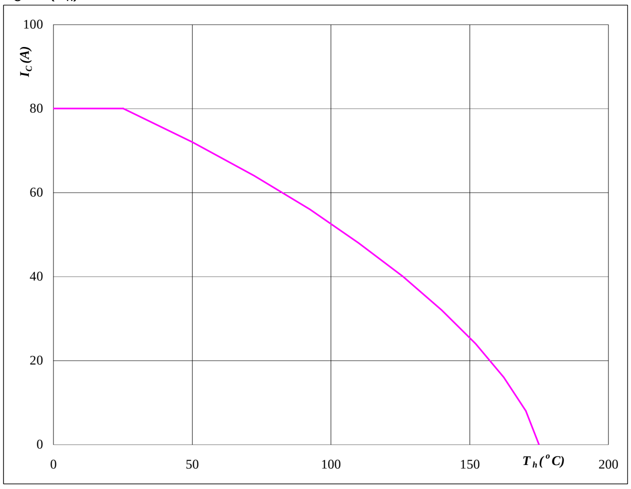
At

T_j = 175 ºC

Figure 14 Brake IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

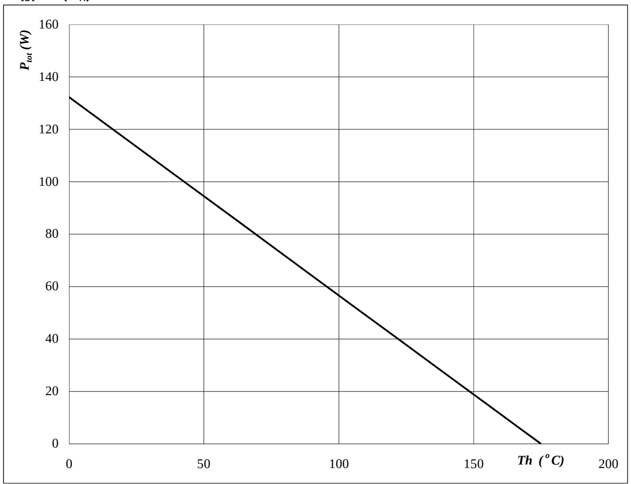
T_j = 175 ºC

V_{GE} = 15 V

Figure 15 Brake FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



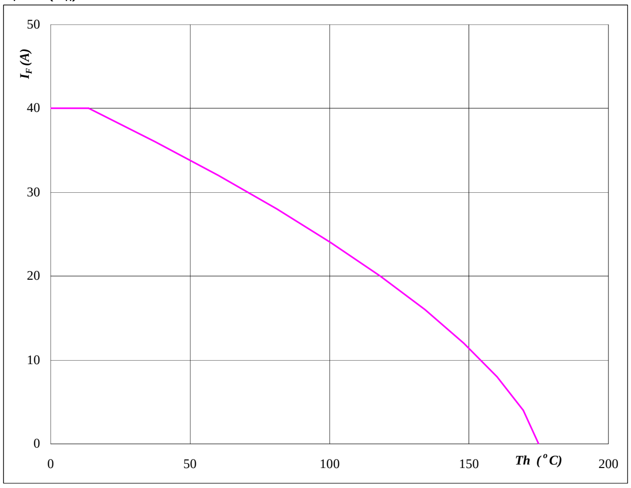
At

T_j = 175 ºC

Figure 16 Brake FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

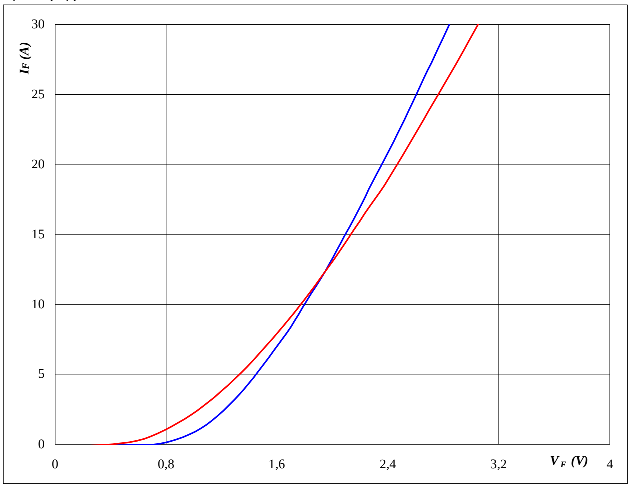
T_j = 175 ºC

Brake Inverse Diode

Figure 1 Brake inverse diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

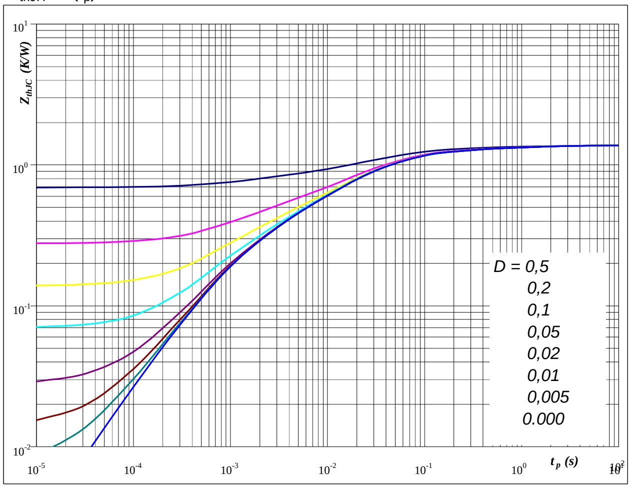
T_j = 25/150 ℃

t_p = 250 µs

Figure 2 Brake inverse diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At D = tp / T

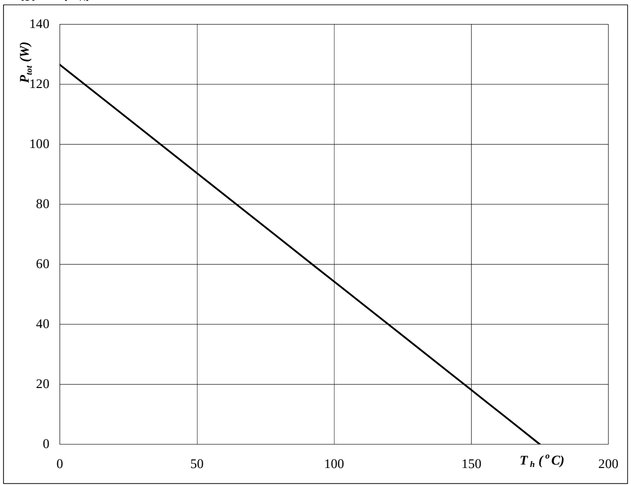
Thermal grease | Phase change interface

R_{thJH} = 1,38 K/W | R_{thJH} = 1,34 K/W

Figure 3 Brake inverse diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



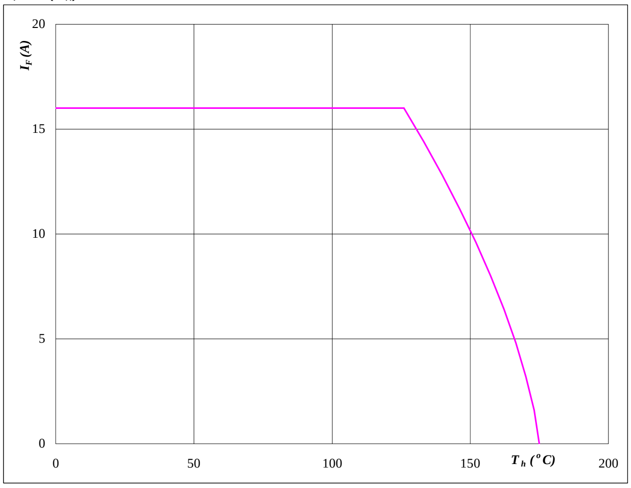
At

T_j = 150 ºC

Figure 4 Brake inverse diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

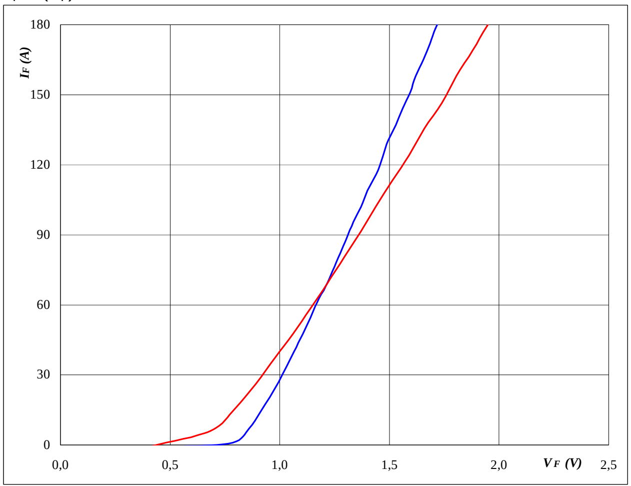
T_j = 150 ºC

Input Rectifier Bridge

Figure 1 Rectifier diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

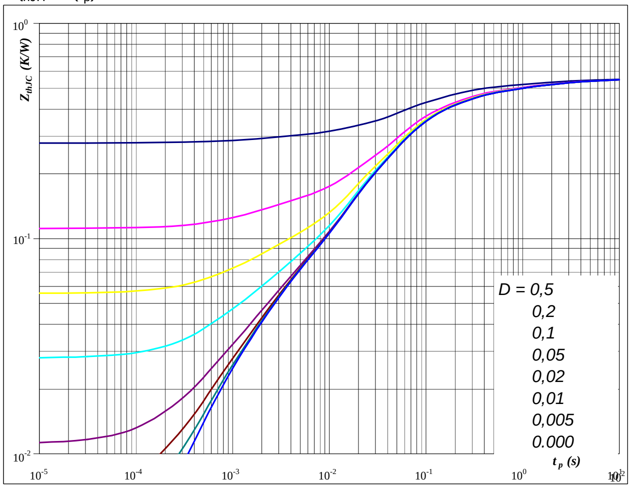
T_j = 25/125 ℃

t_p = 250 µs

Figure 2 Rectifier diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

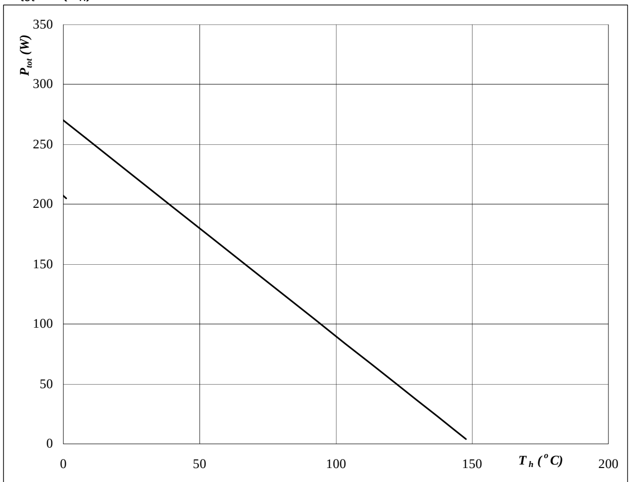
D = t_p / T

R_{thJH} = 0,56 K/W

Figure 3 Rectifier diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



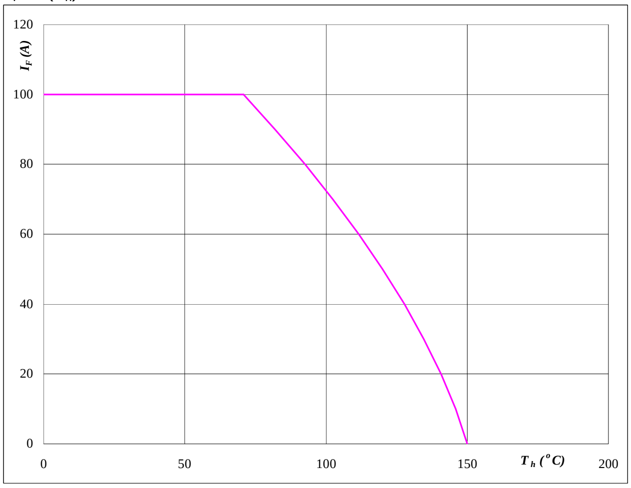
At

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

$R_T = f(T)$

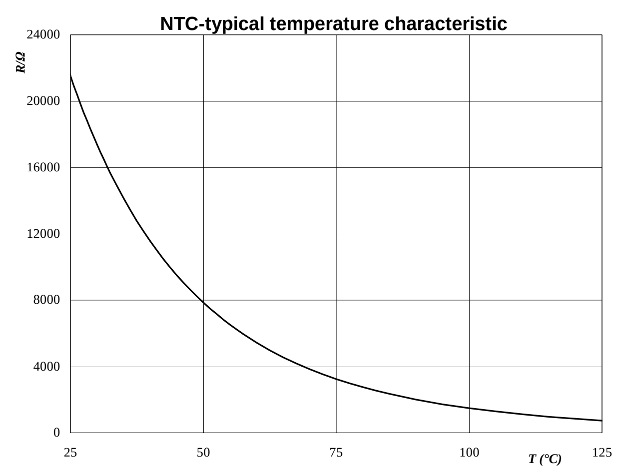


Figure 2 Thermistor

Typical NTC resistance values

$$R(T) = R_{25} \cdot e^{\left(B_{25/100} \cdot \left(\frac{1}{T} - \frac{1}{T_{25}}\right)\right)} \quad [\Omega]$$

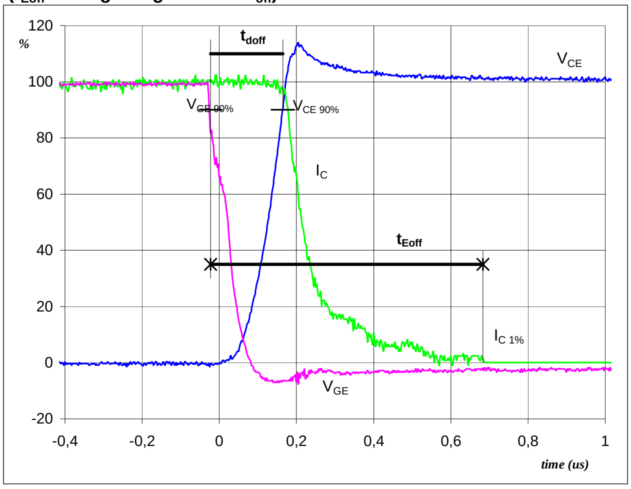
Switching Definitions Output Inverter

General conditions

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

Figure 1 Output inverter IGBT

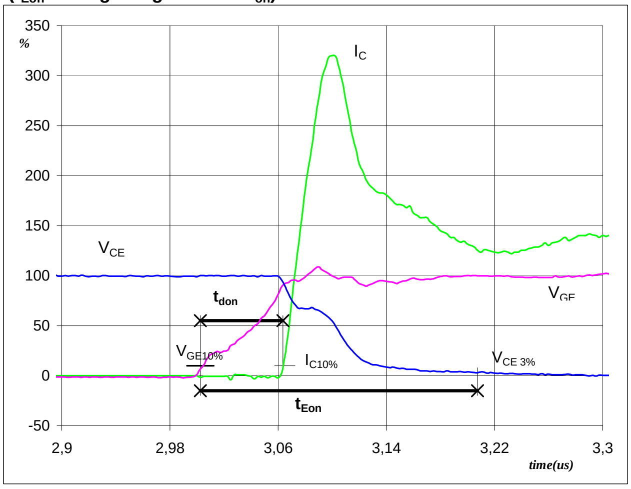
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	75	A
t_{doff} =	0,19	μs
t_{Eoff} =	0,71	μs

Figure 2 Output inverter IGBT

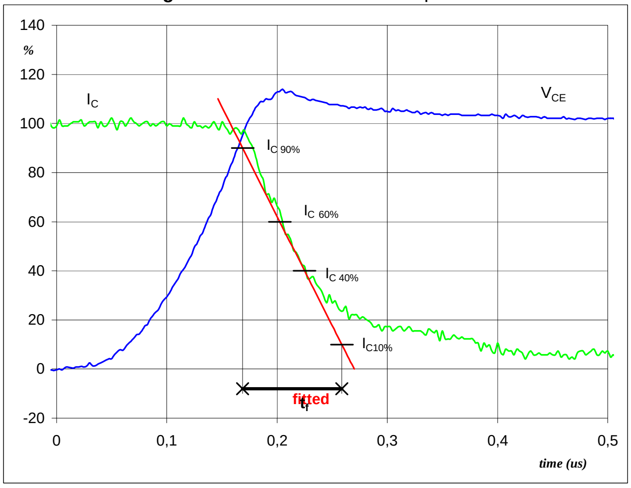
Turn-on Switching Waveforms & definition of tdon, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	75	A
t_{don} =	0,06	μs
t_{Eon} =	0,20	μs

Figure 3 Output inverter IGBT

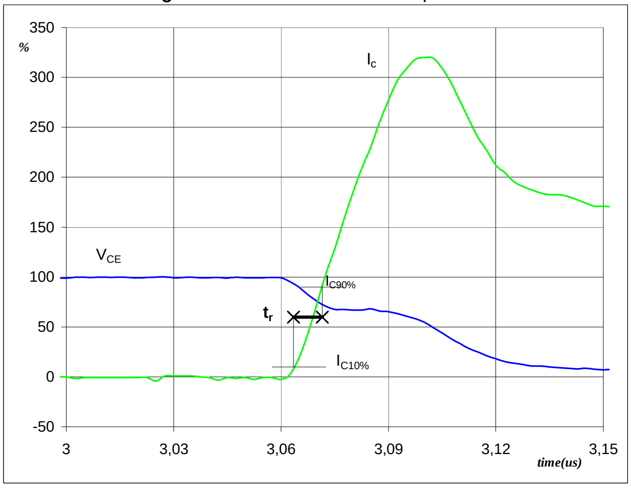
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	75	A
t_f =	0,094	μs

Figure 4 Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

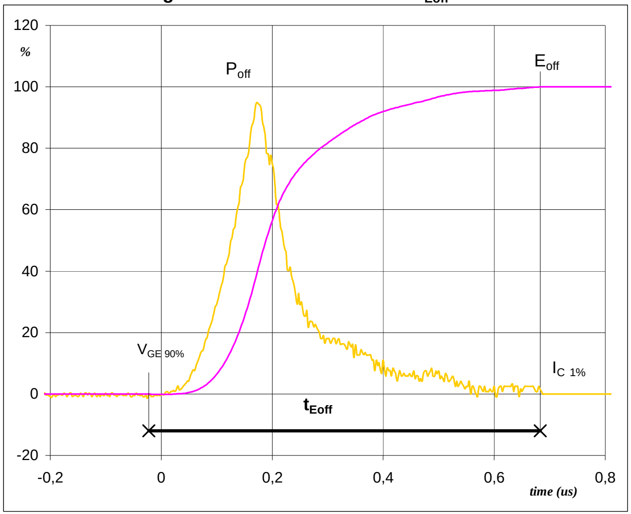


V_C (100%) =	600	V
I_C (100%) =	75	A
t_r =	0,008	μs

Switching Definitions Output Inverter

Figure 5 Output inverter IGBT

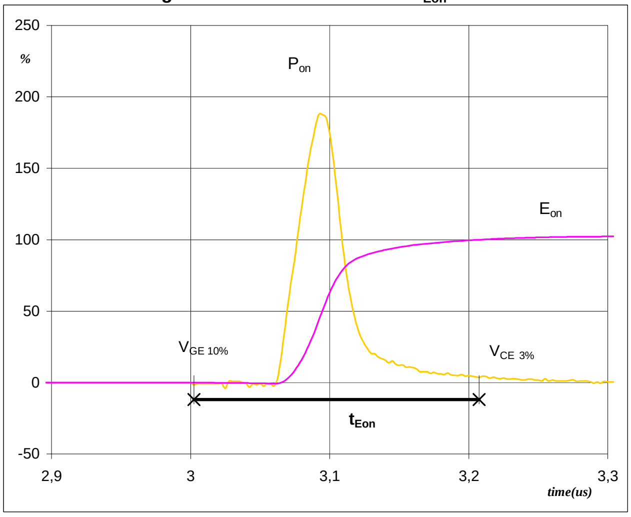
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	44,87	kW
E_{off} (100%) =	6,31	mJ
t_{Eoff} =	0,71	µs

Figure 6 Output inverter IGBT

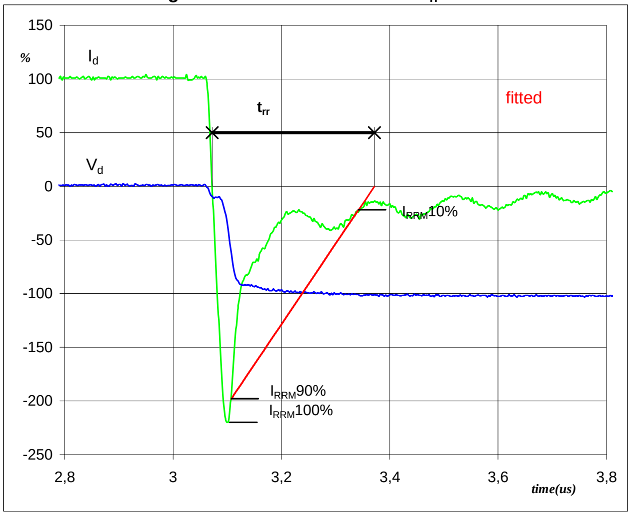
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	44,87	kW
E_{on} (100%) =	3,46	mJ
t_{Eon} =	0,20	µs

Figure 7 Output inverter FWD

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

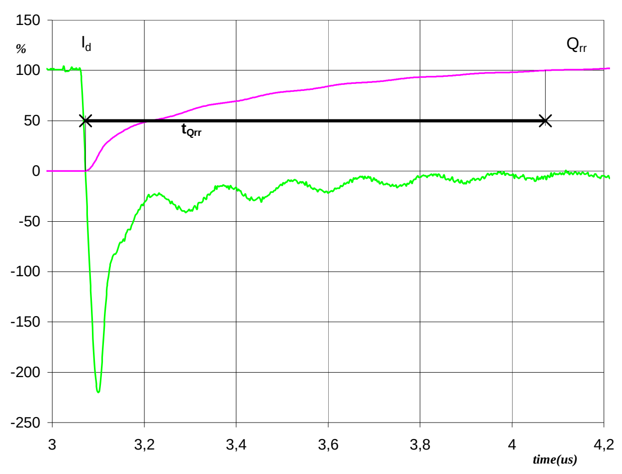


V_d (100%) =	600	V
I_d (100%) =	75	A
I_{RRM} (100%) =	-165	A
t_{rr} =	0,16	µs

Switching Definitions Output Inverter

Figure 8 Output inverter FWD

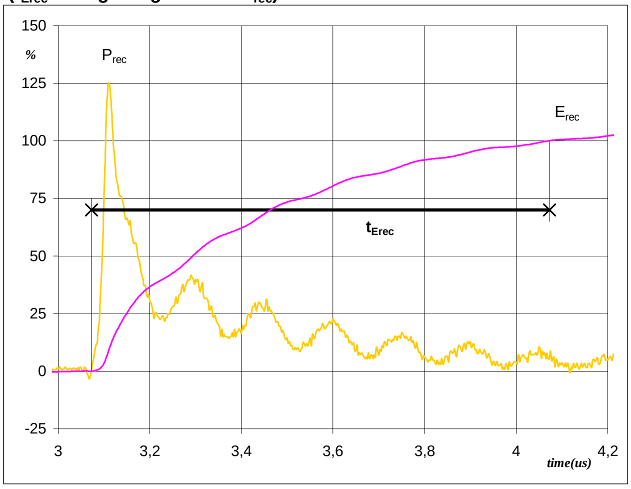
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	75	A
Q_{rr} (100%) =	18,79	µC
t_{Qrr} =	1,00	µs

Figure 9 Output inverter FWD

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



P_{rec} (100%) =	44,87	kW
E_{rec} (100%) =	9,32	mJ
t_{Erec} =	1,00	µs

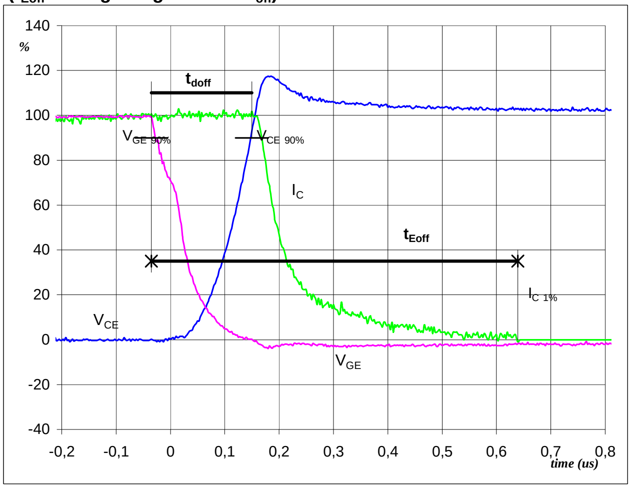
Switching Definitions Brake

General conditions

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

Figure 1 PFC MOSFET / IGBT

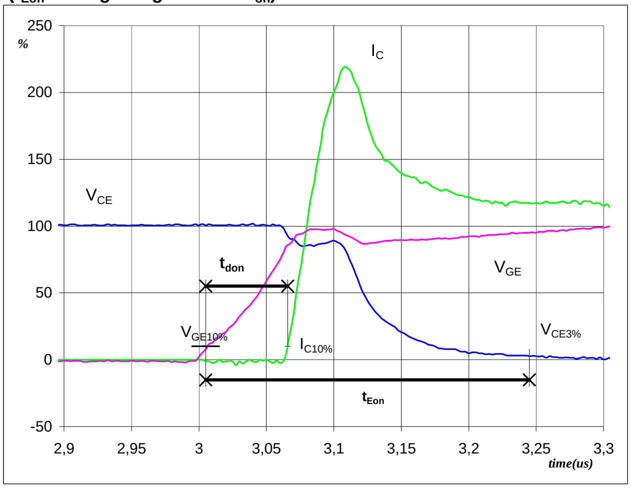
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	50	A
t_{doff} =	0,18	µs
t_{Eoff} =	0,67	µs

Figure 2 PFC MOSFET / IGBT

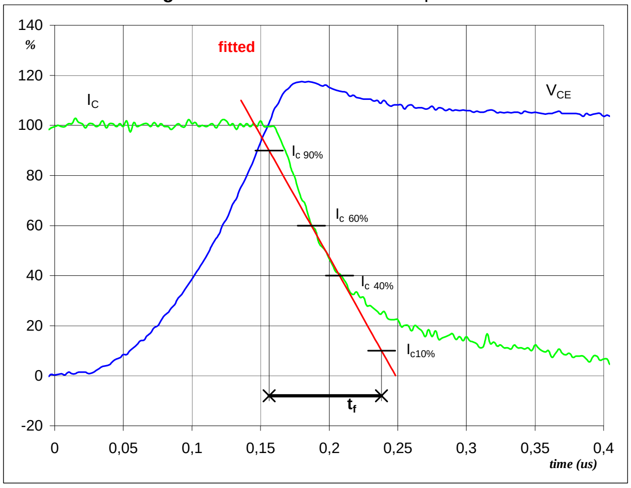
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	50	A
t_{don} =	0,06	µs
t_{Eon} =	0,24	µs

Figure 3 PFC MOSFET / IGBT

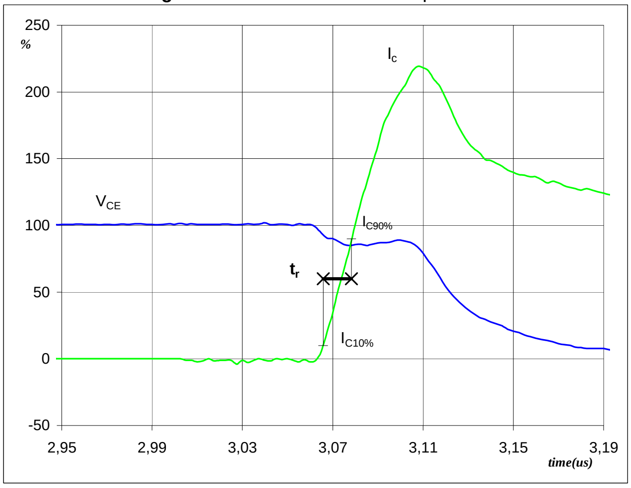
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	50	A
t_f =	0,08	µs

Figure 4 PFC MOSFET / IGBT

Turn-on Switching Waveforms & definition of t_r

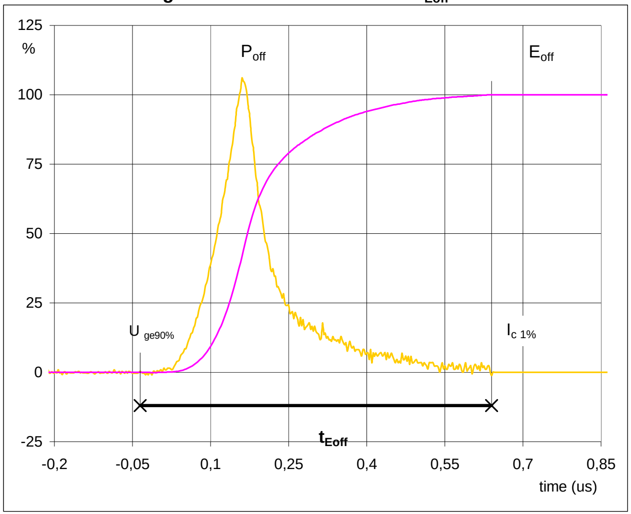


V_C (100%) =	600	V
I_C (100%) =	50	A
t_r =	0,01	µs

Switching Definitions Brake

Figure 5 PFC MOSFET / IGBT

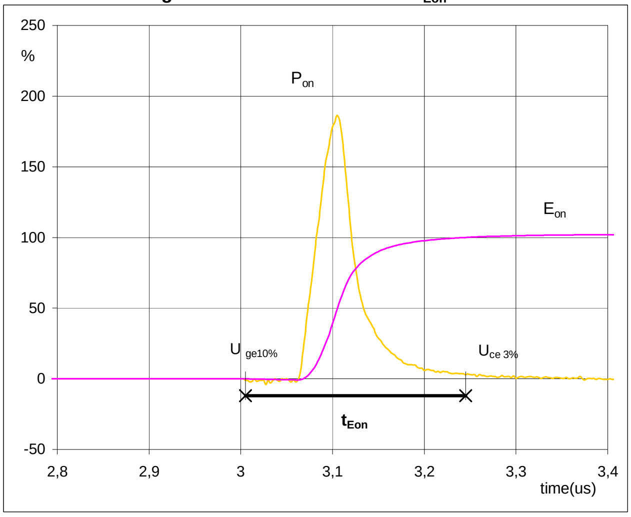
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	30,05	kW
E_{off} (100%) =	4,04	mJ
t_{Eoff} =	0,67	µs

Figure 6 PFC MOSFET / IGBT

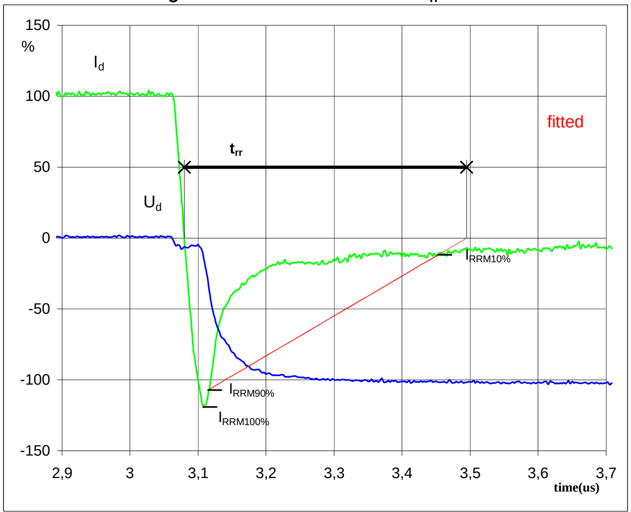
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	30,0456	kW
E_{on} (100%) =	2,80	mJ
t_{Eon} =	0,24	µs

Figure 7 PFC FWD

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

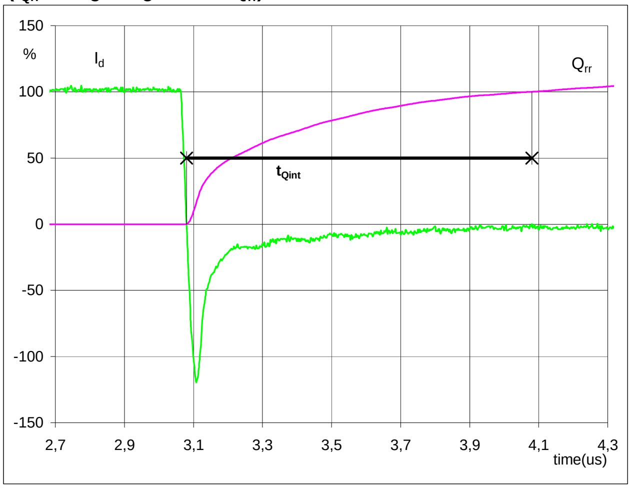


V_d (100%) =	600	V
I_d (100%) =	50	A
I_{RRM} (100%) =	-60	A
t_{rr} =	0,28	µs

Switching Definitions Brake

Figure 8 PFC FWD

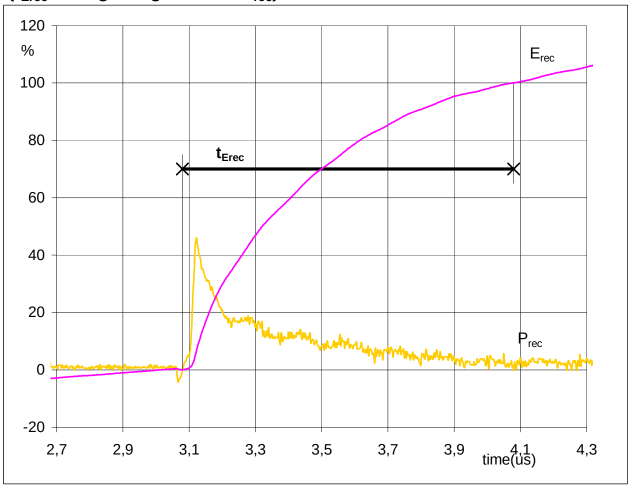
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr}= integrating time for Q_{rr})



I_d (100%) =	50	A
Q_{rr} (100%) =	6,52	µC
t_{Qint} =	1,00	µs

Figure 9 PFC FWD

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



P_{rec} (100%) =	30,05	kW
E_{rec} (100%) =	2,86	mJ
t_{Erec} =	1,00	µs

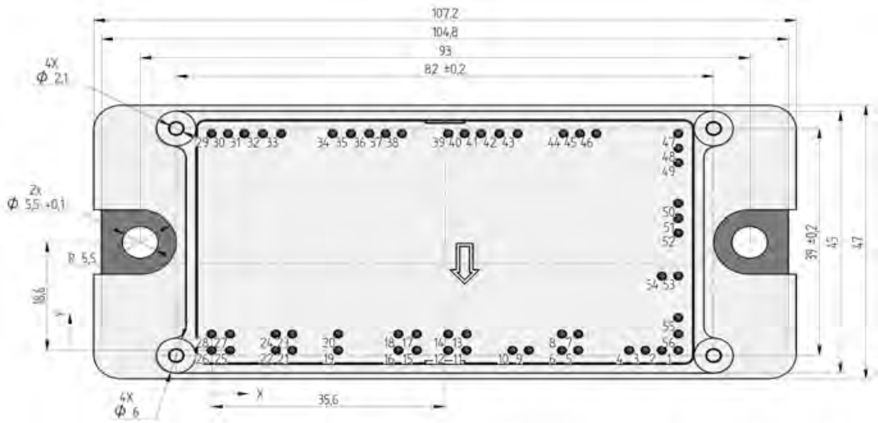
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

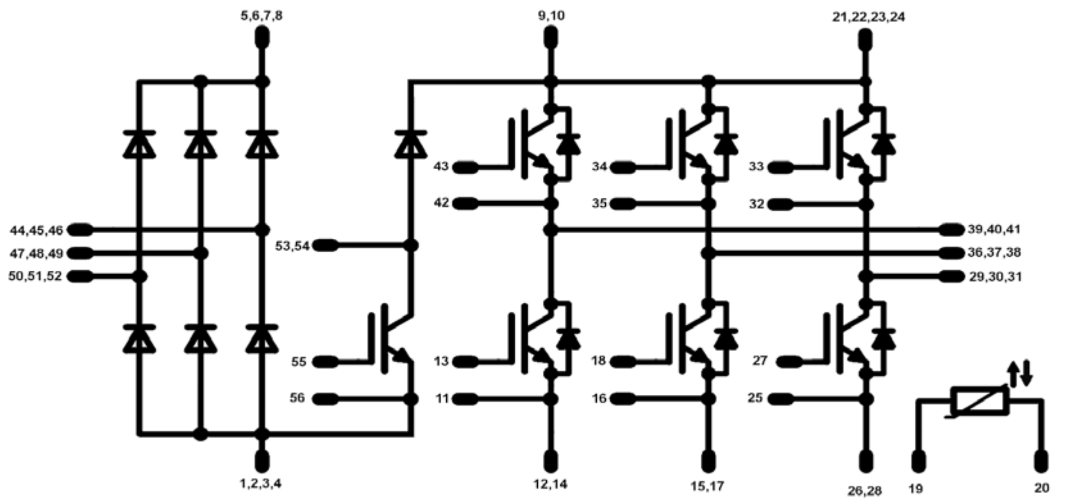
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	V23990-P769-A50	P769-A50	P769-A50

Outline

Pin table				Pin table			
Pin	X	Y		Pin	X	Y	
1	71,2	0	DC-	29	0	37	U
2	68,7	0	DC-	30	2,5	37	U
3	66,2	0	DC-	31	5	37	U
4	63,7	0	DC+	32	7,8	37	E
5	55,95	0	DC+	33	10,6	37	G
6	53,45	0	DC+	34	18,45	37	G
7	55,95	2,8	DC+	35	21,25	37	E
8	53,45	2,8	DC+	36	24,05	37	V
9	48,4	0	DC+	37	26,55	37	V
10	45,9	0	DC+	38	29,05	37	V
11	38,9	0	E	39	36,1	37	W
12	36,1	0	DC-	40	38,6	37	W
13	38,9	2,8	G	41	41,1	37	W
14	36,1	2,8	DC-	42	43,9	37	E
15	31,3	0	DC-	43	46,7	37	G
16	28,5	0	E	44	53,7	37	L1
17	31,3	2,8	DC-	45	56,2	37	L1
18	28,5	2,8	G	46	58,7	37	L1
19	19,3	0	R2	47	71,2	37	L2
20	19,3	2,8	R1	48	71,2	35	L2
21	12,3	0	DC+	49	71,2	32	L2
22	9,8	0	DC+	50	71,2	25	L3
23	12,3	2,8	DC+	51	71,2	23	L3
24	9,8	2,8	DC+	52	71,2	20	L3
25	2,8	0	E	53	71,2	13	BrC
26	0	0	DC-	54	68,7	13	BrC
27	2,8	2,8	G	55	71,2	5,6	BrG
28	0	2,8	DC-	56	71,2	2,8	BrE



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.