Vincotech

flow CON 0 2nd gen — 1200 V / 35 A

Features

- 3 phase input rectifier with BRC
- Compatible with *flow* PACK0 and *flow* PACK1
- Clip-in PCB mounting

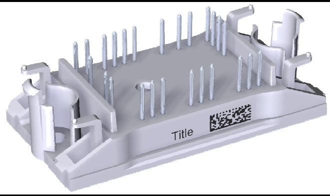
Target Applications

- Motor drives
- Servo drives
- UPS

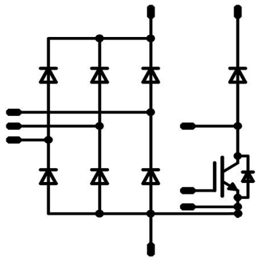
Types

- V23990-P640-G20-PM

***flow* 0**



Schematic



Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Input Rectifier Diode					
Repetitive peak reverse voltage	V_{RRM}			1600	V
DC forward current	I_{FAV}	$T_j=T_jmax$	T_h=80°C T_c=80°C	68 91	A
Surge forward current	I_{FSM}	t_p=10ms, half sine wave	T_j=150°C	600	A
I2t-value	I^2t			1800	A^2s
Power dissipation per Diode	P_{tot}	$T_j=T_jmax$	T_h=80°C T_c=80°C	84 127	W
Maximum Junction Temperature	T_{jmax}			150	°C
Brake Transistor					
Collector-emitter break down voltage	V_{CE}			1200	V
DC collector current	I_C	$T_j=T_jmax$	T_h=80°C T_c=80°C	49 65	A
Pulsed collector current	I_{CRM}	t_p limited by T_jmax		150	A
Turn off safe operating area		VCE ≤ 1200V, Tj ≤ Top max		100	A
Power dissipation per IGBT	P_{tot}	$T_j=T_jmax$	T_h=80°C T_c=80°C	121 183	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150°C V_{GE}=15V		10 800	μs V
Maximum Junction Temperature	T_{jmax}			175	°C

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Brake Inverse Diode					
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 20	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	44 67	W
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Diode					
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	28 30	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	55 83	W
Maximum Junction Temperature	T_{jmax}			175	°C
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(Tjmax - 25)	°C
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

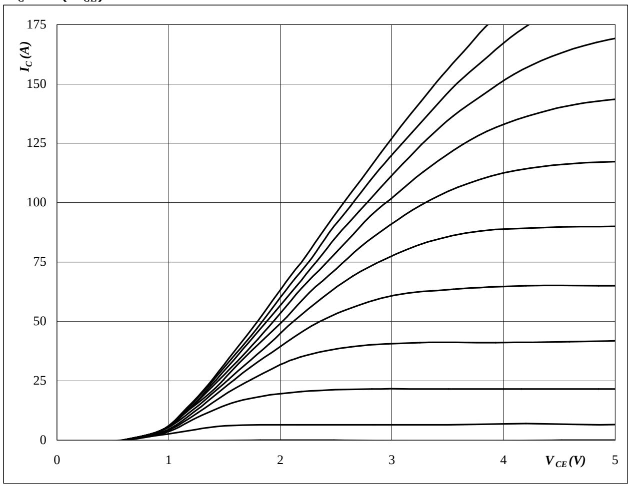
Parameter	Symbol	Conditions	V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Value Min	Value Typ	Value Max	Unit
Input Rectifier Diode										
Forward voltage	V_F				50	Tj=25°C Tj=125°C	0,8	1,21 1,21	1,7	V
Threshold voltage (for power loss calc. only)	V_{to}				65	Tj=25°C Tj=125°C		0,89 0,78		V
Slope resistance (for power loss calc. only)	r_t				65	Tj=25°C Tj=125°C		5,03 6,60		mΩ
Reverse current	I_r			1600		Tj=25°C Tj=125°C			0,05	mA
Thermal resistance chip to heatsink per chip	$R_{th(j-s)}$	Phase-Change Material						0,84		K/W
Brake Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0017	Tj=25°C Tj=150°C	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	Tj=25°C Tj=150°C	1,3	1,88 2,26	2,2	V
Collector-emitter cut-off incl diode	I_{CES}		0	1200		Tj=25°C Tj=150°C			0,01	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=150°C			600	nA
Integrated Gate resistor	R_{gint}							4		Ω
Turn-on delay time	$t_{d(on)}$					Tj=25°C Tj=150°C		32 31		
Rise time	t_r					Tj=25°C Tj=150°C		17 21		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=150°C		372 482		ns
Fall time	t_f	Rgoff=8 Ω Rgon=8 Ω	15	600	35	Tj=25°C Tj=150°C		69 122		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C		1,34 1,98		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C		2,16 3,71		
Input capacitance	C_{ies}							2770		
Output capacitance	C_{oss}	f=1MHz	0	25		Tj=25°C		205		pF
Reverse transfer capacitance	C_{rss}							160		
Gate charge	Q_G		15	960	50	Tj=25°C		230		nC
Thermal resistance chip to heatsink per chip	$R_{th(j-s)}$	Phase-Change Material						0,79		K/W
Brake Inverse Diode										
Diode forward voltage	V_F				10	Tj=25°C Tj=150°C	1,3	1,86 1,80	2,2	V
Thermal resistance chip to heatsink per chip	$R_{th(j-s)}$	Phase-Change Material						2,14		K/W
Brake Diode										
Diode forward voltage	V_F				25	Tj=25°C Tj=150°C	1,3	1,85 1,81	2,2	V
Reverse leakage current	I_r			1200		Tj=25°C Tj=150°C			10	μA
Peak reverse recovery current	I_{RRM}					Tj=25°C Tj=150°C		56 64		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		143 260		ns
Reverse recovered charge	Q_{rr}	Rgon=8 Ω	15	600	35	Tj=25°C Tj=150°C		2,99 5,48		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					Tj=25°C Tj=150°C		3694 2005		A/μs
Reverse recovery energy	E_{rec}					Tj=25°C Tj=150°C		1,29 2,44		mWs
Thermal resistance chip to heatsink per chip	$R_{th(j-s)}$	Phase-Change Material						1,73		K/W

Brake

Figure 1	Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

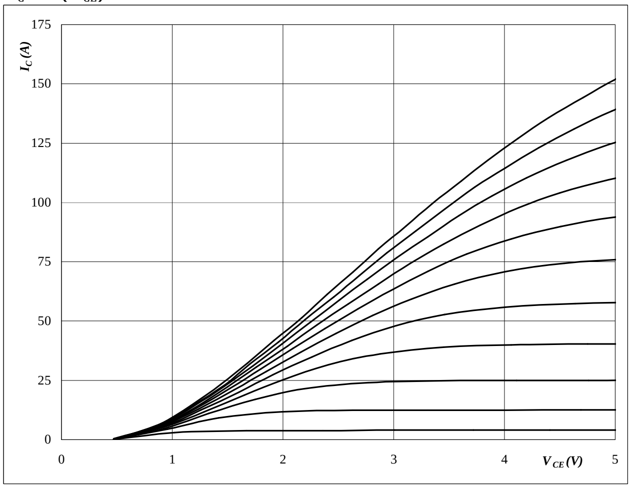
T_j = 25 °C

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

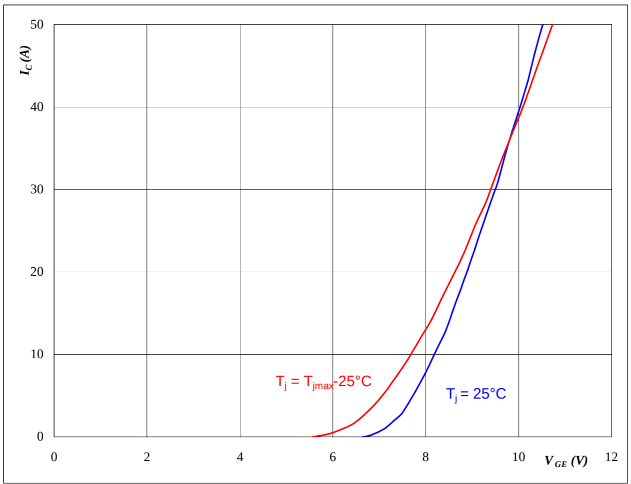
T_j = 150 °C

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

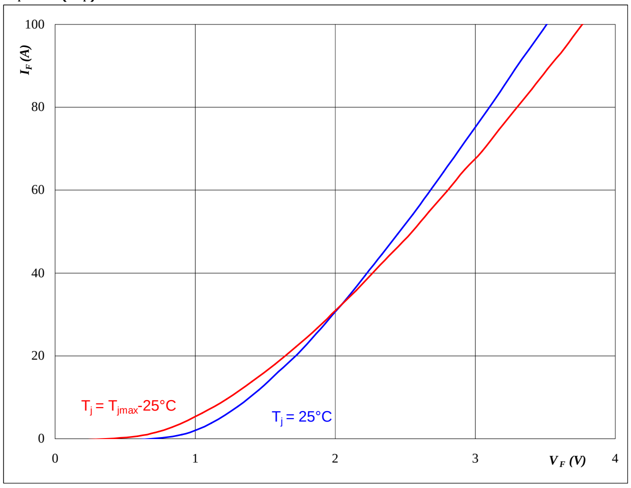
t_p = 250 µs

V_{CE} = 10 V

Figure 4	Brake FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

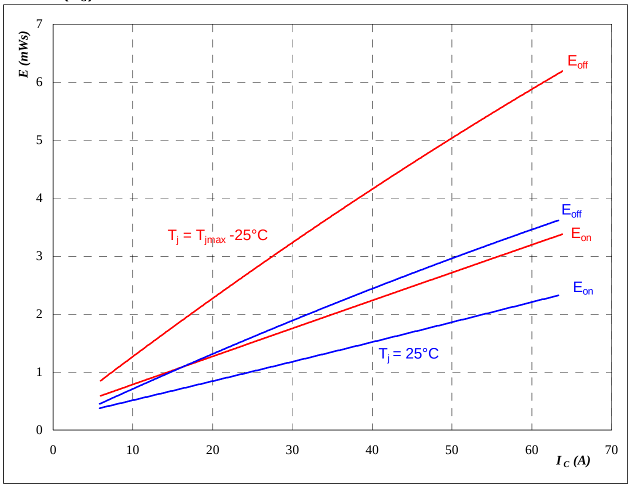
t_p = 250 µs

Brake

Figure 5 Brake IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



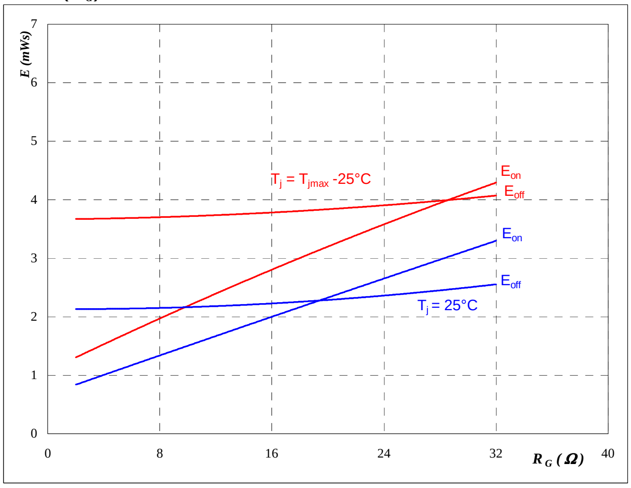
With an inductive load at

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

$E = f(R_G)$



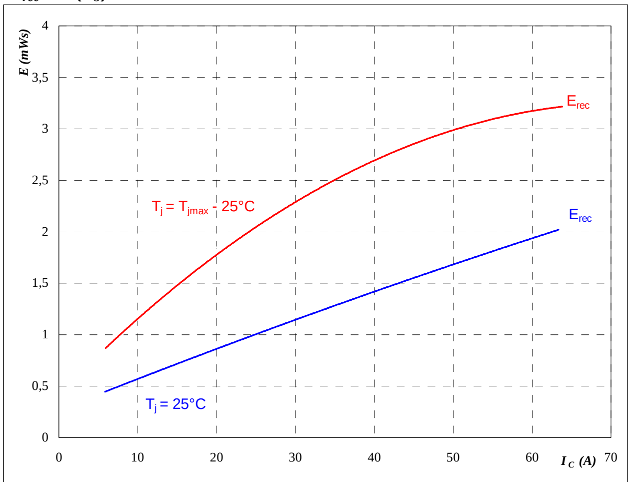
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	15	V
I_C =	35	A

Figure 7 Brake FWD

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_C)$



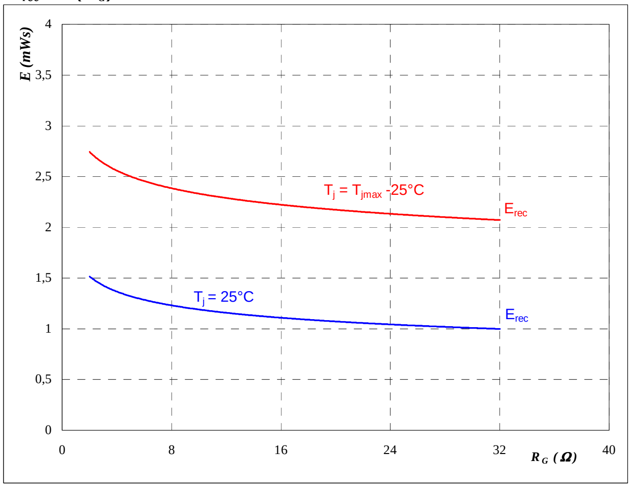
With an inductive load at

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

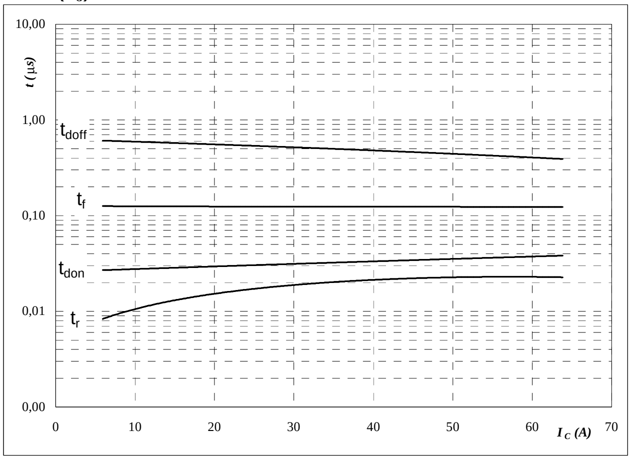
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	15	V
I_C =	35	A

Brake

Figure 9 Brake IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



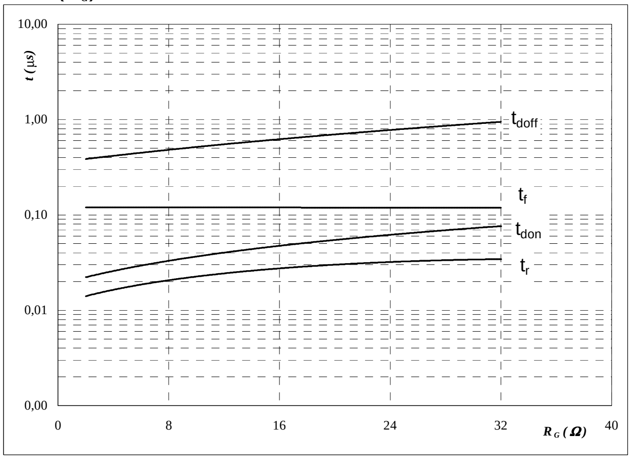
With an inductive load at

T_j =	150	°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

$t = f(R_G)$



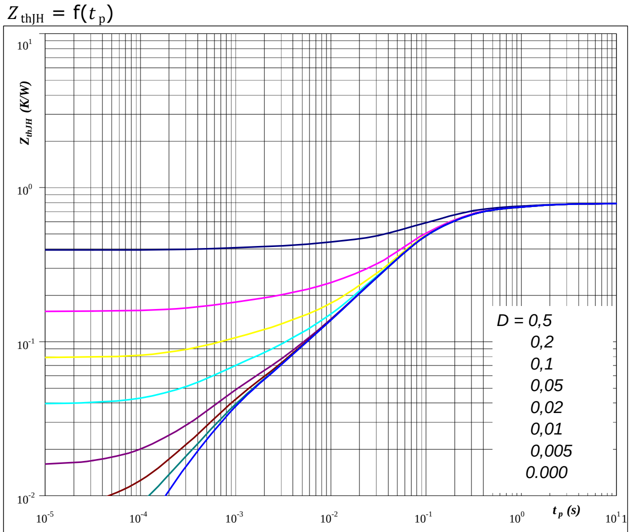
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	15	V
I_C =	35	A

Figure 11 Brake IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$

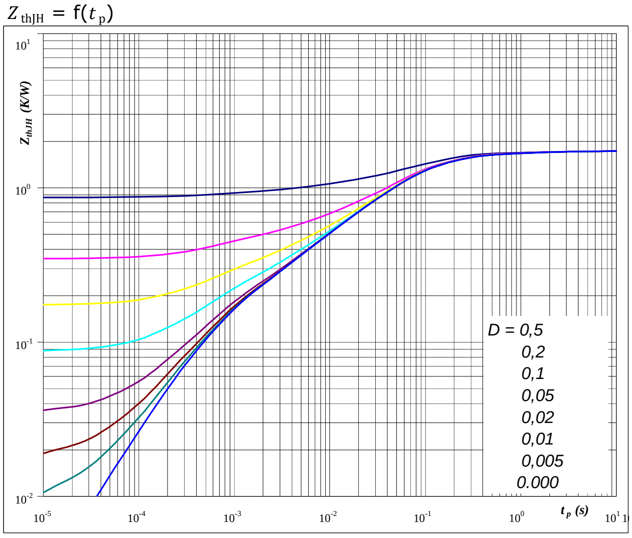


At		D =	t_p / T		
Thermal grease			Phase change interface		
R_{thJH} =	0,79	K/W	R_{thJH} =	0,76	K/W

Figure 12 Brake FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



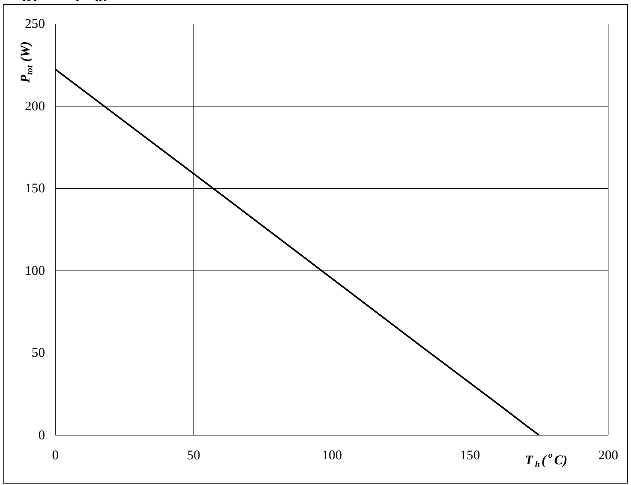
At		D =	t_p / T		
Thermal grease			Phase change interface		
R_{thJH} =	1,73	K/W	R_{thJH} =	1,68	K/W

Brake

Figure 13	Brake IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



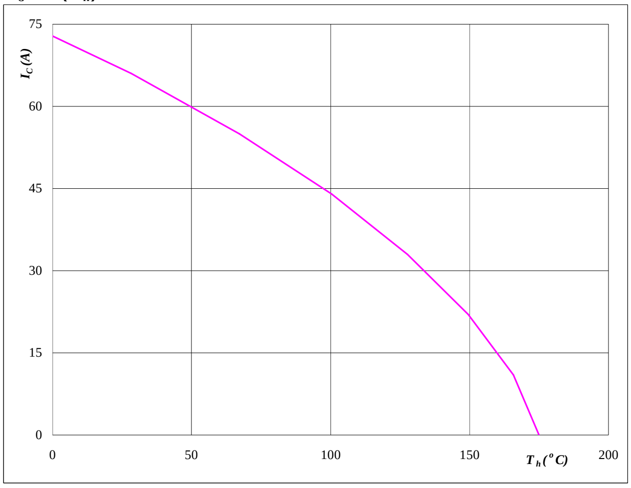
At

T_j = 175 ºC

Figure 14	Brake IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

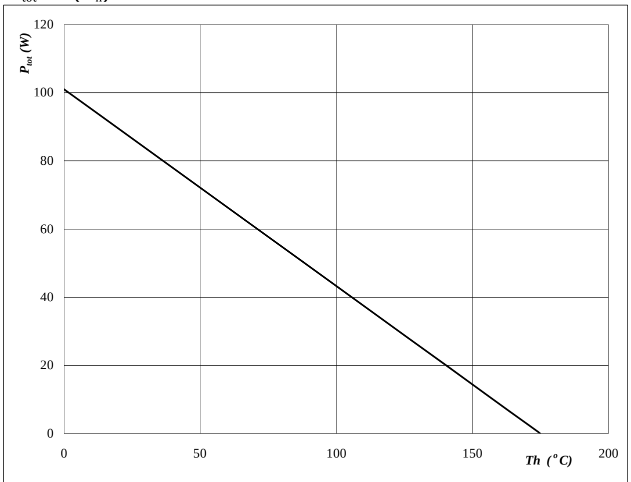
T_j = 175 ºC

V_{GE} = 15 V

Figure 15	Brake FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



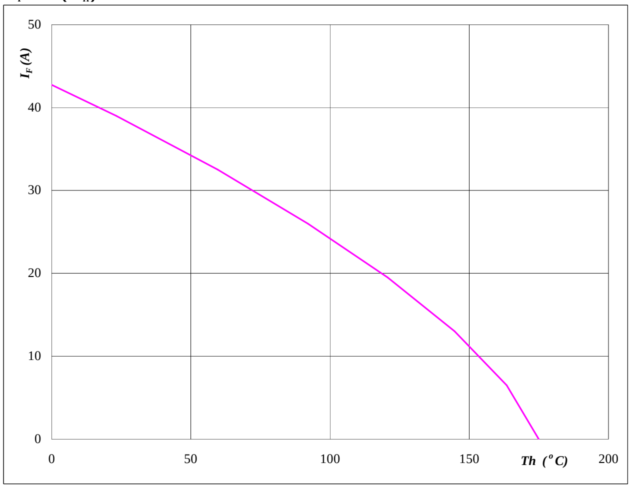
At

T_j = 175 ºC

Figure 16	Brake FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

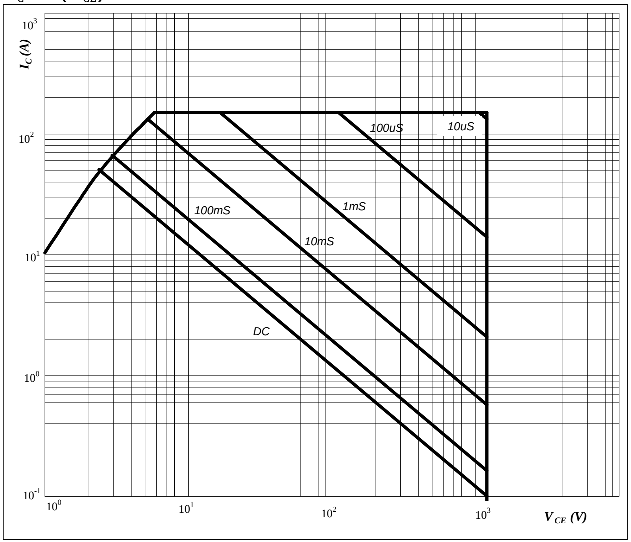
T_j = 175 ºC

Brake

Figure 25 Brake IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



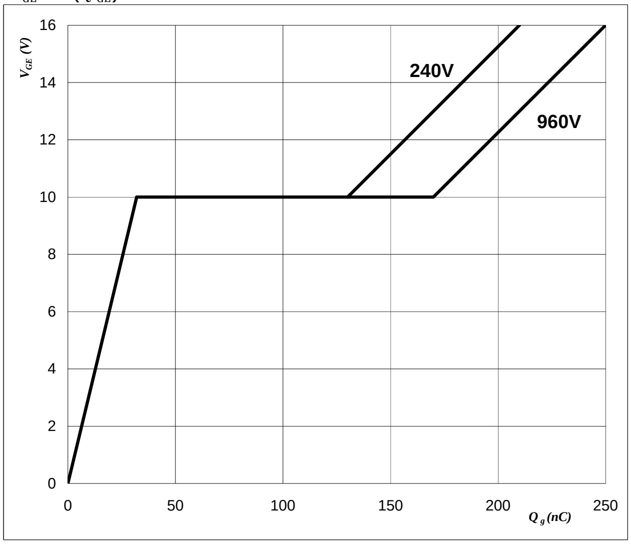
At

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

Figure 26 Brake IGBT

Gate voltage vs Gate charge

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



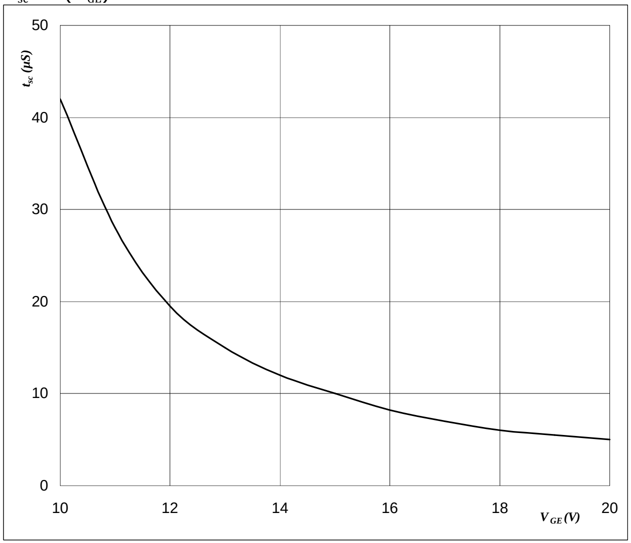
At

I_C =	50	A

Figure 27 Brake IGBT

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

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



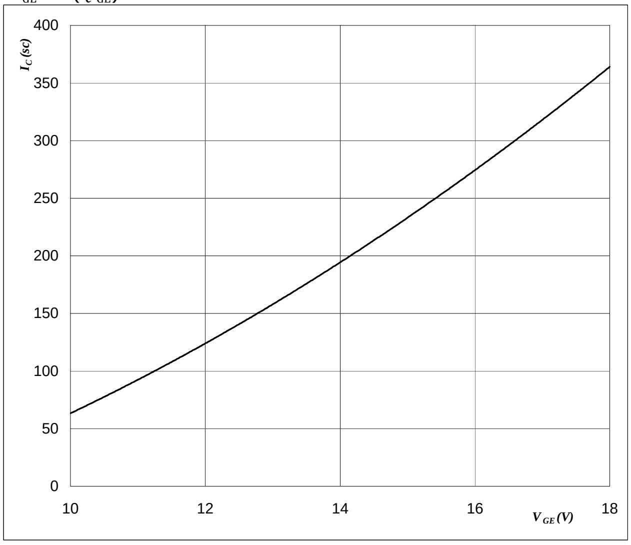
At

V_{CE} =	1200	V
T_j ≤	175	ºC

Figure 28 Brake IGBT

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

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



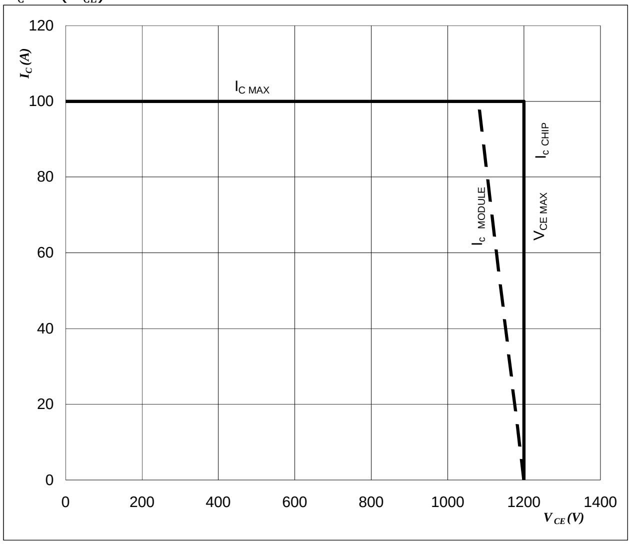
At

V_{CE} ≤	1200	V
T_j =	175	ºC

Figure 29 Brake IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j = T_{jmax}-25 ºC

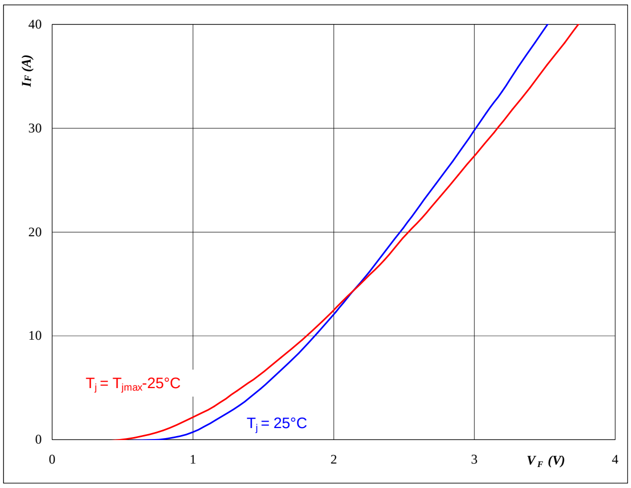
$U_{ccminus}$=U_{ccplus}

Brake Inverse Diode

Figure 25 Brake Inverse Diode

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



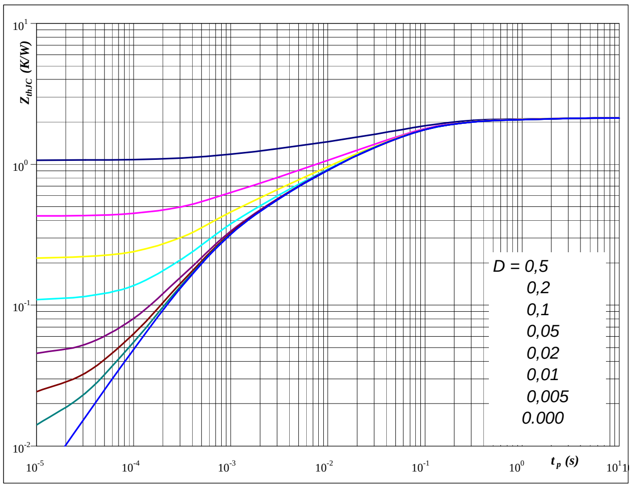
At

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

Figure 26 Brake Inverse Diode

Gate voltage vs Gate charge

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

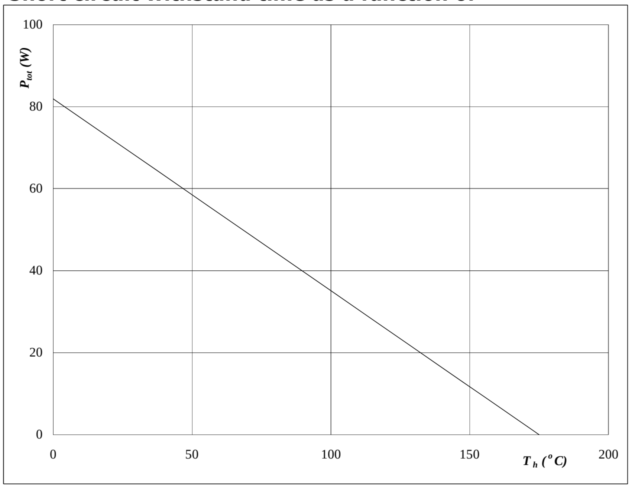


At

I_C =	10	A

Figure 27 Brake Inverse Diode

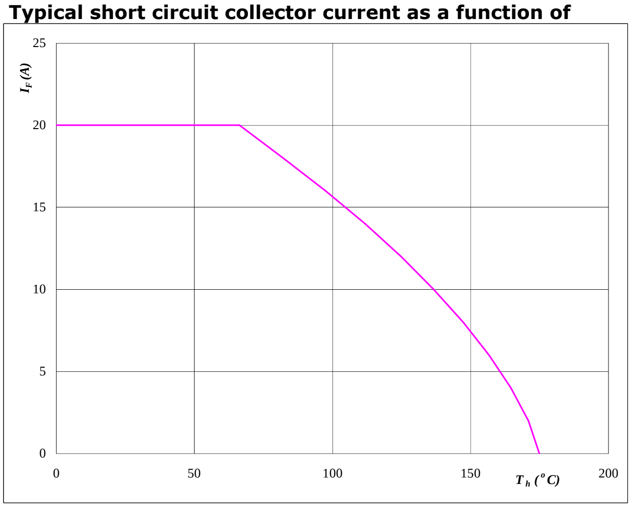
Short circuit withstand time as a function of



T_j = 175 ºC

Figure 28 Brake Inverse Diode

Typical short circuit collector current as a function of



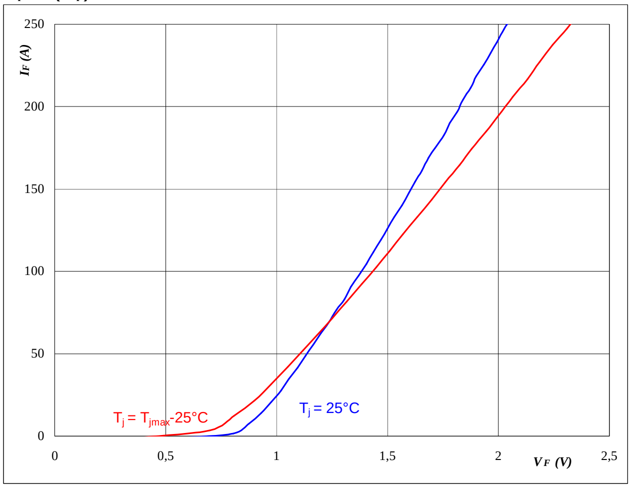
T_j = 175 ºC

Input Rectifier Bridge

Figure 1 — Rectifier diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



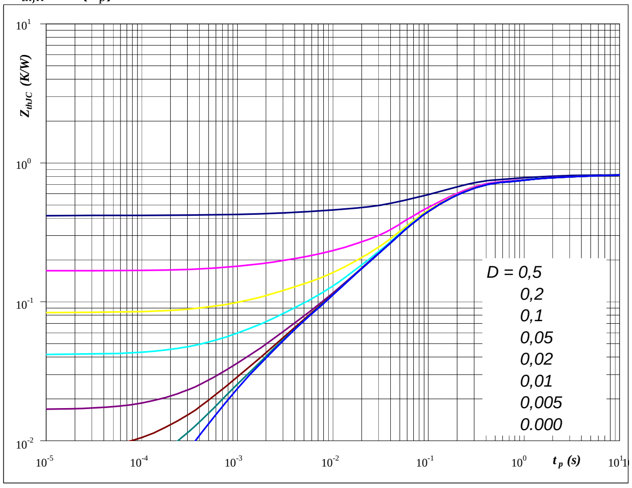
At

t_p = 250 µs

Figure 2 — Rectifier diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

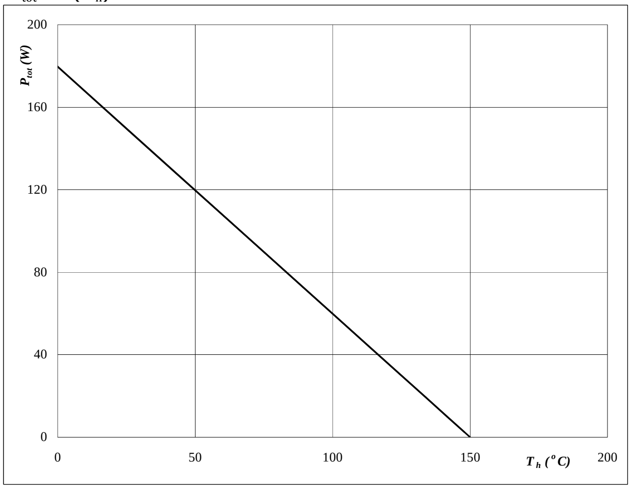
D = t_p / T

R_{thJH} = 0,84 K/W

Figure 3 — Rectifier diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



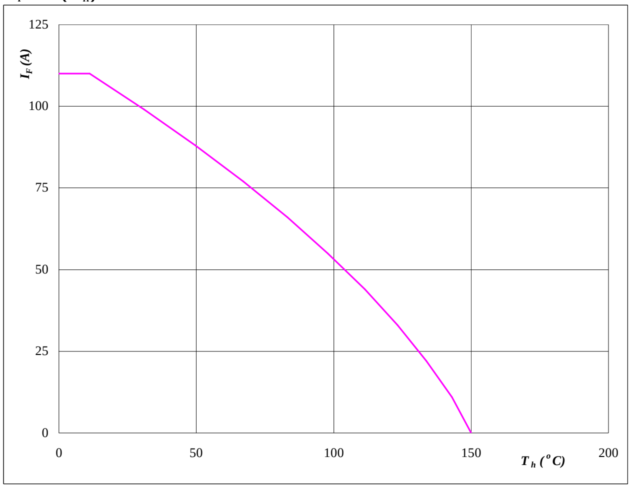
At

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

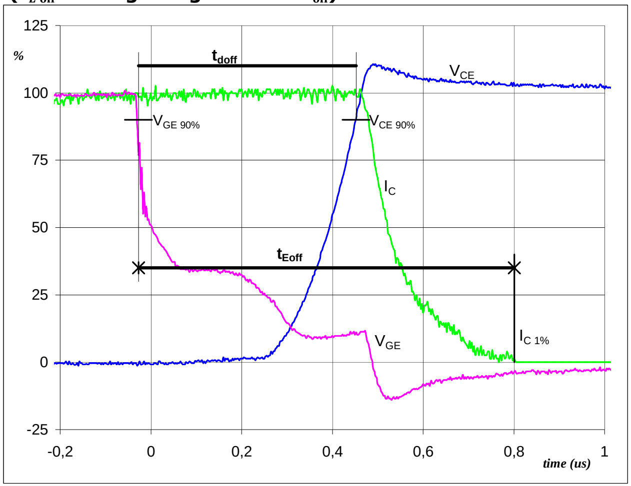
Switching Definitions Brake

General conditions

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

Figure 1 — Brake IGBT

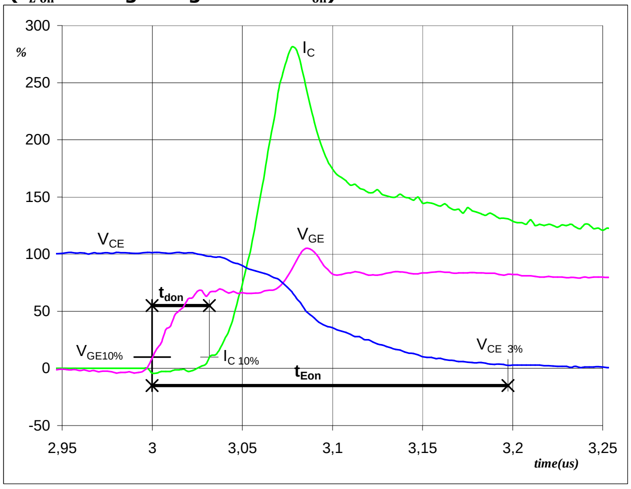
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} ($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	35	A
t_{doff} =	0,48	μs
$t_{E\,off}$ =	0,83	μs

Figure 2 — Brake IGBT

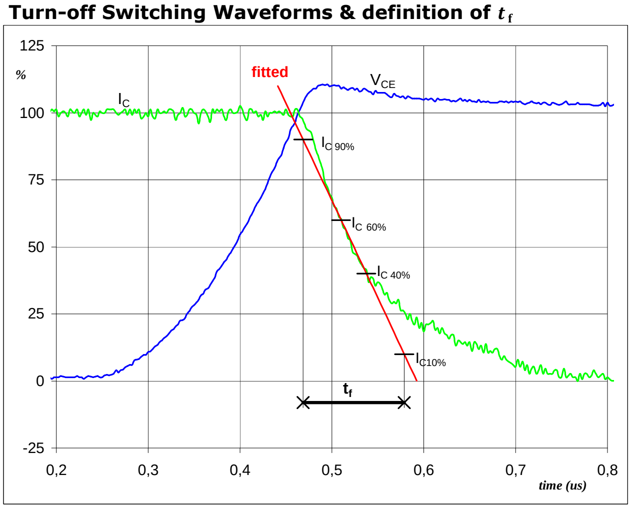
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} ($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	35	A
t_{don} =	0,03	μs
$t_{E\,on}$ =	0,20	μs

Figure 3 — Brake IGBT

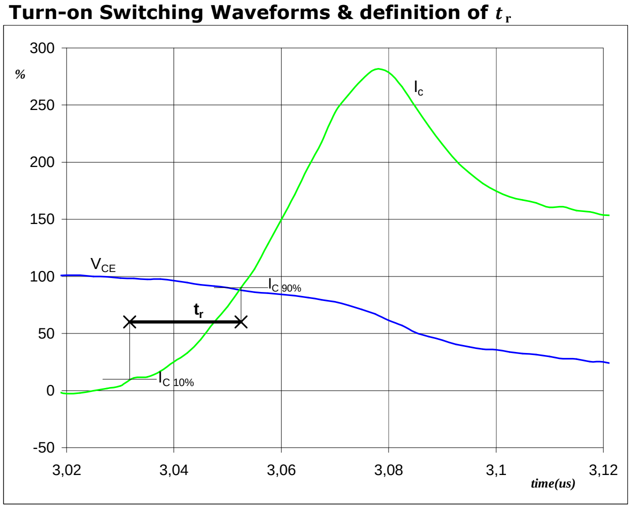
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	35	A
t_f =	0,12	μs

Figure 4 — Brake IGBT

Turn-on Switching Waveforms & definition of t_r

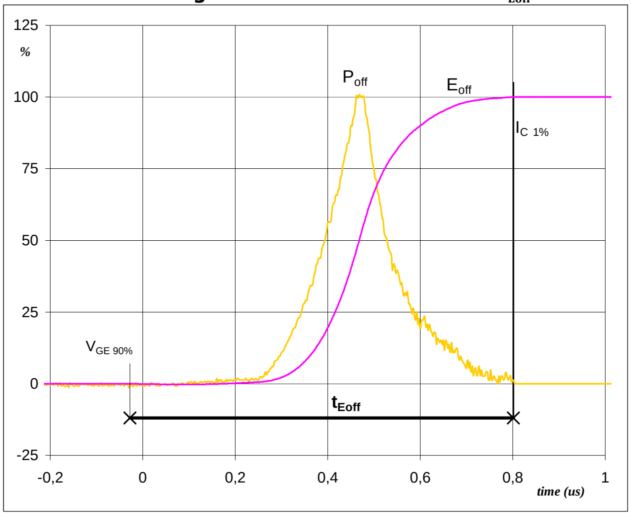


V_C (100%) =	600	V
I_C (100%) =	35	A
t_r =	0,02	μs

Switching Definitions Brake

Figure 5 Brake IGBT

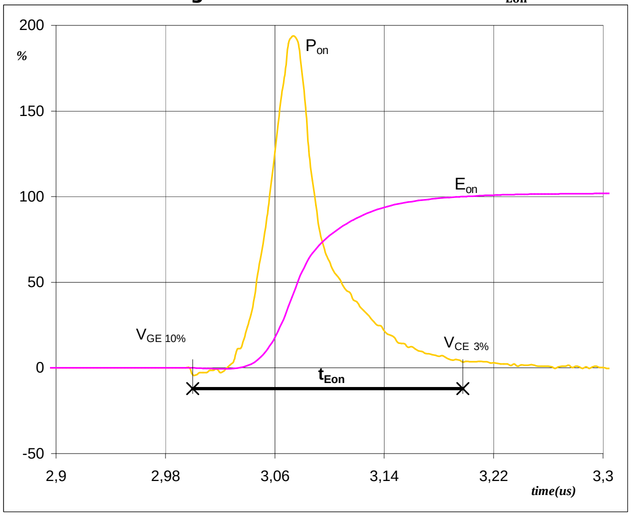
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	21,00	kW
E_{off} (100%) =	3,71	mJ
$t_{E\,off}$ =	0,83	μs

Figure 6 Brake IGBT

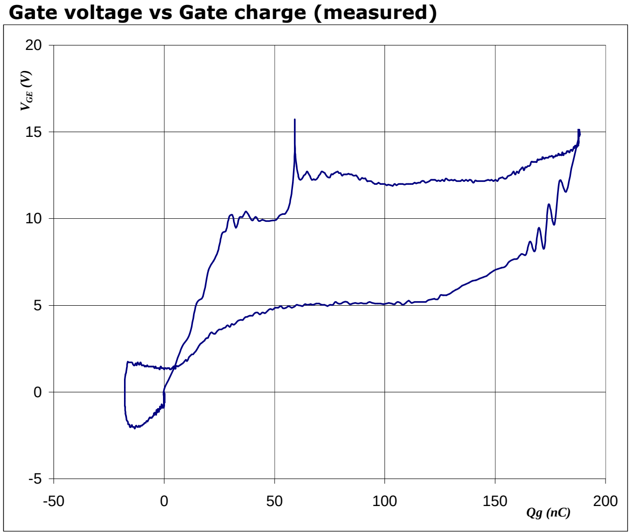
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	21,00	kW
E_{on} (100%) =	1,98	mJ
$t_{E\,on}$ =	0,20	μs

Figure 7 Brake IGBT

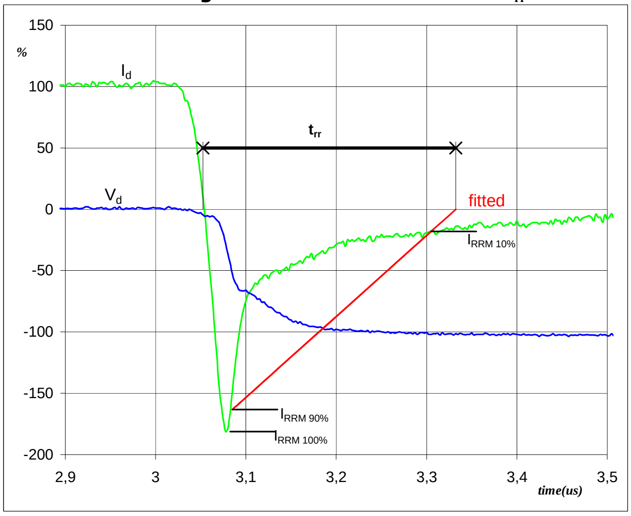
Gate voltage vs Gate charge (measured)



$V_{GE\,off}$ =	0	V
$V_{GE\,on}$ =	15	V
V_C (100%) =	600	V
I_C (100%) =	35	A
Q_g =	188,05	nC

Figure 8 Brake FWD

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

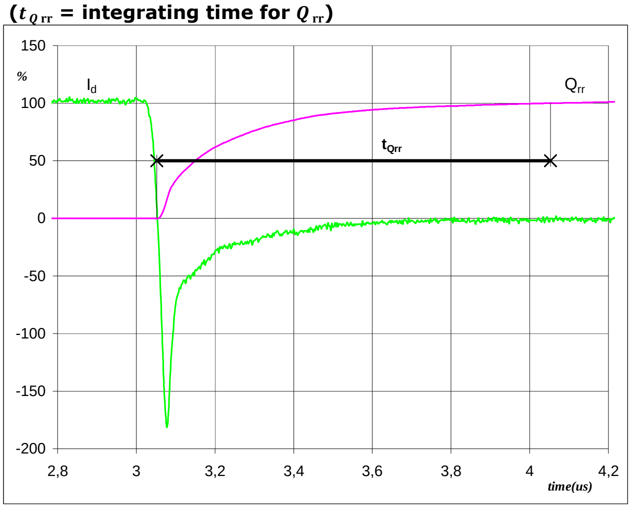


V_d (100%) =	600	V
I_d (100%) =	35	A
I_{RRM} (100%) =	-64	A
t_{rr} =	0,26	μs

Switching Definitions Brake

Figure 9 Brake FWD

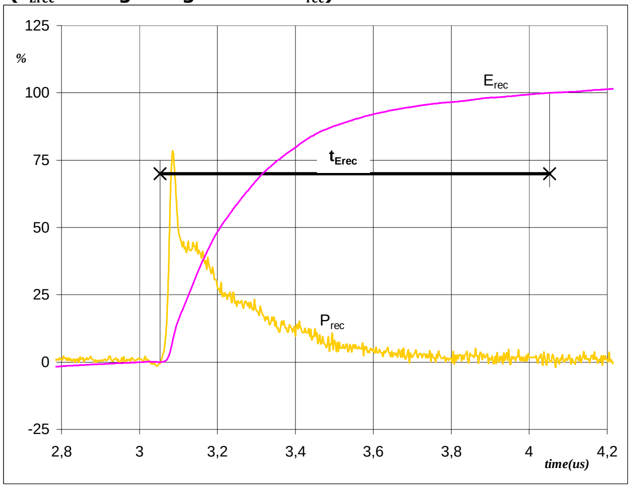
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q rr}$ = integrating time for Q_{rr})



I_d (100%) =	35	A
Q_{rr} (100%) =	5,48	µC
$t_{Q rr}$ =	1,00	µs

Figure 10 Brake FWD

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



P_{rec} (100%) =	21,00	kW
E_{rec} (100%) =	2,44	mJ
$t_{E rec}$ =	1,00	µs

Ordering Code and Marking - Outline - Pinout

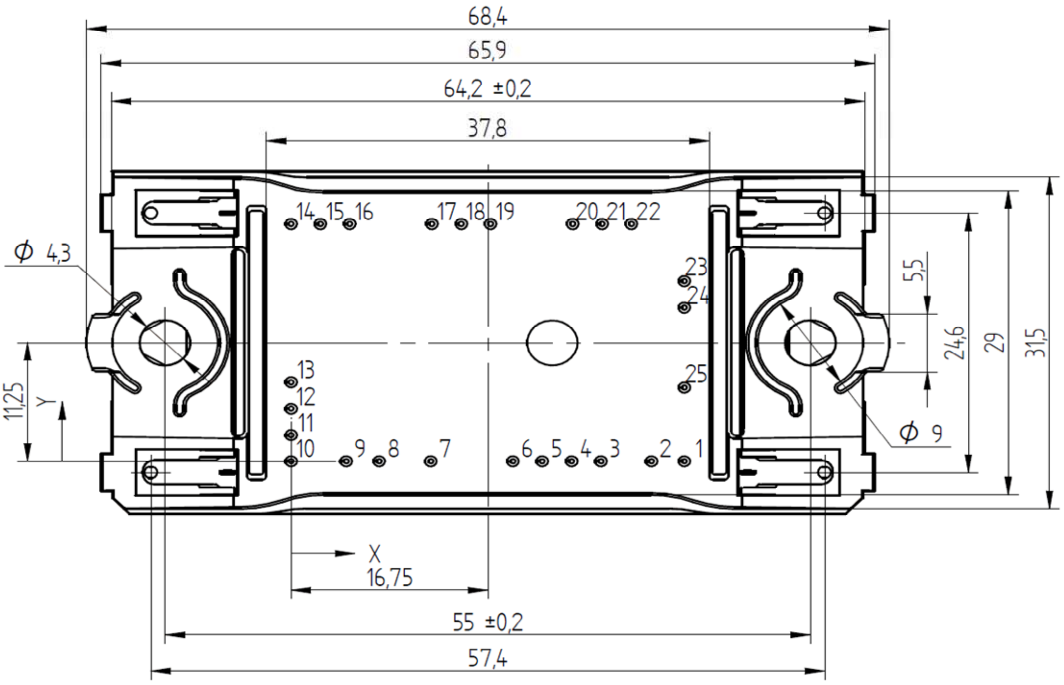
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 17mm housing	V23990-P640-G20-PM	P640-G20	P640-G20

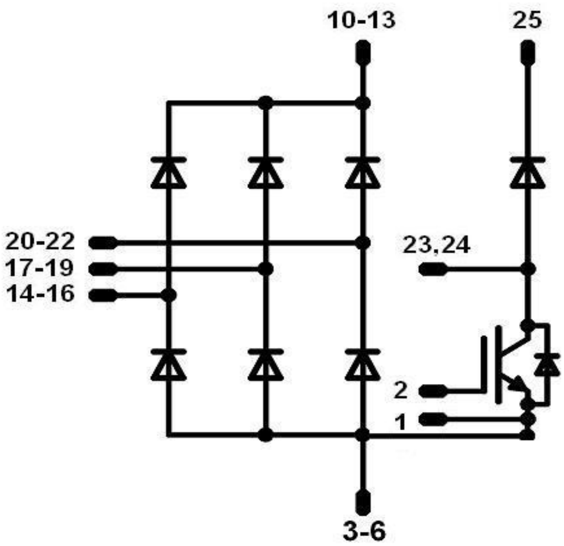
Outline

Pin table

Pin	X	Y
1	33,5	0
2	30,7	0
3	26,4	0
4	23,9	0
5	21,4	0
6	18,9	0
7	11,9	0
8	7,5	0
9	4,7	0
10	0	0
11	0	2,5
12	0	5
13	0	7,5
14	0	22,5
15	2,5	22,5
16	5	22,5
17	12	22,5
18	14,5	22,5
19	17	22,5
20	24	22,5
21	26,5	22,5
22	29	22,5
23	33,5	17,1
24	33,5	14,6
25	33,5	7



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.