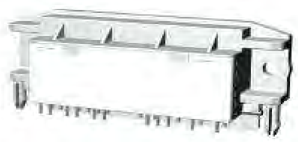
flow 90CON 1 **1600V/75A**

Features

- 3~ phase input rectifier with or withot BRC
  *optional half controlled
- Compatible with flow 90PACK 1
- Support designs with 90° mounting angle between heatsink and PCB
- Clip-in PCB mounting

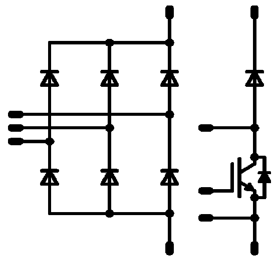
flow 90 housing



Target Applications

- Motor drives
- Servo drives

Schematic



Types

- V23990-P719-G-PM
- V23990-P719-H-PM w/o brake

Maximum Ratings

T_j=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Input Rectifier Diode					
Repetitive peak reverse voltage	V_{RRM}			1600	V
Forward current per diode	I_{FAV}	DC current	T_h=80℃ T_c=80℃	66 90	A
Surge forward current	I_{FSM}	t_p=10ms	T_j=45℃	900	A
I^2t-value	I^2t			4050	A^2s
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	72 110	W
Maximum Junction Temperature	$T_j$max			150	℃
Brake IGBT					
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℃	35 45	A
Pulsed collector current	I_{Cpuls}	t_p limited by $T_j$max		105	A
Power dissipation per IGBT	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	75 114	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤125℃ V_{GE}=15V		10 900	µs V
Maximum Junction Temperature	$T_j$max			150	℃

Maximum Ratings

Tj=25℃, 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℃ T_c=80℃	7,5 7,5	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		6	A
Brake Inverse Diode	P_{tot}	$T_j=T_j$max	T_h=80℃ T_c=80℃	21 32	W
Maximum Junction Temperature	$T_j$max			150	℃
Brake FWD					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	$T_j=T_j$max	T_h=80℃ T_c=80℃	20 25	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		30	A
Power dissipation per Diode	P_{tot}	$T_j=T_j$max	T_h=80℃ T_c=80℃	37 56	W
Maximum Junction Temperature	$T_j$max			150	℃
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

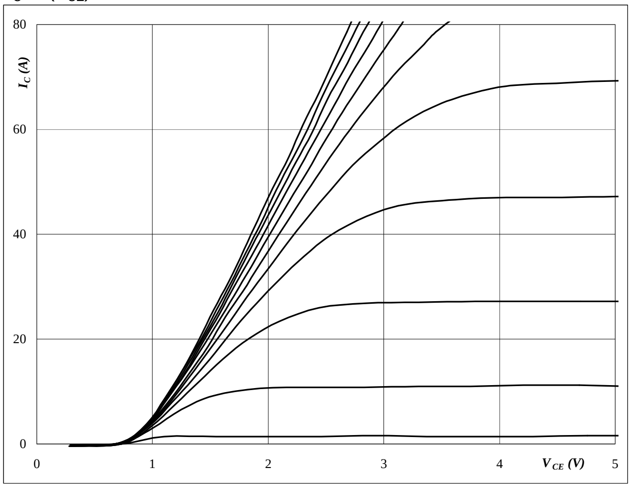
Parameter	Symbol	Conditions	V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Value Min	Value Typ	Value Max	Unit
Input Rectifier Diode										
Forward voltage	V_F				76	Tj=25°C Tj=125°C	0,8	1,19 1,16	1,7	V
Threshold voltage (for power loss calc. only)	V_{to}				76	Tj=25°C Tj=125°C		0,91 0,78		V
Slope resistance (for power loss calc. only)	r_t				76	Tj=25°C Tj=125°C		0,004 0,005		Ω
Reverse current	I_r			1500		Tj=25°C Tj=125°C			0,1	mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 0,61 W/mK						0,97		K/W
Brake IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	VCE=VGE			0,0015	Tj=25°C Tj=125°C	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		35	Tj=25°C Tj=125°C	1,3	1,80 2,02	2,25	V
Collector-emitter cut-off incl diode	I_{CES}		0	1200		Tj=25°C Tj=125°C			0,25	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=125°C			650	nA
Integrated Gate resistor	R_{gint}							6		Ω
Turn-on delay time	$t_{d(on)}$	Rgon=32 Ω Rgoff=16 Ω	±15	600	35	Tj=25°C Tj=125°C		47 48		ns
Rise time	t_r					Tj=25°C Tj=125°C		19 25		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=125°C		457 544		
Fall time	t_f					Tj=25°C Tj=125°C		122 187		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		2,99 3,60		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		2,68 4,11		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		2530		pF
Output capacitance	C_{oss}							132		
Reverse transfer capacitance	C_{rss}							115		
Gate charge	Q_{Gate}					Tj=25°C		205		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 0,61 W/mK						0,93		K/W
Brake Inverse Diode										
Diode forward voltage	V_F				3	Tj=25°C Tj=125°C	1	1,60 1,57	2,2	V
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 0,61 W/mK						3,3		K/W
Brake FWD										
Diode forward voltage	V_F				15	Tj=25°C Tj=125°C	1	1,75 1,73	2,3	V
Reverse leakage current	I_r		±15	300	25	Tj=25°C Tj=125°C			250	µA
Peak reverse recovery current	I_{RRM}	Rgon=32 Ω Rgon=32 Ω	±15	300	25	Tj=25°C Tj=125°C		21 24		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		356 522		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=125°C		2,83 4,56		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=125°C		280 137		A/µs
Reverse recovery energy	E_{rec}					Tj=25°C Tj=125°C		2,83 4,56		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 0,61 W/mK						1,88		K/W

Brake

Figure 1 Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$



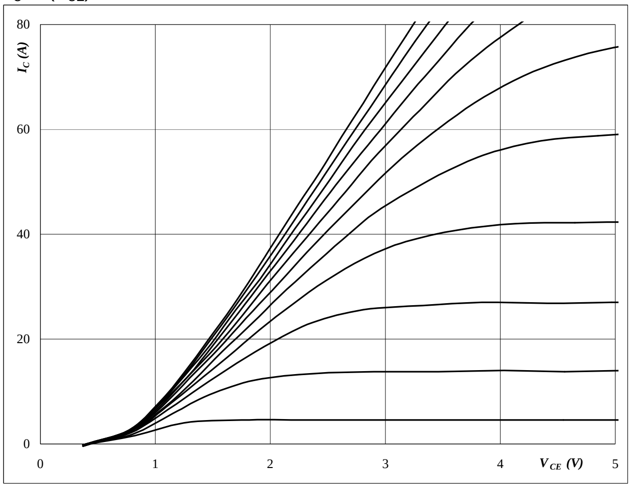
At

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

$I_C = f(V_{CE})$



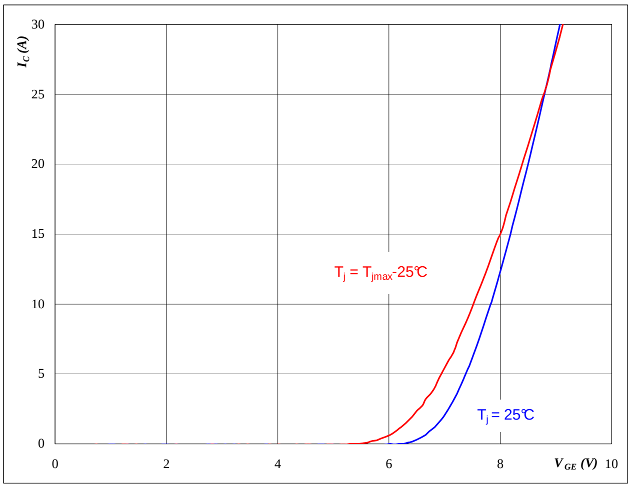
At

t_p =	250	μs
T_j =	125	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 3 Brake IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



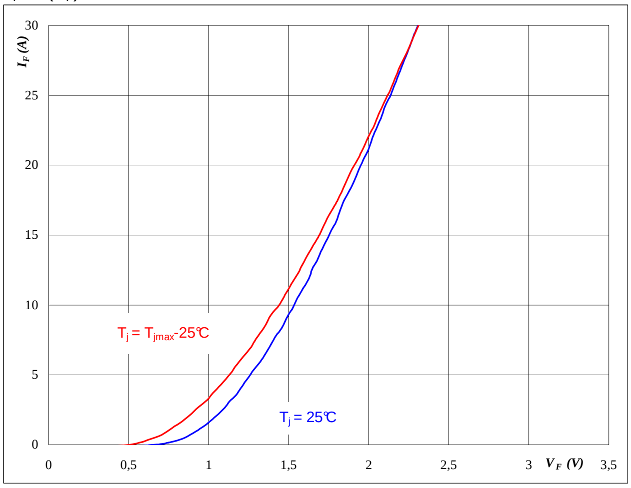
At

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

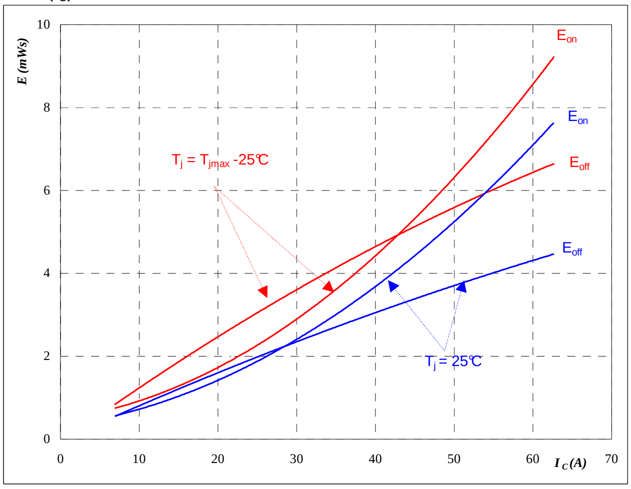
t_p =	250	μs

Brake

Figure 5 Brake IGBT

Typical switching energy losses as a function of collector current

E = f(I_C)



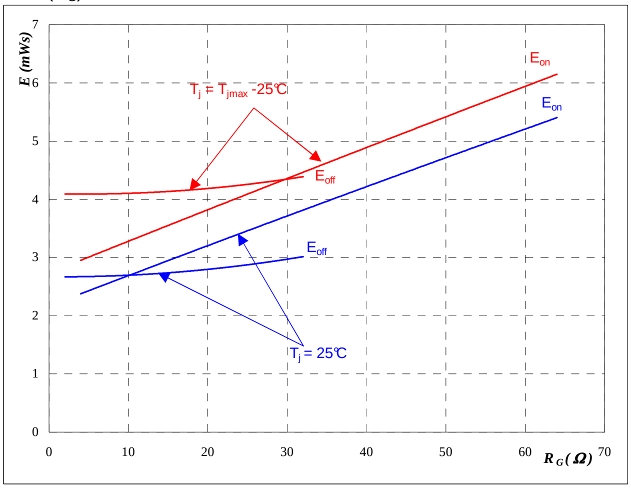
With an inductive load at

T_j =	25/125	℃
V_{CE} =	600	V
V_{GE} =	15	V
R_{gon} =	16	Ω
R_{goff} =	8	Ω

Figure 6 Brake IGBT

Typical switching energy losses as a function of gate resistor

E = f(R_G)



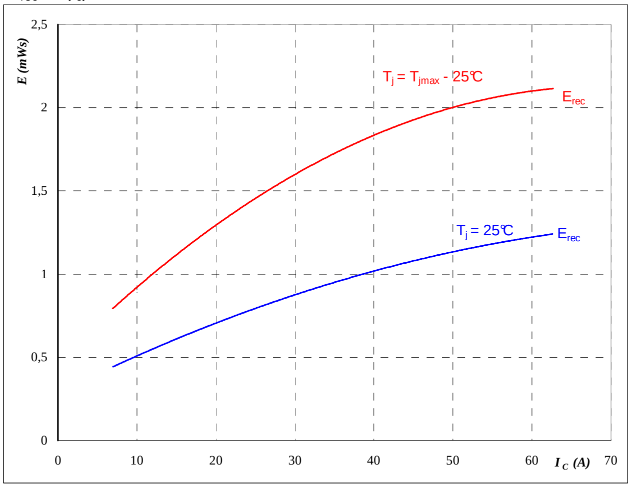
With an inductive load at

T_j =	25/125	℃
V_{CE} =	600	V
V_{GE} =	15	V
I_C =	35	A

Figure 7 Brake IGBT

Typical reverse recovery energy loss as a function of collector current

E_{rec} = f(I_c)



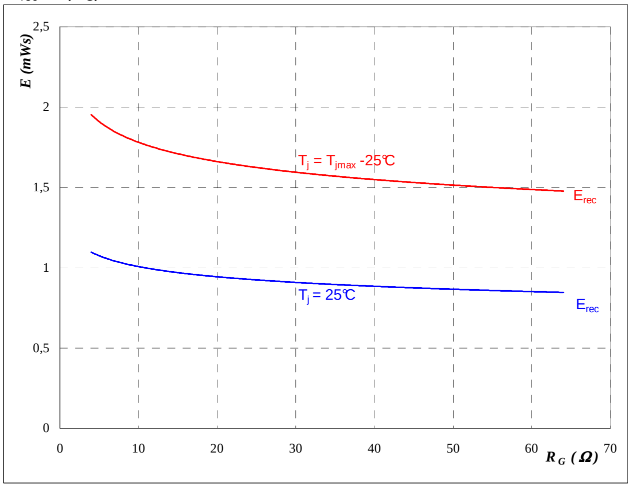
With an inductive load at

T_j =	25/125	℃
V_{CE} =	600	V
V_{GE} =	15	V
R_{gon} =	16	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

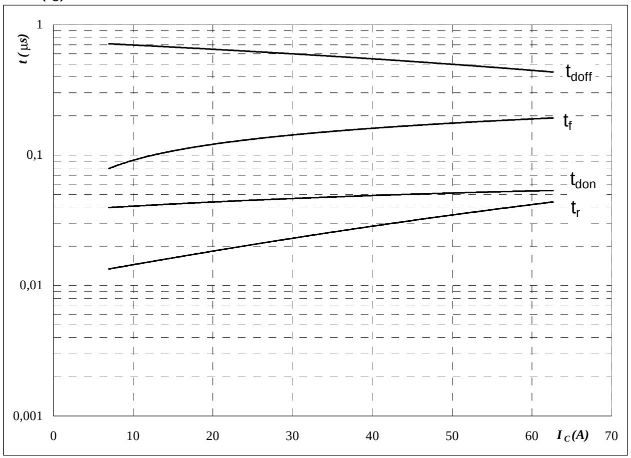
T_j =	25/125	℃
V_{CE} =	600	V
V_{GE} =	15	V
I_C =	35	A

Brake

Figure 9 Brake IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



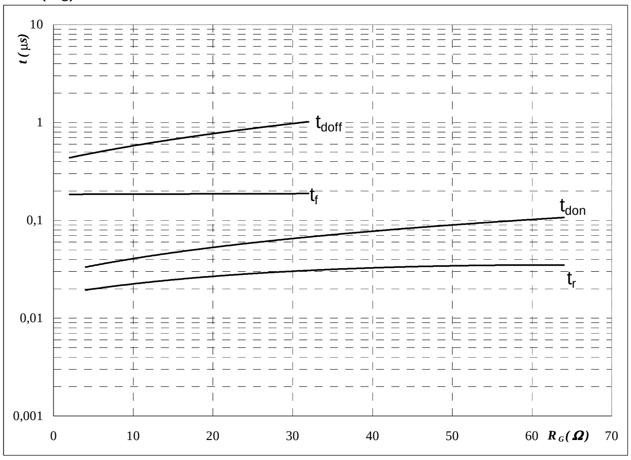
With an inductive load at

T_j =	125	℃
V_{CE} =	600	V
V_{GE} =	15	V
R_{gon} =	16	Ω
R_{goff} =	8	Ω

Figure 10 Brake IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



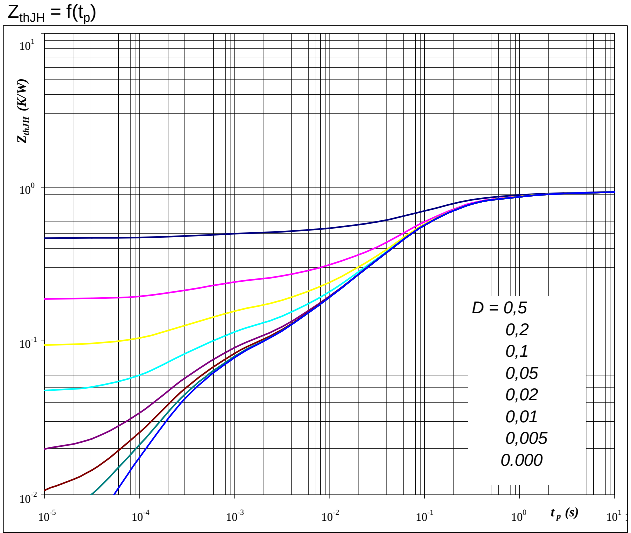
With an inductive load at

T_j =	125	℃
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 =	tp / T	
R_{thJH} =	0,93	K/W

IGBT thermal model values

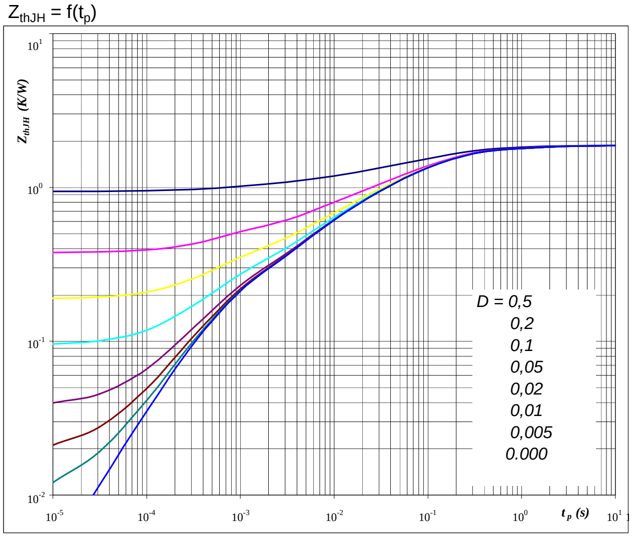
Thermal grease

R (C/W)	Tau (s)
0,03	6,2E+00
0,11	9,8E-01
0,44	1,4E-01
0,23	4,2E-02
0,06	5,5E-03
0,06	3,5E-04

Figure 12 Brake FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	tp / T	
R_{thJH} =	1,88	K/W

FWD thermal model values

Thermal grease

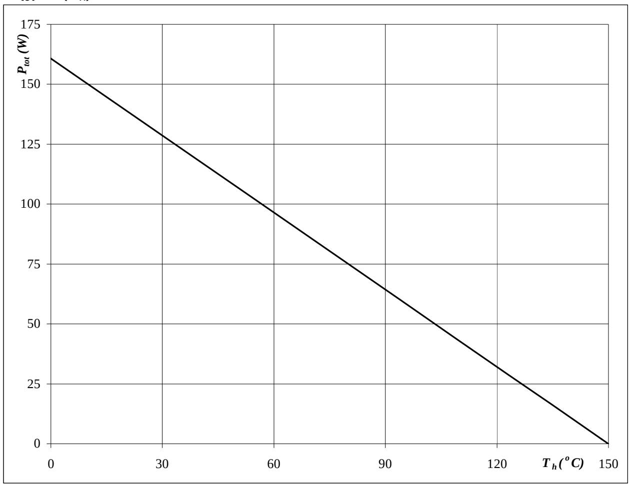
R (C/W)	Tau (s)
0,04	9,4E+00
0,16	9,2E-01
0,72	1,3E-01
0,47	3,1E-02
0,32	6,1E-03
0,17	5,7E-04

Brake

Figure 13 Brake IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



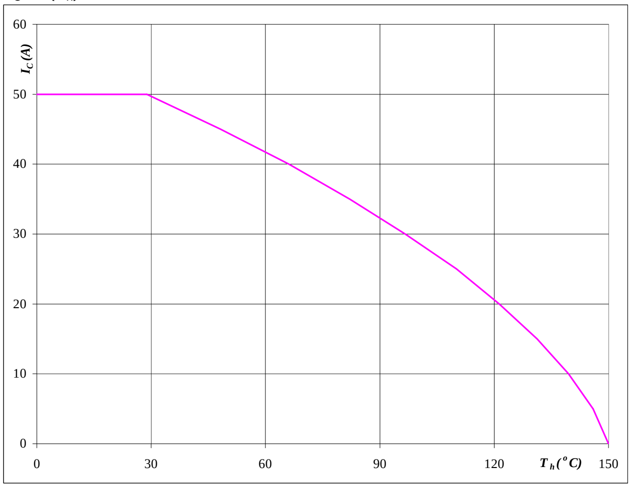
At

T_j = 150 ºC

Figure 14 Brake IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

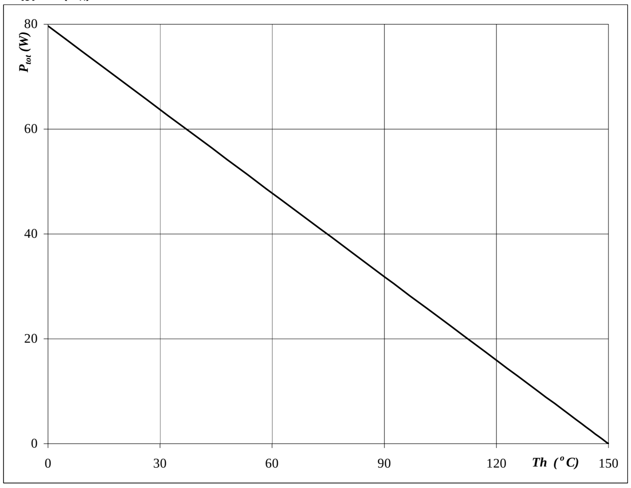
T_j = 150 ºC

V_{GE} = 15 V

Figure 15 Brake FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



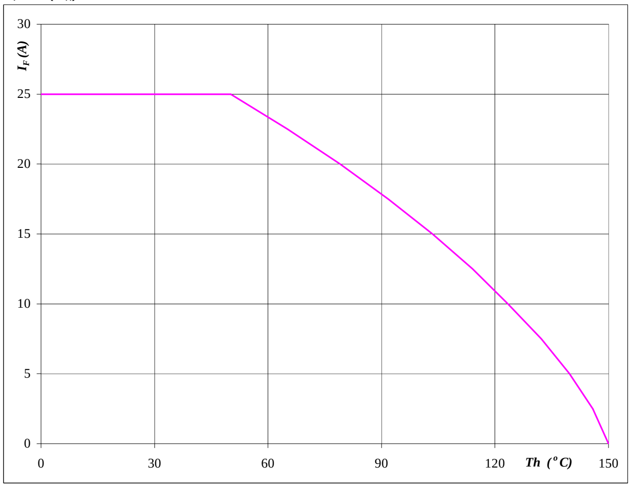
At

T_j = 150 ºC

Figure 16 Brake FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

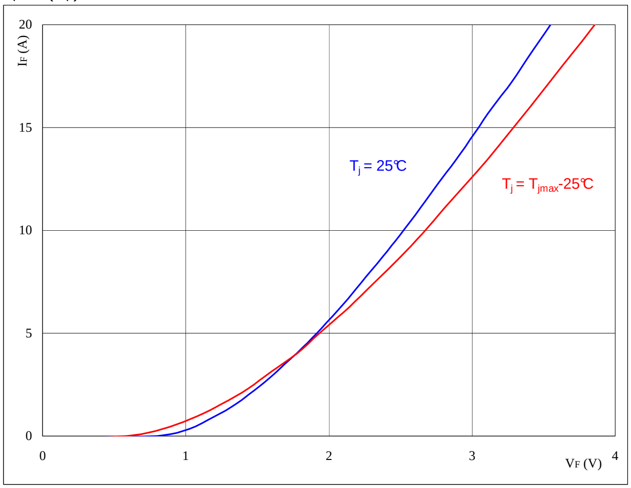
T_j = 150 ºC

Brake Inverse Diode

Figure 1 Brake inverse diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



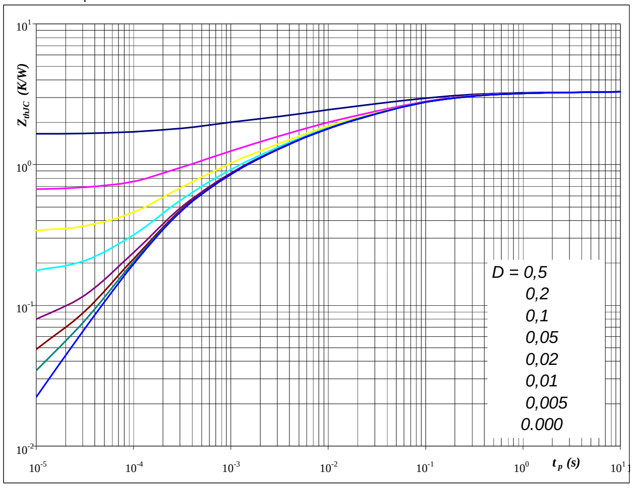
At

t_p = 250 µs

Figure 2 Brake inverse diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

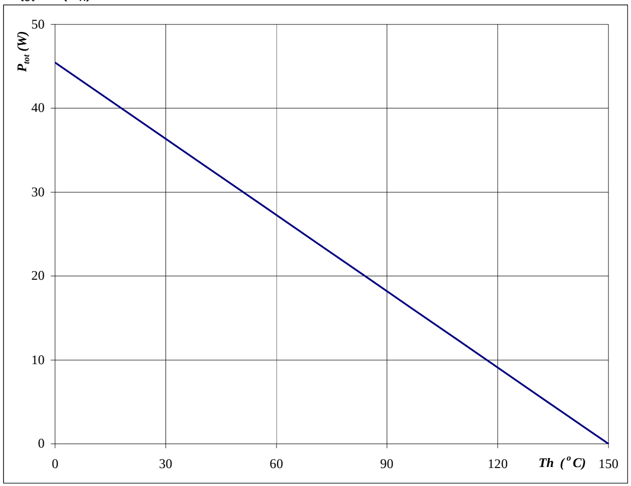
D = tp / T

R_{thJH} = 3,30 K/W

Figure 3 Brake inverse diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



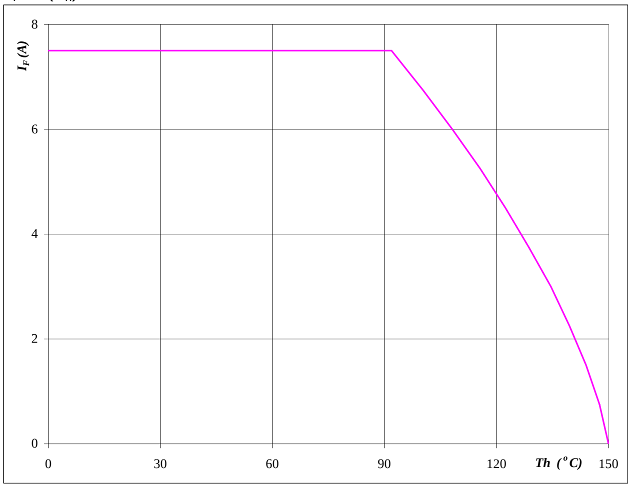
At

T_j = 150 ºC

Figure 4 Brake inverse diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

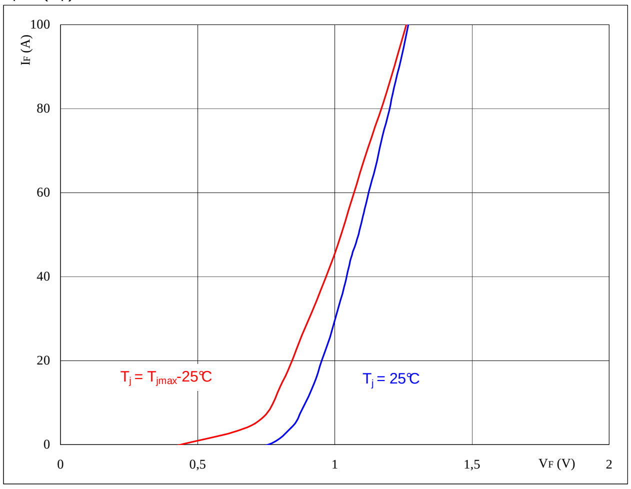
T_j = 150 ºC

Input rectifier diode

Figure 1 Input rectifier diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



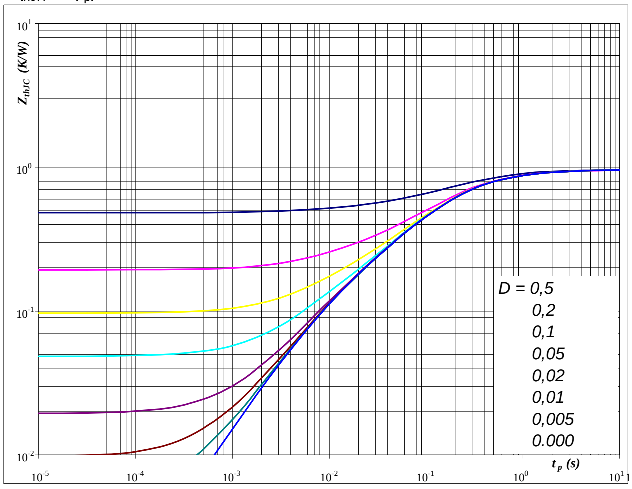
At

t_p = 250 µs

Figure 2 Input rectifier diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

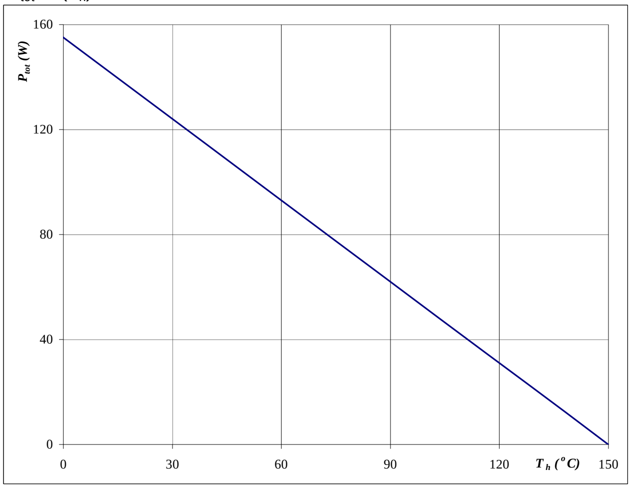
D = t_p / T

R_{thJH} = 0,967 K/W

Figure 3 Input rectifier diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



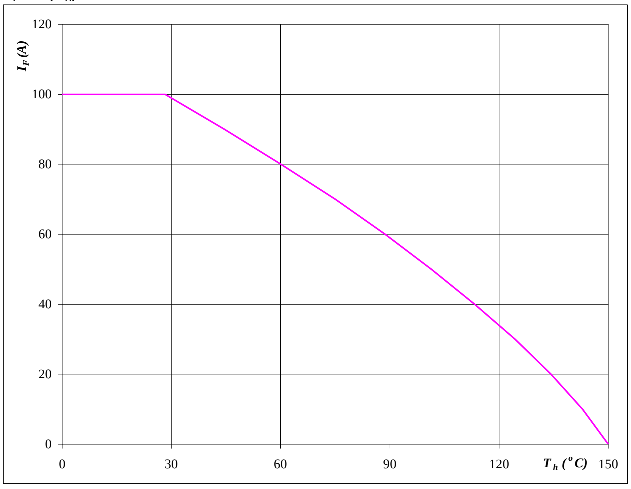
At

T_j = 150 ºC

Figure 4 Input rectifier diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

T_j = 150 ºC

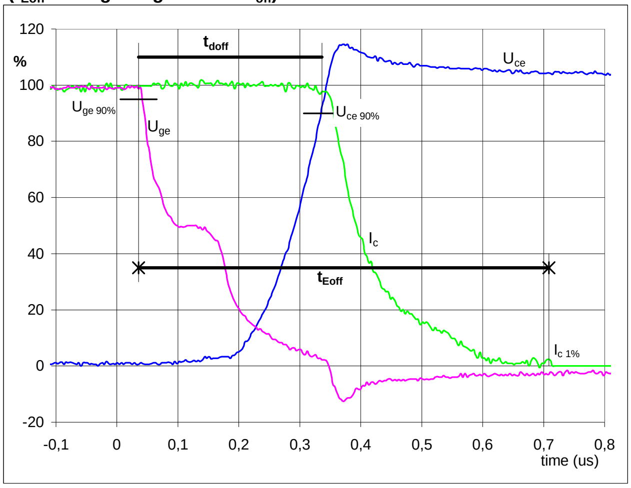
Switching Definitions Brake IGBT

General conditions

T_j	=	125 °C
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

Figure 1 Brake IGBT

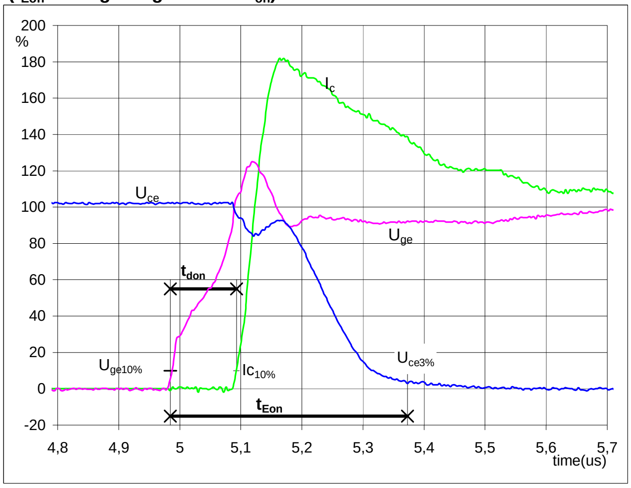
Turn-off Switching Waveforms & definition of tdoff, tEoff
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	100	A
t_{doff} =	0,29	µs
t_{Eoff} =	0,67	µs

Figure 2 Brake IGBT

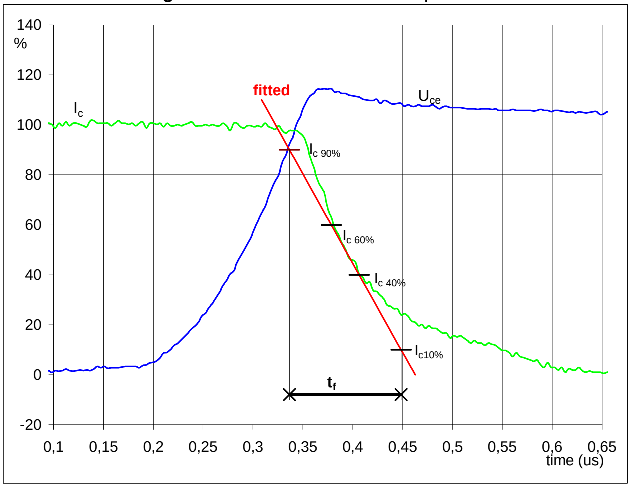
Turn-on Switching Waveforms & definition of tdon, tEon
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	100	A
t_{don} =	0,11	µs
t_{Eon} =	0,39	µs

Figure 3 Brake IGBT

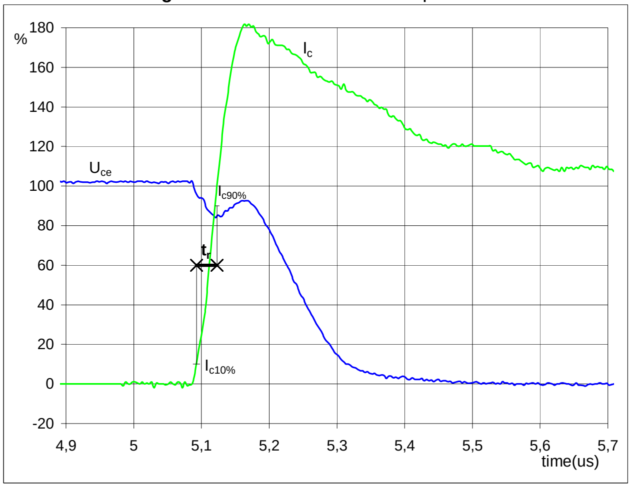
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	100	A
t_f =	0,11	µs

Figure 4 Brake IGBT

Turn-on Switching Waveforms & definition of t_r

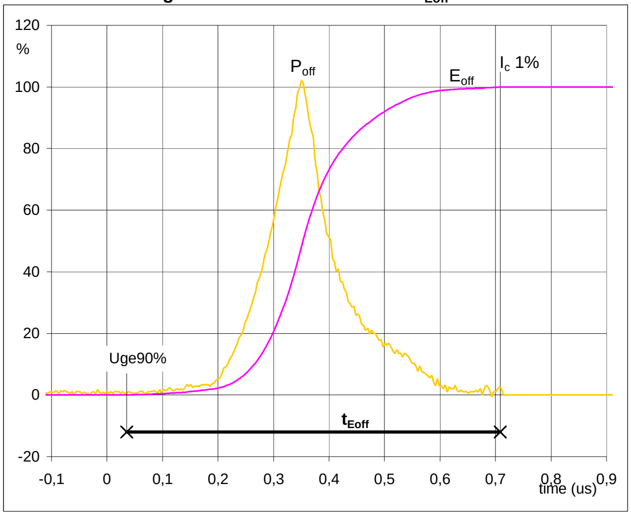


V_C (100%) =	600	V
I_C (100%) =	100	A
t_r =	0,03	µs

Switching Definitions Brake IGBT

Figure 5 Braker IGBT

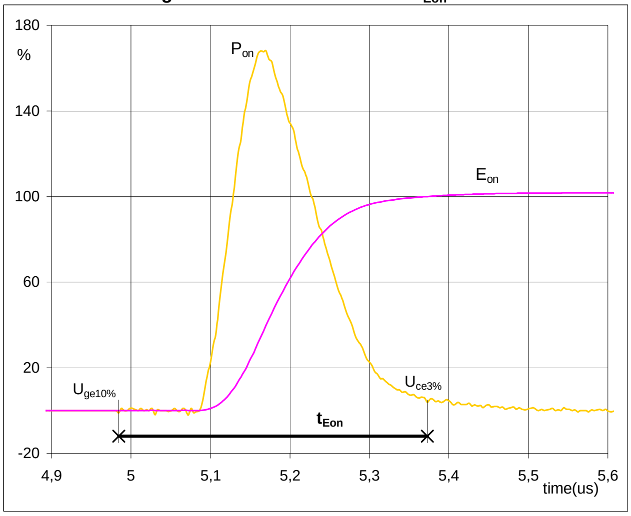
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	59,91	kW
E_{off} (100%) =	8,87	mJ
t_{Eoff} =	0,67	µs

Figure 6 Brake IGBT

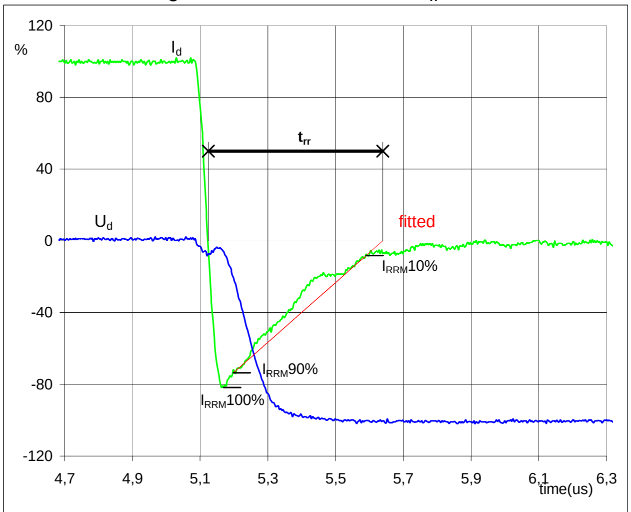
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	59,91	kW
E_{on} (100%) =	12,48	mJ
t_{Eon} =	0,39	µs

Figure 7 Brake FWD

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

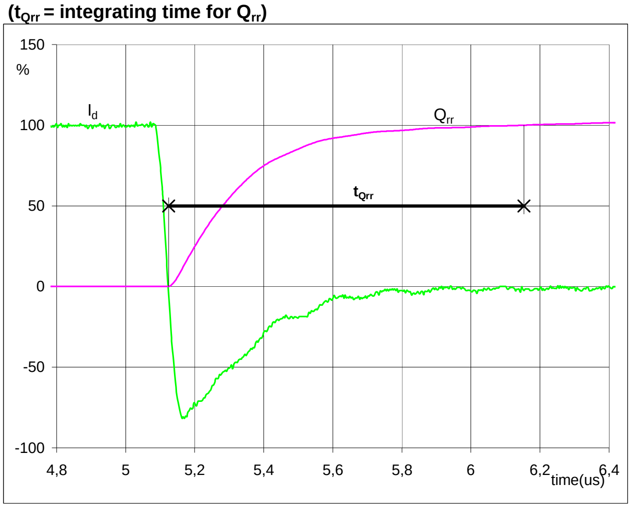


V_d (100%) =	600	V
I_d (100%) =	100	A
I_{RRM} (100%) =	10	A
t_{rr} =	0,11	µs

Switching Definitions Brake IGBT

Figure 8 Brake FWD

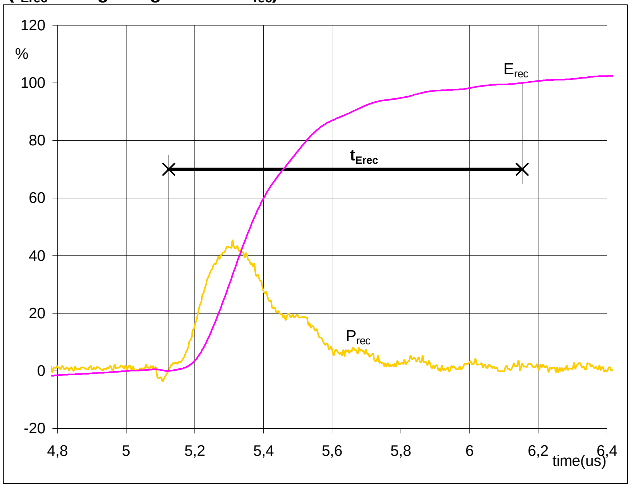
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	100	A
Q_{rr} (100%) =	20,73	µC
t_{Qrr} =	1,03	µs

Figure 9 Brake FWD

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



P_{rec} (100%) =	59,91	kW
E_{rec} (100%) =	7,85	mJ
t_{Erec} =	1,03	µs

Ordering Code and Marking - Outline - Pinout

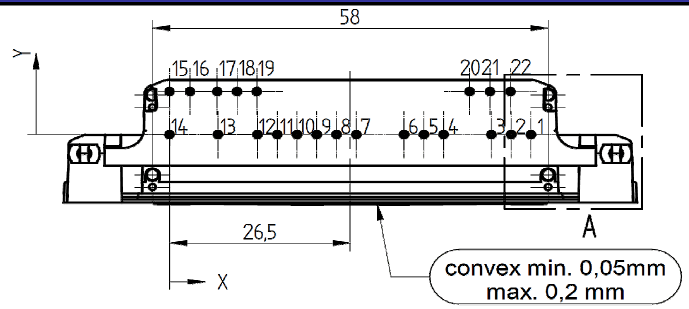
Ordering Code & Marking

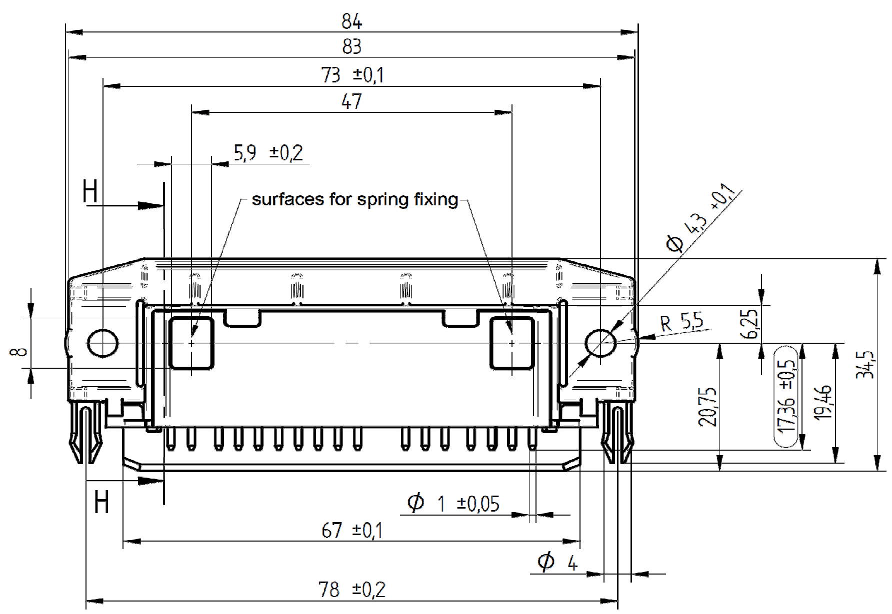
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	V23990-P719-G-PM	P719-G	P719-G
without thermal paste 12mm housing	V23990-P588-H-PM	P719-H	P719-H

Outline

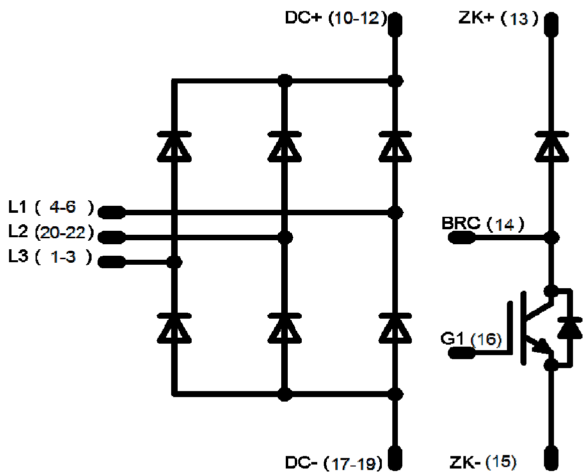
Pin table

Pin	X	Y
1	53	0
2	50,1	0
3	47,2	0
4	40,2	0
5	37,3	0
6	34,4	0
7	27,4	0
8	24,5	0
9	21,6	0
10	18,7	0
11	15,8	0
12	12,9	0
13	7,1	0
14	0	0
15	0	7
16	3	7
17	7	7
18	9,9	7
19	12,8	7
20	44	7
21	47	7
22	50	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.