Vincotech

V23990-P729-F48-PM
V23990-P729-F49-PM
datasheet

flow **PACK 0** **1200 V / 40 A**

Features

- Low inductance layout
- Clip-in PCB mounting

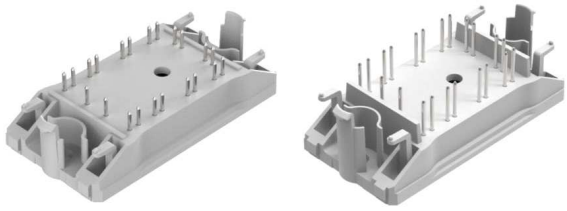
Target applications

- Solar

Types

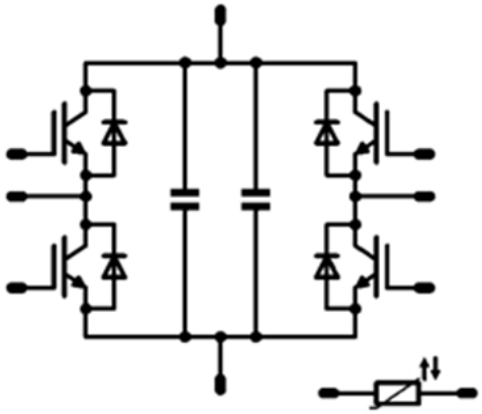
- V23990-P729-F48-PM
- V23990-P729-F49-PM

flow 0 housing



12mm housing 17mm housing

Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
H-Bridge Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ T_s = 80 °C	43	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	120	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	113	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \leq$ 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
H-Bridge Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	25	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	61	W
Maximum Junction Temperature	T_{jmax}		175	°C
Capacitor (DC)				
Maximum DC voltage	V_{MAX}		1000	V
Operation Temperature	T_{op}		-55…+125	°C
Module Properties				
Thermal Properties				
Storage temperature	T_{stg}		-40…+125	°C
Operation temperature under switching condition	T_{jop}		-40…(T_{jmax} - 25)	°C
Isolation Properties				
Isolation voltage	V_{isol}	DC Test Voltage t_p = 2 s	4000	V
Creepage distance			min. 12,7	mm
Clearance		12mm / 17mm housing	9,55 / min. 12,7	mm
Comparative Tracking Index	CTI		> 200	

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V]	I_C [A] I_D [A]	T_j [°C]	Min	Typ	Max	
H-Bridge Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0015	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		40	25 125	1,78	1,96 2,29	2,42	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			5	µA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		2330		pF
Output capacitance	C_{oes}							150		
Reverse transfer capacitance	C_{res}							130		
Gate charge	Q_g		15	960	40	25		185		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,84		K/W
IGBT Switching										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 8 Ω R_{gon} = 8 Ω	±15	600	40	25 125 150		64 65 66		ns
Rise time	t_r					25 125 150		15 19 18		
Turn-off delay time	$t_{d(off)}$					25 125 150		162 216 230		
Fall time	t_f					25 125 150		26 63 70		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 2,7 µC Q_{rFWD} = 4,8 µC Q_{rFWD} = 5,8 µC				25 125 150		1,542 2,194 2,410		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		1,321 2,287 2,529		

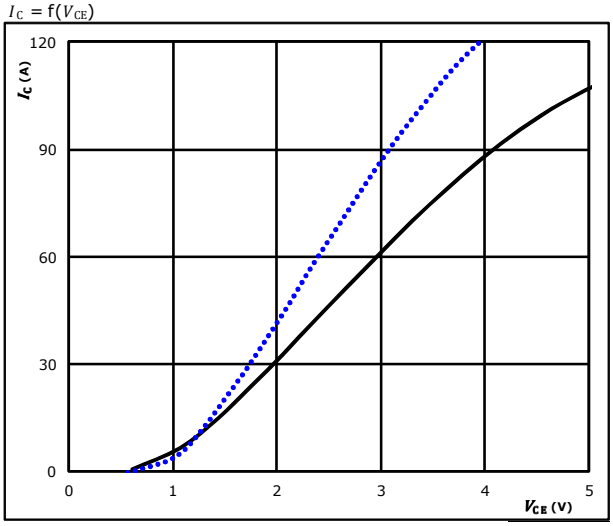
Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V]	I_C [A] I_D [A]	T_j [°C]	Min	Typ	Max	
H-Bridge Diode										
Static										
Forward voltage	V_F				25	25 150		2,47 2,49	2,74	V
Reverse leakage current	I_r			1200		25 150			60 3300	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,56		K/W
FWD Switching										
Peak recovery current	I_{RRM}	di/dt = 3019 A/µs di/dt = 3104 A/µs di/dt = 2972 A/µs	±15	600	40	25 125 150		48 55 60		A
Reverse recovery time	t_{rr}					25 125 150		101 222 251		ns
Recovered charge	Q_r					25 125 150		2,701 4,784 5,825		µC
Reverse recovered energy	E_{rec}					25 125 150		1,132 2,113 2,604		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		3780 2583 2658		A/µs
Capacitor (DC)										
Capacitance	C							56		nF
Tolerance							-20		+20	%
Climatic category							55/125/56			
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 Ω				100	-12		+14	%
Power dissipation	P					25		200		mW
Power dissipation constant						25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				25		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				25		3998		K
Vincotech NTC Reference									B	

H-Bridge Switch Characteristics

Typical output characteristics **IGBT**

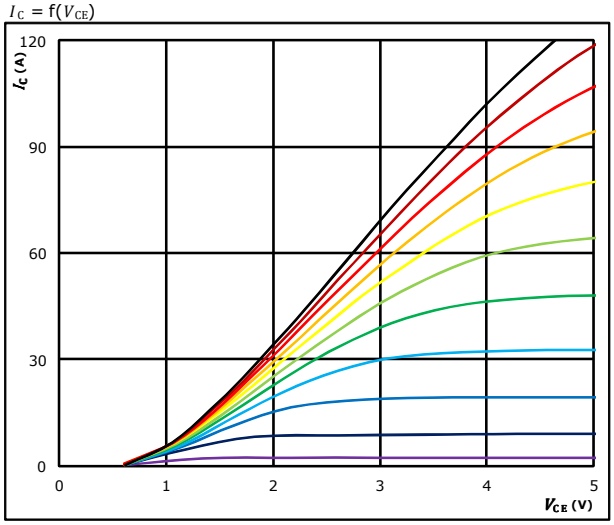
$I_C = f(V_{CE})$



t_p =	250	µs		**25 °C**
V_{GE} =	15	V	T_j:	**125 °C**

Typical output characteristics **IGBT**

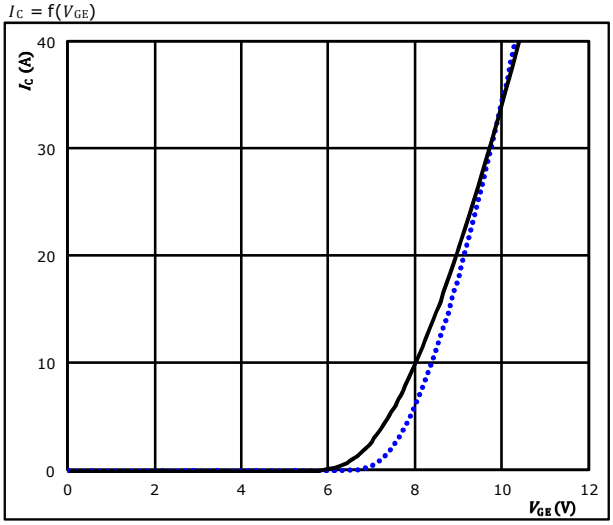
$I_C = f(V_{CE})$



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

Typical transfer characteristics **IGBT**

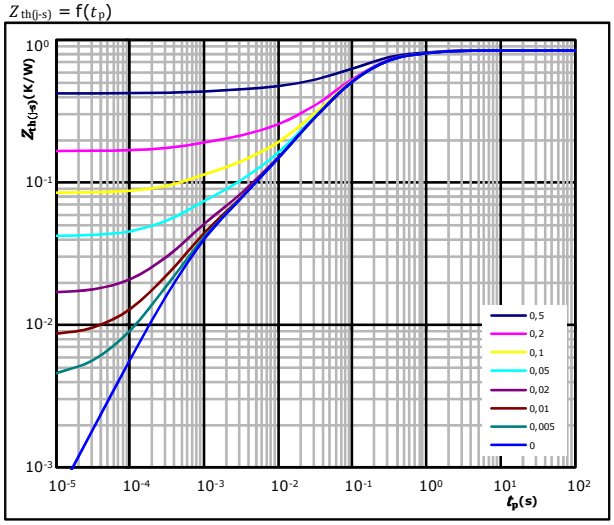
$I_C = f(V_{GE})$



t_p =	100	µs		**25 °C**
V_{CE} =	10	V	T_j:	**125 °C**

Transient Thermal Impedance as function of Pulse duration **IGBT**

$Z_{th(j-s)} = f(t_p)$



D =	t_p / T	
$R_{th(j-s)}$ =	0,84	K/W

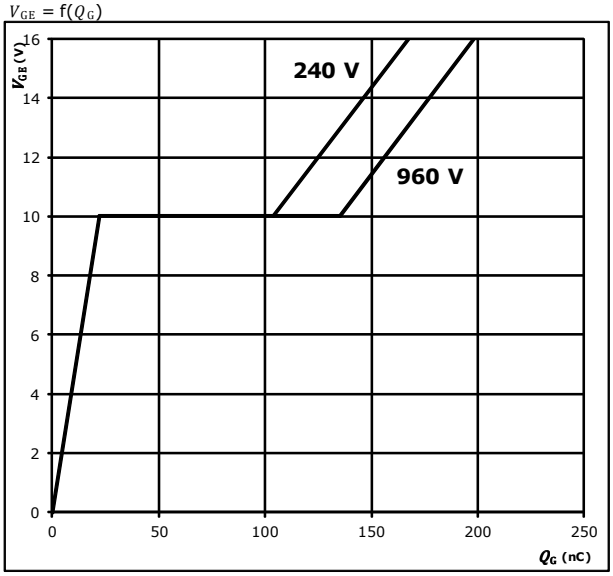
IGBT thermal model values

R (K/W)	τ (s)
1,18E-01	8,20E-01
4,24E-01	1,32E-01
2,01E-01	4,79E-02
6,46E-02	9,26E-03
3,72E-02	8,03E-04

H-Bridge Switch Characteristics

Gate voltage vs Gate charge **IGBT**

$V_{GE} = f(Q_G)$

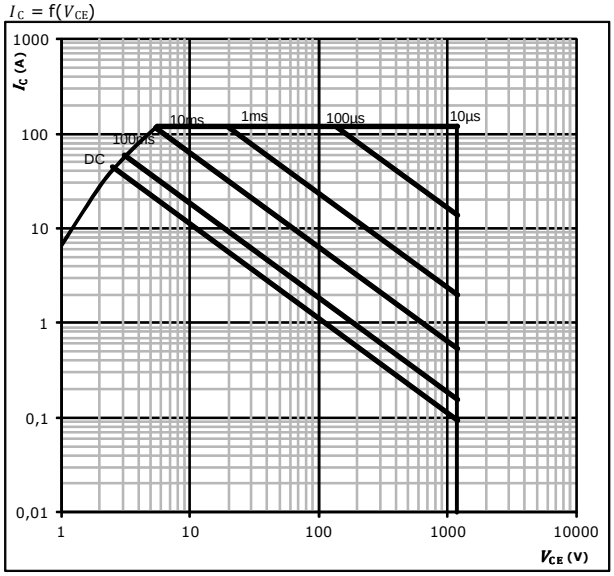


At

I_C= 40 A

Safe operating area **IGBT**

$I_C = f(V_{CE})$

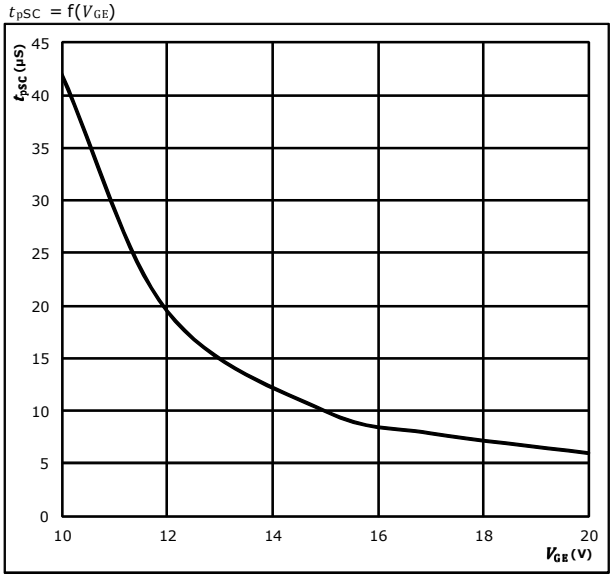


At

D = single pulse
T_s = 80 °C
V_{GE} = ±15 V
T_j = T_{jmax} °C

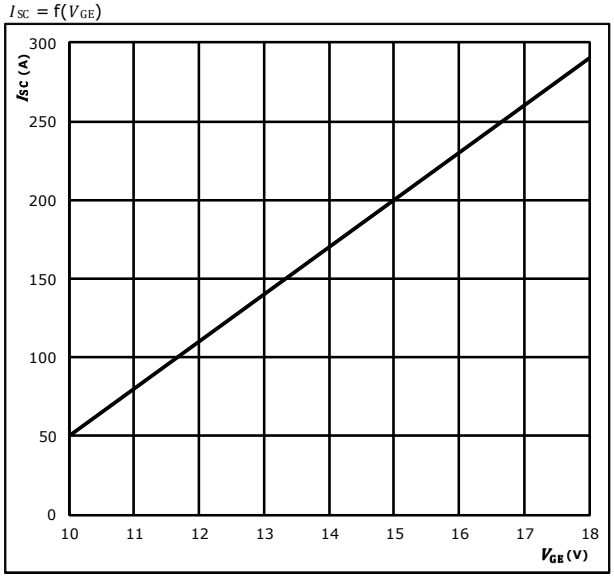
Short circuit duration as a function of V_{GE} **IGBT**

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



Typical short circuit current as a function of V_{GE} **IGBT**

$I_{SC} = f(V_{GE})$

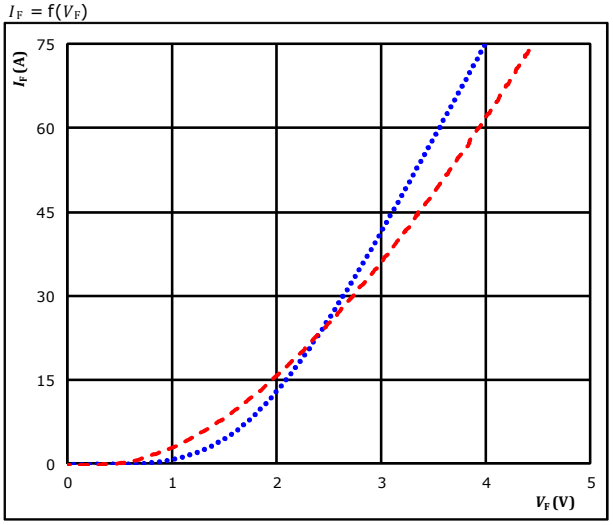


H-Bridge Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



t_p = 250 µs

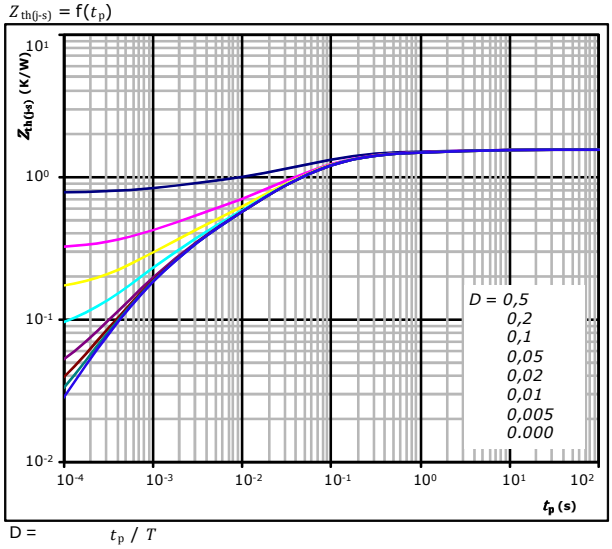
T_j: 25 °C

150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



D = t_p / T

$R_{th(j-s)}$ = 1,56 K/W

FWD thermal model values

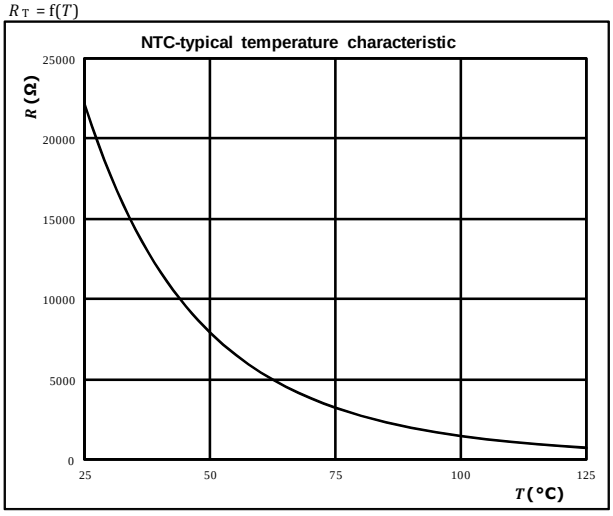
R (K/W)	τ (s)
4,65E-02	4,86E+00
1,06E-01	8,11E-01
4,71E-01	1,09E-01
4,83E-01	3,07E-02
2,34E-01	7,03E-03
1,81E-01	1,25E-03
3,38E-02	3,28E-04

Thermistor Characteristics

Thermistor typical temperature characteristic

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$

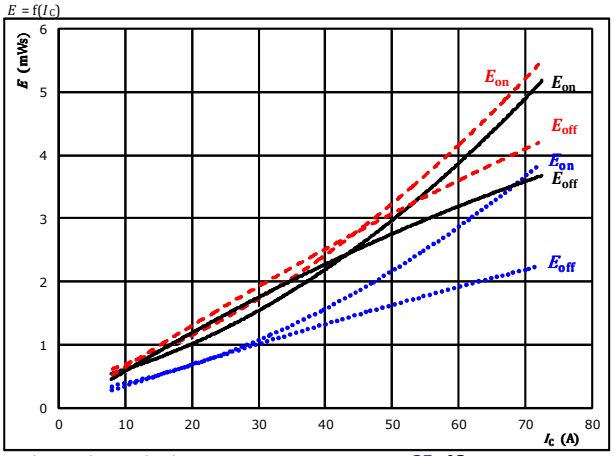


H-Bridge Switching Characteristics

Figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



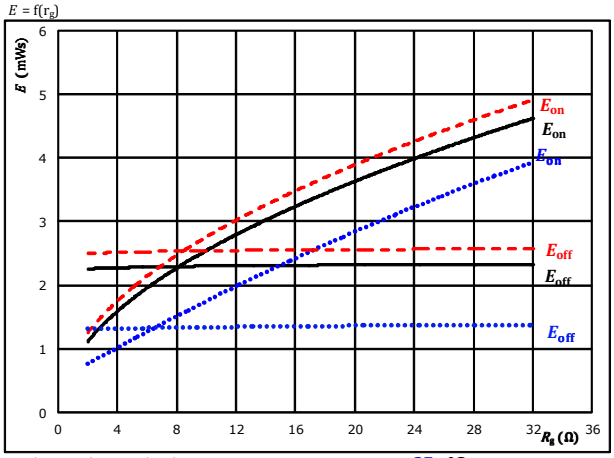
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C
R_{goff} =	8	Ω		

Figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(r_g)$



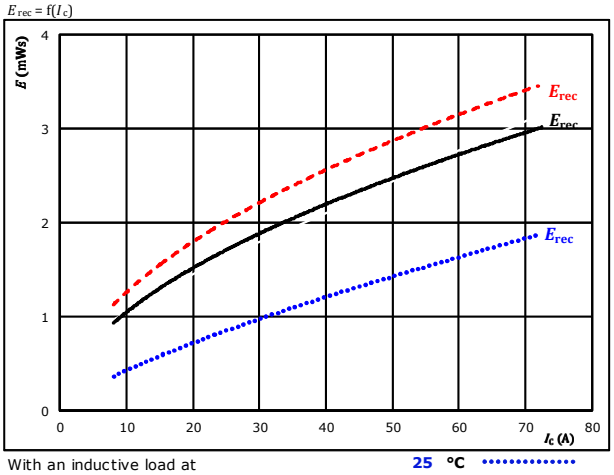
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	40	A		150 °C

Figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_c)$



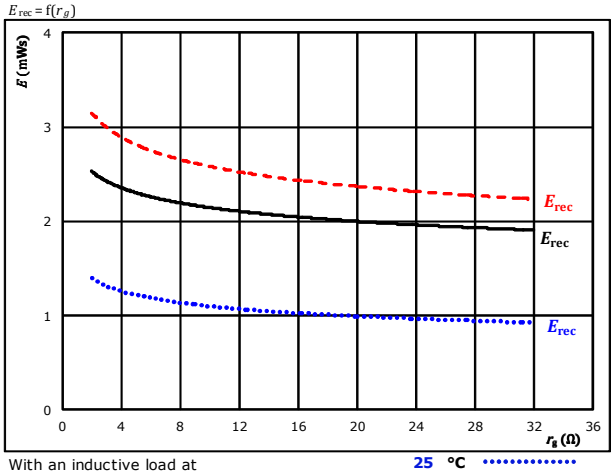
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C

Figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(r_g)$



With an inductive load at

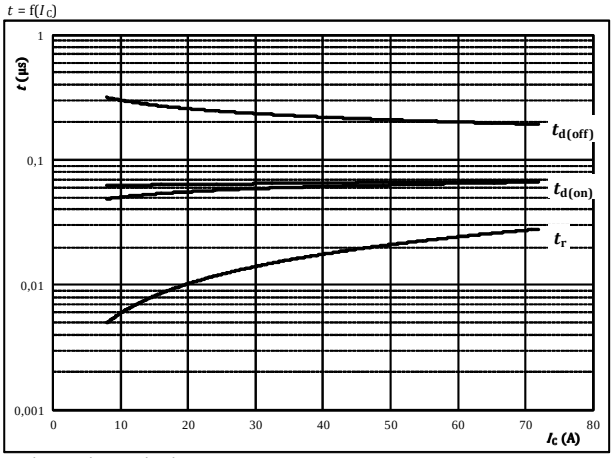
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	40	A		150 °C

H-Bridge Switching Characteristics

Figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



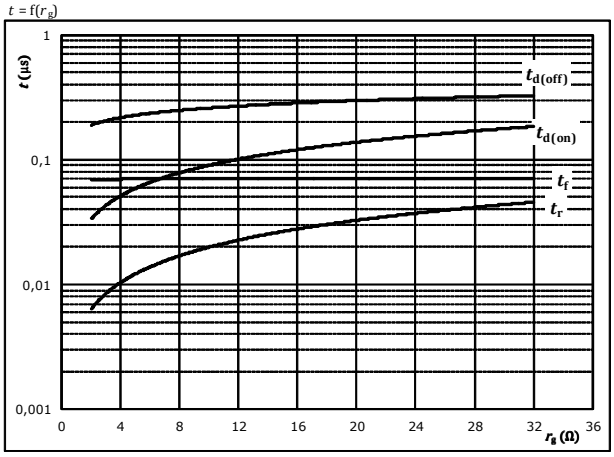
With an inductive load at

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

Figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(r_g)$



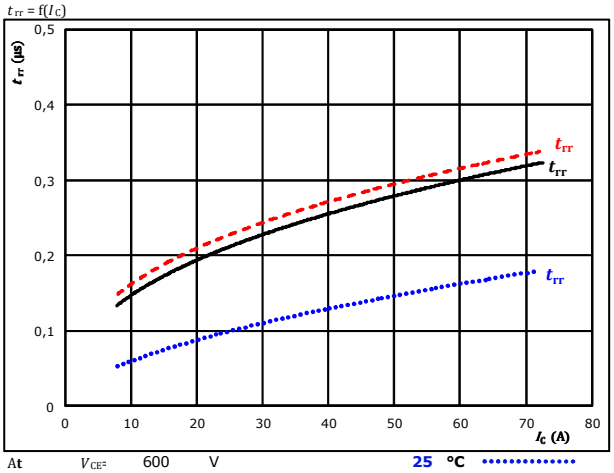
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	40	A

Figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

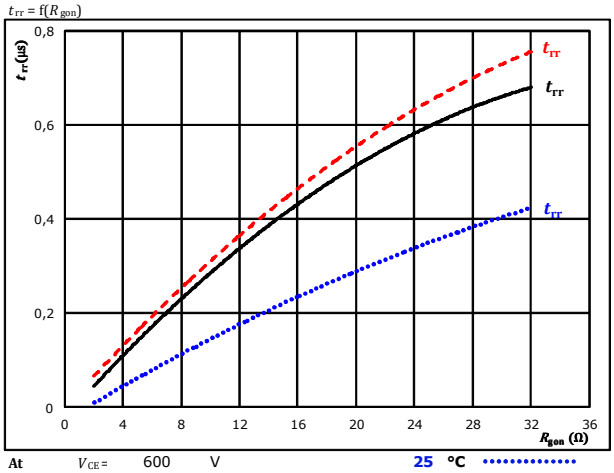


At	V_{CE}=	600	V		25 °C
	V_{GE} =	±15	V	T_j:	125 °C
	R_{gon} =	8	Ω		150 °C

Figure 8. **FWD**

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

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



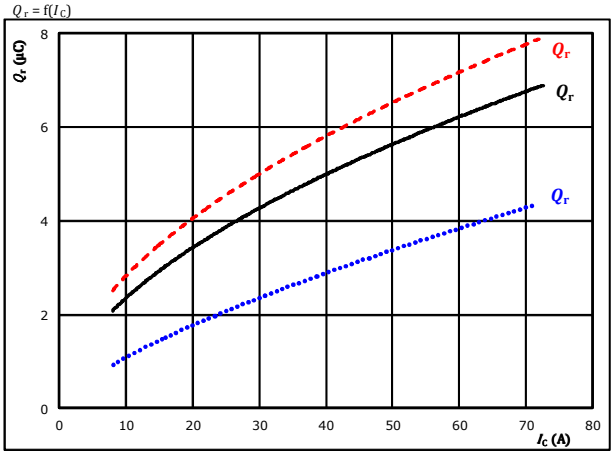
At	V_{CE} =	600	V		25 °C
	V_{GE} =	±15	V	T_j:	125 °C
	I_C =	40	A		150 °C

H-Bridge Switching Characteristics

Figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

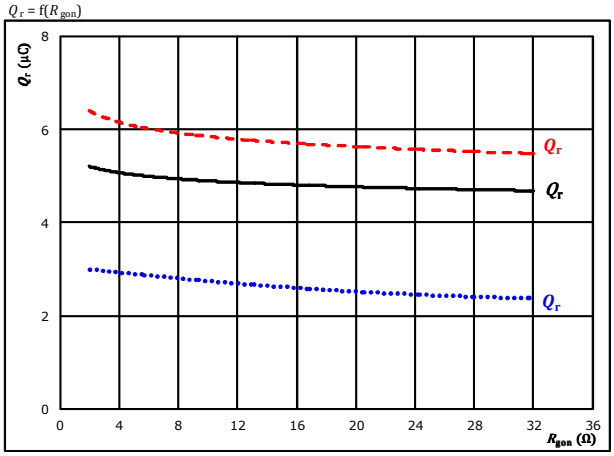


At						
	V_{CE} =	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	8	Ω		150 °C	

Figure 10. **FWD**

Typical recoved charge as a function of IGBT turn on gate resistor

$Q_r = f(R_{gon})$

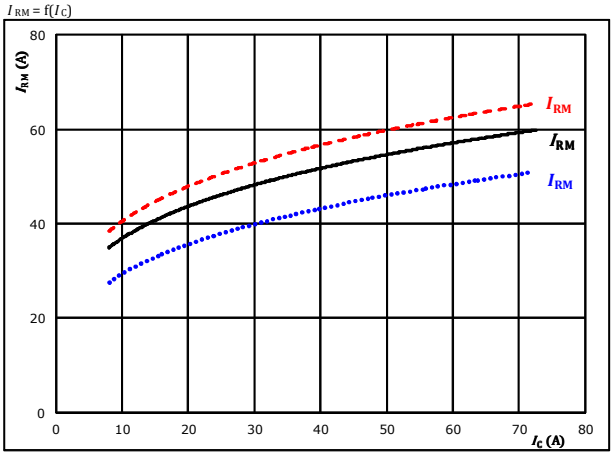


At						
	V_{CE}=	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C=	40	A		150 °C	

Figure 11. **FWD**

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

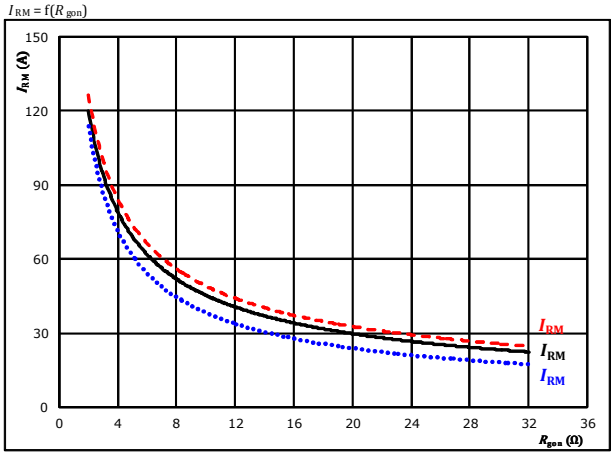


At						
	V_{CE}:	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	8	Ω		150 °C	

Figure 12. **FWD**

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

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



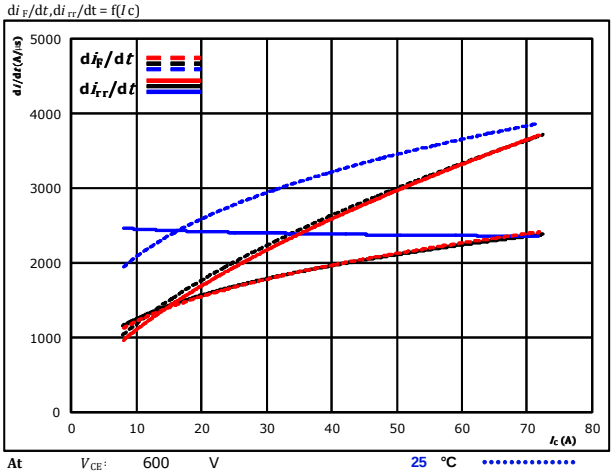
At						
	V_{CE} =	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C =	40	A		150 °C	

H-Bridge Switching Characteristics

Figure 13. **FWD**

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

$di_F/dt, di_{rr}/dt = f(I_C)$

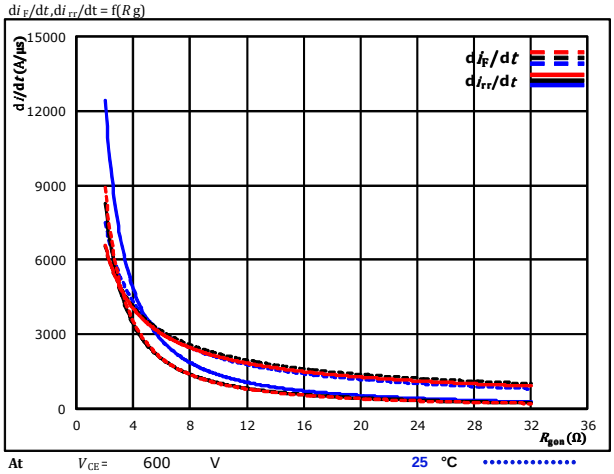


At	V_{CE} =	600	V	25 °C	
	V_{GE} =	±15	V	T_j: 125 °C	
	R_{gon} =	8	Ω	150 °C	

Figure 14. **FWD**

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

$di_F/dt, di_{rr}/dt = f(R_g)$

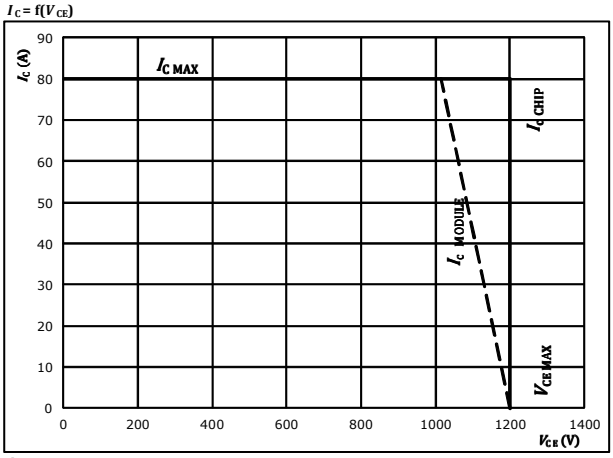


At	V_{CE} =	600	V	25 °C	
	V_{GE} =	±15	V	T_j: 125 °C	
	I_C =	40	A	150 °C	

Figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

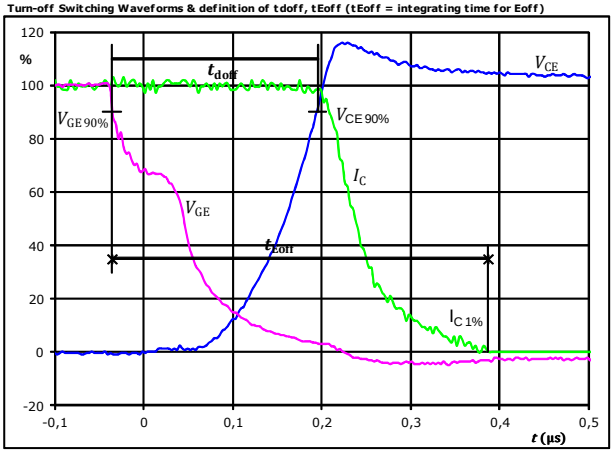
T_j =	175	°C	
R_{gon} =	8	Ω	
R_{goff} =	8	Ω	

H-Bridge Switching Characteristics

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

Figure 1. **IGBT**

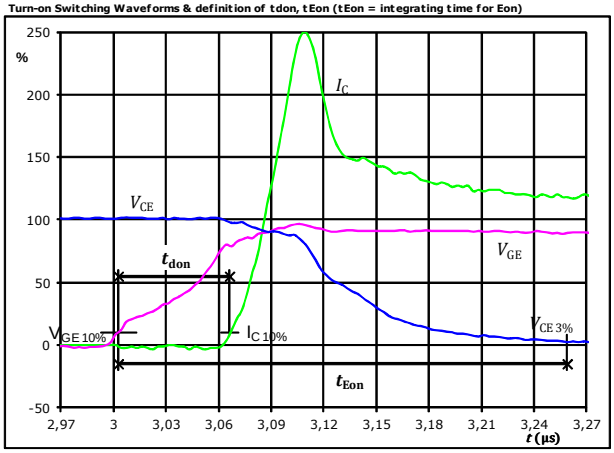
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	40	A
t_{doff} =	0,230	µs
t_{Eoff} =	0,423	µs

Figure 2. **IGBT**

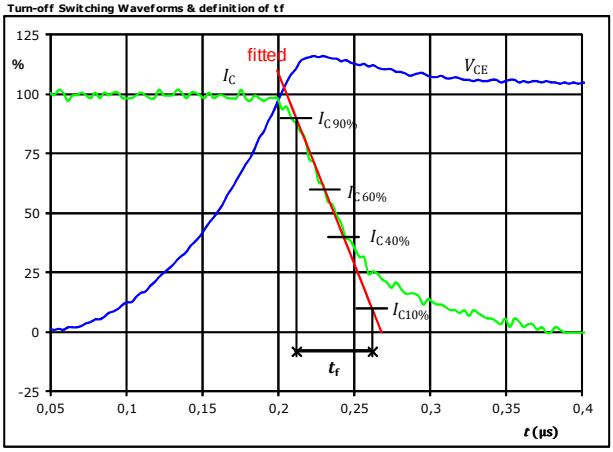
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	40	A
t_{don} =	0,066	µs
t_{Eon} =	0,256	µs

Figure 3. **IGBT**

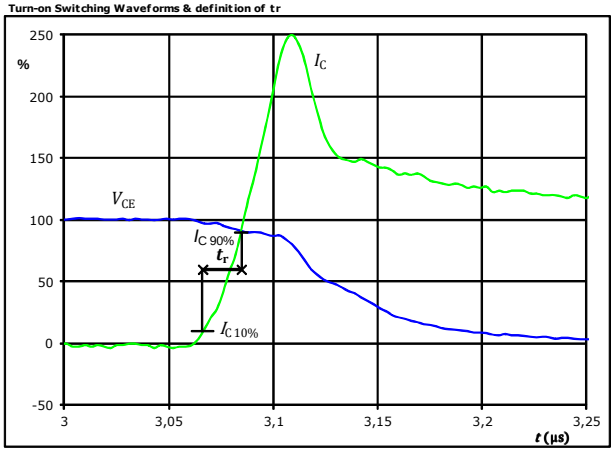
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	40	A
t_f =	0,070	µs

Figure 4. **IGBT**

Turn-on Switching Waveforms & definition of tr

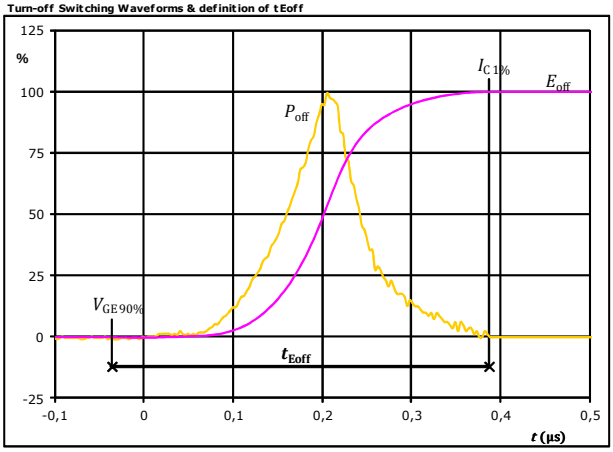


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	40	A
t_r =	0,018	µs

H-Bridge Switching Characteristics

Figure 5. **IGBT**

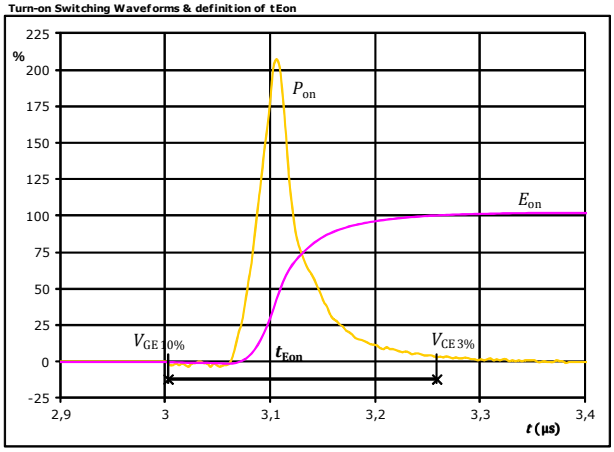
Turn-off Switching Waveforms & definition of tEoff



$P_{off}(100\%)$ =	24,01	kW
$E_{off}(100\%)$ =	2,53	mJ
t_{Eoff} =	0,42	µs

Figure 6. **IGBT**

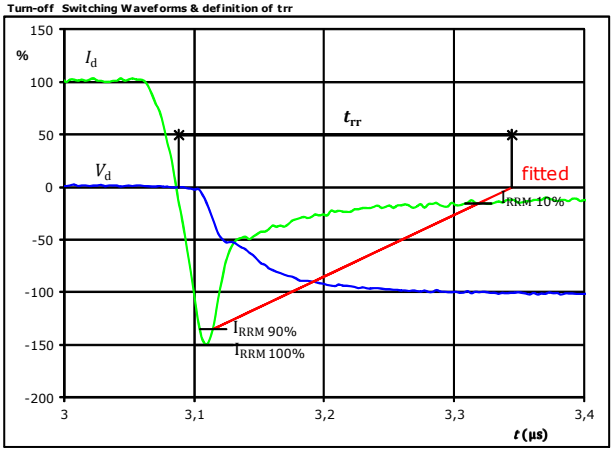
Turn-on Switching Waveforms & definition of tEon



$P_{on}(100\%)$ =	24,01	kW
$E_{on}(100\%)$ =	2,41	mJ
t_{Eon} =	0,26	µs

Figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

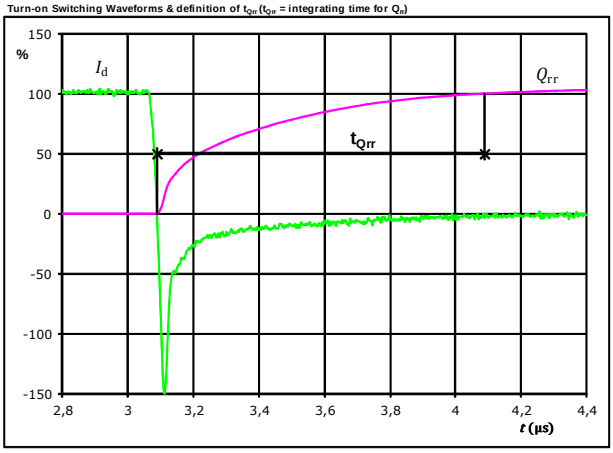


$V_d(100\%)$ =	600	V
$I_d(100\%)$ =	40	A
$I_{RRM}(100\%)$ =	-60	A
t_{rr} =	0,251	µs

H-Bridge Switching Characteristics

Figure 8. **FWD**

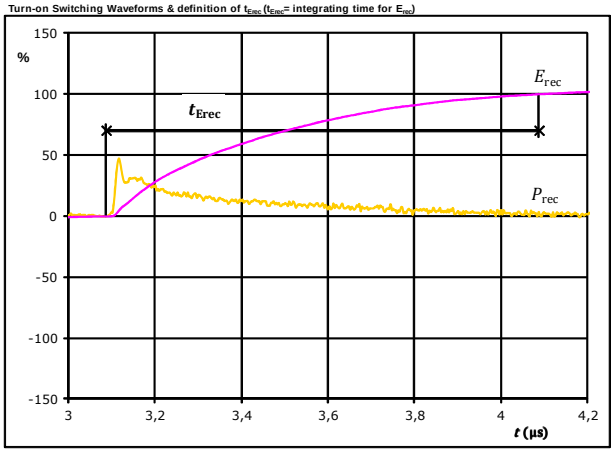
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	40	A
Q_{rr} (100%) =	5,83	µC
t_{Qrr} =	1,00	µs

Figure 9. **FWD**

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



P_{rec} (100%) =	24,01	kW
E_{rec} (100%) =	2,60	mJ
t_{Erec} =	1,00	µs

Ordering Code & Marking

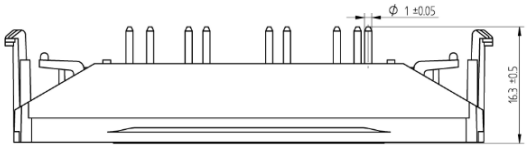
Version	Ordering Code
without thermal paste PCM 12mm housing with solder pins	V23990-P729-F48-PM
with thermal paste PCM 12mm housing with solder pins	V23990-P729-F48-/3/-PM
without thermal paste PCM 17mm housing with solder pins	V23990-P729-F49-PM

Text	**VIN**	**Date code**	**Name&Ver**	**UL**	**Lot**	**Serial**
	VIN	WWYY	NNNNNNNVV	UL	LLLLL	SSSS
Datamatrix	**Name&Ver**	**Lot number**	**Serial**	**Date code**		
	NNNNNNNVV	LLLLL	SSSS	WWYY		

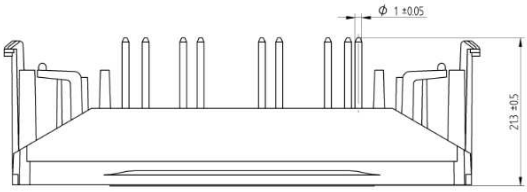
Outline

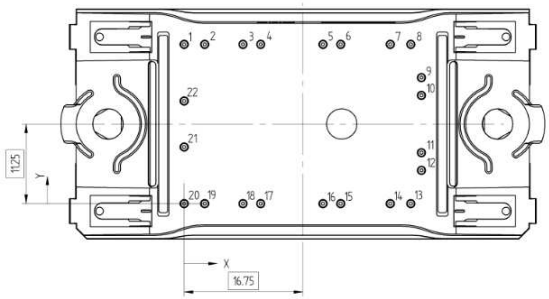
Pin table [mm]			
Pin	X	Y	Function
1	0	22,5	G1
2	2,9	22,5	S1
3	8,3	22,5	DC-
4	10,8	22,5	DC-
5	19,6	22,5	DC+
6	22,1	22,5	DC+
7	29,1	22,5	S2
8	32	22,5	G2
9	33,5	17,8	OUT1
10	33,5	15,3	OUT1
11	33,5	7,2	OUT2
12	33,5	4,7	OUT2
13	32	0	G4
14	29,1	0	S4
15	22,1	0	DC+
16	19,6	0	DC+
17	10,8	0	DC-
18	8,3	0	DC-
19	2,9	0	S3
20	0	0	G3
21	0	8	Th1
22	0	14,5	Th2

12mm housing



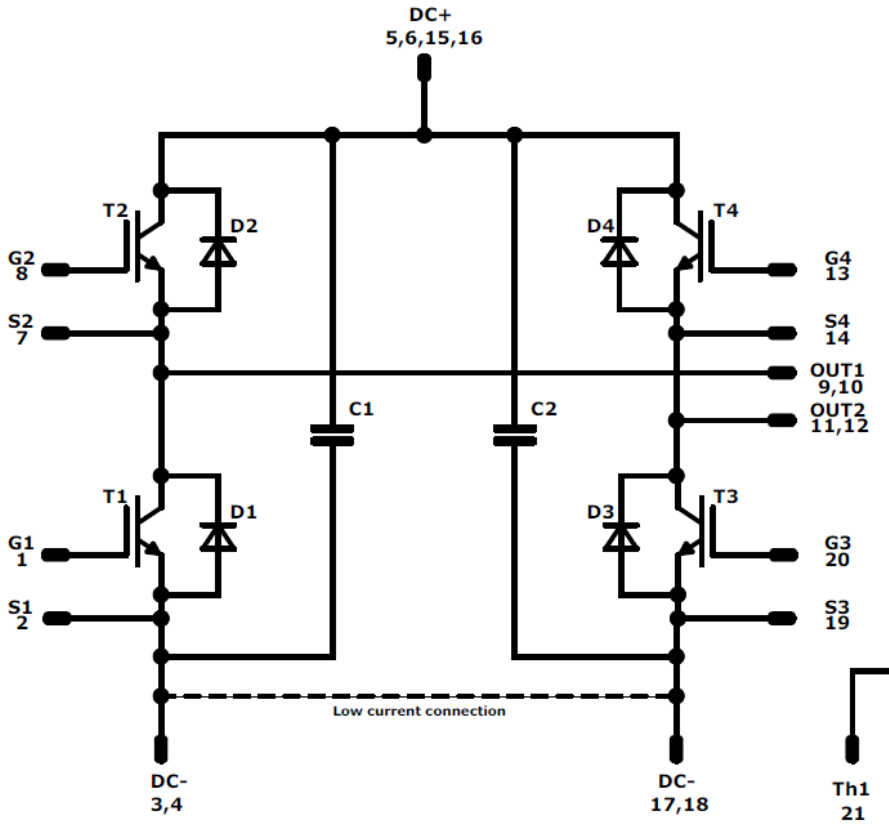
17mm housing





Tolerance of pinpositions ±0,5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1,T2,T3,T4	IGBT	1200 V	40 A	H-Bridge Switch	
D1,D2,D3,D4	FWD	1200 V	25 A	H-Bridge Diode	
C1,C2	Capacitor	1000 V		H-Bridge Switch	
NTC	Thermistor			H-Bridge	

Packaging instruction				
Standard packaging quantity (SPQ) 135	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 0 packages see vincotech.com website.

Package data
Package data for *flow* 0 packages see vincotech.com website.

UL recognition and file number
This device is certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
V23990-P729-F4x-D2-14	24 May. 2016	New brand, 17mm housig added	all