



<i>flow</i> PACK 0	1200 V / 40 A
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">Features</div> <ul style="list-style-type: none"> Low inductance layout Clip-in PCB mounting 	<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">flow0 housing</div> <div style="display: flex; justify-content: space-around;"> </div> <div style="display: flex; justify-content: space-around; font-size: small;"> 12mm housing 17mm housing </div>
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">Target applications</div> <ul style="list-style-type: none"> Solar 	<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">Schematic</div>
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">Types</div> <ul style="list-style-type: none"> V23990-P729-F48-PM V23990-P729-F49-PM 	

Maximum Ratings

$T_j = 25\text{ }^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
H-Bridge Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ }^\circ\text{C}$	43	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	120	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ }^\circ\text{C}$	113	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$T_j \leq 150\text{ }^\circ\text{C}$	10	μs
	V_{CC}	$V_{GE} = 15\text{V}$	800	V
Maximum Junction Temperature	T_{jmax}		175	$^\circ\text{C}$



Maximum Ratings

$T_j = 25\text{ °C}$, 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	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	25	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	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 $t_p = 2\text{ s}$	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

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V]	I_C [A] I_D [A]	T_j [°C]	Min	Typ	Max	Unit
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}							2330		pF
Output capacitance	C_{oes}	$f = 1$ MHz	0	25		25		150		
Reverse transfer capacitance	C_{res}							130		
Gate charge	Q_g		15	960	40	25		185		nC

Thermal

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V]	I_C [A] I_D [A]	T_j [°C]	Min	Typ	Max	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material $\lambda = 3,4$ W/mK						0,84		K/W

IGBT Switching

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V]	I_C [A] I_D [A]	T_j [°C]	Min	Typ	Max	Unit
Turn-on delay time	$t_{d(on)}$					25 125 150		64 65 66		ns
Rise time	t_r	$R_{goff} = 8$ Ω $R_{gon} = 8$ Ω				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}	$Q_{iFWD} = 2,7$ μC $Q_{iFWD} = 4,8$ μC $Q_{iFWD} = 5,8$ μC				25 125 150		1,542 2,194 2,410		
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 $\lambda = 3,4$ W/mK						1,56		K/W
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FWD Switching

Peak recovery current	I_{RRM}					25 125 150		48 55 60		A
Reverse recovery time	t_{rr}					25 125 150		101 222 251		ns
Recovered charge	Q_r	$di/dt = 3019$ A/μs $di/dt = 3104$ A/μs $di/dt = 2972$ A/μs	±15	600	40	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	$(di_{rr}/dt)_{max}$					25 125 150		3780 2583 2658		A/μs

Capacitor (DC)

Capacitance	C							56		nF
Tolerance								-20	+20	%
Climatic category								55/125/56		

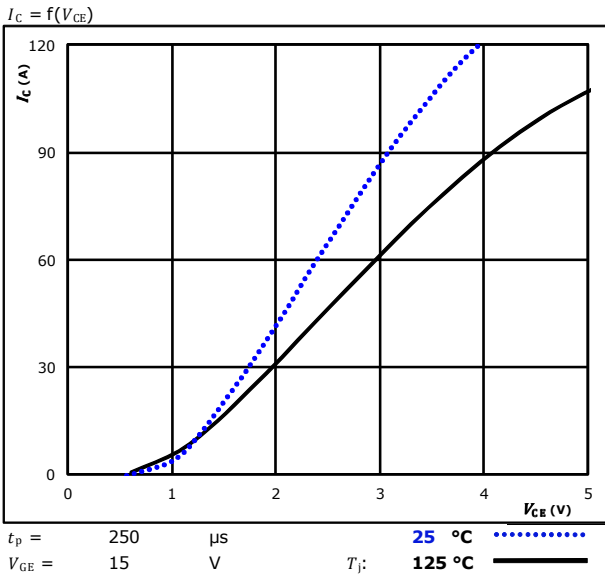
Thermistor

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	

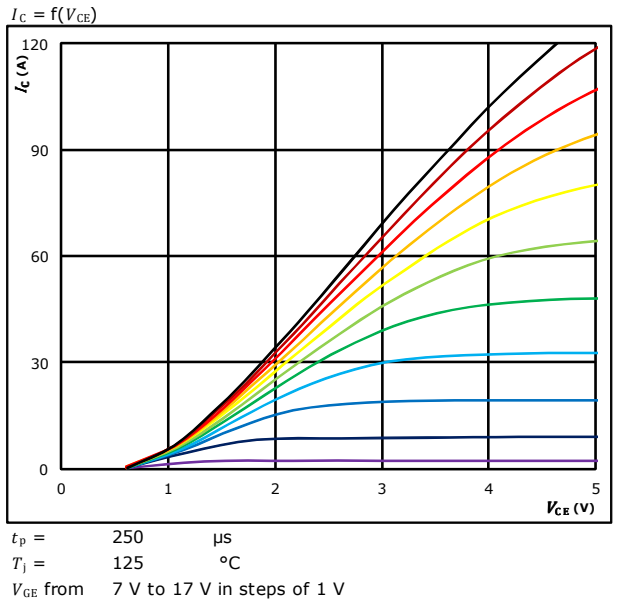


H-Bridge Switch Characteristics

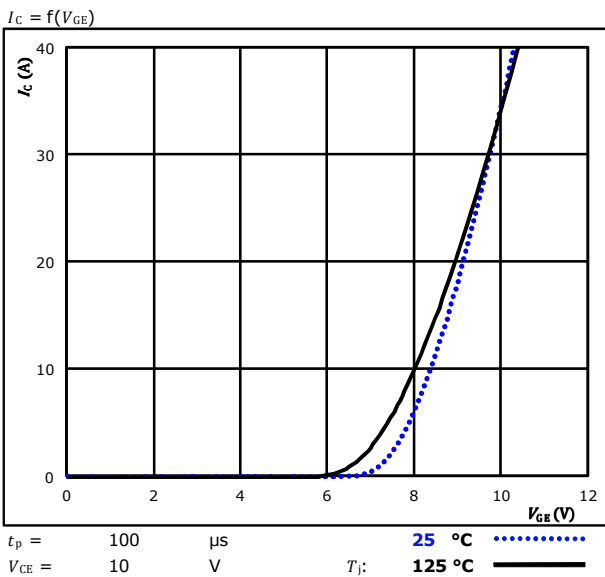
Typical output characteristics IGBT



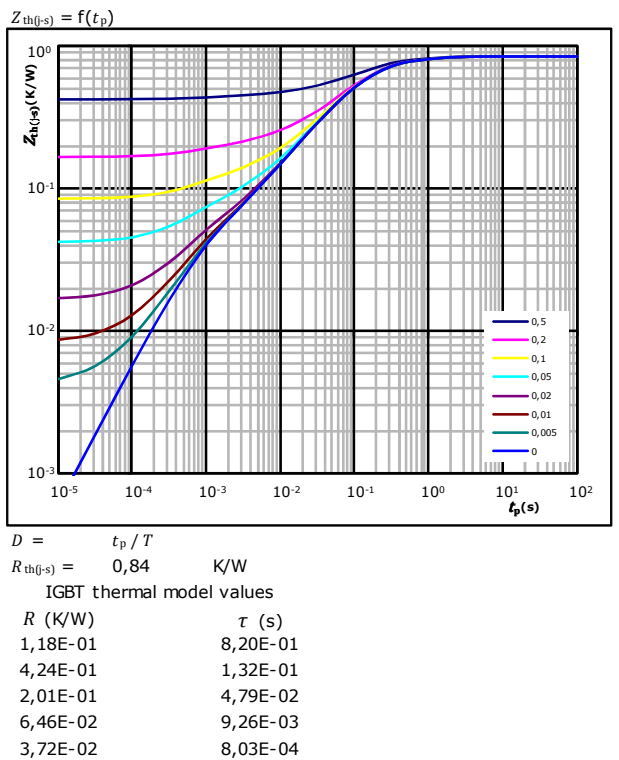
Typical output characteristics IGBT



Typical transfer characteristics IGBT



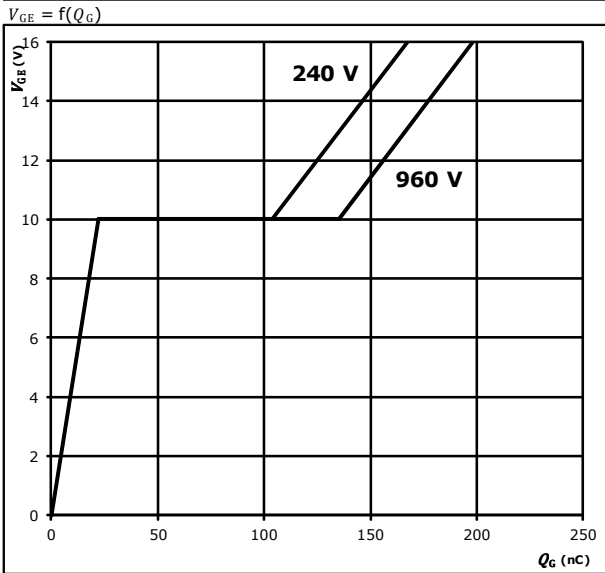
Transient Thermal Impedance as function of Pulse duration IGBT



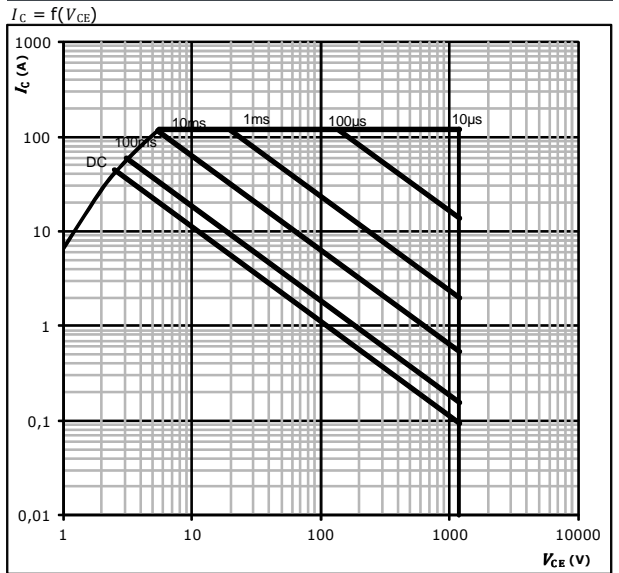


H-Bridge Switch Characteristics

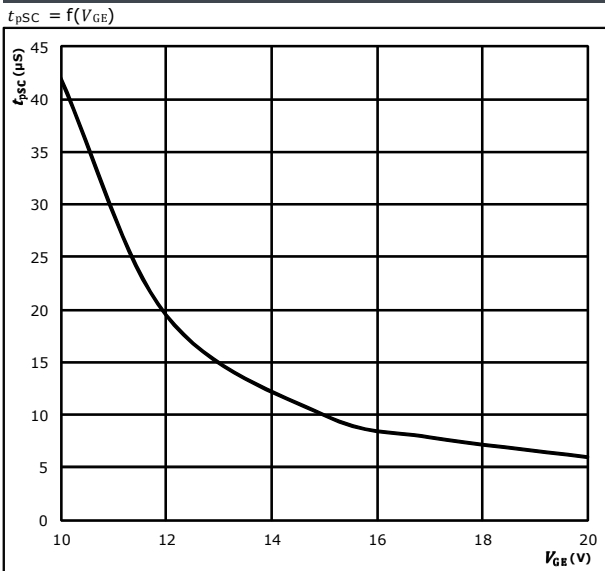
Gate voltage vs Gate charge IGBT



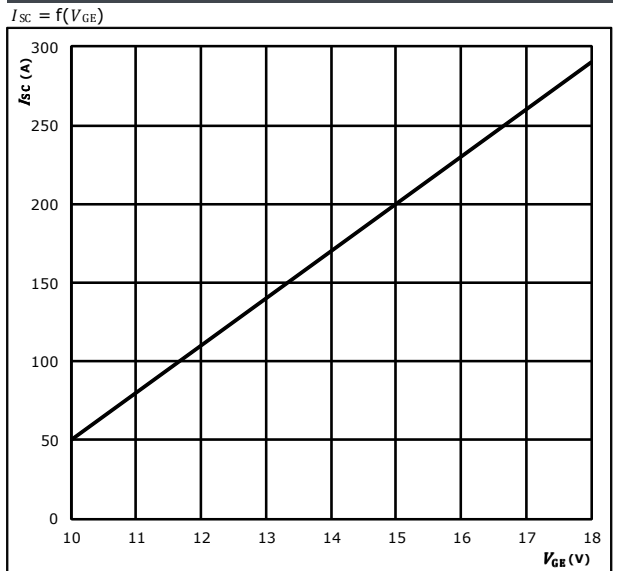
Safe operating area IGBT



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



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





H-Bridge Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

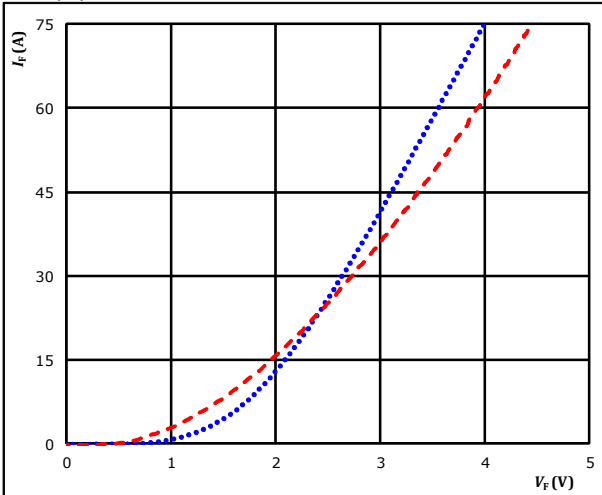
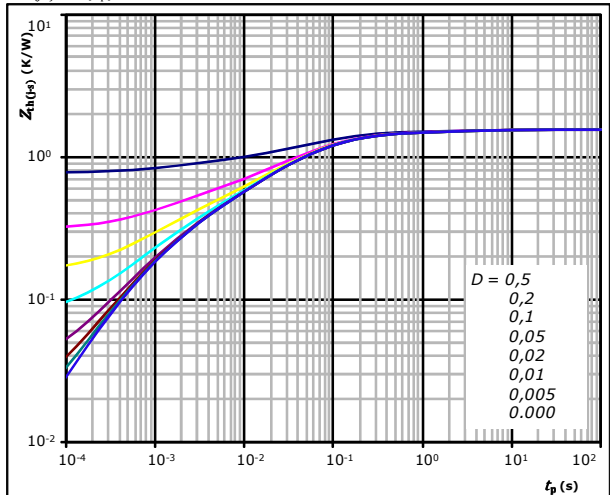


figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

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

FWD thermal model values

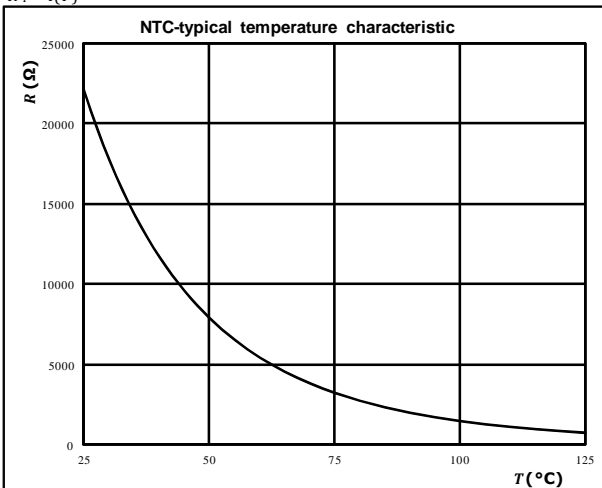
R (K/W)	τ (s)
4,65E-02	4,86E+00
1,06E-01	8,11E-01
4,71E-01	1,09E-01
4,83E-01	3,07E-02
2,34E-01	7,03E-03
1,81E-01	1,25E-03
3,38E-02	3,28E-04

Thermistor Characteristics

Thermistor typical temperature characteristic

Typical NTC characteristic
 as a function of temperature

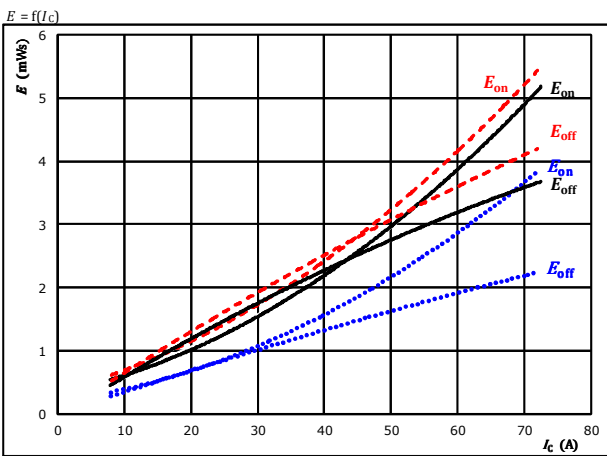
$$R_T = f(T)$$





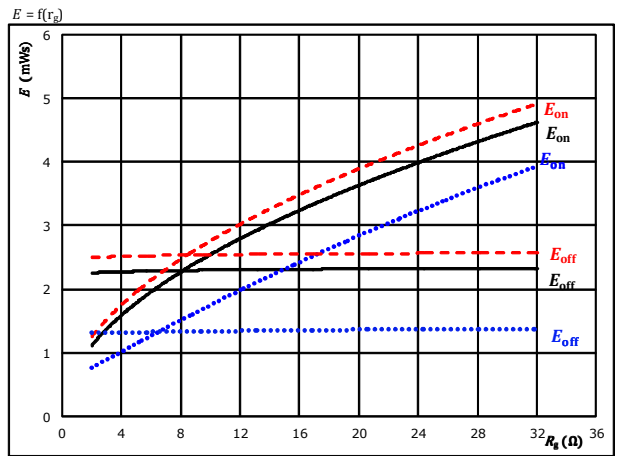
H-Bridge Switching Characteristics

Figure 1. IGBT
Typical switching energy losses as a function of collector current



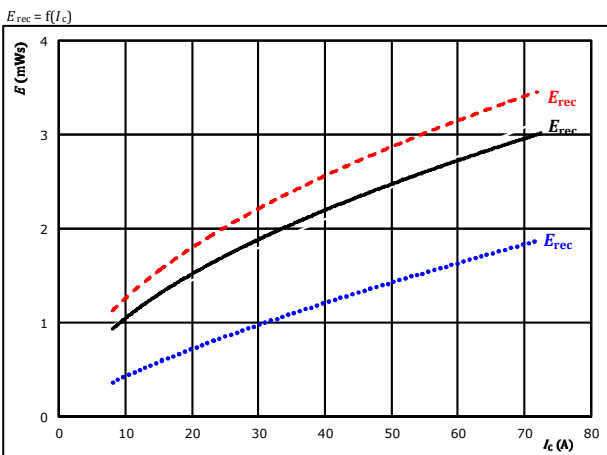
With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{g\text{on}} = 8$ Ω
 $R_{g\text{off}} = 8$ Ω
 T_j : 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

Figure 2. IGBT
Typical switching energy losses as a function of gate resistor



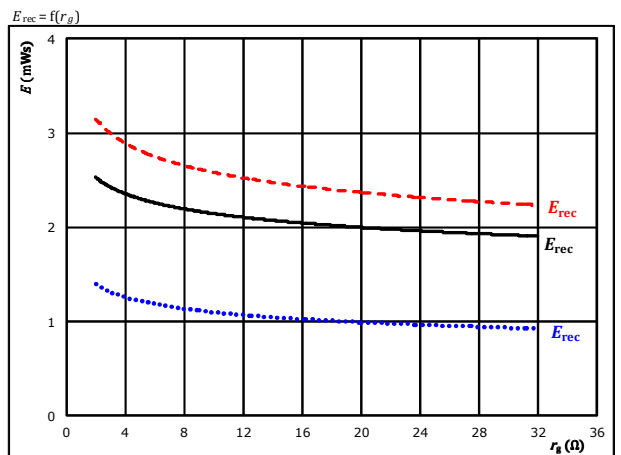
With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 40$ A
 T_j : 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

Figure 3. FWD
Typical reverse recovered energy loss as a function of collector current



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{g\text{on}} = 8$ Ω
 T_j : 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

Figure 4. FWD
Typical reverse recovered energy loss as a function of gate resistor



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 40$ A
 T_j : 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

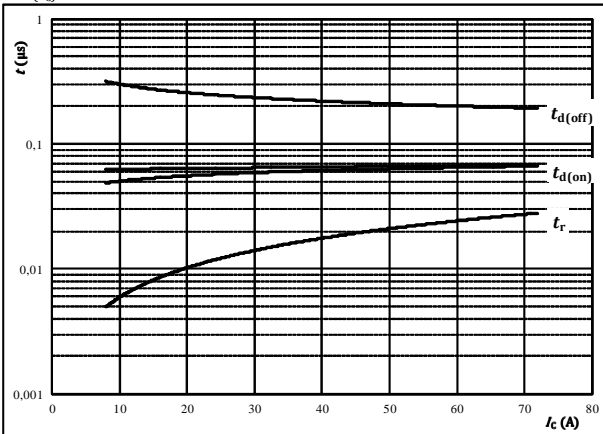


H-Bridge Switching Characteristics

Figure 5. IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



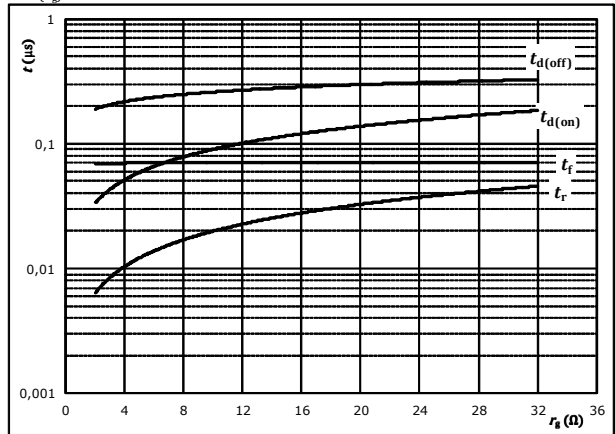
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{g(on)} =$	8	Ω
$R_{g(off)} =$	8	Ω

Figure 6. IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



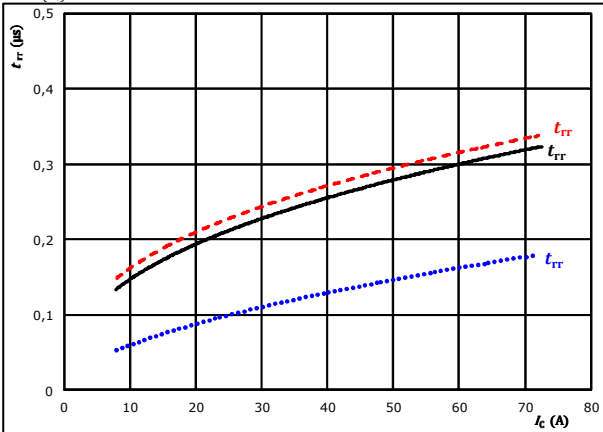
With an inductive load at

$T_j =$	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

$$t_{rr} = f(I_C)$$

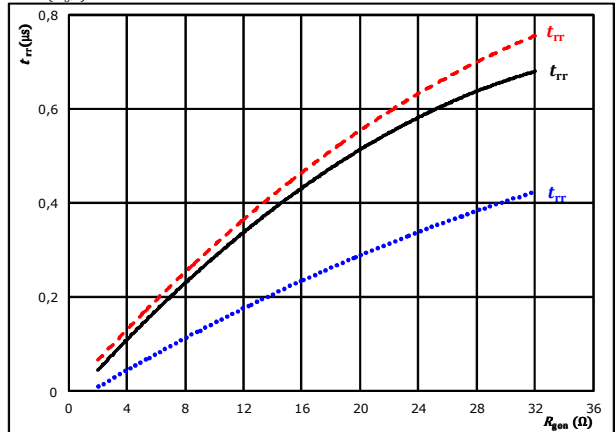


At	$V_{CE} =$	600	V	$T_j:$	25 °C
	$V_{GE} =$	±15	V		125 °C	————
	$R_{g(on)} =$	8	Ω		150 °C	-----

Figure 8. FWD

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

$$t_{rr} = f(R_{g(on)})$$

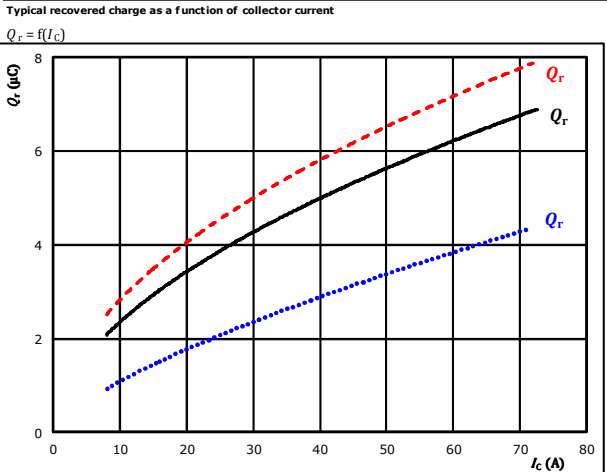


At	$V_{CE} =$	600	V	$T_j:$	25 °C
	$V_{GE} =$	±15	V		125 °C	————
	$I_C =$	40	A		150 °C	-----



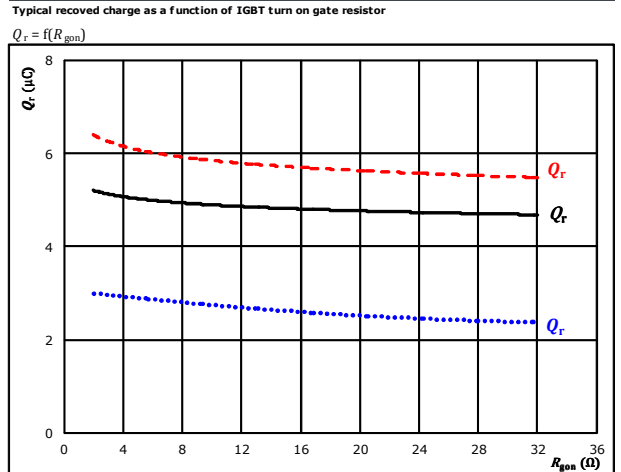
H-Bridge Switching Characteristics

Figure 9. FWD
Typical recovered charge as a function of collector current



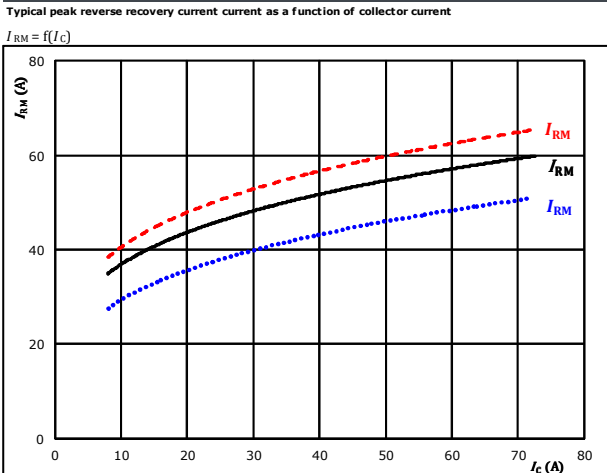
At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gdn} = 8$ Ω
 T_j : 25 °C (dotted blue)
125 °C (solid black)
150 °C (dashed red)

Figure 10. FWD
Typical recovered charge as a function of IGBT turn on gate resistor



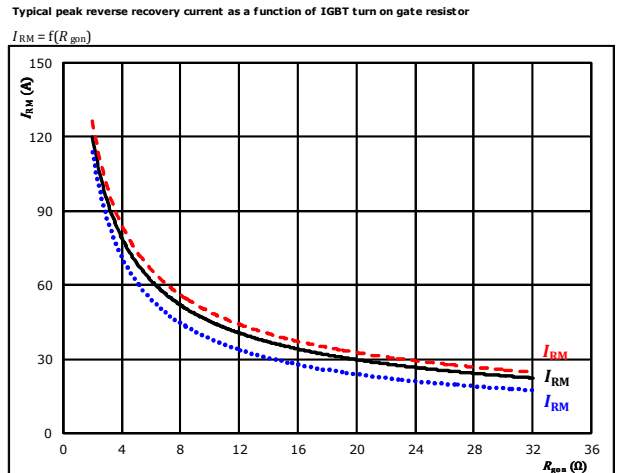
At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 40$ A
 T_j : 25 °C (dotted blue)
125 °C (solid black)
150 °C (dashed red)

Figure 11. FWD
Typical peak reverse recovery current current as a function of collector current



At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gdn} = 8$ Ω
 T_j : 25 °C (dotted blue)
125 °C (solid black)
150 °C (dashed red)

Figure 12. FWD
Typical peak reverse recovery current as a function of IGBT turn on gate resistor



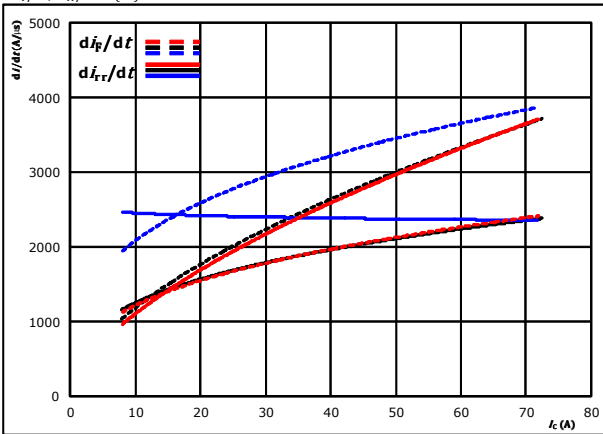
At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 40$ A
 T_j : 25 °C (dotted blue)
125 °C (solid black)
150 °C (dashed red)



H-Bridge Switching Characteristics

Figure 13. FWD

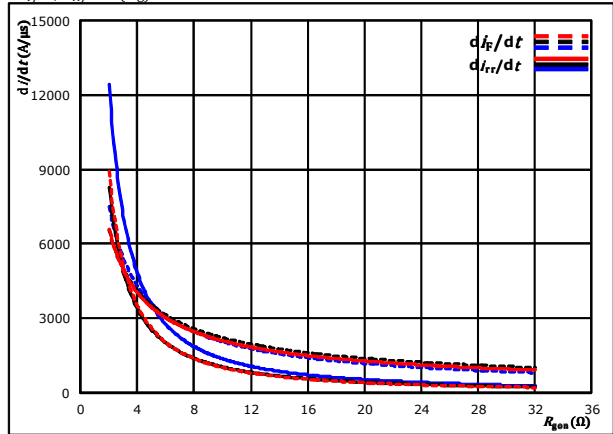
Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_{rr}/dt = f(I_c)$



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

Figure 14. FWD

Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
 $di_f/dt, di_{rr}/dt = f(R_g)$

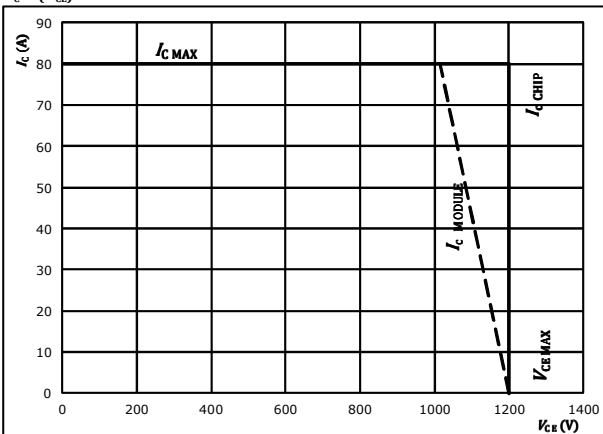


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 40$ A
 $T_j: 25$ °C
 125 °C
 150 °C

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

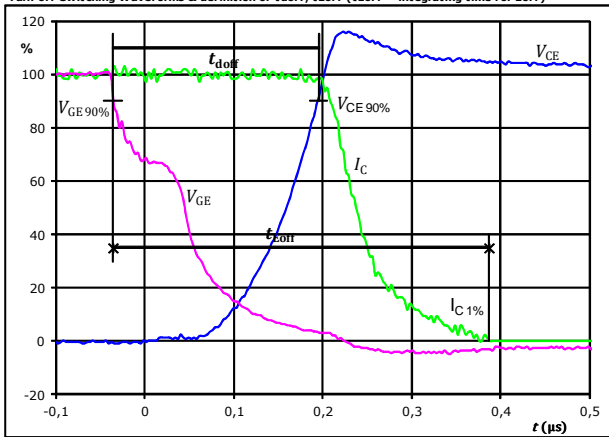


H-Bridge Switching Characteristics

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

Figure 1. IGBT

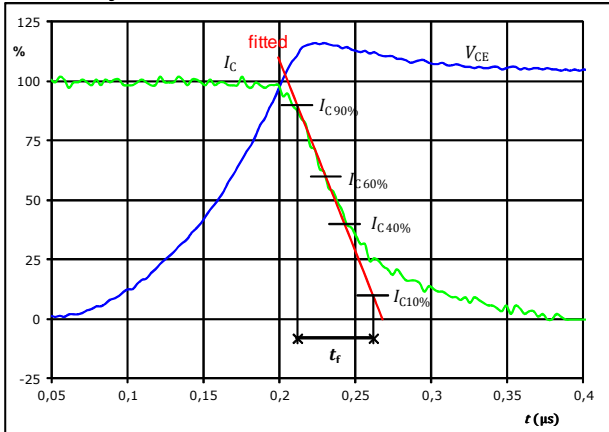
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff} (t_{Eoff} = integrating time for E_{off})



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

Figure 3. IGBT

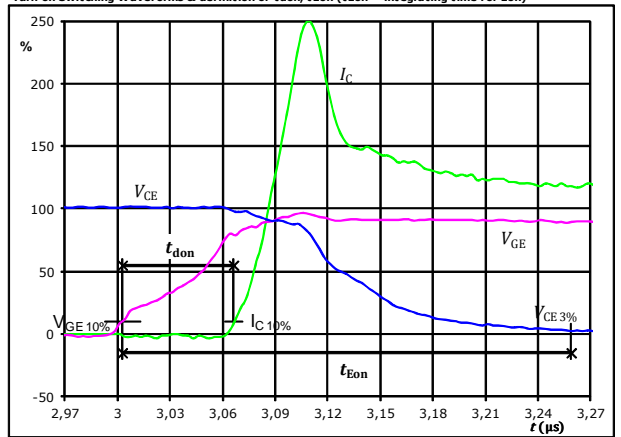
Turn-off Switching Waveforms & definition of t_f



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

Figure 2. IGBT

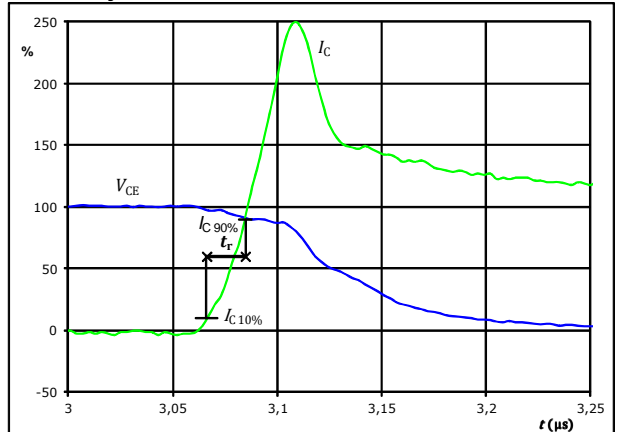
Turn-on Switching Waveforms & definition of t_{don} , t_{Eon} (t_{Eon} = integrating time for E_{on})



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

Figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

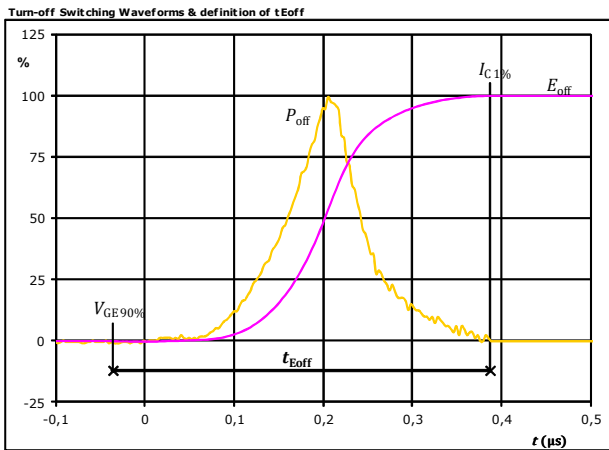


$V_C(100\%)$	=	600	V
$I_C(100\%)$	=	40	A
t_r	=	0,018	μs



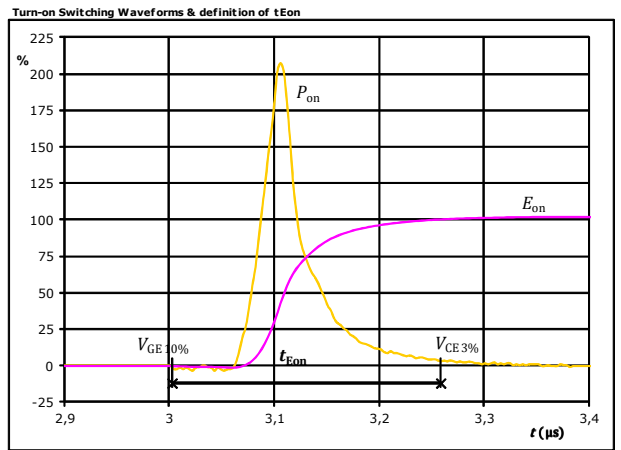
H-Bridge Switching Characteristics

Figure 5. IGBT



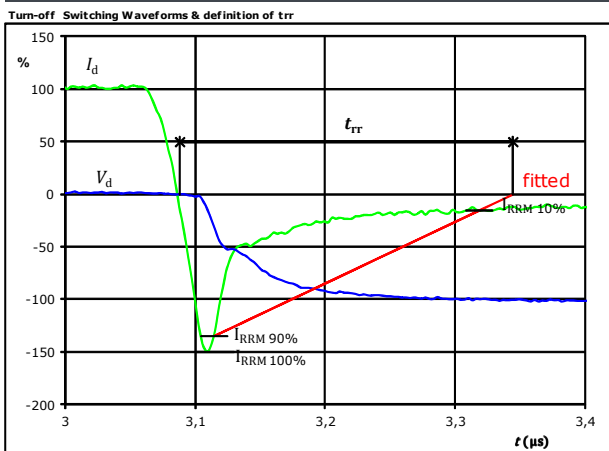
$P_{off}(100\%) = 24,01$ kW
 $E_{off}(100\%) = 2,53$ mJ
 $t_{Eoff} = 0,42$ μs

Figure 6. IGBT



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

Figure 7. FWD

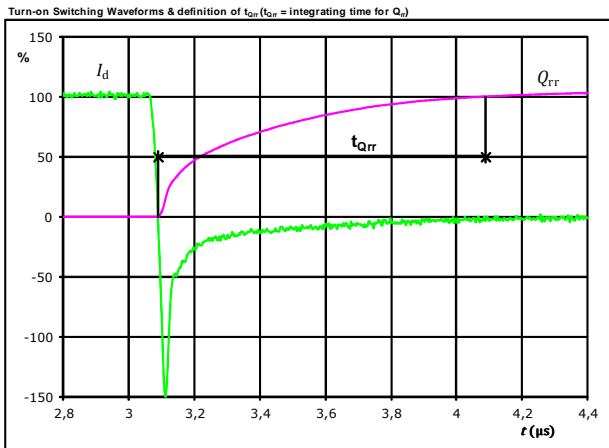


$V_d(100\%) = 600$ V
 $I_d(100\%) = 40$ A
 $I_{RRM}(100\%) = -60$ A
 $t_{rr} = 0,251$ μs



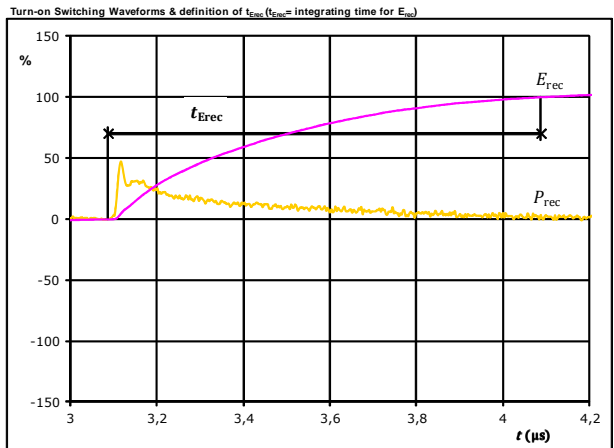
H-Bridge Switching Characteristics

Figure 8. FWD



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

Figure 9. FWD



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



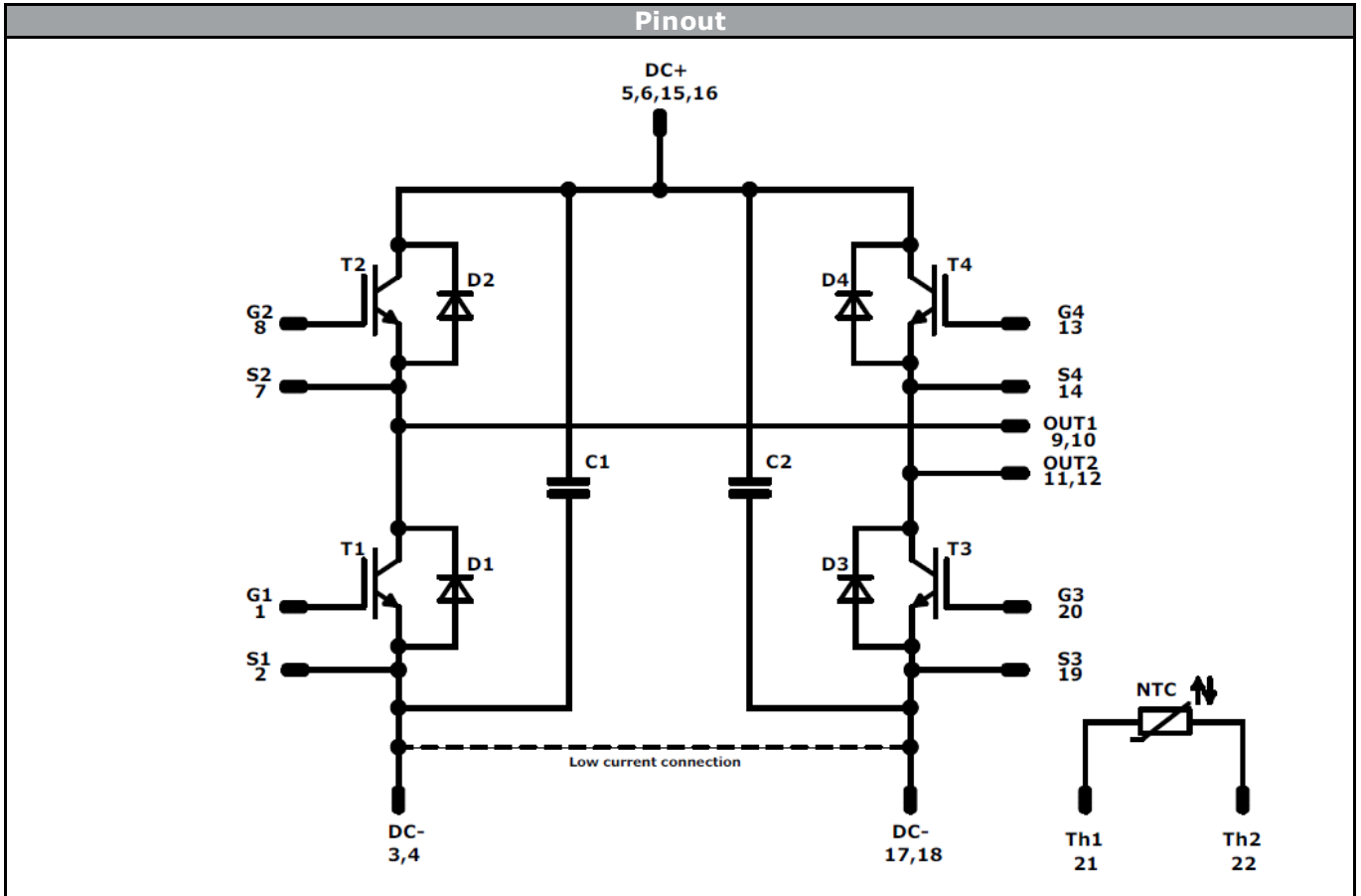
Ordering Code & Marking							
Version				Ordering Code			
without thermal paste PCM 12mm housing with solder pins				V23990-P729-F48-PM			
with thermal paste PCM 12mm housing with solder pins				V23990-P729-F48-/3/-PM			
without thermal paste PCM 17mm housing with solder pins				V23990-P729-F49-PM			
	Text	VIN	Date code	Name&Ver	UL	Lot	Serial
		VIN	WWYY	NNNNNNVV	UL	LLLL	SSSS
	Datamatrix	Name&Ver	Lot number	Serial	Date code		
NNNNNNVV		LLLL	SSSS	WWYY			

Pin table [mm]				Outline	
Pin	X	Y	Function		
1	0	22,5	G1	12mm housing	
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	17mm housing	
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		

Tolerance of pinpositions: $\pm 0,5\text{mm}$ at the end of pins
 Dimension of coordinate axis is only offset without tolerance



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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 <i>flow 0</i> packages see vincotech.com website.

Package data
Package data for <i>flow 0</i> 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

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As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.