flowPACK 1H 600V/50A

Features

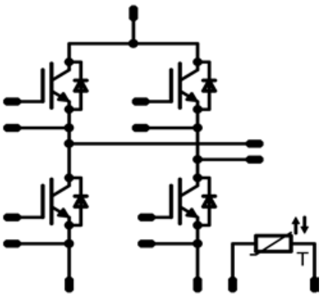
- Low inductive 12mm flow1 package
- H-Bridge topology
- High-speed IGBT + ultrafast FWD
- Temperature sensor

flow 1

Target Applications

- Solar inverter
- Power Supply
- Inverter based welding

Schematic



Types

- 10-FY064PA050SG10-M582F08

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
H-Bridge IGBT					
Collector-emitter break down voltage	V_{CE}			650	V
DC collector current *	I_{DC}	$T_j=T_j$max	T_h=80°C T_c=80°C	46 61	A
Pulsed collector current	I_{Cpulse}	t_p limited by $T_j$max		150	A
Turn off safe operating area		VCE ≤ 650V, Tj ≤ Top max		150	A
Power dissipation per IGBT *	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	95 144	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150°C V_{GE}=15V		5 400	µs V
Maximum Junction Temperature	$T_j$max			175	°C

* measured with phase-change material

Parameter	Symbol	Condition		Value	Unit
H-Bridge FWD					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
DC forward current *	I_F	$T_j=T_j$max	T_h=80°C T_c=80°C	30 39	A
Non-repetitive Peak Surge Current	I_{FSM}	60Hz Single Half-Sine Wave		300	A
Power dissipation per Diode *	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	50 76	W
Maximum Junction Temperature	$T_j$max			150	°C

* measured with phase-change material

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
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	Min	Typ	Max	Unit
H-Bridge IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0008	Tj=25°C Tj=125°C	4,2	5,1	5,8	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		50	Tj=25°C Tj=125°C	1,38	1,79 1,99	2,22	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	650		Tj=25°C Tj=125°C			0,0028	uA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=125°C			150	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=8 Ω Rgon=8 Ω	±15	300	50	Tj=25°C Tj=125°C		93 96		ns
Rise time	t_r					Tj=25°C Tj=125°C		19 21		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=125°C		133 148		
Fall time	t_f					Tj=25°C Tj=125°C		6 24		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		0,54 0,79		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		0,32 0,57		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		3000		pF
Reverse transfer capacitance	C_{rss}							11		
Gate charge	Q_{Gate}		15	520	50	Tj=25°C		120		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						1,00		K/W
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,17		K/W
H-Bridge FWD										
Diode forward voltage	V_F				30	Tj=25°C Tj=125°C		2,52 1,84	2,6	V
Peak reverse recovery current	I_{RRM}	Rgon=8 Ω	±15	300	50	Tj=25°C Tj=125°C		32 49		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		16 50		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=125°C		0,29 1,10		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=125°C		9152 5573		A/µs
Reverse recovered energy	Erec					Tj=25°C Tj=125°C		0,02 0,13		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						1,39		K/W
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,64		K/W
Thermistor										
Rated resistance	R					Tj=25°C		22000		Ω
Deviation of R25	ΔR/R	R100=1486Ω				Tj=100°C	-5		+5	%
Power dissipation	P					Tj=25°C		200		mW
Power dissipation constant						Tj=25°C		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				Tj=25°C		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				Tj=25°C		3996		K
Vincotech NTC Reference									B	

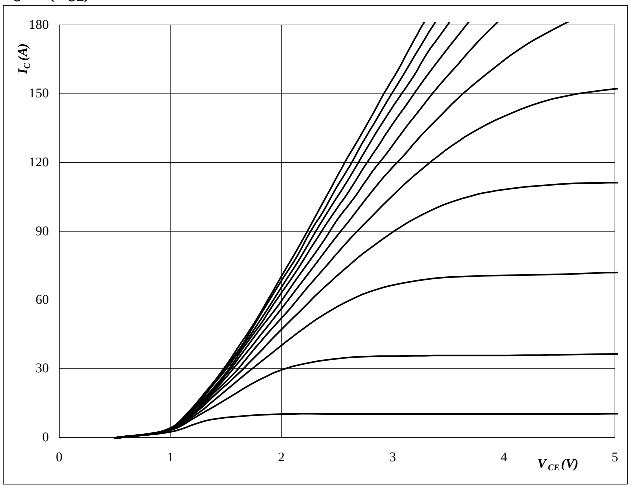
copyright by Vincotech

H-Bridge

Figure 1 H-Bridge IGBT

Typical output characteristics

$I_C = f(V_{CE})$



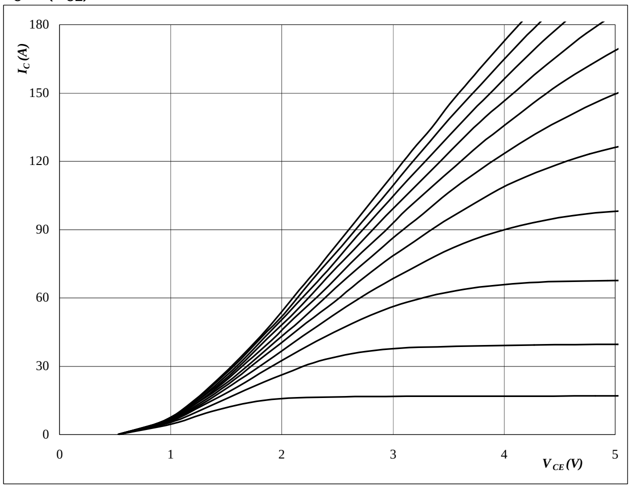
At

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

Figure 2 H-Bridge IGBT

Typical output characteristics

$I_C = f(V_{CE})$



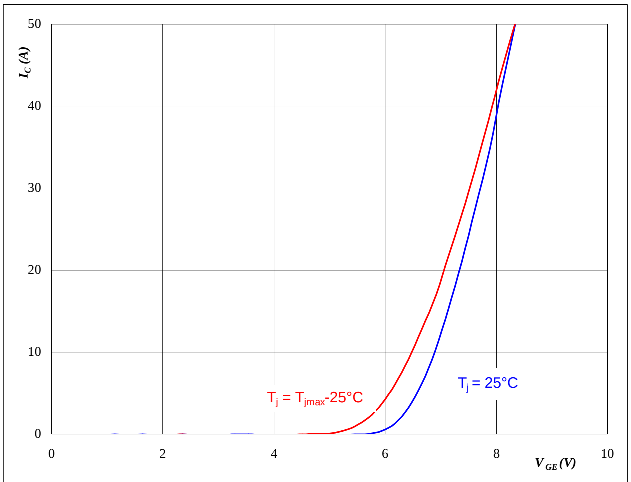
At

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

Figure 3 H-Bridge IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



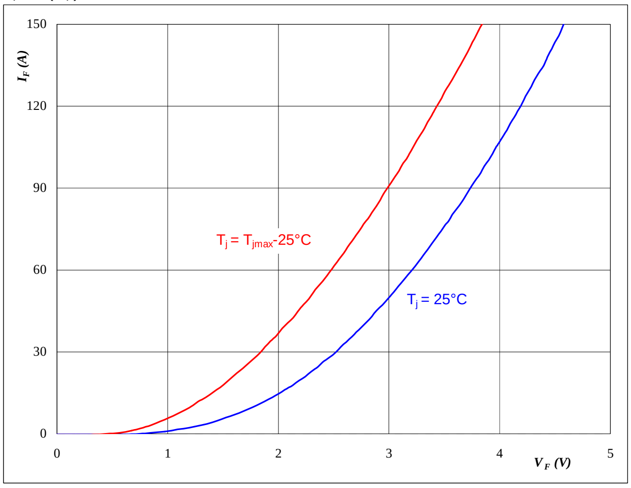
At

t_p =	250	µs
V_{CE} =	10	V

Figure 4 H-Bridge FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

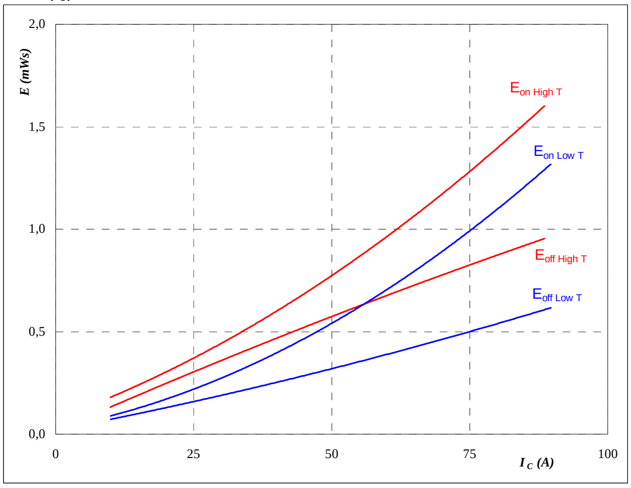
t_p =	250	µs

H-Bridge

Figure 5 H-Bridge IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



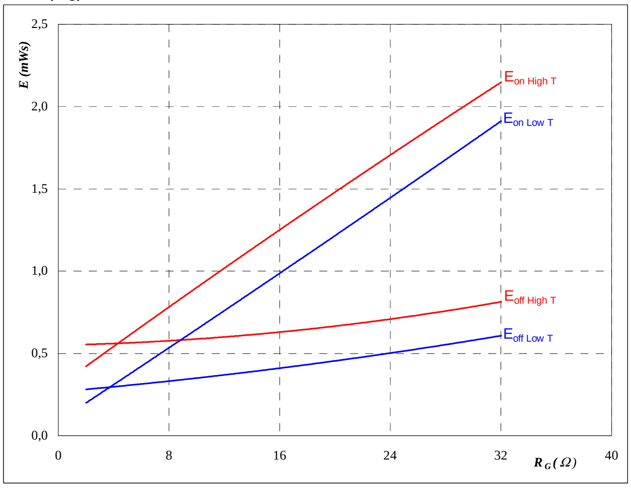
With an inductive load at

T_j =	25/126	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 6 H-Bridge IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



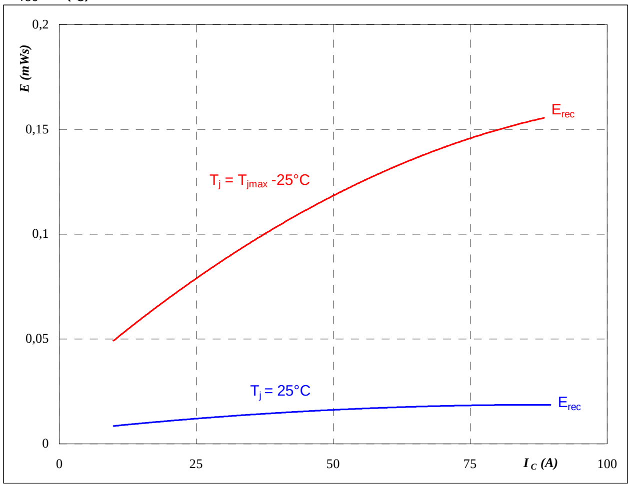
With an inductive load at

T_j =	25/126	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	50	A

Figure 7 H-Bridge FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



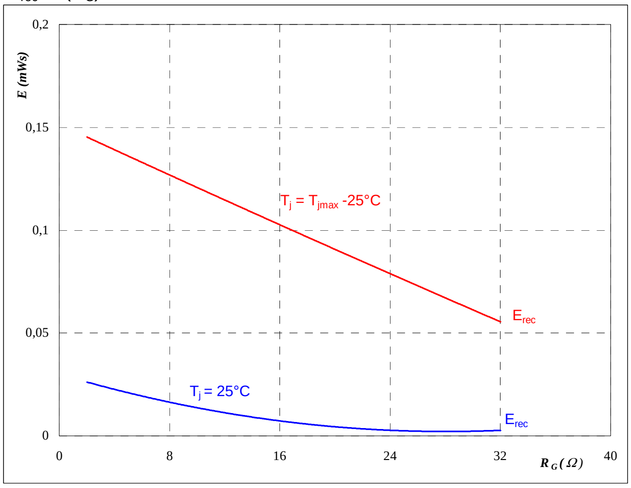
With an inductive load at

T_j =	25/126	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 8 H-Bridge FWD

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

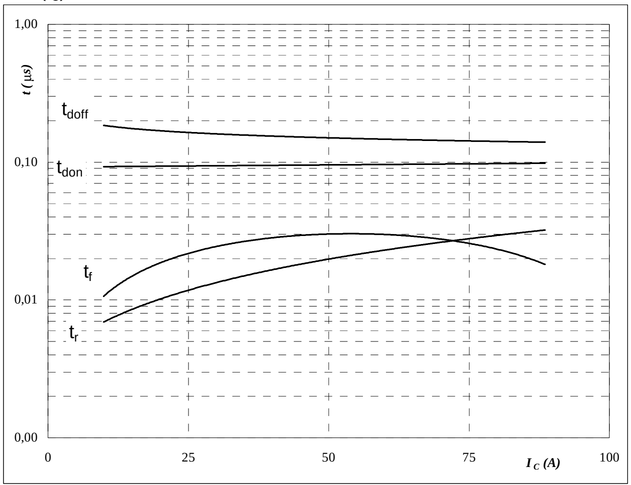
T_j =	25/126	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	50	A

H-Bridge

Figure 9 H-Bridge IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



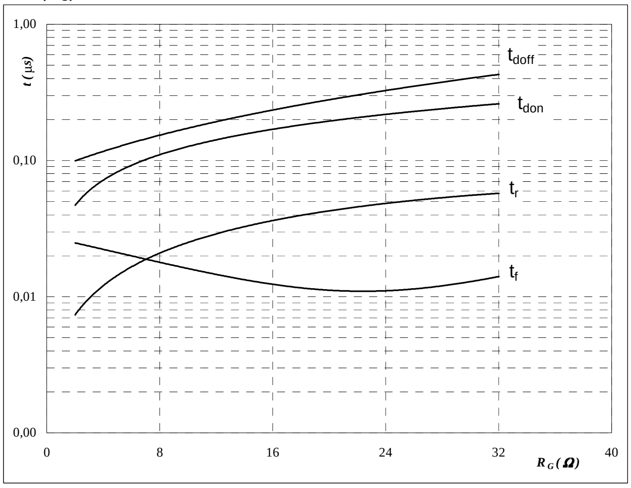
With an inductive load at

T_j =	126	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 10 H-Bridge IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



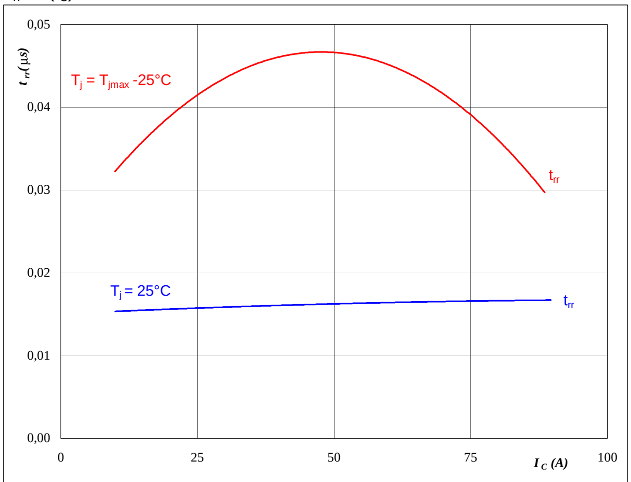
With an inductive load at

T_j =	126	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	50	A

Figure 11 H-Bridge FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



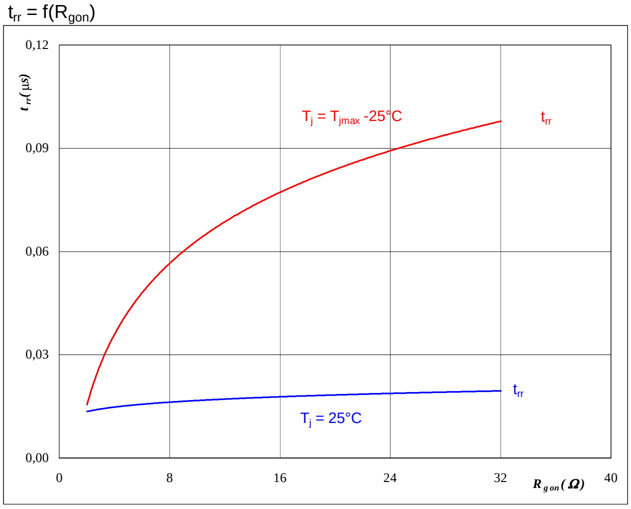
At

T_j =	25/126	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 12 H-Bridge FWD

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

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



At

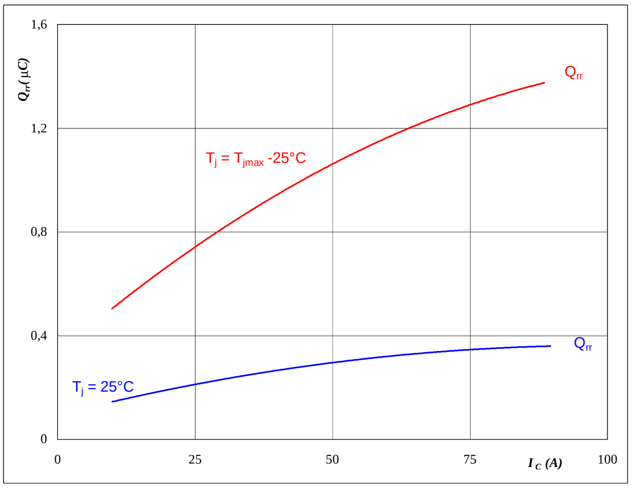
T_j =	25/126	°C
V_R =	300	V
I_F =	50	A
V_{GE} =	±15	V

H-Bridge

Figure 13 H-Bridge FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



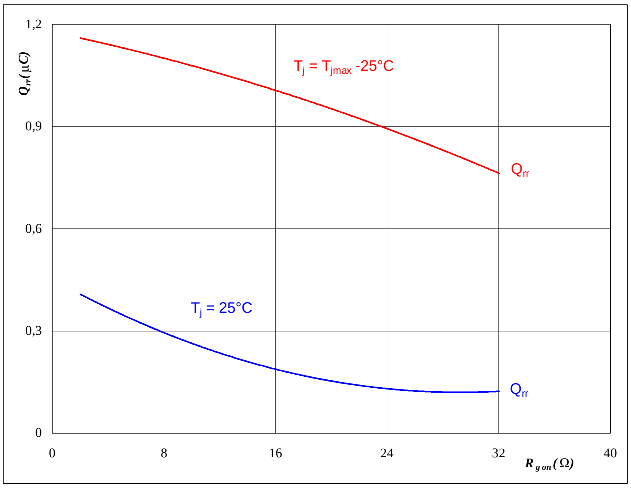
At

T_j =	25/126	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 14 H-Bridge FWD

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

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



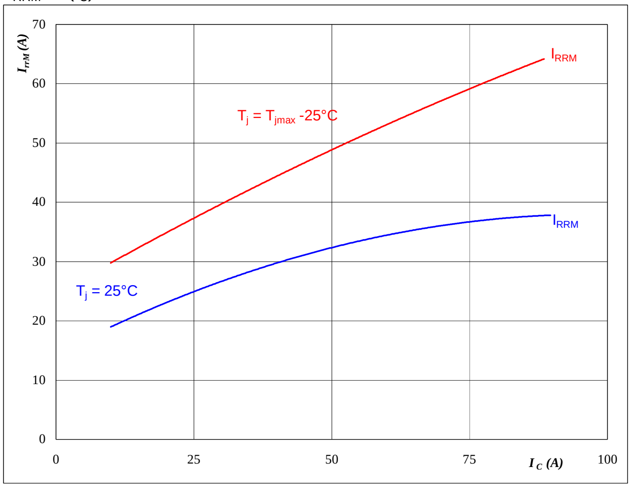
At

T_j =	25/126	°C
V_R =	300	V
I_F =	50	A
V_{GE} =	±15	V

Figure 15 H-Bridge FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



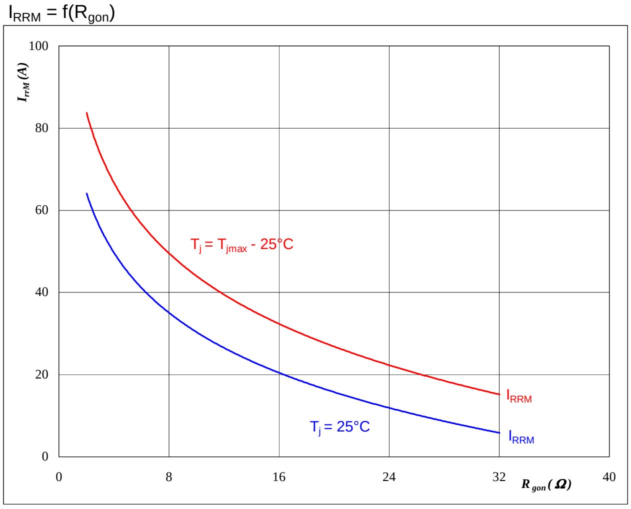
At

T_j =	25/126	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 16 H-Bridge FWD

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

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



At

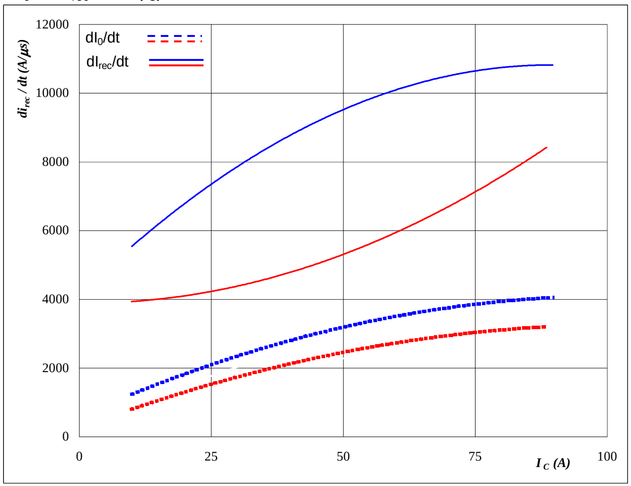
T_j =	25/126	°C
V_R =	300	V
I_F =	50	A
V_{GE} =	±15	V

H-Bridge

Figure 17	H-Bridge FWD

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

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



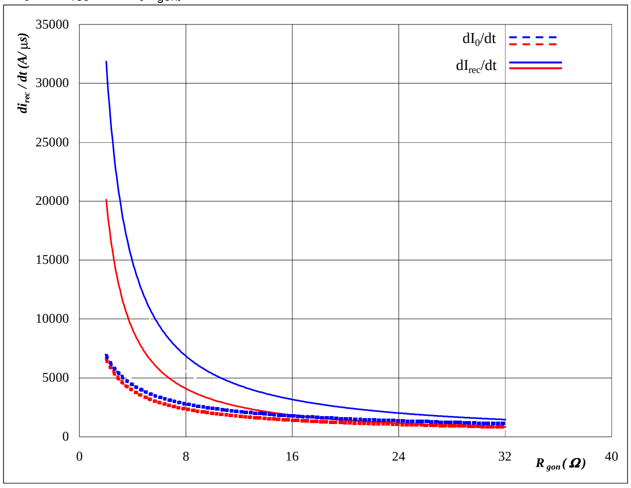
At

T_j =	25/126	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 18	H-Bridge FWD

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

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



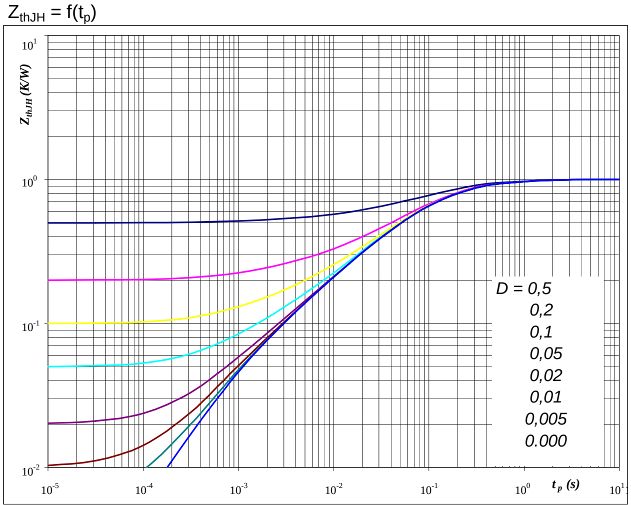
At

T_j =	25/126	°C
V_R =	300	V
I_F =	50	A
V_{GE} =	±15	V

Figure 19	H-Bridge IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T				
R_{thJH} =	1,00	K/W	R_{thJH} =	1,17	K/W

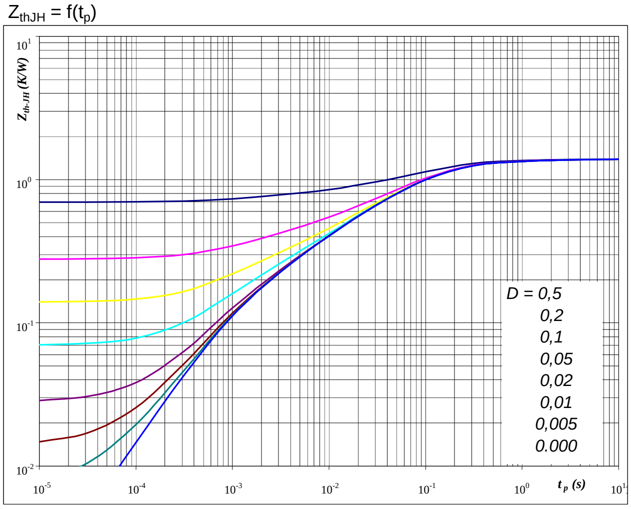
IGBT thermal model values

Phase change interface		Thermal grease	
R (C/W)	Tau (s)	R (C/W)	Tau (s)
0,12	7,7E-01	0,15	7,7E-01
0,46	1,3E-01	0,54	1,3E-01
0,25	4,3E-02	0,29	4,3E-02
0,12	9,4E-03	0,14	9,4E-03
0,04	1,2E-03	0,05	1,2E-03

Figure 20	H-Bridge FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T				
R_{thJH} =	1,39	K/W	R_{thJH} =	1,64	K/W

FWD thermal model values

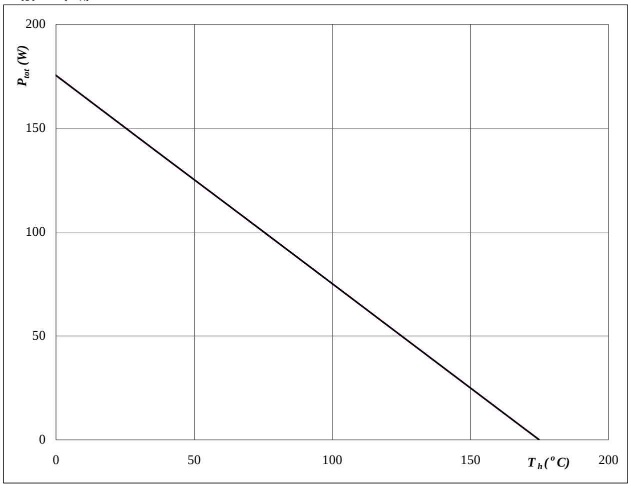
Phase change interface		Thermal grease	
R (C/W)	Tau (s)	R (C/W)	Tau (s)
0,04	4,0E+00	0,04	4,0E+00
0,09	8,3E-01	0,10	8,3E-01
0,56	1,3E-01	0,65	1,3E-01
0,40	3,6E-02	0,47	3,6E-02
0,20	7,3E-03	0,24	7,3E-03
0,12	1,1E-03	0,14	1,1E-03

H-Bridge

Figure 21 H-Bridge IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



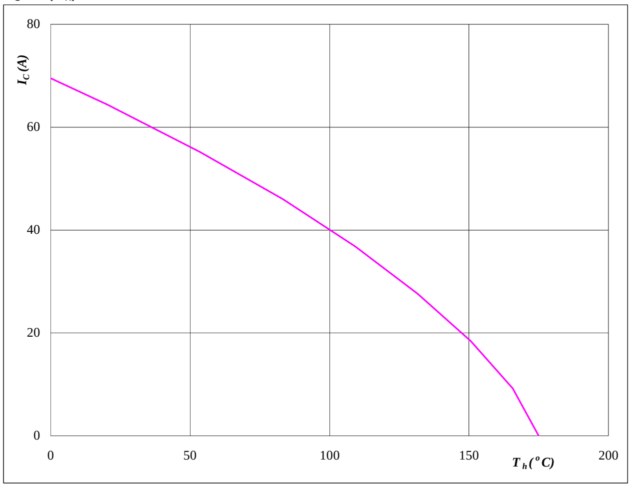
At

T_j = 175 °C

Figure 22 H-Bridge IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

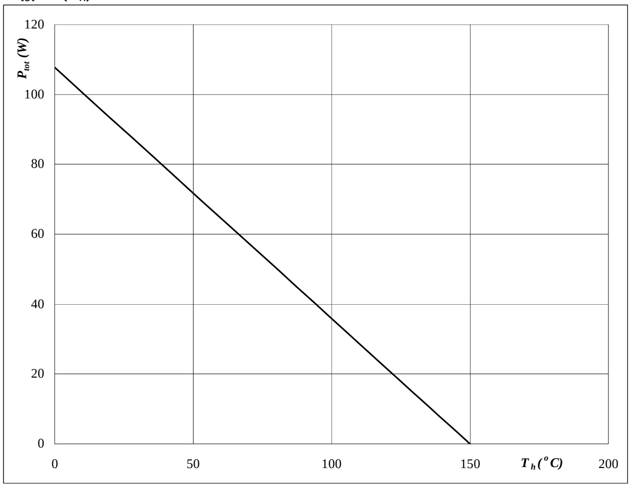
T_j = 175 °C

V_{GE} = 15 V

Figure 23 H-Bridge FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



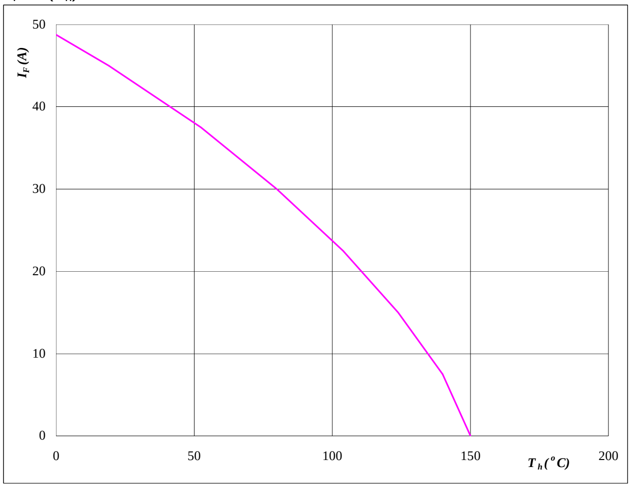
At

T_j = 150 °C

Figure 24 H-Bridge FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

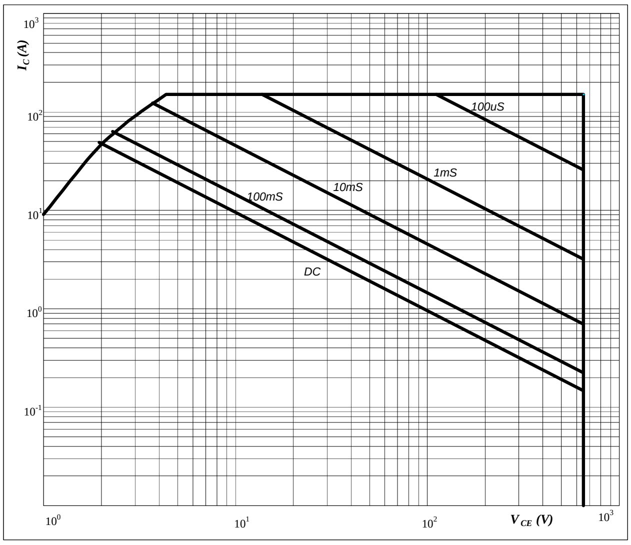
T_j = 150 °C

H-Bridge

Figure 25 H-Bridge IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



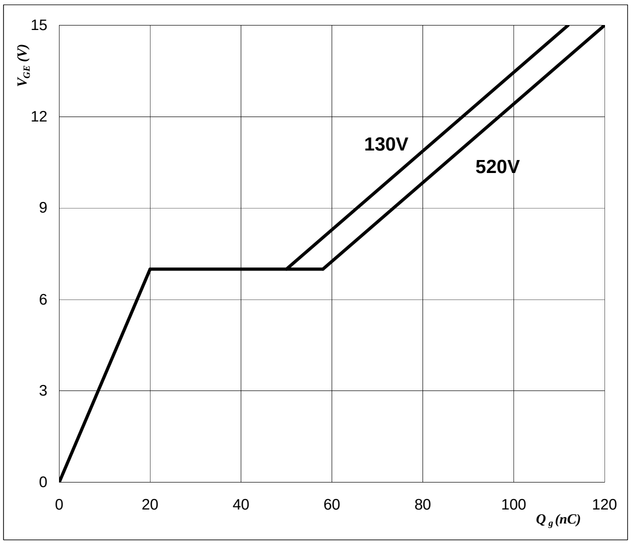
At

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

Figure 26 H-Bridge IGBT

Gate voltage vs Gate charge

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



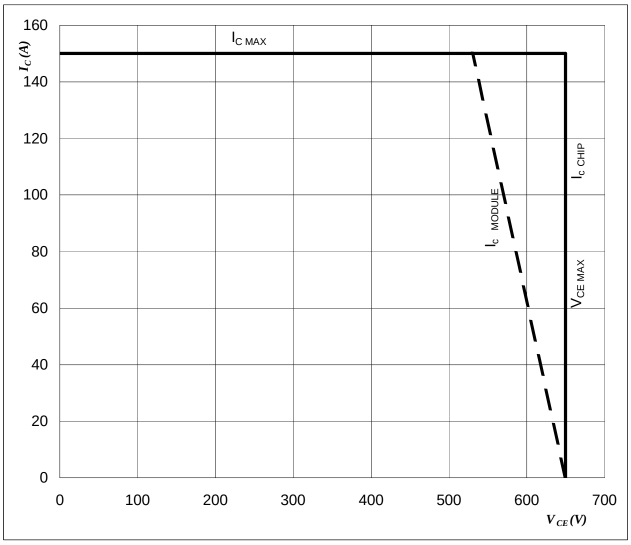
At

I_C =	50	A

Figure 29 H-Bridge IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	T_{jmax}-25	ºC

Switching mode : 3phase SPWM

Thermistor

Figure 1	Thermistor

Typical NTC characteristic
as a function of temperature
$R_T = f(T)$

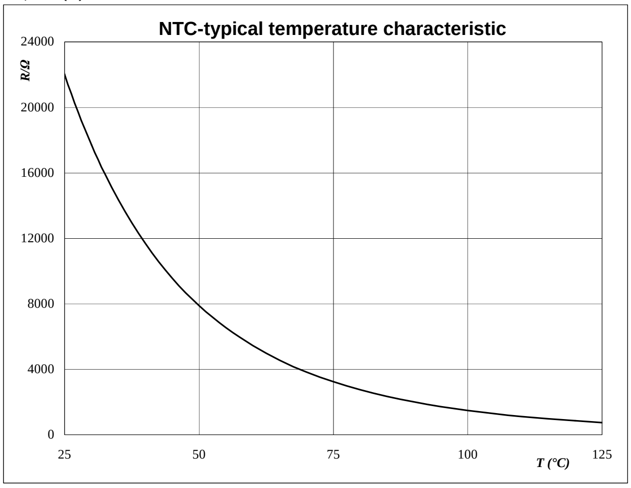


Figure 2	Thermistor

Typical NTC resistance values

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

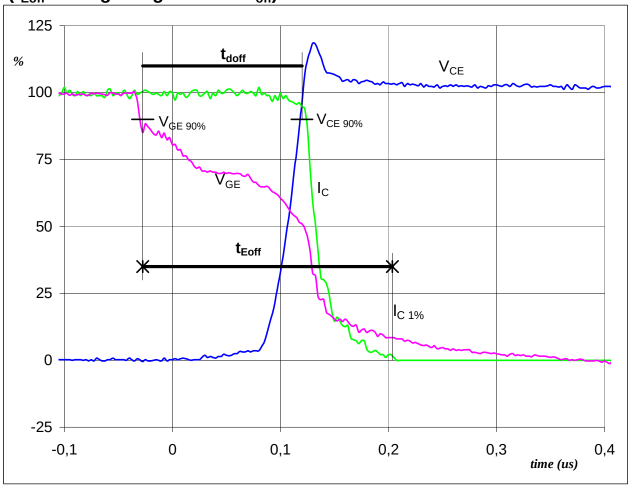
Switching Definitions H-Bridge

General conditions

T_j	=	125 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

Figure 1 H-Bridge IGBT

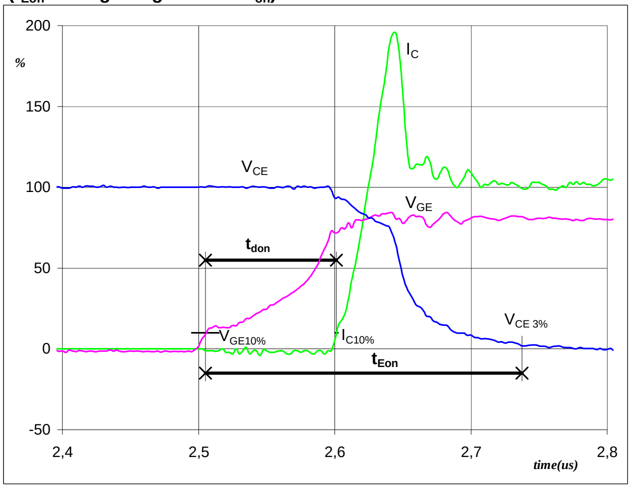
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	50	A
t_{doff} =	0,15	μs
t_{Eoff} =	0,23	μs

Figure 2 H-Bridge IGBT

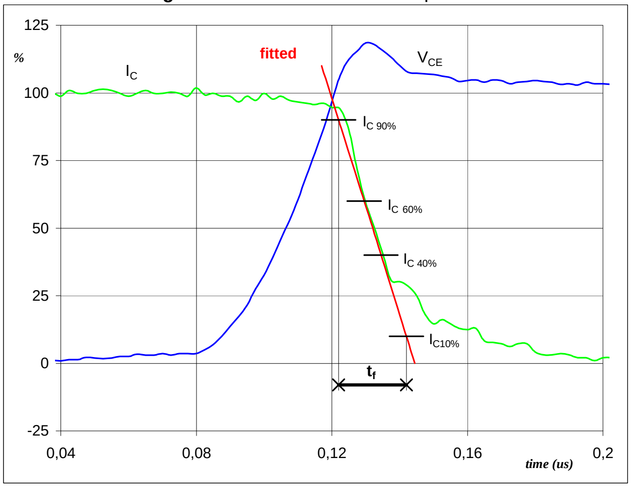
Turn-on Switching Waveforms & definition of tdon, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	50	A
t_{don} =	0,10	μs
t_{Eon} =	0,23	μs

Figure 3 H-Bridge IGBT

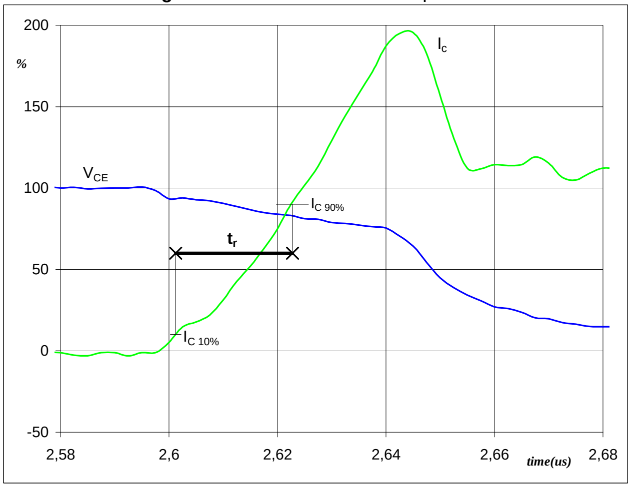
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	300	V
I_C (100%) =	50	A
t_f =	0,024	μs

Figure 4 H-Bridge IGBT

Turn-on Switching Waveforms & definition of t_r

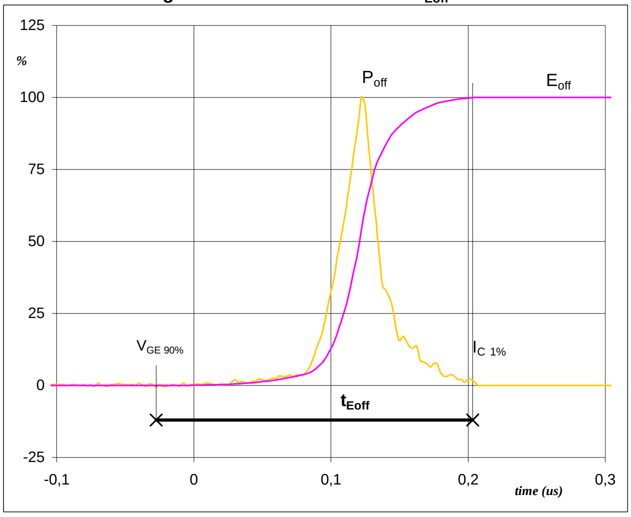


V_C (100%) =	300	V
I_C (100%) =	50	A
t_r =	0,021	μs

Switching Definitions H-Bridge

Figure 5 H-Bridge IGBT

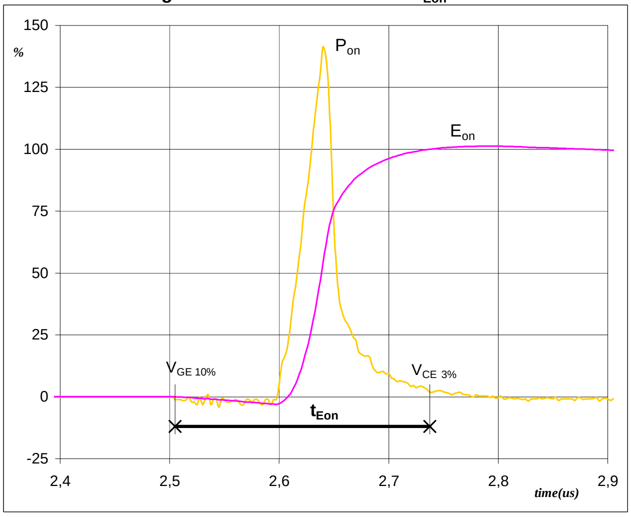
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	15,12	kW
E_{off} (100%) =	0,57	mJ
t_{Eoff} =	0,23	μs

Figure 6 H-Bridge IGBT

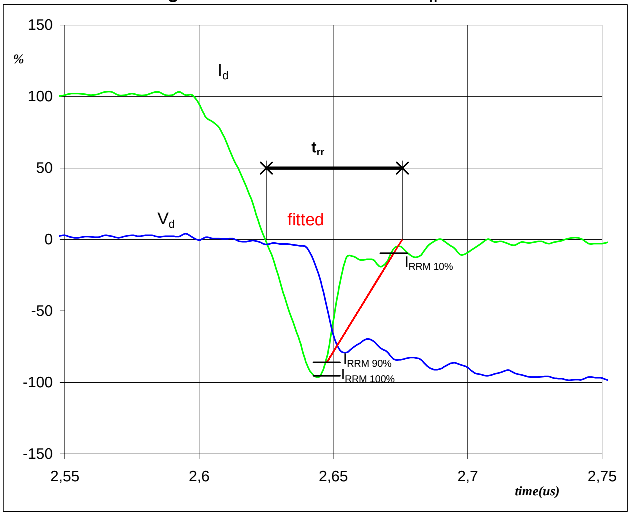
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	15,12	kW
E_{on} (100%) =	0,79	mJ
t_{Eon} =	0,23	μs

Figure 7 H-Bridge IGBT

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

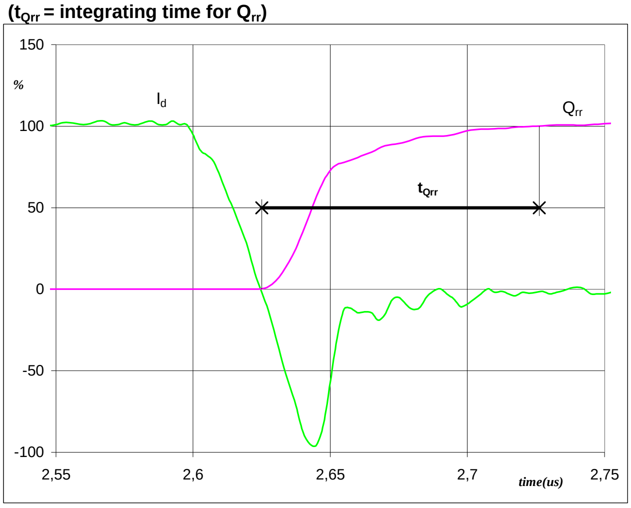


V_d (100%) =	300	V
I_d (100%) =	50	A
I_{RRM} (100%) =	-49	A
t_{rr} =	0,05	μs

Switching Definitions H-Bridge

Figure 8 H-Bridge FWD

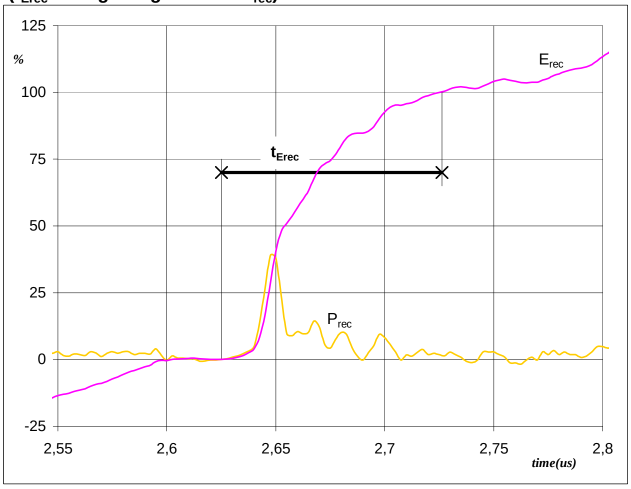
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	50	A
Q_{rr} (100%) =	1,10	µC
t_{Qrr} =	0,10	µs

Figure 9 H-Bridge FWD

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



P_{rec} (100%) =	15,12	kW
E_{rec} (100%) =	0,13	mJ
t_{Erec} =	0,10	µs

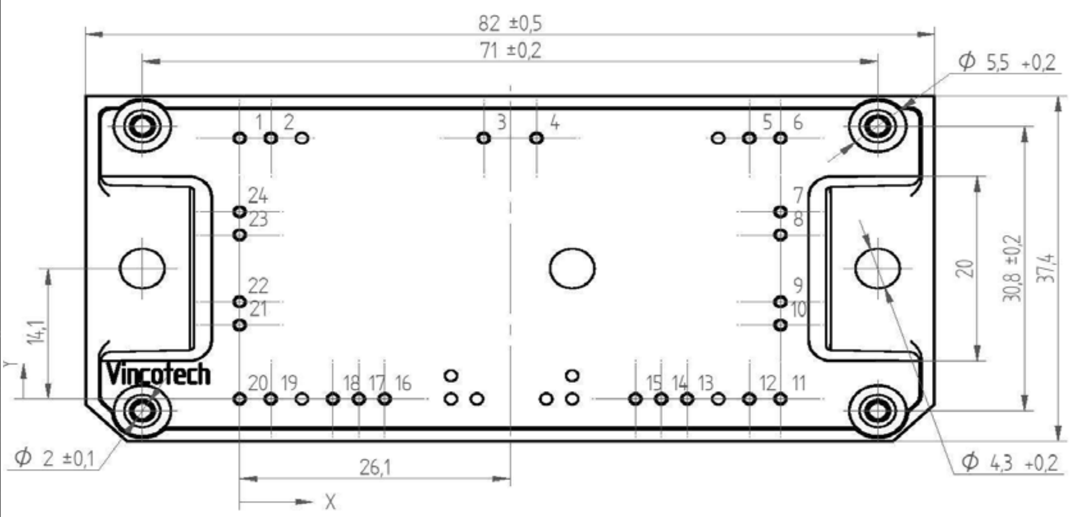
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

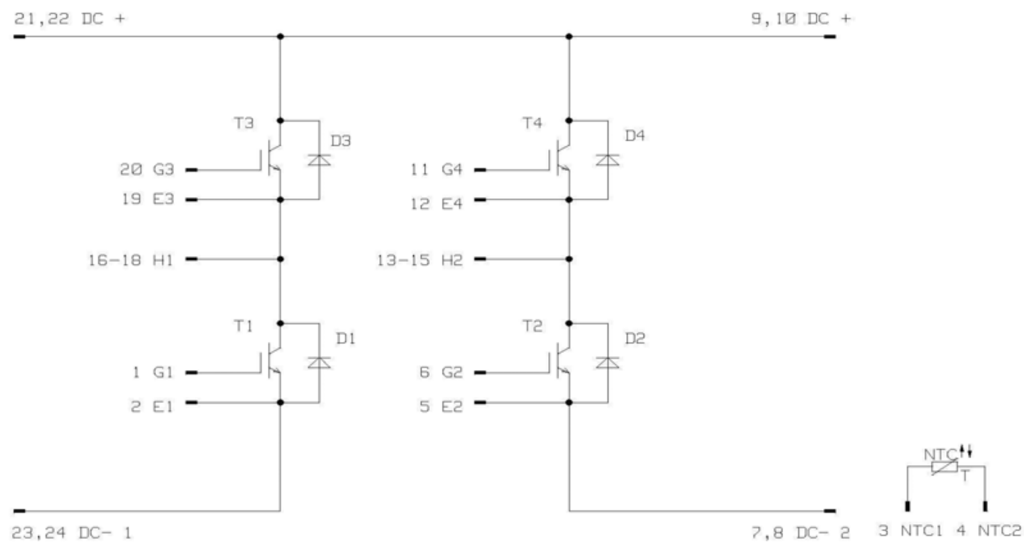
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	10-FY064PA050SG10-M582F08	M582F08	M582F08

Outline

Pin table		
Pin	X	Y
1	0	28,2
2	3	28,2
3	23,55	28,2
4	28,65	28,2
5	49,2	28,2
6	52,2	28,2
7	52,2	20,25
8	52,2	17,75
9	52,2	10,5
10	52,2	8
11	52,2	0
12	49,2	0
13	43,2	0
14	40,7	0
15	38,2	0
16	14	0
17	11,5	0
18	9	0
19	3	0
20	0	0
21	0	8
22	0	10,5
23	0	17,75
24	0	20,25



Pinout



copyright by Vincotech

DISCLAIMER

The information given in this datasheet describes the type of component and does not represent assured characteristics. For tested values please contact Vincotech.Vincotech reserves the right to make changes without further notice to any products herein to improve reliability, function or design. Vincotech does not assume any liability arising out of the application or use of any product or circuit described herein; neither does it convey any license under its patent rights, nor the rights of others.

LIFE SUPPORT POLICY

Vincotech products are not authorised for use as critical components in life support devices or systems without the express written approval of Vincotech.

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.