



Vincotech

V23990-P623-F59-PM

datasheet

fastPACK 0 H

650 V / 50 A

Features

- High efficient H-bridge
- High-speed IGBT
- High-switching frequency
- Low inductive design

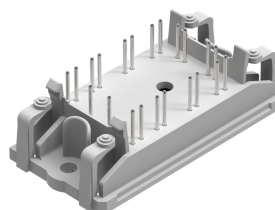
Target applications

- SMPS
- Welding
- UPS
- Solar

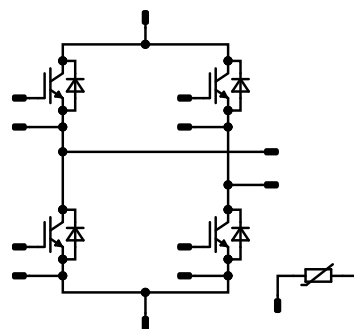
Types

- V23990-P623-F59-PM

flow 0 17 mm housing



Schematic



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Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
H-Bridge Switch				
Collector-emitter voltage	V_{CES}		650	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	43	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	150	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	84	W
Gate-emitter voltage	V_{GES}		± 20	V
Maximum junction temperature	T_{jmax}		175	°C

H-Bridge Diode

Peak repetitive reverse voltage	V_{RRM}		650	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	46	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	120	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	83	W
Maximum junction temperature	T_{jmax}		175	°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* $t_p = 2\text{ s}$	6000	V
Isolation voltage	V_{isol}	AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			>12,7	mm
Clearance			>12,7	mm
Comparative Tracking Index	CTI		≥ 200	

*100 % tested in production



Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	

H-Bridge Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0005	25	3,3	4	4,7	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		50	25 125		1,83 2,01	2,22 ⁽¹⁾	V
Collector-emitter cut-off current	I_{CES}		0	650		25			40	µA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	$f = 1 \text{ Mhz}$	0	25	25			3000		pF
Output capacitance	C_{oes}							50		pF
Reverse transfer capacitance	C_{res}							11		pF
Gate charge	Q_g		15	520	50	25		120		nC

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						1,13		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 8 \Omega$ $R_{goff} = 8 \Omega$	± 15	300	50	25 125 150		61,2 62,8 62,6		ns
Rise time	t_r					25 125 150		9 10,2 11		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		66,4 77,8 80,4		ns
Fall time	t_f					25 125 150		4,53 7,71 8,6		ns
Turn-on energy (per pulse)	E_{on}	$Q_{tFWD}=0,776 \mu\text{C}$ $Q_{tFWD}=1,55 \mu\text{C}$ $Q_{tFWD}=1,82 \mu\text{C}$				25 125 150		0,454 0,569 0,606		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,171 0,302 0,334		mWs



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Characteristic Values

Parameter	Symbol	Conditions						Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]		Min	Typ	Max	

H-Bridge Diode

Static

Forward voltage	V_F				60	25 125 150		1,94 1,97 1,95	2,22 ⁽¹⁾		V
Reverse leakage current	I_R	$V_i = 650$ V				25			3,2		µA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,14			K/W
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Dynamic

Peak recovery current	I_{RRM}	$di/dt=3540$ A/µs $di/dt=4127$ A/µs $di/dt=4560$ A/µs	± 15	300	50	25 125 150		44,07 58,29 63,12			A
Reverse recovery time	t_{rr}					25 125 150		28,05 41,86 47,23			ns
Recovered charge	Q_r					25 125 150		0,776 1,55 1,82			µC
Reverse recovered energy	E_{rec}					25 125 150		0,084 0,235 0,288			mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		2585 2673 2525			A/µs



Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	

Thermistor

Static

Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	$R_{100} = 1484 \Omega$				100	-5		5	%
Power dissipation	P							5		mW
Power dissipation constant	d					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 1 \%$						3962		K
B-value	$B_{(25/100)}$	Tol. $\pm 1 \%$						4000		K
Vincotech Thermistor Reference									I	

⁽¹⁾ Value at chip level

⁽²⁾ Only valid with pre-applied Vincotech thermal interface material.



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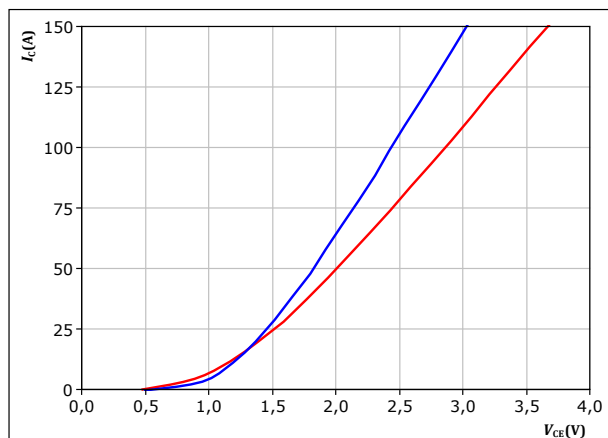
H-Bridge Switch Characteristics

figure 1.

IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$



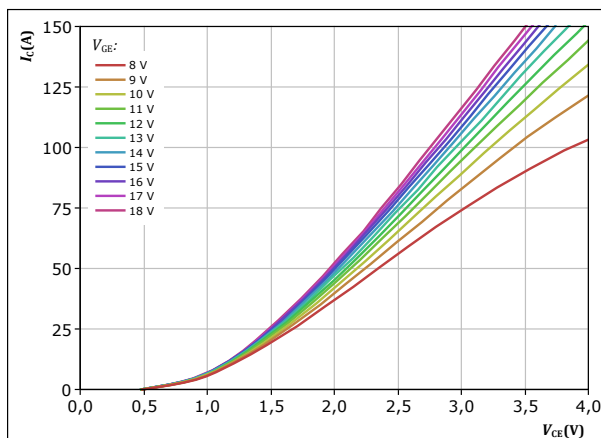
$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j: 25 ^\circ C$
 $125 ^\circ C$

figure 2.

IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$



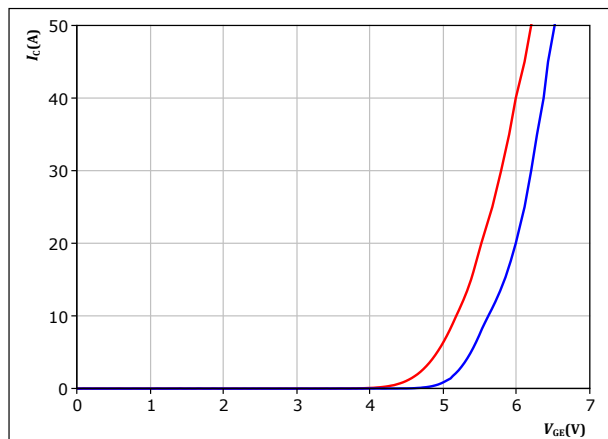
$t_p = 250 \mu s$
 $T_j = 125 ^\circ C$
 V_{GE} from 8 V to 18 V in steps of 1 V

figure 3.

IGBT

Typical transfer characteristics

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



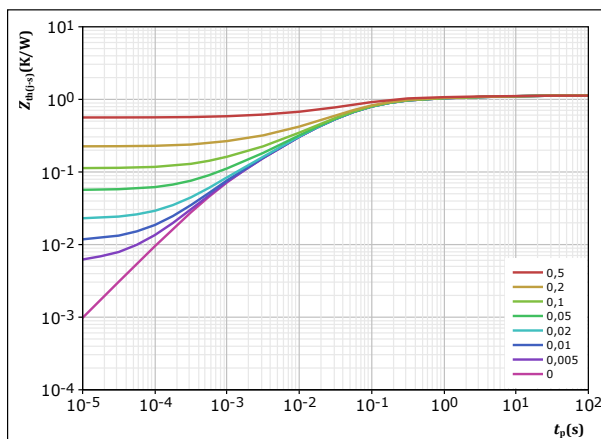
$t_p = 250 \mu s$
 $V_{CE} = 10 V$
 $T_j: 25 ^\circ C$
 $125 ^\circ C$

figure 4.

IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,126 K/W$
IGBT thermal model values

$R (K/W)$	$\tau (s)$
7,12E-02	8,15E+00
1,29E-01	6,00E-01
4,31E-01	9,13E-02
3,15E-01	2,59E-02
1,31E-01	5,80E-03
5,02E-02	8,53E-04



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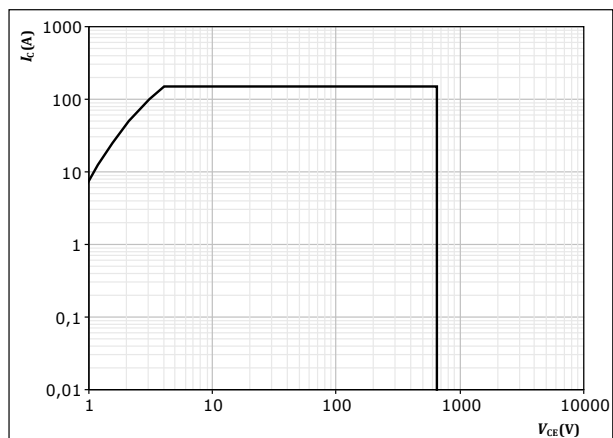
H-Bridge Switch Characteristics

figure 5.

IGBT

Safe operating area

$I_C = f(V_{CE})$



$D = \text{single pulse}$

$T_s = 80 \text{ } ^\circ\text{C}$
 $V_{GE} = 15 \text{ V}$
 $T_j = T_{jmax}$



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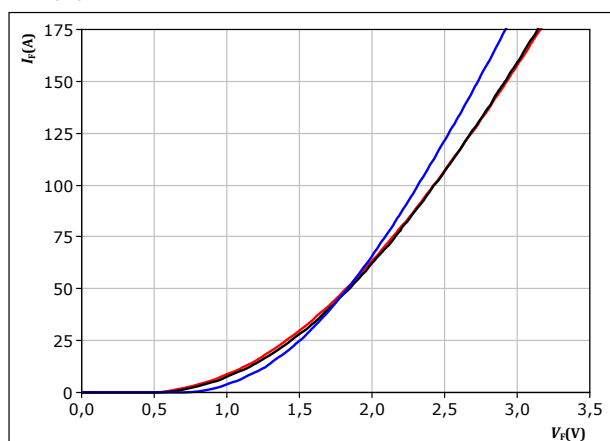
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datasheet

H-Bridge Diode Characteristics

figure 6. FWD

Typical forward characteristics

$$I_F = f(V_F)$$



$t_p = 250 \mu s$

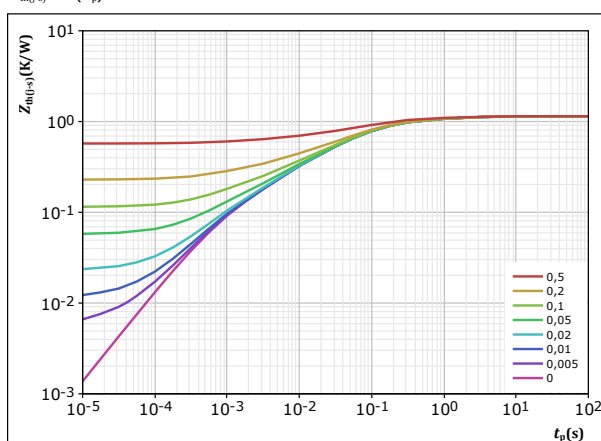
$T_j:$

- 25 °C
- 125 °C
- 150 °C

figure 7. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)} = 1,145 \text{ K/W}$

FWD thermal model values

R (K/W)	τ (s)
7,96E-02	2,71E+00
1,58E-01	4,48E-01
4,60E-01	9,11E-02
2,26E-01	2,44E-02
1,52E-01	5,42E-03
6,96E-02	7,31E-04

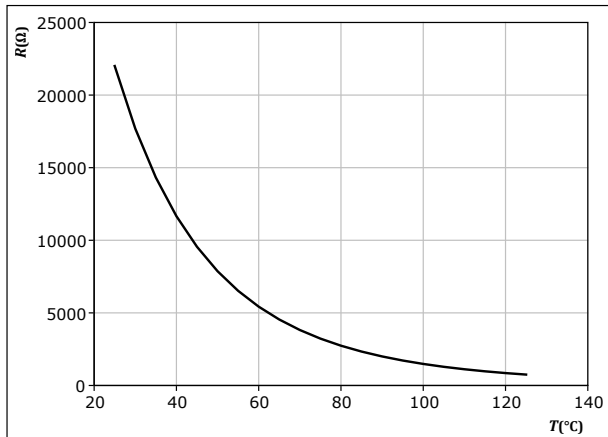


Thermistor Characteristics

figure 8. Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$





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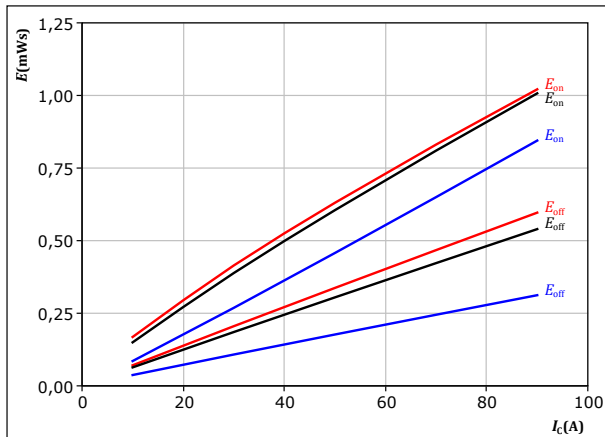
H-Bridge Switching Characteristics

figure 9.

IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 8$ Ω
 $R_{goff} = 8$ Ω

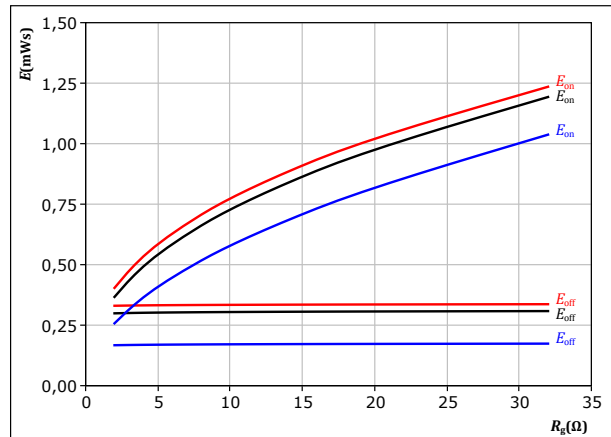
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 10.

IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_C = 50$ A

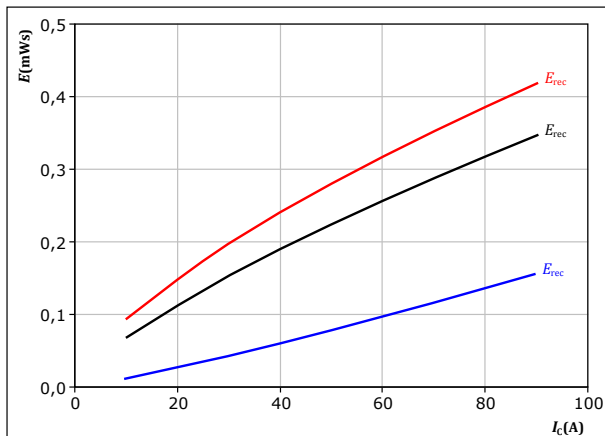
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 11.

FWD

Typical reverse recovered energy loss as a function of collector current

$$E_{rec} = f(I_C)$$



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 8$ Ω

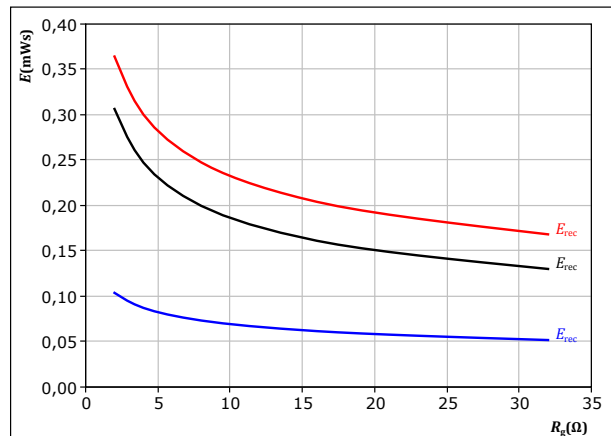
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 12.

FWD

Typical reverse recovered energy loss as a function of gate resistor

$$E_{rec} = f(R_g)$$



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_C = 50$ A

T_j :
— 25 °C
— 125 °C
— 150 °C



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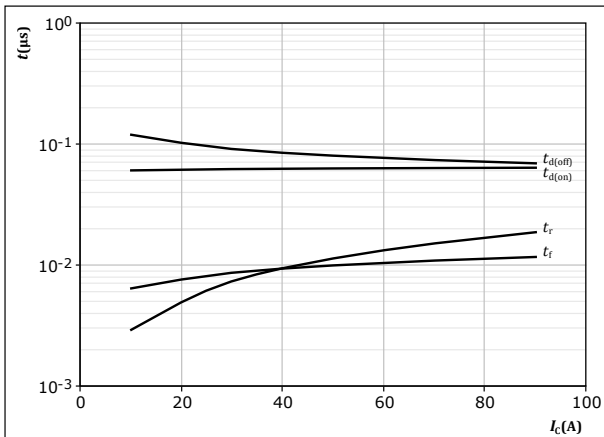
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datasheet

H-Bridge Switching Characteristics

figure 13.

IGBT

Typical switching times as a function of collector current
 $t = f(I_c)$



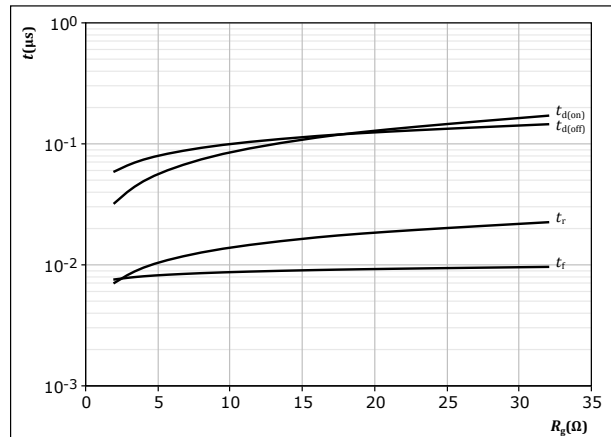
With an inductive load at

$T_j = 150$ °C
 $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 8$ Ω
 $R_{goff} = 8$ Ω

figure 14.

IGBT

Typical switching times as a function of gate resistor
 $t = f(R_g)$



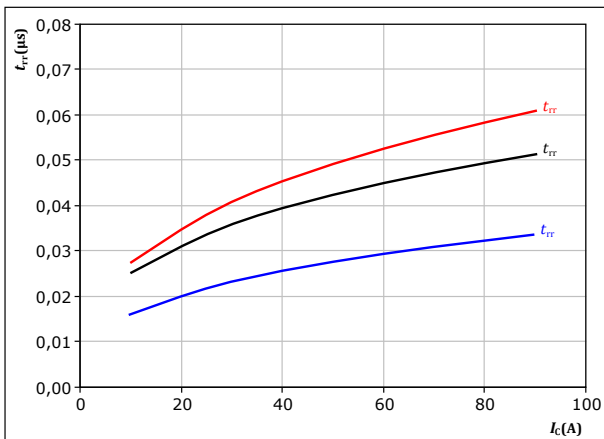
With an inductive load at

$T_j = 150$ °C
 $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_c = 50$ A

figure 15.

FWD

Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at

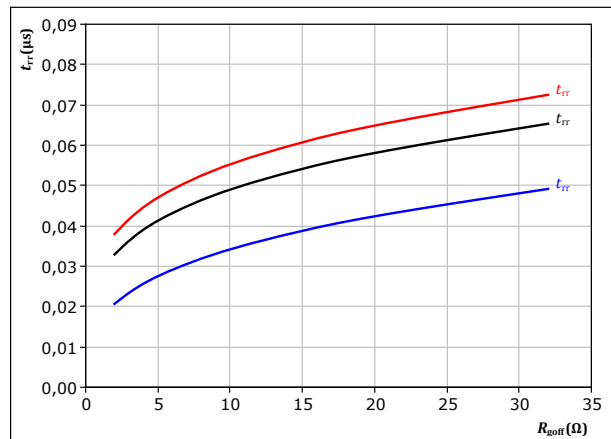
$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 8$ Ω

T_j : 25 °C
125 °C
150 °C

figure 16.

FWD

Typical reverse recovery time as a function of IGBT turn off gate resistor
 $t_{rr} = f(R_{goff})$



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_c = 50$ A

T_j : 25 °C
125 °C
150 °C



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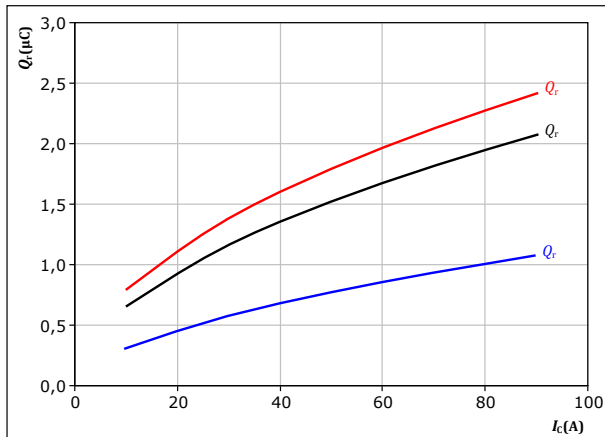
H-Bridge Switching Characteristics

figure 17.

FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 8$ Ω

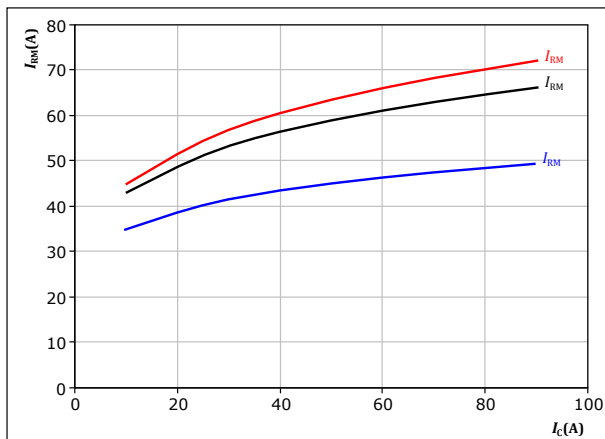
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 19.

FWD

Typical peak reverse recovery current as a function of collector current

$$I_{RM} = f(I_c)$$



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 8$ Ω

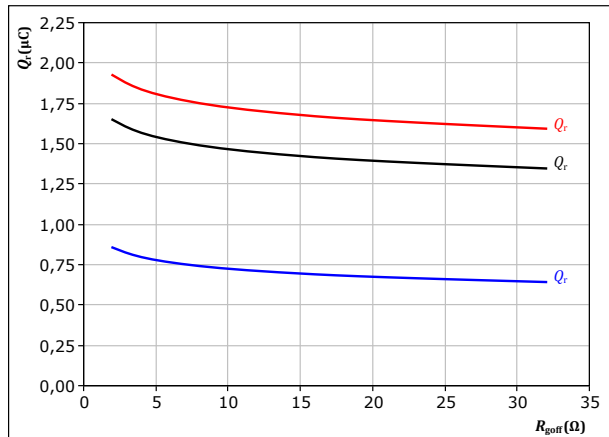
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 18.

FWD

Typical recovered charge as a function of turn off gate resistor

$$Q_r = f(R_{goff})$$



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_c = 50$ A

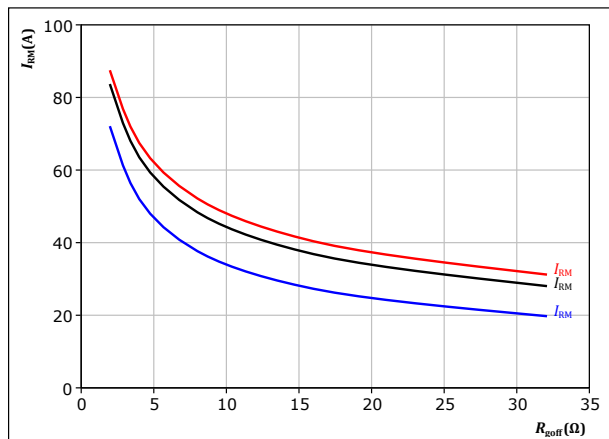
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 20.

FWD

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

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



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_c = 50$ A

T_j :
— 25 °C
— 125 °C
— 150 °C



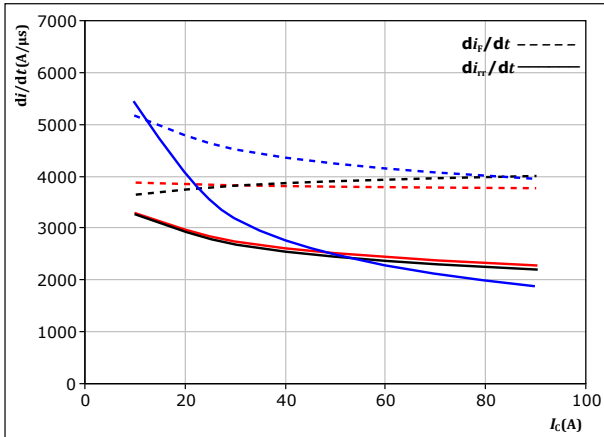
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datasheet

H-Bridge Switching Characteristics

figure 21. FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_r/dt = f(I_C)$



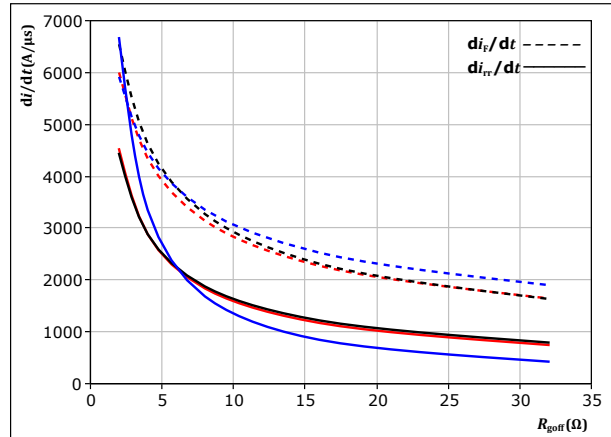
With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 8$ Ω

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 22. FWD

Typical rate of fall of forward and reverse recovery current as a function of turn off gate resistor
 $di_f/dt, di_r/dt = f(R_{goff})$



With an inductive load at

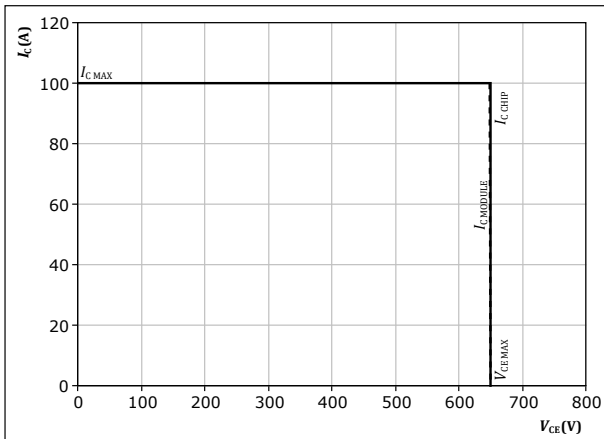
$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_C = 50$ A

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 23. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



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



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H-Bridge Switching Definitions

figure 24. IGBT

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

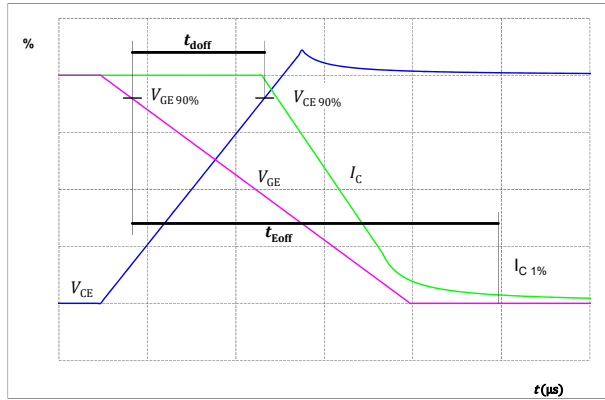


figure 25. IGBT

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

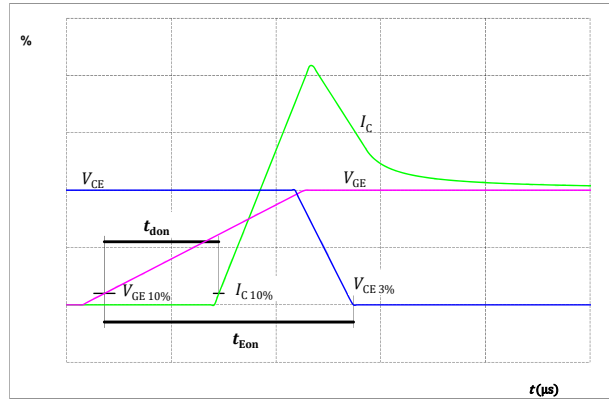


figure 26. IGBT

Turn-off Switching Waveforms & definition of t_f

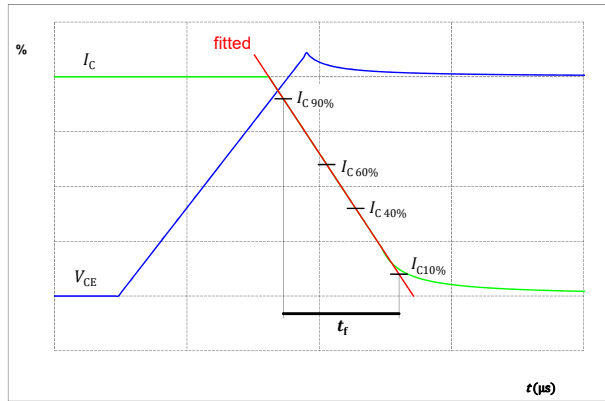
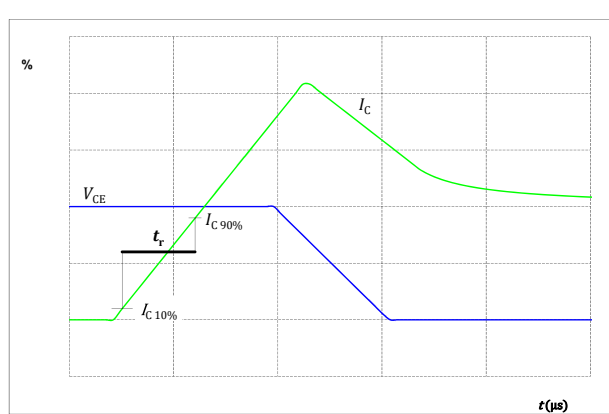


figure 27. IGBT

Turn-on Switching Waveforms & definition of t_r





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H-Bridge Switching Definitions

figure 28.

FWD

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

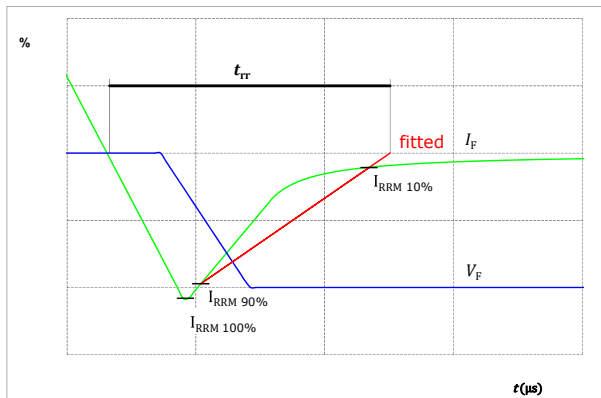
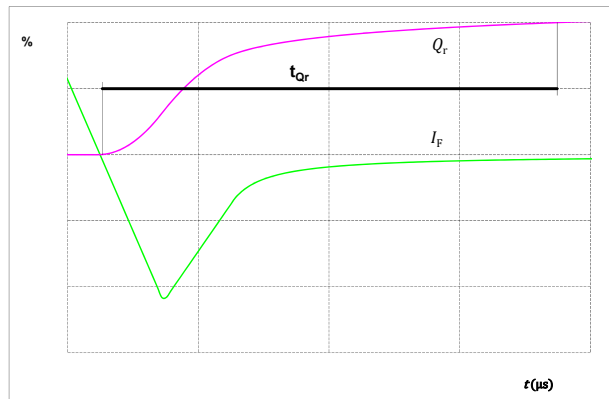


figure 29.

FWD

Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)





Vincotech

V23990-P623-F59-PM

datasheet

Ordering Code	
Version	Ordering Code
Without thermal paste	V23990-P623-F59-PM
With thermal paste	V23990-P623-F59-/3/-PM

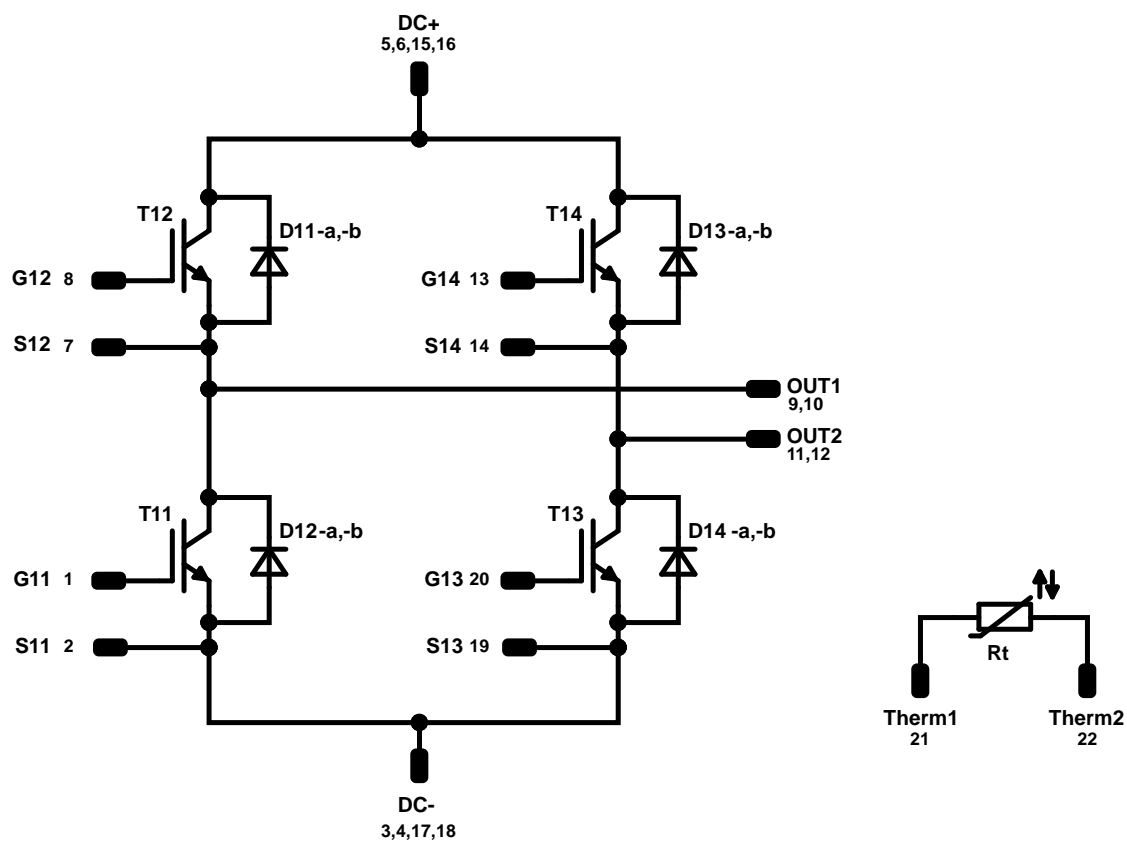
Marking						
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		VIN	WWYY	TTTTTTTV	UL	LLLL
	Datamatrix	Type&Ver	Lot number	Serial	Date code	
		TTTTTTTV	LLLL	SSSS	WWYY	

Outline																																																																																															
<p>Pin table [mm]</p> <table> <tr> <th>Pin</th><th>X</th><th>Y</th><th>Function</th></tr> <tr><td>1</td><td>0</td><td>22,5</td><td>G11</td></tr> <tr><td>2</td><td>2,9</td><td>22,5</td><td>S11</td></tr> <tr><td>3</td><td>8,3</td><td>22,5</td><td>DC-</td></tr> <tr><td>4</td><td>10,8</td><td>22,5</td><td>DC-</td></tr> <tr><td>5</td><td>19,6</td><td>22,5</td><td>DC+</td></tr> <tr><td>6</td><td>22,1</td><td>22,5</td><td>DC+</td></tr> <tr><td>7</td><td>29,1</td><td>22,5</td><td>S12</td></tr> <tr><td>8</td><td>32</td><td>22,5</td><td>G12</td></tr> <tr><td>9</td><td>33,5</td><td>17,8</td><td>OUT1</td></tr> <tr><td>10</td><td>33,5</td><td>15,3</td><td>OUT1</td></tr> <tr><td>11</td><td>33,5</td><td>7,2</td><td>OUT2</td></tr> <tr><td>12</td><td>33,5</td><td>4,7</td><td>OUT2</td></tr> <tr><td>13</td><td>32</td><td>0</td><td>G14</td></tr> <tr><td>14</td><td>29,1</td><td>0</td><td>S14</td></tr> <tr><td>15</td><td>22,1</td><td>0</td><td>DC+</td></tr> <tr><td>16</td><td>19,6</td><td>0</td><td>DC+</td></tr> <tr><td>17</td><td>10,8</td><td>0</td><td>DC-</td></tr> <tr><td>18</td><td>8,3</td><td>0</td><td>DC-</td></tr> <tr><td>19</td><td>2,9</td><td>0</td><td>S13</td></tr> <tr><td>20</td><td>0</td><td>0</td><td>G13</td></tr> <tr><td>21</td><td>0</td><td>8</td><td>Therm1</td></tr> <tr><td>22</td><td>0</td><td>14,5</td><td>Therm2</td></tr> </table>				Pin	X	Y	Function	1	0	22,5	G11	2	2,9	22,5	S11	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	S12	8	32	22,5	G12	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	G14	14	29,1	0	S14	15	22,1	0	DC+	16	19,6	0	DC+	17	10,8	0	DC-	18	8,3	0	DC-	19	2,9	0	S13	20	0	0	G13	21	0	8	Therm1	22	0	14,5	Therm2
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<p>Top view dimensions: $\phi 1 \pm 0,05$, $21,2 \pm 0,5$</p> <p>Bottom view dimensions: $16,75$, $11,25$</p> <p>Tolerance of pinpositions: $\pm 0,5\text{mm}$ at the end of pins Dimension of coordinate axis is only offset without tolerance</p>																																																																																															



Vincotech

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14	IGBT	650 V	50 A	H-Bridge Switch	
D11, D12, D13, D14	FWD	650 V	60 A	H-Bridge Diode	
Rt	Thermistor			Thermistor	



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.

Vincotech thermistor reference
See Vincotech thermistor reference table at 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-P623-F59-PM-D2-14	19 Apr. 2021	New Datasheet format Update Thermistor	

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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.