



fastPACK 0 H

1200 V / 40 A

**Topology features**

- Kelvin Emitter for improved switching performance
- Temperature sensor

**Component features**

- Easy paralleling
- High speed switching
- Low switching losses

**Housing features**

- Base isolation: Al<sub>2</sub>O<sub>3</sub>
- Clip-in, reliable mechanical connection, qualified for wave soldering
- Convex shaped substrate for superior thermal contact
- Thermo-mechanical push-and-pull force relief
- Press-fit pin
- Reliable cold welding connection

**Target applications**

- Charging Stations
- Power Supply
- UPS
- Welding & Cutting

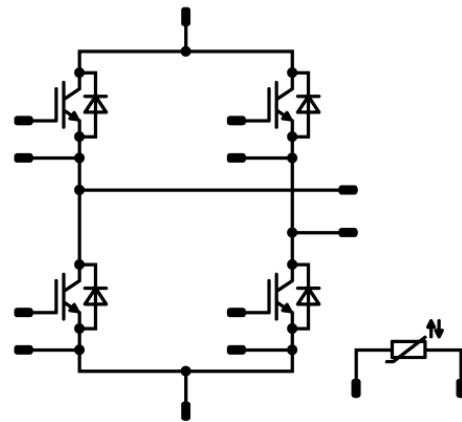
**Types**

- V23990-P629-F48Y-PM

**flow 0 12 mm housing**



**Schematic**





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**V23990-P629-F48Y-PM**  
datasheet

## Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
<b>H-Bridge Switch</b>				
Collector-emitter voltage	$V_{CES}$		1200	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	44	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	120	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	113	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Short circuit ratings	$t_{SC}$	$V_{GE} = 15\text{ V}$ , $V_{CC} = 800\text{ V}$ $T_j = 150\text{ °C}$	10	$\mu\text{s}$
Maximum junction temperature	$T_{jmax}$		175	$^{\circ}\text{C}$

## H-Bridge Diode

Peak repetitive reverse voltage	$V_{RRM}$		1200	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	24	A
Surge (non-repetitive) forward current	$I_{FSM}$	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	100	A
Surge current capability	$I^2t$		50	$\text{A}^2\text{s}$
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	61	W
Maximum junction temperature	$T_{jmax}$		175	$^{\circ}\text{C}$

## Module Properties

### Thermal Properties

Storage temperature	$T_{stg}$		-40...+125	$^{\circ}\text{C}$
Operation temperature under switching condition	$T_{jop}$		-40...+( $T_{jmax} - 25$ )	$^{\circ}\text{C}$

### 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			9,15	mm
Comparative Tracking Index	CTI		$\geq 200$	

\*100 % tested in production



### Characteristic Values

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

### H-Bridge Switch

#### Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0015	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		40	25 125	1,78	1,96 2,29	2,42 <sup>(1)</sup>	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		pF
Reverse transfer capacitance	$C_{res}$							130		pF
Gate charge	$Q_g$	$V_{CC} = 960$ V	15		40	25		185		nC

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,84		K/W
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#### Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		63,6 65 66		ns
Rise time	$t_r$	$R_{gon} = 8$ Ω $R_{goff} = 8$ Ω				25 125 150		15,4 18,6 18		ns
Turn-off delay time	$t_{d(off)}$		±15	600	40	25 125 150		162,4 215,8 229,6		ns
Fall time	$t_f$					25 125 150		26,3 62,8 70,15		ns
Turn-on energy (per pulse)	$E_{on}$	$Q_{tFWD} = 2,7$ μC $Q_{tFWD} = 4,78$ μC $Q_{tFWD} = 5,82$ μC				25 125 150		1,54 2,19 2,41		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		1,32 2,29 2,53		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	$V_F$				25	25 150		2,47 2,49	2,74 <sup>(1)</sup> 2,79 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_i = 1200$ V				25 150			60 3300	μA

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,56		K/W
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#### Dynamic

Peak recovery current	$I_{RM}$	$di/dt=3019$ A/μs $di/dt=3104$ A/μs $di/dt=2972$ A/μs	±15	600	40	25		48,06		A
Reverse recovery time	$t_{rr}$					125		54,99		
						150		60,27		
						25		101,42		
Recovered charge	$Q_r$					125		221,81		
						150		250,67		
		25		2,7						
Reverse recovered energy	$E_{rec}$	125		4,78						
		150		5,82						
		25		1,13						
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$	125		2,11						
		150		2,6						
		25		3780						
						2583				
						150		2658		A/μs



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### Characteristic Values

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

### Thermistor

#### Static

Rated resistance	$R$					25		22		kΩ
Deviation of R100	$A_{R/R}$	$R_{100} = 1484 \Omega$				100	-5		5	%
Power dissipation	$P$					25		130		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	

<sup>(1)</sup> Value at chip level

<sup>(2)</sup> Only valid with pre-applied Vincotech thermal interface material.

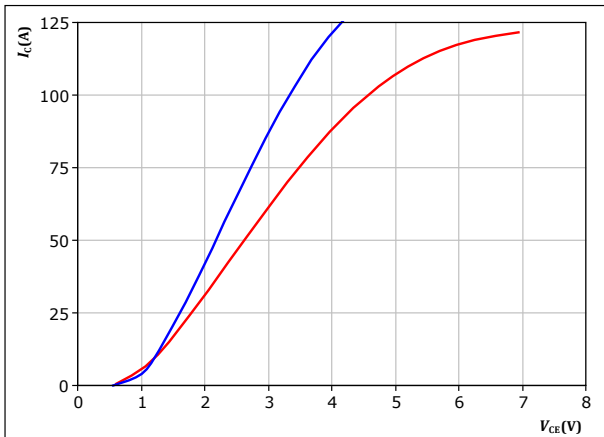


## H-Bridge Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

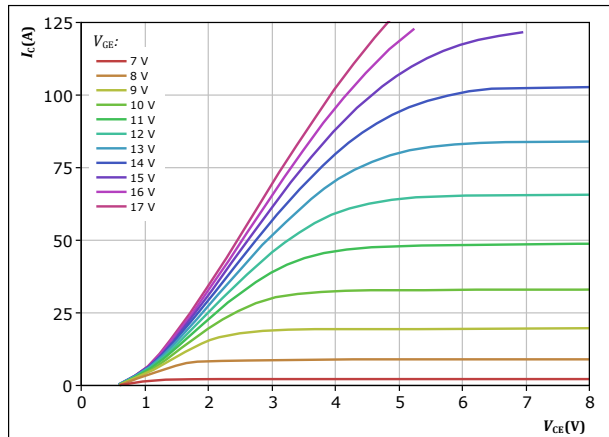


$t_p = 250 \mu s$   
 $V_{GE} = 15 V$   
 $T_j:$  — 25 °C  
— 125 °C

figure 2. IGBT

Typical output characteristics

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

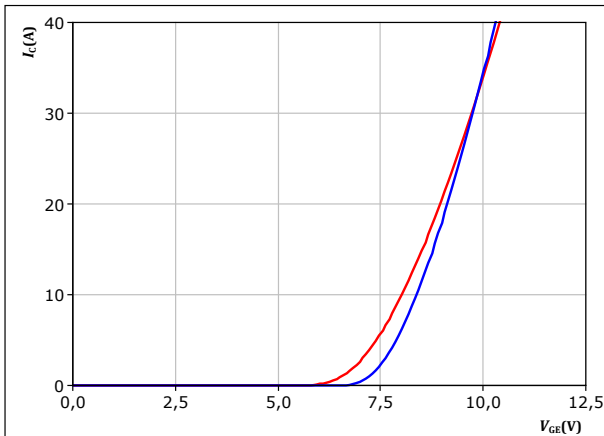


$t_p = 250 \mu s$   
 $T_j = 125 \text{ °C}$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

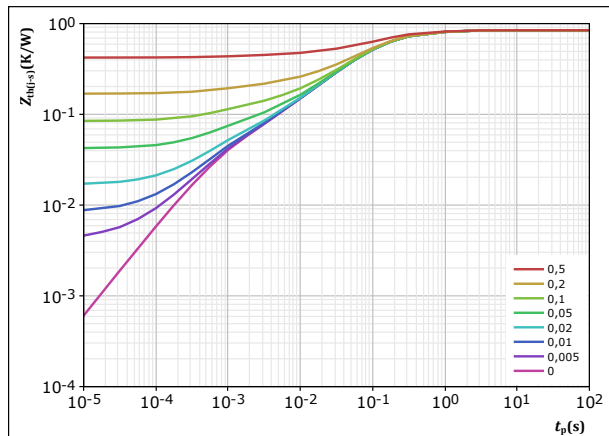


$t_p = 250 \mu s$   
 $V_{CE} = 10 V$   
 $T_j:$  — 25 °C  
— 125 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,844 \text{ K/W}$

IGBT thermal model values

R (K/W)	$\tau$ (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

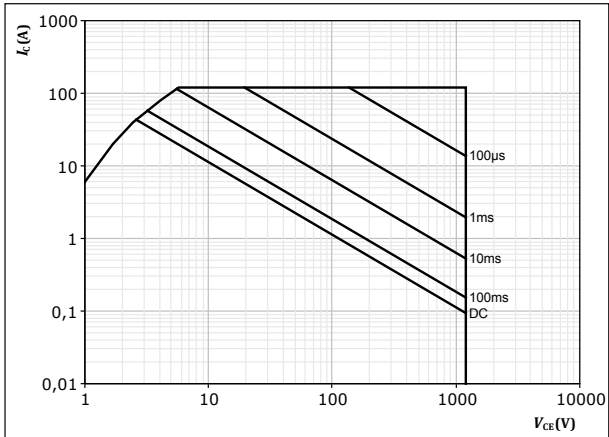


## H-Bridge Switch Characteristics

figure 5. IGBT

Safe operating area

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



$D =$  single pulse

$T_s = 80 \text{ } ^\circ\text{C}$

$V_{GE} = 15 \text{ V}$

$T_j = T_{jmax}$

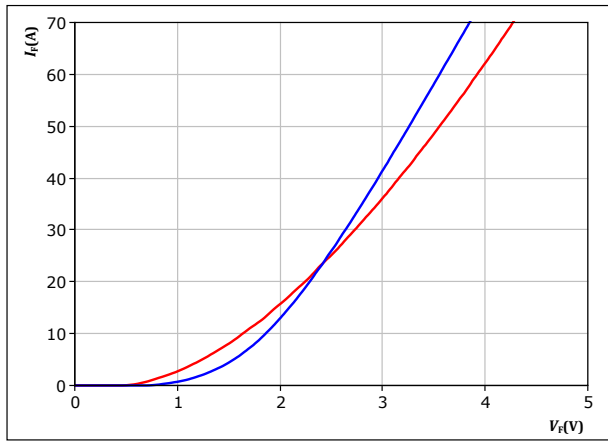


## H-Bridge Diode Characteristics

figure 6. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

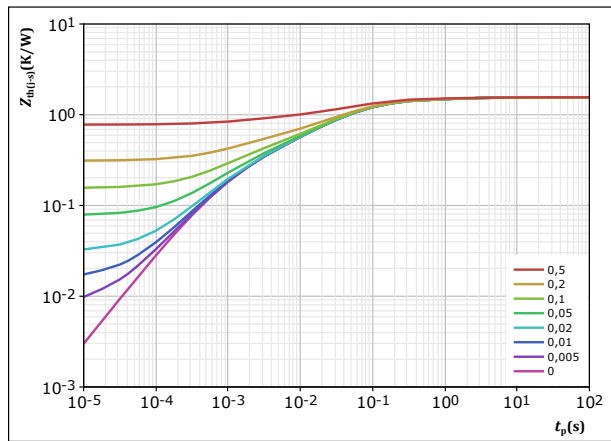


$t_p = 250 \mu s$   
 $T_j$ : — 25 °C  
 — 150 °C

figure 7. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 1,556 \text{ K/W}$   
 FWD thermal model values

$R$ (K/W)	$\tau$ (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



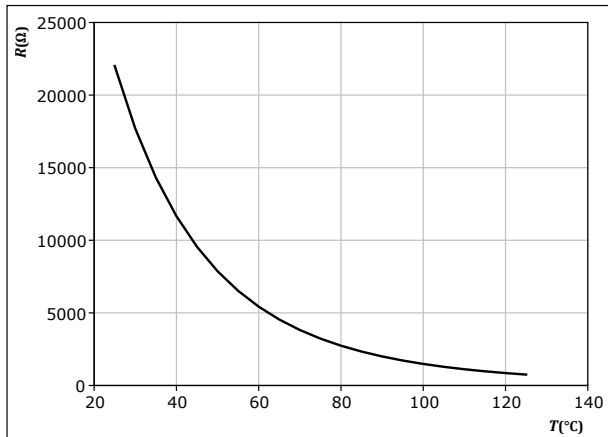


## Thermistor Characteristics

figure 8. Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$

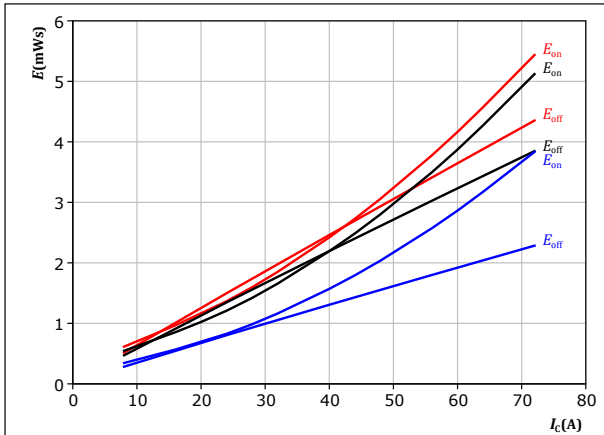




## H-Bridge Switching Characteristics

**figure 9.** IGBT

Typical switching energy losses as a function of collector current  
 $E = f(I_c)$

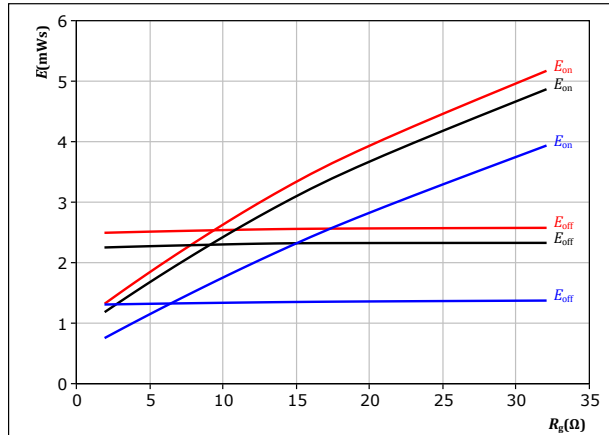


With an inductive load at

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

**figure 10.** IGBT

Typical switching energy losses as a function of IGBT turn on gate resistor  
 $E = f(R_g)$

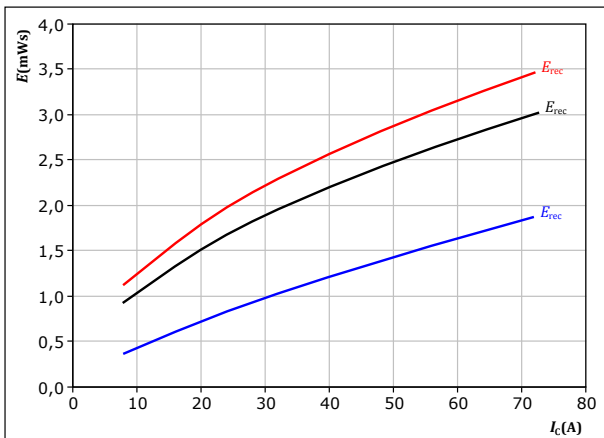


With an inductive load at

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

**figure 11.** FWD

Typical reverse recovered energy loss as a function of collector current  
 $E_{rec} = f(I_c)$

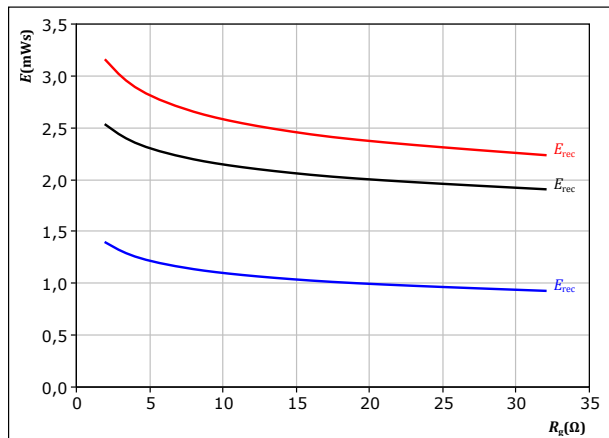


With an inductive load at

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

**figure 12.** FWD

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor  
 $E_{rec} = f(R_g)$



With an inductive load at

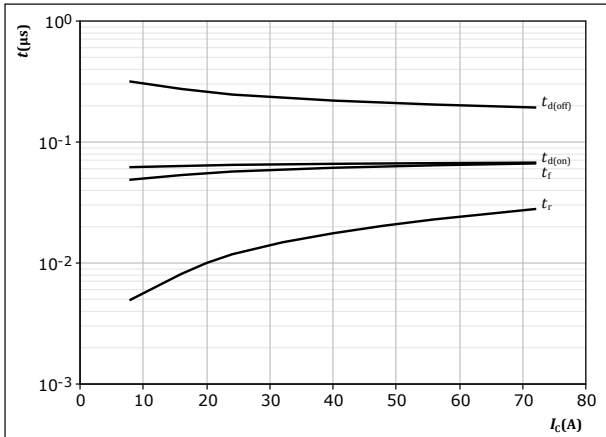
$V_{CE} =$	600	V	$T_j:$	—	25 °C
$V_{GE} =$	±15	V		—	125 °C
$I_c =$	40	A		—	150 °C



## H-Bridge Switching Characteristics

**figure 13.** IGBT

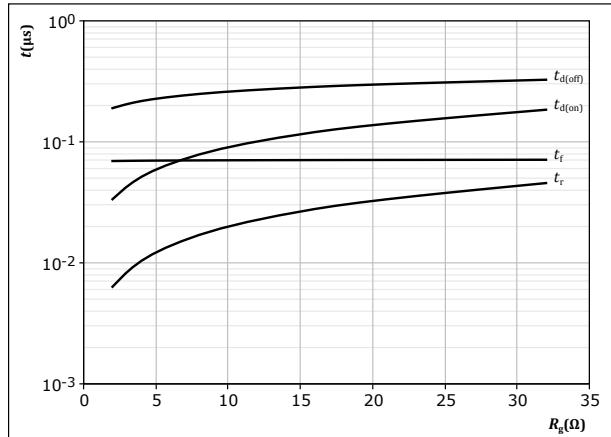
Typical switching times as a function of collector current  
 $t = f(I_c)$



With an inductive load at  
 $T_j = 150$  °C  
 $V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$  Ω  
 $R_{goff} = 8$  Ω

**figure 14.** IGBT

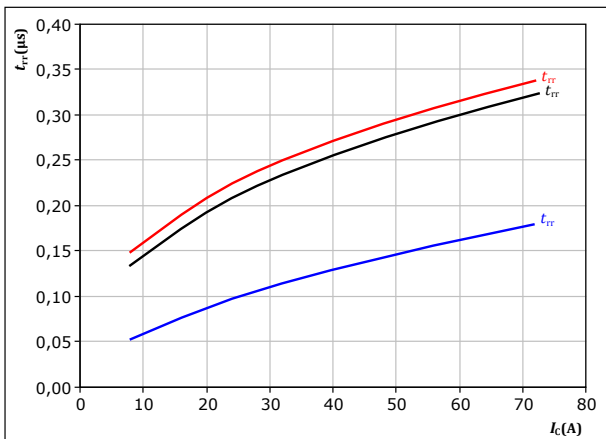
Typical switching times as a function of IGBT turn on gate resistor  
 $t = f(R_g)$



With an inductive load at  
 $T_j = 150$  °C  
 $V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 40$  A

**figure 15.** FWD

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

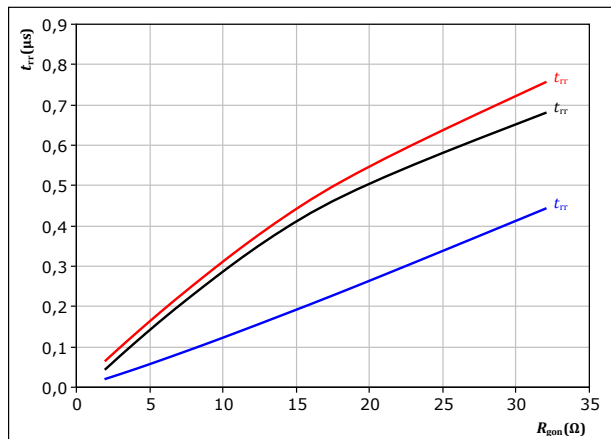


With an inductive load at  
 $V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$  Ω

$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

**figure 16.** FWD

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



With an inductive load at  
 $V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 40$  A

$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

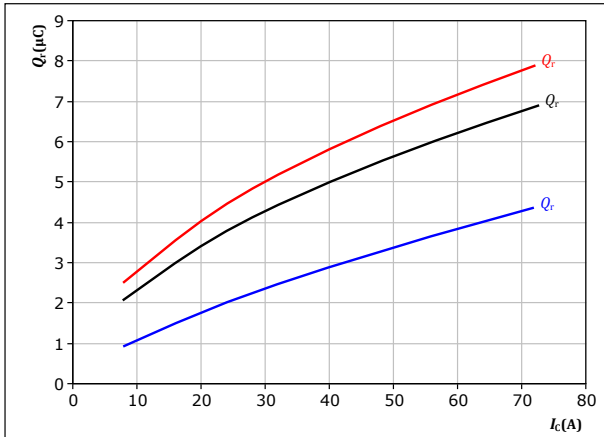


## H-Bridge Switching Characteristics

**figure 17.** FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

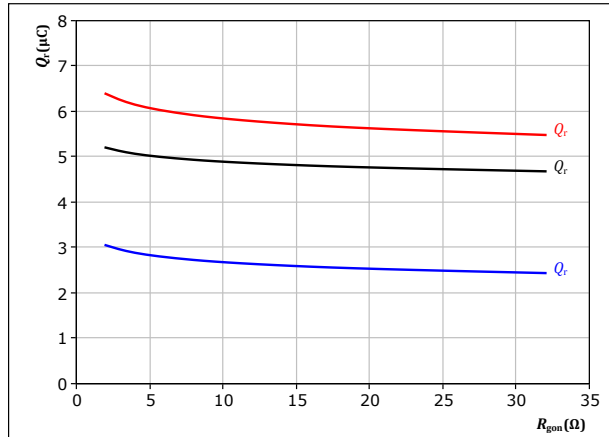
$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 8 \text{ } \Omega$

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

**figure 18.** FWD

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

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



With an inductive load at

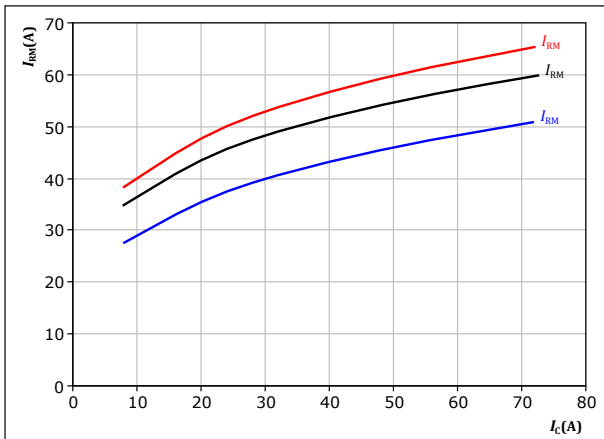
$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_c = 40 \text{ A}$

$T_j$ : — 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

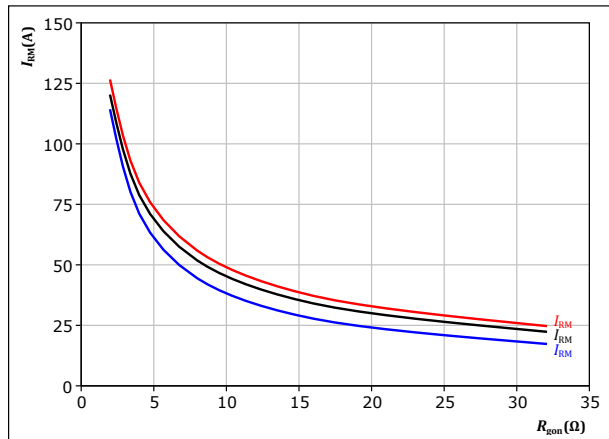
$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 8 \text{ } \Omega$

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

**figure 20.** FWD

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

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



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_c = 40 \text{ A}$

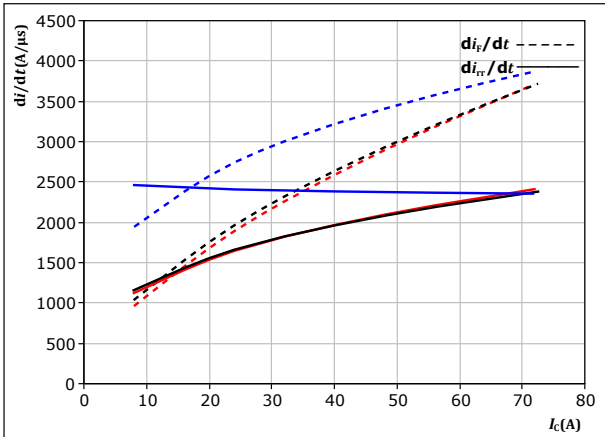
$T_j$ : — 25 °C  
— 125 °C  
— 150 °C



## H-Bridge Switching Characteristics

**figure 21.** FWD

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



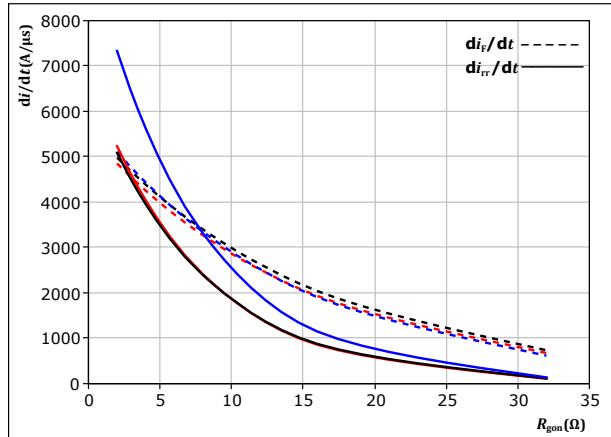
With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$   $\Omega$

$T_j = 25$  °C  
 $125$  °C  
 $150$  °C

**figure 22.** FWD

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



With an inductive load at

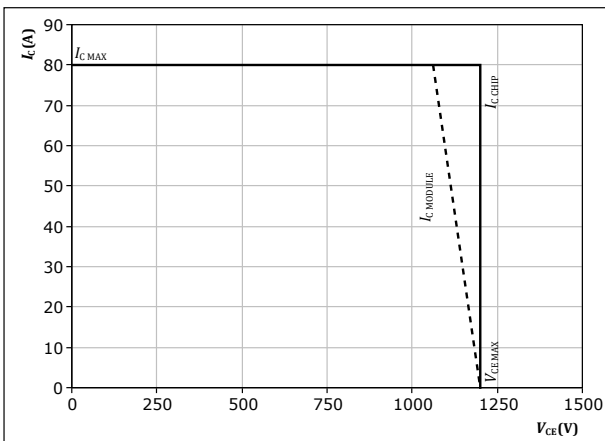
$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 40$  A

$T_j = 25$  °C  
 $125$  °C  
 $150$  °C

**figure 23.** IGBT

Reverse bias safe operating area

$I_c = f(V_{CE})$



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



## H-Bridge Switching Definitions

figure 24. IGBT

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

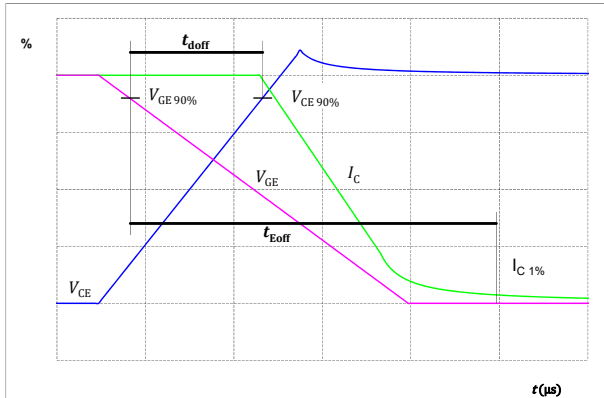


figure 25. IGBT

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

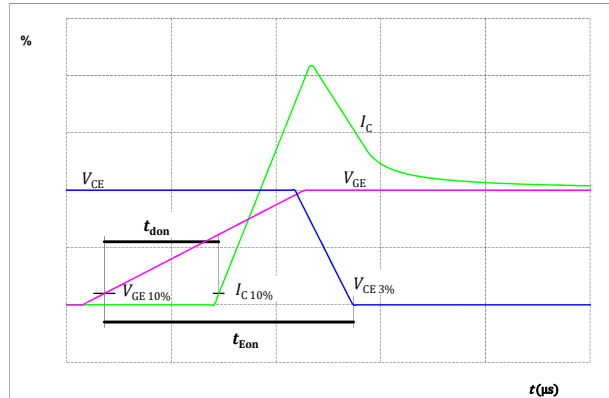


figure 26. IGBT

Turn-off Switching Waveforms & definition of  $t_f$

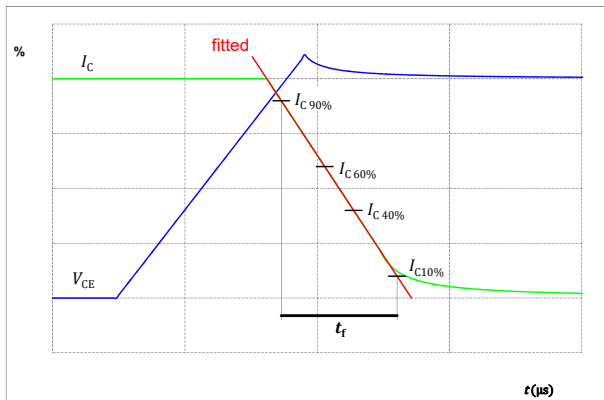
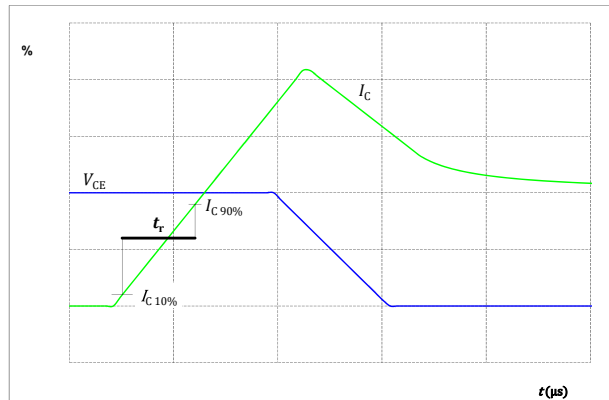


figure 27. IGBT

Turn-on Switching Waveforms & definition of  $t_r$





### H-Bridge Switching Definitions

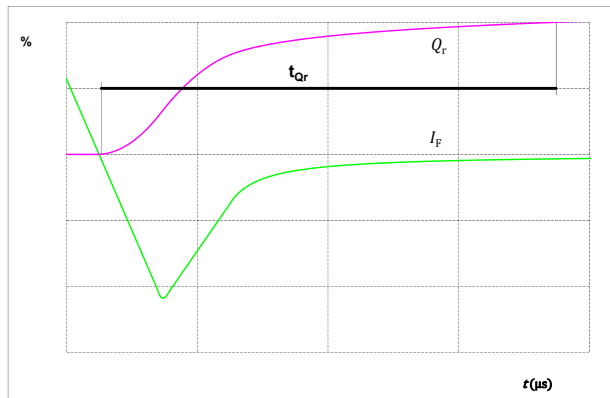
figure 28. FWD

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




figure 29. FWD

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

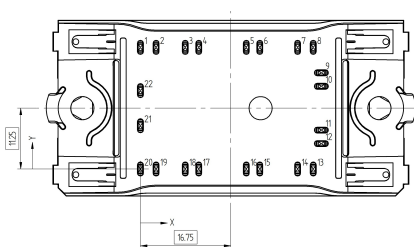




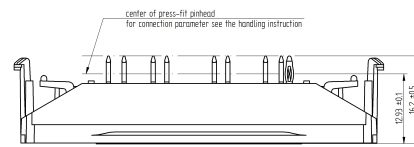
Ordering Code	
<b>Version</b>	<b>Ordering Code</b>
Without thermal paste	V23990-P629-F48Y-PM
With thermal paste (5,2 W/mK, PTM6000HV)	V23990-P629-F48Y-/7/-PM
With thermal paste (3,4 W/mK, PSX-P7)	V23990-P629-F48Y-/3/-PM

Marking							
	<b>Text</b>	<b>VIN</b> VIN	<b>Date code</b> WWYY	<b>Type&amp;Ver</b> TTTTTTVV	<b>UL</b> UL	<b>Lot</b> LLLLL	<b>Serial</b> SSSS
	<b>Datamatrix</b>	<b>Type&amp;Ver</b>	<b>Lot number</b>	<b>Serial</b>	<b>Date code</b>		
		TTTTTTVV	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	



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

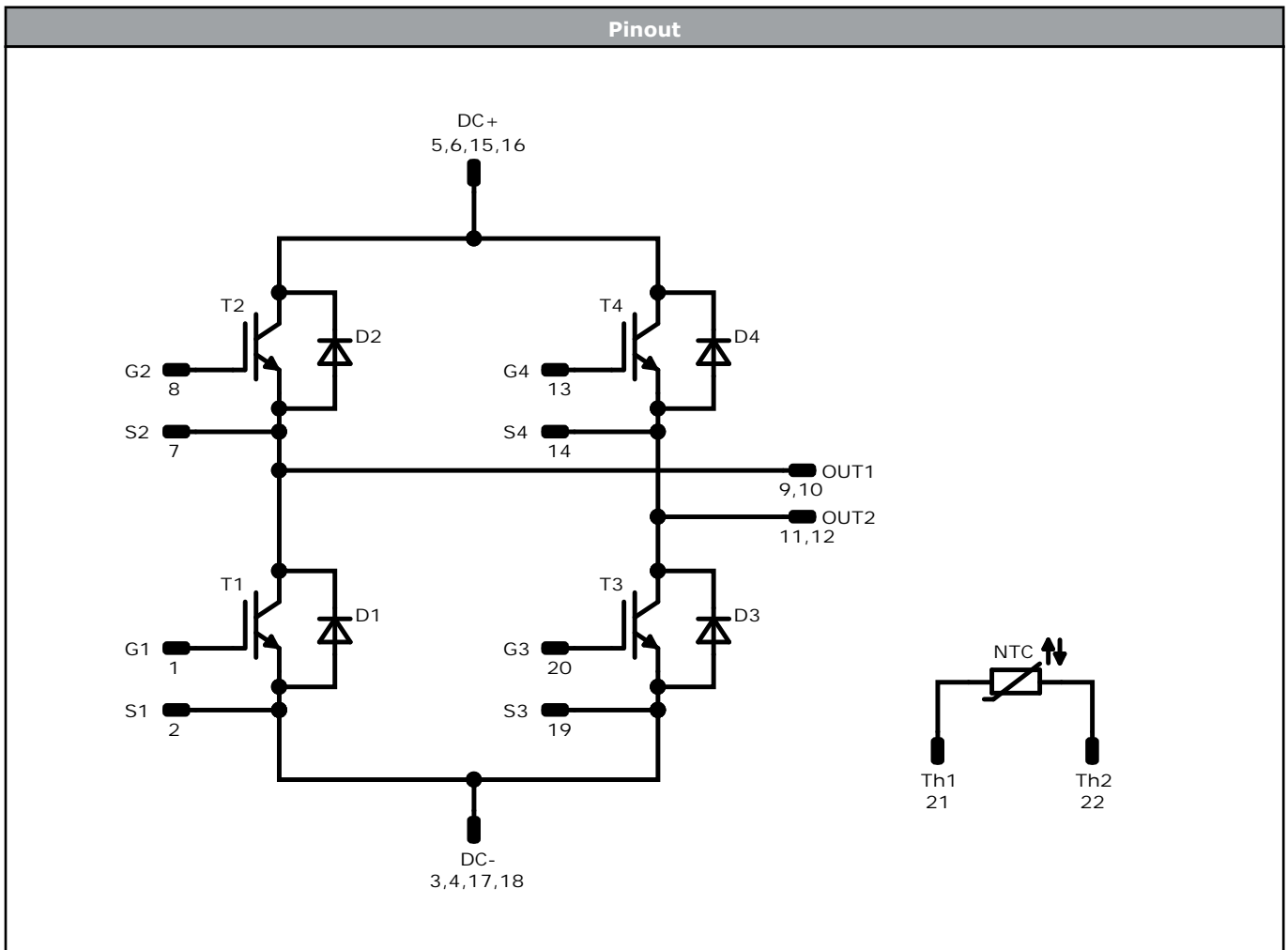


center of press-fit shroud  
for correction parameter see the handling instruction





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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	
NTC	Thermistor			Thermistor	




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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-P629-F48Y-PM-D1-14	16 May, 2023	Initial release	

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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.