



Vincotech

## V23990-P849-C49-PM

datasheet

flowPIM 0

1200 V / 8 A

### Features

- 2 Clips housing in 17 mm height
- Trench Fieldstop Technology IGBT4

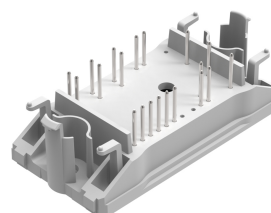
### Target applications

- Industrial Drives

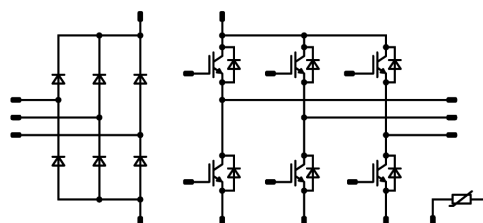
### Types

- V23990-P849-C49-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
<b>Inverter Switch</b>				
Collector-emitter voltage	$V_{CES}$		1200	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	16	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	24	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	61	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	$^{\circ}\text{C}$

## Inverter Diode

Peak repetitive reverse voltage	$V_{RRM}$		1200	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	19	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	20	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	46	W
Maximum junction temperature	$T_{jmax}$		175	$^{\circ}\text{C}$

## Rectifier Diode

Peak repetitive reverse voltage	$V_{RRM}$		1600	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	35	A
Surge (non-repetitive) forward current	$I_{FSM}$	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	200	A
Surge current capability	$I^2_t$		200	$\text{A}^2\text{s}$
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	44	W
Maximum junction temperature	$T_{jmax}$		150	$^{\circ}\text{C}$



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## Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
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## Module Properties

### Thermal Properties

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

### Isolation Properties

Isolation voltage	$V_{\text{isol}}$	DC Test Voltage* $t_p = 2\text{ s}$	6000	V
Isolation voltage	$V_{\text{isol}}$	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		

### Inverter Switch

#### Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00015	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	$V_{CEsat}$		15		8	25 125	1,58	1,87 2,21	2,07 <sup>(1)</sup>	V
Collector-emitter cut-off current	$I_{CES}$		0	1200		25			1	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		490		pF
Reverse transfer capacitance	$C_{res}$							30		pF
Gate charge	$Q_g$	$V_{CC} = 960 \text{ V}$	15		8	25		53		nC

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						1,57		K/W
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#### Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 32 \text{ } \Omega$ $R_{goff} = 32 \text{ } \Omega$	$\pm 15$	600	8	25 125		71,4 70,6		ns
Rise time	$t_r$					25 125		18,6 22,8		ns
Turn-off delay time	$t_{d(off)}$					25 125		194,4 236,4		ns
Fall time	$t_f$					25 125		78,46 108,16		ns
Turn-on energy (per pulse)	$E_{on}$					25 125		0,499 0,748		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125		0,435 0,624		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	

### Inverter Diode

#### Static

Forward voltage	$V_F$				10	25 150	1,35	1,85 1,77	2,05 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_r = 1200$ V				25			2,7	μA

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						2,07		K/W
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#### Dynamic

Peak recovery current	$I_{RRM}$	$di/dt=452$ A/μs $di/dt=399$ A/μs	$\pm 15$	600	8	25 125		8,46 9,88		A
Reverse recovery time	$t_{rr}$					25 125		250,51 382,73		ns
Recovered charge	$Q_r$					25 125		0,885 1,57		μC
Reverse recovered energy	$E_{rec}$					25 125		0,345 0,634		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125		83,99 69,05		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	

### Rectifier Diode

#### Static

Forward voltage	$V_F$				8	25 125 150		0,976 0,879 0,85	1,21 <sup>(1)</sup> 1,1 <sup>(1)</sup>		V
Reverse leakage current	$I_R$	$V_i = 1600$ V				25			50		μA

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,59			K/W
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### Thermistor

#### Static

Rated resistance	$R$					25		22			kΩ
Deviation of $R_{100}$	$\Delta_{R/R}$	$R_{100} = 1484$ Ω				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		

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

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



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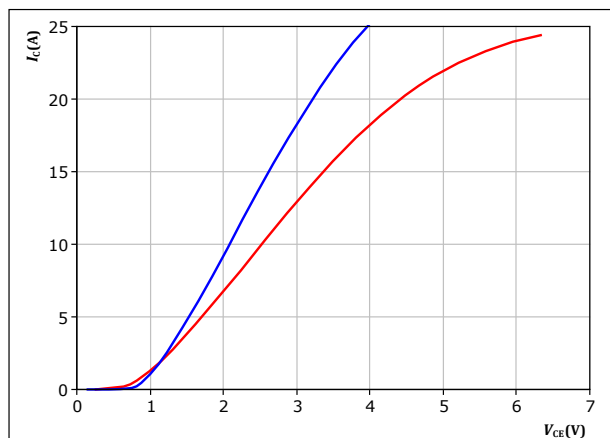
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## Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

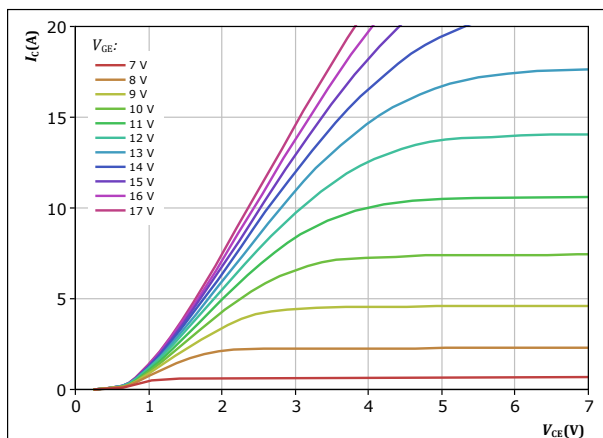


$t_p = 250 \mu s$   
 $V_{GE} = 15 V$   
 $T_j: 25 ^\circ C$   
 $125 ^\circ C$

figure 2. IGBT

Typical output characteristics

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

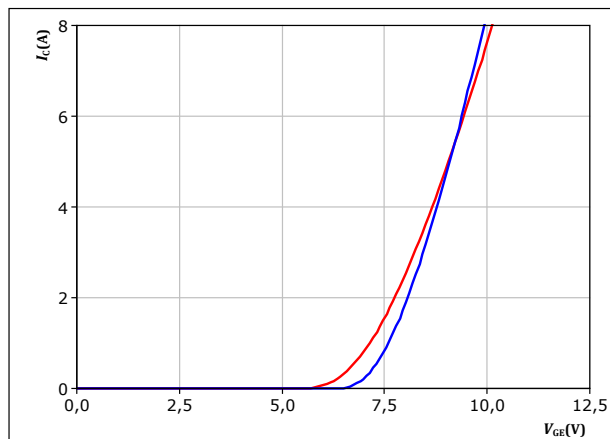


$t_p = 250 \mu s$   
 $T_j = 125 ^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

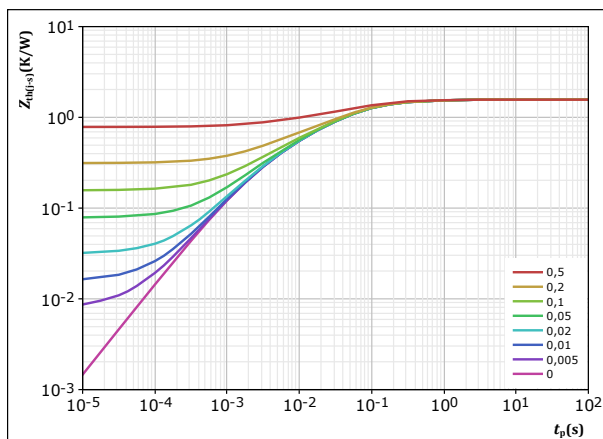


$t_p = 250 \mu s$   
 $V_{CE} = 10 V$   
 $T_j: 25 ^\circ C$   
 $125 ^\circ C$

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 1,566 K/W$   
IGBT thermal model values  

$R (K/W)$	$\tau (s)$
1,42E-01	5,98E-01
6,32E-01	7,71E-02
3,98E-01	2,43E-02
2,86E-01	6,16E-03
1,08E-01	1,44E-03



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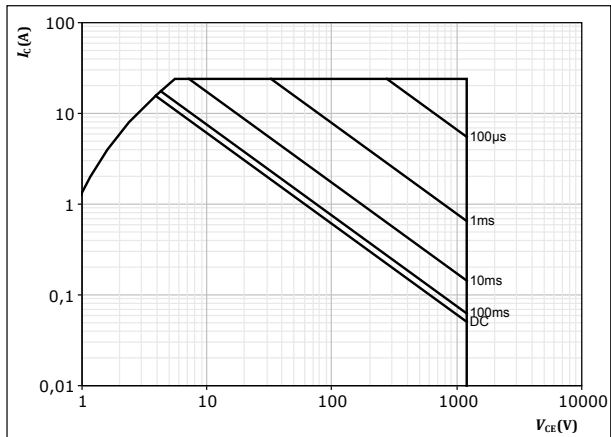
## Inverter Switch Characteristics

figure 5.

IGBT

Safe operating area

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



$D$  = single pulse

$T_s = 80$  °C

$V_{GE} = 15$  V

$T_j = T_{jmax}$





## Inverter Diode Characteristics

figure 6.

FWD

Typical forward characteristics

$$I_F = f(V_F)$$

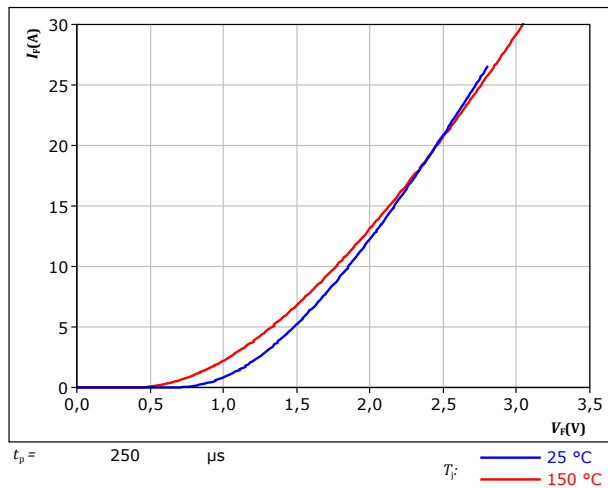
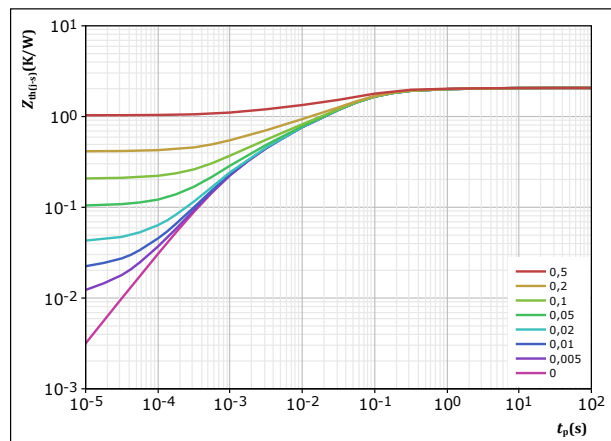


figure 7.

FWD

Transient thermal impedance as a function of pulse width

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





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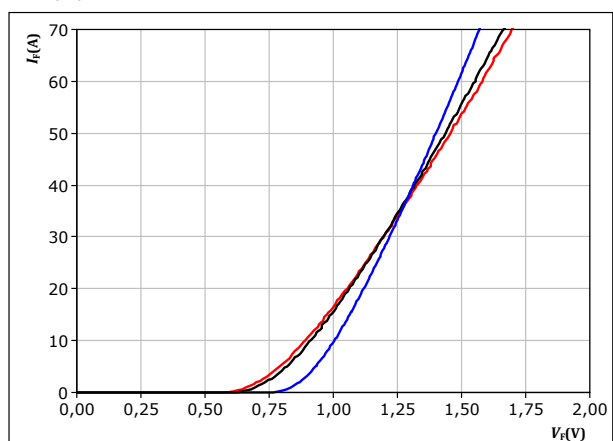
## Rectifier Diode Characteristics

figure 8.

Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$



$t_p = 250 \mu s$

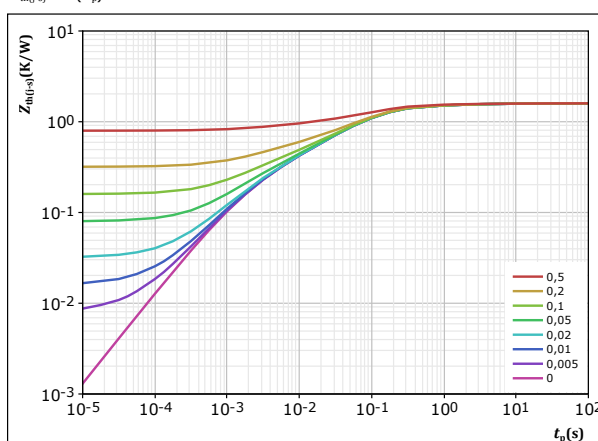
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 9.

Rectifier

Transient thermal impedance as a function of pulse width

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



$D =$	$t_p / T$
$R_{th(j-s)} =$	1,594 K/W
Rectifier thermal model values	
$R$ (K/W)	$\tau$ (s)
3,44E-02	9,66E+00
1,12E-01	1,22E+00
5,81E-01	1,45E-01
4,89E-01	5,05E-02
2,38E-01	9,26E-03
1,22E-01	1,79E-03
1,81E-02	7,88E-04

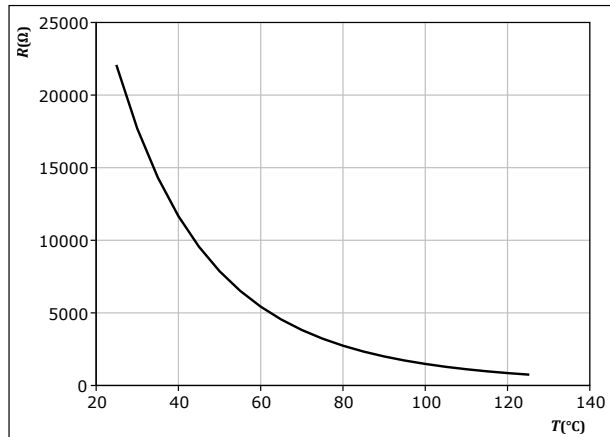


## Thermistor Characteristics

**figure 10.** Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$





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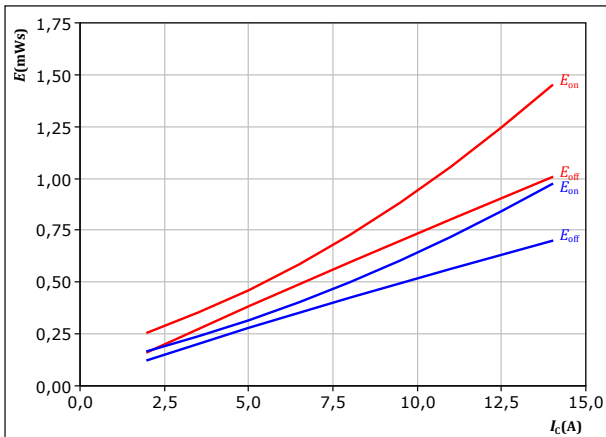
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## Inverter Switching Characteristics

figure 11. IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$



With an inductive load at

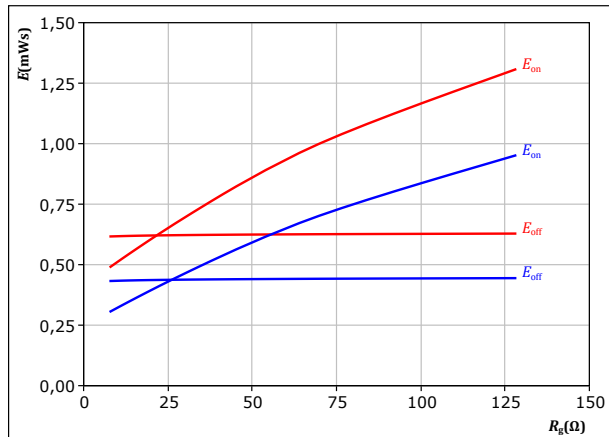
$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 32$   $\Omega$   
 $R_{goff} = 32$   $\Omega$

$T_j$ : — 25 °C  
— 125 °C

figure 12. IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$



With an inductive load at

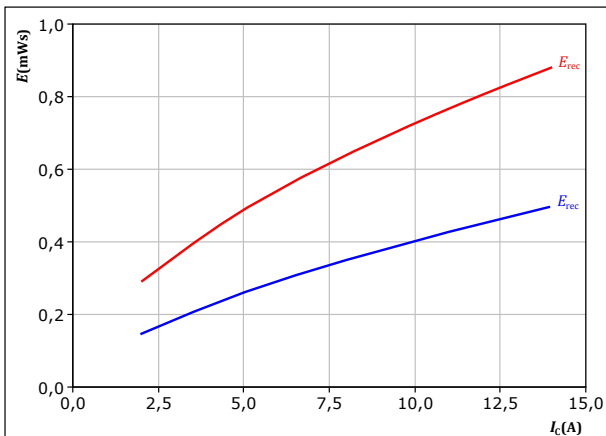
$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_C = 8$  A

$T_j$ : — 25 °C  
— 125 °C

figure 13. FWD

Typical reverse recovered energy loss as a function of collector current

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



With an inductive load at

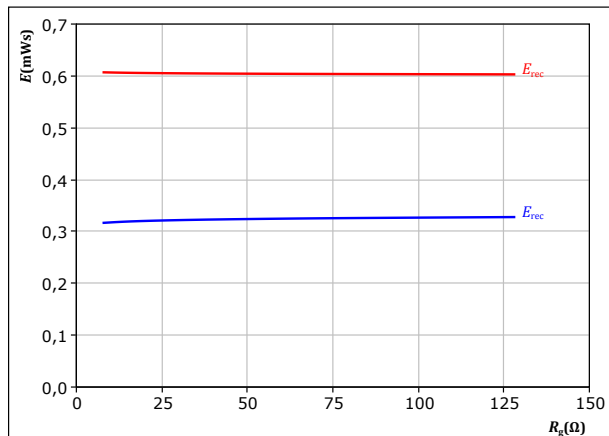
$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 32$   $\Omega$

$T_j$ : — 25 °C  
— 125 °C

figure 14. 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  
 $V_{GE} = \pm 15$  V  
 $I_C = 8$  A

$T_j$ : — 25 °C  
— 125 °C



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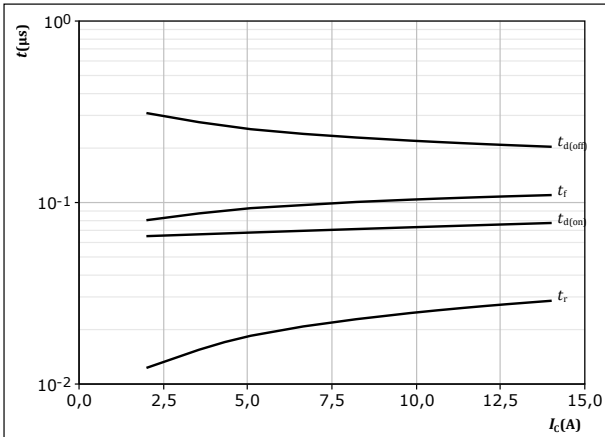
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## Inverter Switching Characteristics

figure 15.

IGBT

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



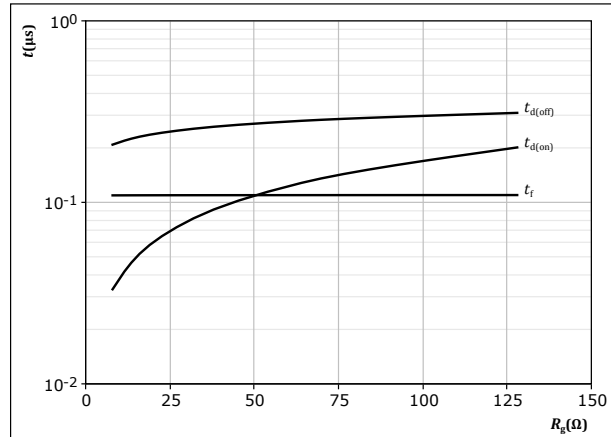
With an inductive load at

$T_j = 125 \text{ } ^\circ\text{C}$   
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 32 \text{ } \Omega$   
 $R_{goff} = 32 \text{ } \Omega$

figure 16.

IGBT

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



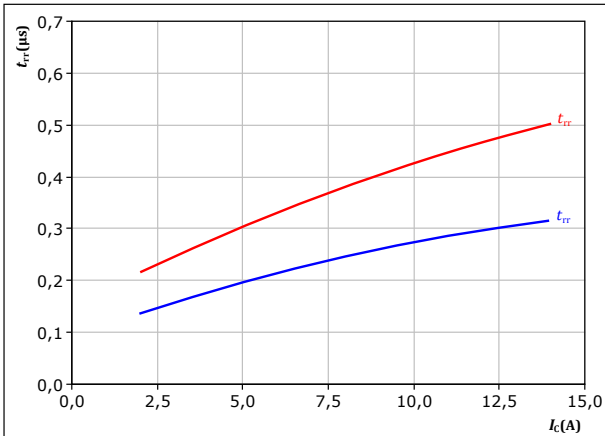
With an inductive load at

$T_j = 125 \text{ } ^\circ\text{C}$   
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_C = 8 \text{ A}$

figure 17.

FWD

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



With an inductive load at

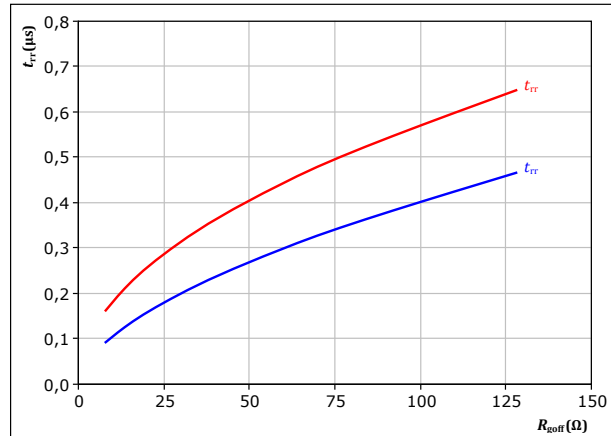
$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 32 \text{ } \Omega$

$T_j$ : — 25 °C  
— 125 °C

figure 18.

FWD

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



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_C = 8 \text{ A}$

$T_j$ : — 25 °C  
— 125 °C



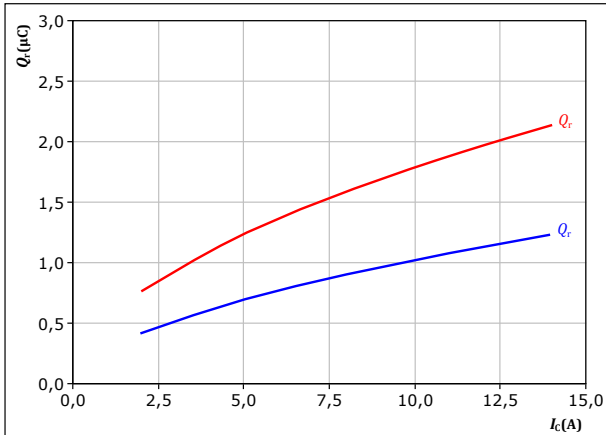
## Inverter Switching Characteristics

figure 19.

FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 32$  Ω

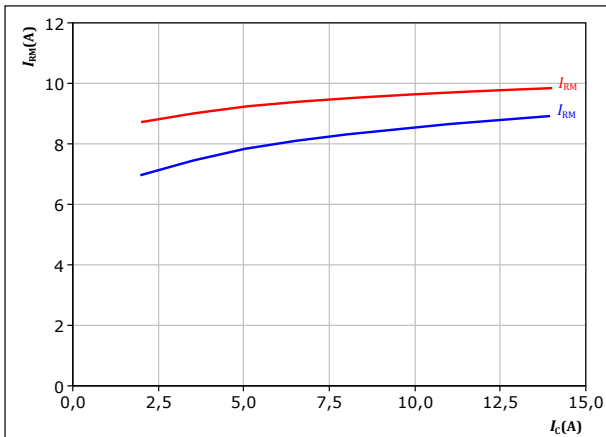
$T_j$ : — 25 °C  
— 125 °C

figure 21.

FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 32$  Ω

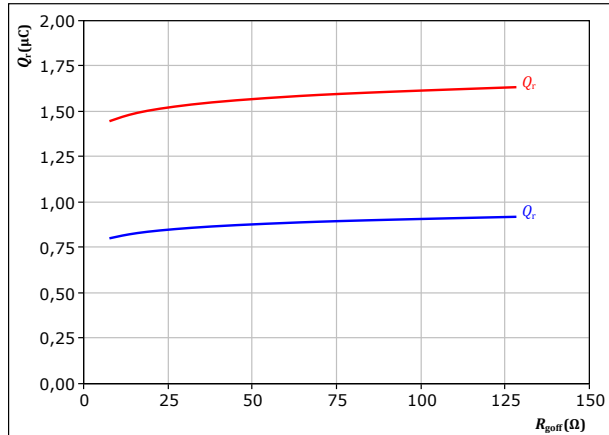
$T_j$ : — 25 °C  
— 125 °C

figure 20.

FWD

Typical recovered charge as a function of turn off gate resistor

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



With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 8$  A

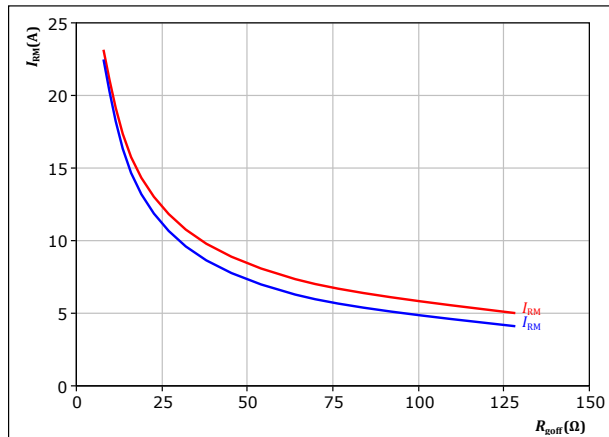
$T_j$ : — 25 °C  
— 125 °C

figure 22.

FWD

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

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



With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 8$  A

$T_j$ : — 25 °C  
— 125 °C



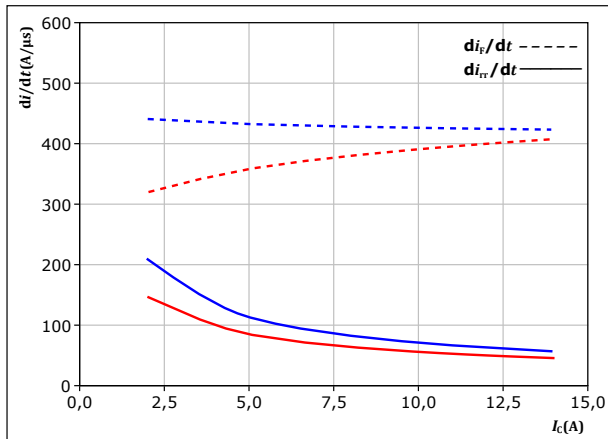
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## Inverter Switching Characteristics

**figure 23.** FWD

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



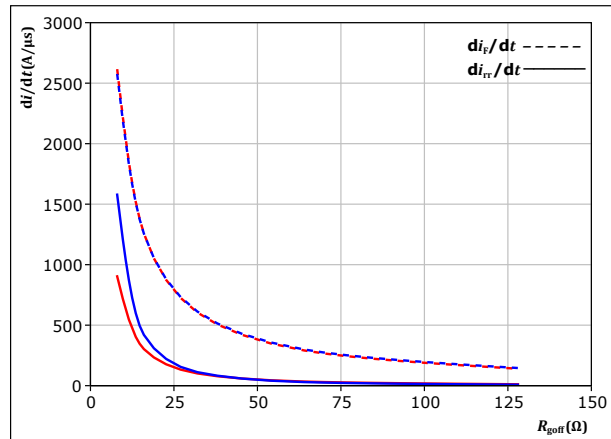
With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 32$   $\Omega$

$T_j$ : — 25 °C  
 — 125 °C

**figure 24.** 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

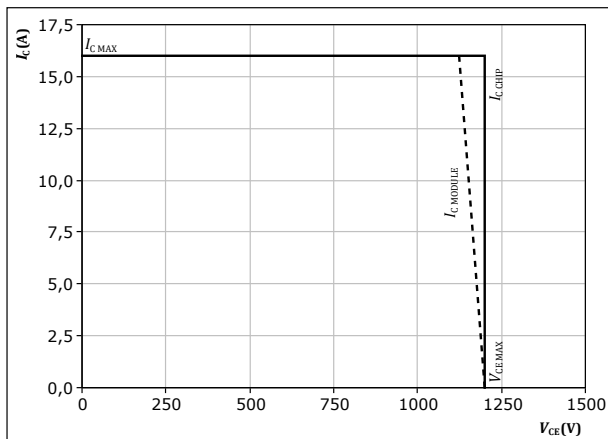
$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_C = 8$  A

$T_j$ : — 25 °C  
 — 125 °C

**figure 25.** IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At  $T_j = 125$  °C  
 $R_{gon} = 32$   $\Omega$   
 $R_{goff} = 32$   $\Omega$



## Inverter Switching Definitions

figure 26. IGBT

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

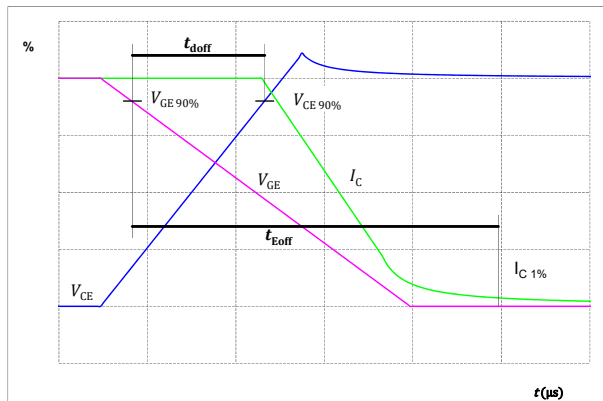


figure 27. IGBT

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

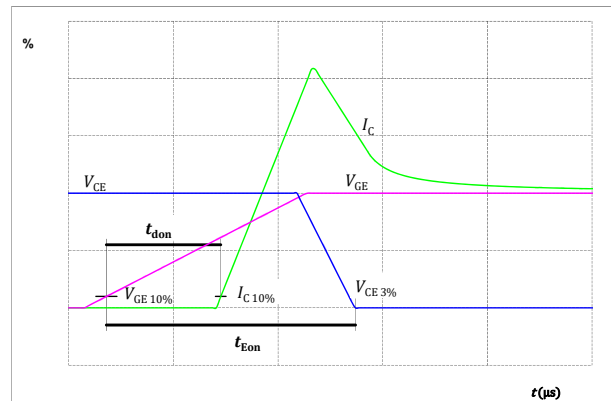


figure 28. IGBT

Turn-off Switching Waveforms & definition of  $t_f$

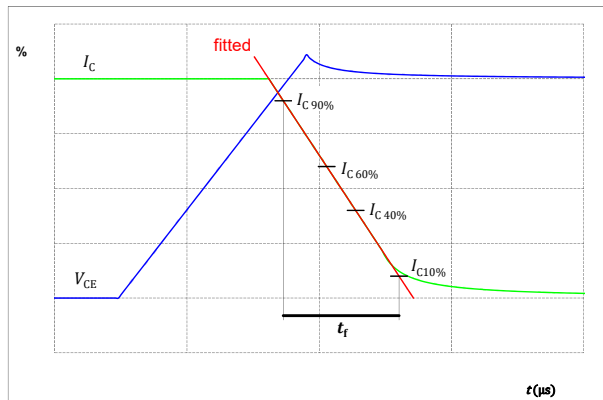
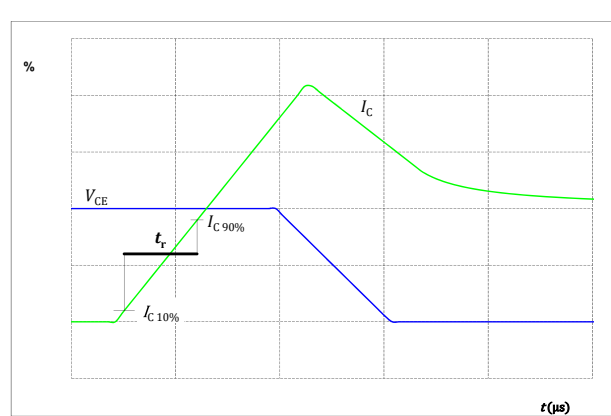


figure 29. IGBT

Turn-on Switching Waveforms & definition of  $t_r$







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## Inverter Switching Definitions

figure 30.

FWD

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

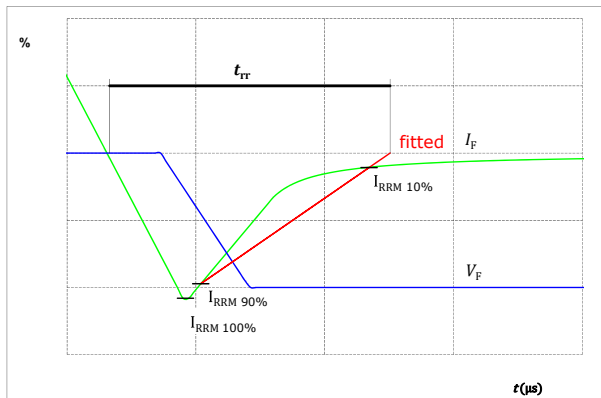
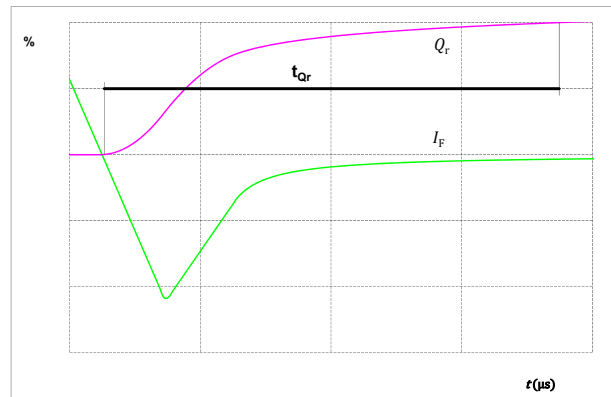


figure 31.

FWD

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






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# V23990-P849-C49-PM

datasheet

Ordering Code	
Version	Ordering Code
Without thermal paste	V23990-P849-C49-PM
With thermal paste (5,2 W/mK, PTM6000HV)	V23990-P849-C49-/7/-PM
With thermal paste (3,4 W/mK, PSX-P7)	V23990-P849-C49-/3/-PM

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

## Outline

Pin table [mm]

Pin	X	Y	Function
1	25,5	2,7	NTC1
2	25,5	0	NTC2
3	22,8	0	-DC
4	not assembled		
5	not assembled		
6	13,5	0	G6
7	10,8	0	E6
8	8,1	0	G5
9	5,4	0	E5
10	2,7	0	G4
11	0	0	E4
12	0	19,8	G1
13	0	22,5	U
14	7,5	19,8	G2
15	7,5	22,5	V
16	15	19,8	G3
17	15	22,5	W
18	22,8	22,5	+INV
19	25,5	22,5	+DC
20	not assembled		
21	33,5	15	L1
22	33,5	7,5	L2
23	33,5	0	L3

3D perspective view of the component showing pins and dimensions. The dimension 1 ±0.05 is indicated for the pin height, and 213 ±0.5 is indicated for the overall height of the component.

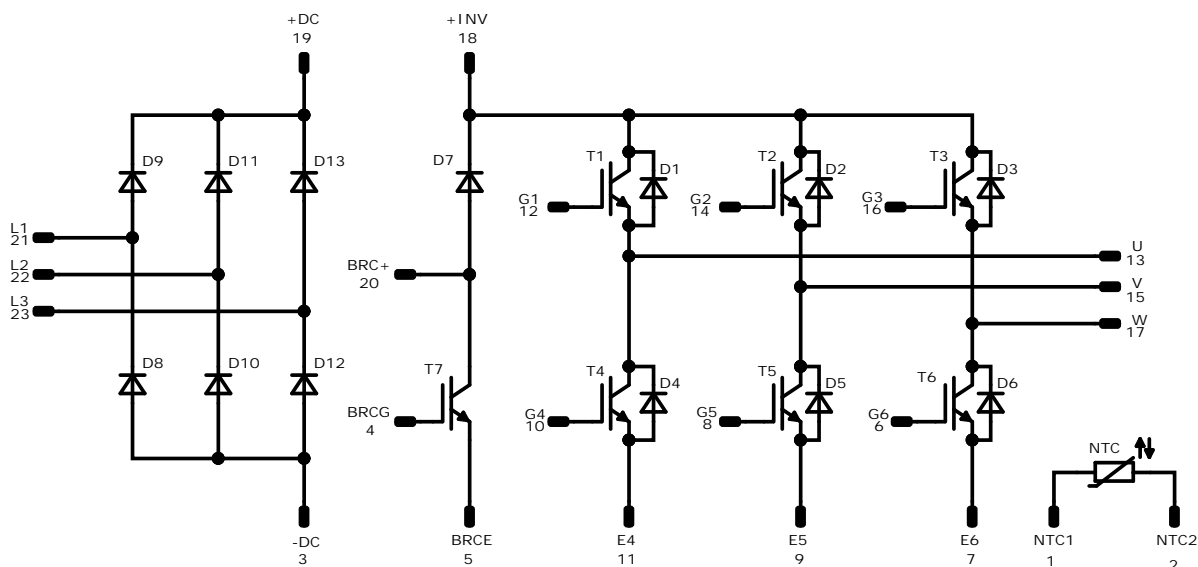
Top view of the component showing pin layout, dimensions, and coordinate axes. The dimension 16.75 is indicated for the width of the component, and 11.25 is indicated for the height of the component. The coordinate axes X and Y are shown, with X pointing to the right and Y pointing upwards.

Tolerance of pinpositions: ±0.5mm at the end of pins  
Dimension of coordinate axis is only offset without tolerance



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Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T4, T1, T5, T2, T6, T3	IGBT	1200 V	8 A	Inverter Switch	
D1, D4, D2, D5, D3, D6	FWD	1200 V	10 A	Inverter Diode	
D8, D9, D10, D11, D12, D13	Rectifier	1600 V	25 A	Rectifier Diode	
NTC	Thermistor			Thermistor	



Vincotech

**V23990-P849-C49-PM**  
datasheet

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-P849-C49-PM-D9-14	30 Sep. 2021	New Datasheet format, module is unchanged Correct Static values of Inverter Diode, Rectifier Diode Separate datasheet	

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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.