



Vincotech

# 10-FZ074PA050RG-L624F88

datasheet

fastPACK 0

650 V / 50 A

## Features

- High speed H-Bridge
- High efficiency IGBT RGW
- Full current fast FWD
- Integrated capacitors
- Thermistor

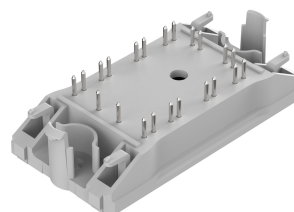
## Target applications

- Power Supply

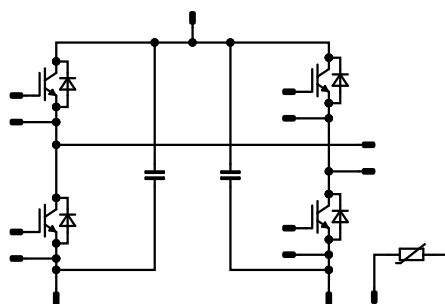
## Types

- 10-FZ074PA050RG-L624F88

## flow 0 12 mm housing



## Schematic





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## Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
<b>H-Bridge Switch</b>				
Collector-emitter voltage	$V_{CES}$		650	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	46	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	200	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	77	W
Gate-emitter voltage	$V_{GES}$		±30	V
Maximum junction temperature	$T_{jmax}$		175	°C

## H-Bridge Diode

Peak repetitive reverse voltage	$V_{RRM}$		650	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	42	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	200	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	$V_{MAX}$		630	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* $t_p = 2\text{ s}$	6000	V
Isolation voltage	$V_{isol}$	AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			>12,7	mm
Clearance			9,55	mm
Comparative Tracking Index	CTI		≥ 200	

\*100 % tested in production



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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 Switch

#### Static

Gate-emitter threshold voltage	$V_{GE(th)}$			5	0,033	25	5	6	7	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		50	25 125 150		1,5 1,66 1,7	1,9 <sup>(1)</sup>	V
Collector-emitter cut-off current	$I_{CES}$		0	650		25			0,01	mA
Gate-emitter leakage current	$I_{GES}$		30	0		25			0,2	μA
Internal gate resistance	$r_g$							None		Ω
Input capacitance	$C_{ies}$	$f = 1 \text{ Mhz}$	0	30	25			4200		pF
Output capacitance	$C_{oes}$							104		pF
Reverse transfer capacitance	$C_{res}$							79		pF
Gate charge	$Q_g$		15	400	50	25		141		nC

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						1,23		K/W
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#### Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 8 \Omega$ $R_{goff} = 8 \Omega$	-5/15	350	50	25 125 150		41,36 40,06 39,39		ns
Rise time	$t_r$					25 125 150		13,52 14,64 15,21		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		99,76 112,37 116,32		ns
Fall time	$t_f$					25 125 150		32,77 42,86 47,81		ns
Turn-on energy (per pulse)	$E_{on}$	$Q_{tFWD}=1,27 \mu\text{C}$ $Q_{tFWD}=2,23 \mu\text{C}$ $Q_{tFWD}=2,64 \mu\text{C}$				25 125 150		0,433 0,581 0,616		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		0,729 0,984 1,06		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	$V_F$				50	25 125 150		1,51 1,57 1,54	1,9 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_i = 650$ V				25			10	µA

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,55		K/W
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#### Dynamic

Peak recovery current	$I_{RRM}$	$di/dt=4080$ A/µs $di/dt=3911$ A/µs $di/dt=3781$ A/µs	-5/15	350	50	25 125 150		65,21 75,29 79,28		A
Reverse recovery time	$t_{rr}$					25 125 150		36,82 81,55 91,29		ns
Recovered charge	$Q_r$					25 125 150		1,27 2,23 2,64		µC
Reverse recovered energy	$E_{rec}$					25 125 150		0,288 0,544 0,682		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		4416,77 4195,59 3964,85		A/µs



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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	

### Capacitor (DC)

#### Static

Capacitance	$C$	DC bias voltage = 0 V				25		33		nF
Tolerance							-10		10	%
Dissipation factor		$f = 1$ kHz				25		0,1		%

### Thermistor

#### Static

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

(1) Value at chip level

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



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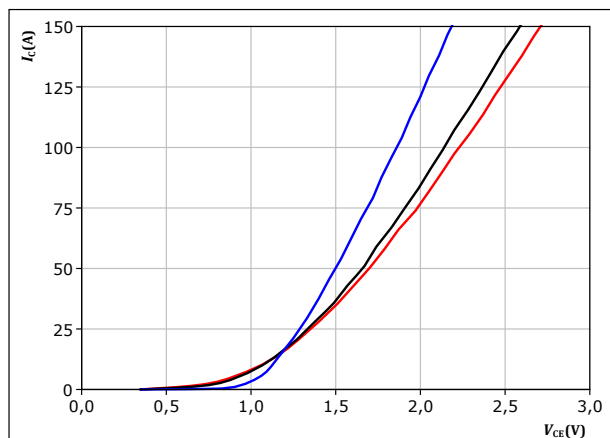
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## H-Bridge Switch Characteristics

figure 1. IGBT

Typical output characteristics

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



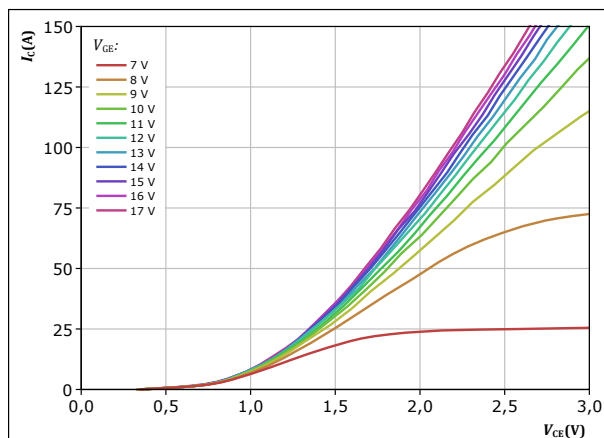
$t_p = 250 \mu s$   
 $V_{GE} = 15 V$

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

figure 2. IGBT

Typical output characteristics

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

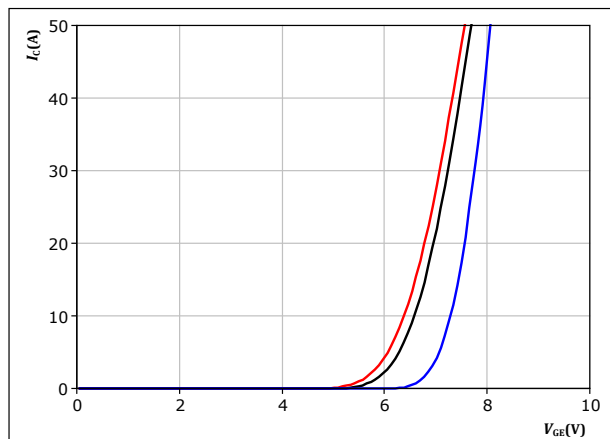


$t_p = 250 \mu s$   
 $T_j = 150 ^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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



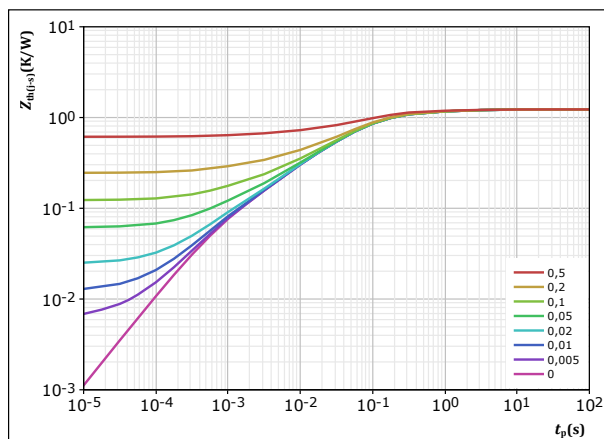
$t_p = 250 \mu s$   
 $V_{CE} = 10 V$

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

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 1,228 K/W$   
IGBT thermal model values  

$R (K/W)$	$\tau (s)$
5,07E-02	3,25E+00
1,43E-01	5,26E-01
5,97E-01	9,03E-02
2,58E-01	2,71E-02
1,27E-01	5,65E-03
5,33E-02	7,25E-04



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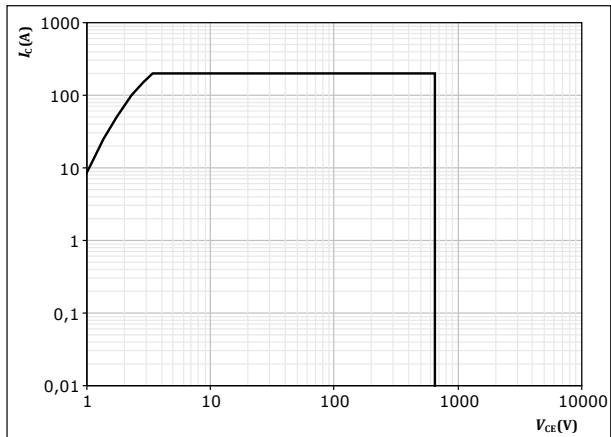
## H-Bridge Switch Characteristics

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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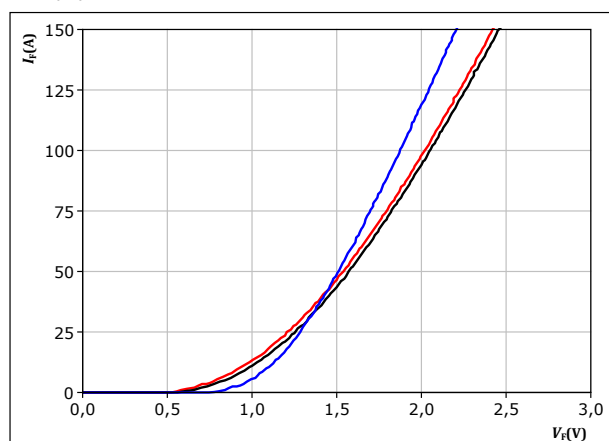
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## H-Bridge Diode Characteristics

**figure 6.** FWD

Typical forward characteristics

$$I_F = f(V_F)$$



$t_p = 250 \mu s$

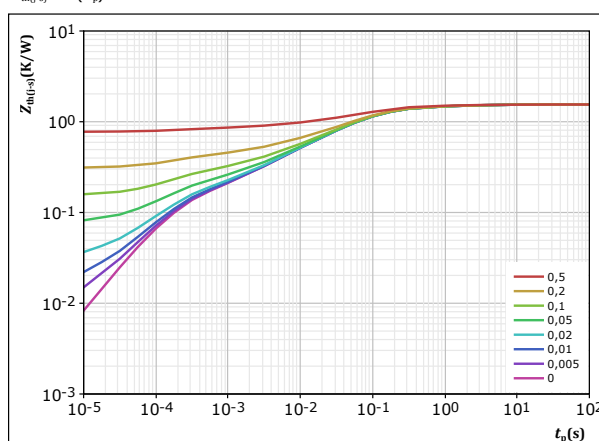
$T_j$ :

- 25 °C
- 125 °C
- 150 °C

**figure 7.** FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)} = 1,548 \text{ K/W}$

FWD thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
4,44E-02	5,26E+00
1,14E-01	8,12E-01
4,83E-01	1,25E-01
4,67E-01	4,08E-02
2,41E-01	7,57E-03
7,79E-02	1,14E-03
1,22E-01	1,66E-04





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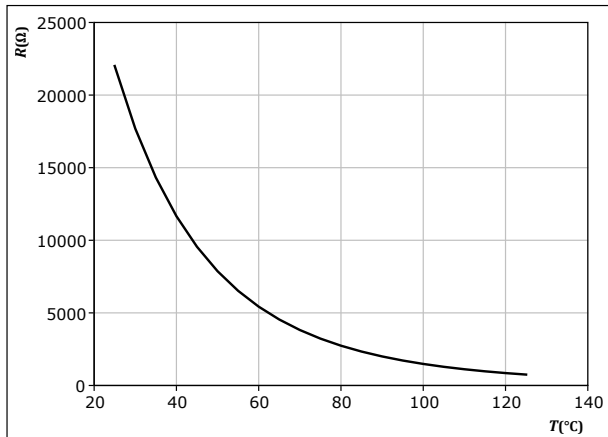
## Thermistor Characteristics

figure 8.

Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$





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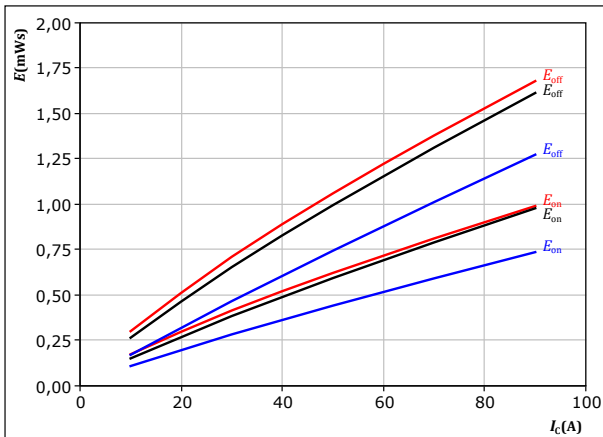
## H-Bridge Switching Characteristics

figure 9.

IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$



With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = -5/15$  V  
 $R_{gon} = 8$   $\Omega$   
 $R_{goff} = 8$   $\Omega$

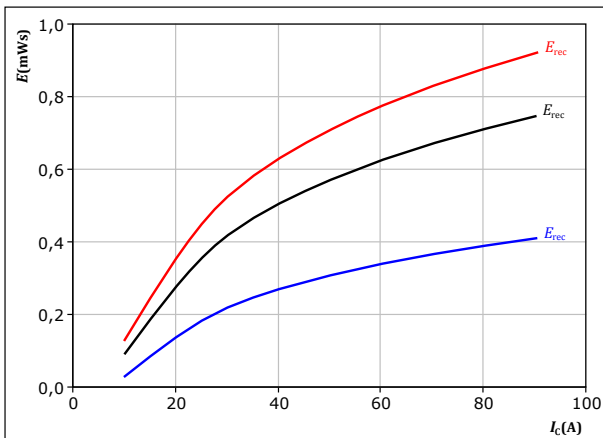
$T_j$ : 25 °C  
125 °C  
150 °C

figure 11.

FWD

Typical reverse recovered energy loss as a function of collector current

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



With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = -5/15$  V  
 $R_{gon} = 8$   $\Omega$

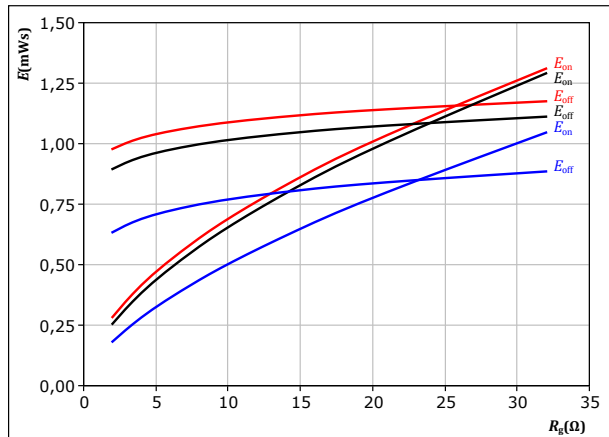
$T_j$ : 25 °C  
125 °C  
150 °C

figure 10.

IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$



With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = -5/15$  V  
 $I_C = 50$  A

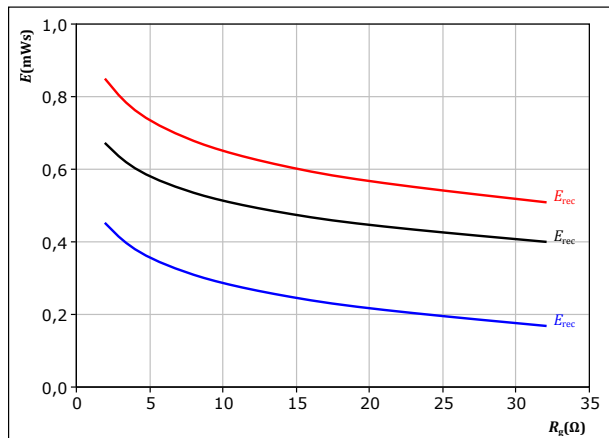
$T_j$ : 25 °C  
125 °C  
150 °C

figure 12.

FWD

Typical reverse recovered energy loss as a function of gate resistor

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



With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = -5/15$  V  
 $I_C = 50$  A

$T_j$ : 25 °C  
125 °C  
150 °C



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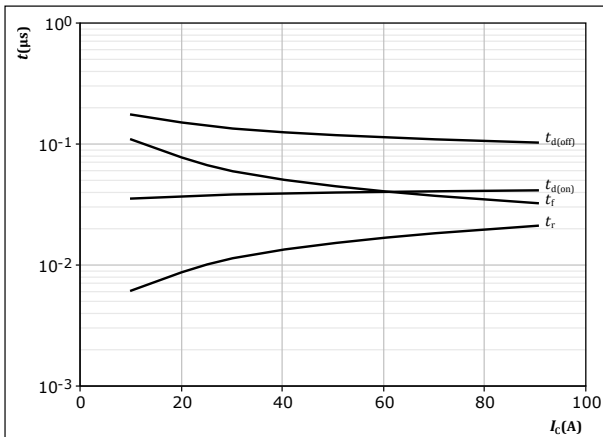
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## H-Bridge Switching Characteristics

figure 13.

IGBT

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



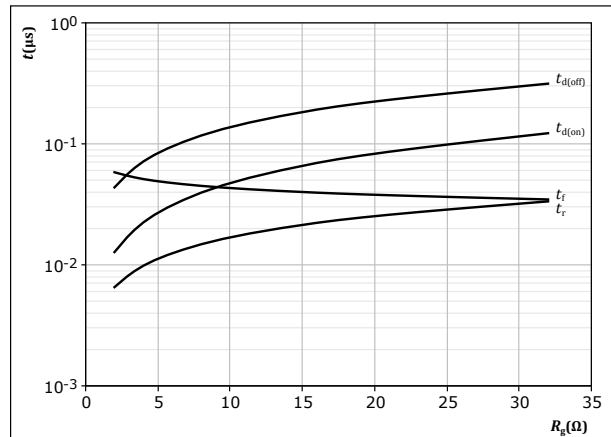
With an inductive load at

$T_j = 150$  °C  
 $V_{CE} = 350$  V  
 $V_{GE} = -5/15$  V  
 $R_{gon} = 8$  Ω  
 $R_{goff} = 8$  Ω

figure 14.

IGBT

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



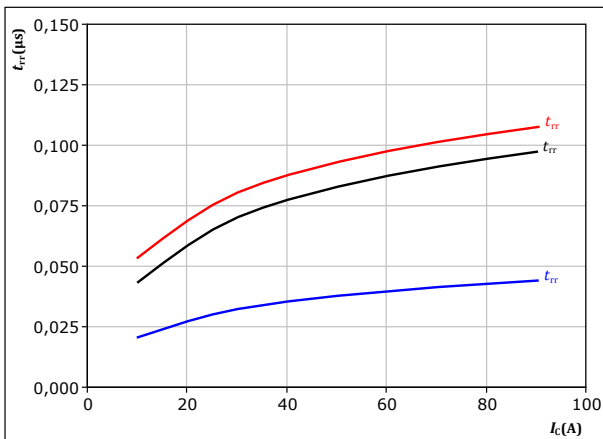
With an inductive load at

$T_j = 150$  °C  
 $V_{CE} = 350$  V  
 $V_{GE} = -5/15$  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

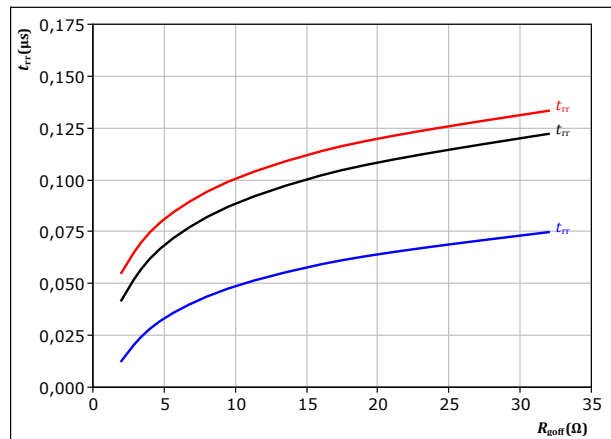
$V_{CE} = 350$  V  
 $V_{GE} = -5/15$  V  
 $R_{gon} = 8$  Ω

$T_j$ : — 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

$V_{CE} = 350$  V  
 $V_{GE} = -5/15$  V  
 $I_C = 50$  A

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C



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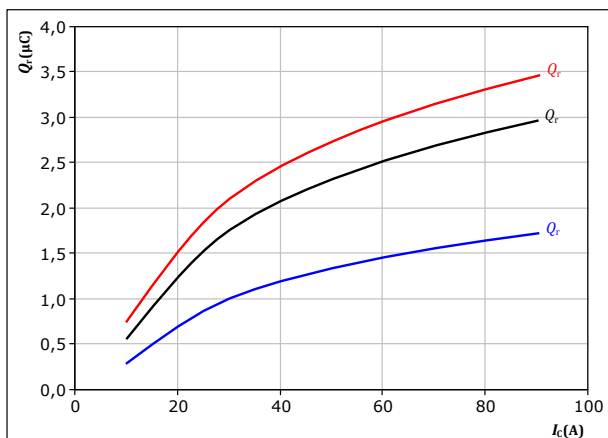
## H-Bridge Switching Characteristics

figure 17.

FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

$$\begin{aligned} V_{CE} &= 350 \text{ V} \\ V_{GE} &= -5/15 \text{ V} \\ R_{gon} &= 8 \text{ } \Omega \end{aligned}$$

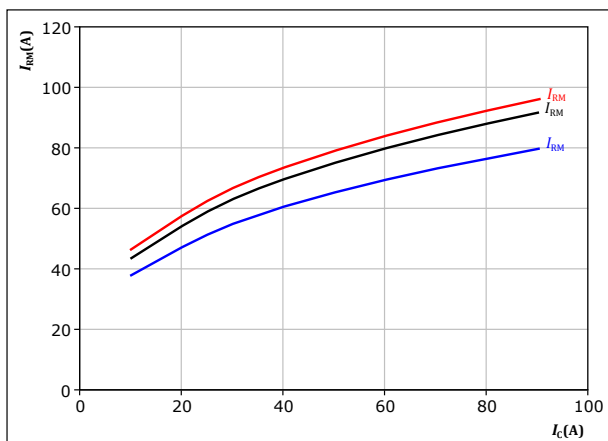
$$T_j: \begin{aligned} &\text{— } 25 \text{ } ^\circ\text{C} \\ &\text{— } 125 \text{ } ^\circ\text{C} \\ &\text{— } 150 \text{ } ^\circ\text{C} \end{aligned}$$

figure 19.

FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

$$\begin{aligned} V_{CE} &= 350 \text{ V} \\ V_{GE} &= -5/15 \text{ V} \\ R_{gon} &= 8 \text{ } \Omega \end{aligned}$$

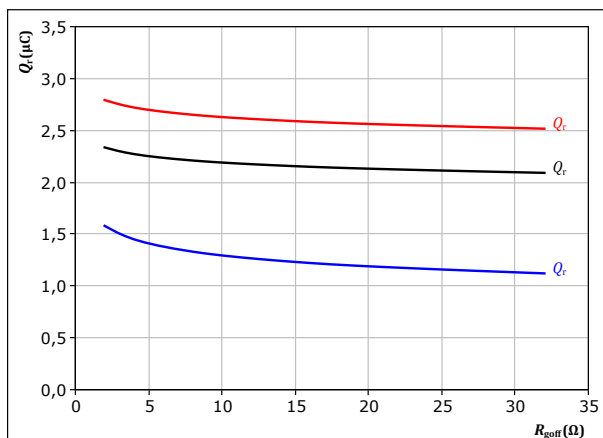
$$T_j: \begin{aligned} &\text{— } 25 \text{ } ^\circ\text{C} \\ &\text{— } 125 \text{ } ^\circ\text{C} \\ &\text{— } 150 \text{ } ^\circ\text{C} \end{aligned}$$

figure 18.

FWD

Typical recovered charge as a function of turn off gate resistor

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



With an inductive load at

$$\begin{aligned} V_{CE} &= 350 \text{ V} \\ V_{GE} &= -5/15 \text{ V} \\ I_c &= 50 \text{ A} \end{aligned}$$

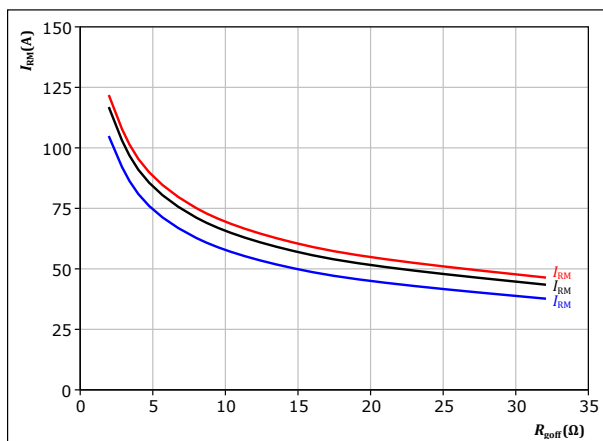
$$T_j: \begin{aligned} &\text{— } 25 \text{ } ^\circ\text{C} \\ &\text{— } 125 \text{ } ^\circ\text{C} \\ &\text{— } 150 \text{ } ^\circ\text{C} \end{aligned}$$

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

$$\begin{aligned} V_{CE} &= 350 \text{ V} \\ V_{GE} &= -5/15 \text{ V} \\ I_c &= 50 \text{ A} \end{aligned}$$

$$T_j: \begin{aligned} &\text{— } 25 \text{ } ^\circ\text{C} \\ &\text{— } 125 \text{ } ^\circ\text{C} \\ &\text{— } 150 \text{ } ^\circ\text{C} \end{aligned}$$



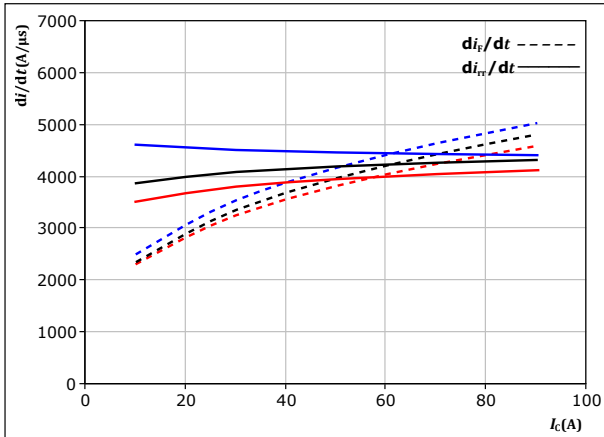
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## H-Bridge Switching Characteristics

**figure 21.** FWD

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



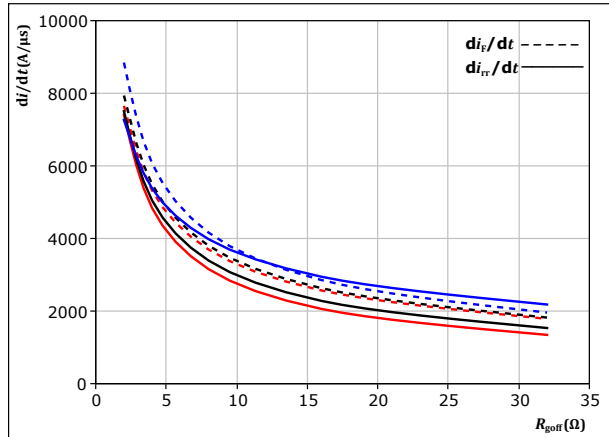
With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = -5/15$  V  
 $R_{goff} = 8$   $\Omega$

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

**figure 22.** FWD

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



With an inductive load at

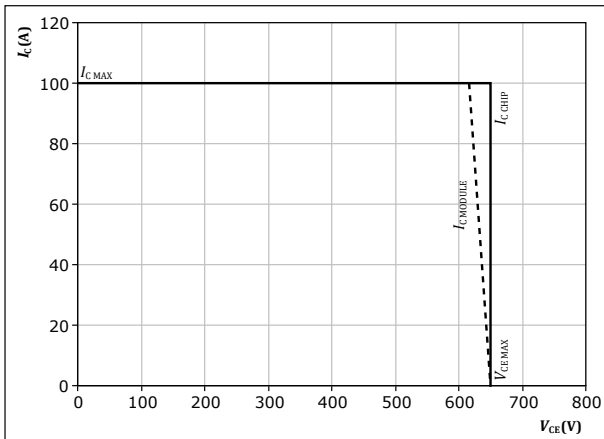
$V_{CE} = 350$  V  
 $V_{GE} = -5/15$  V  
 $I_C = 50$  A

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

**figure 23.** IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



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



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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  $E_{off}$ )

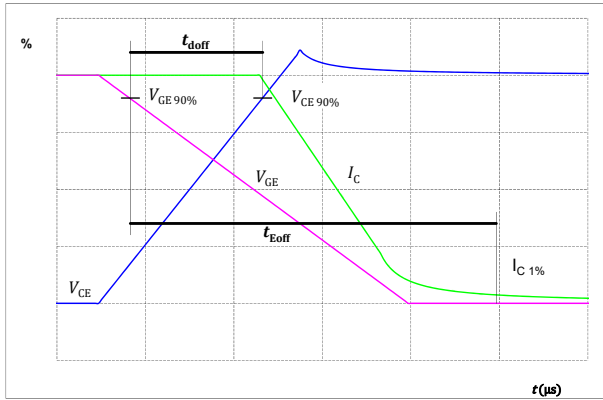


figure 25. IGBT

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

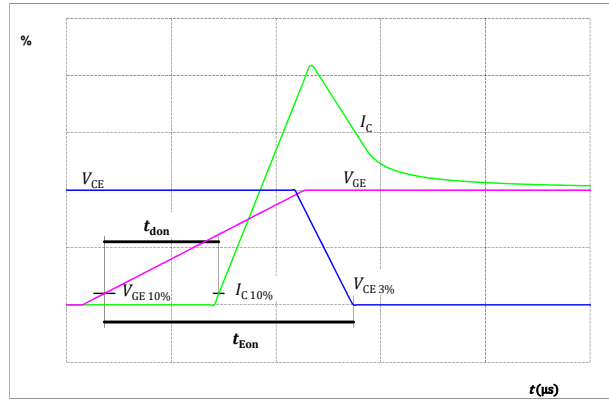


figure 26. IGBT

Turn-off Switching Waveforms & definition of  $t_f$

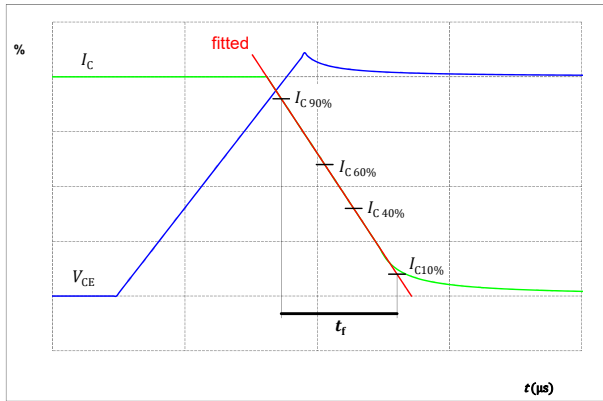
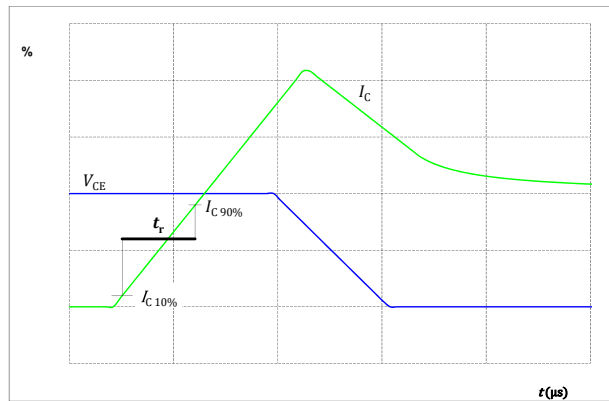


figure 27. IGBT

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  $t_{rr}$

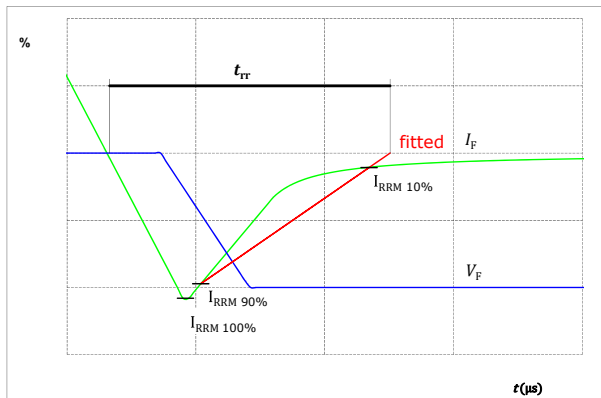
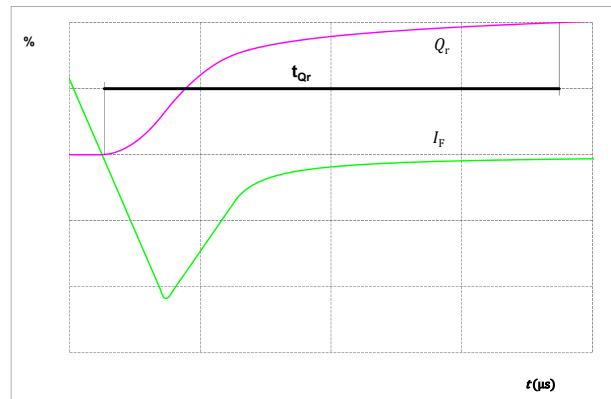


figure 29.

FWD

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






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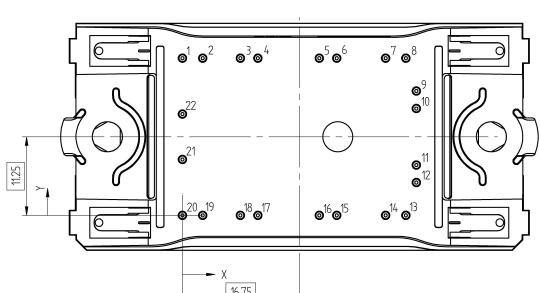
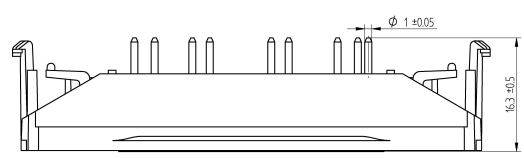
# 10-FZ074PA050RG-L624F88

datasheet

Ordering Code	
Version	Ordering Code
Without thermal paste	10-FZ074PA050RG-L624F88
With thermal paste (5,2 W/mK, PTM6000HV)	10-FZ074PA050RG-L624F88-/7/
With thermal paste (3,4 W/mK, PSX-P7)	10-FZ074PA050RG-L624F88-/3/

Marking						
	Text	Name	Date code	UL & VIN	Lot	Serial
		NN-NNNNNNNNNNNNNN- TTTTTVV	WWYY	UL VIN	LLLLL	SSSS
Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTVV	LLLLL	SSSS	WWYY		

Outline				
Pin table [mm]				
Pin	X	Y	Function	
1	0	22,5	G11	
2	2,9	22,5	S11	
3	8,3	22,5	DC-1	
4	10,8	22,5	DC-1	
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	Ph1	
10	33,5	15,3	Ph1	
11	33,5	7,2	Ph2	
12	33,5	4,7	Ph2	
13	32	0	G14	
14	29,1	0	S14	
15	22,1	0	DC+	
16	19,6	0	DC+	
17	10,8	0	DC-2	
18	8,3	0	DC-2	
19	2,9	0	S13	
20	0	0	G13	
21	0	8	Therm1	
22	0	14,5	Therm2	



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

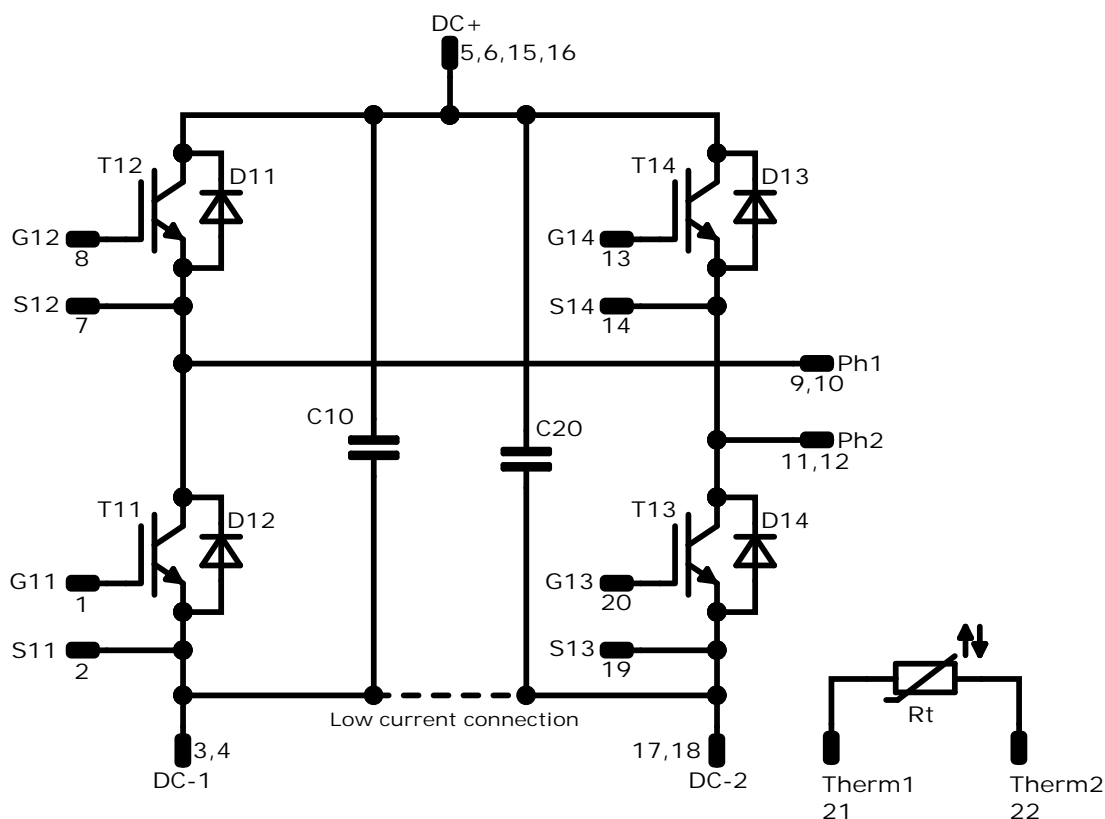




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**10-FZ074PA050RG-L624F88**  
datasheet

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	50 A	H-Bridge Diode	
C10, C20	Capacitor	630 V		Capacitor (DC)	
Rt	NTC			Thermistor	



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**10-FZ074PA050RG-L624F88**  
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
10-FZ074PA050RG-L624F88-D1-14	15 Dec. 2021	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.