



Vincotech

# 10-FZ122PB050SC02-M817F08

datasheet

flowPHASE 0 + NTC

1200 V / 50 A

## Features

- High efficiency IGBT
- Full current FWD
- Thermistor

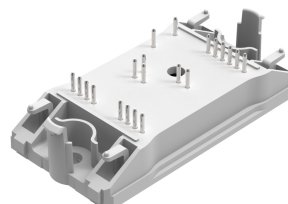
## Target applications

- Industrial Drives
- Power Supply
- Solar
- UPS
- Welding & Cutting

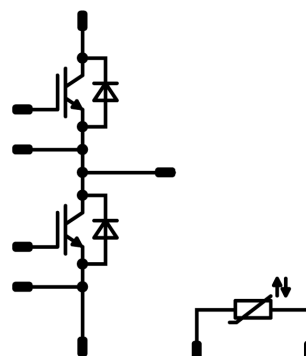
## Types

- 10-FZ122PB050SC02-M817F08

## 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>Half-Bridge Switch</b>				
Collector-emitter voltage	$V_{CES}$		1200	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	56	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	150	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	144	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	$\mu s$
Maximum junction temperature	$T_{jmax}$		175	°C

## Half-Bridge Diode

Peak repetitive reverse voltage	$V_{RRM}$		1200	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	53	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	100	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	90	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			9,12	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	

### Half-Bridge Switch

#### Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0017	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	$V_{CEsat}$		15		50	25 150	1,58	1,93 2,34	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	$r_g$							4		Ω
Input capacitance	$C_{ies}$	$f = 1 \text{ Mhz}$	0	25	25			2800		pF
Reverse transfer capacitance	$C_{res}$							100		pF
Gate charge	$Q_g$		15		0	25		380		nC

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						0,66		K/W
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#### Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 8 \Omega$ $R_{goff} = 8 \Omega$	$\pm 15$	600	50	25 150		96,2 100,8		ns
Rise time	$t_r$					25 150		17,2 23,6		ns
Turn-off delay time	$t_{d(off)}$					25 150		214 281,4		ns
Fall time	$t_f$					25 150		86,48 121,84		ns
Turn-on energy (per pulse)	$E_{on}$					25 150		2,7 4,21		mWs
Turn-off energy (per pulse)	$E_{off}$					25 150		2,74 4,53		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	

### Half-Bridge Diode

#### Static

Forward voltage	$V_F$			50	25 125 150		1,35	1,73 1,7 1,68	2,05 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_i = 1200$ V			25				10	μA

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,06		K/W
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#### Dynamic

Peak recovery current	$I_{RRM}$	$di/dt=3866$ A/μs $di/dt=2820$ A/μs	±15	600	50	25 150		81,08 84,75		A
Reverse recovery time	$t_{rr}$					25 150		139,07 315,77		ns
Recovered charge	$Q_r$					25 150		4,8 9,71		μC
Reverse recovered energy	$E_{rec}$					25 150		1,79 3,97		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 150		4803 1209		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	

### 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	

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

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



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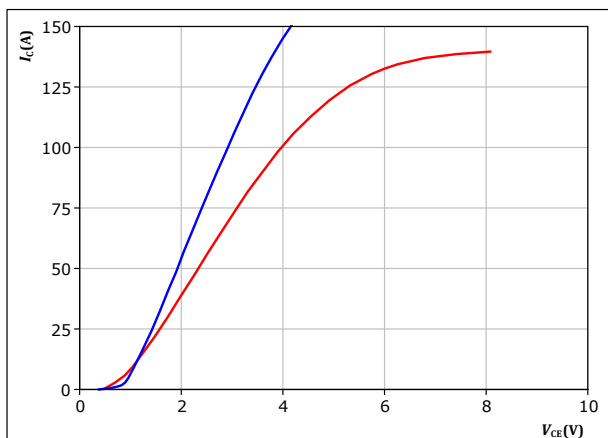
datasheet

## Half-Bridge Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

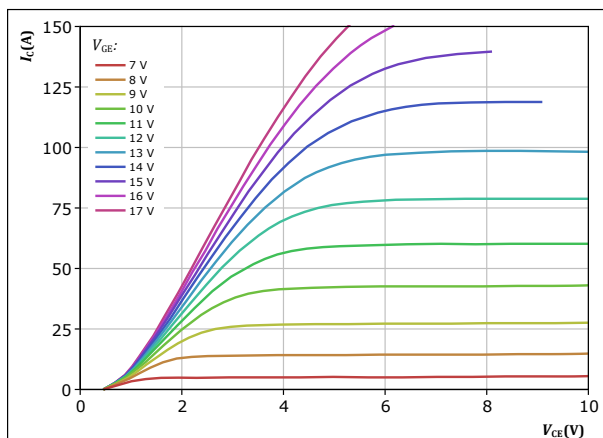


$t_p = 250 \mu s$   
 $V_{GE} = 15 V$   
 $T_J: 25 ^\circ C$   
 $150 ^\circ C$

figure 2. IGBT

Typical output characteristics

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

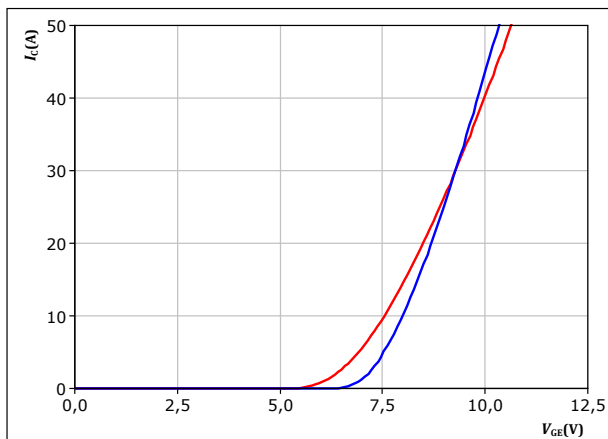


$t_p = 250 \mu s$   
 $T_J = 150 ^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

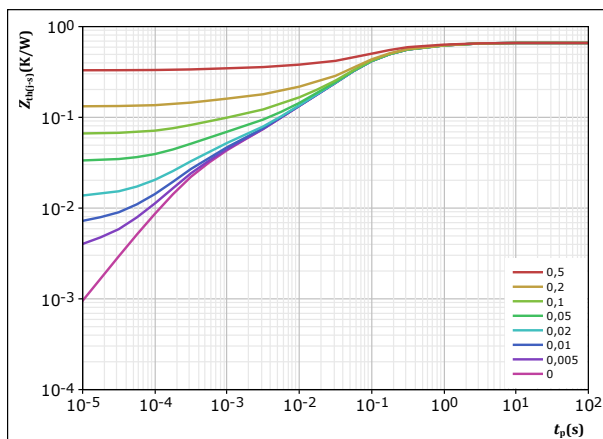


$t_p = 250 \mu s$   
 $V_{CE} = 10 V$   
 $T_J: 25 ^\circ C$   
 $150 ^\circ C$

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,66 K/W$   
IGBT thermal model values  

$R (K/W)$	$\tau (s)$
8,54E-02	1,27E+00
1,79E-01	1,86E-01
3,14E-01	6,03E-02
5,28E-02	4,65E-03
2,90E-02	3,68E-04



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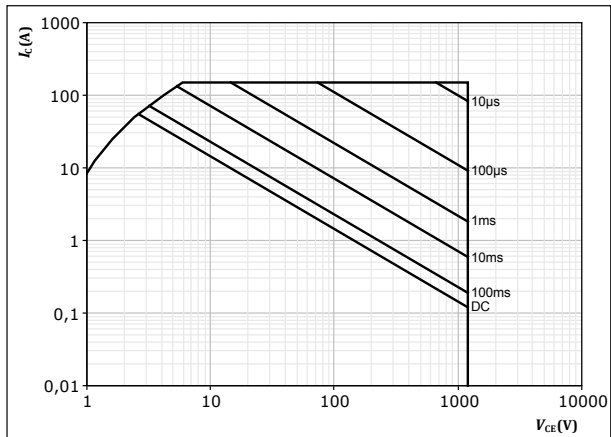
**10-FZ122PB050SC02-M817F08**  
datasheet

## Half-Bridge Switch Characteristics

**figure 5.** IGBT

Safe operating area

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



$D$  = single pulse

$T_s = 80$  °C

$V_{GE} = 15$  V

$T_j = T_{jmax}$



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## Half-Bridge Diode Characteristics

figure 6.

FWD

Typical forward characteristics

$$I_F = f(V_F)$$

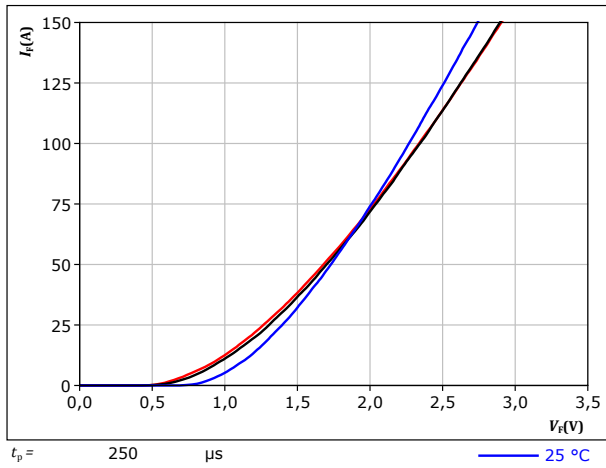
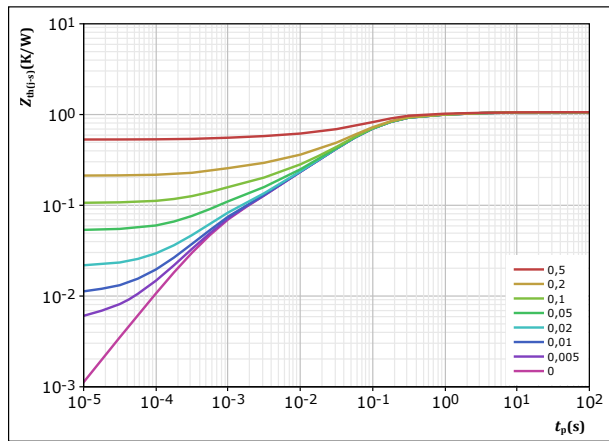


figure 7.

FWD

Transient thermal impedance as a function of pulse width

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



$D =$	$t_p / T$	
$R_{th(j-s)} =$	1,061	K/W
FWD thermal model values		
$R$ (K/W)	$\tau$ (s)	
4,19E-02	4,68E+00	
8,50E-02	8,80E-01	
4,99E-01	1,21E-01	
2,83E-01	4,12E-02	
9,28E-02	6,53E-03	
5,92E-02	6,76E-04	





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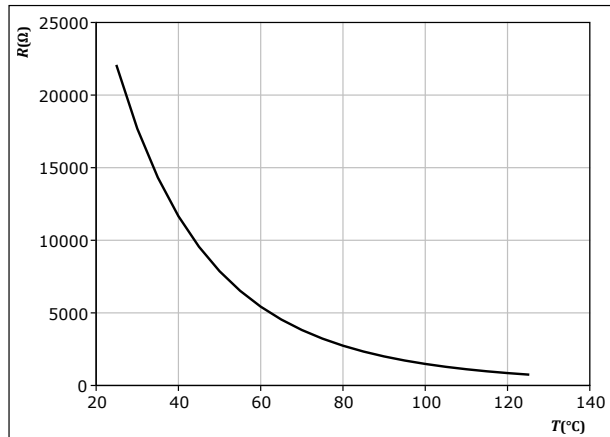
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## Thermistor Characteristics

**figure 8.** Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$





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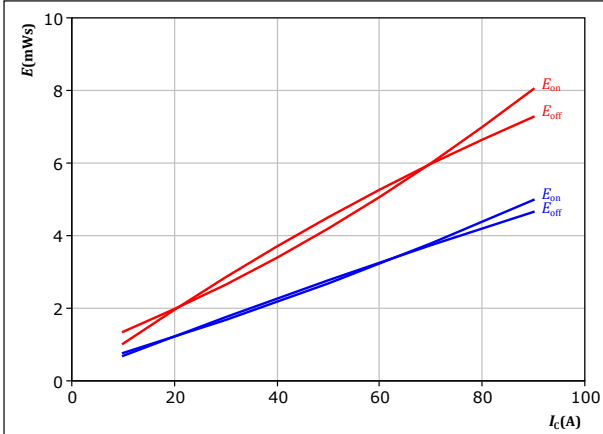
## Half-Bridge Switching Characteristics

figure 9.

IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$



With an inductive load at

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

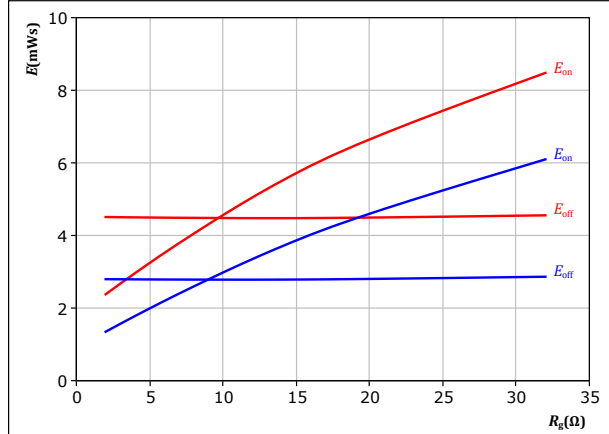
$T_j$ : — 25 °C  
— 150 °C

figure 10.

IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_C = 50 \text{ A}$

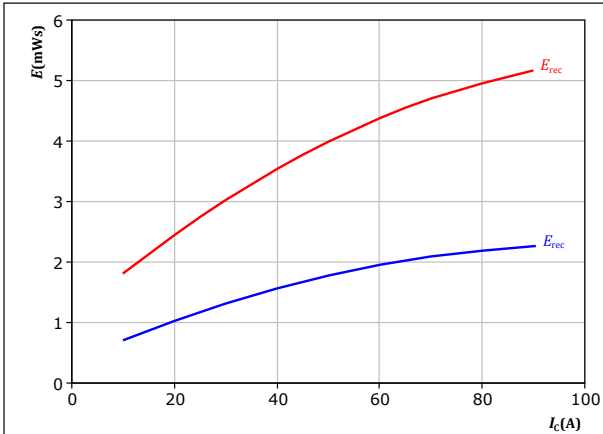
$T_j$ : — 25 °C  
— 150 °C

figure 11.

FWD

Typical reverse recovered energy loss as a function of collector current

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



With an inductive load at

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

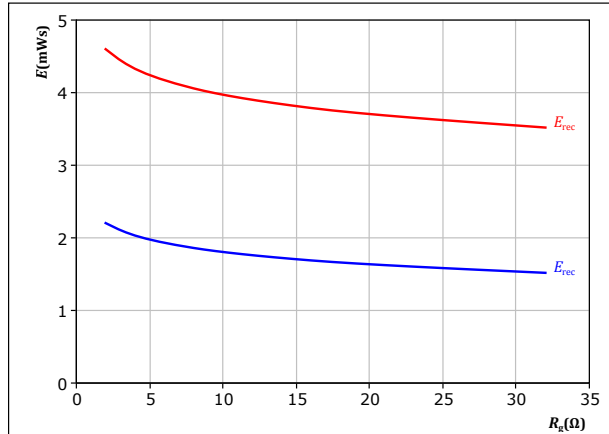
$T_j$ : — 25 °C  
— 150 °C

figure 12.

FWD

Typical reverse recovered energy loss as a function of gate resistor

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



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_C = 50 \text{ A}$

$T_j$ : — 25 °C  
— 150 °C



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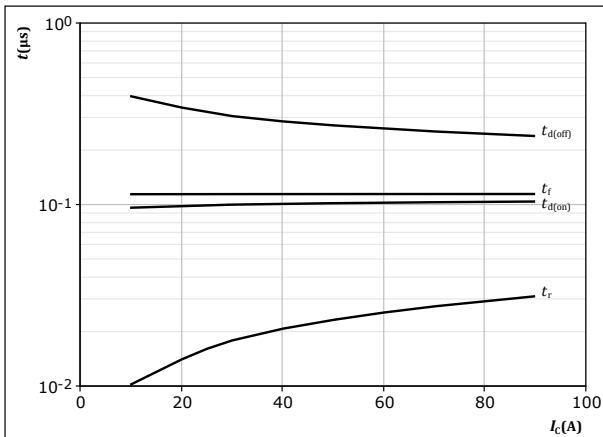
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datasheet

## Half-Bridge Switching Characteristics

figure 13.

IGBT

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



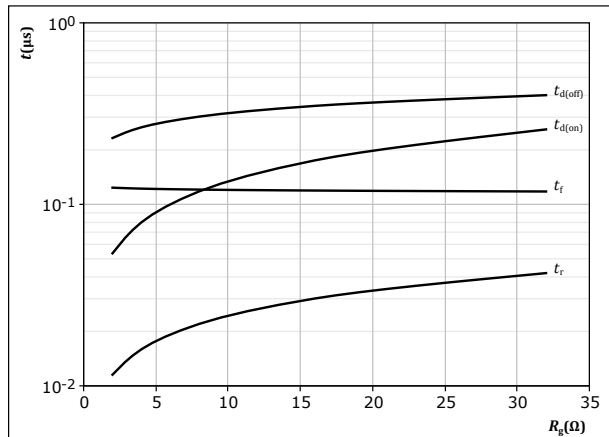
With an inductive load at

$T_j = 150$  °C  
 $V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$   $\Omega$   
 $R_{goff} = 8$   $\Omega$

figure 14.

IGBT

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



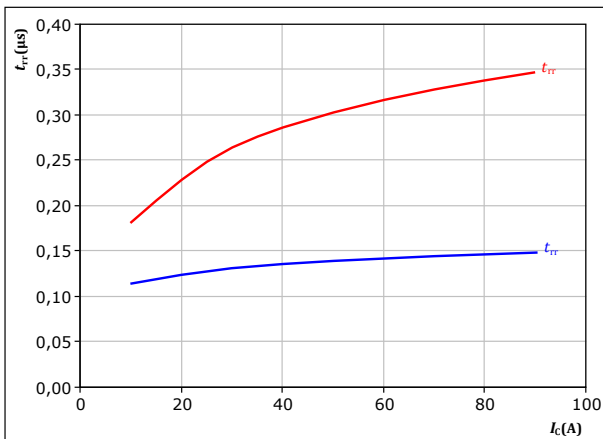
With an inductive load at

$T_j = 150$  °C  
 $V_{CE} = 600$  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

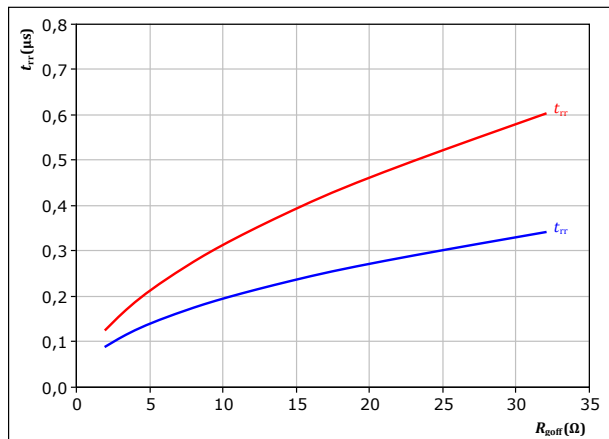
$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$   $\Omega$

$T_j$ : — 25 °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

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_C = 50$  A

$T_j$ : — 25 °C  
— 150 °C



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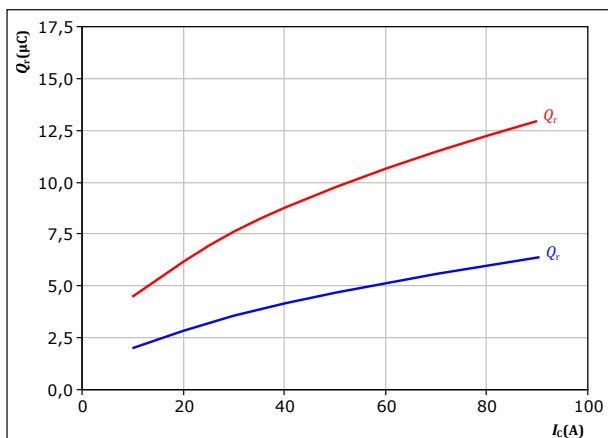
## Half-Bridge Switching Characteristics

figure 17.

FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

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

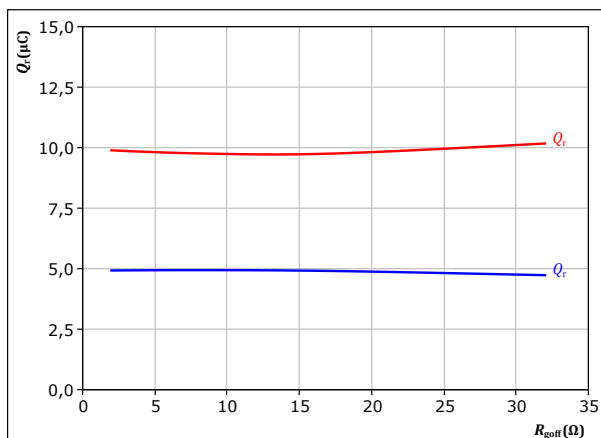
$T_j$ : — 25 °C  
— 150 °C

figure 18.

FWD

Typical recovered charge as a function of turn off gate resistor

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



With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 50$  A

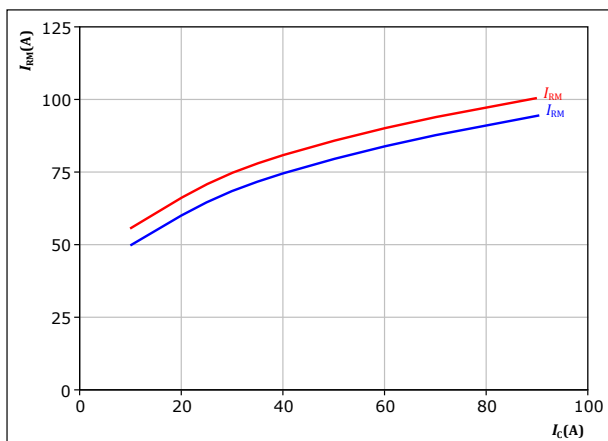
$T_j$ : — 25 °C  
— 150 °C

figure 19.

FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

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

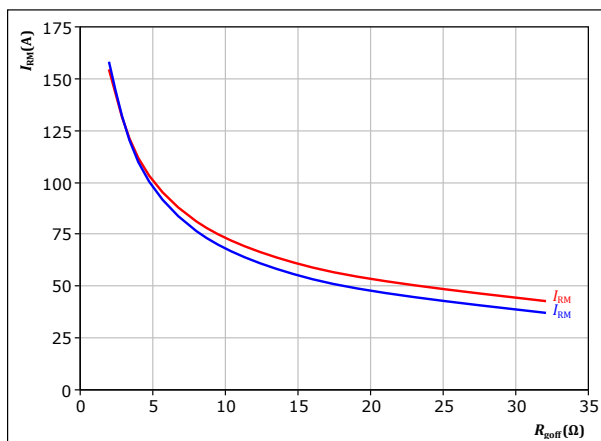
$T_j$ : — 25 °C  
— 150 °C

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

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 50$  A

$T_j$ : — 25 °C  
— 150 °C



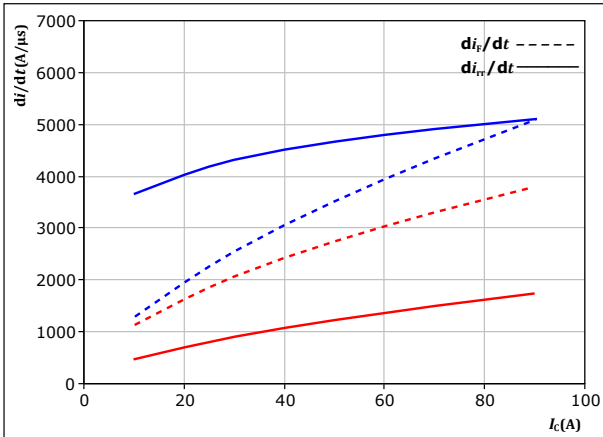
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datasheet

## Half-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

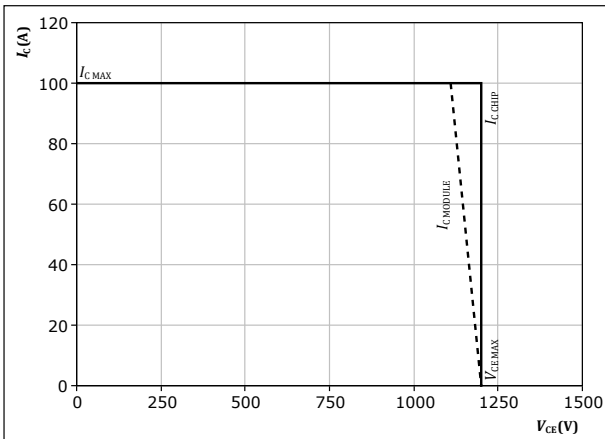
$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{goff} = 8$  Ω

$T_j$ : 25 °C  
150 °C

figure 23. IGBT

Reverse bias safe operating area

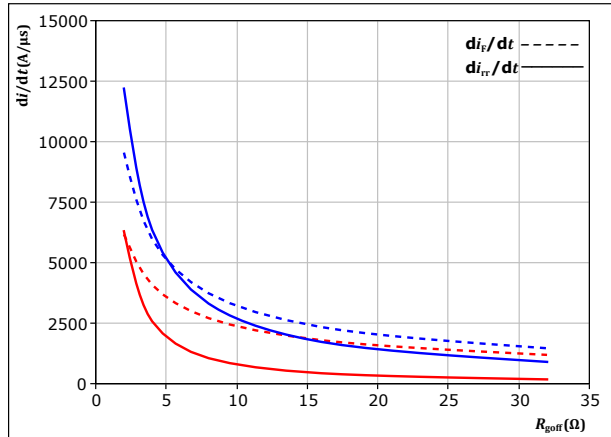
$I_C = f(V_{CE})$



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

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

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_C = 50$  A

$T_j$ : 25 °C  
150 °C



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## Half-Bridge Switching Definitions

figure 24. IGBT

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

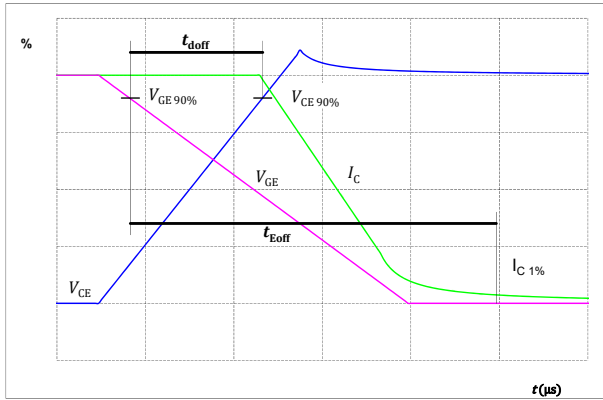


figure 25. IGBT

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

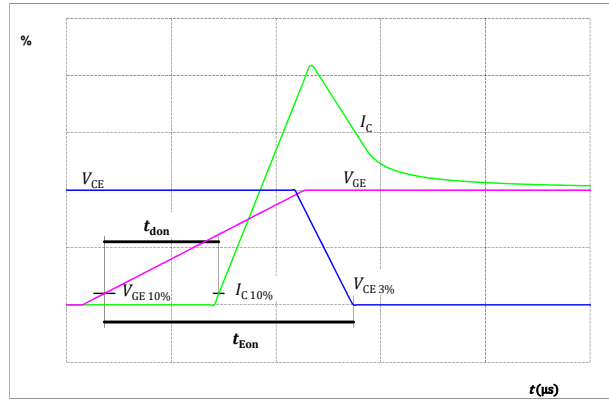


figure 26. IGBT

Turn-off Switching Waveforms & definition of  $t_f$

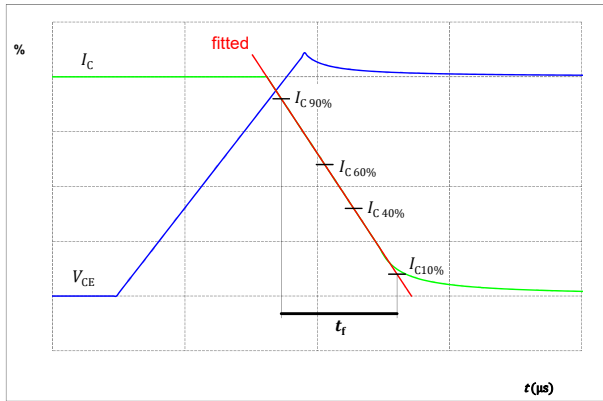
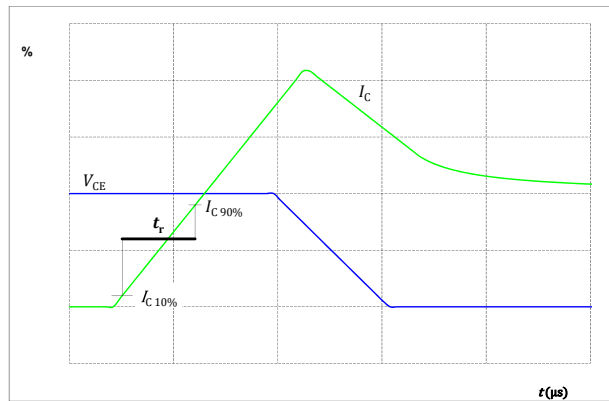


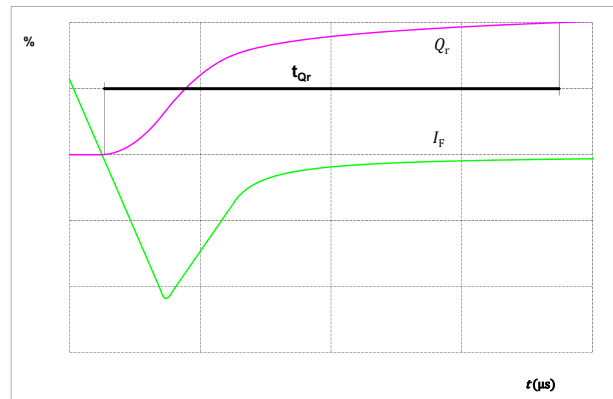
figure 27. IGBT

Turn-on Switching Waveforms & definition of  $t_r$





FWD





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# 10-FZ122PB050SC02-M817F08

datasheet

Ordering Code	
Version	Ordering Code
Without thermal paste	10-FZ122PB050SC02-M817F08
With thermal paste (5,2 W/mK, PTM6000HV)	10-FZ122PB050SC02-M817F08-/7/
With thermal paste (3,4 W/mK, PSX-P7)	10-FZ122PB050SC02-M817F08-/3/

Marking						
	Text	Name	Date code	UL & VIN	Lot	Serial
		NN-NNNNNNNNNNNNNNNN- TTTTIV	WWYY	UL VIN	LLLL	SSSS
Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTIV	LLLL	SSSS	WWYY		

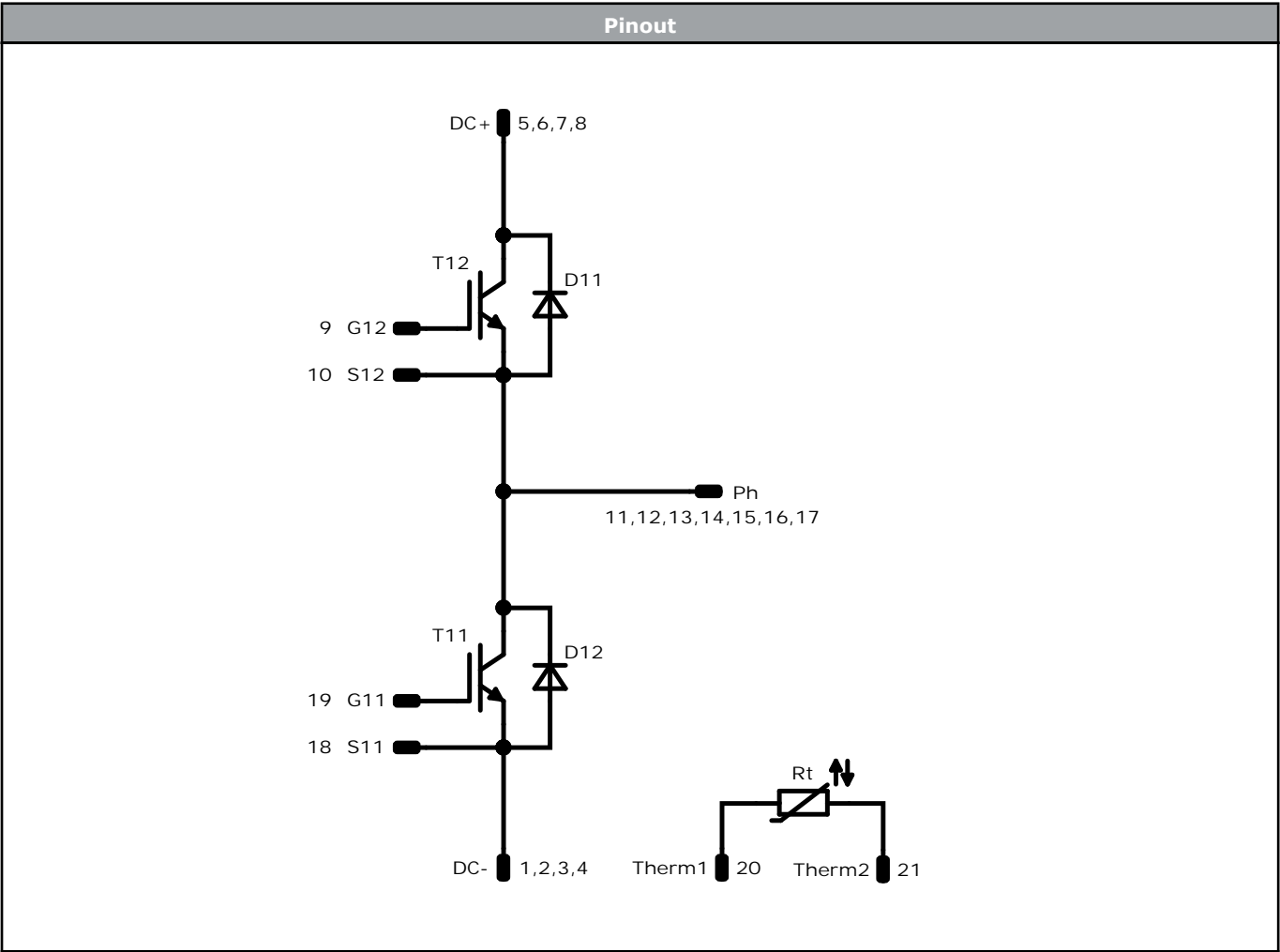
Outline			
Pin table [mm]			
Pin	X	Y	Function
1	0	0	DC-
2	0	2,3	DC-
3	0	4,6	DC-
4	0	6,9	DC-
5	0	15,6	DC+
6	0	17,9	DC+
7	0	20,2	DC+
8	0	22,5	DC+
9	13,85	16,45	G12
10	16,75	16,45	S12
11	33,5	11,5	Ph
12	33,5	9,2	Ph
13	33,5	6,9	Ph
14	33,5	4,6	Ph
15	33,5	2,3	Ph
16	33,5	0	Ph
17	13,85	13,55	Ph
18	19,55	4,95	S11
19	19,55	7,85	G11
20	33,5	22,5	Therm1
21	26,1	22,5	Therm2

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






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Identification					
ID	Component	Voltage	Current	Function	Comment
T11, T12	IGBT	1200 V	50 A	Half-Bridge Switch	
D11, D12	FWD	1200 V	50 A	Half-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
10-FZ122PB050SC02-M817F08-D2-14	7 Sep. 2021	Switch static characteristics updated New datasheet format, module is unchanged	

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