



flowPFC 0

650 V / 30 A

**Topology features**

- Current sense interface in the collector with low inductive bypass diode
- Integrated DC capacitor
- Integrated Shunt Resistor
- Single Boost PFC
- Temperature sensor

**Component features**

- High speed and smooth switching
- Low gate charge
- Very low collector emitter saturation voltage

**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
- Solder pin

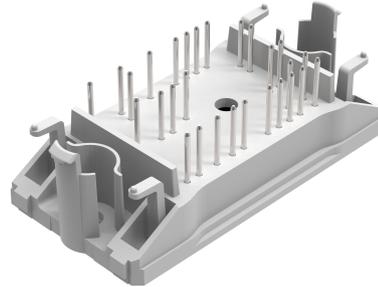
**Target applications**

- Embedded Drives
- Heat Pumps
- HVAC
- Industrial Drives

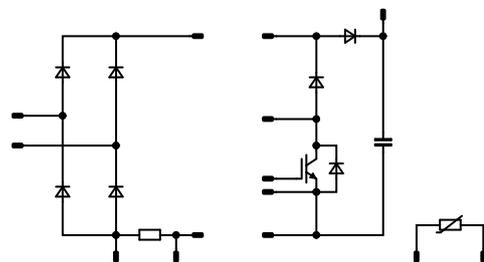
**Types**

- 10-F0070TA030S5-P982D64

**flow 0 17 mm housing**



**Schematic**





Vincotech

10-F0070TA030S5-P982D64  
datasheet

## Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
<b>PFC Switch</b>				
Collector-emitter voltage	$V_{CES}$		650	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	36	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	90	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	58	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Maximum junction temperature	$T_{jmax}$		175	°C

## PFC Diode

Peak repetitive reverse voltage	$V_{RRM}$		650	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	32	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	90	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	45	W
Maximum junction temperature	$T_{jmax}$		175	°C

## PFC Sw. Protection Diode

Peak repetitive reverse voltage	$V_{RRM}$		650	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s \leq 80\text{ °C}$	12 <sup>(1)</sup>	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	12	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	24	W
Maximum junction temperature	$T_{jmax}$		175	°C

<sup>(1)</sup> limited by  $I_{FRM}$



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## Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
<b>Current Transformer Protection Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		650	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s \leq 80\text{ °C}$	12 <sup>(2)</sup>	A
Repetitive peak forward current	$I_{FRM}$	$I_p$ limited by $T_{jmax}$	12	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	24	W
Maximum junction temperature	$T_{jmax}$		175	°C

<sup>(2)</sup> limited by  $I_{FRM}$

## Rectifier Diode

Peak repetitive reverse voltage	$V_{RRM}$		1600	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	54	A
Surge (non-repetitive) forward current	$I_{FSM}$	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	280	A
Surge current capability	$I^2t$		390	A <sup>2</sup> s
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	68	W
Maximum junction temperature	$T_{jmax}$		150	°C

## PFC Shunt

DC current	$I$		15,8	A
Power dissipation	$P_{tot}$	$T_c = 70\text{ °C}$	5	W
Operation Temperature	$T_{op}$		-55 ... 170	°C

## Capacitor (DC)

Maximum DC voltage	$V_{MAX}$		500	V
Operation Temperature	$T_{op}$		-55 ... 125	°C



### 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	$T_{stg}$		-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
Creepage distance			>12,7	mm
Clearance			>12,7	mm
Comparative Tracking Index	CTI		≥ 200	

\*100 % tested in production



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### Characteristic Values

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

#### PFC Switch

##### Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0003	25	3,2	4	4,8	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		30	25 125 150		1,35 1,45 1,47	1,75 <sup>(3)</sup>	V
Collector-emitter cut-off current	$I_{CES}$		0	650		25			50	μA
Gate-emitter leakage current	$I_{GES}$		20	0		25			100	nA
Internal gate resistance	$r_g$							None		Ω
Input capacitance	$C_{ies}$							1800		pF
Output capacitance	$C_{oes}$	$f = 1$ Mhz	0	25		25		55		pF
Reverse transfer capacitance	$C_{res}$							7		pF
Gate charge	$Q_g$	$V_{CC} = 520$ V	15		30	25		70		nC

##### Thermal

Thermal resistance junction to sink <sup>(4)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,64		K/W
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##### Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		13,56 13,39 13,23		ns
Rise time	$t_r$					25 125 150		5,22 6,51 6,86		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		73,77 91,19 95,67		ns
Fall time	$t_f$					25 125 150		12,56 27,93 31,94		ns
Turn-on energy (per pulse)	$E_{on}$	$Q_{tFWD} = 0,895$ μC $Q_{tFWD} = 1,73$ μC $Q_{tFWD} = 1,99$ μC				25 125 150		0,142 0,212 0,234		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		0,346 0,534 0,577		mWs



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10-F0070TA030S5-P982D64  
datasheet

### 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		
<b>PFC Diode</b>										
<b>Static</b>										
Forward voltage	$V_F$				30	25 125 150		1,52 1,46 1,43	1,92 <sup>(3)</sup>	V
Reverse leakage current	$I_R$	$V_r = 650$ V				25			1,6	μA
<b>Thermal</b>										
Thermal resistance junction to sink <sup>(4)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						2,09		K/W
<b>Dynamic</b>										
Peak recovery current	$I_{RM}$					25 125 150		49,04 61,35 64,86		A
Reverse recovery time	$t_{rr}$					25 125 150		39,45 62,55 68,66		ns
Recovered charge	$Q_r$	$di/dt=3528$ A/μs $di/dt=3669$ A/μs $di/dt=3662$ A/μs	0/15	400	30	25 125 150		0,895 1,73 1,99		μC
Reverse recovered energy	$E_{rec}$					25 125 150		0,3 0,58 0,666		mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$					25 125 150		2867,07 2277,92 2308,26		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		

#### PFC Sw. Protection Diode

##### Static

Forward voltage	$V_F$				6	25 125 150	1,23	1,72 1,58 1,54	1,87 <sup>(3)</sup>	V
Reverse leakage current	$I_R$	$V_r = 650$ V				25			0,1	μA

##### Thermal

Thermal resistance junction to sink <sup>(4)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						4,03		K/W
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#### Current Transformer Protection Diode

##### Static

Forward voltage	$V_F$				6	25 125 150	1,23	1,72 1,58 1,54	1,87 <sup>(3)</sup>	V
Reverse leakage current	$I_R$	$V_r = 650$ V				25			0,1	μA

##### Thermal

Thermal resistance junction to sink <sup>(4)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						4,03		K/W
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#### Rectifier Diode

##### Static

Forward voltage	$V_F$				50	25 125		1,24 1,24	1,3 <sup>(3)</sup> 1,33 <sup>(3)</sup>	V
Reverse leakage current	$I_R$	$V_r = 1600$ V				25 150			20 1500	μA

##### Thermal

Thermal resistance junction to sink <sup>(4)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,03		K/W
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### Characteristic Values

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

#### PFC Shunt

##### Static

Resistance	$R$							20		mΩ
Tolerance							-1		1	%
Temperature coefficient	tc							50		ppm/K

#### Capacitor (DC)

##### Static

Capacitance	$C$	DC bias voltage = 0 V				25		270		nF
Tolerance							-20		20	%

#### Thermistor

##### Static

Rated resistance	$R$					25		22		kΩ
Deviation of R100	$\Delta_{R/R}$	$R_{100} = 1484 \Omega$				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	

<sup>(3)</sup> Value at chip level

<sup>(4)</sup> Only valid with pre-applied Vincotech thermal interface material.

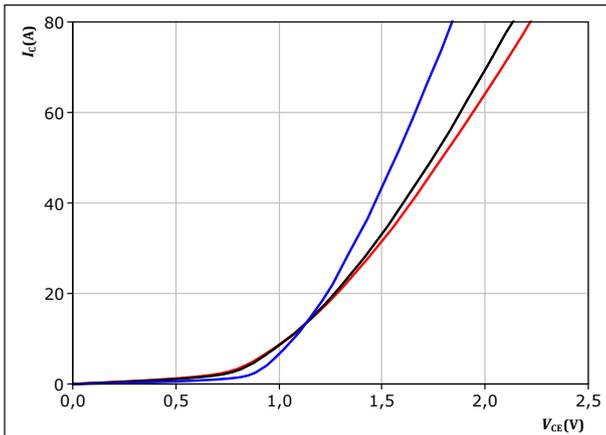


### PFC Switch Characteristics

**figure 1.** IGBT

Typical output characteristics

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

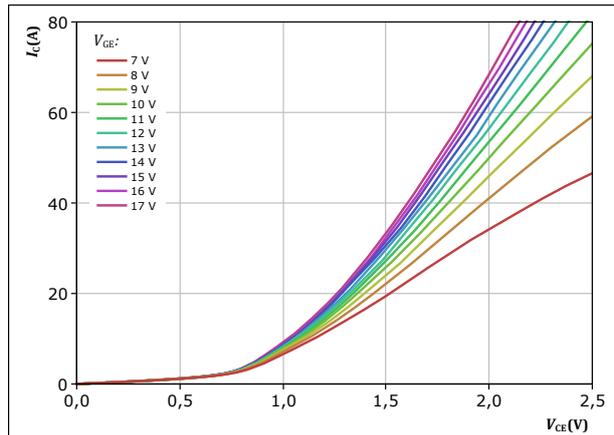


$t_p = 250 \mu s$   
 $V_{GE} = 15 V$   
 $T_j:$  25 °C, 125 °C, 150 °C

**figure 2.** IGBT

Typical output characteristics

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

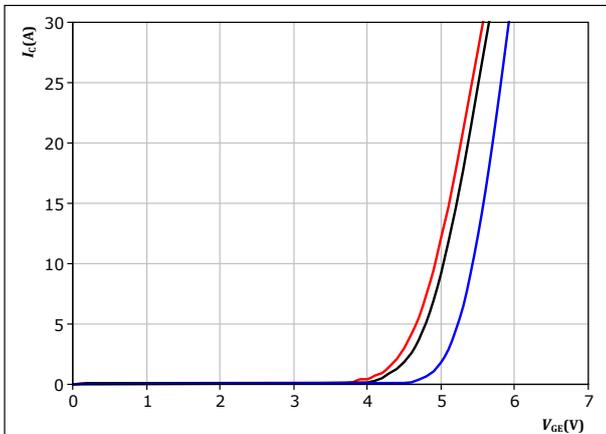


$t_p = 250 \mu s$   
 $T_j = 150 \text{ °C}$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

**figure 3.** IGBT

Typical transfer characteristics

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

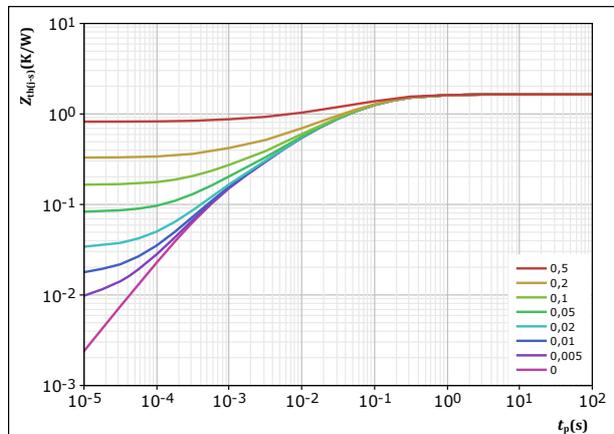


$t_p = 250 \mu s$   
 $V_{CE} = 30 V$   
 $T_j:$  25 °C, 125 °C, 150 °C

**figure 4.** IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 1,643 \text{ K/W}$   
IGBT thermal model values  

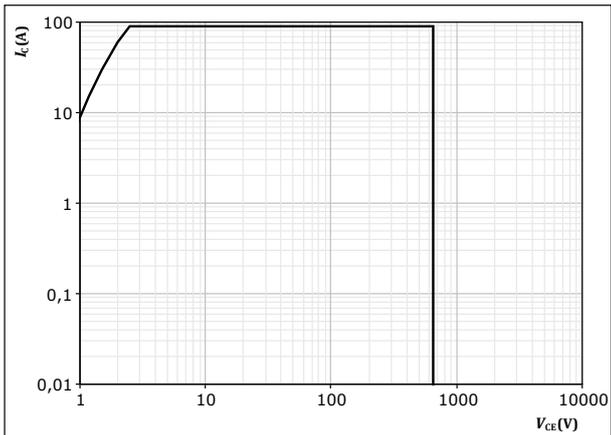
R (K/W)	$\tau$ (s)
2,02E-01	5,18E-01
7,34E-01	8,30E-02
4,15E-01	1,67E-02
1,98E-01	4,28E-03
9,39E-02	5,84E-04



### PFC Switch Characteristics

figure 5. IGBT

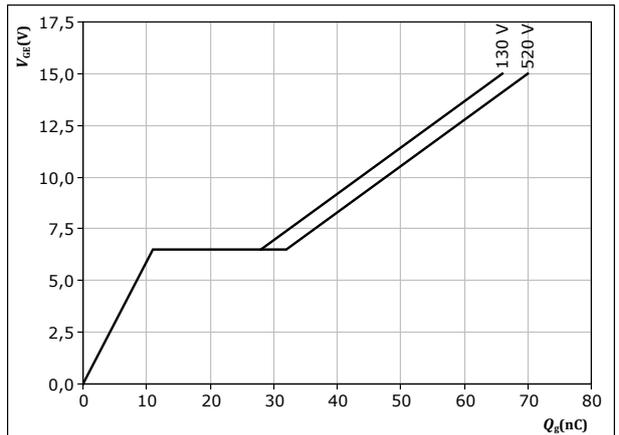
Safe operating area  
 $I_C = f(V_{CE})$



$D =$  single pulse  
 $T_s = 80$  °C  
 $V_{GE} = 15$  V  
 $T_j = T_{jmax}$

figure 6. IGBT

Gate voltage vs gate charge  
 $V_{GE} = f(Q_g)$



$I_C = 30$  A  
 $T_j = 25$  °C



### PFC Diode Characteristics

figure 7. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

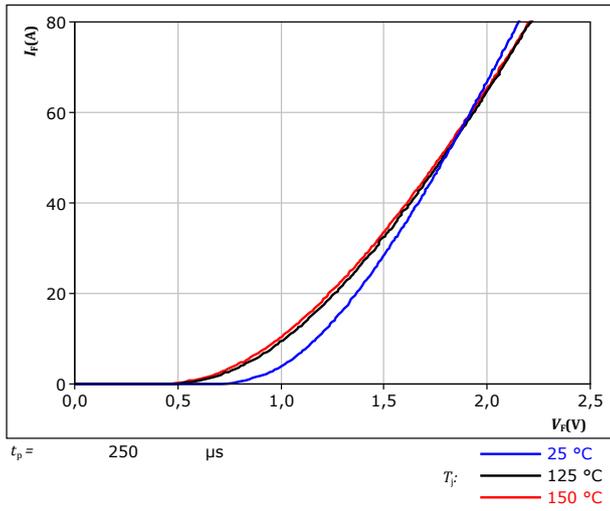
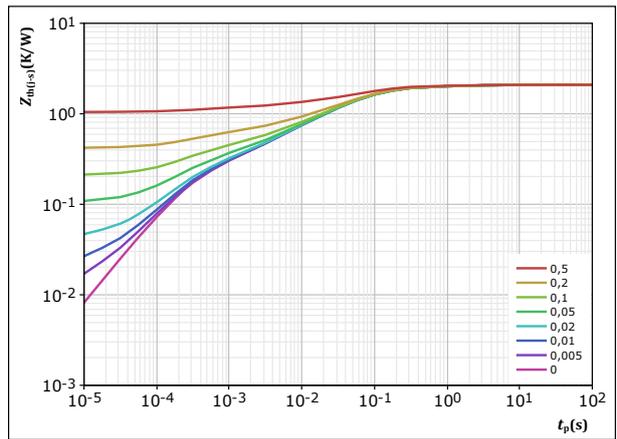


figure 8. FWD

Transient thermal impedance as a function of pulse width

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



$D =$	$t_p / T$	
$R_{th(j-s)} =$	2,09	K/W
FWD thermal model values		
$R$ (K/W)	$\tau$ (s)	
4,56E-02	5,65E+00	
1,41E-01	7,78E-01	
8,06E-01	9,49E-02	
6,37E-01	2,37E-02	
2,49E-01	3,36E-03	
2,12E-01	2,94E-04	



## PFC Sw. Protection Diode Characteristics

figure 9. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

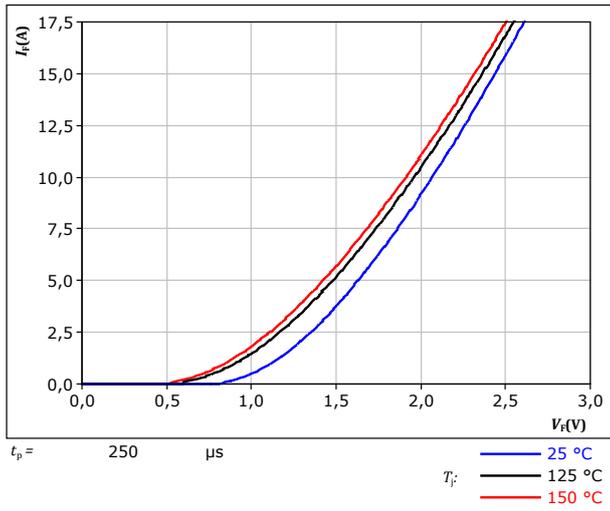
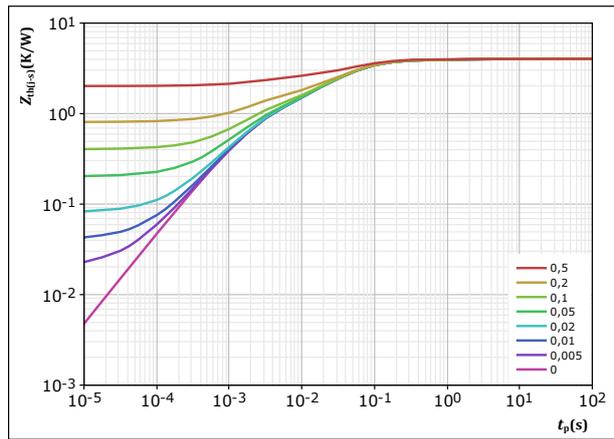


figure 10. FWD

Transient thermal impedance as a function of pulse width

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



$D = \frac{t_p}{T}$   
 $R_{th(j-s)} = 4,033 \text{ K/W}$   
 FWD thermal model values

R (K/W)	$\tau$ (s)
5,78E-02	1,22E+01
1,55E-01	7,00E-01
1,57E+00	7,18E-02
1,44E+00	2,40E-02
8,16E-01	2,06E-03



## Current Transformer Protection Diode Characteristics

figure 11. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

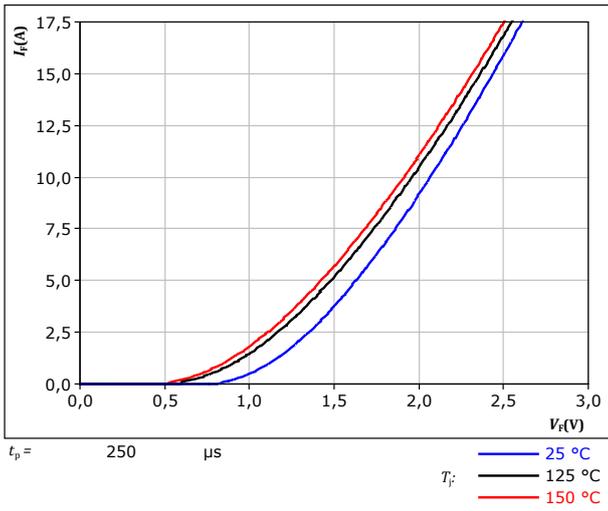
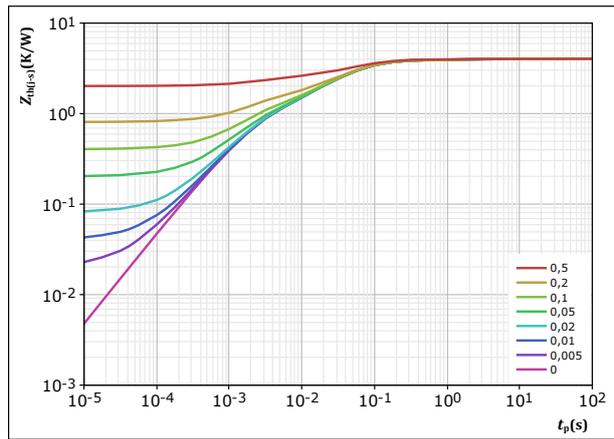


figure 12. FWD

Transient thermal impedance as a function of pulse width

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



$D = \frac{t_p}{T}$   
 $R_{th(j-s)} = 4,033 \text{ K/W}$   
 FWD thermal model values

R (K/W)	$\tau$ (s)
5,78E-02	1,22E+01
1,55E-01	7,00E-01
1,57E+00	7,18E-02
1,44E+00	2,40E-02
8,16E-01	2,06E-03



## Rectifier Diode Characteristics

figure 13. Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

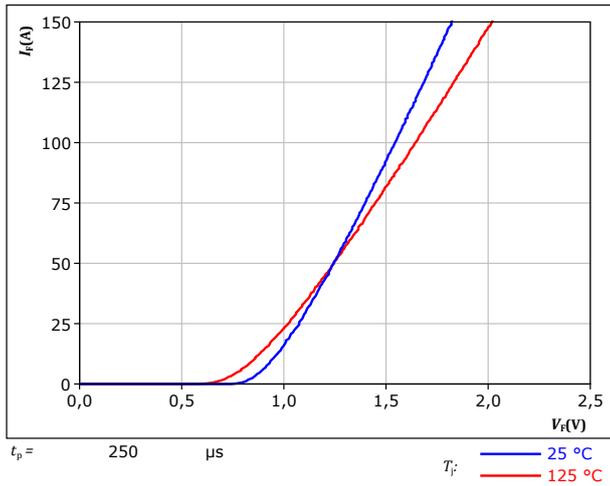
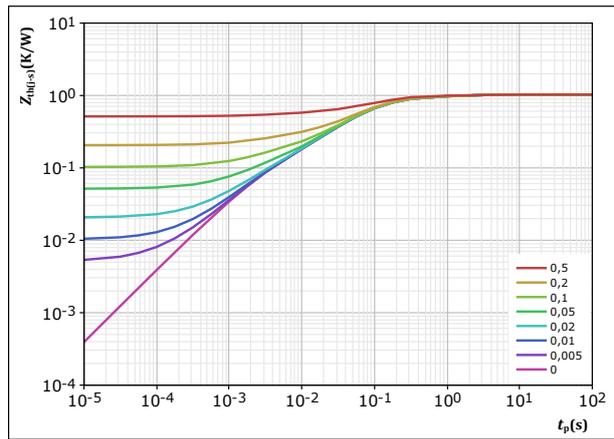


figure 14. Rectifier

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)} = 1,03 \text{ K/W}$

Rectifier thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
5,79E-02	2,65E+00
1,32E-01	4,48E-01
6,73E-01	8,28E-02
1,09E-01	1,86E-02
5,86E-02	2,34E-03

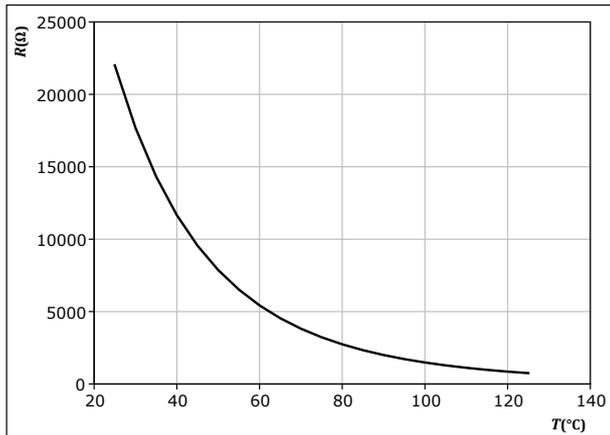


## Thermistor Characteristics

figure 15. Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$

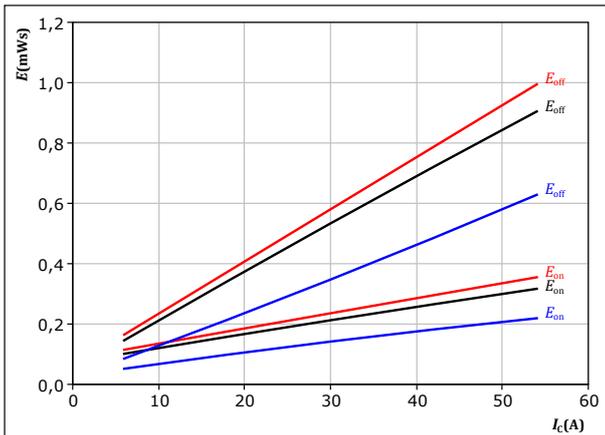




## PFC Switching Characteristics

**figure 16.** IGBT

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

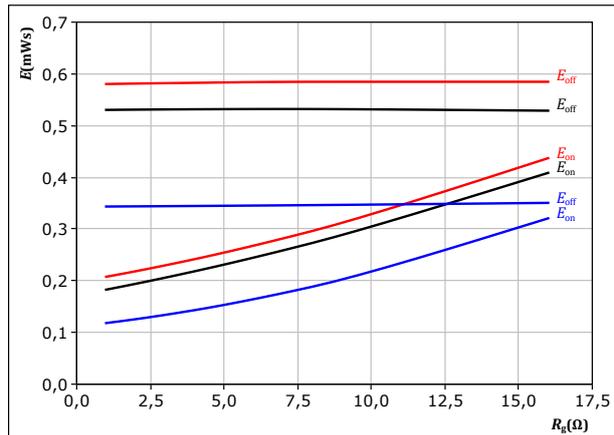


With an inductive load at  
 $V_{CE} = 400 \text{ V}$   
 $V_{GE} = 0/15 \text{ V}$   
 $R_{gon} = 4 \text{ } \Omega$   
 $R_{goff} = 4 \text{ } \Omega$

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

**figure 17.** IGBT

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

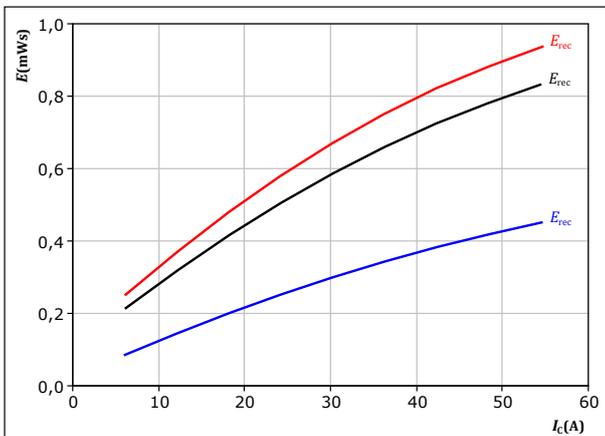


With an inductive load at  
 $V_{CE} = 400 \text{ V}$   
 $V_{GE} = 0/15 \text{ V}$   
 $I_c = 30 \text{ A}$

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

**figure 18.** FWD

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

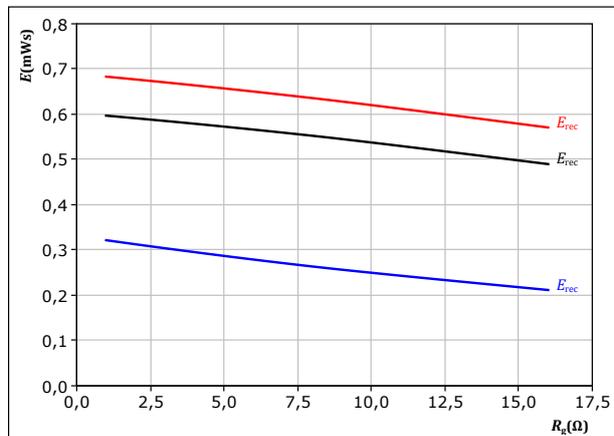


With an inductive load at  
 $V_{CE} = 400 \text{ V}$   
 $V_{GE} = 0/15 \text{ V}$   
 $R_{gon} = 4 \text{ } \Omega$

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

**figure 19.** 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  
 $V_{CE} = 400 \text{ V}$   
 $V_{GE} = 0/15 \text{ V}$   
 $I_c = 30 \text{ A}$

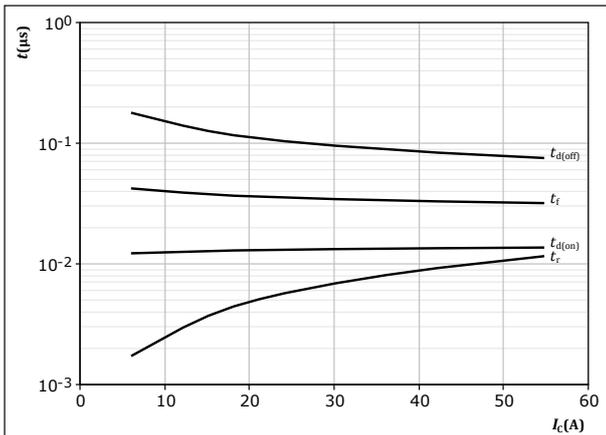
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C



## PFC Switching Characteristics

**figure 20.** IGBT

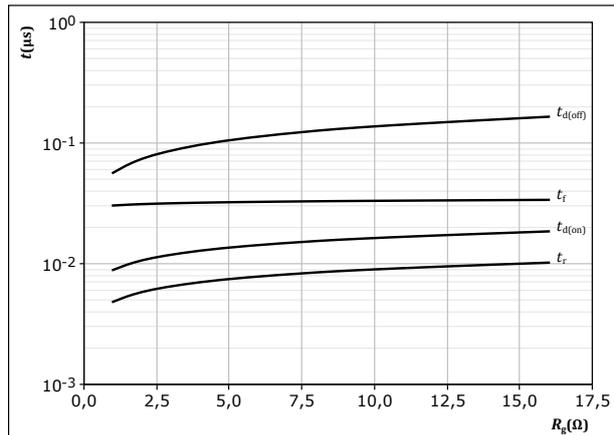
Typical switching times as a function of collector current  
 $t = f(I_c)$



With an inductive load at  
 $T_j = 150$  °C  
 $V_{CE} = 400$  V  
 $V_{GE} = 0/15$  V  
 $R_{gon} = 4$  Ω  
 $R_{goff} = 4$  Ω

**figure 21.** IGBT

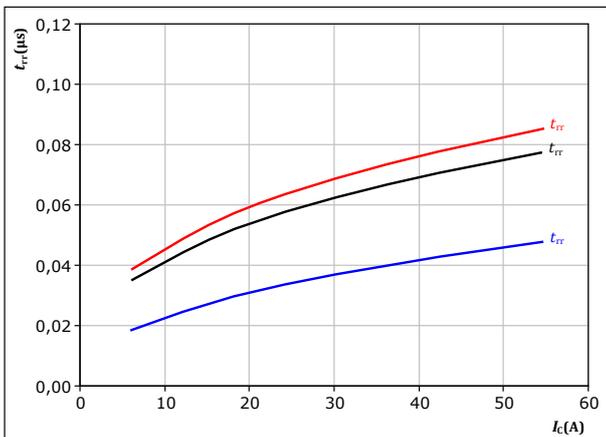
Typical switching times as a function of IGBT turn on gate resistor  
 $t = f(R_g)$



With an inductive load at  
 $T_j = 150$  °C  
 $V_{CE} = 400$  V  
 $V_{GE} = 0/15$  V  
 $I_c = 30$  A

**figure 22.** FWD

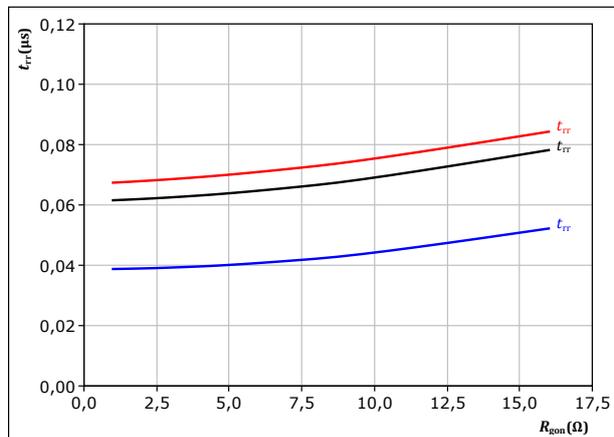
Typical reverse recovery time as a function of collector current  
 $t_{rr} = f(I_c)$



With an inductive load at  
 $V_{CE} = 400$  V  
 $V_{GE} = 0/15$  V  
 $R_{gon} = 4$  Ω  
 $T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)

**figure 23.** FWD

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



With an inductive load at  
 $V_{CE} = 400$  V  
 $V_{GE} = 0/15$  V  
 $I_c = 30$  A  
 $T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)

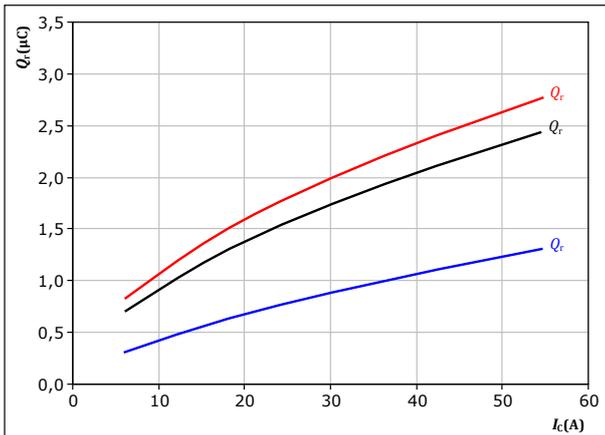


## PFC Switching Characteristics

figure 24. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

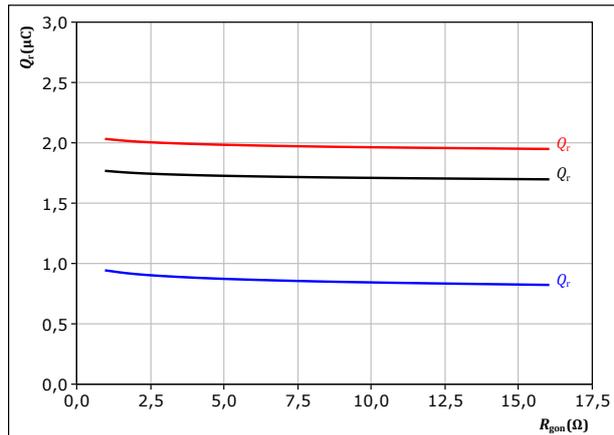
$V_{CE} = 400$  V  
 $V_{GE} = 0/15$  V  
 $R_{gon} = 4$  Ω

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

figure 25. FWD

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

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



With an inductive load at

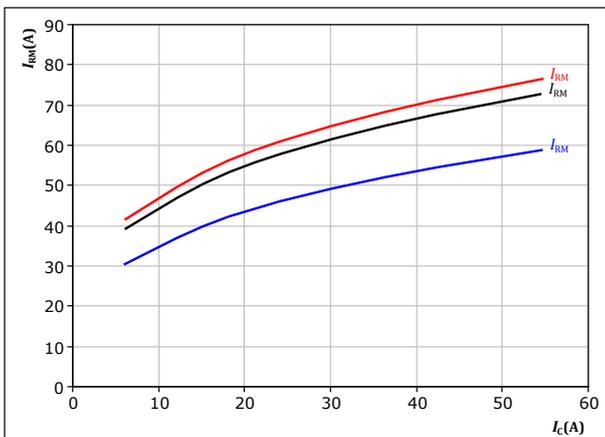
$V_{CE} = 400$  V  
 $V_{GE} = 0/15$  V  
 $I_c = 30$  A

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

figure 26. FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

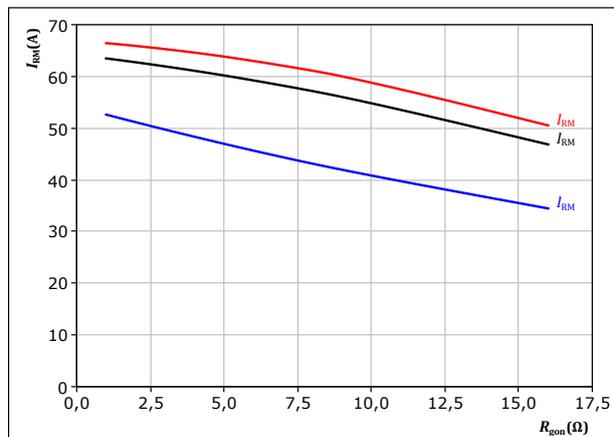
$V_{CE} = 400$  V  
 $V_{GE} = 0/15$  V  
 $R_{gon} = 4$  Ω

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

figure 27. 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

$V_{CE} = 400$  V  
 $V_{GE} = 0/15$  V  
 $I_c = 30$  A

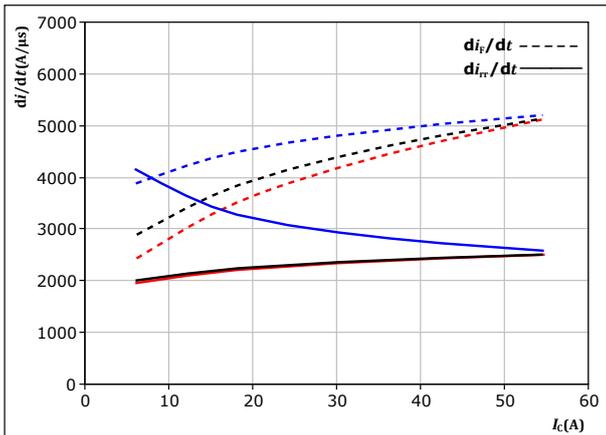
$T_j$ : — 25 °C  
— 125 °C  
— 150 °C



### PFC Switching Characteristics

**figure 28.** FWD

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

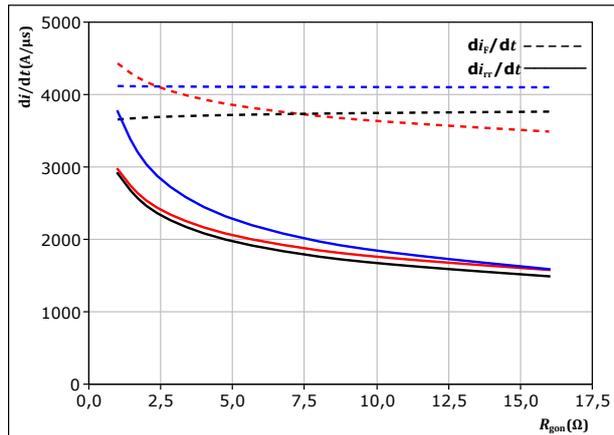


With an inductive load at  
 $V_{CE} = 400$  V  
 $V_{GE} = 0/15$  V  
 $R_{gon} = 4$  Ω

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

**figure 29.** FWD

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

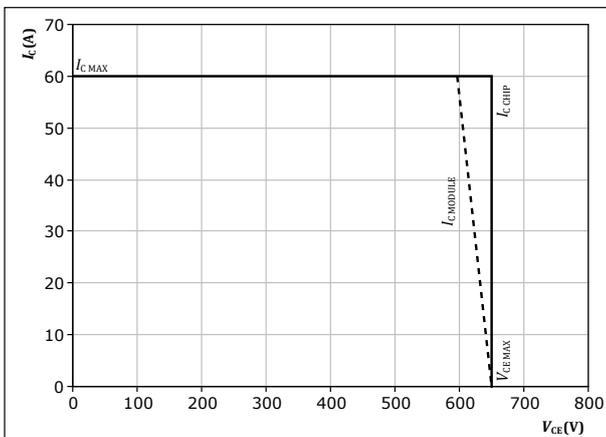


With an inductive load at  
 $V_{CE} = 400$  V  
 $V_{GE} = 0/15$  V  
 $I_C = 30$  A

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

**figure 30.** IGBT

Reverse bias safe operating area  
 $I_C = f(V_{CE})$

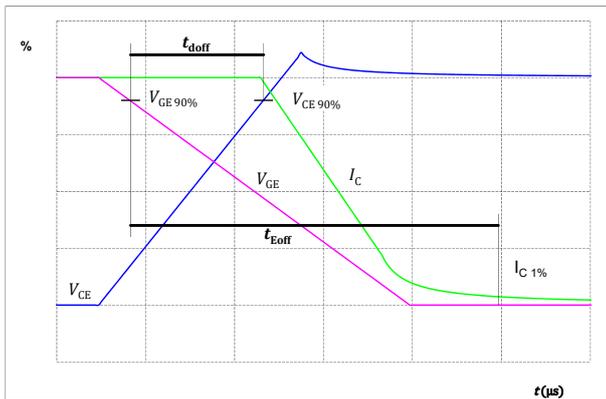


At  $T_j = 150$  °C  
 $R_{gon} = 4$  Ω  
 $R_{goff} = 4$  Ω

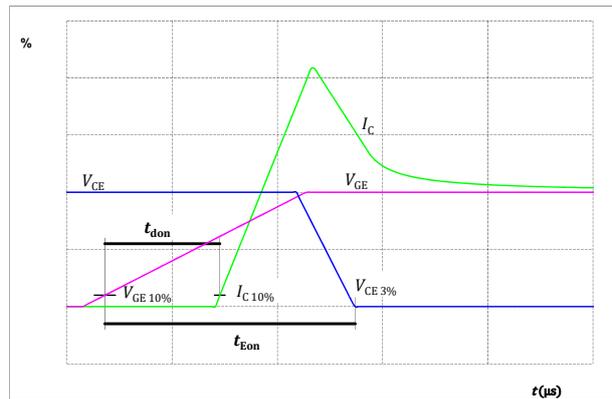


### PFC Switching Definitions

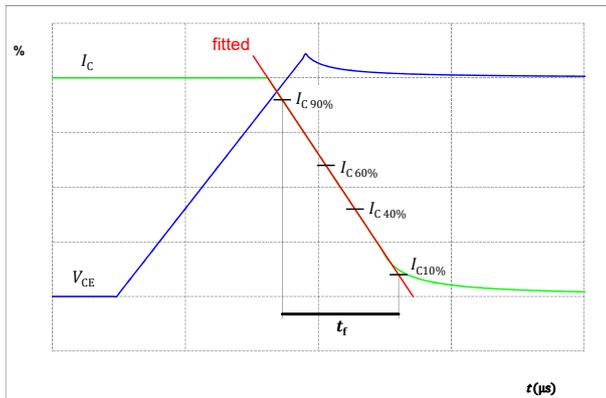
**figure 31.** IGBT  
Turn-off Switching Waveforms & definition of  $t_{doff}$ ,  $t_{Eoff}$  ( $t_{Eoff}$  = integrating time for  $E_{off}$ )



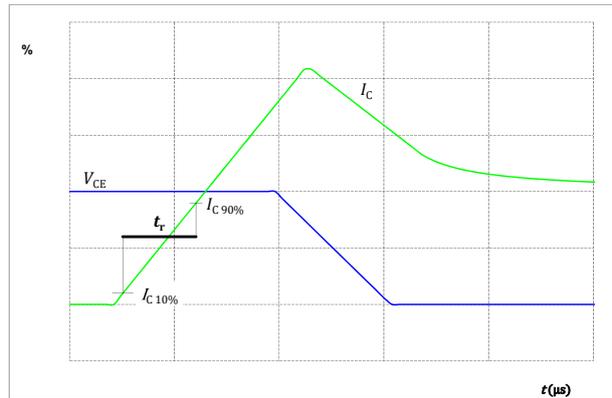
**figure 32.** IGBT  
Turn-on Switching Waveforms & definition of  $t_{don}$ ,  $t_{Eon}$  ( $t_{Eon}$  = integrating time for  $E_{on}$ )



**figure 33.** IGBT  
Turn-off Switching Waveforms & definition of  $t_f$



**figure 34.** IGBT  
Turn-on Switching Waveforms & definition of  $t_r$





### PFC Switching Definitions

figure 35. FWD

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

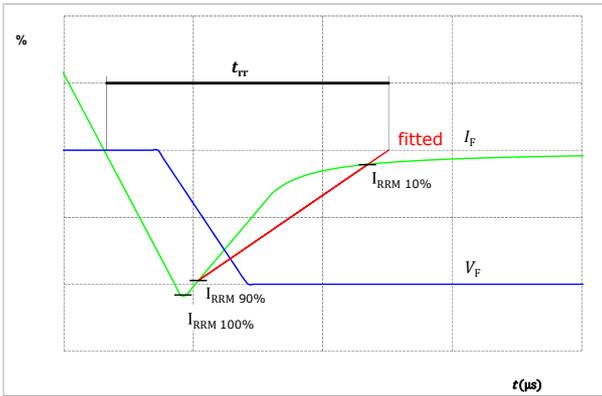
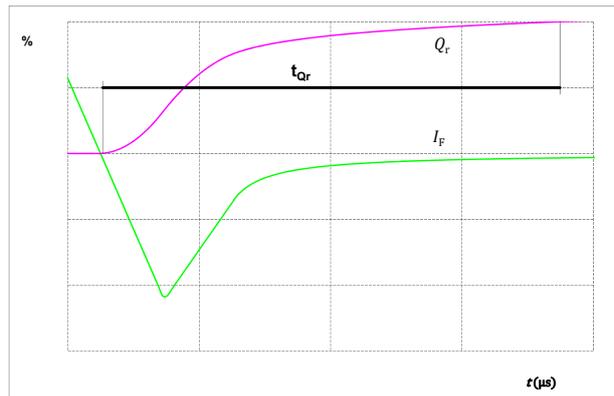


figure 36. FWD

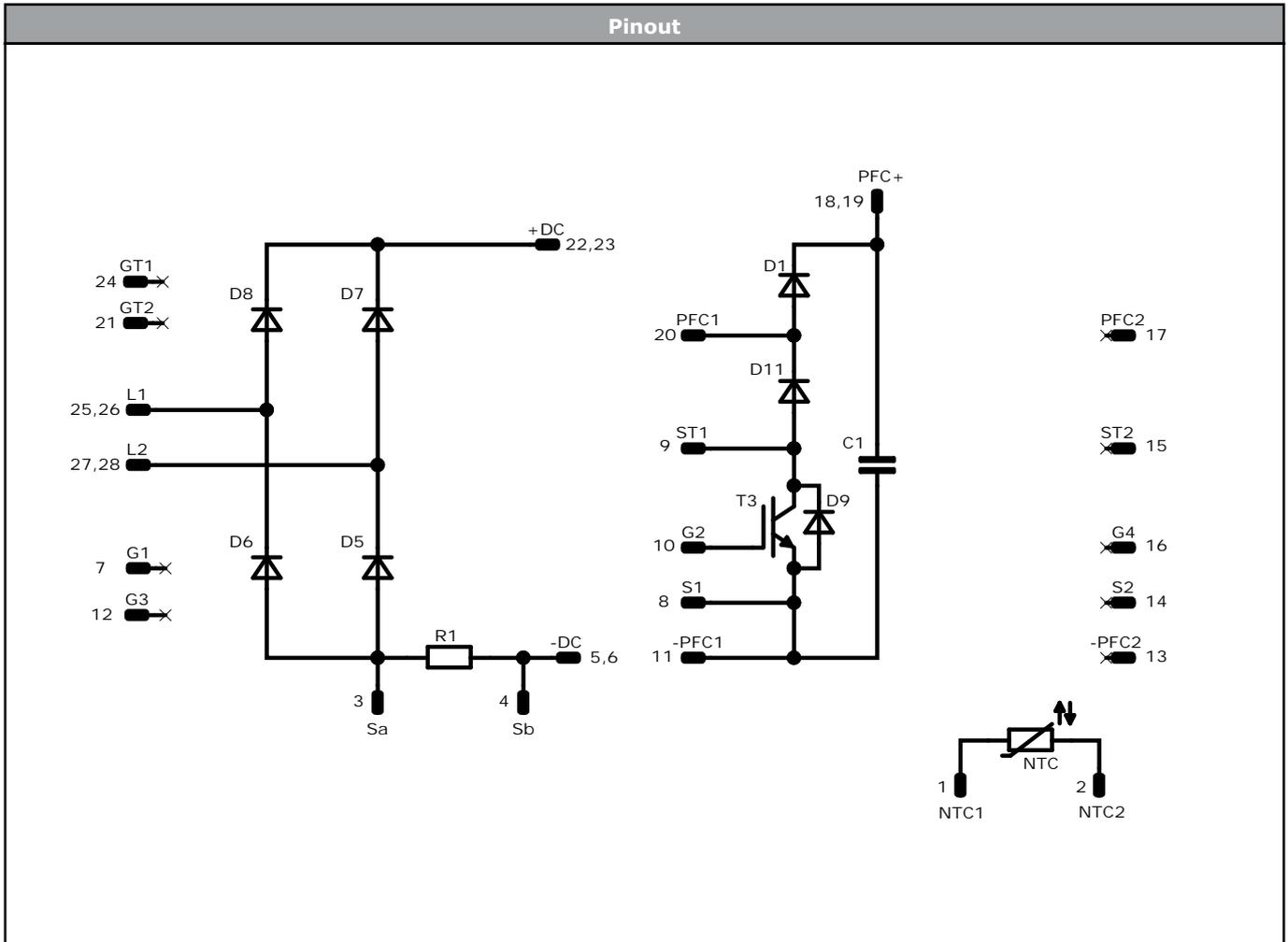
Turn-on Switching Waveforms & definition of  $t_{Qr}$  ( $t_{Qr}$  = integrating time for  $Q_r$ )







Vincotech



Identification					
ID	Component	Voltage	Current	Function	Comment
T3	IGBT	650 V	30 A	PFC Switch	
D1	FWD	650 V	30 A	PFC Diode	
D9	FWD	650 V	6 A	PFC Sw. Protection Diode	
D11	FWD	650 V	6 A	Current Transformer Protection Diode	
D6, D8, D5, D7	Rectifier	1600 V	50 A	Rectifier Diode	
R1	Shunt			PFC Shunt	
C1	Capacitor	500 V		Capacitor (DC)	
NTC	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 UL 1557 recognized under E192116 up to a junction temperature under switching condition $T_{j,op}=175^{\circ}C$ and up to 3500VAC/1min isolation voltage. For more information see vincotech.com website.



Document No.:	Date:	Modification:	Pages
10-F0070TA030S5-P982D64-D1-14	29 Apr. 2024		

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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.