Vincotech

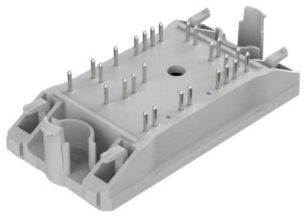
10-FZ062TA050SM-P987D13
datasheet

flow PFC 0 CD — **600 V / 50 A**

Features

- High-efficient rectifier
- High-efficient IGBT H5 + Stealth 2 Diode
- Ultra-fast switching speed
- Integrated capacitors
- Thermistor

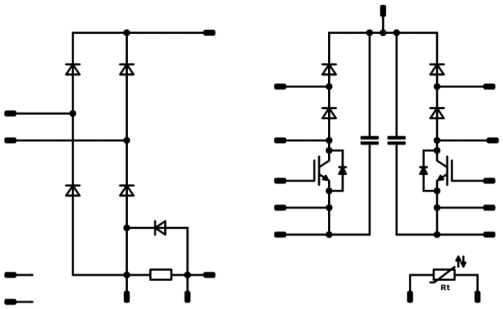
flow 0 12mm housing



Target applications

- SMPS
- Welding

Schematic



Types

- 10-FZ062TA050SM-P987D13

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
PFC Switch					
Collector-emitter voltage	V_{CES}			650	V
Collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	43	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 °C	84	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum Junction Temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
PFC Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80°C	26	A
Repetitive peak forward current	I_{FRM}		90	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80°C	48	W
Maximum Junction Temperature	T_{jmax}		150	°C
PFC Protection\ Current Transforme Protection Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		650	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80°C	17	A
Repetitive peak forward current	I_{FRM}		20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80°C	33	W
Maximum Junction Temperature	T_{jmax}		175	°C
Rectifier \ Shunt Protection Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_h = 80°C	46	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms 50 Hz sine T_j = 150°C	280	A
Surge current capability	I^2t		390	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_h = 80°C	59	W
Maximum Junction Temperature	T_{jmax}		150	°C
DC Link Capacitor				
Maximum DC voltage	V_{MAX}		1000	V
Operation Temperature	T_{op}		-55…+125	°C
PFC Shunt				
Max DC current	I_{MAX}	T_c = 25 °C	27	A
Power dissipation	P_{tot}	T_c = 105 °C	5	W

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
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 Voltage t_p = 2s	4000	V
Creepage distance			min. 12,7	mm
Clearance			9,42	mm
Comparative Tracking Index	CTI		> 200	

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{GS} [V] V_r [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
PFC Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0005	25	3,3	4	4,7	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	25 125		1,82 2,00	2,22	V
Collector-emitter cut-off current	I_{CES}		0	650		25			40	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 MHz	0	25		25		3000		pF
Output capacitance	C_{oes}							50		
Reverse transfer capacitance	C_{res}							11		
Gate charge	Q_g		15	520	50	25		120		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,13		K/W
IGBT Switching										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 8 Ω R_{gon} = 8 Ω	15/0	400	50	25 125		24 24		ns
Rise time	t_r					25 125		10 11		
Turn-off delay time	$t_{d(off)}$					25 125		137 154		
Fall time	t_f					25 125		4 10		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,3 µC Q_{rFWD} = 1 µC				25 125		0,561 0,874		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,241 0,428		

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{GS} [V] V_r [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
PFC Diode										
Static										
Forward voltage	V_F				30	25 125		2,34 2,01	2,8	V
Reverse leakage current	I_r			600		25			100	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,46		K/W
FWD Switching										
Peak recovery current	I_{RRM}	di/dt = 4853 A/µs di/dt = 3854 A/µs	15/0	400	50	25 125		34 51		A
Reverse recovery time	t_{rr}					25 125		16 35		ns
Recovered charge	Q_r					25 125		0,312 1,035		µC
Reverse recovered energy	E_{rec}					25 125		0,028 0,156		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		9776 4737		A/µs
PFC Protection\ Current Transforme Protection Diode										
Static										
Forward voltage	V_F				10	25 125		1,67 1,56	1,87	V
Reverse leakage current	I_r			650		25			0,14	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,87		K/W
Rectifier \ Shunt Protection Diode										
Static										
Forward voltage	V_F				30	25 125		1,16 1,11	1,3	V
Reverse leakage current	I_r			1600		25 150			20 1500	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ=3,4W/mK						1,19		K/W

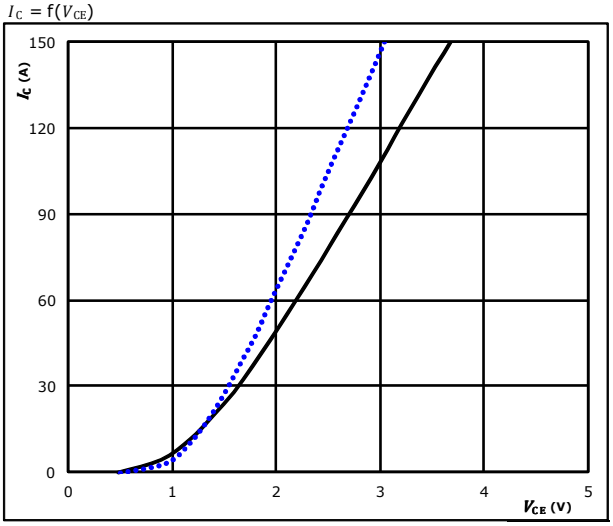
Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{GS} [V] V_r [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
DC Link Capacitor										
Capacitance	C							100		nF
Tolerance							-10		+10	%
PFC Shunt										
Static										
Resistance	R							6,8		mΩ
Tolerance							-1		+1	%
Temperature coeficient	t_c					20 - 60			50	ppm/K
Internal heat resistance	R_{thi}								13	K/W
Inductance	L								3	nH
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R100	$\Delta_{R/R}$	R100 = 1486 Ω				100	-12		+14	%
Power dissipation	P					25		200		mW
Power dissipation constant						25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				25		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				25		3998		K
Vincotech NTC Reference									B	

PFC Switch Characteristics

Typical output characteristics **IGBT**

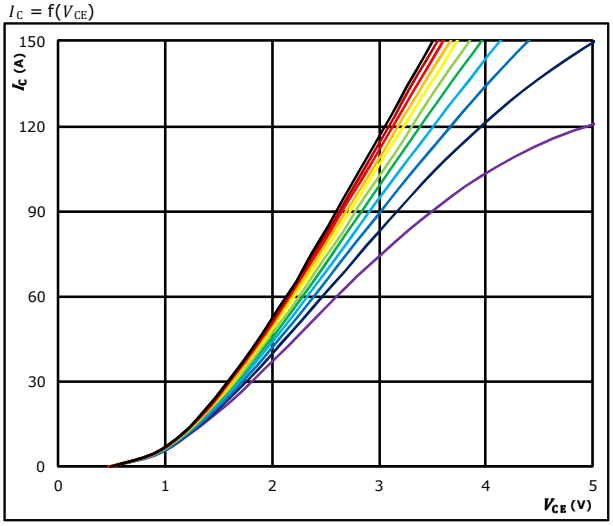
$I_C = f(V_{CE})$



t_p =	250	µs		**25 °C**
V_{GE} =	15	V	T_j:	**125 °C**

Typical output characteristics **IGBT**

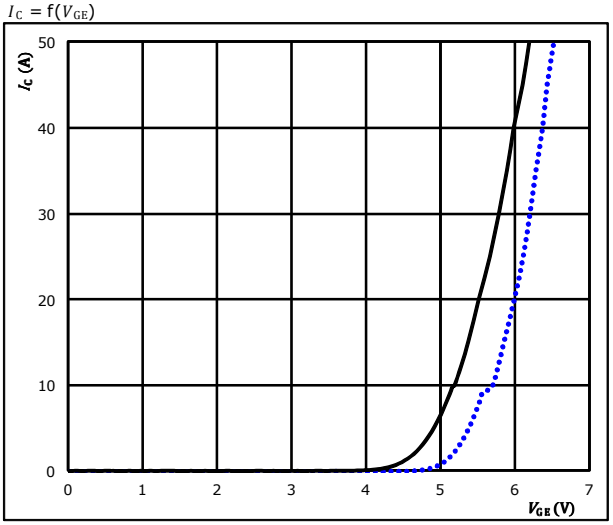
$I_C = f(V_{CE})$



t_p =	250	µs
T_j =	125	°C
V_{GE} from	8 V to 18 V in steps of 1 V	

Typical transfer characteristics **IGBT**

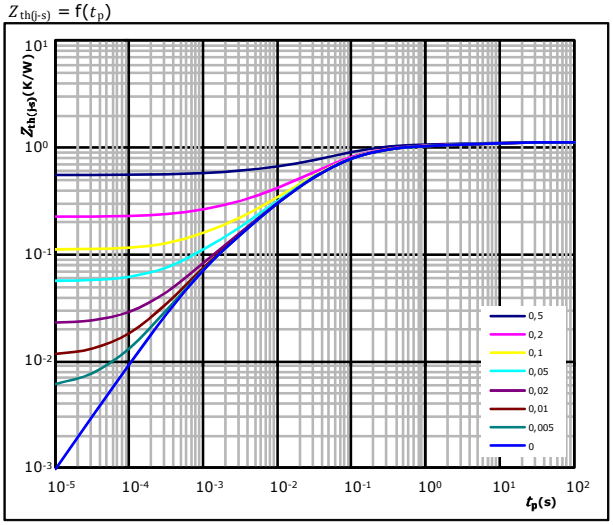
$I_C = f(V_{GE})$



t_p =	100	µs		**25 °C**
V_{CE} =	10	V	T_j:	**125 °C**

Transient Thermal Impedance as function of Pulse duration **IGBT**

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,13	K/W

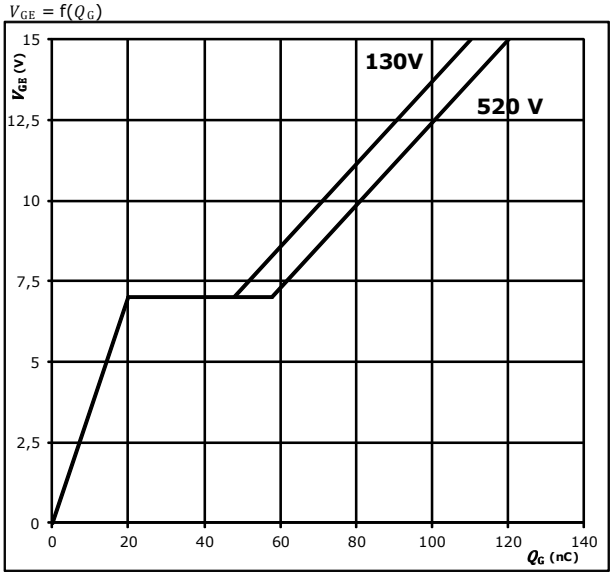
IGBT thermal model values

R (K/W)	τ (s)
7,12E-02	8,15E+00
1,29E-01	6,00E-01
4,31E-01	9,13E-02
3,15E-01	2,59E-02
1,31E-01	5,80E-03
5,02E-02	8,53E-04

PFC Switch Characteristics

Gate voltage vs Gate charge **IGBT**

$V_{GE} = f(Q_G)$

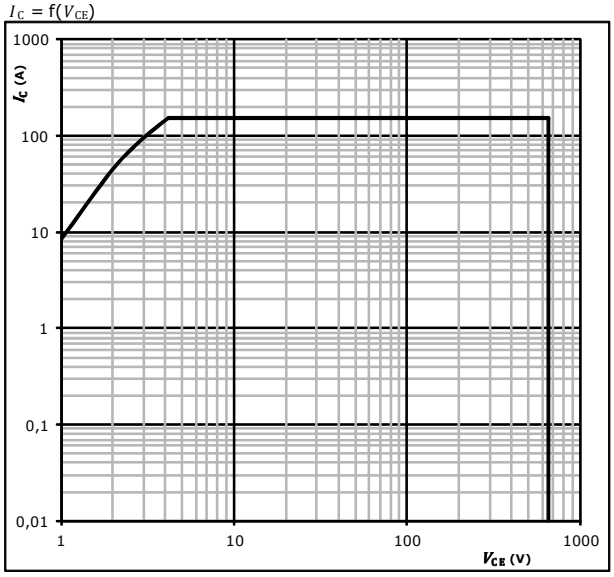


At

I_C= 50 A

Safe operating area **IGBT**

$I_C = f(V_{CE})$



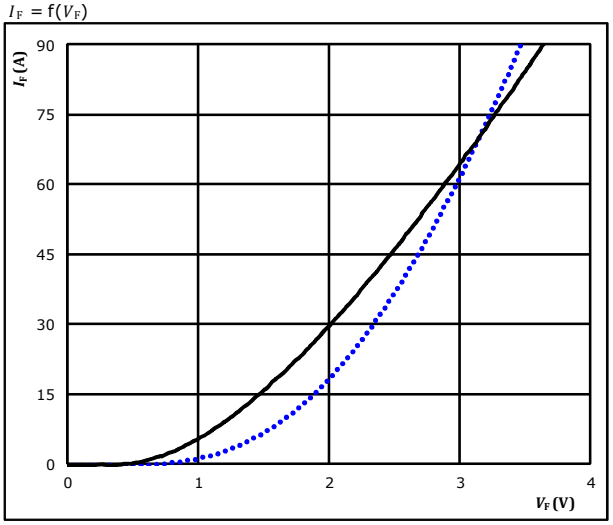
At

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

PFC Diode Characteristics

Typical forward characteristics **FWD**

$I_F = f(V_F)$



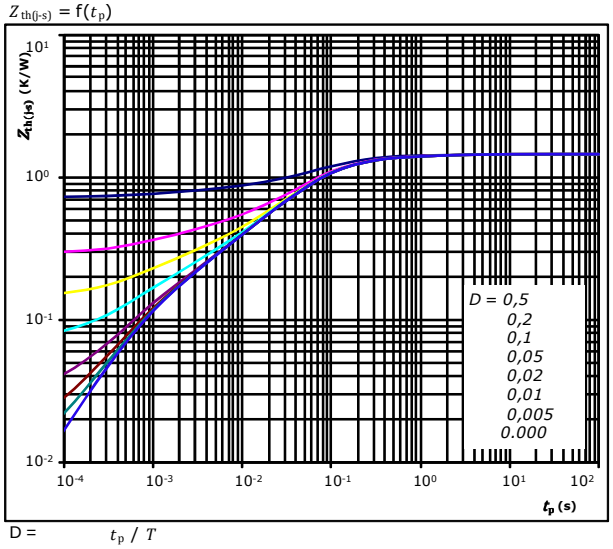
t_p = 250 µs

T_j: **25 °C** ••••••••••••

125 °C ——————

Transient thermal impedance as a function of pulse width **FWD**

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



D = t_p / T

$R_{th(j-s)}$ = 1,46 K/W

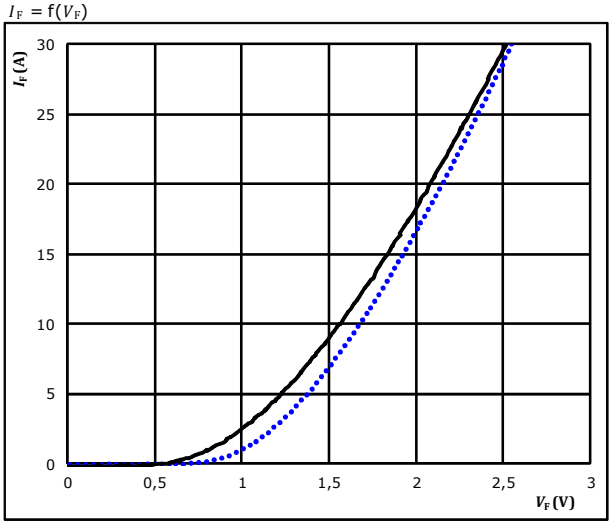
FWD thermal model values

R (K/W)	τ (s)
6,8400E-02	2,7070E+00
1,8520E-01	3,2380E-01
7,7650E-01	6,8840E-02
2,2980E-01	1,9350E-02
1,1460E-01	3,4610E-03
8,1930E-02	7,0190E-04

PFC Protection \ Current Transformer Protection Diode Characteristics

Typical forward characteristics **Prot. Diode**

$I_F = f(V_F)$

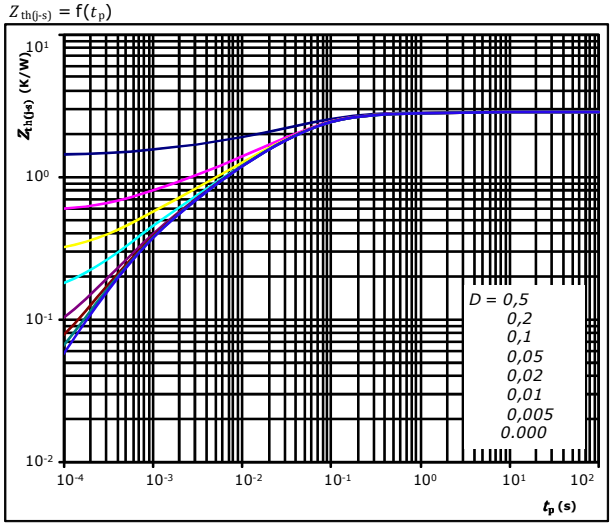


t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

Transient thermal impedance as a function of pulse width **Prot. Diode**

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



D = t_p / T

$R_{th(j-s)}$ = 2,87 K/W

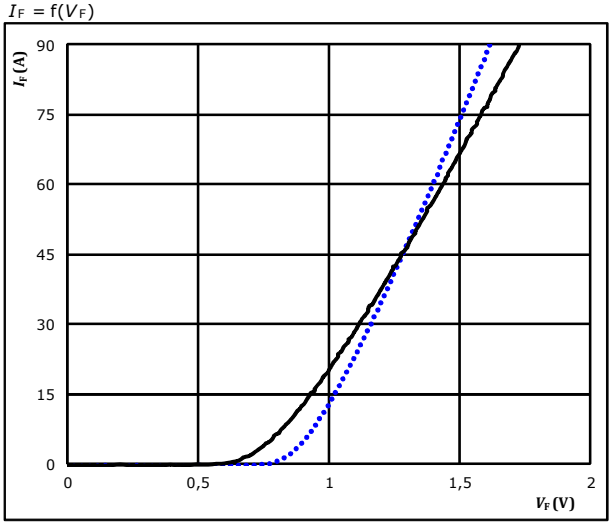
Prot. Diode thermal model values

R (K/W)	τ (s)
6,5290E-02	3,9390E+00
1,4760E-01	4,4830E-01
1,3130E+00	5,9640E-02
7,3180E-01	1,3610E-02
4,0440E-01	2,7940E-03
2,1060E-01	5,3720E-04

Rectifier \ Shunt Protection Diode Characteristics

Typical forward characteristics **Diode**

$I_F = f(V_F)$



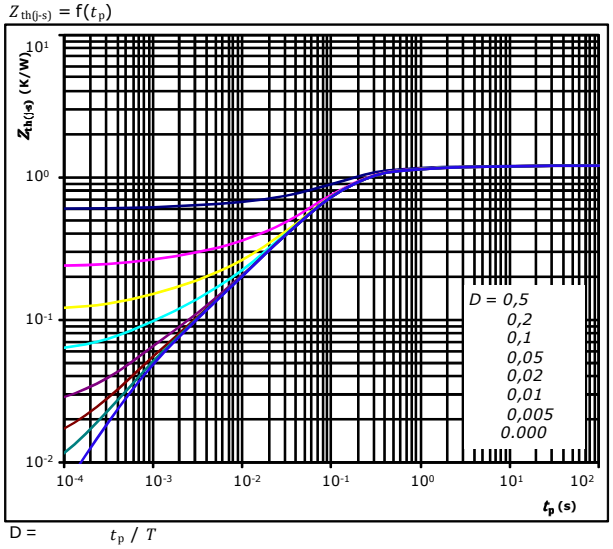
t_p = 250 µs

T_j: **25 °C** (dotted)

125 °C (solid)

Transient thermal impedance as a function of pulse width **Diode**

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



D = t_p / T

$R_{th(j-s)}$ = 1,19 K/W

Diode thermal model values

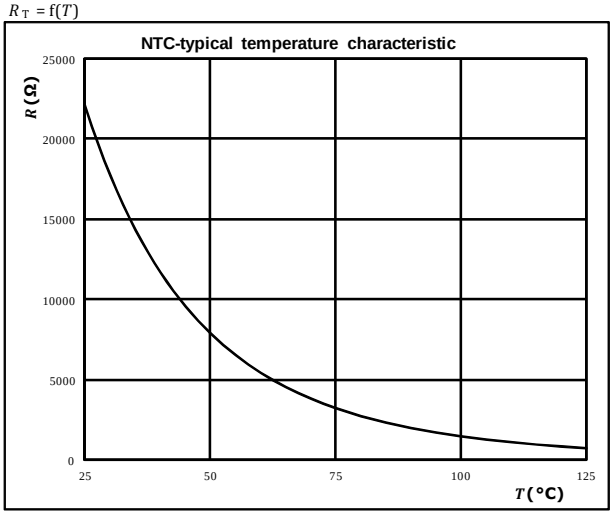
R (K/W)	τ (s)
3,27E-02	9,47E+00
1,25E-01	7,59E-01
7,11E-01	1,23E-01
2,20E-01	3,75E-02
6,56E-02	5,63E-03
3,68E-02	8,27E-04

Thermistor Characteristics

Thermistor typical temperature characteristic

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$

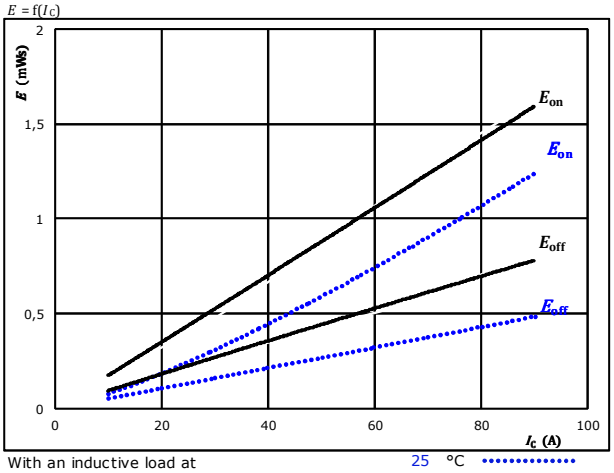


PFC Switching Characteristics

Figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



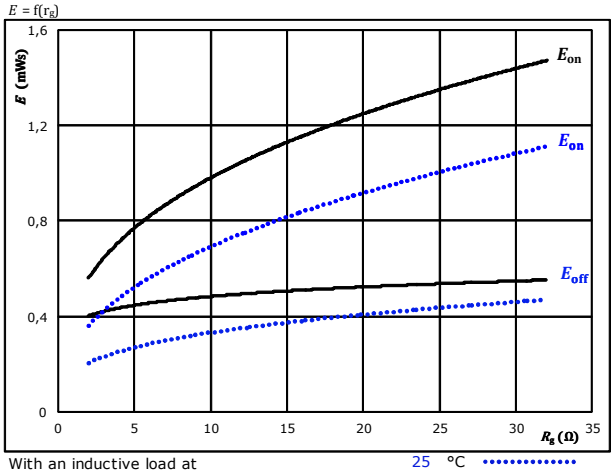
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	15/0	V		125 °C
R_{gon} =	8	Ω		
R_{goff} =	8	Ω		

Figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(r_g)$



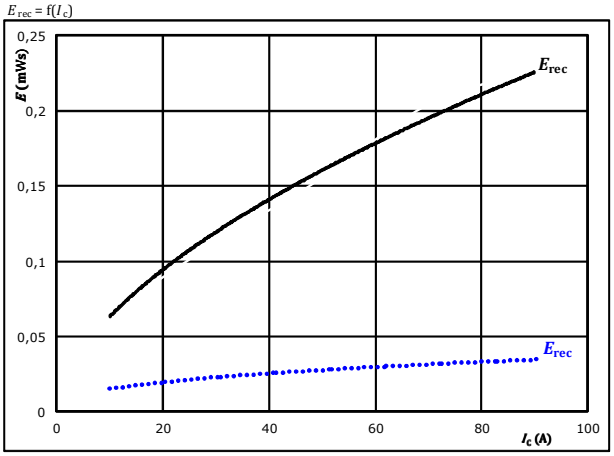
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	15/0	V		125 °C
I_C =	50	A		

Figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_c)$



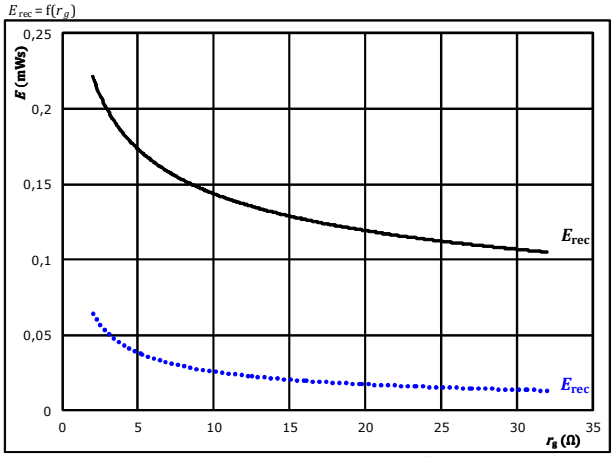
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	15/0	V		125 °C
R_{gon} =	8	Ω		

Figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(r_g)$



With an inductive load at

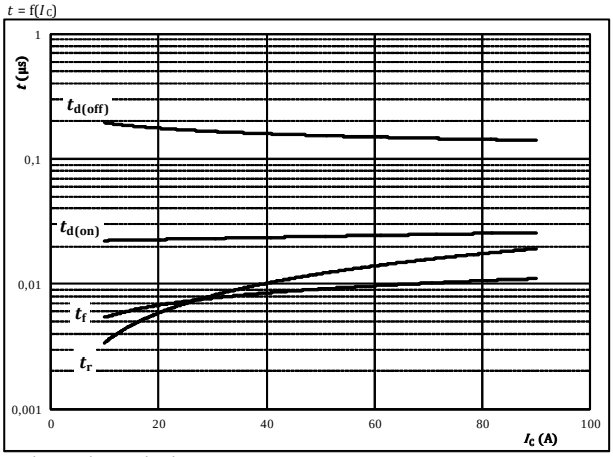
V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	15/0	V		125 °C
I_C =	50	A		

PFC Switching Characteristics

Figure 5. IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



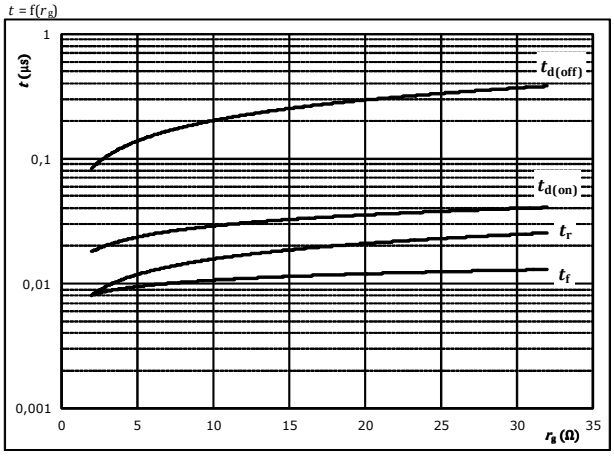
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	15/0	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 6. IGBT

Typical switching times as a function of gate resistor

$t = f(r_g)$



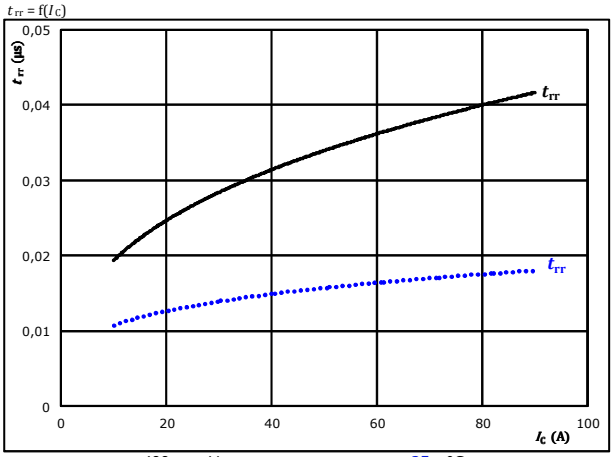
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	15/0	V
I_C =	50	A

Figure 7. FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

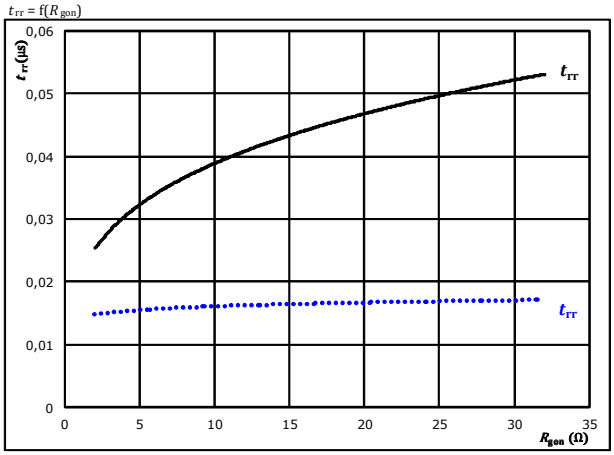


At	V_{CE}=	400	V	25 °C	•••••••••••••••
	V_{GE} =	15/0	V	T_j: 125 °C	———
	R_{gon} =	8	Ω		

Figure 8. FWD

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

$t_{rr} = f(R_{gon})$



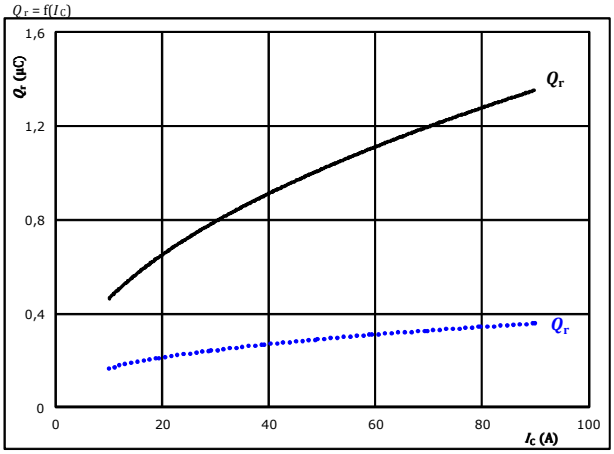
At	V_{CE} =	400	V	25 °C	•••••••••••••••
	V_{GE} =	15/0	V	T_j: 125 °C	———
	I_C =	50	A		

PFC Switching Characteristics

Figure 9. FWD

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

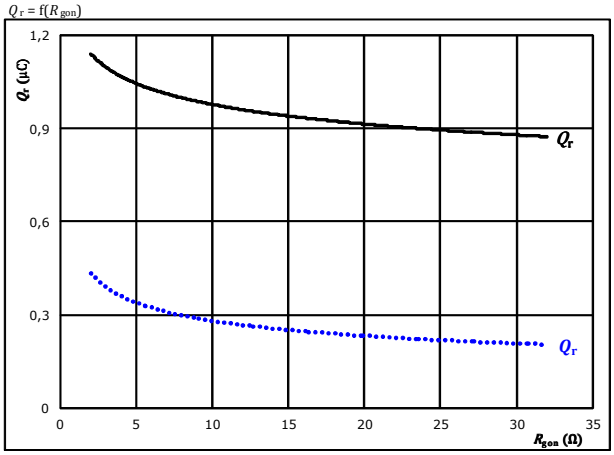


At						
	V_{CE} =	400	V		25 °C	
	V_{GE} =	15/0	V	T_j:	125 °C	
	R_{gon} =	8	Ω			

Figure 10. FWD

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

$Q_r = f(R_{gon})$

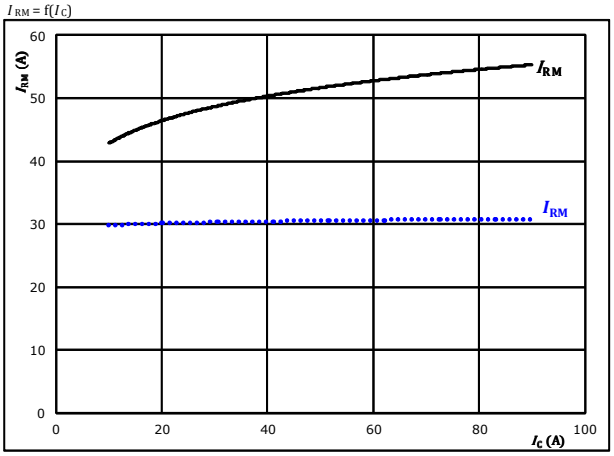


At						
	V_{CE}=	400	V		25 °C	
	V_{GE} =	15/0	V	T_j:	125 °C	
	I_C=	50	A			

Figure 11. FWD

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

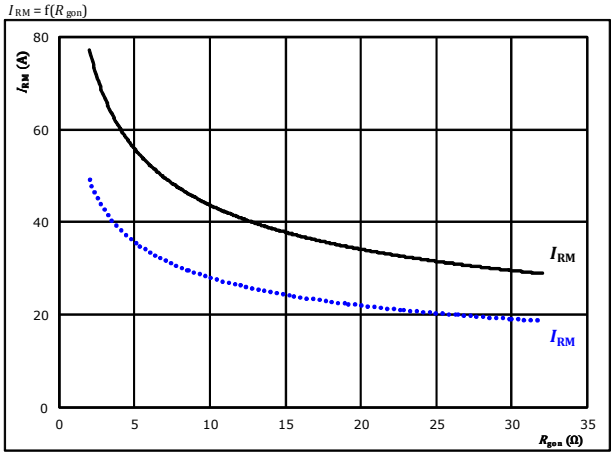


At						
	V_{CE} =	400	V		25 °C	
	V_{GE} =	15/0	V	T_j:	125 °C	
	R_{gon} =	8	Ω			

Figure 12. FWD

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

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



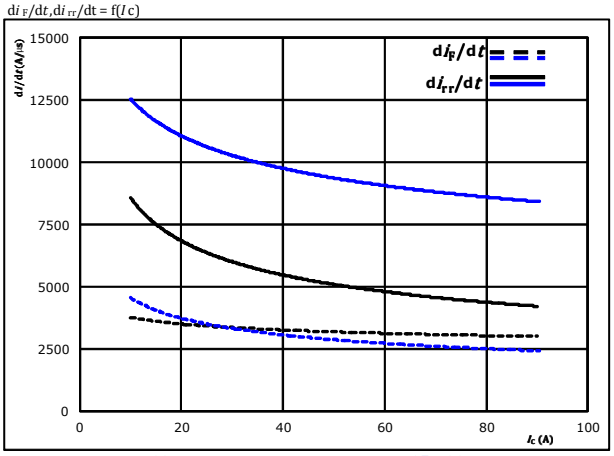
At						
	V_{CE} =	400	V		25 °C	
	V_{GE} =	15/0	V	T_j:	125 °C	
	I_C =	50	A			

PFC Switching Characteristics

Figure 13. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of collector current

$di_F/dt, di_{rr}/dt = f(I_C)$

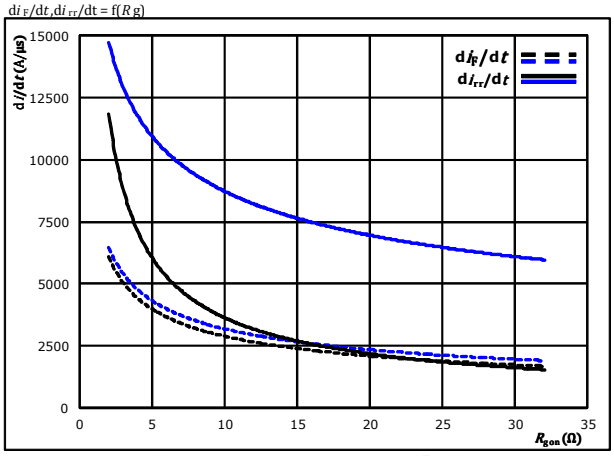


At					
V_{CE} =	400	V		25 °C	•••••••••••••••
V_{GE} =	15/0	V	T_j:	125 °C	———
R_{gon} =	8	Ω			

Figure 14. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor

$di_F/dt, di_{rr}/dt = f(R_g)$

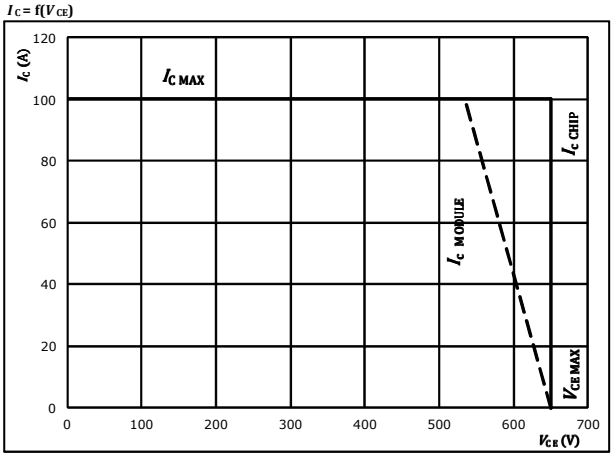


At					
V_{CE} =	400	V		25 °C	•••••••••••••••
V_{GE} =	15/0	V	T_j:	125 °C	———
I_C =	50	A			

Figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At		
T_j =	175	°C
R_{gon} =	8	Ω
R_{goff} =	8	Ω

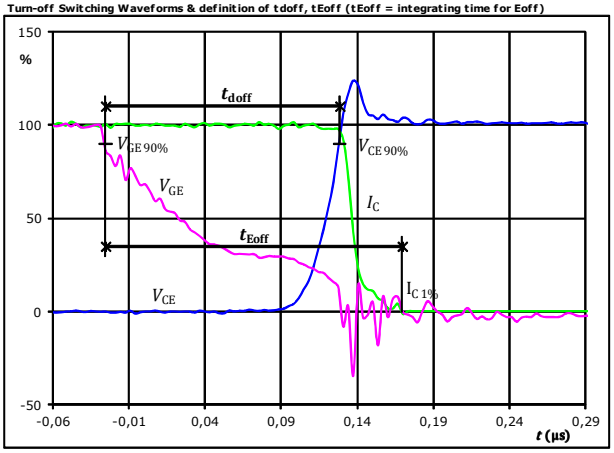
PFC Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

Figure 1. IGBT

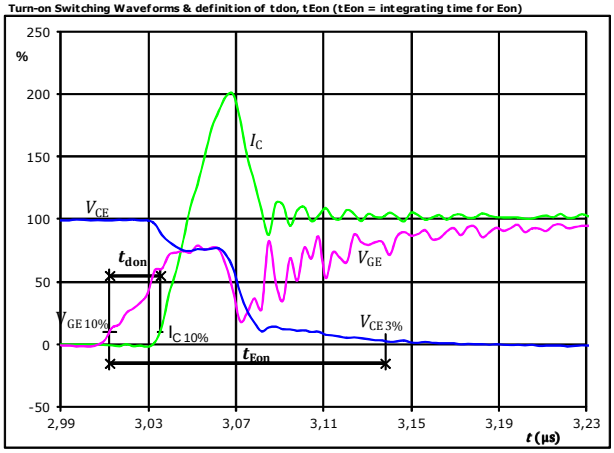
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	50	A
t_{doff} =	0,154	µs
t_{Eoff} =	0,195	µs

Figure 2. IGBT

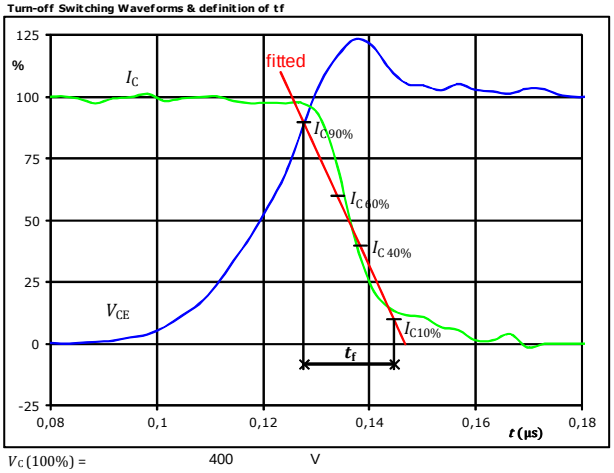
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	50	A
t_{don} =	0,024	µs
t_{Eon} =	0,126	µs

Figure 3. IGBT

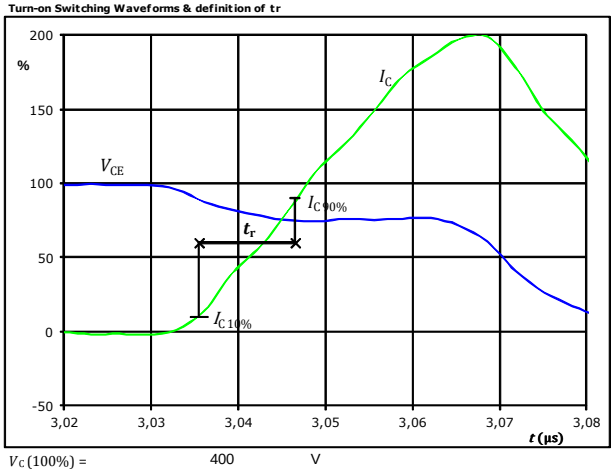
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	50	A
t_f =	0,010	µs

Figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

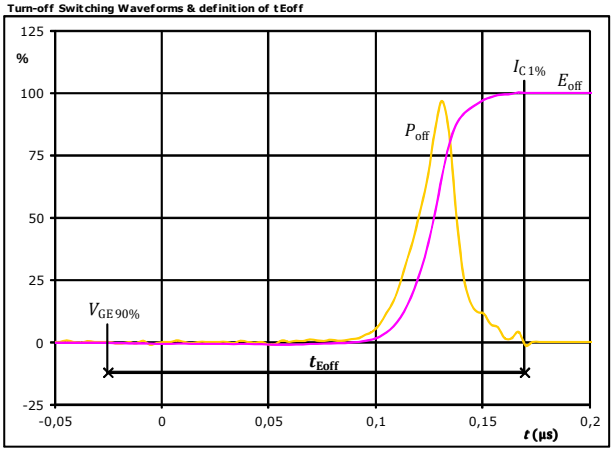


$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	50	A
t_r =	0,011	µs

PFC Switching Definitions

Figure 5. **IGBT**

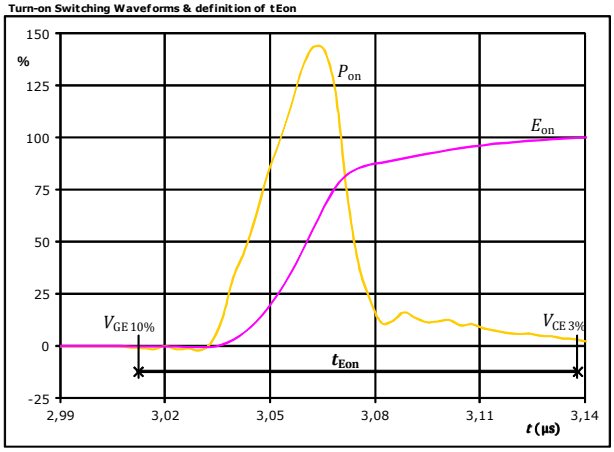
Turn-off Switching Waveforms & definition of tEoff



$P_{off}(100\%)$ =	20,05	kW
$E_{off}(100\%)$ =	0,43	mJ
t_{Eoff} =	0,19	µs

Figure 6. **IGBT**

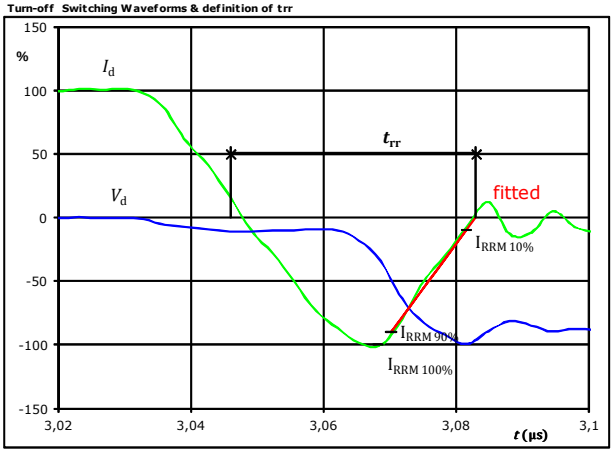
Turn-on Switching Waveforms & definition of tEon



$P_{on}(100\%)$ =	20,05	kW
$E_{on}(100\%)$ =	0,87	mJ
t_{Eon} =	0,13	µs

Figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

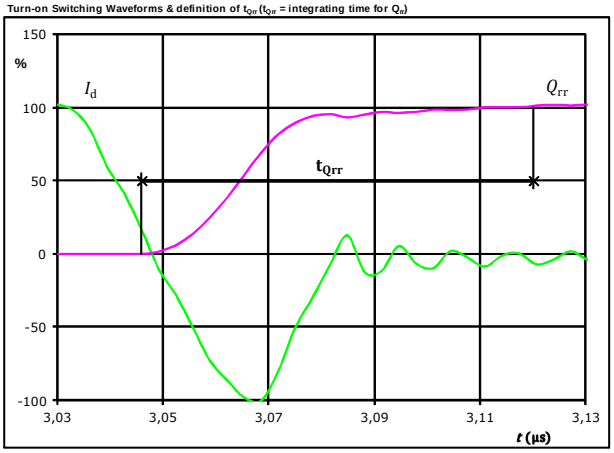


$V_d(100\%)$ =	400	V
$I_d(100\%)$ =	50	A
$I_{RRM}(100\%)$ =	-51	A
t_{rr} =	0,035	µs

PFC Switching Definitions

Figure 8. **FWD**

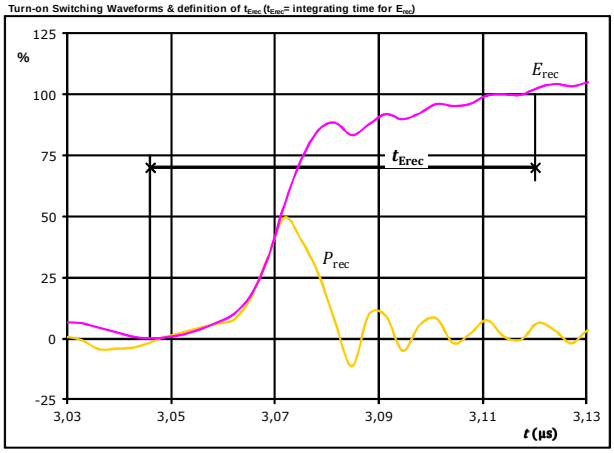
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	50	A
Q_{rr} (100%) =	1,04	µC
t_{Qrr} =	0,07	µs

Figure 9. **FWD**

Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	20,05	kW
E_{rec} (100%) =	0,16	mJ
t_{Erec} =	0,07	µs

Vincotech

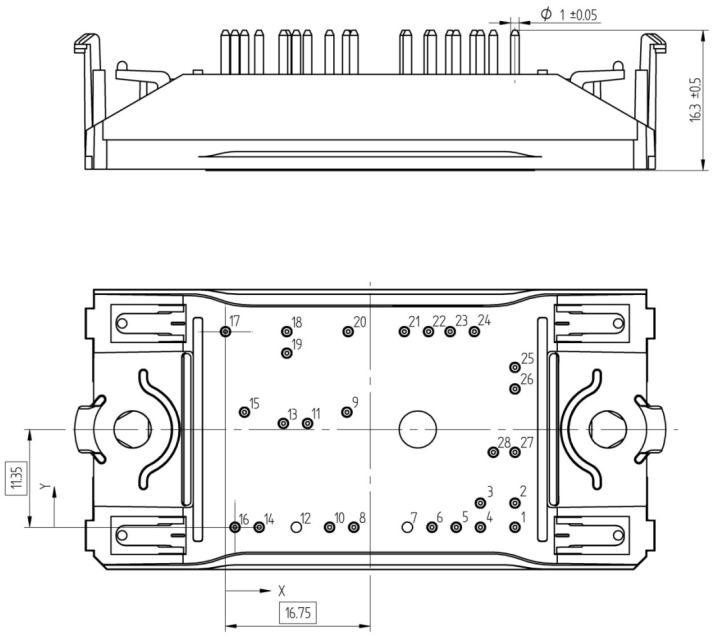
Ordering Code & Marking

Version	Ordering Code
without thermal paste with Solder pins 12mm housing	10-FZ062TA050SM-P987D13

Text	**Name**		**Date code**	**UL & Vinco**	**Lot**	**Serial**
	NN-NNNNNNNNNNNNN-TTTTTTVV		WWYY	UL Vinco	LLLLL	SSSS
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

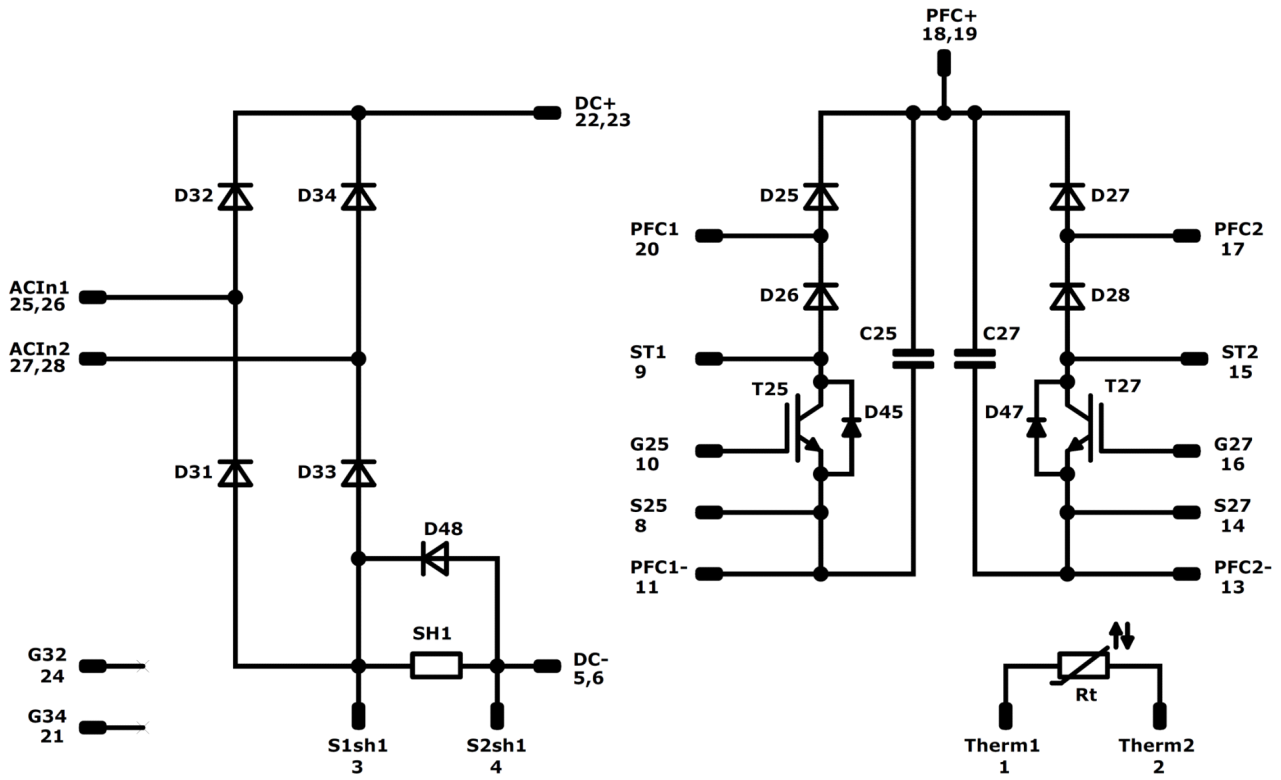
Outline

Pin table [mm]			
Pin	X	Y	Function
1	33,5	0	Therm1
2	33,5	2,8	Therm2
3	29,5	2,8	S1sh1
4	29,5	0	S2sh1
5	26,7	0	DC-
6	23,9	0	DC-
7	Not assembled		
8	14,85	0	S25
9	14,05	13,35	ST1
10	12,05	0	G25
11	9,5	12,05	PFC1-
12	Not assembled		
13	6,7	12,05	PFC2-
14	3,9	0	S27
15	2,2	13,35	ST2
16	1,1	0	G27
17	0	22,7	PFC2
18	7,1	22,7	PFC+
19	7,1	20,2	PFC+
20	14,2	22,7	PFC1
21	20,7	22,7	G34
22	23,5	22,7	DC+
23	26	22,7	DC+
24	28,8	22,7	G32
25	33,5	18,55	ACIn1
26	33,5	16,05	ACIn1
27	33,5	8,7	ACIn2
28	31	8,7	ACIn2



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

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T25, T27	IGBT	650 V	50 A	PFC Switch	
D25, D27	FWD	600 V	30 A	PFC Diode	
D45, D47	FWD	650 V	10 A	PFC Sw. Protection Diode	
D31, D32, D33, D34	Rectifier	1600 V	50 A	Rectifier Diode	
D48	FWD	1600 V	50 A	Shunt Protection Diode	
D26, D28	FWD	650 V	10 A	Current Transformer Protection Diode	
SH1	Shunt			Shunt Resistor	
C25, C27	Capacitor	1000 V		DC Link Capacitance	
Rt	NTC			Thermistor	

Packaging instruction					
Standard packaging quantity (SPQ)	135	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 0 packages see vincotech.com website.

General datasheet
General datasheet for *flow* 0 packages see vincotech.com website.

Package data
Package data for *flow* 0 packages see 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-FZ062TA050SM-P987D13-D1-14	11 Mar. 2016		