Vincotech

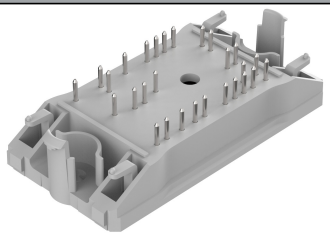
10-FZ062TA099FS05-P980D68
datasheet

***flow* PFC 0**	**600 V / 99 mΩ**

Features

- Compact and low inductance design
- Suitable for Interleaved topology
- Suitable for curent sensing in drain
- C6 series CoolMOS™ and SiC boost FWD

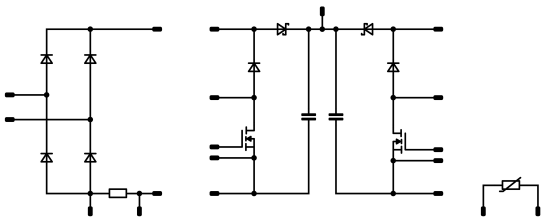
flow 0 12 mm housing



Target applications

- Embedded Drives
- Power Supply
- UPS
- Welding & Cutting

Schematic



Types

- 10-FZ062TA099FS05-P980D68

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
PFC Switch				
Drain-source voltage	V_{DSS}		600	V
Drain current	I_D	$T_j = T_{jmax}$ T_S = 80 °C	18	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}	112	A
Avalanche energy, single pulse	E_{AS}	I_D = 6,6 A V_{DD} = 50 V	796	mJ
Avalanche energy, repetitive	E_{AR}	I_D = 6,6 A V_{DD} = 50 V	1,20	mJ
Avalanche current, repetitive	I_{AR}	t_p limited by $P_{AV} = E_{AR}$*f	6,6	A
MOSFET dv/dt ruggedness	dv/dt	V_{DS} = 480 V	50	V/ns
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_S = 80 °C	79	W
Gate-source voltage	V_{GSS}		±20	V
Reverse diode dv/dt	dv/dt		15	V/ns
Maximum Junction Temperature	T_{jmax}		150	°C
PFC Diode				
Peak repetitive reverse voltage	V_{RRM}		650	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	16	A
Repetitive peak forward current	I_{FRM}		114	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms	440	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	50	W
Maximum junction temperature	T_{jmax}		175	°C
Current Transformer Protection Diode				
Peak repetitive reverse voltage	V_{RRM}		600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	6	A
Repetitive peak forward current	I_{FRM}		12	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	35	W
Maximum junction temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Rectifier Diode				
Peak repetitive reverse voltage	V_{RRM}		1600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	48	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 150 °C	280	A
Surge current capability	I^2t		390	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	59	W
Maximum junction temperature	T_{jmax}		150	°C
PFC Shunt				
DC forward current	I_F	T_c = 105 °C	32	A
Power dissipation	P_{tot}	T_c = 105 °C	10	W
Capacitor (DC)				
Maximum DC voltage	V_{MAX}		500	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 s	6000	V
		AC Voltage t_p = 1 min	2500	V
Creepage distance			min. 12,7	mm
Clearance			8,99	mm
Comparative Tracking Index	CTI		> 200	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions					Value			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 Switch										
Static										
Drain-source on-state resistance	$r_{DS(on)}$		10		18,1	25 125		100 202	116	mΩ
Gate-source threshold voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}$			0,00121	25	2,5	3	3,6	V
Gate to Source Leakage Current	I_{GSS}		20	0		25			100	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	600		25			5	µA
Internal gate resistance	r_g							1,6		Ω
Gate charge	Q_g		0/10	480	18,1	25		119		nC
Gate to source charge	Q_{GS}							14		
Gate to drain charge	Q_{GD}							61		
Short-circuit input capacitance	C_{iss}	f= 1MHz	0	100		25		2660		pF
Short-circuit output capacitance	C_{oss}							154		
Reverse Diode Static										
Diode forward voltage	VSD		0		18,1	25		0,9		V
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,88		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 4 Ω R_{gon} = 4 Ω	0/10	350	18	25 125		30 22		ns
Rise time	t_r					25 125		12 9		
Turn-off delay time	$t_{d(off)}$					25 125		137 126		
Fall time	t_f					25 125		3763 85		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,1 µC Q_{rFWD} = 0,1 µC				25 125		0,111 0,094		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,051 0,063		

Characteristic Values

Parameter	Symbol	Conditions					Value			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 Diode										
Static										
Forward voltage	V_F				16	25 125		1,62 1,87	1,8	V
Reverse leakage current	I_R			650		25			120	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,90		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 1847 A/µs di/dt = 2375 A/µs	0/10	350	18	25 125		9 11		A
Reverse recovery time	t_{rr}					25 125		10 9		ns
Recovered charge	Q_r					25 125		0,065 0,063		µC
Reverse recovered energy	E_{rec}					25 125		0,010 0,007		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		2521 3460		A/µs
Current Transformer Protection Diode										
Static										
Forward voltage	V_F				6	25 125 150		1,79 1,65 1,60	1,95	V
Reverse leakage current	I_R			600		25			27	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,68		K/W
Rectifier Diode										
Static										
Forward voltage	V_F				50	25 125		1,24 1,24	1,3	V
Reverse leakage current	I_R			1600		25 150			20 1500	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,20		K/W

Characteristic Values

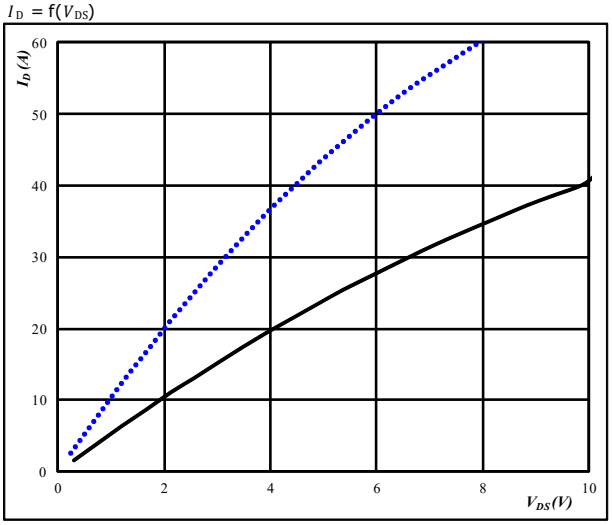
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
PFC Shunt										
Resistance value	R						9,9	10	10,1	mΩ
Temperature coeficient	t_c					20 - 60			50	ppm/K
Internal heat resistance	R_{thi}								6,5	K/W
Inductance	L								1,5	nH
Capacitor (DC)										
Capacitance	C							270		nF
Tolerance							-20		+20	%
Dissipation factor		f= 1 kHz				25			2,5	%
Climatic category							55/125/56			
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %				25		3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %				25		4000		K
Vincotech NTC Reference									I	

PFC Switch Characteristics

figure 1. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

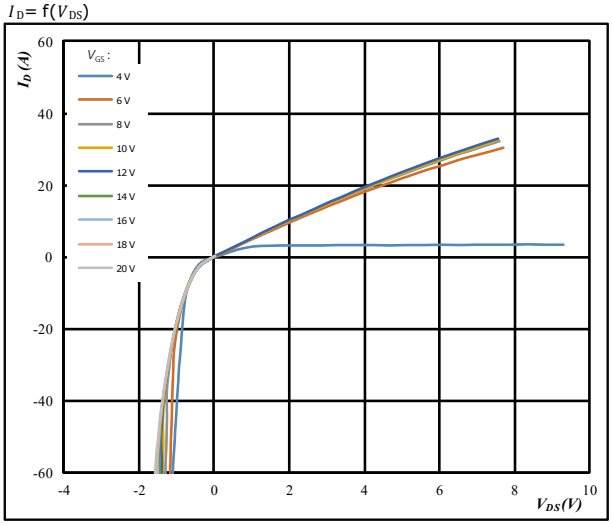


t_p =	250	µs	T_j:	25 °C	
V_{GS}=	10	V		125 °C	

figure 2. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

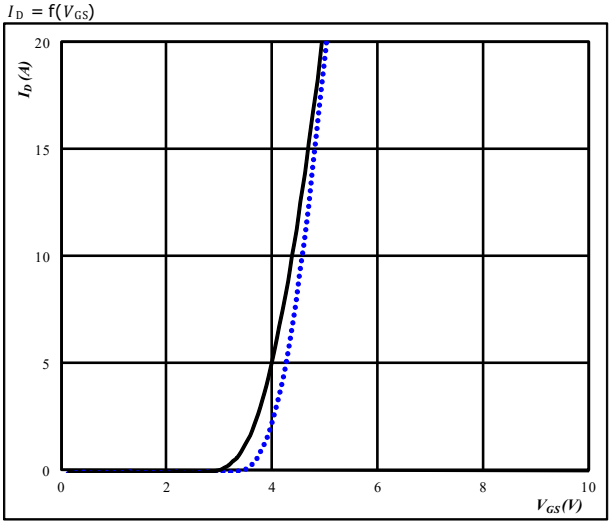


t_p =	250	µs
T_j =	125	°C
V_{GS} from	4 V to 20 V in steps of 2 V	

figure 3. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$

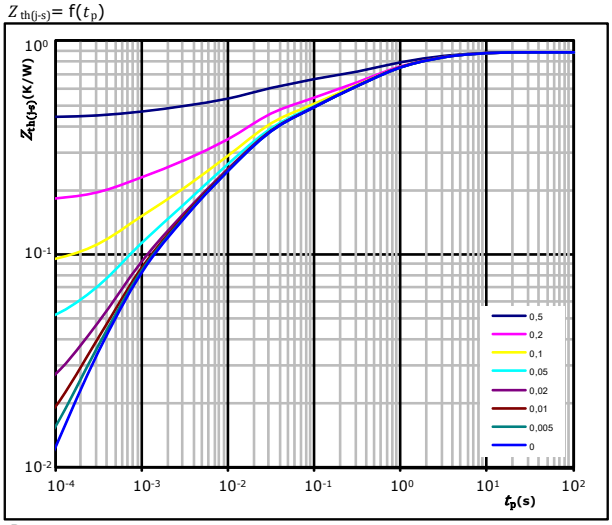


t_p =	100	µs	T_j:	25 °C	
V_{DS} =	10	V		125 °C	

figure 4. **MOSFET**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,88	K/W

MOSFET thermal model values

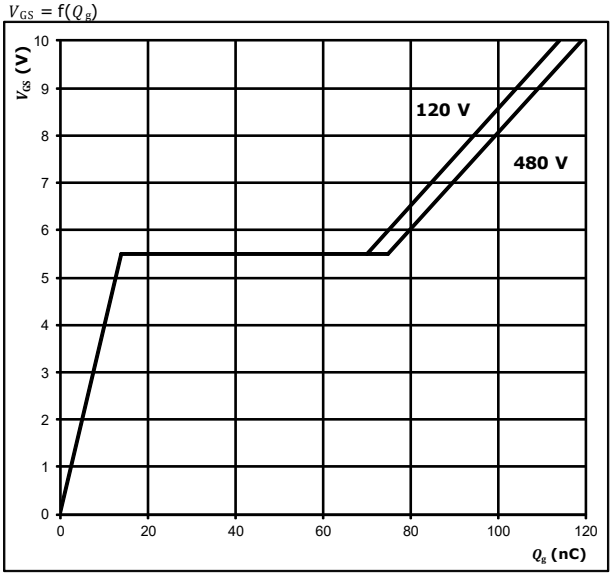
R (K/W)	τ (s)
9,67E-02	3,76E+00
2,24E-01	7,23E-01
1,72E-01	1,99E-01
2,62E-01	1,89E-02
6,41E-02	3,22E-03
6,48E-02	6,83E-04

PFC Switch Characteristics

figure 5. **MOSFET**

Gate voltage vs Gate charge

$V_{GS} = f(Q_g)$



At

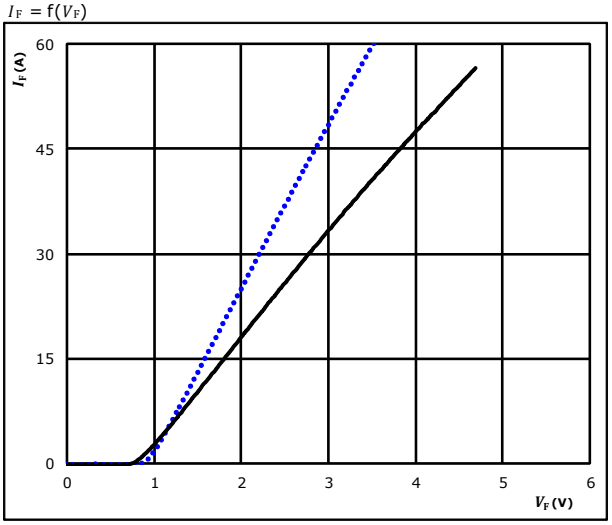
I_C= 18 A

PFC Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



t_p = 250 µs

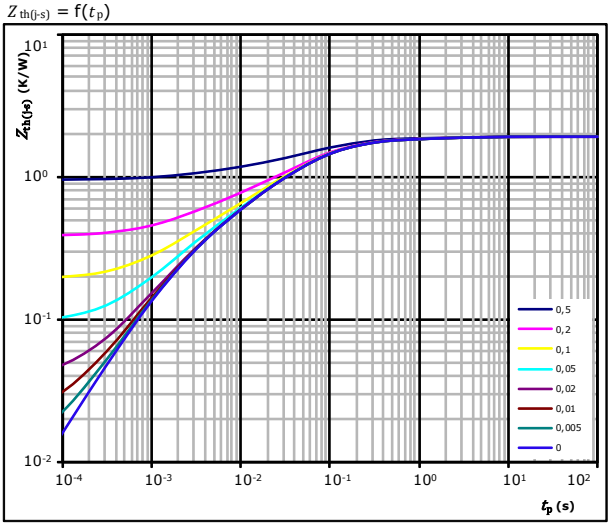
T_j: 25 °C

125 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,90 K/W

FWD thermal model values

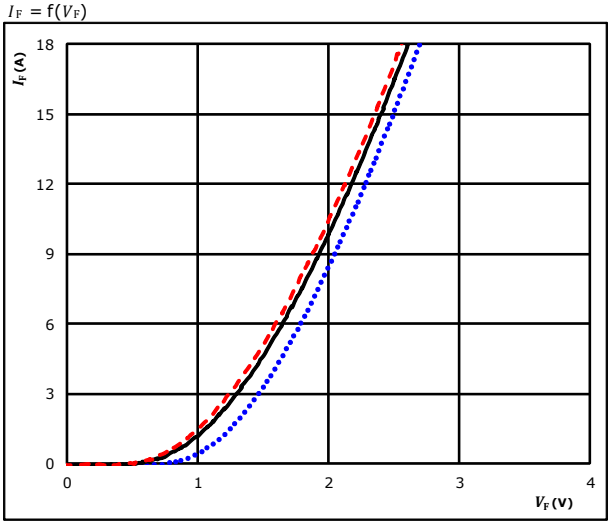
R (K/W)	τ (s)
7,15E-02	3,48E+00
1,55E-01	4,88E-01
6,64E-01	9,51E-02
5,55E-01	3,49E-02
3,01E-01	7,59E-03
1,46E-01	1,63E-03
1,17E-02	1,33E-03

Current Transformer Protection Diode Characteristics

figure 1. **Prot. Diode**

Typical forward characteristics

$I_F = f(V_F)$



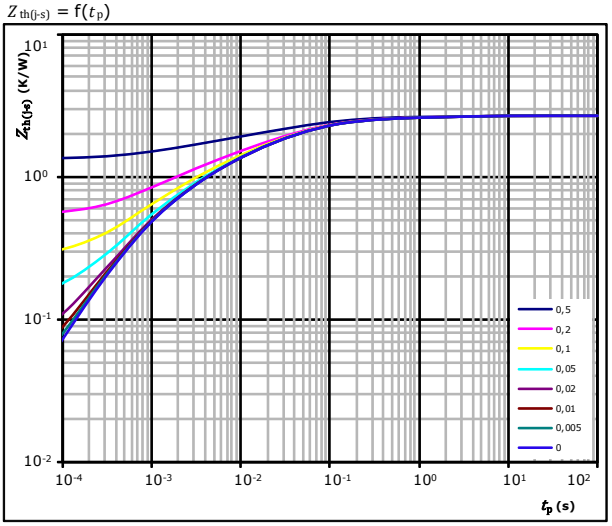
t_p = 250 µs

T_j: 25 °C
125 °C
150 °C

figure 2. **Prot. Diode**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 2,68 K/W

Prot. Diode thermal model values

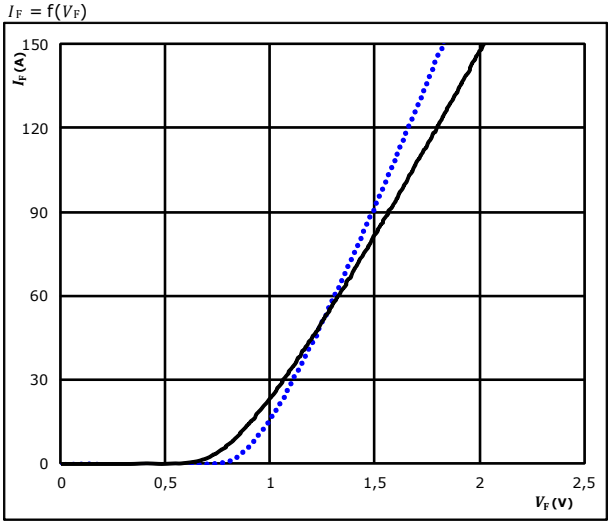
R (K/W)	τ (s)
1,11E-01	2,77E+00
2,71E-01	2,27E-01
7,97E-01	4,98E-02
6,34E-01	1,25E-02
5,36E-01	2,88E-03
3,32E-01	6,60E-04

Rectifier Diode Characteristics

figure 1. **Rectifier Diode**

Typical forward characteristics

$I_F = f(V_F)$



t_p = 250 µs

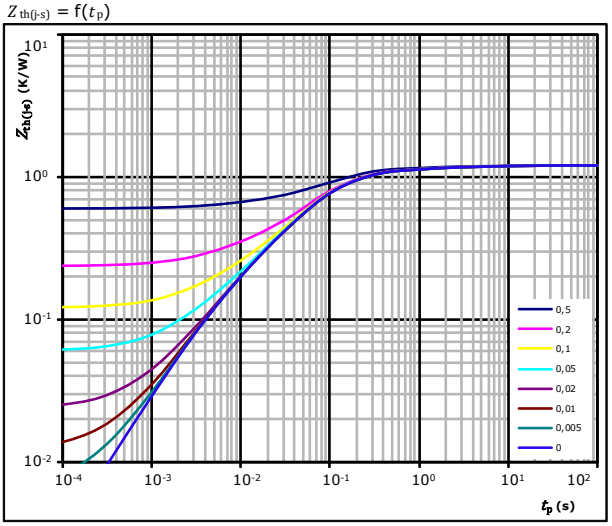
T_j: 25 °C

125 °C

figure 2. **Rectifier Diode**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,20 K/W

Diode thermal model values

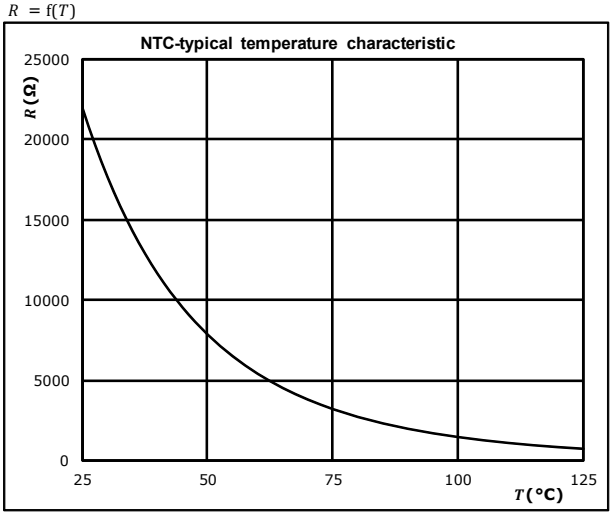
R (K/W)	τ (s)
4,87E-02	7,85E+00
1,57E-01	7,27E-01
7,33E-01	1,05E-01
1,69E-01	3,58E-02
7,37E-02	5,50E-03
1,39E-02	1,76E-02

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic as a function of temperature

$R = f(T)$

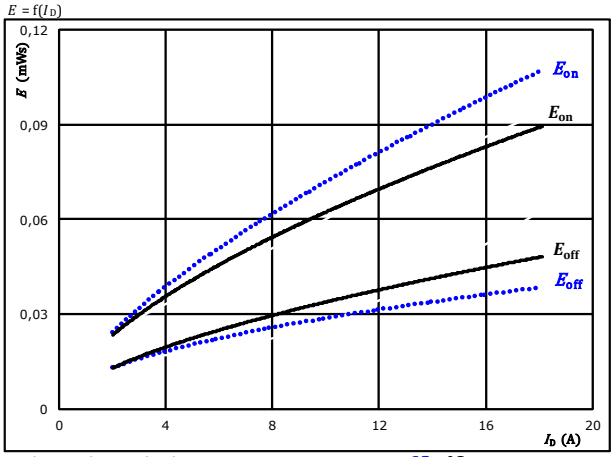


PFC Switching Characteristics

figure 1. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$

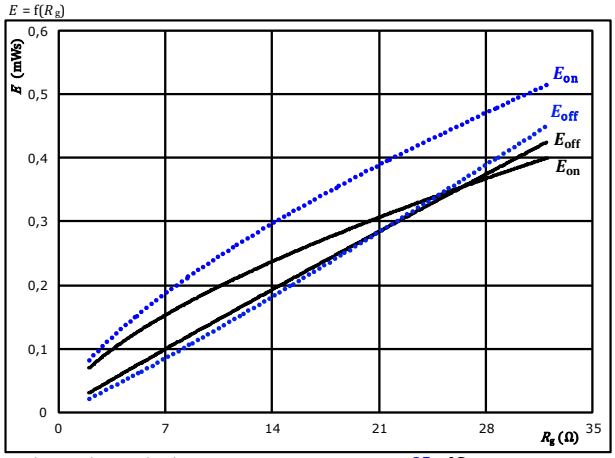


With an inductive load at — 25 °C
V_{DS} = 350 V — T_j: 125 °C
V_{GS} = 0/10 V
R_{gon} = 4 Ω
R_{goff} = 4 Ω

figure 2. **MOSFET**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$

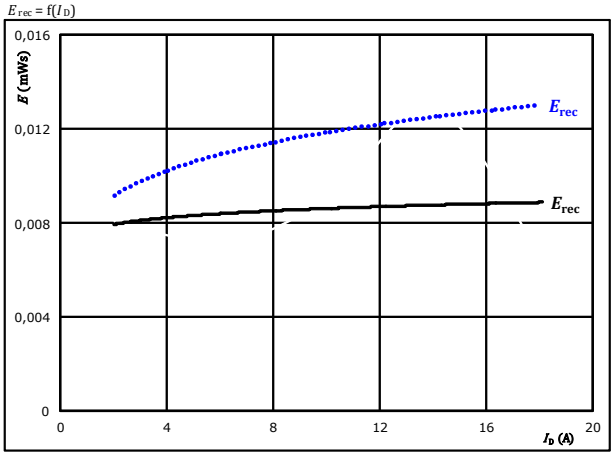


With an inductive load at — 25 °C
V_{DS} = 350 V — T_j: 125 °C
V_{GS} = 0/10 V
I_D = 18 A

figure 3. **FWD**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$

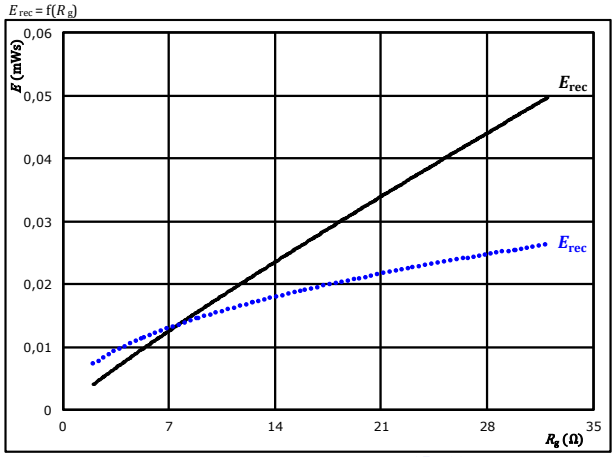


With an inductive load at — 25 °C
V_{DS} = 350 V — T_j: 125 °C
V_{GS} = 0/10 V
R_{gon} = 4 Ω

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



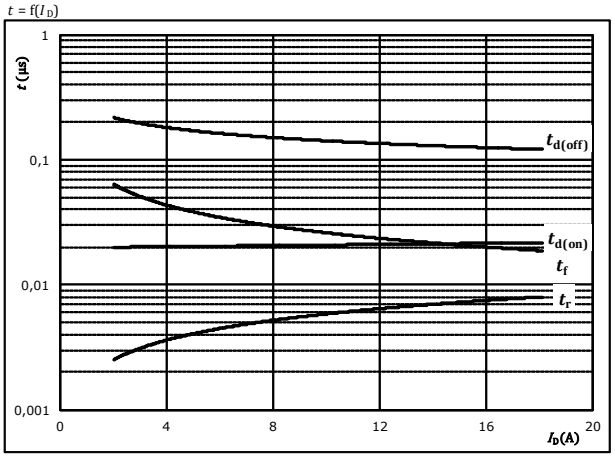
With an inductive load at — 25 °C
V_{DS} = 350 V — T_j: 125 °C
V_{GS} = 0/10 V
I_D = 18 A

PFC Switching Characteristics

figure 5. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



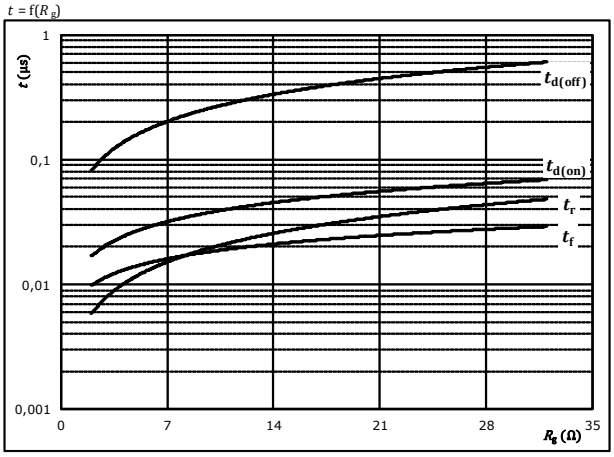
With an inductive load at

T_j =	125	°C
V_{DS} =	350	V
V_{GS} =	0/10	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 6. **MOSFET**

Typical switching times as a function of gate resistor

$t = f(R_g)$



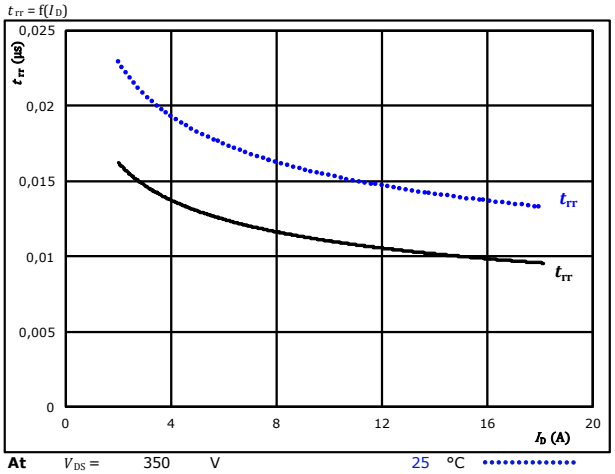
With an inductive load at

T_j =	125	°C
V_{DS} =	350	V
V_{GS} =	0/10	V
I_D =	18	A

figure 7. **FWD**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$

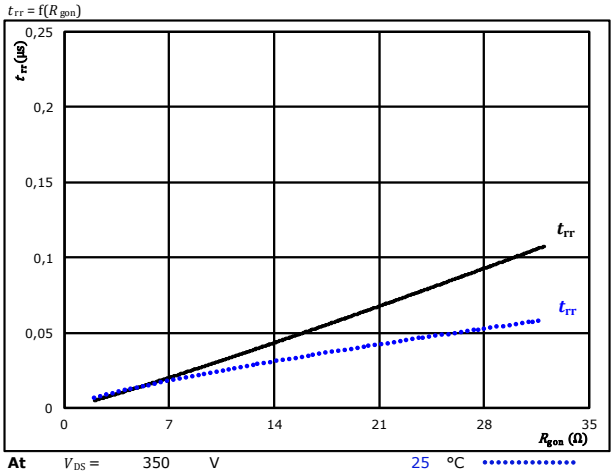


At	V_{DS} =	350	V	25 °C	•••••••••••••••
	V_{GS} =	0/10	V	T_j: 125 °C	———
	R_{gon} =	4	Ω		

figure 8. **FWD**

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

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



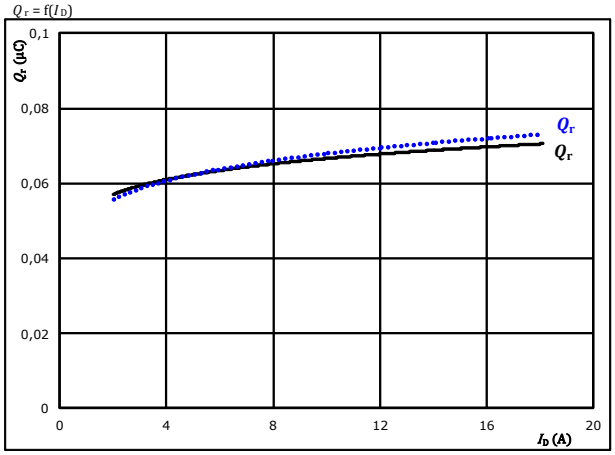
At	V_{DS} =	350	V	25 °C	•••••••••••••••
	V_{GS} =	0/10	V	T_j: 125 °C	———
	I_D =	18	A		

PFC Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

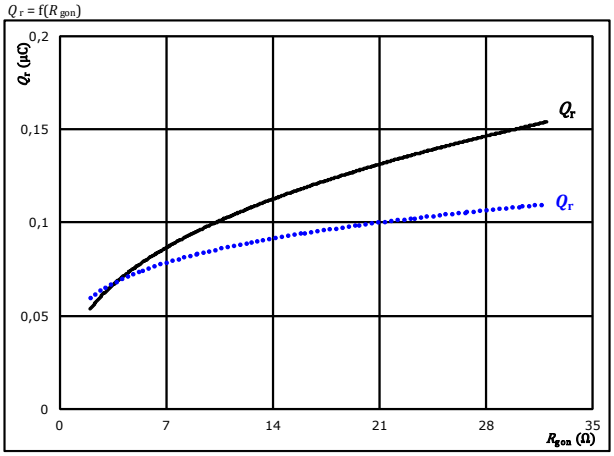


At						
	V_{DS} =	350	V		25 °C	•••••••••••••••
	V_{GS} =	0/10	V	T_j:	125 °C	———
	R_{gon} =	4	Ω			

figure 10. FWD

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

$Q_r = f(R_{gon})$

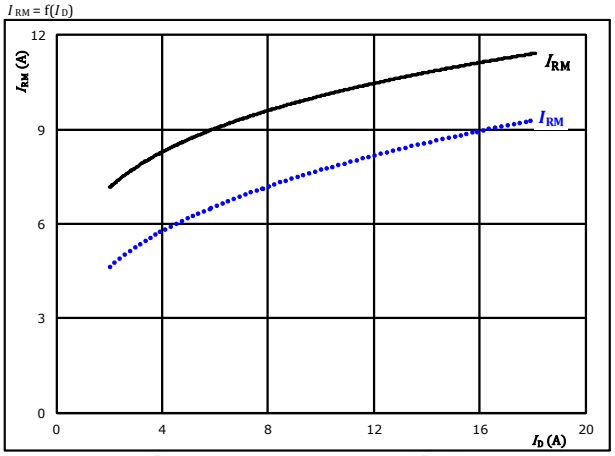


At						
	V_{DS} =	350	V		25 °C	•••••••••••••••
	V_{GS} =	0/10	V	T_j:	125 °C	———
	I_D =	18	A			

figure 11. FWD

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

$I_{RM} = f(I_D)$

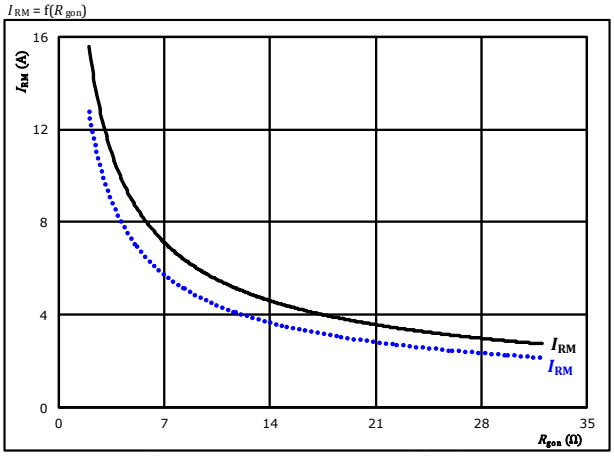


At						
	V_{DS} =	350	V		25 °C	•••••••••••••••
	V_{GS} =	0/10	V	T_j:	125 °C	———
	R_{gon} =	4	Ω			

figure 12. FWD

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

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



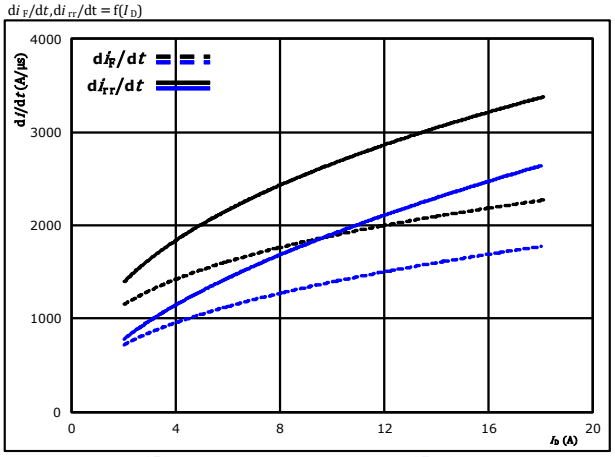
At						
	V_{DS} =	350	V		25 °C	•••••••••••••••
	V_{GS} =	0/10	V	T_j:	125 °C	———
	I_D =	18	A			

PFC Switching Characteristics

figure 13. **FWD**

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

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

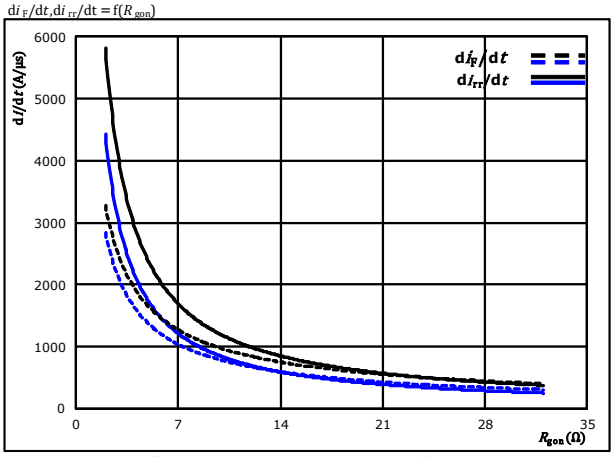


At					
V_{DS} =	350	V		25 °C	
V_{GS} =	0/10	V	T_j:	125 °C	
R_{gon} =	4	Ω			

figure 14. **FWD**

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

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

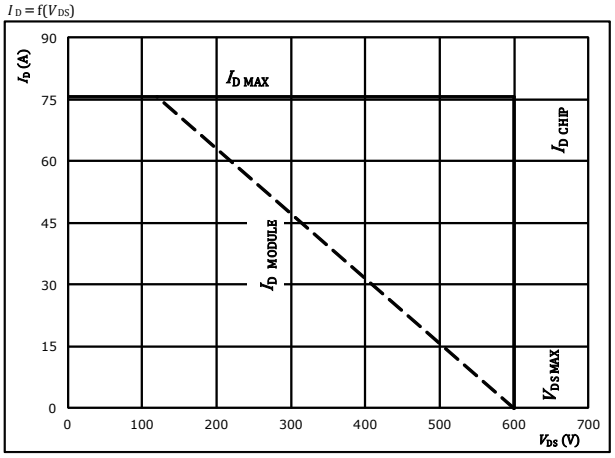


At					
V_{DS} =	350	V		25 °C	
V_{GS} =	0/10	V	T_j:	125 °C	
I_D =	18	A			

figure 15. **MOSFET**

Reverse bias safe operating area

$I_D = f(V_{DS})$



At

T_j =	175	°C
R_{gon} =	4	Ω
R_{goff} =	4	Ω

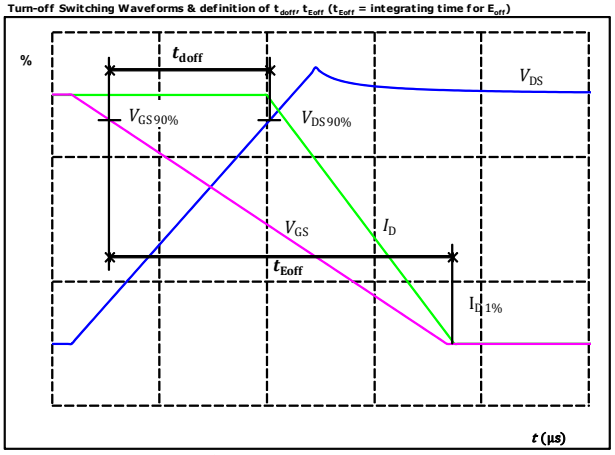
PFC Switching Definitions

General conditions

T_j	=	**125 °C**
R_{gon}	=	**4 Ω**
R_{goff}	=	**4 Ω**

figure 1. MOSFET

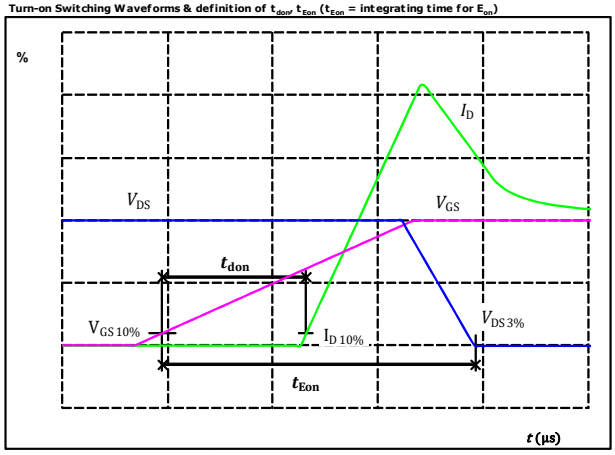
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GS}(0\%)$ =	0	V
$V_{GS}(100\%)$ =	10	V
$V_{DS}(100\%)$ =	350	V
$I_D(100\%)$ =	18	A
t_{doff} =	0,126	µs

figure 2. MOSFET

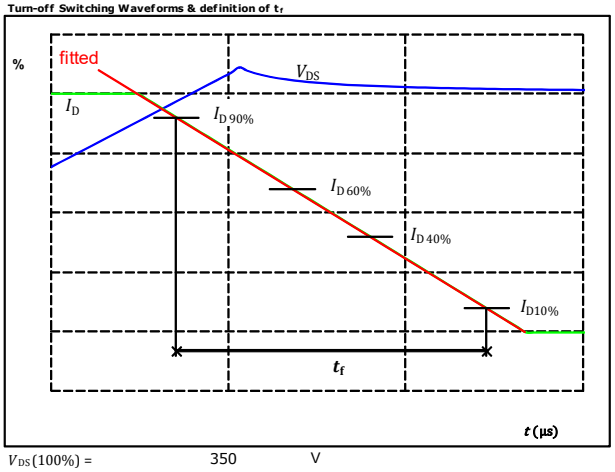
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GS}(0\%)$ =	0	V
$V_{GS}(100\%)$ =	10	V
$V_{DS}(100\%)$ =	350	V
$I_D(100\%)$ =	18	A
t_{don} =	0,022	µs

figure 3. MOSFET

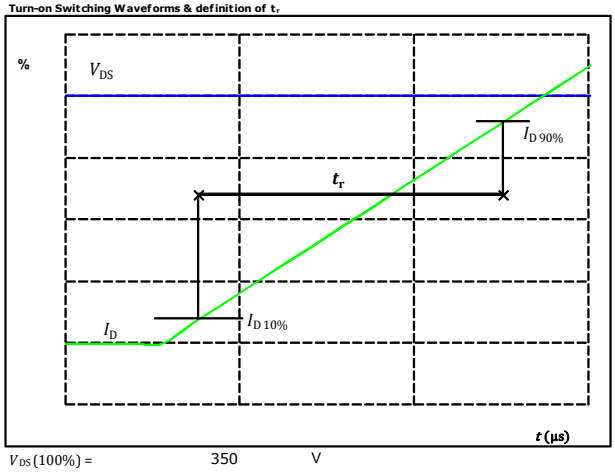
Turn-off Switching Waveforms & definition of t_f



$V_{DS}(100\%)$ =	350	V
$I_D(100\%)$ =	18	A
t_f =	0,085	µs

figure 4. MOSFET

Turn-on Switching Waveforms & definition of t_r

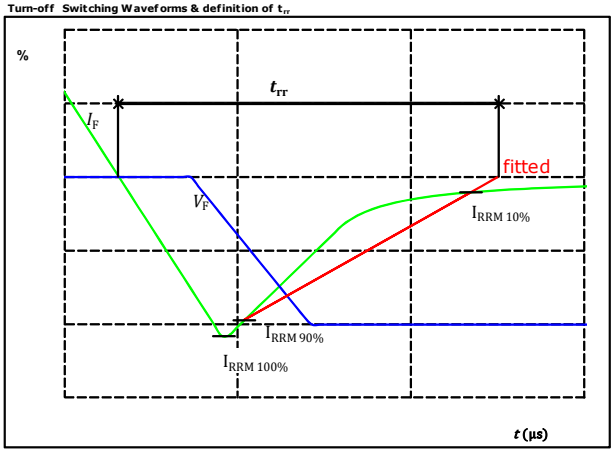


$V_{DS}(100\%)$ =	350	V
$I_D(100\%)$ =	18	A
t_r =	0,009	µs

PFC Switching Characteristics

figure 7. **FWD**

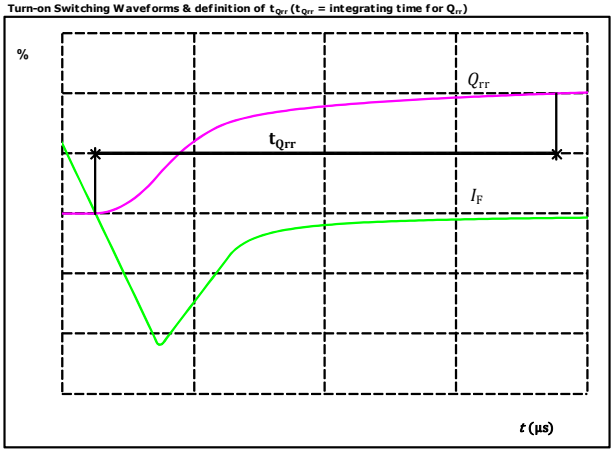
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	350	V
I_F (100%) =	18	A
I_{RRM} (100%) =	11	A
t_{rr} =	0,009	µs

figure 8. **FWD**

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



I_F (100%) =	18	A
Q_{rr} (100%) =	0,06	µC

Vincotech

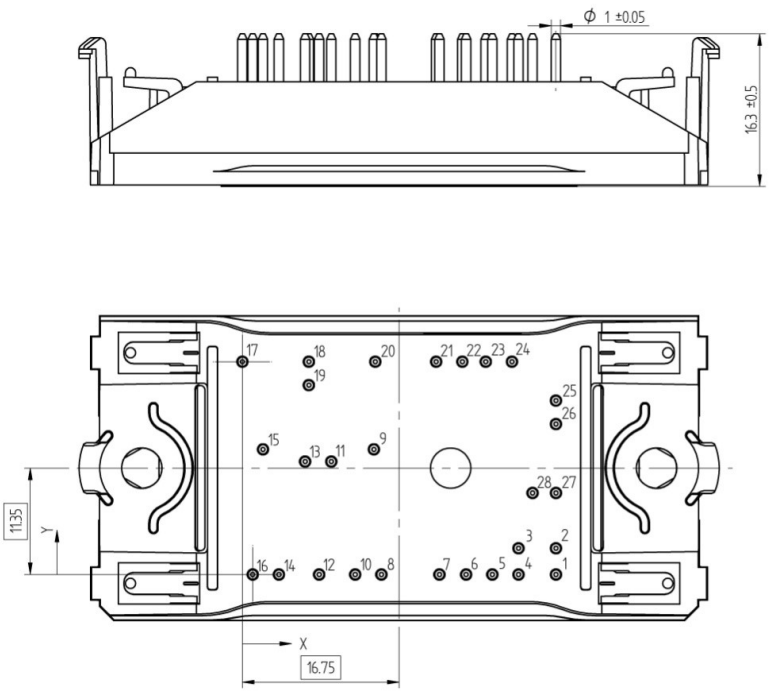
Ordering Code & Marking

Version	Ordering Code
without thermal paste 12 mm housing with solder pins	10-FZ062TA099FS05-P980D68

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

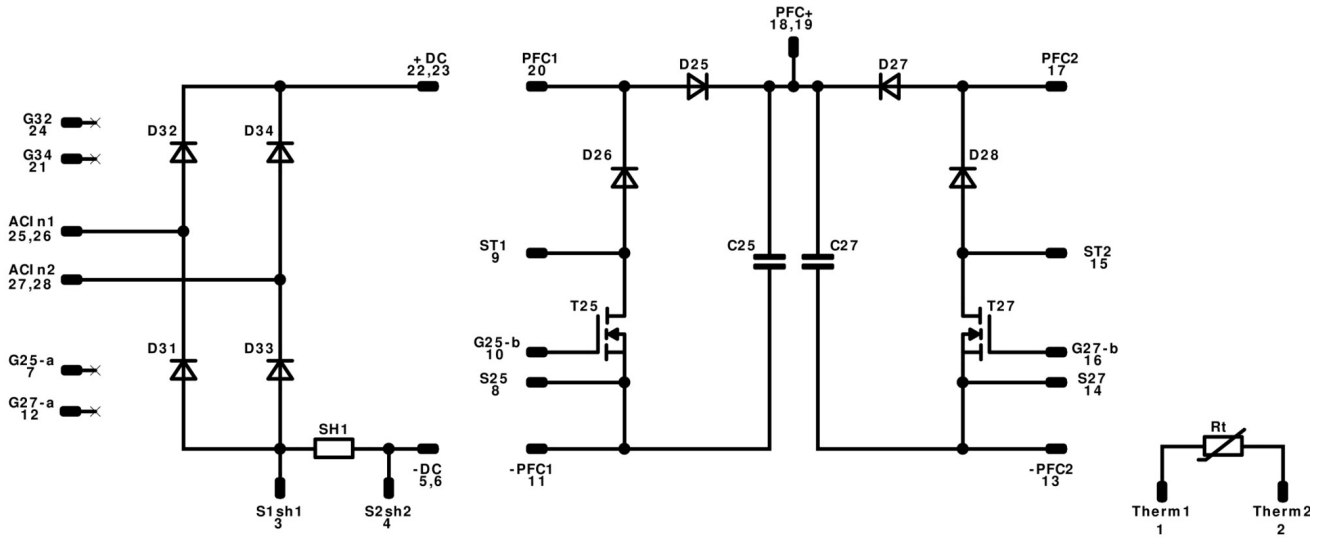
Outline

Pin table			
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	S1sh2
5	26,7	0	-DC
6	23,9	0	-DC
7	21,05	0	G25-a
8	14,85	0	S25
9	14,05	13,35	ST1
10	12,05	0	G25-b
11	9,5	12,05	-PFC1
12	8,2	0	G27-a
13	6,7	12,05	-PFC2
14	3,9	0	S27
15	2,2	13,35	ST2
16	1,1	0	G27-b
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	G34
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	MOSFET	600 V	99 mΩ	PFC Switch	
D25, D27	FWD	650 V	16 A	PFC Diode	
D26, D28	FWD	600 V	6 A	Current Transformer Protection Diode	
D31, D32, D33, D34	Rectifier	1600 V	50 A	Rectifier Diode	
SH1	Shunt		32 A	PFC Shunt	
C25, C27	Capacitor	500 V		Capacitor (DC)	
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.

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-FZ062TA099FS05-P980D68-D2-14	13 Mar. 2019	Correction of I_c/I_f values	2