Vincotech

10-FZ062TA099P7-P980D08
datasheet

***flow*PFC 0 CD** **600 V / 99 mΩ**

Topology features

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

Component features

- Commutation rugged
- Easy to use / drive
- Suitable for hard and soft switching

Housing features

- Base isolation: Al_2O_3
- 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

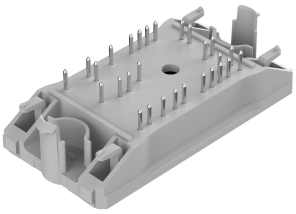
Target applications

- Embedded Drives
- Industrial Drives

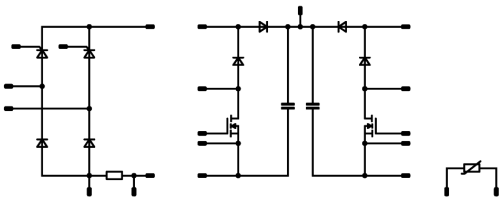
Types

- 10-FZ062TA099P7-P980D08

flow 0 12 mm housing



Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
PFC Switch					
Drain-source voltage	V_{DSS}			600	V
Drain current (DC current)	I_D	$T_j = T_{jmax}$	T_s = 80 °C	16	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}		100	A
Avalanche energy, single pulse	E_{AS}	V_{DD} = 50 V	I_D = 5,1 A	105	mJ
Avalanche energy, repetitive	E_{AR}	V_{DD} = 50 V	I_D = 5,1 A	0,53	mJ
MOSFET dv/dt ruggedness	dv/dt	V_{DS}= 0..400 V	T_s = 25 °C	80	V/ns
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	48	W
Gate-source voltage	V_{GSS}			±20	V
Reverse diode dv/dt	dv/dt			50	V/ns
Maximum Junction Temperature	T_{jmax}			150	°C
PFC Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	22	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		75	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 25 °C	142	A
Surge current capability	I^2t			100	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	50	W
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Current Transformer Protection Diode					
Peak repetitive reverse voltage	V_{RRM}			600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	16	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 °C	35	W
Maximum junction temperature	T_{jmax}			175	°C
Rectifier Thyristor					
Repetitive peak reverse voltage	V_{RRM}			1200	V
Maximum RMS on-state current	I_{TRMSM}	$T_j = T_{jmax}$	T_s = 80 °C	25	A
Surge on-state current	I_{TSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 125 °C	320	A
I2t value	I^2t	Single Half Sine Wave, t_p = 8,3 ms	T_j = 125 °C	510	A^2s
Mean total power loss	$P_{tot}(AV)$	$T_j = T_{jmax}$	T_s = 80 °C	60	W
Maximum Junction Temperature	T_{jmax}			150	°C
Rectifier Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	51	A
Surge (non-repetitive) forward current	I_{FSM}	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	68	W
Maximum junction temperature	T_{jmax}			150	°C
PFC Shunt					
DC current	I			31,6	A
Power dissipation	P_{tot}		T_c = 70 °C	10	W
Operation Temperature	T_{op}			-55 ... 170	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
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
Isolation voltage	V_{isol}	AC Voltage t_p = 1 min	2500	V
Creepage distance			>12,7	mm
Clearance			8,99	mm
Comparative Tracking Index	CTI		≥ 200	

*100 % tested in production

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 Switch										
Static										
Drain-source on-state resistance	$r_{DS(on)}$		10		10,5	25 125		94,4 168	99(1)	mΩ
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$	0		0,00053	25	3	3,5	4	V
Gate to Source Leakage Current	I_{GSS}		20	0		25			100	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	600		25			1	µA
Internal gate resistance	r_g							5,9		Ω
Gate charge	Q_g		0/10	400	10,5	25		45		nC
Short-circuit input capacitance	C_{iss}	f = 250 kHz	0	400	0	25		1952		pF
Short-circuit output capacitance	C_{oss}							33		
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,47		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	0/10	400	15	25 125		33,19 31,19		ns
Rise time	t_r					25 125		8,8 9,61		ns
Turn-off delay time	$t_{d(off)}$					25 125		140,6 154,91		ns
Fall time	t_f					25 125		31,73 34,12		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,049 µC Q_{rFWD}=0,05 µC				25 125		0,074 0,089		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,046 0,058		mWs

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 Diode										
Static										
Forward voltage	V_F				16	25 125 150		1,49 1,75 1,87	1,8(1)	V
Reverse leakage current	I_R	V_r = 650 V				25		20	102	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,9		K/W
Dynamic										
Peak recovery current	I_{RM}	di/dt=1931 A/µs di/dt=1599 A/µs	0/10	400	15	25 125		8,93 7,65		A
Reverse recovery time	t_{rr}					25 125		9,58 11,32		ns
Recovered charge	Q_r					25 125		0,049 0,05		µC
Reverse recovered energy	E_{rec}					25 125		$6,958x10^{-3}$ $6,961x10^{-3}$		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		2628,83 1684,95		A/µs

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	
Current Transformer Protection Diode										
Static										
Forward voltage	V_F				6	25 125	1,25	1,58 1,5	1,95(1)	V
Reverse leakage current	I_R	V_r = 600 V				25			27	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,68		K/W
Rectifier Thyristor										
Static										
On-state voltage	V_T				44	25 125		1,39 1,41	1,33 1,32	V
On-state threshold voltage	$V_{T(TO)}$				44	125			0,9	V
On-state slope resistance	r_T				44	125			9	mΩ
Direct reverse current	I_{RD}	V_r = 1200 V				25 125			10 2	µA
Holding current	I_H			6		25			50	mA
Latching current	I_L	t_p = 10 µs I_G = 0,2 A di_G/dt = A/µs				25			90	mA
Gate trigger voltage	V_{GT}			6		25			1,3	V
Gate trigger current	I_{GT}			6		25	11		28	mA
Gate non-trigger voltage	V_{GD}			2/3 V_{DRM}		125			0,2	V
Gate non-trigger current	I_{GD}					25			1	mA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,16		K/W

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	
Rectifier Diode										
Static										
Forward voltage	V_F				50	25 125		1,31 1,33	1,3(1) 1,33(1)	V
Reverse leakage current	I_R	V_r = 1600 V				25 150			20 1500	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,03		K/W
PFC Shunt										
Static										
Resistance	R							10		mΩ
Tolerance							-1		1	%
Temperature coeficient	tc							50		ppm/K
Capacitor (DC)										
Static										
Capacitance	C	DC bias voltage = 0 V				25		270		nF
Tolerance							-20		20	%

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 Ω				100	-5		5	%
Power dissipation	P					25		130		mW
Power dissipation constant	d					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %						3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %						4000		K
Vincotech Thermistor Reference									I	

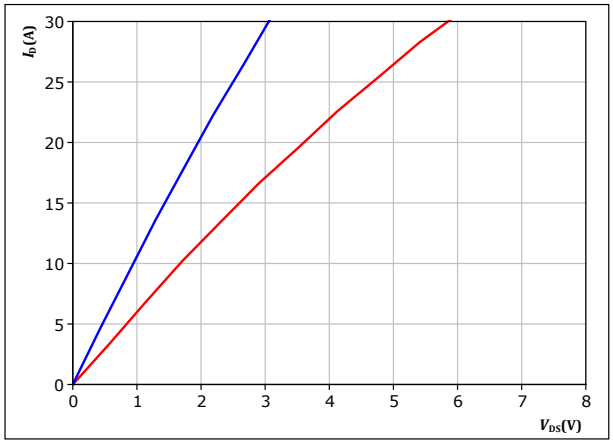
(1) Value at chip level
(2) Only valid with pre-applied Vincotech thermal interface material.

PFC Switch Characteristics

figure 1. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

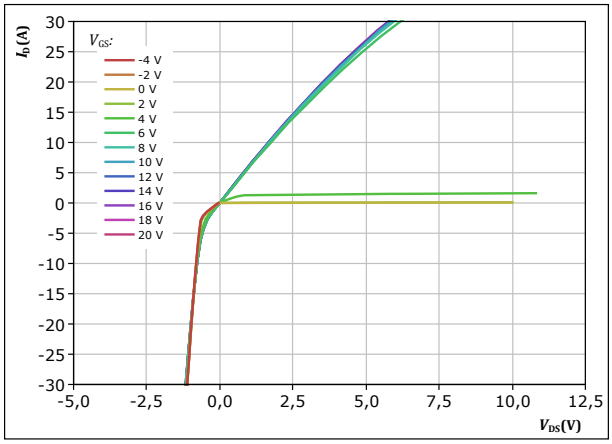


t_p =	250	µs	T_j:	25 °C
V_{GS} =	10	V		125 °C

figure 2. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$



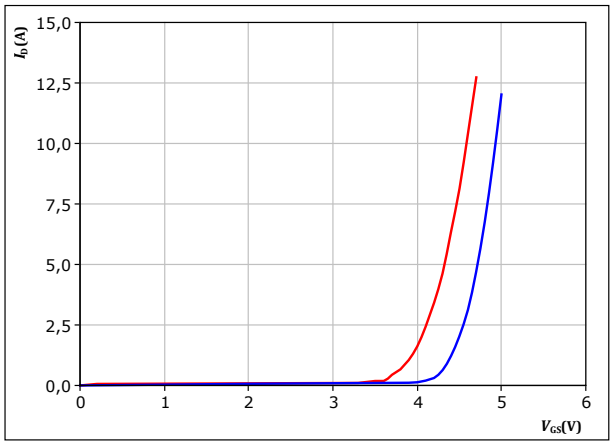
t_p =	250	µs
T_j =	125	°C

V_{GS} from -4 V to 20 V in steps of 2 V

figure 3. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$

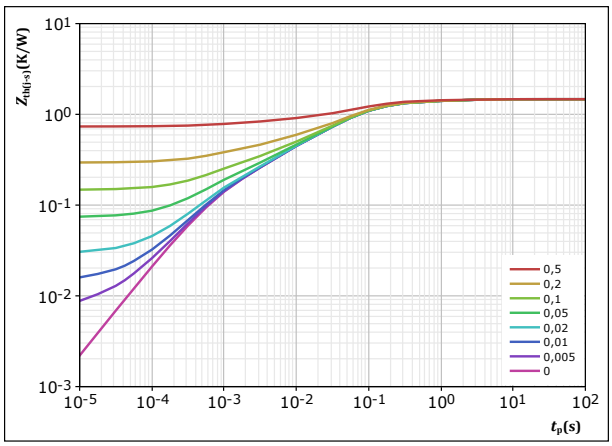


t_p =	250	µs	T_j:	25 °C
V_{DS} =	10	V		125 °C

figure 4. **MOSFET**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,469	K/W

MOSFET thermal model values

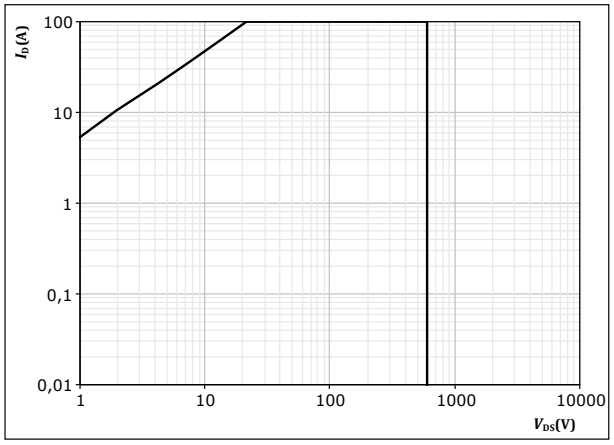
R (K/W)	τ (s)
1,02E-01	1,98E+00
3,83E-01	1,58E-01
6,43E-01	4,63E-02
2,21E-01	6,10E-03
1,22E-01	7,22E-04

PFC Switch Characteristics

figure 5. **MOSFET**

Safe operating area

$I_D = f(V_{DS})$



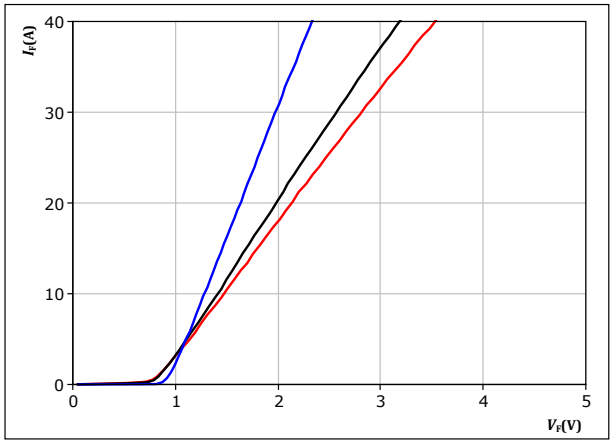
D =	single pulse	
T_s =	80	°C
V_{GS} =	10	V
T_j =	T_{jmax}	

PFC Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



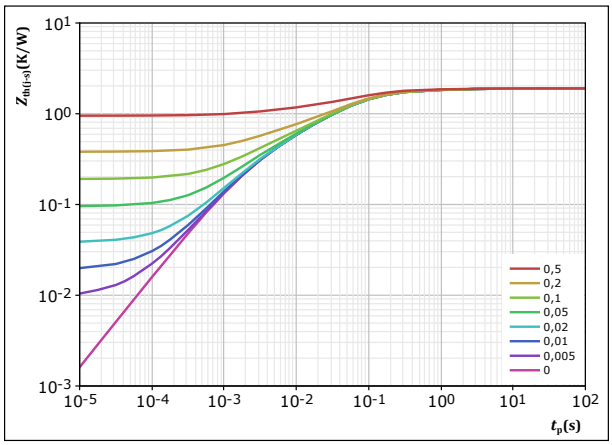
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 7. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,904 K/W

FWD thermal model values

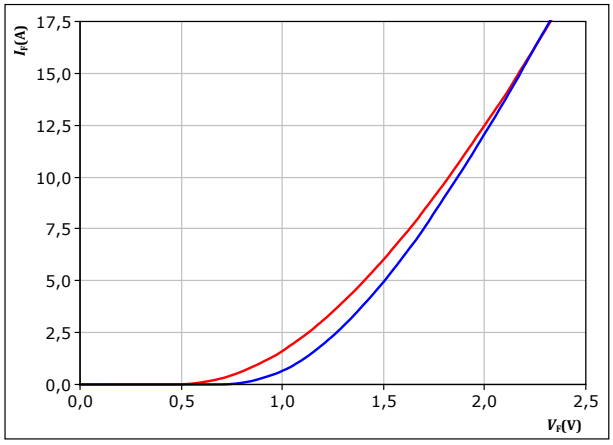
R (K/W)	τ (s)
7,15E-02	3,48E+00
1,55E-01	4,88E-01
6,64E-01	9,51E-02
5,55E-01	3,49E-02
3,01E-01	7,59E-03
1,46E-01	1,63E-03
1,17E-02	1,33E-03

Current Transformer Protection Diode Characteristics

figure 8. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



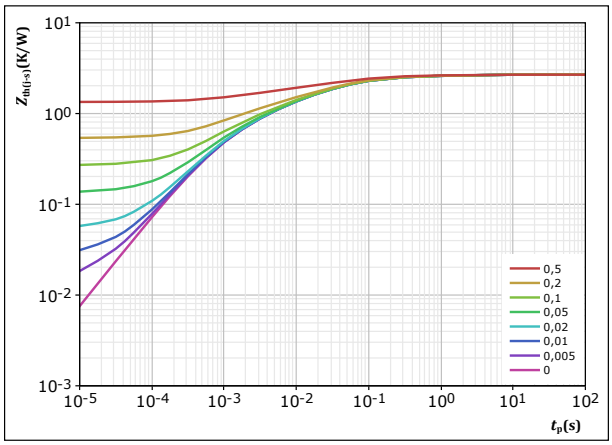
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 9. **FWD**

Transient thermal impedance as a function of pulse width

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



$D =$ t_p / T

$R_{th(j-s)} =$ 2,682 K/W

FWD thermal model values

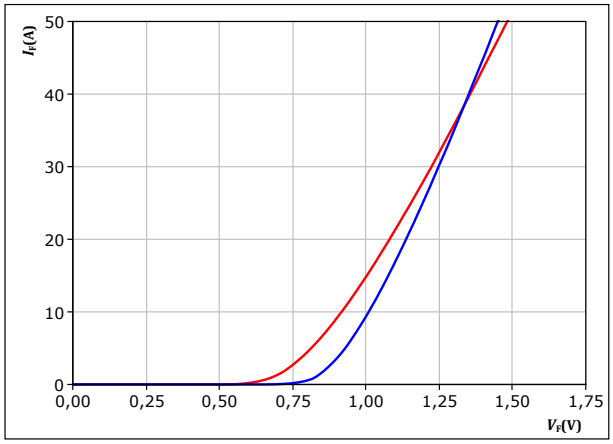
R (K/W)	τ (s)
1,11E-01	2,77E+00
2,71E-01	2,27E-01
7,97E-01	4,98E-02
6,34E-01	1,25E-02
5,36E-01	2,88E-03
3,32E-01	6,60E-04

Rectifier Thyristor Characteristics

figure 10. **Thyristor**

Typical forward characteristics

$I_F = f(V_F)$



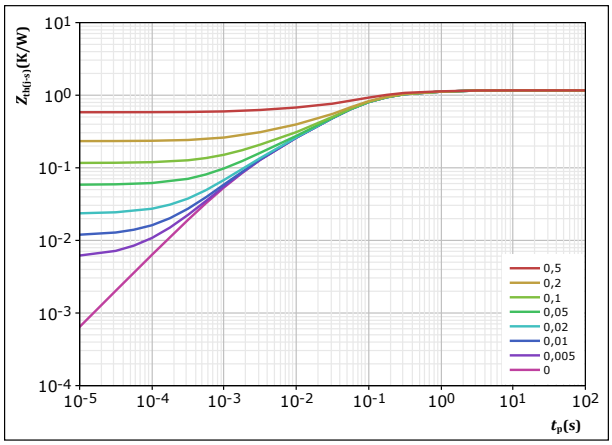
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 11. **Thyristor**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,165 K/W

Thyristor thermal model values

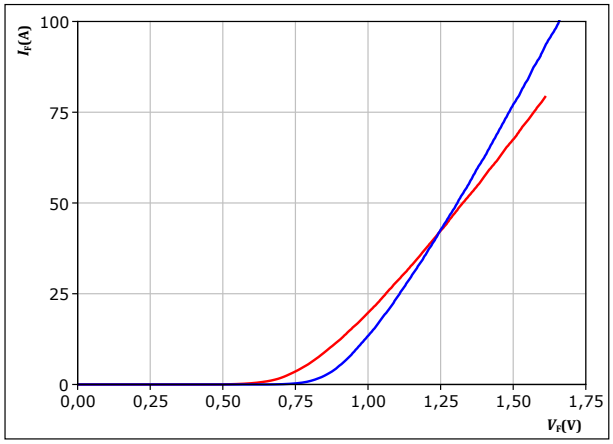
R (K/W)	τ (s)
1,32E-01	9,48E-01
4,51E-01	1,25E-01
4,32E-01	4,22E-02
1,06E-01	5,61E-03
4,49E-02	1,42E-03

Rectifier Diode Characteristics

figure 12. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



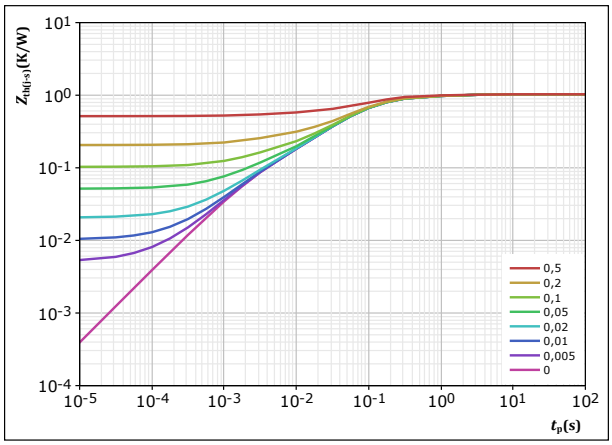
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 13. **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 K/W

Rectifier thermal model values

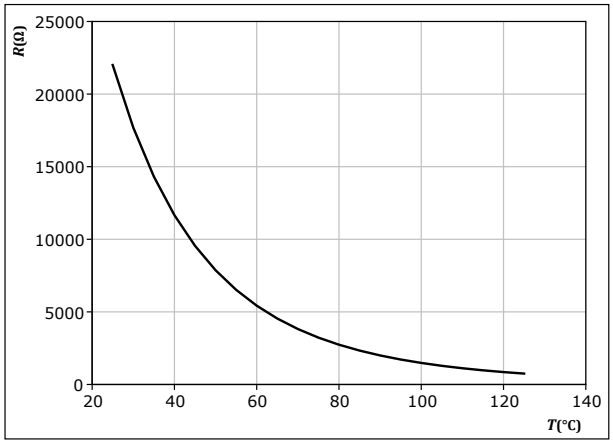
R (K/W)	τ (s)
5,79E-02	2,65E+00
1,32E-01	4,48E-01
6,73E-01	8,28E-02
1,09E-01	1,86E-02
5,86E-02	2,34E-03

Thermistor Characteristics

figure 14. **Thermistor**

Typical NTC characteristic as function of temperature

$R_T = f(T)$

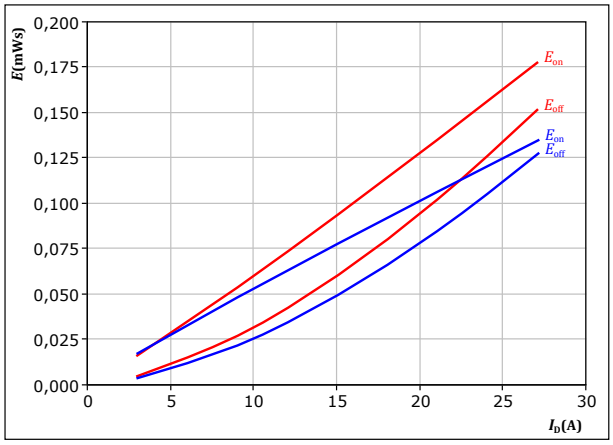


PFC Switching Characteristics

figure 15. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



With an inductive load at

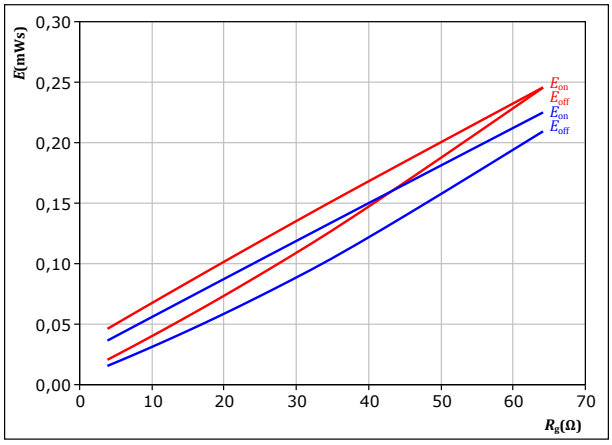
V_{DS} =	400	V
V_{GS} =	0/10	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

T_j: 25 °C, 125 °C

figure 16. **MOSFET**

Typical switching energy losses as a function of MOSFET turn on gate resistor

$E = f(R_g)$



With an inductive load at

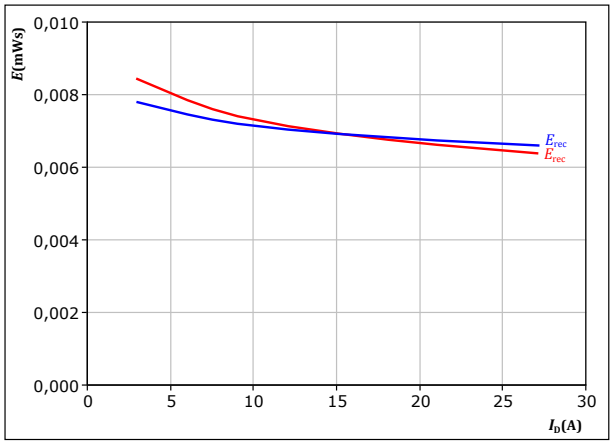
V_{DS} =	400	V
V_{GS} =	0/10	V
I_D =	15	A

T_j: 25 °C, 125 °C

figure 17. **FWD**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



With an inductive load at

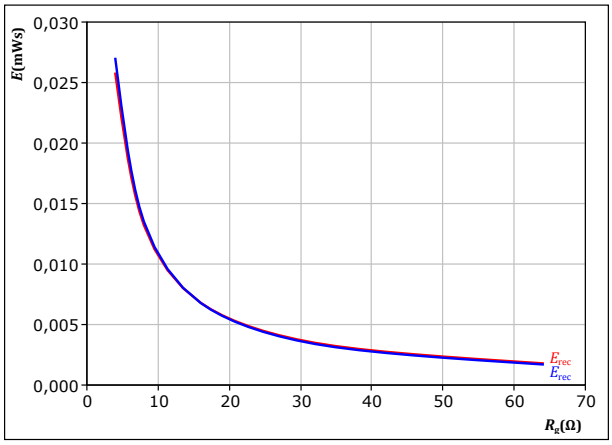
V_{DS} =	400	V
V_{GS} =	0/10	V
R_{gon} =	16	Ω

T_j: 25 °C, 125 °C

figure 18. **FWD**

Typical reverse recovered energy loss as a function of MOSFET turn on gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

V_{DS} =	400	V
V_{GS} =	0/10	V
I_D =	15	A

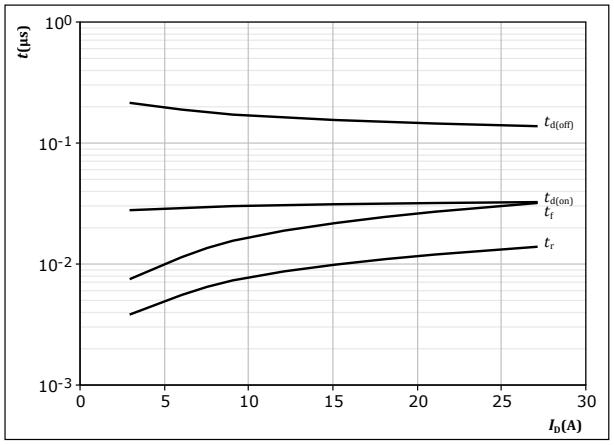
T_j: 25 °C, 125 °C

PFC Switching Characteristics

figure 19. **MOSFET**

Typical switching times as a function of drain current

t = f(I_D)



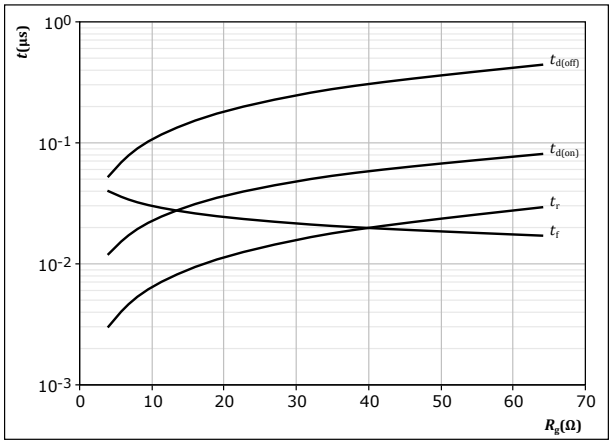
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	0/10	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 20. **MOSFET**

Typical switching times as a function of MOSFET turn on gate resistor

t = f(R_g)



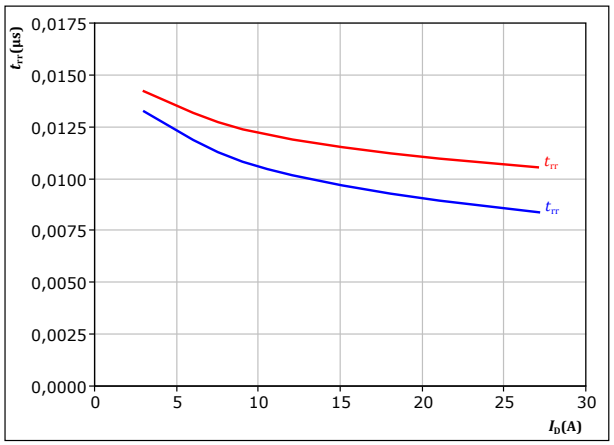
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	0/10	V
I_D =	15	A

figure 21. **FWD**

Typical reverse recovery time as a function of drain current

t_{rr} = f(I_D)



At

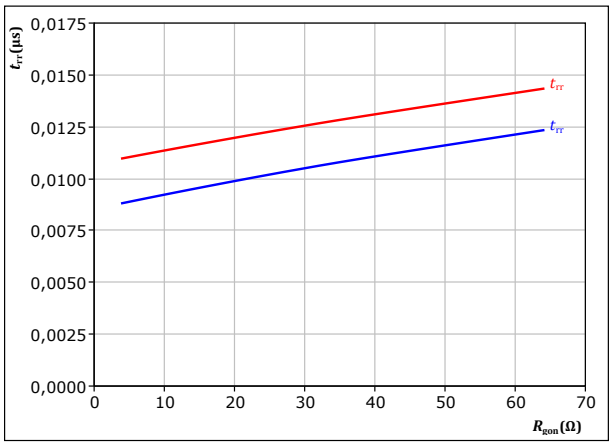
V_{DS} =	400	V
V_{GS} =	0/10	V
R_{gon} =	16	Ω

T_j: 25 °C, 125 °C

figure 22. **FWD**

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

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



At

V_{DS} =	400	V
V_{GS} =	0/10	V
I_D =	15	A

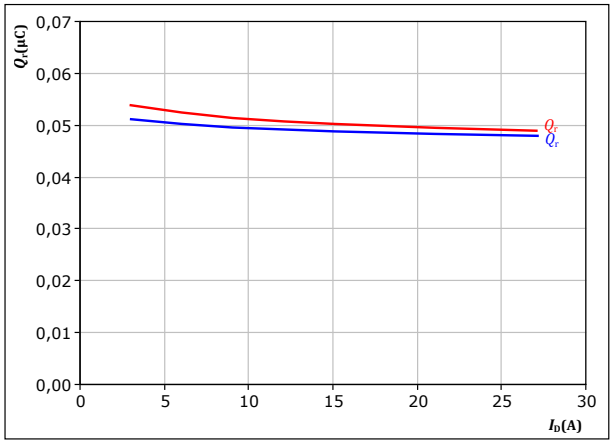
T_j: 25 °C, 125 °C

PFC Switching Characteristics

figure 23. **FWD**

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

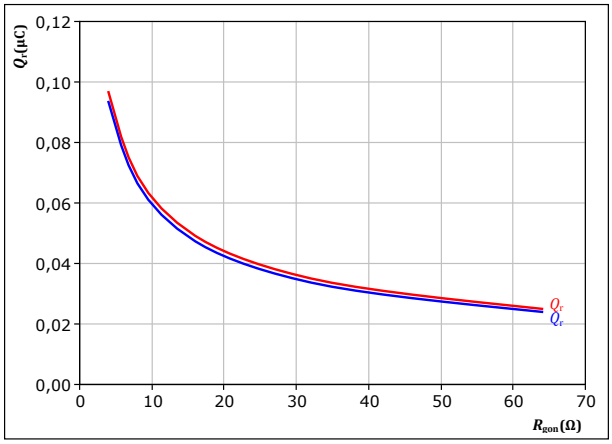


At				T_j:	
	V_{DS} =	400	V		25 °C
	V_{GS} =	0/10	V		125 °C
	R_{gon} =	16	Ω		

figure 24. **FWD**

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

$Q_r = f(R_{gon})$

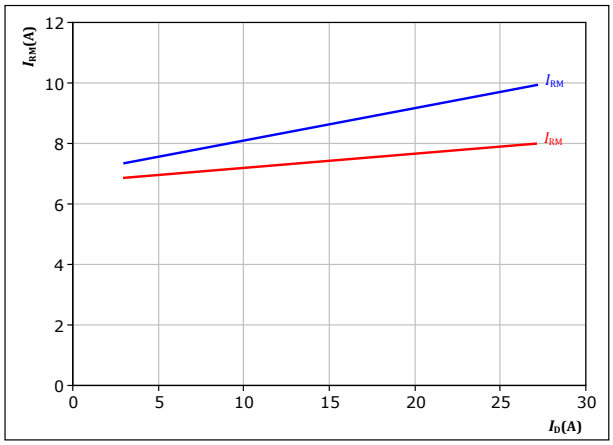


At				T_j:	
	V_{DS} =	400	V		25 °C
	V_{GS} =	0/10	V		125 °C
	I_D =	15	A		

figure 25. **FWD**

Typical peak reverse recovery current as a function of drain current

$I_{RM} = f(I_D)$

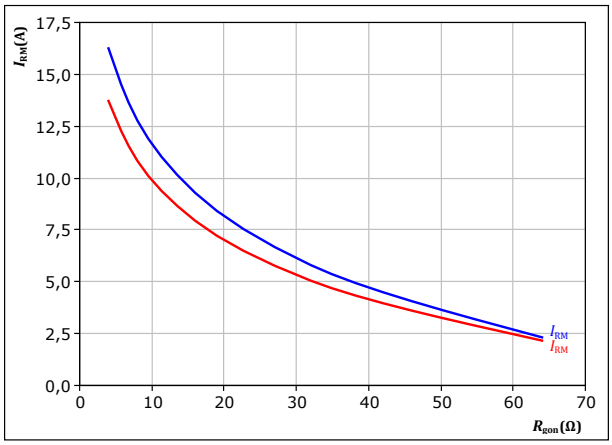


At				T_j:	
	V_{DS} =	400	V		25 °C
	V_{GS} =	0/10	V		125 °C
	R_{gon} =	16	Ω		

figure 26. **FWD**

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

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



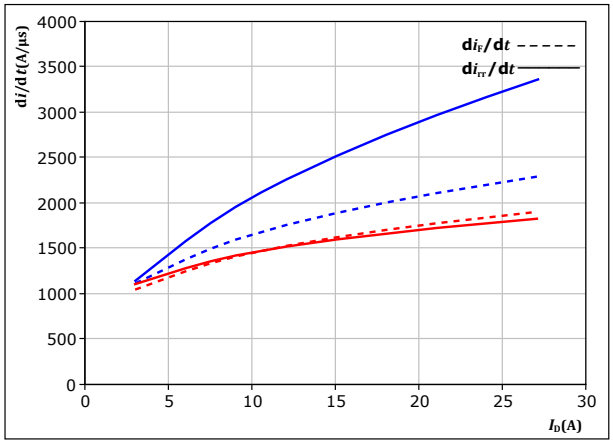
At				T_j:	
	V_{DS} =	400	V		25 °C
	V_{GS} =	0/10	V		125 °C
	I_D =	15	A		

PFC Switching Characteristics

figure 27. **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)



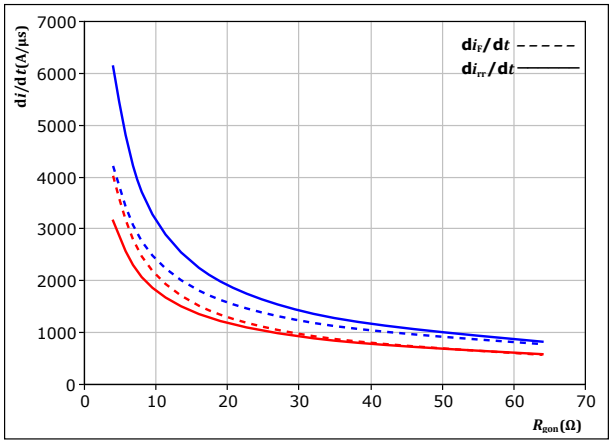
At			
	V_{DS} =	400	V
	V_{GS} =	0/10	V
	R_{gon} =	16	Ω

T_j: 25 °C, 125 °C

figure 28. **FWD**

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

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



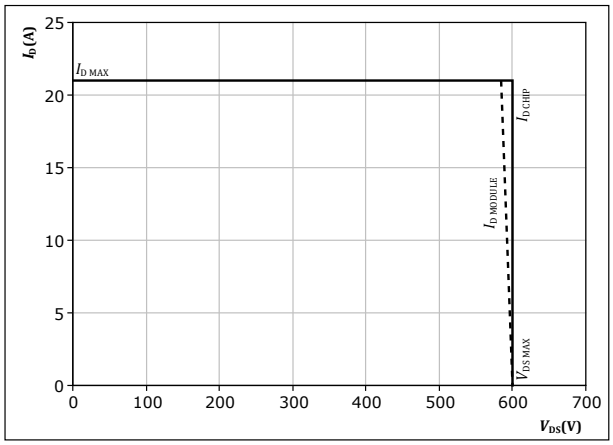
At			
	V_{DS} =	400	V
	V_{GS} =	0/10	V
	I_D =	15	A

T_j: 25 °C, 125 °C

figure 29. **MOSFET**

Reverse bias safe operating area

I_D = f(V_{DS})



At			
	T_j =	125	°C
	R_{gon} =	16	Ω
	R_{goff} =	16	Ω

PFC Switching Definitions

figure 30. MOSFET

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

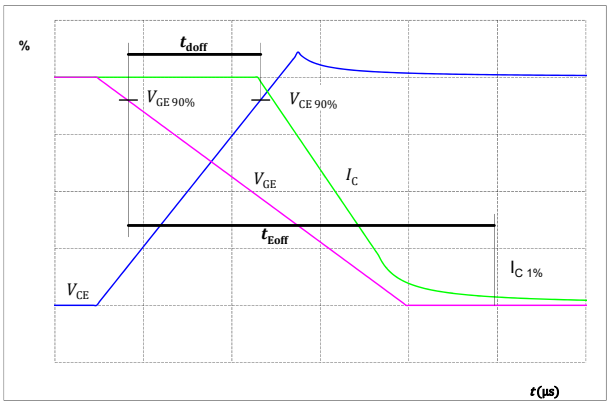


figure 31. MOSFET

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

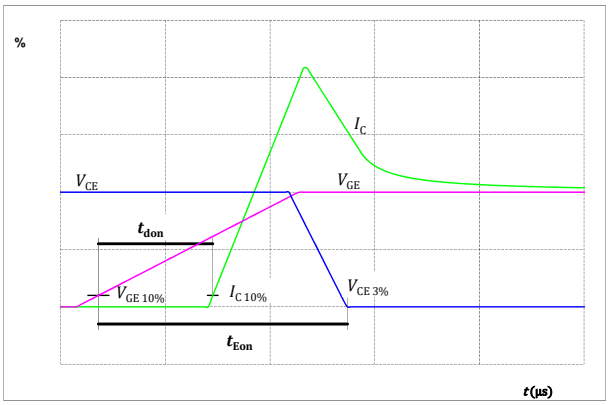


figure 32. MOSFET

Turn-off Switching Waveforms & definition of t_f

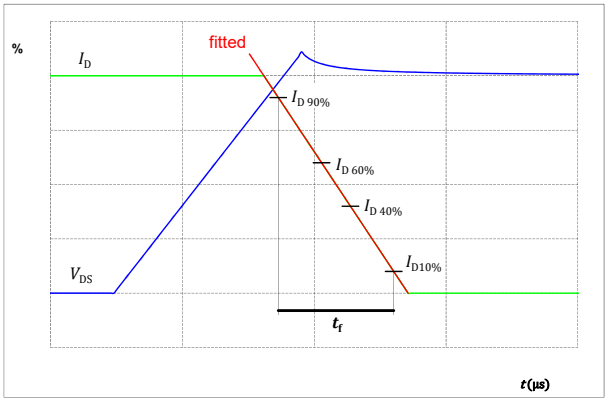
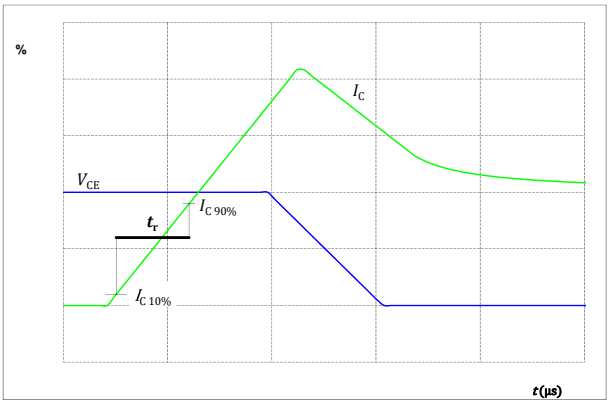


figure 33. MOSFET

Turn-on Switching Waveforms & definition of t_r



PFC Switching Definitions

figure 34. **FWD**

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

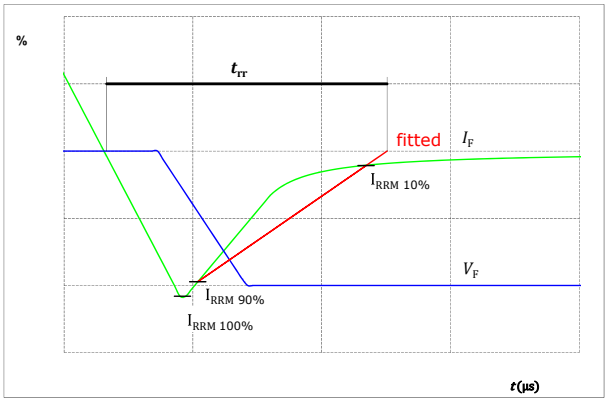


figure 35. **FWD**

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

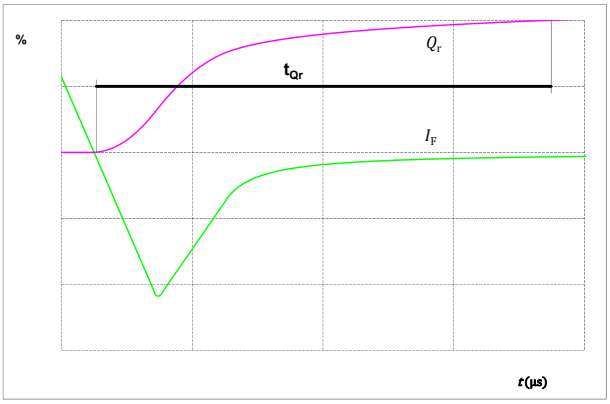
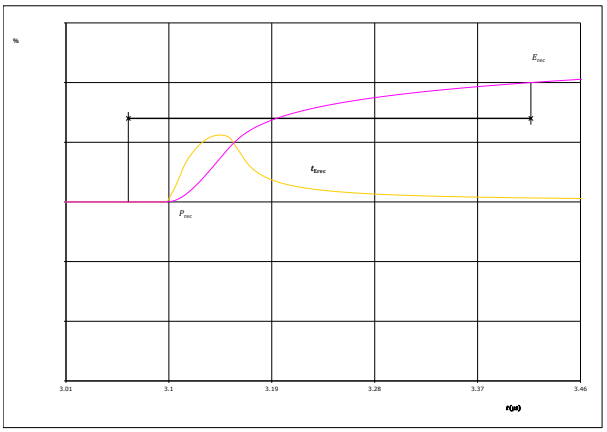


figure 36. **FWD**

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



Ordering Code

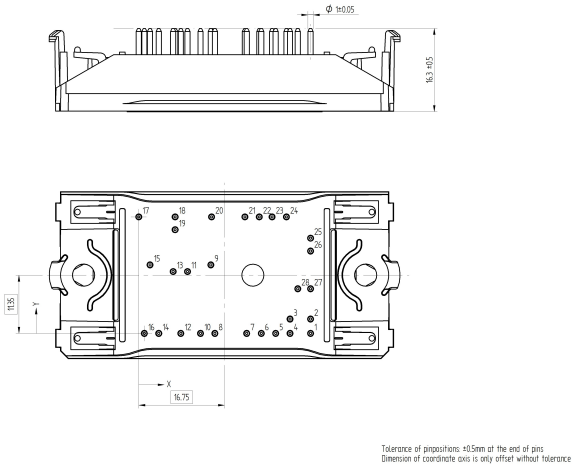
Version	Ordering Code
Without thermal paste	10-FZ062TA099P7-P980D08
With thermal paste (5,2 W/mK, PTM6000HV)	10-FZ062TA099P7-P980D08-/7/
With thermal paste (3,4 W/mK, PSX-P7)	10-FZ062TA099P7-P980D08-/3/

Marking

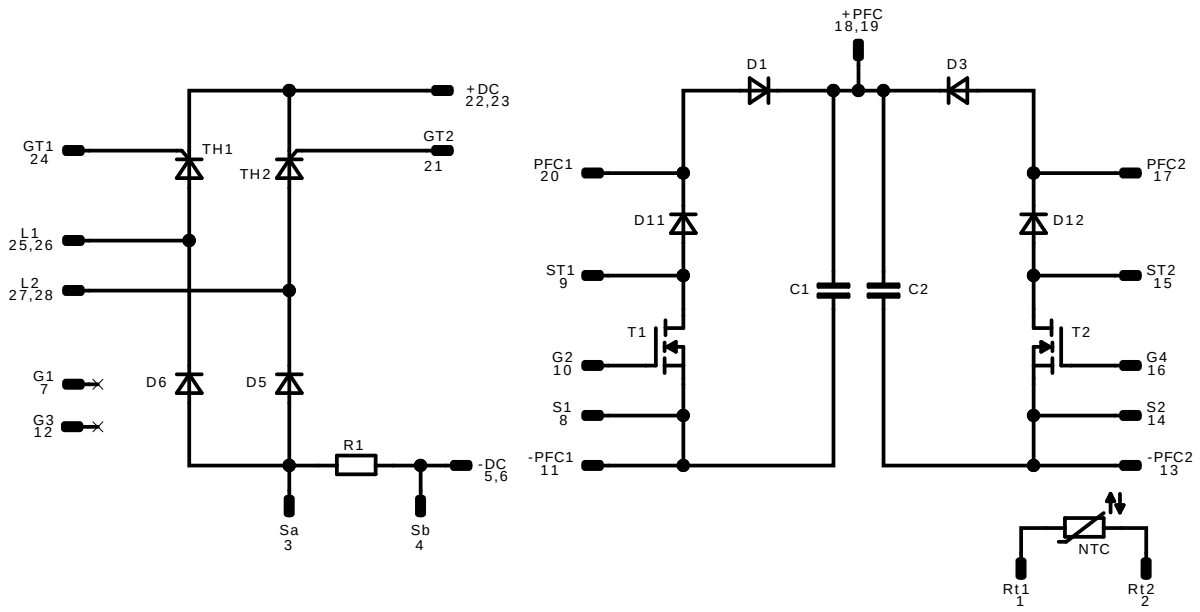
	Name		Date code	UL & VIN	Lot	Serial
Text	NN-NNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline

Pin table [mm]			
Pin	X	Y	Function
1	33,5	0	Rt1
2	33,5	2,8	Rt2
3	29,5	2,8	Sa
4	29,5	0	Sb
5	26,7	0	-DC
6	23,9	0	-DC
7	21,05	0	G1
8	14,85	0	S1
9	14,05	13,35	ST1
10	12,05	0	G2
11	9,5	12,05	-PFC1
12	8,2	0	G3
13	6,7	12,05	-PFC2
14	3,9	0	S2
15	2,2	13,35	ST2
16	1,1	0	G4
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	GT2
22	23,5	22,7	+DC
23	26	22,7	+DC
24	28,8	22,7	GT1
25	33,5	18,55	L1
26	33,5	16,05	L1
27	33,5	8,7	L2
28	31	8,7	L2



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1, T2	MOSFET	600 V	77 mΩ	PFC Switch	
D1, D2, D3, D4	FWD	650 V	16 A	PFC Diode	
D11, D12	FWD	600 V	6 A	Current Transformer Protection Diode	
TH1, TH2	Thyristor	1200 V	25 A	Rectifier Thyristor	
D6, D5	Rectifier	1600 V	50 A	Rectifier Diode	
R1, R2	Shunt			PFC Shunt	
C1, C2	Capacitor	500 V		Capacitor (DC)	
NTC	Thermistor			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.

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-FZ062TA099P7-P980D08-D1-14	29 Jul. 2022	Initial Release	