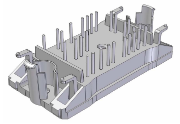
flow PFC 0

600 V/ 2 x 15 A / 50 kHz

Features

- Vincotech clip-in housing
- Compact and low inductance design
- Suitable for Interleaved topology
- Suitable for curent sensing in collector
- Ultrafast boost IGBT and FWD

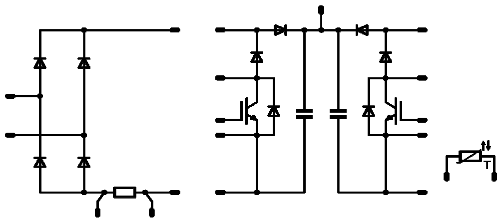
flow 0 housing



Target Applications

- PFC for welding
- PFC for SMPS
- PFC for motor drives
- PFC for UPS
- PFC for battery charger

Schematic



Types

- 10-F0062TA030FB05-P983D59, without SCR, current sense in collector
- 10-F0062TA030FB06-P983D79, without SCR, current sense in collector

Maximum Ratings

T_j=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Input Rectifier Diode					
Repetitive peak reverse voltage	V_{RRM}			1600	V
DC forward current	I_F	$T_j=T_j$max	T_h=80℃ T_c=80℃	35	A
Surge forward current	I_{FSM}	t_p=10ms	T_j=25℃	250	A
I2t-value	I^2t			310	A^2s
Power dissipation per Diode	P_{tot}	$T_j=T_j$max	T_h=80℃ T_c=80℃	40	W
Maximum Junction Temperature	$T_j$max			150	℃
PFC IGBT					
Collector-emitter break down voltage	V_{CE}			600	V
DC collector current	I_C	$T_j=T_j$max	T_h=80℃ T_c=80℃	19	A
Repetitive peak collector current	I_{Cpulse}	t_p limited by $T_j$max		90	A
Power dissipation per IGBT	P_{tot}	$T_j=T_j$max	T_h=80℃ T_c=80℃	57	W
Gate-emitter peak voltage	V_{GE}			+/- 20	V
Maximum Junction Temperature	$T_j$max			150	℃

Maximum Ratings

T_j=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
C.T. Inverse diode					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
DC forward current	I_F	$T_j=T_jmax$	T_h=80℃ T_c=80℃	8	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_jmax		16	A
Power dissipation per Diode	P_{tot}	$T_j=T_jmax$	T_h=80℃ T_c=80℃	14	W
Maximum Junction Temperature	T_jmax			175	℃
PFC Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
DC forward current	I_F	$T_j=T_jmax$	T_h=80℃ T_c=80℃	20	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_jmax		40	A
Power dissipation	P_{tot}	$T_j=T_jmax$	T_h=80℃ T_c=80℃	31	W
Maximum Junction Temperature	T_jmax			600	℃
PFC Shunt(P983D59)					
DC forward current	I_F		T_c=25℃	36,5	A
Power dissipation per Shunt	P_{tot}		T_c=25℃	10	W
PFC Shunt(P983D79)					
DC forward current	I_F		Tc=25℃	18,2	A
Power dissipation per Shunt	P_{tot}		Tc=25℃	5	W
DC link Capacitor					
Max.DC voltage	V_{MAX}		T_c=25℃	500	V
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	℃
Operation temperature under switching condition	T_{op}			-40…+(Tjmax - 25)	℃
Insulation Properties					
Insulation voltage	V_{is}	t=2s	DC voltage	4000	V
Creepage distance				min 12,7	mm
Clearance				min 12,7	mm

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Input Rectifier Diode										
Forward voltage	V_F				30	Tj=25℃ Tj=125℃		1,16 1,11	1,4	V
Threshold voltage (for power loss calc. only)	V_{to}				30	Tj=25℃ Tj=125℃		0,9 0,77		V
Slope resistance (for power loss calc. only)	r_t				30	Tj=25℃ Tj=125℃		9 12		mΩ
Reverse current	I_r			1500		Tj=25℃ Tj=150℃			0,02 2	mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ =1 W/mK						1,72		K/W
PFC IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$		Vce		0,0005	Tj=25℃ Tj=125℃	3	4	5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$				30	Tj=25℃ Tj=125℃		2,89 3,43	3,3	V
Collector-emitter cut-off	I_{CES}			0	600	Tj=25℃ Tj=125℃			30	µA
Gate-emitter leakage current	I_{GES}			20	0	Tj=25℃ Tj=125℃			200	nA
Integrated Gate resistor	R_{gint}							n.a.		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=2Ω Rgon=2Ω	15	400	18	Tj=25℃ Tj=125℃		15,8 15,4		ns
Rise time	t_r					Tj=25℃ Tj=125℃		6,4 7,4		
Turn-off delay time	$t_{d(off)}$					Tj=25℃ Tj=125℃		107,6 120,4		
Fall time	t_f					Tj=25℃ Tj=125℃		4,2 6,6		
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=125℃		0,2197 0,4012		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=125℃		0,1983 0,3086		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25℃		1500		pF
Output capacitance	C_{oss}							150		
Reverse transfer capacitance	C_{rss}							92		
Gate charge	Q_{Gate}		15	480	30	Tj=25℃		92		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,22		K/W

Characteristic Values

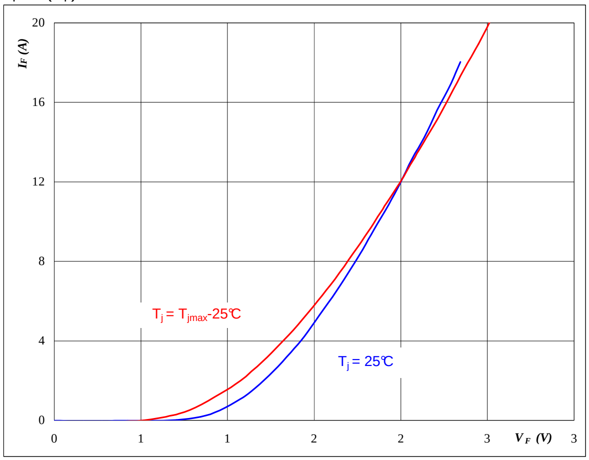
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
C.T. Inverse diode										
Diode forward voltage	V_F					Tj=25°C Tj=125°C		1,66 1,61	2,1	V
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						5,12		K/W
PFC Diode										
Forward voltage	V_F				15	Tj=25°C Tj=125°C		2,03 1,5	2,9	V
Reverse recovery time	I_{rm}	Rgoff=2Ω	15	400	18	Tj=25°C Tj=125°C		12 19		μA
Peak recovery current	I_{RRM}	Rgoff=2Ω	15	400	18	Tj=25°C Tj=125°C		41 61		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		12 19		ns
Reverse recovery charge	Q_{rr}					Tj=25°C Tj=125°C		0,237 0,634		μC
Reverse recovered energy	E_{rec}					Tj=25°C Tj=125°C		0,053 0,133		mWs
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=125°C		13672 12699		A/μs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,29		K/W
PFC Shunt(P983D59)										
R1 value	R						7,35	7,5	7,65	mΩ
Temperature coeficient	t_c	20°C to 60°C						< 50		ppm/K
Internal heat resistance	R_{thi}							< 6.5		K/W
Inductance	L							< 3		nH
PFC Shunt(P983D79)										
R1 value	R						14,7	15	15,3	mΩ
Temperature coeficient	t_c	20°C to 60°C						< 50		ppm/K
Internal heat resistance	R_{thi}							< 13		K/W
Inductance	L							< 3		nH
DC link Capacitor										
C value	C						430	540	650	nF
Thermistor										
Rated resistance	R					Tj=25°C		21,5		kΩ
Deviation of R100	ΔR/R	R100=1486Ω				Tj=100°C	-4,5		+4,5	%
Power dissipation	P					Tj=25°C		210		mW
Power dissipation constant						Tj=25°C		3,5		mW/K
B-value	$B_{(25/50)}$					Tj=25°C		3884		K
B-value	$B_{(25/100)}$					Tj=25°C		3964		K

PFC Switch & C.T. Inverse Diode

Figure 1 Inverse diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$

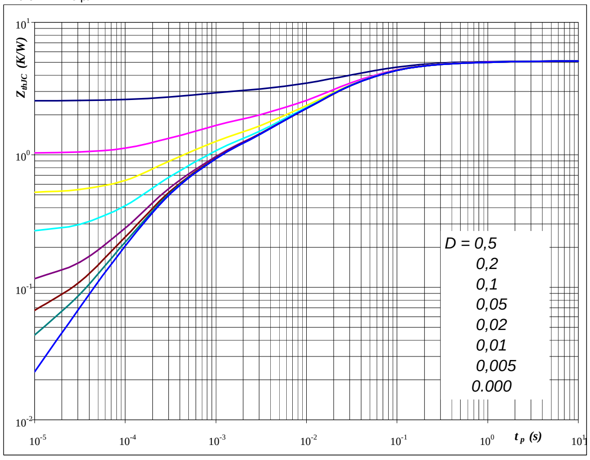


t_p = 250 μs

Figure 2 Inverse diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



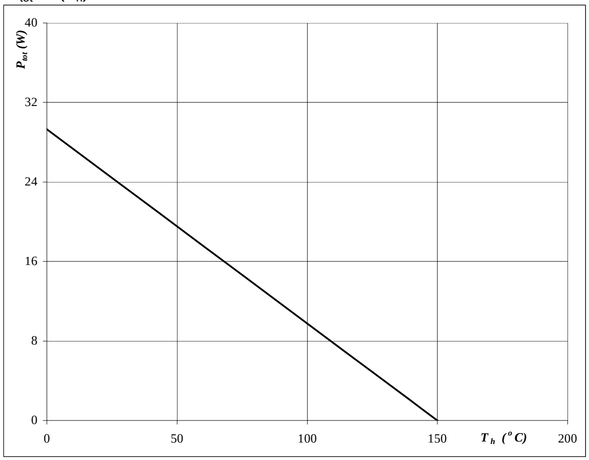
D = tp / T

R_{thJH} = 5,12 K/W

Figure 3 Inverse diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

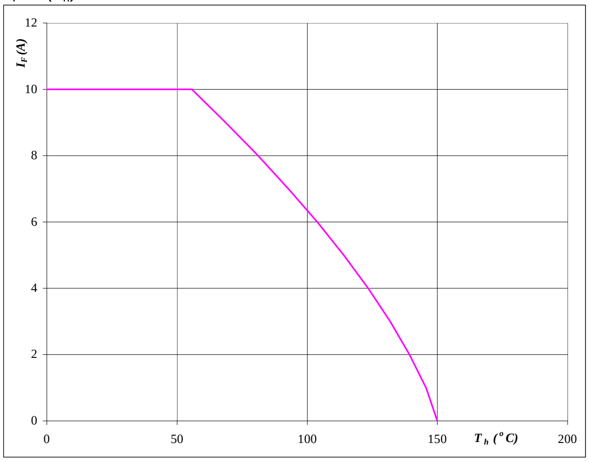


T_j = 150 ºC

Figure 4 Inverse diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



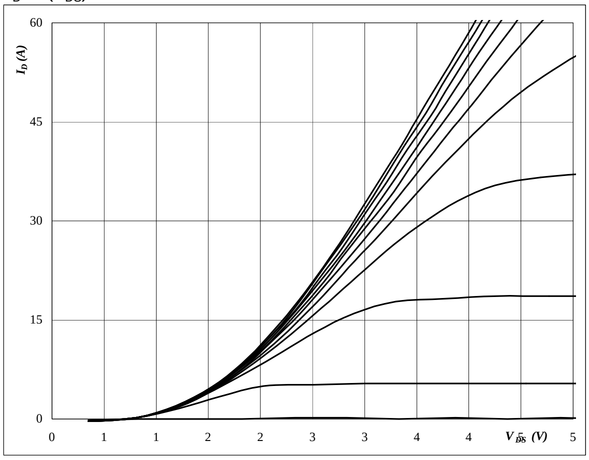
T_j = 150 ºC

PFC

Figure 1 PFC SWITCH

Typical output characteristics

$I_D = f(V_{DS})$

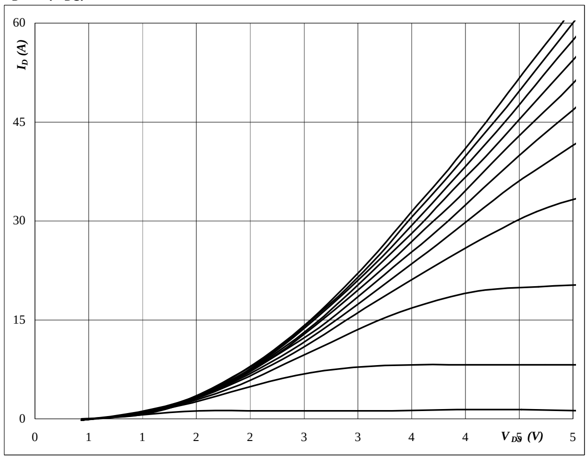


t_p =	250	μs
T_j =	25	℃
V_{GS} from	5 V to 15 V in steps of 1 V	

Figure 2 PFC SWITCH

Typical output characteristics

$I_D = f(V_{DS})$

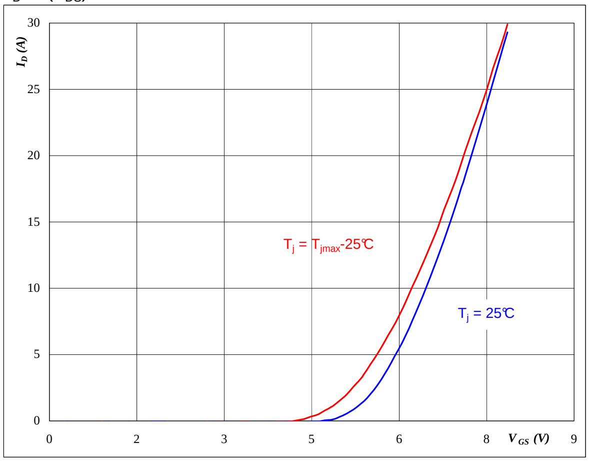


t_p =	250	μs
T_j =	125	℃
V_{GS} from	5 V to 15 V in steps of 1 V	

Figure 3 PFC SWITCH

Typical transfer characteristics

$I_D = f(V_{DS})$

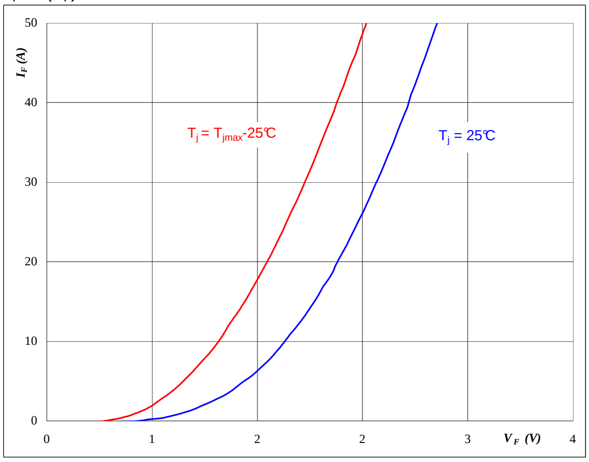


t_p =	250	μs
V_{DS} =	10	V

Figure 4 PFC FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



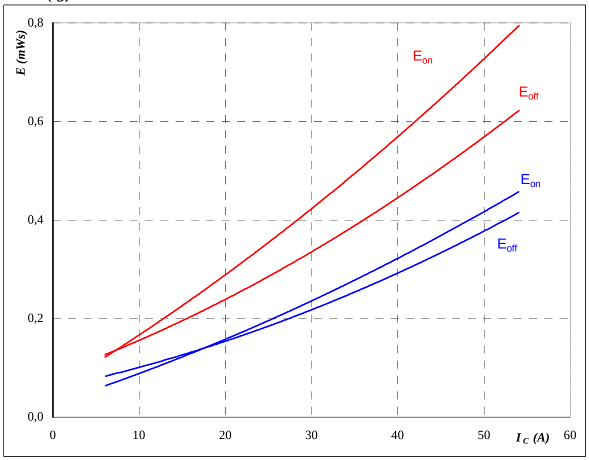
t_p =	250	μs

PFC

Figure 5 PFC SWITCH

Typical switching energy losses
as a function of collector current

$E = f(I_D)$



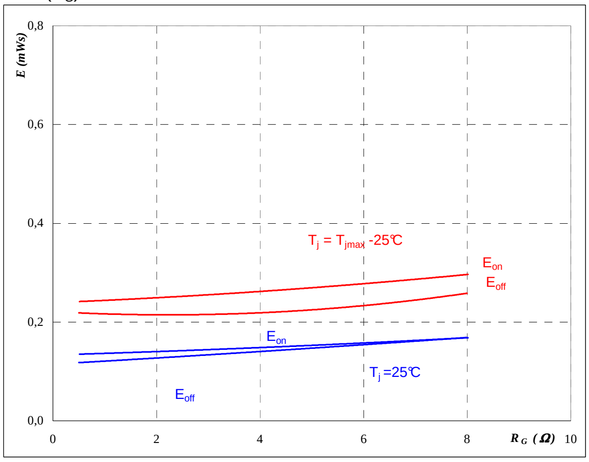
inductive load

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 6 PFC SWITCH

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



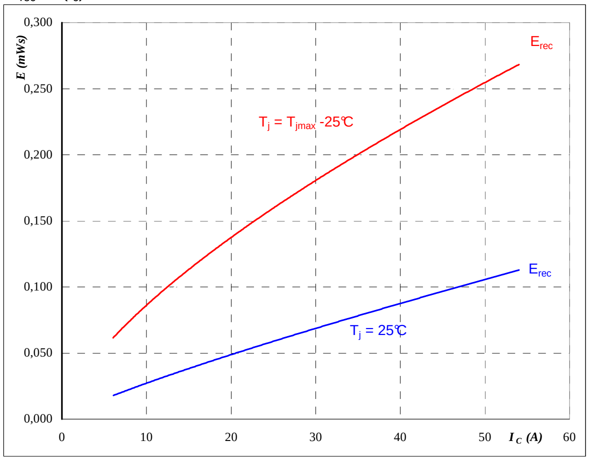
inductive load

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	15	V
I_D =	18	A

Figure 7 PFC SWITCH

Typical reverse recovery energy loss
as a function of collector (drain) current

$E_{rec} = f(I_c)$



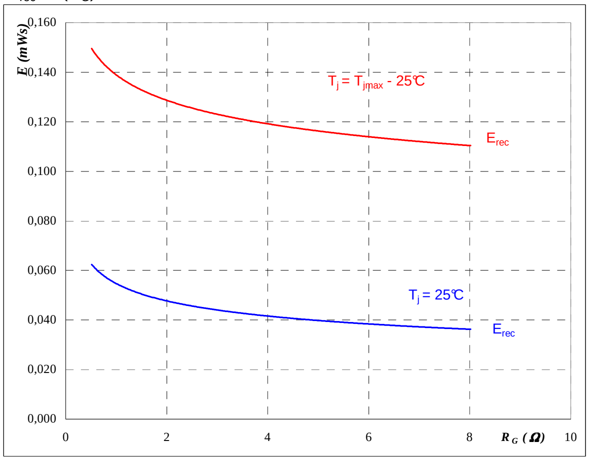
inductive load

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 8 PFC SWITCH

Typical reverse recovery energy loss
as a function of gate resistor

$E_{rec} = f(R_G)$



inductive load

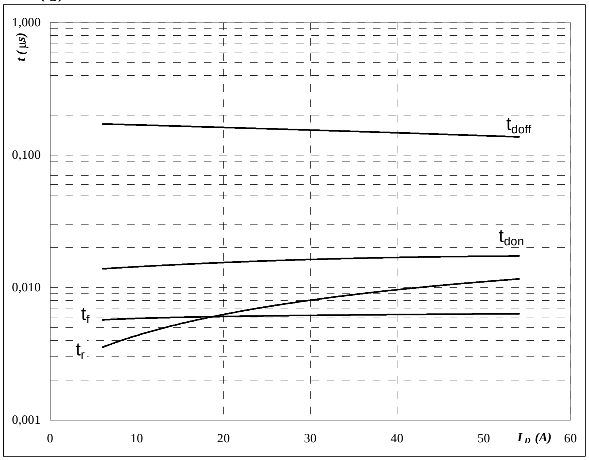
T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	15	V
I_D =	18	A

PFC

Figure 9 PFC SWITCH

Typical switching times as a function of collector current

t = f(I_D)



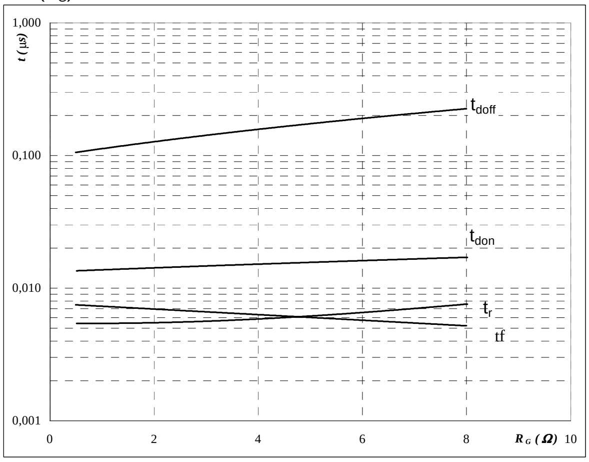
inductive load

T_j =	125	℃
V_{DS} =	400	V
V_{GS} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10 PFC SWITCH

Typical switching times as a function of gate resistor

t = f(R_G)



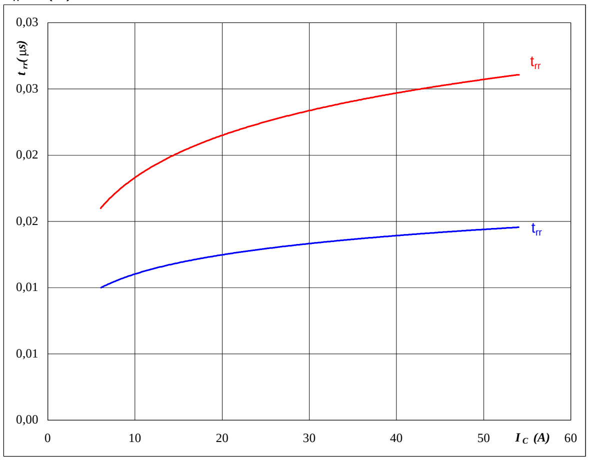
inductive load

T_j =	125	℃
V_{DS} =	400	V
V_{GS} =	15	V
I_C =	18	A

Figure 11 PFC FWD

Typical reverse recovery time as a function of collector current

t_{rr} = f(Ic)

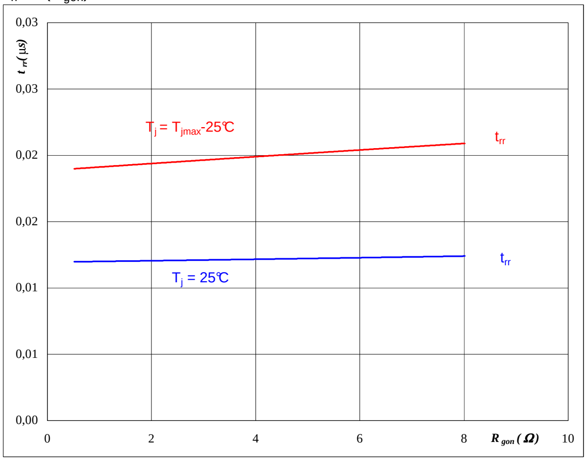


T_j =	25/125	℃
V_{CE} =	400	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 12 PFC FWD

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

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



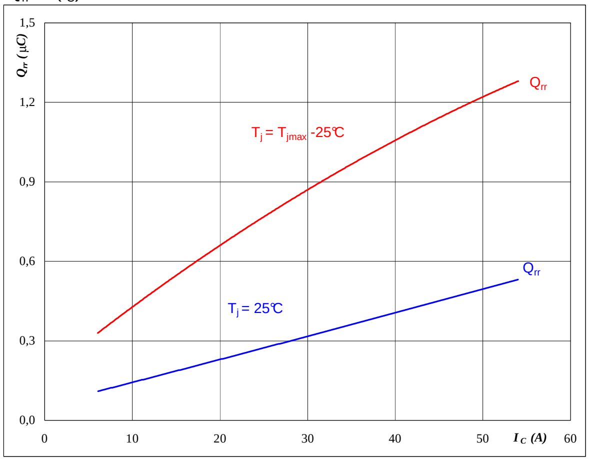
T_j =	25/125	℃
V_R =	400	V
I_F =	18	A
V_{GS} =	15	V

PFC

Figure 13 PFC FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$

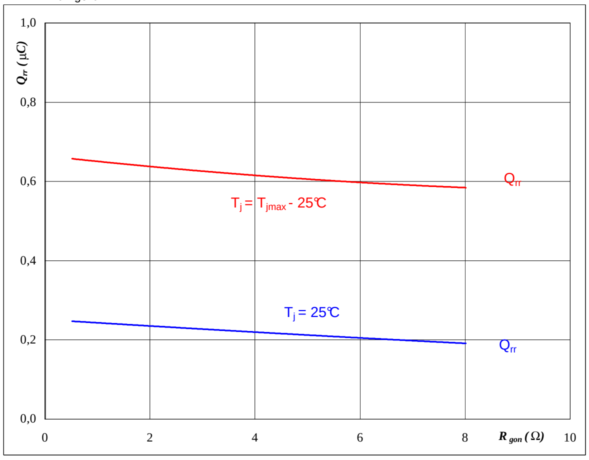


T_j =	25/125	℃
V_{CE} =	400	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 14 PFC FWD

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

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

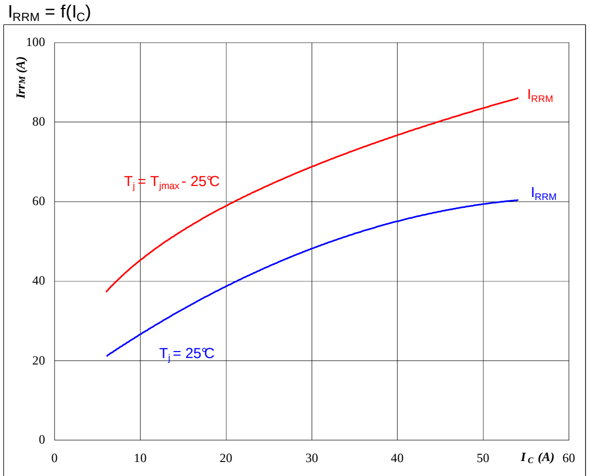


T_j =	25/125	℃
V_R =	400	V
I_F =	18	A
V_{GS} =	15	V

Figure 15 PFC FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$

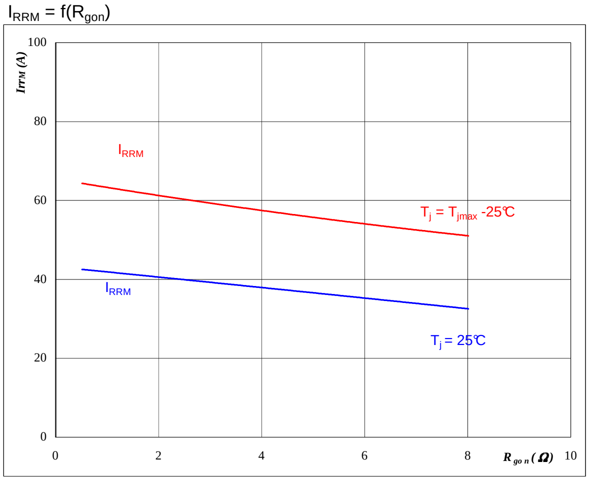


T_j =	25/125	℃
V_{CE} =	400	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 16 PFC FWD

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

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



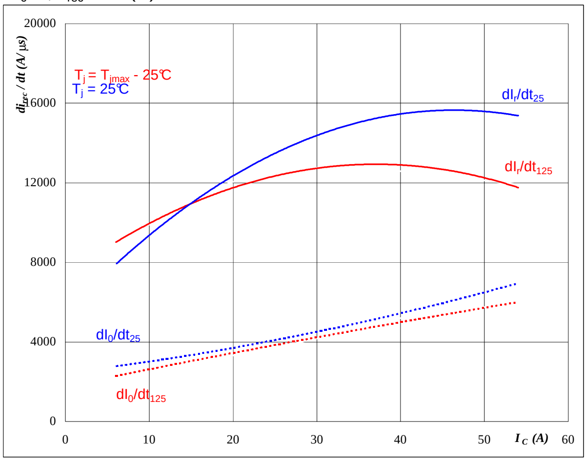
T_j =	25/125	℃
V_R =	400	V
I_F =	18	A
V_{GS} =	15	V

PFC

Figure 17 — PFC FWD

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

$dI_0/dt, dI_{rec}/dt = f(Ic)$

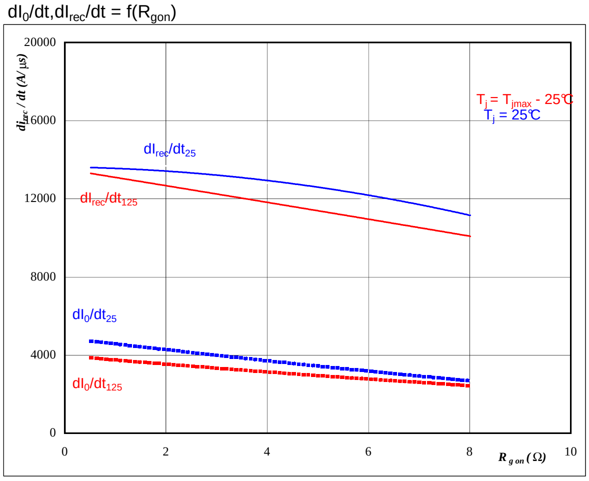


T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 18 — PFC FWD

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

$dI_0/dt, dI_{rec}/dt = f(R_{gon})$

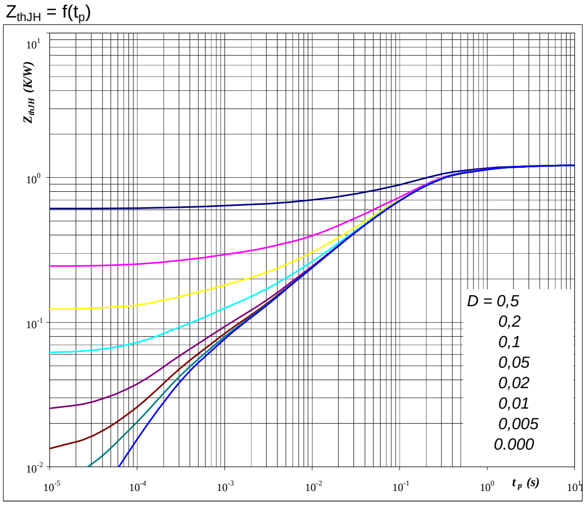


T_j =	25/125	°C
V_R =	400	V
I_F =	18	A
V_{GS} =	15	V

Figure 19 — PFC SWITCH

IGBT/MOSFET transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



D =	t_p / T	
R_{thJH} =	1,22	K/W

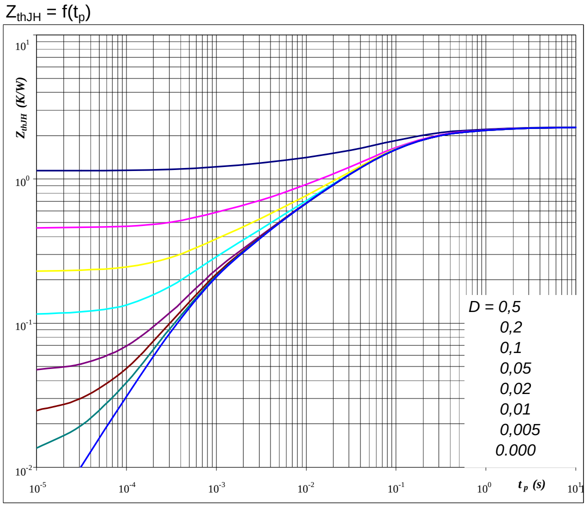
IGBT thermal model values

R (C/W)	Tau (s)
0,047	4,30E+00
0,176	7,15E-01
0,676	1,39E-01
0,214	2,03E-02
0,062	2,91E-03
0,046	3,33E-04

Figure 20 — PFC FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



D =	t_p / T	
R_{thJH} =	2,29	K/W

FWD thermal model values

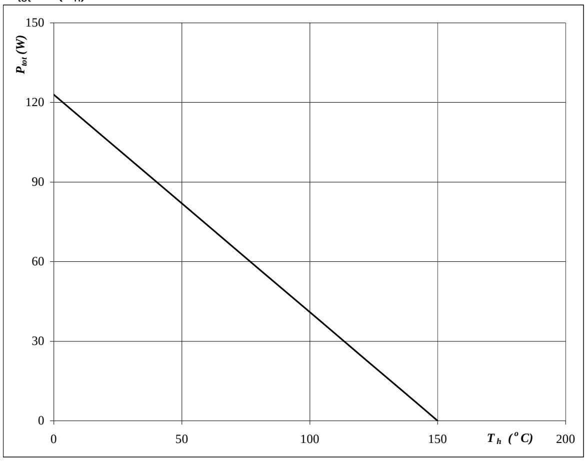
R (C/W)	Tau (s)
0,05	7,26E+00
0,24	8,03E-01
0,85	1,32E-01
0,69	3,21E-02
0,30	4,97E-03
0,17	7,13E-04

PFC

Figure 21 PFC SWITCH

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

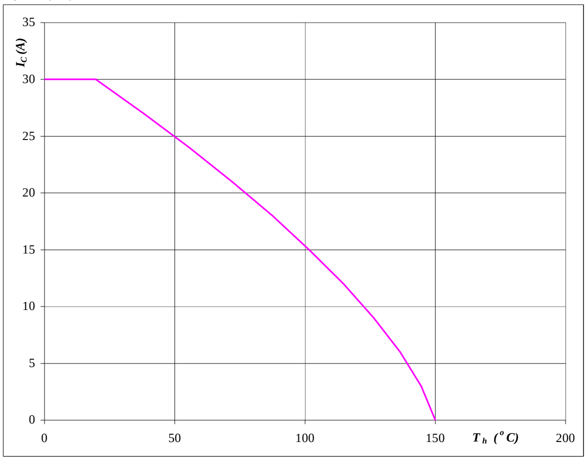


T_j = 150 ºC

Figure 22 PFC SWITCH

Collector/Drain current as a function of heatsink temperature

$I_C = f(T_h)$



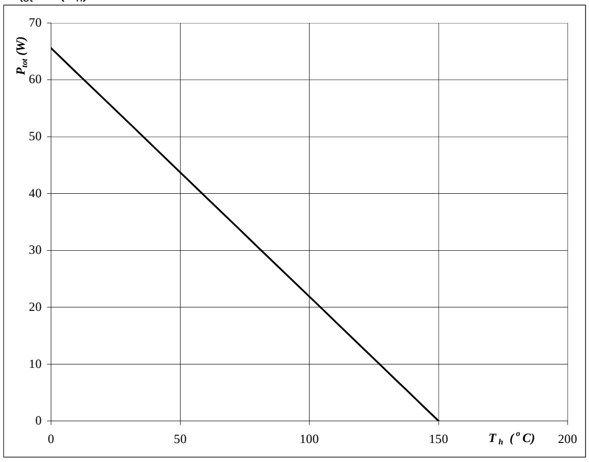
T_j = 150 ºC

V_{GS} = 15 V

Figure 23 PFC FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

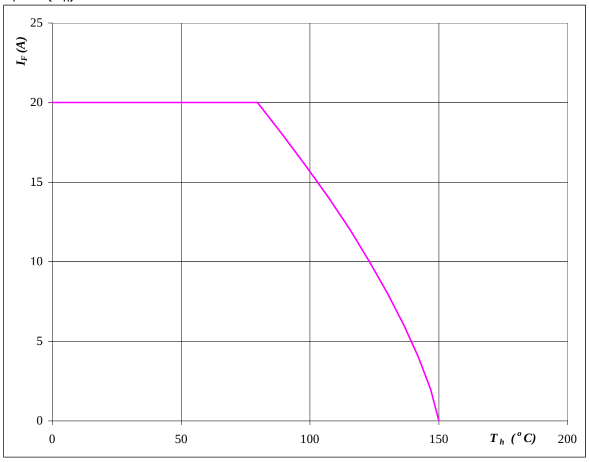


T_j = 150 ºC

Figure 24 PFC FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



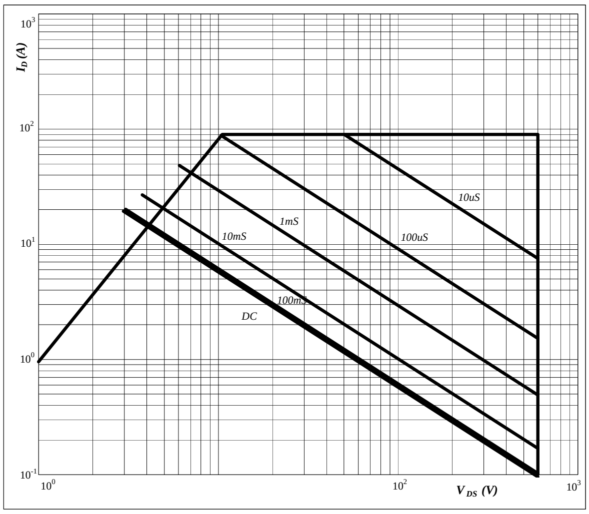
T_j = 150 ºC

PFC

Figure 25	PFC SWITCH

Safe operating area as a function of drain-source voltage

$I_D = f(V_{DS})$

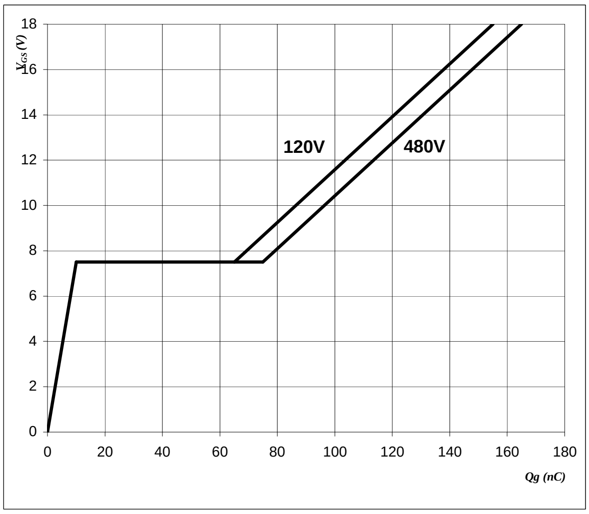


D =	single pulse	
T_h =	80	ºC
V_{GS} =	15	V
T_j =	T_{jmax}	ºC

Figure 26	PFC SWITCH

Gate voltage vs Gate charge

$V_{GS} = f(Qg)$



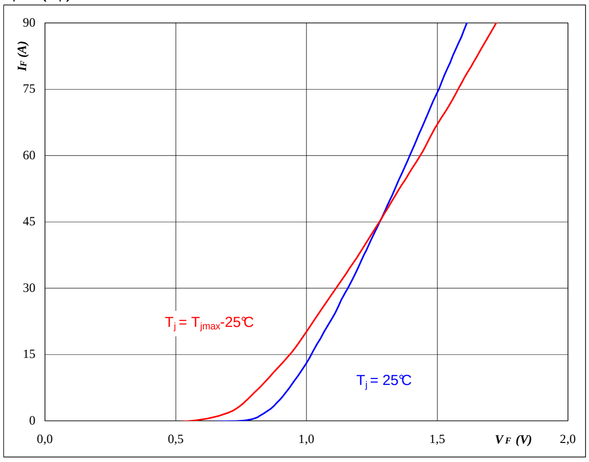
I_D =	30	A

Input Rectifier Bridge

Figure 1 Rectifier diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$

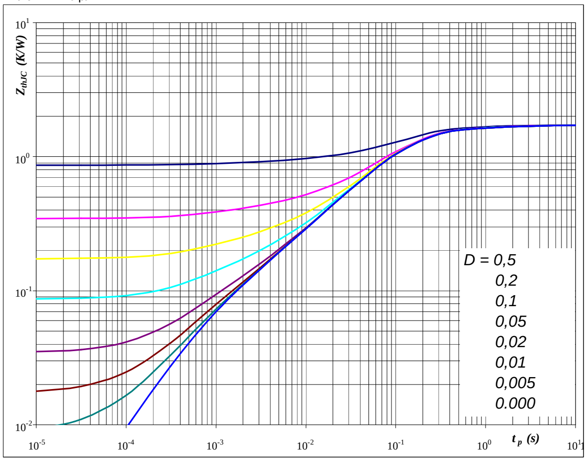


t_p = 250 μs

Figure 2 Rectifier diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



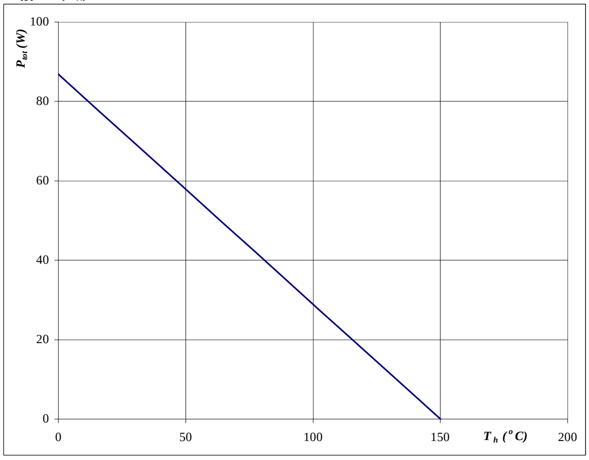
D = t_p / T

R_{thJH} = 1,73 K/W

Figure 3 Rectifier diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

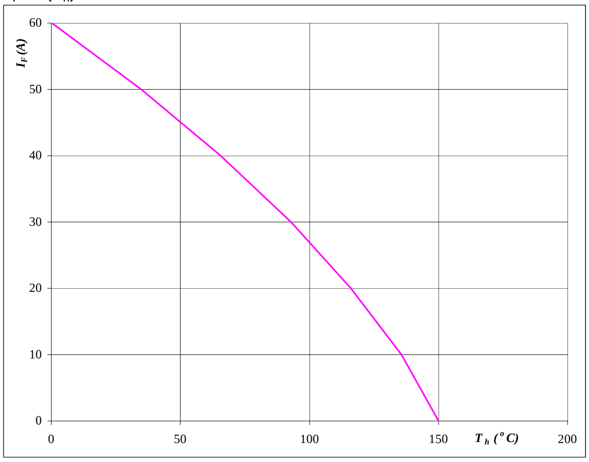


T_j = 150 ºC

Figure 4 Rectifier diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$

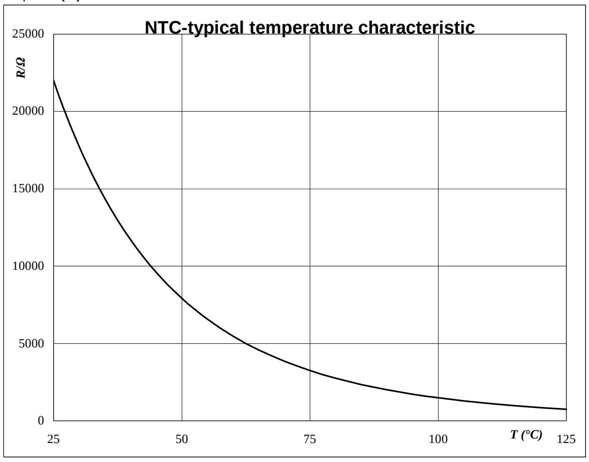


T_j = 150 ºC

Thermistor

Figure 1	Thermistor

Typical NTC characteristic
as a function of temperature
R_T = f(T)



Switching Definitions PFC

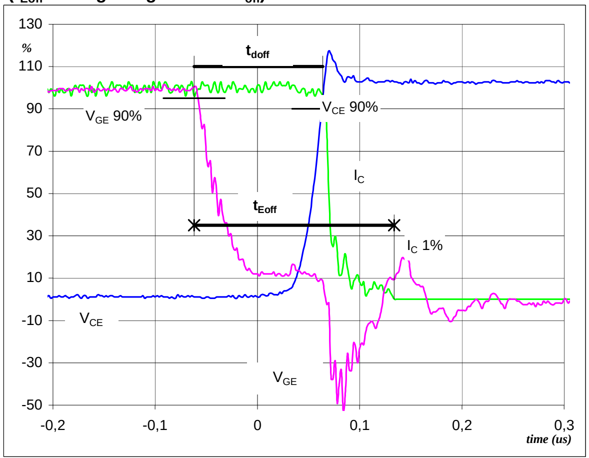
General conditions

T_j	=	125 °C
R_{gon}	=	2 Ω
R_{goff}	=	2 Ω

Figure 1 PFC SWITCH

Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}

(t_{Eoff} = integrating time for E_{off})

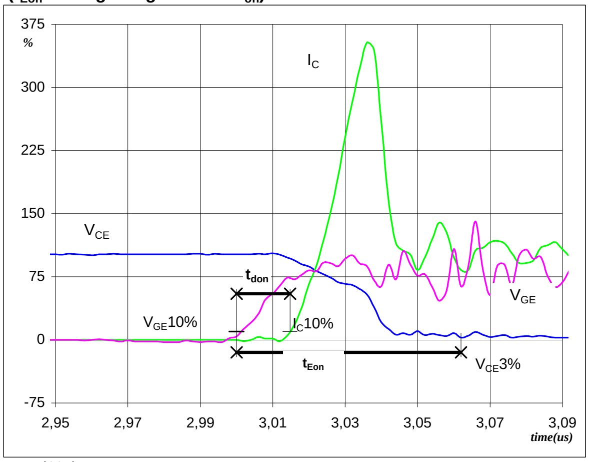


V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	400	V
I_C (100%) =	30	A
t_{doff} =	0,12	µs
t_{Eoff} =	0,20	µs

Figure 2 PFC SWITCH

Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}

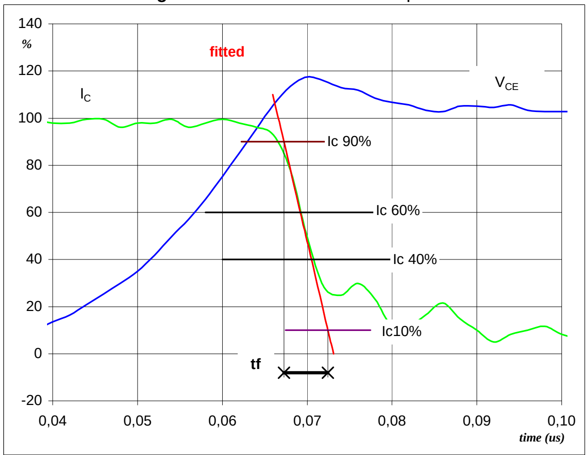
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	400	V
I_C (100%) =	30	A
t_{don} =	0,02	µs
t_{Eon} =	0,06	µs

Figure 3 PFC SWITCH

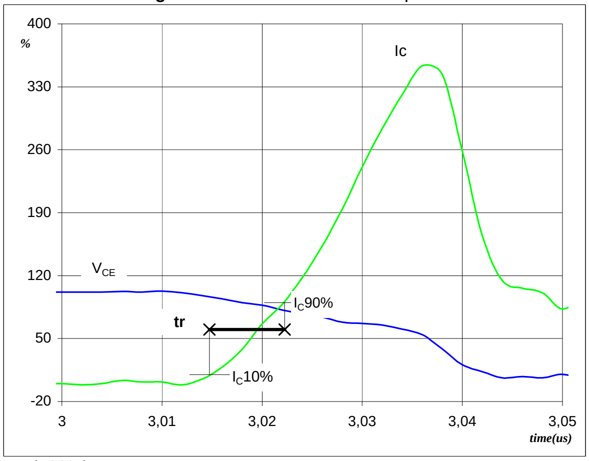
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	400	V
I_C (100%) =	30	A
t_f =	0,007	µs

Figure 4 PFC SWITCH

Turn-on Switching Waveforms & definition of t_r

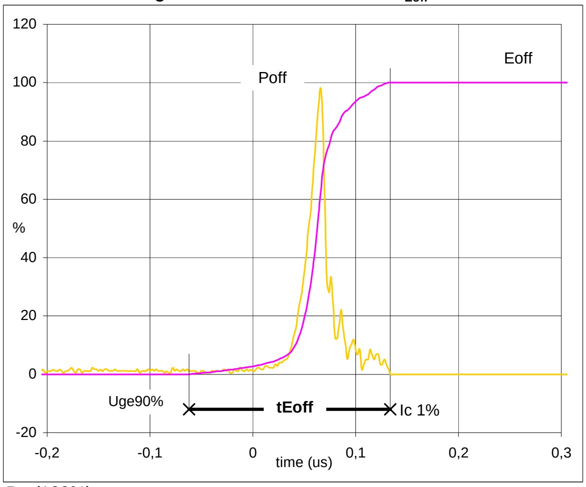


V_C (100%) =	400	V
I_C (100%) =	30	A
t_r =	0,007	µs

Switching Definitions PFC

Figure 5 PFC SWITCH

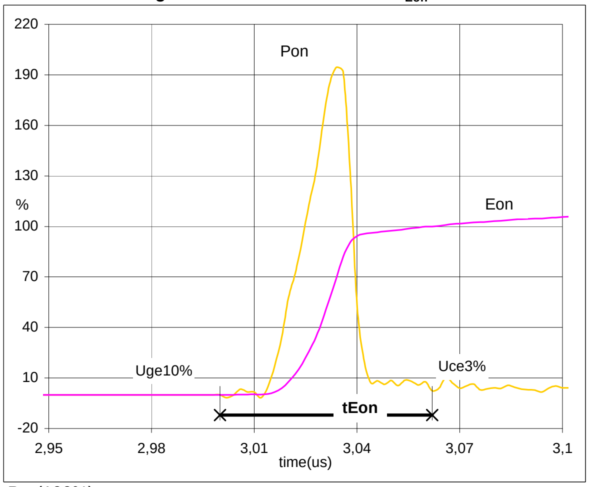
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	12,06	kW
E_{off} (100%) =	0,31	mJ
t_{Eoff} =	0,20	μs

Figure 6 PFC SWITCH

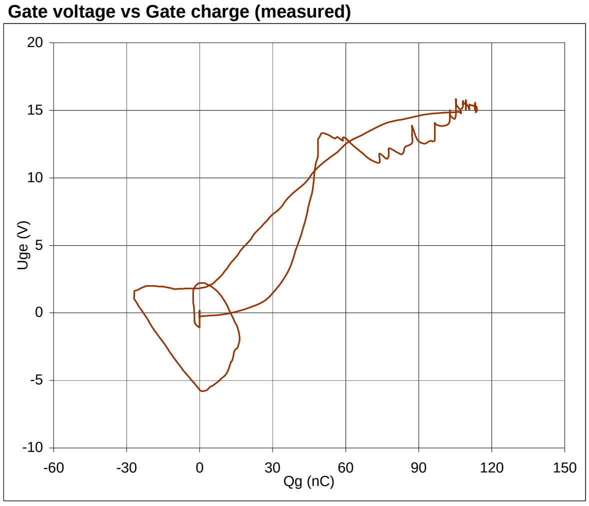
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	12,06	kW
E_{on} (100%) =	0,40	mJ
t_{Eon} =	0,062	μs

Figure 7 PFC SWITCH

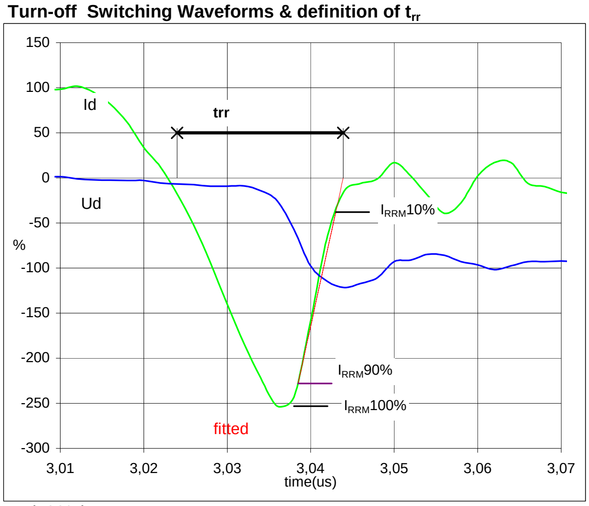
Gate voltage vs Gate charge (measured)



V_{GEoff} =	0	V
V_{GEon} =	15	V
V_C (100%) =	400	V
I_C (100%) =	30	A
Q_g =	113,90	nC

Figure 8 PFC FWD

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

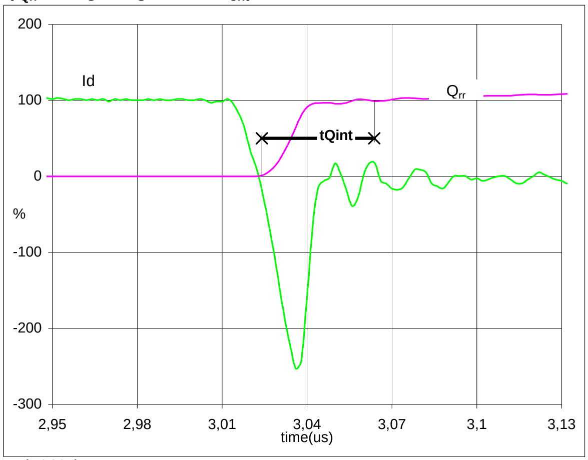


V_d (100%) =	400	V
I_d (100%) =	30	A
I_{RRM} (100%) =	-75	A
t_{rr} =	0,02	μs

Switching Definitions PFC

Figure 9 PFC FWD

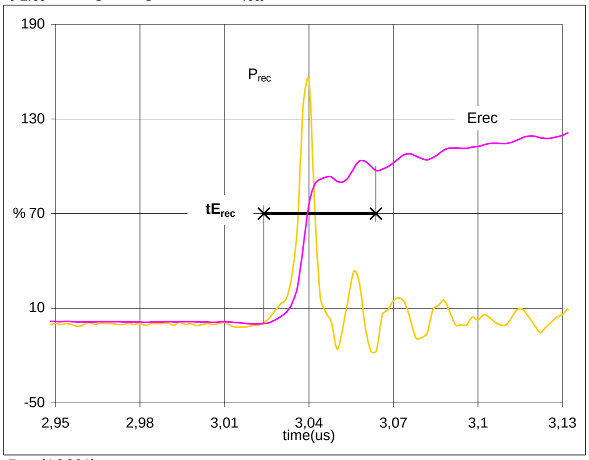
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr}= integrating time for Q_{rr})



I_d (100%) =	30	A
Q_{rr} (100%) =	0,89	μC
t_{Qint} =	0,04	μs

Figure 10 PFC FWD

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



P_{rec} (100%) =	12,06	kW
E_{rec} (100%) =	0,19	mJ
t_{Erec} =	0,04	μs

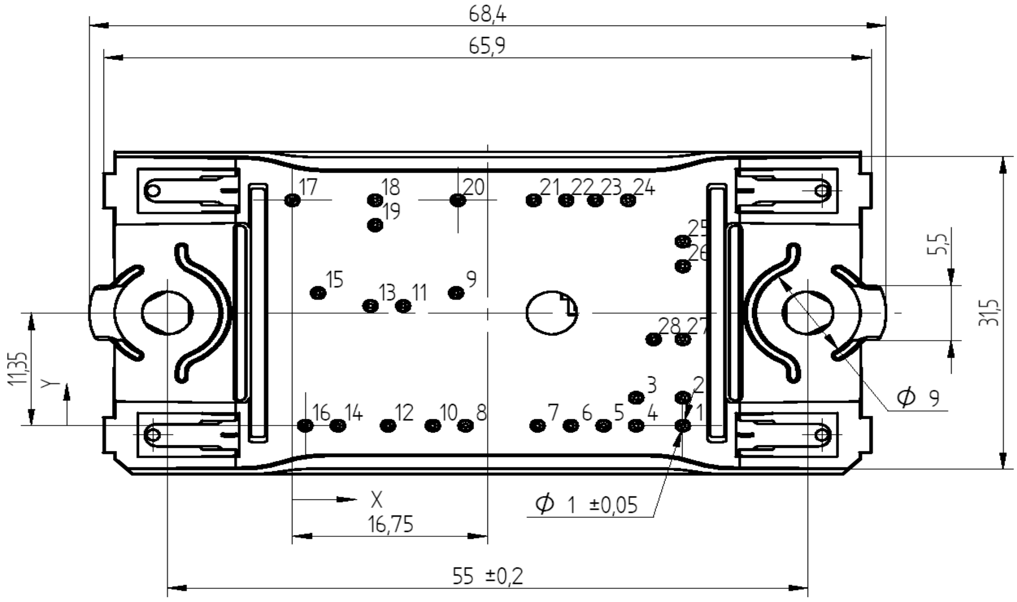
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without SCR, current sense in collector	10-FZ062TA030FB05-P983D59	P983D59	10-FZ062TA030FB05-P983D59
without SCR, current sense in collector	10-F0062TA030FB06-P983D79	P983D79	10-F0062TA030FB06-P983D79

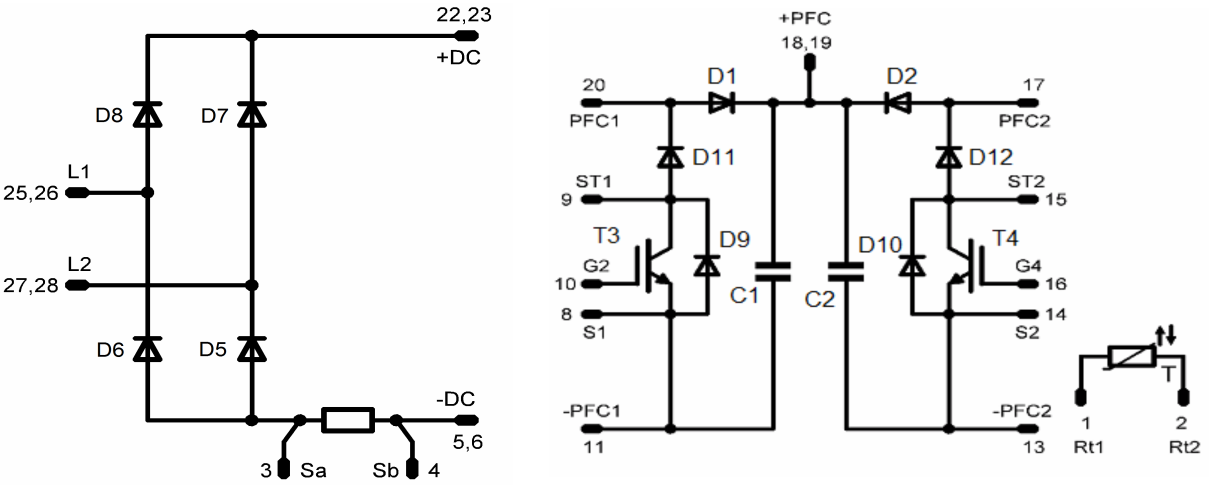
Outline

Pin table		
Pin	X	Y
1	33,5	0
2	33,5	2,8
3	29,5	2,8
4	29,5	0
5	26,7	0
6	23,9	0
7	21,05	0
8	14,85	0
9	14,05	13,35
10	12,05	0
11	9,5	12,05
12	8,2	0
13	6,7	12,05
14	3,9	0
15	2,2	13,35
16	1,1	0
17	0	22,7
18	7,1	22,7
19	7,1	20,2
20	14,2	22,7
21	20,7	22,7
22	23,5	22,7
23	26	22,7
24	28,8	22,7
25	33,5	18,55
26	33,5	16,05
27	33,5	8,7
28	31	8,7



Pinout

Pin nr. 21 & 24 without electrical connection



Pin nr. 7 & 12 without electrical connection

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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.