Vincotech

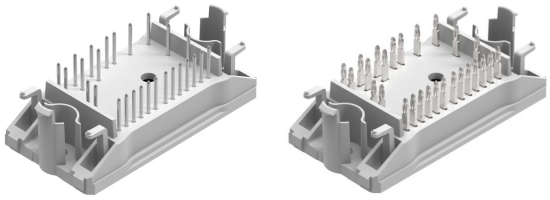
10-F006PPA010SB-M683B50
10-P006PPA010SB-M683B50Y
datasheet

***flow* PIM 0 + PFC** **600 V / 10 A**

Features

- Clip in PCB mounting
- Trench Fieldstop IGBT's for low saturation losses
- Latest generation superjunction MOSFET for PFC
- Integrated PFC shunt
- Temperature sensor

flow 0 17 mm housing



Solder pin Press-fit pin

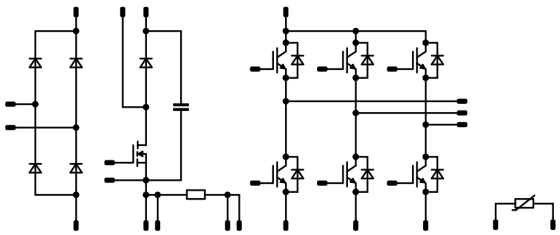
Target applications

- Industrial Drives
- Embedded Drives

Types

- 10-F006PPA010SB03-M683B50
- 10-P006PPA010SB03-M683B50Y

Schematic



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	33	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave T_j = 150 °C	200	A
Surge current capability	I^2t	t_p = 10 ms	200	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	44	W
Maximum Junction Temperature	T_{jmax}		150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		600	V
Collector current	I_C	T_j = T_{jmax} T_s = 80 °C	14	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	30	A
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	44	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V	6 360	µs V
Maximum Junction Temperature	T_{jmax}		175	°C
Inverter Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		600	V
Continuous (direct) forward current	I_F	T_j = T_{jmax} T_s = 80 °C	14	A
Repetitive peak forward current	I_{FRM}	T_j = T_{jmax} T_s = 80 °C	20	A
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	32	W
Maximum Junction Temperature	T_{jmax}		175	°C
PFC Switch				
Drain-source voltage	V_{DSS}		600	V
Drain current	I_D	T_j = T_{jmax} T_s = 80 °C	16	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 T_{jmax} P_{AV}=EAR*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	72	W
Gate-source voltage	V_{GSS}		±20	V
Reverse diode dv/dt	dv/dt		15	V/ns
Maximum Junction Temperature	T_{jmax}		150	°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	20	A
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	40	W
Maximum junction temperature	T_{jmax}		150	°C
PFC Shunt				
DC forward current	I_F	T_c = 25 °C	10	A
Capacitor (PFC)				
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			min. 12,7	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	
Rectifier Diode										
Static										
Forward voltage	V_F				25	25 125		1,22 1,21	1,90	V
Reverse leakage current	I_r			1600		25 145			50 1100	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,59		K/W
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	V_{GE} = V_{CE}			0,00015	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		10	25 150	1,1	1,50 1,79	1,9	V
Collector-emitter cut-off current	I_{CES}		0	600		25			0,6	µA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f= 1 MHz	0	25		25		551		pF
Output capacitance	C_{oes}							40		
Reverse transfer capacitance	C_{res}							17		
Gate charge	Q_g		15	480	10	25		70		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,15		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 32 Ω R_{gon} = 32 Ω	±15	400	10	25 125		75 74		ns
Rise time	t_r					25 125		24 26		
Turn-off delay time	$t_{d(off)}$					25 125		136 159		
Fall time	t_f					25 125		83 123		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,5 µC Q_{rFWD} = 0,9 µC				25 125		0,28 0,38		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,33 0,45		

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	
Inverter Diode										
Static										
Forward voltage	V_F				10	25		1,58	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)						2,99		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 400 A/µs di/dt = 467 A/µs	±15	400	10	25 125		5 7		A
Reverse recovery time	t_{rr}					25 125		194 270		ns
Recovered charge	Q_r					25 125		0,47 0,90		µC
Reverse recovered energy	E_{rec}					25 125		0,13 0,26		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		21 65		A/µs

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		100 209		mΩ
Gate-source threshold voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}$			0,00121	25	2,5	3	3,5	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		
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,97		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 8 Ω R_{gon} = 8 Ω	0/10	400	10	25 125		21 23		ns
Rise time	t_r					25 125		5 4		
Turn-off delay time	$t_{d(off)}$					25 125		131 202		
Fall time	t_f					25 125		8 4		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,2 µC Q_{rFWD} = 0,5 µC				25 125		0,083 0,147		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,020 0,045		

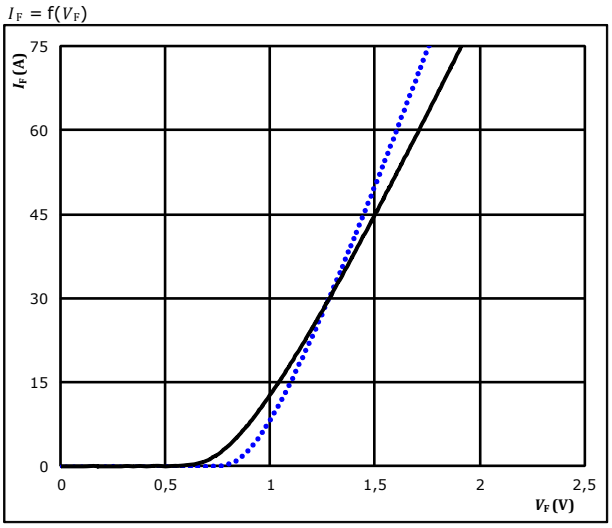
Characteristic Values

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				15	25 125		2,85 1,81	3,2	V
Reverse leakage current	I_R			600		25			50	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,75		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 2415 A/µs di/dt = 2378 A/µs	0/10	400	10	25 125		20 36		A
Reverse recovery time	t_{rr}					25 125		14 23		ns
Recovered charge	Q_r					25 125		0,160 0,493		µC
Reverse recovered energy	E_{rec}					25 125		0,047 0,106		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		4429 6331		A/µs
PFC Shunt										
R1 value	R							50		mΩ
Temperature coeficient	t_c					20 - 60			50	ppm/K
Internal heat resistance	R_{thi}								13	K/W
Inductance	L								3	nH
Capacitor (PFC)										
Capacitance	C							100		nF
Tolerance							-10		+10	%
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	

Rectifier Characteristics

figure 1. **FWD**

Typical forward characteristics

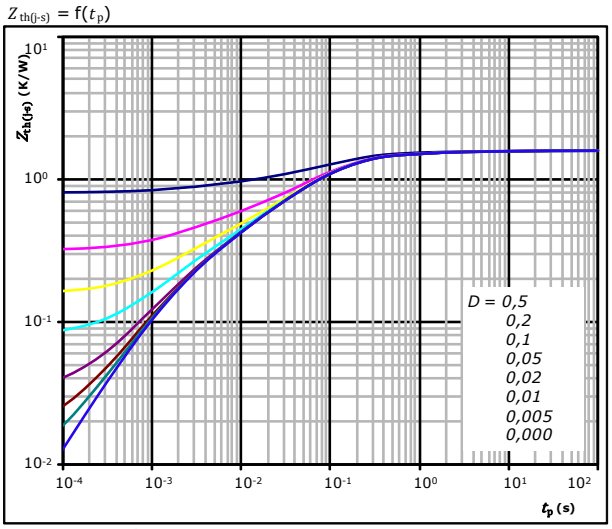


t_p = 250 µs 25 °C

T_j: 125 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width



D = t_p / T

$R_{th(j-s)}$ = 1,59 K/W

Diode thermal model values

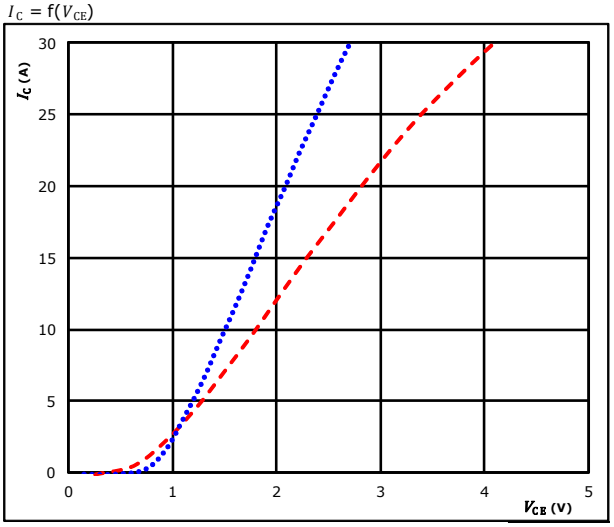
R (K/W)	τ (s)
3,44E-02	9,66E+00
1,12E-01	1,22E+00
5,81E-01	1,45E-01
4,89E-01	5,05E-02
2,38E-01	9,26E-03
1,22E-01	1,79E-03
1,2160E-01	1,7910E-03
1,8080E-02	7,8790E-04

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

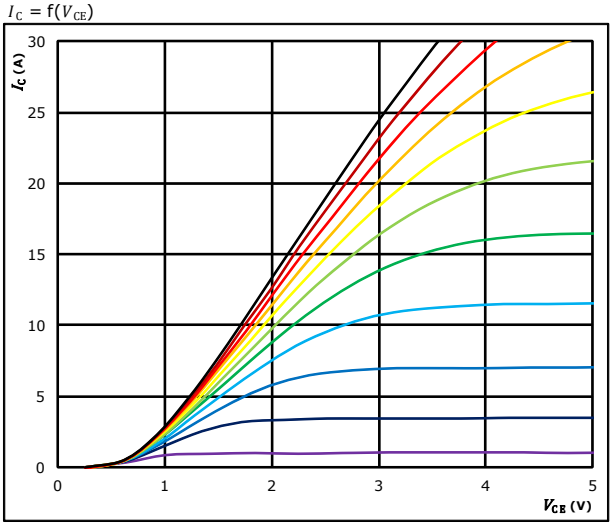


t_p =	250	µs		25 °C	
V_{GE} =	15	V	T_j:	150 °C	

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

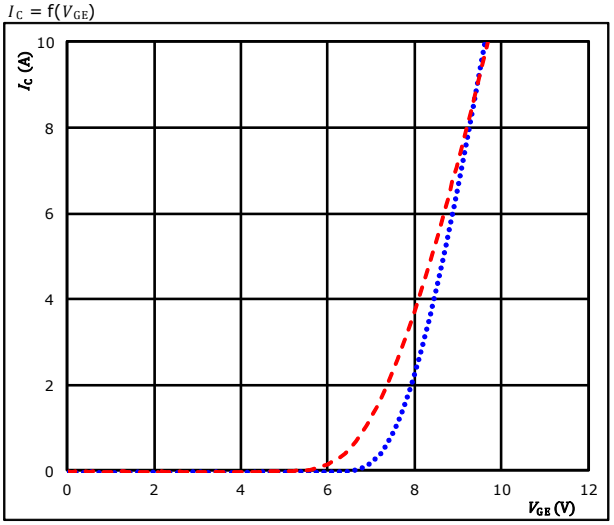


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

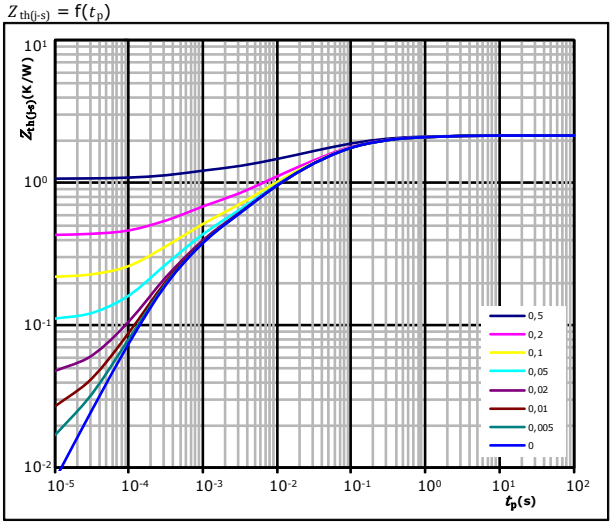


t_p =	100	µs		25 °C	
V_{CE} =	10	V	T_j:	150 °C	

figure 4. **IGBT**

Transient Thermal Impedance as function of Pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	2,15	K/W

IGBT thermal model values

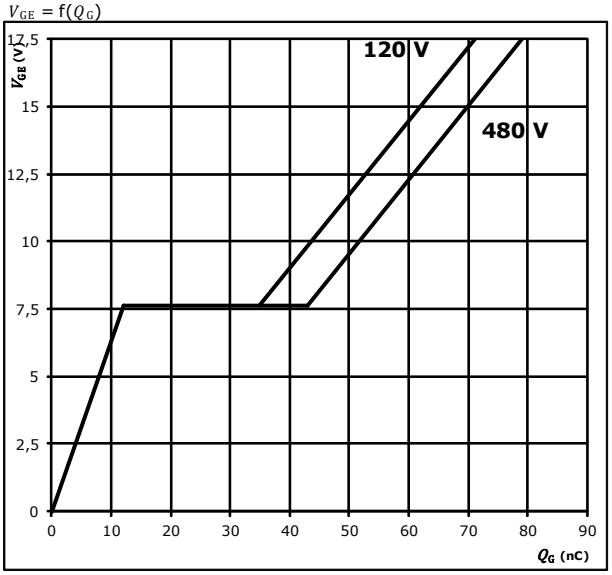
R (K/W)	τ (s)
1,04E-01	1,37E+00
2,88E-01	2,01E-01
6,99E-01	5,27E-02
4,91E-01	1,22E-02
3,07E-01	2,97E-03
2,60E-01	3,80E-04

Inverter Switch Characteristics

figure 5. **IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_G)$



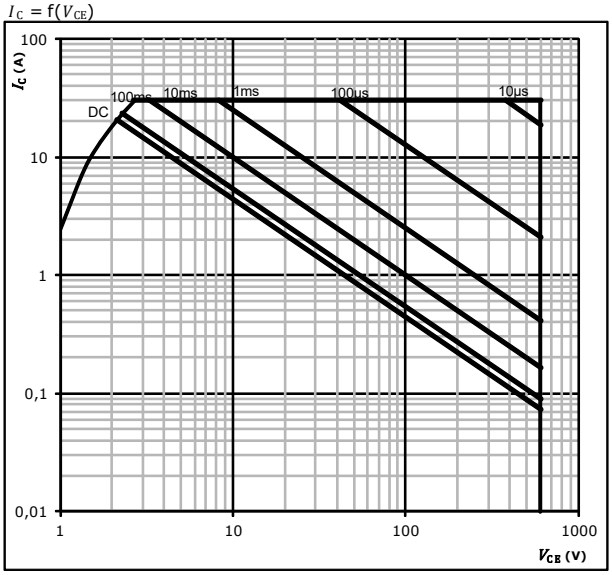
At

I_C= 10 A

figure 6. **IGBT**

Safe operating area as a function of V_{GE}

$I_C = f(V_{CE})$



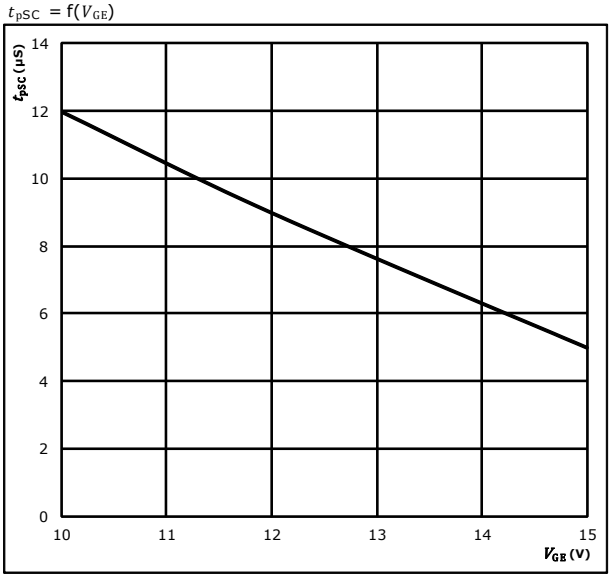
At

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

figure 7. **IGBT**

Short circuit withstand time as a function of V_{GE}

$t_{pSC} = f(V_{GE})$



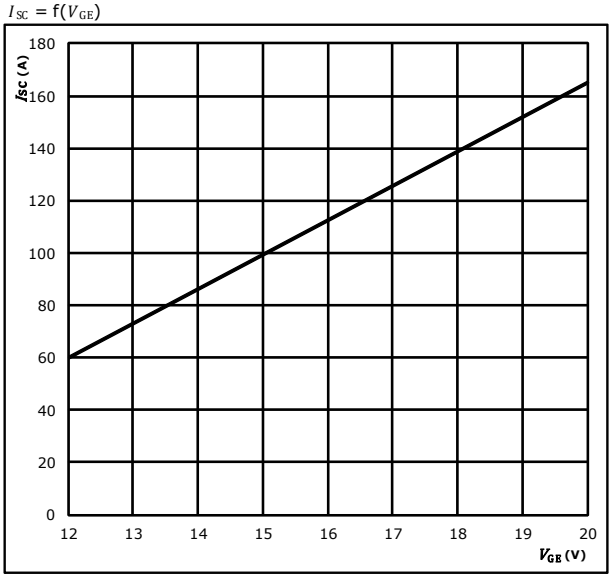
At

V_{CE} = 600 V
T_j ≤ 175 °C

figure 8. **IGBT**

Typical short circuit collector current as a function of V_{GE}

$I_{SC} = f(V_{GE})$



At

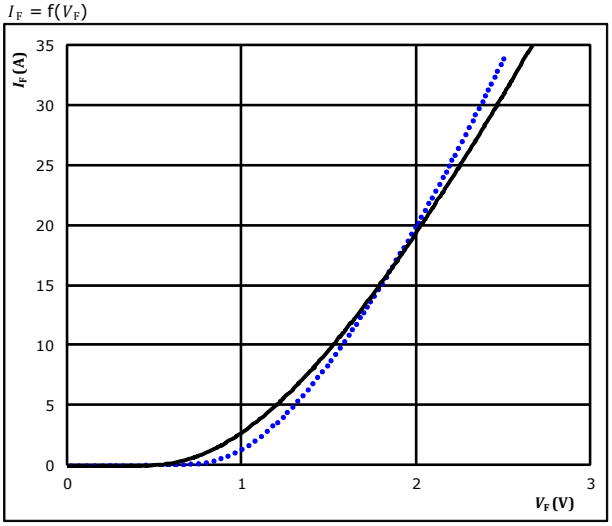
V_{CE} ≤ 600 V
T_j ≤ 175 °C

Inverter Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



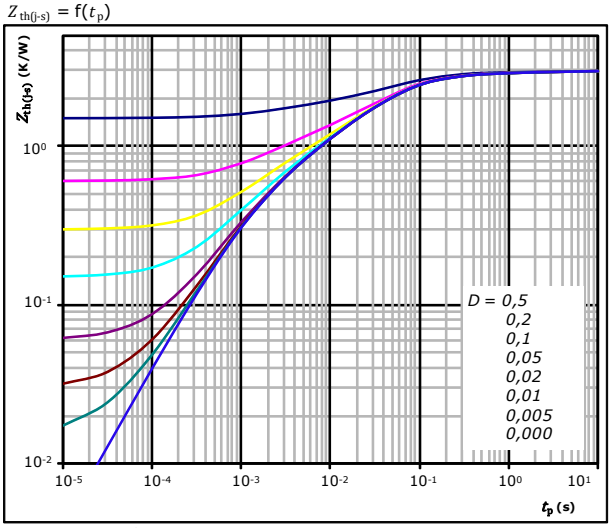
t_p = 250 µs 25 °C

T_j: 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

$R_{th(j-s)}$ = 2,99 K/W

FWD thermal model values

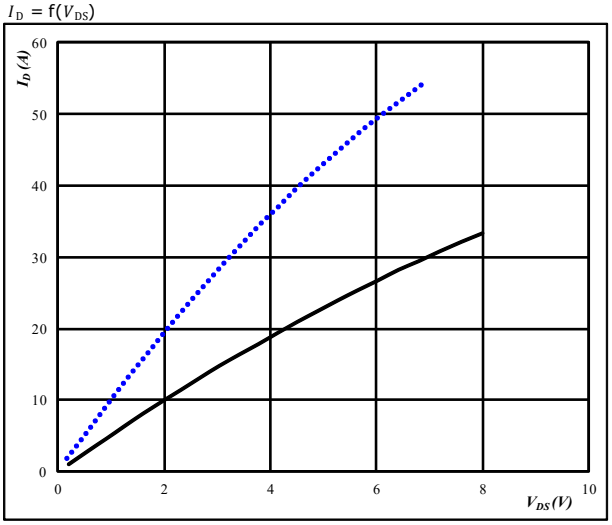
R (K/W)	τ (s)
8,74E-02	5,59E+00
2,41E-01	4,60E-01
1,22E+00	6,53E-02
6,89E-01	2,20E-02
4,52E-01	5,14E-03
2,99E-01	1,11E-03

PFC Switch Characteristics

figure 1. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

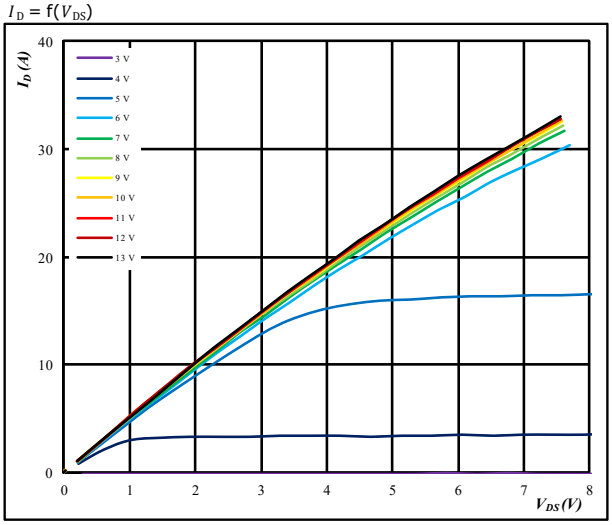


t_p =	250	µs		25 °C	•••••••••••
V_{GS}=	10	V	T_j:	125 °C	———

figure 2. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

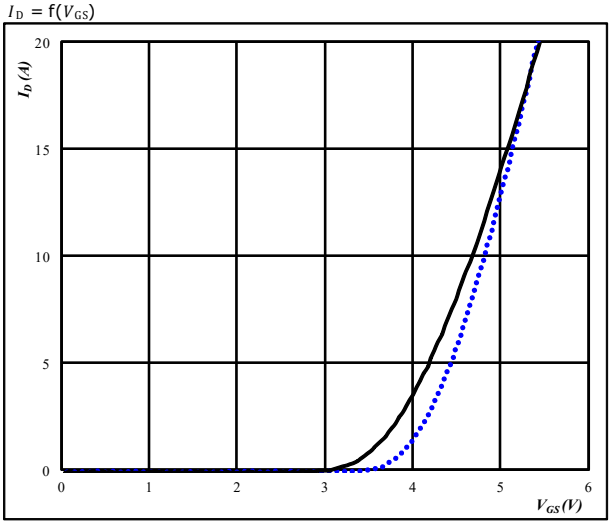


t_p =	250	µs
T_j =	125	°C
V_{GS} from	3 V to 13 V in steps of 1 V	

figure 3. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$

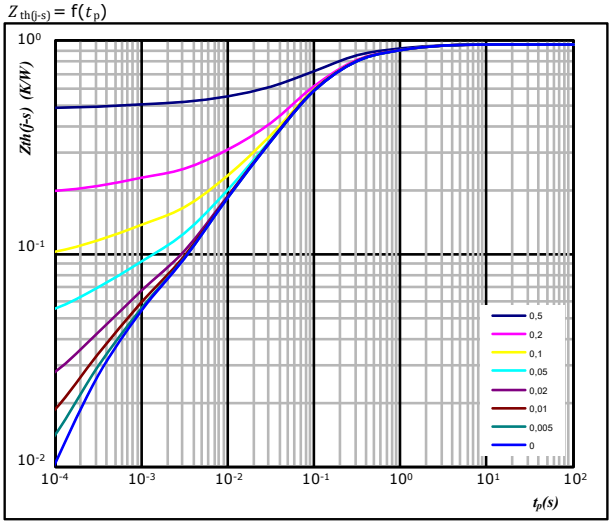


t_p =	100	µs		25 °C	•••••••••••
V_{DS} =	10	V	T_j:	125 °C	———

figure 4. **MOSFET**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,97	K/W

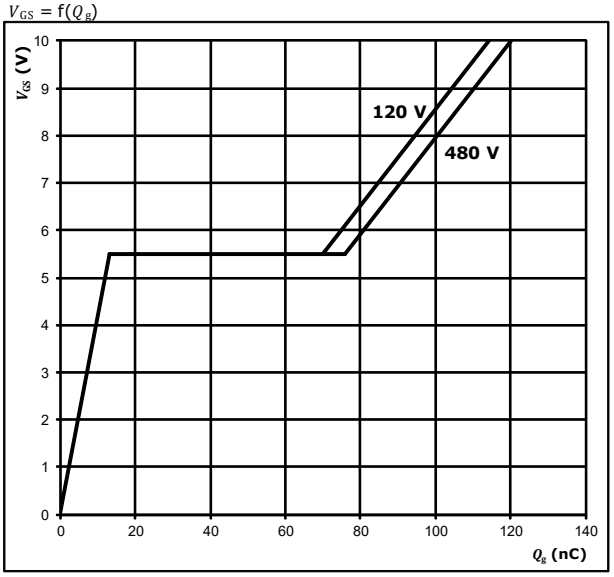
R (K/W)	τ (s)
1,16E-01	1,34E+00
2,88E-01	2,07E-01
4,26E-01	6,72E-02
9,86E-02	7,51E-03
3,70E-02	4,03E-04

PFC Switch Characteristics

figure 5. **MOSFET**

Gate voltage vs Gate charge

$V_{GS} = f(Q_g)$



At

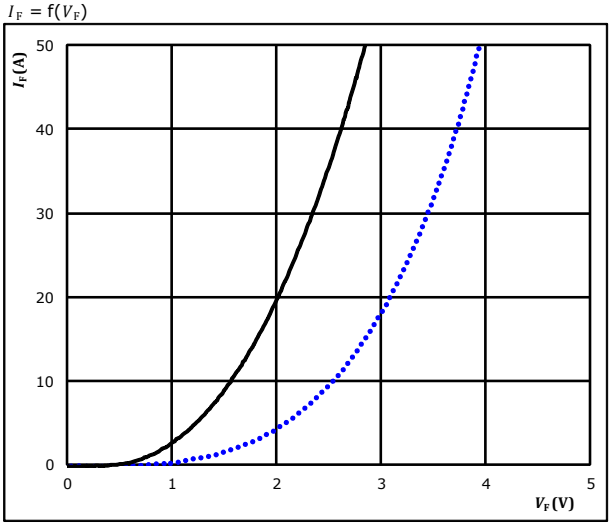
$I_D =$ 18 A

PFC Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



t_p = 250 µs

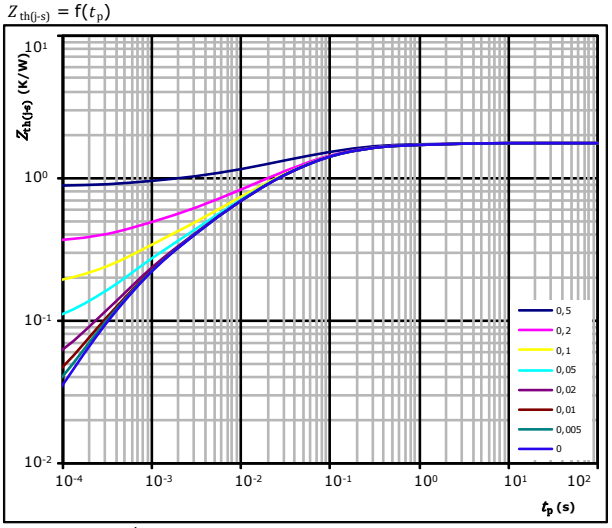
T_j: 25 °C

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

$R_{th(j-s)}$ = 1,75 K/W

FWD thermal model values

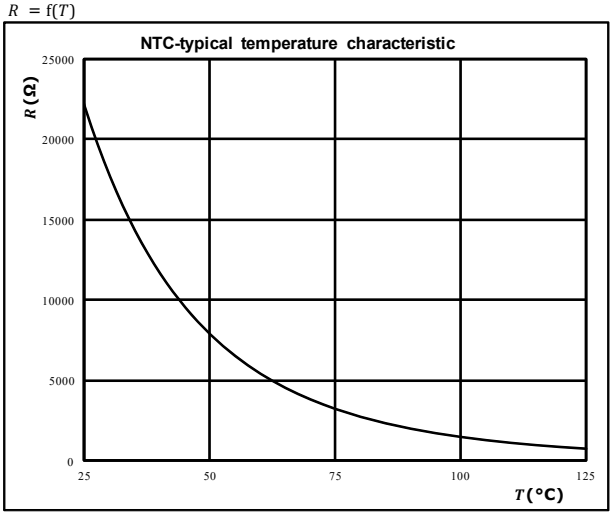
R (K/W)	τ (s)
8,09E-02	1,93E+00
1,89E-01	2,40E-01
6,58E-01	6,34E-02
4,62E-01	1,40E-02
2,29E-01	2,92E-03
1,31E-01	5,08E-04

NTC Characteristics

figure 1. **Thermistor**

Typical NTC characteristic as a function of temperature

$R = f(T)$

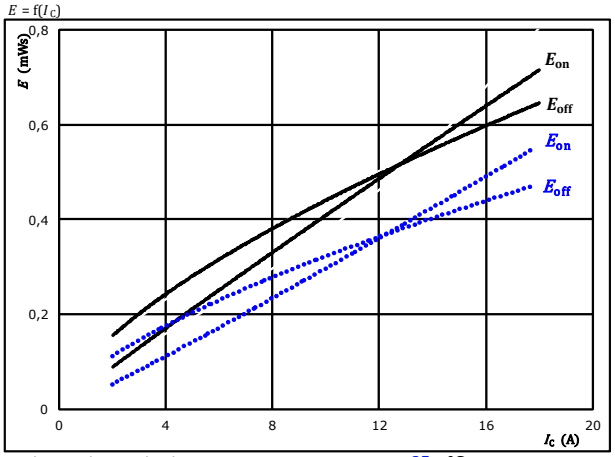


Inverter Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



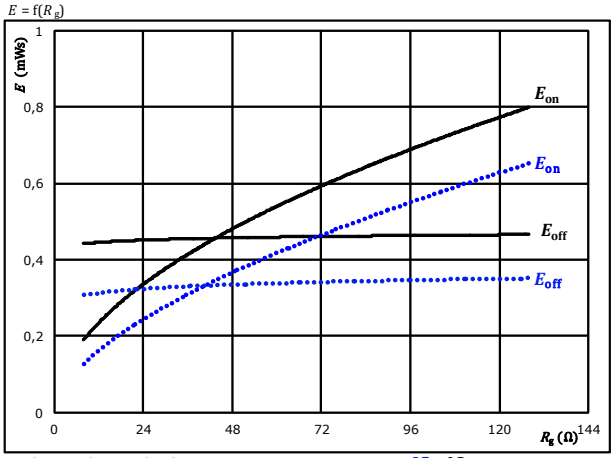
With an inductive load at — 25 °C ••••••••••••••

V_{CE} =	400	V	T_j:	125 °C	———
V_{GE} =	±15	V			
R_{gon} =	32	Ω			
R_{goff} =	32	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



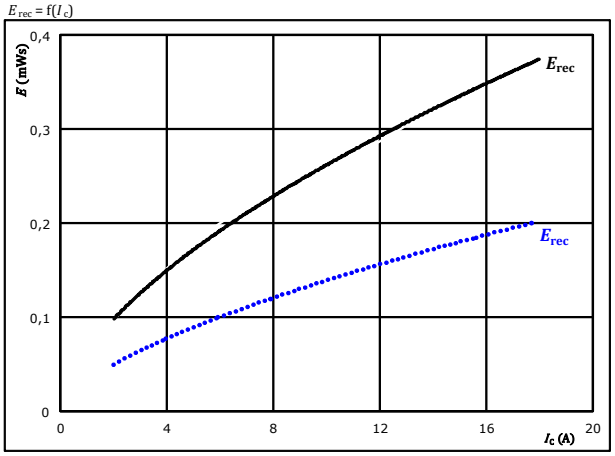
With an inductive load at — 25 °C ••••••••••••••

V_{CE} =	400	V	T_j:	125 °C	———
V_{GE} =	±15	V			
I_C =	10	A			

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



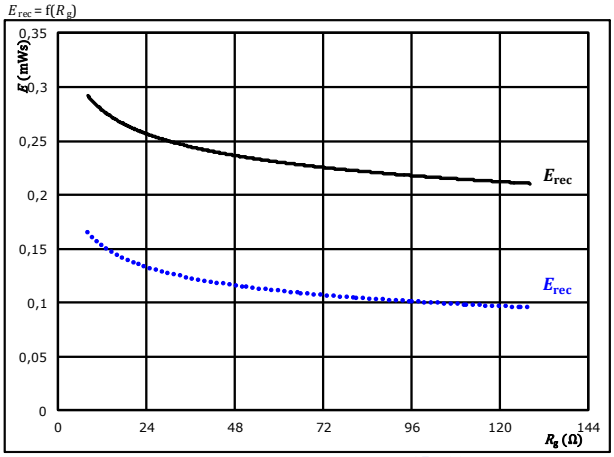
With an inductive load at — 25 °C ••••••••••••••

V_{CE} =	400	V	T_j:	125 °C	———
V_{GE} =	±15	V			
R_{gon} =	32	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 ••••••••••••••

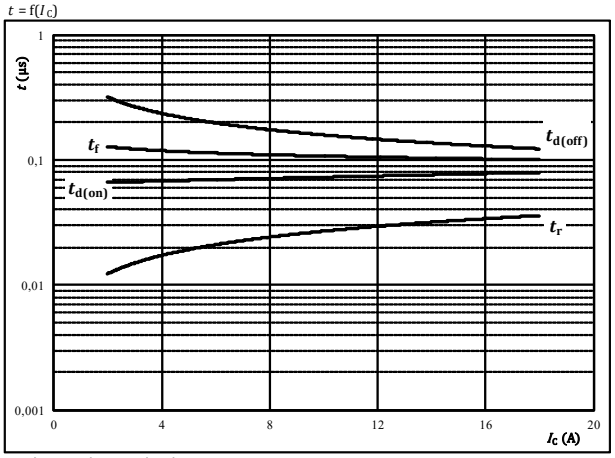
V_{CE} =	400	V	T_j:	125 °C	———
V_{GE} =	±15	V			
I_C =	10	A			

Inverter Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



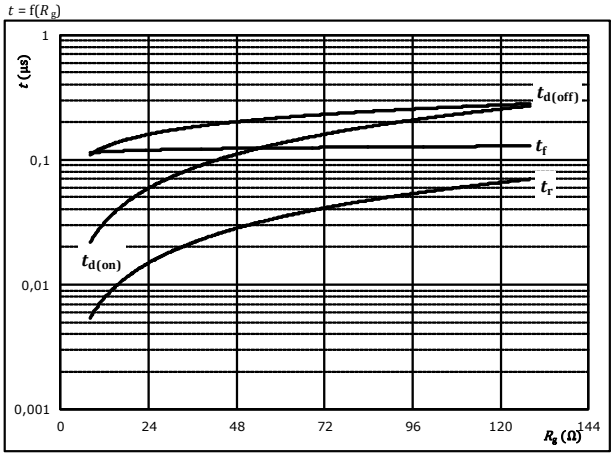
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



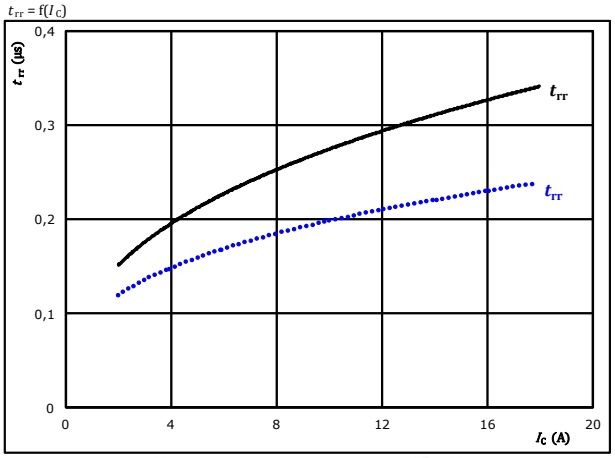
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	±15	V
I_C =	10	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

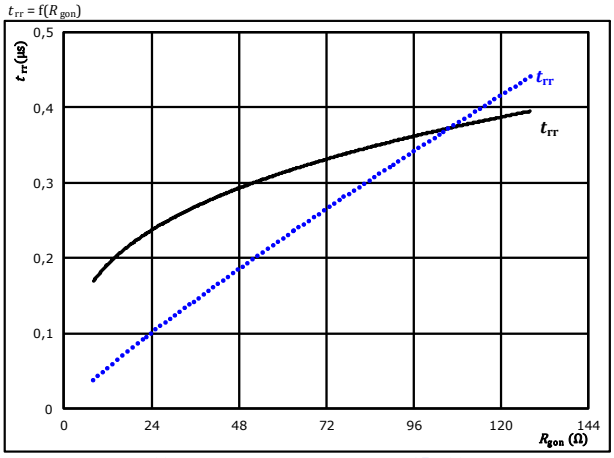


At	V_{CE} =	400	V	T_j:	25 °C
	V_{GE} =	±15	V		125 °C
	R_{gon} =	32	Ω		

figure 8. **FWD**

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

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



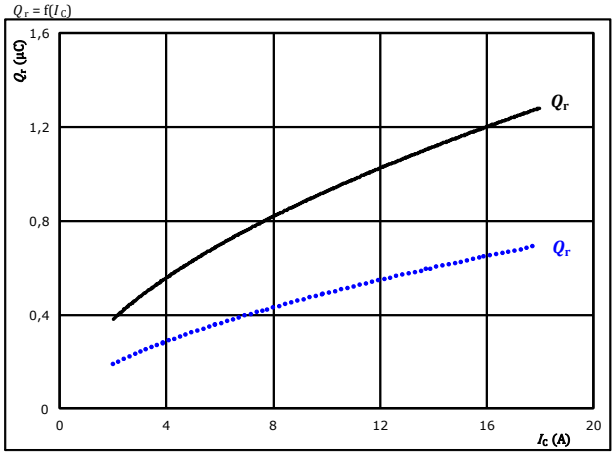
At	V_{CE} =	400	V	T_j:	25 °C
	V_{GE} =	±15	V		125 °C
	I_C =	10	A		

Inverter Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

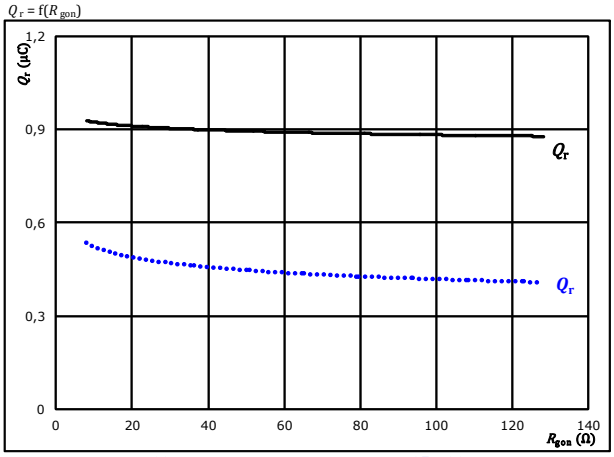


At						
	V_{CE} =	400	V		25 °C	·····
	V_{GE} =	±15	V	T_j:	125 °C	———
	R_{gon} =	32	Ω			

figure 10. FWD

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

$Q_r = f(R_{gon})$

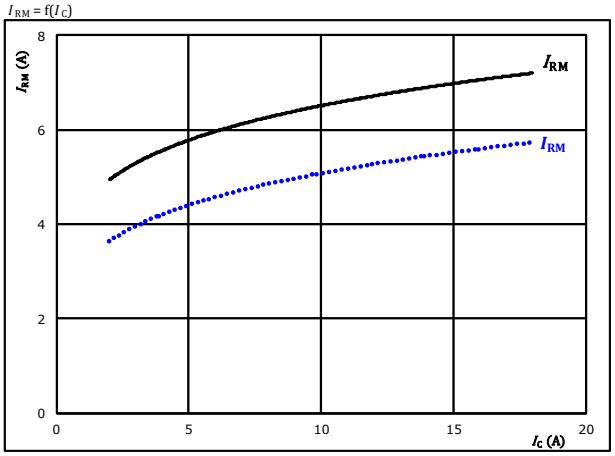


At						
	V_{CE}=	400	V		25 °C	·····
	V_{GE} =	±15	V	T_j:	125 °C	———
	I_C=	10	A			

figure 11. FWD

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

$I_{RM} = f(I_C)$

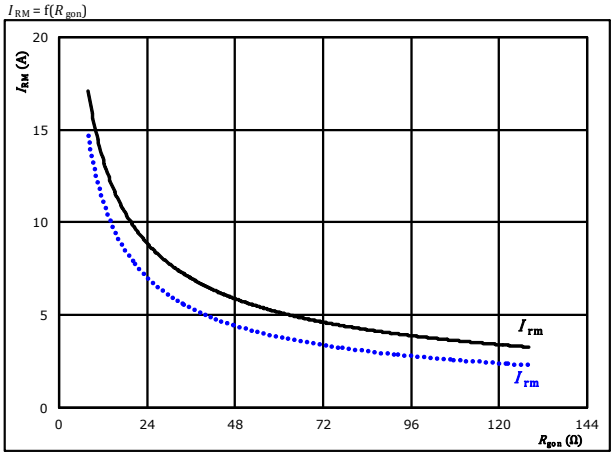


At						
	V_{CE}:	400	V		25 °C	·····
	V_{GE} =	±15	V	T_j:	125 °C	———
	R_{gon} =	32	Ω			

figure 12. FWD

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

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



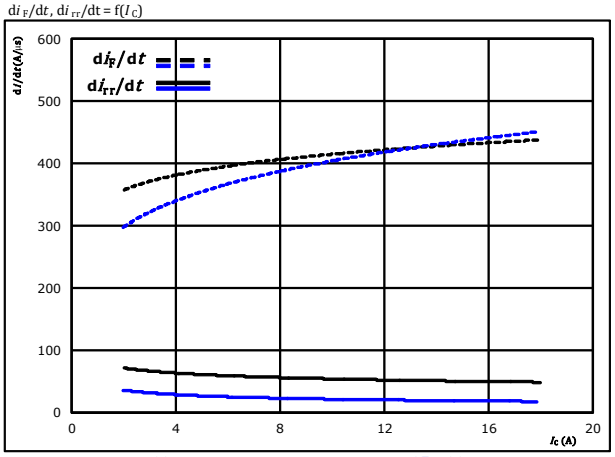
At						
	V_{CE} =	400	V		25 °C	·····
	V_{GE} =	±15	V	T_j:	125 °C	———
	I_C =	10	A			

Inverter Switching Characteristics

figure 13. **FWD**

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

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

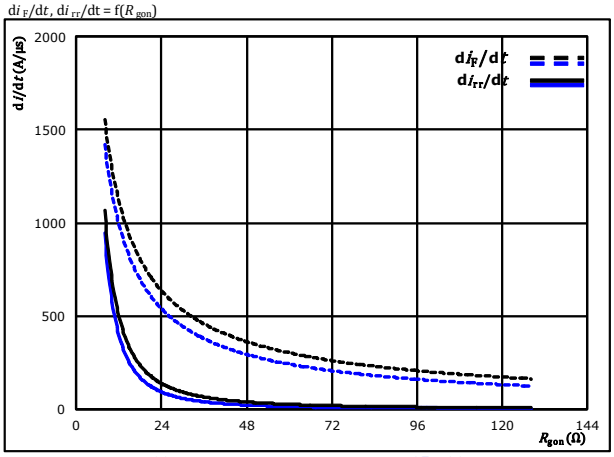


At						
V_{CE} =	400	V		25	°C	
V_{GE} =	±15	V	T_j:	125	°C	
R_{gon} =	32	Ω				

figure 14. **FWD**

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

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

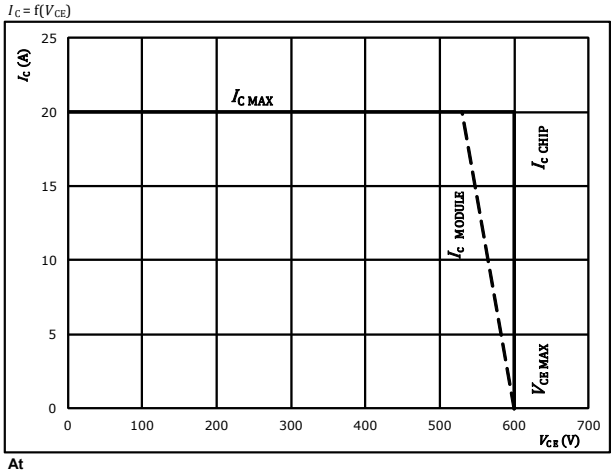


At						
V_{CE} =	400	V		25	°C	
V_{GE} =	±15	V	T_j:	125	°C	
I_C =	10	A				

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	175	°C
R_{gon} =	32	Ω
R_{goff} =	32	Ω

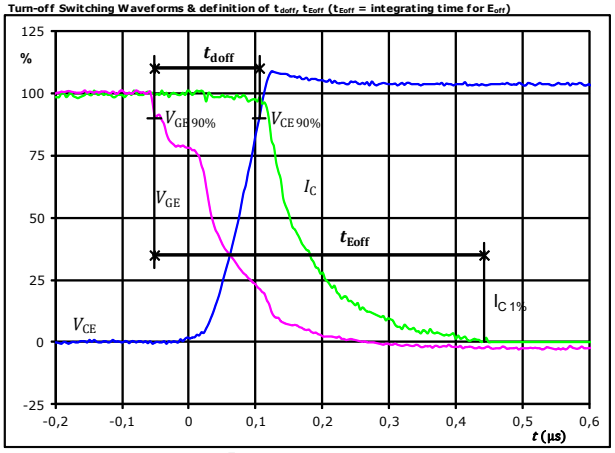
Inverter Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	32 Ω
R_{goff}	=	32 Ω

figure 1. IGBT

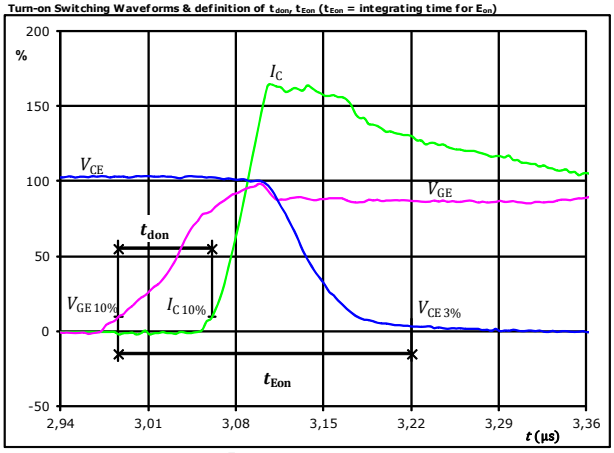
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	10	A
t_{doff} =	0,159	µs
t_{Eoff} =	0,494	µs

figure 2. IGBT

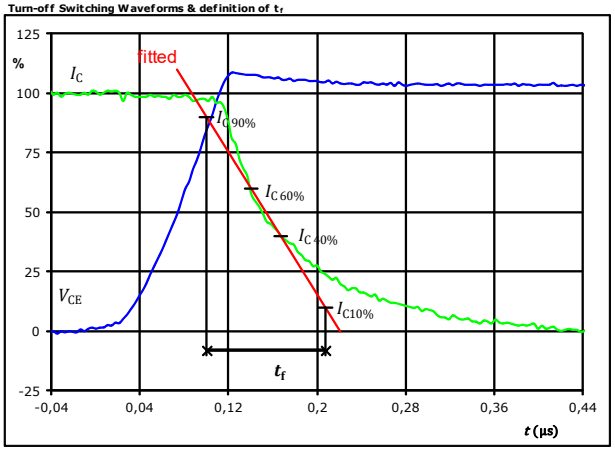
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	10	A
t_{don} =	0,074	µs
t_{Eon} =	0,234	µs

figure 3. IGBT

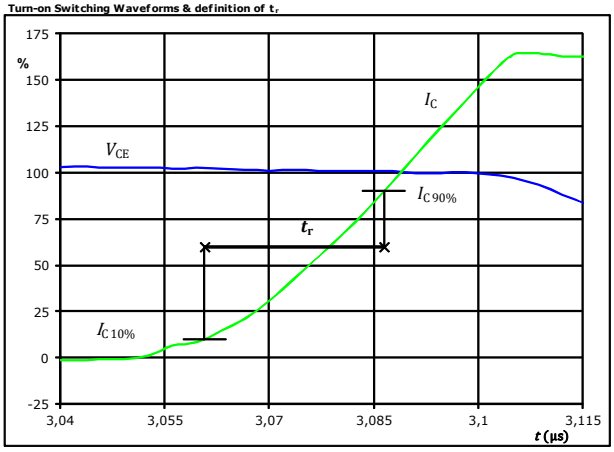
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	10	A
t_f =	0,123	µs

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

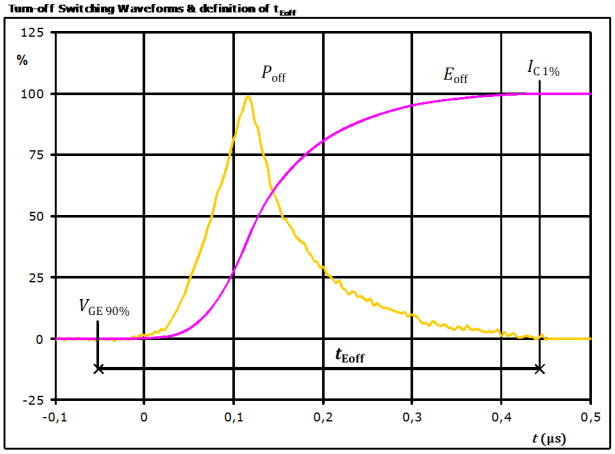


$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	10	A
t_r =	0,026	µs

Inverter Switching Characteristics

figure 5. **IGBT**

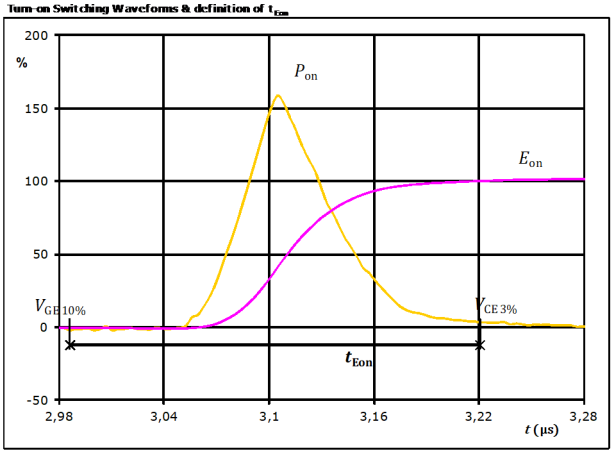
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	4,00	kW
E_{off} (100%) =	0,45	mJ
t_{Eoff} =	0,49	µs

figure 6. **IGBT**

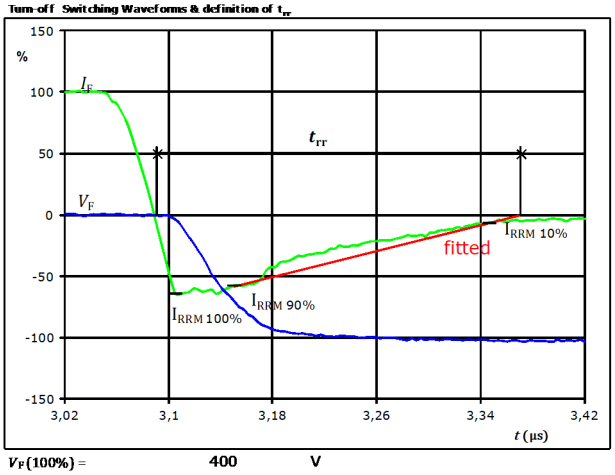
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	4,00	kW
E_{on} (100%) =	0,38	mJ
t_{Eon} =	0,23	µs

figure 7. **FWD**

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

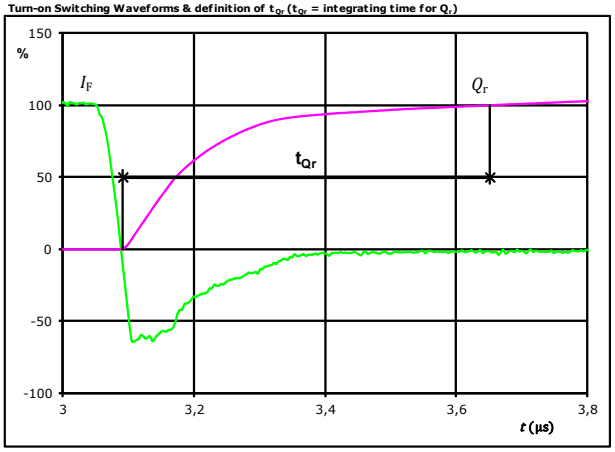


V_F (100%) =	400	V
I_F (100%) =	10	A
I_{RRM} (100%) =	-7	A
t_{rr} =	0,270	µs

Inverter Switching Characteristics

figure 8. **FWD**

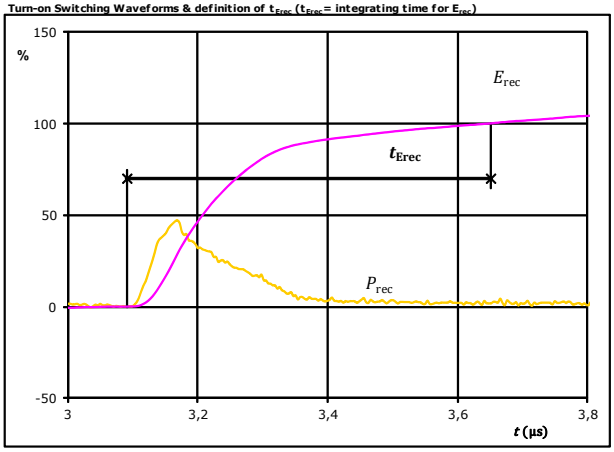
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	10	A
Q_r (100%) =	0,90	µC
t_{Qr} =	0,56	µs

figure 9. **FWD**

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



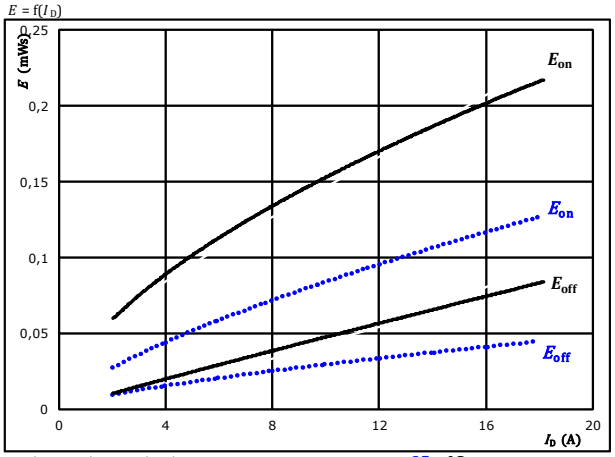
P_{rec} (100%) =	4,00	kW
E_{rec} (100%) =	0,26	mJ
t_{Erec} =	0,56	µs

PFC Switching Characteristics

figure 1. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



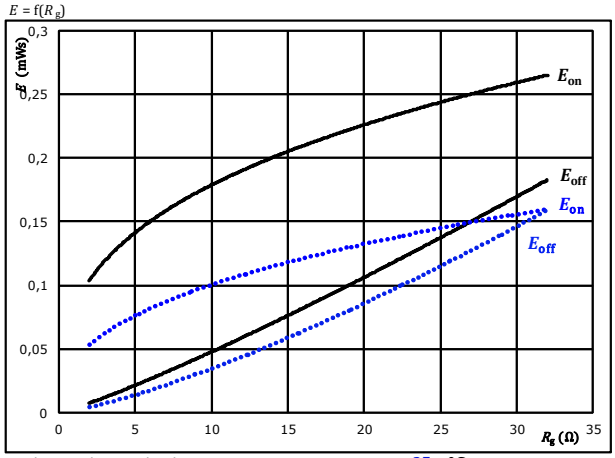
With an inductive load at — 25 °C ••••••••••••••

V_{DS} =	400	V	T_j:	125 °C	———
V_{GS} =	0/10	V			
R_{gon} =	8	Ω			
R_{goff} =	8	Ω			

figure 2. **MOSFET**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



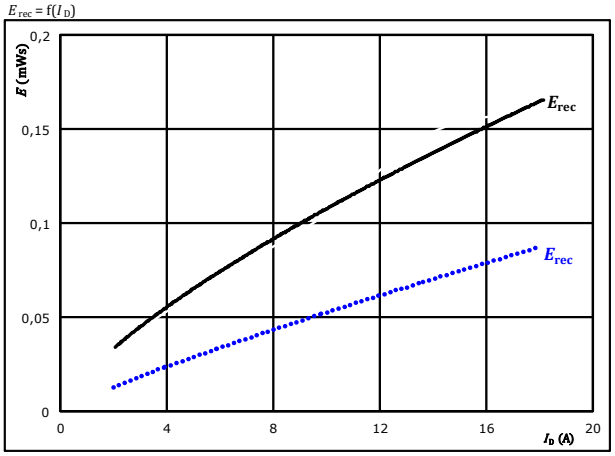
With an inductive load at — 25 °C ••••••••••••••

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

figure 3. **FWD**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



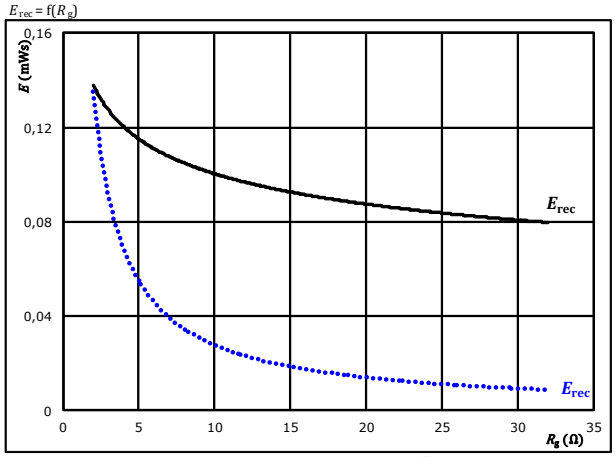
With an inductive load at — 25 °C ••••••••••••••

V_{DS} =	400	V	T_j:	125 °C	———
V_{GS} =	0/10	V			
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 — 25 °C ••••••••••••••

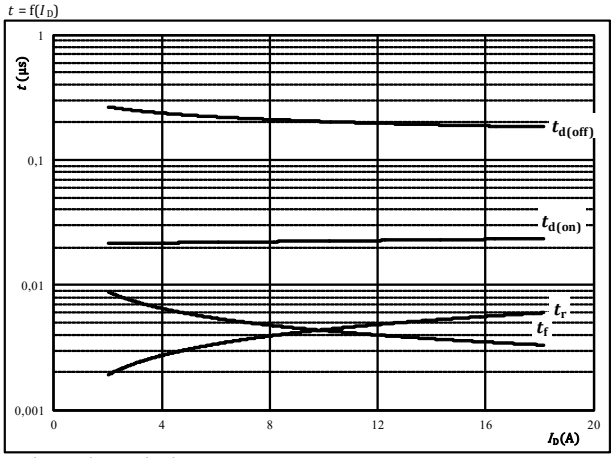
V_{DS} =	400	V	T_j:	125 °C	———
V_{GS} =	0/10	V			
I_D =	10	A			

PFC Switching Characteristics

figure 5. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



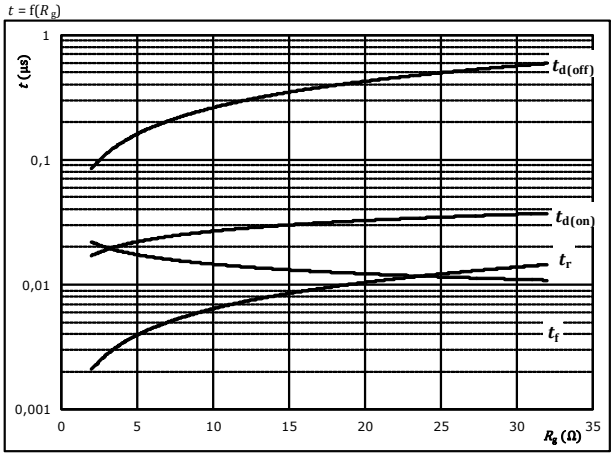
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	0/10	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

figure 6. **MOSFET**

Typical switching times as a function of gate resistor

$t = f(R_g)$



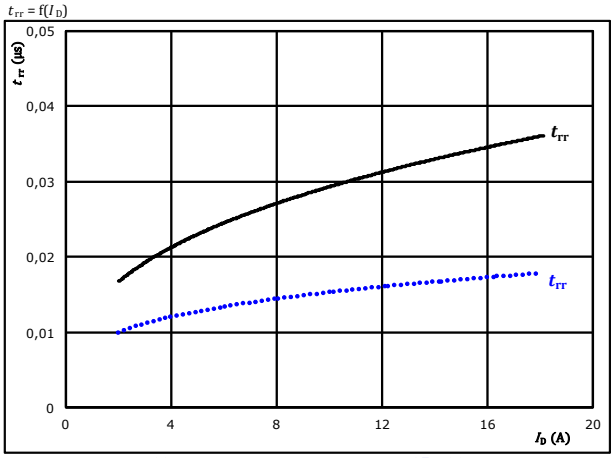
With an inductive load at

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

figure 7. **FWD**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$



At

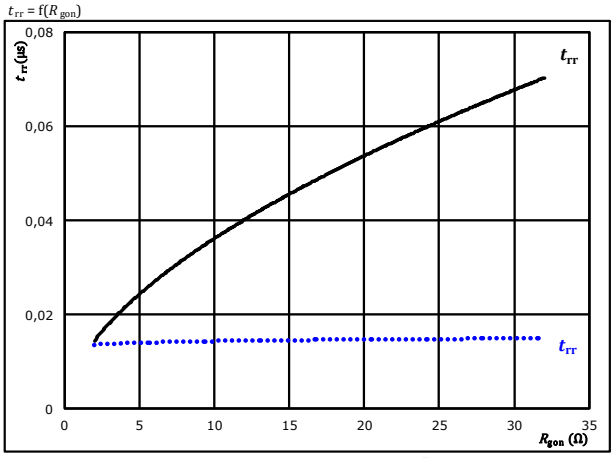
V_{DS} =	400	V
V_{GS} =	0/10	V
R_{gon} =	8	Ω

T_j: 25 °C (dotted) / 125 °C (solid)

figure 8. **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 =	10	A

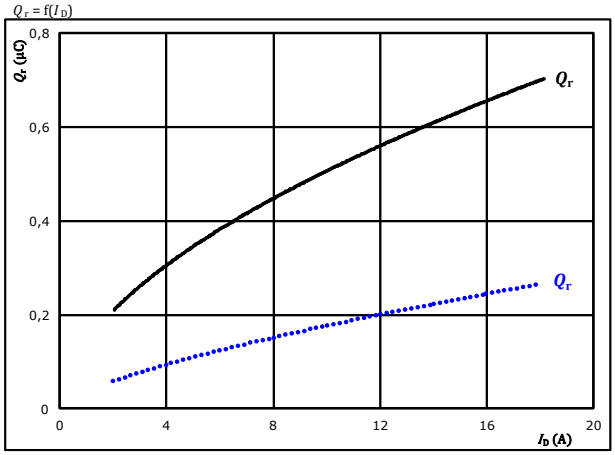
T_j: 25 °C (dotted) / 125 °C (solid)

PFC Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

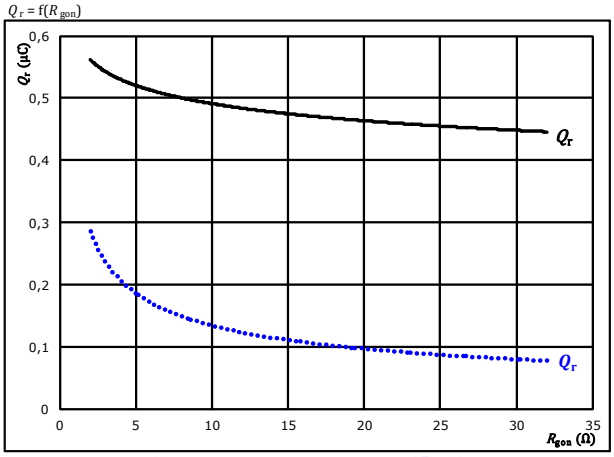


At						
	V_{DS} =	400	V		25 °C	·····
	V_{GS} =	0/10	V	T_j:	125 °C	———
	R_{gon} =	8	Ω			

figure 10. FWD

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

$Q_r = f(R_{gon})$

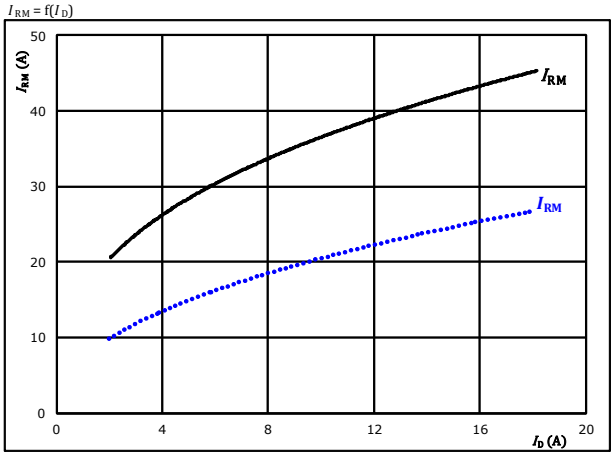


At						
	V_{DS} =	400	V		25 °C	·····
	V_{GS} =	0/10	V	T_j:	125 °C	———
	I_D =	10	A			

figure 11. FWD

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

$I_{RM} = f(I_D)$

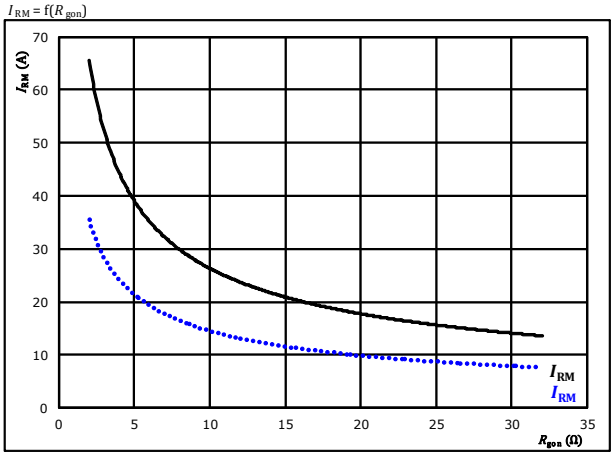


At						
	V_{DS} =	400	V		25 °C	·····
	V_{GS} =	0/10	V	T_j:	125 °C	———
	R_{gon} =	8	Ω			

figure 12. FWD

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

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



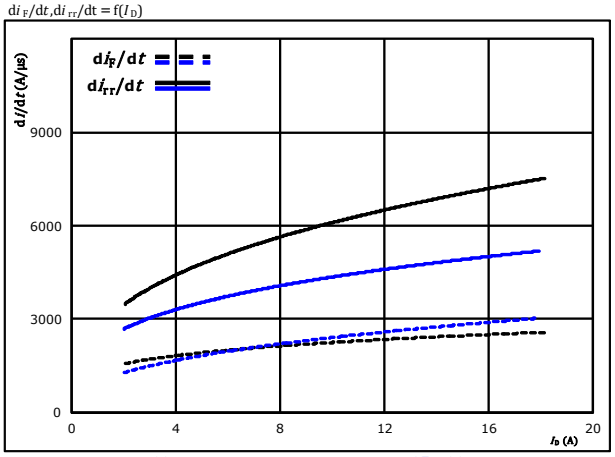
At						
	V_{DS} =	400	V		25 °C	·····
	V_{GS} =	0/10	V	T_j:	125 °C	———
	I_D =	10	A			

PFC Switching Characteristics

figure 13. **FWD**

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

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

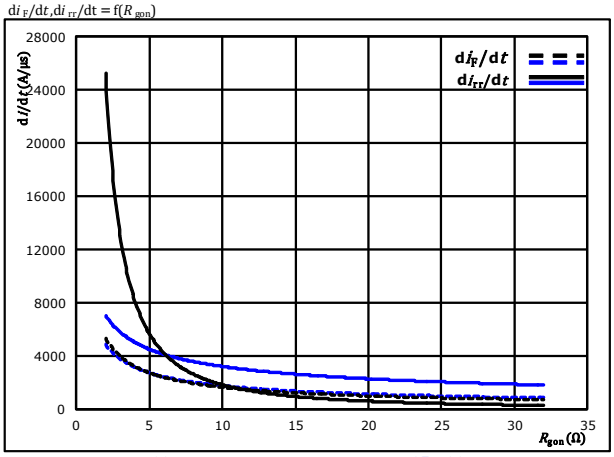


At	V_{DS} =	400	V		25 °C	
	V_{GS} =	0/10	V	T_j:	125 °C	
	R_{gon} =	8	Ω			

figure 14. **FWD**

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

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

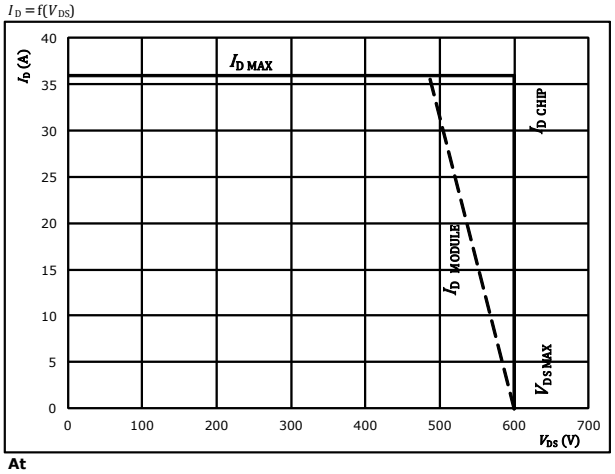


At	V_{DS} =	400	V		25 °C	
	V_{GS} =	0/10	V	T_j:	125 °C	
	I_D =	10	A			

figure 15. **MOSFET**

Reverse bias safe operating area

$I_D = f(V_{DS})$



At

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

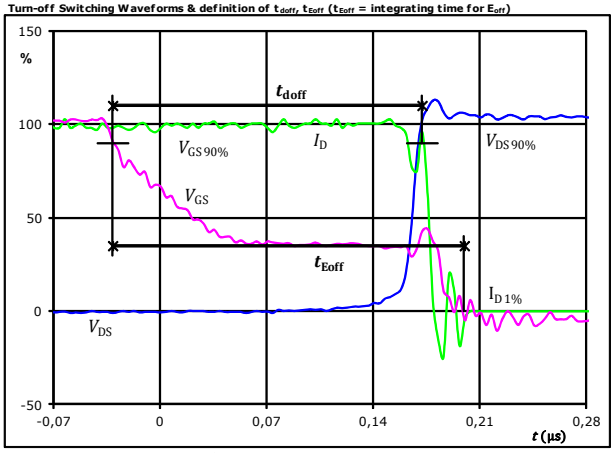
PFC Switching Definitions

General conditions

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

figure 1. MOSFET

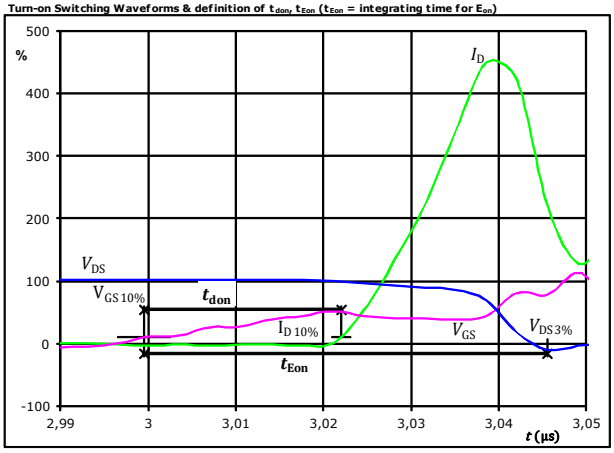
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GS}(0\%)$ =	0	V
$V_{GS}(100\%)$ =	10	V
$V_{DS}(100\%)$ =	400	V
$I_D(100\%)$ =	10	A
t_{doff} =	0,202	µs
t_{Eoff} =	0,231	µs

figure 2. MOSFET

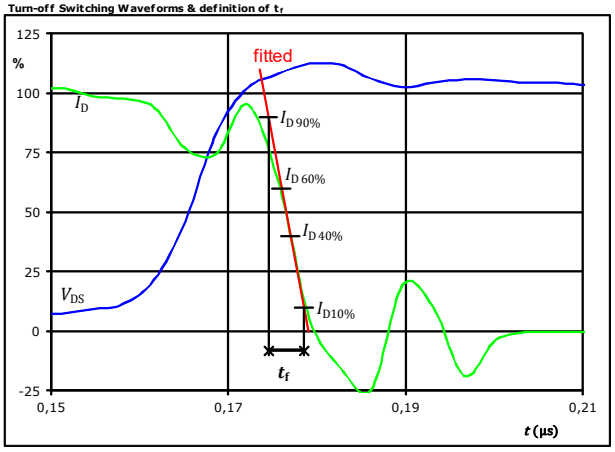
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GS}(0\%)$ =	0	V
$V_{GS}(100\%)$ =	10	V
$V_{DS}(100\%)$ =	400	V
$I_D(100\%)$ =	10	A
t_{don} =	0,023	µs
t_{Eon} =	0,046	µs

figure 3. MOSFET

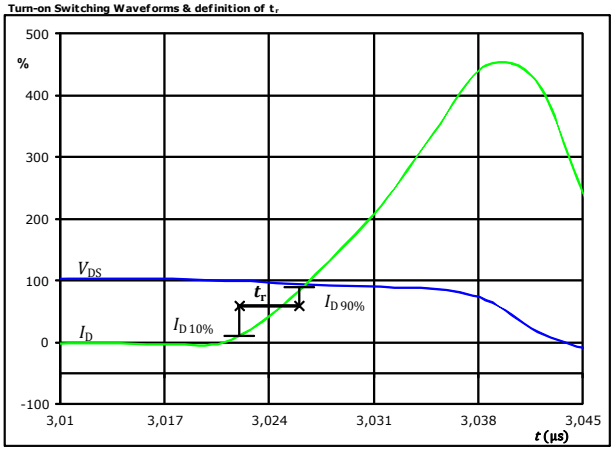
Turn-off Switching Waveforms & definition of t_f



$V_{DS}(100\%)$ =	400	V
$I_D(100\%)$ =	10	A
t_f =	0,004	µs

figure 4. MOSFET

Turn-on Switching Waveforms & definition of t_r

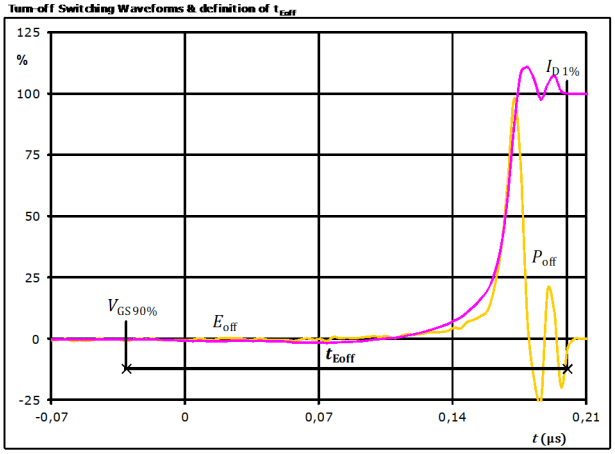


$V_{DS}(100\%)$ =	400	V
$I_D(100\%)$ =	10	A
t_r =	0,004	µs

PFC Switching Characteristics

figure 5. **MOSFET**

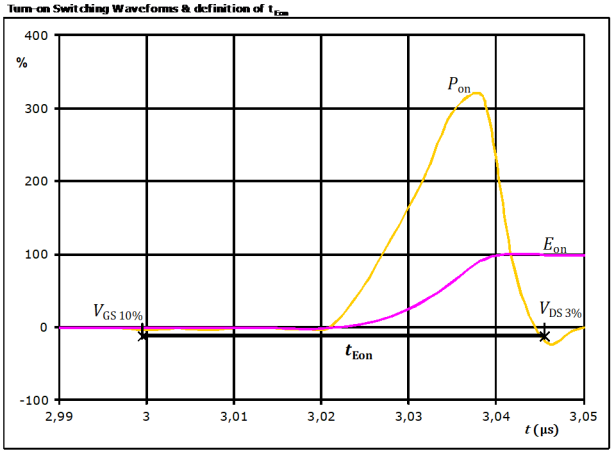
Turn-off Switching Waveforms & definition of t_{Eoff}



$P_{off}(100\%)$ =	4,03	kW
$E_{off}(100\%)$ =	0,05	mJ
t_{Eoff} =	0,23	µs

figure 6. **MOSFET**

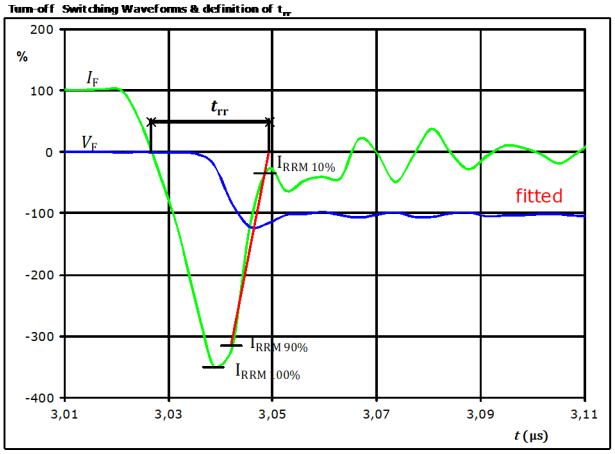
Turn-on Switching Waveforms & definition of t_{Eon}



$P_{on}(100\%)$ =	4,03	kW
$E_{on}(100\%)$ =	0,15	mJ
t_{Eon} =	0,05	µs

figure 7. **FWD**

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

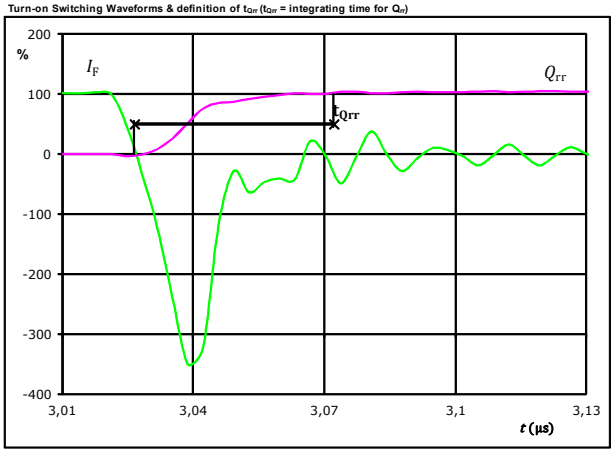


$V_F(100\%)$ =	400	V
$I_F(100\%)$ =	10	A
$I_{RRM}(100\%)$ =	-36	A
t_{rr} =	0,023	µs

PFC Switching Characteristics

figure 8. **FWD**

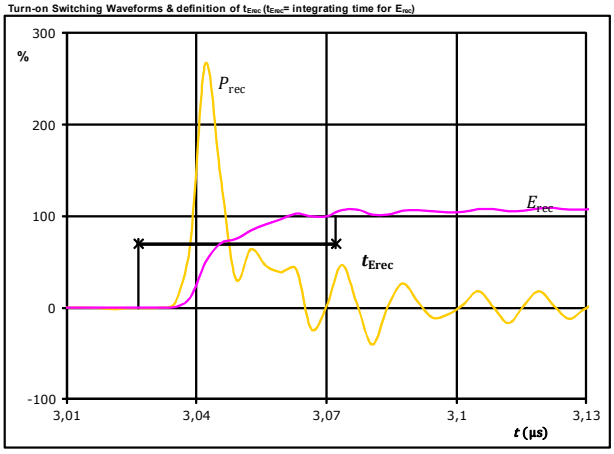
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_F (100%) =	10	A
Q_{rr} (100%) =	0,49	µC
t_{Qrr} =	0,05	µs

figure 9. **FWD**

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



P_{rec} (100%) =	4,03	kW
E_{rec} (100%) =	0,11	mJ
t_{Erec} =	0,05	µs

Ordering Code & Marking

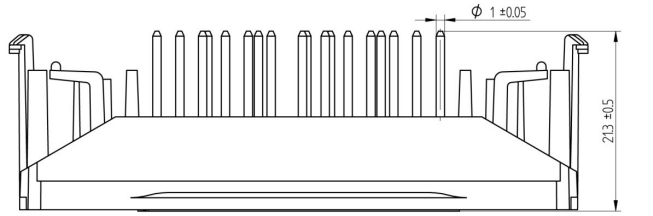
Version	Ordering Code
without thermal paste with solder pins with 17 mm housing	10-F006PPA010SB03-M683B50
with thermal paste with solder pins with 17 mm housing	10-F006PPA010SB03-M683B50-/3/
without thermal paste with pressfit pins with 17 mm housing	10-P006PPA010SB03-M683B50Y
with thermal paste with pressfit pins with 17 mm housing	10-P006PPA010SB03-M683B50Y-/3/

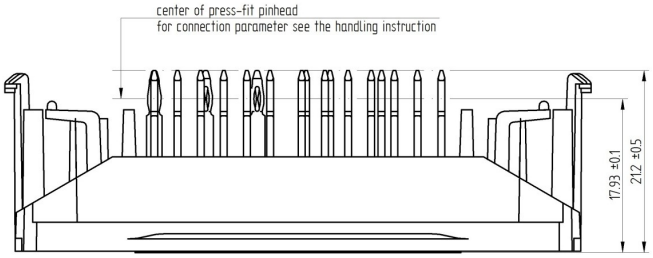
	Name		Date code	UL & VIN	Lot	Serial
Text	NN-NNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
	Type&Ver	**Lot number**	**Serial**	**Date code**		
Datamatrix	TTTTTTTVV	LLLLL	SSSS	WWYY		

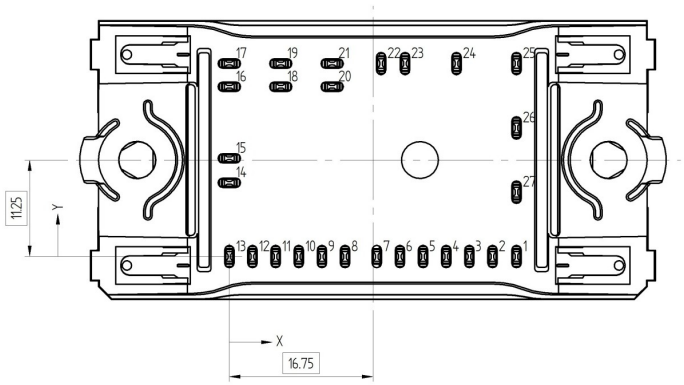
Outline

Pin table

Pin	X	Y	Function
1	33,5	0	DC-
2	30,7	0	PFC-
3	28	0	S1
4	25,3	0	S2
5	22,6	0	INV-
6	19,9	0	G7
7	17,2	0	S7
8	13,5	0	G6
9	10,8	0	E6
10	8,1	0	G5
11	5,4	0	E5
12	2,7	0	G4
13	0	0	E4
14	0	8,6	NTC1
15	0	11,45	NTC2
16	0	19,8	G1
17	0	22,5	U
18	6	19,8	G2
19	6	22,5	V
20	12	19,8	G3
21	12	22,5	W
22	17,7	22,5	+INV
23	20,5	22,5	PFC+
24	26,5	22,5	PFC IN
25	33,5	22,5	DC+
26	33,5	15	L1
27	33,5	7,5	L2

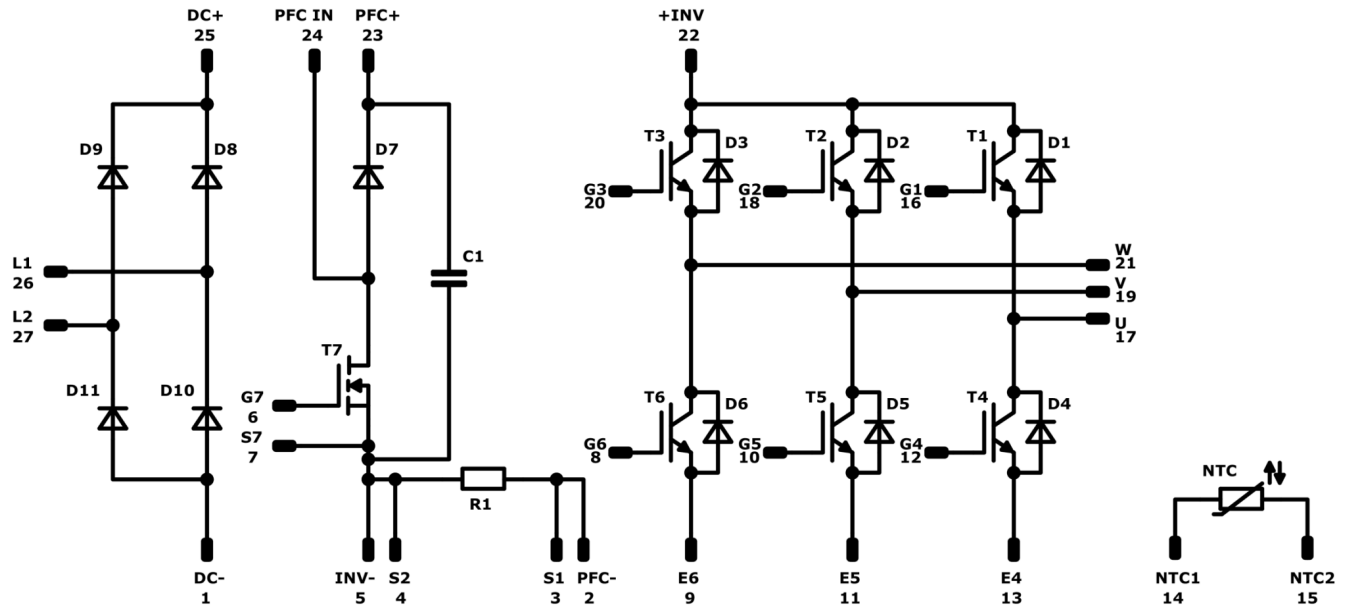






Tolerance of pinpositions: ±0.5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
D8, D9,D10, D11	Rectifier	1600 V	25 A	Rectifier	
T1, T2, T3, T4, T5, T6	IGBT	600 V	10 A	Inverter Switch	
D1, D2, D3, D4, D5, D6	FWD	600 V	10 A	Inverter Diode	
T7	MOSFET	600 V	99 mΩ	PFC Switch	
D7	FWD	600 V	15 A	PFC Diode	
R1	Resistor	600 V	10 A	PFC Shunt	
C1	Capacitor	500 V		Capacitor (PFC)	
NTC	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-x006PPA010SB03-M683B50x-D2-14	03 Nov. 2019	Add pressfit version	1, 30

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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.