Vincotech

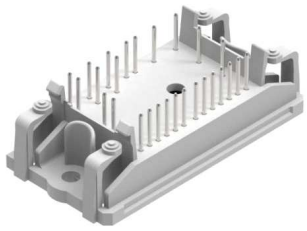
10-F006PPA006SB02-L832B10
datasheet

flow **PIM 0** **600 V / 6 A**

Features

- Clip in PCB mounting
- Trench Fieldstop IGBT's for low saturation losses
- Tandem diode and MOSFET for PFC high switching frequency operation

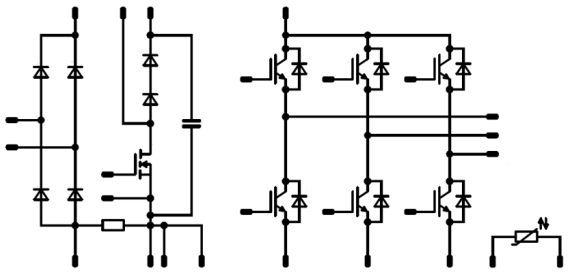
flow 0 17mm housing



Target applications

- Industrial Drives
- Embedded Drives

Schematic



Types

- 10-F006PPA006SB02-L832B10

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	9	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	18	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	38	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \leq$ 150 °C V_{GE} = 15 V	6 360	µs V
Maximum Junction Temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		600	V
Continuous (direct) forward current	I_F	T_j = T_{jmax} T_s = 80 °C	8	A
Repetitive peak forward current	I_{FRM}		12	A
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	35	W
Maximum Junction Temperature	T_{jmax}		175	°C
PFC Switch				
Drain-source voltage	V_{DSS}		500	V
Drain current	I_D	T_j = T_{jmax} T_s = 80 °C	12	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}	63	A
Avalanche energy, single pulse	E_{AS}	I_D = 10 A V_{DD} = 50 V	690	mJ
Avalanche energy, repetitive	E_{AR}	I_D = 21 A V_{DD} = 50 V	1	mJ
Avalanche current, repetitive	I_{AR}	t_p limited by P_{AV} = E_{AR}*f	21	A
MOSFET dv/dt ruggedness	dv/dt	V_{DS} = 400 V T_s = 125 °C	50	V/ns
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	66	W
Gate-source voltage	V_{GSS}		±20	V
Reverse diode dv/dt	dv/dt		6	V/ns
Maximum Junction Temperature	T_{jmax}		150	°C
PFC Diode				
Peak repetitive reverse voltage	V_{RRM}		600	V
Continuous (direct) forward current	I_F	T_j = T_{jmax} T_s = 80 °C	21	A
Surge (non-repetitive) forward current	I_{FSM}	60 Hz Single Half Sine Wave T_j = 45 °C t_p = 8,3 ms	110	A
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	56	W
Maximum junction temperature	T_{jmax}		150	°C
PFC Capacitor				
Maximum DC voltage	V_{MAX}		500	V
Operation Temperature	T_{op}		-55…+125	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
PFC Shunt				
Max DC current	I_{MAX}	T_c = 70 °C	18	A
Rectifier Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	17	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 45 °C	150	A
Surge current capability	I^2t		110	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	36	W
Maximum Junction Temperature	T_{jmax}		150	°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	4000	V
Creepage distance			min. 12,7	mm
Clearance			min. 12,7	mm
Comparative Tracking Index	CTI		> 200	

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 Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,00009	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		6	25 125	1,1	1,49 1,68	1,9	V
Collector-emitter cut-off current	I_{CES}		0	600		25			0,4	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		368		pF
Output capacitance	C_{oes}							28		
Reverse transfer capacitance	C_{res}							11		
Gate charge	Q_g		15	480	6	25		42		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,53		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 32 Ω R_{gon} = 64 Ω	15/0	300	6	25 125		17 17		ns
Rise time	t_r					25 125		11 14		
Turn-off delay time	$t_{d(off)}$					25 125		155 173		
Fall time	t_f					25 125		88 86		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,2 µC Q_{rFWD} = 0,4 µC				25 125		0,099 0,132		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,133 0,169		

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				6	25 125		1,58 1,50	1,95	V
Reverse leakage current	I_r			600		25			27	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,68		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 720 A/µs di/dt = 450 A/µs	15/0	300	6	25 125		6 7		A
Reverse recovery time	t_{rr}					25 125		102 175		ns
Recovered charge	Q_r					25 125		0,223 0,425		µC
Reverse recovered energy	E_{rec}					25 125		0,039 0,083		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		408 250		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		13,1	25 125		183 440	190	mΩ
Gate-source threshold voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}$			0,001	25	2,1	3	3,9	V
Gate to Source Leakage Current	I_{GSS}		20	0		25			100	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	500		25			1	µA
Internal gate resistance	r_g							none		Ω
Gate charge	Q_g							95		
Gate to source charge	Q_{GS}		0/10	380	21	25		10		nC
Gate to drain charge	Q_{GD}							50		
Short-circuit input capacitance	C_{iss}							2400		
Short-circuit output capacitance	C_{oss}	f= 1MHz	0	25		25		1200		pF
Reverse transfer capacitance	C_{rss}							30		
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,05		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$					25 125		12 12		
Rise time	t_r	R_{goff} = 16 Ω R_{gon} = 16 Ω				25 125		5 6		ns
Turn-off delay time	$t_{d(off)}$		15/0	350	12	25 125		315 331		
Fall time	t_f					25 125		10 10		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,1 µC Q_{rFWD} = 0,3 µC				25 125		0,045 0,087		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,093 0,113		

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		2,57 2,30	4	V
Reverse leakage current	I_R			600		25 125			250 500	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,24		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 2550 A/µs di/dt = 2396 A/µs	15/0	350	12	25 125		24 33		A
Reverse recovery time	t_{rr}					25 125		12 18		ns
Recovered charge	Q_r					25 125		0,123 0,325		µC
Reverse recovered energy	E_{rec}					25 125		0,037 0,088		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		8996 7360		A/µs
PFC Capacitor										
Capacitance	C							100		nF
Tolerance							-10		+10	%
PFC Shunt										
Static										
Resistance	R							22		mΩ
Tolerance							-1		+1	%
Temperature coeficient	t_c					20 - 60			50	ppm/K
Internal heat resistance	R_{thi}								13	K/W
Inductance	L								3	nH

Characteristic Values

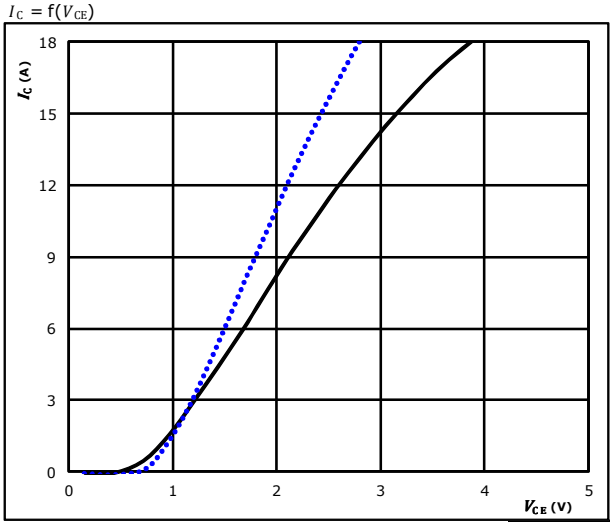
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Rectifier Diode										
Static										
Forward voltage	V_F				7	25 125		1,04 0,97	1,11	V
Reverse leakage current	I_r			1600		25			5	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,92		K/W
Thermistor										
Rated resistance	R					25		21,5		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 Ω				100	-4,5		+4,5	%
Power dissipation	P					25		210		mW
Power dissipation constant						25		3,5		mW/K
B-value	$B_{(25/50)}$					25		3884		K
B-value	$B_{(25/100)}$					25		3964		K
Vincotech NTC Reference									F	

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

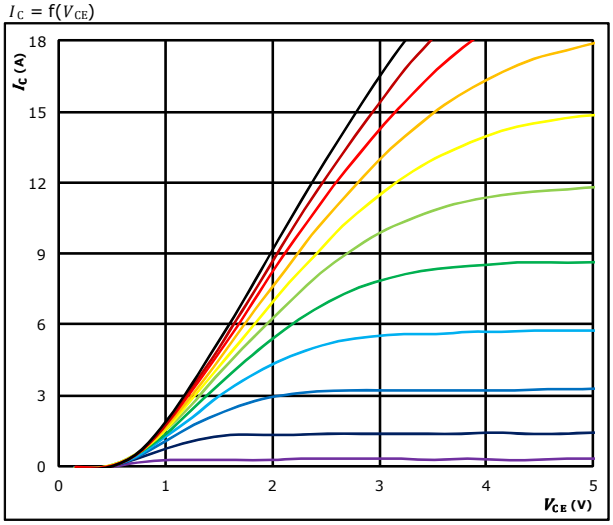


t_p =	250	µs		25 °C	
V_{GE} =	15	V	T_j:	125 °C	

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

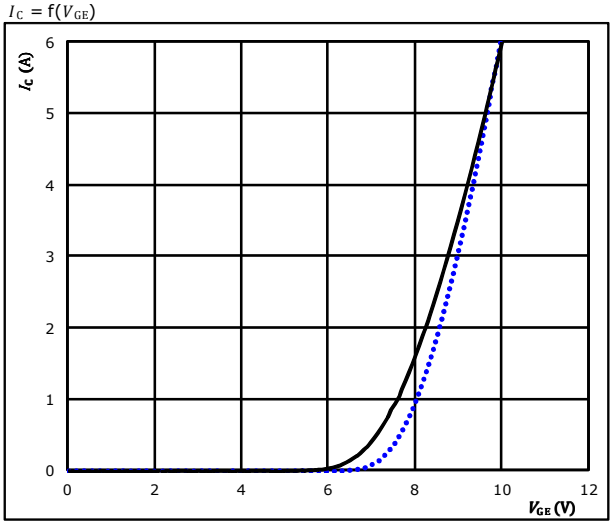


t_p =	250	µs
T_j =	125	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

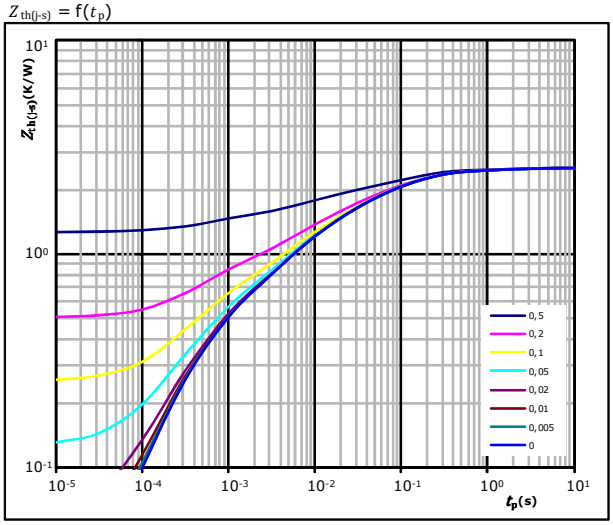


t_p =	100	µs		25 °C	
V_{CE} =	10	V	T_j:	125 °C	

figure 4. **IGBT**

Transient Thermal Impedance as function of Pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	2,53	K/W

IGBT thermal model values

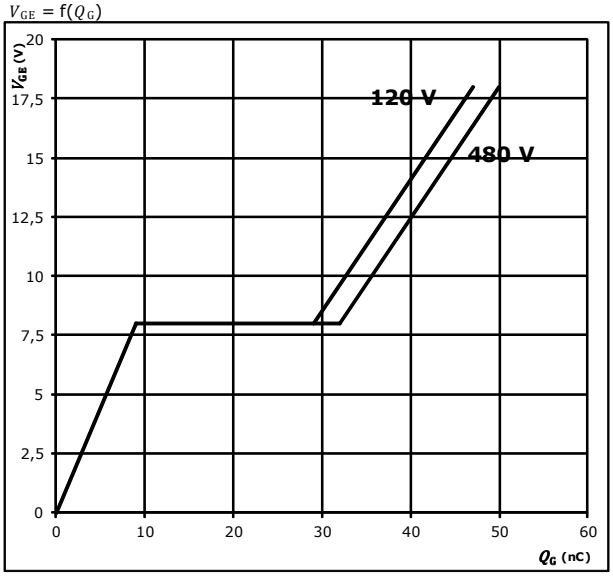
R (K/W)	τ (s)
4,08E-02	6,43E+00
1,93E-01	5,70E-01
8,18E-01	8,70E-02
6,50E-01	1,56E-02
4,72E-01	3,26E-03
3,65E-01	4,01E-04

Inverter Switch Characteristics

figure 5. **IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_G)$



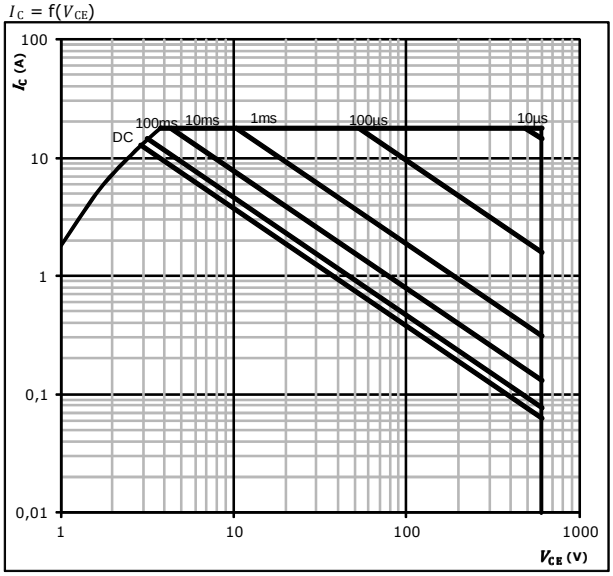
At

I_C= 6 A

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



At

D = single pulse

T_s = 80 °C

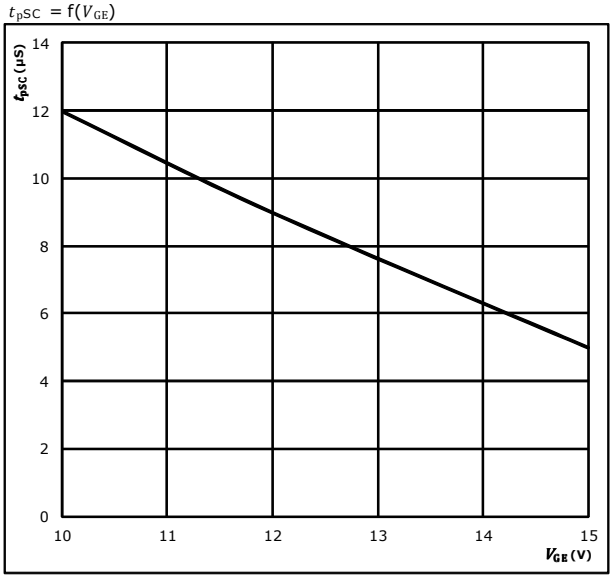
V_{GE} = ±15 V

T_j = T_{jmax}

figure 7. **IGBT**

Short circuit duration as a function of VGE

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



At

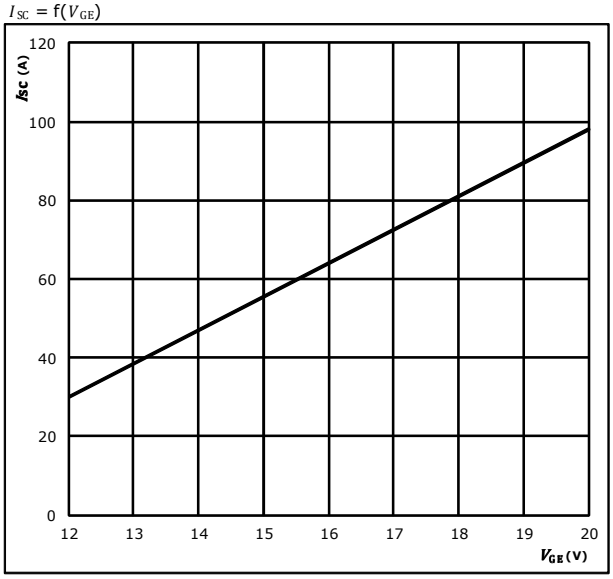
V_{CE} = 600 V

T_j ≤ 175 °C

figure 8. **IGBT**

Typical short circuit current as a function of VGE

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



At

V_{CE} ≤ 600 V

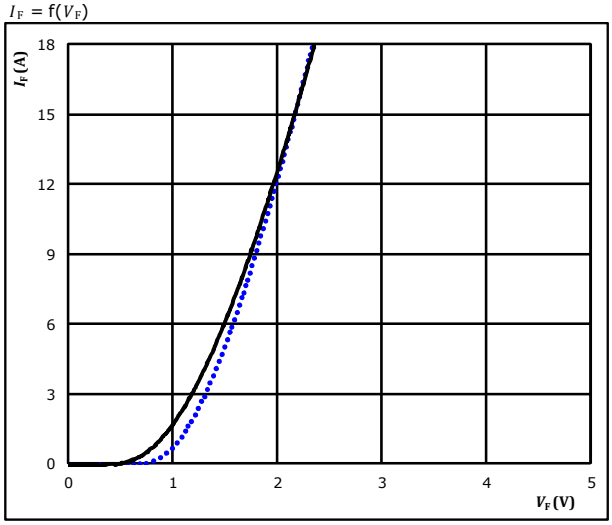
T_j ≤ 175 °C

Inverter Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



t_p = 250 µs

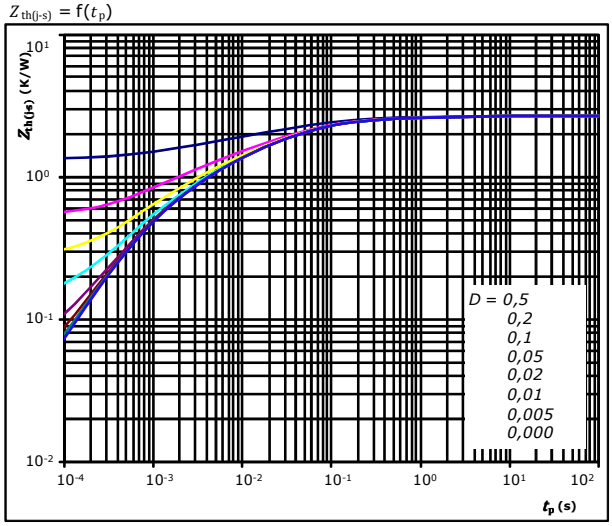
25 °C

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

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

FWD thermal model values

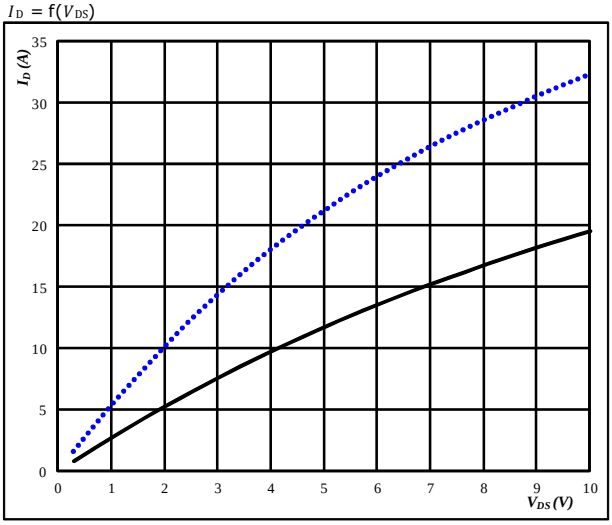
R (K/W)	τ (s)
1,1080E-01	2,7740E+00
2,7120E-01	2,2660E-01
7,9740E-01	4,9820E-02
6,3400E-01	1,2490E-02
5,3640E-01	2,8780E-03
3,3240E-01	6,5980E-04

PFC Switch Characteristics

figure 1. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

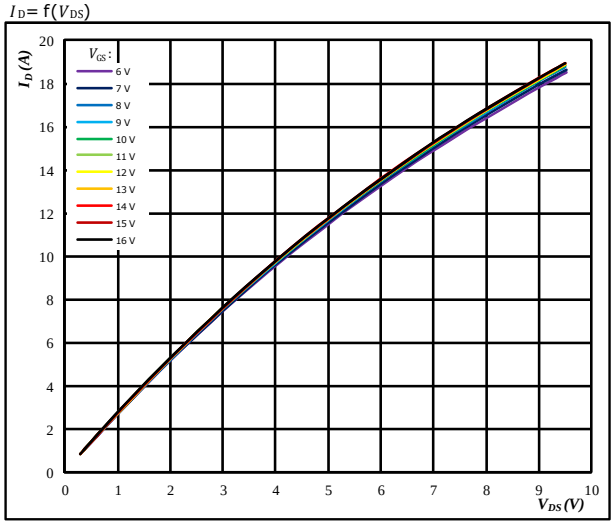


t_p =	250	µs	T_j:	25 °C	
V_{GS}=	10	V		125 °C	

figure 2. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

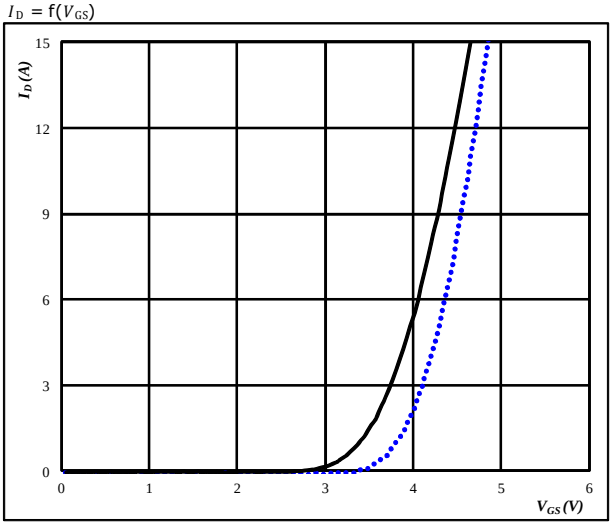


t_p =	250	µs
T_j =	125	°C
V_{GS} from	6 V to 16 V in steps of 1 V	

figure 3. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$

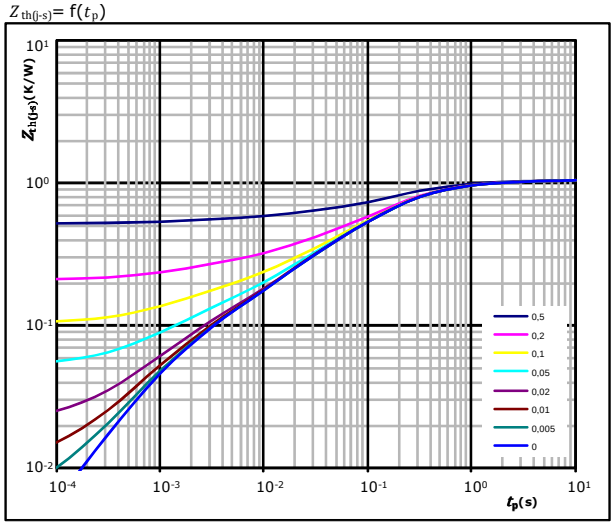


t_p =	100	µs	T_j:	25 °C	
V_{DS} =	10	V		125 °C	

figure 4. **MOSFET**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,05	K/W

MOSFET thermal model values

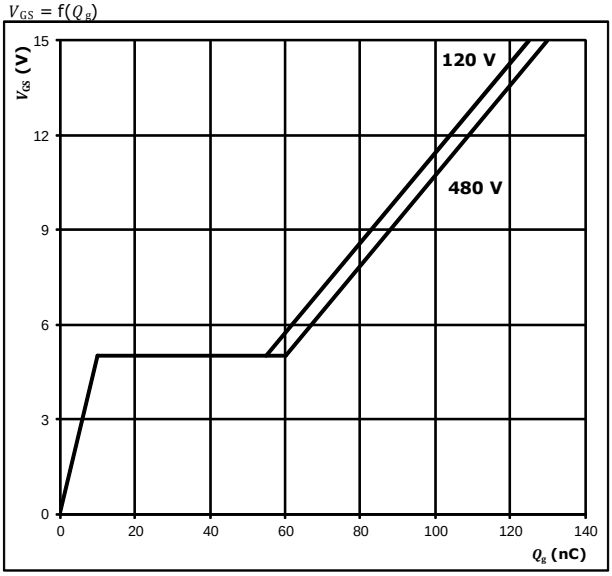
R (K/W)	τ (s)
6,56E-02	4,21E+00
3,16E-01	4,68E-01
4,75E-01	1,17E-01
1,41E-01	1,43E-02
6,15E-02	1,36E-03

PFC Switch Characteristics

figure 5. **MOSFET**

Gate voltage vs Gate charge

$V_{GS} = f(Q_g)$



At

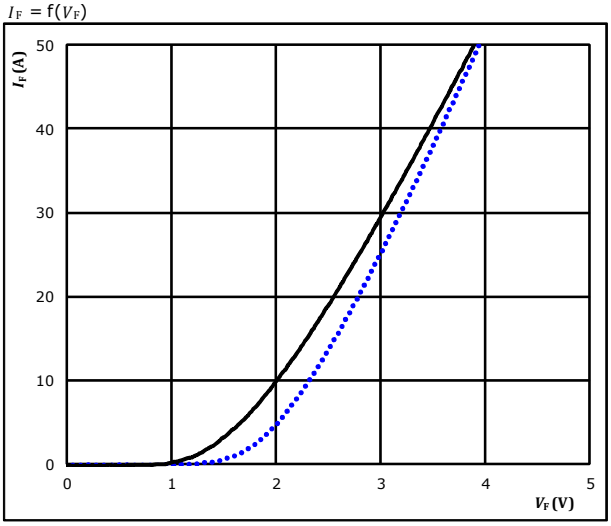
I_C= 13 A

PFC Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



t_p = 250 µs

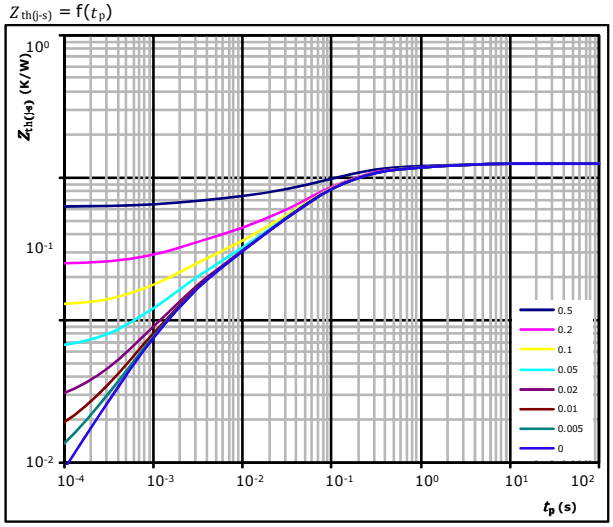
T_j: 25 °C

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

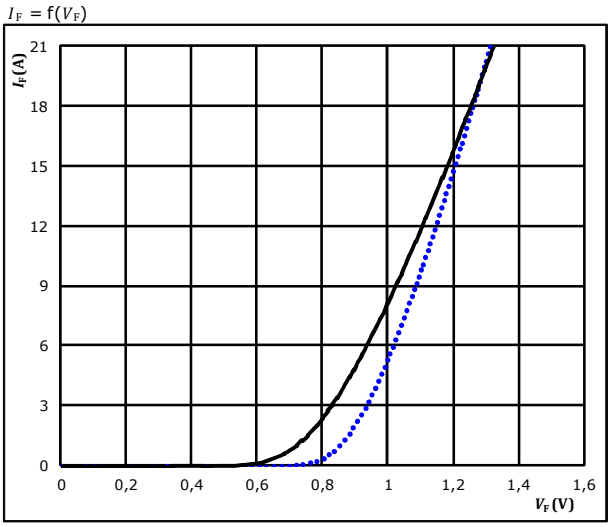
$R_{th(j-s)}$ = 1,24 K/W

FWD thermal model values

R (K/W)	τ (s)
7,31E-02	2,92E+00
1,30E-01	5,88E-01
5,59E-01	1,08E-01
2,62E-01	3,65E-02
1,13E-01	7,60E-03
1,04E-01	1,62E-03

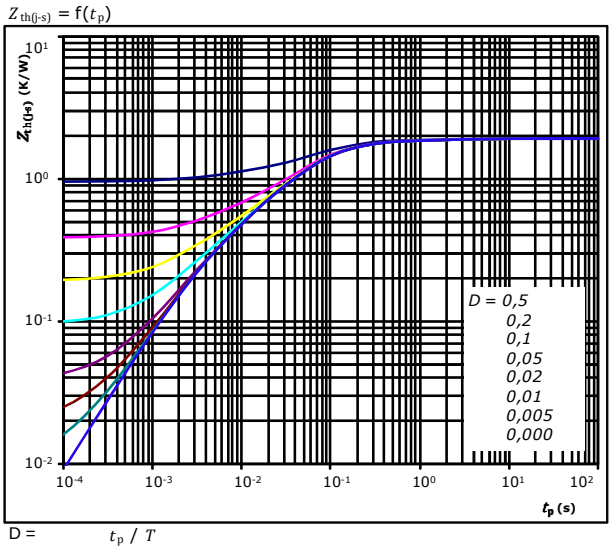
Rectifier Diode Characteristics

figure 1. **Rectifier Diode**
Typical forward characteristics



t_p = 250 µs 25 °C
T_j: 125 °C

figure 2. **Rectifier Diode**
Transient thermal impedance as a function of pulse width



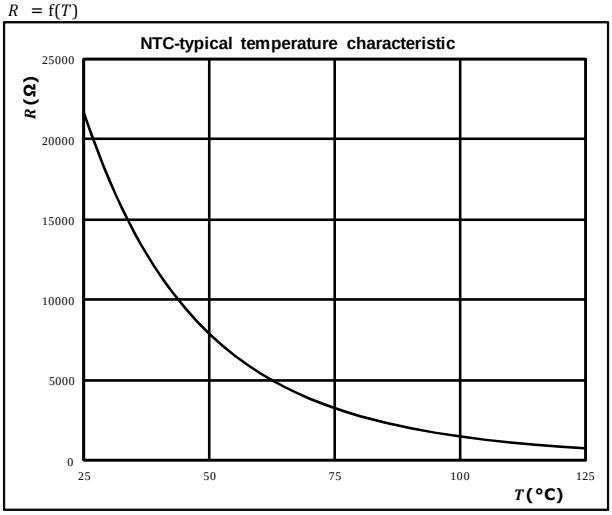
D = t_p / T
$R_{th(j-s)}$ = 1,92 K/W

Diode thermal model values

R (K/W)	τ (s)
6,27E-02	3,73E+00
1,55E-01	4,92E-01
9,43E-01	8,01E-02
5,55E-01	2,72E-02
2,07E-01	3,56E-03

Thermistor Characteristics

figure 1. **Thermistor**
Thermistor typical temperature characteristic

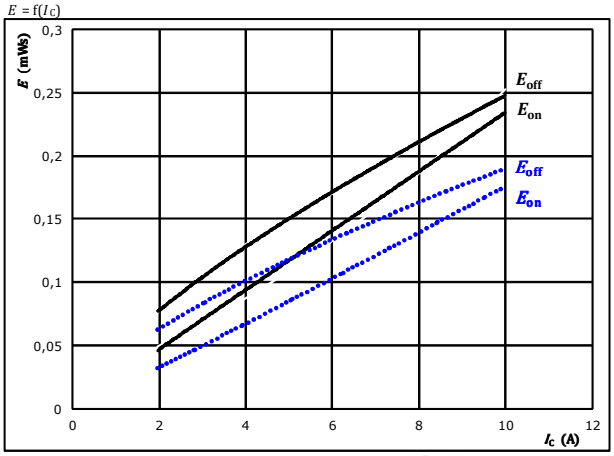


Inverter Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



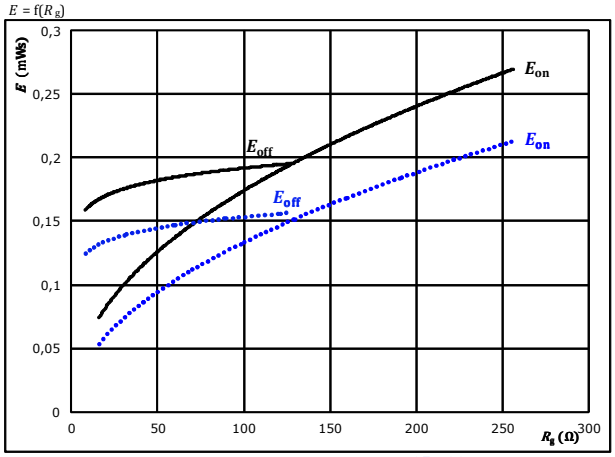
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	·····
V_{GE} =	15/0	V		125 °C	———
R_{gon} =	64	Ω			
R_{goff} =	32	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



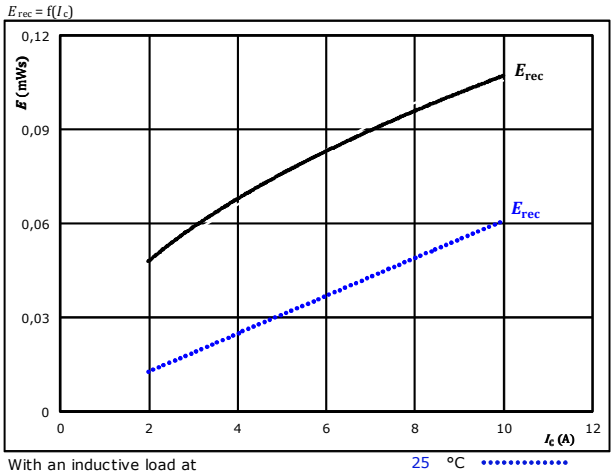
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	·····
V_{GE} =	15/0	V		125 °C	———
I_C =	6	A			

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



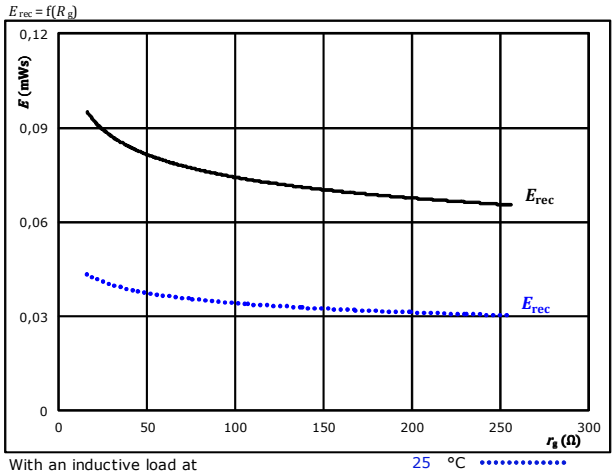
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	·····
V_{GE} =	15/0	V		125 °C	———
R_{gon} =	64	Ω			

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

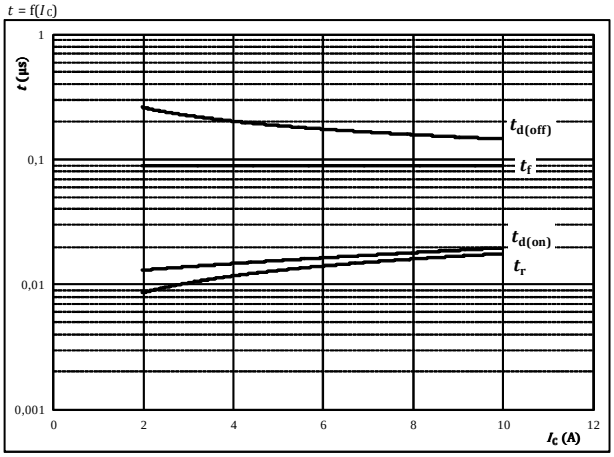
V_{CE} =	300	V	T_j:	25 °C	·····
V_{GE} =	15/0	V		125 °C	———
I_C =	6	A			

Inverter Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



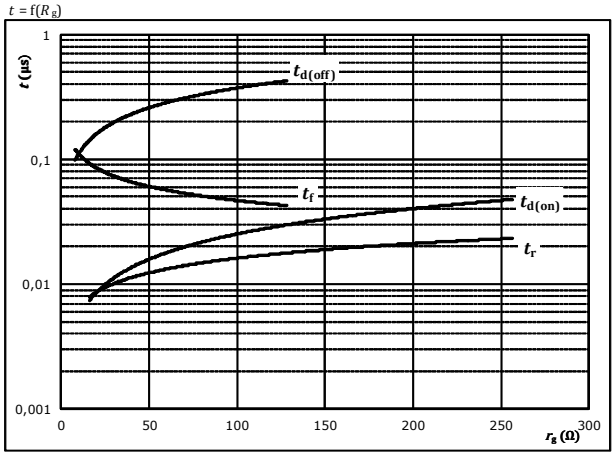
With an inductive load at

T_j =	125	°C
V_{CE} =	300	V
V_{GE} =	15/0	V
R_{gon} =	64	Ω
R_{goff} =	32	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



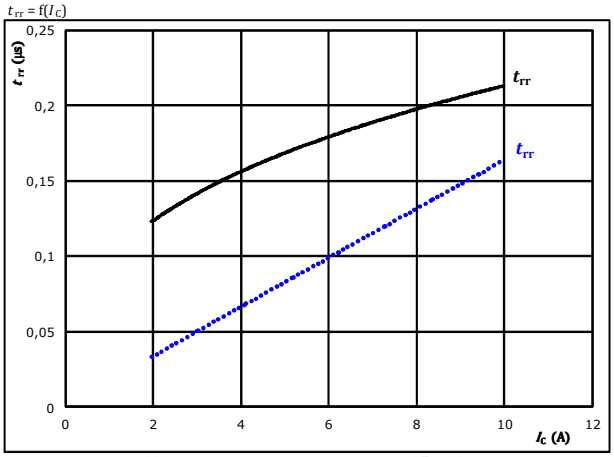
With an inductive load at

T_j =	125	°C
V_{CE} =	300	V
V_{GE} =	15/0	V
I_C =	6	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

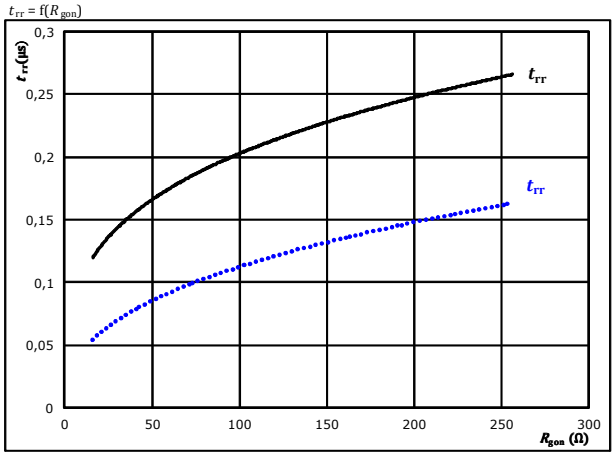


At	V_{CE} =	300	V	T_j:	25 °C
	V_{GE} =	15/0	V		125 °C
	R_{gon} =	64	Ω		

figure 8. **FWD**

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

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



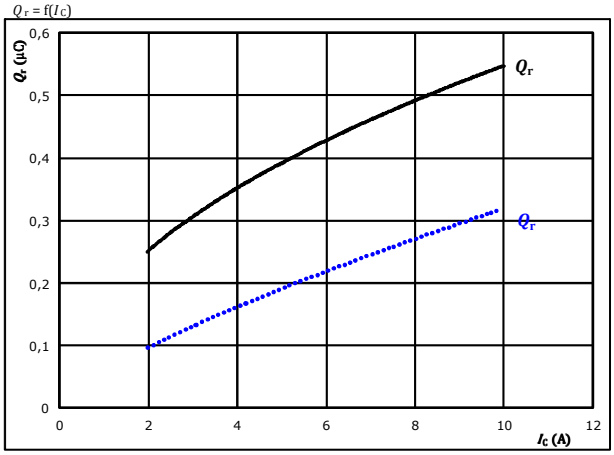
At	V_{CE} =	300	V	T_j:	25 °C
	V_{GE} =	15/0	V		125 °C
	I_C =	6	A		

Inverter Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

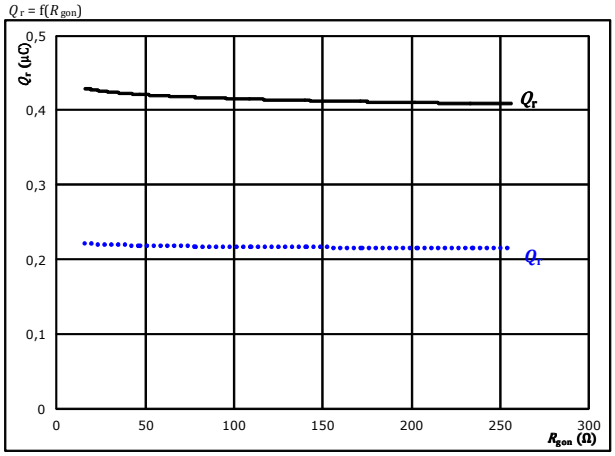


At						
	V_{CE} =	300	V		25 °C	•••••••••••••
	V_{GE} =	15/0	V	T_j:	125 °C	———
	R_{gon} =	64	Ω			

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

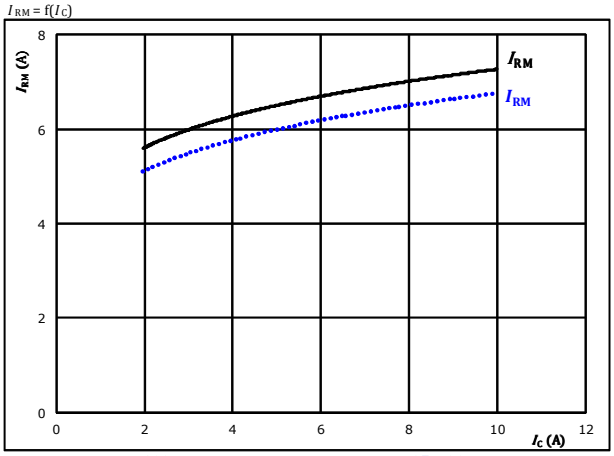


At						
	V_{CE}=	300	V		25 °C	•••••••••••••
	V_{GE} =	15/0	V	T_j:	125 °C	———
	I_C=	6	A			

figure 11. **FWD**

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

$I_{RM} = f(I_C)$

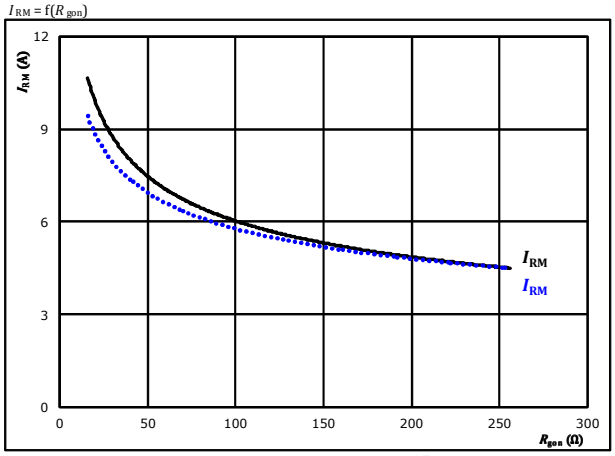


At						
	V_{CE}:	300	V		25 °C	•••••••••••••
	V_{GE} =	15/0	V	T_j:	125 °C	———
	R_{gon} =	64	Ω			

figure 12. **FWD**

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

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



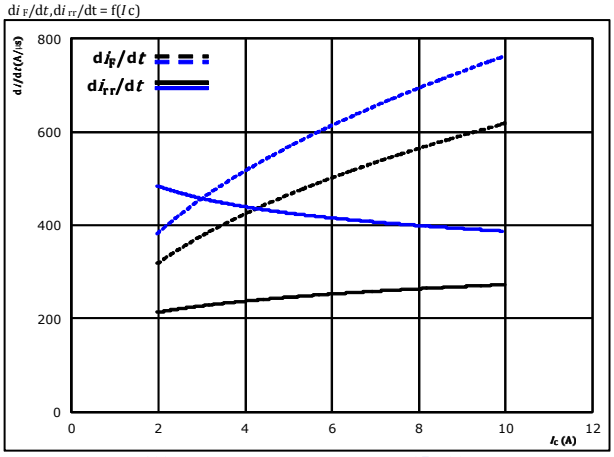
At						
	V_{CE} =	300	V		25 °C	•••••••••••••
	V_{GE} =	15/0	V	T_j:	125 °C	———
	I_C =	6	A			

Inverter Switching Characteristics

figure 13. **FWD**

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

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

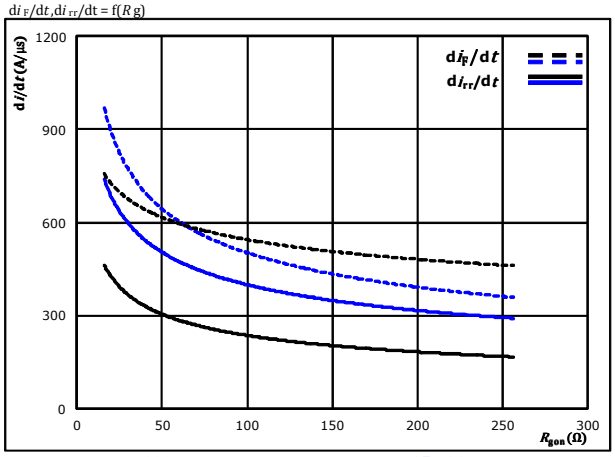


At	V_{CE} =	300	V	T_j:	25 °C	·····
	V_{GE} =	15/0	V		125 °C	———
	R_{gon} =	64	Ω			

figure 14. **FWD**

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

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

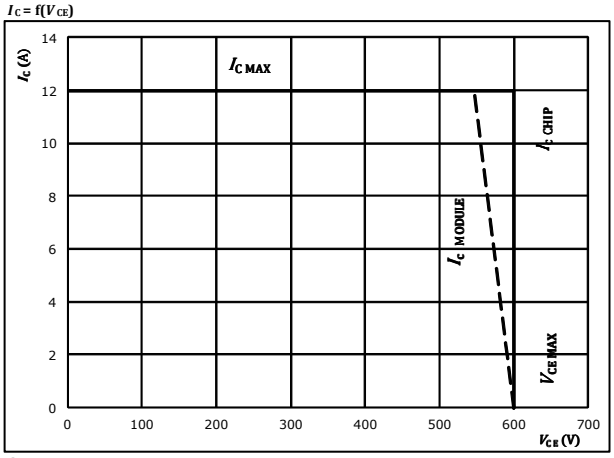


At	V_{CE} =	300	V	T_j:	25 °C	·····
	V_{GE} =	15/0	V		125 °C	———
	I_C =	6	A			

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	175	°C	
R_{gon} =	64	Ω	
R_{goff} =	32	Ω	

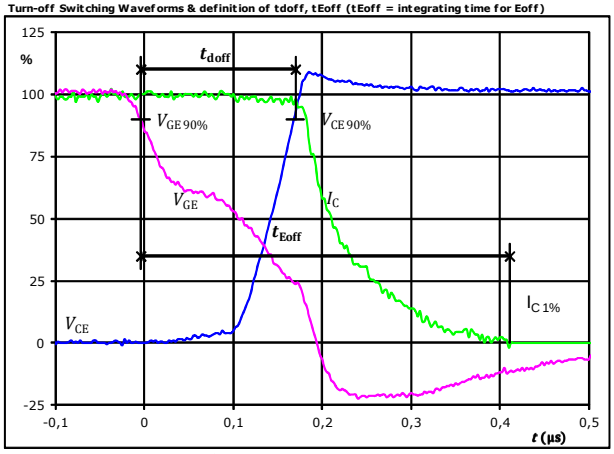
Inverter Switching Characteristics

General conditions

T_j	=	125 °C
R_{gon}	=	64 Ω
R_{goff}	=	32 Ω

figure 1. IGBT

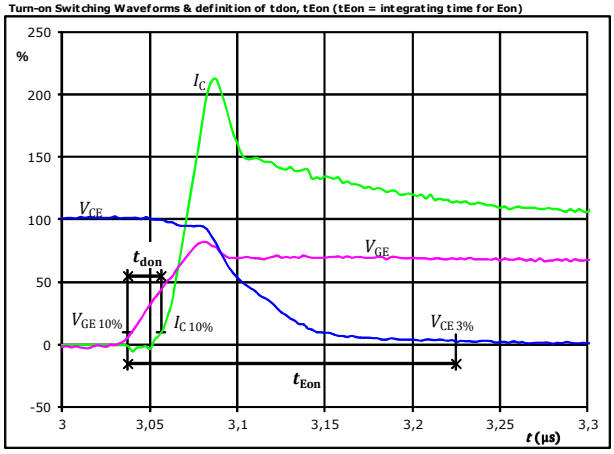
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	6	A
t_{doff} =	0,173	µs
t_{Eoff} =	0,415	µs

figure 2. IGBT

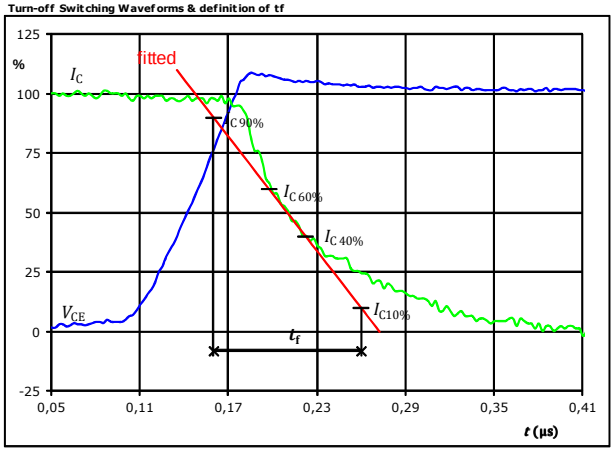
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	6	A
t_{don} =	0,017	µs
t_{Eon} =	0,188	µs

figure 3. IGBT

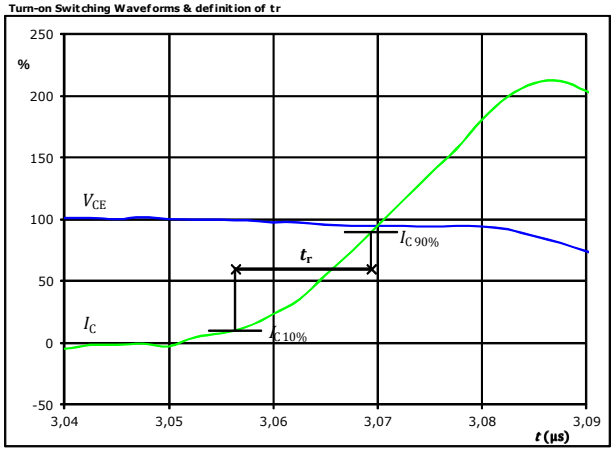
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	6	A
t_f =	0,086	µs

figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

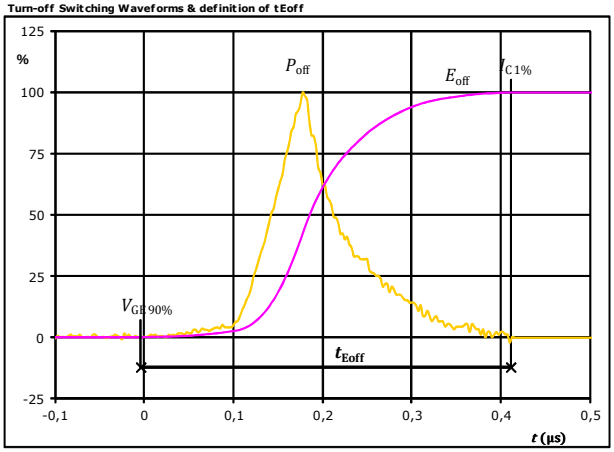


$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	6	A
t_r =	0,014	µs

Inverter Switching Characteristics

figure 5. **IGBT**

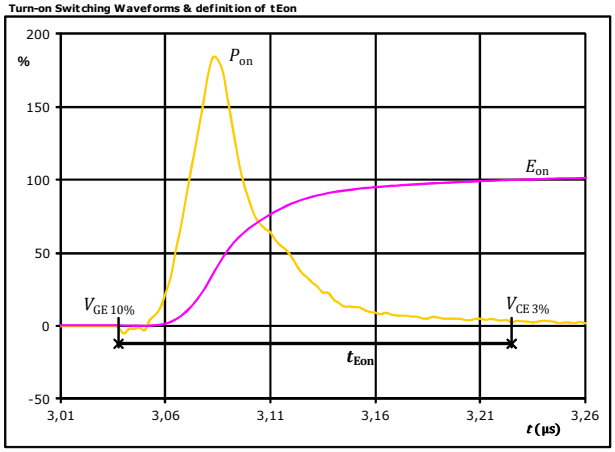
Turn-off Switching Waveforms & definition of tEoff



$P_{off}(100\%)$ =	1,78	kW
$E_{off}(100\%)$ =	0,17	mJ
t_{Eoff} =	0,41	µs

figure 6. **IGBT**

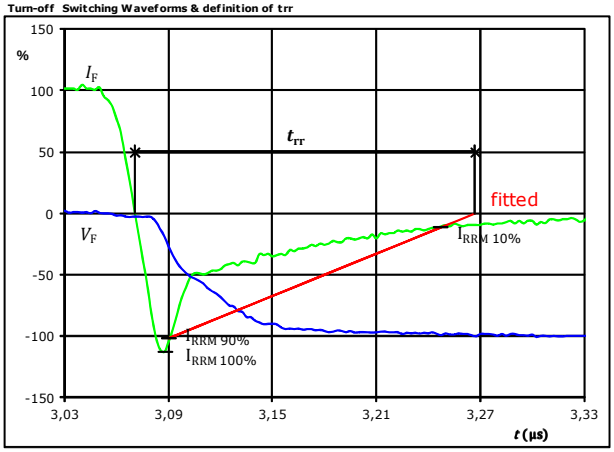
Turn-on Switching Waveforms & definition of tEon



$P_{on}(100\%)$ =	1,78	kW
$E_{on}(100\%)$ =	0,13	mJ
t_{Eon} =	0,19	µs

figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

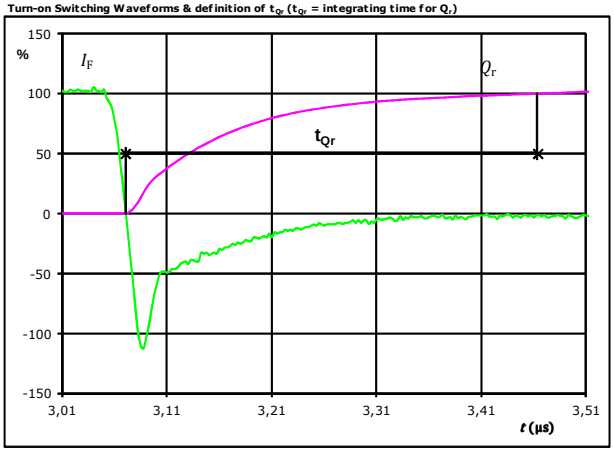


$V_F(100\%)$ =	300	V
$I_F(100\%)$ =	6	A
$I_{RRM}(100\%)$ =	7	A
t_{rr} =	0,175	µs

Inverter Switching Characteristics

figure 8. **FWD**

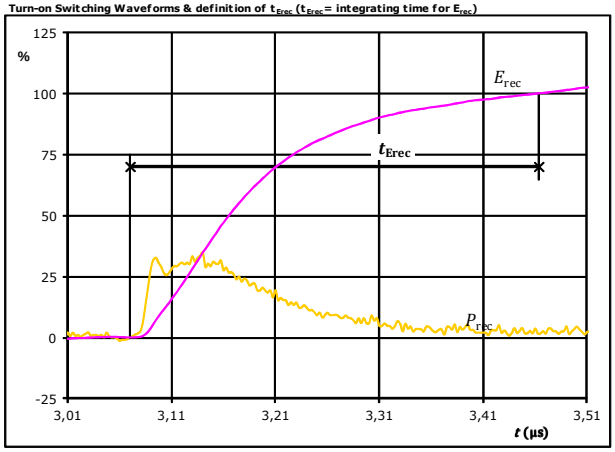
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	6	A
Q_r (100%) =	0,42	µC
t_{Qr} =	0,39	µs

figure 9. **FWD**

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



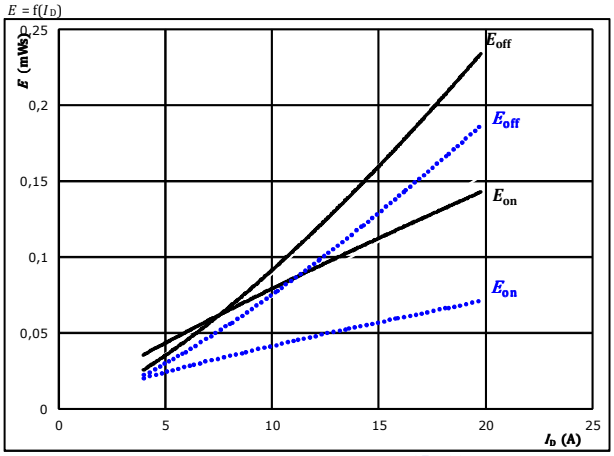
P_{rec} (100%) =	1,78	kW
E_{rec} (100%) =	0,08	mJ
t_{Erec} =	0,39	µs

PFC Switching Characteristics

figure 1. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



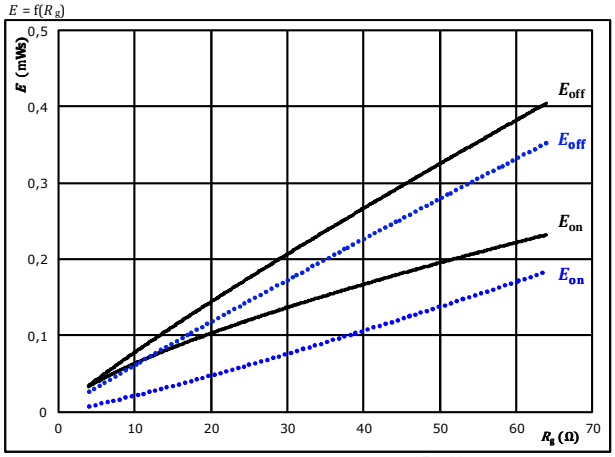
With an inductive load at

V_{DS} =	350	V	T_J:	25 °C	
V_{GS} =	15/0	V		125 °C	
R_{gon} =	16	Ω			
R_{goff} =	16	Ω			

figure 2. **MOSFET**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



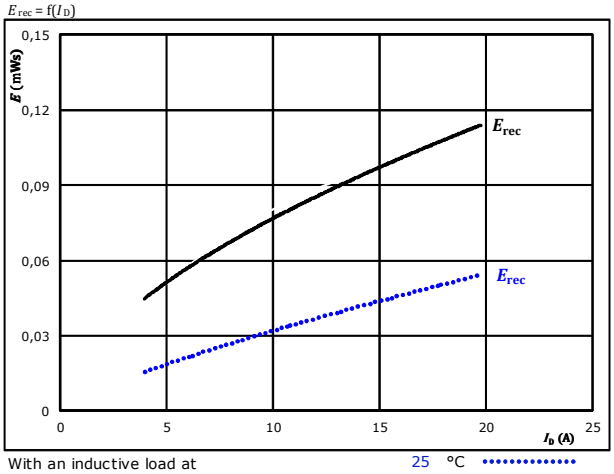
With an inductive load at

V_{DS} =	350	V	T_J:	25 °C	
V_{GS} =	15/0	V		125 °C	
I_D =	12	A			

figure 3. **FWD**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



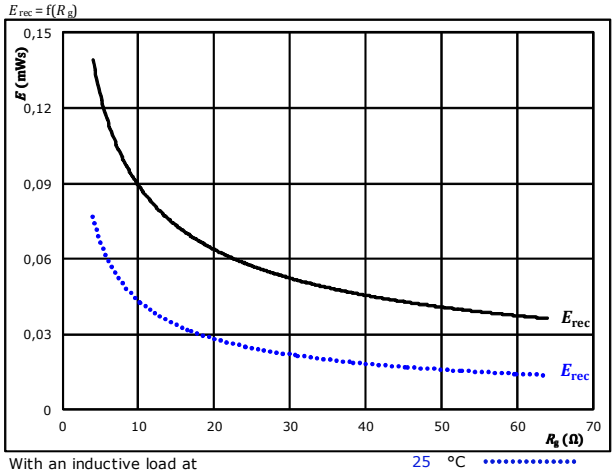
With an inductive load at

V_{DS} =	350	V	T_J:	25 °C	
V_{GS} =	15/0	V		125 °C	
R_{gon} =	16	Ω			

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

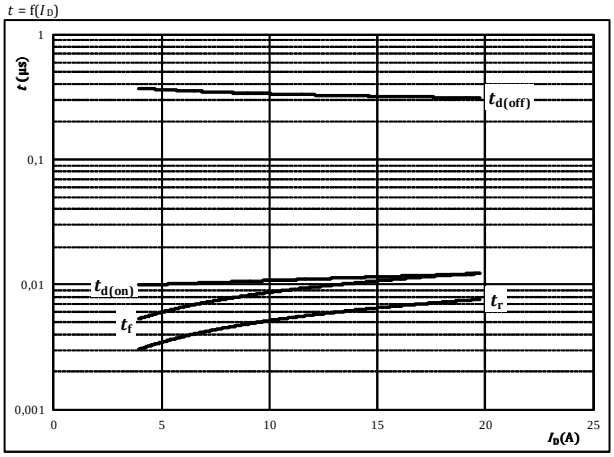
V_{DS} =	350	V	T_J:	25 °C	
V_{GS} =	15/0	V		125 °C	
I_D =	12	A			

PFC Switching Characteristics

figure 5. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



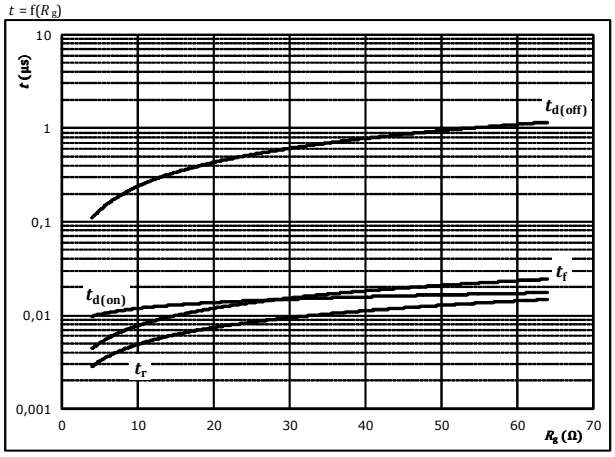
With an inductive load at

T_j =	125	°C
V_{DS} =	350	V
V_{GS} =	15/0	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 6. **MOSFET**

Typical switching times as a function of gate resistor

$t = f(R_g)$



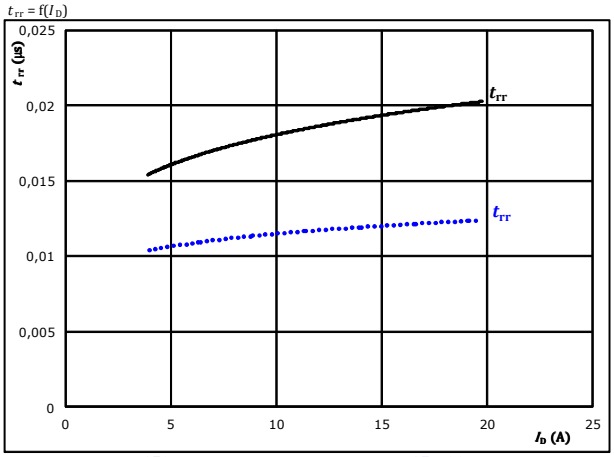
With an inductive load at

T_j =	125	°C
V_{DS} =	350	V
V_{GS} =	15/0	V
I_D =	12	A

figure 7. **FWD**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$

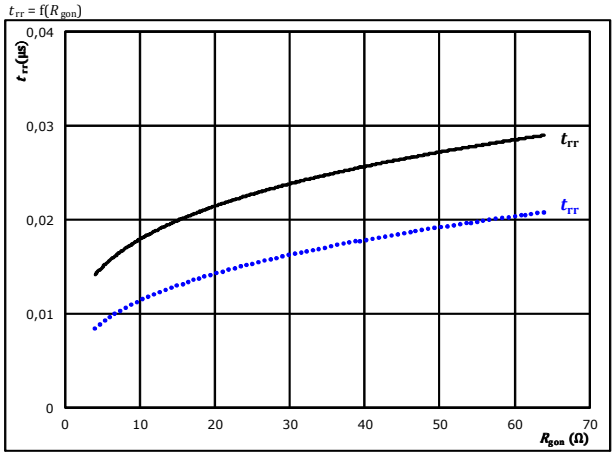


At	V_{DS} =	350	V	T_j:	25 °C
	V_{GS} =	15/0	V		125 °C
	R_{gon} =	16	Ω		

figure 8. **FWD**

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

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



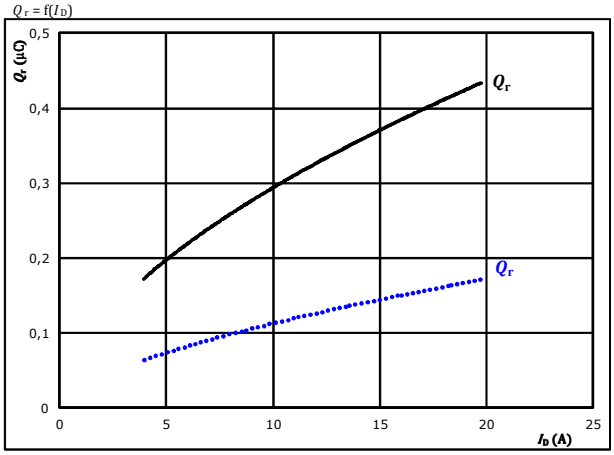
At	V_{DS} =	350	V	T_j:	25 °C
	V_{GS} =	15/0	V		125 °C
	I_D =	12	A		

PFC Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

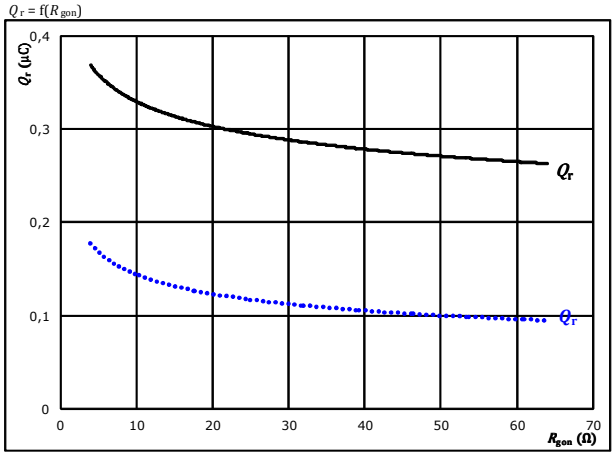


At	V_{DS} =	350	V		25 °C	•••••••••••••••
	V_{GS} =	15/0	V	T_j:	125 °C	———
	R_{gon} =	16	Ω			

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

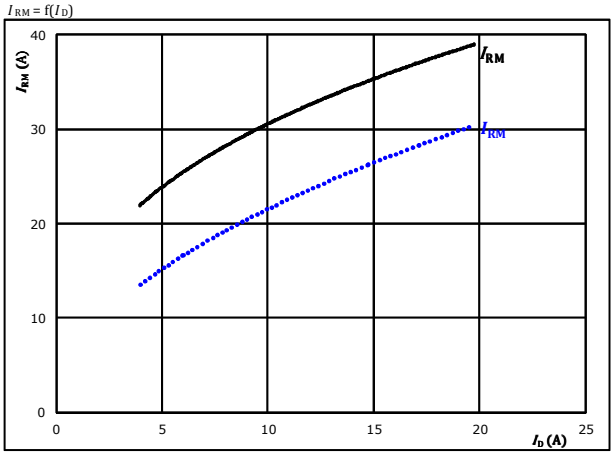


At	V_{DS} =	350	V		25 °C	•••••••••••••••
	V_{GS} =	15/0	V	T_j:	125 °C	———
	I_D =	12	A			

figure 11. **FWD**

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

$I_{RM} = f(I_D)$

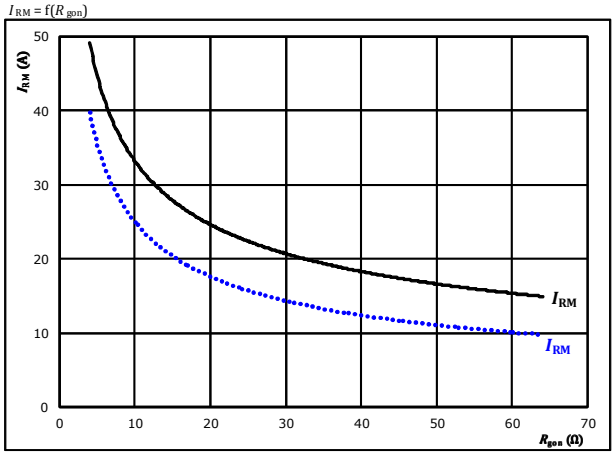


At	V_{DS} =	350	V		25 °C	•••••••••••••••
	V_{GS} =	15/0	V	T_j:	125 °C	———
	R_{gon} =	16	Ω			

figure 12. **FWD**

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

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



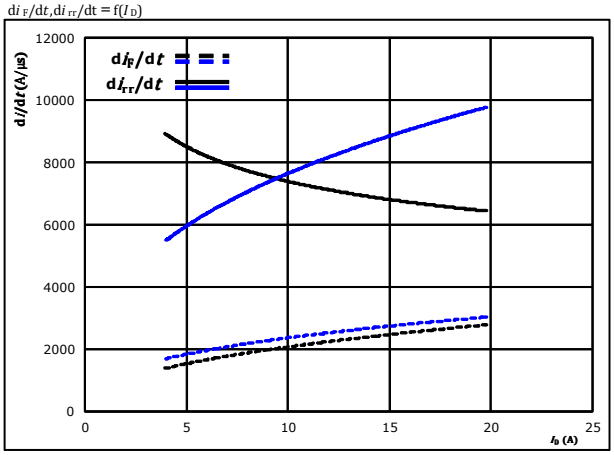
At	V_{DS} =	350	V		25 °C	•••••••••••••••
	V_{GS} =	15/0	V	T_j:	125 °C	———
	I_D =	12	A			

PFC Switching Characteristics

figure 13. **FWD**

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

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

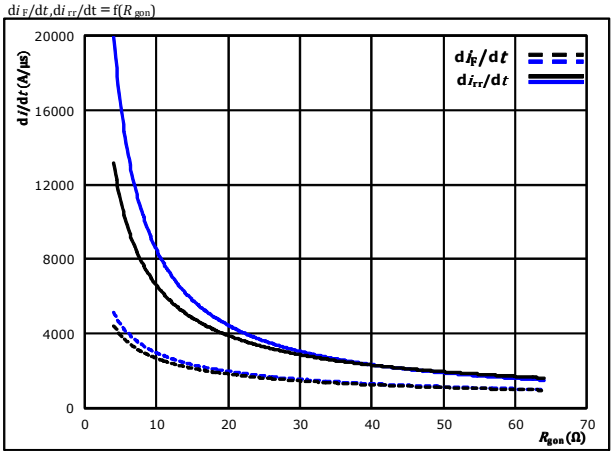


At	V_{DS} =	350	V	25 °C	
	V_{GS} =	15/0	V	T_j: 125 °C	
	R_{gon} =	16	Ω		

figure 14. **FWD**

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

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

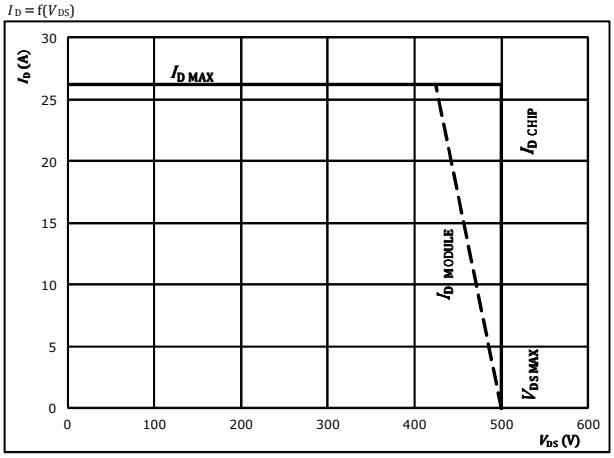


At	V_{DS} =	350	V	25 °C	
	V_{GS} =	15/0	V	T_j: 125 °C	
	I_D =	12	A		

figure 15. **MOSFET**

Reverse bias safe operating area

$I_D = f(V_{DS})$



At

T_j =	175	°C	
R_{gon} =	16	Ω	
R_{goff} =	16	Ω	

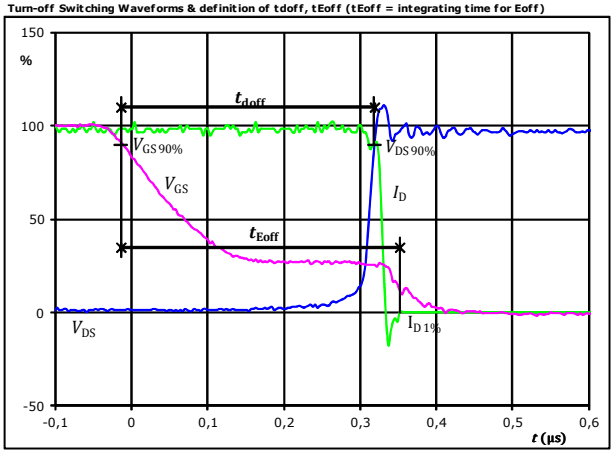
PFC Switching Characteristics

General conditions

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

figure 1. **MOSFET**

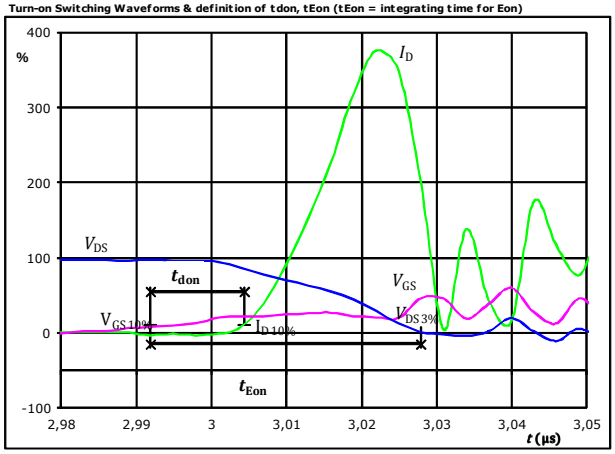
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GS}(0\%)$ =	0	V
$V_{GS}(100\%)$ =	15	V
$V_{DS}(100\%)$ =	400	V
$I_D(100\%)$ =	12	A
t_{doff} =	0,331	µs
t_{Eoff} =	0,366	µs

figure 2. **MOSFET**

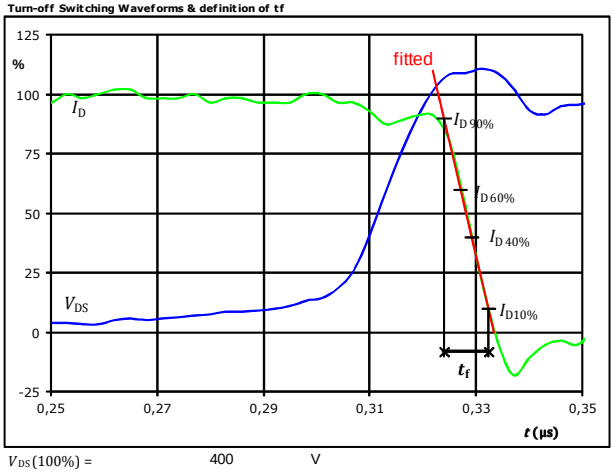
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GS}(0\%)$ =	0	V
$V_{GS}(100\%)$ =	15	V
$V_{DS}(100\%)$ =	400	V
$I_D(100\%)$ =	12	A
t_{don} =	0,012	µs
t_{Eon} =	0,036	µs

figure 3. **MOSFET**

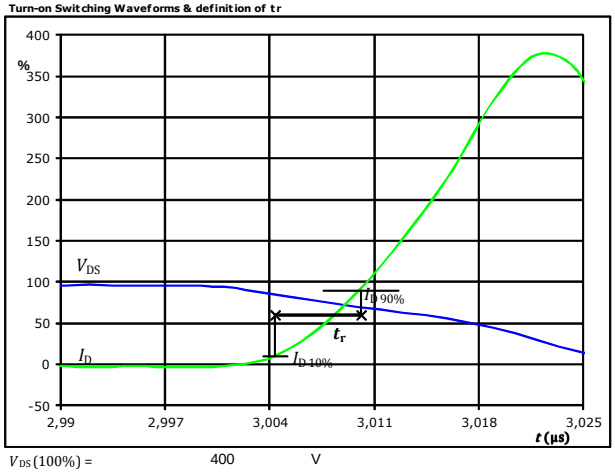
Turn-off Switching Waveforms & definition of tf



$V_{DS}(100\%)$ =	400	V
$I_D(100\%)$ =	12	A
t_f =	0,010	µs

figure 4. **MOSFET**

Turn-on Switching Waveforms & definition of tr

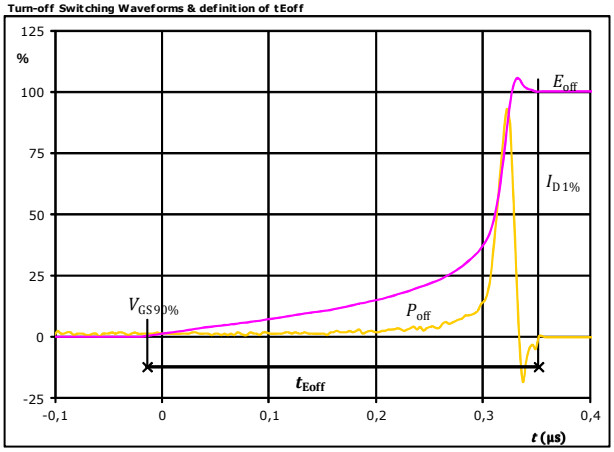


$V_{DS}(100\%)$ =	400	V
$I_D(100\%)$ =	12	A
t_r =	0,006	µs

PFC Switching Characteristics

figure 5. **MOSFET**

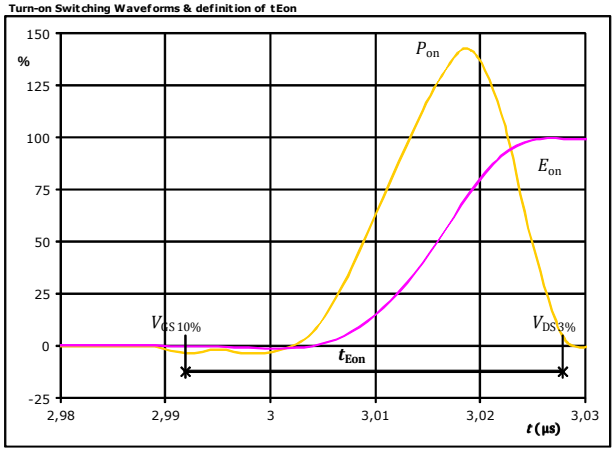
Turn-off Switching Waveforms & definition of tEoff



$P_{off}(100\%) =$	4,75	kW
$E_{off}(100\%) =$	0,11	mJ
$t_{Eoff} =$	0,37	µs

figure 6. **MOSFET**

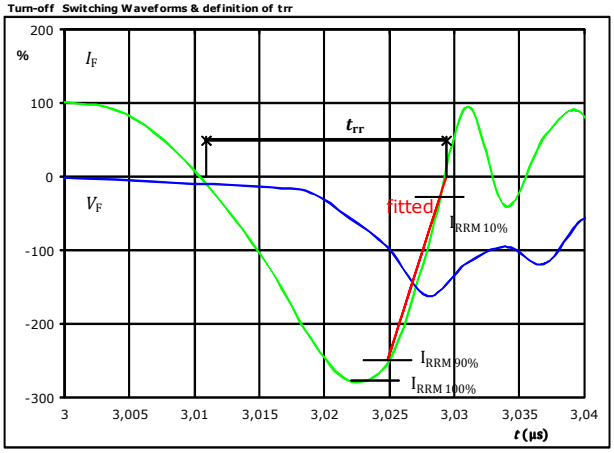
Turn-on Switching Waveforms & definition of tEon



$P_{on}(100\%) =$	4,75	kW
$E_{on}(100\%) =$	0,09	mJ
$t_{Eon} =$	0,04	µs

figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

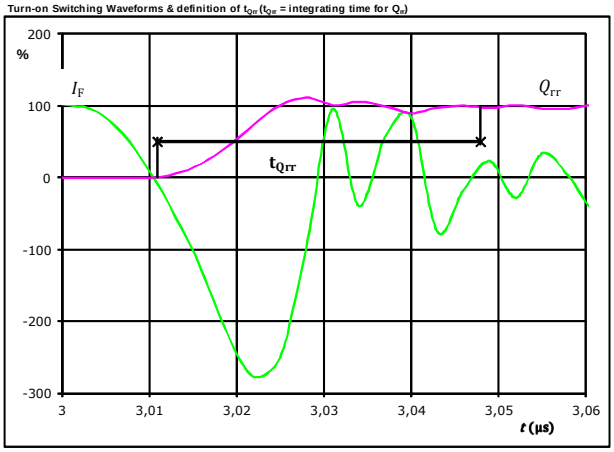


$V_F(100\%) =$	400	V
$I_F(100\%) =$	12	A
$I_{RRM}(100\%) =$	33	A
$t_{rr} =$	0,018	µs

PFC Switching Characteristics

figure 8. **FWD**

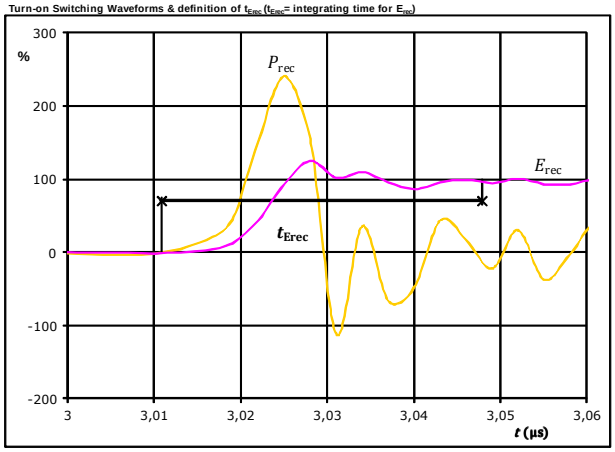
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_F (100%) =	12	A
Q_{rr} (100%) =	0,33	µC
t_{Qrr} =	0,04	µs

figure 9. **FWD**

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



P_{rec} (100%) =	4,75	kW
E_{rec} (100%) =	0,09	mJ
t_{Erec} =	0,04	µs

Vincotech

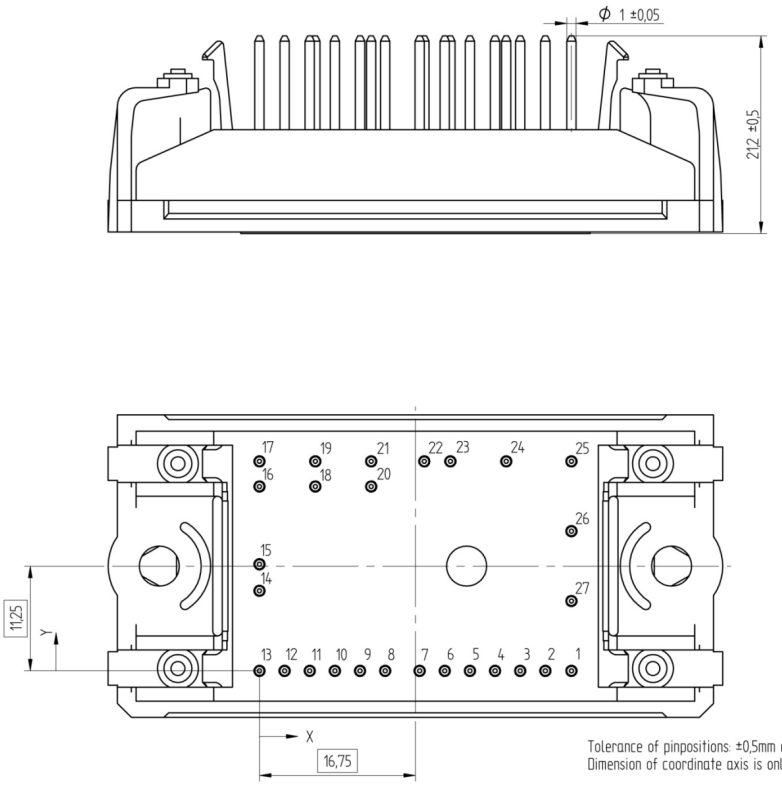
Ordering Code & Marking

Version	Ordering Code
without thermal paste 17mm housing	10-F006PPA006SB02-L832B10
with thermal paste 17mm housing	10-F006PPA006SB02-L832B10-/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		

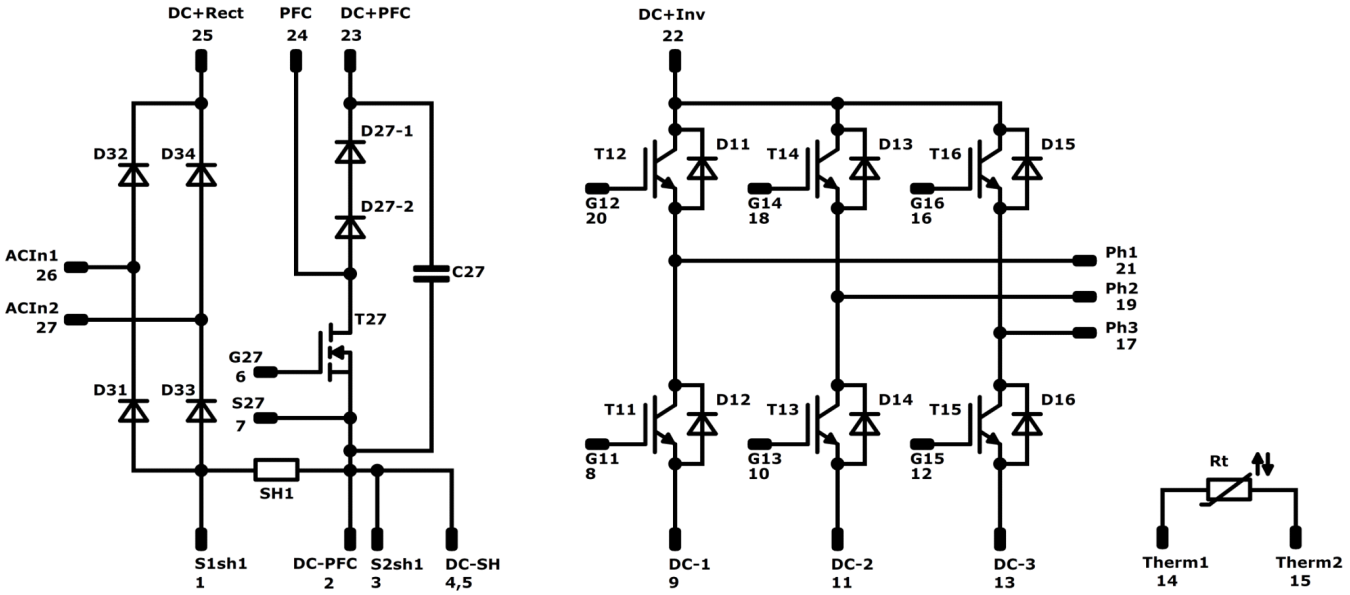
Outline

Pin table [mm]			
Pin	X	Y	Function
1	33,5	0	S1sh1
2	30,7	0	DC-PFC
3	28	0	S2sh1
4	25,3	0	DC-SH
5	22,6	0	DC-SH
6	19,9	0	G27
7	17,2	0	S27
8	13,5	0	G11
9	10,8	0	DC-1
10	8,1	0	G13
11	5,4	0	DC-2
12	2,7	0	G15
13	0	0	DC-3
14	0	8,6	Therm1
15	0	11,45	Therm2
16	0	19,8	G16
17	0	22,5	Ph3
18	6	19,8	G14
19	6	22,5	Ph2
20	12	19,8	G12
21	12	22,5	Ph1
22	17,7	22,5	DC+Inv
23	20,5	22,5	DC+PFC
24	26,5	22,5	PFC
25	33,5	22,5	DC+Rect
26	33,5	15	ACIn1
27	33,5	7,5	ACIn2



Vincotech

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11-T16	IGBT	600 V	6 A	Inverter Switch	
D11-D16	FWD	600 V	6 A	Inverter Diode	
T27	MOSFET	500 V	160 mΩ	PFC Switch	
D27	FWD	600 V	15 A	PFC Diode	
C27	Capacitor	500 V		PFC Capacitor	
SH1	Shunt		15 A	PFC Shunt	
D31-D34	FWD	1600 V	7 A	Rectifier Diode	
Rt	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.

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-F006PPA006SB02-L832B10-D1-14	11 Aug. 2016		