10-F006PPA010SB02-L833B10
datasheet

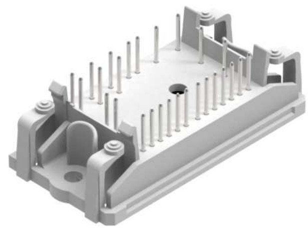
Vincotech

***flow* PIM 0** — **600 V / 10 A**

Features

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

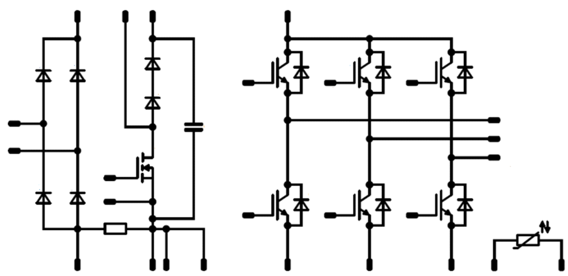
flow 0 17mm housing



Target applications

- Industrial Drives
- Embedded Drives

Schematic



Types

- 10-F006PPA010SB02-L833B10

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	16	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	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	14	A
Repetitive peak forward current	I_{FRM}			20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	33	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}		96	A
Avalanche energy, single pulse	E_{AS}	I_D = 10 A V_{DD} = 50 V		1100	mJ
Avalanche energy, repetitive	E_{AR}	I_D = 20 A V_{DD} = 50 V		1	mJ
Avalanche current, repetitive	I_{AR}	t_p limited by T_{jmax} $P_{AV} = E_{AR}$*f		20	A
MOSFET dv/dt ruggedness	dv/dt	V_{DS} = 400 V		50	V/ns
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	33	W
Gate-source voltage	V_{GSS}			±20	V
Reverse diode dv/dt	dv/dt			15	V/ns
Maximum Junction Temperature	T_{jmax}			150	°C
PFC Diode					
Peak repetitive reverse voltage	V_{RRM}			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_p = 8,3 ms	T_j = 45 °C	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	26	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	33	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms	T_j = 150 °C	230	A
Surge current capability	I^2t			260	A^2s
Total power dissipation	P_{tot}	T_j = T_{jmax}	T_s = 80 °C	42	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	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	Unit
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		62		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,48		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 16 Ω R_{gon} = 32 Ω	15/0	300	10	25 125		15 14		ns
Rise time	t_r					25 125		11 14		
Turn-off delay time	$t_{d(off)}$					25 125		155 170		
Fall time	t_f					25 125		89 98		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,5 µC Q_{rFWD} = 0,8 µC				25 125		0,163 0,218		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,242 0,291		

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	25 150		1,60 1,56	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						2,87		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 866 A/µs di/dt = 907 A/µs	15/0	300	10	25 125		10 11		A
Reverse recovery time	t_{rr}					25 125		142 219		ns
Recovered charge	Q_r					25 125		0,461 0,800		µC
Reverse recovered energy	E_{rec}					25 125		0,091 0,167		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		703 397		A/µs

Characteristic Values

Parameter	Symbol	Conditions	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	Unit
PFC Switch										
Static										
Drain-source on-state resistance	$r_{DS(on)}$		10		20	25 125		102 198	110	mΩ
Gate-source threshold voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}$			0,0018	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			25	µA
Internal gate resistance	r_g							0,8		Ω
Gate charge	Q_g		0/10	380	32	25		170		nC
Gate to source charge	Q_{GS}							15		
Gate to drain charge	Q_{GD}							90		
Short-circuit input capacitance	C_{iss}	f = 1 MHz	0	25		25		4200		pF
Short-circuit output capacitance	C_{oss}							1700		
Reverse transfer capacitance	C_{rss}							90		
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,15		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 8 Ω R_{gon} = 8 Ω	15/0	400	20	25 125		17 16		ns
Rise time	t_r					25 125		7 7		
Turn-off delay time	$t_{d(off)}$					25 125		320 343		
Fall time	t_f					25 125		10 12		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,2 µC Q_{rFWD} = 0,5 µC				25 125		0,062 0,109		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,211 0,250		

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 = 3673 A/µs di/dt = 3453 A/µs	15/0	400	20	25 125		34 47		A
Reverse recovery time	t_{rr}					25 125		13 20		ns
Recovered charge	Q_r					25 125		0,197 0,490		µC
Reverse recovered energy	E_{rec}					25 125		0,066 0,144		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		11291 8075		A/µs
PFC Capacitor										
Capacitance	C							100		nF
Tolerance							-10		+10	%
PFC Shunt										
Static										
Resistance	R							10		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

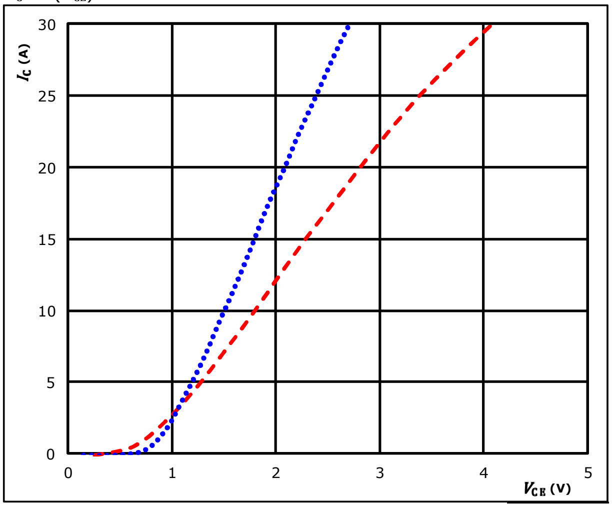
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Rectifier Diode										
Static										
Forward voltage	V_F				30	25 125		1,25 1,24	1,29	V
Reverse leakage current	I_r			1600		25 125			10 1000	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,65		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

$I_C = f(V_{CE})$

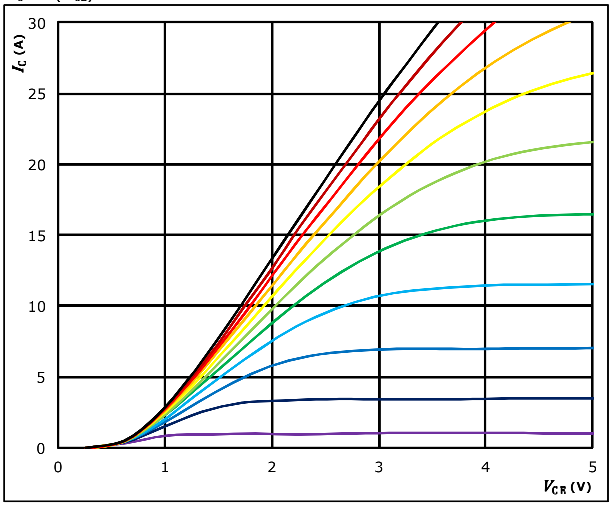


t_p =	250	μs		25	°C	···········
V_{GE} =	15	V	T_j:	150	°C	– – –

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

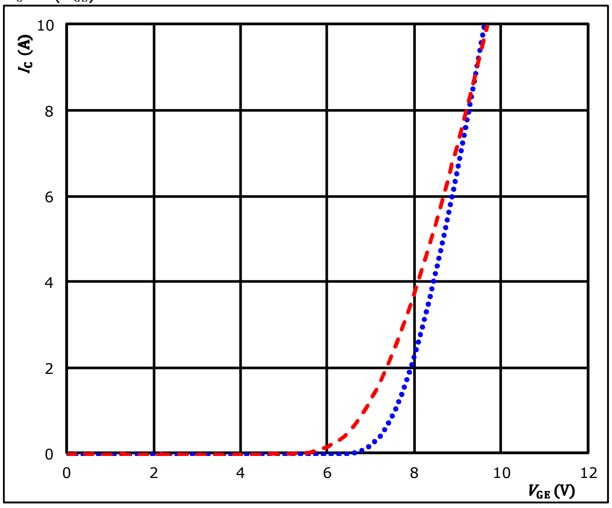


t_p =	250	μs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

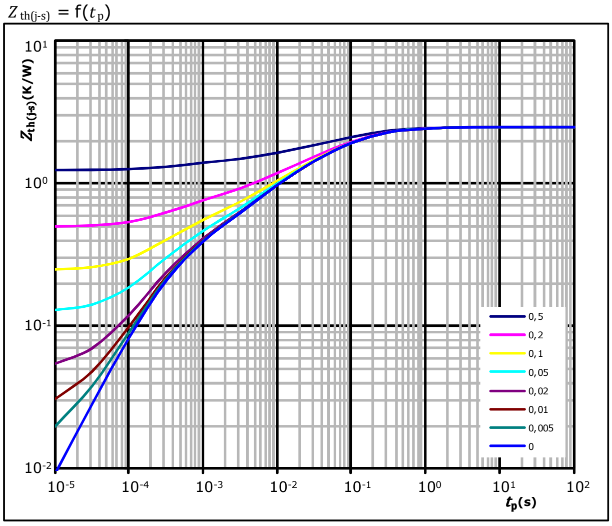


t_p =	100	μs		25	°C	···········
V_{CE} =	10	V	T_j:	150	°C	– – –

figure 4. **IGBT**

Transient Thermal Impedance as function of Pulse duration

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 2,48 K/W

IGBT thermal model values

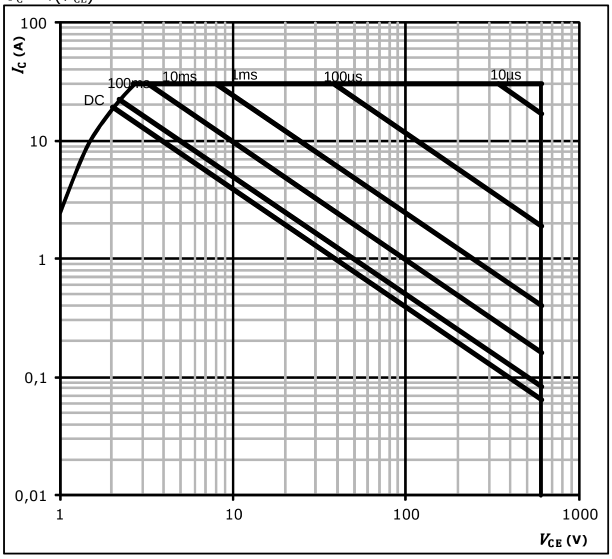
R (K/W)	τ (s)
3,20E-02	6,52E+00
2,64E-01	4,98E-01
9,63E-01	8,83E-02
6,33E-01	1,64E-02
3,25E-01	2,98E-03
2,66E-01	3,39E-04

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



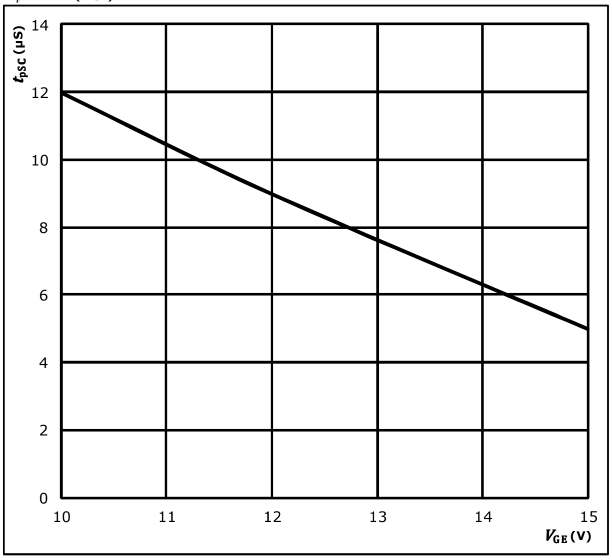
At

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

figure 6. **IGBT**

Short circuit duration as a function of VGE

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



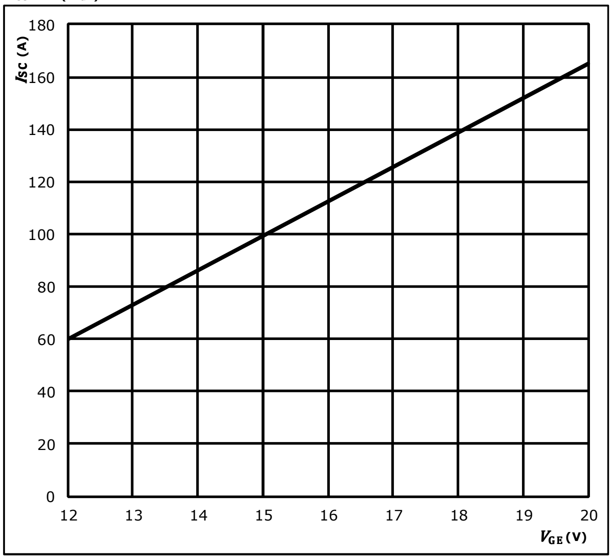
At

V_{CE} =	600	V
T_j ≤	175	ºC

figure 7. **IGBT**

Typical short circuit current as a function of VGE

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



At

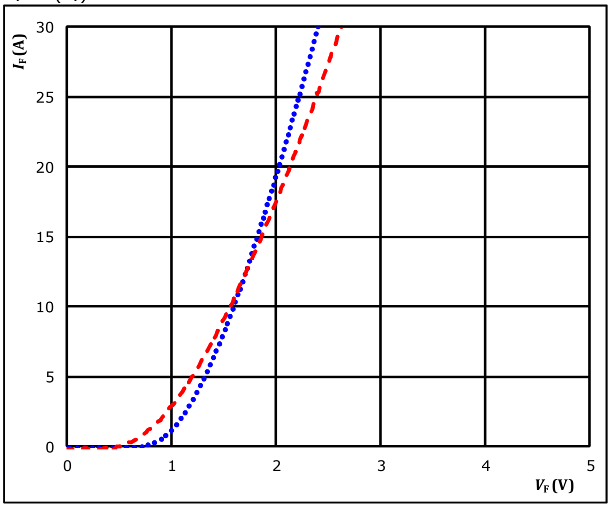
V_{CE} ≤	600	V
T_j ≤	175	ºC

Inverter Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



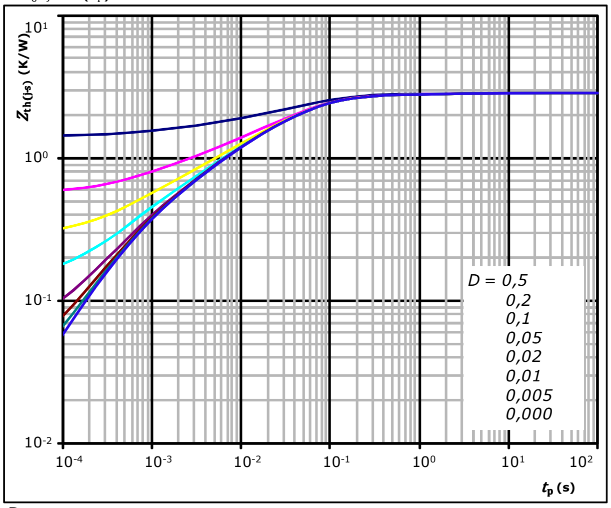
t_p = 250 µs

T_j: 25 °C; 150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 2,87 K/W

FWD thermal model values

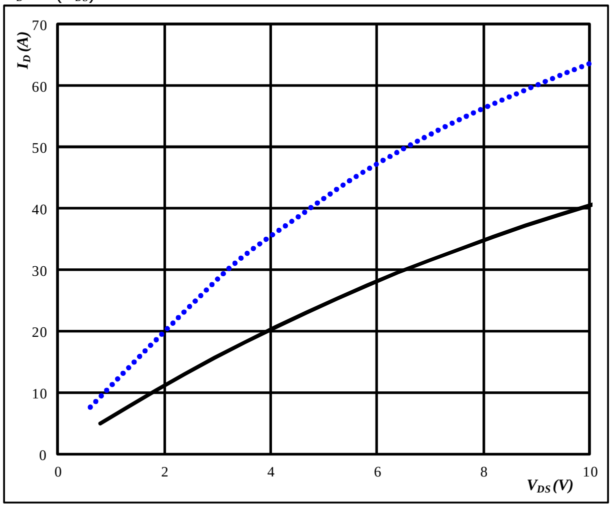
R (K/W)	τ (s)
6,53E-02	3,94E+00
1,48E-01	4,48E-01
1,31E+00	5,96E-02
7,32E-01	1,36E-02
4,04E-01	2,79E-03
2,11E-01	5,37E-04

PFC Switch Characteristics

figure 1. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

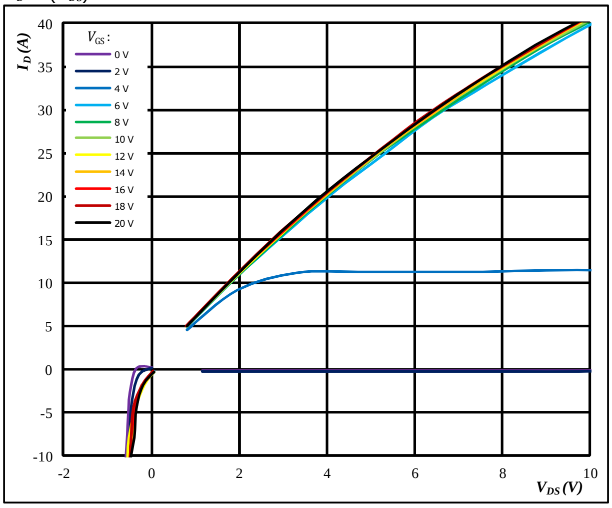


t_p =	250	μs	T_j:	25 °C	dotted blue
V_{GS}=	10	V		125 °C	solid black

figure 2. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$



t_p = 250 μs

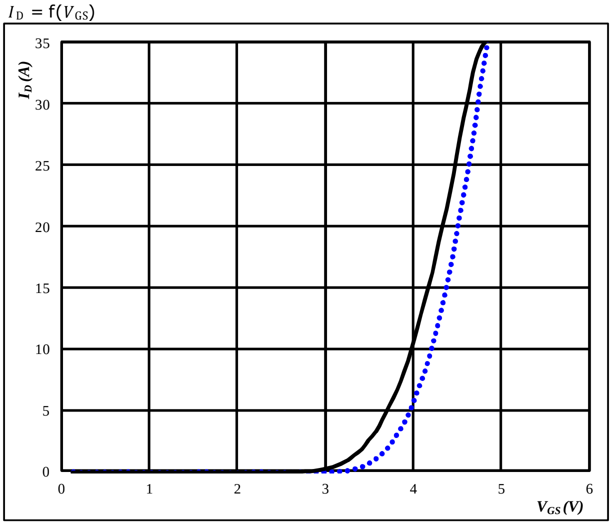
T_j = 125 °C

V_{GS} from 0 V to 20 V in steps of 2 V

figure 3. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$

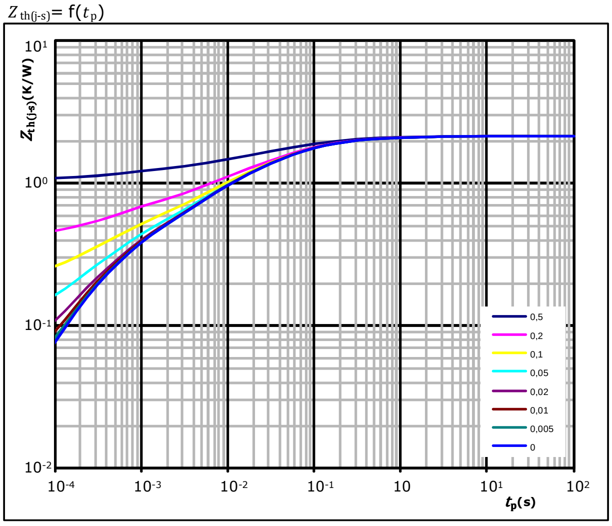


t_p =	100	μs	T_j:	25 °C	dotted blue
V_{DS} =	10	V		125 °C	solid black

figure 4. **MOSFET**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

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

MOSFET thermal model values

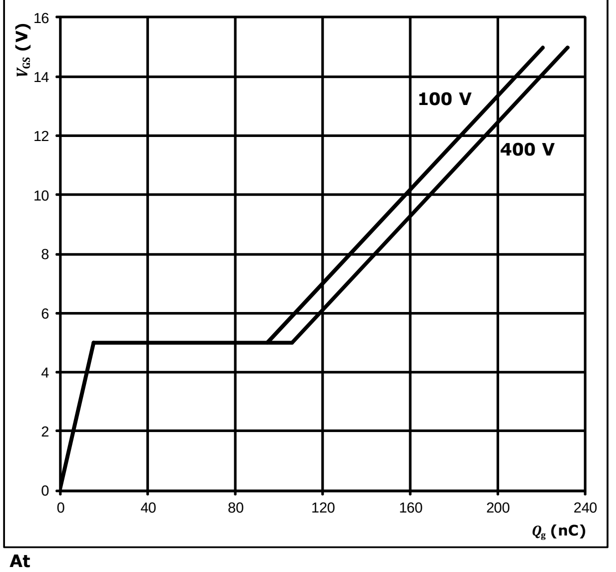
R (K/W)	τ (s)
1,04E-01	1,37E+00
2,88E-01	2,01E-01
6,99E-01	5,27E-02
4,91E-01	1,22E-02
3,07E-01	2,97E-03
2,60E-01	3,80E-04

PFC Switch Characteristics

figure 5. **MOSFET**

Gate voltage vs Gate charge

$V_{GS} = f(Q_g)$



At

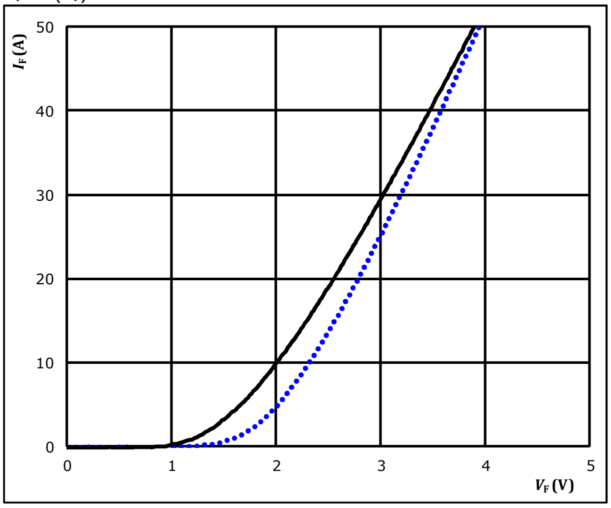
I_C=	20	A

PFC Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



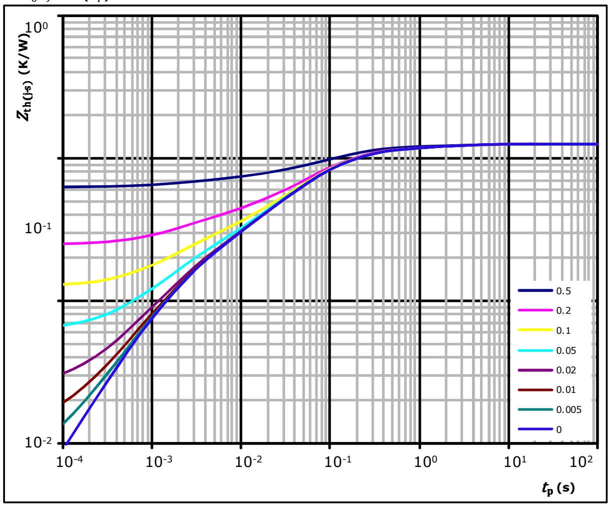
t_p = 250 µs

T_j: 25 °C (dotted) / 125 °C (solid)

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

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

FWD thermal model values

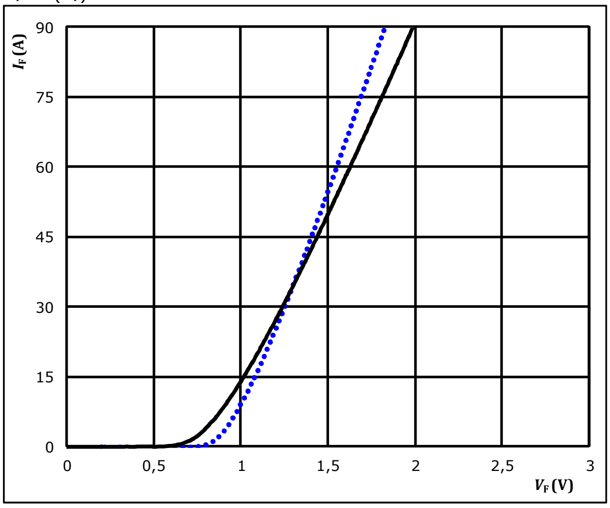
R (K/W)	τ (s)
7,31E-02	2,92E+00
1,30E-01	5,88E-01
5,59E-01	1,08E-01
2,62E-01	3,65E-02
1,13E-01	7,60E-03
1,04E-01	1,62E-03

Rectifier Diode Characteristics

figure 1. **Rectifier Diode**

Typical forward characteristics

$I_F = f(V_F)$



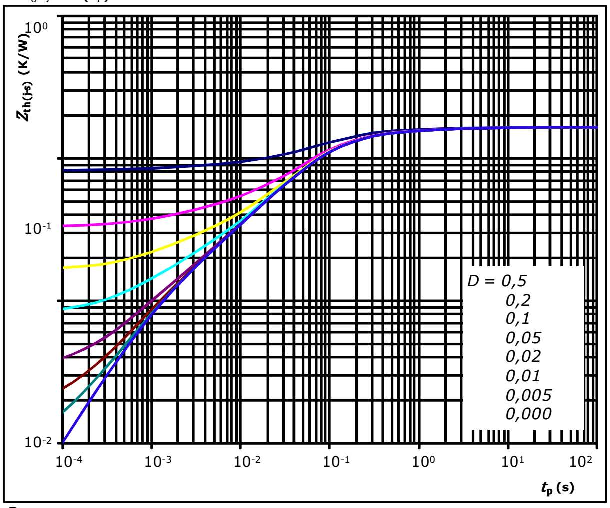
t_p = 250 μs

T_j: 25 °C (dotted line); 125 °C (solid line)

figure 2. **Rectifier Diode**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,65 K/W

Diode thermal model values

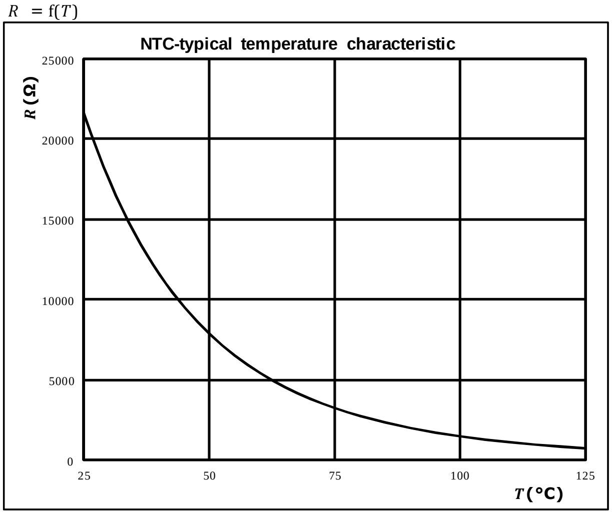
R (K/W)	τ (s)
4,2770E-02	8,5590E+00
1,3970E-01	1,0930E+00
3,8170E-01	1,8300E-01
8,4840E-01	5,8290E-02
1,5690E-01	8,6310E-03
7,8220E-02	1,1590E-03

Thermistor Characteristics

figure 1. **Thermistor**

Thermistor typical temperature characteristic

$R = f(T)$

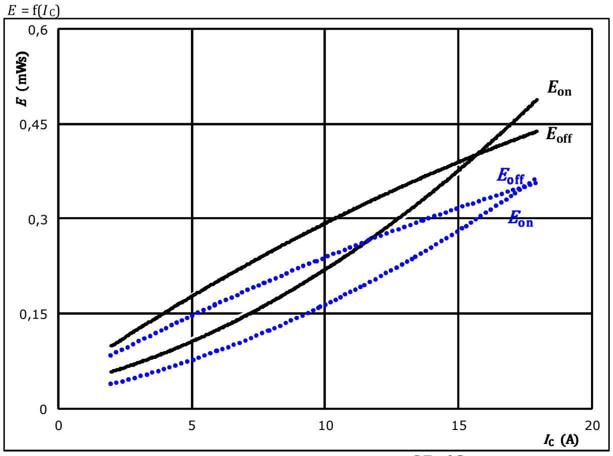


Inverter Switching Characteristics

Figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



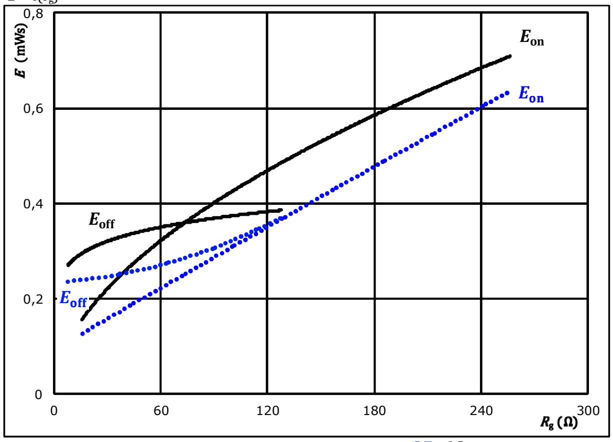
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	···········
V_{GE} =	15/0	V		125 °C	———
R_{gon} =	32	Ω			
R_{goff} =	16	Ω			

Figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(r_g)$



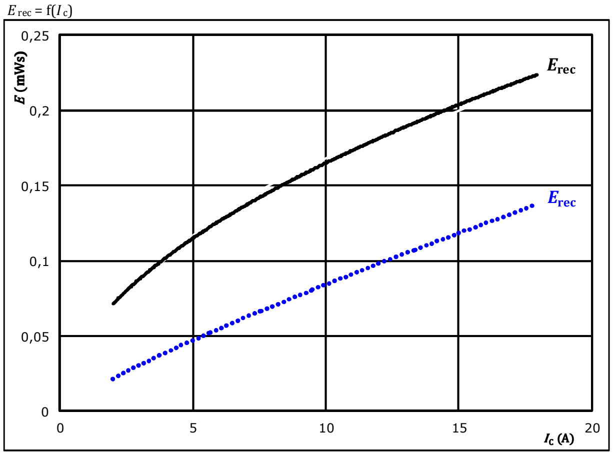
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	···········
V_{GE} =	15/0	V		125 °C	———
I_C =	10	A			

Figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



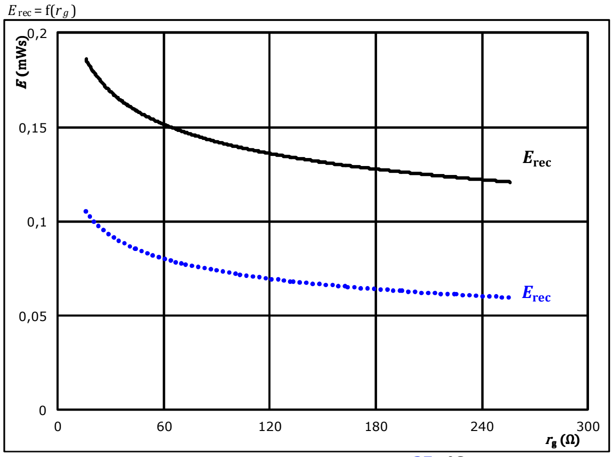
With an inductive load at

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

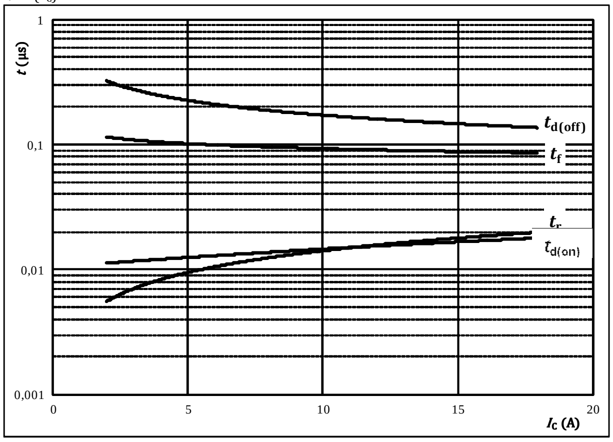
V_{CE} =	300	V	T_j:	25 °C	···········
V_{GE} =	15/0	V		125 °C	———
I_C =	10	A			

Inverter Switching Characteristics

Figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



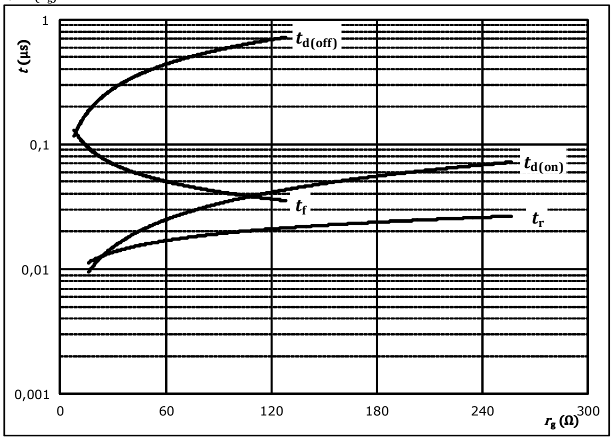
With an inductive load at

T_j =	125	°C
V_{CE} =	300	V
V_{GE} =	15/0	V
R_{gon} =	32	Ω
R_{goff} =	16	Ω

Figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(r_g)$



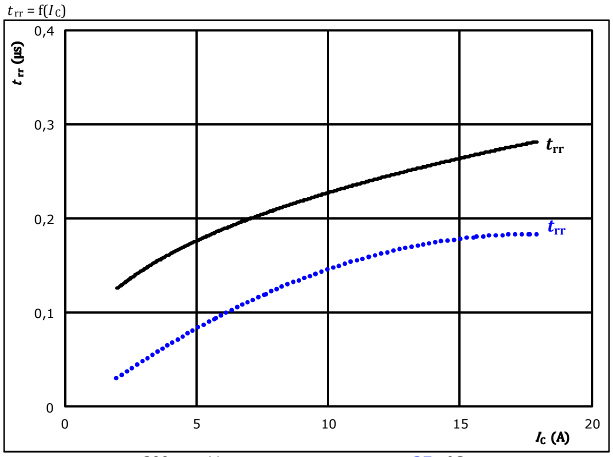
With an inductive load at

T_j =	125	°C
V_{CE} =	300	V
V_{GE} =	15/0	V
I_C =	10	A

Figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

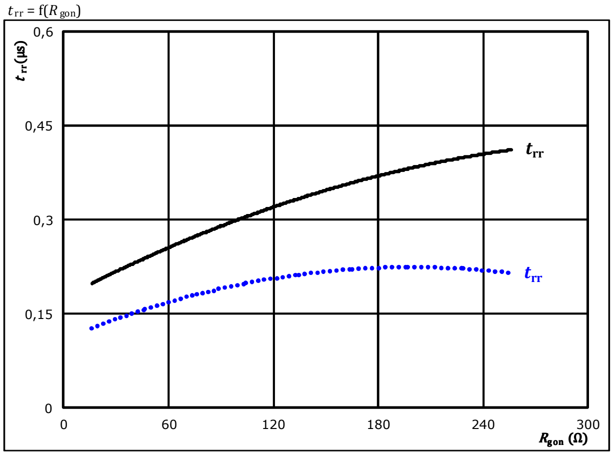


At					
V_{CE}=	300	V		**25**	**°C** ···········
V_{GE} =	15/0	V	T_j:	**125 °C**	———
R_{gon} =	32	Ω			

Figure 8. **FWD**

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

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



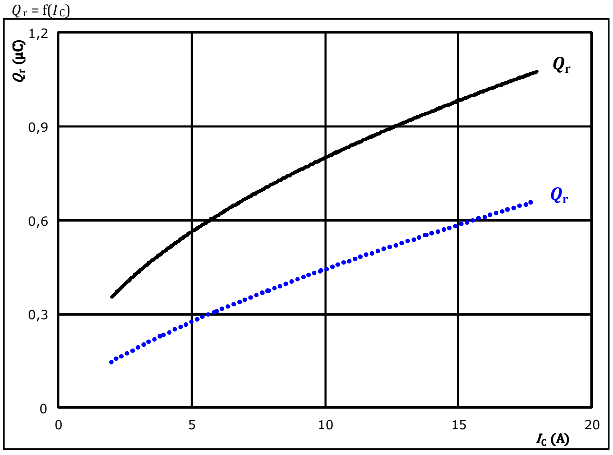
At					
V_{CE} =	300	V		**25**	**°C** ···········
V_{GE} =	15/0	V	T_j:	**125 °C**	———
I_C =	10	A			

Inverter Switching Characteristics

Figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

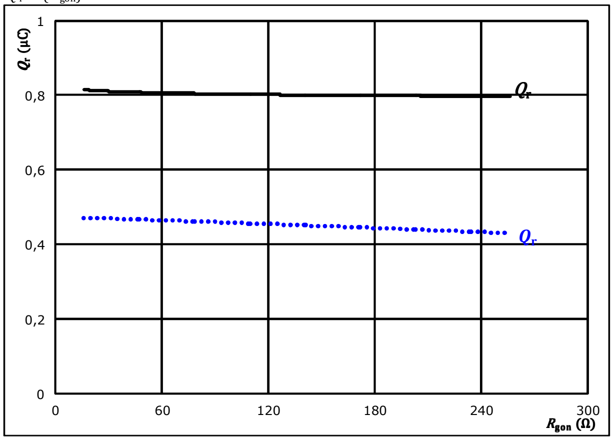


At					
V_{CE} =	300	V		**25 °C**	··············
V_{GE} =	15/0	V	T_j:	**125 °C**	———
R_{gon} =	32	Ω			

Figure 10. **FWD**

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

$Q_r = f(R_{gon})$

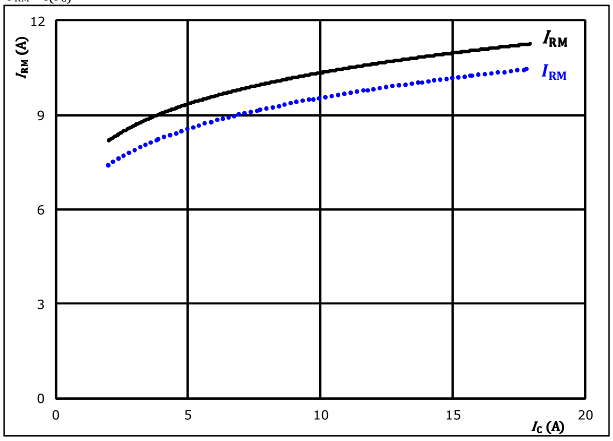


At					
V_{CE}=	300	V		**25 °C**	··············
V_{GE} =	15/0	V	T_j:	**125 °C**	———
I_C=	10	A			

Figure 11. **FWD**

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

$I_{RM} = f(I_C)$

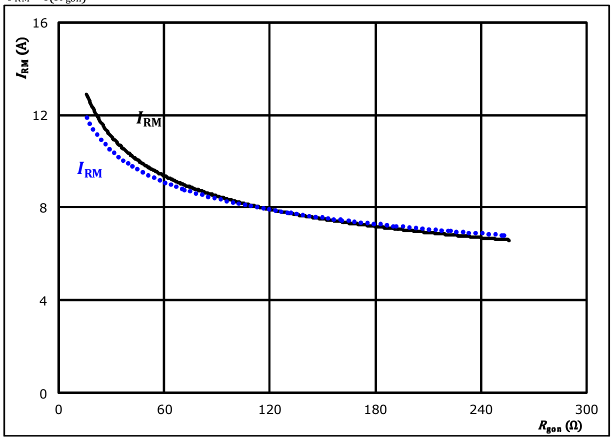


At					
V_{CE} =	300	V		**25 °C**	··············
V_{GE} =	15/0	V	T_j:	**125 °C**	———
R_{gon} =	32	Ω			

Figure 12. **FWD**

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

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



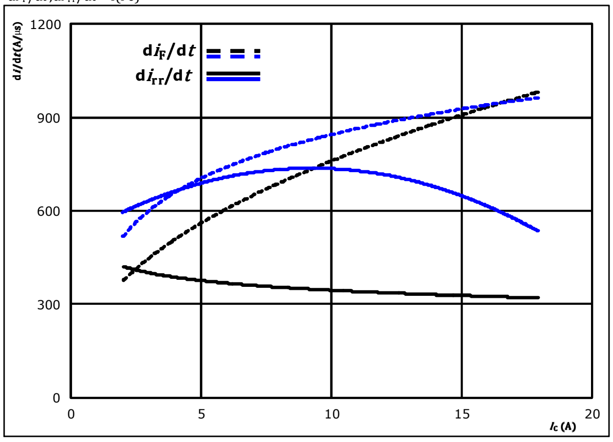
At					
V_{CE} =	300	V		**25 °C**	··············
V_{GE} =	15/0	V	T_j:	**125 °C**	———
I_C =	10	A			

Inverter Switching Characteristics

Figure 13. FWD

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

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

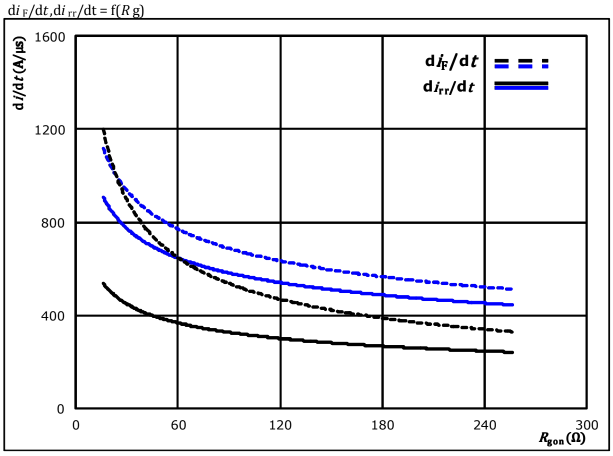


At					
V_{CE} =	300	V	T_j:	25 °C	···········
V_{GE} =	15/0	V		125 °C	———
R_{gon} =	32	Ω			

Figure 14. FWD

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

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

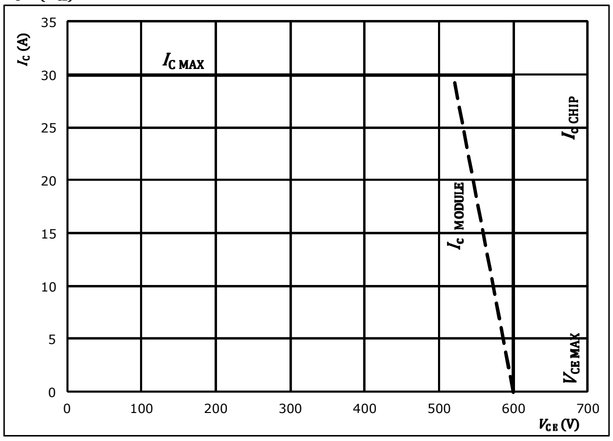


At					
V_{CE} =	300	V	T_j:	25 °C	···········
V_{GE} =	15/0	V		125 °C	———
I_C =	10	A			

Figure 15. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At		
T_j =	175	°C
R_{gon} =	32	Ω
R_{goff} =	16	Ω

10-F006PPA010SB02-L833B10
datasheet

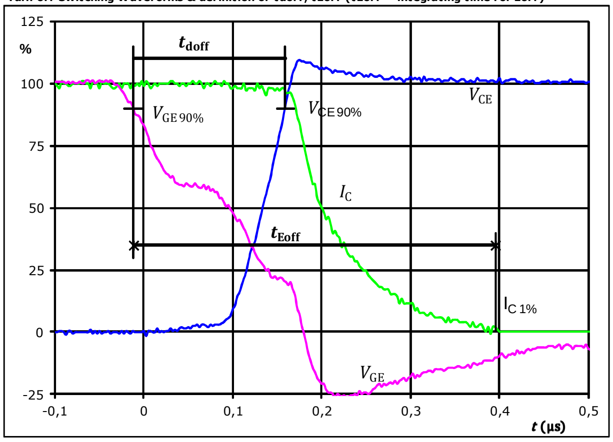
Inverter Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	32 Ω
R_{goff}	=	16 Ω

Figure 1. IGBT

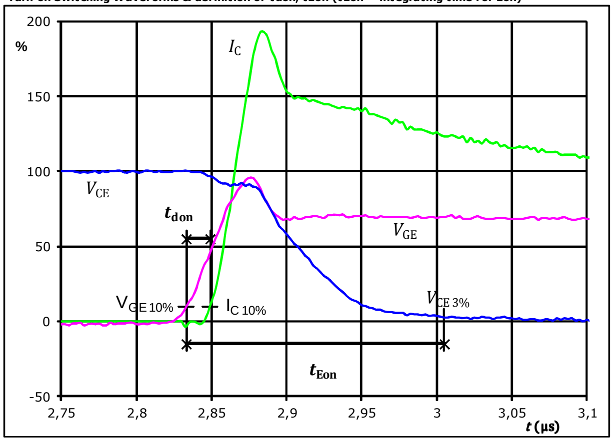
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	10	A
t_{doff} =	0,171	µs
t_{Eoff} =	0,407	µs

Figure 2. IGBT

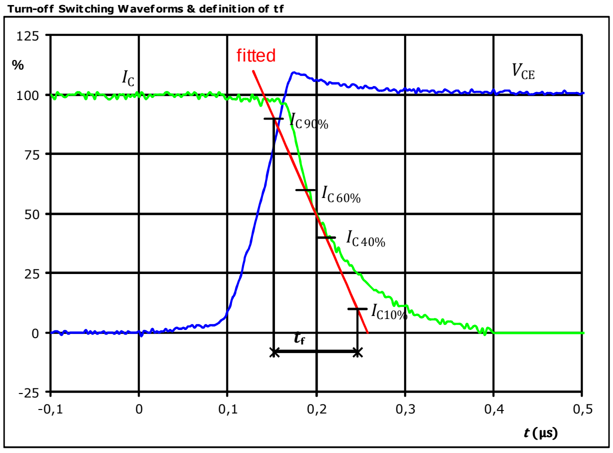
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	10	A
t_{don} =	0,015	µs
t_{Eon} =	0,172	µs

Figure 3. IGBT

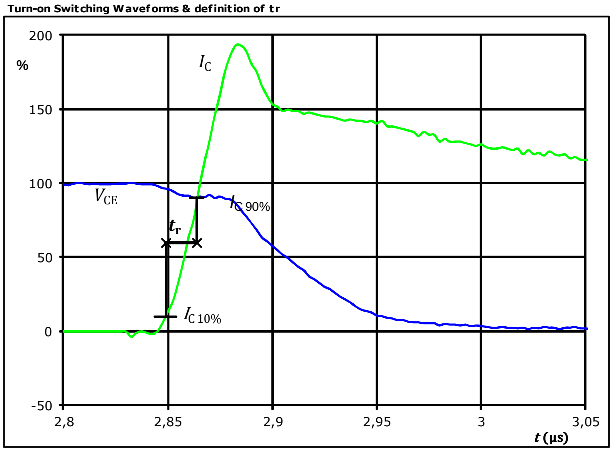
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	10	A
t_f =	0,092	µs

Figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

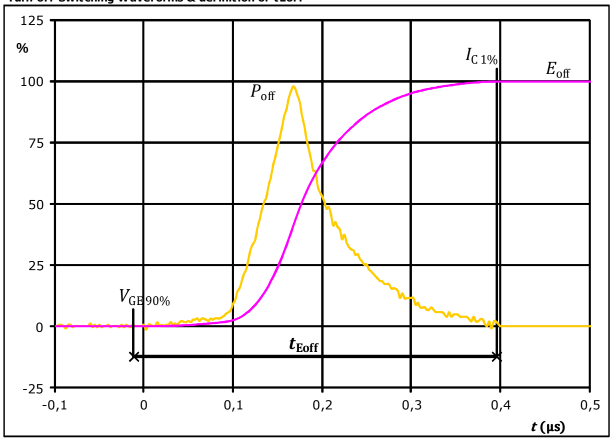


$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	10	A
t_r =	0,015	µs

Inverter Switching Characteristics

Figure 5. **IGBT**

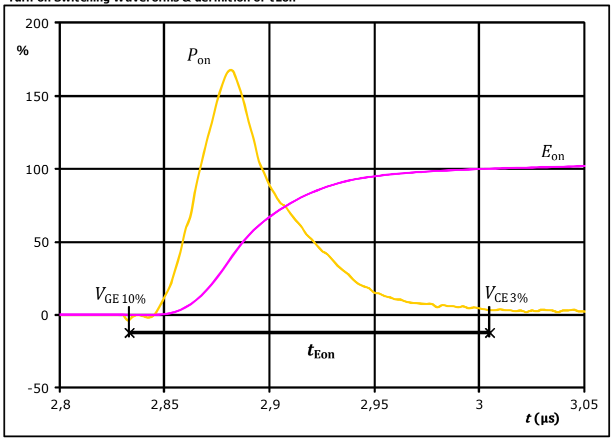
Turn-off Switching Waveforms & definition of tEoff



P_{off} (100%) =	2,99	kW
E_{off} (100%) =	0,28	mJ
t_{Eoff} =	0,407	µs

Figure 6. **IGBT**

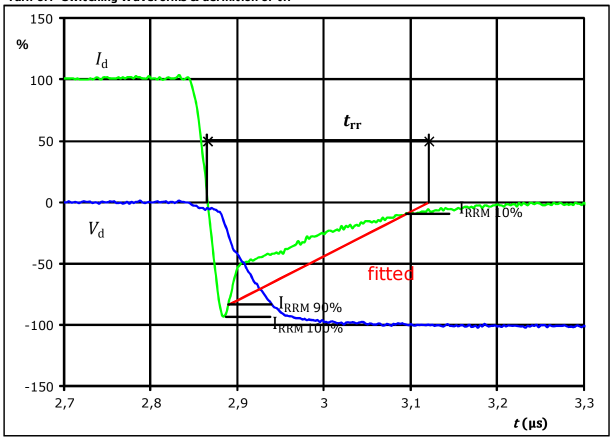
Turn-on Switching Waveforms & definition of tEon



P_{on} (100%) =	2,99	kW
E_{on} (100%) =	0,25	mJ
t_{Eon} =	0,172	µs

Figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

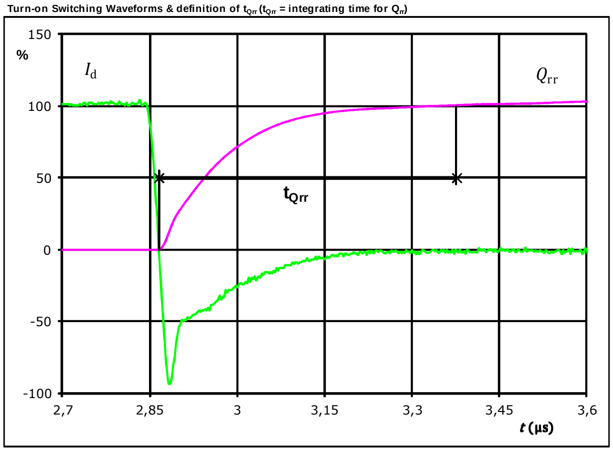


V_d (100%) =	300	V
I_d (100%) =	10	A
I_{RRM} (100%) =	9	A
t_{rr} =	0,256	µs

Inverter Switching Characteristics

Figure 8. **FWD**

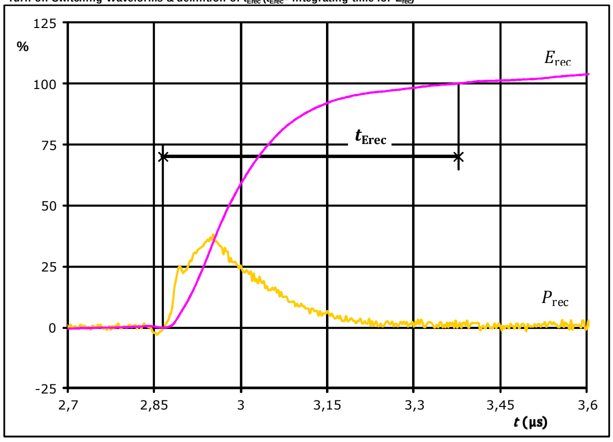
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	10	A
Q_{rr} (100%) =	0,85	µC
t_{Qrr} =	0,511	µs

Figure 9. **FWD**

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



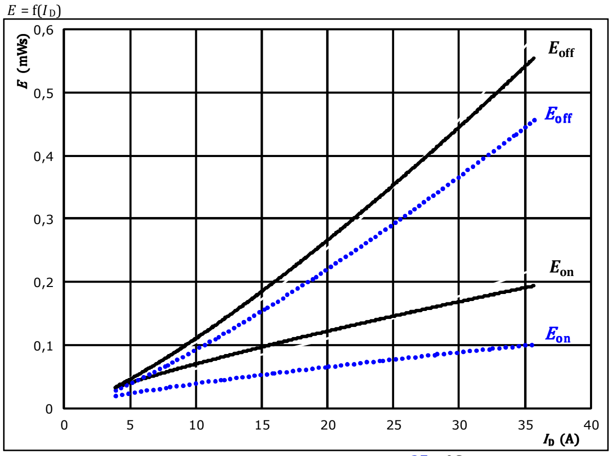
P_{rec} (100%) =	2,99	kW
E_{rec} (100%) =	0,18	mJ
t_{Erec} =	0,511	µs

PFC Switching Characteristics

figure 1. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



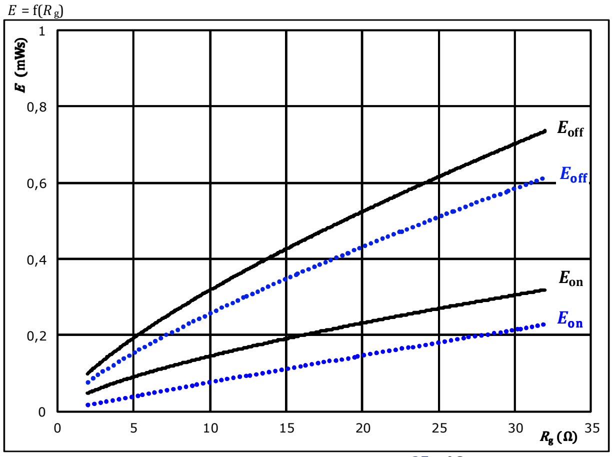
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C	···········
V_{GS} =	15/0	V		125 °C	———
R_{gon} =	8	Ω			
R_{goff} =	8	Ω			

figure 2. **MOSFET**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



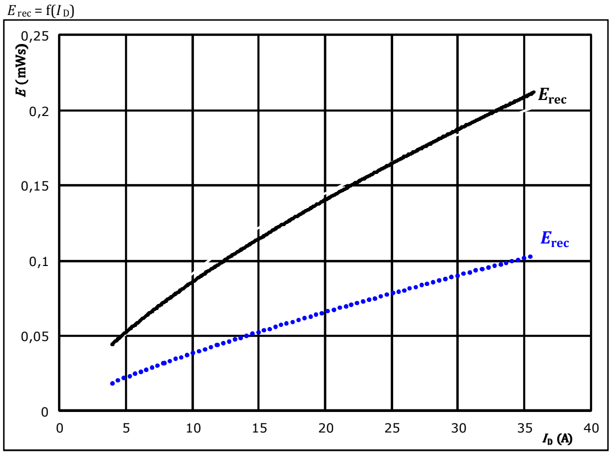
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C	···········
V_{GS} =	15/0	V		125 °C	———
I_D =	20	A			

figure 3. **FWD**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



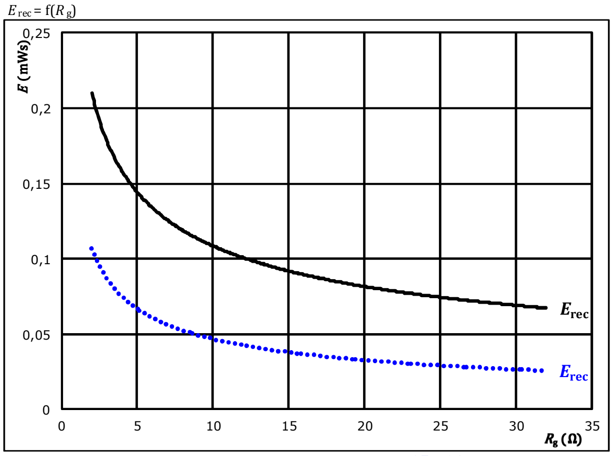
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C	···········
V_{GS} =	15/0	V		125 °C	———
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

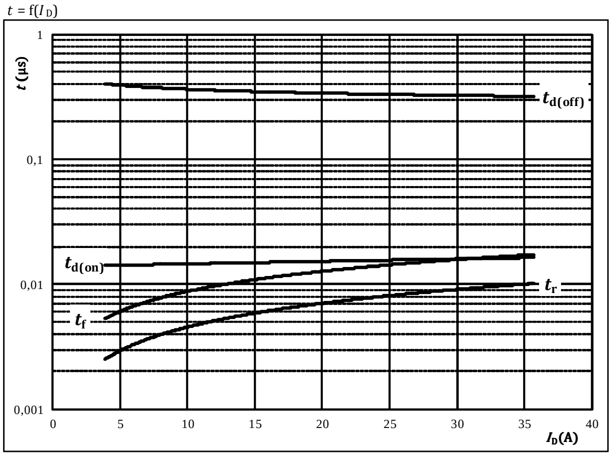
V_{DS} =	400	V	T_j:	25 °C	···········
V_{GS} =	15/0	V		125 °C	———
I_D =	20	A			

PFC Switching Characteristics

figure 5. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



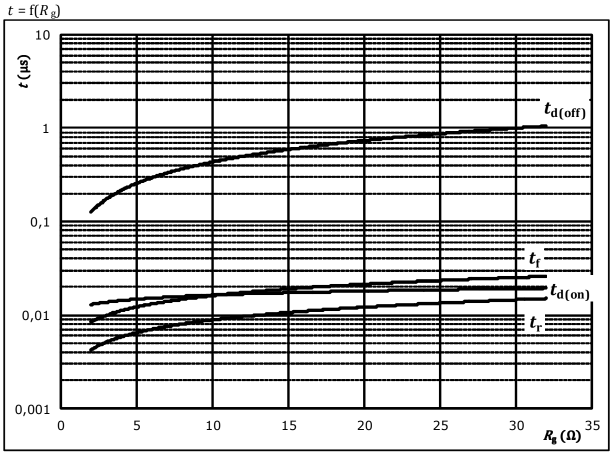
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	15/0	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

figure 6. **MOSFET**

Typical switching times as a function of gate resistor

$t = f(R_g)$



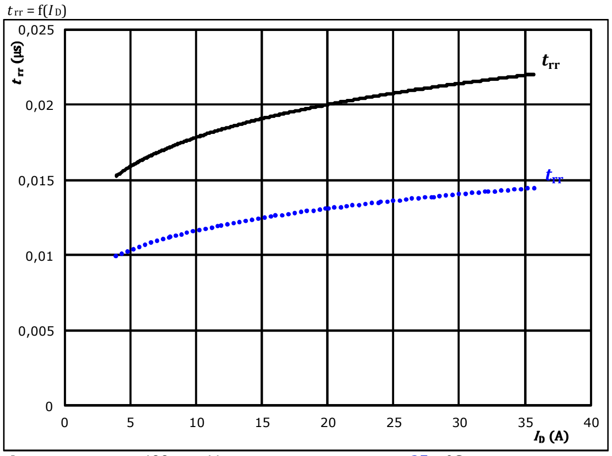
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	15/0	V
I_D =	20	A

figure 7. **FWD**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$

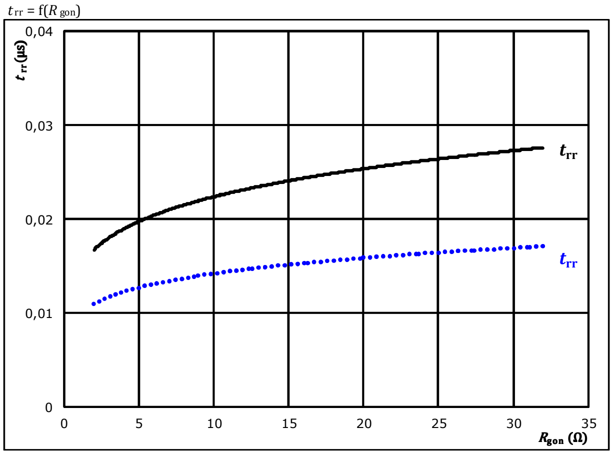


At	V_{DS} =	400	V		25 °C (dotted)
	V_{GS} =	15/0	V	T_j:	125 °C (solid)
	R_{gon} =	8	Ω		

figure 8. **FWD**

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

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



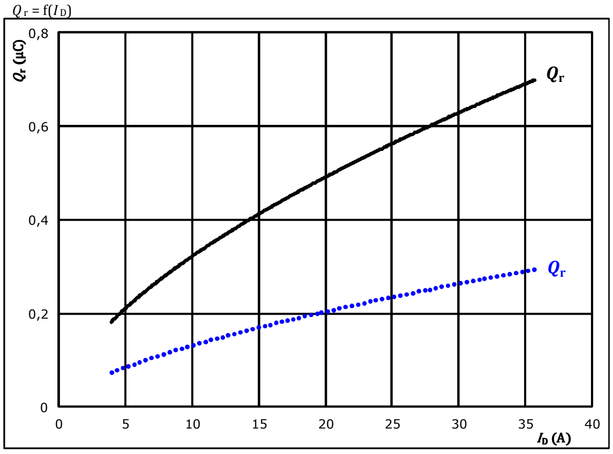
At	V_{DS} =	400	V		25 °C (dotted)
	V_{GS} =	15/0	V	T_j:	125 °C (solid)
	I_D =	20	A		

PFC Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

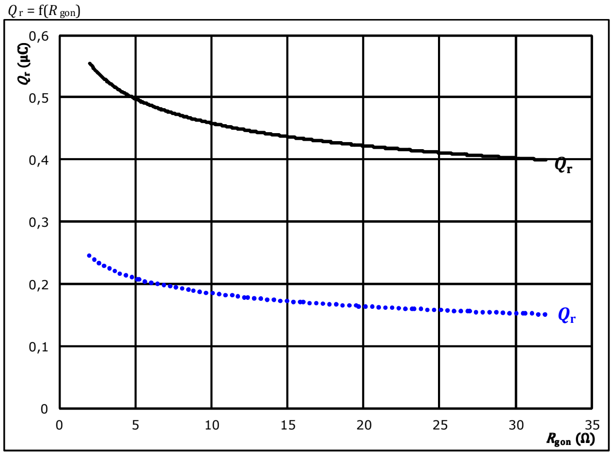


At					
V_{DS} =	400	V		25 °C	············
V_{GS} =	15/0	V	T_j:	125 °C	———
R_{gon} =	8	Ω			

figure 10. FWD

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

$Q_r = f(R_{gon})$

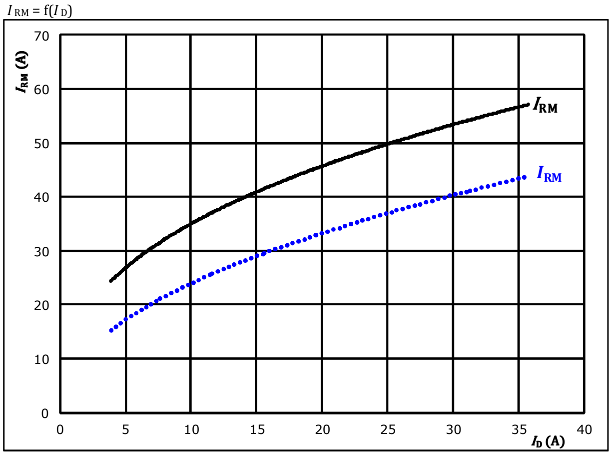


At					
V_{DS} =	400	V		25 °C	············
V_{GS} =	15/0	V	T_j:	125 °C	———
I_D =	20	A			

figure 11. FWD

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

$I_{RM} = f(I_D)$

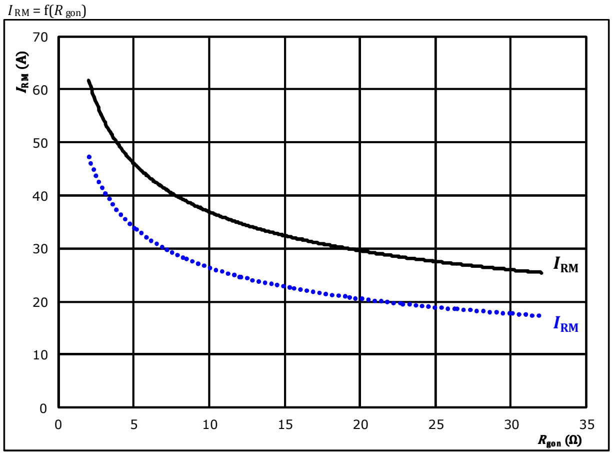


At					
V_{DS} =	400	V		25 °C	············
V_{GS} =	15/0	V	T_j:	125 °C	———
R_{gon} =	8	Ω			

figure 12. FWD

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

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



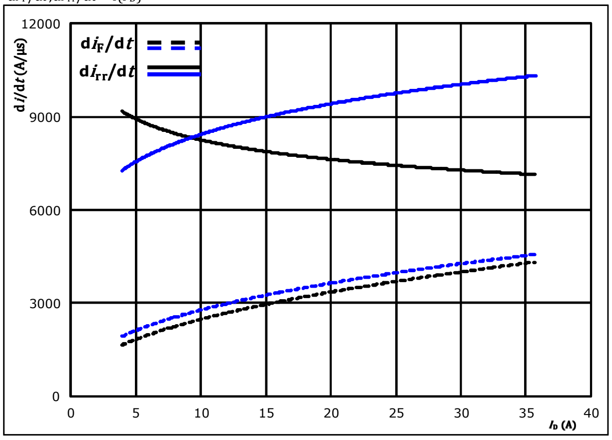
At					
V_{DS} =	400	V		25 °C	············
V_{GS} =	15/0	V	T_j:	125 °C	———
I_D =	20	A			

PFC Switching Characteristics

figure 13. **FWD**

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

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

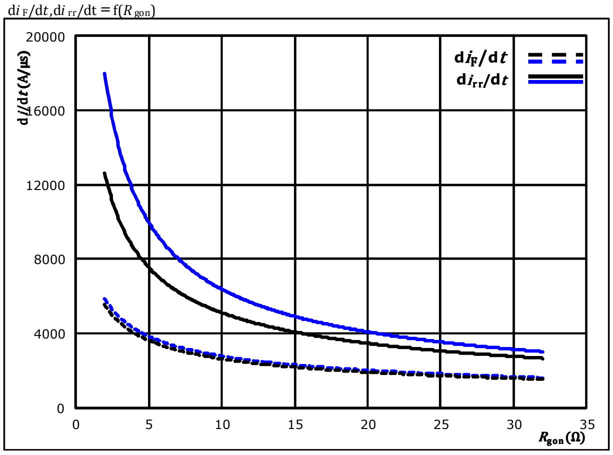


At						
V_{DS} =	400	V		25	°C	•••••••••••••
V_{GS} =	15/0	V	T_j:	125	°C	————
R_{gon} =	8	Ω				

figure 14. **FWD**

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

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

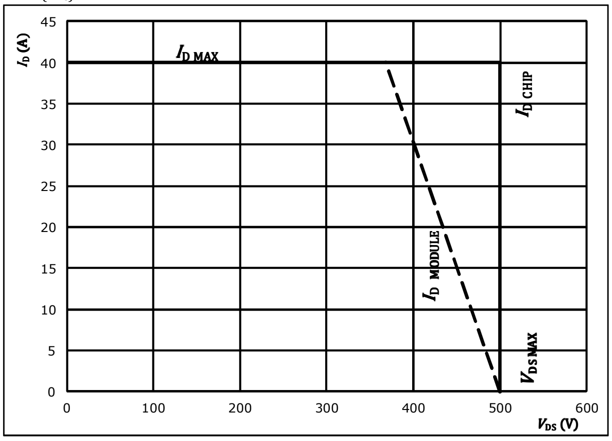


At						
V_{DS} =	400	V		25	°C	•••••••••••••
V_{GS} =	15/0	V	T_j:	125	°C	————
I_D =	20	A				

figure 15. **MOSFET**

Reverse bias safe operating area

$I_D = f(V_{DS})$



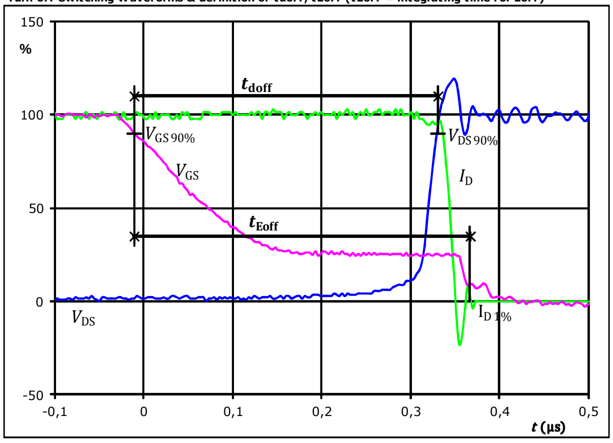
At		
T_j =	175	°C
R_{gon} =	8	Ω
R_{goff} =	8	Ω

PFC Switching Characteristics

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

figure 1. **MOSFET**

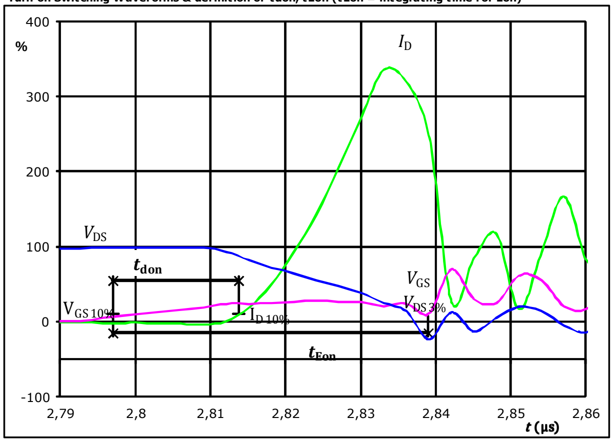
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GS}(0\%)$ =	0	V
$V_{GS}(100\%)$ =	15	V
$V_{DS}(100\%)$ =	400	V
$I_D(100\%)$ =	20	A
t_{doff} =	0,343	µs
t_{Eoff} =	0,378	µs

figure 2. **MOSFET**

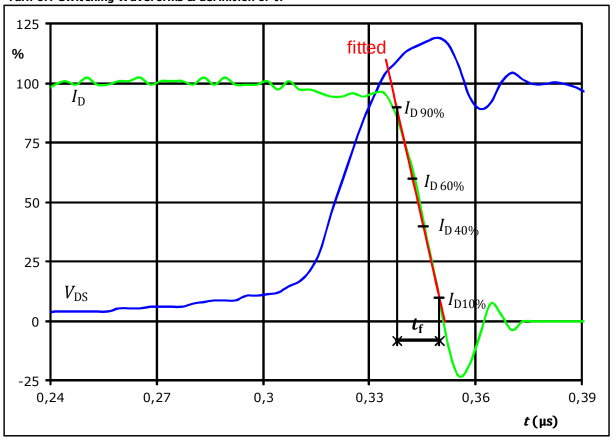
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GS}(0\%)$ =	0	V
$V_{GS}(100\%)$ =	15	V
$V_{DS}(100\%)$ =	400	V
$I_D(100\%)$ =	20	A
t_{don} =	0,016	µs
t_{Eon} =	0,042	µs

figure 3. **MOSFET**

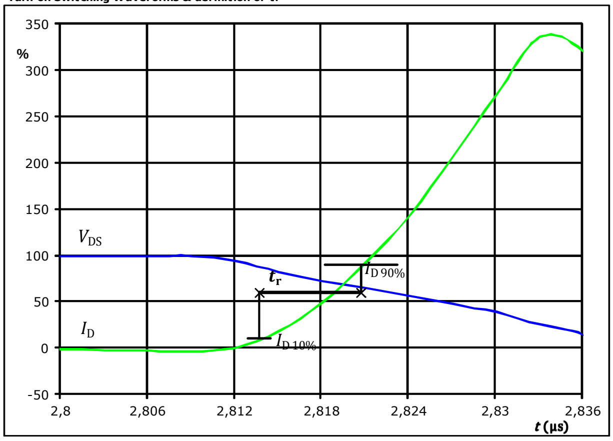
Turn-off Switching Waveforms & definition of tf



$V_{DS}(100\%)$ =	400	V
$I_D(100\%)$ =	20	A
t_f =	0,012	µs

figure 4. **MOSFET**

Turn-on Switching Waveforms & definition of tr

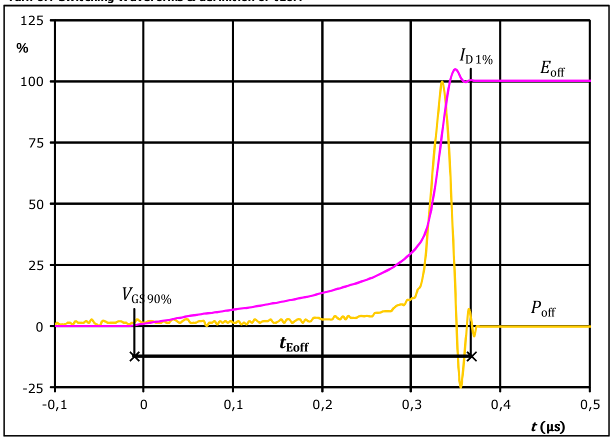


$V_{DS}(100\%)$ =	400	V
$I_D(100\%)$ =	20	A
t_r =	0,007	µs

PFC Switching Characteristics

figure 5. **MOSFET**

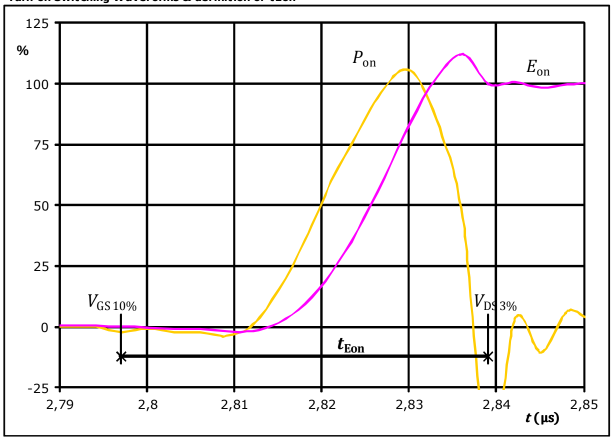
Turn-off Switching Waveforms & definition of tEoff



P_{off} (100%) =	7,92	kW
E_{off} (100%) =	0,25	mJ
t_{Eoff} =	0,38	µs

figure 6. **MOSFET**

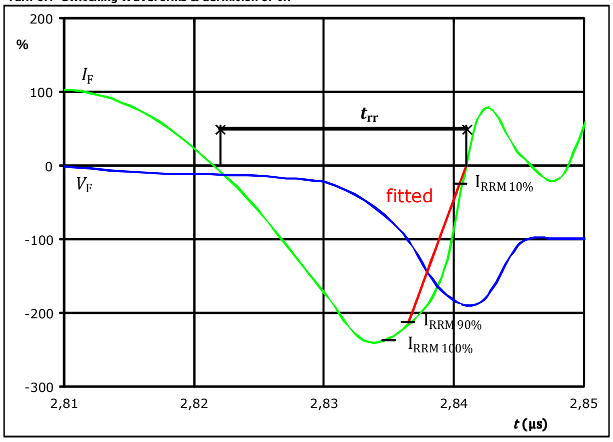
Turn-on Switching Waveforms & definition of tEon



P_{on} (100%) =	7,92	kW
E_{on} (100%) =	0,11	mJ
t_{Eon} =	0,04	µs

figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

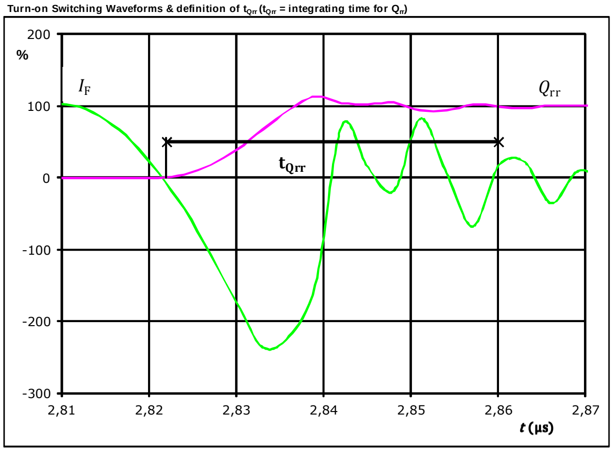


V_F (100%) =	400	V
I_F (100%) =	20	A
I_{RRM} (100%) =	47	A
t_{rr} =	0,020	µs

PFC Switching Characteristics

figure 8. **FWD**

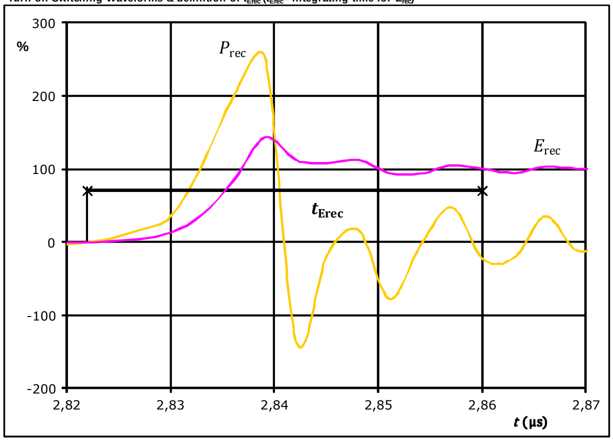
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_F (100%) =	20	A
Q_{rr} (100%) =	0,49	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%) =	7,92	kW
E_{rec} (100%) =	0,14	mJ
t_{Erec} =	0,04	µs

Vincotech

Ordering Code & Marking

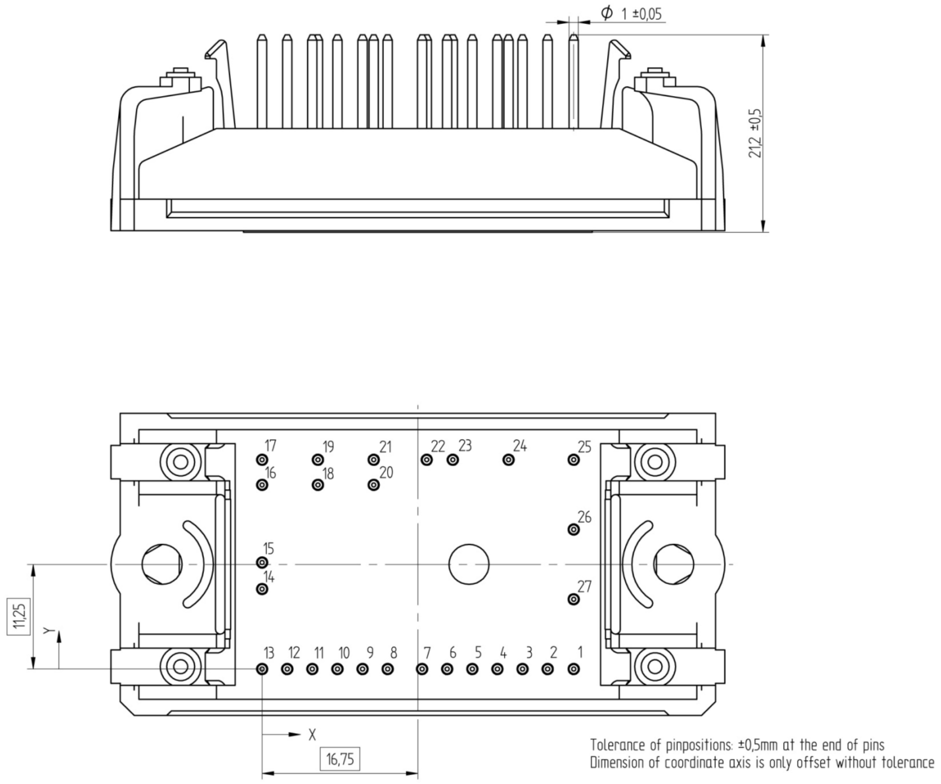
Version	Ordering Code
without thermal paste 17mm housing	10-F006PPA010SB02-L833B10
with thermal paste 17mm housing	10-F006PPA010SB02-L833B10-/3/

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

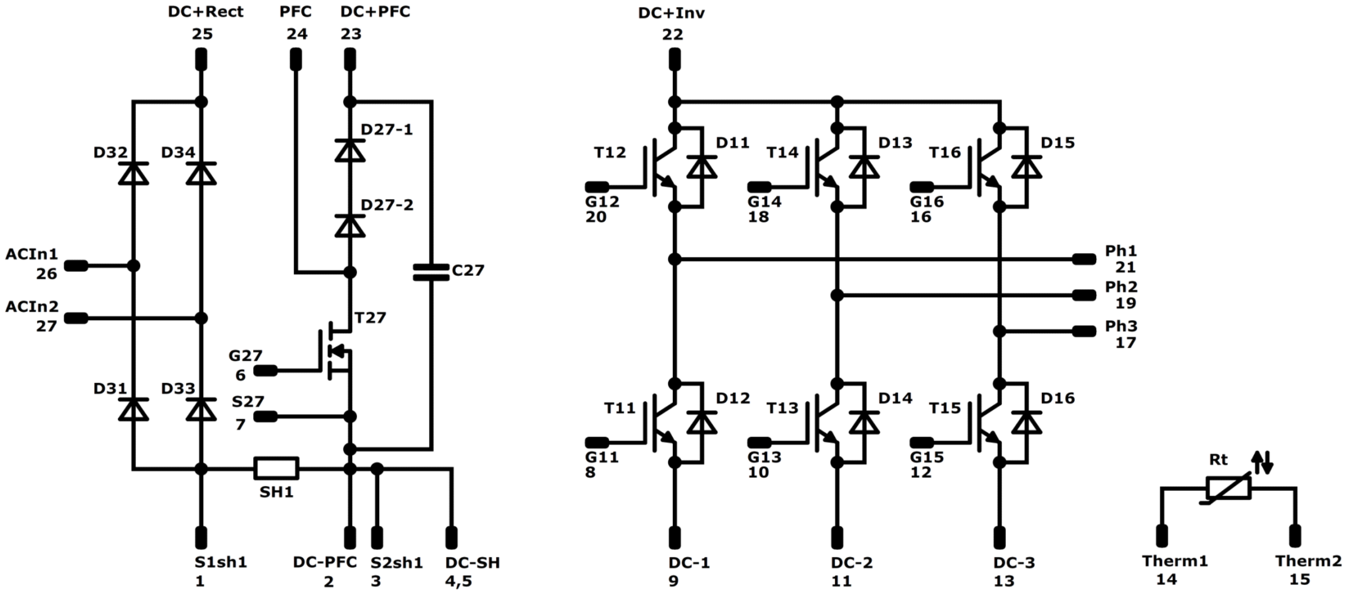
Outline

Pin table [mm]

Pin	X	Y	Function
1	33,5	0	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



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11-T16	IGBT	600 V	10 A	Inverter Switch	
D11-D16	FWD	600 V	10 A	Inverter Diode	
T27	MOSFET	500 V	90 mΩ	PFC Switch	
D27	FWD	600 V	15 A	PFC Diode	
C27	Capacitor	500 V		PFC Capacitor	
SH1	Shunt		26 A	PFC Shunt	
D31-D34	FWD	1600 V	30 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-F006PPA010SB02-L833B10-D1-14	11 Aug. 2016		