20-1B06IPB004RC01-P952A45
20-PB06IPB004RC01-P952A45Y

datasheet

***flow* IPM 1B** — **600 V / 4 A**

Features

- Optimized for PFC frequencies of 20kHz..150kHz and inverter frequencies of 4kHz..20kHz
- Input Rectifier, PFC-Boost with integrated PFC-Shunt, PFC-Gate driver and DC-capacitor
- 3 phase inverter with integrated DC Shunt, gate driver circuit incl. bootstrap circuit and over current protection
- Sense output of DC-current
- Conclusive Power Flow, all power connections on one side, no input output X-ing

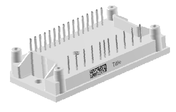
Target Applications

- Low Power Industrial Drives
- Motor Integrated Fans and Pumps
- AirCon
- Electrical Tools

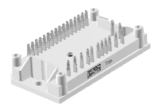
Types

- 20-1B06IPB004RC01-P952A45
- 20-PB06IPB004RC01-P952A45Y

flow 1B housing

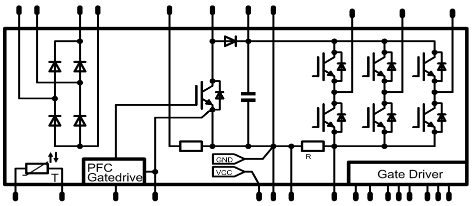


solder pins



Press-fit pins

Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Input Rectifier Diode					
Repetitive peak reverse voltage	V_{RRM}			1600	V
DC forward current	I_{FAV}	$T_j = T_{jmax}$	T_s = 80 °C	13	A
Surge (non-repetitive) forward current	I_{FSM}	t_p = 10 ms 50 Hz half sine wave	T_j = 45 °C	130	A
I^2t-value	I^2t			80	A^2s
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	15	W
Maximum Junction Temperature	T_{jmax}			150	°C
PFC IGBT					
Collector-emitter breakdown voltage	V_{CE}			650	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	8	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		45	A
Turn off safe operating area		V_{CE} ≤ 650V, $T_j \le T_{op}$ max		45	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	16	W
Gate-emitter peak voltage	V_{GE}			±20	V
Maximum Junction Temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
PFC Inverse Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			650	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	6	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		12	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	10	W
Maximum Junction Temperature	T_{jmax}			175	°C
PFC Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			650	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	9	A
Surge (non-repetitive) forward current	I_{FSM}	t_p=8,3ms 60 Hz half sine wave		100	A
I^2t-value	I^2t			40	A^2s
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		30	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	15	W
Maximum Junction Temperature	T_{jmax}			175	°C
Inverter Transistor					
Collector-emitter breakdown voltage	V_{CE}			600	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	4	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		12	A
Turn off safe operating area		V_{CE} ≤ 600V, T_j ≤Tjmax		8	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	12	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V		8 400	μs V
Maximum Junction Temperature	T_{jmax}			175	°C
Inverter Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	5	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		8	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	9	W
Maximum Junction Temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
PFC Shunt				
DC forward current	I_F	T_c = 25 °C	10	A
Power dissipation	P_{tot}	T_c = 25 °C	9	W
PFC Driver*				
Collector-emitter voltage	V_{CEO}		45	V
Collector current	I_C		500	mA
Peak collector current	I_{CM}	t_P ≤ 10 ms	1000	mA
Base current	I_B		100	mA
Peak base current	I_{BM}		200	mA
Maximum Junction Temperature	T_{jmax}		150	°C

* for more information see infineon's datasheet BC817

Parameter	Symbol	Condition	Value	Unit
DC - Shunt				
DC forward current	I_F	T_c = 25 °C	8	A
Power dissipation	P_{tot}	T_c = 25 °C	3,2	W
DC link Capacitor				
Max.DC voltage	V_{MAX}	T_c = 25 °C	500	V
Gate Driver*				
Supply voltage	V_{CC}	V_{CC} common with PFC driver	20	V
Input voltage (LIN, HIN, EN)	U_{IN}		10	V
Output voltage (FAULT)	U_{OUT}		V_{CC} + 0.5	V

* for more information see infineon's datasheet 6ED003L02-F2

Parameter	Symbol	Condition	Value	Unit
Thermal Properties				
Storage temperature	T_{stg}		-40…+125	°C
Operation temperature under switching condition	T_{op}		-40…+(T_{jmax} - 25)	°C
Isolation Properties				
Isolation voltage	V_{is}	t = 2 s DC Test Voltage	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_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	Unit
Input Rectifier Diode										
Forward voltage *	V_F				7	25 125		1,04 0,97		V
Threshold voltage (for power loss calc. only)	V_{to}				7	25 125		0,87 0,74		V
Slope resistance (for power loss calc. only)	r_t				7	25 125		25 33		mΩ
Reverse current	I_r			1200		25			0,01	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						4,56		K/W
* chip data										
PFC IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}$			0,0004	25	3,3	4	4,7	V
Collector-emitter saturation voltage*	V_{CEsat}		15		6	25 150		1,43 1,55	2,05	V
Collector-emitter cut-off	I_{CES}		0	650		25			0,04	mA
Rise time	t_r					25 125		2 2		
Turn-off delay time **	$t_{d(off)}$					25 125		107 161		ns
Fall time	t_f		U_{CC} = 15 V V_{IN} = 5 V	400	4	25 125		4 2		
Turn-on energy loss	E_{on}					25 125		0,055 0,091		mWs
Turn-off energy loss	E_{off}					25 125		0,020 0,038		
Input capacitance	C_{ies}							930		
Output capacitance	C_{oss}	f = 1 MHz	0	25		25		24		pF
Reverse transfer capacitance	C_{rss}							4		
Gate charge	Q_G		±15	520	15	25		38		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						5,80		K/W
* chip data										
PFC Inverse Diode										
Diode forward voltage	V_F				6	25 125	1,23	1,73 1,59	2,15	V
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						9,56		K/W
PFC Diode										
Forward voltage *	V_F				6	25 150		1,51 1,42	2,13	V
Peak recovery current	I_{RRM}					25 125		11 13		A
Reverse recovery time	t_{rr}					25 125		18 28		ns
Reverse recovery charge	Q_{rr}		U_{CC} = 15 V V_{IN} = 5 V	400	4	25 125		0,12 0,24		μC
Reverse recovered energy	E_{rec}					25 125		0,013 0,033		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		959 452		A/μs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						7,19		K/W
* chip data										
PFC Shunt										
R1 value	R							100		mΩ

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	
Inverter Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,000075	25	4,4	5	5,6	V
Collector-emitter saturation voltage*	V_{CEsat}		15		4	25 150	1,7	2,20 2,29	2,8	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		25			0,1	mA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time **	$t_{d(on)}$		U_{CC} = 15 V V_{IN} = 5 V	400	4	25 125		586 635		ns
Rise time	t_r					25 125		21 30		ns
Turn-off delay time **	$t_{d(off)}$					25 125		666 749		ns
Fall time	t_f					25 125		20 50		ns
Turn-on energy loss	E_{on}					25 125		0,117 0,198		mWs
Turn-off energy loss	E_{off}					25 125		0,072 0,115		mWs
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		305		pF
Output capacitance	C_{oss}							18		pF
Reverse transfer capacitance	C_{rss}							9		pF
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						8,93		K/W

* chip data
** including gate driver

Parameter	Symbol	Conditions	V_{GE} [V]	V_{CE} [V]	I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Inverter Diode										
Diode forward voltage *	V_F				4	25 150	1,5	2,08 1,92	2,6	V
Peak reverse recovery current	I_{RRM}		U_{CC} = 15 V V_{IN} = 5 V	400	4	25 125		2 3		A
Reverse recovery time	t_{rr}					25 125		166 254		ns
Reverse recovered charge	Q_{rr}					25 125		0,18 0,35		nC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		25 16		A/μs
Reverse recovered energy	E_{rec}					25 125		0,045 0,085		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						10,05		K/W

* chip data

Parameter	Symbol	Conditions				T_j [°C]	Min	Typ	Max	Unit
DC - Shunt										
R2 value	R					25		50		mΩ
DC link Capacitor										
C value	C							100		nF

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	
Gate Driver										
Supply voltage	V_{CC}					25 125	13	15	17,5	V
Quiescent Vcc supply current	I_{QCC}	VLIN=0V; VHIN=3,3V				25 125		1,3	2	mA
Input voltage (LIN, HIN, EN)	V_{IN}	V_{CC} = 15V				25 125	0		5	V
Input voltage (GATE)	V_{GATE}					25 125	0		15	
Logic "0" input voltage (LIN, HIN)	V_{IH}					25 125	1,7	2,1	2,4	
Logic "1" input voltage (LIN, HIN)	V_{IL}					25 125	0,7	0,9	1,1	
Positive going threshold voltage (EN)	$V_{EN, TH+}$					25 125	1,9	2,1	2,3	
Negative going threshold voltage (EN)	$V_{EN, TH-}$					25 125	1,1	1,3	1,5	
Input clamp voltage (LIN, HIN, EN)	$V_{IN, CLAMP}$	IIN = 4mA				25 125	9	10,3	12	
ITRIP positive going threshold	$V_{IT, TH+}$					25 125	380	445	510	mV
Input bias current LIN high	I_{LIN+}	VLIN = 3,3V				25 125		70	100	µA
Input bias current LIN low	I_{LIN-}	VLIN = 0V				25 125		10	200	
Input bias current HIN high	I_{HIN+}	VHIN = 3,3V				25 125		70	100	
Input bias current HIN low	I_{HIN-}	VHIN = 0V				25 125		110	200	
Input bias current EN high	I_{EN+}	VHIN = 3,3V				25 125		45	120	
Output voltage (FAULT)	V_{FLT}					25 125	0		V_{CC}	V
Low on resistor of pull down trans. (FAULT)	$R_{ON, FLT}$	V_FAULT=0.5 V				25 125		45,0	100	Ω
Pulse width for ON or OFF	t_{IN}					25 125	1			µs
Turn-on propagation delay (LIN, HIN)	t_{ON}	VLIN/HIN = 0V or 3,3V				25 125	400	530	800	ns
Turn-off propagation delay (LIN, HIN)	t_{OFF}	VLIN/HIN = 0V or 3,3V				25 125	360	490	760	
FAULT reset time	t_{RST}					25 125		4		ms
Fixed deadtime between high and low side	t_{DT}	VLIN/HIN = 0V & 3,3V				25 125	150	310		ns

Characteristic Values

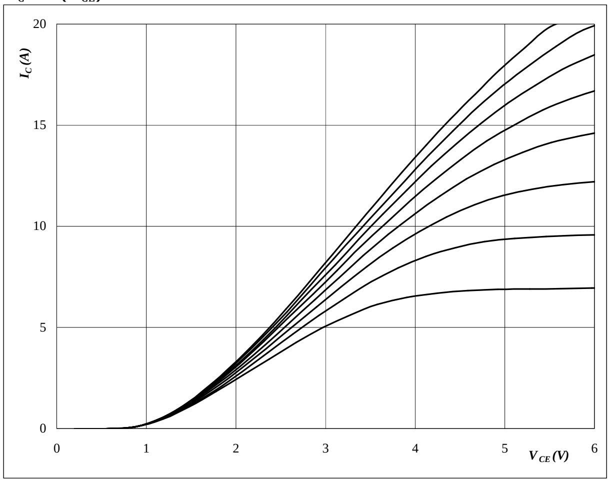
Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	Unit
Thermistor										
Rated resistance	R					25		22000		Ω
Deviation of R_{100}	$\Delta R/R$					100	-12		12	%
Power dissipation	P					25		200		mW
Power dissipation constant						25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				25		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				25		3998		K
Vincotech NTC Reference									B	
PFC Driver										
Base resistor	R_b							100,00		Ω
Base pull down resistor	R_{bpd}							2,70		KΩ
Thermal Resistance Junction - heat sink	R_{thJS}							≤105		K/W
DC Characteristics										
DC current gain	h_{FE}	I_C =100 mA, V_{CE} =1 V				25	160	250	400	
		I_C =300 mA, V_{CE} =1 V					100			
Collector-emitter saturation voltage	V_{CEsat}	I_C = 500 mA, I_B = 50 mA							0,7	V
Base emitter saturation voltage	V_{BEsat}								1,2	
AC Characteristics										
Transition frequency	f_T	I_C = 50 mA, V_{CE} = 5 V, f = 100 MHz				25		170		MHz
Collector-base capacitance	C_{cb}	f = 1 Mhz, V_{BE} = 10 V						6		pF
Emitter-base capacitance	C_{eb}	V_{EB}= 0,5 V, f = 1 MHz						60		

Output Inverter

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$



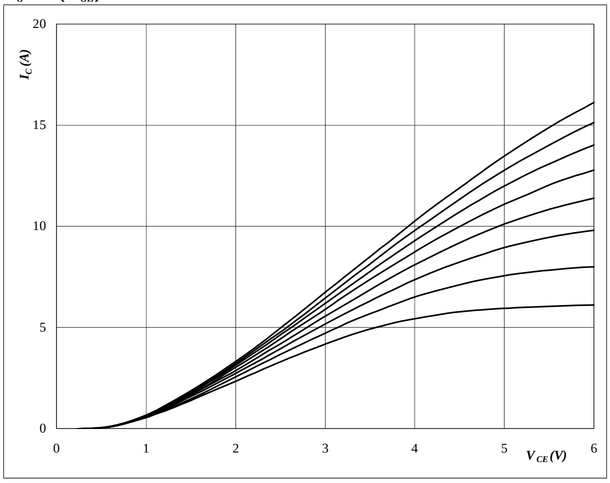
At

t_p =	250	µs
T_j =	25	°C
U_{CC} from	10 V to	17V in steps of 1V

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$



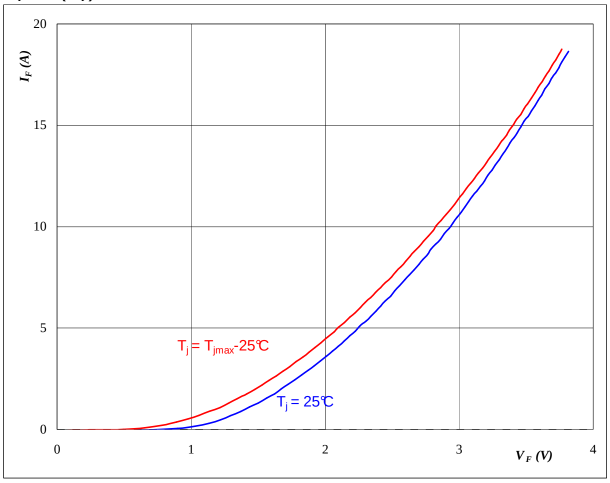
At

t_p =	250	µs
T_j =	150	°C
U_{CC} from	10 V to	17V in steps of 1V

figure 3. FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

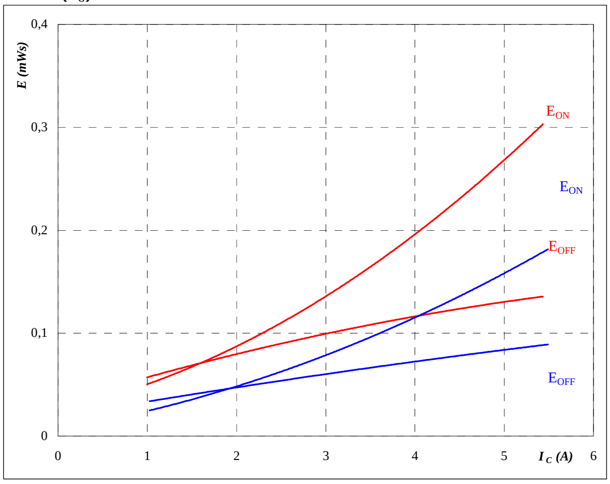
t_p =	250	µs

Output Inverter

figure 4.	IGBT

Typical switching energy losses
as a function of collector current

E = f(I_C)



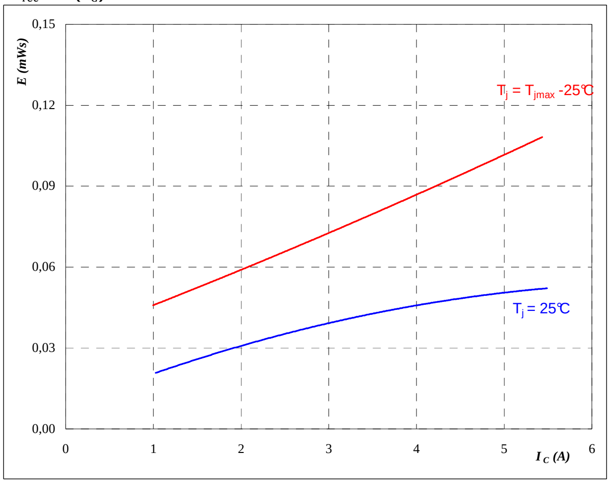
With an inductive load at

T_j =	25/125	°C
V_{CE} =	400	V
U_{CC}=	15	V

figure 5.	FWD

Typical reverse recovery energy loss
as a function of collector current

E_{rec} = f(I_C)



With an inductive load at

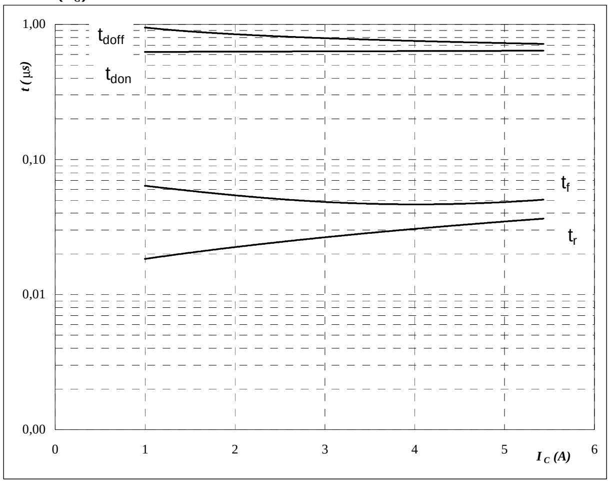
T_j =	25/125	°C
V_{CE} =	400	V
U_{CC}=	15	V

Output Inverter

figure 6. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



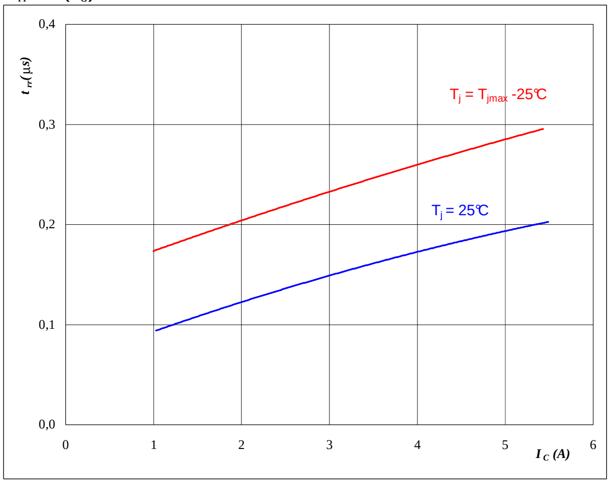
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
U_{CC}=	15	V

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



At

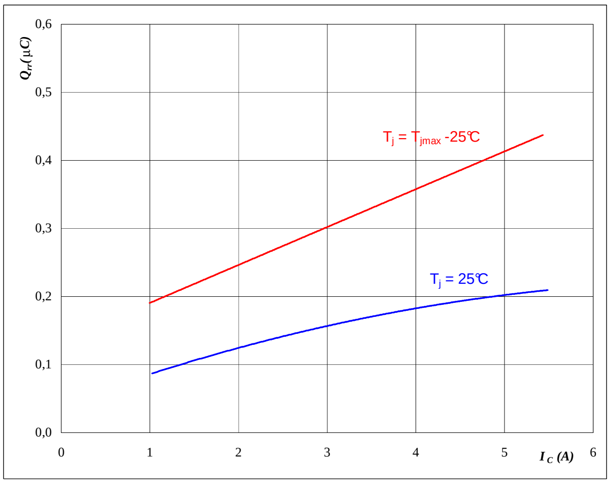
T_j =	25/125	°C
V_{CE} =	400	V
U_{CC}=	15	V

Output Inverter

figure 8. **FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



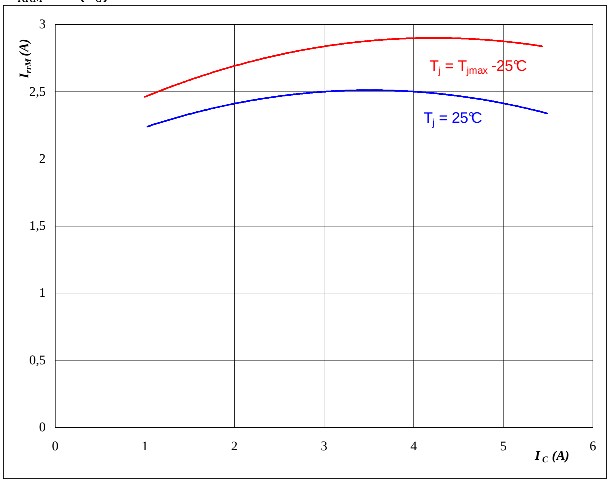
At

T_j =	25/125	°C
V_{CE} =	400	V
U_{CC}=	15	V

figure 9. **FWD**

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



At

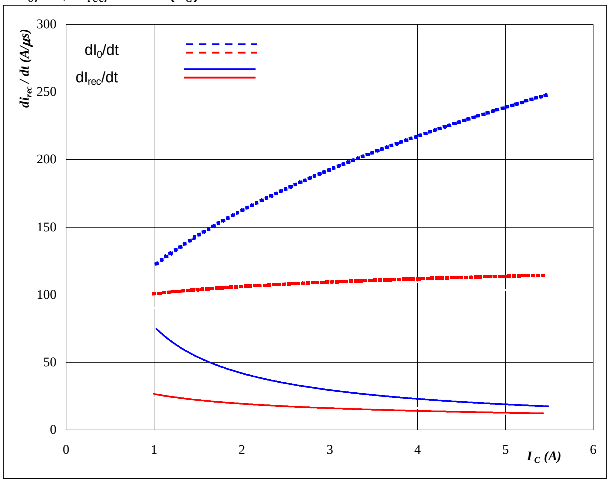
T_j =	25/125	°C
V_{CE} =	400	V
U_{CC}=	15	V

Output Inverter

figure 10. **FWD**

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

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



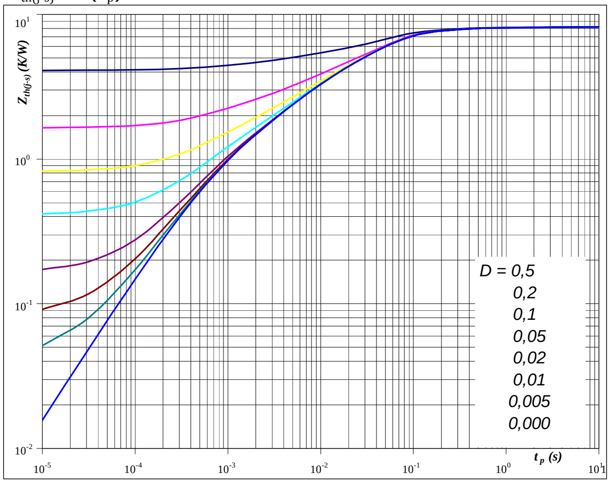
At

T_j =	25/125	°C
V_{CE} =	400	V
U_{CC} =	15	V

figure 11. **IGBT**

IGBT transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j-s)}$ =	8,20	K/W

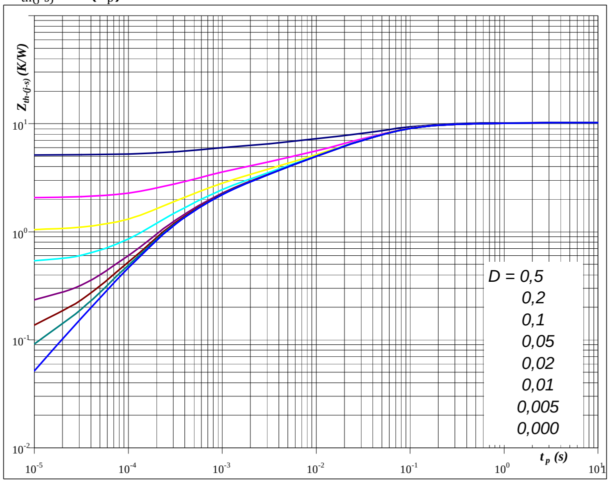
IGBT thermal model values

R (K/W)	Tau (s)
2,49E-01	1,64E+00
9,97E-01	1,59E-01
4,55E+00	3,81E-02
1,65E+00	5,10E-03
6,64E-01	7,96E-04
9,00E-02	3,11E-04

figure 12. **FWD**

FWD transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j-s)}$ =	10,24	K/W

FWD thermal model values

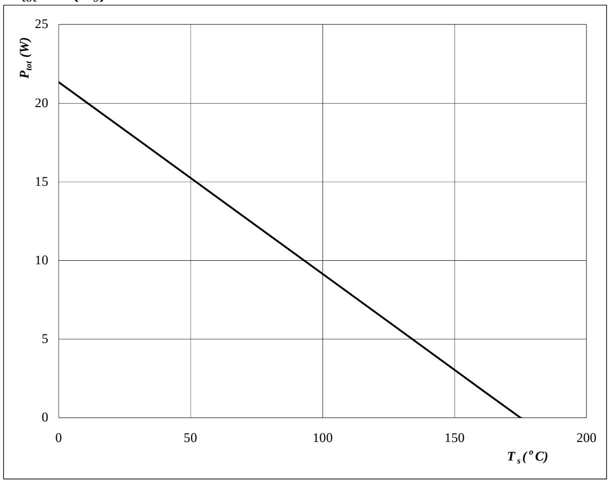
R (K/W)	Tau (s)
5,43E-01	6,92E-01
3,81E+00	5,93E-02
2,56E+00	1,81E-02
1,83E+00	2,58E-03
1,50E+00	3,50E-04

Output Inverter

figure 13. **IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



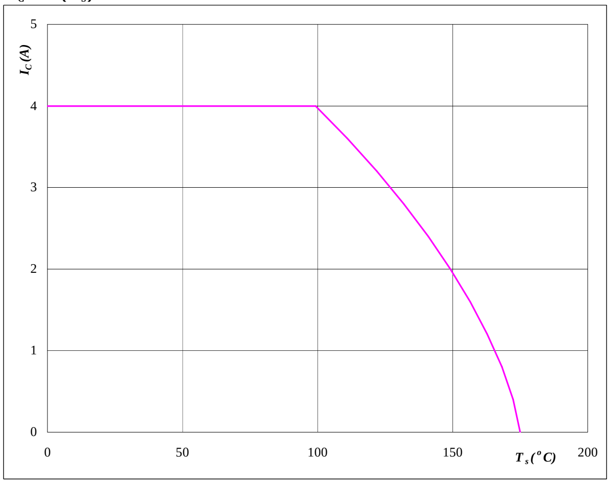
At

T_j = 175 °C

figure 14. **IGBT**

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

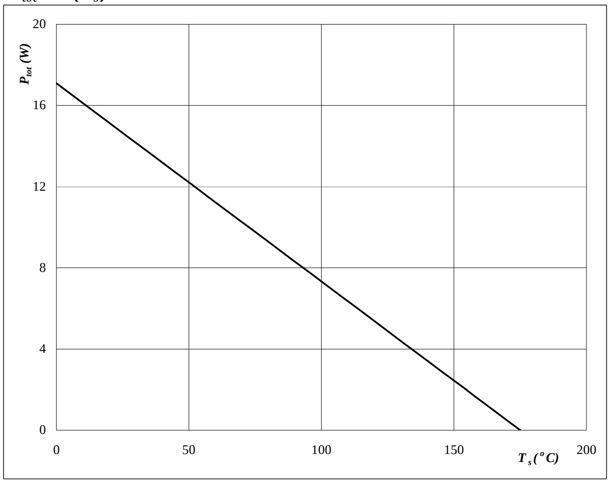
T_j = 175 °C

U_{CC} = 15 V

figure 15. **FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



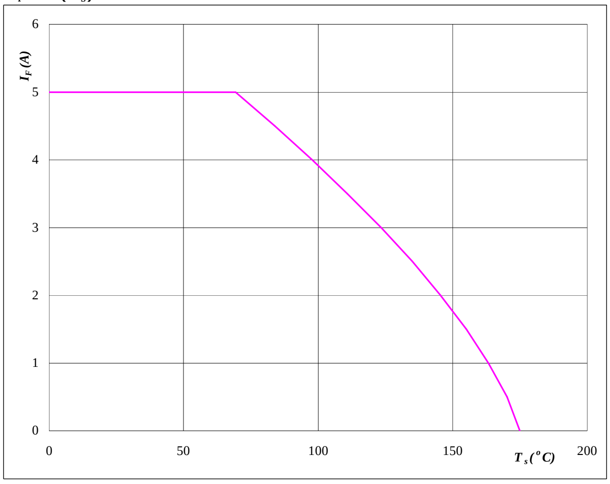
At

T_j = 175 °C

figure 16. **FWD**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

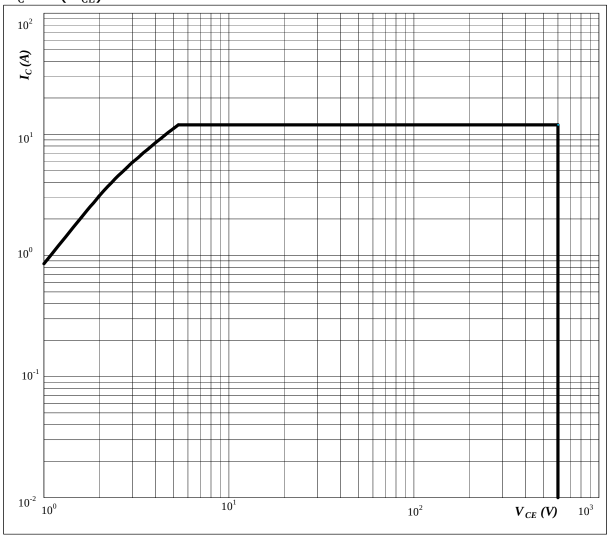
T_j = 175 °C

Output Inverter

figure 17.	IGBT

Safe operating area as a function of collector-emitter voltage

I_C = f(V_{CE})



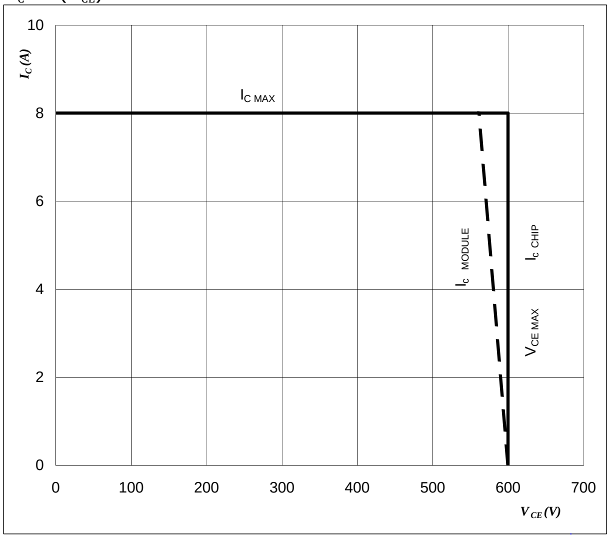
At

T_j ≤	T_{jmax}	
U_{CC}=	15	V

figure 18.	IGBT

Reverse bias safe operating area

I_C = f(V_{CE})



At

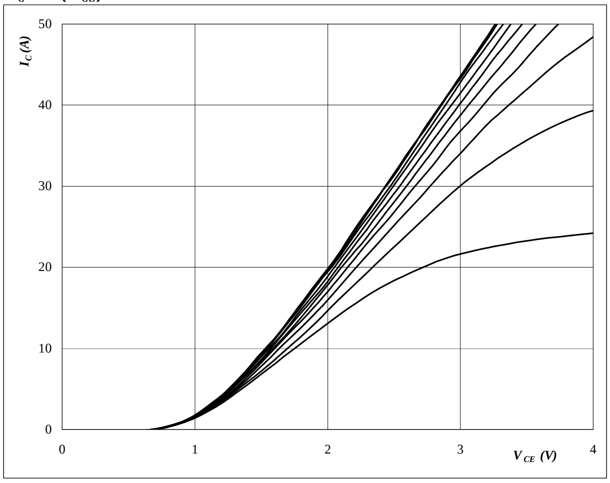
T_j =	T_{jmax}-25	ºC

PFC

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



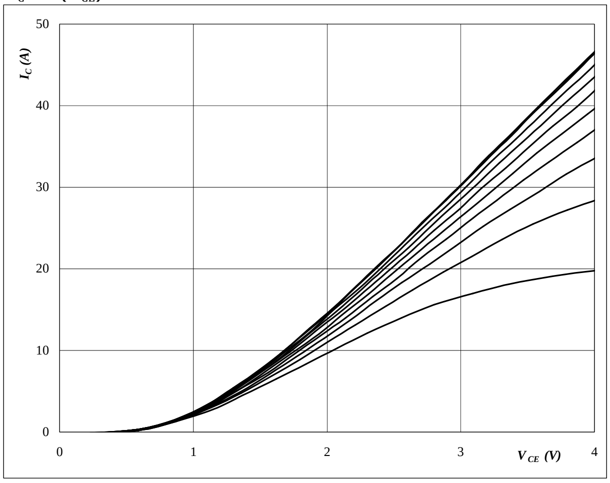
At

t_p =	250	µs
T_j =	25	°C
U_{CC} from	7 V to	17V in steps of 1V

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



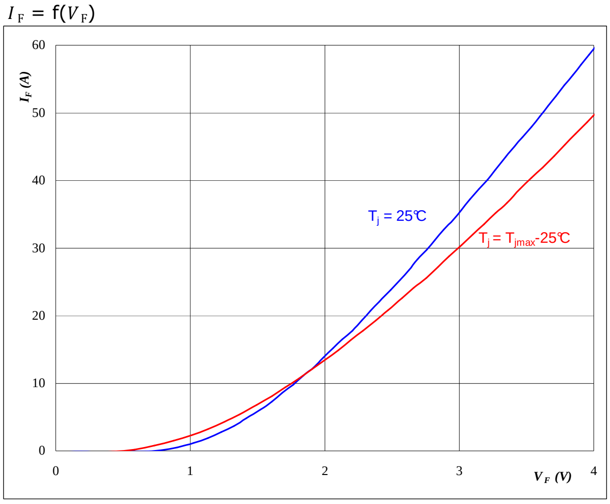
At

t_p =	250	µs
T_j =	0	°C
U_{CC} from	7 V to	17V in steps of 1V

figure 3. **FWD**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

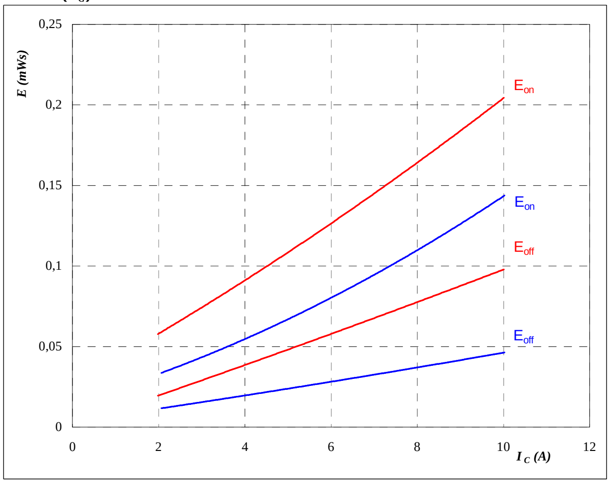
t_p =	250	µs

PFC

figure 4.	IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



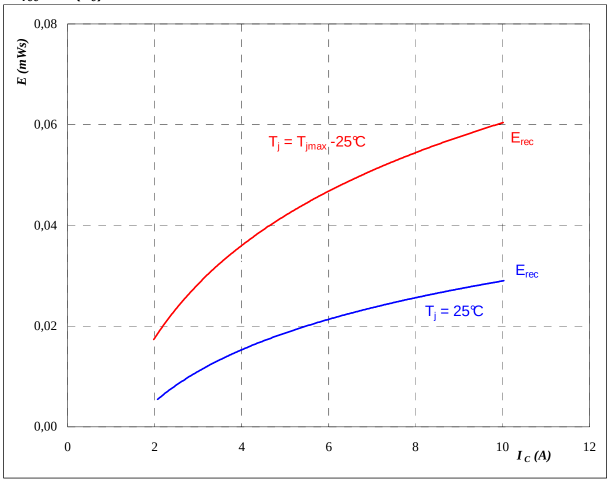
With an inductive load at

T_j =	25/125	°C
V_{CE} =	400	V
U_{CC}=	15	V

figure 5.	IGBT

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_c)$



With an inductive load at

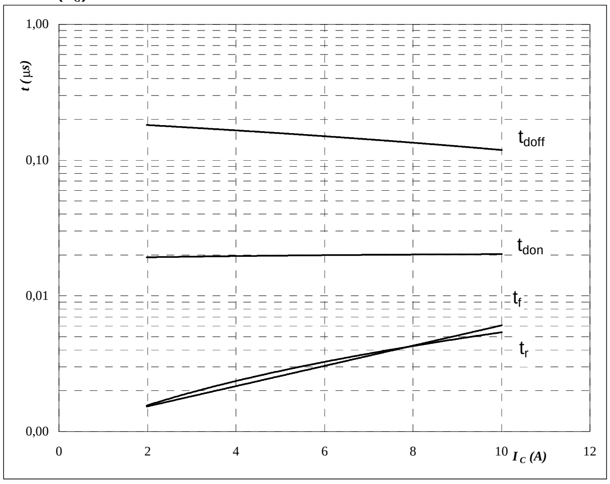
T_j =	25/125	°C
V_{CE} =	400	V
U_{CC}=	15	V

PFC

figure 6. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



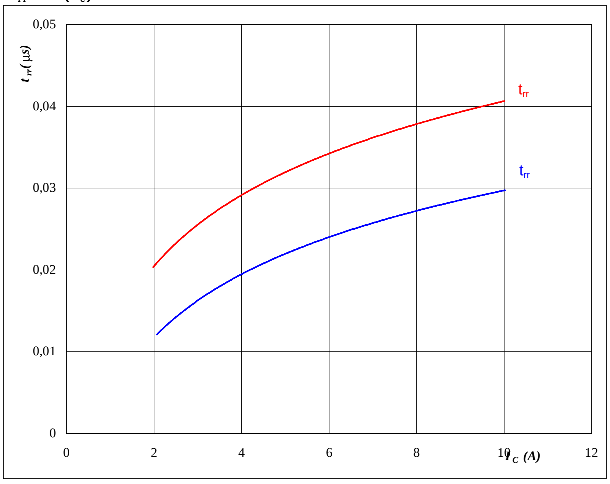
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
U_{CC}=	15	V

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



At

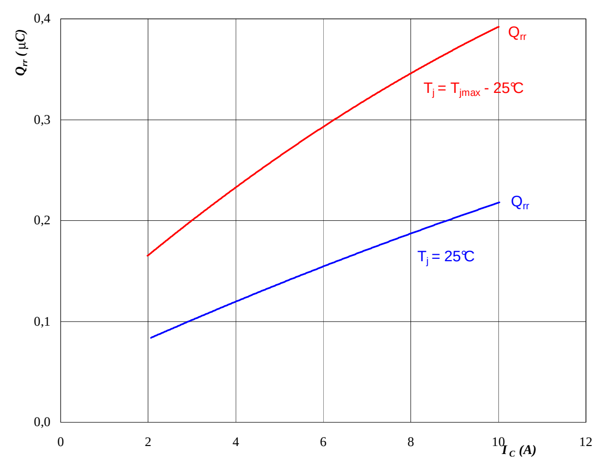
T_j =	25/125	°C
V_{CE} =	400	V
U_{CC}=	15	V

PFC

figure 8. **FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



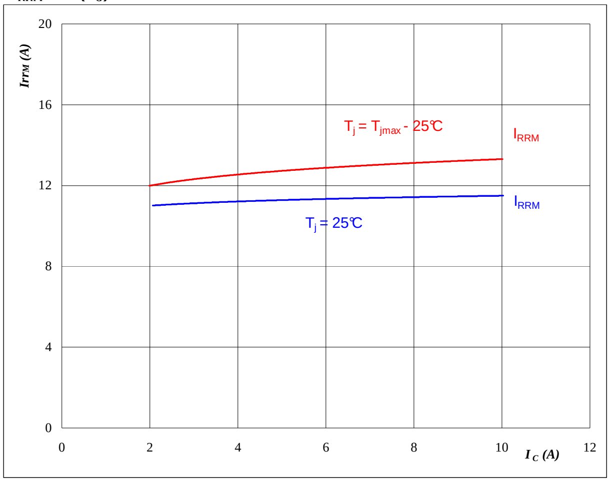
At

T_j =	25/125	°C
V_{CE} =	400	V
U_{CC}=	15	V

figure 9. **FWD**

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



At

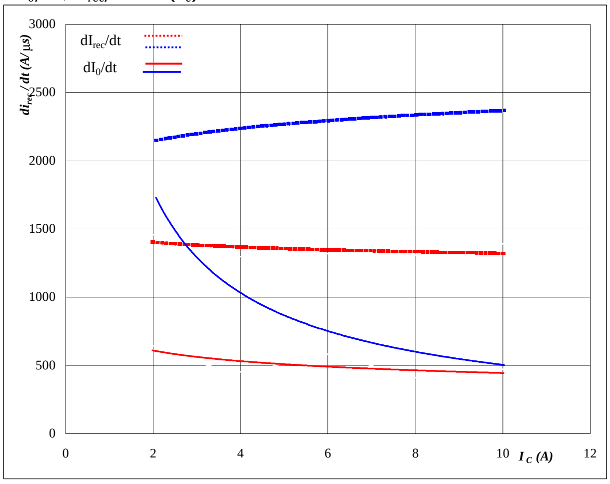
T_j =	25/125	°C
V_{CE} =	400	V
U_{CC}=	15	V

PFC

figure 10. **FWD**

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

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



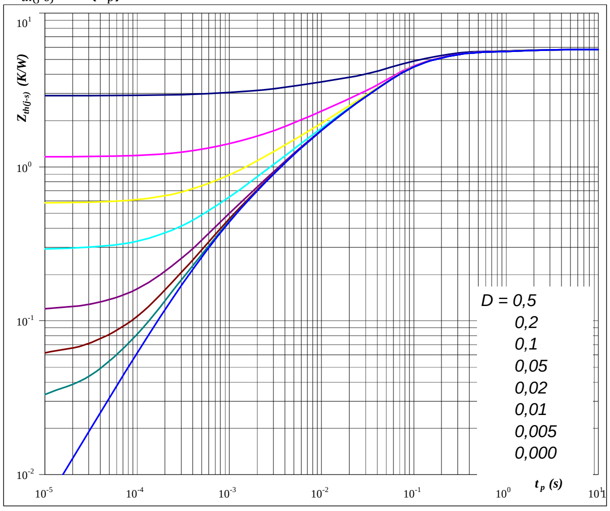
At

T_j =	25/125	°C
V_{CE} =	400	V
U_{CC}=	15	V

figure 11. **IGBT**

IGBT transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j-s)}$ =	5,80	K/W

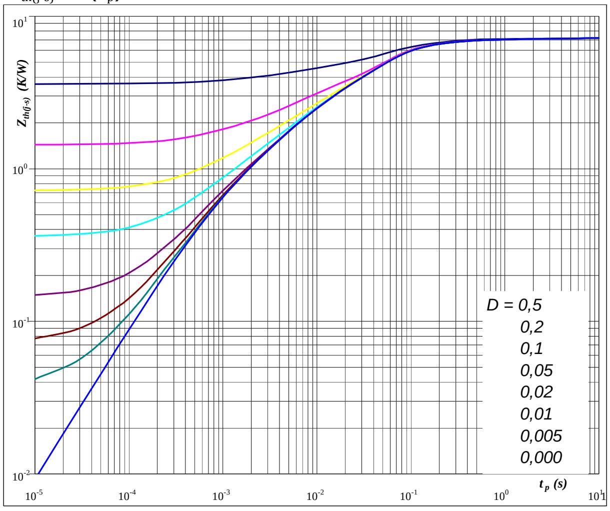
IGBT thermal model values

R (K/W)	Tau (s)
8,85E-02	4,38E+00
3,12E-01	8,32E-01
1,99E+00	1,12E-01
2,31E+00	3,80E-02
8,99E-01	4,25E-03
2,11E-01	5,94E-04

figure 12. **FWD**

FWD transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j-s)}$ =	7,19	K/W

FWD thermal model values

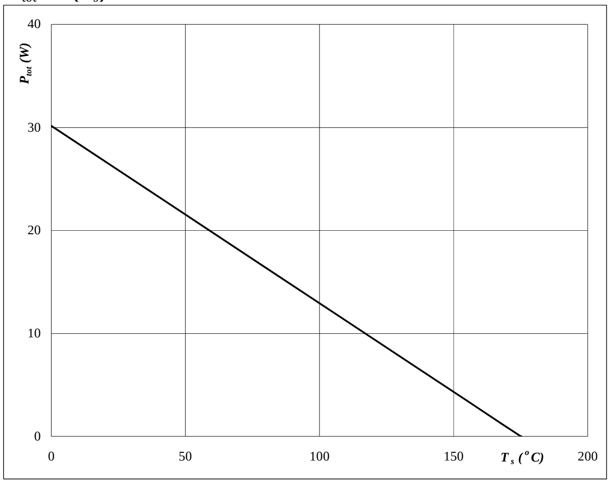
R (K/W)	Tau (s)
2,22E-01	2,69E+00
6,61E-01	2,71E-01
4,47E+00	4,89E-02
1,43E+00	5,11E-03
4,13E-01	7,51E-04

PFC

figure 13. **IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



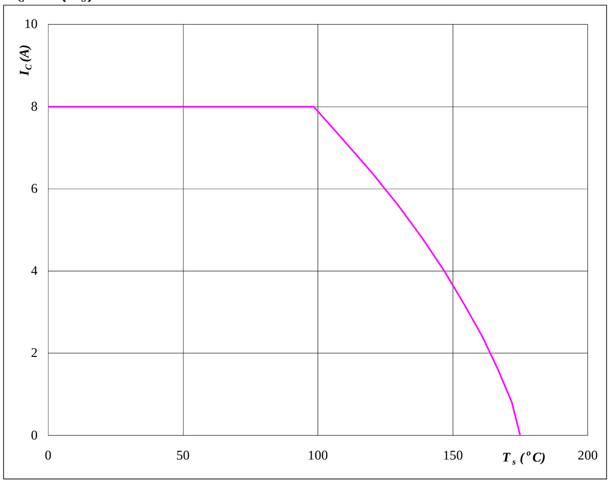
At

T_j = 175 ºC

figure 14. **IGBT**

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

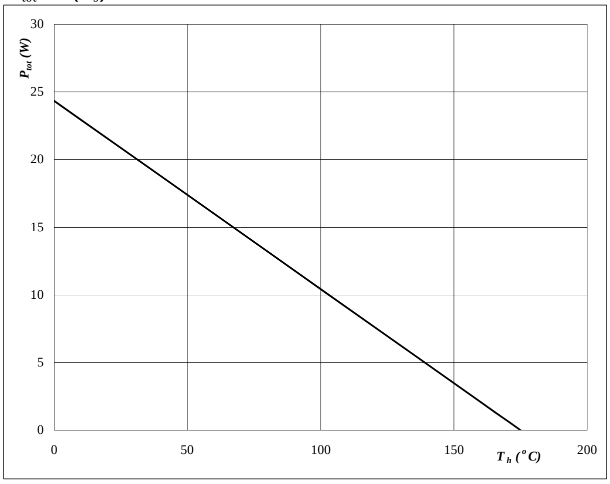
T_j = 175 ºC

U_{CC} = 15 V

figure 15. **FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



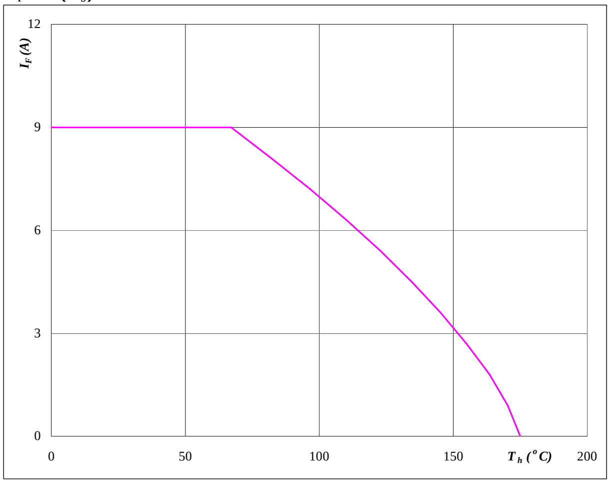
At

T_j = 175 ºC

figure 16. **FWD**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

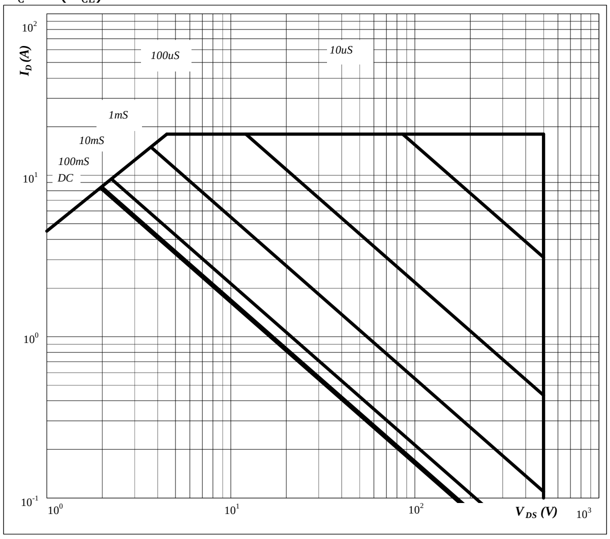
T_j = 175 ºC

PFC

figure 17. **IGBT**

Safe operating area as a function of collector-emitter voltage

I_C = f(V_{CE})



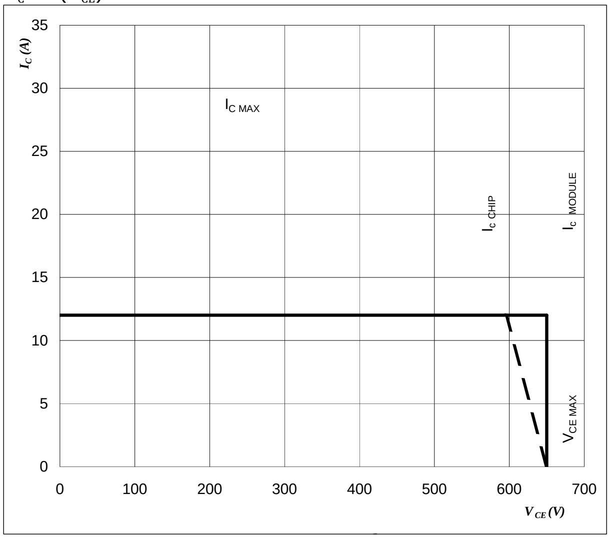
At

D =	single pulse	
T_s =	80	ºC
U_{CC}=	15	V
T_j =	T_{jmax}	

figure 18. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At

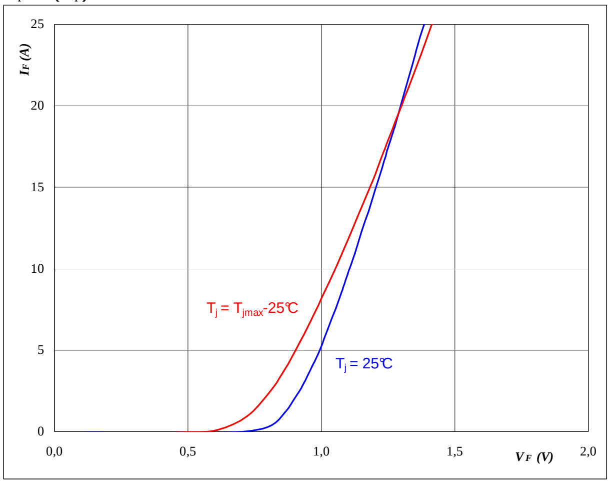
T_j =	T_{jmax}-25	ºC

Input Rectifier Bridge

figure 1. **Rectifier Diode**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



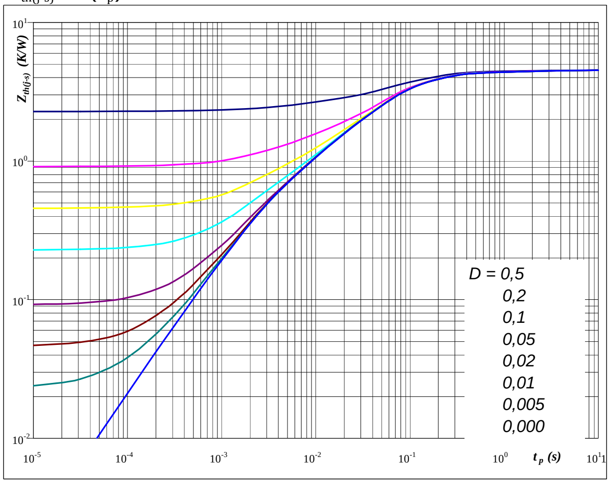
At

t_p = 250 µs

figure 2. **Rectifier Diode**

Diode transient thermal impedance as a function of pulse width

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



At

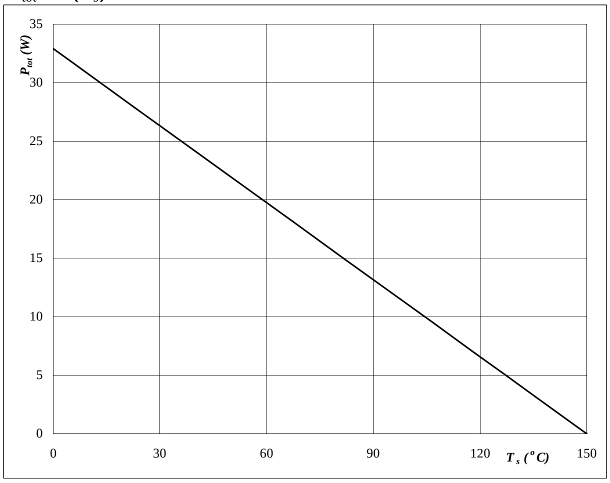
$D = t_p / T$

$R_{th(j-s)}$ = 4,56 K/W

figure 3. **Rectifier Diode**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



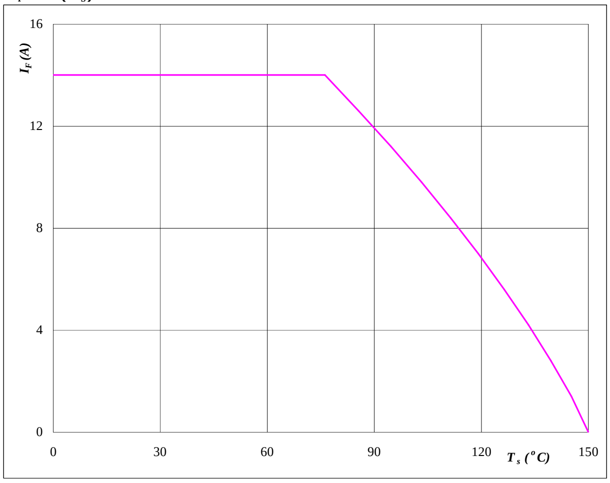
At

T_j = 150 ºC

figure 4. **Rectifier Diode**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



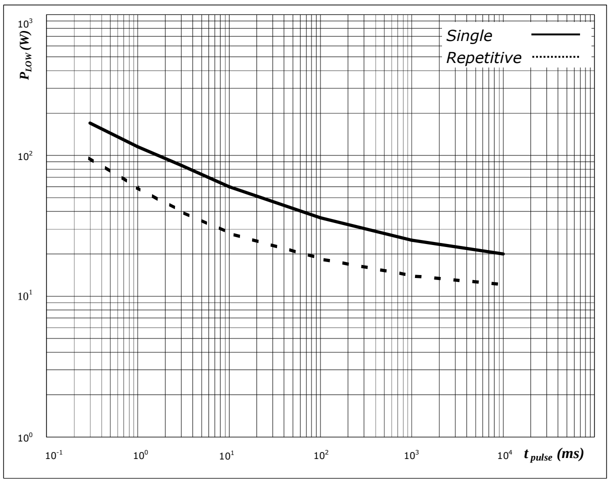
At

T_j = 150 ºC

Shunt

figure 1. **PFC Shunt**

Pulse Power R1

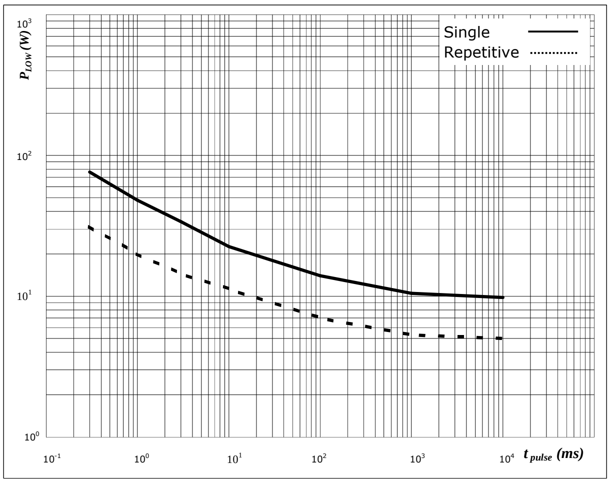


——— dR/R_0 < 5% after 1 pulse

········ dR/R_0 < 5% after 10.000 cycles; duty cycle< 0,1%

figure 2. **DC Shunt**

Pulse Power R2



——— dR/R_0 < 1% after 1 pulse

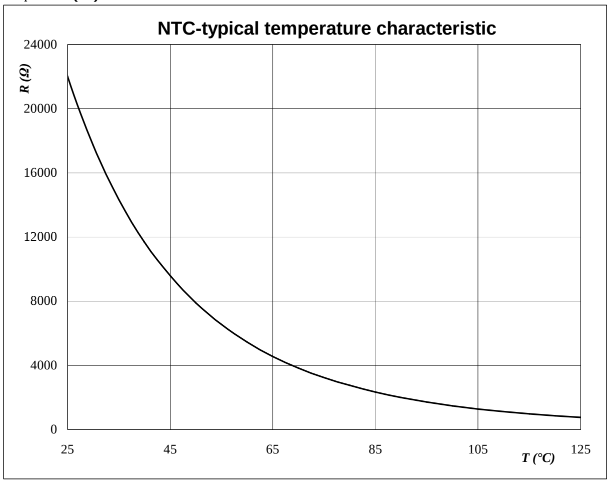
········ dR/R_0 < 1% after 10.000 cycles; duty cycle< 0,1%

Thermistor

figure 1. **Thermistor**

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$



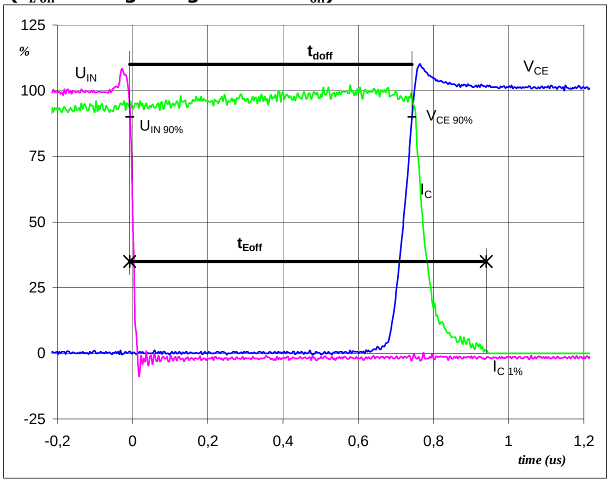
Switching Definitions Output Inverter

General conditions

T_j	=	125 °C

figure 1. IGBT

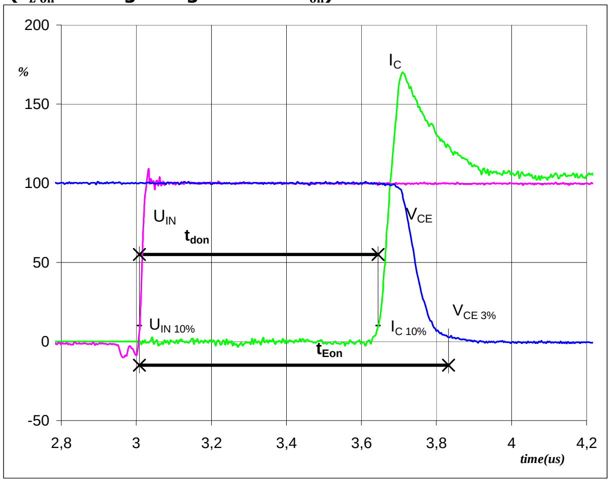
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} ($t_{E\,off}$ = integrating time for E_{off})



UIN (0%) =	0	V
UIN (100%) =	5	V
V_C (100%) =	400	V
I_C (100%) =	4	A
t_{doff} =	0,75	µs
$t_{E\,off}$ =	0,95	µs

figure 2. IGBT

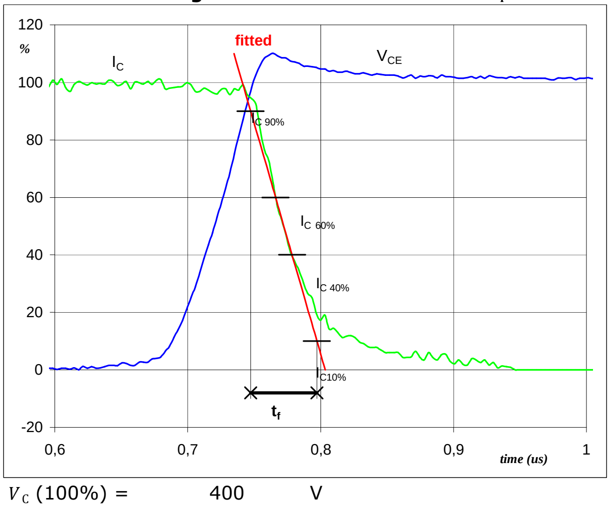
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} ($t_{E\,on}$ = integrating time for E_{on})



UIN (0%) =	0	V
UIN (100%) =	5	V
V_C (100%) =	400	V
I_C (100%) =	4	A
t_{don} =	0,64	µs
$t_{E\,on}$ =	0,82	µs

figure 3. IGBT

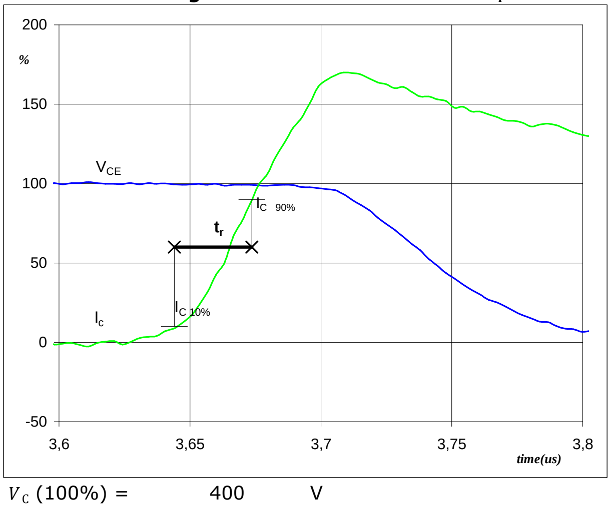
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	400	V
I_C (100%) =	4	A
t_f =	0,05	µs

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

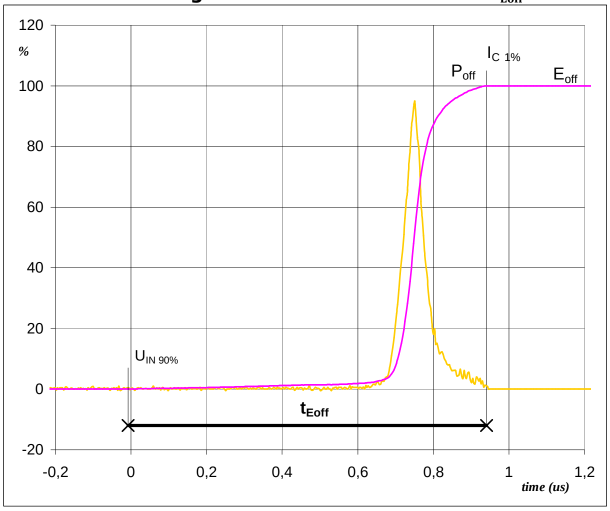


V_C (100%) =	400	V
I_C (100%) =	4	A
t_r =	0,03	µs

Switching Definitions Output Inverter

figure 5. **IGBT**

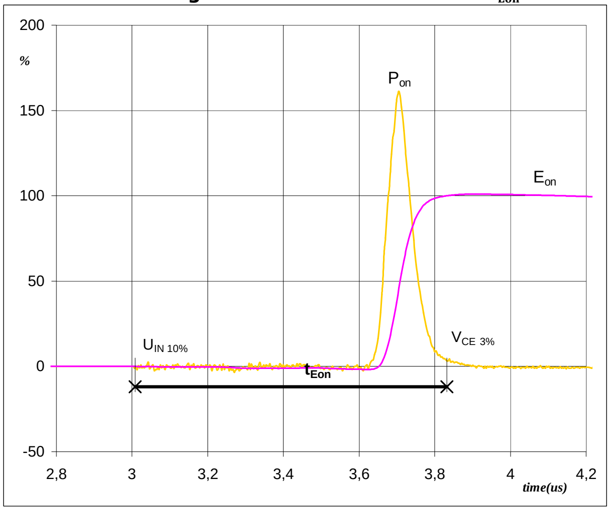
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) = 1,61 kW
E_{off} (100%) = 0,12 mJ
$t_{E\,off}$ = 0,95 μs

figure 6. **IGBT**

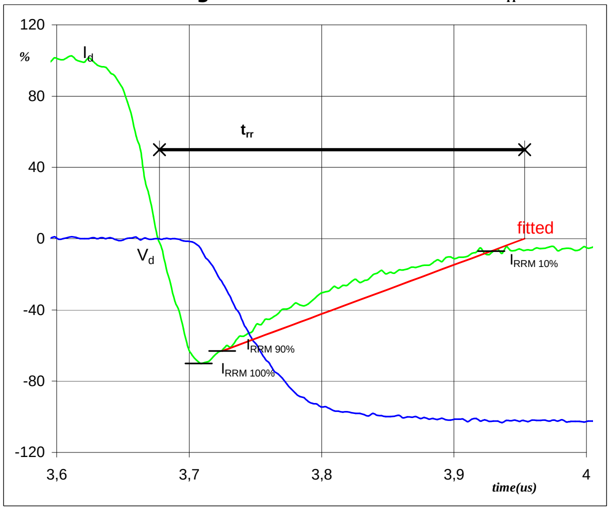
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) = 1,61 kW
E_{on} (100%) = 0,20 mJ
$t_{E\,on}$ = 0,82 μs

figure 7. **FWD**

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

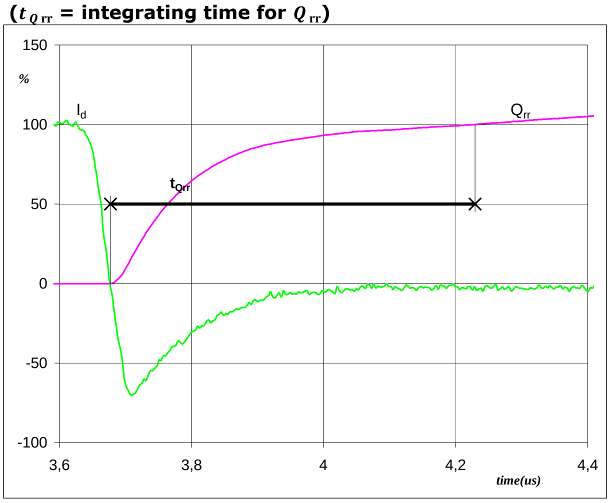


V_d (100%) = 400 V
I_d (100%) = 4 A
I_{RRM} (100%) = -3 A
t_{rr} = 0,25 μs

Switching Definitions Output Inverter

figure 8. **FWD**

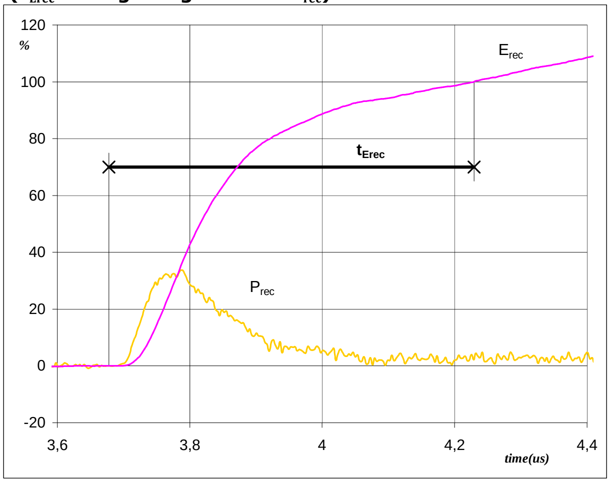
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	4	A
Q_{rr} (100%) =	0,35	µC
$t_{Q\,rr}$ =	0,55	µs

figure 9. **FWD**

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



P_{rec} (100%) =	1,61	kW
E_{rec} (100%) =	0,09	mJ
$t_{E\,rec}$ =	0,55	µs

Application data

Static logic funtion table

VCC	VBS	RCIN	ITRIP	ENABLE	FAULT	LO1,2,3	HO1,2,3
$<V_{CCUV-}$	X	X	X	X	0	0	0
15V	$<V_{BSUV-}$	X	0	3.3V	High imp	/LIN1,2,3	0
15V	15V	<3.2V↓	0	3.3V	0	0	0
15V	15V	X	$> V_{IT,TH+}$	3.3V	0	0	0
15V	15V	$> V_{RCIN,TH}$	0	3.3V	High imp	/LIN1,2,3	/HIN1,2,3
15V	15V	$> V_{RCIN,TH}$	0	0	High imp	0	0

Pin Descriptions

Pin #	Pin Name	Pin Description
1	NTC2	Temperature sensor connector 1
2	NTC1	Temperature sensor connector 2
3	InvS +	Inverter sense resistor high-side
4	InvS -	Inverter sense resistor low-side
5	EN	Enable I/O functionality
6	¬Fault	Fault output, indicates over current or under voltage (negative
7	¬LIN3	Signal input for low-side W phase
8	¬LIN2	Signal input for low-side V phase
9	¬LIN1	Signal input for low-side U phase
10	¬HIN3	Signal input for high-side W phase
11	¬HIN2	Signal input for high-side V phase
12	¬HIN1	Signal input for high-side U phase
13	V_{CC}	Driver circuit supply voltage
14	GND2	Inverter ground
15	GND	PFC ground
16	GATE	PFC gate driver input
17	AC1	Rectifier input
18	AC2	Rectifier input
19	DC1 + (coil)	Rectifier output DC +
20	PFC + (coil)	PFC coil connector
21	DC1 -	Rectifier output DC -
22	PFC -	PFC return
23	DC2 -	Inverter input DC -
24	DC2 +	Inverter input DC +
25	W	Output for W phase
26	V	Output for V phase
27	U	Output for U phase

Ordering Code & Marking - Outline - Pinout

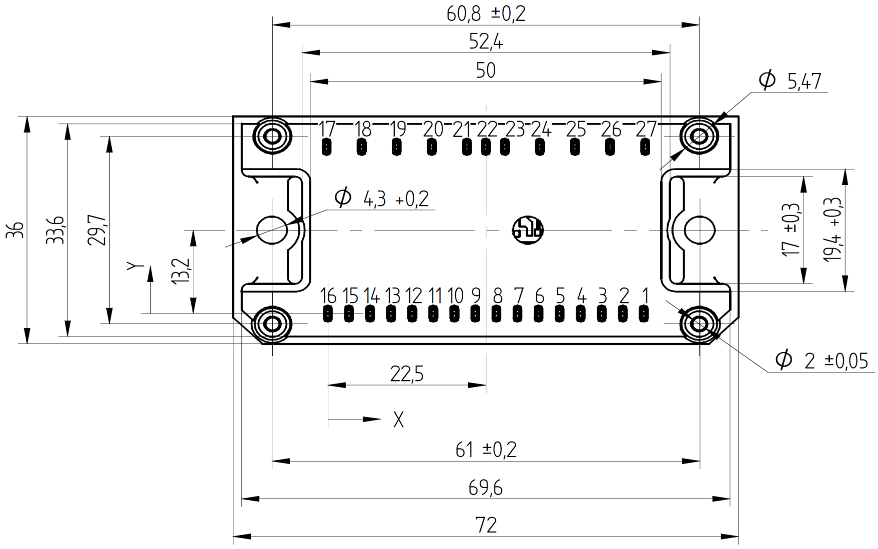
Ordering Code & Marking

Version	Ordering Code
without thermal paste, solder pins	20-1B06IPB004RC01-P952A45
with thermal paste, solder pins	20-1B06IPB004RC01-P952A45-/3/
without thermal paste, press fit pins	20-PB06IPB004RC01-P952A45Y
with thermal paste, press fit pins	20-PB06IPB004RC01-P952A45Y-/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		

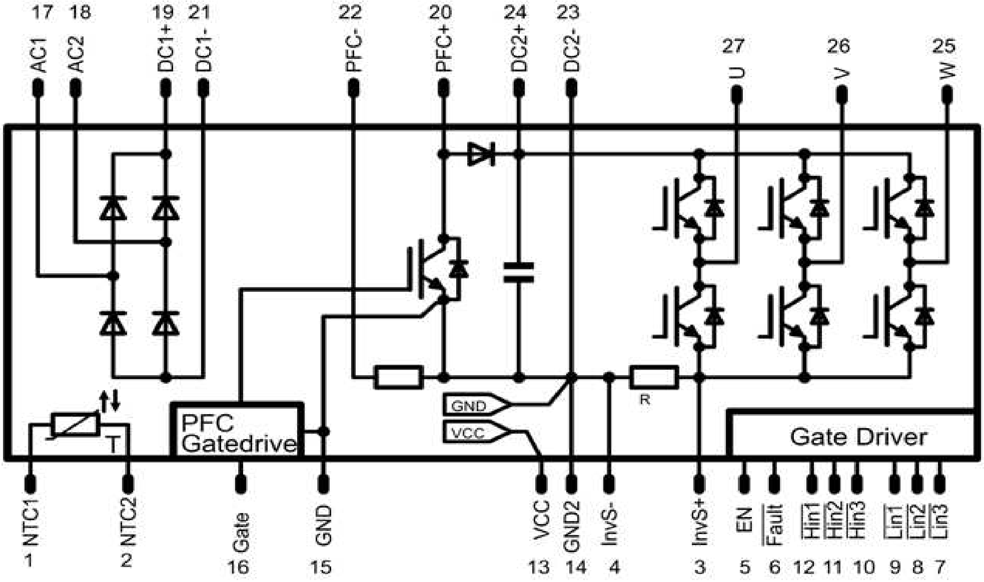
Outline

Pin table [mm]			
Pin	X	Y	Function
1	45	0	NTC2
2	42	0	NTC1
3	39	0	Inv_S+
4	36	0	Inv_S-
5	33	0	EN
6	30	0	FAULT
7	27	0	LIN3
8	24	0	LIN2
9	21	0	LIN1
10	18	0	HIN3
11	15	0	HIN2
12	12	0	HIN1
13	9	0	VCC
14	6	0	GND2
15	3	0	GND
16	0	0	GATE
17	-0,2	26,4	AC1
18	4,8	26,4	AC2
19	9,8	26,4	DC1+
20	14,8	26,4	PFC+
21	19,8	26,4	DC1-
22	22,5	26,4	PFC-
23	25,2	26,4	DC2-
24	30,2	26,4	DC2+
25	35,2	26,4	W
26	40,2	26,4	V
27	45,2	26,4	U



Ordering Code & Marking - Outline - Pinout

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1,T2,T3,T4,T5,T6	IGBT	600 V	4 A	Inverter Transistor	
D1,D2,D3,D4,D5,D6	FWD	600 V	4 A	Inverter Diode	
T7	IGBT	650 V	15 A	PFC IGBT	
D12	FWD	650 V	15 A	PFC Diode	
D11	FWD	650 V	6 A	PFC inverse Diode	
R3	Resistor			PFC Shunt	
D7,D8,D9,D10	Rectifier	1600 V	12 A	Input Rectifier Diode	
R2	Resistor			DC Shunt	
C1	Capacitor	500 V		DC link Capacitor	
T	Thermistor			Thermistor	

Packaging instruction					
Standard packaging quantity (SPQ)	**100**	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 1B packages see vincotech.com website.

Package data
Package data for *flow* 1B 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
20-xB06IPB010RC01-P952A45x-D3-14	20 Jan. 2017	Rth values and conditions values changed	1-2, 4-5, 12, 19, 22