20-PB06IPB010RC-P955A40Y
20-1B06IPB010RC-P955A40

datasheet

***flow* IPM 1B** — **600 V / 10 A**

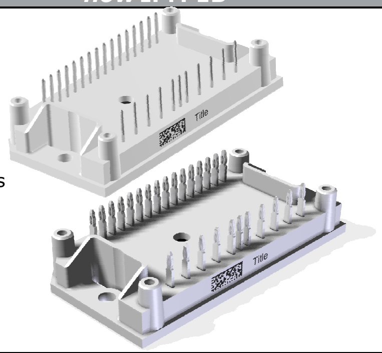
Features
• CIP-topology (converter + inverter + PFC) • Optimized for PFC frequencies of 20kHz..100kHz and inverter frequencies of 4kHz..20kHz • Integrated PFC controller circuit with programmable DC output voltage and PWM frequency • Inverter gate drive inclusive bootstrap for high side power supply • Over current and short circuit protection • Integrated DC-capacitor • Sense output of DC-current • Temperature sensor • Conclusive power flow, all power connections on one side, no input output X-ing • Optional pre-applied thermal interface material

Target Applications
• Fans and Pumps • AirCon • Electrical Tools • Low power industrial drive

Types
• 20-1B06IPB010RC-P955A40 • 20-PB06IPB010RC-P955A40Y

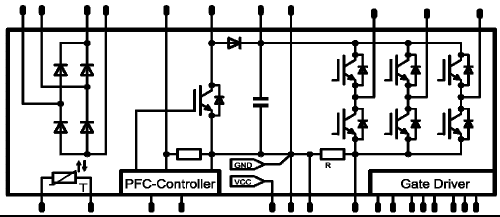
***flow* IPM 1B**

Solder pins



Press-fit

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=Tjmax	T_h=80°C T_c=80°C	16 21	A
Surge forward current	I_{FSM}	t_p=10ms 50Hz half sine wave	T_j=150°C	130	A
I2t-value	I^2t			80	A2s
Power dissipation	P_{tot}	T_j=Tjmax	T_h=80°C T_c=80°C	19 29	W
Maximum Junction Temperature	T_{jmax}			150	°C
PFC IGBT					
Collector-emitter break down voltage	V_{CE}			650	V
DC collector current	I_C	T_j=Tjmax	T_h=80°C T_c=80°C	19 20	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		90	A
Turn off safe operating area		V_{CE} ≤ 650V, T_j ≤ T_{op} max		90	A
Power dissipation	P_{tot}	T_j=Tjmax	T_h=80°C T_c=80°C	37 56	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=Tjmax	T_h=80°C T_c=80°C	6 8	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		12	A
Power dissipation	P_{tot}	T_j=Tjmax	T_h=80°C T_c=80°C	12 19	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=Tjmax	T_h=80°C T_c=80°C	13 16	A
Surge forward current	I_{FSM}	t_p=8,3ms 60 Hz half sine wave		180	A
I^2t-value	I^2t			130	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		60	A
Power dissipation	P_{tot}	T_j=Tjmax	T_h=80°C T_c=80°C	25 37	W
Maximum Junction Temperature	T_{jmax}			175	°C
Inverter Transistor					
Collector-emitter break down voltage	V_{CE}			600	V
DC collector current	I_C	T_j=Tjmax	T_h=80°C T_c=80°C	9 12	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		30	A
Turn off safe operating area		V_{CE} ≤ 600V, T_j ≤150°C		20	A
Power dissipation	P_{tot}	T_j=Tjmax	T_h=80°C T_c=80°C	20 31	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150°C V_{GE}=15V		5 400	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=Tjmax	T_h=80°C T_c=80°C	8 11	A
Power dissipation	P_{tot}	T_j=Tjmax	T_h=80°C T_c=80°C	17 25	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 Controller*				
VCC supply voltage	V_{CC}	VCC common with gate driver IC	26	V
VSENSE voltage	V_{VSENSE}		5,3	V
Vsense Current	I_{VSENSE}		±1	mA
FREQ pin voltage	V_{FREQ}		5,3	V
Maximum Junction Temperature	T_{jmax}		125	°C

* for more information see infineon's datasheet ICE3PCS02

Parameter	Symbol	Condition	Value	Unit
DC - Shunt				
DC forward current	I_F		8	A
Power dissipation	P_{tot}		3,2	W
DC link Capacitor				
Maximum DC voltage	V_{MAX}	T_c=25°C	500	V
Gate Driver*				
Supply voltage	U_{CC}		20	V
Input voltage (LIN, HIN, EN)	U_{IN}		10	V
Output voltage (FAULT)	U_{OUT}		VCC+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 conditio	T_{op}		-40...+(Tjmax - 25)	°C
Insulation Properties				
Insulation voltage	V_{is}	t=2s DC voltage	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] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Input Rectifier Diode										
Forward voltage	V_F				7	Tj=25°C Tj=125°C		1,04 0,97		V
Threshold voltage (for power loss calc. only)	V_{to}				7	Tj=25°C Tj=125°C		0,87 0,74		V
Slope resistance (for power loss calc. only)	r_t				7	Tj=25°C Tj=125°C		25 33		mΩ
Reverse current	I_r			1200		Tj=25°C Tj=125°C			0,01	mA
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Phase-Change Material λ = 3,4W/mK						3,66		K/W
PFC IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0003	Tj=25°C Tj=125°C	3,3	4	4,7	V
Collector-emitter saturation voltage	V_{CEsat}		15		30	Tj=25°C Tj=125°C		2,12 2,44	2,22	V
Collector-emitter cut-off	I_{CES}		0	650		Tj=25°C Tj=125°C			0,04	mA
Turn-on delay time	$t_{d(on)}$					Tj=25°C Tj=125°C		27 28		
Rise time	t_r					Tj=25°C Tj=125°C		5 7		ns
Turn-off delay time	$t_{d(off)}$		U_{CC}=15V	400	10	Tj=25°C Tj=125°C		122 154		
Fall time	t_f					Tj=25°C Tj=125°C		2 2		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		0,1516 0,2417		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		0,0317 0,0583		
Input capacitance	C_{ies}							2100		
Output capacitance	C_{oss}	f=1MHz	0	25		Tj=25°C		45		pF
Reverse transfer capacitance	C_{rss}							7,7		
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Phase-Change Material λ = 3,4W/mK						2,56		K/W
PFC Inverse Diode										
Diode forward voltage	V_F				10	Tj=25°C Tj=125°C	1,23	1,12 0,97	1,87	V
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Phase-Change Material λ = 3,4W/mK						7,75		K/W
PFC Diode										
Forward voltage	V_F				15	Tj=25°C Tj=125°C		1,92 1,97	2,22	V
Reverse leakage current	I_{rm}			400	10	Tj=25°C Tj=125°C			1,6	μA
Peak recovery current	I_{RRM}					Tj=25°C Tj=125°C		15 19		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		22 36		ns
Reverse recovery charge	Q_{rr}		U_{CC}=15V	400	10	Tj=25°C Tj=125°C		0,2008 0,4358		μC
Reverse recovered energy	E_{rec}					Tj=25°C Tj=125°C		0,0150 0,0504		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					Tj=25°C Tj=125°C		2033 891		A/μs
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Phase-Change Material λ = 3,4W/mK						3,87		K/W
PFC Shunt										
R1 value	R							50		mΩ

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Inverter Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,00017	Tj=25°C Tj=125°C	4,4	5	5,6	V
Collector-emitter saturation voltage*	V_{CEsat}		15		10	Tj=25°C Tj=125°C	1,88	2,20 2,32	2,62	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		Tj=25°C Tj=125°C			0,002	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=125°C			120	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time **	$t_{d(on)}$		U_{CC}=15V U_{IN}=5V	400	6	Tj=25°C Tj=125°C		582 631		ns
Rise time	t_r					Tj=25°C Tj=125°C		20 25		
Turn-off delay time **	$t_{d(off)}$					Tj=25°C Tj=125°C		837 950		
Fall time	t_f					Tj=25°C Tj=125°C		16 22		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		0,1950 0,3241		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		0,1611 0,2042		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		655		pF
Output capacitance	C_{oss}							37		
Reverse transfer capacitance	C_{rss}							22		
Gate charge	Q_G		15	480	10	Tj=25°C		64		nC
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Phase-Change Material λ = 3,4W/mK						4,72		K/W
* chip data ** including gate driver										
Inverter Diode										
Diode forward voltage	V_F				10	Tj=25°C Tj=125°C	1,68	2,23 2,18	2,42	V
Peak reverse recovery current	I_{RRM}		U_{CC}=15V U_{IN}=5V	400	6	Tj=25°C Tj=125°C		6 6		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		179 276		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=125°C		0,3566 0,6738		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					Tj=25°C Tj=125°C		181 46		A/μs
Reverse recovered energy	E_{rec}					Tj=25°C Tj=125°C		0,0867 0,1610		mWs
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Phase-Change Material λ = 3,4W/mK						5,72		K/W
DC - Shunt										
R2 value	R	Tol. ±1%				Tj=25°C		25		mΩ
DC link Capacitor										
C Value	C							100		nF

Characteristic Values

Parameter	Symbol	Conditions	V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	Unit
Gate Driver										
Supply voltage	U_{CC}					Tj=25°C Tj=125°C	13	15	17,5	V
Quiescent Vcc supply current	I_{QCC}	U_{LIN} = 0V; U_{HIN}=3,3V				Tj=25°C Tj=125°C		1,3	2	mA
Input voltage (LIN, HIN, EN)	U_{IN}					Tj=25°C Tj=125°C	0		5	
Logic "0" input voltage (LIN, HIN)	U_{IH}					Tj=25°C Tj=125°C	1,7	2,1	2,4	
Logic "1" input voltage (LIN, HIN)	U_{IL}	U_{CC} = 15V				Tj=25°C Tj=125°C	0,7	0,9	1,1	
Positive going threshold voltage (EN)	$U_{EN,TH+}$					Tj=25°C Tj=125°C	1,9	2,1	2,3	V
Negative going threshold voltage (EN)	$U_{EN,TH-}$					Tj=25°C Tj=125°C	1,1	1,3	1,5	
Input clamp voltage (LIN, HIN, EN)	$U_{IN,CLAMP}$	I_{IN} = 4mA				Tj=25°C Tj=125°C	9	10,3	12	
ITRIP positive going threshold	$U_{TR,TH+}$					Tj=25°C Tj=125°C	380	445	510	mV
Input bias current LIN high	I_{LIN+}	U_{LIN} = 3,3V				Tj=25°C Tj=125°C		70	100	
Input bias current LIN low	I_{LIN-}	U_{LIN} = 0V				Tj=25°C Tj=125°C		110	200	
Input bias current HIN high	I_{HIN+}	U_{HIN} = 3,3V				Tj=25°C Tj=125°C		70	100	µA
Input bias current HIN low	I_{HIN-}	U_{HIN} = 0V				Tj=25°C Tj=125°C		110	120	
Input bias current EN high	I_{EN+-}	U_{HIN} = 3,3V				Tj=25°C Tj=125°C		45	120	
Output voltage (FAULT)	U_{FLT}					Tj=25°C Tj=125°C	0		U_{CC}	V
Low on resistor of pull down trans. (FAULT)	$R_{ON,FLT}$	U_{FAULT}=0,5V				Tj=25°C Tj=125°C		45	100	Ω
Pulse width for ON or OFF	t_{IN}					Tj=25°C Tj=125°C	1			µs
Turn-on propagation delay (LIN, HIN)	t_{ON}	$U_{LIN/HIN}$ = 0V or 3,3V				Tj=25°C Tj=125°C	400	530	800	ns
Turn-off propagation delay (LIN, HIN)	t_{OFF}	$U_{LIN/HIN}$ = 0V or 3,3V				Tj=25°C Tj=125°C	360	490	760	
FAULT reset time	t_{RST}					Tj=25°C Tj=125°C		4		ms
Fixed deadtime between high and low side	t_{DT}	$U_{LIN/HIN}$ = 0V & 3,3V				Tj=25°C Tj=125°C	150	310		ns
PFC Controller										
VCC turn-on threshold	V_{CCon}						11,5	12,0	12,9	V
VCC turn-off threshold	V_{CCUVLO}						10,5	11,0	11,9	V
Operating current with active GATE	I_{CCHG}	C_L=1nF						6,4	8,5	mA
Operating current during standby	I_{CCstby}							3,5	4,7	mA
PFC switching fequency	F_{SWnom}	Set with an internal resistor R_{FREQ}=220kΩ*						20		kHz
DC link voltage	DC2+	Set with an internal resistor divider**					339	350	361	V
DC link treshold (OVP1) low to high	$V_{OVP1L2H}$	relative to output voltage OVP1 values varies with external resistor Feedback voltage V_{DClink}/130 can be measured at VSENSE pin				Tj=25°C		108		%
DC link treshold (OVP1) high to low	$V_{OVP1H2L}$							100		%
Blanking time for OVP1	t_{OVP1}							12		µs
DC link treshold (OVP1) hysteresis	V_{OVP1_HYS}						6	8	11	%
DC link treshold (OVP2) low to high	V_{OVP2_L2H}						428	443	460	V
DC link treshold (OVP2) high to low	V_{OVP2_H2L}	relative to OVP2						92		%
Blanking time for OVP2	t_{OVP2}							12		µs

*switching frequency is setable by an external resistor between pins 32 (see figure 1 for values)
**DC link voltage is setable by an external resistor between pins 32 (see figure 2 for values)

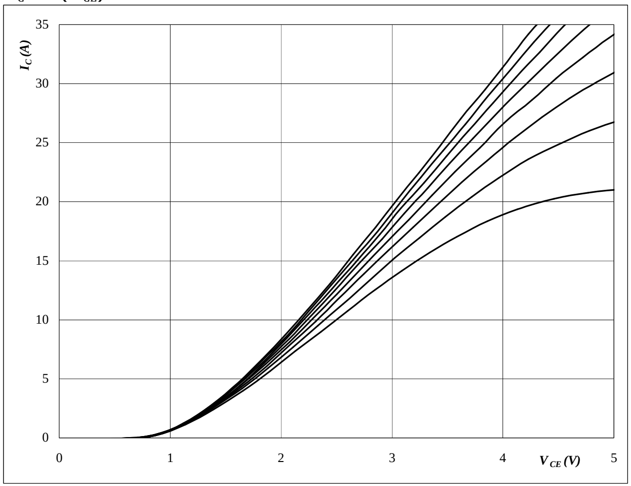
Parameter	Symbol	Conditions	V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	Unit
Thermistor										
Rated resistance	R					Tj=25°C		22000		Ω
Deviation of R100	$\Delta R/R$	R100=1486 Ω				Tj=100°C	-12		12	%
Power dissipation	P					Tj=25°C		200		mW
Power dissipation constant						Tj=25°C		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				Tj=25°C		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				Tj=25°C		3998		K
Vincotech NTC Reference						Tj=25°C			B	

Output Inverter

Figure 1 Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

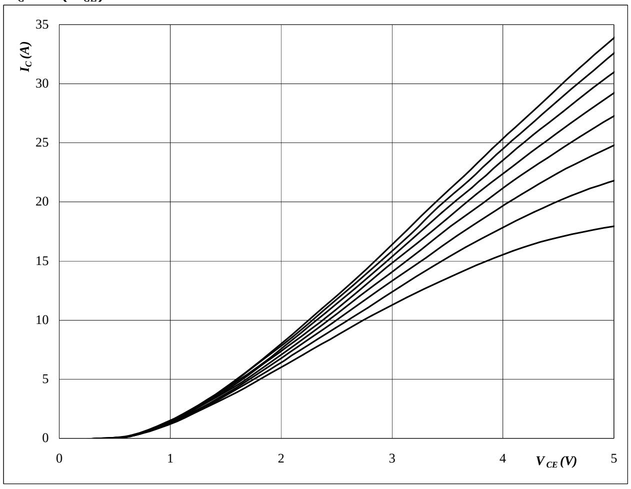
T_j = 25 °C

U_{CC} from 10 V to 17 V in steps of 1 V

Figure 2 Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

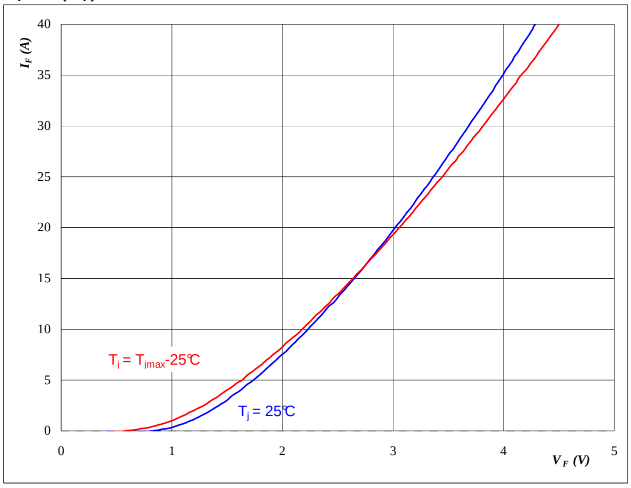
T_j = 125 °C

U_{CC} from 10 V to 17 V in steps of 1 V

Figure 3 Output inverter FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

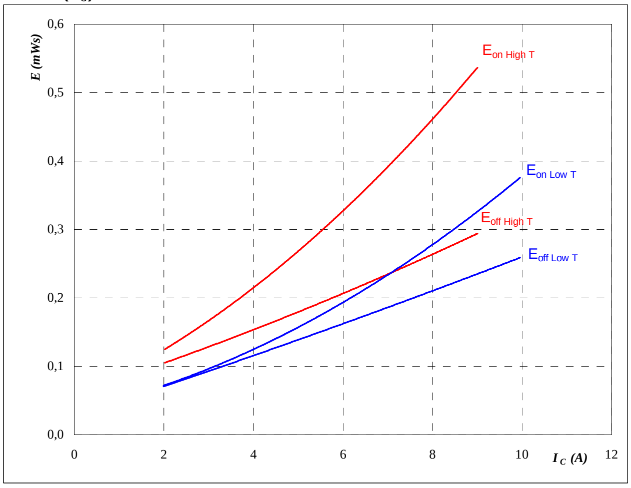
t_p = 250 µs

Output Inverter

Figure 4 Output inverter IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



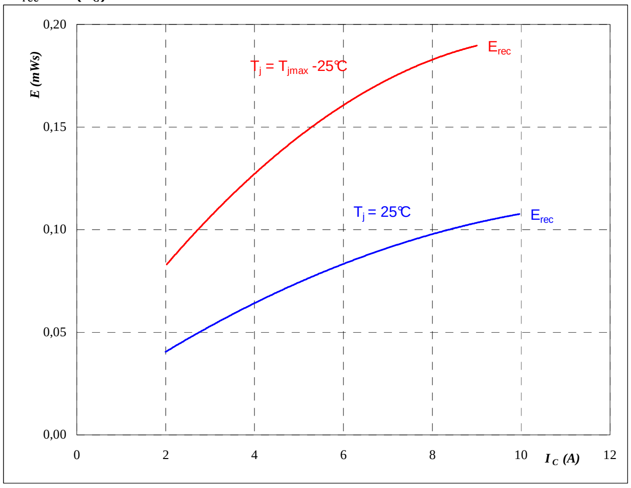
With an inductive load at

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

Figure 5 Output inverter FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



With an inductive load at

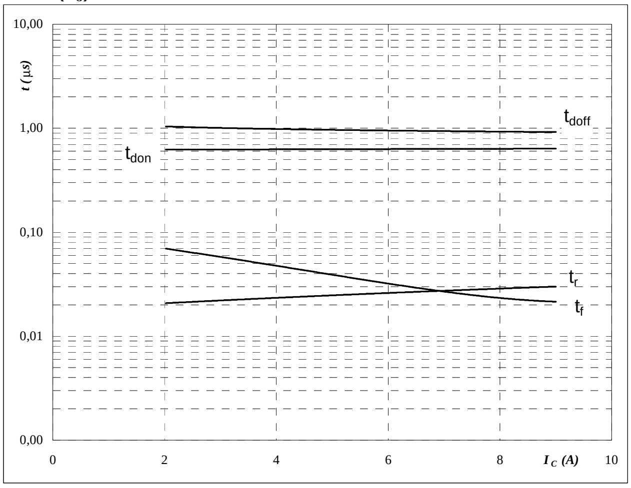
T_j =	25/125	°C
V_{CE} =	400	V
U_{CC} =	15	V

Output Inverter

Figure 6	Output inverter IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



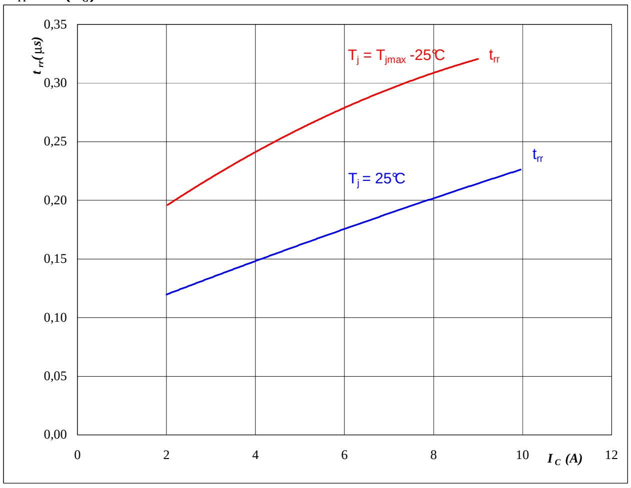
With an inductive load at

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

Figure 7	Output inverter FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



At

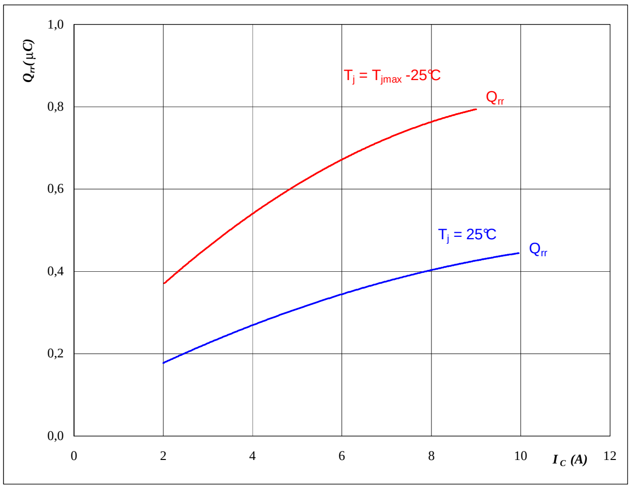
T_j =	25/125	°C
V_{CE} =	400	V
U_{CC} =	15	V

Output Inverter

Figure 8	Output inverter FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



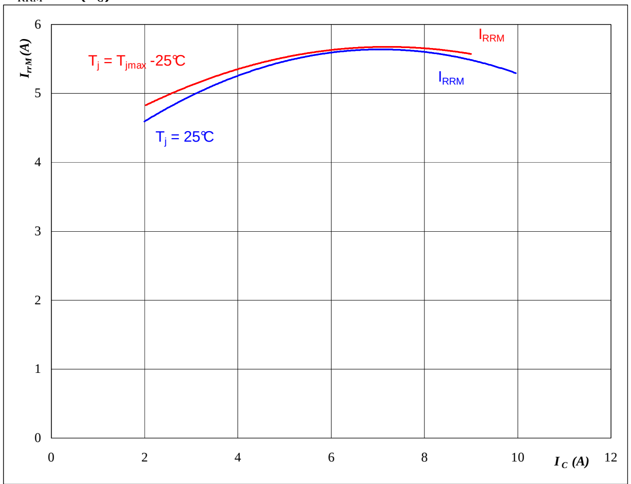
At

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

Figure 9	Output inverter FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



At

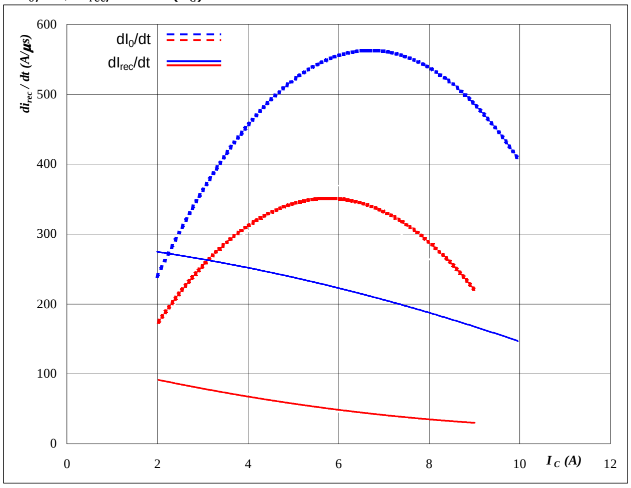
T_j =	25/125	°C
V_{CE} =	400	V
U_{CC} =	15	V

Output Inverter

Figure 10 Output inverter FWD

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

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



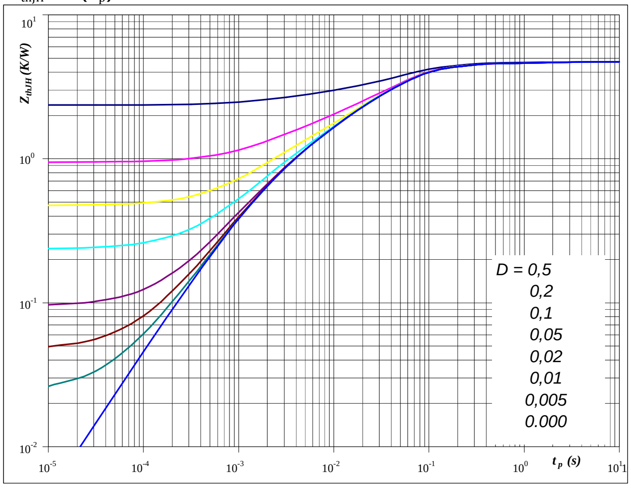
At

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

Figure 11 Output inverter IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	4,72	K/W

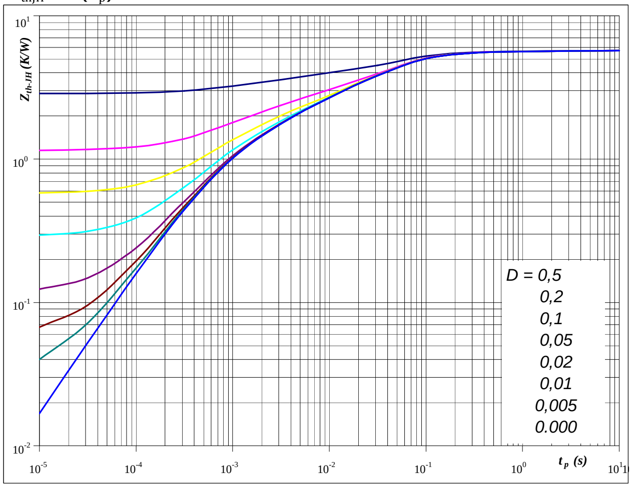
IGBT thermal model values
Phase change interface

R (K/W)	Tau (s)
0,14	2,1E+00
0,66	1,7E-01
2,74	4,0E-02
0,76	6,5E-03
0,42	1,5E-03

Figure 12 Output inverter FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	5,72	K/W

FWD thermal model values
Phase change interface

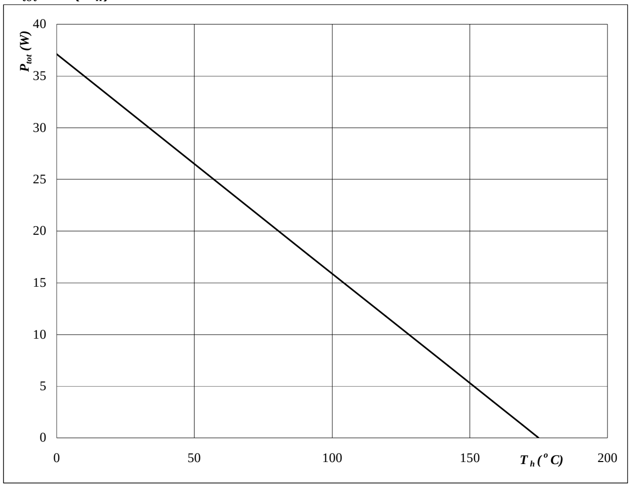
R (K/W)	Tau (s)
0,11	3,2E+00
0,37	2,6E-01
2,69	4,8E-02
0,84	1,2E-02
0,98	2,8E-03
0,73	6,0E-04

Output Inverter

Figure 13 Output inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



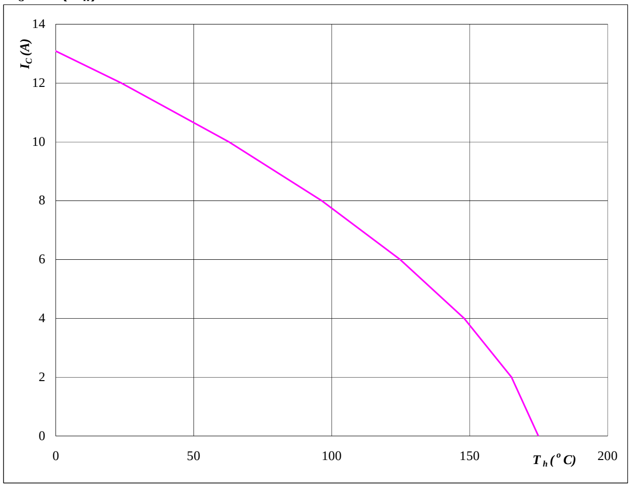
At

T_j = 175 °C

Figure 14 Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

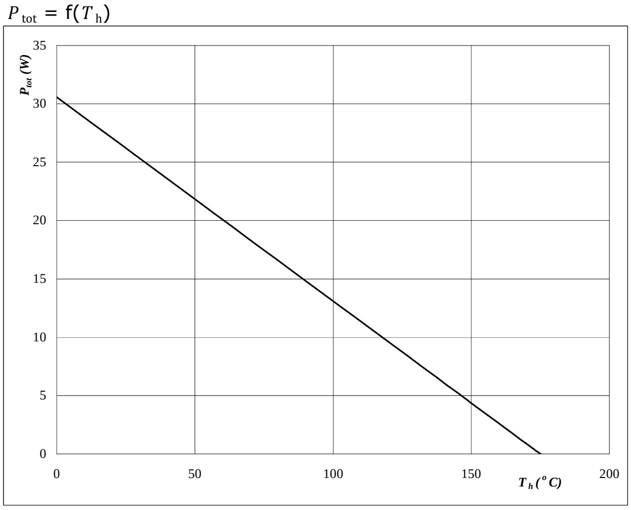
T_j = 175 °C

U_{CC} = 15 V

Figure 15 Output inverter FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



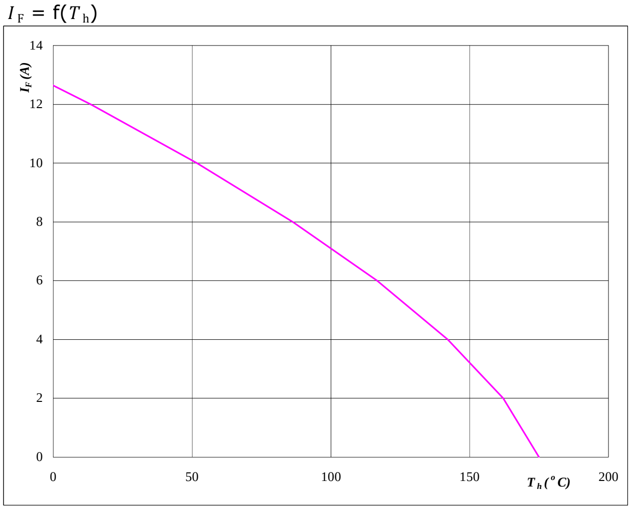
At

T_j = 175 °C

Figure 16 Output inverter FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

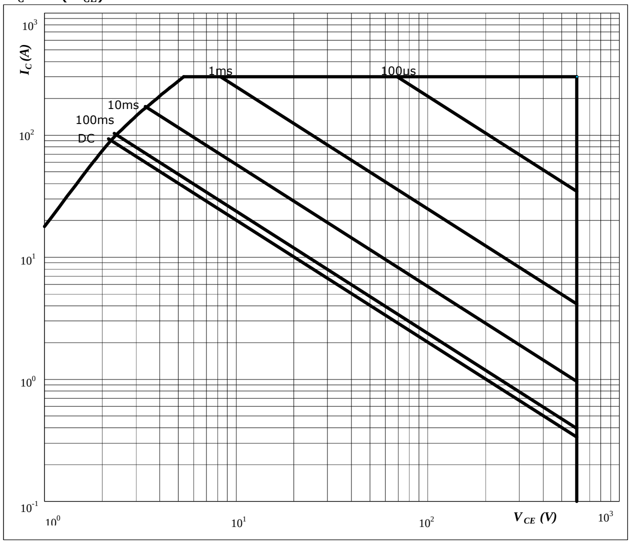
T_j = 175 °C

Output Inverter

Figure 17	Output inverter IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



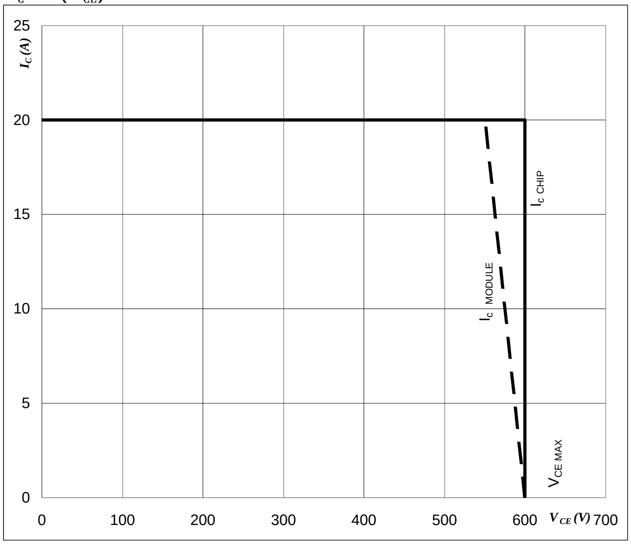
At

$T_j \leq$	T_{jmax}	
U_{CC} =	15	V

Figure 18 Output inverter IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j = T_{jmax}-25 ºC

$U_{ccminus}=U_{ccplus}$

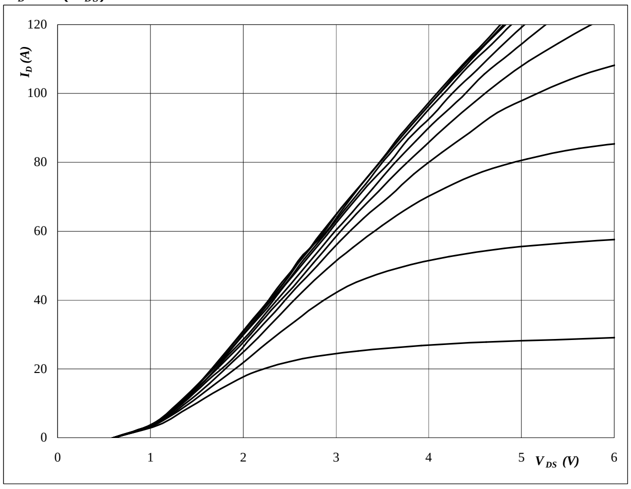
Switching mode : 3 level switching

PFC

Figure 1 PFC IGBT

Typical output characteristics

$I_D = f(V_{DS})$



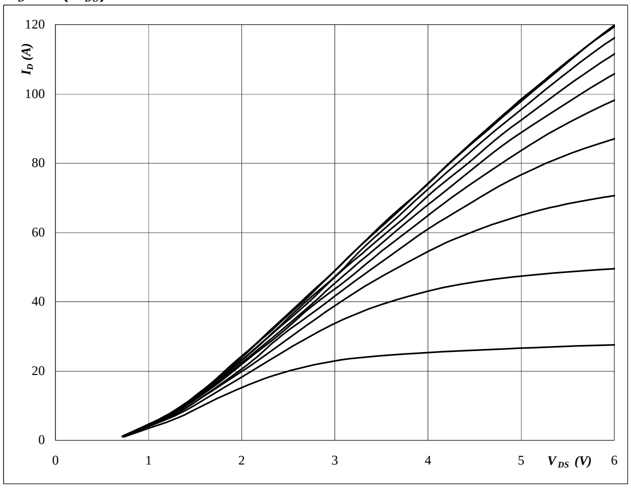
At

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

Figure 2 PFC IGBT

Typical output characteristics

$I_D = f(V_{DS})$



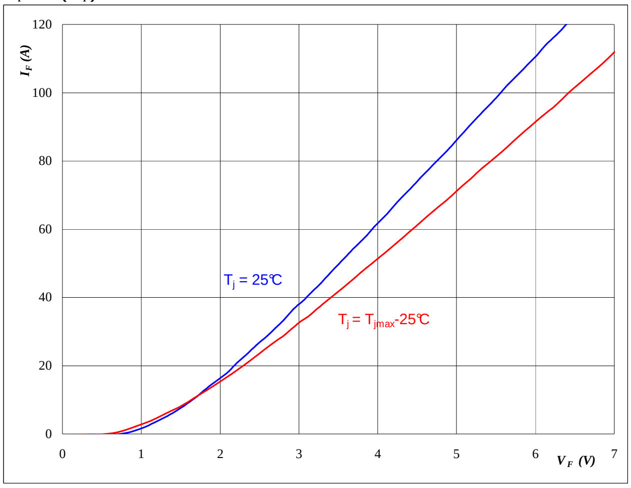
At

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

Figure 3 PFC FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

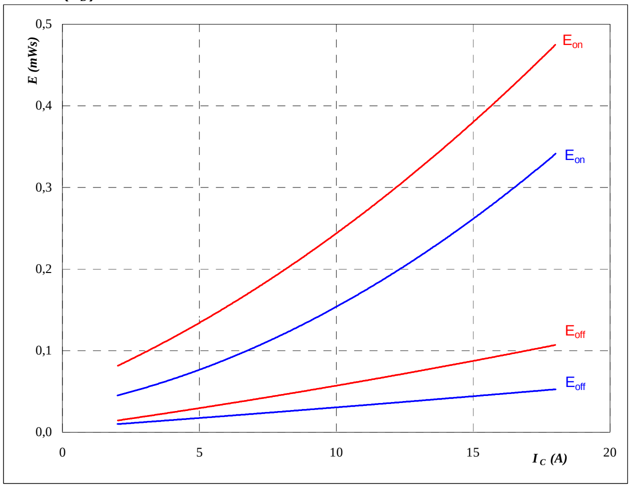
t_p =	250	µs

PFC

Figure 4 PFC IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_D)$



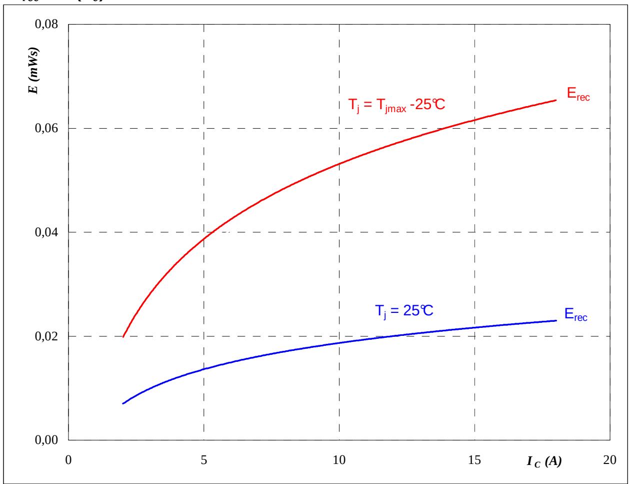
With an inductive load at

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

Figure 5 PFC IGBT

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

$E_{rec} = f(I_c)$



With an inductive load at

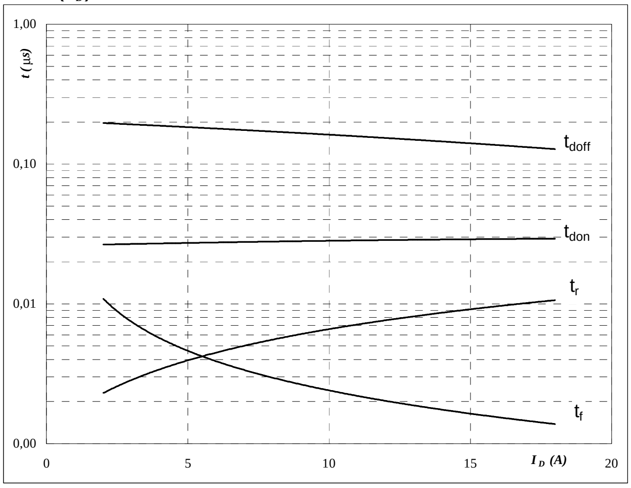
T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	15	V

PFC

Figure 6 PFC IGBT

Typical switching times as a function of collector current

$t = f(I_D)$



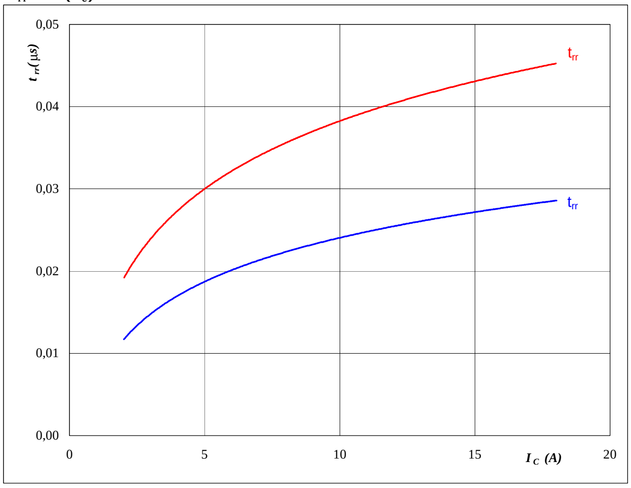
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	15	V

Figure 7 PFC FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



At

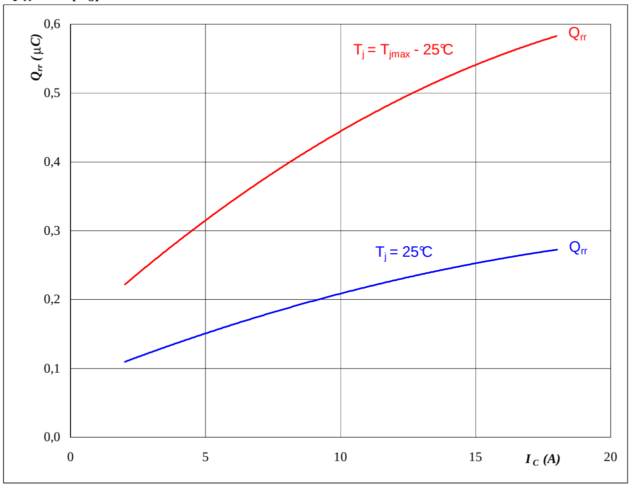
T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	15	V

PFC

Figure 8 PFC FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



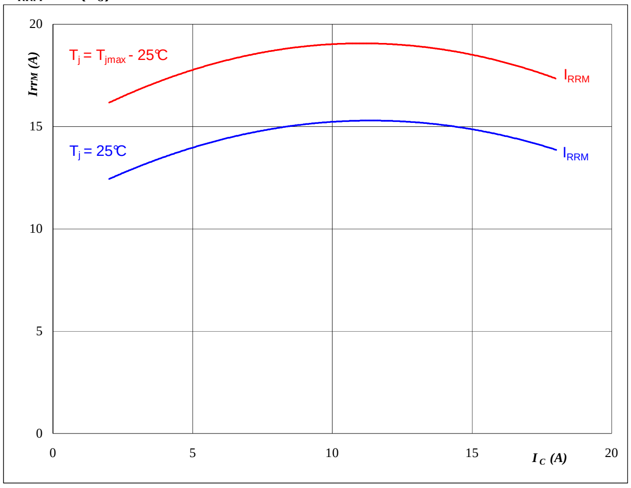
At

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

Figure 9 PFC FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



At

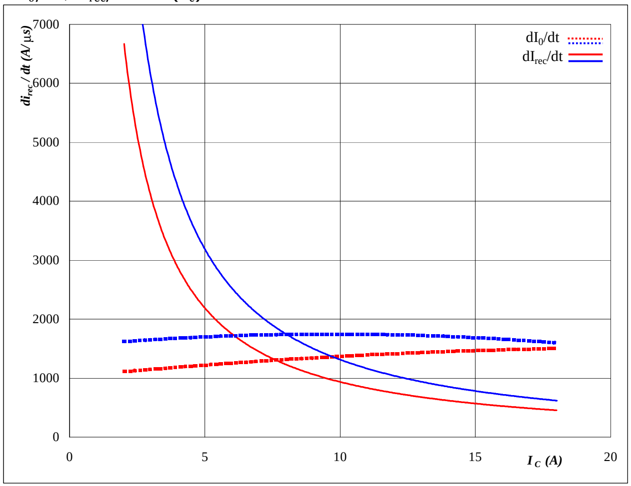
T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	15	V

PFC

Figure 10 PFC FWD

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

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



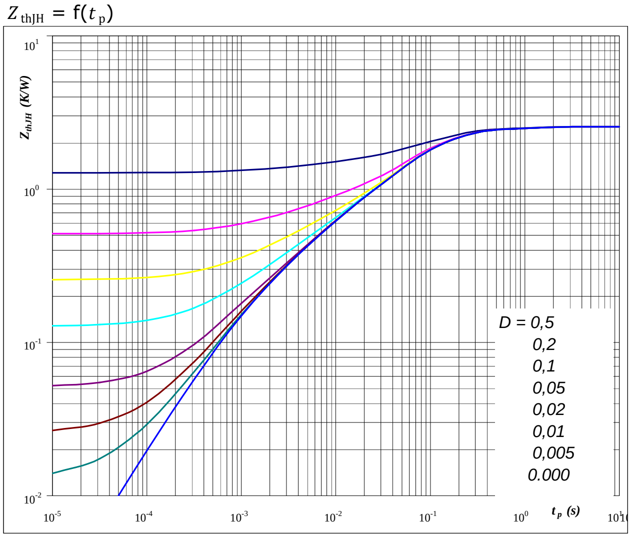
At

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

Figure 11 PFC IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	2,56	K/W

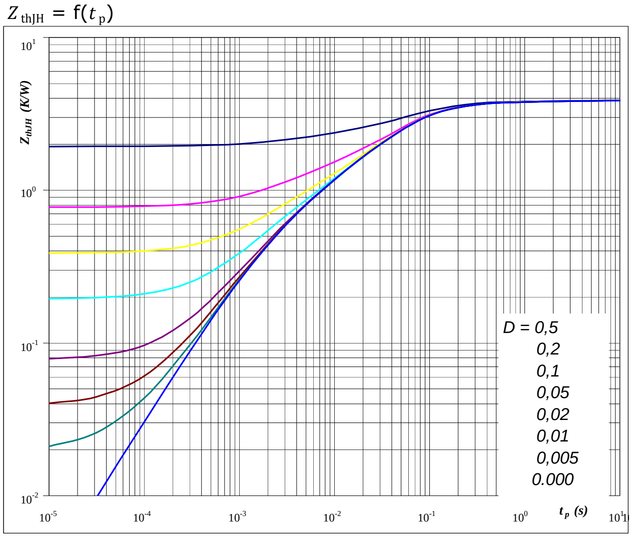
IGBT thermal model values
Phase change interface

R (K/W)	Tau (s)
0,21	0,780
1,120	0,117
0,829	0,044
0,314	0,005
0,078	0,001

Figure 12 PFC FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	3,87	K/W

FWD thermal model values
Phase change interface

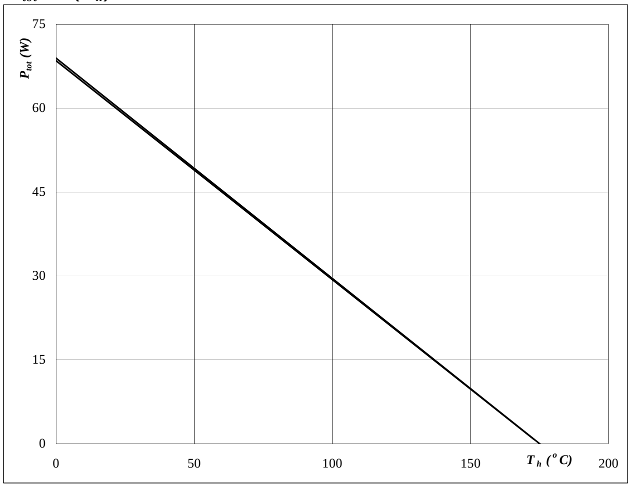
R (K/W)	Tau (s)
0,11	2,763
0,56	0,226
2,29	0,051
0,62	0,008
0,28	0,002

PFC

Figure 13 PFC IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



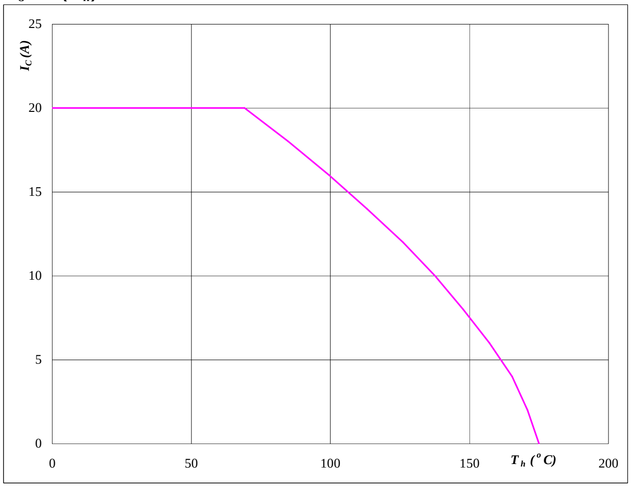
At

T_j = 175 °C

Figure 14 PFC IGBT

Collector/Drain current as a function of heatsink temperature

$I_C = f(T_h)$



At

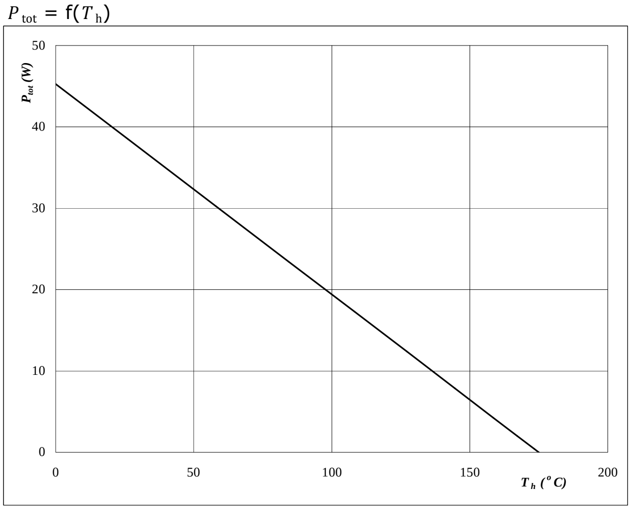
T_j = 175 °C

U_{CC} = 10 V

Figure 15 PFC FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



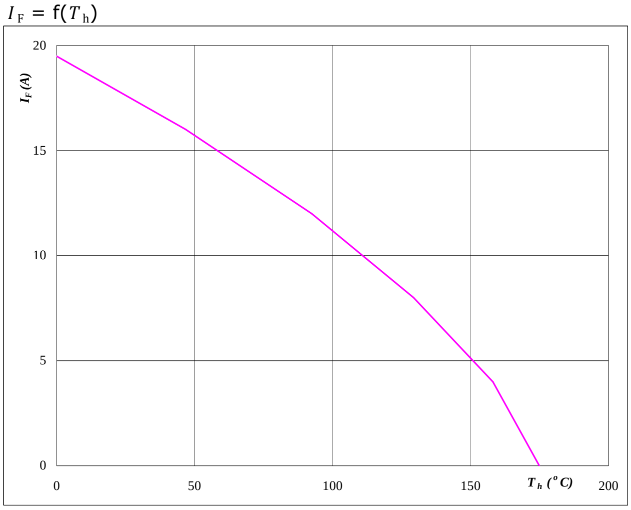
At

T_j = 175 °C

Figure 16 PFC FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

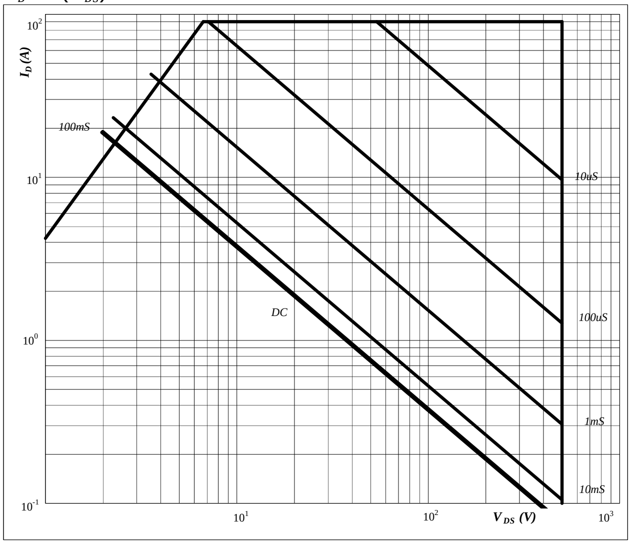
T_j = 175 °C

PFC

Figure 17 PFC IGBT

Safe operating area as a function of drain-source voltage

$I_D = f(V_{DS})$



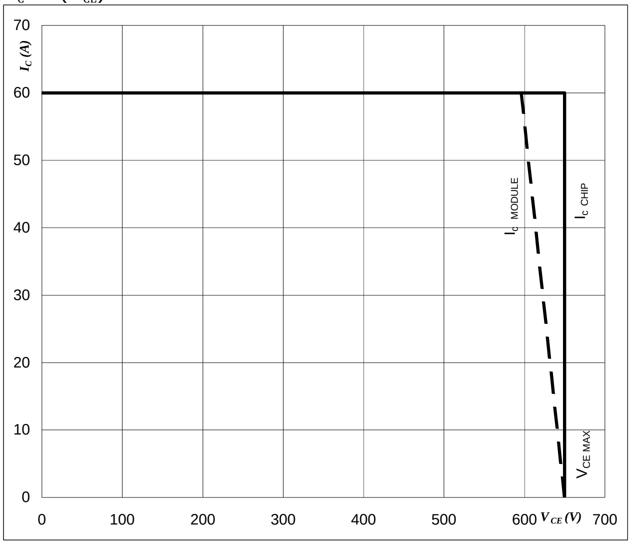
At

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

Figure 18 PFC IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

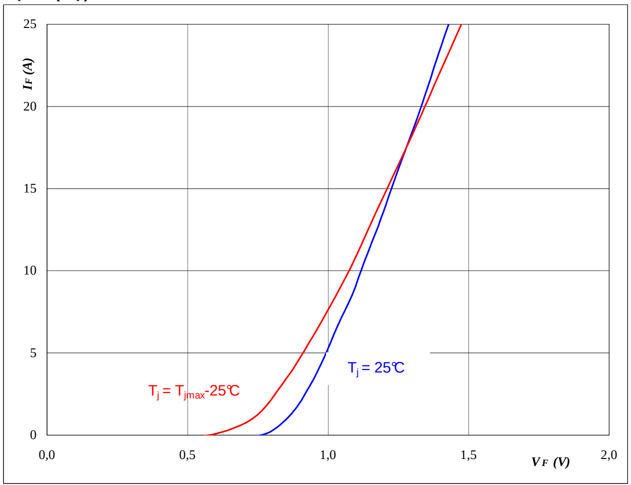
T_j =	T_{jmax}-25	ºC

Input Rectifier Bridge

Figure 1 Rectifier Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



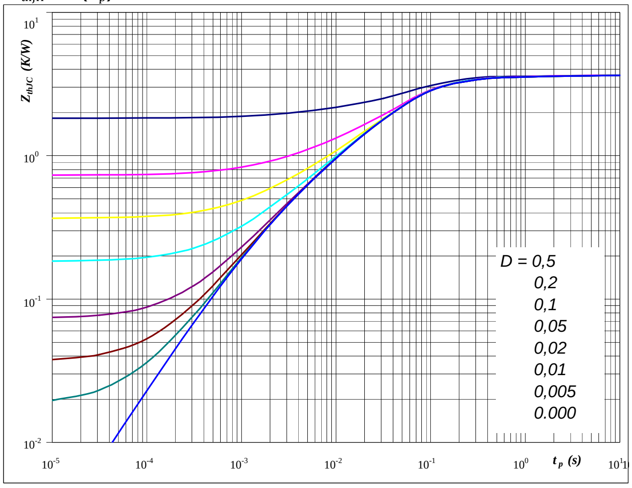
At

t_p = 250 µs

Figure 2 Rectifier Diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

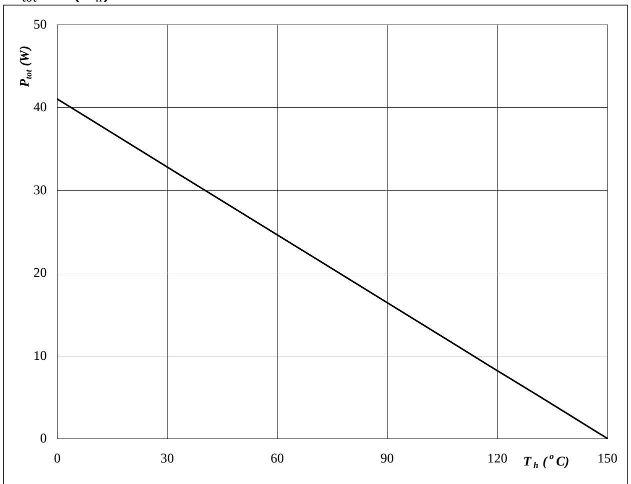
$D = t_p / T$

R_{thJH} = 3,66 K/W

Figure 3 Rectifier diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



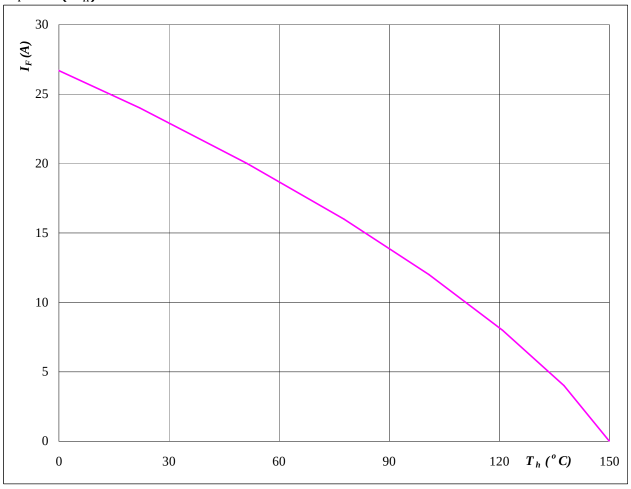
At

T_j = 150 ºC

Figure 4 Rectifier diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



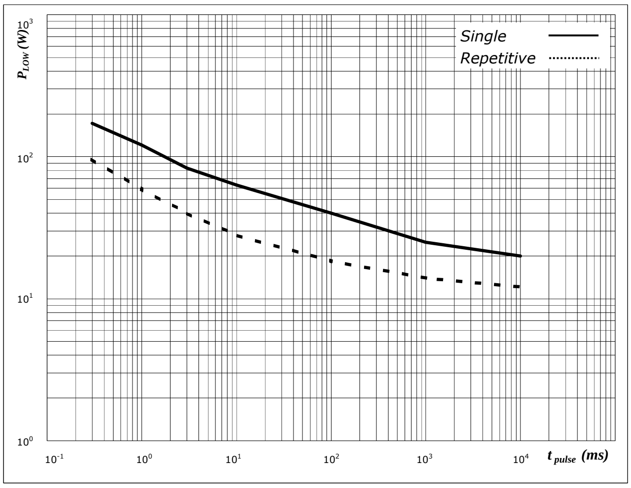
At

T_j = 150 ºC

Shunt

Figure 1	PFC Shunt

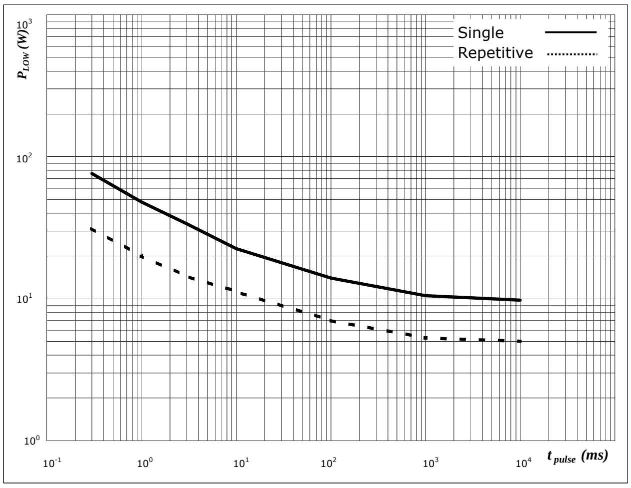
Pulse Power R1



——— dR/R_0 < 1% after 1 pulse
.... dR/R_0 < 1% after 10.000 cycles; duty cycle< 0,1%

Figure 2	DC Shunt

Pulse Power R2

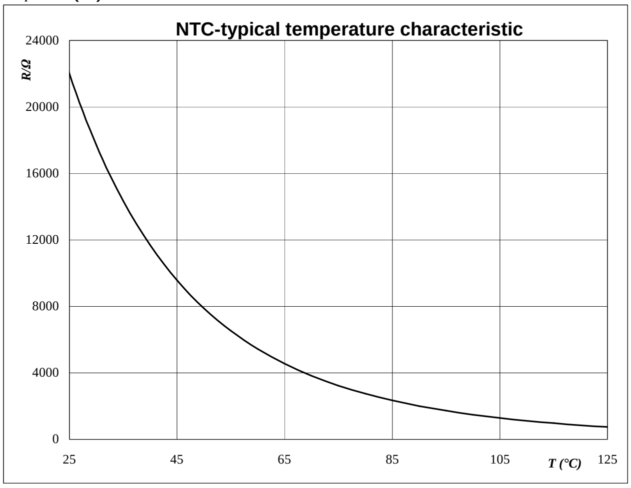


——— dR/R_0 < 1% after 1 pulse
.... dR/R_0 < 1% after 10.000 cycles; duty cycle< 0,1%

Thermistor

Figure 1	Thermistor

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



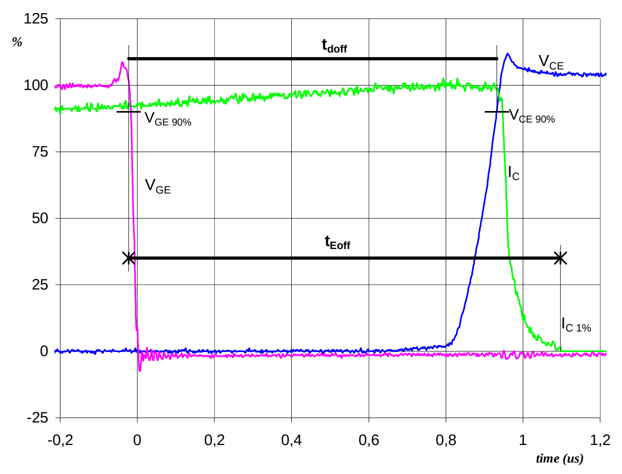
Switching Definitions Output Inverter

General conditions

T_j	=	125 °C

Figure 1 Output inverter IGBT

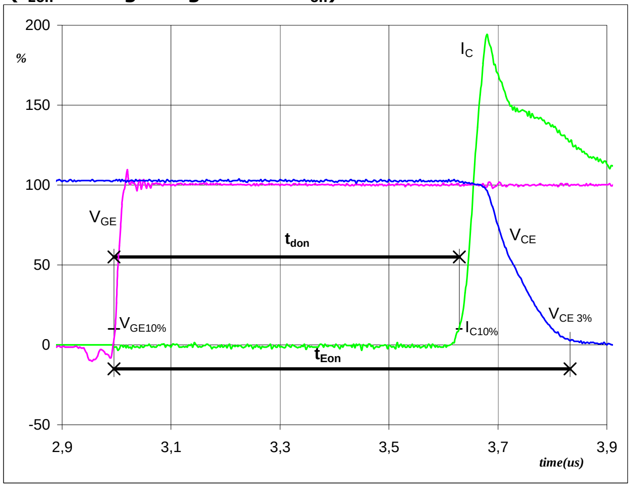
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



U_{IN} (0%) =	0	V
U_{IN} (100%) =	5	V
V_C (100%) =	400	V
I_C (100%) =	6	A
t_{doff} =	0,95	µs
t_{Eoff} =	1,12	µs

Figure 2 Output inverter IGBT

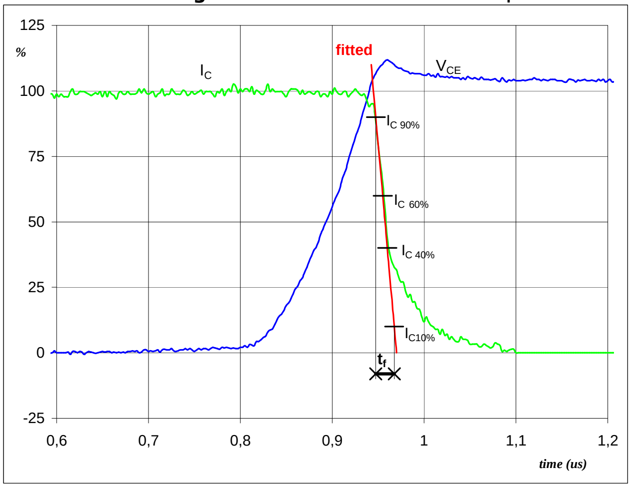
Turn-on Switching Waveforms & definition of tdon, t_{Eon} (t_{Eon} = integrating time for E_{on})



U_{IN} (0%) =	0	V
U_{IN} (100%) =	5	V
V_C (100%) =	400	V
I_C (100%) =	6	A
t_{don} =	0,63	µs
t_{Eon} =	0,84	µs

Figure 3 Output inverter IGBT

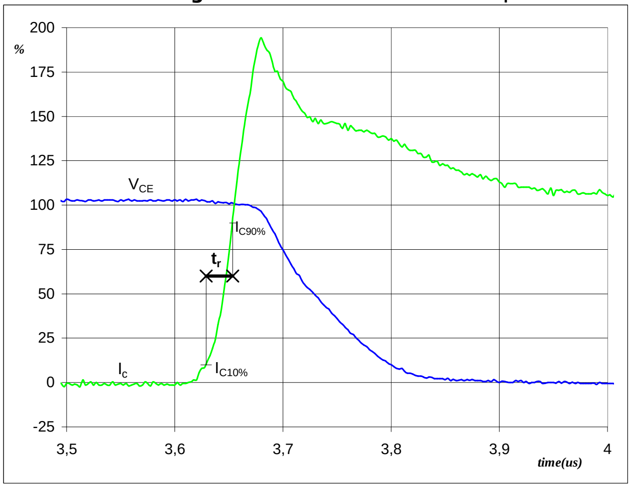
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	400	V
I_C (100%) =	6	A
t_f =	0,02	µs

Figure 4 Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

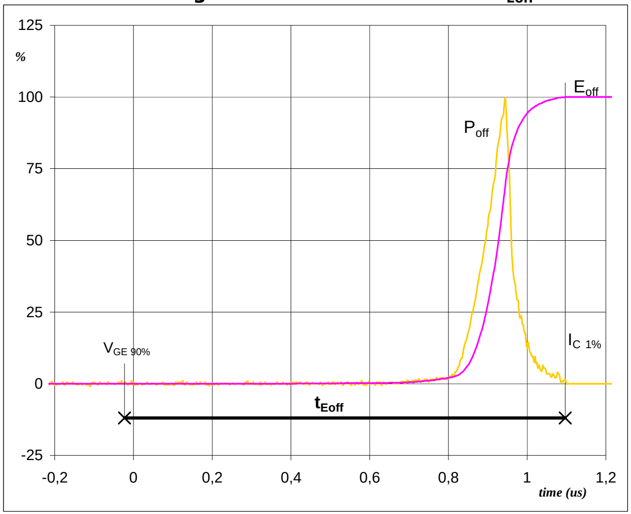


V_C (100%) =	400	V
I_C (100%) =	6	A
t_r =	0,03	µs

Switching Definitions Output Inverter

Figure 5 Output inverter IGBT

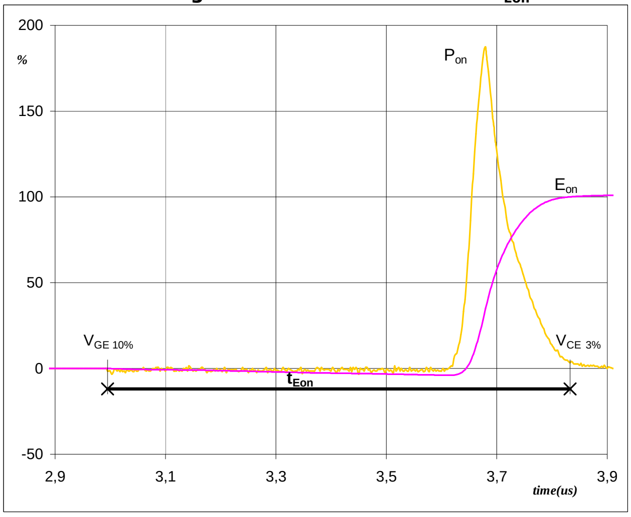
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	2,39	kW
E_{off} (100%) =	0,20	mJ
t_{Eoff} =	1,12	μs

Figure 6 Output inverter IGBT

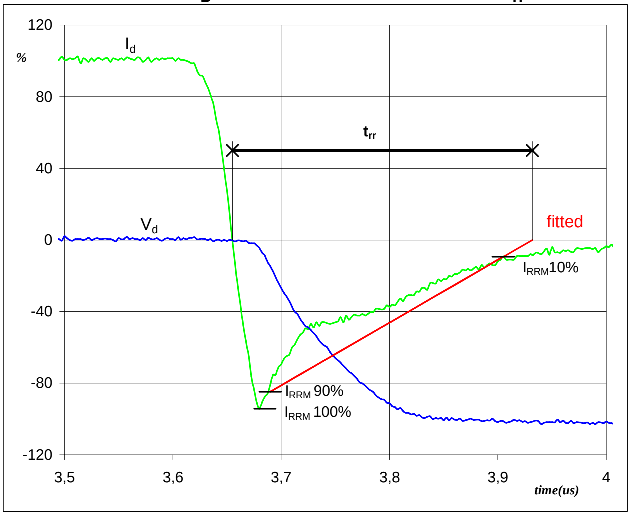
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	2,39	kW
E_{on} (100%) =	0,32	mJ
t_{Eon} =	0,84	μs

Figure 7 Output inverter FWD

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

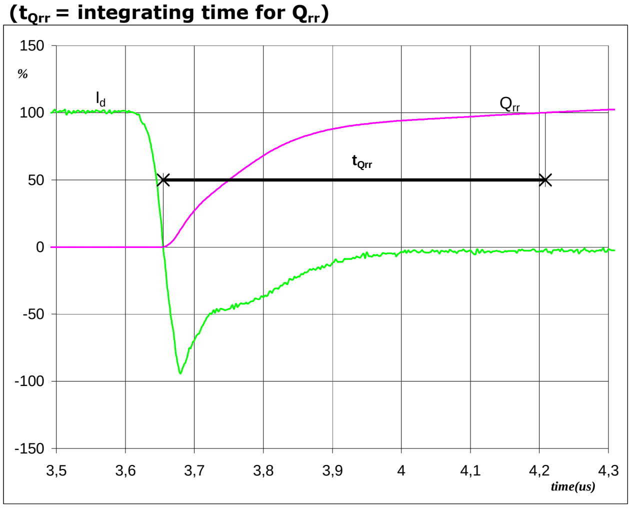


V_d (100%) =	400	V
I_d (100%) =	6	A
I_{RRM} (100%) =	-6	A
t_{rr} =	0,28	μs

Switching Definitions Output Inverter

Figure 8 Output inverter FWD

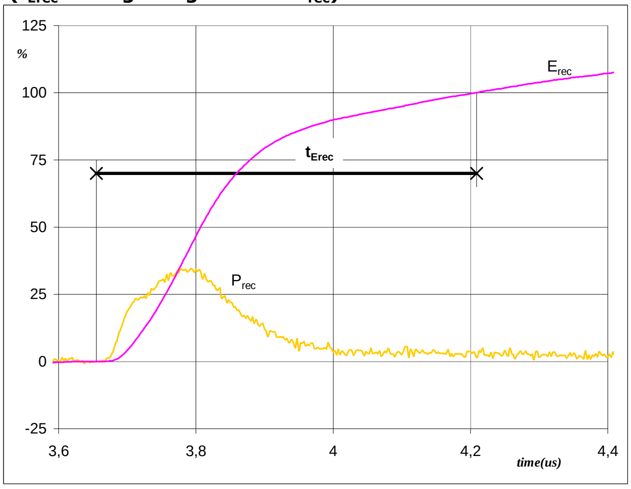
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	6	A
Q_{rr} (100%) =	0,67	µC
t_{Qrr} =	0,55	µs

Figure 9 Output inverter FWD

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



P_{rec} (100%) =	2,39	kW
E_{rec} (100%) =	0,16	mJ
t_{Erec} =	0,55	µs

Ordering Code and Marking - Outline - Pinout

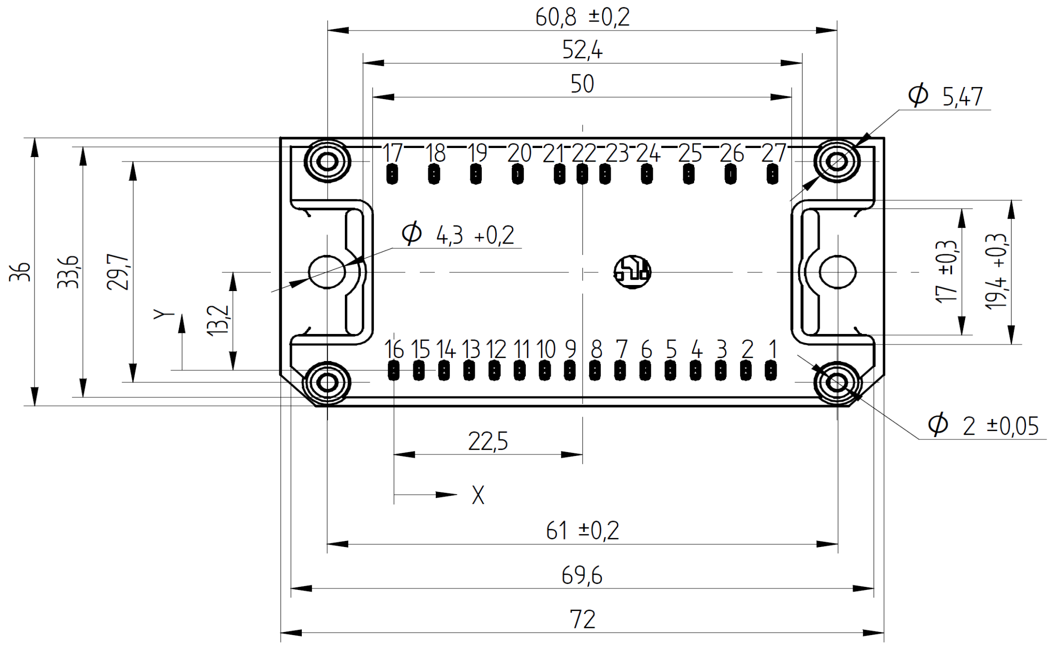
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste, solder pins	20-1B06IPB010RC-P955A40	P955A40	P955A40
with thermal paste, solder pins	20-1B06IPB010RC-P955A40-/3/	P955A40	P955A40-/3/
without thermal paste, press fit pins	20-PB06IPB010RC-P955A40Y	P955A40Y	P955A40Y
with thermal paste, press fit solder pins	20-PB06IPB010RC-P955A40Y-/3/	P955A40Y	P955A40Y-/3/

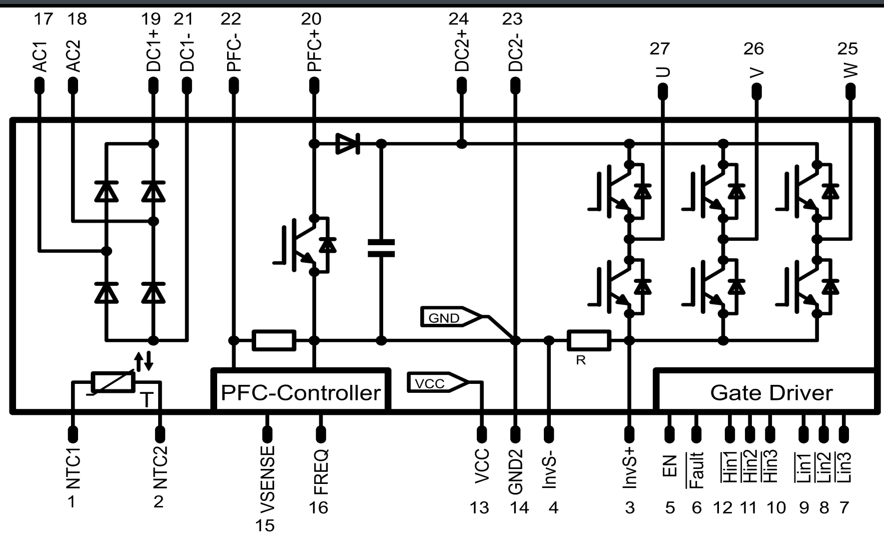
Outline

Pin table

Pin	X	Y
1	45	0
2	42	0
3	39	0
4	36	0
5	33	0
6	30	0
7	27	0
8	24	0
9	21	0
10	18	0
11	15	0
12	12	0
13	9	0
14	6	0
15	3	0
16	0	0
17	-0,2	26,4
18	4,8	26,4
19	9,8	26,4
20	14,8	26,4
21	19,8	26,4
22	22,5	26,4
23	25,2	26,4
24	30,2	26,4
25	35,2	26,4
26	40,2	26,4
27	45,2	26,4



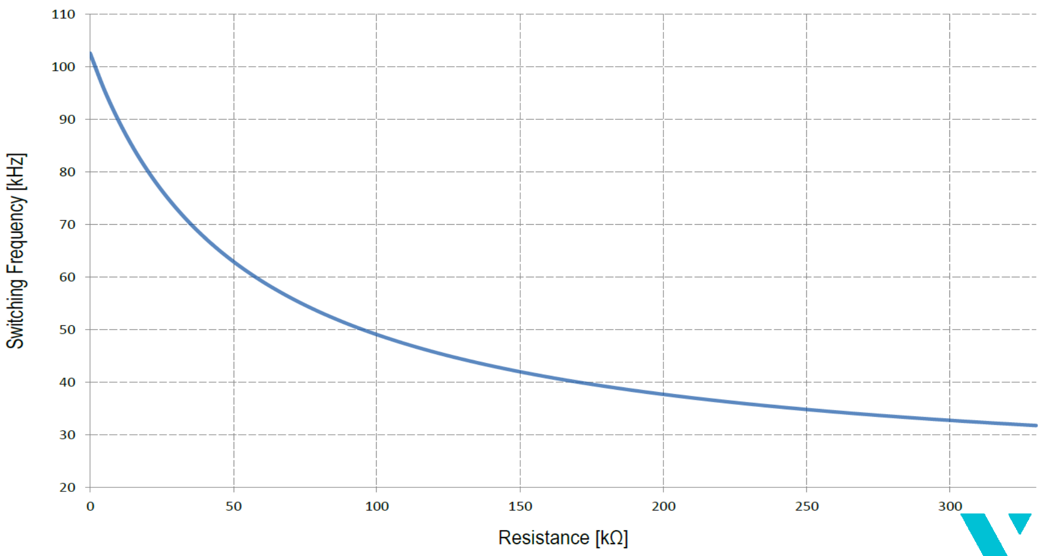
Pinout



Application data

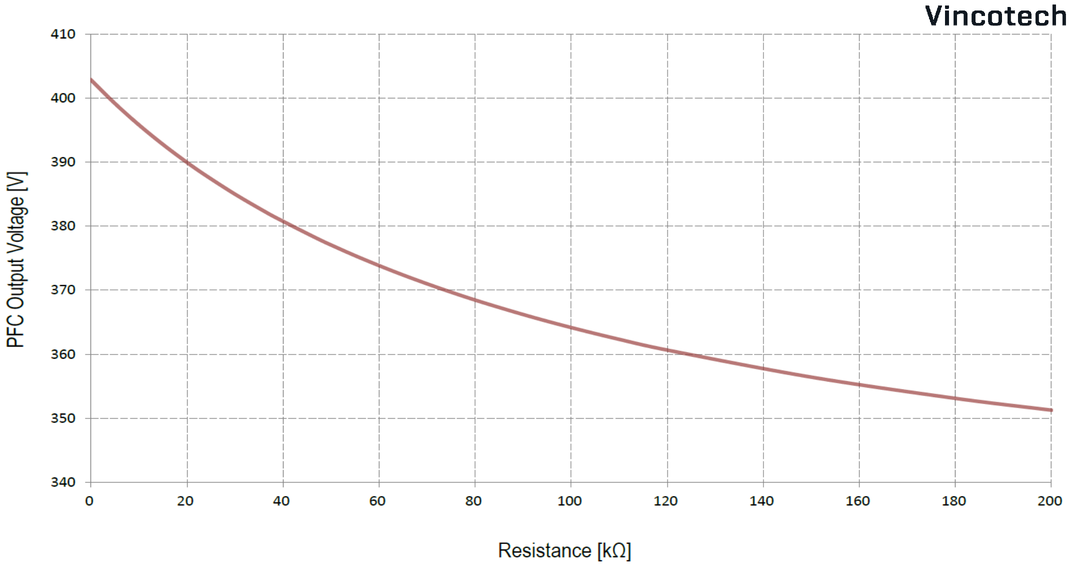
Static logic funtion table

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



Resistance on f_{set}	Switching Frequency
0Ω	102.6kHz
5.1kΩ	95.5kHz
10.0kΩ	89.7kHz
15.0kΩ	84.7kHz
20.0kΩ	80.3kHz
24.0kΩ	77.2kHz
30.0kΩ	73.2kHz
36.0kΩ	69.6kHz
39.0kΩ	68.0kHz
47.0kΩ	64.3kHz
51.0kΩ	62.6kHz
56.0kΩ	60.7kHz
62.0kΩ	58.6kHz
68.0kΩ	56.7kHz
75.0kΩ	54.7kHz
82.0kΩ	52.9kHz
91.0kΩ	50.9kHz
100.0kΩ	49.1kHz
110.0kΩ	47.3kHz
120.0kΩ	45.8kHz
150.0kΩ	42.0kHz
180.0kΩ	39.2kHz
200.0kΩ	37.7kHz

Vincotech



Resistance on V_{set}	Output Voltage
0Ω	402.9V
5.1kΩ	399.2V
10.0kΩ	395.9V
15.0kΩ	392.8V
20.0kΩ	390.0V
24.0kΩ	387.9V
30.0kΩ	385.0V
36.0kΩ	382.4V
39.0kΩ	381.2V
47.0kΩ	378.1V
51.0kΩ	376.7V
56.0kΩ	375.1V
62.0kΩ	373.3V
68.0kΩ	371.5V
75.0kΩ	369.7V
82.0kΩ	368.0V
91.0kΩ	366.0V
100.0kΩ	364.2V
110.0kΩ	362.3V
120.0kΩ	360.6V
150.0kΩ	356.4V
180.0kΩ	353.1V
200.0kΩ	351.3V

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	VSENSE	PFC Bulk voltage sense
16	FREQ	PFC Switching frequency adjust
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

DISCLAIMER

The information, specifications, procedures, methods and recommendations herein (together "information") are presented by Vincotech to reader in good faith, are believed to be accurate and reliable, but may well be incomplete and/or not applicable to all conditions or situations that may exist or occur. Vincotech reserves the right to make any changes without further notice to any products to improve reliability, function or design. No representation, guarantee or warranty is made to reader as to the accuracy, reliability or completeness of said information or that the application or use of any of the same will avoid hazards, accidents, losses, damages or injury of any kind to persons or property or that the same will not infringe third parties rights or give desired results. It is reader's sole responsibility to test and determine the suitability of the information and the product for reader's intended use.

LIFE SUPPORT POLICY

Vincotech products are not authorised for use as critical components in life support devices or systems without the express written approval of Vincotech.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.