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

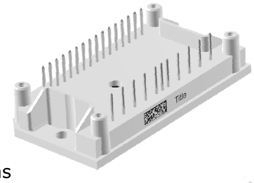
Target Applications

- Fans and Pumps
- AirCon
- Electrical Tools
- Low power industrial drive

Types

- 20-1B06IPB010RC-P955A40
- 20-PB06IPB010RC-P955A40Y

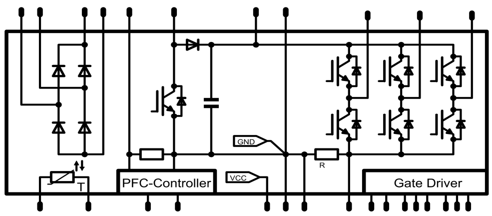
flow **IPM 1B**



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}	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80 °C	13 14	A
Surge (non-repetitive) forward current	I_{FSM}	t_p = 10 ms 50 Hz half sine wave	T_j = 150 °C	130	A
I^2t-value	I^2t			80	A²s
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80 °C	15 23	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 T_c = 80 °C	12 14	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		90	A
Turn off safe operating area		V_{CE} ≤ 650 V, T_j ≤ T_{op} max		90	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80 °C	19 29	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 $T_c = 80$ °C	5 7	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 $T_c = 80$ °C	10 15	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 $T_c = 80$ °C	10 14	A
Surge forward current	I_{FSM}	$t_p = 8{,}3$ ms 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}	$T_j = T_{jmax}$ $T_s = 80$ °C $T_c = 80$ °C	17 26	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 $T_c = 80$ °C	8 10	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	30	A
Turn off safe operating area		$V_{CE} \le 600$ V, $T_j \le 150$ °C	20	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80$ °C $T_c = 80$ °C	16 25	W
Gate-emitter peak voltage	V_{GE}		±20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \le 150$ °C $V_{GE} = 15$ V	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	$T_j = T_{jmax}$ $T_s = 80$ °C $T_c = 80$ °C	8 10	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80$ °C $T_c = 80$ °C	14 22	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	10	W
PFC Controller*				
VCC supply voltage	V_{CC}	V_{CC} common with gate driver IC	26	V
VSENSE voltage	V_{VSENSE}		26	V
Vsense Current	I_{VSENSE}		800	µA
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
Isolation Properties				
Isolation voltage	V_{is}	t = 2 s 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] 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	
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			1600		25			0,01	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4W/mK						4,56		K/W
PFC IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0003	25	3,3	4	4,7	V
Collector-emitter saturation voltage	V_{CEsat}		15		10	25 125		1,28 1,28	1,9	V
Collector-emitter cut-off	I_{CES}		0	650		25			0,04	mA
Turn-on delay time	$t_{d(on)}$		U_{CC} = 15 V	400	10	25 125		27 28		ns
Rise time	t_r					25 125		5 7		
Turn-off delay time	$t_{d(off)}$					25 125		122 154		
Fall time	t_f					25 125		2 2		
Turn-on energy loss	E_{on}					25 125		0,1516 0,2417		mWs
Turn-off energy loss	E_{off}					25 125		0,0317 0,0583		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		2100		pF
Output capacitance	C_{oss}							45		
Reverse transfer capacitance	C_{rss}							7,7		
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4W/mK						4,96		K/W
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 = 3,4W/mK						9,56		K/W
PFC Diode										
Forward voltage	V_F				10	25 125		1,64 1,63	2,26	V
Reverse leakage current	I_{rm}			650		25			5	µA
Peak recovery current	I_{RRM}		U_{CC} = 15 V	400	10	25 125		15 19		A
Reverse recovery time	t_{rr}					25 125		22 36		ns
Reverse recovery charge	Q_{rr}					25 125		0,2008 0,4358		µC
Reverse recovered energy	E_{rec}					25 125		0,0150 0,0504		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		2033 891		A/µs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4W/mK						5,48		K/W
PFC Shunt										
R1 value	R							40		mΩ

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
Inverter Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00017	25	4,4	5	5,6	V
Collector-emitter saturation voltage*	V_{CEsat}		15		10	25 125	1,7	2,20 2,32	2,95	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 U_{IN} = 5 V	400	6	25 125		582 631		ns
Rise time	t_r					25 125		20 25		
Turn-off delay time **	$t_{d(off)}$					25 125		837 950		
Fall time	t_f					25 125		16 22		
Turn-on energy loss	E_{on}					25 125		0,1950 0,3241		mWs
Turn-off energy loss	E_{off}					25 125		0,1611 0,2042		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		655		pF
Output capacitance	C_{oss}							37		
Reverse transfer capacitance	C_{rss}							22		
Gate charge	Q_G		15	480	10	25		64		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4W/mK						5,79		K/W

* chip data
** including gate driver

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
Inverter Diode										
Diode forward voltage	V_F				10	25 125	1,5	2,23 2,18	2,85	V
Peak reverse recovery current	I_{RRM}		U_{CC} = 15 V U_{IN} = 5 V	400	6	25 125		6 6		A
Reverse recovery time	t_{rr}					25 125		179 276		ns
Reverse recovered charge	Q_{rr}					25 125		0,3566 0,6738		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		181 46		A/μs
Reverse recovered energy	E_{rec}					25 125		0,0867 0,1610		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4W/mK						6,66		K/W
DC - Shunt										
R2 value	R					25		25		mΩ
DC link Capacitor										
C Value	C							100		nF

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
Gate Driver										
Supply voltage	U_{CC}						13	15	17,5	V
Quiescent Vcc supply current	I_{QCC}	U_{LIN} = 0 V; U_{HIN}=3,3 V						1,3	2	mA
Input voltage (LIN, HIN, EN)	U_{IN}						0		5	
Logic "0" input voltage (LIN, HIN)	U_{IH}						1,7	2,1	2,4	
Logic "1" input voltage (LIN, HIN)	U_{IL}	U_{CC} = 15 V					0,7	0,9	1,1	V
Positive going threshold voltage (EN)	$U_{EN,TH+}$						1,9	2,1	2,3	
Negative going threshold voltage (EN)	$U_{EN,TH-}$						1,1	1,3	1,5	
Input clamp voltage (LIN, HIN, EN)	$U_{IN,CLAMP}$	I_{IN} = 4 mA					9	10,3	12	
ITRIP positive going threshold	$U_{TR,TH+}$						380	445	510	mV
Input bias current LIN high	I_{LIN+}	U_{LIN} = 3,3 V						70	100	
Input bias current LIN low	I_{LIN-}	U_{LIN} = 0 V				25		110	200	
Input bias current HIN high	I_{HIN+}	U_{HIN} = 3,3 V						70	100	μA
Input bias current HIN low	I_{HIN-}	U_{HIN} = 0 V						110	120	
Input bias current EN high	I_{EN+-}	U_{HIN} = 3,3 V						45	120	
Output voltage (FAULT)	U_{FLT}						0		U_{CC}	V
Low on resistor of pull down trans. (FAULT)	$R_{ON,FLT}$	U_{FAULT} = 0,5 V						45,0	100	Ω
Pulse width for ON or OFF	t_{IN}						1			μs
Turn-on propagation delay (LIN, HIN)	t_{ON}	$U_{LIN/HIN}$ = 0 V or 3,3 V					400	530	800	ns
Turn-off propagation delay (LIN, HIN)	t_{OFF}						360	490	760	
FAULT reset time	t_{RST}							4		ms
Fixed deadtime between high and low side	t_{DT}	$U_{LIN/HIN}$ = 0 V & 3,3 V					150	310		ns
PFC Controller										
Supply voltage*	V_{CC}						15		26	V
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 = 1 nF						6,4	8,5	mA
Operating current during standby	I_{CCstby}							3,5	4,7	mA
PFC switching frequency	F_{SWnom}	Set with an internal resistor R_{FREQ} = 220 kΩ**						20		kHz
PFC disable threshold	$V_{dis\ PFC}$	pull Vsense higher than Vdis PFC to disable PFC operation					14			V
DC link voltage	DC2+	Set with an internal resistor divider***				25	325		410	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						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

*recommended supply voltage range: 15-18 V
**switching frequency is setable by an external resistor between pins 14-16 (see figure on page27 for values)
***DC link voltage is setable by an external resistor between pins 14-15 (see figure on page27 for values)

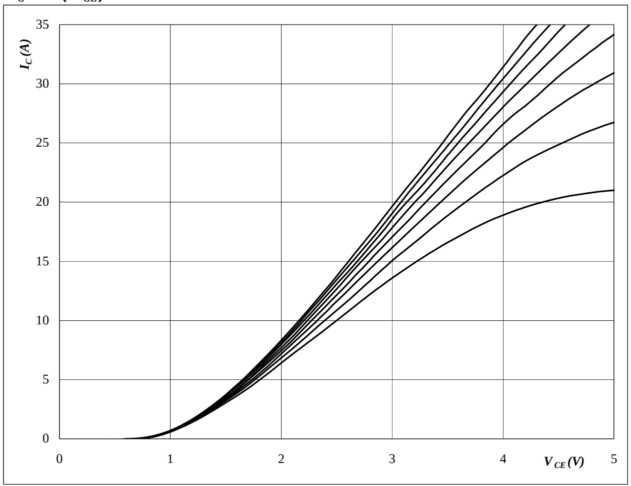
Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	Unit
Thermistor										
Rated resistance	R					25		22000		Ω
Deviation of R_{100}	$\Delta R/R$	R_{100} = 1486 Ω				100	-12		12	%
Power dissipation	P					25		200		mW
Power dissipation 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	

Output Inverter

Figure 1 Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

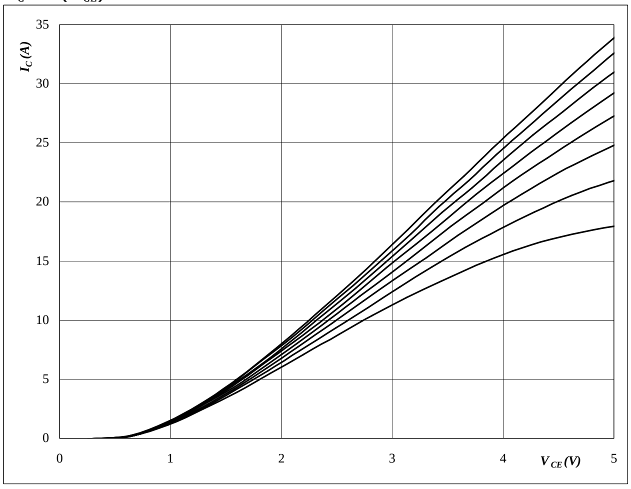
T_j = 25 °C

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

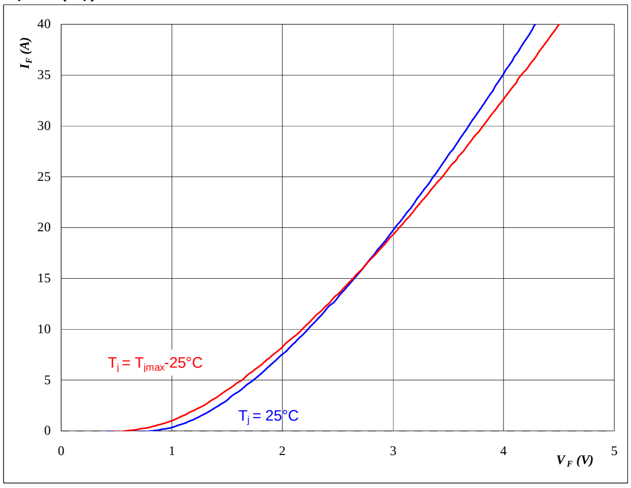
T_j = 125 °C

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

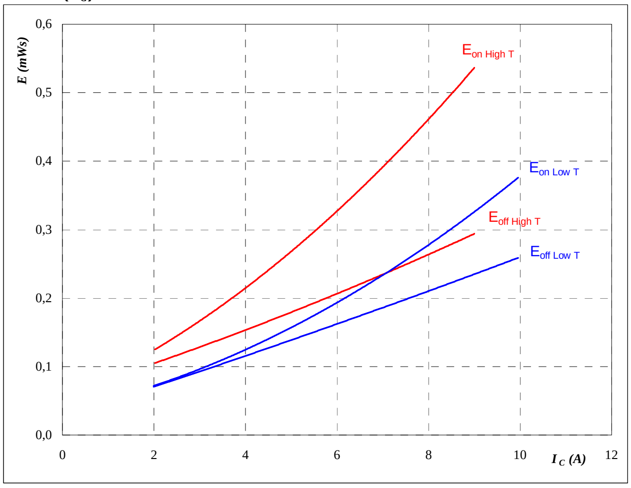
t_p = 250 µs

Output Inverter

Figure 4	Output inverter IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



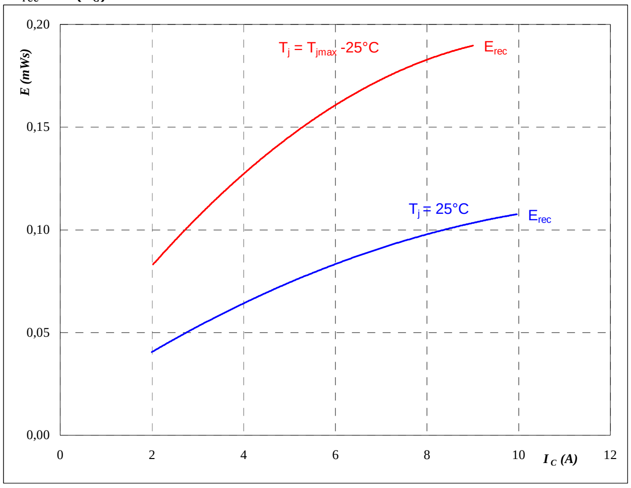
With an inductive load at

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

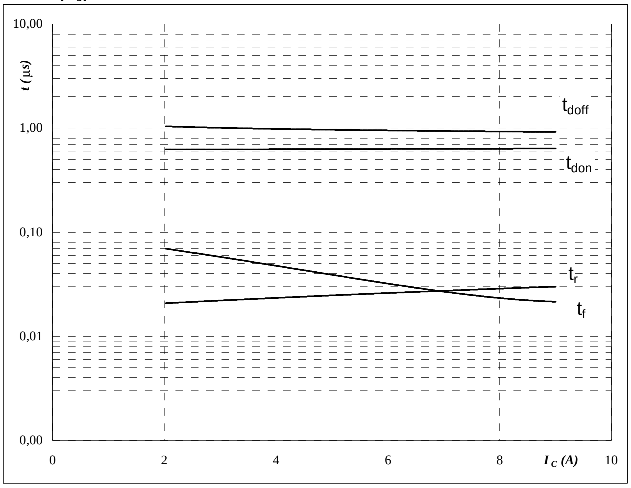
T_j =	25/125	°C
V_{CE} =	400	V
U_{CC} =	15	V

Output Inverter

Figure 6 Output inverter IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



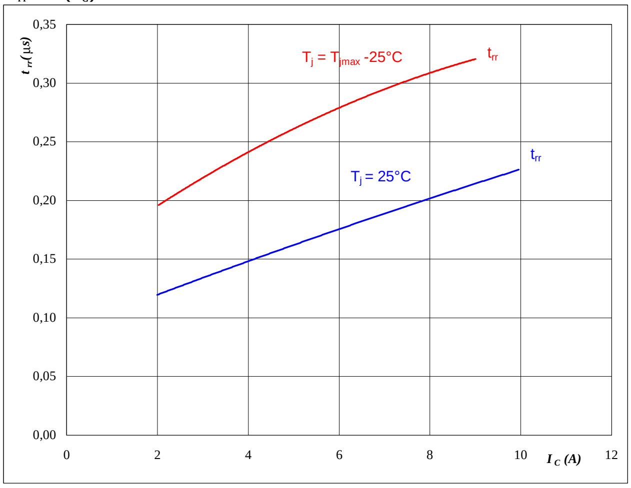
With an inductive load at

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

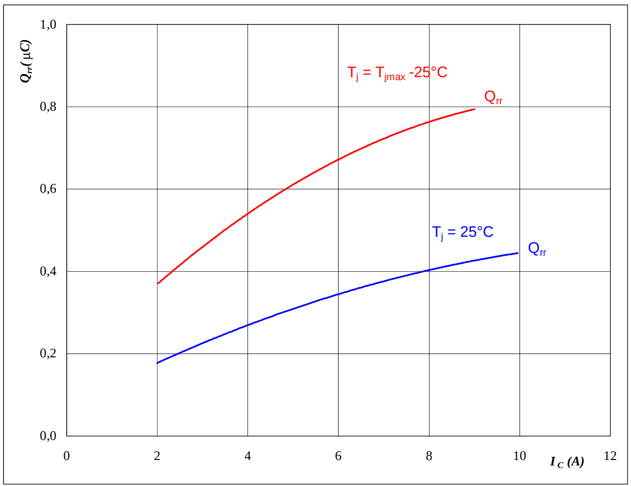
T_j =	25/125	°C
V_{CE} =	400	V
U_{CC} =	15	V

Output Inverter

Figure 8	Output inverter FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



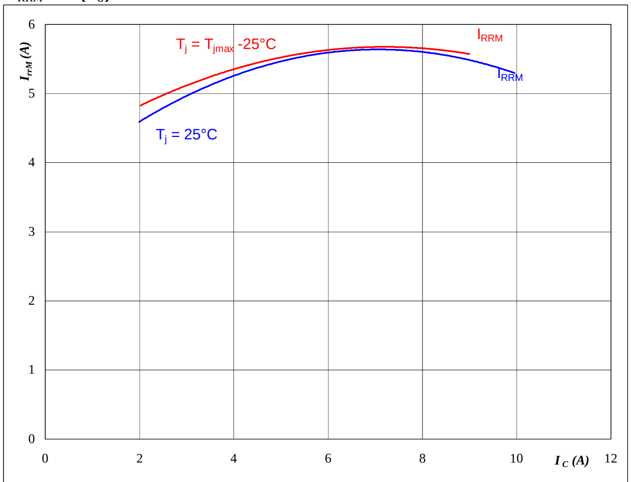
At

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

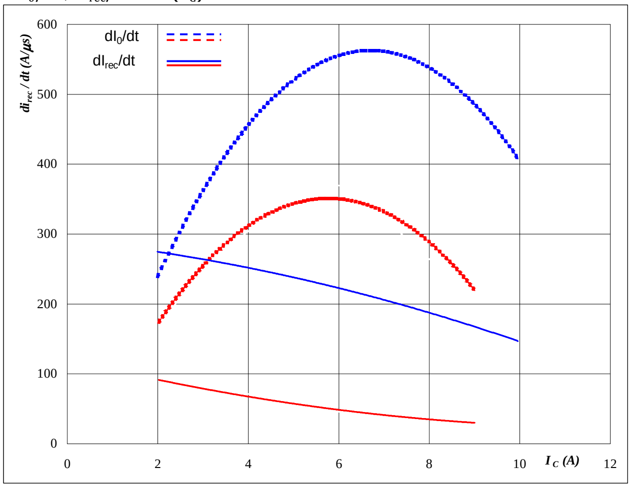
T_j =	25/125	°C
V_{CE} =	400	V
U_{CC} =	15	V

Output Inverter

Figure 10 Output inverter FWD

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

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



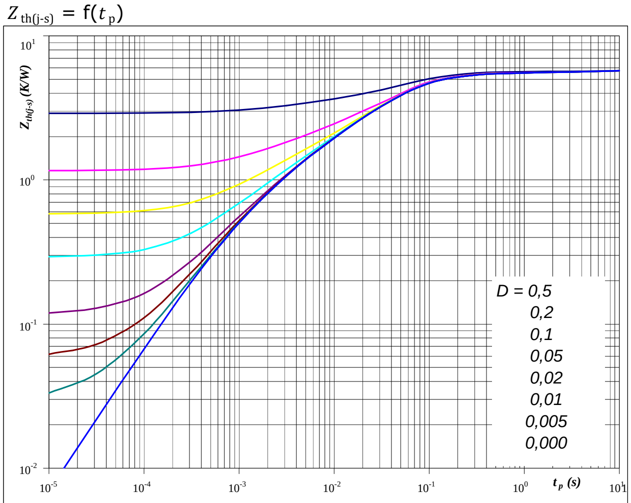
At

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

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



At

D =	t_p / T	
$R_{th(j\text{-}s)}$ =	5,79	K/W

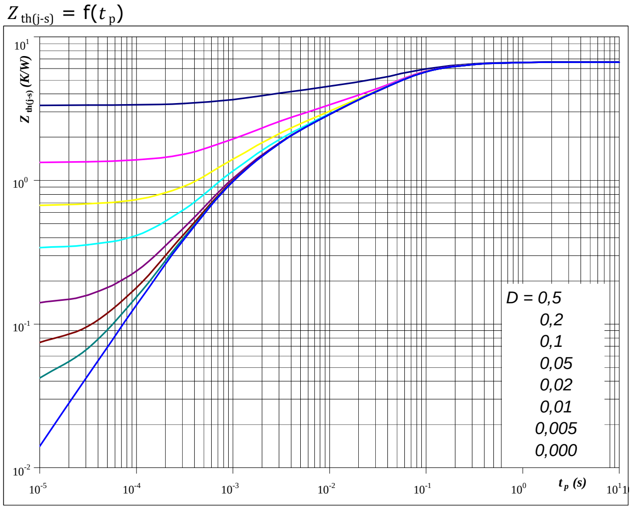
IGBT thermal model values

R (K/W)	Tau (s)
0,30	6,6E+00
0,61	2,1E-01
3,21	4,9E-02
0,84	1,0E-02
0,56	2,9E-03
0,26	7,4E-04

Figure 12 Output inverter FWD

FWD transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j\text{-}s)}$ =	6,66	K/W

FWD thermal model values

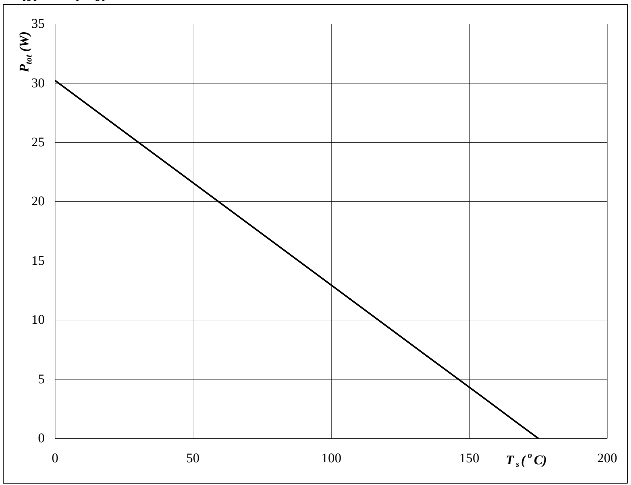
R (K/W)	Tau (s)
0,62	3,1E-01
3,07	5,4E-02
0,76	2,3E-02
1,19	4,7E-03
0,95	9,8E-04
0,08	7,5E-04

Output Inverter

Figure 13 Output inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



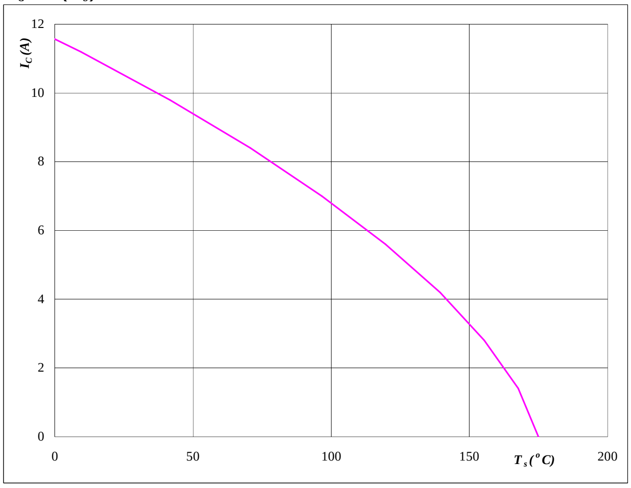
At

T_j = 175 °C

Figure 14 Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

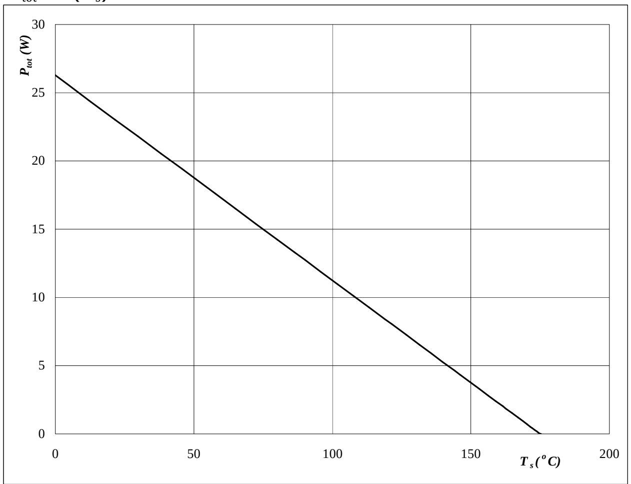
T_j = 175 °C

U_{CC} = 15 V

Figure 15 Output inverter FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



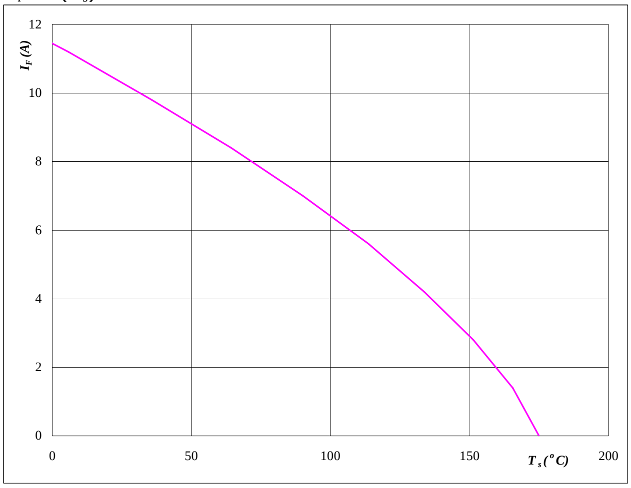
At

T_j = 175 °C

Figure 16 Output inverter FWD

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

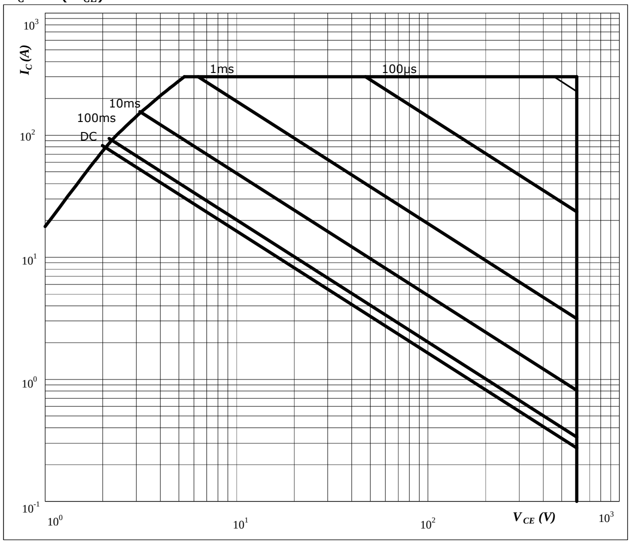
T_j = 175 °C

Output Inverter

Figure 17	Output inverter IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



At

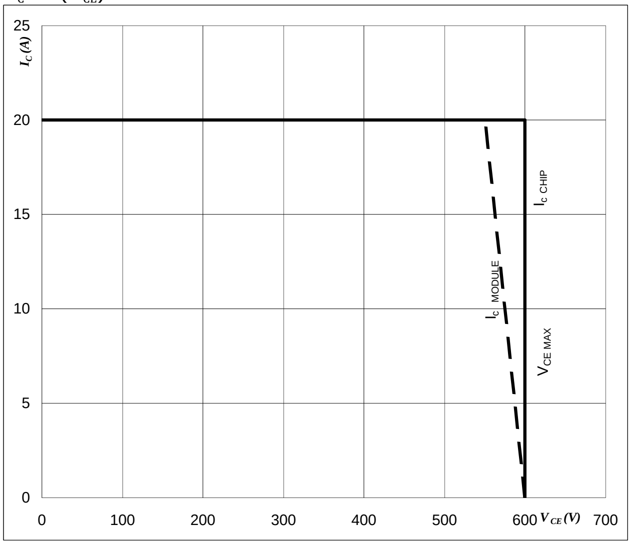
$T_j \leq$ T_{jmax}

$U_{CC} =$ 15 V

Figure 18	Output inverter IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

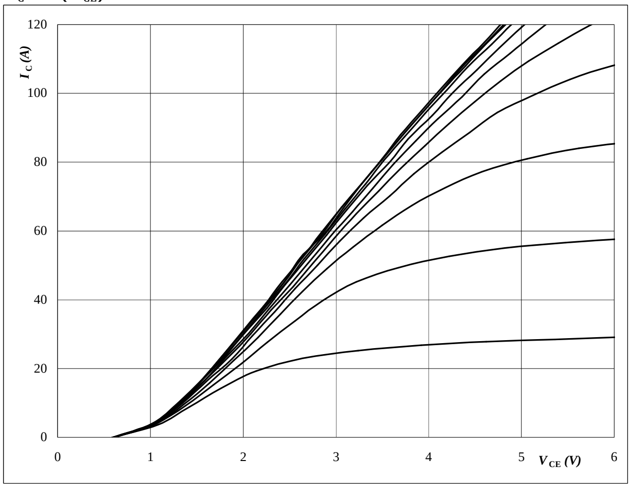
$T_j =$ T_{jmax}-25 ºC

PFC

Figure 1 PFC IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

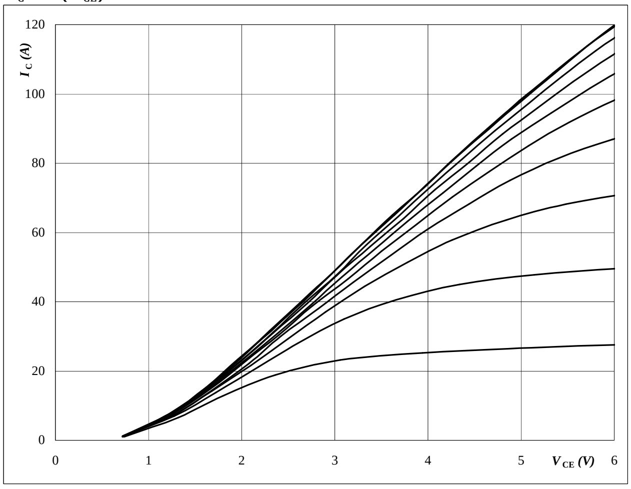
T_j = 25 °C

U_{CC} from 7 V to 17 V in steps of 1 V

Figure 2 PFC IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

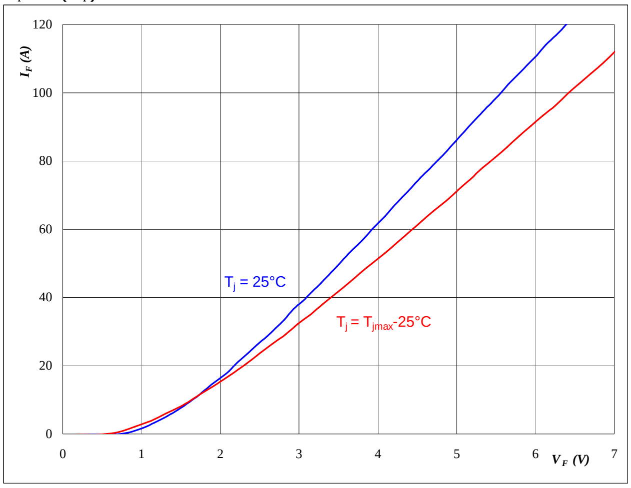
T_j = 125 °C

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

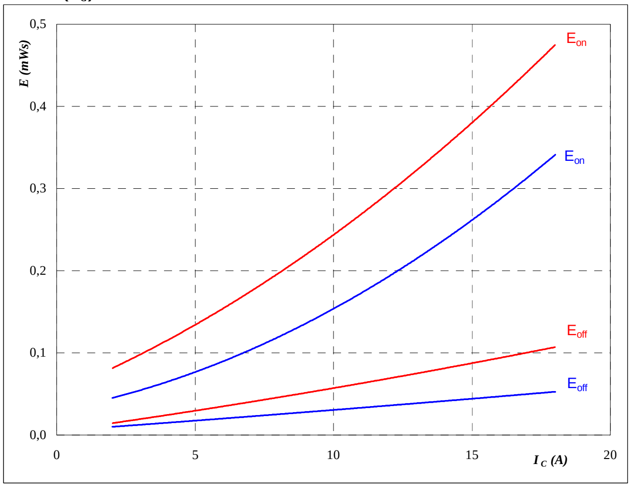
t_p = 250 µs

PFC

Figure 4 PFC IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



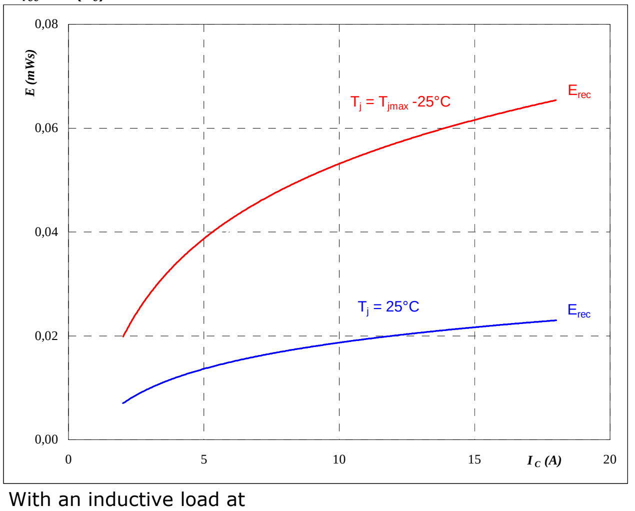
With an inductive load at

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

Figure 5 PFC IGBT

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_c)$



With an inductive load at

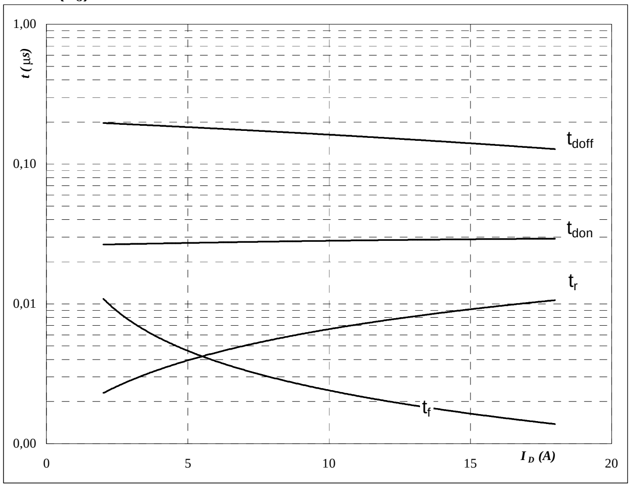
T_j =	25/125	°C
V_{CE} =	400	V
U_{CC} =	15	V

PFC

Figure 6 PFC IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



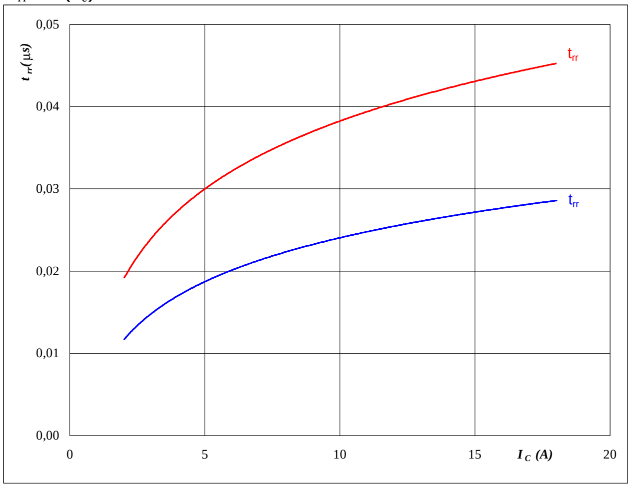
With an inductive load at

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

Figure 7 PFC FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



At

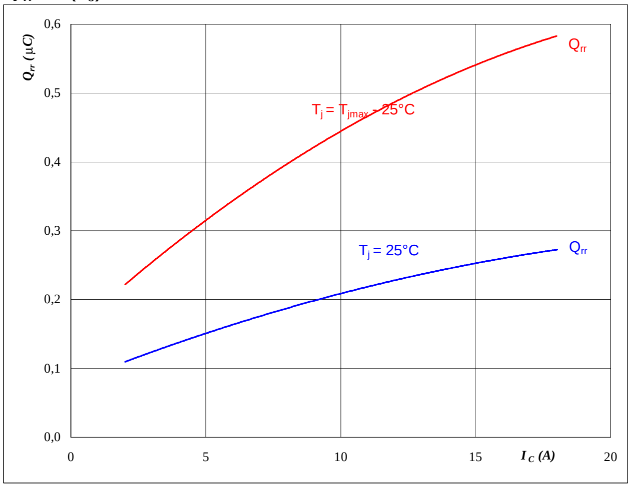
T_j =	25/125	°C
V_{CE} =	400	V
U_{CC} =	15	V

PFC

Figure 8 PFC FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



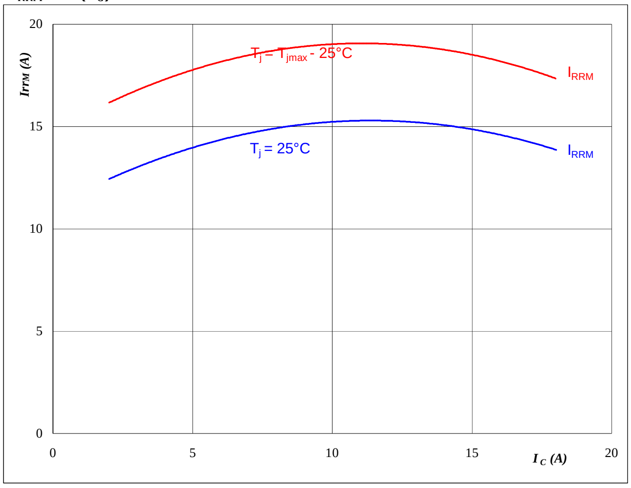
At

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

Figure 9 PFC FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



At

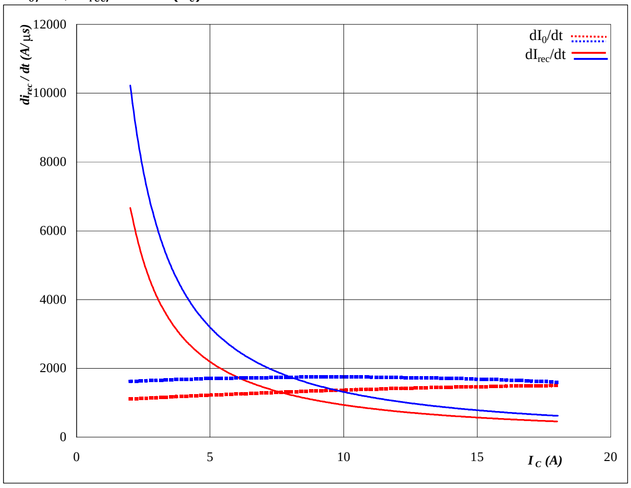
T_j =	25/125	°C
V_{CE} =	400	V
U_{CC} =	15	V

PFC

Figure 10 PFC FWD

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

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



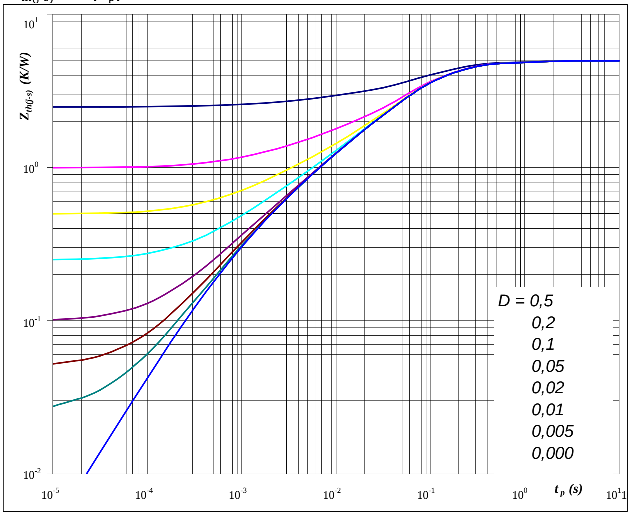
At

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

Figure 11 PFC IGBT

IGBT transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j-s)}$ =	4,96	K/W

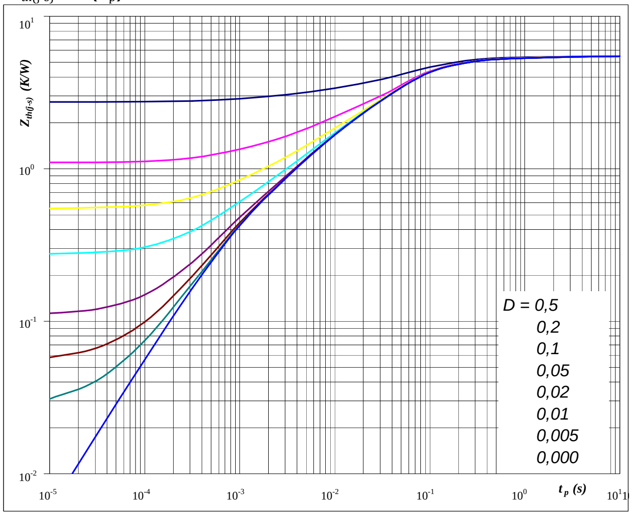
IGBT thermal model values

R (K/W)	Tau (s)
0,42	0,775
2,554	0,104
1,288	0,033
0,560	0,004
0,142	0,001

Figure 12 PFC FWD

FWD transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j-s)}$ =	5,48	K/W

FWD thermal model values

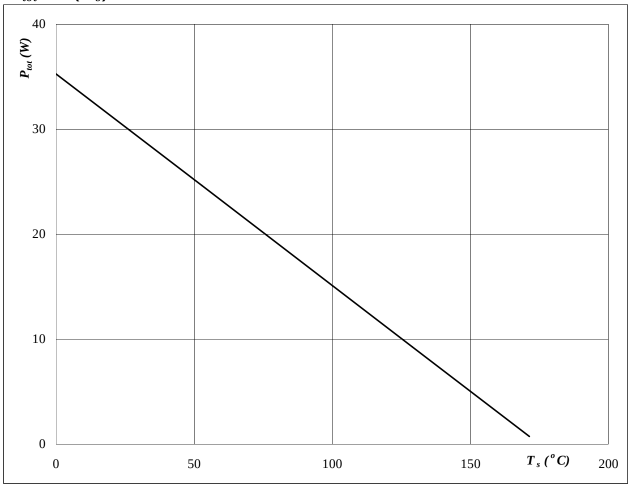
R (K/W)	Tau (s)
0,20	2,872
0,69	0,254
3,28	0,055
0,98	0,007
0,33	0,001

PFC

Figure 13 PFC IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



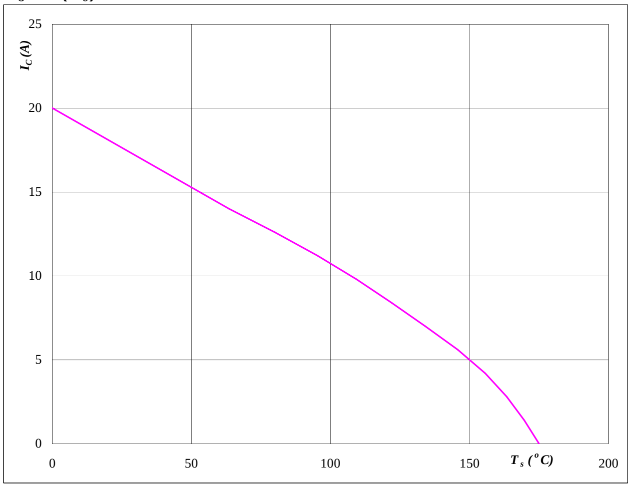
At

T_j = 175 ºC

Figure 14 PFC IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

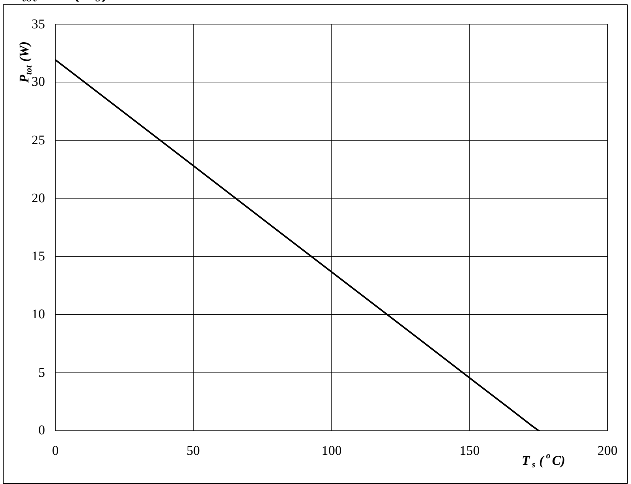
T_j = 175 ºC

U_{CC} = 15 V

Figure 15 PFC FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



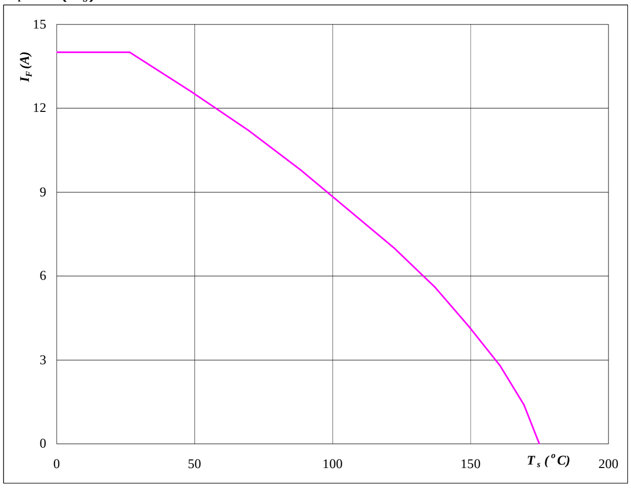
At

T_j = 175 ºC

Figure 16 PFC FWD

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

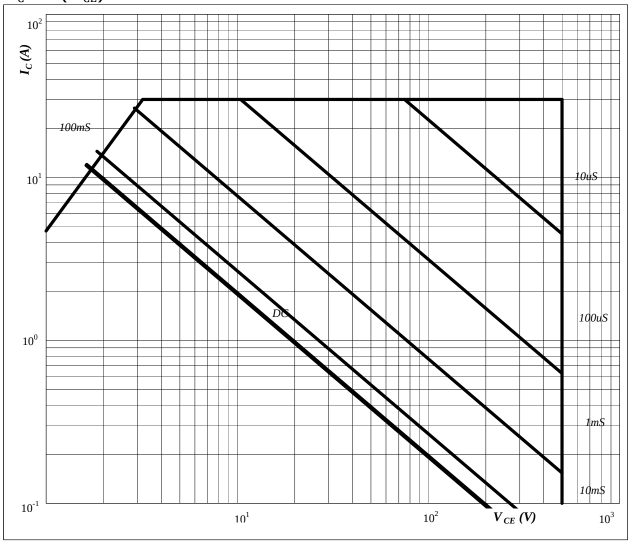
T_j = 175 ºC

PFC

Figure 17 PFC IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



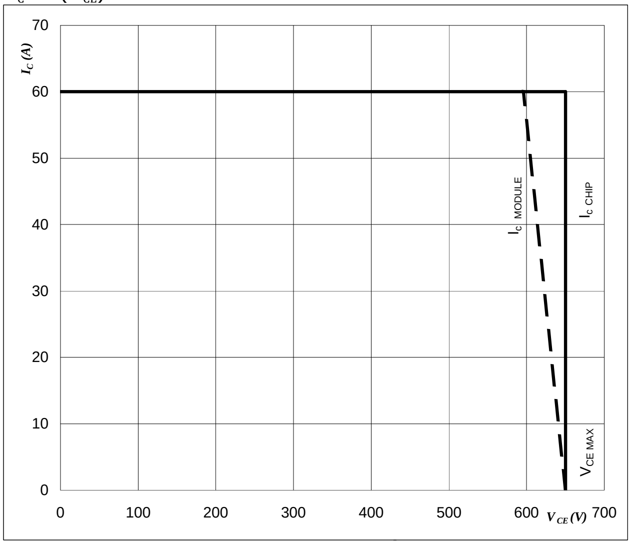
At

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

Figure 18 PFC IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

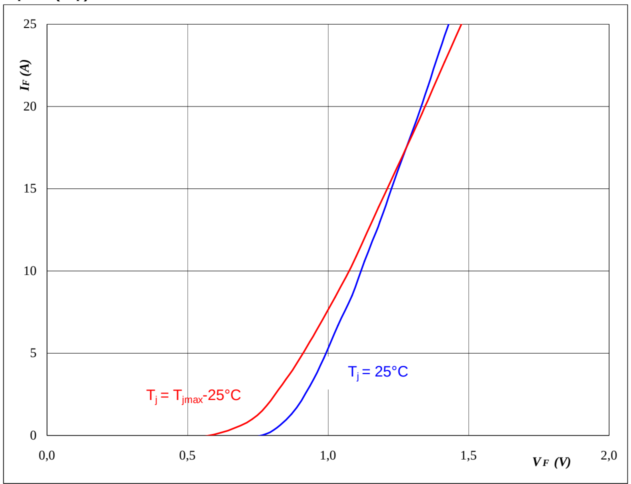
T_j =	T_{jmax}-25	ºC

Input Rectifier Diode

Figure 1 Rectifier Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



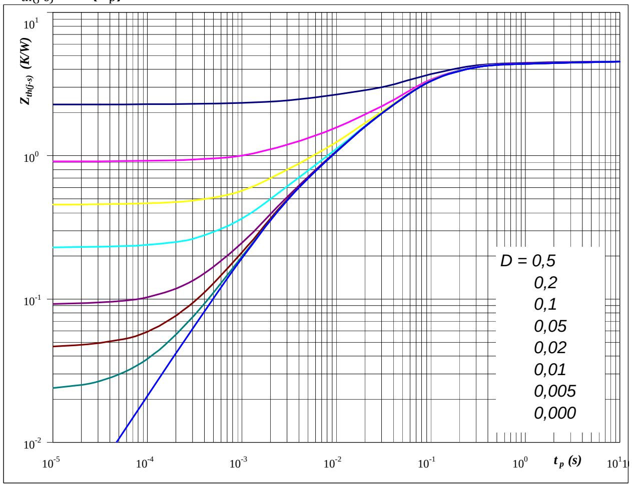
At

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

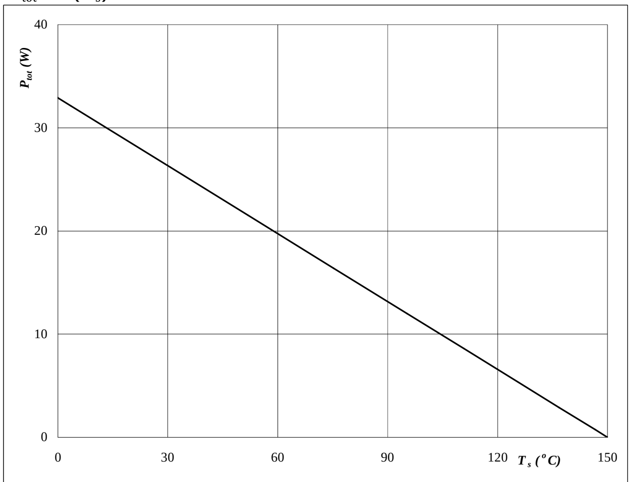
D = t_p / T

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

Figure 3 Rectifier diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



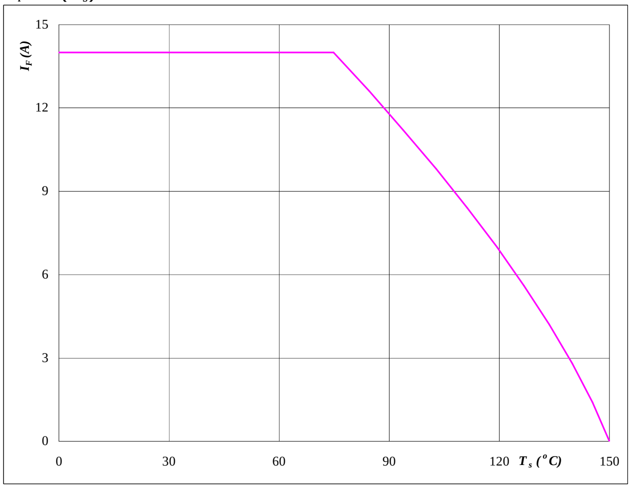
At

T_j = 150 ºC

Figure 4 Rectifier diode

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



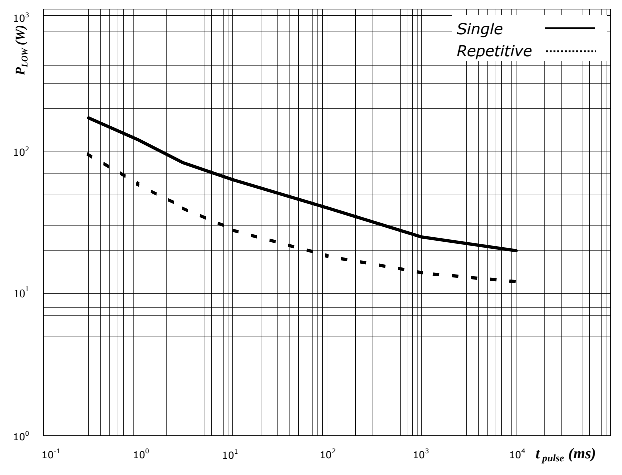
At

T_j = 150 ºC

Shunt

Figure 1 PFC Shunt

Pulse Power R1

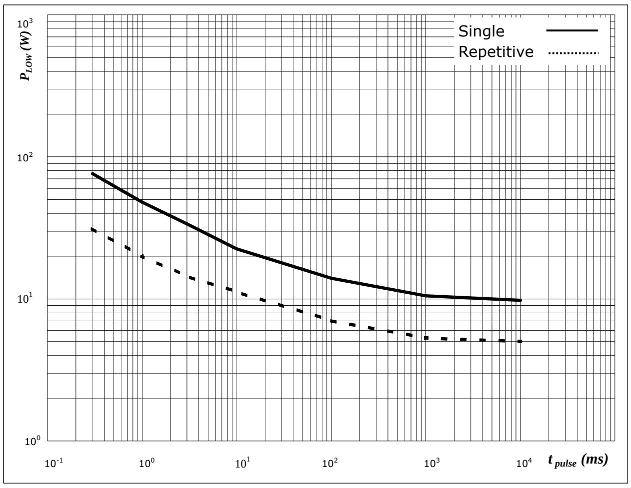


dR/R0 < 5% after 1 pulse

dR/R0 < 5% after 10.000 cycles; duty cycle< 0,1%

Figure 2 DC Shunt

Pulse Power R2



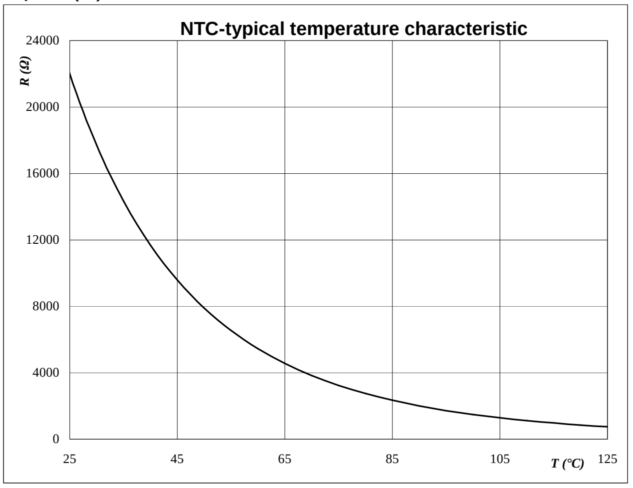
dR/R0 < 1% after 1 pulse

dR/R0 < 1% after 10.000 cycles; duty cycle< 0,1%

Thermistor

Figure 1	Thermistor

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



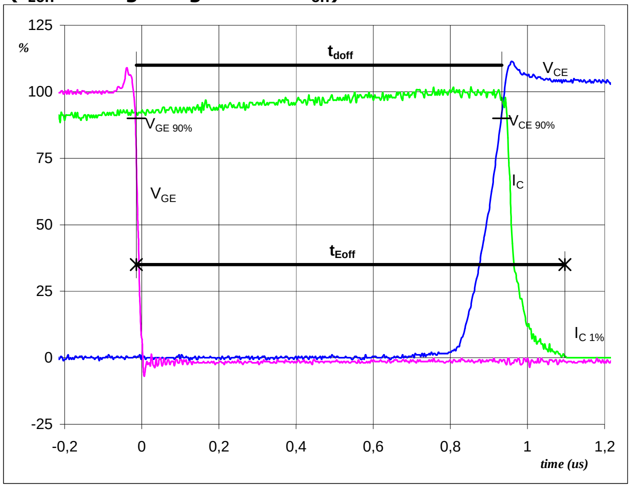
Switching Definitions Output Inverter

General conditions

T_j	=	125 °C

Figure 1 Output inverter IGBT

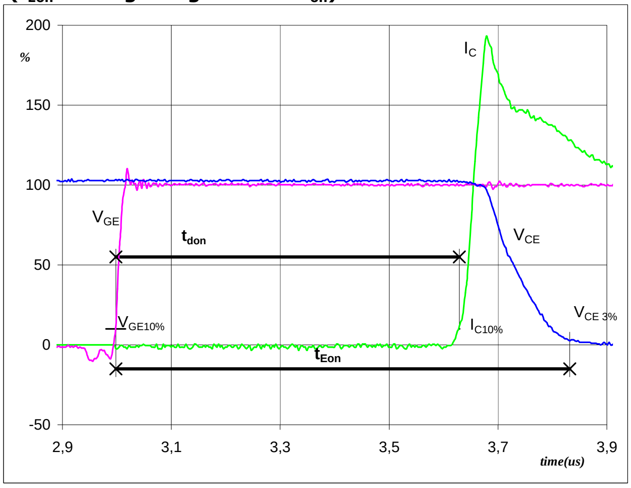
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



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} =	1,11	µs

Figure 2 Output inverter IGBT

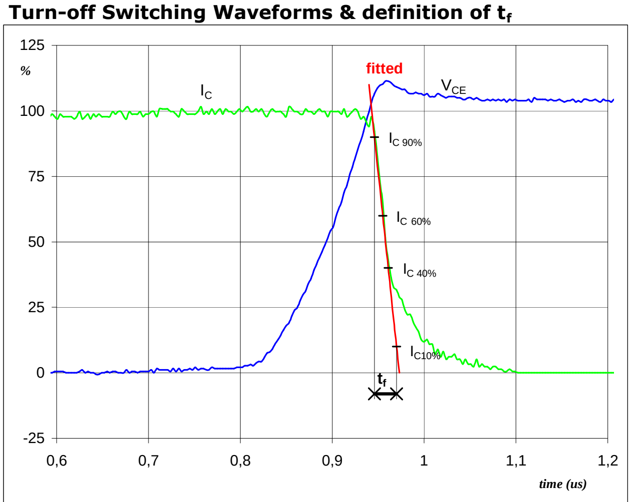
Turn-on Switching Waveforms & definition of tdon, t_{Eon} (t_{Eon} = integrating time for E_{on})



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} =	0,83	µs

Figure 3 Output inverter IGBT

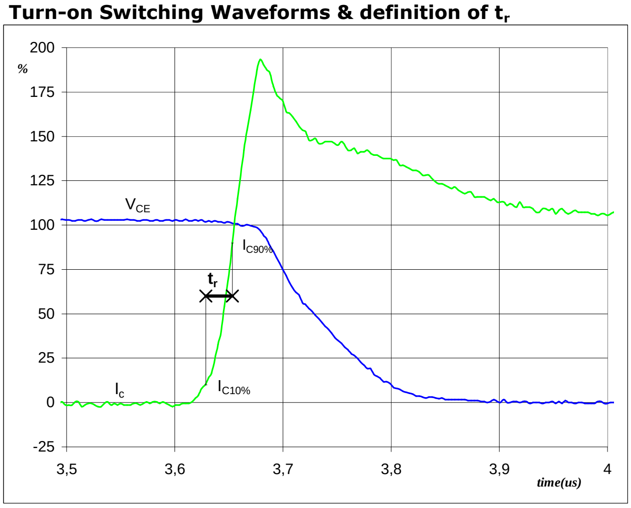
Turn-off Switching Waveforms & definition of t_f



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

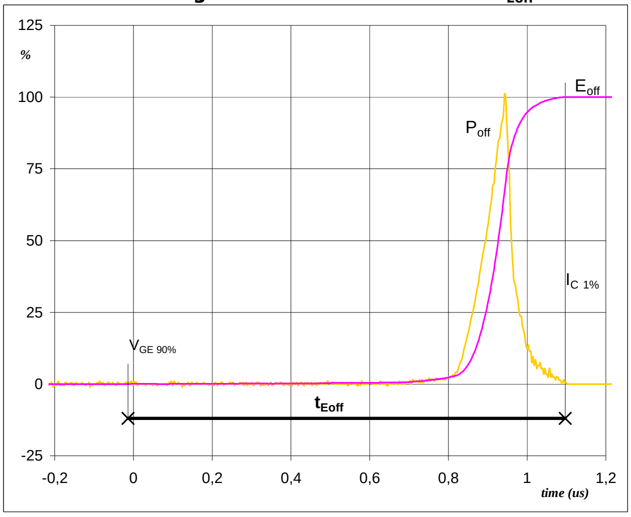


V_C (100%) =	400	V
I_C (100%) =	6	A
t_r =	0,03	µs

Switching Definitions Output Inverter

Figure 5 Output inverter IGBT

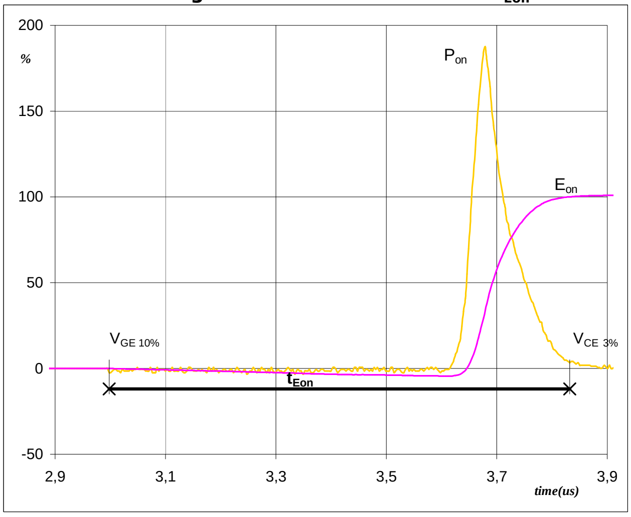
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	2,39	kW
E_{off} (100%) =	0,20	mJ
t_{Eoff} =	1,11	µs

Figure 6 Output inverter IGBT

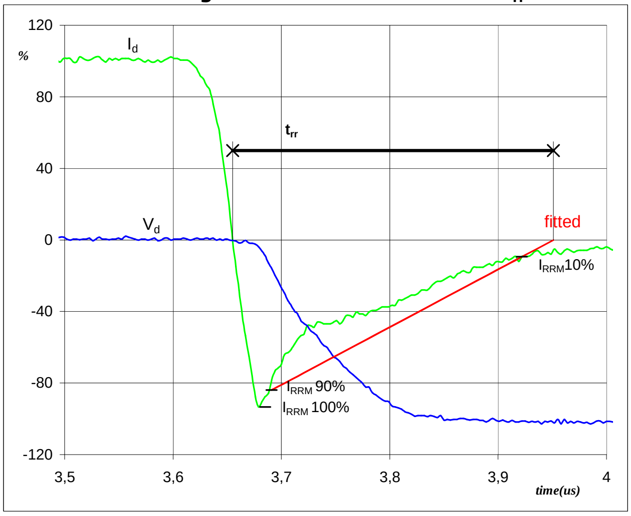
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	2,39	kW
E_{on} (100%) =	0,32	mJ
t_{Eon} =	0,83	µs

Figure 7 Output inverter FWD

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

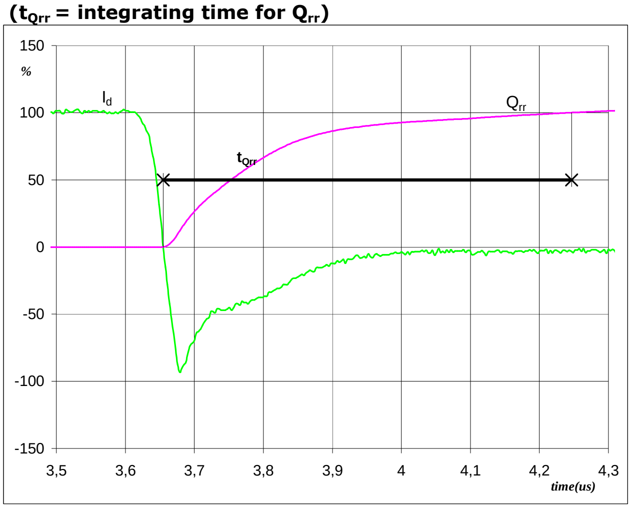


V_d (100%) =	400	V
I_d (100%) =	6	A
I_{RRM} (100%) =	-6	A
t_{rr} =	0,28	µs

Switching Definitions Output Inverter

Figure 8 Output inverter FWD

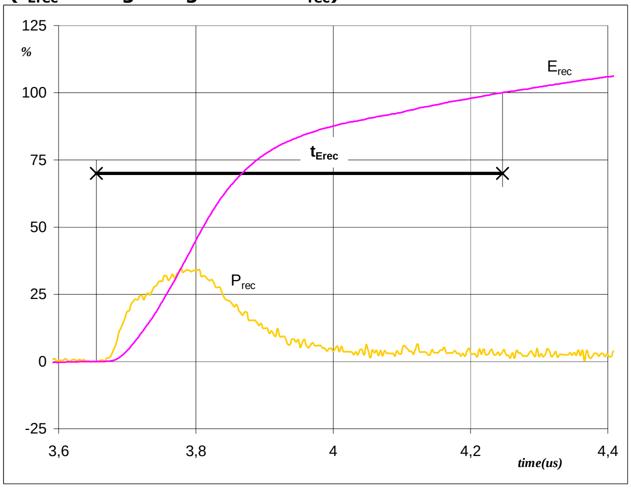
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	6	A
Q_{rr} (100%) =	0,67	μC
t_{Qrr} =	0,59	μs

Figure 9 Output inverter FWD

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

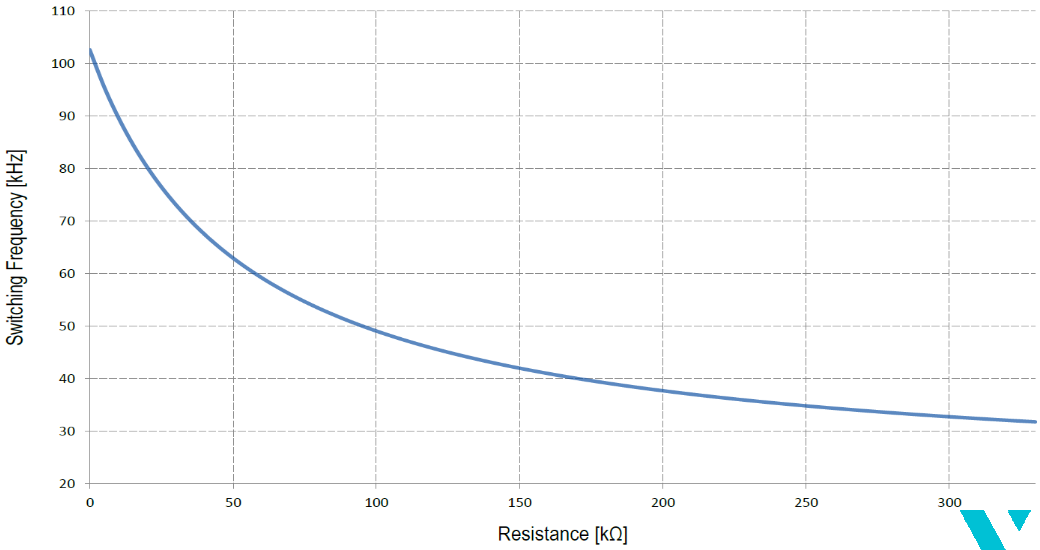


P_{rec} (100%) =	2,39	kW
E_{rec} (100%) =	0,16	mJ
t_{Erec} =	0,59	μs

Application data

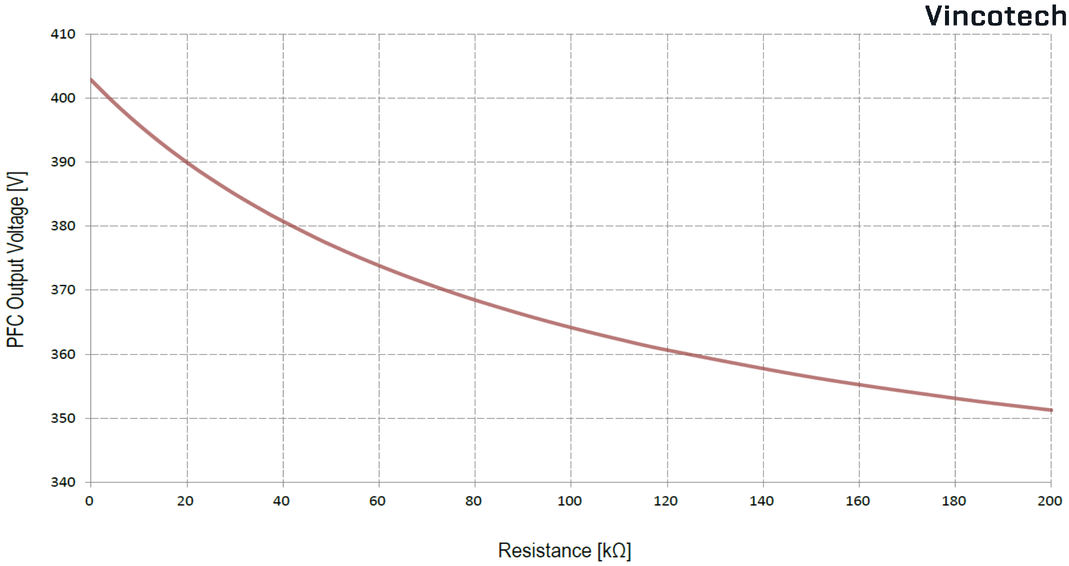
Static logic funtion table

V_{CC}	V_{BS}	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



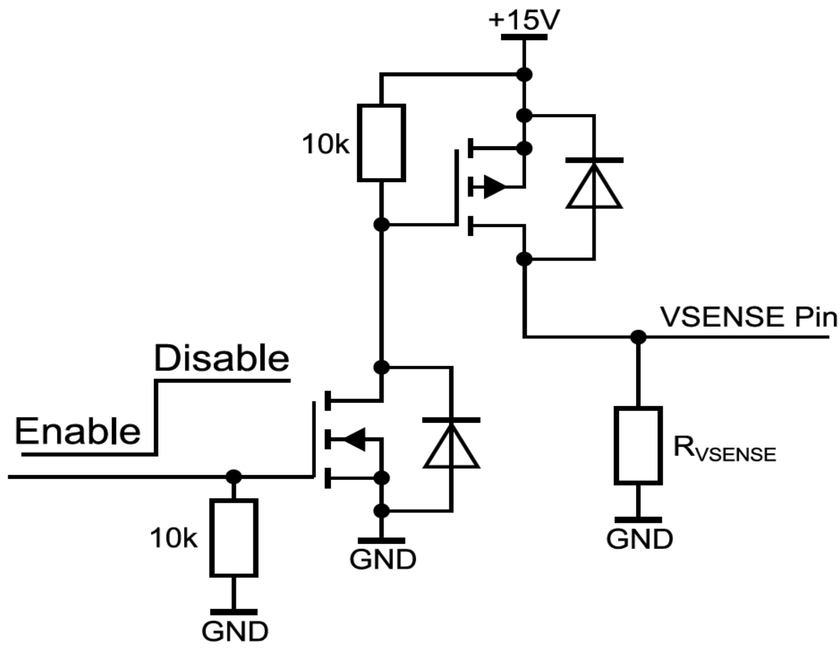
Resistance on f_{set}	Switching Frequency
0Ω	102.6kHz
5.1kΩ	95.5kHz
10.0kΩ	89.7kHz
15.0kΩ	84.7kHz
20.0kΩ	80.3kHz
24.0kΩ	77.2kHz
30.0kΩ	73.2kHz
36.0kΩ	69.6kHz
39.0kΩ	68.0kHz
47.0kΩ	64.3kHz
51.0kΩ	62.6kHz
56.0kΩ	60.7kHz
62.0kΩ	58.6kHz
68.0kΩ	56.7kHz
75.0kΩ	54.7kHz
82.0kΩ	52.9kHz
91.0kΩ	50.9kHz
100.0kΩ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

PFC enable circuit



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 logic, open-drain output)
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

Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

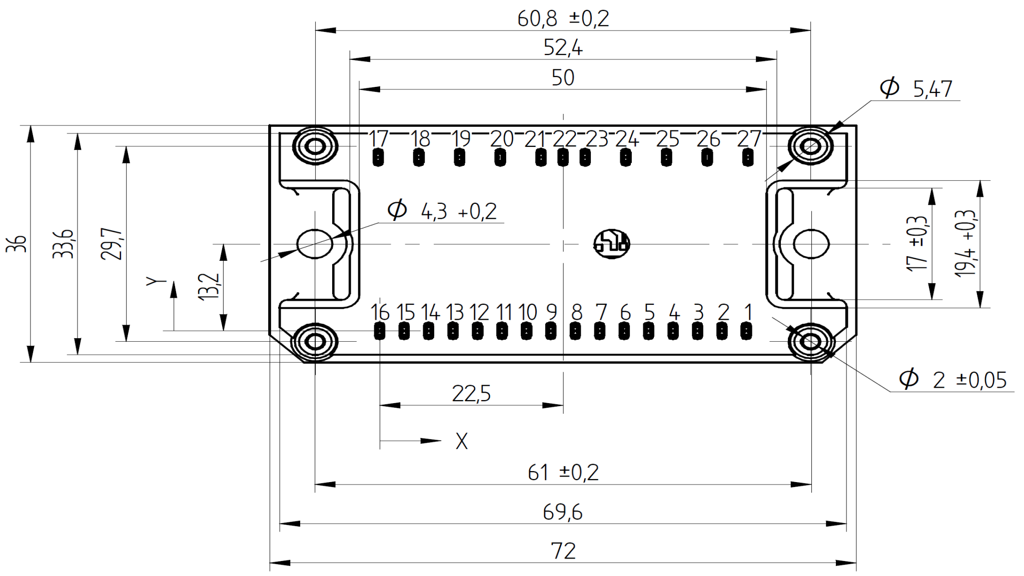
Version	Ordering Code
without thermal paste, solder pins	20-1B06IPB010RC-P955A40
with thermal paste, solder pins	20-1B06IPB010RC-P955A40-/3/
without thermal paste, press fit pins	20-PB06IPB010RC-P955A40Y
with thermal paste, press fit solder pins	20-PB06IPB010RC-P955A40Y-/3/

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

Outline

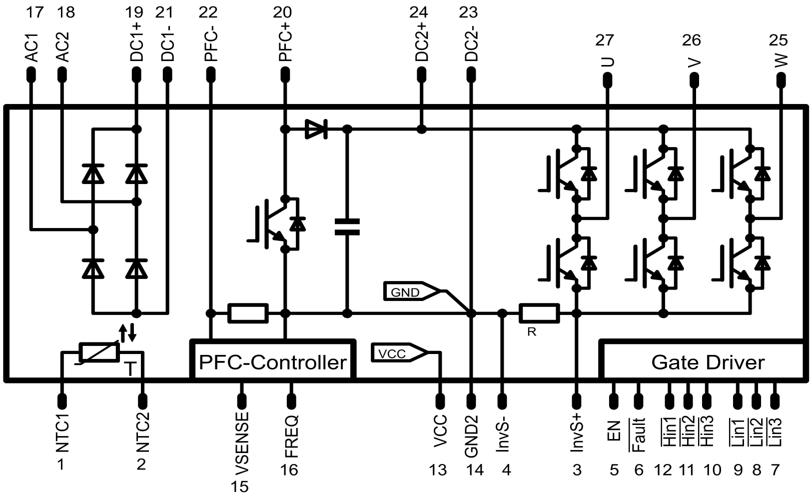
Pin table

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



Ordering Code and Marking - Outline - Pinout

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1,T2,T3,T4,T5,T6	IGBT	600 V	10 A	Inverter Transistor	
T7	IGBT	650 V	30 A	PFC IGBT	
D12	FWD	650 V	30 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-xB06IPB010RC-P955A40x-D8-14	08 Apr. 2017	Page number correction	6