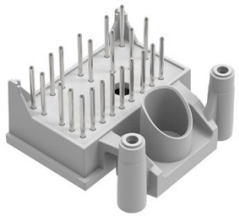
Vincotech

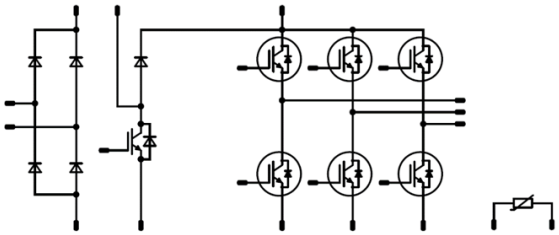
10-0B06PPA004RC-L022A09
datasheet

flowPIM 0B + PFC **600 V / 4 A**

Features
- Converter, PFC, inverter in one housing
- High speed IGBT for PFC
- One screw heatsink mounting

flow 0B 17 mm housing


Target applications
- Embedded Drives

Schematic


Types
- 10-0B06PPA004RC-L022A09

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Rectifier Diode				
Peak repetitive reverse voltage	V_{RRM}		1600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	18	A
Repetitive peak forward current	I_{FRM}	60 Hz Single Half Sine Wave	150	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	34	W
Maximum junction temperature	T_{jmax}		150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		600	V
Collector current	I_C	$T_j = T_{jmax}$ T_s = 80 °C	6	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	12	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	37	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V V_{cc} = 400 V T_j = 150 °C	5	µs
Maximum junction temperature	T_{jmax}		175	°C
Inverter Diode				
Peak repetitive reverse voltage	V_{RRM}		600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	6	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	37	W
Maximum junction temperature	T_{jmax}		175	°C
PFC Switch				
Collector-emitter voltage	V_{CES}		650	V
Collector current	I_C	$T_j = T_{jmax}$ T_s = 80 °C	21	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	45	A
Turn off safe operating area		T_j ≤ 150°C, V_{CE} ≤ 650 V	45	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	44	W
Gate-emitter voltage	V_{GES}		±20	V
Maximum junction temperature	T_{jmax}		175	°C
PFC Diode				
Peak repetitive reverse voltage	V_{RRM}		650	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	15	A
Repetitive peak forward current	I_{FRM}		30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	43	W
Maximum junction temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
PFC Sw. Protection Diode				
Peak repetitive reverse voltage	V_{RRM}		650	V
Continuous (direct) forward current	I_F	T_j = T_{jmax} T_s = 80 °C	6	A
Repetitive peak forward current	I_{FRM}		12	A
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	32	W
Maximum junction temperature	T_{jmax}		175	°C
Module Properties				
Thermal Properties				
Storage temperature	T_{stg}		-40…+125	°C
Operation temperature under switching condition	T_{jop}		-40…(T_{jmax} - 25)	°C
Isolation Properties				
Isolation voltage	V_{isol}	DC Test Voltage* t_p = 2 s	6000	V
		AC Voltage t_p = 1 min	2500	V
Creepage distance			min. 12,7	mm
Clearance			min. 12,7	mm
Comparative Tracking Index	CTI		> 200	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Rectifier Diode										
Static										
Forward voltage	V_F				7	25 125		1,04 0,97	1,14	V
Reverse leakage current	I_R			1600		25			20	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,09		K/W
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	V_{GE} = V_{CE}			0,000075	25	4,4	5	5,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		4	25 125 150	1,88	2,20 2,30 2,29	2,62	V
Collector-emitter cut-off current	I_{CES}		0	600		25			2	µA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f= 1 Mhz	0	25		25		305		pF
Output capacitance	C_{oes}							18		
Reverse transfer capacitance	C_{res}							9		
Gate charge	Q_g		15	480	4	25		27		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,60		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 64 Ω R_{goff} = 64 Ω	±15	400	4	25 125		88 81		ns
Rise time	t_r					25 125		15 18		
Turn-off delay time	$t_{d(off)}$					25 125		84 98		
Fall time	t_f					25 125		25 47		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,2 µC Q_{rFWD} = 0,4 µC				25 125		0,099 0,158		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,049 0,079		

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Diode										
Static										
Forward voltage	V_F				4	25 125 150		2,08 1,96 1,92	2,5	V
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,60		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 447 A/µs di/dt = 196 A/µs	±15	400	4	25 125		4 4		A
Reverse recovery time	t_{rr}					25 125		164 219		ns
Recovered charge	Q_r					25 125		0,199 0,379		µC
Reverse recovered energy	E_{rec}					25 125		0,051 0,096		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		47 45		A/µs

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
PFC Switch										
Static										
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		15	25 125 150		1,64 1,77 1,80	2,22	V
Collector-emitter cut-off current	I_{CES}		0	650		25			40	µA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f= 1 Mhz	0	25		25		930		pF
Output capacitance	C_{oes}							24		
Reverse transfer capacitance	C_{res}							4		
Gate charge	Q_g		15	520	15	25		38		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,14		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 32 Ω R_{goff} = 32 Ω	0 / 15	400	15	25 125 150		17 17 18		ns
Rise time	t_r					25 125 150		25 26 26		
Turn-off delay time	$t_{d(off)}$					25 125 150		129 141 145		
Fall time	t_f					25 125 150		14 14 14		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,5 µC Q_{rFWD} = 0,9 µC Q_{rFWD} = 1 µC				25 125 150		0,418 0,535 0,571		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,106 0,141 0,154		

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
PFC Diode										
Static										
Forward voltage	V_F				15	25 125 150		1,51 1,43 1,39	1,92	V
Reverse leakage current	I_R			650		25			0,94	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,19		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 616 A/µs di/dt = 605 A/µs di/dt = 593 A/µs	0 / 15	400	15	25 125 150		8 12 13		A
Reverse recovery time	t_{rr}					25 125 150		88 114 125		ns
Recovered charge	Q_r					25 125 150		0,463 0,949 1,047		µC
Reverse recovered energy	E_{rec}					25 125 150		0,101 0,222 0,244		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		390 241 171		A/µs
PFC Sw. Protection Diode										
Static										
Forward voltage	V_F				6	25 125 150		1,73 1,59 1,54	1,87	V
Reverse leakage current	I_R			650		25			0,1	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						3,01		K/W

Characteristic Values

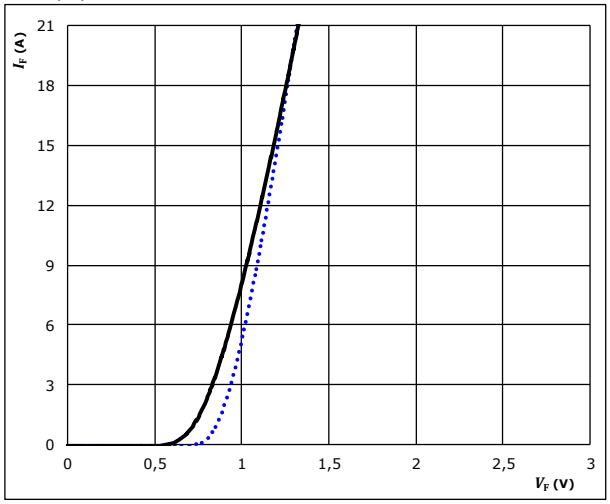
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %				25		3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %				25		4000		K
Vincotech NTC Reference									I	

Rectifier Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



t_p = 250 µs

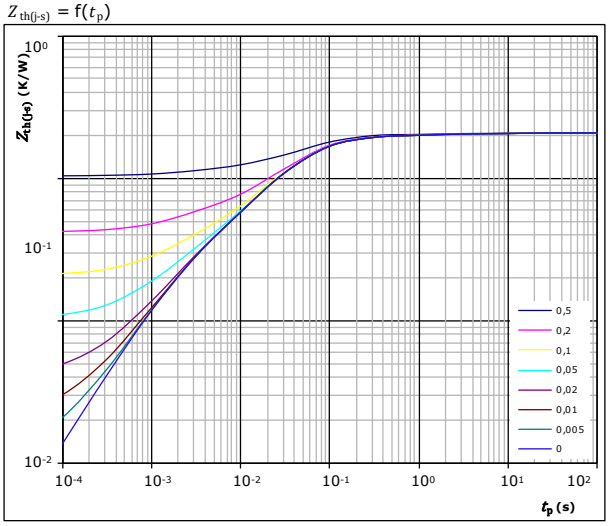
T_j: 25 °C

125 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 2,09 K/W

FWD thermal model values

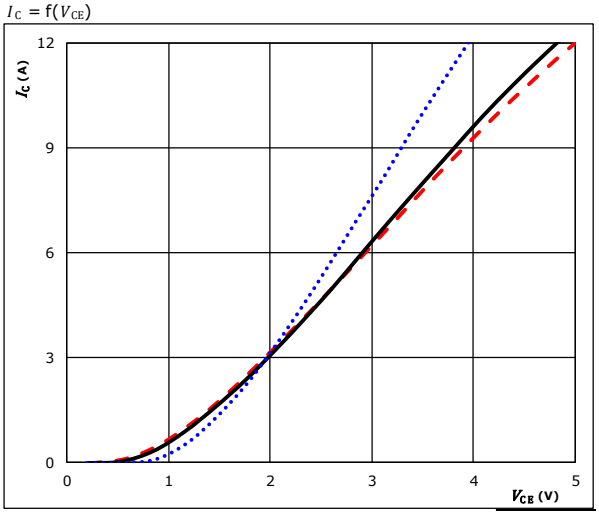
R (K/W)	τ (s)
4,86E-02	1,03E+01
1,45E-01	6,91E-01
1,18E+00	6,09E-02
5,40E-01	1,88E-02
1,74E-01	1,96E-03

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

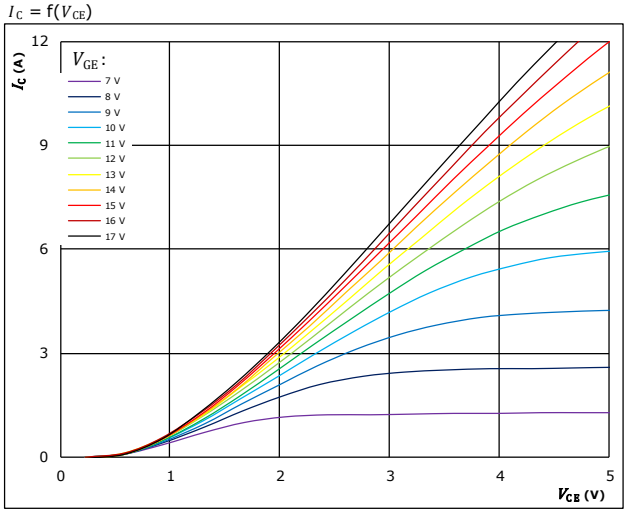


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

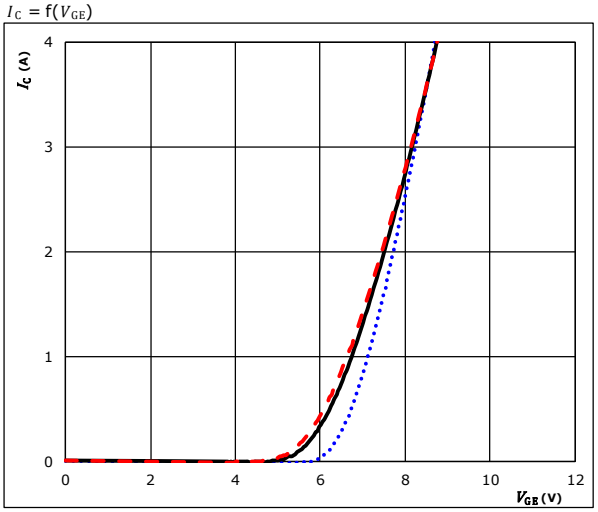


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

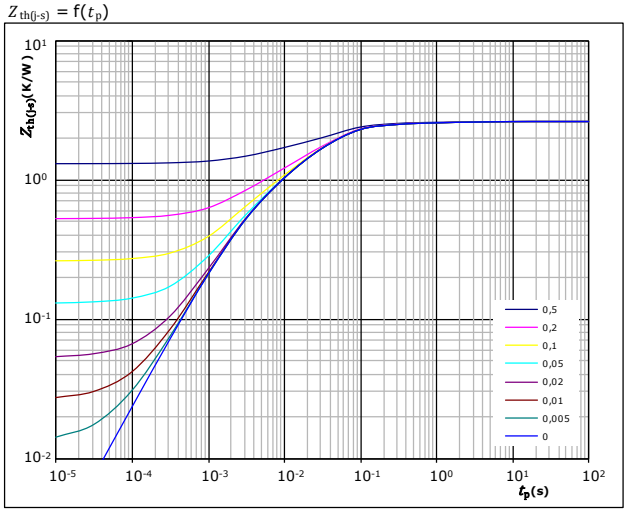


t_p =	100	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	2,60	K/W

IGBT thermal model values

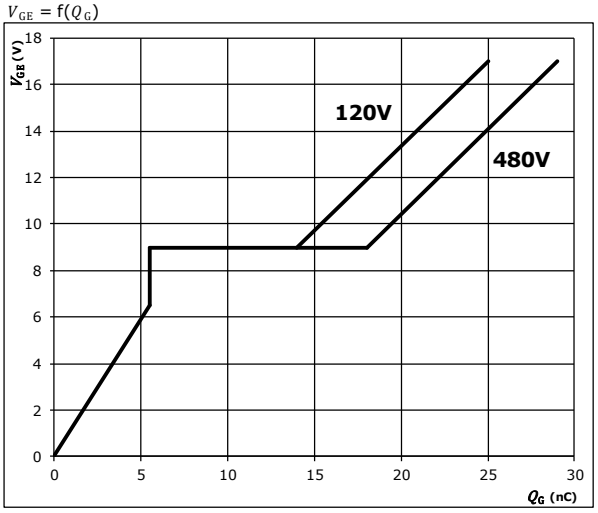
R (K/W)	τ (s)
7,48E-02	2,66E+00
1,91E-01	2,47E-01
1,40E+00	4,11E-02
4,54E-01	1,27E-02
4,75E-01	2,92E-03

Inverter Switch Characteristics

figure 5. **IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

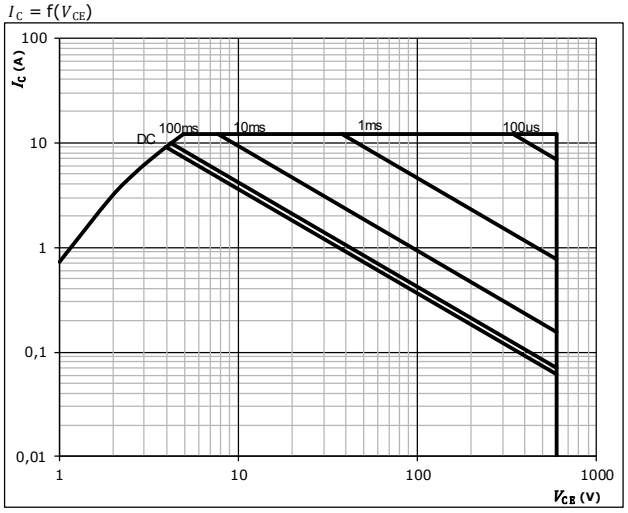


I_C = 4 A

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$

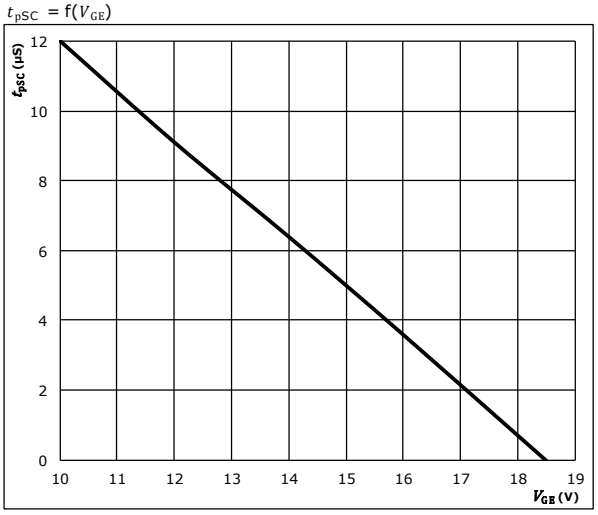


D = single pulse
T_s = 80 °C
V_{GE} = ±15 V
T_j = T_{jmax}

figure 7. **IGBT**

Short circuit duration as a function of V_{GE}

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

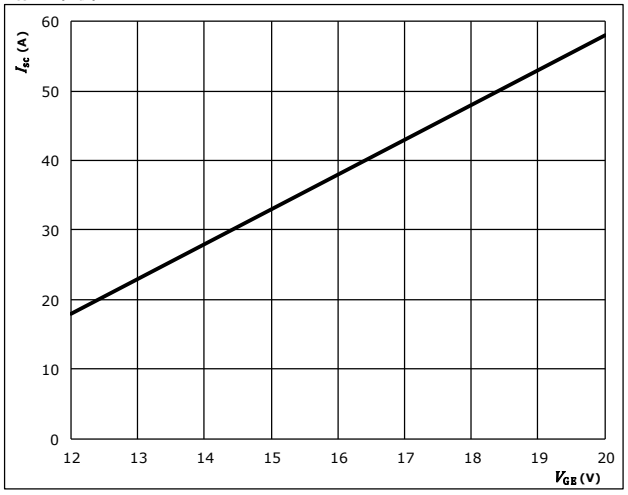


V_{CE} = 1200 V
$T_j \leq$ 150 °C

figure 8. **IGBT**

Typical short circuit current as a function of V_{GE}

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



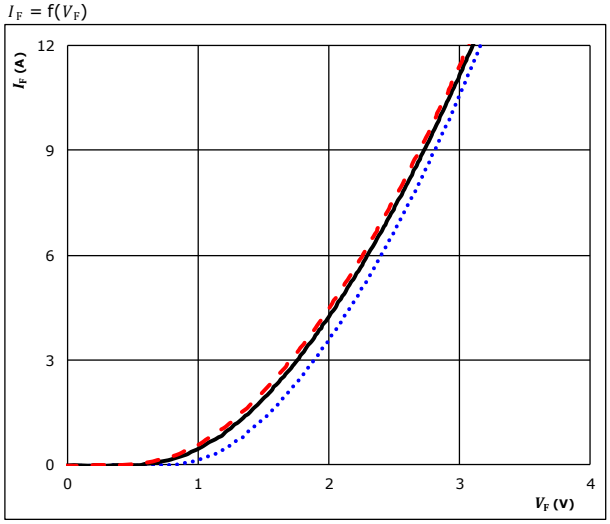
$V_{CE} \leq$ 400 V
$T_j \leq$ 150 °C

Inverter Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



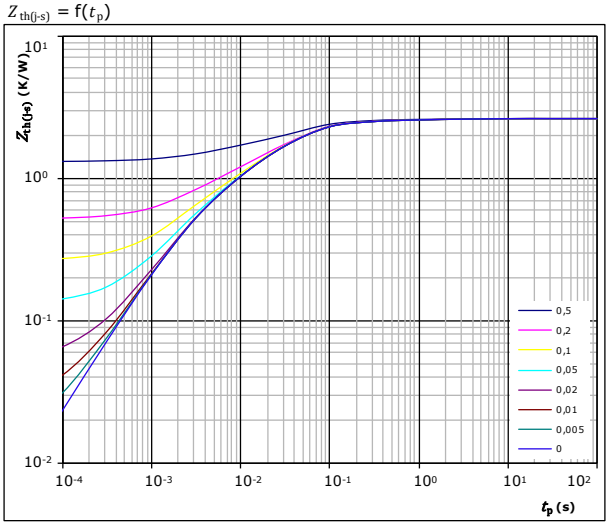
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 2,60 K/W

FWD thermal model values

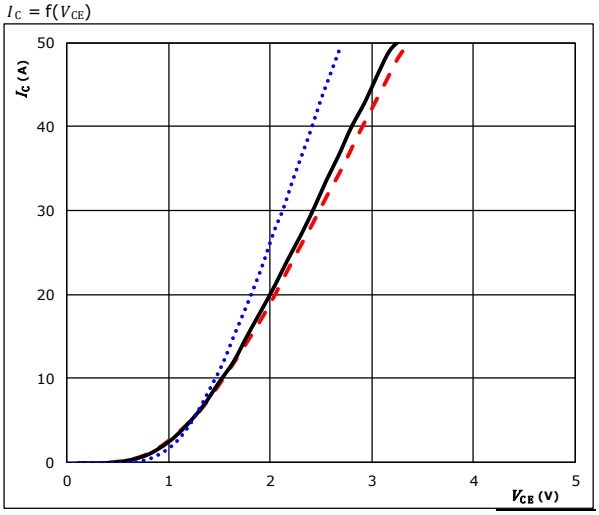
R (K/W)	τ (s)
7,48E-02	2,66E+00
1,91E-01	2,47E-01
1,40E+00	4,11E-02
4,54E-01	1,27E-02
4,75E-01	2,92E-03

PFC Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

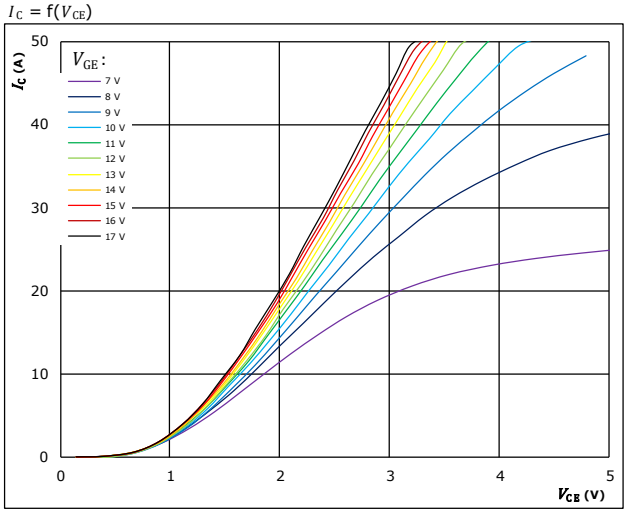


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

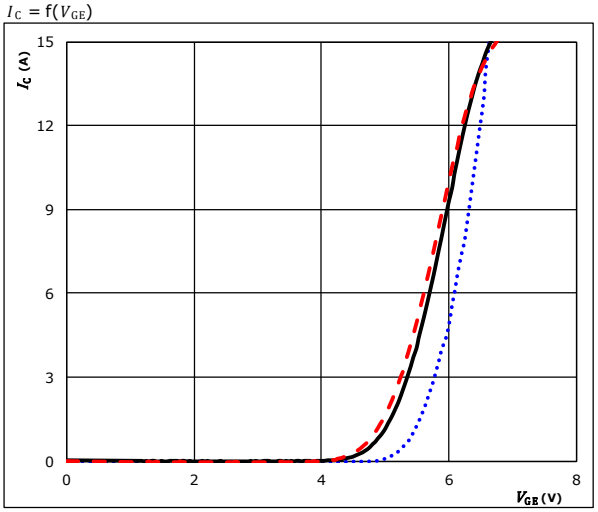


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

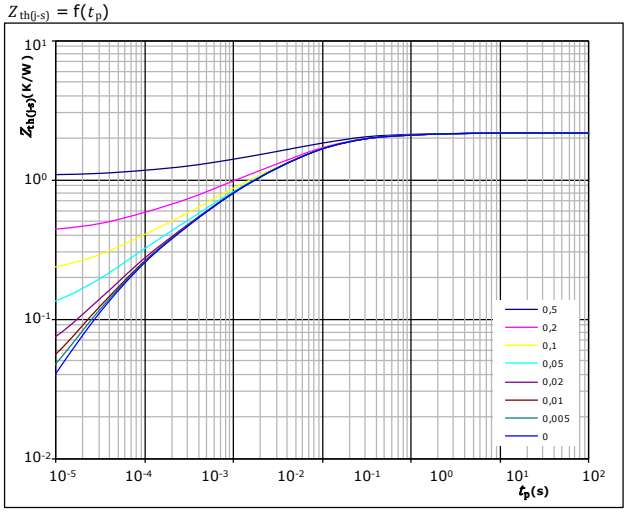


t_p =	100	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	2,14	K/W

IGBT thermal model values

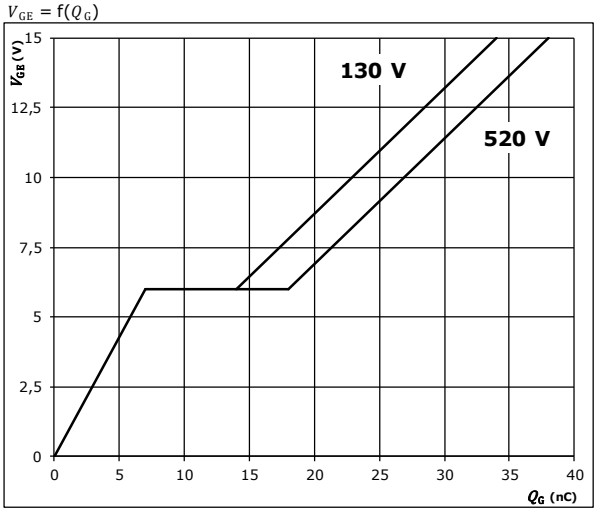
R (K/W)	τ (s)
1,10E-01	1,85E+00
3,05E-01	2,58E-01
8,44E-01	6,42E-02
4,55E-01	1,26E-02
2,79E-01	3,05E-03
1,45E-01	4,84E-04

PFC Switch Characteristics

figure 5. **IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

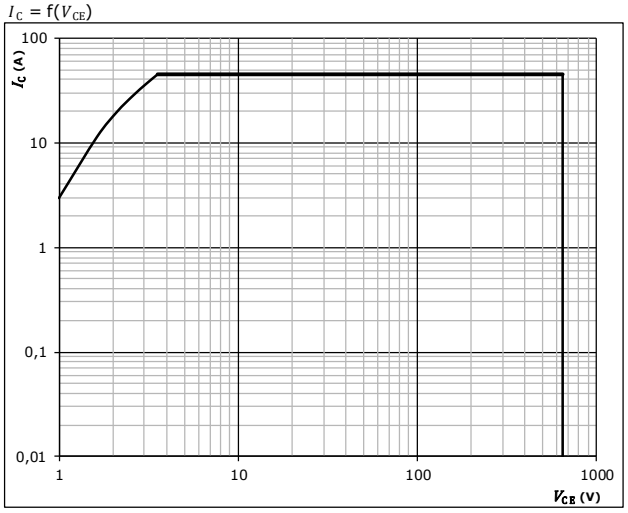


I_C = 15 A

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



D = single pulse

T_s = 80 °C

V_{GE} = ±15 V

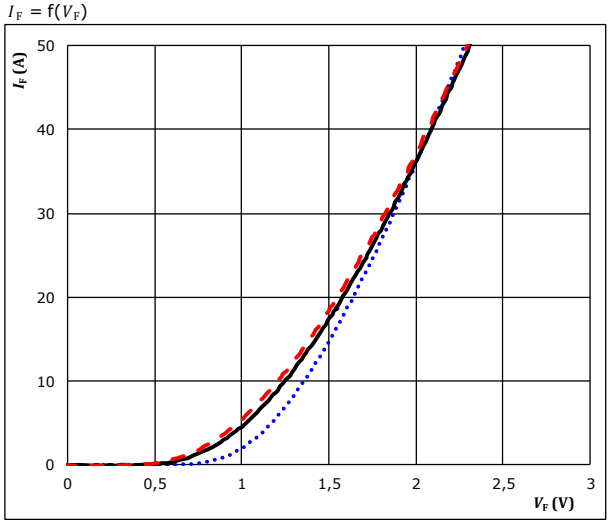
T_j = T_{jmax}

PFC Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



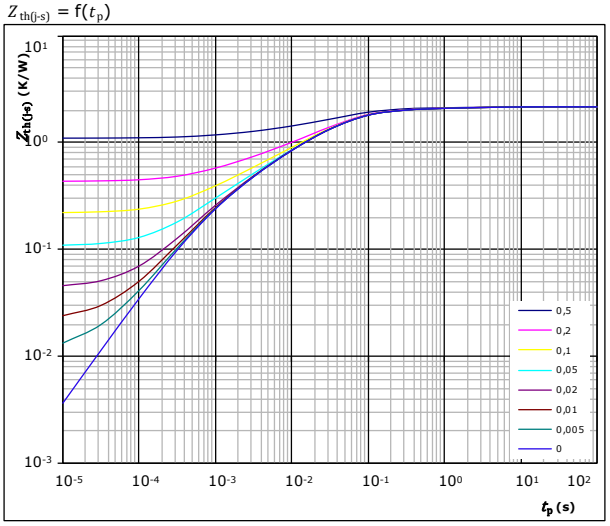
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 2,19 K/W

FWD thermal model values

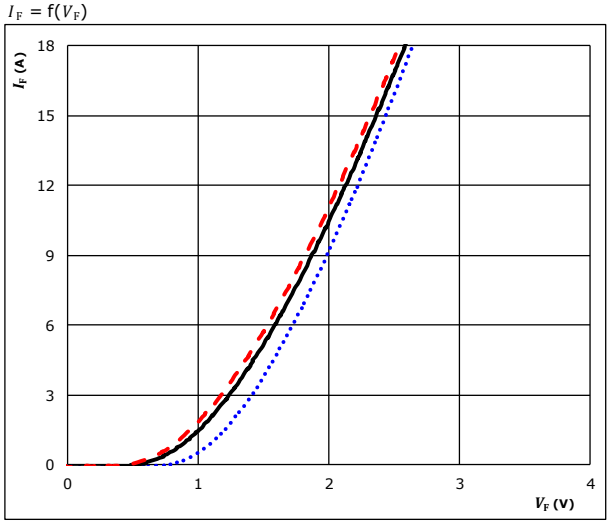
R (K/W)	τ (s)
6,49E-02	4,22E+00
1,67E-01	4,66E-01
9,76E-01	5,57E-02
5,62E-01	1,45E-02
3,00E-01	2,81E-03
1,17E-01	5,62E-04

PFC Sw. Protection Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



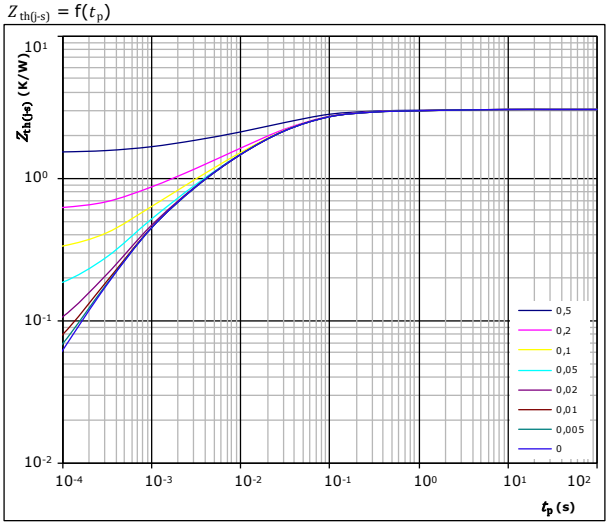
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 3,01 K/W

FWD thermal model values

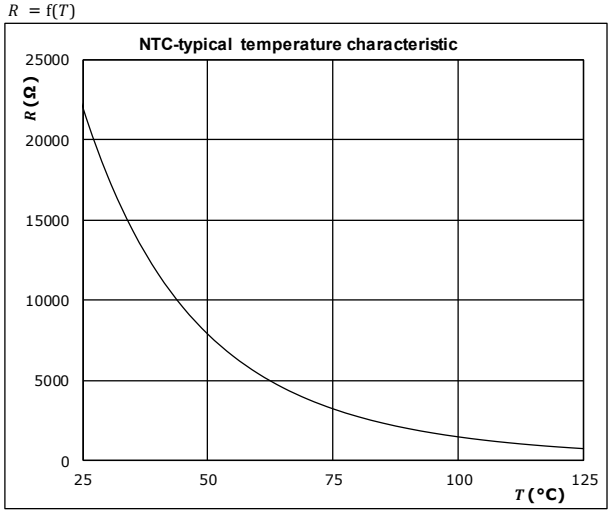
R (K/W)	τ (s)
5,15E-02	9,38E+00
9,53E-02	8,91E-01
3,22E-01	1,25E-01
1,35E+00	2,97E-02
8,32E-01	8,19E-03
3,58E-01	1,78E-03

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic as a function of temperature

$R = f(T)$

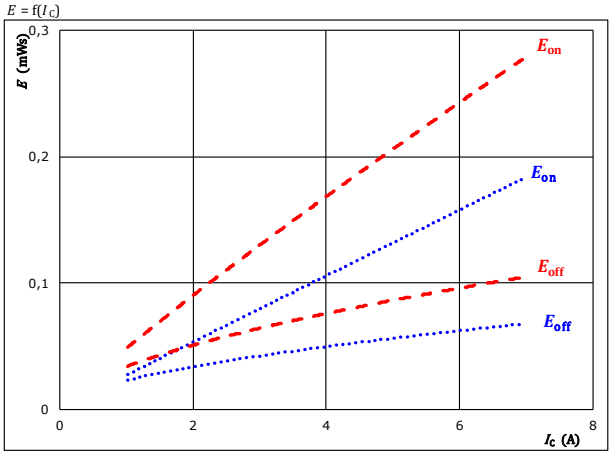


Inverter Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



With an inductive load at

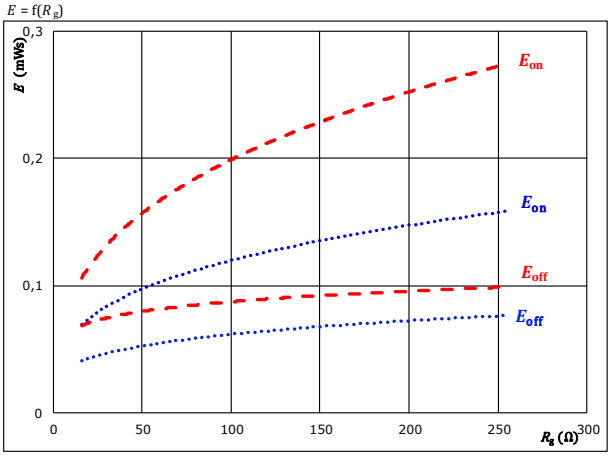
V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	64	Ω
R_{goff} =	64	Ω

T_j: 25 °C, 125 °C

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



With an inductive load at

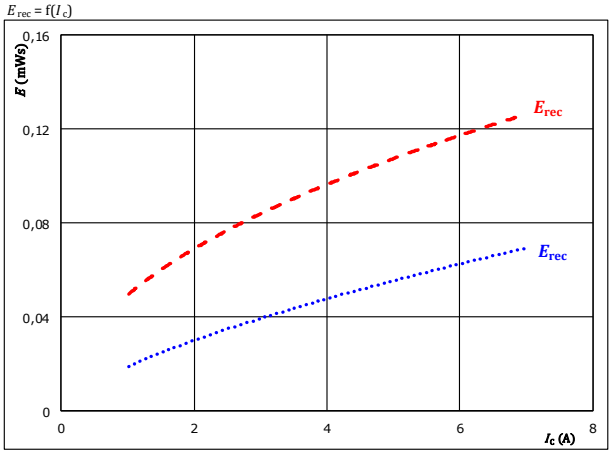
V_{CE} =	400	V
V_{GE} =	±15	V
I_C =	4	A

T_j: 25 °C, 125 °C

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



With an inductive load at

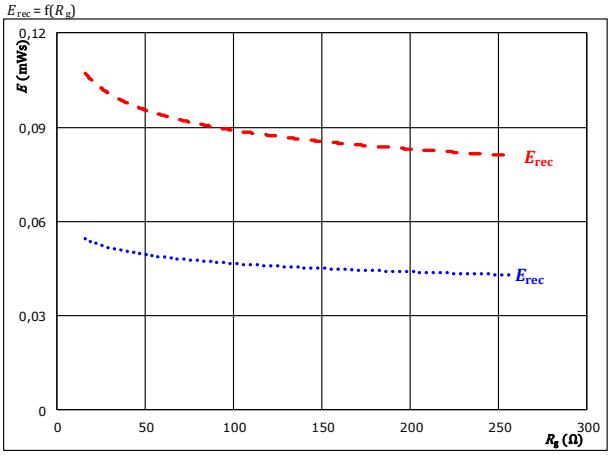
V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	64	Ω

T_j: 25 °C, 125 °C

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

V_{CE} =	400	V
V_{GE} =	±15	V
I_C =	4	A

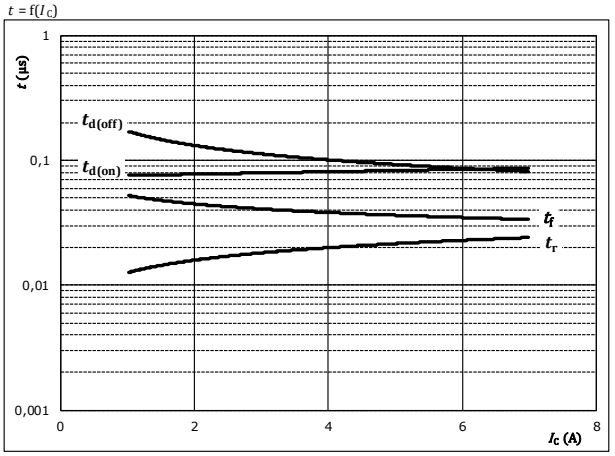
T_j: 25 °C, 125 °C

Inverter Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



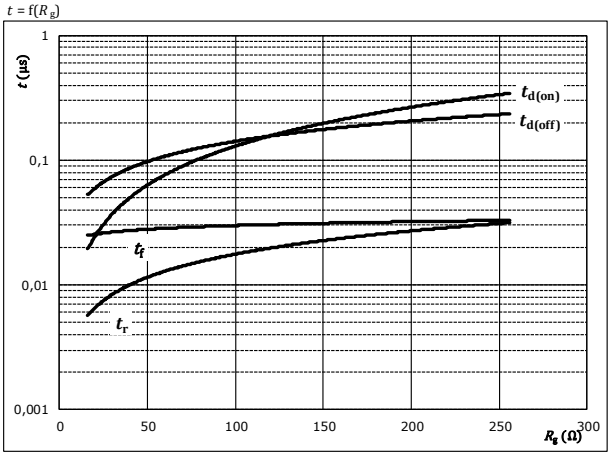
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	64	Ω
R_{goff} =	64	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



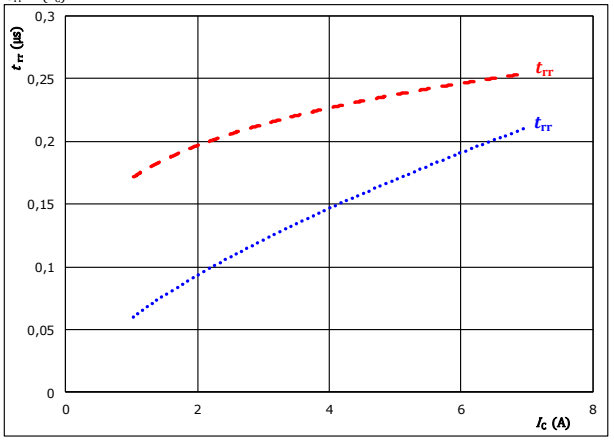
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	±15	V
I_C =	4	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



With an inductive load at

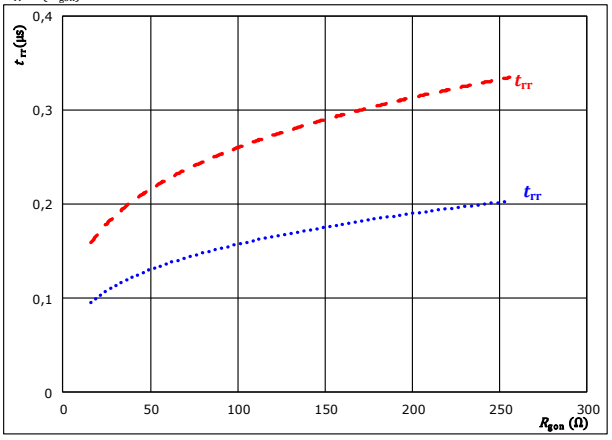
V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	64	Ω

T_j: 25 °C, 125 °C

figure 8. **FWD**

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

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



With an inductive load at

V_{CE} =	400	V
V_{GE} =	±15	V
I_C =	4	A

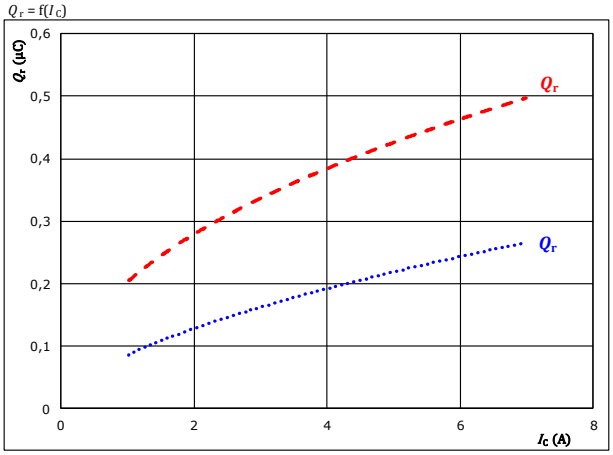
T_j: 25 °C, 125 °C

Inverter Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



With an inductive load at

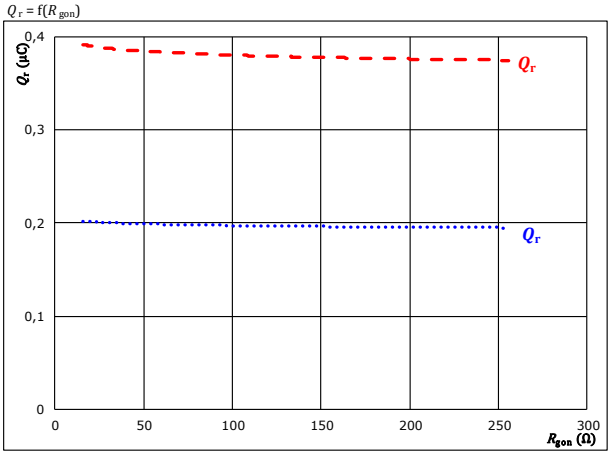
V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	64	Ω

T_j: 25 °C, 125 °C

figure 10. **FWD**

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

$Q_r = f(R_{gon})$



With an inductive load at

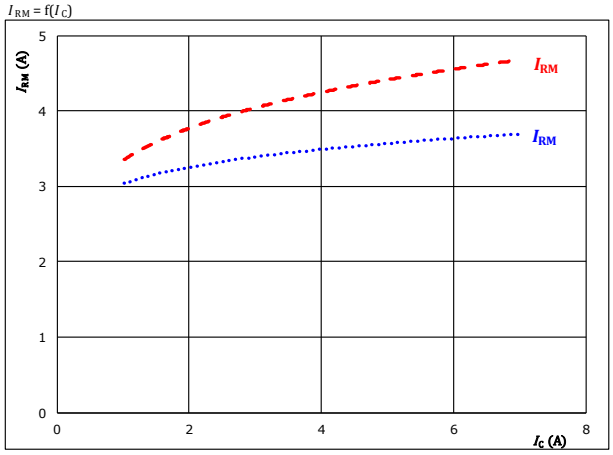
V_{CE} =	400	V
V_{GE} =	±15	V
I_C =	4	A

T_j: 25 °C, 125 °C

figure 11. **FWD**

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

$I_{RM} = f(I_C)$



With an inductive load at

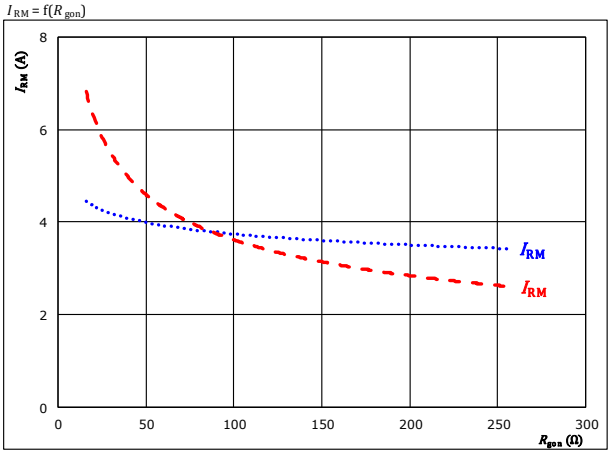
V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	64	Ω

T_j: 25 °C, 125 °C

figure 12. **FWD**

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

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



With an inductive load at

V_{CE} =	400	V
V_{GE} =	±15	V
I_C =	4	A

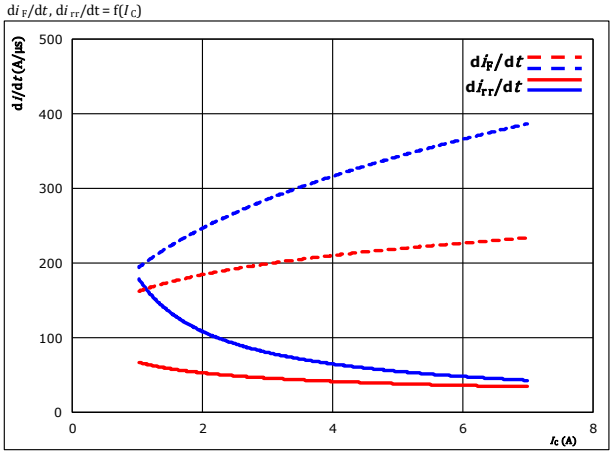
T_j: 25 °C, 125 °C

Inverter Switching Characteristics

figure 13. **FWD**

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

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



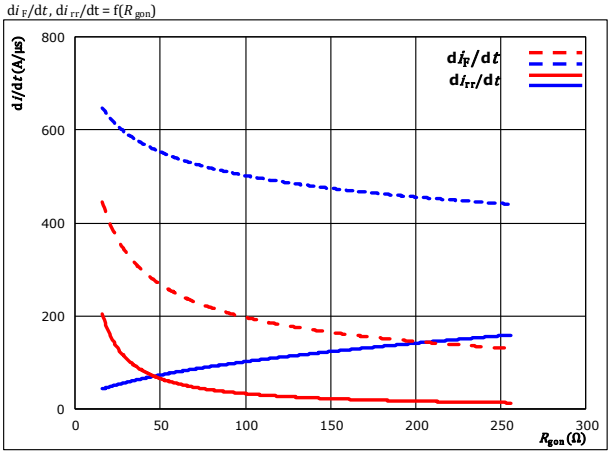
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	64	Ω		

figure 14. **FWD**

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

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



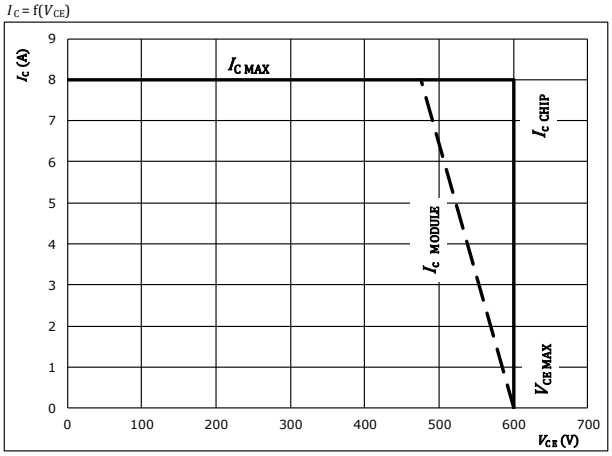
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	4	A		

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

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

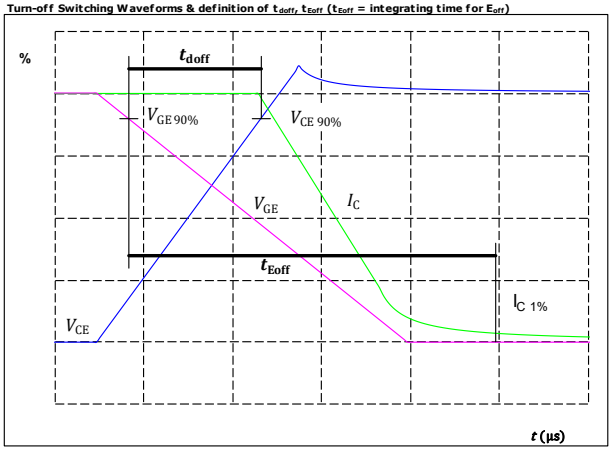
Inverter Switching Definitions

General conditions

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

figure 1. IGBT

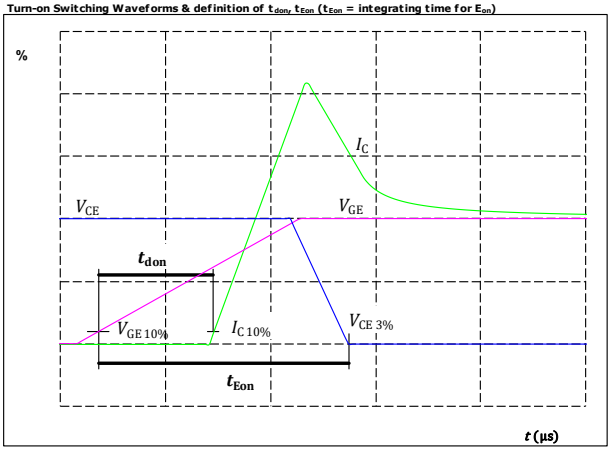
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	4	A
t_{doff} =	98	ns

figure 2. IGBT

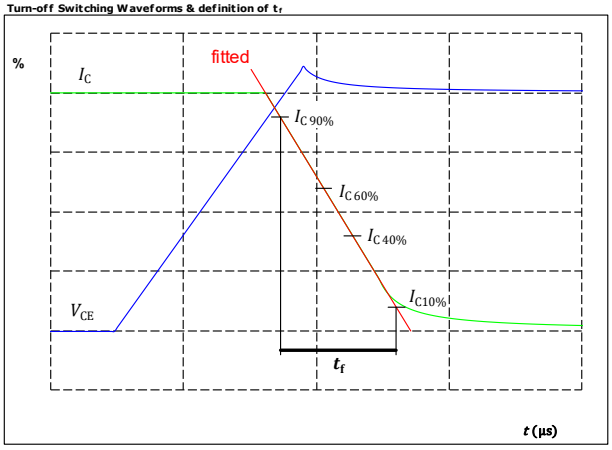
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	4	A
t_{don} =	81	ns

figure 3. IGBT

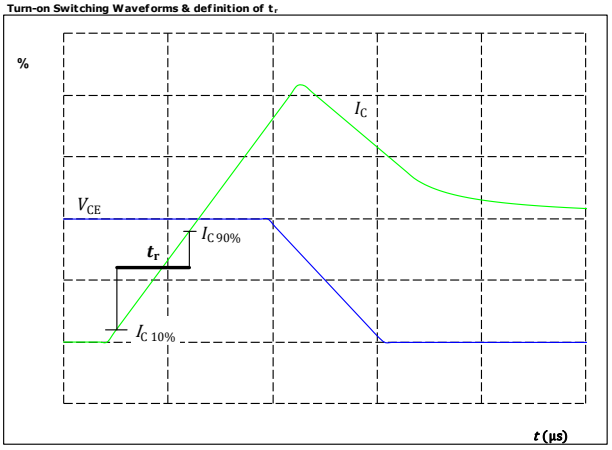
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	4	A
t_f =	47	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

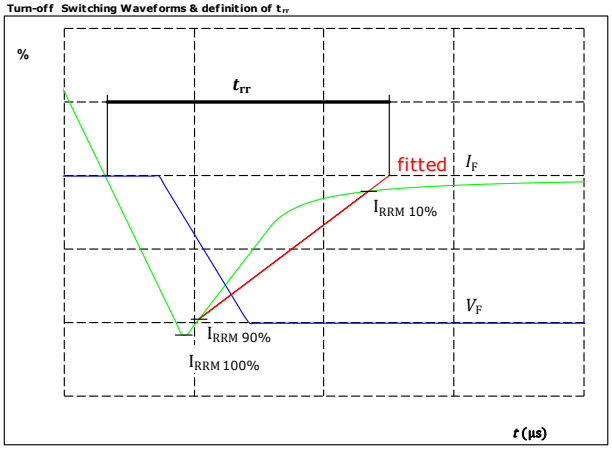


$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	4	A
t_r =	18	ns

Inverter Switching Characteristics

figure 5. **FWD**

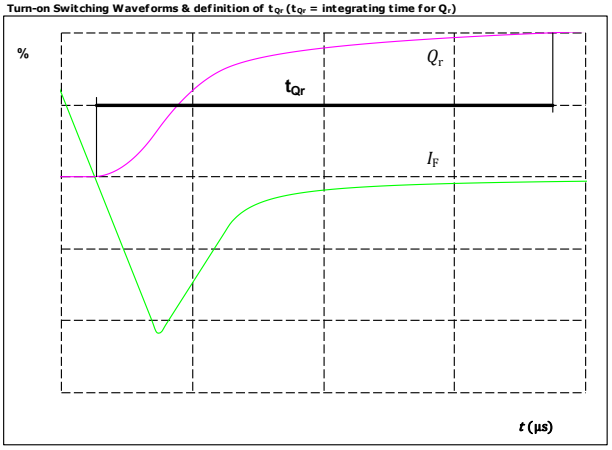
Turn-off Switching Waveforms & definition of t_{rr}



$V_F(100\%)$ =	400	V
$I_F(100\%)$ =	4	A
$I_{RRM}(100\%)$ =	4	A
t_{rr} =	219	ns

figure 6. **FWD**

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



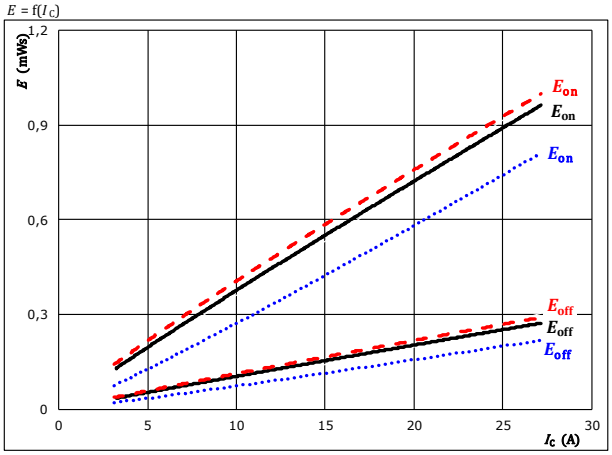
$I_F(100\%)$ =	4	A
$Q_r(100\%)$ =	0	µC

PFC Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



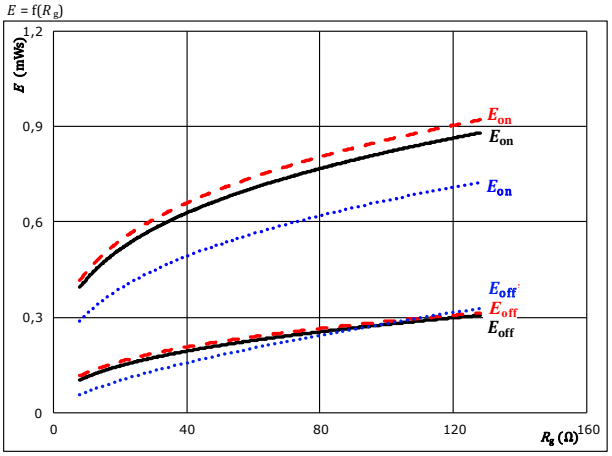
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0 / 15	V		125 °C
R_{gon} =	32	Ω		150 °C
R_{goff} =	32	Ω		

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



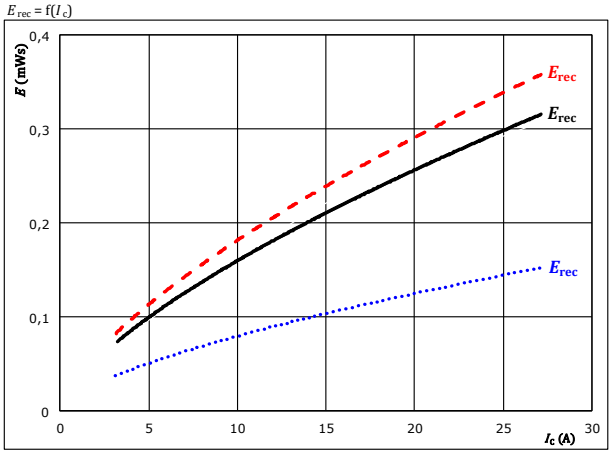
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0 / 15	V		125 °C
I_C =	15	A		150 °C

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_c)$



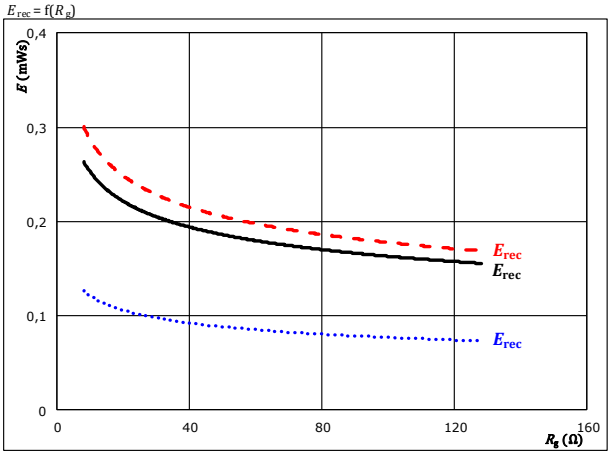
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0 / 15	V		125 °C
R_{gon} =	32	Ω		150 °C

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

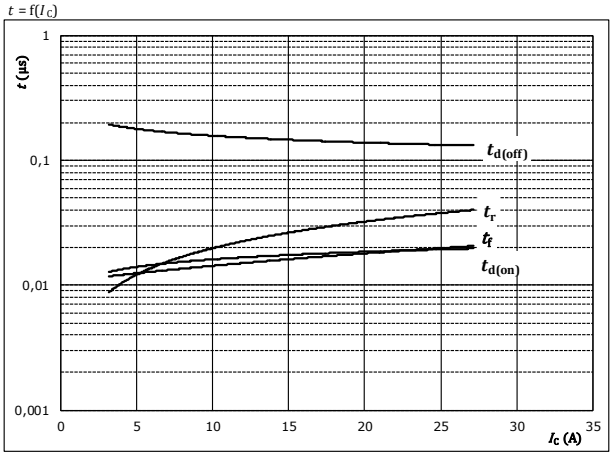
V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0 / 15	V		125 °C
I_C =	15	A		150 °C

PFC Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



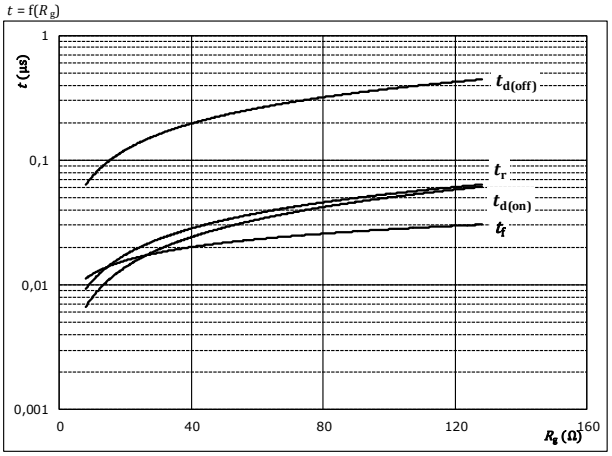
With an inductive load at

T_j =	150	°C
V_{CE} =	400	V
V_{GE} =	0 / 15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



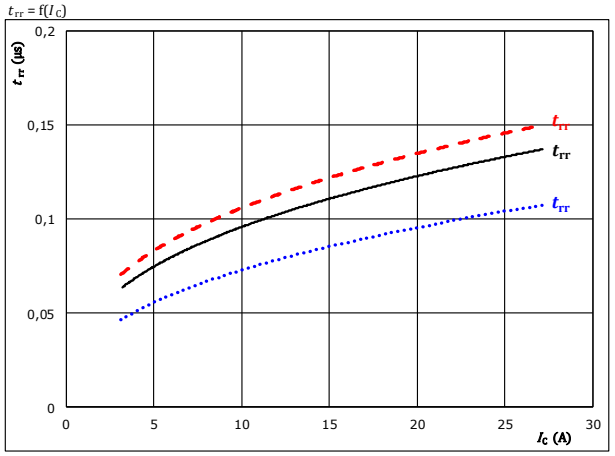
With an inductive load at

T_j =	150	°C
V_{CE} =	400	V
V_{GE} =	0 / 15	V
I_C =	15	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



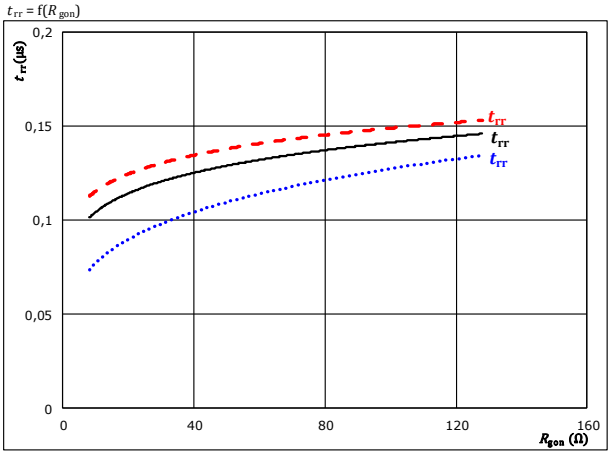
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0 / 15	V		125 °C
R_{gon} =	32	Ω		150 °C

figure 8. **FWD**

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

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



With an inductive load at

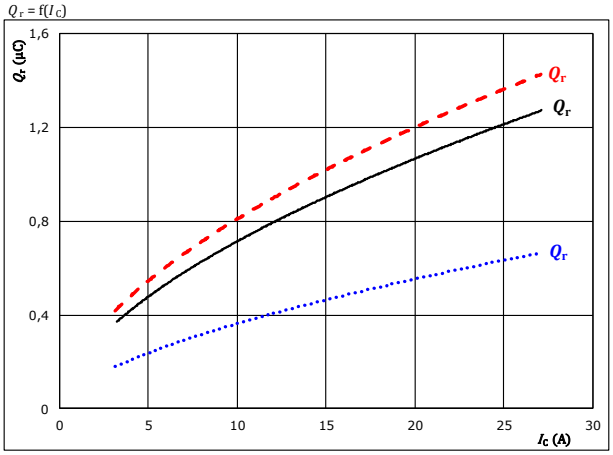
V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0 / 15	V		125 °C
I_C =	15	A		150 °C

PFC Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



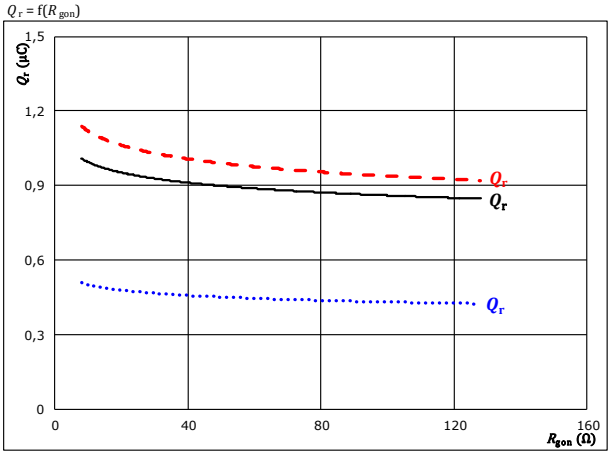
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C	
V_{GE} =	0 / 15	V		125 °C	
R_{gon} =	32	Ω		150 °C	

figure 10. **FWD**

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

$Q_r = f(R_{gon})$



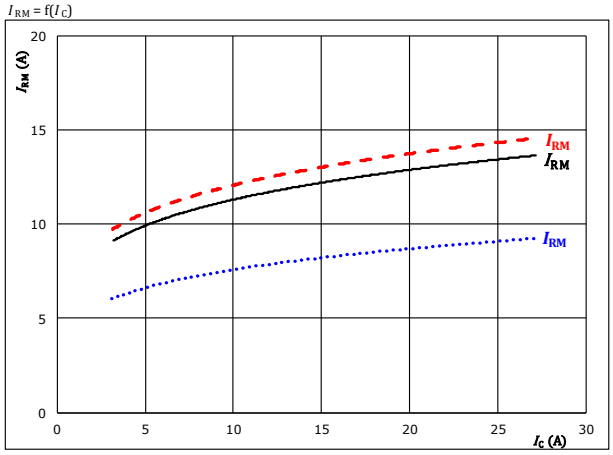
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C	
V_{GE} =	0 / 15	V		125 °C	
I_C =	15	A		150 °C	

figure 11. **FWD**

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

$I_{RM} = f(I_C)$



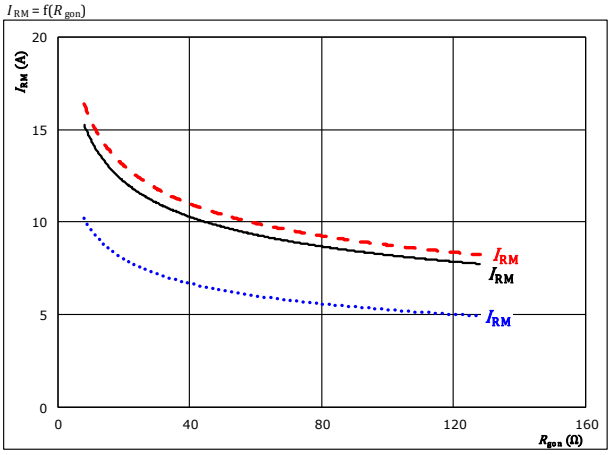
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C	
V_{GE} =	0 / 15	V		125 °C	
R_{gon} =	32	Ω		150 °C	

figure 12. **FWD**

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

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



With an inductive load at

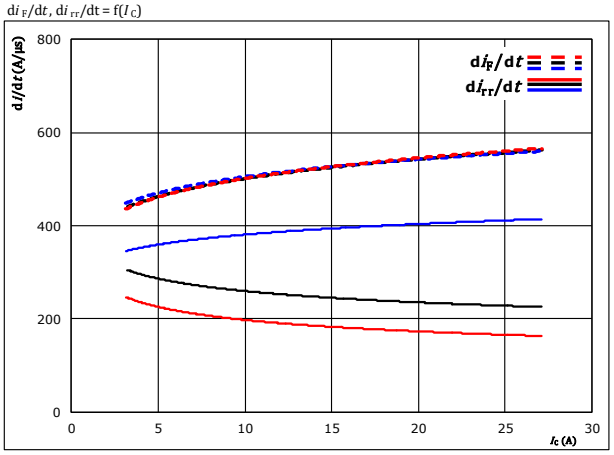
V_{CE} =	400	V	T_j:	25 °C	
V_{GE} =	0 / 15	V		125 °C	
I_C =	15	A		150 °C	

PFC Switching Characteristics

figure 13. **FWD**

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

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



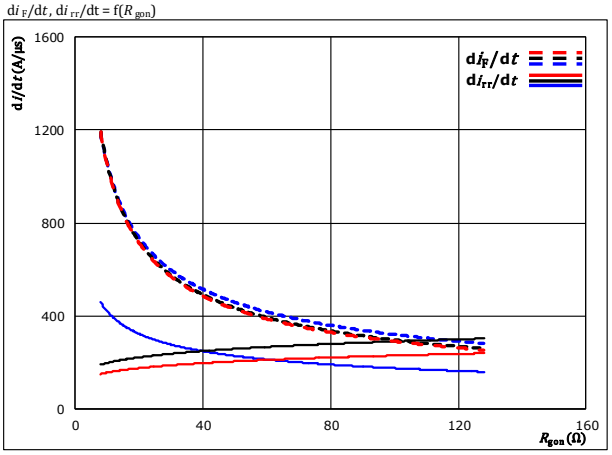
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0 / 15	V		125 °C
R_{gon} =	32	Ω		150 °C

figure 14. **FWD**

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

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



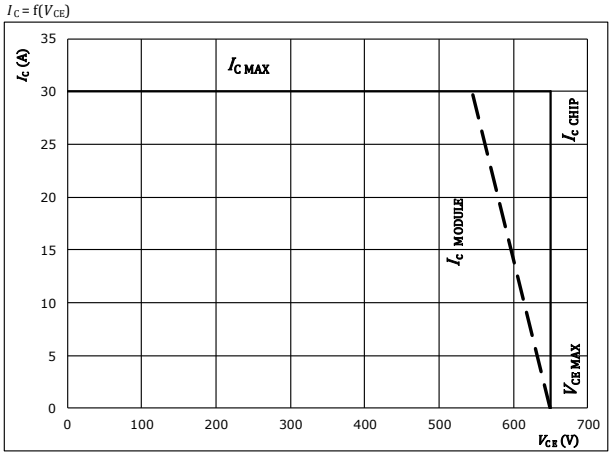
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0 / 15	V		125 °C
I_C =	15	A		

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

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

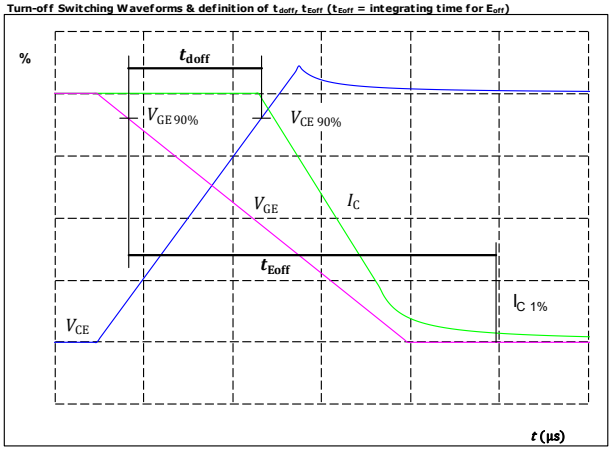
PFC Switching Definitions

General conditions

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

figure 1. IGBT

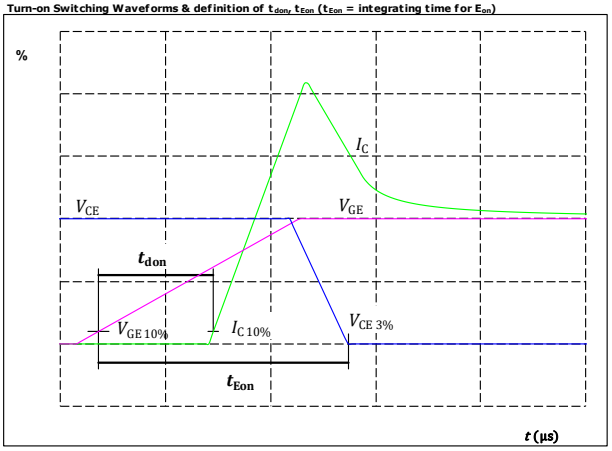
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	15	A
t_{doff} =	141	ns

figure 2. IGBT

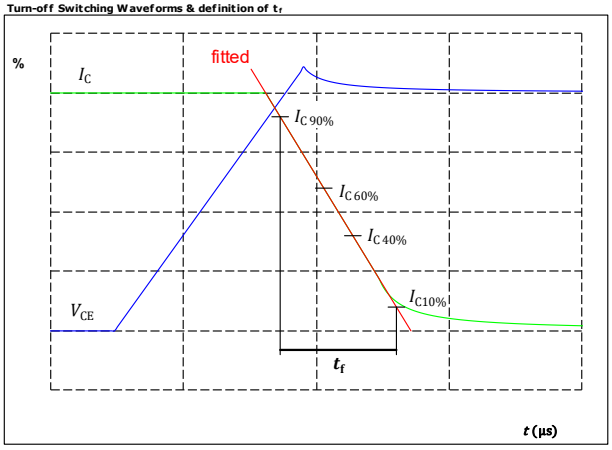
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	15	A
t_{don} =	17	ns

figure 3. IGBT

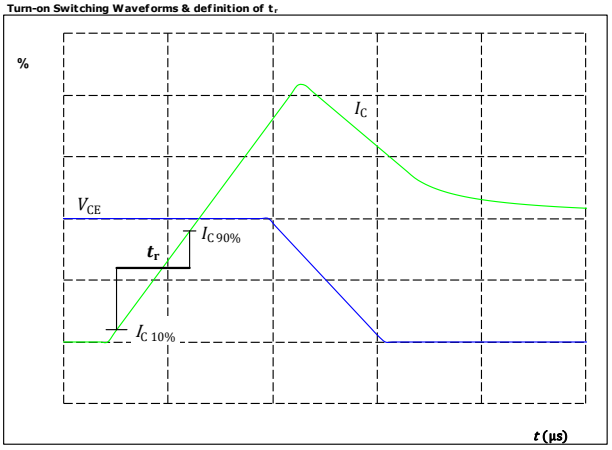
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	15	A
t_f =	14	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

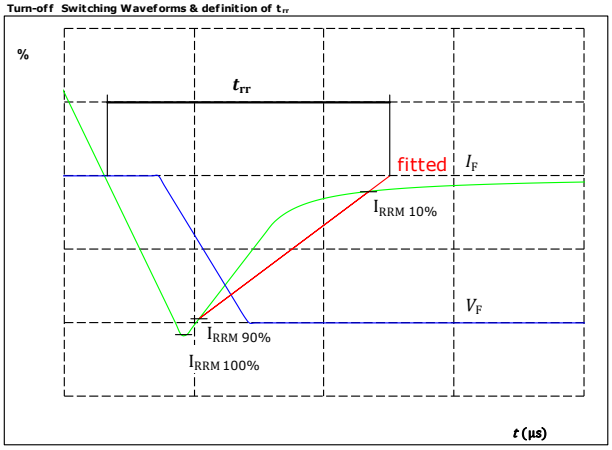


$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	15	A
t_r =	26	ns

PFC Switching Characteristics

figure 5. **FWD**

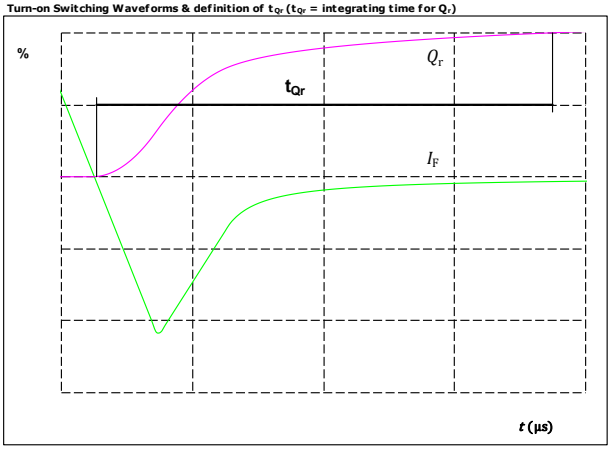
Turn-off Switching Waveforms & definition of t_{rr}



$V_F(100\%)$ =	400	V
$I_F(100\%)$ =	15	A
$I_{RRM}(100\%)$ =	12	A
t_{rr} =	114	ns

figure 6. **FWD**

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



$I_F(100\%)$ =	15	A
$Q_r(100\%)$ =	0	µC

Vincotech

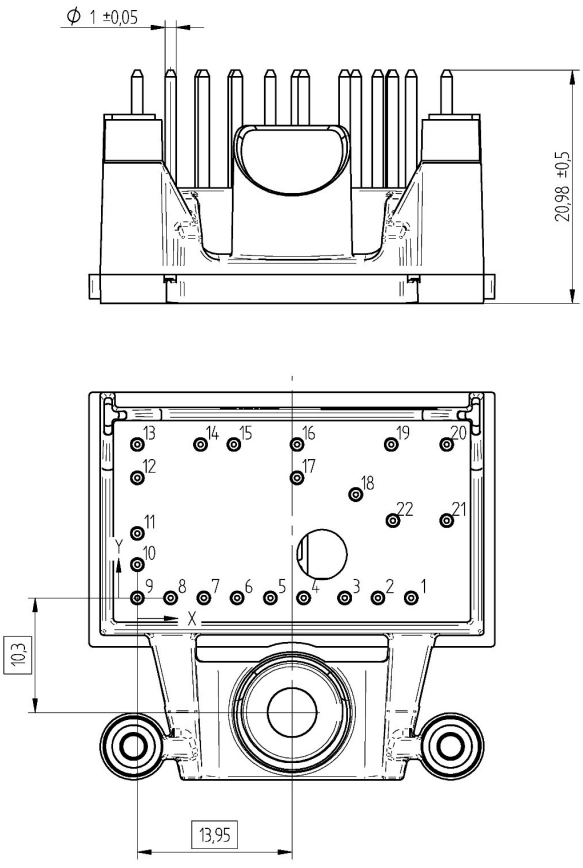
Ordering Code & Marking

Version	Ordering Code
without thermal paste 17mm housing with solder pins	10-0B06PPA004RC-L022A09
with thermal paste 17mm housing with solder pins	10-0B06PPA004RC-L022A09-/3/

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

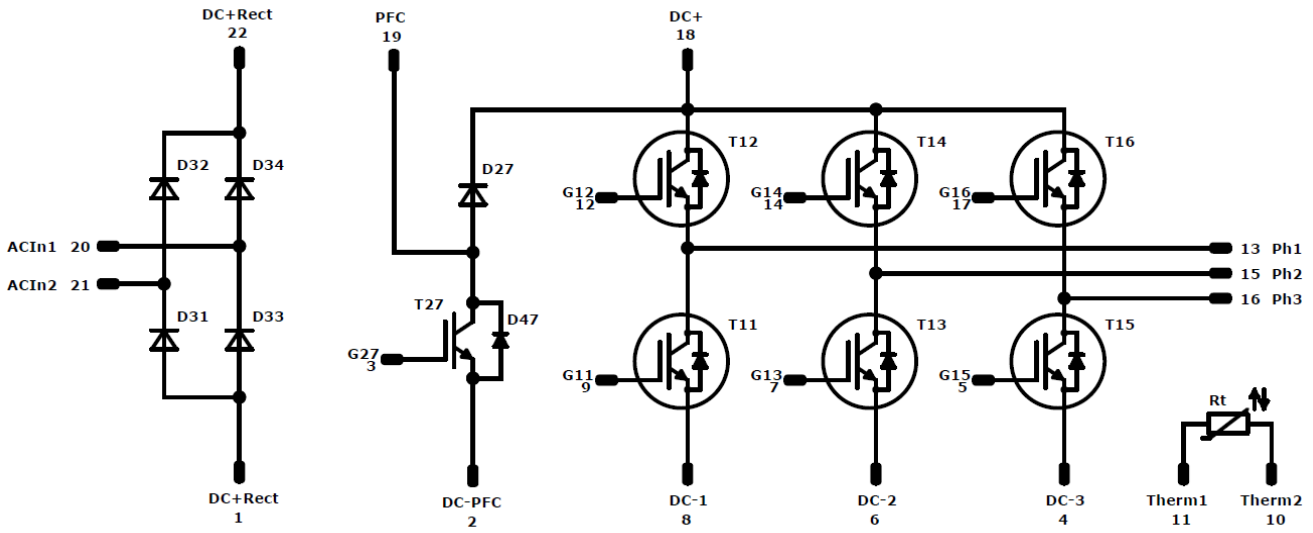
Outline

Pin table			
Pin	X	Y	Function
1	24,7	0	DC-Rect
2	21,7	0	DC-PFC
3	18,7	0	G27
4	15	0	DC-3
5	12	0	G15
6	9	0	DC-2
7	6	0	G13
8	3	0	DC-1
9	0	0	G11
10	0	3	Therm2
11	0	5,8	Therm1
12	0	10,8	G12
13	0	13,8	Ph1
14	5,7	13,8	G14
15	8,7	13,8	Ph2
16	14,4	13,8	Ph3
17	14,4	10,8	G16
18	19,7	9,3	DC+
19	22,9	13,8	PFC
20	27,9	13,8	ACIn1
21	27,9	6,95	ACIn2
22	23,05	6,95	DC+Rect



Tolerance of pinpositions: ±0,5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
D31, D32, D33, D34	Rectifier	1600 V	13 A	Rectifier Diode	
T11, T12, T13, T14, T15, T16	IGBT	600 V	4 A	Inverter Switch	
T27	IGBT	650 V	15 A	PFC Switch	
D27	FWD	650 V	15 A	PFC Diode	
D47	FWD	650 V	6 A	PFC Sw. Protection Diode	
Rt	Thermistor			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 160	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow*0 B packages see vincotech.com website.

Package data
Package data for *flow*0 B packages see vincotech.com website.

UL recognition and file number
This device is certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
10-0B06PPA004RC-L022A09-D5-14	18 Feb. 2019	PCN implementation: IFX Rapid1-> Rapid1Solar PCN implementation: Tateyama NTC	6,7,15,23-28 8,16