Vincotech

10-F006PPA020SB-M685B

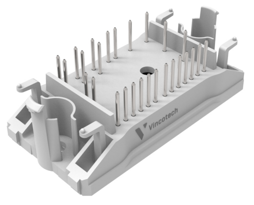
datasheet

***flow*PIM 0 + PFC** **600 V / 20 A**

Features

- Clip in PCB mounting
- Trench Fieldstop IGBTs for low saturation losses
- Latest generation superjunction MOSFET for PFC

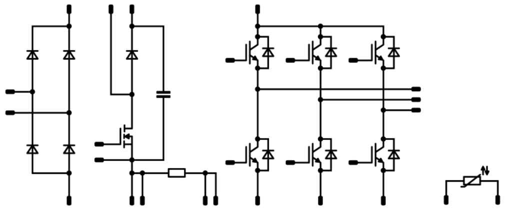
flow 0 17 mm housing



Target applications

- Embedded Drives
- Industrial Drives

Schematic



Types

- 10-F006PPA020SB-M685B

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Inverter Switch					
Collector-emitter voltage	V_{CES}			600	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	26	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	56	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 360 V	T_j = 150 °C	6	μs
Maximum junction temperature	T_{jmax}			175	°C
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	32	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	52	W
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
PFC Switch					
Drain-source voltage	V_{DSS}			600	V
Drain current (DC current)	I_D	$T_j = T_{jmax}$	T_s = 80 °C	24	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}		159	A
Avalanche energy, single pulse	E_{AS}	V_{DD} = 50 V	I_D = 9,3 A	1135	mJ
Avalanche energy, repetitive	E_{AR}	V_{DD} = 50 V	I_D = 9,3 A	1,72	mJ
Avalanche current, repetitive	I_{AR}	t_p limited by T_{jmax}	$P_{AV} = E_{AR}*f$	9,3	A
MOSFET dv/dt ruggedness	dv/dt	V_{DS}= 480 V	T_s = 25 °C	50	V/ns
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	90	W
Gate-source voltage	V_{GSS}			±20	V
Maximum Junction Temperature	T_{jmax}			150	°C
PFC Diode					
Peak repetitive reverse voltage	V_{RRM}			600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	33	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 8,3 ms	T_j = 25 °C	300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	52	W
Maximum junction temperature	T_{jmax}			175	°C
Rectifier Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	33	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	200	A
Surge current capability	I^2t			200	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	44	W
Maximum junction temperature	T_{jmax}			150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
PFC Shunt					
DC current	I		T_c = 70 °C	22	A
Power dissipation	P_{tot}		T_c = 70 °C	5	W
Operation Temperature	T_{op}			-55 … 170	°C
Capacitor (PFC)					
Maximum DC voltage	V_{MAX}			500	V
Operation Temperature	T_{op}			-55 … 125	°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
Isolation voltage	V_{isol}	AC Voltage	t_p = 1 min	2500	V
Creepage distance				>12,7	mm
Clearance				>12,7	mm
Comparative Tracking Index	CTI			≥ 200	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00029	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		20	25 125	1,1	1,55 1,75	1,9(1)	V
Collector-emitter cut-off current	I_{CES}		0	600		25			1,1	µA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		1100		pF
Output capacitance	C_{oes}							71		pF
Reverse transfer capacitance	C_{res}							32		pF
Gate charge	Q_g	V_{CC} = 480 V	15		20	25		120		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,7		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	±15	400	15	25 125		65,6 65,2		ns
Rise time	t_r					25 125		19,8 21		ns
Turn-off delay time	$t_{d(off)}$					25 125		141,8 167		ns
Fall time	t_f					25 125		76,33 86,36		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,883 µC Q_{rFWD}=1,79 µC				25 125		0,45 0,667		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,385 0,523		mWs

Characteristic Values

Parameter	Symbol	Conditions					Values			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				30	25 125	1,25	1,65 1,61	1,95(1)	V
Reverse leakage current	I_R	V_r = 600 V				25			27	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,81		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=731 A/µs d*i*/d*t*=708 A/µs	±15	400	15	25 125		10,06 13,55		A
Reverse recovery time	t_{rr}					25 125		173,99 233,08		ns
Recovered charge	Q_r					25 125		0,883 1,79		µC
Reverse recovered energy	E_{rec}					25 125		0,236 0,474		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		36,18 85,35		A/µs

Characteristic Values

Parameter	Symbol	Conditions					Values			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										
Drain-source on-state resistance	$r_{DS(on)}$		10		25,8	25 125		70 144	70(1)	mΩ
Gate-source threshold voltage	$V_{GS(th)}$		0		0,00172	25	2,4	3	3,6	V
Gate to Source Leakage Current	I_{GSS}		20	0		25			100	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	600		25			5	µA
Internal gate resistance	r_g							0,85		Ω
Gate charge	Q_g	V_{DD} = 480 V	10		25,8	25		170		nC
Short-circuit input capacitance	C_{iss}	f = 1 Mhz	0	100	0	25		3800		pF
Short-circuit output capacitance	C_{oss}							215		
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,78		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 8 Ω R_{goff} = 8 Ω	-5/10	400	15	25 125 150		38,2 43,6 24,6		ns
Rise time	t_r					25 125 150		4,8 5,8 7		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		130,2 136 250,4		ns
Fall time	t_f					25 125 150		10,51 13,88 5,36		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,253 µC Q_{rFWD}=0,585 µC Q_{rFWD}=0,786 µC				25 125 150		0,136 0,208 0,345		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,042 0,053 0,12		mWs

Characteristic Values

Parameter	Symbol	Conditions					Values			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				30	25 125 150	1,88	2,32 1,78 1,67	2,78(1)	V
Reverse leakage current	I_R	V_r = 600 V				25 125			10 500	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,81		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=2946 A/µs d*i*/d*t*=2625 A/µs d*i*/d*t*=2104 A/µs	-5/10	400	15	25 125 150		29,17 43,07 45,18		A
Reverse recovery time	t_{rr}					25 125 150		13,71 24,66 29,89		ns
Recovered charge	Q_r					25 125 150		0,253 0,585 0,786		µC
Reverse recovered energy	E_{rec}					25 125 150		0,046 0,185 0,125		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		8586 6089 4643		A/µs

Characteristic Values

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Rectifier Diode										
Static										
Forward voltage	V_F				8	25 125		0,996 0,907	1,21(1) 1,1(1)	V
Reverse leakage current	I_R	V_r = 1600 V				25			50	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,59		K/W
PFC Shunt										
Static										
Resistance	R							10		mΩ
Tolerance							-1		1	%
Temperature coeficient	tc								30	ppm/K
Capacitor (PFC)										
Static										
Capacitance	C	DC bias voltage = 0 V				25		100		nF
Tolerance							-10		10	%
Dissipation factor		f = 1 kHz				25		2,5		%

Characteristic Values

Parameter	Symbol	Conditions					Values			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										
Static										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P							5		mW
Power dissipation constant	d					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %						3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %						4000		K
Vincotech Thermistor Reference									I	

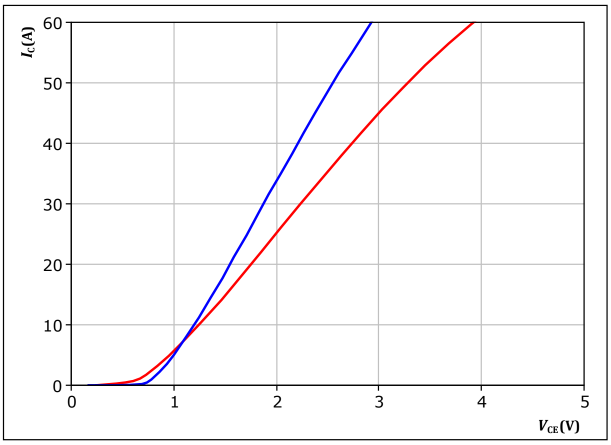
(1) Value at chip level
(2) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

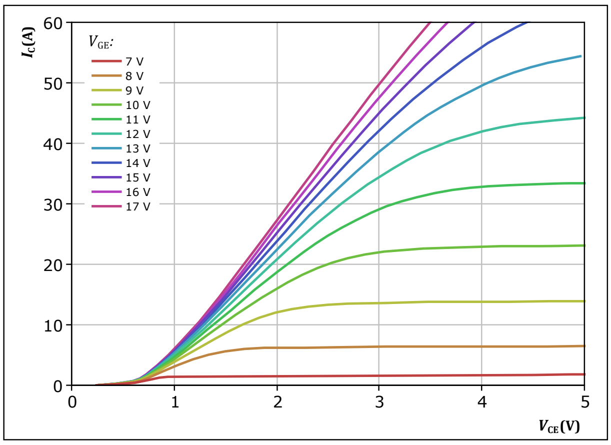


t_p = 250 µs
V_{GE} = 15 V
T_j: 25 °C, 125 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

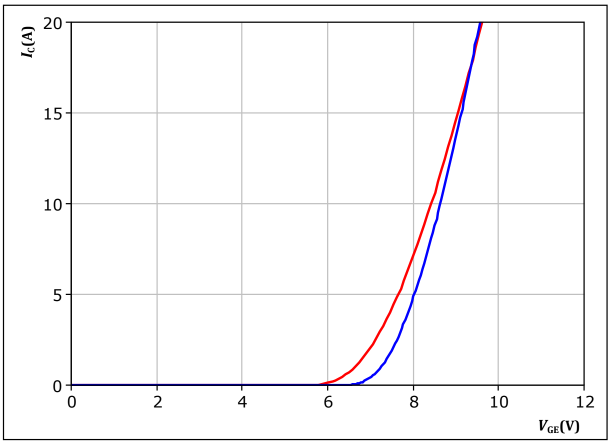


t_p = 250 µs
T_j = 125 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

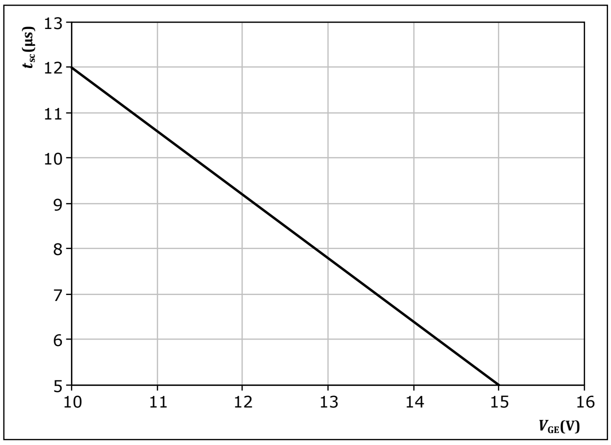


t_p = 250 µs
V_{CE} = 10 V
T_j: 25 °C, 125 °C

figure 4. **IGBT**

Short circuit withstand time as a function of V_{GE}

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



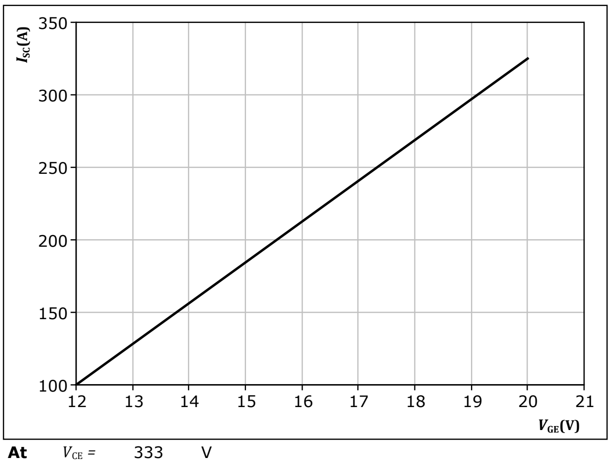
At V_{CE} = 333 V
T_j ≤ 333 °C

Inverter Switch Characteristics

figure 5. **IGBT**

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

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



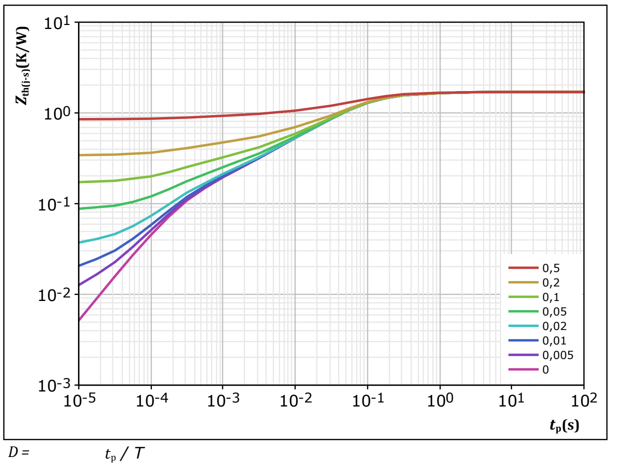
At V_{CE} = 333 V

$T_j \le$ 333 °C

figure 6. **IGBT**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,701 K/W

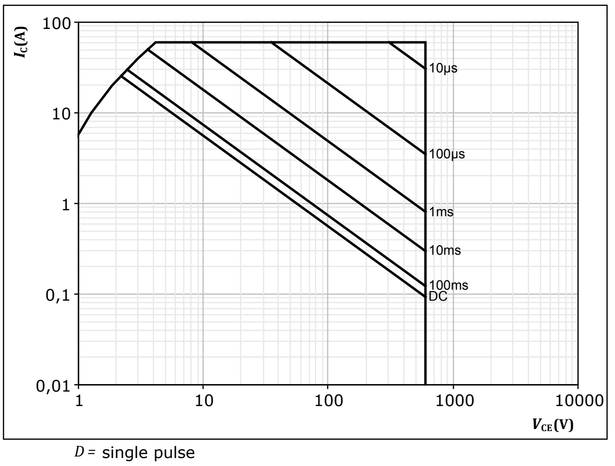
IGBT thermal model values

R (K/W)	τ (s)
9,97E-02	1,34E+00
3,46E-01	1,70E-01
8,15E-01	5,34E-02
2,54E-01	7,74E-03
7,70E-02	1,33E-03
1,09E-01	2,63E-04

figure 7. **IGBT**

Safe operating area

I_C = f(V_{CE})



D = single pulse

T_s = 80 °C

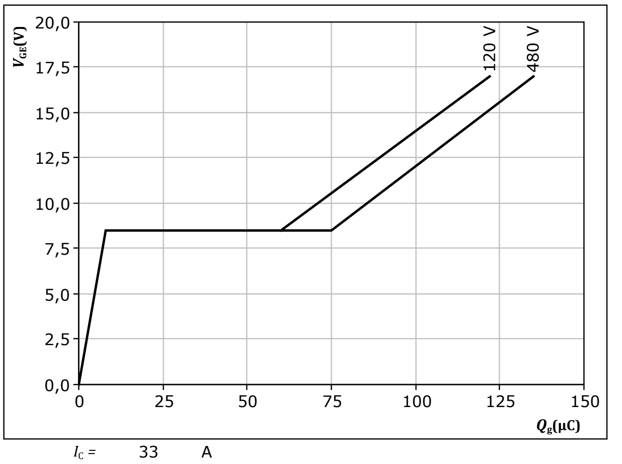
V_{GE} = 15 V

T_j = T_{jmax}

figure 8. **IGBT**

Gate voltage vs gate charge

V_{GE} = f(Q_g)



I_C = 33 A

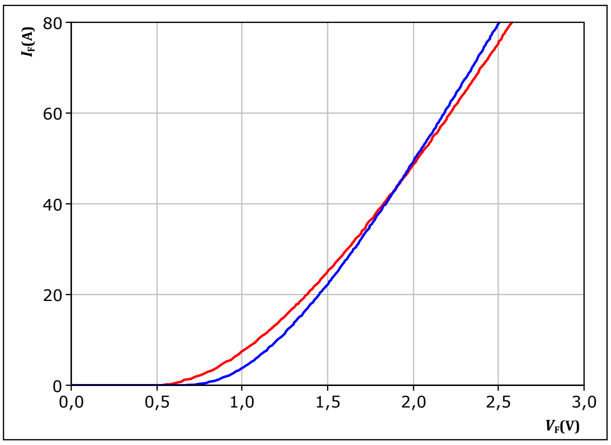
T_j = 25 °C

Inverter Diode Characteristics

figure 9. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



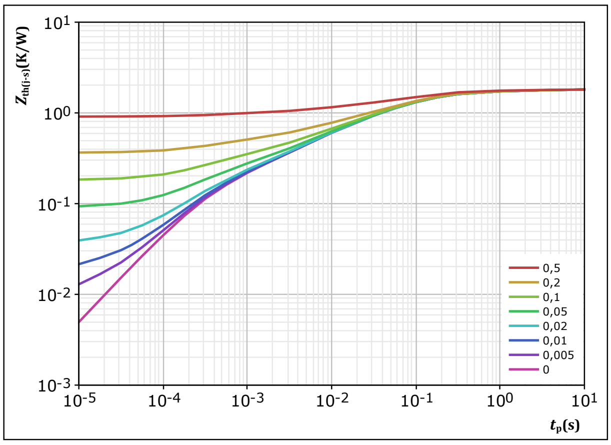
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 10. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,811 K/W

FWD thermal model values

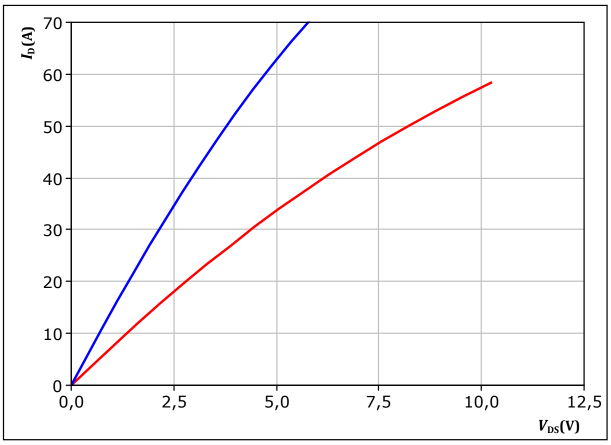
R (K/W)	τ (s)
8,35E-02	4,59E+00
2,01E-01	4,81E-01
7,60E-01	9,25E-02
4,22E-01	1,80E-02
2,13E-01	3,31E-03
1,40E-01	3,46E-04

PFC Switch Characteristics

figure 11. **MOSFET**

Typical output characteristics

I_D = f(V_{DS})

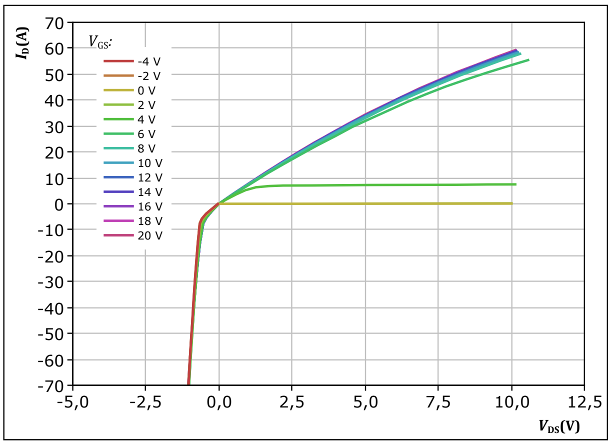


t_p =	250	µs	T_j:	25 °C
V_{GS} =	10	V		125 °C

figure 12. **MOSFET**

Typical output characteristics

I_D = f(V_{DS})



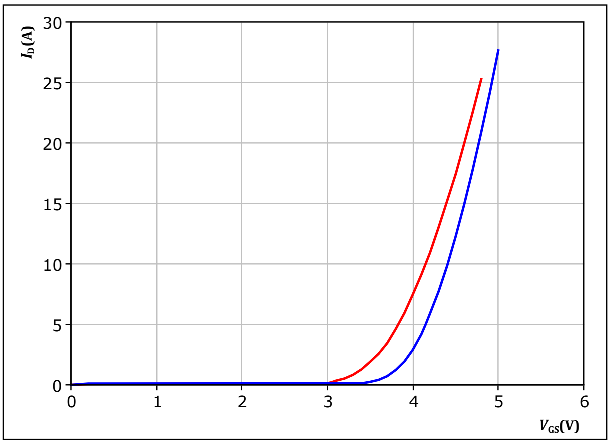
t_p =	250	µs
T_j =	125	°C

V_{GS} from -4 V to 20 V in steps of 2 V

figure 13. **MOSFET**

Typical transfer characteristics

I_D = f(V_{GS})

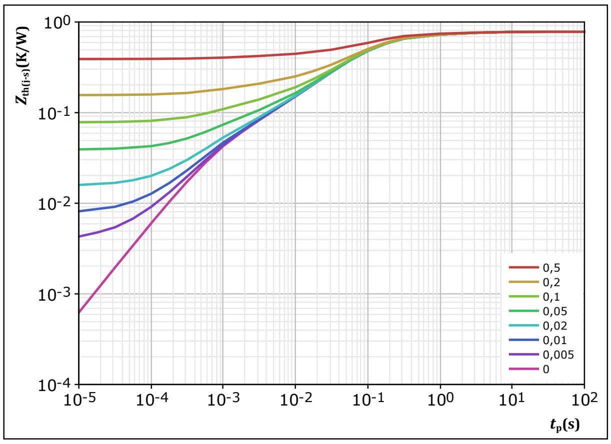


t_p =	250	µs	T_j:	25 °C
V_{DS} =	10	V		125 °C

figure 14. **MOSFET**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,78	K/W

MOSFET thermal model values

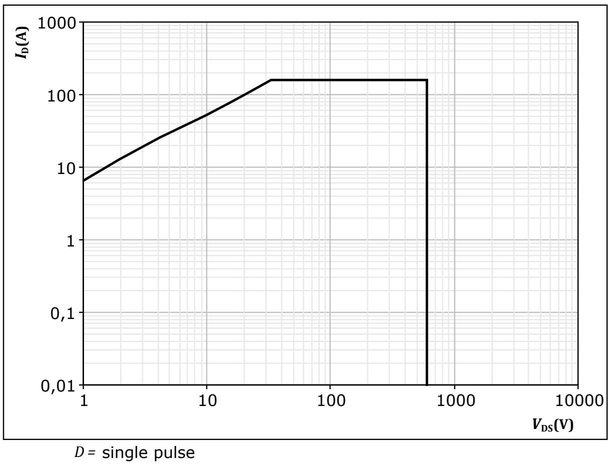
R (K/W)	τ (s)
4,90E-02	3,64E+00
1,03E-01	5,74E-01
4,25E-01	1,04E-01
1,20E-01	2,91E-02
4,27E-02	6,05E-03
4,10E-02	8,69E-04

PFC Switch Characteristics

figure 15.	MOSFET

Safe operating area

I_D = f(V_{DS})

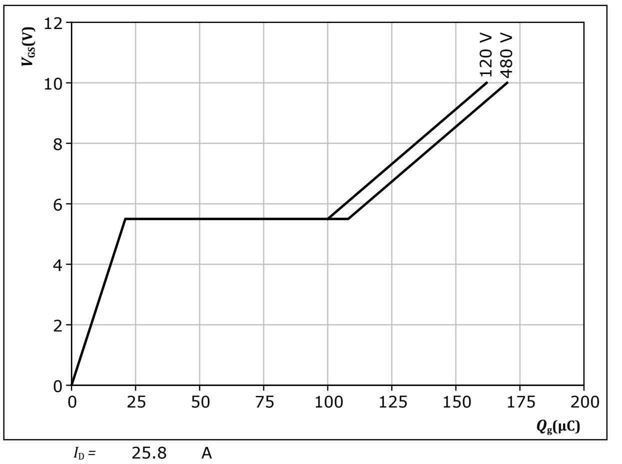


D =	single pulse	
T_s =	80	°C
V_{GS} =	10	V
T_j =	T_{jmax}	

figure 16.	MOSFET

Gate voltage vs gate charge

V_{GS} = f(Q_g)



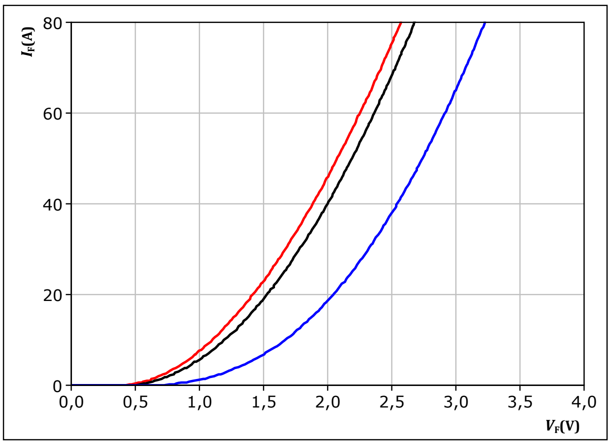
I_D =	25.8	A
T_j =	25	°C

PFC Diode Characteristics

figure 17. **FWD**

Typical forward characteristics

I_F = f(V_F)



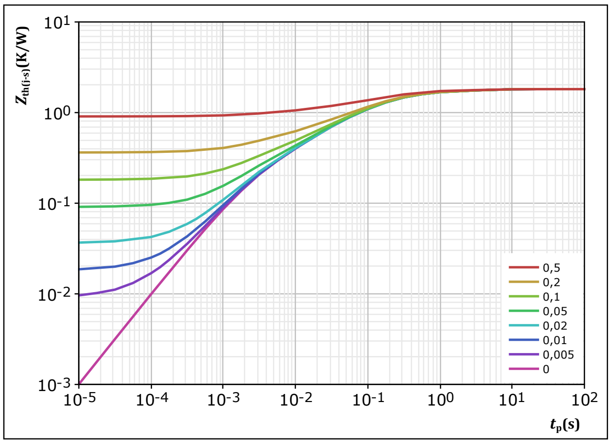
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 18. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,814 K/W

FWD thermal model values

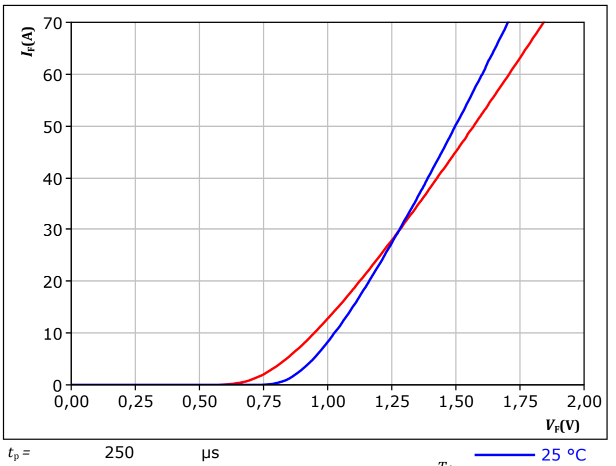
R (K/W)	τ (s)
1,53E-01	3,12E+00
5,19E-01	3,17E-01
6,76E-01	7,98E-02
3,13E-01	1,47E-02
1,53E-01	2,20E-03

Rectifier Diode Characteristics

figure 19. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



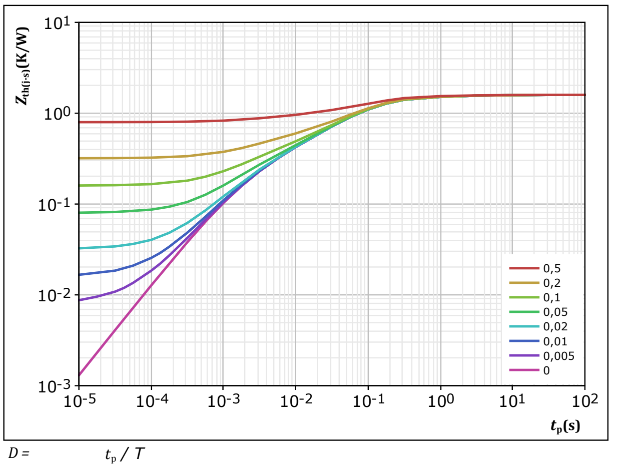
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 20. **Rectifier**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,594 K/W

Rectifier thermal model values

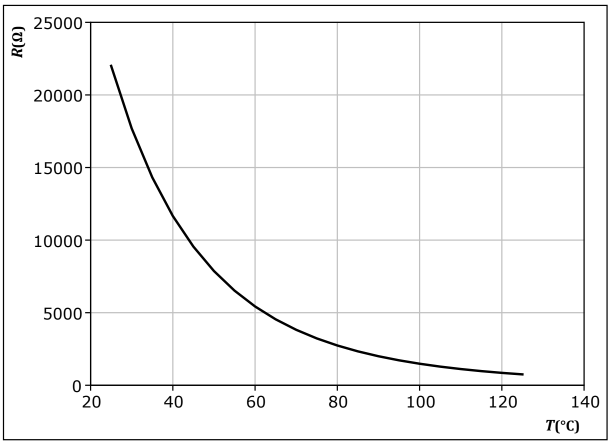
R (K/W)	τ (s)
3,44E-02	9,66E+00
1,12E-01	1,22E+00
5,81E-01	1,45E-01
4,89E-01	5,05E-02
2,38E-01	9,26E-03
1,22E-01	1,79E-03
1,81E-02	7,88E-04

Thermistor Characteristics

figure 21.	Thermistor

Typical NTC characteristic as function of temperature

R_T = f(T)

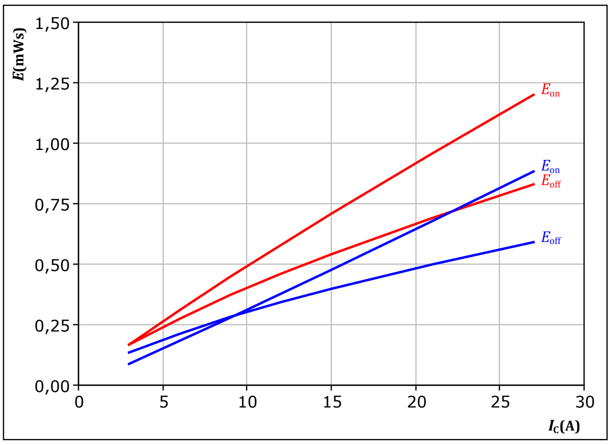


Inverter Switching Characteristics

figure 22. **IGBT**

Typical switching energy losses as a function of collector current

E = f(I_C)



With an inductive load at

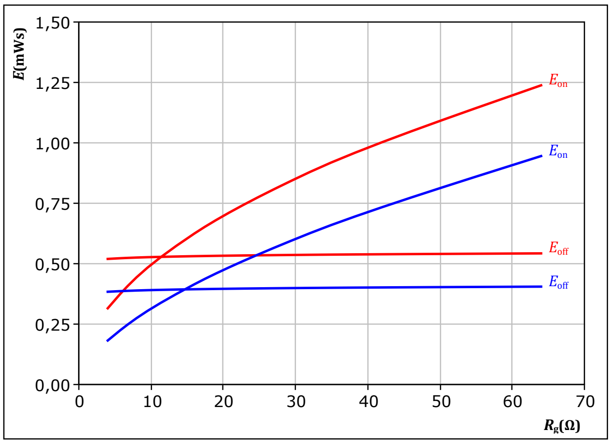
T_j: 25 °C, 125 °C

V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 23. **IGBT**

Typical switching energy losses as a function of gate resistor

E = f(R_g)



With an inductive load at

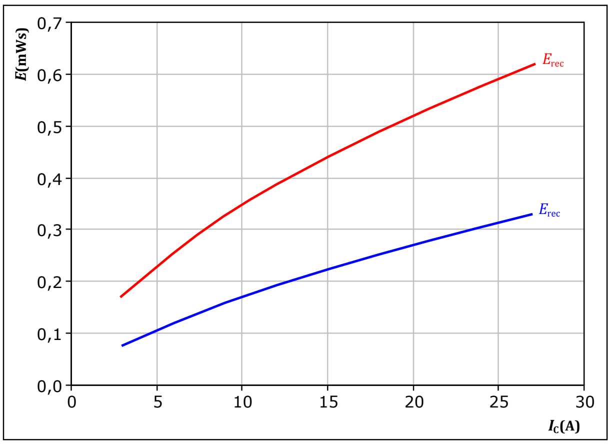
T_j: 25 °C, 125 °C

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

figure 24. **FWD**

Typical reverse recovered energy loss as a function of collector current

E_{rec} = f(I_C)



With an inductive load at

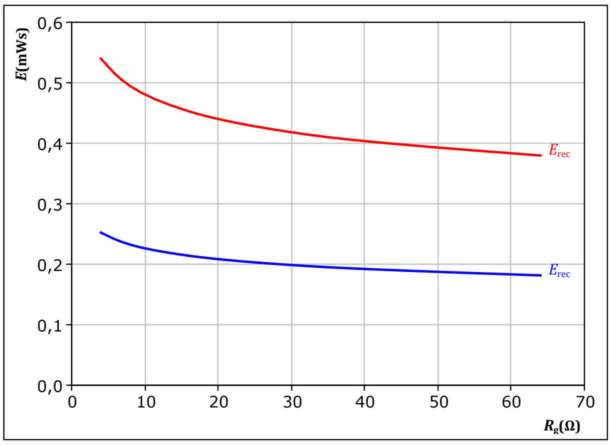
T_j: 25 °C, 125 °C

V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

figure 25. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

E_{rec} = f(R_g)



With an inductive load at

T_j: 25 °C, 125 °C

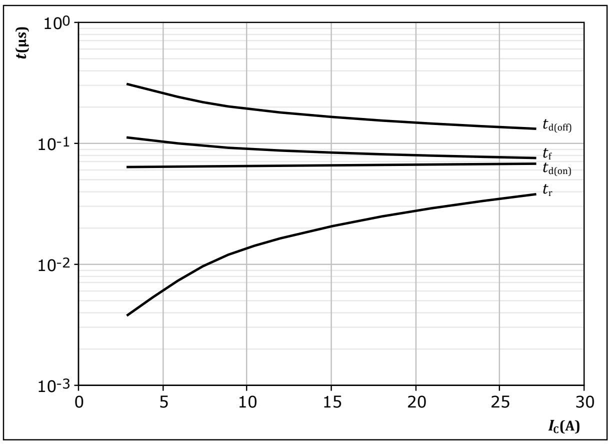
V_{CE} =	400	V
V_{GE} =	±15	V
I_C =	15	A

Inverter Switching Characteristics

figure 26. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



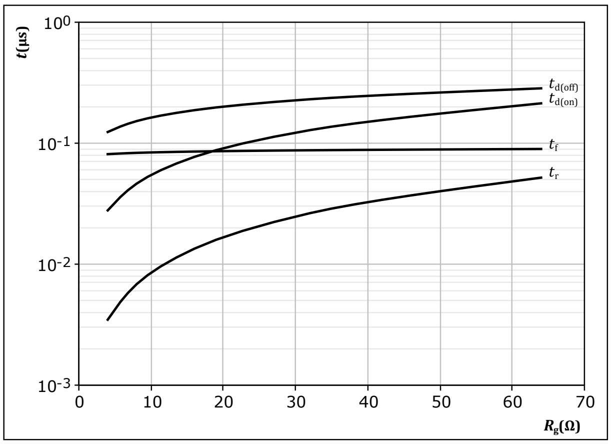
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 27. **IGBT**

Typical switching times as a function of gate resistor

t = f(R_g)



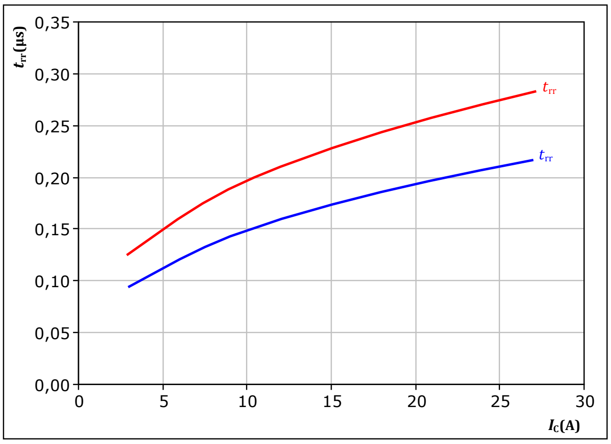
With an inductive load at

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

figure 28. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

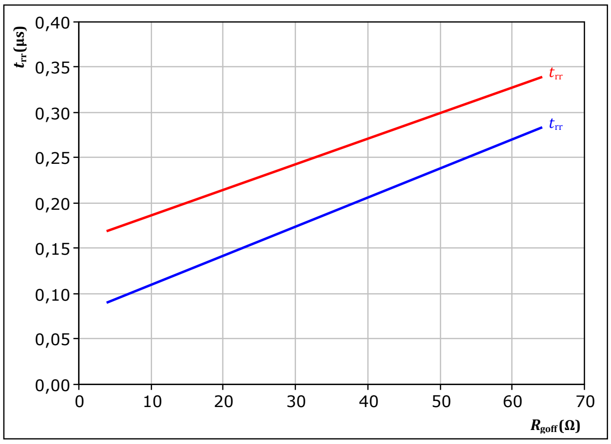
V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

T_j: 25 °C, 125 °C

figure 29. **FWD**

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

t_{rr} = f(R_{goff})



With an inductive load at

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

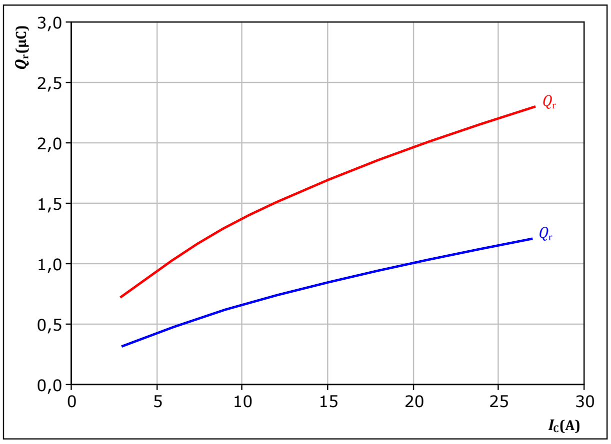
T_j: 25 °C, 125 °C

Inverter Switching Characteristics

figure 30. FWD

Typical recovered charge as a function of collector current

Q_r = f(I_C)



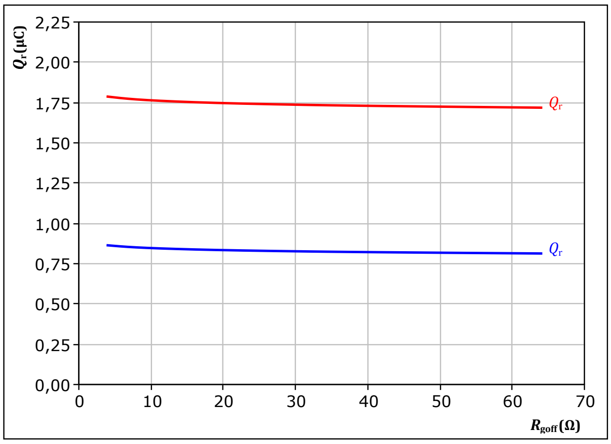
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		

figure 31. FWD

Typical recovered charge as a function of turn off gate resistor

Q_r = f(R_{goff})



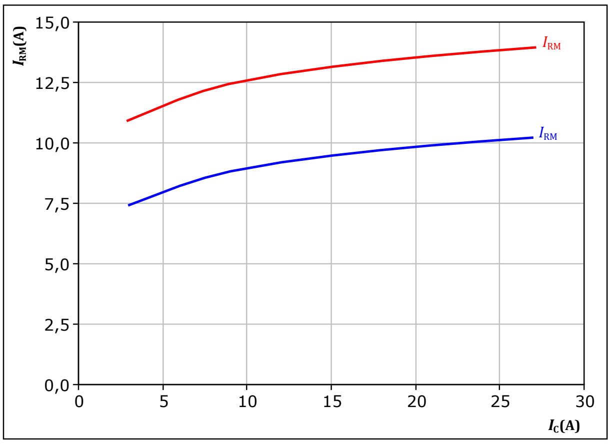
With an inductive load at

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

figure 32. FWD

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



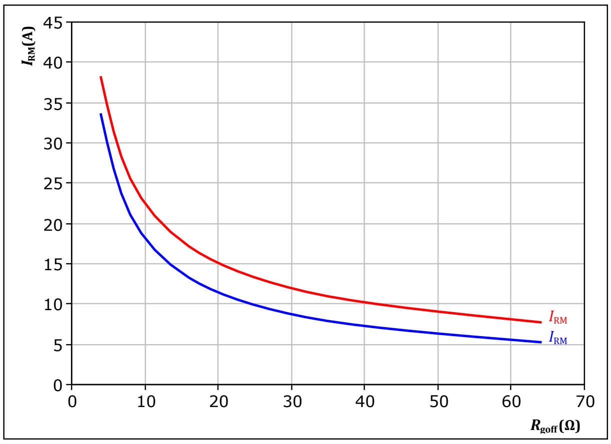
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		

figure 33. FWD

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

I_{RM} = f(R_{goff})



With an inductive load at

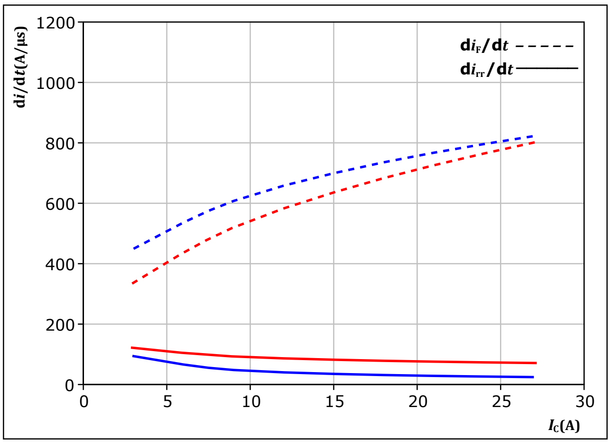
V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	15	A		

Inverter Switching Characteristics

figure 34. **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)



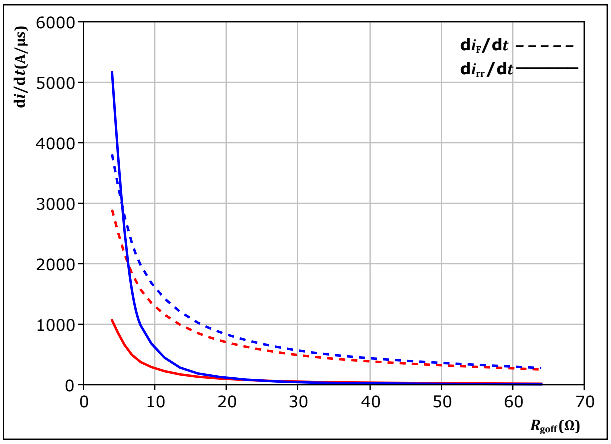
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		

figure 35. **FWD**

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

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



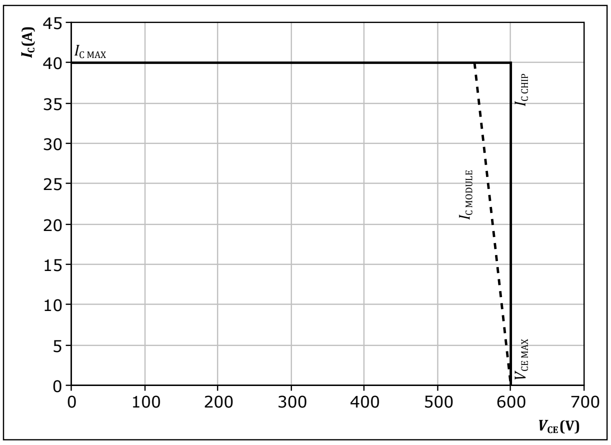
With an inductive load at

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

figure 36. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



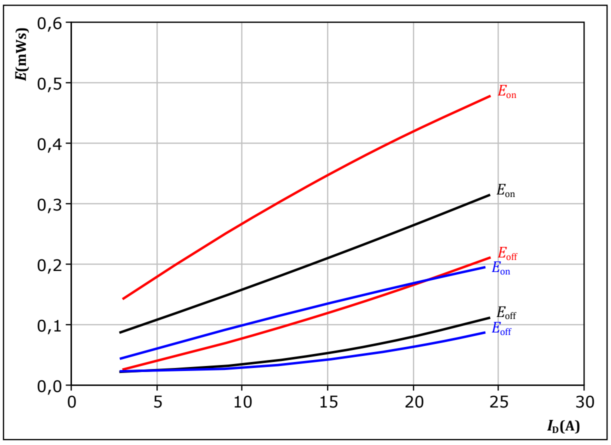
At	T_j =	125	°C
	R_{gon} =	16	Ω
	R_{goff} =	16	Ω

PFC Switching Characteristics

figure 37. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



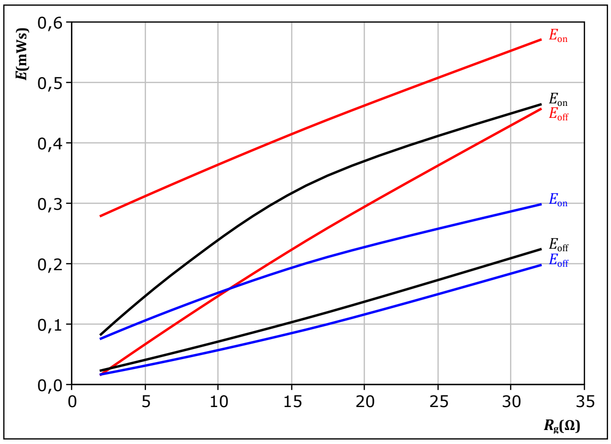
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	-5/10	V		125 °C
R_{gon} =	8	Ω		150 °C
R_{goff} =	8	Ω		

figure 38. **MOSFET**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



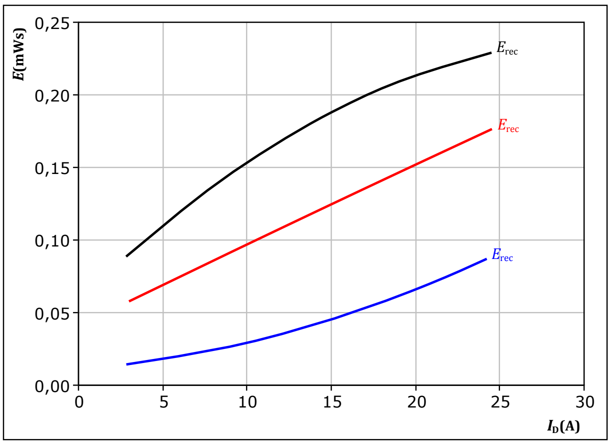
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	-5/10	V		125 °C
I_D =	15	A		150 °C

figure 39. **FWD**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



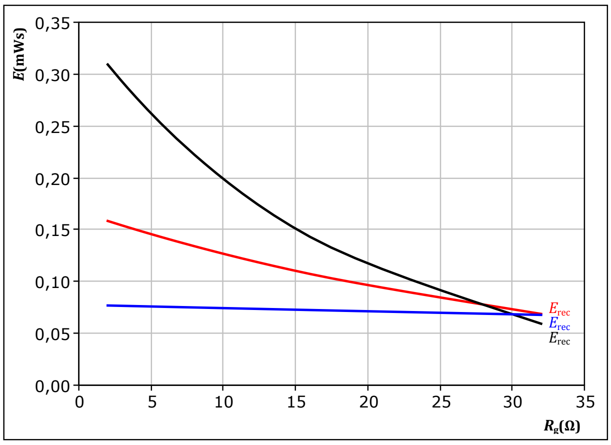
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	-5/10	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 40. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	-5/10	V		125 °C
I_D =	15	A		150 °C

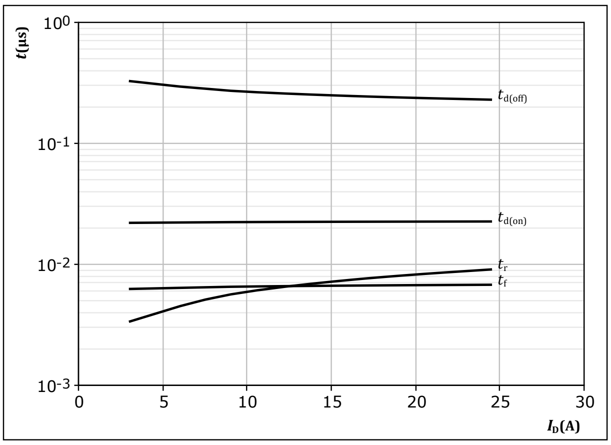
Vincotech

PFC Switching Characteristics

figure 41. **MOSFET**

Typical switching times as a function of drain current

t = f(I_D)



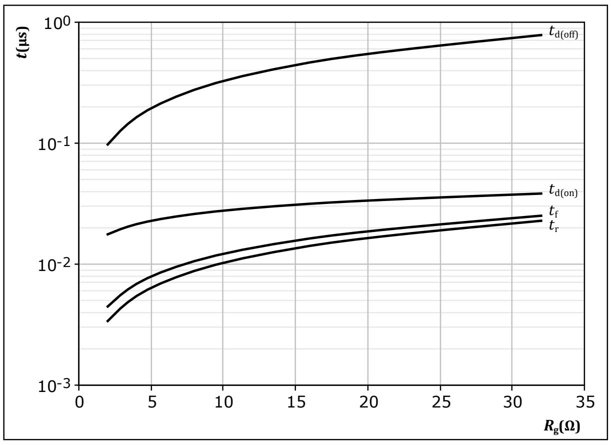
With an inductive load at

T_j =	150	°C
V_{DS} =	400	V
V_{GS} =	-5/10	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

figure 42. **MOSFET**

Typical switching times as a function of gate resistor

t = f(R_g)



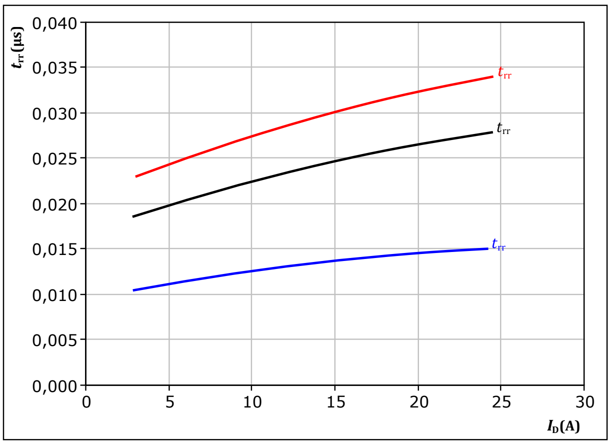
With an inductive load at

T_j =	150	°C
V_{DS} =	400	V
V_{GS} =	-5/10	V
I_D =	15	A

figure 43. **FWD**

Typical reverse recovery time as a function of drain current

t_{rr} = f(I_D)



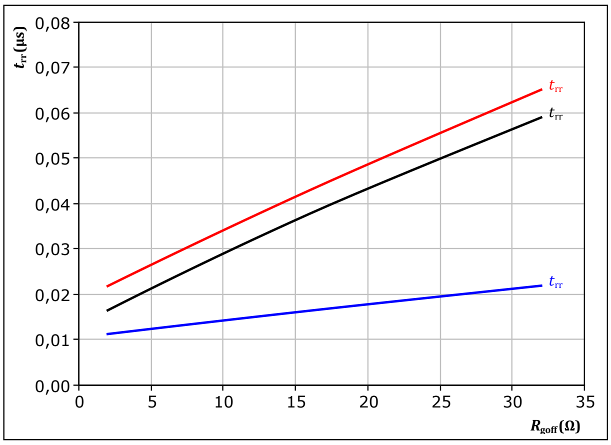
At			
	V_{DS} =	400	V
	V_{GS} =	-5/10	V
	R_{gon} =	8	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 44. **FWD**

Typical reverse recovery time as a function of turn off gate resistor

t_{rr} = f(R_{goff})



At			
	V_{DS} =	400	V
	V_{GS} =	-5/10	V
	I_D =	15	A

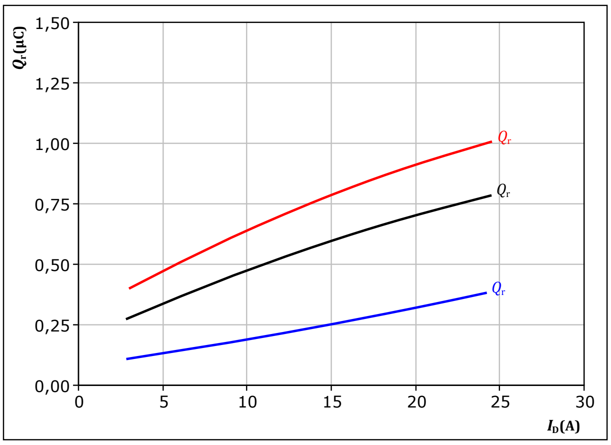
T_j: 25 °C, 125 °C, 150 °C

PFC Switching Characteristics

figure 45. FWD

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

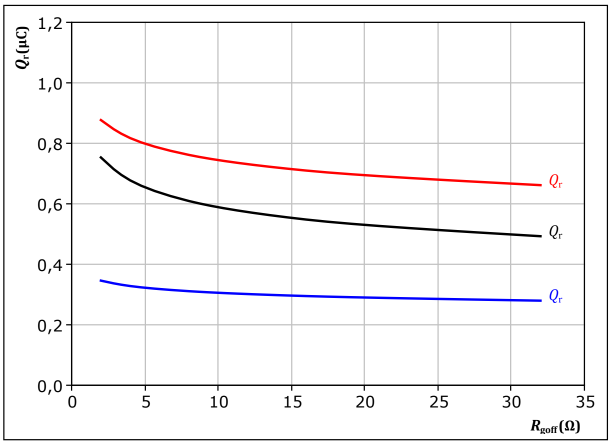


At					
V_{DS} =	400	V			25 °C
V_{GS} =	-5/10	V	T_j:		125 °C
R_{gon} =	8	Ω			150 °C

figure 46. FWD

Typical recovered charge as a function of turn off gate resistor

$Q_r = f(R_{goff})$

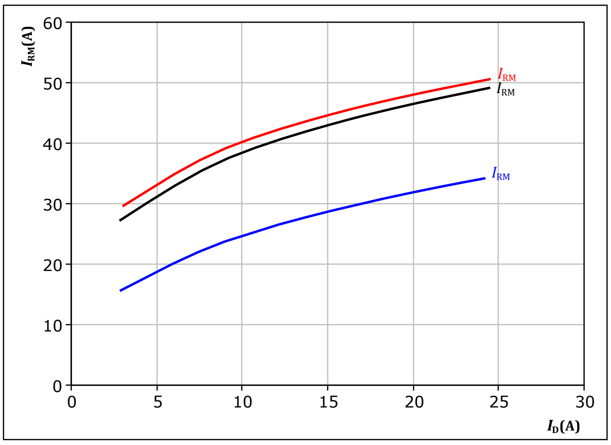


At					
V_{DS} =	400	V			25 °C
V_{GS} =	-5/10	V	T_j:		125 °C
I_D =	15	A			150 °C

figure 47. FWD

Typical peak reverse recovery current as a function of drain current

$I_{RM} = f(I_D)$

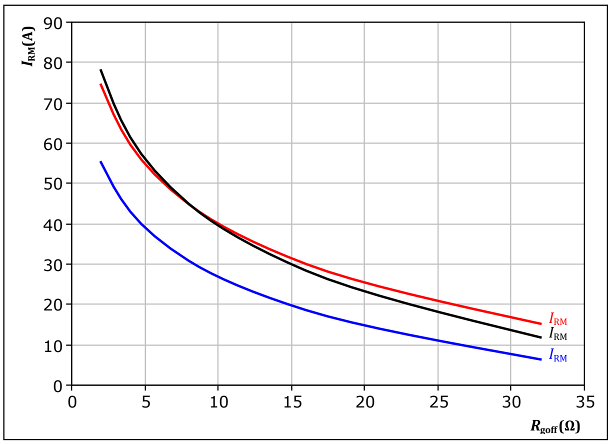


At					
V_{DS} =	400	V			25 °C
V_{GS} =	-5/10	V	T_j:		125 °C
R_{gon} =	8	Ω			150 °C

figure 48. FWD

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

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



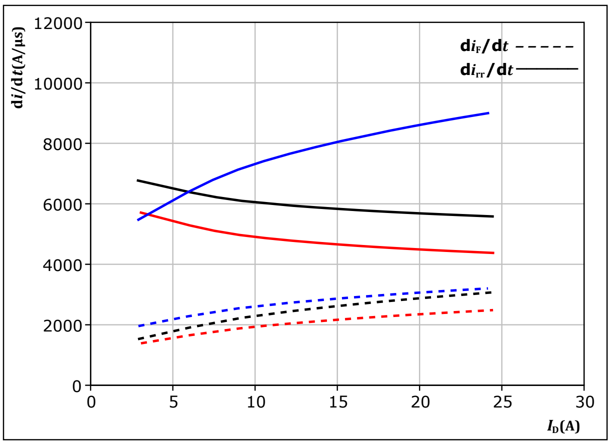
At					
V_{DS} =	400	V			25 °C
V_{GS} =	-5/10	V	T_j:		125 °C
I_D =	15	A			150 °C

PFC Switching Characteristics

figure 49. **FWD**

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

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

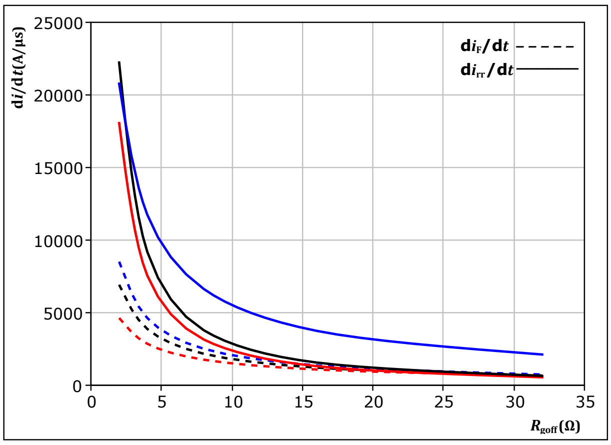


At				
	V_{DS} =	400	V	T_j: 25 °C
	V_{GS} =	-5/10	V	125 °C
	R_{gon} =	8	Ω	150 °C

figure 50. **FWD**

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

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

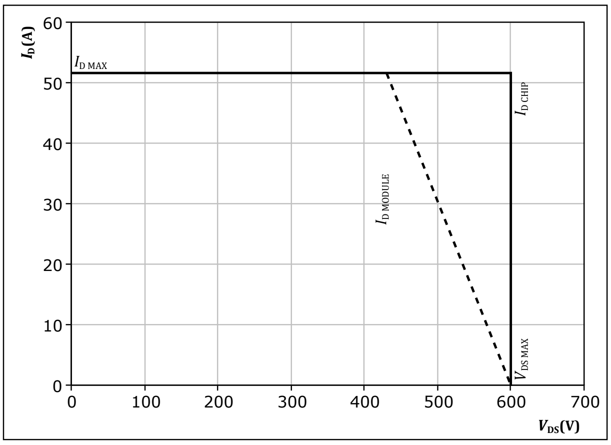


At				
	V_{DS} =	400	V	T_j: 25 °C
	V_{GS} =	-5/10	V	125 °C
	I_D =	15	A	150 °C

figure 51. **MOSFET**

Reverse bias safe operating area

I_D = f(V_{DS})



At			
	T_j =	150	°C
	R_{gon} =	8	Ω
	R_{goff} =	8	Ω

Inverter Switching Definitions

figure 52. **IGBT**

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

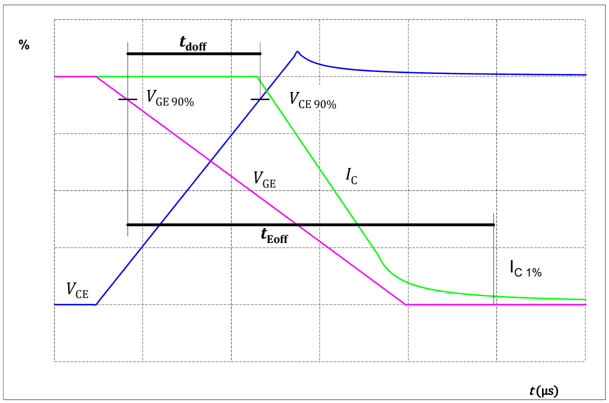


figure 53. **IGBT**

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

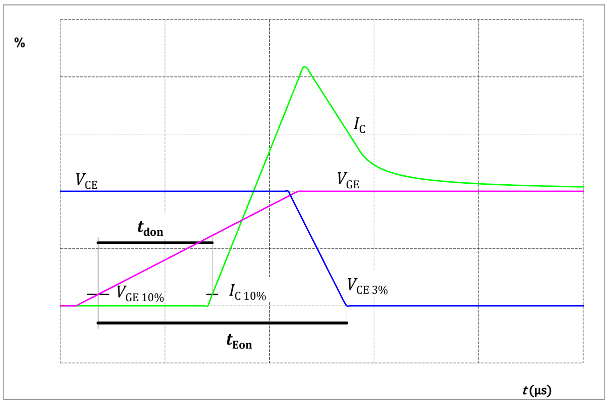


figure 54. **IGBT**

Turn-off Switching Waveforms & definition of t_f

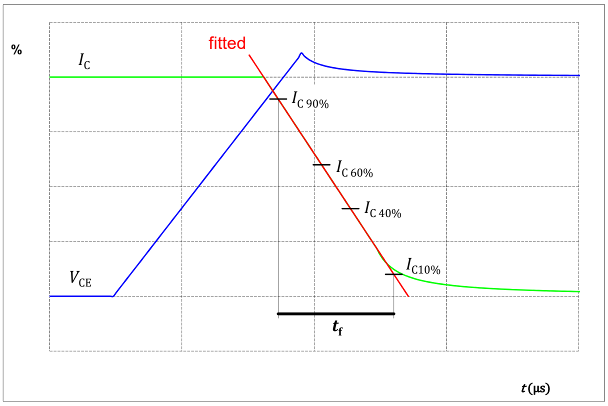
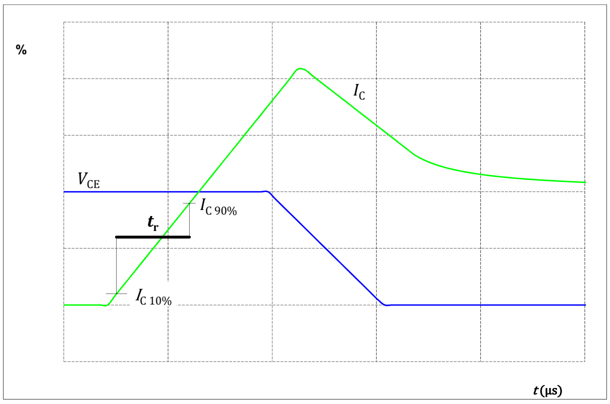


figure 55. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Inverter Switching Definitions

figure 56.	FWD

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

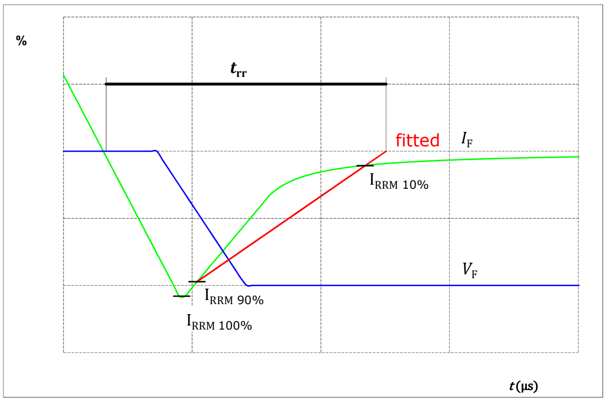
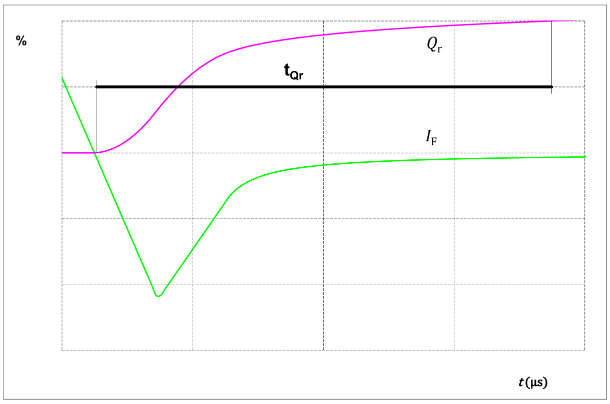


figure 57.	FWD

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



PFC Switching Definitions

figure 52.	**MOSFET**

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

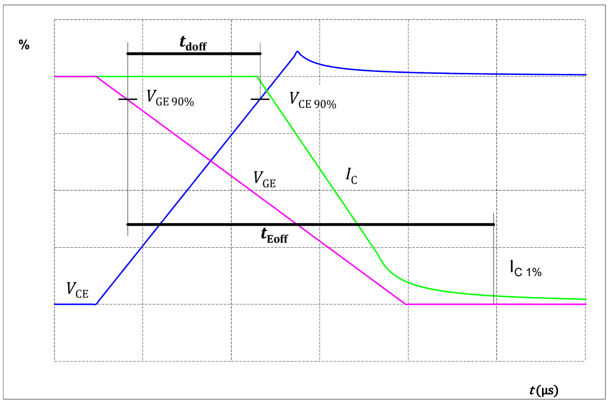


figure 53.	**MOSFET**

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

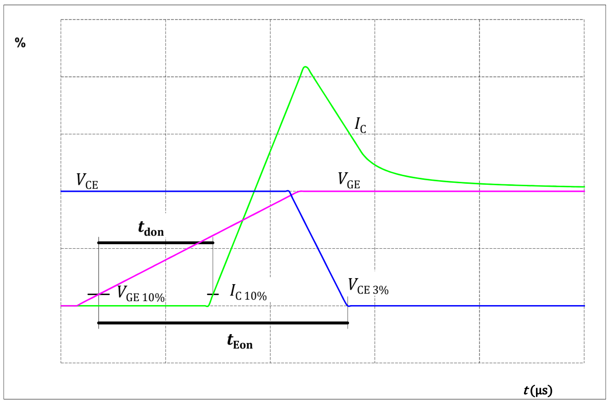


figure 54.	**MOSFET**

Turn-off Switching Waveforms & definition of t_f

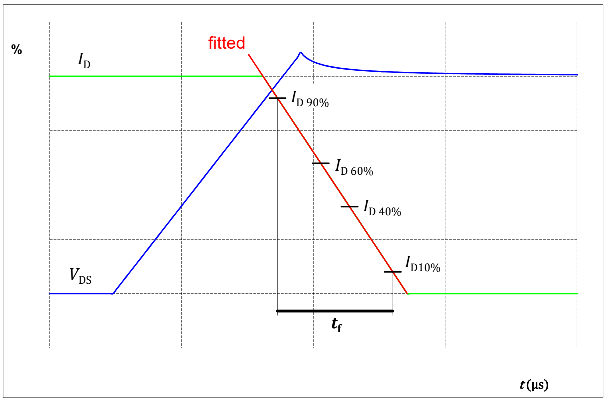
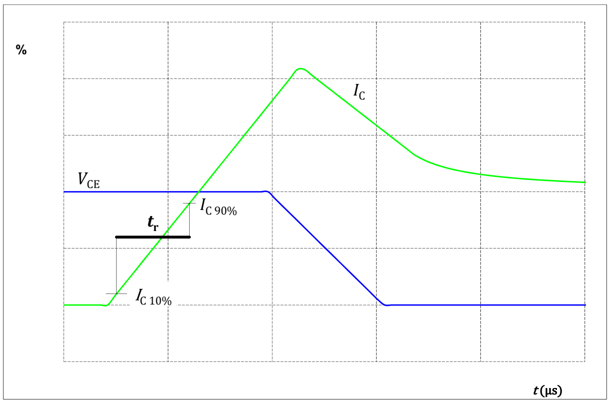


figure 55.	**MOSFET**

Turn-on Switching Waveforms & definition of t_r



PFC Switching Definitions

figure 56. FWD

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

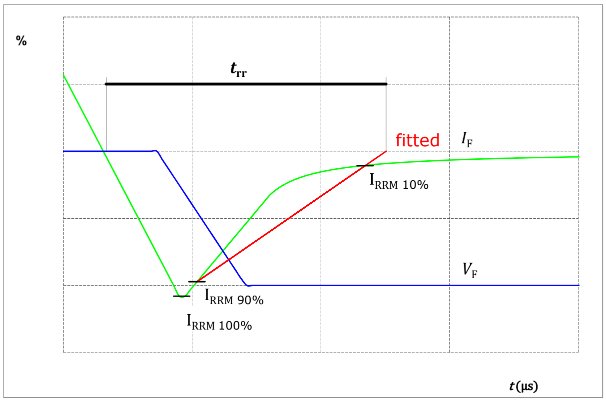


figure 57. FWD

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

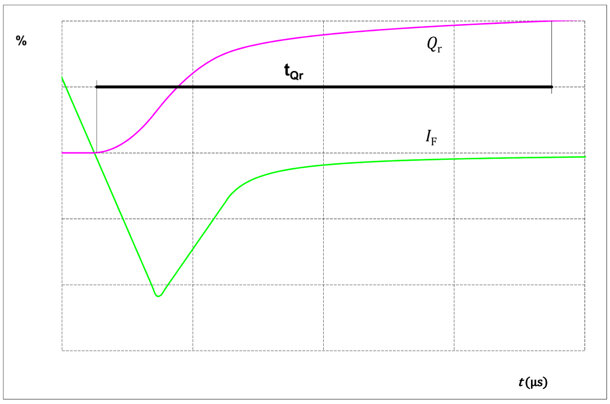
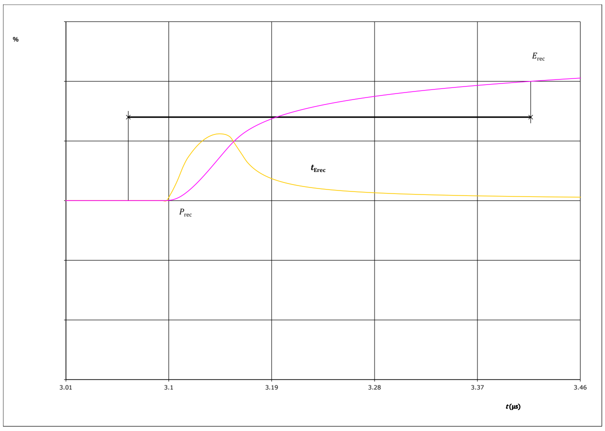


figure 58. FWD

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



Ordering Code

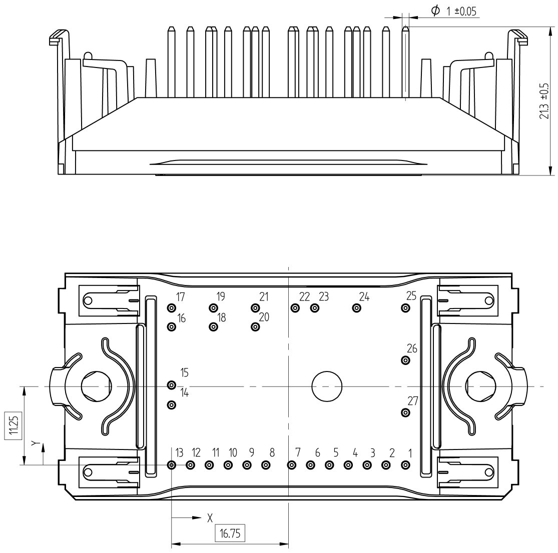
Version	Ordering Code
Without thermal paste	10-F006PPA020SB-M685B
With thermal paste (5,2 W/mK, PTM6000HV)	10-F006PPA020SB-M685B-/7/
With thermal paste (3,4 W/mK, PSX-P7)	10-F006PPA020SB-M685B-/3/

Marking

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

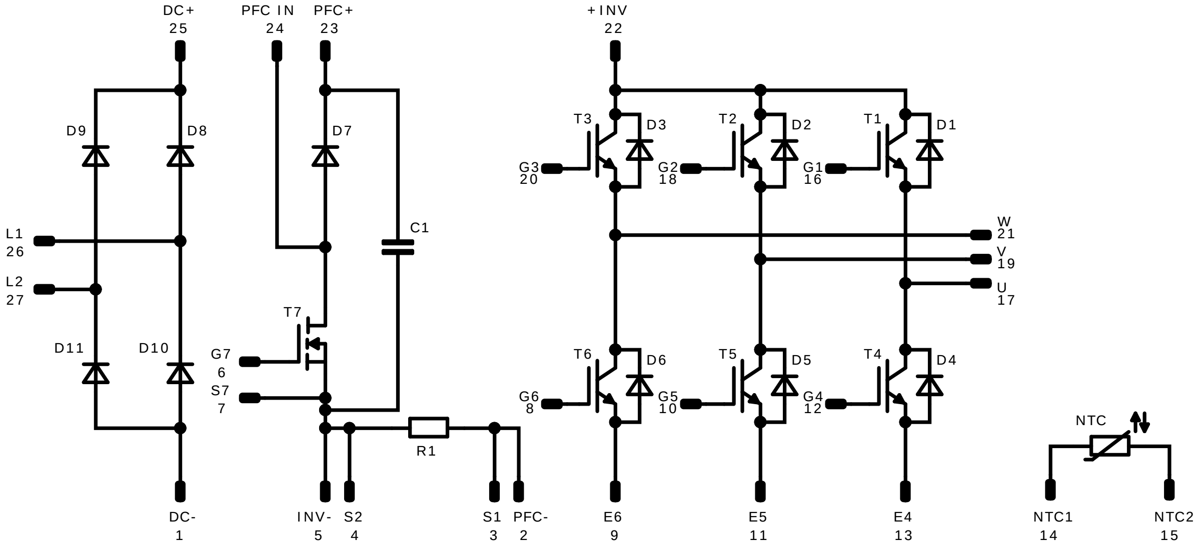
Outline

Pin table [mm]			
Pin	X	Y	Function
1	33,5	0	DC-
2	30,7	0	PFC-
3	28	0	S1
4	25,3	0	S2
5	22,6	0	INV-
6	19,9	0	G7
7	17,2	0	S7
8	13,5	0	G6
9	10,8	0	E6
10	8,1	0	G5
11	5,4	0	E5
12	2,7	0	G4
13	0	0	E4
14	0	8,6	NTC1
15	0	11,45	NTC2
16	0	19,8	G1
17	0	22,5	U
18	6	19,8	G2
19	6	22,5	V
20	12	19,8	G3
21	12	22,5	W
22	17,7	22,5	+INV
23	20,5	22,5	PFC+
24	26,5	22,5	PFC IN
25	33,5	22,5	DC+
26	33,5	15	L1
27	33,5	7,5	L2



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
T6, T3, T5, T2, T4, T1	IGBT	600 V	20 A	Inverter Switch	
D3, D6, D2, D5, D1, D4	FWD	600 V	30 A	Inverter Diode	
T7	MOSFET	600 V	63 mΩ	PFC Switch	
D7a	FWD	600 V	30 A	PFC Diode	
D11, D9, D10, D8	Rectifier	1600 V	25 A	Rectifier Diode	
R1	Shunt			PFC Shunt	
C1	Capacitor	500 V		Capacitor (PFC)	
NTC	NTC			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 135	>SPQ	Standard	<SPQ	Sample

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

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

Vincotech thermistor reference
See Vincotech thermistor reference table at 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-F006PPA020SB-M685B-D4-14	31 Mar. 2021	New Datasheet format Correct Rth values (module unchanged)	
10-F006PPA020SB-M685B-D5-14	14 Sep. 2021	Correct component and pin designations on schematic.	