10-F006PPA015SB04-M684B09

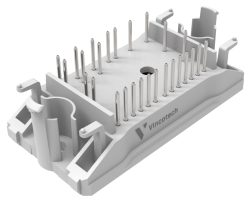
datasheet

***flow*PIM 0 + PFC** **600 V / 15 A**

Features

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

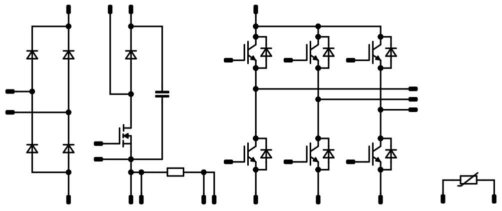
flow 0 17 mm housing



Target applications

- Embedded Drives
- Industrial Drives

Schematic



Types

- 10-F006PPA015SB04-M684B09

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	22	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		45	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	52	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	19	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	35	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	23	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}		151	A
Avalanche energy, single pulse	E_{AS}	V_{DD} = 50 V	I_D = 0 A	159	mJ
Avalanche energy, repetitive	E_{AR}	V_{DD} = 50 V	I_D = 0 A	0,8	mJ
MOSFET dv/dt ruggedness	dv/dt	V_{DS}= 0..400 V	T_s = 25 °C	80	V/ns
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	67	W
Gate-source voltage	V_{GSS}			±20	V
Reverse diode dv/dt	dv/dt			50	V/ns
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	43	A
Surge (non-repetitive) forward current	I_{FSM}		T_j = 25 °C	180	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	59	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	38	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	46	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	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00021	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		15	25 150	1,1	1,6 1,85	1,9(1)	V
Collector-emitter cut-off current	I_{CES}		0	600		25			0,85	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		800		pF
Output capacitance	C_{oes}							55		pF
Reverse transfer capacitance	C_{res}							24		pF
Gate charge	Q_g		0/15		0	25		87		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,83		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 32 Ω R_{goff} = 32 Ω	±15	400	15	25 125 150		102 101,4 101		ns
Rise time	t_r					25 125 150		28,8 31 31,4		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		156,6 178,6 181,4		ns
Fall time	t_f					25 125 150		61,75 71,56 85,28		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,646 µC Q_{rFWD}=1,3 µC Q_{rFWD}=1,53 µC				25 125 150		0,482 0,678 0,693		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,426 0,553 0,598		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				15	25 125 150	1,25	1,76 1,66 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)						2,75		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=446 A/µs d*i*/d*t*=490 A/µs d*i*/d*t*=382 A/µs	±15	400	15	25 125 150		5,96 7,85 8,52		A
Reverse recovery time	t_{rr}					25 125 150		231,41 308,74 350		ns
Recovered charge	Q_r					25 125 150		0,646 1,3 1,53		µC
Reverse recovered energy	E_{rec}					25 125 150		0,178 0,353 0,431		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		20,77 43,15 51,04		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]	Values Min	Values Typ	Values Max	Unit
PFC Switch										
Static										
Drain-source on-state resistance	$r_{DS(on)}$		10		15,9	25 125		63 115	60(1)	mΩ
Gate-source threshold voltage	$V_{GS(th)}$		0		0,0008	25	3	3,5	4	V
Gate to Source Leakage Current	I_{GSS}		20	0		25			100	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	600		25			1	µA
Internal gate resistance	r_g							2,8		Ω
Gate charge	Q_g		0/10	400	15,9	25		67		nC
Short-circuit input capacitance	C_{iss}	f = 250 kHz	0	400	0	25		2895		pF
Short-circuit output capacitance	C_{oss}							48		
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,05		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	0/10	400	20	25 125		20,66 19,66		ns
Rise time	t_r					25 125		5,52 6,02		ns
Turn-off delay time	$t_{d(off)}$					25 125		72,75 81,2		ns
Fall time	t_f					25 125		1,38 2,18		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,58 µC Q_{rFWD}=1,19 µC				25 125		0,087 0,229		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,052 0,063		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		1,76 1,39 1,31	2,65(1) 1,8(1)	V
Reverse leakage current	I_R	V_r = 600 V				25 150		0,02 50	30 300	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,61		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=3939 A/µs d*i*/d*t*=3830 A/µs	0/10	400	20	25 125		50,16 64,72		A
Reverse recovery time	t_{rr}					25 125		21,86 29,63		ns
Recovered charge	Q_r					25 125		0,58 1,19		µC
Reverse recovered energy	E_{rec}					25 125		0,203 0,341		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		28158,38 2947,25		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	
Rectifier Diode										
Static										
Forward voltage	V_F				18	25 125 150		1,06 0,994 0,973	1,5(1)	V
Reverse leakage current	I_R	V_r = 1600 V				25 150			100 1000	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,54		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					25		130		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	

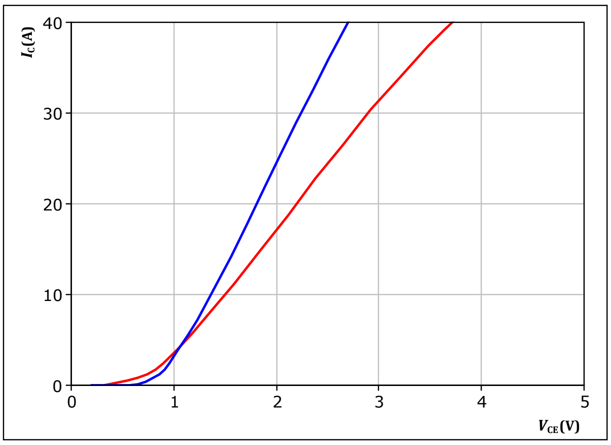
(1) Value at chip level
(2) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

I_C = f(V_{CE})



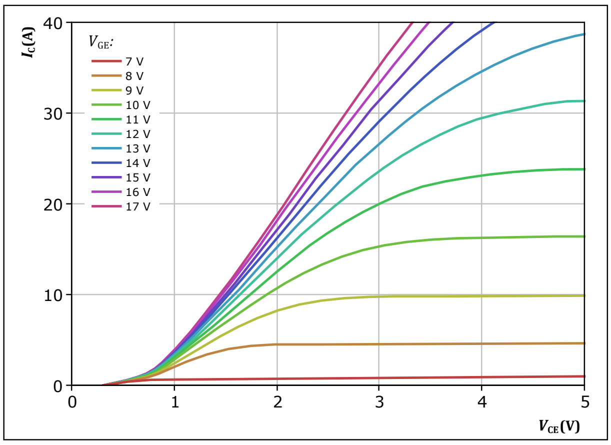
t_p =	250	µs
V_{GE} =	15	V

T_j: 25 °C / 150 °C

figure 2. IGBT

Typical output characteristics

I_C = f(V_{CE})



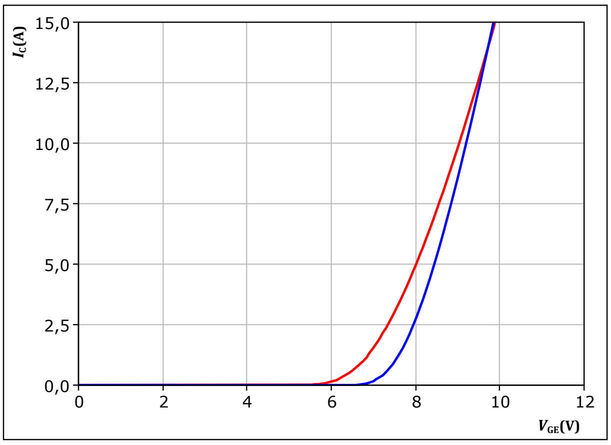
t_p =	250	µs
T_j =	150	°C

V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

I_C = f(V_{GE})



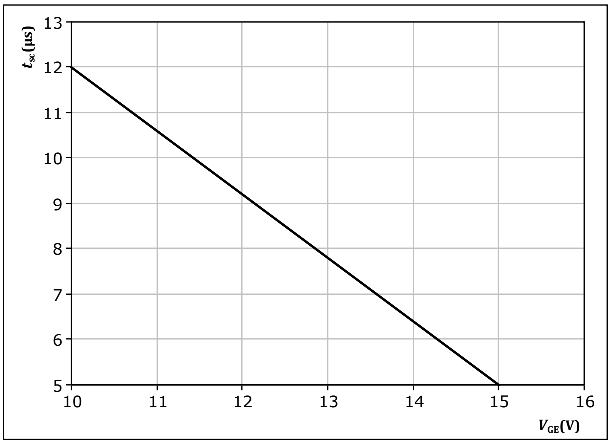
t_p =	250	µs
V_{CE} =	10	V

T_j: 25 °C / 150 °C

figure 4. IGBT

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

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



At	V_{CE} =	600	V
	T_j ≤	25	°C

Inverter Switch Characteristics

figure 5. **IGBT**

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

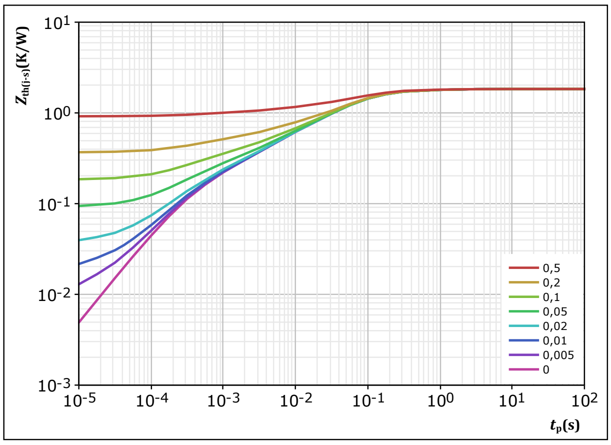
I_{SC} = f(V_{GE})

At	V_{CE} =	400	V
	T_j ≤	150	°C

figure 6. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,834	K/W

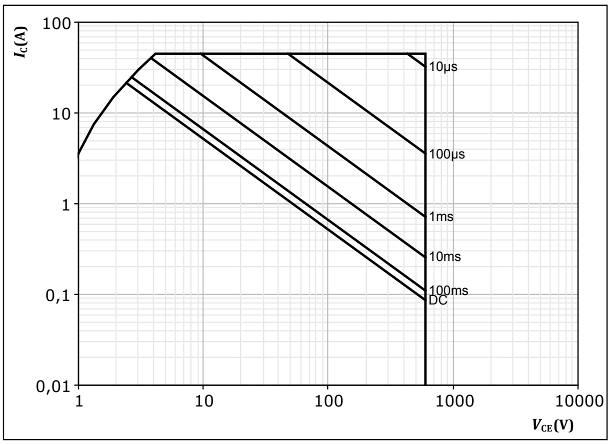
IGBT thermal model values

R (K/W)	τ (s)
8,30E-02	1,29E+00
3,76E-01	1,56E-01
8,46E-01	5,15E-02
2,81E-01	8,16E-03
1,16E-01	2,04E-03
1,32E-01	3,43E-04

figure 7. **IGBT**

Safe operating area

I_C = f(V_{CE})

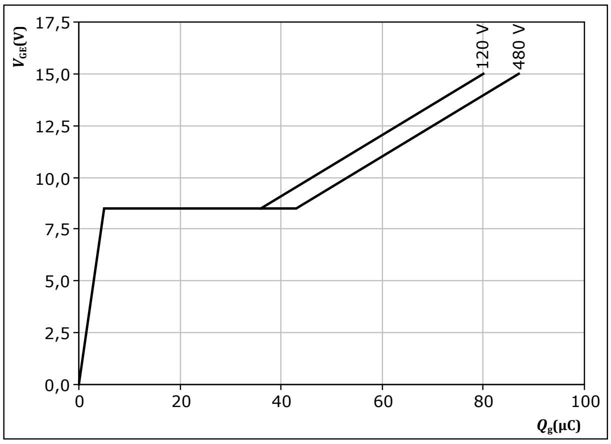


D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

figure 8. **IGBT**

Gate voltage vs gate charge

V_{GE} = f(Q_g)



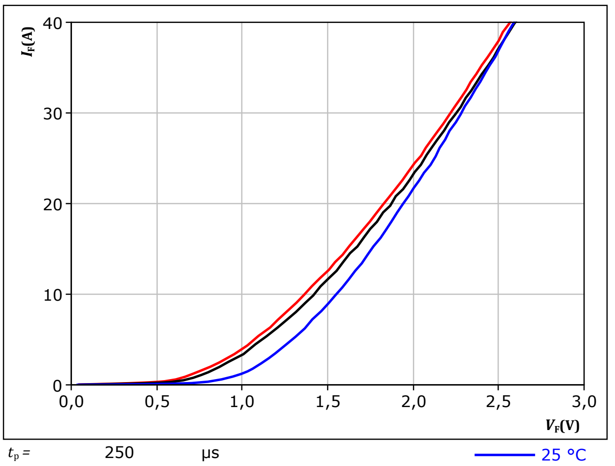
I_C =	15	A
T_j =	25	°C

Inverter Diode Characteristics

figure 9. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



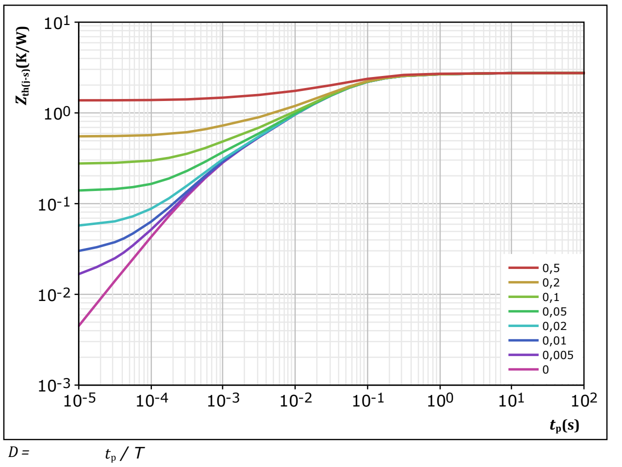
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 10. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 2,75 K/W

FWD thermal model values

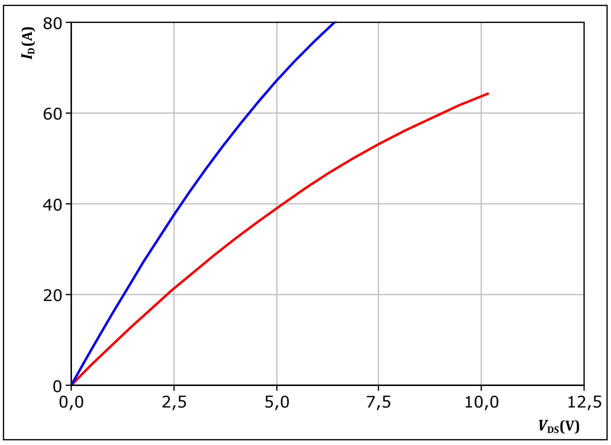
R (K/W)	τ (s)
1,03E-01	3,14E+00
3,03E-01	2,74E-01
1,23E+00	6,07E-02
5,94E-01	1,63E-02
3,18E-01	4,11E-03
2,02E-01	6,37E-04

PFC Switch Characteristics

figure 11. **MOSFET**

Typical output characteristics

I_D = f(V_{DS})



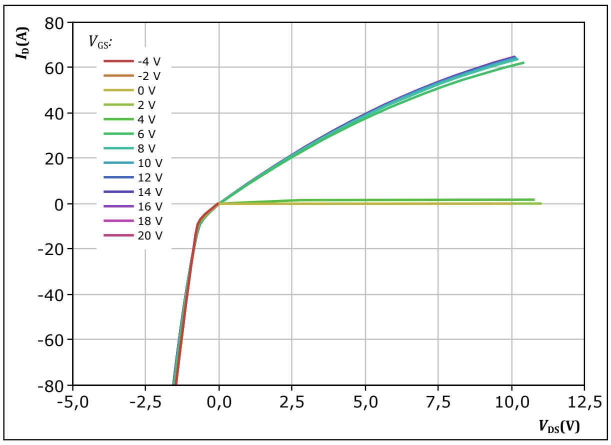
t_p =	250	μs
V_{GS} =	10	V

T_j: 25 °C (blue), 125 °C (red)

figure 12. **MOSFET**

Typical output characteristics

I_D = f(V_{DS})



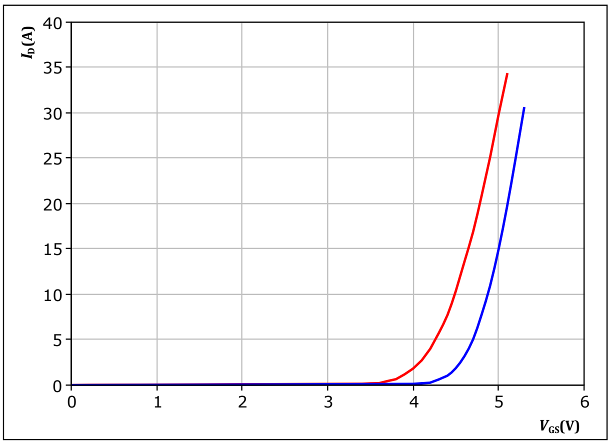
t_p =	250	μs
T_j =	125	°C

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

figure 13. **MOSFET**

Typical transfer characteristics

I_D = f(V_{GS})



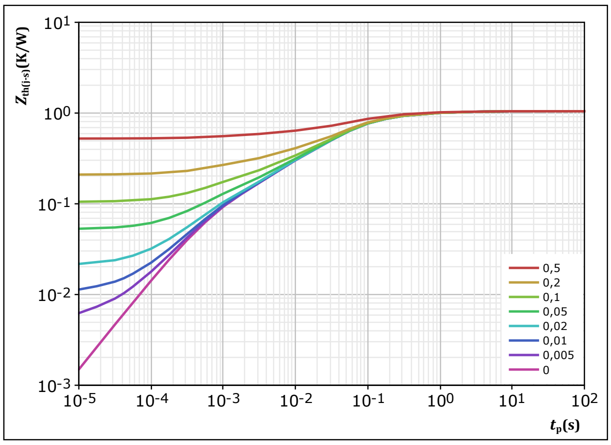
t_p =	250	μs
V_{DS} =	10	V

T_j: 25 °C (blue), 125 °C (red)

figure 14. **MOSFET**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,047	K/W

MOSFET thermal model values

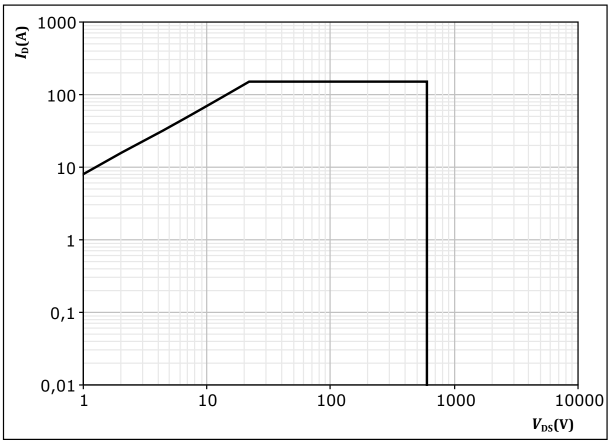
R (K/W)	τ (s)
6,31E-02	1,89E+00
2,11E-01	2,50E-01
5,41E-01	5,16E-02
1,55E-01	6,52E-03
7,68E-02	6,66E-04

PFC Switch Characteristics

figure 15.	MOSFET

Safe operating area

I_D = f(V_{DS})



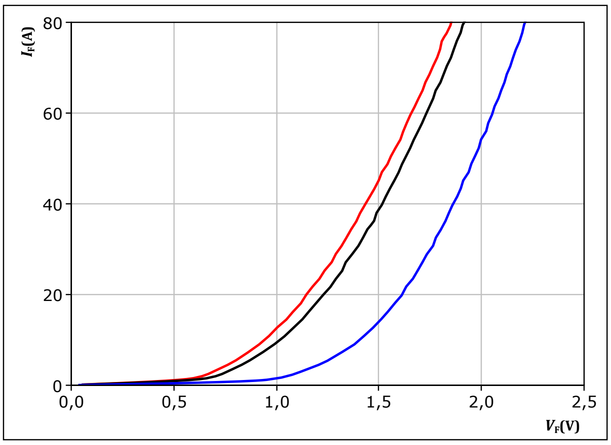
D =	single pulse	
T_s =	80	°C
V_{GS} =	10	V
T_j =	T_{jmax}	

PFC Diode Characteristics

figure 16. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



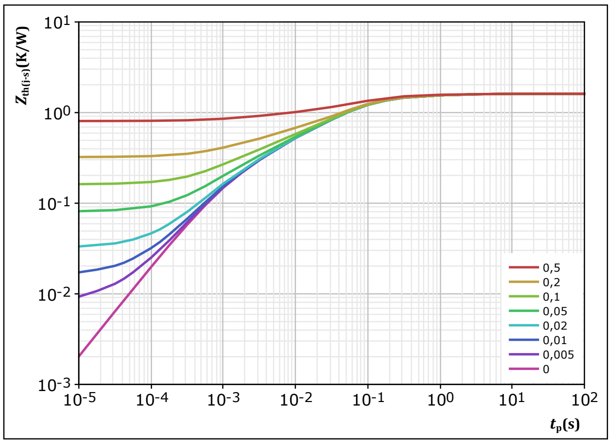
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 17. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,613 K/W

FWD thermal model values

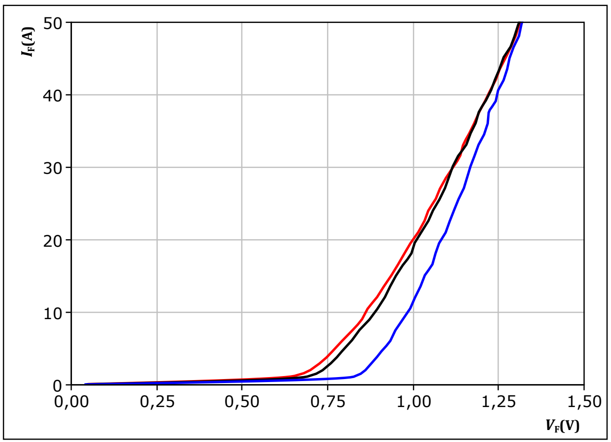
R (K/W)	τ (s)
9,69E-02	2,09E+00
2,90E-01	2,16E-01
7,68E-01	5,39E-02
3,12E-01	7,17E-03
1,46E-01	1,00E-03

Rectifier Diode Characteristics

figure 18. **Rectifier**

Typical forward characteristics

I_F = f(V_F)



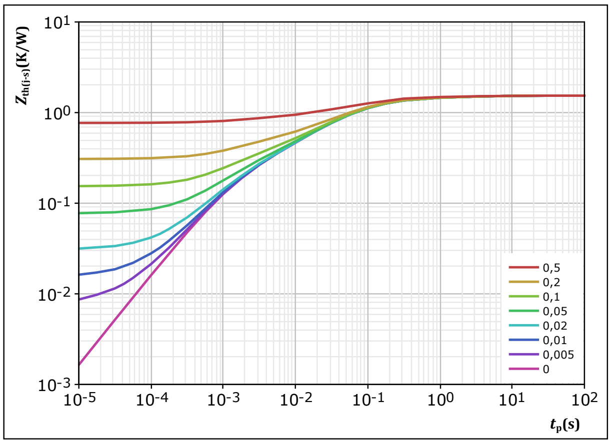
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 19. **Rectifier**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,537 K/W

Rectifier thermal model values

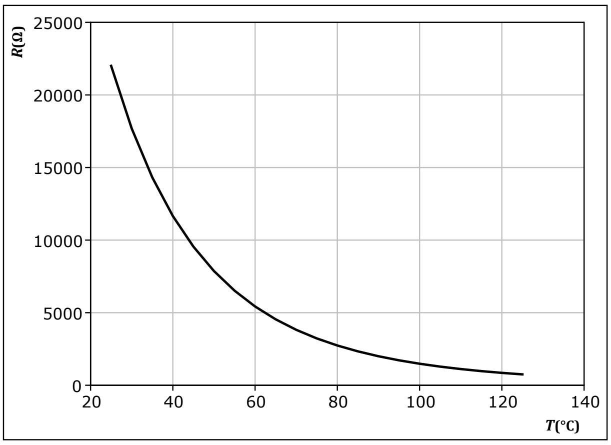
R (K/W)	τ (s)
7,03E-02	4,42E+00
2,01E-01	4,56E-01
7,63E-01	7,09E-02
3,40E-01	1,14E-02
1,63E-01	1,31E-03

Thermistor Characteristics

figure 20.	Thermistor

Typical NTC characteristic as function of temperature

$R_T = f(T)$

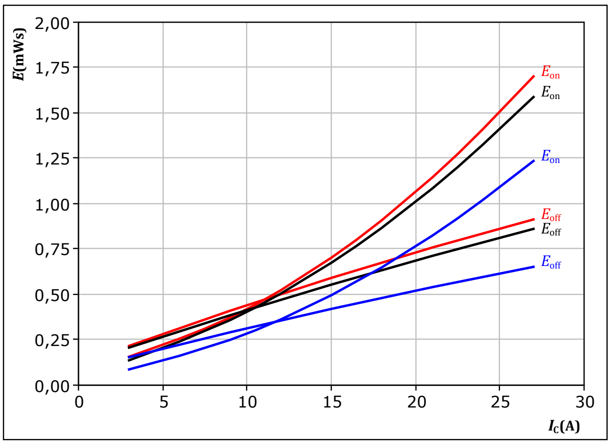


Inverter Switching Characteristics

figure 21. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



With an inductive load at

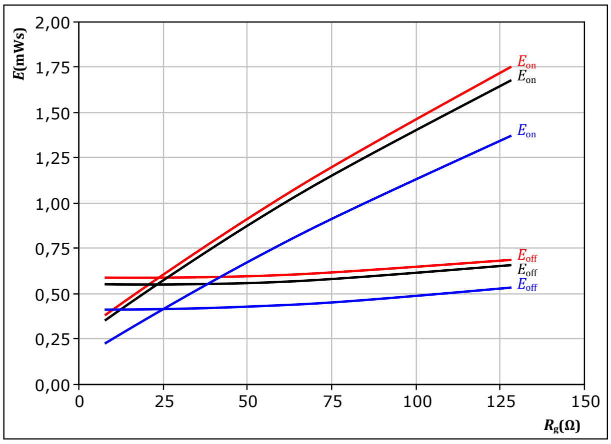
V_{CE} =	400	V	
V_{GE} =	±15	V	
R_{gon} =	32	Ω	
R_{goff} =	32	Ω	

T_j: 25 °C, 125 °C, 150 °C

figure 22. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



With an inductive load at

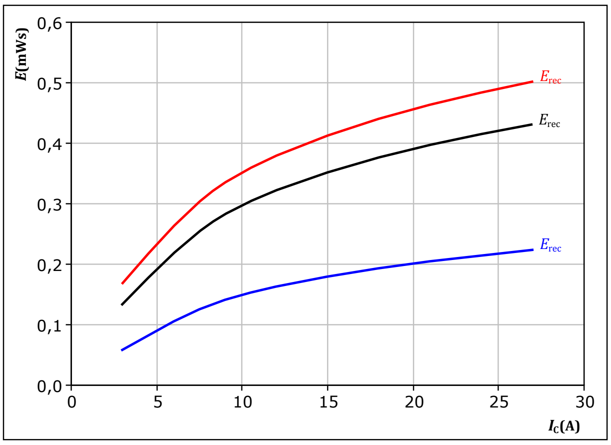
V_{CE} =	400	V
V_{GE} =	±15	V
I_C =	15	A

T_j: 25 °C, 125 °C, 150 °C

figure 23. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



With an inductive load at

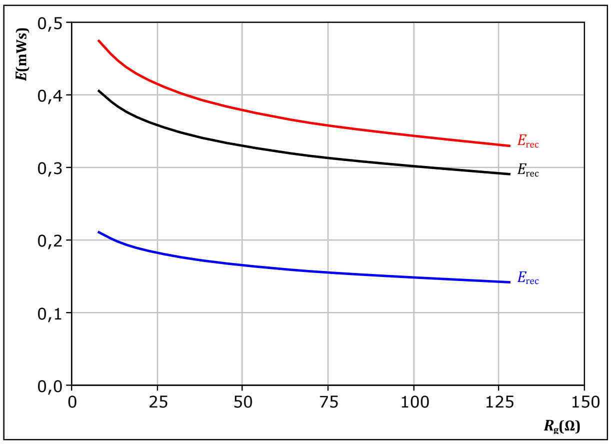
V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 24. **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 =	15	A

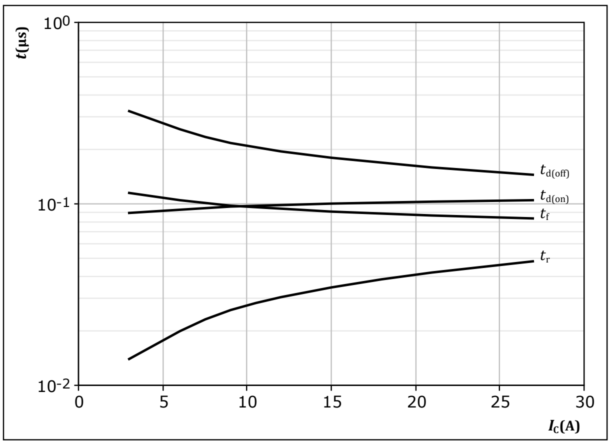
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 25. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



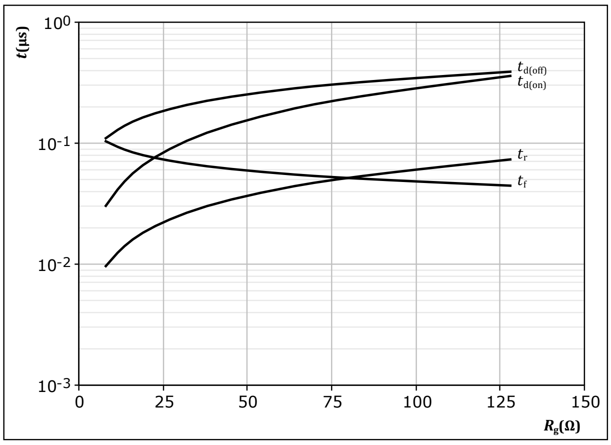
With an inductive load at

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

figure 26. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



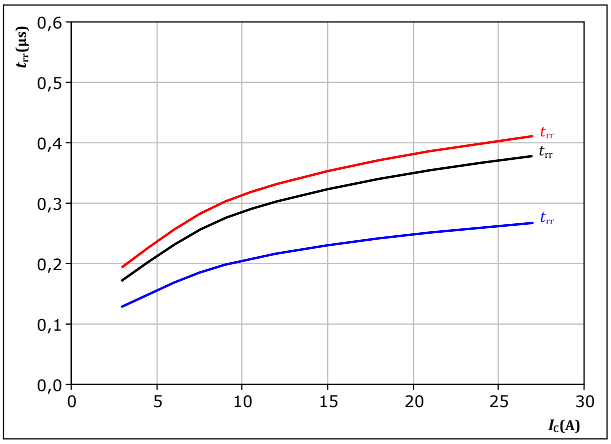
With an inductive load at

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

figure 27. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



With an inductive load at

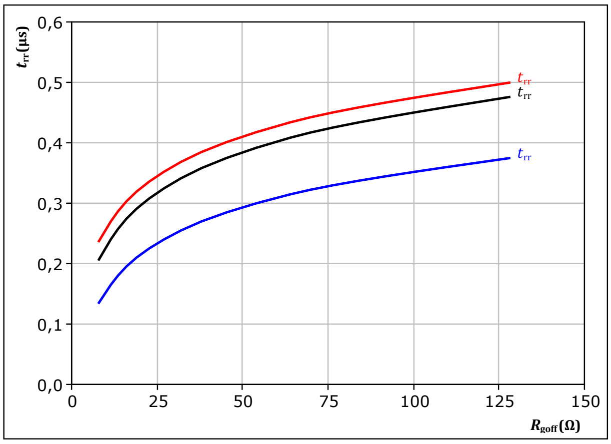
V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 28. **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

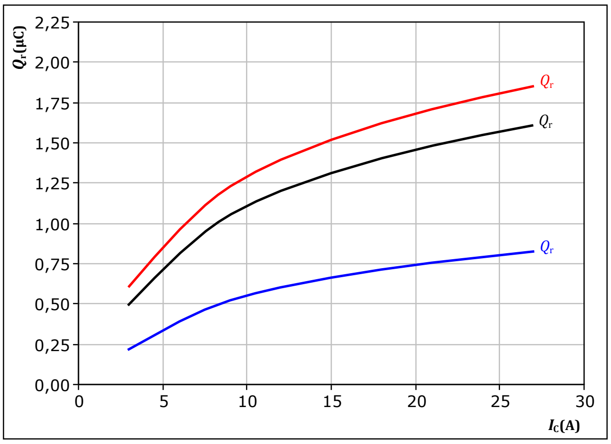
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 29. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



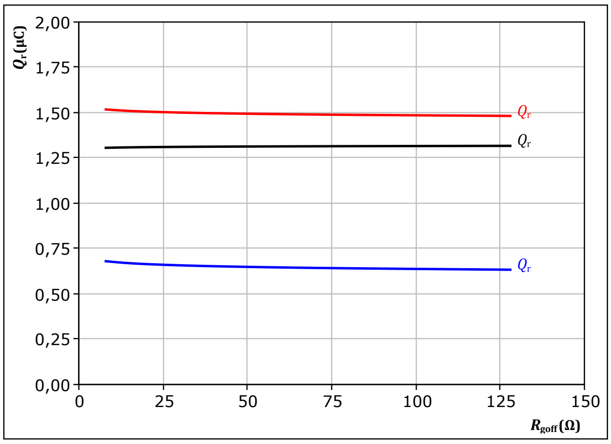
With an inductive load at

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

figure 30. **FWD**

Typical recovered charge as a function of turn off gate resistor

Q_r = f(R_{goff})



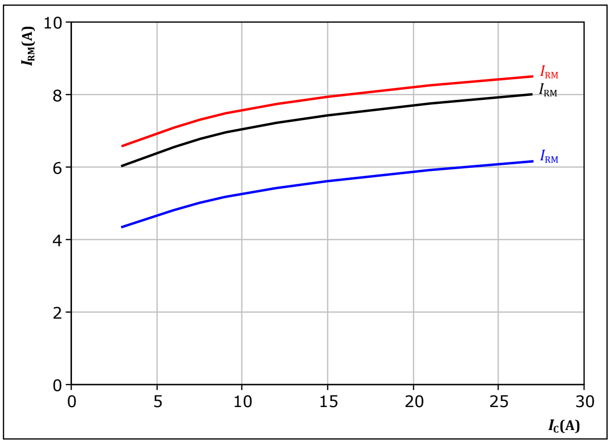
With an inductive load at

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

figure 31. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



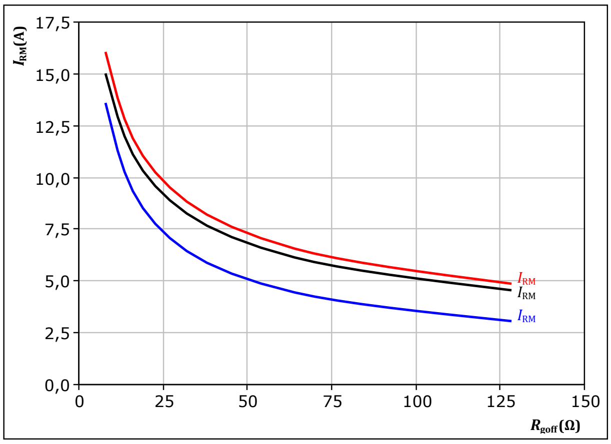
With an inductive load at

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

figure 32. **FWD**

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

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



With an inductive load at

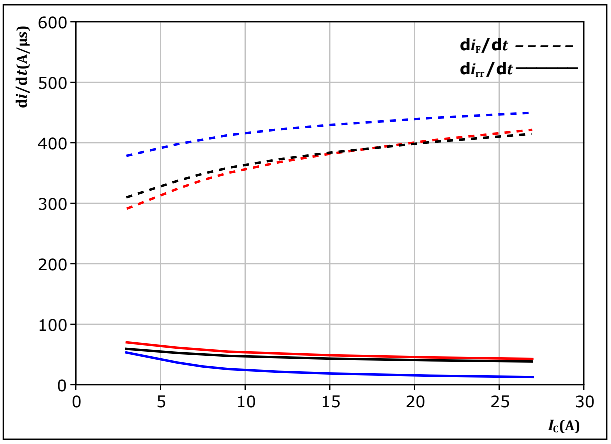
V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	15	A		150 °C

Inverter Switching Characteristics

figure 33. **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)



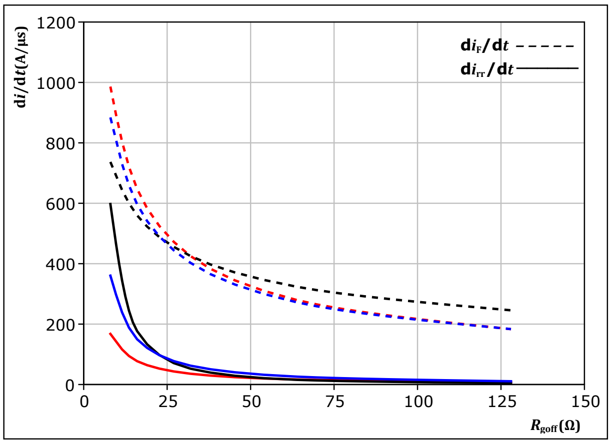
With an inductive load at

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

figure 34. **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})



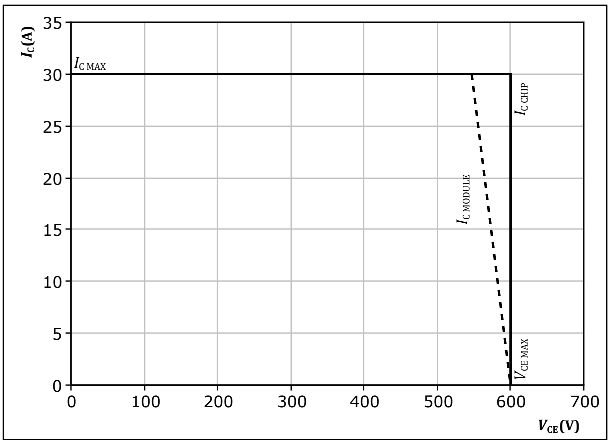
With an inductive load at

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

figure 35. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



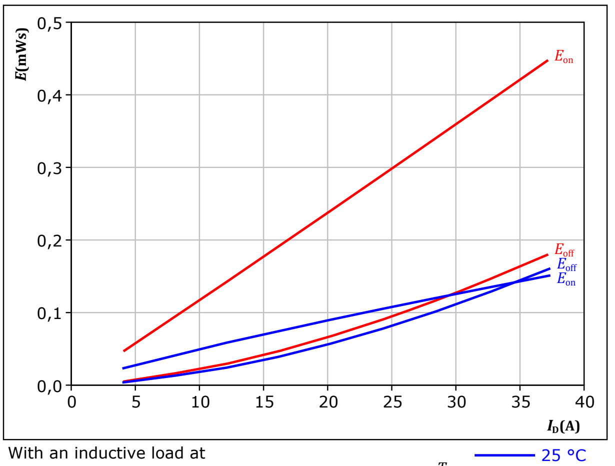
At	T_j =	150	°C
	R_{gon} =	32	Ω
	R_{goff} =	32	Ω

PFC Switching Characteristics

figure 36. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



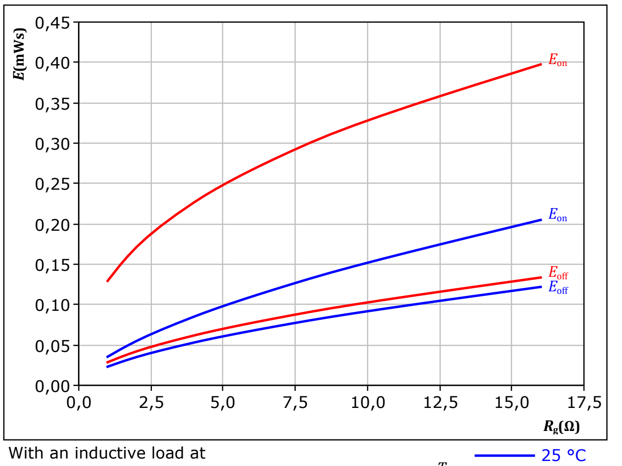
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	0/10	V		125 °C
R_{gon} =	4	Ω		
R_{goff} =	4	Ω		

figure 37. **MOSFET**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



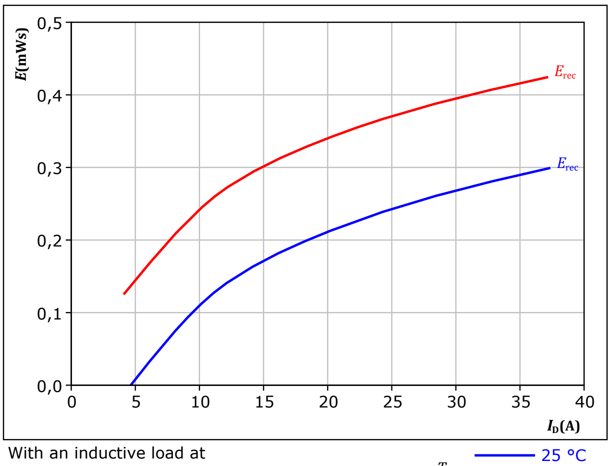
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	0/10	V		125 °C
I_D =	20	A		

figure 38. **FWD**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



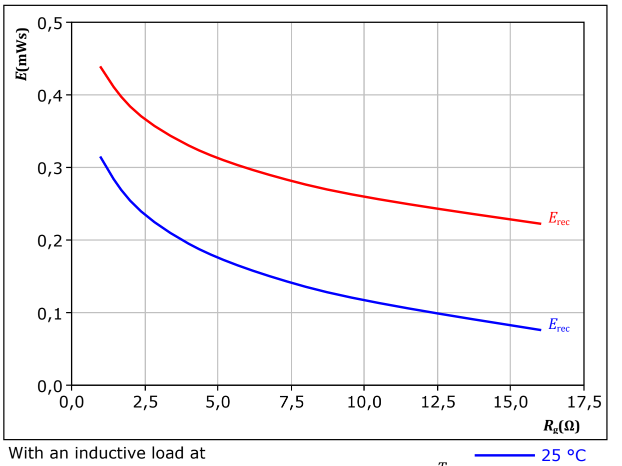
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	0/10	V		125 °C
R_{gon} =	4	Ω		

figure 39. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

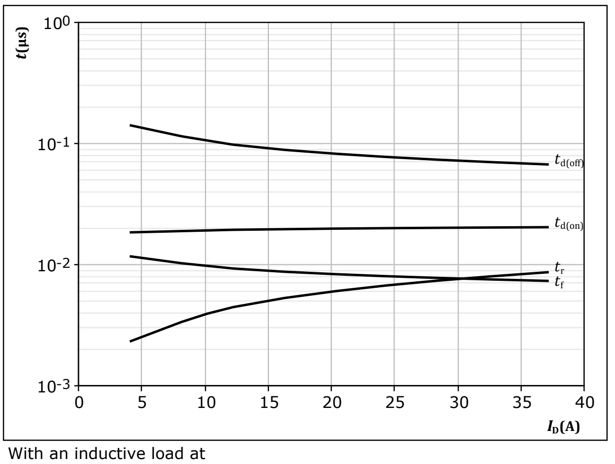
V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	0/10	V		125 °C
I_D =	20	A		

PFC Switching Characteristics

figure 40. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



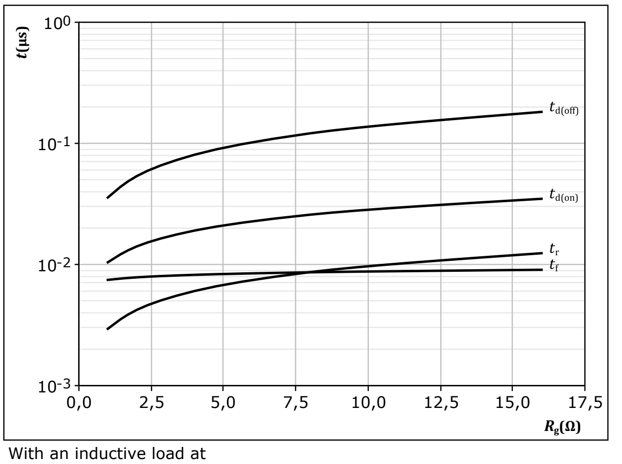
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	0/10	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 41. **MOSFET**

Typical switching times as a function of gate resistor

$t = f(R_g)$



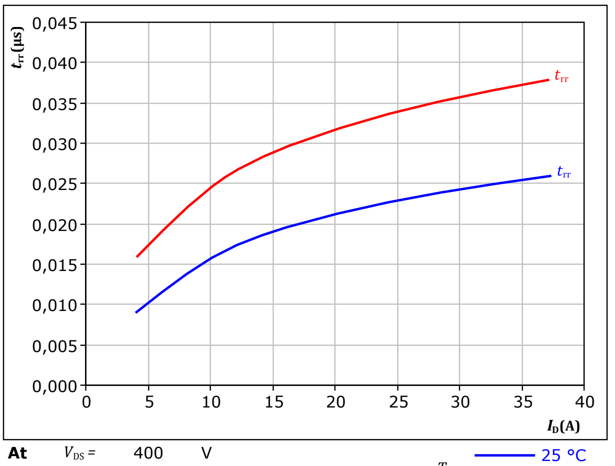
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	0/10	V
I_D =	20	A

figure 42. **FWD**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$



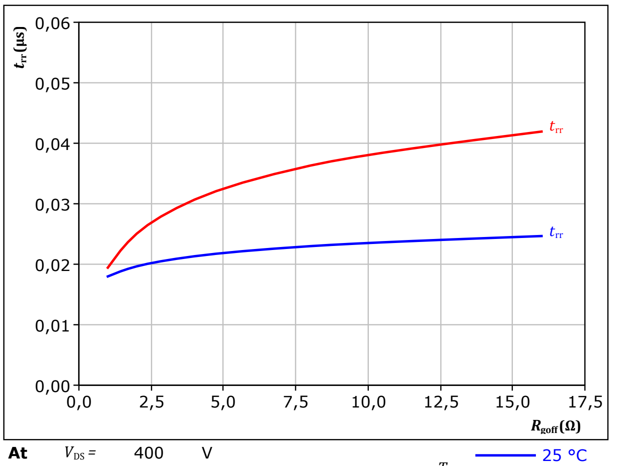
At			
	V_{DS} =	400	V
	V_{GS} =	0/10	V
	R_{gon} =	4	Ω

T_j: 25 °C, 125 °C

figure 43. **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} =	0/10	V
	I_D =	20	A

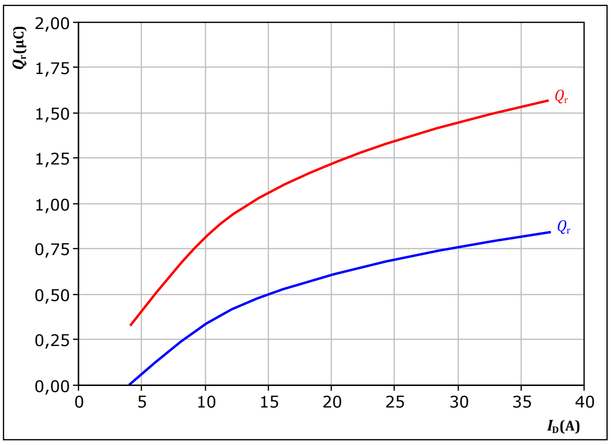
T_j: 25 °C, 125 °C

PFC Switching Characteristics

figure 44. FWD

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

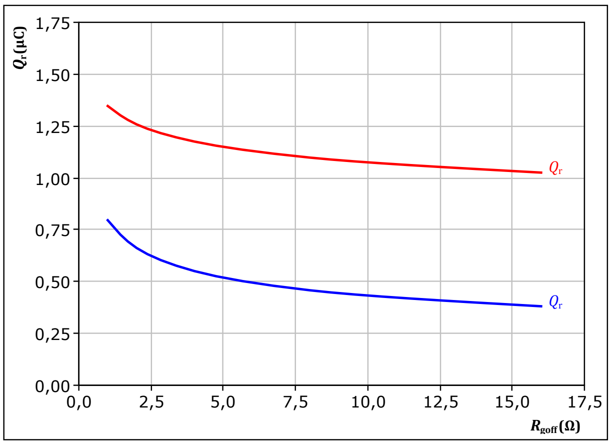


At				
V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	0/10	V		125 °C
R_{gon} =	4	Ω		

figure 45. FWD

Typical recovered charge as a function of turn off gate resistor

$Q_r = f(R_{goff})$

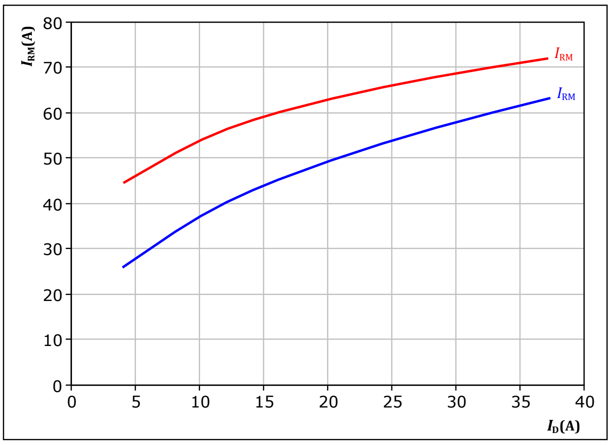


At				
V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	0/10	V		125 °C
I_D =	20	A		

figure 46. FWD

Typical peak reverse recovery current as a function of drain current

$I_{RM} = f(I_D)$

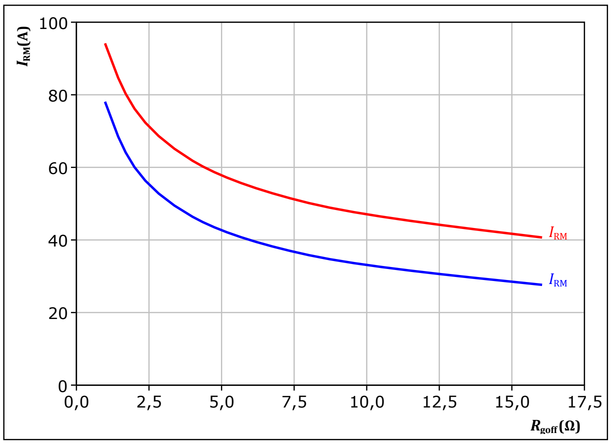


At				
V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	0/10	V		125 °C
R_{gon} =	4	Ω		

figure 47. FWD

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

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



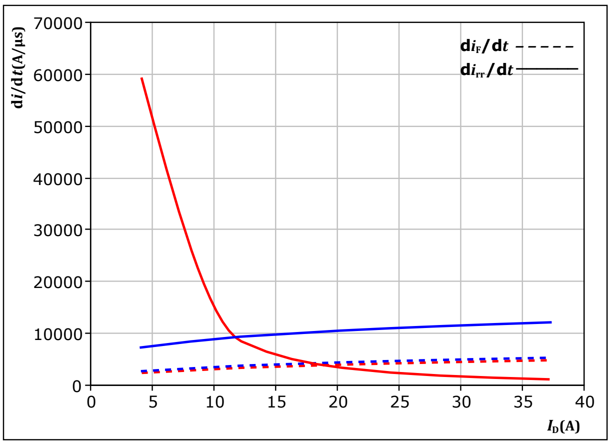
At				
V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	0/10	V		125 °C
I_D =	20	A		

PFC Switching Characteristics

figure 48. **FWD**

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

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

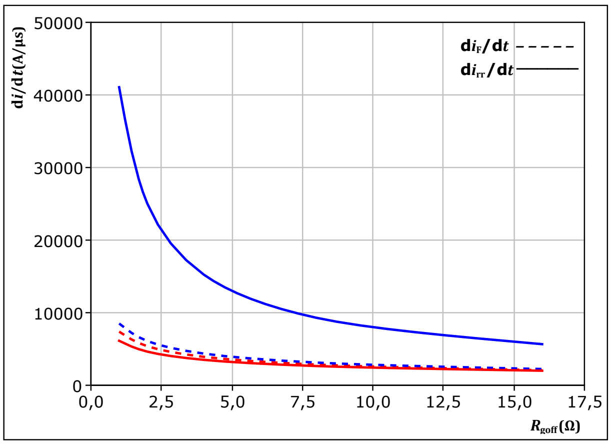


At				
	V_{DS} =	400	V	T_j: 25 °C
	V_{GS} =	0/10	V	125 °C
	R_{gon} =	4	Ω	

figure 49. **FWD**

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

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

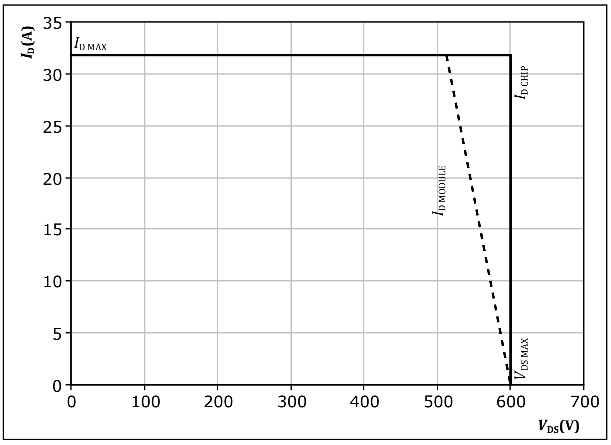


At				
	V_{DS} =	400	V	T_j: 25 °C
	V_{GS} =	0/10	V	125 °C
	I_D =	20	A	

figure 50. **MOSFET**

Reverse bias safe operating area

$I_D = f(V_{DS})$



At			
	T_j =	125	°C
	R_{gon} =	4	Ω
	R_{goff} =	4	Ω

Inverter Switching Definitions

figure 51. **IGBT**

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

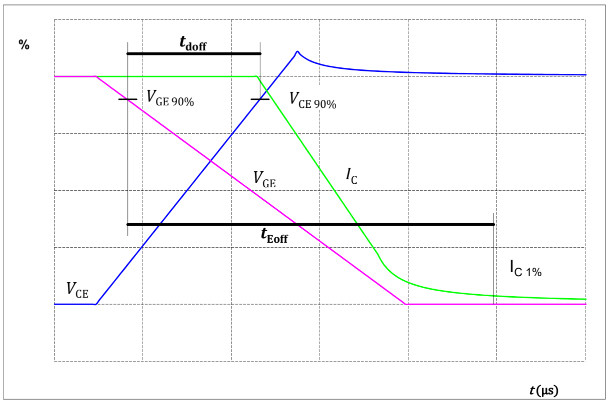


figure 52. **IGBT**

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

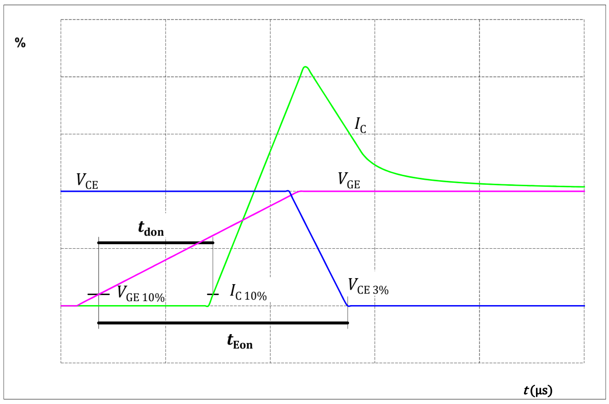


figure 53. **IGBT**

Turn-off Switching Waveforms & definition of t_f

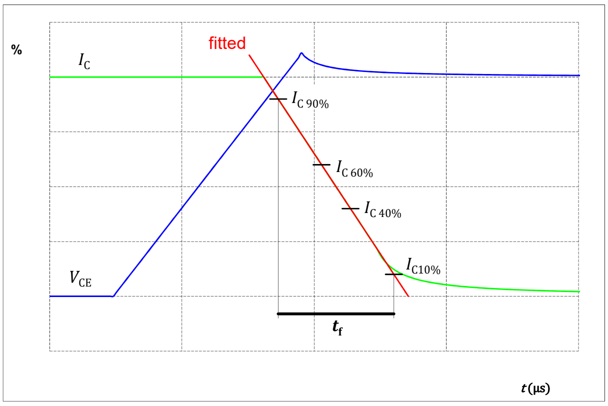
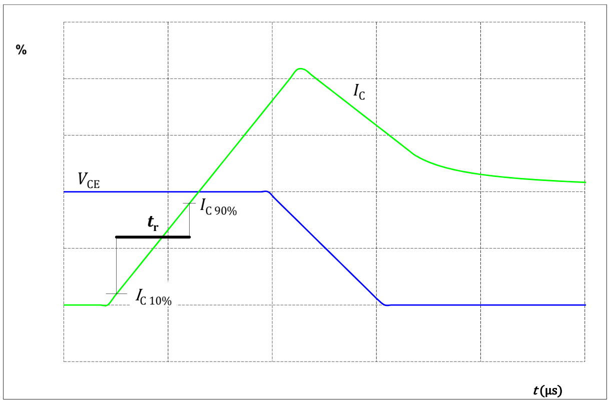


figure 54. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Inverter Switching Definitions

figure 55.	FWD

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

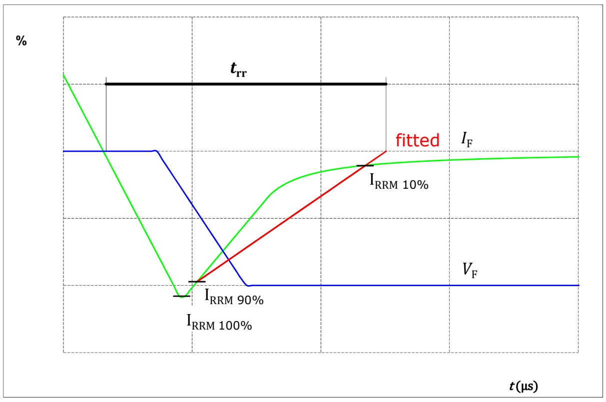
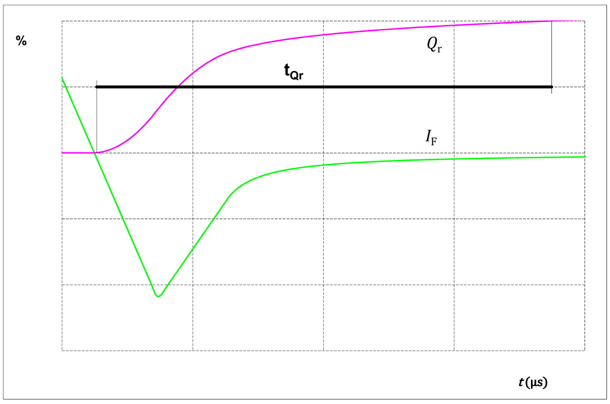


figure 56.	FWD

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



PFC Switching Definitions

figure 51. MOSFET

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

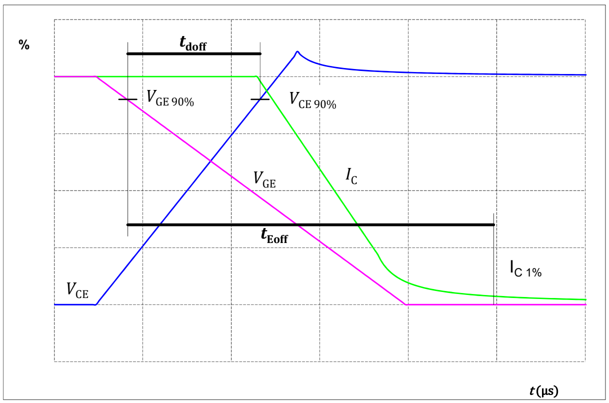


figure 52. MOSFET

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

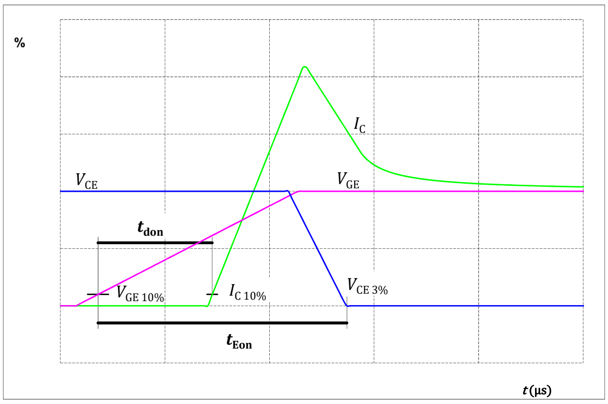


figure 53. MOSFET

Turn-off Switching Waveforms & definition of t_f

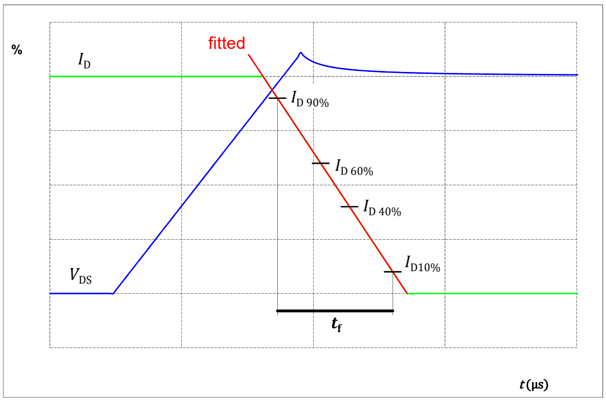
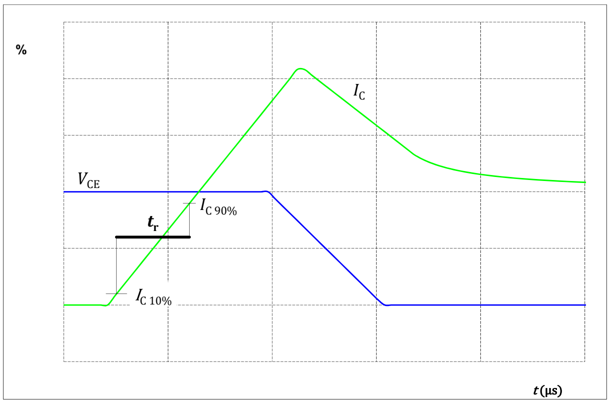


figure 54. MOSFET

Turn-on Switching Waveforms & definition of t_r



PFC Switching Definitions

figure 55. **FWD**

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

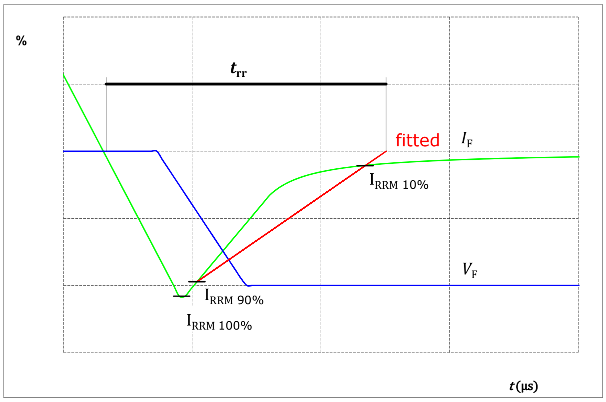


figure 56. **FWD**

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

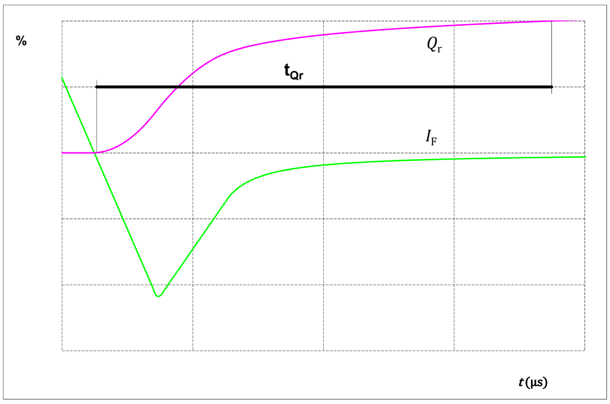
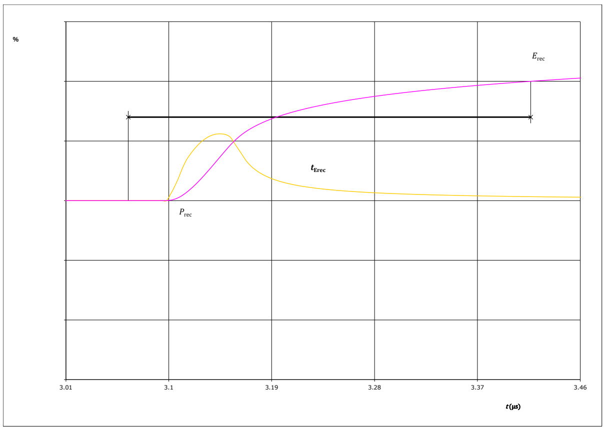


figure 57. **FWD**

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



Ordering Code

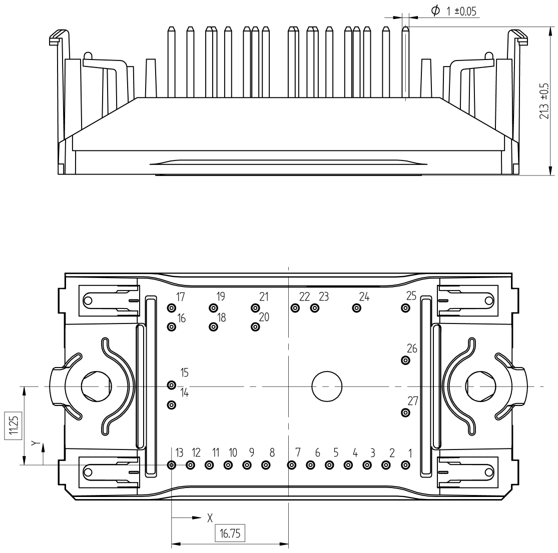
Version	Ordering Code
Without thermal paste	10-F006PPA015SB04-M684B09
With thermal paste (5,2 W/mK, PTM6000HV)	10-F006PPA015SB04-M684B09-/7/
With thermal paste (3,4 W/mK, PSX-P7)	10-F006PPA015SB04-M684B09-/3/

Marking

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

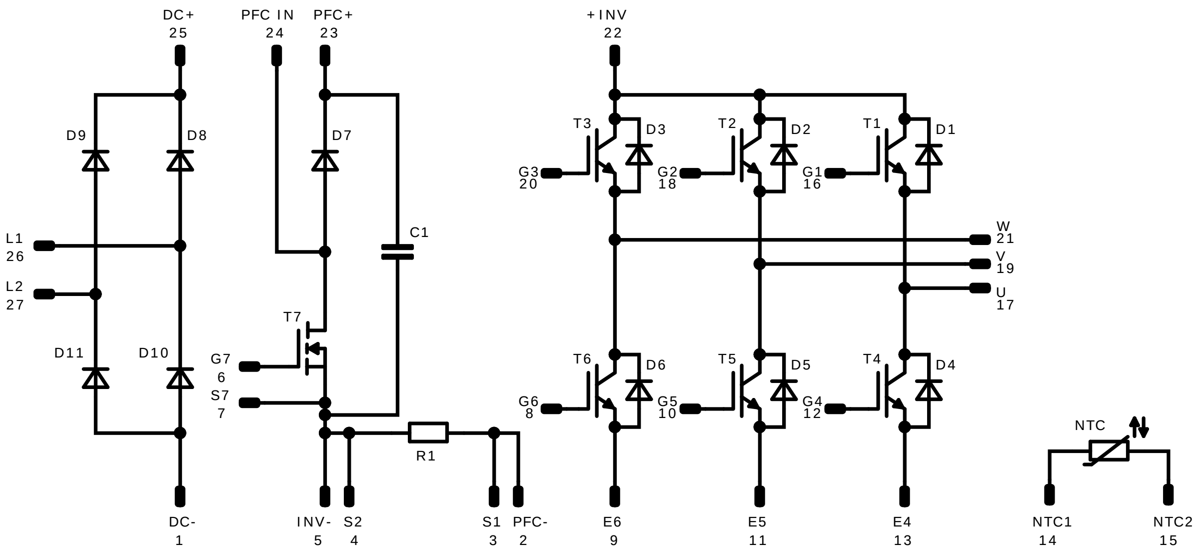
Outline

Pin table [mm]			
Pin	X	Y	Function
1	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	15 A	Inverter Switch	
D3, D6, D2, D5, D1, D4	FWD	600 V	15 A	Inverter Diode	
T7	MOSFET	600 V	49 mΩ	PFC Switch	
D7	FWD	600 V	30 A	PFC Diode	
D11, D9, D10, D8	Rectifier	1600 V	18 A	Rectifier Diode	
R1	Shunt			PFC Shunt	
C1	Capacitor	500 V		Capacitor (PFC)	
NTC	Thermistor			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-F006PPA015SB04-M684B09-D1-14	7 Jan. 2022		