10-R106PPA020SB03-M934A10
datasheet

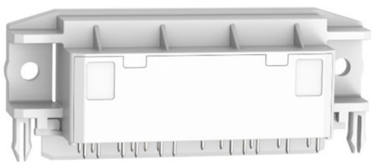
Vincotech

*flow*90PIM 1 + PFC	600 V / 20 A

Features

- Clip in PCB mounting
- Trench Fieldstop IGBT's for low saturation losses
- Latest generation MOSFET for PFC

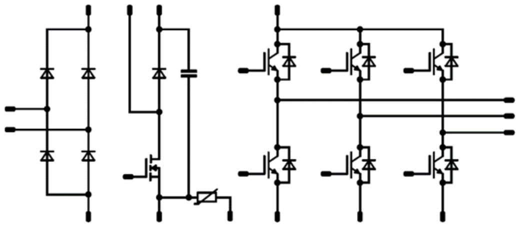
***flow* 90 housing**



Target applications

- Embedded Drives
- Industrial Drives

Schematic



Types

- 10-R106PPA020SB03-M934A10

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	24	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	53	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V Vcc = 360 V T_j = 150 °C	6	µs
Maximum junction temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	32	A
Repetitive peak forward current	I_{FRM}			60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	53	W
Maximum junction temperature	T_{jmax}			175	°C
PFC Switch					
Drain-source voltage	V_{DSS}			600	V
Drain current	I_D	$T_j = T_{jmax}$	T_s = 80 °C	21	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}		141	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	77	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
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	30	A
Repetitive peak forward current	I_{FRM}	t_p limitid by T_{jmax}		105	A
Total power dissipation	P_{tot}		T_s = 80 °C	50	W
Maximum junction temperature	T_{jmax}			175	°C
Rectifier Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	33	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz 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	43	W
Maximum junction temperature	T_{jmax}			150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
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
		AC Voltage	t_p = 1 min	2500	V
Creepage distance				min. 12,7	mm
Clearance				11,84	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	
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,00029	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		20	25 125	1,1	1,52 1,84	1,9	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		
Reverse transfer capacitance	C_{res}							32		
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,81		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 16 Ω R_{gon} = 16 Ω	±15	400	15	25 125		66 65		ns
Rise time	t_r					25 125		20 21		
Turn-off delay time	$t_{d(off)}$					25 125		142 167		
Fall time	t_f					25 125		76 86		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,9 µC Q_{rFWD} = 1,8 µC				25 125		0,450 0,667		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,385 0,523		

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				30	25 150	1,25	1,65 1,62	1,95	V
Reverse leakage current	I_R			600		25			27	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,80		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 731 A/µs di/dt = 708 A/µs	±15	400	15	25 125		10 14		A
Reverse recovery time	t_{rr}					25 125		174 233		ns
Recovered charge	Q_r					25 125		0,883 1,790		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 85		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
PFC Switch										
Static										
Drain-source on-state resistance	$r_{DS(on)}$		10		9,5	25 125 150		69 132 156	90	mΩ
Gate-source threshold voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}$			0,001	25	2		4	V
Gate to Source Leakage Current	I_{GSS}		20	0		25			100	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	600		25			100	µA
Gate charge	Q_g		0/10	300	47	25		145		nC
Gate to source charge	Q_{GS}							20		
Gate to drain charge	Q_{GD}							80		
Short-circuit input capacitance	C_{iss}	f = 1 MHz	0	25		25		3850		pF
Short-circuit output capacitance	C_{oss}							2950		
Reverse transfer capacitance	C_{rss}							320		
Reverse Diode Static										
Diode forward voltage	V_{SD}		0		9,5	25			1,5	V
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,91		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 8 Ω R_{goff} = 8 Ω	0 / 10	400	20	25 125		25 25		ns
Rise time	t_r					25 125		33 34		
Turn-off delay time	$t_{d(off)}$					25 125		244 254		
Fall time	t_f					25 125		31 43		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,1 µC Q_{rFWD} = 0,1 µC				25 125		0,397 0,408		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,289 0,331		

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
PFC Diode										
Static										
Forward voltage	V_F				24	25 125		1,38 1,49	1,7	V
Reverse leakage current	I_R			600		25			480	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,89		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 301 A/µs di/dt = 310 A/µs	0 / 10	400	20	25 125		3 3		A
Reverse recovery time	t_{rr}					25 125		45 46		ns
Recovered charge	Q_r					25 125		0,108 0,134		µC
Reverse recovered energy	E_{rec}					25 125		0,025 0,035		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		309 259		A/µs
Rectifier Diode										
Static										
Forward voltage	V_F				25	25 125		1,22 1,21		V
Reverse leakage current	I_R			1600		25			50	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,61		K/W
Capacitor (PFC)										
Capacitance	C							100		nF
Tolerance							-10		+10	%
Climatic category								55/125/56		

Characteristic Values

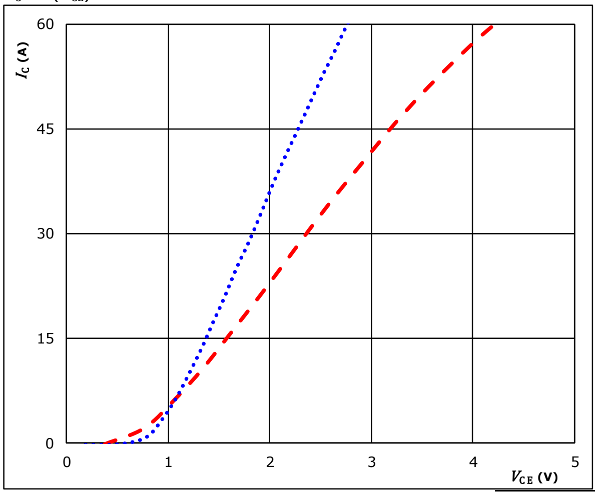
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_{F} [V]	I_{C} [A] I_{D} [A] I_{F} [A]	T_{j} [°C]	Min	Typ	Max	
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					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	

Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

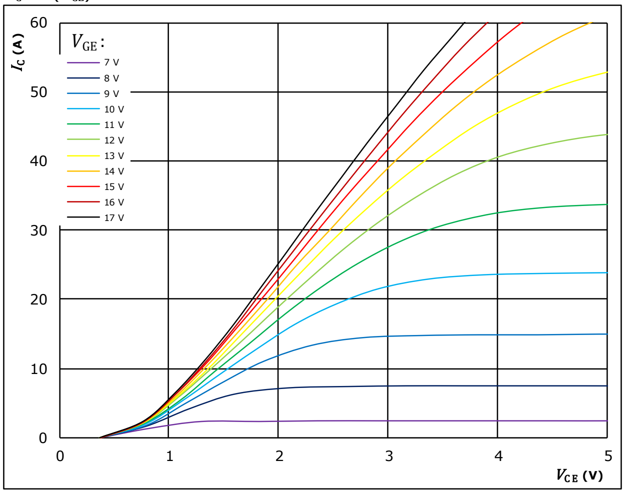


t_p =	250	µs	T_j:	25 °C	········
V_{GE} =	15	V		150 °C	– – –

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

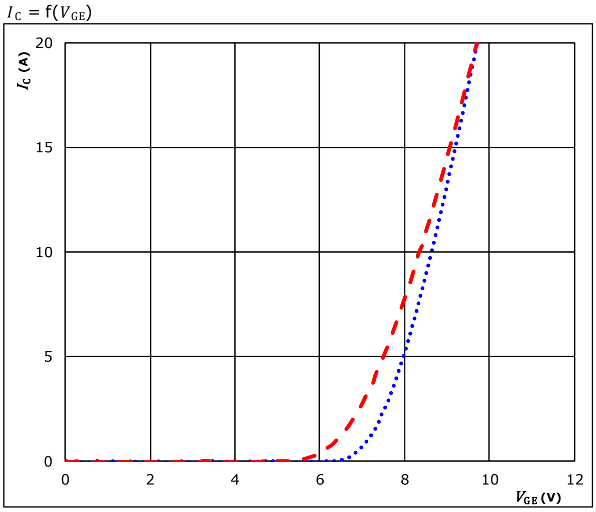


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

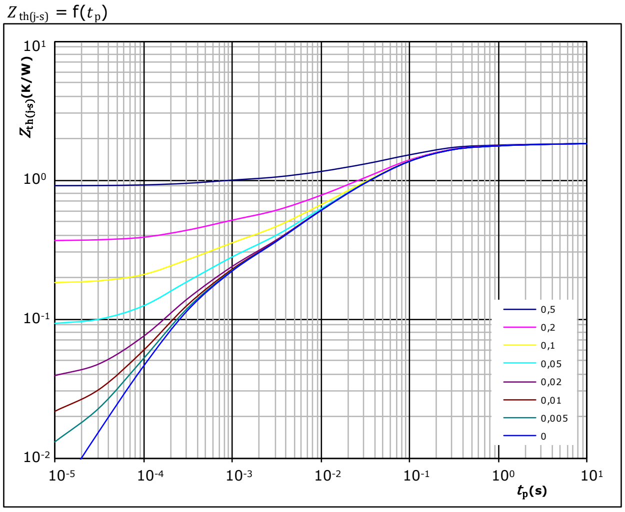


t_p =	100	µs	T_j:	25 °C	········
V_{CE} =	10	V		150 °C	– – –

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,81	K/W

IGBT thermal model values

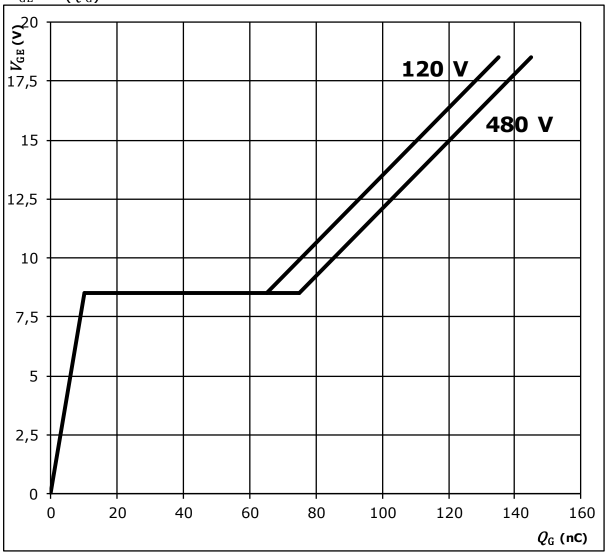
R (K/W)	τ (s)
6,63E-02	3,68E+00
1,83E-01	4,61E-01
8,24E-01	8,38E-02
3,93E-01	1,82E-02
1,96E-01	3,57E-03
1,49E-01	3,52E-04

Inverter Switch Characteristics

figure 5. **IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_G)$



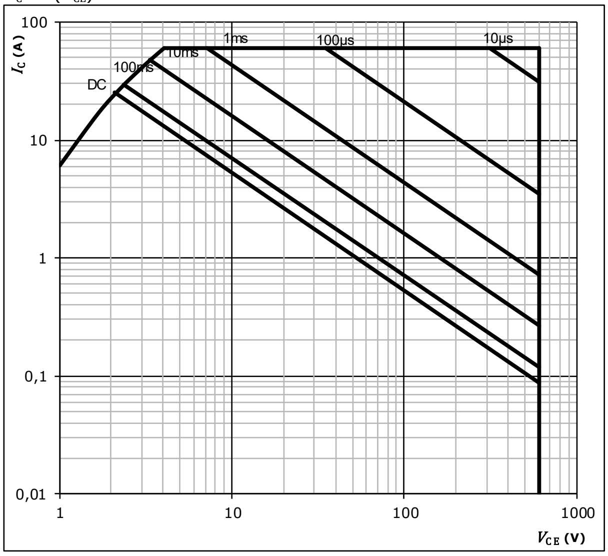
At

I_C= 20 A

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



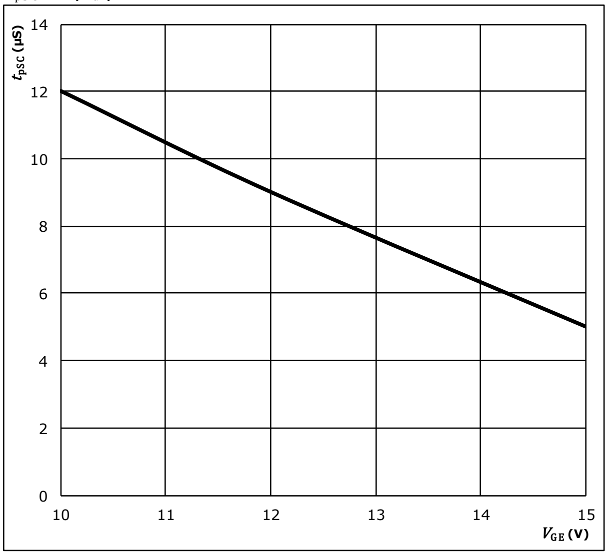
At

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

figure 7. **IGBT**

Short circuit duration as a function of VGE

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



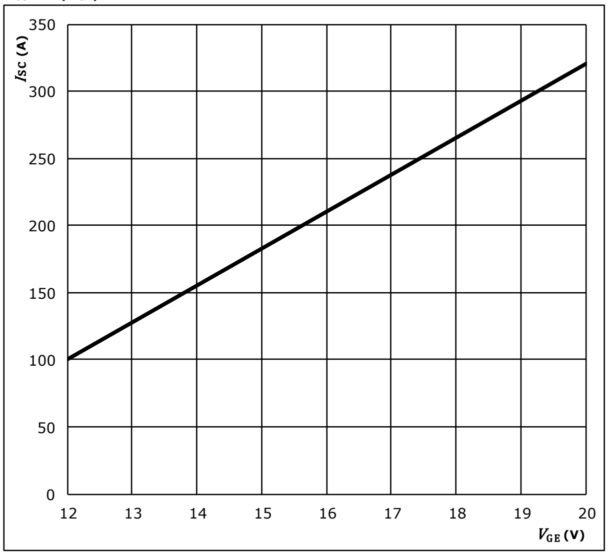
At

V_{CE} =	600	V
T_j ≤	175	ºC

figure 8. **IGBT**

Typical short circuit current as a function of VGE

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



At

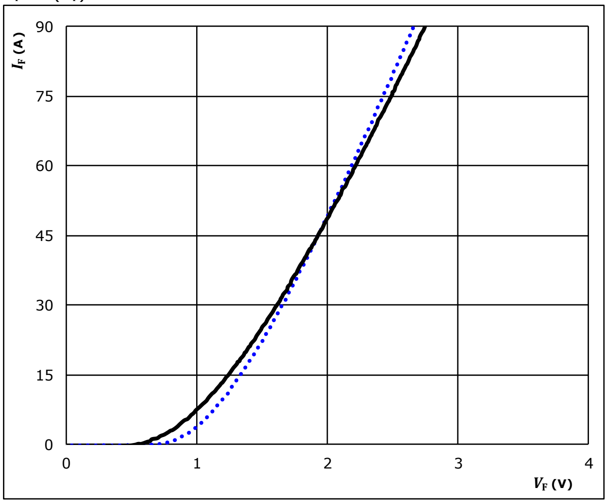
V_{CE} ≤	600	V
T_j ≤	175	ºC

Inverter Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



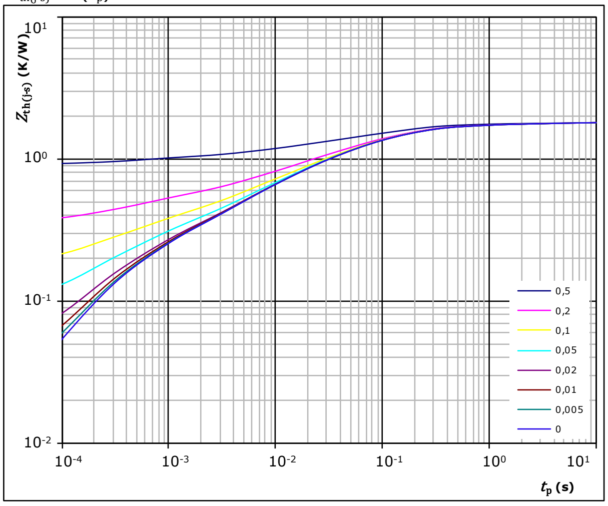
t_p = 250 µs

T_j: 25 °C (dotted), 125 °C (solid)

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,80 K/W

FWD thermal model values

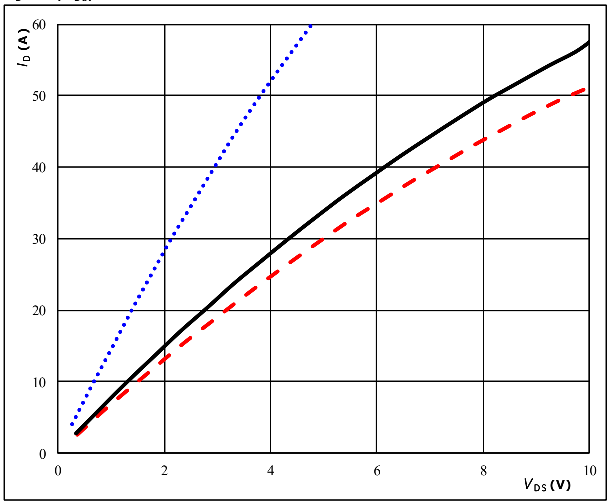
R (K/W)	τ (s)
7,95E-02	3,72E+00
2,06E-01	4,02E-01
7,04E-01	8,35E-02
4,39E-01	1,56E-02
2,12E-01	2,93E-03
1,68E-01	3,31E-04

PFC Switch Characteristics

figure 1. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

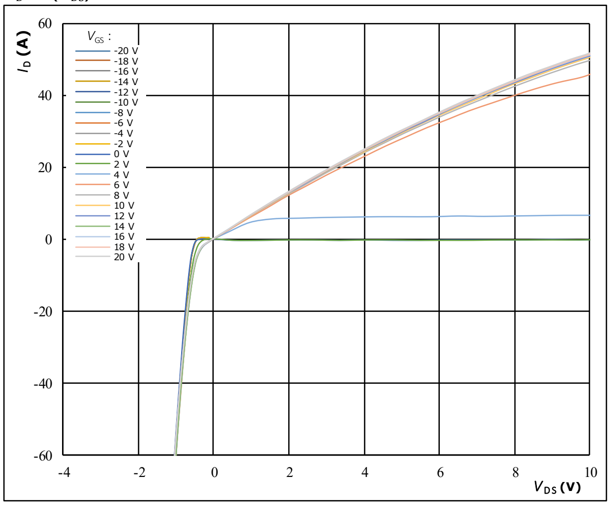


t_p =	250	µs		25 °C	···········
V_{GS} =	10	V	T_j:	125 °C	———
				150 °C	– – –

figure 2. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

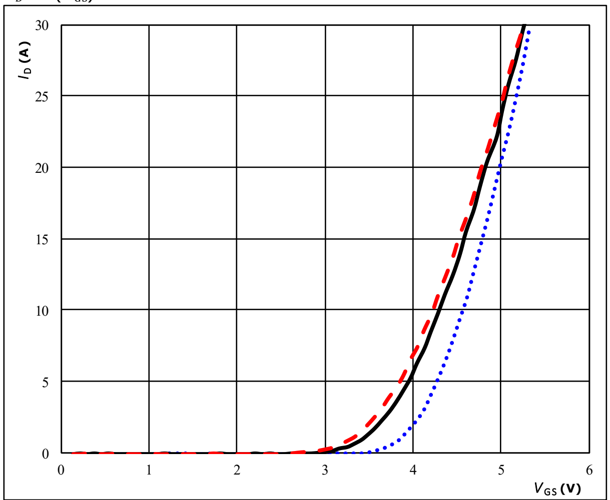


t_p =	250	µs
T_j =	150	°C
V_{GS} from	0 V to 20 V in steps of 2 V	

figure 3. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$

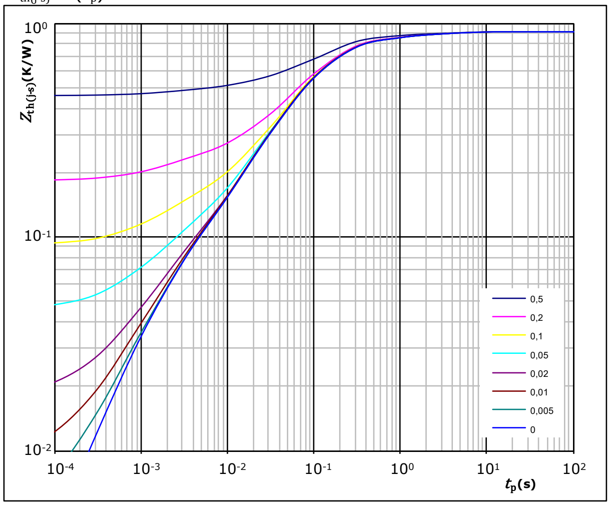


t_p =	100	µs		25 °C	···········
V_{DS} =	10	V	T_j:	125 °C	———
				150 °C	– – –

figure 4. **MOSFET**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,91 K/W

MOSFET thermal model values

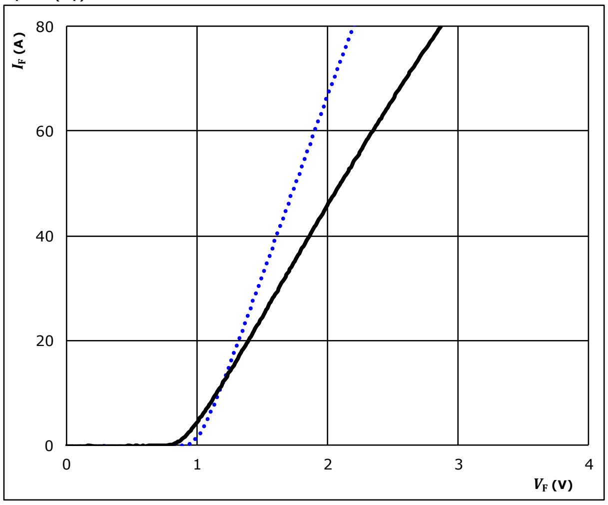
R (K/W)	τ (s)
6,61E-02	2,56E+00
1,31E-01	4,03E-01
5,69E-01	9,20E-02
9,94E-02	1,74E-02
4,81E-02	1,64E-03

PFC Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



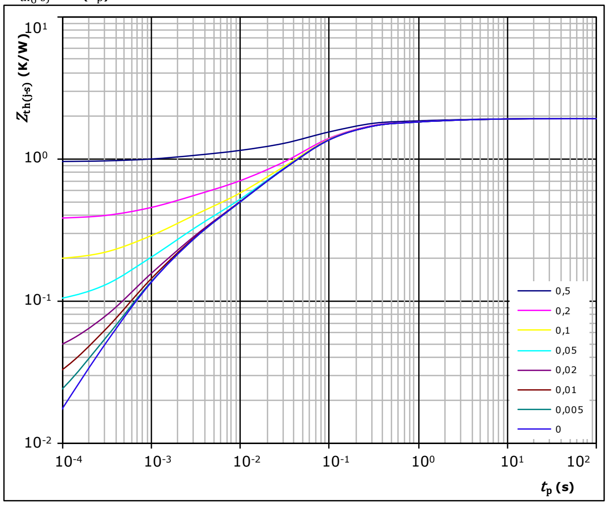
t_p = 250 µs

T_j: 25 °C (dotted), 125 °C (solid)

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,89 K/W

FWD thermal model values

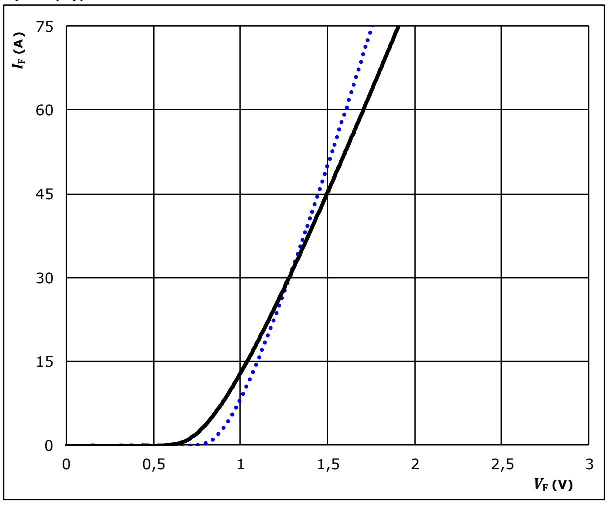
R (K/W)	τ (s)
8,90E-02	3,09E+00
4,63E-01	3,43E-01
8,81E-01	8,40E-02
2,39E-01	1,66E-02
1,44E-01	2,77E-03
7,55E-02	3,37E-04

Rectifier Diode Characteristics

figure 1. **Rectifier Diode**

Typical forward characteristics

$I_F = f(V_F)$



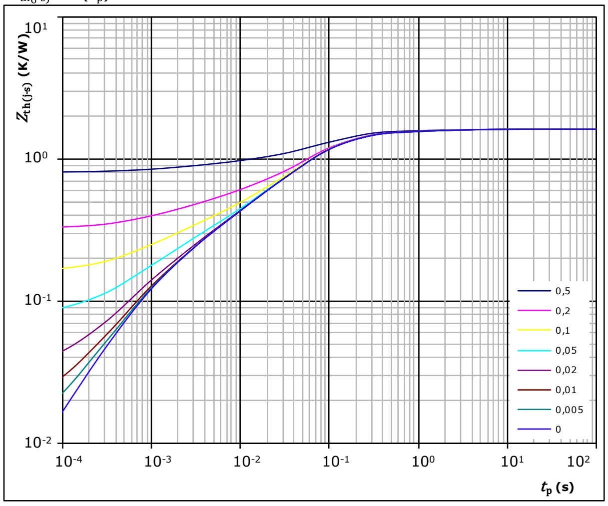
t_p = 250 µs

T_j: 25 °C (dotted); 125 °C (solid)

figure 2. **Rectifier Diode**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j\text{-}s)}$ = 1,61 K/W

Diode thermal model values

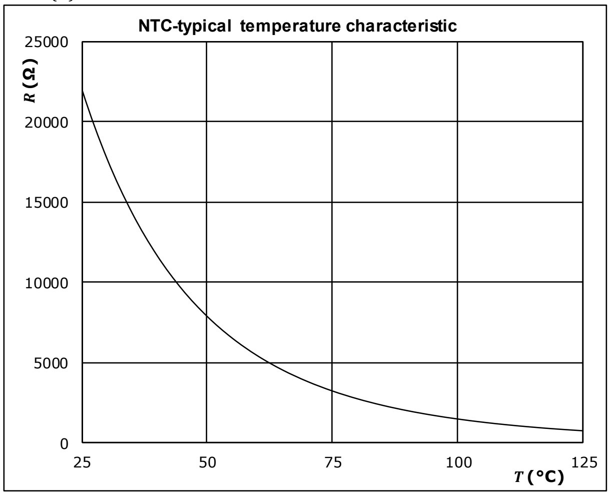
R (K/W)	τ (s)
6,72E-02	2,72E+00
1,48E-01	4,14E-01
8,68E-01	8,33E-02
2,53E-01	2,89E-02
1,69E-01	5,15E-03
1,06E-01	9,10E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic as a function of temperature

$R = f(T)$

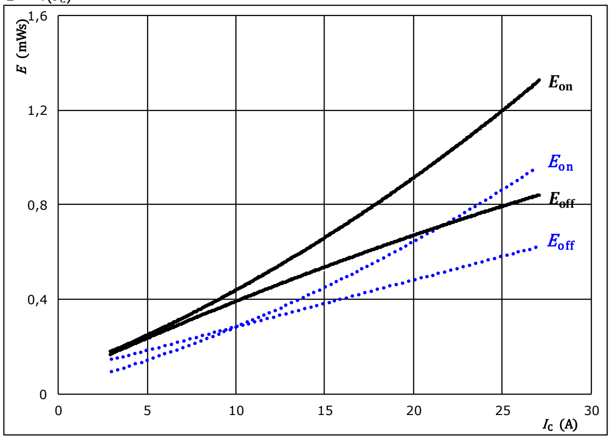


Inverter Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



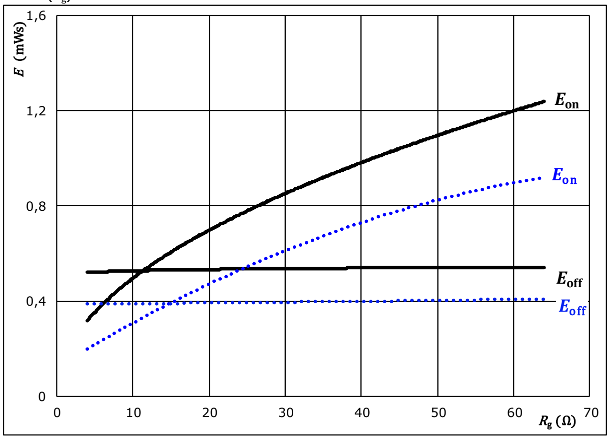
With an inductive load at

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

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(r_g)$



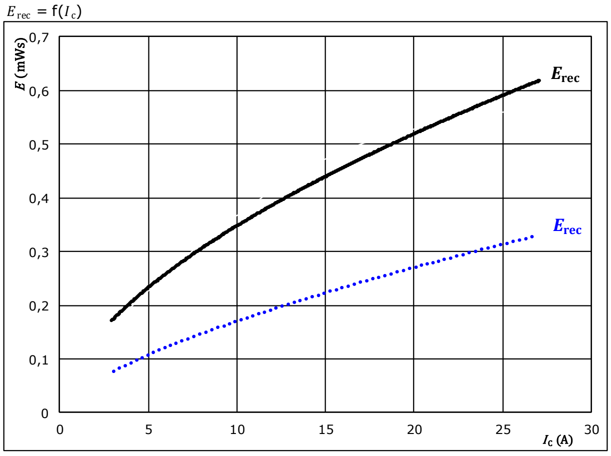
With an inductive load at

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

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



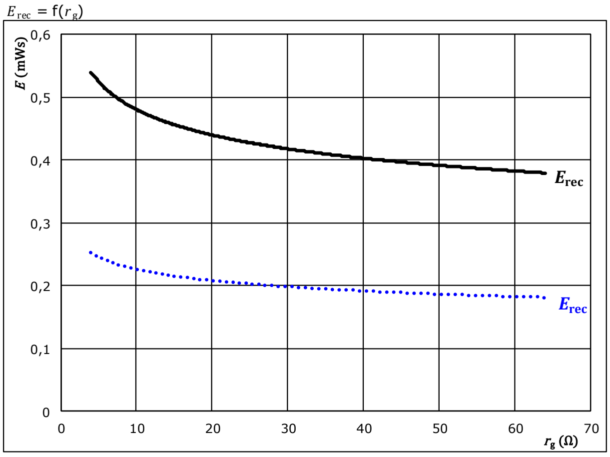
With an inductive load at

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

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(r_g)$



With an inductive load at

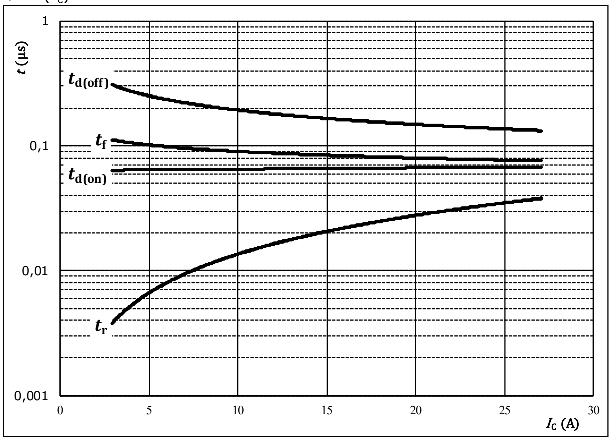
V_{CE} =	400	V	T_j:	25 °C	···········
V_{GE} =	±15	V		125 °C	———
I_C =	15	A			

Inverter Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



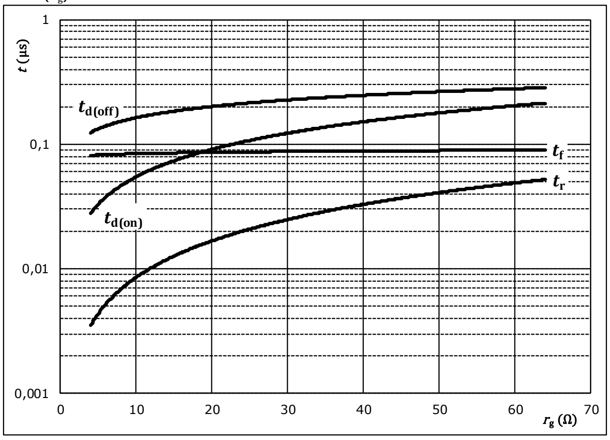
With an inductive load at

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

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(r_g)$



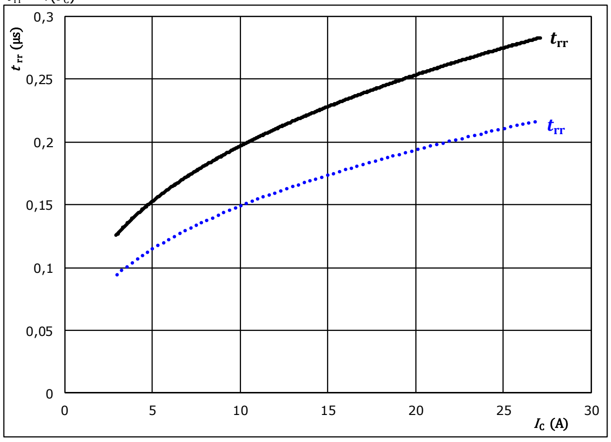
With an inductive load at

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

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

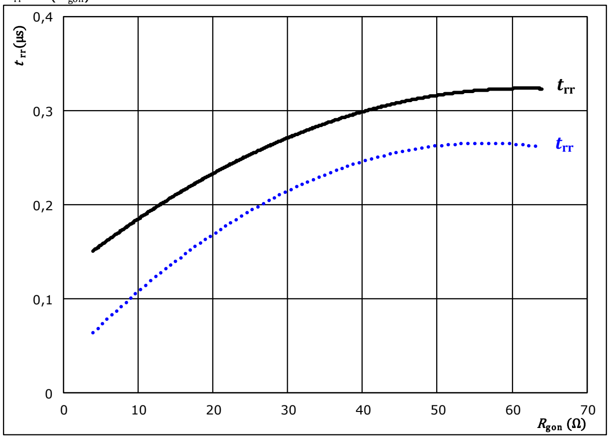


At V_{CE}=	400	V		25	°C	············
V_{GE} =	±15	V	T_j:	125	°C	————
R_{gon} =	16	Ω				

figure 8. **FWD**

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

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



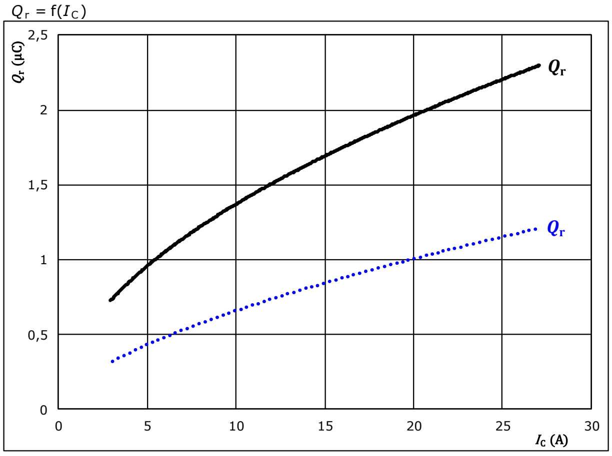
At V_{CE} =	400	V		25	°C	············
V_{GE} =	±15	V	T_j:	125	°C	————
I_C =	15	A				

Inverter Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

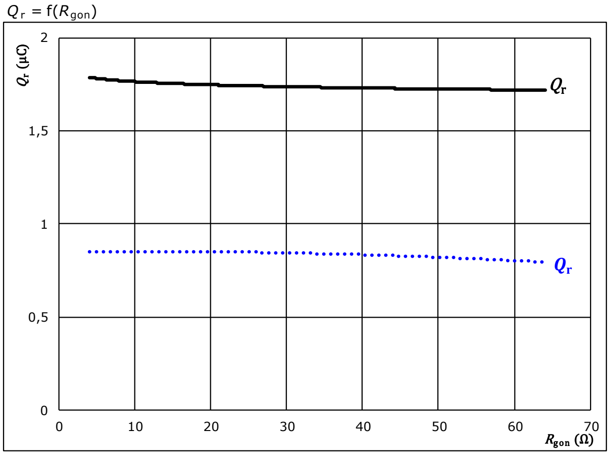


At	V_{CE} =	400	V		25	°C	············
	V_{GE} =	±15	V	T_j:	125	°C	———
	R_{gon} =	16	Ω				

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

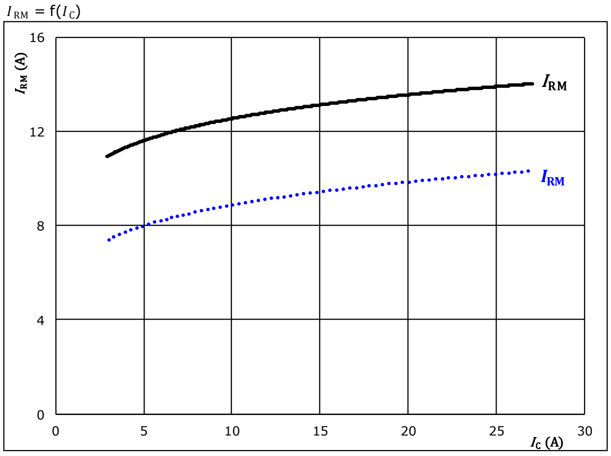


At	V_{CE}=	400	V		25	°C	············
	V_{GE} =	±15	V	T_j:	125	°C	———
	I_C=	15	A				

figure 11. **FWD**

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

$I_{RM} = f(I_C)$

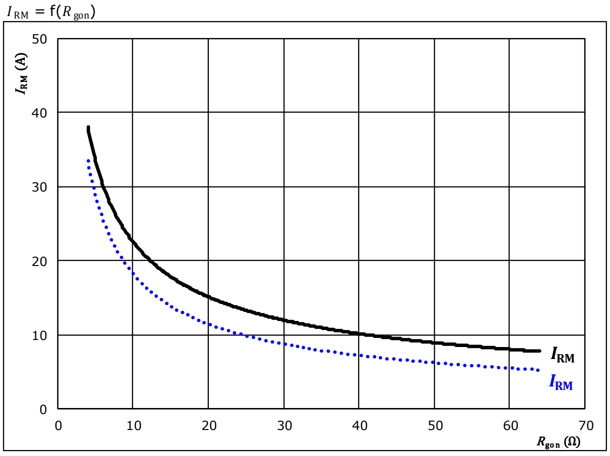


At	V_{CE} =	400	V		25	°C	············
	V_{GE} =	±15	V	T_j:	125	°C	———
	R_{gon} =	16	Ω				

figure 12. **FWD**

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

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



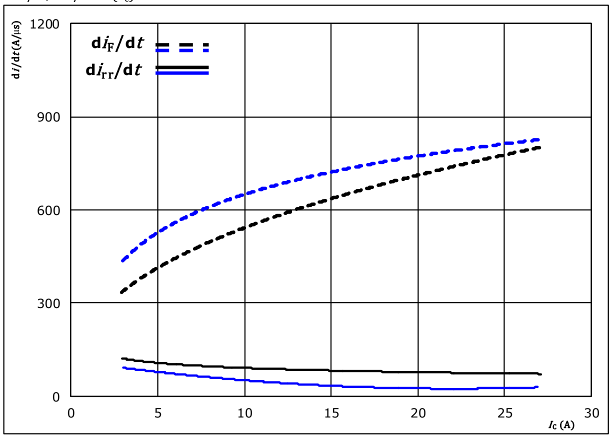
At	V_{CE} =	400	V		25	°C	············
	V_{GE} =	±15	V	T_j:	125	°C	———
	I_C =	15	A				

Inverter Switching Characteristics

figure 13. **FWD**

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

diF/dt,dirr/dt = f(I_c)

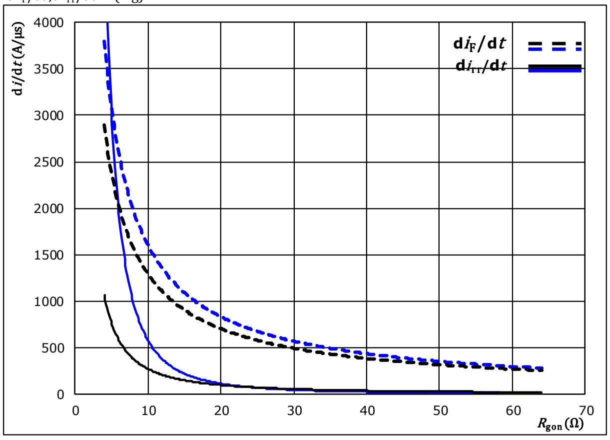


At					
V_{CE} =	400	V		25 °C	···········
V_{GE} =	±15	V	T_j:	125 °C	————
R_{gon} =	16	Ω			

figure 14. **FWD**

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

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

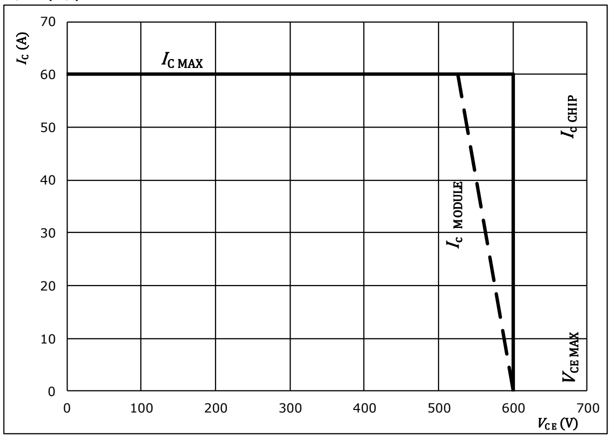


At				
V_{CE} =	400	V	25 °C	···········
V_{GE} =	±15	V	125 °C	————
I_C=	15	A		

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At		
T_j =	175	°C
R_{gon} =	16	Ω
R_{goff} =	16	Ω

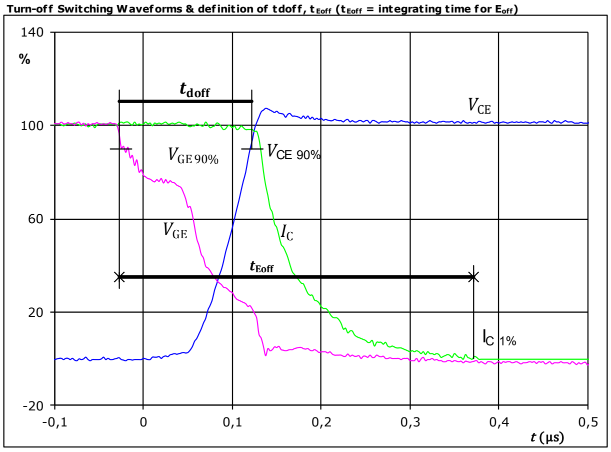
Inverter Switching Definitions

General conditions

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

figure 1. **IGBT**

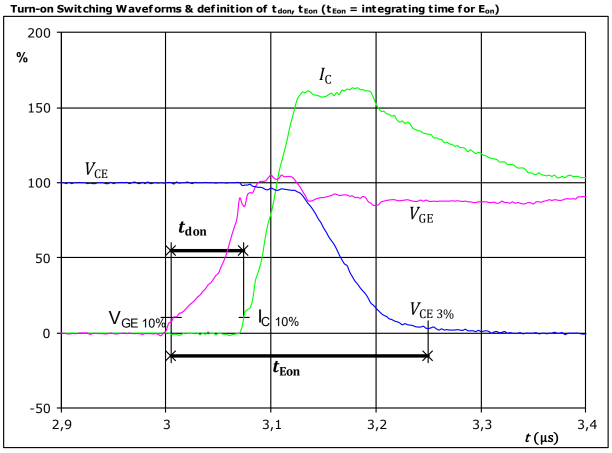
Turn-off Switching Waveforms & definition of tdoff, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	400	V
I_C (100%) =	21	A
t_{doff} =	0,145	µs
t_{Eoff} =	0,400	µs

figure 2. **IGBT**

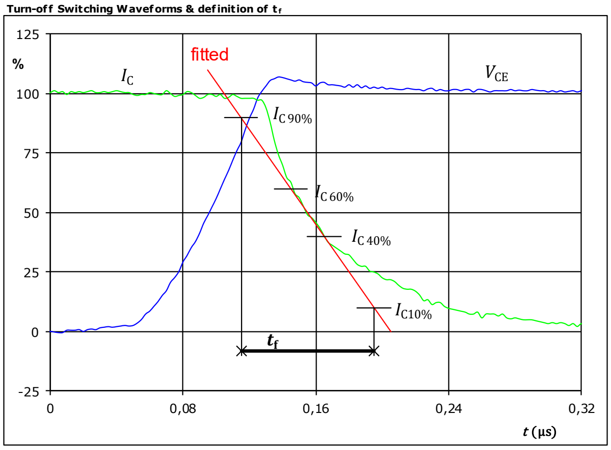
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	400	V
I_C (100%) =	21	A
t_{don} =	0,067	µs
t_{Eon} =	0,245	µs

figure 3. **IGBT**

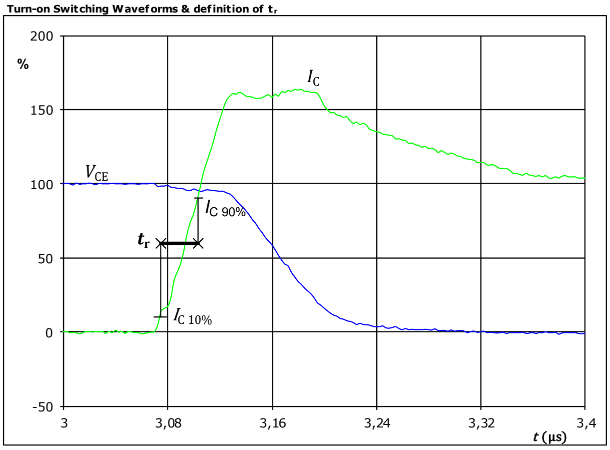
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	400	V
I_C (100%) =	21	A
t_f =	0,075	µs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

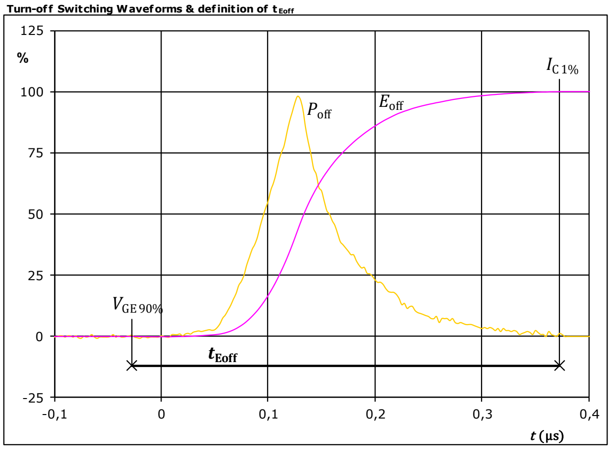


V_C (100%) =	400	V
I_C (100%) =	21	A
t_r =	0,029	µs

Inverter Switching Characteristics

figure 5. **IGBT**

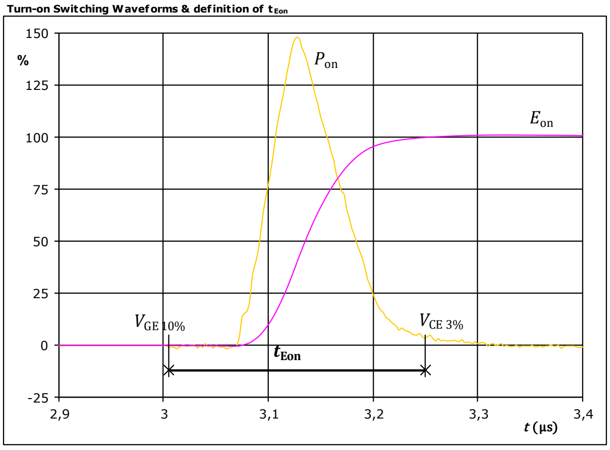
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	8,37	kW
E_{off} (100%) =	0,71	mJ
t_{Eoff} =	0,40	µs

figure 6. **IGBT**

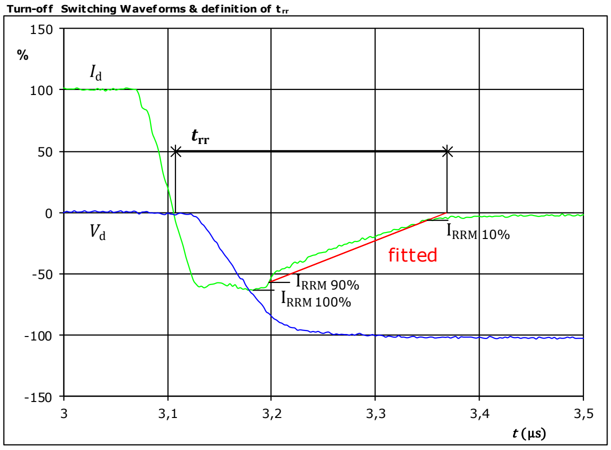
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	8,37	kW
E_{on} (100%) =	0,96	mJ
t_{Eon} =	0,24	µs

figure 7. **FWD**

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



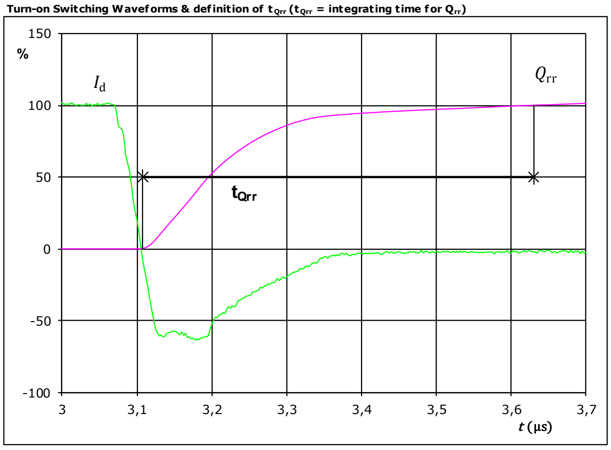
V_d (100%) =	400	V
I_d (100%) =	21	A
I_{RRM} (100%) =	-13	A
t_{rr} =	0,257	µs

10-R106PPA020SB03-M934A10
datasheet

Inverter Switching Characteristics

figure 8. **FWD**

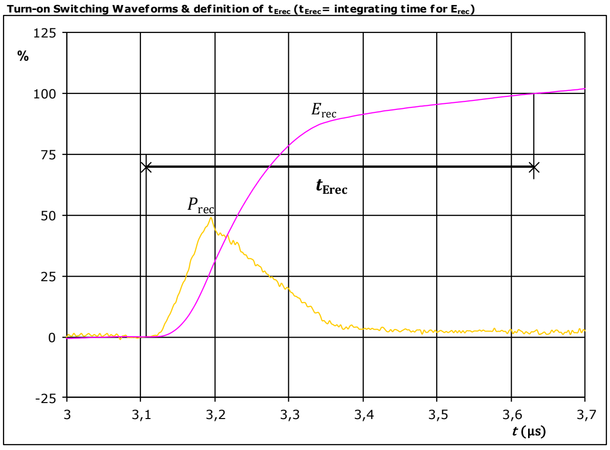
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	21	A
Q_{rr} (100%) =	2,01	µC
t_{Qrr} =	0,52	µs

figure 9. **FWD**

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



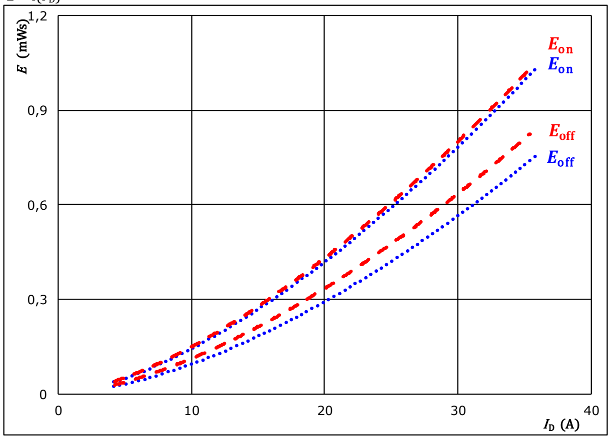
P_{rec} (100%) =	8,37	kW
E_{rec} (100%) =	0,54	mJ
t_{Erec} =	0,52	µs

PFC Switching Characteristics

figure 1. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



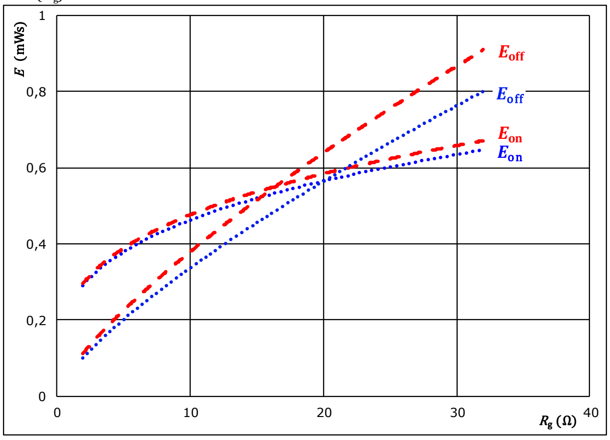
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C	··········
V_{GS} =	0 / 10	V		125 °C	———
R_{gon} =	8	Ω		150 °C	– – –
R_{goff} =	8	Ω			

figure 2. **MOSFET**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



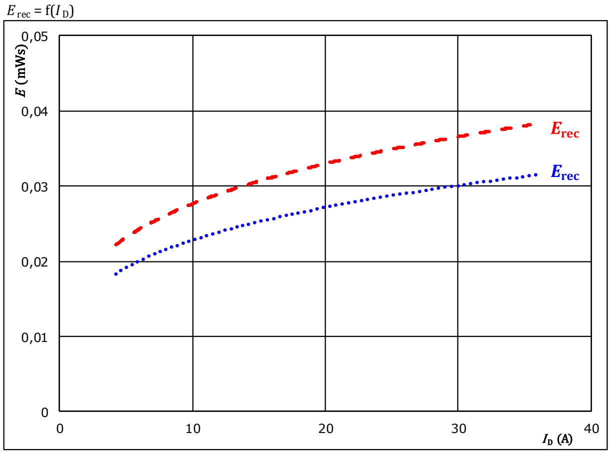
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C	··········
V_{GS} =	0 / 10	V		125 °C	———
I_D =	20	A		150 °C	– – –

figure 3. **FWD**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



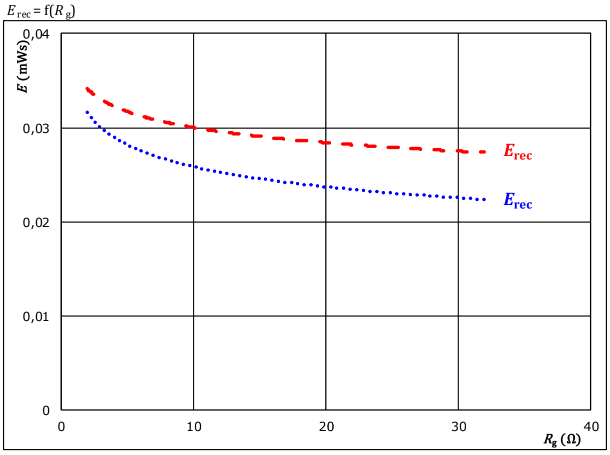
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C	··········
V_{GS} =	0 / 10	V		125 °C	———
R_{gon} =	8	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

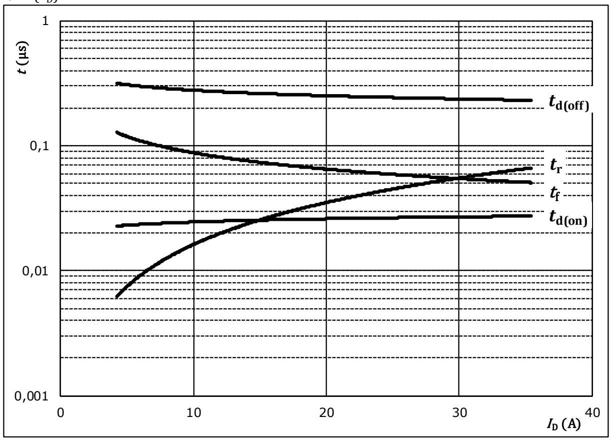
V_{DS} =	400	V	T_j:	25 °C	··········
V_{GS} =	0 / 10	V		125 °C	———
I_D =	20	A		150 °C	– – –

PFC Switching Characteristics

figure 5. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



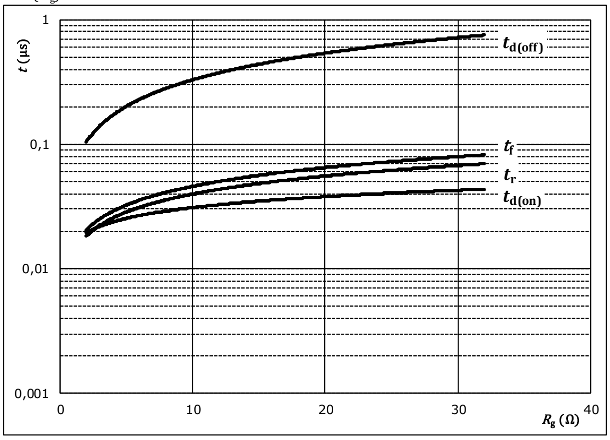
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	0 / 10	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

figure 6. **MOSFET**

Typical switching times as a function of gate resistor

$t = f(R_g)$



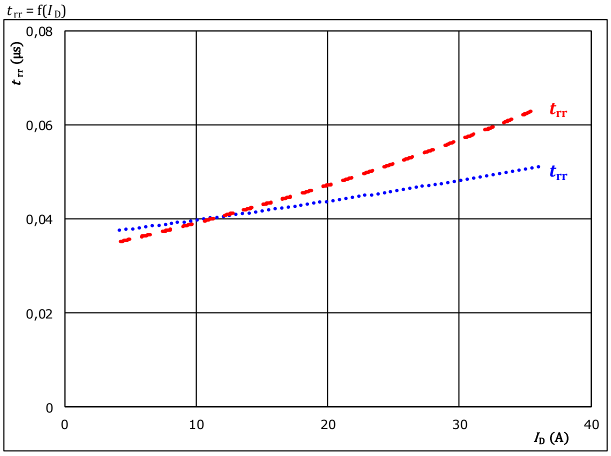
With an inductive load at

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

figure 7. **FWD**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$



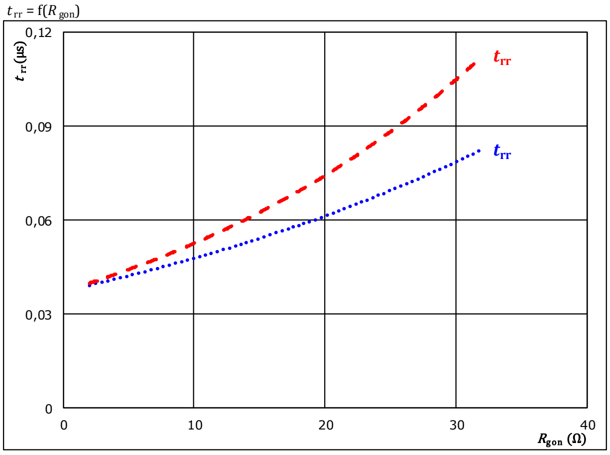
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C (dotted)
V_{GS} =	0 / 10	V		125 °C (solid)
R_{gon} =	8	Ω		150 °C (dashed)

figure 8. **FWD**

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

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



With an inductive load at

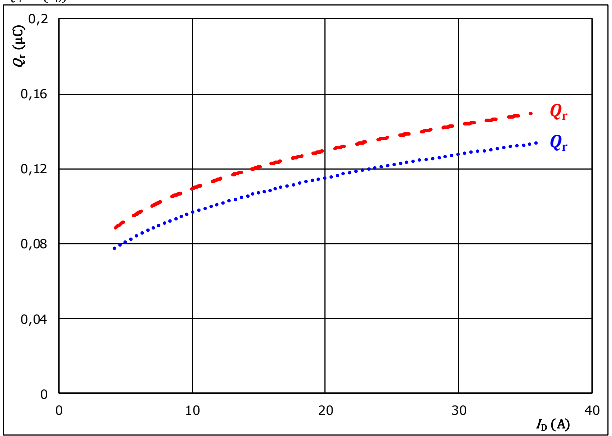
V_{DS} =	400	V	T_j:	25 °C (dotted)
V_{GS} =	0 / 10	V		125 °C (solid)
I_D =	20	A		150 °C (dashed)

PFC Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$



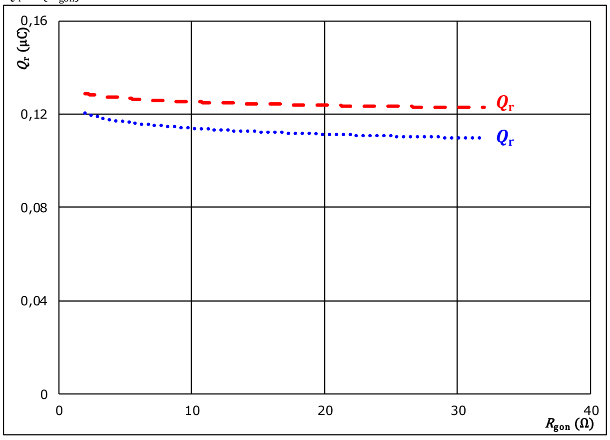
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C	············
V_{GS} =	0 / 10	V		125 °C	——
R_{gon} =	8	Ω		150 °C	– – –

figure 10. **FWD**

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

$Q_r = f(R_{gon})$



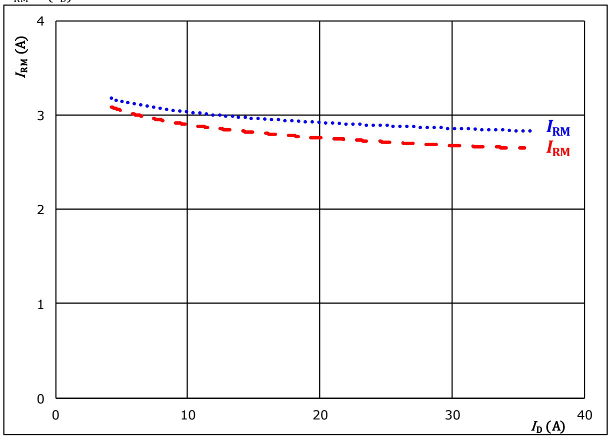
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C	············
V_{GS} =	0 / 10	V		125 °C	——
I_D =	20	A		150 °C	– – –

figure 11. **FWD**

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

$I_{RM} = f(I_D)$



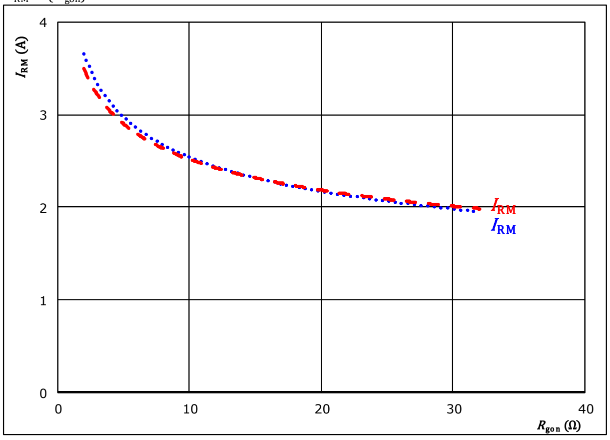
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C	············
V_{GS} =	0 / 10	V		125 °C	——
R_{gon} =	8	Ω		150 °C	– – –

figure 12. **FWD**

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

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



With an inductive load at

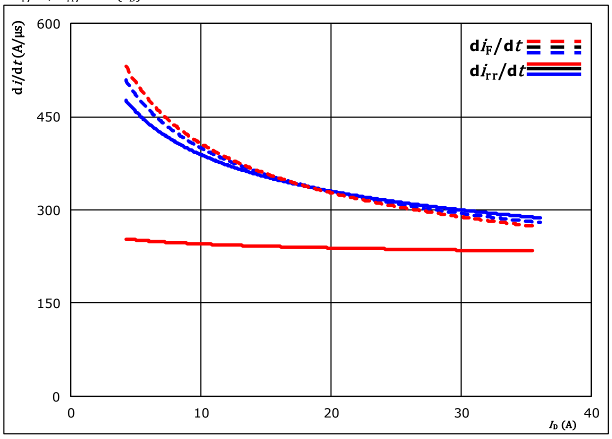
V_{DS} =	400	V	T_j:	25 °C	············
V_{GS} =	0 / 10	V		125 °C	——
I_D =	20	A		150 °C	– – –

PFC Switching Characteristics

figure 13. **FWD**

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

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



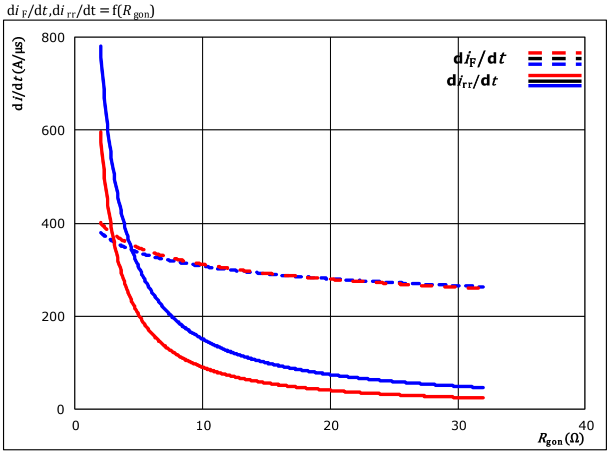
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	0 / 10	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 14. **FWD**

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

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



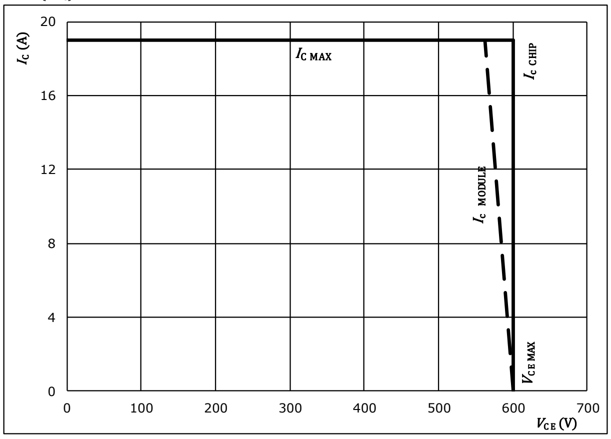
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	0 / 10	V		125 °C
I_D =	20	A		150 °C

figure 15. **MOSFET**

Reverse bias safe operating area

$I_D = f(V_{DS})$



At

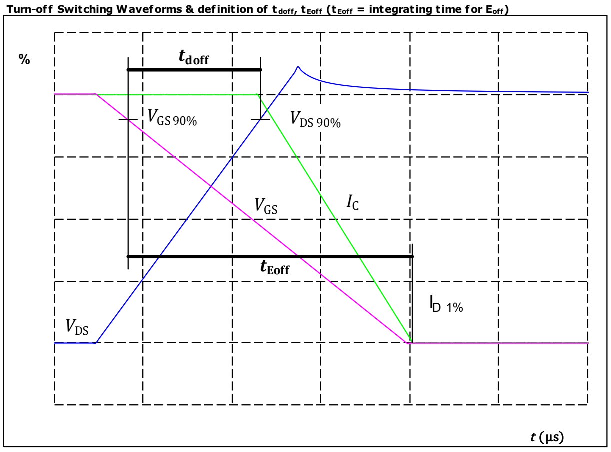
T_j =	125	°C
R_{gon} =	8	Ω
R_{goff} =	8	Ω

PFC Switching Definitions

General conditions		
T_j	=	125 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

figure 1. IGBT

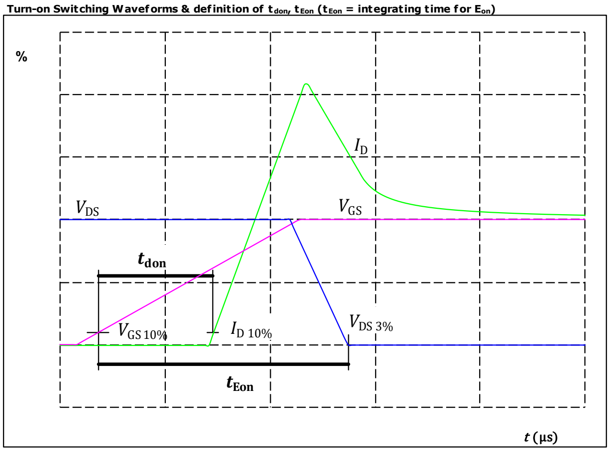
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GS}(0\%)$ =	0	V
$V_{GS}(100\%)$ =	10	V
$V_{DS}(100\%)$ =	400	V
$I_D(100\%)$ =	20	A
t_{doff} =	254	ns

figure 2. IGBT

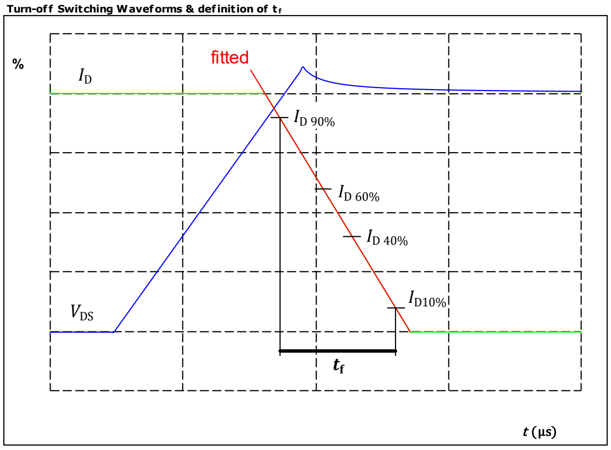
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GS}(0\%)$ =	0	V
$V_{GS}(100\%)$ =	10	V
$V_{DS}(100\%)$ =	400	V
$I_D(100\%)$ =	20	A
t_{don} =	25	ns

figure 3. IGBT

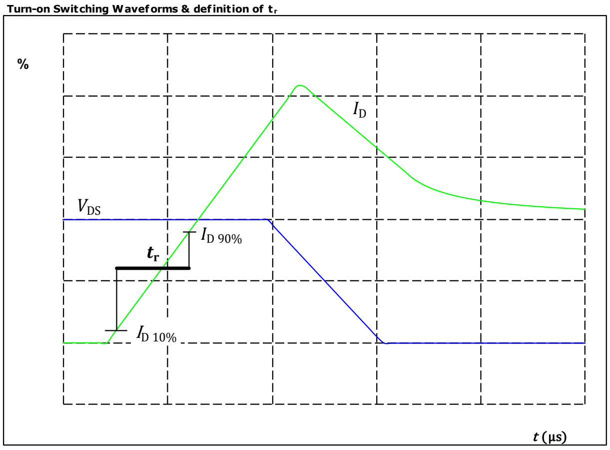
Turn-off Switching Waveforms & definition of t_f



$V_{DS}(100\%)$ =	400	V
$I_D(100\%)$ =	20	A
t_f =	43	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

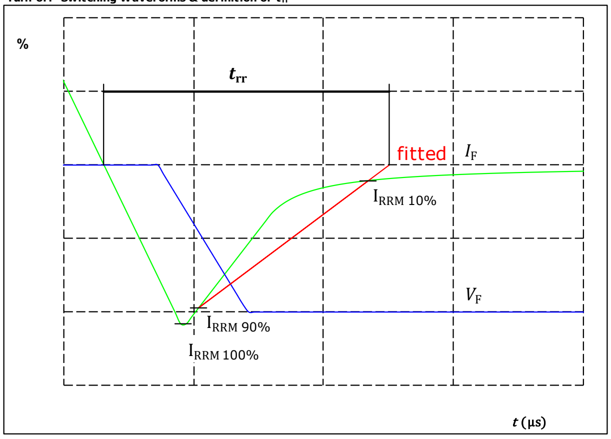


$V_{DS}(100\%)$ =	400	V
$I_D(100\%)$ =	20	A
t_r =	34	ns

PFC Switching Characteristics

figure 5. **FWD**

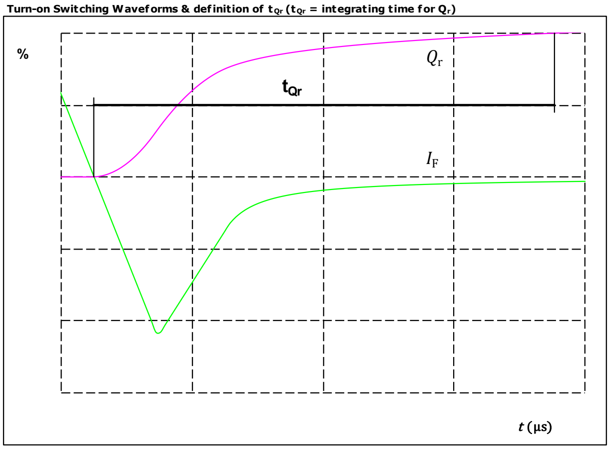
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	400	V
I_F (100%) =	20	A
I_{RRM} (100%) =	3	A
t_{rr} =	46	ns

figure 6. **FWD**

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

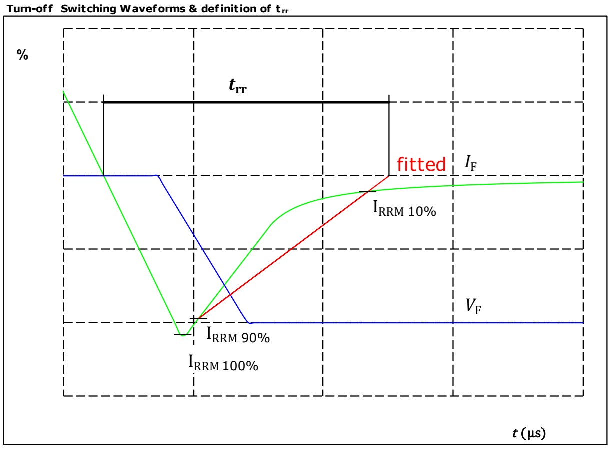


I_F (100%) =	20	A
Q_r (100%) =	0	µC

PFC Switching Characteristics

figure 5. FWD

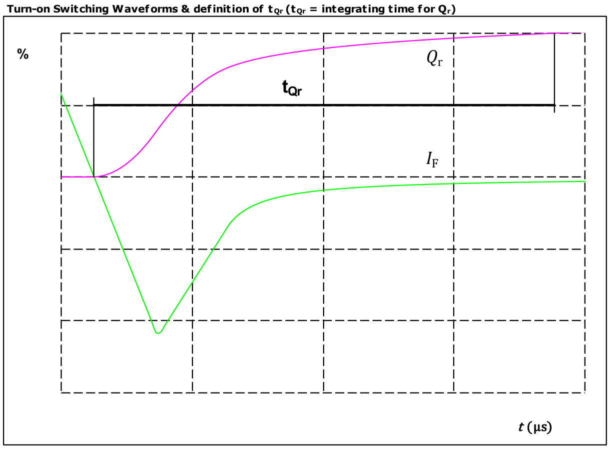
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) = 400 V
I_F (100%) = 20 A
I_{RRM} (100%) = 3 A
t_{rr} = 46 ns

figure 6. FWD

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



I_F (100%) = 20 A
Q_r (100%) = 0 µC

Vincotech

Ordering Code & Marking

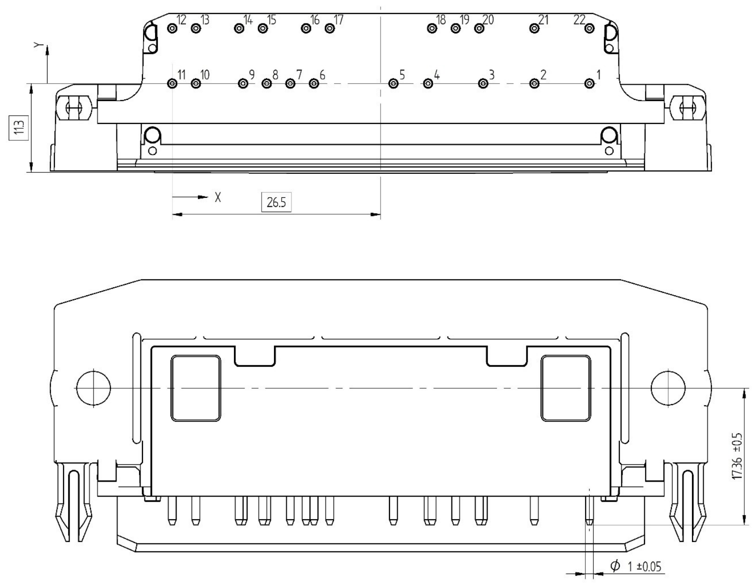
Version	Ordering Code
without thermal paste	10-R106PPA020SB03-M934A10
with thermal paste	10-R106PPA020SB03-M934A10-/3/

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

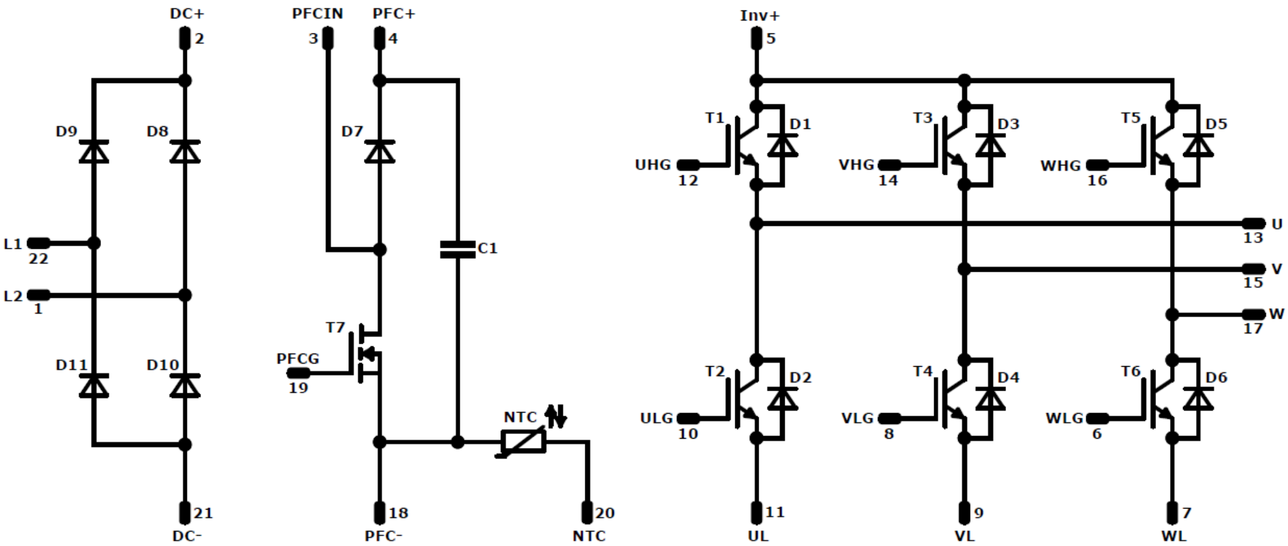
Pin table

Pin	X	Y	Function
1	53	0	L2
2	46	0	DC+
3	39,5	0	PFCIN
4	32,5	0	PFC+
5	28,1	0	Inv+
6	18	0	WLG
7	15	0	WL
8	12	0	VLG
9	9	0	VL
10	3	0	ULG
11	0	0	UL
12	0	7	UHG
13	3	7	U
14	8,5	7	VHG
15	11,5	7	V
16	17	7	WHG
17	20	7	W
18	33	7	PFC-
19	36	7	PFCG
20	39	7	NTC
21	46	7	DC-
22	53	7	L1



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
T1, T2, T3, T4, T5, T6	IGBT	600 V	20 A	Inverter Switch	
D1, D2, D3, D4, D5, D6	FWD	600 V	30 A	Inverter Diode	
T7	MOSFET	600 V	70 mΩ	PFC Switch	
D7	FWD	600 V	24 A	PFC Diode	
D8, D9, D10, D11	Rectifier	1600 V	25 A	Rectifier Diode	
C1	Capacitor	500 V		Capacitor (PFC)	
NTC	NTC			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 80	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 90 1 packages see vincotech.com website.

Package data
Package data for *flow* 90 1 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-R106PPA020SB03-M934A10-D1-14	02 May. 2019		