10-R106PPA020SB01-M934A
datasheet

flow 90PIM 1 + PFC — 600 V / 20 A

Features

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

Target applications

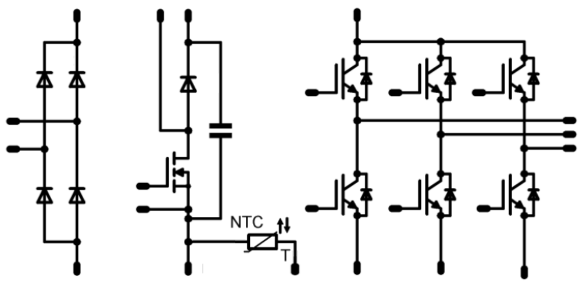
- Industrial Drives
- Embedded Drives

Types

- 10-R106PPA020SB01-M934A

flow 90 housing

Schematic



Maximum Ratings

Parameter	Symbol	Condition		Value	Unit
PFC Mosfet					
Drain-source voltage	V_{DS}			600	V
Drain current	I_D	$T_j = T_{jmax}$	T_h=80°C	23	A
Peak drain current	I_{Dpulse}	t_p limited by T_{jmax}		159	A
Avalanche energy, single pulse	E_{AS}	I_D = 9,3 V_{DD} = 50		1135	mJ
Avalanche energy, repetitive	E_{AR}	I_D = 9,3 V_{DD} = 50		1,7	mJ
Avalanche current, repetitive	I_{AR}	t_p limited by T_{jmax} PAV = EAR*f		9,3	A
MOSFET dv/dt ruggedness	dv/dt	V_{DS} = 0-480V		50	V/ns
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_h=80°C	90	W
Gate-source voltage	V_{GS}			±20	V
Reverse diode dv/dt	dv/dt			15	V/ns
Maximum Junction Temperature	T_{jmax}			150	°C

Parameter	Symbol	Conditions		Value	Unit
PFC Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	$T_h = 80°C$	25	A
Repetitive peak forward current	I_{FRM}			99	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave		87	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	$T_h = 80°C$	39	W
Maximum Junction Temperature	T_{jmax}			150	°C

Parameter	Symbol	Condition		Value	Unit
Inverter Switch					
Collector-emitter voltage	V_{CES}			600	V
Collector current	I_C	$T_j=T_j$max	T_S=80°C	24	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_j$max		60	A
Total power dissipation	P_{tot}	$T_j=T_j$max	T_S=80°C	53	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \leq 150°C$ V_{GE} = 15V		6 360	µs V
Maximum Junction Temperature	T_{jmax}			175	°C

Parameter	Symbol	Conditions		Value	Unit
Inverter Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
Continuous (direct) forward current	I_F	$T_j=T_{jmax}$	T_h=80°C	32	A
Repetitive peak forward current	I_{FRM}			90	A
Total power dissipation	P_{tot}	$T_j=T_{jmax}$	T_h=80°C	53	W
Maximum Junction Temperature	T_{jmax}			175	°C

Parameter	Symbol	Conditions		Value	Unit
Rectifier Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	$T_h = 80°C$	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}	$T_j = T_{jmax}$	$T_h = 80°C$	43	W
Maximum Junction Temperature	T_{jmax}			150	°C

Parameter	Symbol	Conditions	Value	Unit
DC Link Capacitor				
Maximum DC voltage	V_{MAX}		630	V

Parameter	Symbol	Conditions		Value	Unit
Module Properties					
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation Junction Temperature	T_{jop}			-40…+(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{isol}	DC voltage	t_p=2s	4000	V
Creepage distance				min 12,7	mm
Clearance				11,84	mm
Comparative Tracking Index	CTI			>200	

Characteristic Values

PFC Mosfet

Parameter	Symbol	Conditions	V_{GS} [V]	V_{DS} [V]	I_D [A]	T_j[°C]	Min	Typ	Max	Unit
Static										
Drain-source on-state resistance	$r_{DS(on)}$		10		25	25 125		71 151	80	mΩ
Gate-source threshold voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}$			0,00172	25 125	2,5	3	3,5	V
Gate to Source Leakage Current	I_{GSS}		20	0		25 125			100	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	600		25 125			5	μA
Internal gate resistance	r_g							0,85		Ω
Gate charge	Q_g		0/10	480	25,8	25		170		nC
Gate to source charge	Q_{GS}							21		
Gate to drain charge	Q_{GD}							87		
Short-circuit input capacitance	C_{iss}	f=1MHz	0	100		25		3800		pF
Short-circuit output capacitance	C_{oss}							215		
Reverse transfer capacitance	C_{rss}							35		

Thermal

Parameter	Symbol	Conditions	V_{GS} [V]	V_{DS} [V]	I_D [A]	T_j[°C]	Min	Typ	Max	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	Phase-Change Material ʎ=3,4W/mK						0,8		K/W

MOSFET Switching

Parameter	Symbol	Conditions	V_{GS} [V]	V_{DS} [V]	I_D [A]	T_j[°C]	Min	Typ	Max	Unit
Turn-on delay time	$t_{d(on)}$	Rgoff=4Ω Rgon=4Ω	±15	400	3	25 125		23 21		ns
Rise time	t_r					25 125		4 3		
Turn-off delay time	$t_{d(off)}$					25 125		253 327		
Fall time	t_f					25 125		-85 61		
Turn-on energy (per pulse)	E_{on}	QrrFWD=0,1uC QrrFWD=0,1uC				25 125		0,084 0,040		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,037 0,019		

PFC Diode

Parameter	Symbol	Conditions					Value			Unit
				V_r [V]	I_F [A]	T_j [°C]	Min	Typ	Max	
Static										
Forward voltage	V_F				24	25 125 150		1,40 1,55 -	1,7	V
Reverse leakage current	I_r			600		25 150			4,8 24	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j\text{-}s)}$	Phase-Change Material λ=3,4W/mK						1,82		K/W

FWD Switching

Peak recovery current	I_{RRM}	di/dt=1792A/µs di/dt=1540A/µs	±15	400	3	25 125		9 8		A
Reverse recovery time	t_{rr}	di/dt=1792A/µs di/dt=1540A/µs				25 125		11 12		ns
Recovered charge	Q_r	di/dt=1792A/µs di/dt=1540A/µs				25 125		0,092 0,079		µC
Reverse recovered energy	E_{rec}	di/dt=1792A/µs di/dt=1540A/µs				25 125		0,013 0,011		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$	di/dt=1792A/µs di/dt=1540A/µs				25 125		2688 1876		A/µs

Inverter Switch

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}$			0,00029	25 125	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		20	25 125 150	1,1	1,52 - 1,84	1,9	V
Collector-emitter cut-off current	I_{CES}		0	600		25 125			1,1	µA
Gate-emitter leakage current	I_{GES}		20	0		25 125			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		
Gate charge	Q_g		15	480	20	25		120		nC

Parameter	Symbol	Conditions	V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	Unit
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Phase-Change Material λ=3,4W/mK						1,81		K/W

Parameter	Symbol	Conditions	V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	Unit
IGBT Switching										
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		

Inverter Diode

Parameter	Symbol	Conditions					Value			Unit
				V_r [V]	I_F [A]	T_j [°C]	Min	Typ	Max	
Static										
Forward voltage	V_F				30	25 125 150		1,65 1,62 -	1,95	V
Reverse leakage current	I_r			600		25 150			200 -	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Phase-Change Material λ=3,4W/mK						1,80		K/W
FWD Switching										
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

Rectifier Diode

Parameter	Symbol	Conditions					Value			Unit
				V_r [V]	I_F [A]	T_j [°C]	Min	Typ	Max	
Static										
Forward voltage	V_F				25	25 125		1,22 1,21	1,9	V
Reverse leakage current	I_r			1600		25 150			50 1100	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Phase-Change Material λ=3,4W/mK						1,61		K/W

Thermistor

Parameter	Symbol	Conditions					Value			Unit
			V_{GE}[V]	V_{CE}[V]	I_C[A]	T_j[°C]	Min	Typ	Max	
Rated resistance	R					25		21,5		kΩ
Deviation of R100	$\Delta_{R/R}$	R100=1486 Ω				100	-4,5		+4,5	%
Power dissipation	P					25		210		mW
Power dissipation constant						25		3,5		mW/K
B-value	$B_{(25/50)}$					25		3884		K
B-value	$B_{(25/100)}$					25		3964		K
Vincotech NTC Reference									F	

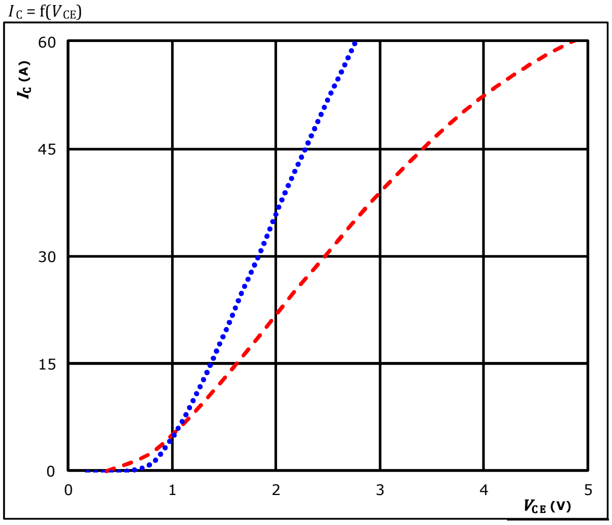
DC Link Capacitor

Parameter	Symbol	Conditions					Value			Unit
						T_j[°C]	Min	Typ	Max	
Capacitance	C							100		nF

Inverter Switch Characteristics

Typical output characteristics **IGBT**

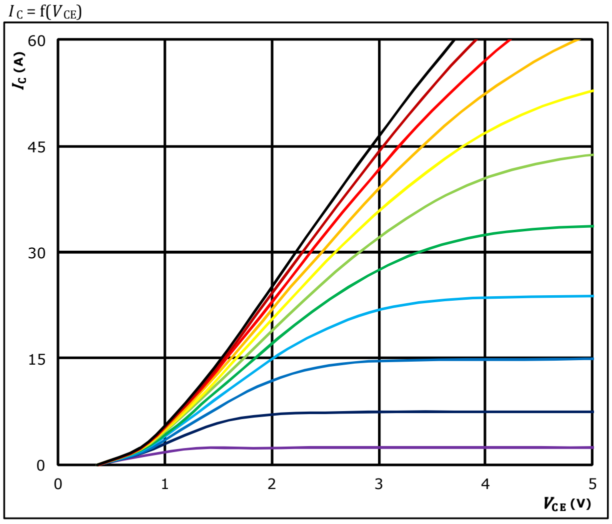
$I_C = f(V_{CE})$



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

Typical output characteristics **IGBT**

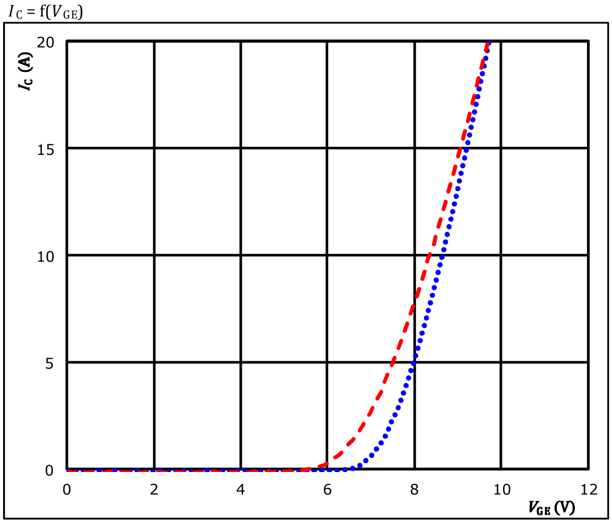
$I_C = f(V_{CE})$



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

Typical transfer characteristics **IGBT**

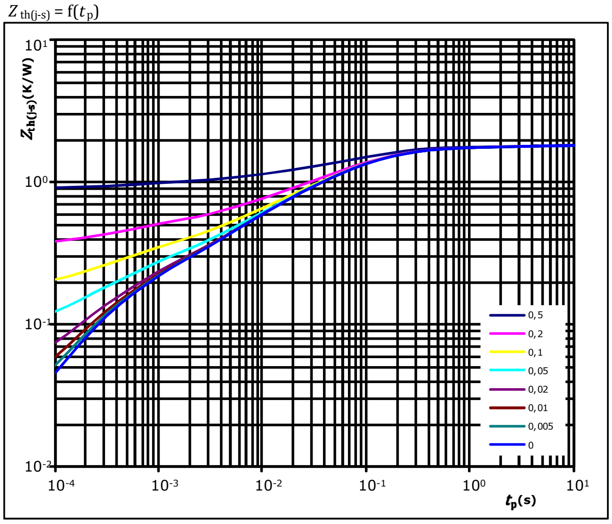
$I_C = f(V_{GE})$



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

Transient Thermal Impedance as function of Pulse duration **IGBT**

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 1,81 K/W

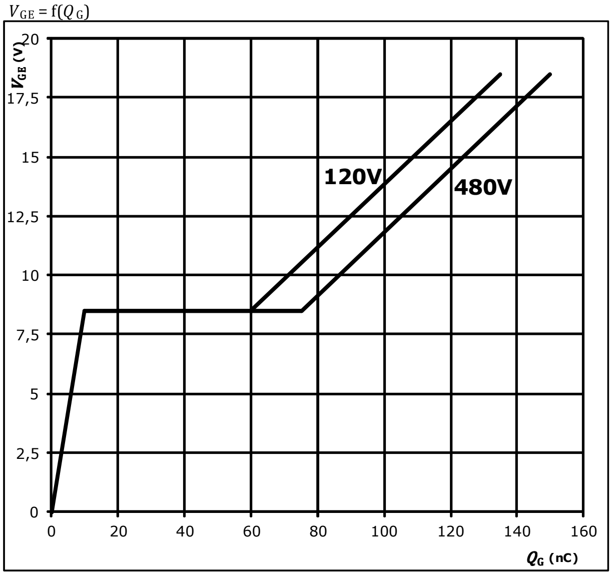
IGBT thermal model values

R_{th} (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

Gate voltage vs Gate charge | **IGBT**

$V_{GE} = f(Q_G)$

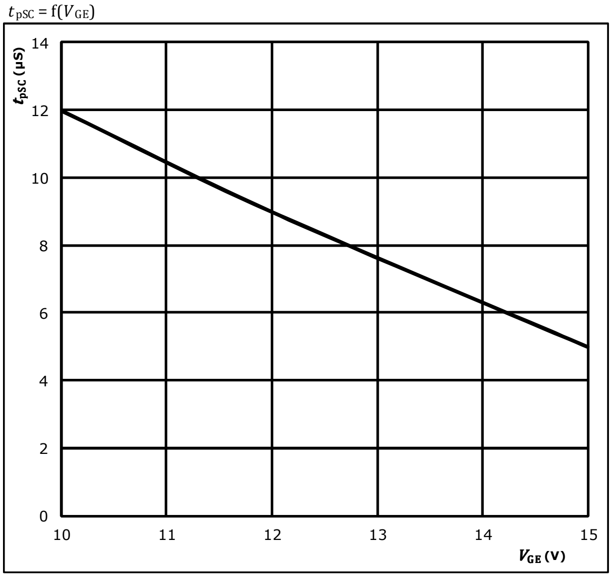


At

I_C= 20 A

Short circuit duration as a function of V_{GE} | **IGBT**

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



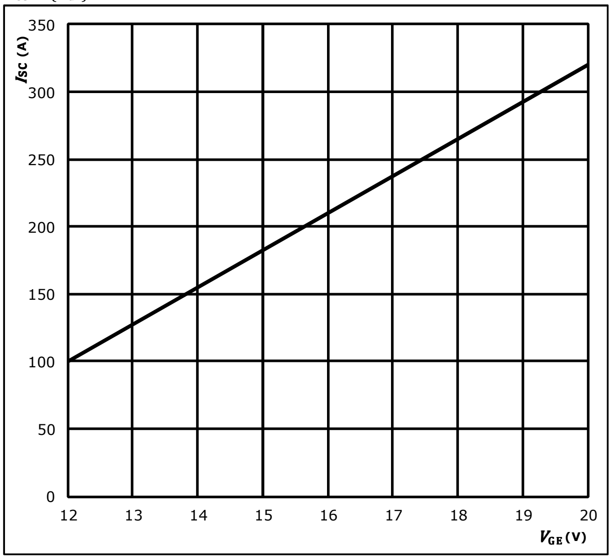
At

V_{CE} = 600 V

T_j ≤ 175 ºC

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

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



At

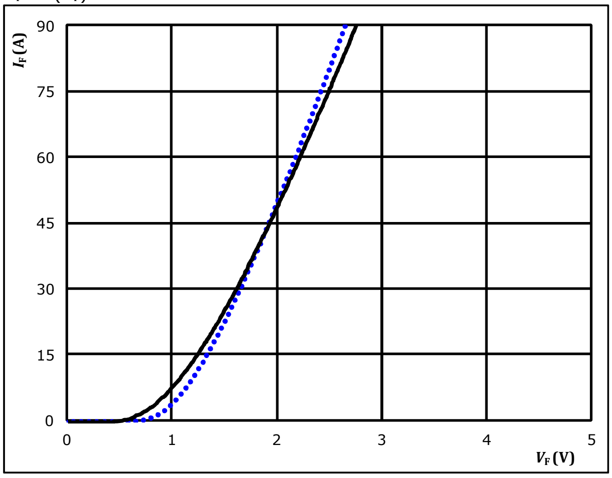
V_{CE} ≤ 600 V

T_j ≤ 175 ºC

Inverter Diode Characteristics

Typical forward characteristics FWD

$I_F = f(V_F)$

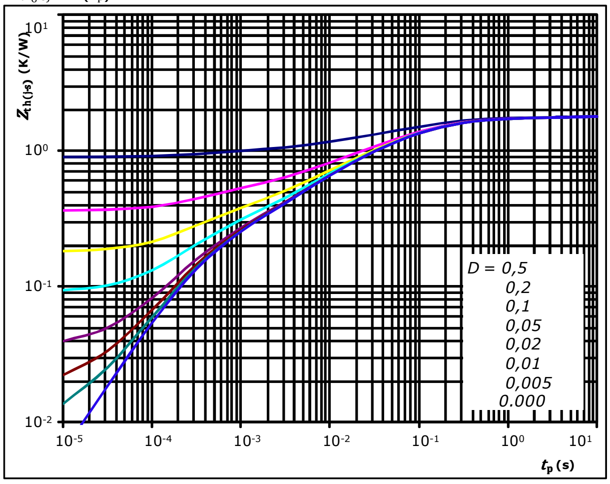


t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

Transient thermal impedance as a function of pulse width FWD

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



D = t_p / T

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

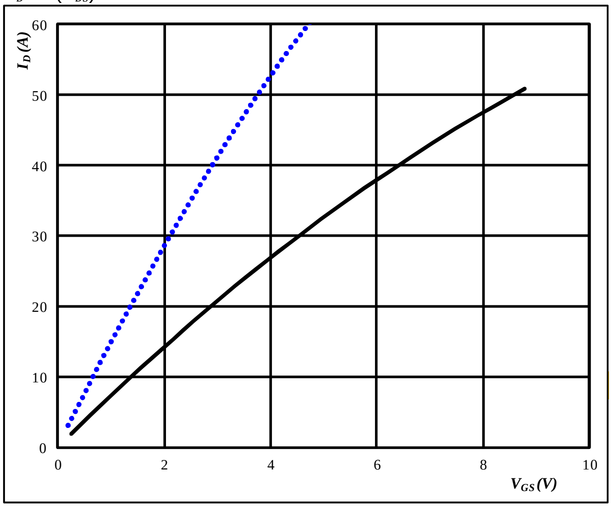
FWD thermal model values

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

Typical output characteristics **MOSFET**

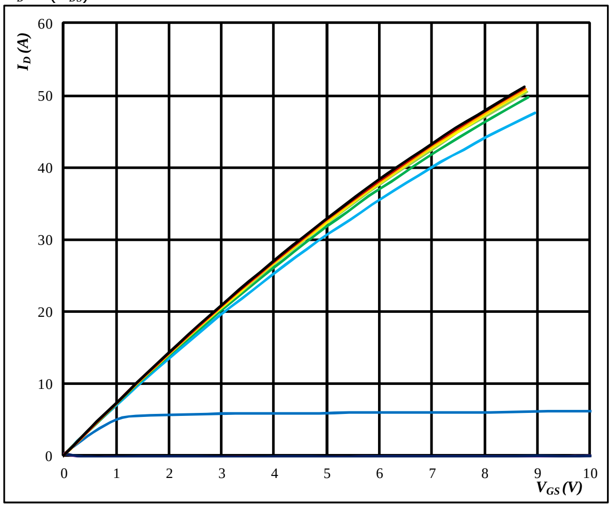
$I_D = f(V_{DS})$



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

Typical output characteristics **MOSFET**

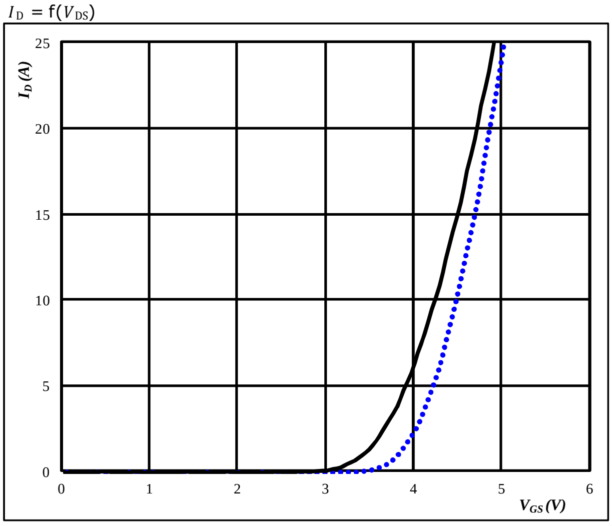
$I_D = f(V_{DS})$



t_p = 250 μs
T_j = 25oC °C
V_{GS} from 0 V to 20 V in steps of 2 V

Typical transfer characteristics **MOSFET**

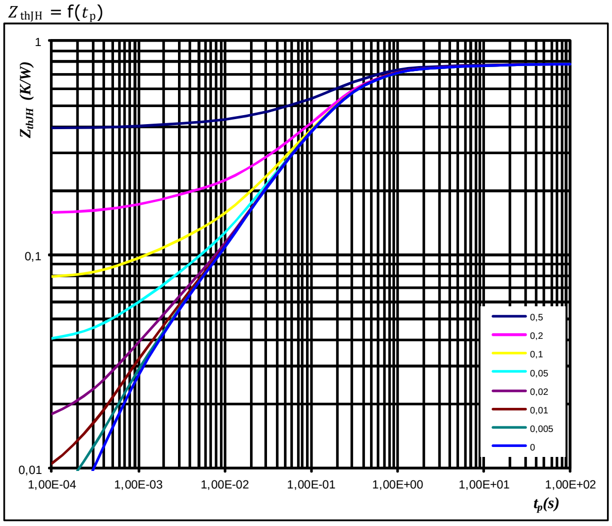
$I_D = f(V_{DS})$



t_p =	100	μs		**25 °C**	
V_{DS} =	0	V	**T_j:**	**125 °C**	
				150 °C	

Transient thermal impedance as a function of pulse width **MOSFET**

$Z_{thJH} = f(t_p)$



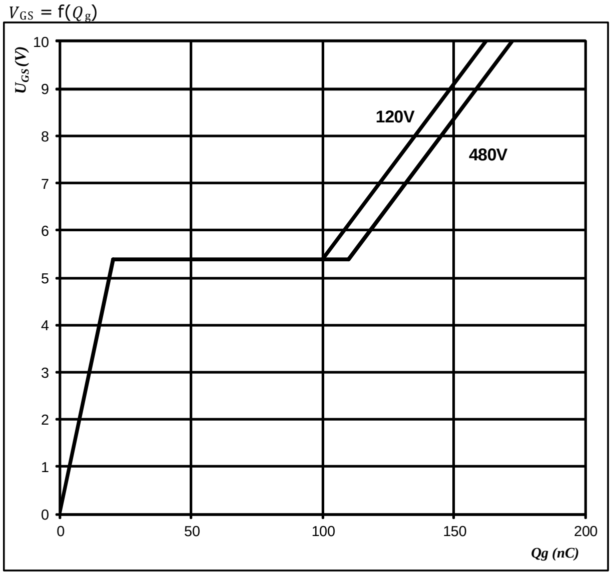
D = t_p / T
R_{thJH} = 0,78 K/W

R (K/W)	Tau (s)
2,79E-02	1,48E+01
9,18E-02	1,22E+00
4,16E-01	2,24E-01
1,49E-01	5,85E-02
6,36E-02	1,29E-02
3,14E-02	1,19E-03

PFC Switch Characteristics

Gate voltage vs Gate charge MOSFET

V_{GS} = f(Q_g)



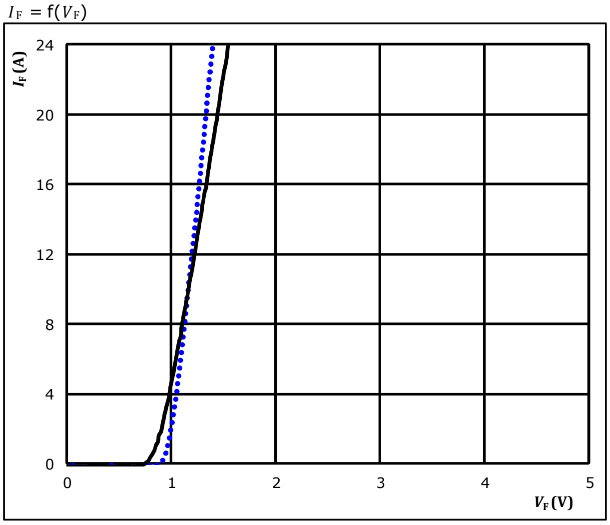
At

I_C= 25 A

PFC Diode Characteristics

Typical forward characteristics FWD

I_F = f(V_F)

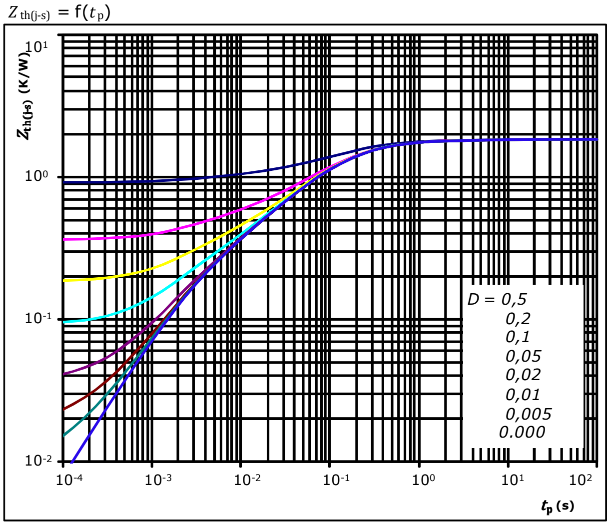


t_p = 250 μs

T_j: 25 °C, 125 °C, 150 °C

Transient thermal impedance as a function of pulse width FWD

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



D = t_p / T

$R_{th(j-s)}$ = 1,82 K/W

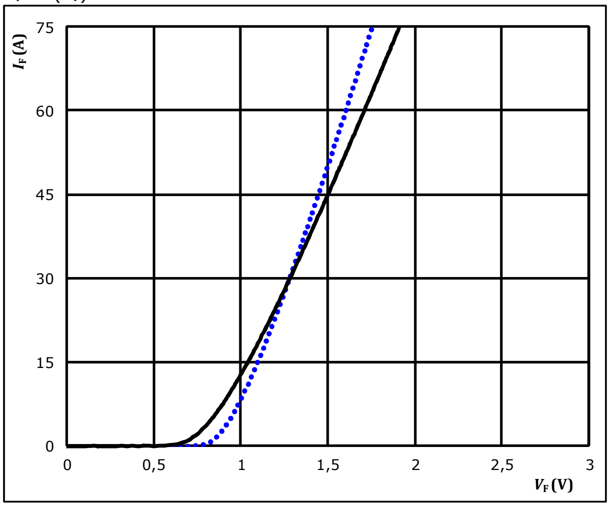
FWD thermal model values

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

Typical forward characteristics	Rectifier Diode

$I_F = f(V_F)$

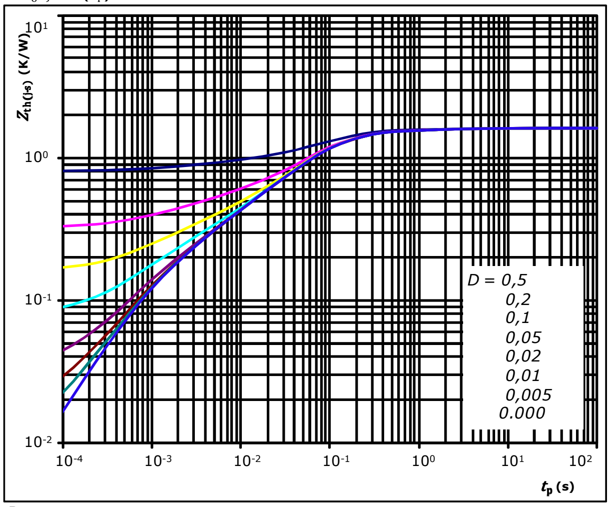


t_p = 250 µs

T_j: 25 °C; 125 °C; 150 °C

Transient thermal impedance as a function of pulse width	Rectifier Diode

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



D = t_p / T

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

Diode thermal model values

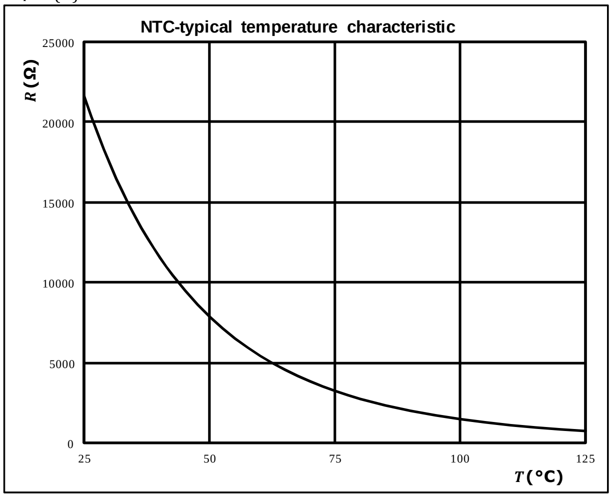
R (K/W)	τ (s)
6,72E-02	2,72E+00
1,48E-01	4,14E-01
8,68E-01	8,33E-02
2,53E-01	2,89E-02
1,69E-01	5,15E-03
1,06E-01	9,10E-04

Thermistor Characteristics

Thermistor typical temperature characteristic

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$

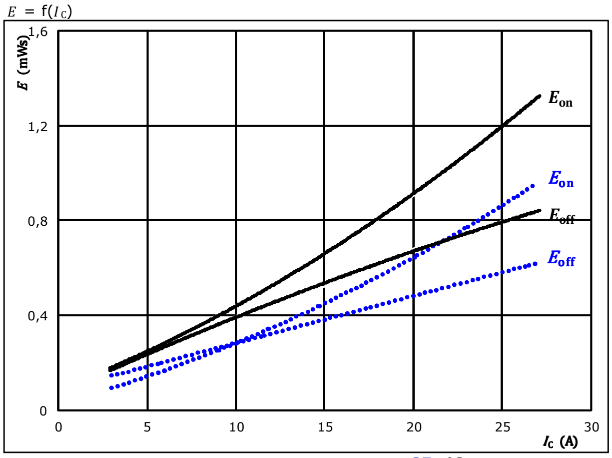


Inverter Switching Characteristics

Figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



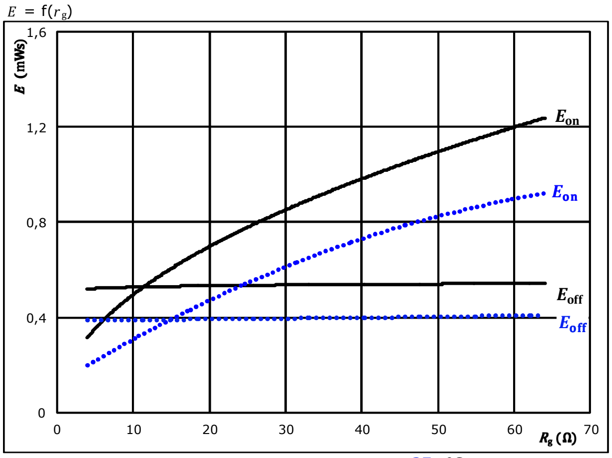
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C	•••••••••••••
V_{GE} =	±15	V		125 °C	———
R_{gon} =	16	Ω		150 °C	– – – –
R_{goff} =	16	Ω			

Figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(r_g)$



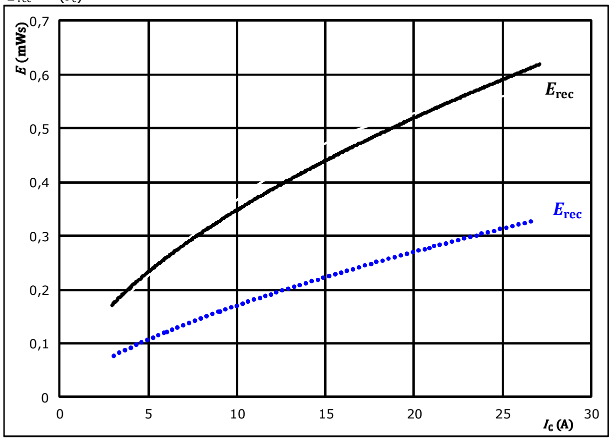
With an inductive load at

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

Figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



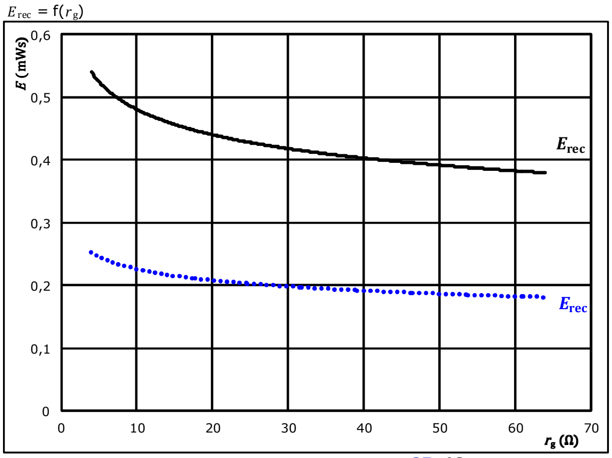
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C	•••••••••••••
V_{GE} =	±15	V		125 °C	———
R_{gon} =	16	Ω		150 °C	– – – –

Figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(r_g)$



With an inductive load at

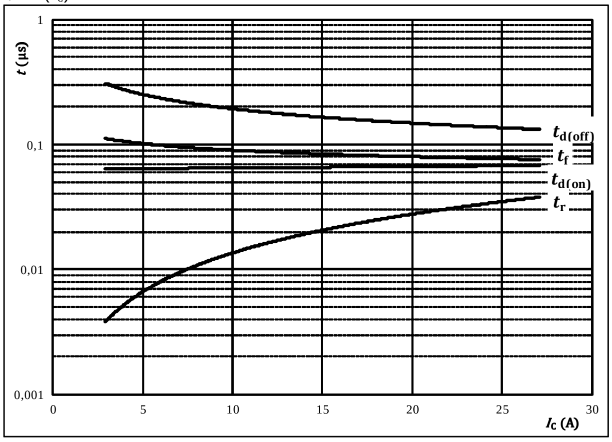
V_{CE} =	400	V	T_j:	25 °C	•••••••••••••
V_{GE} =	±15	V		125 °C	———
I_C =	15	A		150 °C	– – – –

Inverter Switching Characteristics

Figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



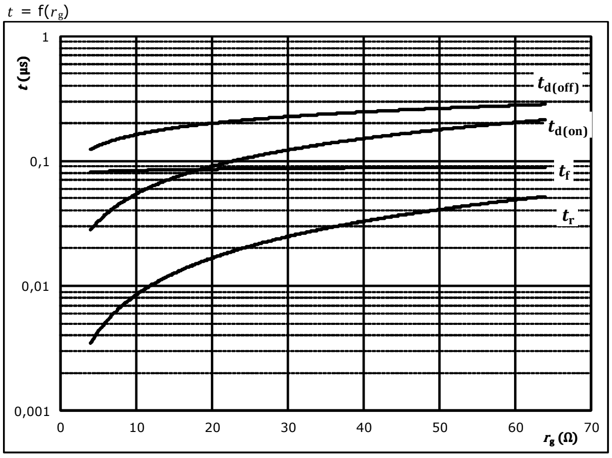
With an inductive load at

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

Figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(r_g)$



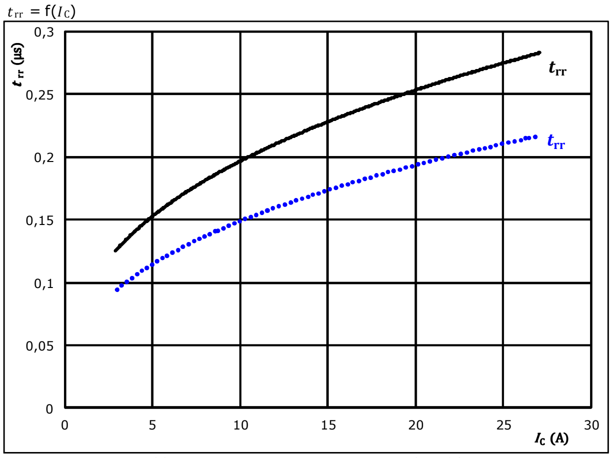
With an inductive load at

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

$t_{rr} = f(I_C)$

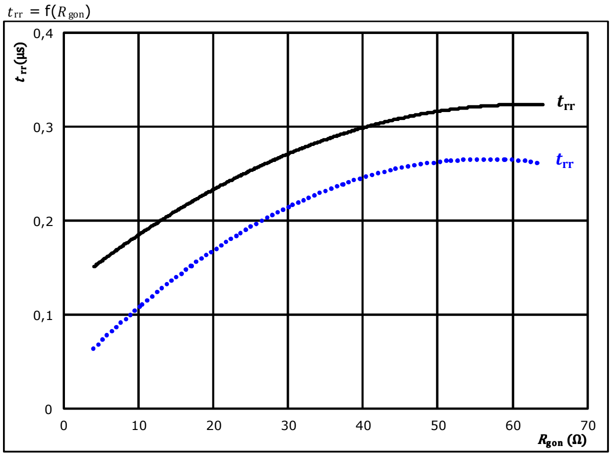


At					
V_{CE}=	400	V		25 °C	···········
V_{GE} =	±15	V	T_j:	125 °C	———
R_{gon} =	16	Ω		150 °C	— — —

Figure 8. **FWD**

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

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



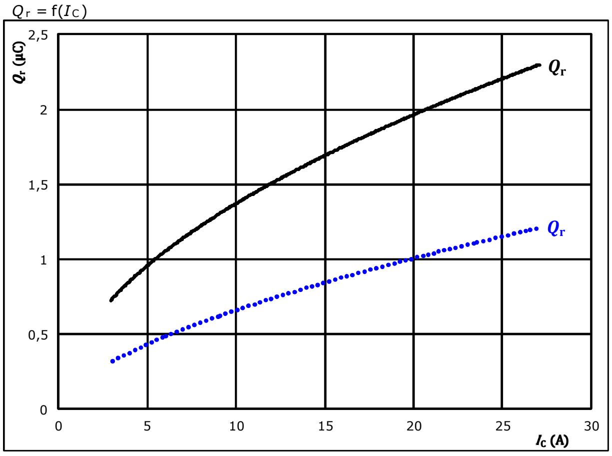
At					
V_{CE} =	400	V		25 °C	···········
V_{GE} =	±15	V	T_j:	125 °C	———
I_C =	15	A		150 °C	— — —

Inverter Switching Characteristics

Figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

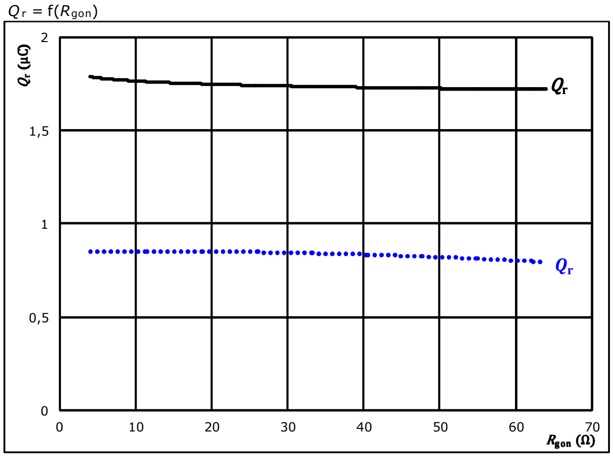


At						
	V_{CE} =	400	V		25 °C	···········
	V_{GE} =	±15	V	T_j:	125 °C	———
	R_{gon} =	16	Ω		150 °C	– – – –

Figure 10. **FWD**

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

$Q_r = f(R_{gon})$

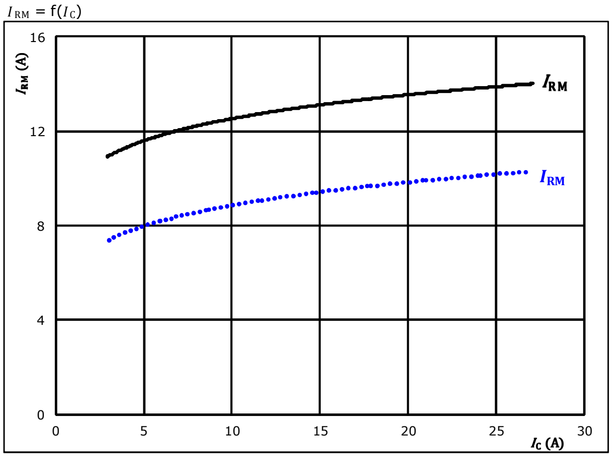


At						
	V_{CE}=	400	V		25 °C	···········
	V_{GE} =	±15	V	T_j:	125 °C	———
	I_C=	15	A		150 °C	– – – –

Figure 11. **FWD**

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

$I_{RM} = f(I_C)$

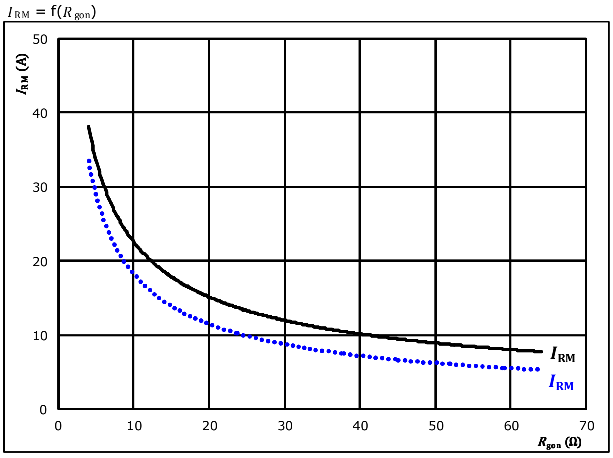


At						
	V_{CE} =	400	V		25 °C	···········
	V_{GE} =	±15	V	T_j:	125 °C	———
	R_{gon} =	16	Ω		150 °C	– – – –

Figure 12. **FWD**

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

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



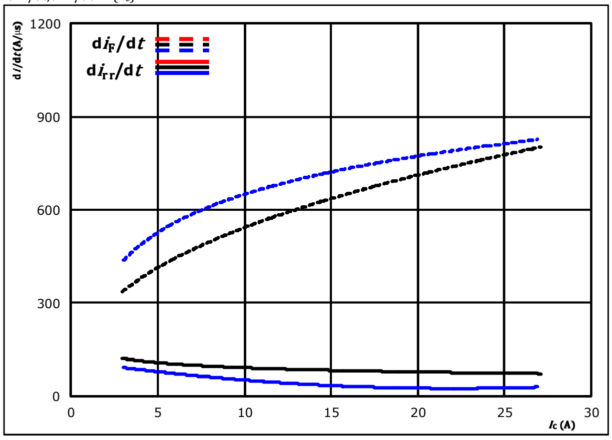
At						
	V_{CE} =	400	V		25 °C	···········
	V_{GE} =	±15	V	T_j:	125 °C	———
	I_C =	15	A		150 °C	– – – –

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)

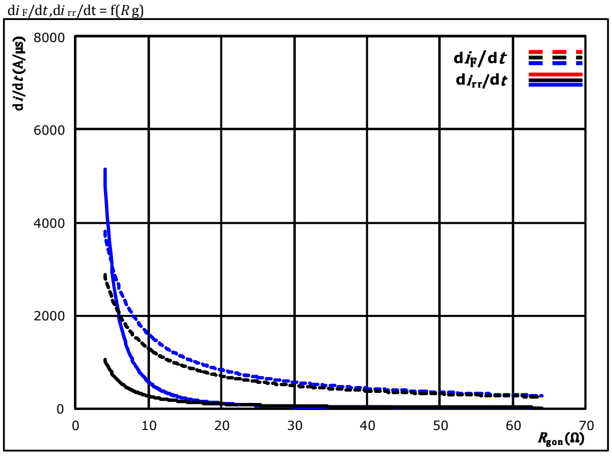


At					
V_{CE} =	400	V		25 °C	··············
V_{GE} =	±15	V	T_j:	125 °C	———
R_{gon} =	16	Ω		150 °C	– – – –

Figure 14. **FWD**

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

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

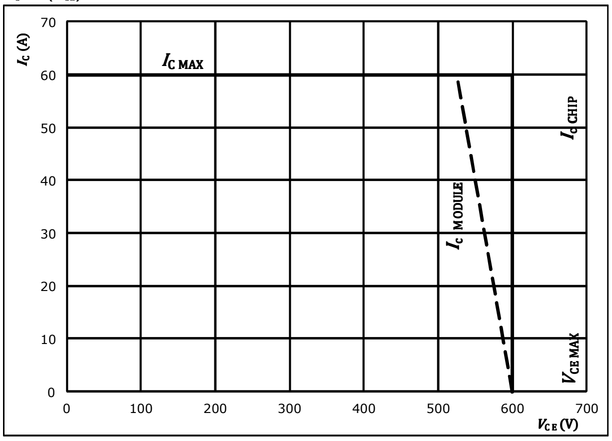


At		
V_{CE} =	400	V
V_{GE} =	±15	V
I_C=	15	A

Figure 15. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



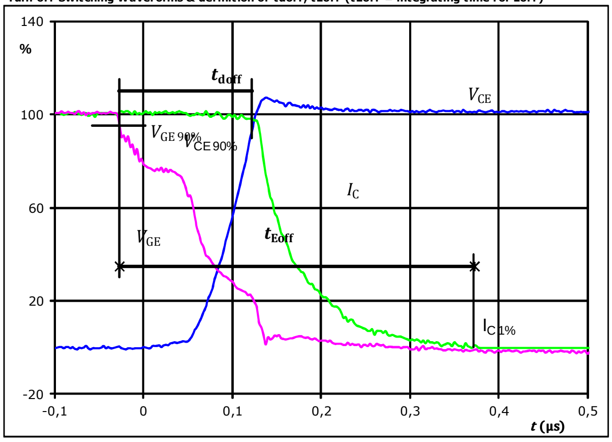
At		
T_j =	175	°C
R_{gon} =	16	Ω
R_{goff} =	16	Ω

Inverter Switching Definition

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

Figure 1. IGBT

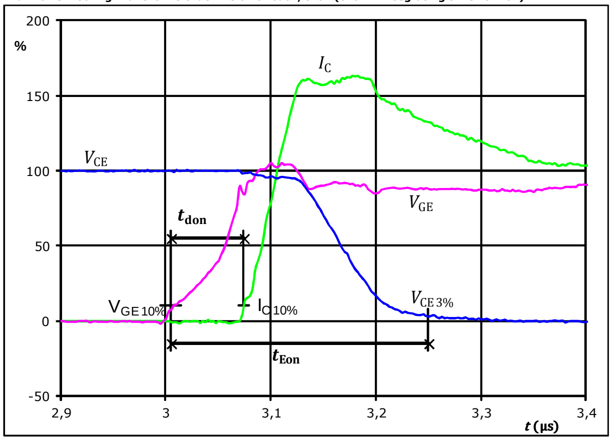
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



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

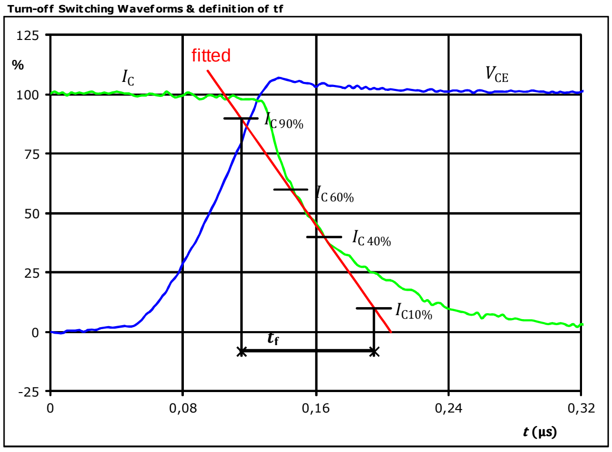
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



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

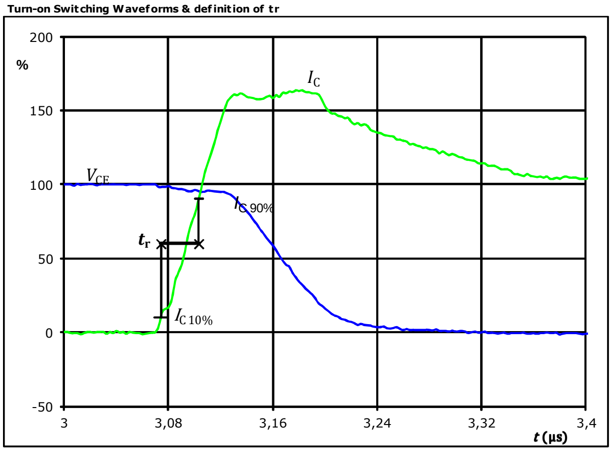
Turn-off Switching Waveforms & definition of tf



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

Figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

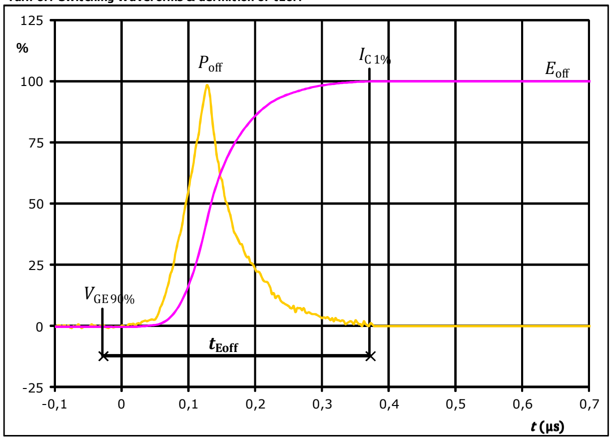


V_C (100%) =	400	V
I_C (100%) =	21	A
t_r =	0,029	µs

Inverter Switching Definition

Figure 5. **IGBT**

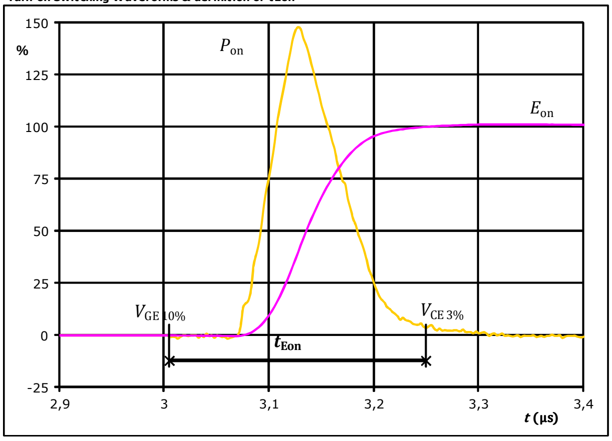
Turn-off Switching Waveforms & definition of tEoff



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

Figure 6. **IGBT**

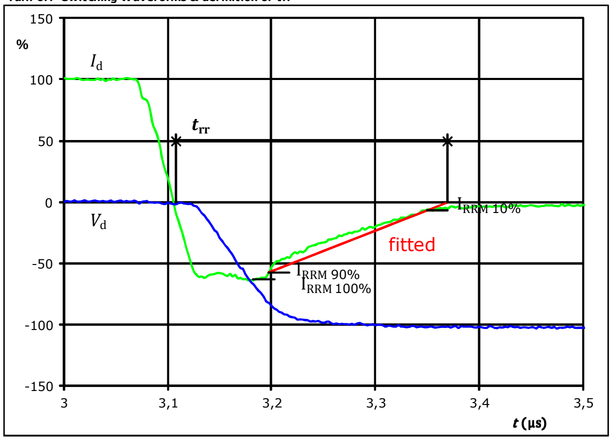
Turn-on Switching Waveforms & definition of tEon



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 trr

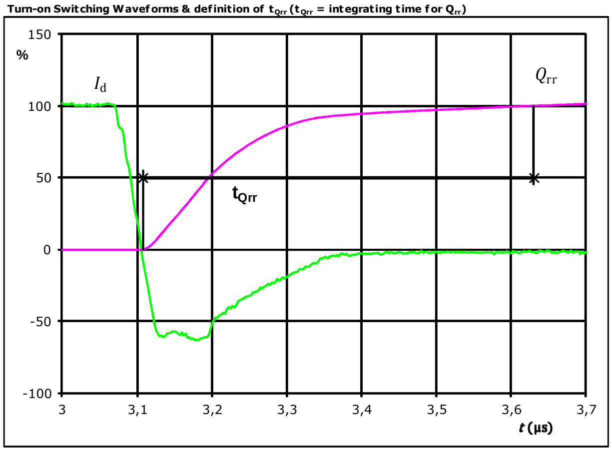


V_d (100%) =	400	V
I_d (100%) =	21	A
I_{RRM} (100%) =	-13	A
t_{rr} =	0,257	µs

Inverter Switching Definition

Figure 8.	**FWD**

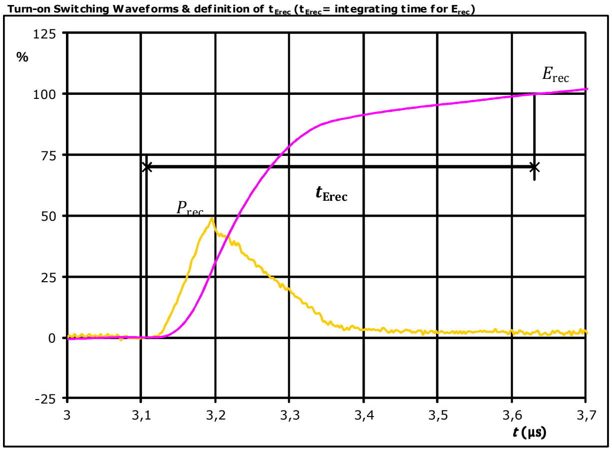
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



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})



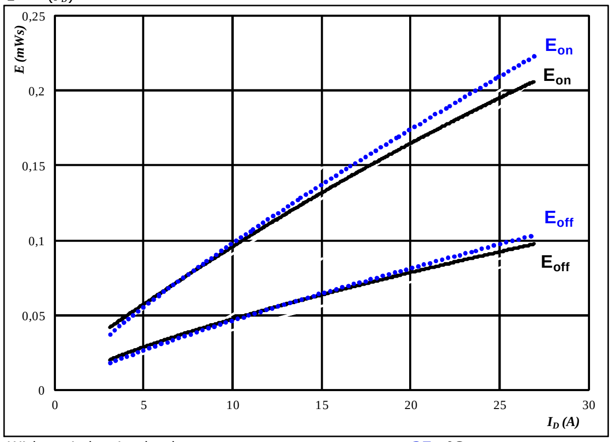
P_{rec} (100%) =	8,37	kW
E_{rec} (100%) =	0,54	mJ
t_{Erec} =	0,52	µs

PFC Switching Characteristics

Figure 1. MOSFET

Typical switching energy losses as a function of drain current

$E = f(I_D)$



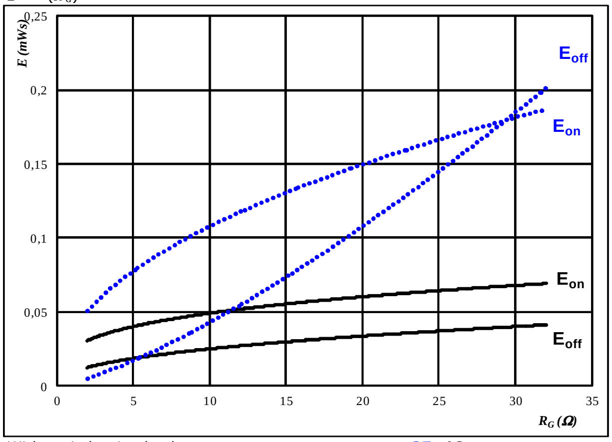
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	±15	V		125 °C
R_{gon} =	4	Ω		150 °C
R_{goff} =	4	Ω		

Figure 2. MOSFET

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



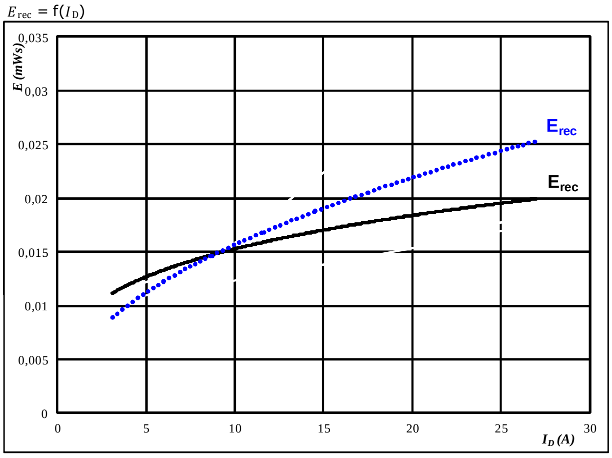
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	±15	V		125 °C
I_D =	3	A		150 °C

Figure 3. FWD

Typical reverse recovery energy loss as a function of drain current

$E_{rec} = f(I_D)$



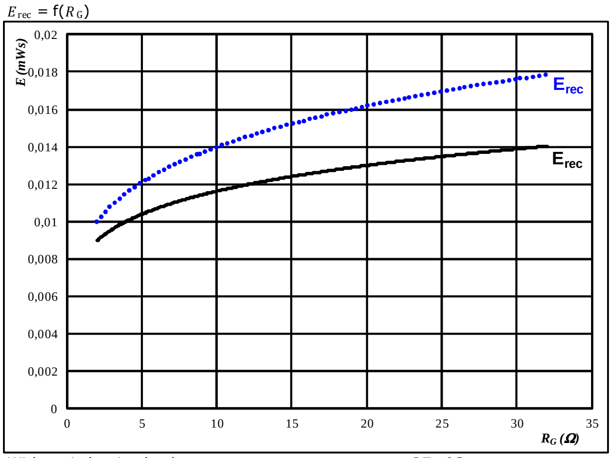
With an inductive load at

V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	±15	V		125 °C
R_{gon} =	4	Ω		150 °C
R_{goff} =	4	Ω		

Figure 4. FWD

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

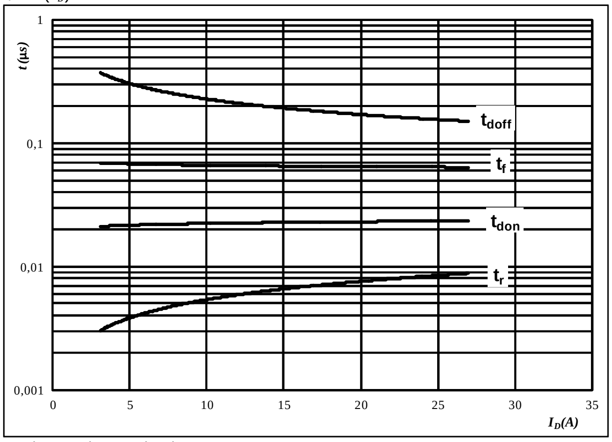
V_{DS} =	400	V	T_j:	25 °C
V_{GS} =	±15	V		125 °C
I_D =	3	A		150 °C

PFC Switching Characteristics

Figure 5. MOSFET

Typical switching times as a function of drain current

$t = f(I_D)$



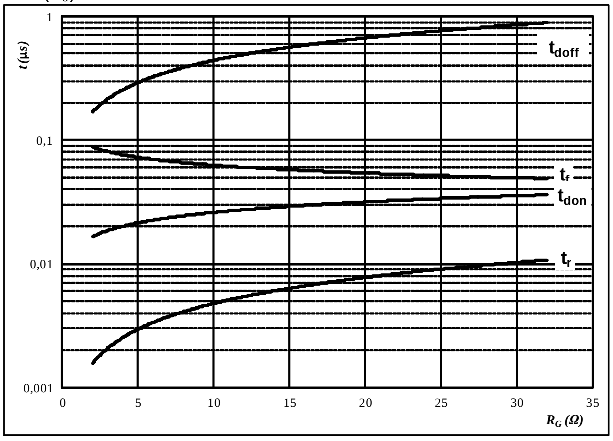
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 6. MOSFET

Typical switching times as a function of gate resistor

$t = f(R_G)$



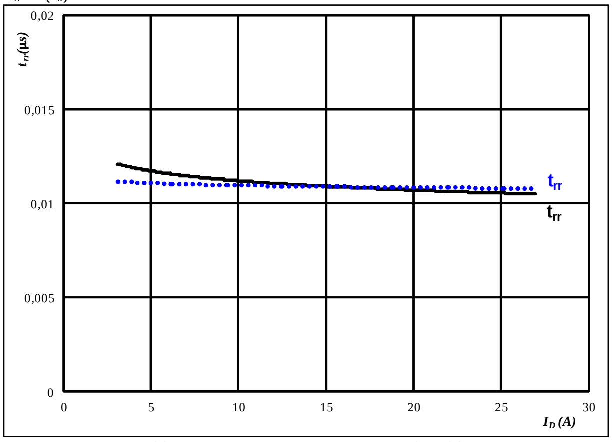
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	±15	V
I_D =	3	A

Figure 7. FWD

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$

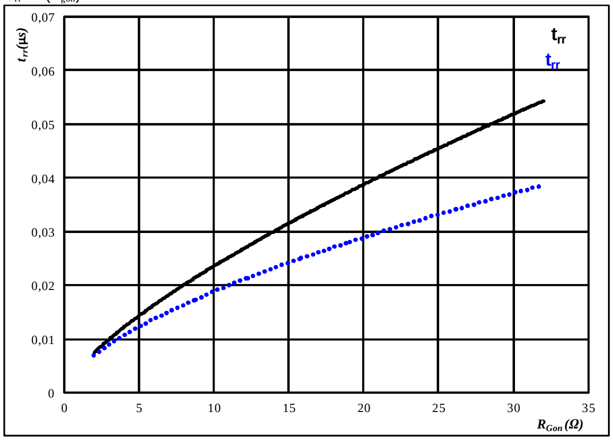


At						
V_{DS}	400	V		25	°C	············
V_{GS} =	±15	V	T_j:	125	°C	———
R_{gon} =	4	Ω		150	°C	– – – –

Figure 8. FWD

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

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



At						
V_{DS}	400	V		25	°C	············
V_{GS} =	±15	V	T_j:	125	°C	———
I_D =	3	A		150	°C	– – – –

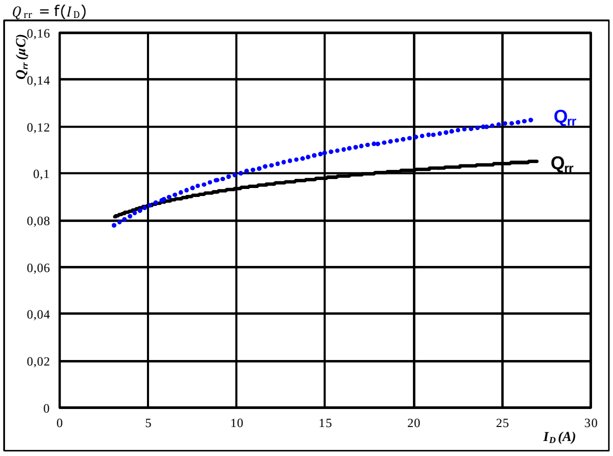
10-R106PPA020SB01-M934A
datasheet

PFC Switching Characteristics

Figure 9. FWD

Typical reverse recovery charge as a function of drain current

$Q_{rr} = f(I_D)$

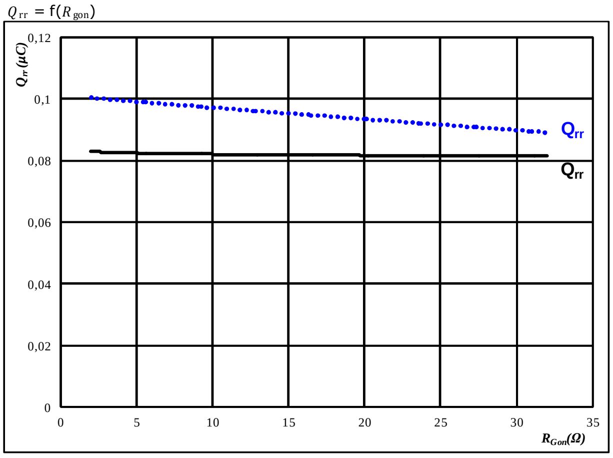


At					
V_{DS}	400	V		**25 °C**	············
V_{GS} =	±15	V	T_j:	**125 °C**	———
R_{gon} =	4	Ω		**150 °C**	– – – –

Figure 10. FWD

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

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

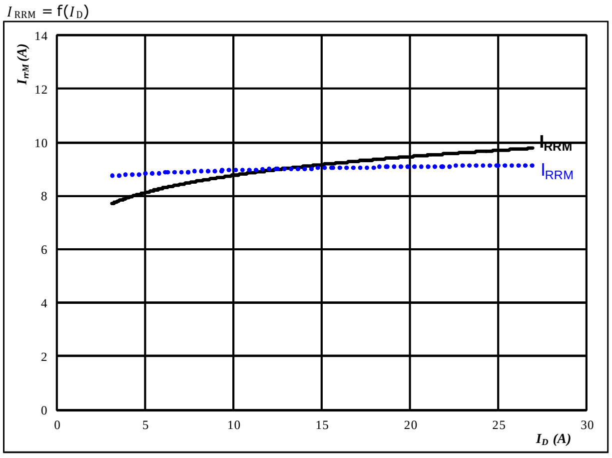


At					
V_{DS}	400	V		**25 °C**	············
V_{GS} =	±15	V	T_j:	**125 °C**	———
I_D =	3	A		**150 °C**	– – – –

Figure 11. FWD

Typical reverse recovery current as a function of drain current

$I_{RRM} = f(I_D)$

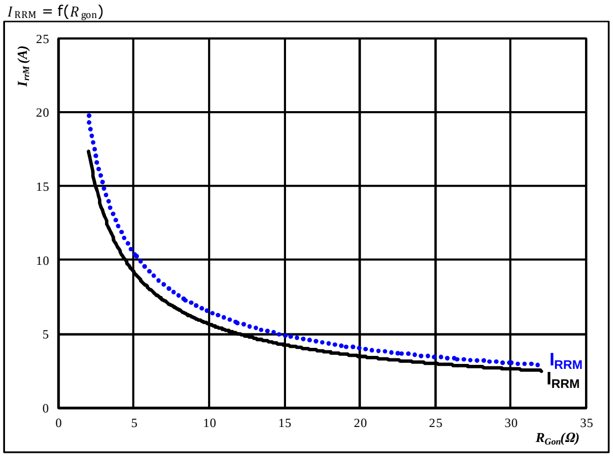


At					
V_{DS}	400	V		**25 °C**	············
V_{GS} =	±15	V	T_j:	**125 °C**	———
R_{gon} =	4	Ω		**150 °C**	– – – –

Figure 12. FWD

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

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



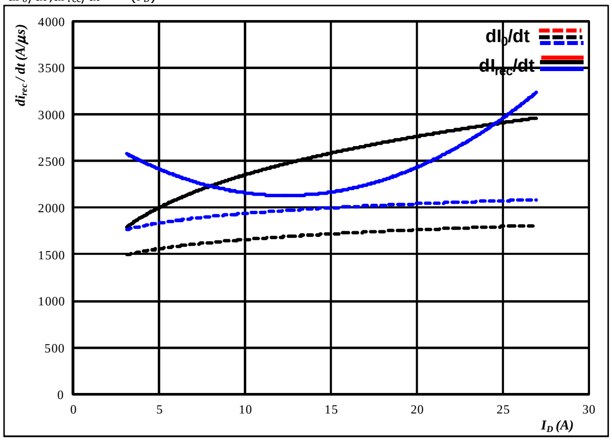
At					
V_{DS}	400	V		**25 °C**	············
V_{GS} =	±15	V	T_j:	**125 °C**	———
I_D =	3	A		**150 °C**	– – – –

PFC Switching Characteristics

Figure 13. FWD

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

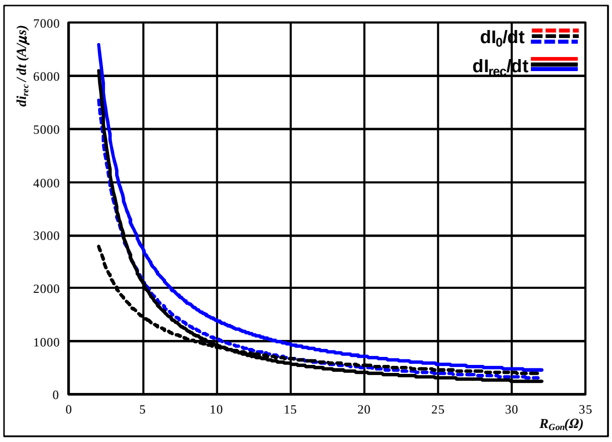
$dI_0/dt, dI_{rec}/dt = f(I_D)$



At				
V_{DS}	400	V		25 °C
V_{GS} =	±15	V	T_j:	125 °C
R_{gon} =	4	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

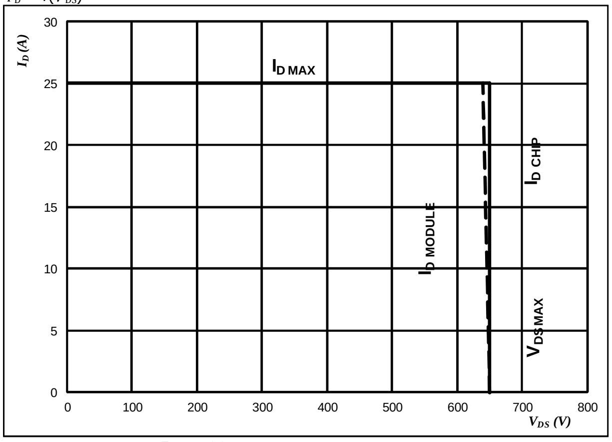


At				
V_{DS}	400	V		25 °C
V_{GS} =	±15	V	T_j:	125 °C
I_D =	3	A		150 °C

Figure 15. MOSFET

Reverse bias safe operating area

$I_D = f(V_{DS})$



At		
T_j =	175	°C
R_{gon} =	4	Ω
R_{goff} =	4	Ω

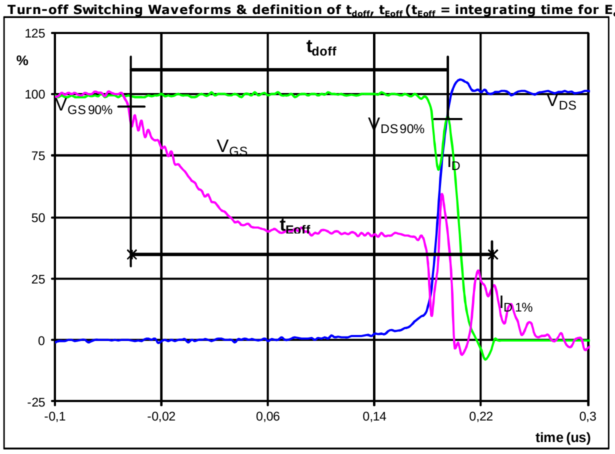
PFC Switching Definition

General conditions

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

Figure 1. MOSFET

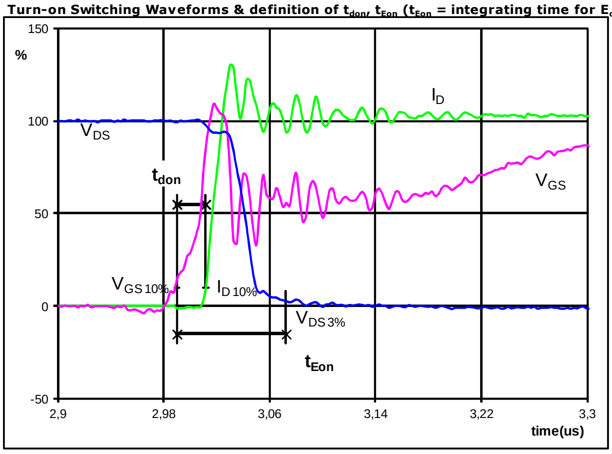
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



V_{GS} (0%) =	0	V
V_{GS} (100%) =	10	V
V_{DS} (100%) =	400	V
I_D (100%) =	21	A
t_{doff} =	0,237	μs
t_{Eoff} =	0,271	μs

Figure 2. MOSFET

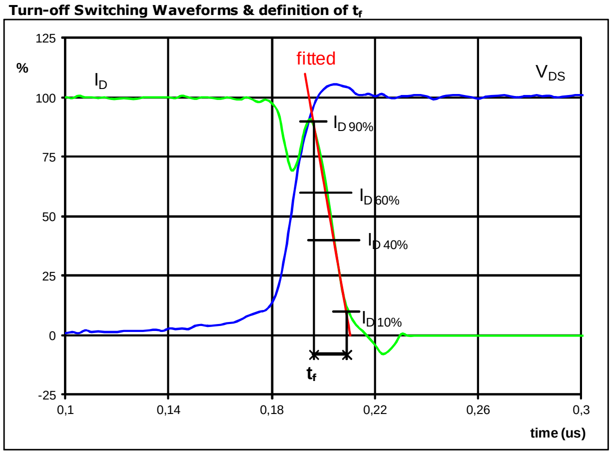
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



V_{GS} (0%) =	0	V
V_{GS} (100%) =	10	V
V_{DS} (100%) =	400	V
I_D (100%) =	21	A
t_{don} =	0,023	μs
t_{Eon} =	0,082	μs

Figure 3. MOSFET

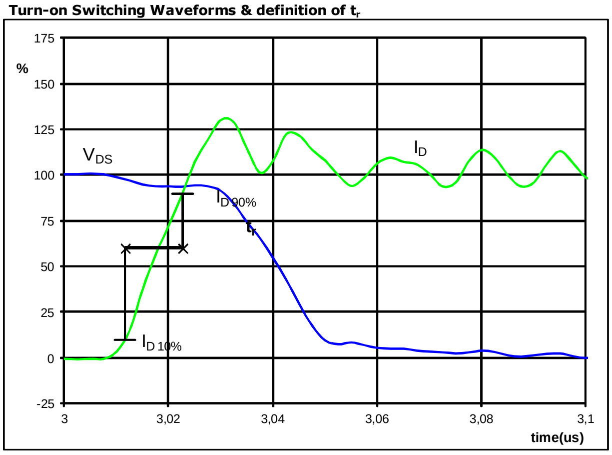
Turn-off Switching Waveforms & definition of t_f



V_{DS} (100%) =	400	V
I_D (100%) =	21	A
t_f =	0,011	μs

Figure 4. MOSFET

Turn-on Switching Waveforms & definition of t_r

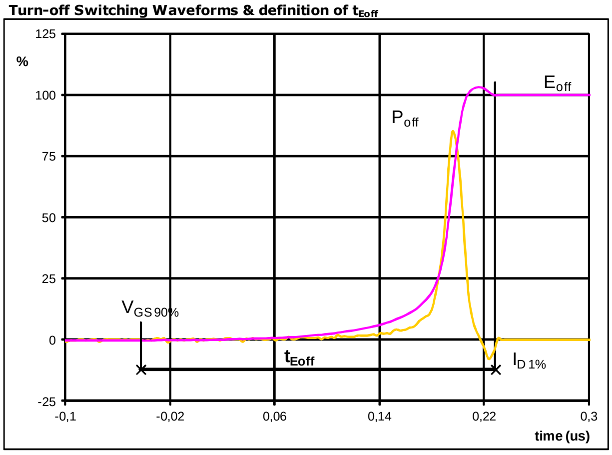


V_{DS} (100%) =	400	V
I_D (100%) =	21	A
t_r =	0,011	μs

PFC Switching Definition

Figure 5. MOSFET

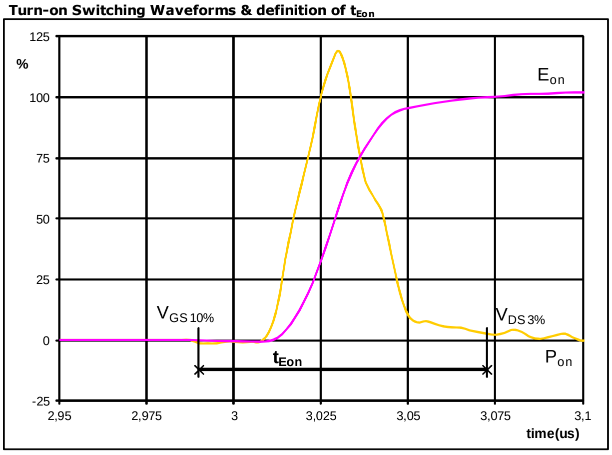
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	8,40	kW
E_{off} (100%) =	0,14	mJ
t_{Eoff} =	0,27	μs

Figure 6. MOSFET

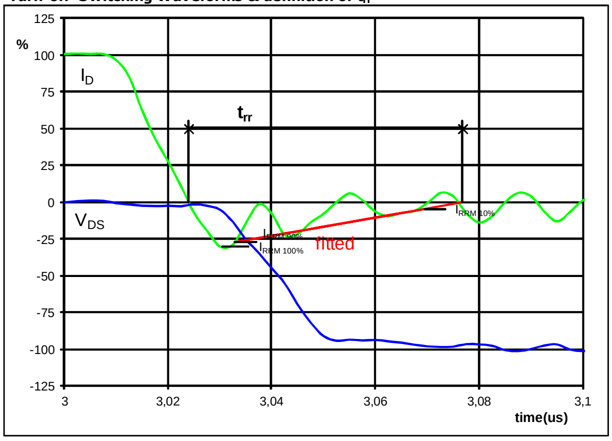
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	8,40	kW
E_{on} (100%) =	0,23	mJ
t_{Eon} =	0,08	μs

Figure 7. FWD

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

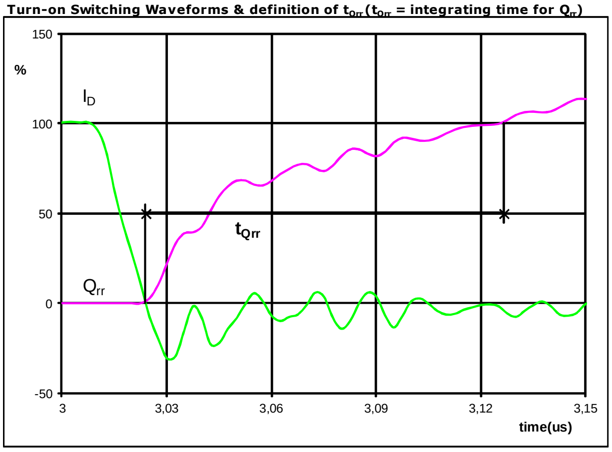


V_{DS} (100%) =	400	V
I_D (100%) =	21	A
I_{RRM} (100%) =	-6	A
t_{rr} =	0,013	μs

PFC Switching Definition

Figure 8. FWD

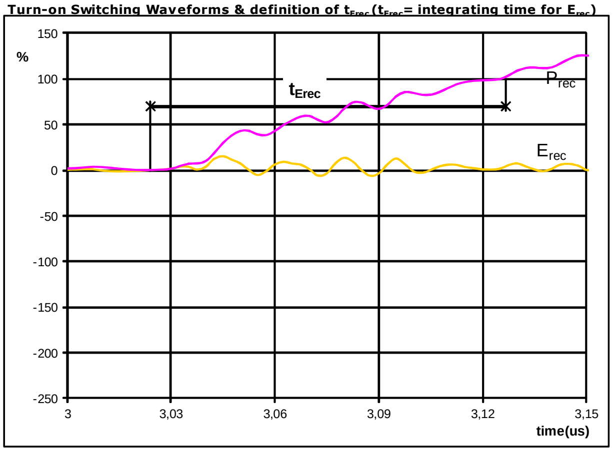
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_D (100%) =	21	A
Q_{rr} (100%) =	0,13	μC
t_{Qrr} =	0,10	μs

Figure 9. FWD

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



P_{rec} (100%) =	8,40	kW
E_{rec} (100%) =	0,03	mJ
t_{Erec} =	0,10	μs

Vincotech

Ordering Code & Marking

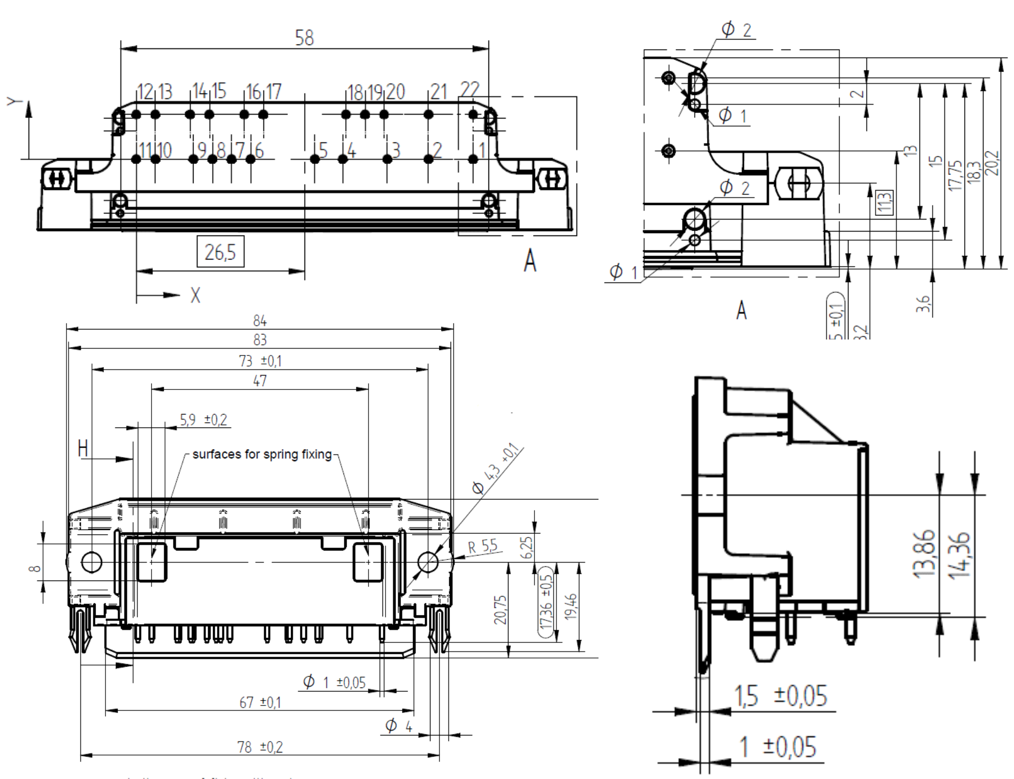
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste	10-R106PPA020SB01-M934A	M934A	M934A

Text	**Vinco**	**Date code**	**Name&Ver**	**UL**	**Lot**	**Serial**
	Vinco	WWYY	NNNNNNNNVV	UL	LLLLL	SSSS
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

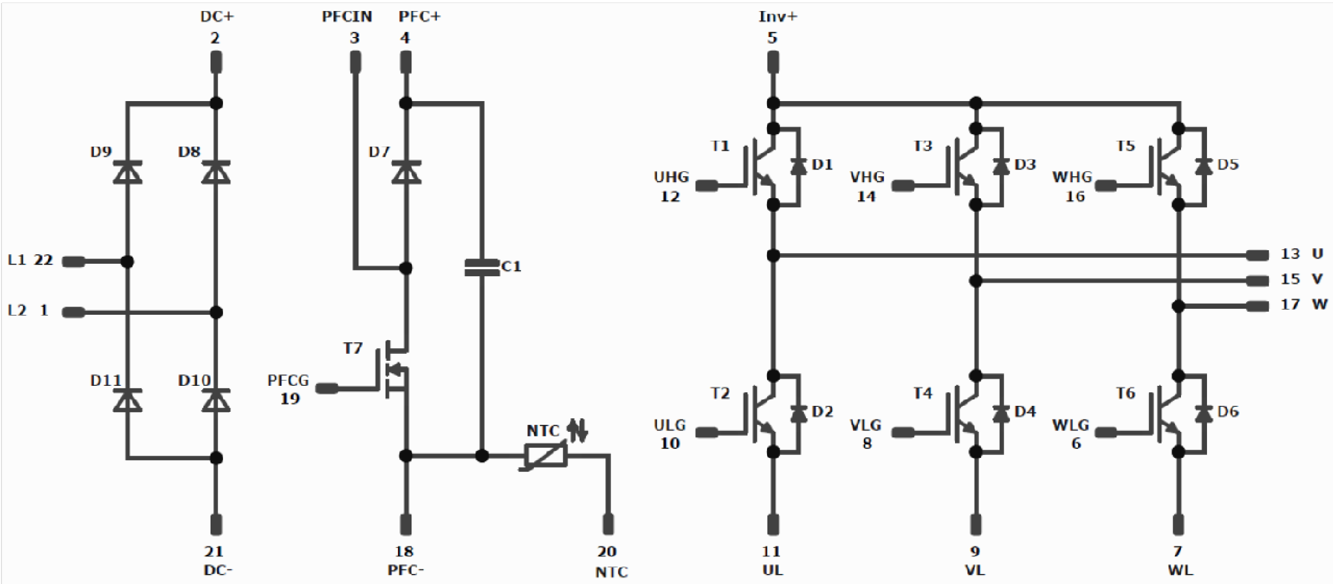
Outline

Pin table [mm]

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



Pinout


DC+
2
PFCIN
3
PFC+
4
Inv+
5
D9
D8
D7
T1
D1
T3
D3
T5
D5
UHG
12
VHG
14
WHG
16
L1 22
L2 1
C1
13 U
15 V
17 W
T7
PFCG
19
D11
D10
NTC
T2
D2
T4
D4
T6
D6
ULG
10
VLG
8
WLG
6
21
DC-
18
PFC-
20
NTC
11
UL
9
VL
7
WL

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

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

Document No.:	**Date:**	**Modification:**	**Pages**
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