Vincotech

10-F006PPA020SB02-M685B30
datasheet

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

Topology features

- Open Emitter configuration
- Temperature sensor
- Converter+PFC+Inverter
- Integrated Shunt Resistor

Component features

- Highest efficiency in hard switching and resonant topologies
- Lowest switching losses
- Optimized for ultra-fast switching

Housing features

- Base isolation: Al_2O_3
- Clip-in, reliable mechanical connection, qualified for wave soldering
- Convex shaped substrate for superior thermal contact
- Thermo-mechanical push-and-pull force relief
- Solder pin

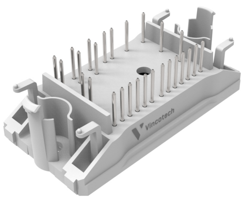
Target applications

- Embedded Drives
- Industrial Drives

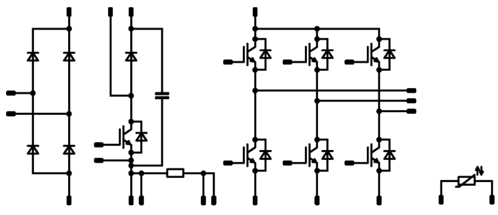
Types

- 10-F006PPA020SB02-M685B30

flow 0 17 mm housing



Schematic



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	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, V_{CC} = 360 V	T_j = 150 °C	6	μs
Maximum junction temperature	T_{jmax}			175	°C
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	32	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	52	W
Maximum junction temperature	T_{jmax}			175	°C
PFC Switch					
Collector-emitter voltage	V_{CES}			650	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	44	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		150	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	72	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
PFC Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	46	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		150	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	63	W
Maximum junction temperature	T_{jmax}			175	°C
PFC Sw. Inverse Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s <= 80 °C	12 (1)	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		12	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	36	W
Maximum junction temperature	T_{jmax}			175	°C

(1) limited by I_{FRM}

Parameter	Symbol	Conditions		Value	Unit
Rectifier Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	33	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	200	A
Surge current capability	I^2t			200	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	44	W
Maximum junction temperature	T_{jmax}			150	°C
PFC Shunt					
DC current	I			27,1	A
Power dissipation	P_{tot}		T_c = 70 °C	5	W
Operation Temperature	T_{op}			-55 ... 170	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		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
Creepage distance				>12,7	mm
Clearance				>12,7	mm
Comparative Tracking Index	CTI			≥ 200	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00029	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		20	25 150	1,1	1,53 1,85	1,9(2)	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}							1100		pF
Output capacitance	C_{oes}	f = 1 Mhz	0	25		25		71		pF
Reverse transfer capacitance	C_{res}							32		pF
Gate charge	Q_g	V_{CC} = 480 V	0/15		20	25		120		nC
Thermal										
Thermal resistance junction to sink(3)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,81		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$					25 125		65,6 65,2		ns
Rise time	t_r	R_{gon} = 16 Ω R_{goff} = 16 Ω				25 125		19,8 21		ns
Turn-off delay time	$t_{d(off)}$		±15	400	15	25 125		141,8 167		ns
Fall time	t_f					25 125		76,33 86,36		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,883 μC Q_{rFWD}=1,79 μC				25 125		0,45 0,667		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,385 0,523		mWs

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Diode										
Static										
Forward voltage	V_F				30	25 125	1,25	1,65 1,62	1,95(2)	V
Reverse leakage current	I_R	V_r = 600 V				25			27	µA
Thermal										
Thermal resistance junction to sink(3)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,81		K/W
Dynamic										
Peak recovery current	I_{RM}	di/dt=731 A/µs di/dt=708 A/µs	±15	400	15	25 125		10,06 13,55		A
Reverse recovery time	t_{rr}					25 125		173,99 233,08		ns
Recovered charge	Q_r					25 125		0,883 1,79		µC
Reverse recovered energy	E_{rec}					25 125		0,236 0,474		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		36,18 85,35		A/µs

Characteristic Values

Parameter	Symbol	Conditions	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										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0005	25	3,3	4	4,7	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	25 125 150		1,52 1,64 1,7	2,22(2)	V
Collector-emitter cut-off current	I_{CES}		0	650		25			40	µA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		3000		pF
Output capacitance	C_{oes}							50		pF
Reverse transfer capacitance	C_{res}							11		pF
Gate charge	Q_g	V_{CC} = 520 V	15		50	25		120		nC
Thermal										
Thermal resistance junction to sink(3)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,32		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	0/15	400	50	25 125 150		19,2 19,2 19,04		ns
Rise time	t_r					25 125 150		9,76 11,04 11,52		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		87,36 103,52 107,68		ns
Fall time	t_f					25 125 150		5 4,22 4,39		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=1,66 µC Q_{rFWD}=3,14 µC Q_{rFWD}=3,57 µC				25 125 150		0,365 0,58 0,624		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,364 0,476 0,518		mWs

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				50	25 125 150		1,5 1,44 1,42	1,92(2)	V
Reverse leakage current	I_R	V_r = 650 V				25			2,65	µA
Thermal										
Thermal resistance junction to sink(3)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,5		K/W
Dynamic										
Peak recovery current	I_{RM}	di/dt=4427 A/µs di/dt=4057 A/µs di/dt=4001 A/µs	0/15	400	50	25 125 150		56,36 70,28 74,71		A
Reverse recovery time	t_{rr}					25 125 150		47,37 78,83 87,49		ns
Recovered charge	Q_r					25 125 150		1,66 3,14 3,57		µC
Reverse recovered energy	E_{rec}					25 125 150		0,555 1,02 1,17		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		1599 1123 1211		A/µs

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
PFC Sw. Inverse Diode										
Static										
Forward voltage	V_F				6	25 125 150	1,23	1,72 1,58 1,54	1,87(2)	V
Reverse leakage current	I_R	V_r = 650 V				25			0,1	µA
Thermal										
Thermal resistance junction to sink(3)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,65		K/W
Rectifier Diode										
Static										
Forward voltage	V_F				8	25 125		0,996 0,907	1,21(2) 1,1(2)	V
Reverse leakage current	I_R	V_r = 1600 V				25 125			100 1000	µA
Thermal										
Thermal resistance junction to sink(3)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,59		K/W
PFC Shunt										
Static										
Resistance	R							6,8		mΩ
Tolerance							-1		1	%
Temperature coeficient	tc								100	ppm/K

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	
Capacitor (PFC)										
Static										
Capacitance	C	DC bias voltage = 0 V				25		100		nF
Tolerance							-10		10	%
Dissipation factor		f = 1 kHz				25		2,5		%
Thermistor										
Static										
Rated resistance	R					25		22		kΩ
Deviation of R100	$\Delta_{R/R}$	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	

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

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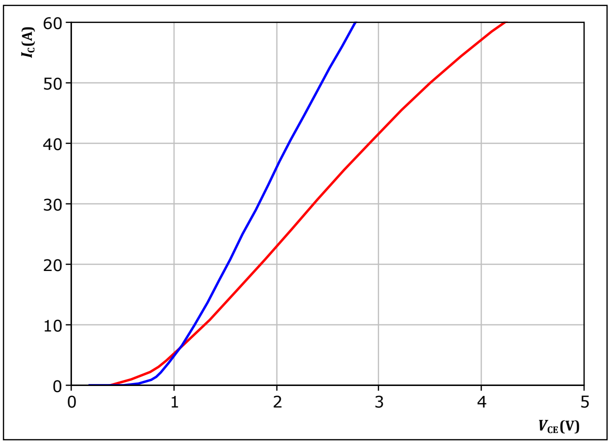
datasheet

Inverter Switch Characteristics

figure 1.	IGBT

Typical output characteristics

I_C = f(V_{CE})

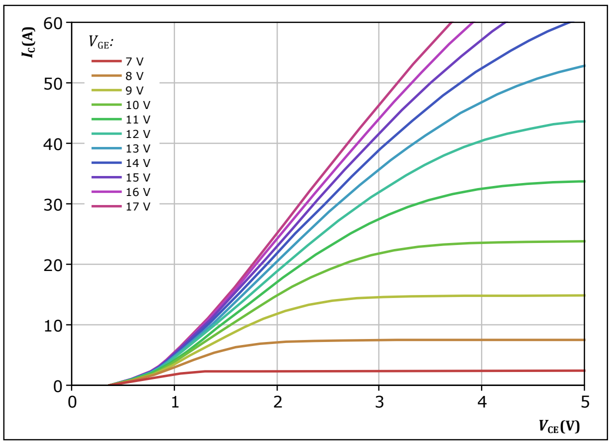


t_p =	250	μs	T_j:	25 °C
V_{GE} =	15	V		150 °C

figure 2.	IGBT

Typical output characteristics

I_C = f(V_{CE})



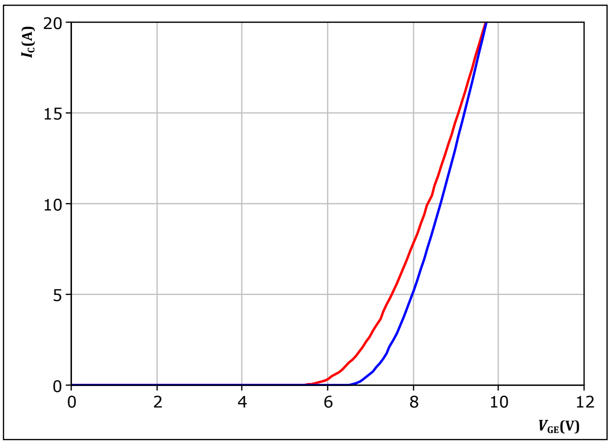
t_p =	250	μs
T_j =	150	°C

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

figure 3.	IGBT

Typical transfer characteristics

I_C = f(V_{GE})

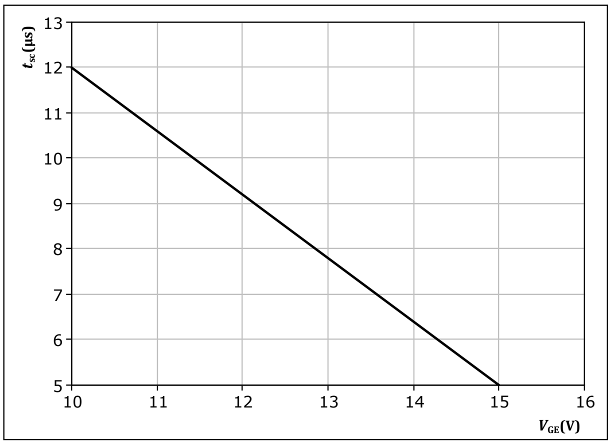


t_p =	250	μs	T_j:	25 °C
V_{CE} =	10	V		150 °C

figure 4.	IGBT

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

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



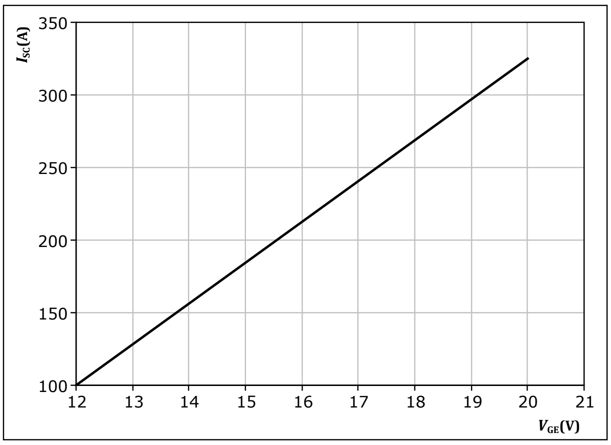
At	V_{CE} =	333	V
	T_j ≤	333	°C

Inverter Switch Characteristics

figure 5. **IGBT**

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

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

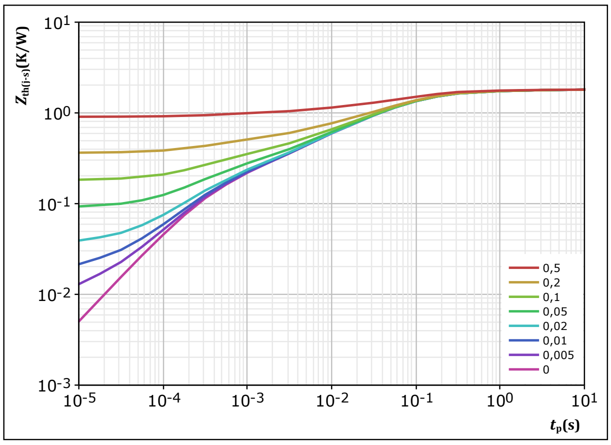


At	V_{CE} =	333	V
	T_j ≤	333	°C

figure 6. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,808	K/W

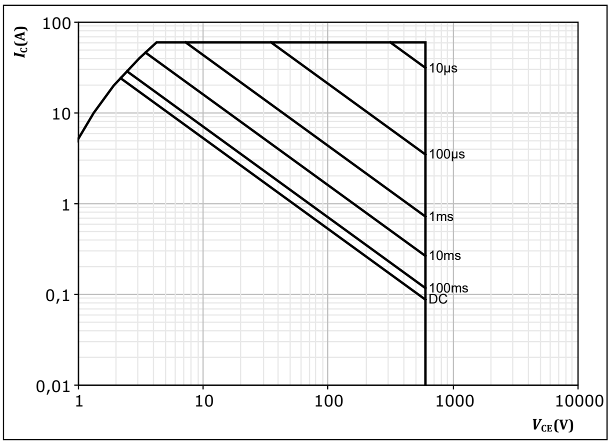
IGBT thermal model values

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

figure 7. **IGBT**

Safe operating area

I_C = f(V_{CE})

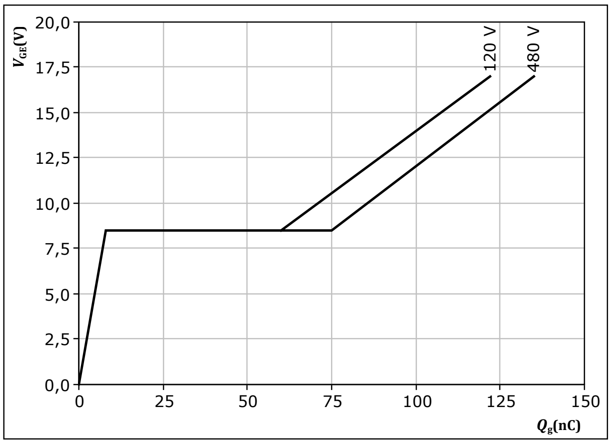


D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

figure 8. **IGBT**

Gate voltage vs gate charge

V_{GE} = f(Q_g)



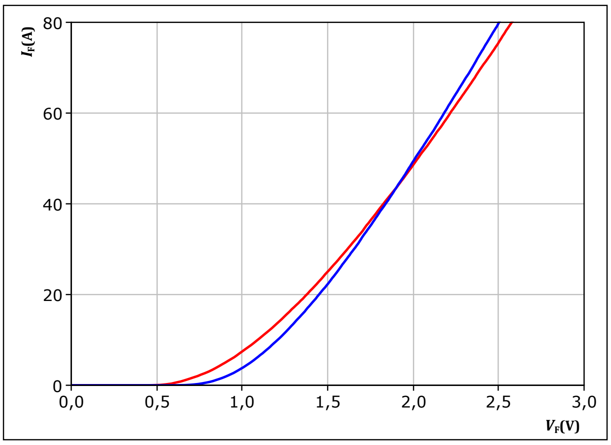
I_C =	33	A
T_j =	25	°C

Inverter Diode Characteristics

figure 9. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



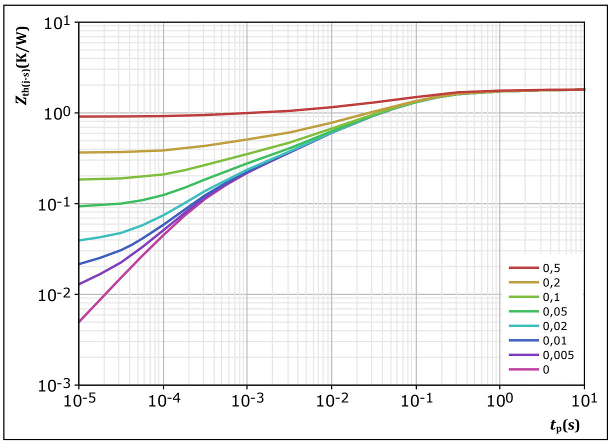
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 10. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

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

FWD thermal model values

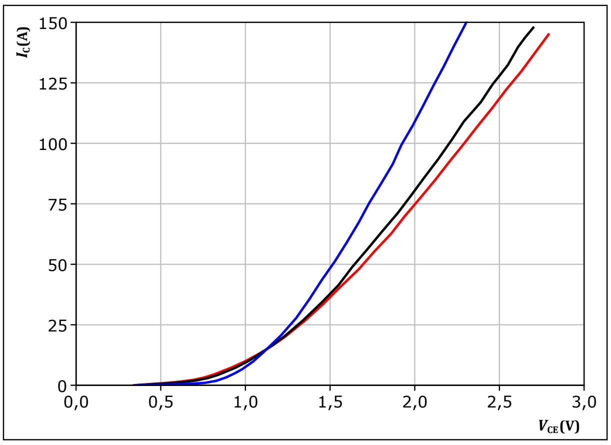
R (K/W)	τ (s)
8,35E-02	4,59E+00
2,01E-01	4,81E-01
7,60E-01	9,25E-02
4,22E-01	1,80E-02
2,13E-01	3,31E-03
1,40E-01	3,46E-04

PFC Switch Characteristics

figure 11. IGBT

Typical output characteristics

I_C = f(V_{CE})



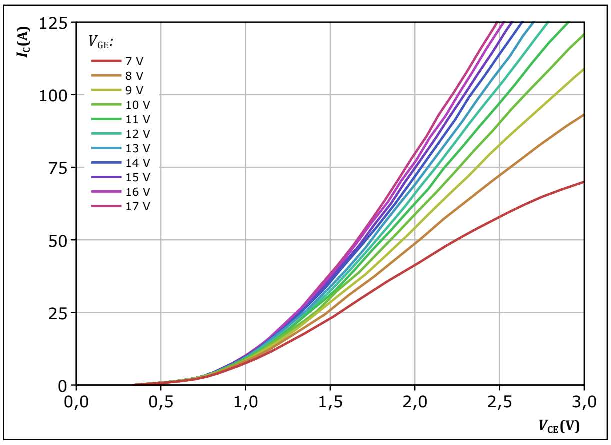
t_p =	250	µs
V_{GE} =	15	V

T_j: 25 °C, 125 °C, 150 °C

figure 12. IGBT

Typical output characteristics

I_C = f(V_{CE})



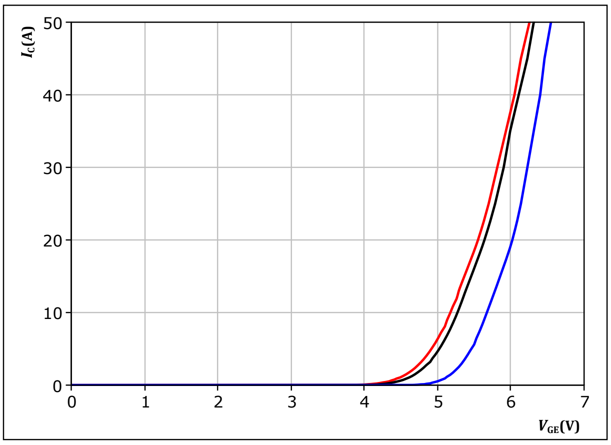
t_p =	250	µs
T_j =	150	°C

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

figure 13. IGBT

Typical transfer characteristics

I_C = f(V_{GE})



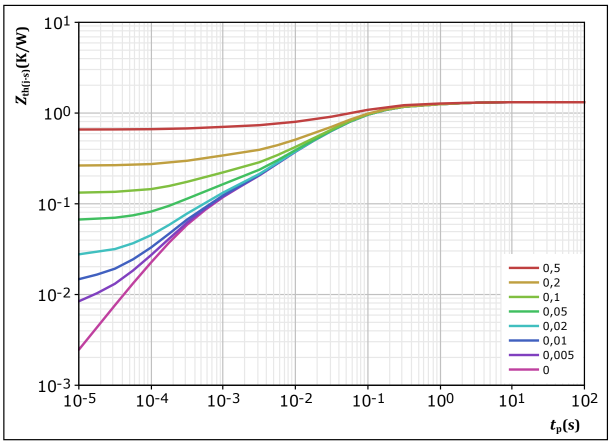
t_p =	250	µs
V_{CE} =	10	V

T_j: 25 °C, 125 °C, 150 °C

figure 14. IGBT

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,316 K/W

IGBT thermal model values

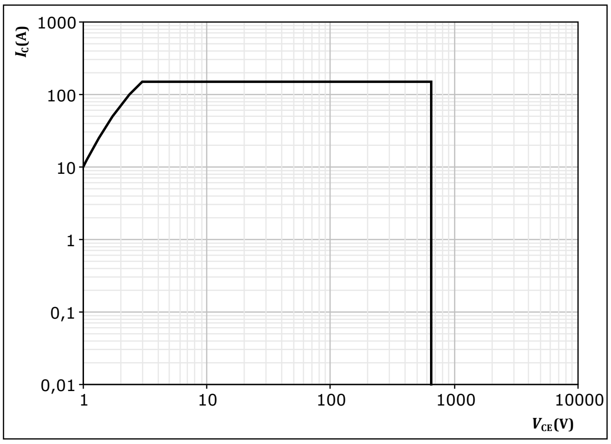
R (K/W)	τ (s)
1,31E-01	1,38E+00
4,26E-01	1,35E-01
5,06E-01	3,67E-02
1,72E-01	5,83E-03
8,20E-02	4,05E-04

PFC Switch Characteristics

figure 15.	IGBT

Safe operating area

I_C = f(V_{CE})



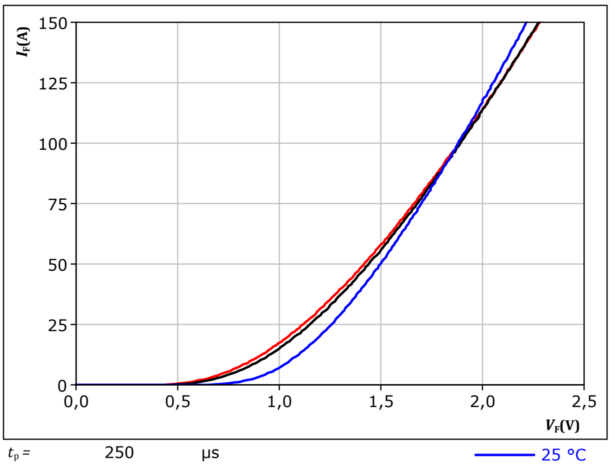
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

PFC Diode Characteristics

figure 16. **FWD**

Typical forward characteristics

I_F = f(V_F)



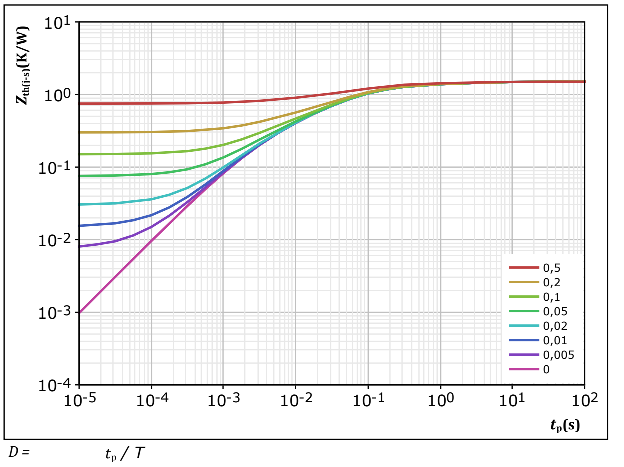
t_p = 250 µs

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

$R_{th(j-s)}$ = 1,501 K/W

FWD thermal model values

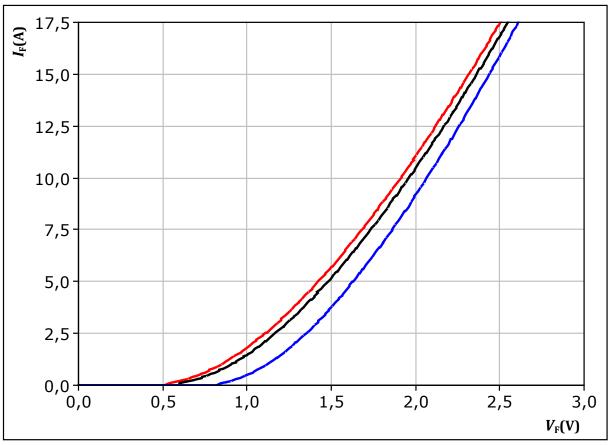
R (K/W)	τ (s)
1,03E-01	4,73E+00
2,05E-01	5,53E-01
6,39E-01	8,31E-02
3,39E-01	2,02E-02
1,71E-01	4,42E-03
4,45E-02	1,30E-03

PFC Sw. Inverse Diode Characteristics

figure 18. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



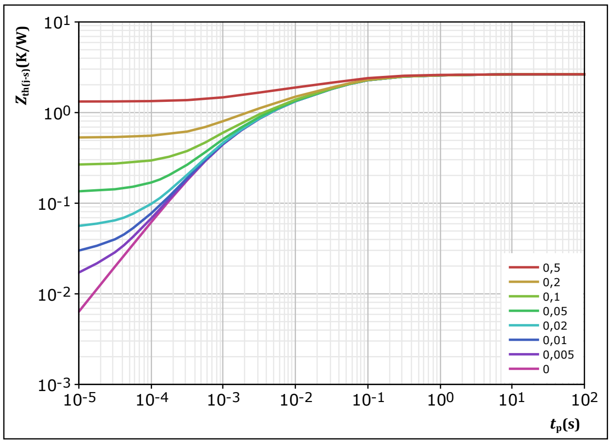
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 19. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 2,646 K/W

FWD thermal model values

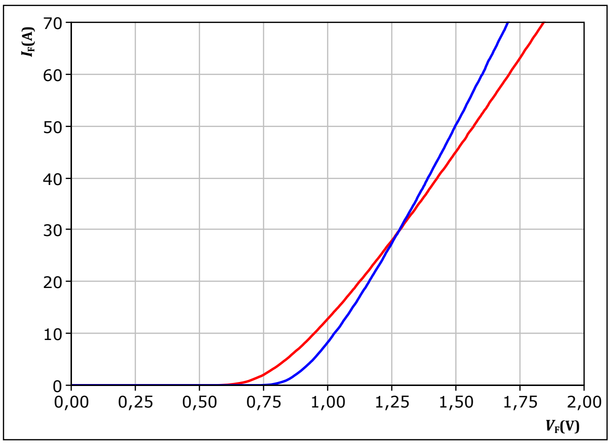
R (K/W)	τ (s)
1,02E-01	2,56E+00
3,50E-01	1,72E-01
9,53E-01	3,96E-02
7,66E-01	5,83E-03
4,76E-01	9,87E-04

Rectifier Diode Characteristics

figure 20. Rectifier

Typical forward characteristics

I_F = f(V_F)



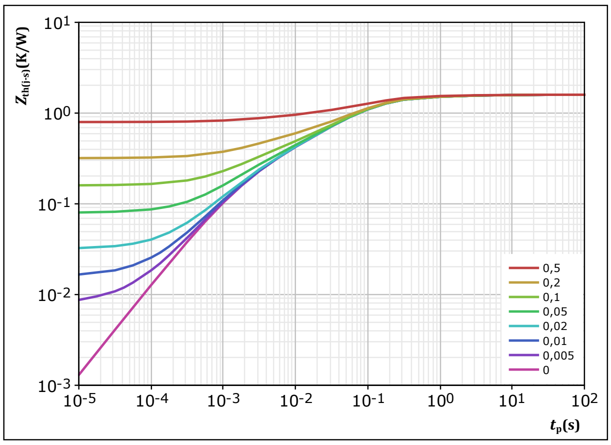
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 21. Rectifier

Transient thermal impedance as a function of pulse width

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



D = t_p / T

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

Rectifier thermal model values

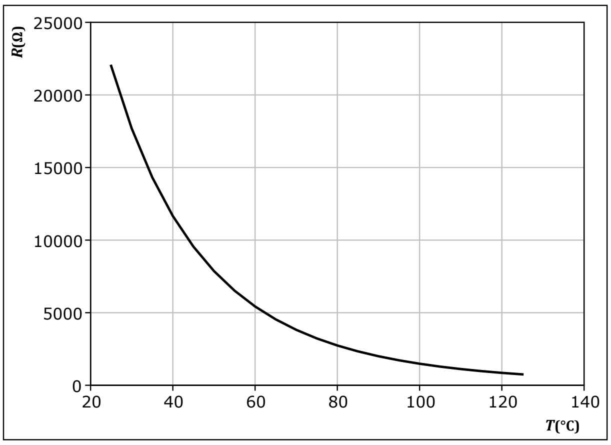
R (K/W)	τ (s)
3,44E-02	9,66E+00
1,12E-01	1,22E+00
5,81E-01	1,45E-01
4,89E-01	5,05E-02
2,38E-01	9,26E-03
1,22E-01	1,79E-03
1,81E-02	7,88E-04

Thermistor Characteristics

figure 22.	Thermistor

Typical NTC characteristic as function of temperature

R_T = f(T)

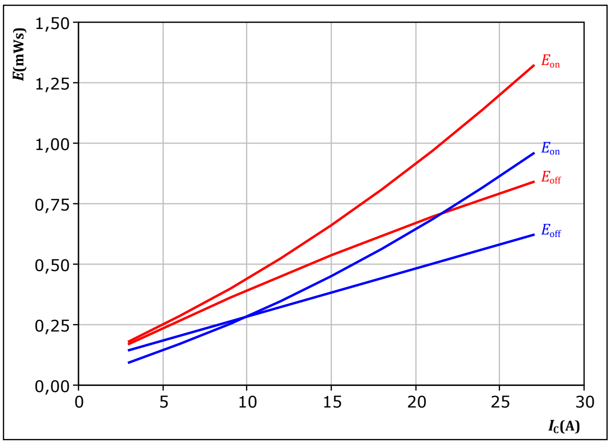


Inverter Switching Characteristics

figure 23. **IGBT**

Typical switching energy losses as a function of collector current

E = f(I_C)



With an inductive load at

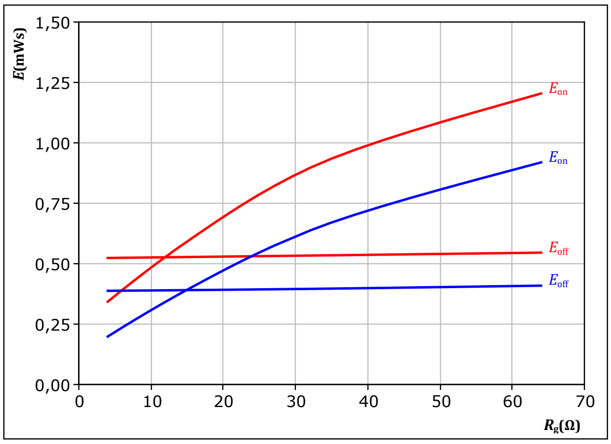
T_j: 25 °C (blue), 125 °C (red)

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

figure 24. **IGBT**

Typical switching energy losses as a function of IGBT turn on gate resistor

E = f(R_g)



With an inductive load at

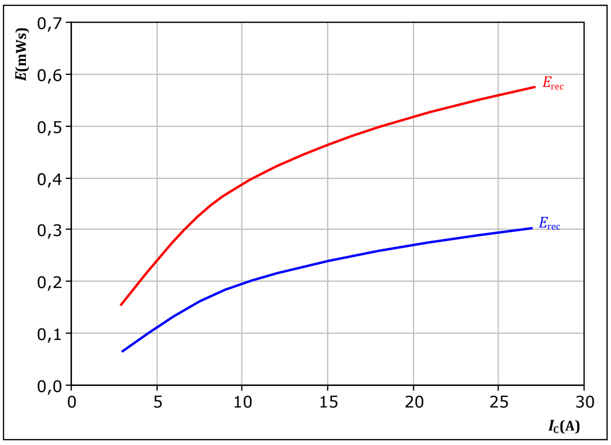
T_j: 25 °C (blue), 125 °C (red)

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

figure 25. **FWD**

Typical reverse recovered energy loss as a function of collector current

E_{rec} = f(I_C)



With an inductive load at

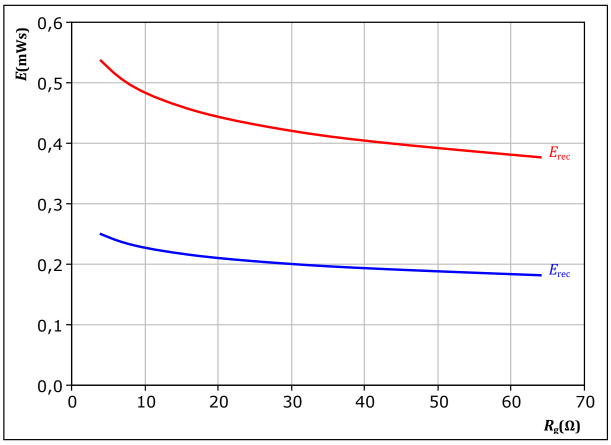
T_j: 25 °C (blue), 125 °C (red)

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

figure 26. **FWD**

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor

E_{rec} = f(R_g)



With an inductive load at

T_j: 25 °C (blue), 125 °C (red)

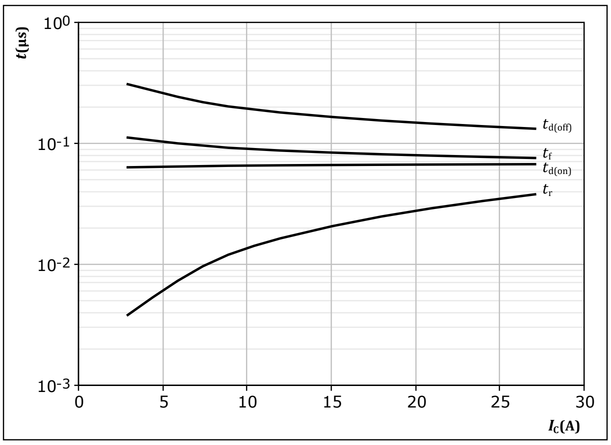
V_{CE} =	400	V
V_{GE} =	±15	V
I_C =	15	A

Inverter Switching Characteristics

figure 27. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



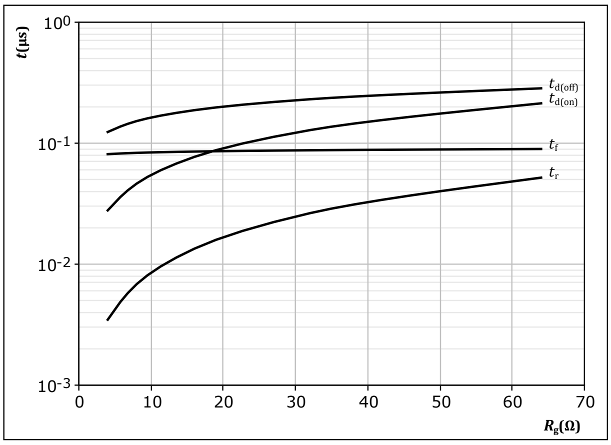
With an inductive load at

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

figure 28. **IGBT**

Typical switching times as a function of IGBT turn on gate resistor

t = f(R_g)



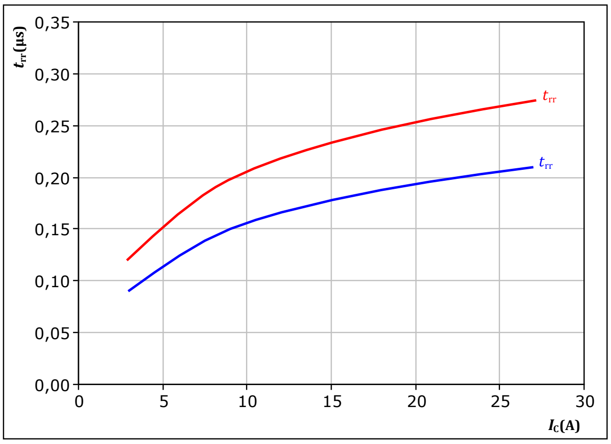
With an inductive load at

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

figure 29. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

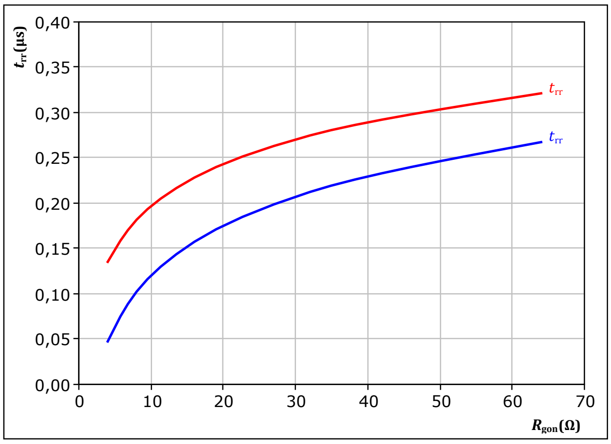
V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

T_j: 25 °C (blue), 125 °C (red)

figure 30. **FWD**

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

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



With an inductive load at

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

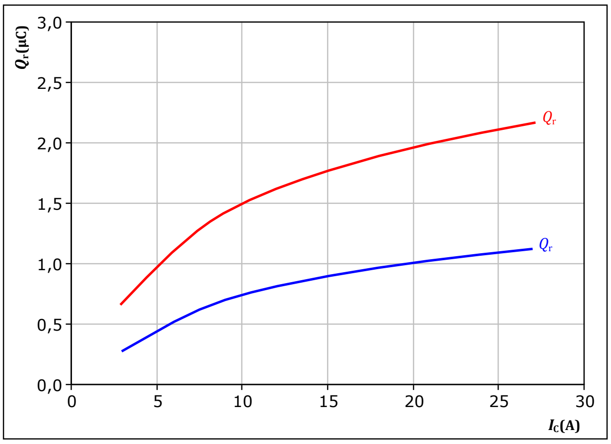
T_j: 25 °C (blue), 125 °C (red)

Inverter Switching Characteristics

figure 31. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



With an inductive load at

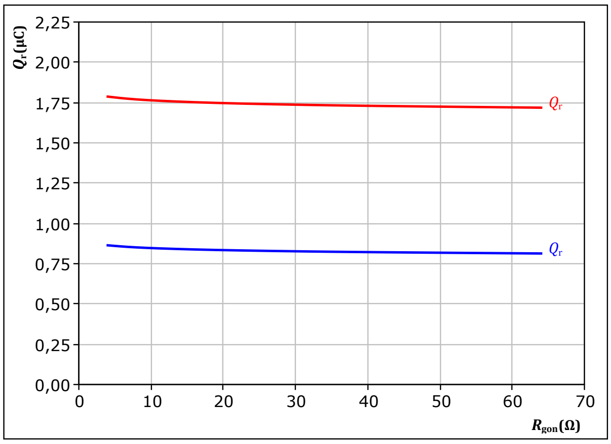
V_{CE} =	400	V	
V_{GE} =	±15	V	
R_{gon} =	16	Ω	

T_j: 25 °C / 125 °C

figure 32. **FWD**

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

Q_r = f(R_{gon})



With an inductive load at

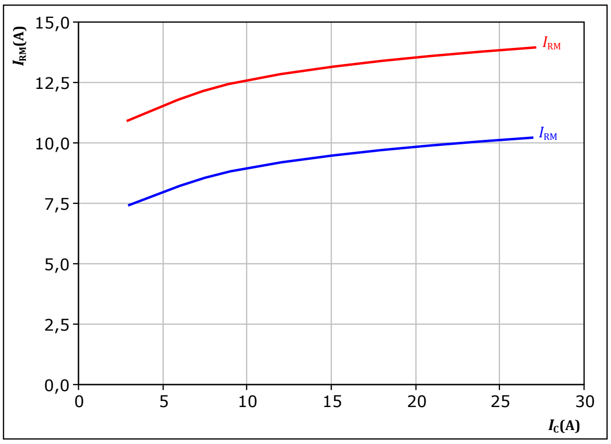
V_{CE} =	400	V
V_{GE} =	±15	V
I_C =	15	A

T_j: 25 °C / 125 °C

figure 33. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



With an inductive load at

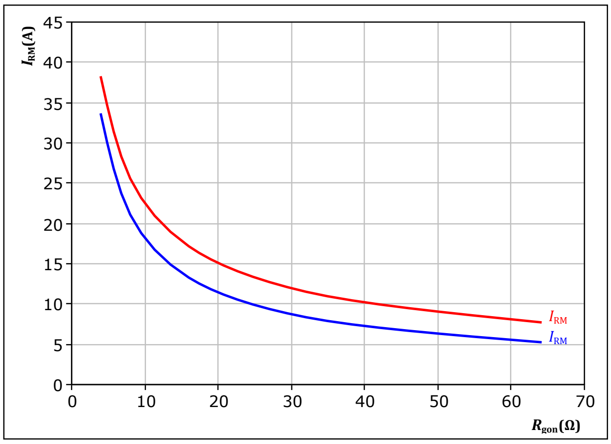
V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

T_j: 25 °C / 125 °C

figure 34. **FWD**

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

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



With an inductive load at

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

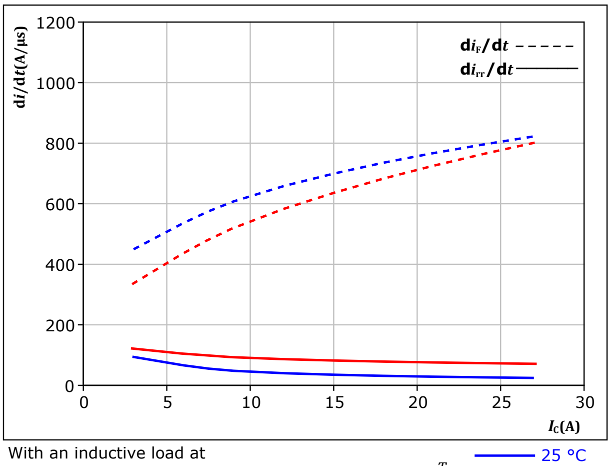
T_j: 25 °C / 125 °C

Inverter Switching Characteristics

figure 35. **FWD**

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

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



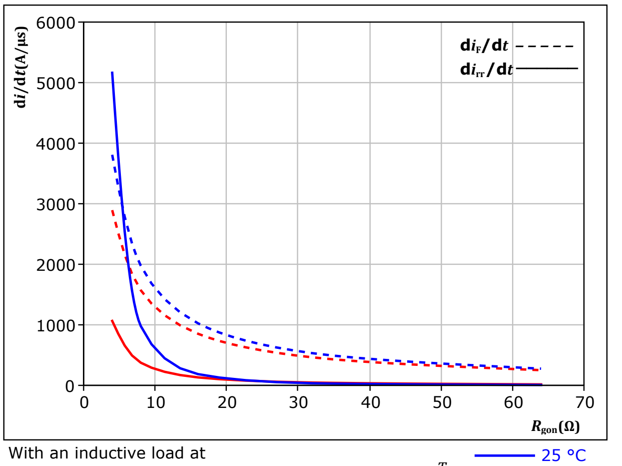
With an inductive load at

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

figure 36. **FWD**

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

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



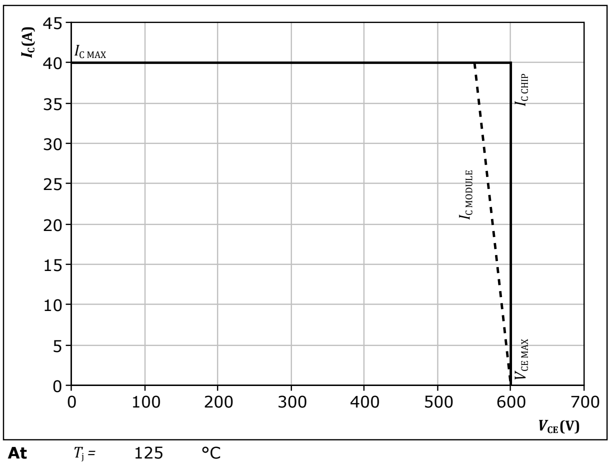
With an inductive load at

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

figure 37. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



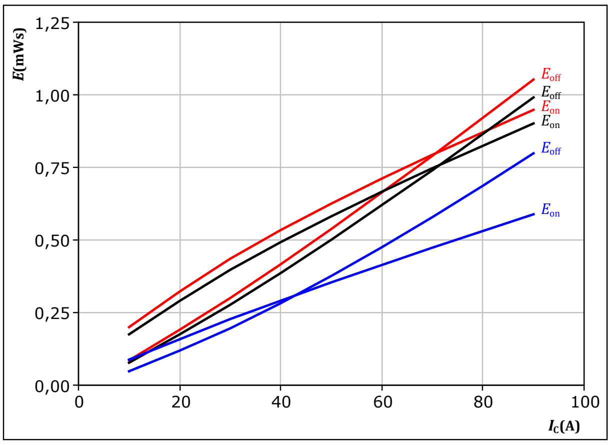
At	T_j =	125	°C
	R_{gon} =	16	Ω
	R_{goff} =	16	Ω

PFC Switching Characteristics

figure 38. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



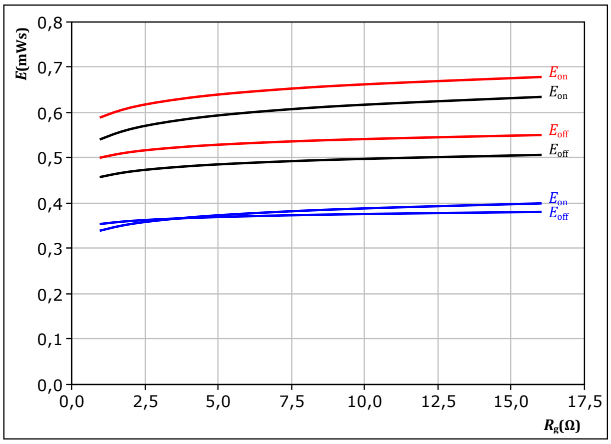
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		150 °C
R_{goff} =	4	Ω		

figure 39. **IGBT**

Typical switching energy losses as a function of IGBT turn on gate resistor

$E = f(R_g)$



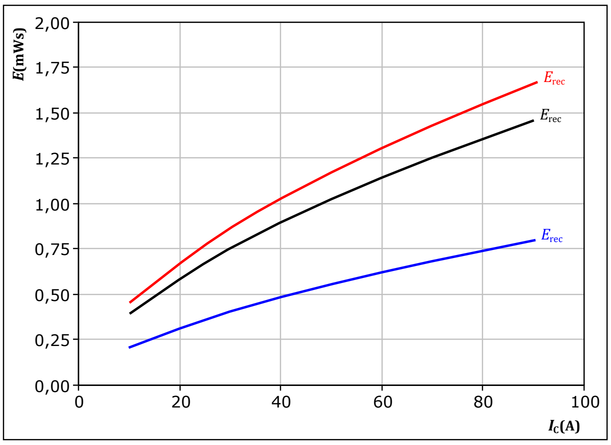
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	50	A		150 °C

figure 40. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



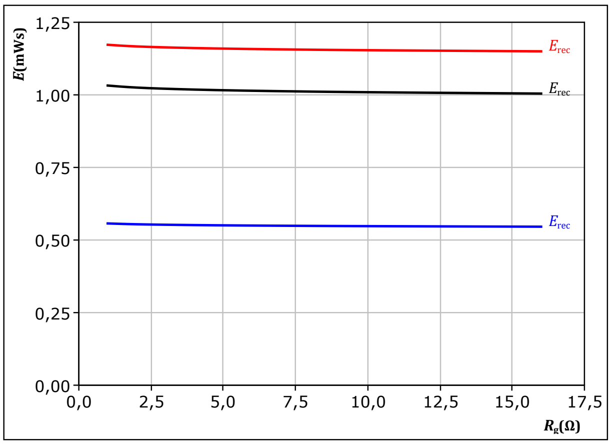
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 41. **FWD**

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

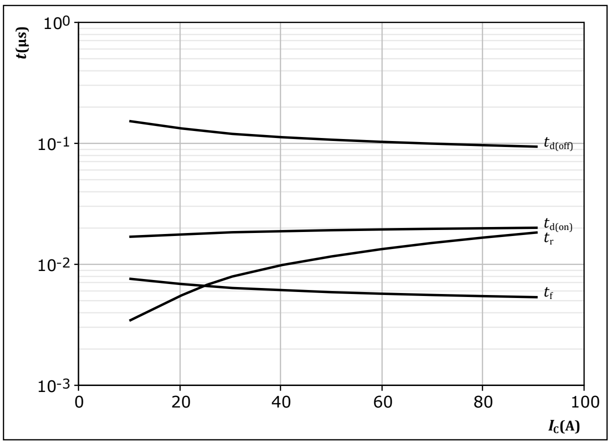
V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	50	A		150 °C

PFC Switching Characteristics

figure 42. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



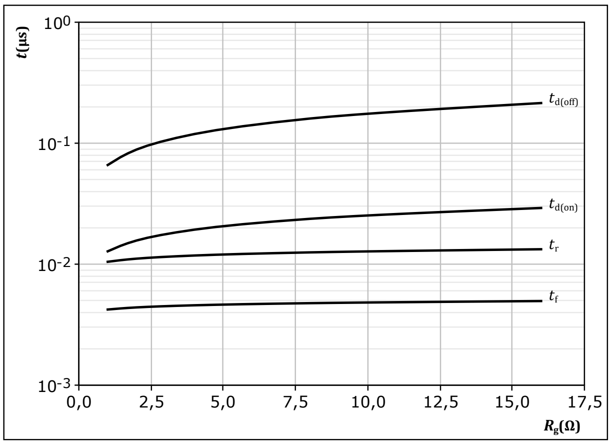
With an inductive load at

T_j =	150	°C
V_{CE} =	400	V
V_{GE} =	0/15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 43. **IGBT**

Typical switching times as a function of IGBT turn on gate resistor

t = f(R_g)



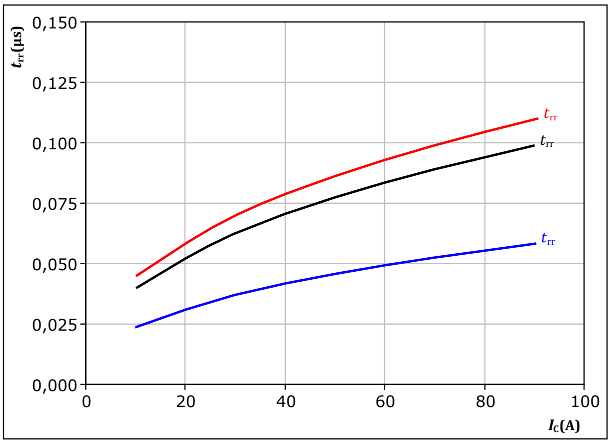
With an inductive load at

T_j =	150	°C
V_{CE} =	400	V
V_{GE} =	0/15	V
I_C =	50	A

figure 44. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

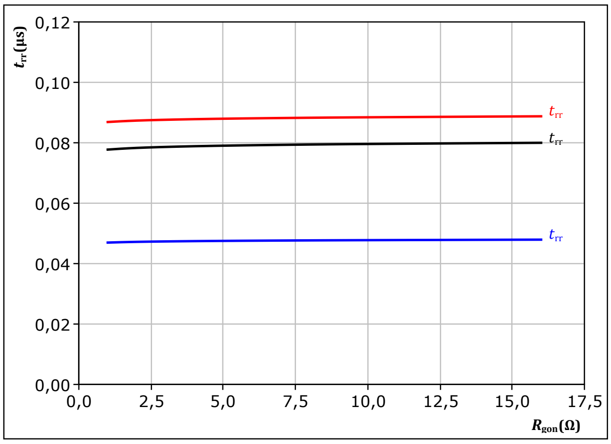
V_{CE} =	400	V
V_{GE} =	0/15	V
R_{gon} =	4	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 45. **FWD**

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

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



With an inductive load at

V_{CE} =	400	V
V_{GE} =	0/15	V
I_C =	50	A

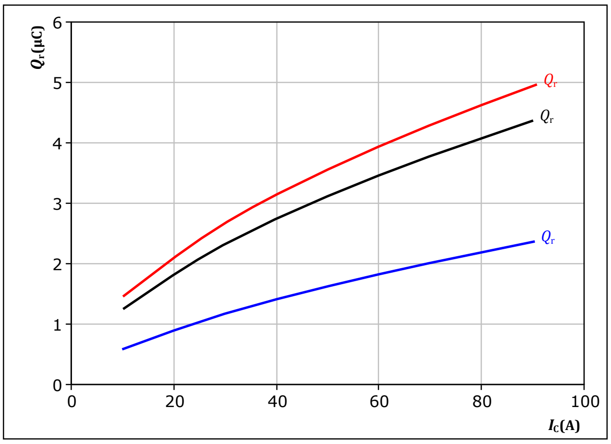
T_j: 25 °C, 125 °C, 150 °C

PFC Switching Characteristics

figure 46. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



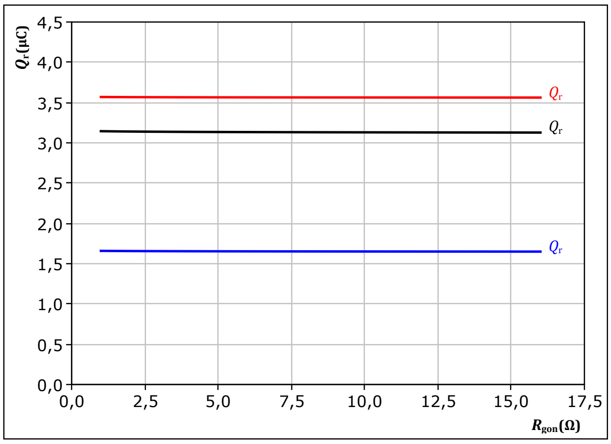
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 47. **FWD**

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

Q_r = f(R_{gon})



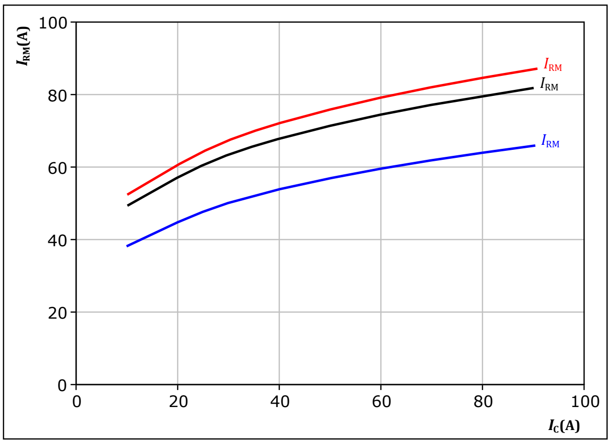
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	50	A		150 °C

figure 48. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



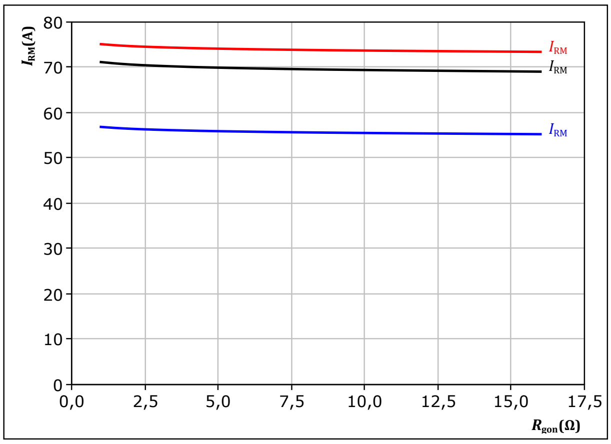
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 49. **FWD**

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

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



With an inductive load at

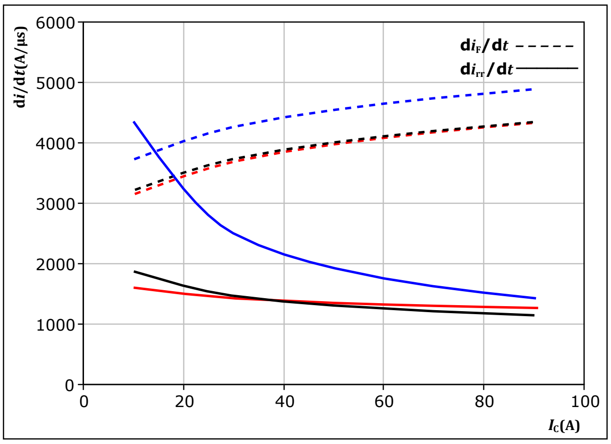
V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	50	A		150 °C

PFC Switching Characteristics

figure 50. **FWD**

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

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



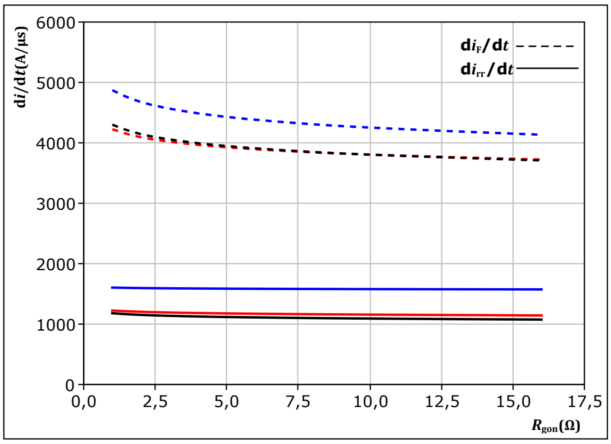
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 51. **FWD**

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

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



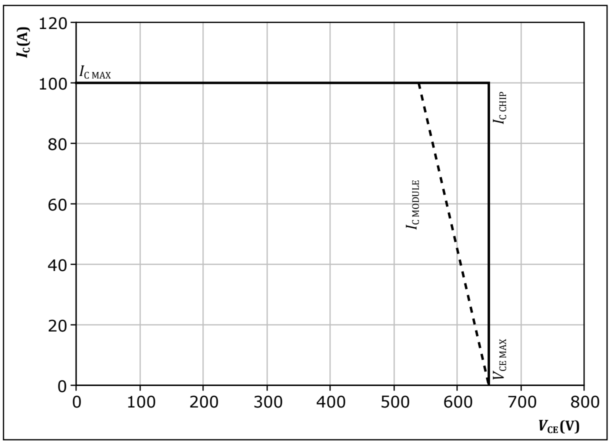
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	50	A		150 °C

figure 52. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At	T_j =	150	°C
	R_{gon} =	4	Ω
	R_{goff} =	4	Ω

Switching Definitions

figure 53. **IGBT**

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

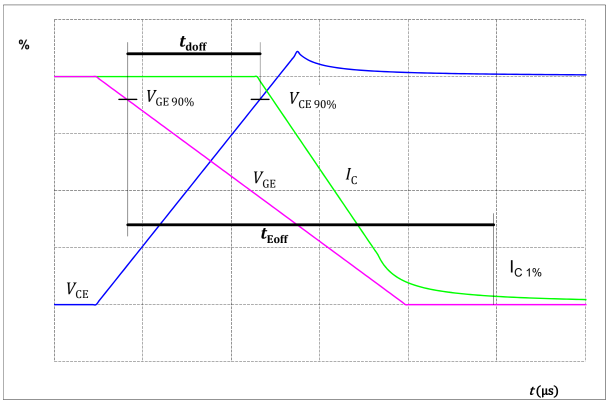


figure 54. **IGBT**

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

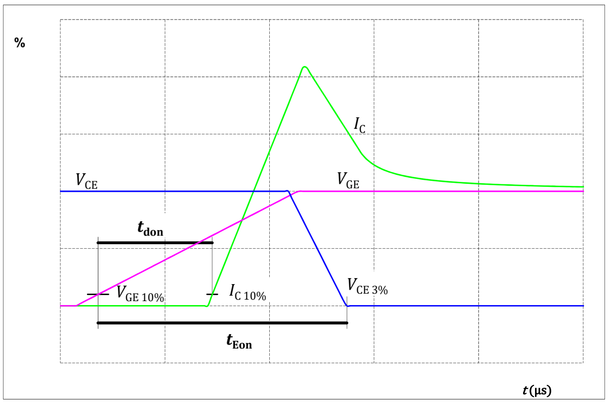


figure 55. **IGBT**

Turn-off Switching Waveforms & definition of t_f

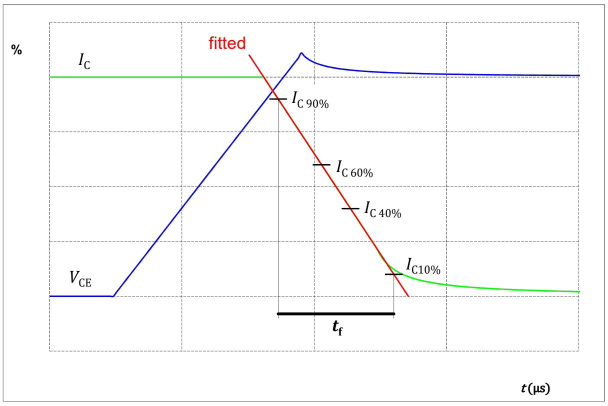
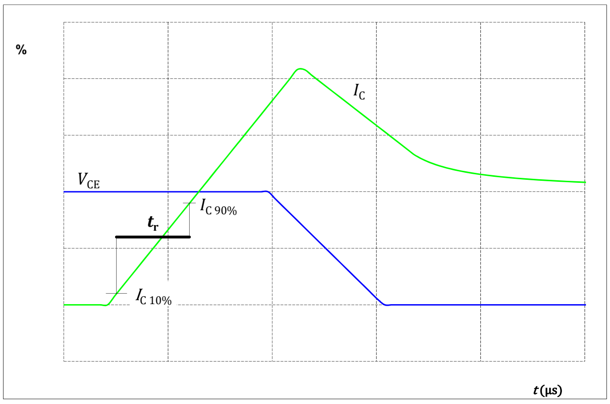


figure 56. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Switching Definitions

figure 57.	FWD

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

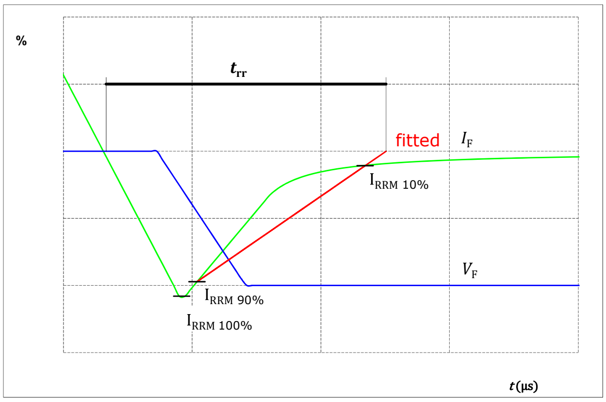
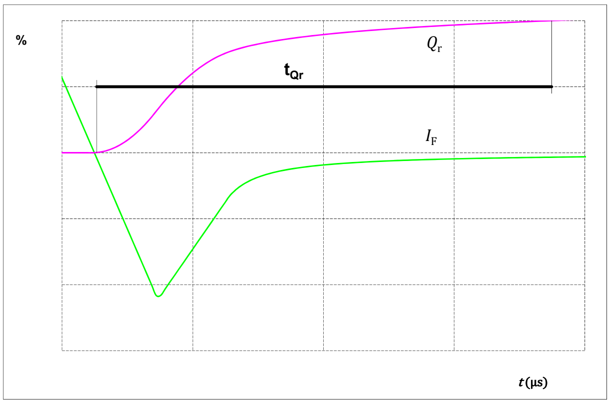


figure 58.	FWD

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



Ordering Code

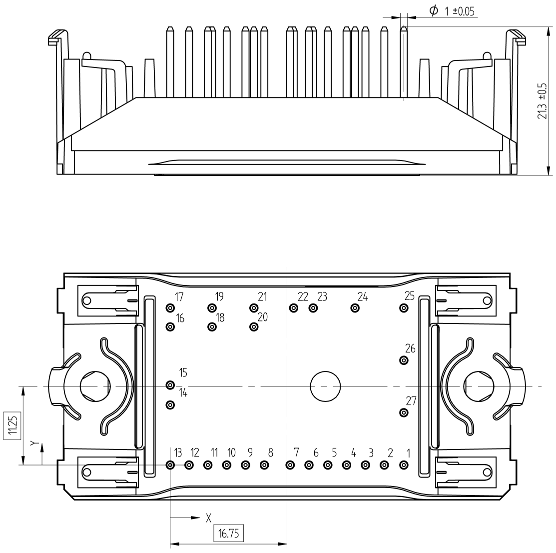
Version	Ordering Code
Without thermal paste	10-F006PPA020SB02-M685B30
With thermal paste (5,2 W/mK, PTM6000HV)	10-F006PPA020SB02-M685B30-/7/
With thermal paste (3,4 W/mK, PSX-P7)	10-F006PPA020SB02-M685B30-/3/

Marking

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

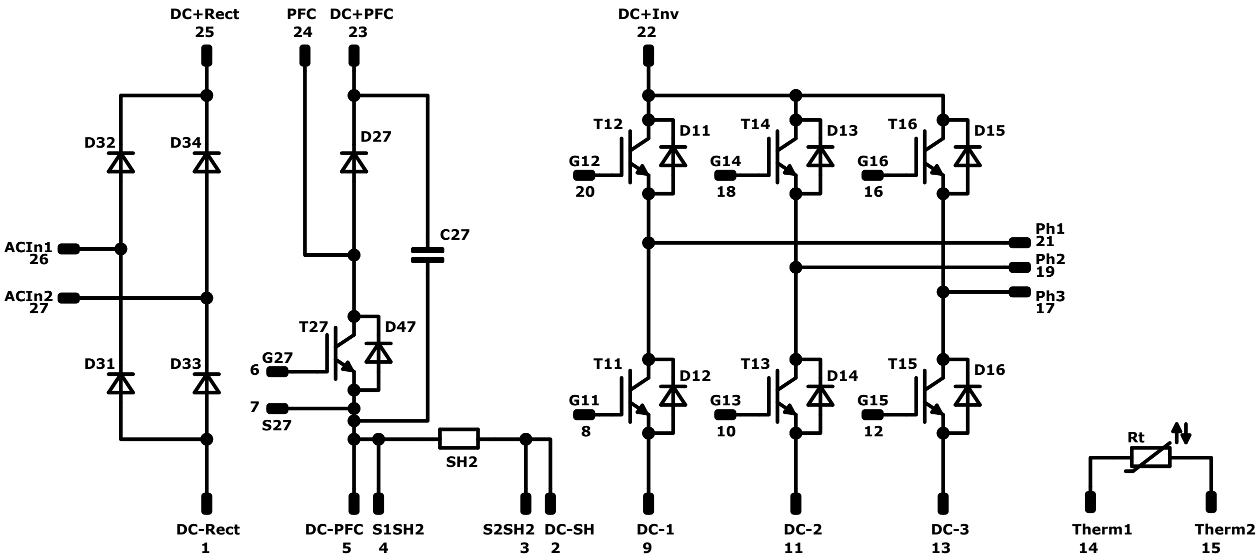
Outline

Pin table [mm]			
Pin	X	Y	Function
1	33,5	0	DC-Rect
2	30,7	0	DC-SH
3	28	0	S2SH2
4	25,3	0	S1SH2
5	22,6	0	DC-PFC
6	19,9	0	G27
7	17,2	0	S27
8	13,5	0	G11
9	10,8	0	DC-1
10	8,1	0	G13
11	5,4	0	DC-2
12	2,7	0	G15
13	0	0	DC-3
14	0	8,6	Therm1
15	0	11,45	Therm2
16	0	19,8	G16
17	0	22,5	Ph3
18	6	19,8	G14
19	6	22,5	Ph2
20	12	19,8	G12
21	12	22,5	Ph1
22	17,7	22,5	DC+INV
23	20,5	22,5	DC+PFC
24	26,5	22,5	PFC
25	33,5	22,5	DC+Rect
26	33,5	15	ACIn1
27	33,5	7,5	ACIn2



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
T11, T12, T13, T14, T15, T16	IGBT	600 V	20 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	600 V	30 A	Inverter Diode	
T27	IGBT	650 V	50 A	PFC Switch	
D27	FWD	650 V	50 A	PFC Diode	
D47	FWD	650 V	6 A	PFC Sw. Inverse Diode	
D31, D32, D33, D34	Rectifier	1600 V	25 A	Rectifier Diode	
SH2	Shunt			PFC Shunt	
C27	Capacitor	500 V		Capacitor (PFC)	
Rt	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 UL 1557 recognized under E192116 up to a junction temperature under switching condition $T_{j,op}$=175°C and up to 3500VAC/1min isolation voltage. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
10-F006PPA020SB02-M685B30-D3-14	14 Mar. 2024	Add alternative rectifier source	