



Vincotech

10-P006PPA010SB04-M683B30Y
datasheet

flowPIM 0 + PFC

600 V / 10 A

Features

- Clip in PCB mounting
- Trench Fieldstop IGBT's for low saturation losses
- High speed IGBT in the PFC circuit
- Integrated NTC

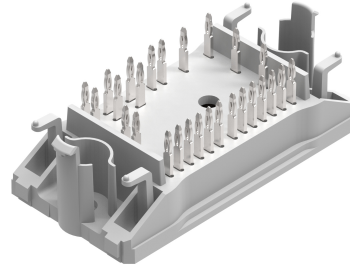
Target applications

- Embedded Drives
- Industrial Drives

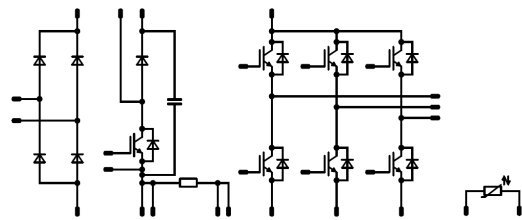
Types

- 10-P006PPA010SB04-M683B30Y

flow 0 17 mm housing



Schematic





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Maximum Ratings

$T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		600	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	14	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	44	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$, $V_{CC} = 360\text{ V}$ $T_j = 150\text{ °C}$	6	μs
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

Inverter Diode

Peak repetitive reverse voltage	V_{RRM}		600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	14	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	32	W
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

PFC Switch

Collector-emitter voltage	V_{CES}		650	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	30	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	90	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	71	W
Gate-emitter voltage	V_{GES}		± 20	V
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$



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Maximum Ratings

$T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
PFC Diode				
Peak repetitive reverse voltage	V_{RRM}		650	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	28	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	47	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	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	8	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	12	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	36	W
Maximum junction temperature	T_{jmax}		175	°C

Rectifier Diode

Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	33	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	200	A
Surge current capability	I^2t		200	A ² s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	44	W
Maximum junction temperature	T_{jmax}		150	°C

Shunt

DC current	I	$T_c = 70\text{ °C}$	22	A
Power dissipation	P_{tot}	$T_c = 70\text{ °C}$	5	W
Operation Temperature	T_{op}		-55 ... 170	°C



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Maximum Ratings

$T_j = 25\text{ °C}$, 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* $t_p = 2\text{ s}$	6000	V
Isolation voltage	V_{isol}	AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			>12,7	mm
Clearance			>12,7	mm
Comparative Tracking Index	CTI		≥ 200	

*100 % tested in production



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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 Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00015	25	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		10	25 125	1,1	1,59 1,78	1,9 ⁽¹⁾	V
Collector-emitter cut-off current	I_{CES}		0	600		25			0,6	μA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}							551		pF
Output capacitance	C_{oes}	$f = 1$ Mhz	0	25		25		40		pF
Reverse transfer capacitance	C_{res}							17		pF

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						2,15		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 32$ Ω $R_{goff} = 32$ Ω	±15	400	10	25		75,2		ns
Rise time	t_r					125		74,4		ns
Turn-off delay time	$t_{d(off)}$					25		136		ns
Fall time	t_f					125		158,8		ns
Turn-on energy (per pulse)	E_{on}					25		83,29		mWs
						125		123,18		mWs
Turn-off energy (per pulse)	E_{off}					25		0,33		mWs
		125		0,449		mWs				



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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				10	25 125	1,25	1,58 1,52	1,95 ⁽¹⁾	V
Reverse leakage current	I_R	$V_i = 600$ V				25			27	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						2,99		K/W
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Dynamic

Peak recovery current	I_{RRM}	$di/dt=400$ A/μs $di/dt=467$ A/μs	±15	400	10	25		5,13		A
	125						6,56			
Reverse recovery time	t_{rr}					25		193,87		ns
	125						269,56			
Recovered charge	Q_r					25		0,466		μC
	125			0,896						
Reverse recovered energy	E_{rec}	25		0,132		mWs				
	125			0,255						
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$	25		21,2		A/μs				
	125			64,56						



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Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
		V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	

PFC Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0003	25	3,3	4	4,7	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		30	25 125		1,97 2,25	2,22 ⁽¹⁾	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}							2100		pF
Output capacitance	C_{oes}	$f = 1$ Mhz	0	25		25		45		pF
Reverse transfer capacitance	C_{res}							7,7		pF
Gate charge	Q_g	$V_{CC} = 520$ V	15		30	25		65		nC

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,34		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		18,08 17,6 18,56		ns
Rise time	t_r					25 125 150		7,2 8,48 8,8		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		86,72 104,16 108,8		ns
Fall time	t_f					25 125 150		1,89 3,49 6,23		ns
Turn-on energy (per pulse)	E_{on}	$Q_{tFWD} = 0,351$ μC $Q_{tFWD} = 0,731$ μC $Q_{tFWD} = 0,865$ μC				25 125 150		0,179 0,279 0,301		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,188 0,298 0,325		mWs



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Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
		V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max		

PFC Diode

Static

Forward voltage	V_F				30	25 125		1,74 1,74	2,22 ⁽¹⁾	V
Reverse leakage current	I_R	$V_i = 650$ V				25			1,6	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						2,02		K/W
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Dynamic

Peak recovery current	I_{RRM}	$di/dt=3505$ A/μs $di/dt=3215$ A/μs $di/dt=3136$ A/μs	0/15	400	30	25		30,69		A
Reverse recovery time	t_{rr}					125		39,38		
						150		42,06		
						25		18,88		
Recovered charge	Q_r					125		31,18		
						150		35,06		
		25		0,351						
Reverse recovered energy	E_{rec}	125		0,731						
		150		0,865						
		25		0,107						
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$	125		0,2						
		150		0,256						
		25		3437						
						125		2114		A/μs
						150		2125		



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Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
		V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	I_D [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 1,53	1,87 ⁽¹⁾	V
Reverse leakage current	I_R	$V_r = 650$ V				25			0,1	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						2,65		K/W
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Rectifier Diode

Static

Forward voltage	V_F				25	25 125		1,22 1,2		V
Reverse leakage current	I_R	$V_r = 1600$ V				25			50	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,59		K/W
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Shunt

Static

Resistance	R							10		mΩ
Tolerance							-1		1	%
Temperature coefficient	tc								30	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		k Ω
Deviation of R_{100}	$A_{R/R}$	$R_{100} = 1484 \Omega$				100	-5		5	%
Power dissipation	P							5		mW
Power dissipation constant	d					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ± 1 %						3962		K
B-value	$B_{(25/100)}$	Tol. ± 1 %						4000		K
Vincotech Thermistor Reference									I	

(1) Value at chip level

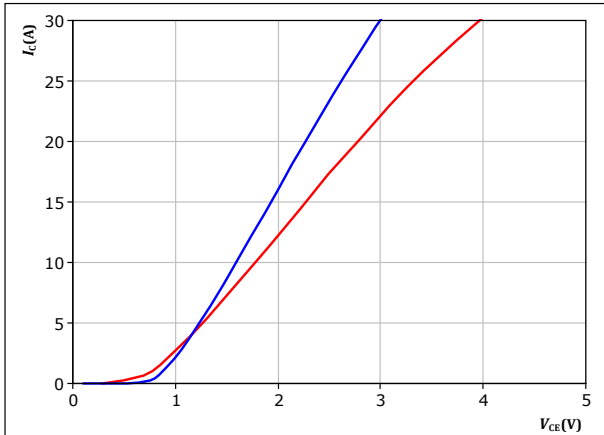
(2) Only valid with pre-applied Vincotech thermal interface material.



Inverter Switch Characteristics

figure 1. IGBT

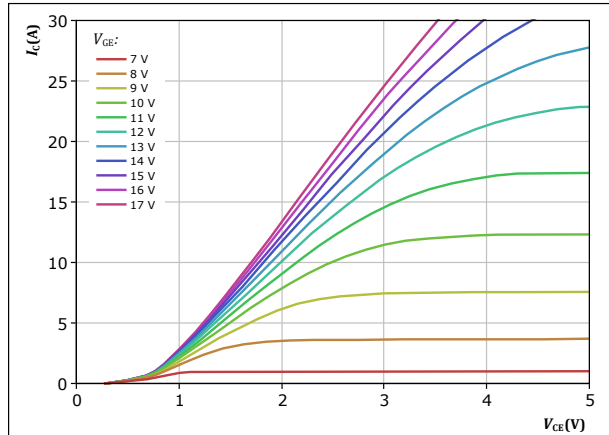
Typical output characteristics
 $I_C = f(V_{CE})$



$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 T_j : — 25 °C
— 125 °C

figure 2. IGBT

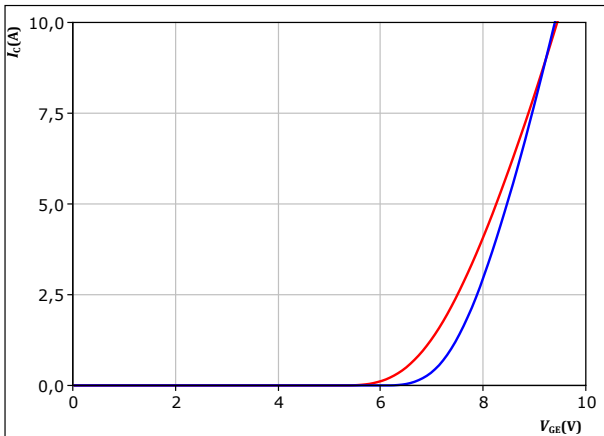
Typical output characteristics
 $I_C = f(V_{CE})$



$t_p = 250 \mu s$
 $T_j = 125 \text{ °C}$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

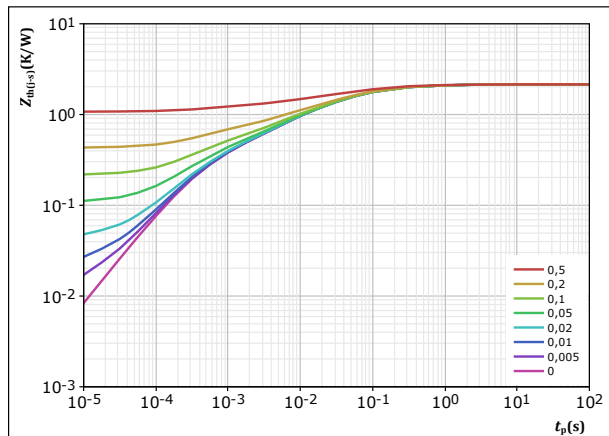
Typical transfer characteristics
 $I_C = f(V_{GE})$



$t_p = 250 \mu s$
 $V_{CE} = 10 V$
 T_j : — 25 °C
— 125 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width
 $Z_{th(j-s)} = f(t_p)$



$D = t_p / T$
 $R_{th(j-s)} = 2,149 \text{ K/W}$
IGBT thermal model values

R (K/W)	τ (s)
1,04E-01	1,37E+00
2,88E-01	2,01E-01
6,99E-01	5,27E-02
4,91E-01	1,22E-02
3,07E-01	2,97E-03
2,60E-01	3,80E-04



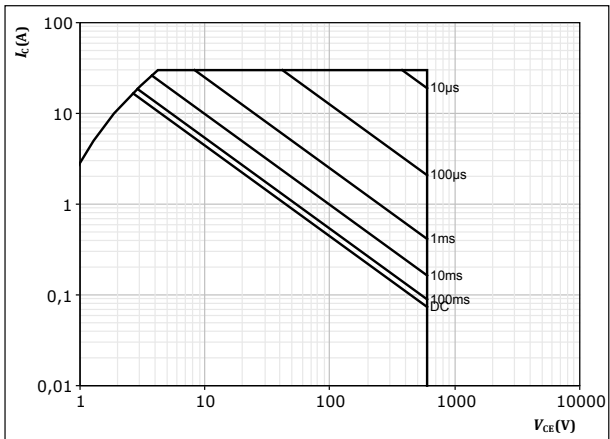
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Inverter Switch Characteristics

figure 5. IGBT

Safe operating area

$$I_C = f(V_{CE})$$



$D =$ single pulse

$T_s = 80$ °C

$V_{GE} = 15$ V

$T_j = T_{jmax}$



Inverter Diode Characteristics

figure 6. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

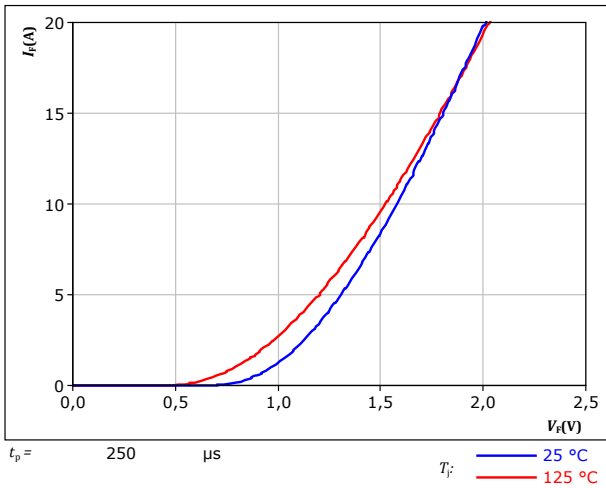
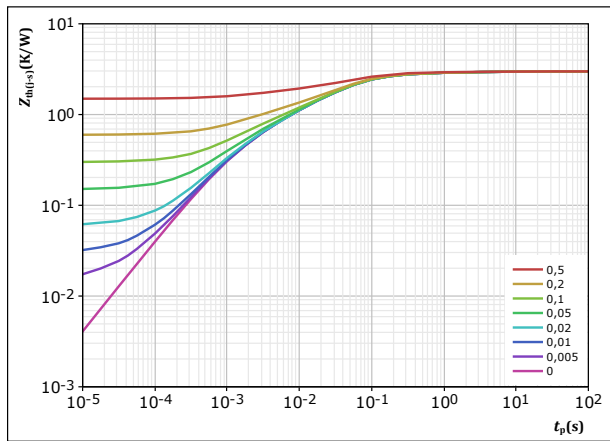


figure 7. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)} = 2,988 \text{ K/W}$

FWD thermal model values

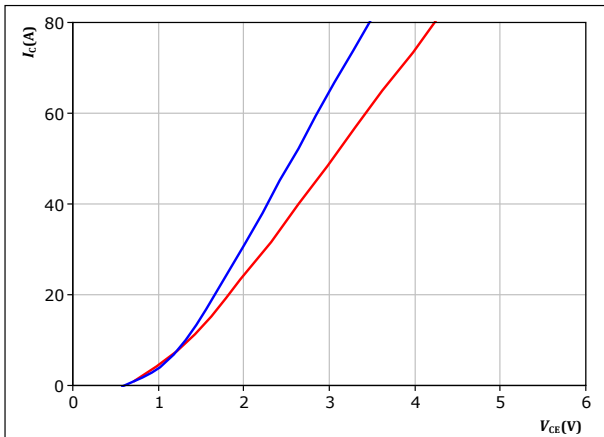
$R \text{ (K/W)}$	$\tau \text{ (s)}$
8,74E-02	5,59E+00
2,41E-01	4,60E-01
1,22E+00	6,53E-02
6,89E-01	2,20E-02
4,52E-01	5,14E-03
2,99E-01	1,11E-03



PFC Switch Characteristics

figure 8. IGBT

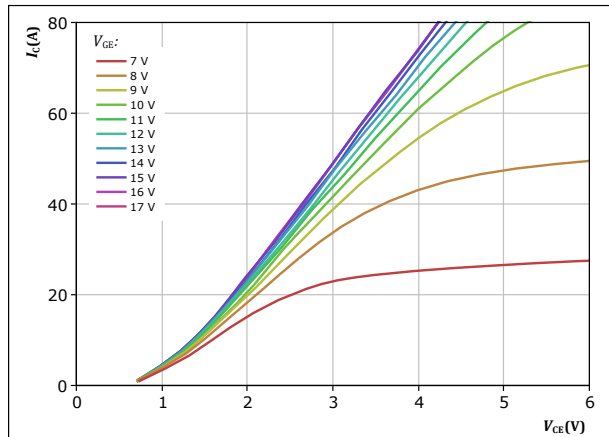
Typical output characteristics
 $I_C = f(V_{CE})$



$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j:$ — 25 °C
— 125 °C

figure 9. IGBT

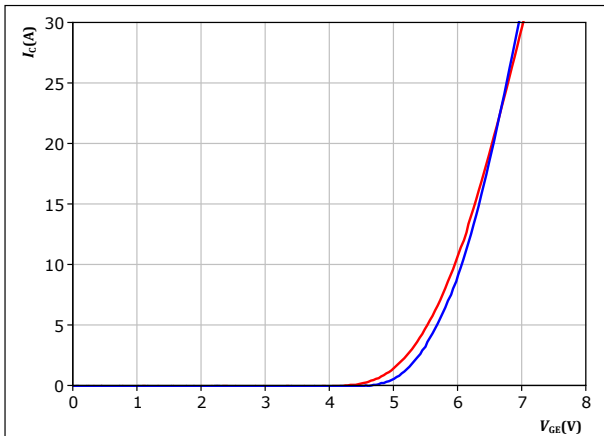
Typical output characteristics
 $I_C = f(V_{CE})$



$t_p = 250 \mu s$
 $T_j = 125 \text{ } ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 10. IGBT

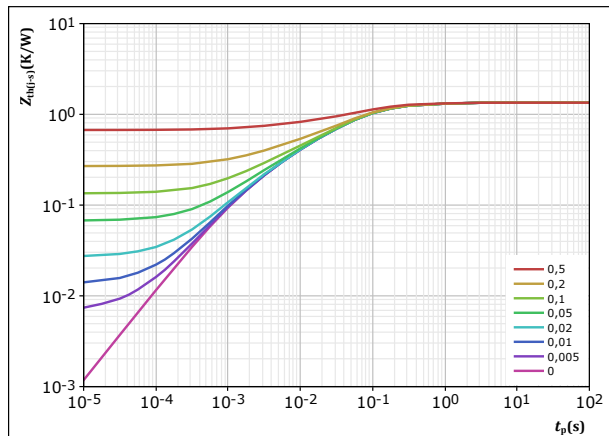
Typical transfer characteristics
 $I_C = f(V_{GE})$



$t_p = 250 \mu s$
 $V_{CE} = 10 V$
 $T_j:$ — 25 °C
— 125 °C

figure 11. IGBT

Transient thermal impedance as a function of pulse width
 $Z_{th(j-s)} = f(t_p)$



$D = t_p / T$
 $R_{th(j-s)} = 1,344 \text{ K/W}$
IGBT thermal model values

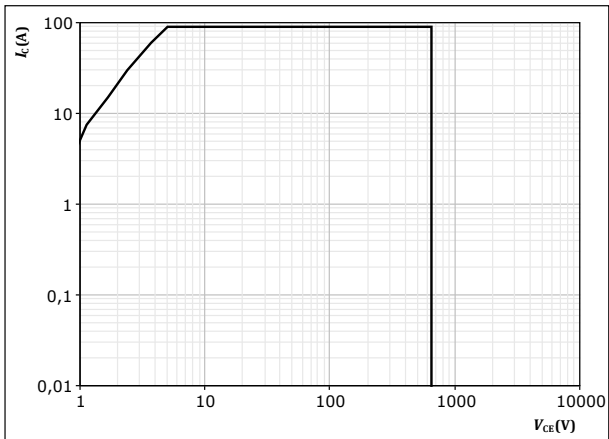
R (K/W)	τ (s)
1,09E-01	8,15E-01
4,65E-01	1,08E-01
4,65E-01	3,70E-02
2,22E-01	6,76E-03
8,42E-02	1,24E-03



PFC Switch Characteristics

figure 12. IGBT

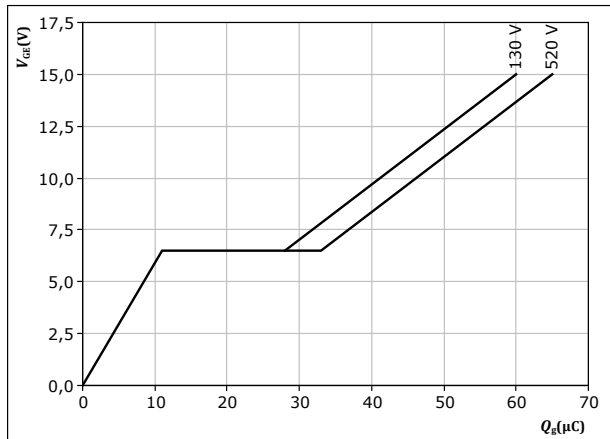
Safe operating area
 $I_C = f(V_{CE})$



$D =$ single pulse
 $T_s = 80 \text{ } ^\circ\text{C}$
 $V_{GE} = 15 \text{ V}$
 $T_j = T_{jmax}$

figure 13. IGBT

Gate voltage vs gate charge
 $V_{GE} = f(Q_g)$



$I_C = 30 \text{ A}$
 $T_j = 25 \text{ } ^\circ\text{C}$



PFC Diode Characteristics

figure 14. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

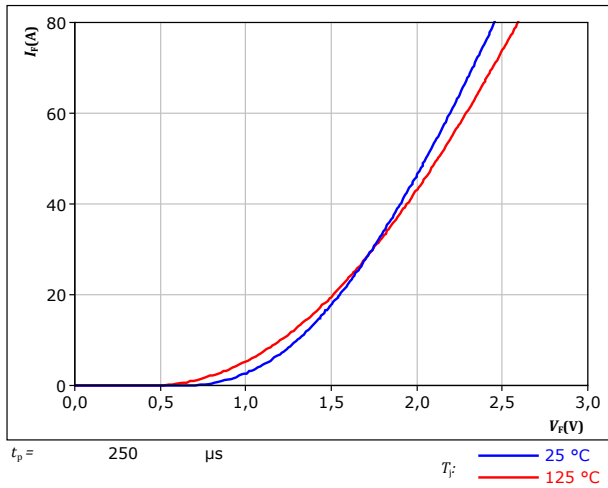
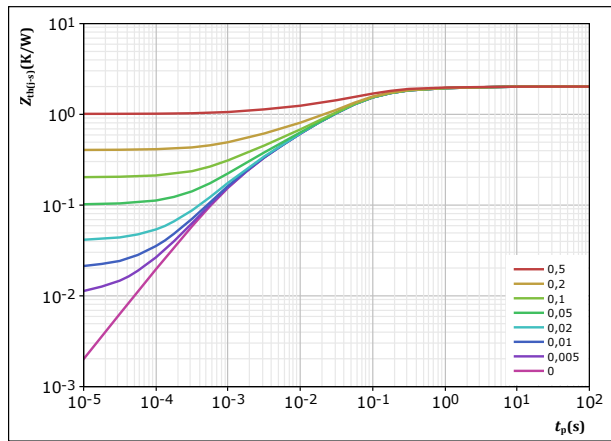


figure 15. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)} = 2,024 \text{ K/W}$

FWD thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
8,68E-02	3,48E+00
2,45E-01	3,50E-01
1,12E+00	6,11E-02
3,96E-01	9,10E-03
1,72E-01	1,24E-03



PFC Sw. Inverse Diode Characteristics

figure 16. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

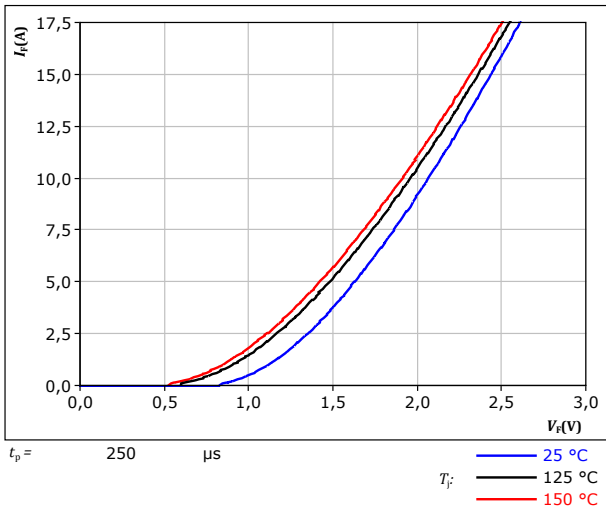
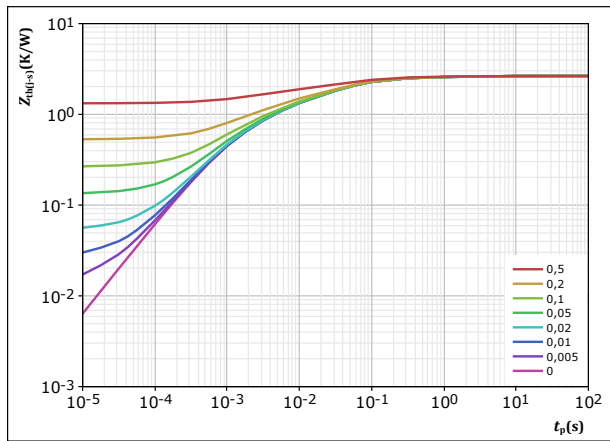


figure 17. FWD

Transient thermal impedance as a function of pulse width

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



$D = \frac{t_p}{T}$
 $R_{th(j-s)} = 2,646 \text{ K/W}$
 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 18. Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

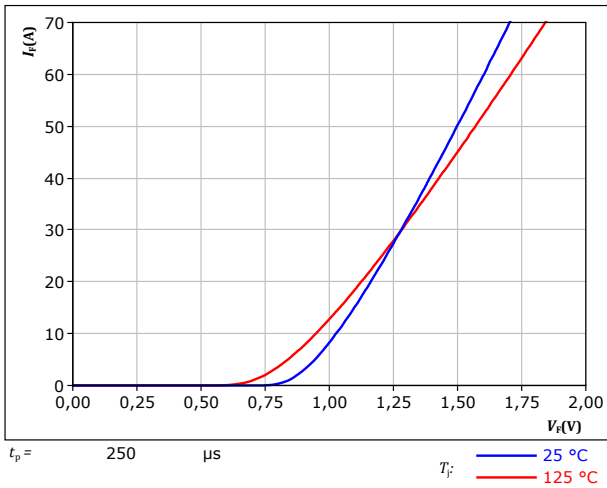
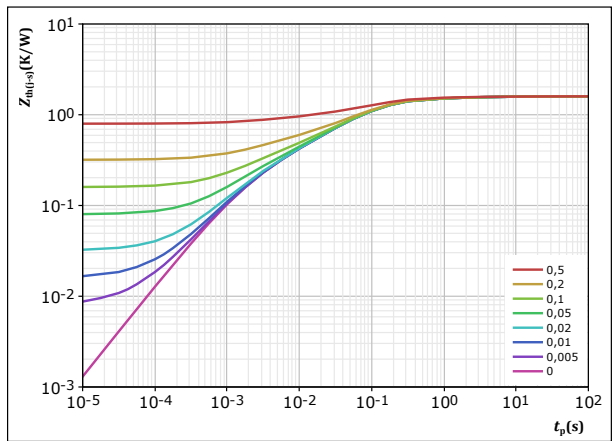


figure 19. Rectifier

Transient thermal impedance as a function of pulse width

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



$D = \frac{t_p}{T}$

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

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

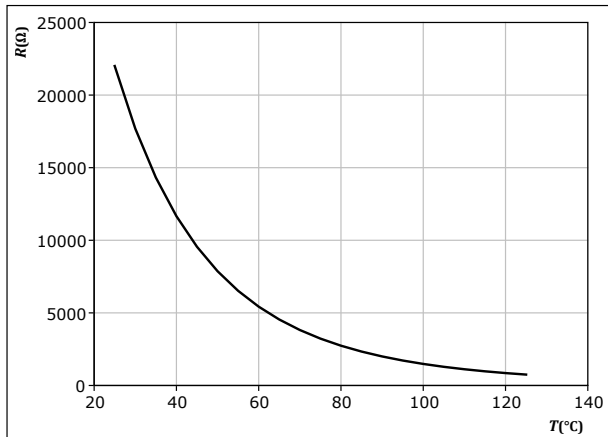


Thermistor Characteristics

figure 20. Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$

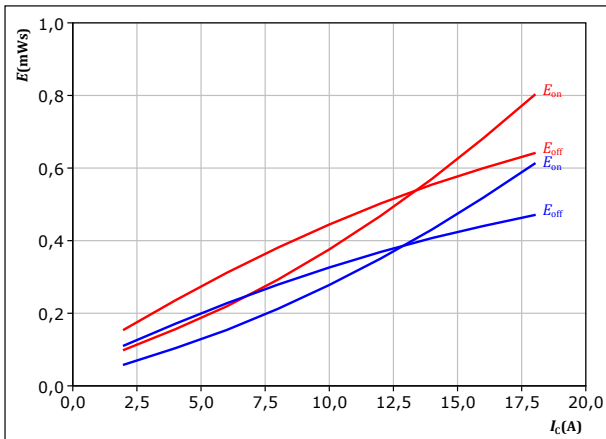




Inverter Switching Characteristics

figure 21. IGBT

Typical switching energy losses as a function of collector current
 $E = f(I_c)$



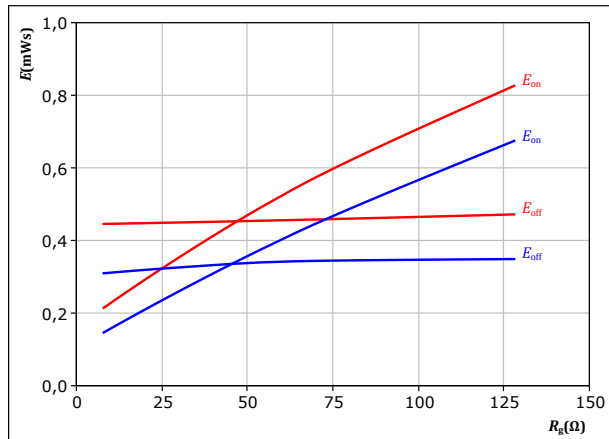
With an inductive load at

$V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω
 $R_{goff} = 32$ Ω

T_j : — 25 °C
 — 125 °C

figure 22. IGBT

Typical switching energy losses as a function of gate resistor
 $E = f(R_g)$



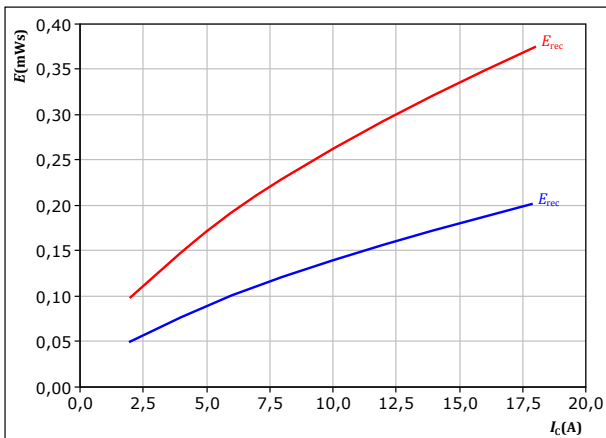
With an inductive load at

$V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $I_c = 10$ A

T_j : — 25 °C
 — 125 °C

figure 23. FWD

Typical reverse recovered energy loss as a function of collector current
 $E_{rec} = f(I_c)$



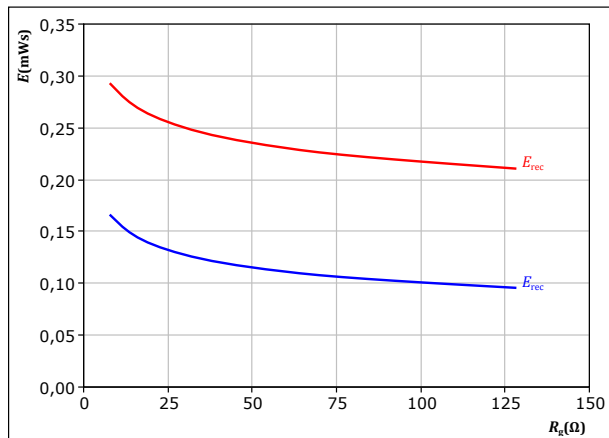
With an inductive load at

$V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω

T_j : — 25 °C
 — 125 °C

figure 24. FWD

Typical reverse recovered energy loss as a function of gate resistor
 $E_{rec} = f(R_g)$



With an inductive load at

$V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $I_c = 10$ A

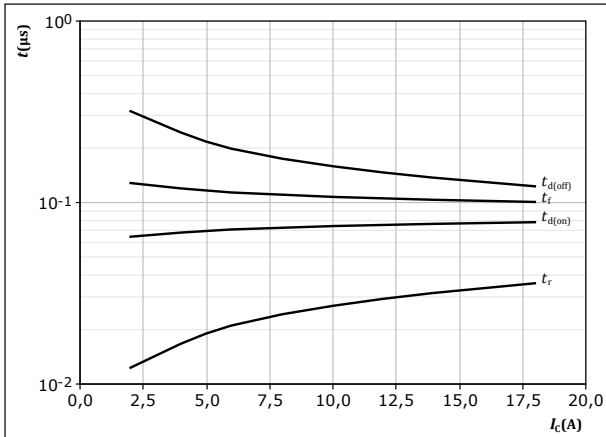
T_j : — 25 °C
 — 125 °C



Inverter Switching Characteristics

figure 25. IGBT

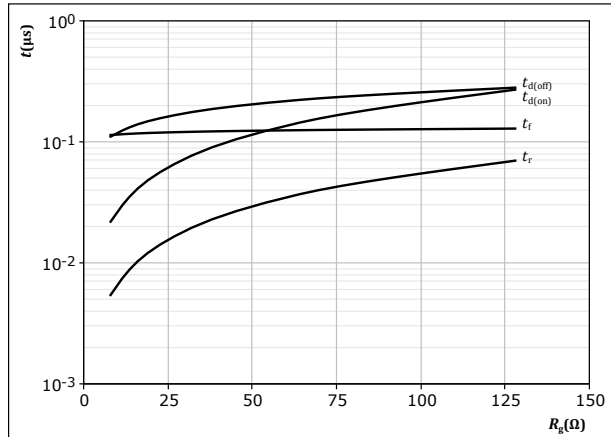
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 125 \text{ } ^\circ\text{C}$
 $V_{CE} = 400 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 32 \text{ } \Omega$
 $R_{goff} = 32 \text{ } \Omega$

figure 26. IGBT

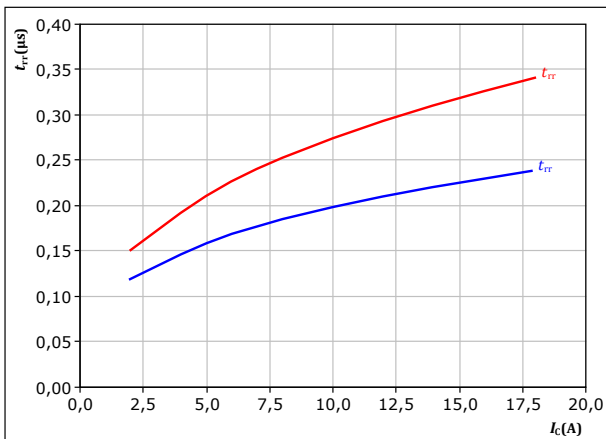
Typical switching times as a function of gate resistor
 $t = f(R_g)$



With an inductive load at
 $T_j = 125 \text{ } ^\circ\text{C}$
 $V_{CE} = 400 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 10 \text{ A}$

figure 27. FWD

Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$

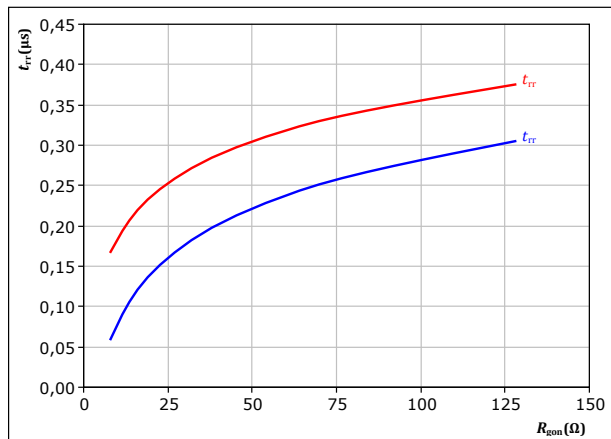


With an inductive load at
 $V_{CE} = 400 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 32 \text{ } \Omega$

T_j : — 25 $^\circ\text{C}$
 — 125 $^\circ\text{C}$

figure 28. FWD

Typical reverse recovery time as a function of IGBT turn on gate resistor
 $t_{rr} = f(R_{gon})$



With an inductive load at
 $V_{CE} = 400 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 10 \text{ A}$

T_j : — 25 $^\circ\text{C}$
 — 125 $^\circ\text{C}$

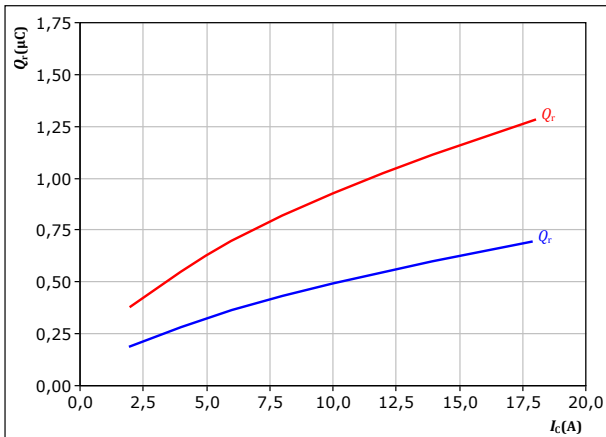


Inverter Switching Characteristics

figure 29. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

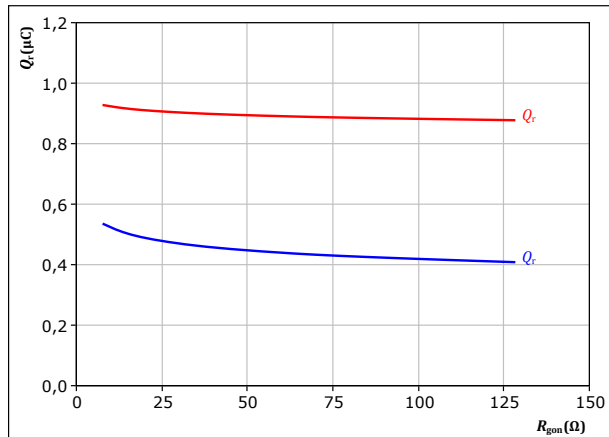
$V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω

T_j : — 25 °C
— 125 °C

figure 30. FWD

Typical recovered charge as a function of turn on gate resistor

$$Q_r = f(R_{gon})$$



With an inductive load at

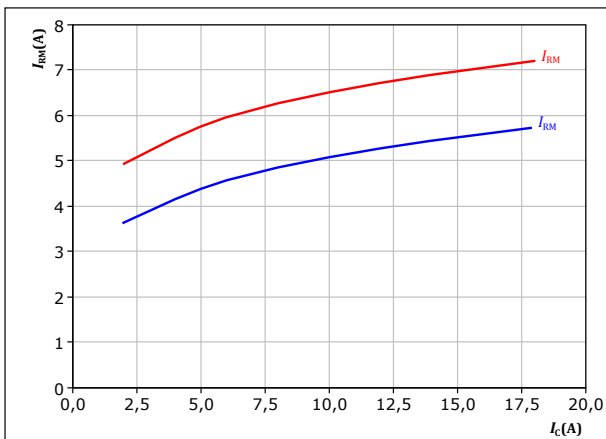
$V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $I_c = 10$ A

T_j : — 25 °C
— 125 °C

figure 31. FWD

Typical peak reverse recovery current as a function of collector current

$$I_{RM} = f(I_c)$$



With an inductive load at

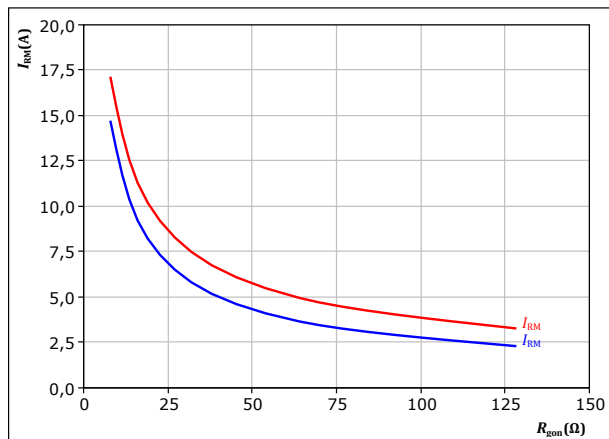
$V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω

T_j : — 25 °C
— 125 °C

figure 32. FWD

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

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



With an inductive load at

$V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $I_c = 10$ A

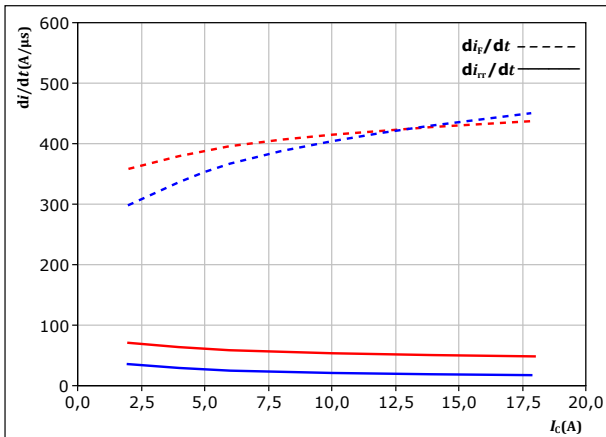
T_j : — 25 °C
— 125 °C



Inverter Switching Characteristics

figure 33. FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_{rr}/dt = f(I_c)$

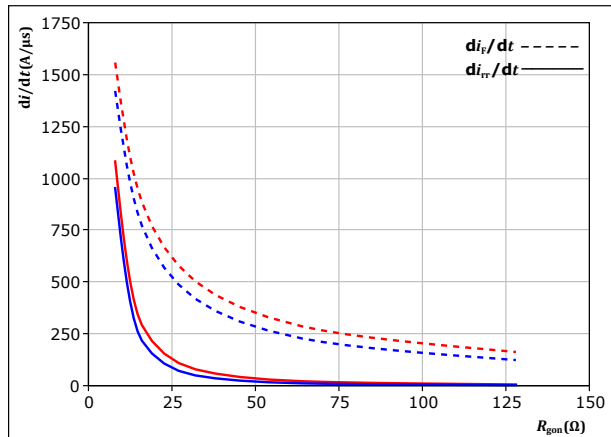


With an inductive load at
 $V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω

T_j : — 25 °C
 — 125 °C

figure 34. FWD

Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor
 $di_f/dt, di_{rr}/dt = f(R_{gon})$

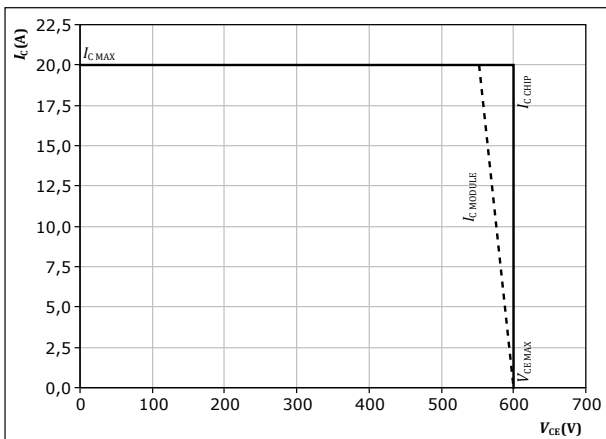


With an inductive load at
 $V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $I_c = 10$ A

T_j : — 25 °C
 — 125 °C

figure 35. IGBT

Reverse bias safe operating area
 $I_c = f(V_{CE})$



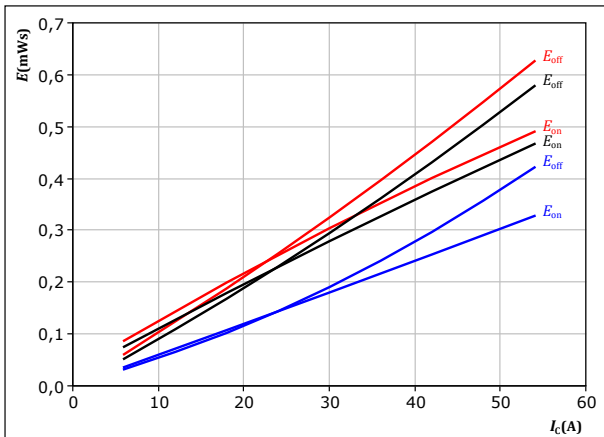
At $T_j = 125$ °C
 $R_{gon} = 32$ Ω
 $R_{goff} = 32$ Ω



PFC Switching Characteristics

figure 36. IGBT

Typical switching energy losses as a function of collector current
 $E = f(I_c)$

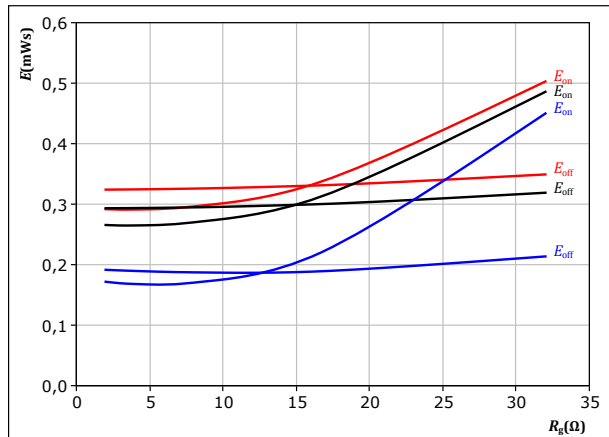


With an inductive load at

$V_{CE} = 400$ V	$T_j:$ 25 °C
$V_{GE} = 0/15$ V	125 °C
$R_{gon} = 8$ Ω	150 °C
$R_{goff} = 8$ Ω	

figure 37. IGBT

Typical switching energy losses as a function of gate resistor
 $E = f(R_g)$

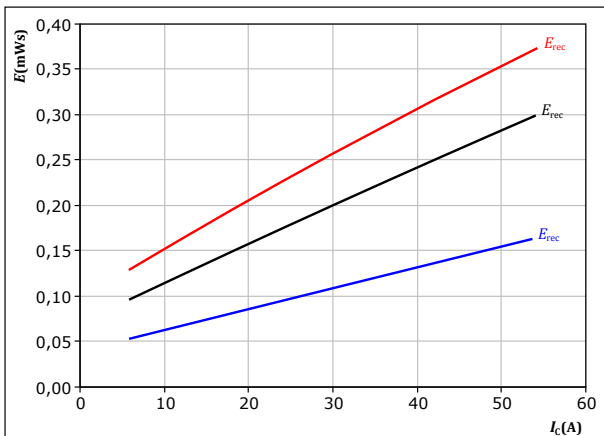


With an inductive load at

$V_{CE} = 400$ V	$T_j:$ 25 °C
$V_{GE} = 0/15$ V	125 °C
$I_c = 30$ A	150 °C

figure 38. FWD

Typical reverse recovered energy loss as a function of collector current
 $E_{rec} = f(I_c)$

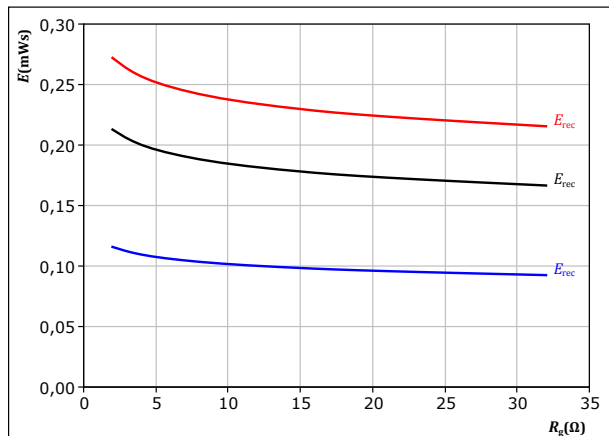


With an inductive load at

$V_{CE} = 400$ V	$T_j:$ 25 °C
$V_{GE} = 0/15$ V	125 °C
$R_{gon} = 8$ Ω	150 °C

figure 39. FWD

Typical reverse recovered energy loss as a function of gate resistor
 $E_{rec} = f(R_g)$



With an inductive load at

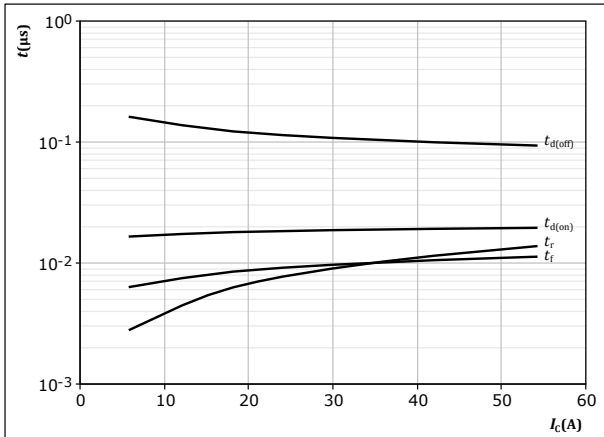
$V_{CE} = 400$ V	$T_j:$ 25 °C
$V_{GE} = 0/15$ V	125 °C
$I_c = 30$ A	150 °C



PFC Switching Characteristics

figure 40. IGBT

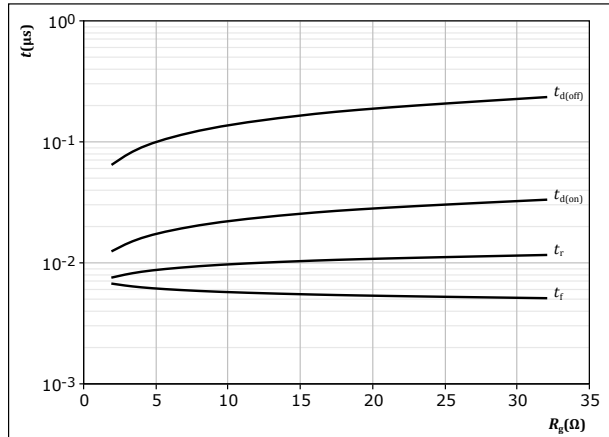
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 150$ °C
 $V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 8$ Ω
 $R_{goff} = 8$ Ω

figure 41. IGBT

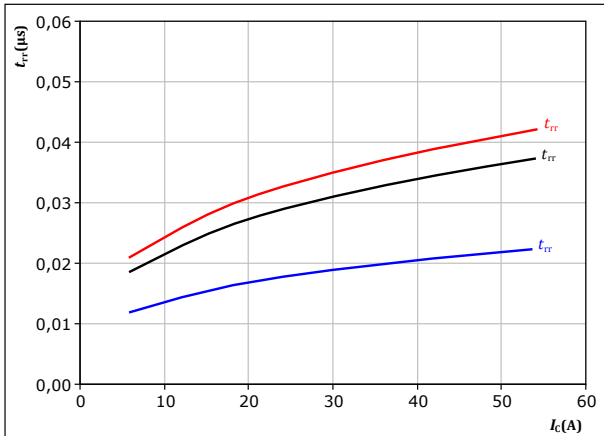
Typical switching times as a function of gate resistor
 $t = f(R_g)$



With an inductive load at
 $T_j = 150$ °C
 $V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $I_c = 30$ A

figure 42. FWD

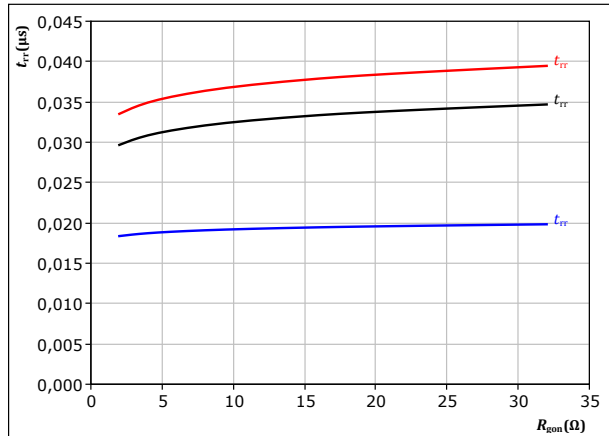
Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at
 $V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 8$ Ω
 $T_j:$ — 25 °C
 — 125 °C
 — 150 °C

figure 43. 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
 $I_c = 30$ A
 $T_j:$ — 25 °C
 — 125 °C
 — 150 °C

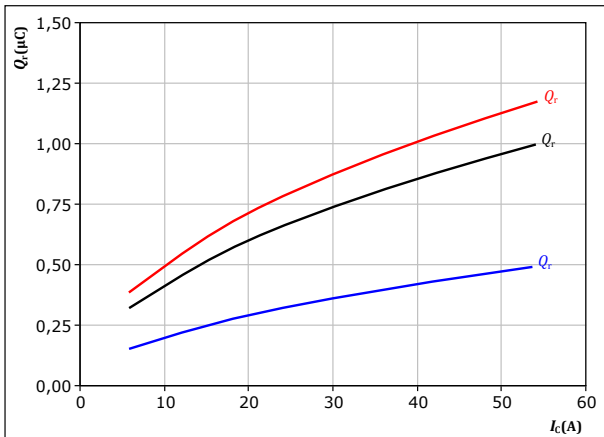


PFC Switching Characteristics

figure 44. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

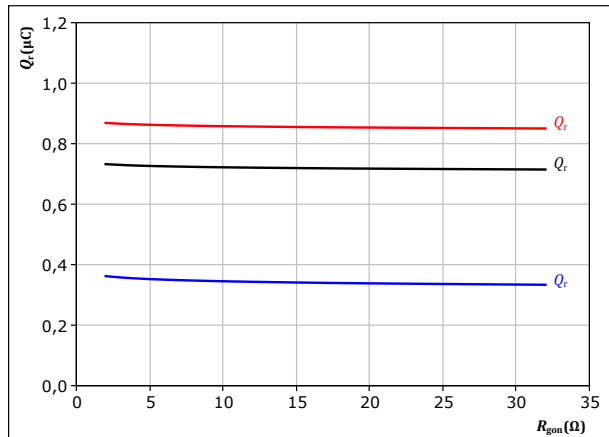
$V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 8$ Ω

T_j : — 25 °C
— 125 °C
— 150 °C

figure 45. FWD

Typical recovered charge as a function of turn on gate resistor

$$Q_r = f(R_{gon})$$



With an inductive load at

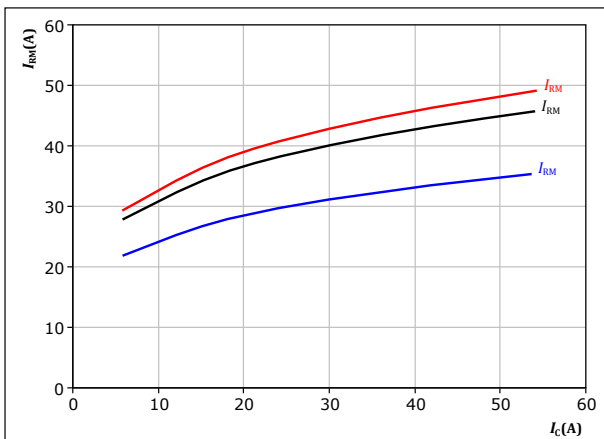
$V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $I_c = 30$ A

T_j : — 25 °C
— 125 °C
— 150 °C

figure 46. FWD

Typical peak reverse recovery current as a function of collector current

$$I_{RM} = f(I_c)$$



With an inductive load at

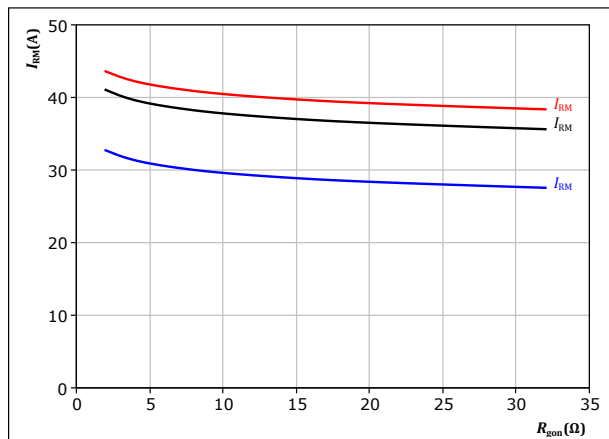
$V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 8$ Ω

T_j : — 25 °C
— 125 °C
— 150 °C

figure 47. FWD

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

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



With an inductive load at

$V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $I_c = 30$ A

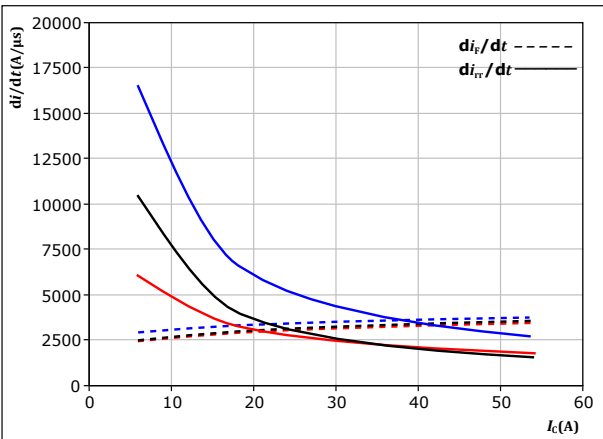
T_j : — 25 °C
— 125 °C
— 150 °C



PFC Switching Characteristics

figure 48. FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_{rr}/dt = f(I_c)$

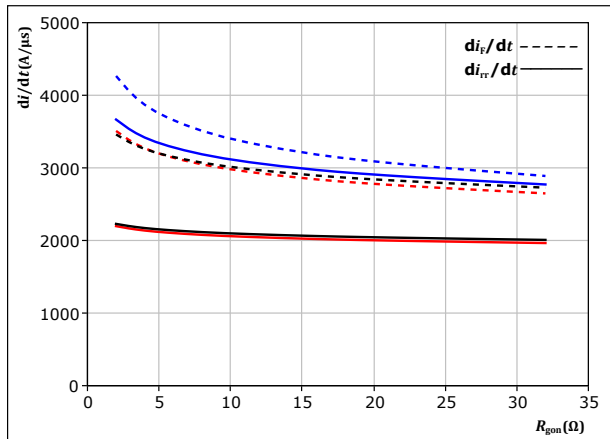


With an inductive load at
 $V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 8$ Ω

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 49. FWD

Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor
 $di_f/dt, di_{rr}/dt = f(R_{gon})$

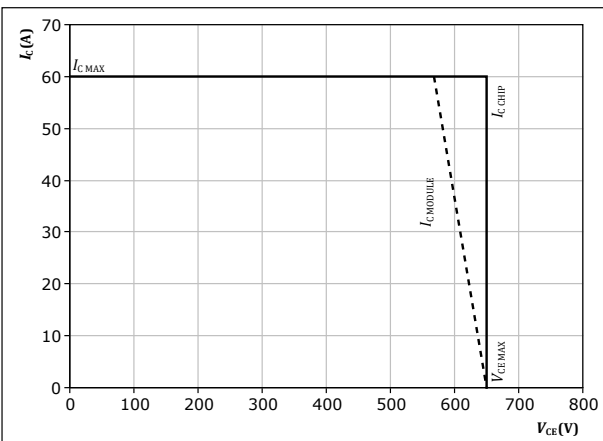


With an inductive load at
 $V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $I_c = 30$ A

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 50. IGBT

Reverse bias safe operating area
 $I_c = f(V_{CE})$



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



Switching Definitions

figure 51. IGBT

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

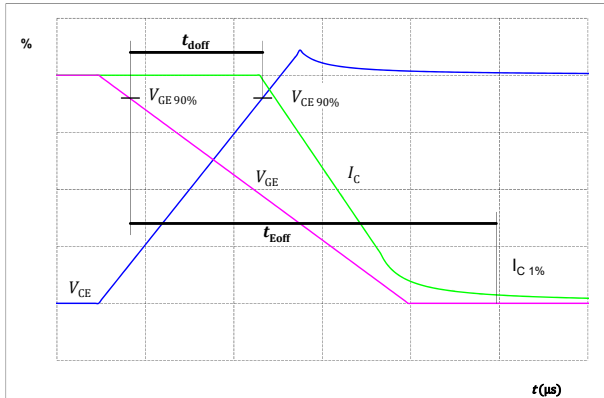


figure 52. IGBT

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

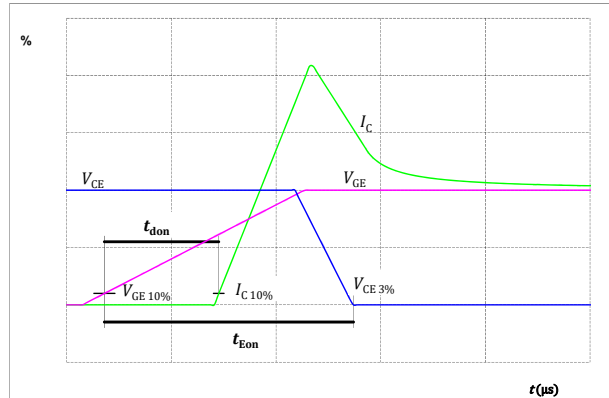


figure 53. IGBT

Turn-off Switching Waveforms & definition of t_f

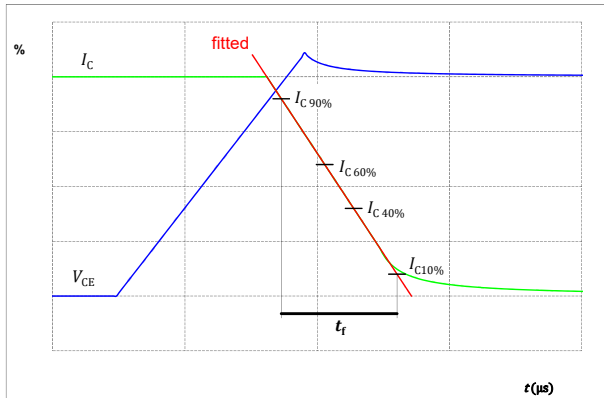
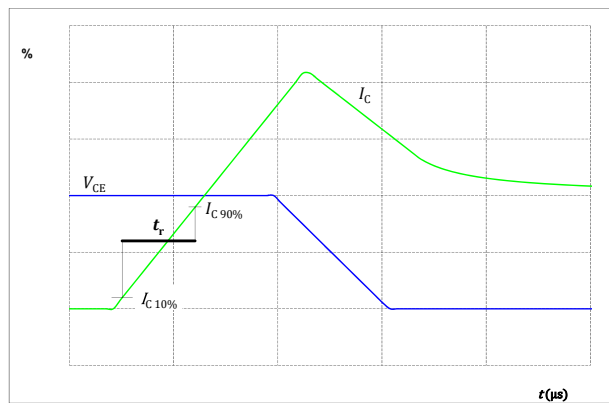


figure 54. IGBT

Turn-on Switching Waveforms & definition of t_r





Switching Definitions

figure 55. FWD

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

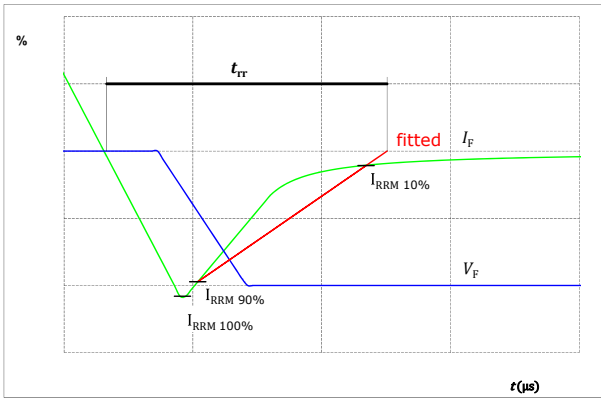
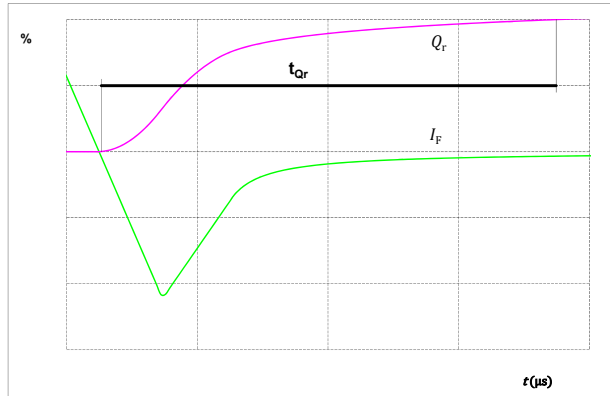


figure 56. FWD


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

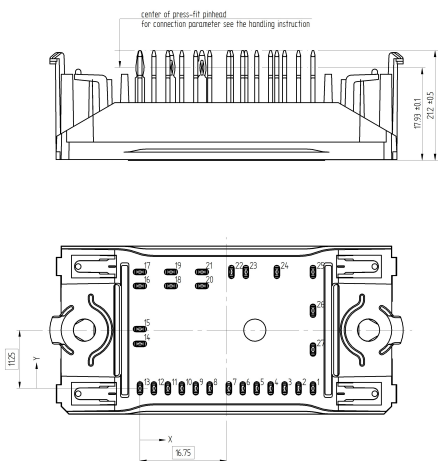




Vincotech

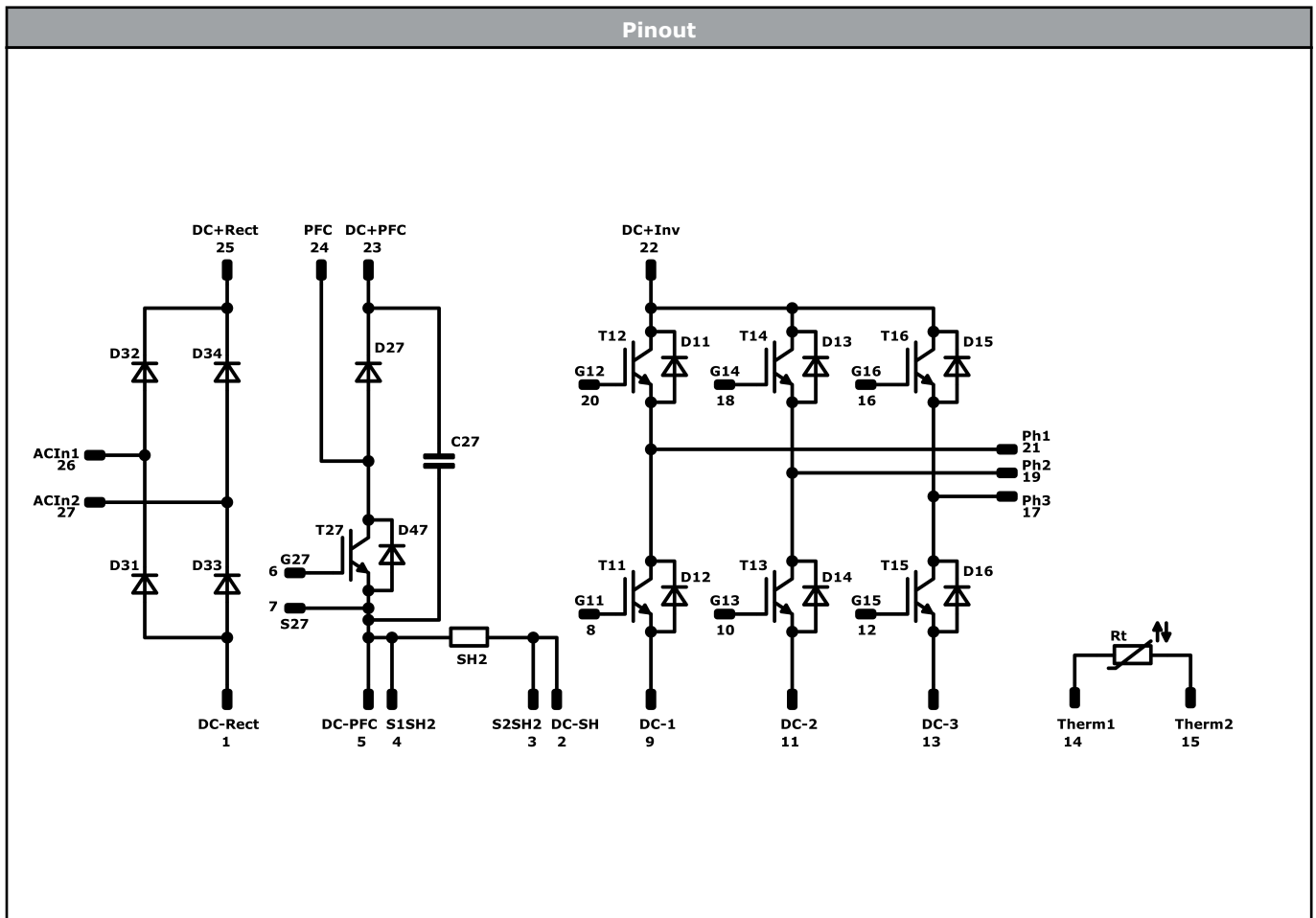
Ordering Code	
Version	Ordering Code
Without thermal paste	10-P006PPA010SB04-M683B30Y
With thermal paste	10-P006PPA010SB04-M683B30Y-/3/

Marking						
	Text	Name NN-NNNNNNNNNNNNNN- TTTTTV	Date code WWYY	UL & VIN UL VIN	Lot LLLLL	Serial SSSS
	Datamatrix	Type&Ver TTTTTTTV	Lot number LLLLL	Serial SSSS	Date code WWYY	

Pin table [mm]				Outline	
Pin	X	Y	Function	 <p>center of press-fit pinhead for connection parameter see the handling instruction</p> <p>Tolerance of pinposition: ±0.5mm at the end of pins Dimension of coordinate axis is only offset without tolerance</p>	
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		



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Identification					
ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	600 V	10 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	600 V	10 A	Inverter Diode	
T27	IGBT	650 V	30 A	PFC Switch	
D27	FWD	650 V	30 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			Shunt	
C27	Capacitor	500 V		Capacitor (PFC)	
Rt	Thermistor			Thermistor	




Vincotech

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

Handling instruction
Handling instructions for <i>flow 0</i> packages see vincotech.com website.

Package data
Package data for <i>flow 0</i> packages see vincotech.com website.

Vincotech thermistor reference
See Vincotech thermistor reference table at vincotech.com website.

UL recognition and file number
This device is certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website. 

Document No.:	Date:	Modification:	Pages
10-P006PPA010SB04-M683B30Y-D1-14	11 Nov. 2020		

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.