



Vincotech

10-F006PPA010SB04-M683B30

datasheet

flowPIM 0 + PFC

600 V / 10 A

Topology features

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

Component features

- Easy paralleling
- Low turn-off losses
- Low collector emitter saturation voltage
- Positive temperature coefficient
- Short tail current

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

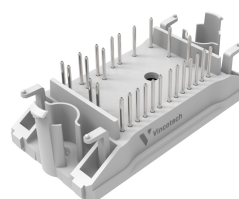
Target applications

- Embedded Drives
- Industrial Drives

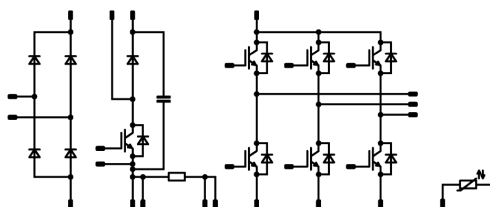
Types

- 10-F006PPA010SB04-M683B30

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	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	17	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	$T_j = T_{jmax}$ $T_s \leq 80\text{ °C}$	20 ⁽¹⁾	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	$^{\circ}\text{C}$

⁽¹⁾ limited by I_{FRM}

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
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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	$T_j = T_{jmax}$ $T_s \leq 80\text{ °C}$	12 ⁽²⁾	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

⁽²⁾ limited by I_{FRM}

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		26,4	A
Power dissipation	P_{tot}	$T_c = 70\text{ °C}$	7	W



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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}		630	V
Operation Temperature	T_{op}		-55 ... 150	°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
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_{CEsat}		15		10	25 125	1,1	1,59 1,78	1,9 ⁽³⁾	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}	$f = 1 \text{ Mhz}$	0	25		25		551		pF
Output capacitance	C_{oes}							40		pF
Reverse transfer capacitance	C_{res}							17		pF

Thermal

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

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 32 \Omega$ $R_{goff} = 32 \Omega$	± 15	400	10	25 125		75,2 74,4		ns
Rise time	t_r					25 125		23,8 25,8		ns
Turn-off delay time	$t_{d(off)}$					25 125		136 158,8		ns
Fall time	t_f					25 125		83,29 123,18		ns
Turn-on energy (per pulse)	E_{on}					25 125		0,277 0,376		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,33 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 ⁽³⁾	V
Reverse leakage current	I_R	$V_r = 600$ V				25			27	μA

Thermal

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

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



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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 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_{CEsat}		15		30	25 125		1,97 2,25	2,22 ⁽³⁾	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}	$f = 1 \text{ Mhz}$	0	25		25		1800		pF
Output capacitance	C_{oes}							45		pF
Reverse transfer capacitance	C_{res}							9		pF
Gate charge	Q_g	$V_{CC} = 520 \text{ V}$	15		30	25		65		nC

Thermal

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

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 8 \Omega$ $R_{goff} = 8 \Omega$	0/15	400	30	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}					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 ⁽³⁾	V
Reverse leakage current	I_R	$V_r = 650$ V				25			1,6	μA

Thermal

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

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



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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 Sw. Inverse Diode

Static

Forward voltage	V_F				6	25 125 150	1,23	1,72 1,58 1,54	1,87 ⁽³⁾	V
Reverse leakage current	I_R	$V_r = 650$ V				25			0,1	μA

Thermal

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

Static

Forward voltage	V_F				8	25 125		0,996 0,907	1,21 ⁽³⁾ 1,1 ⁽³⁾	V
Reverse leakage current	I_R	$V_r = 1600$ V				25			50	μA

Thermal

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

Static

Resistance	R							10		mΩ
Tolerance							-1		1	%
Temperature coefficient	tc							50		ppm/K



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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	

Capacitor (PFC)

Static

Capacitance	C	DC bias voltage = 0 V				25		33		nF
Tolerance							-5		5	%

Thermistor

Static

Rated resistance	R					25		22		kΩ
Deviation of R100	$\Delta_{R/R}$	$R_{100} = 1484 \Omega$				100	-5		5	%
Power dissipation	P					25		130		mW
Power dissipation constant	d					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 1 \%$						3962		K
B-value	$B_{(25/100)}$	Tol. $\pm 1 \%$						4000		K
Vincotech Thermistor Reference									I	

⁽³⁾ Value at chip level

⁽⁴⁾ Only valid with pre-applied Vincotech thermal interface material.



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Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

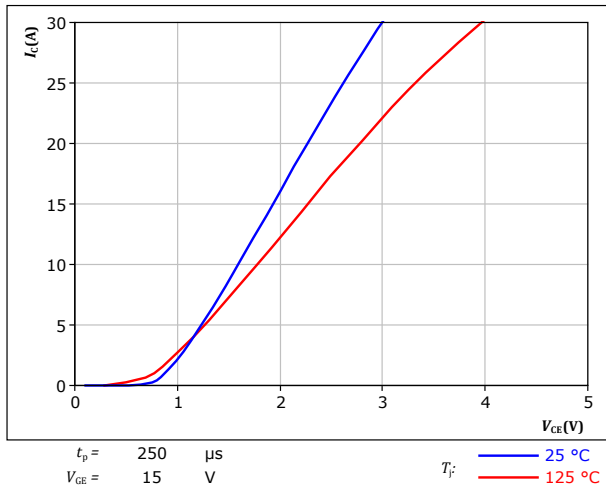


figure 2. IGBT

Typical output characteristics

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

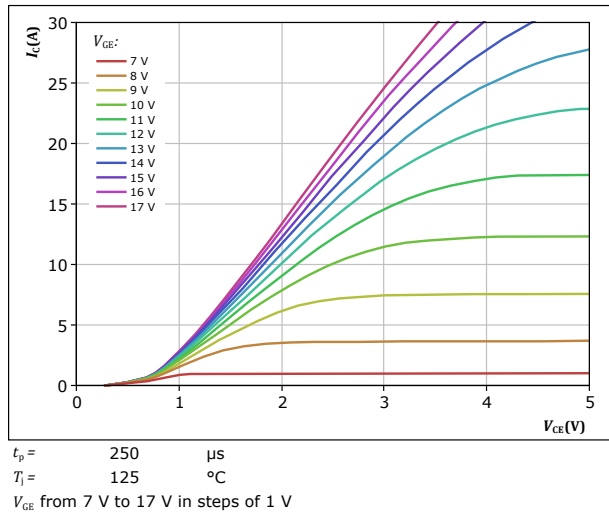


figure 3. IGBT

Typical transfer characteristics

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

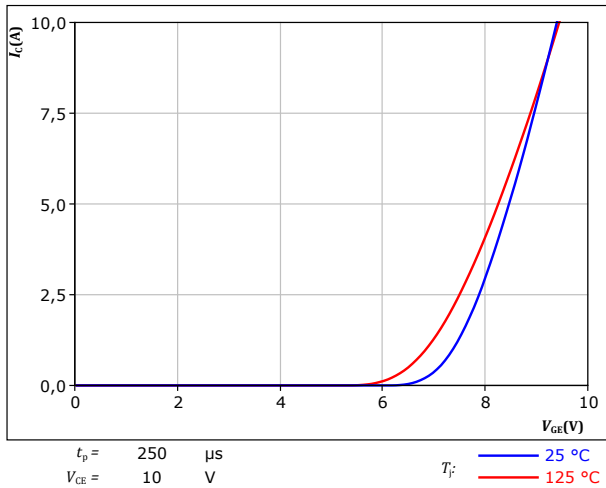
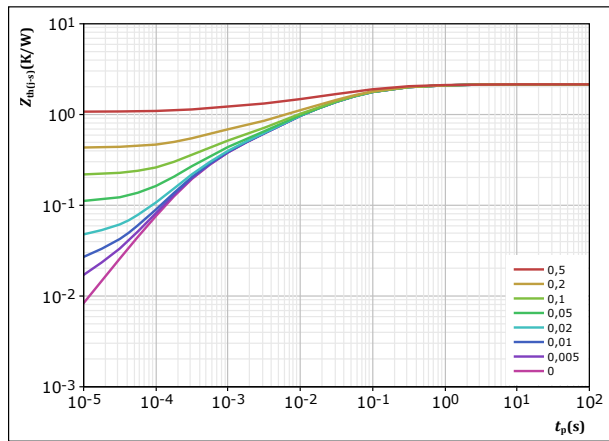


figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D =$	t_p / T	K/W
$R_{th(j-s)} =$	2,149	
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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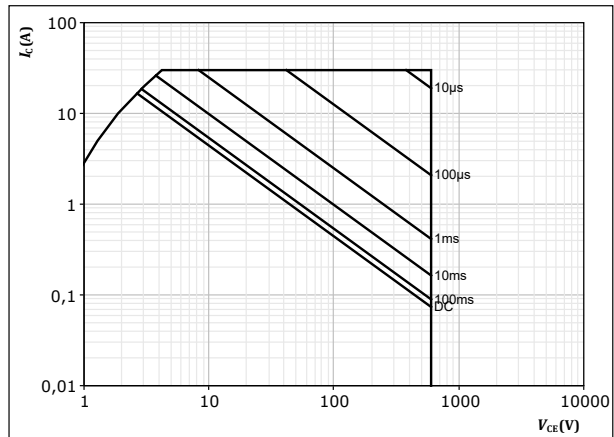
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Inverter Switch Characteristics

figure 5. IGBT

Safe operating area

$I_C = f(V_{CE})$



$D =$ single pulse

$T_s = 80$ °C

$V_{GE} = 15$ V

$T_j = T_{jmax}$



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Inverter Diode Characteristics

figure 6.

FWD

Typical forward characteristics

$$I_F = f(V_F)$$

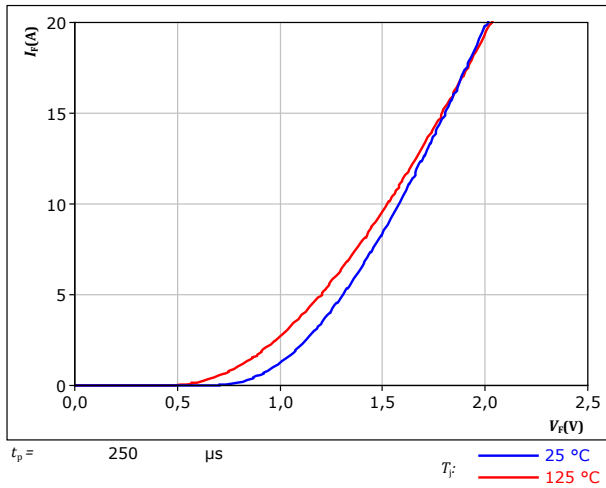
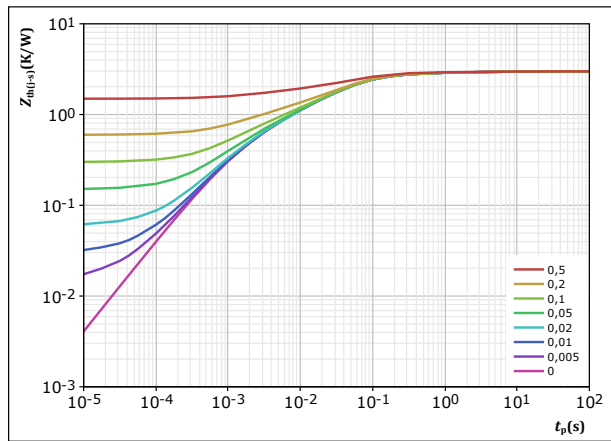


figure 7.

FWD

Transient thermal impedance as a function of pulse width

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





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PFC Switch Characteristics

figure 8. IGBT

Typical output characteristics

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

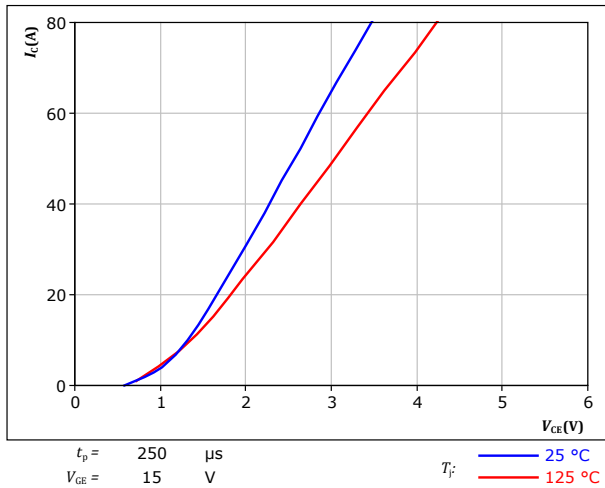


figure 9. IGBT

Typical output characteristics

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

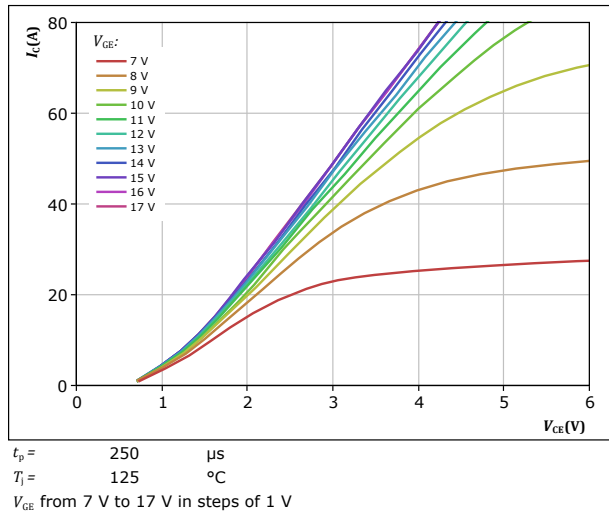


figure 10. IGBT

Typical transfer characteristics

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

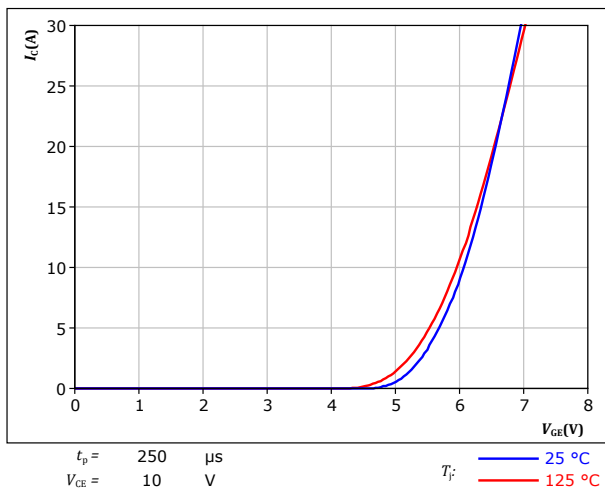
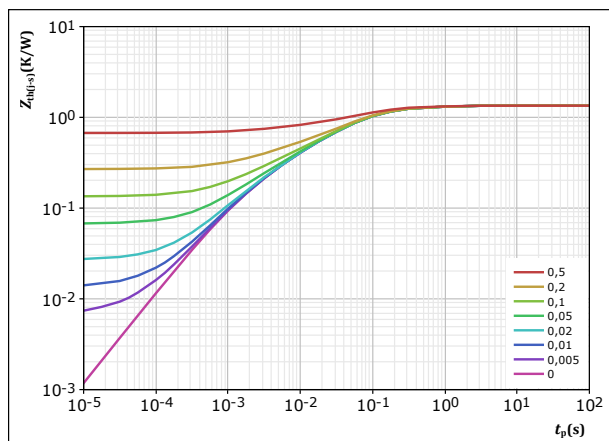


figure 11. IGBT

Transient thermal impedance as a function of pulse width

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



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



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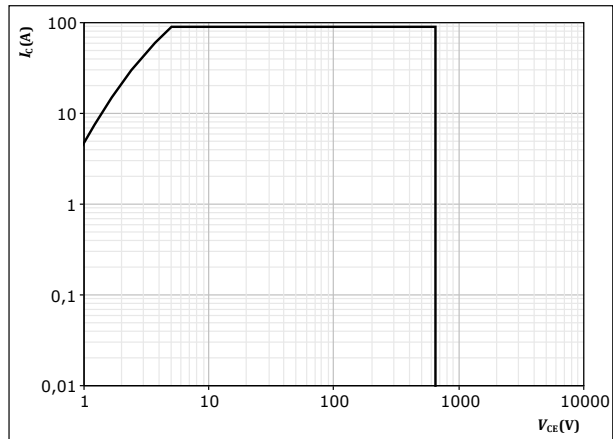
PFC Switch Characteristics

figure 12.

IGBT

Safe operating area

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



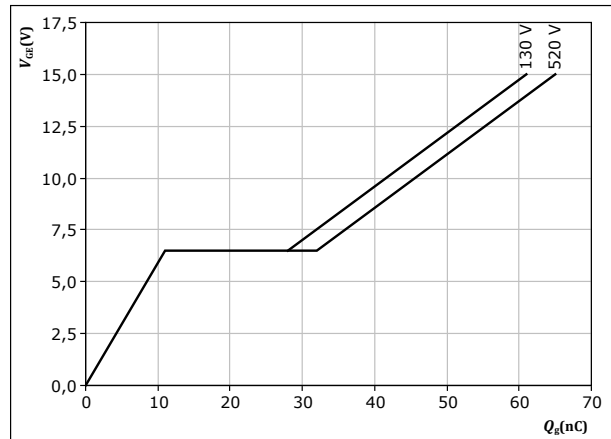
$D = \text{single pulse}$
 $T_s = 80 \text{ } ^\circ\text{C}$
 $V_{GE} = 15 \text{ V}$
 $T_j = T_{jmax}$

figure 13.

IGBT

Gate voltage vs gate charge

$$V_{GE} = f(Q_g)$$



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



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PFC Diode Characteristics

figure 14.

FWD

Typical forward characteristics

$$I_F = f(V_F)$$

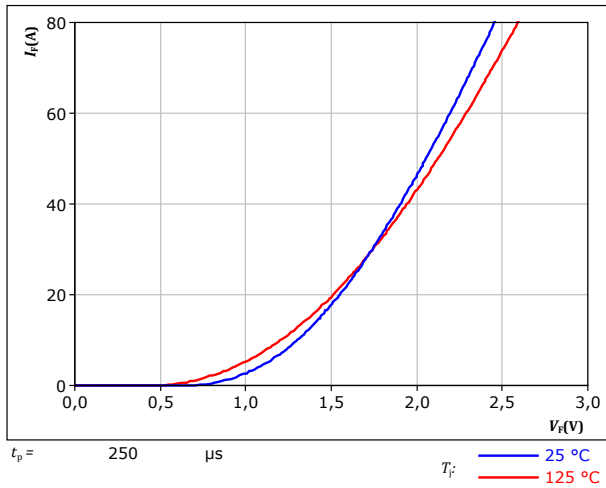
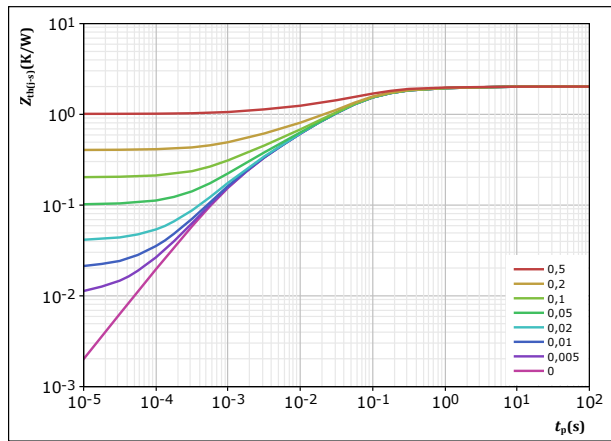


figure 15.

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 K/W
FWD thermal model values	
R (K/W)	τ (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



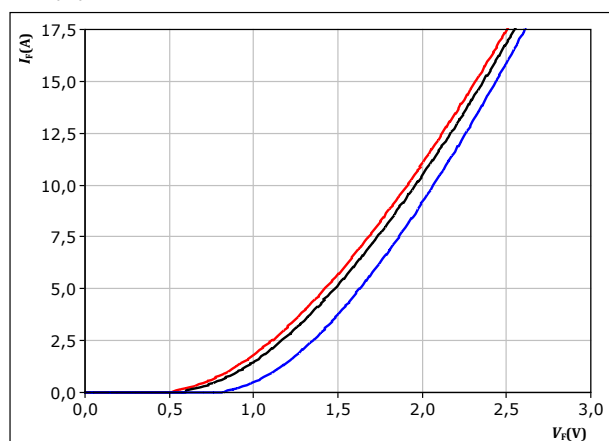
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PFC Sw. Inverse Diode Characteristics

figure 16. FWD

Typical forward characteristics

$$I_F = f(V_F)$$



$t_p = 250 \mu s$

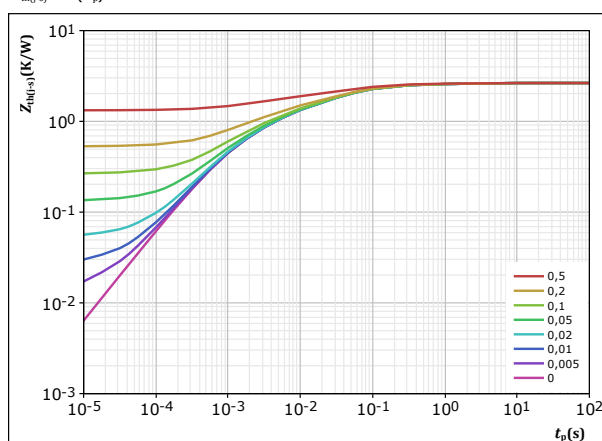
$T_j:$

- 25 °C
- 125 °C
- 150 °C

figure 17. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

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

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



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Rectifier Diode Characteristics

figure 18.

Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

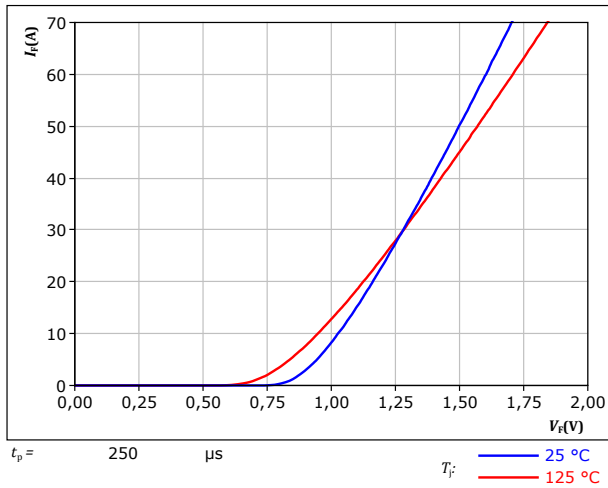
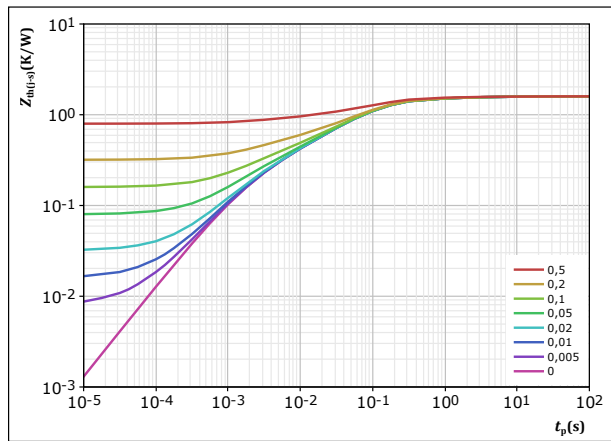


figure 19.

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



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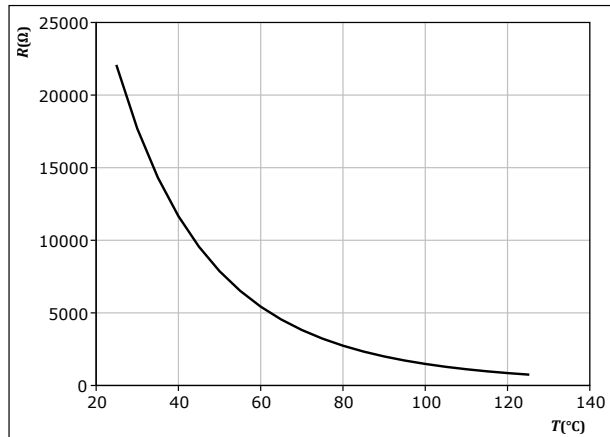
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Thermistor Characteristics

figure 20. Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$





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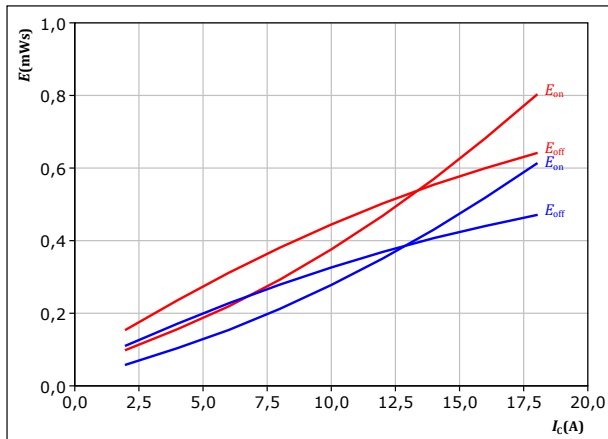
10-F006PPA010SB04-M683B30 datasheet

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

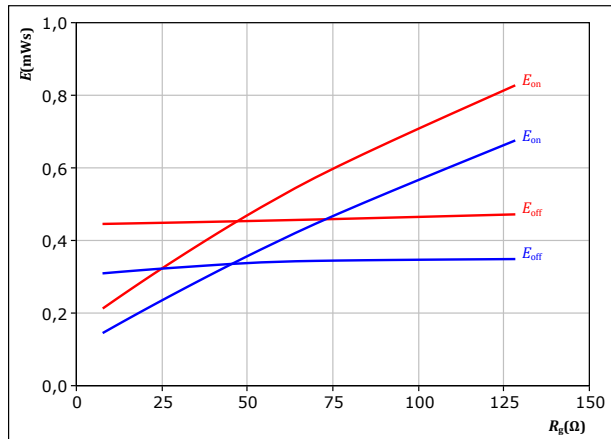
$V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω
 $R_{goff} = 32$ Ω

T_j : — 25 °C
— 125 °C

figure 22. IGBT

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

$$E = f(R_g)$$



With an inductive load at

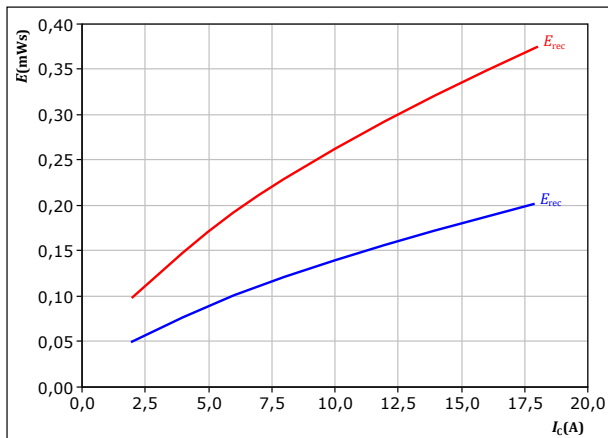
$V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $I_C = 10$ A

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

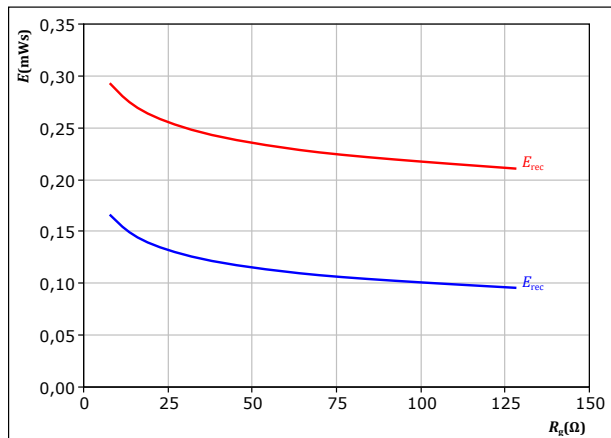
$V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω

T_j : — 25 °C
— 125 °C

figure 24. FWD

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



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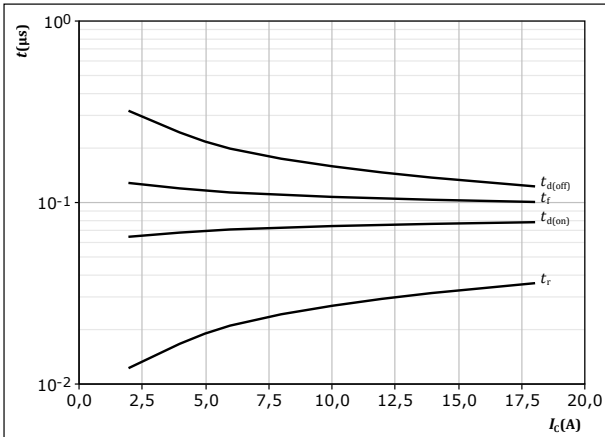
10-F006PPA010SB04-M683B30 datasheet

Inverter Switching Characteristics

figure 25.

IGBT

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



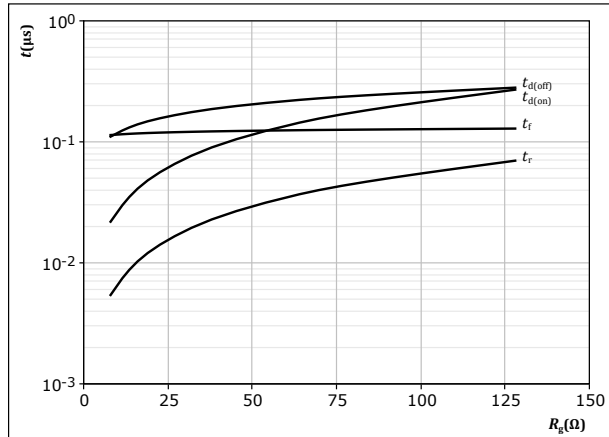
With an inductive load at

$T_j = 125$ °C
 $V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω
 $R_{goff} = 32$ Ω

figure 26.

IGBT

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



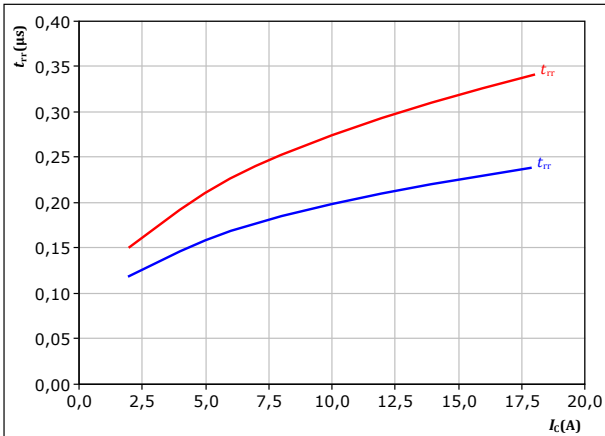
With an inductive load at

$T_j = 125$ °C
 $V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $I_C = 10$ A

figure 27.

FWD

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



With an inductive load at

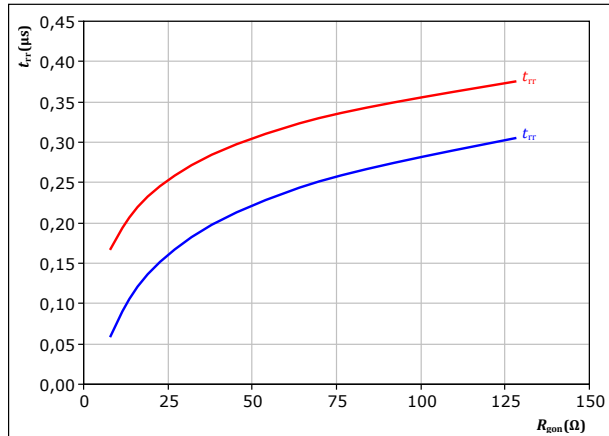
$V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω

T_j : — 25 °C
— 125 °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

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

T_j : — 25 °C
— 125 °C



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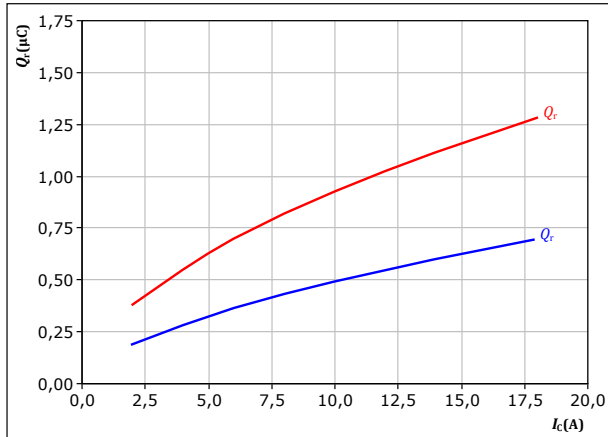
datasheet

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

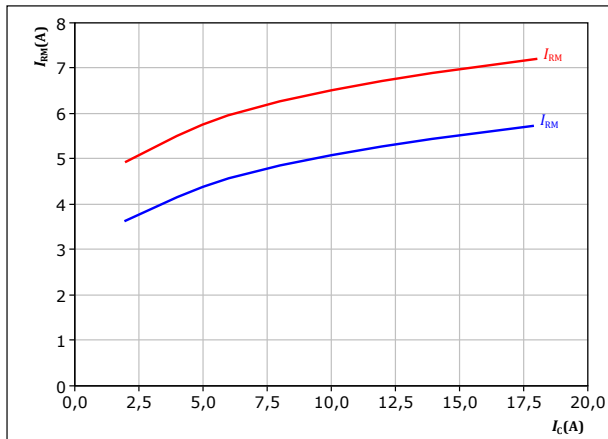
$V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω

T_j : — 25 °C
— 125 °C

figure 31. FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

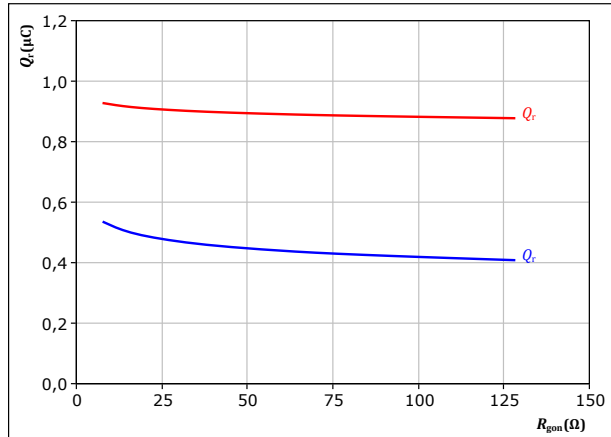
$V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω

T_j : — 25 °C
— 125 °C

figure 30. FWD

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

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



With an inductive load at

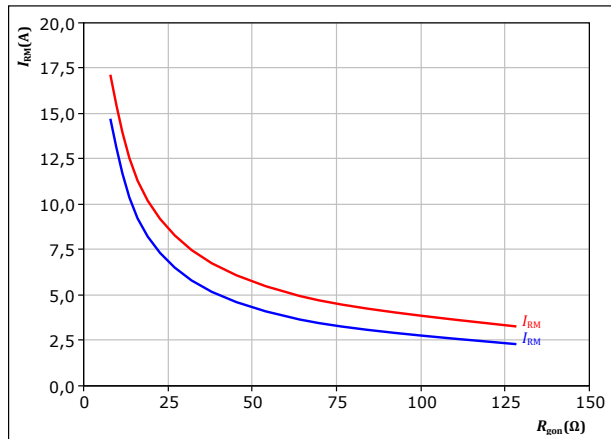
$V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $I_c = 10$ A

T_j : — 25 °C
— 125 °C

figure 32. 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
 $V_{GE} = \pm 15$ V
 $I_c = 10$ A

T_j : — 25 °C
— 125 °C



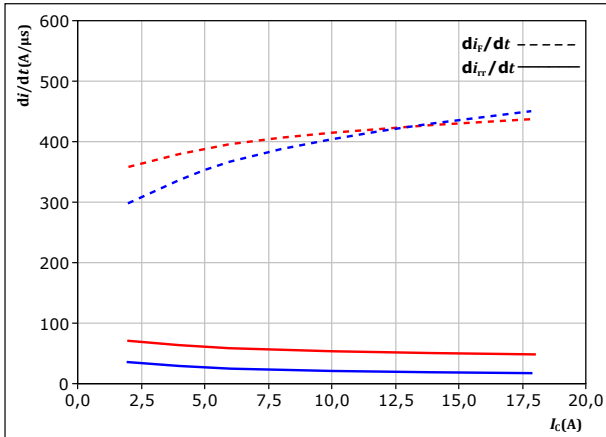
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datasheet

Inverter Switching Characteristics

figure 33. FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_r/dt = f(I_C)$

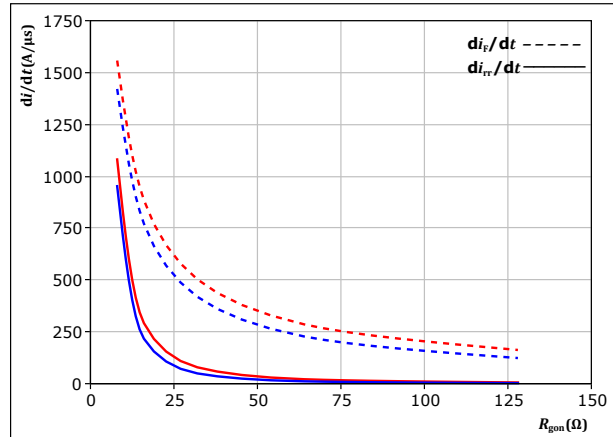


With an inductive load at

$V_{CE} = 400 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 32 \text{ } \Omega$
 $T_j: 25 \text{ } ^\circ\text{C}$ (blue line)
 $125 \text{ } ^\circ\text{C}$ (red line)

figure 34. FWD

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



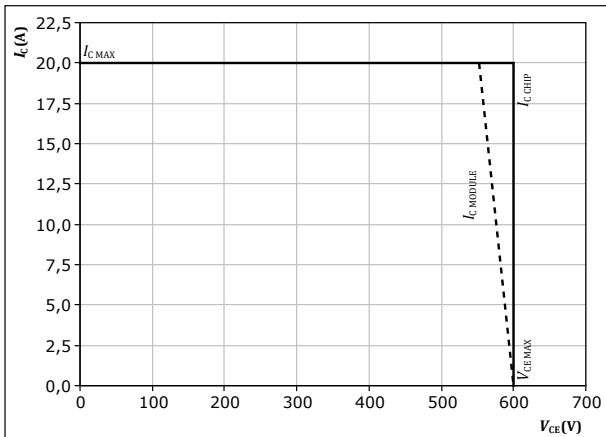
With an inductive load at

$V_{CE} = 400 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_C = 10 \text{ A}$
 $T_j: 25 \text{ } ^\circ\text{C}$ (blue line)
 $125 \text{ } ^\circ\text{C}$ (red line)

figure 35. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At $T_j = 125 \text{ } ^\circ\text{C}$
 $R_{gon} = 32 \text{ } \Omega$
 $R_{goff} = 32 \text{ } \Omega$



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datasheet

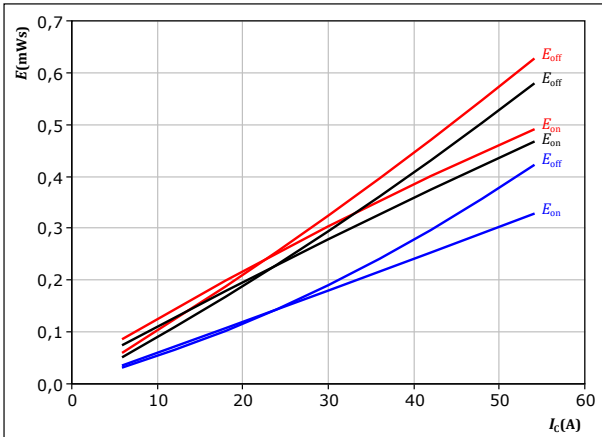
PFC Switching Characteristics

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

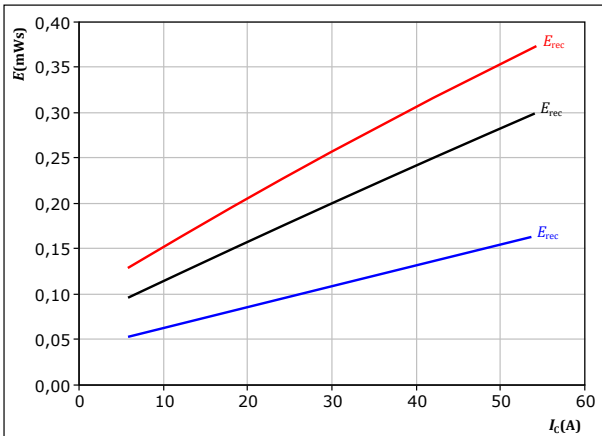
T_j :
— 25 °C
— 125 °C
— 150 °C

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
 $V_{GE} = 0/15$ V
 $R_{gon} = 8$ Ω

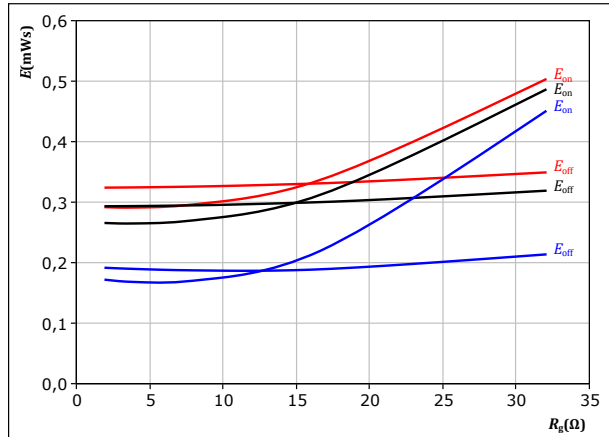
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 37.

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

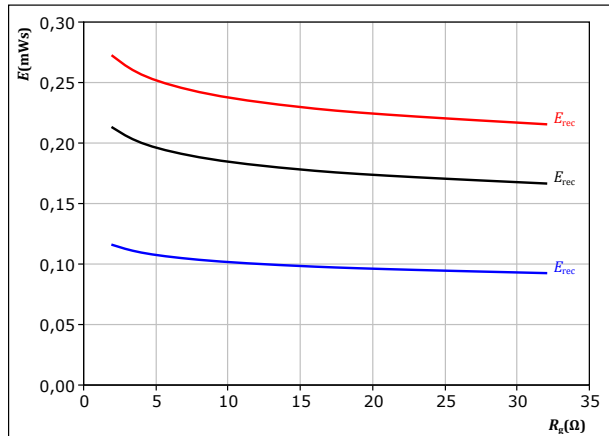
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 39.

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

T_j :
— 25 °C
— 125 °C
— 150 °C



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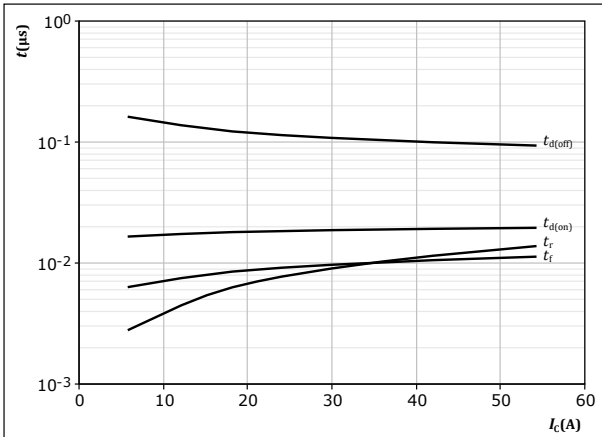
datasheet

PFC Switching Characteristics

figure 40.

IGBT

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



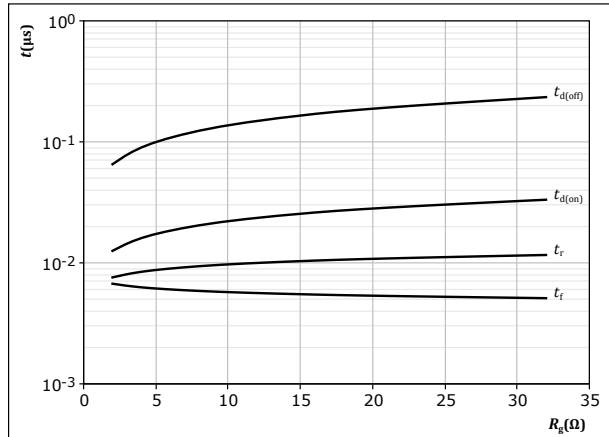
With an inductive load at

$T_j = 150$ °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 IGBT turn on gate resistor
 $t = f(R_g)$



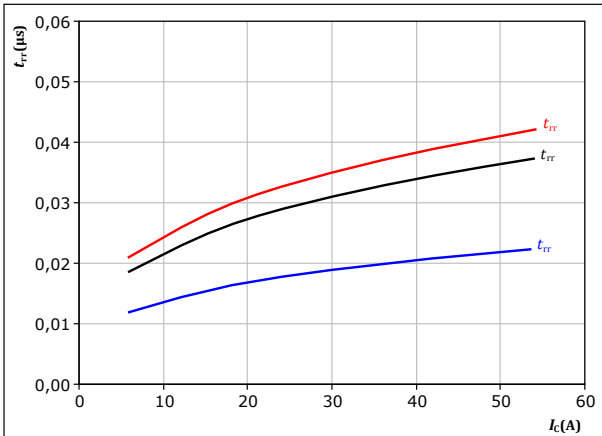
With an inductive load at

$T_j = 150$ °C
 $V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $I_C = 30$ A

figure 42.

FWD

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



With an inductive load at

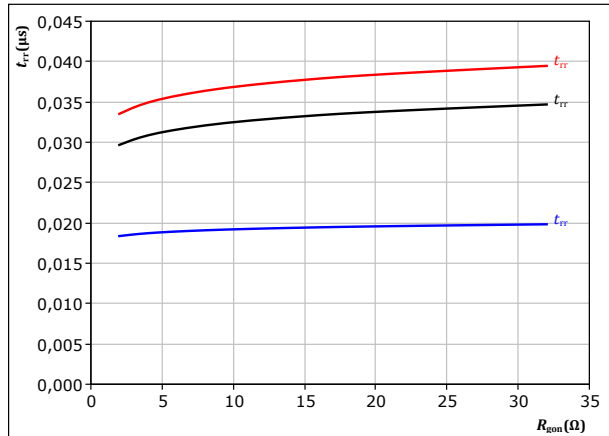
$V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 8$ Ω

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



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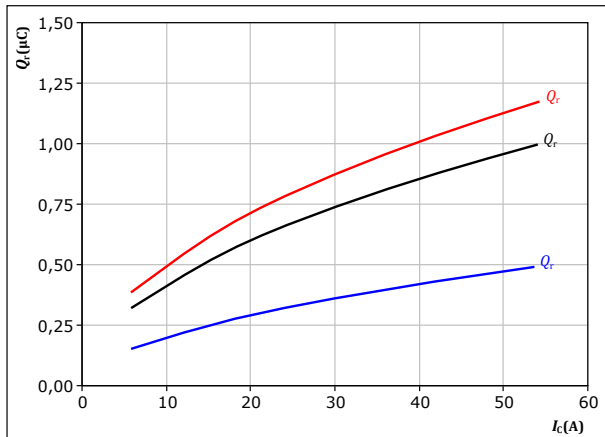
PFC Switching Characteristics

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

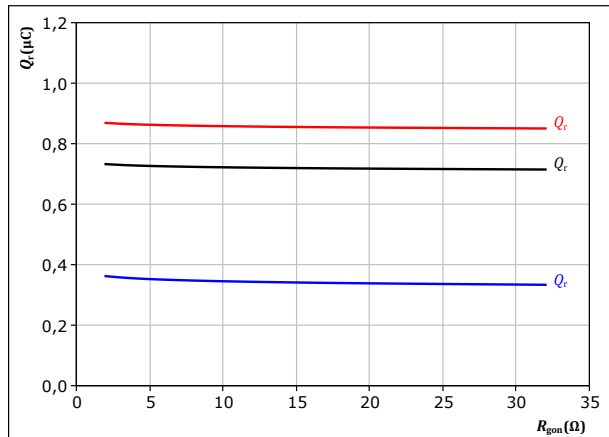
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 45.

FWD

Typical recovered charge as a function of IGBT 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

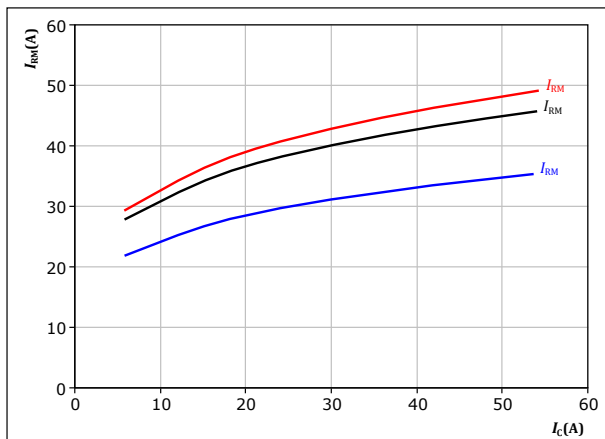
T_j :
— 25 °C
— 125 °C
— 150 °C

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

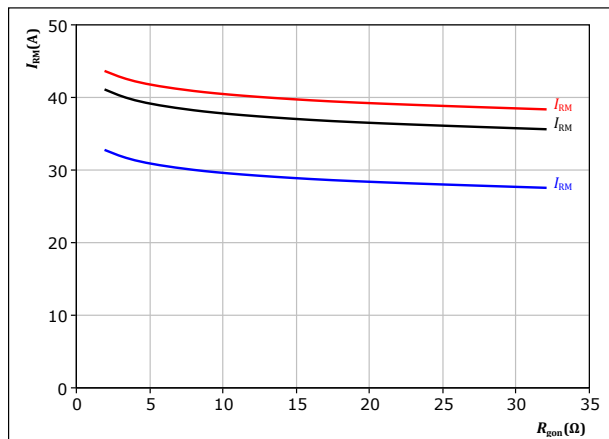
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 47.

FWD

Typical peak reverse recovery current as a function of IGBT 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



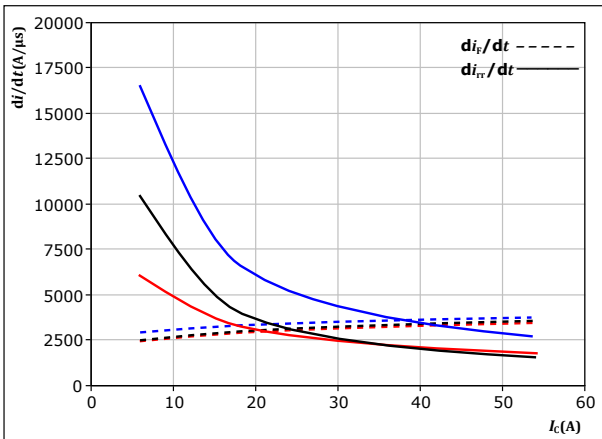
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10-F006PPA010SB04-M683B30
datasheet

PFC Switching Characteristics

figure 48. FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_r/dt = f(I_C)$



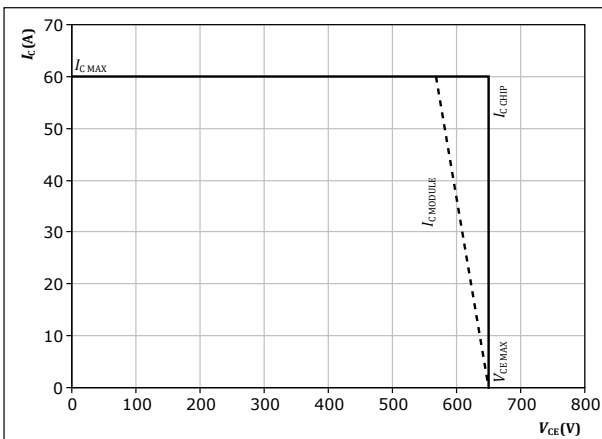
With an inductive load at

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

figure 50. IGBT

Reverse bias safe operating area

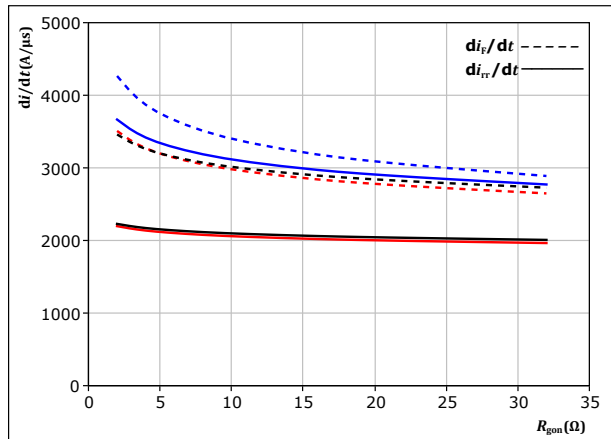
$I_C = f(V_{CE})$



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

figure 49. FWD

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



With an inductive load at

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



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Switching Definitions

figure 51. IGBT

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

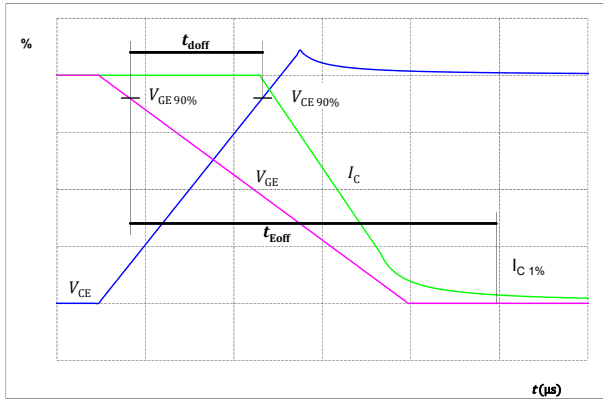


figure 52. IGBT

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

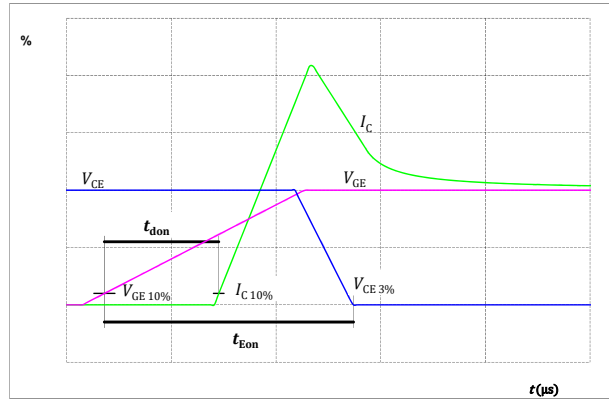


figure 53. IGBT

Turn-off Switching Waveforms & definition of t_f

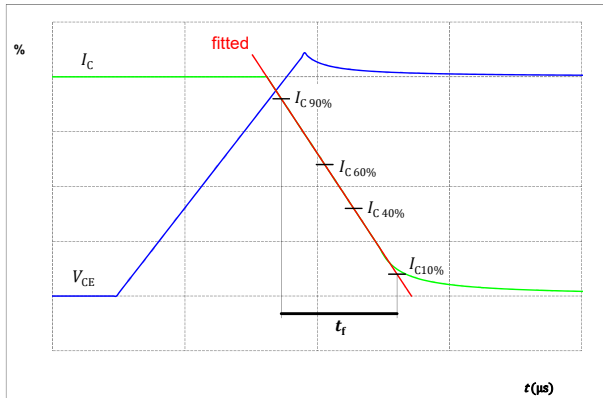
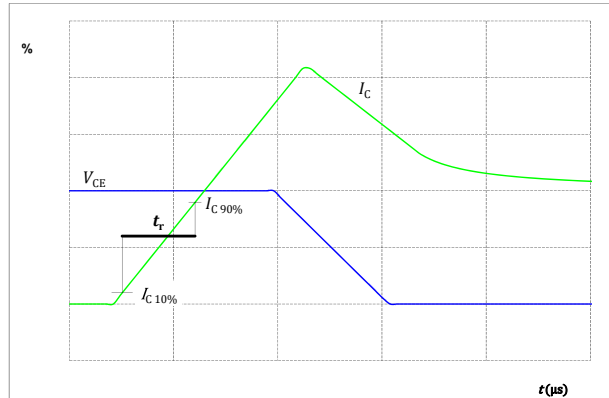


figure 54. IGBT

Turn-on Switching Waveforms & definition of t_r





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Switching Definitions

figure 55.

FWD

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

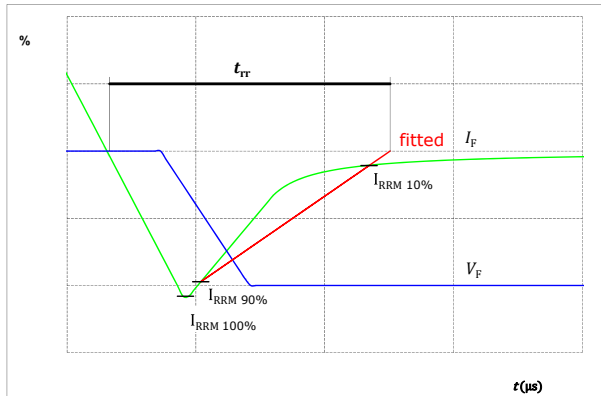
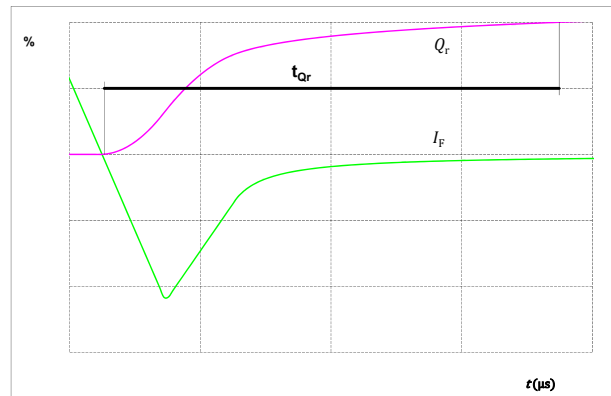


figure 56.

FWD

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





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10-F006PPA010SB04-M683B30

datasheet

Ordering Code	
Version	Ordering Code
Without thermal paste	10-F006PPA010SB04-M683B30
With thermal paste (5,2 W/mK, PTM6000HV)	10-F006PPA010SB04-M683B30-/7/

Marking					
	Text	Name NN-NNNNNNNNNNNNNNNN- TTTTIVV	Date code WWYY	UL & VIN UL VIN	Lot LLLLL
	Datamatrix	Type&Ver TTTTITTV	Lot number LLLLL	Serial SSSS	Date code WWYY

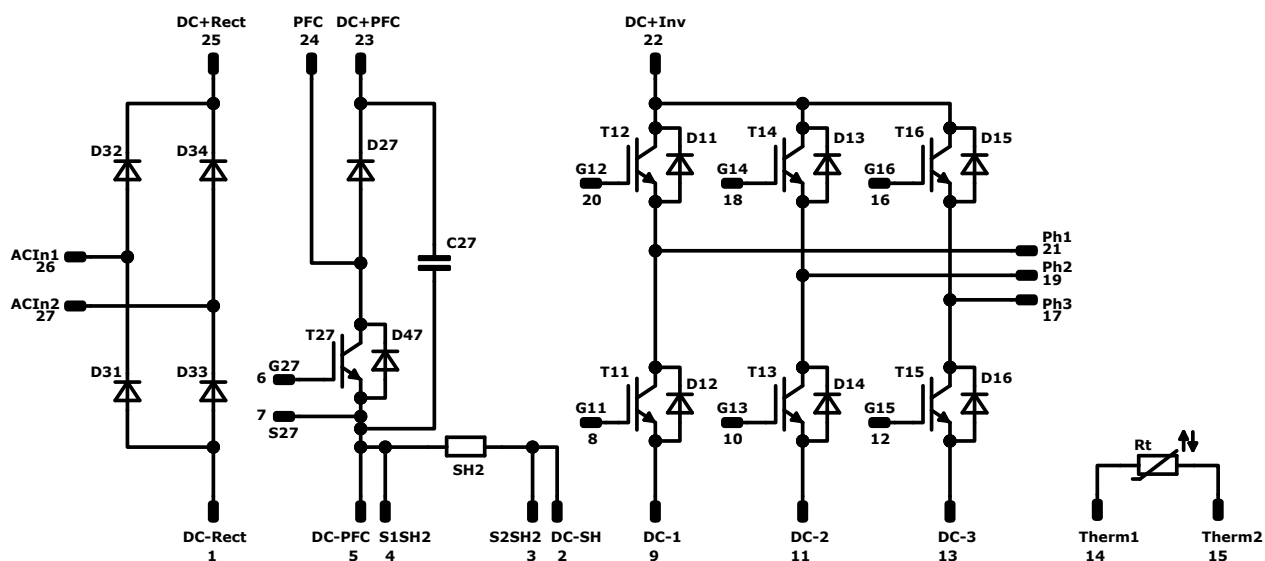
Pin table [mm]				Outline	
Pin	X	Y	Function		
1	33,5	0	DC-Rect		
2	30,7	0	DC-SH		
3	28	0	S2SH2		
4	25,3	0	S1SH2		
5	22,6	0	DC-PFC		
6	19,9	0	G27		
7	17,2	0	S27		
8	13,5	0	G11		
9	10,8	0	DC-1		
10	8,1	0	G13		
11	5,4	0	DC-2		
12	2,7	0	G15		
13	0	0	DC-3		
14	0	8,6	Therm1		
15	0	11,45	Therm2		
16	0	19,8	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: $\pm 0,5\text{mm}$ at the end of pins
Dimension of coordinate axis is only offset without tolerance



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Pinout



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	630 V		Capacitor (PFC)	
Rt	Thermistor			Thermistor	



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datasheet

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 UL 1557 recognized under E192116 up to a junction temperature under switching condition $T_{j,sp}=175^{\circ}\text{C}$ and up to 3500VAC/1min isolation voltage. For more information see vincotech.com website.



Document No.:	Date:	Modification:	Pages
10-F006PPA010SB04-M683B30-D1-14	23 Apr. 2026	Initial Release	

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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.