

**10-F006PPA020SB01-M685B10**

datasheet

Vincotech

flowPIM 0 + PFC		600 V / 20 A
Features		flow 0 17 mm housing
<ul style="list-style-type: none">• Clip in PCB mounting• Trench Fieldstop IGBTs for low saturation losses• Latest generation superjunction MOSFET with SiC boost diode for PFC switching frequencies up to 200 kHz		
Target applications		Schematic
<ul style="list-style-type: none">• Embedded Drives• Industrial Drives		
Types		
<ul style="list-style-type: none">• 10-F006PPA020SB01-M685B10		



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Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		600	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	26	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	56	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$, $V_{CC} = 360\text{ V}$ $T_j = 150^\circ\text{C}$	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	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	32	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	52	W
Maximum junction temperature	T_{jmax}		175	$^\circ\text{C}$



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Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
PFC Switch				
Drain-source voltage	V_{DSS}		600	V
Drain current (DC current)	I_D	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	23	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}	159	A
Avalanche energy, single pulse	E_{AS}	$V_{DD} = 50\text{ V}$ $I_D = 9,3\text{ A}$	1135	mJ
Avalanche energy, repetitive	E_{AR}	$V_{DD} = 50\text{ V}$ $I_D = 9,3\text{ A}$	1,72	mJ
Avalanche current, repetitive	I_{AR}	t_p limited by T_{jmax} $P_{AV} = E_{AR}*f$	9,3	A
MOSFET dv/dt ruggedness	dv/dt	$V_{DS} = 480\text{ V}$ $T_s = 25^\circ\text{C}$	50	V/ns
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	90	W
Gate-source voltage	V_{GSS}		± 20	V
Maximum Junction Temperature	T_{jmax}		150	$^\circ\text{C}$

PFC Diode

Peak repetitive reverse voltage	V_{RRM}		650	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	29	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	105	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 8,3\text{ ms}$ $T_j = 150^\circ\text{C}$	75	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	52	W
Maximum junction temperature	T_{jmax}		175	$^\circ\text{C}$



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Maximum Ratings

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

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

PFC Shunt

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

Capacitor (PFC)

Maximum DC voltage	V_{MAX}		500	V
Operation Temperature	T_{op}		-55 ... 125	$^\circ\text{C}$

Module Properties

Thermal Properties

Storage temperature	T_{stg}		-40...+125	$^\circ\text{C}$
Operation temperature under switching condition	T_{jop}		-40...+($T_{jmax} - 25$)	$^\circ\text{C}$

Isolation Properties

Isolation voltage	V_{isol}	DC Test Voltage*	$t_p = 2 \text{ s}$	4000	V
Isolation voltage	V_{isol}	AC Voltage	$t_p = 1 \text{ min}$	2500	V
Creepage distance				min. 12,7	mm
Clearance				min. 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]	I_C [A]	T_j [°C]	Min	Typ	

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	25 125	1,1	1,55 1,75	1,9 ⁽¹⁾	V
Collector-emitter cut-off current	I_{CES}		0	600		25			1,1	µA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	$f = 1 \text{ MHz}$	0	25	25	25	1100		pF	
Output capacitance	C_{oes}									
Reverse transfer capacitance	C_{res}									
Gate charge	Q_g	$V_{CC} = 480 \text{ V}$	15		20	25		120		nC

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{\text{paste}} = 3,4 \text{ W/mK (PSX)}$						1,7		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 16 \Omega$ $R_{goff} = 16 \Omega$	± 15	400	15	25 125		65,6 65,2		ns
Rise time	t_r					25 125		19,8 21		ns
Turn-off delay time	$t_{d(off)}$					25 125		141,8 167		ns
Fall time	t_f					25 125		76,33 86,36		ns
Turn-on energy (per pulse)	E_{on}					25 125		0,45 0,667		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,385 0,523		mWs



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Characteristic Values

Parameter	Symbol	Conditions						Values			Unit
		V_{GE} [V]	V_{GS} [V]	V_{CE} [V]	V_{DS} [V]	I_C [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 ⁽¹⁾	V
Reverse leakage current	I_R	$V_r = 600$ V			25			27	μA	

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,81		K/W
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Dynamic

Peak recovery current	I_{RRM}	$di/dt=731$ 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	$(di_{rr}/dt)_{max}$					25 125		36,18 85,35		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

Drain-source on-state resistance	$r_{DS(on)}$		10		25,8	25 125		71 150	70 ⁽¹⁾	mΩ
Gate-source threshold voltage	$V_{GS(th)}$		0		0,00172	25	2,4	3	3,6	V
Gate to Source Leakage Current	I_{GSS}		20	0		25			100	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	600		25			5	μA
Internal gate resistance	r_g							0,85		Ω
Gate charge	Q_g	$V_{DD} = 480$ V	10		25,8	25		170		nC
Short-circuit input capacitance	C_{iss}	$f = 1$ MHz	0	100	0	25		3800		pF
Short-circuit output capacitance	C_{oss}							215		

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,78		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 8 \Omega$ $R_{goff} = 8 \Omega$	0/16	400	15	25 125		19,2 18,88		ns
Rise time	t_r					25 125		5,12 5,44		ns
Turn-off delay time	$t_{d(off)}$					25 125		292 310,72		ns
Fall time	t_f					25 125		28 44,28		ns
Turn-on energy (per pulse)	E_{on}					25 125		0,022 0,028		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,081 0,095		mWs



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Characteristic Values

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

PFC Diode

Static

Forward voltage	V_F				24	25 125		1,37 1,55	1,55 ⁽¹⁾	V
Reverse leakage current	I_R	$V_r = 650$ V			25 150		4,8 72	480	μ A	

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,82		K/W
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Dynamic

Peak recovery current	I_{RRM}	$di/dt=4560$ A/ μ s $di/dt=4207$ A/ μ s	0/16	400	15	25 125		16,34 15,7		A
Reverse recovery time	t_{rr}					25 125		9,91 10,09		ns
Recovered charge	Q_r					25 125		0,092 0,091		μ C
Reverse recovered energy	E_{rec}					25 125		0,068 0,064		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125		4360 4238		A/ μ s



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Characteristic Values

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

Rectifier Diode

Static

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

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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PFC Shunt

Static

Resistance	R							10		$m\Omega$
Tolerance							-1		1	%
Temperature coefficient	t_c								30	ppm/K

Capacitor (PFC)

Static

Capacitance	C	DC bias voltage = 0 V				25		100		nF
Tolerance							-10		10	%
Dissipation factor		$f = 1$ kHz				25		2,5		%



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Characteristic Values

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

Thermistor

Static

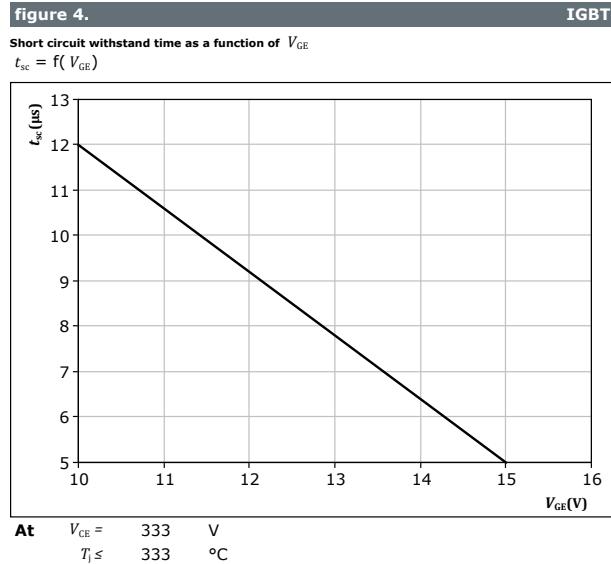
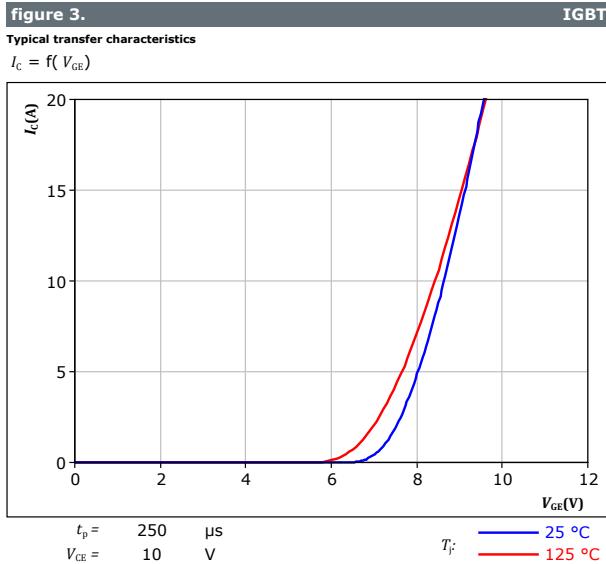
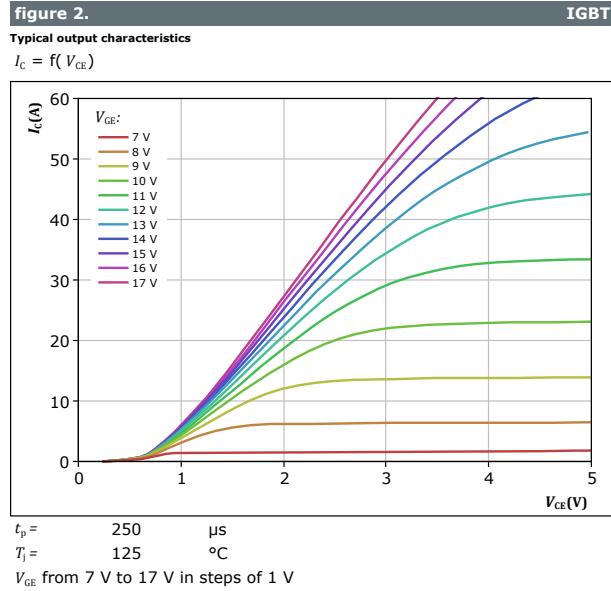
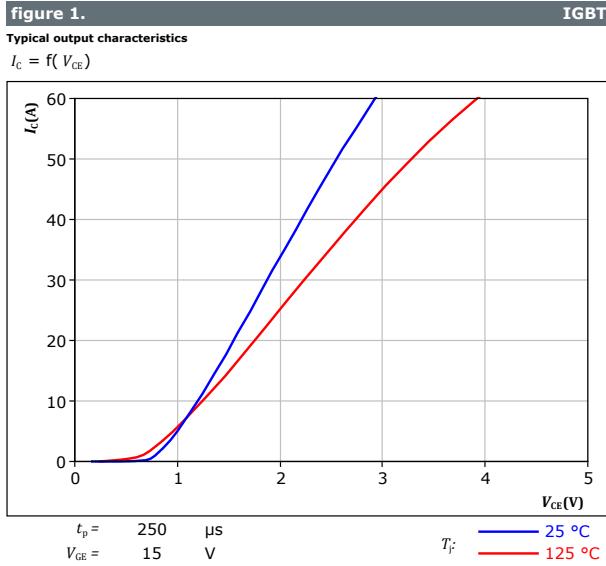
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$A_{R/R}$	$R_{100} = 1484 \Omega$				100	-5		5	%
Power dissipation	P							5		mW
Power dissipation constant	d					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %						3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %						4000		K
Vincotech Thermistor Reference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

⁽¹⁾ Value at chip level⁽²⁾ Only valid with pre-applied Vincotech thermal interface material.



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Inverter Switch Characteristics





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Inverter Switch Characteristics

figure 5. IGBT

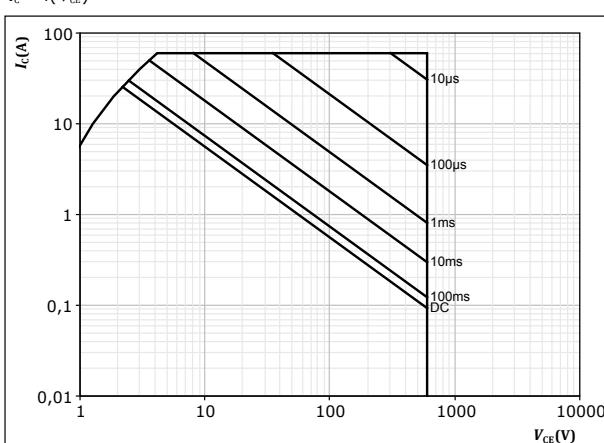
Typical short circuit current as a function of V_{GE}
 $I_{SC} = f(V_{GE})$



At $V_{CE} = 333$ V
 $T_j \leq 333$ °C

figure 7. IGBT

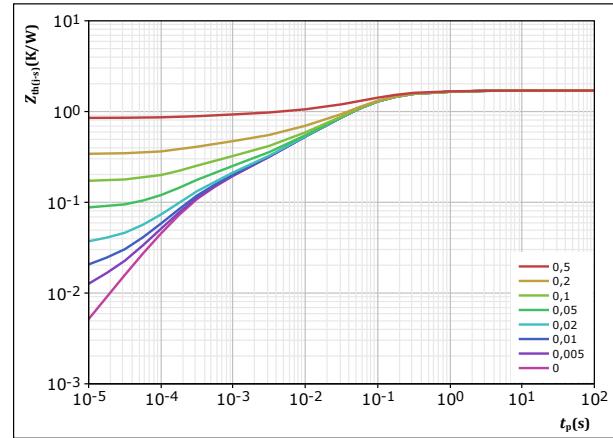
Safe operating area
 $I_C = f(V_{CE})$



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

figure 6. IGBT

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



$D = t_p / T$
 $R_{th(j-s)} = 1,701$ K/W

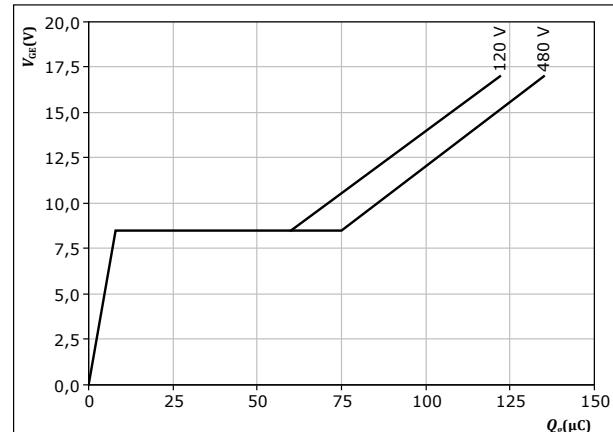
IGBT thermal model values

R (K/W)	τ (s)
9,97E-02	1,34E+00
3,46E-01	1,70E-01
8,15E-01	5,34E-02
2,54E-01	7,74E-03
7,70E-02	1,33E-03
1,09E-01	2,63E-04

figure 8. IGBT

Gate voltage vs gate charge

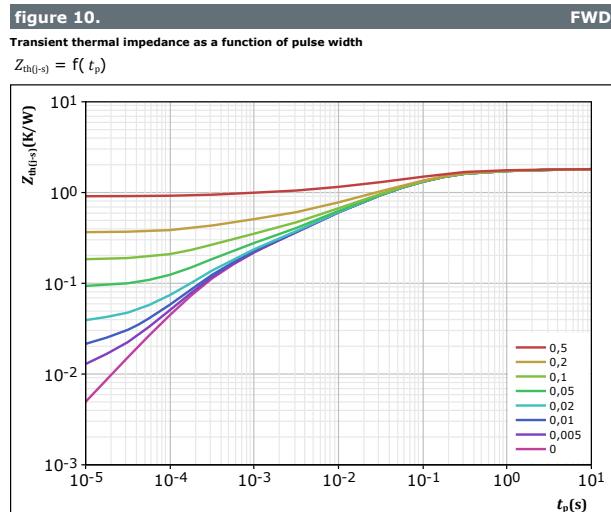
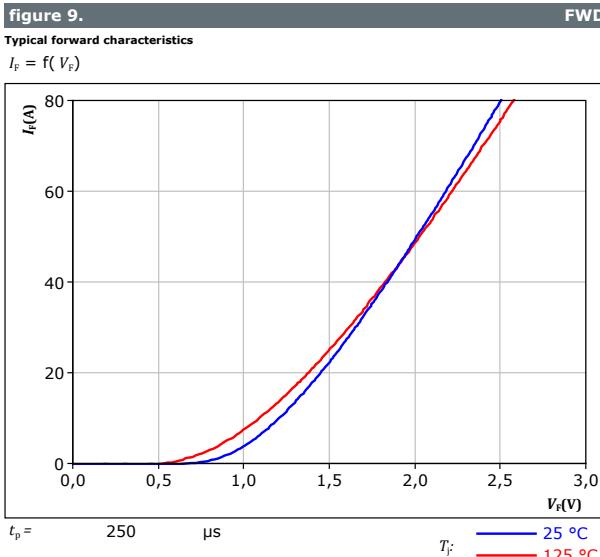
$V_{GE} = f(Q_g)$



$I_C = 33$ A
 $T_j = 25$ °C



Inverter Diode Characteristics





Vincotech

PFC Switch Characteristics

figure 11.

Typical output characteristics

$$I_D = f(V_{DS})$$

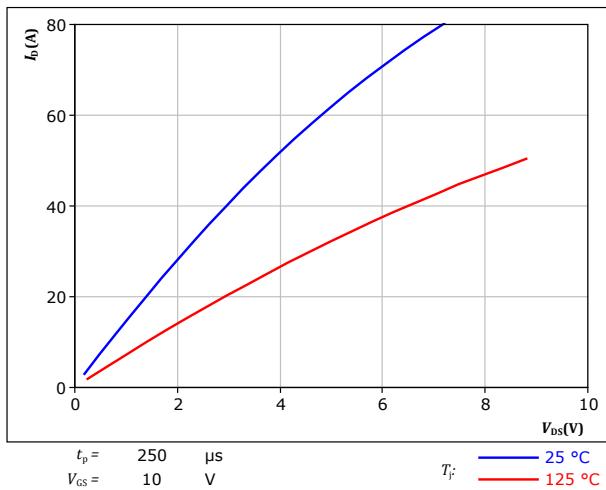


figure 13.

Typical transfer characteristics

$$I_D = f(V_{GS})$$

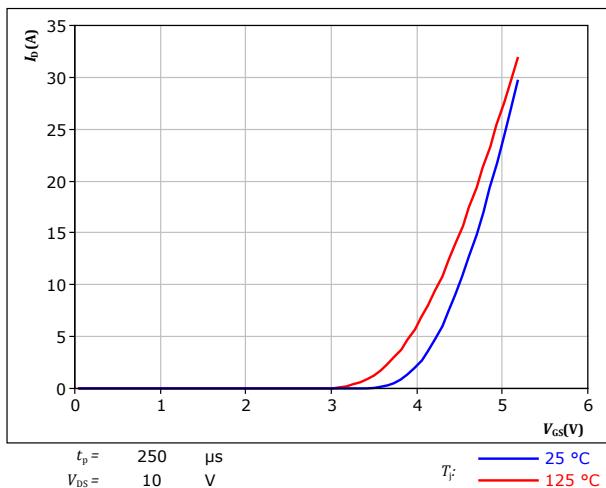


figure 12.

Typical output characteristics

$$I_D = f(V_{DS})$$

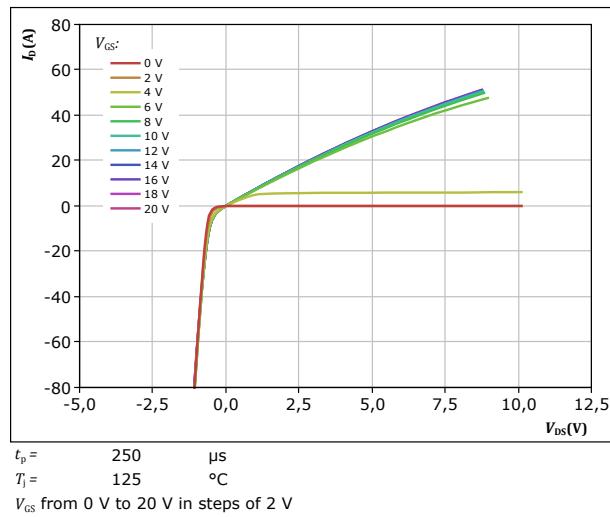
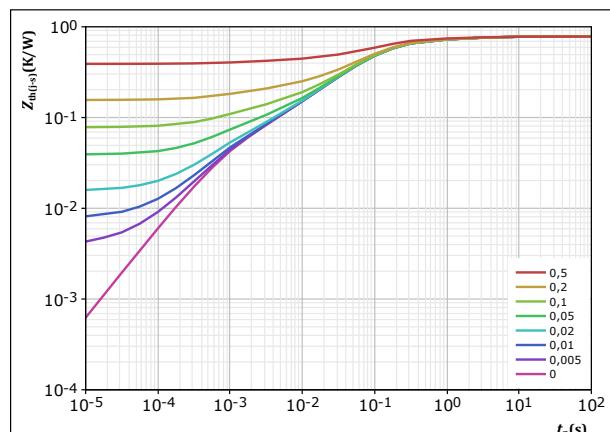


figure 14.

Transient thermal impedance as a function of pulse width

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



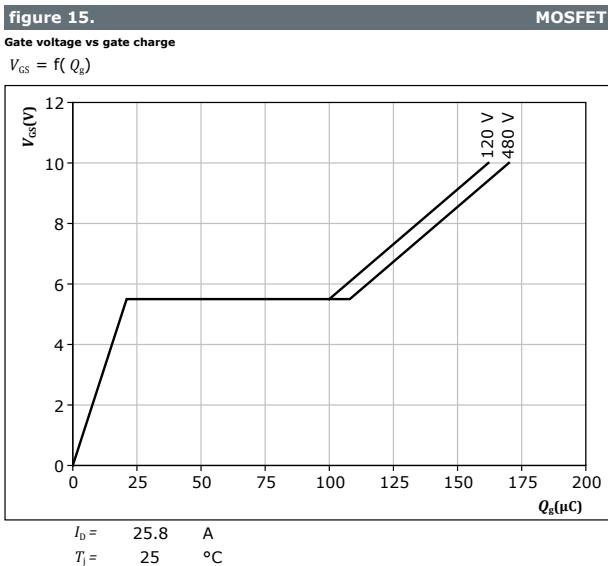
MOSFET thermal model values

R (K/W)	τ (s)
4,90E-02	3,64E+00
1,03E-01	5,74E-01
4,25E-01	1,04E-01
1,20E-01	2,91E-02
4,27E-02	6,05E-03
4,10E-02	8,69E-04



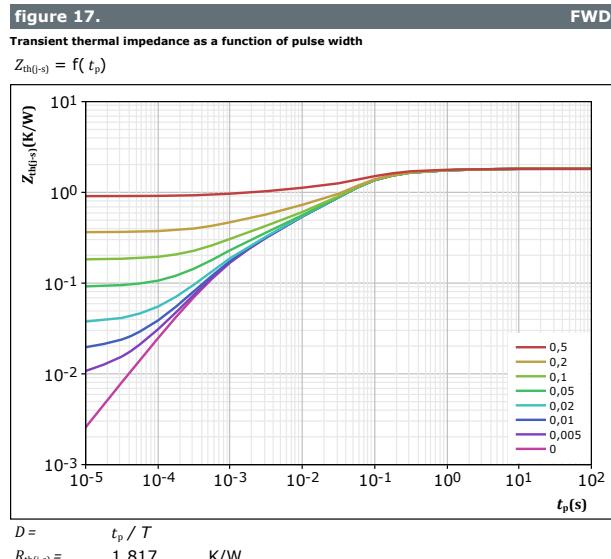
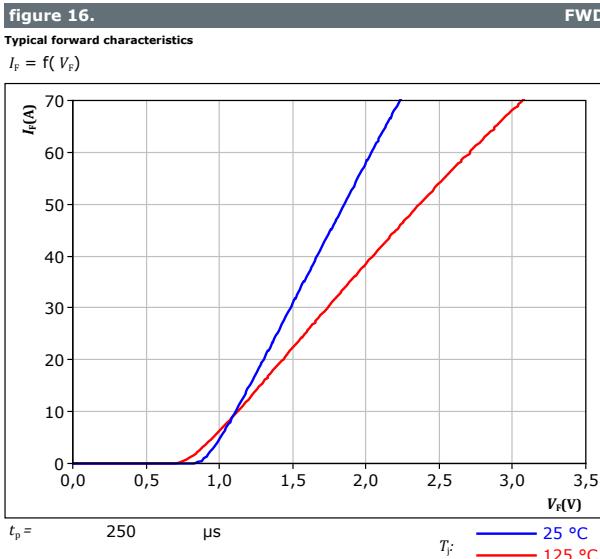
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PFC Switch Characteristics





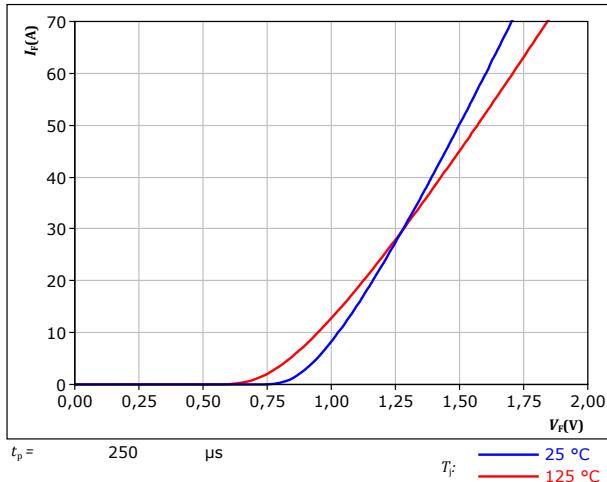
PFC Diode Characteristics





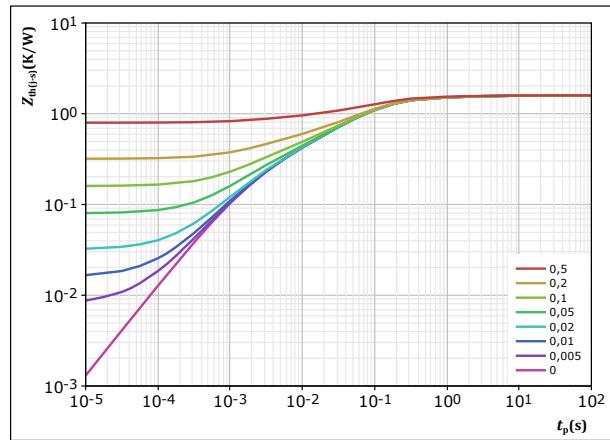
Rectifier Diode Characteristics

figure 18.
Typical forward characteristics
 $I_F = f(V_F)$



Rectifier

figure 19.
Transient thermal impedance as a function of pulse width
 $Z_{th(j-s)} = f(t_p)$



Rectifier

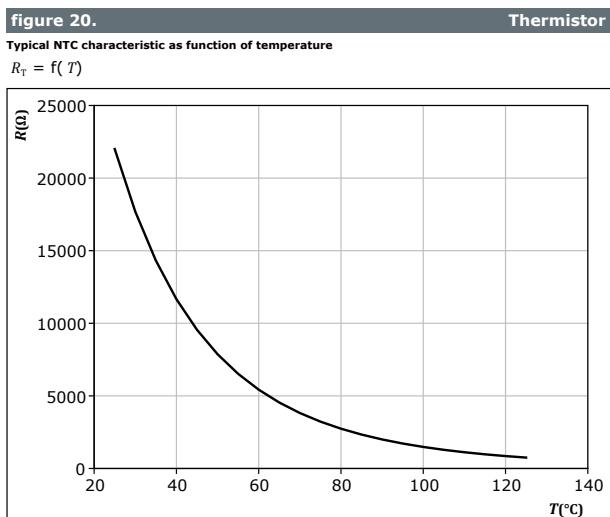
$$D = \frac{t_p / T}{1,594} \quad R_{th(j-s)} = \frac{1}{1,594} \text{ K/W}$$

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





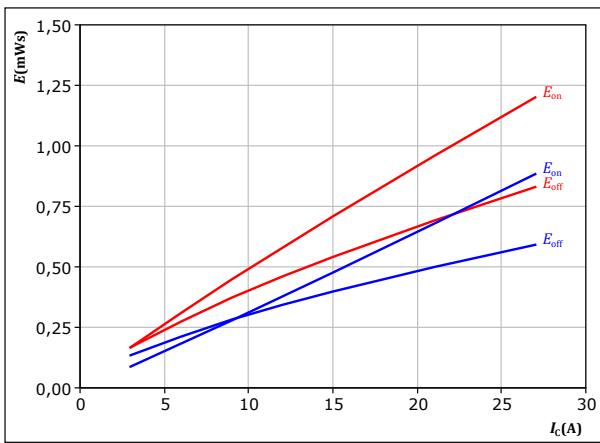
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Inverter Switching Characteristics

figure 21.

Typical switching energy losses as a function of collector current

$$E = f(I_c)$$



With an inductive load at

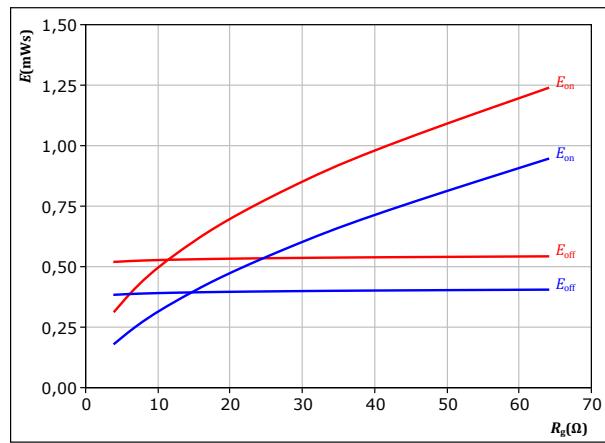
$$\begin{aligned} V_{CE} &= 400 \quad V \\ V_{GE} &= \pm 15 \quad V \\ R_{gon} &= 16 \quad \Omega \\ R_{goff} &= 16 \quad \Omega \end{aligned}$$

IGBT

figure 22.

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$



With an inductive load at

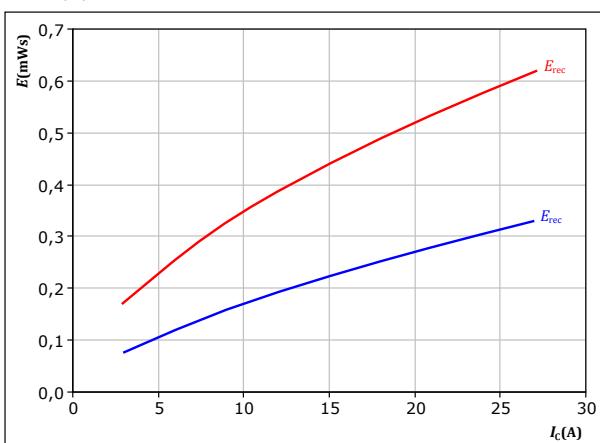
$$\begin{aligned} V_{CE} &= 400 \quad V \\ V_{GE} &= \pm 15 \quad V \\ I_c &= 15 \quad A \end{aligned}$$

IGBT

figure 23.

Typical reverse recovered energy loss as a function of collector current

$$E_{rec} = f(I_c)$$



With an inductive load at

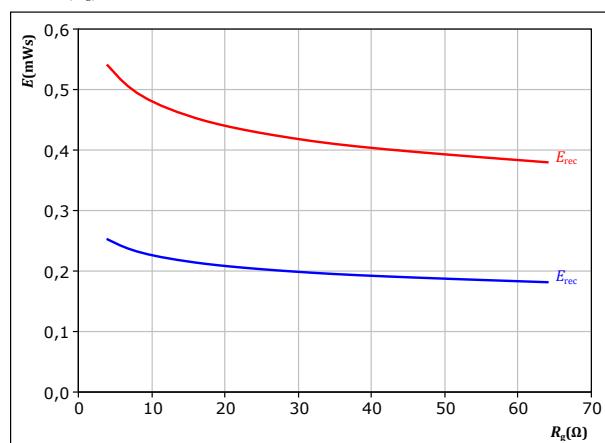
$$\begin{aligned} V_{CE} &= 400 \quad V \\ V_{GE} &= \pm 15 \quad V \\ R_{gon} &= 16 \quad \Omega \end{aligned}$$

FWD

figure 24.

Typical reverse recovered energy loss as a function of gate resistor

$$E_{rec} = f(R_g)$$



With an inductive load at

$$\begin{aligned} V_{CE} &= 400 \quad V \\ V_{GE} &= \pm 15 \quad V \\ I_c &= 15 \quad A \end{aligned}$$

FWD



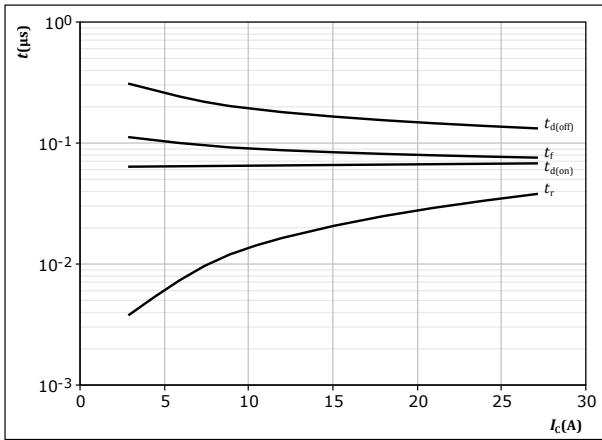
Vincotech

Inverter Switching Characteristics

figure 25.

IGBT

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



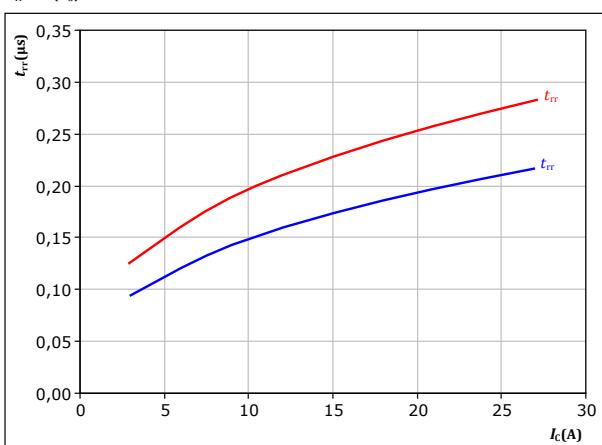
With an inductive load at

$T_j = 125^\circ\text{C}$
 $V_{CE} = 400 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 16 \Omega$
 $R_{goff} = 16 \Omega$

figure 27.

FWD

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



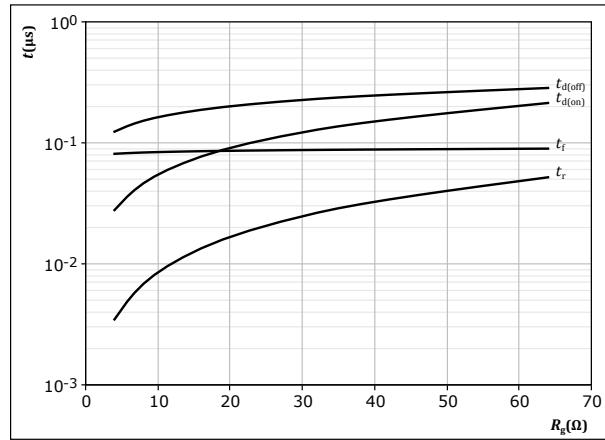
With an inductive load at

$V_{CE} = 400 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 16 \Omega$

figure 26.

IGBT

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



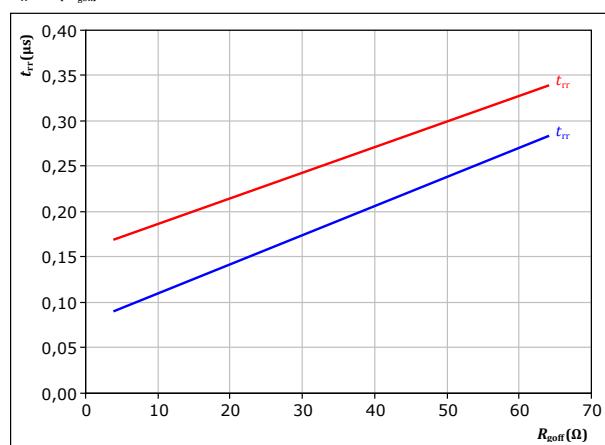
With an inductive load at

$T_j = 125^\circ\text{C}$
 $V_{CE} = 400 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_C = 15 \text{ A}$

figure 28.

FWD

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



With an inductive load at

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



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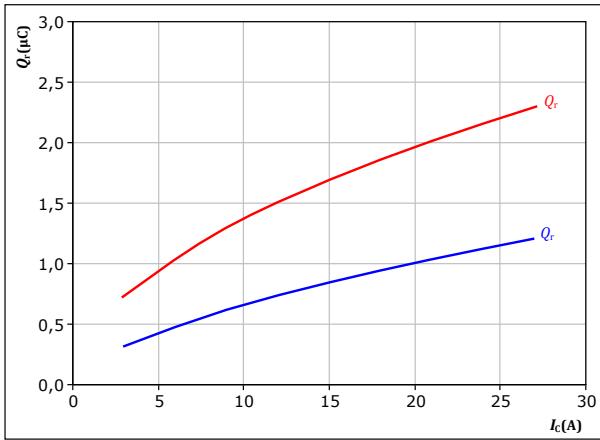
Inverter Switching Characteristics

figure 29.

FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

$$\begin{aligned} V_{CE} &= 400 \quad \text{V} \\ V_{GE} &= \pm 15 \quad \text{V} \\ R_{gon} &= 16 \quad \Omega \end{aligned}$$

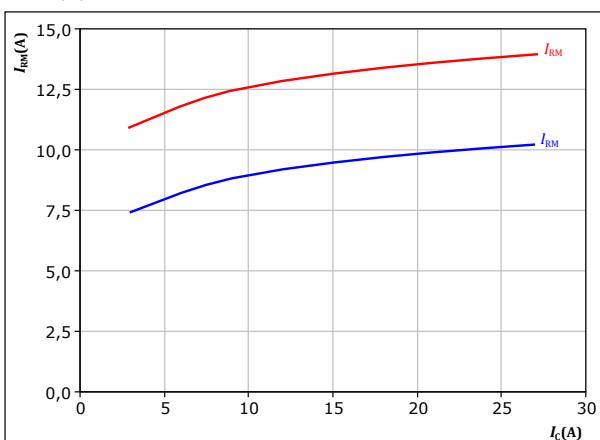
$T_f:$ 25^\circ\text{C} 125^\circ\text{C}

figure 31.

FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

$$\begin{aligned} V_{CE} &= 400 \quad \text{V} \\ V_{GE} &= \pm 15 \quad \text{V} \\ R_{gon} &= 16 \quad \Omega \end{aligned}$$

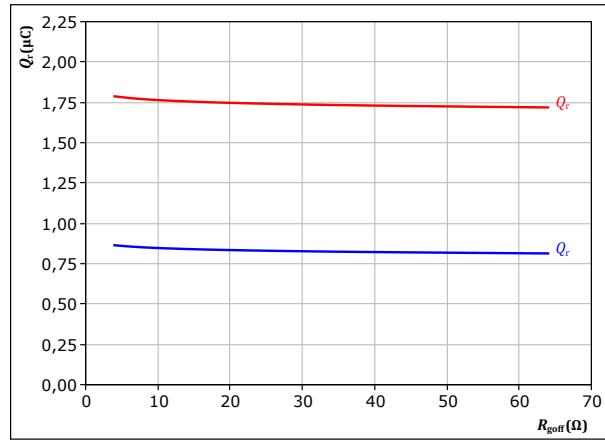
$T_f:$ 25^\circ\text{C} 125^\circ\text{C}

figure 30.

FWD

Typical recovered charge as a function of turn off gate resistor

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



With an inductive load at

$$\begin{aligned} V_{CE} &= 400 \quad \text{V} \\ V_{GE} &= \pm 15 \quad \text{V} \\ I_c &= 15 \quad \text{A} \end{aligned}$$

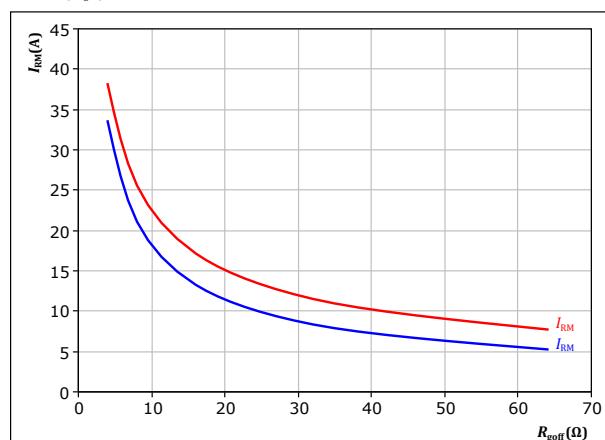
$T_f:$ 25^\circ\text{C} 125^\circ\text{C}

figure 32.

FWD

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

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



With an inductive load at

$$\begin{aligned} V_{CE} &= 400 \quad \text{V} \\ V_{GE} &= \pm 15 \quad \text{V} \\ I_c &= 15 \quad \text{A} \end{aligned}$$

$T_f:$ 25^\circ\text{C} 125^\circ\text{C}



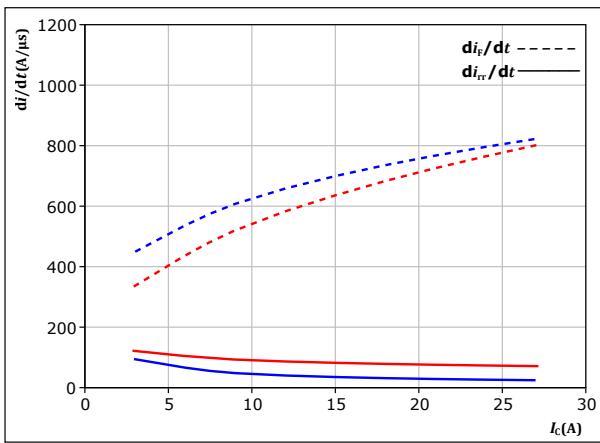
Vincotech

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

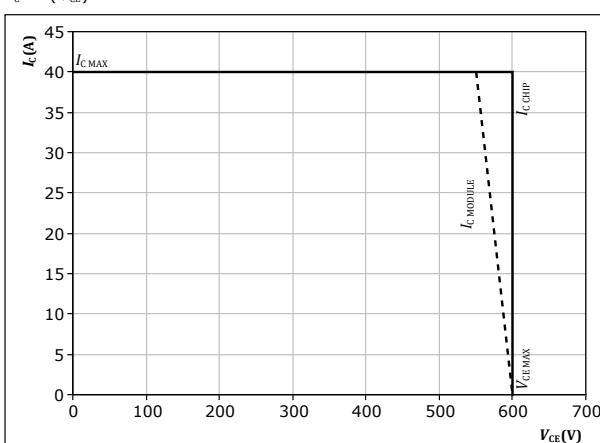
$V_{CE} = 400$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

T_j : — 25 °C — 125 °C

figure 35. IGBT

Reverse bias safe operating area

$I_c = f(V_{CE})$

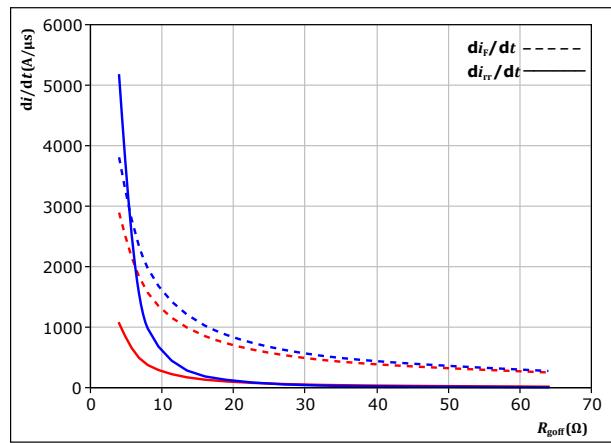


At $T_j = 125$ °C
 $R_{gon} = 16$ Ω
 $R_{goff} = 16$ Ω

figure 34. FWD

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

$di_f/dt, di_{rr}/dt = f(R_{goff})$



With an inductive load at

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

T_j : — 25 °C — 125 °C

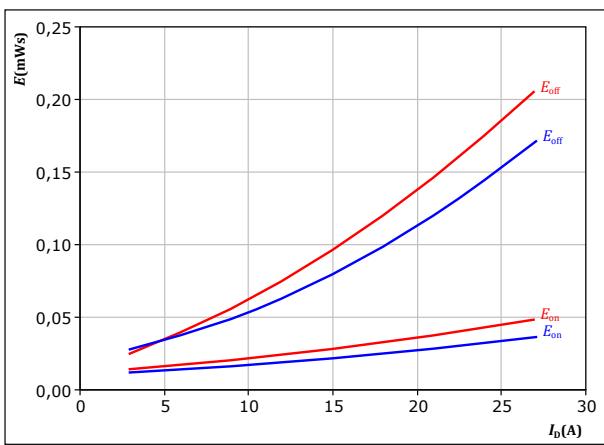


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PFC Switching Characteristics

figure 36.

Typical switching energy losses as a function of drain current
 $E = f(I_D)$

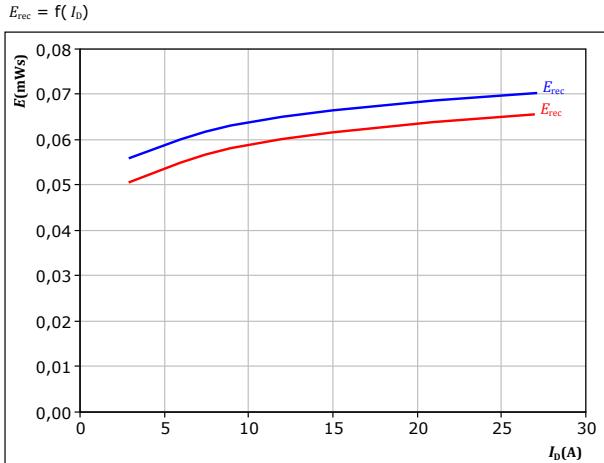


With an inductive load at

$V_{DS} = 400$ V
 $V_{GS} = 0/16$ V
 $R_{gon} = 8$ Ω
 $R_{goff} = 8$ Ω

figure 38.

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

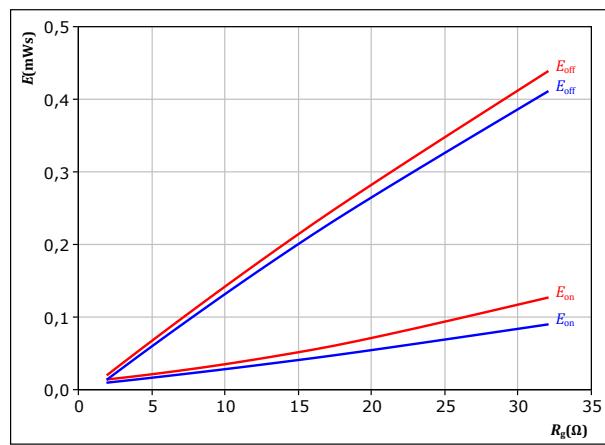


With an inductive load at

$V_{DS} = 400$ V
 $V_{GS} = 0/16$ V
 $R_{gon} = 8$ Ω

figure 37.

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

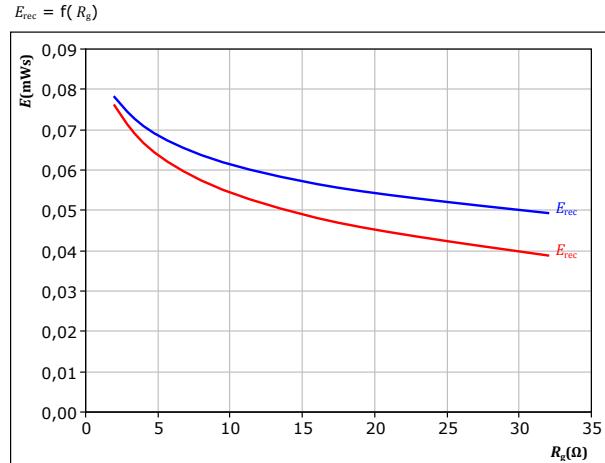


With an inductive load at

$V_{DS} = 400$ V
 $V_{GS} = 0/16$ V
 $I_D = 15$ A

figure 39.

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



With an inductive load at

$V_{DS} = 400$ V
 $V_{GS} = 0/16$ V
 $I_D = 15$ A

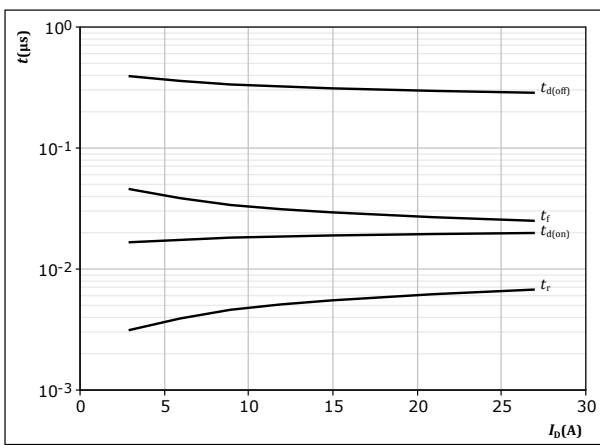


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PFC Switching Characteristics

figure 40.

Typical switching times as a function of drain current
 $t = f(I_D)$



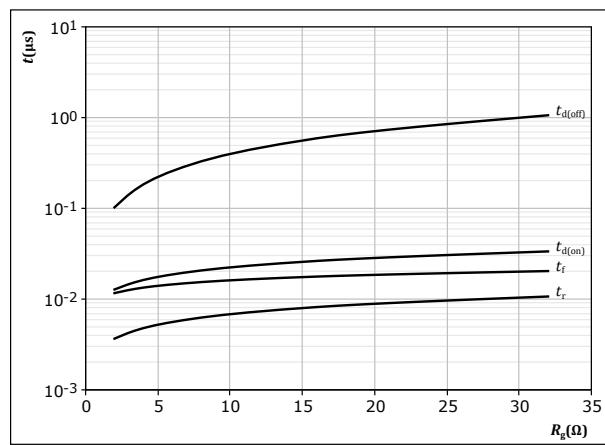
With an inductive load at

$T_j = 125^\circ\text{C}$
 $V_{DS} = 400 \text{ V}$
 $V_{GS} = 0/16 \text{ V}$
 $R_{gon} = 8 \Omega$
 $R_{goff} = 8 \Omega$

MOSFET

figure 41.

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



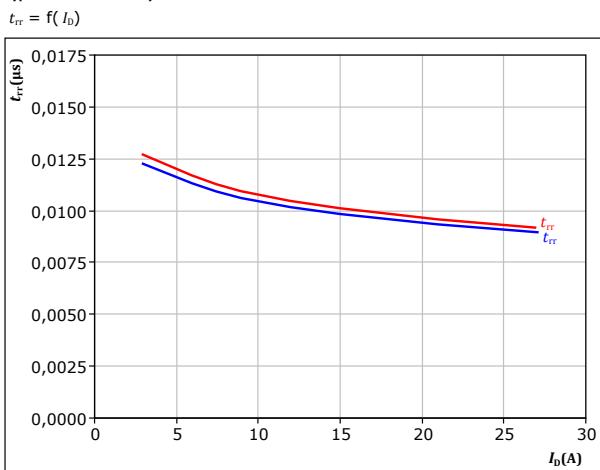
With an inductive load at

$T_j = 125^\circ\text{C}$
 $V_{DS} = 400 \text{ V}$
 $V_{GS} = 0/16 \text{ V}$
 $I_D = 15 \text{ A}$

MOSFET

figure 42.

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

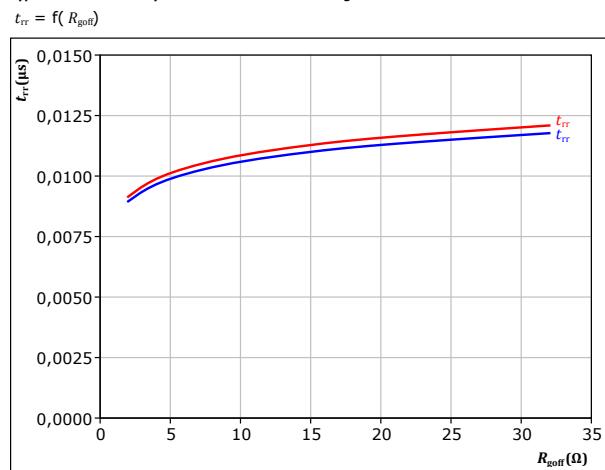


At $V_{DS} = 400 \text{ V}$
 $V_{GS} = 0/16 \text{ V}$
 $R_{gon} = 8 \Omega$

FWD

figure 43.

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



At $V_{DS} = 400 \text{ V}$
 $V_{GS} = 0/16 \text{ V}$
 $I_D = 15 \text{ A}$



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PFC Switching Characteristics

figure 44.

FWD

Typical recovered charge as a function of drain current
 $Q_r = f(I_D)$

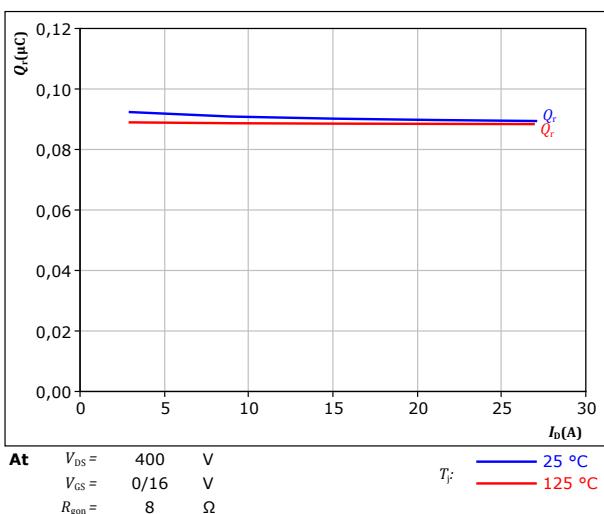


figure 46.

FWD

Typical peak reverse recovery current as a function of drain current
 $I_{RM} = f(I_D)$

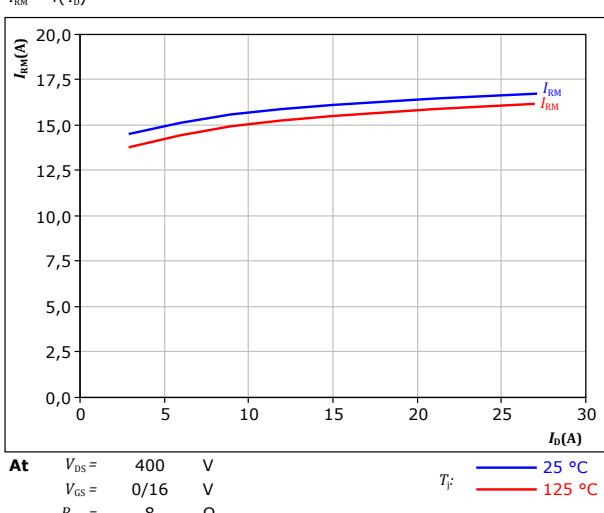


figure 45.

FWD

Typical recovered charge as a function of turn off gate resistor
 $Q_r = f(R_{goff})$

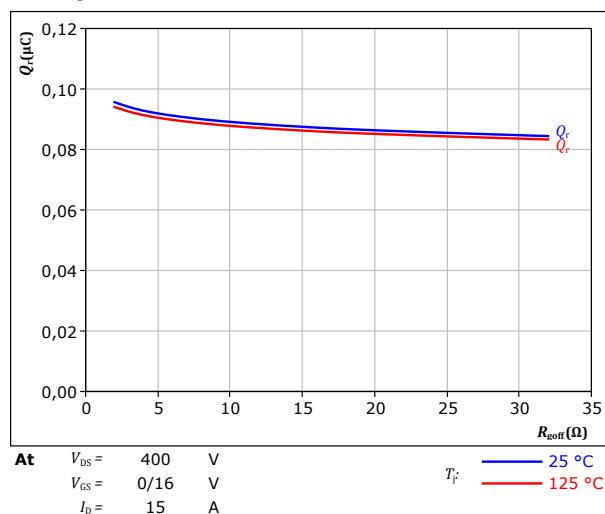
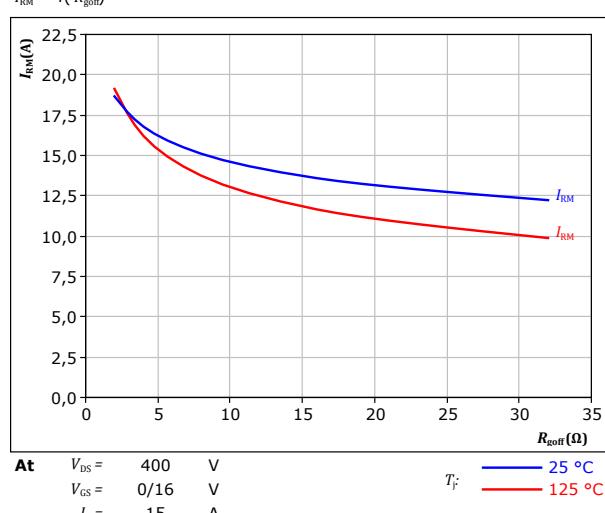


figure 47.

FWD

Typical peak reverse recovery current as a function of turn off gate resistor
 $I_{RM} = f(R_{goff})$





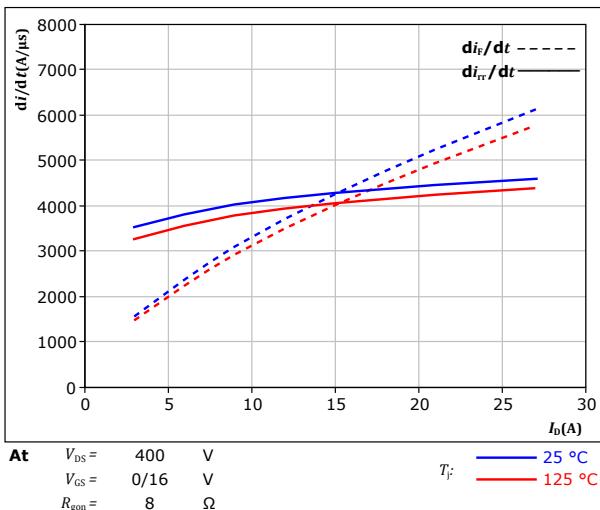
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PFC Switching Characteristics

figure 48. FWD

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

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



At $V_{DS} = 400$ V
 $V_{GS} = 0/16$ V
 $R_{gon} = 8$ Ω

figure 49. FWD

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

$$di_f/dt, di_{rr}/dt = f(R_{goff})$$

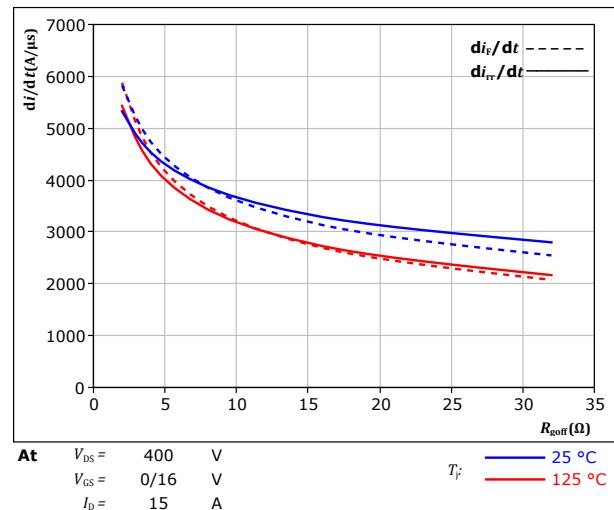
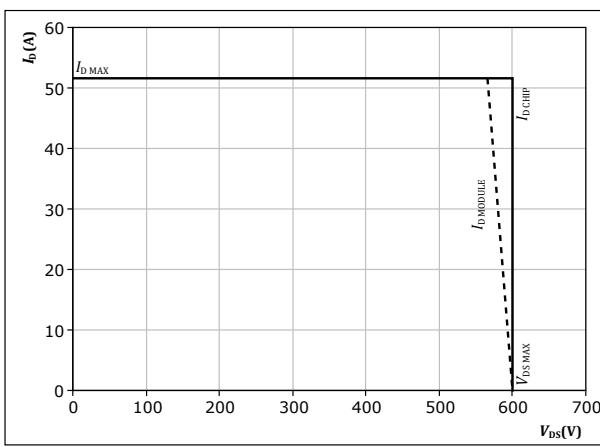


figure 50. MOSFET

Reverse bias safe operating area

$$I_D = f(V_{DS})$$



At $T_f = 125$ °C
 $R_{gon} = 8$ Ω
 $R_{goff} = 8$ Ω



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Inverter Switching Definitions

figure 51. IGBT

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

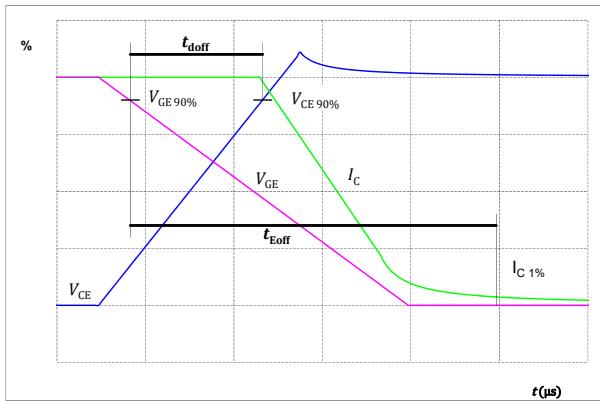


figure 52. IGBT

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

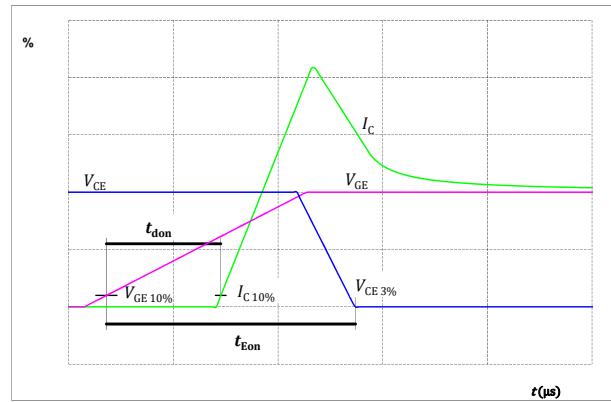


figure 53. IGBT

Turn-off Switching Waveforms & definition of t_f

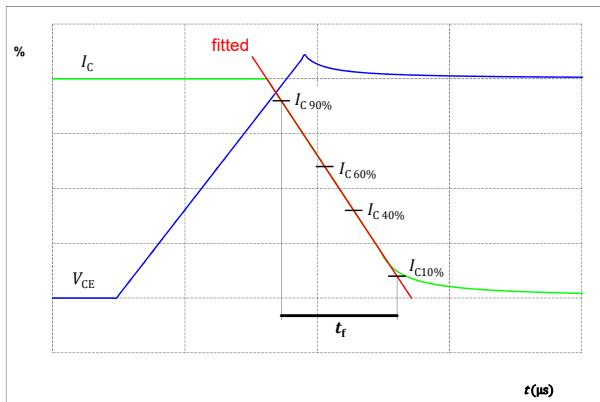
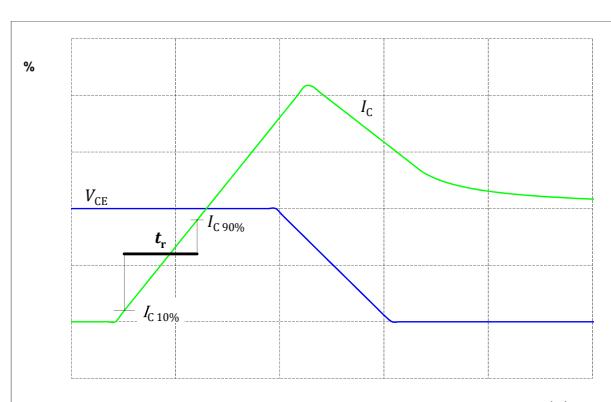


figure 54. IGBT

Turn-on Switching Waveforms & definition of t_r





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Inverter Switching Definitions

figure 55.

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

FWD

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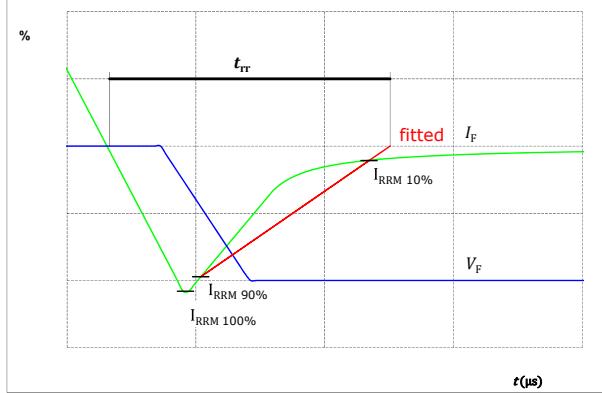
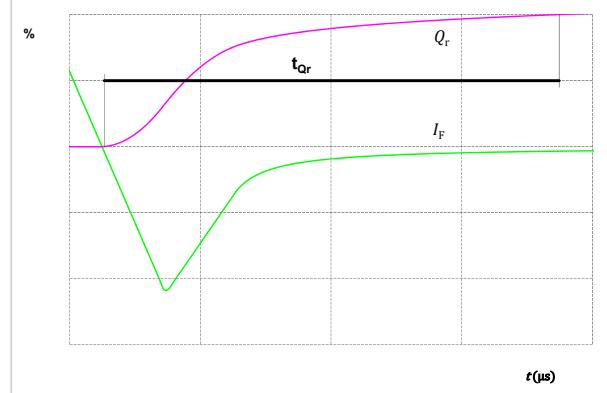


figure 56.

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

FWD

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PFC Switching Definitions

figure 51. **MOSFET**

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

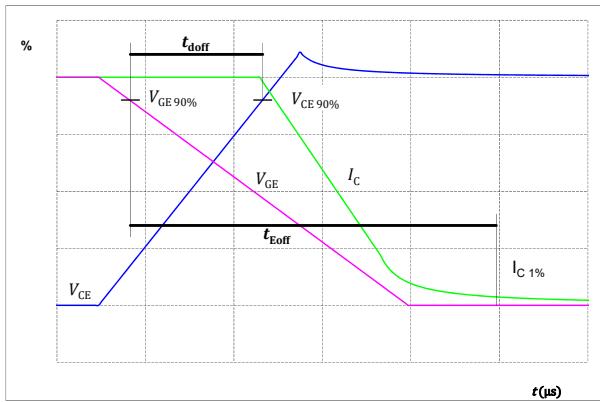


figure 52. **MOSFET**

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

figure 52. **MOSFET**

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

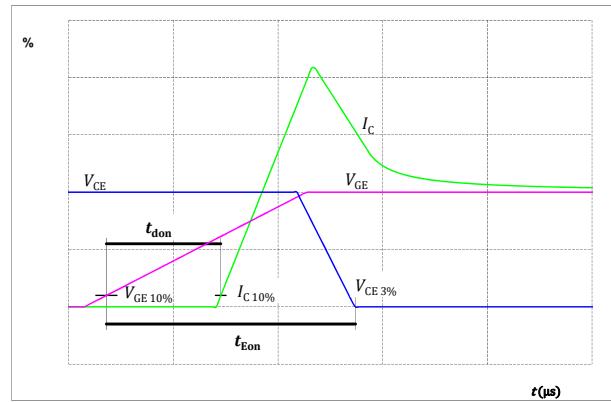


figure 53. **MOSFET**

Turn-off Switching Waveforms & definition of t_f

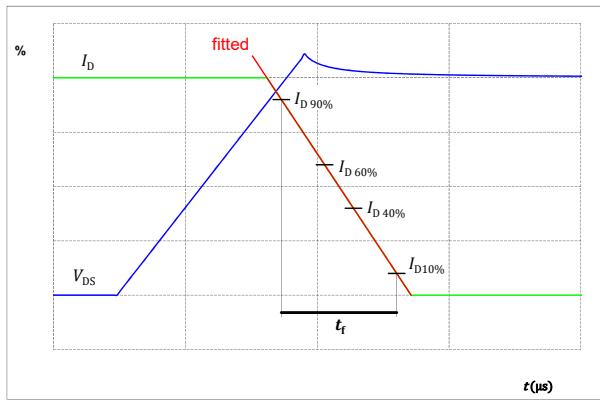
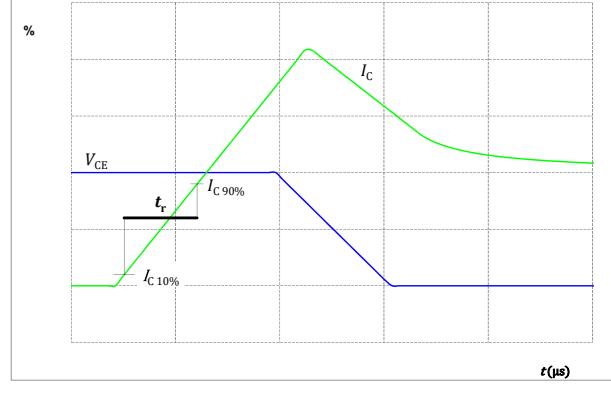


figure 54. **MOSFET**

Turn-on Switching Waveforms & definition of t_r





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PFC Switching Definitions

figure 55.

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

FWD

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

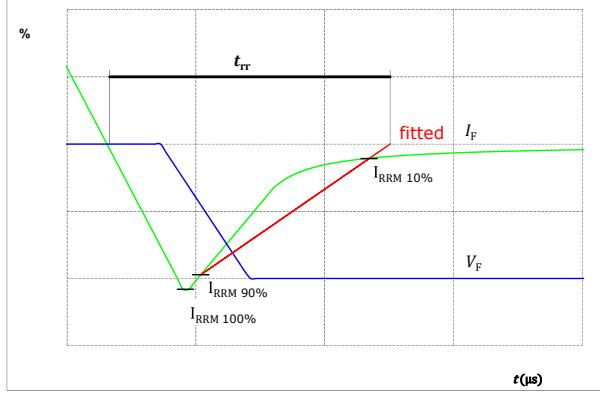


figure 56.

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

FWD

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

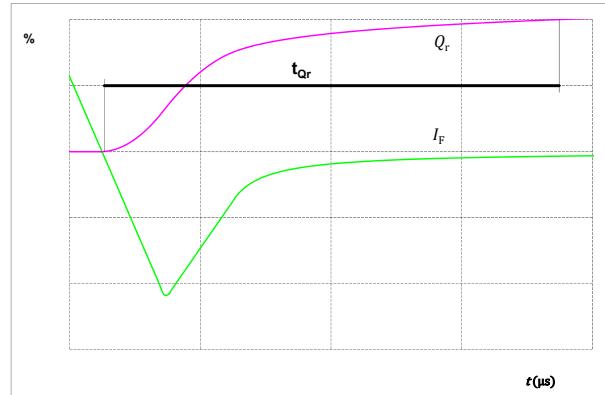
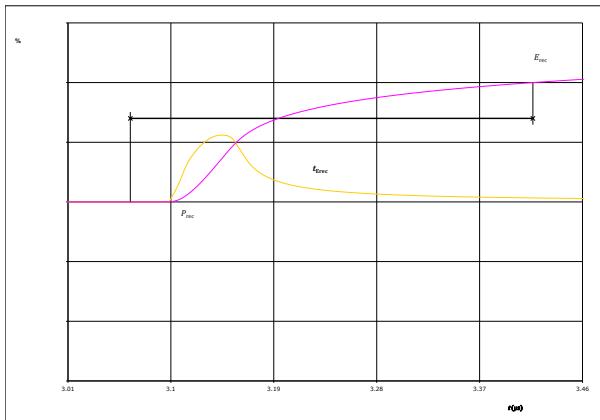


figure 57.

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

FWD

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





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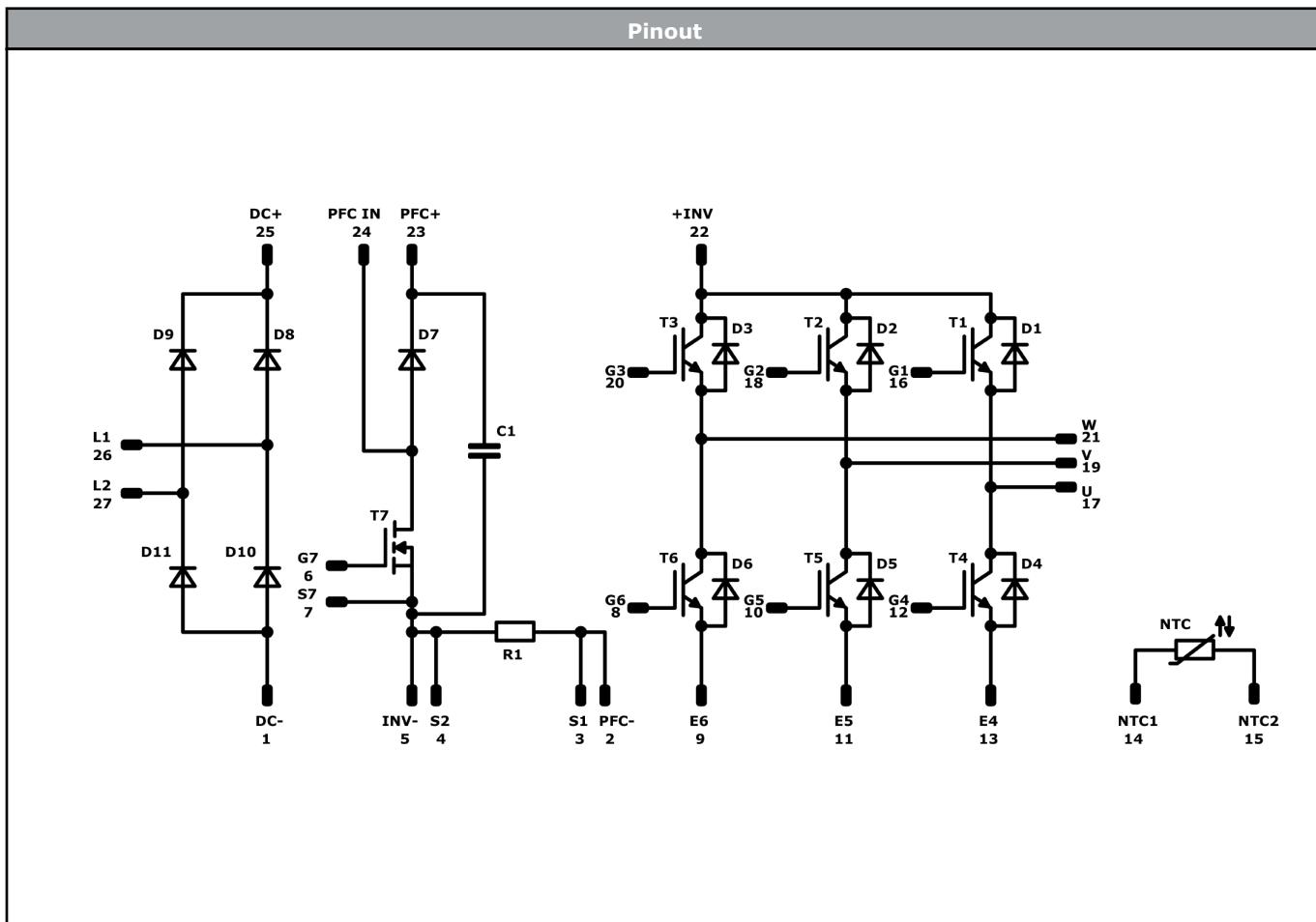
Ordering Code	
Version	Ordering Code
Without thermal paste	10-F006PPA020SB01-M685B10
With thermal paste (4,4 W/mK, PTM6000)	10-F006PPA020SB01-M685B10-/7/
With thermal paste (3,4 W/mK, PSX-P7)	10-F006PPA020SB01-M685B10-/3/

Marking						
Text	Name		Date code	UL & VIN	Lot	Serial
	NN-NNNNNNNNNNNNNNNNNN-	TTTTTTVV	WWYY	UL VIN	LLLLL	SSSS
Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTTVV	LLLLL	SSSS	WWYY		

Outline																																																																																																																						
Pin table [mm]																																																																																																																						
<table border="1"><thead><tr><th>Pin</th><th>X</th><th>Y</th><th>Function</th></tr></thead><tbody><tr><td>1</td><td>33,5</td><td>0</td><td>DC-</td></tr><tr><td>2</td><td>30,7</td><td>0</td><td>PFC-</td></tr><tr><td>3</td><td>28</td><td>0</td><td>S1</td></tr><tr><td>4</td><td>25,3</td><td>0</td><td>S2</td></tr><tr><td>5</td><td>22,6</td><td>0</td><td>INV-</td></tr><tr><td>6</td><td>19,9</td><td>0</td><td>G7</td></tr><tr><td>7</td><td>17,2</td><td>0</td><td>S7</td></tr><tr><td>8</td><td>13,5</td><td>0</td><td>G6</td></tr><tr><td>9</td><td>10,8</td><td>0</td><td>E6</td></tr><tr><td>10</td><td>8,1</td><td>0</td><td>G5</td></tr><tr><td>11</td><td>5,4</td><td>0</td><td>E5</td></tr><tr><td>12</td><td>2,7</td><td>0</td><td>G4</td></tr><tr><td>13</td><td>0</td><td>0</td><td>E4</td></tr><tr><td>14</td><td>0</td><td>8,6</td><td>NTC1</td></tr><tr><td>15</td><td>0</td><td>11,45</td><td>NTC2</td></tr><tr><td>16</td><td>0</td><td>19,8</td><td>G1</td></tr><tr><td>17</td><td>0</td><td>22,5</td><td>U</td></tr><tr><td>18</td><td>6</td><td>19,8</td><td>G2</td></tr><tr><td>19</td><td>6</td><td>22,5</td><td>V</td></tr><tr><td>20</td><td>12</td><td>19,8</td><td>G3</td></tr><tr><td>21</td><td>12</td><td>22,5</td><td>W</td></tr><tr><td>22</td><td>17,7</td><td>22,5</td><td>+INV</td></tr><tr><td>23</td><td>20,5</td><td>22,5</td><td>PFC+</td></tr><tr><td>24</td><td>26,5</td><td>22,5</td><td>PFC IN</td></tr><tr><td>25</td><td>33,5</td><td>22,5</td><td>DC+</td></tr><tr><td>26</td><td>33,5</td><td>15</td><td>L1</td></tr><tr><td>27</td><td>33,5</td><td>7,5</td><td>L2</td></tr></tbody></table>	Pin						X	Y	Function	1	33,5	0	DC-	2	30,7	0	PFC-	3	28	0	S1	4	25,3	0	S2	5	22,6	0	INV-	6	19,9	0	G7	7	17,2	0	S7	8	13,5	0	G6	9	10,8	0	E6	10	8,1	0	G5	11	5,4	0	E5	12	2,7	0	G4	13	0	0	E4	14	0	8,6	NTC1	15	0	11,45	NTC2	16	0	19,8	G1	17	0	22,5	U	18	6	19,8	G2	19	6	22,5	V	20	12	19,8	G3	21	12	22,5	W	22	17,7	22,5	+INV	23	20,5	22,5	PFC+	24	26,5	22,5	PFC IN	25	33,5	22,5	DC+	26	33,5	15	L1	27	33,5	7,5	L2	
Pin	X	Y	Function																																																																																																																			
1	33,5	0	DC-																																																																																																																			
2	30,7	0	PFC-																																																																																																																			
3	28	0	S1																																																																																																																			
4	25,3	0	S2																																																																																																																			
5	22,6	0	INV-																																																																																																																			
6	19,9	0	G7																																																																																																																			
7	17,2	0	S7																																																																																																																			
8	13,5	0	G6																																																																																																																			
9	10,8	0	E6																																																																																																																			
10	8,1	0	G5																																																																																																																			
11	5,4	0	E5																																																																																																																			
12	2,7	0	G4																																																																																																																			
13	0	0	E4																																																																																																																			
14	0	8,6	NTC1																																																																																																																			
15	0	11,45	NTC2																																																																																																																			
16	0	19,8	G1																																																																																																																			
17	0	22,5	U																																																																																																																			
18	6	19,8	G2																																																																																																																			
19	6	22,5	V																																																																																																																			
20	12	19,8	G3																																																																																																																			
21	12	22,5	W																																																																																																																			
22	17,7	22,5	+INV																																																																																																																			
23	20,5	22,5	PFC+																																																																																																																			
24	26,5	22,5	PFC IN																																																																																																																			
25	33,5	22,5	DC+																																																																																																																			
26	33,5	15	L1																																																																																																																			
27	33,5	7,5	L2																																																																																																																			
Tolerance of pinpositions $\pm 0.5\text{mm}$ at the end of pins Dimension of coordinate axis is only offset without tolerance																																																																																																																						



Vincotech



Identification

ID	Component	Voltage	Current	Function	Comment
T6, T3, T5, T2, T4, T1	IGBT	600 V	20 A	Inverter Switch	
D3, D6, D2, D5, D1, D4	FWD	600 V	30 A	Inverter Diode	
T7	MOSFET	600 V	63 mΩ	PFC Switch	
D7	FWD	650 V	24 A	PFC Diode	
D11, D9, D10, D8	Rectifier	1600 V	25 A	Rectifier Diode	
R1	Shunt			PFC Shunt	
C1	Capacitor	500 V		Capacitor (PFC)	
NTC	Thermistor			Thermistor	

**10-F006PPA020SB01-M685B10**

datasheet

Vincotech**Packaging instruction**

Standard packaging quantity (SPQ) 135	>SPQ	Standard	<SPQ	Sample
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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 certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.



Document No.:	Date:	Modification:	Pages
10-F006PPA020SB01-M685B10-D4-14	30 Jun. 2020	Datasheet format update: Generalized format to Type-specific format Correct Rth of PFC Switch	
10-F006PPA020SB01-M685B10-D5-14	21 May. 2021	PFC Diode change (PCN 15-2019), new ordering code	

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As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.
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.