



**flowPIM 1 + PFC**

**600 V / 30 A**

**Features**

- One-phase rectifier
- Interleaved PFC circuit
- High speed IGBT in the inverter
- On-board capacitors
- Built-in NTC

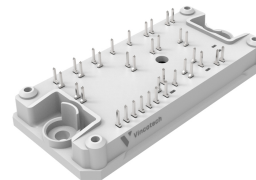
**Target applications**

- Embedded Drives
- Heat Pumps
- HVAC
- Industrial Drives

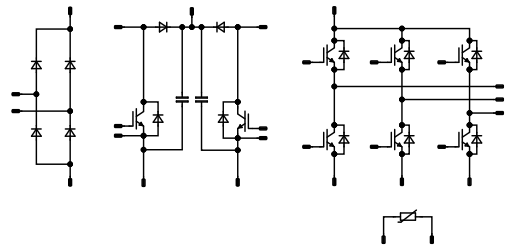
**Types**

- 10-FE06PPA030SJ07-LV82B03Z

**flow 1 12 mm housing**



**Schematic**





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## Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
<b>Inverter Switch</b>				
Collector-emitter voltage	$V_{CES}$		600	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	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	63	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Short circuit ratings	$t_{SC}$	$V_{GE} = 15\text{ V}$ , $V_{CC} = 400\text{ V}$ $T_j = 150\text{ °C}$	5	$\mu\text{s}$
Maximum junction temperature	$T_{jmax}$		175	$^{\circ}\text{C}$
<b>Inverter Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		600	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 $T_{jmax}$	40	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	50	W
Maximum junction temperature	$T_{jmax}$		175	$^{\circ}\text{C}$
<b>PFC Switch</b>				
Collector-emitter voltage	$V_{CES}$		650	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	29	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	90	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	68	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	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
<b>PFC Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		650	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	32	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	180	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	59	W
Maximum junction temperature	$T_{jmax}$		175	°C

## PFC Sw. Protection Diode

Peak repetitive reverse voltage	$V_{RRM}$		650	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	16	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	12	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	38	W
Maximum junction temperature	$T_{jmax}$		175	°C

## Rectifier Diode

Peak repetitive reverse voltage	$V_{RRM}$		1600	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	99	A
Surge (non-repetitive) forward current	$I_{FSM}$	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	890	A
Surge current capability	$I^2t$		3960	A <sup>2</sup> s
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	108	W
Maximum junction temperature	$T_{jmax}$		150	°C

## Capacitor (PFC)

Maximum DC voltage	$V_{MAX}$		630	V
Operation Temperature	$T_{op}$		-55 ... 150	°C



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**10-FE06PPA030SJ07-LV82B03Z**  
datasheet

## Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
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### 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			7,82	mm
Comparative Tracking Index	CTI		≥ 600	

\*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	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00048	25	4,1	5,1	5,7	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		30	25 125 150		1,73 1,97 2,01	1,8 <sup>(1)</sup>	V
Collector-emitter cut-off current	$I_{CES}$		0	600		25			1,6	μA
Gate-emitter leakage current	$I_{GES}$		20	0		25			100	nA
Internal gate resistance	$r_g$							None		Ω
Input capacitance	$C_{ies}$							1050		pF
Output capacitance	$C_{oes}$	$f = 1$ Mhz	0	25		25		45		pF
Reverse transfer capacitance	$C_{res}$							36		pF
Gate charge	$Q_g$	$V_{CC} = 480$ V	15		30	25		130		nC

##### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,52		K/W
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##### Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		37 38 38		ns
Rise time	$t_r$					25 125 150		12 13 15		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		90 109 113		ns
Fall time	$t_f$					25 125 150		12 19,35 23,06		ns
Turn-on energy (per pulse)	$E_{on}$	$Q_{tFWD} = 0,812$ μC $Q_{tFWD} = 1,81$ μC $Q_{tFWD} = 2,02$ μC				25 125 150		0,758 0,981 1,04		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		0,233 0,422 0,469		mWs



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datasheet

### 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		
<b>Inverter Diode</b>										
<b>Static</b>										
Forward voltage	$V_F$				20	25 125 150	1,25	1,7 1,58 1,58	1,95 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_r = 600$ V				25			27	μA
<b>Thermal</b>										
Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,91		K/W
<b>Dynamic</b>										
Peak recovery current	$I_{RRM}$	$di/dt=500$ A/μs $di/dt=1295$ A/μs $di/dt=1294$ A/μs	±15	350	30	25 125 150		7,86 12,39 13,22		A
Reverse recovery time	$t_{rr}$					25 125 150		200,95 276,23 327,76		ns
Recovered charge	$Q_r$					25 125 150		0,812 1,81 2,02		μC
Reverse recovered energy	$E_{rec}$					25 125 150		0,161 0,388 0,431		mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$					25 125 150		53,57 61,27 82,45		A/μs



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datasheet

### Characteristic Values

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

#### 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 <sup>(1)</sup>	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 <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,39		K/W
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##### Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		12 12 13		ns
Rise time	$t_r$	$R_{gon} = 8$ Ω $R_{goff} = 8$ Ω				25 125 150		8 8 8		ns
Turn-off delay time	$t_{d(off)}$		0/15	400	30	25 125 150		80 94 98		ns
Fall time	$t_f$					25 125 150		7,96 9,61 10,37		ns
Turn-on energy (per pulse)	$E_{on}$	$Q_{tFWD} = 0,394$ μC $Q_{tFWD} = 0,956$ μC $Q_{tFWD} = 1,17$ μC				25 125 150		0,391 0,524 0,451		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		0,086 0,207 0,332		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		2,47 2,03	2,6 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_i = 650$ V				25			10	μA

##### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,61		K/W
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##### Dynamic

Peak recovery current	$I_{RRM}$	$di/dt=4524$ A/μs $di/dt=4528$ A/μs $di/dt=4350$ A/μs	0/15	400	30	25		24,18		A
Reverse recovery time	$t_{rr}$					125		39,85		
						150		45,05		
						25		18,85		
Recovered charge	$Q_r$					125		0,956		
						150		1,17		
		25		0,088						
Reverse recovered energy	$E_{rec}$	125		0,221						
		150		0,275						
		25		2361						
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$	125		2958						
		150		3147						





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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. Protection Diode

##### Static

Forward voltage	$V_F$			6	25 125 150	1,23	1,72 1,59 1,54	1,87 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_r = 650$ V			25			0,1	$\mu$ A

##### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)					2,53		K/W
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#### Rectifier Diode

##### Static

Forward voltage	$V_F$			5	25 125 150		0,83 0,69 0,656	1,1 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_r = 1600$ V			25 150			100 2	$\mu$ A

##### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)					0,65		K/W
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#### Capacitor (PFC)

##### Static

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



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### Characteristic Values

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

### 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. $\pm 1 \%$						3962		K
B-value	$B_{(25/100)}$	Tol. $\pm 1 \%$						4000		K
Vincotech Thermistor Reference									I	

<sup>(1)</sup> Value at chip level

<sup>(2)</sup> Only valid with pre-applied Vincotech thermal interface material.

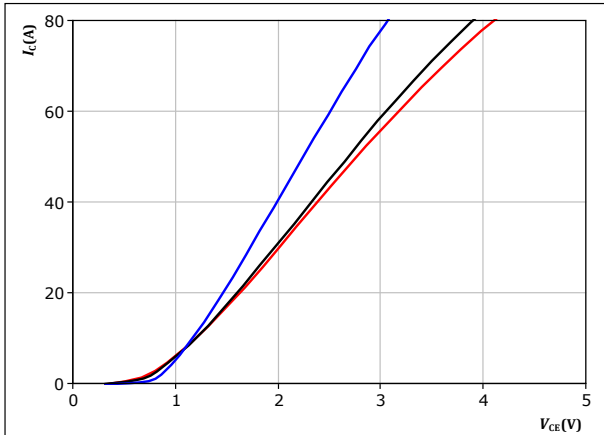


## Inverter Switch Characteristics

**figure 1.** IGBT

Typical output characteristics

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



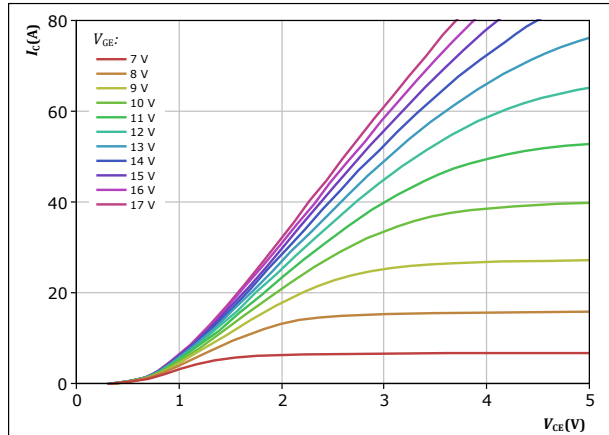
$t_p = 250 \mu s$   
 $V_{GE} = 15 V$

$T_j:$  — 25 °C  
— 125 °C  
— 150 °C

**figure 2.** IGBT

Typical output characteristics

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

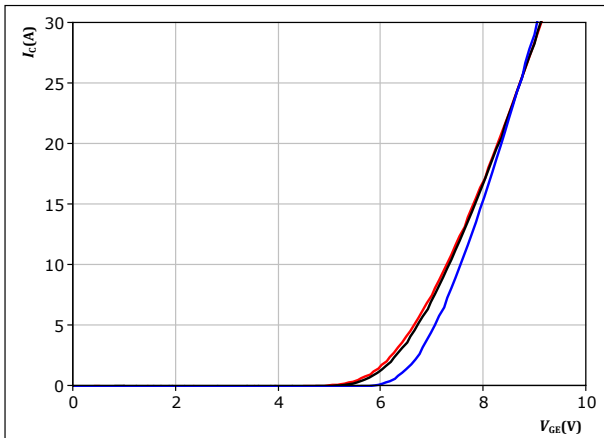


$t_p = 250 \mu s$   
 $T_j = 150 \text{ } ^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

**figure 3.** IGBT

Typical transfer characteristics

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



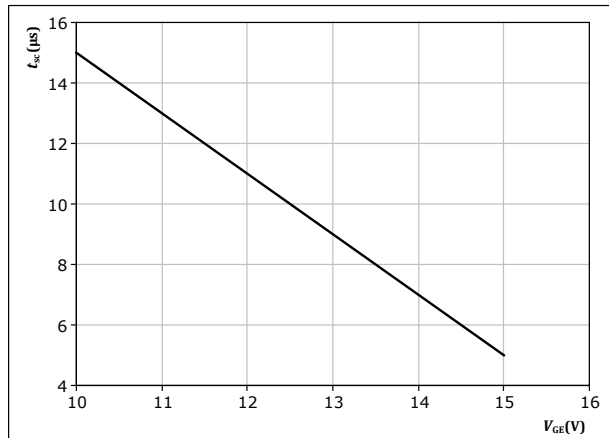
$t_p = 250 \mu s$   
 $V_{CE} = 10 V$

$T_j:$  — 25 °C  
— 125 °C  
— 150 °C

**figure 4.** IGBT

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

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



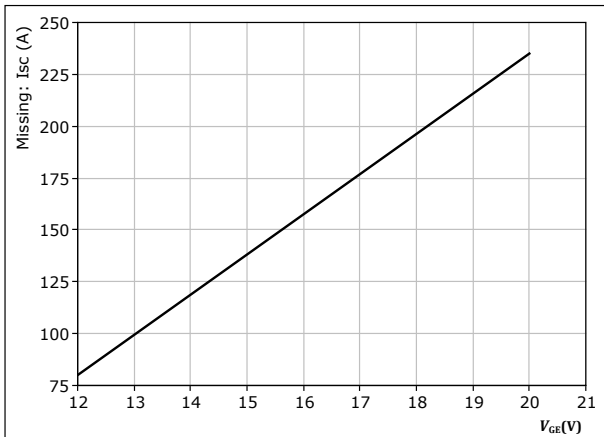
At  $V_{CE} = V$   
 $T_j \leq \text{ } ^\circ C$



## Inverter Switch Characteristics

**figure 5.** IGBT

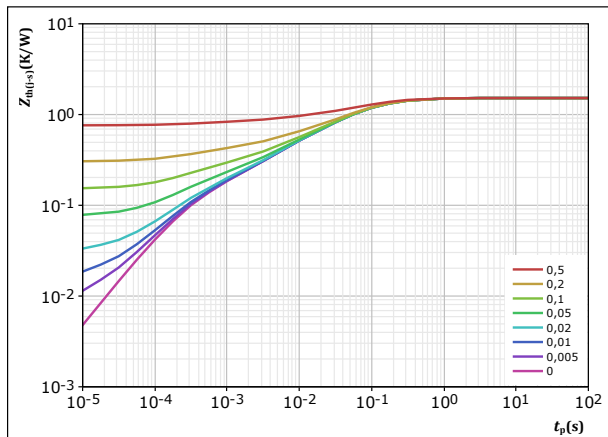
Typical short circuit current as a function of  $V_{GE}$   
Missing:  $I_{sc} = f(V_{GE})$



At  $T_j \leq$  °C

**figure 6.** IGBT

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

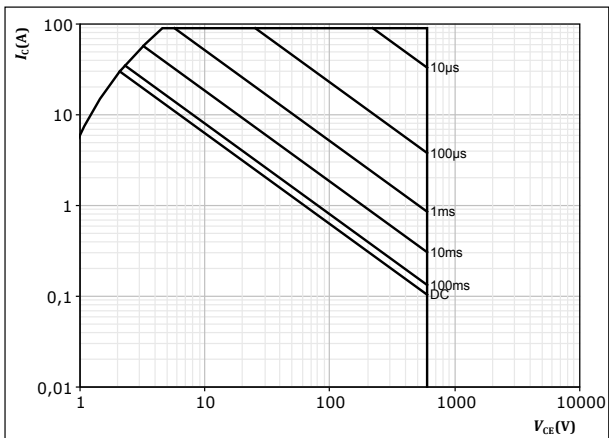


$D = \frac{t_p}{T}$   
 $R_{th(j-s)} = 1,52$  K/W  
IGBT thermal model values

$R$ (K/W)	$\tau$ (s)
1,77E-01	4,26E-01
6,88E-01	7,72E-02
3,07E-01	2,26E-02
2,02E-01	5,04E-03
6,94E-02	7,36E-04
7,56E-02	2,30E-04

**figure 7.** IGBT

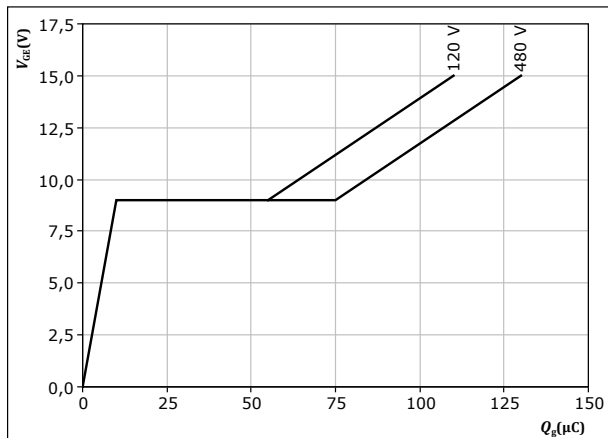
Safe operating area  
 $I_c = f(V_{CE})$



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

**figure 8.** IGBT

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



$I_c = 30$  A  
 $T_j = 25$  °C



## Inverter Diode Characteristics

figure 9. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

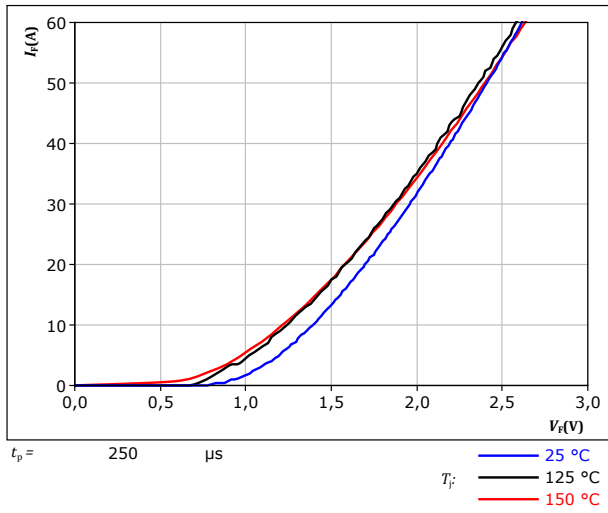
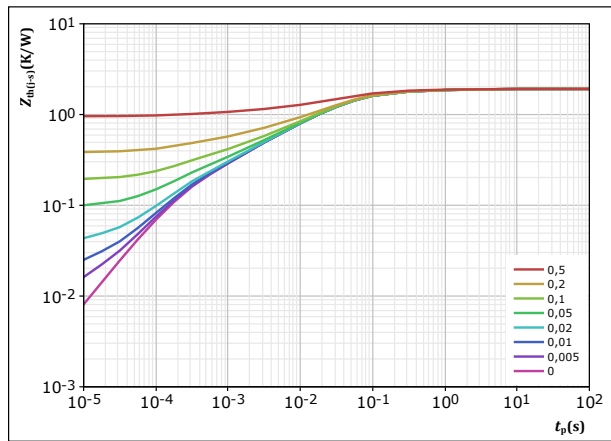


figure 10. FWD

Transient thermal impedance as a function of pulse width

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



$D = \frac{t_p}{T}$   
 $R_{th(j-s)} = 1,914 \text{ K/W}$   
 FWD thermal model values

R (K/W)	$\tau$ (s)
8,07E-02	2,21E+00
2,18E-01	2,22E-01
8,50E-01	4,41E-02
4,32E-01	9,35E-03
2,00E-01	1,60E-03
1,34E-01	2,12E-04

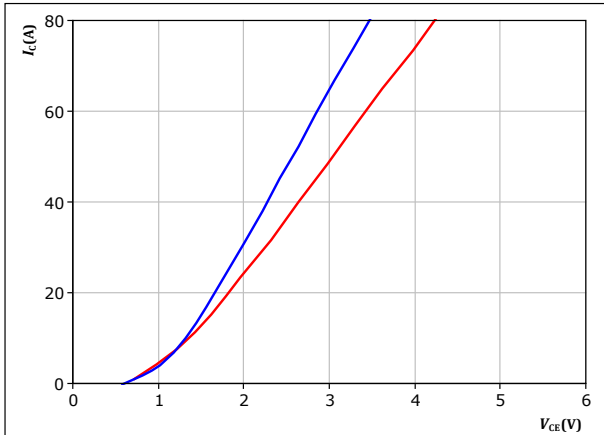


### PFC Switch Characteristics

**figure 11.** IGBT

Typical output characteristics

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

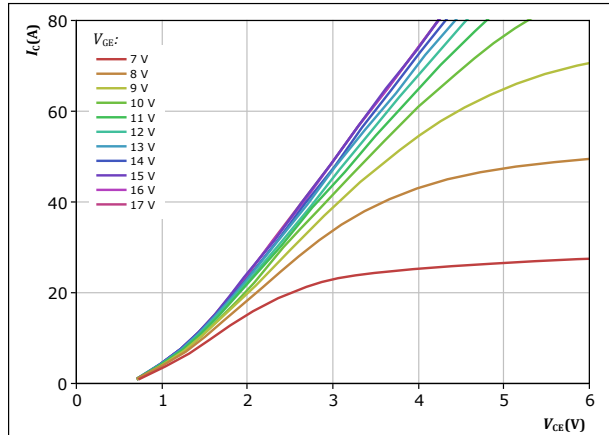


$t_p = 250 \mu s$   
 $V_{GE} = 15 V$   
 $T_j: 25^\circ C$  (blue line)  
 $125^\circ C$  (red line)

**figure 12.** IGBT

Typical output characteristics

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

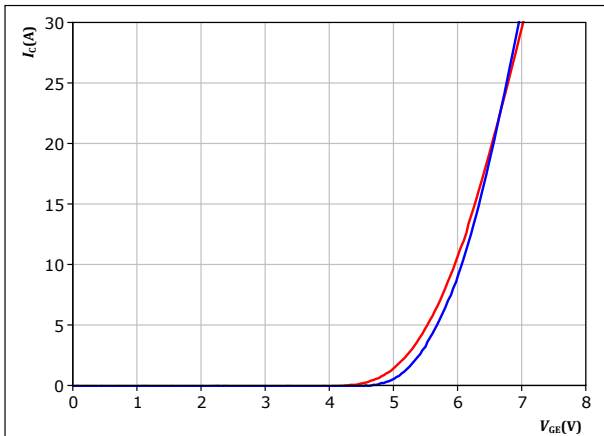


$t_p = 250 \mu s$   
 $T_j = 125^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

**figure 13.** IGBT

Typical transfer characteristics

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

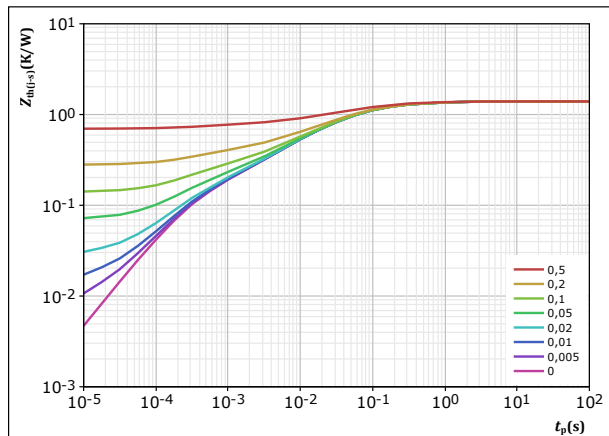


$t_p = 250 \mu s$   
 $V_{CE} = 10 V$   
 $T_j: 25^\circ C$  (blue line)  
 $125^\circ C$  (red line)

**figure 14.** IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 1,394 K/W$   
IGBT thermal model values

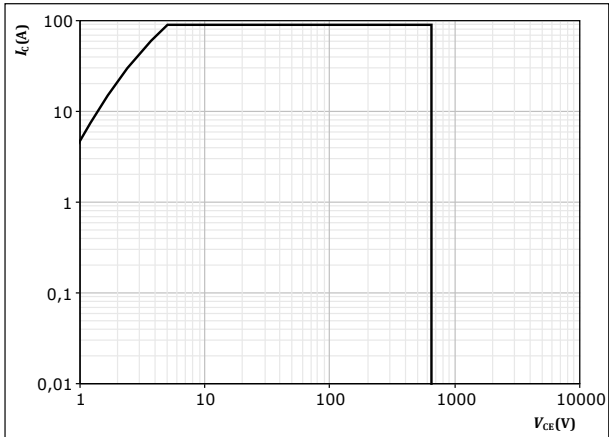
R (K/W)	$\tau$ (s)
8,66E-02	1,03E+00
1,95E-01	1,93E-01
5,59E-01	5,17E-02
3,47E-01	9,99E-03
9,37E-02	1,86E-03
1,12E-01	2,95E-04



### PFC Switch Characteristics

**figure 15.** IGBT

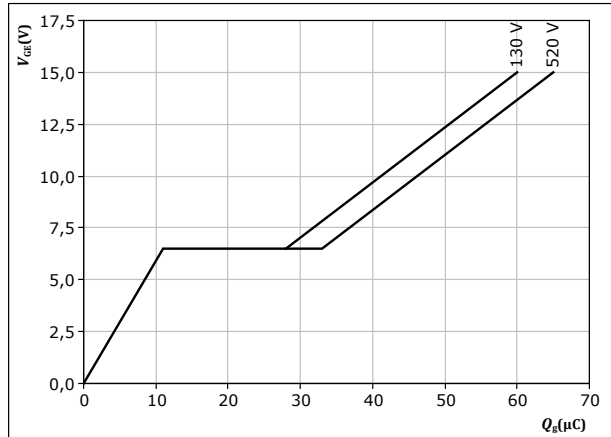
Safe operating area  
 $I_C = f(V_{CE})$



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

**figure 16.** IGBT

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



$I_C = 30$  A  
 $T_j = 25$  °C



### PFC Diode Characteristics

figure 17. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

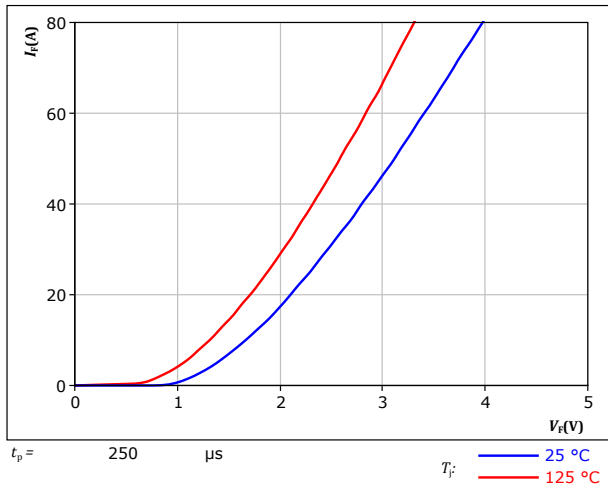
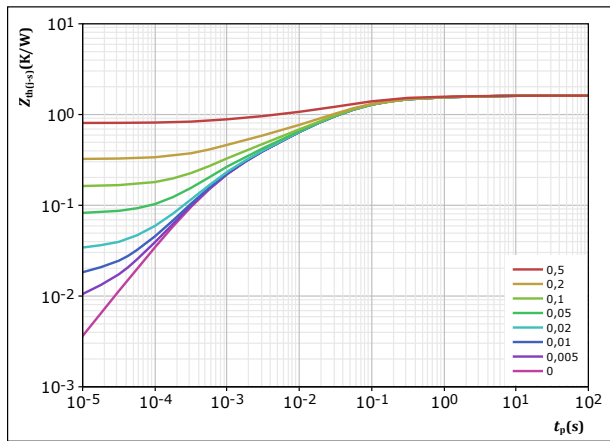


figure 18. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)} = 1,615 \text{ K/W}$

FWD thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
6,26E-02	3,75E+00
1,57E-01	4,48E-01
5,80E-01	7,07E-02
4,30E-01	1,76E-02
2,34E-01	3,12E-03
1,51E-01	5,87E-04





## PFC Sw. Protection Diode Characteristics

figure 19. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

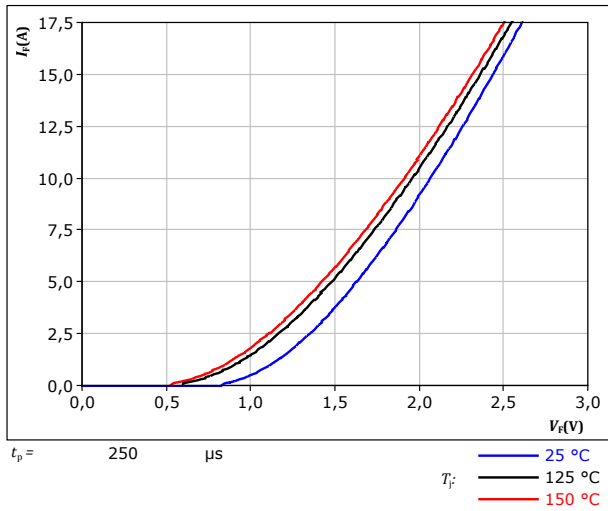
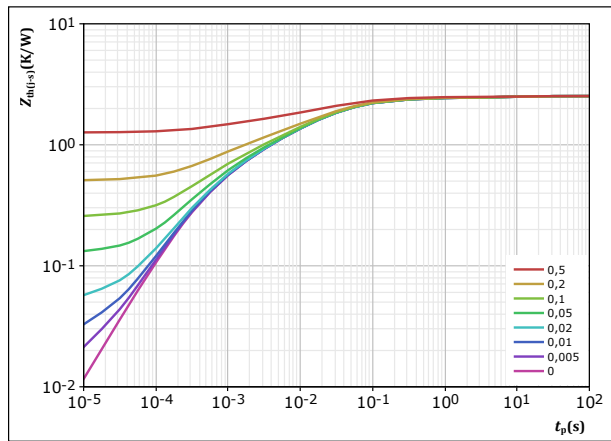


figure 20. FWD

Transient thermal impedance as a function of pulse width

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



$D = \frac{t_p}{T}$   
 $R_{th(j-s)} = 2,527 \text{ K/W}$   
 FWD thermal model values

R (K/W)	$\tau$ (s)
9,24E-02	9,29E+00
1,75E-01	3,21E-01
7,31E-01	4,97E-02
7,14E-01	1,16E-02
4,89E-01	2,11E-03
3,27E-01	3,78E-04



## Rectifier Diode Characteristics

figure 21. Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

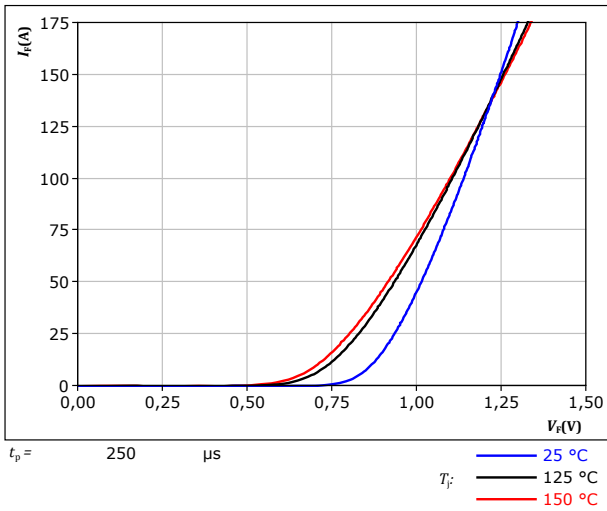
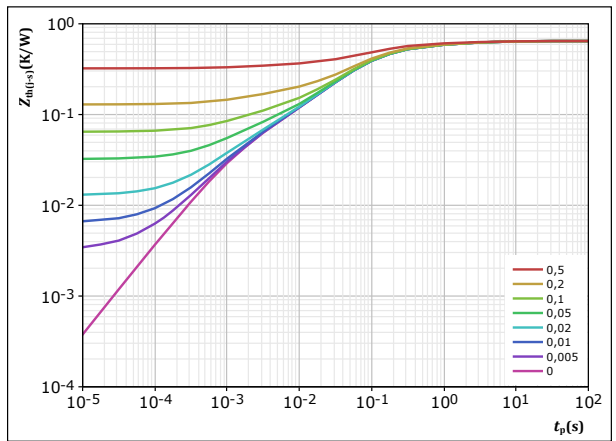


figure 22. Rectifier

Transient thermal impedance as a function of pulse width

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



$D = \frac{t_p}{T}$   
 $R_{th(j-s)} = 0,646 \text{ K/W}$

Rectifier thermal model values

$R$ (K/W)	$\tau$ (s)
2,68E-02	6,32E+00
7,07E-02	1,29E+00
1,46E-01	2,31E-01
3,15E-01	6,56E-02
5,35E-02	9,74E-03
3,41E-02	1,27E-03

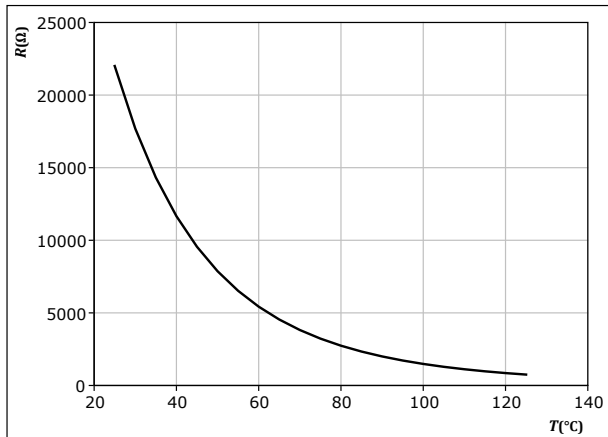


### Thermistor Characteristics

figure 23. Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$

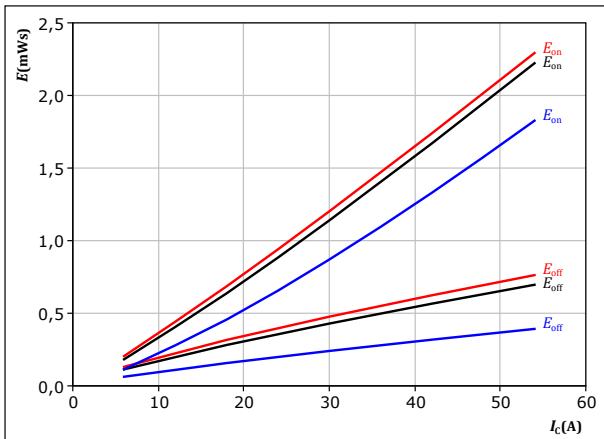




## Inverter Switching Characteristics

figure 24. IGBT

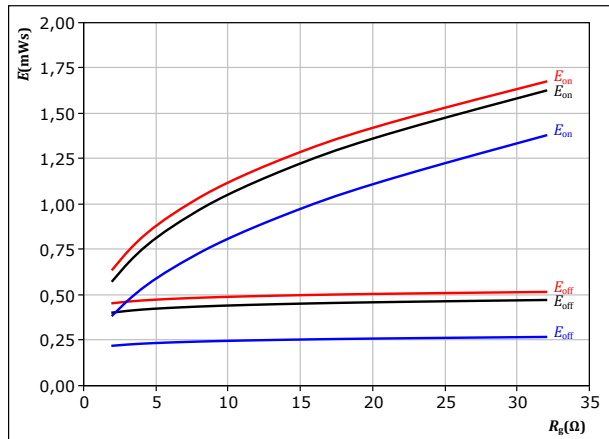
Typical switching energy losses as a function of collector current  
 $E = f(I_c)$



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$   $\Omega$   
 $R_{goff} = 8$   $\Omega$   
 $T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 25. IGBT

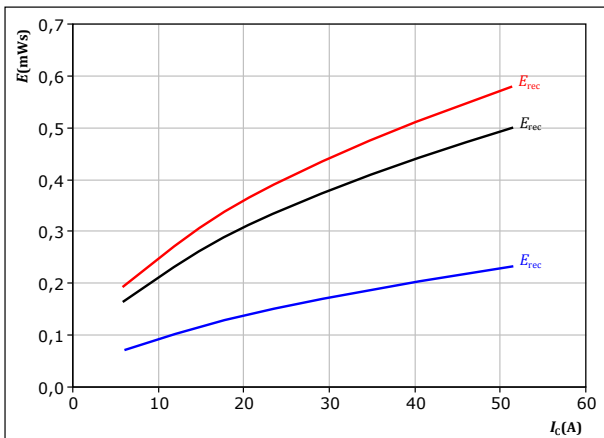
Typical switching energy losses as a function of gate resistor  
 $E = f(R_g)$



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 30$  A  
 $T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 26. FWD

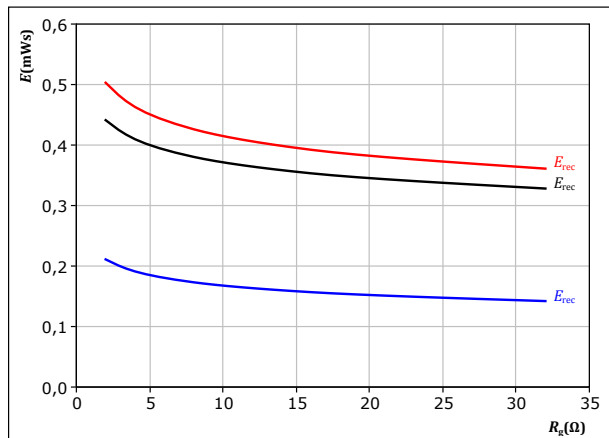
Typical reverse recovered energy loss as a function of collector current  
 $E_{rec} = f(I_c)$



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$   $\Omega$   
 $T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 27. FWD

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



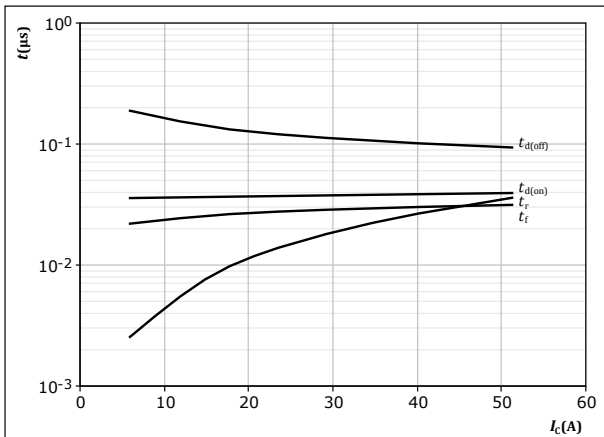
With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 30$  A  
 $T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)



## Inverter Switching Characteristics

**figure 28.** IGBT

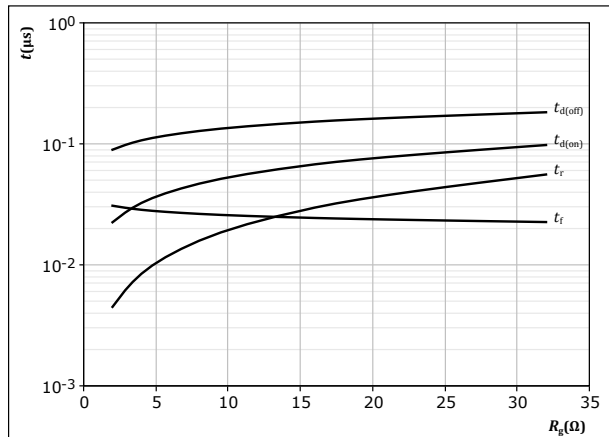
Typical switching times as a function of collector current  
 $t = f(I_c)$



With an inductive load at  
 $T_j = 150$  °C  
 $V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$   $\Omega$   
 $R_{goff} = 8$   $\Omega$

**figure 29.** IGBT

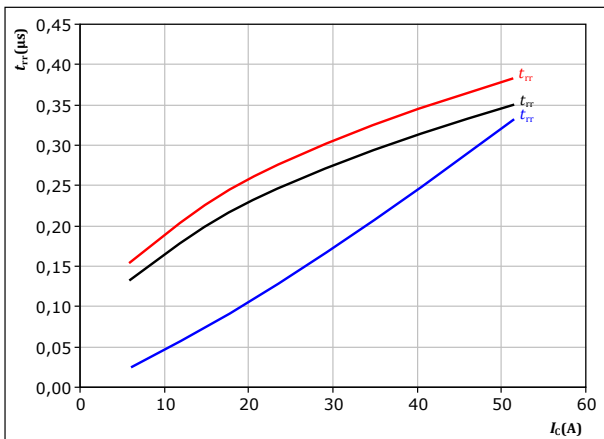
Typical switching times as a function of gate resistor  
 $t = f(R_g)$



With an inductive load at  
 $T_j = 150$  °C  
 $V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 30$  A

**figure 30.** FWD

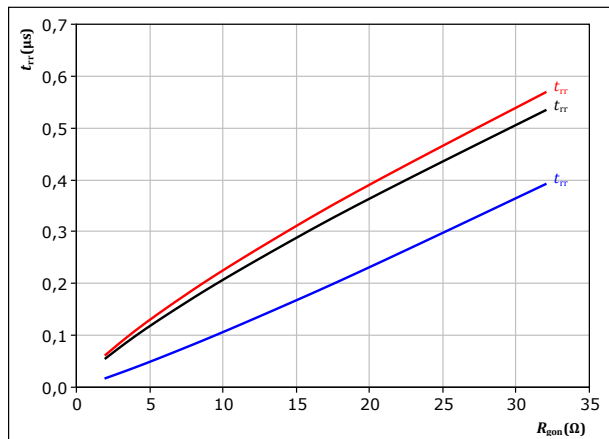
Typical reverse recovery time as a function of collector current  
 $t_{rr} = f(I_c)$



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$   $\Omega$   
 $T_j$ : — 25 °C  
           — 125 °C  
           — 150 °C

**figure 31.** FWD

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



With an inductive load at  
 $V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 30$  A  
 $T_j$ : — 25 °C  
           — 125 °C  
           — 150 °C

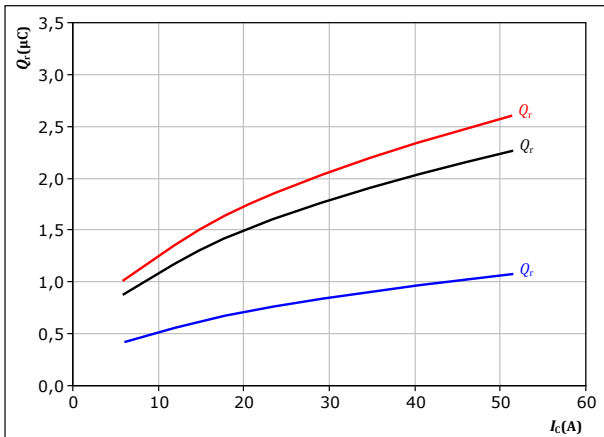


## Inverter Switching Characteristics

figure 32. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



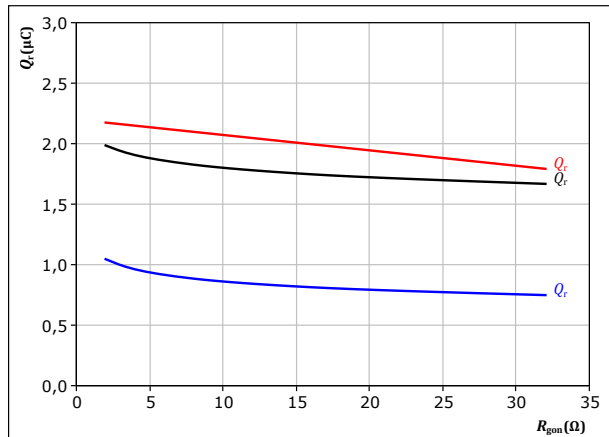
With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$  Ω  
 $T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 33. FWD

Typical recovered charge as a function of turn on gate resistor

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



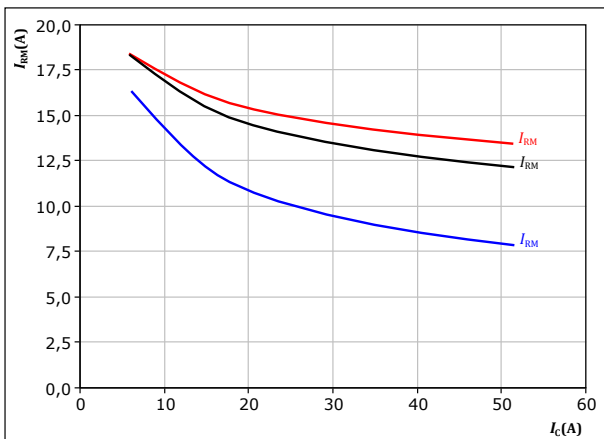
With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 30$  A  
 $T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 34. FWD

Typical peak reverse recovery current as a function of collector current

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



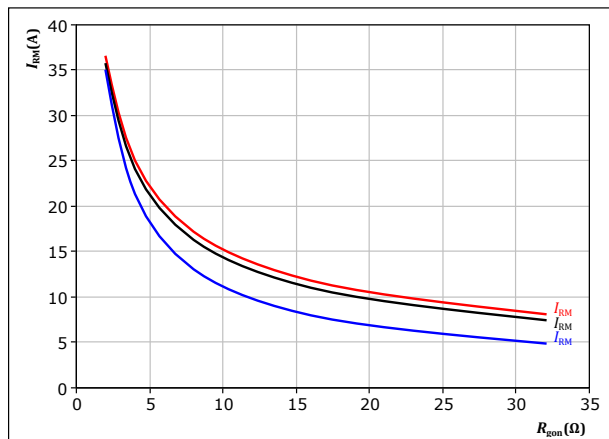
With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$  Ω  
 $T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 35. FWD

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

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



With an inductive load at

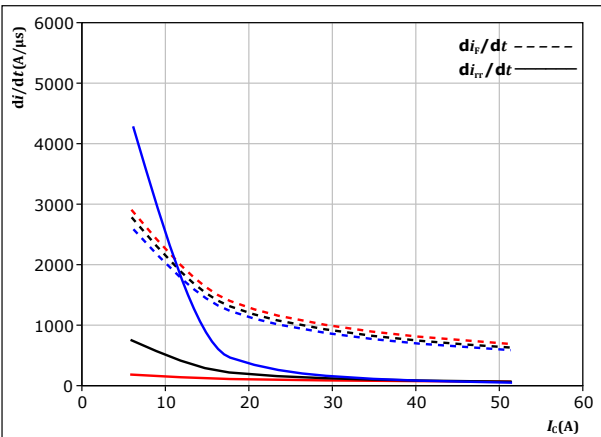
$V_{CE} = 350$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 30$  A  
 $T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)



## Inverter Switching Characteristics

**figure 36.** FWD

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

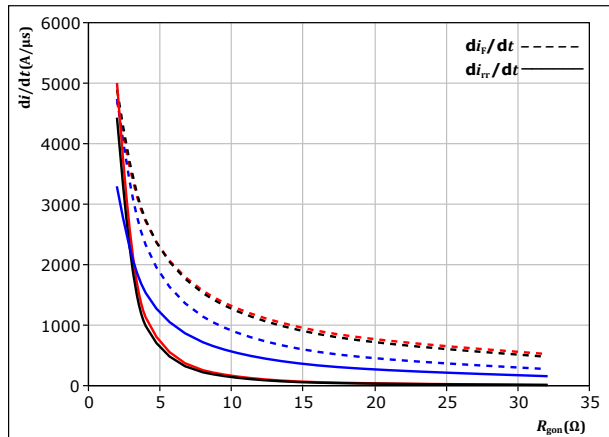


With an inductive load at

$V_{CE} =$	350	V	$T_j:$	25 °C
$V_{GE} =$	±15	V		125 °C
$R_{gon} =$	8	Ω		150 °C

**figure 37.** FWD

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

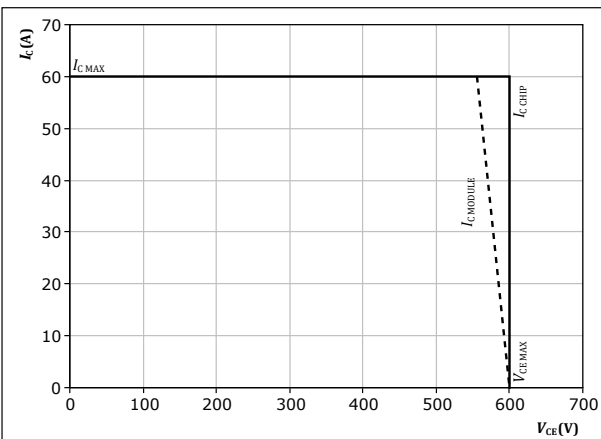


With an inductive load at

$V_{CE} =$	350	V	$T_j:$	25 °C
$V_{GE} =$	±15	V		125 °C
$I_c =$	30	A		150 °C

**figure 38.** IGBT

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



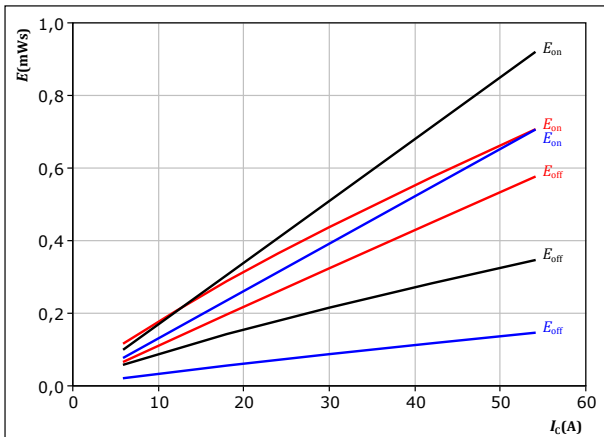
At  $T_j =$  150 °C  
 $R_{gon} =$  8 Ω  
 $R_{goff} =$  8 Ω



## PFC Switching Characteristics

**figure 39.** IGBT

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

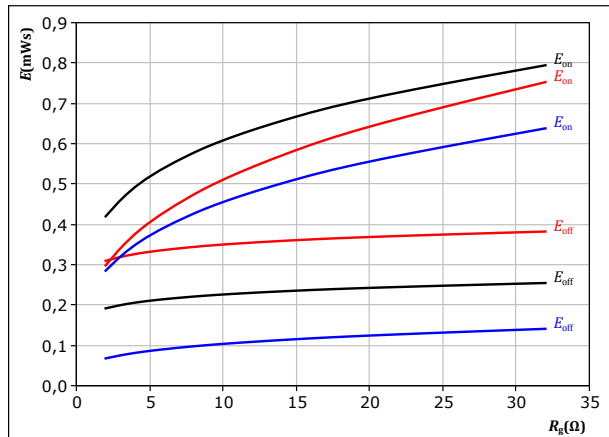


With an inductive load at  
 $V_{CE} = 400$  V  
 $V_{GE} = 0/15$  V  
 $R_{g(on)} = 8$   $\Omega$   
 $R_{g(off)} = 8$   $\Omega$

$T_j$ : — 25 °C  
 — 125 °C  
 — 150 °C

**figure 40.** IGBT

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

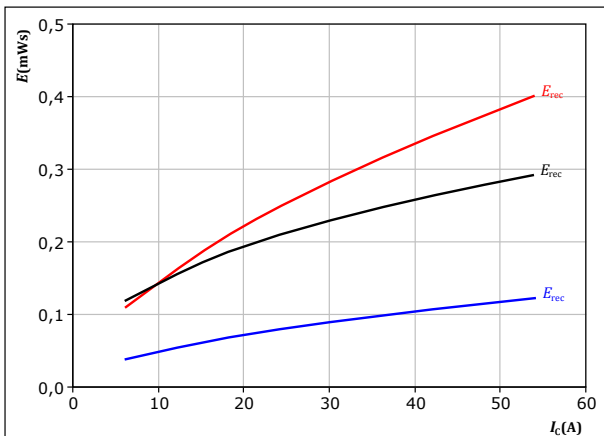


With an inductive load at  
 $V_{CE} = 400$  V  
 $V_{GE} = 0/15$  V  
 $I_c = 30$  A

$T_j$ : — 25 °C  
 — 125 °C  
 — 150 °C

**figure 41.** FWD

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

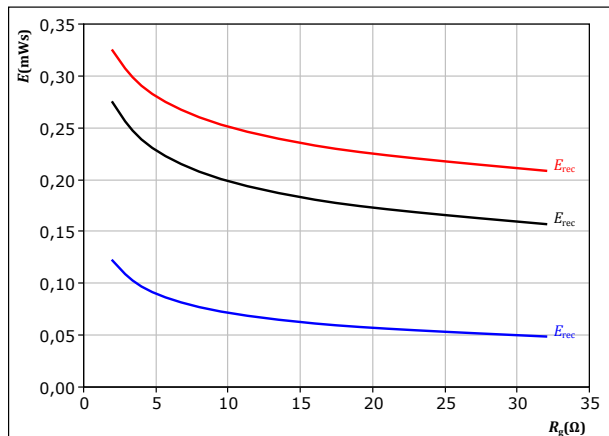


With an inductive load at  
 $V_{CE} = 400$  V  
 $V_{GE} = 0/15$  V  
 $R_{g(on)} = 8$   $\Omega$

$T_j$ : — 25 °C  
 — 125 °C  
 — 150 °C

**figure 42.** 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  
 $V_{GE} = 0/15$  V  
 $I_c = 30$  A

$T_j$ : — 25 °C  
 — 125 °C  
 — 150 °C

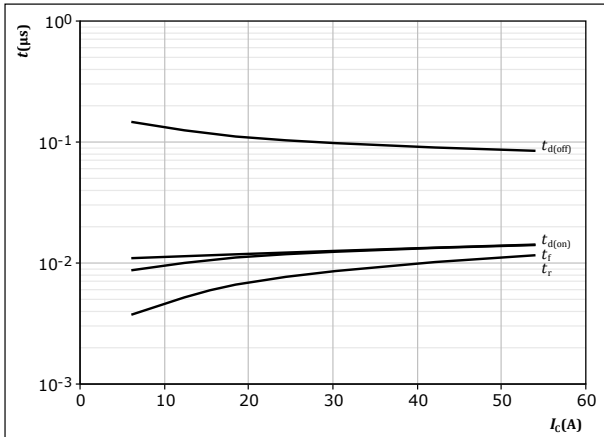




## PFC Switching Characteristics

**figure 43.** IGBT

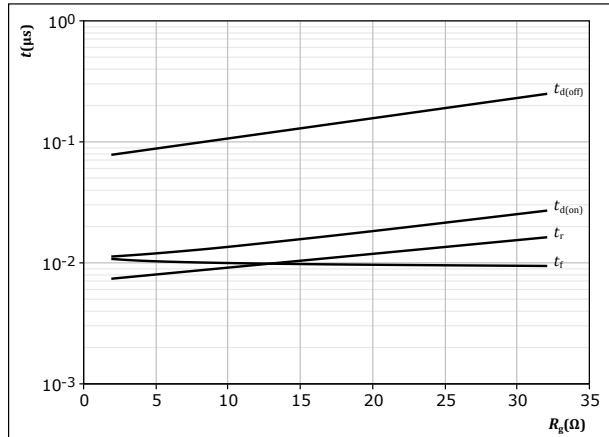
Typical switching times as a function of collector current  
 $t = f(I_c)$



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 44.** IGBT

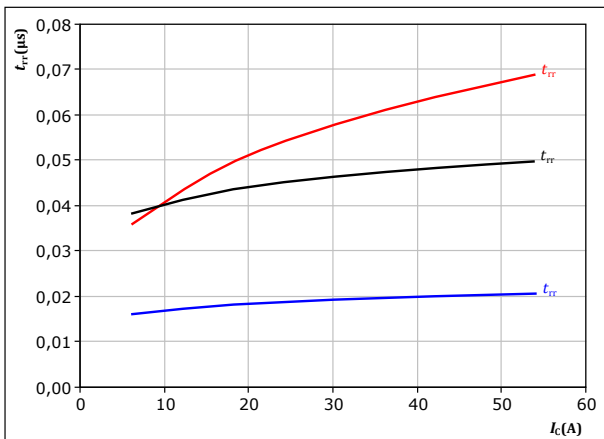
Typical switching times as a function of gate resistor  
 $t = f(R_g)$



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

**figure 45.** FWD

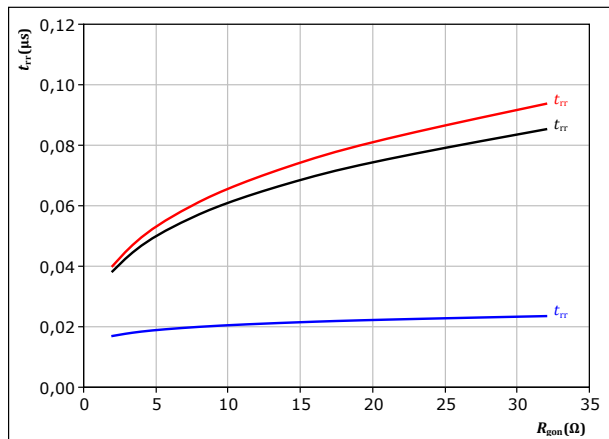
Typical reverse recovery time as a function of collector current  
 $t_{rr} = f(I_c)$



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 46.** 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

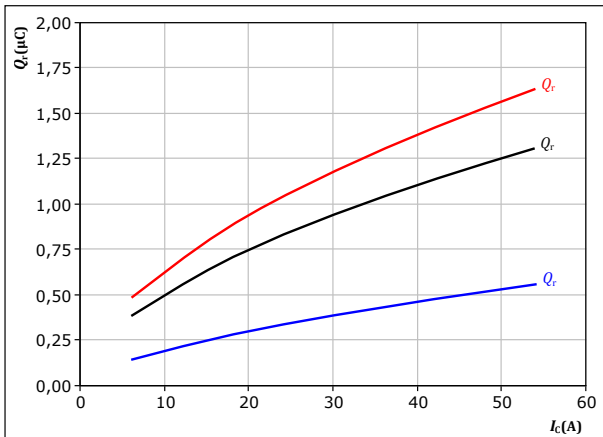


## PFC Switching Characteristics

figure 47. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



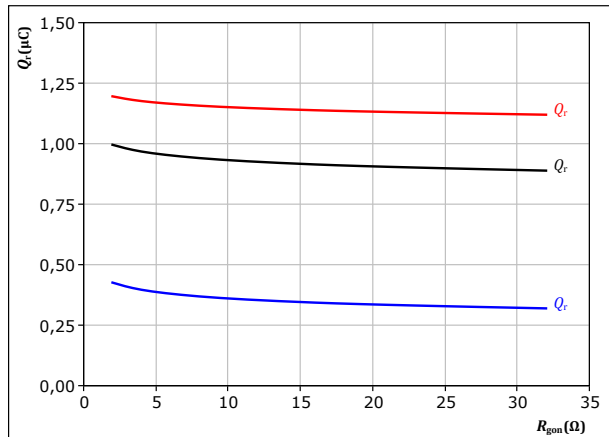
With an inductive load at

$V_{CE} = 400$  V  
 $V_{GE} = 0/15$  V  
 $R_{gon} = 8$  Ω  
 $T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 48. FWD

Typical recovered charge as a function of turn on gate resistor

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



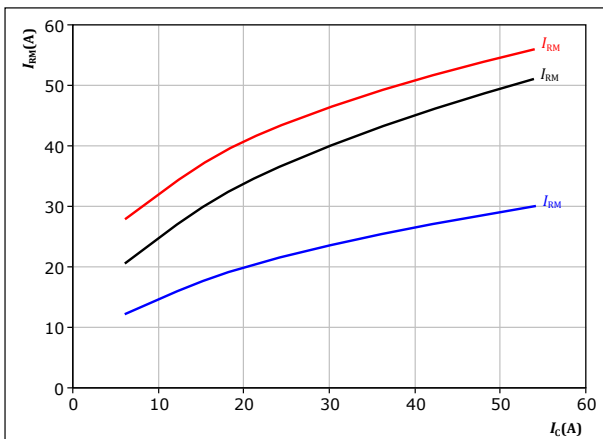
With an inductive load at

$V_{CE} = 400$  V  
 $V_{GE} = 0/15$  V  
 $I_c = 30$  A  
 $T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 49. FWD

Typical peak reverse recovery current as a function of collector current

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



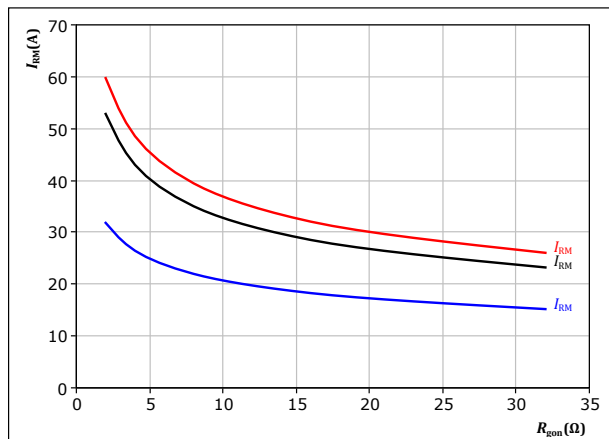
With an inductive load at

$V_{CE} = 400$  V  
 $V_{GE} = 0/15$  V  
 $R_{gon} = 8$  Ω  
 $T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 50. FWD

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

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



With an inductive load at

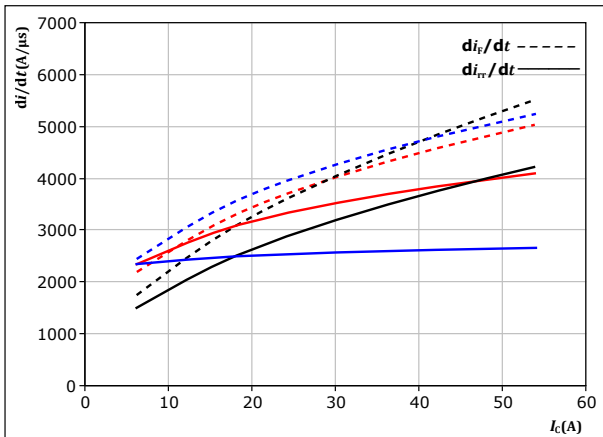
$V_{CE} = 400$  V  
 $V_{GE} = 0/15$  V  
 $I_c = 30$  A  
 $T_j$ : 25 °C (blue), 125 °C (black), 150 °C (red)



## PFC Switching Characteristics

**figure 51.** FWD

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

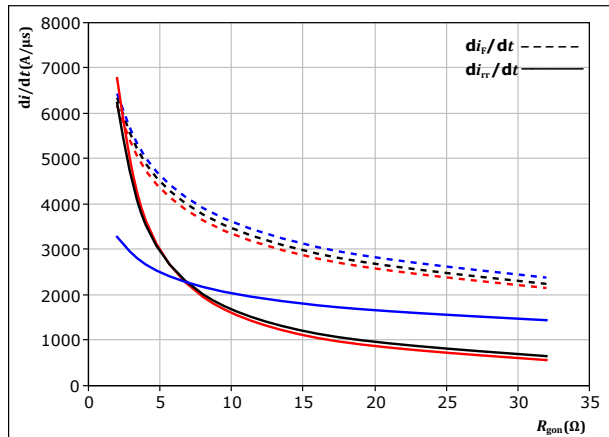


With an inductive load at

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

**figure 52.** FWD

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



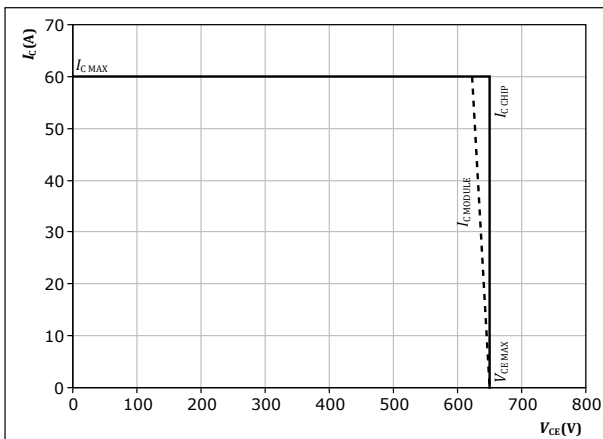
With an inductive load at

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

**figure 53.** 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 54. IGBT

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

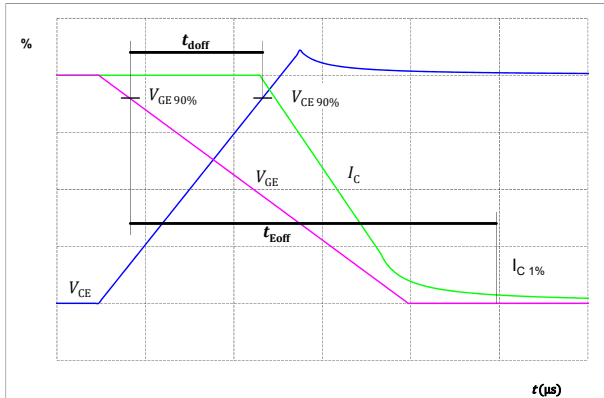


figure 55. IGBT

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

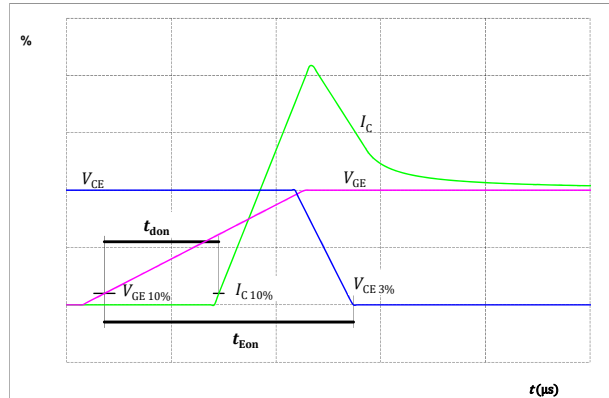


figure 56. IGBT

Turn-off Switching Waveforms & definition of  $t_f$

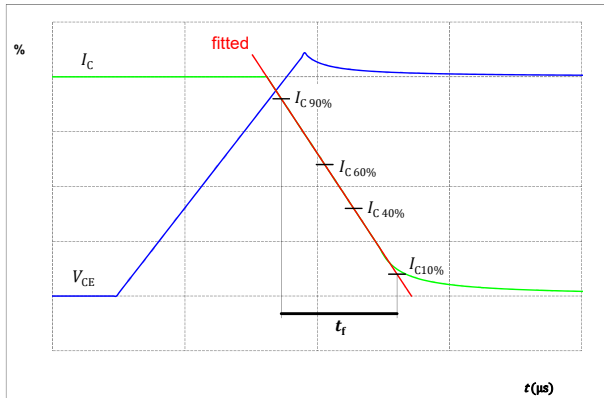
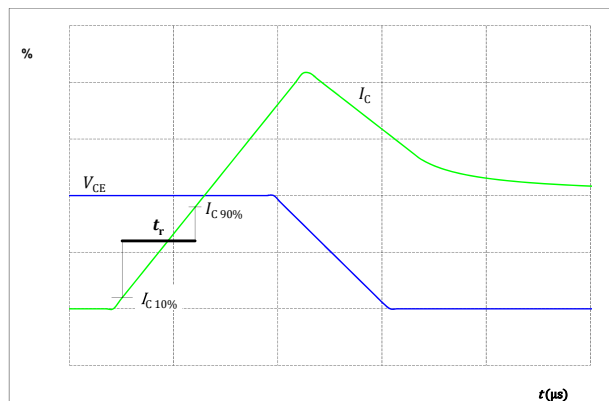


figure 57. IGBT

Turn-on Switching Waveforms & definition of  $t_r$





### Switching Definitions

figure 58. FWD

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

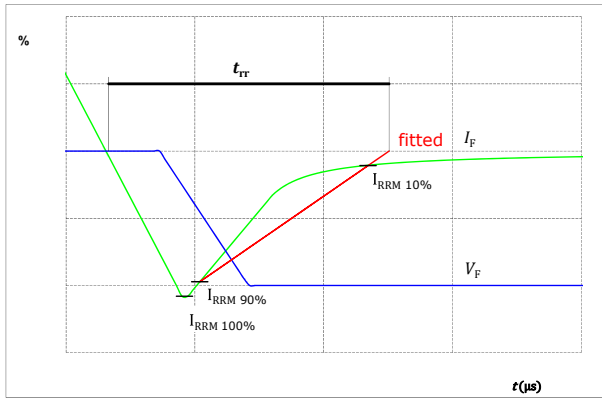
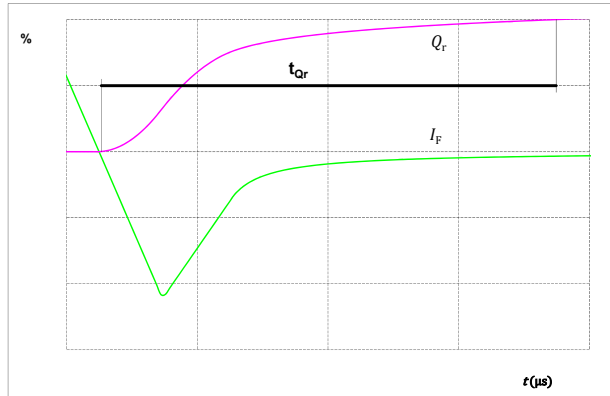


figure 59. FWD


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



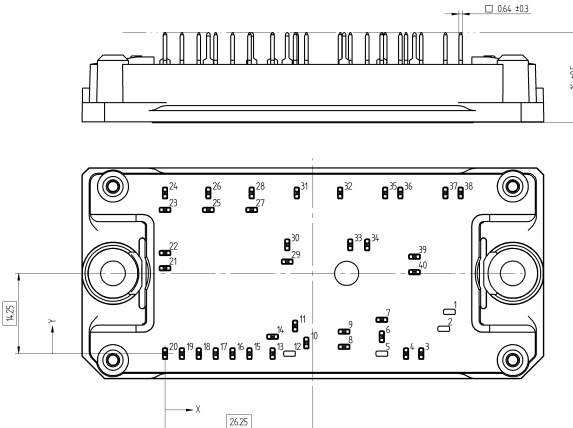


Vincotech

Ordering Code	
<b>Version</b>	<b>Ordering Code</b>
Without thermal paste	10-FE06PPA030SJ07-LV82B03Z
With thermal paste	10-FE06PPA030SJ07-LV82B03Z-/3/

Marking						
	<b>Text</b>	<b>Name</b> NN-NNNNNNNNNNNNNN- TTTTTVV	<b>Date code</b> WWYY	<b>UL &amp; VIN</b> UL VIN	<b>Lot</b> LLLLL	<b>Serial</b> SSSS
	<b>Datamatrix</b>	<b>Type&amp;Ver</b> TTTTTTTV	<b>Lot number</b> LLLLL	<b>Serial</b> SSSS	<b>Date code</b> WWYY	

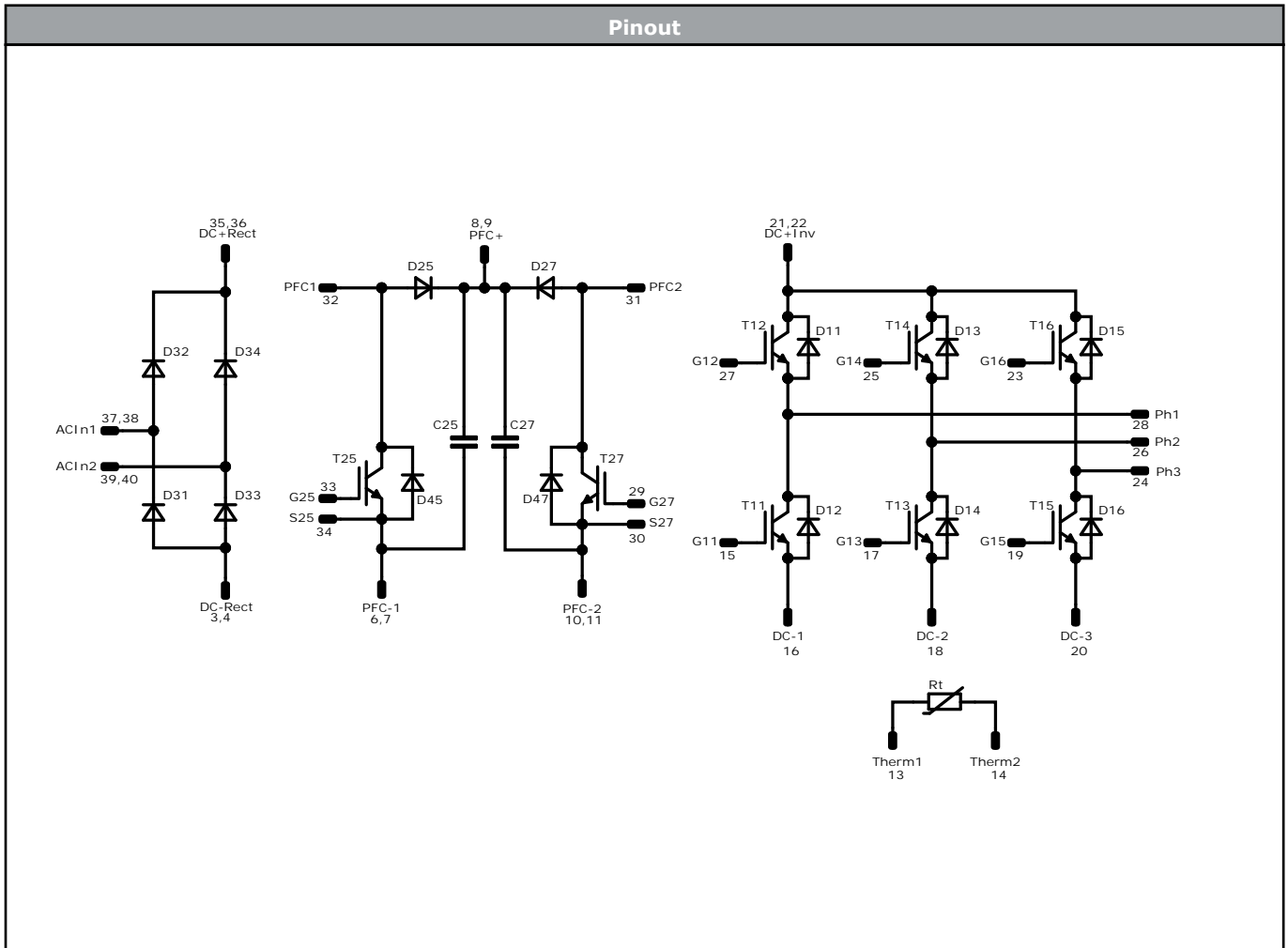
Outline			
Pin table [mm]			
Pin	X	Y	Function
1			not assembled
2			not assembled
3	45,5	0	DC-Rect
4	42,8	0	DC-Rect
5			not assembled
6	38,5	3	PFC-1
7	38,5	6	PFC-1
8	31,8	1,2	PFC+
9	31,8	3,9	PFC+
10	25,1	1,9	PFC-2
11	23,1	4,9	PFC-2
12			not assembled
13	19,1	0	Therm1
14	19,1	3	Therm2
15	15	0	G11
16	12	0	DC-1
17	9	0	G13
18	6	0	DC-2
19	3	0	G15
20	0	0	DC-3
21	0	15,15	DC+Inv
22	0	17,85	DC+Inv
23	0	25,5	G16
24	0	28,5	Ph3
25	7,7	25,5	G14
26	7,7	28,5	Ph2
27	15,4	25,5	G12
28	15,4	28,5	Ph1
29	21,7	16,3	G27
30	21,7	19,3	S27
31	23,4	28,5	PFC2
32	31,1	28,5	PFC1
33	32,9	19,3	G25
34	35,9	19,3	S25
35	39,1	28,5	DC+Rect
36	41,8	28,5	DC+Rect
37	49,8	28,5	ACIn1
38	52,5	28,5	ACIn1
39	44,3	17,2	ACIn2
40	44,3	14,45	ACIn2



Tolerance of pinpositions: ±0.4mm at the end of pins  
Dimension of coordinate axis is only offset without tolerance



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Identification					
ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	600 V	30 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	600 V	20 A	Inverter Diode	
T25, T27	IGBT	650 V	30 A	PFC Switch	
D25, D27	FWD	650 V	30 A	PFC Diode	
D45, D47	FWD	650 V	6 A	PFC Sw. Protection Diode	
D31, D32, D33, D34	Rectifier	1600 V	60 A	Rectifier Diode	
C25, C27	Capacitor	630 V		Capacitor (PFC)	
Rt	Thermistor			Thermistor	




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Packaging instruction				
Standard packaging quantity (SPQ) 100	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for <i>flow 1</i> packages see vincotech.com website.

Package data
Package data for <i>flow 1</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-FE06PPA030SJ07-LV82B03Z-D1-14	8 Jan. 2021		

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