10-FY07ZAA030SM-L513B28
datasheet

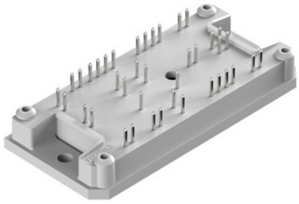
Vincotech

*flow*RPI 1	650 V / 30 A

Features

- High integration level of Rectifier, PFC and Inverter
- Interleaved PFC with high efficiency, fast IGBT H5 + ultra-fast Si Diode
- High efficiency H-Bridge inverter with fast IGBT H5
- Integrated Temperature Sensor and Capacitor

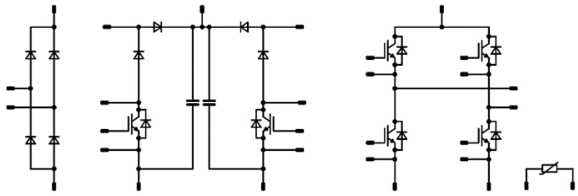
flow 1 12 mm housing



Target applications

- Charging Stations
- Power Supply
- Welding & Cutting

Schematic



Types

- 10-FY07ZAA030SM-L513B28

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Rectifier Diode				
Peak repetitive reverse voltage	V_{RRM}		1600	V
Continuous (direct) forward current	I_F	T_j = T_{jmax} T_s = 80 °C	46	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 150 °C	270	A
Surge current capability	I^2t		370	A^2s
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	56	W
Maximum junction temperature	T_{jmax}		150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
PFC Switch					
Collector-emitter voltage	V_{CES}			650	V
Collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	25	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	51	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C
PFC Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	38	W
Maximum junction temperature	T_{jmax}			175	°C
H-Bridge Switch					
Collector-emitter voltage	V_{CES}			650	V
Collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	31	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 °C	60	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C
H-Bridge Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	28	A
Repetitive peak forward current	I_{FRM}			40	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	51	W
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Current Transformer Protection Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	14	A
Repetitive peak forward current	I_{FRM}			20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	33	W
Maximum junction temperature	T_{jmax}			175	°C
PFC Sw. Protection Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	14	A
Repetitive peak forward current	I_{FRM}			20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	33	W
Maximum junction temperature	T_{jmax}			175	°C
Capacitor (DC)					
Maximum DC voltage	V_{MAX}			630	V
Operation Temperature	T_{op}			-55…+125	°C
Module Properties					
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{jop}			-40…(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{isol}	DC Test Voltage*	t_p = 2 s	6000	V
		AC Voltage	t_p = 1 min	2500	V
Creepage distance				min. 12,7	mm
Clearance				7,58	mm
Comparative Tracking Index	CTI			> 200	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions					Value			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	
Rectifier Diode										
Static										
Forward voltage	V_F				35	25 125		1,17 1,13		V
Reverse leakage current	I_R			1600		25			50	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,25		K/W

Characteristic Values

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
PFC Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0002	25	3,3	4	4,7	V
Collector-emitter saturation voltage	V_{CEsat}		15		20	25 125 150		1,60 1,75 1,79	2,22	V
Collector-emitter cut-off current	I_{CES}		0	650		25			40	µA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		1200		pF
Output capacitance	C_{oes}							30		
Reverse transfer capacitance	C_{res}							5,2		
Gate charge	Q_g		15	520	20	25		48		
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,88		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	0 / 15	400	20	25 125 150		17 15 14		ns
Rise time	t_r					25 125 150		8 7 8		
Turn-off delay time	$t_{d(off)}$					25 125 150		100 123 121		
Fall time	t_f					25 125 150		8 8 10		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,3 µC Q_{rFWD} = 0,7 µC Q_{rFWD} = 0,8 µC				25 125 150		0,321 0,443 0,438		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,071 0,116 0,162		

Characteristic Values

Parameter	Symbol	Conditions					Value			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				20	25 125 150		2,16 1,93 1,88	2,6	V
Reverse leakage current	I_R			650		25			10	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,52		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 2752 A/µs di/dt = 2749 A/µs di/dt = 2605 A/µs	0 / 15	400	20	25 125 150		15 18 18		A
Reverse recovery time	t_{rr}					25 125 150		20 107 123		ns
Recovered charge	Q_r					25 125 150		0,303 0,675 0,808		µC
Reverse recovered energy	E_{rec}					25 125 150		0,061 0,137 0,179		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		1718 1004 753		A/µs

Characteristic Values

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
H-Bridge Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	V_{GE} = V_{CE}			0,0003	25	3,3	4	4,7	V
Collector-emitter saturation voltage	V_{CEsat}		15		30	25 125 150		1,67 1,80 1,84	2,22	V
Collector-emitter cut-off current	I_{CES}		0	650		25			40	µA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f= 1 Mhz	0	25		25		2100		pF
Reverse transfer capacitance	C_{res}	f= 1 Mhz	0	25		25		7,7		pF
Gate charge	Q_g		15	520	30	25		70		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,57		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	-5 / 15	350	30	25 125 150		35 34 37		ns
Rise time	t_r					25 125 150		10 10 10		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		87 101 105		ns
Fall time	t_f					25 125 150		8 9 10		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,8 µC Q_{rFWD} = 1,5 µC Q_{rFWD} = 1,8 µC				25 125 150		0,632 0,786 0,803		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,111 0,166 0,191		mWs

Characteristic Values

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
H-Bridge Diode										
Static										
Forward voltage	V_F				20	25 125 150		1,56 1,51 1,51	1,92	V
Reverse leakage current	I_R			650		25			1,28	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,88		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 2702 A/µs di/dt = 2470 A/µs di/dt = 2358 A/µs	-5 / 15	350	30	25 125 150		14 20 23		A
Reverse recovery time	t_{rr}					25 125 150		105 126 137		ns
Recovered charge	Q_r					25 125 150		0,801 1,539 1,781		µC
Reverse recovered energy	E_{rec}					25 125 150		0,139 0,289 0,352		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		78 162 149		A/µs
Current Transformer Protection Diode										
Static										
Forward voltage	V_F				10	25 125		1,67 1,56	1,87	V
Reverse leakage current	I_R			650		25			0,14	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,87		K/W

Characteristic Values

Parameter	Symbol	Conditions					Value			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

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Forward voltage	V_F				10	25 125		1,67 1,56	1,87	V
Reverse leakage current	I_R			650		25			0,14	µA

Thermal

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,87		K/W

Capacitor (DC)

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Capacitance	C							100		nF
Tolerance							-10		+10	%
Dissipation factor		f = 1 kHz				25			2,5	%

Thermistor

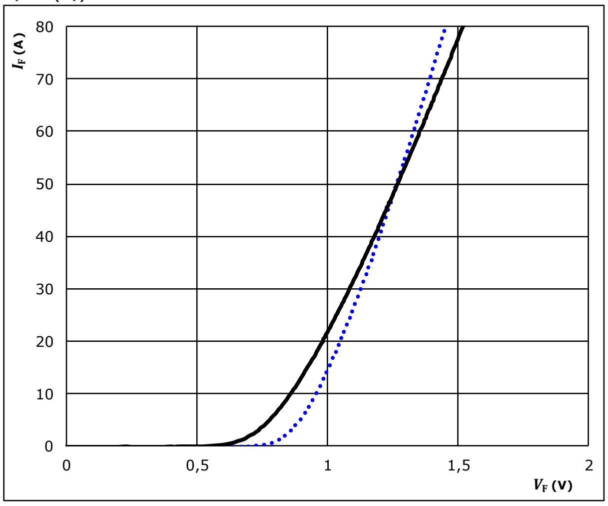
Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %				25		3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %				25		4000		K
Vincotech NTC Reference									I	

Rectifier Diode Characteristics

figure 1.	Rectifier Diode

Typical forward characteristics

$I_F = f(V_F)$



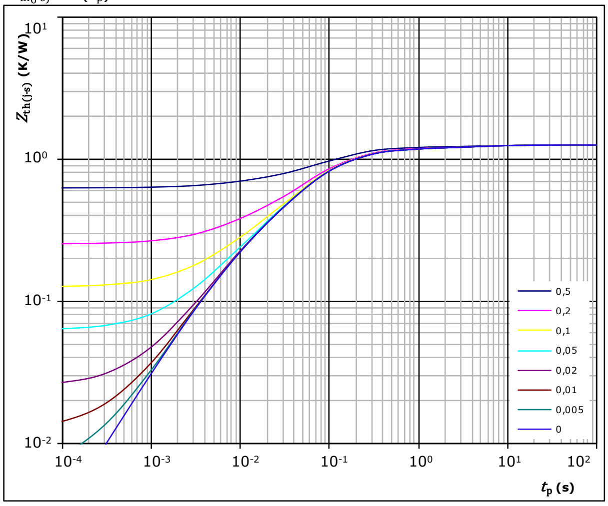
t_p = 250 μs

T_j: 25 °C (dotted) / 125 °C (solid)

figure 2.	Rectifier Diode

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,25 K/W

Diode thermal model values

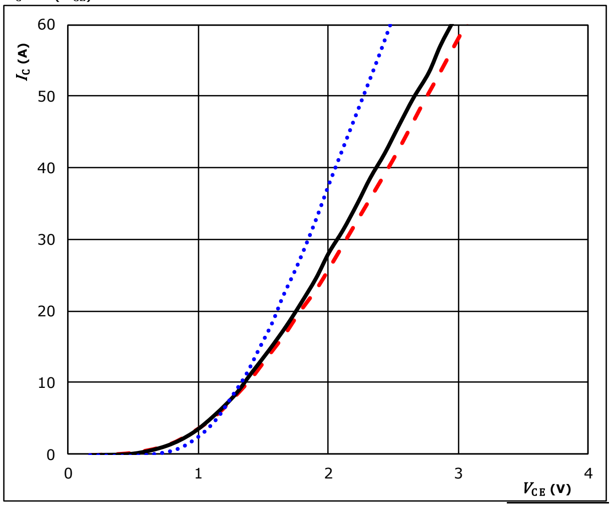
R (K/W)	τ (s)
8,00E-02	5,22E+00
1,56E-01	4,18E-01
6,95E-01	8,82E-02
2,23E-01	3,07E-02
9,97E-02	5,99E-03

PFC Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

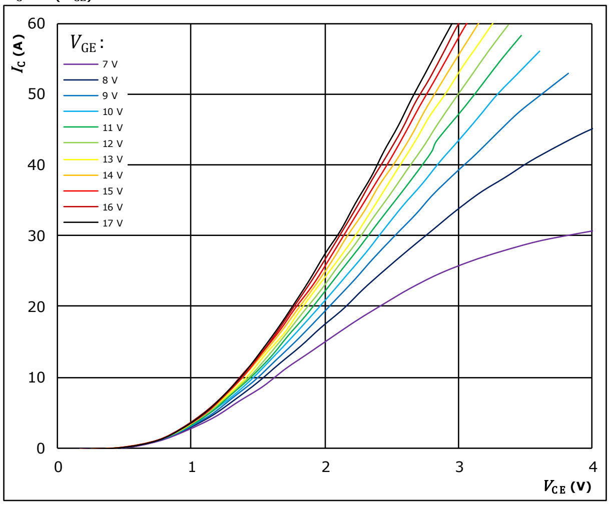


t_p =	250	µs		25 °C	
V_{GE} =	15	V	T_j:	125 °C	
				150 °C	

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

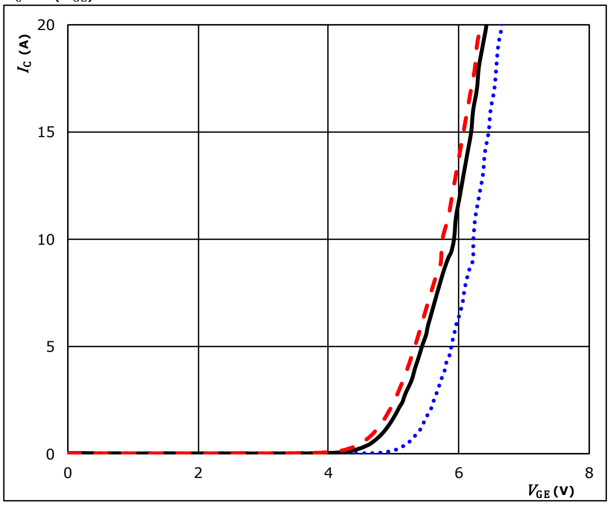


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

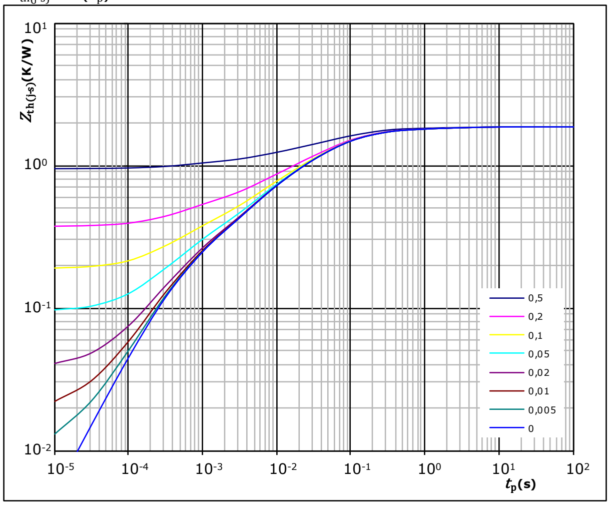


t_p =	100	µs		25 °C	
V_{CE} =	9	V	T_j:	125 °C	
				150 °C	

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T

$R_{th(j-s)}$ = 1,88 K/W

IGBT thermal model values

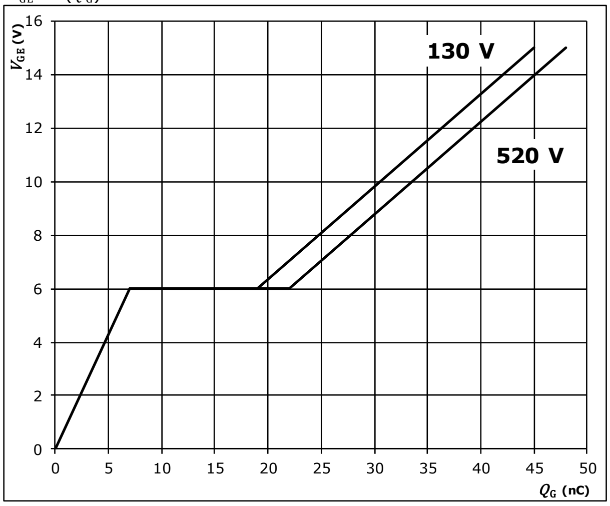
R (K/W)	τ (s)
7,73E-02	2,79E+00
1,62E-01	3,73E-01
7,45E-01	7,14E-02
4,66E-01	1,63E-02
2,69E-01	3,67E-03
1,63E-01	4,26E-04

PFC Switch Characteristics

figure 5. **IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

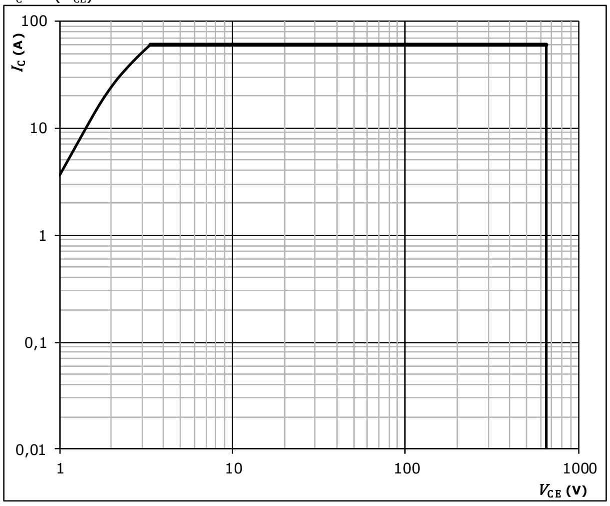


$I_C =$ 20 A

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



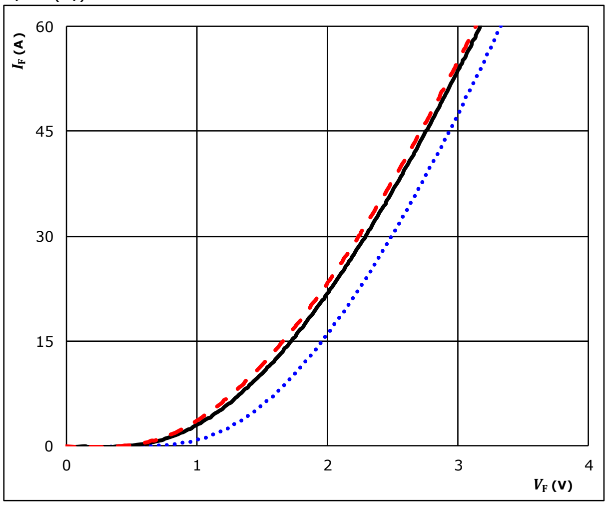
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

PFC Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



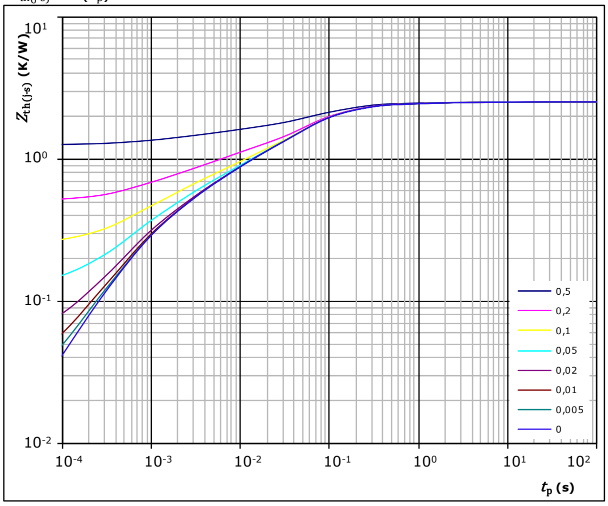
t_p = 250 µs

T_j: 25 °C (dotted); 125 °C (solid); 150 °C (dashed)

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 2,52 K/W

FWD thermal model values

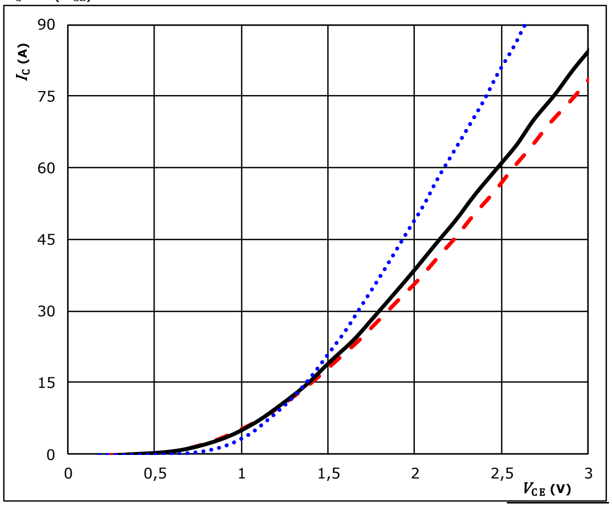
R (K/W)	τ (s)
3,20E-02	7,61E+00
1,12E-01	1,11E+00
4,90E-01	1,60E-01
1,19E+00	5,16E-02
4,38E-01	5,33E-03
2,68E-01	8,38E-04

H-Bridge Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

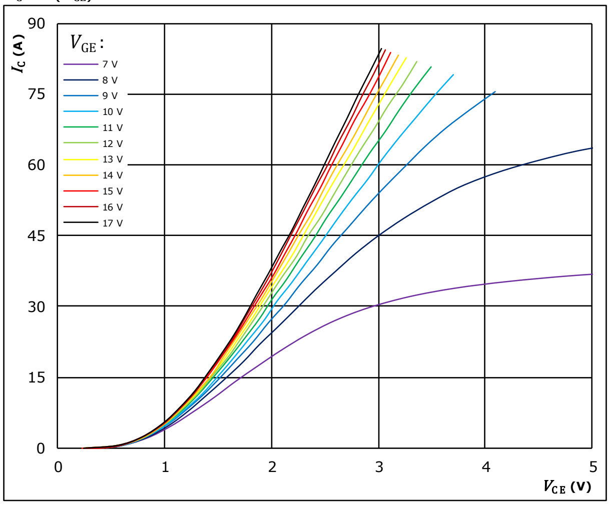


t_p =	250	μs		25 °C	············
V_{GE} =	15	V	T_j:	125 °C	———
				150 °C	– – –

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

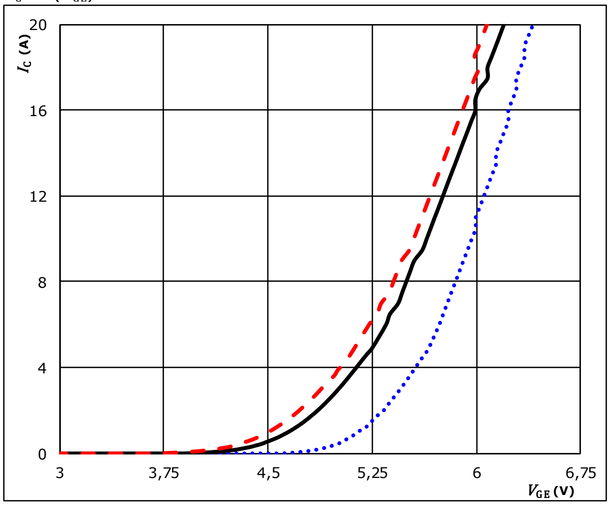


t_p =	250	μs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

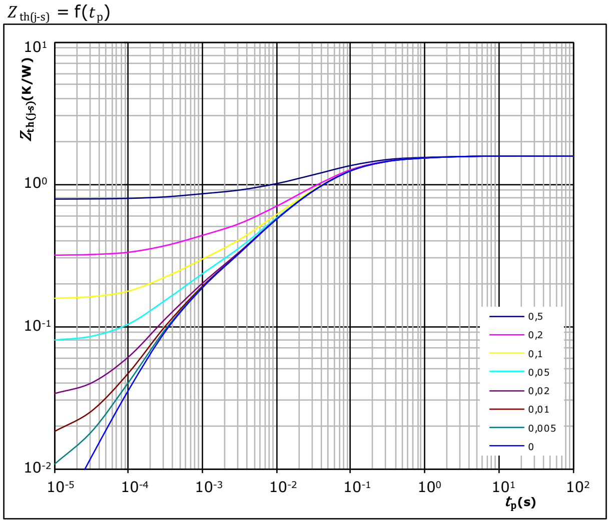


t_p =	100	μs		25 °C	············
V_{CE} =	10	V	T_j:	125 °C	———
				150 °C	– – –

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T

$R_{th(j-s)}$ = 1,57 K/W

IGBT thermal model values

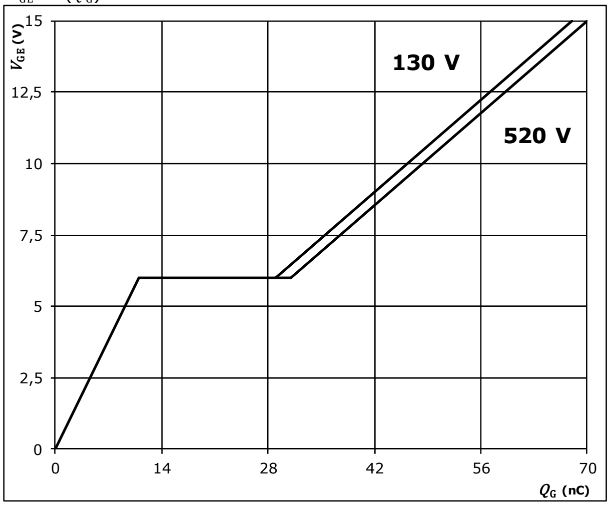
R (K/W)	τ (s)
7,66E-02	1,73E+00
2,00E-01	2,58E-01
6,54E-01	5,93E-02
3,77E-01	1,31E-02
1,51E-01	2,99E-03
1,13E-01	3,69E-04

H-Bridge Switch Characteristics

figure 5. **IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

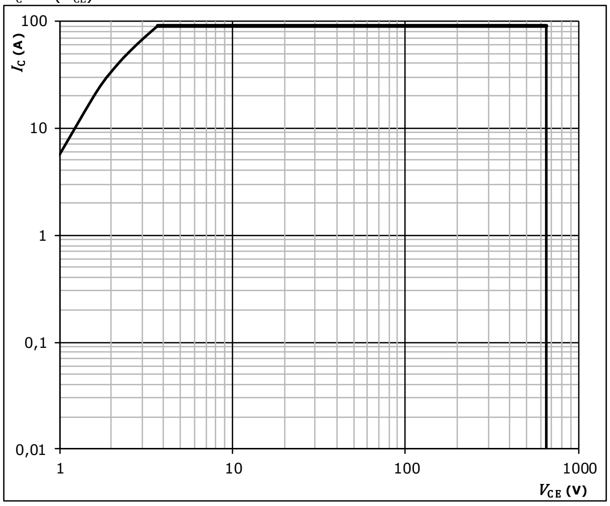


I_C = 30 A

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

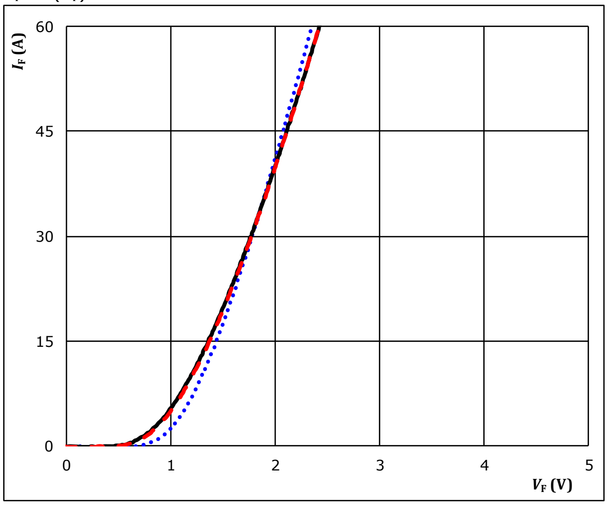
Vincotech

H-Bridge Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



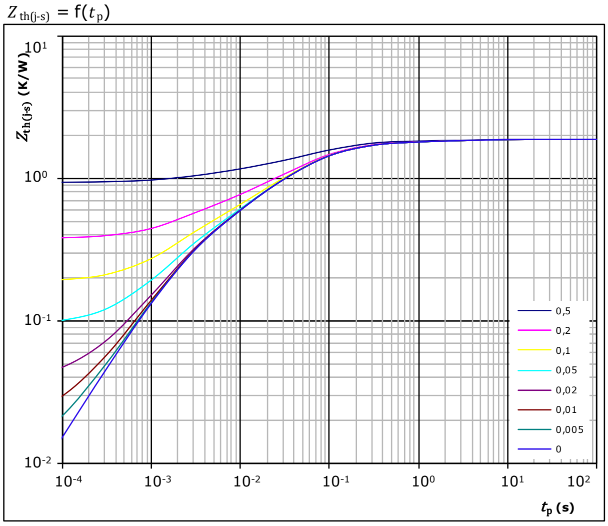
t_p = 250 µs

T_j:
25 °C
125 °C
150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,88 K/W

FWD thermal model values

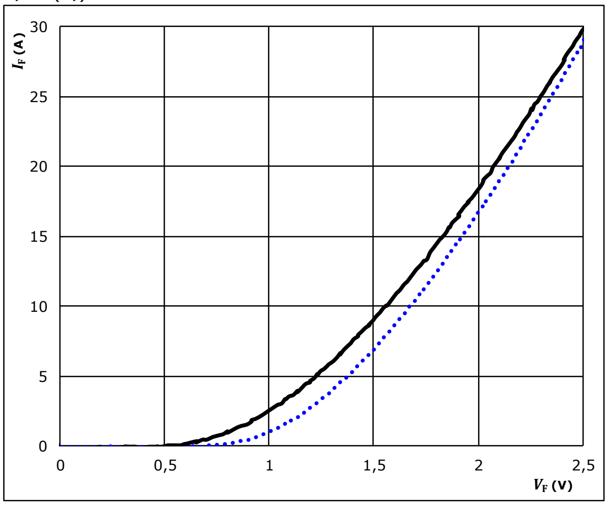
R (K/W)	τ (s)
8,42E-02	3,60E+00
1,79E-01	3,95E-01
8,86E-01	7,08E-02
4,50E-01	1,69E-02
2,75E-01	2,45E-03

Current Transformer Protection Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$

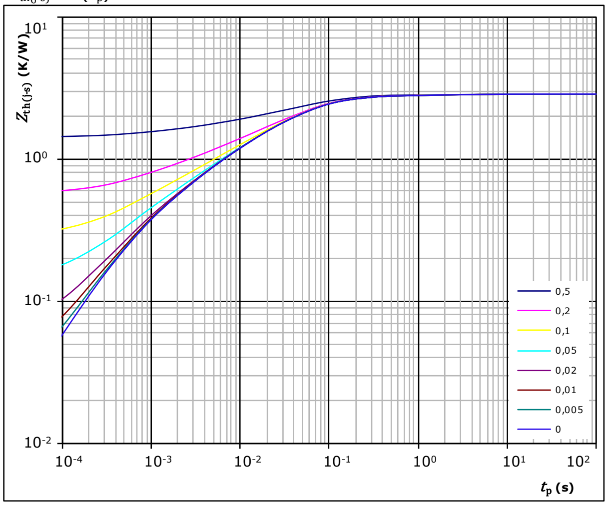


t_p =	250	μs	T_j:	25 °C (dotted)
				125 °C (solid)

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 2,87 K/W

FWD thermal model values

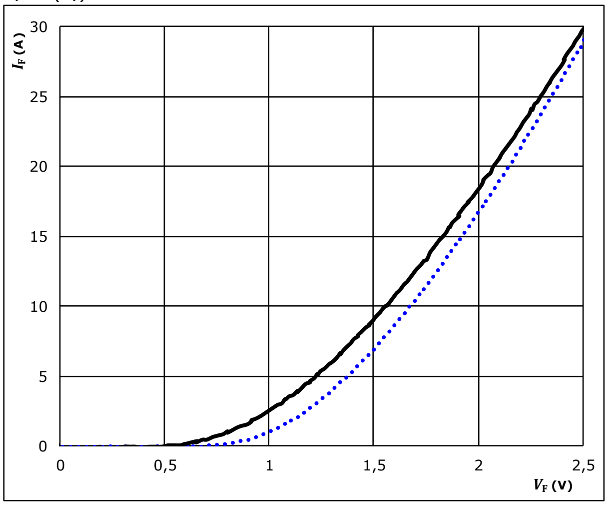
R (K/W)	τ (s)
6,53E-02	3,94E+00
1,48E-01	4,48E-01
1,31E+00	5,96E-02
7,32E-01	1,36E-02
4,04E-01	2,79E-03
2,11E-01	5,37E-04

PFC Sw. Protection Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



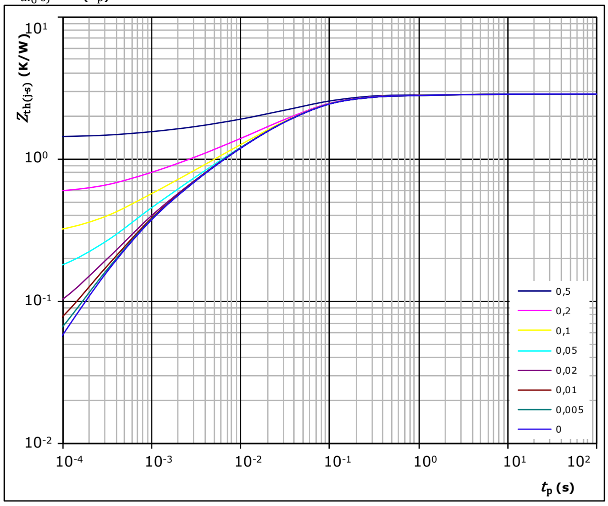
t_p = 250 μs

T_j: 25 °C ....
125 °C ———

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 2,87 K/W

FWD thermal model values

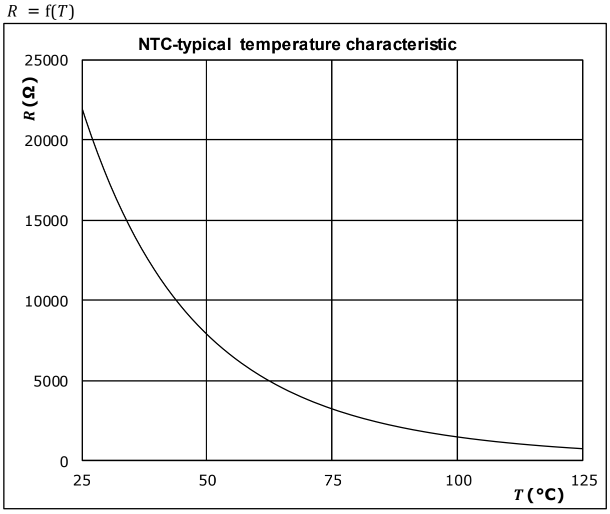
R (K/W)	τ (s)
6,53E-02	3,94E+00
1,48E-01	4,48E-01
1,31E+00	5,96E-02
7,32E-01	1,36E-02
4,04E-01	2,79E-03
2,11E-01	5,37E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic as a function of temperature

$R = f(T)$

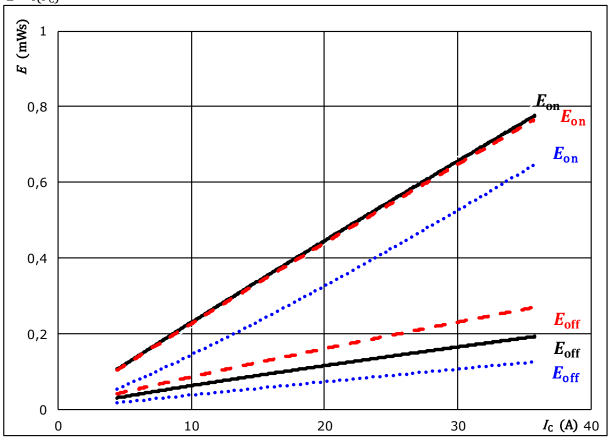


PFC Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



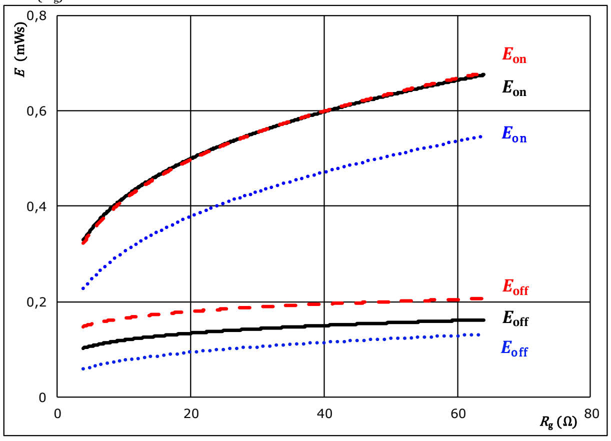
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C	dotted
V_{GE} =	0 / 15	V		125 °C	solid
R_{gon} =	16	Ω		150 °C	dashed
R_{goff} =	16	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



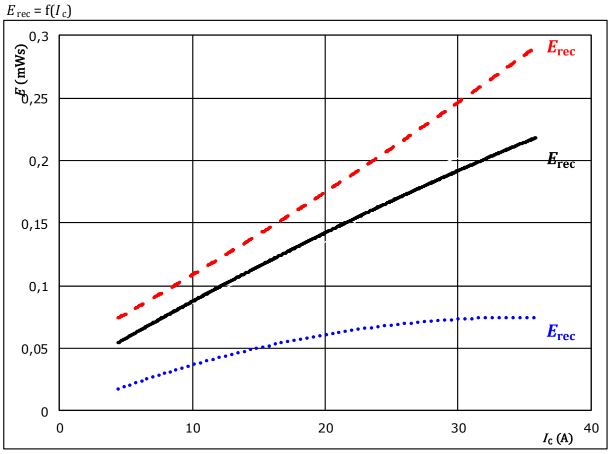
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C	dotted
V_{GE} =	0 / 15	V		125 °C	solid
I_C =	20	A		150 °C	dashed

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



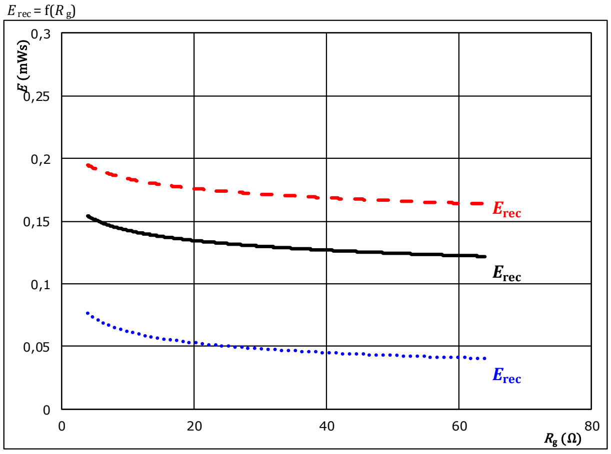
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C	dotted
V_{GE} =	0 / 15	V		125 °C	solid
R_{gon} =	16	Ω		150 °C	dashed

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

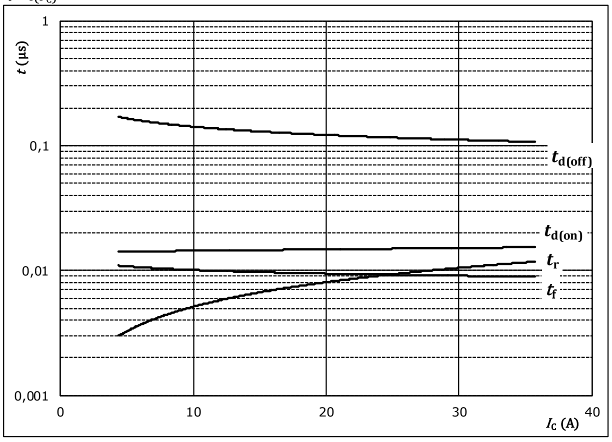
V_{CE} =	400	V	T_j:	25 °C	dotted
V_{GE} =	0 / 15	V		125 °C	solid
I_C =	20	A		150 °C	dashed

PFC Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



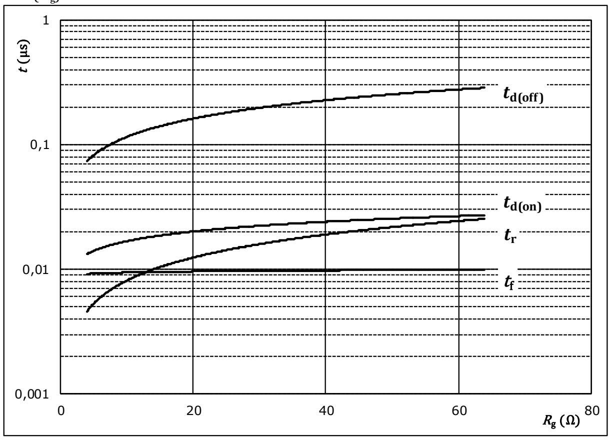
With an inductive load at

T_j =	150	°C
V_{CE} =	400	V
V_{GE} =	0 / 15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 6. IGBT

Typical switching times as a function of gate resistor

$t = f(R_g)$



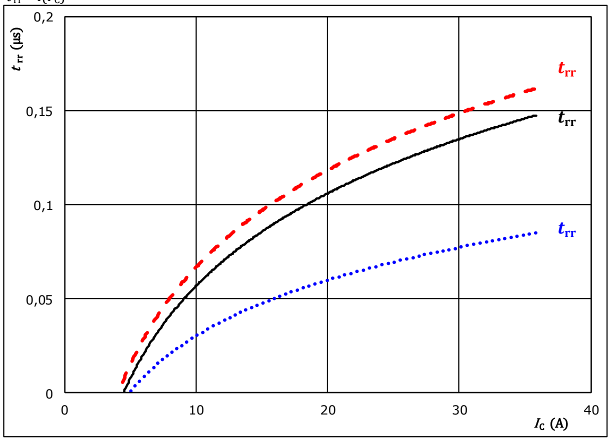
With an inductive load at

T_j =	150	°C
V_{CE} =	400	V
V_{GE} =	0 / 15	V
I_C =	20	A

figure 7. FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



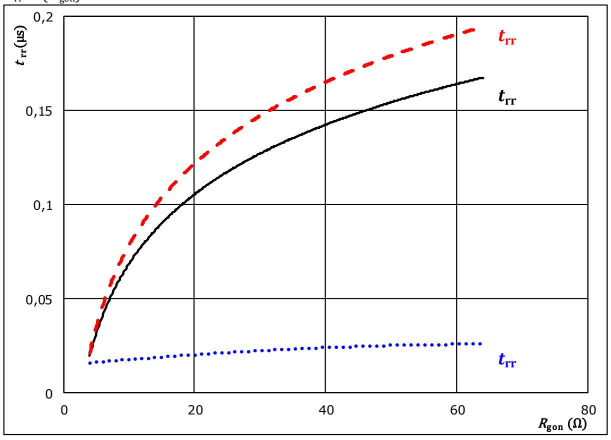
With an inductive load at

V_{CE}=	400	V	T_j:	25 °C (dotted)
V_{GE} =	0 / 15	V		125 °C (solid)
R_{gon} =	16	Ω		150 °C (dashed)

figure 8. FWD

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

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



With an inductive load at

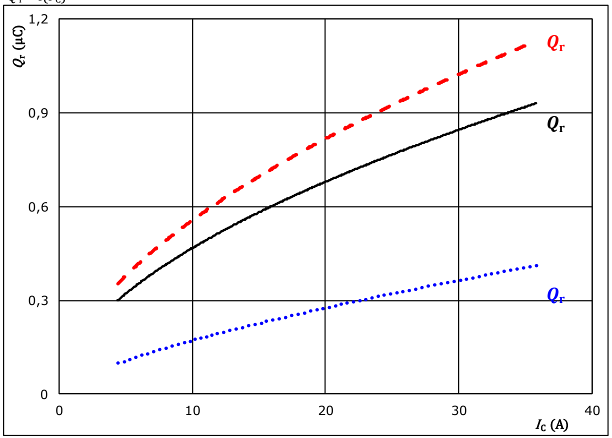
V_{CE} =	400	V	T_j:	25 °C (dotted)
V_{GE} =	0 / 15	V		125 °C (solid)
I_C =	20	A		150 °C (dashed)

PFC Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



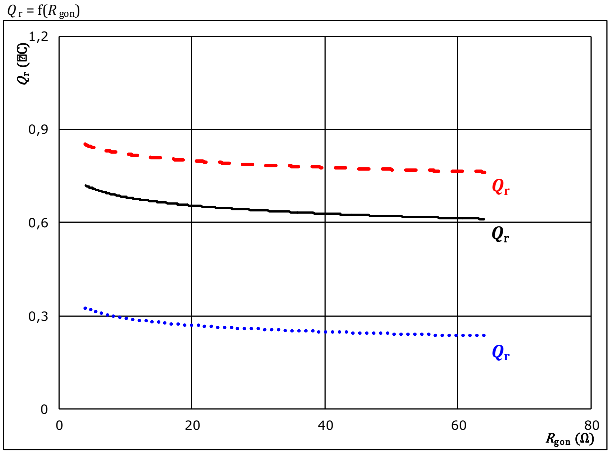
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C	dotted
V_{GE} =	0 / 15	V		125 °C	solid
R_{gon} =	16	Ω		150 °C	dashed

figure 10. **FWD**

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

$Q_r = f(R_{gon})$



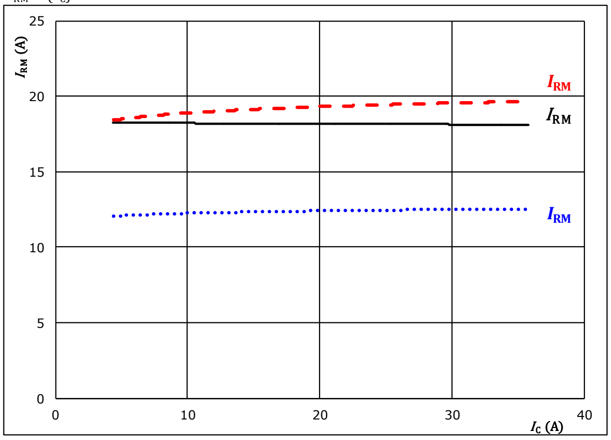
With an inductive load at

V_{CE}=	400	V	T_j:	25 °C	dotted
V_{GE} =	0 / 15	V		125 °C	solid
I_C=	20	A		150 °C	dashed

figure 11. **FWD**

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$



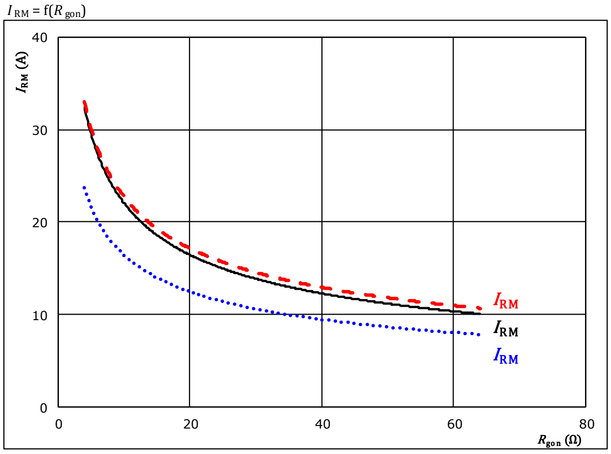
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C	dotted
V_{GE} =	0 / 15	V		125 °C	solid
R_{gon} =	16	Ω		150 °C	dashed

figure 12. **FWD**

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

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



With an inductive load at

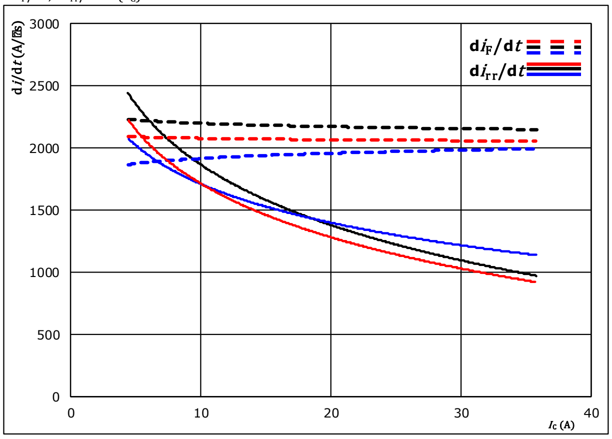
V_{CE} =	400	V	T_j:	25 °C	dotted
V_{GE} =	0 / 15	V		125 °C	solid
I_C =	20	A		150 °C	dashed

PFC Switching Characteristics

figure 13. **FWD**

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

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



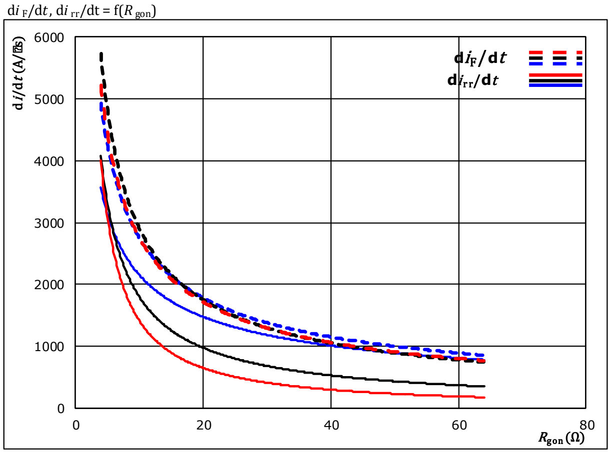
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0 / 15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 14. **FWD**

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

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



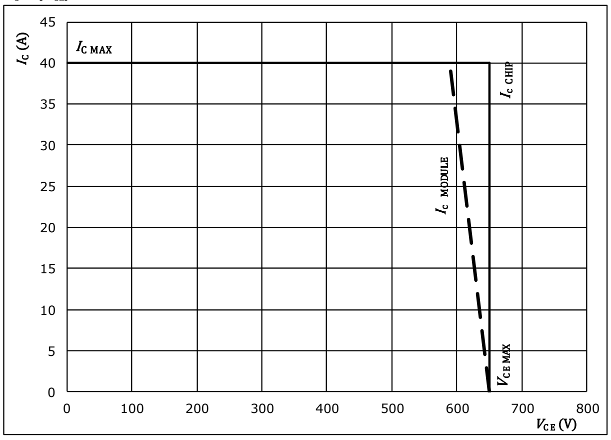
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0 / 15	V		125 °C
I_C=	20	A		150 °C

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

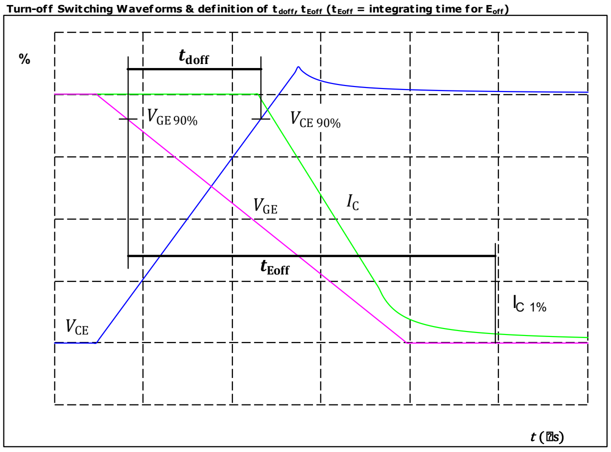
T_j =	150	°C
R_{gon} =	16	Ω
R_{goff} =	16	Ω

PFC Switching Definitions

General conditions		
T_j	=	150 °C
R_{gon}	=	16 Ω
R_{goff}	=	16 Ω

figure 1. IGBT

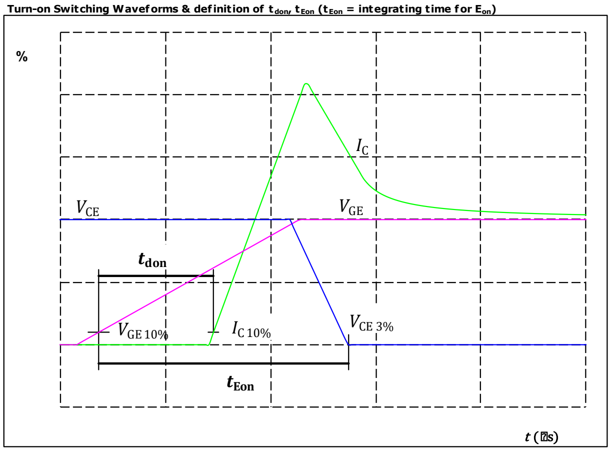
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	400	V
I_C (100%) =	20	A
t_{doff} =	121	ns

figure 2. IGBT

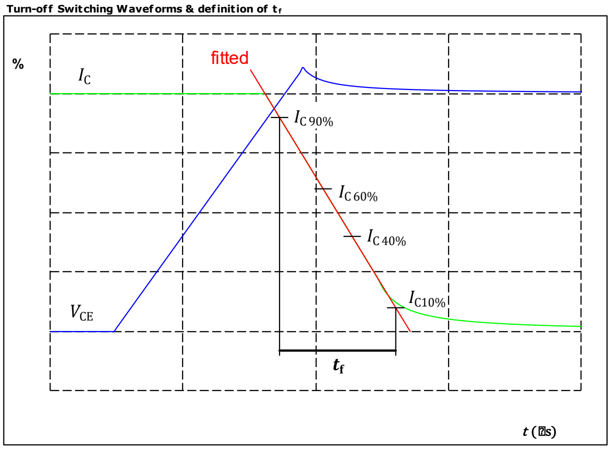
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	400	V
I_C (100%) =	20	A
t_{don} =	14	ns

figure 3. IGBT

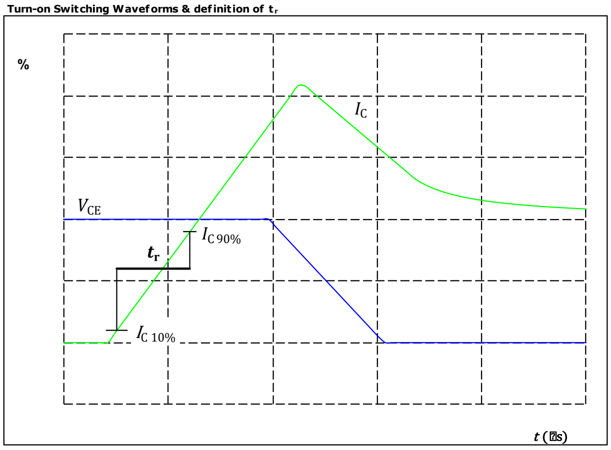
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	400	V
I_C (100%) =	20	A
t_f =	10	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r



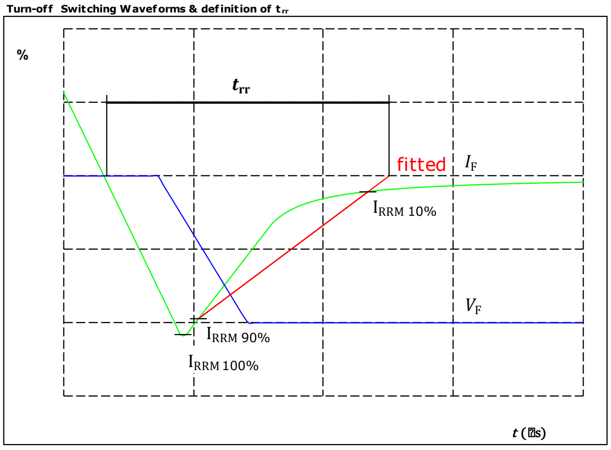
V_C (100%) =	400	V
I_C (100%) =	20	A
t_r =	8	ns

Vincotech

PFC Switching Characteristics

figure 5. **FWD**

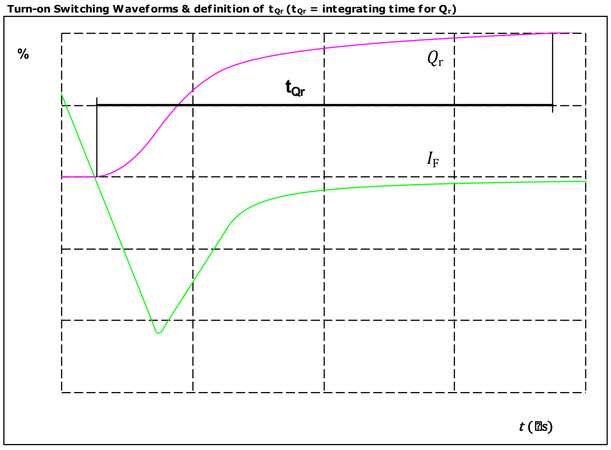
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	400	V
I_F (100%) =	20	A
I_{RRM} (100%) =	18	A
t_{rr} =	123	ns

figure 6. **FWD**

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



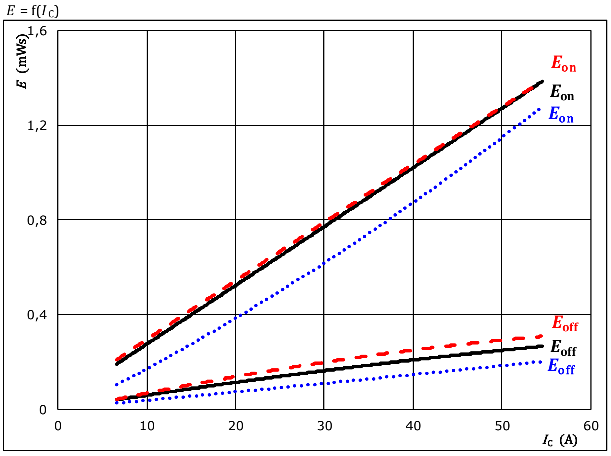
I_F (100%) =	20	A
Q_r (100%) =	1	µC

H-Bridge Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



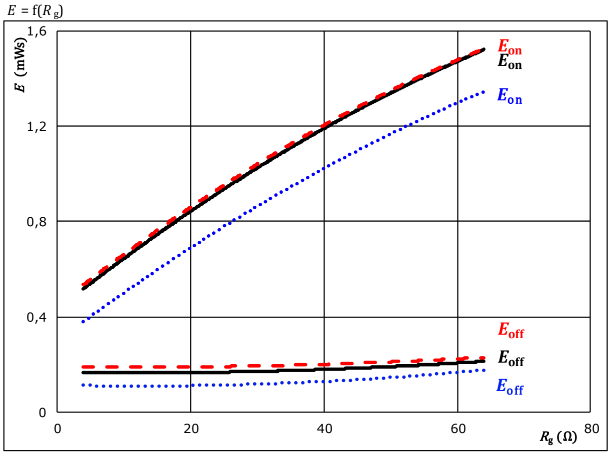
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C (dotted)
V_{GE} =	-5 / 15	V		125 °C (solid)
R_{gon} =	16	Ω		150 °C (dashed)
R_{goff} =	16	Ω		

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



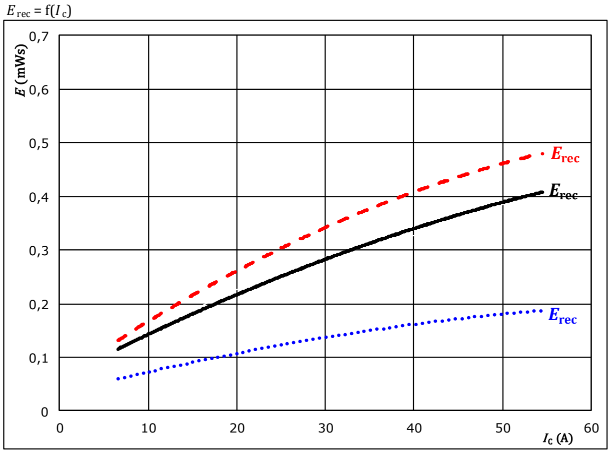
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C (dotted)
V_{GE} =	-5 / 15	V		125 °C (solid)
I_C =	30	A		150 °C (dashed)

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



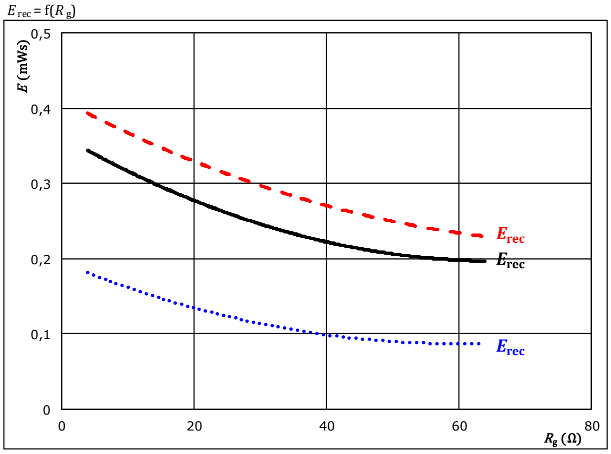
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C (dotted)
V_{GE} =	-5 / 15	V		125 °C (solid)
R_{gon} =	16	Ω		150 °C (dashed)

figure 4. **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	T_j:	25 °C (dotted)
V_{GE} =	-5 / 15	V		125 °C (solid)
I_C =	30	A		150 °C (dashed)

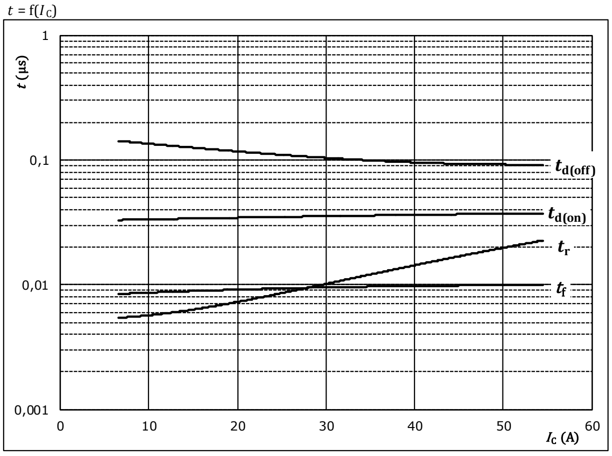
Vincotech

H-Bridge Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



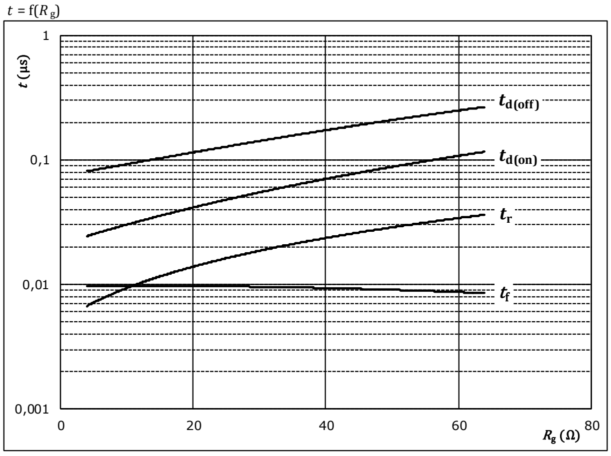
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	-5 / 15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



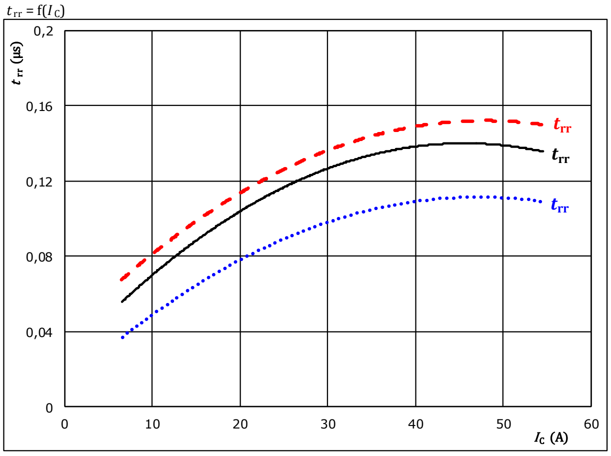
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	-5 / 15	V
I_C =	30	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



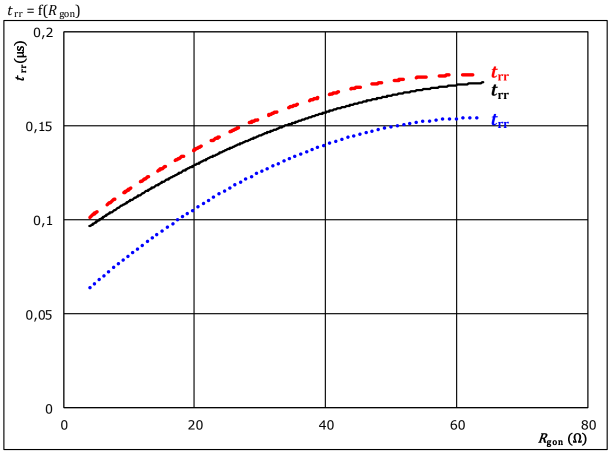
With an inductive load at

V_{CE}=	350	V	T_j:	25 °C (dotted)
V_{GE} =	-5 / 15	V		125 °C (solid)
R_{gon} =	16	Ω		150 °C (dashed)

figure 8. **FWD**

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

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



With an inductive load at

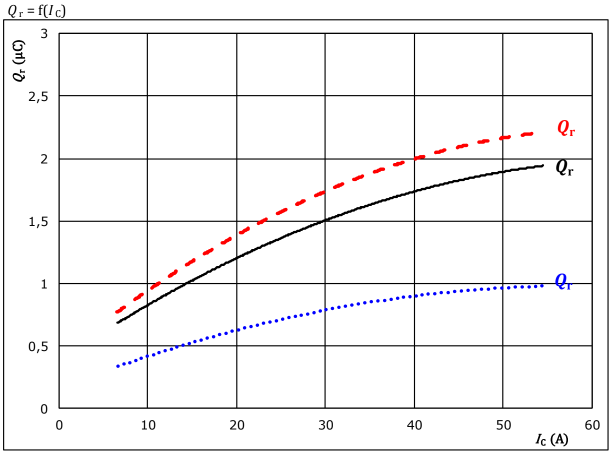
V_{CE} =	350	V	T_j:	25 °C (dotted)
V_{GE} =	-5 / 15	V		125 °C (solid)
I_C =	30	A		150 °C (dashed)

H-Bridge Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

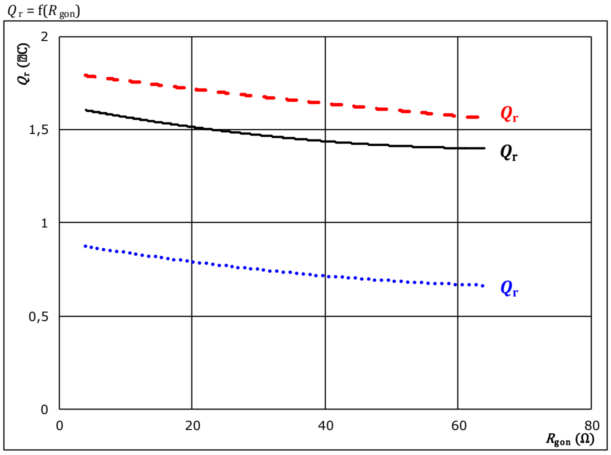


With an inductive load at					
V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	-5 / 15	V		125 °C	solid
R_{gon} =	16	Ω		150 °C	dashed

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

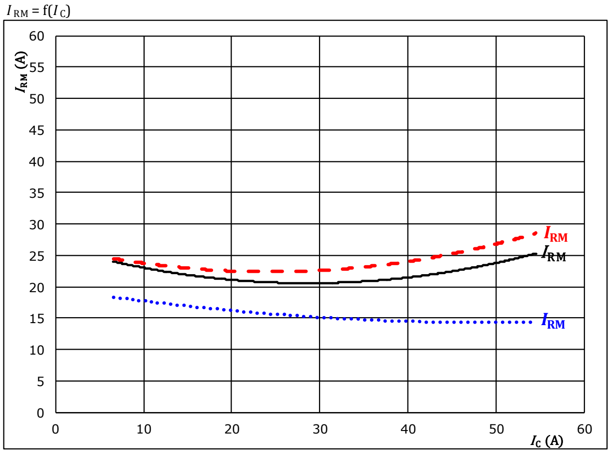


With an inductive load at					
V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	-5 / 15	V		125 °C	solid
I_C =	30	A		150 °C	dashed

figure 11. **FWD**

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

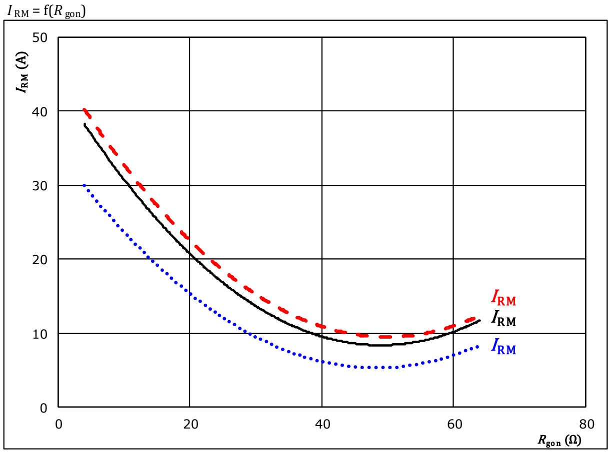


With an inductive load at					
V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	-5 / 15	V		125 °C	solid
R_{gon} =	16	Ω		150 °C	dashed

figure 12. **FWD**

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

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



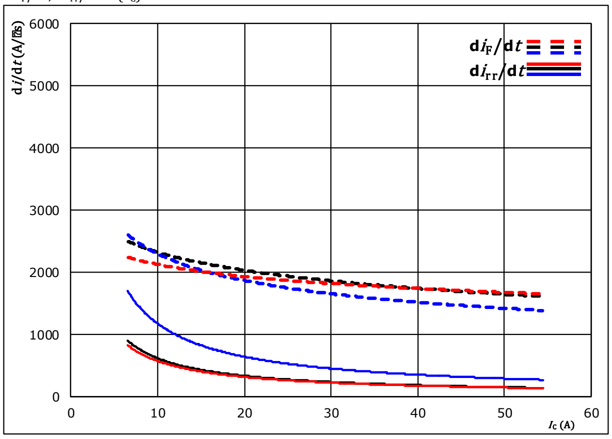
With an inductive load at					
V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	-5 / 15	V		125 °C	solid
I_C =	30	A		150 °C	dashed

H-Bridge Switching Characteristics

figure 13. **FWD**

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

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



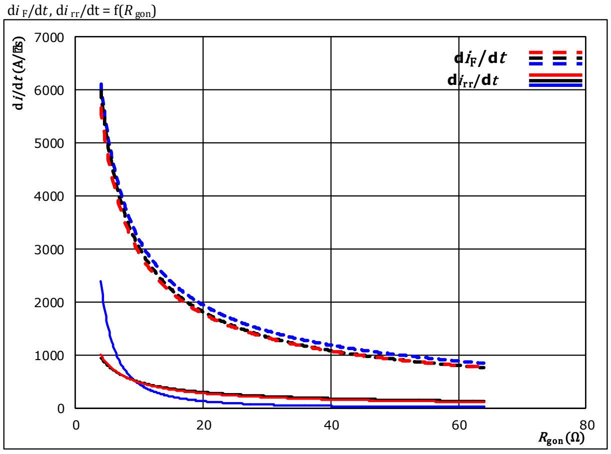
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	-5 / 15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 14. **FWD**

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

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



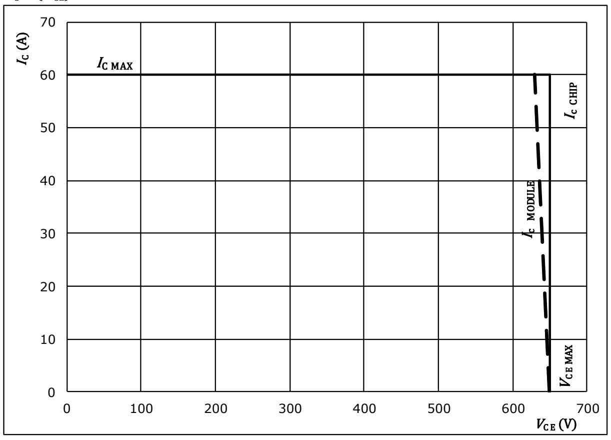
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	-5 / 15	V		125 °C
I_C=	30	A		150 °C

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	150	°C
R_{gon} =	16	Ω
R_{goff} =	16	Ω

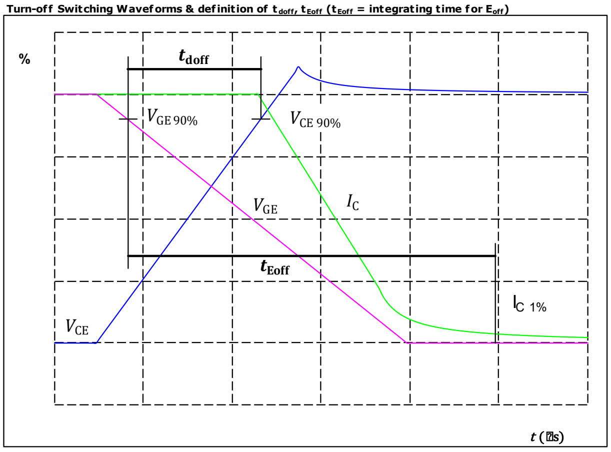
H-Bridge Switching Definitions

General conditions

T_j	=	150 °C
R_{gon}	=	16 Ω
R_{goff}	=	16 Ω

figure 1. IGBT

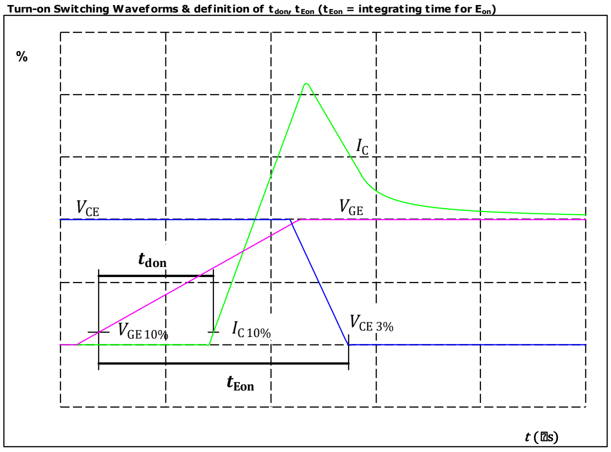
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-5	V
V_{GE} (100%) =	15	V
V_C (100%) =	350	V
I_C (100%) =	30	A
t_{doff} =	105	ns

figure 2. IGBT

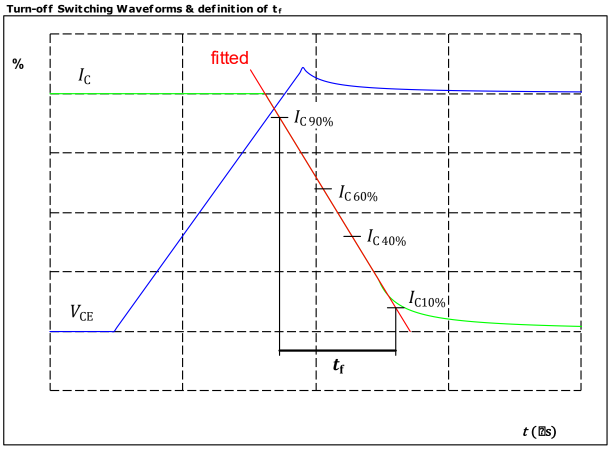
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-5	V
V_{GE} (100%) =	15	V
V_C (100%) =	350	V
I_C (100%) =	30	A
t_{don} =	37	ns

figure 3. IGBT

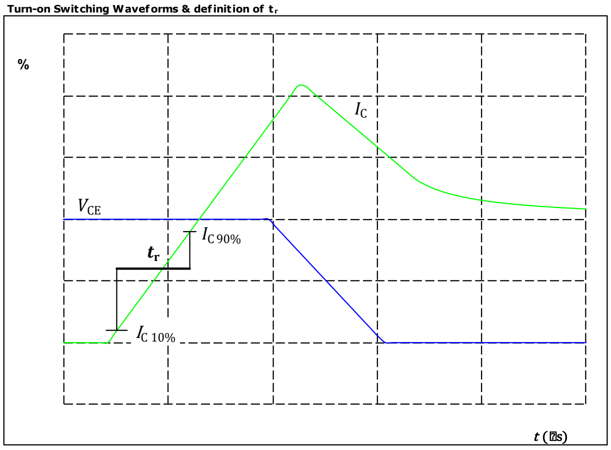
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	350	V
I_C (100%) =	30	A
t_f =	10	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

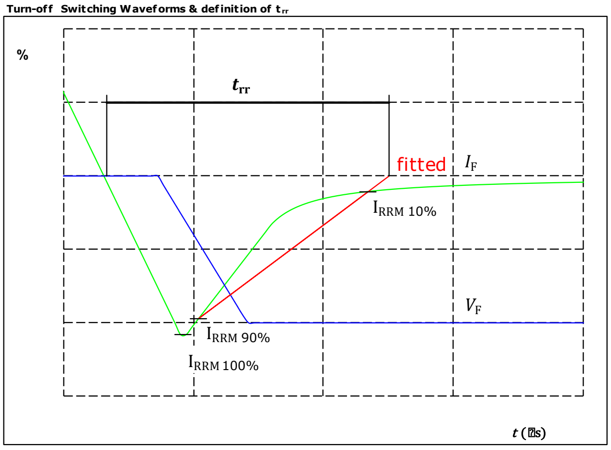


V_C (100%) =	350	V
I_C (100%) =	30	A
t_r =	10	ns

H-Bridge Switching Characteristics

figure 5. **FWD**

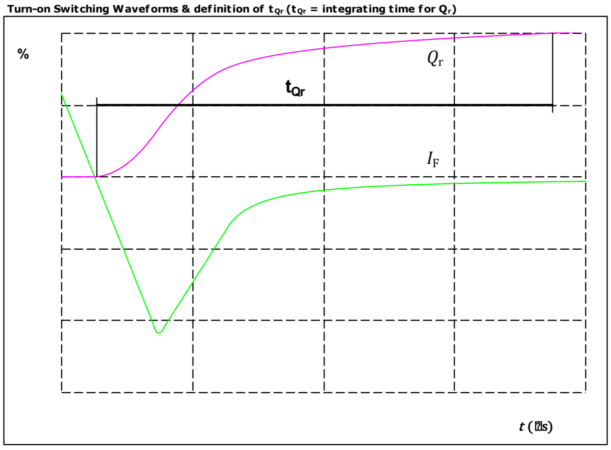
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	350	V
I_F (100%) =	30	A
I_{RRM} (100%) =	23	A
t_{rr} =	137	ns

figure 6. **FWD**

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



I_F (100%) =	30	A
Q_r (100%) =	2	µC

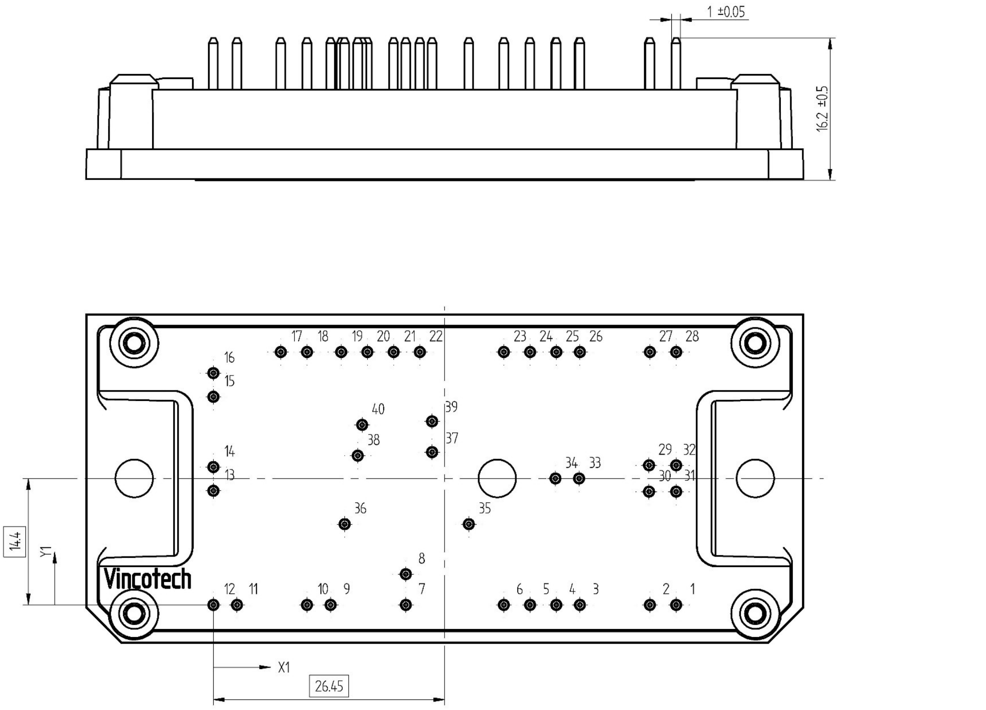
Ordering Code & Marking

Version	Ordering Code
without thermal paste 12 mm housing with Solder Pins	10-FY07ZAA030SM-L513B28
with thermal paste 12 mm housing with Solder Pins	10-FY07ZAA030SM-L513B28-/3/

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

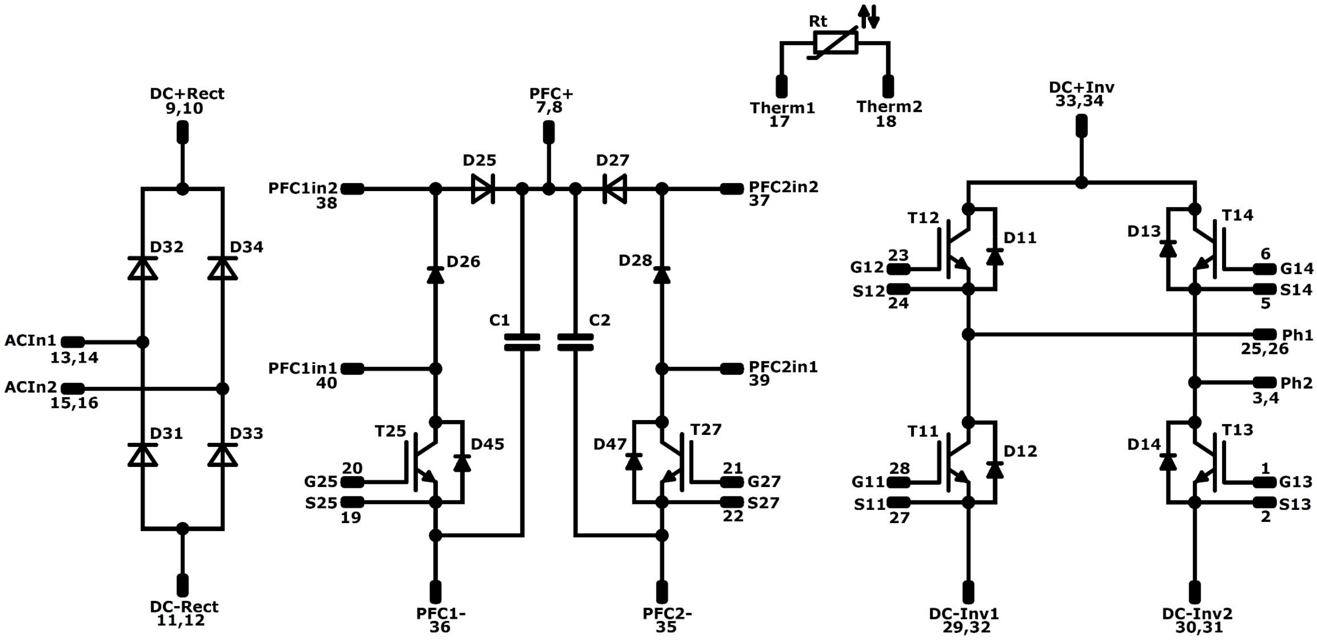
Outline

Pin table			
Pin	X	Y	Function
1	52,9	0	G13
2	49,9	0	S13
3	41,9	0	Ph2
4	39,2	0	Ph2
5	36,2	0	S14
6	33,2	0	G14
7	22	0	PFC+
8	22	3,5	PFC+
9	13,4	0	DC+Rect
10	10,7	0	DC+Rect
11	2,7	0	DC-Rect
12	0	0	DC-Rect
13	0	13	ACIn1
14	0	15,7	ACIn1
15	0	23,7	ACIn2
16	0	26,4	ACIn2
17	7,7	28,8	Therm1
18	10,7	28,8	Therm2
19	14,6	28,8	S25
20	17,6	28,8	G25
21	20,6	28,8	G27
22	23,6	28,8	S27
23	33,2	28,8	G12
24	36,2	28,8	S12
25	39,2	28,8	Ph1
26	41,9	28,8	Ph1
27	49,9	28,8	S11
28	52,9	28,8	G11
29	49,8	15,9	DC-Inv1
30	49,8	12,9	DC-Inv2
31	52,9	12,9	DC-Inv2
32	52,9	15,9	DC-Inv1
33	41,8	14,4	DC+Inv
34	39,1	14,4	DC+Inv
35	29,2	9,2	PFC2-
36	15	9,2	PFC1-
37	25	17,4	PFC2in2
38	16,5	17	PFC1in2
39	25	20,9	PFC2in1
40	17	20,5	PFC1in1



Tolerance of pinpositions: ±0,5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
D31, D32, D33, D34	Rectifier	1600 V	35 A	Rectifier Diode	
T25, T27	IGBT	650 V	20 A	PFC Switch	
D25, D27	FWD	650 V	20 A	PFC Diode	
T11, T12, T13, T14	IGBT	650 V	30 A	H-Bridge Switch	
D11, D12, D13, D14	FWD	650 V	20 A	H-Bridge Diode	
D26, D28	FWD	650 V	10 A	Current Transformer Protection Diode	
D45, D47	FWD	650 V	10 A	PFC Sw. Protection Diode	
C1, C2	Capacitor	630 V		Capacitor (DC)	
Rt	NTC			Thermistor	

Vincotech

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

Handling instruction
Handling instructions for *flow* 1 packages see vincotech.com website.

Package data
Package data for *flow* 1 packages see 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-FY07ZAA030SM-L513B28-D1-14	20 May. 2019		