10-FY07ZAA015SM-L512B28
datasheet

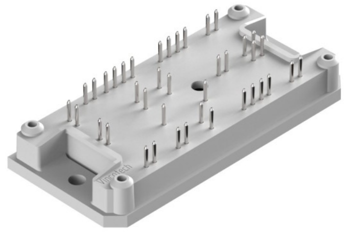
Vincotech

_flow_RPI 1 | **650 V / 15 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

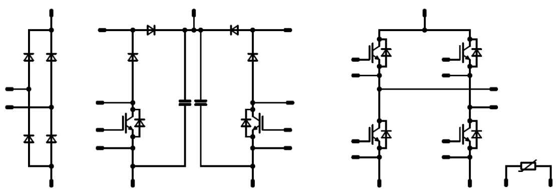
flow 1 12mm housing



Target applications

- Charging Stations
- Power Supply
- Welding & Cutting

Schematic



Types

- 10-FY07ZAA015SM-L512B28

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	21	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		45	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	44	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	21	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	57	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
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

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
H-Bridge Switch					
Collector-emitter voltage	V_{CES}			650	V
Collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	21	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		45	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	44	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	14	A
Repetitive peak forward current	I_{FRM}			20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	38	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	1,5	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					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 Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0004	25	3,3	4	4,7	V
Collector-emitter saturation voltage	V_{CEsat}		15		15	25 125 150		1,64 1,77 1,80	2,3	V
Collector-emitter cut-off current	I_{CES}		0	650		25			40	µA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		930		pF
Output capacitance	C_{oes}							24		
Reverse transfer capacitance	C_{res}							4		
Gate charge	Q_g		15	520	15	25		38		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j\text{-}s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,14		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 32 Ω R_{goff} = 32 Ω	0 / 15	400	15	25 125 150		18 18 21		ns
Rise time	t_r					25 125 150		13 14 14		
Turn-off delay time	$t_{d(off)}$					25 125 150		136 170 175		
Fall time	t_f					25 125 150		7 10 9		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,2 µC Q_{rFWD} = 0,4 µC Q_{rFWD} = 0,6 µC				25 125 150		0,299 0,427 0,450		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,076 0,103 0,118		

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				15	25 125	1,98	2,48 1,73	3	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)						1,65		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 886 A/µs di/dt = 878 A/µs di/dt = 915 A/µs	0 / 15	400	15	25 125 150		8 11 13		A
Reverse recovery time	t_{rr}					25 125 150		21 84 102		ns
Recovered charge	Q_r					25 125 150		0,153 0,442 0,563		µC
Reverse recovered energy	E_{rec}					25 125 150		0,022 0,071 0,087		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		1052 182 184		A/µs
PFC Sw. Protection Diode										
Static										
Forward voltage	V_F				10	25 125		1,67 1,56	2	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
Current Transformer Protection Diode										
Static										
Forward voltage	V_F				10	25 125		1,67 1,56	2	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	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	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0004	25	3,3	4	4,7	V
Collector-emitter saturation voltage	V_{CEsat}		15		15	25 125 150		1,64 1,77 1,80	2,3	V
Collector-emitter cut-off current	I_{CES}		0	650		25			40	µA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		930		pF
Output capacitance	C_{oes}							24		
Reverse transfer capacitance	C_{res}							4		
Gate charge	Q_g		15	520	15	25		38		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,14		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 32 Ω R_{goff} = 32 Ω	-5 / 15	350	15	25 125 150		38 35 35		ns
Rise time	t_r					25 125 150		12 13 12		
Turn-off delay time	$t_{d(off)}$					25 125 150		98 111 118		
Fall time	t_f					25 125 150		8 9 9		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,4 µC Q_{rFWD} = 0,8 µC Q_{rFWD} = 0,9 µC				25 125 150		0,335 0,387 0,428		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,049 0,093 0,109		

Characteristic Values

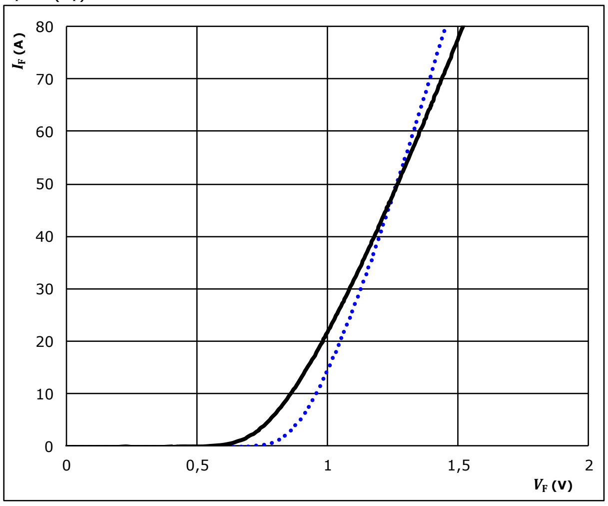
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
H-Bridge Diode										
Static										
Forward voltage	V_F				10	25 125 150		1,52 1,43 1,41	2,3	V
Reverse leakage current	I_R			650		25			0,64	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j\text{-}s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,53		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 1199 A/µs di/dt = 1204 A/µs di/dt = 1243 A/µs	-5 / 15	350	15	25 125 150		9 11 13		A
Reverse recovery time	t_{rr}					25 125 150		100 125 136		ns
Recovered charge	Q_r					25 125 150		0,443 0,813 0,928		µC
Reverse recovered energy	E_{rec}					25 125 150		0,077 0,153 0,174		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		50 79 84		A/µs
Capacitor (DC)										
Capacitance	C							100		nF
Tolerance							-10		+10	%
Dissipation factor		f = 1 kHz				25			2,5	%
Thermistor										
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

$I_F = f(V_F)$



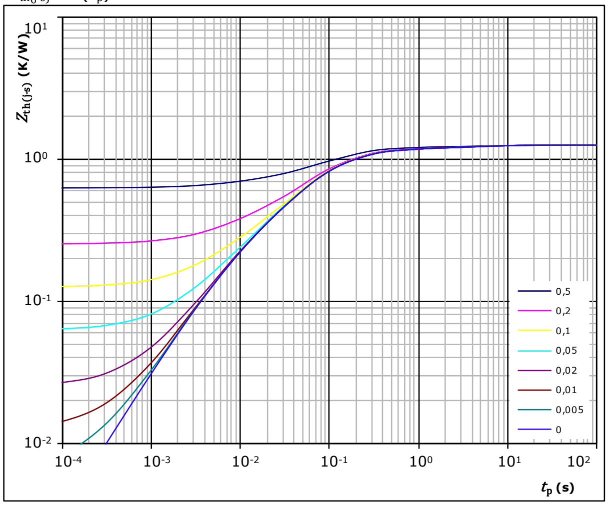
t_p = 250 µs

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

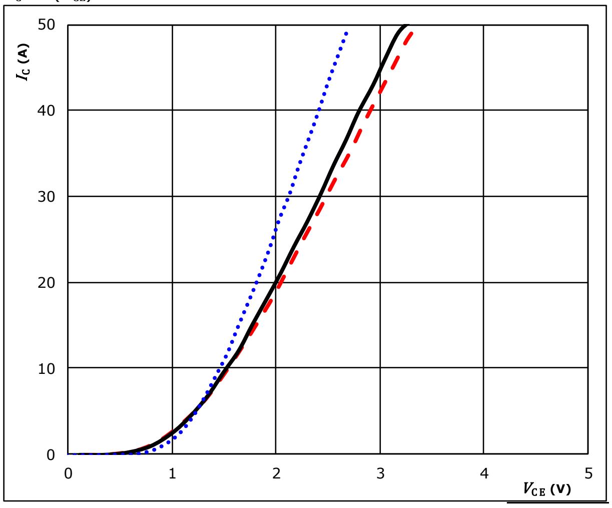
R (K/W)	τ (s)
8,00E-02	5,22E+00
1,56E-01	4,18E-01
6,95E-01	8,82E-02
2,23E-01	3,07E-02
9,97E-02	5,99E-03

PFC Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

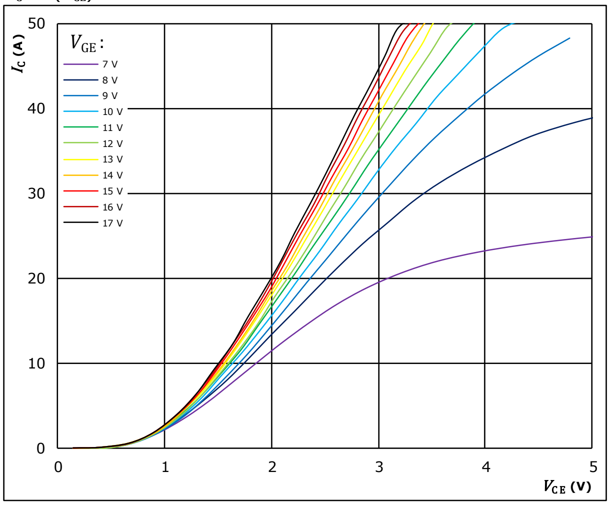


t_p =	250	µs		25 °C	···········
V_{GE} =	15	V	T_j:	125 °C	———
				150 °C	– – – –

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

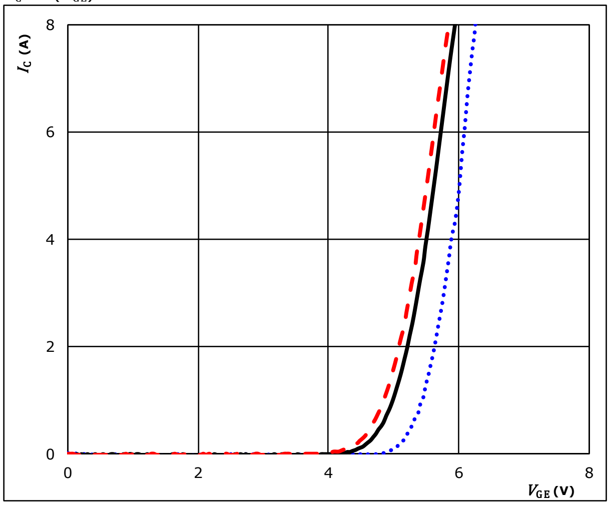


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

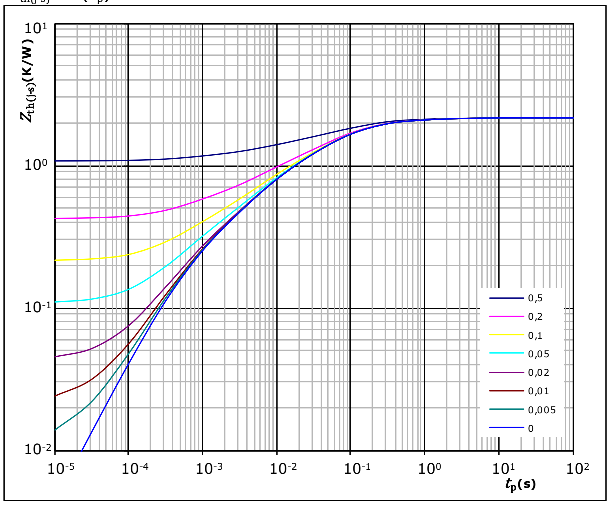


t_p =	100	µs		25 °C	···········
V_{CE} =	10	V	T_j:	125 °C	———
				150 °C	– – – –

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T

$R_{th(j-s)}$ = 2,14 K/W

IGBT thermal model values

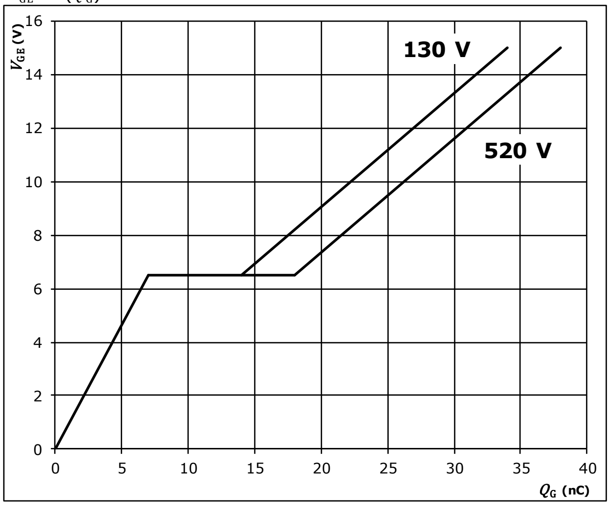
R (K/W)	τ (s)
1,10E-01	1,85E+00
3,05E-01	2,58E-01
8,44E-01	6,42E-02
4,55E-01	1,26E-02
2,79E-01	3,05E-03
1,45E-01	4,84E-04

PFC Switch Characteristics

figure 5. **IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

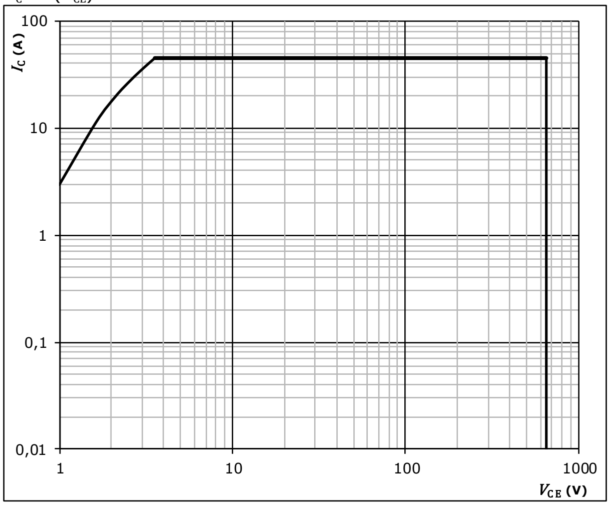


$I_C =$ 15 A

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



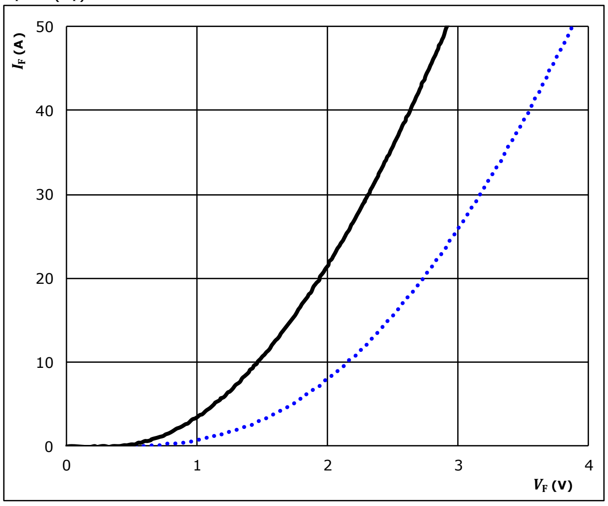
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

PFC Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



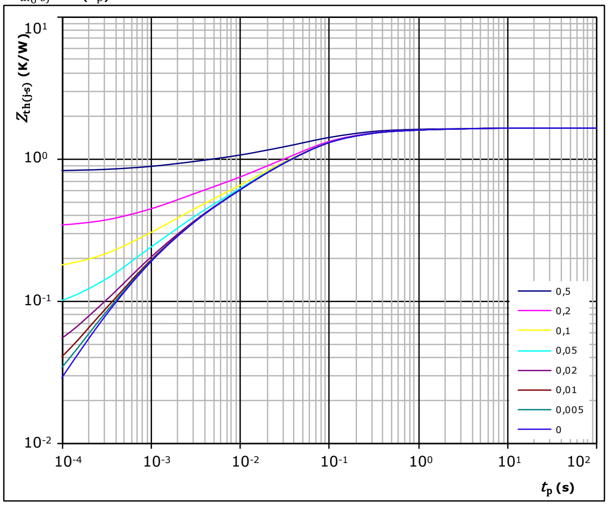
t_p = 250 µs

T_j: 25 °C
125 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,65 K/W

FWD thermal model values

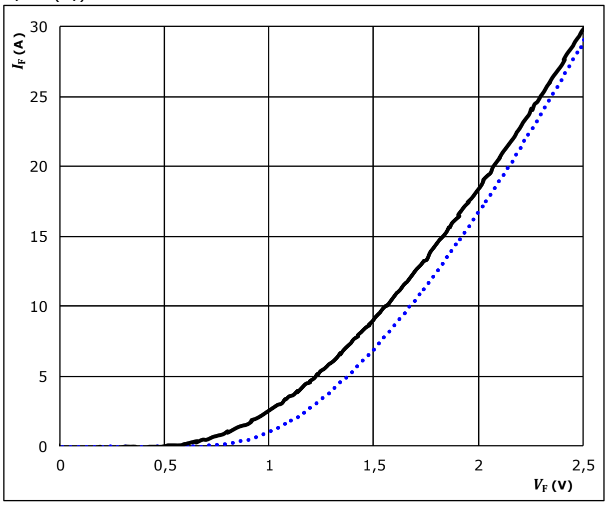
R (K/W)	τ (s)
7,51E-02	2,42E+00
2,35E-01	2,44E-01
7,47E-01	5,47E-02
3,32E-01	1,02E-02
2,07E-01	1,74E-03
5,85E-02	4,12E-04

PFC Sw. Protection Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



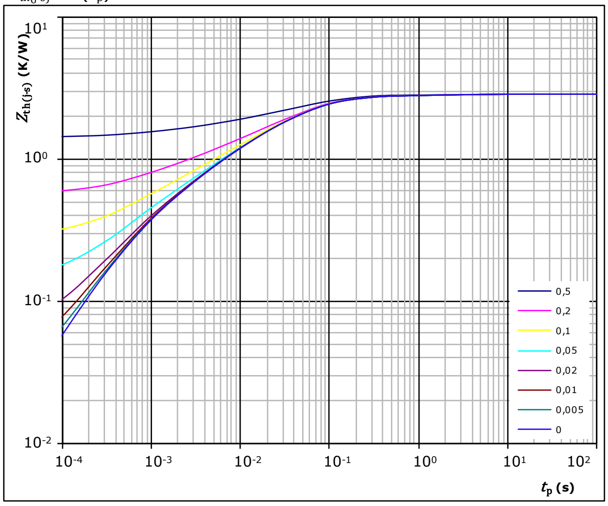
t_p = 250 µs

T_j: 25 °C (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

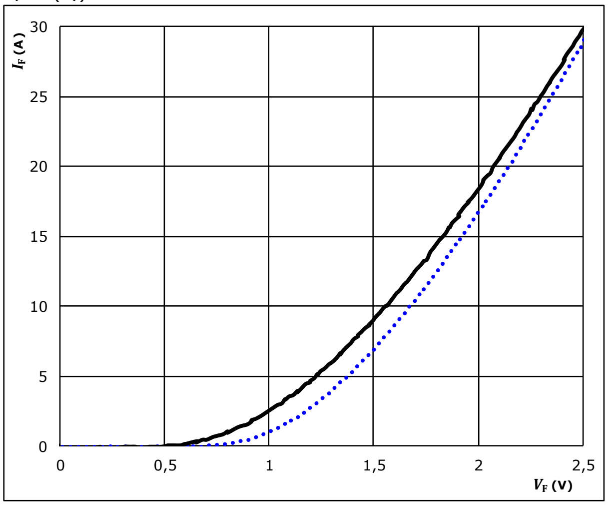
R (K/W)	τ (s)
6,53E-02	3,94E+00
1,48E-01	4,48E-01
1,31E+00	5,96E-02
7,32E-01	1,36E-02
4,04E-01	2,79E-03
2,11E-01	5,37E-04

Current Transformer Protection Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



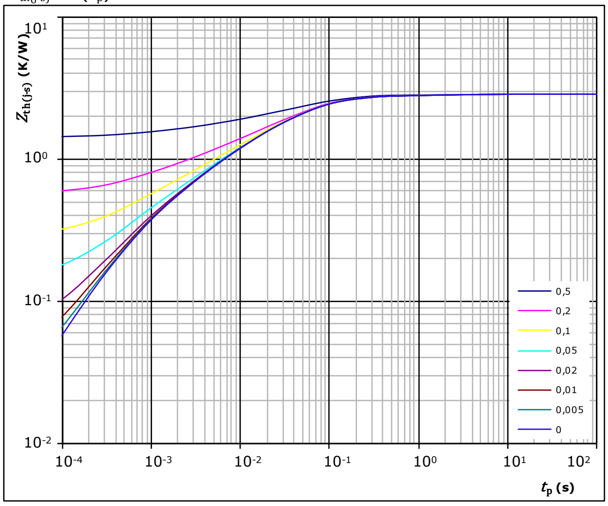
t_p = 250 µs

T_j: 25 °C (dotted line); 125 °C (solid line)

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

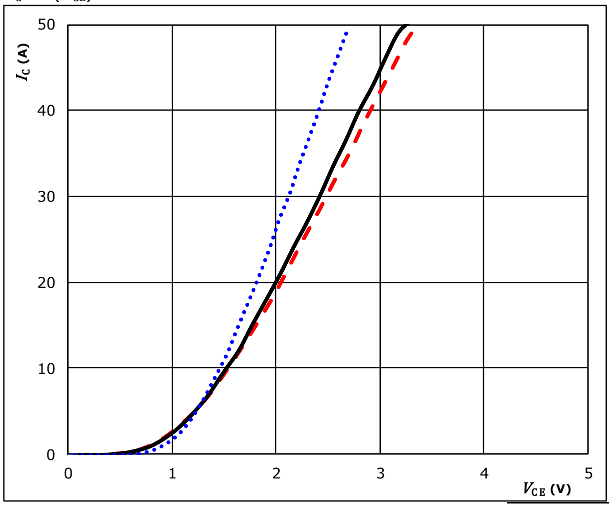
R (K/W)	τ (s)
6,53E-02	3,94E+00
1,48E-01	4,48E-01
1,31E+00	5,96E-02
7,32E-01	1,36E-02
4,04E-01	2,79E-03
2,11E-01	5,37E-04

H-Bridge Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

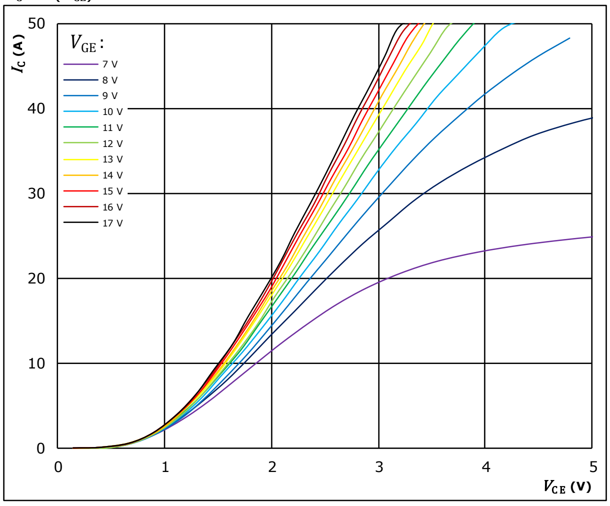


t_p =	250	µs	T_j:	25 °C	dotted
V_{GE} =	15	V		125 °C	solid
				150 °C	dashed

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

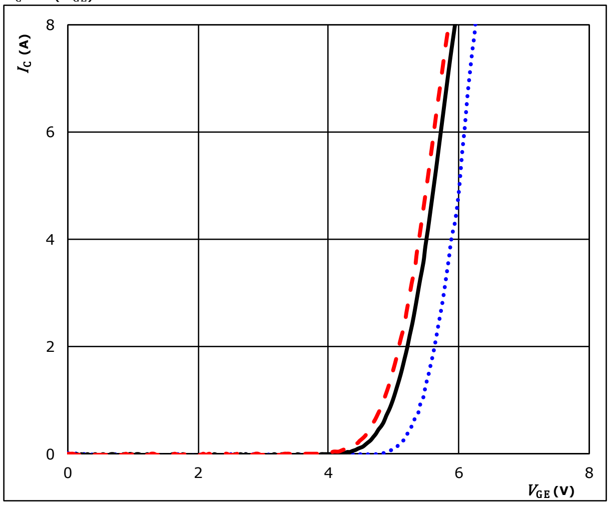


t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

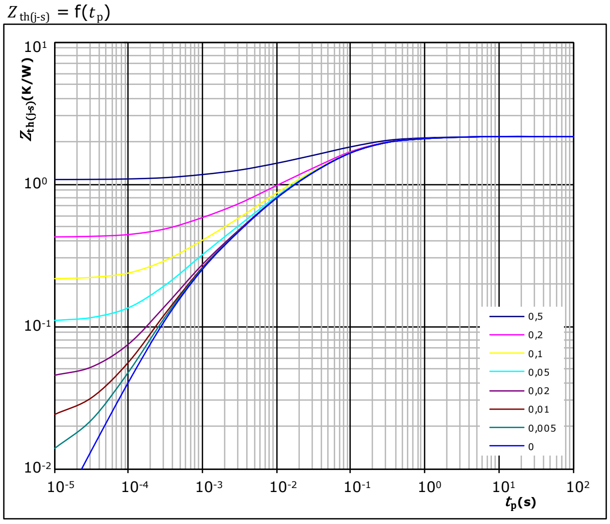


t_p =	100	µs	T_j:	25 °C	dotted
V_{CE} =	10	V		125 °C	solid
				150 °C	dashed

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T
$R_{th(j\text{-}s)}$ = 2,14 K/W

IGBT thermal model values

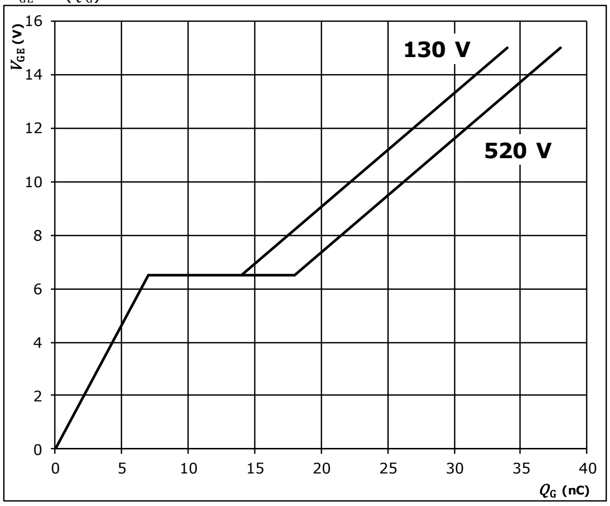
R (K/W)	τ (s)
1,10E-01	1,85E+00
3,05E-01	2,58E-01
8,44E-01	6,42E-02
4,55E-01	1,26E-02
2,79E-01	3,05E-03
1,45E-01	4,84E-04

H-Bridge Switch Characteristics

figure 5. **IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

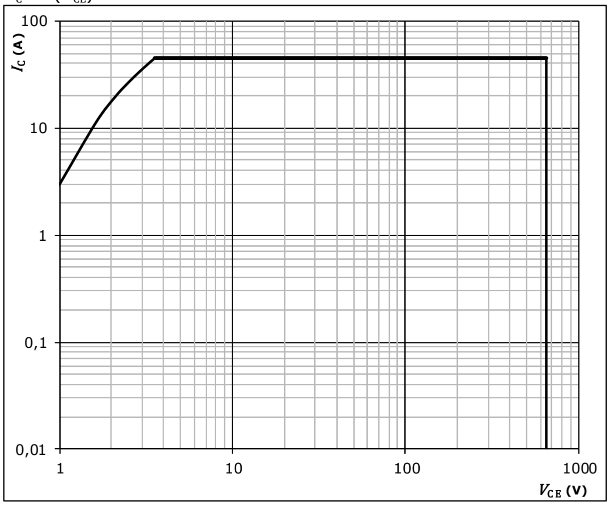


$I_C =$ 15 A

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



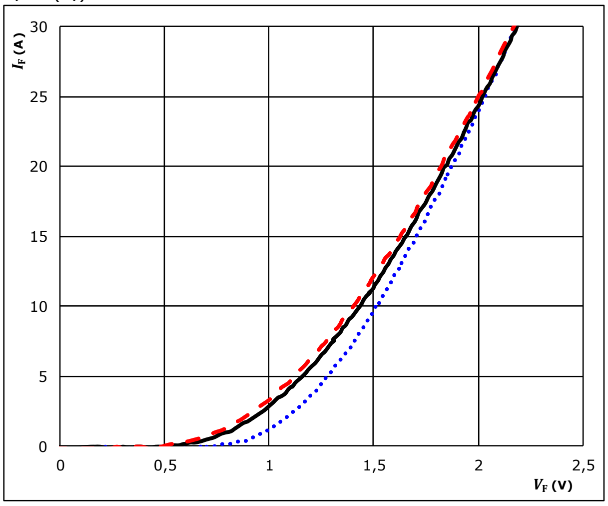
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

H-Bridge Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



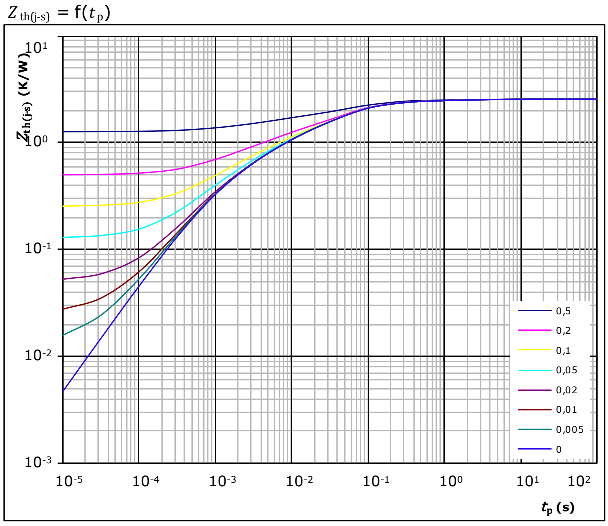
t_p = 250 µs

T_j: 25 °C; 125 °C; 150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 2,53 K/W

FWD thermal model values

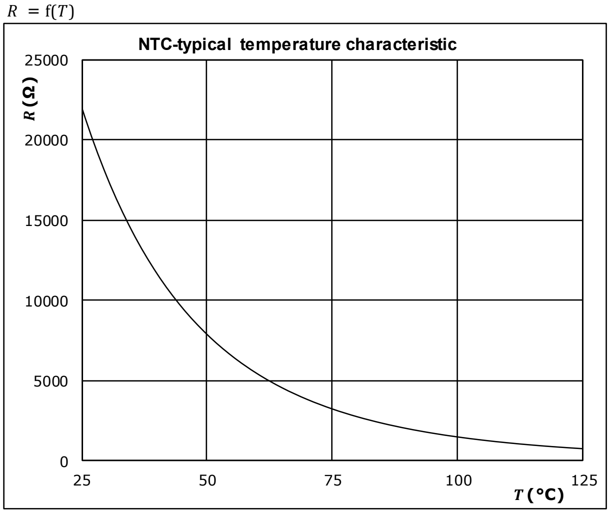
R (K/W)	τ (s)
1,04E-01	2,72E+00
2,14E-01	3,17E-01
1,08E+00	5,77E-02
4,24E-01	1,53E-02
4,88E-01	3,55E-03
2,17E-01	7,36E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic as a function of temperature

$R = f(T)$

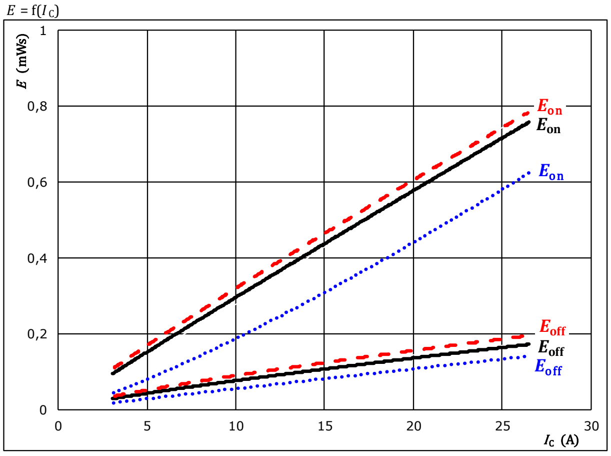


PFC Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



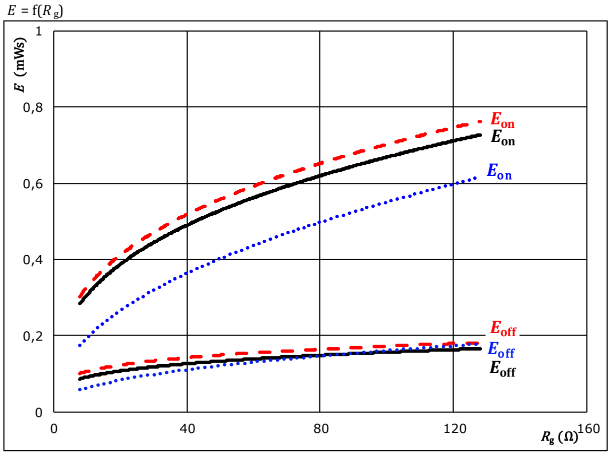
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C	dotted
V_{GE} =	0 / 15	V		125 °C	solid
R_{gon} =	32	Ω		150 °C	dashed
R_{goff} =	32	Ω			

figure 2. IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



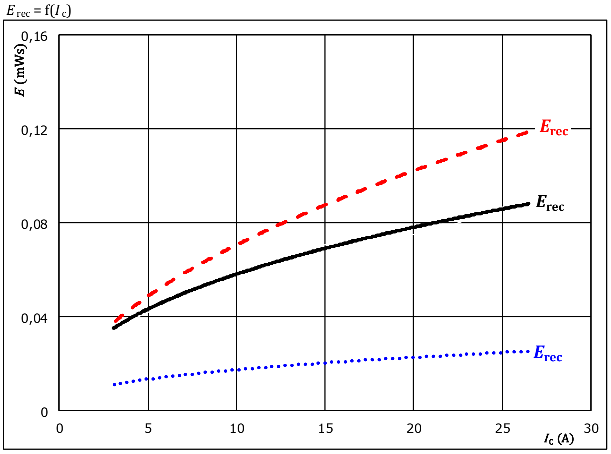
With an inductive load at

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

figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_c)$



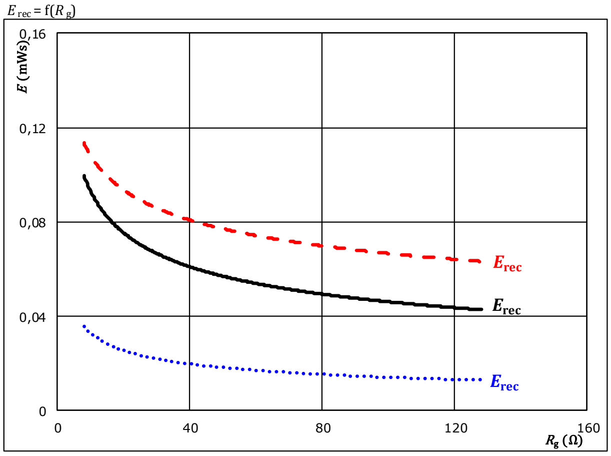
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C	dotted
V_{GE} =	0 / 15	V		125 °C	solid
R_{gon} =	32	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

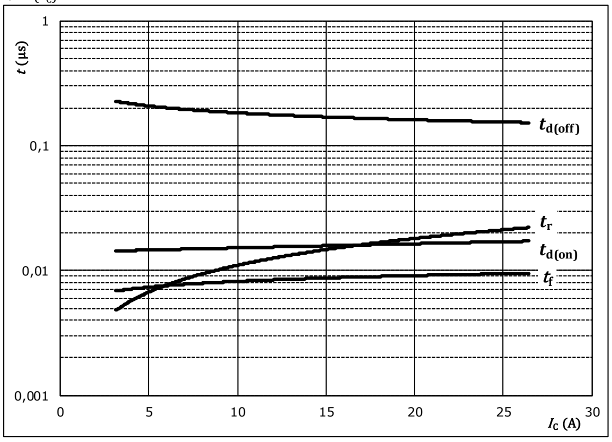
V_{CE} =	400	V	T_j:	25 °C	dotted
V_{GE} =	0 / 15	V		125 °C	solid
I_C =	15	A		150 °C	dashed

PFC Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



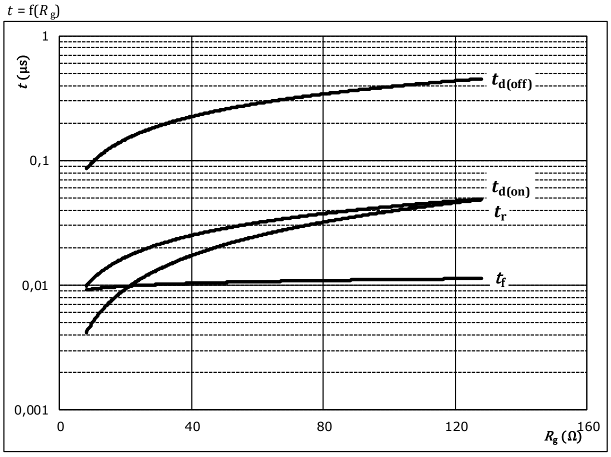
With an inductive load at

T_j =	150	°C
V_{CE} =	400	V
V_{GE} =	0 / 15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



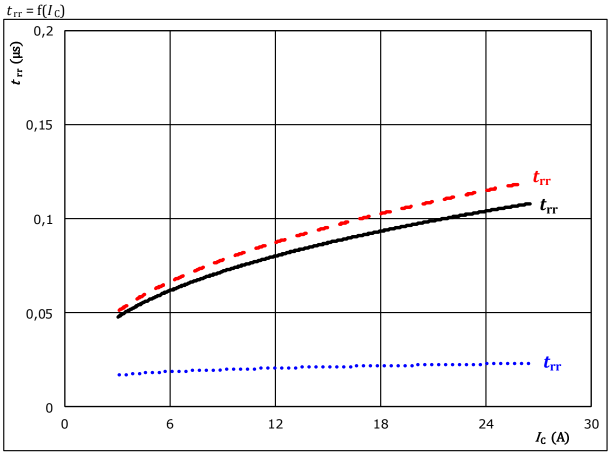
With an inductive load at

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

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



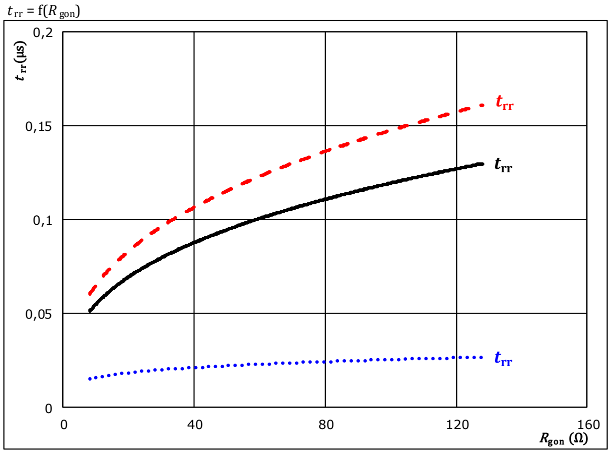
With an inductive load at

V_{CE}=	400	V	T_j:	25 °C	············
V_{GE}=	0 / 15	V		125 °C	————
R_{gon} =	32	Ω		150 °C	– – – –

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

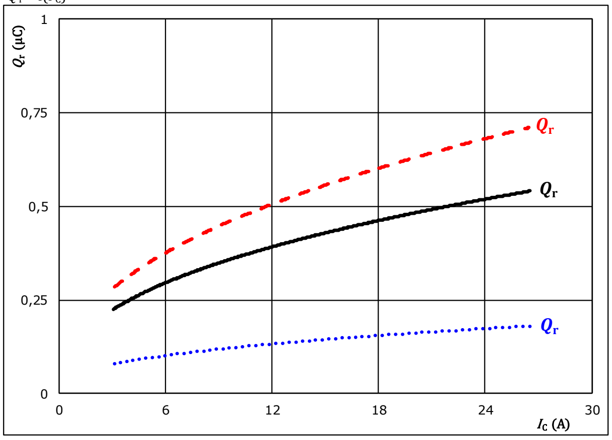
V_{CE} =	400	V	T_j:	25 °C	············
V_{GE} =	0 / 15	V		125 °C	————
I_C =	15	A		150 °C	– – – –

PFC Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



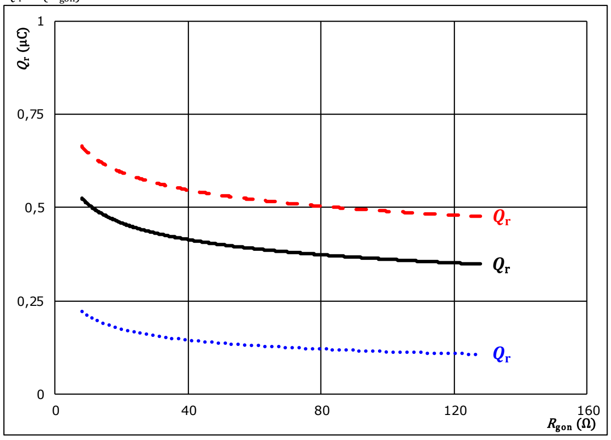
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C	···········
V_{GE} =	0 / 15	V		125 °C	———
R_{gon} =	32	Ω		150 °C	– – –

figure 10. **FWD**

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

$Q_r = f(R_{gon})$



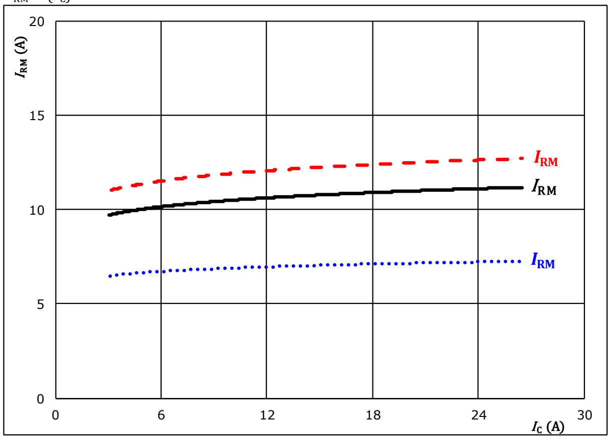
With an inductive load at

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

figure 11. **FWD**

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

$I_{RM} = f(I_C)$



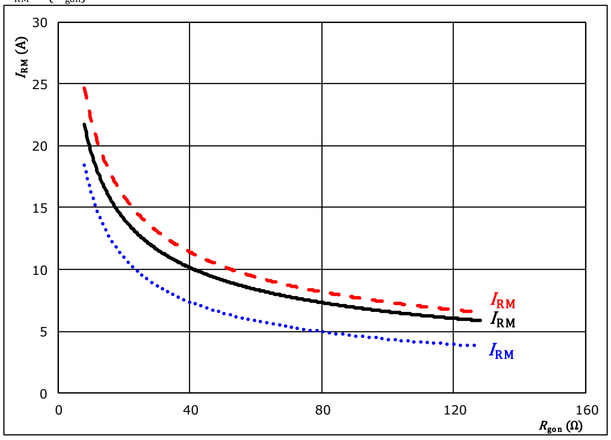
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C	···········
V_{GE} =	0 / 15	V		125 °C	———
R_{gon} =	32	Ω		150 °C	– – –

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

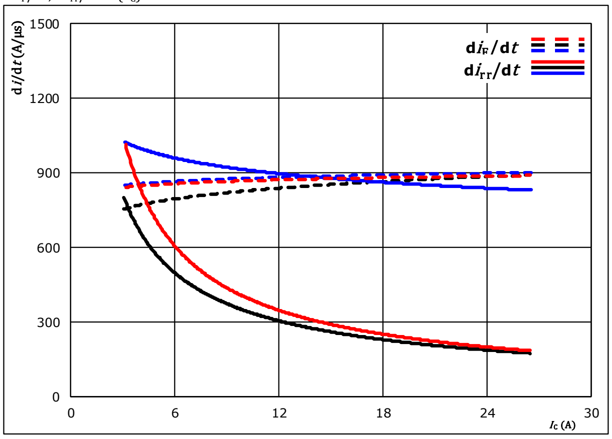
V_{CE} =	400	V	T_j:	25 °C	···········
V_{GE} =	0 / 15	V		125 °C	———
I_C =	15	A		150 °C	– – –

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



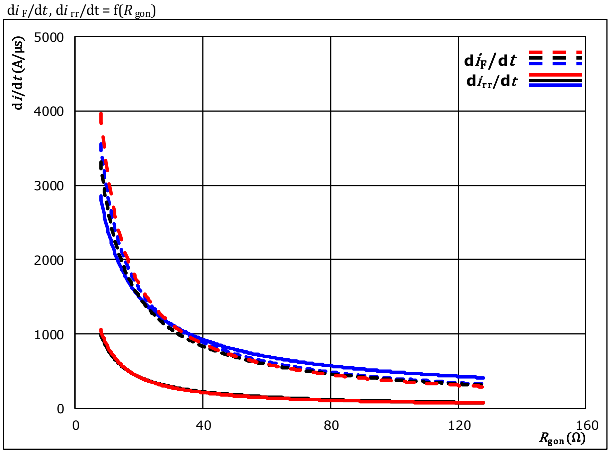
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0 / 15	V		125 °C
R_{gon} =	32	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, $di_{rr}/dt = f(R_{gon})$



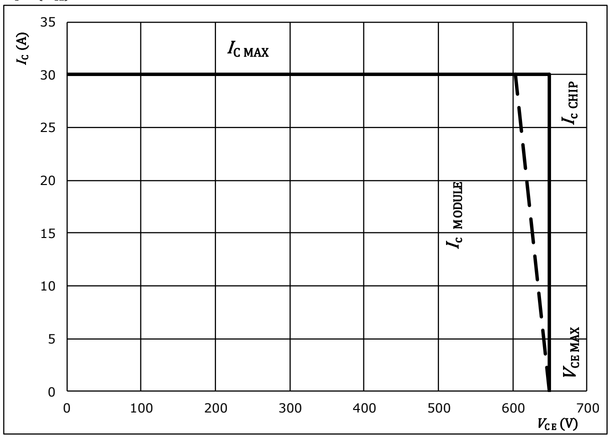
With an inductive load at

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

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

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

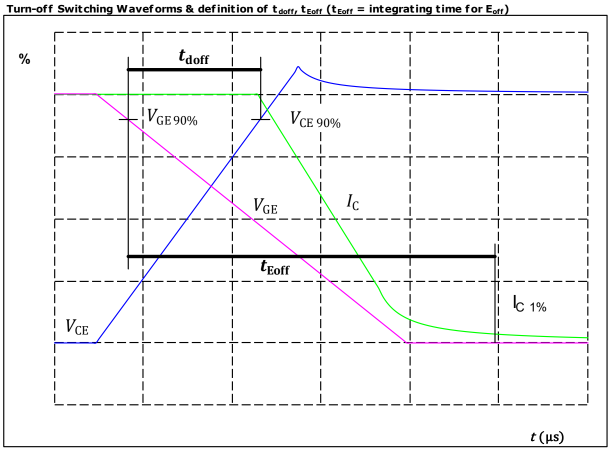
PFC Switching Definitions

General conditions

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

figure 1. IGBT

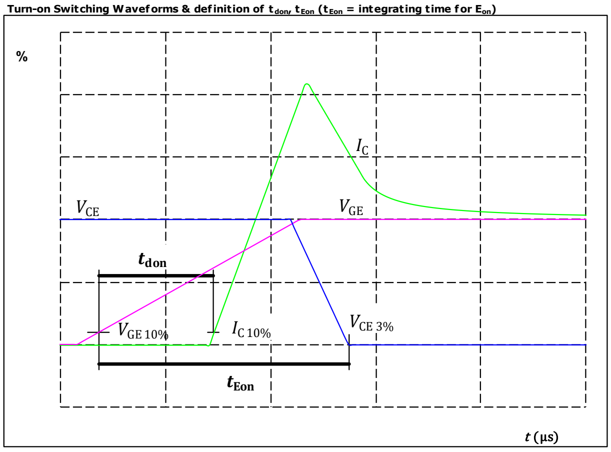
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	15	A
t_{doff} =	170	ns

figure 2. IGBT

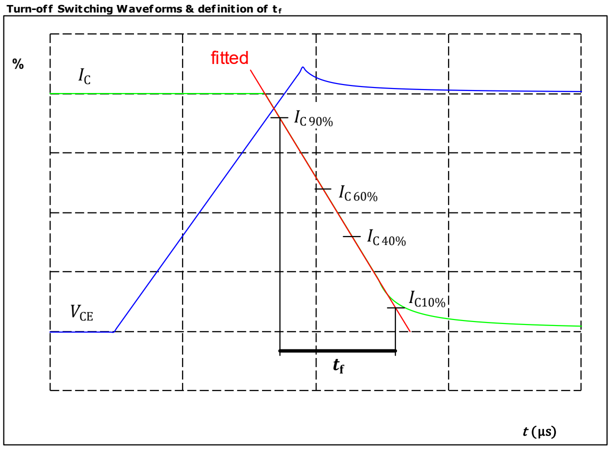
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	15	A
t_{don} =	18	ns

figure 3. IGBT

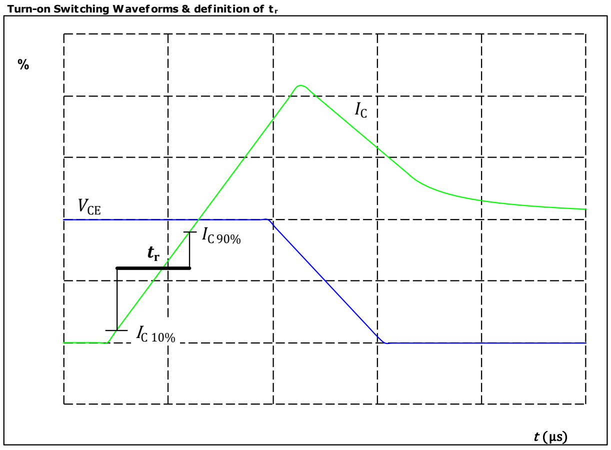
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	15	A
t_f =	10	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

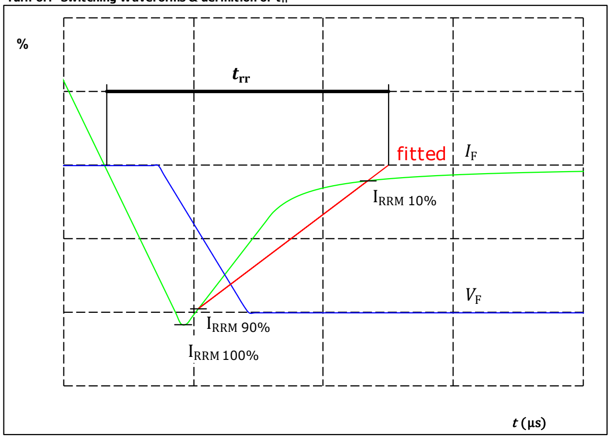


$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	15	A
t_r =	14	ns

PFC Switching Characteristics

figure 5.	FWD

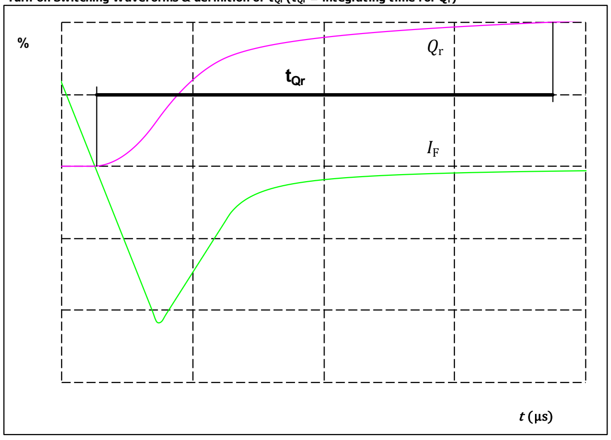
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	400	V
I_F (100%) =	15	A
I_{RRM} (100%) =	11	A
t_{rr} =	84	ns

figure 6.	FWD

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



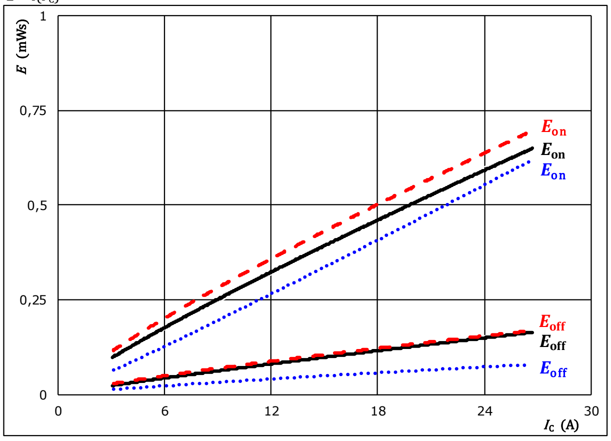
I_F (100%) =	15	A
Q_r (100%) =	0,442	µC

H-Bridge Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$

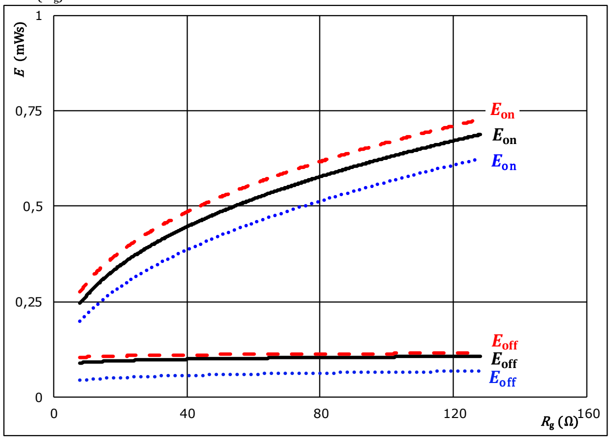


With an inductive load at				T_j:	
	V_{CE} =	350	V		25 °C
	V_{GE} =	-5 / 15	V		125 °C
	R_{gon} =	32	Ω		150 °C
	R_{goff} =	32	Ω		

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$

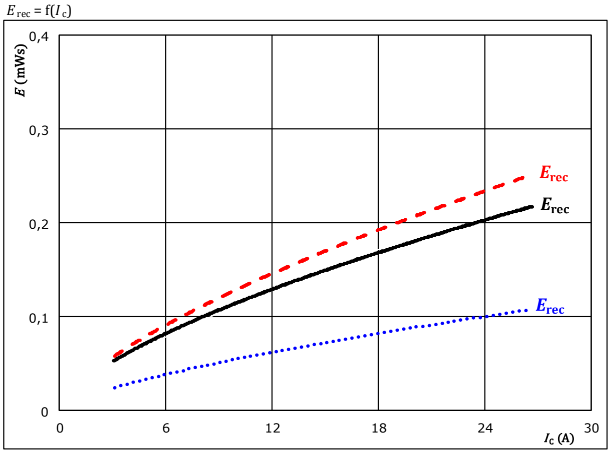


With an inductive load at				T_j:	
	V_{CE} =	350	V		25 °C
	V_{GE} =	-5 / 15	V		125 °C
	I_C =	15	A		150 °C

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_c)$

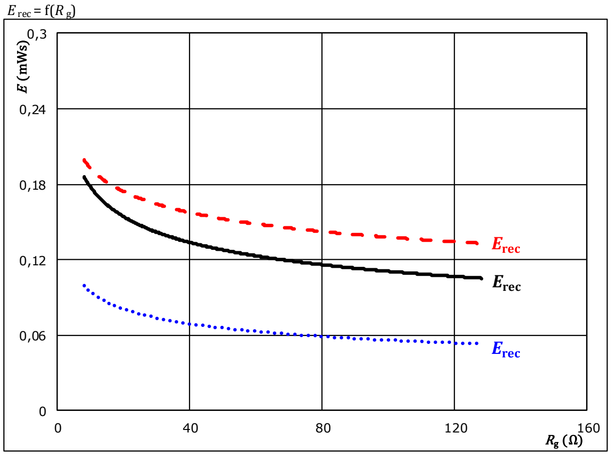


With an inductive load at				T_j:	
	V_{CE} =	350	V		25 °C
	V_{GE} =	-5 / 15	V		125 °C
	R_{gon} =	32	Ω		150 °C

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



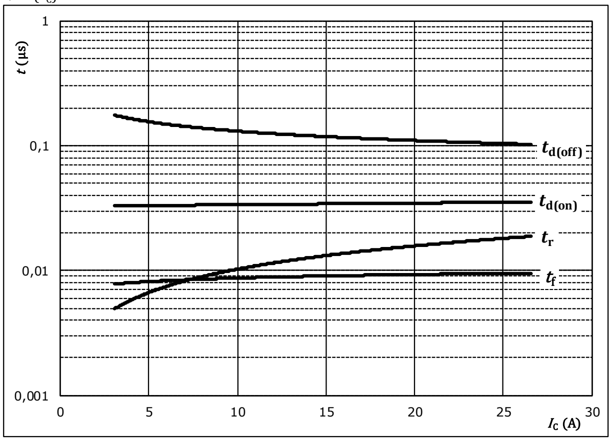
With an inductive load at				T_j:	
	V_{CE} =	350	V		25 °C
	V_{GE} =	-5 / 15	V		125 °C
	I_C =	15	A		150 °C

H-Bridge Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



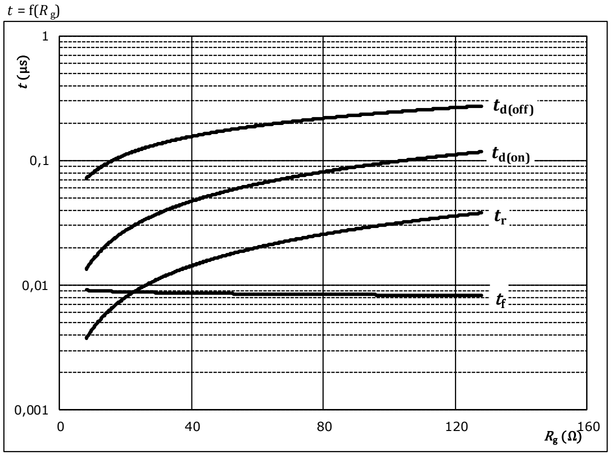
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	-5 / 15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



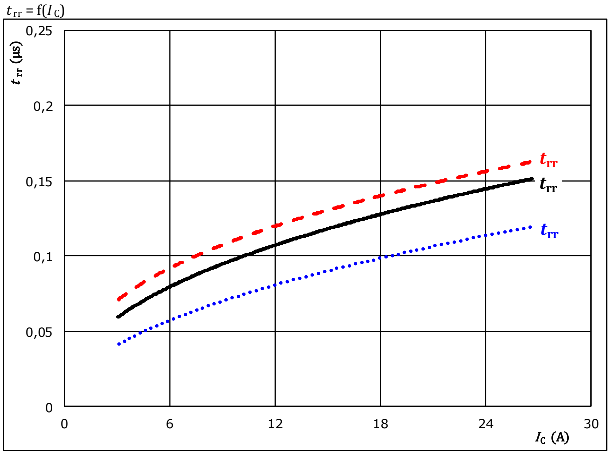
With an inductive load at

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

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



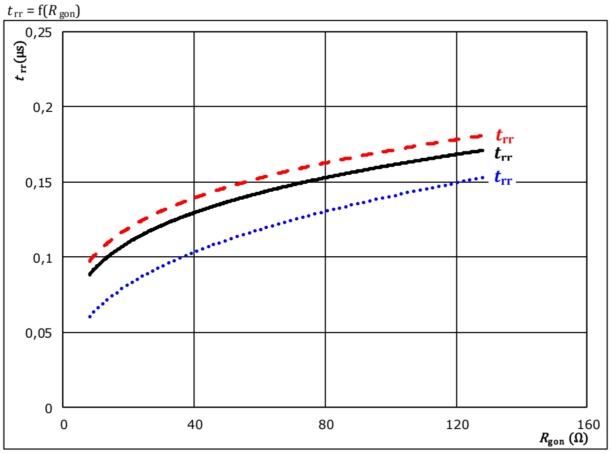
With an inductive load at

V_{CE}=	350	V	T_j:	25 °C	dotted (blue)
V_{GE} =	-5 / 15	V		125 °C	solid (black)
R_{gon} =	32	Ω		150 °C	dashed (red)

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

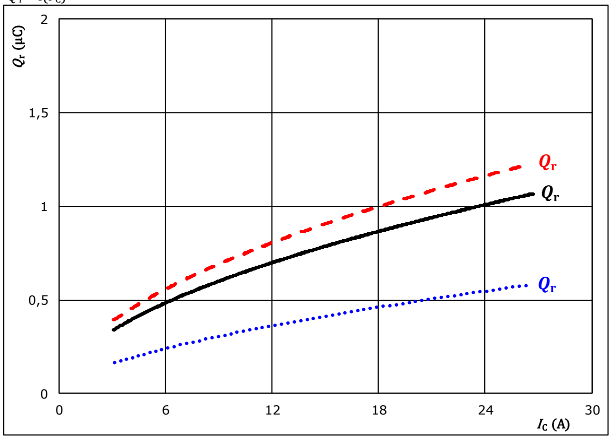
V_{CE} =	350	V	T_j:	25 °C	dotted (blue)
V_{GE} =	-5 / 15	V		125 °C	solid (black)
I_C =	15	A		150 °C	dashed (red)

H-Bridge Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



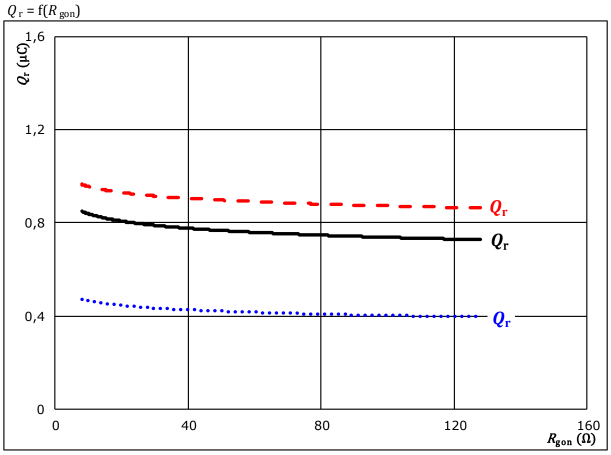
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	-5 / 15	V		125 °C	solid
R_{gon} =	32	Ω		150 °C	dashed

figure 10. FWD

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

$Q_r = f(R_{gon})$



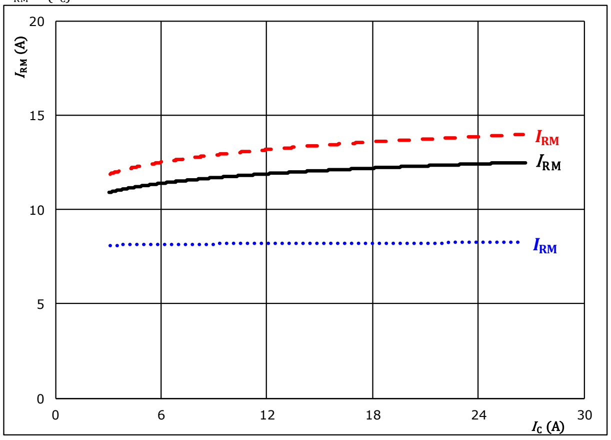
With an inductive load at

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

figure 11. FWD

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

$I_{RM} = f(I_C)$



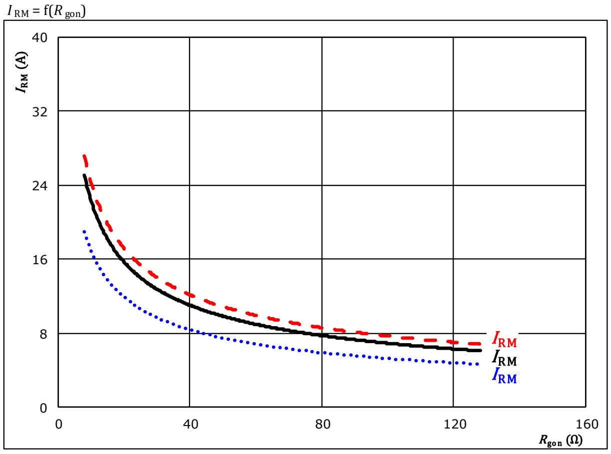
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	-5 / 15	V		125 °C	solid
R_{gon} =	32	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

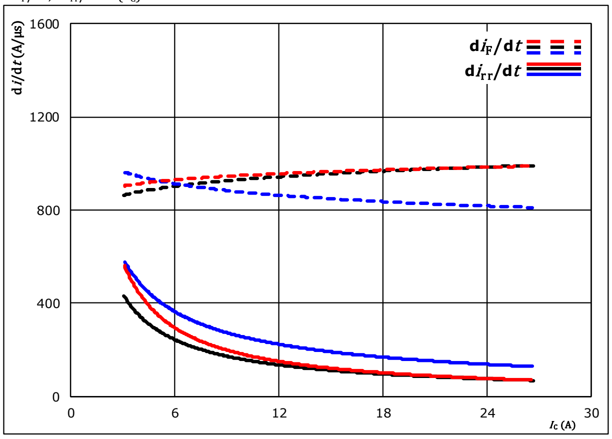
V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	-5 / 15	V		125 °C	solid
I_C =	15	A		150 °C	dashed

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



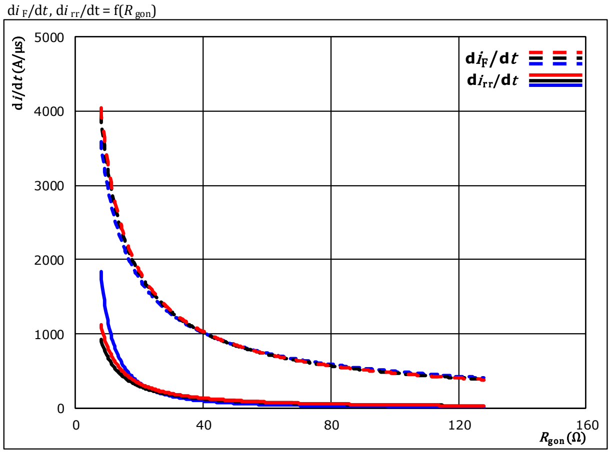
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	-5 / 15	V		125 °C
R_{gon} =	32	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, $di_{rr}/dt = f(R_{gon})$



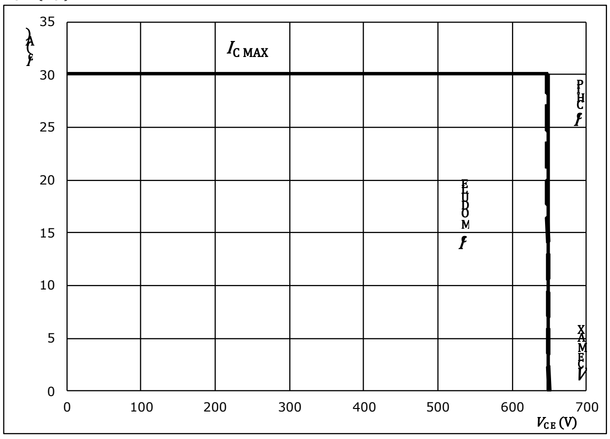
With an inductive load at

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

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

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

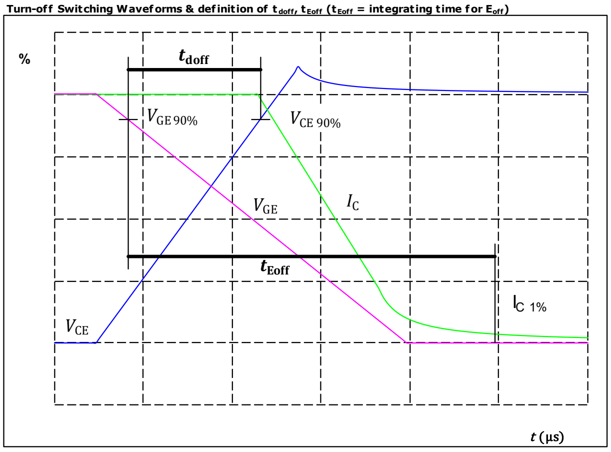
H-Bridge Switching Definitions

General conditions

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

figure 1. **IGBT**

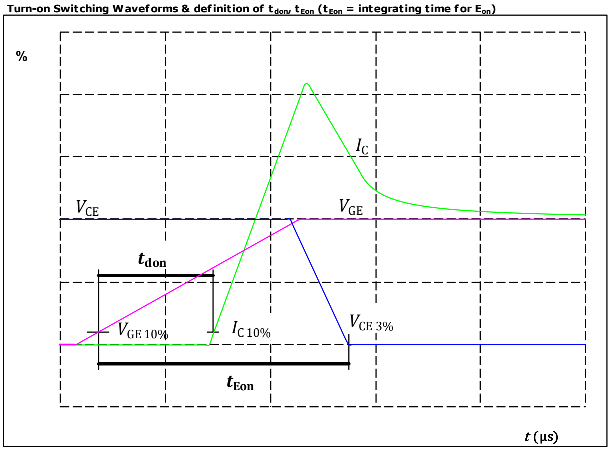
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-5	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_{doff} =	111	ns

figure 2. **IGBT**

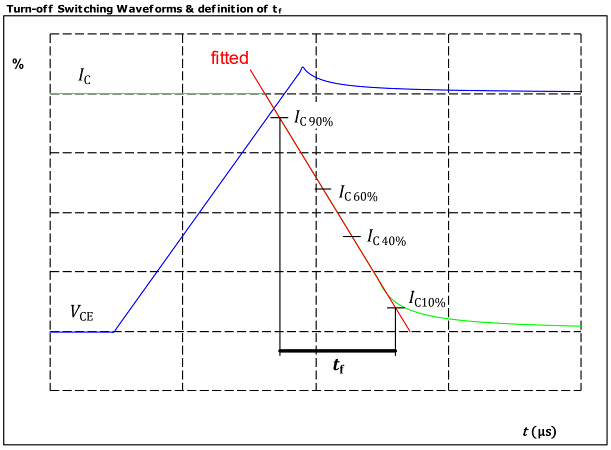
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-5	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_{don} =	35	ns

figure 3. **IGBT**

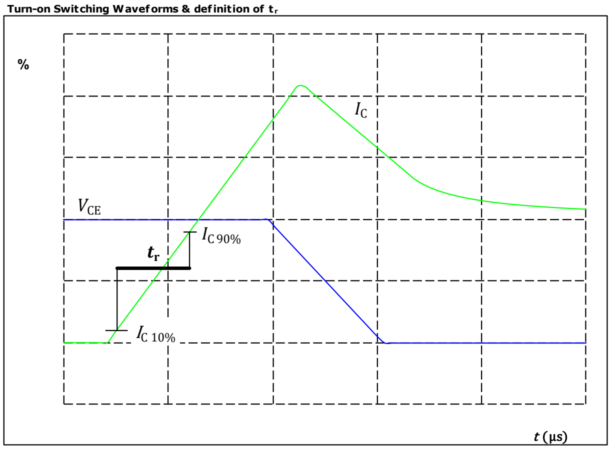
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_f =	9	ns

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

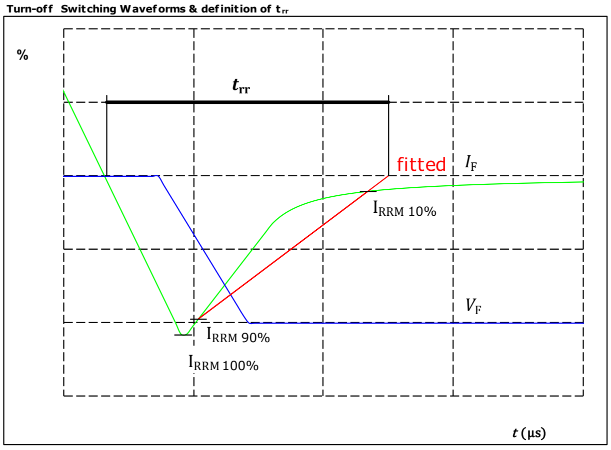


$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_r =	13	ns

H-Bridge Switching Characteristics

figure 5. **FWD**

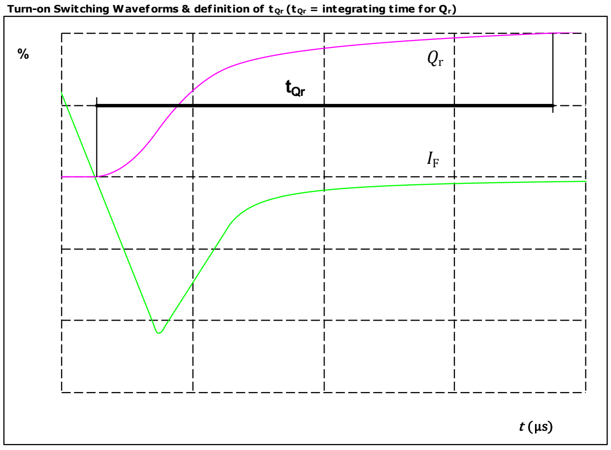
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	350	V
I_F (100%) =	15	A
I_{RRM} (100%) =	11	A
t_{rr} =	125	ns

figure 6. **FWD**

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



I_F (100%) =	15	A
Q_r (100%) =	0,813	μC

10-FY07ZAA015SM-L512B28
datasheet

Ordering Code & Marking

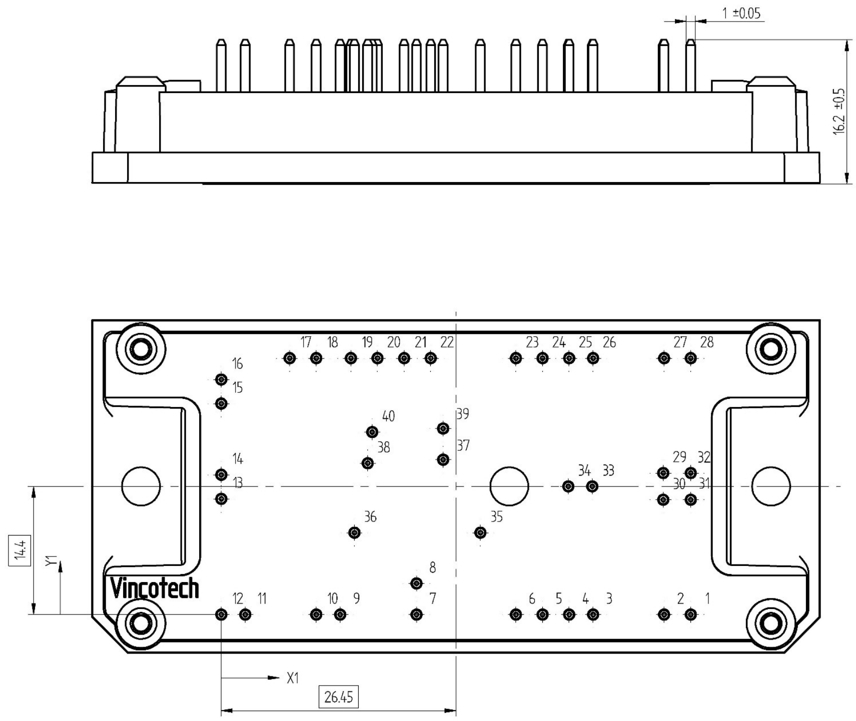
Version	Ordering Code
without thermal paste 12mm housing with solder pins	10-FY07ZAA015SM-L512B28
with thermal paste 12mm housing with solder pins	10-FY07ZAA015SM-L512B28-/3/

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

Outline

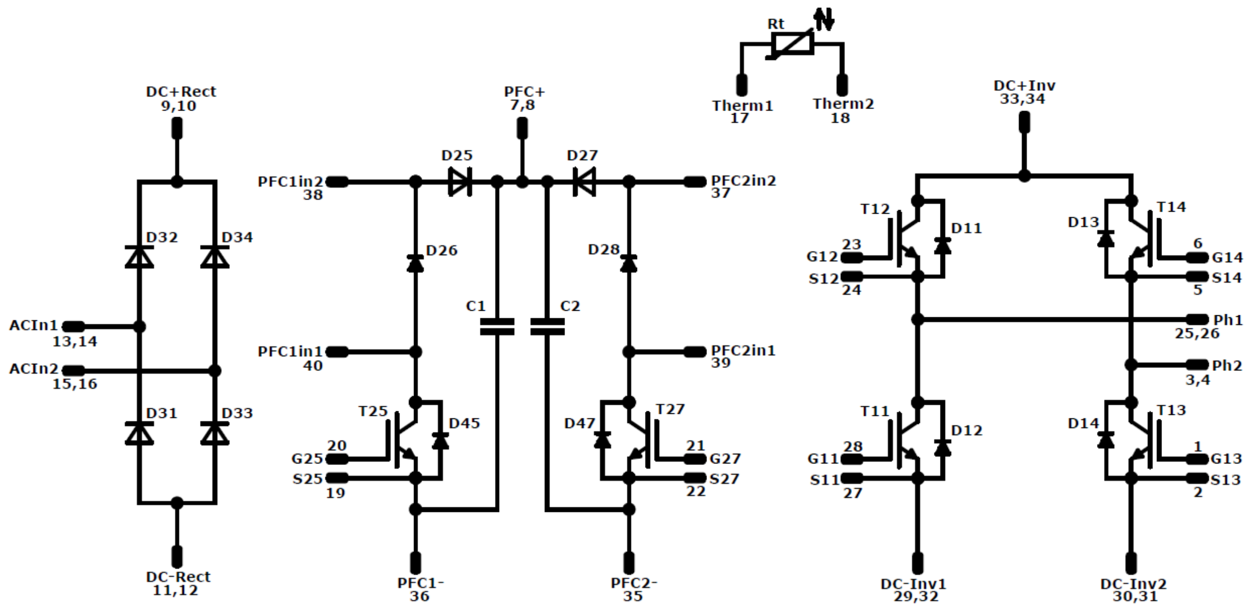
Pin table

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	15 A	PFC Switch	
D25, D27	FWD	650 V	15 A	PFC Diode	
D45, D47	FWD	650 V	10 A	PFC Sw. Protection Diode	
D26, D28	FWD	650 V	10 A	Current Transformer Protection Diode	
T11, T12, T13, T14	IGBT	650 V	15 A	H-Bridge Switch	
D11, D12, D13, D14	FWD	650 V	10 A	H-Bridge 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-FY07ZAA015SM-L512B28-D1-14	20 Mar. 2019		