10-FY074PA100SM01-L583F18
10-PY074PA100SM01-L583F18Y
datasheet

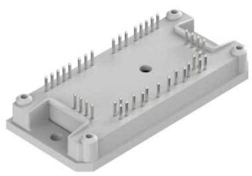
Vincotech

fast **PACK 1 H C** — **650 V / 100 A**

Features

- High-efficient H-Bridge
- Open emitter topology
- Fast IGBT H5 + Fast Rapid 1 Diode
- Integrated capacitors
- Integrated thermistor
- Low inductive 12 mm housing

flow 1 12 mm housing



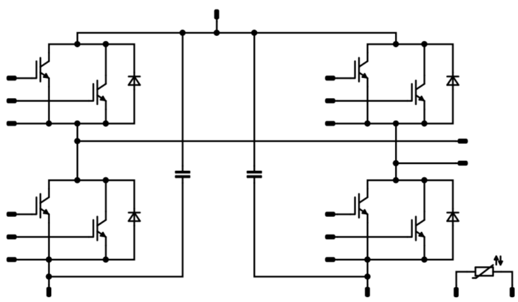
with solder pins

with press-fit pins

Target applications

- Power Supply
- Solar Inverters
- Welding & Cutting

Schematic



Types

- 10-FY074PA100SM01-L583F18
- 10-PY074PA100SM01-L583F18Y

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	79	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	133	W
Gate-emitter voltage	V_{GES}		±20	V
Maximum junction temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
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	88	A
Repetitive peak forward current	I_{FRM}		180	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	112	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		with solder pins / with press-fit pins	8,1 / 7,92	mm
Comparative Tracking Index	CTI		> 200	

*100 % tested in production

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

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
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,001	25	3,3	4	4,7	V
Collector-emitter saturation voltage	V_{CEsat}		15		100	25 125		1,63 1,78	2,22	V
Collector-emitter cut-off current	I_{CES}		0	650		25			80	µA
Gate-emitter leakage current	I_{GES}		20	0		25			240	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		6000		pF
Output capacitance	C_{oes}							100		
Reverse transfer capacitance	C_{res}							22		
Gate charge	Q_g		15	520	100	25		240		nC

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)						0,72		K/W

Dynamic

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
Turn-on delay time	$t_{d(on)}$	R_{goff} = 4 Ω R_{gon} = 4 Ω	-5/15	350	101	25 125 150		41 41 41		ns
Rise time	t_r					25 125 150		12 13 14		
Turn-off delay time	$t_{d(off)}$					25 125 150		104 119 121		
Fall time	t_f					25 125 150		5 12 14		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 2,9 µC Q_{rFWD} = 5,3 µC Q_{rFWD} = 6,1 µC				25 125 150		0,936 1,30 1,41		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,556 0,927 1,03		

Characteristic Values

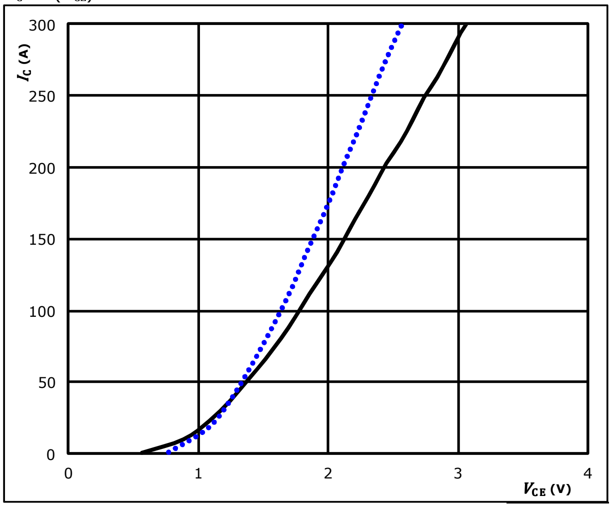
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
H-Bridge Diode										
Static										
Forward voltage	V_F				90	25 125		1,43 1,34	1,77	V
Reverse leakage current	I_R			650		25			4,8	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,85		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 6656 A/µs di/dt = 5321 A/µs di/dt = 5376 A/µs	-5/15	350	101	25 125 150		89 119 127		A
Reverse recovery time	t_{rr}					25 125 150		53 79 89		ns
Recovered charge	Q_r					25 125 150		2,90 5,32 6,07		µC
Reverse recovered energy	E_{rec}					25 125 150		0,673 1,26 1,45		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		2309 1777 1789		A/µs
Capacitor (DC)										
Capacitance	C							200		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	

H-Bridge Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

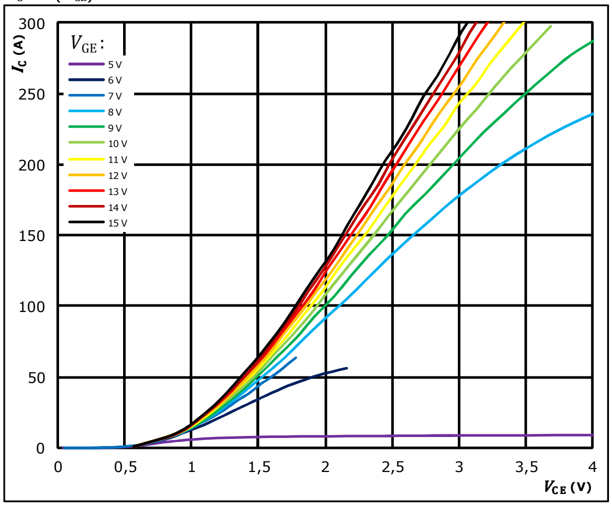


t_p =	250	µs	T_j:	25 °C	dotted
V_{GE} =	15	V		125 °C	solid

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$



t_p = 250 µs

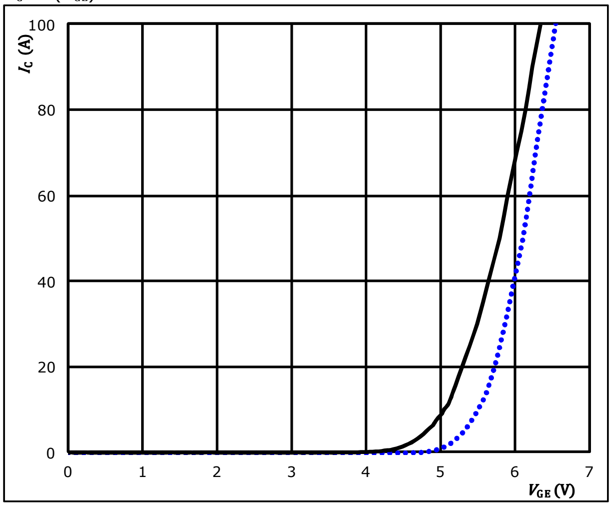
T_j = 125 °C

V_{GE} from 5 V to 19 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

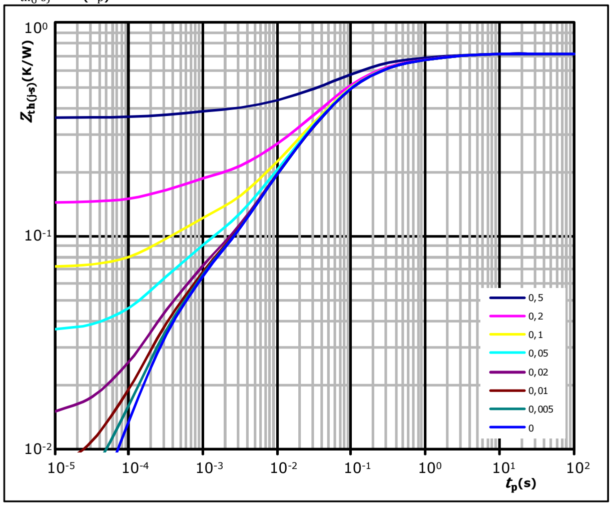


t_p =	100	µs	T_j:	25 °C	dotted
V_{CE} =	10	V		125 °C	solid

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



D = t_p / T

$R_{th(j-s)}$ = 0,72 K/W

IGBT thermal model values

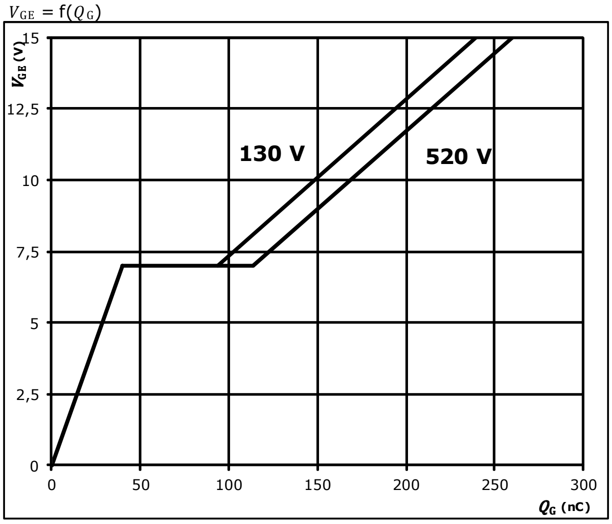
R (K/W)	τ (s)
7,52E-02	1,73E+00
1,31E-01	2,44E-01
3,01E-01	6,32E-02
1,21E-01	1,39E-02
4,30E-02	3,50E-03
4,35E-02	3,33E-04

H-Bridge Switch Characteristics

figure 5. **IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

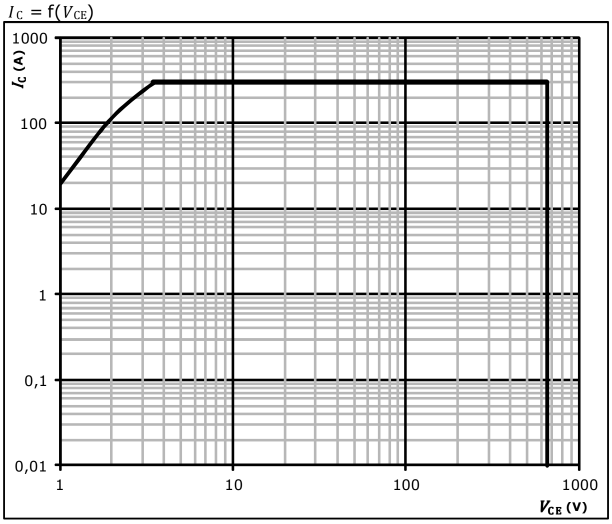


I_C= 100 A

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



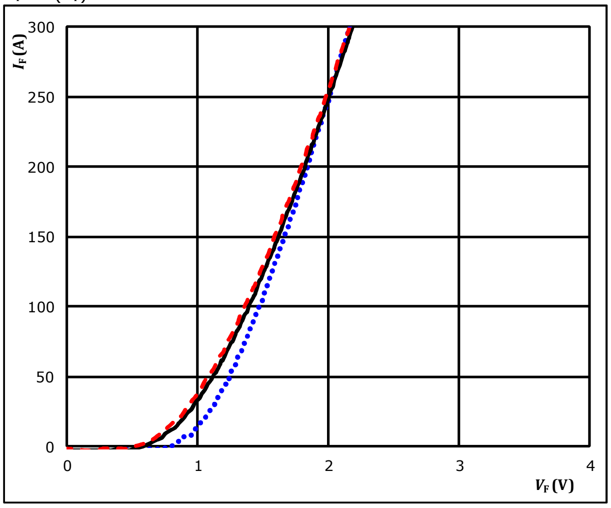
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

H-Bridge Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



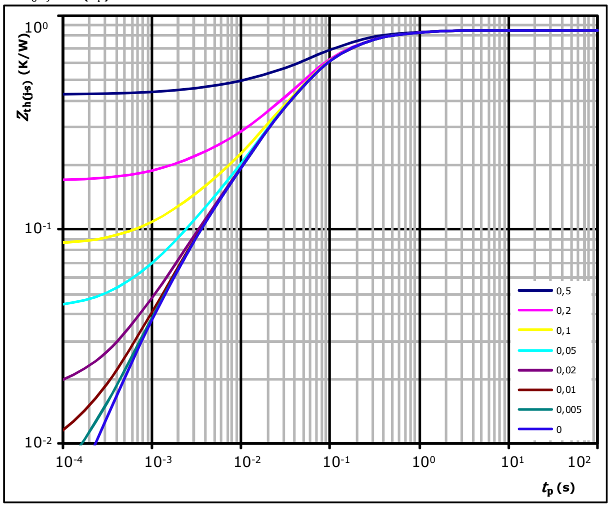
t_p = 250 µs

T_j: 25 °C; 125 °C; 150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j\text{-}s)}$ = 0,85 K/W

FWD thermal model values

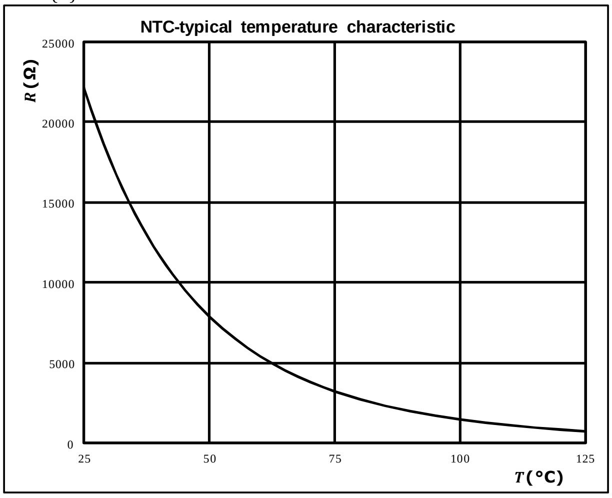
R (K/W)	τ (s)
1,23E-01	5,54E-01
3,72E-01	9,53E-02
2,40E-01	3,72E-02
7,91E-02	8,75E-03
3,66E-02	1,66E-03

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic
as a function of temperature

$R = f(T)$

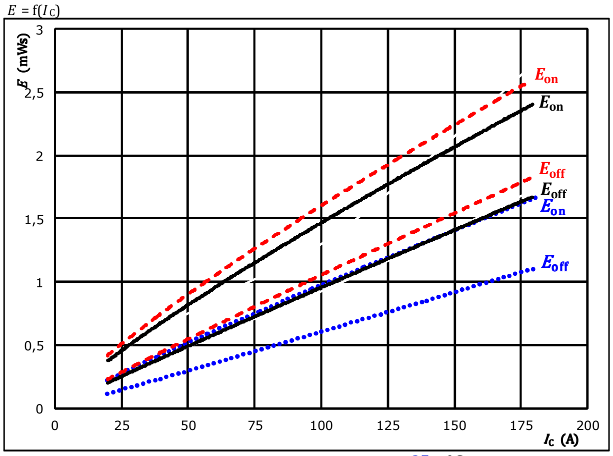


Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



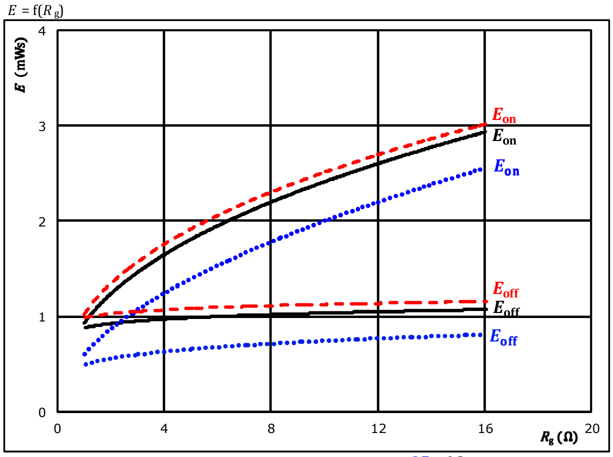
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	-5/15	V		125 °C	solid
R_{gon} =	4	Ω		150 °C	dashed
R_{goff} =	4	Ω			

figure 2. IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



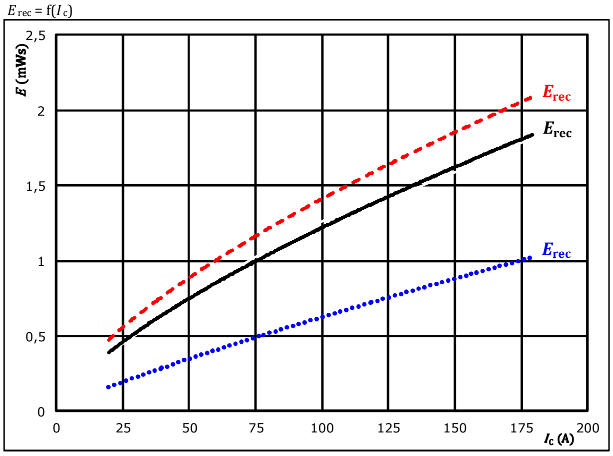
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	-5/15	V		125 °C	solid
I_C =	101	A		150 °C	dashed

figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



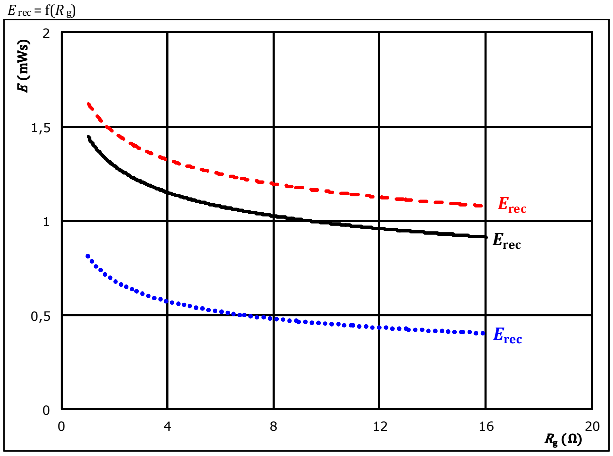
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	-5/15	V		125 °C	solid
R_{gon} =	4	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

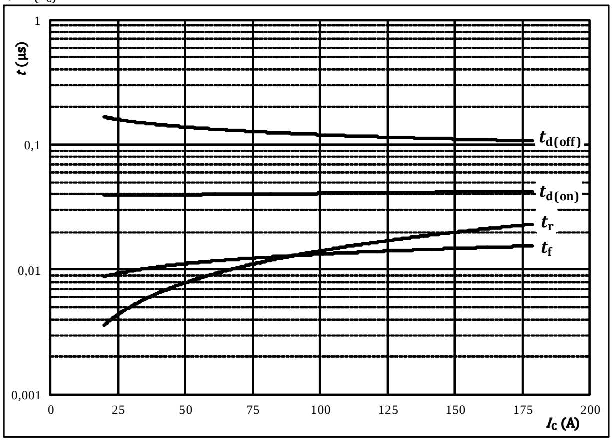
V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	-5/15	V		125 °C	solid
I_C =	101	A		150 °C	dashed

Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



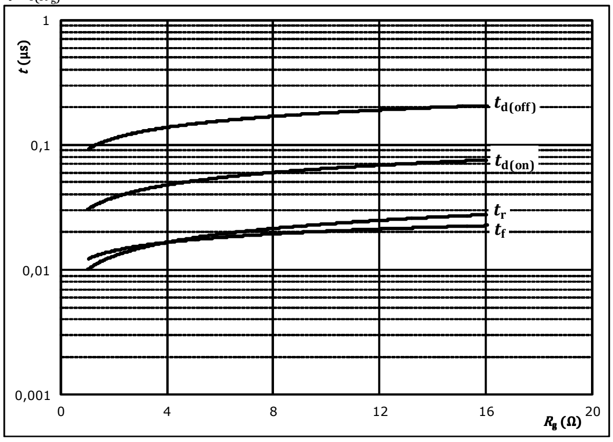
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	-5/15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



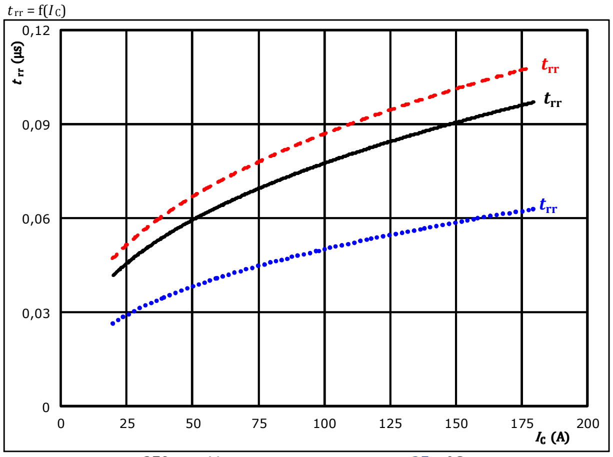
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	-5/15	V
I_C =	101	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

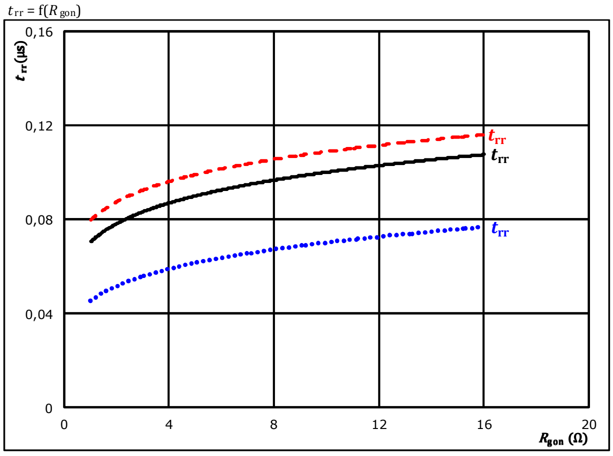


At						
V_{CE} =	350	V		25	°C	dotted blue
V_{GE} =	-5/15	V	T_j:	125	°C	solid black
R_{gon} =	4	Ω		150	°C	dashed red

figure 8. **FWD**

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

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



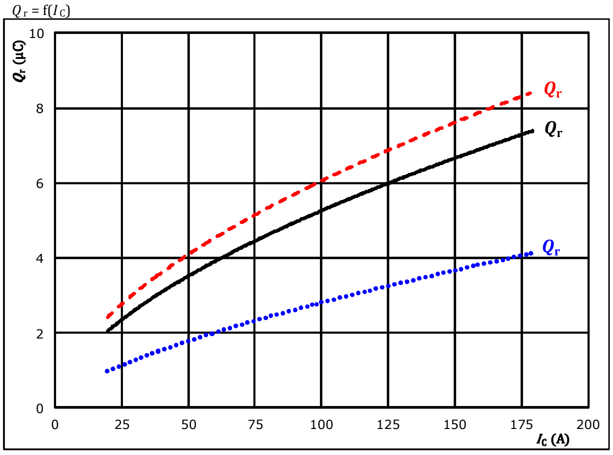
At						
V_{CE} =	350	V		25	°C	dotted blue
V_{GE} =	-5/15	V	T_j:	125	°C	solid black
I_C =	101	A		150	°C	dashed red

Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



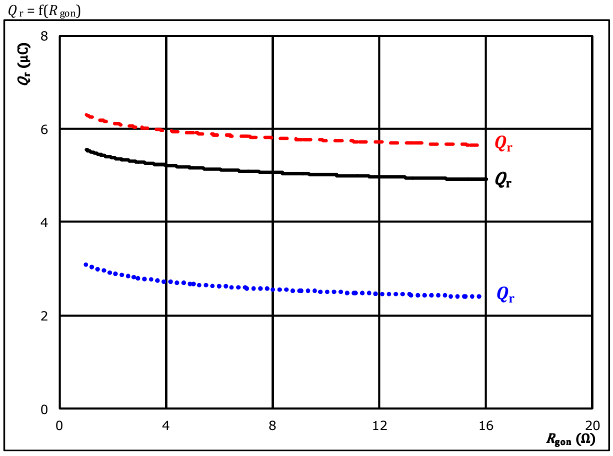
At V_{CE} = 350 V, V_{GE} = -5/15 V, R_{gon} = 4 Ω

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

figure 10. **FWD**

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

$Q_r = f(R_{gon})$



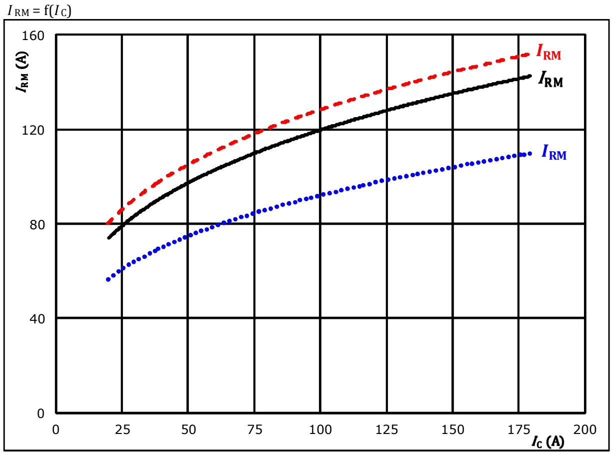
At V_{CE} = 350 V, V_{GE} = -5/15 V, I_C = 101 A

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

figure 11. **FWD**

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

$I_{RM} = f(I_C)$



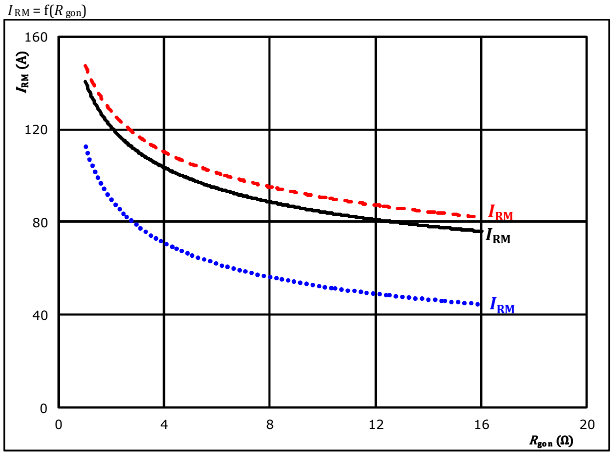
At V_{CE} = 350 V, V_{GE} = -5/15 V, R_{gon} = 4 Ω

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

figure 12. **FWD**

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

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



At V_{CE} = 350 V, V_{GE} = -5/15 V, I_C = 101 A

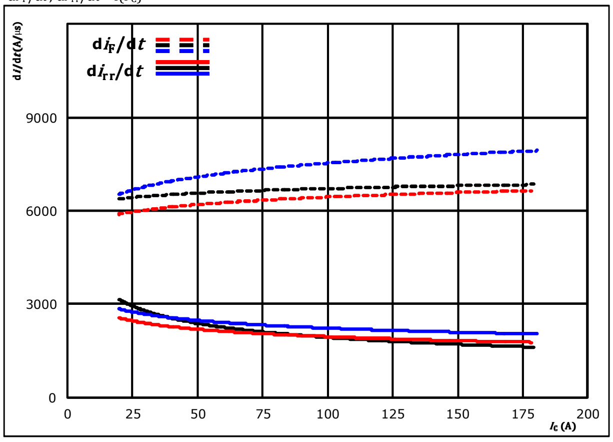
T_j: 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

Switching Characteristics

figure 13. **FWD**

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

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

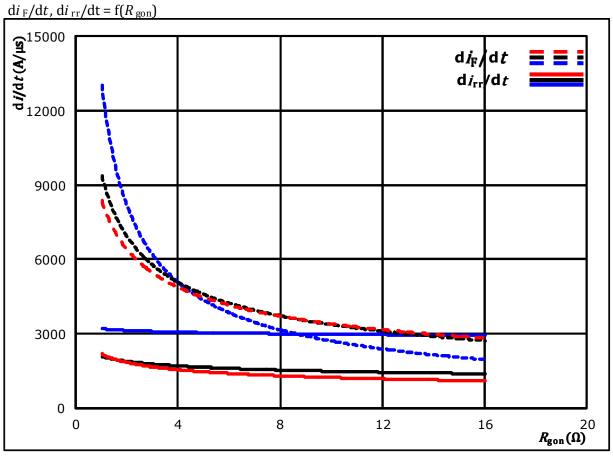


At						
V_{CE} =	350	V		25	°C	··············
V_{GE} =	-5/15	V	T_j:	125	°C	———
R_{gon} =	4	Ω		150	°C	– – – –

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

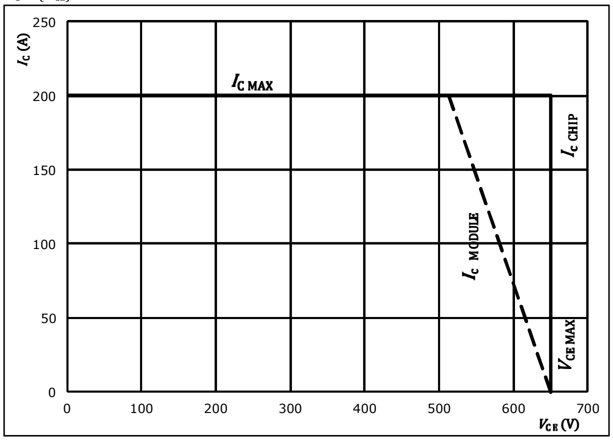


At						
V_{CE} =	350	V		25	°C	··············
V_{GE} =	-5/15	V	T_j:	125	°C	———
I_C =	101	A		150	°C	– – – –

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



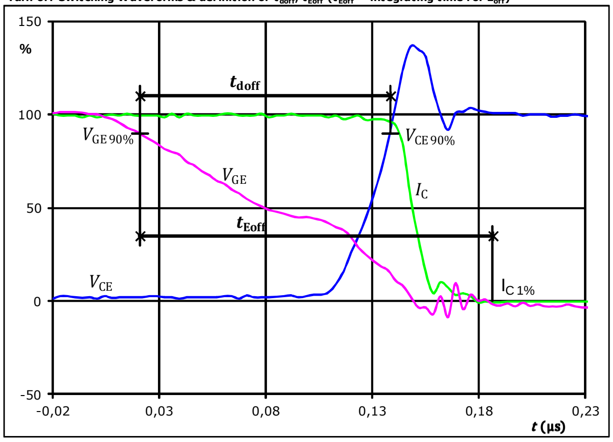
At		
T_j =	175	°C
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Switching Definitions

General conditions		
T_j	=	125 °C
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

figure 1. IGBT

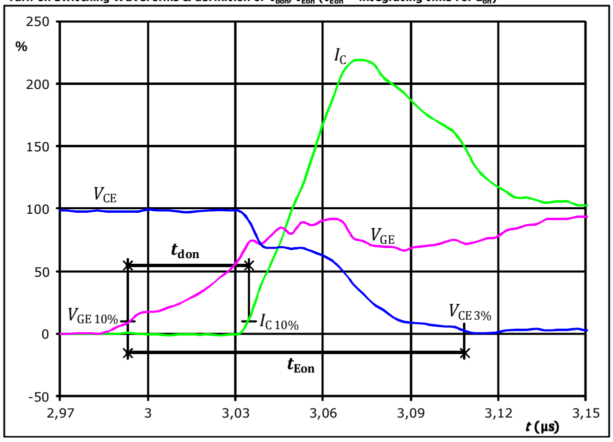
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-5	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	100	A
t_{doff} =	0,119	µs
t_{Eoff} =	0,165	µs

figure 2. IGBT

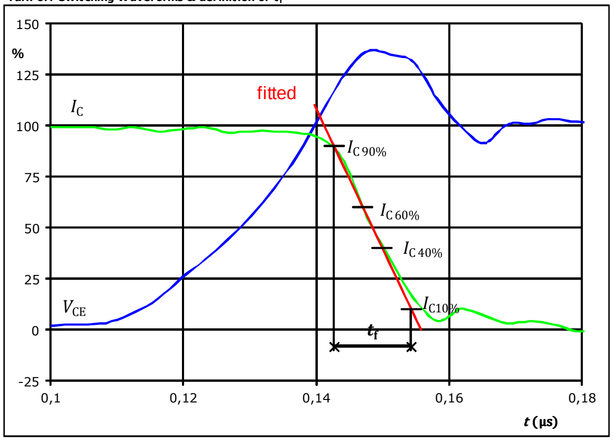
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-5	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	100	A
t_{don} =	0,041	µs
t_{Eon} =	0,115	µs

figure 3. IGBT

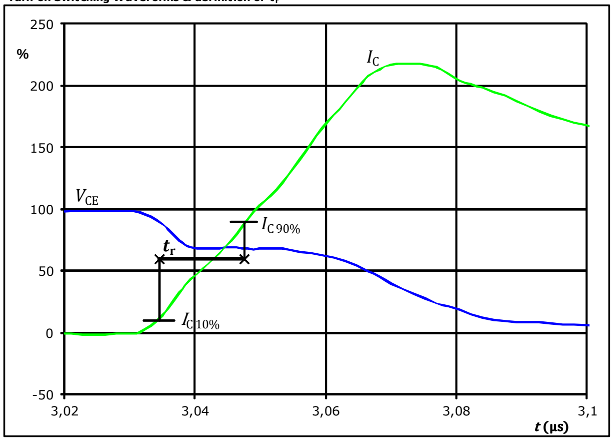
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	100	A
t_f =	0,012	µs

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

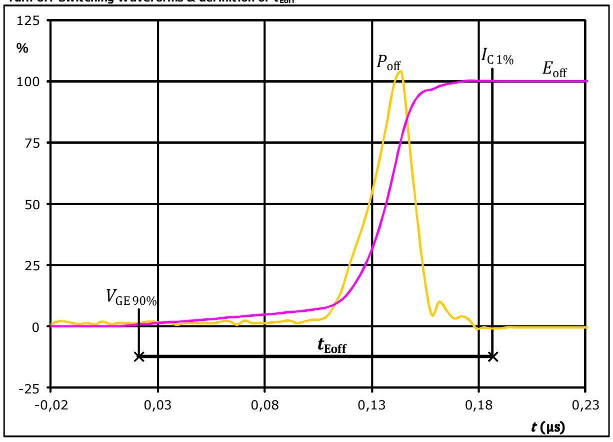


$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	100	A
t_r =	0,013	µs

Switching Characteristics

figure 5. IGBT

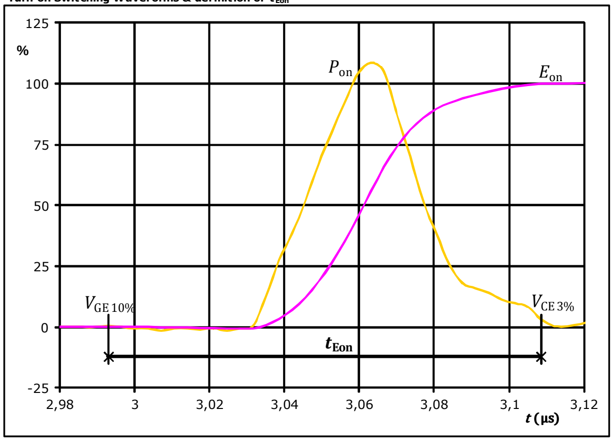
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	35,02	kW
E_{off} (100%) =	0,93	mJ
t_{Eoff} =	0,17	µs

figure 6. IGBT

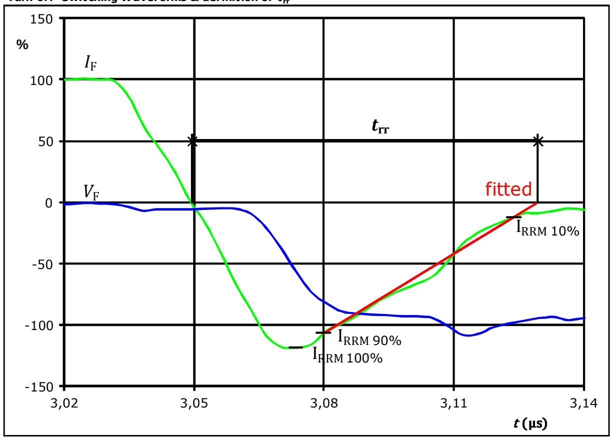
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	35,02	kW
E_{on} (100%) =	1,30	mJ
t_{Eon} =	0,12	µs

figure 7. FWD

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

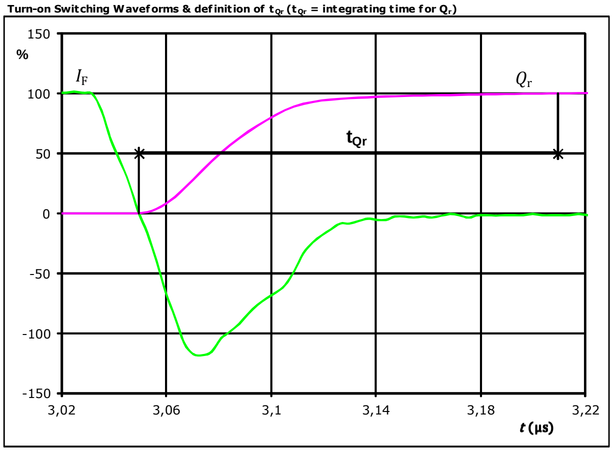


V_F (100%) =	350	V
I_F (100%) =	100	A
I_{RRM} (100%) =	-119	A
t_{rr} =	0,079	µs

Switching Characteristics

figure 8. **FWD**

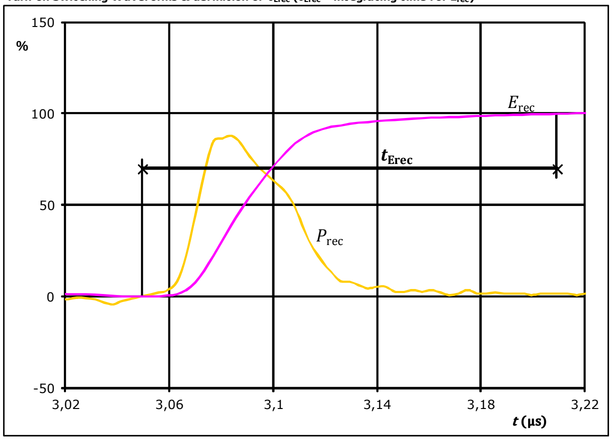
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	100	A
Q_r (100%) =	5,32	µC
t_{Qr} =	0,16	µs

figure 9. **FWD**

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



P_{rec} (100%) =	35,02	kW
E_{rec} (100%) =	1,26	mJ
t_{Erec} =	0,16	µs

Ordering Code & Marking

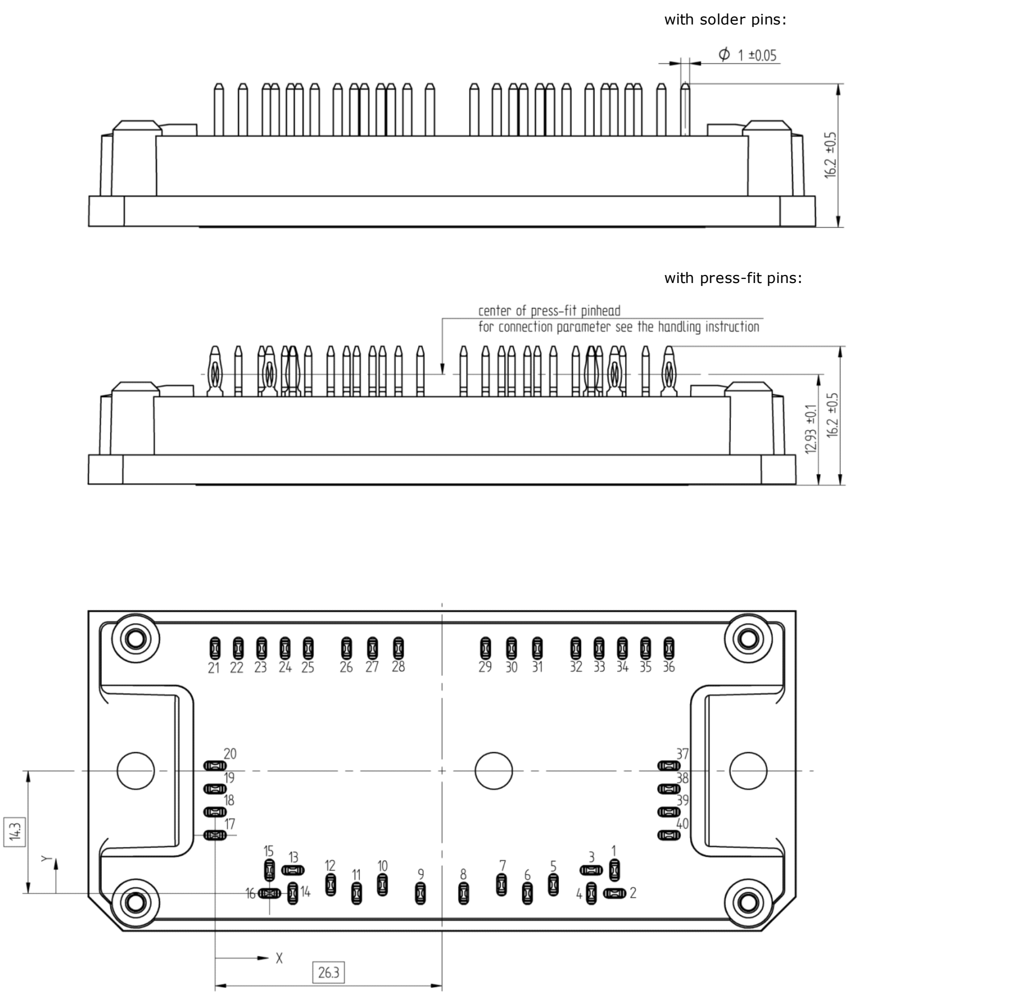
Version	Ordering Code
without thermal paste 12 mm housing with solder pins	10-FY074PA100SM01-L583F18
without thermal paste 12 mm housing with press-fit pins	10-PY074PA100SM01-L583F18Y

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

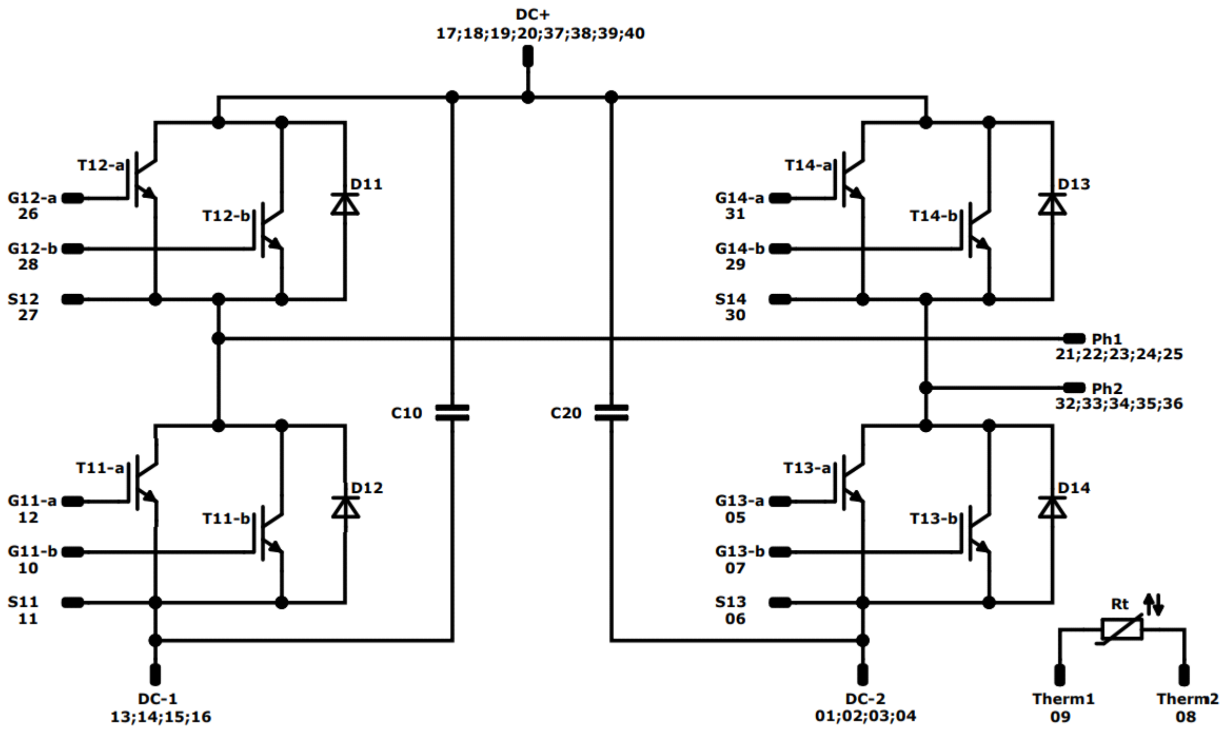
Pin table

Pin	X	Y	Function
1	46,3	2,7	DC-2
2	46,3	0	DC-2
3	43,6	2,7	DC-2
4	43,6	0	DC-2
5	39,2	1	G13-a
6	36,2	0	S13
7	33,2	1	G13-b
8	28,8	0	Therm2
9	23,8	0	Therm1
10	19,4	1	G11-b
11	16,4	0	S11
12	13,4	1	G11-a
13	9	2,7	DC-1
14	9	0	DC-1
15	6,3	2,7	DC-1
16	6,3	0	DC-1
17	0	6,8	DC+
18	0	9,5	DC+
19	0	12,2	DC+
20	0	14,9	DC+
21	0	28,6	Ph1
22	2,7	28,6	Ph1
23	5,4	28,6	Ph1
24	8,1	28,6	Ph1
25	10,8	28,6	Ph1
26	15,25	28,6	G12-a
27	18,25	28,6	S12
28	21,25	28,6	G12-b
29	31,35	28,6	G14-b
30	34,35	28,6	S14
31	37,35	28,6	G14-a
32	41,8	28,6	Ph2
33	44,5	28,6	Ph2
34	47,2	28,6	Ph2
35	49,9	28,6	Ph2
36	52,6	28,6	Ph2
37	52,6	14,9	DC+
38	52,6	12,2	DC+
39	52,6	9,5	DC+
40	52,6	6,8	DC+



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
T11, T12, T13, T14	IGBT	650 V	100 A	H-Bridge Switch	Parallel devices with separate control. Values apply to complete device.
D11, D12, D13, D14	FWD	650 V	90 A	H-Bridge Diode	
C10, C20	Capacitor	630 V		Capacitor (DC)	
Rt	NTC			Thermistor	

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-xY074PA100SM01-L583F18x-D1-14	25 Sep. 2017		