Vincotech

10-FY074PA050SM-M582F38
datasheet

flow **PACK 1** **650 V / 50 A**

Features

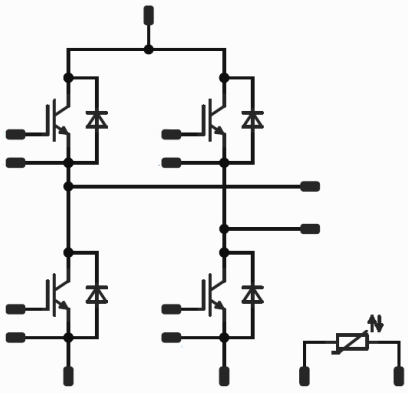
- 650V IGBT H5 and 650V Stealth Si diode
- High-efficiency
- Ultra-fast switching frequency
- Integrated temperature sensor
- Low inductance layout

flow 1 12mm housing

Target applications

- Solar Inverters
- Power Supply
- Inverter based welding

Schematic



Types

- 10-FY074PA050SM-M582F38

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=$T_j$max	T_S=80°C	43	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_j$max		150	A
Total power dissipation	P_{tot}	T_j=$T_j$max	T_S=80°C	84	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum Junction Temperature	T_{jmax}			175	°C

Parameter	Symbol	Conditions		Value	Unit
H-bridge Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			650	V
Continuous (direct) forward current	I_F	$T_j=T_{jmax}$	T_h=80°C	29	A
Repetitive peak forward current	I_{FRM}			180	A
Total power dissipation	P_{tot}	$T_j=T_{jmax}$	T_h=80°C	52	W
Maximum Junction Temperature	T_{jmax}			175	°C

Module Properties

Parameter	Symbol	Conditions		Value	Unit
Thermal Properties					
Storage temperature	T_{stg}			-40...+125	°C
Operation Junction Temperature	T_{jop}			-40...+(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{isol}	DC voltage	t_p=2s	4000	V
Creepage distance				min 12,7	mm
Clearance				8,47	mm
Comparative Tracking Index	CTI			>200	

Characteristic Values

H-bridge Switch

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j[°C]	Min	Typ	Max	
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	V_{GE}=V_{CE}			0,0005	25 125	3,3	4	4,7	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	25 125 150	1	1,82 2,00 -	2,22	V
Collector-emitter cut-off current	I_{CES}		0	650		25 125			40	µA
Gate-emitter leakage current	I_{GES}		20	0		25 125			120	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f=1 MHz	0	25		25		3000		pF
Output capacitance	C_{oes}							50		
Reverse transfer capacitance	C_{res}							11		
Gate charge	Q_g		15	520	50	25		120		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Phase-Change Material ʎ=3,4W/mK						1,13		K/W
IGBT Switching										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 8 Ω R_{gon} = 8 Ω	±15	300	50	25 125 150		59 60 60		ns
Rise time	t_r					25 125 150		9 11 11		
Turn-off delay time	$t_{d(off)}$					25 125 150		64 74 76		
Fall time	t_f					25 125 150		4 8 9		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,8 µC Q_{rFWD} = 1,8 µC Q_{rFWD} = 2,2 µC				25 125 150		0,412 0,516 0,555		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,170 0,303 0,337		

Inverter Diode

Parameter	Symbol	Conditions					Value			Unit
				V_r [V]	I_F [A]	T_j [°C]	Min	Typ	Max	
Static										
Forward voltage	V_F				30	25 125 150		2,46 2,03 -	2,6	V
Reverse leakage current	I_r			665		25 150			10 -	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Phase-Change Material λ=3,4W/mK						1,83		K/W
FWD Switching										
Peak recovery current	I_{RRM}	di/dt = 4872 A/µs di/dt = 4560 A/µs di/dt = 4066 A/µs	±15	300	50	25 125 150		39 47 49		A
Reverse recovery time	t_{rr}					25 125 150		20 100 117		ns
Recovered charge	Q_r					25 125 150		0,783 1,798 2,183		µC
Reverse recovered energy	E_{rec}					25 125 150		0,133 0,376 0,466		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		6525 3267 2773		A/µs

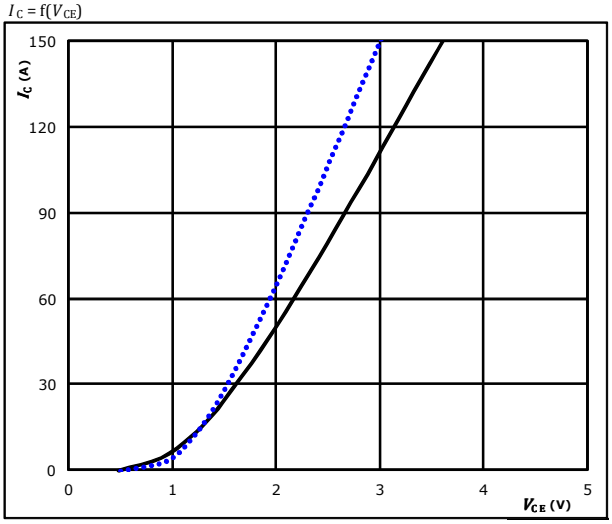
Thermistor

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	
Rated resistance	R					25		22		kΩ
Deviation of R100	$\Delta_{R/R}$	R100=1486 Ω				100	-12		+12	%
Power dissipation	P					25		200		mW
Power dissipation constant						25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				25		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				25		3998		K
Vincotech NTC Reference									B	

H-bridge Switch Characteristics

Typical output characteristics **IGBT**

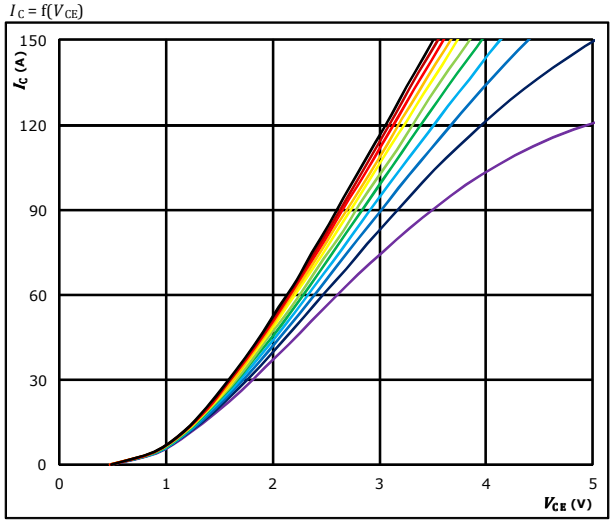
$I_C = f(V_{CE})$



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

Typical output characteristics **IGBT**

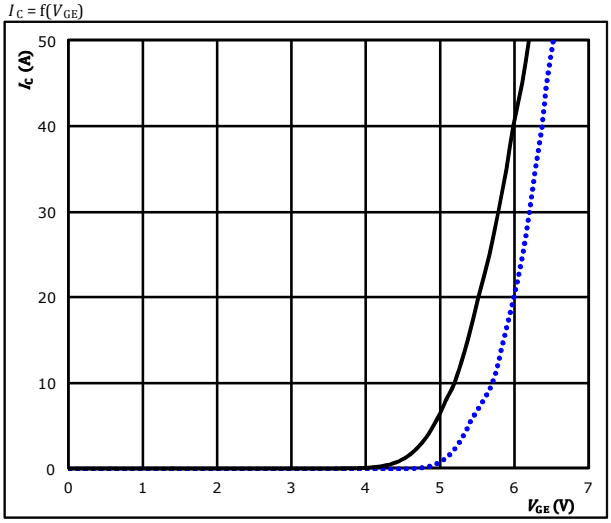
$I_C = f(V_{CE})$



t_p =	250	µs
T_j =	125	°C
V_{GE} from	8 V to 18 V in steps of 1 V	

Typical transfer characteristics **IGBT**

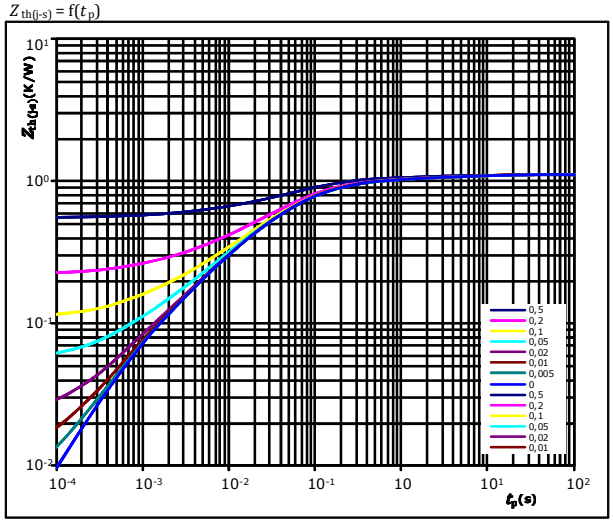
$I_C = f(V_{GE})$



t_p =	100	µs	**25 °C**
V_{CE} =	10	V	**125 °C**
			150 °C

Transient Thermal Impedance as function of Pulse duration **IGBT**

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,13	K/W

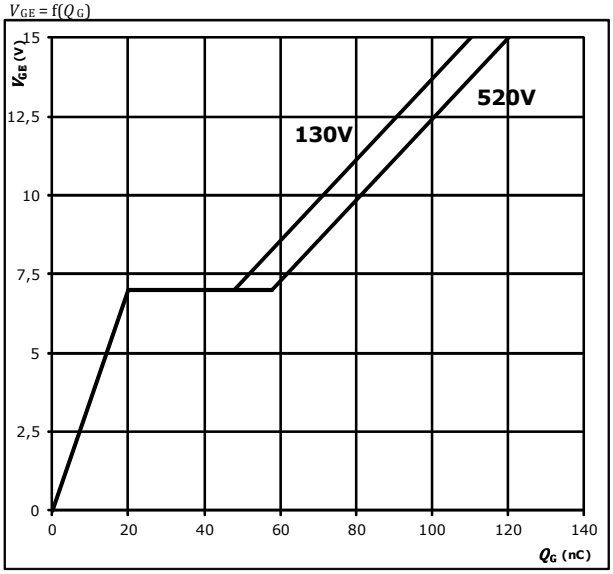
IGBT thermal model values

R_{th} (K/W)	τ (s)
7,12E-02	8,15E+00
1,29E-01	6,00E-01
4,31E-01	9,13E-02
3,15E-01	2,59E-02
1,31E-01	5,80E-03
5,02E-02	8,53E-04

H-bridge Switch Characteristics

Gate voltage vs Gate charge **IGBT**

$V_{GE} = f(Q_G)$



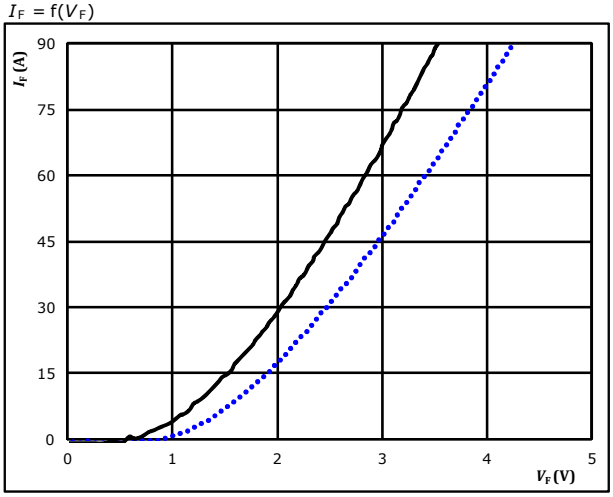
At

I_C= 50 A

H-bridge Diode Characteristics

Typical forward characteristics **FWD**

$I_F = f(V_F)$

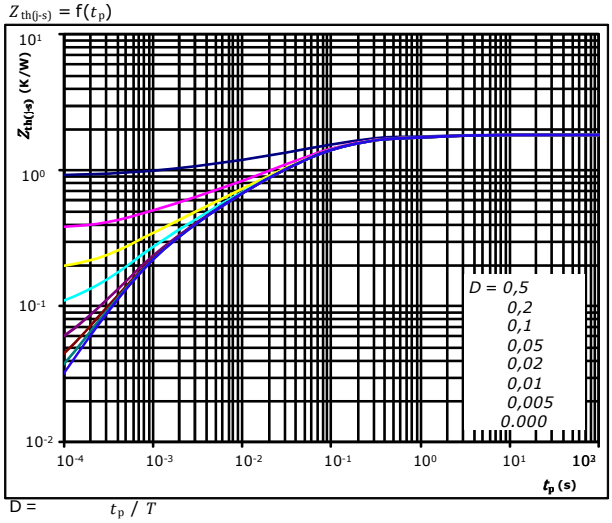


t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

Transient thermal impedance as a function of pulse width **FWD**

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



D = t_p / T

$R_{th(j-s)}$ = 1,83 K/W

FWD thermal model values

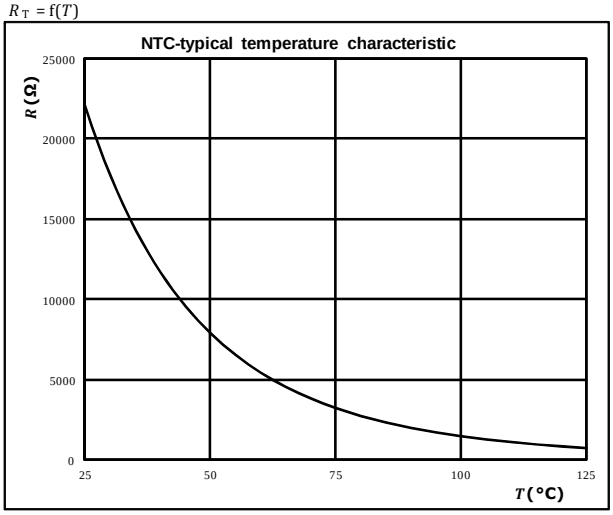
R (K/W)	τ (s)
6,05E-02	3,63E+00
1,50E-01	6,48E-01
8,27E-01	7,70E-02
4,06E-01	1,51E-02
2,16E-01	3,45E-03
1,73E-01	7,36E-04

Thermistor Characteristics

Thermistor typical temperature characteristic

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$

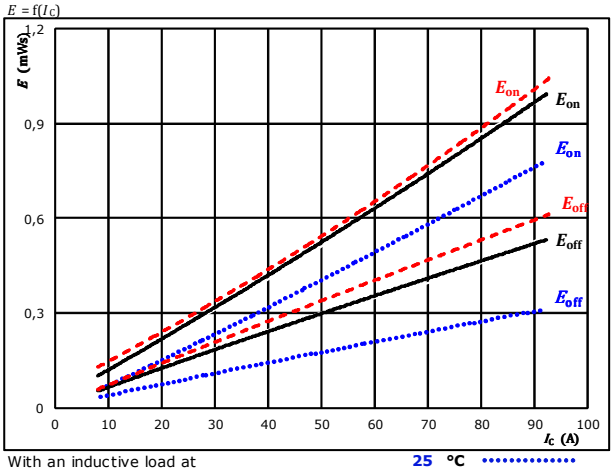


H-bridge Switching Characteristics

Figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



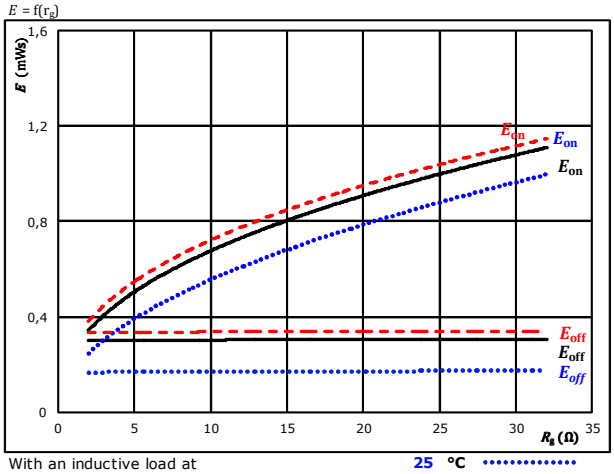
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C
R_{goff} =	8	Ω		

Figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(r_g)$



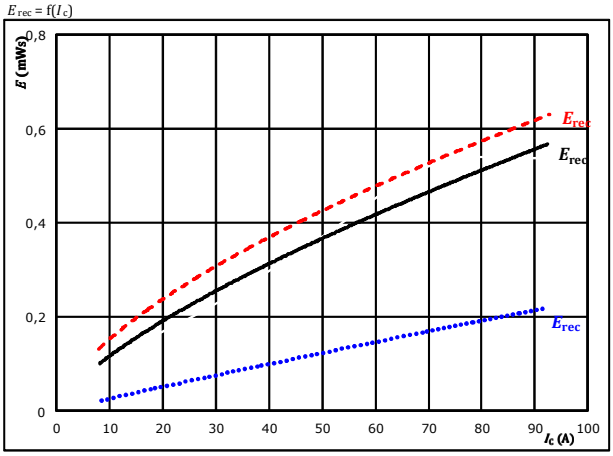
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	50	A		150 °C

Figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



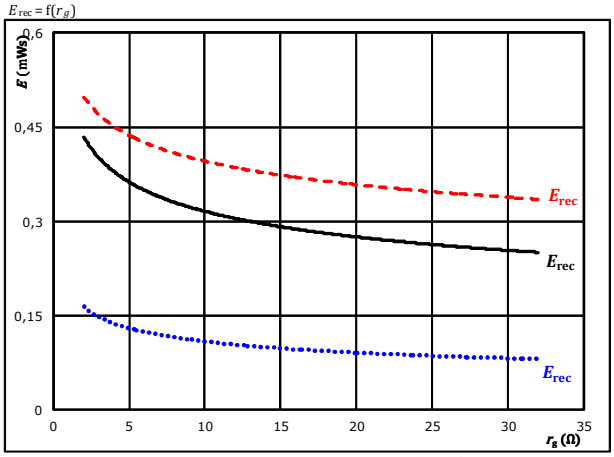
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	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

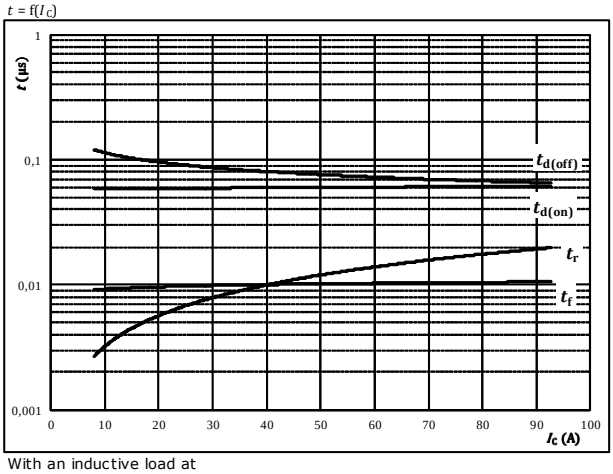
V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	50	A		150 °C

H-bridge Switching Characteristics

Figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



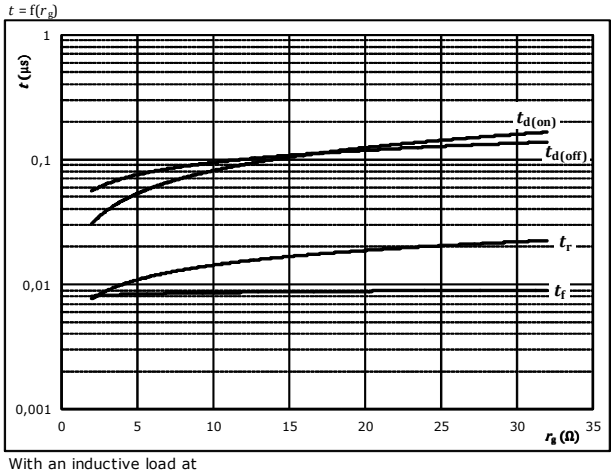
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(r_g)$



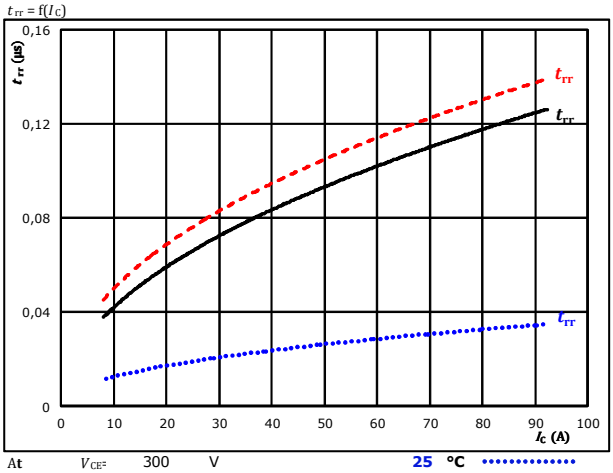
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	50	A

Figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

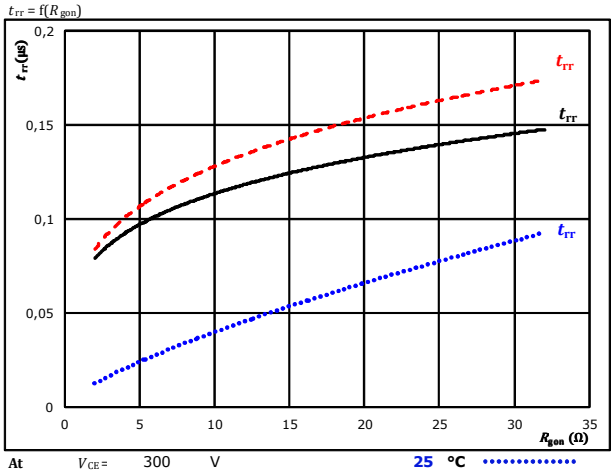


At	V_{CE}=	300	V		25 °C
	V_{GE} =	±15	V	T_j:	125 °C
	R_{gon} =	8	Ω		150 °C

Figure 8. **FWD**

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

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



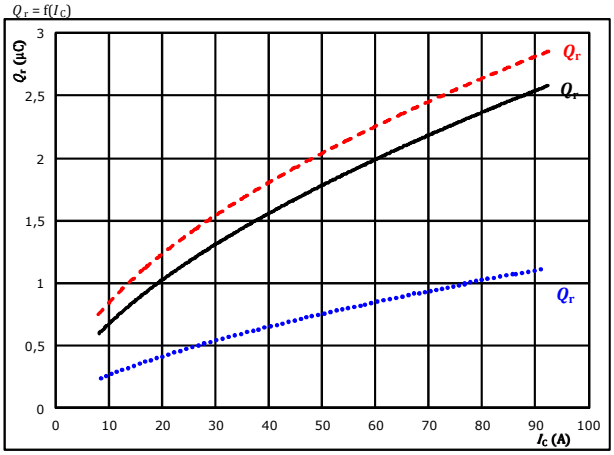
At	V_{CE} =	300	V		25 °C
	V_{GE} =	±15	V	T_j:	125 °C
	I_C =	50	A		150 °C

H-bridge Switching Characteristics

Figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

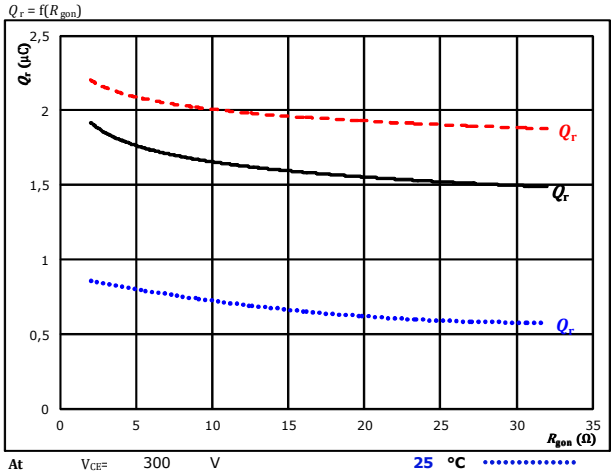


At						
	V_{CE} =	300	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	8	Ω		150 °C	

Figure 10. **FWD**

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

$Q_r = f(R_{gon})$

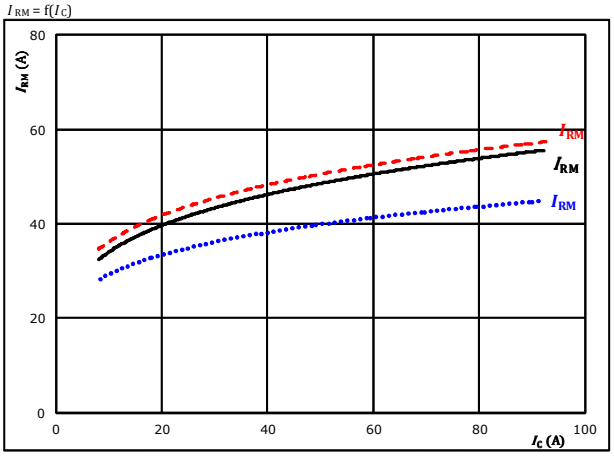


At						
	V_{CE}=	300	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C=	50	A		150 °C	

Figure 11. **FWD**

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

$I_{RM} = f(I_C)$

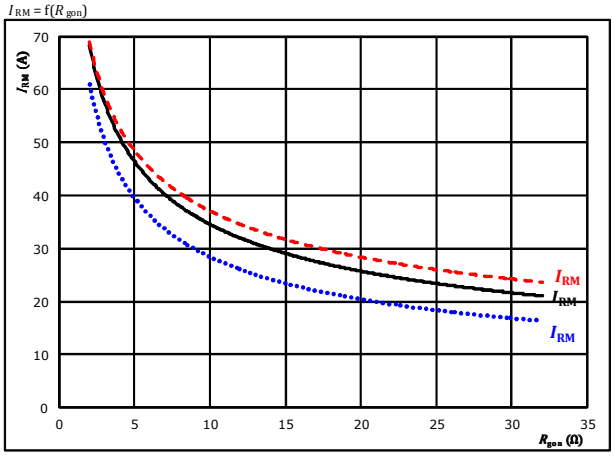


At						
	V_{CE} =	300	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	8	Ω		150 °C	

Figure 12. **FWD**

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

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



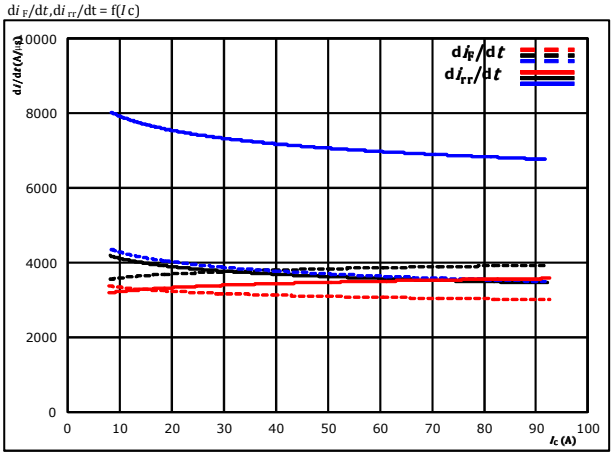
At						
	V_{CE} =	300	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C =	50	A		150 °C	

H-bridge Switching Characteristics

Figure 13. **FWD**

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

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

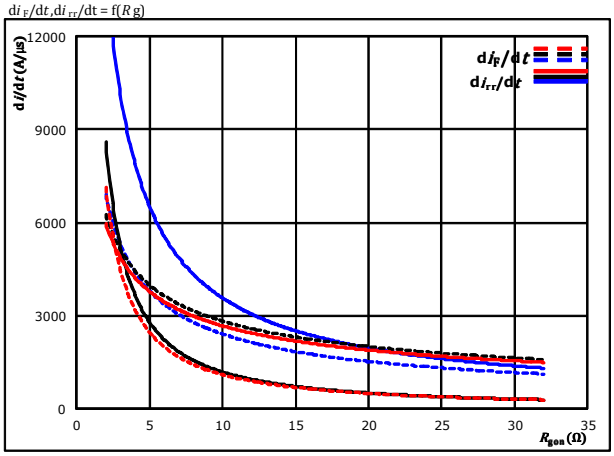


At					
V_{CE} =	300	V	T_j:	25 °C	
V_{GE} =	±15	V		125 °C	
R_{gon} =	8	Ω		150 °C	

Figure 14. **FWD**

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

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

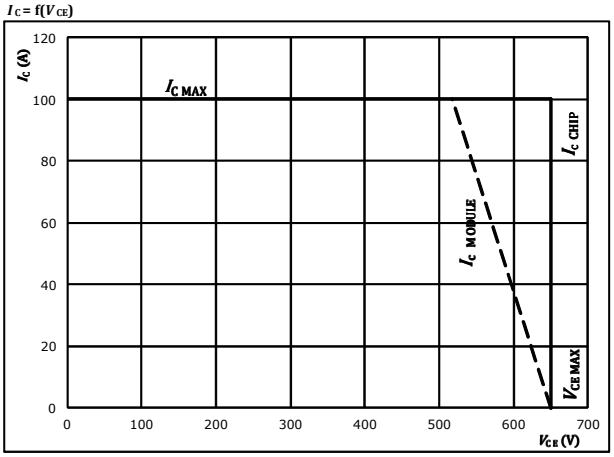


At			
V_{CE} =	300	V	
V_{GE} =	±15	V	
I_C =	50	A	

Figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	175	°C
R_{gon} =	8	Ω
R_{goff} =	8	Ω

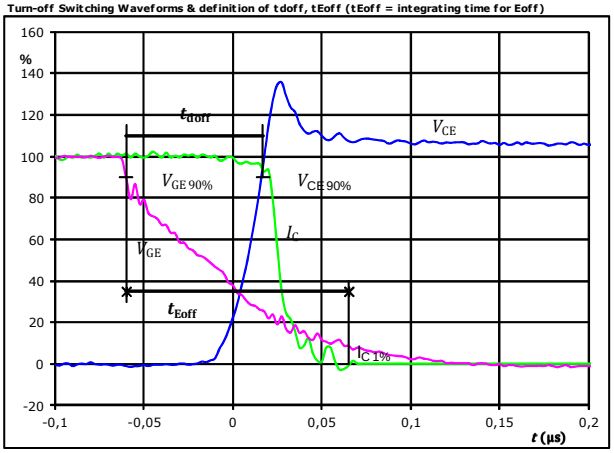
H-bridge Switching Definitions

General conditions

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

Figure 1. IGBT

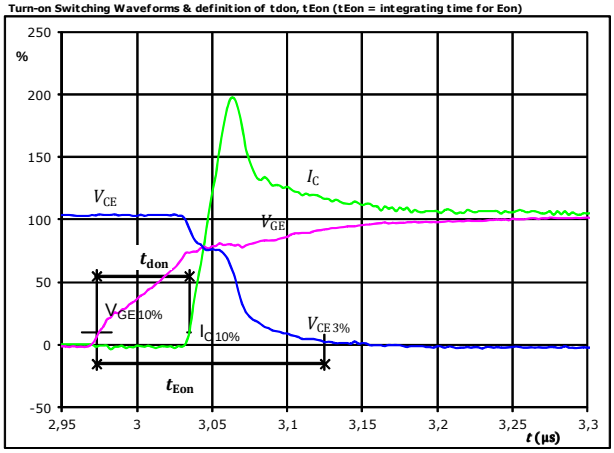
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	50	A
t_{doff} =	0,076	µs
t_{Eoff} =	0,125	µs

Figure 2. IGBT

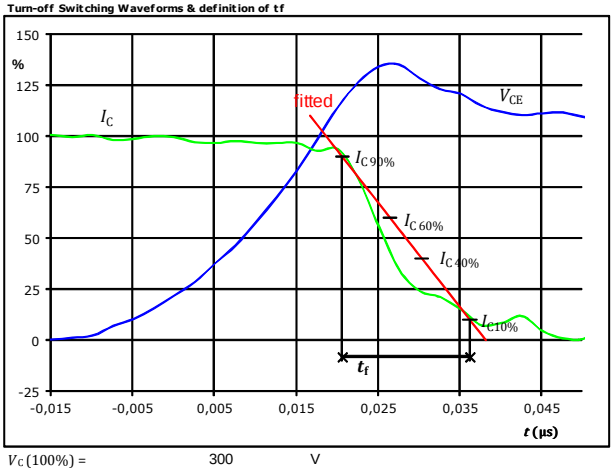
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	50	A
t_{don} =	0,060	µs
t_{Eon} =	0,152	µs

Figure 3. IGBT

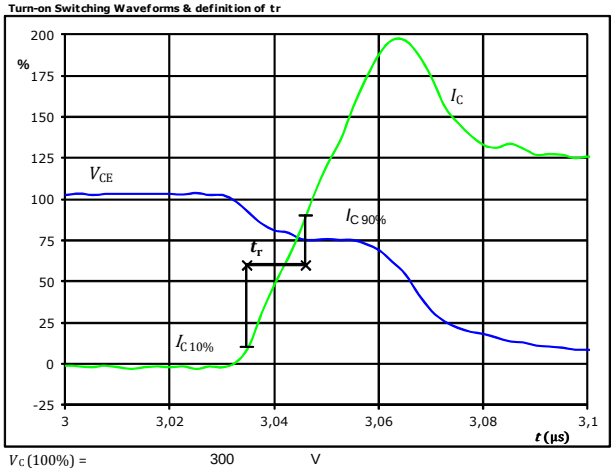
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	50	A
t_f =	0,009	µs

Figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

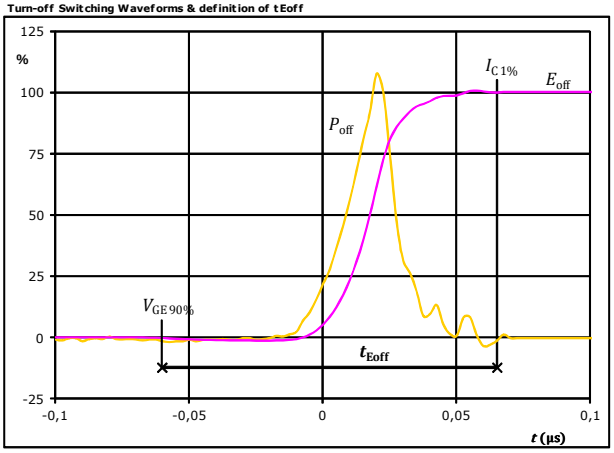


$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	50	A
t_r =	0,011	µs

H-bridge Switching Definitions

Figure 5. **IGBT**

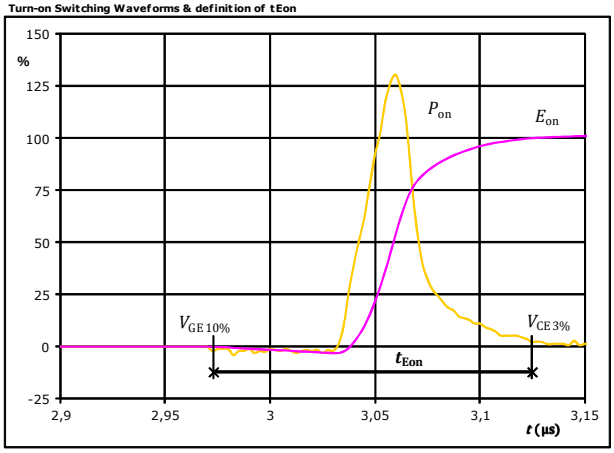
Turn-off Switching Waveforms & definition of tEoff



$P_{off}(100\%) =$	14,99	kW
$E_{off}(100\%) =$	0,34	mJ
$t_{Eoff} =$	0,13	µs

Figure 6. **IGBT**

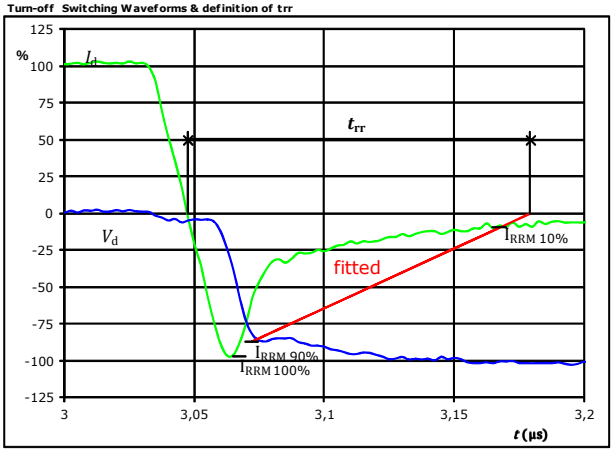
Turn-on Switching Waveforms & definition of tEon



$P_{on}(100\%) =$	14,99	kW
$E_{on}(100\%) =$	0,56	mJ
$t_{Eon} =$	0,15	µs

Figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

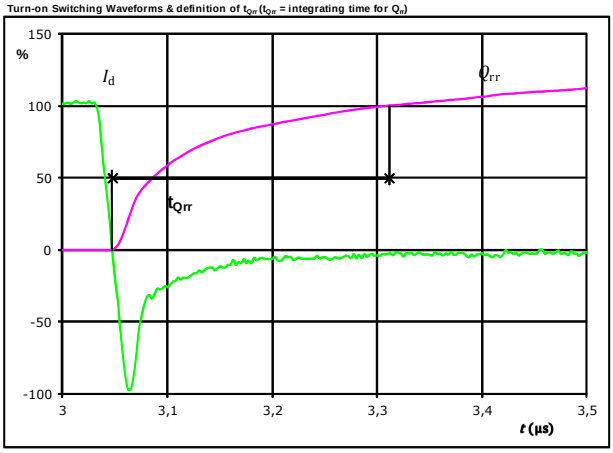


$V_d(100\%) =$	300	V
$I_d(100\%) =$	50	A
$I_{RRM}(100\%) =$	-49	A
$t_{rr} =$	0,117	µs

H-bridge Switching Definitions

Figure 8. **FWD**

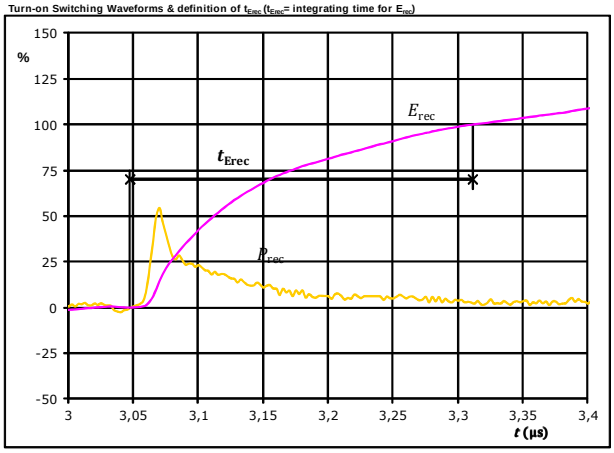
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	50	A
Q_{rr} (100%) =	2,18	µC
t_{Qrr} =	0,26	µs

Figure 9. **FWD**

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



P_{rec} (100%) =	14,99	kW
E_{rec} (100%) =	0,47	mJ
t_{Erec} =	0,26	µs

Vincotech

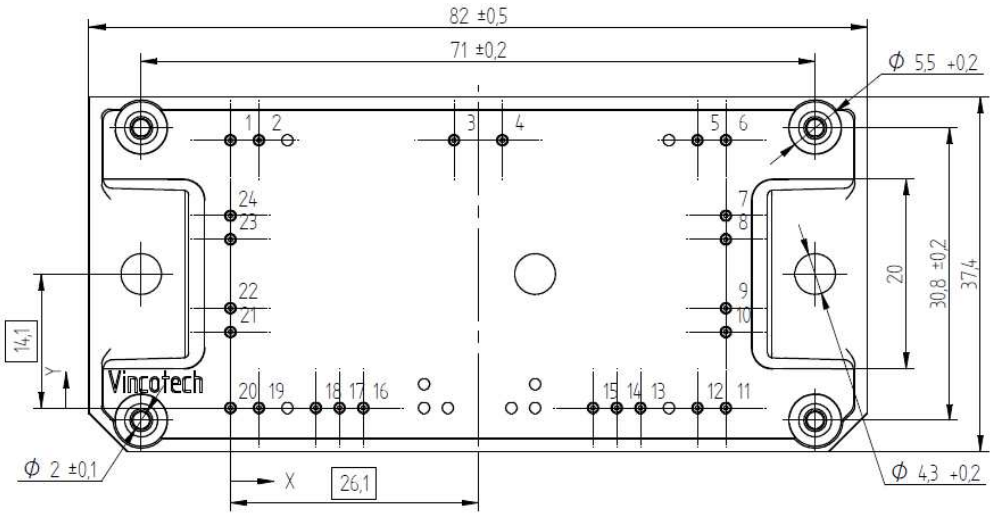
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	10-FY074PA050SM-M582F38	M582F38	M582F38

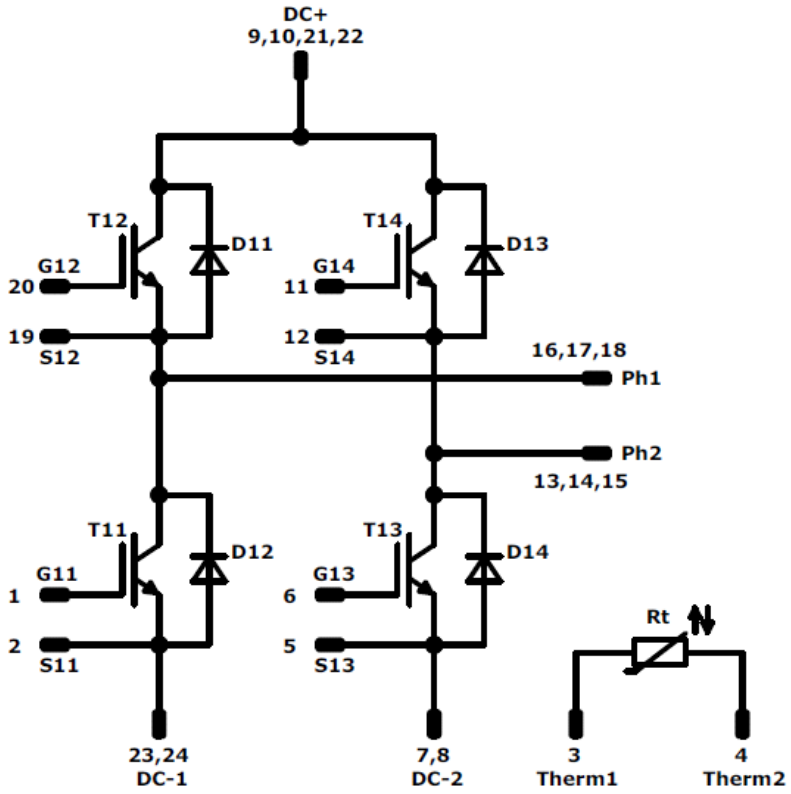
	Name		Date code	UL & Vinco	Lot	Serial
Text	NN-NNNNNNNNNNNNNN-NNNNNNNN		WWYY	UL Vinco	LLLLL	SSSS
	Type&Ver	**Lot number**	**Serial**	**Date code**		
Datamatrix	TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline

Pin table [mm]			
Pin	X	Y	Function
1	0	28,2	G11
2	3	28,2	S11
3	23,55	28,2	Therm1
4	28,65	28,2	Therm2
5	49,2	28,2	S13
6	52,2	28,2	G13
7	52,2	20,25	DC-2
8	52,2	17,75	DC-2
9	52,2	10,5	DC+
10	52,2	8	DC+
11	52,2	0	G14
12	49,2	0	S14
13	43,2	0	Ph2
14	40,7	0	Ph2
15	38,2	0	Ph2
16	14	0	Ph1
17	11,5	0	Ph1
18	9	0	Ph1
19	3	0	S12
20	0	0	G12
21	0	8	DC+
22	0	10,5	DC+
23	0	17,75	DC-1
24	0	20,25	DC-1



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11,T12,T13,T14	IGBT	650V	50A	H-bridge Switch	
D11,D12,D13,D14	FWD	650V	30A	H-bridge Diode	
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.

Document No.:	Date:	Modification:	Pages
10-FY074PA050SM-M582F38-D2-14	23 Jul. 2015		