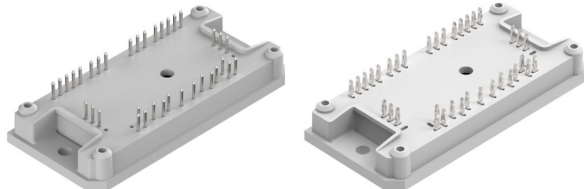
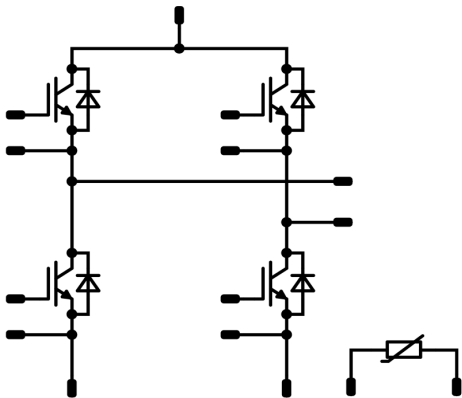




Vincotech

10-FY124PA040SH-L588F48
10-PY124PA040SH-L588F48Y
datasheet

flowPACK 1 H		1200 V / 40 A
Features • High speed IGBT • Fast, soft reverse Diode • Open emitter topology • Integrated thermistor	flow 1 12 mm housing  solder pins press-fit pins	
Target applications • Charging Stations • Power Supply • Solar Inverters • Welding & Cutting	Schematic 	
Types • 10-FY124PA040SH-L588F48 • 10-PY124PA040SH-L588F48Y		

Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
H-Bridge Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	35	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	120	A
Turn off safe operating area		$T_j \leq 175\text{ °C}$, $V_{CE} \leq 1200\text{ V}$	160	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	81	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$ $V_{CC} = 800\text{ V}$ $T_j \leq 150\text{ °C}$	10	μs
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$



Vincotech

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datasheet

Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
H-Bridge Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	26	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	61	W
Maximum junction temperature	T_{jmax}		175	°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* $t_p = 2\text{ s}$	6000	V
		AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			min. 12,7	mm
Clearance		with solder pins	8,1	mm
		with press-fit pins	7,92	mm
Comparative Tracking Index	CTI		> 200	

*100 % tested in production



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 datasheet

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 Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0015	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		40	25 125 150	1,78	1,99 2,33 2,41	2,42	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			5	μA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g						none			Ω
Input capacitance	C_{ies}	$f = 1 \text{ Mhz}$	0	25	25			2330		pF
Output capacitance	C_{oes}							150		
Reverse transfer capacitance	C_{res}							130		
Gate charge	Q_g		15	960	40	25		185		nC

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						1,18		K/W
-------------------------------------	---------------	---	--	--	--	--	--	------	--	-----

Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 8 \Omega$ $R_{goff} = 8 \Omega$	± 15	600	40	25 125 150		64 65 66		ns
Rise time	t_r					25 125 150		15 18 18		
Turn-off delay time	$t_{d(off)}$					25 125 150		162 213 230		
Fall time	t_f					25 125 150		26 60 70		
Turn-on energy (per pulse)	E_{on}	$Q_{tFWD} = 2,7 \mu C$ $Q_{tFWD} = 5,3 \mu C$ $Q_{tFWD} = 5,8 \mu C$	± 15	600	40	25 125 150		1,54 2,19 2,41		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		1,32 2,29 2,53		



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10-PY124PA040SH-L588F48Y
 datasheet

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				25	25 125 150		2,27 2,44 2,36	2,74	V
Reverse leakage current	I_R			1200		25 150			60 3300	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						1,56		K/W
-------------------------------------	---------------	---	--	--	--	--	--	------	--	-----

Dynamic

Peak recovery current	I_{RRM}	$di/dt = 3019 \text{ A/}\mu\text{s}$ $di/dt = 2918 \text{ A/}\mu\text{s}$ $di/dt = 2972 \text{ A/}\mu\text{s}$	± 15	600	40	25 125 150		48 56 60		A
Reverse recovery time	t_{rr}					25 125 150		101 253 251		ns
Recovered charge	Q_r					25 125 150		2,70 5,29 5,83		μC
Reverse recovered energy	E_{rec}					25 125 150		1,13 2,42 2,60		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		3780 2648 2658		A/μs

Thermistor

Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	$R_{100} = 1484 \Omega$				100	-5		5	%
Power dissipation	P					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 1 \%$				25		3962		K
B-value	$B_{(25/100)}$	Tol. $\pm 1 \%$				25		4000		K
Vincotech NTC Reference									I	



Vincotech

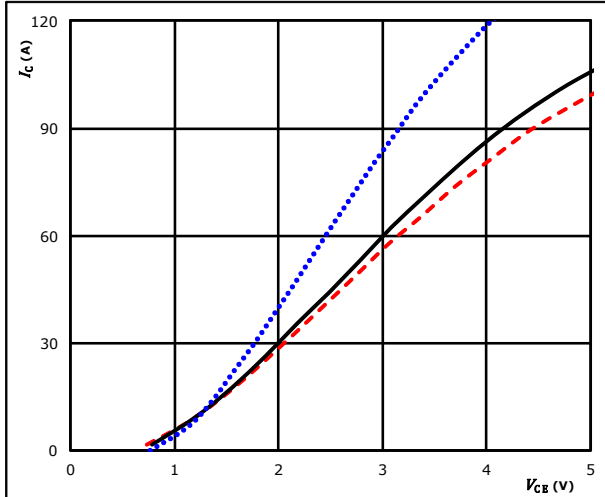
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 datasheet

H-Bridge Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

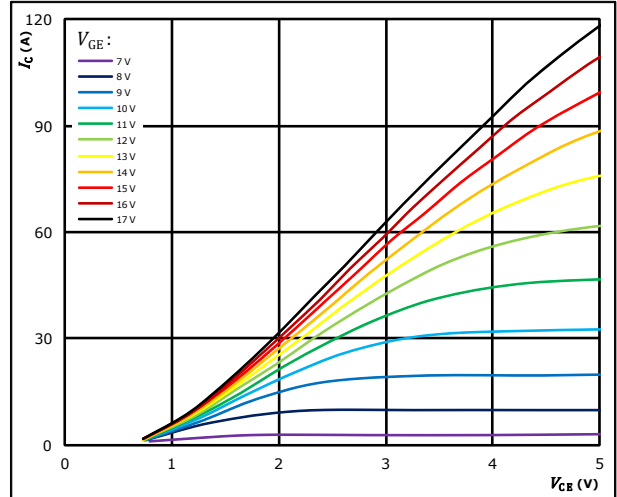


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j: 25 \text{ } ^\circ C$
 $125 \text{ } ^\circ C$
 $150 \text{ } ^\circ C$ - - - - -

figure 2. IGBT

Typical output characteristics

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

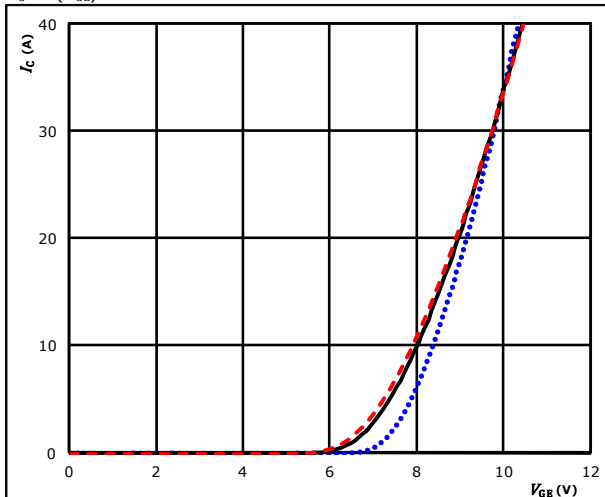


$t_p = 250 \mu s$
 $T_j = 150 \text{ } ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

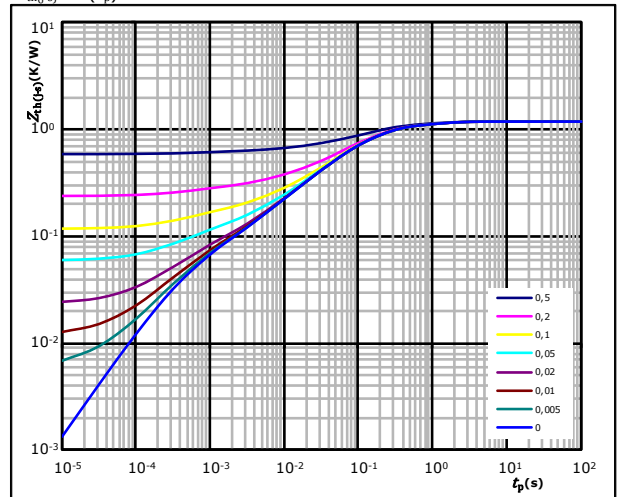


$t_p = 100 \mu s$
 $V_{CE} = 10 V$
 $T_j: 25 \text{ } ^\circ C$
 $125 \text{ } ^\circ C$
 $150 \text{ } ^\circ C$ - - - - -

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



$$D = t_p / T$$

$$R_{th(j-s)} = 1,18 \text{ K/W}$$

IGBT thermal model values

R (K/W)	τ (s)
1,59E-01	1,00E+00
4,43E-01	1,70E-01
3,88E-01	6,29E-02
1,17E-01	1,14E-02
2,45E-02	2,60E-03
2,75E-02	6,82E-04
2,15E-02	3,21E-04



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 datasheet

H-Bridge Switch Characteristics

figure 5. IGBT

Gate voltage vs gate charge

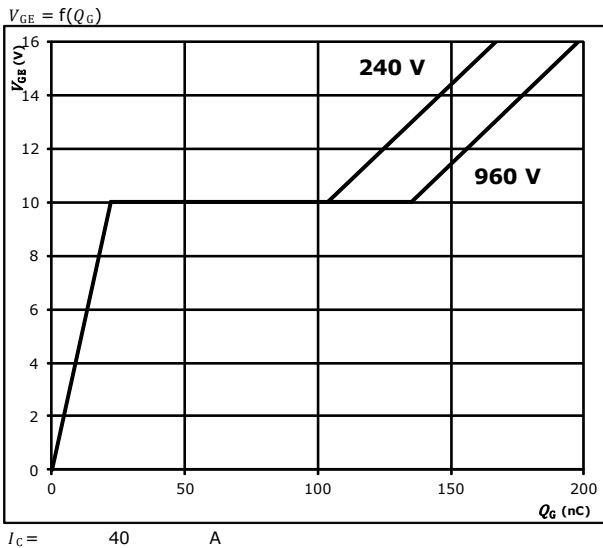
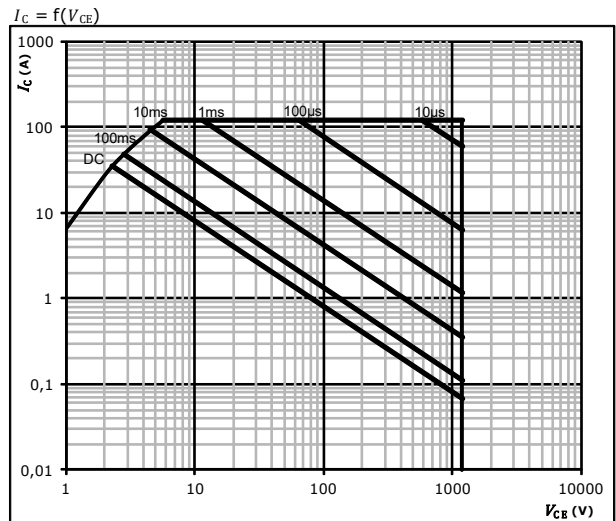


figure 6. IGBT

Safe operating area



$D =$ single pulse
 $T_s = 80 \text{ } ^\circ\text{C}$
 $V_{GE} = \pm 15 \text{ V}$
 $T_j = T_{jmax}$

figure 7. IGBT

Short circuit duration as a function of V_{GE}

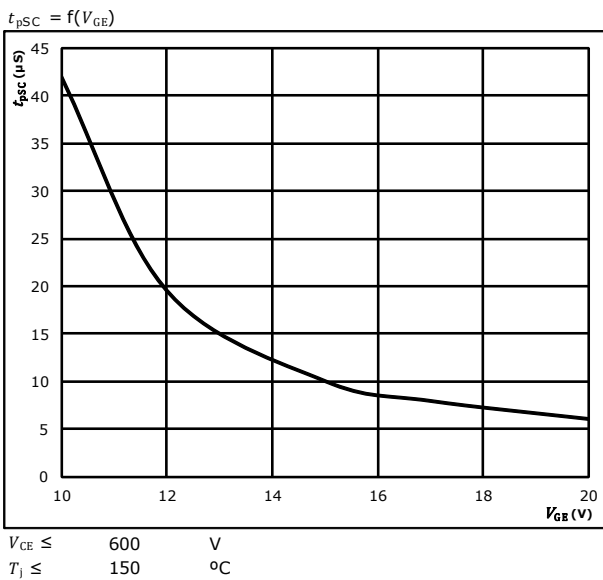
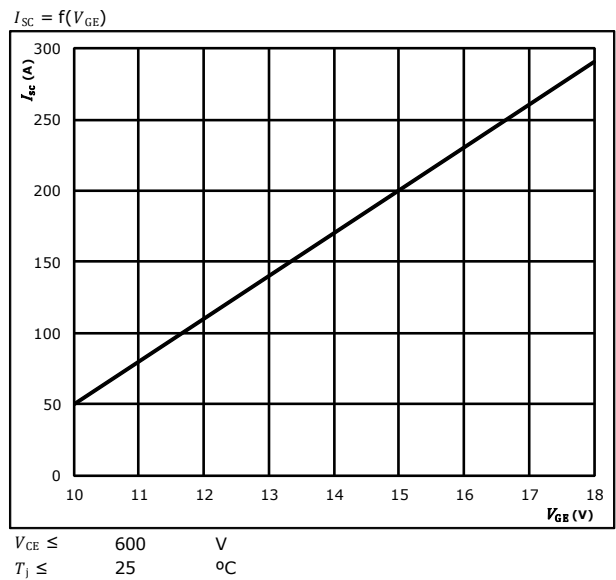


figure 8. IGBT

Typical short circuit current as a function of V_{GE}





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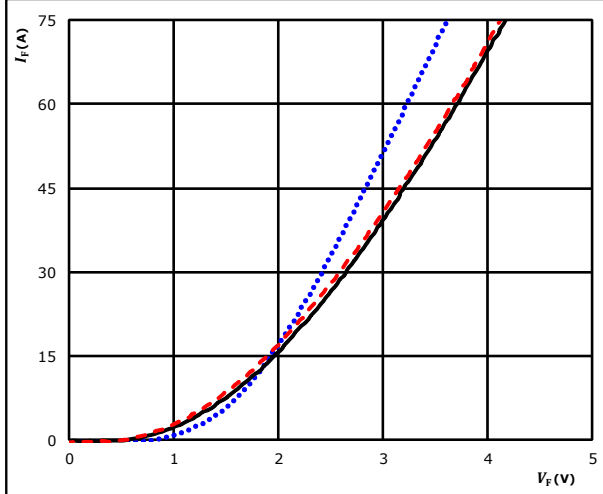
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 datasheet

H-Bridge Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

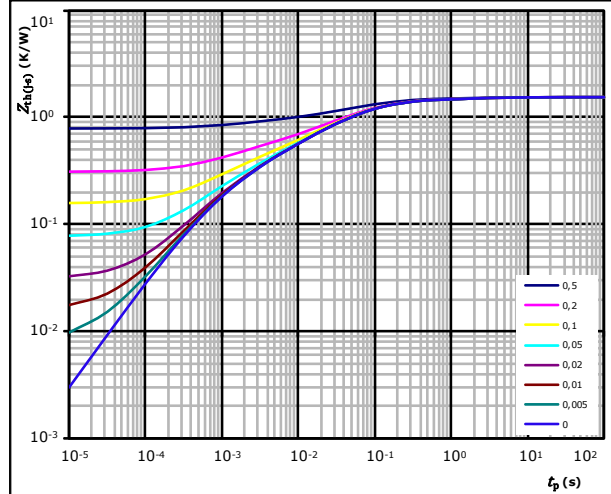


$t_p = 250 \mu s$
 T_j : 25 °C (blue dotted line)
 125 °C (black solid line)
 150 °C (red dashed line)

figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,56 \text{ K/W}$
 FWD thermal model values

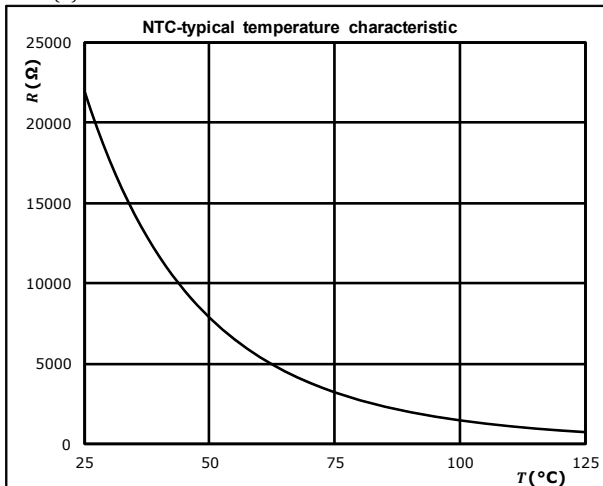
$R \text{ (K/W)}$	$\tau \text{ (s)}$
4,65E-02	4,86E+00
1,06E-01	8,11E-01
4,71E-01	1,09E-01
4,83E-01	3,07E-02
2,34E-01	7,03E-03
1,81E-01	1,25E-03
3,38E-02	3,28E-04

Thermistor Characteristics

figure 1. Thermistor

Typical NTC characteristic as a function of temperature

$$R = f(T)$$





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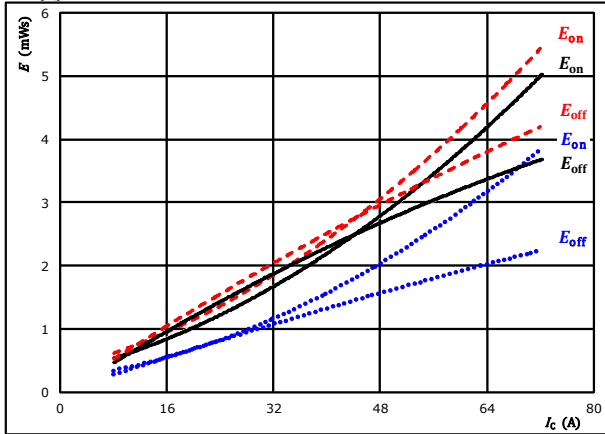
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10-PY124PA040SH-L588F48Y
 datasheet

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

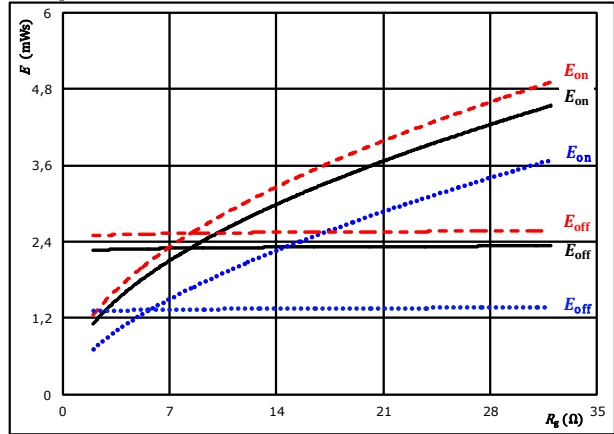
$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 8$ Ω
 $R_{goff} = 8$ Ω

T_j : 25 °C (blue dotted)
 125 °C (black solid)
 150 °C (red dashed)

figure 2. IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$



With an inductive load at

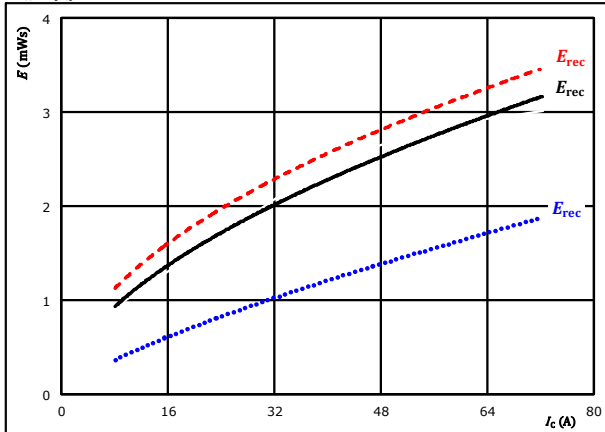
$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 40$ A

T_j : 25 °C (blue dotted)
 125 °C (black solid)
 150 °C (red 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

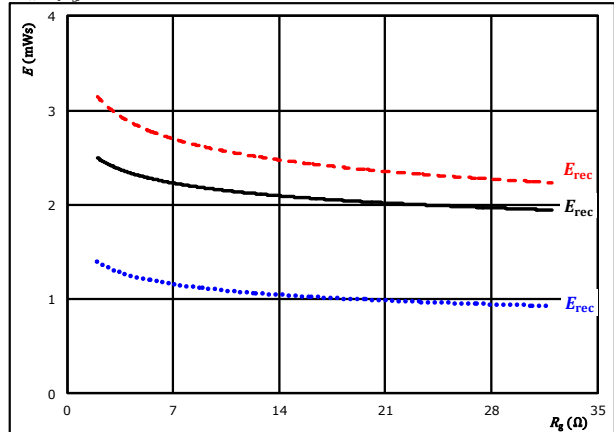
$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 8$ Ω

T_j : 25 °C (blue dotted)
 125 °C (black solid)
 150 °C (red 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

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 40$ A

T_j : 25 °C (blue dotted)
 125 °C (black solid)
 150 °C (red dashed)



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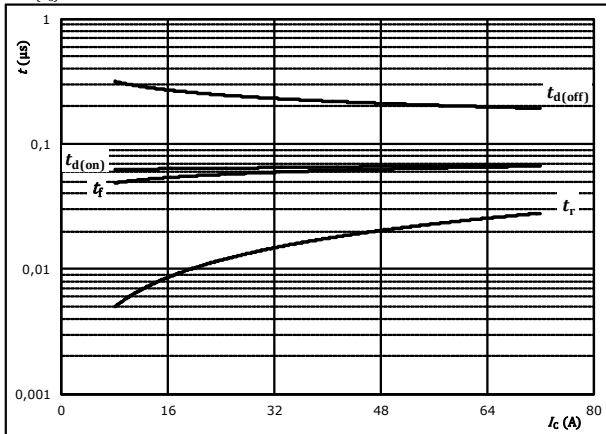
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 datasheet

H-Bridge Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



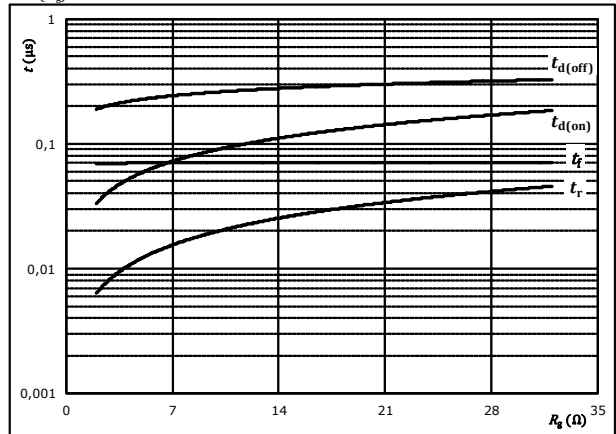
With an inductive load at

$T_j = 150$ °C
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 8$ Ω
 $R_{goff} = 8$ Ω

figure 6. IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



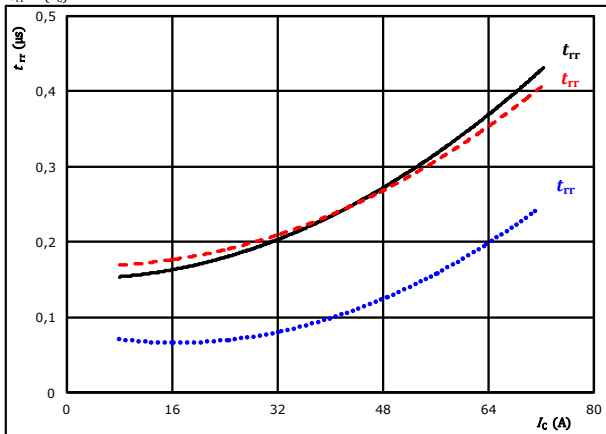
With an inductive load at

$T_j = 150$ °C
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 40$ A

figure 7. FWD

Typical reverse recovery time as a function of collector current

$$t_{rr} = f(I_C)$$

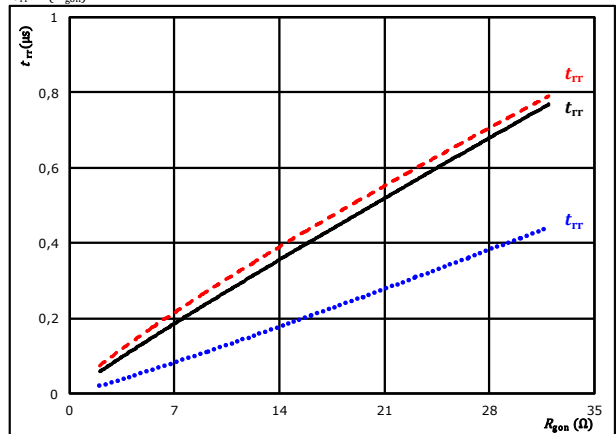


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 8$ Ω
 $T_j: 25$ °C (dotted blue)
 125 °C (solid black)
 150 °C (dashed red)

figure 8. FWD

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

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



At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 40$ A
 $T_j: 25$ °C (dotted blue)
 125 °C (solid black)
 150 °C (dashed red)



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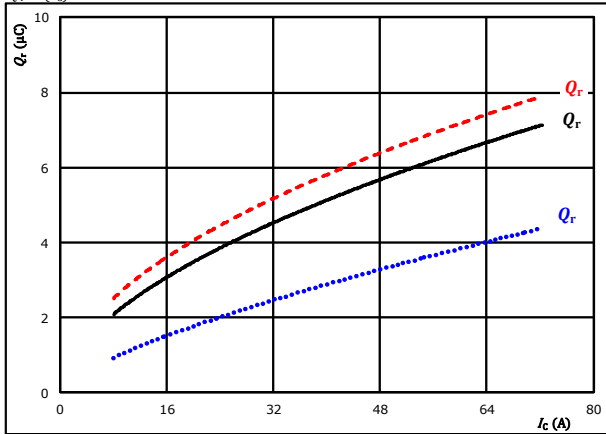
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 datasheet

H-Bridge Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

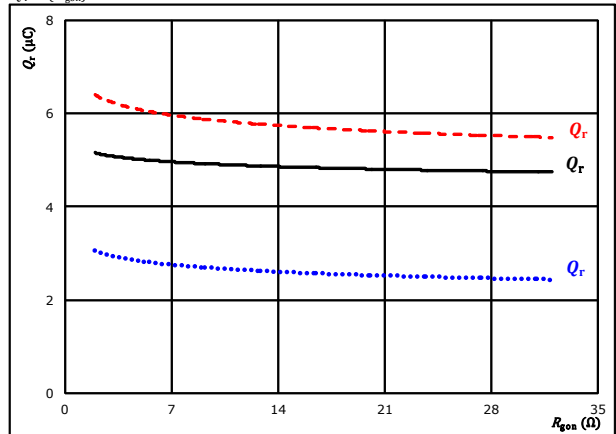


At $V_{CE} = 600$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C
 $R_{gon} = 8$ Ω $T_j = 150$ °C -----

figure 10. FWD

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

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

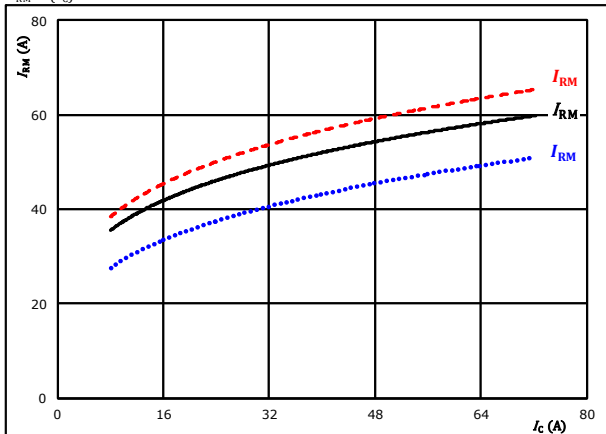


At $V_{CE} = 600$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C
 $I_c = 40$ A $T_j = 150$ °C -----

figure 11. FWD

Typical peak reverse recovery current as a function of collector current

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

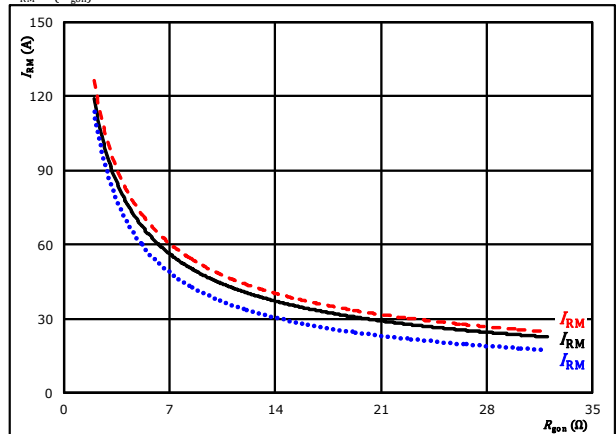


At $V_{CE} = 600$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C
 $R_{gon} = 8$ Ω $T_j = 150$ °C -----

figure 12. FWD

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

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



At $V_{CE} = 600$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C
 $I_c = 40$ A $T_j = 150$ °C -----



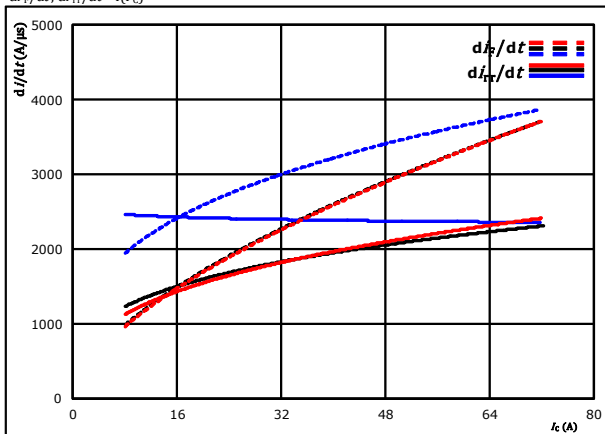
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 datasheet

H-Bridge Switching Characteristics

figure 13. FWD

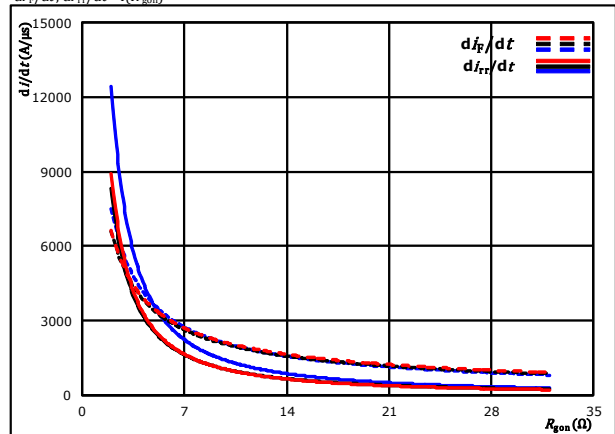
Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_F/dt, di_{rr}/dt = f(I_C)$



At $V_{CE} = 600$ V $T_J = 25$ °C
 $V_{GE} = \pm 15$ V $T_J = 125$ °C
 $R_{gon} = 8$ Ω $T_J = 150$ °C

figure 14. FWD

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

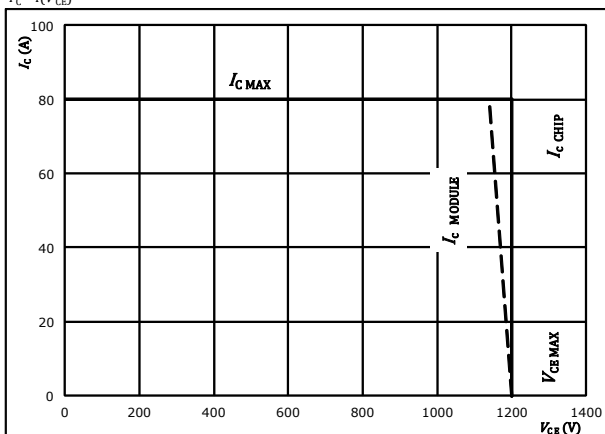


At $V_{CE} = 600$ V $T_J = 25$ °C
 $V_{GE} = \pm 15$ V $T_J = 125$ °C
 $I_C = 40$ A $T_J = 150$ °C

H-Bridge Switch Switching Characteristics

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



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 datasheet

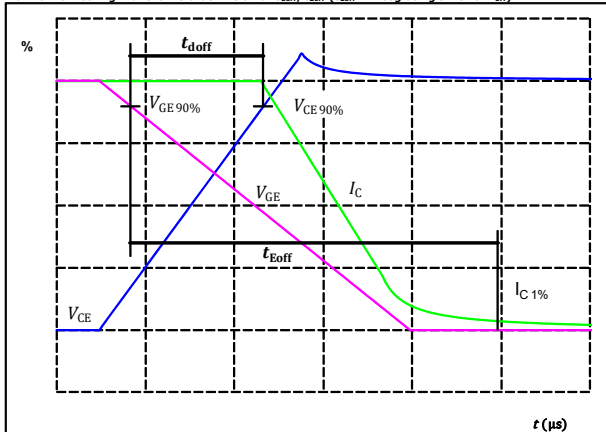
H-Bridge Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

figure 1. IGBT

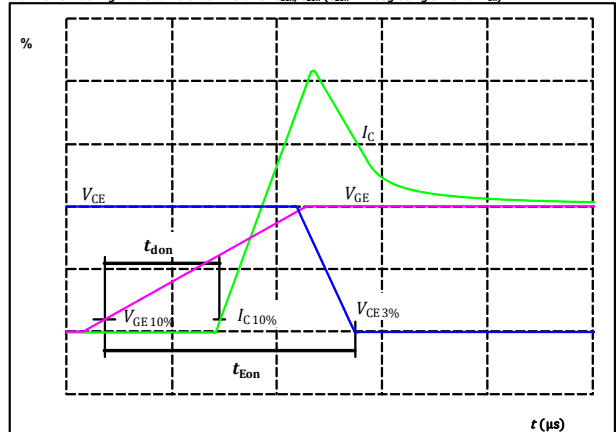
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	600	V
$I_C(100\%) =$	40	A
$t_{doff} =$	213	ns

figure 2. IGBT

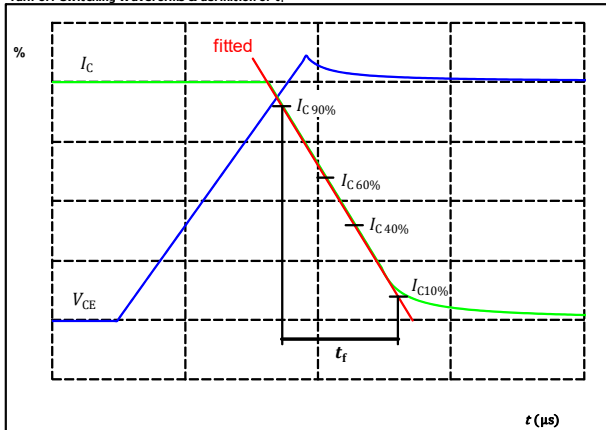
Turn-on Switching Waveforms & definition of t_{don} , t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	600	V
$I_C(100\%) =$	40	A
$t_{don} =$	65	ns

figure 3. IGBT

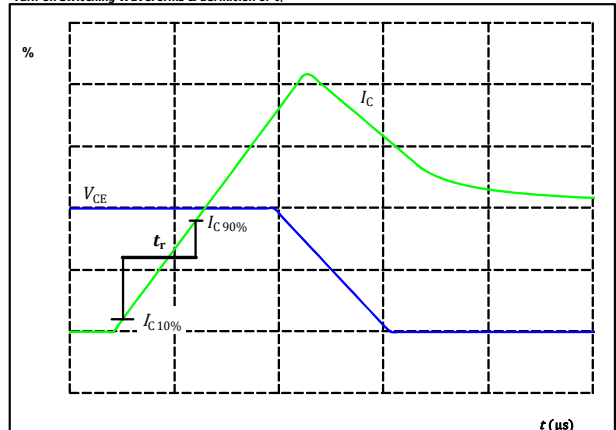
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%) =$	600	V
$I_C(100\%) =$	40	A
$t_f =$	60	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r



$V_C(100\%) =$	600	V
$I_C(100\%) =$	40	A
$t_r =$	18	ns

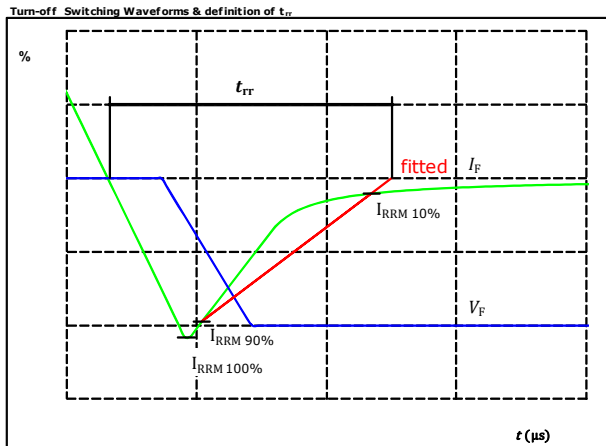


Vincotech

10-FY124PA040SH-L588F48
10-PY124PA040SH-L588F48Y
 datasheet

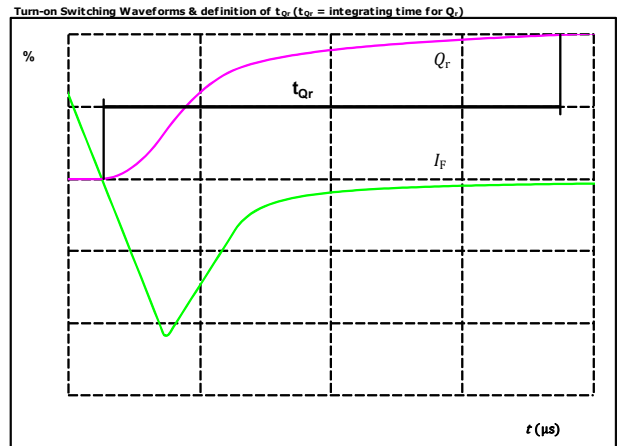
H-Bridge Switching Characteristics

figure 5. FWD



$V_F(100\%) =$	600	V
$I_F(100\%) =$	40	A
$I_{RRM}(100\%) =$	56	A
$t_{rr} =$	253	ns

figure 6. FWD



$I_F(100\%) =$	40	A
$Q_r(100\%) =$	5,29	μC



datasheet

Outline

Pin table			
Pin	X	Y	Function
1	Not assembled		
2	46,3	0	DC-2
3	43,6	2,7	DC-2
4	43,6	0	DC-2
5	39,2	1	G13
6	36,2	0	S13
7	33,2	1	NC
8	28,8	0	Therm2
9	23,8	0	Therm1
10	19,4	1	NC
11	16,4	0	S11
12	13,4	1	G11
13	9	2,7	DC-1
14	9	0	DC-1
15	Not assembled		
16	6,3	0	DC-1
17	Not assembled		
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
27	18,25	28,6	S12
28	21,25	28,6	NC
29	31,35	28,6	NC
30	34,35	28,6	S14
31	37,35	28,6	G14
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	Not assembled		

solder pins

press-fit pins

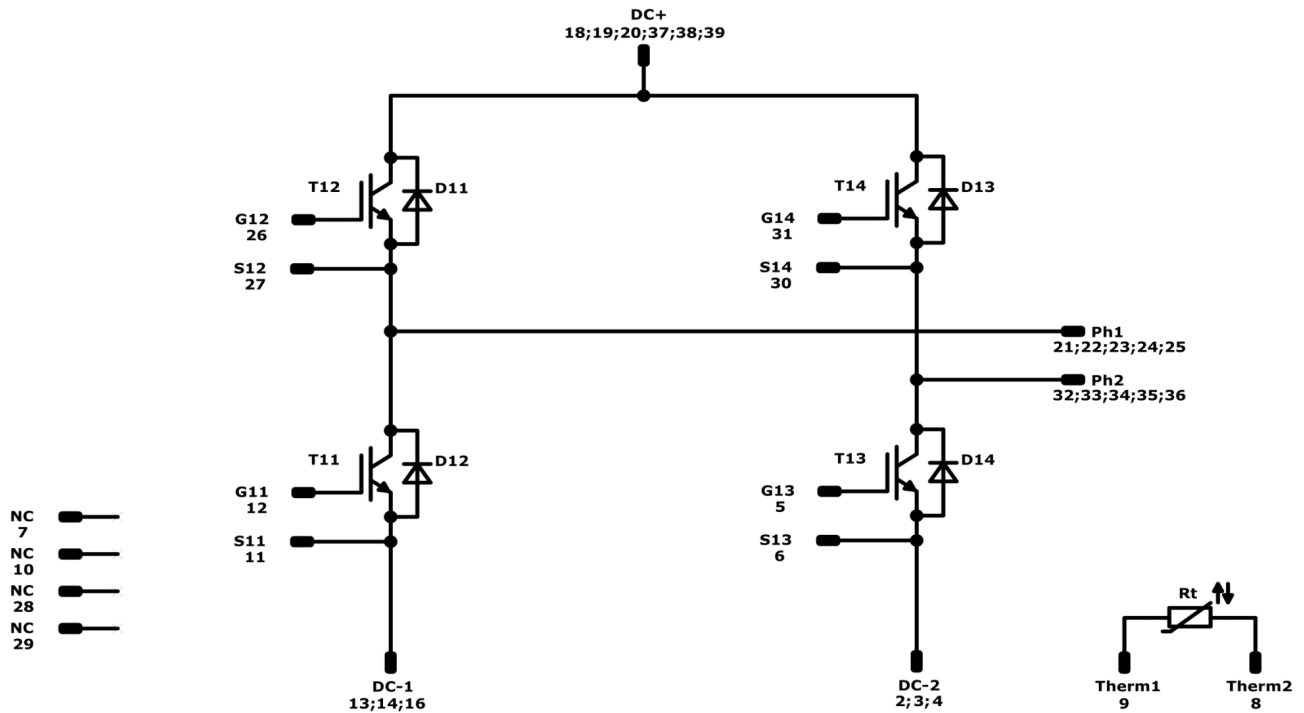
Tolerance of pinpositions: ±0.5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance



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10-FY124PA040SH-L588F48
10-PY124PA040SH-L588F48Y
datasheet

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11-T14	IGBT	1200 V	40 A	H-Bridge Switch	
D11-D14	FWD	1200 V	25 A	H-Bridge Diode	
Rt	Thermistor			Thermistor	



Vincotech

10-FY124PA040SH-L588F48
10-PY124PA040SH-L588F48Y
datasheet

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

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

Package data
Package data for <i>flow</i> 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-xy124PA040SH-L588F48x-D2-14	19 Mar. 2019	Correction of I_c/I_f values	2

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