Vincotech

flow PACK 2	1200 V / 50 A

Features

- IGBT4 (1200 V) technology for low saturation losses and improved EMC behavior

- Compact and low inductive design

- Integrated temperature sensor

flow 2 17 mm housing

Target applications

- Industrial drives

Schematic
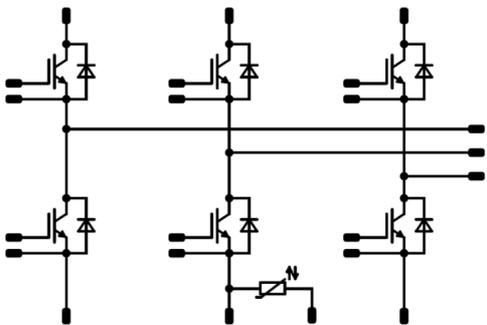
Types

- 30-P2126PA050SC-L287F09Y

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	65	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		150	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	185	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V		10 800	µs V
Maximum Junction Temperature	T_{jmax}			175	°C

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Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	$T_s = 80°C$	65	A
Repetitive peak forward current	I_{FRM}			100	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	$T_s = 80°C$	127	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 s	4000	V
		AC Voltage	t_p = 1 min	2500	V
Creepage distance				min. 12,7	mm
Clearance				min. 12,7	mm
Comparative Tracking Index	CTI			> 200	

*100 % tested in production

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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	

Inverter Switch

Static

Parameter	Symbol	V_{GE}/V_{GS}	V_{CE}/V_{DS}/V_{F}	I_{C}/I_{D}/I_{F}	T_{j}	Min	Typ	Max	Unit
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$		0,0017	25 125	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}	15		50	25 150	1,58	1,88 2,30	2,07	V
Collector-emitter cut-off current	I_{CES}	0	1200		25			1	µA
Gate-emitter leakage current	I_{GES}	20	0		25			120	nA
Internal gate resistance	r_{g}						4		Ω
Input capacitance	C_{ies}	f = 1 MHz, 0	25		25		2800		pF
Reverse transfer capacitance	C_{res}						100		pF

Thermal

Parameter	Symbol	Conditions				Min	Typ	Max	Unit
Thermal resistance junction to sink	$R_{th(j\text{-}s)}$	phase-change material λ = 3,4 W/mK					0,51		K/W

IGBT Switching

Parameter	Symbol	V_{GE}/V_{GS}	V_{CE}/V_{DS}/V_{F}	I_{C}/I_{D}/I_{F}	T_{j}	Min	Typ	Max	Unit
Turn-on delay time	$t_{d(on)}$	R_{goff} = 8 Ω R_{gon} = 8 Ω	±15 / 600	50	25 150		96 101		ns
Rise time	t_{r}				25 150		17 24		ns
Turn-off delay time	$t_{d(off)}$				25 150		214 281		ns
Fall time	t_{f}				25 150		87 122		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 4,8 µC Q_{rFWD} = 9,7 µC			25 150		2,701 4,211		mWs
Turn-off energy (per pulse)	E_{off}				25 150		2,744 4,531		mWs

Characteristic Values

Parameter	Symbol	Conditions		V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_{F} [V]	I_{C} [A] I_{D} [A] I_{F} [A]	T_{j} [°C]	Value Min	Typ	Max	Unit

Inverter Diode

Static

Parameter	Symbol	Conditions	V_{GE}/V_{GS} [V]	$V_{CE}/V_{DS}/V_F$ [V]	$I_C/I_D/I_F$ [A]	T_j [°C]	Min	Typ	Max	Unit
Forward voltage	V_F				50	25 125 150		1,73 1,70 1,68	2,05	V
Reverse leakage current	I_r			1200		25			10	µA

Thermal

Parameter	Symbol	Conditions	V_{GE}/V_{GS} [V]	$V_{CE}/V_{DS}/V_F$ [V]	$I_C/I_D/I_F$ [A]	T_j [°C]	Min	Typ	Max	Unit
Thermal resistance junction to sink	$R_{th(j\text{-}s)}$	phase-change material $\lambda = 3{,}4$ W/mK						0,75		K/W

FWD Switching

Parameter	Symbol	Conditions	V_{GE}/V_{GS} [V]	$V_{CE}/V_{DS}/V_F$ [V]	$I_C/I_D/I_F$ [A]	T_j [°C]	Min	Typ	Max	Unit
Peak recovery current	I_{RRM}	$di/dt = 3866$ A/µs $di/dt = 2820$ A/µs	±15	600	50	25 150		81 85		A
Reverse recovery time	t_{rr}					25 150		139 316		ns
Recovered charge	Q_r					25 150		4,797 9,708		µC
Reverse recovered energy	E_{rec}					25 150		1,790 3,972		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		4803 1209		A/µs

Thermistor

Parameter	Symbol	Conditions	V_{GE}/V_{GS} [V]	$V_{CE}/V_{DS}/V_F$ [V]	$I_C/I_D/I_F$ [A]	T_j [°C]	Min	Typ	Max	Unit
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	$R_{100} = 1486$ Ω				100	-12		+14	%
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	

Inverter 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: | 150 | °C |
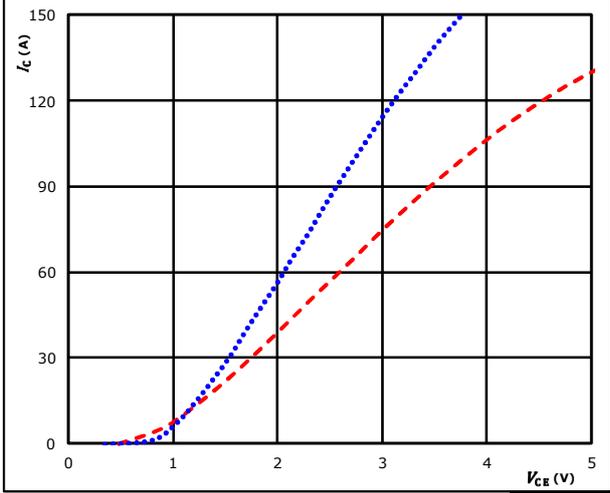
figure 2.　　　　　　　　　　　　　　　　　　**IGBT**
Typical output characteristics
$I_C = f(V_{CE})$
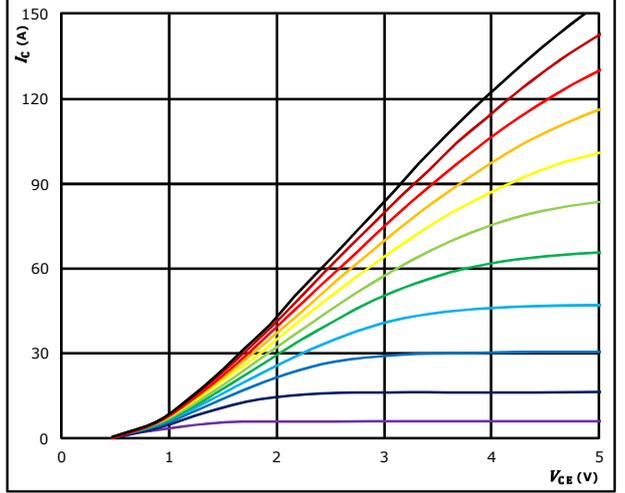
| t_p = | 250 | µs |
| T_j = | 150 | °C |

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: | 150 | °C |
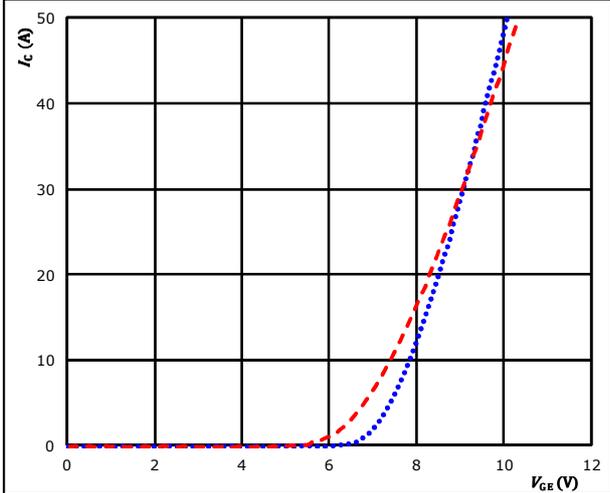
figure 4.　　　　　　　　　　　　　　　　　　**IGBT**
Transient Thermal Impedance as function of Pulse duration
$Z_{th(j-s)} = f(t_p)$
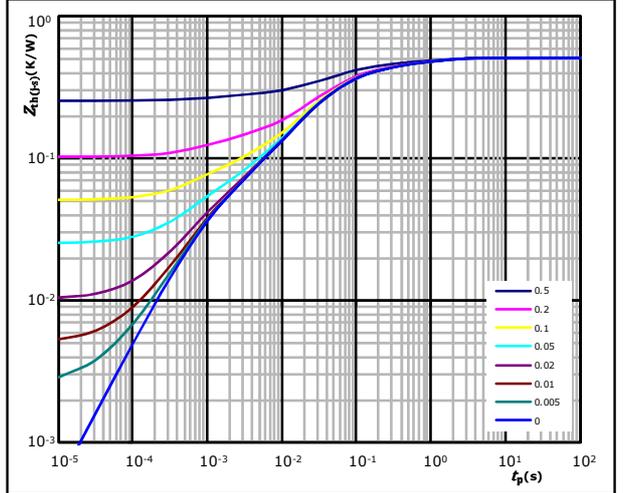
$D = t_p / T$
$R_{th(j-s)} = 0.51$ K/W

IGBT thermal model values

R (K/W)	τ (s)
7,12E-02	1,13E+00
1,15E-01	1,65E-01
2,22E-01	3,78E-02
6,59E-02	1,21E-02
3,86E-02	9,52E-04

Vincotech

Inverter Switch Characteristics

Safe operating area   **IGBT**

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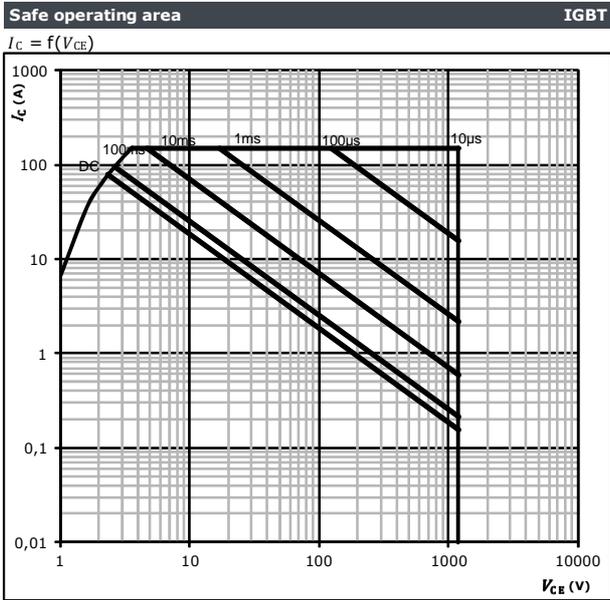
At

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

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Inverter Diode Characteristics

Typical forward characteristics	FWD

$I_F = f(V_F)$

t_p =	250	µs	25 °C	....
	T_j:	125 °C		———
		150 °C		– – –
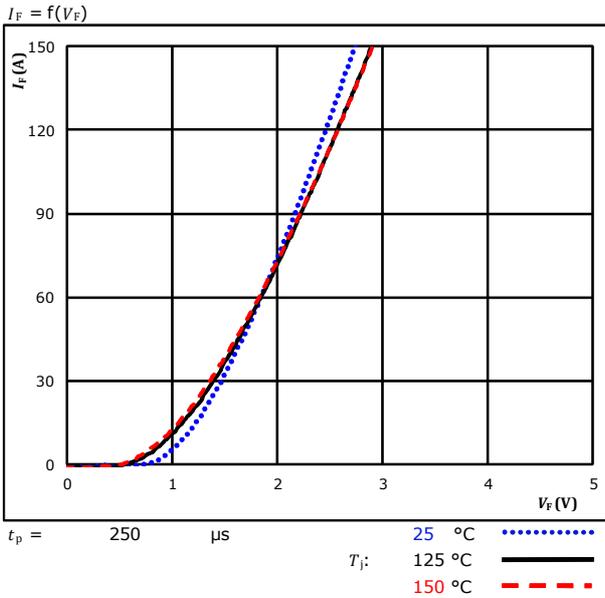
Transient thermal impedance as a function of pulse width	FWD

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

D = 0,5
0,2
0,1
0,05
0,02
0,01
0,005
0,000

D = t_p / T
$R_{th(j-s)}$ =   0,75   K/W

FWD thermal model values

R (K/W)	τ (s)
4,26E-02	3,64E+00
6,76E-02	6,18E-01
2,53E-01	8,65E-02
3,23E-01	2,11E-02
6,24E-02	3,47E-03
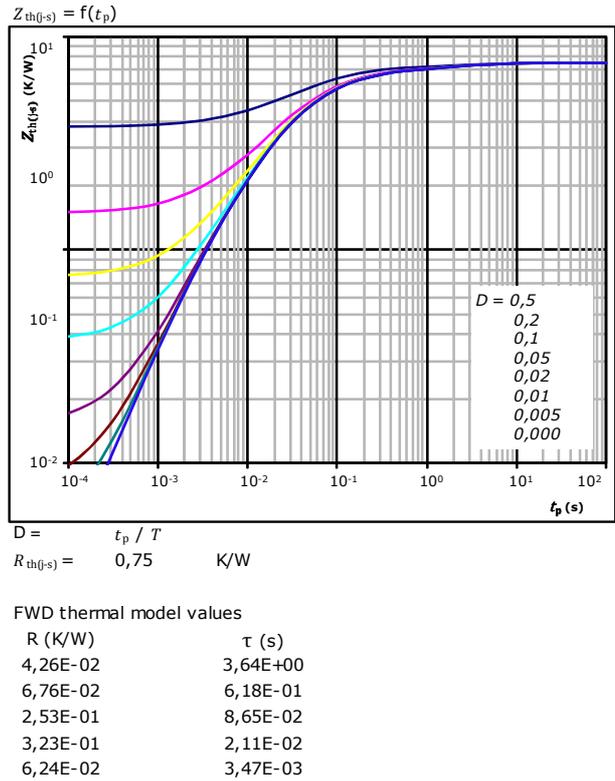
Thermistor Characteristics

figure 1.	Thermistor

**Typical NTC characteristic
as a function of temperature**

R = f(T)
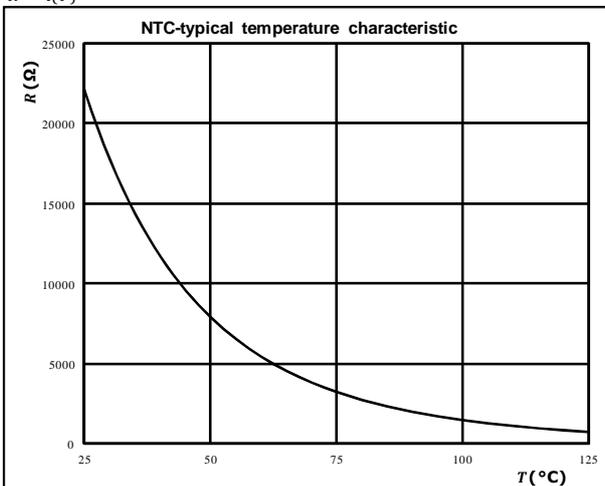
Inverter Switching Definitions

Figure 1. IGBT
Typical switching energy losses as a function of collector current
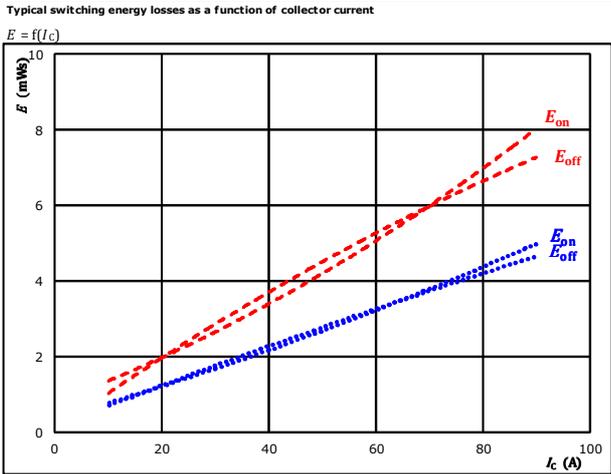
$E = f(I_C)$

With an inductive load at

				25 °C
$V_{CE}=$	600	V	T_j:	150 °C
$V_{GE}=$	±15	V		
$R_{gon}=$	8	Ω		
$R_{goff}=$	8	Ω		

Figure 2. IGBT
Typical switching energy losses as a function of gate resistor

$E = f(r_g)$

With an inductive load at

				25 °C
$V_{CE}=$	600	V	T_j:	150 °C
$V_{GE}=$	±15	V		
$I_C=$	50	A		
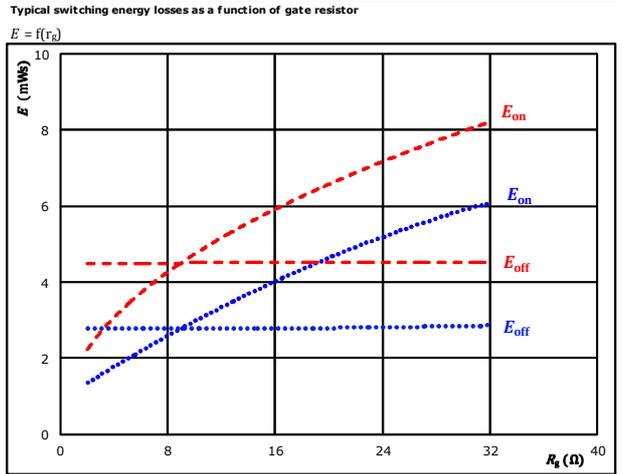
Figure 3. FWD
Typical reverse recovered energy loss as a function of collector current
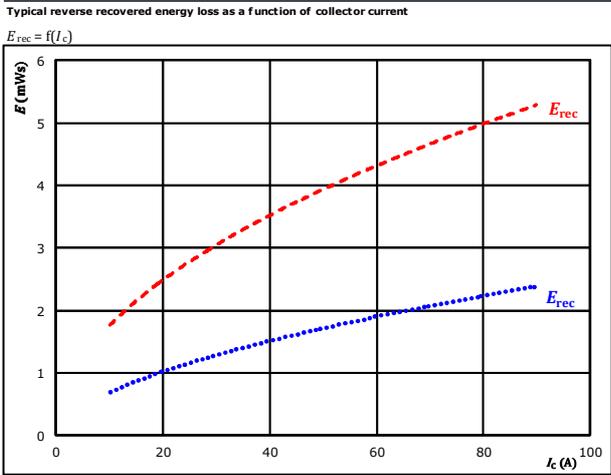
$E_{rec} = f(I_C)$

With an inductive load at

				25 °C
$V_{CE}=$	600	V	T_j:	150 °C
$V_{GE}=$	±15	V		
$R_{gon}=$	8	Ω		

Figure 4. FWD
Typical reverse recovered energy loss as a function of gate resistor
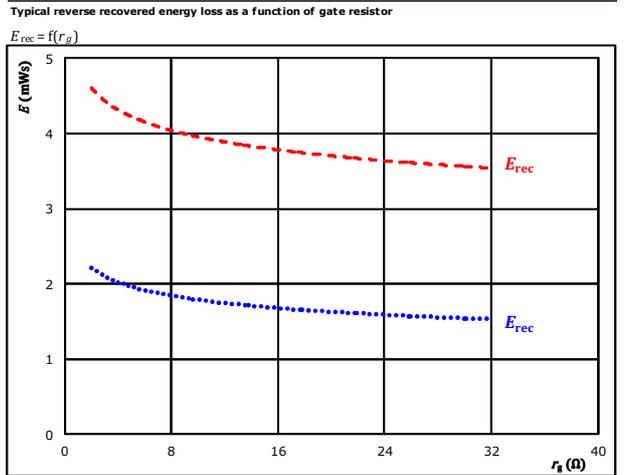
$E_{rec} = f(r_g)$

With an inductive load at

				25 °C
$V_{CE}=$	600	V	T_j:	150 °C
$V_{GE}=$	±15	V		
$I_C=$	50	A		

Inverter Switching Definitions

Figure 5.   IGBT

Typical switching times as a function of collector current

$t = f(I_C)$
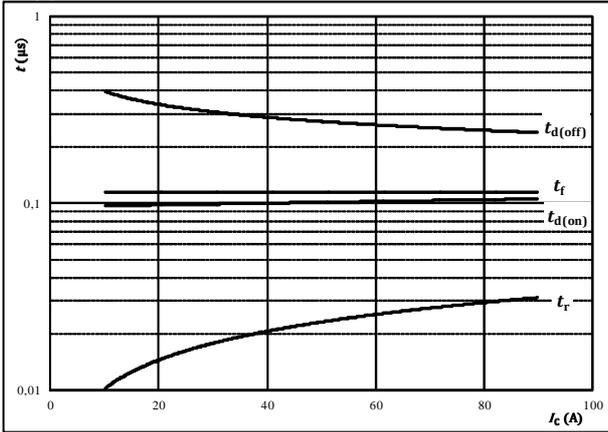
With an inductive load at

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

Figure 6.   IGBT

Typical switching times as a function of gate resistor

$t = f(r_g)$
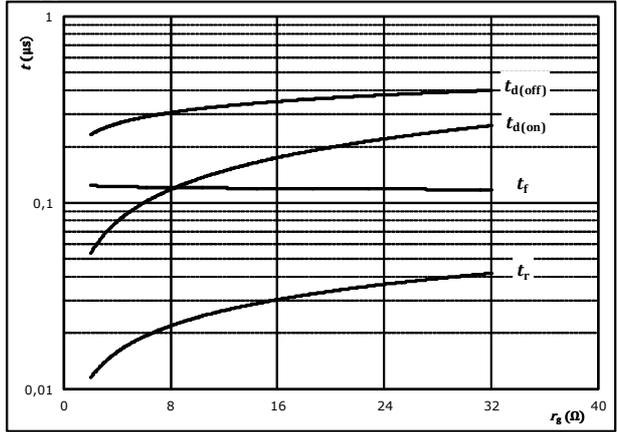
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±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	$V_{CE} =$	600	V		**25** °C	••••••
	$V_{GE} =$	±15	V	T_j:	**150 °C**	– – –
	$R_{gon} =$	8	Ω			

Figure 8.   FWD

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

$t_{rr} = f(R_{gon})$
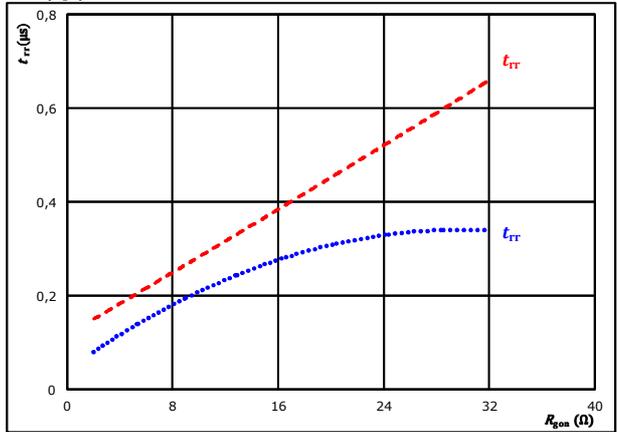
At	$V_{CE} =$	600	V		**25** °C	••••••
	$V_{GE} =$	±15	V	T_j:	**150 °C**	– – –
	$I_C =$	50	A			

# Inverter Switching Definitions

Figure 9.   **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$
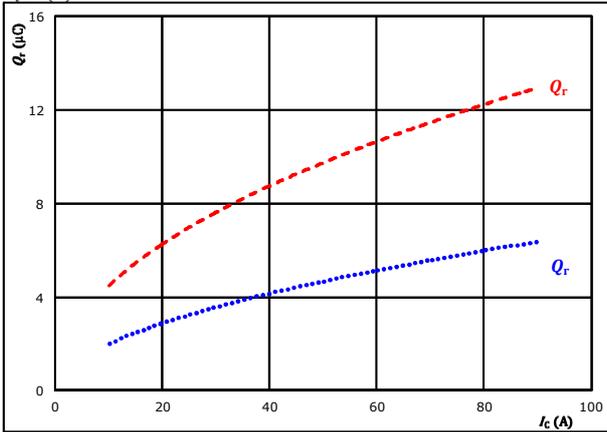
At	$V_{CE}=$	600	V		**25**	**°C**	·········
	$V_{GE}=$	±15	V	T_j:	**150**	**°C**	– – –
	$R_{gon}=$	8	Ω				

Figure 10.   **FWD**

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

$Q_r = f(R_{gon})$
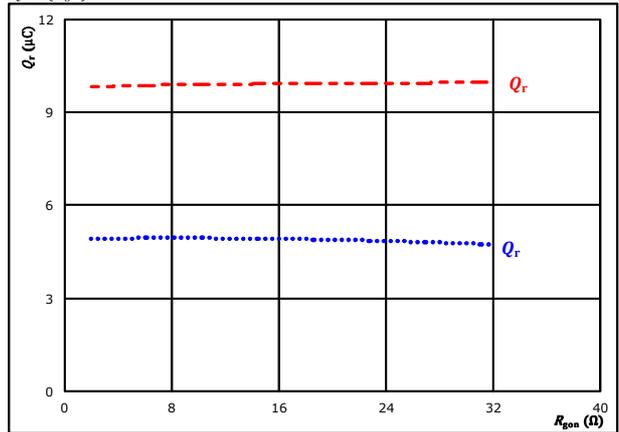
At	$V_{CE}=$	600	V		**25**	**°C**	·········
	$V_{GE}=$	±15	V	T_j:	**150**	**°C**	– – –
	$I_C=$	50	A				

Figure 11.   **FWD**

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

$I_{RM} = f(I_C)$
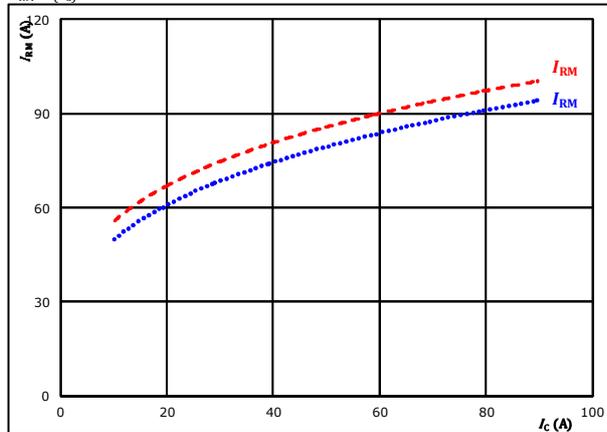
At	$V_{CE}=$	600	V		**25**	**°C**	·········
	$V_{GE}=$	±15	V	T_j:	**150**	**°C**	– – –
	$R_{gon}=$	8	Ω				

Figure 12.   **FWD**

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

$I_{RM} = f(R_{gon})$
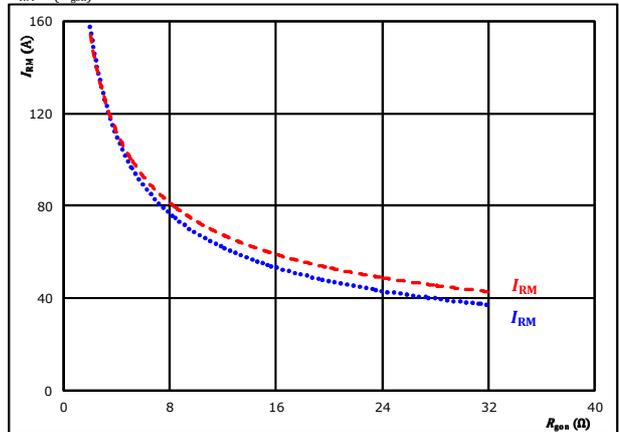
At	$V_{CE}=$	600	V		**25**	**°C**	·········
	$V_{GE}=$	±15	V	T_j:	**150**	**°C**	– – –
	$I_C=$	50	A				

# Inverter Switching Definitions

Figure 13. FWD

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

$di_F/dt, di_{rr}/dt = f(I_C)$
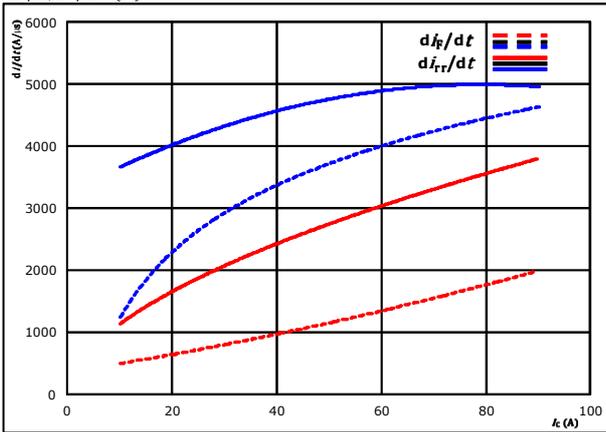
| At | V_{CE}: | 600 | V | | | 25 °C | |
| | V_{GE} = | ±15 | V | | T_j: | 150 °C | |
| | R_{gon} = | 8 | Ω | | | | |

Figure 14. FWD

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

$di_F/dt, di_{rr}/dt = f(R_g)$
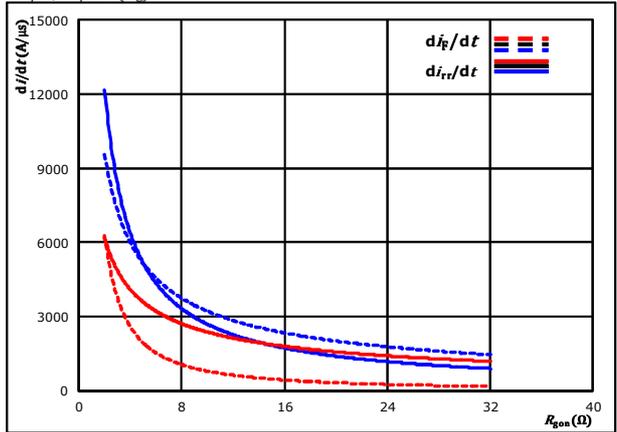
At	V_{CE} =	600	V			25 °C	
	V_{GE} =	±15	V		T_j:	150 °C	
	I_C=	50	A				

Figure 15. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$
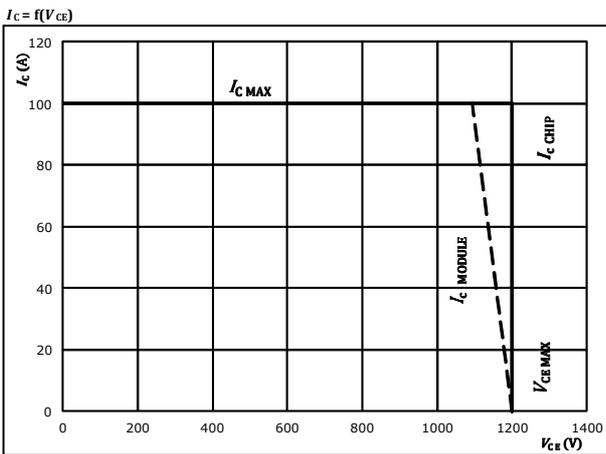
At			
	T_j =	175	°C
	R_{gon} =	8	Ω
	R_{goff} =	8	Ω

Inverter Switching Characteristics

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)
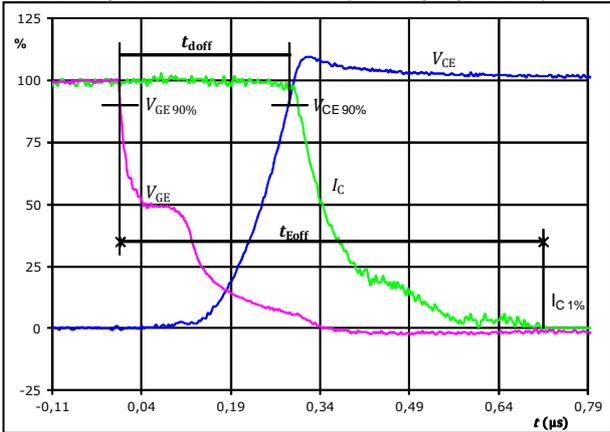
$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	50	A
t_{doff} =	0,281	µs
t_{Eoff} =	0,710	µs

Figure 2. IGBT

Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)
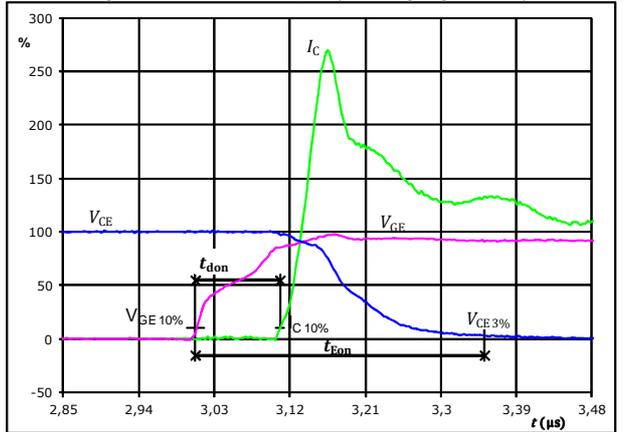
$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	50	A
t_{don} =	0,101	µs
t_{Eon} =	0,345	µs

Figure 3. IGBT

Turn-off Switching Waveforms & definition of tf
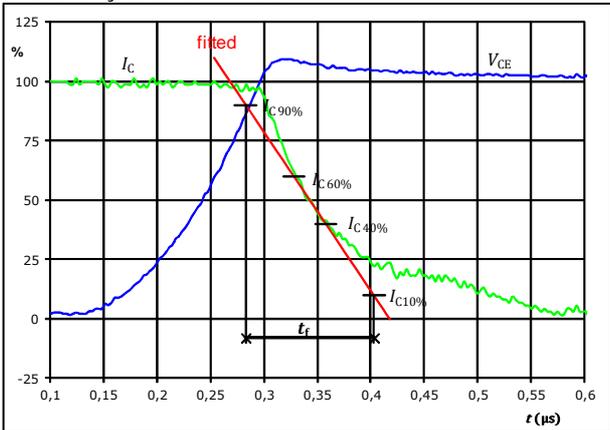
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	50	A
t_f =	0,122	µs

Figure 4. IGBT

Turn-on Switching Waveforms & definition of tr
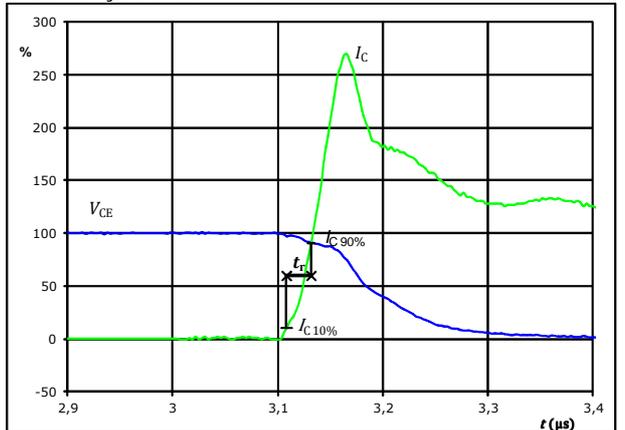
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	50	A
t_r =	0,024	µs

Inverter Switching Characteristics

Figure 5. IGBT

Turn-off Switching Waveforms & definition of tEoff
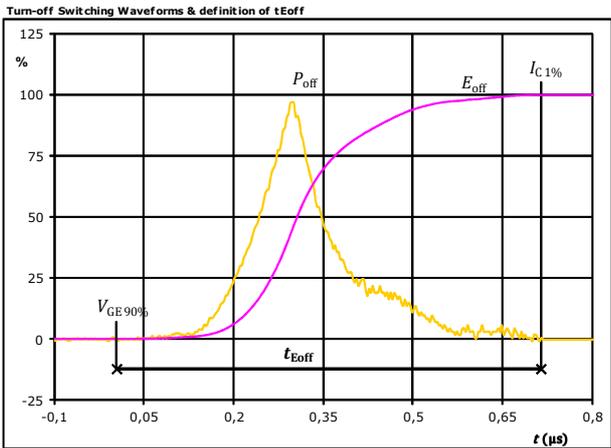
P_{off} (100%) =	30,10	kW
E_{off} (100%) =	4,53	mJ
t_{Eoff} =	0,71	µs

Figure 6. IGBT

Turn-on Switching Waveforms & definition of tEon
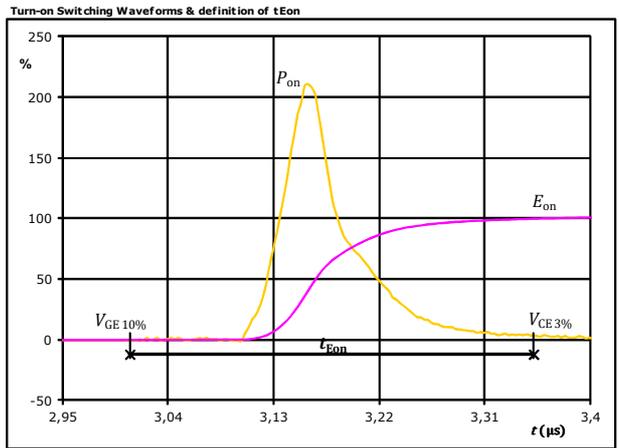
P_{on} (100%) =	30,10	kW
E_{on} (100%) =	4,21	mJ
t_{Eon} =	0,345	µs

Figure 7. FWD

Turn-off Switching Waveforms & definition of trr
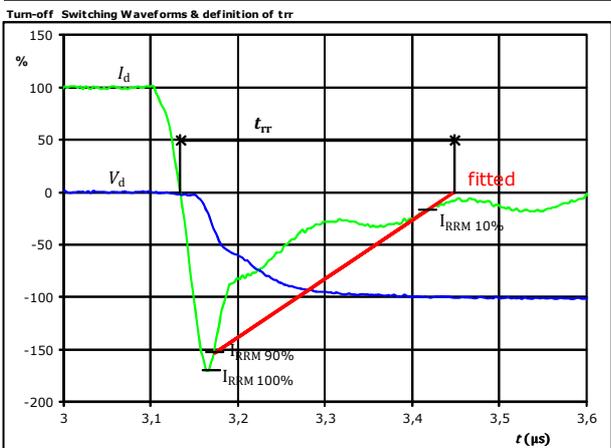
V_d (100%) =	600	V
I_d (100%) =	50	A
I_{RRM} (100%) =	-85	A
t_{rr} =	0,316	µs

Inverter Switching Characteristics

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%) =	9,71	µC
t_{Qrr} =	0,63	µs

Figure 9. **FWD**

Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec}= integrating time for E_{rec})
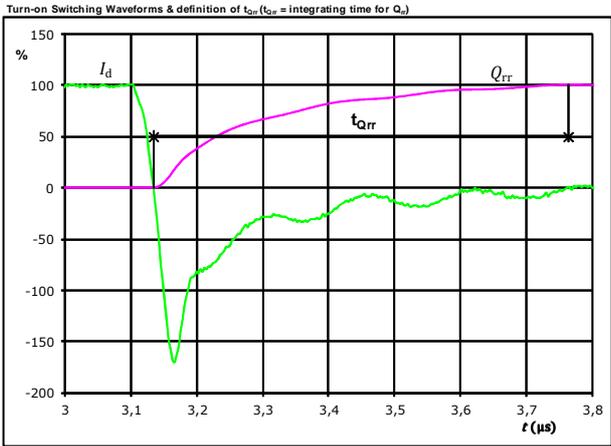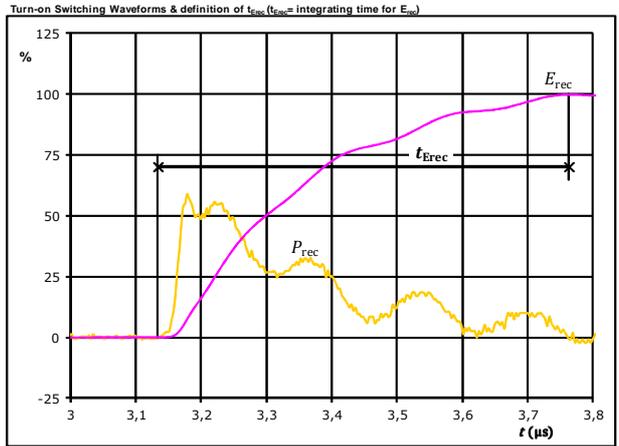
P_{rec} (100%) =	30,10	kW
E_{rec} (100%) =	3,97	mJ
t_{Erec} =	0,63	µs

Ordering Code & Marking

Version		Ordering Code	
without thermal paste 17 mm housing		30-P2126PA050SC-L287F09Y	

		Name	Date code	UL & VIN	Lot	Serial
Text		N-NNNNNNNNNNNNNN-TTTTTTV	WWYY	UL VIN	LLLLL	SSSS
	Type&Ver	**Lot number**	**Serial**	**Date code**		
Datamatrix	TTTTTTVV	LLLLL	SSSS	WWYY		

NN-NNNNNNNNNNNNNN
TTTTTTVV WWYY UL
VIN LLLLL SSSS

Outline

	Pin table [mm]		
Pin	X	Y	Function
1	0,9	0	S11
2	0,9	3	G11
3	3,9	0	DC-1
4	3,9	2,7	DC-1
5	3,9	5,4	DC-1
6	6,6	0	DC-1
7	15,2	0	DC+1
8	15,2	2,7	DC+1
9	17,9	0	DC+1
10	17,9	2,7	DC+1
11	26,2	0	S13
12	26,2	3	G13
13	29,2	0	DC-2
14	29,2	2,7	DC-2
15	29,2	5,4	DC-2
16	31,9	0	DC-2
17	32,2	4,05	NTC
18	40,5	0	DC+2
19	40,5	2,7	DC+2
20	43,2	0	DC+2
21	43,2	2,7	DC+2
22	51,5	0	S15
23	51,5	3	G15
24	54,5	0	DC-3
25	54,5	2,7	DC-3
26	54,5	5,4	DC-3
27	57,2	0	DC-3
28	65,8	0	DC+3
29	65,8	2,7	DC+3
30	68,5	0	DC+3
31	68,5	2,7	DC+3
32	64,7	36	G16
33	61,7	36	S16
34	58,7	36	PH3
35	56	36	PH3
36	53,3	36	PH3
37	50,6	36	PH3
38	39,4	36	G14
39	36,4	36	S14
40	33,4	36	PH2
41	30,7	36	PH2
42	28	36	PH2
43	25,3	36	PH2
44	14,1	36	G12
45	11,1	36	S12
46	8,1	36	PH1
47	5,4	36	PH1
48	2,7	36	PH1
49	0	36	PH1

Centerline of pinhead

214 ±0,5

18,08 ±0,21

Title

18

Y

X

34.25
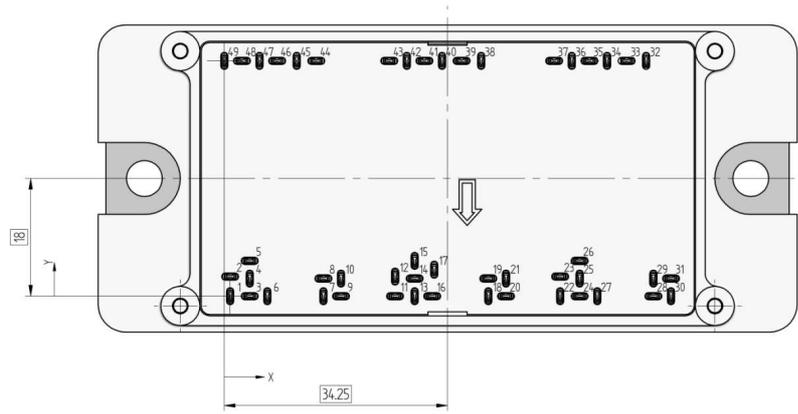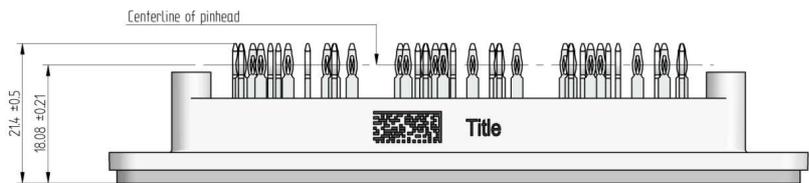
Tolerance of pinpositions: ±0,5 mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

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Pinout
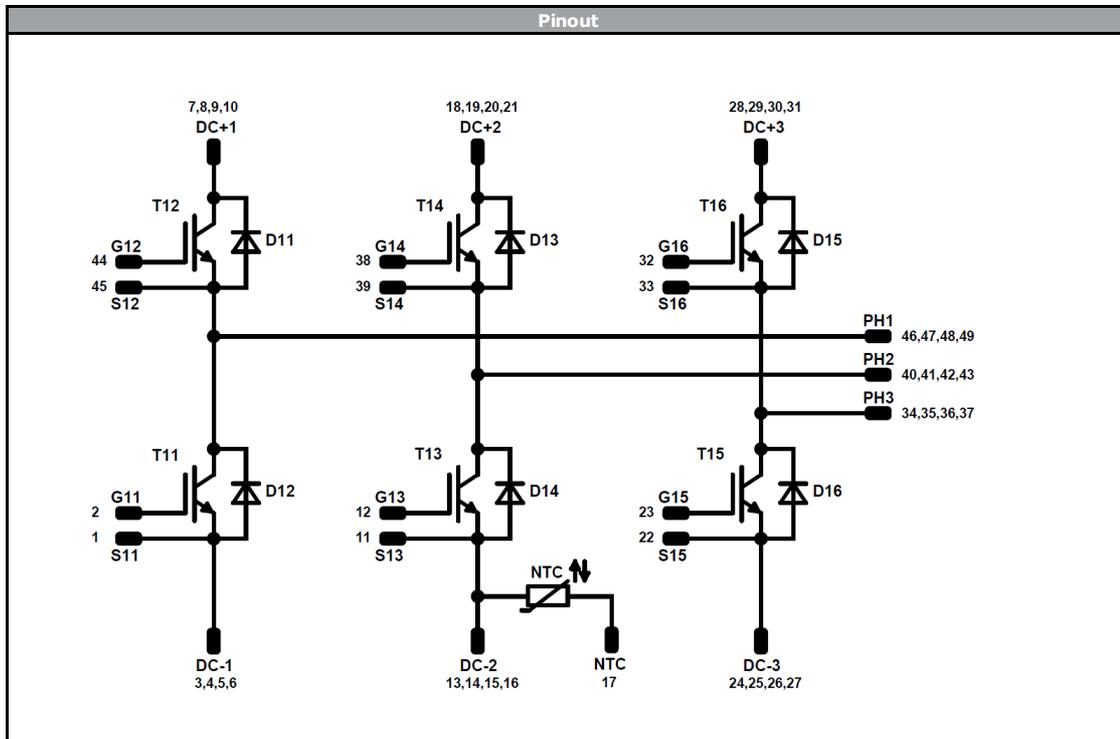
Identification					
ID	**Component**	**Voltage**	**Current**	**Function**	**Comment**
T11 , T12 , T13 , T14 , T15 , T16	IGBT	1200 V	50 A	Inverter Switch	
D11 , D12 , D13 , D14 , D15 , D16	FWD	1200 V	50 A	Inverter Diode	
NTC	Thermistor			Thermistor	

Packaging instruction					
Standard packaging quantity (SPQ)	36	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 2 packages see vincotech.com website.

Package data
Package data for *flow* 2 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.	®UL

Document No.:	**Date:**	**Modification:**	**Pages**
30-x2126PA050SC-L287F09x-D3-14	31 May. 2017	New package quantity	All

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.