V23990-P829-F*-PM
V23990-P829-F08*-PM
datasheet

flow PACK 1 — 1200 V / 50 A

Features

- Compact *flow* 1 housing
- Trench Fieldstop IGBT4 technology
- Compact and low inductance design
- AlN substrate for improved performance
- Built-in NTC

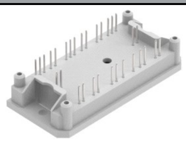
Target applications

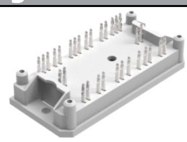
- Motor Drive
- Power generation
- UPS

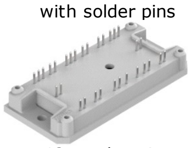
Types

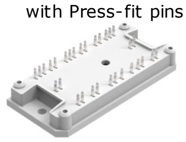
- V23990-P829-F-PM
- V23990-P829-FY-PM
- V23990-P829-F08-PM
- V23990-P829-F08Y-PM

flow 1 housing

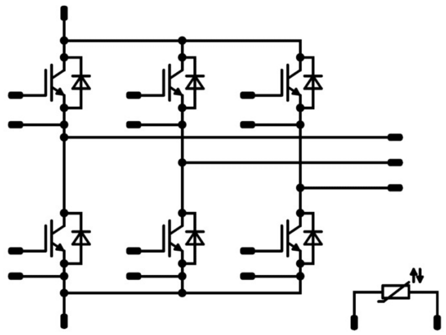

17 mm housing
with solder pins


17 mm housing
with Press-fit pins


12 mm housing
with solder pins


12 mm housing
with Press-fit pins

Schematic



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	71	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	216	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \leq$ 150°C V_{GE} = 15V		10 800	µs V
Maximum Junction Temperature	T_{jmax}			175	°C

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	146	W
Maximum Junction Temperature	T_{jmax}			175	°C

Module Properties

Thermal Properties

Parameter	Symbol	Condition		Value	Unit
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{jop}			-40…(T_{jmax} - 25)	°C

Isolation Properties

Parameter	Symbol	Condition		Value	Unit
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		17mm housing with solder pins		12,64	mm
		17mm housing with Press-fit pins		min. 12,7	mm
		12mm housing with solder pins		7,81	mm
		12mm housing with Press-fit pins		7,9	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	
Inverter Switch										
Static										
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}	f = 1 MHz	0	25		25		100		pF
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,44		K/W
IGBT Switching										
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	R_{goff} = 8 Ω R_{gon} = 8 Ω	±15	600	50	25 150		17 24		ns
Turn-off delay time	$t_{d(off)}$	R_{goff} = 8 Ω R_{gon} = 8 Ω	±15	600	50	25 150		214 281		ns
Fall time	t_f	R_{goff} = 8 Ω R_{gon} = 8 Ω	±15	600	50	25 150		87 122		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 4,8 µC Q_{rFWD} = 9,7 µC	±15	600	50	25 150		2,701 4,211		mWs
Turn-off energy (per pulse)	E_{off}		±15	600	50	25 150		2,744 4,531		mWs

Characteristic Values

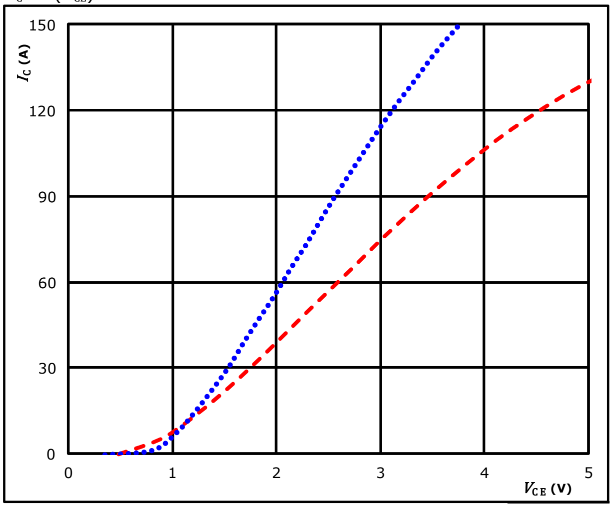
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Diode										
Static										
Forward voltage	V_F				50	25 125 150		1,73 1,70 1,68	2,05	V
Reverse leakage current	I_r			1200		25			10	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,65		K/W
FWD Switching										
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										
Rated resistance	R					25		4,7		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 401 Ω				100	-12,4		12,4	%
Power dissipation	P					25		210		mW
Power dissipation constant						25		3,5		mW/K
B-value	$B_{(25/50)}$					25		3590		K
B-value	$B_{(25/100)}$					25		3650		K
Vincotech NTC Reference									D	

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

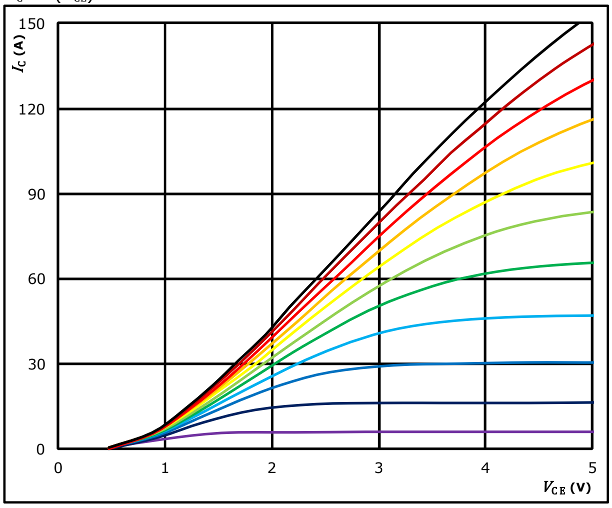


t_p =	250	µs		25	°C	··········
V_{GE} =	15	V	T_j:	150	°C	– – –

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

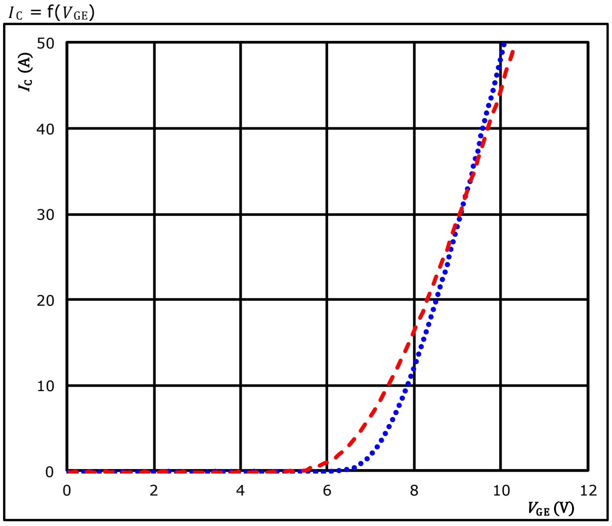


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

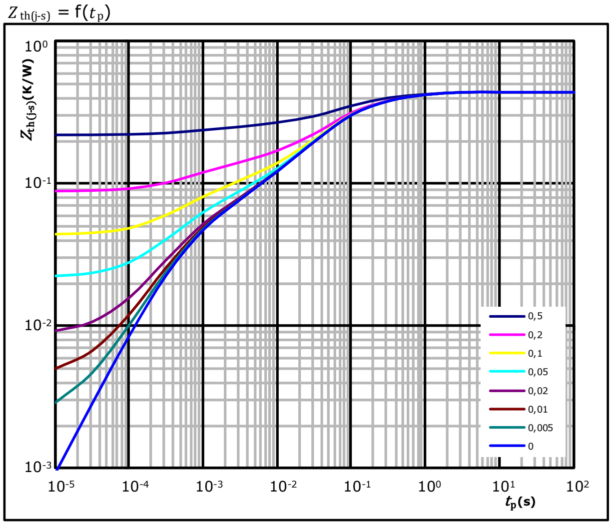


t_p =	100	µs		25	°C	··········
V_{CE} =	10	V	T_j:	150	°C	– – –

figure 4. **IGBT**

Transient Thermal Impedance as function of Pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,44	K/W

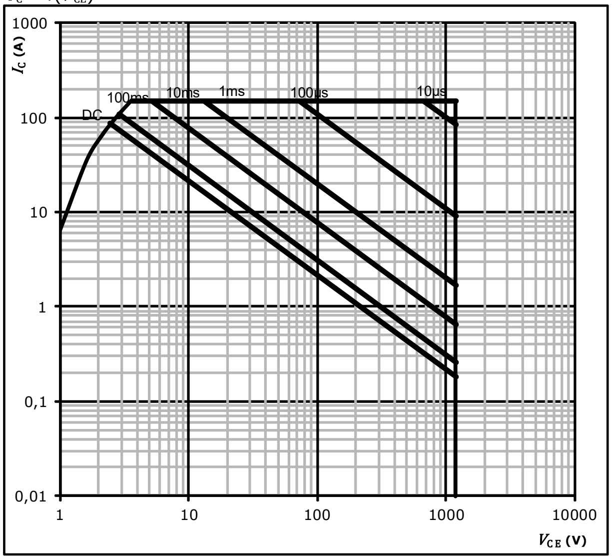
IGBT thermal model values

R (K/W)	τ (s)
9,12E-02	6,01E-01
1,84E-01	8,26E-02
9,04E-02	2,81E-02
4,02E-02	2,85E-03
3,41E-02	4,57E-04

Inverter Switch Characteristics

Safe operating area	**IGBT**

$I_C = f(V_{CE})$



At

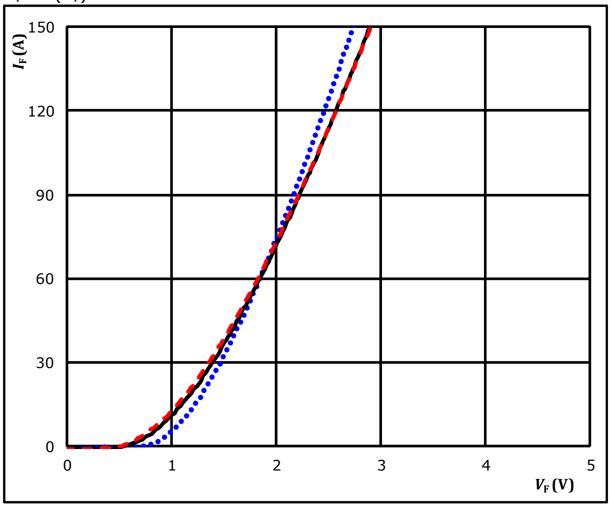
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	ºC

Inverter Diode Characteristics

figure 1.	FWD

Typical forward characteristics

$I_F = f(V_F)$

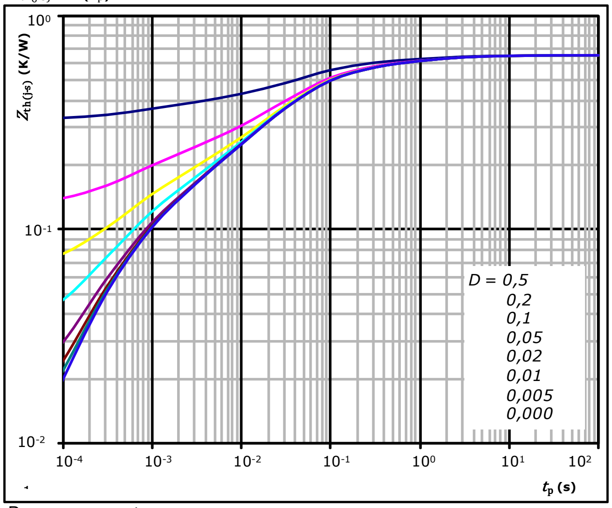


t_p =	250	µs		25 °C
			T_j:	125 °C
				150 °C

figure 2.	FWD

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,65 K/W

FWD thermal model values

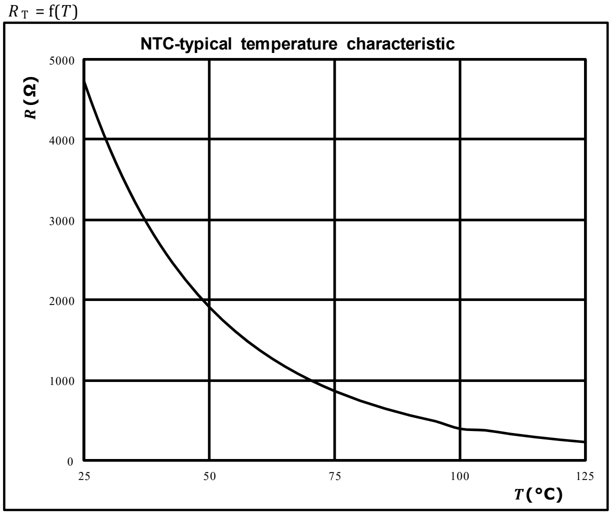
R (K/W)	τ (s)
2,16E-02	5,63E+00
7,48E-02	7,71E-01
1,39E-01	1,16E-01
2,24E-01	3,15E-02
7,32E-02	6,56E-03
5,99E-02	1,57E-03
5,87E-02	3,68E-04

Thermistor Characteristics

Thermistor typical temperature characteristic

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$

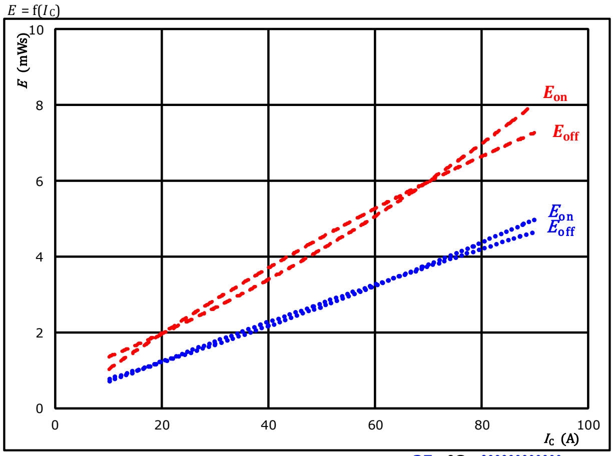


Inverter Switching Characteristics

Figure 1. IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



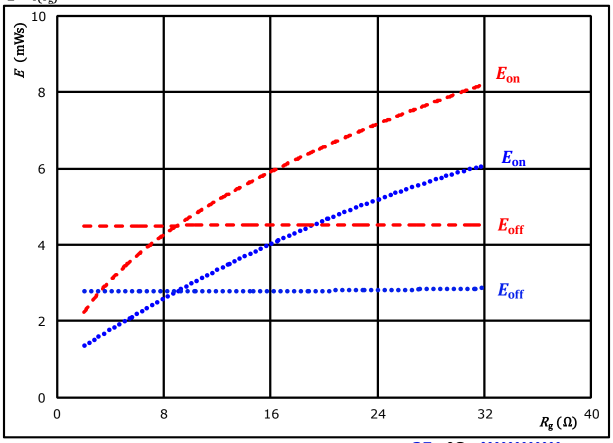
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C / 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

$E = f(r_g)$



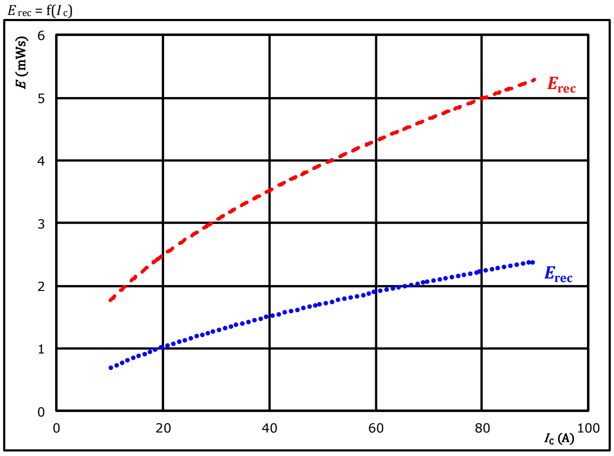
With an inductive load at

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

Figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_c)$



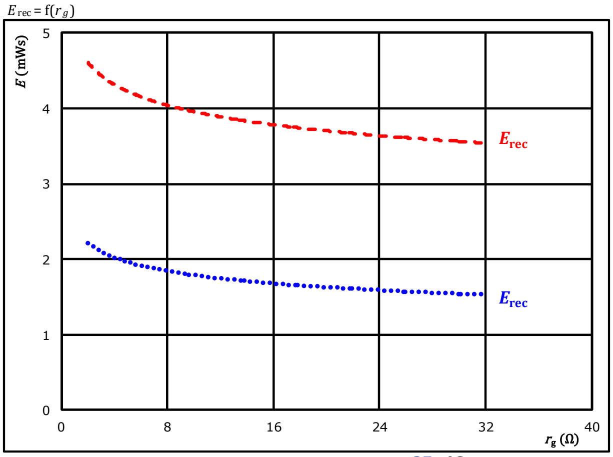
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C / 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

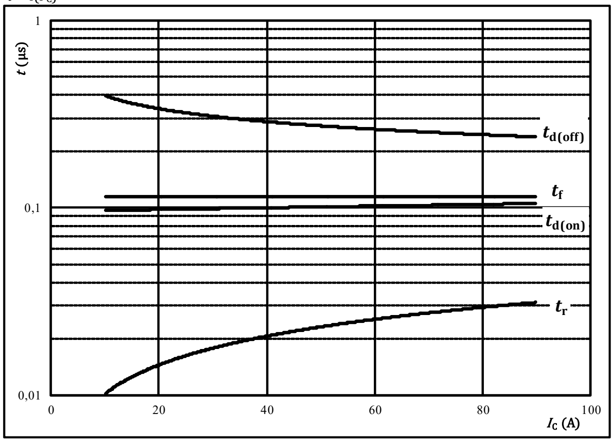
V_{CE} =	600	V	T_j:	25 °C / 150 °C
V_{GE} =	±15	V		
I_C =	50	A		

Inverter Switching Characteristics

Figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



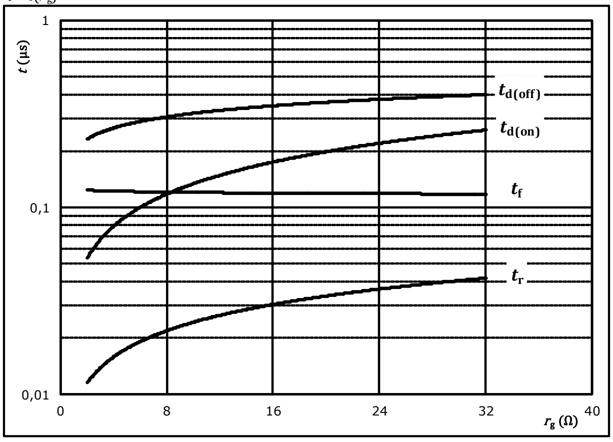
With an inductive load at

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

Figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(r_g)$



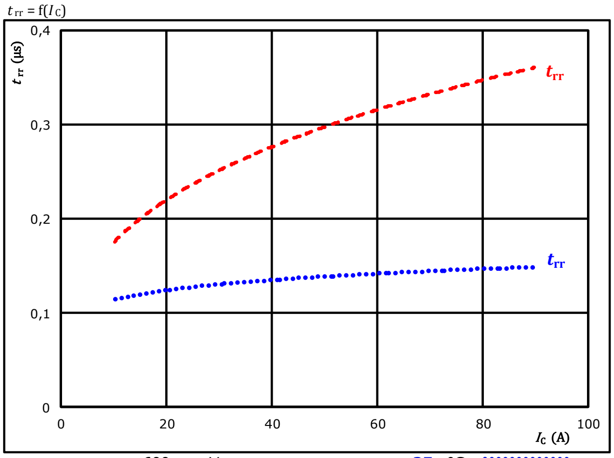
With an inductive load at

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

$t_{rr} = f(I_C)$

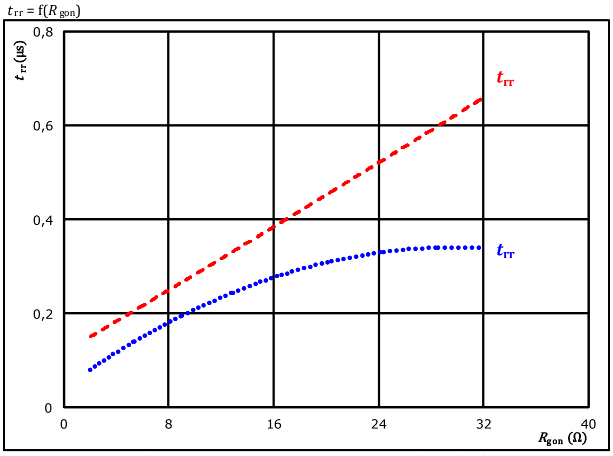


At	V_{CE} =	600	V		25 °C (dotted)
	V_{GE} =	±15	V	T_j:	150 °C (dashed)
	R_{gon} =	8	Ω		

Figure 8. **FWD**

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

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



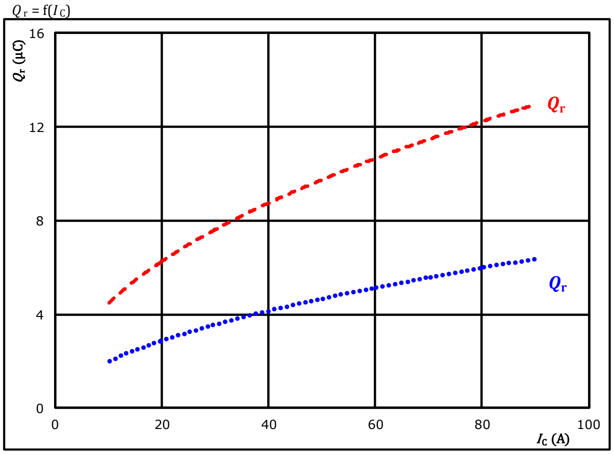
At	V_{CE} =	600	V		25 °C (dotted)
	V_{GE} =	±15	V	T_j:	150 °C (dashed)
	I_C =	50	A		

Inverter Switching Characteristics

Figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

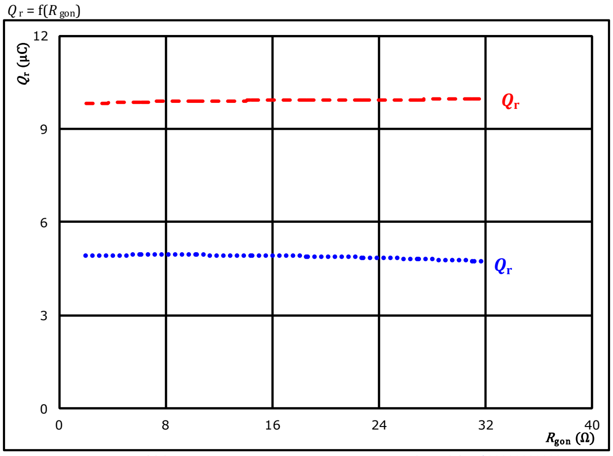


At	V_{CE} =	600	V	T_j:	25 °C	············
	V_{GE} =	±15	V		150 °C	– – – –
	R_{gon} =	8	Ω			

Figure 10. **FWD**

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

$Q_r = f(R_{gon})$

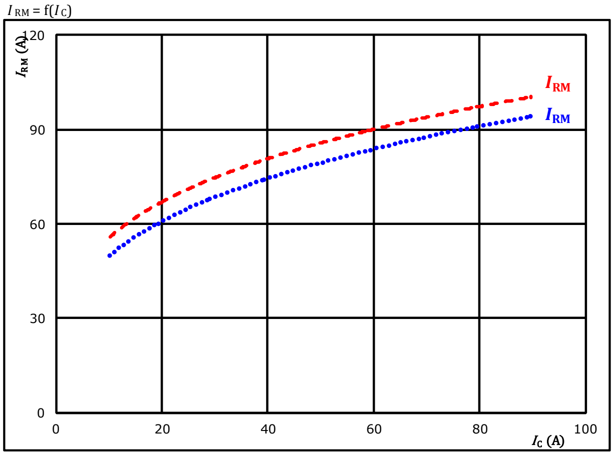


At	V_{CE}=	600	V	T_j:	25 °C	············
	V_{GE} =	±15	V		150 °C	– – – –
	I_C=	50	A			

Figure 11. **FWD**

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

$I_{RM} = f(I_C)$

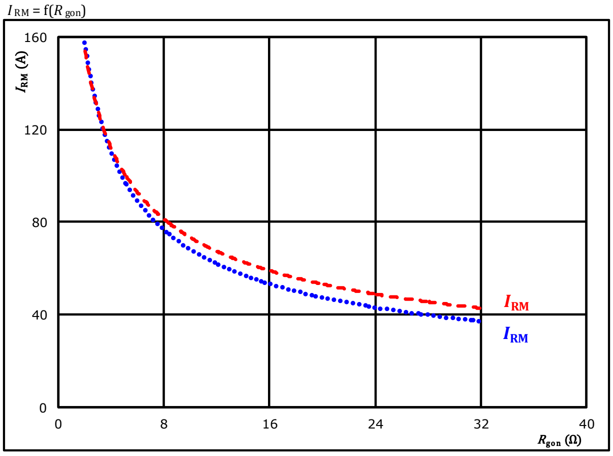


At	V_{CE}:	600	V	T_j:	25 °C	············
	V_{GE} =	±15	V		150 °C	– – – –
	R_{gon} =	8	Ω			

Figure 12. **FWD**

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

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



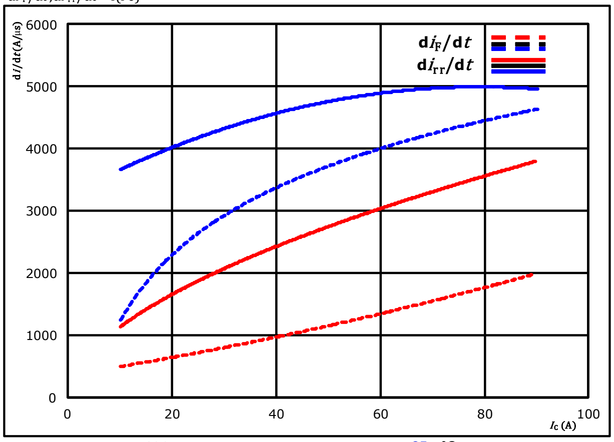
At	V_{CE} =	600	V	T_j:	25 °C	············
	V_{GE} =	±15	V		150 °C	– – – –
	I_C =	50	A			

Inverter Switching Characteristics

Figure 13. **FWD**

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

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

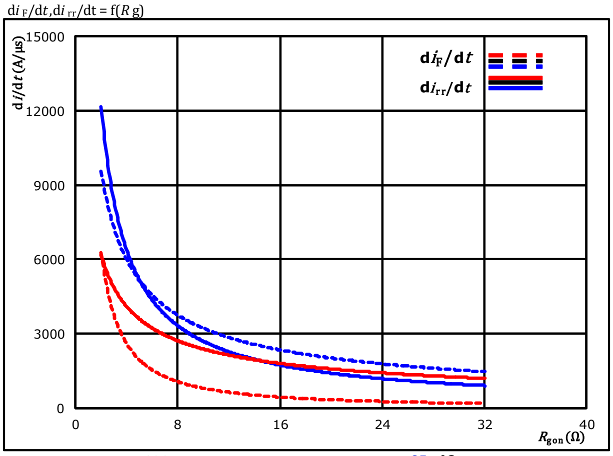


At				
V_{CE} =	600	V	T_j: 25 °C	....
V_{GE} =	±15	V	150 °C	– – – –
R_{gon} =	8	Ω		

Figure 14. **FWD**

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

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

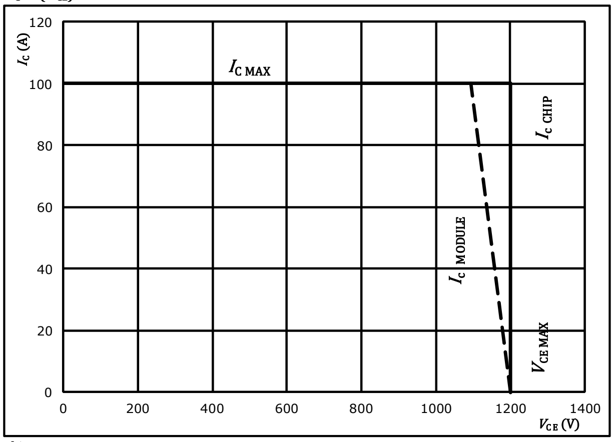


At				
V_{CE} =	600	V	T_j: 25 °C	....
V_{GE} =	±15	V	150 °C	– – – –
I_C =	50	A		

Figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



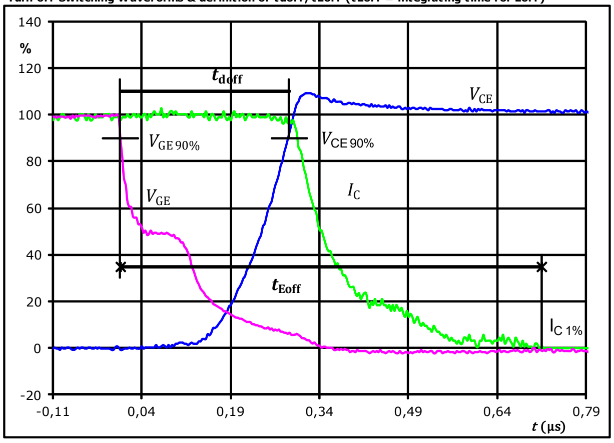
At		
T_j =	175	°C
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Inverter Switching Definitions

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

Figure 1. IGBT

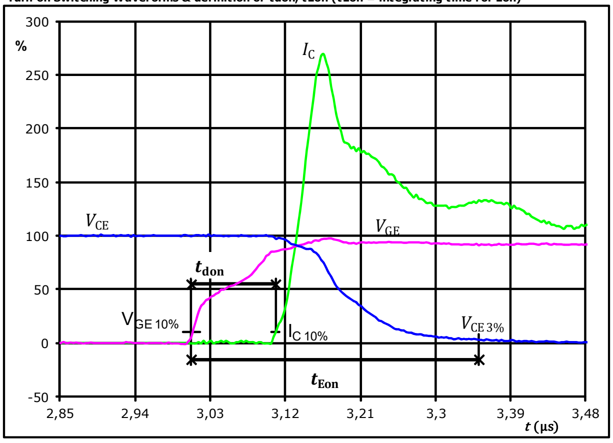
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



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

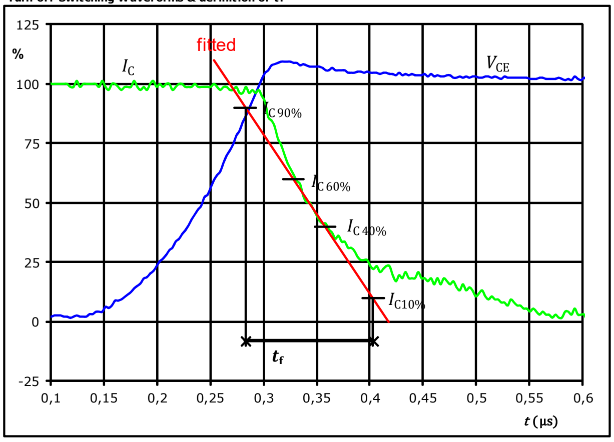
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



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

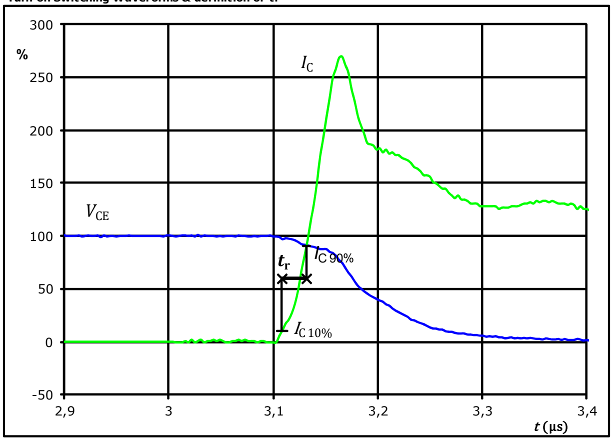
Turn-off Switching Waveforms & definition of tf



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

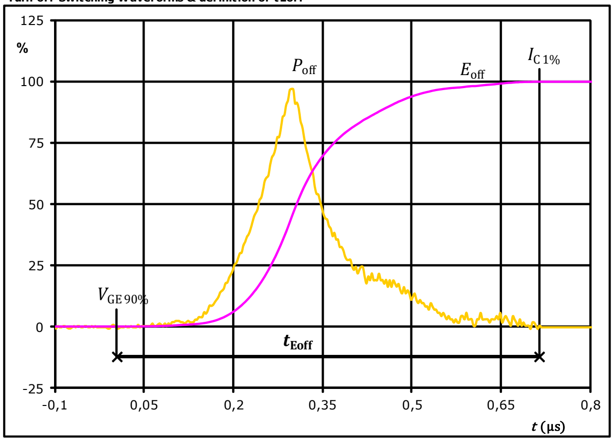


V_C(100%) =	600	V
I_C(100%) =	50	A
t_r =	0,024	µs

Inverter Switching Definitions

Figure 5. IGBT

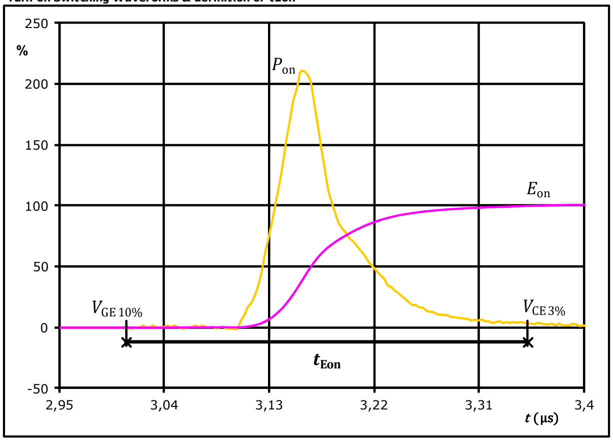
Turn-off Switching Waveforms & definition of tEoff



P_{off} (100%) =	30,10	kW
E_{off} (100%) =	4,53	mJ
t_{Eoff} =	0,71	µs

Figure 6. IGBT

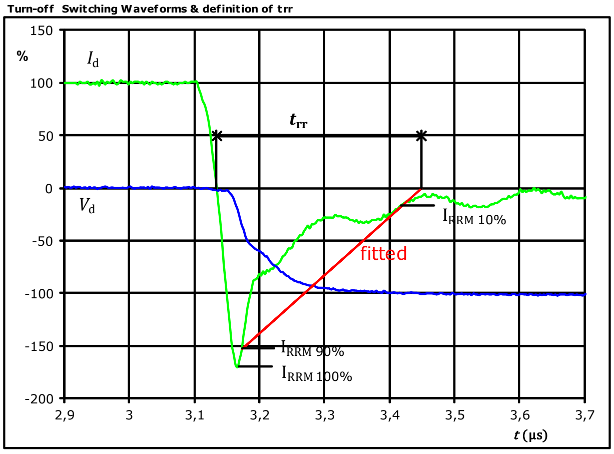
Turn-on Switching Waveforms & definition of tEon



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

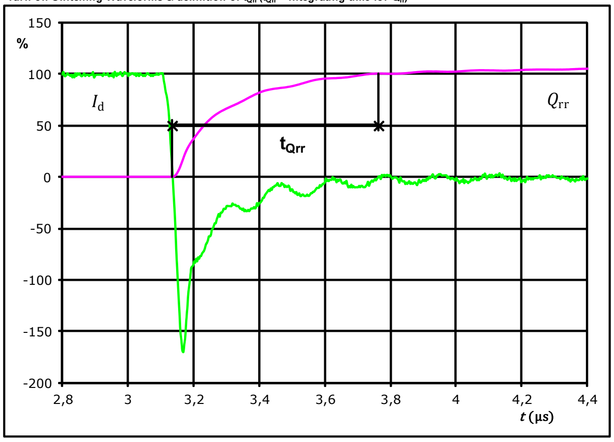


V_d (100%) =	600	V
I_d (100%) =	50	A
I_{RRM} (100%) =	-85	A
t_{rr} =	0,316	µs

Inverter Switching Definitions

Figure 8. **FWD**

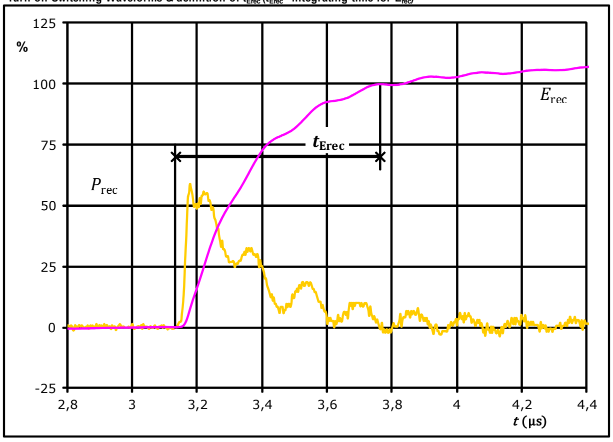
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	50	A
Q_{rr} (100%) =	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
with thermal paste 17mm housing with solder pins	V23990-P829-F-/3/-PM
with thermal paste 17mm housing with Press-fit pins	V23990-P829-FY-/3/-PM
with thermal paste 12mm housing with Press-fit pins	V23990-P829-F08Y-/3/-PM
with thermal paste 12mm housing with solder pins	V23990-P829-F08-/3/-PM
without thermal paste 17mm housing with solder pins	V23990-P829-F-PM
without thermal paste 17mm housing with Press-fit pins	V23990-P829-FY-PM
without thermal paste 12mm housing with Press-fit pins	V23990-P829-F08Y-PM
without thermal paste 12mm housing with solder pins	V23990-P829-F08-PM

Text	**VIN**	**Date code**	**Name&Ver**	**UL**	**Lot**	**Serial**
	VIN	WWYY	NNNNNNNNVV	UL	LLLLL	SSSS
Datamatrix	**Name&Ver**	**Lot number**	**Serial**	**Date code**		
	NNNNNNNNVV	LLLLL	SSSS	WWYY		

Outline

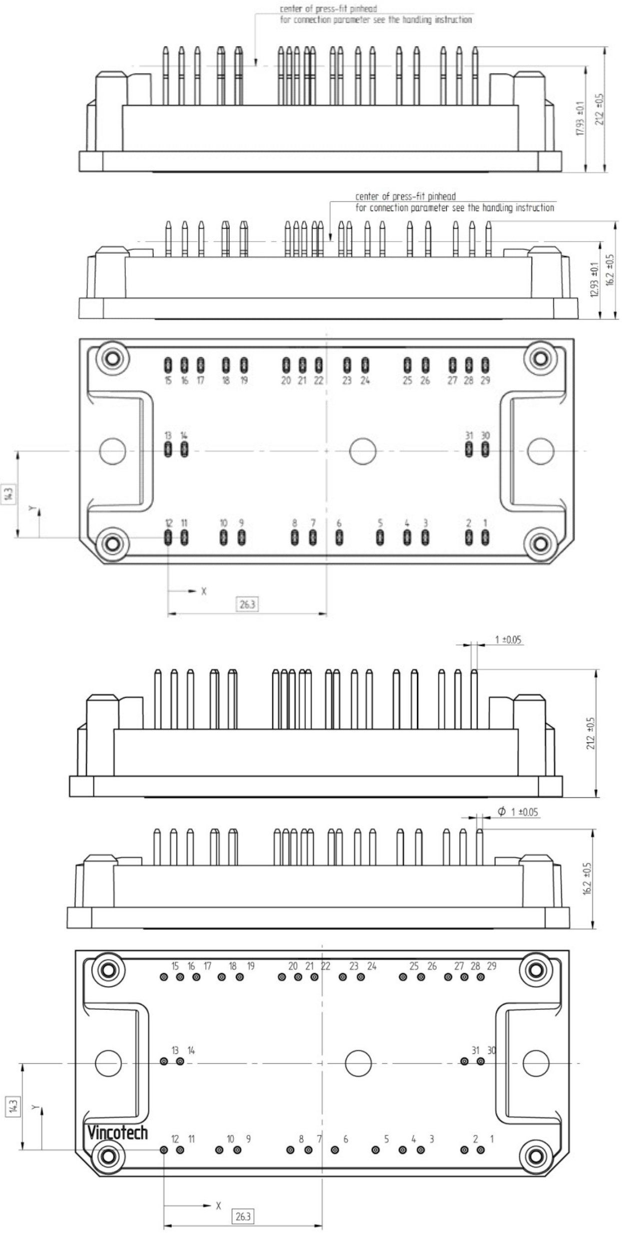
Pin table [mm]			
Pin	X	Y	Function
1	52,6	0	DC-
2	49,9	0	DC-
3	42,65	0	G6
4	39,65	0	S6
5	35,15	0	NTC1
6	28,4	0	NTC2
7	24	0	G4
8	21	0	S4
9	12,2	0	G2
10	9,2	0	S2
11	2,7	0	DC-
12	0	0	DC-
13	0	14,65	DC+
14	2,7	14,65	DC+
15	0	28,6	U
16	2,7	28,6	U
17	5,4	28,6	U
18	9,6	28,6	S1
19	12,6	28,6	G1
20	19,6	28,6	V
21	22,3	28,6	V
22	25	28,6	V
23	29,7	28,6	S3
24	32,7	28,6	G3
25	39,7	28,6	S5
26	42,7	28,6	G5
27	47,2	28,6	W
28	49,9	28,6	W
29	52,6	28,6	W
30	52,6	14,65	DC+
31	49,9	14,65	DC+

17 mm housing Press-fit

12 mm housing Press-fit

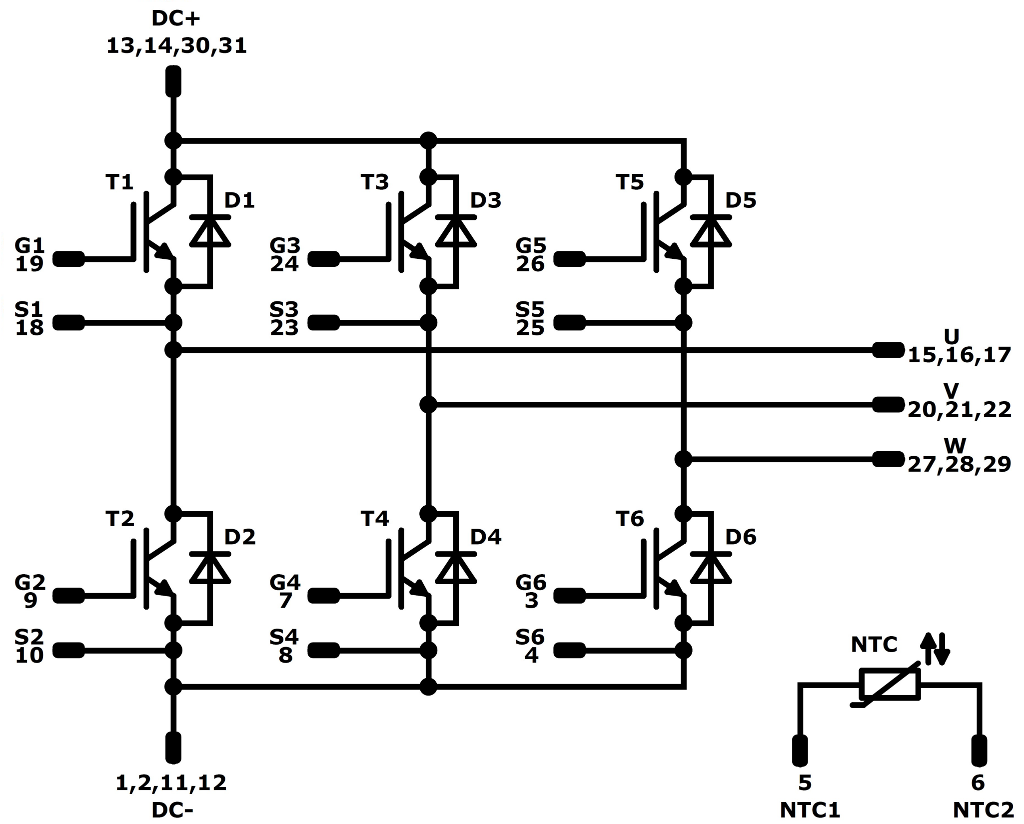
17 mm housing solder pin

12 mm housing solder pin



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
T1,T2,T3,T4,T5,T6	IGBT	1200 V	50 A	Inverter Switch	
D1,D2,D3,D4,D5,D6	FWD	1200 V	50 A	Inverter Diode	
NTC	Thermistor			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
V23990-P829-F08x-D4-14	18 Jul. 2017	V23990-P829-F08-PM version added	all