Vincotech

V23990-P629-F48-PM
datasheet

*flow*PACK 0	1200 V / 40 A

Features

- Low Inductance Layout
- Clip-In PCB mounting

Target applications

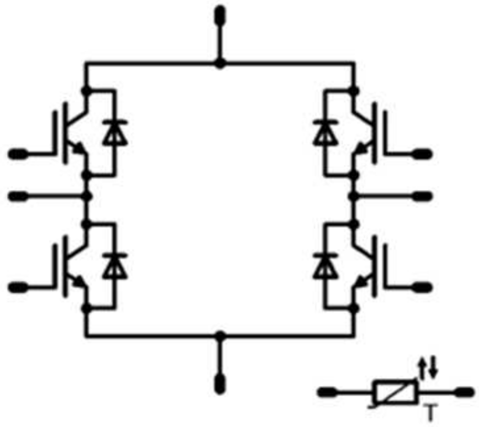
- Solar

Types

- V23990-P629-F48-PM

flow 0 12mm housing

Schematic



Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
H-bridge Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current	I_C	$T_j = T_j$max	T_S=80 °C	43	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_j$max		120	A
Total power dissipation	P_{tot}	$T_j = T_j$max	T_S=80 °C	113	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

Parameter	Symbol	Conditions		Value	Unit
H-bridge Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
Continuous (direct) forward current	I_F	$T_j=T_{jmax}$	T_h=80°C	27	A
Surge (non-repetitive) forward current	I_{FSM}	50Hz Single Half Sine Wave		100	A
Total power dissipation	P_{tot}	$T_j=T_{jmax}$	T_h=80°C	69	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				9,55	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	$V_{GE(th)}$	$V_{GE}=V_{CE}$			0,0015	25 125	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		40	25 125 150	1,78	1,96 2,29 -	2,42	V
Collector-emitter cut-off current	I_{CES}		0	1200		25 125			5	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		2330		pF
Output capacitance	C_{oes}	f=1 MHz	0	25		25		150		pF
Reverse transfer capacitance	C_{res}	f=1 MHz	0	25		25		130		pF
Gate charge	Q_g		15	960	40	25		185		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Phase-Change Material λ=3,4W/mK						0,84		K/W
IGBT Switching										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 8 Ω R_{gon} = 8 Ω	±15	600	40	25 125 150		64 65 66		ns
Rise time	t_r	R_{goff} = 8 Ω R_{gon} = 8 Ω	±15	600	40	25 125 150		15 19 18		ns
Turn-off delay time	$t_{d(off)}$	R_{goff} = 8 Ω R_{gon} = 8 Ω	±15	600	40	25 125 150		162 216 230		ns
Fall time	t_f		±15	600	40	25 125 150		26 63 70		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 2,7 µC Q_{rFWD} = 4,8 µC Q_{rFWD} = 5,8 µC	±15	600	40	25 125 150		1,542 2,194 2,410		mWs
Turn-off energy (per pulse)	E_{off}		±15	600	40	25 125 150		1,321 2,287 2,529		mWs

H-bridge Diode

Parameter	Symbol	Conditions					Value			Unit
				V_r [V]	I_F [A]	T_j [°C]	Min	Typ	Max	
Static										
Forward voltage	V_F				25	25 125 150		2,47 - 2,49	2,74	V
Reverse leakage current	I_r			1200		25 150			60 -	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Phase-Change Material λ=3,4W/mK						1,38		K/W
FWD Switching										
Peak recovery current	I_{RRM}	di/dt = 3019 A/µs di/dt = 3104 A/µs di/dt = 2972 A/µs	±15	600	40	25 125 150		48 55 60		A
Reverse recovery time	t_{rr}					25 125 150		101 222 251		ns
Recovered charge	Q_r					25 125 150		2,701 4,784 5,825		µC
Reverse recovered energy	E_{rec}					25 125 150		1,132 2,113 2,604		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		3780 2583 2658		A/µs

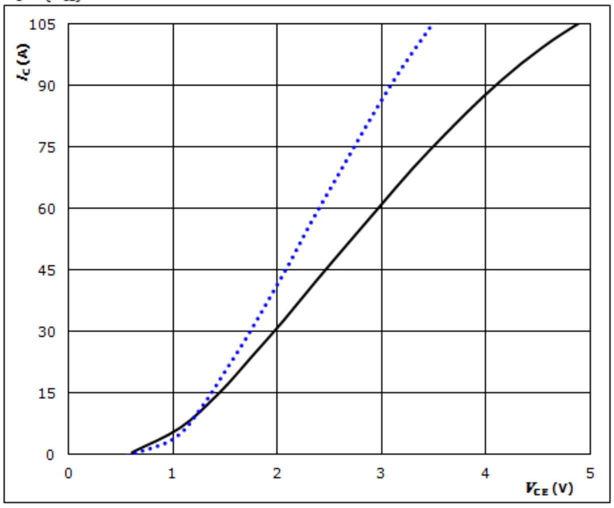
Thermistor

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

$I_C = f(V_{CE})$

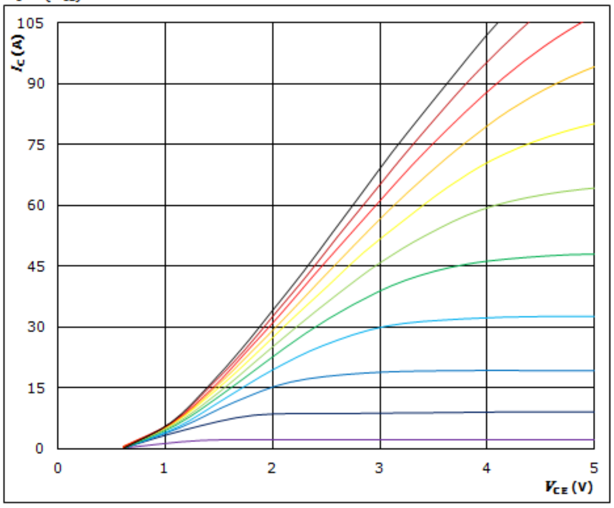


t_p = 250 µs
V_{GE} = 15 V

25 °C
125 °C
150 °C

Typical output characteristics IGBT

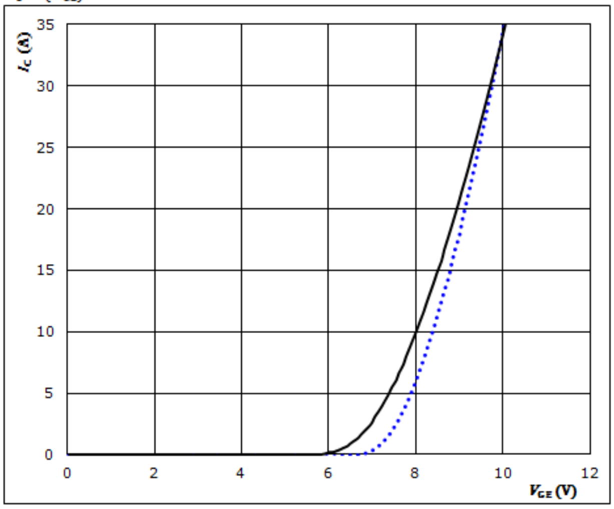
$I_C = f(V_{CE})$



t_p = 250 µs
T_j = 125 °C
V_{GE} from 7 V to 17 V in steps of 1 V

Typical transfer characteristics IGBT

$I_C = f(V_{GE})$

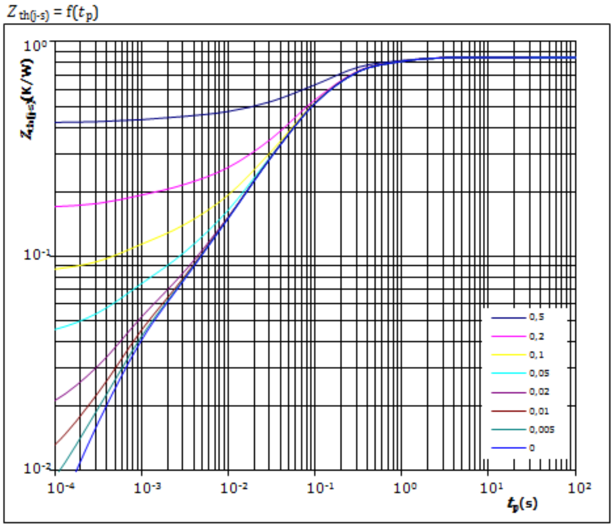


t_p = 100 µs
V_{CE} = 10 V

25 °C
125 °C
150 °C

Transient Thermal Impedance as function of Pulse duration IGBT

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



D = t_p / T
$R_{th(j\text{-}s)}$ = 0,84 K/W

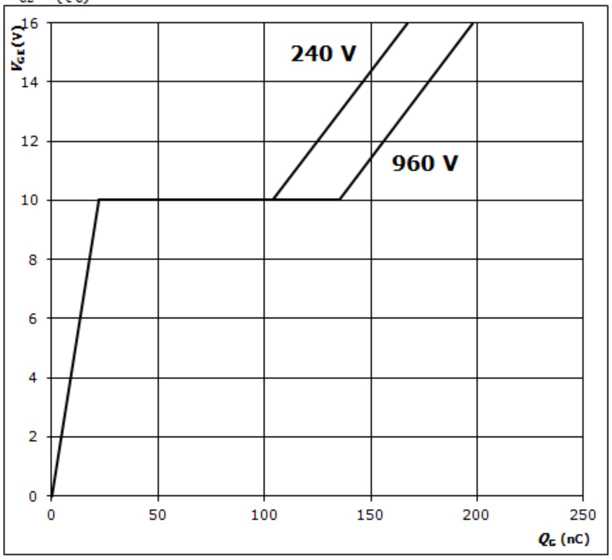
IGBT thermal model values

R_{th} (K/W)	τ (s)
1,18E-01	8,20E-01
4,24E-01	1,32E-01
2,01E-01	4,79E-02
6,46E-02	9,26E-03
3,72E-02	8,03E-04

H-bridge Switch Characteristics

Gate voltage vs Gate charge **IGBT**

$V_{GE} = f(Q_G)$



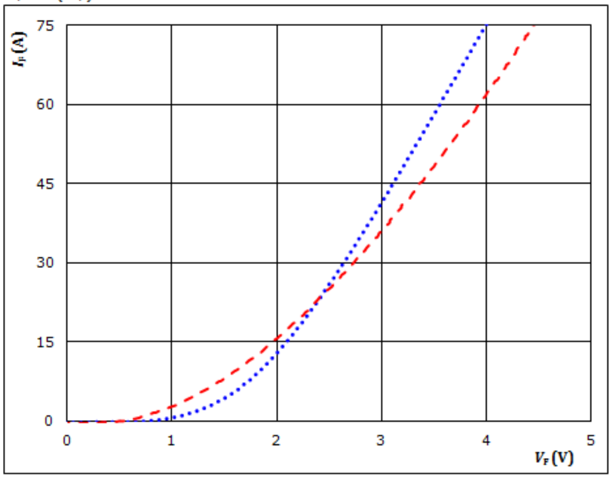
At

I_C= 40 A

H-bridge diode Characteristics

Typical forward characteristics FWD

$I_F = f(V_F)$

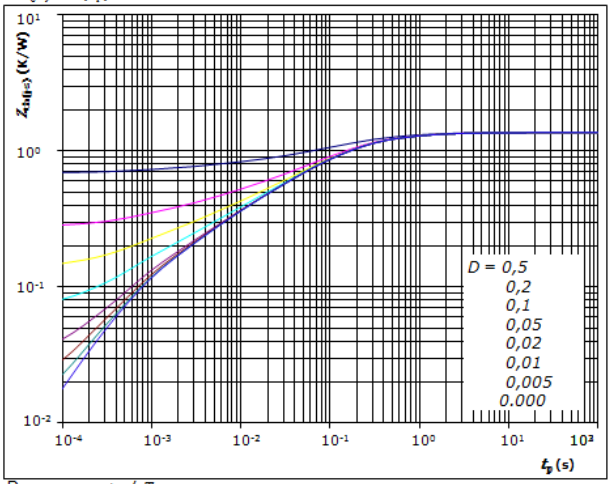


t_p = 250 μs

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

$R_{th(j-s)}$ = 1,38 K/W

FWD thermal model values

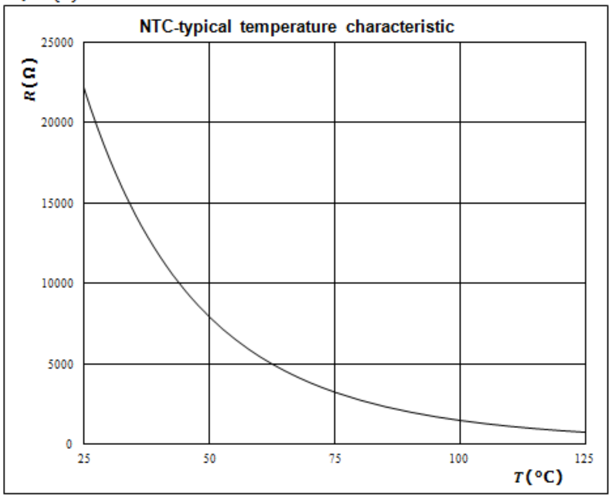
R (K/W)	τ (s)
2,65E-02	9,28E+00
2,03E-01	7,62E-01
5,75E-01	1,47E-01
3,32E-01	2,99E-02
1,56E-01	4,40E-03
8,92E-02	6,49E-04

Thermistor

Thermistor typical temperature characteristic

Typical NTC characteristic as a function of temperature

$R_T = f(T)$

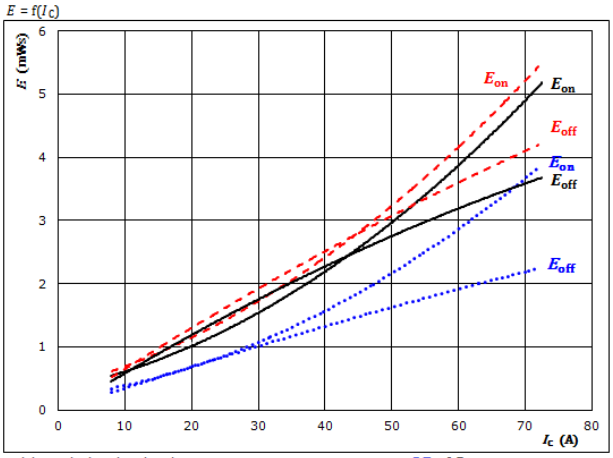


H-bridge switching Characteristics

Figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



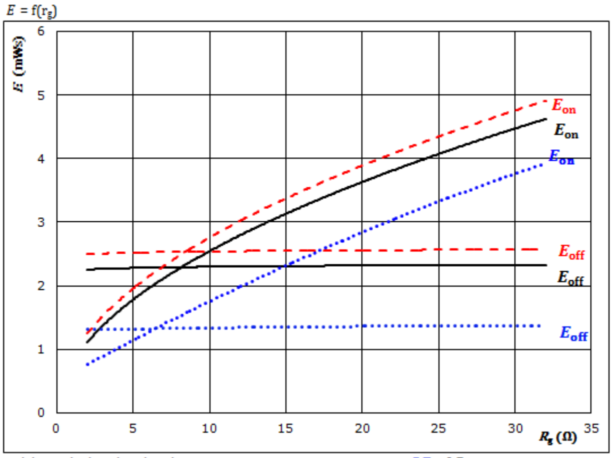
With an inductive load at

V_{CE} =	600	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

$E = f(R_g)$



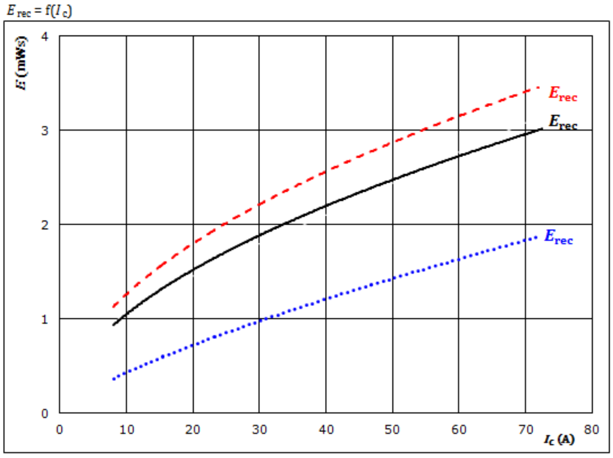
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	···········
V_{GE} =	±15	V		125 °C	———
I_C =	40	A		150 °C	– – –

Figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



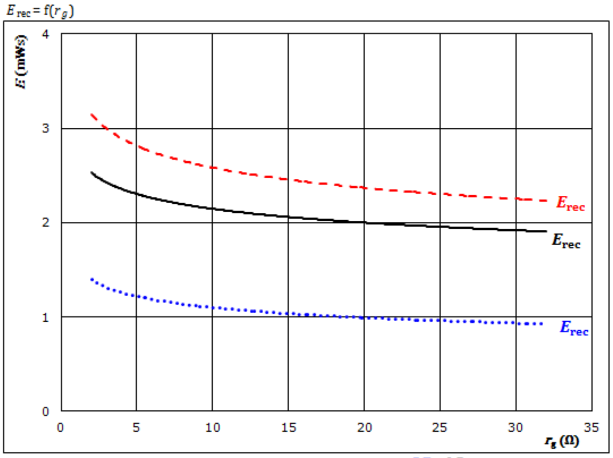
With an inductive load at

V_{CE} =	600	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

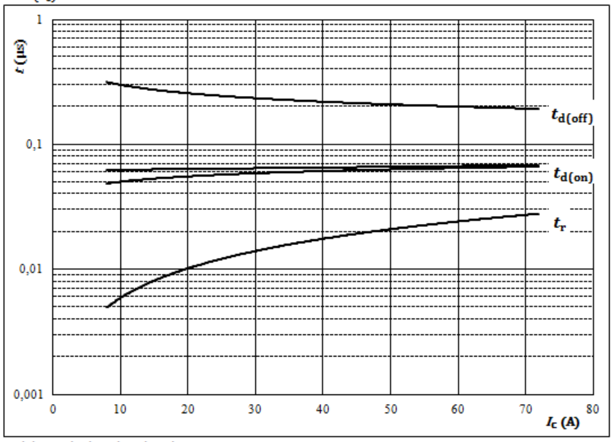
V_{CE} =	600	V	T_j:	25 °C	···········
V_{GE} =	±15	V		125 °C	———
I_C =	40	A		150 °C	– – –

H-bridge switching Characteristics

Figure 5. IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



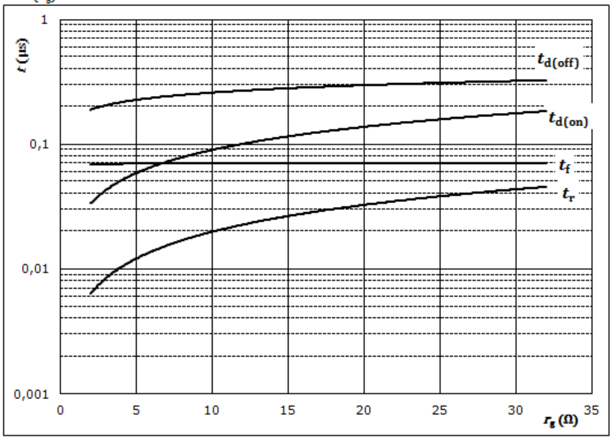
With an inductive load at

T_j =	150	°C
V_{CE} =	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

$t = f(r_g)$



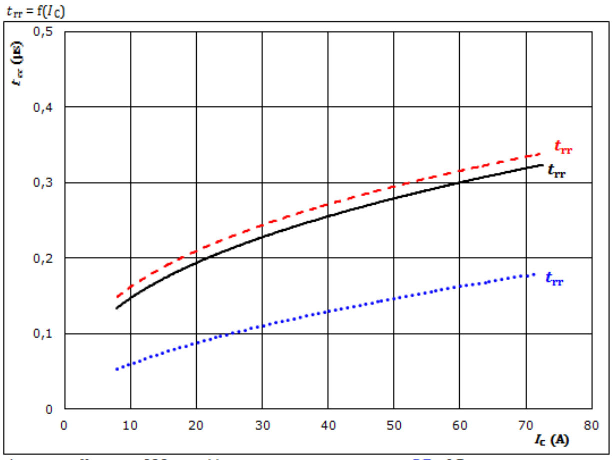
With an inductive load at

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

Figure 7. FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

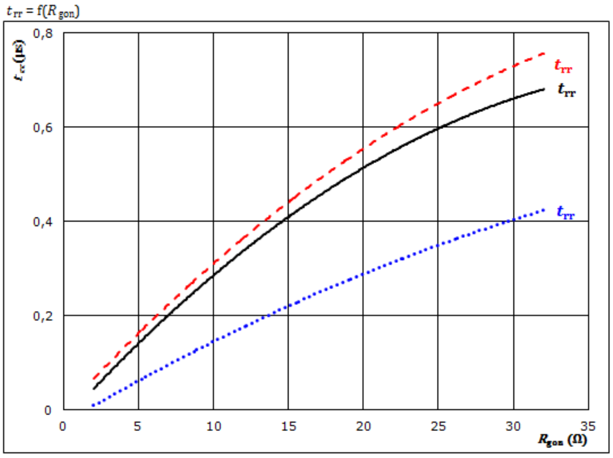


At						
V_{CE}=	600	V		25	°C	··········
V_{GE} =	±15	V	T_j:	125	°C	———
R_{gon} =	8	Ω		150	°C	– – –

Figure 8. FWD

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

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



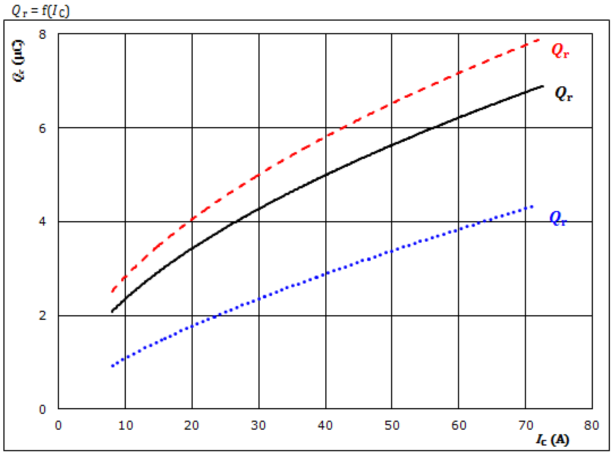
At						
V_{CE} =	600	V		25	°C	··········
V_{GE} =	±15	V	T_j:	125	°C	———
I_C =	40	A		150	°C	– – –

H-bridge switching Characteristics

Figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

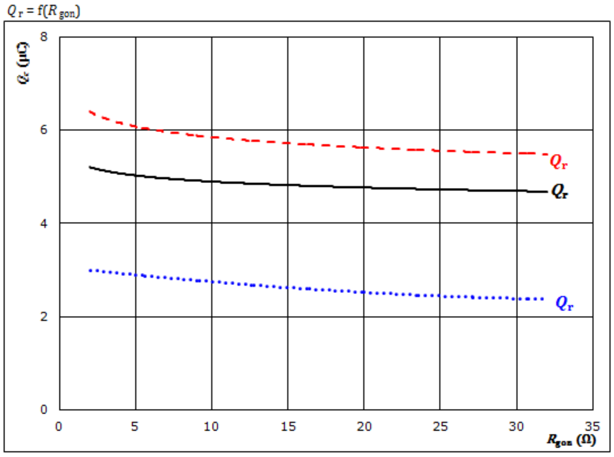


At						
	V_{CE} =	600	V		25 °C	············
	V_{GE} =	±15	V	T_j:	125 °C	———
	R_{gon} =	8	Ω		150 °C	– – – –

Figure 10. **FWD**

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

$Q_r = f(R_{gon})$

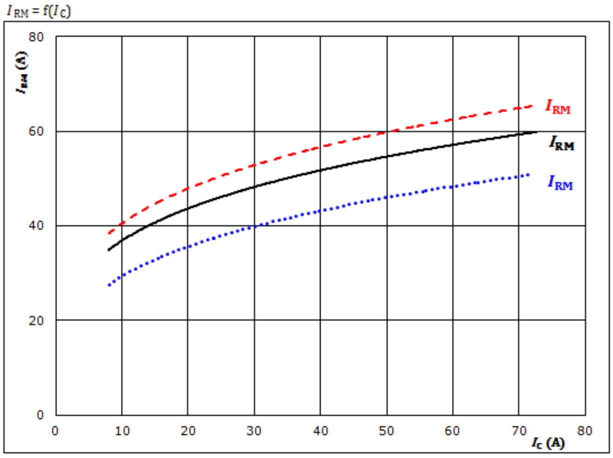


At						
	V_{CE}=	600	V		25 °C	············
	V_{GE} =	±15	V	T_j:	125 °C	———
	I_C=	40	A		150 °C	– – – –

Figure 11. **FWD**

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

$I_{RM} = f(I_C)$

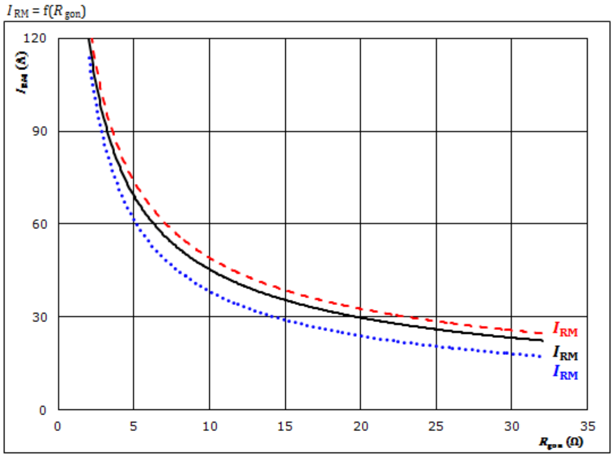


At						
	V_{CE}	600	V		25 °C	············
	V_{GE} =	±15	V	T_j:	125 °C	———
	R_{gon} =	8	Ω		150 °C	– – – –

Figure 12. **FWD**

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

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



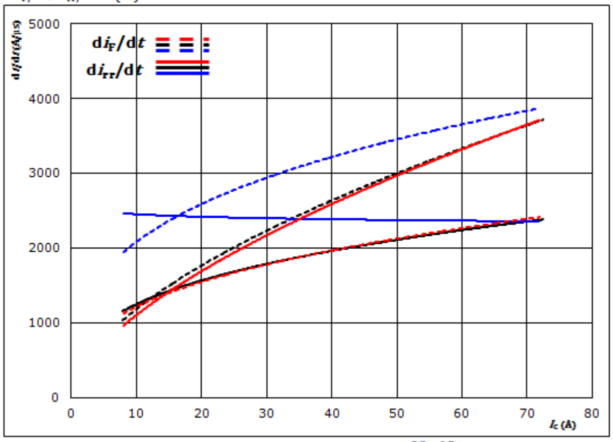
At						
	V_{CE} =	600	V		25 °C	············
	V_{GE} =	±15	V	T_j:	125 °C	———
	I_C=	40	A		150 °C	– – – –

H-bridge switching Characteristics

Figure 13. **FWD**

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

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



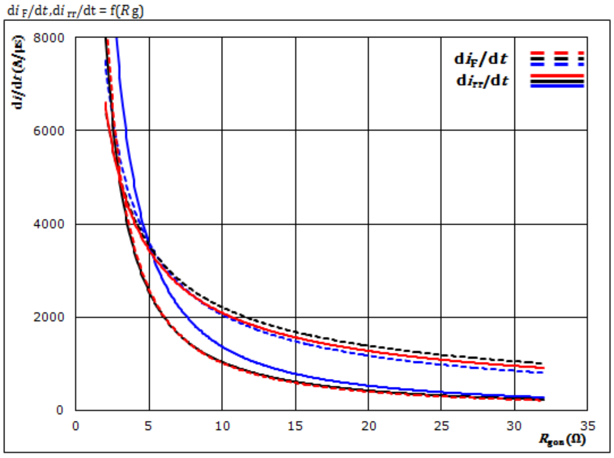
At

V_{CE}	600	V		25	°C	···········
V_{GE} =	±15	V	T_j:	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

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



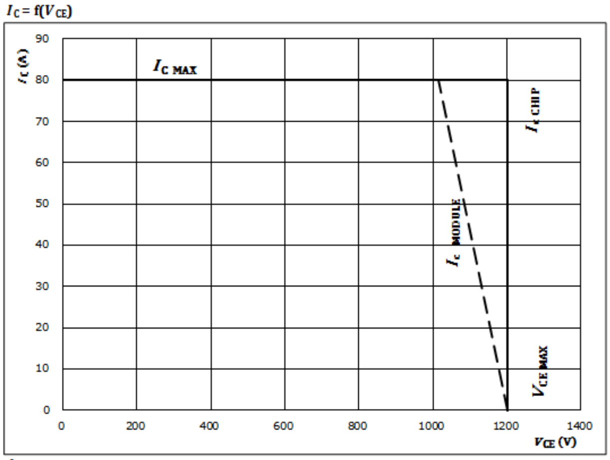
At

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	40	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

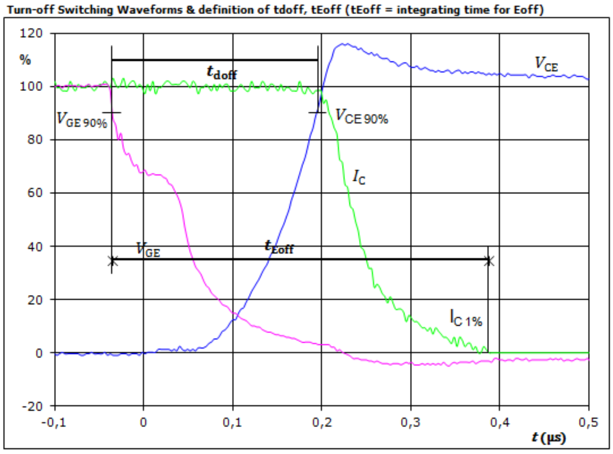
Switching Definitions

General conditions

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

Figure 1. IGBT

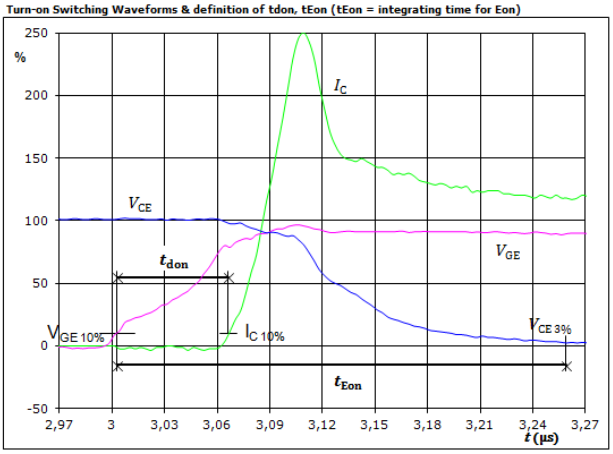
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	40	A
t_{doff} =	0,230	µs
t_{Eoff} =	0,423	µs

Figure 2. IGBT

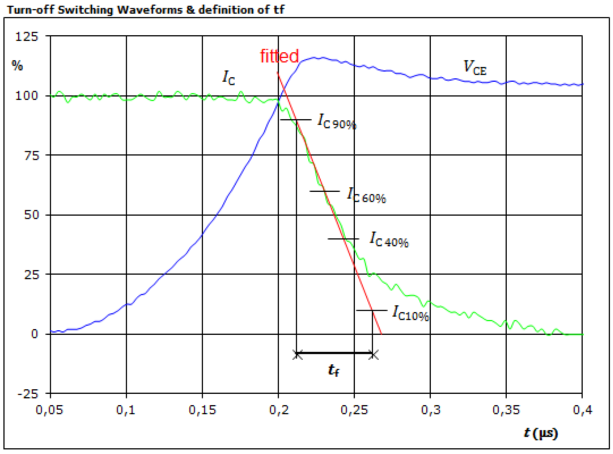
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	40	A
t_{don} =	0,066	µs
t_{Eon} =	0,256	µs

Figure 3. IGBT

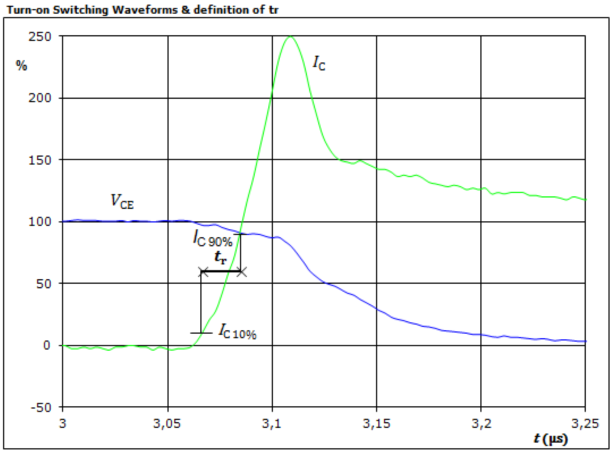
Turn-off Switching Waveforms & definition of tf



V_C (100%) =	600	V
I_C (100%) =	40	A
t_f =	0,070	µs

Figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

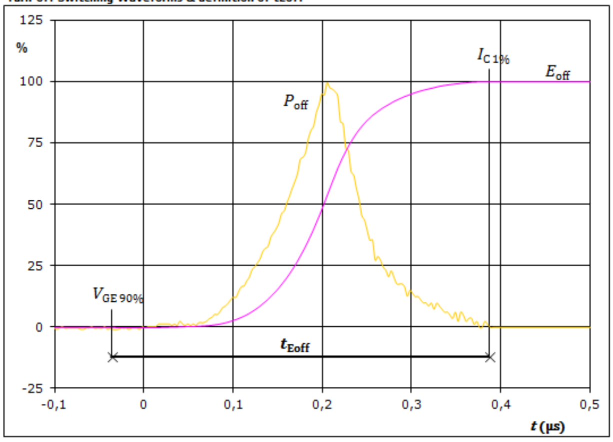


V_C (100%) =	600	V
I_C (100%) =	40	A
t_r =	0,018	µs

Switching Definitions

Figure 5. **IGBT**

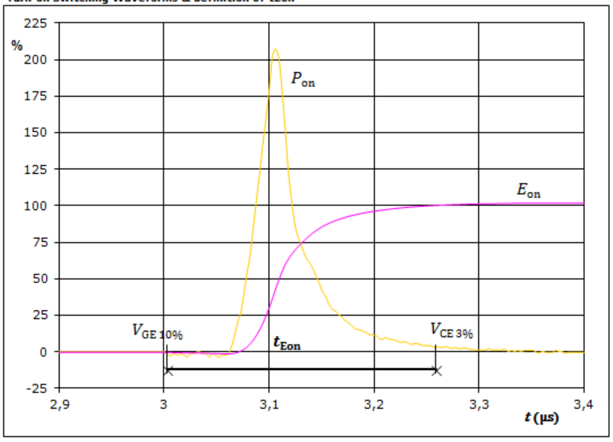
Turn-off Switching Waveforms & definition of tEoff



P_{off} (100%) =	24,01	kW
E_{off} (100%) =	2,53	mJ
t_{Eoff} =	0,42	µs

Figure 6. **IGBT**

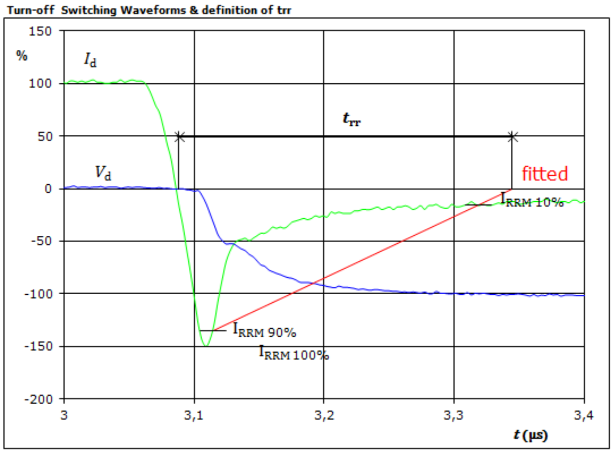
Turn-on Switching Waveforms & definition of tEon



P_{on} (100%) =	24,01	kW
E_{on} (100%) =	2,41	mJ
t_{Eon} =	0,26	µs

Figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr



V_d (100%) =	600	V
I_d (100%) =	40	A
I_{RRM} (100%) =	-60	A
t_{rr} =	0,251	µs

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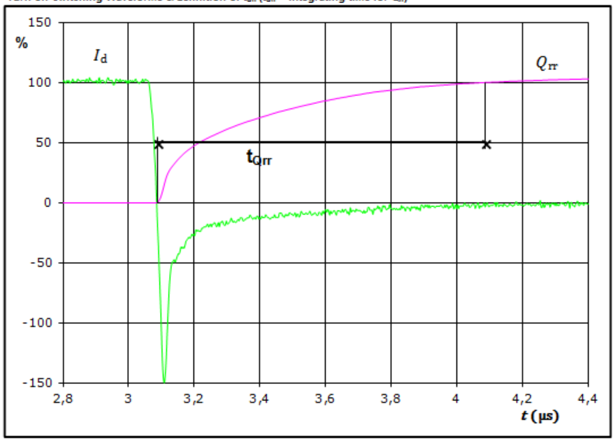
datasheet

Switching Definitions

Figure 8. **FWD**

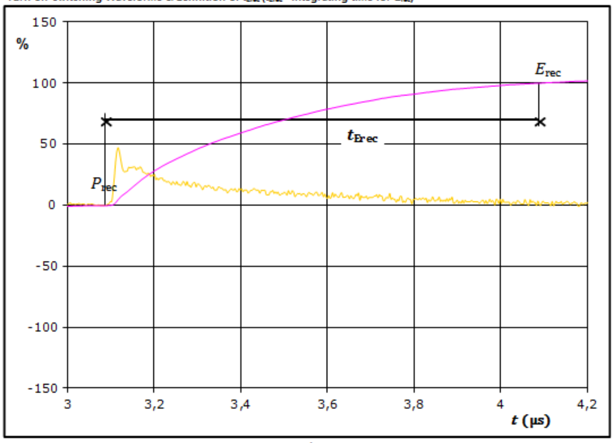
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	40	A
Q_{rr} (100%) =	5,83	µC
t_{Qrr} =	1,00	µs

Figure 9. **FWD**

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



P_{rec} (100%) =	24,01	kW
E_{rec} (100%) =	2,60	mJ
t_{Erec} =	1,00	µs

Ordering Code & Marking

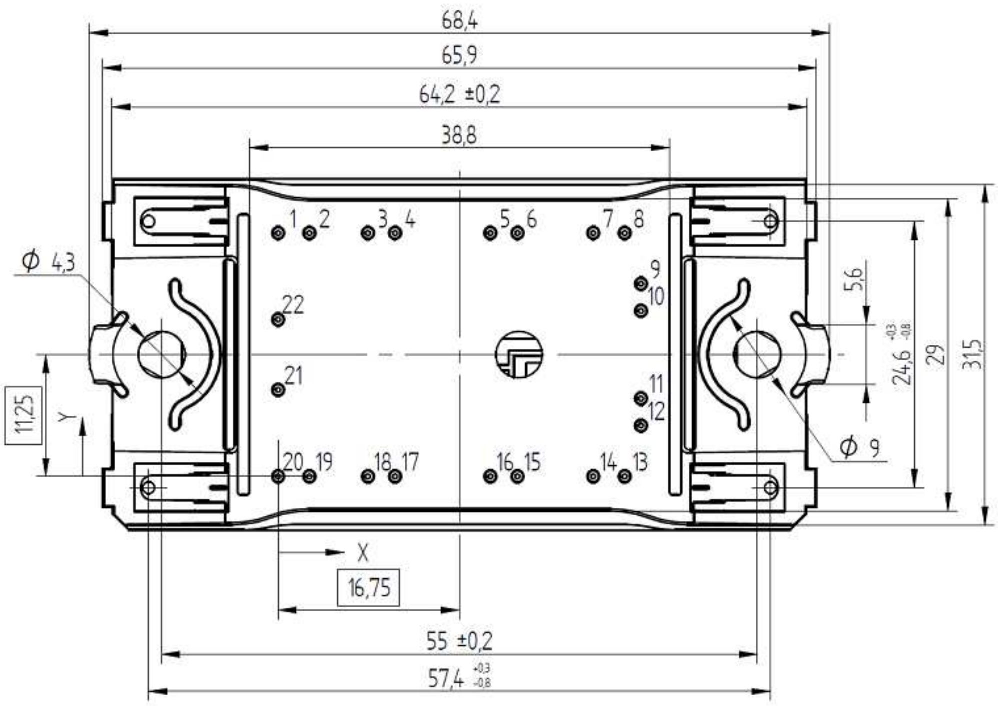
Version	Ordering Code	in DataMatrix as	in packaging barcode as
with thermal paste PCM 12mm housing	V23990-P629-F48-/3/-PM	P629F48	P629F48-/3/
without thermal paste PCM 12mm housing	V23990-P629-F48-PM	P629F48	P629F48

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

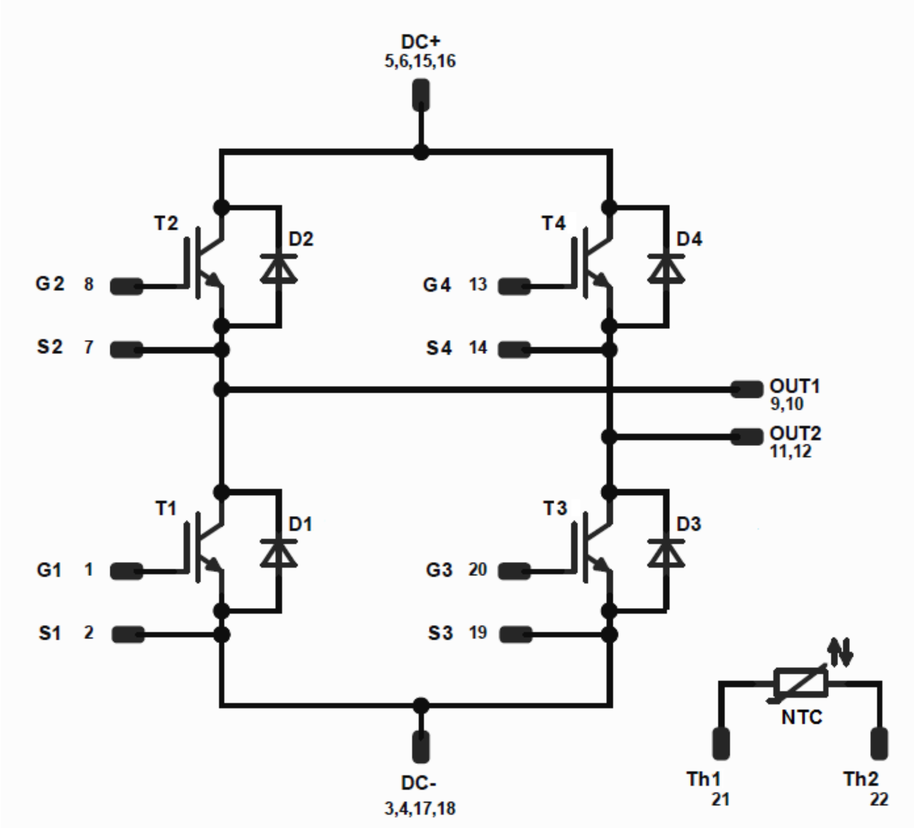
Outline

Pin table [mm]

Pin	X	Y	Function
1	0	22,5	G1
2	2,9	22,5	S1
3	8,3	22,5	DC-
4	10,8	22,5	DC-
5	19,6	22,5	DC+
6	22,1	22,5	DC+
7	29,1	22,5	S2
8	32	22,5	G2
9	33,5	17,5	OUT1
10	33,5	15,3	OUT1
11	33,5	7,2	OUT2
12	33,5	4,7	OUT2
13	32	0	G4
14	29,1	0	S4
15	22,1	0	DC+
16	19,6	0	DC+
17	10,8	0	DC-
18	8,3	0	DC-
19	2,9	0	S3
20	0	0	G3
21	0	8	Th1
22	0	14,5	Th2



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1,T2,T3,T4	IGBT	1200V	40A	H-bridge Switch	
D1,D2,D3,D4	FWD	1200V	25A	H-bridge Diode	
NTC	NTC	-	-	Thermistor	

Packaging instruction					
Standard packaging quantity (SPQ)	135	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 0 packages see vincotech.com website.

Document No.:	Date:	Modification:	Pages
V23990-P629-F48-D1-14	15 Apr. 2015		