V23990-P624-F24-PM
datasheet

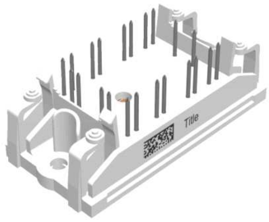
Vincotech

fast PACK 0 H 2nd gen — **600 V / 75 A**

Features

- Low inductive design
- Clip-in PCB mounting
- High-efficiency IGBT3
- fsw<30kHz

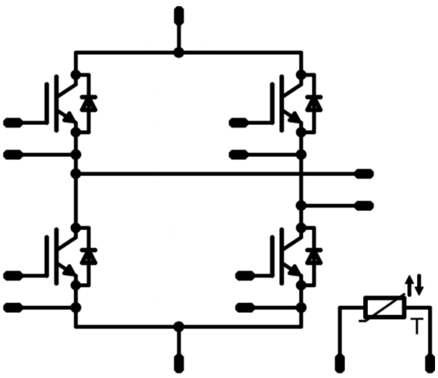
flow 0 17mm housing



Target applications

- Distributed Power Generation
- Welding

Schematic



Types

- V23990-P624-F24

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Switch					
Collector-emitter voltage	V_{CES}			600	V
Collector current	I_C	$T_j = T_j$max	T_S=80 °C	61	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_j$max		225	A
Total power dissipation	P_{tot}	$T_j = T_j$max	T_S=80 °C	96	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC}	T_j ≤ 125°C V_{GE} = 15V V_{CC} = 360 V		6	µs
Maximum Junction Temperature	T_{jmax}			175	°C

Parameter	Symbol	Conditions		Value	Unit
Inverter Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_h = 80°C	50	A
Repetitive peak forward current	I_{FRM}			150	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_h = 80°C	74	W
Maximum Junction Temperature	T_{jmax}			175	°C

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

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
Inverter Switch			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}			0,0012	25 125	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		75	25 125	1,05	1,50 1,67	1,85	V
Collector-emitter cut-off current	I_{CES}		0	600		25 125			3,8	μA
Gate-emitter leakage current	I_{GES}		20	0		25 125			600	nA
Internal gate resistance	r_g							4		Ω
Input capacitance	C_{ies}	f=1 MHz	0	25		25		4700		pF
Output capacitance	C_{oes}							300		
Reverse transfer capacitance	C_{res}							145		
Gate charge	Q_g		15	300	75	25		723		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						0,99		K/W

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V]	V_r [V] or V_{CE} [V]	I_C [A] or I_F [A] or I_D [A]	T_j[°C]	Min	Typ	Max	
IGBT Switching										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 4 Ω R_{gon} = 4 Ω	±15	300	75	25 125		158 167		ns
Rise time	t_r					25 125		19 24		
Turn-off delay time	$t_{d(off)}$					25 125		229 258		
Fall time	t_f					25 125		60 75		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 3,5 μC Q_{rFWD} = 6,1 μC				25 125		0,863 1,280		mWs
Turn-off energy (per pulse)	E_{off}					25 125		1,696 2,138		

Parameter	Symbol	Conditions					Value			Unit
Inverter Diode				V_r [V]	I_F [A]	T_j [°C]	Min	Typ	Max	
Static										
Forward voltage	V_F				75	25 125		1,76 1,81	1,9	V
Reverse leakage current	I_r			600		25			27	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j\text{-}s)}$	Thermal grease thickness≤50um λ = 1 W/mK						1,28		K/W
FWD Switching										
Peak recovery current	I_{RRM}	di/dt = 3753 A/µs di/dt = 4179 A/µs	±15	300	75	25 125		83 95		A
Reverse recovery time	t_{rr}					25 125		45 163		ns
Recovered charge	Q_r					25 125		3,490 6,130		µC
Reverse recovered energy	E_{rec}					25 125		0,772 1,392		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		4493 4016		A/µs

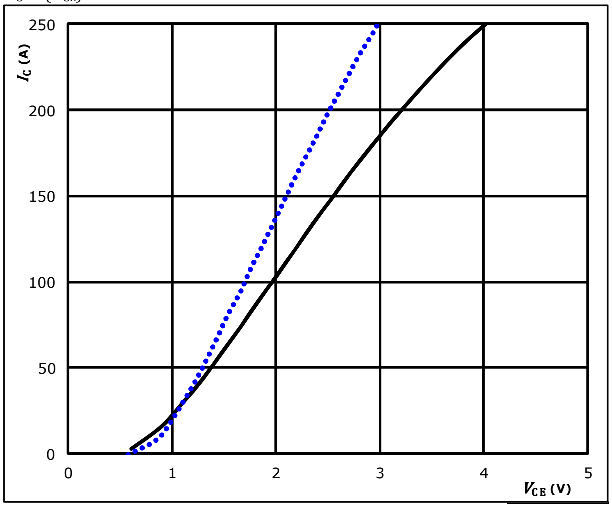
Thermistor

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	
Rated resistance	R					25		21,5		kΩ
Deviation of R100	$\Delta_{R/R}$	R100=1486 Ω				100	-4,5		+4,5	%
Power dissipation	P					25		210		mW
Power dissipation constant						25		3,5		mW/K
B-value	$B_{(25/50)}$					25		3884		K
B-value	$B_{(25/100)}$					25		3964		K
Vincotech NTC Reference									F	

Inverter Switch Characteristics

Typical output characteristics **IGBT**

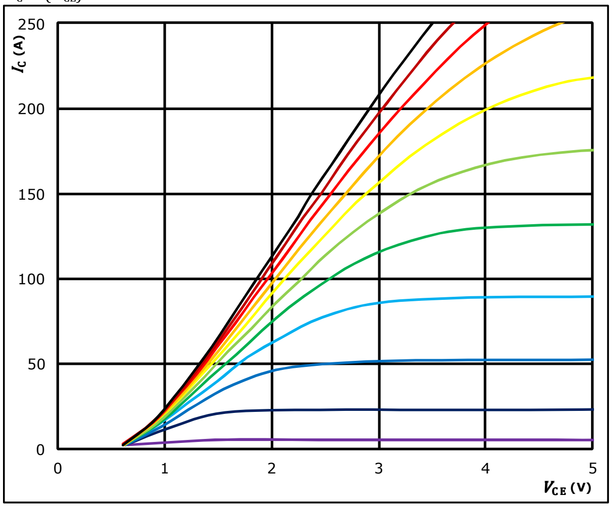
$I_C = f(V_{CE})$



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

Typical output characteristics **IGBT**

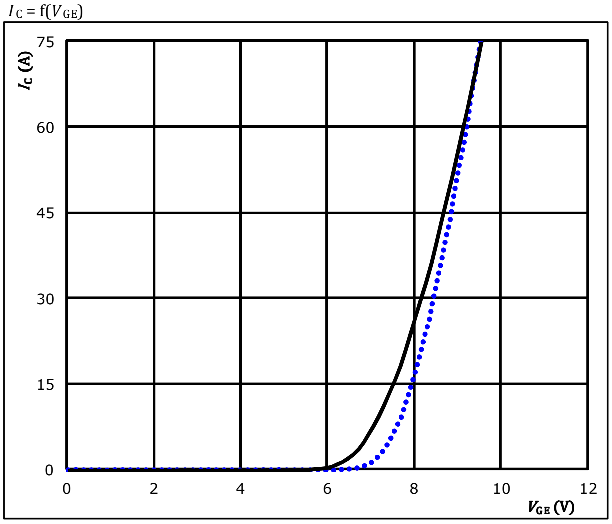
$I_C = f(V_{CE})$



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

Typical transfer characteristics **IGBT**

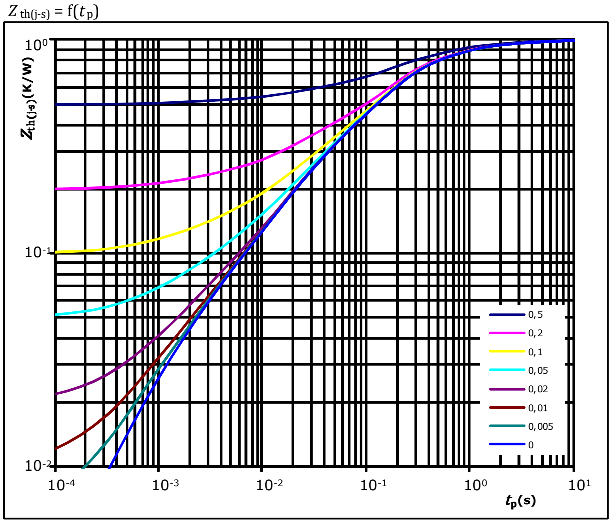
$I_C = f(V_{GE})$



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

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

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 0,99 K/W

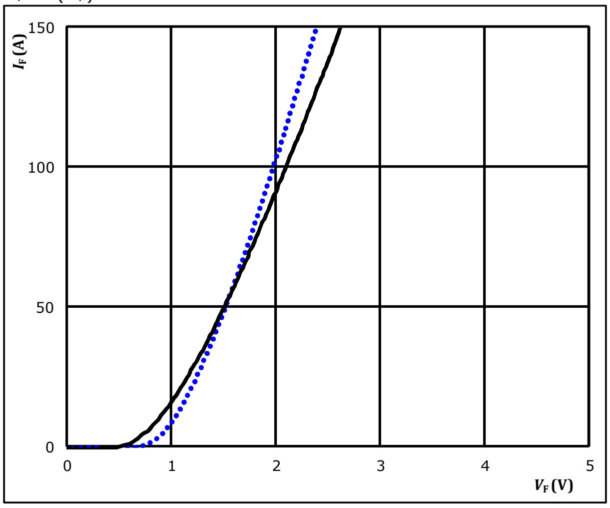
IGBT thermal model values

R_{th} (K/W)	τ (s)
6,02E-02	4,46E+00
2,45E-01	7,01E-01
5,22E-01	1,58E-01
1,40E-01	1,76E-02
3,02E-02	1,52E-03

Inverter Diode Characteristics

Typical forward characteristics	FWD

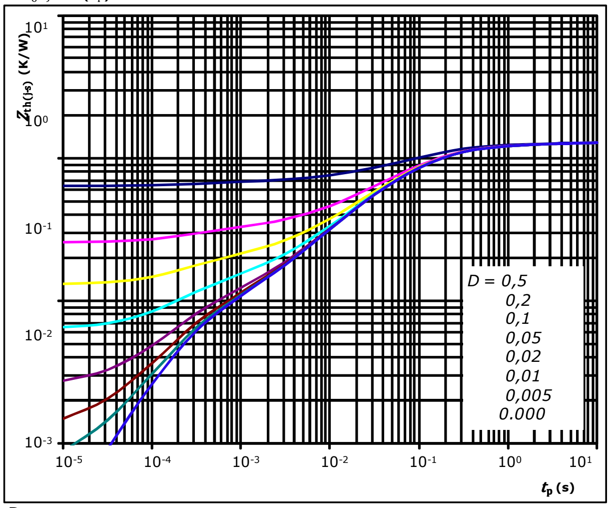
$I_F = f(V_F)$



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 = t_p / T

$R_{th(j-s)}$ = 1,28 K/W

FWD thermal model values

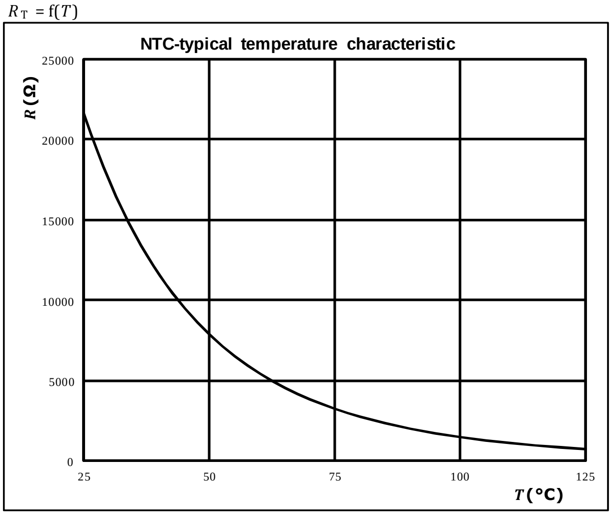
R (K/W)	τ (s)
7,35E-02	3,03E+00
2,05E-01	4,11E-01
6,11E-01	8,86E-02
2,71E-01	1,65E-02
5,78E-02	2,47E-03
6,79E-02	2,61E-04

Thermistor Characteristics

Thermistor typical temperature characteristic

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$

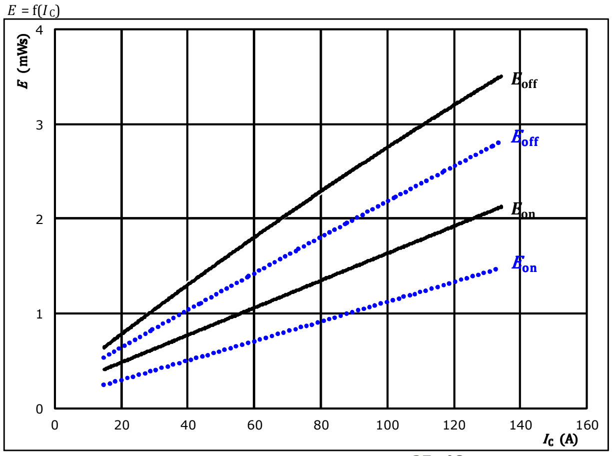


Inverter Switching Characteristics

Figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



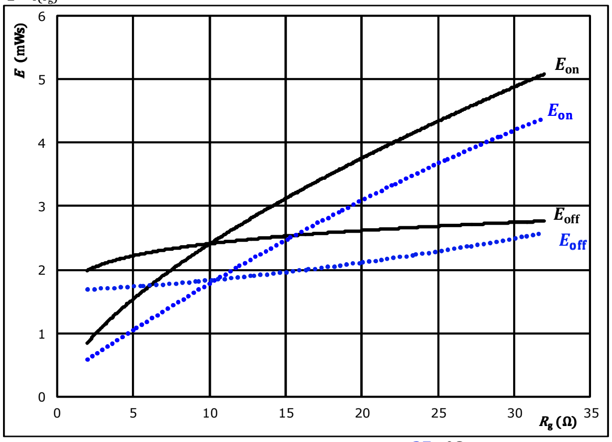
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	··········
V_{GE} =	±15	V		125 °C	———
R_{gon} =	4	Ω		150 °C	– – – –
R_{goff} =	4	Ω			

Figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(r_g)$



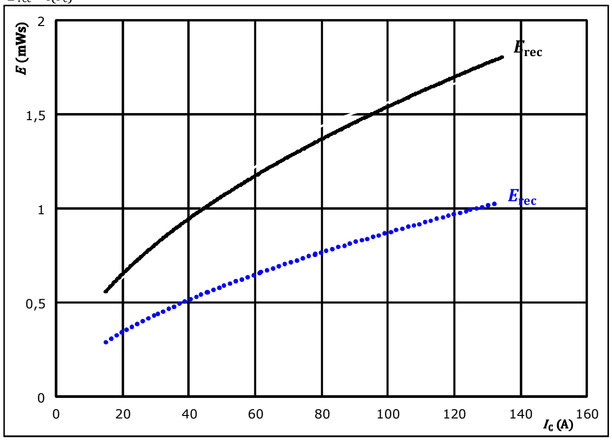
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	··········
V_{GE} =	±15	V		125 °C	———
I_C =	75	A		150 °C	– – – –

Figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_c)$



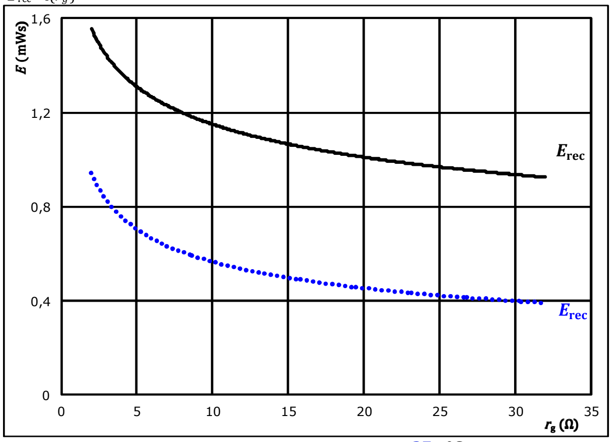
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	··········
V_{GE} =	±15	V		125 °C	———
R_{gon} =	4	Ω		150 °C	– – – –

Figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(r_g)$

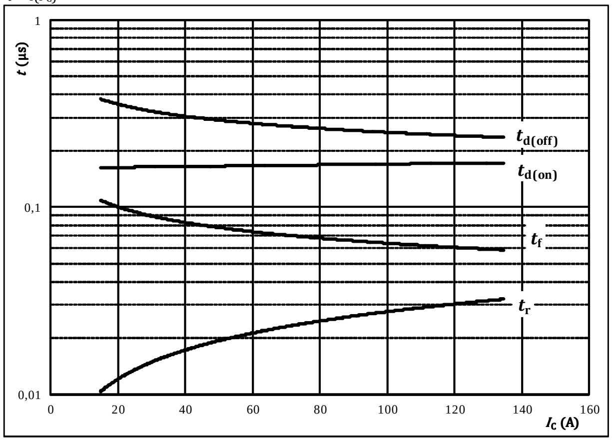


With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	··········
V_{GE} =	±15	V		125 °C	———
I_C =	75	A		150 °C	– – – –

Inverter Switching Characteristics

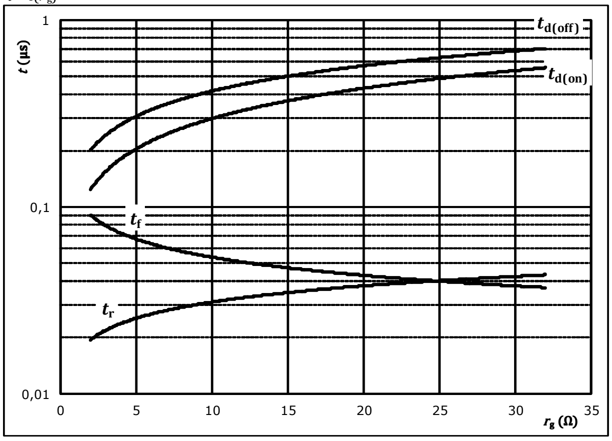
Figure 5. **IGBT**
Typical switching times as a function of collector current
$t = f(I_C)$



With an inductive load at

T_j =	125	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

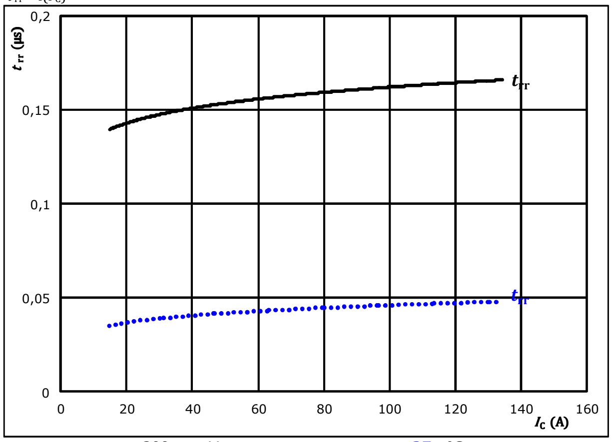
Figure 6. **IGBT**
Typical switching times as a function of gate resistor
$t = f(r_g)$



With an inductive load at

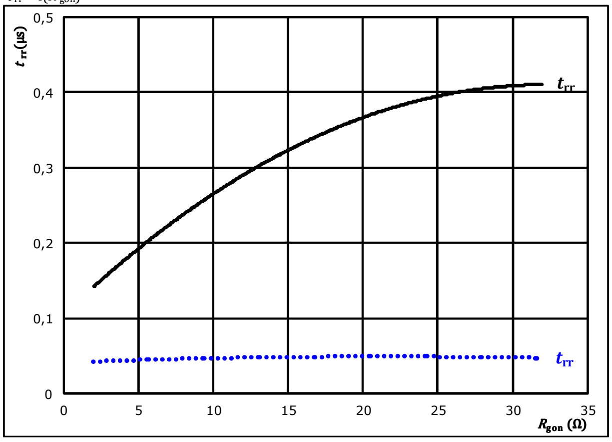
T_j =	125	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	75	A

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} =	4	Ω		150 °C – – – –

Figure 8. **FWD**
Typical reverse recovery time as a function of IGBT turn on gate resistor
$t_{rr} = f(R_{gon})$



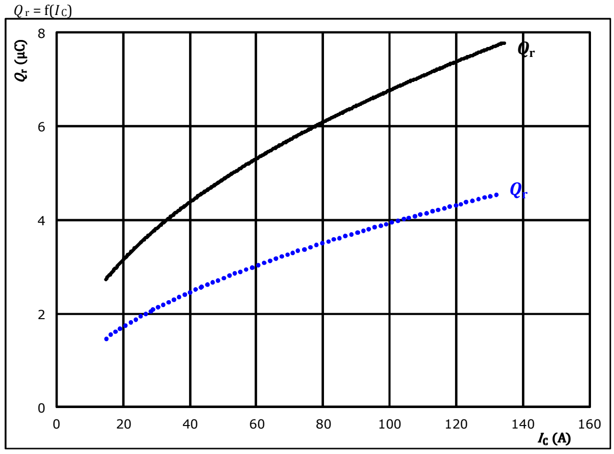
At V_{CE} =	300	V		25 °C ···········
V_{GE} =	±15	V	T_j:	125 °C ———
I_C =	75	A		150 °C – – – –

Inverter Switching Characteristics

Figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

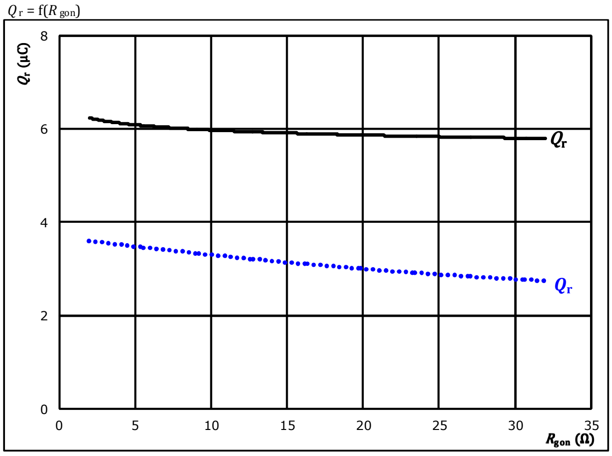


At					
V_{CE} =	300	V		25 °C	···············
V_{GE} =	±15	V	T_j:	125 °C	———
R_{gon} =	4	Ω		150 °C	– – – –

Figure 10. **FWD**

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

$Q_r = f(R_{gon})$

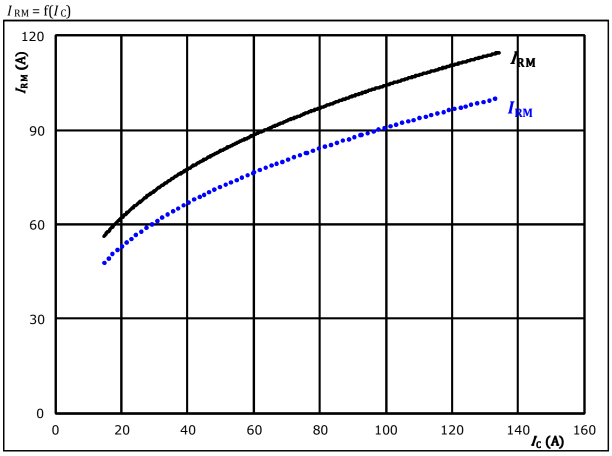


At					
V_{CE}=	300	V		25 °C	···············
V_{GE} =	±15	V	T_j:	125 °C	———
I_C=	75	A		150 °C	– – – –

Figure 11. **FWD**

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

$I_{RM} = f(I_C)$

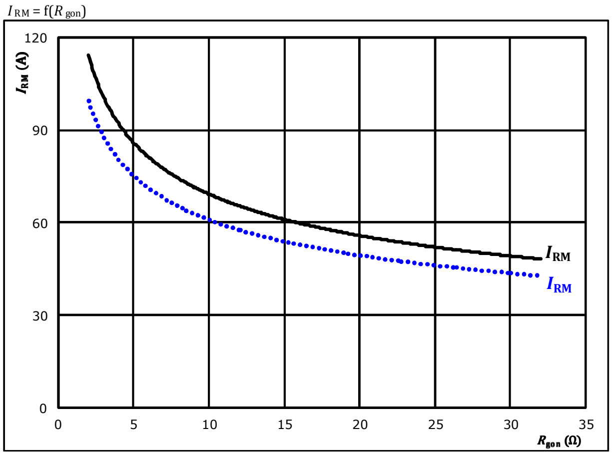


At					
V_{CE} =	300	V		25 °C	···············
V_{GE} =	±15	V	T_j:	125 °C	———
R_{gon} =	4	Ω		150 °C	– – – –

Figure 12. **FWD**

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

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



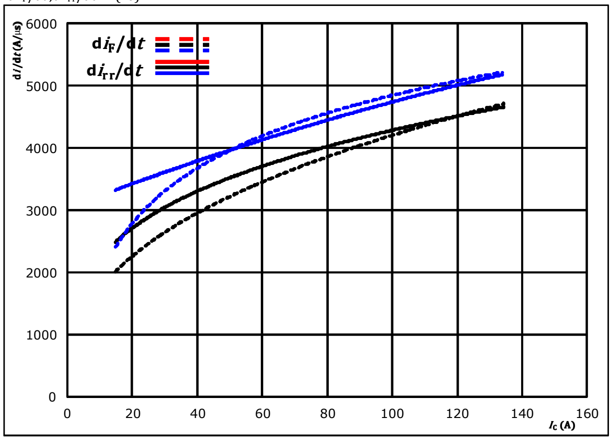
At					
V_{CE} =	300	V		25 °C	···············
V_{GE} =	±15	V	T_j:	125 °C	———
I_C =	75	A		150 °C	– – – –

Inverter Switching Characteristics

Figure 13. **FWD**

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

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

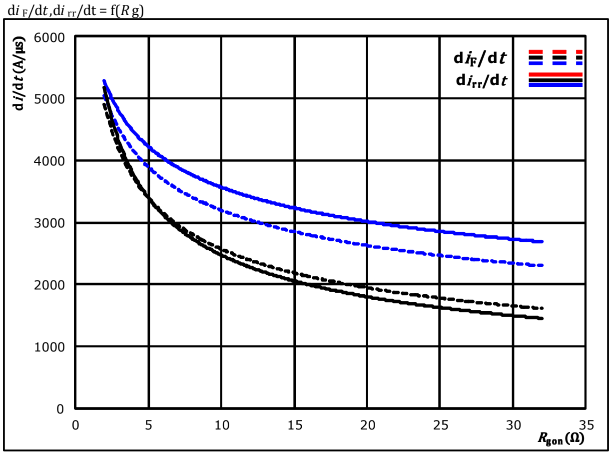


At						
V_{CE} =	300	V		25	°C	··········
V_{GE} =	±15	V	T_j:	125	°C	——
R_{gon} =	4	Ω		150	°C	– – –

Figure 14. **FWD**

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

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



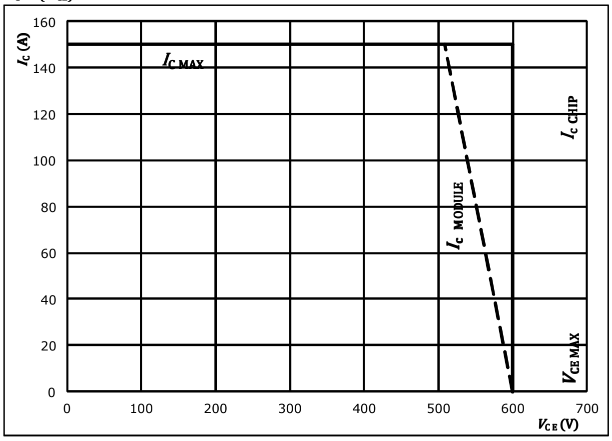
At		
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	75	A

Switching Definitions

Figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At		
T_j =	175	°C
R_{gon} =	4	Ω
R_{goff} =	4	Ω

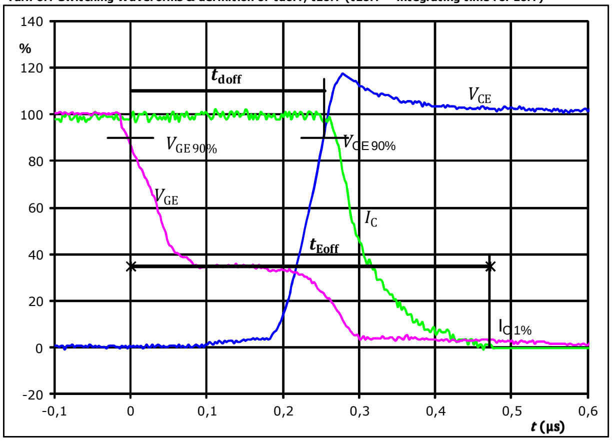
Inverter Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

Figure 1. IGBT

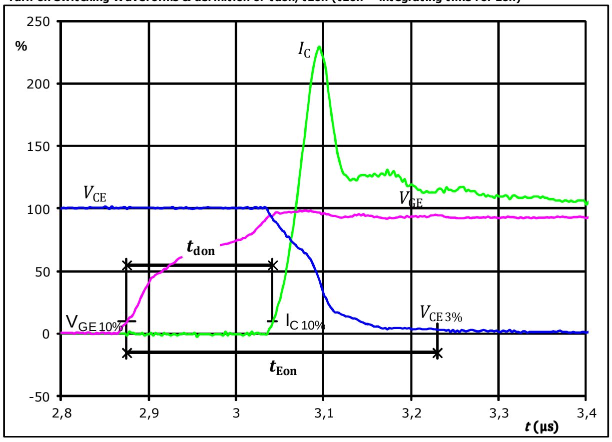
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	74	A
t_{doff} =	0,258	µs
t_{Eoff} =	0,472	µs

Figure 2. IGBT

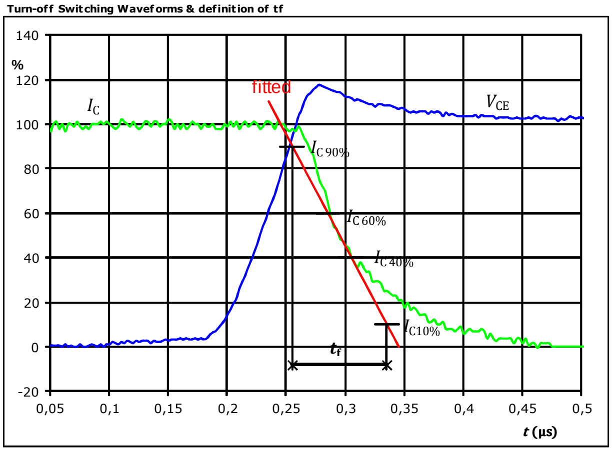
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	74	A
t_{don} =	0,167	µs
t_{Eon} =	0,355	µs

Figure 3. IGBT

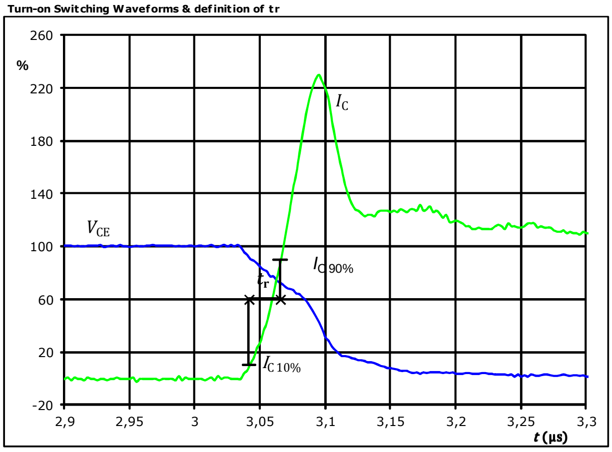
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	74	A
t_f =	0,075	µs

Figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

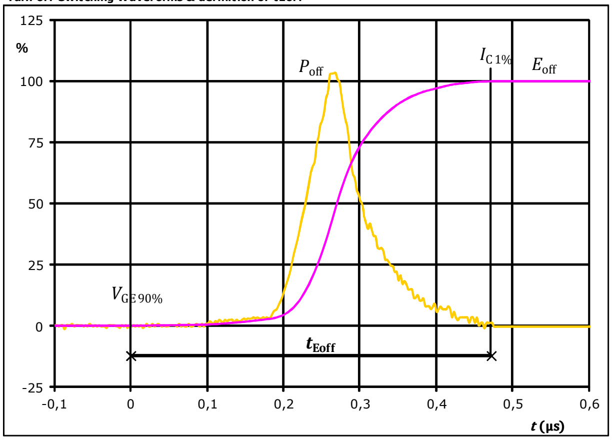


$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	74	A
t_r =	0,024	µs

Inverter Switching Definitions

Figure 5. **IGBT**

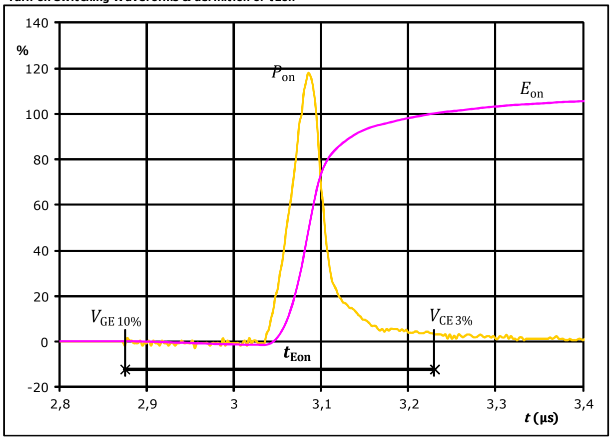
Turn-off Switching Waveforms & definition of tEoff



P_{off} (100%) = 22,32 kW
E_{off} (100%) = 2,14 mJ
t_{Eoff} = 0,47 µs

Figure 6. **IGBT**

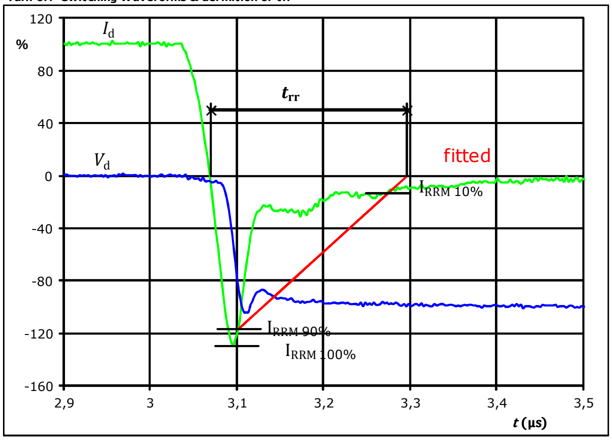
Turn-on Switching Waveforms & definition of tEon



P_{on} (100%) = 22,32 kW
E_{on} (100%) = 1,28 mJ
t_{Eon} = 0,35 µs

Figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

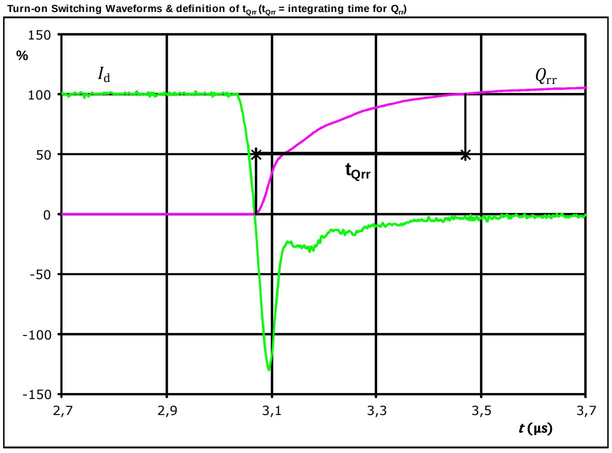


V_d (100%) = 300 V
I_d (100%) = 74 A
I_{RRM} (100%) = 95 A
t_{rr} = 0,163 µs

Inverter Switching Definitions

Figure 8. FWD

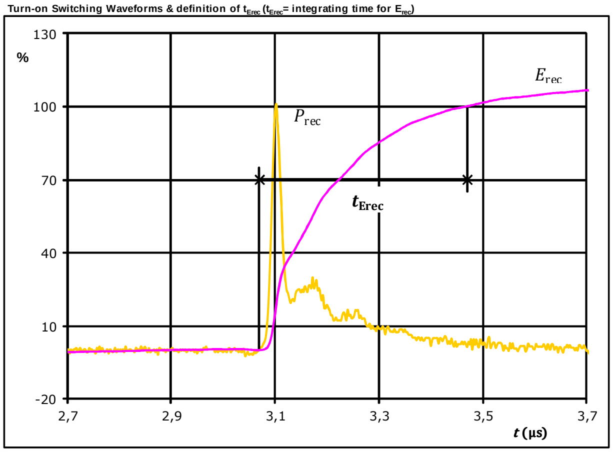
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	74	A
Q_{rr} (100%) =	6,13	µC
t_{Qrr} =	0,40	µs

Figure 9. FWD

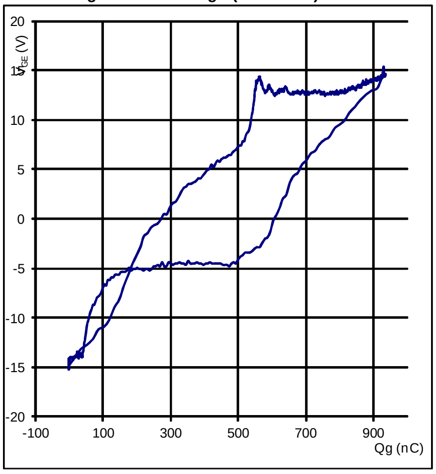
Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	22,32	kW
E_{rec} (100%) =	1,39	mJ
t_{Erec} =	0,40	µs

Figure 10 IGBT

Gate voltage vs Gate charge (measured)



Ordering Code & Marking

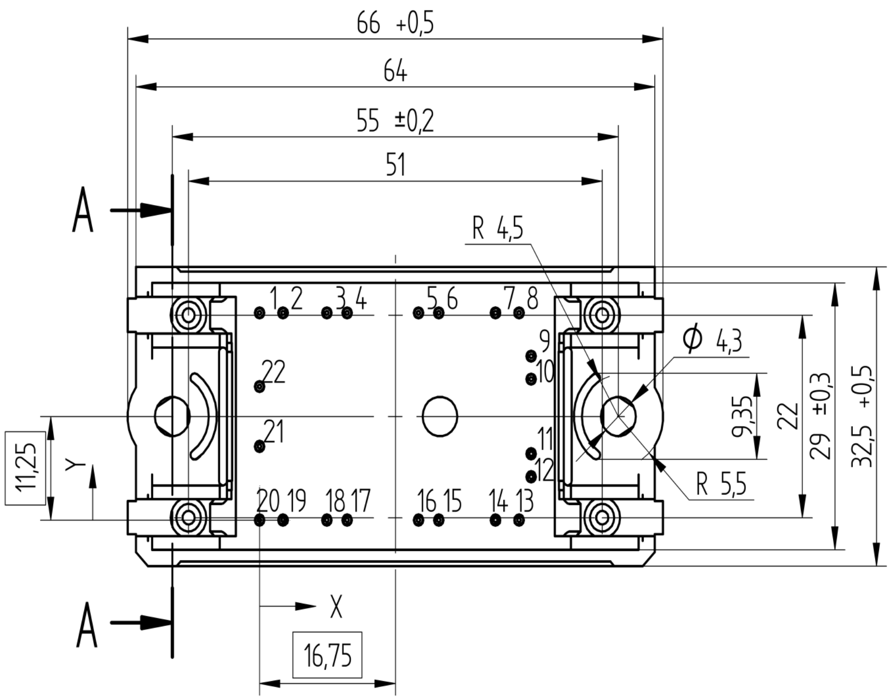
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 17mm housing	V23990-P624-F24	P624-F24	P624-F24

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

Outline

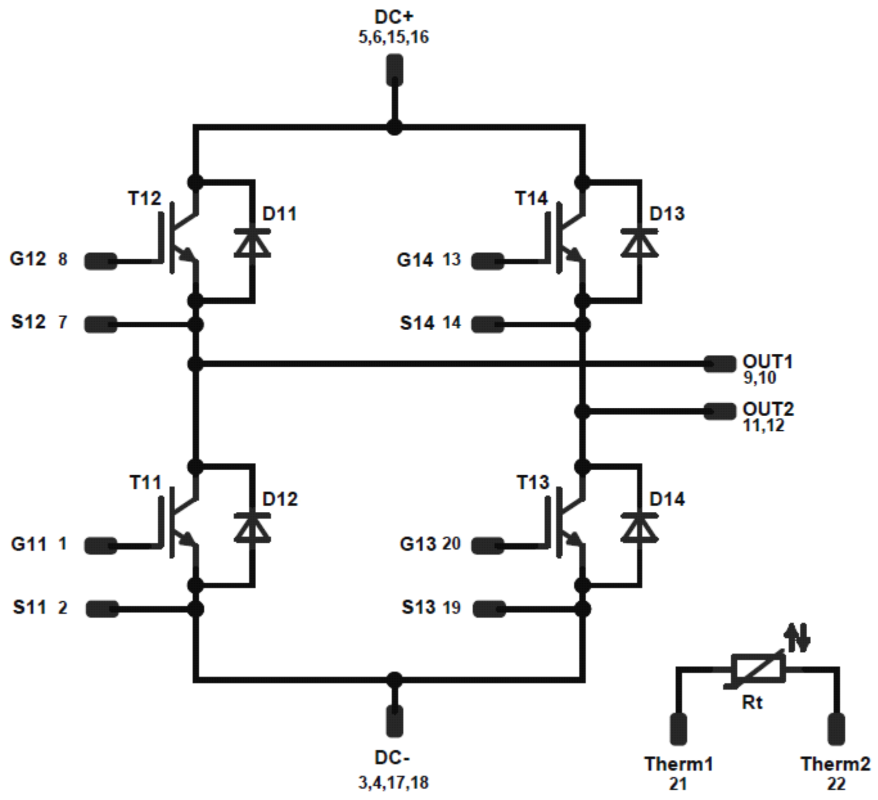
Pinout table

Pin	X	Y
1	0	22,5
2	2,9	22,5
3	8,3	22,5
4	10,8	22,5
5	19,6	22,5
6	22,1	22,5
7	29,1	22,5
8	32	22,5
9	33,5	17,8
10	33,5	15,3
11	33,5	7,2
12	33,5	4,7
13	32	0
14	29,1	0
15	22,1	0
16	19,6	0
17	10,8	0
18	8,3	0
19	2,9	0
20	0	0
21	0	8
22	0	14,5



Vincotech

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11,T12,T13,T14	IGBT	600V	75A	Inverter Switch	
D11,D12,D13,D14	FWD	600V	75A	Inverter Diode	
Rt	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-P624-F24-D3-14	18 Jun. 2015		