

**flow PACK 0****600 V / 75 A****Features**

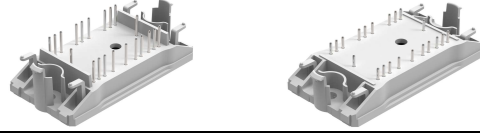
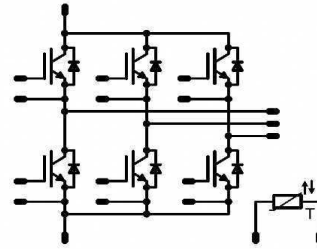
- 2 clip housing in 12 mm and 17 mm height
- Trench Fieldstop IGBT³ technology
- Compact and low inductance design
- Built-in NTC

Target Applications

- Motor Drives
- Power Generation
- UPS

Types

- V23990-P866-F49-PM
- V23990-P866-F48-PM

flow 0 housing**Schematic****Maximum Ratings** $T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter Transistor				
Collector-emitter voltage	V_{CE}		600	V
DC collector current	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	58	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	225	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	90	W
Gate-emitter peak voltage	V_{GE}		± 20	V
Short circuit ratings*	t_{SC} V_{CC}	$T_j \leq 150\text{ °C}$ $V_{GE} = 15\text{ V}$	6 360	μs V
Maximum Junction Temperature	T_{jmax}		175	$^{\circ}\text{C}$
Inverter Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		600	V
DC forward current	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	50	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	150	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	67	W
Maximum Junction Temperature	T_{jmax}		175	$^{\circ}\text{C}$

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

Parameter	Symbol	Condition	Value	Unit
Thermal properties				
Storage temperature	T_{stg}		-40.....+125	°C
Operation junction temperature	T_{op}		-40.....+ T_{jmax} -25	°C
Insulation properties				
Insulation 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		12mm height	9,22	mm
		17mm height	min.12,7	mm
Comparative Tracking Index	CTI		>200	

*100% tested in production

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
		V_{GS} [V]	V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	
Inverter Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0012	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CESat}		15		75	25 150	1,1	1,50 1,72	2,1	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		25			40	µA
Gate-emitter leakage current	I_{GES}		20	0		25			650	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	$R_{gon} = 4 \Omega$ $R_{goff} = 4 \Omega$				25		94,4		ns
Rise time	t_r					150		94,4		
Turn-off delay time	$t_{d(off)}$					25		11		
Fall time	t_f					150		14,6		
Turn-on energy loss	E_{on}					25		159		
Turn-off energy loss	E_{off}					150		183		
Input capacitance	C_{ies}	$f = 1 \text{ MHz}$	0	25	25			4620		pF
Output capacitance	C_{oss}							288		
Reverse transfer capacitance	C_{rss}							137		
Gate charge	Q_G		15	300	75	25		470		nC
Thermal resistance chip to heatsink	$R_{th(j-s)}$	$\lambda_{paste} = 0,8 \text{ W/mK}$ (P12)						1,06		K/W
Inverter Diode										
Diode forward voltage	V_F				75	25 150	1,1	1,63 1,58	2,2	V
Peak reverse recovery current	I_{RRM}	$R_{gon} = 4 \Omega$	± 15	300	75	25		101		A
Reverse recovery time	t_{rr}					150		117		
Reverse recovered charge	Q_{rr}					25		107		
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					150		140		
Reverse recovered energy	E_{rec}					25		3,13		
						150		6,46		
Thermal resistance chip to heatsink	$R_{th(j-s)}$	$\lambda_{paste} = 0,8 \text{ W/mK}$ (P12)						1,43		K/W
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	$R_{100} = 1486 \Omega$				100	-5		+5	%
Power dissipation	P					25		210		mW
Power dissipation constant						25		4,4		mW/K
B-value	$B_{(25/50)}$	Tol. -13,1%				25		3940		K
B-value	$B_{(25/100)}$	Tol. +11,6%				25		4000		K
Vincotech NTC Reference									A	

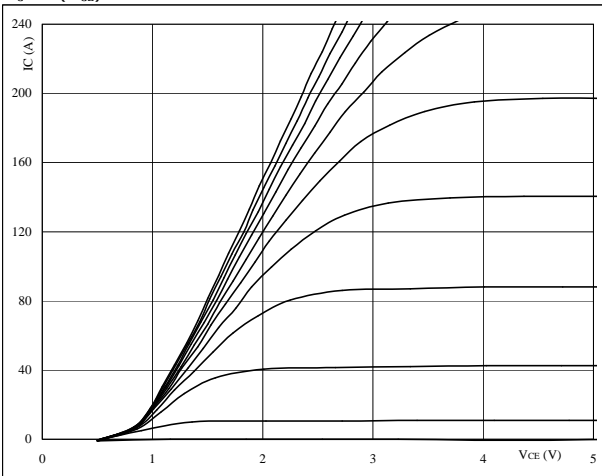


Output Inverter

figure 1 IGBT

Typical output characteristics

$I_C = f(V_{CE})$

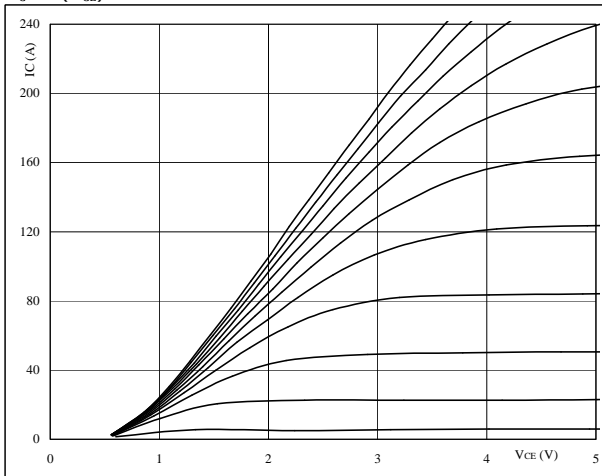


$t_p = 250 \mu s$
 $T_j = 25 \text{ }^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 2 IGBT

Typical output characteristics

$I_C = f(V_{CE})$

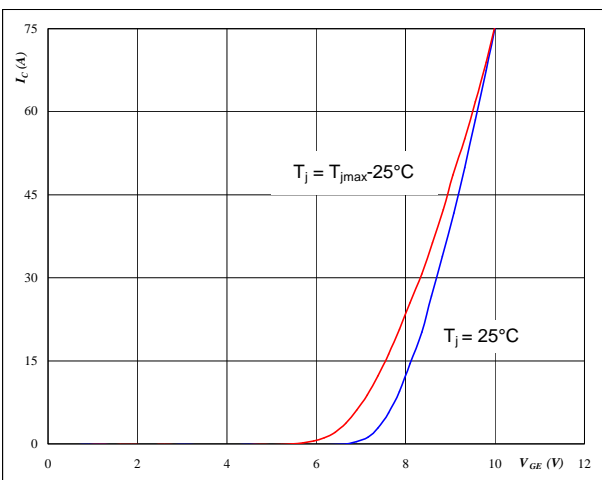


$t_p = 250 \mu s$
 $T_j = 150 \text{ }^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3 IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

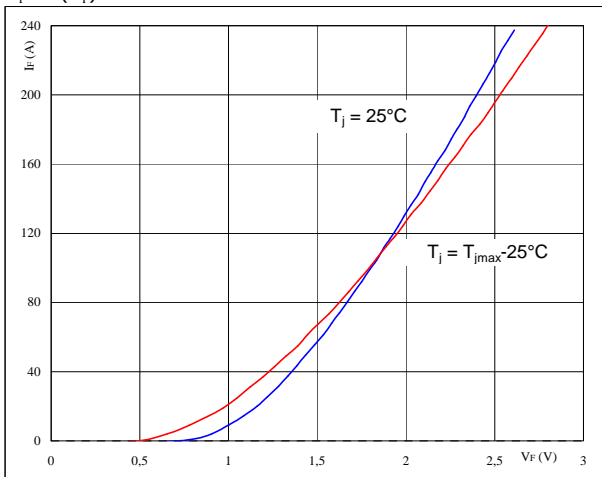


$t_p = 250 \mu s$
 $V_{CE} = 10 V$

figure 4 FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



$t_p = 250 \mu s$

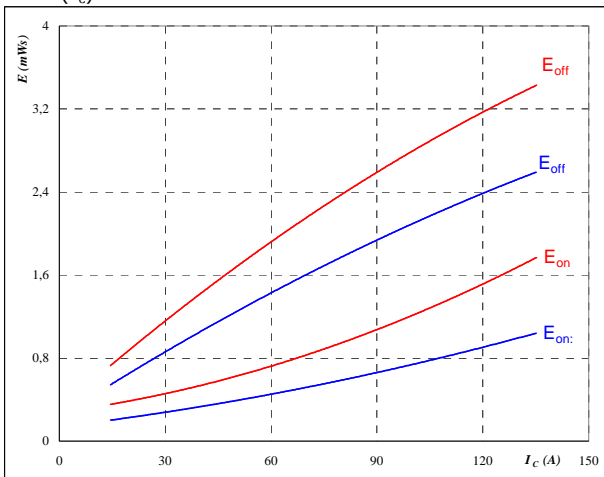


Output Inverter

figure 5 IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



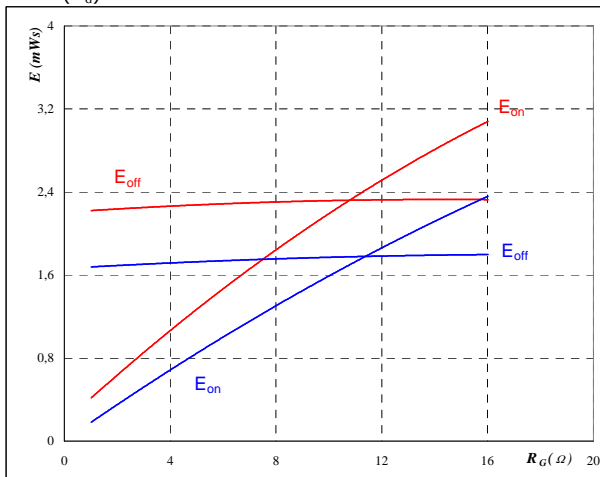
inductive load

$T_j =$	25/150	°C
$V_{CE} =$	300	V
$V_{GE} =$	±15	V
$R_{gon} =$	4	Ω
$R_{goff} =$	4	Ω

figure 6 IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



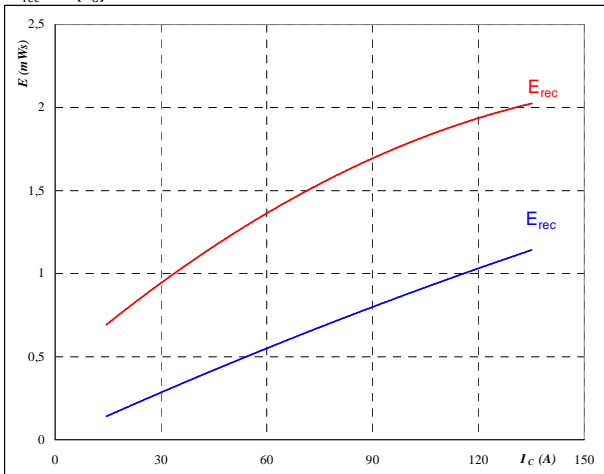
inductive load

$T_j =$	25/150	°C
$V_{CE} =$	300	V
$V_{GE} =$	±15	V
$I_C =$	75	A

figure 7 IGBT

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



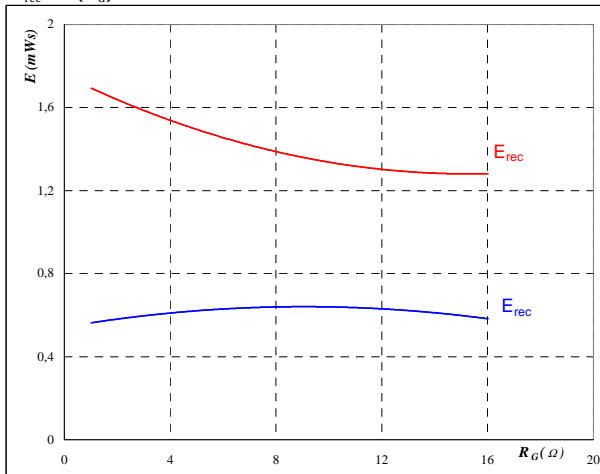
inductive load

$T_j =$	25/150	°C
$V_{CE} =$	300	V
$V_{GE} =$	±15	V
$R_{gon} =$	4	Ω

figure 8 IGBT

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



inductive load

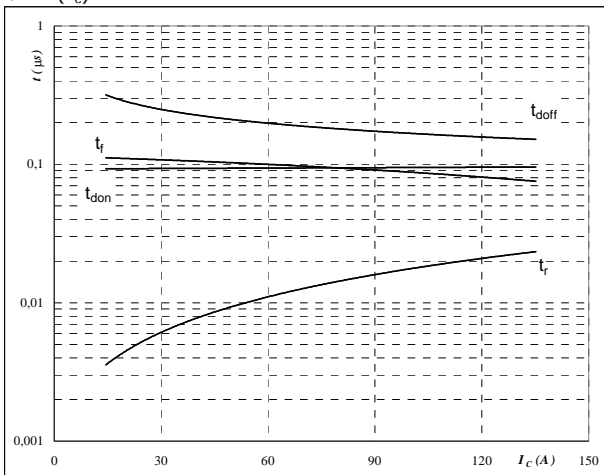
$T_j =$	25/150	°C
$V_{CE} =$	300	V
$V_{GE} =$	±15	V
$I_C =$	75	A

Output Inverter

figure 9 IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



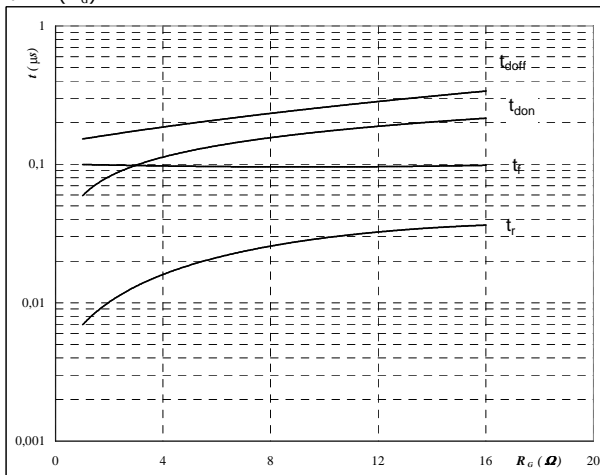
inductive load

$T_j =$	150	°C
$V_{CE} =$	300	V
$V_{GE} =$	±15	V
$R_{gon} =$	4	Ω
$R_{goff} =$	4	Ω

figure 10 IGBT

Typical switching times as a function of gate resistor

$$t = f(R_G)$$



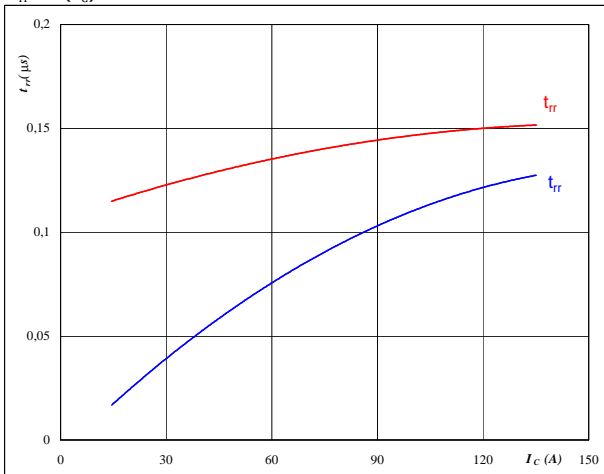
inductive load

$T_j =$	150	°C
$V_{CE} =$	300	V
$V_{GE} =$	±15	V
$I_C =$	75	A

figure 11 FWD

Typical reverse recovery time as a function of collector current

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

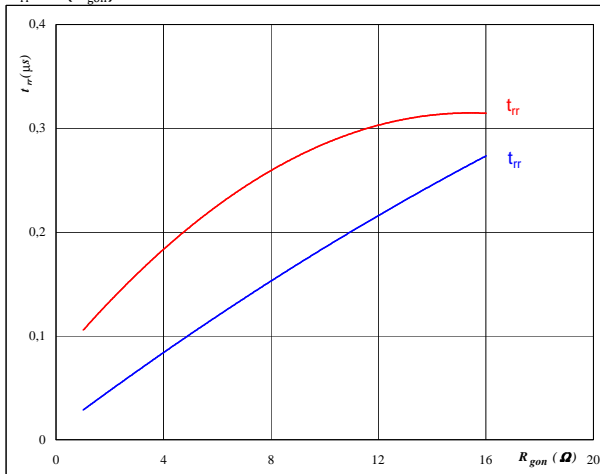


$T_j =$	25/150	°C
$V_{CE} =$	300	V
$V_{GE} =$	±15	V
$R_{gon} =$	4	Ω

figure 12 FWD

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

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



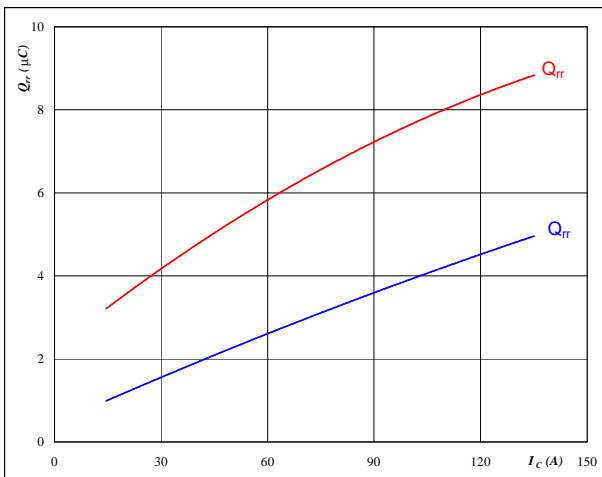
$T_j =$	25/150	°C
$V_R =$	300	V
$I_F =$	75	A
$V_{GE} =$	±15	V

Output Inverter

figure 13 FWD

Typical reverse recovery charge as a function of collector current

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

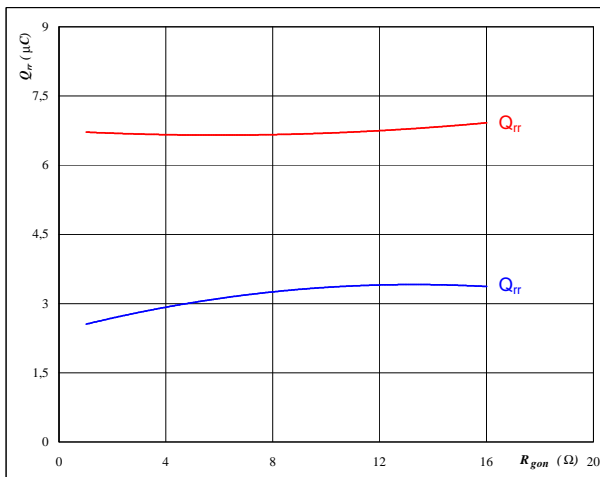


$T_j = 25/150$ °C
 $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω

figure 14 FWD

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

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

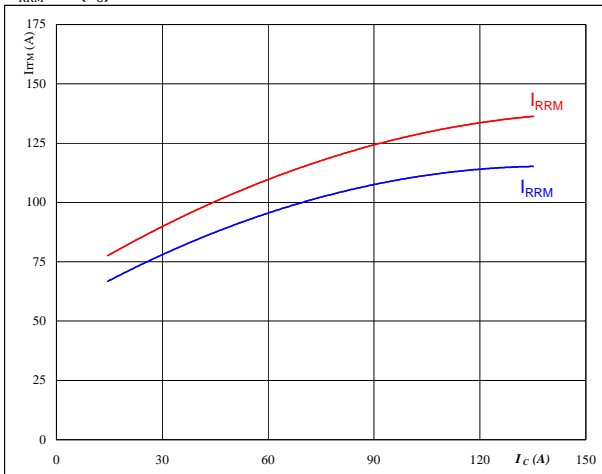


$T_j = 25/150$ °C
 $V_R = 300$ V
 $I_F = 75$ A
 $V_{GE} = \pm 15$ V

figure 15 FWD

Typical reverse recovery current as a function of collector current

$$I_{RRM} = f(I_C)$$

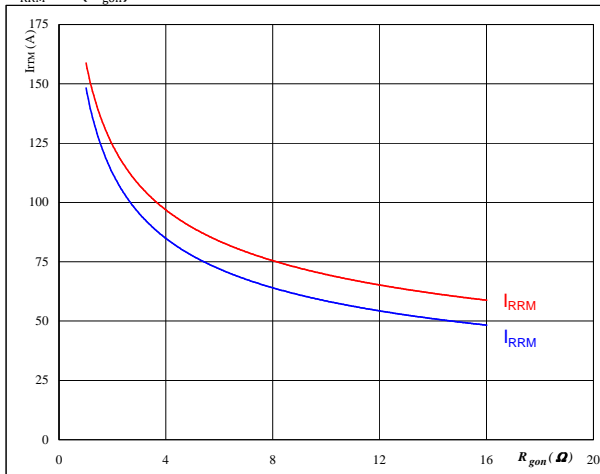


$T_j = 25/150$ °C
 $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω

figure 16 FWD

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

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



$T_j = 25/150$ °C
 $V_R = 300$ V
 $I_F = 75$ A
 $V_{GE} = \pm 15$ V

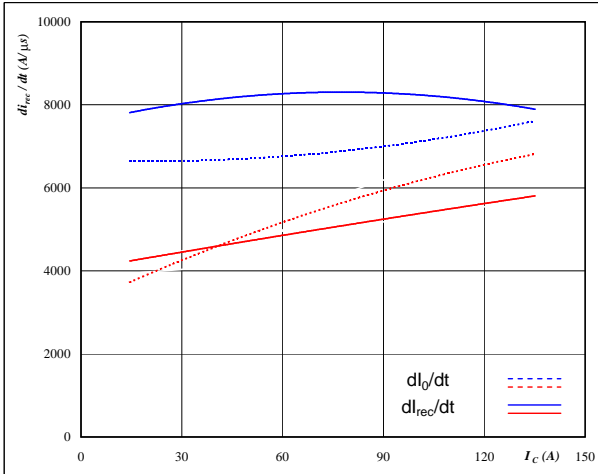


Output Inverter

figure 17 FWD

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

$$dI_0/dt, dI_{rec}/dt = f(I_c)$$

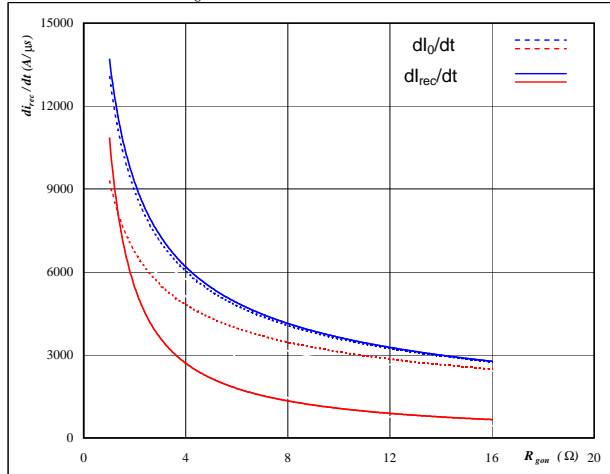


$T_j = 25/150 \text{ } ^\circ\text{C}$
 $V_{CE} = 300 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 4 \text{ } \Omega$

figure 18 FWD

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

$$dI_0/dt, dI_{rec}/dt = f(R_{gon})$$

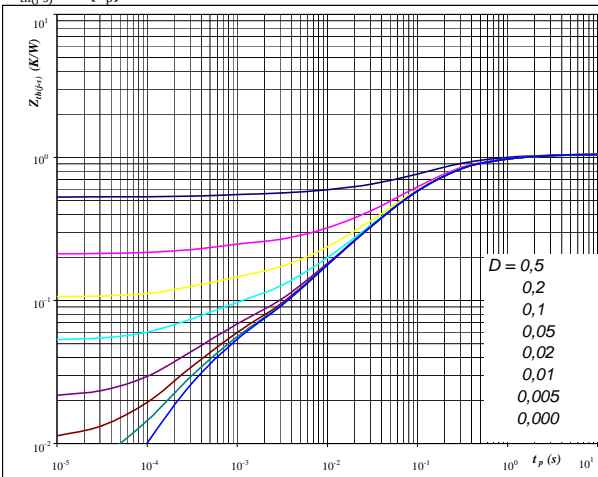


$T_j = 25/150 \text{ } ^\circ\text{C}$
 $V_R = 300 \text{ V}$
 $I_F = 75 \text{ A}$
 $V_{GE} = \pm 15 \text{ V}$

figure 19 IGBT

IGBT transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,06 \text{ K/W}$

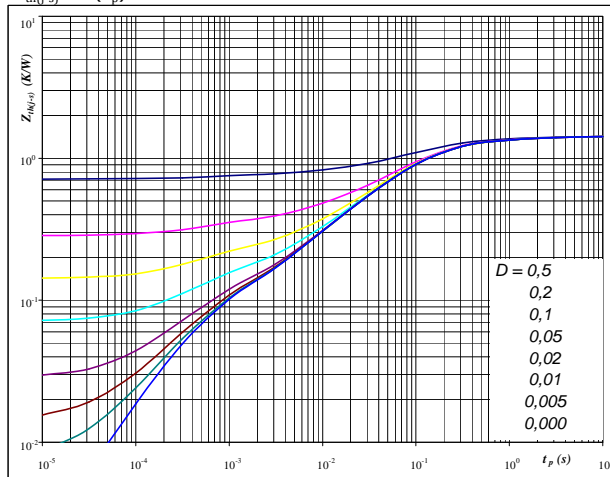
IGBT thermal model values

R (K/W)	Tau (s)
2,34E-02	9,51E+00
1,52E-01	1,14E+00
5,35E-01	1,66E-01
2,37E-01	4,14E-02
7,28E-02	6,92E-03
3,85E-02	4,21E-04

figure 20 FWD

FWD transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,43 \text{ K/W}$

FWD thermal model values

R (K/W)	Tau (s)
2,70E-02	9,09E+00
1,57E-01	1,02E+00
6,34E-01	1,45E-01
4,09E-01	3,99E-02
1,20E-01	6,67E-03
7,94E-02	4,65E-04

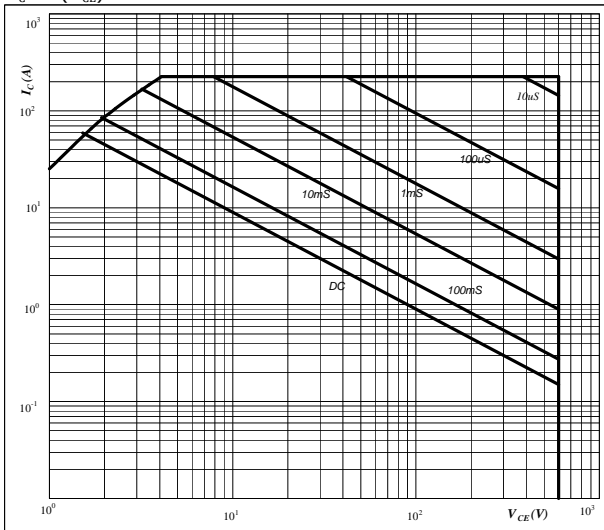


Output Inverter

figure 21 IGBT

Safe operating area as a function of collector-emitter voltage

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

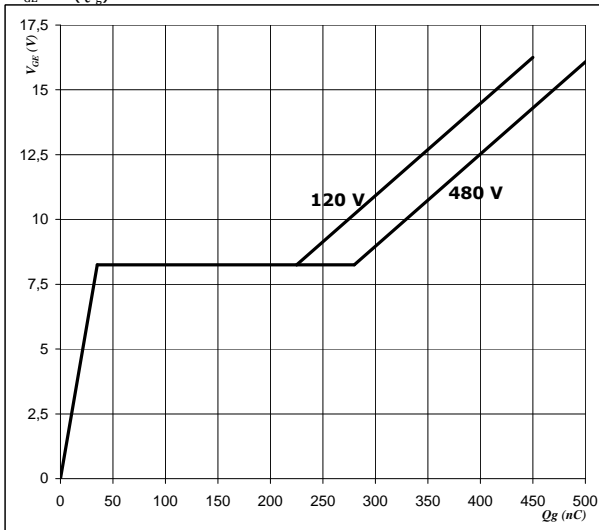


$D =$ single pulse
 $T_s =$ 80 °C
 $V_{GE} =$ ±15 V
 $T_j = T_{jmax}$

figure 22 IGBT

Gate voltage vs Gate charge

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



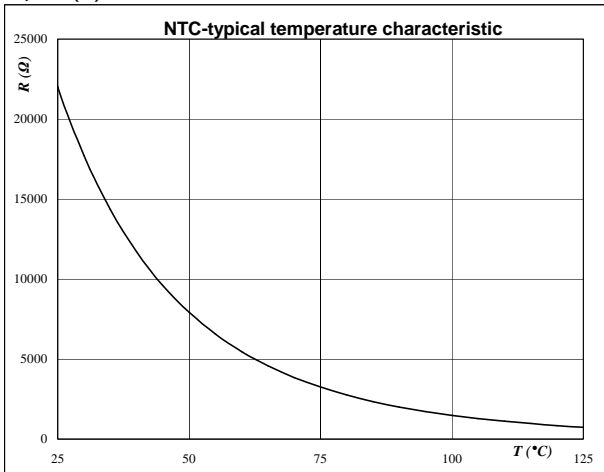
$I_C =$ 75 A

Thermistor

figure 1 Thermistor

Typical NTC characteristic as a function of temperature

$$R_T = f(T)$$



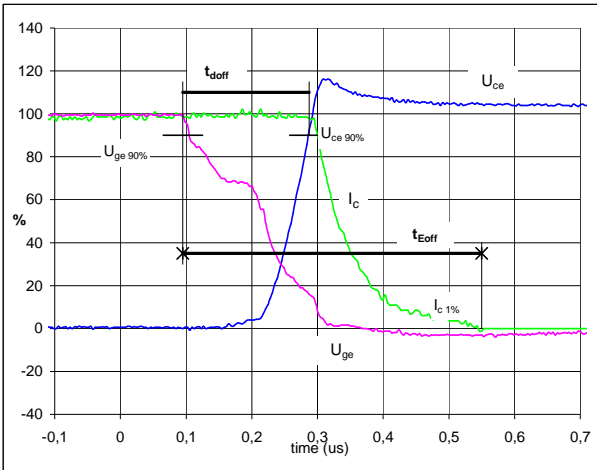
Switching Definitions Inverter

General conditions

T_j	=	150 °C
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

Figure 1 IGBT

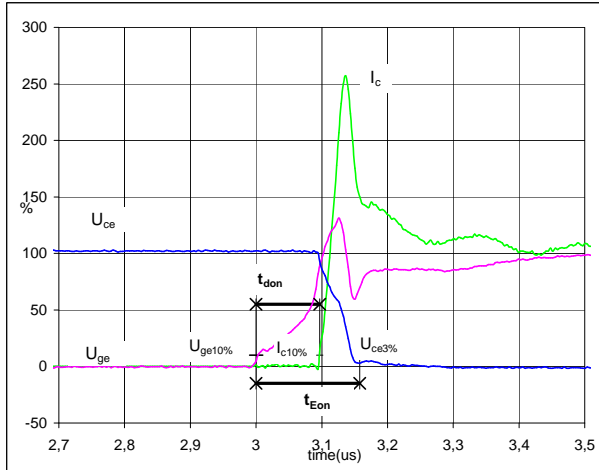
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	75	A
t_{doff} =	0,18	μs
t_{Eoff} =	0,45	μs

Figure 2 IGBT

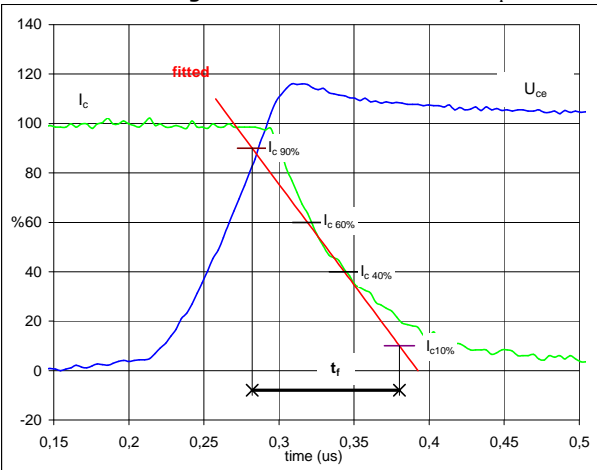
Turn-on Switching Waveforms & definition of t_{donr} , t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	75	A
t_{donr} =	0,09	μs
t_{Eon} =	0,16	μs

Figure 3 IGBT

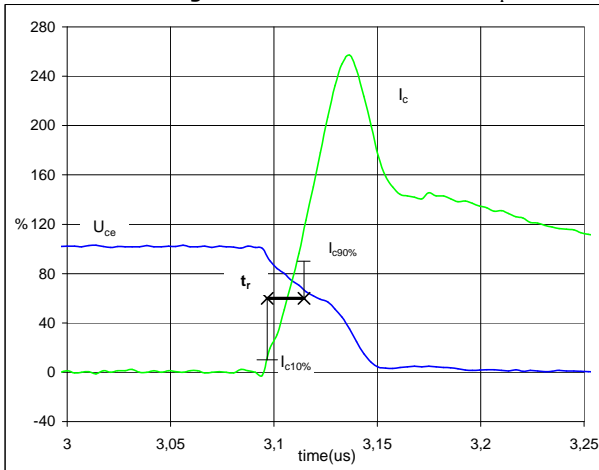
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	300	V
I_C (100%) =	75	A
t_f =	0,10	μs

Figure 4 IGBT

Turn-on Switching Waveforms & definition of t_r

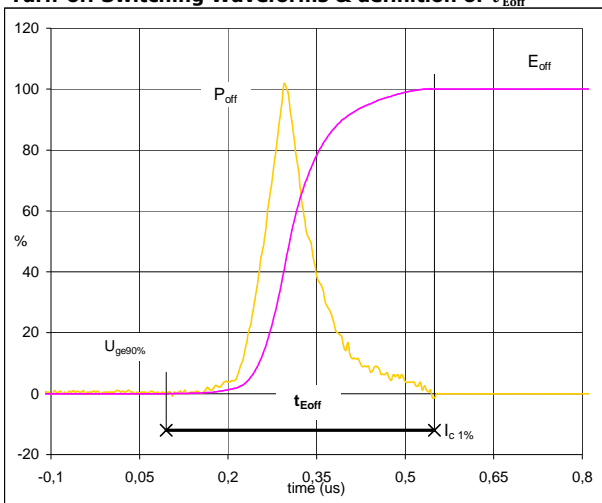


V_C (100%) =	300	V
I_C (100%) =	75	A
t_r =	0,02	μs

Switching Definitions Inverter

Figure 5 IGBT

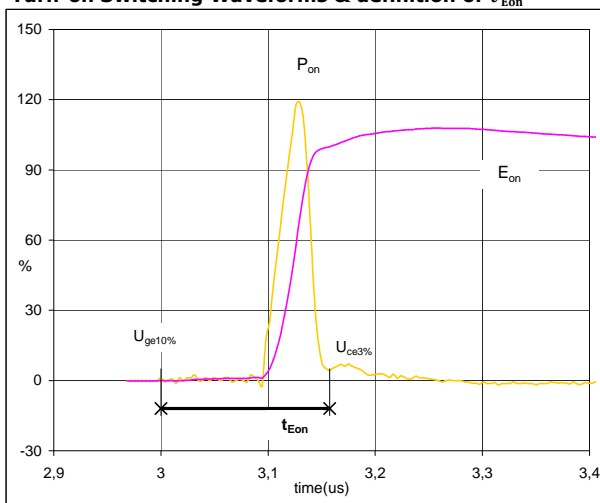
Turn-off Switching Waveforms & definition of t_{Eoff}



$P_{off} (100\%) = 22,56 \text{ kW}$
 $E_{off} (100\%) = 2,26 \text{ mJ}$
 $t_{Eoff} = 0,45 \text{ }\mu\text{s}$

Figure 6 IGBT

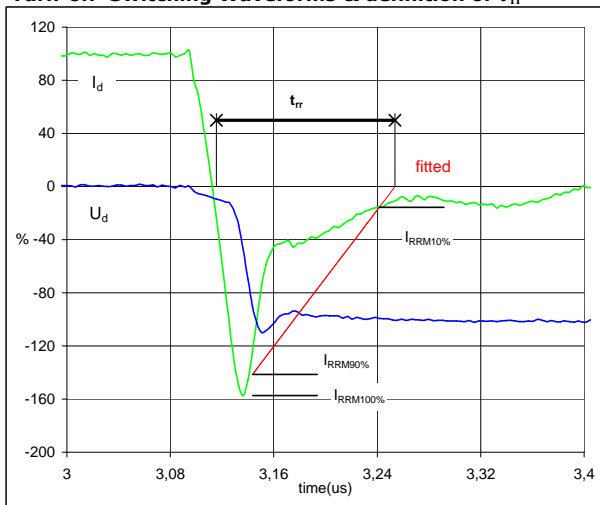
Turn-on Switching Waveforms & definition of t_{Eon}



$P_{on} (100\%) = 22,56 \text{ kW}$
 $E_{on} (100\%) = 0,90 \text{ mJ}$
 $t_{Eon} = 0,16 \text{ }\mu\text{s}$

Figure 7 FWD

Turn-off Switching Waveforms & definition of t_{rr}



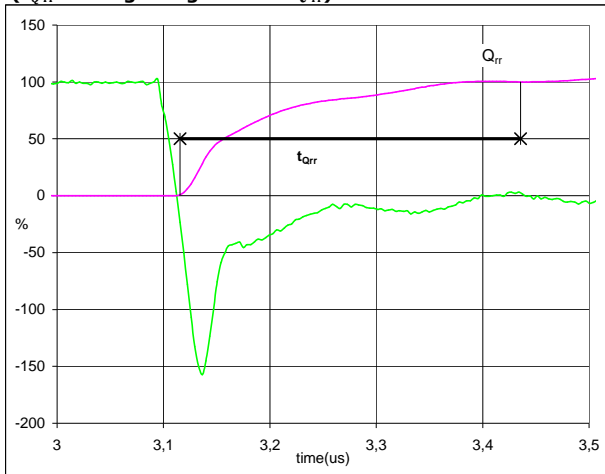
$V_d (100\%) = 300 \text{ V}$
 $I_d (100\%) = 75 \text{ A}$
 $I_{RRM} (100\%) = -117 \text{ A}$
 $t_{rr} = 0,14 \text{ }\mu\text{s}$



Switching Definitions Output Inverter

Figure 8 FWD

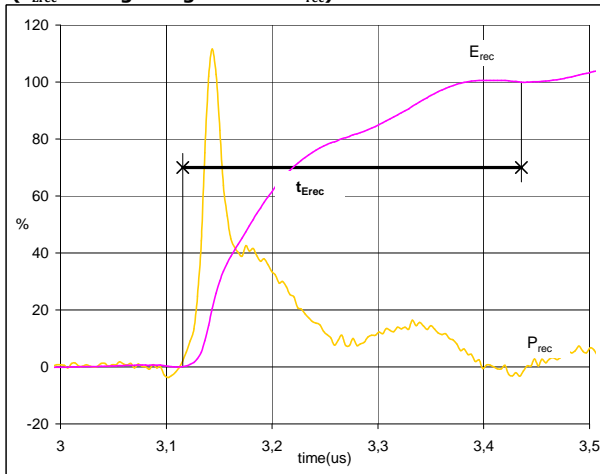
Turn-on Switching Waveforms & definition of t_{Qrr}
 (t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	75	A
Q_{rr} (100%) =	6,46	μC
t_{Qrr} =	0,32	μs

Figure 9 FWD

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



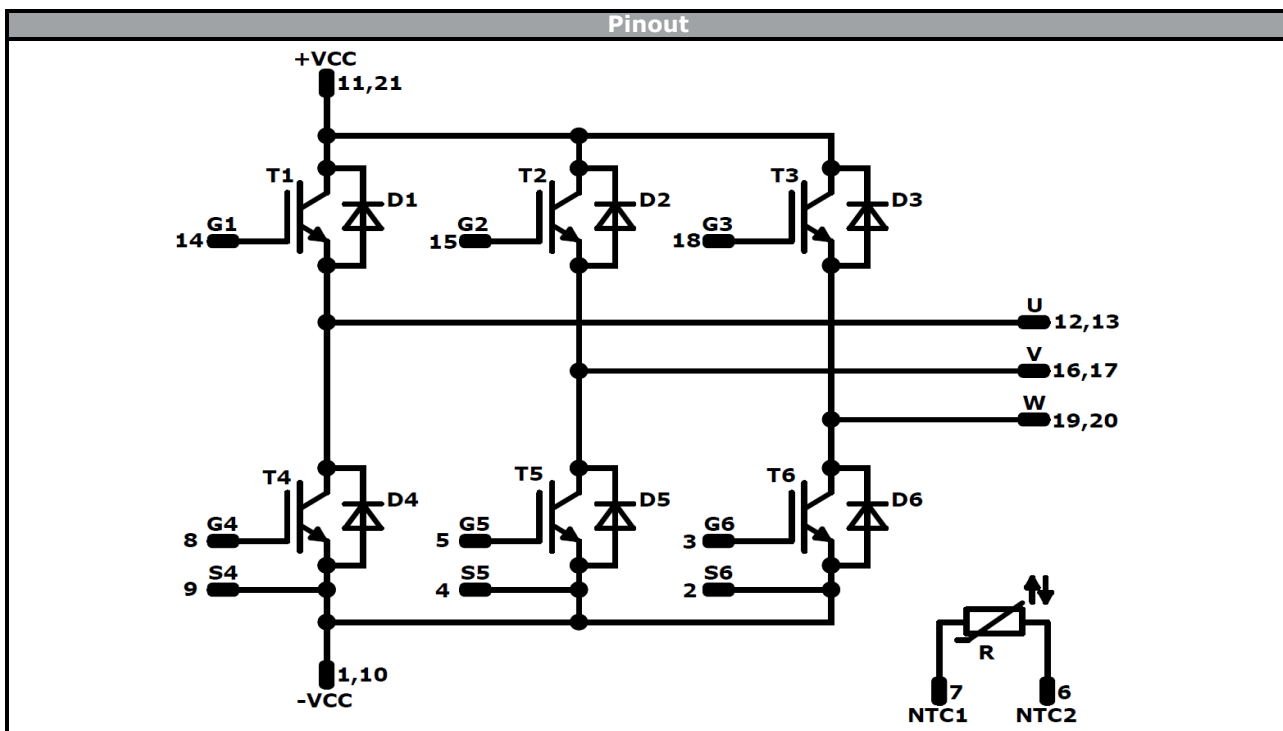
P_{rec} (100%) =	22,56	kW
E_{rec} (100%) =	1,51	mJ
t_{Erec} =	0,32	μs



Ordering Code & Marking							
Version			Ordering Code				
without thermal paste 12 mm housing			V23990-P866-F48-PM				
without thermal paste 17 mm housing			V23990-P866-F49-PM				
	Text	VIN	Date code	Name&Ver	UL	Lot	Serial
		VIN	WWYY	NNNNNVV	UL	LLLLL	SSSS
Datamatrix		Type&Ver	Lot number	Serial	Date code		
		TTTTTTVV	LLLLL	SSSS	WWYY		

Pin table [mm]				Outline	
Pin	X	Y	Function		17 mm housing
1	33,3	0	-Vcc		12 mm housing
2	30,7	0	S6		
3	27,9	0	G6		
4	23,85	0	S5		
5	21,05	0	G5		
6	15,95	0	NTC2		
7	9,6	0	NTC1		
8	5,4	0	G4		
9	2,6	0	S4		
10	0	0	-Vcc		
11	0	11,15	+Vcc		
12	0	22,3	U		
13	2,6	22,3	U		
14	5,5	22,3	G1		
15	13,1	22,3	G2		
16	15,9	22,3	V		
17	19,4	22,3	V		
18	27,7	22,3	G3		
19	30,7	22,3	W		
20	33,3	22,3	W		
21	33,3	11,15	+Vcc		

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




Identification					
ID	Component	Voltage	Current	Function	Comment
T1, T2, T3, T4, T5, T6	IGBT	600 V	75 A	Inverter Transistor	
D1, D2, D3, D4, D5, D6	FWD	600 V	75 A	Inverter Diode	
R	NTC			Thermistor	



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

Handling instruction
Handling instructions for <i>flow</i> 0 packages see vincotech.com website.

Package data
Package data for <i>flow</i> 0 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. 

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As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.
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.