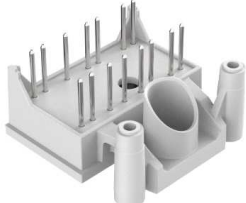
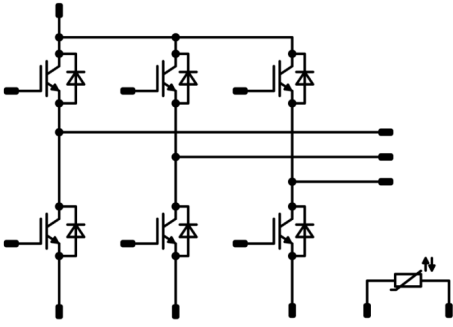




Vincotech

<i>flow</i> PACK 0 B	600 V / 6 A
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">Features</div> <ul style="list-style-type: none"> IGBT3 (600V) technology Open emitter topology New ultra-compact housing Single-screw heat sink mounting 	<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">flow 0 B housing</div> 
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">Target applications</div> <ul style="list-style-type: none"> Dedicated design for motor drive 	<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">Schematic</div> 
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">Types</div> <ul style="list-style-type: none"> 10-0B066PA006SB-M992F09 	

Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		600	V
Collector current	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	8	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	18	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	27	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC}	$T_j \leq 150\text{ °C}$	6	µs
	V_{CC}	$V_{GE} = 15\text{ V}$	360	V
Maximum junction temperature	T_{jmax}		175	°C



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Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
Inverter Diode				
Peak repetitive reverse voltage	V_{RRM}		600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	8	A
Repetitive peak forward current	I_{FRM}		12	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	23	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_{top}		-40...($T_{jmax} - 25$)	°C

Isolation Properties

Isolation voltage	V_{isol}	DC Test Voltage $t_p = 2\text{ s}$	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
		V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	I_D [A]	T_j [°C]	Min	Typ	Max	

Inverter Switch

Static

Parameter	Symbol	Conditions	V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	I_D [A]	T_j [°C]	Min	Typ	Max	Unit
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$				0,00018	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15			6	25 125	1,1	1,49 1,68	1,9	V
Collector-emitter cut-off current	I_{CES}		0	600			25			0,04	μA
Gate-emitter leakage current	I_{GES}		20	0			25			300	nA
Internal gate resistance	r_g								none		Ω
Input capacitance	C_{ies}								368		pF
Output capacitance	C_{oes}	$f = 100$ KHz	0	25			25		28		
Reverse transfer capacitance	C_{res}								11		
Gate charge	Q_g		15	180	6		25		42		nC

Thermal

Parameter	Symbol	Conditions	V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	I_D [A]	T_j [°C]	Min	Typ	Max	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness ≤ 50 μm $\lambda = 1$ W/mK							3,50		K/W

Dynamic

Parameter	Symbol	Conditions	V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	I_D [A]	T_j [°C]	Min	Typ	Max	Unit
Turn-on delay time	$t_{d(on)}$	$R_{goff} = 64$ Ω $R_{gon} = 64$ Ω	±15		300	6		25	105		ns
Rise time	t_r							150	102		
Turn-off delay time	$t_{d(off)}$							25	22		
Fall time	t_f							150	28		
Turn-on energy (per pulse)	E_{on}	$Q_{FWD} = 0,3$ μC $Q_{FWD} = 0,8$ μC						25	0,150		mWs
Turn-off energy (per pulse)	E_{off}							150	0,225		
								25	0,146		
								150	0,193		



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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 Diode

Static

Forward voltage	V_F				6	25 125		1,58 1,50	1,95	V
Reverse leakage current	I_R			600		25			27	μ A

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness $\leq 50 \mu\text{m}$ $\lambda = 1 \text{ W/mK}$						4,20		K/W
-------------------------------------	---------------	---	--	--	--	--	--	------	--	-----

Dynamic

Peak recovery current	I_{RRM}	$di/dt = 219 \text{ A}/\mu\text{s}$ $di/dt = 191 \text{ A}/\mu\text{s}$	± 15	300	6	25 150		4 6		A
Reverse recovery time	t_{rr}					25 150		183 288		ns
Recovered charge	Q_r					25 150		0,324 0,775		μ C
Reverse recovered energy	E_{rec}					25 150		0,059 0,156		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 150		45 57		A/ μ s

Thermistor

Rated resistance	R					25		21,5		k Ω
Deviation of R_{100}	$\Delta_{R/R}$	$R_{100} = 1486 \Omega$				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	

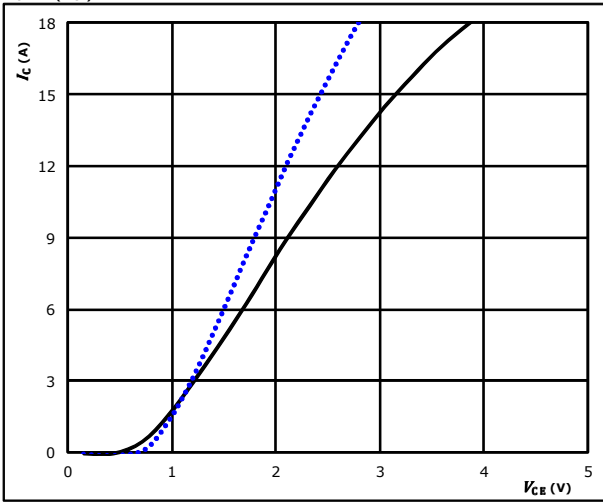


Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

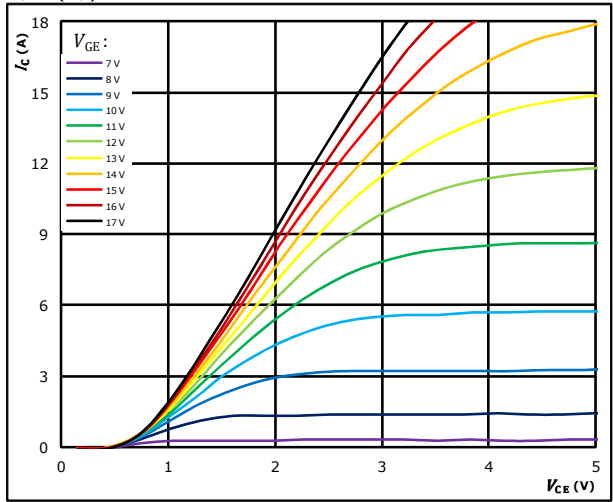


$t_p = 250 \mu s$ $T_j: 25 \text{ }^\circ C$ (dotted blue line)
 $V_{GE} = 15 V$ $T_j: 125 \text{ }^\circ C$ (solid black line)

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

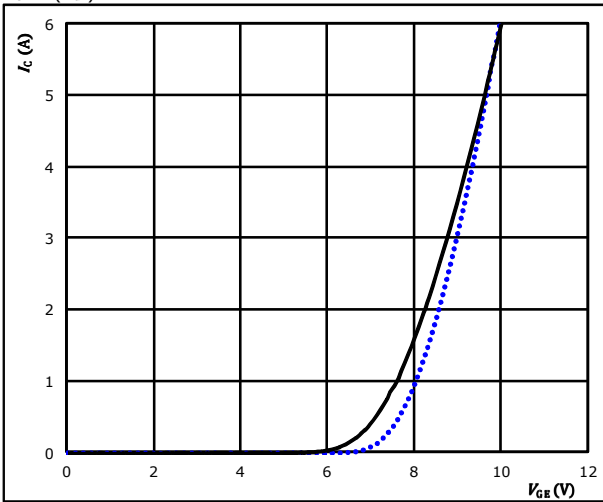


$t_p = 250 \mu s$
 $T_j = 125 \text{ }^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

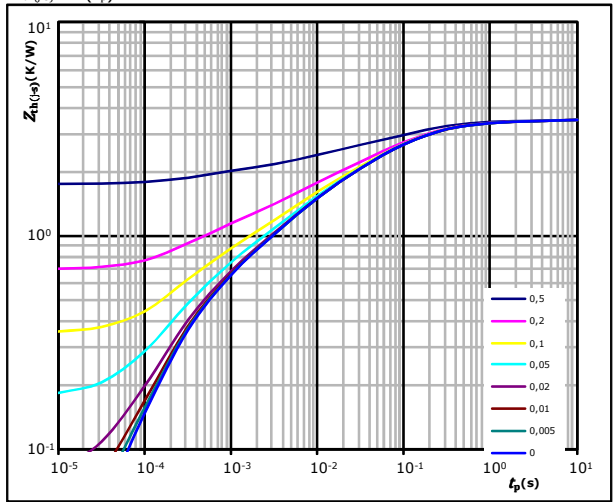


$t_p = 100 \mu s$ $T_j: 25 \text{ }^\circ C$ (dotted blue line)
 $V_{CE} = 10 V$ $T_j: 125 \text{ }^\circ C$ (solid black line)

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$
 $R_{th(j-s)} = 3,50 \text{ K/W}$
 IGBT thermal model values

R (K/W)	τ (s)
1,46E-01	3,65E+00
5,40E-01	3,03E-01
1,16E+00	7,07E-02
7,43E-01	1,16E-02
4,93E-01	2,32E-03
4,22E-01	3,00E-04



Inverter Switch Characteristics

figure 5. IGBT

Gate voltage vs gate charge

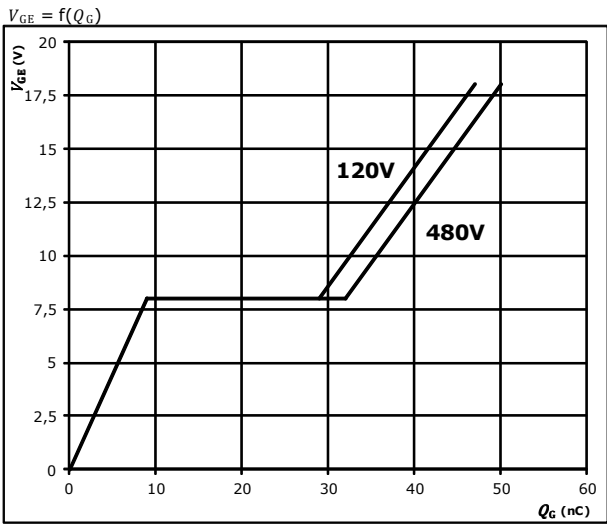
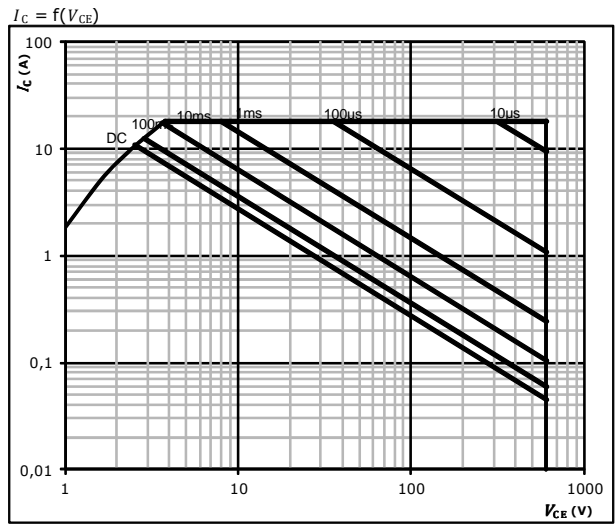


figure 6. IGBT

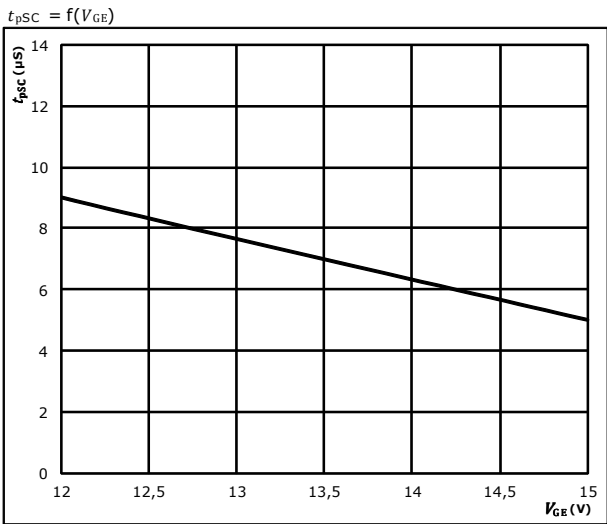
Safe operating area



$D =$ single pulse
 $T_s = 80 \text{ } ^\circ\text{C}$
 $V_{GE} = \pm 15 \text{ V}$
 $T_j = T_{jmax} \text{ } ^\circ\text{C}$

figure 7. IGBT

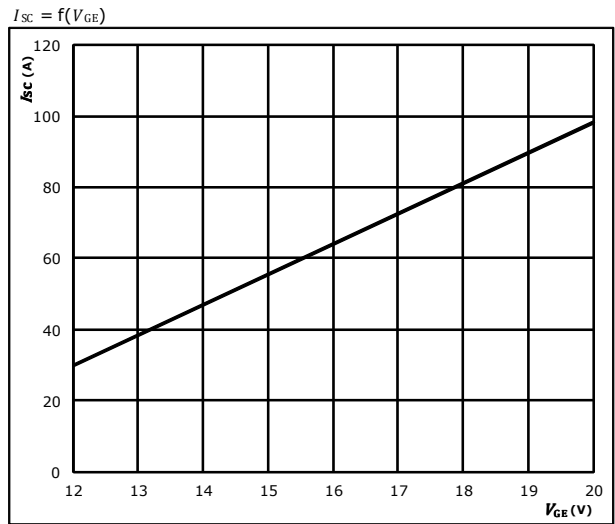
Short circuit duration as a function of V_{GE}



$V_{CE} = 600 \text{ V}$
 $T_j \leq 175 \text{ } ^\circ\text{C}$

figure 8. IGBT

Typical short circuit current as a function of V_{CE}



$V_{CE} \leq 600 \text{ V}$
 $T_j \leq 175 \text{ } ^\circ\text{C}$

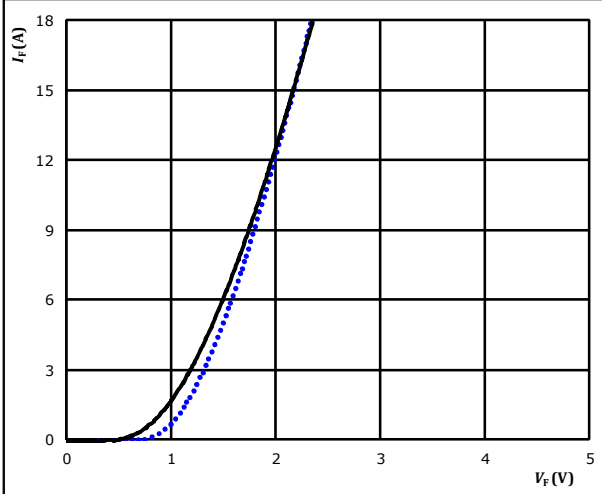


Inverter Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

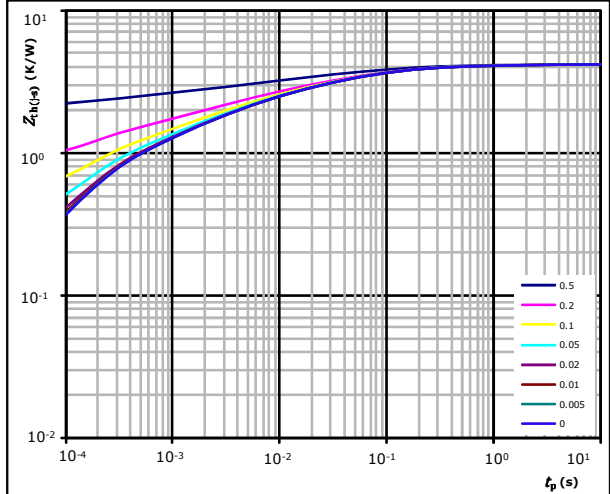


$t_p = 250 \mu s$ T_j : 25 °C (solid line), 125 °C (dashed line)

figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 4,20 \text{ K/W}$
 FWD thermal model values

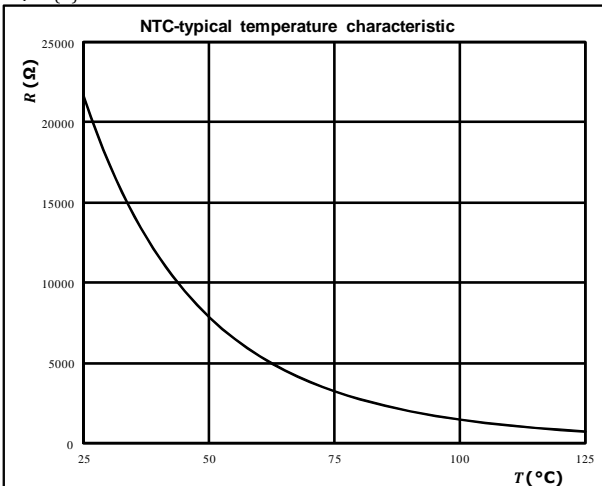
R (K/W)	τ (s)
1,59E-01	2,28E+00
6,49E-01	1,47E-01
9,61E-01	3,33E-02
9,96E-01	6,52E-03
7,19E-01	1,27E-03
7,17E-01	1,89E-04

Thermistor Characteristics

Thermistor typical temperature characteristic

Typical NTC characteristic
as a function of temperature

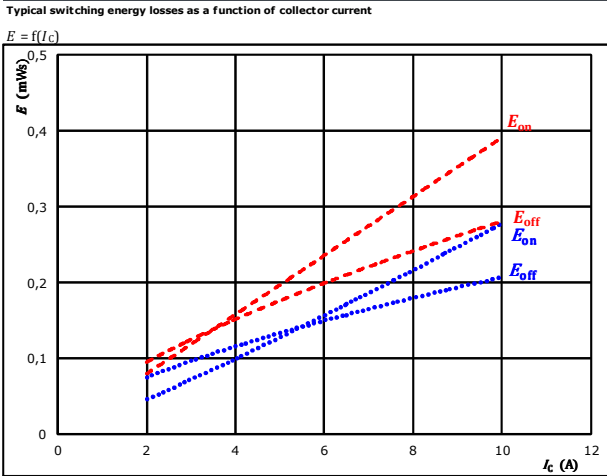
$$R_T = f(T)$$





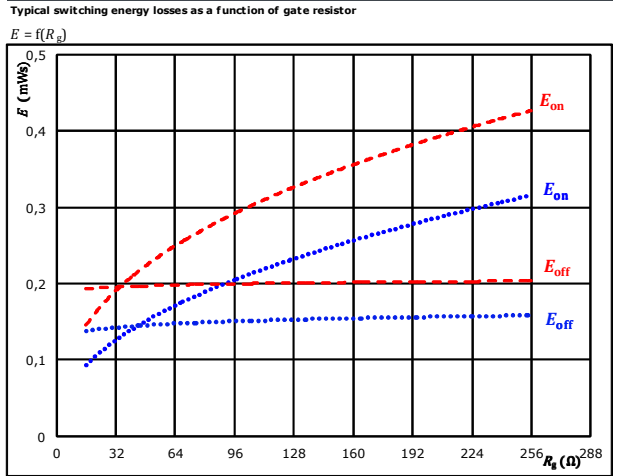
Inverter Switching Characteristics

figure 1. IGBT
Typical switching energy losses as a function of collector current



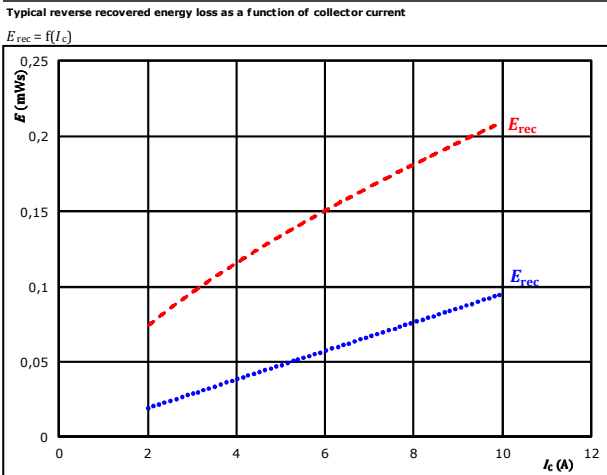
With an inductive load at
 $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 64$ Ω
 $R_{goff} = 64$ Ω
 $T_j: 25$ °C (blue dotted line)
 150 °C (red dashed line)

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



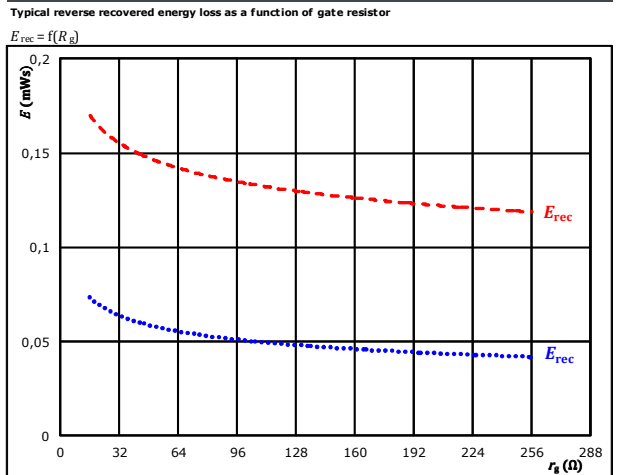
With an inductive load at
 $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_C = 6$ A
 $T_j: 25$ °C (blue dotted line)
 150 °C (red dashed line)

figure 3. FWD
Typical reverse recovered energy loss as a function of collector current



With an inductive load at
 $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 64$ Ω
 $T_j: 25$ °C (blue dotted line)
 150 °C (red dashed line)

figure 4. FWD
Typical reverse recovered energy loss as a function of gate resistor



With an inductive load at
 $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_C = 6$ A
 $T_j: 25$ °C (blue dotted line)
 150 °C (red dashed line)

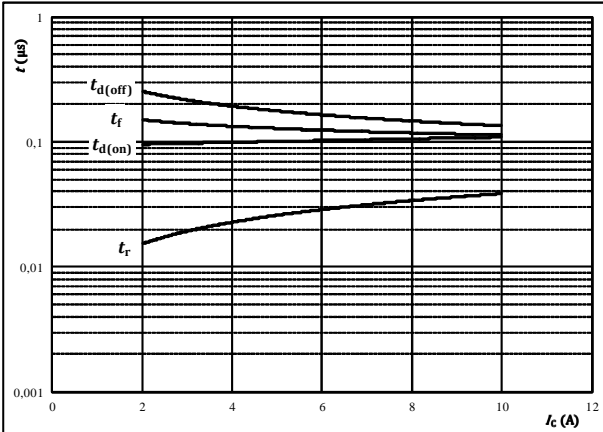


Inverter Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



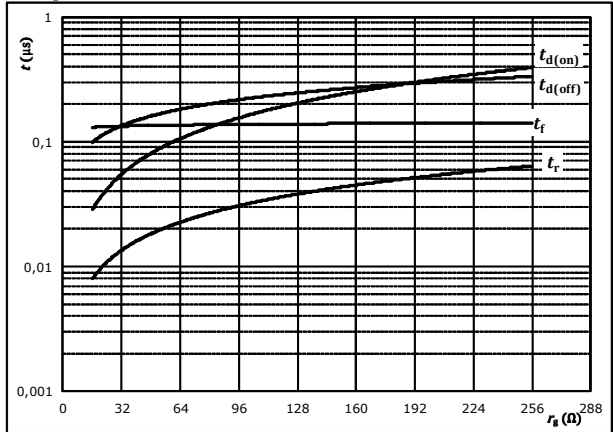
With an inductive load at

$T_j =$	150	$^{\circ}C$
$V_{CE} =$	300	V
$V_{GE} =$	± 15	V
$R_{gon} =$	64	Ω
$R_{goff} =$	64	Ω

figure 6. IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



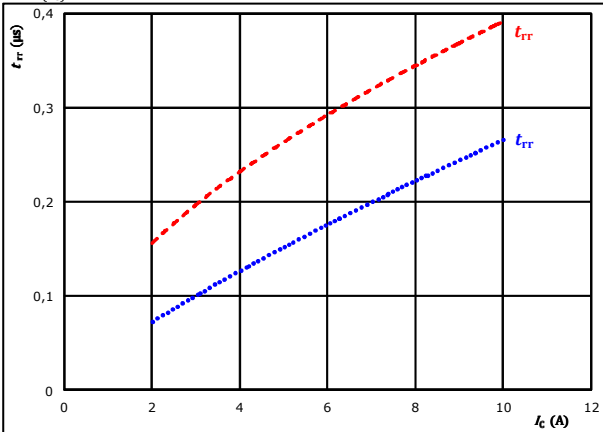
With an inductive load at

$T_j =$	150	$^{\circ}C$
$V_{CE} =$	300	V
$V_{GE} =$	± 15	V
$I_C =$	6	A

figure 7. FWD

Typical reverse recovery time as a function of collector current

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

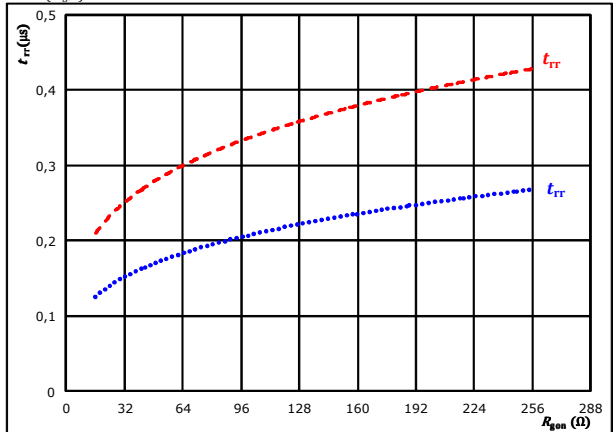


At	$V_{CE} =$	300	V	$T_j:$	25 $^{\circ}C$
	$V_{GE} =$	± 15	V		150 $^{\circ}C$	-----
	$R_{gon} =$	64	Ω			

figure 8. FWD

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

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



At	$V_{CE} =$	300	V	$T_j:$	25 $^{\circ}C$
	$V_{GE} =$	± 15	V		150 $^{\circ}C$	-----
	$I_C =$	6	A			

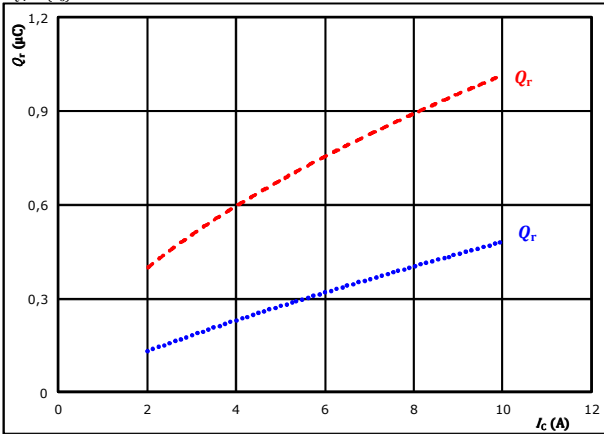


Inverter Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

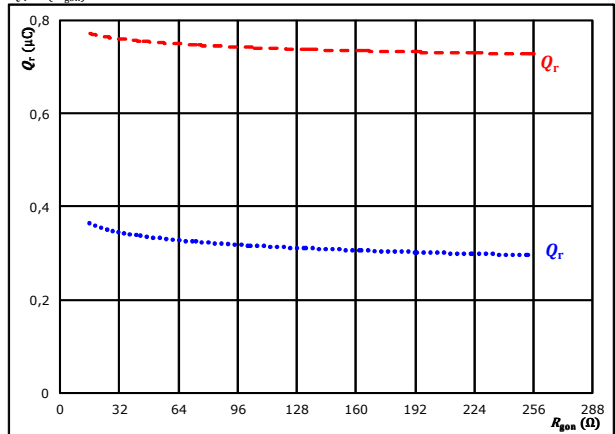


At $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gdn} = 64$ Ω
 $T_j: 25$ °C (blue dotted line)
 150 °C (red dashed line)

figure 10. FWD

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

$$Q_r = f(R_{gdn})$$

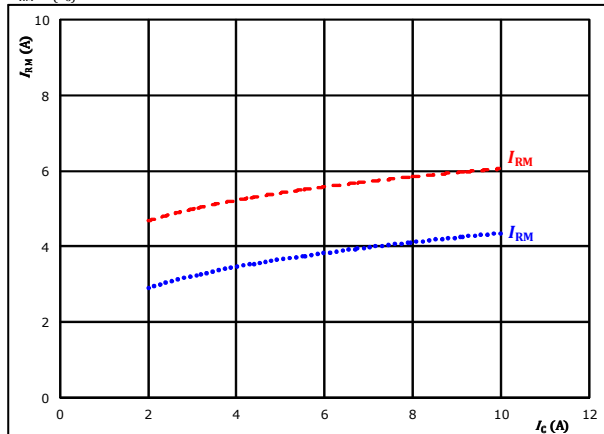


At $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_c = 6$ A
 $T_j: 25$ °C (blue dotted line)
 150 °C (red dashed line)

figure 11. FWD

Typical peak reverse recovery current as a function of collector current

$$I_{RM} = f(I_c)$$

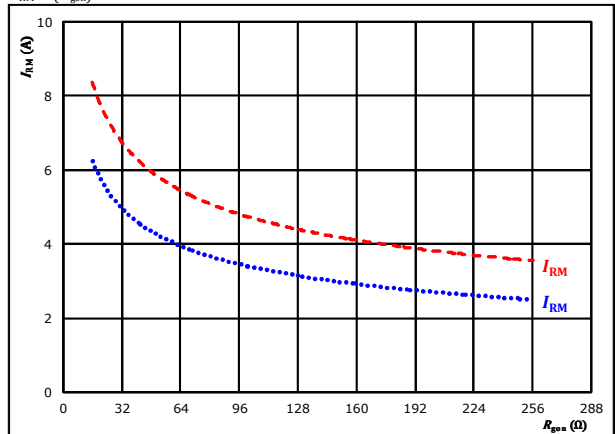


At $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gdn} = 64$ Ω
 $T_j: 25$ °C (blue dotted line)
 150 °C (red dashed line)

figure 12. FWD

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

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



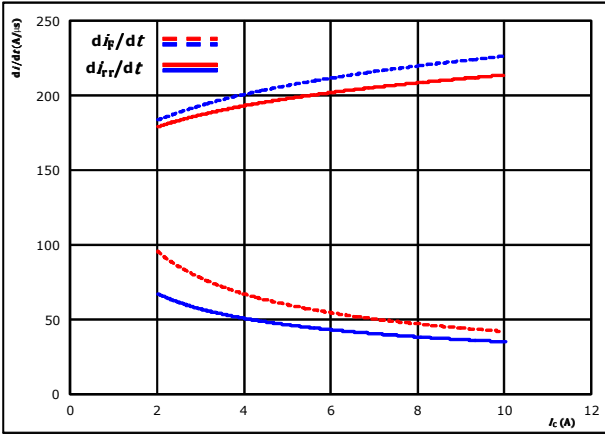
At $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_c = 6$ A
 $T_j: 25$ °C (blue dotted line)
 150 °C (red dashed line)



Inverter Switching Characteristics

figure 13. FWD

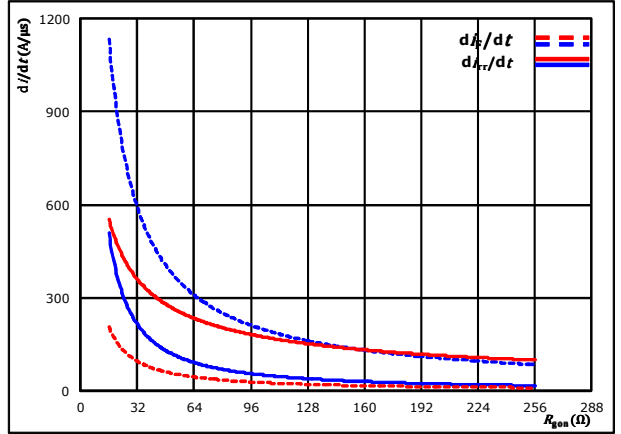
Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_{rr}/dt = f(I_c)$



At $V_{CE} = 300$ V $T_j = 25$ °C (solid blue line)
 $V_{GE} = \pm 15$ V $T_j = 150$ °C (dashed red line)
 $R_{gon} = 64$ Ω

figure 14. FWD

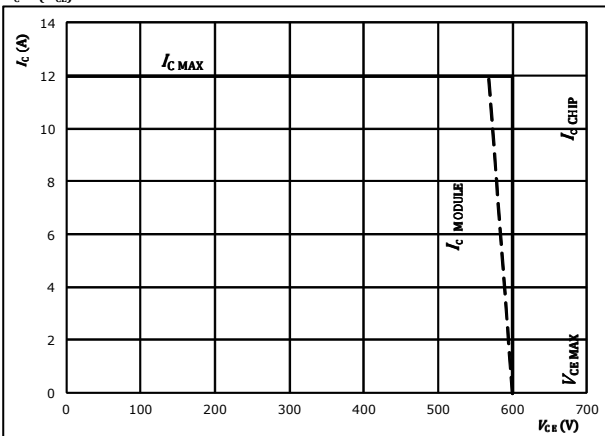
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
 $di_f/dt, di_{rr}/dt = f(R_{gon})$



At $V_{CE} = 300$ V $T_j = 25$ °C (solid blue line)
 $V_{GE} = \pm 15$ V $T_j = 150$ °C (dashed red line)
 $I_c = 6$ A

figure 15. IGBT

Reverse bias safe operating area
 $I_c = f(V_{ce})$



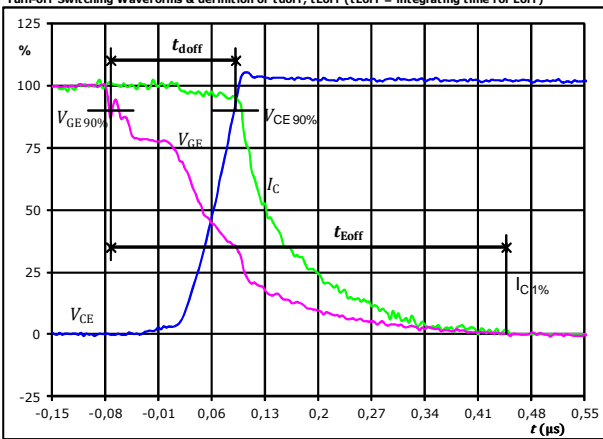
At $T_j = 175$ °C
 $R_{gon} = 64$ Ω
 $R_{goff} = 64$ Ω



Inverter Switching Characteristics

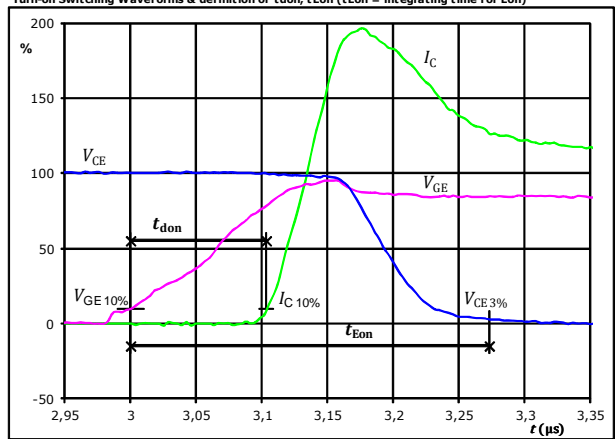
T_j	=	150 °C
R_{gon}	=	64 Ω
R_{goff}	=	64 Ω

figure 1. IGBT
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff} (t_{Eoff} = integrating time for E_{off})



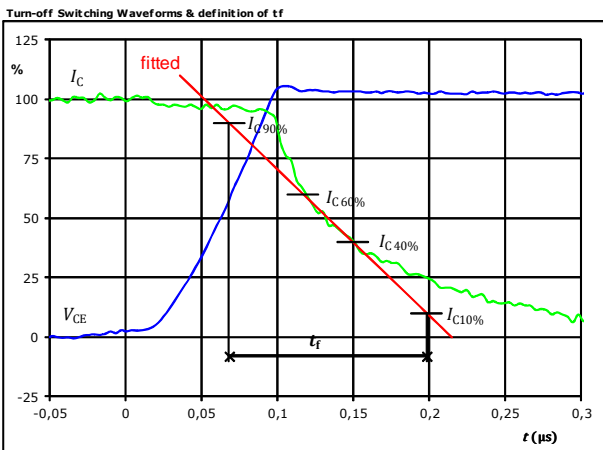
$V_{GE}(0\%)$	=	-15	V
$V_{GE}(100\%)$	=	15	V
$V_C(100\%)$	=	310	V
$I_C(100\%)$	=	6	A
t_{doff}	=	0,164	μs
t_{Eoff}	=	0,519	μs

figure 2. IGBT
Turn-on Switching Waveforms & definition of t_{don} , t_{Eon} (t_{Eon} = integrating time for E_{on})



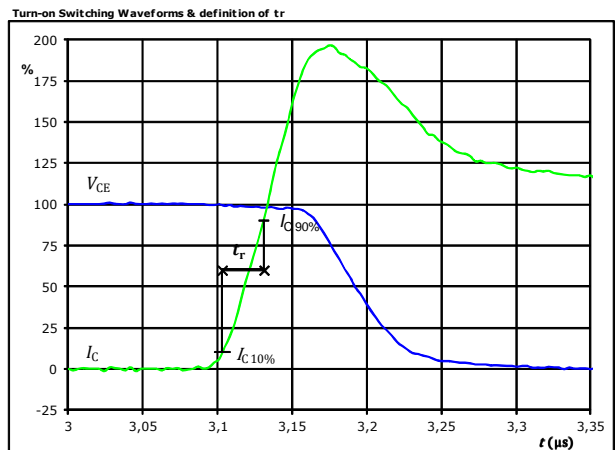
$V_{CE}(0\%)$	=	-15	V
$V_{CE}(100\%)$	=	15	V
$V_C(100\%)$	=	310	V
$I_C(100\%)$	=	6	A
t_{don}	=	0,102	μs
t_{Eon}	=	0,273	μs

figure 3. IGBT
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$	=	310	V
$I_C(100\%)$	=	6	A
t_f	=	0,132	μs

figure 4. IGBT
Turn-on Switching Waveforms & definition of t_r



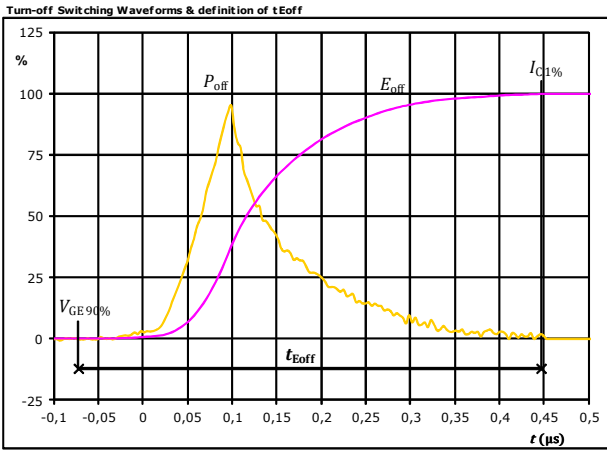
$V_C(100\%)$	=	310	V
$I_C(100\%)$	=	6	A
t_r	=	0,028	μs



Vincotech

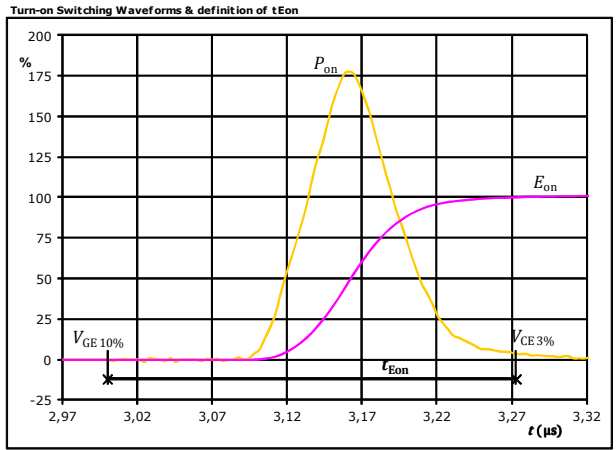
Inverter Switching Characteristics

figure 5. IGBT



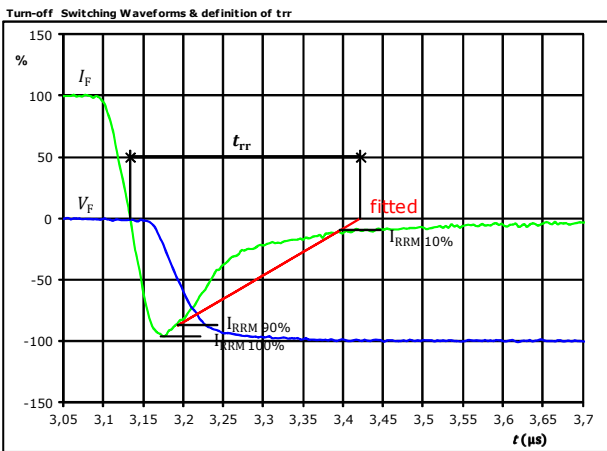
$P_{off}(100\%) = 1,86$ kW
 $E_{off}(100\%) = 0,19$ mJ
 $t_{Eoff} = 0,519$ µs

figure 6. IGBT



$P_{on}(100\%) = 1,86$ kW
 $E_{on}(100\%) = 0,23$ mJ
 $t_{Eon} = 0,27$ µs

figure 7. FWD



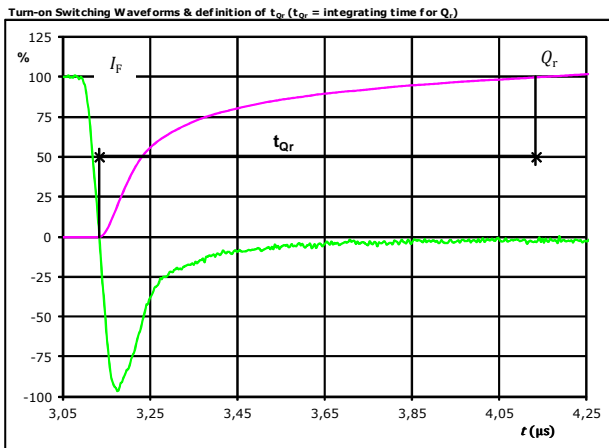
$V_F(100\%) = 310$ V
 $I_F(100\%) = 6$ A
 $I_{RRM}(100\%) = -6$ A
 $t_{rr} = 0,288$ µs



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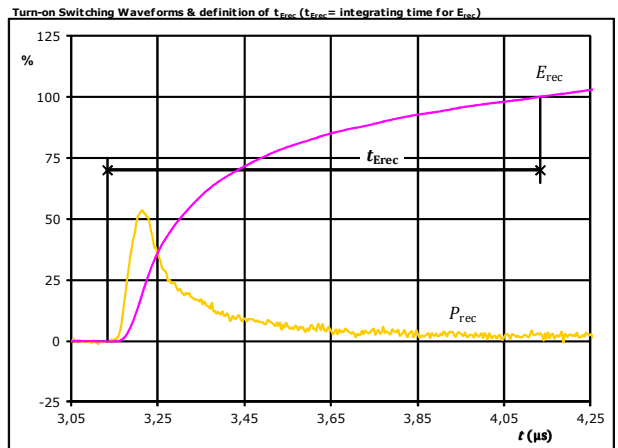
Inverter Switching Characteristics

figure 8. FWD



I_F (100%) = 6 A
 Q_r (100%) = 0,78 μ C
 t_{Qr} = 1,00 μ s


figure 9. FWD



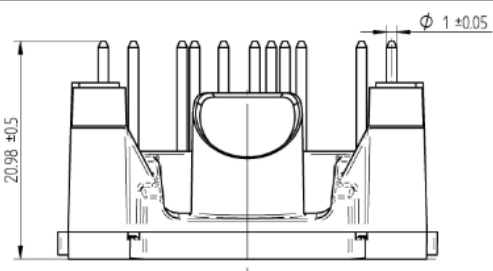
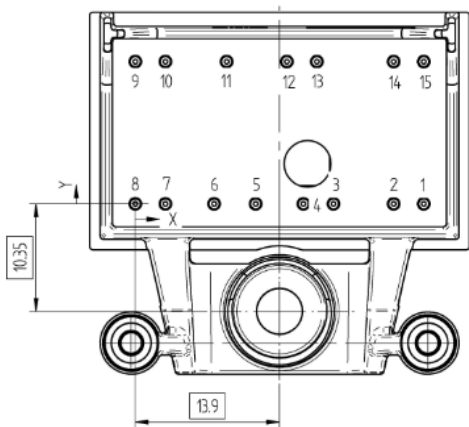
P_{rec} (100%) = 1,86 kW
 E_{rec} (100%) = 0,16 mJ
 t_{Erec} = 1,00 μ s



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Ordering Code & Marking						
Version				Ordering Code		
without thermal paste 17mm housing with solder pins				10-0B066PA006SB-M992F09		
						
Text	Name		Type&Ver	Date code	VIN & Lot	Serial&UL
	NN-NNNNNNNNNNNNNNNN		TTTTTTTVV	WWYY	VIN LLLLL	SSSS UL
Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

Pin table [mm]			
Pin	X	Y	Function
1	27,8	0	G6
2	24,9	0	E6
3	19,1	0	G5
4	16,2	0	E5
5	11,6	0	NTC2
6	7,6	0	NTC1
7	2,9	0	E4
8	0	0	G4
9	0	13,7	U
10	2,9	13,7	G1
11	8,8	13,7	DC+
12	14,6	13,7	V
13	17,5	13,7	G2
14	24,9	13,7	G3
15	27,8	13,7	W

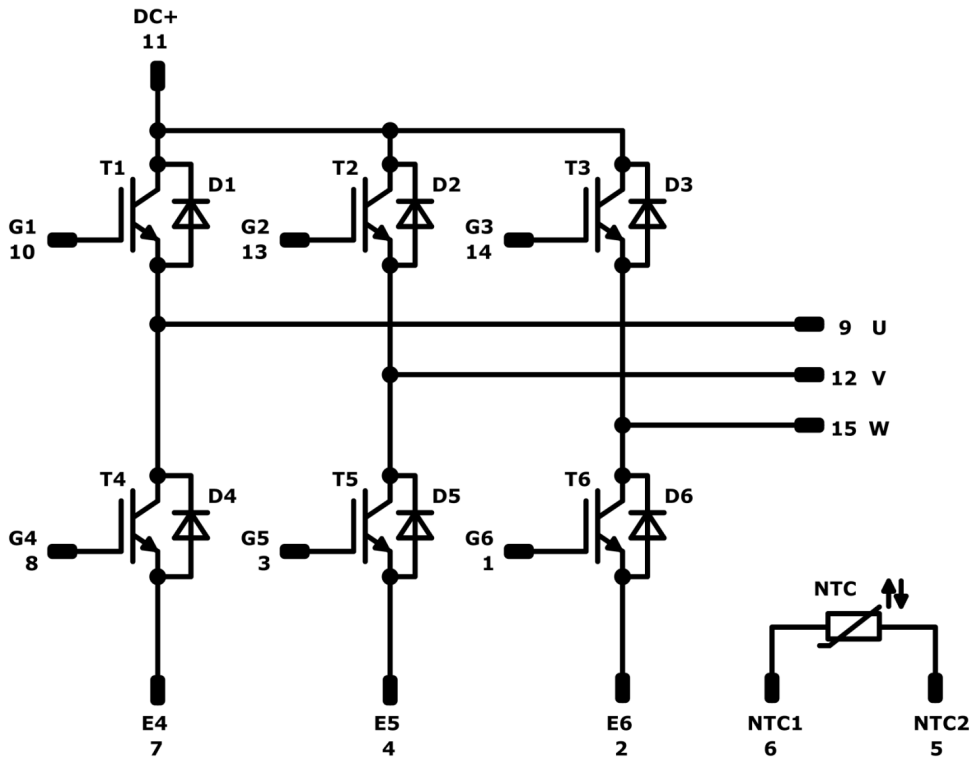



Tolerance of pinpositions: ±0,5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance
PCB cutouts and holes see in handling instruction document



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Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1,T2,T3,T4,T5,T6	IGBT	600 V	6 A	Inverter Switch	
D1,D2,D3,D4,D5,D6	FWD	600 V	6 A	Inverter Diode	
NTC	Thermistor			Thermistor	




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Packaging instruction			
Standard packaging quantity (SPQ)	200	>SPQ	Standard
		<SPQ	Sample

Handling instruction
Handling instructions for <i>flow0</i> B packages see vincotech.com website.

Package data
Package data for <i>flow0</i> B 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
10-0B066PA006SB-M992F09-D2-14	23 Jun. 2016	New brand, Rth value correction	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.