Vincotech

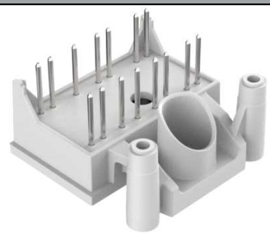
10-0B066PA010SB-M993F09
datasheet

flow PACK 0 B	600 V / 10 A

Features

- IGBT3 (600 V) technology
- Open emitter topology
- New ultra-compact housing
- Single-screw heat sink mounting

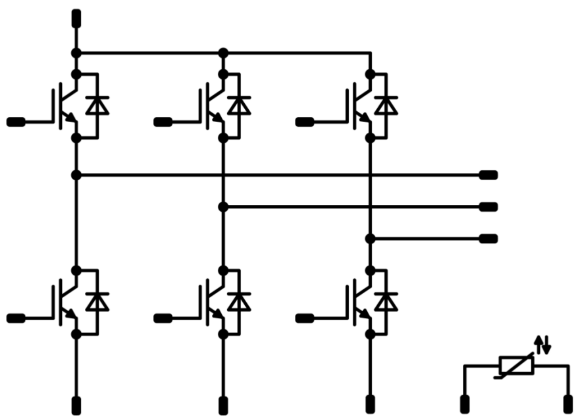
flow 0 B 17 mm housing



Target applications

- Dedicated design for motor drive

Schematic



Types

- 10-0B066PA010SB-M993F09

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	$T_j = T_{jmax}$	T_s = 80 °C	14	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		30	A
Turn off safe operating area		$T_j \le$ 150 °C, $V_{CE} \le$ 600 V		30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	34	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \le$ 150 °C V_{GE} = 15 V		6 360	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}			600	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	17	A
Repetitive peak forward current	I_{FRM}			20	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	33	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_{jop}			-40…+(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{isol}	DC Test Voltage	t_p = 2 s	4000	V
Creepage distance				min. 12,5	mm
Clearance				min. 12,5	mm
Comparative Tracking Index	CTI			> 200	

Characteristic Values

Parameter	Symbol	Conditions	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	Unit
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}$			0,00015	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		10	25 150	1,1	1,50 1,79	1,9	V
Collector-emitter cut-off current	I_{CES}		0	600		25			0,6	µA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		551		pF
Output capacitance	C_{oes}							40		
Reverse transfer capacitance	C_{res}							17		
Gate charge	Q_g		15	480	10	25		62		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness ≤ 50 µm λ = 1 W/mK						2,80		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 32 Ω R_{gon} = 32 Ω	±15	400	10	25 125		75 74		ns
Rise time	t_r					25 125		24 26		
Turn-off delay time	$t_{d(off)}$					25 125		136 159		
Fall time	t_f					25 125		83 123		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,5 µC Q_{rFWD} = 0,9 µC				25 125		0,277 0,376		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,330 0,449		

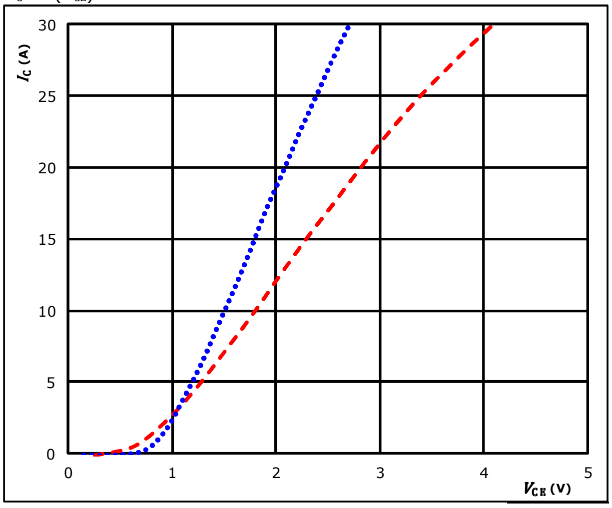
Characteristic Values

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				10	25 150		1,60 1,56	1,95	V
Reverse leakage current	I_{rm}			600		25			27	µA
Thermal										
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						2,85		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 400 A/µs di/dt = 467 A/µs	±15	400	10	25 125		5 7		A
Reverse recovery time	t_{rr}					25 125		194 270		ns
Recovered charge	Q_r					25 125		0,466 0,896		µC
Reverse recovered energy	E_{rec}					25 125		0,132 0,255		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		21 65		A/µs
Thermistor										
Rated resistance	R					25		21,5		kΩ
Deviation of R_{100}	$\Delta R/R$	R_{100} = 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**

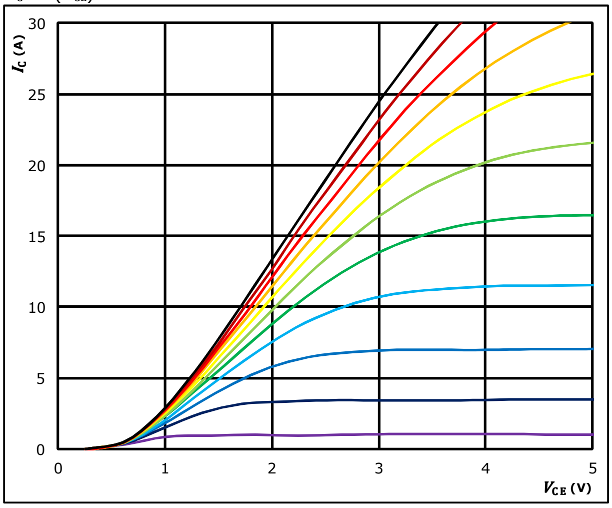
$I_C = f(V_{CE})$



t_p =	250	μs	T_j:	25 °C	blue dotted line
V_{GE} =	15	V		150 °C	red dashed line

Typical output characteristics **IGBT**

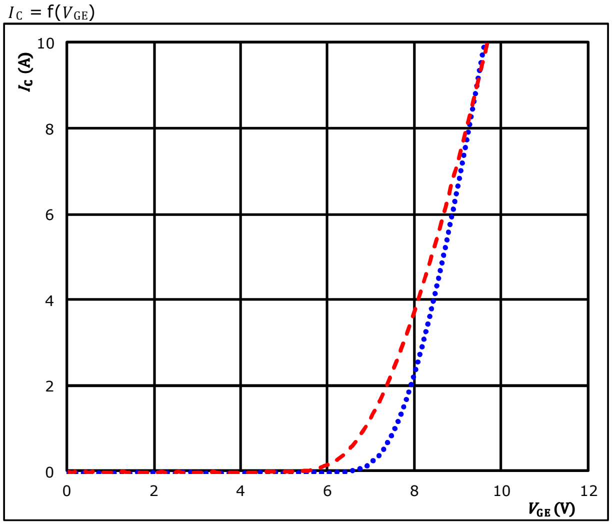
$I_C = f(V_{CE})$



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

Typical transfer characteristics **IGBT**

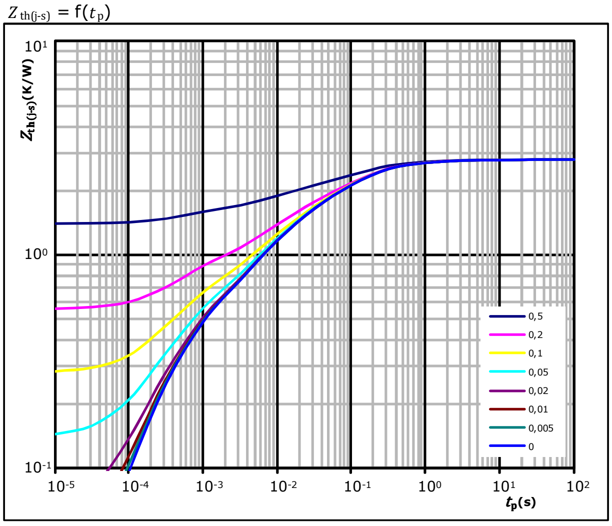
$I_C = f(V_{GE})$



t_p =	100	μs	T_j:	25 °C	blue dotted line
V_{CE} =	10	V		150 °C	red dashed line

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

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



D = t_p / T
$R_{th(j-s)}$ = 2,80 K/W

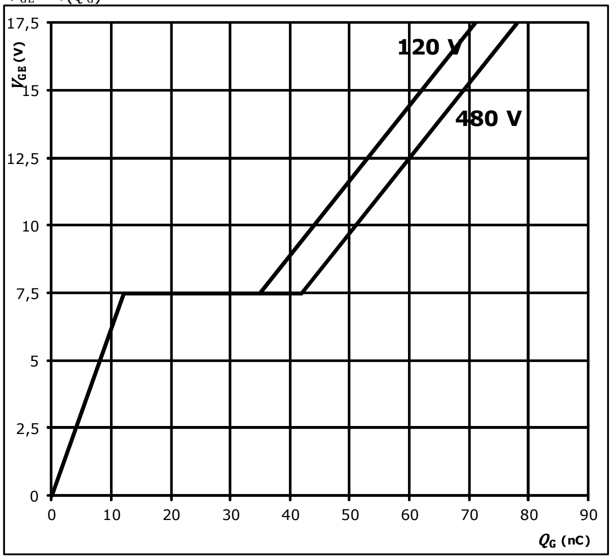
IGBT thermal model values

R (K/W)	τ (s)
4,41E-02	7,36E+00
2,67E-01	6,41E-01
9,50E-01	1,13E-01
7,31E-01	1,82E-02
4,44E-01	3,63E-03
3,64E-01	3,98E-04

Inverter Switch Characteristics

Gate voltage vs Gate charge **IGBT**

$V_{GE} = f(Q_G)$

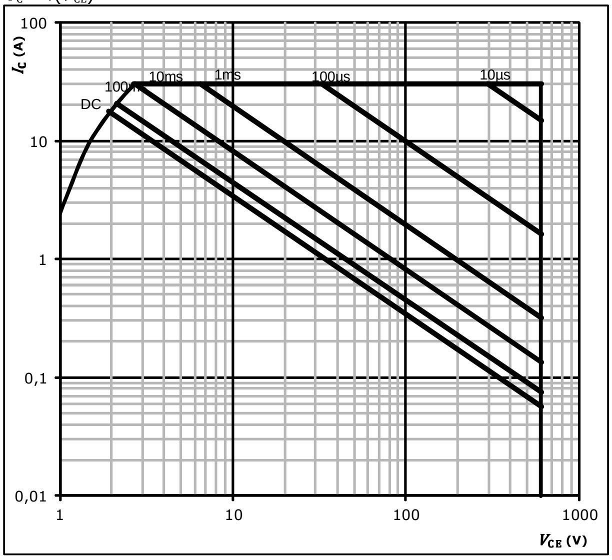


At

I_C= 10 A

Safe operating area **IGBT**

$I_C = f(V_{CE})$

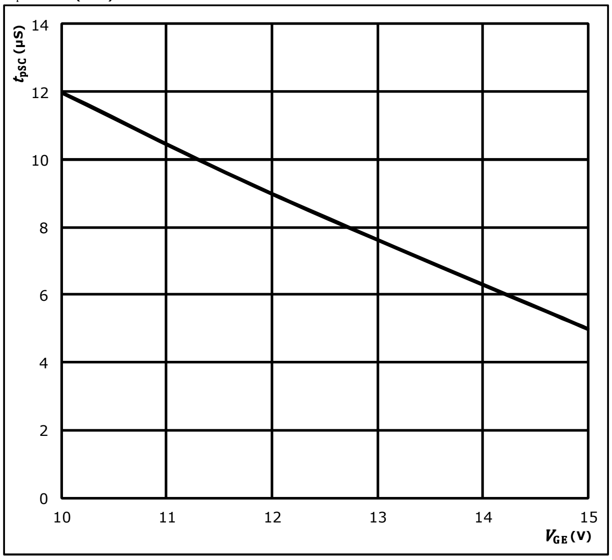


At

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

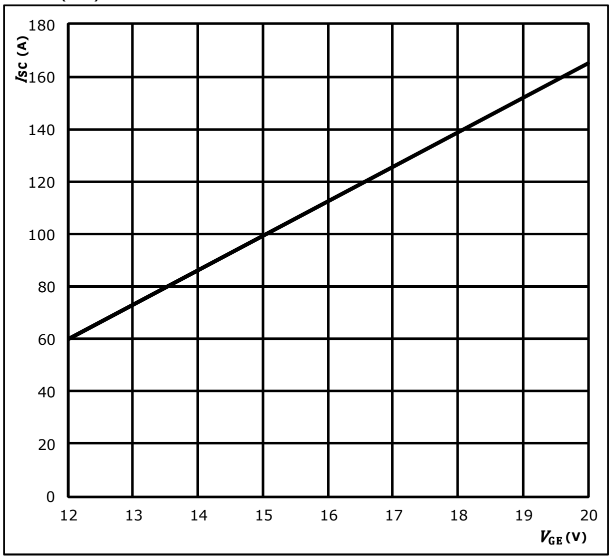
Short circuit duration as a function of V_{GE} **IGBT**

$t_{pSC} = f(V_{GE})$



Typical short circuit current as a function of V_{GE} **IGBT**

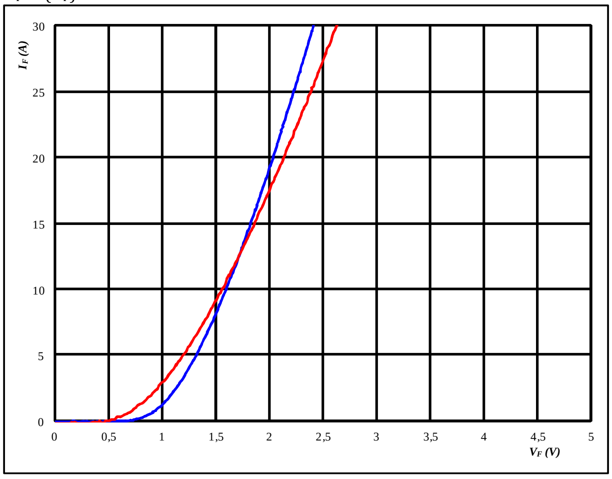
$I_{SC} = f(V_{GE})$



Inverter Diode Characteristics

Typical forward characteristics **FWD**

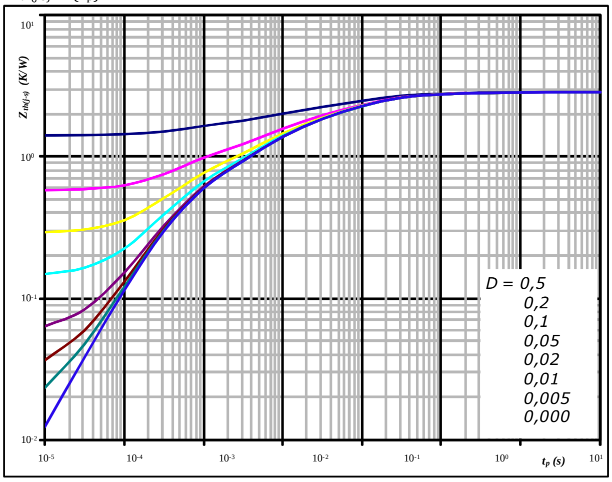
$I_F = f(V_F)$



t_p =	250	μs	T_j:	25 °C
				150 °C

Transient thermal impedance as a function of pulse width **FWD**

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



D = t_p / T

$R_{th(j-s)}$ = 2,85 K/W

FWD thermal model values

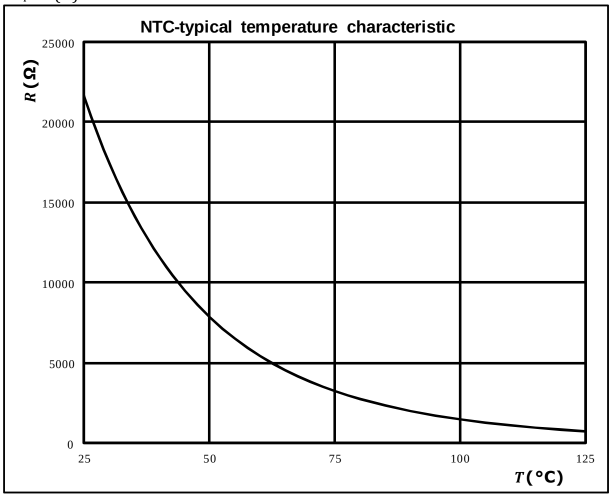
R (K/W)	τ (s)
4,35E-02	9,53E+00
2,14E-01	7,38E-01
7,92E-01	1,19E-01
7,47E-01	1,96E-02
6,00E-01	3,72E-03
4,58E-01	4,38E-04

Thermistor Characteristics

Thermistor typical temperature characteristic

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$

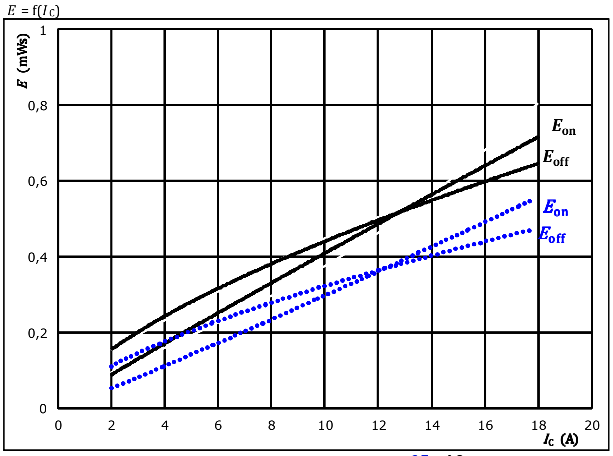


Inverter Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



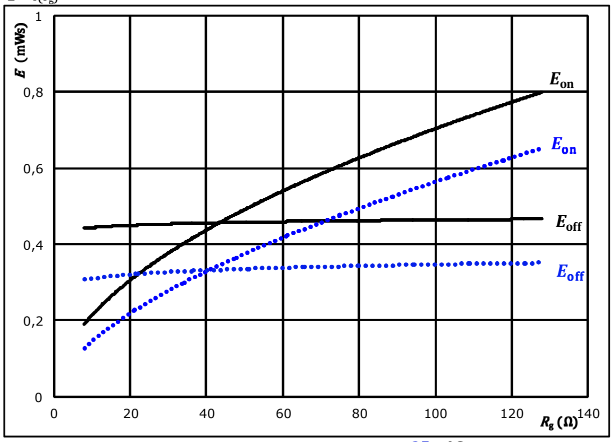
With an inductive load at | 25 °C ······ | Tj: 125 °C ——

V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(r_g)$



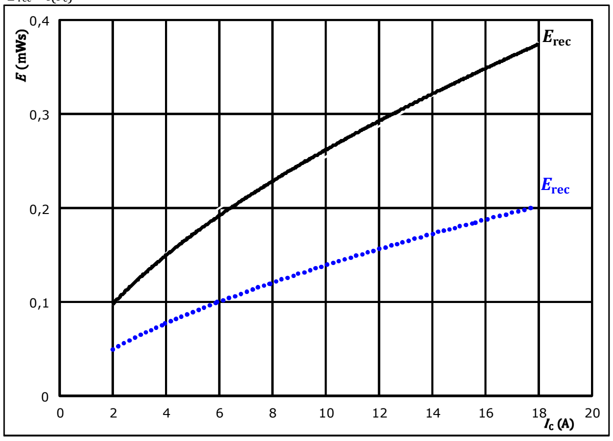
With an inductive load at | 25 °C ······ | Tj: 125 °C ——

V_{CE} =	400	V
V_{GE} =	±15	V
I_C =	10	A

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



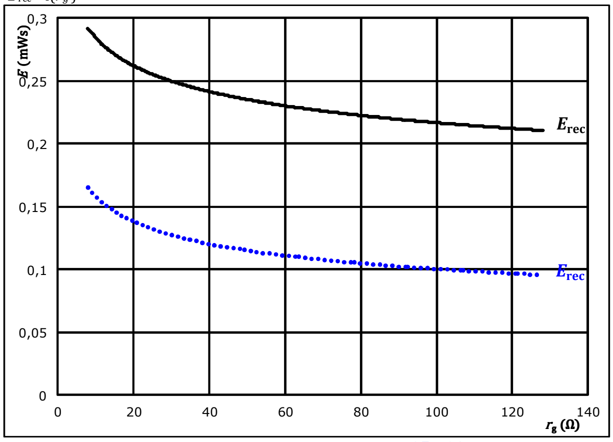
With an inductive load at | 25 °C ······ | Tj: 125 °C ——

V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	32	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 | 25 °C ······ | Tj: 125 °C ——

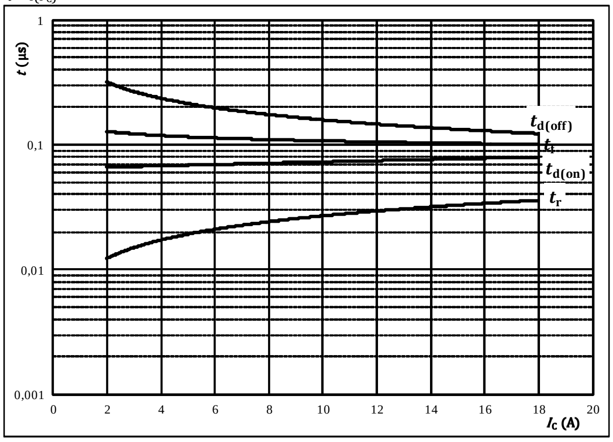
V_{CE} =	400	V
V_{GE} =	±15	V
I_C =	10	A

Inverter Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



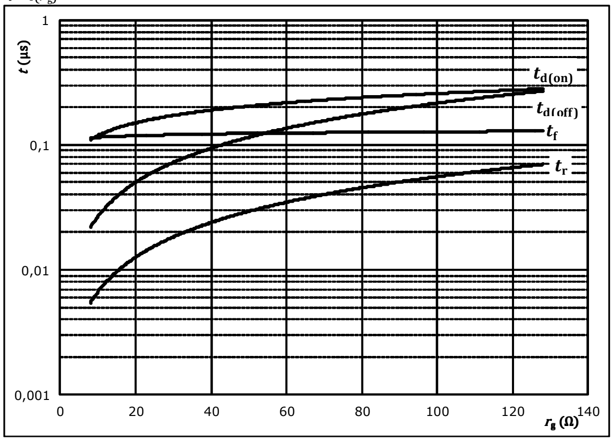
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(r_g)$



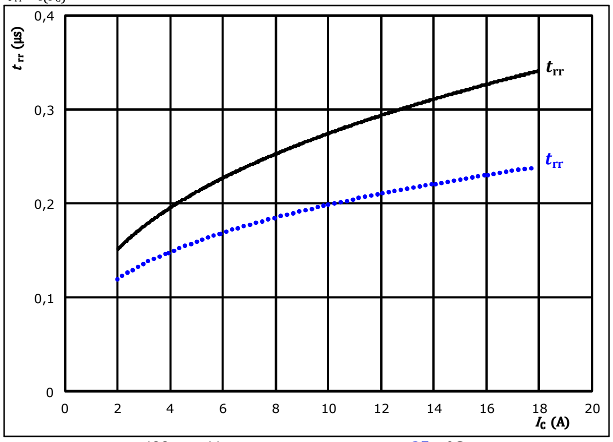
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	±15	V
I_C =	10	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

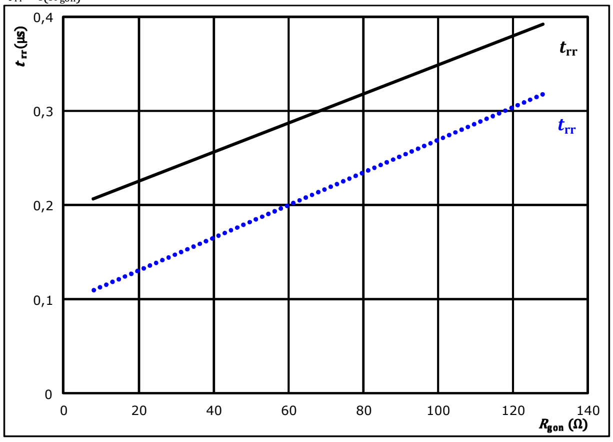


At	V_{CE} =	400	V		25 °C	··············
	V_{GE} =	±15	V	T_j:	125 °C	————
	R_{gon} =	32	Ω			

figure 8. **FWD**

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

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



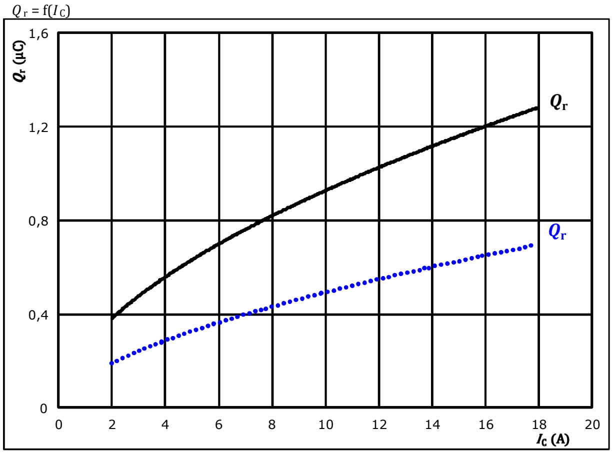
At	V_{CE} =	400	V		25 °C	··············
	V_{GE} =	±15	V	T_j:	125 °C	————
	I_C =	10	A			

Inverter Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

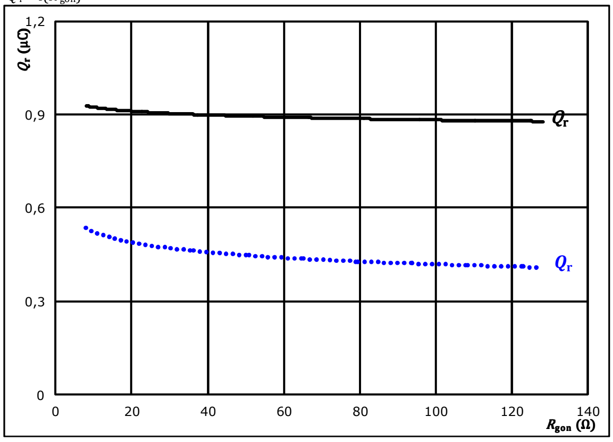


At					
V_{CE} =	400	V		25 °C	dotted
V_{GE} =	±15	V	T_j:	125 °C	solid
R_{gon} =	32	Ω			

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

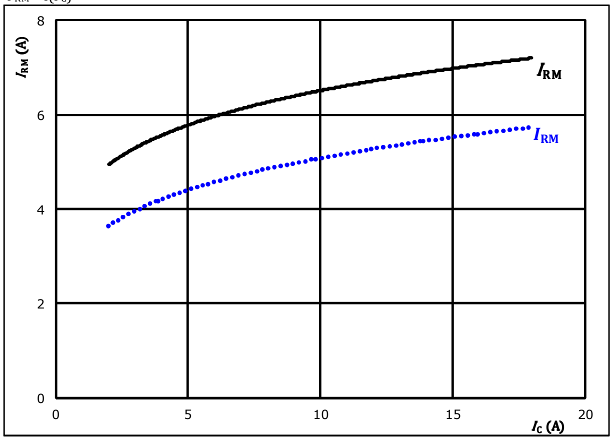


At					
V_{CE}=	400	V		25 °C	dotted
V_{GE} =	±15	V	T_j:	125 °C	solid
I_C=	10	A			

figure 11. **FWD**

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

$I_{RM} = f(I_C)$

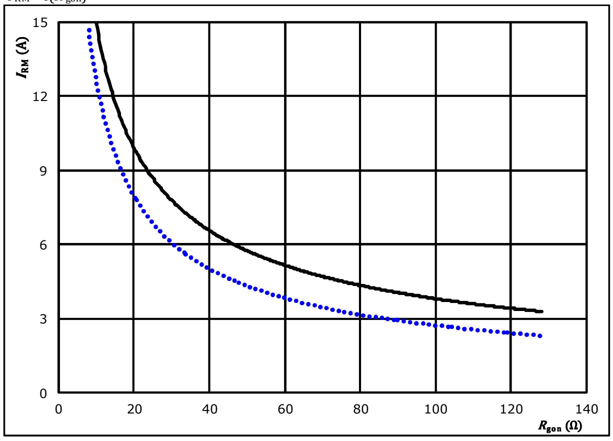


At					
V_{CE}:	400	V		25 °C	dotted
V_{GE} =	±15	V	T_j:	125 °C	solid
R_{gon} =	32	Ω			

figure 12. **FWD**

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

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



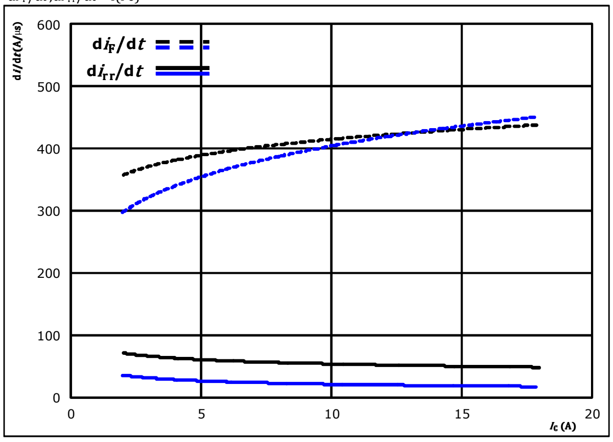
At					
V_{CE} =	400	V		25 °C	dotted
V_{GE} =	±15	V	T_j:	125 °C	solid
I_C =	10	A			

Inverter Switching Characteristics

figure 13. **FWD**

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

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

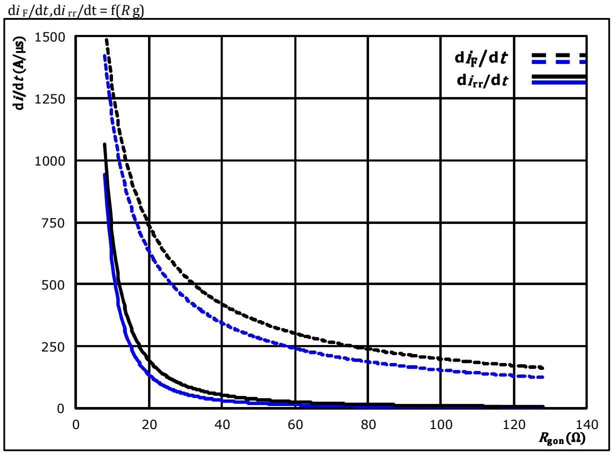


At						
V_{CE} =	400	V		25	°C	··············
V_{GE} =	±15	V	T_j:	125	°C	———
R_{gon} =	32	Ω				

figure 14. **FWD**

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

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

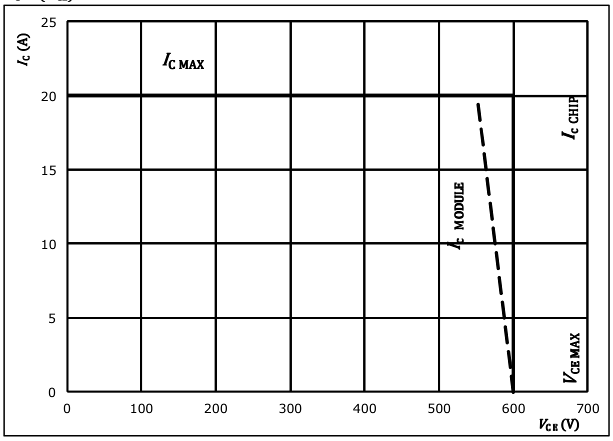


At						
V_{CE} =	400	V		25	°C	··············
V_{GE} =	±15	V	T_j:	125	°C	———
I_C=	10	A				

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



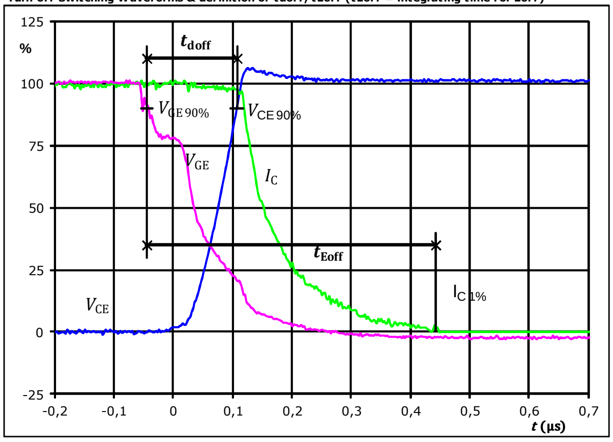
At		
T_j =	175	°C
R_{gon} =	32	Ω
R_{goff} =	32	Ω

Inverter Switching Characteristics

T_j	=	125 °C
R_{gon}	=	32 Ω
R_{goff}	=	32 Ω

figure 1. IGBT

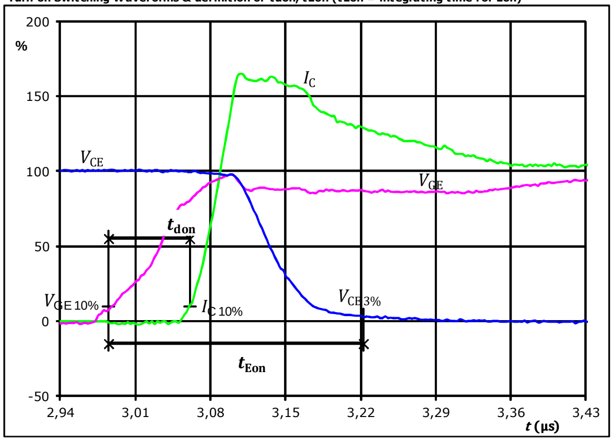
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	10	A
t_{doff} =	0,159	µs
t_{Eoff} =	0,487	µs

figure 2. IGBT

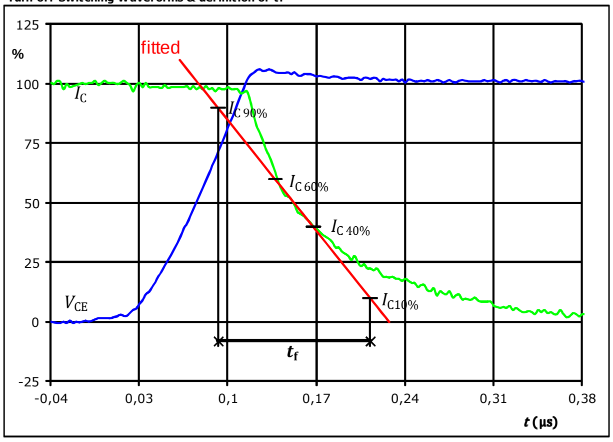
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	10	A
t_{don} =	0,074	µs
t_{Eon} =	0,237	µs

figure 3. IGBT

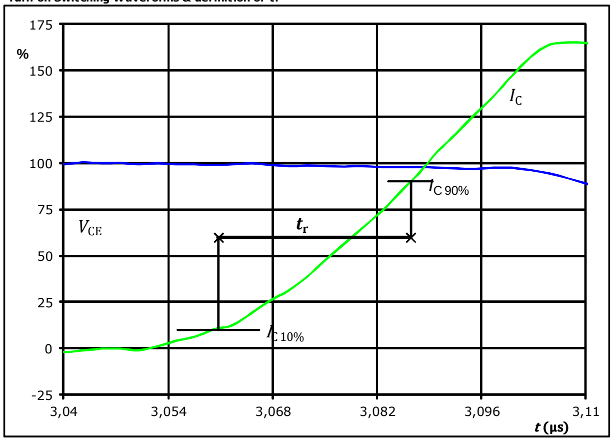
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	10	A
t_f =	0,123	µs

figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

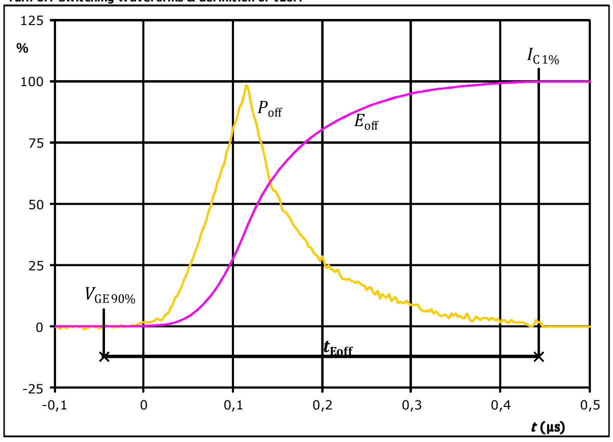


$V_C(100\%)$ =	400	V
$I_C(100\%)$ =	10	A
t_r =	0,026	µs

Inverter Switching Characteristics

figure 5. **IGBT**

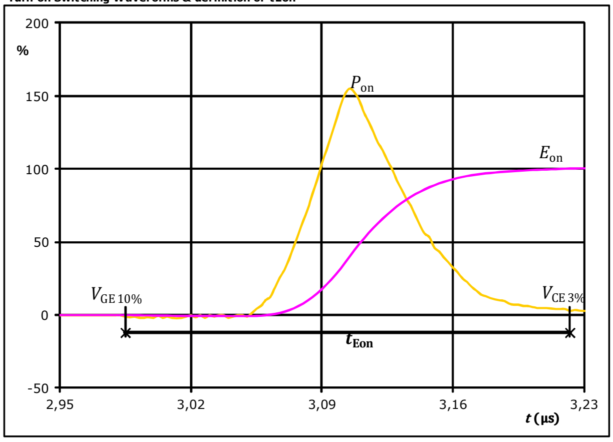
Turn-off Switching Waveforms & definition of tEoff



P_{off} (100%) =	4,00	kW
E_{off} (100%) =	0,45	mJ
t_{Eoff} =	0,49	µs

figure 6. **IGBT**

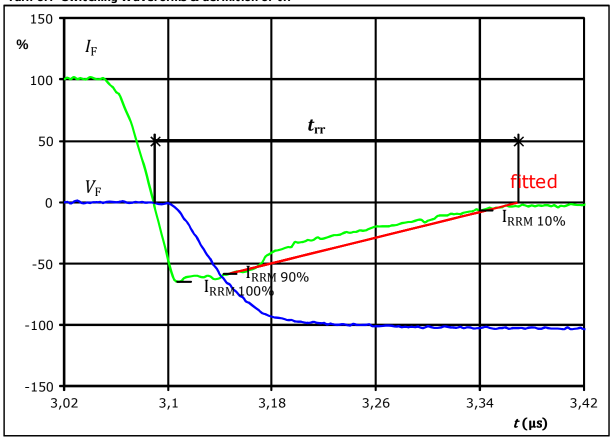
Turn-on Switching Waveforms & definition of tEon



P_{on} (100%) =	4,00	kW
E_{on} (100%) =	0,38	mJ
t_{Eon} =	0,24	µs

figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

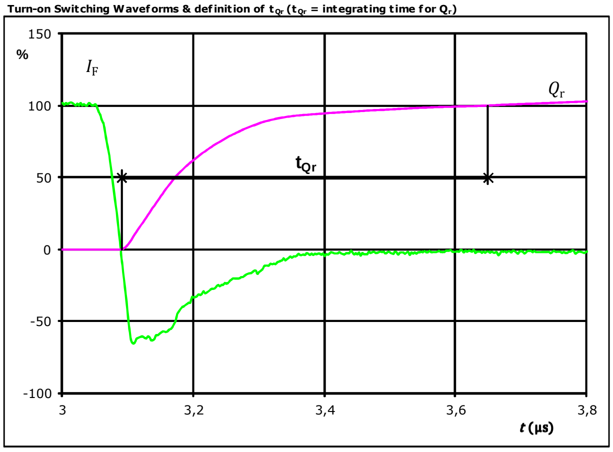


V_F (100%) =	400	V
I_F (100%) =	10	A
I_{RRM} (100%) =	-7	A
t_{rr} =	0,270	µs

Inverter Switching Characteristics

figure 8. **FWD**

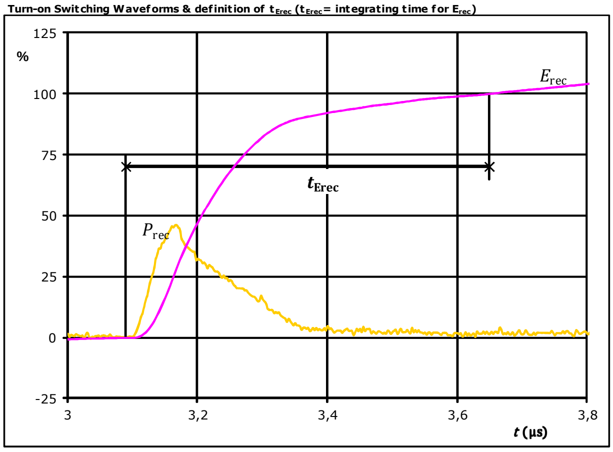
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	10	A
Q_r (100%) =	0,90	µC
t_{Qr} =	0,56	µs

figure 9. **FWD**

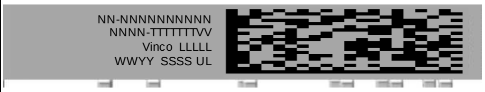
Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec} = integrating time for E_{rec})



P_{rec} (100%) =	4,00	kW
E_{rec} (100%) =	0,26	mJ
t_{Erec} =	0,56	µs

Ordering Code & Marking

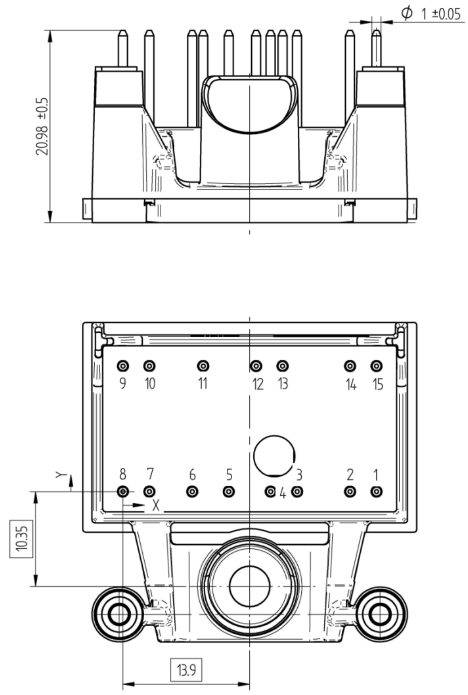
Version	Ordering Code
without thermal paste 17mm housing	10-0B066PA010SB-M993F09



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

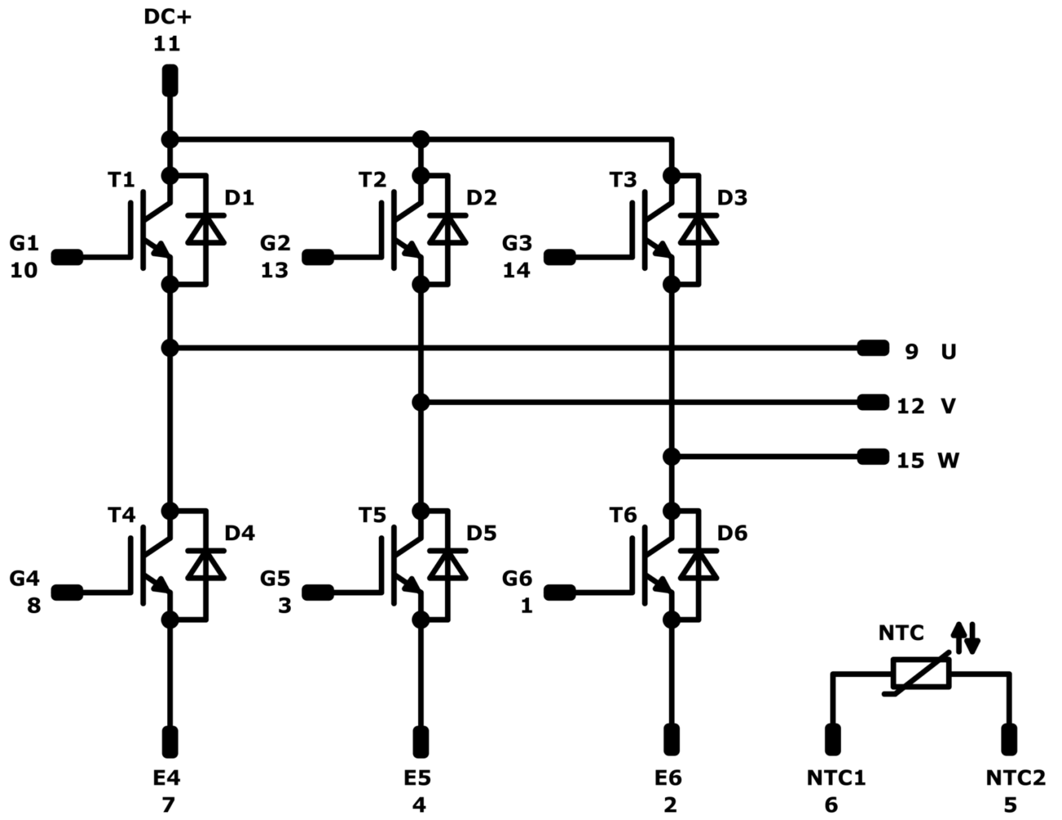
Outline

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

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1-T6	IGBT	600 V	10 A	Inverter Switch	
D1-D6	FWD	600 V	10 A	Inverter Diode	
NTC	NTC			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ)	160	>SPQ Standard	<SPQ Sample	

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

Package data
Package data for *flow*0 B packages see vincotech.com website.

Document No.:	Date:	Modification:	Pages
10-0B066PA010SB-M993F09-D3-14	23 Jun. 2017		