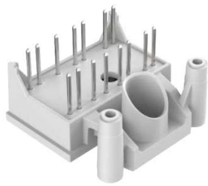
Vincotech

flow PACK 0B — 1200 V / 4 A

Features

- IGBT4 (1200 V) technology
- Open emitter topology
- New ultra-compact housing
- Single-screw heat sink mounting

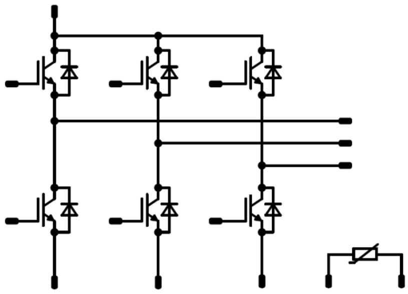
flow 0 17 mm housing



Target applications

- Dedicated design for motor drive

Schematic



Types

- 10-0B126PA004SC-M997F09

Inverter switch maximum ratings

Parameter	Symbol	Condition		Value	Unit
Collector-emitter break down voltage	V_{CES}			1200	V
DC collector current	I_C	$T_j=T_jmax$	$T_h=80°C$	8	A
Pulsed collector current	I_{Cpulse}	t_p limited by T_jmax		12	A
Power dissipation	P_{tot}	$T_j=T_jmax$	$T_h=80°C$	37	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	Tj≤ 150°C VGE= 15V		10 800	µs V
Maximum Junction Temperature	T_jmax			175	°C

Inverter diode maximum ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	$T_j=T_jmax$	$T_h=80°C$	18	A
Repetitive peak forward current	I_{FRM}			20	A
Power dissipation	P_{tot}	$T_j=T_jmax$	$T_h=80°C$	40	W
Maximum Junction Temperature	T_jmax			175	°C

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Module Properties

Parameter	Symbol	Conditions		Value	Unit
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(T_{jmax} - 25)	°C
Insulation Properties					
Insulation voltage	V_{isol}	DC Test Voltage*	t_p = 2s	6000	V
			t_p = 1 min	2500	V
Creepage distance				min 12,7	mm
Clearance				min 12,7	mm
Comparative tracking index	CTI			>200	

*100 % tested in production

Inverter switch characteristic values

Parameter	Symbol	Conditions	V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	Unit
Static										
Gate emitter threshold voltage	$V_{GE(th)}$	V_{GE}=V_{CE}			0,00015	25 125	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		4	25 150	1,6	1,85 2,20	2,1	V
Collector-emitter cut-off	I_{CES}		0	1200		25 125			0,5	µA
Gate-emitter leakage current	I_{GES}		20	0		25 125			120	nA
Integrated Gate resistor	R_{gint}							none		Ω
Input capacitance	C_{ies}	f=1 MHz	0	25		25		250		pF
Output capacitance	C_{oss}							25		
Reverse transfer capacitance	C_{rss}							15		
Gate charge	Q_{Gate}		15	960	4	25		26		nC
Thermal										
Thermal resistance chip to heatsink	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,6		K/W

Inverter dynamic values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [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	$t_{d(on)}$	Rgoff=64Ω Rgon=64Ω	±15	600	4	25 150		83 77		ns
Rise time	t_r					25 150		26 28		
Turn-off delay time	$t_{d(off)}$					25 150		191 254		
Fall time	t_f					25 150		77 122		
Turn-on energy loss per pulse	E_{on}	QrrFWD=0,5uC				25 150		0,356 0,626		mWs
Turn-off energy loss per pulse	E_{off}					25 150		0,228 0,386		
FWD Switching										
Peak recovery current	I_{RRM}	172	±15	600	4	25 150		4 6		A
Reverse recovery time	t_{rr}	172				25 150		246 426		ns
Reverse recovery charge	Q_{rr}	172				25 150		0,536 1,202		µC
Reverse recovered energy	E_{rec}	172				25 150		0,191 0,433		mWs
Peak rate of fall of recovery current	di(rec)max /dt	172				25 150		65 42		A/µs

Inverter diode characteristic values

Parameter	Symbol	Conditions					Value			Unit
		dI_F/dt [A/us]		V_r [V]	I_F [A]	T_j	Min	Typ	Max	
Static										
Forward voltage	V_F				10	25°C 150°C		1,76 1,68	2,05	V
Reverse leakage current	I_{rm}			1200		25°C 150°C			2,7 -	µA
Thermal										
Thermal resistance chip to heatsink	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,4		K/W

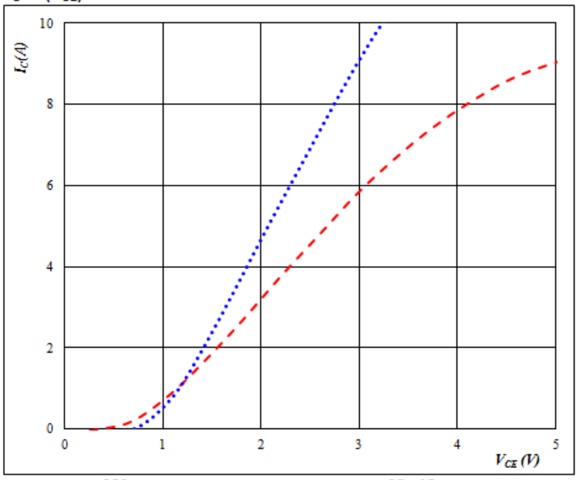
Thermistor

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	ΔR/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

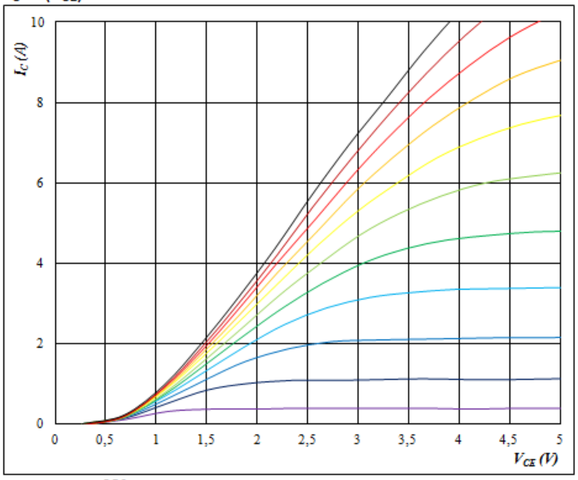
$I_C = f(V_{CE})$



t_p =	250	µs		25 °C	dotted
V_{GE}=	15	V	T_j:	125 °C	solid
				150 °C	dashed

Typical output characteristics	IGBT

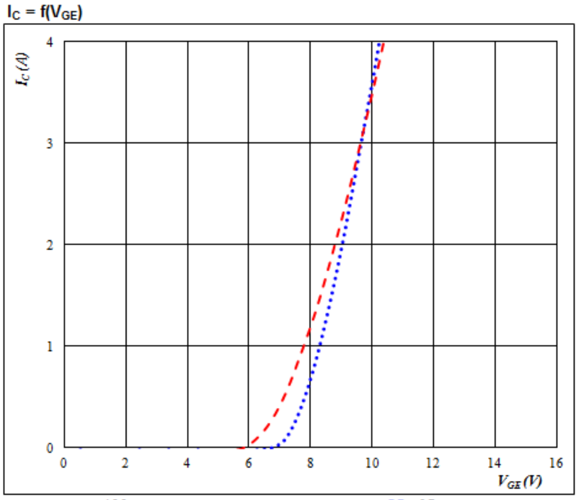
$I_C = f(V_{CE})$



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

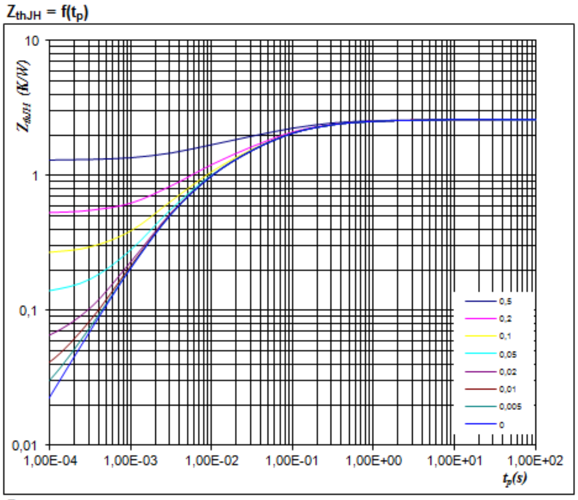
$I_C = f(V_{GE})$



t_p =	100	µs		25 °C	dotted
V_{CE} =	10	V	T_j:	125 °C	solid
				150 °C	dashed

Transient thermal impedance as a function of pulse width	IGBT

$Z_{thJH} = f(t_p)$



D = t_p / T
R_{thJH} = 2,6 K/W

IGBT thermal model values

R (K/W)	Tau (s)
8,38E-02	2,82E+00
3,47E-01	2,43E-01
7,72E-01	5,24E-02
4,93E-01	1,12E-02
3,60E-01	2,85E-03

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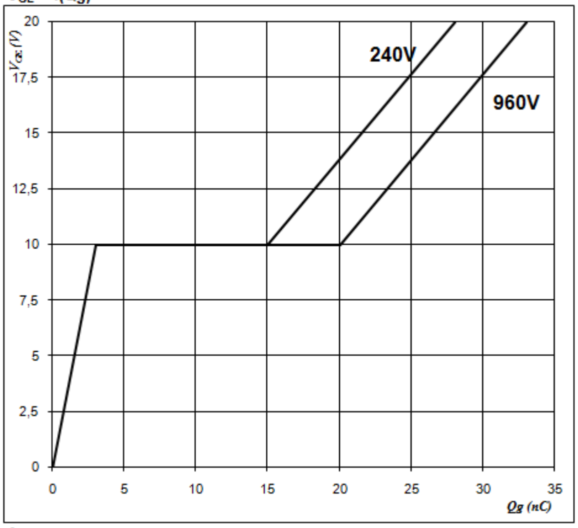
Inverter switch characteristics

Gate voltage vs Gate charge — IGBT

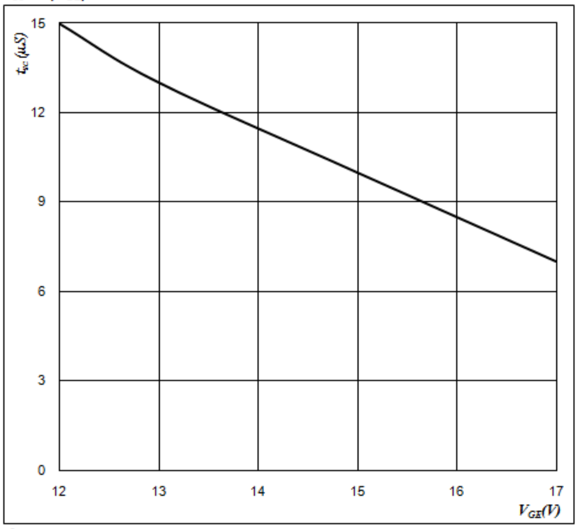
$V_{GE} = f(Q_g)$



At
I_C= 4 A

Short circuit withstand time as a function of V_{GE} — IGBT

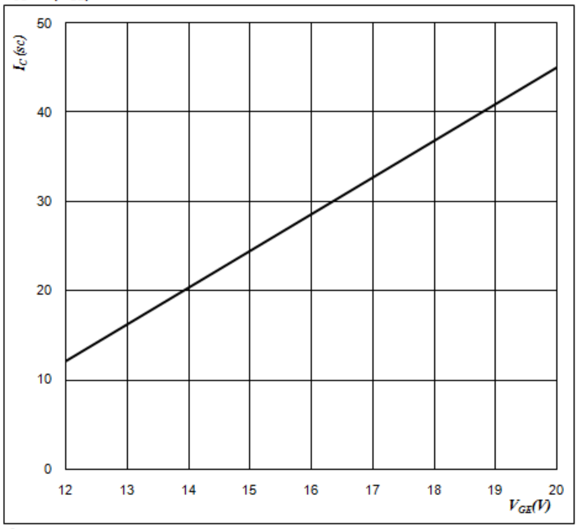
$t_{sc} = f(V_{GE})$



At
V_{CE} = 1200 V
T_j ≤ 175 °C

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

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



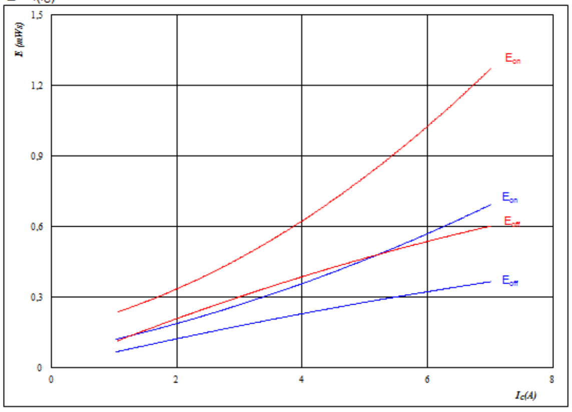
At
V_{CE} ≤ 1200 V
T_j ≤ 175 °C

Inverter switching characteristics

Figure 1. IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



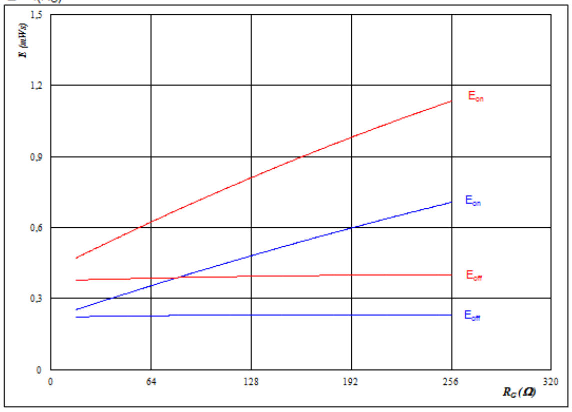
With an inductive load at

T_j =	25/150	°C	R_{gon} =	64	Ω
V_{CE} =	600	V	R_{goff} =	64	Ω
V_{GE} =	±15	V			

Figure 2. IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



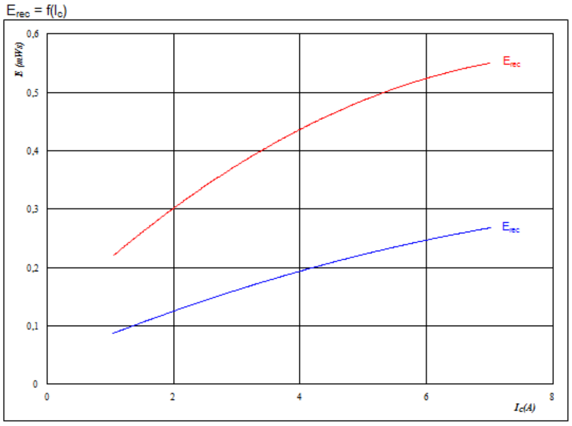
With an inductive load at

T_j =	25/150	°C	V_{GE} =	±15	V
V_{CE} =	600	V	I_C =	4	A

Figure 3. FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_c)$



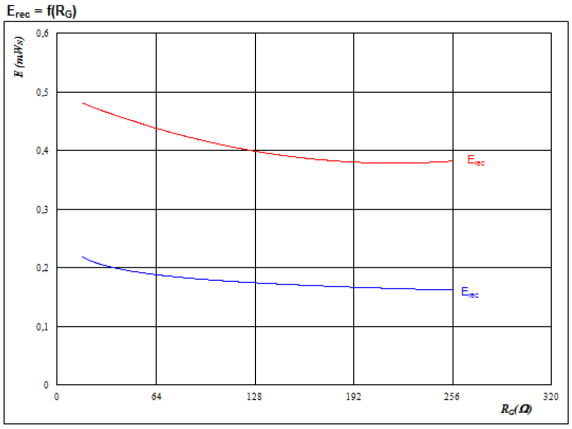
With an inductive load at

T_j =	25/150	°C	R_{gon} =	64	Ω
V_{CE} =	600	V	R_{goff} =	64	Ω
V_{GE} =	±15	V			

Figure 4. FWD

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



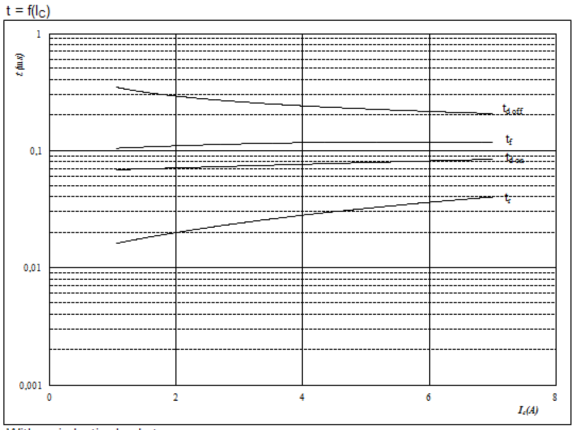
With an inductive load at

T_j =	25/150	°C	V_{GE} =	±15	V
V_{CE} =	600	V	I_C =	4	A

Figure 5. IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



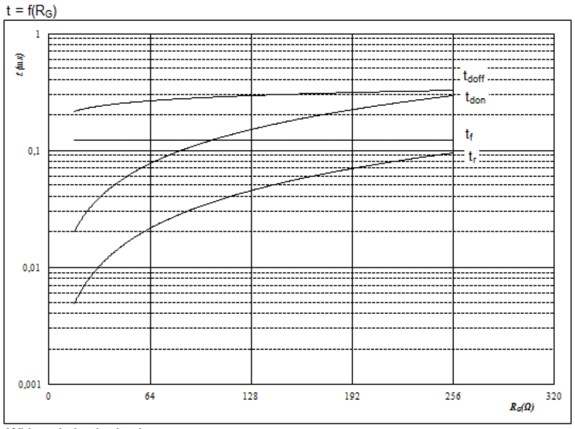
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	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

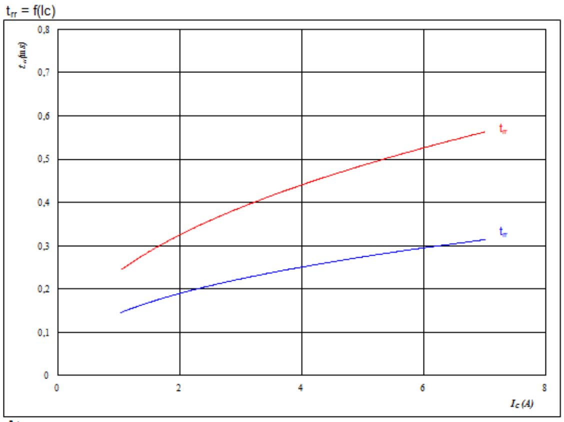
T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	4	A

Inverter switching characteristics

Figure 7. FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



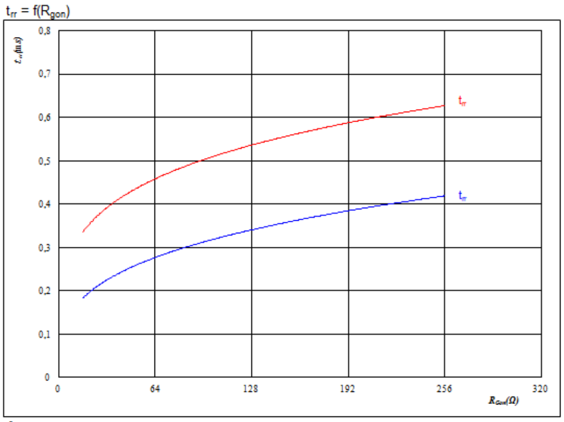
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	64	Ω

Figure 8. FWD

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

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



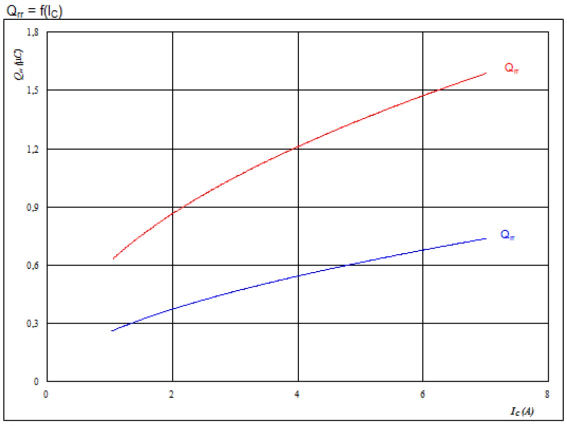
At

T_j =	25/150	°C
V_R =	600	V
I_F =	4	A
V_{GE} =	±15	V

Figure 9. FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



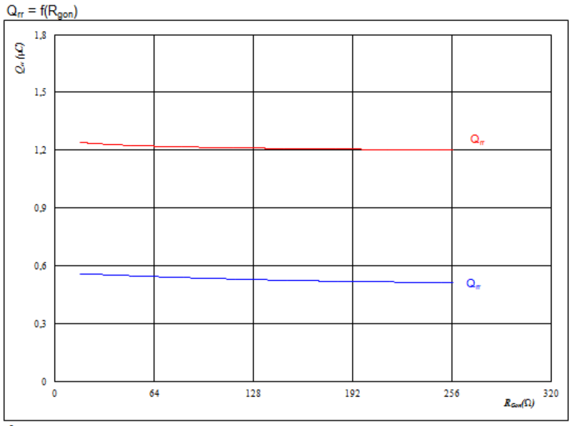
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	64	Ω

Figure 10. FWD

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

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



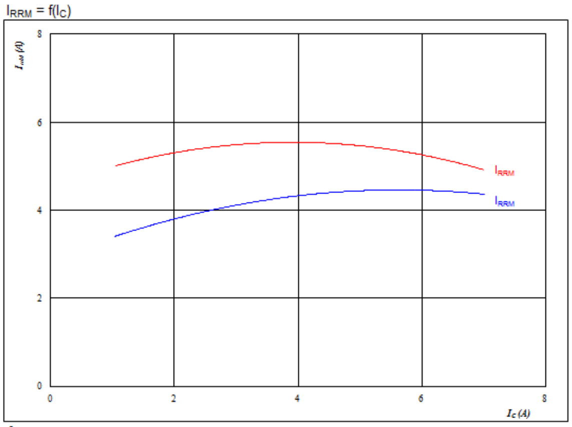
At

Tj =	25/150	°C
VR =	600	V
IF =	4	A
V_{GE} =	±15	V

Figure 11. FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



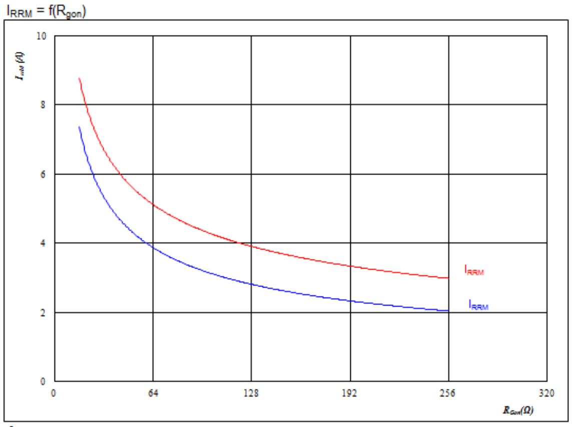
At

T_j =	25/150	°C	R_{gon} =	64	Ω
V_{CE} =	600	V			
V_{GE} =	±15	V			

Figure 12. FWD

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

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



At

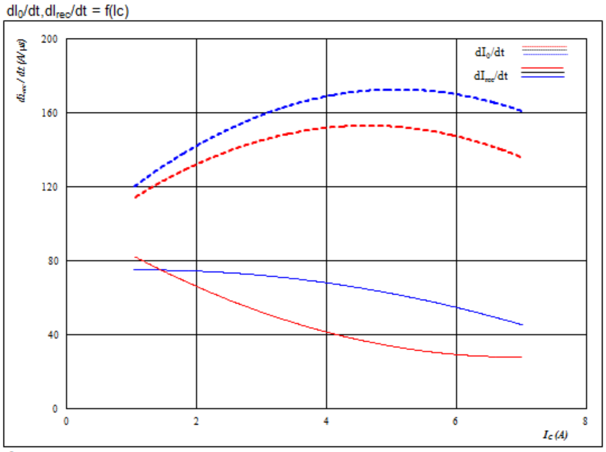
T_j =	25/150	°C	V_{GE} =	±15	V
V_R =	600	V			
I_F =	4	A			

Inverter switching characteristics

Figure 13. FWD

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

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

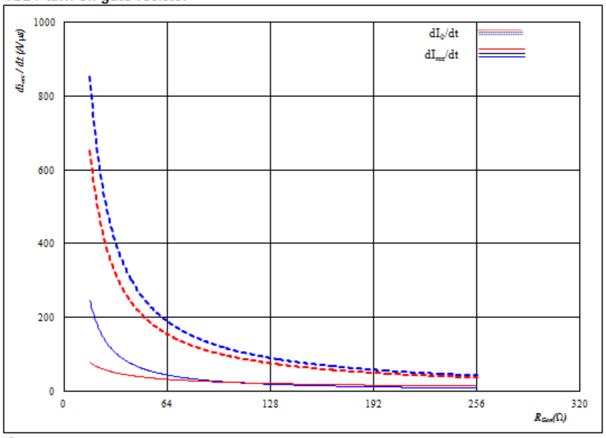


At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
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



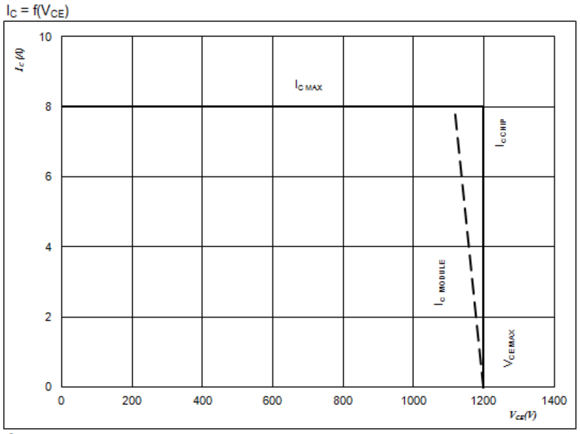
At

Tj =	25/150	°C
VR =	600	V
IF =	4	A
VGE =	±15	V

Figure 15. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

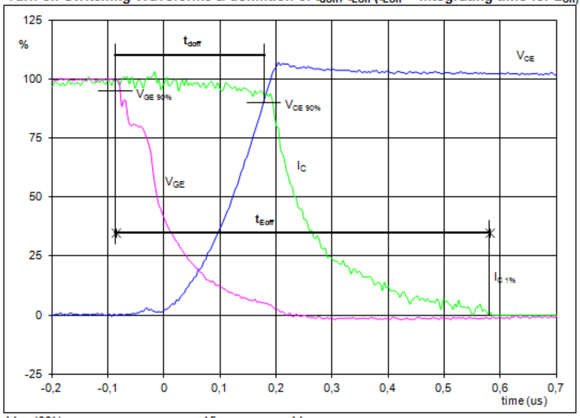
T_j =	175	°C
Rgon =	64	Ω
Rgoff =	64	Ω

Switching Definitions

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

Figure 1. IGBT

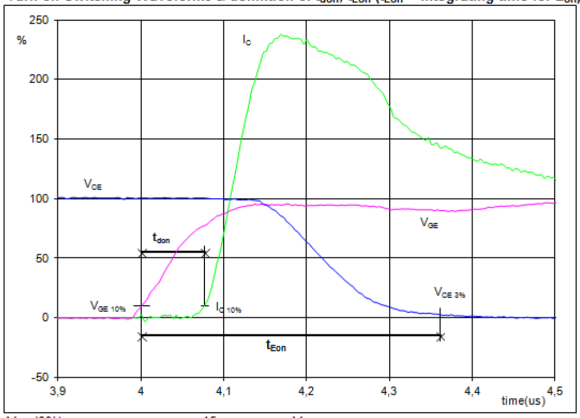
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	4	A
t_{doff} =	0,25	μs
t_{Eoff} =	0,67	μs

Figure 2. IGBT

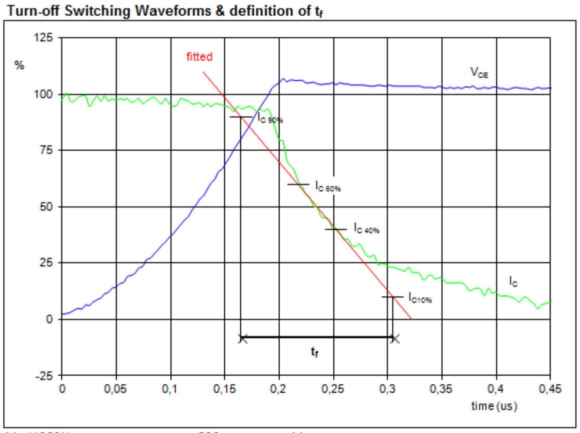
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	4	A
t_{don} =	0,08	μs
t_{Eon} =	0,36	μs

Figure 3. IGBT

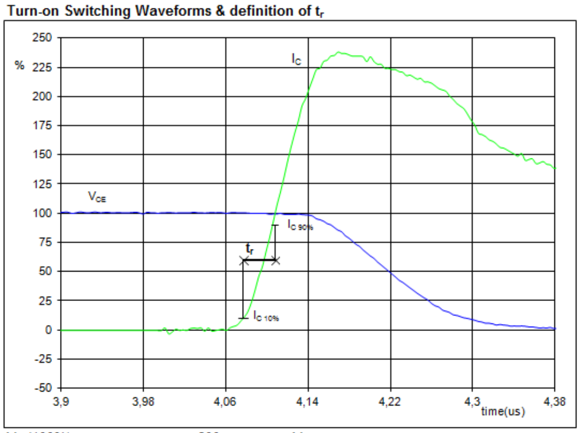
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	4	A
t_f =	0,12	μs

Figure 4. IGBT

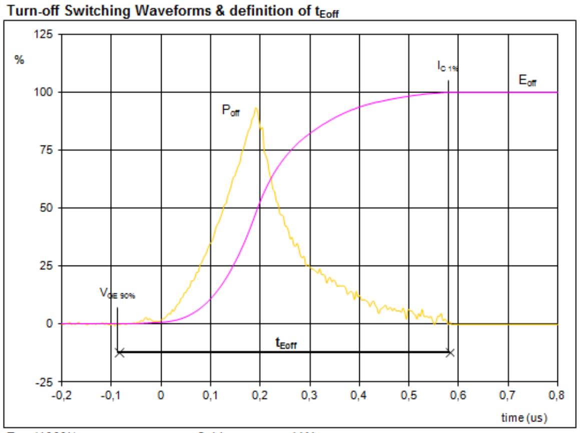
Turn-on Switching Waveforms & definition of t_r



V_C (100%) =	600	V
I_C (100%) =	4	A
t_r =	0,03	μs

Figure 5. IGBT

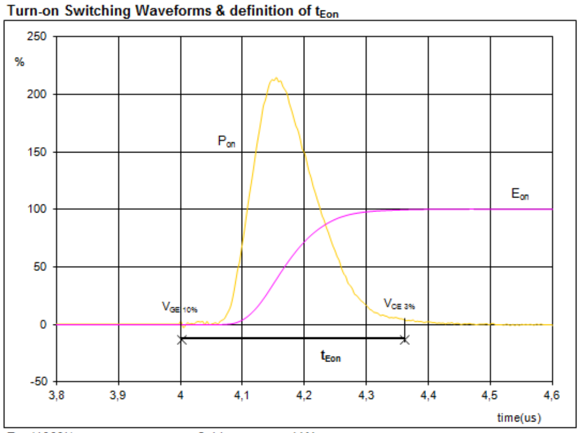
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	2,41	kW
E_{off} (100%) =	0,39	mJ
t_{Eoff} =	0,67	μs

Figure 6. IGBT

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

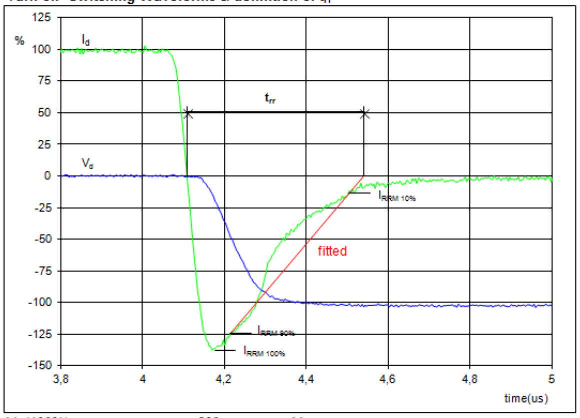


P_{on} (100%) =	2,41	kW
E_{on} (100%) =	0,63	mJ
t_{Eon} =	0,36	μs

Switching Definitions

Figure 7. FWD

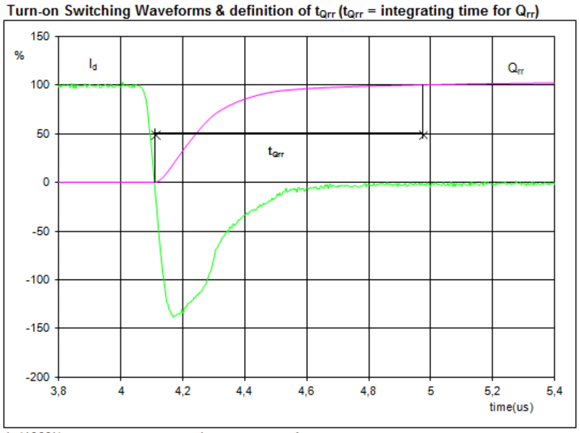
Turn-off Switching Waveforms & definition of t_{rr}



V_d (100%) =	600	V
I_d (100%) =	4	A
I_{RRM} (100%) =	-6	A
t_{rr} =	0,43	μs

Figure 8. FWD

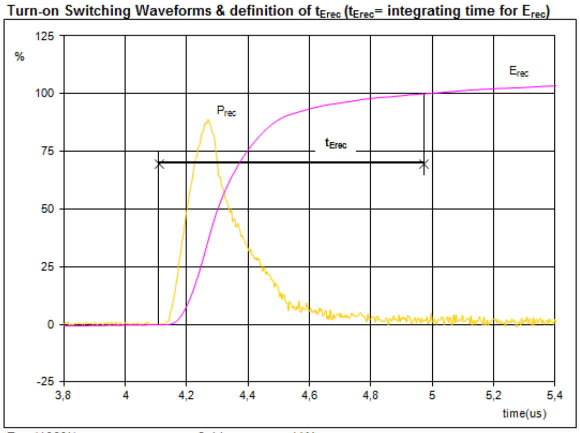
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	4	A
Q_{rr} (100%) =	1,20	μC
t_{Qrr} =	0,86	μs

Figure 9. FWD

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

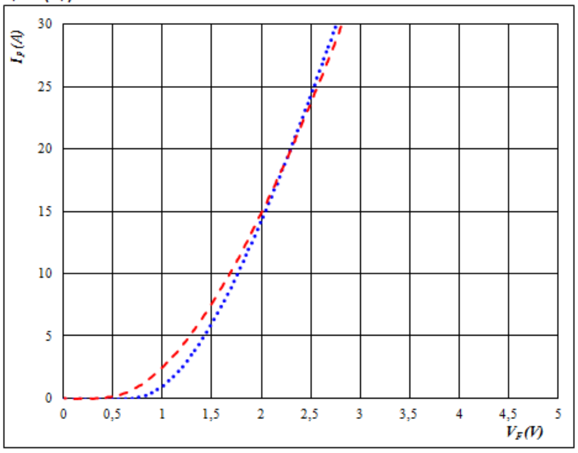


P_{rec} (100%) =	2,41	kW
E_{rec} (100%) =	0,43	mJ
t_{Erec} =	0,86	μs

Inverter diode characteristics

Typical forward characteristics	FWD

$I_F = f(V_F)$

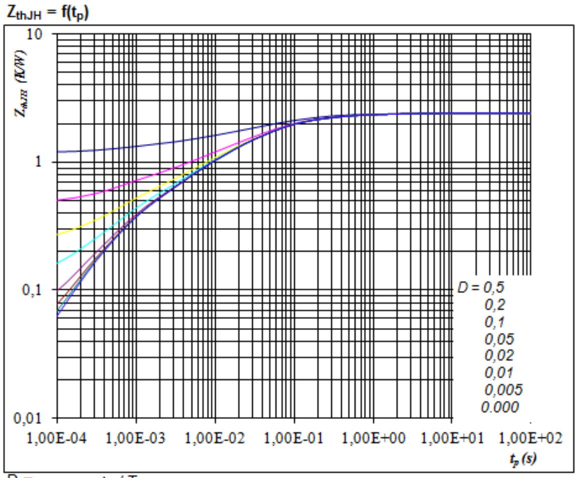


t_p = 250 µs

T_j: 25 °C ············ ; 125 °C ——— ; 150 °C – – –

Transient thermal impedance as a function of pulse width	FWD

$Z_{thJH} = f(t_p)$



D = t_p / T

R_{thJH} = 2,4 K/W

FWD thermal model values

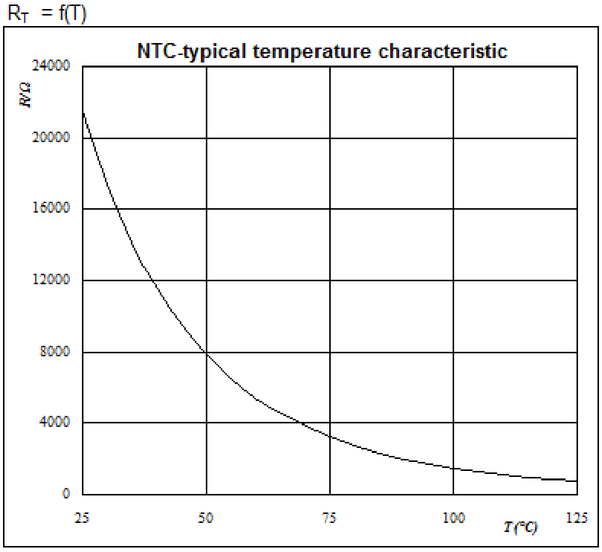
R (K/W)	Tau (s)
7,46E-02	3,12E+00
2,49E-01	3,62E-01
8,60E-01	6,40E-02
5,97E-01	1,50E-02
3,54E-01	3,27E-03
2,60E-01	5,11E-04

Thermistor

Figure 1	Thermistor

Typical NTC characteristic as a function of temperature

$R_T = f(T)$



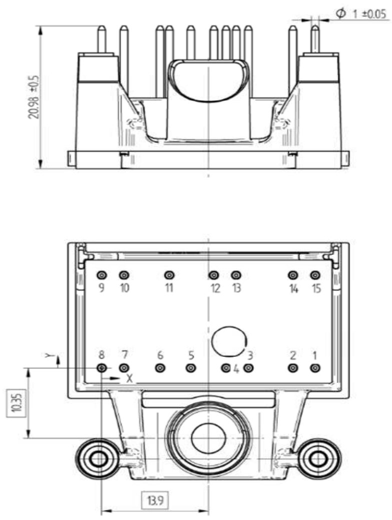
Ordering Code & Marking

Version	Ordering Code
without thermal paste 17mm housing with solder pins	10-0B126PA004SC-M997F09

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

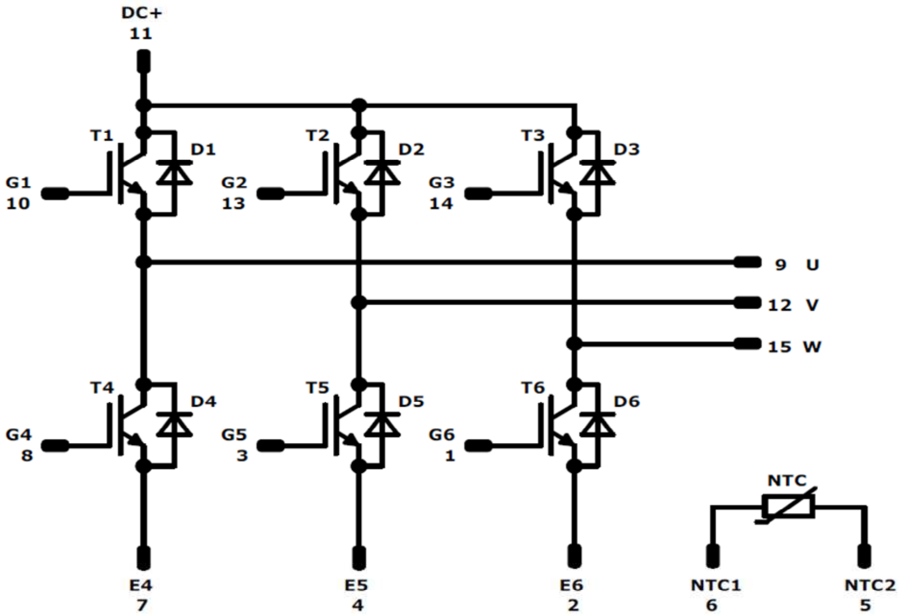
Outline

Pin table [mm]			
Pin	X	Y	Pos
1	27,8	0	G6
2	24,9	0	E6
3	19,1	0	G6
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	1200 V	4 A	Inverter switch	
D1-D6	FWD	1200 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* 0B packages see vincotech.com website.

Document No.:	Date:	Modification:	Pages
10-0B126PA004SC-M997F09-T2-14	26 Jun. 2017	Updated packaging quantity	14

Product status definition		
Datasheet Status	**Product Status**	**Definition**
Target	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice. The data contained is exclusively intended for technically trained staff.