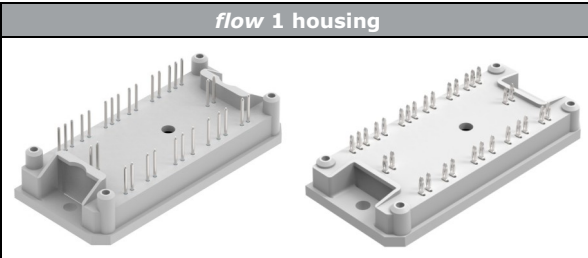
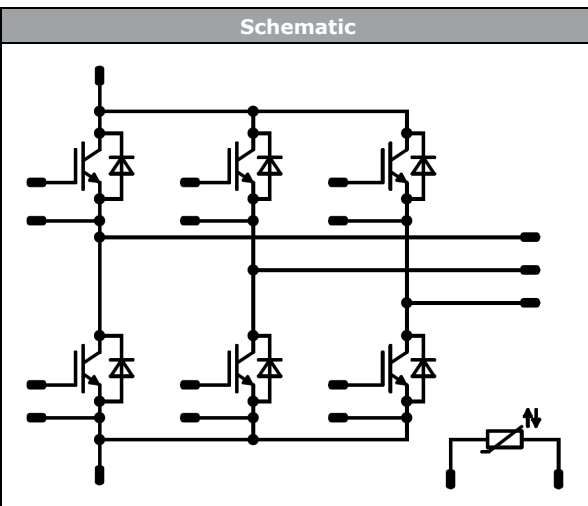




Vincotech

flowPACK 1		600 V / 75 A
Features • Compact <i>flow</i> 1 housing • Compact and Low Inductance Design • Built-in NTC	flow 1 housing 	
Target applications • Motor Drive • Power Generation • UPS	Schematic 	
Types • V23990-P824-F10-PM • V23990-P824-F108Y-PM		

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	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	58	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	225	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	94	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$ $V_{CC} = 360\text{ V}$ $T_j = 150\text{ °C}$	6	µs
Maximum junction temperature	T_{jmax}		175	°C



Vincotech

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	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	48	A
Repetitive peak forward current	I_{FRM}		150	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	69	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* $t_p = 2\text{ s}$	6000	V
		AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			min. 12,7	mm
Clearance			12,64	mm
Comparative Tracking Index	CTI		> 200	

*100 % tested in production



Vincotech

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 Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0012	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		75	25 150	1,05	1,54 1,79	1,85	V
Collector-emitter cut-off current	I_{CES}		0	600		25			3,8	μA
Gate-emitter leakage current	I_{GES}		20	0		25			600	nA
Internal gate resistance	r_g							4		Ω
Input capacitance	C_{ies}	$f = 1 \text{ Mhz}$	0	25		25		4700		pF
Output capacitance	C_{oes}							300		
Reverse transfer capacitance	C_{res}							145		

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 1 \text{ W/mK}$ (P12)						1,01		K/W
-------------------------------------	---------------	---	--	--	--	--	--	------	--	-----

Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 4 \Omega$ $R_{goff} = 4 \Omega$	± 15	300	75	25 150		160 162		ns
Rise time	t_r					25 150		21 26		
Turn-off delay time	$t_{d(off)}$					25 150		208 242		
Fall time	t_f					25 150		105 118		
Turn-on energy (per pulse)	E_{on}	$Q_{iFWD} = 2,2 \mu C$ $Q_{iFWD} = 6,8 \mu C$	± 15	300	75	25 150		1,08 1,60		mWs
Turn-off energy (per pulse)	E_{off}					25 150		1,99 2,76		



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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				75	25 150	1,2	1,79 1,75	1,9	V
Reverse leakage current	I_R			600		25			27	µA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 1 \text{ W/mK}$ (P12)						1,38		K/W
-------------------------------------	---------------	---	--	--	--	--	--	------	--	-----

Dynamic

Peak recovery current	I_{RRM}	$di/dt = 4256 \text{ A/}\mu\text{s}$ $di/dt = 3706 \text{ A/}\mu\text{s}$	± 15	300	75	25 150		58 88		A
Reverse recovery time	t_{rr}					25 150		133 169		ns
Recovered charge	Q_r					25 150		2,23 6,83		µC
Reverse recovered energy	E_{rec}					25 150		0,51 1,50		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		3338 3540		A/µs

Thermistor

Rated resistance	R					25		4,7		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	$R_{100} = 401 \Omega$				100	-12,4		12,4	%
Power dissipation	P					25		210		mW
Power dissipation constant						25		3,5		mW/K
B-value	$B_{(25/50)}$					25		3590		K
B-value	$B_{(25/100)}$					25		3650		K
V_{in} Vincotech NTC Reference									D	



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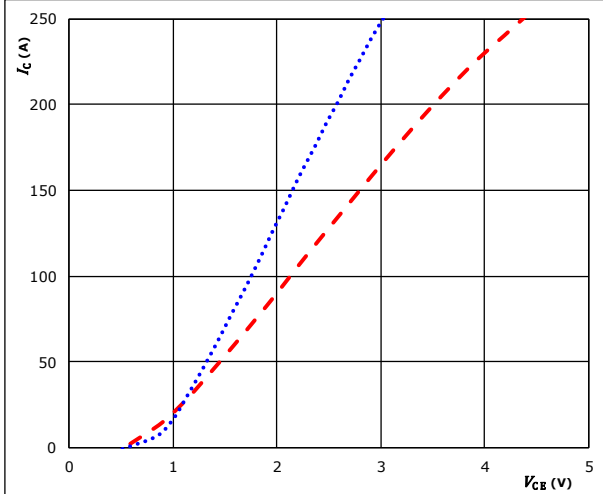
V23990-P824-F10-PM
V23990-P824-F108Y-PM
 datasheet

Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

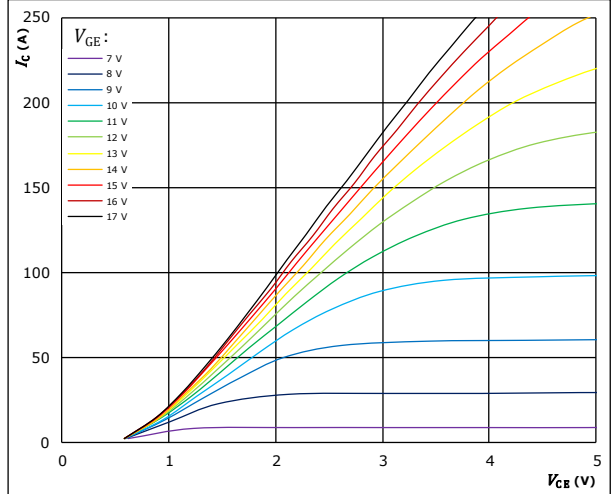


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j: 25 \text{ } ^\circ C$ (blue dotted line)
 $150 \text{ } ^\circ C$ (red dashed line)

figure 2. IGBT

Typical output characteristics

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

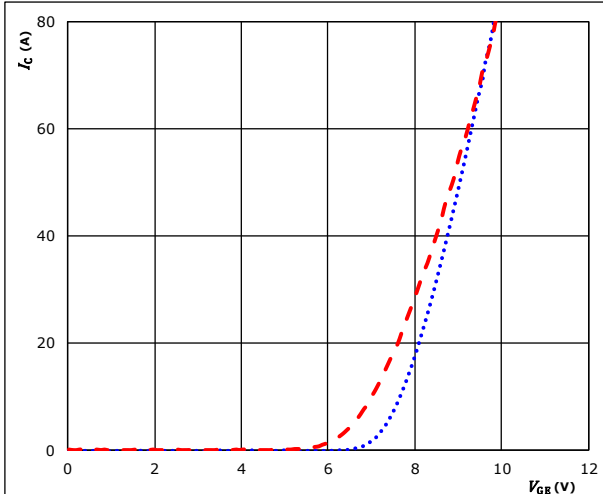


$t_p = 250 \mu s$
 $T_j = 150 \text{ } ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

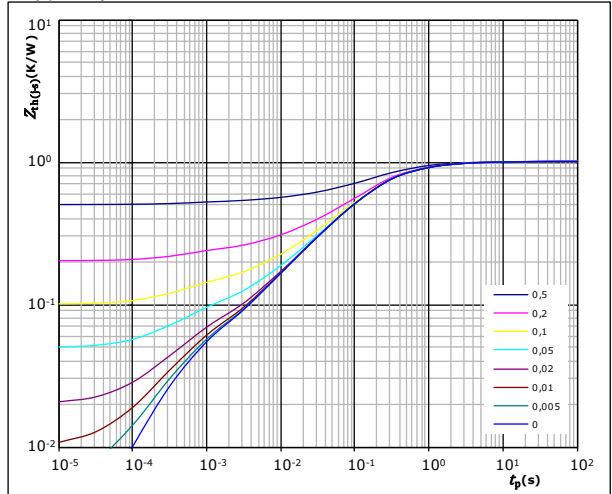


$t_p = 100 \mu s$
 $V_{CE} = 10 V$
 $T_j: 25 \text{ } ^\circ C$ (blue dotted line)
 $150 \text{ } ^\circ C$ (red dashed line)

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$
 $R_{th(j-s)} = 1,01 \text{ K/W}$

IGBT thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
2,59E-02	9,79E+00
1,63E-01	1,12E+00
5,38E-01	1,83E-01
1,81E-01	3,28E-02
5,68E-02	5,83E-03
4,25E-02	4,57E-04



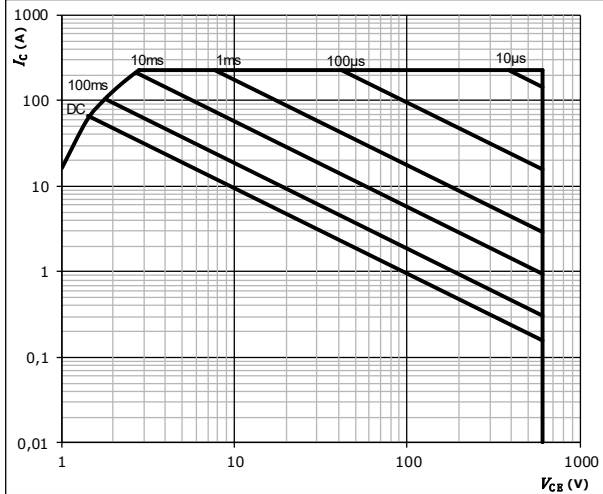
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Inverter Switch Characteristics

figure 5. IGBT

Safe operating area

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



$D =$ single pulse
 $T_s = 80$ °C
 $V_{GE} = \pm 15$ V
 $T_i = T_{imax}$



Inverter Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

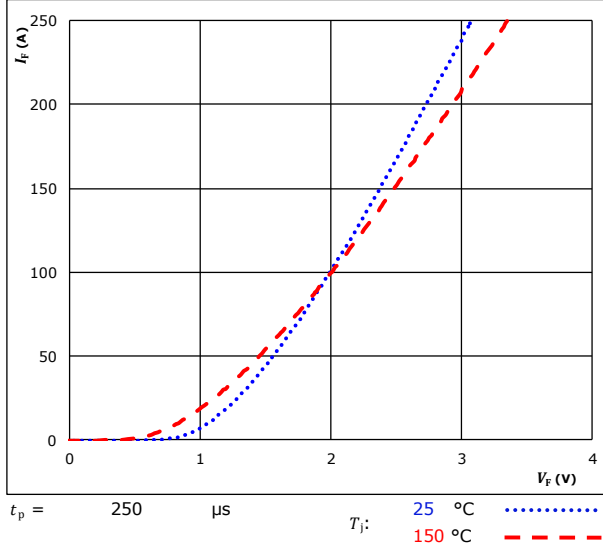
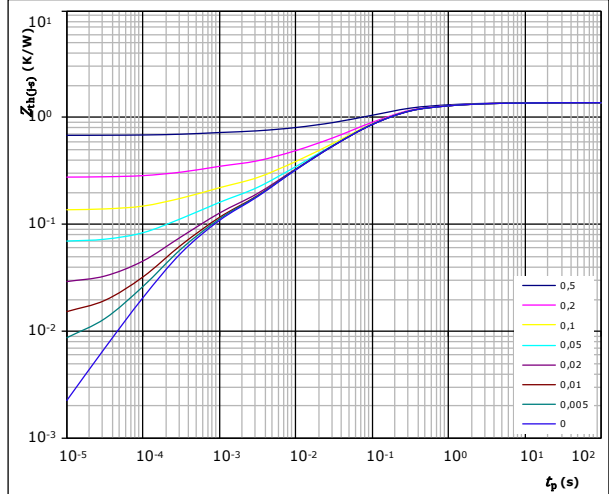


figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$$D = t_p / T$$

$$R_{th(j-s)} = 1,38 \text{ K/W}$$

FWD thermal model values

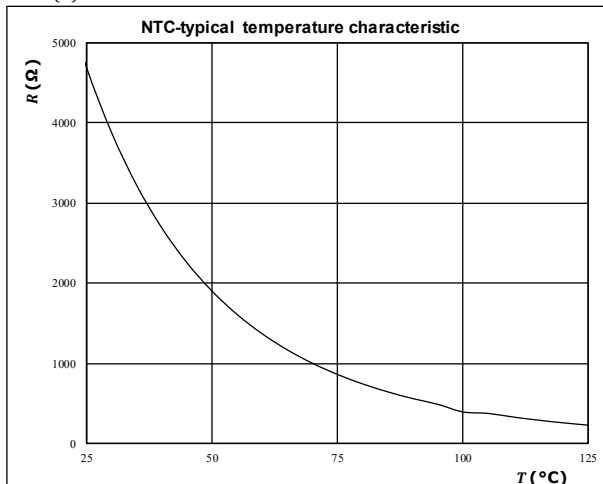
$R \text{ (K/W)}$	$\tau \text{ (s)}$
2,87E-02	9,94E+00
1,67E-01	1,04E+00
6,44E-01	1,45E-01
3,12E-01	3,35E-02
1,48E-01	6,15E-03
8,16E-02	4,22E-04

Thermistor Characteristics

figure 1. Thermistor

Typical NTC characteristic
 as a function of temperature

$$R = f(T)$$



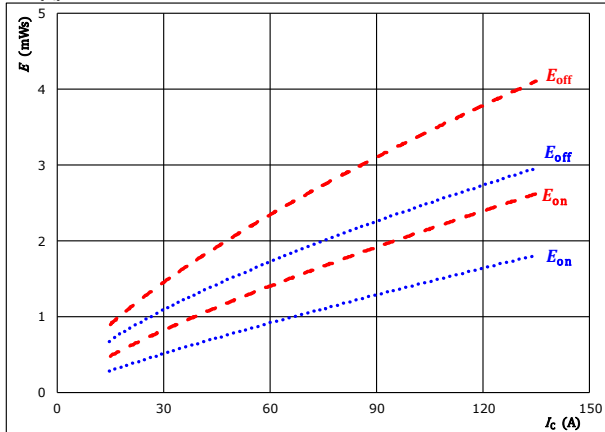


Inverter Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$



With an inductive load at

$$V_{CE} = 300 \text{ V}$$

$$V_{GE} = \pm 15 \text{ V}$$

$$R_{gon} = 4 \text{ } \Omega$$

$$R_{goff} = 4 \text{ } \Omega$$

T_j :

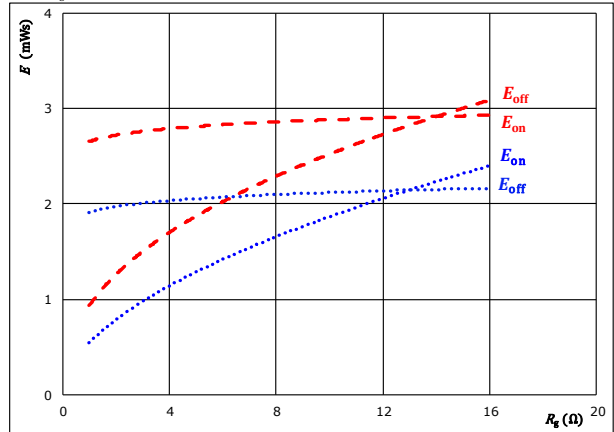
$$25 \text{ } ^\circ\text{C}$$

$$150 \text{ } ^\circ\text{C}$$

figure 2. IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$



With an inductive load at

$$V_{CE} = 300 \text{ V}$$

$$V_{GE} = \pm 15 \text{ V}$$

$$I_C = 75 \text{ A}$$

T_j :

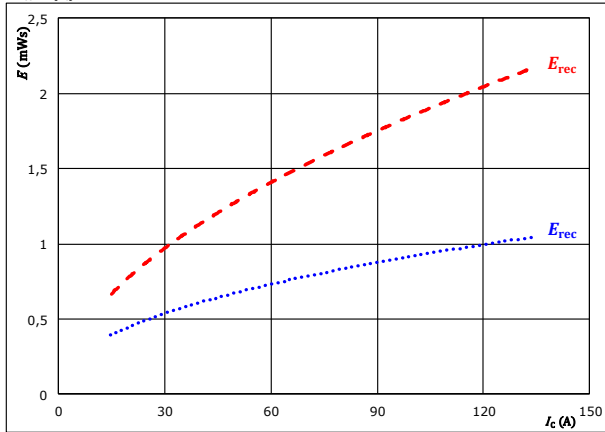
$$25 \text{ } ^\circ\text{C}$$

$$150 \text{ } ^\circ\text{C}$$

figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

$$E_{rec} = f(I_C)$$



With an inductive load at

$$V_{CE} = 300 \text{ V}$$

$$V_{GE} = \pm 15 \text{ V}$$

$$R_{gon} = 4 \text{ } \Omega$$

T_j :

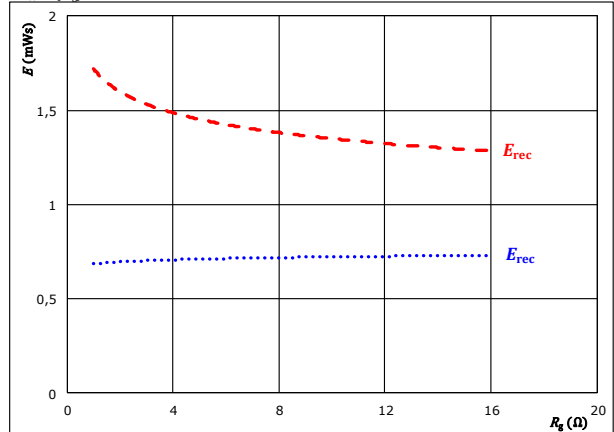
$$25 \text{ } ^\circ\text{C}$$

$$150 \text{ } ^\circ\text{C}$$

figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor

$$E_{rec} = f(R_g)$$



With an inductive load at

$$V_{CE} = 300 \text{ V}$$

$$V_{GE} = \pm 15 \text{ V}$$

$$I_C = 75 \text{ A}$$

T_j :

$$25 \text{ } ^\circ\text{C}$$

$$150 \text{ } ^\circ\text{C}$$



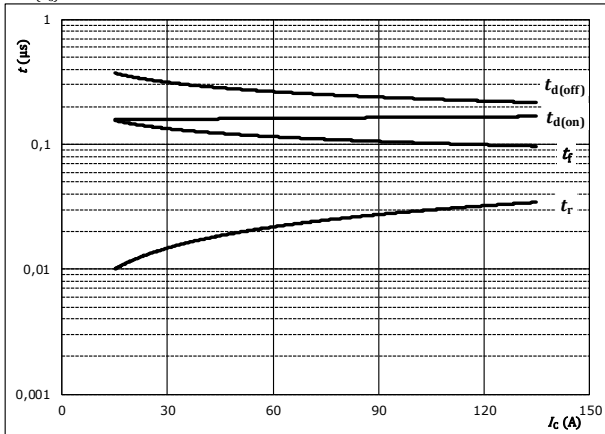
Vincotech

Inverter Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



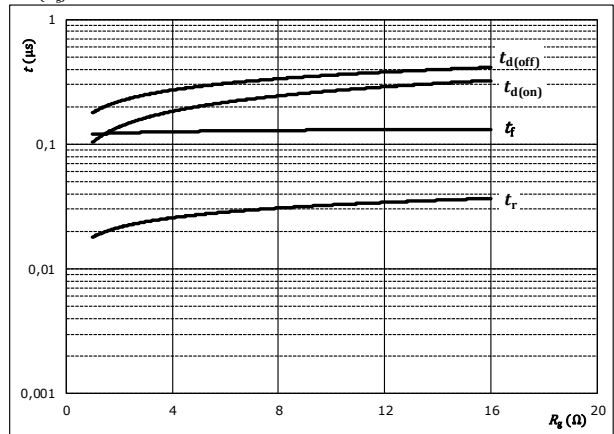
With an inductive load at

$T_j =$	150	°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

$$t = f(R_g)$$



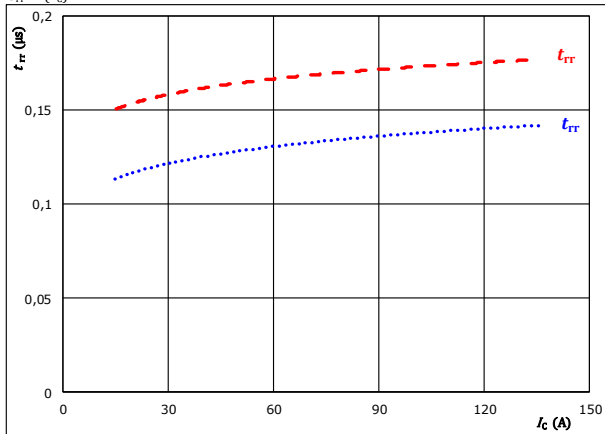
With an inductive load at

$T_j =$	150	°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

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

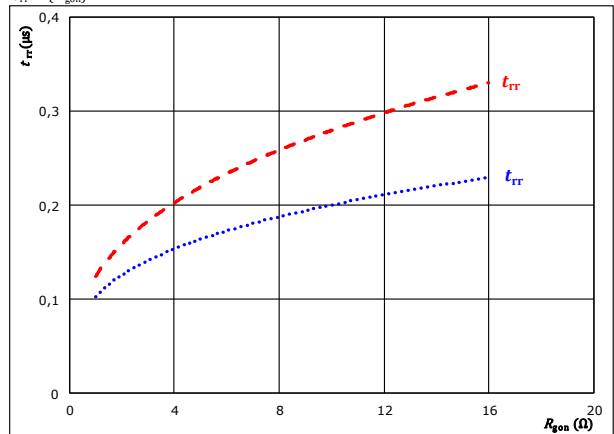


At	$V_{CE} =$	300	V	$T_j:$	25 °C	
	$V_{GE} =$	±15	V		150 °C	-----
	$R_{gon} =$	4	Ω			

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 °C	
	$V_{GE} =$	±15	V		150 °C	-----
	$I_C =$	75	A			

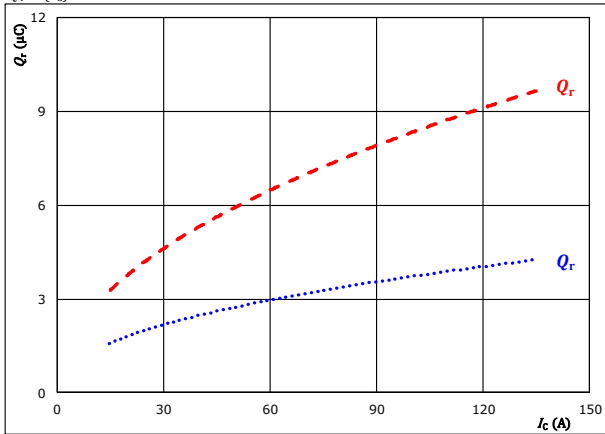


Inverter Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_C)$$

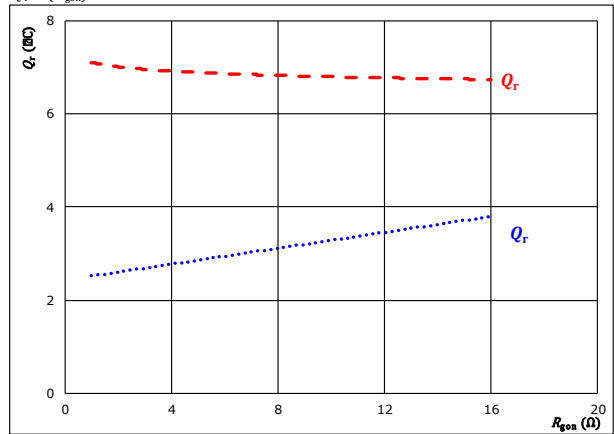


At $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω
 $T_j: 25$ °C (blue dotted line)
 150 °C (red dashed line)

figure 10. FWD

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

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

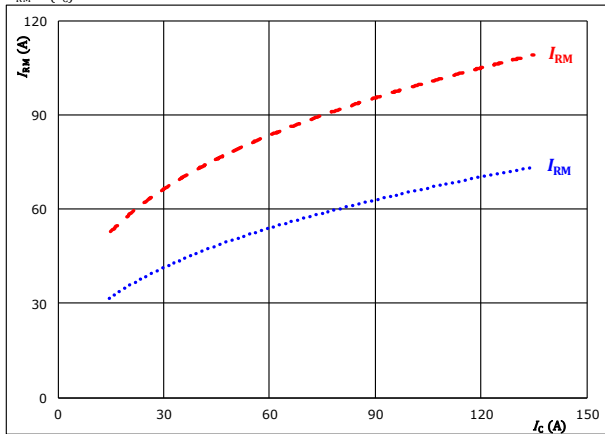


At $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_C = 75$ A
 $T_j: 25$ °C (blue dotted line)
 150 °C (red dashed line)

figure 11. FWD

Typical peak reverse recovery current as a function of collector current

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

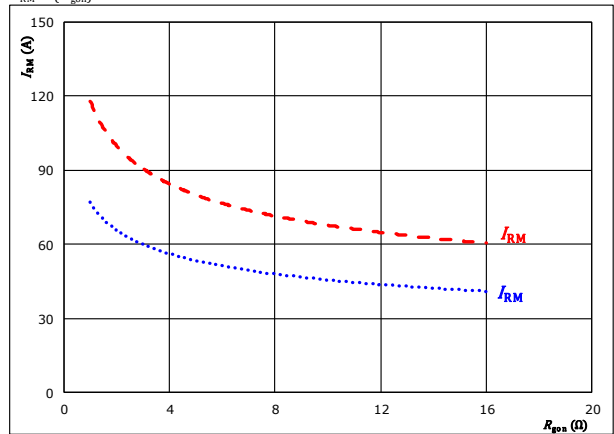


At $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω
 $T_j: 25$ °C (blue dotted line)
 150 °C (red dashed line)

figure 12. FWD

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

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



At $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_C = 75$ A
 $T_j: 25$ °C (blue dotted line)
 150 °C (red dashed line)

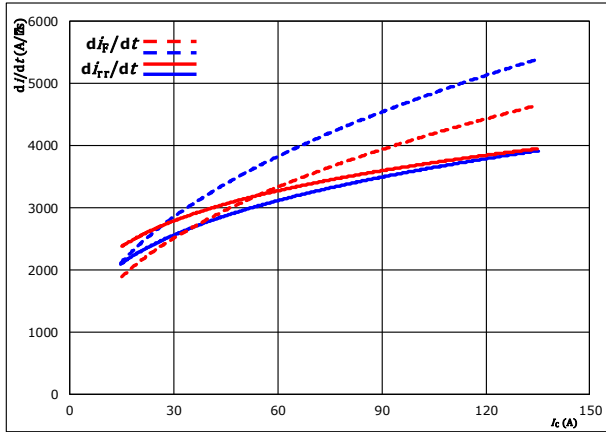


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Inverter Switching Characteristics

figure 13. FWD

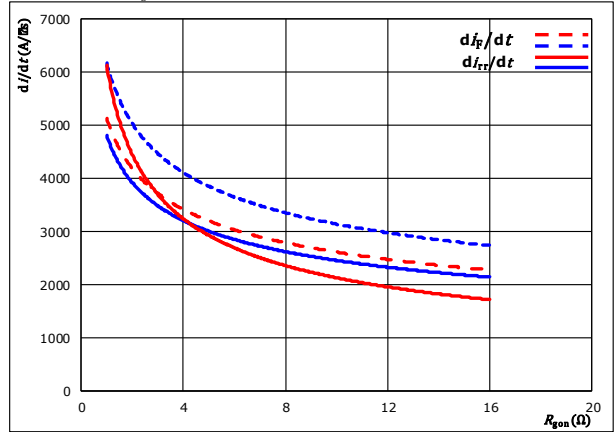
Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_F/dt, di_{rr}/dt = f(I_C)$



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

figure 14. FWD

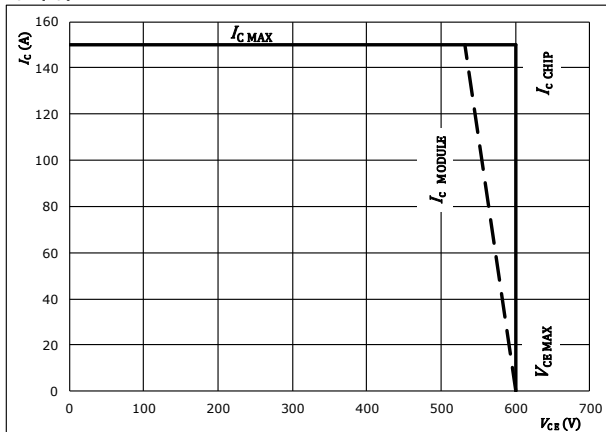
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
 $di_F/dt, di_{rr}/dt = f(R_{gon})$



At $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_C = 75$ A
 $T_j: 25$ °C
 150 °C

figure 15. IGBT

Reverse bias safe operating area
 $I_C = f(V_{CE})$



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



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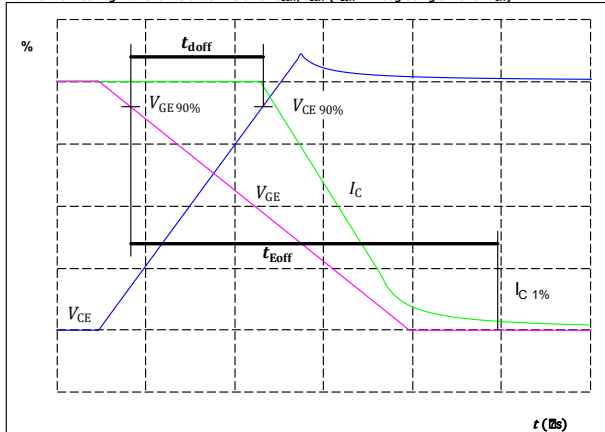
Inverter Switching Definitions

General conditions

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

figure 1. IGBT

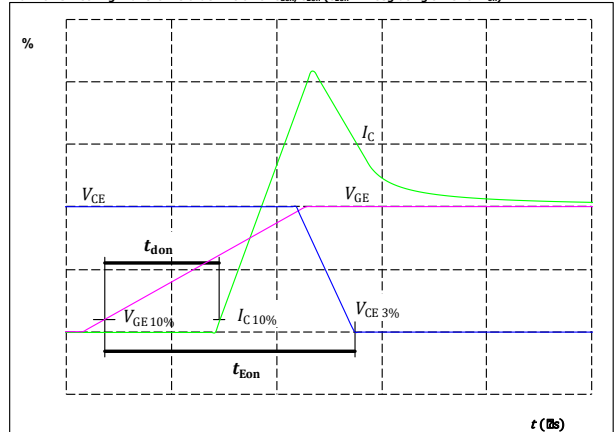
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	300	V
$I_C(100\%) =$	75	A
$t_{doff} =$	242	ns

figure 2. IGBT

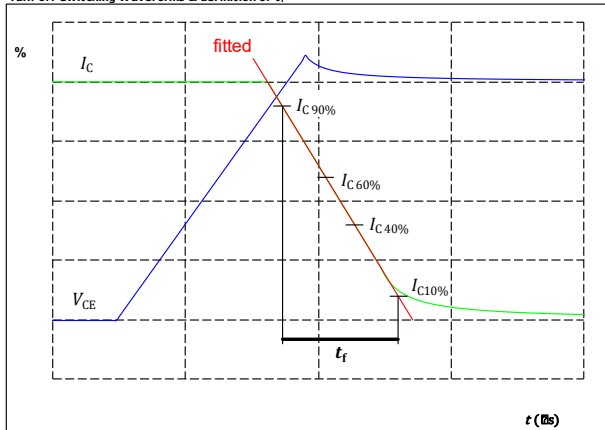
Turn-on Switching Waveforms & definition of t_{don} , t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	300	V
$I_C(100\%) =$	75	A
$t_{don} =$	162	ns

figure 3. IGBT

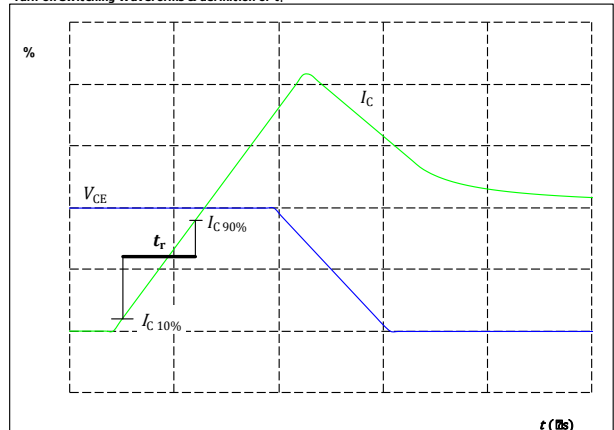
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%) =$	300	V
$I_C(100\%) =$	75	A
$t_f =$	118	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r



$V_C(100\%) =$	300	V
$I_C(100\%) =$	75	A
$t_r =$	26	ns

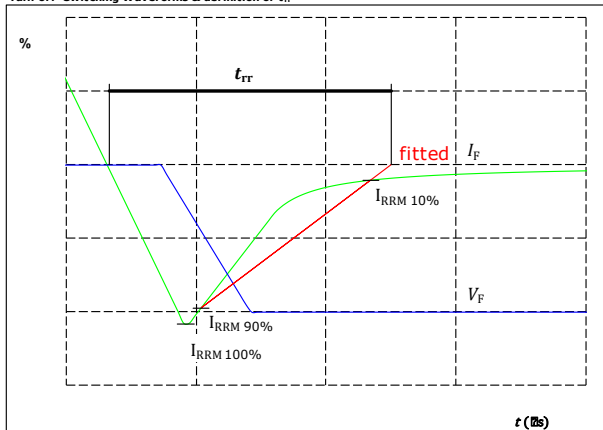


Vincotech

Inverter Switching Characteristics

figure 5. FWD

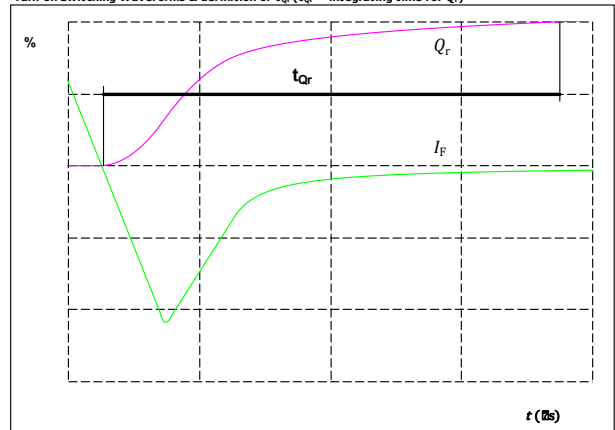
Turn-off Switching Waveforms and definition of t_{rr}



$V_F(100\%) =$	300	V
$I_F(100\%) =$	75	A
$I_{RRM}(100\%) =$	88	A
$t_{rr} =$	169	ns

figure 6. FWD

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



$I_F(100\%) =$	75	A
$Q_r(100\%) =$	6,83	μC

Vincotech

Ordering Code & Marking								
Version				Ordering Code				
without thermal paste with 17 mm housing with solder pins				V23990-P824-F10-PM				
without thermal paste with 12 mm housing with press-fit pins				V23990-P824-F108Y-PM				
		Text	VIN	Date code	Name&Ver	UL	Lot	Serial
			VIN	WWYY	NNNNNNNVV	UL	LLLLL	SSSS
		Datamatrix	Type&Ver	Lot number	Serial	Date code		
TTTTTTTV	LLLLL		SSSS	WWYY				

Pin table

Pin	X	Y	Functions
1	52,6	0	DC-
2	49,9	0	DC-
3	42,65	0	G6
4	39,65	0	S6
5	35,15	0	NTC1
6	28,4	0	NTC2
7	24	0	G4
8	21	0	S4
9	12,2	0	G2
10	9,2	0	S2
11	2,7	0	DC-
12	0	0	DC-
13	0	14,65	DC+
14	2,7	14,65	DC+
15	0	28,6	U
16	2,7	28,6	U
17	5,4	28,6	U
18	9,6	28,6	S1
19	12,6	28,6	G1
20	19,6	28,6	V
21	22,3	28,6	V
22	25	28,6	V
23	29,7	28,6	S3
24	32,7	28,6	G3
25	39,7	28,6	S5
26	42,7	28,6	G5
27	47,2	28,6	W
28	49,9	28,6	W
29	52,6	28,6	W
30	52,6	14,65	DC+
31	49,9	14,65	DC+

Outline

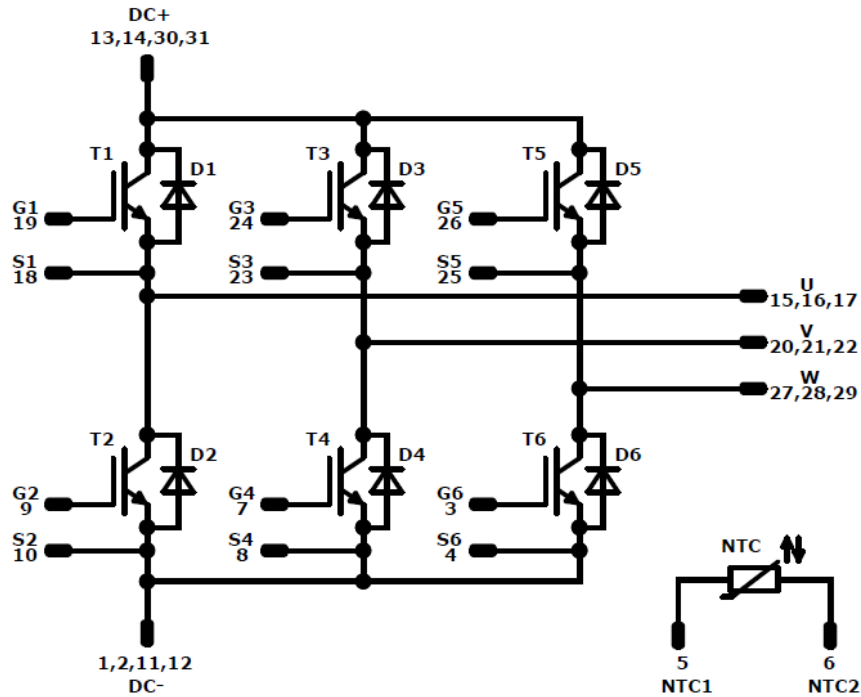
The technical drawing illustrates the sensor module's dimensions and pin configuration. The top view shows a rectangular module with a width of 26.3 mm and a height of 14.3 mm. The side view shows a height of 24.2 ± 0.5 mm. The bottom view shows the pin locations, with pins numbered 1 through 31. The pin pitch is 1 ± 0.05 mm. The center of the press-fit pinhead is marked for connection parameter reference. The pin locations are defined by X and Y coordinates, with X ranging from 0 to 52.6 mm and Y ranging from 0 to 28.6 mm.

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



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Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	600 V	75 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	600 V	75 A	Inverter Diode	
NTC	NTC			Thermistor	



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V23990-P824-F10-PM
V23990-P824-F108Y-PM
datasheet

Packaging instruction			
Standard packaging quantity (SPQ) 100	>SPQ	Standard	<SPQ Sample

Handling instruction
Handling instructions for <i>flow 1</i> packages see vincotech.com website.

Package data
Package data for <i>flow 1</i> 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
V23990-P824-F10xx-D6-14	27 Nov. 2019	Datasheet expansion with V23990-P824-F108Y-PM	1, 14

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