Vincotech

V23990-P689-F-PM
datasheet

***flow*PACK 2** **1200 V / 100 A**

Features

- High power *flow*2 housing
- Trench Fieldstop Technology IGBT4
- Compact and low inductive design

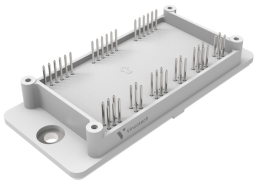
Target applications

- Motor Drive
- Power Generation
- UPS

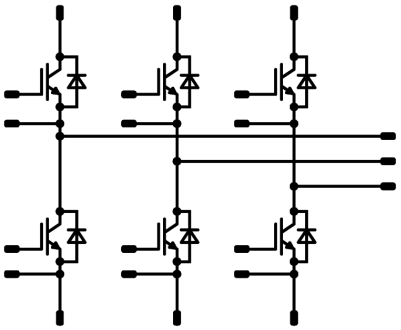
Types

- V23990-P689-F-PM

flow 2 17 mm housing



Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Inverter Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	115	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	307	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 800 V	T_j = 150 °C	10	µs
Maximum junction temperature	T_{jmax}			175	°C
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	91	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	176	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	6000	V
Isolation voltage	V_{isol}	AC Voltage	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

Characteristic Values

Parameter	Symbol	Conditions					Values			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_{CE} = V_{GE}			0,0034	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		100	25 150	1,58	1,94 2,35	2,07(1)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			2	µA
Gate-emitter leakage current	I_{GES}		20	0		25			240	nA
Internal gate resistance	r_g							2		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		5600		pF
Reverse transfer capacitance	C_{res}							200		pF
Gate charge	Q_g		15		0	25		760		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,31		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	±15	600	100	25 150		103,8 107,8		ns
Rise time	t_r					25 150		17,6 23		ns
Turn-off delay time	$t_{d(off)}$					25 150		218,6 293,2		ns
Fall time	t_f					25 150		71,68 110,56		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=9,32 µC Q_{rFWD}=18,66 µC				25 150		4,04 6,73		mWs
Turn-off energy (per pulse)	E_{off}					25 150		5,25 8,77		mWs

Characteristic Values

Parameter	Symbol	Conditions					Values			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				100	25 150	1,35	1,99 2,01	2,05[1]	V
Reverse leakage current	I_R	V_r = 1200 V				25			18	µA
Thermal										
Thermal resistance junction to sink [2]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,54		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt=6900 A/µs di/dt=5512 A/µs	±15	600	100	25 150		163,67 186,62		A
Reverse recovery time	t_{rr}					25 150		130,08 294,35		ns
Recovered charge	Q_r					25 150		9,32 18,66		µC
Reverse recovered energy	E_{rec}					25 150		3,87 7,96		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		8743 3702		A/µs

[1] Value at chip level

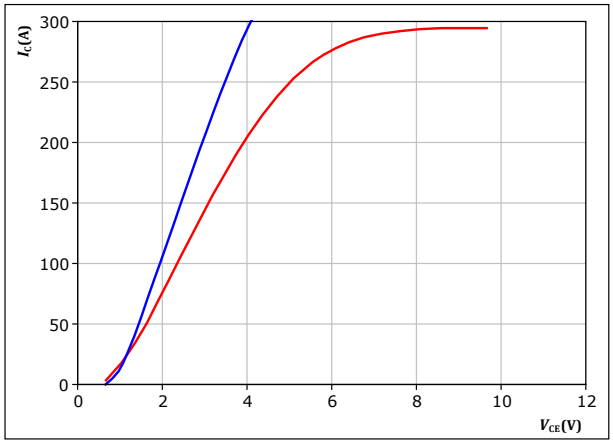
[2] Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

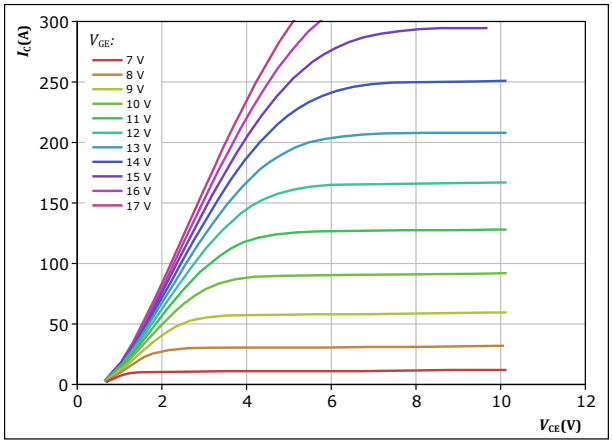


t_p =	250	µs	T_j:	25 °C
V_{GE} =	15	V		150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



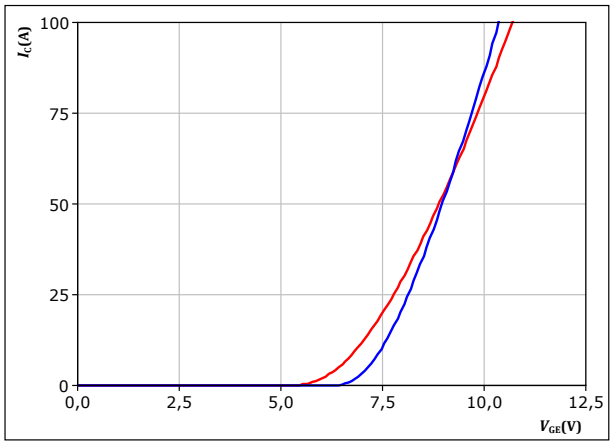
t_p =	250	µs
T_j =	150	°C

V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

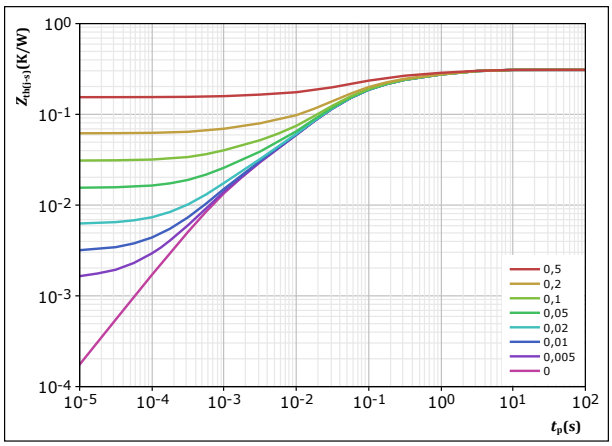


t_p =	250	µs	T_j:	25 °C
V_{CE} =	10	V		150 °C

figure 4. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,309	K/W

IGBT thermal model values

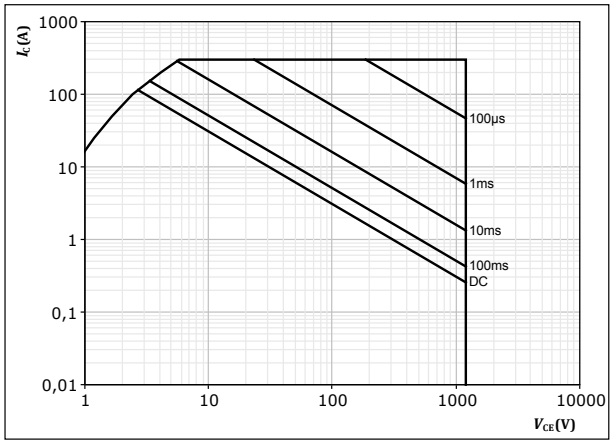
R (K/W)	τ (s)
6,00E-02	1,67E+00
7,30E-02	2,35E-01
1,19E-01	5,35E-02
4,31E-02	1,45E-02
1,45E-02	1,21E-03

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



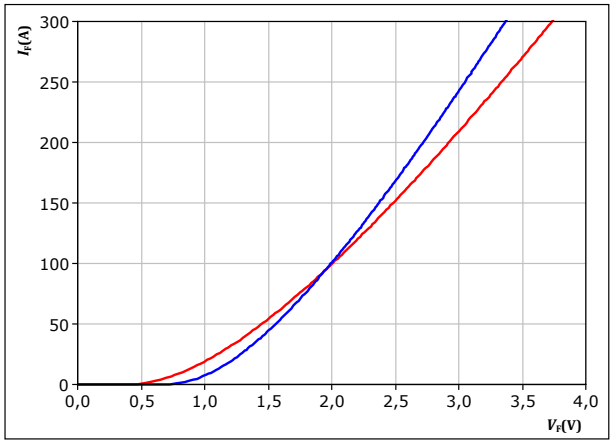
D = single pulse
T_s = 80 °C
V_{GE} = 15 V
T_j = T_{jmax}

Inverter Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



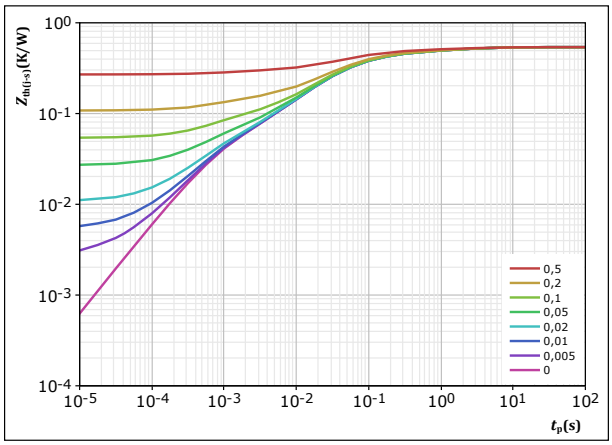
t_p = 250 µs

T_j: 25 °C, 150 °C

figure 7. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,539 K/W

FWD thermal model values

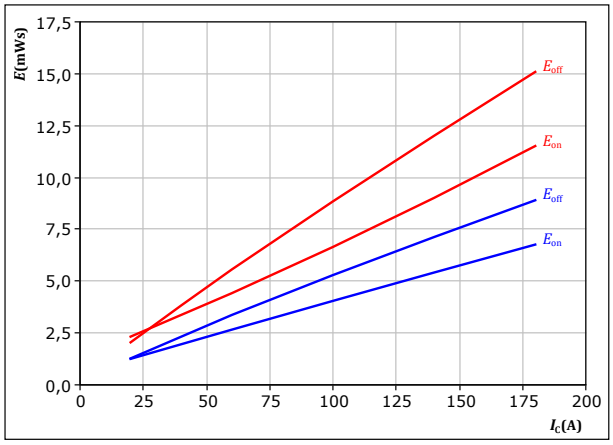
R (K/W)	τ (s)
3,25E-02	4,14E+00
5,01E-02	9,90E-01
1,38E-01	1,45E-01
2,22E-01	3,37E-02
5,69E-02	9,51E-03
3,92E-02	7,97E-04

Inverter Switching Characteristics

figure 8. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



With an inductive load at

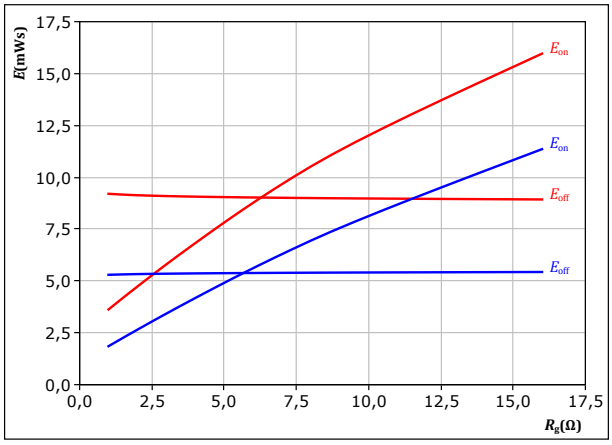
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

T_j: 25 °C, 150 °C

figure 9. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



With an inductive load at

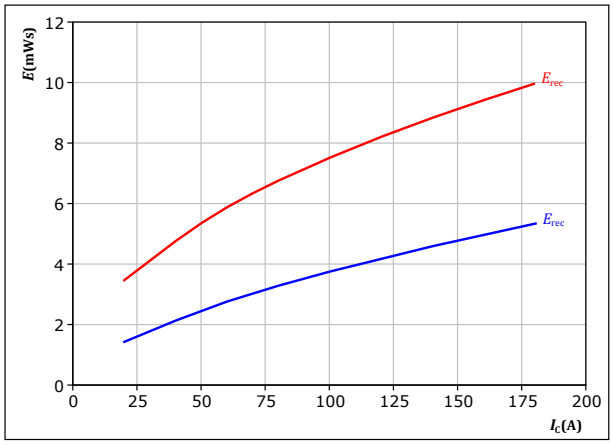
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	100	A

T_j: 25 °C, 150 °C

figure 10. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



With an inductive load at

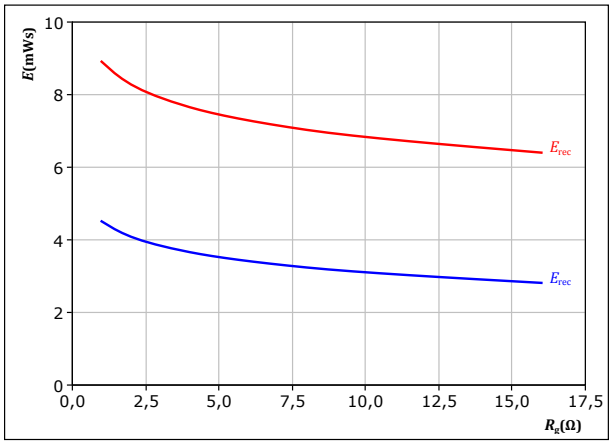
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

T_j: 25 °C, 150 °C

figure 11. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	100	A

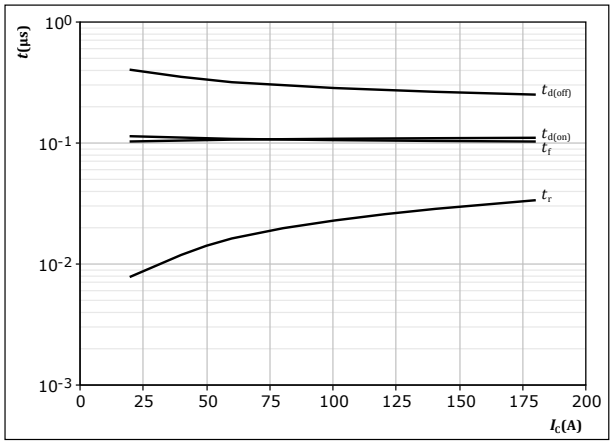
T_j: 25 °C, 150 °C

Inverter Switching Characteristics

figure 12. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



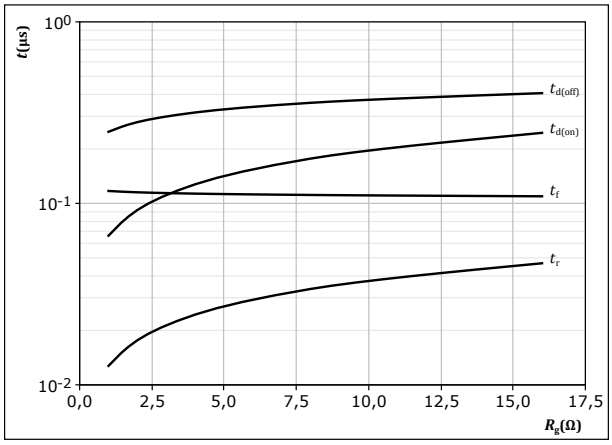
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 13. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



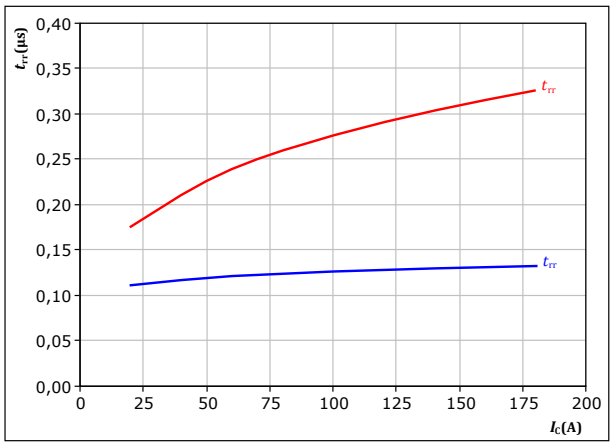
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	100	A

figure 14. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



With an inductive load at

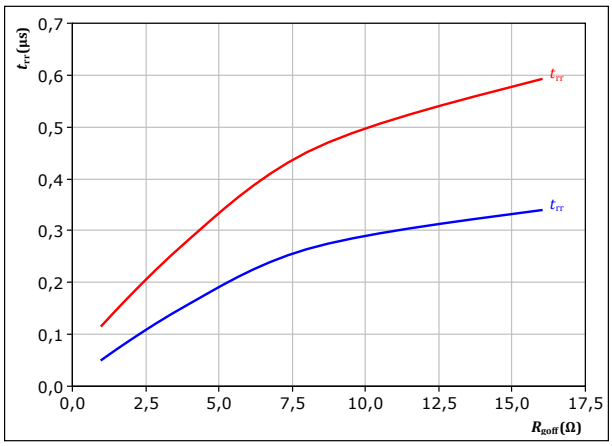
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

T_j: 25 °C, 150 °C

figure 15. **FWD**

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

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



With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	100	A

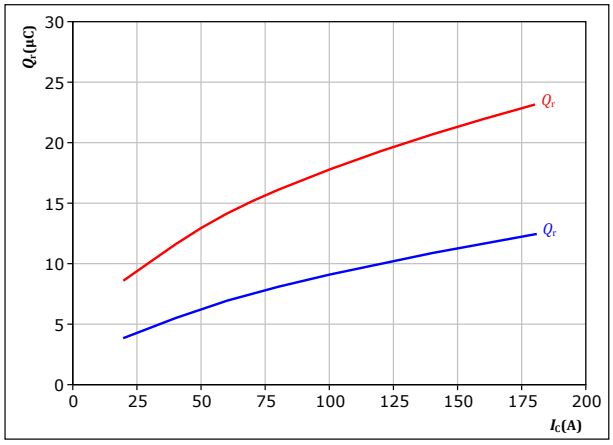
T_j: 25 °C, 150 °C

Inverter Switching Characteristics

figure 16. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



With an inductive load at

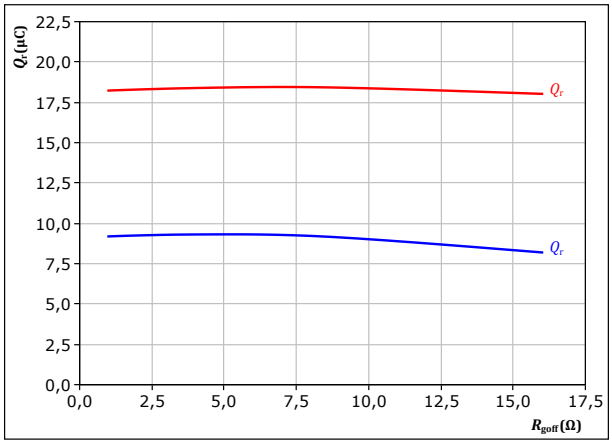
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

T_j: 25 °C, 150 °C

figure 17. **FWD**

Typical recovered charge as a function of turn off gate resistor

$Q_r = f(R_{goff})$



With an inductive load at

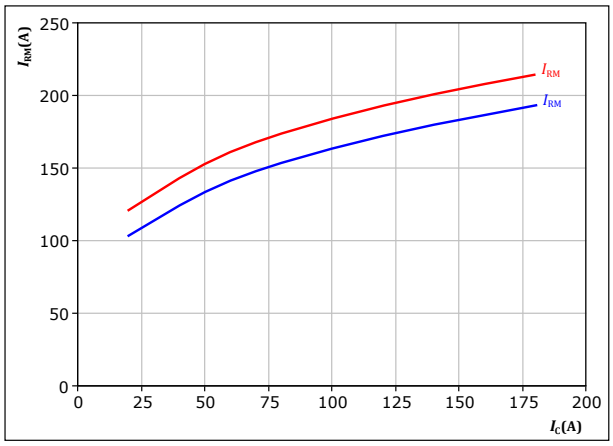
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	100	A

T_j: 25 °C, 150 °C

figure 18. **FWD**

Typical peak reverse recovery current as a function of collector current

$I_{RM} = f(I_C)$



With an inductive load at

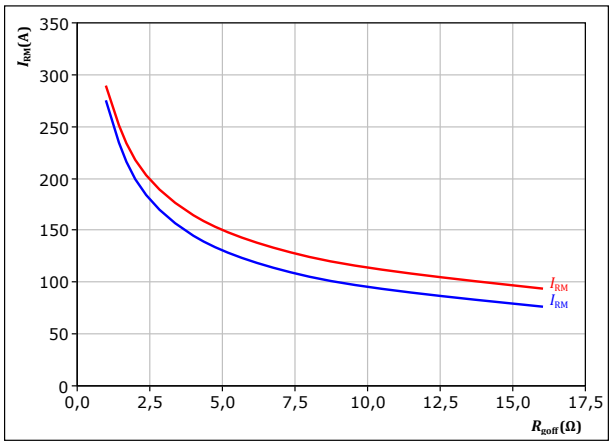
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

T_j: 25 °C, 150 °C

figure 19. **FWD**

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

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



With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	100	A

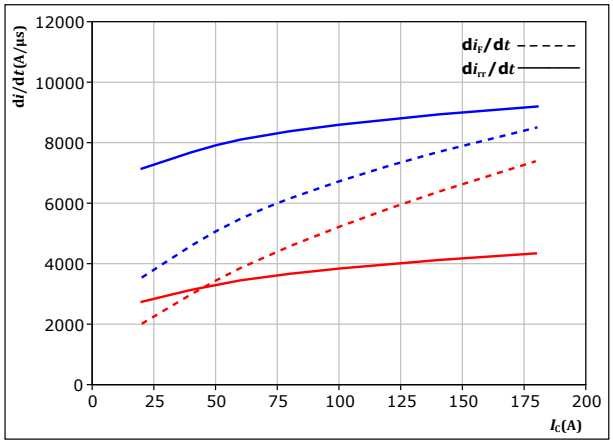
T_j: 25 °C, 150 °C

Inverter Switching Characteristics

figure 20. **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)



With an inductive load at

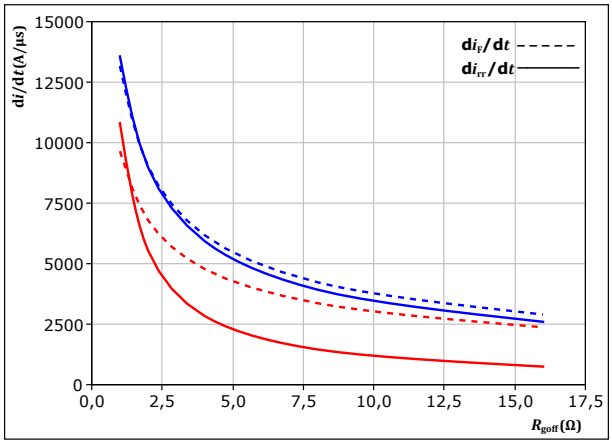
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

T_j: 25 °C, 150 °C

figure 21. **FWD**

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

di_F/dt, di_{rr}/dt = f(R_{goff})



With an inductive load at

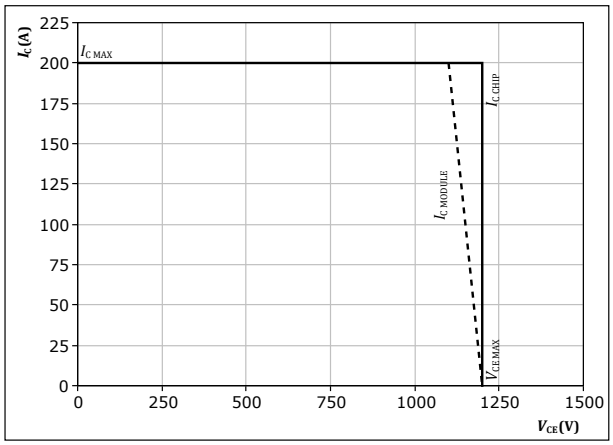
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	100	A

T_j: 25 °C, 150 °C

figure 22. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At

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

Inverter Switching Definitions

figure 23. **IGBT**

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

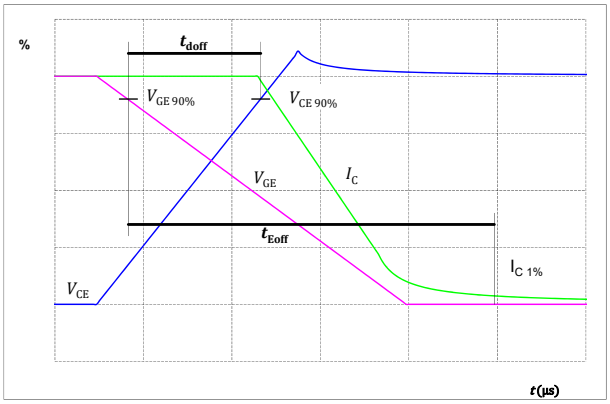


figure 24. **IGBT**

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

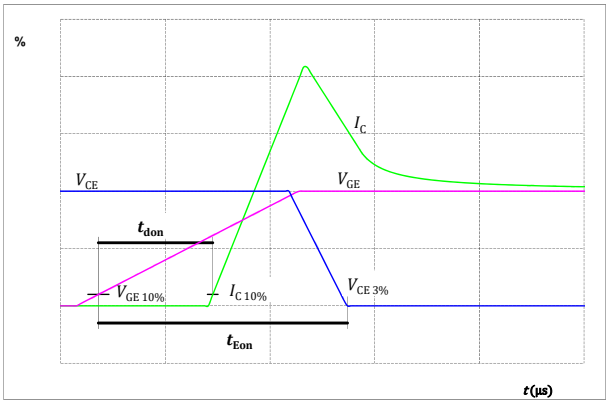


figure 25. **IGBT**

Turn-off Switching Waveforms & definition of t_f

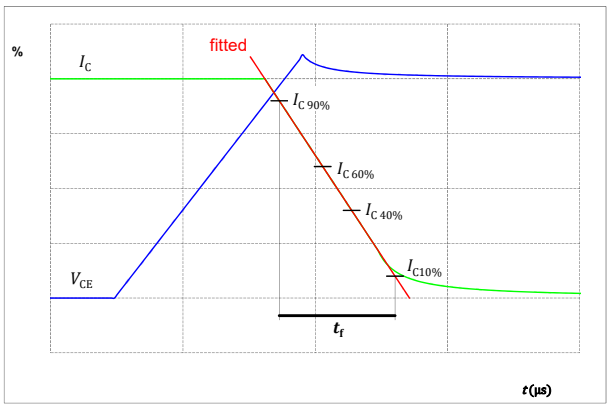
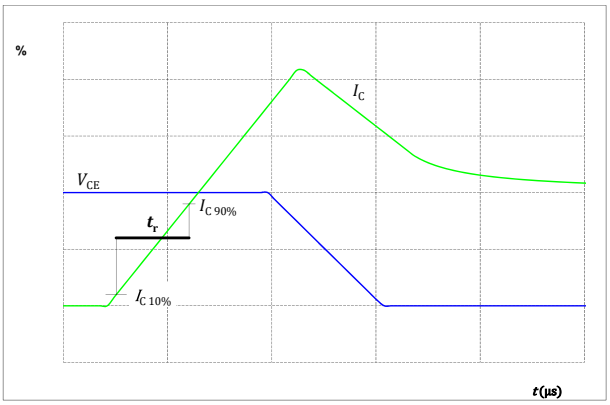


figure 26. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Inverter Switching Definitions

figure 27. **FWD**

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

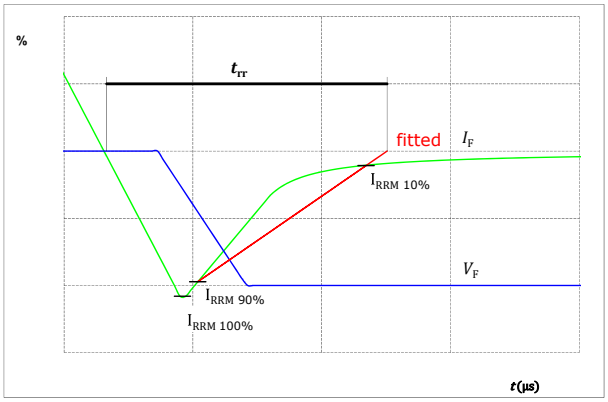
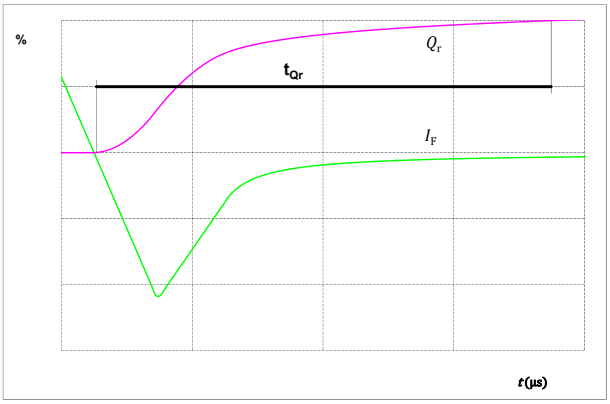


figure 28. **FWD**

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



Ordering Code

Version	Ordering Code
Without thermal paste	V23990-P689-F-PM
With thermal paste (3,4 W/mK, PSX-P7)	V23990-P689-F-/3/-PM

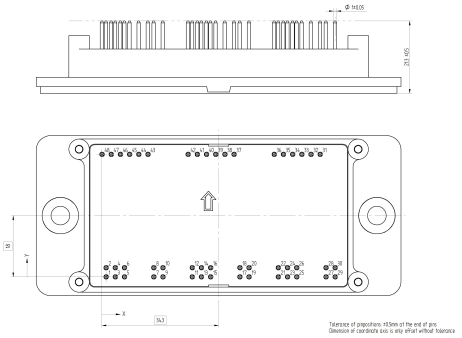
Marking

Text	VIN	Date code	Type&Ver	UL	Lot	Serial
	VIN	WWYY	TTTTTTTVV	UL	LLLLL	SSSS
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

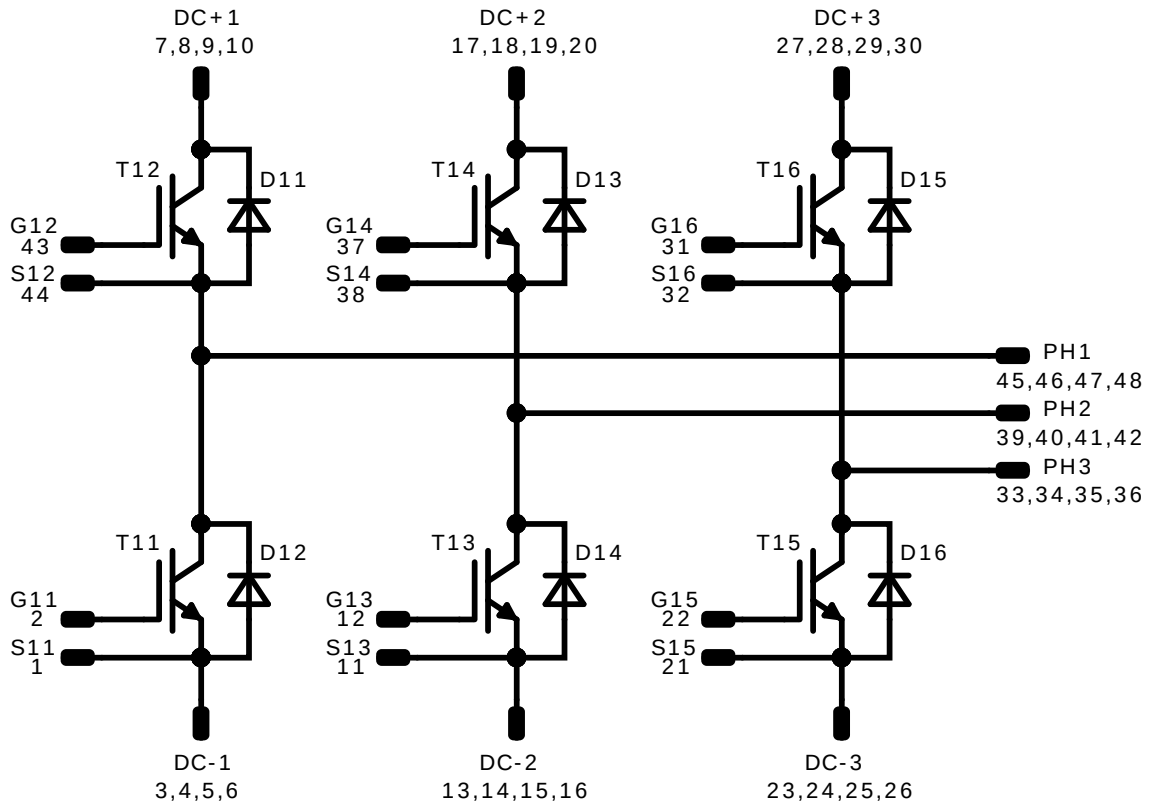
Outline

Pin table [mm]

Pin	X	Y	Function	Pin	X	Y	Function
1	1,2	0	S11	26	57,2	2,7	DC-3
2	1,2	2,7	G11	27	65,8	0	DC+3
3	3,9	0	DC-1	28	65,8	2,7	DC+3
4	3,9	2,7	DC-1	29	68,5	0	DC+3
5	6,6	0	DC-1	30	68,5	2,7	DC+3
6	6,6	2,7	DC-1	31	64,1	36	G16
7	15,2	0	DC+1	32	61,4	36	S16
8	15,2	2,7	DC+1	33	58,7	36	Ph3
9	17,9	0	DC+1	34	56	36	Ph3
10	17,9	2,7	DC+1	35	53,3	36	Ph3
11	26,5	0	S13	36	50,6	36	Ph3
12	26,5	2,7	G13	37	38,8	36	G14
13	29,2	0	DC-2	38	36,1	36	S14
14	29,2	2,7	DC-2	39	33,4	36	Ph2
15	31,9	0	DC-2	40	30,7	36	Ph2
16	31,9	2,7	DC-2	41	28	36	Ph2
17	40,5	0	DC+2	42	25,3	36	Ph2
18	40,5	2,7	DC+2	43	13,5	36	G12
19	43,2	0	DC+2	44	10,8	36	S12
20	43,2	2,7	DC+2	45	8,1	36	Ph1
21	51,8	0	S15	46	5,4	36	Ph1
22	51,8	2,7	G15	47	2,7	36	Ph1
23	54,5	0	DC-3	48	0	36	Ph1
24	54,5	2,7	DC-3				



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	100 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	100 A	Inverter Diode	

Packaging instruction				
Standard packaging quantity (SPQ) 36	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 2 packages see vincotech.com website.

Package data
Package data for *flow* 2 packages see vincotech.com website.

Vincotech thermistor reference
See Vincotech thermistor reference table at 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-P689-F-PM-D4-14	26 Sep. 2021	New Datasheet format, module is unchanged Introduce Rth values with PSX-P7 TIM	