Vincotech

V23990-P719-G56-PM

datasheet

***flow*90CON 1** — **1200 V / 100 A**

Topology features

- Three-phase Rectifier
- Brake Chopper
- Temperature sensor

Component features

- Easy paralleling
- Low turn-off losses
- Low collector emitter saturation voltage
- Positive temperature coefficient
- Short tail current

Housing features

- Base isolation: Al_2O_3
- 90° mounting angle between heatsink and PCB
- Screw-on heatsink mounting
- Clip-in PCB mounting
- Thermo-mechanical push-and-pull force relief
- Solder pin

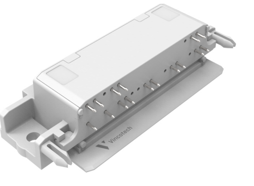
Target applications

- Embedded Drives
- Industrial Drives

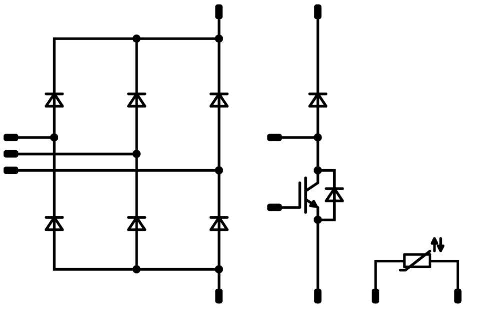
Types

- V23990-P719-G56-PM

*flow*90 1 housing



Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Brake Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	63	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		150	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	167	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
Brake Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	19	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	36	W
Maximum junction temperature	T_{jmax}			150	°C
Brake Sw. Protection Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s <= 80 °C	6 (1)	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		6	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	25	W
Maximum junction temperature	T_{jmax}			150	°C

(1) limited by I_{FRM}

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Rectifier Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	86	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	890	A
Surge current capability	I^2t			3960	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	91	W
Maximum junction temperature	T_{jmax}			150	°C

Module Properties

Parameter	Symbol	Conditions		Value	Unit
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				> 12,7	mm
Clearance				11,84	mm
Comparative Tracking Index	CTI			≥ 200	

*100 % tested in production

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
Brake Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0017	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	25 125 150	1,58	1,83 2,12 2,18	2,07(2)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			4,8	µA
Gate-emitter leakage current	I_{GES}		20	0		25			240	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		2900		pF
Reverse transfer capacitance	C_{res}							100		pF
Gate charge	Q_g		±15		0	25		400		nC
Thermal										
Thermal resistance junction to sink(3)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,57		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	0/15	700	34	25 125		18,88 18,4		ns
Rise time	t_r					25 125		18,18 18,66		ns
Turn-off delay time	$t_{d(off)}$					25 125		251,11 325,19		ns
Fall time	t_f					25 125		66,14 121,68		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=2,02 µC Q_{rFWD}=3,32 µC				25 125		1,69 2,17		mWs
Turn-off energy (per pulse)	E_{off}					25 125		2,69 4,22		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	
Brake Diode										
Static										
Forward voltage	V_F				15	25 125	1,23	1,76 1,73	1,97(2)	V
Reverse leakage current	I_R	V_r = 1200 V				25			27	µA
Thermal										
Thermal resistance junction to sink(3)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,92		K/W
Dynamic										
Peak recovery current	I_{RM}	d*i*/d*t*=1198 A/µs d*i*/d*t*=1307 A/µs	0/15	700	34	25 125		17,7 22,41		A
Reverse recovery time	t_{rr}					25 125		296,82 426,78		ns
Recovered charge	Q_r					25 125		2,02 3,32		µC
Reverse recovered energy	E_{rec}					25 125		1,04 1,75		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		161,63 200,69		A/µs
Brake Sw. Protection Diode										
Static										
Forward voltage	V_F				3	25 125	1,23	1,61 1,58	1,97(2)	V
Reverse leakage current	I_R	V_r = 1200 V				25			27	µA
Thermal										
Thermal resistance junction to sink(3)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,8		K/W

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	
Rectifier Diode										
Static										
Forward voltage	V_F				60	25 125 150		1,06 0,99 0,97	1,5[2]	V
Reverse leakage current	I_R	V_r = 1600 V				25 150			100 2000	µA
Thermal										
Thermal resistance junction to sink[3]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,77		K/W
Thermistor										
Static										
Rated resistance	R					25		22		kΩ
Deviation of R100	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		130		mW
Power dissipation constant	d					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %						3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %						4000		K
Vincotech Thermistor Reference									I	

(2) Value at chip level

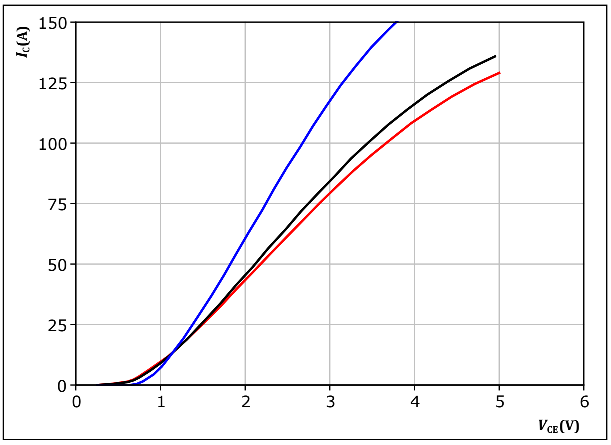
(3) Only valid with pre-applied Vincotech thermal interface material.

Brake Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

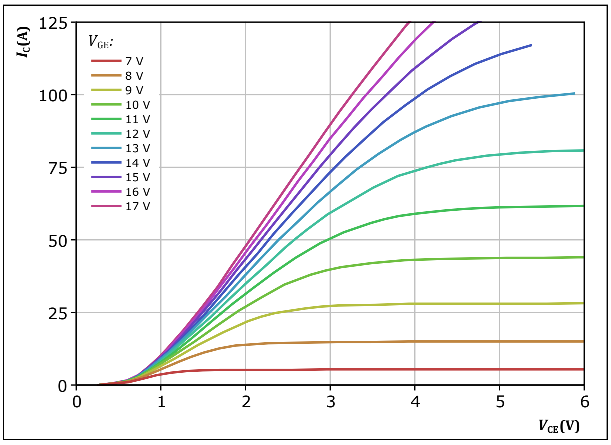


t_p =	250	μs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



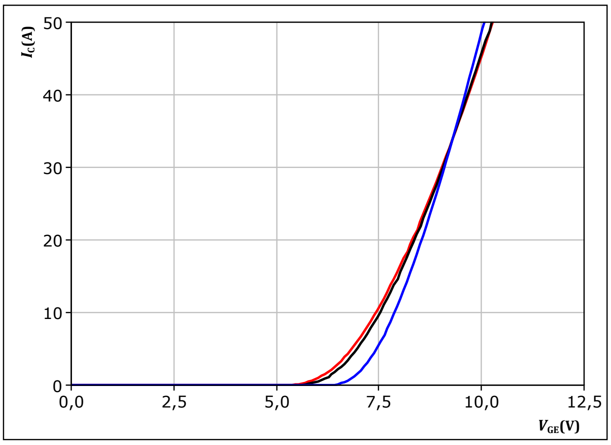
t_p =	250	μs
T_j =	150	°C

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

figure 3. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})

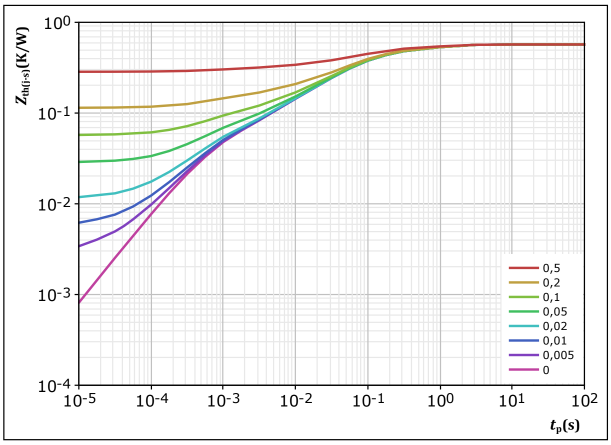


t_p =	250	μs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 4. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j\text{-}s)}$ =	0,57	K/W

IGBT thermal model values

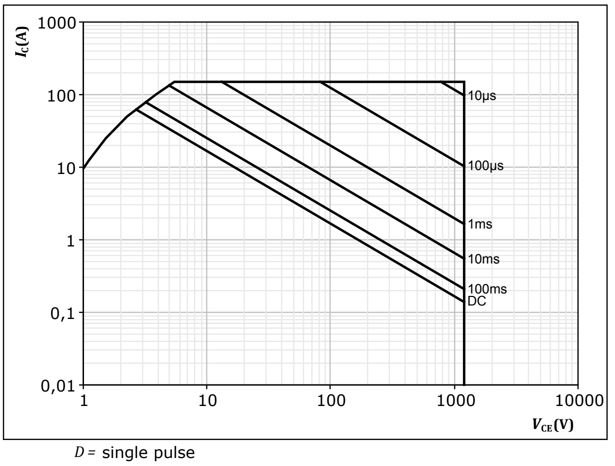
R (K/W)	τ (s)
9,44E-02	1,07E+00
1,78E-01	1,41E-01
1,93E-01	4,28E-02
6,30E-02	6,87E-03
4,25E-02	6,37E-04

Brake Switch Characteristics

figure 5.	IGBT

Safe operating area

I_C = f(V_{CE})



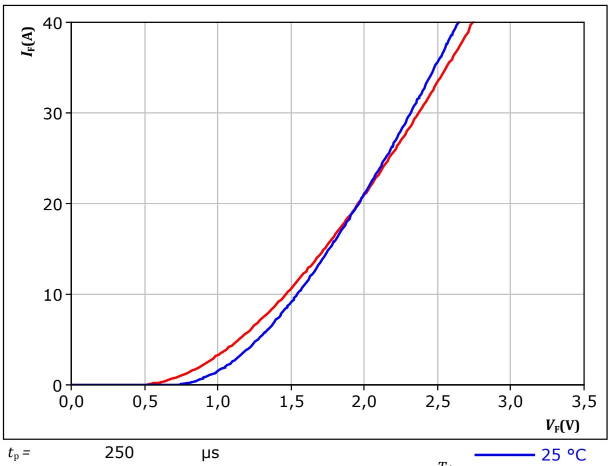
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Brake Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



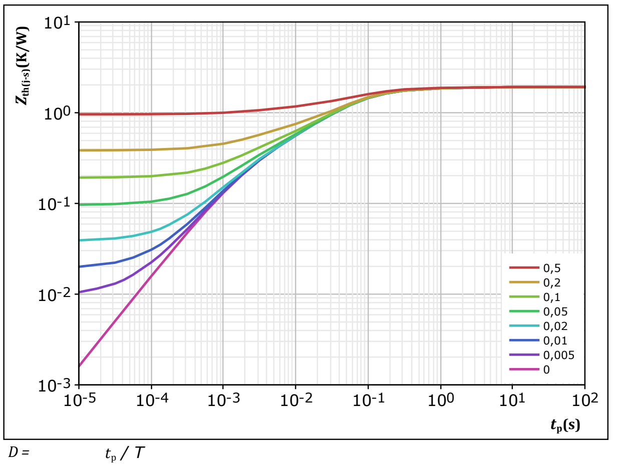
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 7. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j\text{-}s)}$ = 1,92 K/W

FWD thermal model values

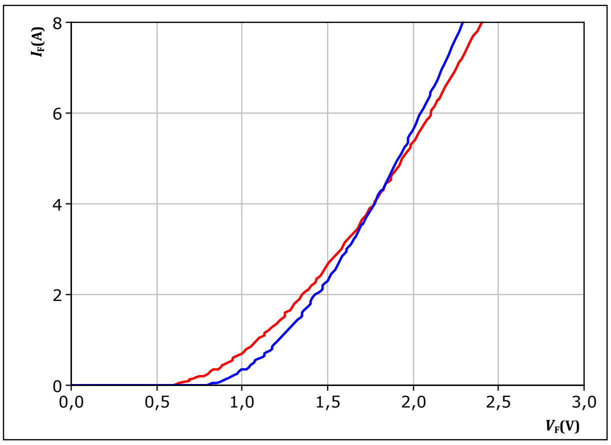
R (K/W)	τ (s)
7,59E-02	2,86E+00
2,78E-01	2,85E-01
1,06E+00	5,95E-02
3,35E-01	9,57E-03
1,71E-01	1,60E-03

Brake Sw. Protection Diode Characteristics

figure 8. **FWD**

Typical forward characteristics

I_F = f(V_F)



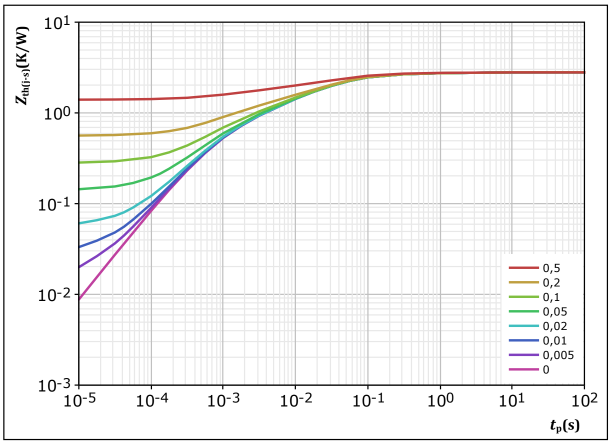
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 9. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 2,796 K/W

FWD thermal model values

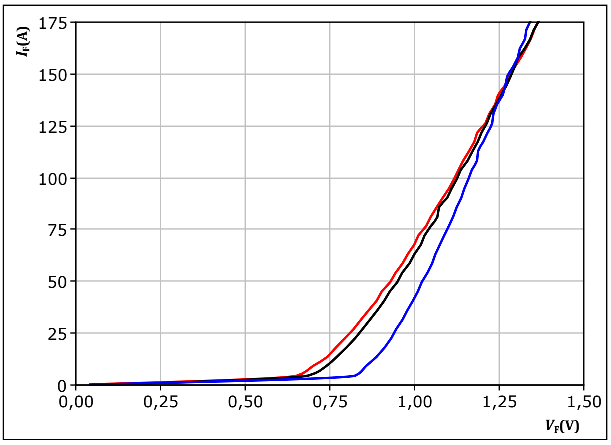
R (K/W)	τ (s)
7,82E-02	2,45E+00
1,95E-01	2,65E-01
9,84E-01	4,77E-02
6,58E-01	1,23E-02
5,09E-01	2,70E-03
3,71E-01	5,98E-04

Rectifier Diode Characteristics

figure 10. **Rectifier**

Typical forward characteristics

I_F = f(V_F)



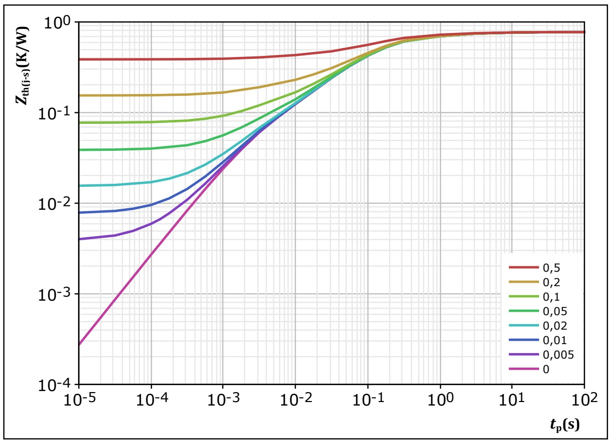
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 11. **Rectifier**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,772 K/W

Rectifier thermal model values

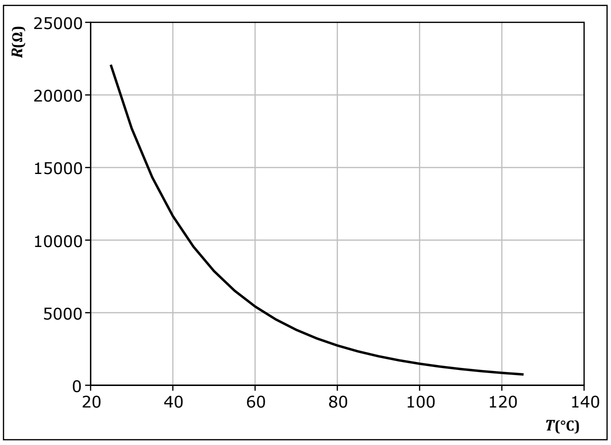
R (K/W)	τ (s)
2,82E-02	8,69E+00
1,16E-01	1,22E+00
4,16E-01	1,44E-01
1,62E-01	2,97E-02
5,02E-02	2,64E-03

Thermistor Characteristics

figure 12. **Thermistor**

Typical NTC characteristic as function of temperature

R_T = f(T)

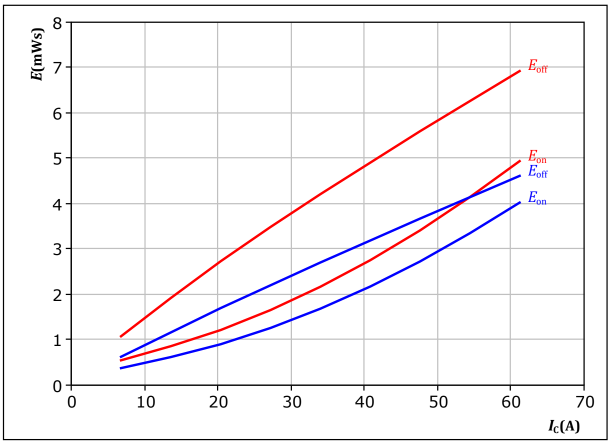


Brake Switching Characteristics

figure 13. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



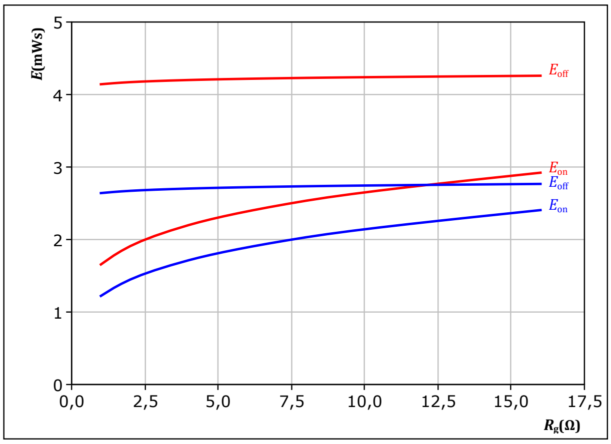
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		
R_{goff} =	4	Ω		

figure 14. **IGBT**

Typical switching energy losses as a function of IGBT turn on gate resistor

$E = f(R_g)$



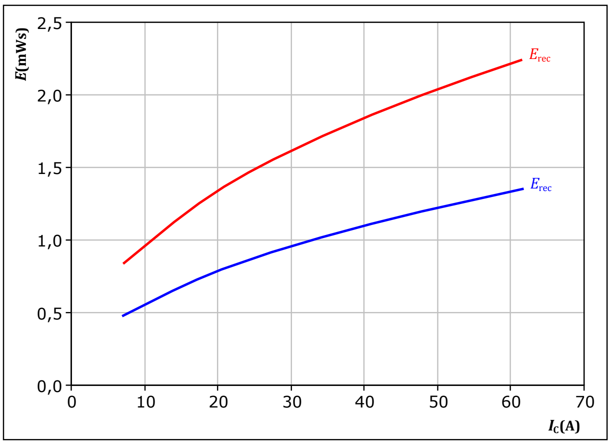
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	34	A		

figure 15. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



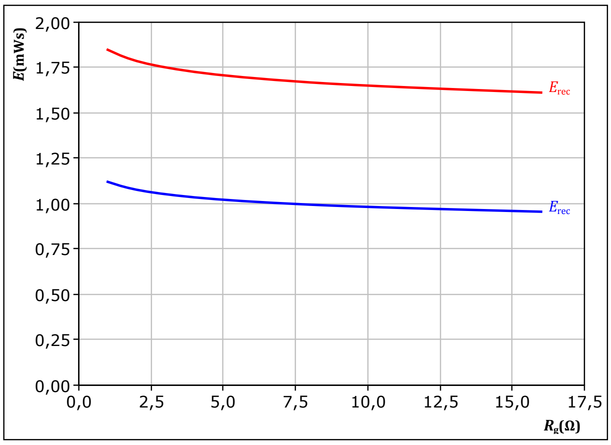
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		

figure 16. **FWD**

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

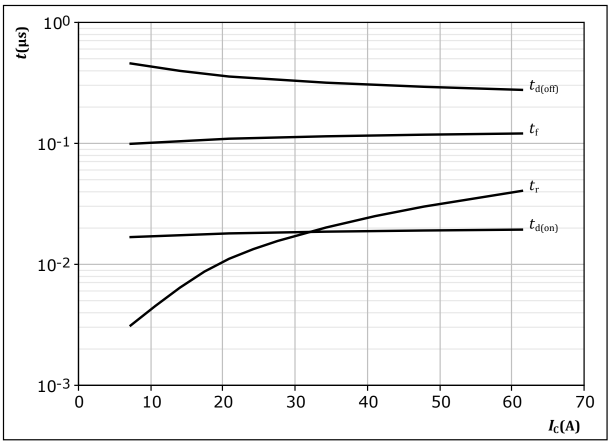
V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	34	A		

Brake Switching Characteristics

figure 17. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



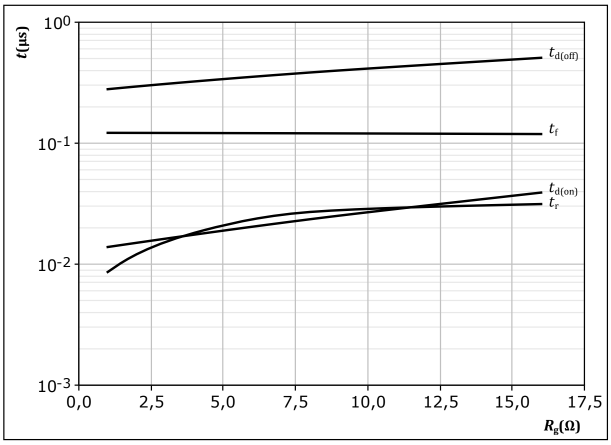
With an inductive load at

T_j =	125	°C
V_{CE} =	700	V
V_{GE} =	0/15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 18. **IGBT**

Typical switching times as a function of IGBT turn on gate resistor

t = f(R_g)



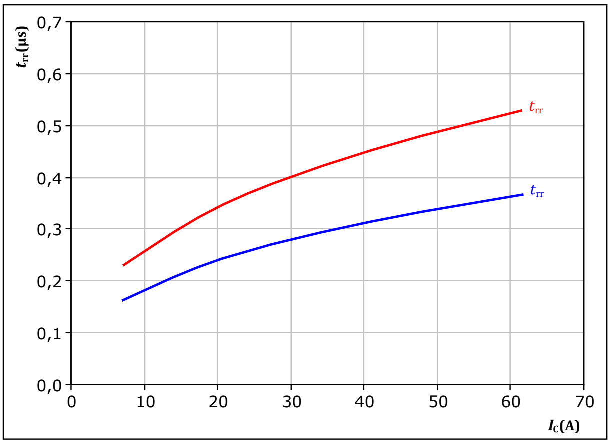
With an inductive load at

T_j =	125	°C
V_{CE} =	700	V
V_{GE} =	0/15	V
I_C =	34	A

figure 19. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

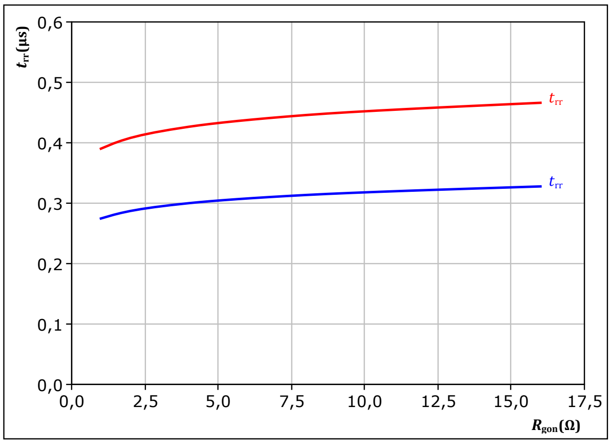
V_{CE} =	700	V
V_{GE} =	0/15	V
R_{gon} =	4	Ω

T_j: 25 °C / 125 °C

figure 20. **FWD**

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

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



With an inductive load at

V_{CE} =	700	V
V_{GE} =	0/15	V
I_C =	34	A

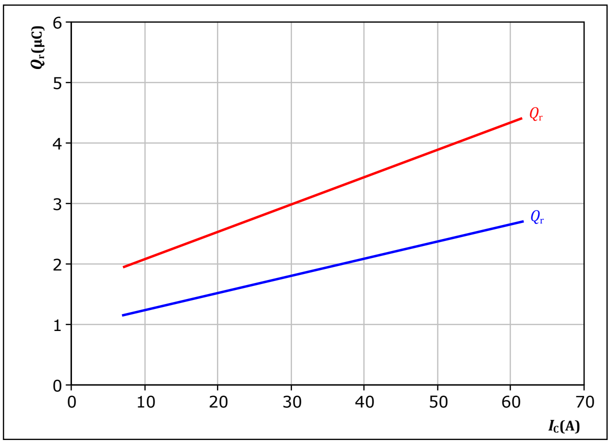
T_j: 25 °C / 125 °C

Brake Switching Characteristics

figure 21. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



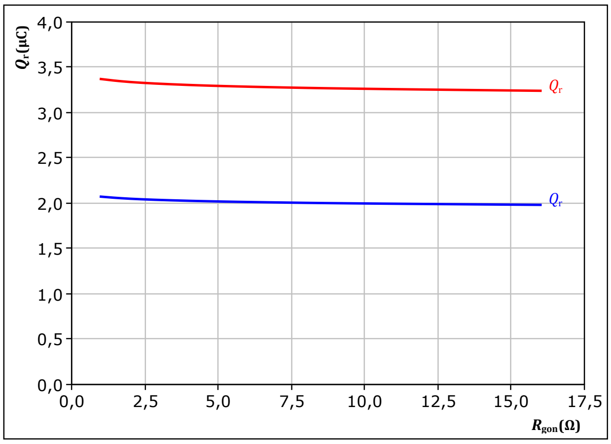
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		

figure 22. **FWD**

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

$Q_r = f(R_{gon})$



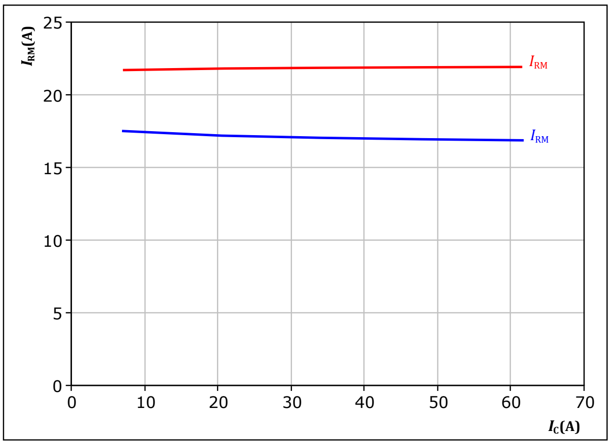
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	34	A		

figure 23. **FWD**

Typical peak reverse recovery current as a function of collector current

$I_{RM} = f(I_C)$



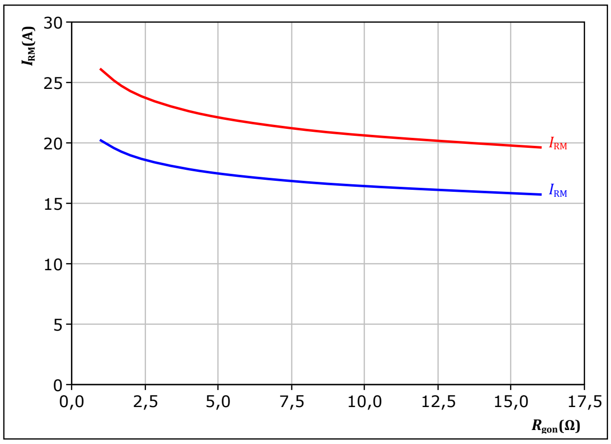
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	4	Ω		

figure 24. **FWD**

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

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



With an inductive load at

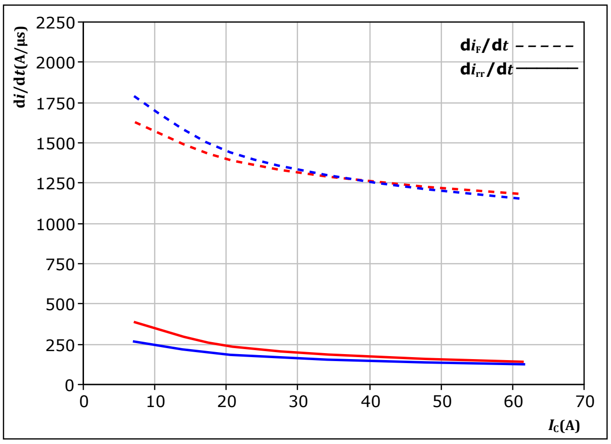
V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	34	A		

Brake Switching Characteristics

figure 25. **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

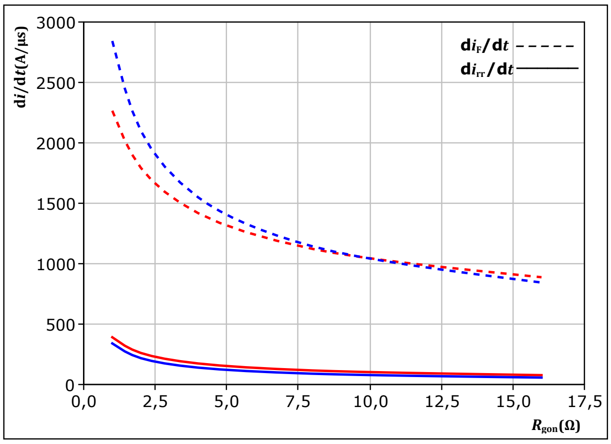
T_j: 25 °C, 125 °C

V_{CE} =	700	V
V_{GE} =	0/15	V
R_{gon} =	4	Ω

figure 26. **FWD**

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

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



With an inductive load at

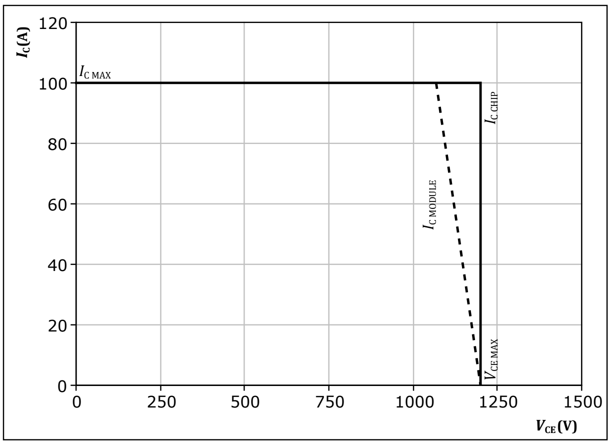
T_j: 25 °C, 125 °C

V_{CE} =	700	V
V_{GE} =	0/15	V
I_C =	34	A

figure 27. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



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

Brake Switching Definitions

figure 28. **IGBT**

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

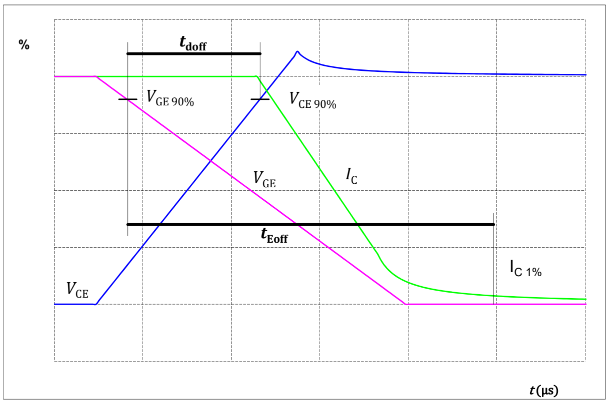


figure 29. **IGBT**

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

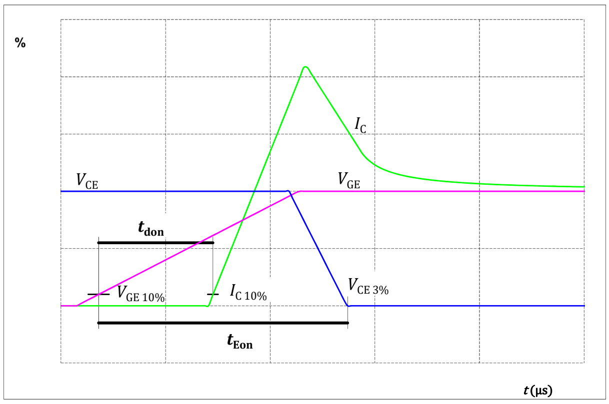


figure 30. **IGBT**

Turn-off Switching Waveforms & definition of t_f

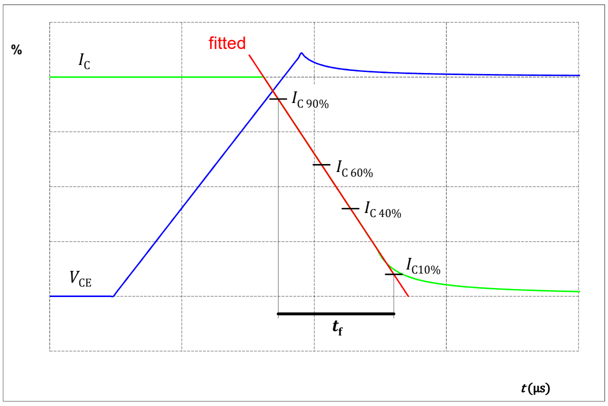
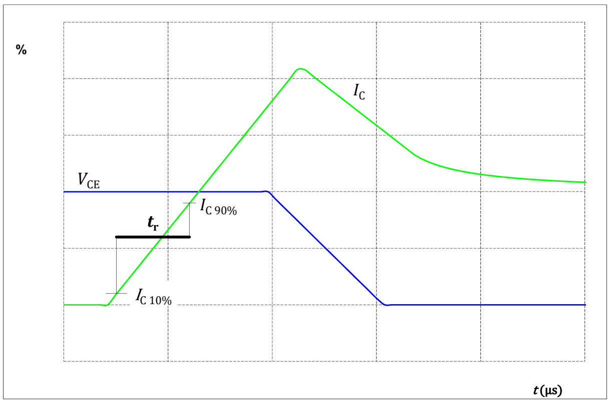


figure 31. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Brake Switching Definitions

figure 32. **FWD**

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

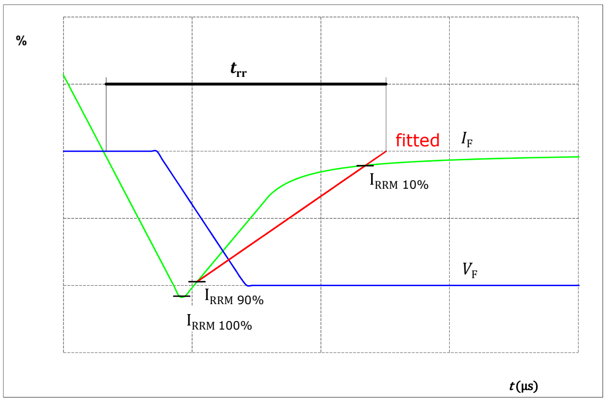
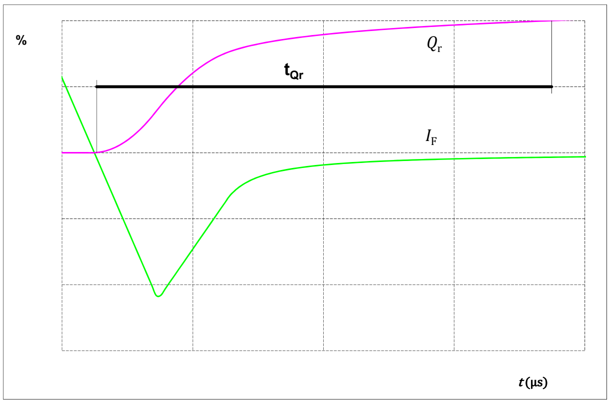


figure 33. **FWD**

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



Ordering Code

Version	Ordering Code
Without thermal paste	V23990-P719-G56-PM
With thermal paste (3,4 W/mK, PSX-P7)	V23990-P719-G56-/3/-PM

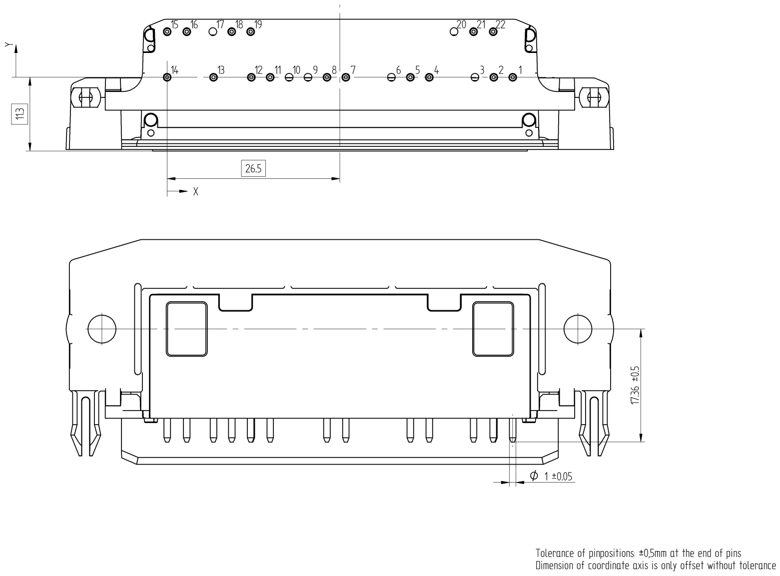
Marking

	**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		

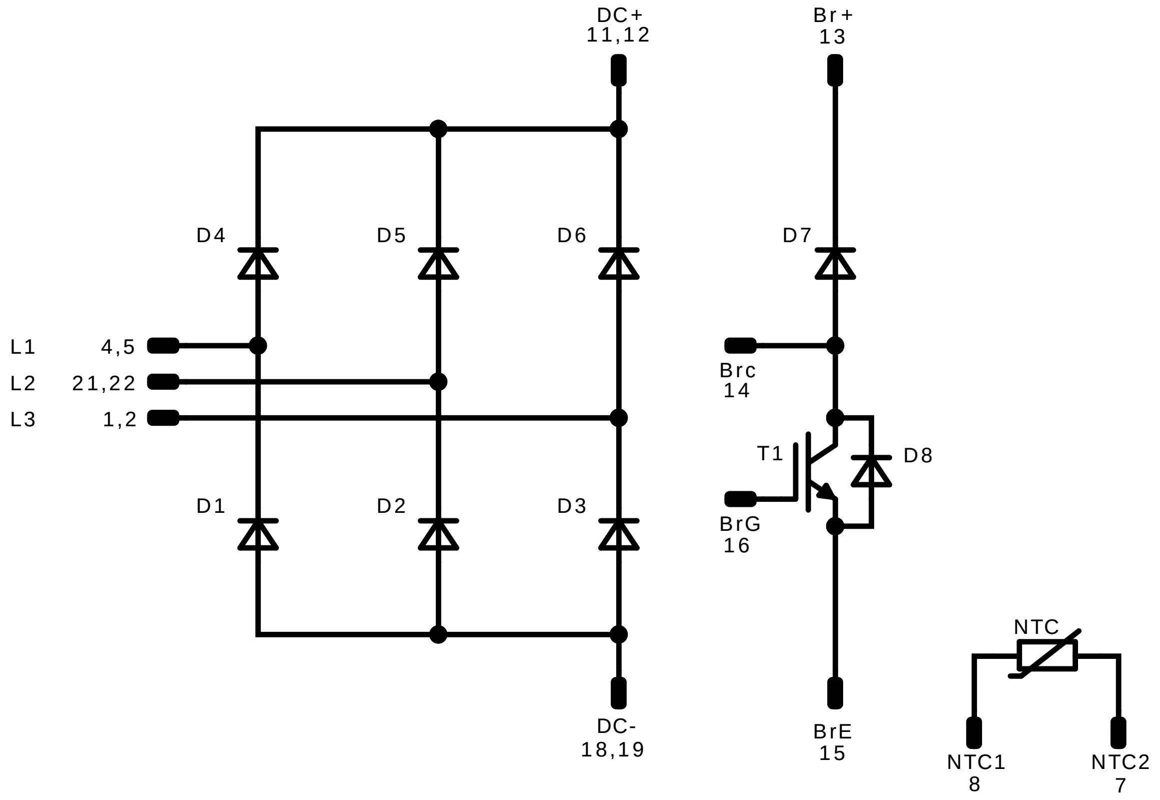
Outline

Pin	X	Y	Function
1	53	0	L3
2	50,1	0	L3
3	47,2	0	NA
4	40,2	0	L1
5	37,3	0	L1
6	34,4	0	NA
7	27,4	0	NTC2
8	24,5	0	NTC1
9	21,6	0	NA
10	18,7	0	NA
11	15,8	0	DC+
12	12,9	0	DC+
13	7,1	0	Br+
14	0	0	BrC
15	0	7	BrE
16	3	7	BrG
17	7	7	NA
18	9,9	7	DC-
19	12,8	7	DC-
20	44	7	NA
21	47	7	L2
22	50	7	L2

Pin table [mm]



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1	IGBT	1200 V	50 A	Brake Switch	
D7	FWD	1200 V	15 A	Brake Diode	
D8	FWD	1200 V	3 A	Brake Sw. Protection Diode	
D1, D4, D2, D5, D3, D6	Rectifier	1600 V	60 A	Rectifier Diode	
NTC	Thermistor			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 80	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow*90 1 packages see vincotech.com website.

Package data
Package data for *flow*90 1 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-P719-G56-PM-D1-14	18 Oct. 2022		
V23990-P719-G56-PM-D2-14	24 May. 2023	Rectifier Diode Ir at 150 °C corrected	