Vincotech

*flow*PIM 1	1200 V / 10 A

Features

- Power Integrated Module
- Trench Fieldstop IGBT's for low saturation losses
- Built-in NTC
- Compact and low inductive design
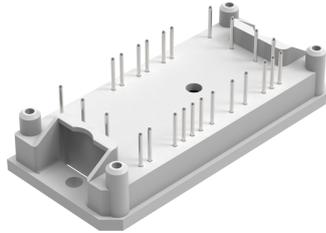
Target applications

- Embedded Drives
- Industrial Drives

Types

- V23990-P487-A39-PM

flow 1 17 mm housing

Schematic

Vincotech

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	16	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		24	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	61	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	19	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	46	W
Maximum junction temperature	T_{jmax}			175	°C
Brake Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	16	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		24	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	61	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

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
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}		20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	46	W
Maximum junction temperature	T_{jmax}			175	°C
Rectifier Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	47	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	280	A
Surge current capability	I^2t			390	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	59	W
Maximum junction temperature	T_{jmax}			150	°C

Module Properties

Thermal Properties

Parameter	Symbol	Conditions		Value	Unit
Storage temperature	T_{stg}			-40...+125	°C
Operation temperature under switching condition	T_{jop}			-40...+(T_{jmax} - 25)	°C

Isolation Properties

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

*100 % tested in production

Vincotech

V23990-P487-A39-PM
datasheet

Characteristic Values

Parameter	Symbol	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
Conditions						**Values**			**Unit**

Inverter Switch

Static

Parameter	Symbol	V_{GE}/V_{GS} [V]	V_{CE}/V_{DS}/V_{F} [V]	I_{C}/I_{D}/I_{F} [A]	T_{j} [°C]	Min	Typ	Max	Unit
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$		0,00015	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}	15		8	25 / 125 / 150	1,58	1,85 / 2,14 / 2,21	2,07[1]	V
Collector-emitter cut-off current	I_{CES}	0	1200		25			1	µA
Gate-emitter leakage current	I_{GES}	20	0		25			120	nA
Internal gate resistance	r_{g}						None		Ω
Input capacitance	C_{ies}	$f = 1$ Mhz · 0	25		25		490		pF
Reverse transfer capacitance	C_{res}						30		pF

Thermal

Parameter	Symbol	Conditions				Min	Typ	Max	Unit
Thermal resistance junction to sink [2]	$R_{th(j-s)}$	$\lambda_{paste} = 3{,}4$ W/mK (PSX)					1,57		K/W

Dynamic

Parameter	Symbol	V_{GE}/V_{GS} [V]	V_{CE}/V_{DS}/V_{F} [V]	I_{C}/I_{D}/I_{F} [A]	T_{j} [°C]	Min	Typ	Max	Unit
Turn-on delay time	$t_{d(on)}$	$R_{gon} = 16$ Ω $R_{goff} = 16$ Ω	±15	600 · 10	25 / 125 / 150		36,8 / 36,16 / 36,48		ns
Rise time	t_{r}				25 / 125 / 150		12,16 / 14,08 / 14,08		ns
Turn-off delay time	$t_{d(off)}$				25 / 125 / 150		148,16 / 190,08 / 201,92		ns
Fall time	t_{f}				25 / 125 / 150		109,82 / 152,5 / 169,1		ns
Turn-on energy (per pulse)	E_{on}	$Q_{rFWD}=0{,}824$ µC $Q_{rFWD}=1{,}5$ µC $Q_{rFWD}=1{,}72$ µC			25 / 125 / 150		0,421 / 0,675 / 0,753		mWs
Turn-off energy (per pulse)	E_{off}				25 / 125 / 150		0,61 / 0,897 / 1,01		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

Parameter	Symbol	Conditions				Min	Typ	Max	Unit
Forward voltage	V_{F}			10	25 125 150	1,35	1,79 1,77 1,73	2,05[1]	V
Reverse leakage current	I_{R}	V_{r} = 1200 V			25			2,7	µA

Thermal

Parameter	Symbol	Conditions				Min	Typ	Max	Unit
Thermal resistance junction to sink [2]	$R_{th(j\text{-}s)}$	λ_{paste} = 3,4 W/mK (PSX)					2,07		K/W

Dynamic

Parameter	Symbol	Conditions				Min	Typ	Max	Unit
Peak recovery current	I_{RRM}				25 125 150		11,07 13,29 13,52		A
Reverse recovery time	t_{rr}				25 125 150		224,55 334 370,11		ns
Recovered charge	Q_{r}	di/dt=841 A/µs di/dt=726 A/µs di/dt=697 A/µs	±15 / 600	10	25 125 150		0,824 1,5 1,72		µC
Reverse recovered energy	E_{rec}				25 125 150		0,342 0,623 0,712		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$				25 125 150		145,65 83,99 75,49		A/µs

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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 Switch

Static

Parameter	Symbol	V_{GE}/V_{GS} [V]	V_{CE}/V_{DS}/V_F [V]	I_C/I_D/I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$		0,00015	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}	15		8	25 125 150	1,58	1,85 2,14 2,21	2,07[1]	V
Collector-emitter cut-off current	I_{CES}	0	1200		25			1	µA
Gate-emitter leakage current	I_{GES}	20	0		25			120	nA
Internal gate resistance	r_g						None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		490	pF
Reverse transfer capacitance	C_{res}						30		pF

Thermal

Parameter	Symbol	Conditions				Min	Typ	Max	Unit
Thermal resistance junction to sink [2]	$R_{th(j\text{-}s)}$	λ_{paste} = 3,4 W/mK (PSX)					1,57		K/W

Dynamic

Parameter	Symbol	V_{GE}/V_{GS} [V]	V_{CE}/V_{DS}/V_F [V]	I_C/I_D/I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Turn-on delay time	$t_{d(on)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	0/15	700	10	25 125 150		19,84 19,2 19,52		ns
Rise time	t_r					25 125 150		16,64 17,92 18,24		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		175,36 221,44 229,44		ns
Fall time	t_f					25 125 150		91,22 155,59 172,69		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,833 µC Q_{rFWD}=1,52 µC Q_{rFWD}=1,74 µC				25 125 150		0,558 0,864 0,991		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,664 1 1,14		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

Parameter	Symbol	Conditions				Min	Typ	Max	Unit
Forward voltage	V_{F}			10	25 125 150	1,35	1,79 1,77 1,73	2,05[1]	V
Reverse leakage current	I_{R}	V_{r} = 1200 V			25			2,7	µA

Thermal

Parameter	Symbol	Conditions				Min	Typ	Max	Unit
Thermal resistance junction to sink [2]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)					2,07		K/W

Dynamic

Parameter	Symbol	Conditions				Min	Typ	Max	Unit
Peak recovery current	I_{RRM}				25 125 150		8,92 10,51 10,73		A
Reverse recovery time	t_{rr}				25 125 150		214,76 333,3 375,07		ns
Recovered charge	Q_{r}	di/dt=521 A/µs di/dt=500 A/µs di/dt=476 A/µs	0/15 700	10	25 125 150		0,833 1,52 1,74		µC
Reverse recovered energy	E_{rec}				25 125 150		0,401 0,727 0,83		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$				25 125 150		150,71 83,42 68,17		A/µs

Vincotech

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

Parameter	Symbol	Conditions				Values			Unit
Forward voltage	V_{F}			50	25 125		1,24 1,24	1,3[1] 1,33[1]	V
Reverse leakage current	I_{R}	V_{r} = 1600 V			25 150			20 1500	µA

Thermal

Parameter	Symbol	Conditions				Values			Unit
Thermal resistance junction to sink [2]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)					1,2		K/W

Thermistor

Static

Parameter	Symbol	Conditions				Values			Unit
Rated resistance	R				25		4,7		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 401 Ω			100	-5		5	%
Power dissipation	P						5		mW
Power dissipation constant	d				25		1,3		mW/K
B-value	$B_{(25/50)}$	Tol. ±3 %					3612		K
B-value	$B_{(25/100)}$	Tol. ±3 %					3650		K

[1] Value at chip level

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

Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics
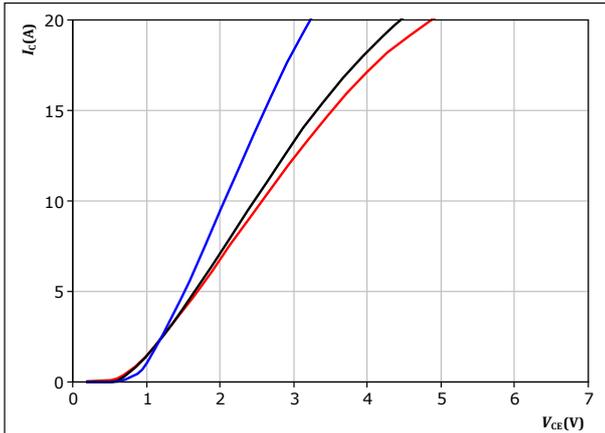
$I_C = f(V_{CE})$

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

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

V_{GE}:
7 V
8 V
9 V
10 V
11 V
12 V
13 V
14 V
15 V
16 V
17 V

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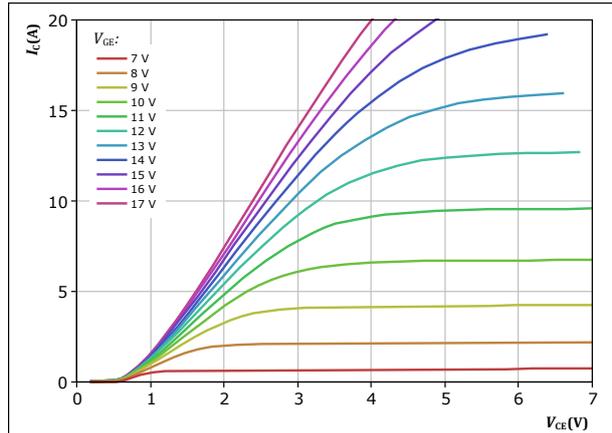
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$
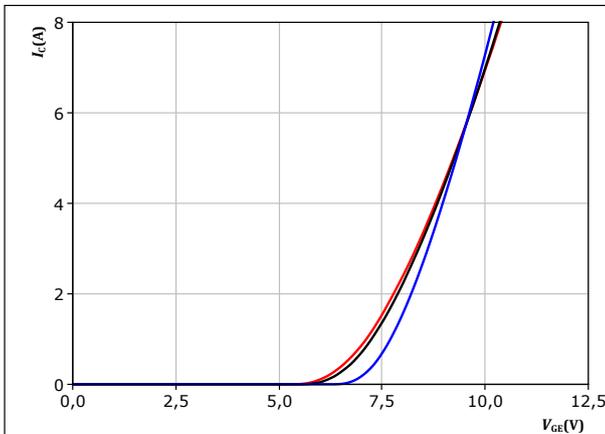
$t_p =$	250	µs		25 °C
$V_{CE} =$	10	V	T_j:	125 °C
				150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width
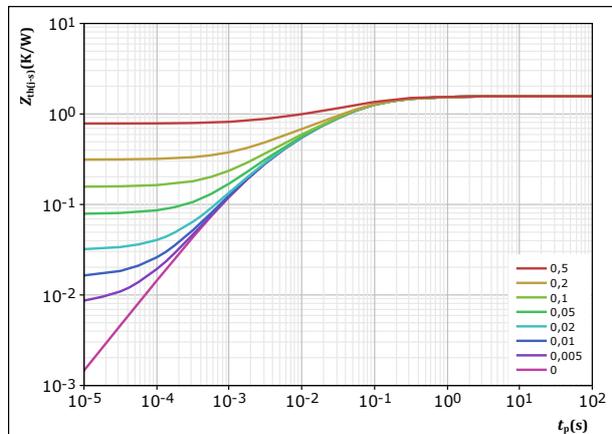
$Z_{th(j-s)} = f(t_p)$

0,5
0,2
0,1
0,05
0,02
0,01
0,005
0

$D = t_p / T$

$R_{th(j-s)} =$ 1,566 K/W

IGBT thermal model values

R (K/W)	τ (s)
1,42E-01	5,98E-01
6,32E-01	7,71E-02
3,98E-01	2,43E-02
2,86E-01	6,16E-03
1,08E-01	1,44E-03

Inverter Switch Characteristics

figure 5.	IGBT

Safe operating area

I_C = f(V_{CE})
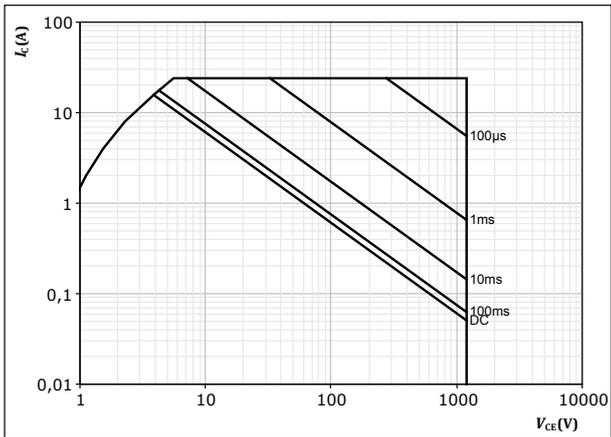
D = single pulse
T_s = 80 °C
V_{GE} = 15 V
T_j = T_{jmax}

Inverter Diode Characteristics

figure 6.   **FWD**

Typical forward characteristics

I_F = f(V_F)

| t_p = | 250 | µs |
| | | |

		25 °C
T_j:		125 °C
		150 °C
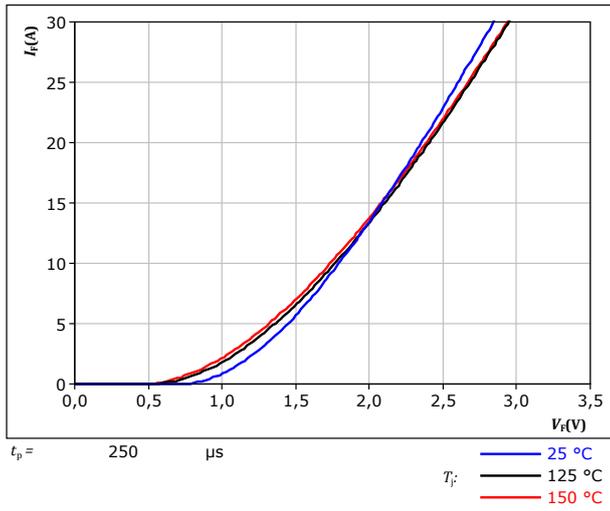
figure 7.   **FWD**

Transient thermal impedance as a function of pulse width
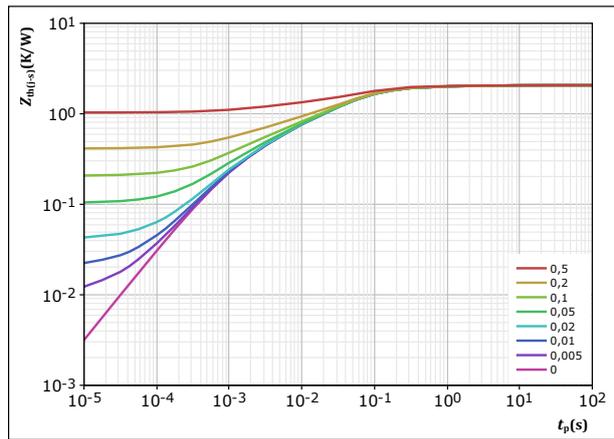
$Z_{th(j-s)}$ = f(t_p)

	0,5
	0,2
	0,1
	0,05
	0,02
	0,01
	0,005
	0

D = t_p / T

$R_{th(j-s)}$ =   2,066   K/W

FWD thermal model values

R (K/W)	τ (s)
5,09E-02	4,26E+00
1,55E-01	5,03E-01
7,75E-01	7,89E-02
5,33E-01	2,68E-02
3,54E-01	5,03E-03
1,97E-01	9,09E-04

Brake Switch Characteristics

figure 8.	IGBT

Typical output characteristics
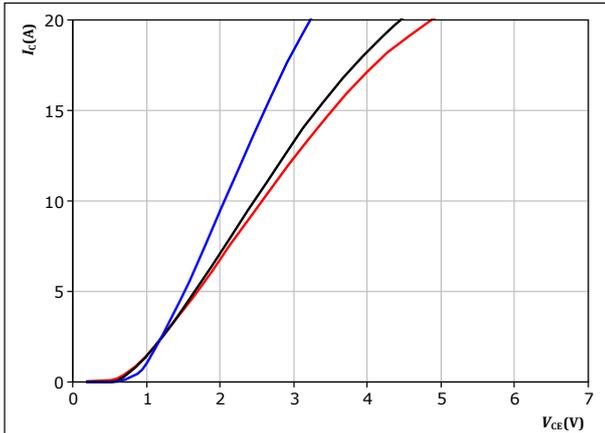
I_C = f(V_{CE})

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

figure 9.	IGBT

Typical output characteristics

I_C = f(V_{CE})

V_{GE}:
- 7 V
- 8 V
- 9 V
- 10 V
- 11 V
- 12 V
- 13 V
- 14 V
- 15 V
- 16 V
- 17 V

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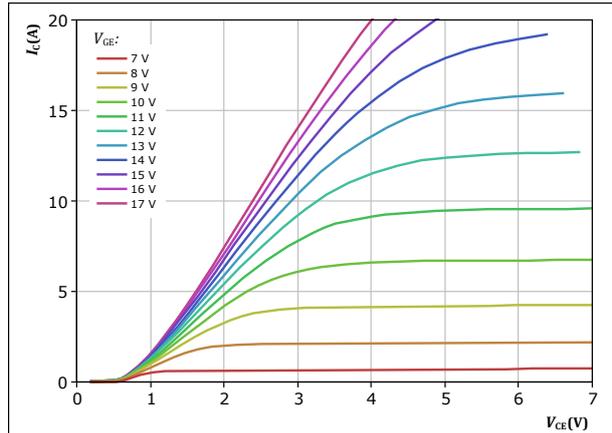
V_{GE} from 7 V to 17 V in steps of 1 V

figure 10.	IGBT

Typical transfer characteristics

I_C = f(V_{GE})
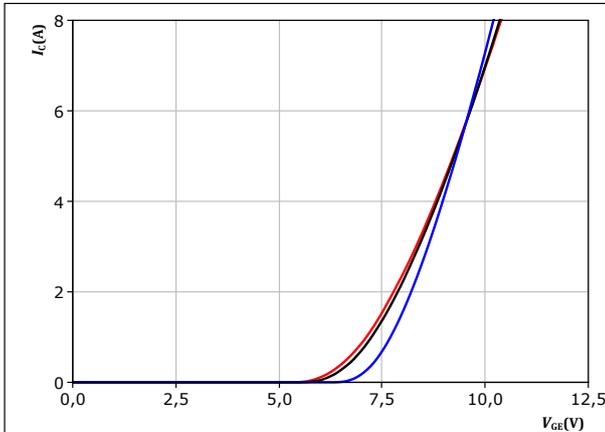
t_p =	250	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 11.	IGBT

Transient thermal impedance as a function of pulse width
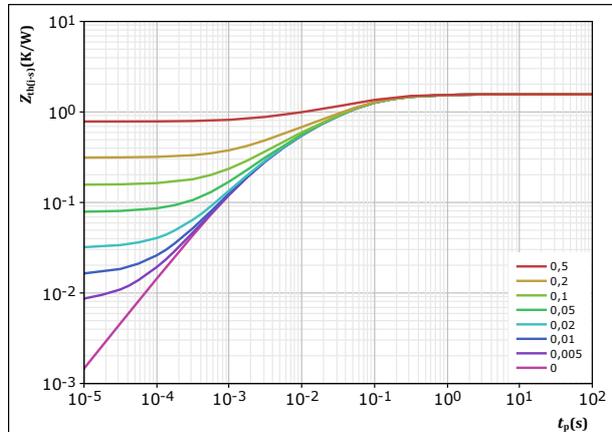
$Z_{th(j-s)}$ = f(t_p)

- 0,5
- 0,2
- 0,1
- 0,05
- 0,02
- 0,01
- 0,005
- 0

D =	t_p / T	
$R_{th(j-s)}$ =	1,566	K/W

IGBT thermal model values

R (K/W)	τ (s)
1,42E-01	5,98E-01
6,32E-01	7,71E-02
3,98E-01	2,43E-02
2,86E-01	6,16E-03
1,08E-01	1,44E-03

Brake Switch Characteristics

figure 12.　　　　　　　　　　　　　　　　　　　　　**IGBT**

Safe operating area

I_C = f(V_{CE})
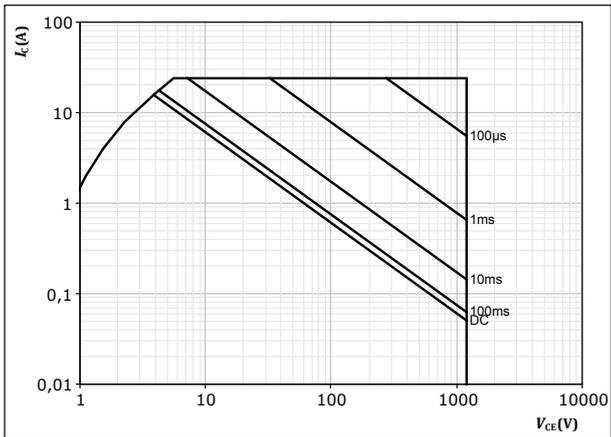
D = single pulse

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

Brake Diode Characteristics

figure 13.	FWD

Typical forward characteristics

$I_F = f(V_F)$

$t_p =$ 250 µs

T_j:
- 25 °C
- 125 °C
- 150 °C
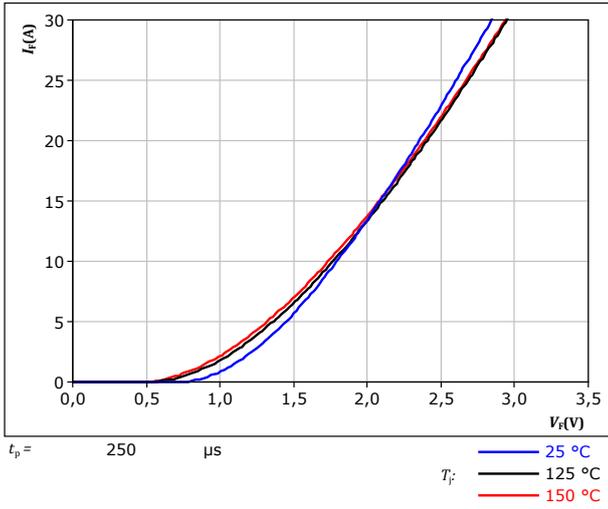
figure 14.	FWD

Transient thermal impedance as a function of pulse width
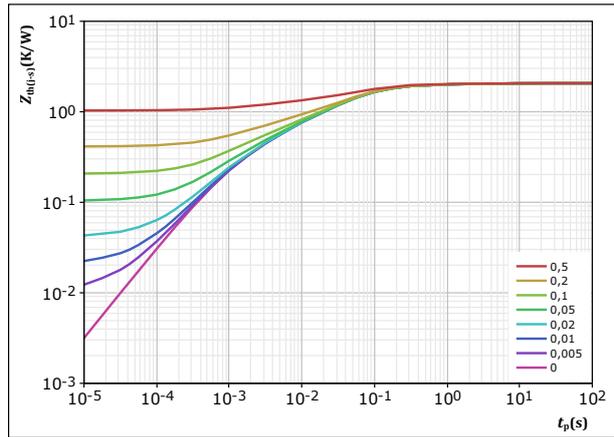
$Z_{th(j-s)} = f(t_p)$

$D = t_p / T$

$R_{th(j-s)} =$ 2,066 K/W

FWD thermal model values

R (K/W)	τ (s)
5,09E-02	4,26E+00
1,55E-01	5,03E-01
7,75E-01	7,89E-02
5,33E-01	2,68E-02
3,54E-01	5,03E-03
1,97E-01	9,09E-04

Rectifier Diode Characteristics

figure 15.	Rectifier

Typical forward characteristics

$I_F = f(V_F)$

$t_p = $ 250 µs

T_j:
— 25 °C
— 125 °C
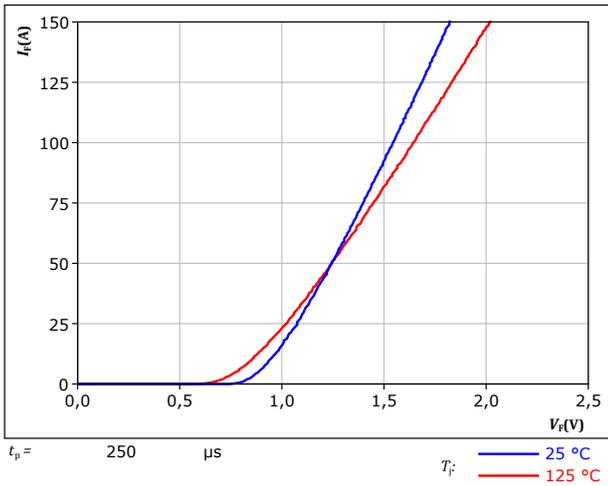
figure 16.	Rectifier

Transient thermal impedance as a function of pulse width

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

	0,5
	0,2
	0,1
	0,05
	0,02
	0,01
	0,005
	0
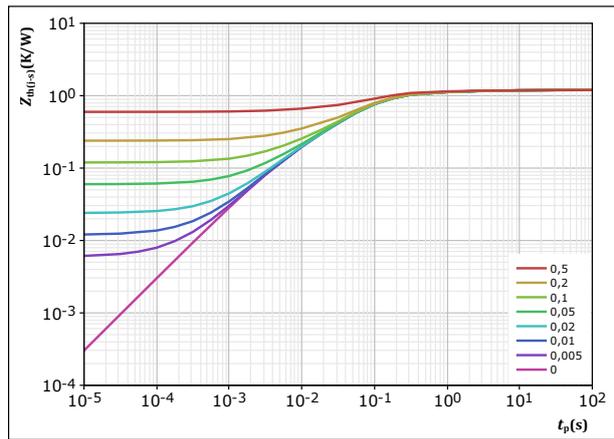
$D = $ t_p / T

$R_{th(j-s)} = $ 1,195 K/W

Rectifier thermal model values

R (K/W)	τ (s)
4,87E-02	6,80E+00
1,57E-01	6,29E-01
7,33E-01	9,05E-02
1,69E-01	3,10E-02
7,37E-02	4,76E-03
1,39E-02	1,53E-02

Thermistor Characteristics

figure 17.	Thermistor

Typical NTC characteristic as function of temperature

$R_T = f(T)$
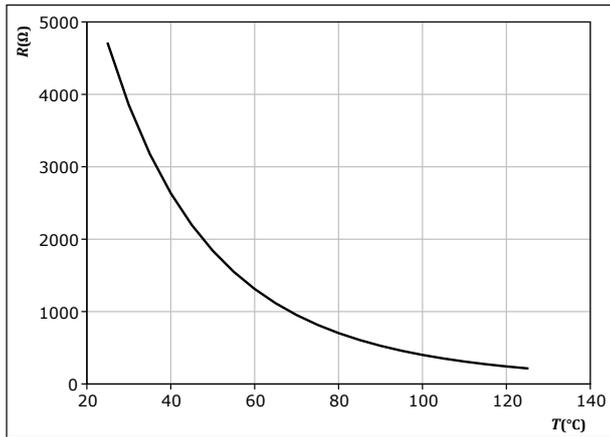
Inverter Switching Characteristics

figure 18. IGBT
Typical switching energy losses as a function of collector current
$E = f(I_C)$
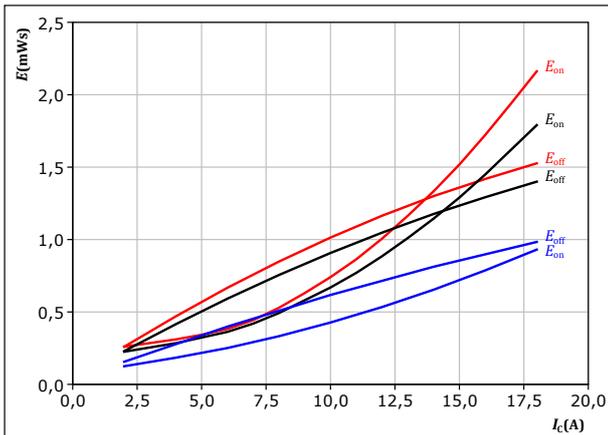
With an inductive load at
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

T_j:
- 25 °C
- 125 °C
- 150 °C

figure 19. IGBT
Typical switching energy losses as a function of gate resistor
$E = f(R_g)$
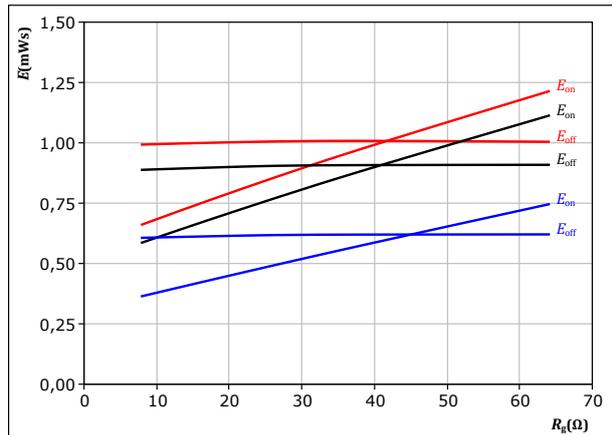
With an inductive load at
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	10	A

T_j:
- 25 °C
- 125 °C
- 150 °C

figure 20. FWD
Typical reverse recovered energy loss as a function of collector current
$E_{rec} = f(I_C)$
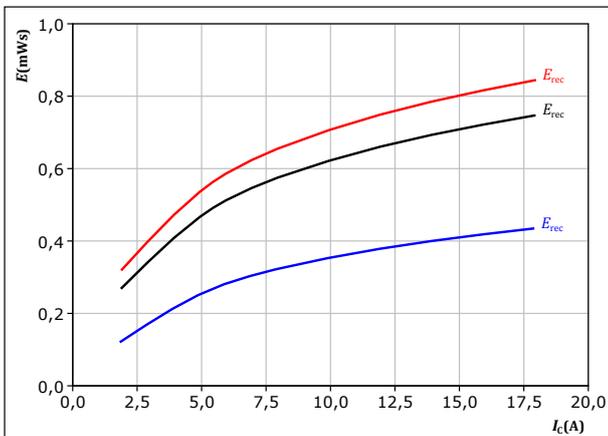
With an inductive load at
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

T_j:
- 25 °C
- 125 °C
- 150 °C

figure 21. FWD
Typical reverse recovered energy loss as a function of gate resistor
$E_{rec} = f(R_g)$
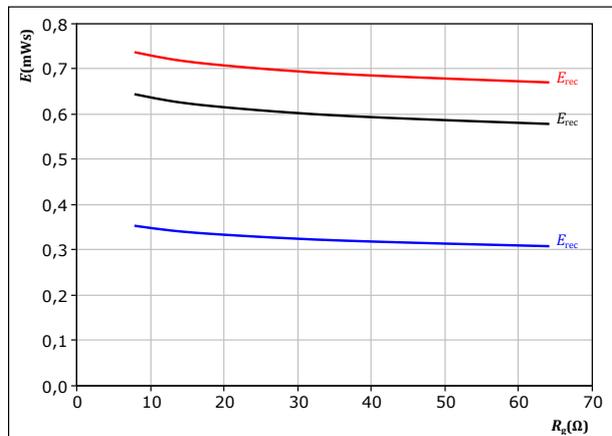
With an inductive load at
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	10	A

T_j:
- 25 °C
- 125 °C
- 150 °C

Inverter Switching Characteristics

figure 22.	IGBT

Typical switching times as a function of collector current

$t = f(I_c)$
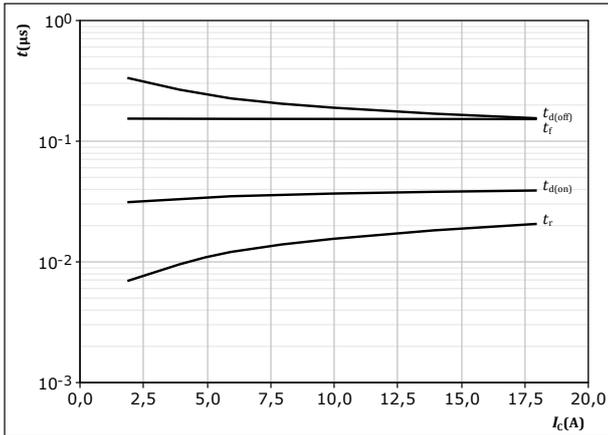
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	16	Ω
$R_{goff} =$	16	Ω

figure 23.	IGBT

Typical switching times as a function of gate resistor

$t = f(R_g)$
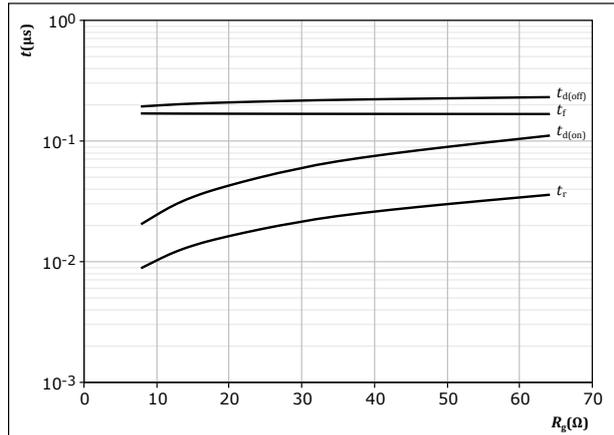
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$I_C =$	10	A

figure 24.	FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$
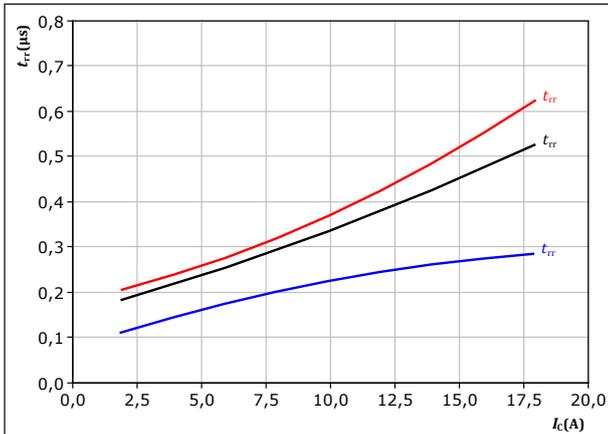
With an inductive load at

$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	16	Ω

T_j:
— 25 °C
— 125 °C
— 150 °C

figure 25.	FWD

Typical reverse recovery time as a function of IGBT turn on gate resistor
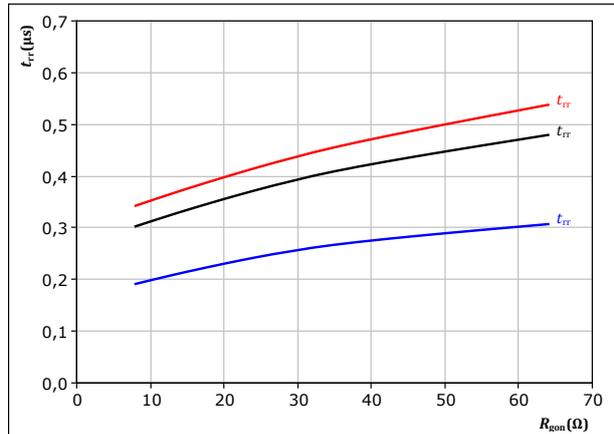
$t_{rr} = f(R_{gon})$

With an inductive load at

$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$I_C =$	10	A

T_j:
— 25 °C
— 125 °C
— 150 °C

Inverter Switching Characteristics

figure 26. FWD

Typical recovered charge as a function of collector current
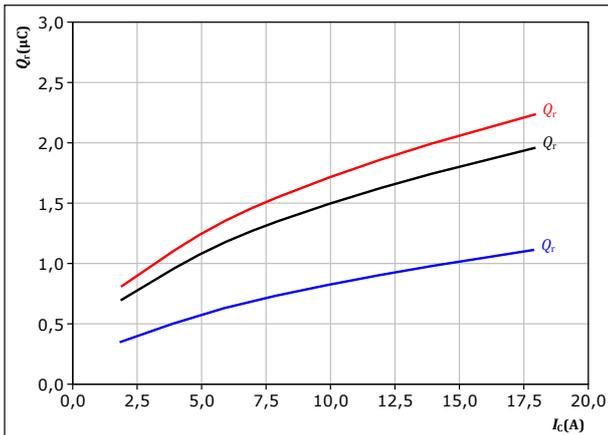
Q_r = f(I_C)

With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

T_j: 25 °C / 125 °C / 150 °C

figure 27. FWD

Typical recovered charge as a function of turn on gate resistor
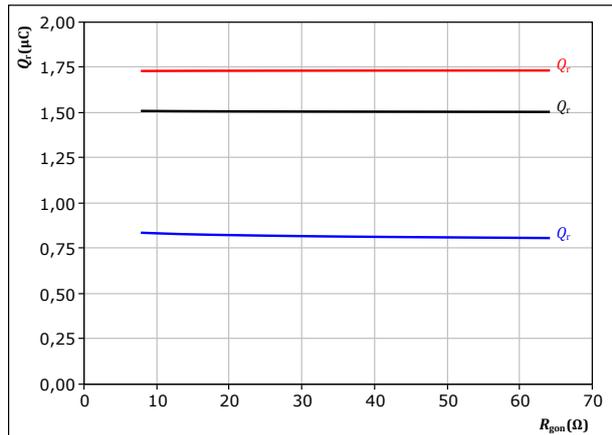
Q_r = f(R_{gon})

With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	10	A

T_j: 25 °C / 125 °C / 150 °C

figure 28. FWD

Typical peak reverse recovery current as a function of collector current
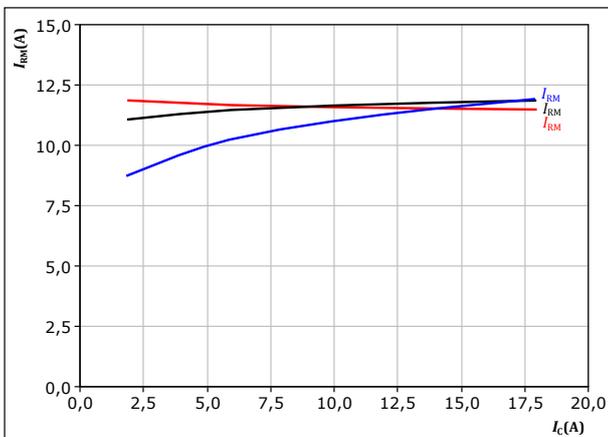
I_{RM} = f(I_C)

With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

T_j: 25 °C / 125 °C / 150 °C

figure 29. FWD

Typical peak reverse recovery current as a function of turn on gate resistor
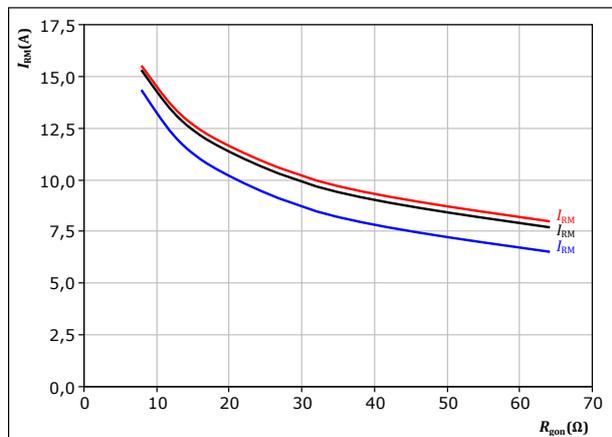
I_{RM} = f(R_{gon})

With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	10	A

T_j: 25 °C / 125 °C / 150 °C

Inverter Switching Characteristics

figure 30.	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)
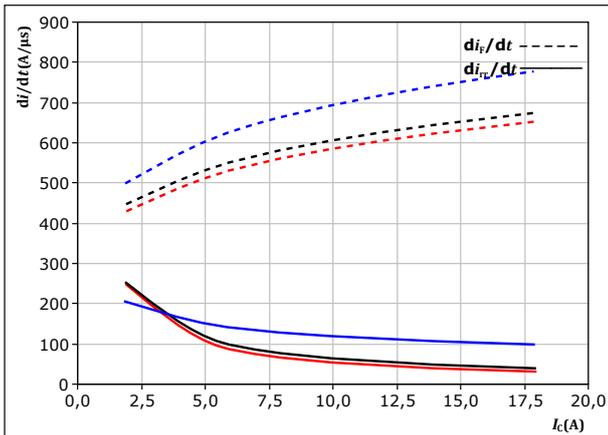
With an inductive load at					25 °C
V_{CE} =	600	V	T_j:		125 °C
V_{GE} =	±15	V			150 °C
R_{gon} =	16	Ω			

figure 31.	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})
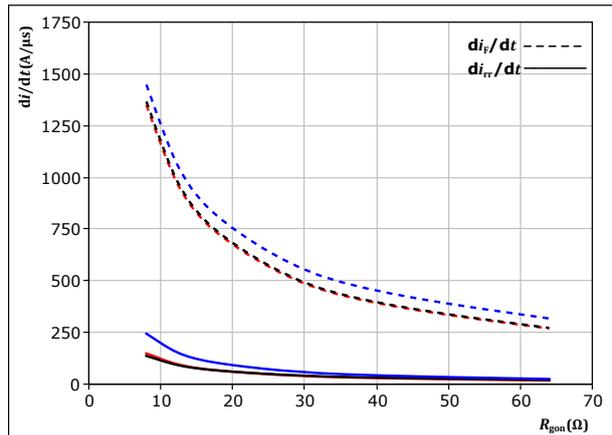
With an inductive load at					25 °C
V_{CE} =	600	V	T_j:		125 °C
V_{GE} =	±15	V			150 °C
I_C =	10	A			

figure 32.	IGBT

Reverse bias safe operating area
I_C = f(V_{CE})
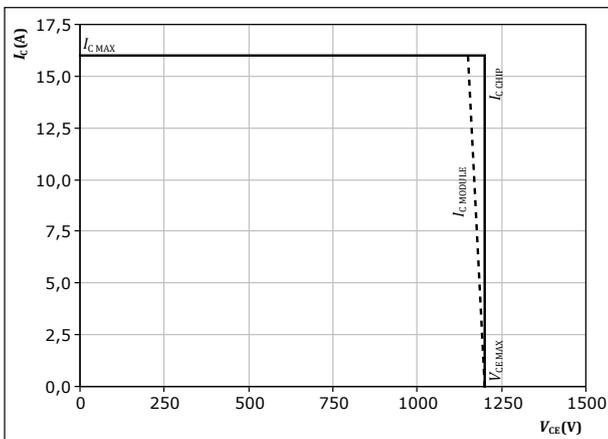
At	T_j =	150	°C
	R_{gon} =	16	Ω
	R_{goff} =	16	Ω

Brake Switching Characteristics

figure 33. IGBT

Typical switching energy losses as a function of collector current
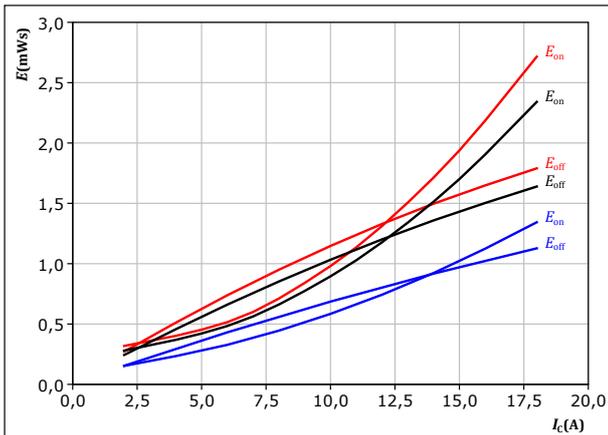
$E = f(I_C)$

With an inductive load at

				T_j:	25 °C
V_{CE} =	700	V			125 °C
V_{GE} =	0/15	V			150 °C
R_{gon} =	16	Ω			
R_{goff} =	16	Ω			

figure 34. IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$
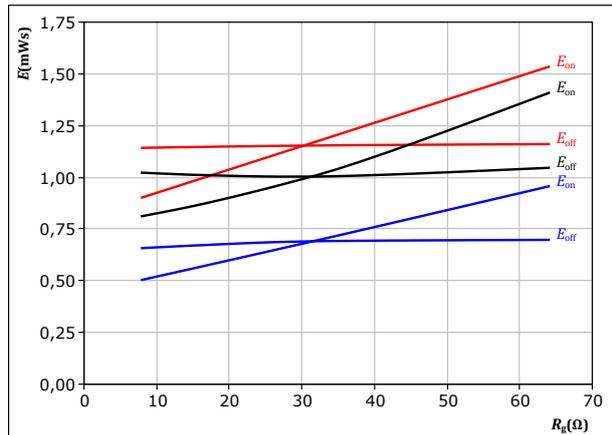
With an inductive load at

				T_j:	25 °C
V_{CE} =	700	V			125 °C
V_{GE} =	0/15	V			150 °C
I_C =	10	A			

figure 35. FWD

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$
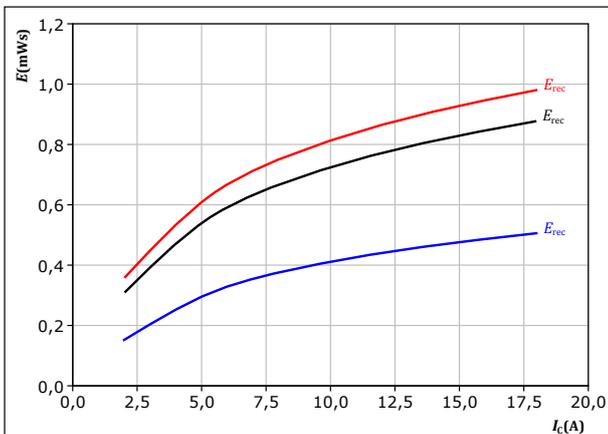
With an inductive load at

				T_j:	25 °C
V_{CE} =	700	V			125 °C
V_{GE} =	0/15	V			150 °C
R_{gon} =	16	Ω			

figure 36. FWD

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$

With an inductive load at

				T_j:	25 °C
V_{CE} =	700	V			125 °C
V_{GE} =	0/15	V			150 °C
I_C =	10	A			

Brake Switching Characteristics

figure 37. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$
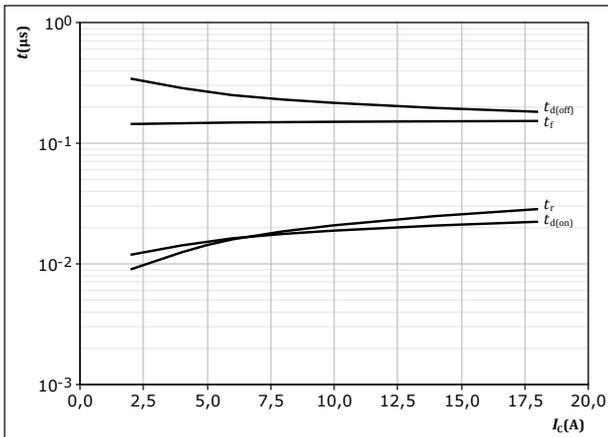
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	700	V
$V_{GE} =$	0/15	V
$R_{gon} =$	16	Ω
$R_{goff} =$	16	Ω

figure 38. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$
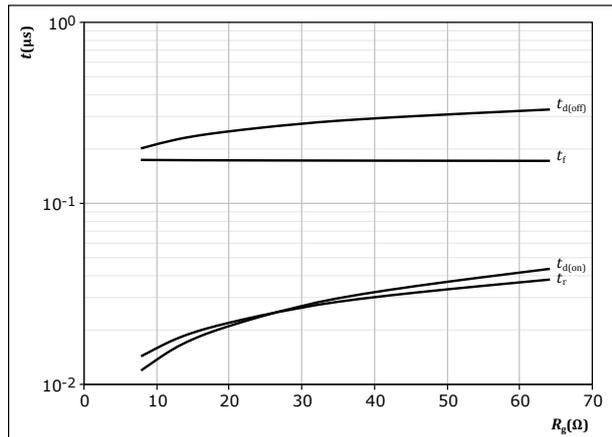
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	700	V
$V_{GE} =$	0/15	V
$I_C =$	10	A

figure 39. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$
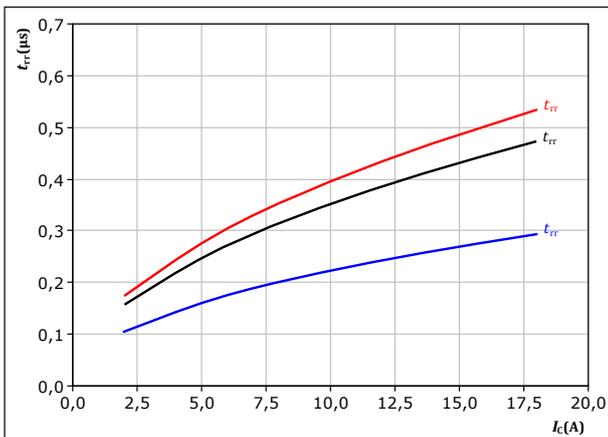
With an inductive load at

$V_{CE} =$	700	V
$V_{GE} =$	0/15	V
$R_{gon} =$	16	Ω

T_j: — 25 °C — 125 °C — 150 °C

figure 40. **FWD**

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

$t_{rr} = f(R_{gon})$
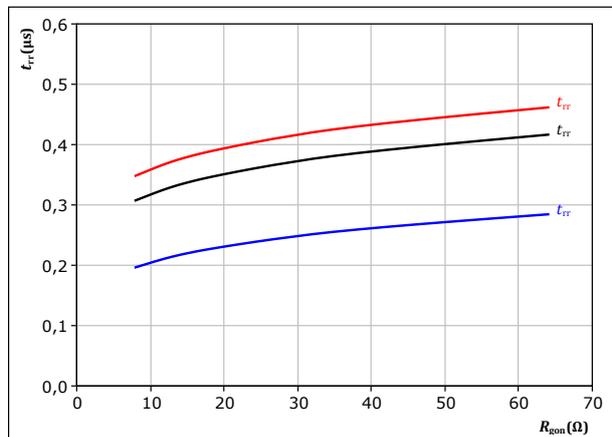
With an inductive load at

$V_{CE} =$	700	V
$V_{GE} =$	0/15	V
$I_C =$	10	A

T_j: — 25 °C — 125 °C — 150 °C

Brake Switching Characteristics

figure 41.	FWD

Typical recovered charge as a function of collector current
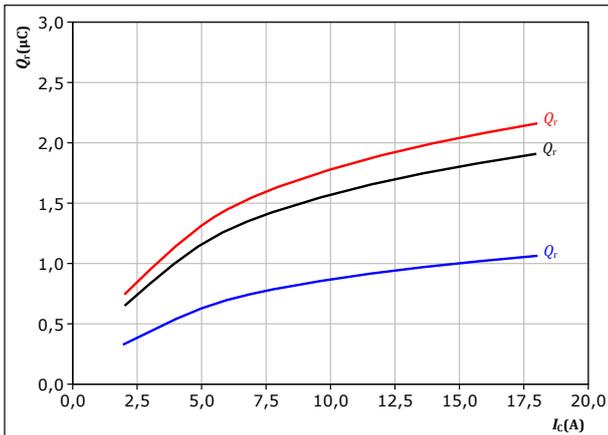
$Q_r = f(I_C)$

With an inductive load at

				25 °C
V_{CE} =	700	V	T_j:	125 °C
V_{GE} =	0/15	V		150 °C
R_{gon} =	16	Ω		

figure 42.	FWD

Typical recovered charge as a function of turn on gate resistor
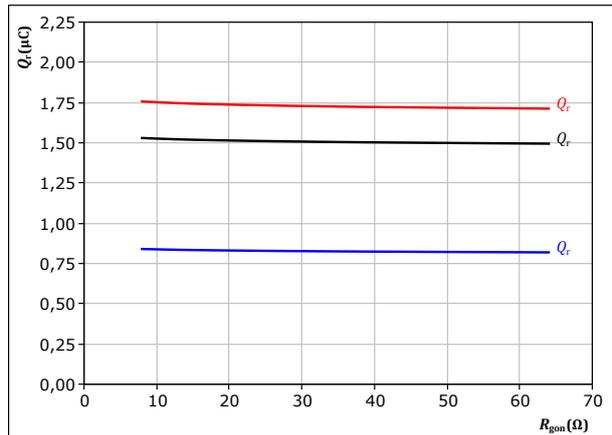
$Q_r = f(R_{gon})$

With an inductive load at

				25 °C
V_{CE} =	700	V	T_j:	125 °C
V_{GE} =	0/15	V		150 °C
I_C =	10	A		

figure 43.	FWD

Typical peak reverse recovery current as a function of collector current
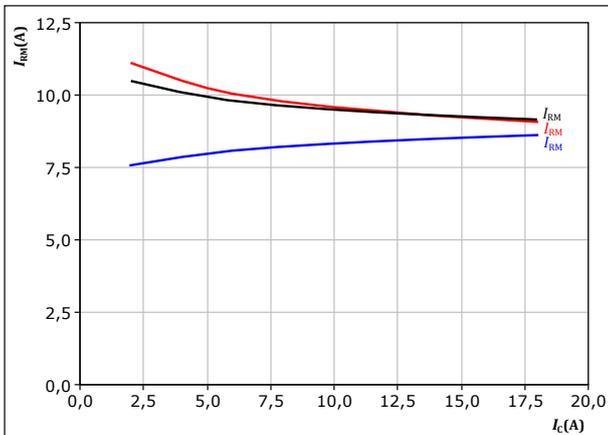
$I_{RM} = f(I_C)$

With an inductive load at

				25 °C
V_{CE} =	700	V	T_j:	125 °C
V_{GE} =	0/15	V		150 °C
R_{gon} =	16	Ω		

figure 44.	FWD

Typical peak reverse recovery current as a function of turn on gate resistor
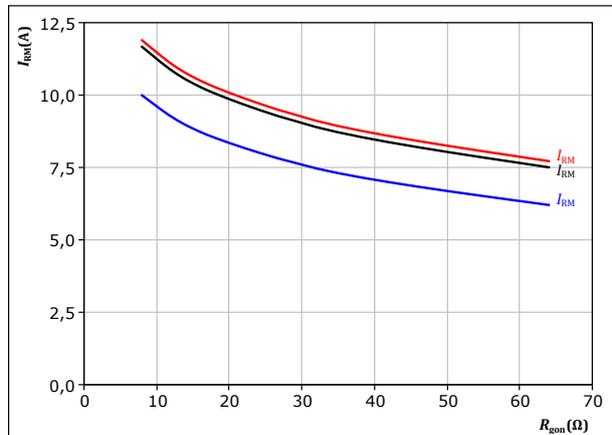
$I_{RM} = f(R_{gon})$

With an inductive load at

|				25 °C
V_{CE} =	700	V	T_j:	125 °C
V_{GE} =	0/15	V		150 °C
I_C =	10	A		

Brake Switching Characteristics

figure 45. FWD

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

di_F/dt, $di_{rr}/dt = f(I_C)$
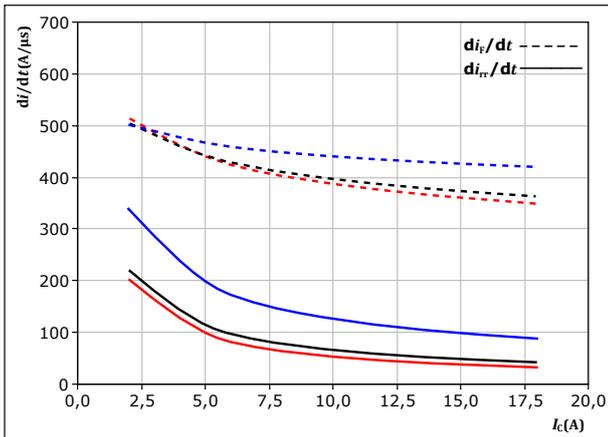
With an inductive load at

V_{CE} =	700	V
V_{GE} =	0/15	V
R_{gon} =	16	Ω

T_j:		
	25 °C	
	125 °C	
	150 °C	

figure 46. FWD

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

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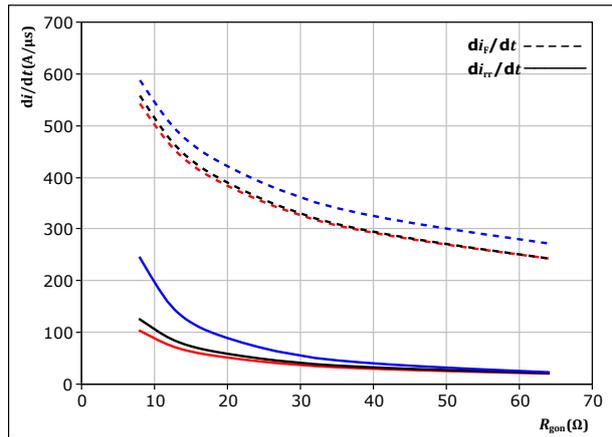

With an inductive load at

V_{CE} =	700	V
V_{GE} =	0/15	V
I_C =	10	A

T_j:		
	25 °C	
	125 °C	
	150 °C	

figure 47. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$

At
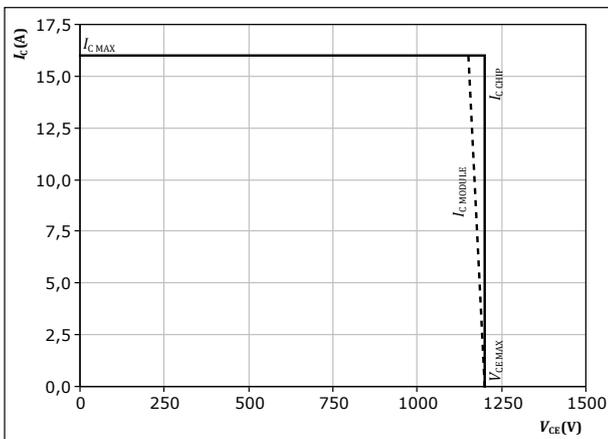
T_j =	150	°C
R_{gon} =	16	Ω
R_{goff} =	16	Ω

Switching Definitions

figure 48.   **IGBT**

Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{tEoff} = integrating time for E_{off})
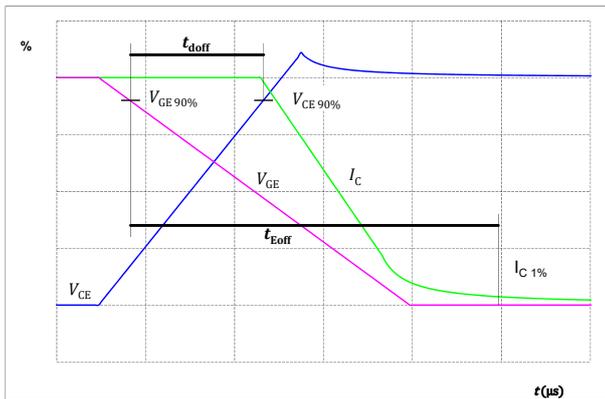
**figure 49.**   **IGBT**

Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})
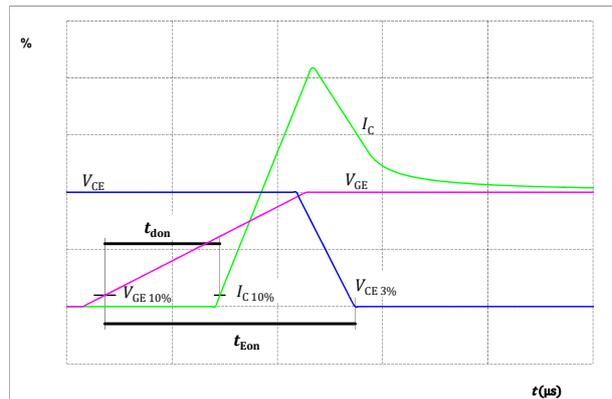
**figure 50.**   **IGBT**

Turn-off Switching Waveforms & definition of t_f
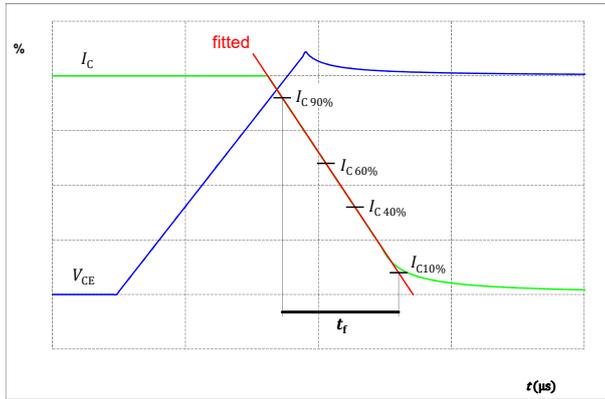
figure 51.   **IGBT**

Turn-on Switching Waveforms & definition of t_r

                                                  11 Dec. 2020 / Revision 1
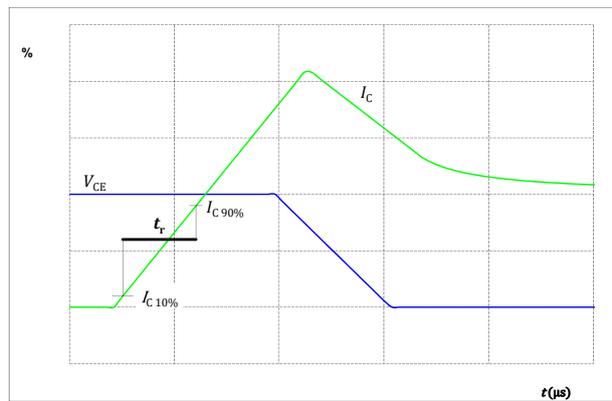
Switching Definitions

figure 52.   **FWD**

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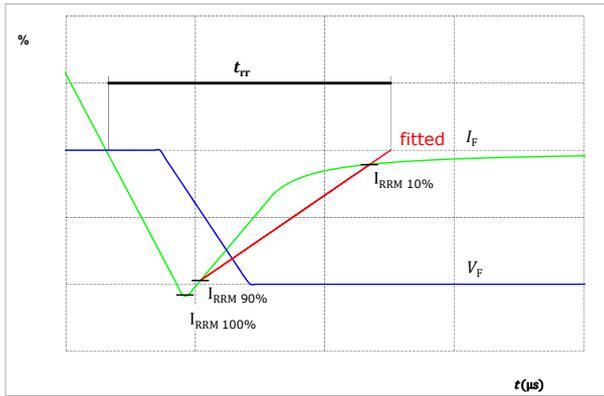

figure 53.   **FWD**

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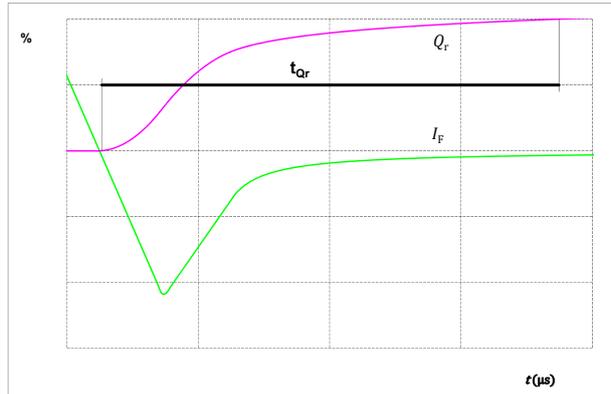
Ordering Code

Version	Ordering Code
Without thermal paste	V23990-P487-A39-PM
With thermal paste	V23990-P487-A39-/3/-PM

Marking

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

Outline

Pin table [mm]

Pin	X	Y	Function
1	49,5	0	BRCG
2	46,5	0	BRCE
3	43,5	0	DC1-
4	36,5	0	DC1+
5	31,5	0	DC2+
6	24,5	0	DC2-
7	20,5	0	LE
8	17,5	0	LWG
9	14,5	0	LVG
10	11,5	0	LUG
11	3	0	NTC2
12	0	0	NTC1
13	0	11,5	W
14	0	20	V
15	0	28	U
16	17,5	28	HUE
17	20,5	28	HUG
18	26,5	28	HVE
19	29,5	28	HVG
20	35,5	28	HWE
21	38,5	28	HWG
22	53	28	L1
23	53	20	L2
24	53	11,5	L3
25	53	5,5	BRC

Tolerance of pinpositions: ±0,5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Pinout
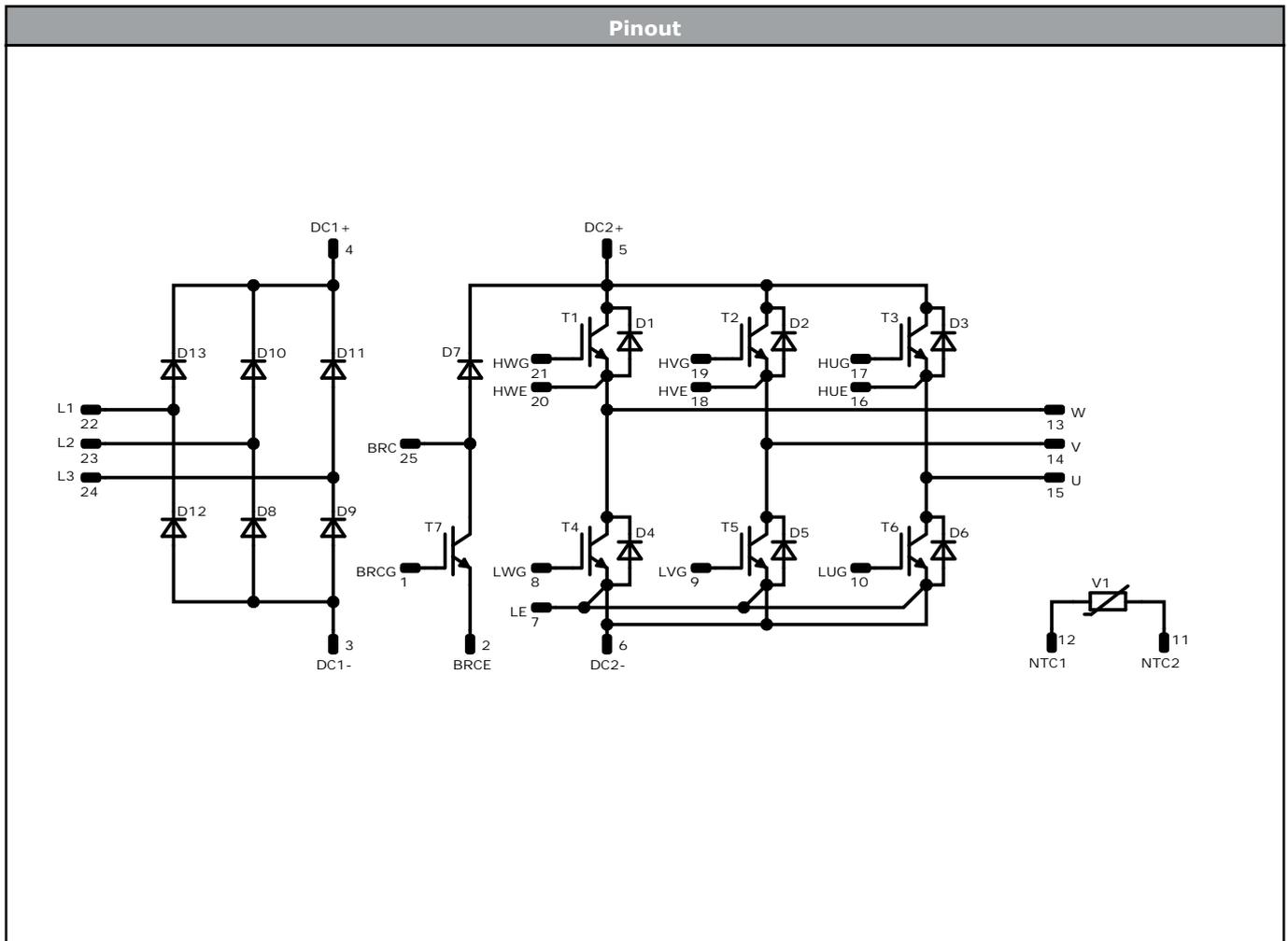
Identification

ID	Component	Voltage	Current	Function	Comment
T4, T1, T2, T5, T6, T3	IGBT	1200 V	8 A	Inverter Switch	
D1, D4, D2, D5, D3, D6	FWD	1200 V	10 A	Inverter Diode	
T7	IGBT	1200 V	8 A	Brake Switch	
D7	FWD	1200 V	10 A	Brake Diode	
D12, D13, D8, D10, D9, D11	Rectifier	1600 V	50 A	Rectifier Diode	
V1	Thermistor			Thermistor	

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

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

Package data
Package data for *flow* 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.	®U

Document No.:	**Date:**	**Modification:**	**Pages**
V23990-P487-A39-PM-D1-14	11 Dec. 2020		

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.