Vincotech

V23990-P849-A49Y-PM
datasheet

*flow*PIM 0 — 1200 V / 8 A

Features

- 2 Clips housing in 12 mm height
- Trench Fieldstop Technology IGBT4
- Integrated BRC
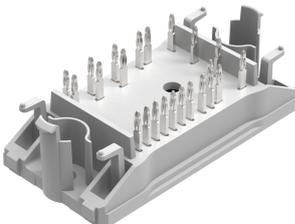
Target applications

- Industrial Drives

Types

- V23990-P849-A49Y-PM

flow 0 12 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	9	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		12	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	37	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

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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	9	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
Rectifier Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	35	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	200	A
Surge current capability	I^2t			200	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	44	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

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

Parameter	Symbol	V_{GE}/V_{GS}	$V_{CE}/V_{DS}/V_F$	$I_C/I_D/I_F$	T_j	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	1,58	1,87 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
Gate charge	Q_g	V_{CC} = 960 V, 15		8	25		53		nC

Thermal

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

Dynamic

Parameter	Symbol	Conditions	V_{GE}/V_{GS}	V_{CE}	I_C	T_j	Typ	Unit
Turn-on delay time	$t_{d(on)}$	R_{gon} = 32 Ω R_{goff} = 32 Ω	±15	600	8	25 125	71,4 70,6	ns
Rise time	t_r					25 125	18,6 22,8	ns
Turn-off delay time	$t_{d(off)}$					25 125	194,4 236,4	ns
Fall time	t_f					25 125	78,46 108,16	ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,885 μC Q_{rFWD}=1,57 μC				25 125	0,499 0,748	mWs
Turn-off energy (per pulse)	E_{off}					25 125	0,435 0,624	mWs

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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	

Inverter Diode

Static

Parameter	Symbol	Conditions					Values			Unit
Forward voltage	V_F				10	25 150	1,35	1,85 1,77	2,05[1]	V
Reverse leakage current	I_R	V_r = 1200 V				25			2,7	µA

Thermal

Parameter	Symbol	Conditions					Values			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					Values			Unit
Peak recovery current	I_{RRM}	di/dt=452 A/µs di/dt=399 A/µs	±15	600	8	25 125		8,46 9,88		A
Reverse recovery time	t_{rr}					25 125		250,51 382,73		ns
Recovered charge	Q_r					25 125		0,885 1,57		µC
Reverse recovered energy	E_{rec}					25 125		0,345 0,634		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125		83,99 69,05		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

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		4	25 125	1,58	1,95 2,17	2,02[1]	V
Collector-emitter cut-off current	I_{CES}	0	1200		25			0,5	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	250		pF
Reverse transfer capacitance	C_{res}						15		pF

Thermal

Thermal resistance junction to sink [2]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)					2,58		K/W

Dynamic

Turn-on delay time	$t_{d(on)}$	R_{gon} = 64 Ω R_{goff} = 64 Ω			25 125 150		93 89,8 90,6		ns
Rise time	t_{r}				25 125 150		18,8 24 24,2		ns
Turn-off delay time	$t_{d(off)}$				25 125 150		184,4 226 235		ns
Fall time	t_{f}	±15	600	4	25 125 150		71,34 98,45 101,98		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,442 µC Q_{rFWD}=0,76 µC Q_{rFWD}=0,871 µC			25 125 150		0,253 0,339 0,366		mWs
Turn-off energy (per pulse)	E_{off}				25 125 150		0,221 0,303 0,324		mWs

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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 Diode									
Static									
Forward voltage	V_{F}			3	25 125	1,23	1,73 1,64	1,97[1]	V
Reverse leakage current	I_{R}	V_{r} = 1200 V			25			27	µA
Thermal									
Thermal resistance junction to sink [2]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)					2,8		K/W
Dynamic									
Peak recovery current	I_{RRM}	di/dt=204 A/µs di/dt=202 A/µs di/dt=191 A/µs	±15	600	4	25 125 150		4,22 4,65 4,74		A
Reverse recovery time	t_{rr}					25 125 150		268,29 445,74 465,72		ns
Recovered charge	Q_{r}					25 125 150		0,442 0,76 0,871		µC
Reverse recovered energy	E_{rec}					25 125 150		0,176 0,324 0,378		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		44,17 39,91 36,33		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**	

Rectifier Diode

Static

Forward voltage	V_{F}			8	25 125 150		0,976 0,879 0,85	1,21[1] 1,1[1]	V
Reverse leakage current	I_{R}	V_{r} = 1600 V			25			50	µA

Thermal

Thermal resistance junction to sink [2]	$R_{th(j\text{-}s)}$	λ_{paste} = 3,4 W/mK (PSX)					1,59		K/W

Thermistor

Static

Rated resistance	R				25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω			100	-5		5	%
Power dissipation	P						5		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	

[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 |
| V_{GE} = | 15 | V |
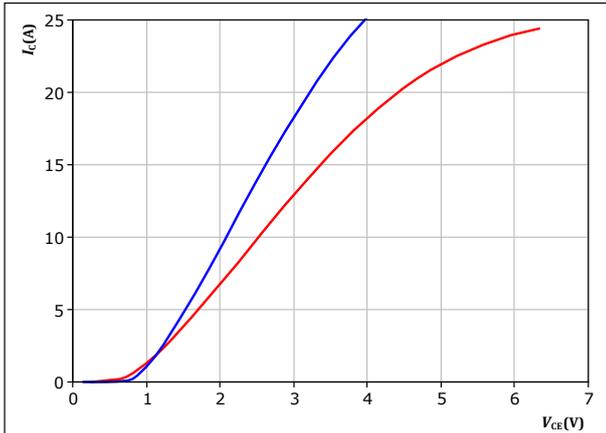
T_j:
— 25 °C
— 125 °C

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 = | 125 | °C |
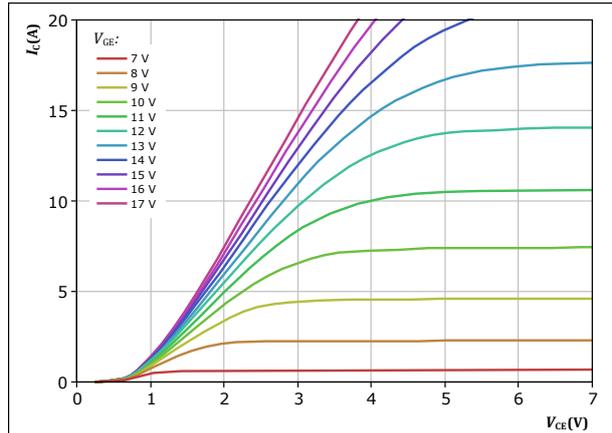
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

I_C = f(V_{GE})

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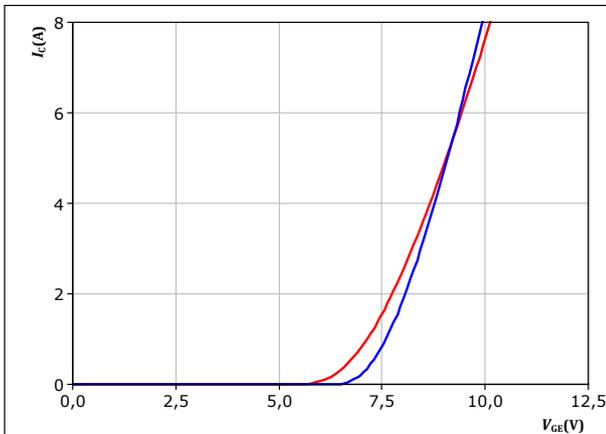
T_j:
— 25 °C
— 125 °C

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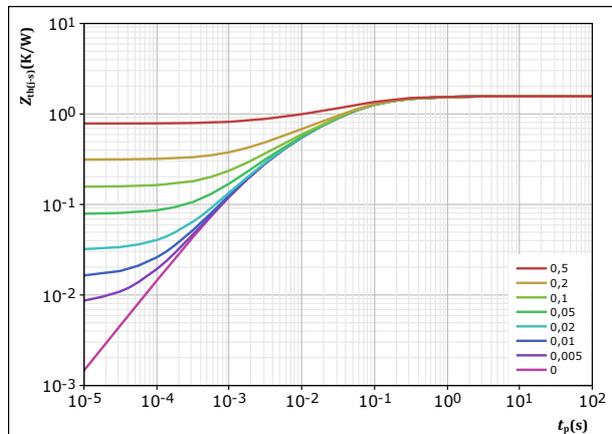
| D = | t_p / T | |
| $R_{th(j-s)}$ = | 1,566 | K/W |

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

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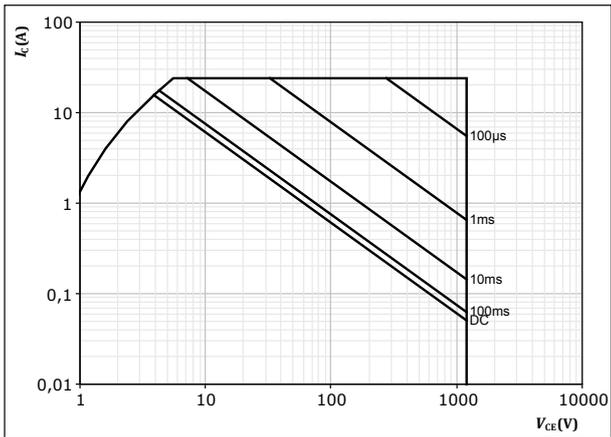
D = single pulse

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

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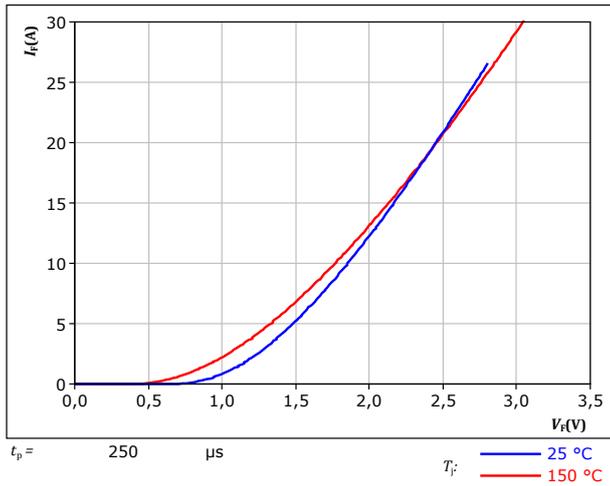
figure 7.   **FWD**

Transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$
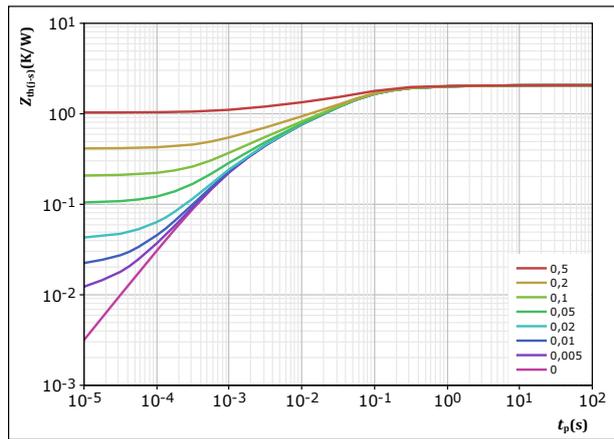
$D =$ t_p / T
$R_{th(j-s)} =$ 2,066   K/W
FWD thermal model values

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
$V_{GE} =$	15	V

T_j: — 25 °C / — 125 °C
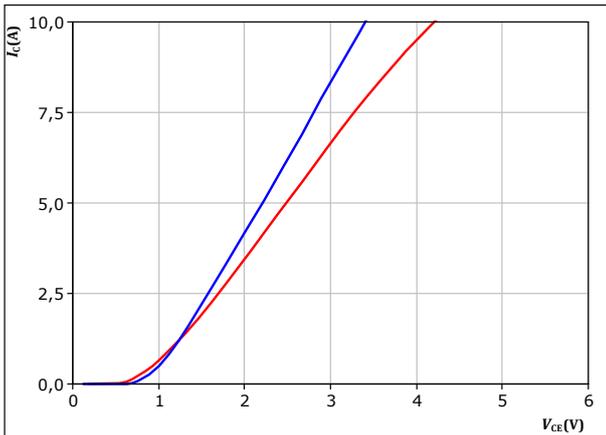
figure 9.	IGBT

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
$T_j =$	125	°C
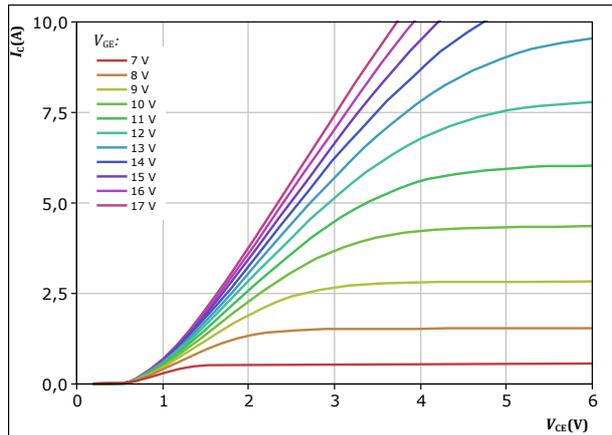
V_{GE} from 7 V to 17 V in steps of 1 V

figure 10.	IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

$t_p =$	250	µs
$V_{CE} =$	10	V

T_j: — 25 °C / — 125 °C
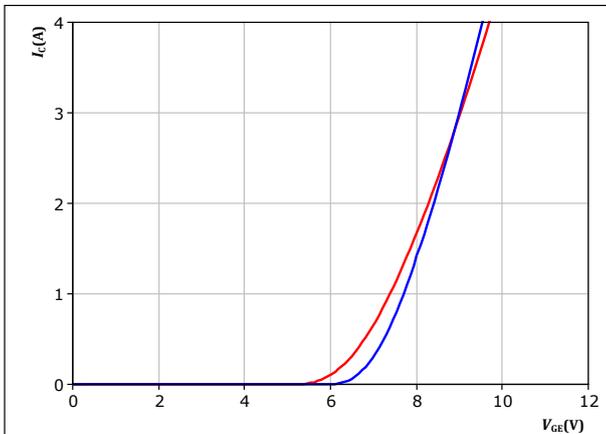
figure 11.	IGBT

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
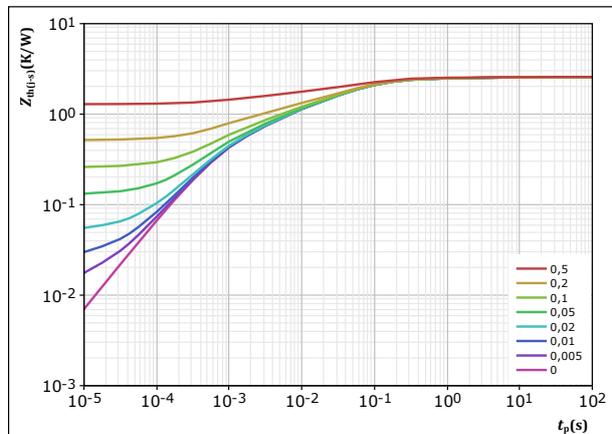
$D =$	t_p / T	
$R_{th(j-s)} =$	2,577	K/W

IGBT thermal model values

R (K/W)	τ (s)
8,49E-02	6,59E+00
1,97E-01	3,69E-01
1,01E+00	6,94E-02
4,64E-01	1,61E-02
4,43E-01	4,16E-03
3,82E-01	6,88E-04

Brake Switch Characteristics

figure 12.	IGBT

Safe operating area

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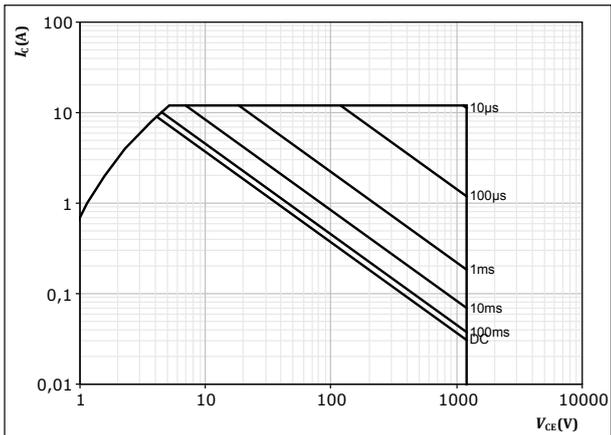
D = single pulse

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

Brake Diode Characteristics

figure 13. **FWD**

Typical forward characteristics

$I_F = f(V_F)$
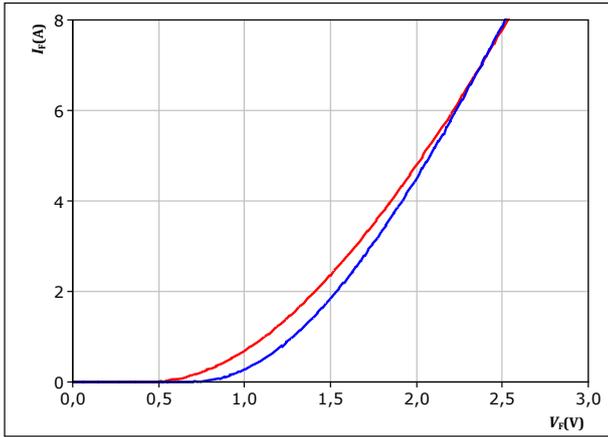
$t_p =$ 250 µs

T_j: — 25 °C — 125 °C

figure 14. **FWD**

Transient thermal impedance as a function of pulse width

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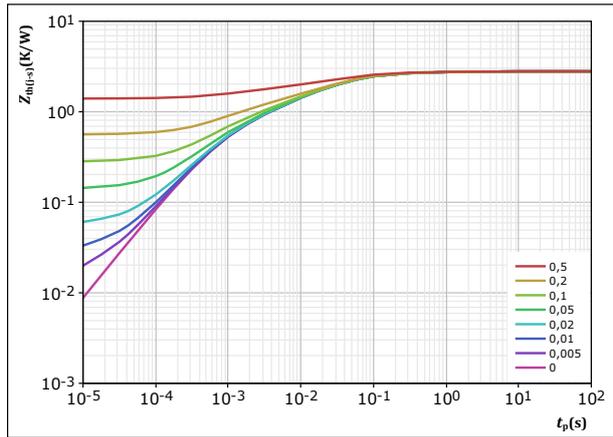
$D = t_p / T$

$R_{th(j-s)} =$ 2,796 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
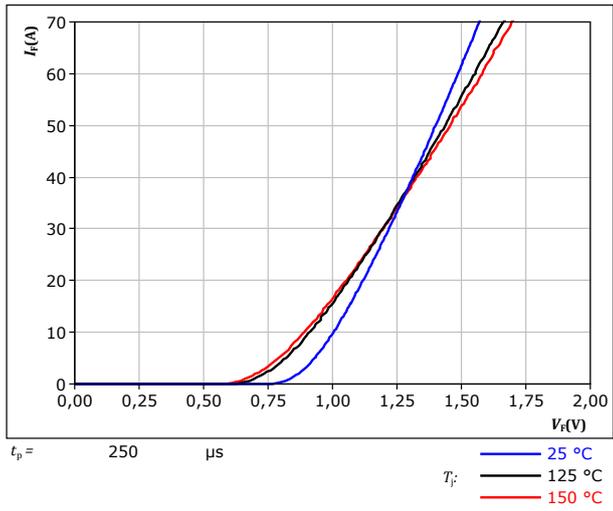
Typical forward characteristics

$I_F = f(V_F)$

$t_p = $ 250   µs

                                             25 °C

T_j: 125 °C

                                               150 °C

Transient thermal impedance as a function of pulse width

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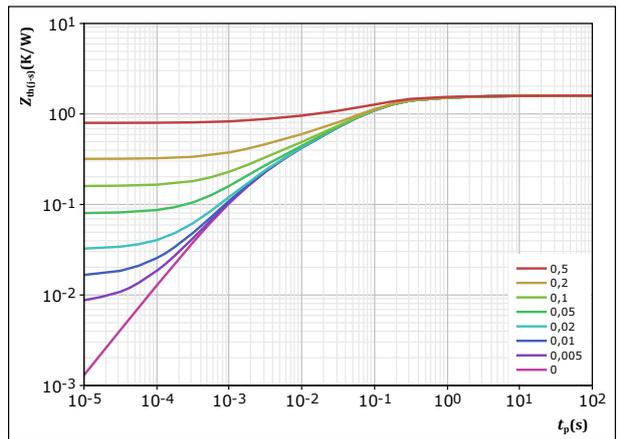
$D = $ t_p / T

$R_{th(j-s)} = $ 1,594   K/W

Rectifier thermal model values

R (K/W)	τ (s)
3,44E-02	9,66E+00
1,12E-01	1,22E+00
5,81E-01	1,45E-01
4,89E-01	5,05E-02
2,38E-01	9,26E-03
1,22E-01	1,79E-03
1,81E-02	7,88E-04

Thermistor Characteristics

figure 17.	Thermistor

Typical NTC characteristic as function of temperature

$R_T = f(T)$
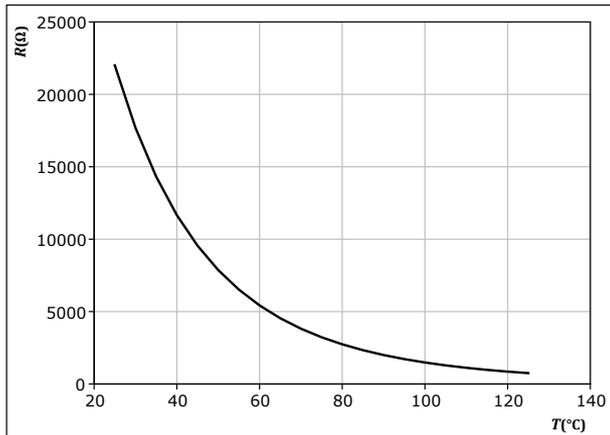
Inverter Switching Characteristics

figure 18.	IGBT

Typical switching energy losses as a function of collector current

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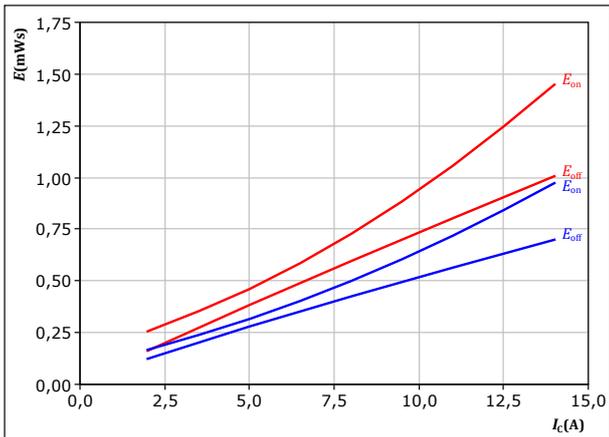
With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

T_j: — 25 °C — 125 °C

figure 19.	IGBT

Typical switching energy losses as a function of gate resistor

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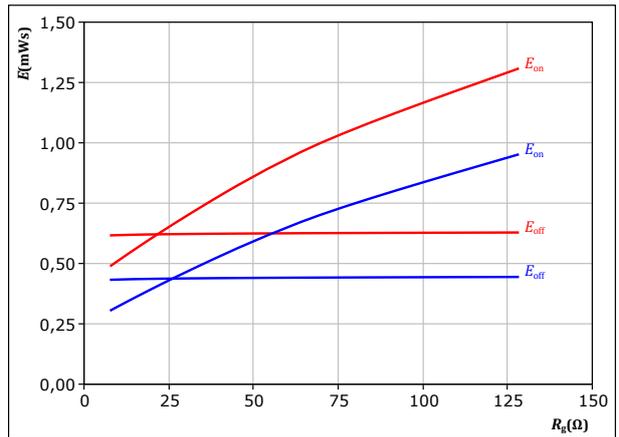
With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	8	A

T_j: — 25 °C — 125 °C

figure 20.	FWD

Typical reverse recovered energy loss as a function of collector current

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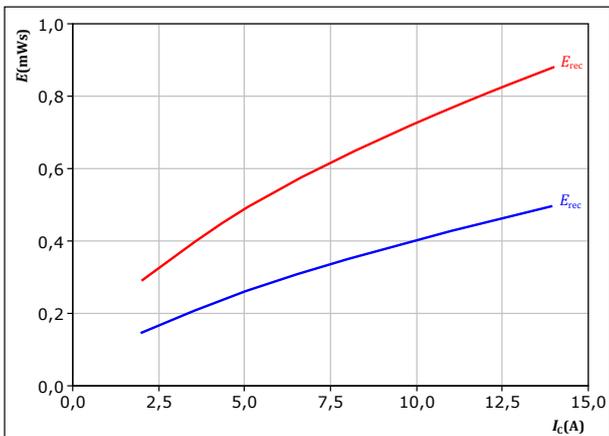
With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

T_j: — 25 °C — 125 °C

figure 21.	FWD

Typical reverse recovered energy loss as a function of gate resistor
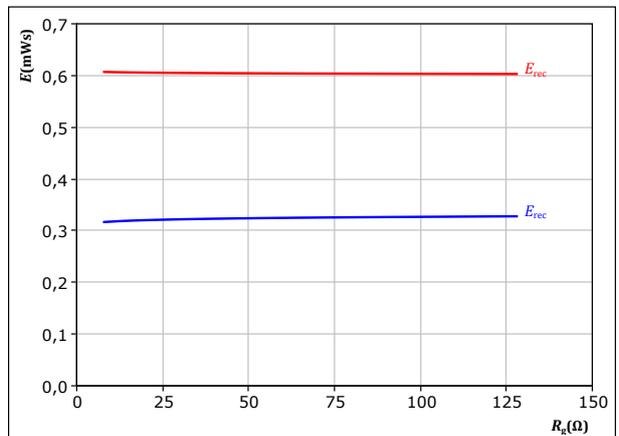
$E_{rec} = f(R_g)$

With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	8	A

T_j: — 25 °C — 125 °C

Inverter Switching Characteristics

figure 22.	IGBT

Typical switching times as a function of collector current

$t = \mathrm{f}(\,I_\mathrm{C}\,)$
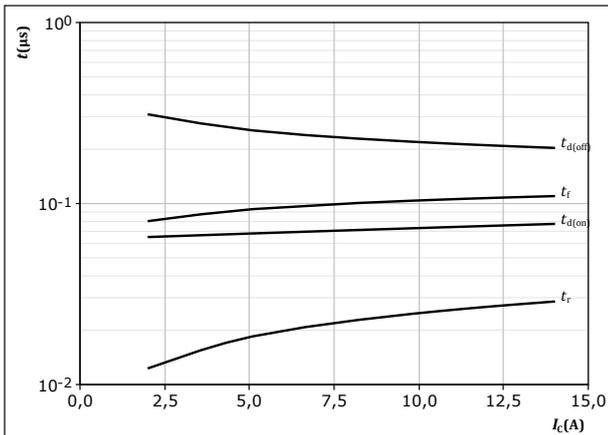
With an inductive load at

$T_\mathrm{j} =$	125	°C
$V_\mathrm{CE} =$	600	V
$V_\mathrm{GE} =$	±15	V
$R_\mathrm{gon} =$	32	Ω
$R_\mathrm{goff} =$	32	Ω

figure 23.	IGBT

Typical switching times as a function of gate resistor

$t = \mathrm{f}(\,R_\mathrm{g}\,)$
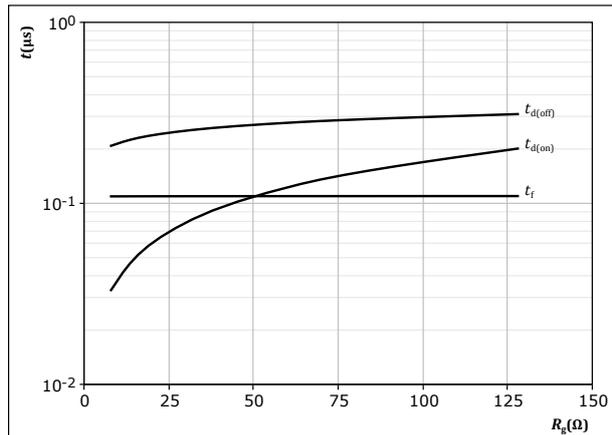
With an inductive load at

$T_\mathrm{j} =$	125	°C
$V_\mathrm{CE} =$	600	V
$V_\mathrm{GE} =$	±15	V
$I_\mathrm{C} =$	8	A

figure 24.	FWD

Typical reverse recovery time as a function of collector current

$t_\mathrm{rr} = \mathrm{f}(\,I_\mathrm{C}\,)$
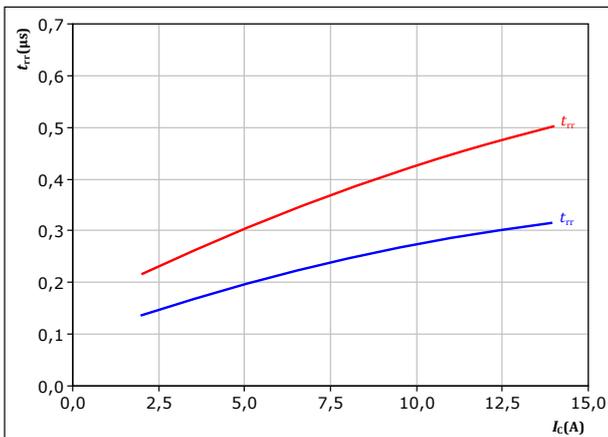
With an inductive load at

$V_\mathrm{CE} =$	600	V
$V_\mathrm{GE} =$	±15	V
$R_\mathrm{gon} =$	32	Ω

T_j: ── 25 °C ── 125 °C

figure 25.	FWD

Typical reverse recovery time as a function of IGBT turn off gate resistor
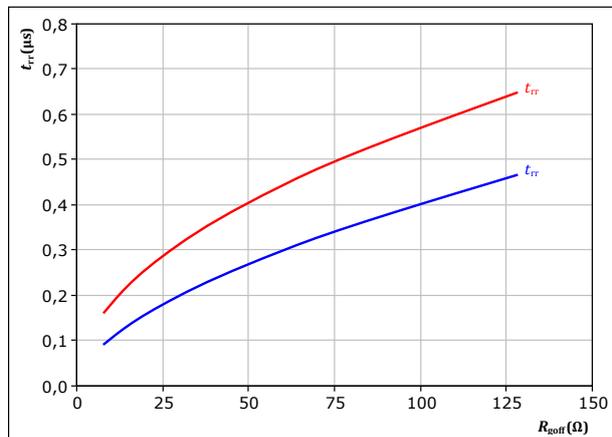
$t_\mathrm{rr} = \mathrm{f}(\,R_\mathrm{goff}\,)$

With an inductive load at

$V_\mathrm{CE} =$	600	V
$V_\mathrm{GE} =$	±15	V
$I_\mathrm{C} =$	8	A

T_j: ── 25 °C ── 125 °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} =	32	Ω
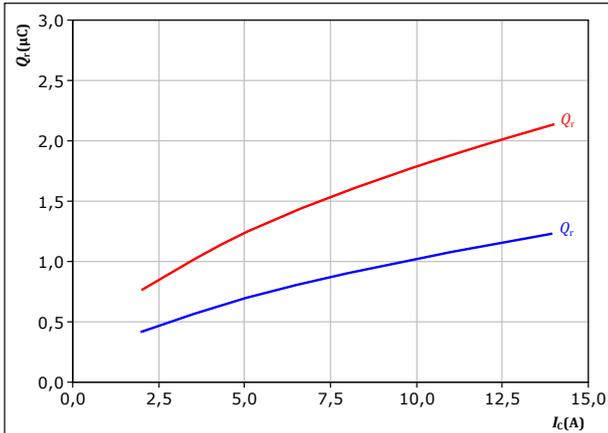
T_j: — 25 °C — 125 °C

figure 27.	FWD

Typical recovered charge as a function of turn off gate resistor

Q_r = f(R_{goff})
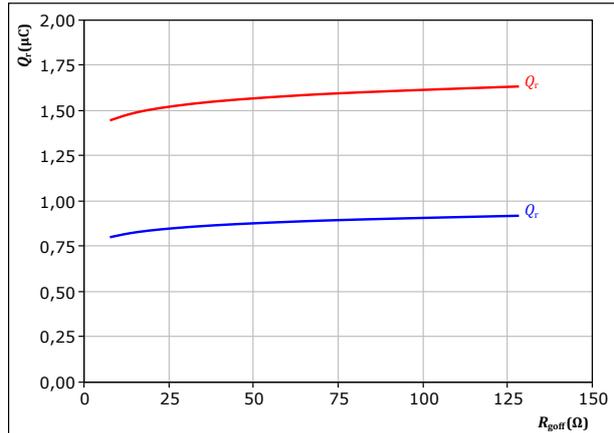
With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	8	A

T_j: — 25 °C — 125 °C

figure 28.	FWD

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)
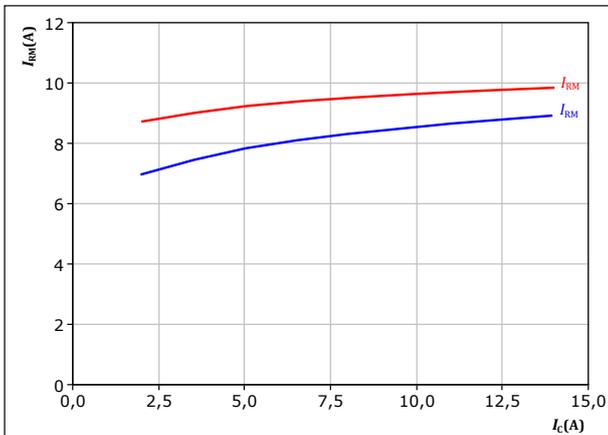
With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

T_j: — 25 °C — 125 °C

figure 29.	FWD

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

I_{RM} = f(R_{goff})
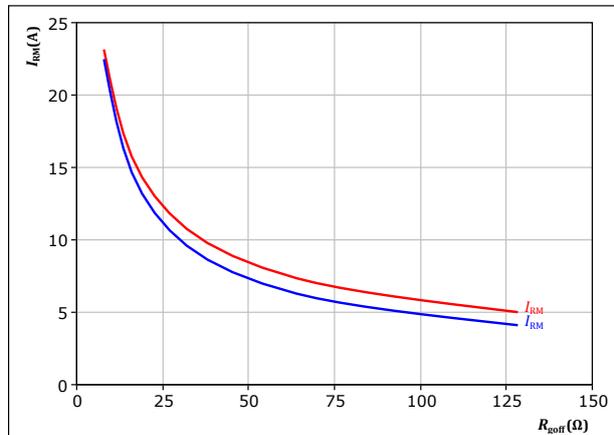
With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	8	A

T_j: — 25 °C — 125 °C

Inverter Switching Characteristics

figure 30.   **FWD**

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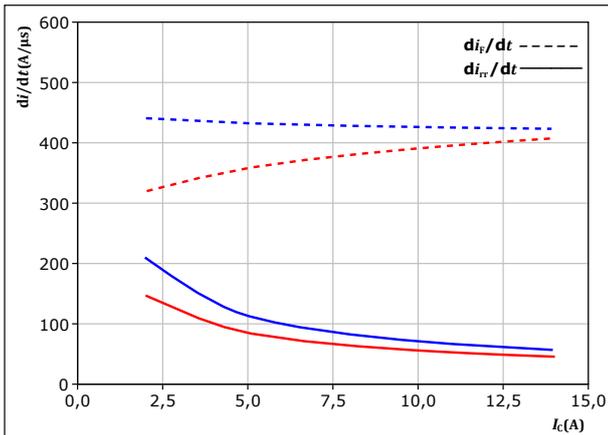
di_F/dt, di_{rr}/dt = f(I_C)

With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

figure 31.   **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})
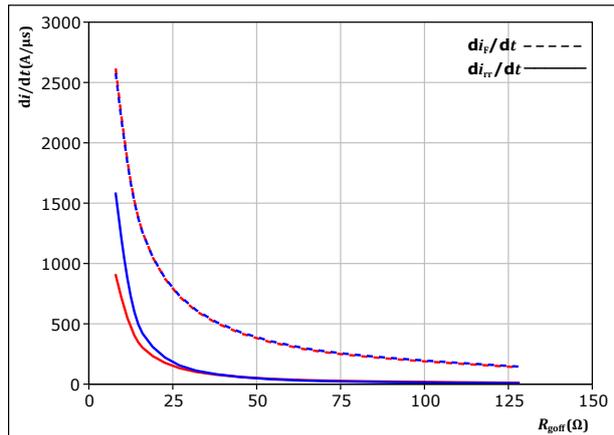
With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	8	A

figure 32.   **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})

At

T_j =	125	°C
R_{gon} =	32	Ω
R_{goff} =	32	Ω

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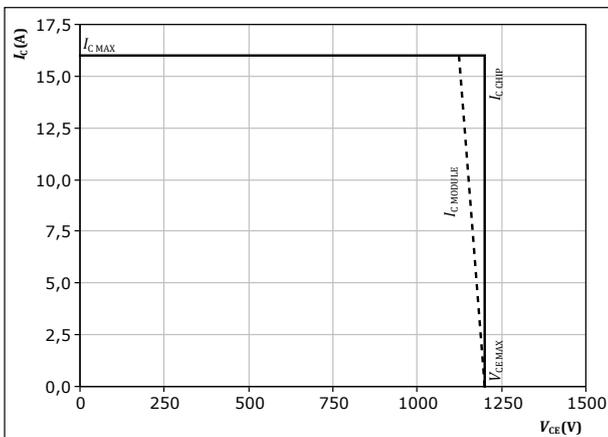
Brake Switching Characteristics

figure 33. IGBT

Typical switching energy losses as a function of collector current

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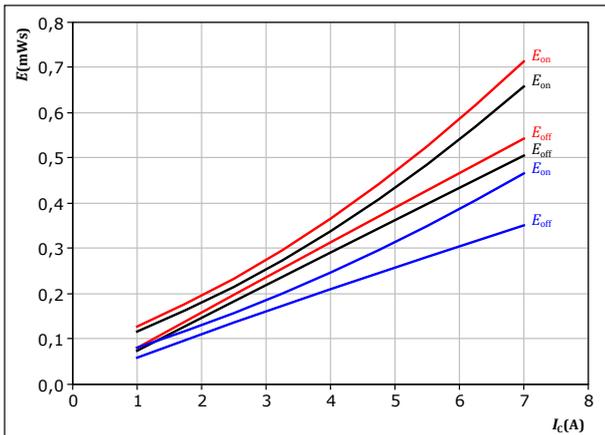
With an inductive load at

V_{CE} =	600	V	T_j:		25 °C
V_{GE} =	±15	V			125 °C
R_{gon} =	64	Ω			150 °C
R_{goff} =	64	Ω			

figure 34. IGBT

Typical switching energy losses as a function of gate resistor

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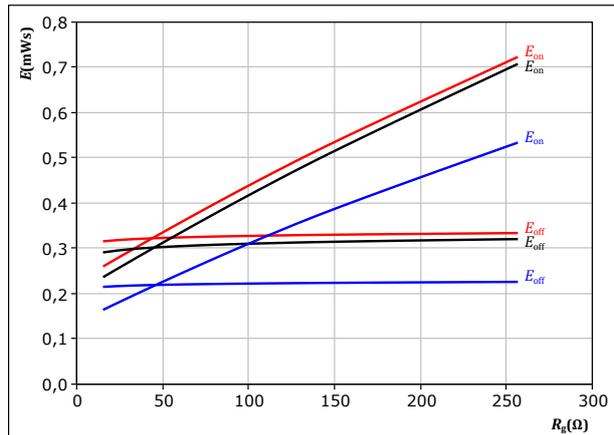
With an inductive load at

V_{CE} =	600	V	T_j:		25 °C
V_{GE} =	±15	V			125 °C
I_C =	4	A			150 °C

figure 35. FWD

Typical reverse recovered energy loss as a function of collector current

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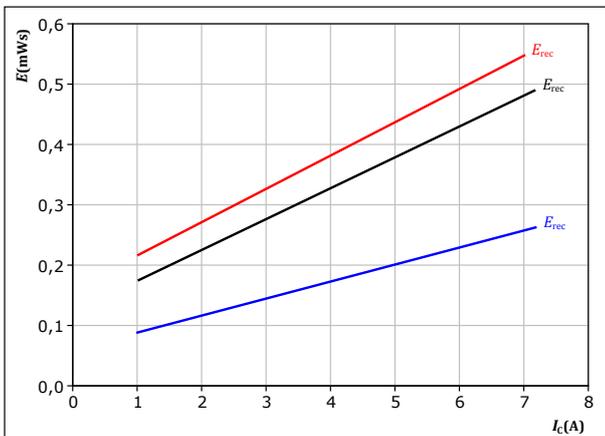
With an inductive load at

V_{CE} =	600	V	T_j:		25 °C
V_{GE} =	±15	V			125 °C
R_{gon} =	64	Ω			150 °C

figure 36. FWD

Typical reverse recovered energy loss as a function of gate resistor

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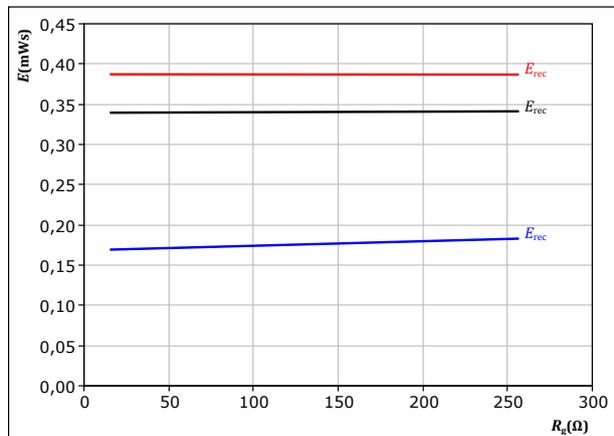
With an inductive load at

V_{CE} =	600	V	T_j:		25 °C
V_{GE} =	±15	V			125 °C
I_C =	4	A			150 °C

Brake Switching Characteristics

figure 37.	IGBT

Typical switching times as a function of collector current

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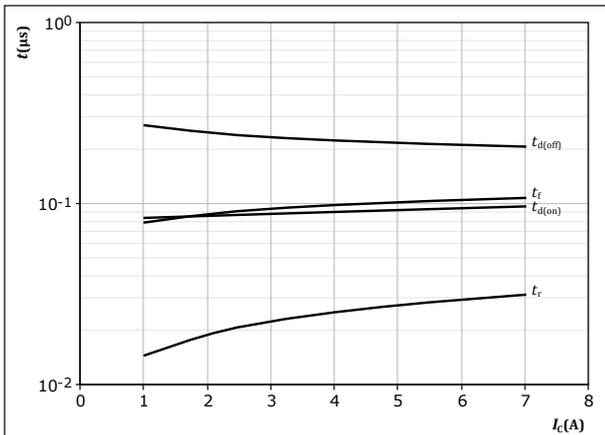
With an inductive load at

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

figure 38.	IGBT

Typical switching times as a function of gate resistor

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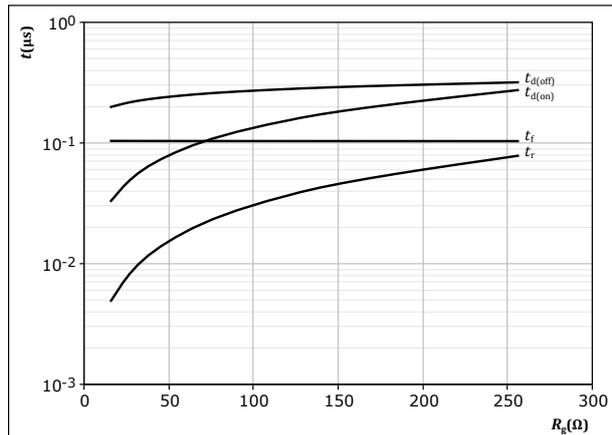
With an inductive load at

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

figure 39.	FWD

Typical reverse recovery time as a function of collector current

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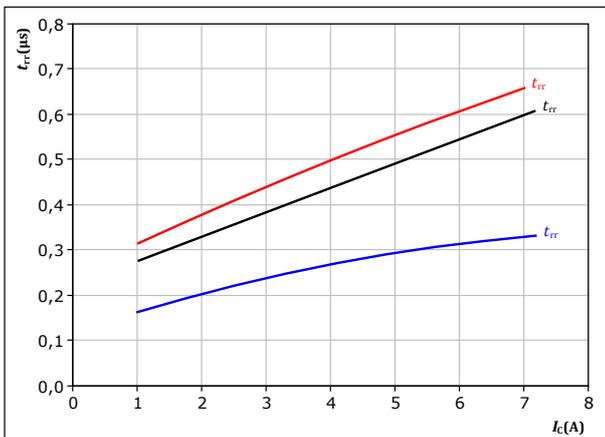
With an inductive load at

$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	64	Ω

T_j:
— 25 °C
— 125 °C
— 150 °C

figure 40.	FWD

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

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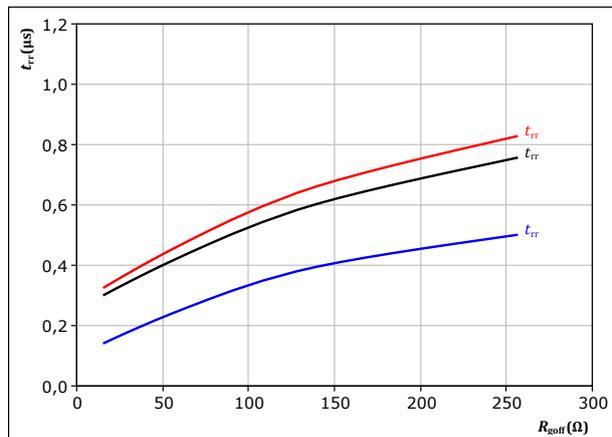
With an inductive load at

$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$I_C =$	4	A

T_j:
— 25 °C
— 125 °C
— 150 °C

Brake Switching Characteristics

figure 41.   **FWD**

Typical recovered charge as a function of collector current

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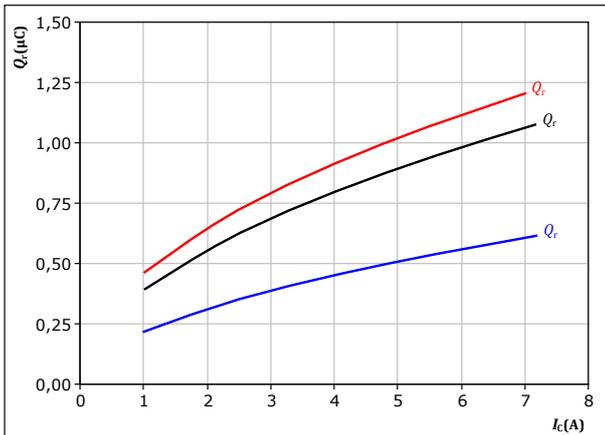
With an inductive load at

V_{CE} =	600	V	
V_{GE} =	±15	V	
R_{gon} =	64	Ω	

T_j:
— 25 °C
— 125 °C
— 150 °C

figure 42.   **FWD**

Typical recovered charge as a function of turn off gate resistor

$Q_r = f(R_{goff})$
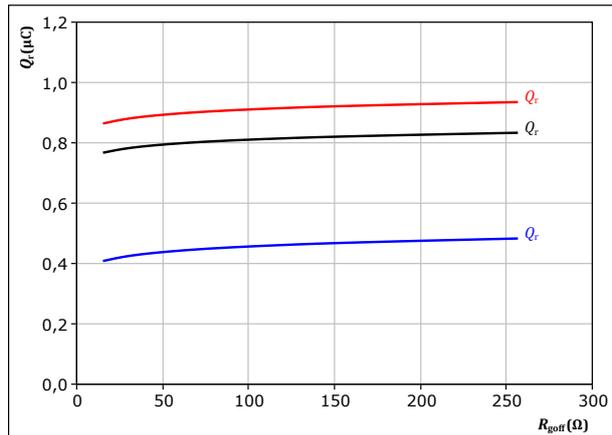
With an inductive load at

V_{CE} =	600	V	
V_{GE} =	±15	V	
I_C =	4	A	

T_j:
— 25 °C
— 125 °C
— 150 °C

figure 43.   **FWD**

Typical peak reverse recovery current as a function of collector current

$I_{RM} = f(I_C)$
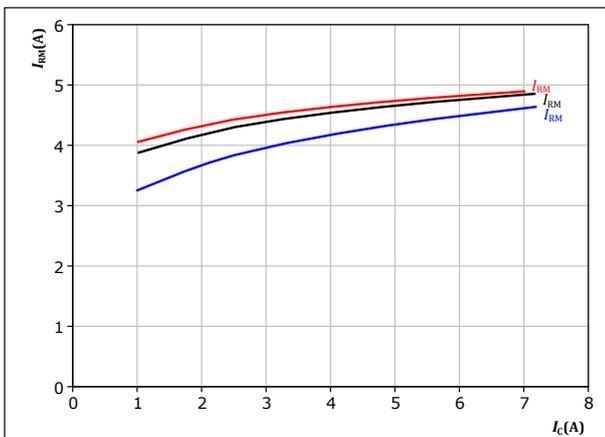
With an inductive load at

V_{CE} =	600	V	
V_{GE} =	±15	V	
R_{gon} =	64	Ω	

T_j:
— 25 °C
— 125 °C
— 150 °C

figure 44.   **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 =	4	A	

T_j:
— 25 °C
— 125 °C
— 150 °C

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Brake Switching Characteristics

figure 45. **FWD**

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

$\mathrm{d}i_F/\mathrm{d}t$, $\mathrm{d}i_{rr}/\mathrm{d}t = \mathrm{f}(I_C)$
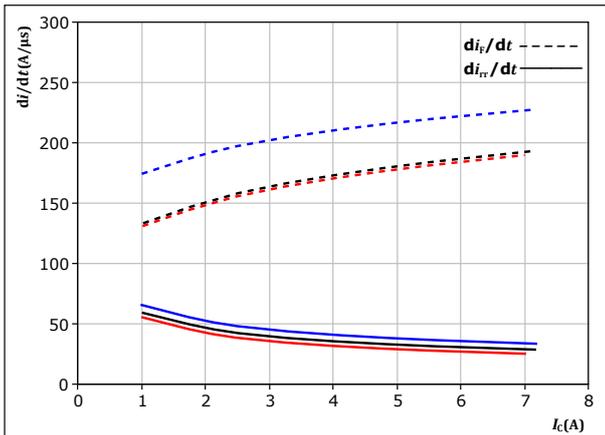
With an inductive load at

V_{CE} =	600	V		25 °C
V_{GE} =	±15	V	T_j:	125 °C
R_{gon} =	64	Ω		150 °C

figure 46. **FWD**

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

$\mathrm{d}i_F/\mathrm{d}t$, $\mathrm{d}i_{rr}/\mathrm{d}t = \mathrm{f}(R_{goff})$
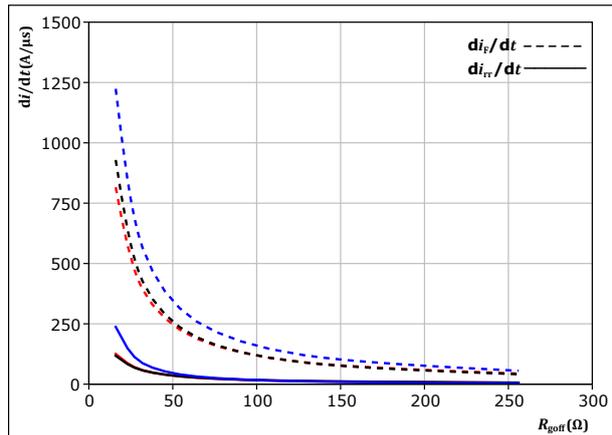
With an inductive load at

V_{CE} =	600	V		25 °C
V_{GE} =	±15	V	T_j:	125 °C
I_C =	4	A		150 °C

figure 47. **IGBT**

Reverse bias safe operating area

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

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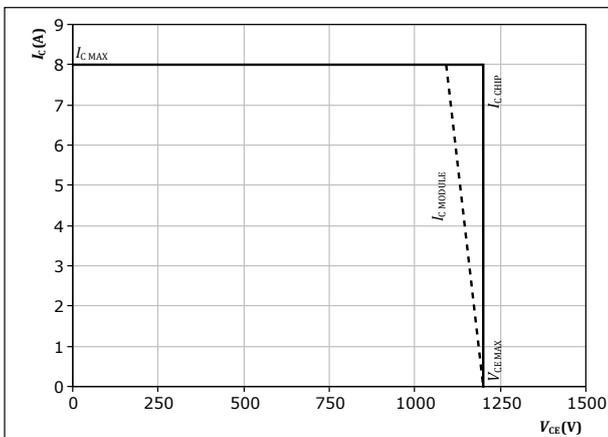
T_j =	150	°C
R_{gon} =	64	Ω
R_{goff} =	64	Ω

Switching Definitions

figure 48.   **IGBT**

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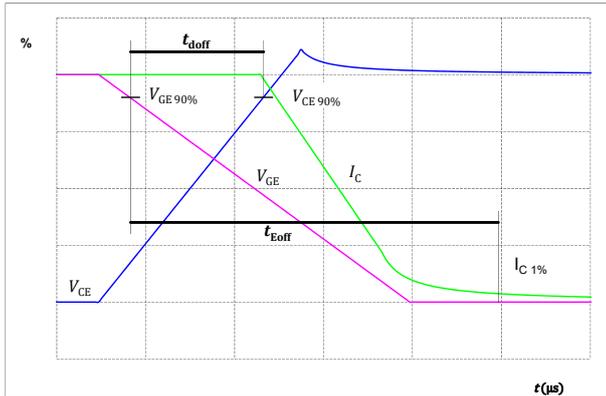
figure 49.   **IGBT**

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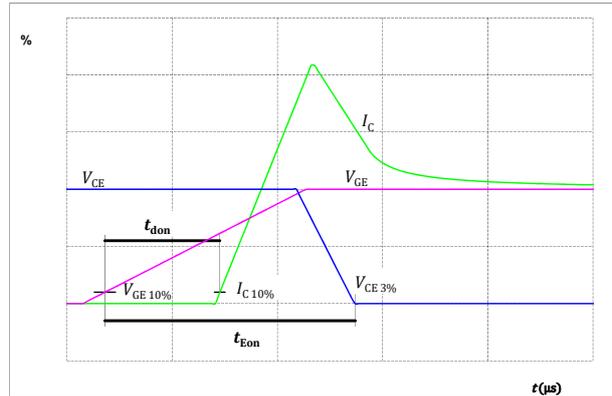
figure 50.   **IGBT**

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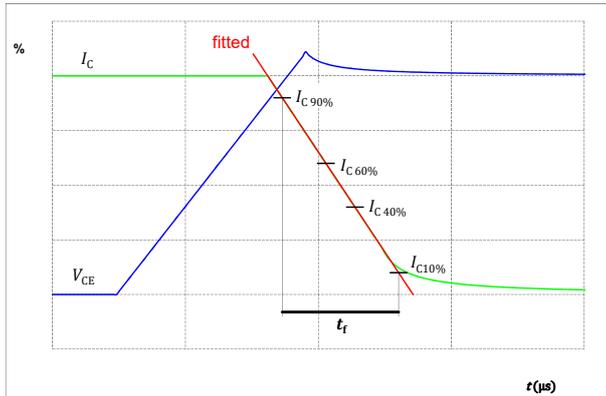
figure 51.   **IGBT**

Turn-on Switching Waveforms & definition of t_r
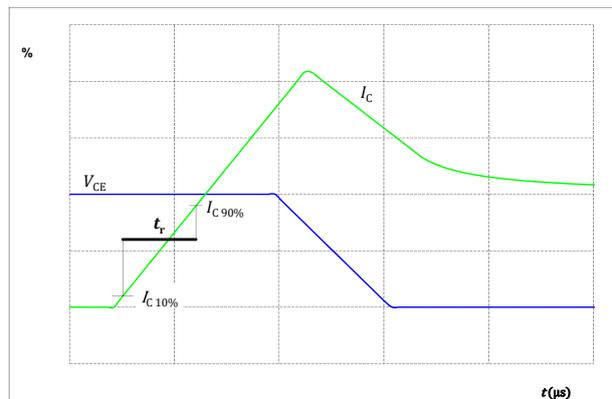
Switching Definitions

figure 52.	FWD

Turn-off Switching Waveforms & definition of t_{rr}
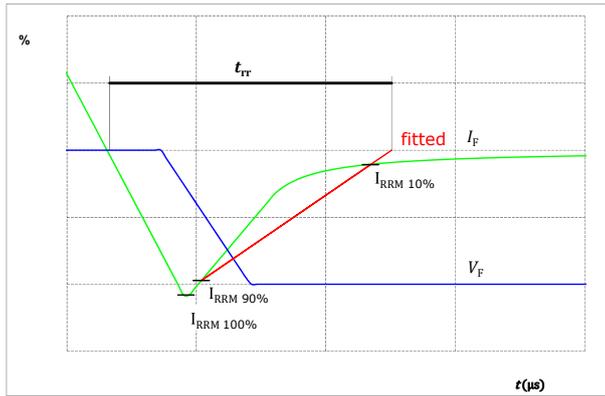
figure 53.	FWD

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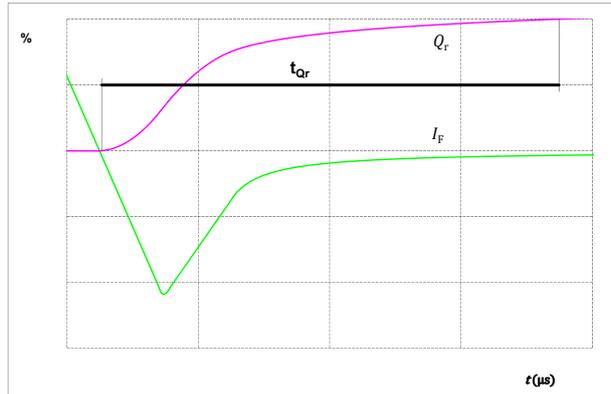
Ordering Code

Version	Ordering Code
Without thermal paste	V23990-P849-A49Y-PM
With thermal paste (5,2 W/mK, PTM6000HV)	V23990-P849-A49Y-/7/-PM
With thermal paste (3,4 W/mK, PSX-P7)	V23990-P849-A49Y-/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	25,5	2,7	NTC1
2	25,5	0	NTC2
3	22,8	0	-DC
4	20,1	0	BRCG
5	16,2	0	BRCE
6	13,5	0	G6
7	10,8	0	E6
8	8,1	0	G5
9	5,4	0	E5
10	2,7	0	G4
11	0	0	E4
12	0	19,8	G1
13	0	22,5	U
14	7,5	19,8	G2
15	7,5	22,5	V
16	15	19,8	G3
17	15	22,5	W
18	22,8	22,5	+INV
19	25,5	22,5	+DC
20	33,5	22,5	BRC+
21	33,5	15	L1
22	33,5	7,5	L2
23	33,5	0	L3

center of press-fit pinhead
for connection parameter see the handling instruction

17.93 ±0.1
21.2 ±0.5

11.25

X
16.75

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

30 Sep. 2021 / Revision 9

Pinout
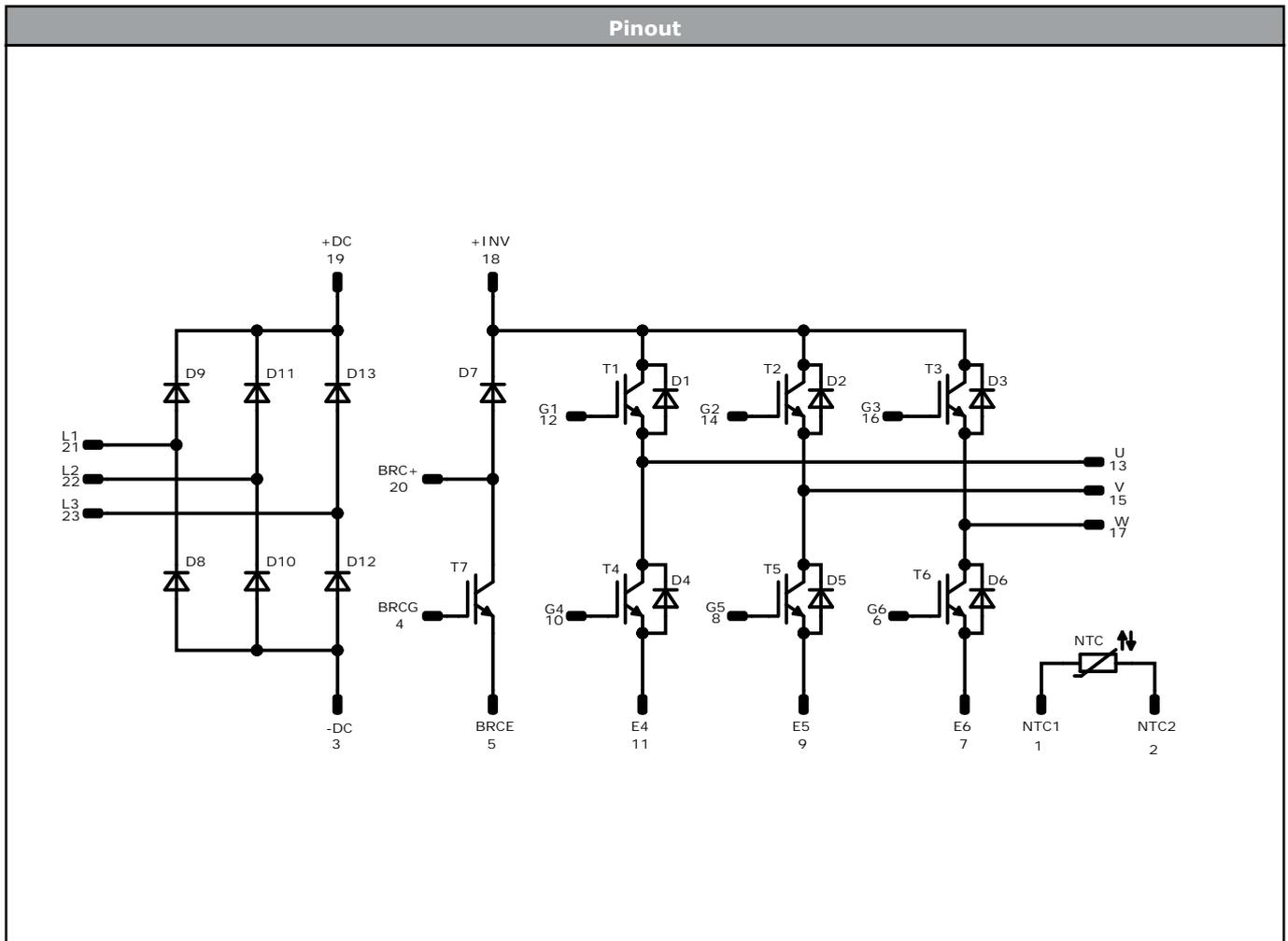
Identification					
ID	**Component**	**Voltage**	**Current**	**Function**	**Comment**
T4, T1, T5, T2, T6, T3	IGBT	1200 V	8 A	Inverter Switch	
D1, D4, D2, D5, D3, D6	FWD	1200 V	10 A	Inverter Diode	
T7	IGBT	1200 V	4 A	Brake Switch	
D7	FWD	1200 V	3 A	Brake Diode	
D8, D9, D10, D11, D12, D13	Rectifier	1600 V	25 A	Rectifier Diode	
NTC	Thermistor			Thermistor	

Vincotech

Packaging instruction					
Standard packaging quantity (SPQ) 135		>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 0 packages see vincotech.com website.

Package data
Package data for *flow* 0 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_L

Document No.:	**Date:**	**Modification:**	**Pages**
V23990-P849-A49Y-PM-D9-14	30 Sep. 2021	New Datasheet format, module is unchanged Correct Static values of Inverter Diode, Brake Diode, Rectifier Diode Correct Thermal values of Brake Switch, Brake Diode Separate datasheet	

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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.