V23990-P767-A-PM

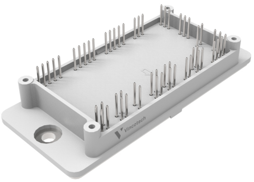
datasheet

***flow*PIM 2** **1200 V / 35 A**

Features

- Three-phase rectifier, BRC, Inverter, NTC
- Very Compact housing, easy to route
- IGBT4/ EmCon4 technology for low saturation losses and improved EMC behavior

flow 2 17 mm housing



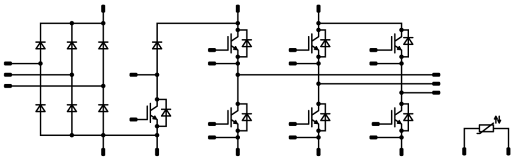
Target applications

- Motor Drives
- Power Generation

Types

- V23990-P767-A-PM

Schematic



Maximum Ratings

T_{j} = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current (DC current)	I_{C}	$T_{\mathrm{j}} = T_{\mathrm{jmax}}$ $T_{\mathrm{s}} = 80$ °C	47	A
Repetitive peak collector current	I_{CRM}	t_{p} limited by T_{jmax}	105	A
Total power dissipation	P_{tot}	$T_{\mathrm{j}} = T_{\mathrm{jmax}}$ $T_{\mathrm{s}} = 80$ °C	135	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC}	$V_{\mathrm{GE}} = 15$ V, $V_{\mathrm{CC}} = 800$ V $T_{\mathrm{j}} = 150$ °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}	$T_{\mathrm{j}} = T_{\mathrm{jmax}}$ $T_{\mathrm{s}} = 80$ °C	51	A
Repetitive peak forward current	I_{FRM}	t_{p} limited by T_{jmax}	70	A
Total power dissipation	P_{tot}	$T_{\mathrm{j}} = T_{\mathrm{jmax}}$ $T_{\mathrm{s}} = 80$ °C	103	W
Maximum junction temperature	T_{jmax}		175	°C
Brake Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current (DC current)	I_{C}	$T_{\mathrm{j}} = T_{\mathrm{jmax}}$ $T_{\mathrm{s}} = 80$ °C	34	A
Repetitive peak collector current	I_{CRM}	t_{p} limited by T_{jmax}	75	A
Total power dissipation	P_{tot}	$T_{\mathrm{j}} = T_{\mathrm{jmax}}$ $T_{\mathrm{s}} = 80$ °C	99	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC}	$V_{\mathrm{GE}} = 15$ V, $V_{\mathrm{CC}} = 800$ V $T_{\mathrm{j}} = 150$ °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	37	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	50	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	87	W
Maximum junction temperature	T_{jmax}		175	°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	21	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	56	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	86	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms T_j = 150 °C	490	A
Surge current capability	I^2t		1200	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	106	W
Maximum junction temperature	T_{jmax}		150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Module Properties					
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{jop}			-40…+(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{isol}	DC Test Voltage*	t_p = 2 s	6000	V
Isolation voltage	V_{isol}	AC Voltage	t_p = 1 min	2500	V
Creepage distance				>12,7	mm
Clearance				12,01	mm
Comparative Tracking Index	CTI			≥ 200	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_{F} [V]	I_{C} [A] I_{D} [A] I_{F} [A]	T_j [°C]	Min	Typ	Max	
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}			0,0012	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		35	25 125 150	1,58	1,87 2,18 2,28	2,07(1)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			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		2000		pF
Reverse transfer capacitance	C_{res}							70		pF
Gate charge	Q_g		15		0	25		270		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,7		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	±15	600	35	25 125 150		100,59 100,69 100,49		ns
Rise time	t_r					25 125 150		27,6 29,5 29,97		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		204,43 267,64 285,09		ns
Fall time	t_f					25 125 150		93,84 160,76 178,04		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=2,56 µC Q_{rFWD}=4,92 µC Q_{rFWD}=5,7 µC				25 125 150		2,15 3,15 3,45		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		1,95 2,97 3,34		mWs

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Diode										
Static										
Forward voltage	V_F				35	25 125 150	1,35	1,76 1,73 1,69	2,05(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			7,7	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,92		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt=1450 A/µs di/dt=1341 A/µs di/dt=1290 A/µs	±15	600	35	25 125 150		29,78 36,77 38,52		A
Reverse recovery time	t_{rr}					25 125 150		248,59 369,59 412,22		ns
Recovered charge	Q_r					25 125 150		2,56 4,92 5,7		µC
Reverse recovered energy	E_{rec}					25 125 150		0,918 1,83 2,14		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		360,31 144,92 141,01		A/µs

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	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00085	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		25	25 125 150	1,58	1,87 2,23 2,32	2,07$^{(1)}$	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			2,4	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		1450		pF
Reverse transfer capacitance	C_{res}							50		pF
Gate charge	Q_g		15		0	25		200		nC
Thermal										
Thermal resistance junction to sink $^{(2)}$	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,96		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 32 Ω R_{goff} = 32 Ω	0/15	600	25	25 125 150		47,08 44,54 43,99		ns
Rise time	t_r					25 125 150		39,68 42,08 42,86		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		366,18 425,59 443,1		ns
Fall time	t_f					25 125 150		108,25 170,55 192,72		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=1,69 µC Q_{rFWD}=3,25 µC Q_{rFWD}=3,66 µC				25 125 150		2,08 2,97 3,2		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		1,51 2,28 2,56		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				25	25 125 150	1,35	1,93 1,94 1,92	2,05(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			5,2	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,09		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=444 A/µs d*i*/d*t*=432 A/µs d*i*/d*t*=462 A/µs	0/15	600	25	25 125 150		13,47 17,18 18,1		A
Reverse recovery time	t_{rr}					25 125 150		292,72 443,48 474,27		ns
Recovered charge	Q_r					25 125 150		1,69 3,25 3,66		µC
Reverse recovered energy	E_{rec}					25 125 150		0,579 1,15 1,3		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		51,57 46,4 43,42		A/µs

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 Sw. Protection Diode										
Static										
Forward voltage	V_F				10	25 125 150	1,35	1,88 1,89 1,87	2,05(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			2,7	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,68		K/W
Rectifier Diode										
Static										
Forward voltage	V_F				25	25 125		0,987 0,901	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)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,66		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**	
Thermistor										
Static										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 Ω				100	-12		14	%
Power dissipation	P							200		mW
Power dissipation constant	d					25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3 %						3950		K
B-value	$B_{(25/100)}$	Tol. ±3 %						3998		K
Vincotech Thermistor Reference									B	

(1) Value at chip level

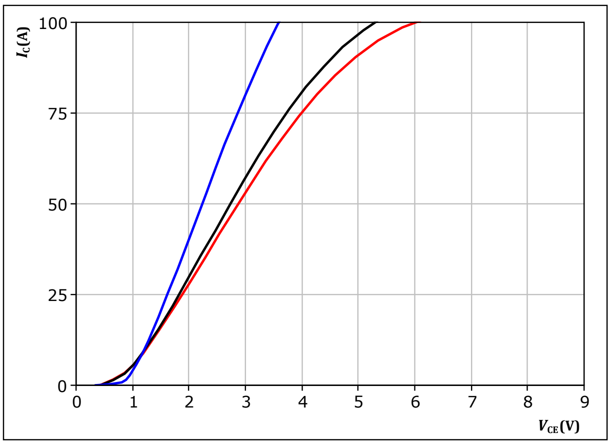
(2) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

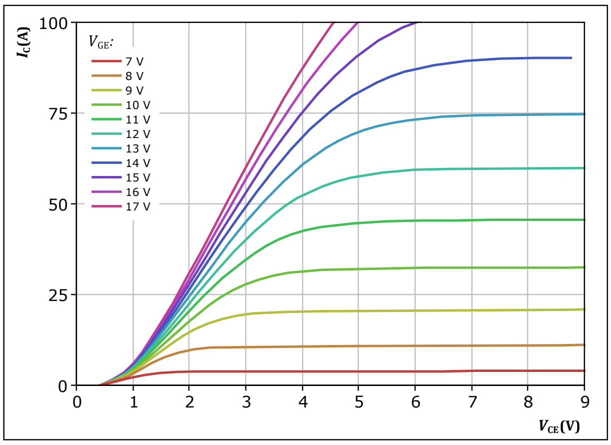


t_p = 250 µs
V_{GE} = 15 V
T_j: 25 °C, 125 °C, 150 °C

figure 2. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

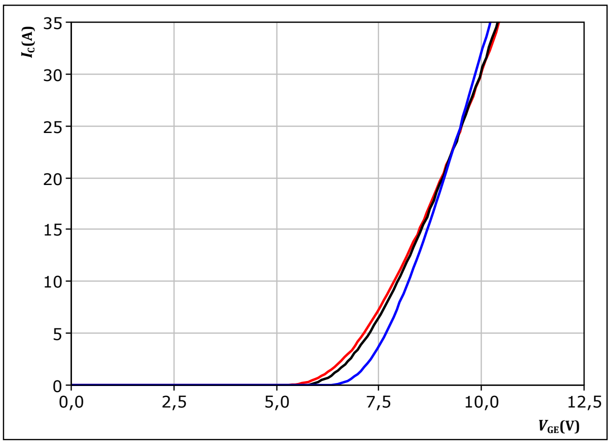


t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})

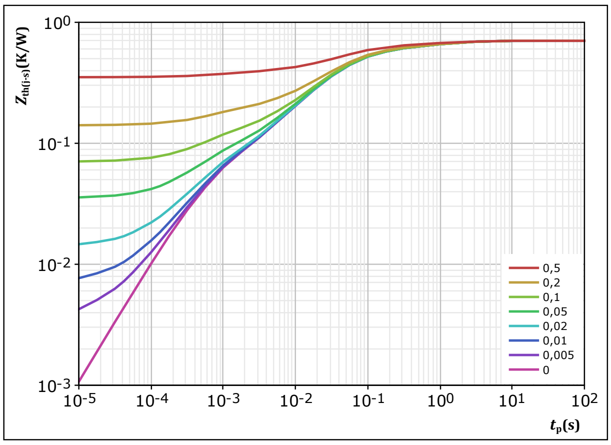


t_p = 250 µs
V_{CE} = 10 V
T_j: 25 °C, 125 °C, 150 °C

figure 4. **IGBT**

Transient thermal impedance as a function of pulse width

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



D = t_p / T
$R_{th(j-s)}$ = 0,704 K/W

IGBT thermal model values

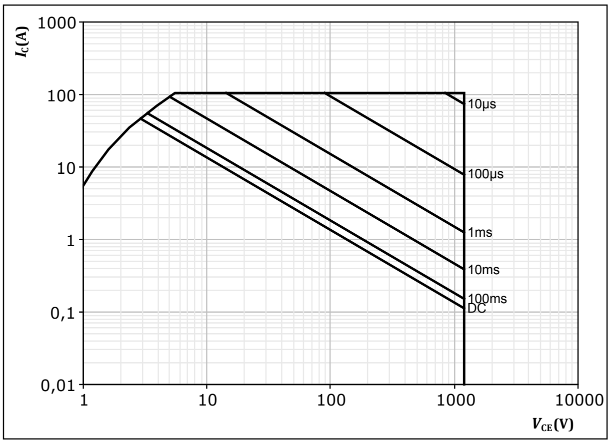
R (K/W)	τ (s)
8,05E-02	1,62E+00
1,47E-01	1,81E-01
3,23E-01	3,75E-02
9,88E-02	9,21E-03
5,47E-02	6,24E-04

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area

I_C = f(V_{CE})



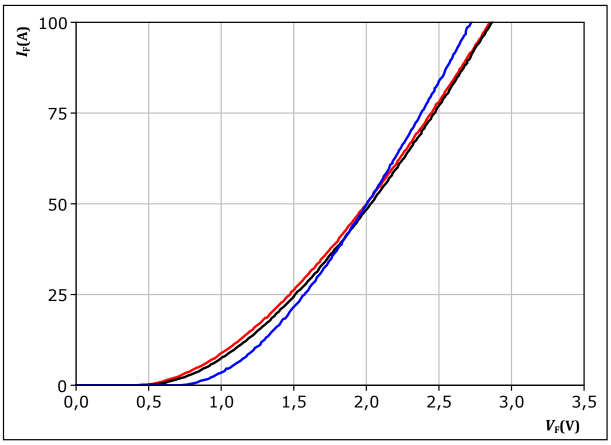
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Inverter Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

I_F = f(V_F)



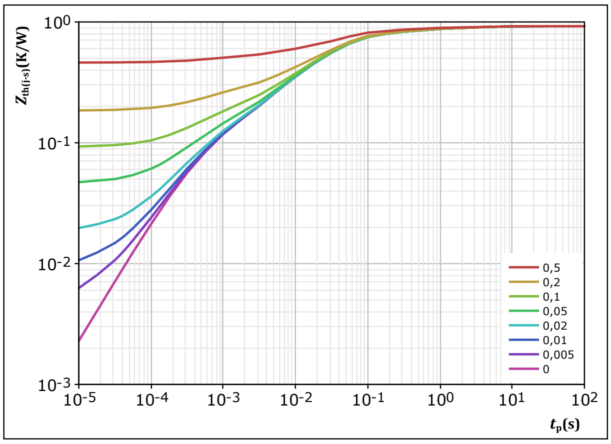
t_p = 250 µs

T_j:
25 °C
125 °C
150 °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

$R_{th(j\text{-}s)}$ = 0,921 K/W

FWD thermal model values

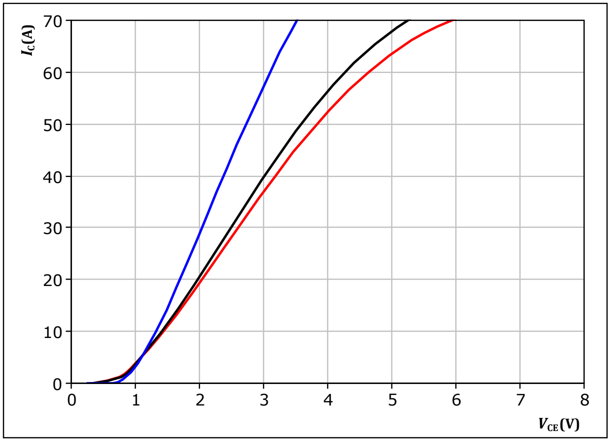
R (K/W)	τ (s)
6,37E-02	2,67E+00
1,36E-01	2,25E-01
4,78E-01	3,27E-02
1,59E-01	5,18E-03
8,43E-02	4,54E-04

Brake Switch Characteristics

figure 8. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



t_p = 250 µs

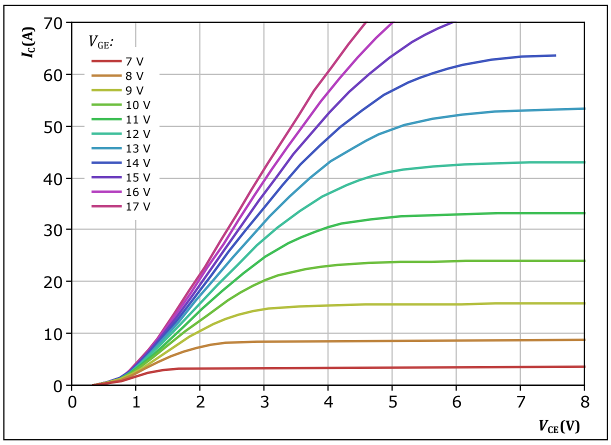
V_{GE} = 15 V

T_j: 25 °C, 125 °C, 150 °C

figure 9. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



t_p = 250 µs

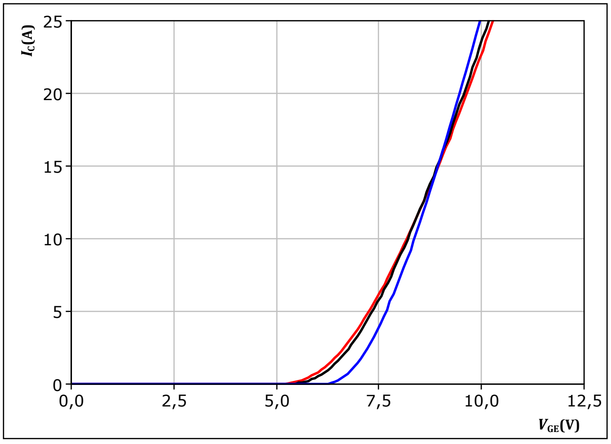
T_j = 150 °C

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

figure 10. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})



t_p = 250 µs

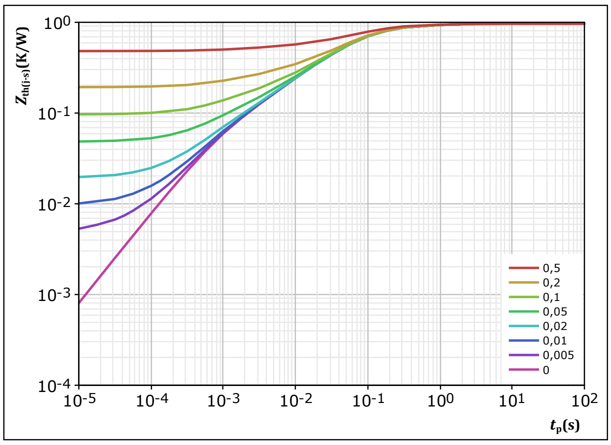
V_{CE} = 10 V

T_j: 25 °C, 125 °C, 150 °C

figure 11. **IGBT**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,964 K/W

IGBT thermal model values

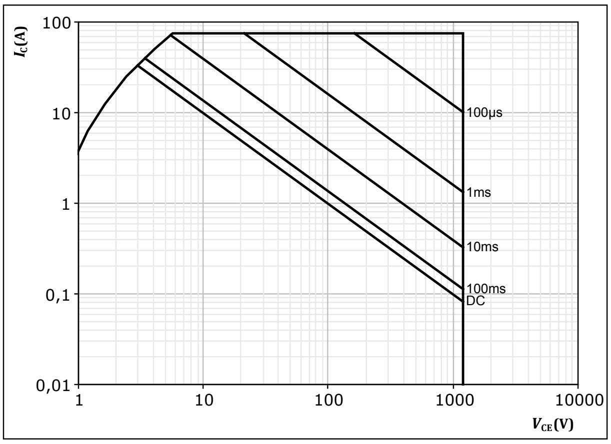
R (K/W)	τ (s)
9,34E-02	8,35E-01
3,42E-01	1,19E-01
3,61E-01	4,14E-02
1,15E-01	7,70E-03
5,33E-02	9,80E-04

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

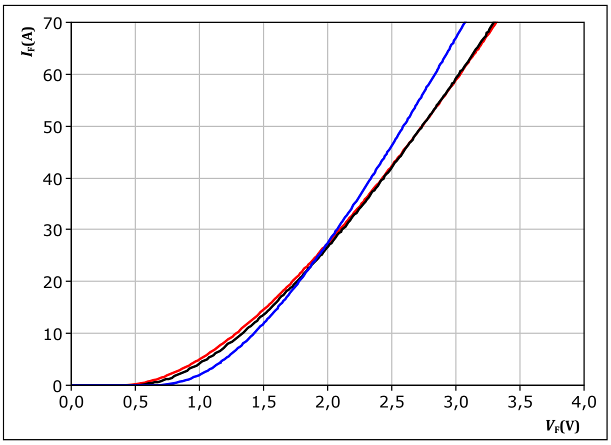
T_j = T_{jmax}

Brake Diode Characteristics

figure 13. **FWD**

Typical forward characteristics

I_F = f(V_F)



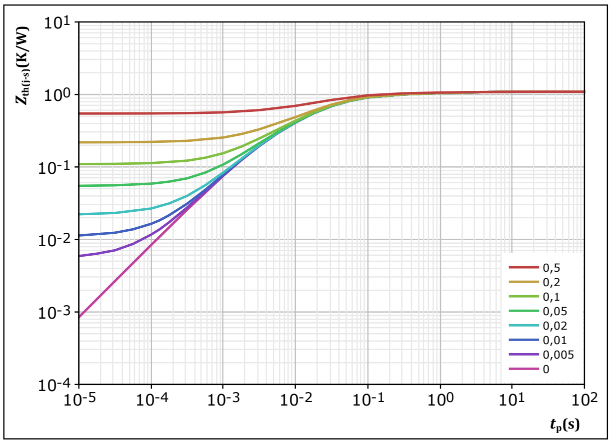
t_p = 250 µs

T_j:
- 25 °C
- 125 °C
- 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

$R_{th(j-s)}$ = 1,091 K/W

FWD thermal model values

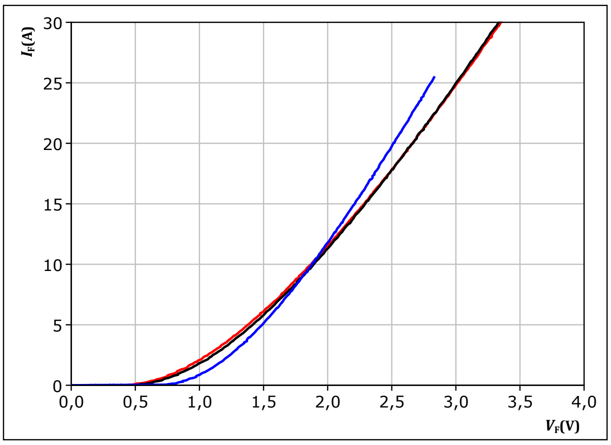
R (K/W)	τ (s)
5,34E-02	2,93E+00
9,71E-02	3,59E-01
4,43E-01	4,79E-02
3,93E-01	1,21E-02
1,05E-01	2,46E-03

Brake Sw. Protection Diode Characteristics

figure 15. **FWD**

Typical forward characteristics

I_F = f(V_F)



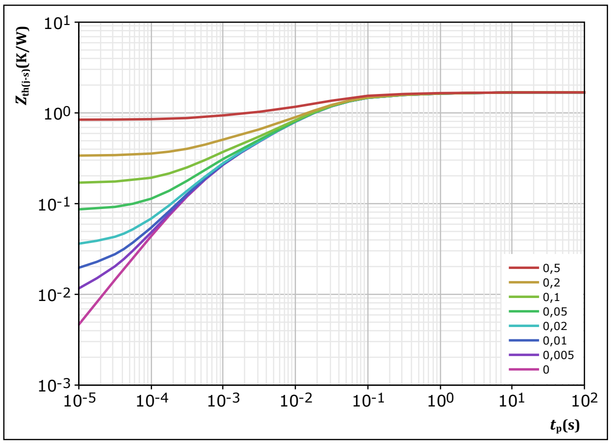
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 16. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,683 K/W

FWD thermal model values

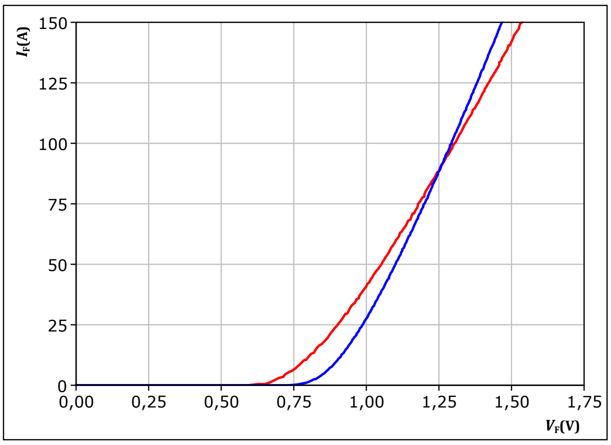
R (K/W)	τ (s)
6,27E-02	2,99E+00
1,53E-01	2,72E-01
5,57E-01	4,10E-02
4,90E-01	1,29E-02
2,45E-01	3,00E-03
1,75E-01	5,24E-04

Rectifier Diode Characteristics

figure 17. **Rectifier**

Typical forward characteristics

I_F = f(V_F)



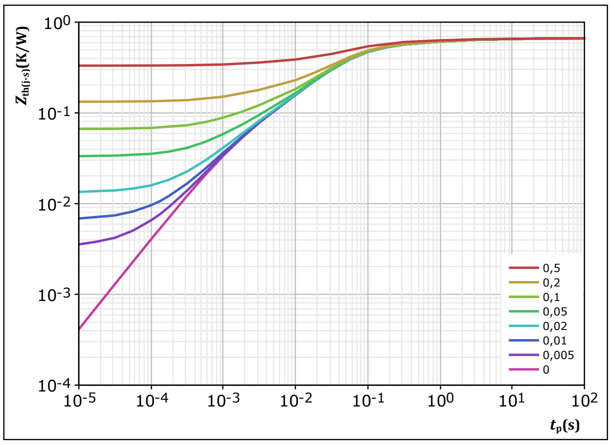
t_p = 250 µs

T_j: 25 °C
125 °C

figure 18. **Rectifier**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,664 K/W

Rectifier thermal model values

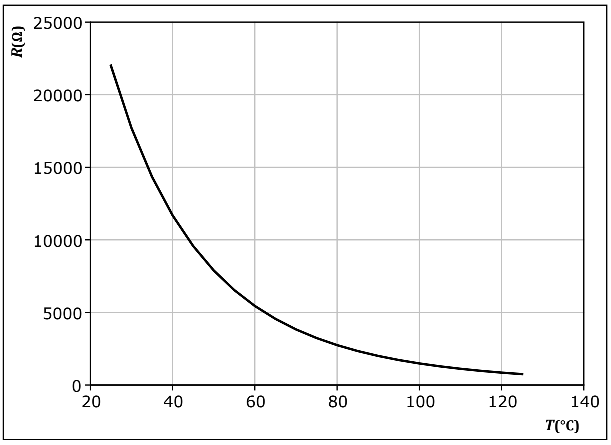
R (K/W)	τ (s)
2,64E-02	1,18E+01
6,63E-02	1,18E+00
1,36E-01	1,65E-01
3,29E-01	4,29E-02
6,63E-02	1,04E-02
3,95E-02	1,49E-03

Thermistor Characteristics

figure 19. **Thermistor**

Typical NTC characteristic as function of temperature

$R_T = f(T)$

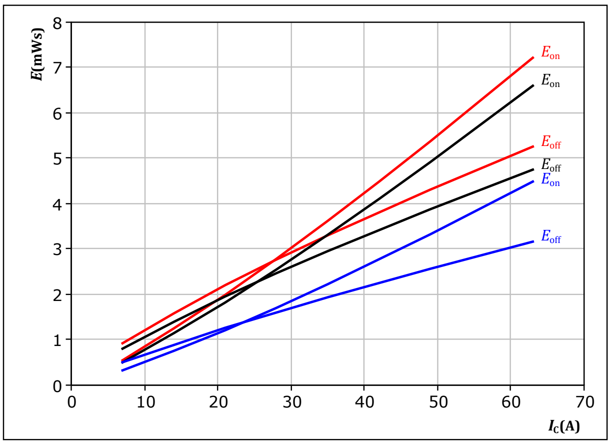


Inverter Switching Characteristics

figure 20. **IGBT**

Typical switching energy losses as a function of collector current

E = f(I_C)



With an inductive load at

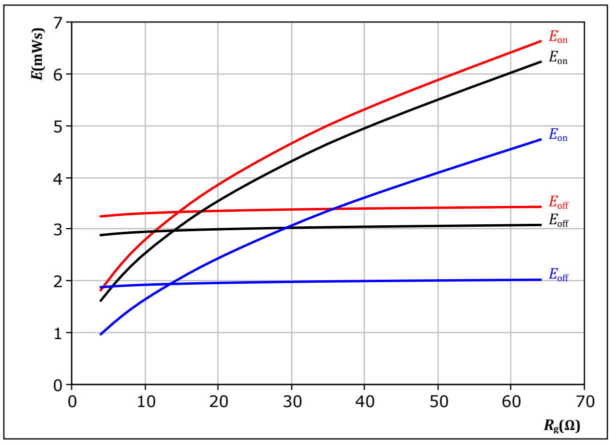
V_{CE} = 600 V
V_{GE} = ±15 V
R_{gon} = 16 Ω
R_{goff} = 16 Ω

T_j: 25 °C
125 °C
150 °C

figure 21. **IGBT**

Typical switching energy losses as a function of gate resistor

E = f(R_g)



With an inductive load at

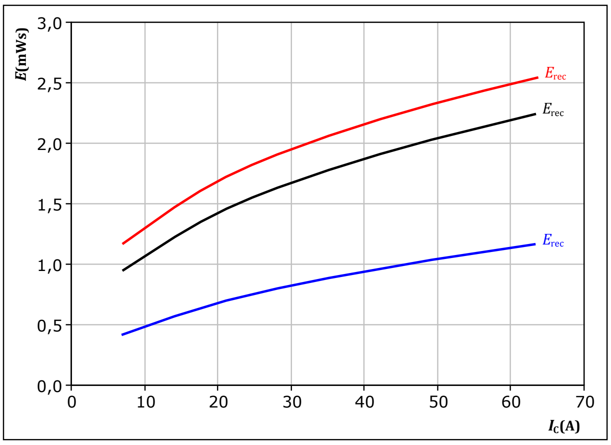
V_{CE} = 600 V
V_{GE} = ±15 V
I_C = 35 A

T_j: 25 °C
125 °C
150 °C

figure 22. **FWD**

Typical reverse recovered energy loss as a function of collector current

E_{rec} = f(I_C)



With an inductive load at

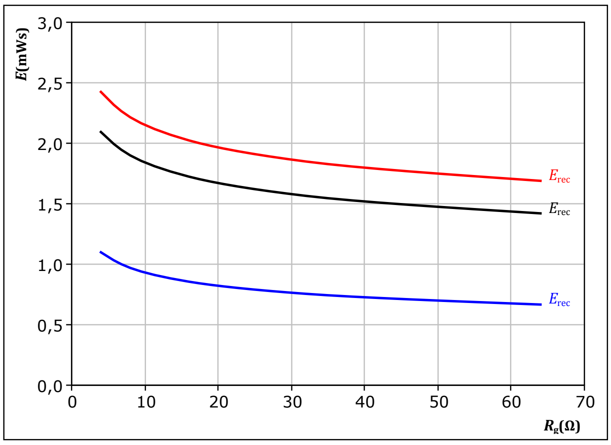
V_{CE} = 600 V
V_{GE} = ±15 V
R_{gon} = 16 Ω

T_j: 25 °C
125 °C
150 °C

figure 23. **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 = 35 A

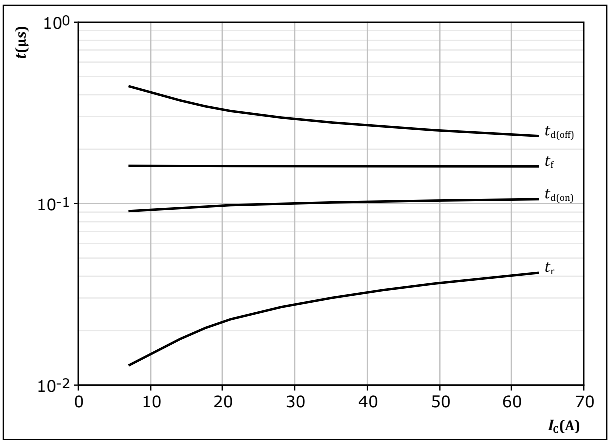
T_j: 25 °C
125 °C
150 °C

Inverter Switching Characteristics

figure 24. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



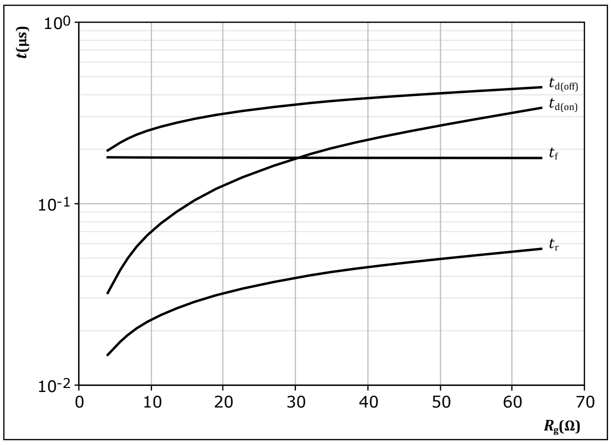
With an inductive load at

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

figure 25. **IGBT**

Typical switching times as a function of gate resistor

t = f(R_g)



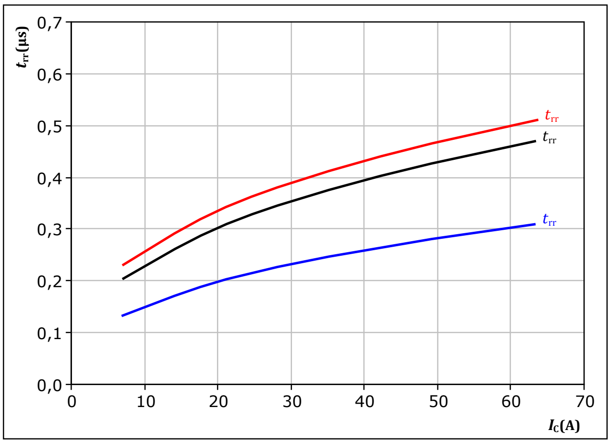
With an inductive load at

T_j = 150 °C
V_{CE} = 600 V
V_{GE} = ±15 V
I_C = 35 A

figure 26. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

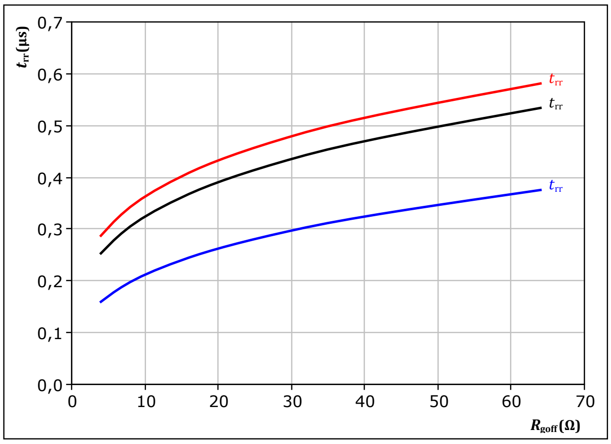
V_{CE} = 600 V
V_{GE} = ±15 V
R_{gon} = 16 Ω

T_j:
— 25 °C
— 125 °C
— 150 °C

figure 27. **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 = 35 A

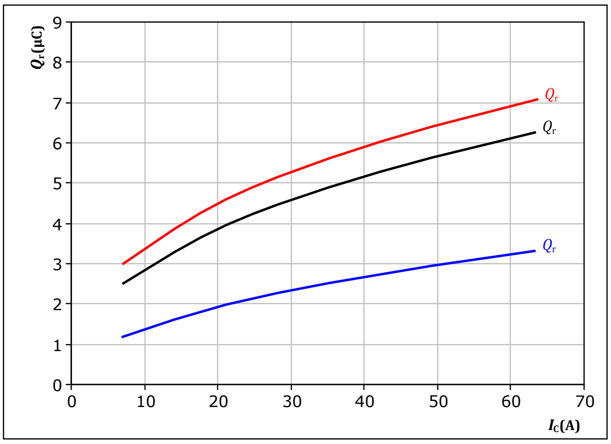
T_j:
— 25 °C
— 125 °C
— 150 °C

Inverter Switching Characteristics

figure 28. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



With an inductive load at

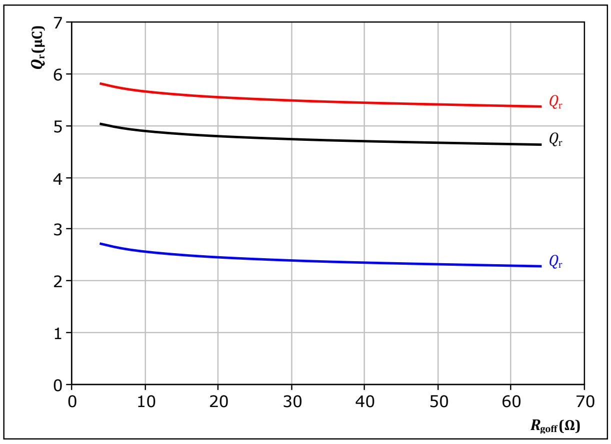
V_{CE} = 600 V
V_{GE} = ±15 V
R_{gon} = 16 Ω

T_j:
25 °C
125 °C
150 °C

figure 29. **FWD**

Typical recovered charge as a function of turn off gate resistor

Q_r = f(R_{goff})



With an inductive load at

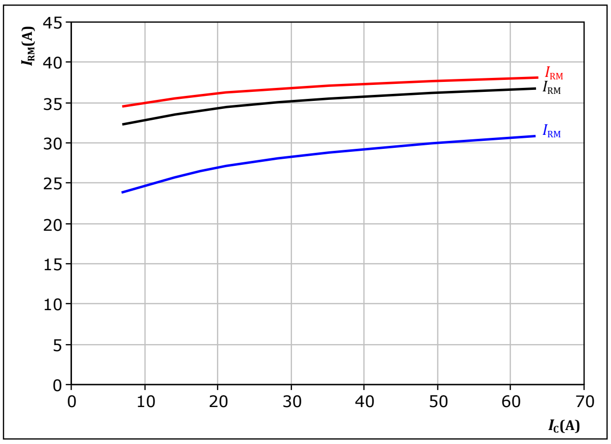
V_{CE} = 600 V
V_{GE} = ±15 V
I_C = 35 A

T_j:
25 °C
125 °C
150 °C

figure 30. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



With an inductive load at

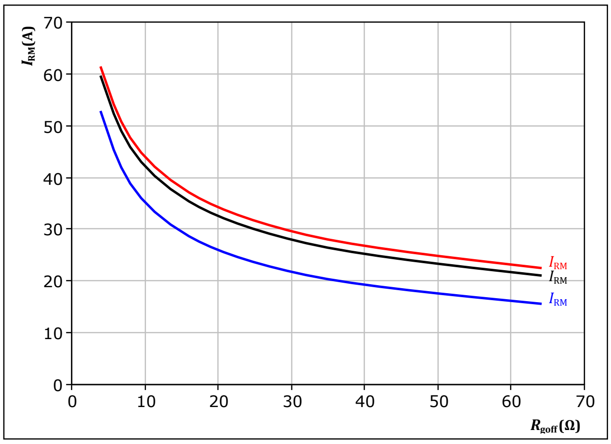
V_{CE} = 600 V
V_{GE} = ±15 V
R_{gon} = 16 Ω

T_j:
25 °C
125 °C
150 °C

figure 31. **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 = 35 A

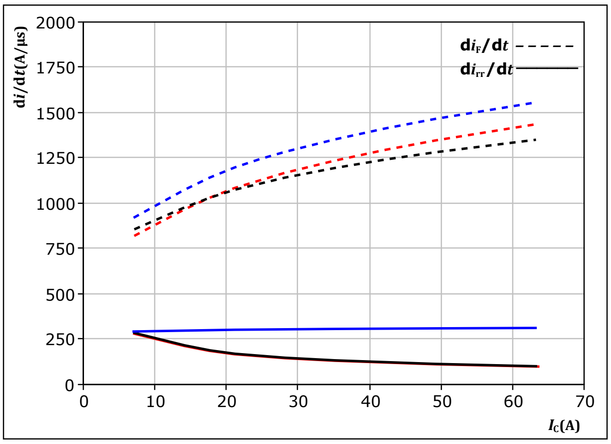
T_j:
25 °C
125 °C
150 °C

Inverter Switching Characteristics

figure 32. **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

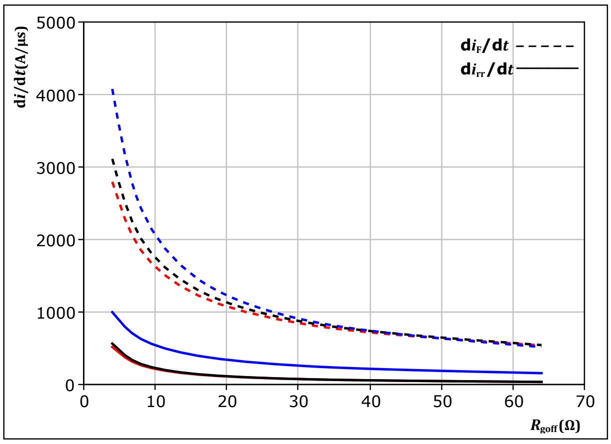
V_{CE} = 600 V
V_{GE} = ±15 V
R_{gon} = 16 Ω

T_j:
25 °C
125 °C
150 °C

figure 33. **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

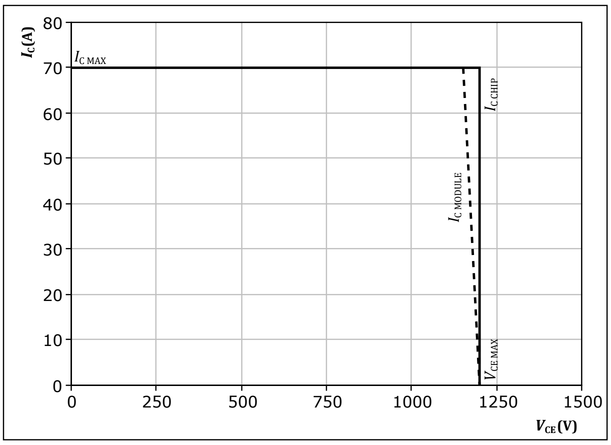
V_{CE} = 600 V
V_{GE} = ±15 V
I_C = 35 A

T_j:
25 °C
125 °C
150 °C

figure 34. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



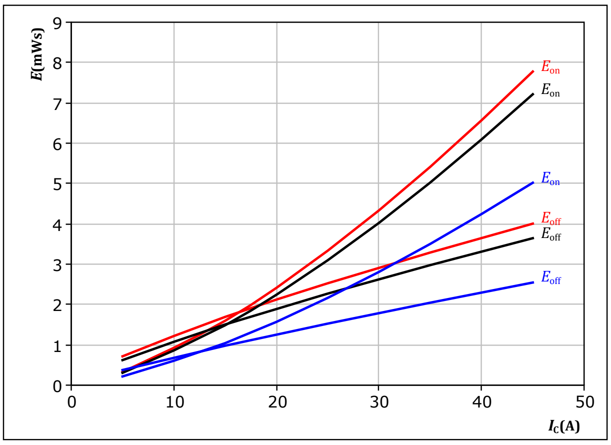
At T_j = 150 °C
R_{gon} = 16 Ω
R_{goff} = 16 Ω

Brake Switching Characteristics

figure 35. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



With an inductive load at

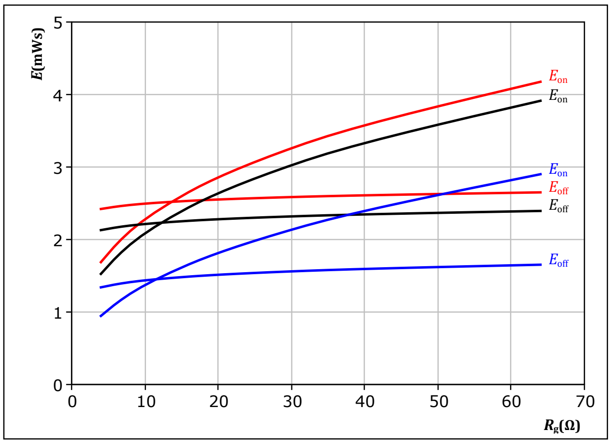
V_{CE} = 600 V
V_{GE} = 0/15 V
R_{gon} = 32 Ω
R_{goff} = 32 Ω

T_j:
25 °C
125 °C
150 °C

figure 36. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



With an inductive load at

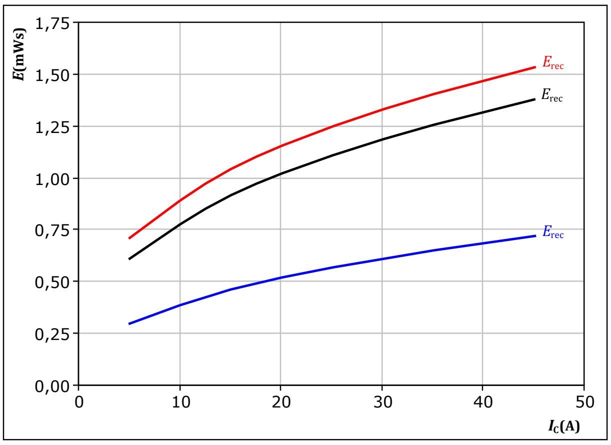
V_{CE} = 600 V
V_{GE} = 0/15 V
I_C = 25 A

T_j:
25 °C
125 °C
150 °C

figure 37. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



With an inductive load at

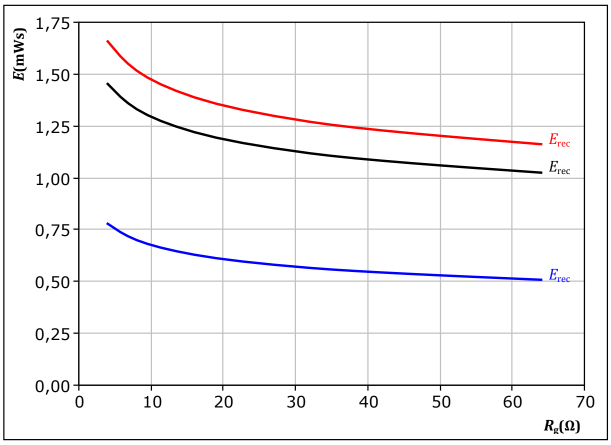
V_{CE} = 600 V
V_{GE} = 0/15 V
R_{gon} = 32 Ω

T_j:
25 °C
125 °C
150 °C

figure 38. **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} = 0/15 V
I_C = 25 A

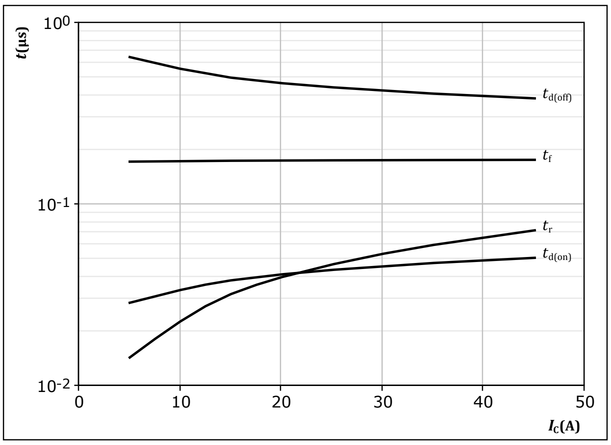
T_j:
25 °C
125 °C
150 °C

Brake Switching Characteristics

figure 39. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



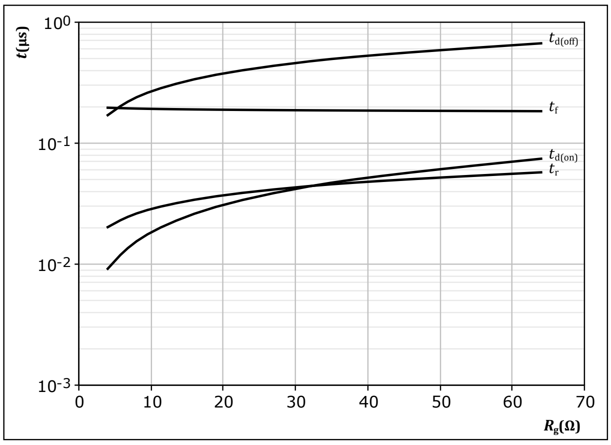
With an inductive load at

T_j = 150 °C
V_{CE} = 600 V
V_{GE} = 0/15 V
R_{gon} = 32 Ω
R_{goff} = 32 Ω

figure 40. **IGBT**

Typical switching times as a function of gate resistor

t = f(R_g)



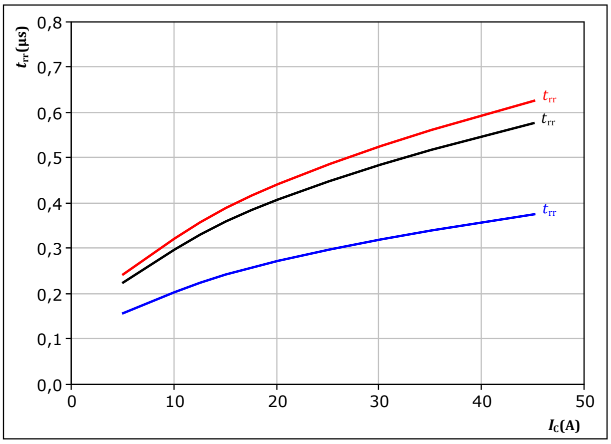
With an inductive load at

T_j = 150 °C
V_{CE} = 600 V
V_{GE} = 0/15 V
I_C = 25 A

figure 41. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

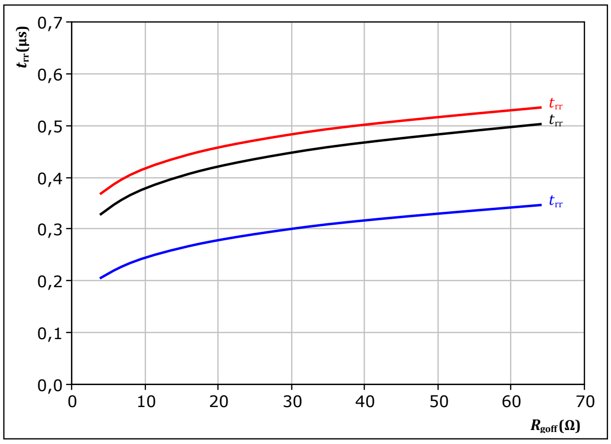
V_{CE} = 600 V
V_{GE} = 0/15 V
R_{gon} = 32 Ω

T_j:
25 °C
125 °C
150 °C

figure 42. **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} = 0/15 V
I_C = 25 A

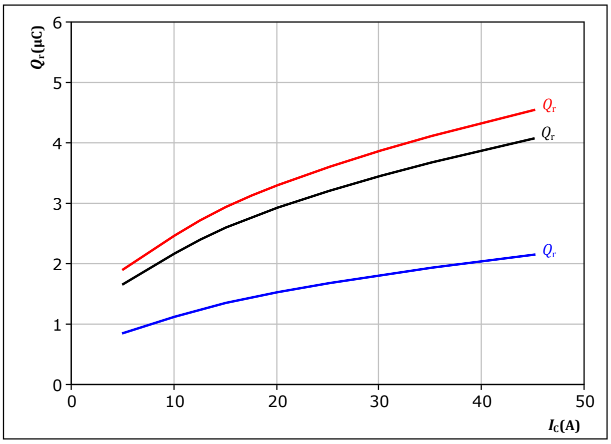
T_j:
25 °C
125 °C
150 °C

Brake Switching Characteristics

figure 43. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



With an inductive load at

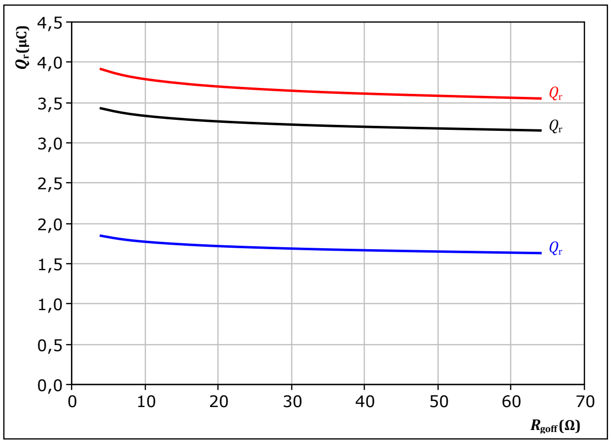
V_{CE} = 600 V
V_{GE} = 0/15 V
R_{gon} = 32 Ω

T_j:
25 °C
125 °C
150 °C

figure 44. **FWD**

Typical recovered charge as a function of turn off gate resistor

Q_r = f(R_{goff})



With an inductive load at

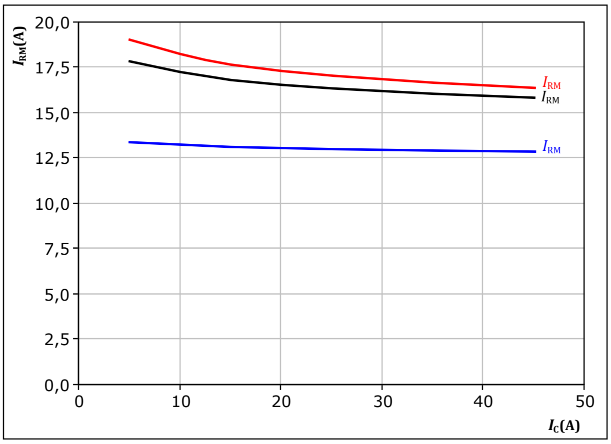
V_{CE} = 600 V
V_{GE} = 0/15 V
I_C = 25 A

T_j:
25 °C
125 °C
150 °C

figure 45. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



With an inductive load at

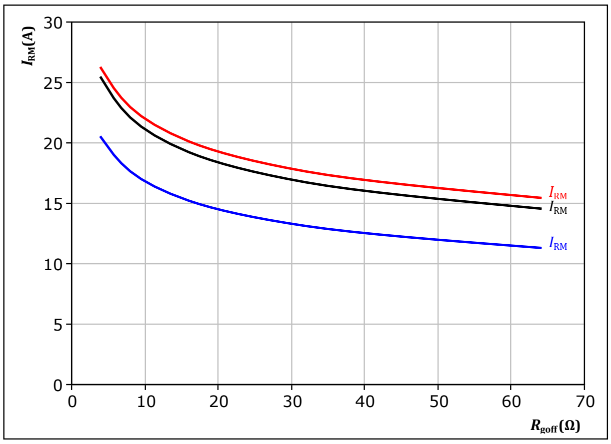
V_{CE} = 600 V
V_{GE} = 0/15 V
R_{gon} = 32 Ω

T_j:
25 °C
125 °C
150 °C

figure 46. **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} = 0/15 V
I_C = 25 A

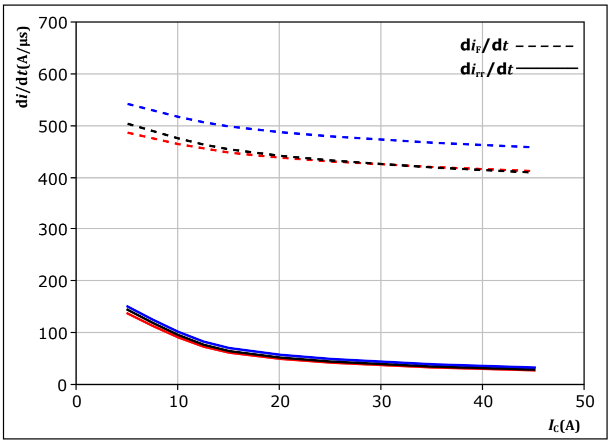
T_j:
25 °C
125 °C
150 °C

Brake Switching Characteristics

figure 47. **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

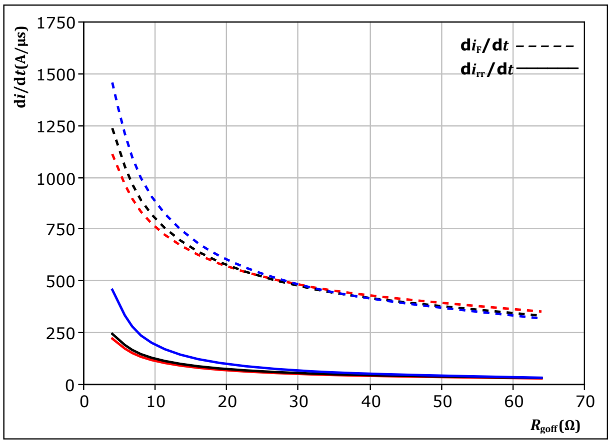
V_{CE} =	600	V	
V_{GE} =	0/15	V	
R_{gon} =	32	Ω	

T_j:
- 25 °C
- 125 °C
- 150 °C

figure 48. **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

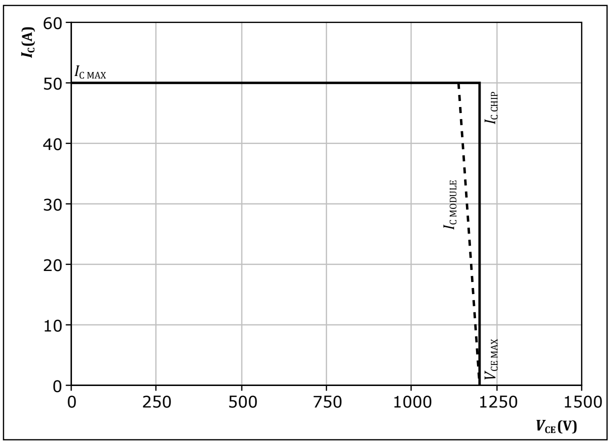
V_{CE} =	600	V
V_{GE} =	0/15	V
I_C =	25	A

T_j:
- 25 °C
- 125 °C
- 150 °C

figure 49. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At

T_j =	150	°C
R_{gon} =	32	Ω
R_{goff} =	32	Ω

Switching Definitions

figure 50. **IGBT**

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

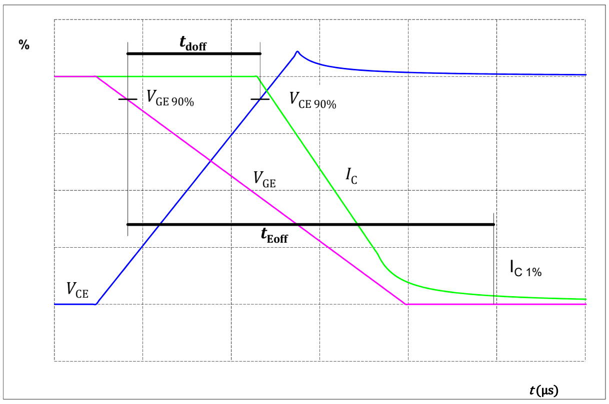


figure 51. **IGBT**

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

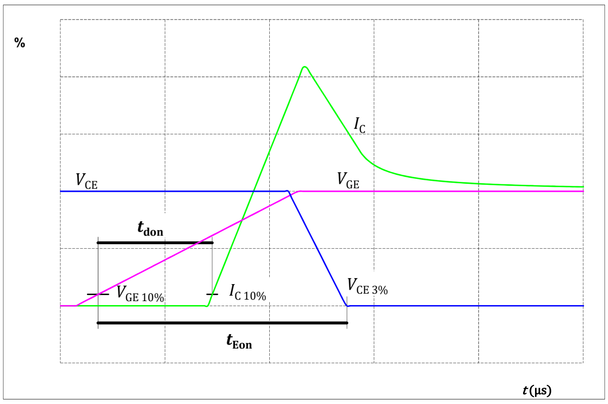


figure 52. **IGBT**

Turn-off Switching Waveforms & definition of t_f

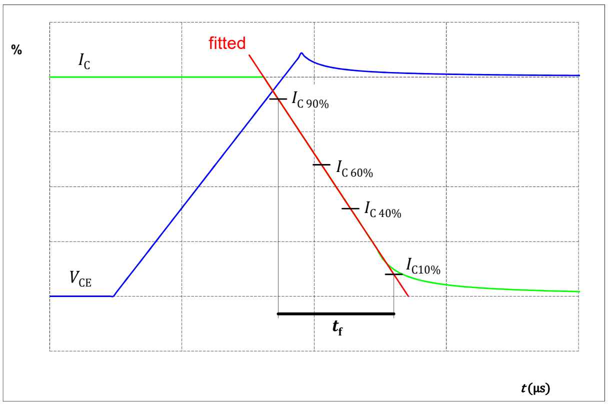
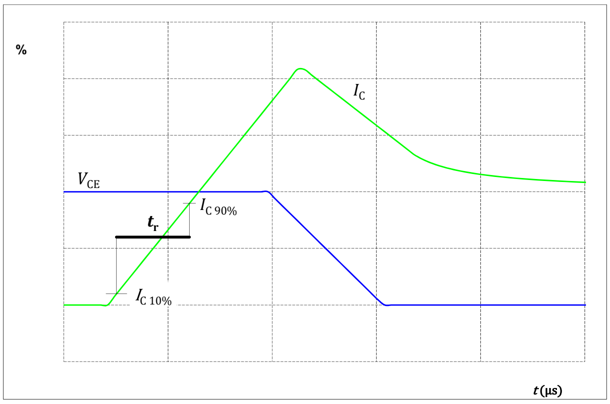


figure 53. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Switching Definitions

figure 54. **FWD**

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

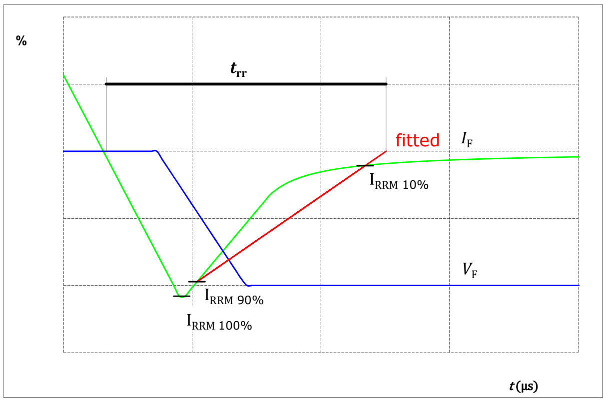
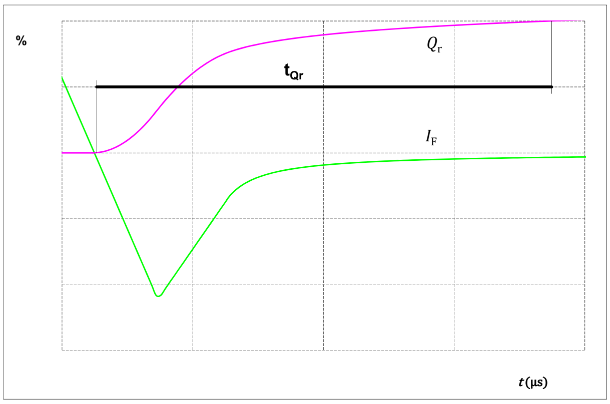


figure 55. **FWD**

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



Ordering Code

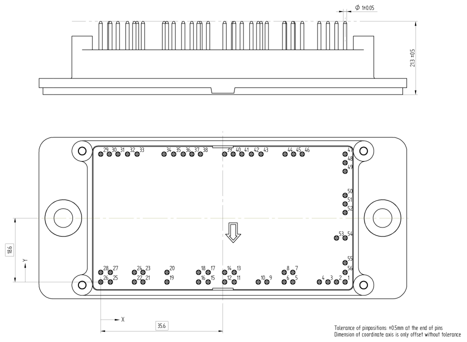
Version	Ordering Code
Without thermal paste	V23990-P767-A-PM
With thermal paste (3,4 W/mK, PSX-P7)	V23990-P767-A-/3/-PM

Marking

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

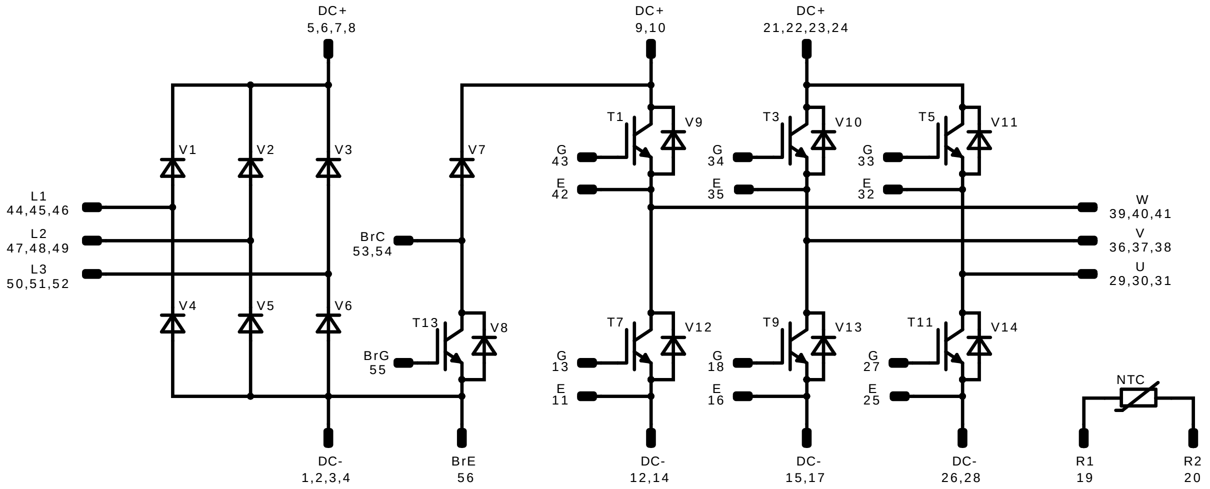
Outline

Pin table [mm]							
Pin	X	Y	Function	29	0	37,2	U
1	71,2	0	DC-	30	2,5	37,2	U
2	68,7	0	DC-	31	5	37,2	U
3	66,2	0	DC-	32	7,8	37,2	E
4	63,7	0	DC-	33	10,6	37,2	G
5	55,95	0	DC+	34	18,45	37,2	G
6	53,45	0	DC+	35	21,25	37,2	E
7	55,95	2,8	DC+	36	24,05	37,2	V
8	53,45	2,8	DC+	37	26,55	37,2	V
9	48,4	0	DC+	38	29,05	37,2	V
10	45,9	0	DC+	39	36,1	37,2	W
11	38,9	0	E	40	38,6	37,2	W
12	36,1	0	DC-	41	41,1	37,2	W
13	38,9	2,8	G	42	43,9	37,2	E
14	36,1	2,8	DC-	43	46,7	37,2	G
15	31,3	0	DC-	44	53,7	37,2	L1
16	28,5	0	E	45	56,2	37,2	L1
17	31,3	2,8	DC-	46	58,7	37,2	L1
18	28,5	2,8	G	47	71,2	37,2	L2
19	19,3	0	R2	48	71,2	34,7	L2
20	19,3	2,8	R1	49	71,2	32,2	L2
21	12,3	0	DC+	50	71,2	25,2	L3
22	9,8	0	DC+	51	71,2	22,7	L3
23	12,3	2,8	DC+	52	71,2	20,2	L3
24	9,8	2,8	DC+	53	68,7	12,8	BrC
25	2,8	0	E	54	71,2	12,8	BrC
26	0	0	DC-	55	71,2	5,6	BrG
27	2,8	2,8	G	56	71,2	2,8	BrE
28	0	2,8	DC-				



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
T7, T1, T9, T3, T11, T5	IGBT	1200 V	35 A	Inverter Switch	
V9, V12, V10, V13, V11, V14	FWD	1200 V	35 A	Inverter Diode	
T13	IGBT	1200 V	25 A	Brake Switch	
V7	FWD	1200 V	25 A	Brake Diode	
V8	FWD	1200 V	10 A	Brake Sw. Protection Diode	
V4, V1, V5, V2, V6, V3	Rectifier	1600 V	50 A	Rectifier Diode	
NTC	Thermistor			Thermistor	

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

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

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

Vincotech thermistor reference
See Vincotech thermistor reference table at vincotech.com website.

UL recognition and file number
This device is certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
V23990-P767-A-PM-D8-14	8 Sep. 2021	Rectifier maximum ratings corrected Isolation test voltage updated Clearance value corrected Rectifier static characteristics updated The thermal characteristics of brake switch, brake diode and brake switch protection diode updated Dynamic characteristics of inverter and brake are updated Thermistor vales updated New datasheet format, module is unchanged	

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1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.
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.