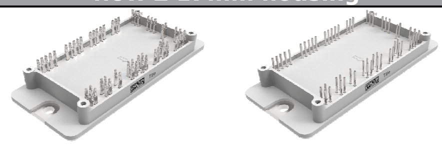
flow PIM 2 3rd — 1200 V / 50 A

Features

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

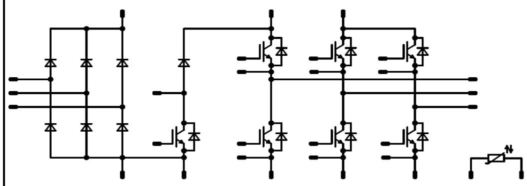
flow 2 17mm housing



Target Applications

- Motor Drives
- Power Generation

Schematic



Types

- V23990-P768-A-PM
- V23990-P768-AY-PM

Maximum Ratings

T_j=25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Input Rectifier Diode					
Repetitive peak reverse voltage	V_{RRM}			1600	V
Forward current	I_{FAV}	DC current	T_s = 80 °C T_c = 80 °C	80 80	A
Surge (non-repetitive) forward current	I_{FSM}	t_p = 10 ms	T_j = 25 °C	700	A
I2t-value	I^2t	t_p = 10 ms	T_j = 25 °C	2450	A^2s
Power dissipation	P_{tot}	T_j = T_{jmax}	T_s = 80 °C T_c = 80 °C	95 144	W
Maximum Junction Temperature	T_{jmax}			150	°C
Inverter IGBT					
Collector-emitter breakdown voltage	V_{CE}			1200	V
DC collector current	I_C	T_j = T_{jmax}	T_s = 80 °C T_c = 80 °C	60 75	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		150	A
Power dissipation	P_{tot}	T_j = T_{jmax}	T_s = 80 °C T_c = 80 °C	163 247	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V		10 900	μs V
Maximum Junction Temperature	T_{jmax}			175	°C

Maximum Ratings

T_j=25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter FWD				
Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
DC forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C T_c = 80 °C	60 80	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	100	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C T_c = 80 °C	114 173	W
Maximum Junction Temperature	T_{jmax}		175	°C
Brake IGBT				
Collector-emitter breakdown voltage	V_{CE}		1200	V
DC collector current	I_C	$T_j = T_{jmax}$ T_s = 80 °C T_c = 80 °C	44 45	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	105	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C T_c = 80 °C	130 198	W
Gate-emitter peak voltage	V_{GE}		±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V	10 900	µs V
Maximum Junction Temperature	T_{jmax}		175	°C
Brake Inverse Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
DC forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	10	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	20	A
Brake Inverse Diode	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	50	W
Maximum Junction Temperature	T_{jmax}		175	°C
Brake FWD				
Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
DC forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	25	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	50	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	75	W
Maximum Junction Temperature	T_{jmax}		175	°C

Maximum Ratings

T_j=25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Thermal properties				
Storage temperature	T_{stg}		-40…+125	°C
Operation temperature under switching condition	T_{op}		-40…+Tjmax-25	°C
Isolation Properties				
Isolation voltage	V_{is}	t = 1 min	4000	V_{DC}
Creepage distance			min 12,7	mm
Clearance		with Press-fit pins / with Solder pins	11,96 / 12,03	mm

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	
Input Rectifier Diode										
Forward voltage	V_F				50	Tj=25°C Tj=125°C		1,1 1,05	1,7	V
Threshold voltage (for power loss calc. only)	V_{to}					Tj=25°C Tj=125°C		0,89 0,78		V
Slope resistance (for power loss calc. only)	r_t					Tj=25°C Tj=125°C		0,004 0,006		Ω
Reverse current	I_r			1500		Tj=25°C Tj=125°C			0,05 1,1	mA
Thermal resistance junction to heatsink	$R_{th(j-s)}$	Thermal grease thickness≤50µm λ = 0,61 W/m·K						0,74		K/W
Thermal resistance junction to case	$R_{th(j-c)}$							0,49		
Inverter IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0017	Tj=25°C Tj=150°C	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	Tj=25°C Tj=150°C		1,86 2,3	2,3	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	1200		Tj=25°C Tj=150°C			0,02	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=150°C			200	nA
Integrated Gate resistor	R_{gint}							4		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 8 Ω R_{gon} = 8 Ω	±15	600	50	Tj=25°C Tj=150°C		104 100		ns
Rise time	t_r					Tj=25°C Tj=150°C		19 23,8		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=150°C		220 295		
Fall time	t_f					Tj=25°C Tj=150°C		78 118		
Turn-on energy loss	E_{on}					Tj=25°C Tj=150°C		2,86 4,5		mWs
Turn-off energy loss	E_{off}					Tj=25°C Tj=150°C		2,69 4,48		
Input capacitance	C_{ies}	f = 1 MHz	0	25		Tj=25°C		2770		pF
Output capacitance	C_{oss}							205		
Reverse transfer capacitance	C_{rss}							160		
Gate charge	Q_G		±15	960		Tj=25°C		290		nC
Thermal resistance junction to heatsink	$R_{th(j-s)}$	Thermal grease thickness≤50µm λ = 0,61 W/m·K						0,58		K/W
Thermal resistance junction to case	$R_{th(j-c)}$							0,38		
Coupled thermal resistance transistor-transistor	R_{thJH}T-T							0,1		
Coupled thermal resistance diode-transistor	R_{thJH}D-T							0,13		
Inverter FWD										
Diode forward voltage	V_F				50	Tj=25°C Tj=150°C		1,75 1,71	2,2	V
Peak reverse recovery current	I_{RRM}	R_{gon} = 8 Ω	±15	600	50	Tj=25°C Tj=150°C		65 82		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		162 313		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=150°C		4,62 9,95		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					Tj=25°C Tj=150°C		2298 1106		A/µs
Reverse recovered energy	E_{rec}					Tj=25°C Tj=150°C		1,92 3,98		mWs
Thermal resistance junction to heatsink	$R_{th(j-s)}$	Thermal grease thickness≤50µm λ = 0,61 W/m·K						0,83		K/W
Thermal resistance junction to case	$R_{th(j-c)}$							0,55		
Coupled thermal resistance transistor-diode	R_{thJH}T-D							0,12		

Characteristic Values

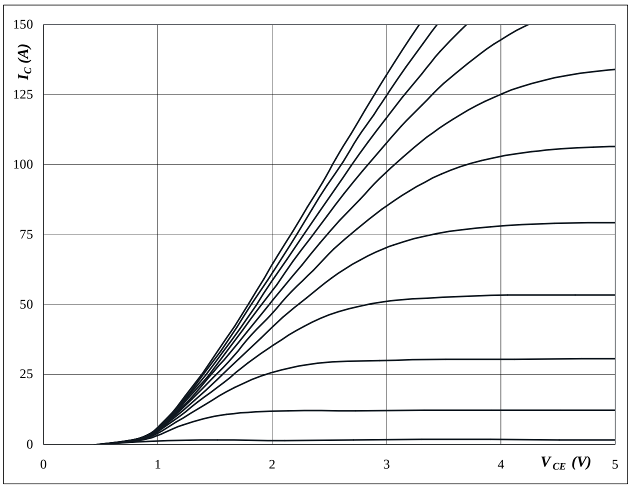
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	
Brake IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0012	Tj=25°C Tj=150°C	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		35	Tj=25°C Tj=150°C		1,91 2,37	2,3	V
Collector-emitter cut-off incl diode	I_{CES}		0	1200		Tj=25°C Tj=150°C			0,25	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=150°C			200	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	$R_{goff} = 16\ \Omega$ $R_{gon} = 16\ \Omega$	±15	600	35	Tj=25°C Tj=150°C		92 84		ns
Rise time	t_r					Tj=25°C Tj=150°C		21 24		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=150°C		182 253		
Fall time	t_f					Tj=25°C Tj=150°C		76 116		
Turn-on energy loss	E_{on}					Tj=25°C Tj=150°C		1,86 2,64		mWs
Turn-off energy loss	E_{off}					Tj=25°C Tj=150°C		1,78 2,95		
Input capacitance	C_{ies}	$f = 1$ MHz	0	25		Tj=25°C		1950		pF
Output capacitance	C_{oss}							155		
Reverse transfer capacitance	C_{rss}							115		
Gate charge	Q_G		±15	960		Tj=25°C		200		nC
Thermal resistance junction to heatsink	$R_{th(j-s)}$	Thermal grease thickness≤50μm λ = 0,61 W/m·K						0,73		K/W
Thermal resistance junction to case	$R_{th(j-c)}$							0,48		
Brake Inverse Diode										
Diode forward voltage	V_F				10	Tj=25°C Tj=150°C	1,1	1,89 1,8	2,1	V
Thermal resistance junction to heatsink	$R_{th(j-s)}$	Thermal grease thickness≤50μm λ = 0,61 W/m·K						1,86		K/W
Thermal resistance junction to case	$R_{th(j-c)}$							1,23		K/W
Brake FWD										
Diode forward voltage	V_F				25	Tj=25°C Tj=150°C		1,9 1,88	2,2	V
Reverse leakage current	I_r		±15	600	35	Tj=25°C Tj=150°C			10	μA
Peak reverse recovery current	I_{RRM}	$R_{gon} = 16\ \Omega$	±15	600	35	Tj=25°C Tj=150°C		27,41 41,04		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		300 322		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=150°C		2,68 5,19		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					Tj=25°C Tj=150°C		254 259		A/μs
Reverse recovery energy	E_{rec}					Tj=25°C Tj=150°C		2,68 5,19		mWs
Thermal resistance junction to heatsink	$R_{th(j-s)}$	Thermal grease thickness≤50μm λ = 0,61 W/m·K						1,24		K/W
Thermal resistance junction to case	$R_{th(j-c)}$							0,82		
Thermistor										
Rated resistance	R_{25}					Tj=25°C		22		kΩ
Deviation of R_{100}	$D_{R/R}$	$R_{100} = 1486\ \Omega$				Tc=100°C	-12		12	%
Power dissipation	P					Tj=25°C		200		mW
Power dissipation constant						Tj=25°C		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				Tj=25°C		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				Tj=25°C		3998		K
Vincotech NTC Reference									B	

Output Inverter

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

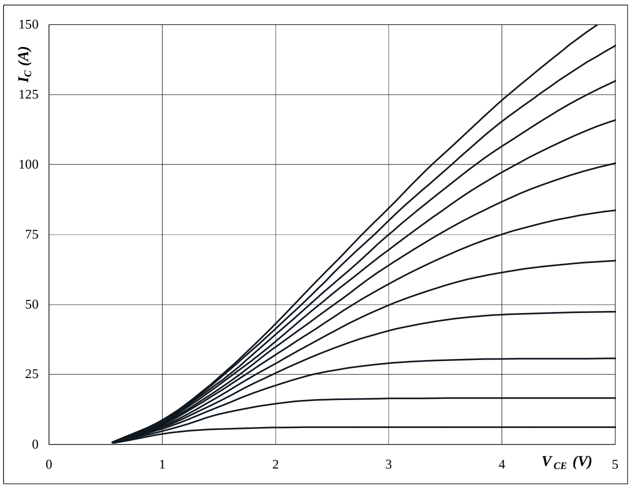
T_j = 25 °C

VGE from 7 V to 17 V in steps of 1 V

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

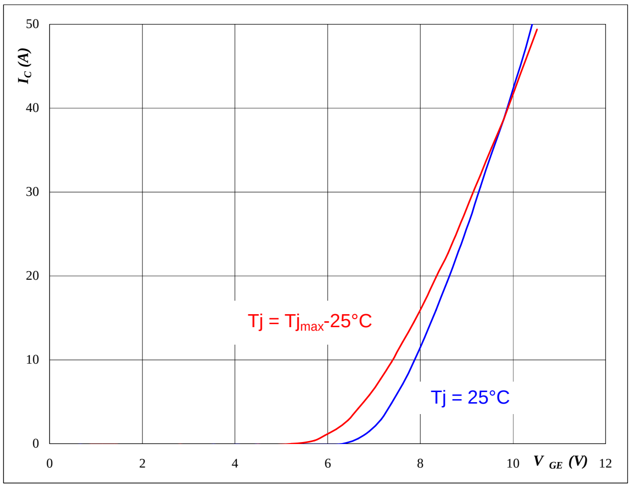
T_j = 150 °C

VGE from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_c = f(V_{GE})$



At

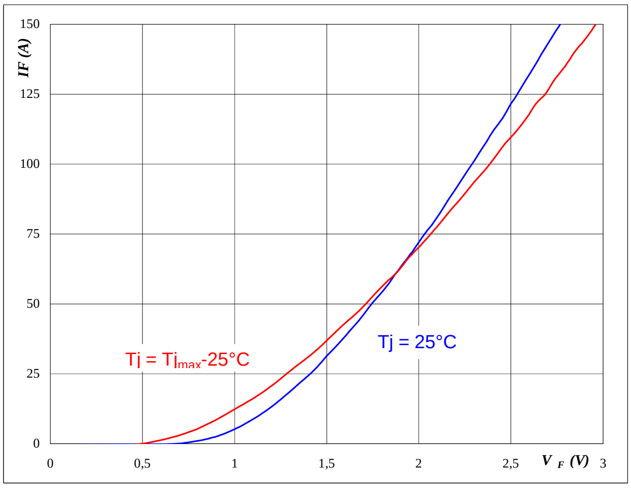
t_p = 250 µs

V_{CE} = 10 V

figure 4. **FWD**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

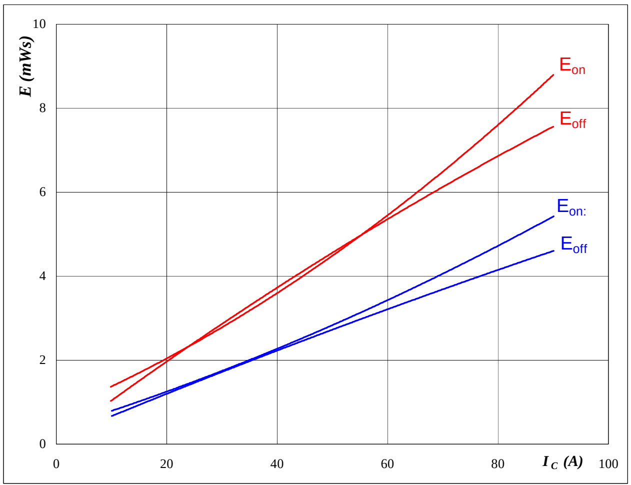
t_p = 250 µs

Output Inverter

figure 5. **IGBT**

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



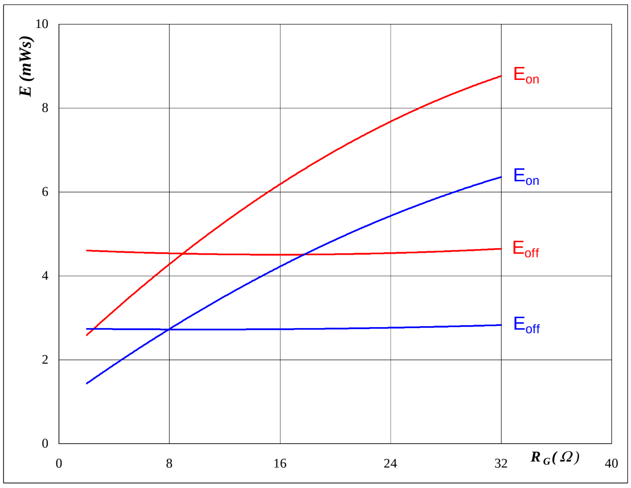
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

figure 6. **IGBT**

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



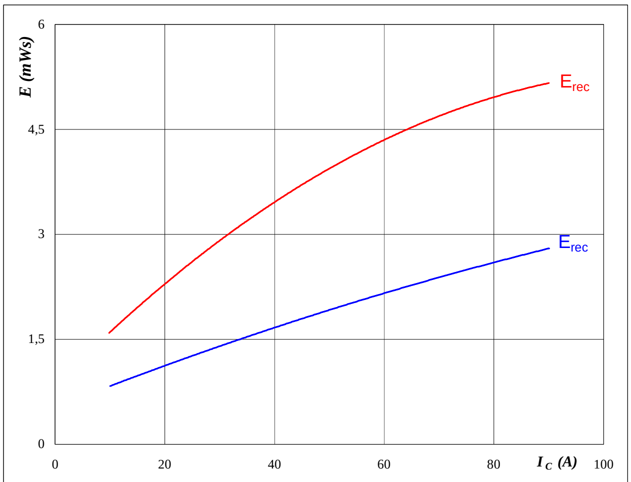
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	50	A

figure 7. **IGBT**

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_C)$



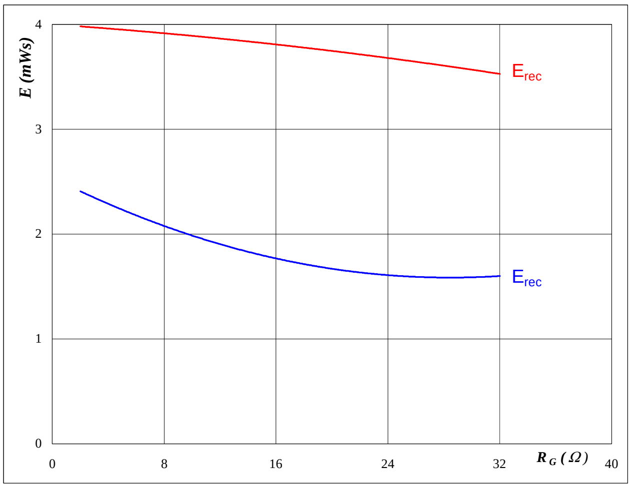
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

figure 8. **IGBT**

Typical reverse recovery energy loss
as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

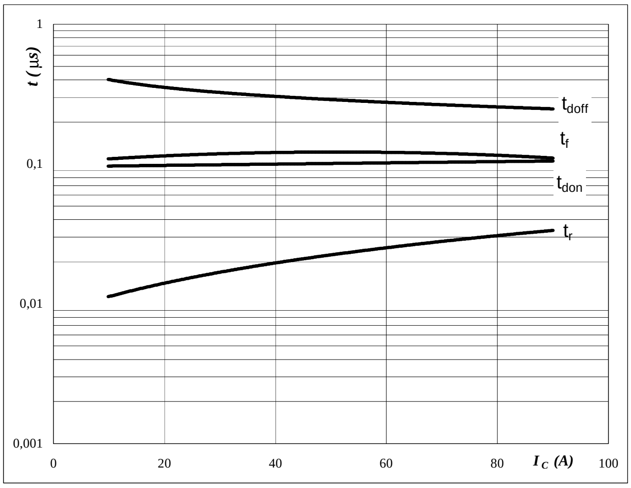
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	50	A

Output Inverter

figure 9. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



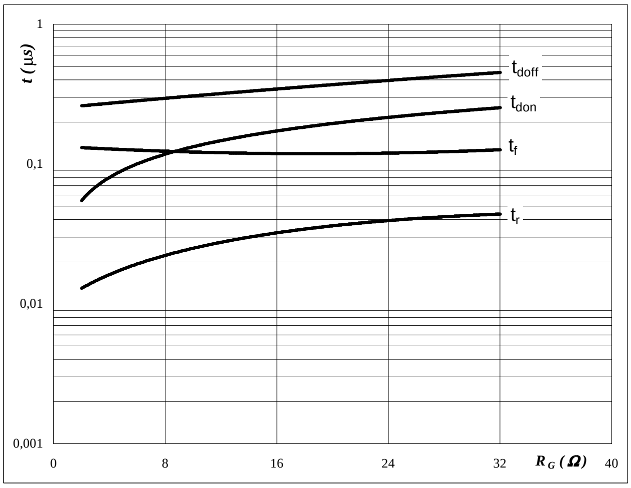
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

figure 10. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_G)$



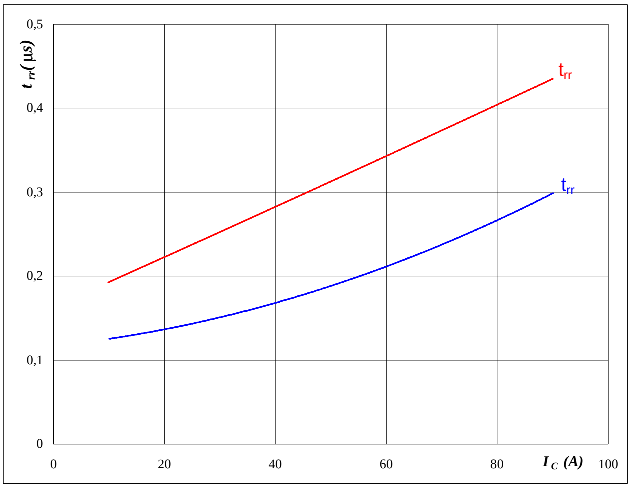
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	50	A

figure 11. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



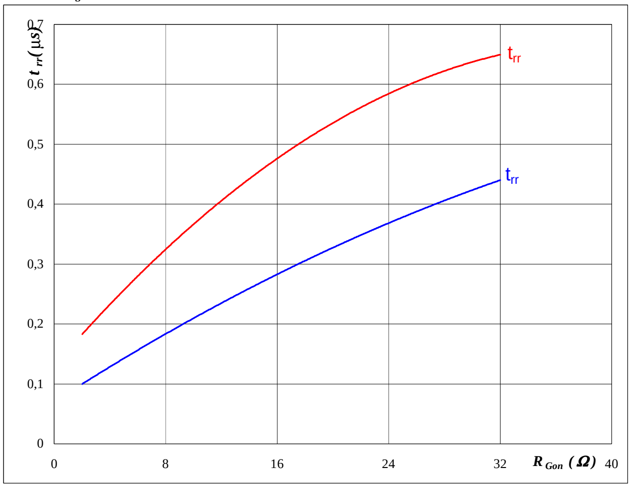
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

figure 12. **FWD**

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

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



At

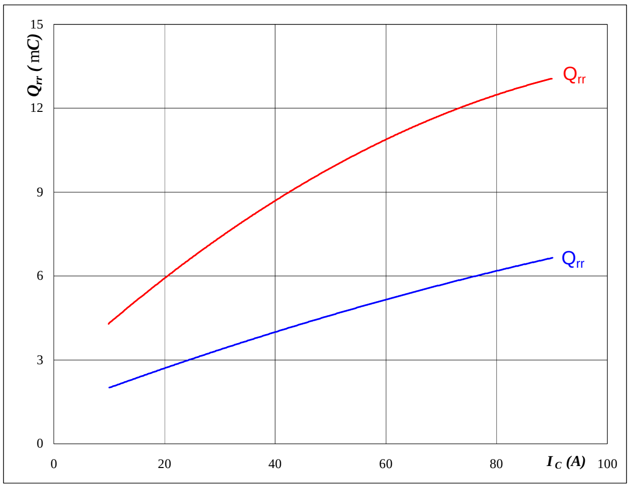
T_j =	25/150	°C
V_R =	600	V
I_F =	50	A
V_{GE} =	±15	V

Output Inverter

figure 13. **FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_c)$



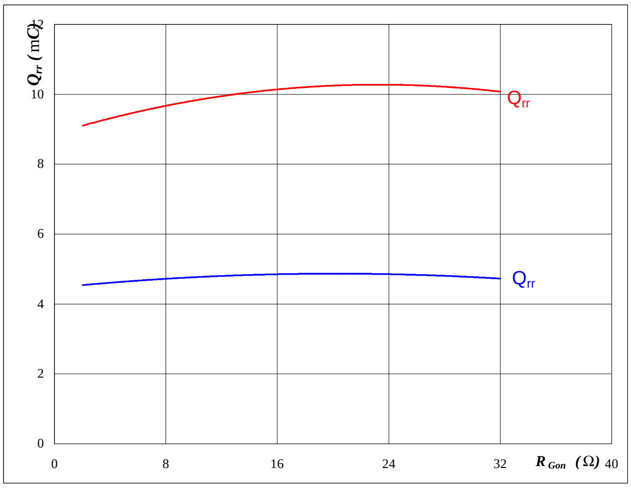
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

figure 14. **FWD**

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

$Q_{rr} = f(R_{gon})$



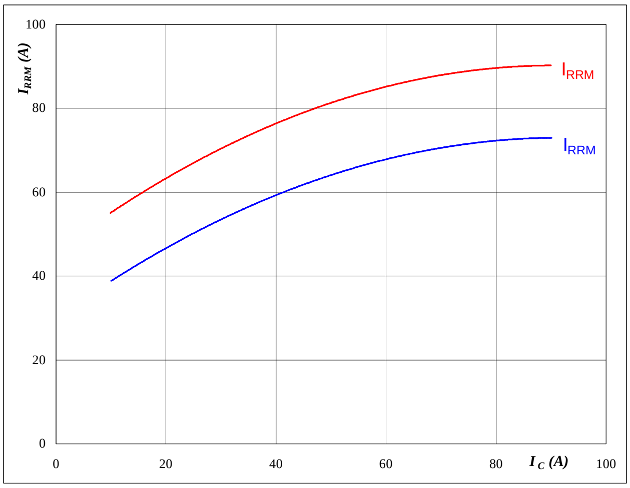
At

T_j =	25/150	°C
V_R =	600	V
I_F =	50	A
V_{GE} =	±15	V

figure 15. **FWD**

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_c)$



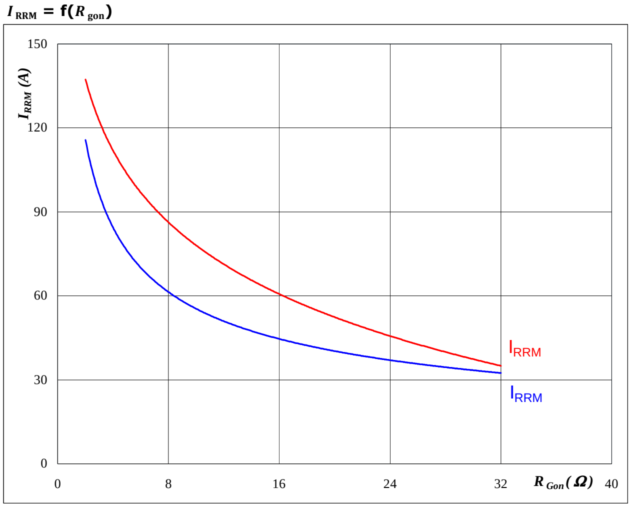
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

figure 16. **FWD**

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

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



At

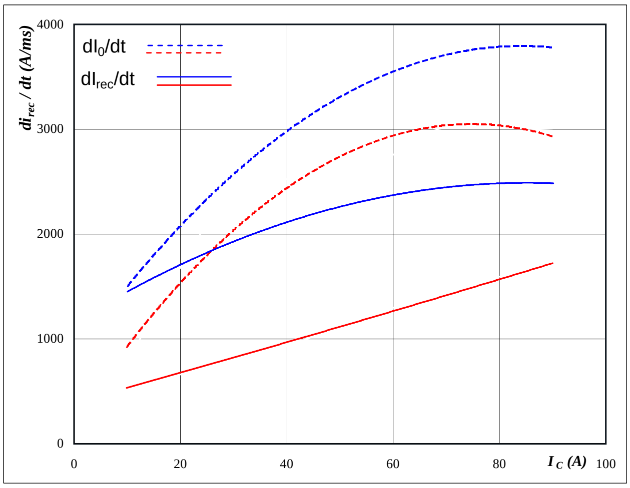
T_j =	25/150	°C
V_R =	600	V
I_F =	50	A
V_{GE} =	±15	V

Output Inverter

figure 17. **FWD**

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

$dI_0/dt, dI_{rec}/dt = f(I_C)$



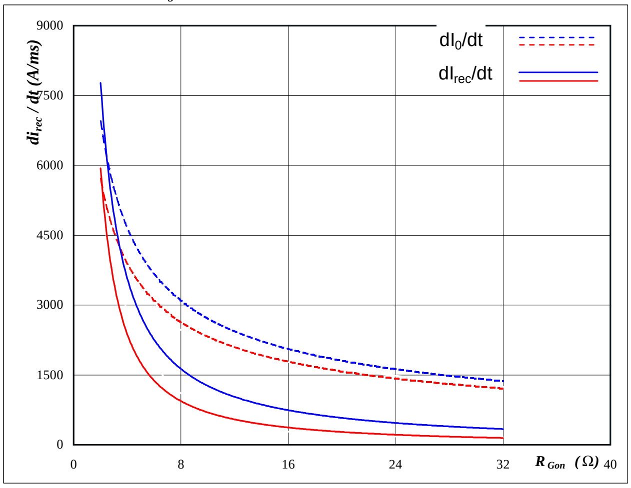
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

figure 18. **FWD**

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

$dI_0/dt, dI_{rec}/dt = f(R_{gon})$



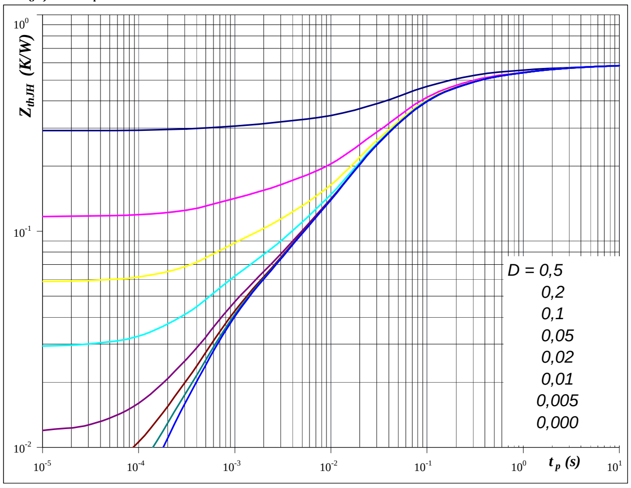
At

T_j =	25/150	°C
V_R =	600	V
I_F =	50	A
V_{GE} =	±15	V

figure 19. **IGBT**

IGBT transient thermal impedance as a function of pulse width

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



At

D = t_p / T

$R_{th(j\text{-}s)}$ = 0,583 K/W — Single device heated

$R_{th(j\text{-}s)}$ = 0,68 K/W — All devices heated

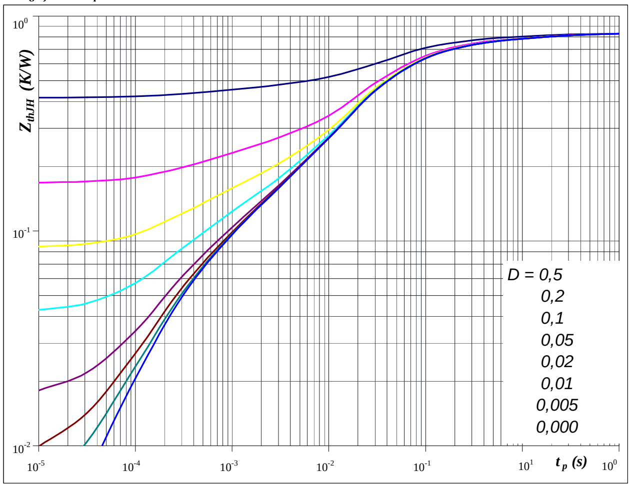
IGBT thermal model values

R (K/W)	Tau (s)	R (K/W)	Tau (s)
6,70E-02	2,10E+00	1,68E-01	2,10E+00
1,25E-01	2,43E-01	1,25E-01	2,43E-01
2,70E-01	5,10E-02	2,70E-01	5,10E-02
7,97E-02	1,21E-02	7,97E-02	1,21E-02
4,11E-02	8,63E-04	4,11E-02	8,63E-04

figure 20. **FWD**

FWD transient thermal impedance as a function of pulse width

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



At

D = t_p / T

$R_{th(j\text{-}s)}$ = 0,83 K/W — Single device heated

$R_{th(j\text{-}s)}$ = 0,83 K/W — All devices heated

FWD thermal model values

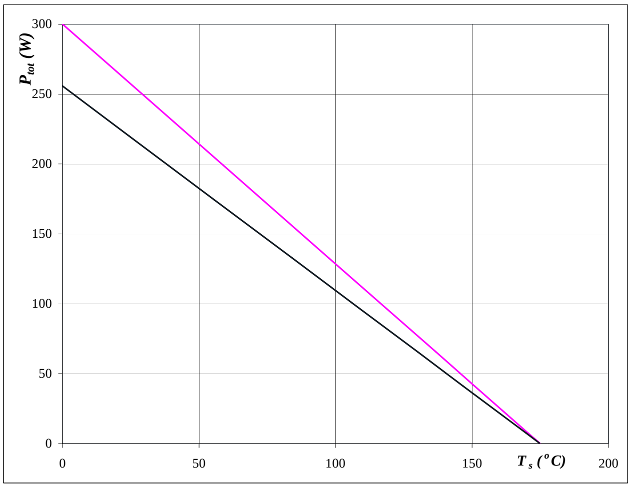
R (K/W)	Tau (s)	R (K/W)	Tau (s)
2,00E-02	9,74E+00	2,00E-02	9,74E+00
7,74E-02	1,11E+00	7,74E-02	1,11E+00
2,22E-01	1,27E-01	2,22E-01	1,27E-01
3,93E-01	2,45E-02	3,93E-01	2,45E-02
6,96E-02	1,97E-03	6,96E-02	1,97E-03
5,24E-02	2,88E-04	5,24E-02	2,88E-04

Output Inverter

figure 21. **IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



At

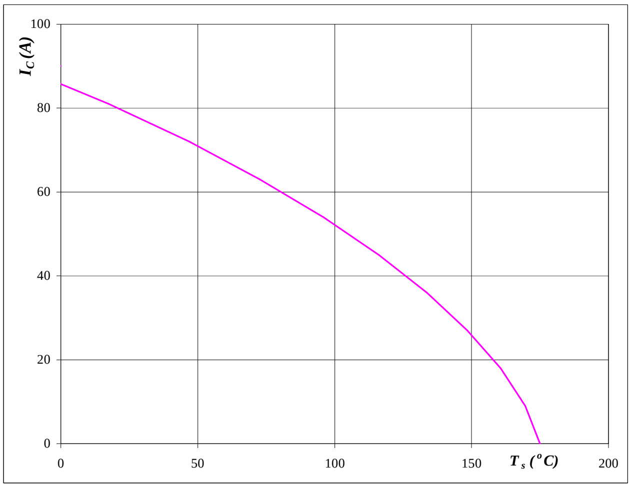
T_j = 175 °C

single heating
overall heating

figure 22. **IGBT**

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

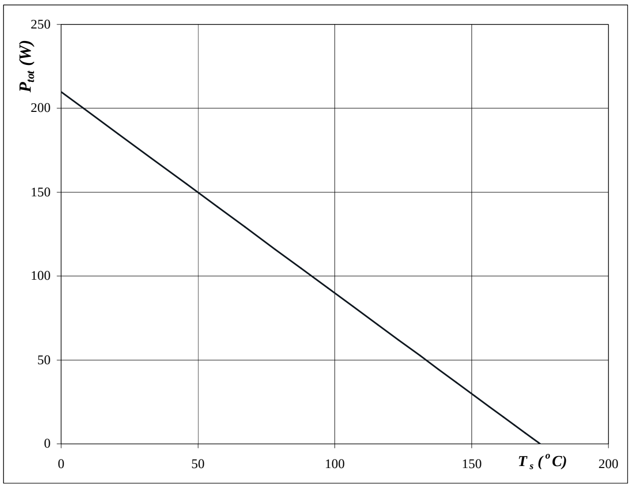
T_j = 175 °C

V_{GE} = 15 V

figure 23. **FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



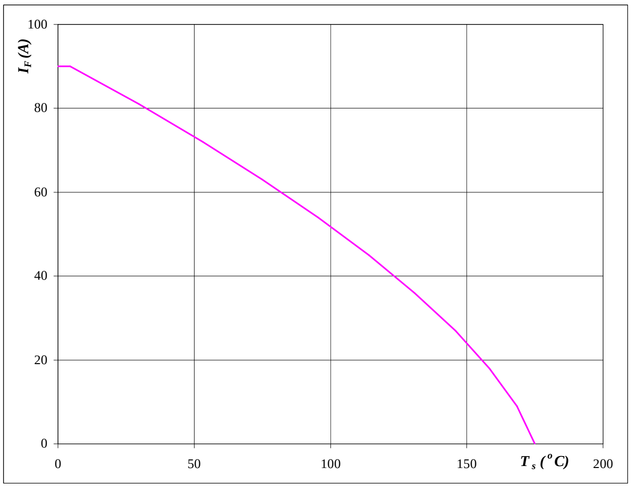
At

T_j = 175 °C

figure 24. **FWD**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

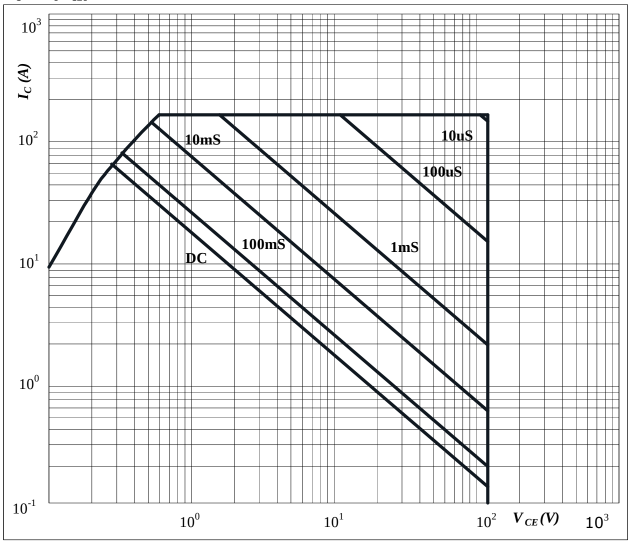
T_j = 175 °C

Output Inverter

figure 25. **IGBT**

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



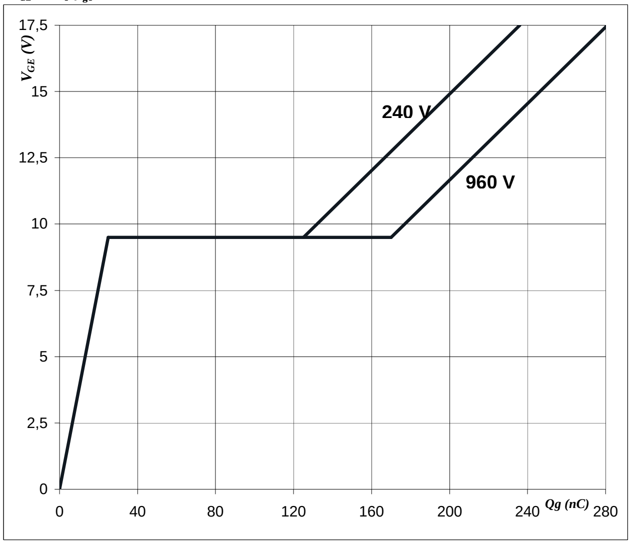
At

D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	ºC

figure 26. **IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



At

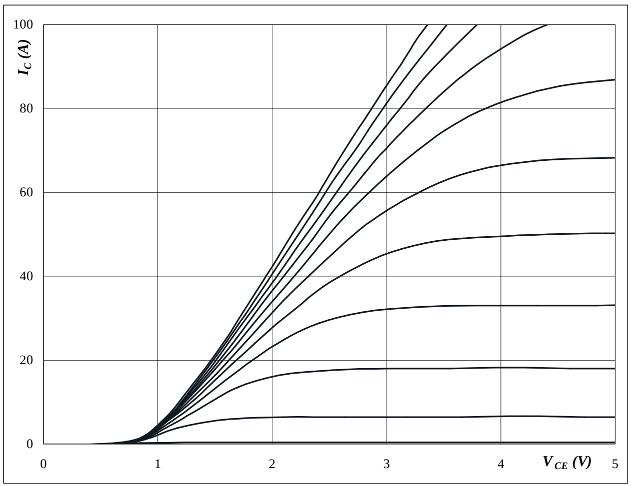
I_C =	50	A

Brake

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

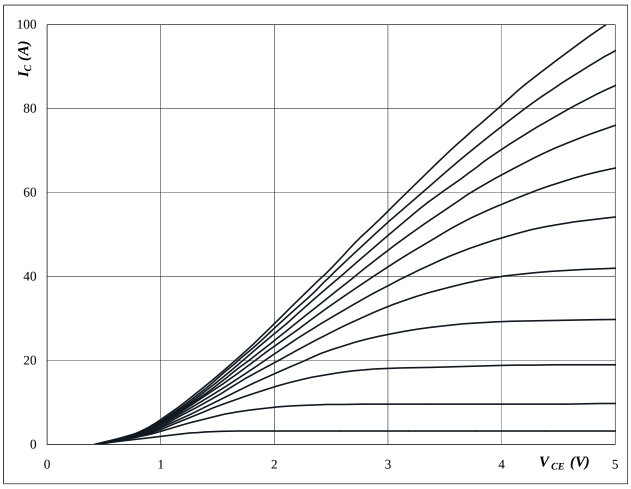
T_j = 25 °C

VGE from 7 V to 17 V in steps of 1 V

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

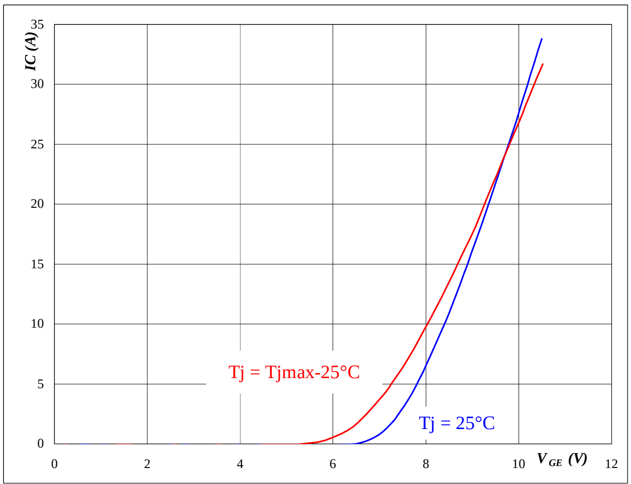
T_j = 150 °C

VGE from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$



At

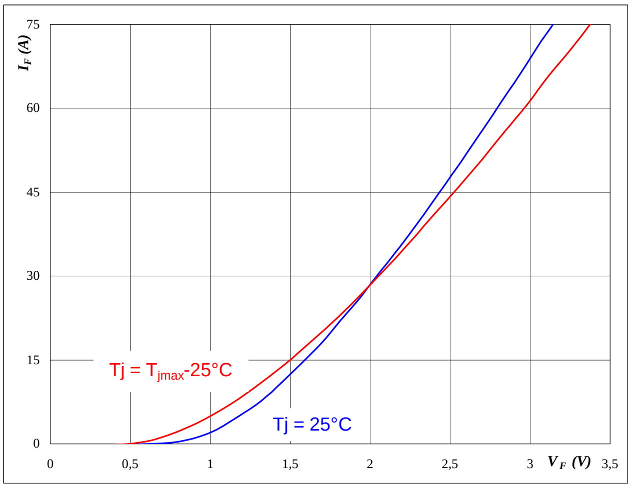
t_p = 250 µs

V_{CE} = 10 V

figure 4. **FWD**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

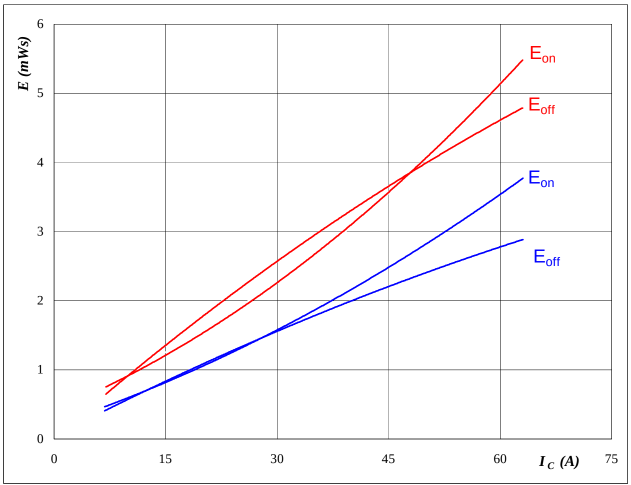
t_p = 250 µs

Brake

figure 5. **IGBT**

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



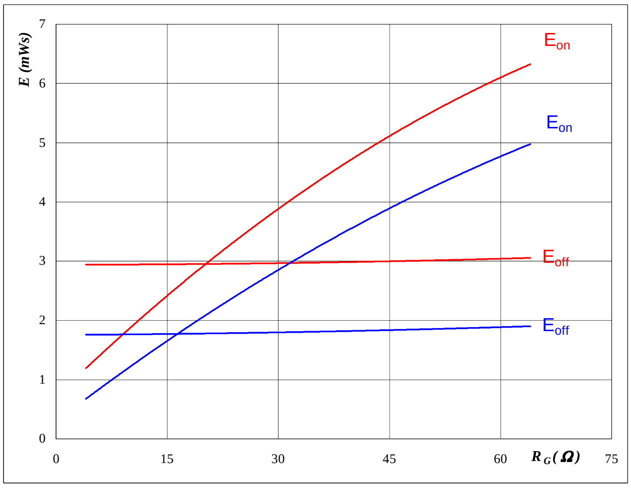
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 6. **IGBT**

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



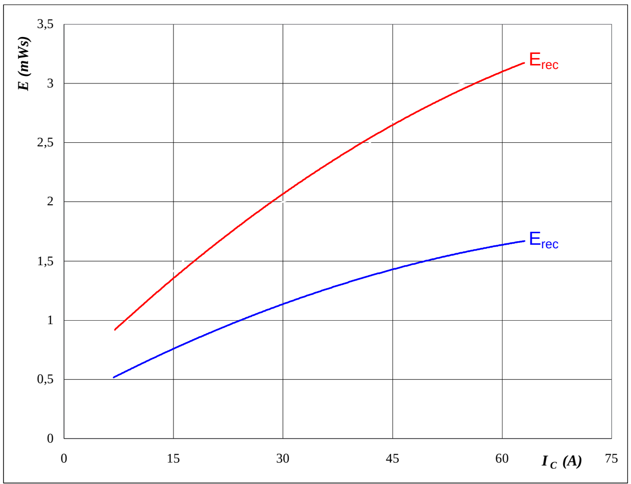
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	35	A

figure 7. **IGBT**

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_C)$



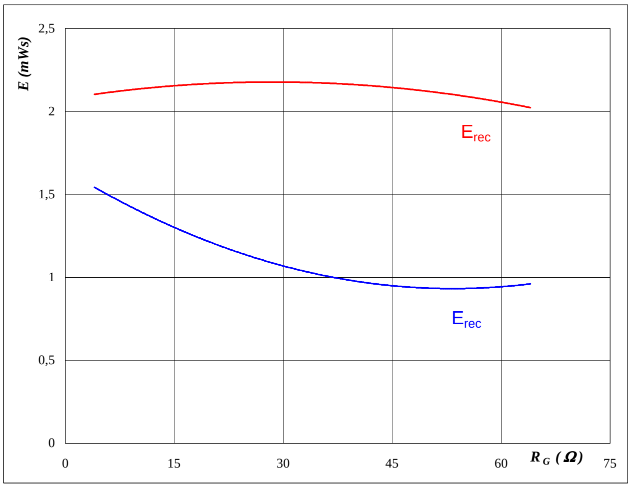
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

figure 8. **IGBT**

Typical reverse recovery energy loss
as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

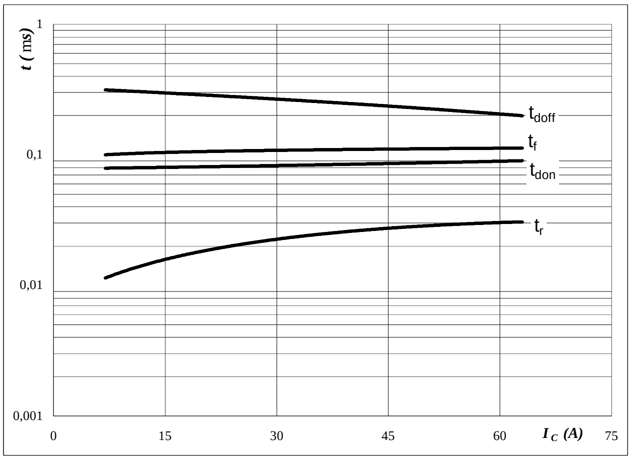
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	35	A

Brake

figure 9.	IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



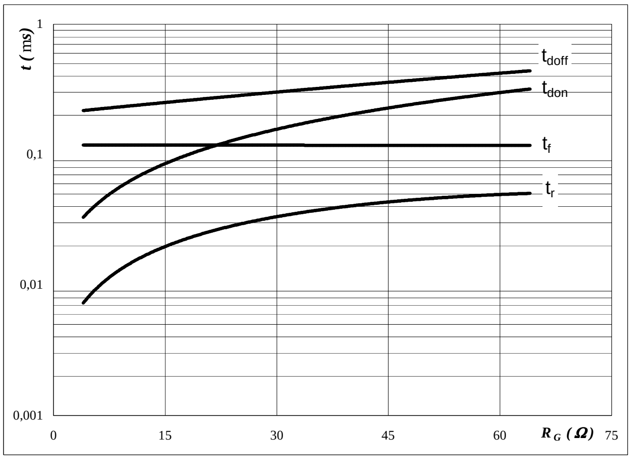
With an inductive load at

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

figure 10.	IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



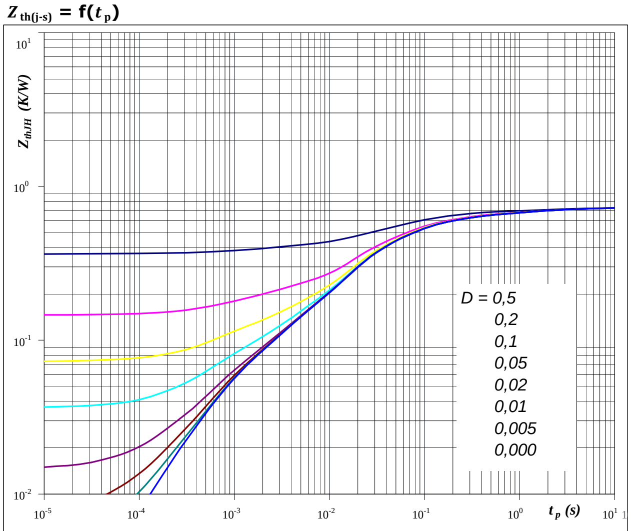
With an inductive load at

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

figure 11.	IGBT

IGBT transient thermal impedance as a function of pulse width

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



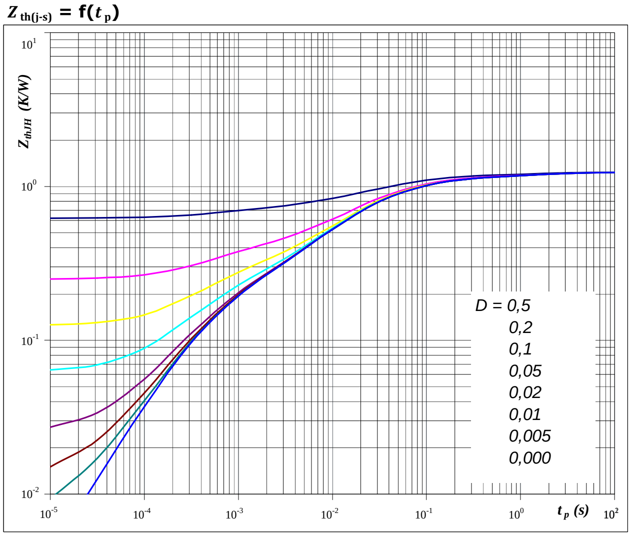
At

D =	t_p / T	
$R_{th(j\text{-}s)}$ =	0,73	K/W

figure 12.	IGBT

FWD transient thermal impedance as a function of pulse width

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



At

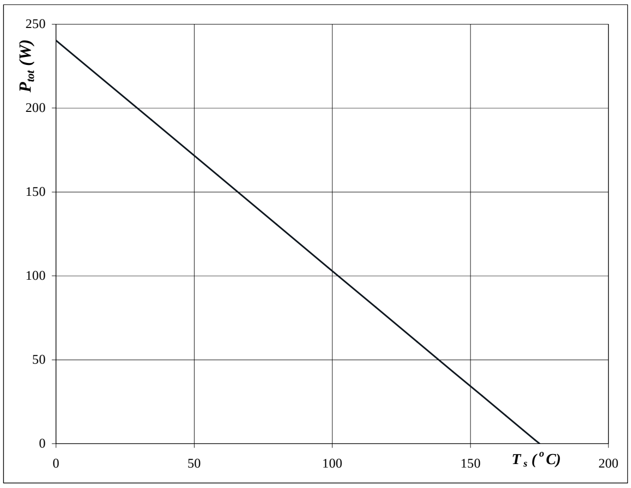
D =	t_p / T	
$R_{th(j\text{-}s)}$ =	1,24	K/W

Brake

figure 13. **IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



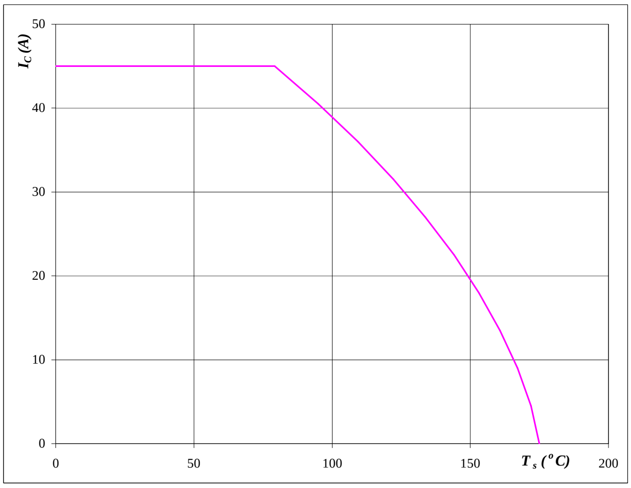
At

T_j = 175 °C

figure 14. **IGBT**

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

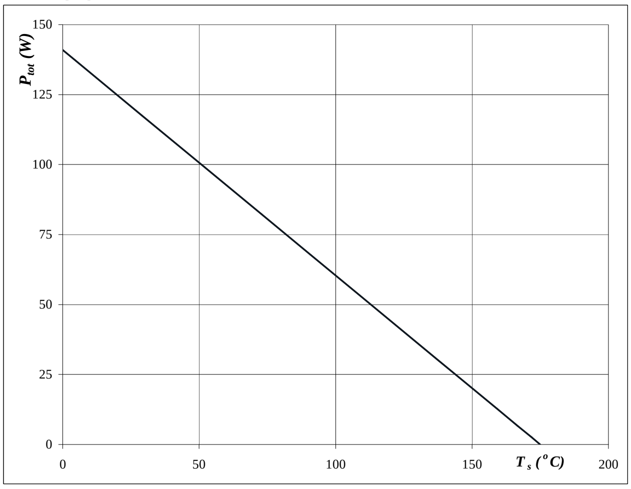
T_j = 175 °C

V_{GE} = 15 V

figure 15. **FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



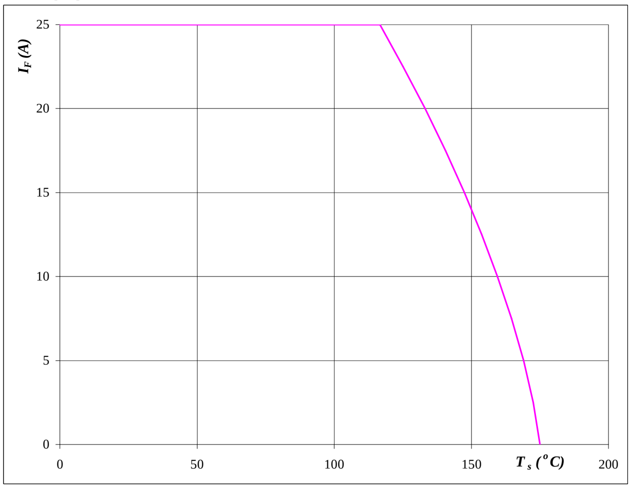
At

T_j = 175 °C

figure 16. **FWD**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

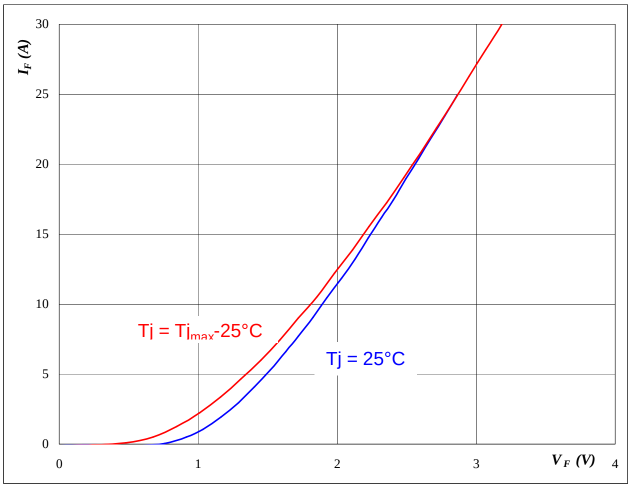
T_j = 175 °C

Brake Inverse Diode

figure 1. **Brake inverse diode**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



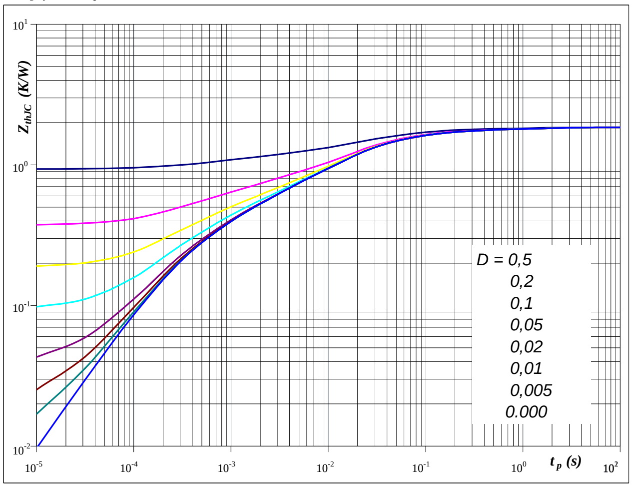
At

t_p = 250 µs

figure 2. **Brake inverse diode**

Diode transient thermal impedance as a function of pulse width

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



At

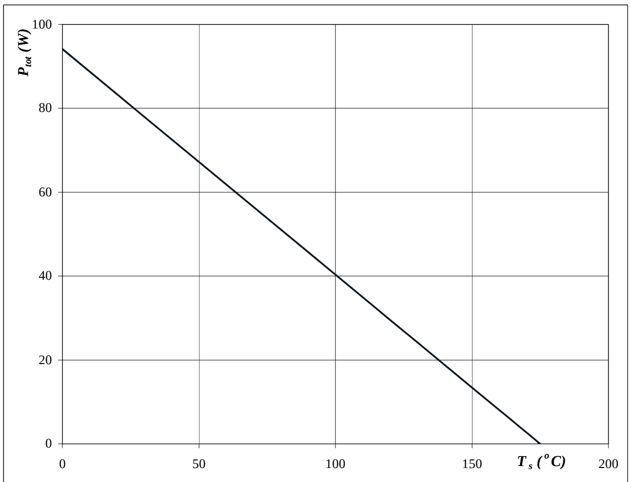
D = t_p / T

$R_{th(j-s)}$ = 1,86 K/W

figure 3. **Brake inverse diode**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



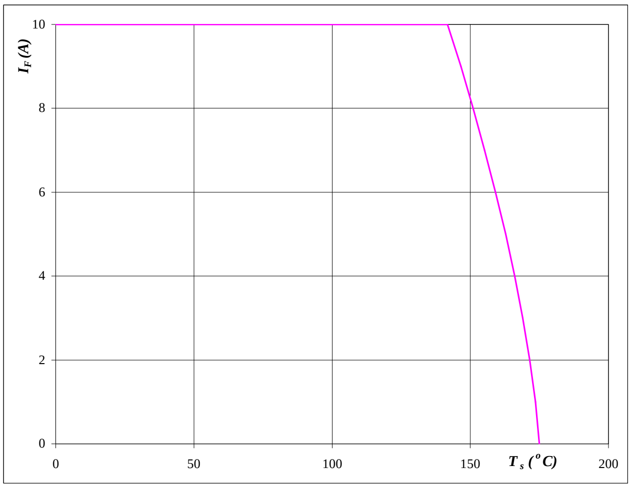
At

T_j = 175 ºC

figure 4. **Brake inverse diode**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

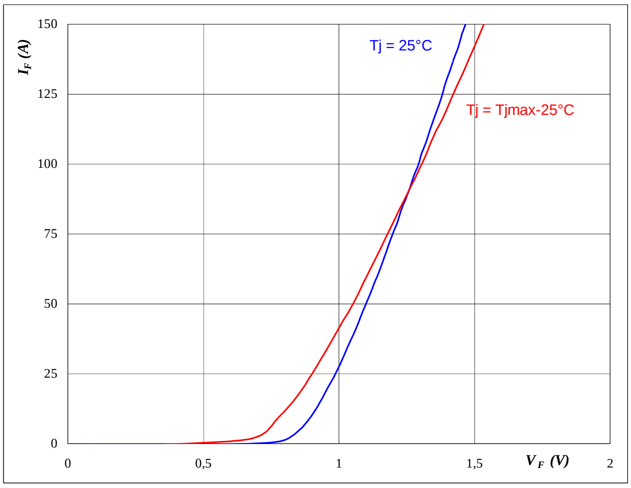
T_j = 175 ºC

Input Rectifier Bridge

figure 1. **Rectifier Diode**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



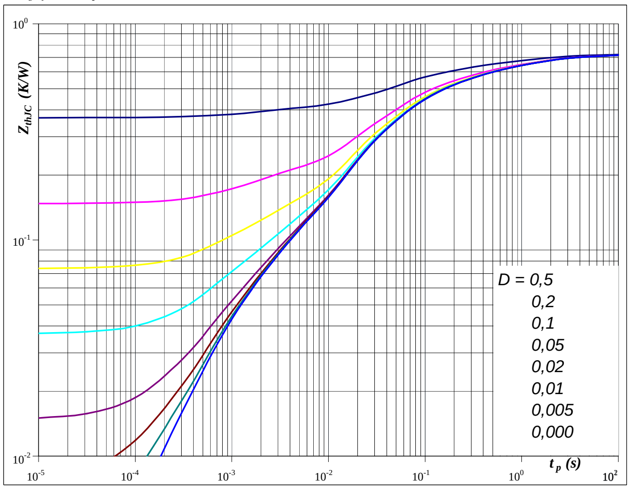
At

t_p = 250 µs

figure 2. **Rectifier Diode**

Diode transient thermal impedance as a function of pulse width

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



At

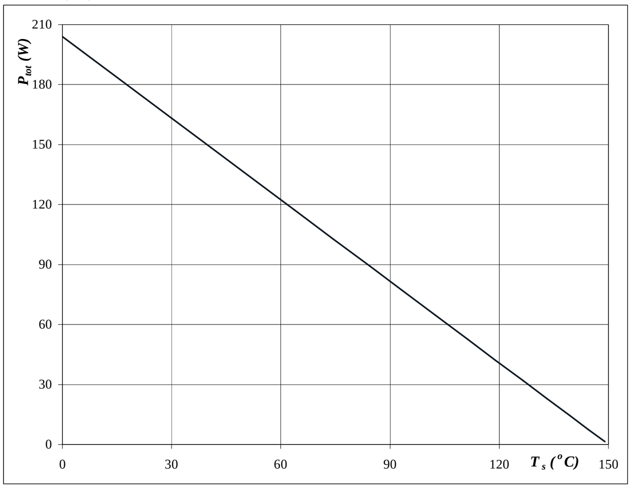
D = t_p / T

$R_{th(j-s)}$ = 0,74 K/W

figure 3. **Rectifier Diode**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



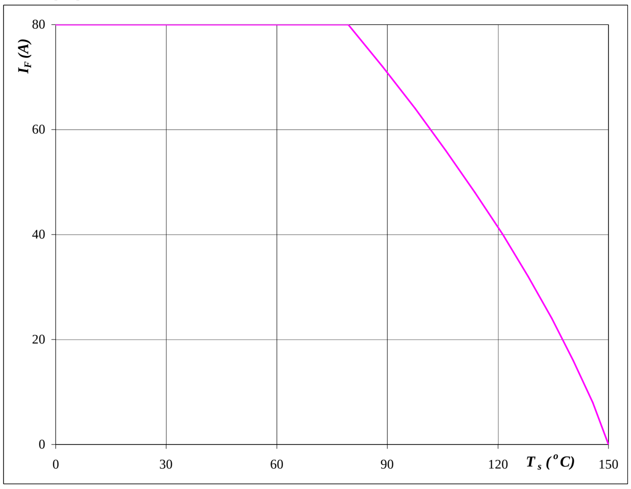
At

T_j = 150 ºC

figure 4. **Rectifier Diode**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



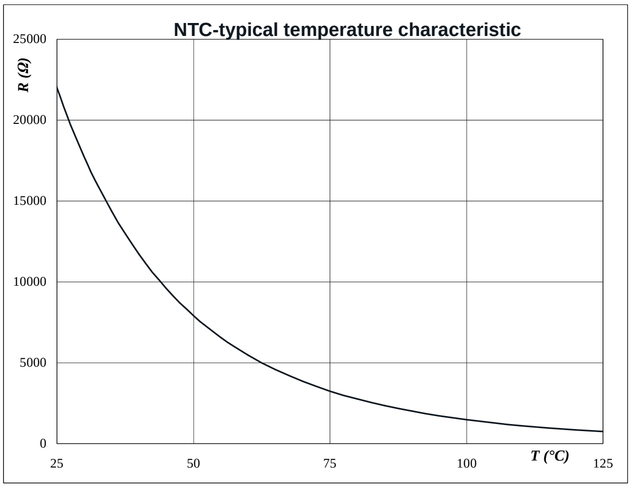
At

T_j = 150 ºC

Thermistor

figure 1. **Thermistor**

Typical NTC characteristic
as a function of temperature
$R_T = f(T)$



Switching Definitions Output Inverter

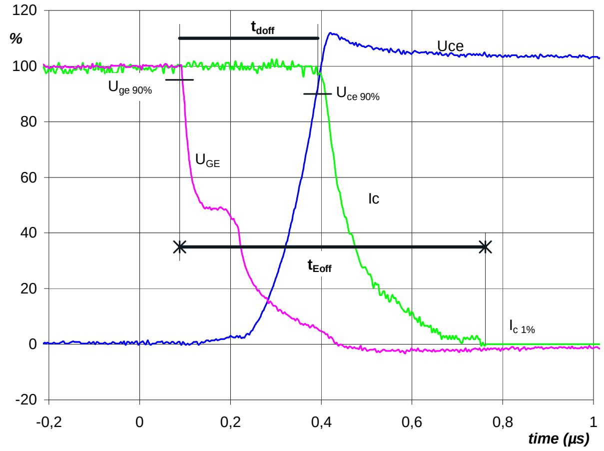
General conditions

T_j	=	150 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

figure 1. **IGBT**

Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}

(t_{Eoff} = integrating time for E_{off})

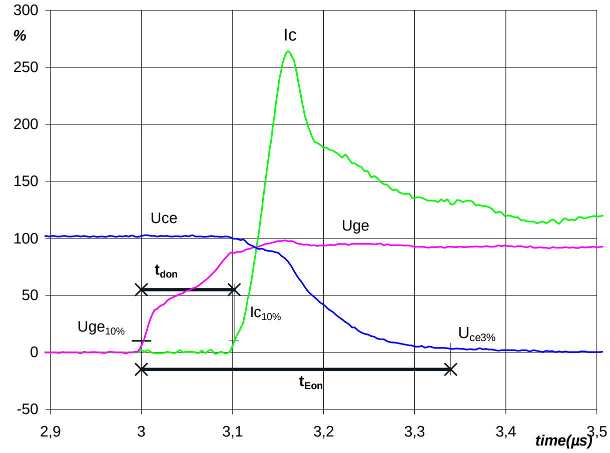


V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	50	A
t_{doff} =	0,30	μs
$t_{E\,off}$ =	0,67	μs

figure 2. **IGBT**

Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}

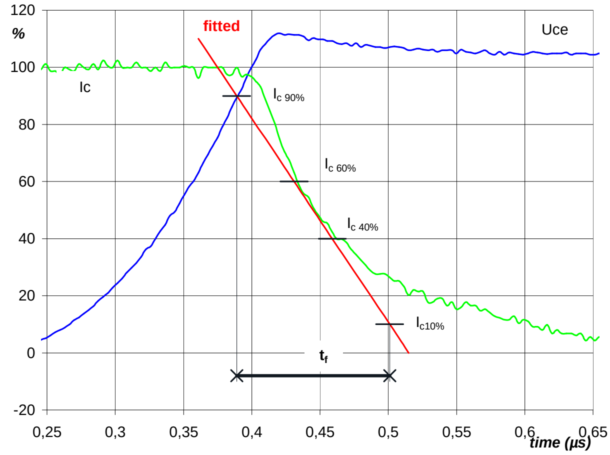
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	50	A
t_{don} =	0,10	μs
$t_{E\,on}$ =	0,34	μs

figure 3. **IGBT**

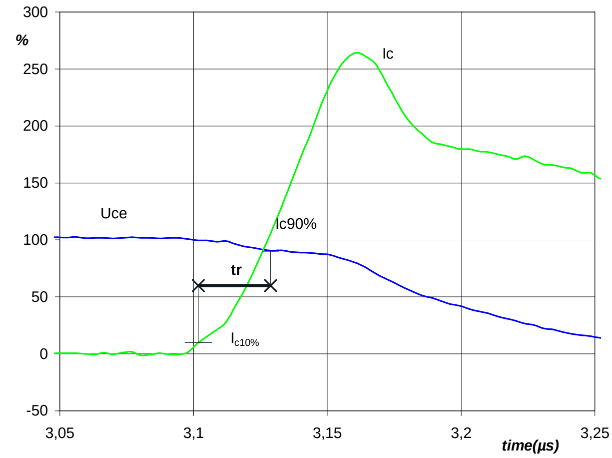
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	50	A
t_f =	0,12	μs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

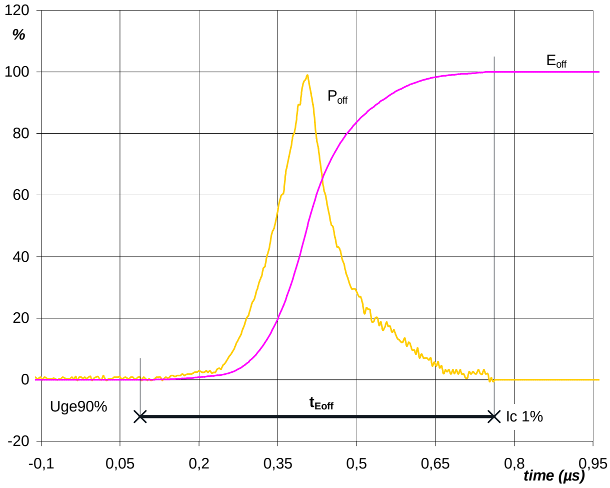


V_C (100%) =	600	V
I_C (100%) =	50	A
t_r =	0,02	μs

Switching Definitions Output Inverter

figure 5. **IGBT**

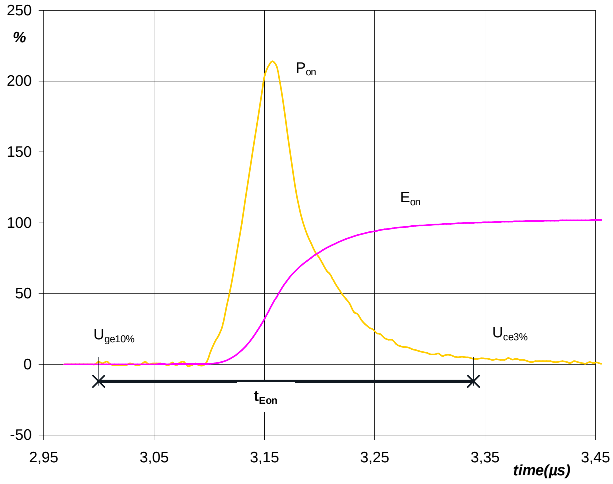
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	29,95	kW
E_{off} (100%) =	4,48	mJ
$t_{E\ off}$ =	0,67	µs

figure 6. **IGBT**

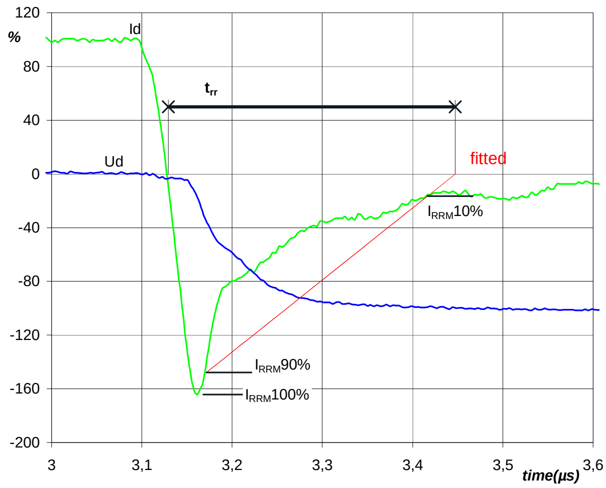
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	29,95	kW
E_{on} (100%) =	4,50	mJ
$t_{E\ on}$ =	0,34	µs

figure 7. **FWD**

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

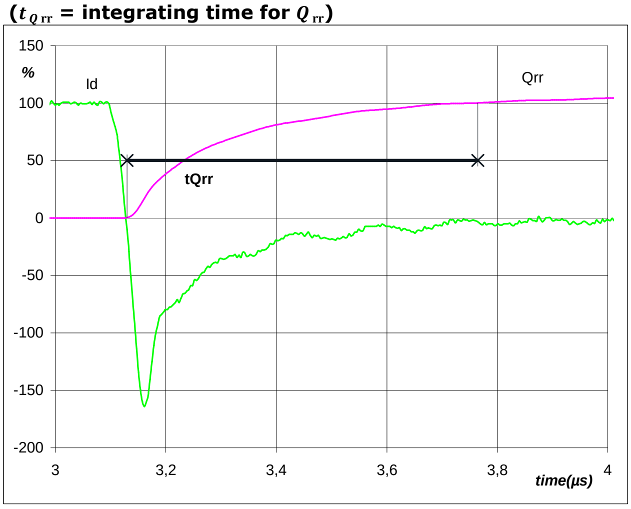


V_d (100%) =	600	V
I_d (100%) =	50	A
I_{RRM} (100%) =	-82	A
t_{rr} =	0,31	µs

Switching Definitions Output Inverter

figure 8.	FWD

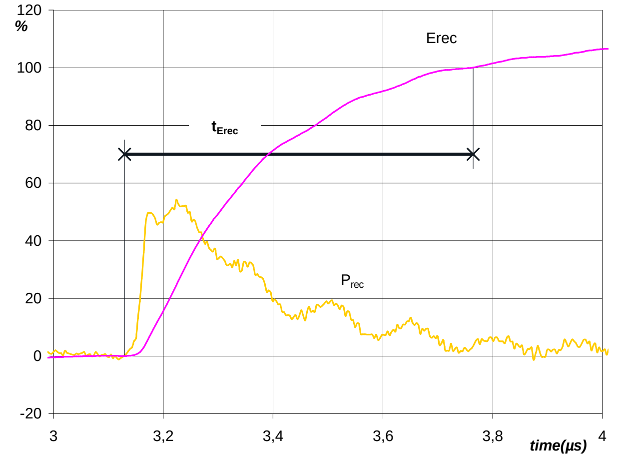
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	50	A
Q_{rr} (100%) =	9,95	µC
t_{Qint} =	0,64	µs

figure 9.	FWD

Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	29,95	kW
E_{rec} (100%) =	3,98	mJ
$t_{E\,rec}$ =	0,64	µs

Ordering Code and Marking - Outline - Pinout

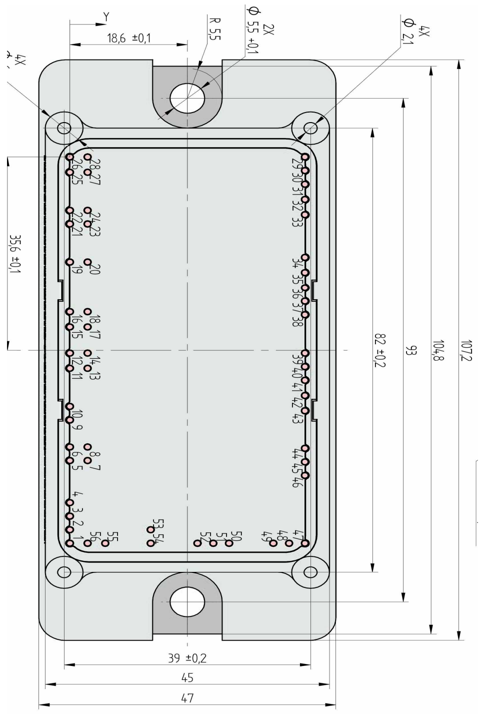
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste with Solder pins	V23990-P768-A-PM	P768A	P768A
without thermal paste with Press-fit pins	V23990-P768-AY-PM	P768AY	P768AY
with thermal paste with Solder pins	V23990-P768-A-/3/-PM	P768A	P768A-/3/
with thermal paste with Press-fit pins	V23990-P768-AY-/3/-PM	P768AY	P768AY-/3/

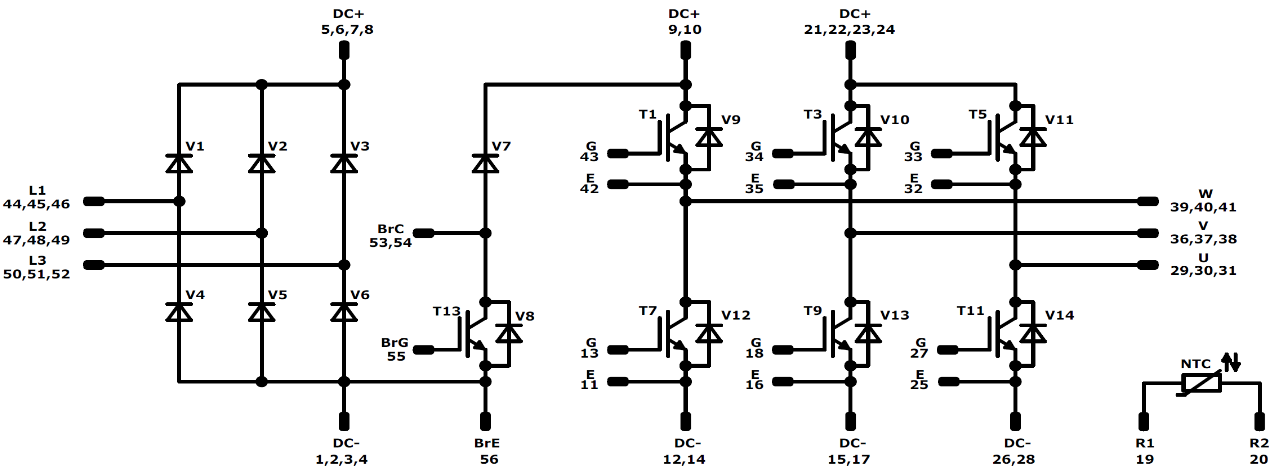
Outline

Pin table

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



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1,T3,T5,T7,T9,T11	IGBT	1200V	50A	Inverter Switch	
V9,V10,V11, V12,V13,V14	FWD	1200V	50A	Inverter Diode	
T13	IGBT	1200V	50A	Brake Switch	
V7	FWD	1200V	25A	Brake Diode	
V8	FWD	1200V	10A	Brake Inverse Diode	
V1,V2,V3,V4,V5,V6	Rectifier	1600V	50A	Rectifier	
NTC	NTC	-	-	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.

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-P768-A-D7-14	08 Feb. 2017		