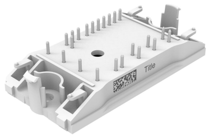
flow PIM 0 — 1200 V / 4 A

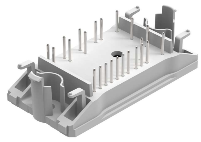
Features

- 2 Clips housing in 12 and 17 mm height
- Trench Fieldstop Technology IGBT4
- Optional w/o BRC

flow 0 housing



12 mm housing

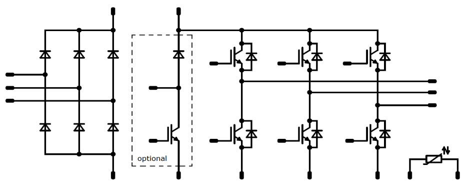


17 mm housing

Target Applications

- Industrial Drives
- Embedded Generation

Schematic



Types

- V23990-P848-A48
- V23990-P848-A49
- V23990-P848-C48
- V23990-P848-C49

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Rectifier Diode					
Repetitive peak reverse voltage	V_{RRM}			1600	V
DC forward current	I_{FAV}	$T_j = T_{jmax}$	T_s = 80 °C	35	A
Surge (non-repetitive) forward current	I_{FSM}	t_p = 10 ms		220	A
I^2t-value	I^2t			200	A^2s
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	67	W
Maximum Junction Temperature	T_{jmax}			150	°C
Inverter Switch					
Collector-emitter breakdown voltage	V_{CE}			1200	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	10	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		12	A
Turn off safe operating area		V_{CE} ≤ 1200V, $T_j \le T_{op\ max}$		8	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	47	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V		10 800	μs V
Maximum Junction Temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	15	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		32	A
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 breakdown voltage	V_{CE}			1200	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	10	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		12	A
Turn off safe operating area		V_{CE} ≤ 1200 V, $T_j \le T_{op\ max}$		8	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	47	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V		10 800	μs V
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward 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
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	25	W
Maximum Junction Temperature	T_{jmax}			175	°C
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{is}	t = 2 s	DC Test Voltage	4000	V
Creepage distance				min 12,7	mm
Clearance		with 12 mm housing / with 17 mm housing		9,84 / 12,7	mm
Comparative tracking index	CTI			>200	

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	
Rectifier Diode										
Forward voltage	V_F				30	25 125		1,2 1,17	1,8	V
Threshold voltage (for power loss calc. only)	V_{to}				30	25 125		0,93 0,8		V
Slope resistance (for power loss calc. only)	r_t				30	25 125		11 15		mΩ
Reverse current	I_r			1600		25			0,1	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,60		K/W
Inverter Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0008	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	25 125		1,95 2,28		V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		25			0,05	mA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 64 Ω R_{gon} = 64 Ω	±15	600	4	25 125		77 75		ns
Rise time	t_r					25 125		18 23		
Turn-off delay time	$t_{d(off)}$					25 125		176 226		
Fall time	t_f					25 125		83 110		
Turn-on energy loss	E_{on}					25 125		0,32 0,56		mWs
Turn-off energy loss	E_{off}					25 125		0,21 0,31		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		250		pF
Output capacitance	C_{oss}							25		
Reverse transfer capacitance	C_{rss}							15		
Gate charge	Q_G		±15	960	4	25		25		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,03		K/W
Inverter Diode										
Diode forward voltage	V_F				10	25 125	1,35	1,41 1,25	2,2	V
Peak reverse recovery current	I_{RRM}	R_{gon} = 64 Ω	15	600	10	25 125		5,24 6,35		A
Reverse recovery time	t_{rr}					25 125		248 431		ns
Reverse recovered charge	Q_{rr}					25 125		0,58 1,24		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		95 49		A/μs
Reverse recovered energy	E_{rec}					25 125		0,21 0,47		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,07		K/W

Characteristic Values

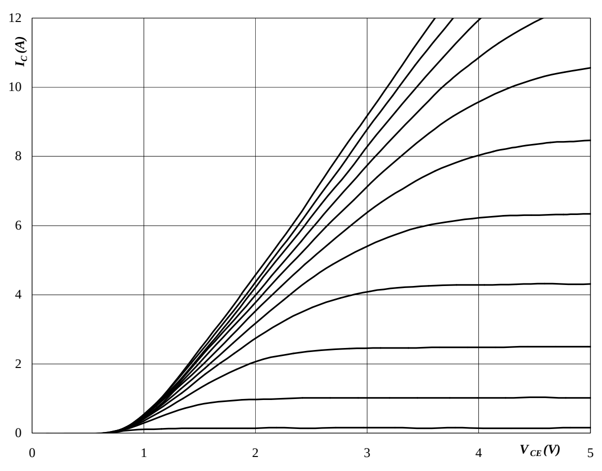
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	
Brake Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00015	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		4	25 125		1,96 2,27		V
Collector-emitter cut-off incl diode	I_{CES}		0	1200		25			0,05	mA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 64 Ω R_{gon} = 64 Ω	±15	600	4	25 125		78 75		ns
Rise time	t_r					25 125		18 24		
Turn-off delay time	$t_{d(off)}$					25 125		170 217		
Fall time	t_f					25 125		81 103		
Turn-on energy loss	E_{on}					25 125		0,24 0,36		mWs
Turn-off energy loss	E_{off}					25 125		0,22 0,33		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		250		pF
Output capacitance	C_{oss}							25		
Reverse transfer capacitance	C_{rss}							15		
Gate charge	Q_G		15	960	4	25		25		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,03		K/W
Brake Diode										
Diode forward voltage	V_F				4	25 125	1	1,88 1,79	2,35	V
Reverse leakage current	I_r			1200		25			250	µA
Peak reverse recovery current	I_{RRM}	R_{gon} = 64 Ω R_{gon} = 64 Ω	15	600	4	25 125		4,03 4,52		A
Reverse recovery time	t_{rr}					25 125		276 485		ns
Reverse recovered charge	Q_{rr}					25 125		0,43 0,43		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		37 31		A/µs
Reverse recovery energy	E_{rec}					25 125		0,17 0,38		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,80		K/W
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				25		3962		K
B-value	$B_{(25/100)}$	Tol. ±3%				25		4000		K
Vincotech NTC Reference									I	

Output Inverter

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

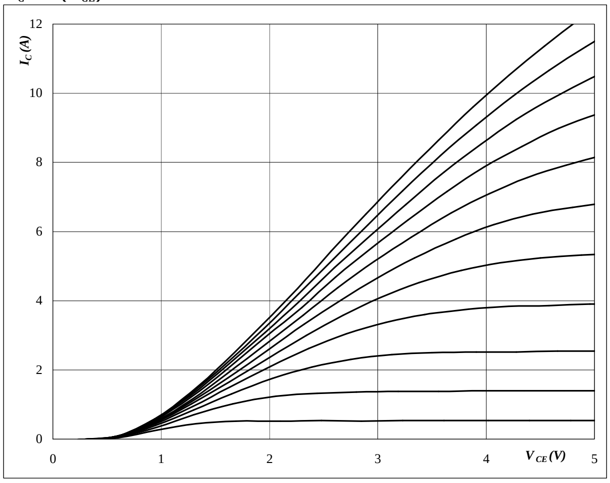
T_j = 25 °C

V_{GE} 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

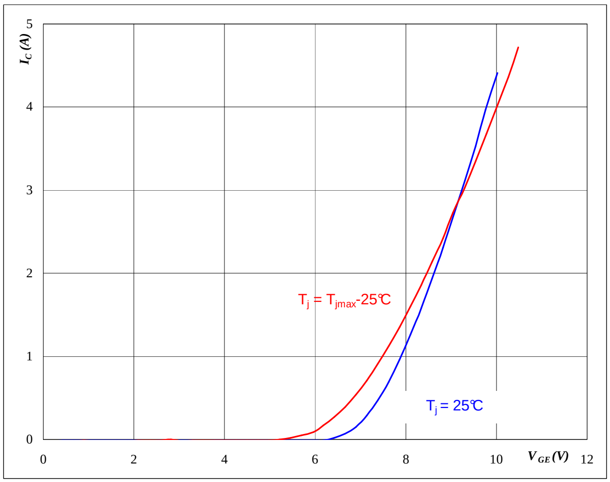
T_j = 150 °C

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

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$



At

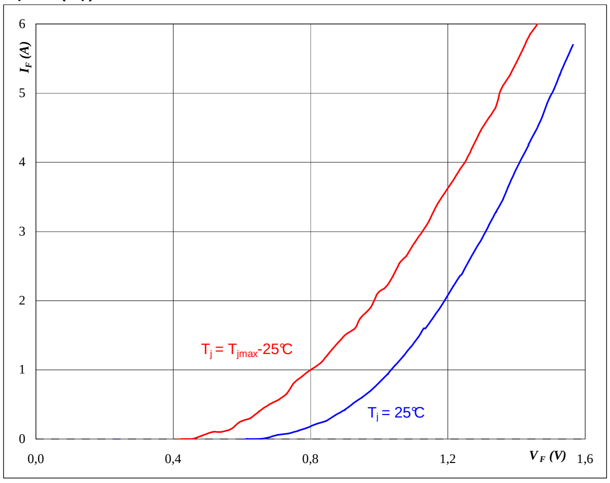
t_p = 250 µs

V_{CE} = 10 V

figure 4. **FWD**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

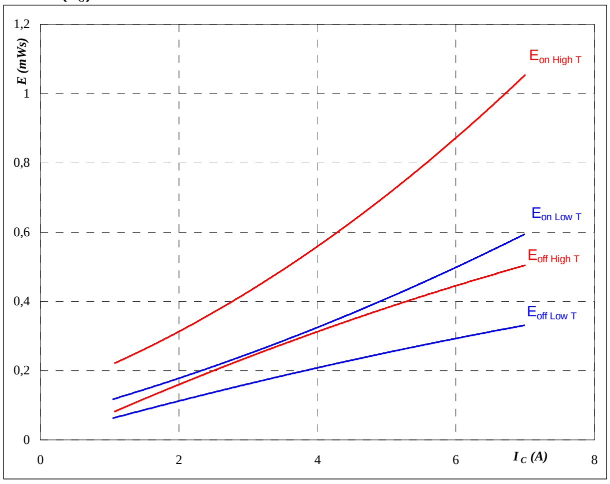
t_p = 250 µs

Output Inverter

figure 5. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



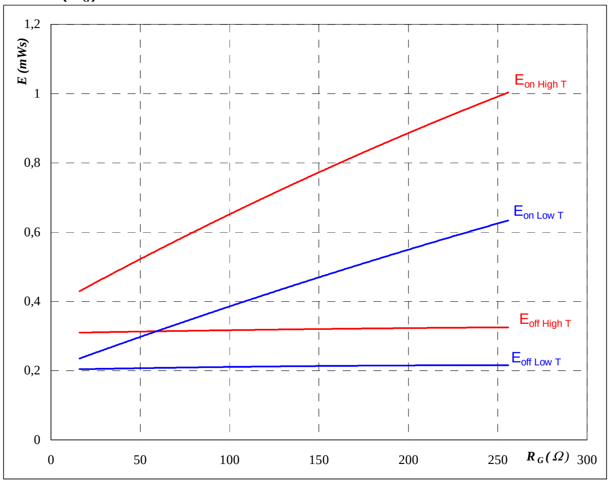
With an inductive load at

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

figure 6. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



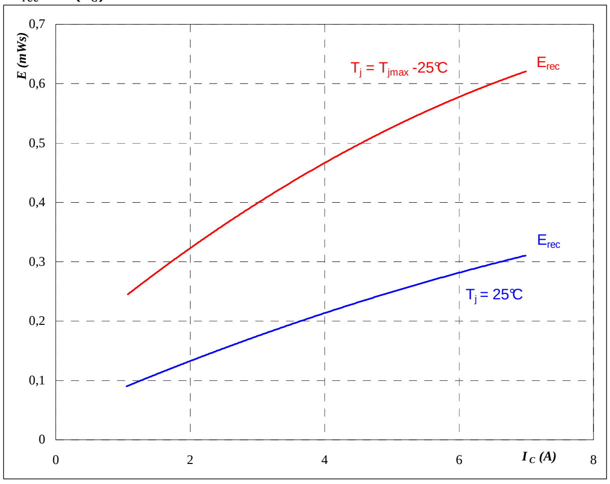
With an inductive load at

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

figure 7. **FWD**

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



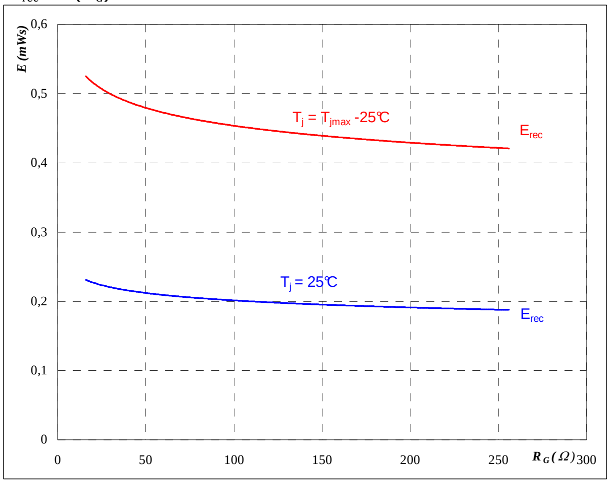
With an inductive load at

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

figure 8. **FWD**

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

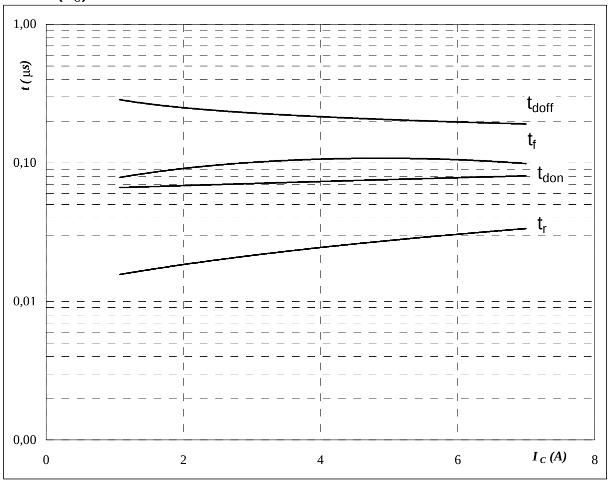
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	4	A

Output Inverter

figure 9. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



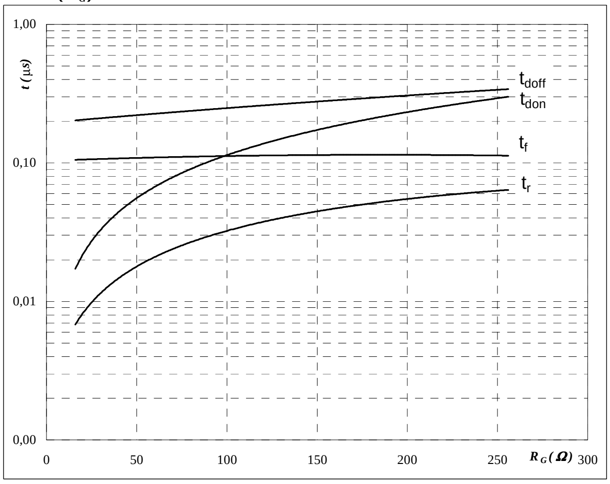
With an inductive load at

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

figure 10. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_G)$



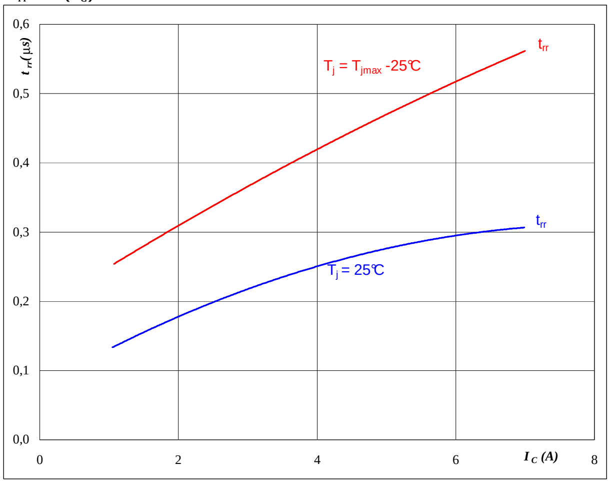
With an inductive load at

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

figure 11. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



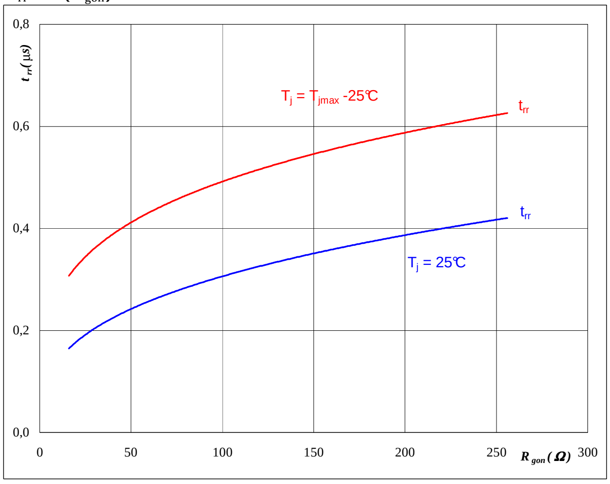
At

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

figure 12. **FWD**

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

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



At

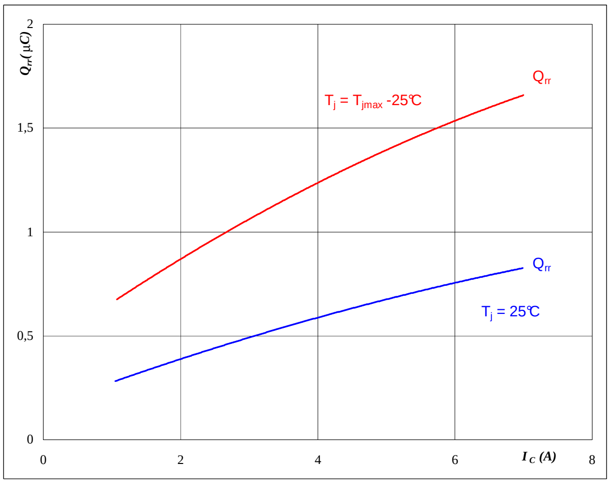
T_j =	25/150	°C
V_R =	600	V
I_F =	4	A
V_{GE} =	±15	V

Output Inverter

figure 13. **FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



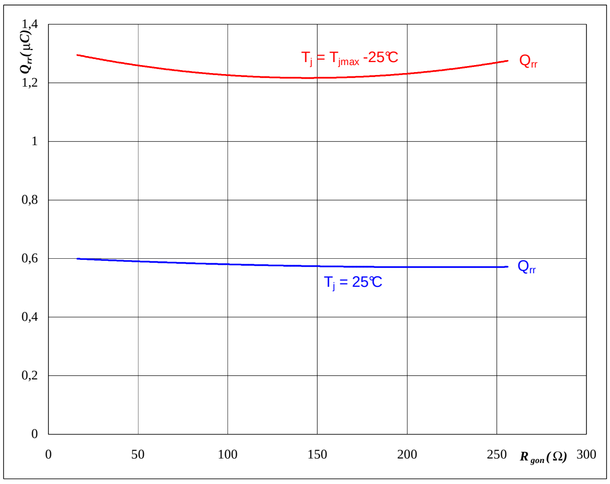
At

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

figure 14. **FWD**

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

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



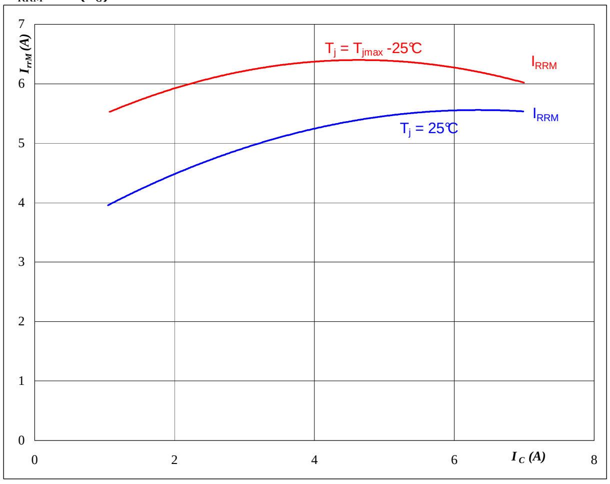
At

T_j =	25/150	°C
V_R =	600	V
I_F =	4	A
V_{GE} =	±15	V

figure 15. **FWD**

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



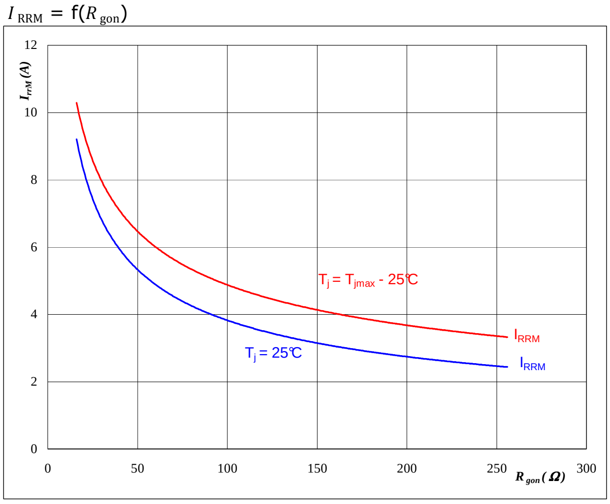
At

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

figure 16. **FWD**

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

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



At

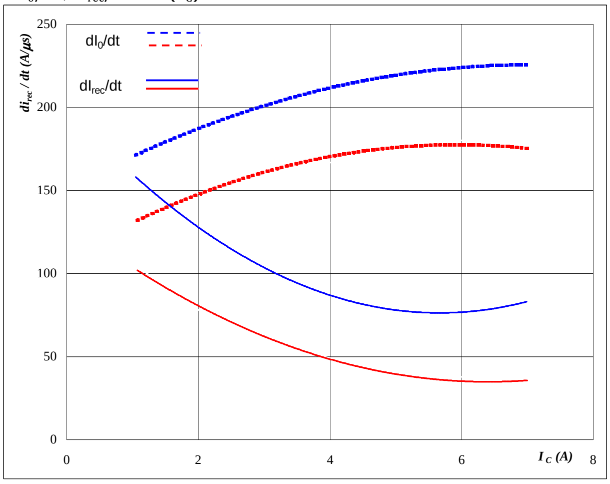
T_j =	25/150	°C
V_R =	600	V
I_F =	4	A
V_{GE} =	±15	V

Output Inverter

figure 17. **FWD**

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

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



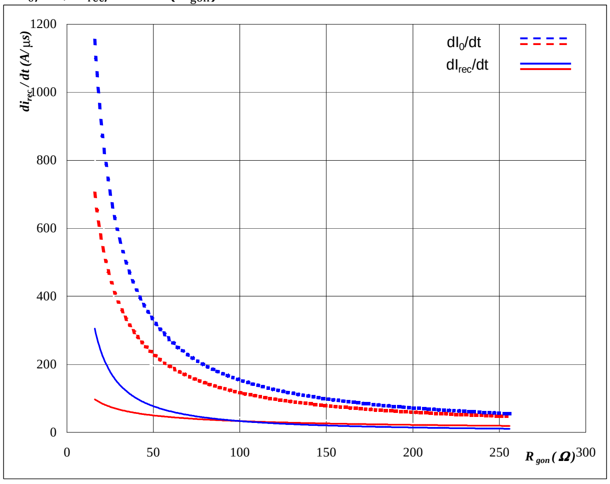
At

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

figure 18. **FWD**

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

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



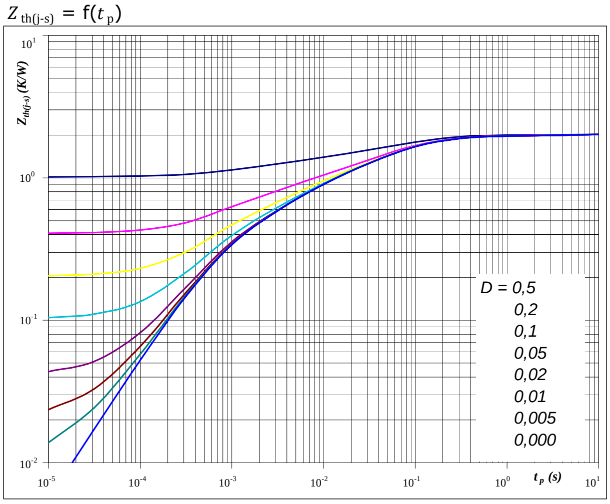
At

T_j =	25/150	°C
V_R =	600	V
I_F =	4	A
V_{GE} =	±15	V

figure 19. **IGBT**

IGBT transient thermal impedance as a function of pulse width

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



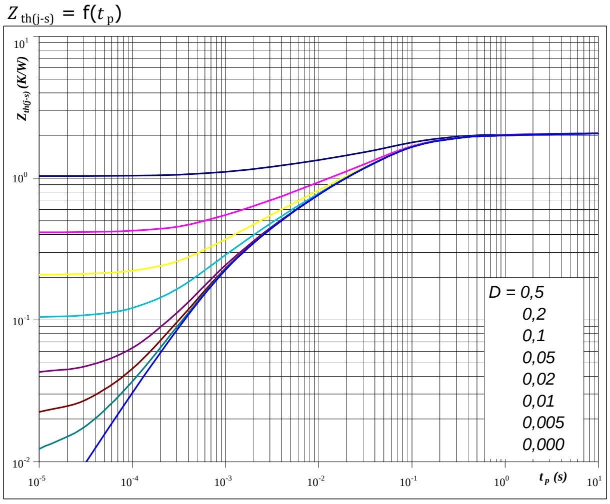
At

D =	t_p / T	
$R_{th(j-s)}$ =	2,03	K/W

figure 20. **FWD**

FWD transient thermal impedance as a function of pulse width

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



At

D =	t_p / T	
$R_{th(j-s)}$ =	2,07	K/W

IGBT thermal model values

R (K/W)	Tau (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

FWD thermal model values

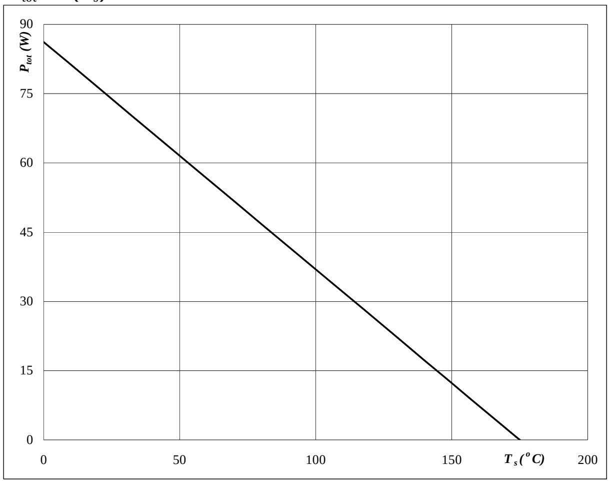
R (K/W)	Tau (s)
5,09E-02	4,26E+00
1,55E-01	5,03E-01
7,75E-01	7,89E-02
5,33E-01	2,68E-02
3,54E-01	5,03E-03
1,97E-01	9,09E-04

Output Inverter

figure 21. **IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



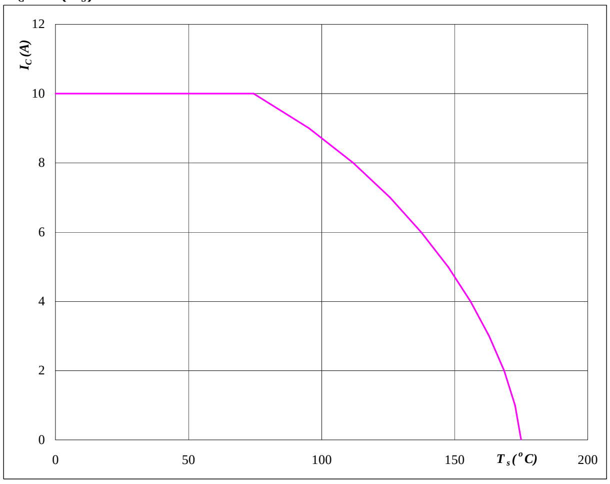
At

T_j = 175 °C

figure 22. **IGBT**

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

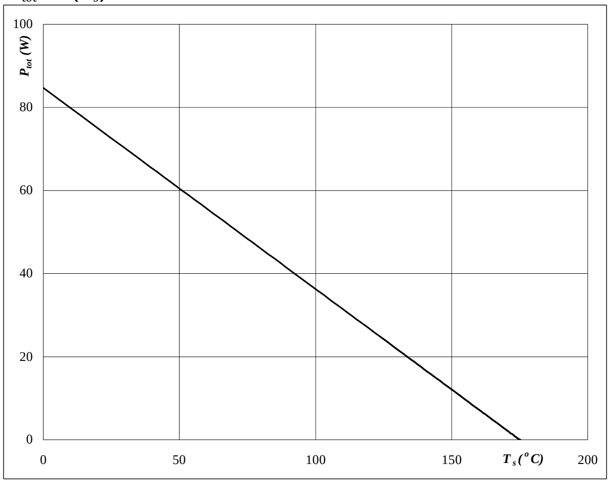
T_j = 175 °C

V_{GE} = 15 V

figure 23. **FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



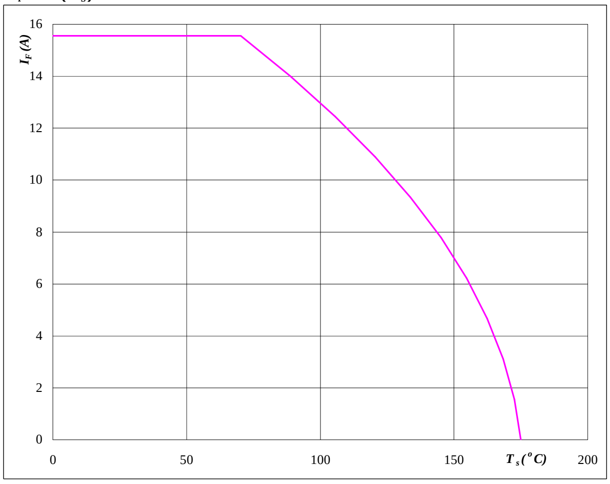
At

T_j = 175 °C

figure 24. **FWD**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

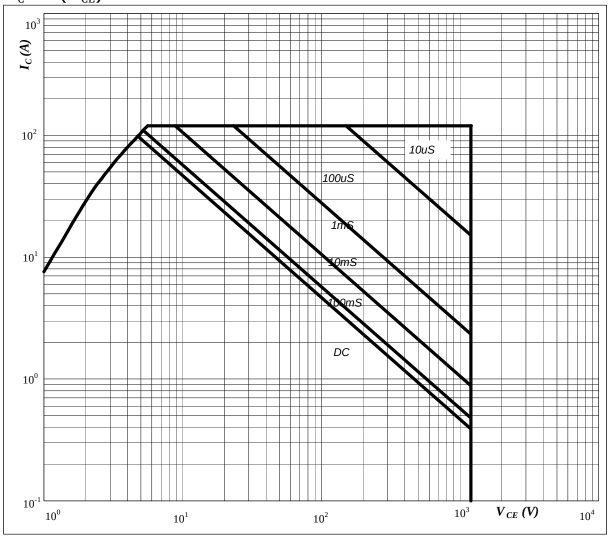
T_j = 175 °C

Output Inverter

figure 25.	IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



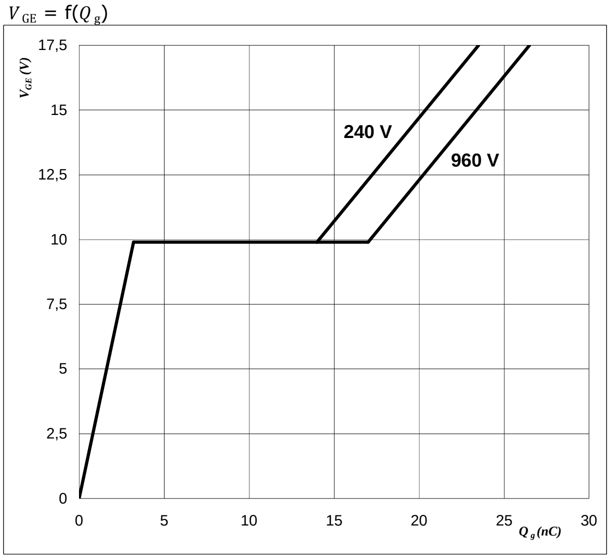
At

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

figure 26.	IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



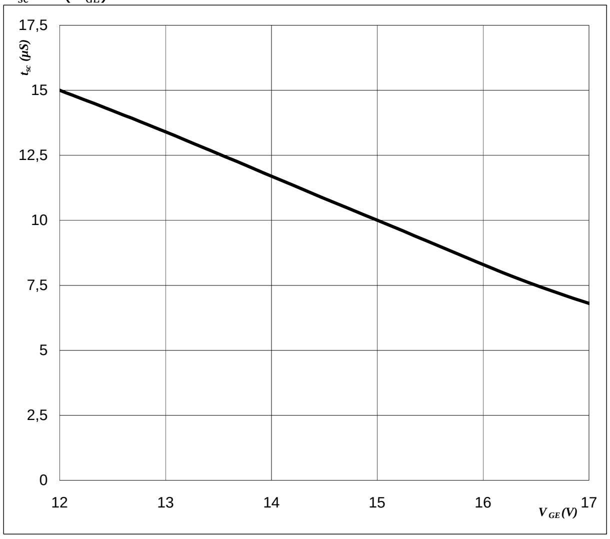
At

I_C =	4	A

figure 27.	IGBT

Short circuit withstand time as a function of gate-emitter voltage

$t_{sc} = f(V_{GE})$



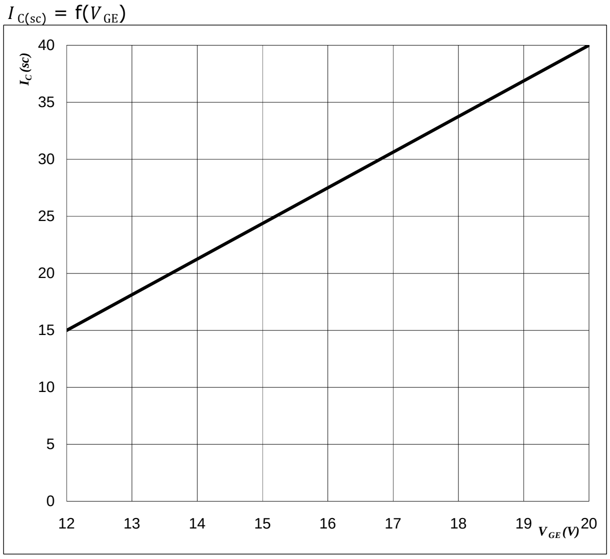
At

V_{CE} =	1200	V
T_j ≤	175	ºC

figure 28.	IGBT

Typical short circuit collector current as a function of gate-emitter voltage

$I_{C(sc)} = f(V_{GE})$



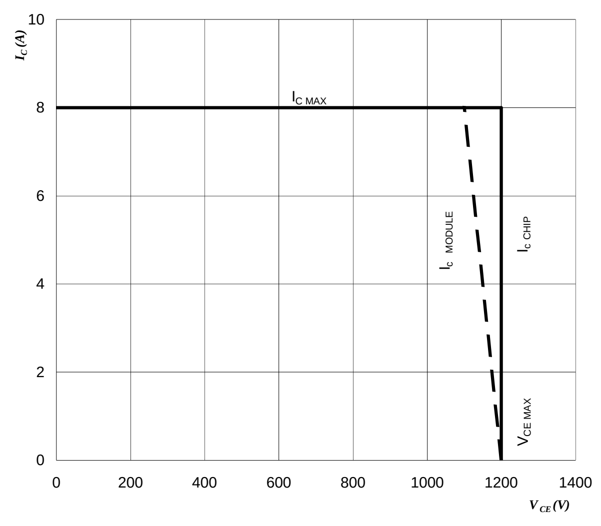
At

V_{CE} ≤	1200	V
T_j =	175	ºC

figure 29.	IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

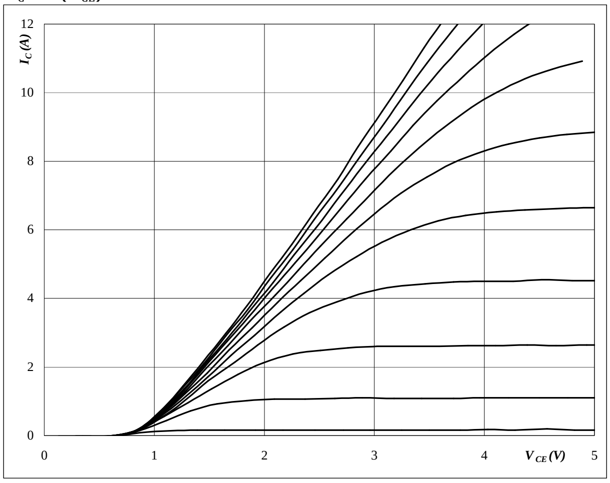
T_j = T_{jmax}-25 ºC

Brake

figure 1. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



At

t_p = 250 µs

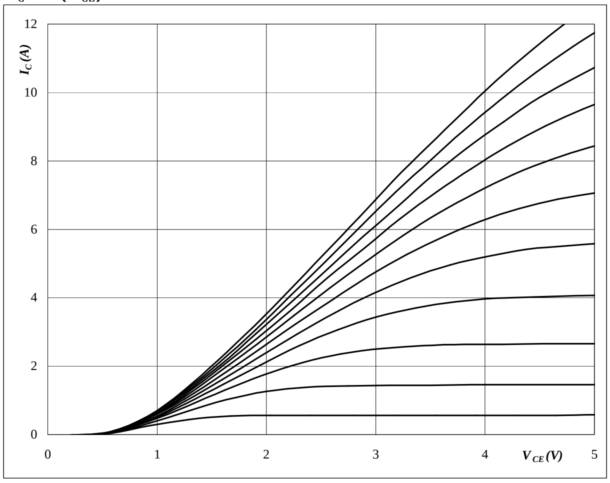
T_j = 25 °C

V_{GE} 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

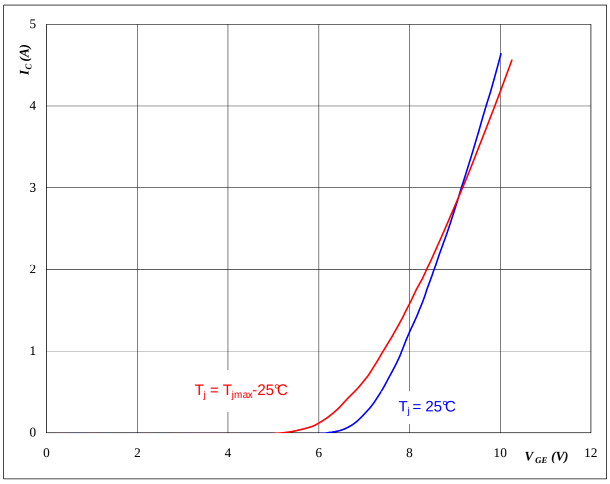
T_j = 150 °C

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

figure 3. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})



At

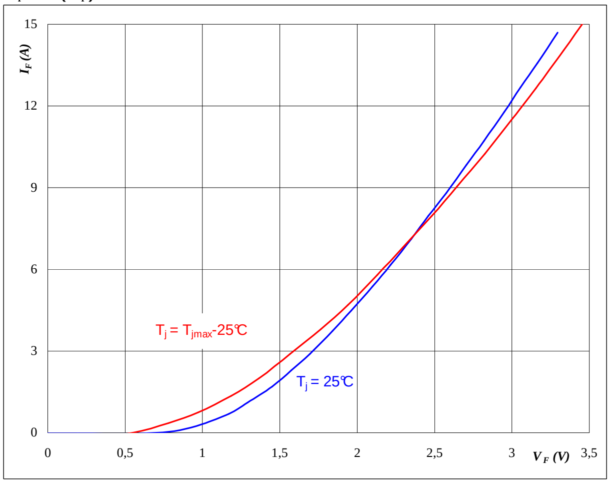
t_p = 250 µs

V_{CE} = 10 V

figure 4. **FWD**

Typical diode forward current as a function of forward voltage

I_F = f(V_F)



At

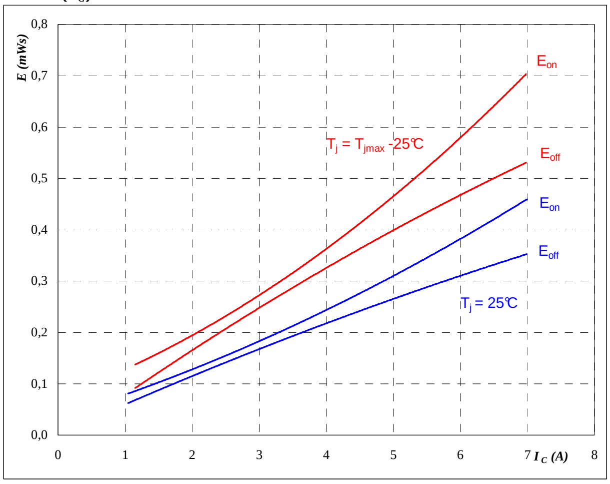
t_p = 250 µs

Brake

figure 5. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



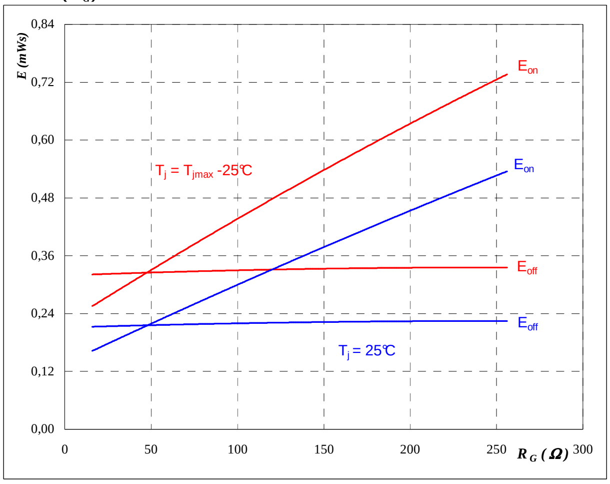
With an inductive load at

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

figure 6. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



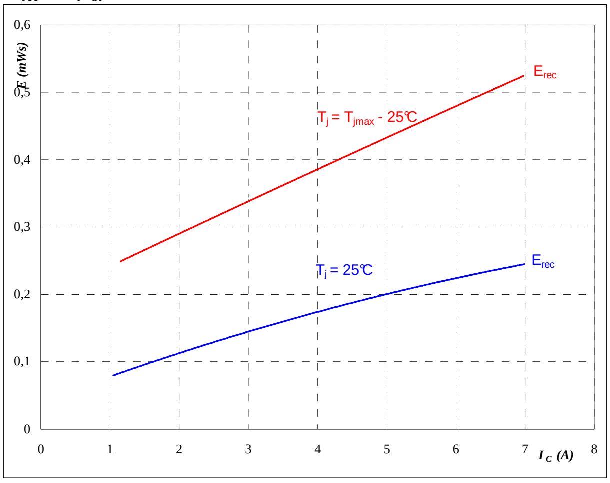
With an inductive load at

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

figure 7. **FWD**

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



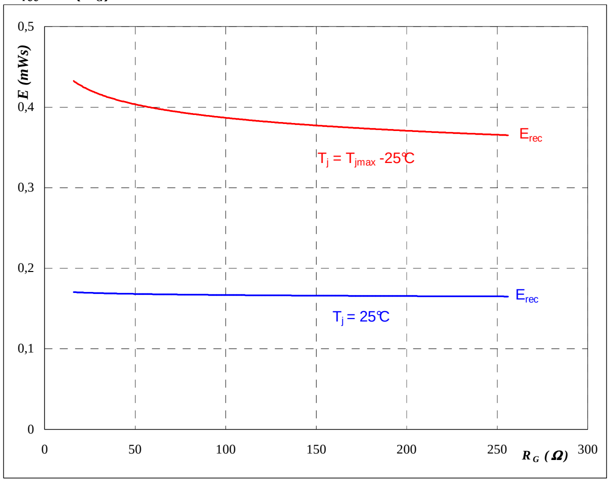
With an inductive load at

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

figure 8. **FWD**

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

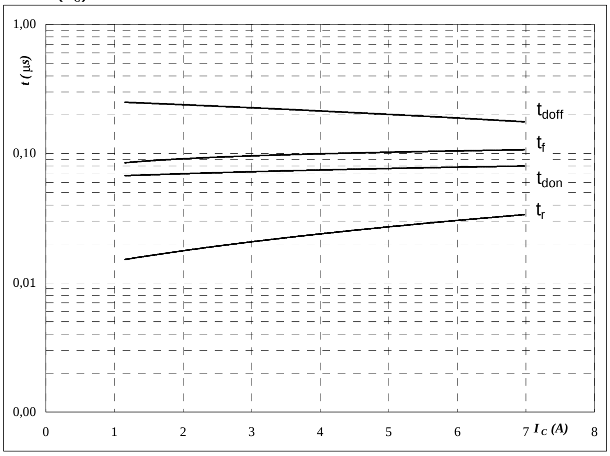
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	4	A

Brake

figure 9. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



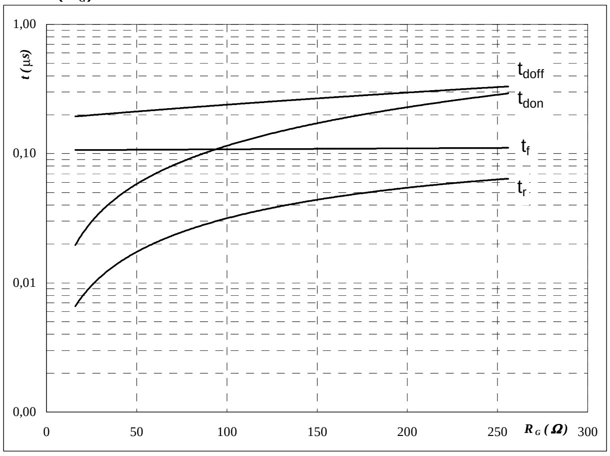
With an inductive load at

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

figure 10. **IGBT**

Typical switching times as a function of gate resistor

t = f(R_G)



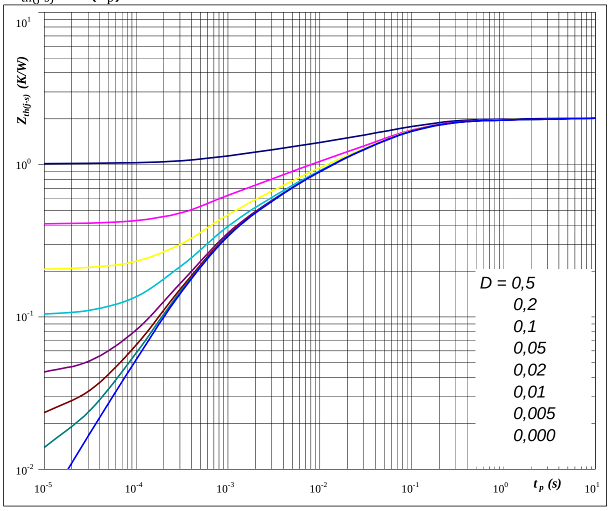
With an inductive load at

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

figure 11. **IGBT**

IGBT transient thermal impedance as a function of pulse width

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



At D = t_p / T

$R_{th(j-s)}$ = 2,03 K/W

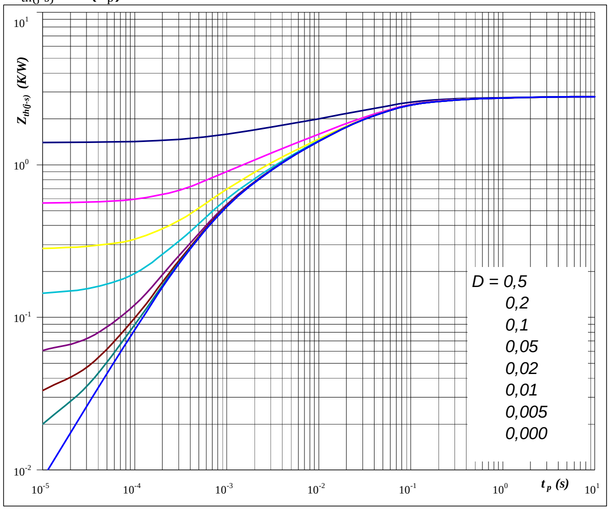
IGBT thermal model values

R (K/W)	Tau (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

figure 12. **FWD**

FWD transient thermal impedance as a function of pulse width

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



At D = t_p / T

$R_{th(j-s)}$ = 2,80 K/W

FWD thermal model values

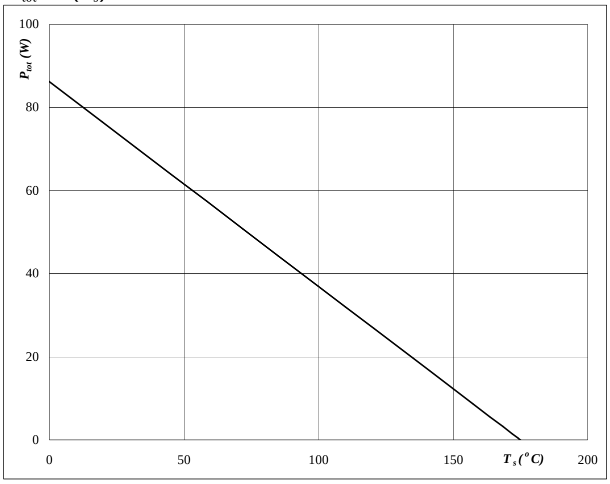
R (K/W)	Tau (s)
7,82E-02	2,45E+00
1,95E-01	2,65E-01
9,84E-01	4,77E-02
6,58E-01	1,23E-02
5,09E-01	2,70E-03
3,71E-01	5,98E-04

Brake

figure 13. **IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



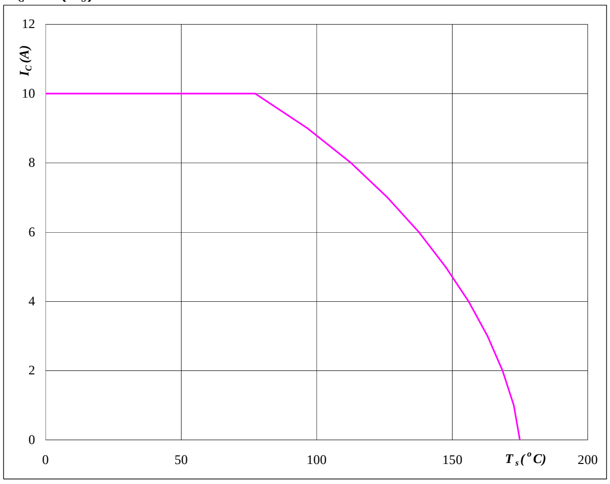
At

T_j = 175 ºC

figure 14. **IGBT**

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

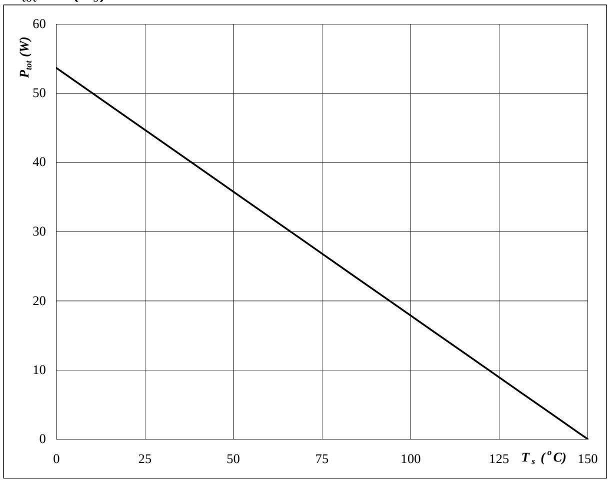
T_j = 175 ºC

V_{GE} = 15 V

figure 15. **FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



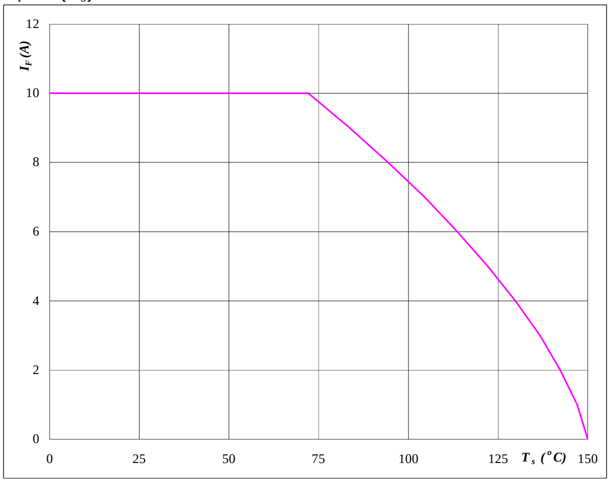
At

T_j = 150 ºC

figure 16. **FWD**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

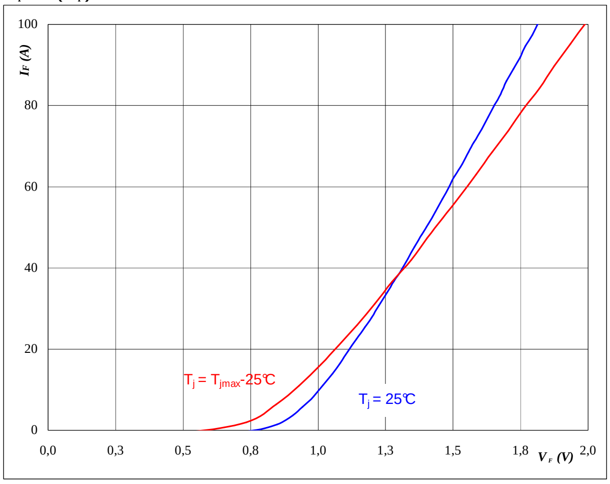
T_j = 150 ºC

Input Rectifier Bridge

figure 1. **Rectifier Diode**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



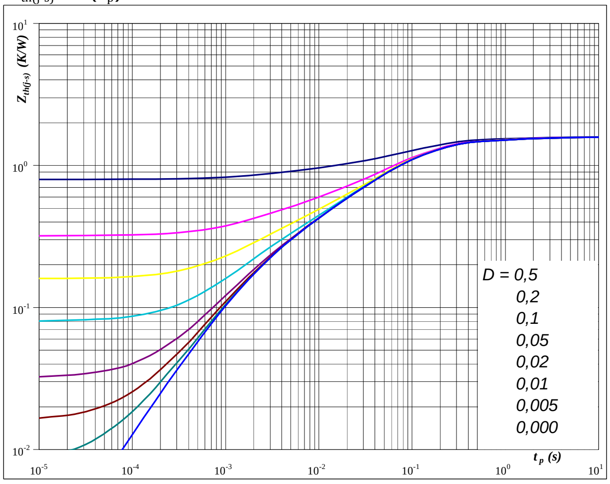
At

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

$D = t_p / T$

$R_{th(j-s)}$ = 1,60 K/W

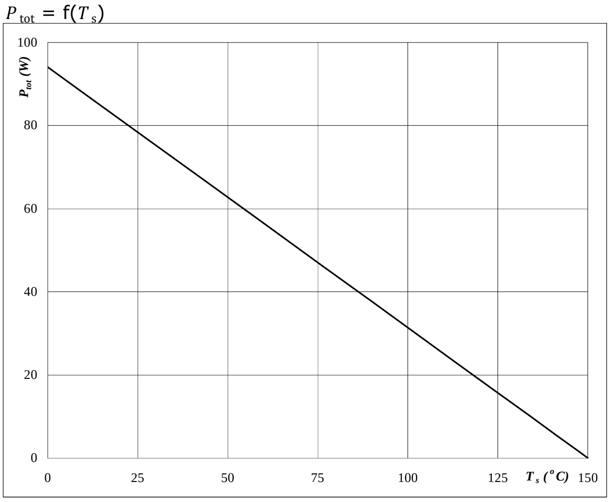
FWD thermal model values

R (K/W)	Tau (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

figure 3. **Rectifier Diode**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



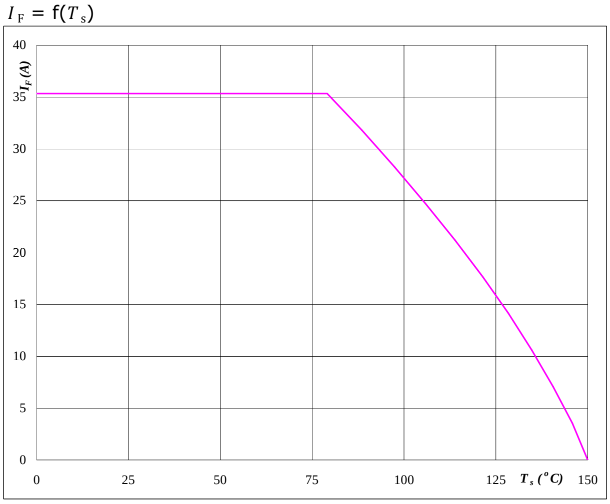
At

T_j = 150 ºC

figure 4. **Rectifier Diode**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

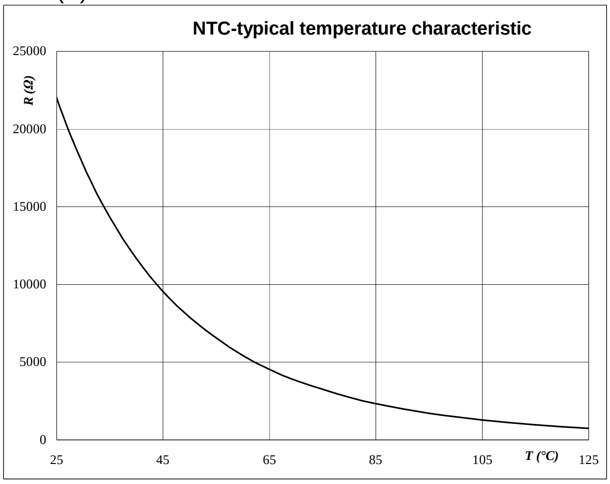
T_j = 150 ºC

Thermistor

figure 1.	Thermistor

Typical NTC characteristic
as a function of temperature

$R = f(T)$



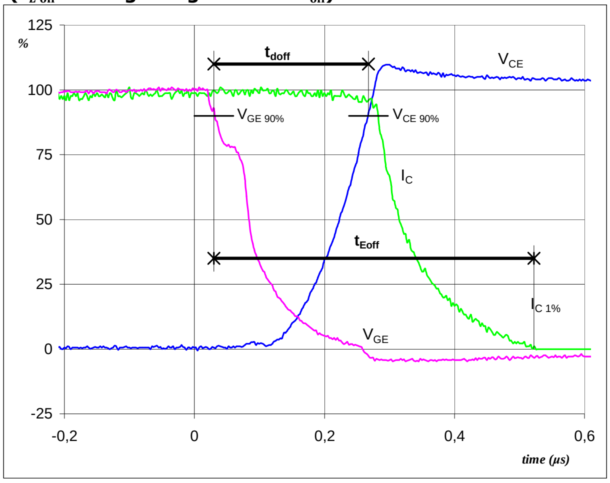
Switching Definitions Output Inverter

General conditions

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

figure 1. **IGBT**

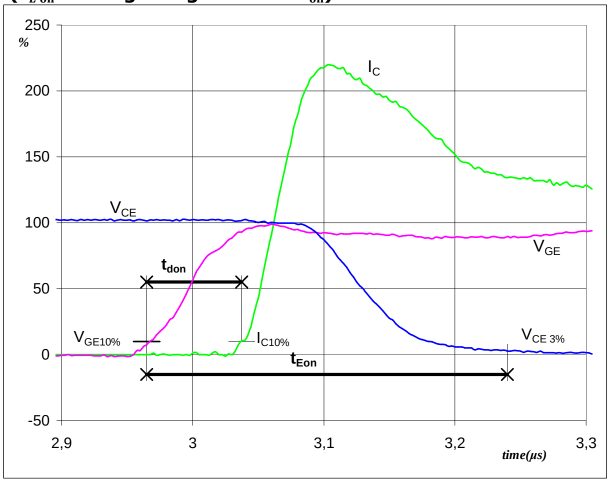
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	8	A
t_{doff} =	0,24	μs
$t_{E\,off}$ =	0,49	μs

figure 2. **IGBT**

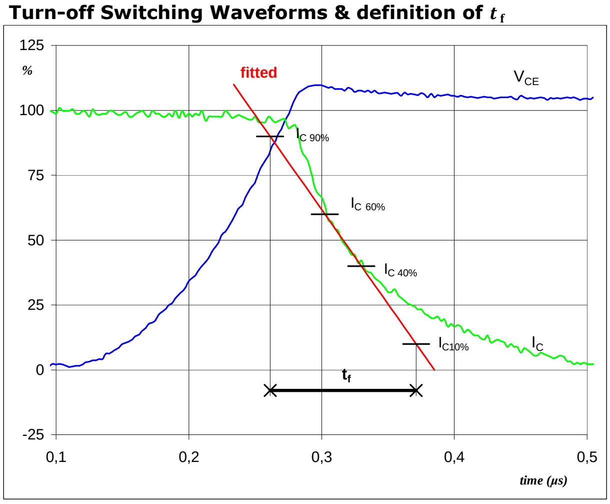
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	8	A
t_{don} =	0,07	μs
$t_{E\,on}$ =	0,27	μs

figure 3. **IGBT**

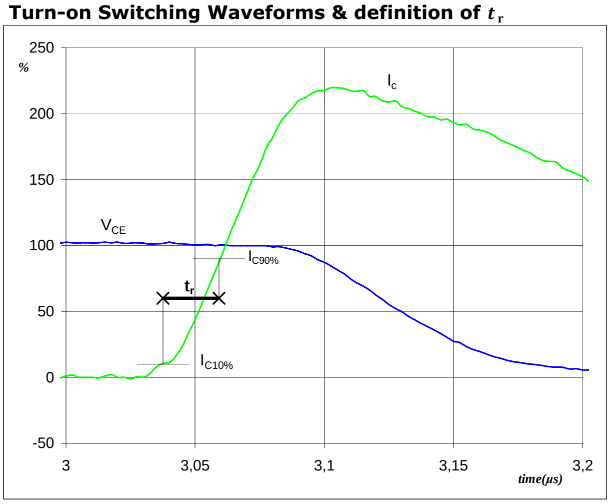
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	8	A
t_f =	0,11	μs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

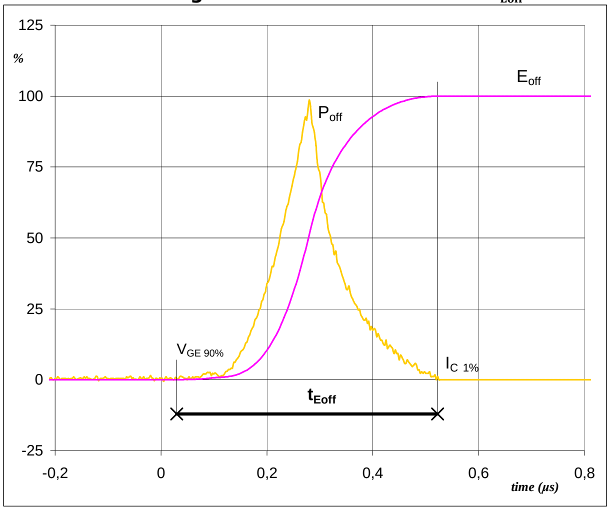


V_C (100%) =	600	V
I_C (100%) =	8	A
t_r =	0,02	μs

Switching Definitions Output Inverter

figure 5. **IGBT**

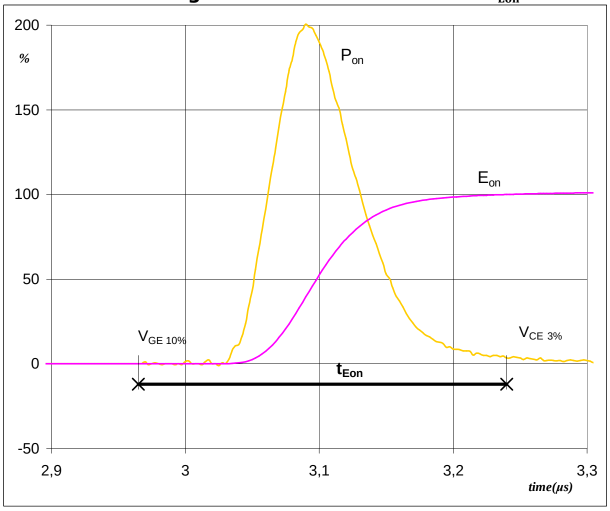
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	4,93	kW
E_{off} (100%) =	0,62	mJ
$t_{E\,off}$ =	0,49	µs

figure 6. **IGBT**

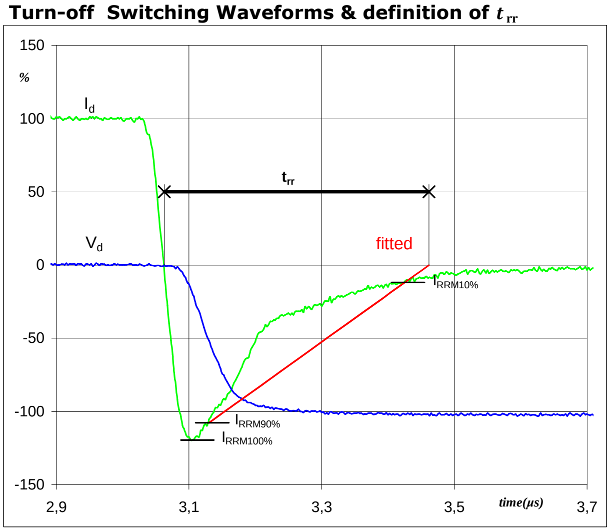
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	4,93	kW
E_{on} (100%) =	0,75	mJ
$t_{E\,on}$ =	0,27	µs

figure 7. **FWD**

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

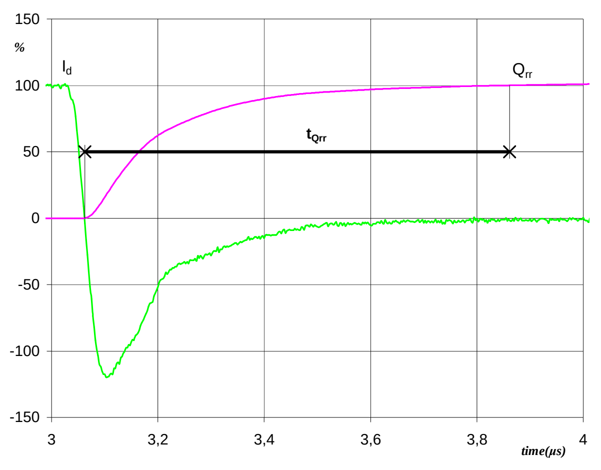


V_d (100%) =	600	V
I_d (100%) =	8	A
I_{RRM} (100%) =	-10	A
t_{rr} =	0,38	µs

Switching Definitions Output Inverter

figure 8. **FWD**

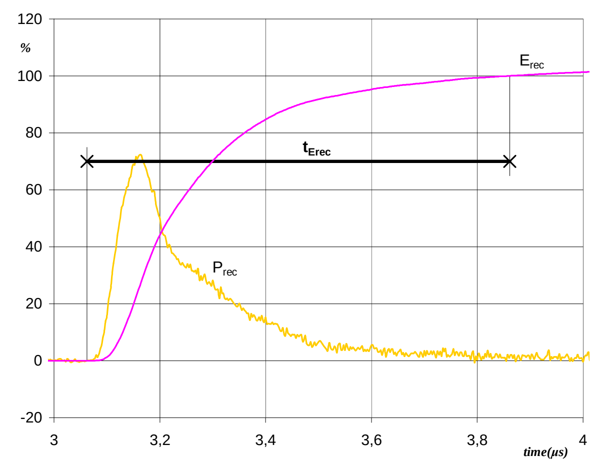
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	8	A
Q_{rr} (100%) =	1,57	µC
$t_{Q\,rr}$ =	0,80	µs

figure 9. **FWD**

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



P_{rec} (100%) =	4,93	kW
E_{rec} (100%) =	0,63	mJ
$t_{E\,rec}$ =	0,80	µs

Ordering Code & Marking

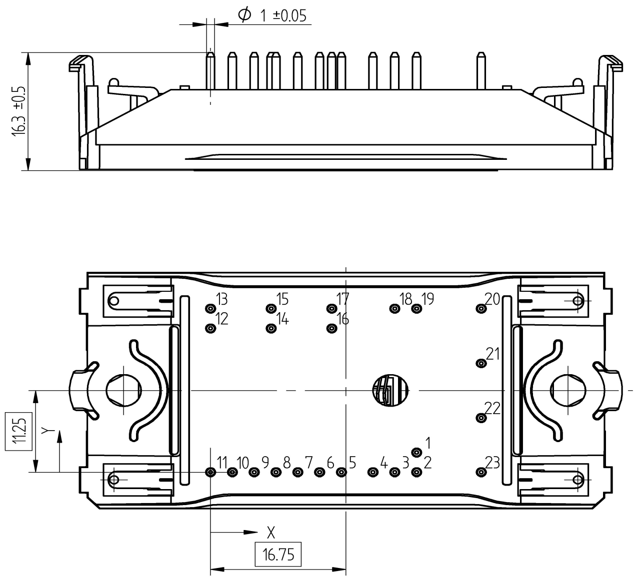
Version	Ordering Code
with brake without thermal paste 12mm housing	V23990-P848-A48-PM
without brake without thermal paste 12mm housing	V23990-P848-C48-PM
with brake without thermal paste 17mm housing	V23990-P848-A49-PM
without brake without thermal paste 17mm housing	V23990-P848-C49-PM

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

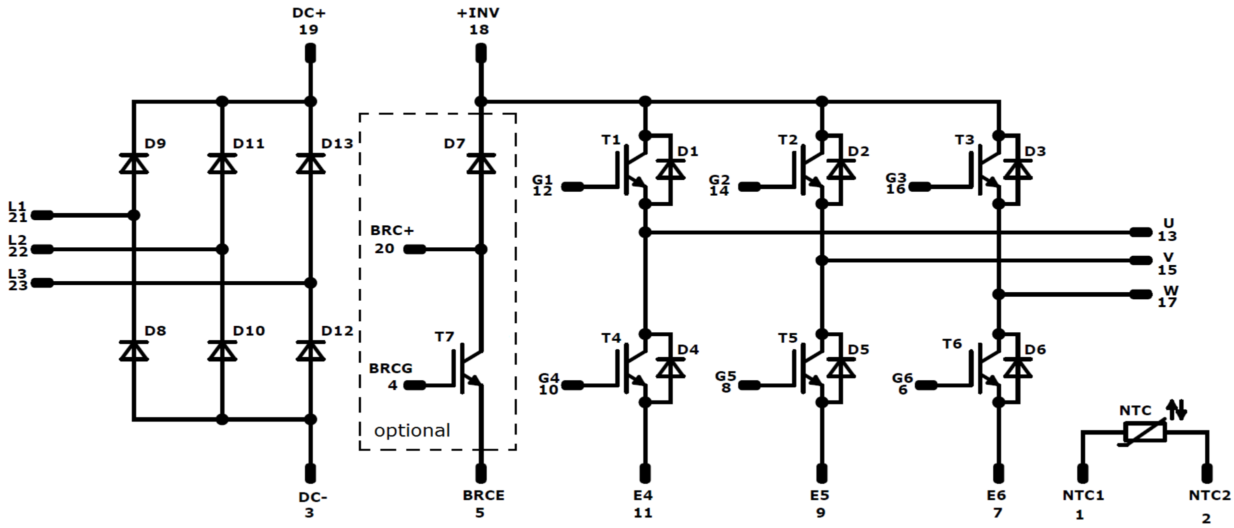
Outline

Pin table [mm]			
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
23	33,5	0	L3

Pinout variation	
Modul subtype	Not assembled pins
P848-A4x	-
P848-C4x	4, 5, 20



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
D8-D13	Rectifier	1600 V	25 A	Rectifier Diode	
T1-T6	IGBT	1200 V	4 A	Inverter Switch	
D1-D6	FWD	1200 V	10 A	Inverter Diode	
T7	IGBT	1200 V	4 A	Brake Switch	
D7	FWD	1200 V	3 A	Brake Diode	
NTC	NTC			Thermistor	

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.

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-P848-*4*-D7-14	06 Jun. 2017	Thermal, Clearance, NTC values	