Vincotech

flow PIM 0 — 600 V / 30 A

Features

- Vincotech clip-in housing
- Trench Fieldstop IGBT's for low saturation losses
- Optional w/o BRC

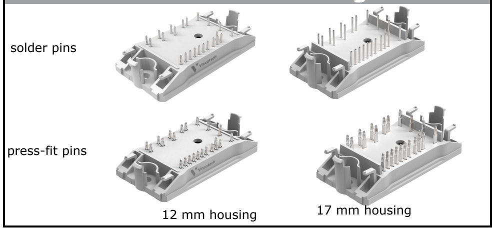
Target Applications

- Industrial drives
- Embedded drives

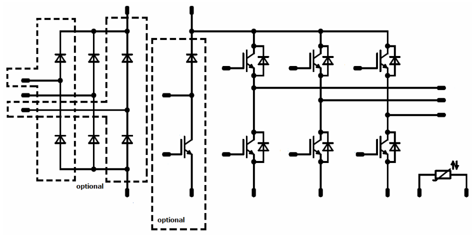
Types

- V23990-P546-A38-PM
- V23990-P546-A38Y-PM
- V23990-P546-A39-PM
- V23990-P546-C38-PM
- V23990-P546-C39Y-PM
- V23990-P546-C39-PM
- V23990-P546-D139-PM

flow PIM 0 housing



Schematic



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	44	A
Surge (non-repetitive) forward current	I_{FSM}	t_p = 10 ms 50Hz half sine wave		250	A
I2t-value	I^2t			310	A^2s
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	56	W
Maximum Junction Temperature	T_{jmax}			150	°C
Inverter Switch					
Collector-emitter break down voltage	V_{CE}			600	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	31	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		90	A
Turn off safe operating area		$V_{CE} \leq$ 600V, $T_j \leq T_{op}$ max		90	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	64	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \leq$ 150 °C V_{GE} = 15 V		6 360	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}			600	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	31	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		60	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	53	W
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Switch					
Collector-emitter break down voltage	V_{CE}			600	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	26	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		60	A
Turn off safe operating area		V_{CE} ≤ 600V, $T_j \leq T_{op}$ max		60	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	56	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V		6 360	μs V
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
DC forward 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}		40	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	77	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…+(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		17 mm Housing	min 12,7	mm
		12 mm housing solder pin / Press-fit pin	9,29 / 9,05	
Comparative Tracking Index	CTI		>200	

*100% tested in production

Characteristic Values

Parameter	Symbol	Conditions	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	Unit
Rectifier Diode										
Forward voltage	V_F				30	25 125	0,8	1,16 1,13	1,6	V
Threshold voltage (for power loss calc. only)	V_{to}				30	25 125		0,90 0,78		V
Slope resistance (for power loss calc. only)	r_t				30	25 125		8 11		mΩ
Reverse current	I_r			1500		25 150			2	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	λpaste = 3,4 W/mK (PSX)						1,25		K/W
Inverter Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00043	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	25 150	1,1	1,67 1,90	1,9	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		25			0,0016	mA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 4 Ω R_{gon} = 8 Ω	±15	300	30	25 150		17 18		ns
Rise time	t_r					25 150		16 18		
Turn-off delay time	$t_{d(off)}$					25 150		156 172		
Fall time	t_f					25 150		88 101		
Turn-on energy loss	E_{on}					25 150		0,52 0,71		mWs
Turn-off energy loss	E_{off}					25 150		0,72 0,90		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		1630		pF
Output capacitance	C_{oss}							108		
Reverse transfer capacitance	C_{rss}							50		
Gate charge	Q_G		±15	480	30	25		167		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	λpaste = 3,4 W/mK (PSX)						1,49		K/W
Inverter Diode										
Diode forward voltage	V_F				30	25 150	1,25	1,64 1,66	1,95	V
Peak reverse recovery current	I_{RRM}	R_{gon} = 8 Ω	±15	300	30	25 150		25 28		A
Reverse recovery time	t_{rr}					25 150		176 256		ns
Reverse recovered charge	Q_{rr}					25 150		1,36 2,45		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		1521 932		A/μs
Reverse recovered energy	E_{rec}					25 150		0,27 0,51		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	λpaste = 3,4 W/mK (PSX)						1,81		K/W

Characteristic Values

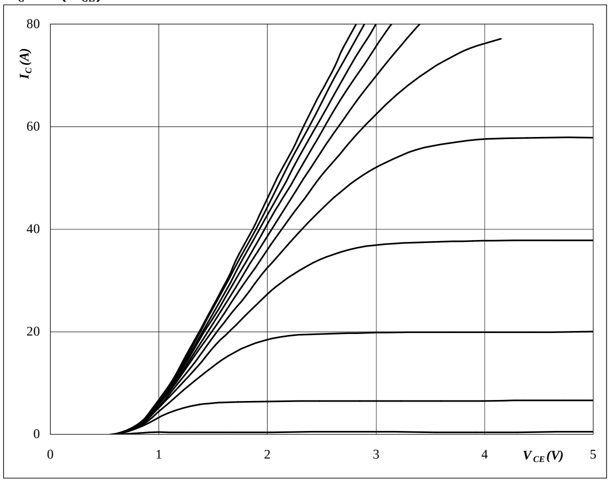
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	
Brake Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00029	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		20	25 150	1	1,58 1,76	2,2	V
Collector-emitter cut-off incl diode	I_{CES}		0	600		25			0,0011	mA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 8 Ω R_{gon} = 16 Ω	±15	300	20	25 150		15 14		ns
Rise time	t_r					25 150		12 15		
Turn-off delay time	$t_{d(off)}$					25 150		197 220		
Fall time	t_f					25 150		100 119		
Turn-on energy loss	E_{on}					25 150		0,31 0,43		mWs
Turn-off energy loss	E_{off}					25 150		0,53 0,67		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		1100		pF
Output capacitance	C_{oss}							71		
Reverse transfer capacitance	C_{rss}							32		
Gate charge	Q_G		±15	480	20	25		120		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	λpaste = 3,4 W/mK (PSX)						1,70		K/W
Brake Diode										
Diode forward voltage	V_F				20	25 150	1,25	1,83 1,76	1,95	V
Reverse leakage current	I_r	R_{gon} = 16 Ω		300		25			27	μA
Peak reverse recovery current	I_{RRM}	R_{gon} = 16 Ω	±15	300	20	25 150		18 21		A
Reverse recovery time	t_{rr}					25 150		31 197		ns
Reverse recovered charge	Q_{rr}					25 150		0,39 0,39		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		1762 927		A/μs
Reverse recovery energy	E_{rec}					25 150		0,05 0,25		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	λpaste = 3,4 W/mK (PSX)						2,60		K/W
Thermistor										
Rated resistance	R					25		22000		Ω
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 Ω				Tj = 100	-5		5	%
Power dissipation	P					Tj = 100		210		mW
Power dissipation constant						25		3,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				25				K
B-value	$B_{(25/100)}$	Tol. ±3%				25		4000		K
Vincotech NTC Reference						25			A	

Output Inverter

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

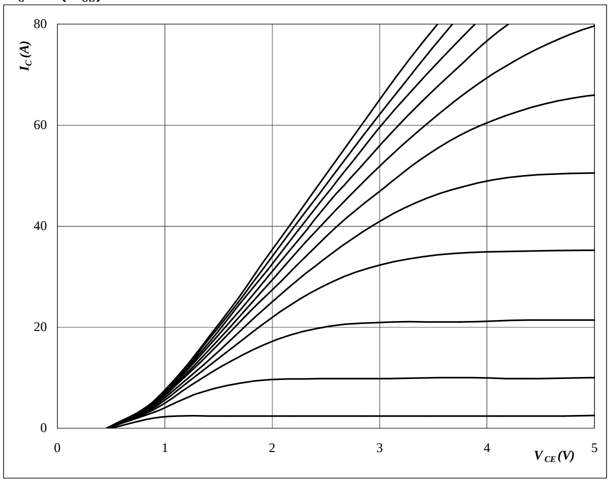
T_j = 25 °C

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

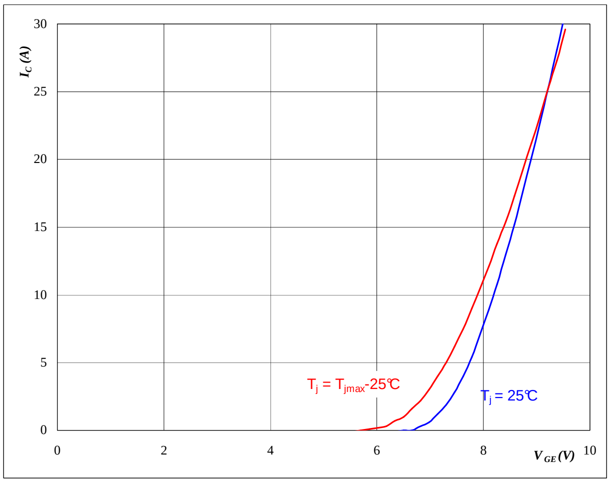
T_j = 125 °C

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

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$



At

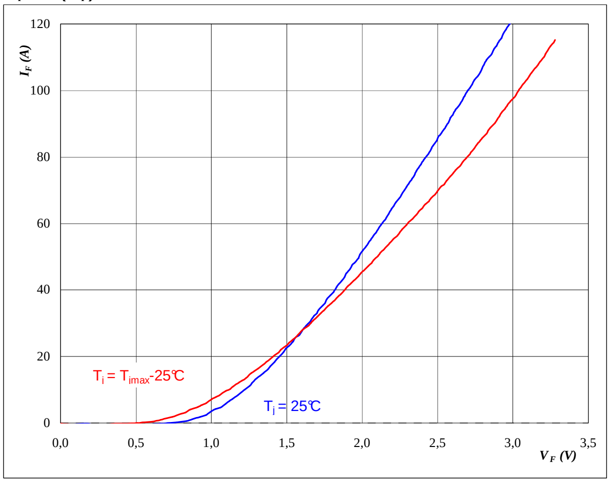
t_p = 250 µs

V_{CE} = 10 V

figure 4. **FWD**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

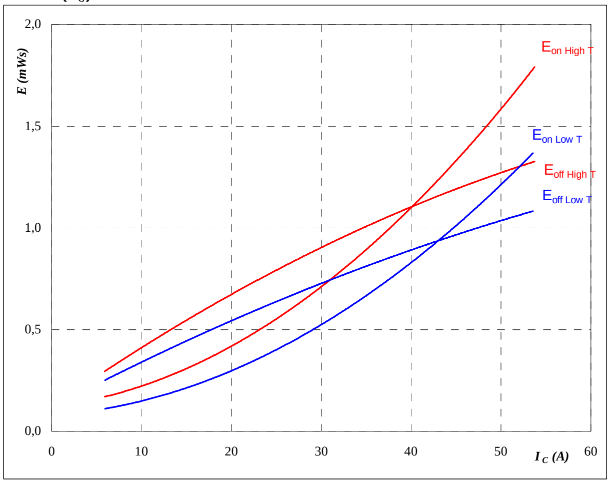
t_p = 250 µs

Output Inverter

figure 5. **IGBT**

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



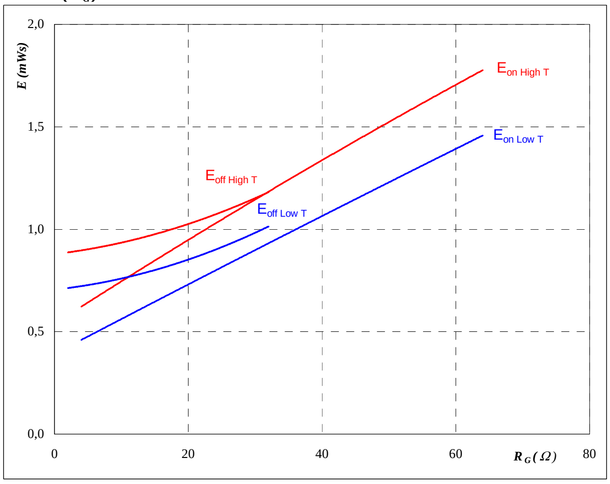
With an inductive load at

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	8	Ω
R_{goff} =	4	Ω

figure 6. **IGBT**

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



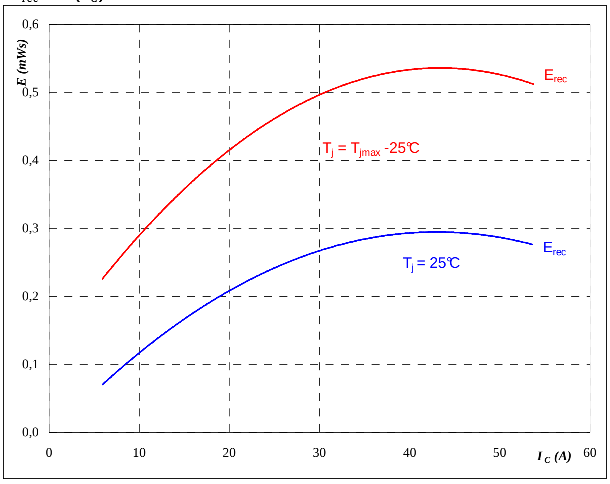
With an inductive load at

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	30	A

figure 7. **FWD**

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_C)$



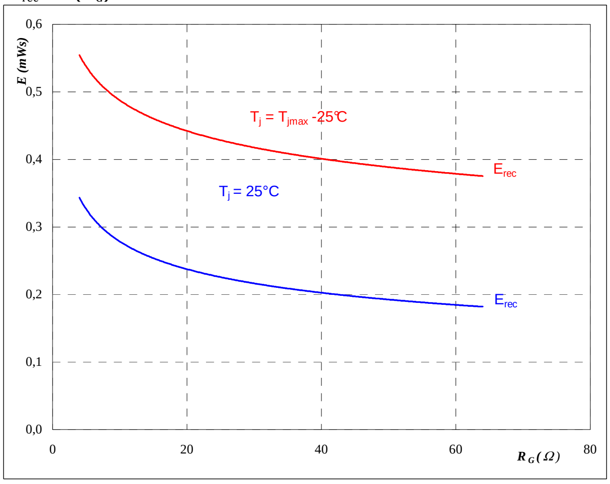
With an inductive load at

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	8	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

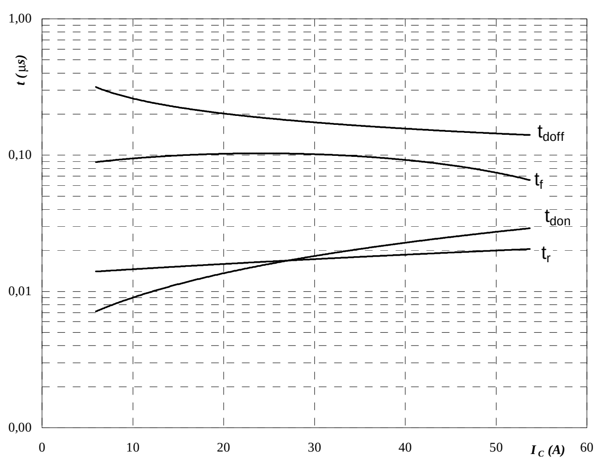
T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	30	A

Output Inverter

figure 9. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



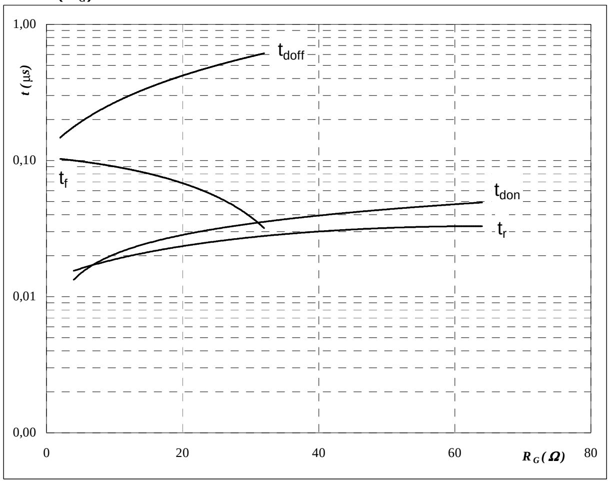
With an inductive load at

T_j =	125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	8	Ω
R_{goff} =	4	Ω

figure 10. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_G)$



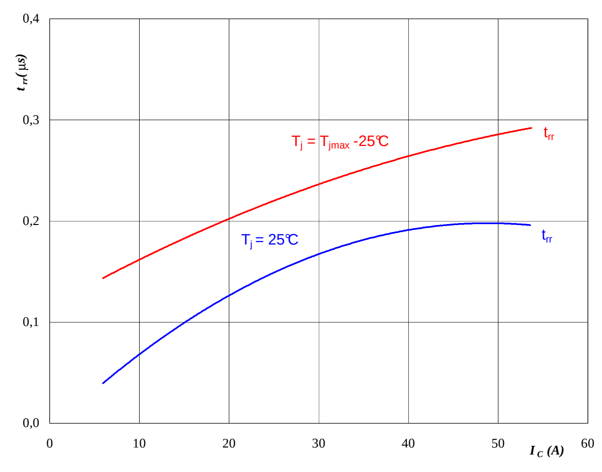
With an inductive load at

T_j =	125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	30	A

figure 11. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



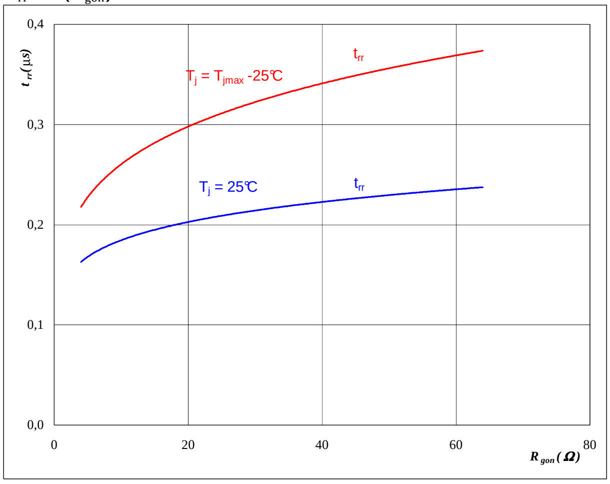
At

T_j =	25/125	°C
V_{CE} =	300	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

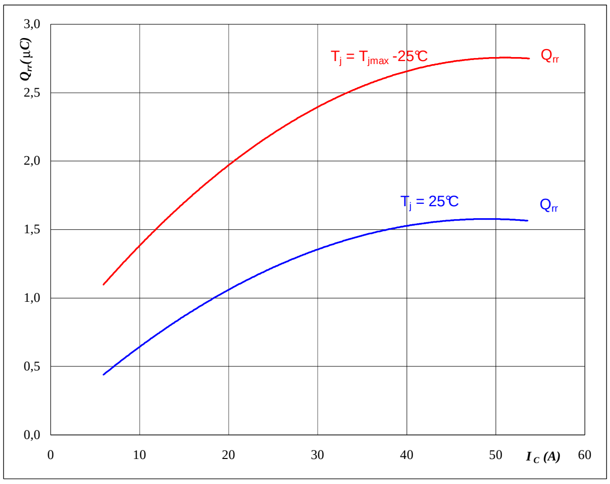
T_j =	25/125	°C
V_R =	300	V
I_F =	30	A
V_{GE} =	15	V

Output Inverter

figure 13. **FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



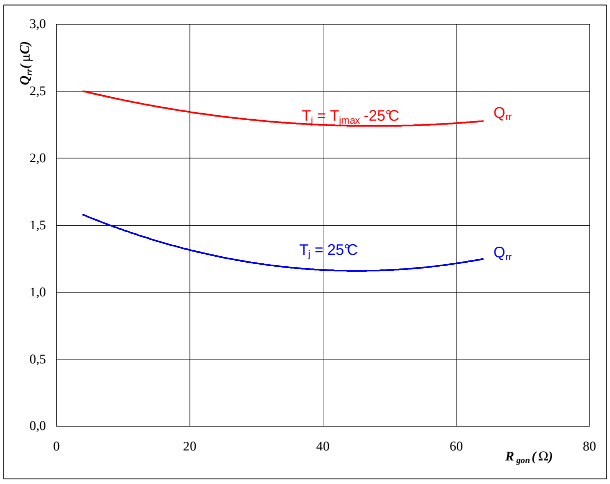
At

T_j =	25/125	°C
V_{CE} =	300	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

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



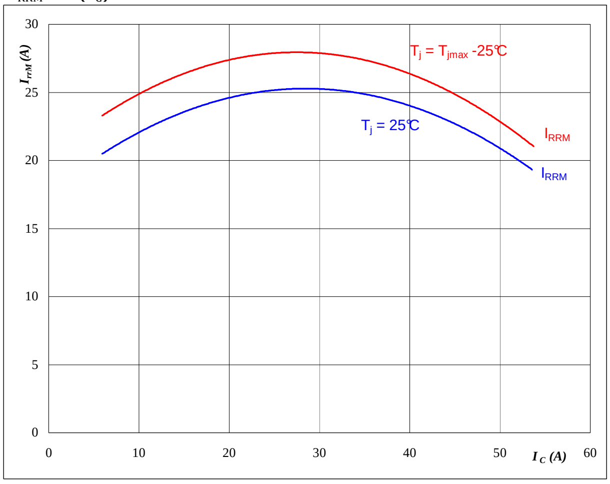
At

T_j =	25/125	°C
V_R =	300	V
I_F =	30	A
V_{GE} =	15	V

figure 15. **FWD**

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



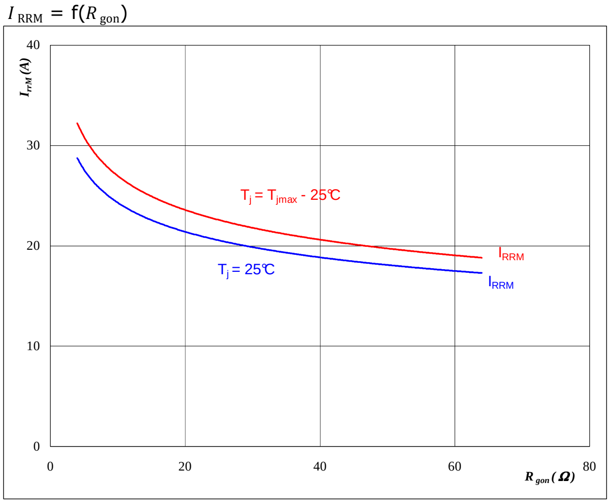
At

T_j =	25/125	°C
V_{CE} =	300	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

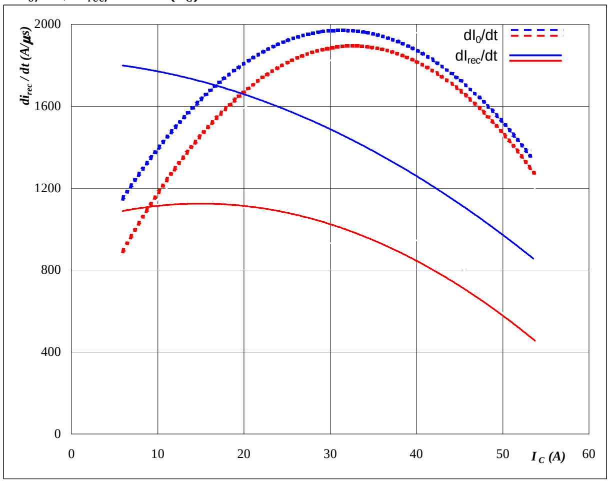
T_j =	25/125	°C
V_R =	300	V
I_F =	30	A
V_{GE} =	15	V

Output Inverter

figure 17. **FWD**

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

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



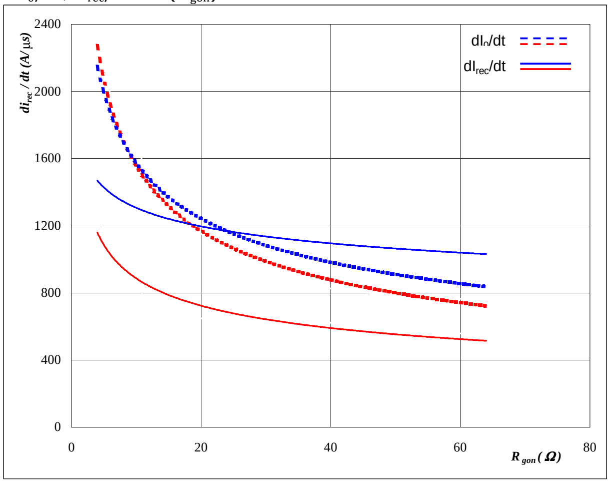
At

T_j =	25/125	°C
V_{CE} =	300	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

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



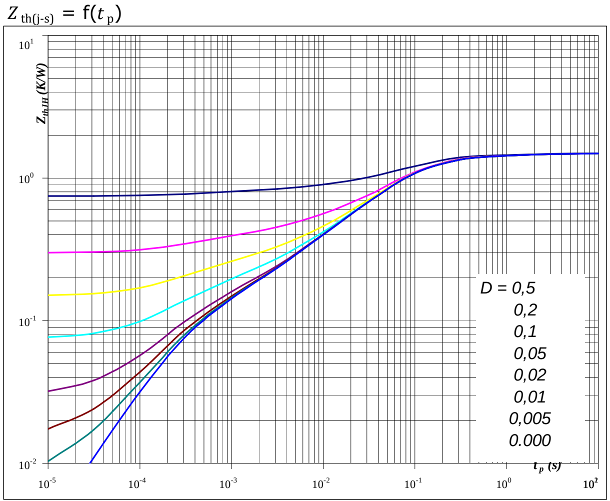
At

T_j =	25/125	°C
V_R =	300	V
I_F =	30	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	
$R_{th(j\text{-}s)}$ =	1,49	K/W

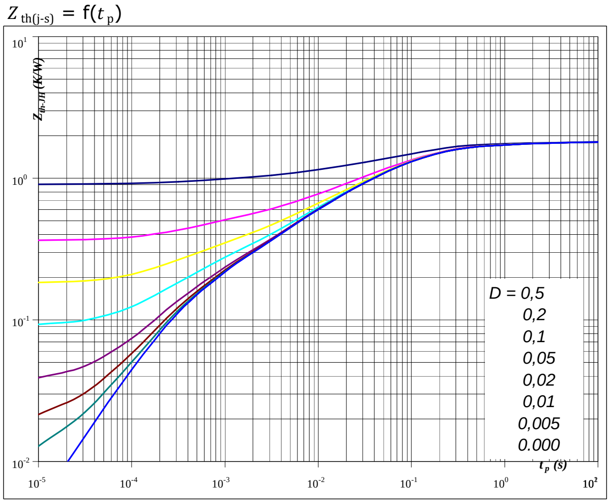
IGBT thermal model values

R (K/W)	Tau (s)
7,25E-02	2,02E+00
1,02E-01	4,53E-01
6,96E-01	8,91E-02
3,56E-01	3,19E-02
1,42E-01	5,59E-03
4,77E-02	9,74E-04
7,51E-02	2,56E-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	
$R_{th(j\text{-}s)}$ =	1,81	K/W

FWD thermal model values

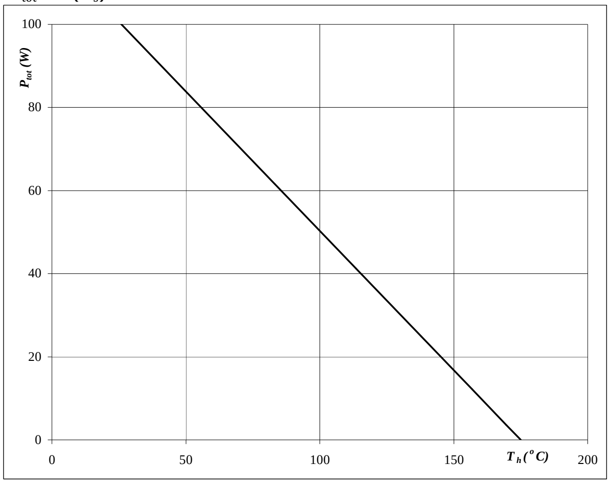
R (K/W)	Tau (s)
8,32E-02	4,59E+00
2,00E-01	4,81E-01
7,57E-01	9,25E-02
4,20E-01	1,80E-02
2,12E-01	3,31E-03
1,39E-01	3,46E-04

Output Inverter

figure 21. **IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



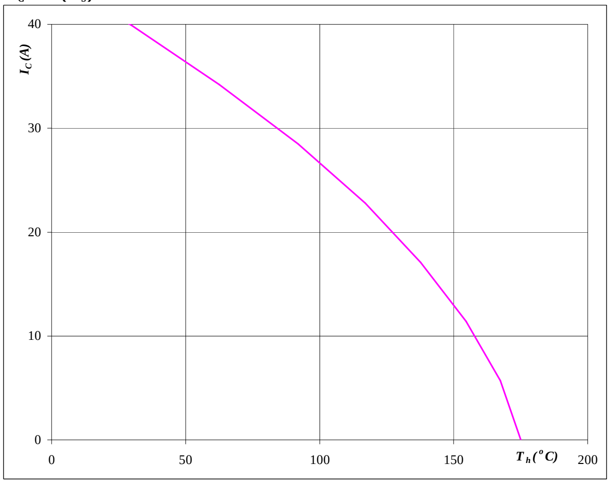
At

T_j = 175 °C

figure 22. **IGBT**

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

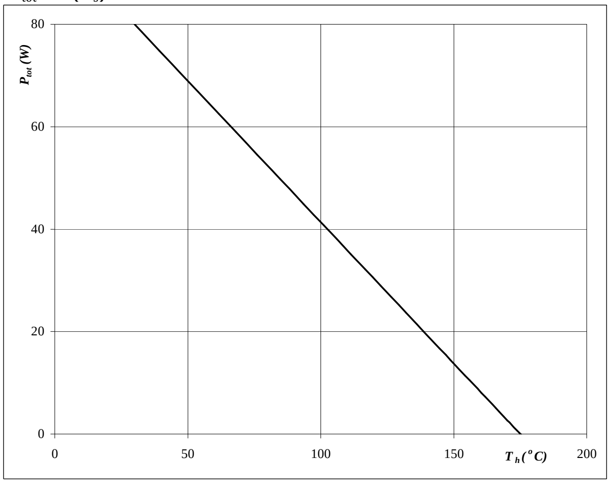
T_j = 175 °C

V_{GE} = 15 V

figure 23. **FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



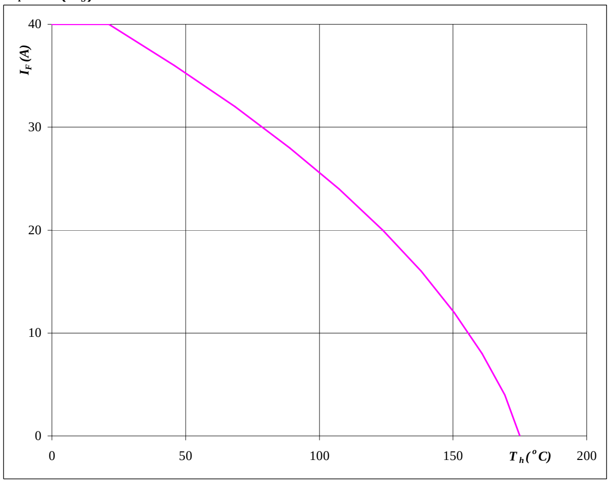
At

T_j = 175 °C

figure 24. **FWD**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

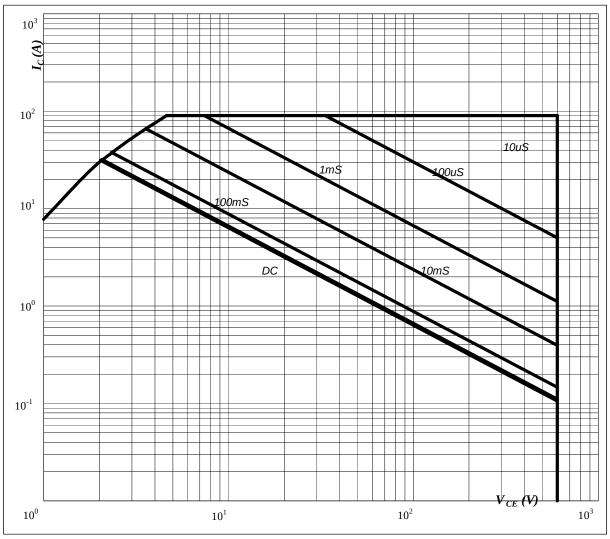
T_j = 175 °C

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

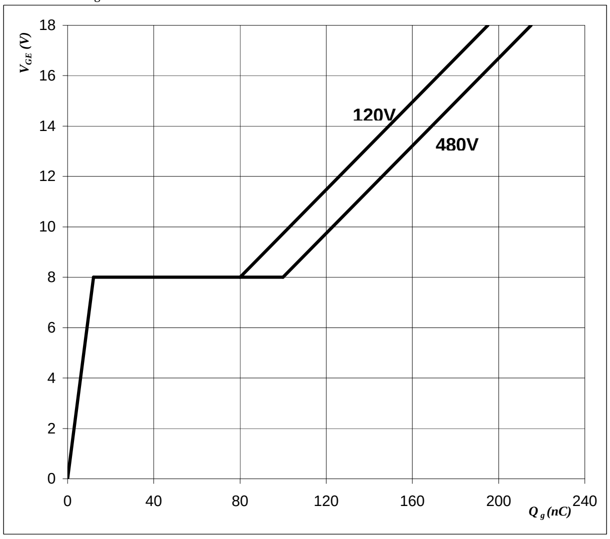
V_{GE} = 15 V

T_j = T_{jmax} ºC

figure 26. **IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



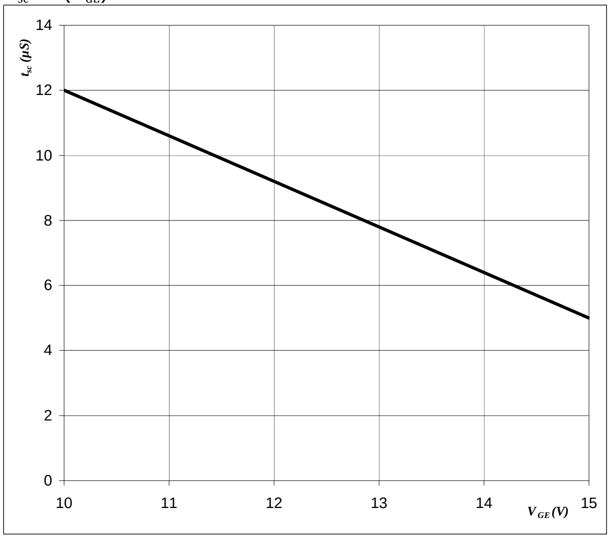
At

I_C = 30 A

figure 27. **IGBT**

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

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



At

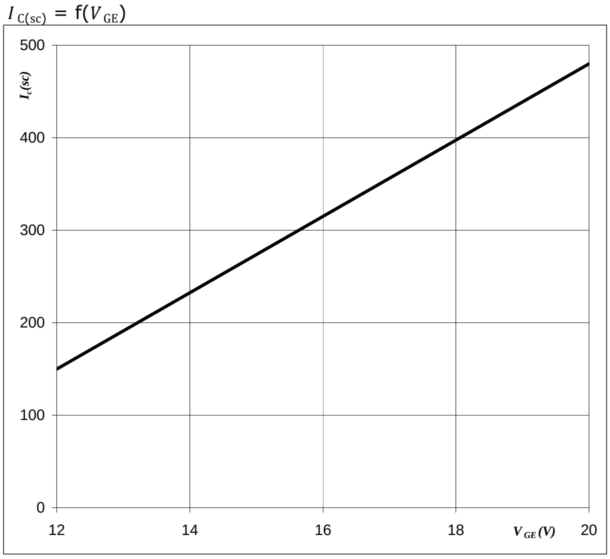
V_{CE} = 600 V

$T_j \leq$ 175 ºC

figure 28. **IGBT**

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

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



At

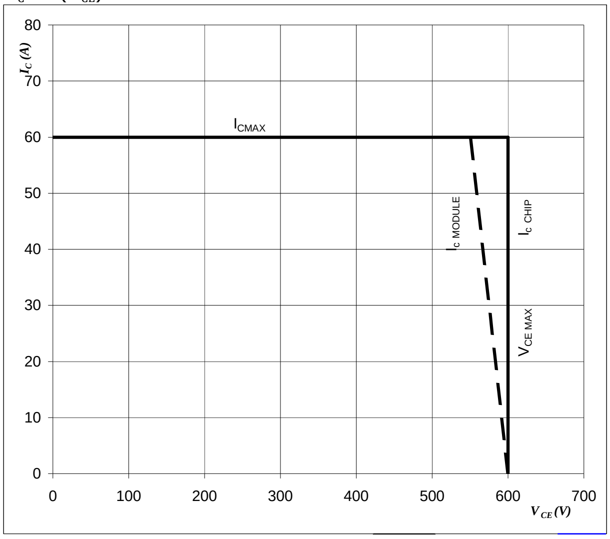
$V_{CE} \leq$ 600 V

T_j = 175 ºC

figure 29. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j = T_{jmax}-25 ºC

$U_{ccminus}$=U_{ccplus}

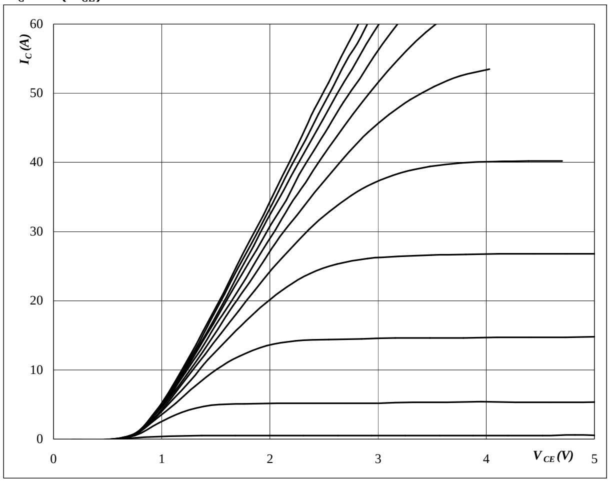
Switching mode : 3phase SPWM

Brake

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 μs

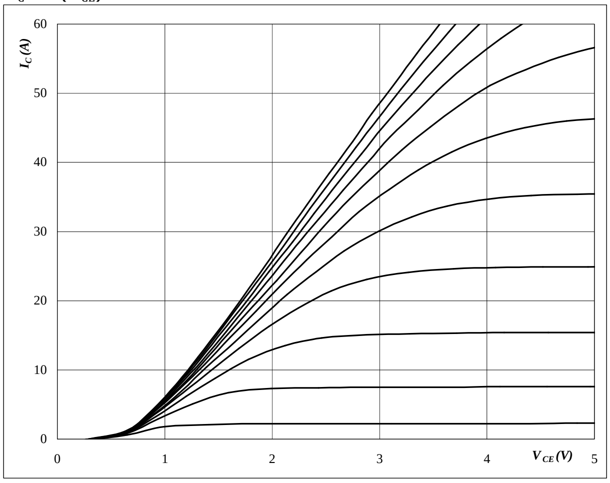
T_j = 25 °C

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

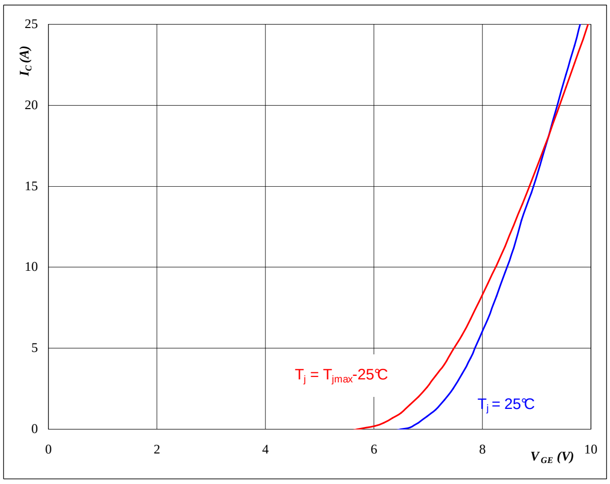
T_j = 125 °C

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

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$



At

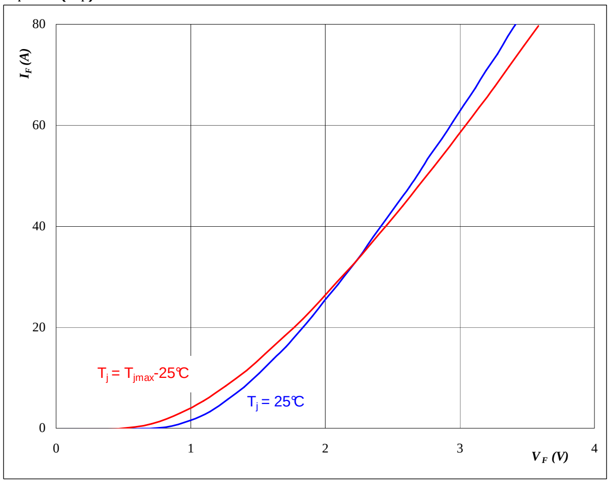
t_p = 250 μs

V_{CE} = 10 V

figure 4. **FWD**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

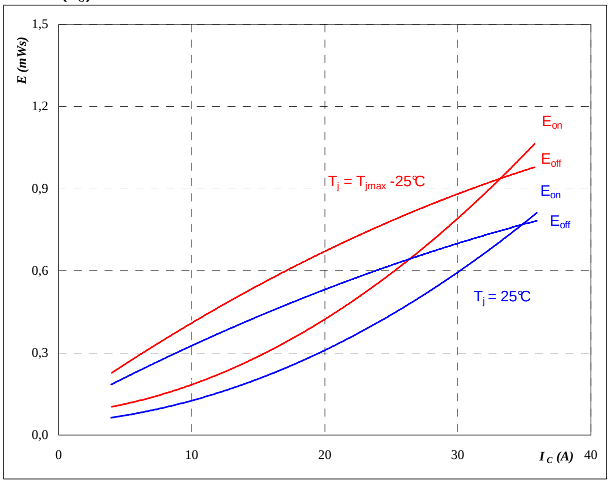
t_p = 250 μs

Brake

figure 5.	IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



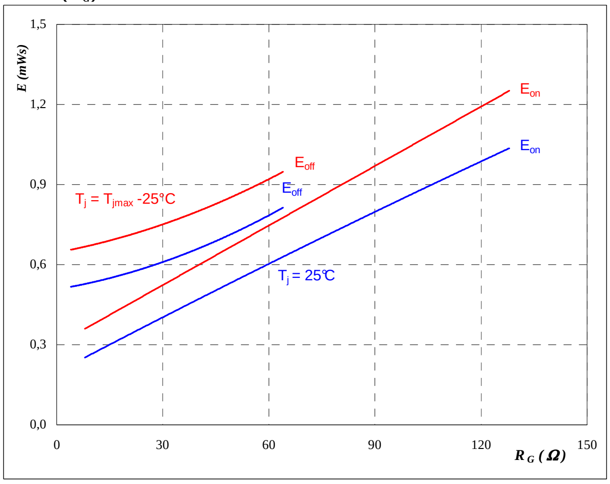
With an inductive load at

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	16	Ω
R_{goff} =	8	Ω

figure 6.	IGBT

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



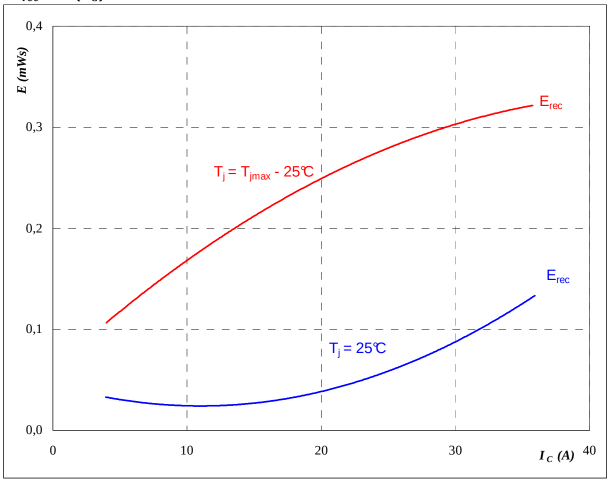
With an inductive load at

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	20	A

figure 7.	FWD

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_C)$



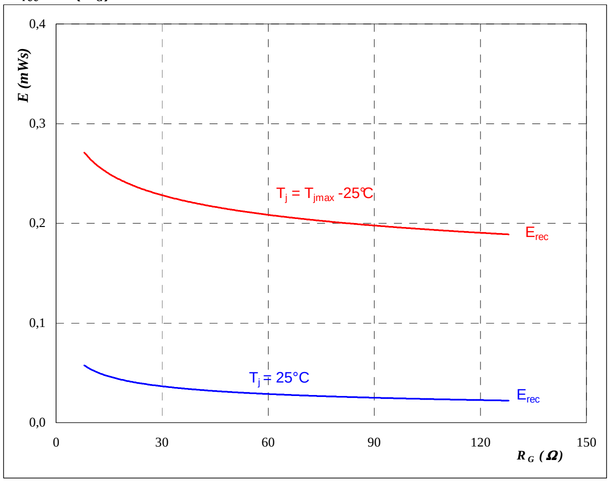
With an inductive load at

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	16	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

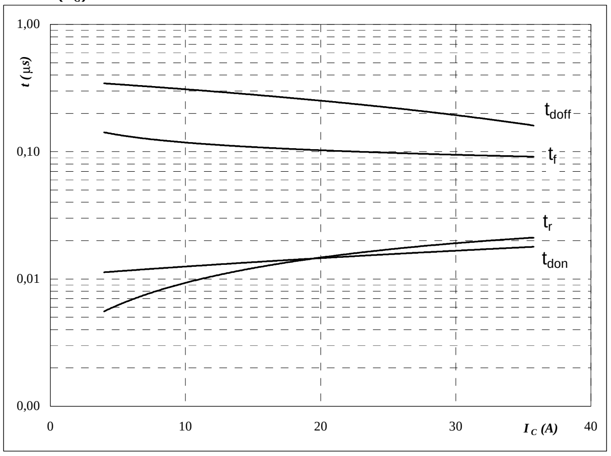
T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	20	A

Brake

figure 9. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



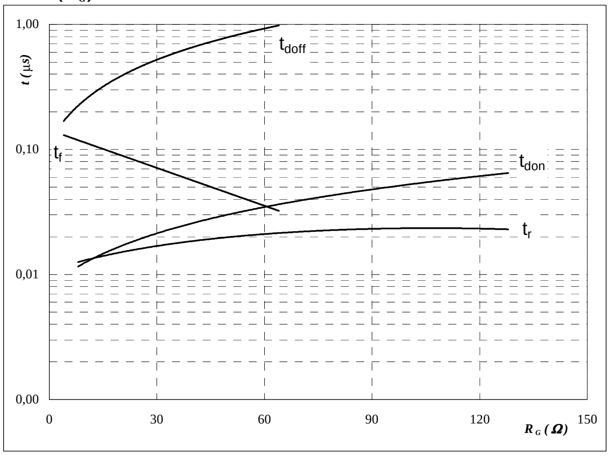
With an inductive load at

T_j =	125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	16	Ω
R_{goff} =	8	Ω

figure 10. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_G)$



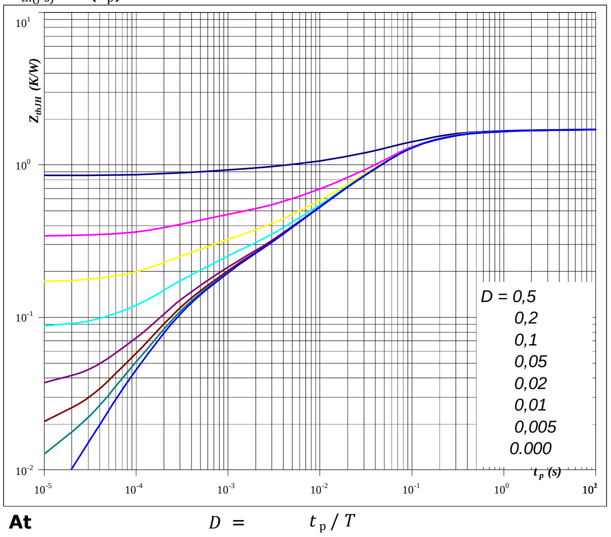
With an inductive load at

T_j =	125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	20	A

figure 11. **IGBT**

IGBT transient thermal impedance as a function of pulse width

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



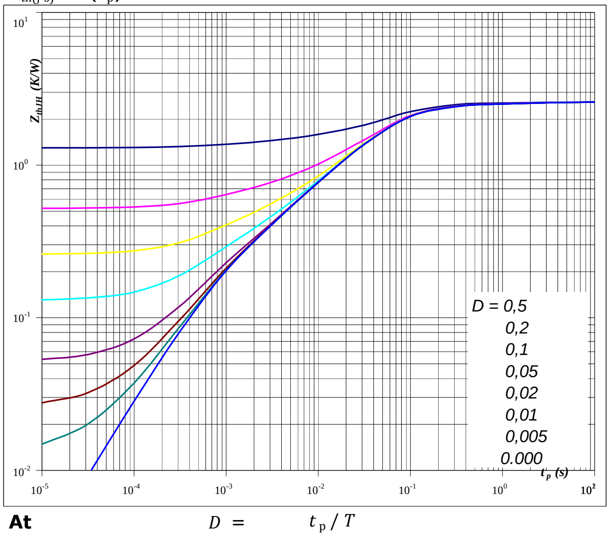
At $D = t_p / T$

$R_{th(j\text{-}s)}$ = 1,70 K/W

figure 12. **FWD**

FWD transient thermal impedance as a function of pulse width

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



At $D = t_p / T$

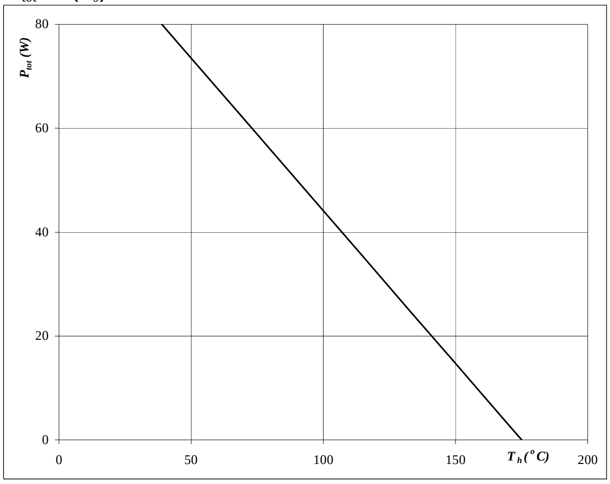
$R_{th(j\text{-}s)}$ = 2,60 K/W

Brake

figure 13. **IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



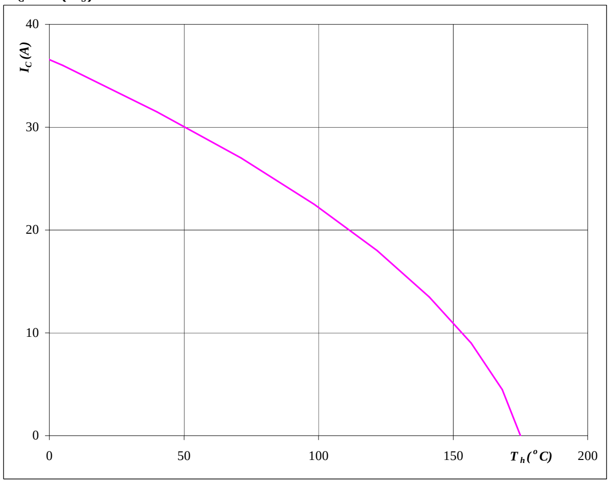
At

T_j = 175 ºC

figure 14. **IGBT**

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

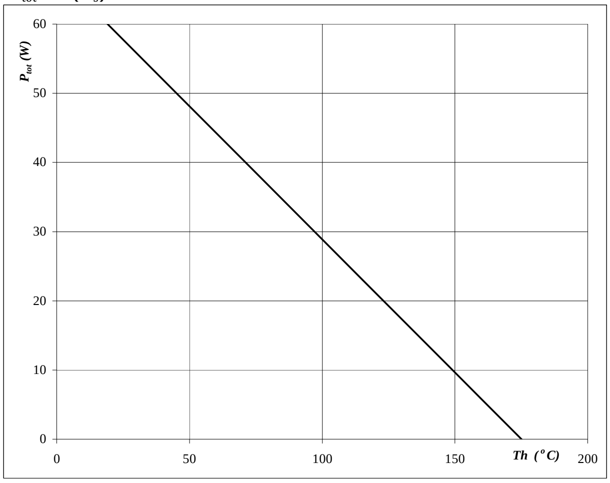
T_j = 175 ºC

V_{GE} = 15 V

figure 15. **FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



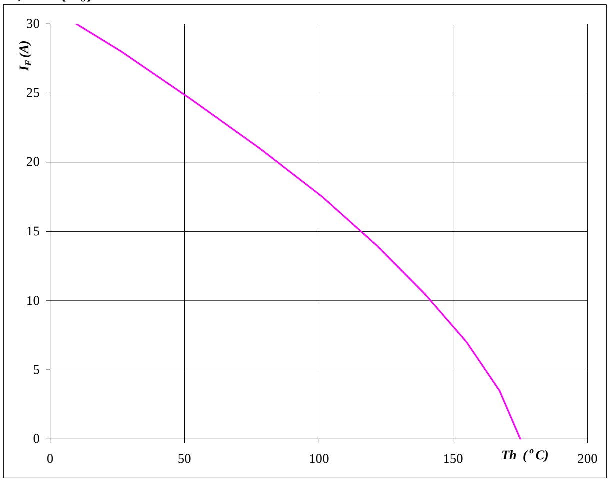
At

T_j = 175 ºC

figure 16. **FWD**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

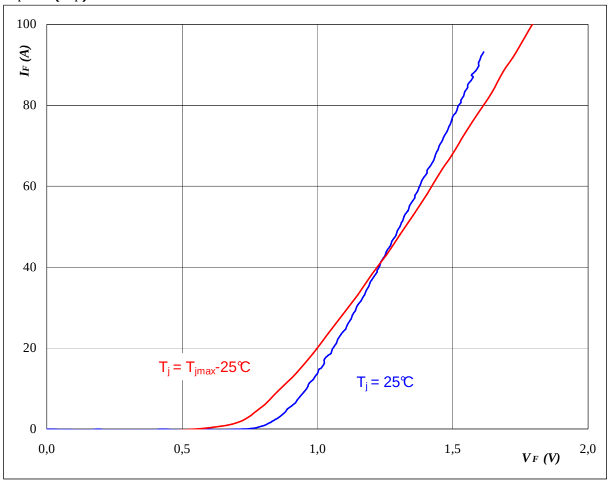
T_j = 175 ºC

Input Rectifier Bridge

figure 1. **Rectifier Diode**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



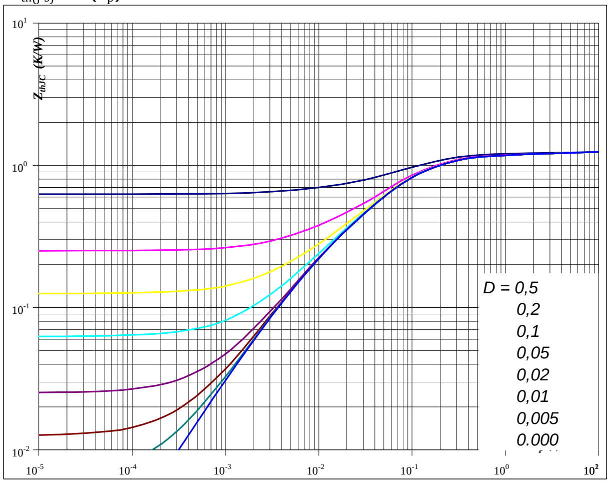
At

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

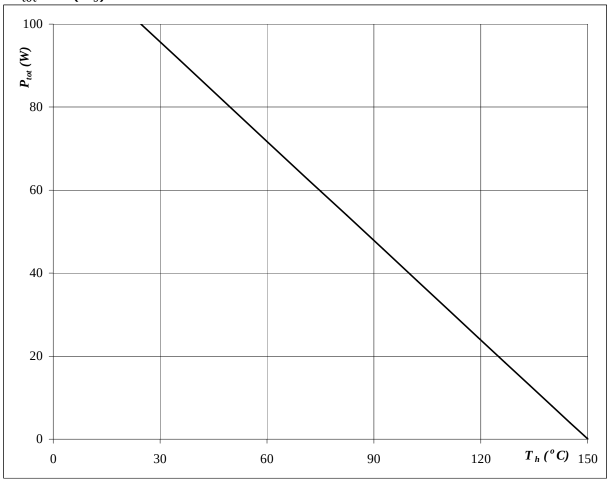
$D = t_p / T$

$R_{th(j-s)}$ = 1,25 K/W

figure 3. **Rectifier Diode**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



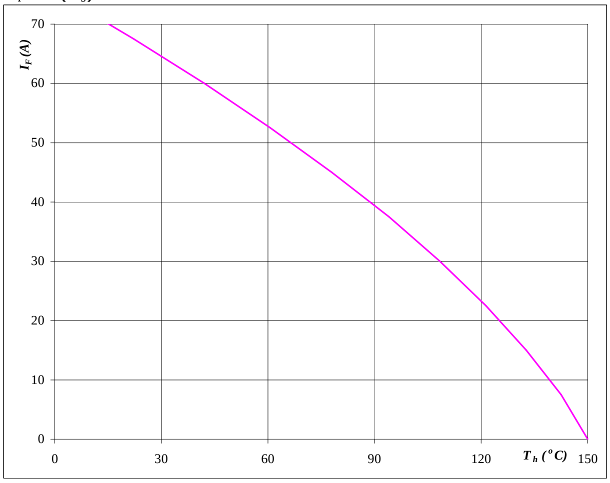
At

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

$R_T = f(T)$

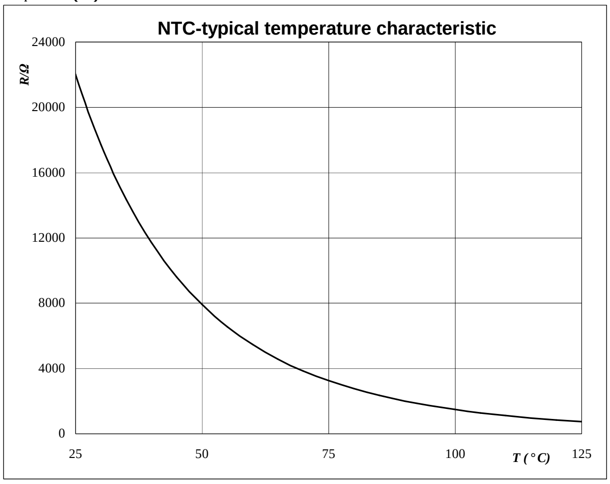


figure 2. **Thermistor**

Typical NTC resistance values

$$R(T) = R_{25} \cdot e^{\left(B_{25/100} \cdot \left(\frac{1}{T} - \frac{1}{T_{25}}\right)\right)} \quad [\Omega]$$

T [°C]	R_{nom} [Ω]	R_{min} [Ω]	R_{max} [Ω]	△R/R [±%]
-55	2089434,5	1506495,4	2672373,6	27,9
0	71804,2	59724,4	83884	16,8
10	43780,4	37094,4	50466,5	15,3
20	27484,6	23684,6	31284,7	13,8
25	22000	19109,3	24890,7	13,1
30	17723,3	15512,2	19934,4	12,5
60	5467,9	4980,6	5955,1	8,9
70	3848,6	3546	4151,1	7,9
80	2757,7	2568,2	2947,1	6,9
90	2008,9	1889,7	2128,2	5,9
100	**1486,1**	**1411,8**	**1560,4**	**5**
150	400,2	364,8	435,7	8,8

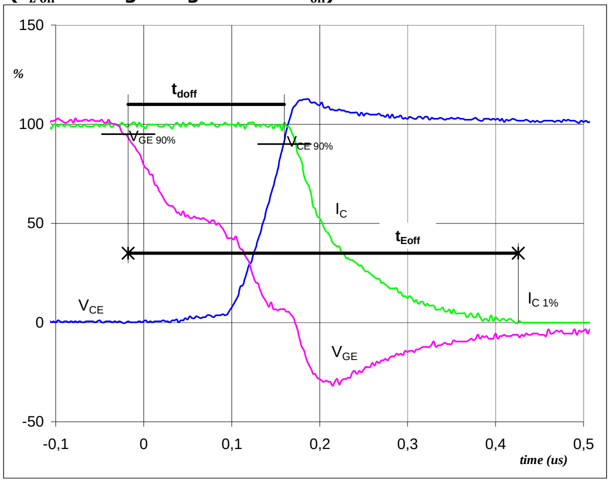
Switching Definitions Output Inverter

General conditions

T_j	=	125 °C
R_{gon}	=	16 Ω
R_{goff}	=	8 Ω

figure 1. **IGBT**

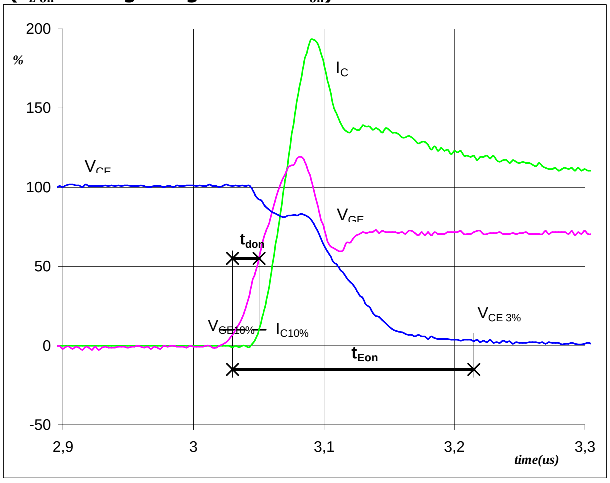
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	30	A
t_{doff} =	0,17	μs
$t_{E\,off}$ =	0,44	μs

figure 2. **IGBT**

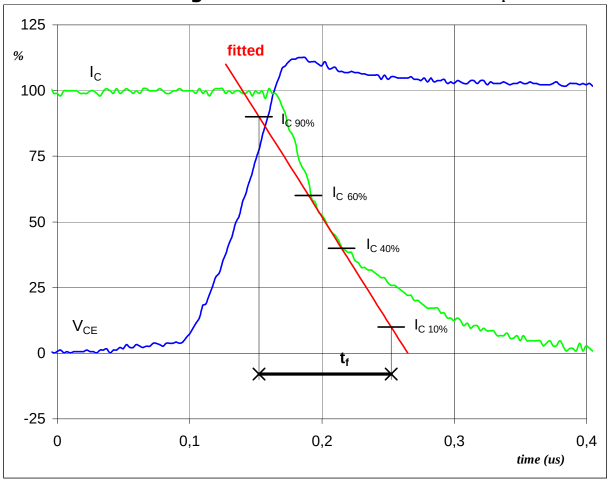
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	30	A
t_{don} =	0,02	μs
$t_{E\,on}$ =	0,18	μs

figure 3. **IGBT**

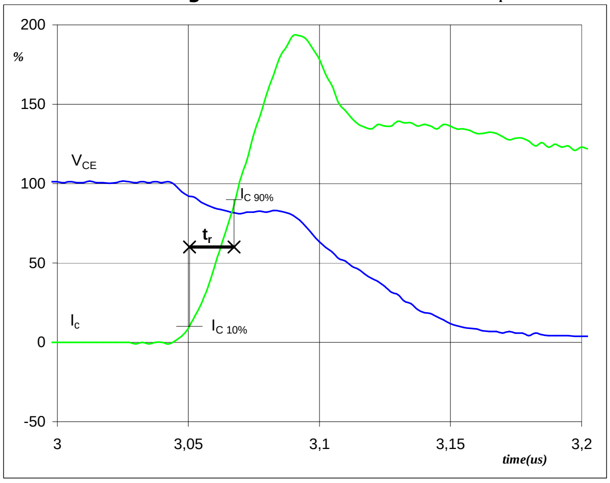
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	300	V
I_C (100%) =	30	A
t_f =	0,10	μs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

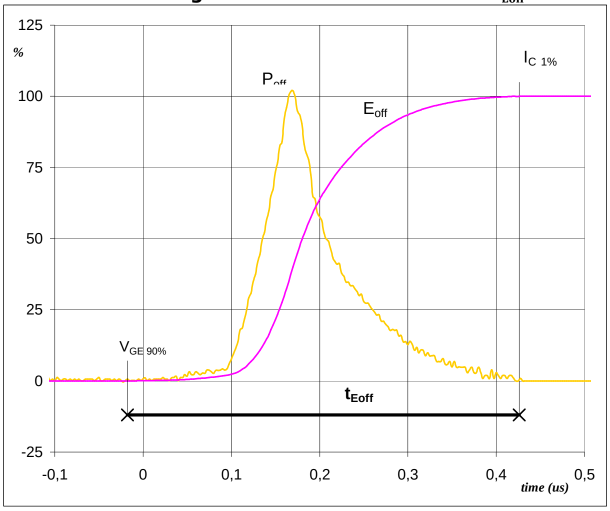


V_C (100%) =	300	V
I_C (100%) =	30	A
t_r =	0,02	μs

Switching Definitions Output Inverter

figure 5. **IGBT**

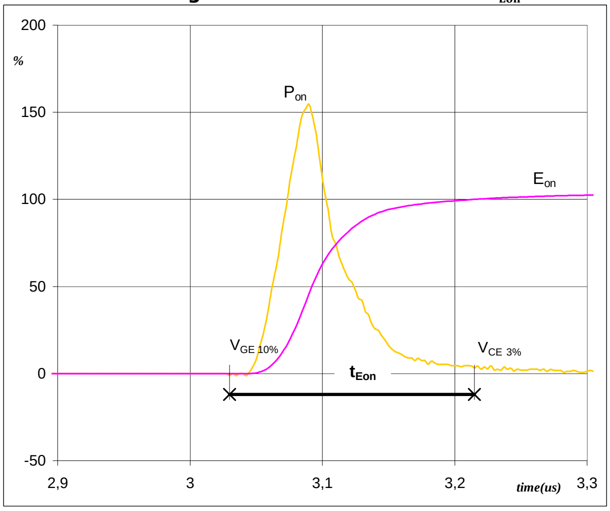
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	8,98	kW
E_{off} (100%) =	0,90	mJ
$t_{E\,off}$ =	0,44	μs

figure 6. **IGBT**

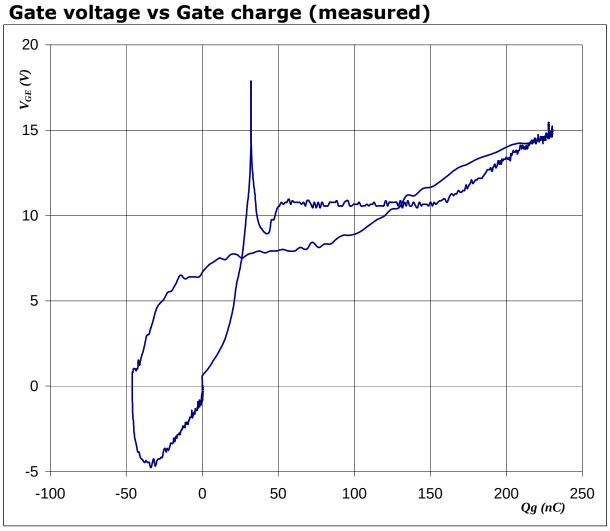
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	8,98	kW
E_{on} (100%) =	0,71	mJ
$t_{E\,on}$ =	0,18	μs

figure 7. **FWD**

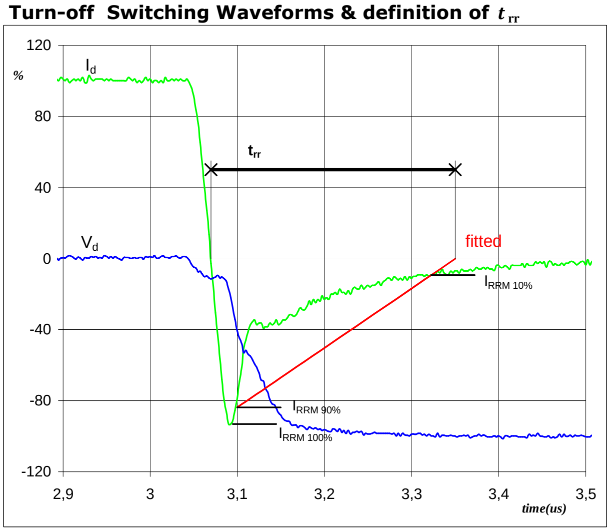
Gate voltage vs Gate charge (measured)



$V_{GE\,off}$ =	0	V
$V_{GE\,on}$ =	15	V
V_C (100%) =	300	V
I_C (100%) =	30	A
Q_g =	230,15	nC

figure 8. **IGBT**

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

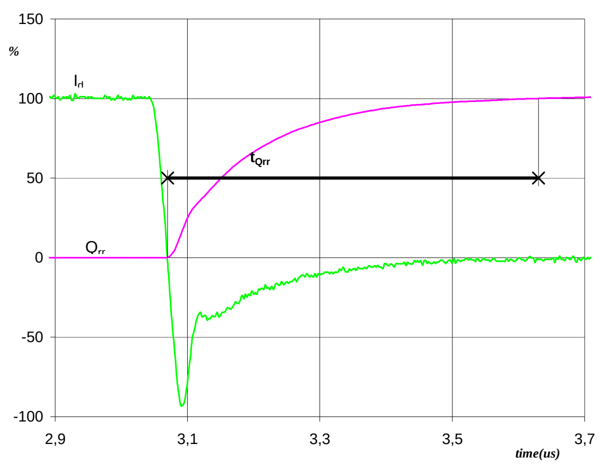


V_d (100%) =	300	V
I_d (100%) =	30	A
I_{RRM} (100%) =	28	A
t_{rr} =	0,26	μs

Switching Definitions Output Inverter

figure 9. **FWD**

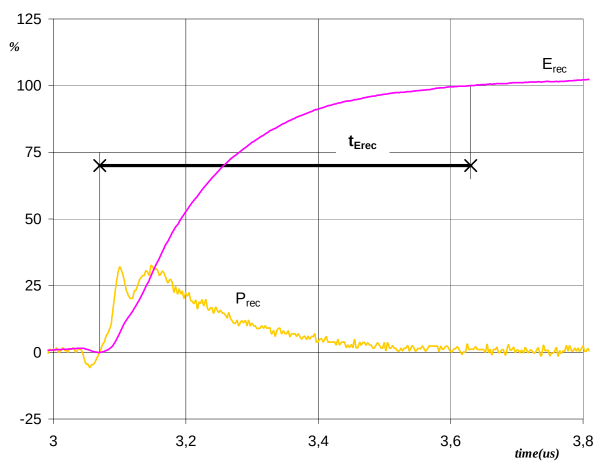
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q rr}$ = integrating time for Q_{rr})



I_d (100%) =	30	A
Q_{rr} (100%) =	2,45	μC
$t_{Q rr}$ =	0,56	μs

figure 10. **FWD**

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



P_{rec} (100%) =	8,98	kW
E_{rec} (100%) =	0,51	mJ
$t_{E rec}$ =	0,56	μs

Ordering Code & Marking

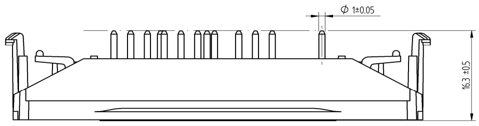
Version	Ordering Code
Without thermal paste 12mm housing full configuration with Solder pins	V23990-P546-A38-PM
With thermal paste 12mm housing full configuration with Solder pins	V23990-P546-A38-PM-/3/
Without thermal paste 12mm housing Full configuration with Pressfit pins	V23990-P546-A38Y-PM
With thermal paste 12mm housing Full configuration with Pressfit pins	V23990-P546-A38Y-PM-/3/
Without thermal paste 17mm housing full configuration with Solder pins	V23990-P546-A39-PM
With thermal paste 17mm housing full configuration with Solder pins	V23990-P546-A39-PM-/3/
Without thermal paste 12mm housing without Brake with Solder pins	V23990-P546-C38-PM
With thermal paste 12mm housing without Brake with Solder pins	V23990-P546-C38-PM-/3/
Without thermal paste 17mm housing without Brake with Solder pins	V23990-P546-C39-PM
With thermal paste 17mm housing without Brake with Solder pins	V23990-P546-C39-PM-/3/
Without thermal paste 17mm housing without Brake with Press-fit pins	V23990-P546-C39Y-PM
With thermal paste 17mm housing without Brake with Press-fit pins	V23990-P546-C39Y-PM-/3/
Without thermal paste 17mm housing without Brake with 1phase rectifier and Solder pins	V23990-P546-D139-PM
With thermal paste 17mm housing without Brake with 1phase rectifier and Solder pins	V23990-P546-D139-PM-/3/

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		

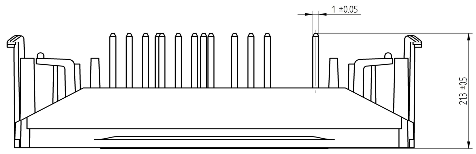
Outline

Pin table [mm]			
Pin	X	Y	Function
1	25,5	2,7	NTC1
2	25,5	0	NTC2
3	22,8	0	-DC
4	20,1	0	BRCG
5	16,2	0	BRCE
6	13,5	0	G6
7	10,8	0	E6
8	8,1	0	G5
9	5,4	0	E5
10	2,7	0	G4
11	0	0	E4
12	0	19,8	G1
13	0	22,5	U
14	7,5	19,8	G2
15	7,5	22,5	V
16	15	19,8	G3
17	15	22,5	W
18	22,8	22,5	+INV
19	25,5	22,5	+DC
20	33,5	22,5	BRC+
21	33,5	15	L1
22	33,5	7,5	L2
23	33,5	0	L3

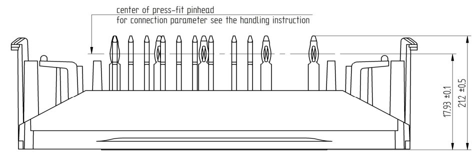
12 mm Solder pin



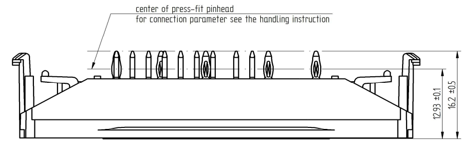
17 mm Solder pin

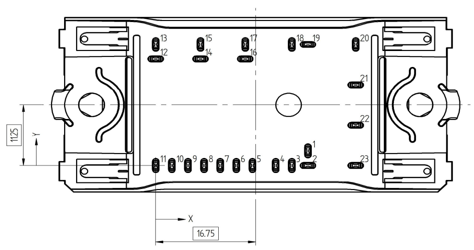


17 mm Press-fit pin



12 mm Press-fit pin

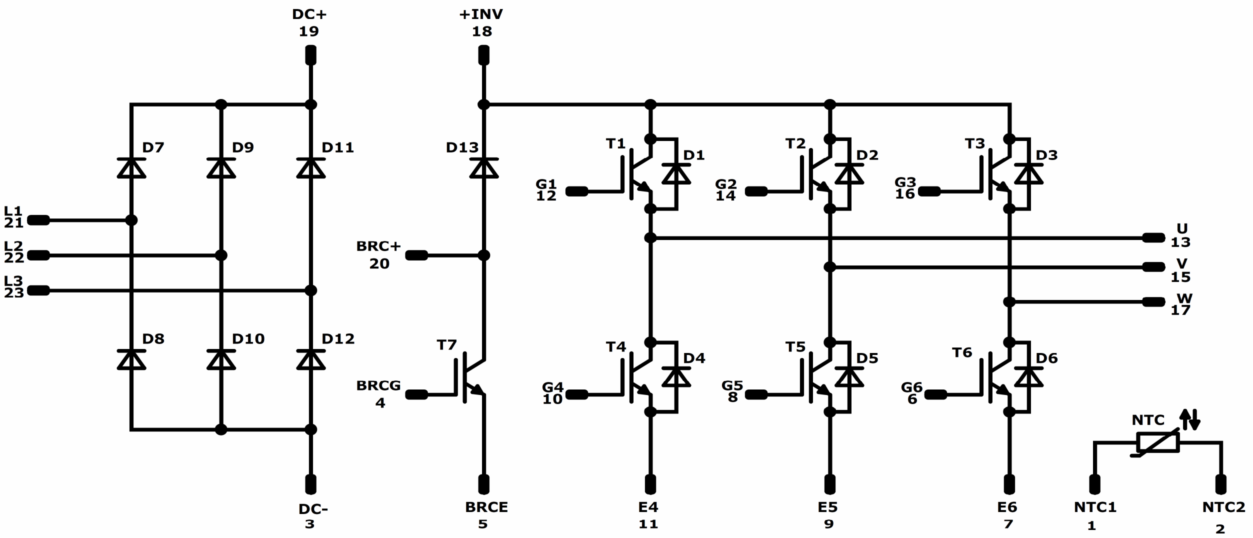




Tolerance of pinpositions: ±0.5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Pinout variation	
Modul subtype	Not assembled pins
V23990-P546-A38-PM	-
V23990-P546-A39-PM	-
V23990-P546-C38-PM	4, 5, 20
V23990-P546-C39-PM	4, 5, 20
V23990-P546-D139-PM	4, 5, 20, 23

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1, T2, T3, T4, T5, T6	IGBT	600	30	Inverter Switch	
D1, D2, D3, D4, D5, D6	FWD	600	30	Inverter Diode	
T7	IGBT	600	20	Brake Switch	
D13	FWD	600	20	Brake Diode	
D7, D8, D9, D10, D11, D11, D12	Rectifier	1600	35	Rectifier	
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-P546-x3x-PM-D6-14	13 May. 2019	Added -D139 variant	1,23