Vincotech

| *flow* PIM 2 | #REF! |

Features

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

Target Applications

- Motor Drives
- Power Generation

Types

- V23990-P760-A-PM
- V23990-P760-AY-PM

flow 2 17mm housing
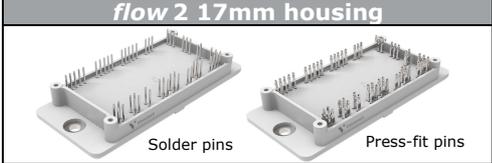
Solder pins   Press-fit pins

Schematic
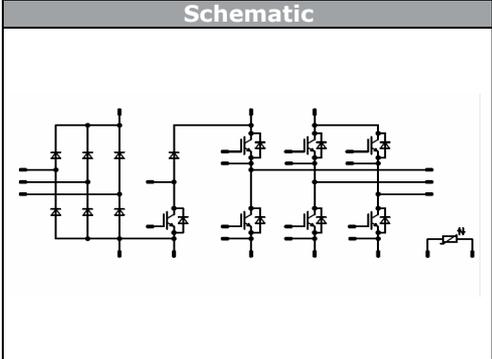
Maximum Ratings

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}		75	A
Surge (non-repetitive) forward current	I_{FSM}	t_p = 10 ms	1000	A
I²t-value	I^2t		5000	A²s
Power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	156	W
Maximum Junction Temperature	T_{jmax}		150	°C
Inverter Switch				
Collector-emitter breakdown voltage	V_{CE}		1200	V
DC collector current	I_C		100	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	300	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	272	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	85	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		200	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	154	W
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Switch					
Collector-emitter breakdown voltage	V_{CE}			1200	V
DC collector current	I_C			50	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	174	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 Inverse Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F			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	52	W
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F			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	87	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

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Maximum Ratings

T_J = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Isolation Properties					
Isolation voltage	V_isol	DC Test Voltage*	t_p = 2 s	4000	V
		AC Voltage	t_p = 1 min	2500	V
Creepage distance				min 12,7	mm
Clearance		with Press-fit pins / with Solder pins		11,58 / 11,82	mm
Comparative Tracking Index	CTI			>200	

* 100 % tested in production

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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

Parameter	Symbol		V_{GE}/V_{GS}	$V_r/V_{CE}/V_{DS}$	$I_C/I_F/I_D$	T_j	Min	Typ	Max	Unit
Forward voltage	V_F				100	25 / 125		1,18 / 1,16	1,9	V
Threshold voltage (for power loss calc. only)	V_{to}				100	25 / 125		0,88 / 0,75		V
Slope resistance (for power loss calc. only)	r_t				100	25 / 125		0,003 / 0,004		Ω
Reverse current	I_r			1500		25 / 125			0,05 / 1,1	mA
Thermal resistance junction to heatsink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,52		K/W

Inverter Switch

Parameter	Symbol		V_{GE}/V_{GS}	$V_r/V_{CE}/V_{DS}$	$I_C/I_F/I_D$	T_j	Min	Typ	Max	Unit
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0034	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		100	25 / 150		1,9 / 2,34	2,5	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	1200		25			0,03	mA
Gate-emitter leakage current	I_{GES}		20	0		25			700	nA
Integrated Gate resistor	R_{gint}							2		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 4 Ω R_{gon} = 4 Ω	±15	600	100	25 / 150		126 / 130		ns
Rise time	t_r					25 / 150		17 / 22		ns
Turn-off delay time	$t_{d(off)}$					25 / 150		242 / 316		ns
Fall time	t_f					25 / 150		63 / 115		ns
Turn-on energy loss	E_{on}					25 / 150		4,07 / 6,64		mWs
Turn-off energy loss	E_{off}					25 / 150		5,22 / 8,71		mWs
Input capacitance	C_{ies}							5540		pF
Output capacitance	C_{oss}	f = 1 MHz	0	25		25		410		pF
Reverse transfer capacitance	C_{rss}							320		pF
Gate charge	Q_G		±15			25		580		nC
Thermal resistance junction to heatsink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,35		K/W

Inverter Diode

Parameter	Symbol		V_{GE}/V_{GS}	$V_r/V_{CE}/V_{DS}$	$I_C/I_F/I_D$	T_j	Min	Typ	Max	Unit
Diode forward voltage	V_F				100	25 / 150		1,83 / 1,86	2,4	V
Peak reverse recovery current	I_{RRM}	R_{gon} = 4 Ω	±15	600	100	25 / 150		167 / 191		A
Reverse recovery time	t_{rr}					25 / 150		134 / 293		ns
Reverse recovered charge	Q_{rr}					25 / 150		9,39 / 19,67		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 / 150		7887 / 3332		A/µs
Reverse recovered energy	E_{rec}					25 / 150		3,82 / 8,55		mWs
Thermal resistance junction to heatsink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,62		K/W

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Characteristic Values

Parameter	Symbol	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
Brake Switch									
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$		0,0017	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}	15		50	25 150		1,84 2,27	2,3	V
Collector-emitter cut-off incl diode	I_{CES}	0	1200		25			0,25	mA
Gate-emitter leakage current	I_{GES}	20	0		25			700	nA
Integrated Gate resistor	R_{gint}						4		Ω
Turn-on delay time	$t_{d(on)}$				25 150		117 121		ns
Rise time	t_r				25 150		18 24		ns
Turn-off delay time	$t_{d(off)}$	$R_{goff} = 8\ \Omega$ $R_{gon} = 8\ \Omega$	600	50	25 150		249 316		ns
Fall time	t_f	±15			25 150		88 125		ns
Turn-on energy loss	E_{on}				25 150		2,39 3,43		mWs
Turn-off energy loss	E_{off}				25 150		2,96 4,8		mWs
Input capacitance	C_{ies}						2770		pF
Output capacitance	C_{oss}	$f = 1\ MHz$	0	25	25		205		pF
Reverse transfer capacitance	C_{rss}						160		pF
Gate charge	Q_G	±15	960		25		290		nC
Thermal resistance junction to heatsink	$R_{th(j-s)}$	$\lambda_{paste} = 3{,}4\ W/mK$ (PSX)					0,55		K/W
Brake Inverse Diode									
Diode forward voltage	V_F			10	25 150	1,1	1,84 1,8	2,1	V
Thermal resistance junction to heatsink	$R_{th(j-s)}$	$\lambda_{paste} = 3{,}4\ W/mK$ (PSX)					1,68		K/W
Brake Diode									
Diode forward voltage	V_F			25	25 150		1,87 1,83	2,2	V
Reverse leakage current	I_r		600		25			10	µA
Peak reverse recovery current	I_{RRM}				25 150		54,29 78,18		A
Reverse recovery time	t_{rr}	$R_{gon} = 8\ \Omega$	600	50	25 150		158,7 295,4		ns
Reverse recovered charge	Q_{rr}	±15			25 150		3,21 6,6		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$				25 150		4114 3412		A/µs
Reverse recovery energy	E_{rec}				25 150		3,21 6,6		mWs
Thermal resistance junction to heatsink	$R_{th(j-s)}$	$\lambda_{paste} = 3{,}4\ W/mK$ (PSX)					1,09		K/W
Thermistor									
Rated resistance	R_{25}				25	20,9	22	23,1	kΩ
Deviation of R_{100}	$D_{R/R}$	$R_{100} = 1486\ \Omega$			100		2,9		%
Power dissipation	P				25		210		mW
Power dissipation constant	$B_{(25/100)}$	Tol. ±3%			25		2		K

24 Jan. 2019 / Revision 9

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

$I_c = f(V_{GE})$

Tj = Tj$_{max}$-25℃

Tj = 25℃

At

$t_p =$ 250 µs
$V_{CE} =$ 10 V

figure 4.	FWD

**Typical diode forward current as
a function of forward voltage**

$I_F = f(V_F)$

Tj = 25℃

Tj = Tj$_{max}$-25℃

At

$t_p =$ 250 µs
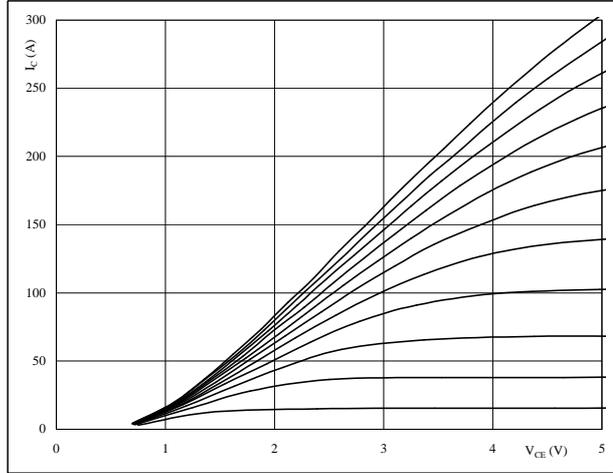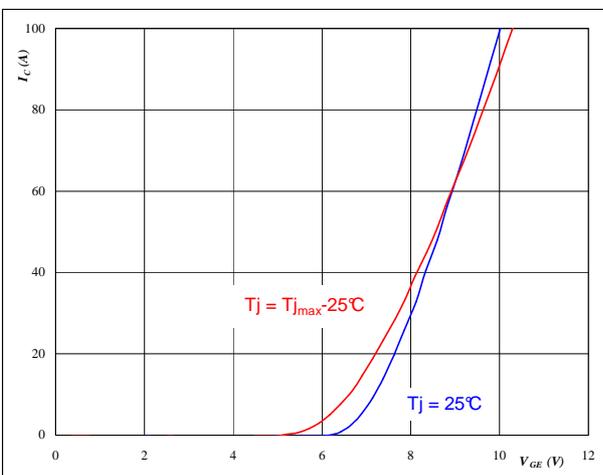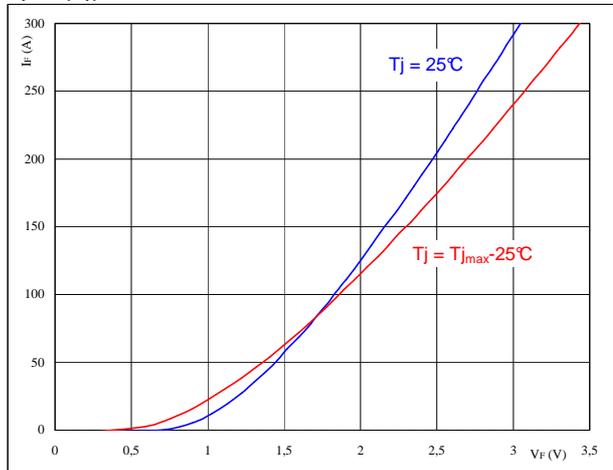
Output Inverter

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} =	4	Ω
R_{goff} =	4	Ω

figure 6. **IGBT**

**Typical switching energy losses
as a function of gate resistor**

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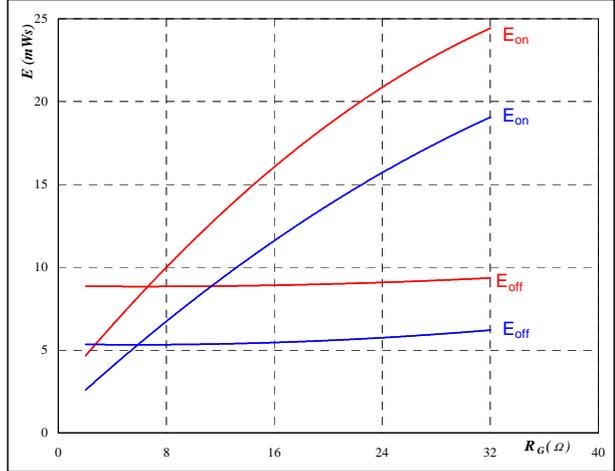
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	100	A

figure 7. **IGBT**

**Typical reverse recovery energy loss
as a function of collector current**

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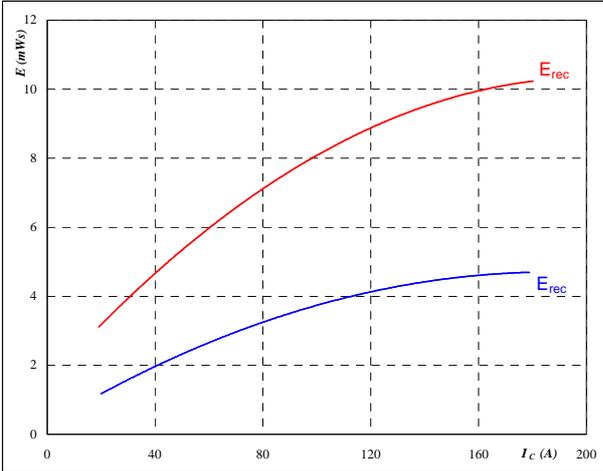
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

figure 8. **IGBT**

**Typical reverse recovery energy loss
as a function of gate resistor**

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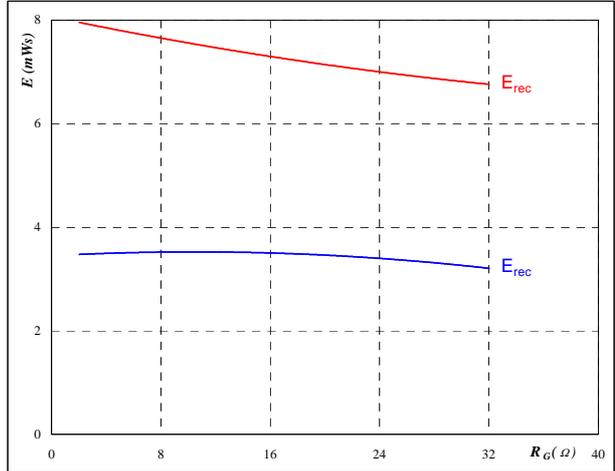
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	100	A

Output Inverter

figure 9.   **IGBT**

Typical switching times as a
function of collector current

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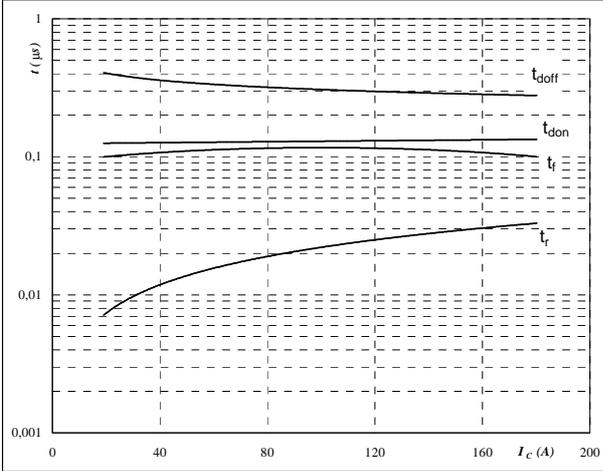
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	4	Ω
$R_{goff} =$	4	Ω

figure 10.   **IGBT**

Typical switching times as a
function of gate resistor

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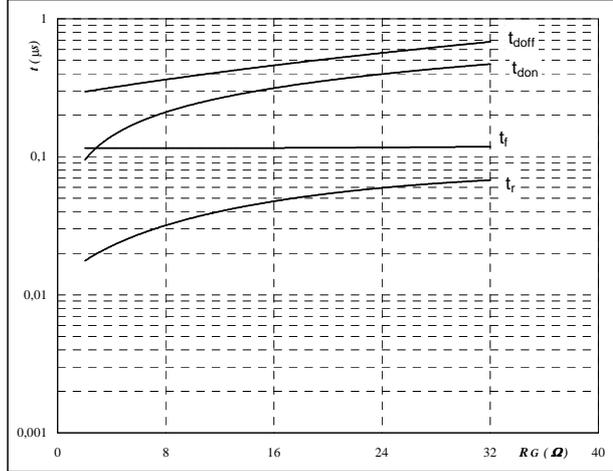
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$I_C =$	100	A

figure 11.   **FWD**

Typical reverse recovery time as a
function of collector current

$t_{rr} = f(I_c)$

At
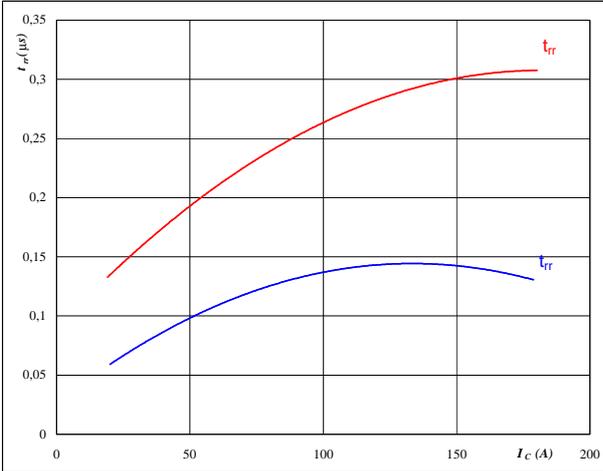
$T_j =$	25/150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	4	Ω

figure 12.   **FWD**

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

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

At
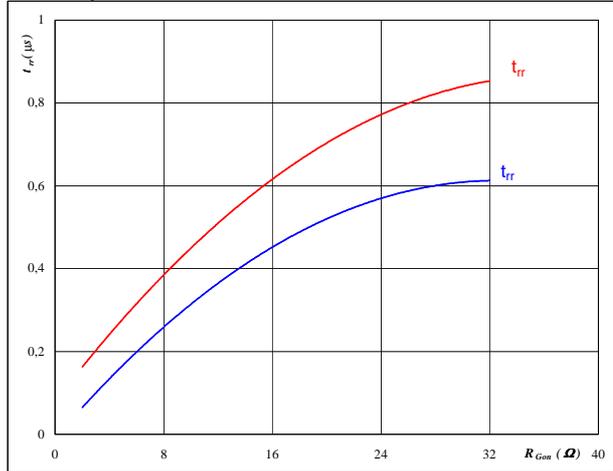
$T_j =$	25/150	°C
$V_R =$	600	V
$I_F =$	100	A
$V_{GE} =$	±15	V

Output Inverter

figure 13. FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_c)$

At
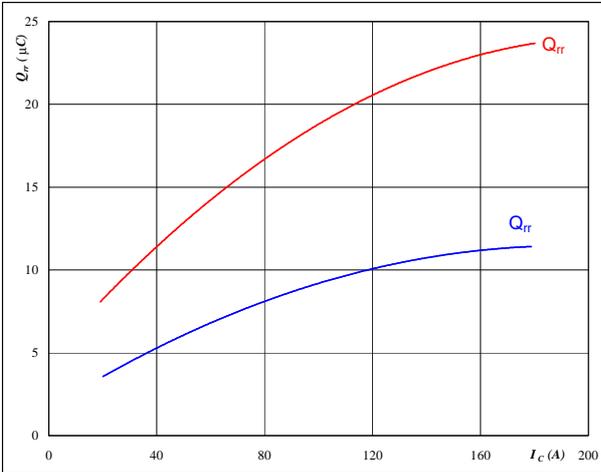
$T_j =$	25/150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	4	Ω

figure 14. FWD

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

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

At
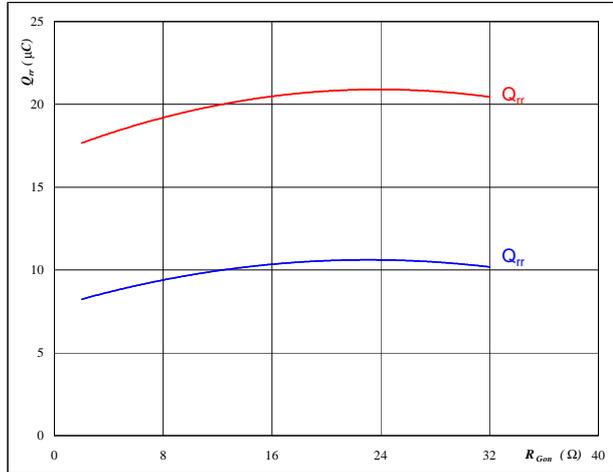
$T_j =$	25/150	°C
$V_R =$	600	V
$I_F =$	100	A
$V_{GE} =$	±15	V

figure 15. FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_c)$

At
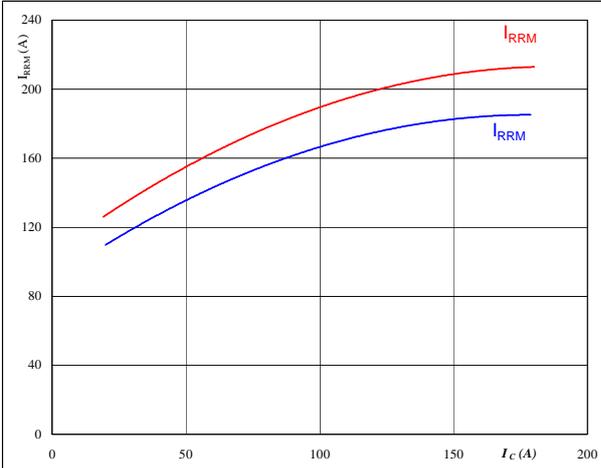
$T_j =$	25/150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	4	Ω

figure 16. FWD

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

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

At
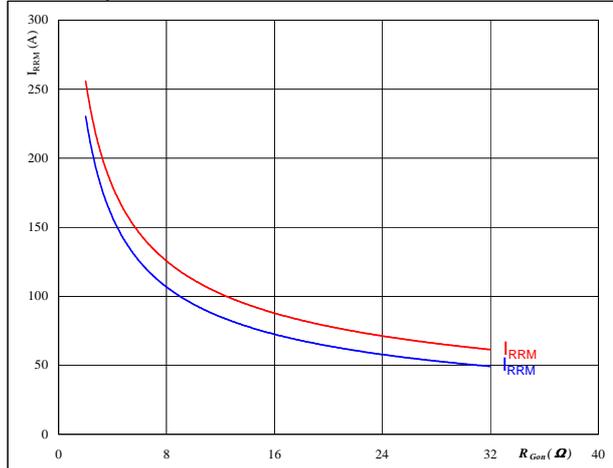
$T_j =$	25/150	°C
$V_R =$	600	V
$I_F =$	100	A
$V_{GE} =$	±15	V

Output Inverter

figure 17.   **FWD**

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

$\mathrm{d}I_0/\mathrm{d}t, \mathrm{d}I_{rec}/\mathrm{d}t = f(I_c)$

At
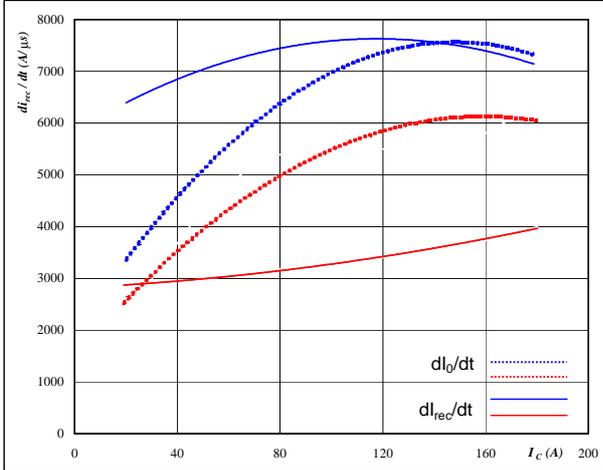
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

figure 18.   **FWD**

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

$\mathrm{d}I_0/\mathrm{d}t, \mathrm{d}I_{rec}/\mathrm{d}t = f(R_{gon})$

At
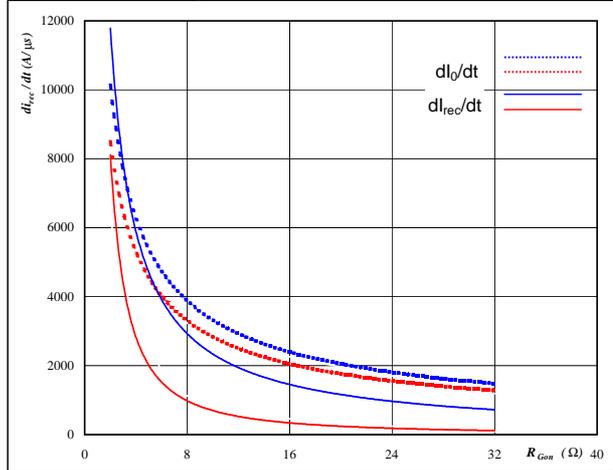
T_j =	25/150	°C
V_R =	600	V
I_F =	100	A
V_{GE} =	±15	V

figure 19.

**IGBT transient thermal impedance
as a function of pulse width**
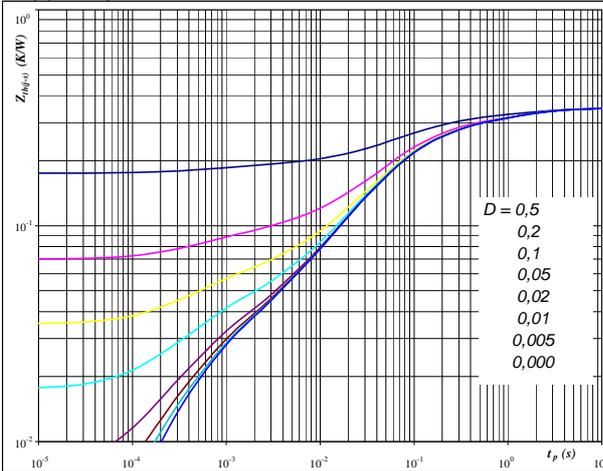
$Z_{th(j\text{-}s)} = f(t_p)$

At

$D = \quad t_p / T$

$R_{th(j\text{-}s)} = \quad 0,35 \quad$ K/W

Single device heated

      IGBT thermal model values

R (K/W)	Tau (s)
6,03E-02	1,65E+00
7,55E-02	2,28E-01
1,42E-01	5,83E-02
4,00E-02	1,39E-02
1,37E-02	1,77E-03
1,79E-02	3,82E-04

figure 20.

**FWD transient thermal impedance
as a function of pulse width**

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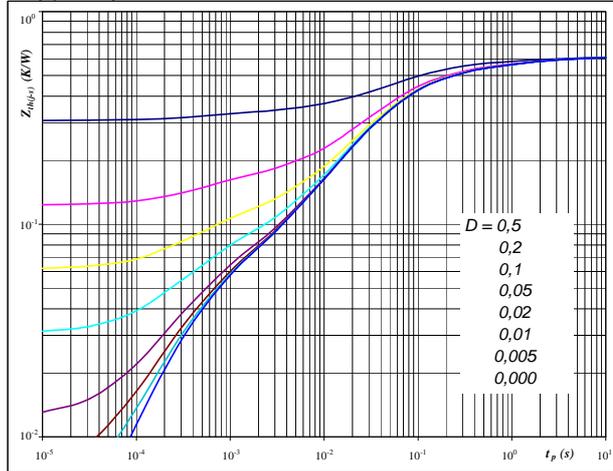
At

$D = \quad t_p / T$

$R_{th(j\text{-}s)} = \quad 0,62 \quad$ K/W

Single device heated

      FWD thermal model values

R (K/W)	Tau (s)
2,75E-02	6,85E+00
5,51E-02	1,37E+00
8,48E-02	2,76E-01
2,34E-01	6,50E-02
1,48E-01	1,93E-02
2,67E-02	2,38E-03
3,98E-02	3,81E-04

Output Inverter

figure 21.   IGBT

**Power dissipation as a
function of heatsink temperature**
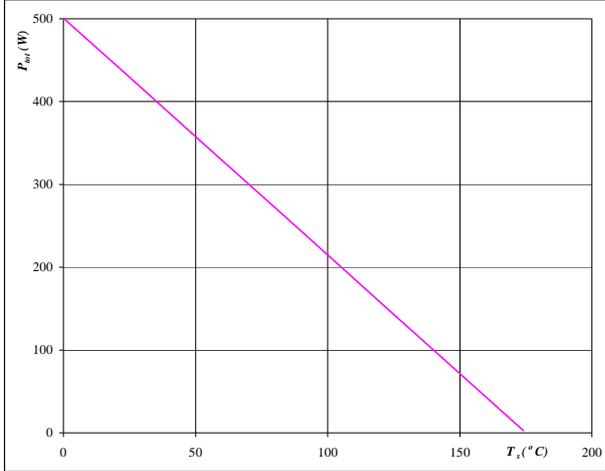
$P_{tot} = f(T_s)$

At

$T_j =$ 175   °C

figure 22.   IGBT

**Collector current as a
function of heatsink temperature**

$I_C = f(T_s)$
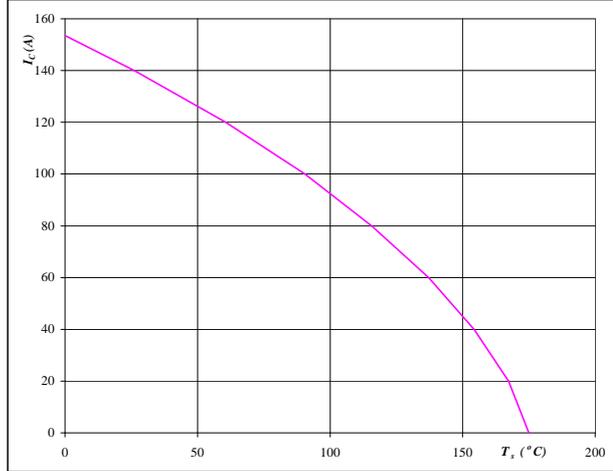
At

$T_j =$ 175   °C
$V_{GE} =$ 15   V

figure 23.   FWD

**Power dissipation as a
function of heatsink temperature**

$P_{tot} = f(T_s)$
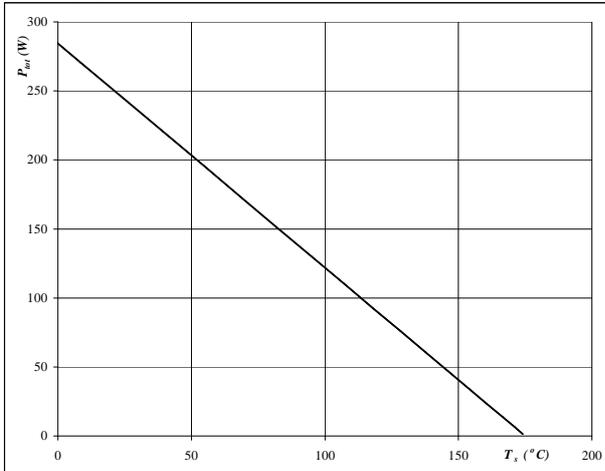
At

$T_j =$ 175   °C

figure 24.   FWD

**Forward current as a
function of heatsink temperature**

$I_F = f(T_s)$
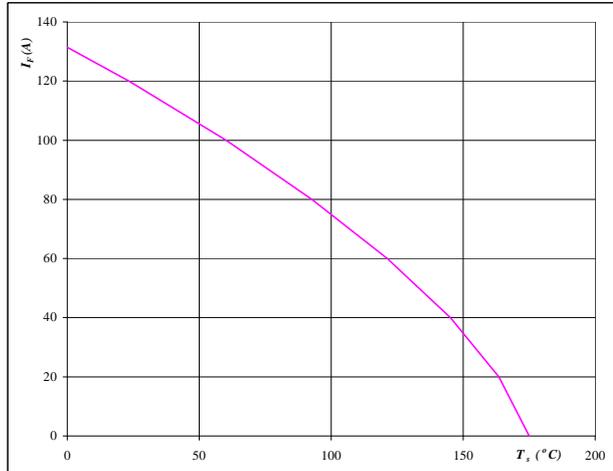
At

$T_j =$ 175   °C

Output Inverter

figure 25.   **IGBT**

**Safe operating area as a function
of collector-emitter voltage**

$I_C = f(V_{CE})$
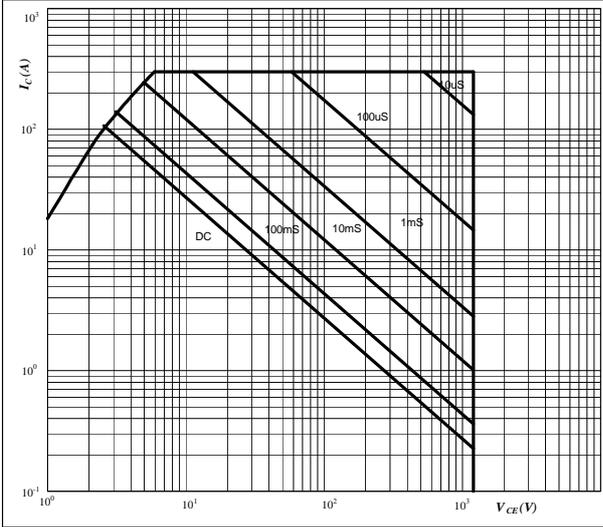
At

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

figure 26.   **IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$
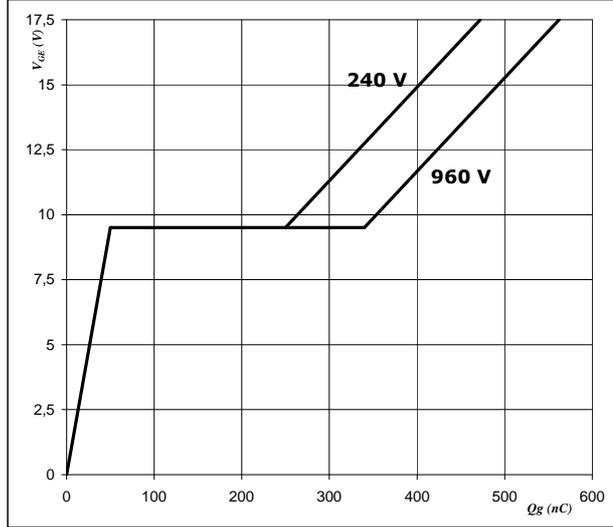
At

I_C =	100	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

$I_C = f(V_{GE})$

Tj = Tj$_{max}$-25°C

Tj = 25°C

At

t_p = 250 µs
V_{CE} = 10 V

figure 4. FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$

Tj = Tj$_{max}$-25°C

Tj = 25°C

At

t_p = 250 µs

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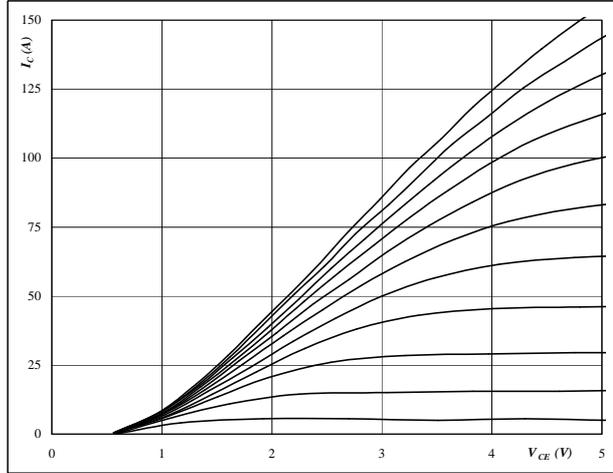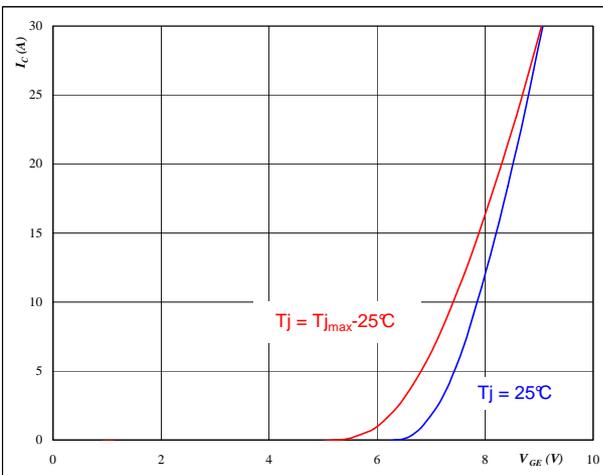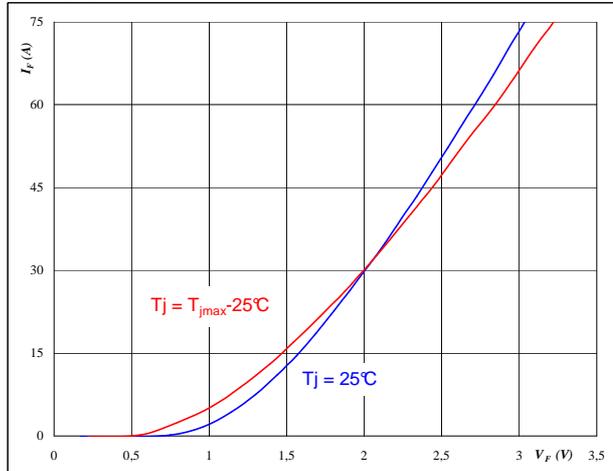
Brake

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} =	8	Ω
R_{goff} =	8	Ω

figure 6. IGBT

Typical switching energy losses
as a function of gate resistor

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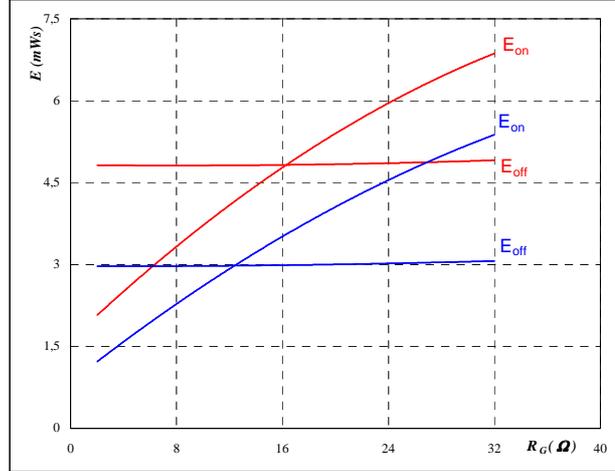
With an inductive load at

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

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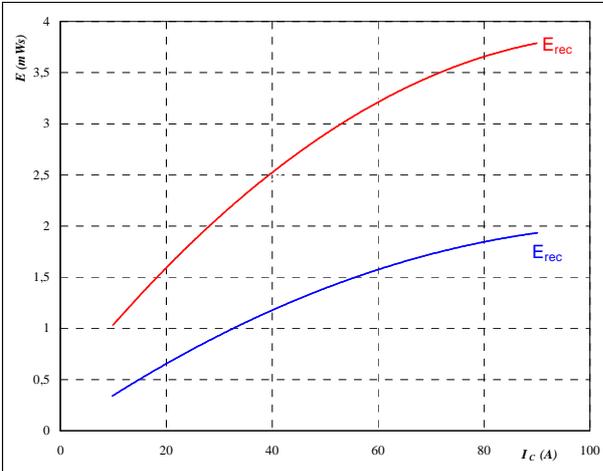
With an inductive load at

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

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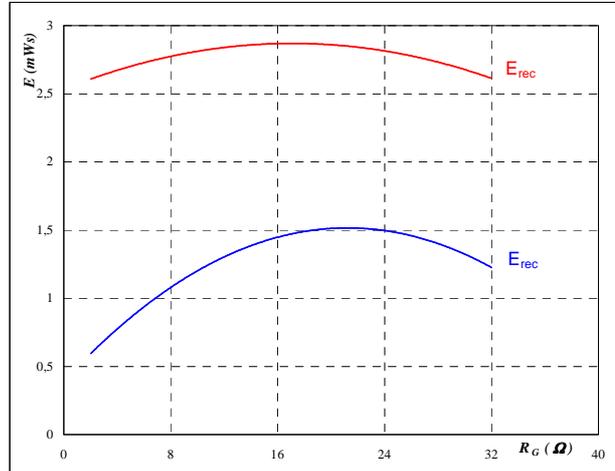
With an inductive load at

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

# Brake

figure 9. IGBT

Typical switching times as a function of collector current

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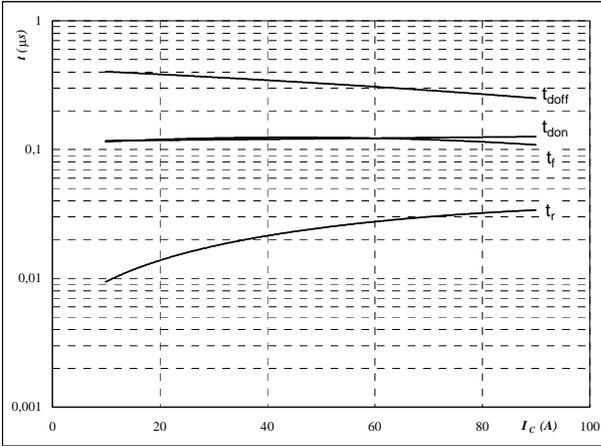
With an inductive load at

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

figure 10. IGBT

Typical switching times as a function of gate resistor

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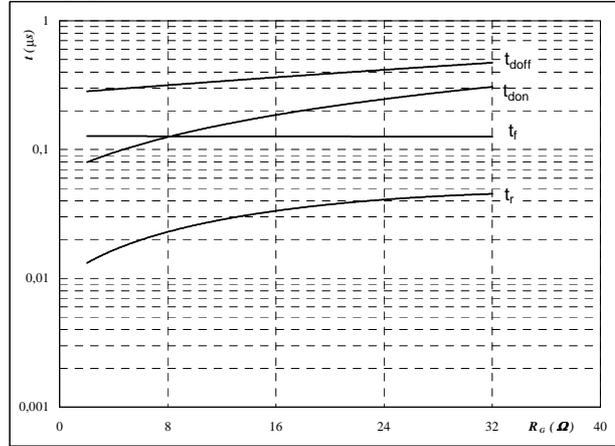
With an inductive load at

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

figure 11. IGBT

IGBT transient thermal impedance as a function of pulse width

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

At
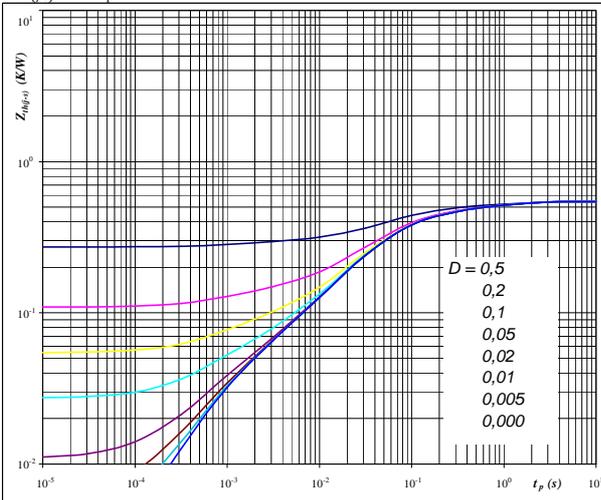
$D = t_p / T$

$R_{th(j-s)} = 0,54$ K/W

figure 12. FWD

FWD transient thermal impedance as a function of pulse width

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

At
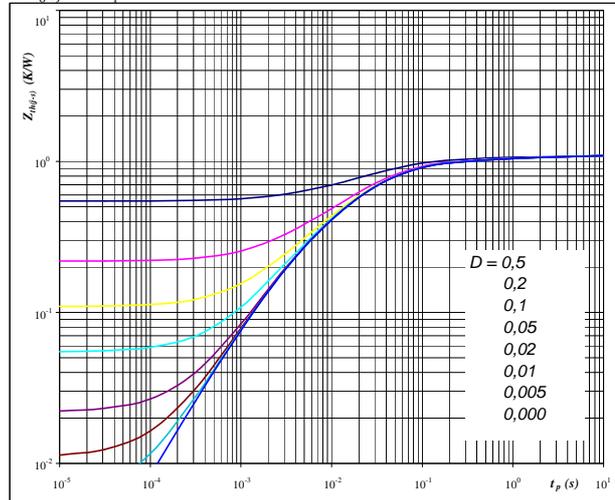
$D = t_p / T$

$R_{th(j-s)} = 1,09$ K/W

Brake

figure 13.	IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$

At
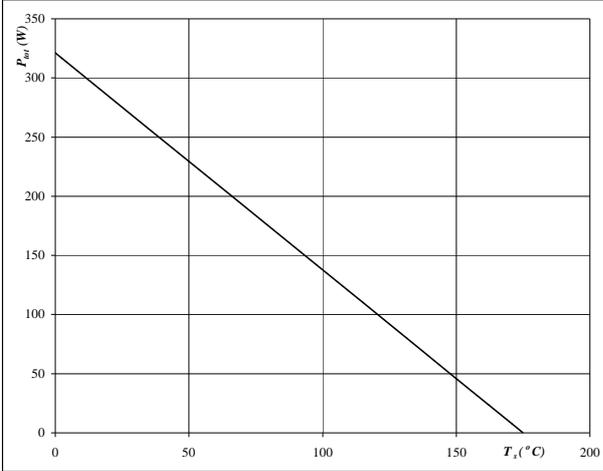
T_j = 175 ºC

figure 14.	IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_s)$

At
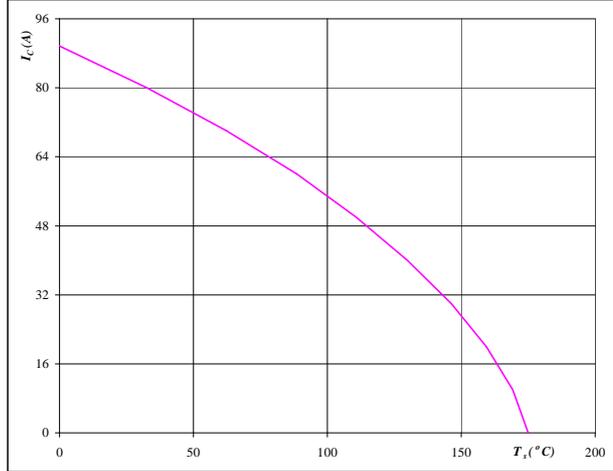
T_j = 175 ºC

V_{GE} = 15 V

figure 15.	FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$

At
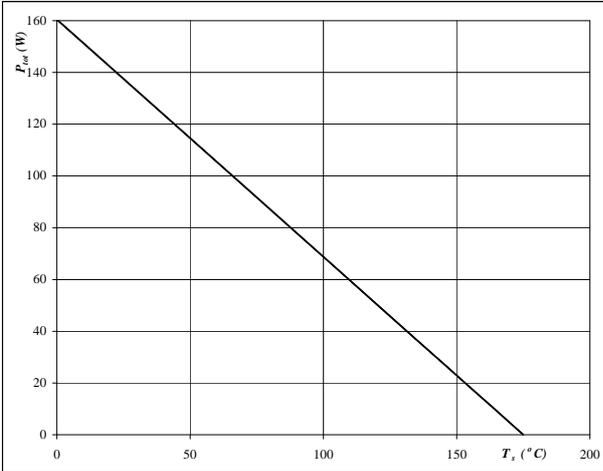
T_j = 175 ºC

figure 16.	FWD

Forward current as a function of heatsink temperature

$I_F = f(T_s)$

At

T_j = 175 ºC
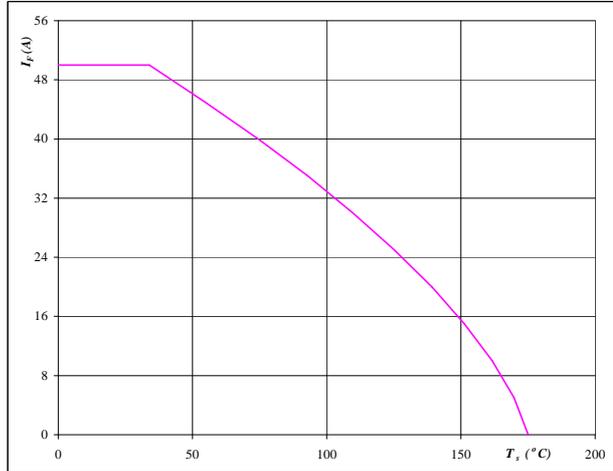
Brake Inverse Diode

Typical diode forward current as
a function of forward voltage

$I_F = f(V_F)$

At

$t_p =$ 250   μs

Diode transient thermal impedance
as a function of pulse width

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

At

$D =$ t_p / T

$R_{th(j-s)} =$ 1,68   K/W

Power dissipation as a
function of heatsink temperature

$P_{tot} = f(T_s)$

At

$T_j =$ 175   ºC

Forward current as a
function of heatsink temperature

$I_F = f(T_s)$

At
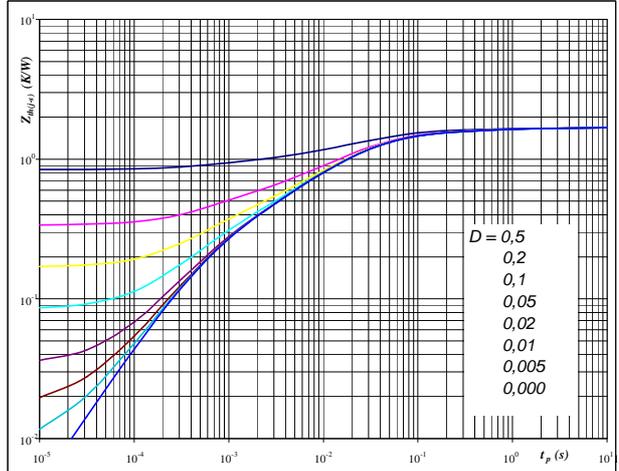
$T_j =$ 175   ºC

Input Rectifier Diode

figure 1.	Rectifier Diode

**Typical diode forward current as
a function of forward voltage**

$I_F = f(V_F)$

At
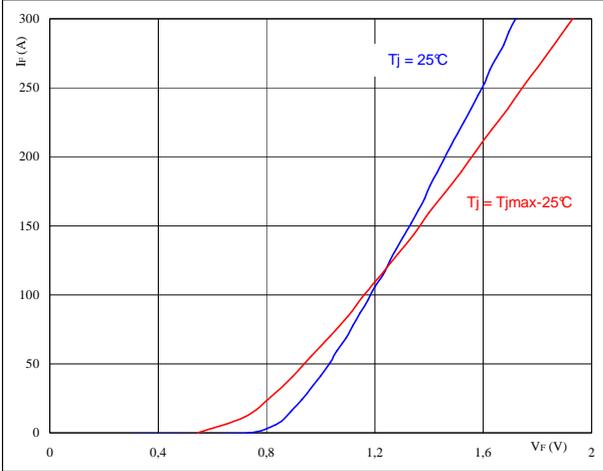
$t_p =$ 250 µs

figure 2.	Rectifier Diode

**Diode transient thermal impedance
as a function of pulse width**

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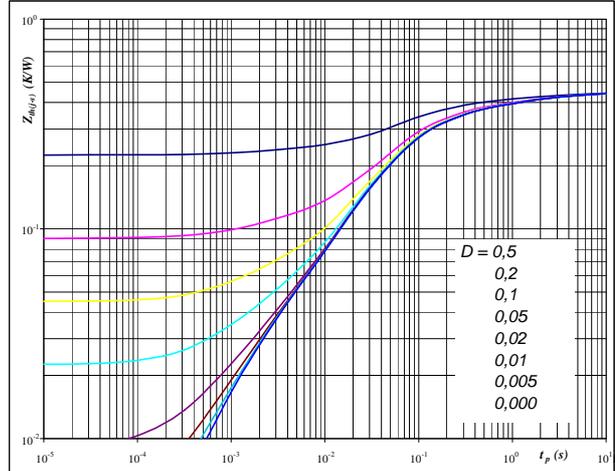
At

$D = t_p / T$

$R_{th(j-s)} =$ 0,45 K/W

figure 3.	Rectifier Diode

**Power dissipation as a
function of heatsink temperature**

$P_{tot} = f(T_s)$

At
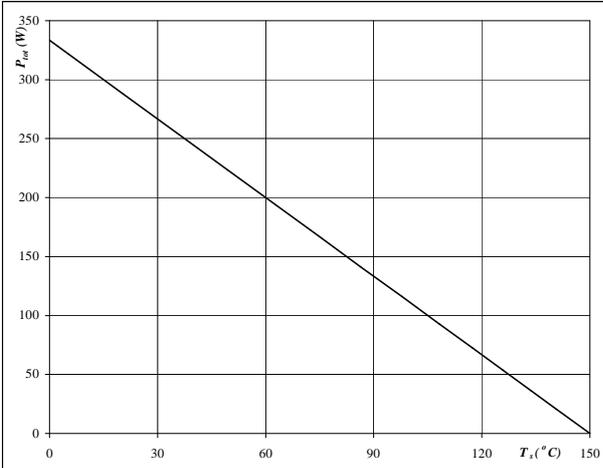
$T_j =$ 150 ºC

figure 4.	Rectifier Diode

**Forward current as a
function of heatsink temperature**

$I_F = f(T_s)$

At
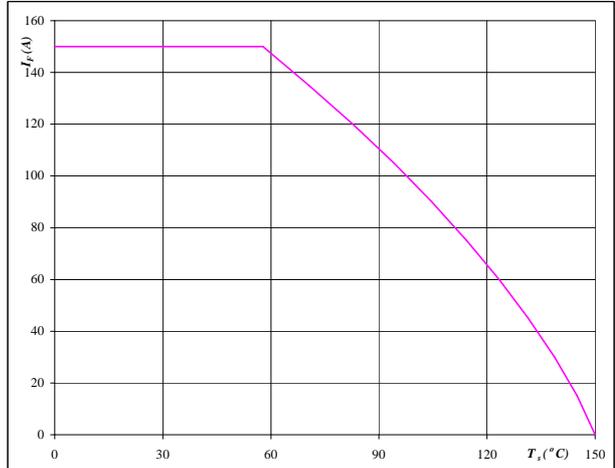
$T_j =$ 150 ºC

Thermistor

figure 1.	Thermistor

Typical NTC characteristic
as a function of temperature

$R_\tau = \mathrm{f}(T)$

NTC-typical temperature characteristic

$R\ (\Omega)$

$T\ (°C)$
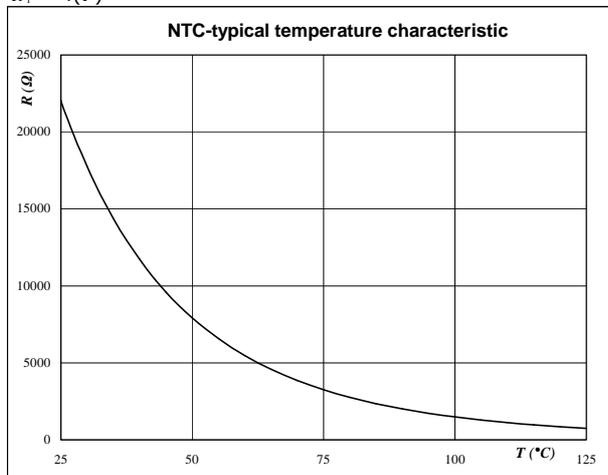
Switching Definitions Output Inverter

General conditions		
T_j	=	125 °C
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

figure 1.　　　　　　　　　　　　　　　　**IGBT**

Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})
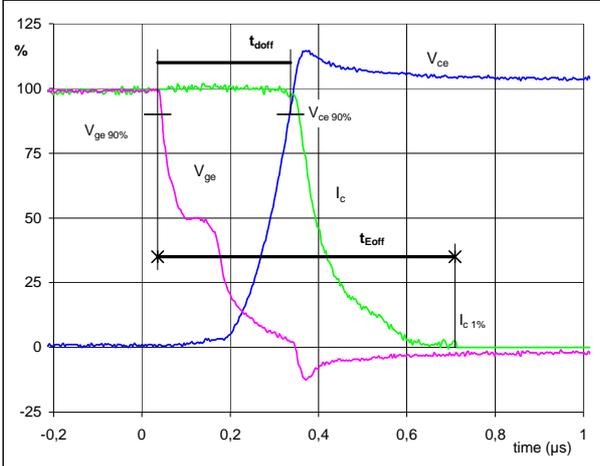
V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	100	A
t_{doff} =	0,29	µs
t_{Eoff} =	0,67	µs

figure 2.　　　　　　　　　　　　　　　　**IGBT**

Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})
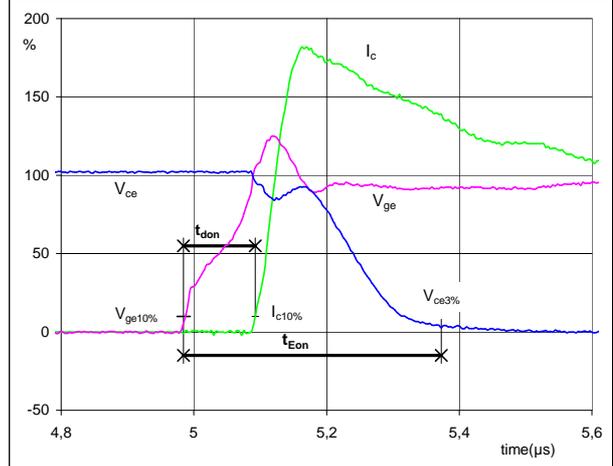
V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	100	A
t_{don} =	0,11	µs
t_{Eon} =	0,39	µs

figure 3.　　　　　　　　　　　　　　　　**IGBT**

Turn-off Switching Waveforms & definition of t_f
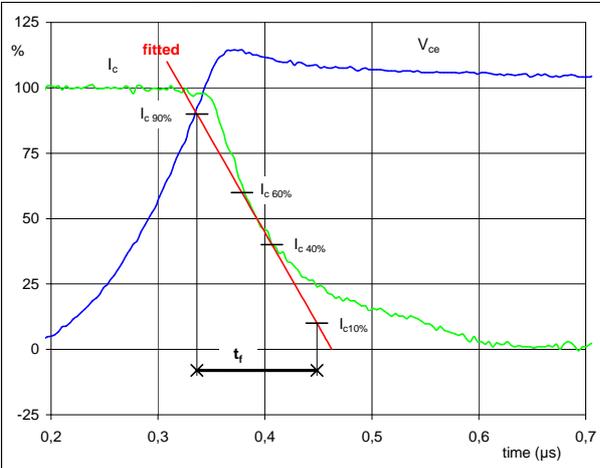
V_C (100%) =	600	V
I_C (100%) =	100	A
t_f =	0,11	µs

figure 4.　　　　　　　　　　　　　　　　**IGBT**

Turn-on Switching Waveforms & definition of t_r
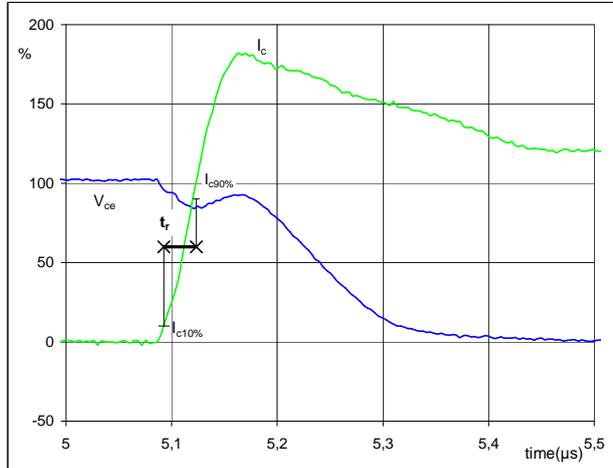
V_C (100%) =	600	V
I_C (100%) =	100	A
t_r =	0,03	µs

Switching Definitions Output Inverter

figure 5.	IGBT

Turn-off Switching Waveforms & definition of t_{Eoff}
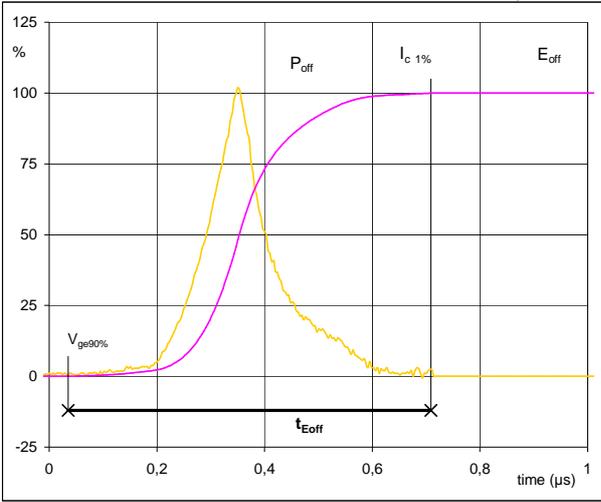
P_{off} (100%) =	59,91	kW
E_{off} (100%) =	8,87	mJ
$t_{E\,off}$ =	0,67	µs

figure 6.	IGBT

Turn-on Switching Waveforms & definition of t_{Eon}
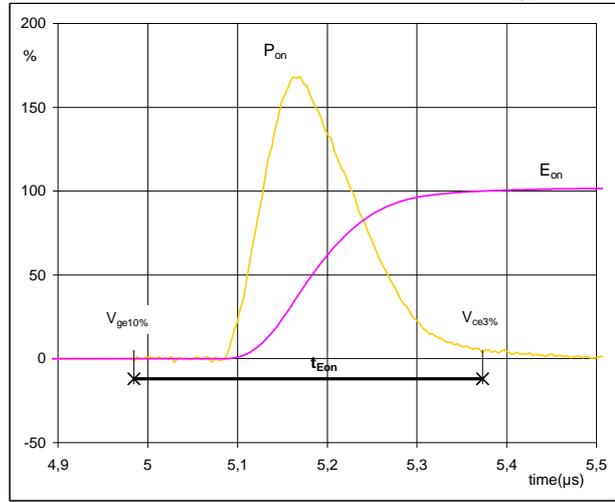
P_{on} (100%) =	59,91	kW
E_{on} (100%) =	12,48	mJ
$t_{E\,on}$ =	0,39	µs

figure 7.	FWD

Turn-off Switching Waveforms & definition of t_{rr}
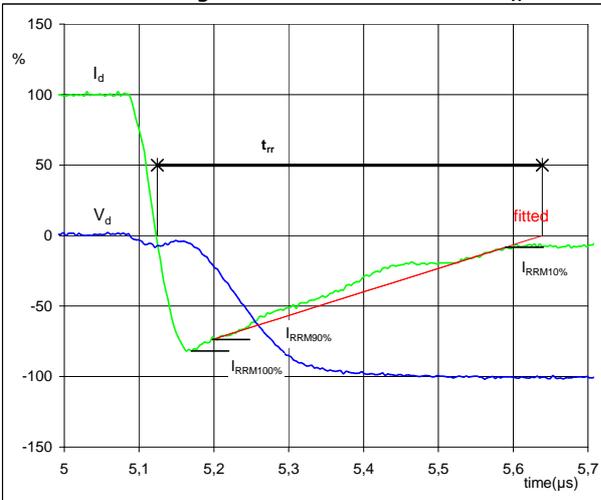
V_d (100%) =	600	V
I_d (100%) =	100	A
I_{RRM} (100%) =	-83	A
t_{rr} =	0,51	µs

Switching Definitions Output Inverter

figure 8. **FWD**

Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})
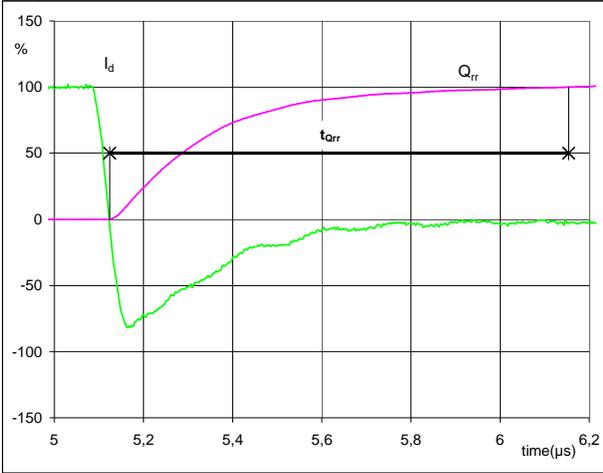
I_d (100%) =	100	A
Q_{rr} (100%) =	20,73	µC
t_{Qint} =	1,03	µs

figure 9. **FWD**

Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec}= integrating time for E_{rec})
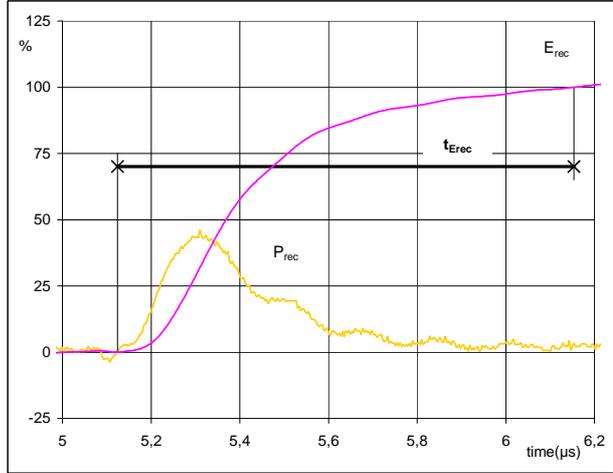
P_{rec} (100%) =	59,91	kW
E_{rec} (100%) =	7,85	mJ
t_{Erec} =	1,03	µs

Ordering Code & Marking

Version	Ordering Code
without thermal paste with solder pins	V23990-P760-A-PM
without thermal paste with Press-fit pins	V23990-P760-AY-PM
with thermal paste with solder pins	V23990-P760-A-/3/-PM
with thermal paste with Press-fit pins	V23990-P760-AY-/3/-PM

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

VIN WWYY
NNNNNNNVV UL
LLLLL SSSS

Outline

Pin	Func	X	Y	Pin	Func	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	R2	19,3	0	47	L2	71,2	37,2
20	R1	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

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

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

Pinout
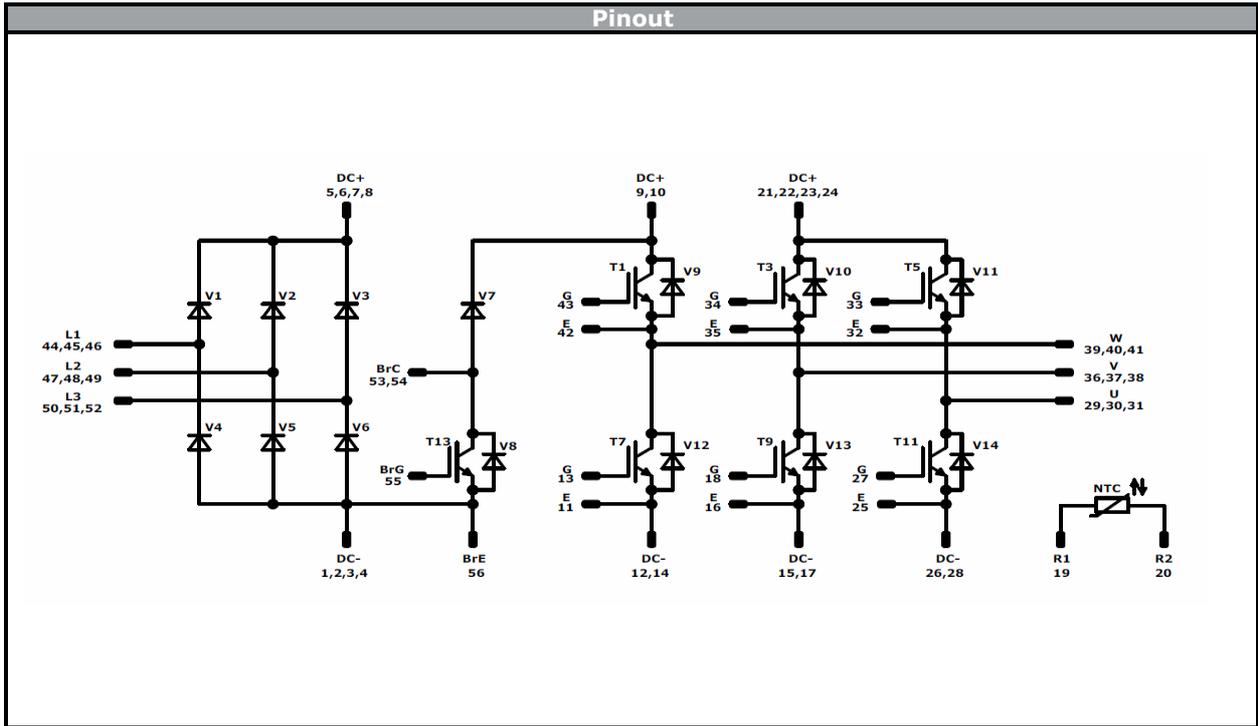
Identification

ID	Component	Voltage	Current	Function	Comment
T1,T3,T5,T7,T9,T11	IGBT	1200 V	100 A	Inverter Switch	
V9-V14	FWD	1200 V	100 A	Inverter Diode	
V1-V6	Rectifier	1600 V	75 A	Input Rectifier Diode	
T13	IGBT	1200 V	50 A	Brake Switch	
V7	FWD	1200 V	25 A	Brake Diode	
V8	FWD	1200 V	10 A	Brake Inverse Diode	
NTC	NTC			Thermistor	

Vincotech

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-P760-Ax-D9-14	24 Jan. 2019	flow2 frame modification	1,23

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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