



<p>flowPIM 1</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center; background-color: #cccccc;">Features</p> <ul style="list-style-type: none"> 3-rectifier, optional BRC, Inverter, NTC Very compact housing, easy to route IGBT! / EmCon4 technology for low saturation losses and improved EMC behaviour </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center; background-color: #cccccc;">Target Applications</p> <ul style="list-style-type: none"> Industrial drives Embedded drives </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; background-color: #cccccc;">Types</p> <ul style="list-style-type: none"> V23990-P586-A20-PM V23990-P586-A20Y-PM V23990-P586-A208-PM V23990-P586-A208Y-PM V23990-P586-C20-PM V23990-P586-C20Y-PM V23990-P586-C208-PM </div>	<p style="text-align: right;">600V/50A</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center; background-color: #cccccc;">flow1 housing</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; background-color: #cccccc;">Schematic</p> </div>
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Maximum Ratings

$T_j=25^{\circ}\text{C}$, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Rectifier Diode				
Repetitive peak reverse voltage	V_{RRM}		1600	V
DC forward current	I_{FAV}	$T_j=T_{jmax}$ $T_h=80^{\circ}\text{C}$ $T_c=80^{\circ}\text{C}$	33 47	A
Surge (non-repetitive) forward current	I_{FSM}	$t_p=10\text{ms}$ 50 Hz half sine wave $T_j=25^{\circ}\text{C}$	250	A
I2t-value	I^2t		310	A^2s
Power dissipation	P_{tot}	$T_j=T_{jmax}$ $T_h=80^{\circ}\text{C}$ $T_c=80^{\circ}\text{C}$	37 60	W
Maximum Junction Temperature	T_{jmax}		150	$^{\circ}\text{C}$
Inverter Switch				
Collector-emitter breakdown voltage	V_{CE}		600	V
DC collector current	I_C	$T_j=T_{jmax}$ $T_h=80^{\circ}\text{C}$ $T_c=80^{\circ}\text{C}$	38 48	A
Repetitive peak collector current	I_{Cpulse}	t_p limited by T_{jmax}	150	A
Turn off safe operating area		$V_{CE} \leq 1200\text{V}$, $T_j \leq T_{op max}$	150	A
Power dissipation	P_{tot}	$T_j=T_{jmax}$ $T_h=80^{\circ}\text{C}$ $T_c=80^{\circ}\text{C}$	70 106	W
Gate-emitter peak voltage	V_{GE}		± 20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \leq 150^{\circ}\text{C}$ $V_{GE} = 15\text{V}$	6 360	μs V
Maximum Junction Temperature	T_{jmax}		175	$^{\circ}\text{C}$



Maximum Ratings

 $T_j=25^{\circ}\text{C}$, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		600	V
DC forward current	I_F	$T_j=T_{jmax}$ $T_h=80^{\circ}\text{C}$ $T_c=80^{\circ}\text{C}$	36 48	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	100	A
Power dissipation	P_{tot}	$T_j=T_{jmax}$ $T_h=80^{\circ}\text{C}$ $T_c=80^{\circ}\text{C}$	58 87	W
Maximum Junction Temperature	T_{jmax}		175	$^{\circ}\text{C}$

Brake Switch

Collector-emitter breakdown voltage	V_{CE}		600	V
DC collector current	I_C	$T_j=T_{jmax}$ $T_h=80^{\circ}\text{C}$ $T_c=80^{\circ}\text{C}$	26 33	A
Repetitive peak collector current	I_{Cpuls}	t_p limited by T_{jmax}	90	A
Turn off safe operating area		$V_{CE} \leq 1200\text{V}$, $T_j \leq T_{op max}$	90	A
Power dissipation	P_{tot}	$T_j=T_{jmax}$ $T_h=80^{\circ}\text{C}$ $T_c=80^{\circ}\text{C}$	46 70	W
Gate-emitter peak voltage	V_{GE}		± 20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \leq 150^{\circ}\text{C}$ $V_{GE} = 15\text{V}$	6 360	μs V
Maximum Junction Temperature	T_{jmax}		175	$^{\circ}\text{C}$

Brake Diode

Peak Repetitive Reverse Voltage	V_{RRM}		600	V
DC forward current	I_F	$T_j=T_{jmax}$ $T_h=80^{\circ}\text{C}$ $T_c=80^{\circ}\text{C}$	13 18	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	40	A
Power dissipation	P_{tot}	$T_j=T_{jmax}$ $T_h=80^{\circ}\text{C}$ $T_c=80^{\circ}\text{C}$	20 30	W
Maximum Junction Temperature	T_{jmax}		175	$^{\circ}\text{C}$

Thermal Properties

Storage temperature	T_{stg}		-40...+125	$^{\circ}\text{C}$
Operation temperature under switching condition	T_{op}		-40...+($T_{jmax} - 25$)	$^{\circ}\text{C}$

Isolation Properties

Isolation voltage	V_{is}	$t=2\text{s}$ DC voltage	4000	V
Creepage distance			min 12,7	mm
Clearance			min 12,7	mm
Comparative tracking index	CTI		>200	



Characteristic Values

Parameter	Symbol	Conditions					Value			Unit	
		$V_{GE}[V]$ or $V_{GS}[V]$	$V_r[V]$ or $V_{CE}[V]$ or $V_{DS}[V]$	$I_c[A]$ or $I_F[A]$ or $I_D[A]$	T_j	Min	Typ	Max			
Rectifier Diode											
Forward voltage	V_F				30	$T_j=25^\circ C$ $T_j=125^\circ C$	0,8	1,16 1,13	1,6	V	
Threshold voltage (for power loss calc. only)	V_{to}				30	$T_j=25^\circ C$ $T_j=125^\circ C$		0,90 0,78	0,83	V	
Slope resistance (for power loss calc. only)	r_t				30	$T_j=25^\circ C$ $T_j=125^\circ C$		8 11		mΩ	
Reverse current	I_r			1500		$T_j=25^\circ C$ $T_j=150^\circ C$			2	mA	
Thermal resistance junction to sink	R_{thJH}	Thermal grease thickness≤50um $\lambda = 1$ W/mK						1,89		K/W	
Thermal resistance junction to sink	R_{thJH}	phase-change material $\lambda = 3,4$ W/mK						1,19		K/W	
Inverter Switch											
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0008	$T_j=25^\circ C$ $T_j=125^\circ C$	5	5,8	6,5	V	
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		50	$T_j=25^\circ C$ $T_j=125^\circ C$		1,76 2,06		V	
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		$T_j=25^\circ C$ $T_j=125^\circ C$			0,04 1	mA	
Gate-emitter leakage current	I_{GES}		20	0		$T_j=25^\circ C$ $T_j=125^\circ C$			600	nA	
Integrated Gate resistor	R_{gint}							-		Ω	
Turn-on delay time	$t_{d(on)}$	$R_{goff}=16 \Omega$ $R_{gon}=16 \Omega$	± 15	300	50	$T_j=25^\circ C$		168		ns	
Rise time	t_r					$T_j=125^\circ C$					171
Turn-off delay time	$t_{d(off)}$					$T_j=25^\circ C$					23
Fall time	t_f					$T_j=125^\circ C$					27
Turn-on energy loss	E_{on}					$T_j=25^\circ C$					213
Turn-off energy loss	E_{off}					$T_j=125^\circ C$					228
Input capacitance	C_{ies}	f=1MHz	0	25		$T_j=25^\circ C$		3140		pF	
Output capacitance	C_{oss}										200
Reverse transfer capacitance	C_{rss}										93
Gate charge	Q_{Gate}		± 15			$T_j=25^\circ C$		310		nC	
Thermal resistance junction to sink	R_{thJH}	Thermal grease thickness≤50um $\lambda = 1$ W/mK						1,25		K/W	
Thermal resistance junction to sink	R_{thJH}	phase-change material $\lambda = 3,4$ W/mK						1,06		K/W	
Inverter Diode											
Diode forward voltage	V_F				50	$T_j=25^\circ C$ $T_j=125^\circ C$	1,2	1,85 1,94	1,9	V	
Peak reverse recovery current	I_{RRM}	$R_{gon}=16 \Omega$				$T_j=25^\circ C$		37		A	
Reverse recovery time	t_{rr}					$T_j=125^\circ C$					42
Reverse recovered charge	Q_{rr}					$T_j=25^\circ C$					144
Peak rate of fall of recovery current	$di(rec)max/dt$					$T_j=125^\circ C$					217
Reverse recovered energy	E_{rec}					$T_j=25^\circ C$					1,9
						$T_j=125^\circ C$					3,4
Thermal resistance junction to sink	R_{thJH}	Thermal grease thickness≤50um $\lambda = 1$ W/mK						1568 1145		A/μs	
Thermal resistance junction to sink	R_{thJH}	phase-change material $\lambda = 3,4$ W/mK						0,31 0,60		mWs	
Thermal resistance junction to sink	R_{thJH}	Thermal grease thickness≤50um $\lambda = 1$ W/mK						1,65		K/W	
Thermal resistance junction to sink	R_{thJH}	phase-change material $\lambda = 3,4$ W/mK						1,4		K/W	



Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
		$V_{GE}[V]$ or $V_{GS}[V]$	$V_r[V]$ or $V_{CE}[V]$ or $V_{DS}[V]$	$I_c[A]$ or $I_F[A]$ or $I_b[A]$	T_j	Min	Typ	Max		
Brake Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,00043	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	4,1	4,9	5,7	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		30	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	1,1	1,55 1,74	1,9	V
Collector-emitter cut-off incl diode	I_{CES}		0	600		$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		0,04 1,00		mA
Gate-emitter leakage current	I_{GES}		20	0		$T_j=25^{\circ}C$ $T_j=125^{\circ}C$			300	nA
Integrated Gate resistor	R_{gint}							-		Ω
Turn-on delay time	$t_{d(on)}$	$R_{goff}=16 \Omega$ $R_{gon}=16 \Omega$	± 15	300	30	$T_j=25^{\circ}C$		95		ns
Rise time	t_r					$T_j=125^{\circ}C$		95		
Turn-off delay time	$t_{d(off)}$					$T_j=25^{\circ}C$		16		
Fall time	t_f					$T_j=125^{\circ}C$		19		
Turn-on energy loss	E_{on}					$T_j=25^{\circ}C$		141		
Turn-off energy loss	E_{off}	$T_j=125^{\circ}C$		157						
Input capacitance	C_{ies}	f=1MHz	0	25		$T_j=25^{\circ}C$		0,50		mWs
Output capacitance	C_{oss}					$T_j=125^{\circ}C$		0,72		
Reverse transfer capacitance	C_{rss}					$T_j=25^{\circ}C$		0,63		
Gate charge	Q_{Gate}					$T_j=25^{\circ}C$		1630		pF
Thermal resistance junction to sink	R_{thJH}	Thermal grease thickness $\leq 50\mu m$ $\lambda = 1 W/mK$						108		pF
Thermal resistance junction to sink	R_{thJH}	phase-change material $\lambda = 3,4 W/mK$						50		pF
Thermal resistance junction to sink	R_{thJH}							167		nC
Thermal resistance junction to sink	R_{thJH}							2,07		K/W
Thermal resistance junction to sink	R_{thJH}							1,78		K/W
Brake Diode										
Diode forward voltage	V_F				20	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	1,25	1,42 1,28	1,95	V
Reverse leakage current	I_r			600		$T_j=25^{\circ}C$ $T_j=125^{\circ}C$			27	μA
Peak reverse recovery current	I_{RRM}	$R_{gon}=16 \Omega$ $R_{goff}=16 \Omega$	15	300	20	$T_j=25^{\circ}C$		19		A
Reverse recovery time	t_{rr}					$T_j=125^{\circ}C$		20		
Reverse recovered charge	Q_{rr}					$T_j=25^{\circ}C$		33		
Peak rate of fall of recovery current	$di(rec)max/dt$					$T_j=125^{\circ}C$		237		ns
Reverse recovery energy	E_{rec}					$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		0,81 0,81		μC
Thermal resistance junction to sink	R_{thJH}	Thermal grease thickness $\leq 50\mu m$ $\lambda = 1 W/mK$						1684 920		A/ μs
Thermal resistance junction to sink	R_{thJH}	phase-change material $\lambda = 3,4 W/mK$						0,14 0,30		mWs
Thermal resistance junction to sink	R_{thJH}							3,58		K/W
Thermal resistance junction to sink	R_{thJH}							3,11		K/W
Thermistor										
Rated resistance	R					$T_j=25^{\circ}C$		22000		Ω
Deviation of R100	$\Delta R/R$					T=25 $^{\circ}C$	-5		5	%
Power dissipation	P					T=25 $^{\circ}C$		200		mW
Power dissipation constant						$T_j=25^{\circ}C$		2		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 3\%$				$T_j=25^{\circ}C$		3950		K
B-value	$B_{(25/100)}$					$T_j=25^{\circ}C$		3996		K
Vincotech NTC Reference						$T_j=25^{\circ}C$			B	

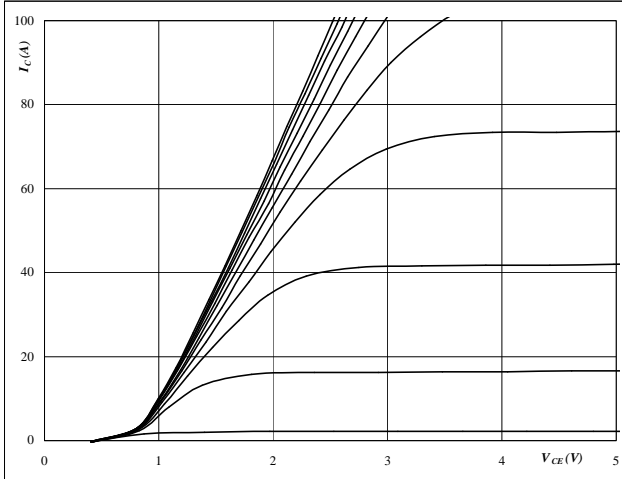


Output Inverter

Figure 1 Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$

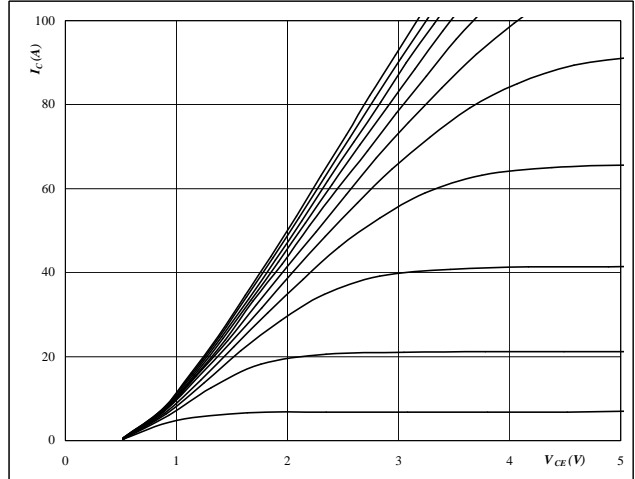


At
 $t_p = 250 \mu s$
 $T_j = 25 \text{ }^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

Figure 2 Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$

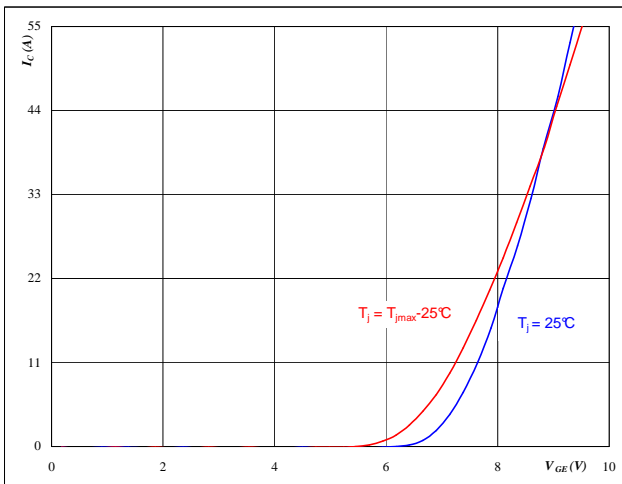


At
 $t_p = 250 \mu s$
 $T_j = 125 \text{ }^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

Figure 3 Output inverter IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

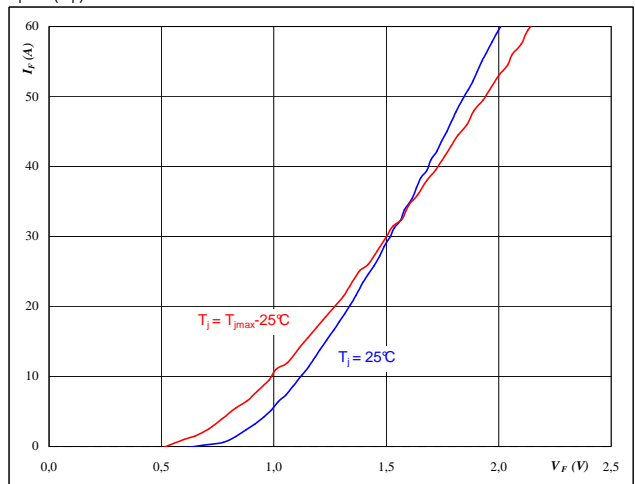


At
 $t_p = 250 \mu s$
 $V_{CE} = 10 V$

Figure 4 Output inverter FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At
 $t_p = 250 \mu s$

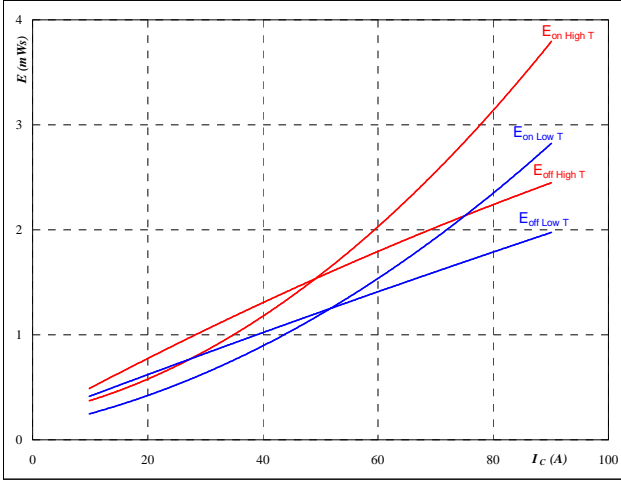


Output Inverter

Figure 5 Output inverter IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



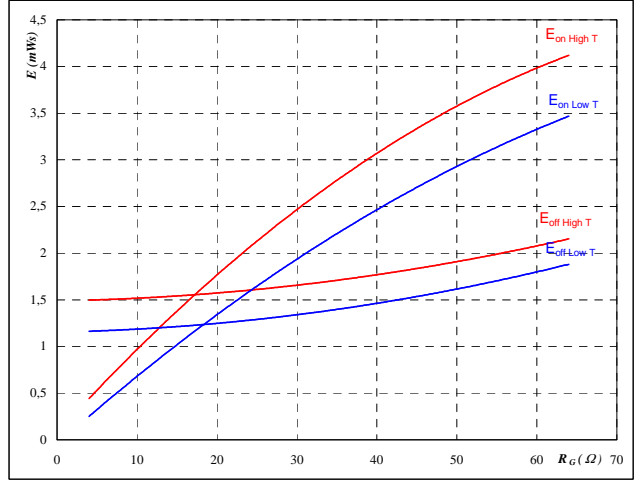
With an inductive load at

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

Figure 6 Output inverter IGBT

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



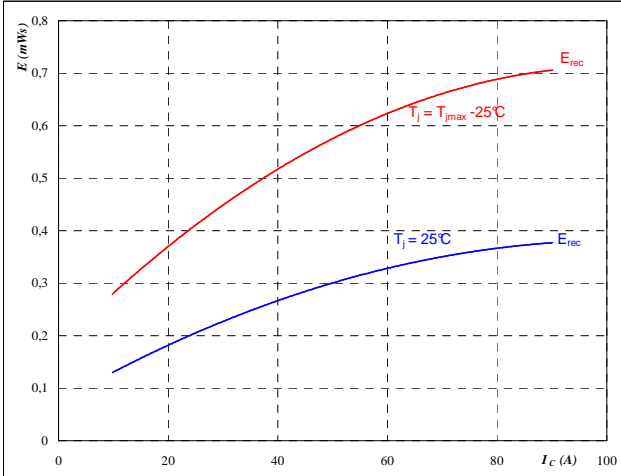
With an inductive load at

- $T_j = 25/125$ °C
- $V_{CE} = 300$ V
- $V_{GE} = \pm 15$ V
- $I_C = 50$ A

Figure 7 Output inverter FWD

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_C)$



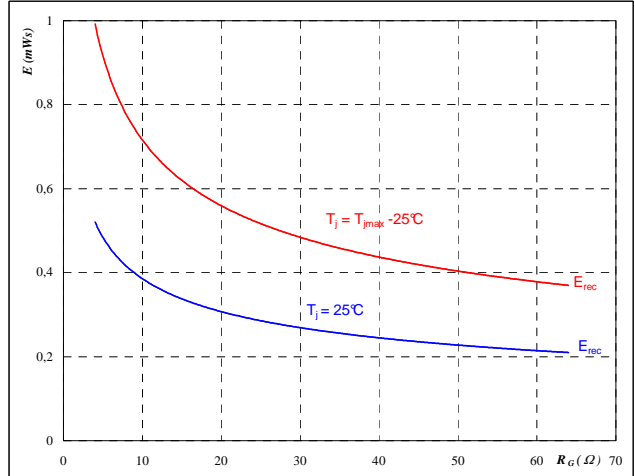
With an inductive load at

- $T_j = 25/125$ °C
- $V_{CE} = 300$ V
- $V_{GE} = \pm 15$ V
- $R_{gon} = 16$ Ω

Figure 8 Output inverter 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
- $V_{GE} = \pm 15$ V
- $I_C = 50$ A

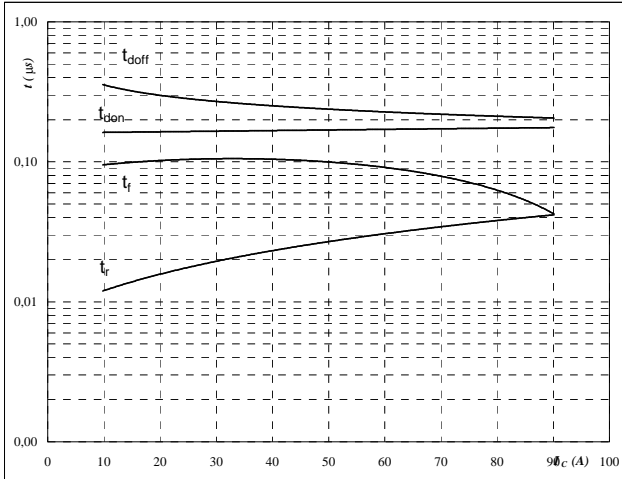


Output Inverter

Figure 9 Output inverter IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



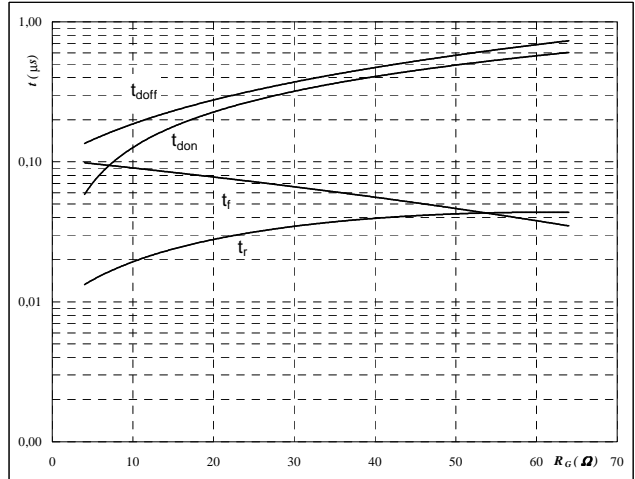
With an inductive load at

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

Figure 10 Output inverter IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



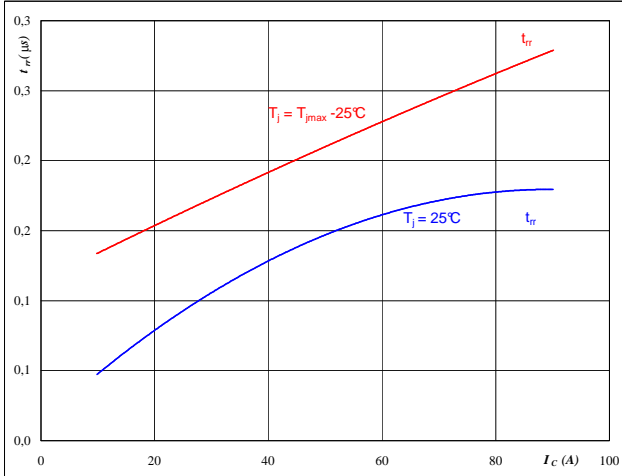
With an inductive load at

$T_j =$	125	°C
$V_{CE} =$	300	V
$V_{GE} =$	±15	V
$I_C =$	50	A

Figure 11 Output inverter FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



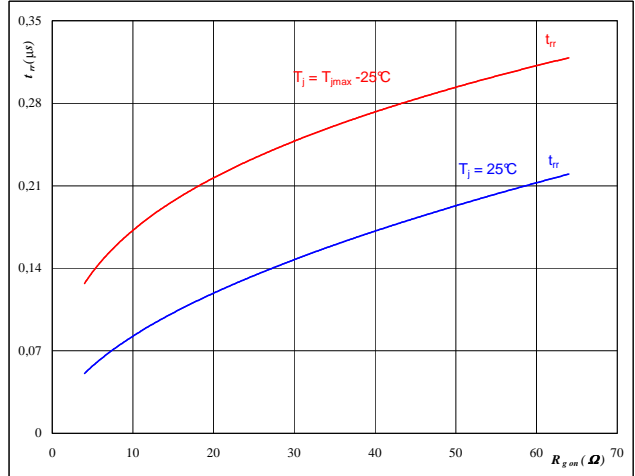
At

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

Figure 12 Output inverter 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
$I_F =$	50	A
$V_{GE} =$	±15	V

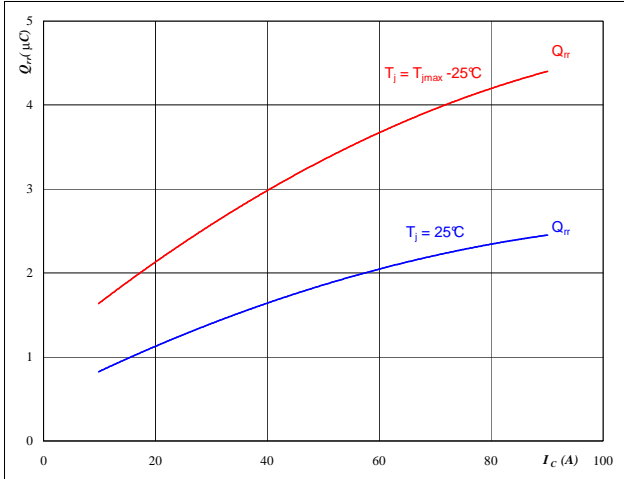


Output Inverter

Figure 13 Output inverter FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$

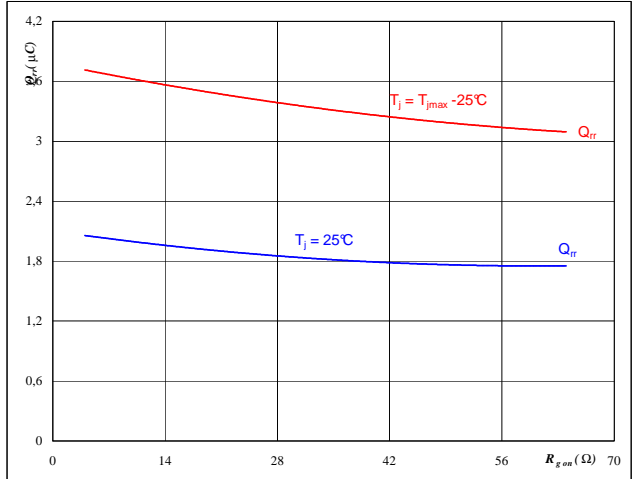


At
 $T_j = 25/125$ °C
 $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

Figure 14 Output inverter FWD

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

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

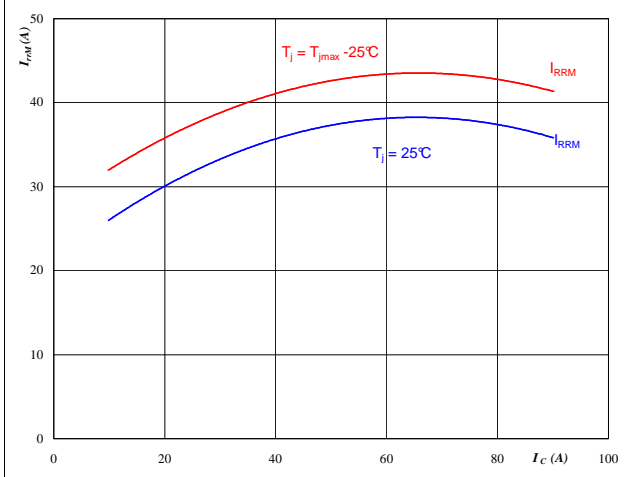


At
 $T_j = 25/125$ °C
 $V_R = 300$ V
 $I_F = 50$ A
 $V_{GE} = \pm 15$ V

Figure 15 Output inverter FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$

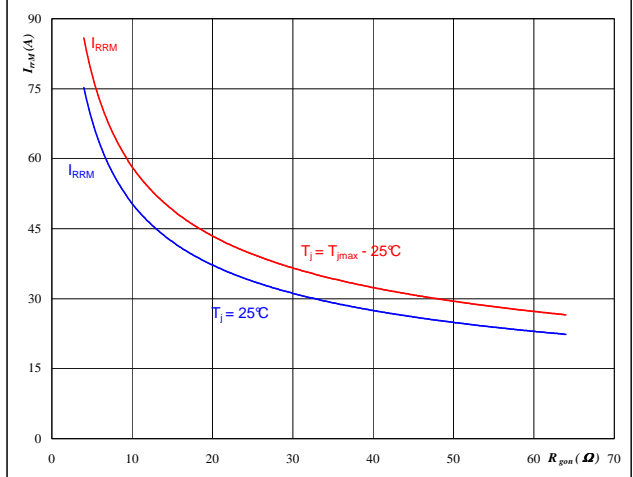


At
 $T_j = 25/125$ °C
 $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

Figure 16 Output inverter 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
 $I_F = 50$ A
 $V_{GE} = \pm 15$ V

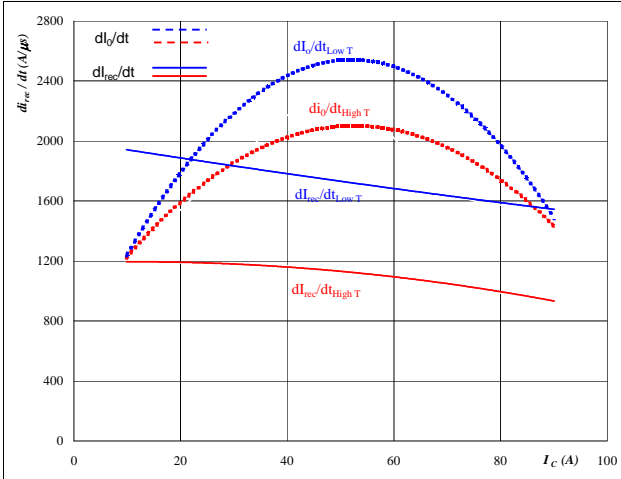


Output Inverter

Figure 17 Output inverter FWD

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

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

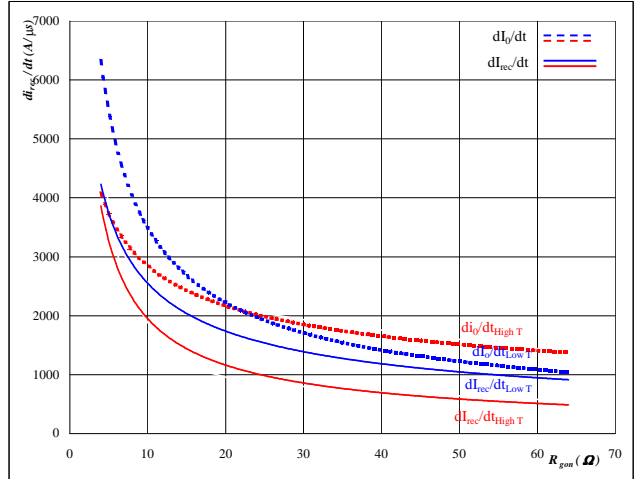


At
 $T_j = 25/125$ °C
 $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

Figure 18 Output inverter FWD

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

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

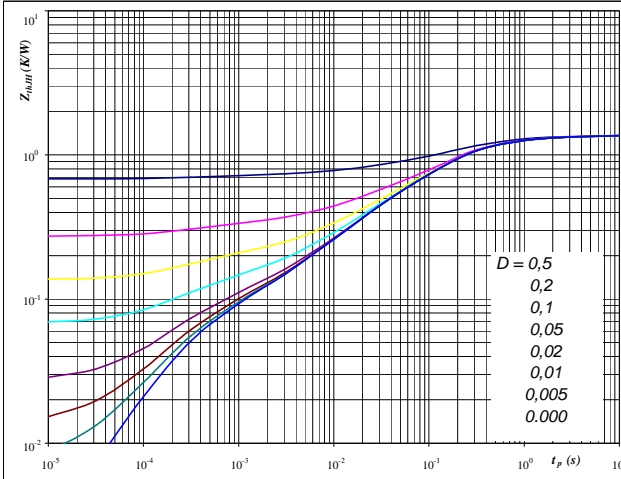


At
 $T_j = 25/125$ °C
 $V_R = 300$ V
 $I_F = 50$ A
 $V_{GE} = \pm 15$ V

Figure 19 Output inverter IGBT

IGBT transient thermal impedance as a function of pulse width

$$Z_{thJH} = f(t_p)$$



At
 $D = t_p / T$ Phase change material
 $R_{thJH} = 1,25$ K/W $R_{thJH} = 1,06$ K/W

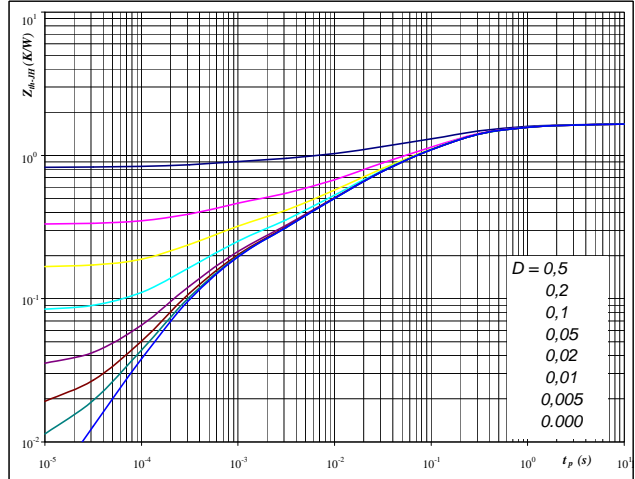
IGBT thermal model values

Thermal grease		Phase change material	
R (C/W)	Tau (s)	R (C/W)	Tau (s)
0,07	3,7E+00	0,11	1,1E+00
0,25	5,5E-01	0,36	1,5E-01
0,61	1,4E-01	0,38	4,7E-02
0,22	1,9E-02	0,12	7,7E-03
0,05	2,9E-03	0,05	6,5E-04
0,06	3,0E-04	0,04	1,6E-04

Figure 20 Output inverter FWD

FWD transient thermal impedance as a function of pulse width

$$Z_{thJH} = f(t_p)$$



At
 $D = t_p / T$ Phase change material
 $R_{thJH} = 1,65$ K/W $R_{thJH} = 1,40$ K/W

FWD thermal model values

Thermal grease		Phase change material	
R (C/W)	Tau (s)	R (C/W)	Tau (s)
0,08	3,2E+00	0,07	3,1E+00
0,28	4,6E-01	0,18	3,5E-01
0,62	1,1E-01	0,67	7,1E-02
0,39	1,8E-02	0,27	1,8E-02
0,14	3,2E-03	0,14	4,1E-03
0,14	4,1E-04	0,08	5,1E-04

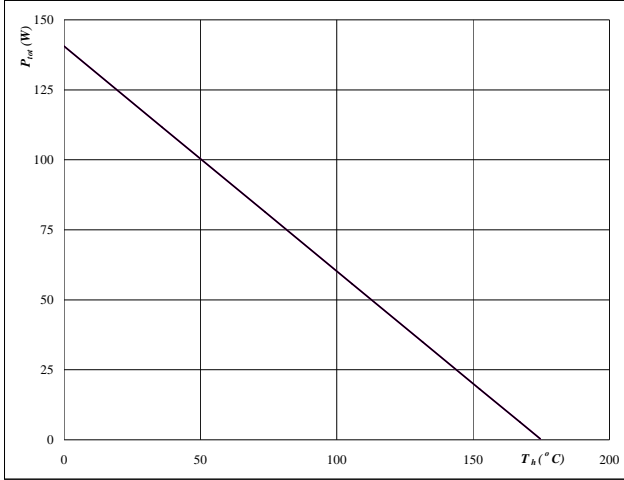


Output Inverter

Figure 21 Output inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

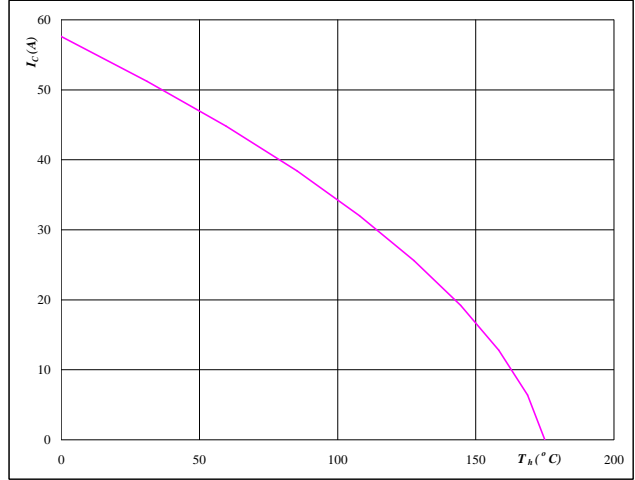


At
 $T_j = 175 \text{ } ^\circ\text{C}$

Figure 22 Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$

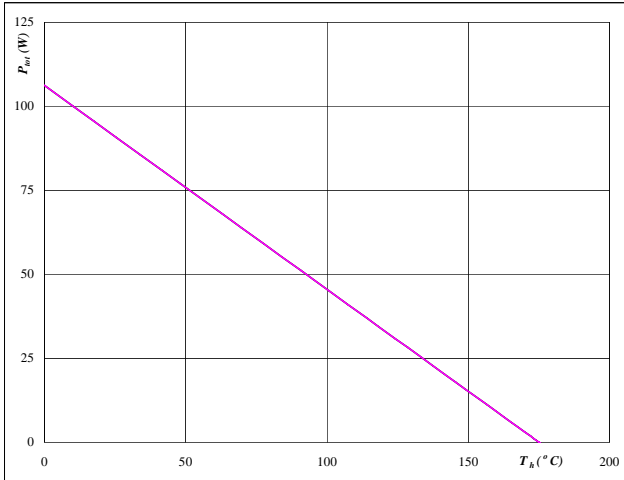


At
 $T_j = 175 \text{ } ^\circ\text{C}$
 $V_{GE} = 15 \text{ V}$

Figure 23 Output inverter FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

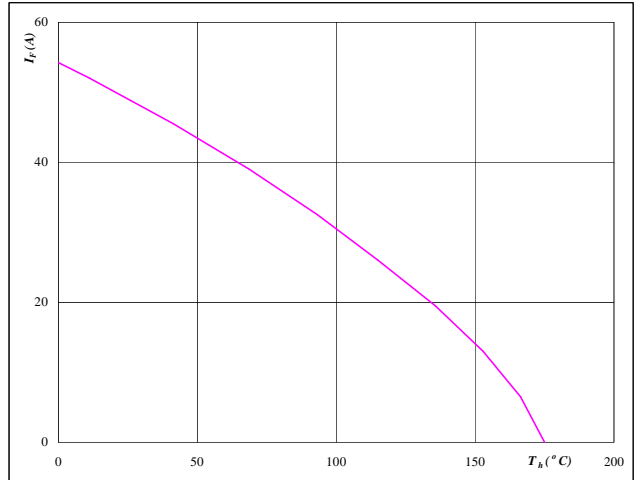


At
 $T_j = 175 \text{ } ^\circ\text{C}$

Figure 24 Output inverter FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



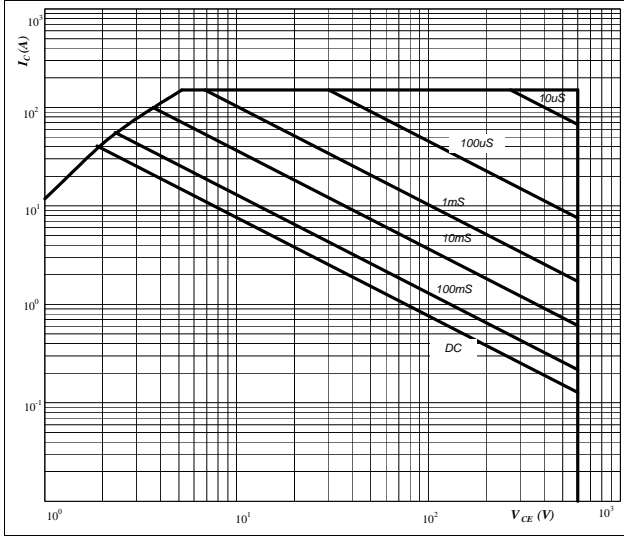
At
 $T_j = 175 \text{ } ^\circ\text{C}$



Output Inverter

Figure 25 Output inverter IGBT

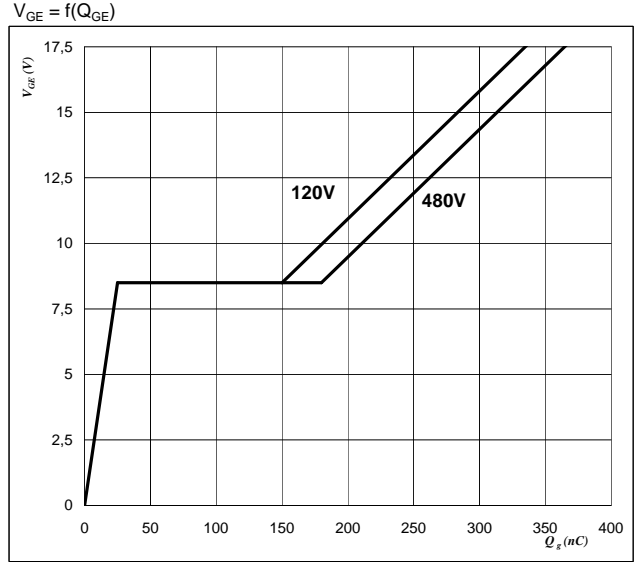
Safe operating area as a function of collector-emitter voltage
 $I_C = f(V_{CE})$



At
D = single pulse
 $T_h = 80$ °C
 $V_{GE} = \pm 15$ V
 $T_j = T_{jmax}$ °C

Figure 26 Output inverter IGBT

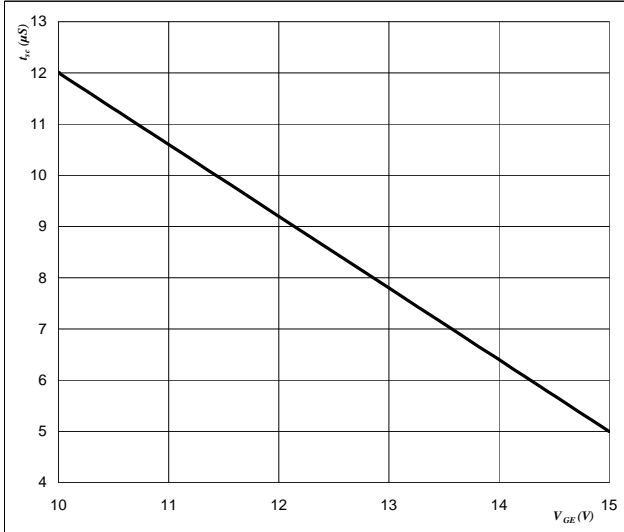
Gate voltage vs Gate charge
 $V_{GE} = f(Q_{GE})$



At
 $I_C = 50$ A

Figure 27 Output inverter IGBT

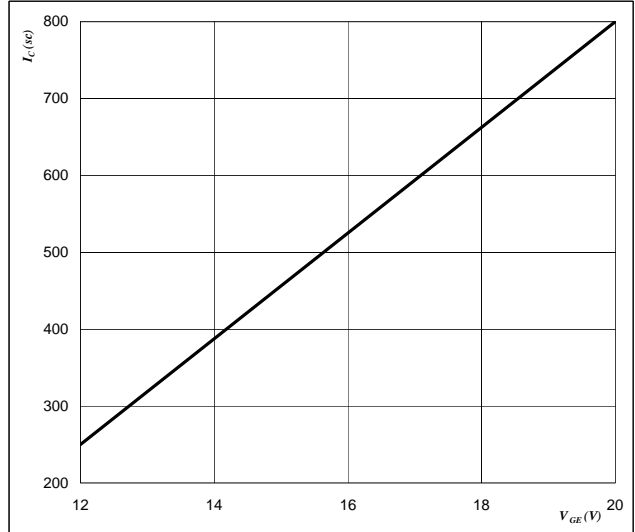
Short circuit withstand time as a function of gate-emitter voltage
 $t_{sc} = f(V_{GE})$



At
 $V_{CE} = 600$ V
 $T_j \leq 175$ °C

Figure 28 Output inverter IGBT

Typical short circuit collector current as a function of gate-emitter voltage
 $V_{GE} = f(Q_{GE})$



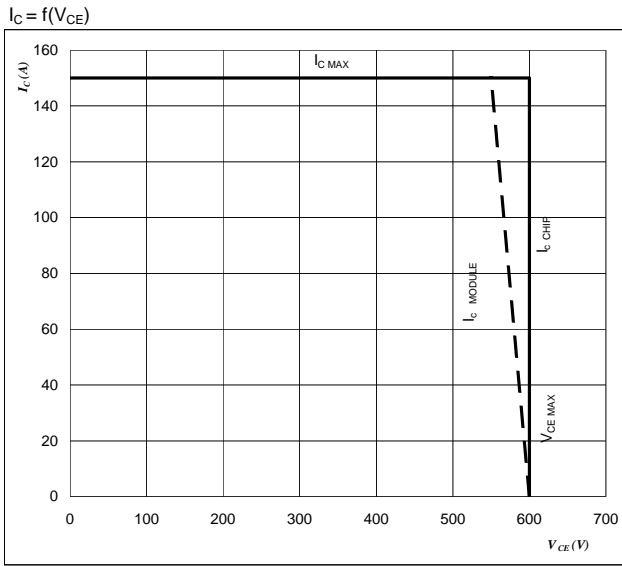
At
 $V_{CE} \leq 600$ V
 $T_j = 175$ °C



Vincotech

Figure 29 IGBT

Reverse bias safe operating area



At
 $T_j = T_{jmax} - 25 \text{ } ^\circ\text{C}$
 $U_{ocminus} = U_{ccplus}$
Switching mode : 3 level switching

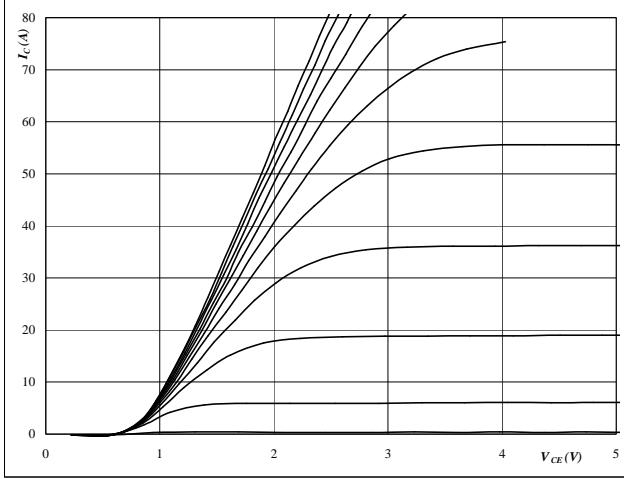


Brake

Figure 1 Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$

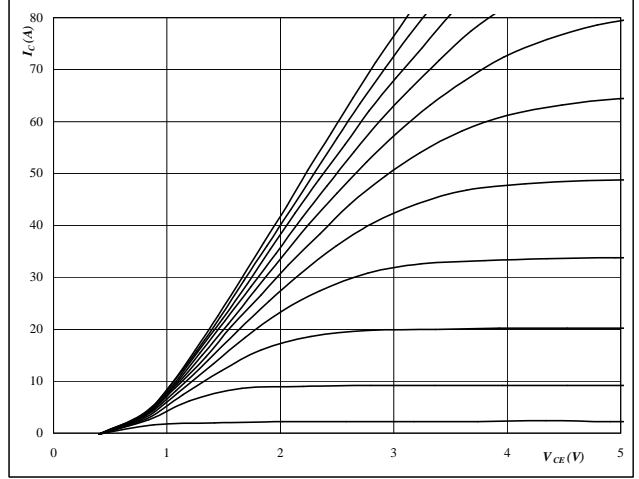


At
 $t_p = 250 \mu s$
 $T_j = 25 \text{ }^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

Figure 2 Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$

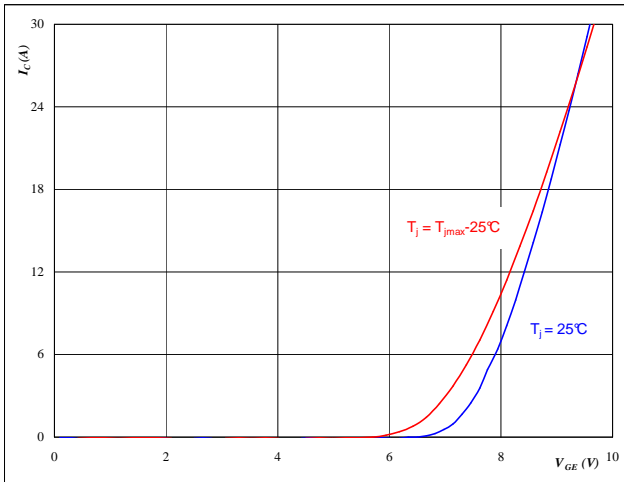


At
 $t_p = 250 \mu s$
 $T_j = 125 \text{ }^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

Figure 3 Brake IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

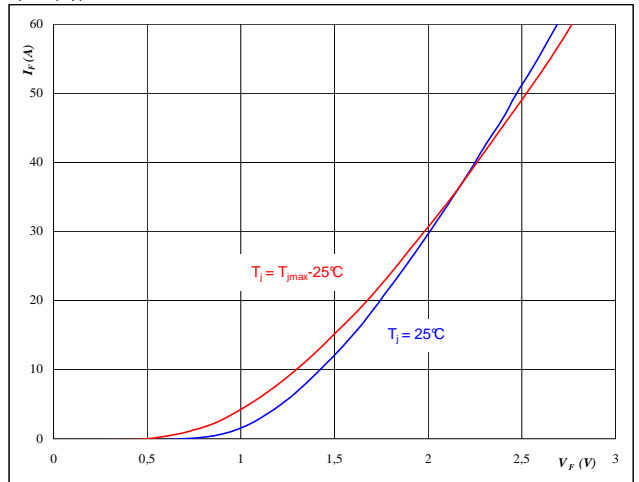


At
 $t_p = 250 \mu s$
 $V_{CE} = 10 V$

Figure 4 Brake FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



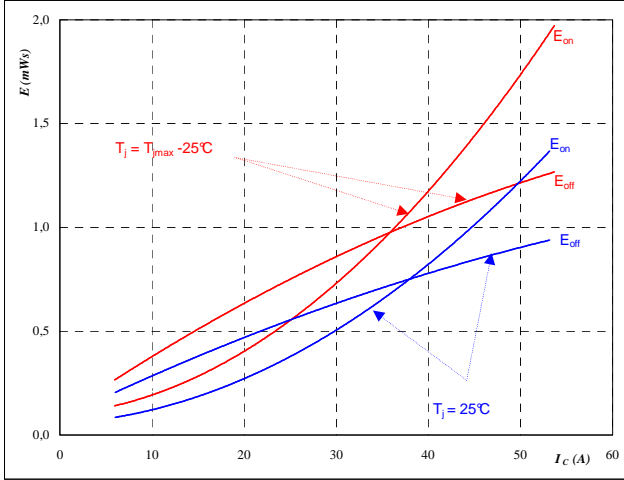
At
 $t_p = 250 \mu s$



Brake

Figure 5 Brake IGBT

Typical switching energy losses as a function of collector current
 $E = f(I_C)$

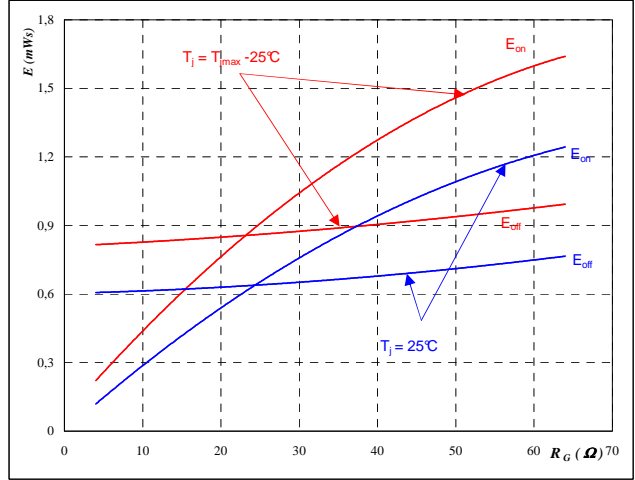


With an inductive load at

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

Figure 6 Brake IGBT

Typical switching energy losses as a function of gate resistor
 $E = f(R_G)$

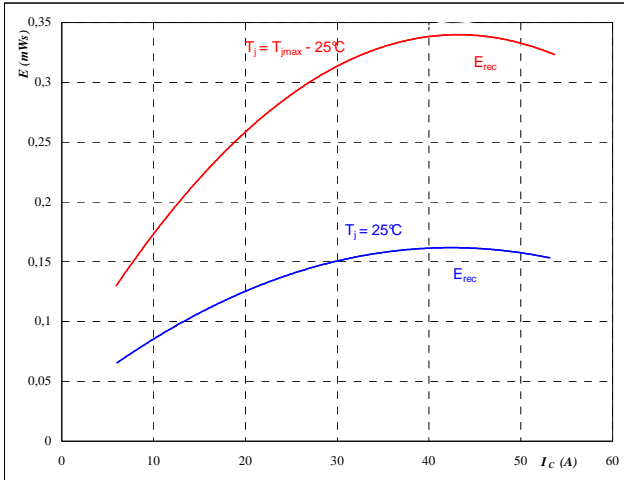


With an inductive load at

$T_j = 25/125$ °C
 $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_C = 29$ A

Figure 7 Brake FWD

Typical reverse recovery energy loss as a function of collector current
 $E_{rec} = f(I_C)$

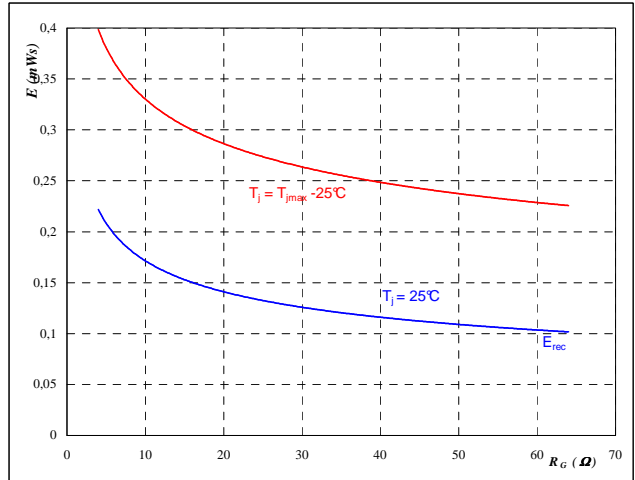


With an inductive load at

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

Figure 8 Brake FWD

Typical reverse recovery energy loss as a function of gate resistor
 $E_{rec} = f(R_G)$



With an inductive load at

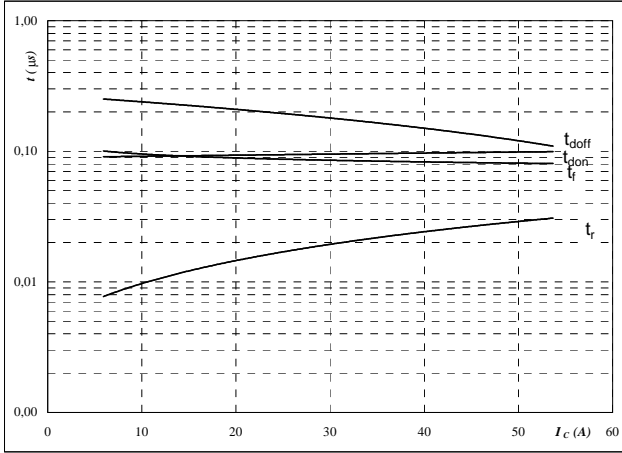
$T_j = 25/125$ °C
 $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_C = 29$ A



Brake

Figure 9 Brake IGBT

Typical switching times as a function of collector current
 $t = f(I_C)$

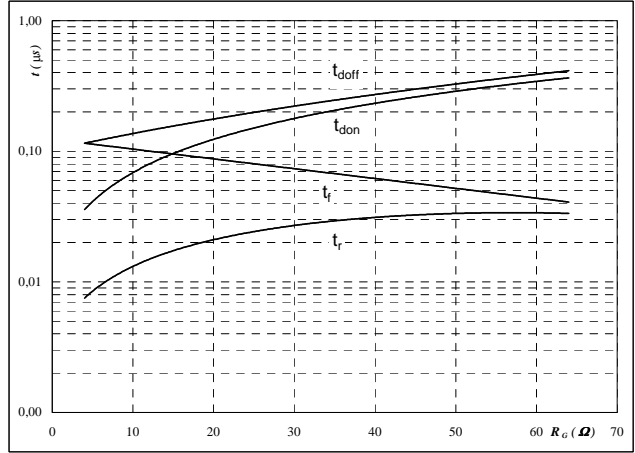


With an inductive load at

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

Figure 10 Brake IGBT

Typical switching times as a function of gate resistor
 $t = f(R_G)$

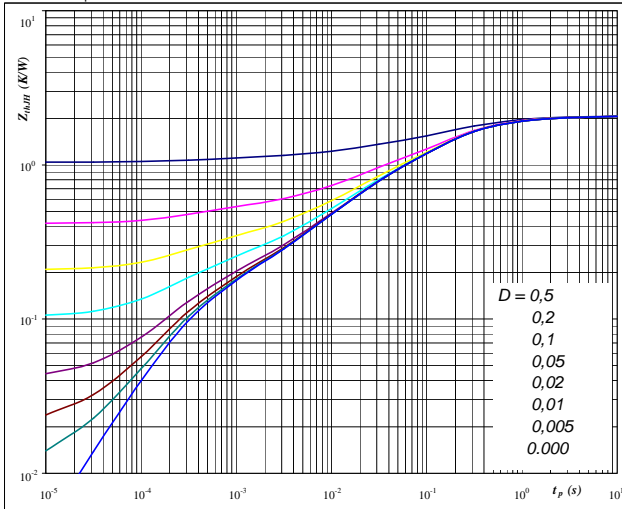


With an inductive load at

$T_j =$	125	°C
$V_{CE} =$	300	V
$V_{GE} =$	±15	V
$I_C =$	29	A

Figure 11 Brake IGBT

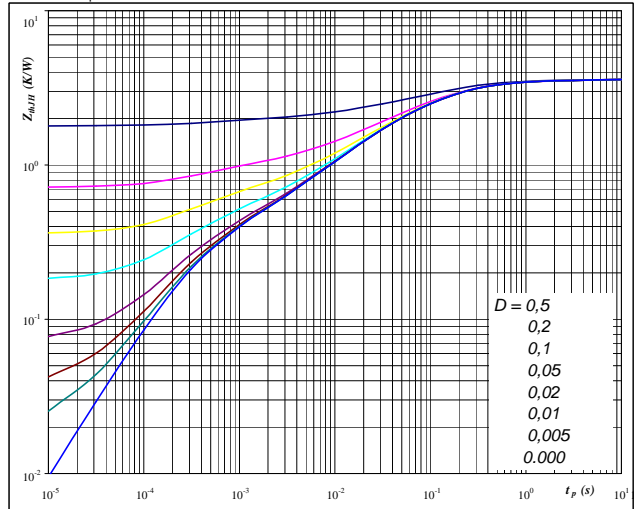
IGBT transient thermal impedance as a function of pulse width
 $Z_{thJH} = f(t_p)$



At	D =	t_p / T			
Thermal grease		Phase change material			
$R_{thJH} =$	2,07	K/W	$R_{thJH} =$	1,78	K/W

Figure 12 Brake FWD

FWD transient thermal impedance as a function of pulse width
 $Z_{thJH} = f(t_p)$



At	D =	t_p / T			
Thermal grease		Phase change material			
$R_{thJH} =$	3,58	K/W	$R_{thJH} =$	3,11	K/W

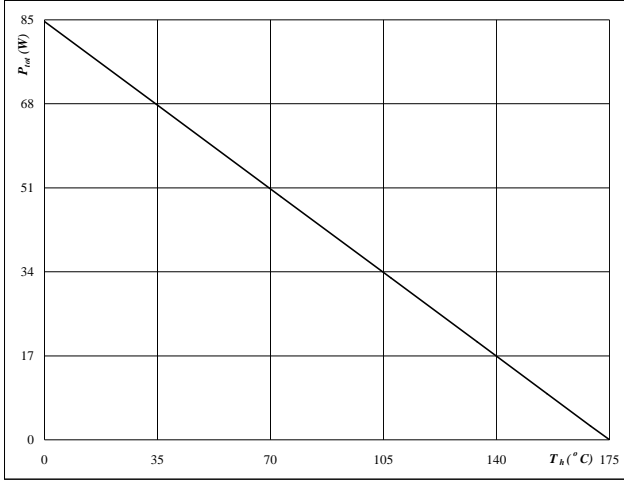


Brake

Figure 13 Brake IGBT

Power dissipation as a function of heatsink temperature

$$P_{tot} = f(T_h)$$

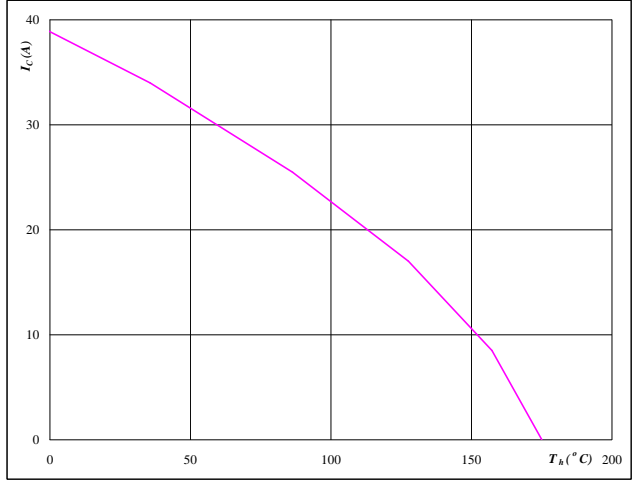


At
 $T_j = 175$ °C

Figure 14 Brake IGBT

Collector current as a function of heatsink temperature

$$I_C = f(T_h)$$

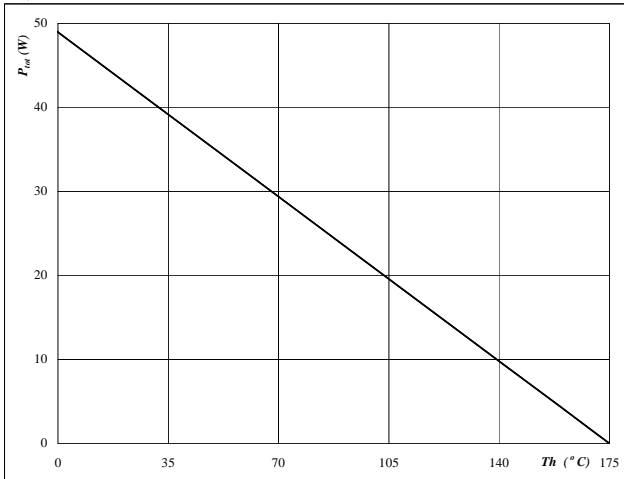


At
 $T_j = 175$ °C
 $V_{GE} = 15$ V

Figure 15 Brake FWD

Power dissipation as a function of heatsink temperature

$$P_{tot} = f(T_h)$$

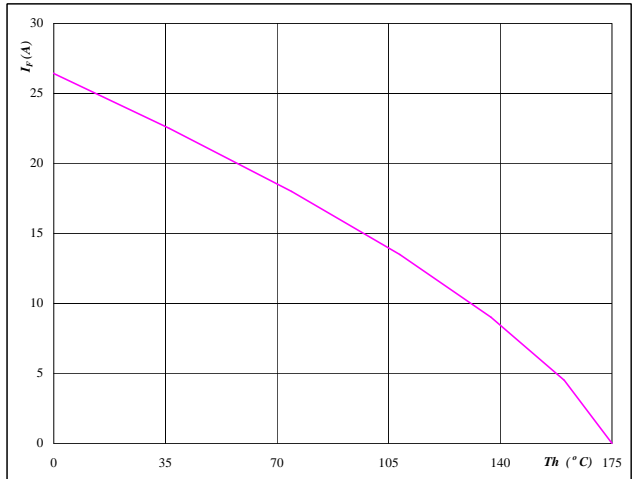


At
 $T_j = 175$ °C

Figure 16 Brake FWD

Forward current as a function of heatsink temperature

$$I_F = f(T_h)$$



At
 $T_j = 175$ °C

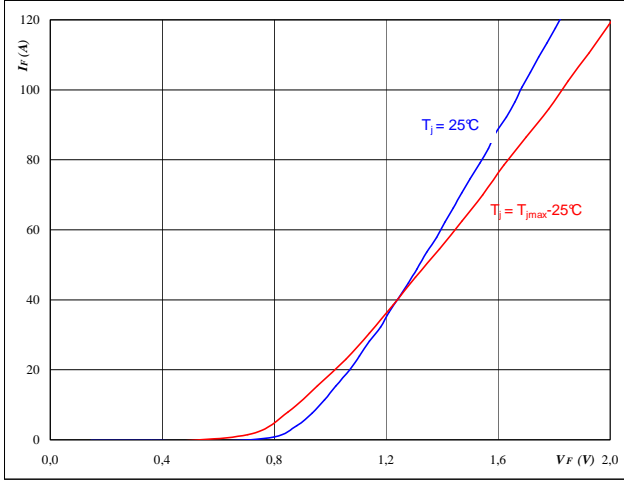


Input Rectifier Bridge

Figure 1 Rectifier diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$

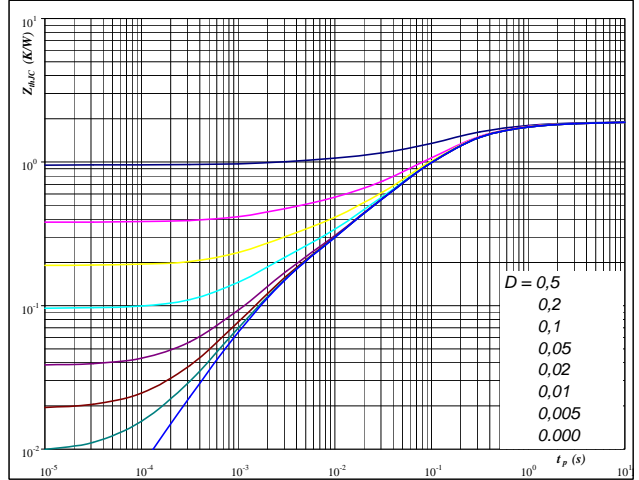


At
 $t_p = 250 \mu s$

Figure 2 Rectifier diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$

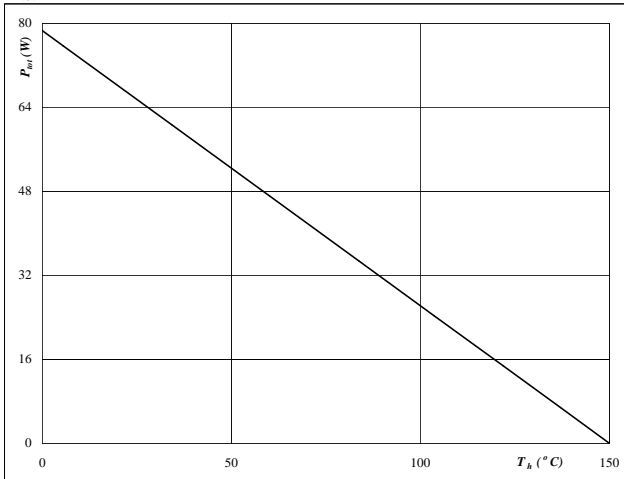


At
 $D = t_p / T$
 Thermal grease $R_{thJH} = 1,89 \text{ K/W}$ Phase change material $R_{thJH} = 1,62 \text{ K/W}$

Figure 3 Rectifier diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

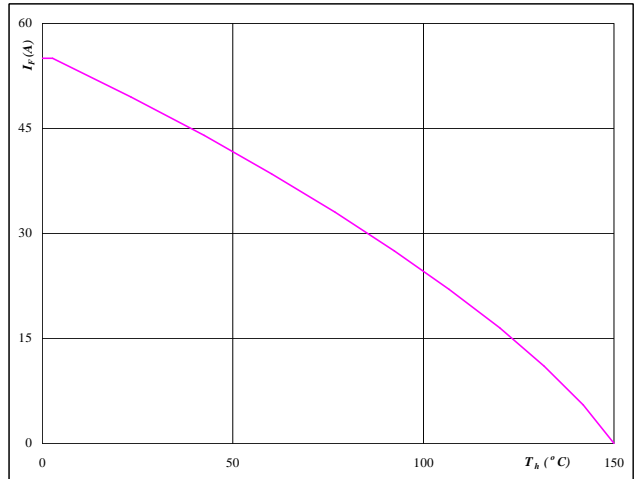


At
 $T_j = 150 \text{ °C}$

Figure 4 Rectifier diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At
 $T_j = 150 \text{ °C}$



Thermistor

Figure 1 Thermistor

Typical NTC characteristic
as a function of temperature

$$R_T = f(T)$$

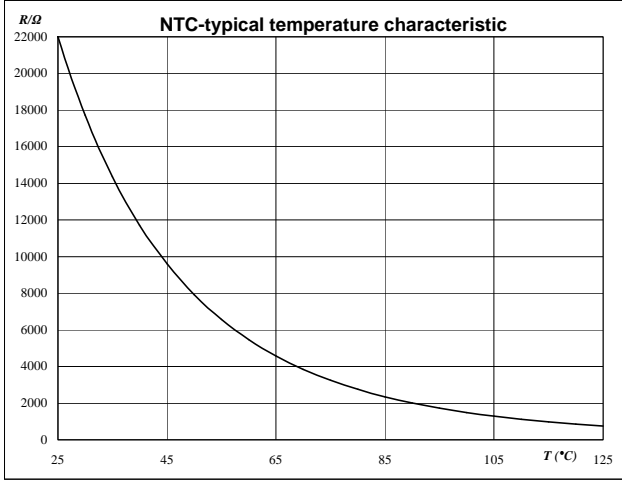


Figure 2 Thermistor

Typical NTC resistance values

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

T [°C]	R _{nom} [Ω]	R _{min} [Ω]	R _{max} [Ω]	ΔR/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

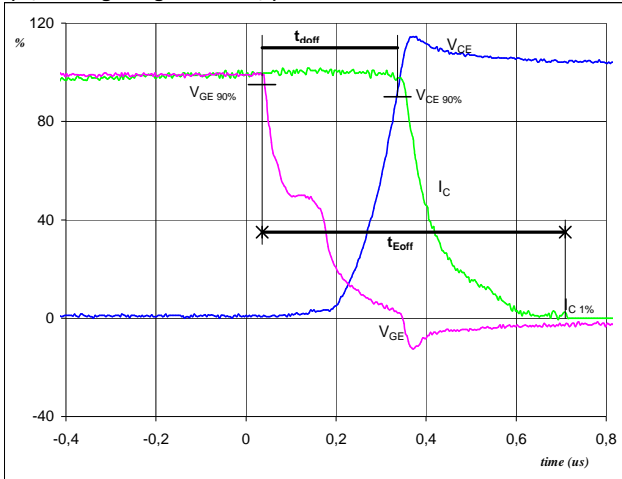


Switching Definitions Output Inverter

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

Figure 1 Output inverter IGBT

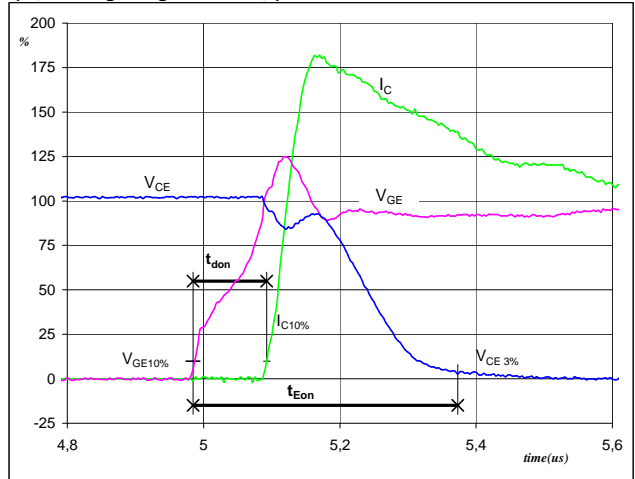
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff}
 (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%) =$	-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 Output inverter IGBT

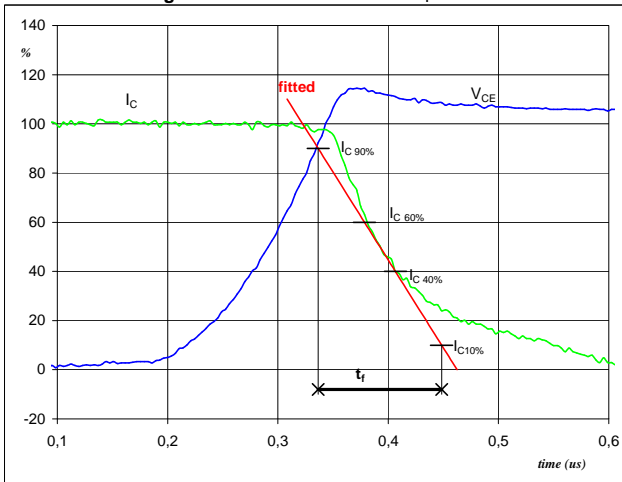
Turn-on Switching Waveforms & definition of t_{don} , t_{Eon}
 (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%) =$	-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 Output inverter IGBT

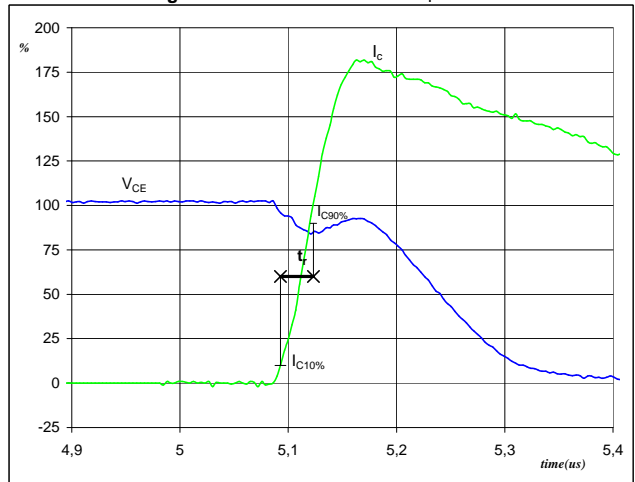
Turn-off Switching Waveforms & definition of t_f



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

Figure 4 Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r



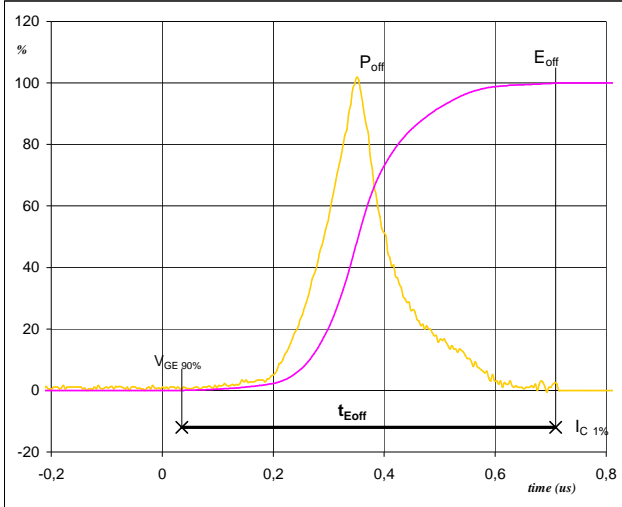
$V_C(100\%) =$	600	V
$I_C(100\%) =$	100	A
$t_r =$	0,03	μs



Switching Definitions Output Inverter

Figure 5 Output inverter IGBT

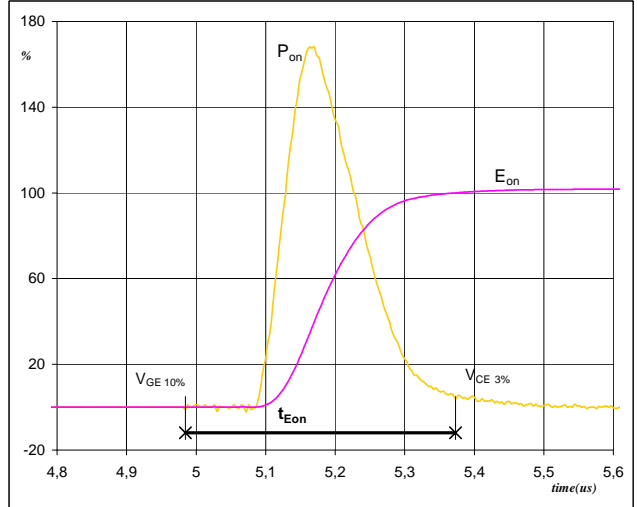
Turn-off Switching Waveforms & definition of t_{Eoff}



$P_{off} (100\%) = 59,91 \text{ kW}$
 $E_{off} (100\%) = 8,87 \text{ mJ}$
 $t_{Eoff} = 0,67 \text{ } \mu\text{s}$

Figure 6 Output inverter IGBT

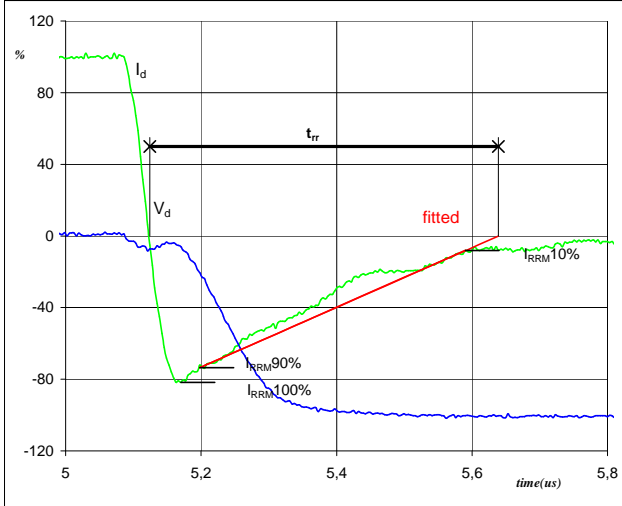
Turn-on Switching Waveforms & definition of t_{Eon}



$P_{on} (100\%) = 59,91 \text{ kW}$
 $E_{on} (100\%) = 12,48 \text{ mJ}$
 $t_{Eon} = 0,39 \text{ } \mu\text{s}$

Figure 7 Output inverter IGBT

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



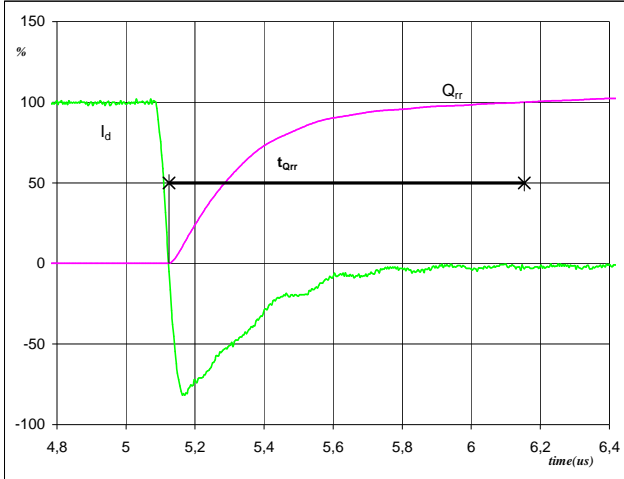
$V_d (100\%) = 600 \text{ V}$
 $I_d (100\%) = 100 \text{ A}$
 $I_{RRM} (100\%) = -83 \text{ A}$
 $t_{rr} = 0,51 \text{ } \mu\text{s}$



Switching Definitions Output Inverter

Figure 8 Output inverter FWD

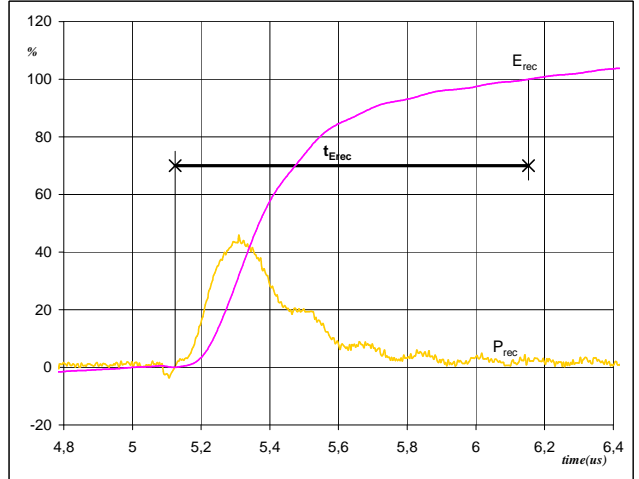
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	100	A
Q_{rr} (100%) =	20,73	μC
t_{Qrr} =	1,03	μs

Figure 9 Output inverter 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



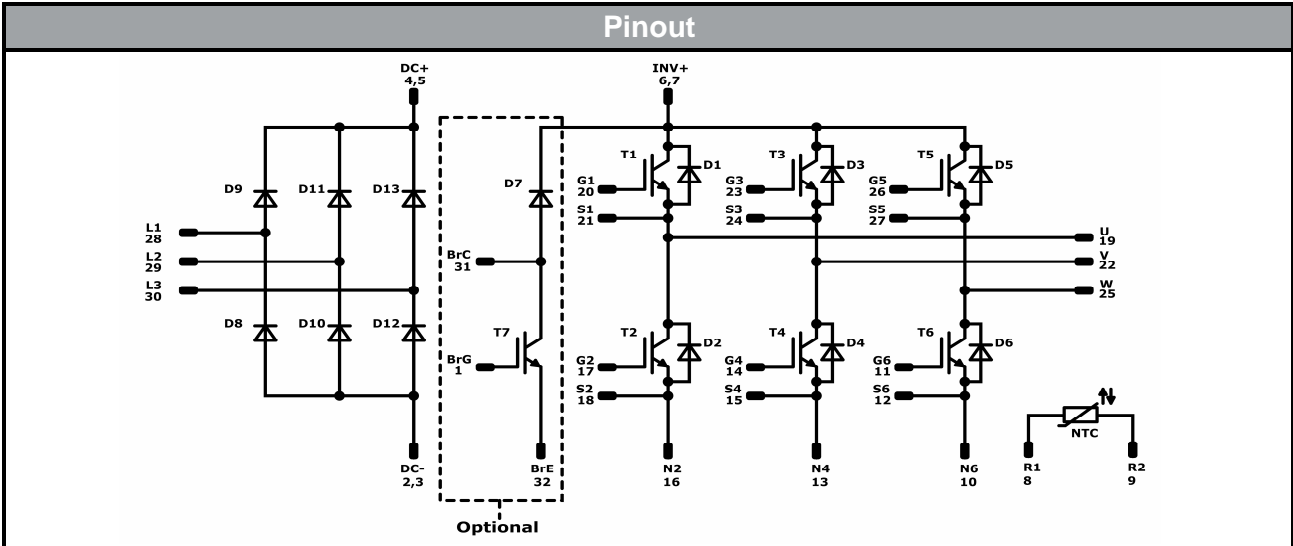
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking			
Version	Ordering Code	in DataMatrix as	in packaging barcode as
17mm housing with solder pins and breake	V23990-P586-A20-PM	P586-A20-PM	P586-A20-PM
17mm housing with pressfit pins and breake	V23990-P586-A20Y-PM	P586-A20Y-PM	P586-A20Y-PM
12mm housing with solder pins and breake	V23990-P586-A208-PM	P586-A208-PM	P586-A208-PM
12mm housing with pressfit pins and breake	V23990-P586-A208Y-PM	P586-A208Y-PM	P586-A208Y-PM
17mm housing with solder pins w/o breake	V23990-P586-C20-PM	P586-C20-PM	P586-C20-PM
17mm housing with pressfit pins w/o breake	V23990-P586-C20Y-PM	P586-C20Y-PM	P586-C20Y-PM
12mm housing with solder pins w/o breake	V23990-P586-C208-PM	P586-C208-PM	P586-C208-PM
17mm housing with solder pins and breake with thermal paste	V23990-P586-A20-/3/-PM	P586-A20-PM	P586-A20-PM
17mm housing with pressfit pins and breake with thermal paste	V23990-P586-A20Y-/3/-PM	P586-A20Y-PM	P586-A20Y-PM
12mm housing with solder pins and breake with thermal paste	V23990-P586-A208-/3/-PM	P586-A208-PM	P586-A208-PM
12mm housing with pressfit pins and breake with thermal paste	V23990-P586-A208Y-/3/-PM	P586-A208Y-PM	P586-A208Y-PM
17mm housing with solder pins w/o breake with thermal paste	V23990-P586-C20-/3/-PM	P586-C20-PM	P586-C20-PM
17mm housing with pressfit pins w/o breake with thermal paste	V23990-P586-C20Y-/3/-PM	P586-C20Y-PM	P586-C20Y-PM
12mm housing with solder pins w/o breake with thermal paste	V23990-P586-C208-/3/-PM	P586-C208-PM	P586-C208-PM

Features		
	A version	C version
Rectifier	3-leg	3-leg
Break IGBT	✓	w/o pin
Break FWD	✓	1,31,32
Inverter IGBT	✓	✓
Inverter FWD	✓	✓

Pin table			
Pin	X	Y	Function
1	52,55	0	BrG
2	47,7	0	DC-
3	44,8	0	DC-
4	37,8	0	DC+
5	37,8	2,8	DC+
6	35	0	Inv+
7	35	2,8	Inv+
8	28	0	R1
9	25,2	0	R2
10	22,4	0	N6
11	19,6	0	G6
12	16,8	0	S6
13	14	0	N4
14	11,2	0	G4
15	8,4	0	S4
16	5,6	0	N2
17	2,8	0	G2
18	0	0	S2
19	0	28,5	U
20	2,8	28,5	G1
21	7,5	28,5	S1
22	14,5	28,5	V
23	17,3	28,5	G3
24	22	28,5	S3
25	29	28,5	W
26	31,8	28,5	G5
27	36,5	28,5	S5
28	43,5	28,5	L1
29	52,55	25	L2
30	52,55	16,9	L3
31	52,55	8,6	BrC
32	52,55	2,8	BrE

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




Identification					
ID	Component	Voltage	Current	Function	Comment
T1-T6	IGBT	600 V	50 A	Inverter Switch	
D1-D6	FWD	600 V	50 A	Inverter Diode	
T7	IGBT	600 V	30 A	Brake Switch	
D7	FWD	600 V	20 A	Brake Diode	
D8-D13	Rectifier	1600 V	35 A	Rectifier Diode	
NTC	NTC			Thermistor	



Packaging instruction			
Standard packaging quantity (SPQ)	100	>SPQ Standard	<SPQ Sample

Handling instruction
Handling instructions for <i>flow</i> 1 packages see vincotech.com website.

Package data
Package data for <i>flow</i> 1 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-P586-x2x-PM-D5-14	16 Jan. 2019	Added thermal paste options to ordering code section	22

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Vincotech products are not authorised for use as critical components in life support devices or systems without the express written approval of Vincotech.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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