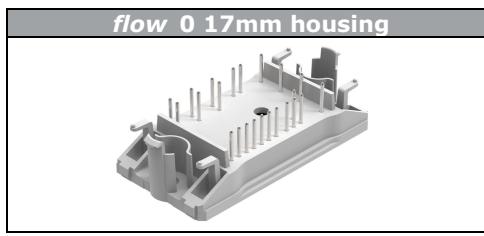
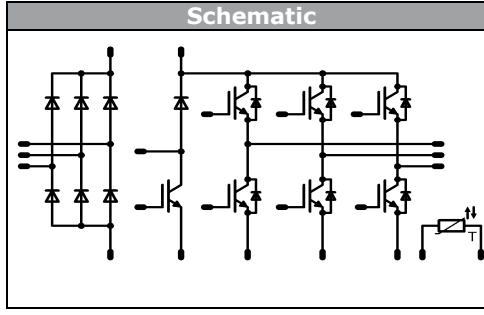


flow PIM 0		600 V / 10 A		
<table border="1"> <thead> <tr> <th>Features</th> </tr> </thead> <tbody> <tr> <td> <ul style="list-style-type: none"> Clip-in housing Trench Fieldstop IGBT's for low saturation losses Optional w/o BRC </td></tr> </tbody> </table>		Features	<ul style="list-style-type: none"> Clip-in housing Trench Fieldstop IGBT's for low saturation losses Optional w/o BRC 	
Features				
<ul style="list-style-type: none"> Clip-in housing Trench Fieldstop IGBT's for low saturation losses Optional w/o BRC 				
<table border="1"> <thead> <tr> <th>Target Applications</th> </tr> </thead> <tbody> <tr> <td> <ul style="list-style-type: none"> Industrial drives Embedded drives </td></tr> </tbody> </table>		Target Applications	<ul style="list-style-type: none"> Industrial drives Embedded drives 	
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<table border="1"> <thead> <tr> <th>Types</th> </tr> </thead> <tbody> <tr> <td> <ul style="list-style-type: none"> V23990-P543-A39-PM </td></tr> </tbody> </table>		Types	<ul style="list-style-type: none"> V23990-P543-A39-PM 	
Types				
<ul style="list-style-type: none"> V23990-P543-A39-PM 				
				
				

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}	$T_j = T_{jmax}$	44 46	A
Surge (non-repetitive) forward current	I_{FSM}	$t_p = 10\text{ms}$ 50Hz half sine wave	270	A
I^2t -value	I^2t		370	A^2s
Power dissipation	P_{tot}	$T_j = T_{jmax}$	56 59	W
Maximum Junction Temperature	T_{jmax}		150	$^\circ\text{C}$
Inverter Switch				
Collector-emitter break down voltage	V_{CE}		600	V
DC collector current	I_C	$T_j = T_{jmax}$	14 20	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	30	A
Turn off safe operating area		$V_{CE} \leq 600\text{V}, T_j \leq T_{op\ max}$	30	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	44 60	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	$^\circ\text{C}$



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Maximum Ratings

 $T_1 = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
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Inverter Diode

Peak Repetitive Reverse Voltage	V_{RRM}		600	V
DC forward current	I_F	$T_j = T_{jmax}$ $T_c = 80^\circ\text{C}$	14 25	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	20	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$ $T_c = 80^\circ\text{C}$	21 32	W
Maximum Junction Temperature	T_{jmax}		175	$^\circ\text{C}$

Brake Switch

Collector-emitter break down voltage	V_{CE}		600	V
DC collector current	I_C	$T_j = T_{jmax}$ $T_c = 80^\circ\text{C}$	8 14	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	18	A
Turn off safe operating area		$V_{CE} \leq 600 \text{ V}, T_j \leq T_{op\ max}$	18	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$ $T_c = 80^\circ\text{C}$	36 47	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	$T_j = T_{jmax}$ $T_c = 80^\circ\text{C}$	8 10	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	12	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$ $T_c = 80^\circ\text{C}$	27 34	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	



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datasheet

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 [°C]	Min	Typ	Max	
Rectifier Diode										
Forward voltage	V_F				30	25 125	0,8	1,19 1,17	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			1600		25 145			0,05 1,1	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	phase change material $\lambda = 3,4 \text{ W/mK}$						1,25		K/W
Inverter Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00015	25 150	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CESat}		15		10	25 150	1	1,59 1,78	2,2	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		25 150			0,08	mA
Gate-emitter leakage current	I_{GES}		20	0		25 150			350	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	$R_{goff}=16 \Omega$ $R_{gon}=32 \Omega$	± 15	300	10	25 150		15 14		ns
Rise time	t_r					25 150		11 14		
Turn-off delay time	$t_{d(off)}$					25 150		155 170		
Fall time	t_f					25 150		89 98		
Turn-on energy loss	E_{on}					25 150		0,16 0,22		mWs
Turn-off energy loss	E_{off}					25 150		0,24 0,29		
Input capacitance	C_{ies}							551		
Output capacitance	C_{oss}					f = 1 MHz	0	25	40	pF
Reverse transfer capacitance	C_{rss}								17	
Gate charge	Q_G		±15	480	10	25			62	nC
Thermal resistance junction to sink	$R_{th(j-s)}$	phase change material $\lambda = 3,4 \text{ W/mK}$							2,15	K/W
Inverter Diode										
Diode forward voltage	V_F				10	25 150	1	1,61 1,51	2,25	V
Peak reverse recovery current	I_{RRM}	$R_{gin}=32 \Omega$	± 15	300	10	25 150		10 11		A
Reverse recovery time	t_{rr}					25 150		142 219		ns
Reverse recovered charge	Q_{rr}					25 150		0,46 0,80		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		703 397		A/μs
Reverse recovered energy	E_{rec}					25 150		0,09 0,17		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase change material $\lambda = 3,4 \text{ W/mK}$						2,98		K/W



Vincotech

V23990-P543-A39 -PM

datasheet

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 [°C]	Min	Typ	Max	
Brake Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00043	25 150	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		6	25 150	1	1,55 1,72	2,1	V
Collector-emitter cut-off incl diode	I_{CES}		0	600		25 150			0,06	mA
Gate-emitter leakage current	I_{GES}		20	0		25 150			350	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$					25 150	11 10			
Rise time	t_r					25 150	8 10			
Turn-off delay time	$t_{d(off)}$	$R_{goff}=16 \Omega$ $R_{gon}=32 \Omega$	±15	300	6	25 150	118 130			ns
Fall time	t_f					25 150	93 117			
Turn-on energy loss	E_{on}					25 150	0,07 0,10			mWs
Turn-off energy loss	E_{off}					25 150	0,15 0,18			
Input capacitance	C_{ies}						368			
Output capacitance	C_{oss}	$f = 1 \text{ MHz}$	0	25		25	28			pF
Reverse transfer capacitance	C_{rss}						11			
Gate charge	Q_G					25		42		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	phase change material $\lambda = 3,4 \text{ W/mK}$						2,44		K/W
Brake Diode										
Diode forward voltage	V_F				6	25 150	1	1,69 1,61	2,5	V
Reverse leakage current	I_r	$R_{gon}=32 \Omega$		600		25 150			60	μA
Peak reverse recovery current	I_{RRM}					25 150		7 8		A
Reverse recovery time	t_{rr}					25 150		97 151		ns
Reverse recovered charge	Q_{rr}	$R_{gon}=32 \Omega$	±15	300	6	25 150		0,23 0,23		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		522 321		A/μs
Reverse recovery energy	E_{rec}					25 150		0,05 0,09		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase change material $\lambda = 3,4 \text{ W/mK}$						2,68		K/W
Thermistor										
Rated resistance	R					25		22000		Ω
Deviation of R100	$\Delta R/R$	$R_{100}=1486 \Omega$				100	-5		5	%
Power dissipation	P					25		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	

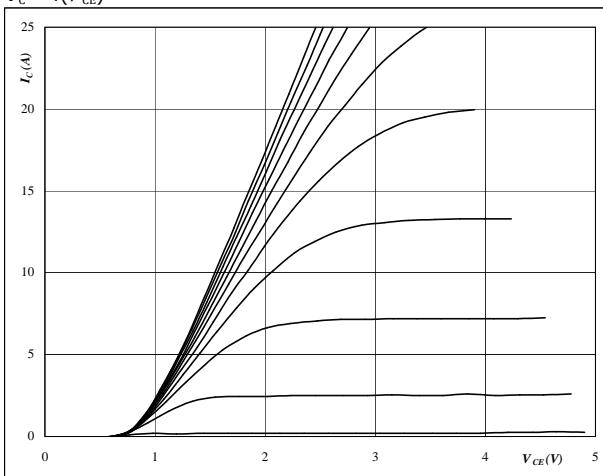
Inverter Characteristics

Figure 1

Inverter IGBT

Typical output characteristics

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

**At**

$$t_p = 250 \mu\text{s}$$

$$T_j = 25^\circ\text{C}$$

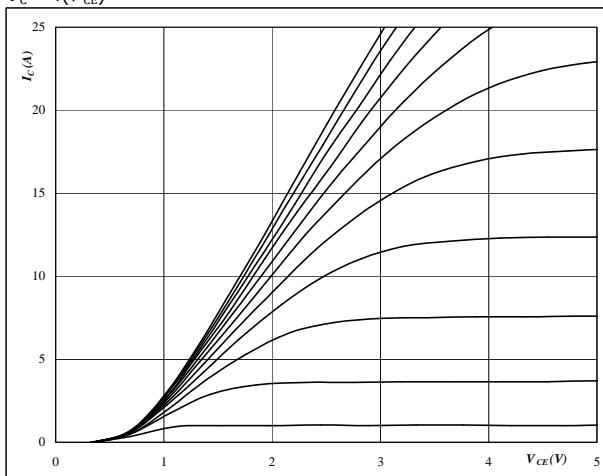
V_{GE} from 7 V to 17 V in steps of 1 V

Figure 2

Inverter IGBT

Typical output characteristics

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

**At**

$$t_p = 250 \mu\text{s}$$

$$T_j = 125^\circ\text{C}$$

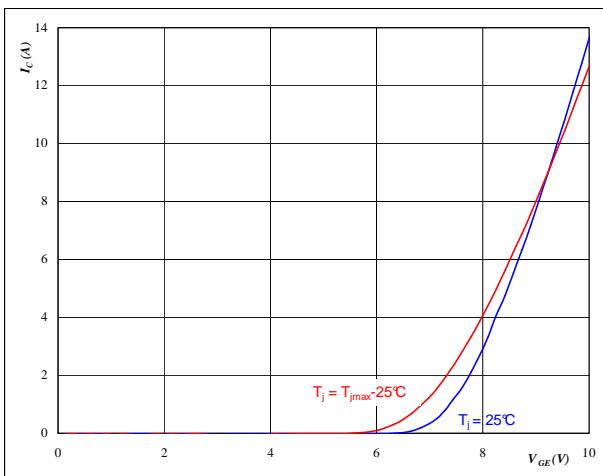
V_{GE} from 7 V to 17 V in steps of 1 V

Figure 3

Inverter IGBT

Typical transfer characteristics

$$I_C = f(V_{GE})$$

**At**

$$t_p = 250 \mu\text{s}$$

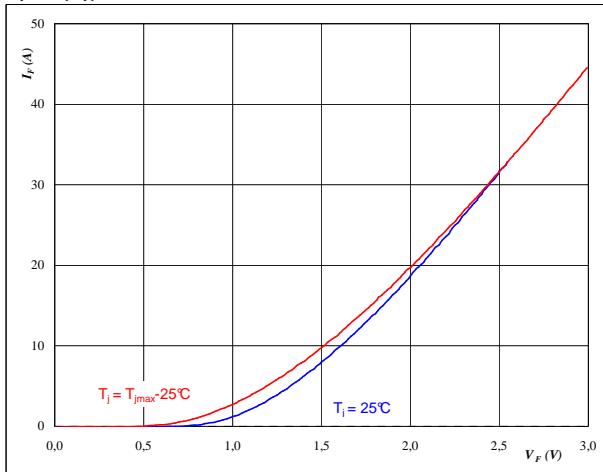
$$V_{CE} = 10 \text{ V}$$

Figure 4

Inverter FWD

Typical diode forward current as a function of forward voltage

$$I_F = f(V_F)$$

**At**

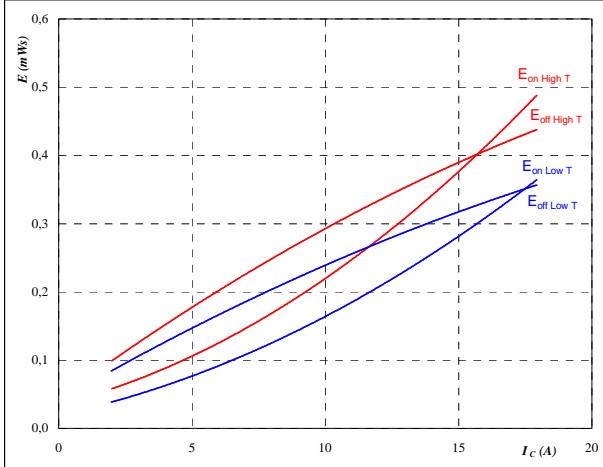
$$t_p = 250 \mu\text{s}$$

Inverter Characteristics

Figure 5
Typical switching energy losses
as a function of collector current

Inverter IGBT

$$E = f(I_C)$$



With an inductive load at

T_j = 25/125 °C

V_{CE} = 300 V

V_{GE} = 15 V

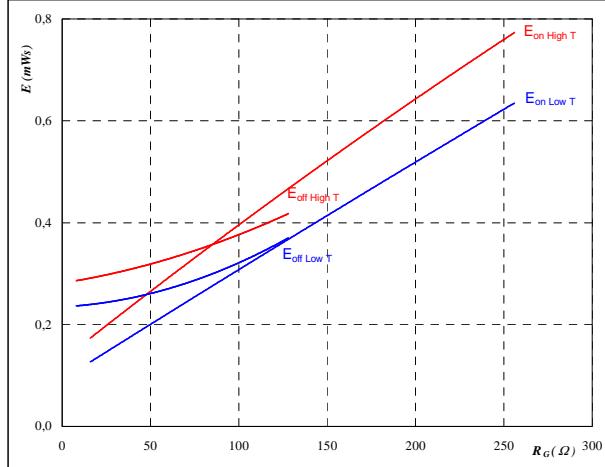
R_{gon} = 32 Ω

R_{goff} = 16 Ω

Figure 6
Typical switching energy losses
as a function of gate resistor

Inverter IGBT

$$E = f(R_G)$$



With an inductive load at

T_j = 25/125 °C

V_{CE} = 300 V

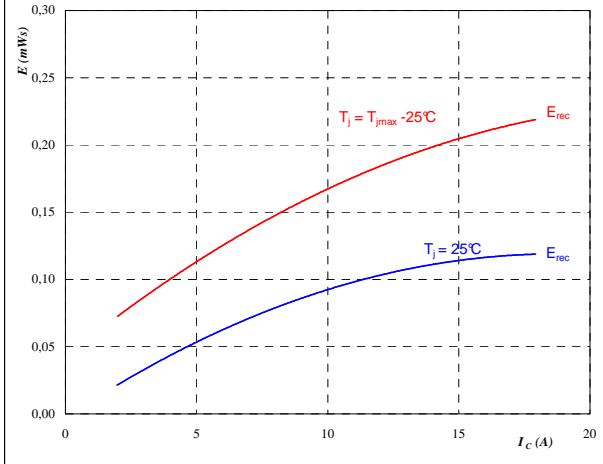
V_{GE} = 15 V

I_C = 10 A

Figure 7
Typical reverse recovery energy loss
as a function of collector current

Inverter FWD

$$E_{rec} = f(I_C)$$



With an inductive load at

T_j = 25/125 °C

V_{CE} = 300 V

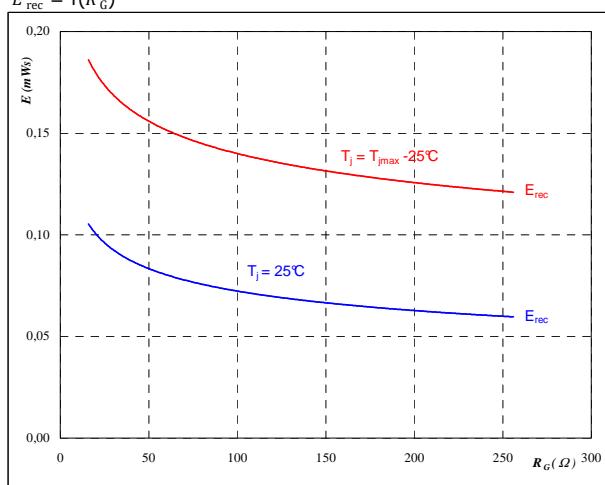
V_{GE} = 15 V

R_{gon} = 32 Ω

Figure 8
Typical reverse recovery energy loss
as a function of gate resistor

Inverter FWD

$$E_{rec} = f(R_G)$$



With an inductive load at

T_j = 25/125 °C

V_{CE} = 300 V

V_{GE} = 15 V

I_C = 10 A

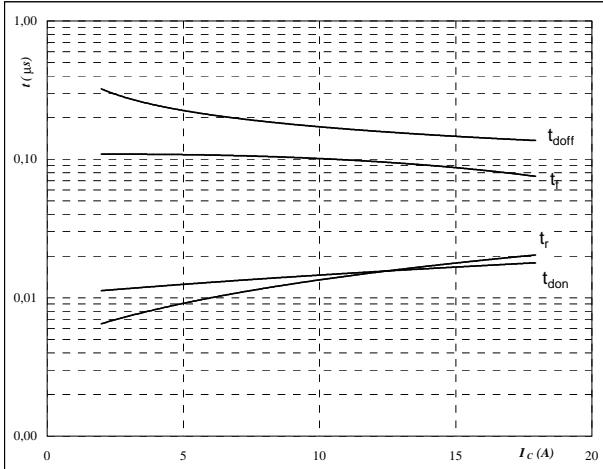
Inverter Characteristics

Figure 9

Inverter IGBT

Typical switching times as a function of collector current

$$t = f(I_c)$$



With an inductive load at

$$T_j = 125 \text{ } ^\circ\text{C}$$

$$V_{CE} = 300 \text{ V}$$

$$V_{GE} = 15 \text{ V}$$

$$R_{gon} = 32 \Omega$$

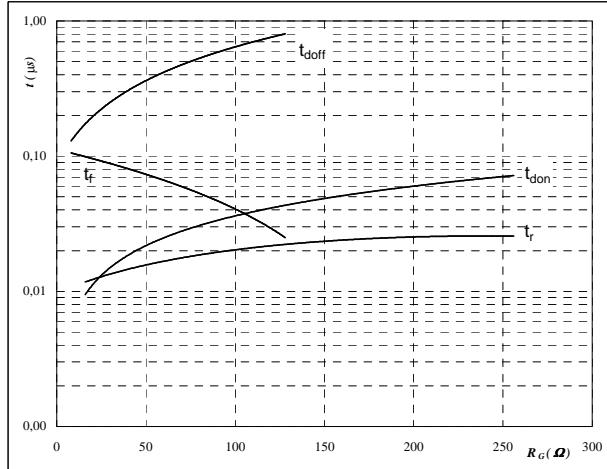
$$R_{goff} = 16 \Omega$$

Figure 10

Inverter IGBT

Typical switching times as a function of gate resistor

$$t = f(R_G)$$



With an inductive load at

$$T_j = 125 \text{ } ^\circ\text{C}$$

$$V_{CE} = 300 \text{ V}$$

$$V_{GE} = 15 \text{ V}$$

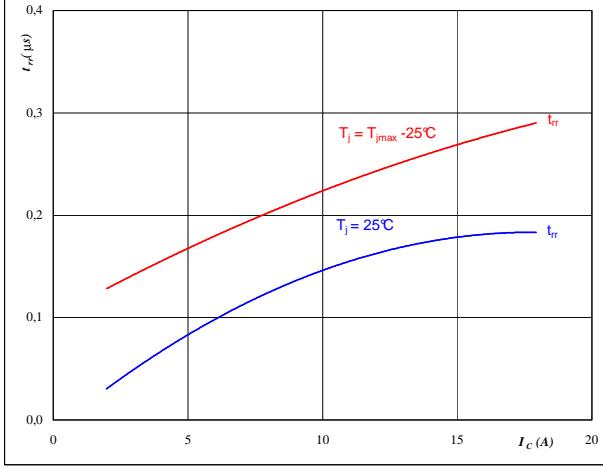
$$I_c = 10 \text{ A}$$

Figure 11

Inverter FWD

Typical reverse recovery time as a function of collector current

$$t_{rr} = f(I_c)$$



At

$$T_j = 25/125 \text{ } ^\circ\text{C}$$

$$V_{CE} = 300 \text{ V}$$

$$V_{GE} = 15 \text{ V}$$

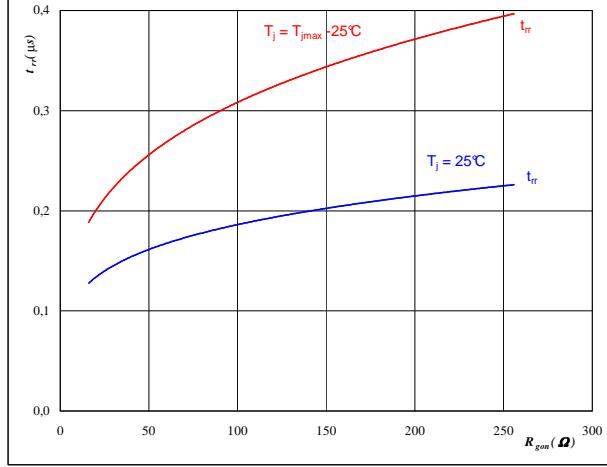
$$R_{gon} = 32 \Omega$$

Figure 12

Inverter FWD

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

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



At

$$T_j = 25/125 \text{ } ^\circ\text{C}$$

$$V_R = 300 \text{ V}$$

$$I_F = 10 \text{ A}$$

$$V_{GE} = 15 \text{ V}$$

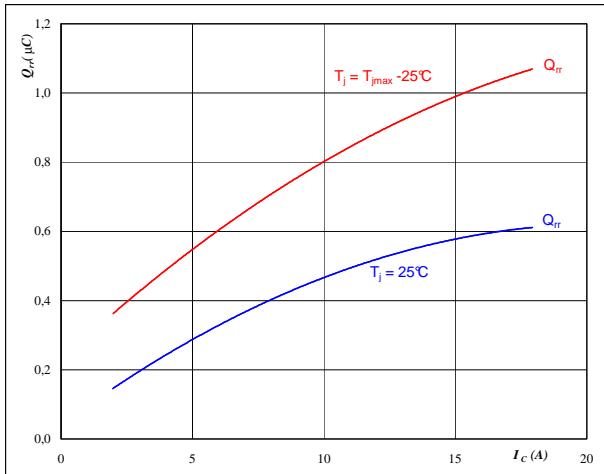
Inverter Characteristics

Figure 13

Inverter FWD

Typical reverse recovery charge as a function of collector current

$$Q_{rr} = f(I_c)$$

**At**

$$T_j = \frac{25}{125} \quad {}^\circ\text{C}$$

$$V_{CE} = 300 \quad \text{V}$$

$$V_{GE} = 15 \quad \text{V}$$

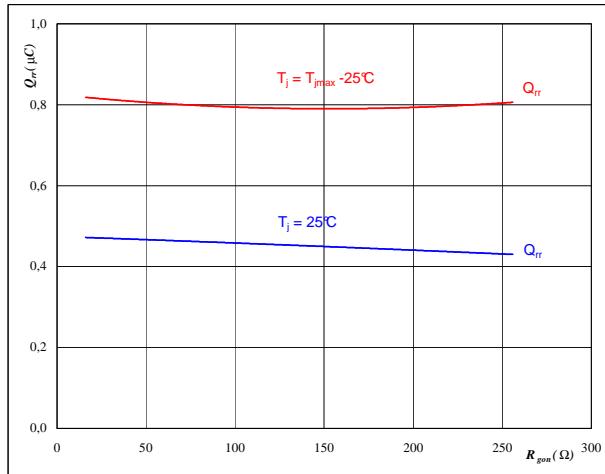
$$R_{gon} = 32 \quad \Omega$$

Figure 14

Inverter FWD

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

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

**At**

$$T_j = \frac{25}{125} \quad {}^\circ\text{C}$$

$$V_R = 300 \quad \text{V}$$

$$I_F = 10 \quad \text{A}$$

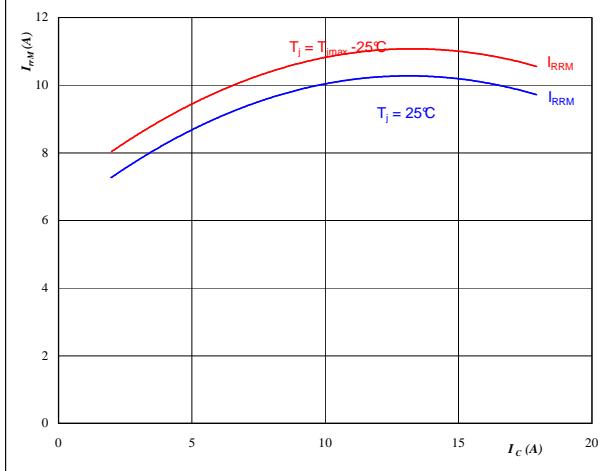
$$V_{GE} = 15 \quad \text{V}$$

Figure 15

Inverter FWD

Typical reverse recovery current as a function of collector current

$$I_{RRM} = f(I_c)$$

**At**

$$T_j = \frac{25}{125} \quad {}^\circ\text{C}$$

$$V_{CE} = 300 \quad \text{V}$$

$$V_{GE} = 15 \quad \text{V}$$

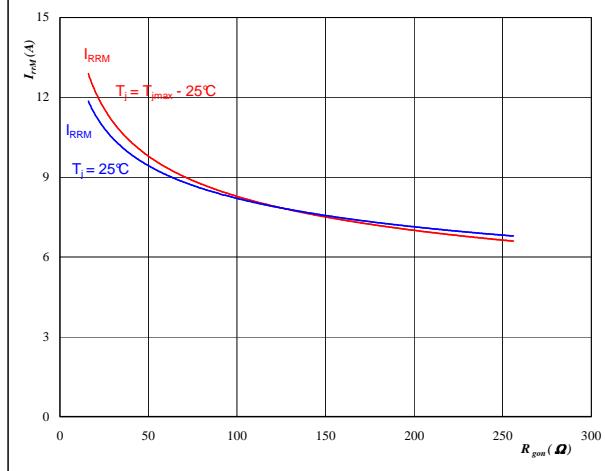
$$R_{gon} = 32 \quad \Omega$$

Figure 16

Inverter FWD

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

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

**At**

$$T_j = \frac{25}{125} \quad {}^\circ\text{C}$$

$$V_R = 300 \quad \text{V}$$

$$I_F = 10 \quad \text{A}$$

$$V_{GE} = 15 \quad \text{V}$$

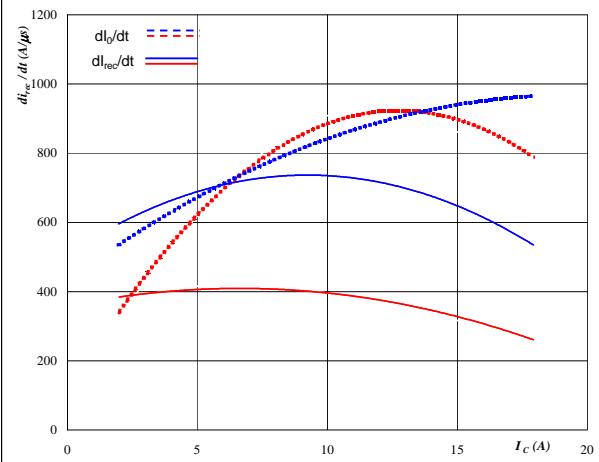
Inverter Characteristics

Figure 17

Inverter 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**

$$T_j = 25/125 \quad {}^\circ\text{C}$$

$$V_{CE} = 300 \quad \text{V}$$

$$V_{GE} = 15 \quad \text{V}$$

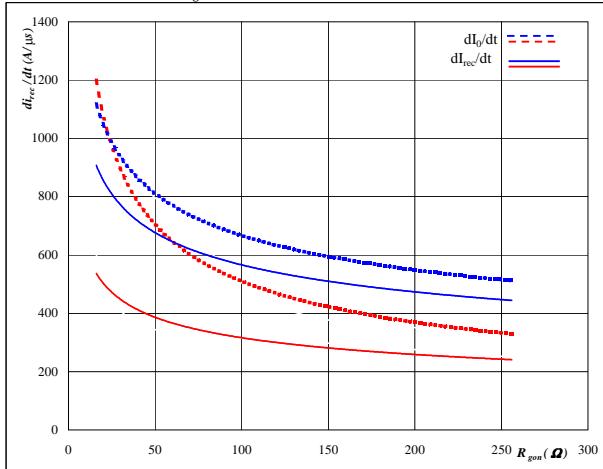
$$R_{gon} = 32 \quad \Omega$$

Figure 18

Inverter 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**

$$T_j = 25/125 \quad {}^\circ\text{C}$$

$$V_R = 300 \quad \text{V}$$

$$I_F = 10 \quad \text{A}$$

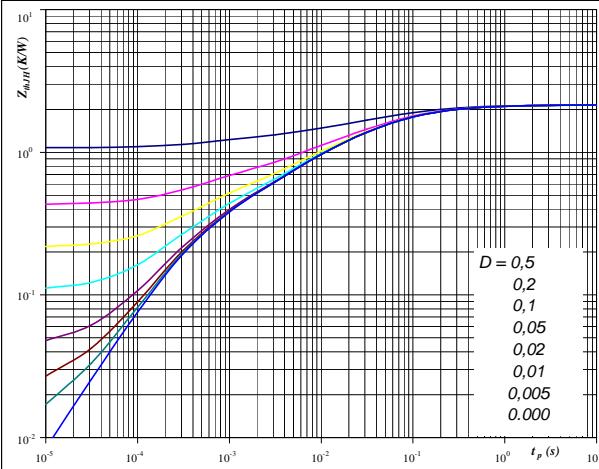
$$V_{GE} = 15 \quad \text{V}$$

Figure 19

Inverter IGBT

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

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

**At**

$$D = t_p / T$$

$$R_{thIH} = 2,15 \quad \text{K/W}$$

IGBT thermal model values

phase-change material

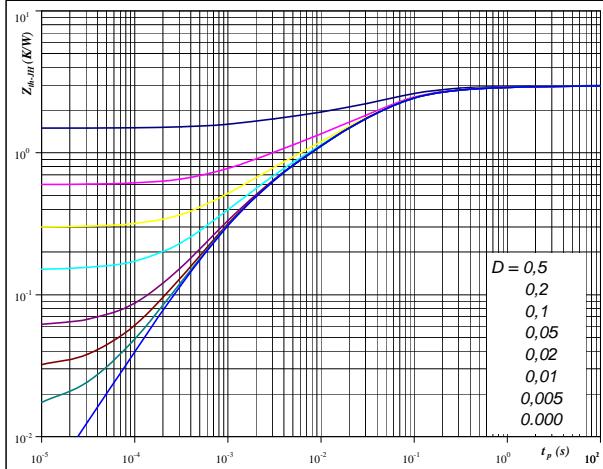
R (C/W)	Tau (s)
1,0E-01	1,4E+00
2,9E-01	2,0E-01
7,0E-01	5,3E-02
4,9E-01	1,2E-02
3,1E-01	3,0E-03
2,6E-01	3,8E-04

Figure 20

Inverter FWD

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

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

**At**

$$D = t_p / T$$

$$R_{thFH} = 2,98 \quad \text{K/W}$$

FWD thermal model values

phase-change material

R (C/W)	Tau (s)
8,7E-02	5,6E+00
2,4E-01	4,6E-01
1,2E+00	6,5E-02
6,9E-01	2,2E-02
4,5E-01	5,1E-03
3,0E-01	1,1E-03

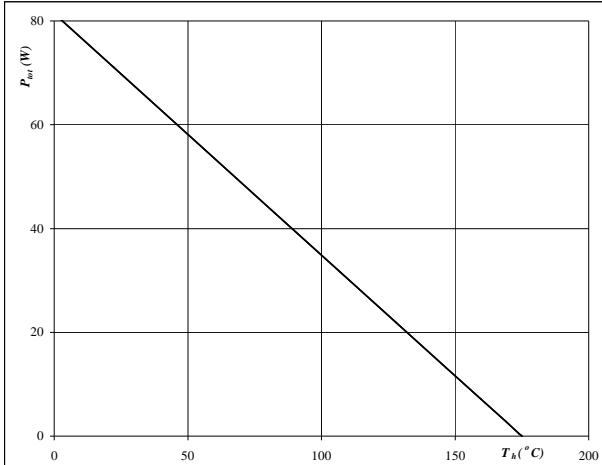
Inverter Characteristics

Figure 21

Inverter IGBT

Power dissipation as a function of heatsink temperature

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

**At**

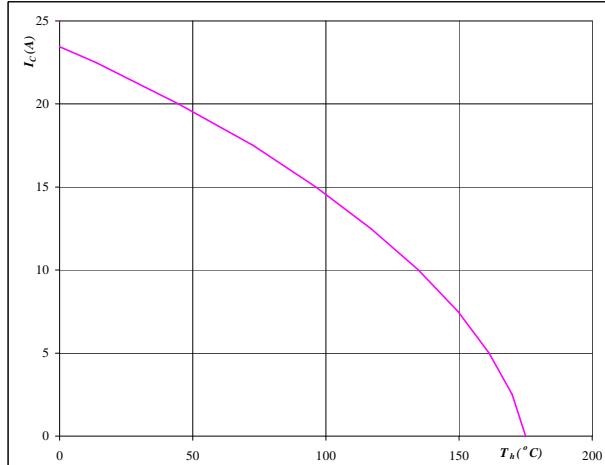
$$T_j = 175 \text{ } ^\circ\text{C}$$

Figure 22

Inverter IGBT

Collector current as a function of heatsink temperature

$$I_C = f(T_h)$$

**At**

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

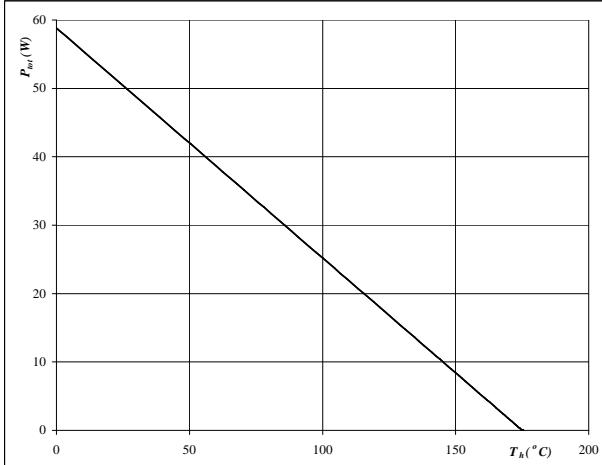
$$V_{GE} = 15 \text{ V}$$

Figure 23

Inverter FWD

Power dissipation as a function of heatsink temperature

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

**At**

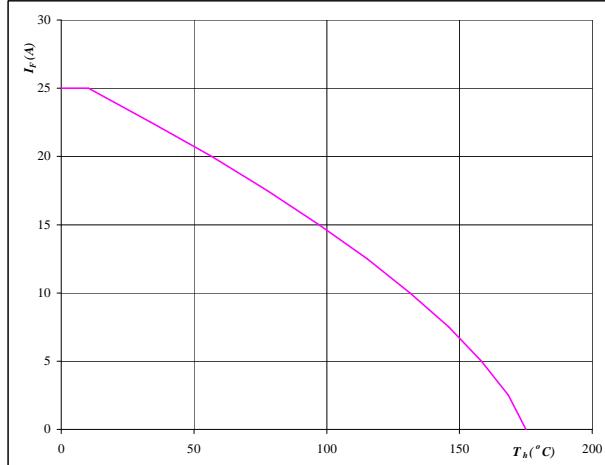
$$T_j = 175 \text{ } ^\circ\text{C}$$

Figure 24

Inverter FWD

Forward current as a function of heatsink temperature

$$I_F = f(T_h)$$

**At**

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

Inverter Characteristics

Figure 25
Safe operating area as a function
of collector-emitter voltage
 $I_C = f(V_{CE})$

Inverter IGBT

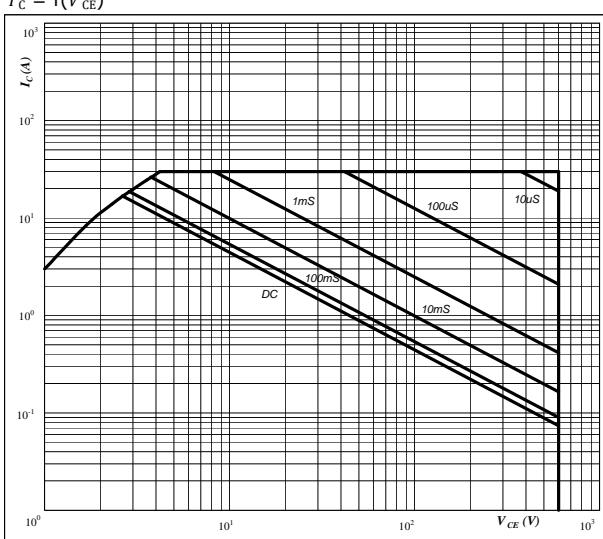
**At** $D =$ single pulse $T_h =$ 80 °C $V_{GE} =$ 15 V $T_j = T_{jmax}$ °C

Figure 26
Gate voltage vs Gate charge
 $V_{GE} = f(Q_{GE})$

Inverter IGBT

$$V_{GE} = f(Q_{GE})$$

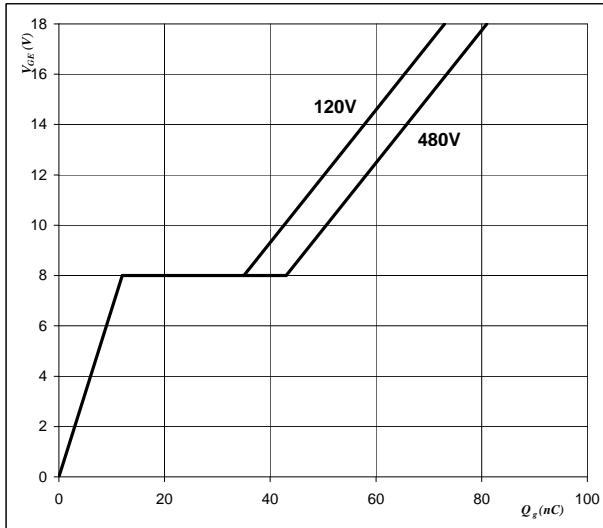
**At** $I_C =$ 10 A

Figure 27
Short circuit withstand time as a function of
gate-emitter voltage
 $t_{sc} = f(V_{GE})$

Inverter IGBT

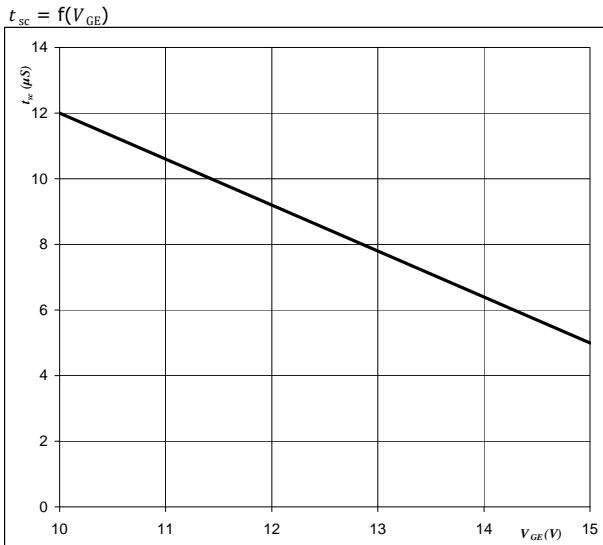
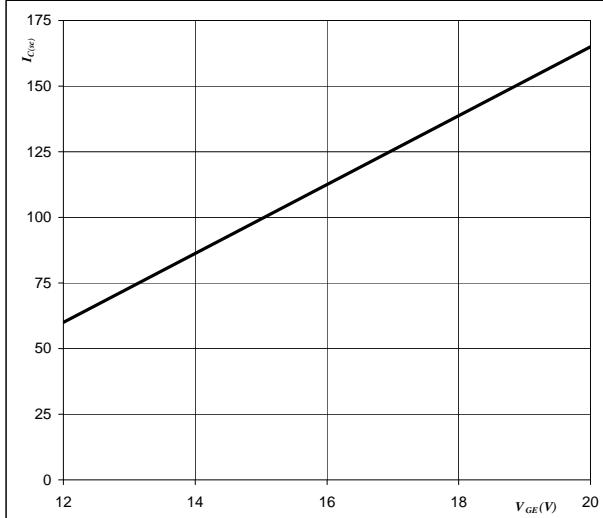
**At** $V_{CE} =$ 600 V $T_j \leq$ 175 °C

Figure 28
Typical short circuit collector current as a function of
gate-emitter voltage
 $I_{Csc} = f(V_{GE})$

Inverter IGBT

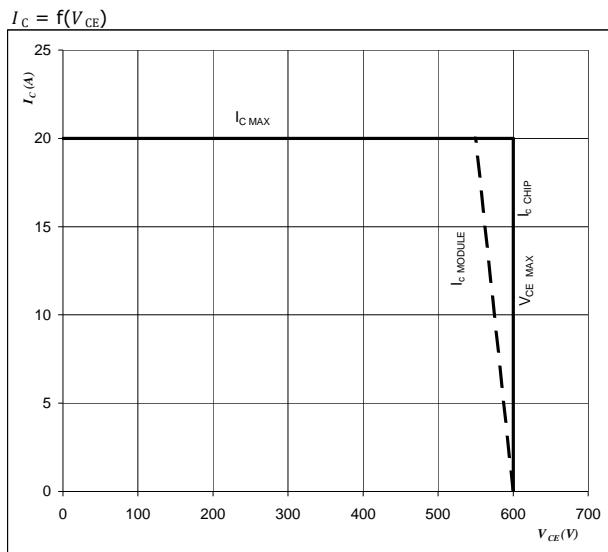
$$I_{Csc} = f(V_{GE})$$

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

Inverter Characteristics

Figure 29
Reverse bias safe operating area

Inverter IGBT



At

$T_j = T_{jmax} - 25$ °C

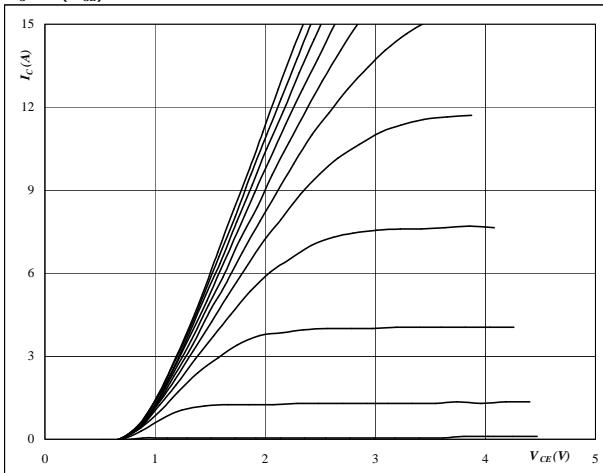
Switching mode : 3phase SPWM

Brake Characteristics

Figure 1**Typical output characteristics**

Brake IGBT

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

**At**

$$t_p = 250 \mu\text{s}$$

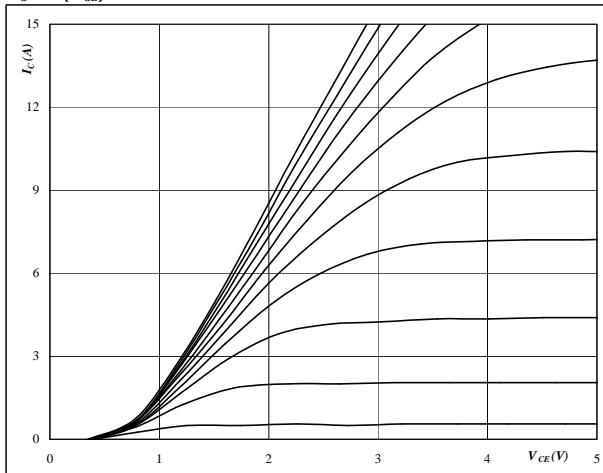
$$T_j = 25^\circ\text{C}$$

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

Figure 2**Typical output characteristics**

Brake IGBT

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

**At**

$$t_p = 250 \mu\text{s}$$

$$T_j = 125^\circ\text{C}$$

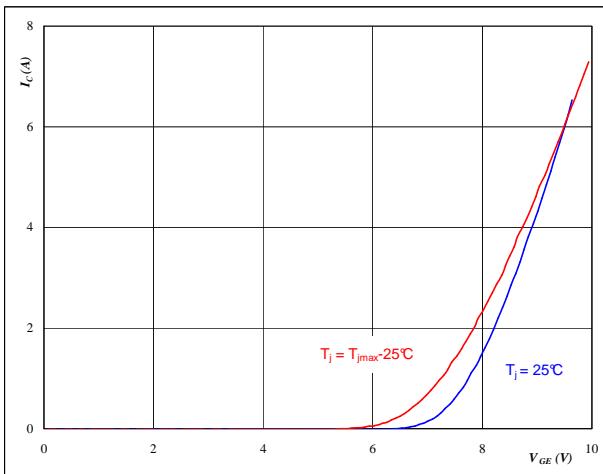
V_{GE} from 7 V to 17 V in steps of 1 V

Figure 3

Brake IGBT

Typical transfer characteristics

$$I_C = f(V_{GE})$$

**At**

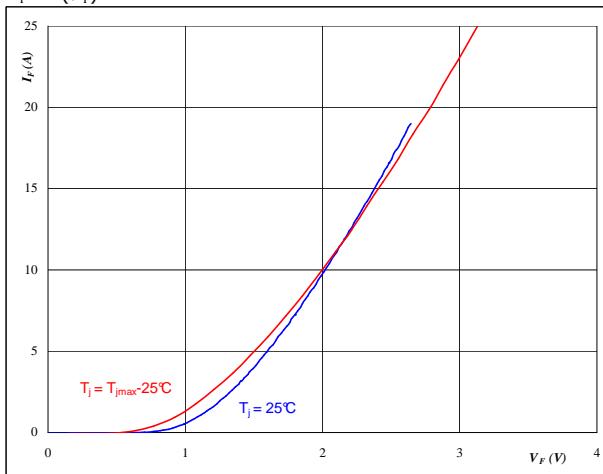
$$t_p = 250 \mu\text{s}$$

$$V_{CE} = 10 \text{ V}$$

Figure 4**Typical diode forward current as a function of forward voltage**

Brake FWD

$$I_F = f(V_F)$$

**At**

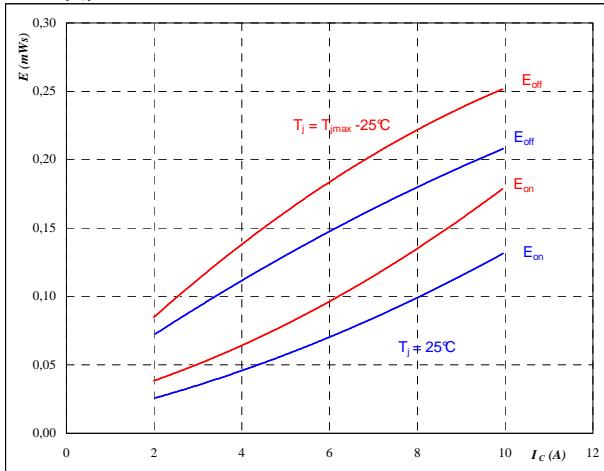
$$t_p = 250 \mu\text{s}$$

Brake Characteristics

Figure 5

**Typical switching energy losses
as a function of collector current**

$$E = f(I_C)$$



With an inductive load at

$$T_j = \textcolor{red}{25/125} \quad ^\circ\text{C}$$

$$V_{CE} = 300 \quad \text{V}$$

$$V_{GE} = 15 \quad \text{V}$$

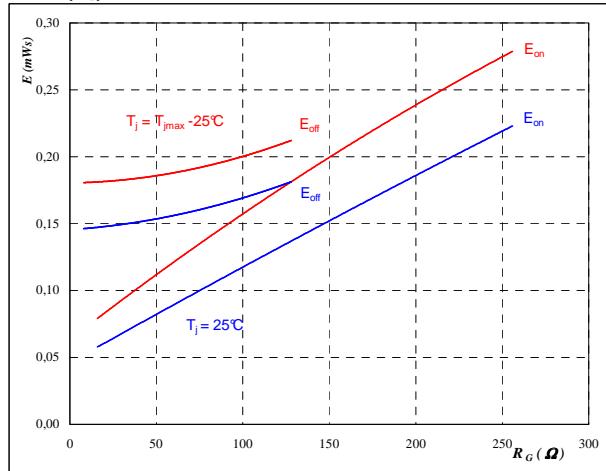
$$R_{gon} = 32 \quad \Omega$$

$$R_{goff} = 16 \quad \Omega$$

Figure 6

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

$$E = f(R_G)$$



With an inductive load at

$$T_j = \textcolor{red}{25/125} \quad ^\circ\text{C}$$

$$V_{CE} = 300 \quad \text{V}$$

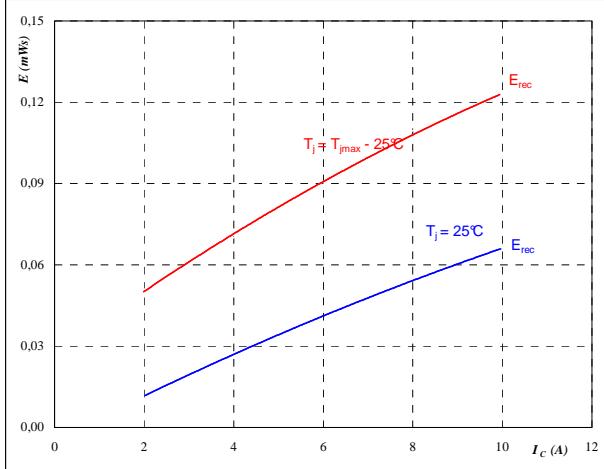
$$V_{GE} = 15 \quad \text{V}$$

$$I_C = 6 \quad \text{A}$$

Figure 7

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

$$E_{rec} = f(I_C)$$



With an inductive load at

$$T_j = \textcolor{red}{25/125} \quad ^\circ\text{C}$$

$$V_{CE} = 300 \quad \text{V}$$

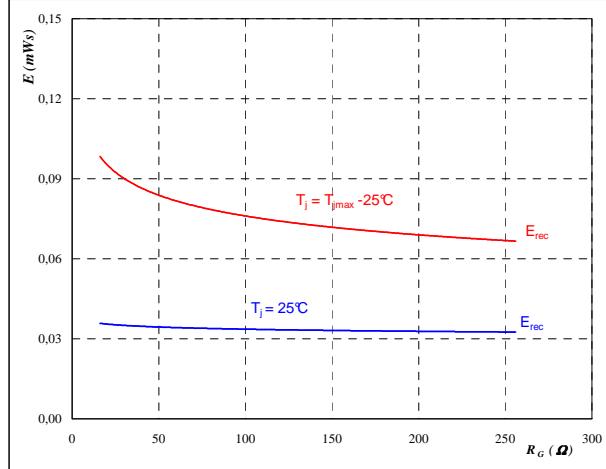
$$V_{GE} = 15 \quad \text{V}$$

$$R_{gon} = 32 \quad \Omega$$

Figure 8

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

$$E_{rec} = f(R_G)$$



With an inductive load at

$$T_j = \textcolor{red}{25/125} \quad ^\circ\text{C}$$

$$V_{CE} = 300 \quad \text{V}$$

$$V_{GE} = 15 \quad \text{V}$$

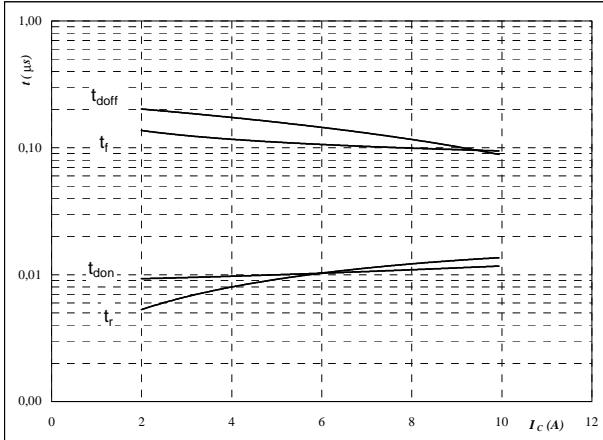
$$I_C = 6 \quad \text{A}$$

Brake Characteristics

Figure 9

Typical switching times as a function of collector current

$$t = f(I_C)$$



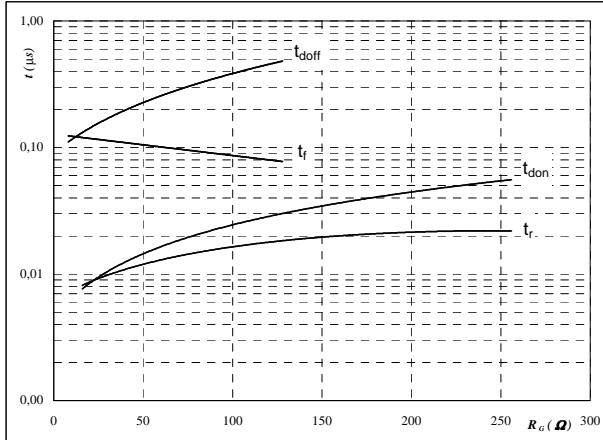
With an inductive load at

T _j =	125	°C
V _{CE} =	300	V
V _{GE} =	15	V
R _{gon} =	32	Ω
R _{goff} =	16	Ω

Figure 10

Typical switching times as a function of gate resistor

$$t = f(R_G)$$



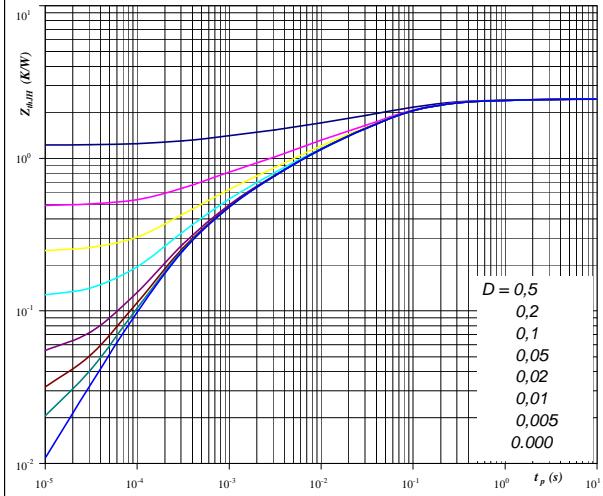
With an inductive load at

T _j =	125	°C
V _{CE} =	300	V
V _{GE} =	15	V
I _C =	6	A

Figure 11

IGBT transient thermal impedance as a function of pulse width

$$Z_{\text{th}H} = f(t_p)$$



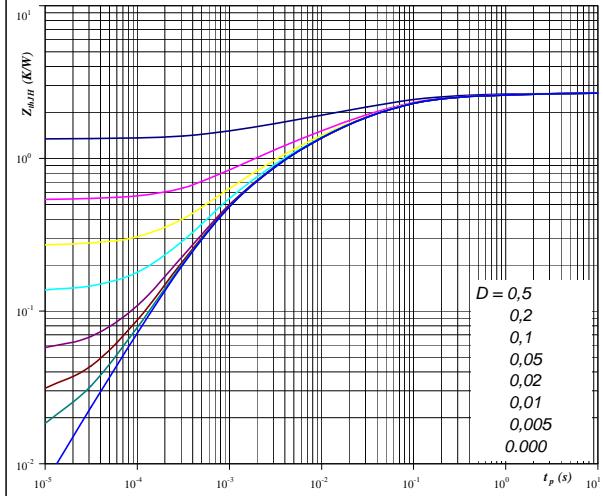
At $D = t_p / T$
phase-change material

$$R_{\text{th}H} = 2.44 \text{ K/W}$$

Figure 12

FWD transient thermal impedance as a function of pulse width

$$Z_{\text{th}H} = f(t_p)$$



At $D = t_p / T$
phase-change material

$$R_{\text{th}H} = 2.68 \text{ K/W}$$

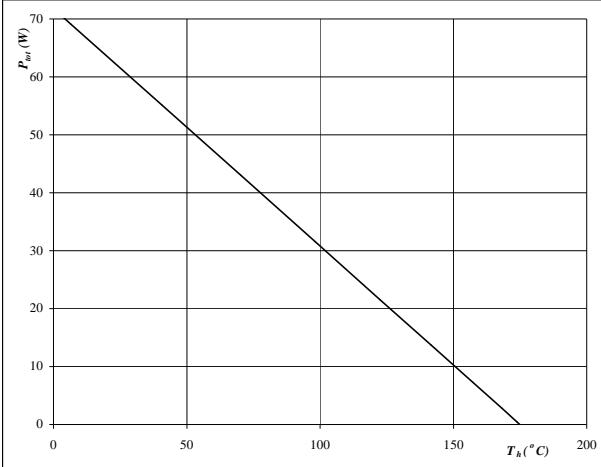
Brake Characteristics

Figure 13

Power dissipation as a function of heatsink temperature

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

Brake IGBT

**At**

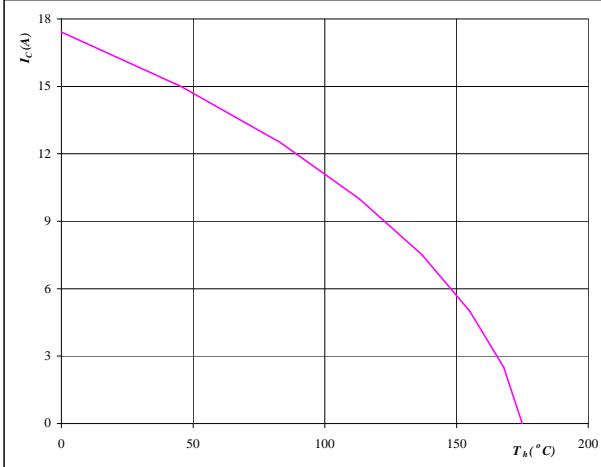
$$T_j = 175 \text{ } ^\circ\text{C}$$

Figure 14

Collector current as a function of heatsink temperature

$$I_C = f(T_h)$$

Brake IGBT

**At**

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

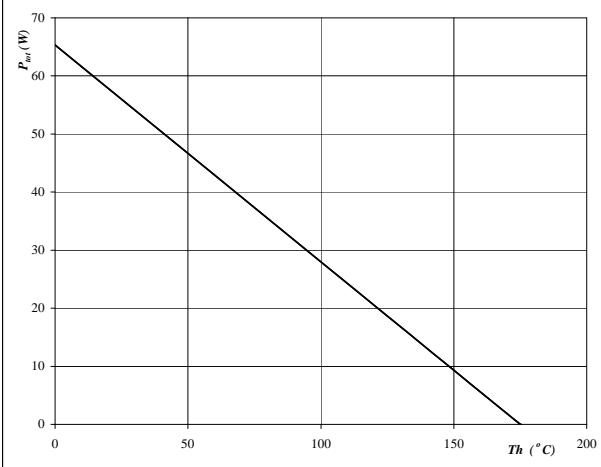
$$V_{GE} = 15 \text{ V}$$

Figure 15

Brake FWD

Power dissipation as a function of heatsink temperature

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

**At**

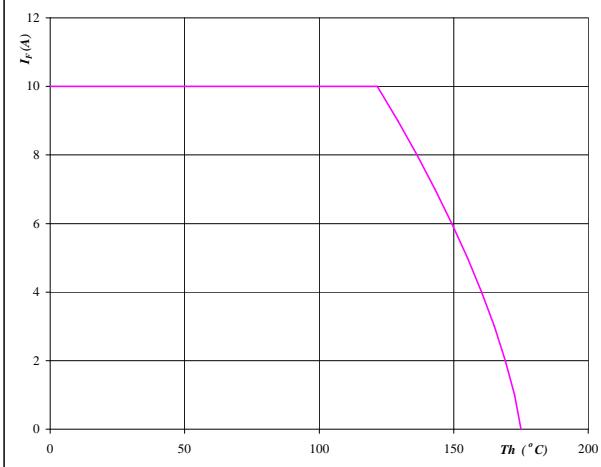
$$T_j = 175 \text{ } ^\circ\text{C}$$

Figure 16

Forward current as a function of heatsink temperature

$$I_F = f(T_h)$$

Brake FWD

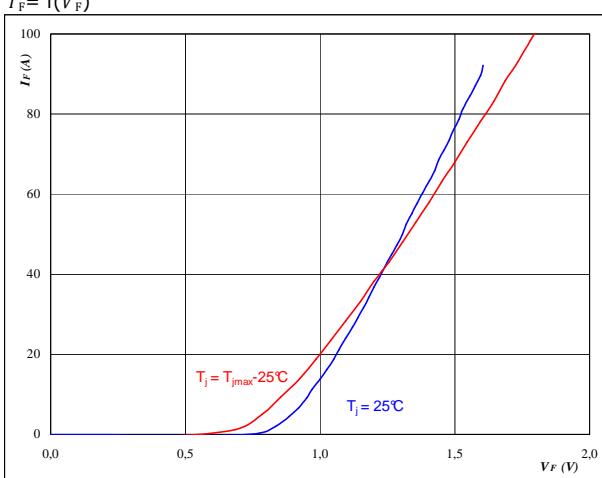
**At**

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

Rectifier Charaterisitcs

Figure 1
Typical diode forward current as a function of forward voltage
 $I_F = f(V_F)$

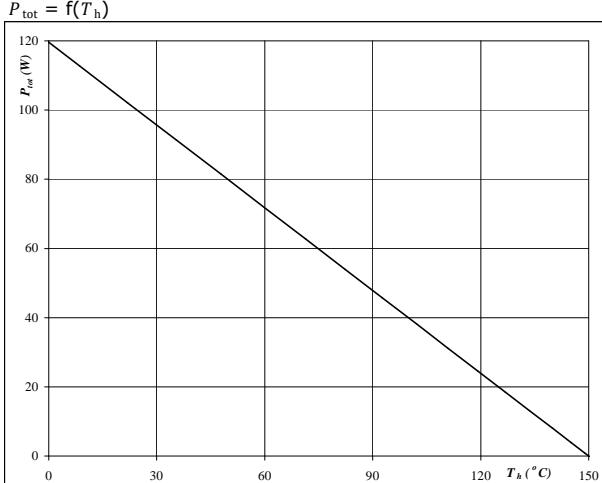
Rectifier Diode



At
 $t_p = 250 \mu\text{s}$

Figure 3
Power dissipation as a function of heatsink temperature
 $P_{tot} = f(T_h)$

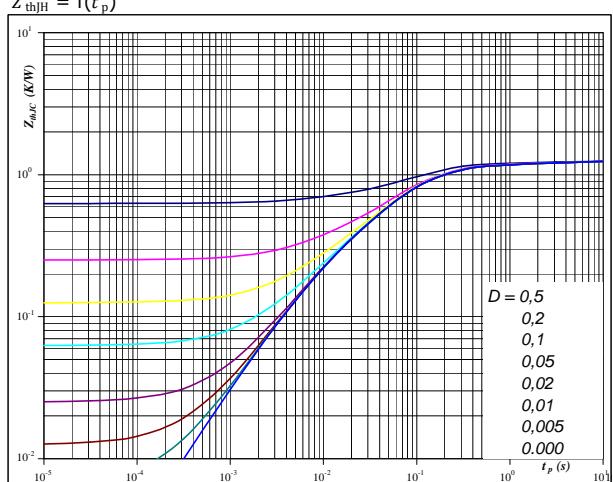
Rectifier Diode



At
 $T_j = 150^\circ\text{C}$

Figure 2
Diode transient thermal impedance as a function of pulse width
 $Z_{thH} = f(t_p)$

Rectifier Diode



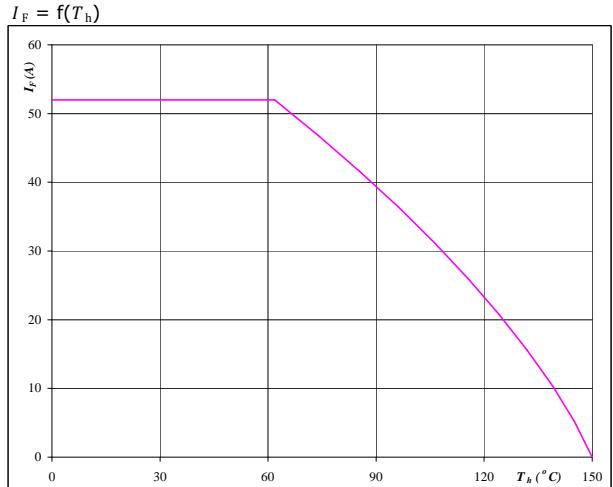
At
 $D = t_p / T$
 $R_{thH} = 1,25 \text{ K/W}$

Figure 3
Power dissipation as a function of heatsink temperature
 $P_{tot} = f(T_h)$

Rectifier Diode

Figure 4
Forward current as a function of heatsink temperature
 $I_F = f(T_h)$

Rectifier Diode



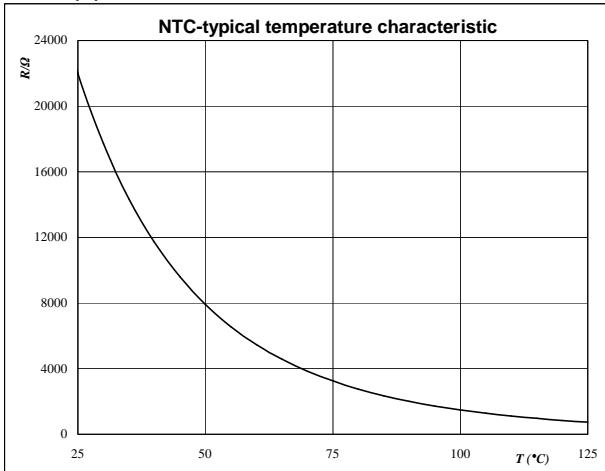
At
 $T_j = 150^\circ\text{C}$

Thermistor

Figure 1 Thermistor

**Typical NTC characteristic
as a function of temperature**

$$R_T = f(T)$$



Switching Definitions Inverter

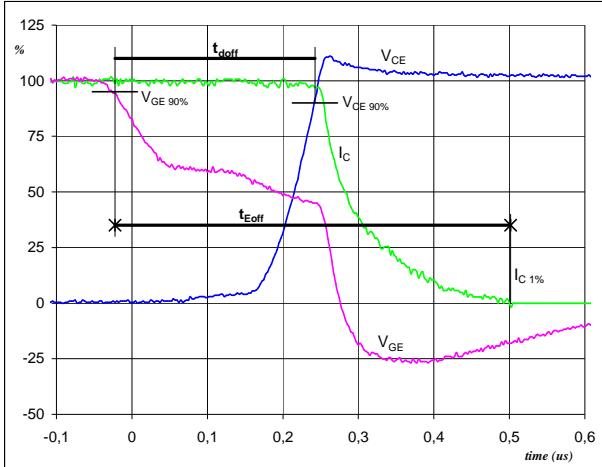
General conditions

T_j	= 125 °C
R_{gon}	= 32 Ω
R_{goff}	= 16 Ω

Figure 1

Inverter IGBT

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

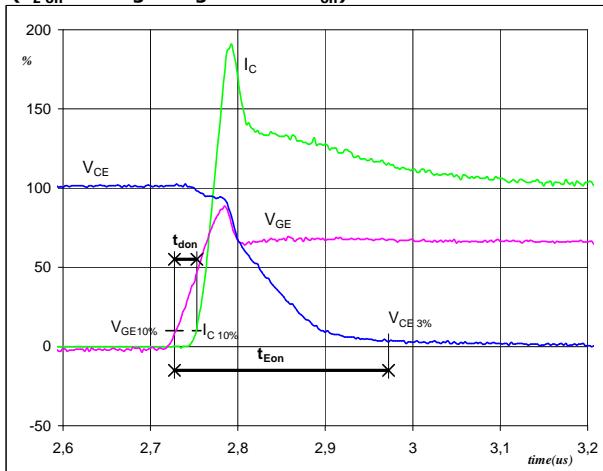


$V_{GE}(0\%) = 0 \text{ V}$
 $V_{GE}(100\%) = 15 \text{ V}$
 $V_C(100\%) = 300 \text{ V}$
 $I_C(100\%) = 10 \text{ A}$
 $t_{doff} = 0,26 \mu\text{s}$
 $t_{Eoff} = 0,52 \mu\text{s}$

Figure 2

Inverter IGBT

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

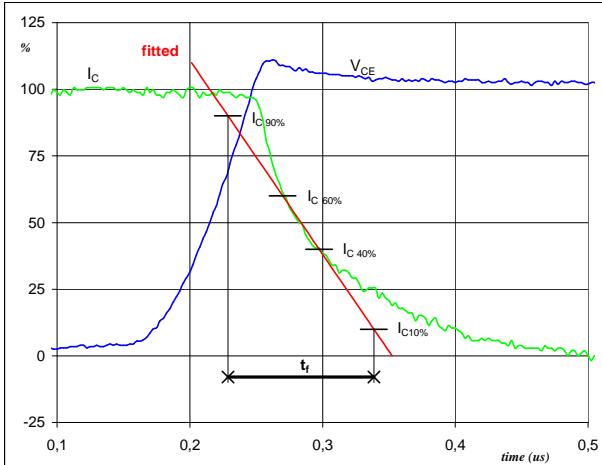


$V_{GE}(0\%) = 0 \text{ V}$
 $V_{GE}(100\%) = 15 \text{ V}$
 $V_C(100\%) = 300 \text{ V}$
 $I_C(100\%) = 10 \text{ A}$
 $t_{don} = 0,02 \mu\text{s}$
 $t_{Eon} = 0,24 \mu\text{s}$

Figure 3

Inverter IGBT

Turn-off Switching Waveforms & definition of t_f

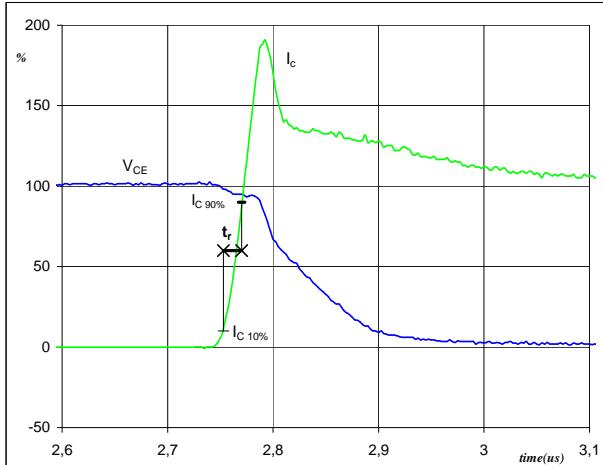


$V_C(100\%) = 300 \text{ V}$
 $I_C(100\%) = 10 \text{ A}$
 $t_f = 0,10 \mu\text{s}$

Figure 4

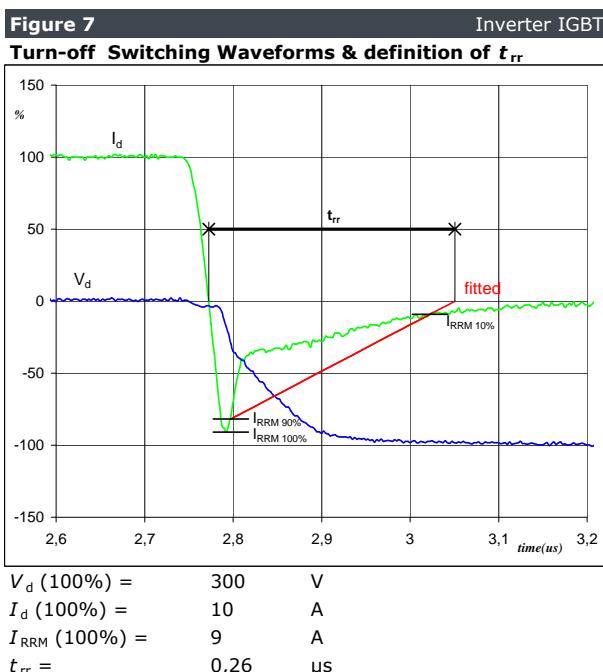
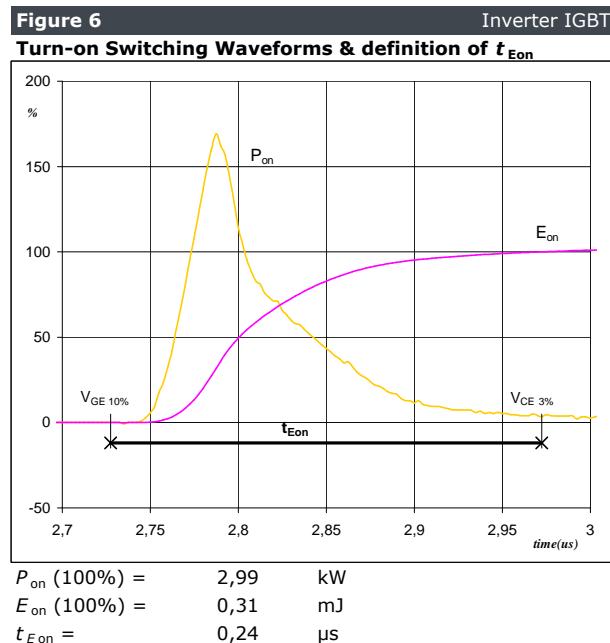
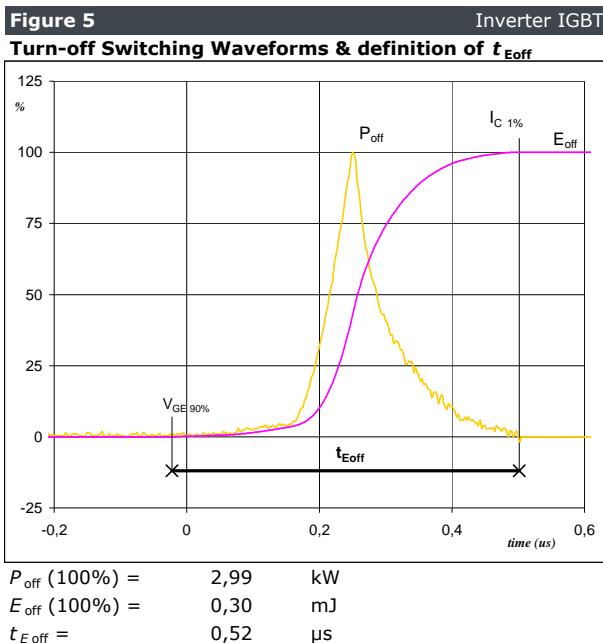
Inverter IGBT

Turn-on Switching Waveforms & definition of t_r

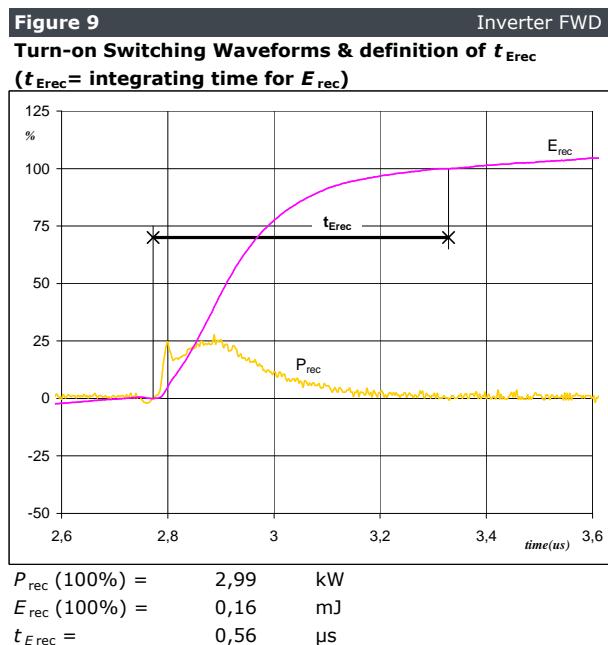
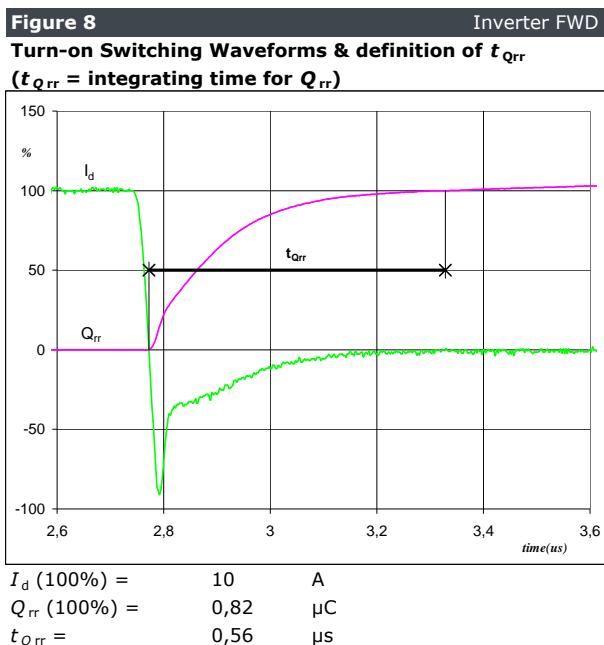


$V_C(100\%) = 300 \text{ V}$
 $I_C(100\%) = 10 \text{ A}$
 $t_r = 0,02 \mu\text{s}$

Switching Definitions Inverter



Switching Definitions Inverter

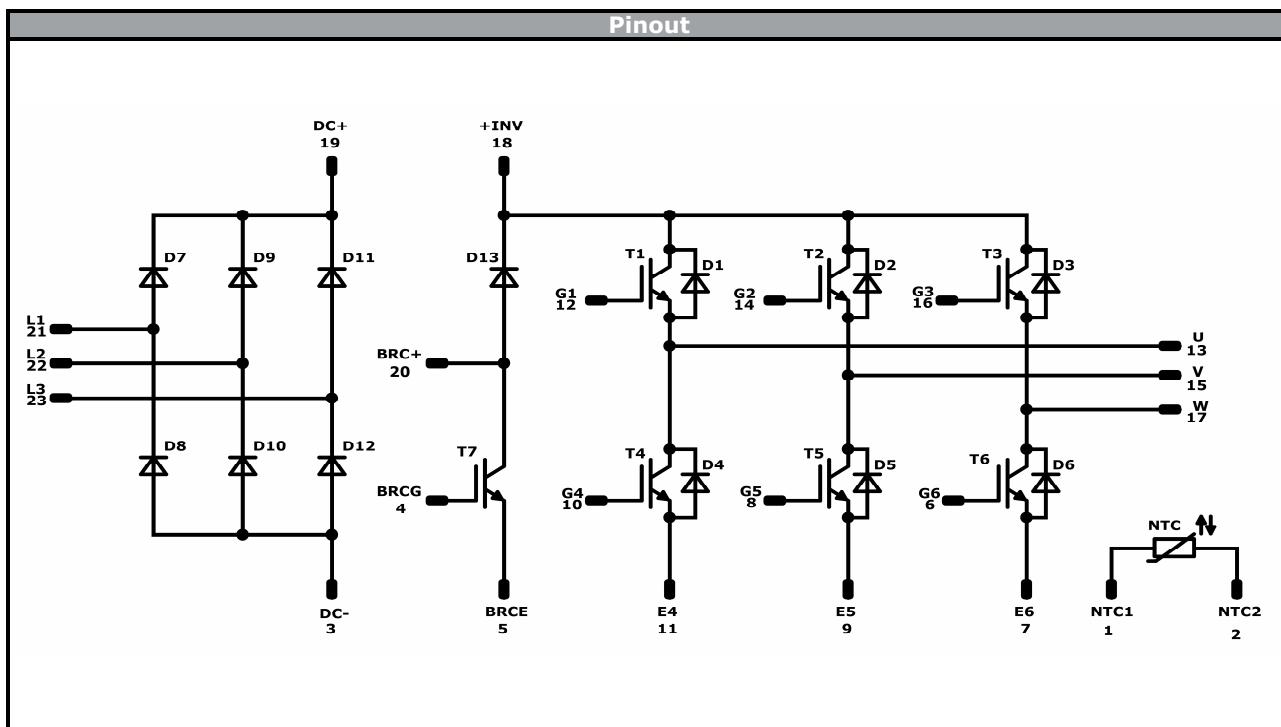


Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking			
Version		Ordering Code	
without thermal paste 17mm housing		V23990-P543-A39-PM	
		Text	VIN
VINWWYVUL NNNNNNVVUL LLLLLSSSS			Date code
		Name&Ver	UL
		Lot number	Lot
		Serial	Serial
		Nnnnnnnvvv	WWYY
		LLLLL	SSSS

Outline																																																																																																			
Pin table		Outline																																																																																																	
<table border="1"> <thead> <tr> <th>Pin</th><th>X</th><th>Y</th><th>Function</th></tr> </thead> <tbody> <tr><td>1</td><td>25,5</td><td>2,7</td><td>NTC1</td></tr> <tr><td>2</td><td>25,5</td><td>0</td><td>NTC2</td></tr> <tr><td>3</td><td>22,8</td><td>0</td><td>-DC</td></tr> <tr><td>4</td><td>20,1</td><td>0</td><td>BRCG</td></tr> <tr><td>5</td><td>16,2</td><td>0</td><td>BRCE</td></tr> <tr><td>6</td><td>13,5</td><td>0</td><td>G6</td></tr> <tr><td>7</td><td>10,8</td><td>0</td><td>E6</td></tr> <tr><td>8</td><td>8,1</td><td>0</td><td>G5</td></tr> <tr><td>9</td><td>5,4</td><td>0</td><td>E5</td></tr> <tr><td>10</td><td>2,7</td><td>0</td><td>G4</td></tr> <tr><td>11</td><td>0</td><td>0</td><td>E4</td></tr> <tr><td>12</td><td>0</td><td>19,8</td><td>G1</td></tr> <tr><td>13</td><td>0</td><td>22,5</td><td>U</td></tr> <tr><td>14</td><td>7,5</td><td>19,8</td><td>G2</td></tr> <tr><td>15</td><td>7,5</td><td>22,5</td><td>V</td></tr> <tr><td>16</td><td>15</td><td>19,8</td><td>G3</td></tr> <tr><td>17</td><td>15</td><td>22,5</td><td>W</td></tr> <tr><td>18</td><td>22,8</td><td>22,5</td><td>+INV</td></tr> <tr><td>19</td><td>25,5</td><td>22,5</td><td>+DC</td></tr> <tr><td>20</td><td>33,5</td><td>22,5</td><td>BRC+</td></tr> <tr><td>21</td><td>33,5</td><td>15</td><td>L1</td></tr> <tr><td>22</td><td>33,5</td><td>7,5</td><td>L2</td></tr> <tr><td>23</td><td>33,5</td><td>0</td><td>L3</td></tr> </tbody> </table>		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	<p>1 ± 0.05</p> <p>213 ± 0.5</p> <p>16.75</p>	
Pin	X	Y	Function																																																																																																
1	25,5	2,7	NTC1																																																																																																
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19	25,5	22,5	+DC																																																																																																
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22	33,5	7,5	L2																																																																																																
23	33,5	0	L3																																																																																																
		<p>Tolerance of pinpositions ±0.5mm at the end of pins Dimension of coordinate axis is only offset without tolerance</p>																																																																																																	

Ordering Code and Marking - Outline - Pinout



Identification					
ID	Component	Voltage	Current	Function	Comment
T1, T2, T3, T4, T5, T6	IGBT	600 V	10 A	Inverter Switch	
D1, D2, D3, D4, D5, D6	FWD	600 V	10 A	Inverter Diode	
T7	IGBT	600 V	6 A	Brake Switch	
D13	FWD	600 V	6 A	Brake Diode	
D7, D8, D9, D10, D11, D12	FWD	1600 V	35 A	Rectifier Diode	
NTC	Thermistor			Thermistor	



Vincotech

V23990-P543-A39 -PM

datasheet

Packaging instruction		>SPQ	Standard	<SPQ	Sample
Standard packaging quantity (SPQ)	135				

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-P543-A39-D6-14	25 Nov. 2018	R_{th} , I_{max} , P_{tot} values corrected	All

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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.