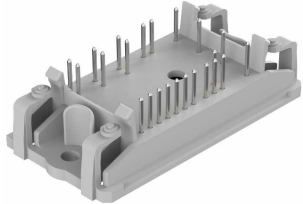
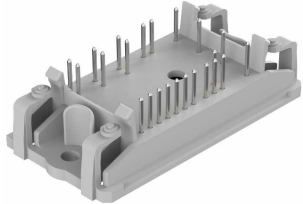
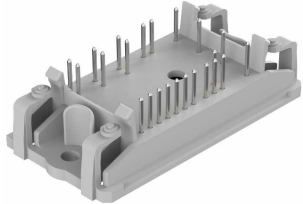
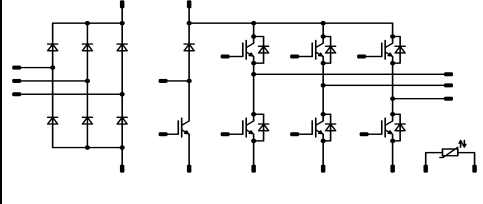
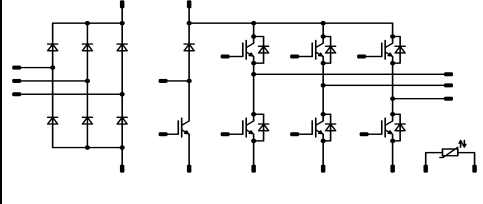
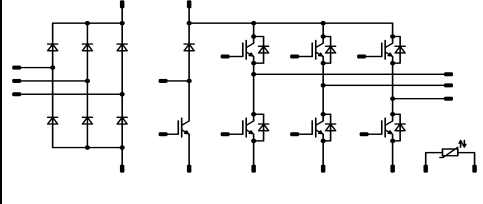




flow PIM 0	600 V / 20 A				
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="background-color: #cccccc;">Features</th> </tr> <tr> <td style="padding: 5px;"> <ul style="list-style-type: none"> Vincotech clip-in housing Trench Fieldstop IGBT's for low saturation losses </td> </tr> </table>	Features	<ul style="list-style-type: none"> Vincotech clip-in housing Trench Fieldstop IGBT's for low saturation losses 	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="background-color: #cccccc;">flow 0 17mm housing</th> </tr> <tr> <td style="text-align: center; padding: 10px;">  </td> </tr> </table>	flow 0 17mm housing	
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<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="background-color: #cccccc;">Target Applications</th> </tr> <tr> <td style="padding: 5px;"> <ul style="list-style-type: none"> Industrial Drives Embedded Generation </td> </tr> </table>	Target Applications	<ul style="list-style-type: none"> Industrial Drives Embedded Generation 	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="background-color: #cccccc;">Schematic</th> </tr> <tr> <td style="text-align: center; padding: 10px;">  </td> </tr> </table>	Schematic	
Target Applications					
<ul style="list-style-type: none"> Industrial Drives Embedded Generation 					
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<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="background-color: #cccccc;">Types</th> </tr> <tr> <td style="padding: 5px;"> <ul style="list-style-type: none"> V23990-P545-A20-PM </td> </tr> </table>	Types	<ul style="list-style-type: none"> V23990-P545-A20-PM 			
Types					
<ul style="list-style-type: none"> V23990-P545-A20-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}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	34	A
Surge (non-repetitive) forward current	I_{FSM}	$t_p = 10\text{ ms}$	200	A
I^2t -value	I^2t	50 Hz half sine wave $T_j = 150^\circ\text{C}$	200	A ² s
Power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	43	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	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	26	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	60	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	56	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	$^\circ\text{C}$
Inverter Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		600	V
DC forward current	I_F	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	21	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	40	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	37	W
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
Brake Switch				
Collector-emitter breakdown voltage	V_{CE}		600	V
DC collector current	I_C	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	21	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	45	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	52	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	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	18	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	30	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	35	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			10,07	mm
Comparative tracking index	CTI		>200	



Characteristic Values

Parameter	Symbol	Conditions					Value			Unit				
		V_{GE} [V]	V_{GS} [V]	V_r [V]	V_{CE} [V]	V_{DS} [V]	I_C [A]	I_F [A]	I_D [A]		T_j [°C]	Min	Typ	Max
Rectifier Diode														
Forward voltage	V_F					25				25	0,8	1,22	1,45	V
Threshold voltage (for power loss calc. only)	V_{to}					25				125		1,20		V
Slope resistance (for power loss calc. only)	r_t					25				125		10		mΩ
Reverse current	I_r					1600				25			0,05	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)										1,61		K/W
Inverter Switch														
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$				0,00029				25	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15			20				25	1	1,55	2,2	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600						25			0,0011	mA
Gate-emitter leakage current	I_{GES}		20	0						25			300	nA
Integrated Gate resistor	R_{gint}											none		Ω
Turn-on delay time	$t_{d(on)}$	$R_{goff} = 8$ Ω $R_{gon} = 16$ Ω	15	300	20	25				25		15		ns
Rise time	t_r					125				14				
Turn-off delay time	$t_{d(off)}$					25				12				
Fall time	t_f					125				16				
Turn-on energy loss	E_{on}					25				198				
Turn-off energy loss	E_{off}	125				212			25		100		mWs	
Input capacitance	C_{ies}					104			25		0,31			
Output capacitance	C_{oss}	$f = 1$ MHz	0	25					25		0,43		pF	
Reverse transfer capacitance	C_{rss}								25		0,55			
Gate charge	Q_G		±15	480	20	25					0,65			
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)										1,70		K/W
Inverter Diode														
Diode forward voltage	V_F					20				25	1,25	1,81	1,95	V
Peak reverse recovery current	I_{RRM}	$R_{gon} = 16$ Ω	15	300	20	25				25		1,76		A
Reverse recovery time	t_{rr}					125				19				
Reverse recovered charge	Q_{rr}					25				21				
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					125				33				
Reverse recovered energy	E_{rec}					25				192				
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)										0,45		μC
												1,35		A/μs
												0,06		mWs
												0,27		K/W



Characteristic Values

Parameter	Symbol	Conditions					Value			Unit			
		V_{GE} [V]	V_{GS} [V]	V_r [V]	V_{CE} [V]	V_{DS} [V]	I_C [A]	I_F [A]	I_D [A]		T_j [°C]	Min	Typ
Brake Switch													
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$				0,00021	25			5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15			15	25 125			1,1	1,79 2,08	1,9	V
Collector-emitter cut-off incl diode	I_{CES}		0	600			25					0,00085	mA
Gate-emitter leakage current	I_{GES}		20	0			25					300	nA
Integrated Gate resistor	R_{gint}										none		Ω
Turn-on delay time	$t_{d(on)}$						25 125				15 14		ns
Rise time	t_r						25 125				11 14		
Turn-off delay time	$t_{d(off)}$	$R_{goff} = 8 \Omega$ $R_{gon} = 16 \Omega$	± 15	300	15		25 125				128 145		
Fall time	t_f					25 125			91 94				
Turn-on energy loss	E_{on}						25 125				0,20 0,28		mWs
Turn-off energy loss	E_{off}						25 125				0,32 0,40		
Input capacitance	C_{ies}										860		pF
Output capacitance	C_{oss}	$f = 1 \text{ MHz}$	0	25		25					55		
Reverse transfer capacitance	C_{rss}											24	
Gate charge	Q_G		± 15	480	15	25					87		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{baste} = 3,4 \text{ W/mK (PSX)}$									1,83		K/W
Brake Diode													
Diode forward voltage	V_F					15	25 125			1,25	1,86 1,75	1,95	V
Reverse leakage current	I_r			600			25					27	μA
Peak reverse recovery current	I_{RRM}						25 125				14 15		A
Reverse recovery time	t_{rr}	$R_{goff} = 16 \Omega$	± 15	300	15		25 125				128 201		ns
Reverse recovered charge	Q_{rr}					25 125			0,52 1,02				
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$						25 125				1307 657		A/ μs
Reverse recovery energy	E_{rec}						25 125				0,10 0,21		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{baste} = 3,4 \text{ W/mK (PSX)}$									2,75		K/W
Thermistor													
Rated resistance	R						25				22000		Ω
Deviation of R_{100}	$\Delta_{R/R}$	$R_{100} = 1486 \Omega$					100		-5		5		%
Power dissipation	P						25				210		mW
Power dissipation constant							25				3,5		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 3\%$					25						K
B-value	$B_{(25/100)}$	Tol. $\pm 3\%$					25				4000		K
Vincotech NTC Reference							25					A	

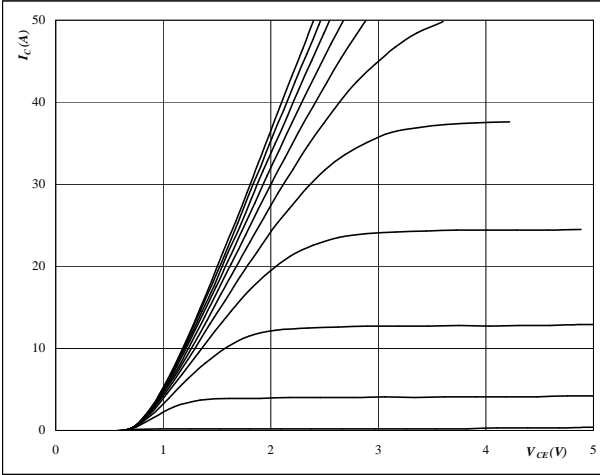


Inverter Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$



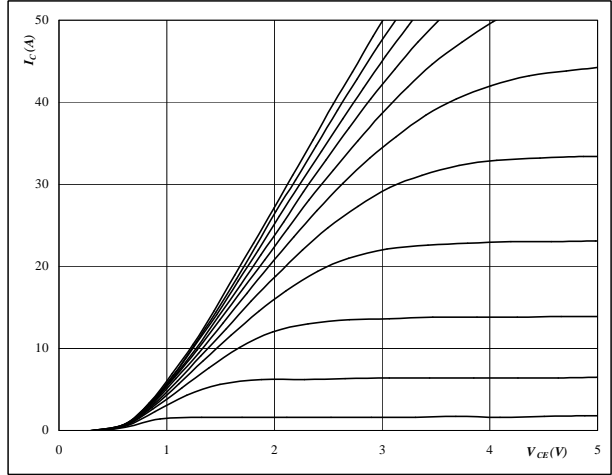
At

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

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$



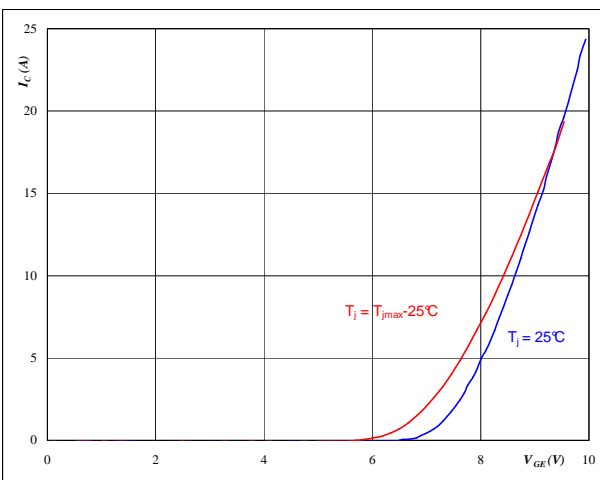
At

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

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



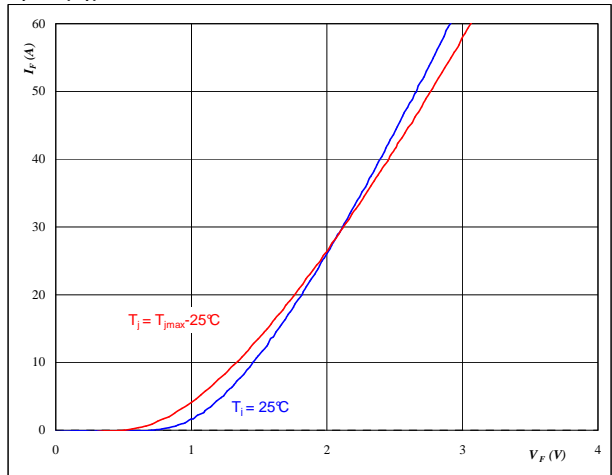
At

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

figure 4. FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

$t_p = 250 \mu s$

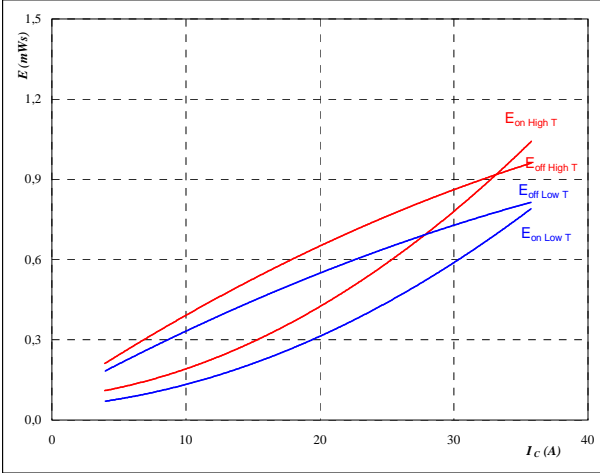


Inverter Characteristics

figure 5. IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$



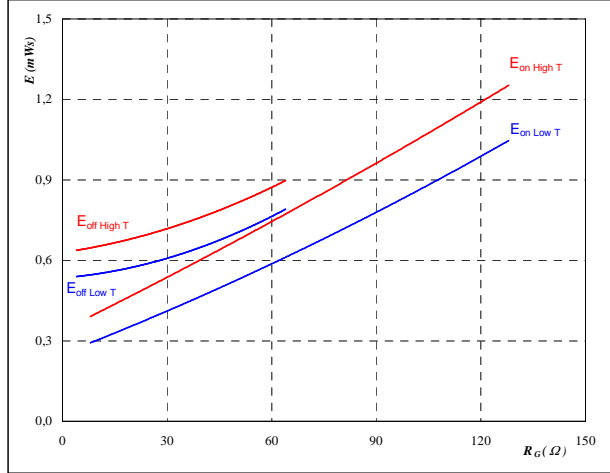
With an inductive load at

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

figure 6. IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_G)$$



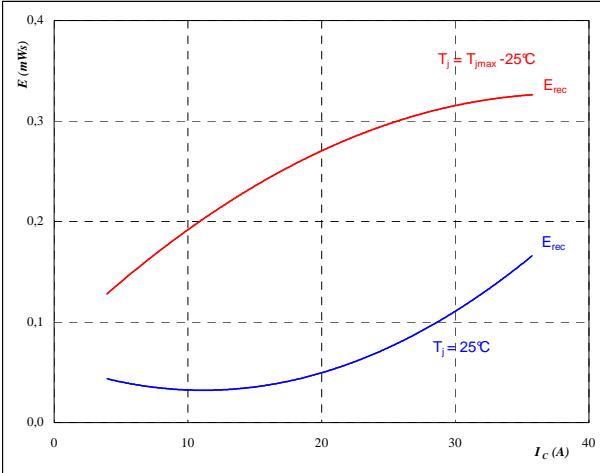
With an inductive load at

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

figure 7. FWD

Typical reverse recovery energy loss as a function of collector current

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



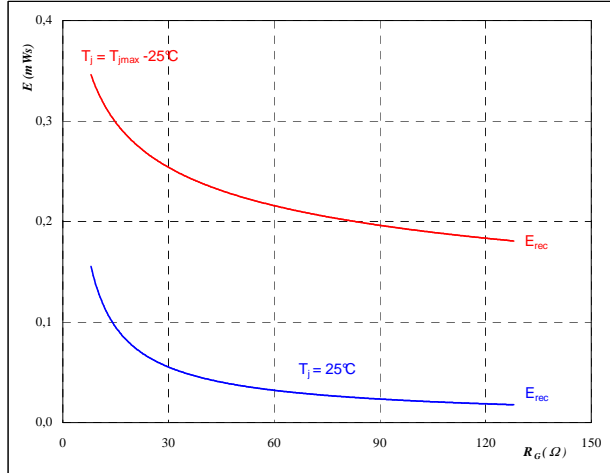
With an inductive load at

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

figure 8. FWD

Typical reverse recovery energy loss as a function of gate resistor

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



With an inductive load at

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

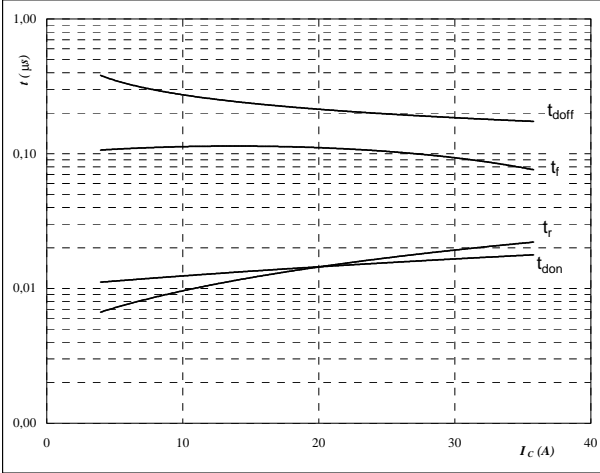


Inverter Characteristics

figure 9. IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



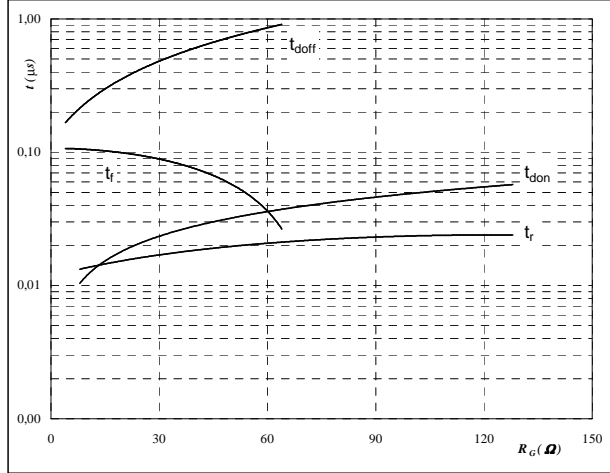
With an inductive load at

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

figure 10. IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



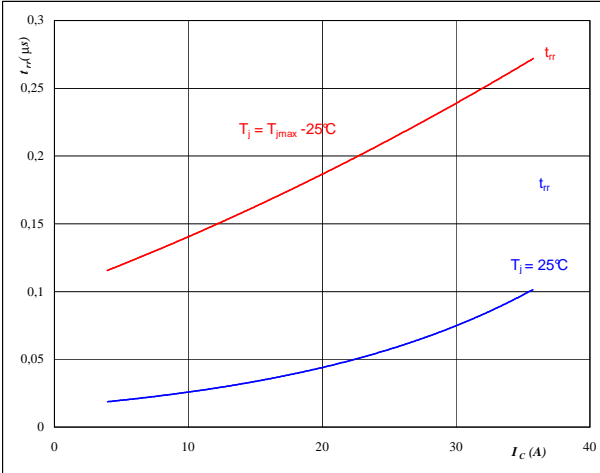
With an inductive load at

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

figure 11. FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



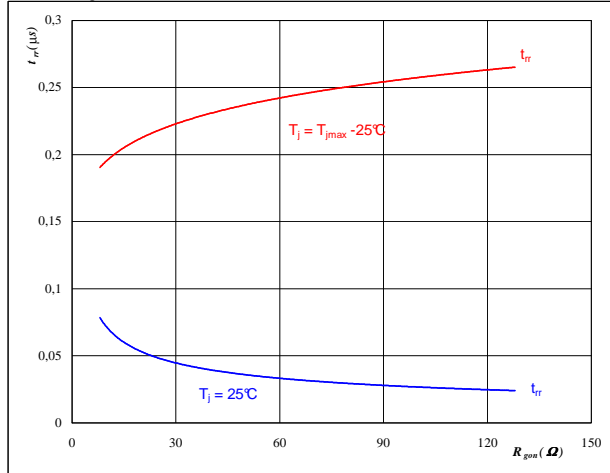
At

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

figure 12. 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
$I_F =$	20	A
$V_{GE} =$	15	V

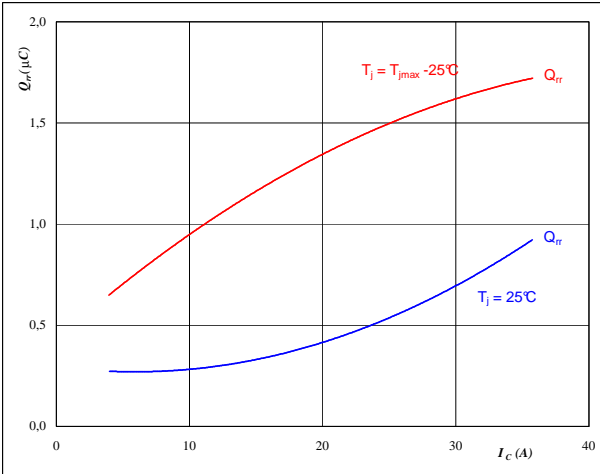


Inverter Characteristics

figure 13. FWD

Typical reverse recovery charge as a function of collector current

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

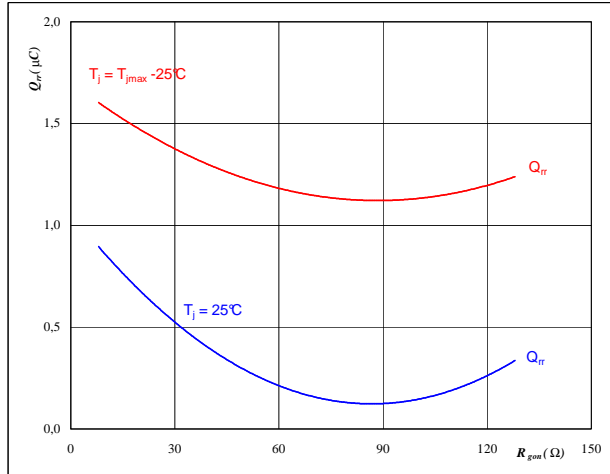


At
 $T_j = 25/125$ °C
 $V_{CE} = 300$ V
 $V_{GE} = 15$ V
 $R_{gon} = 16$ Ω

figure 14. FWD

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

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

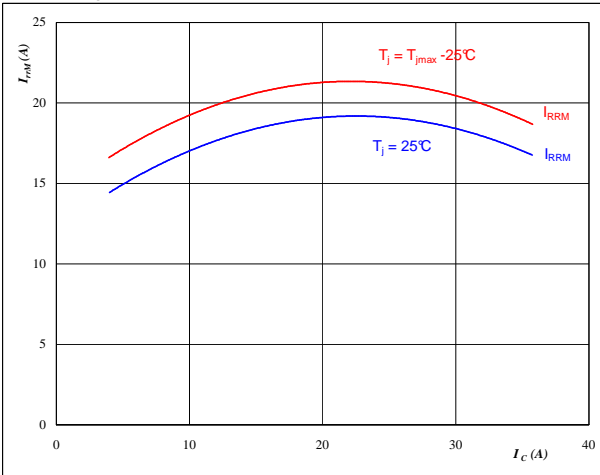


At
 $T_j = 25/125$ °C
 $V_R = 300$ V
 $I_F = 20$ A
 $V_{GE} = 15$ V

figure 15. FWD

Typical reverse recovery current as a function of collector current

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

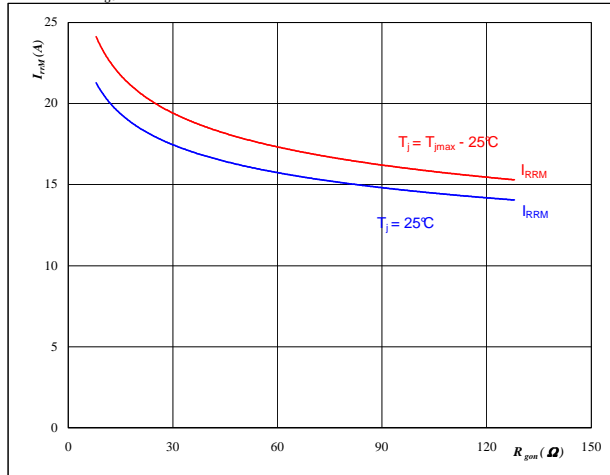


At
 $T_j = 25/125$ °C
 $V_{CE} = 300$ V
 $V_{GE} = 15$ V
 $R_{gon} = 16$ Ω

figure 16. FWD

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

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



At
 $T_j = 25/125$ °C
 $V_R = 300$ V
 $I_F = 20$ A
 $V_{GE} = 15$ V

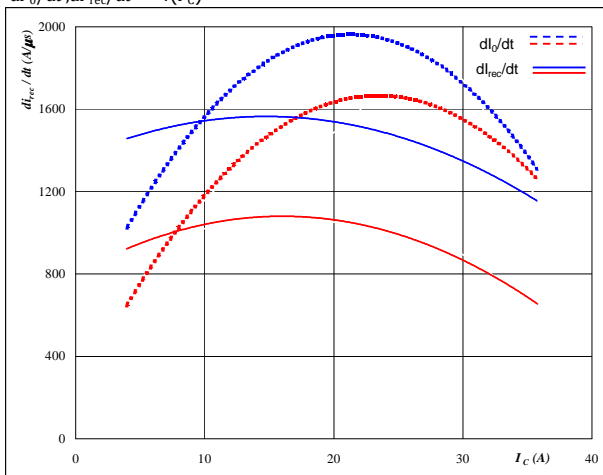


Inverter Characteristics

figure 17. FWD

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

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



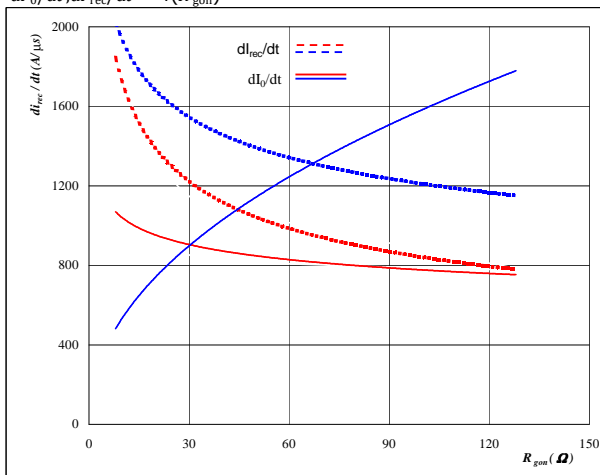
At

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

figure 18. FWD

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

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



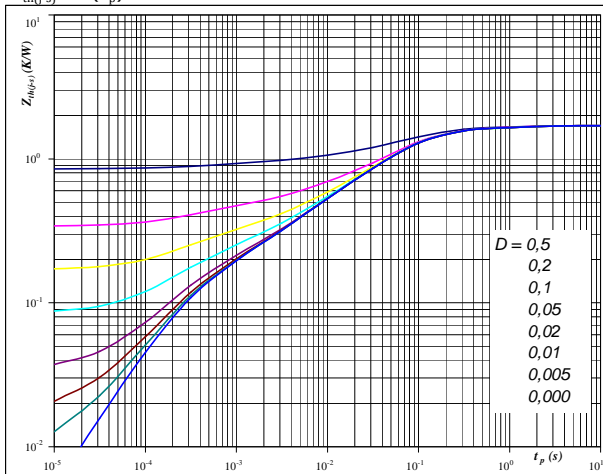
At

$T_j = 25/125$ °C
 $V_R = 300$ V
 $I_F = 20$ A
 $V_{GE} = 15$ V

figure 19. IGBT

IGBT transient thermal impedance as a function of pulse width

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



At

$D = t_p / T$
 $R_{th(j-s)} = 1,70$ K/W

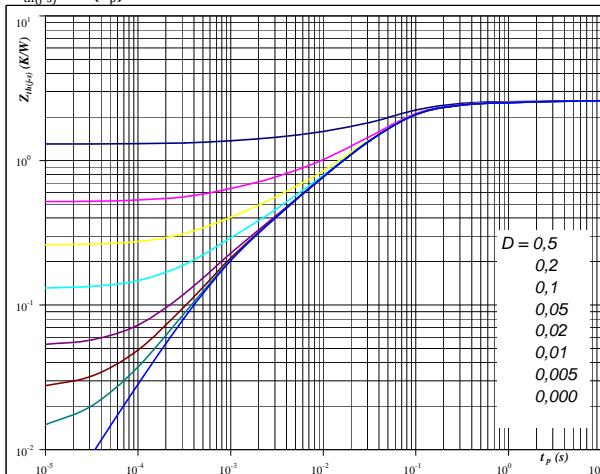
IGBT thermal model values

R (K/W)	Tau (s)
9,97E-02	1,34E+00
3,46E-01	1,70E-01
8,15E-01	5,34E-02
2,54E-01	7,74E-03
7,70E-02	1,33E-03
1,09E-01	2,63E-04

figure 20. FWD

FWD transient thermal impedance as a function of pulse width

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



At

$D = t_p / T$
 $R_{th(j-s)} = 2,60$ K/W

FWD thermal model values

R (K/W)	Tau (s)
6,56E-02	4,59E+00
1,58E-01	5,68E-01
8,97E-01	8,42E-02
1,05E+00	3,29E-02
2,75E-01	4,96E-03
1,51E-01	7,65E-04

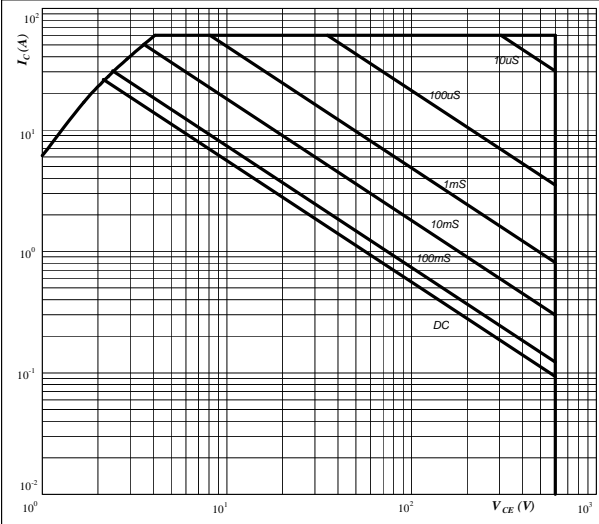


Inverter Characteristics

figure 25. IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$

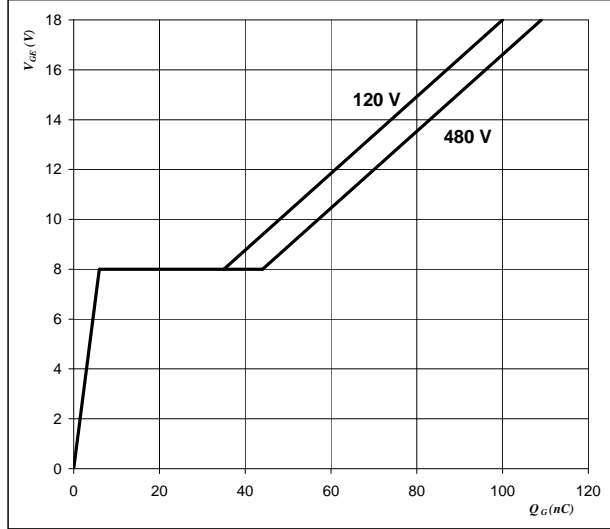


At
 $D =$ single pulse
 $T_h = 80$ °C
 $V_{GE} = 15$ V
 $T_j = T_{jmax}$

figure 26. IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_G)$

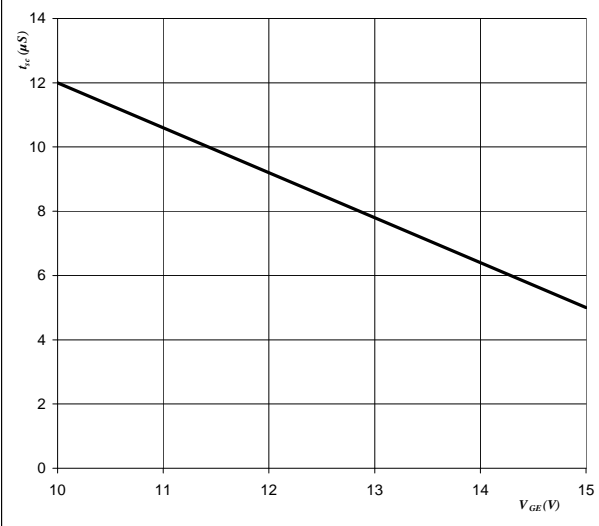


At
 $I_C = 20$ A

figure 27. IGBT

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

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

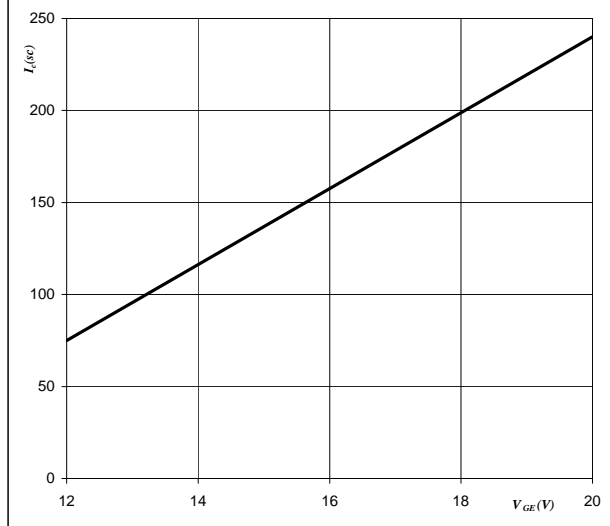


At
 $V_{CE} = 600$ V
 $T_j \leq 175$ °C

figure 28. IGBT

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

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

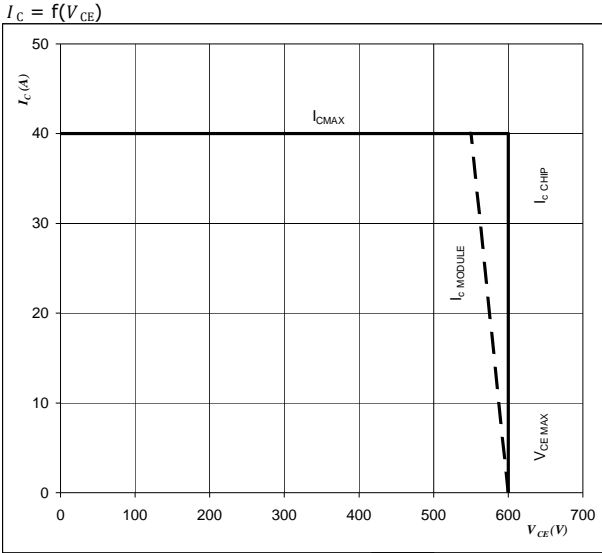


At
 $V_{CE} \leq 600$ V
 $T_j = 175$ °C



Inverter Characteristics

figure 29. IGBT
Reverse bias safe operating area



At

$T_j = T_{j\text{max}} - 25 \text{ } ^\circ\text{C}$

Switching mode : 3phase SPWM

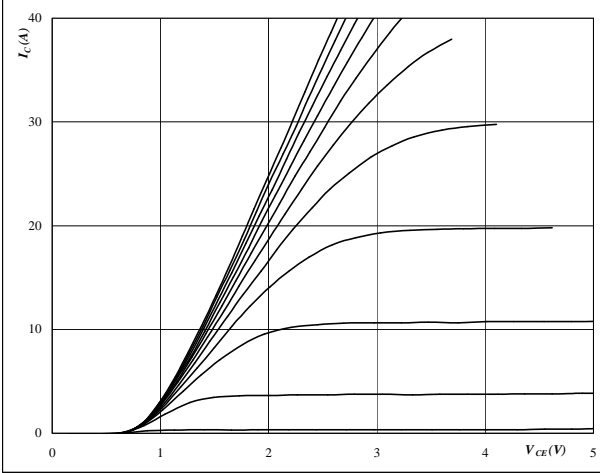


Brake Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$



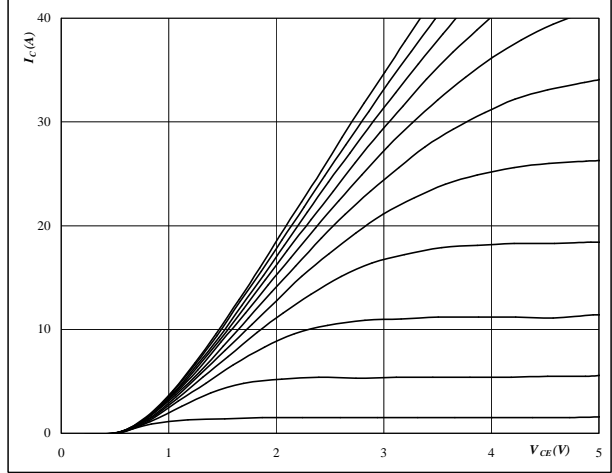
At

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

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$



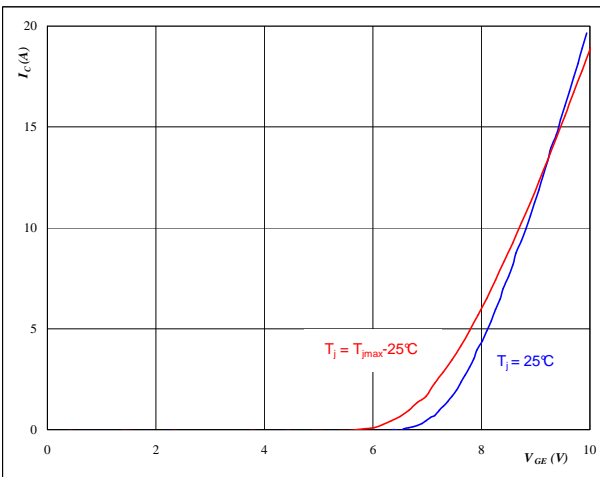
At

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

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



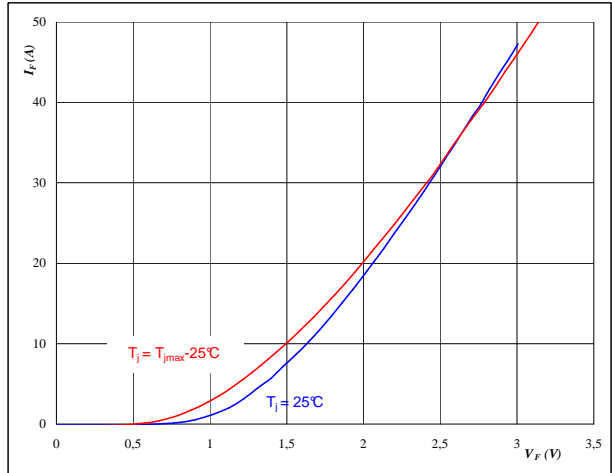
At

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

figure 4. FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

$t_p = 250 \mu s$

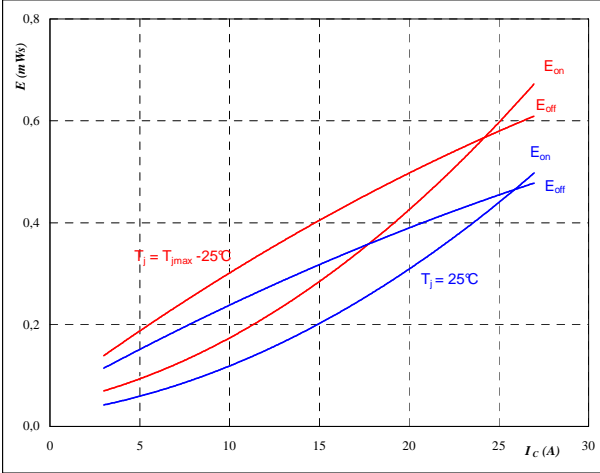


Brake Characteristics

figure 5. IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$



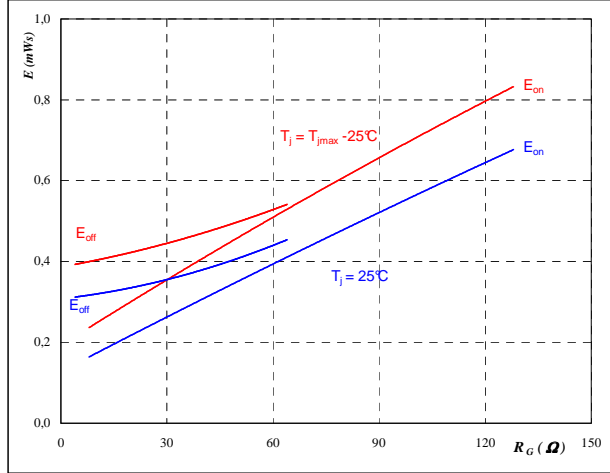
With an inductive load at

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

figure 6. IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_G)$$



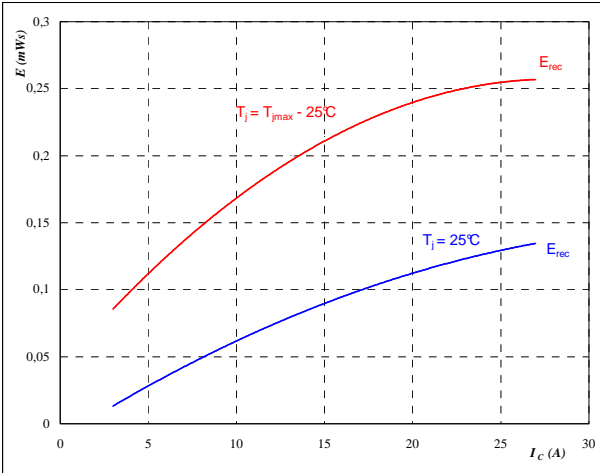
With an inductive load at

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

figure 7. FWD

Typical reverse recovery energy loss as a function of collector current

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



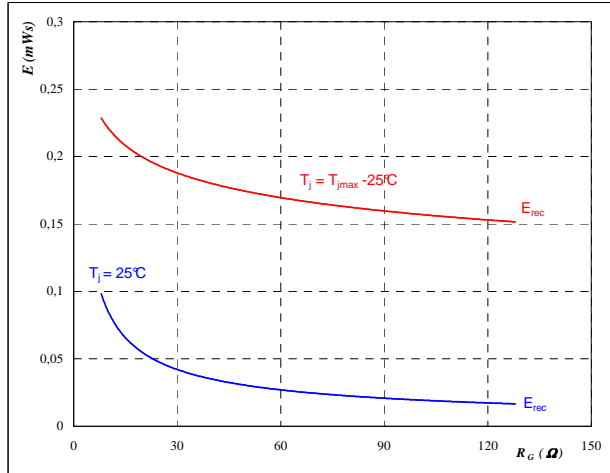
With an inductive load at

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

figure 8. FWD

Typical reverse recovery energy loss as a function of gate resistor

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



With an inductive load at

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

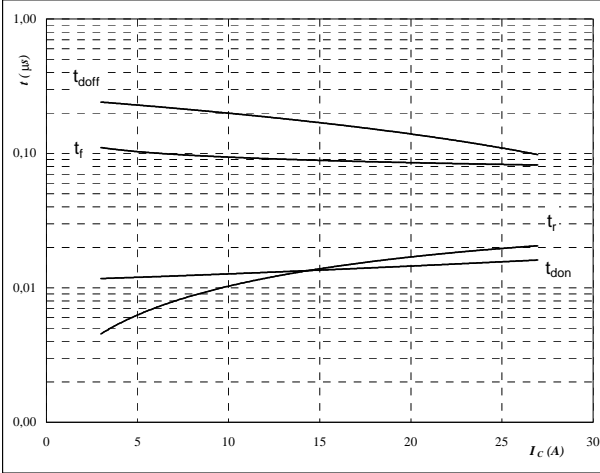


Brake Characteristics

figure 9. IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



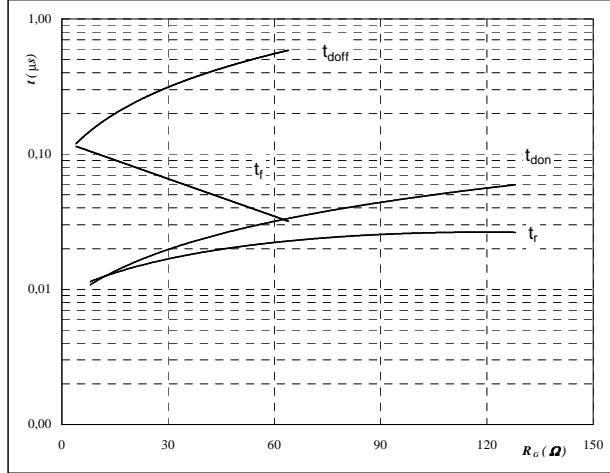
With an inductive load at

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

figure 10. IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



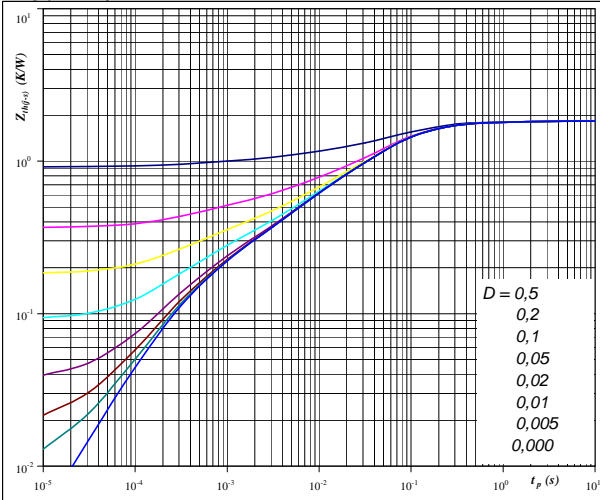
With an inductive load at

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

figure 11. IGBT

IGBT transient thermal impedance as a function of pulse width

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



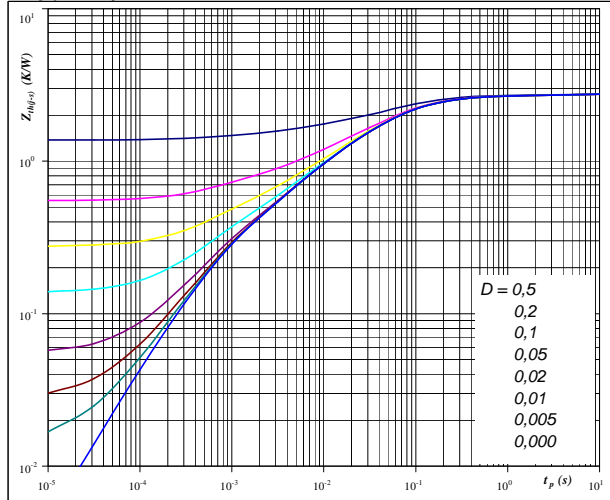
At

$D =$	t_p / T
$R_{th(j-s)} =$	1,83 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
$R_{th(j-s)} =$	2,75 K/W

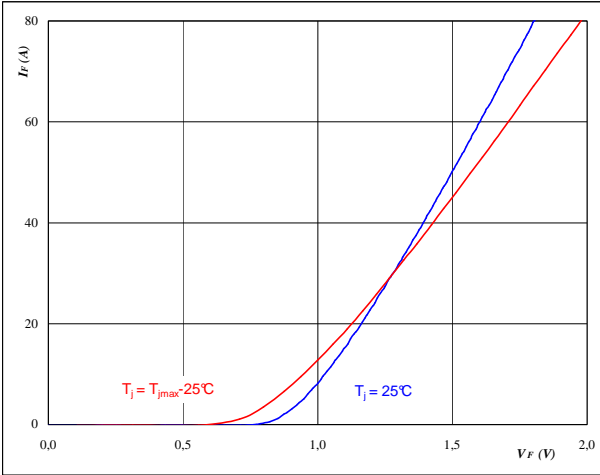


Rectifier Diode

figure 1. Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



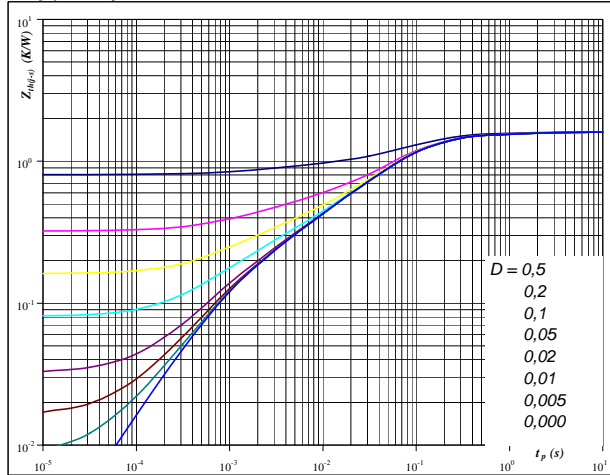
At

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

figure 2. Diode

Diode transient thermal impedance as a function of pulse width

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



At

$D = t_p / T$

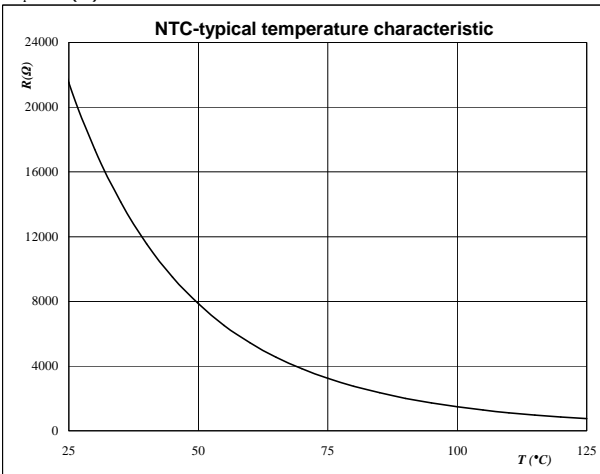
$R_{th(j-s)} = 1,61 \text{ K/W}$

Thermistor

figure 1. Thermistor

Typical NTC characteristic as a function of temperature

$R_T = f(T)$





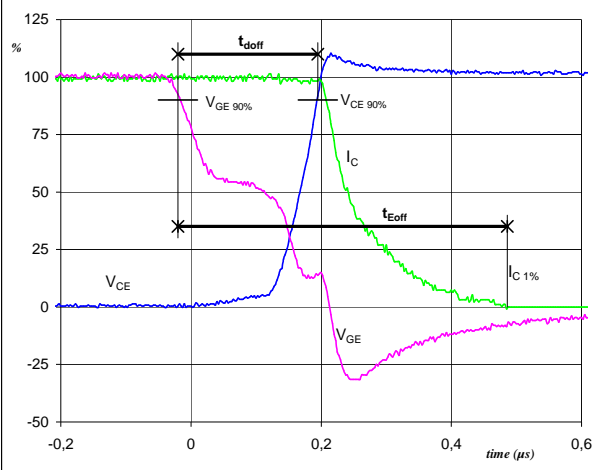
Switching Definitions Inverter

General conditions

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

figure 1. IGBT

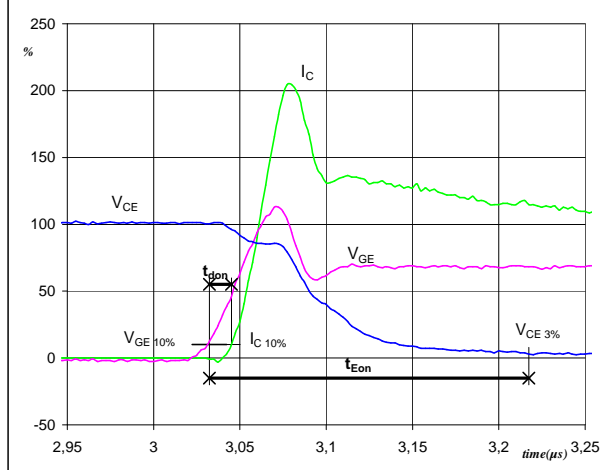
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff}
 (t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	20	A
t_{doff} =	0,21	μs
t_{Eoff} =	0,51	μs

figure 2. IGBT

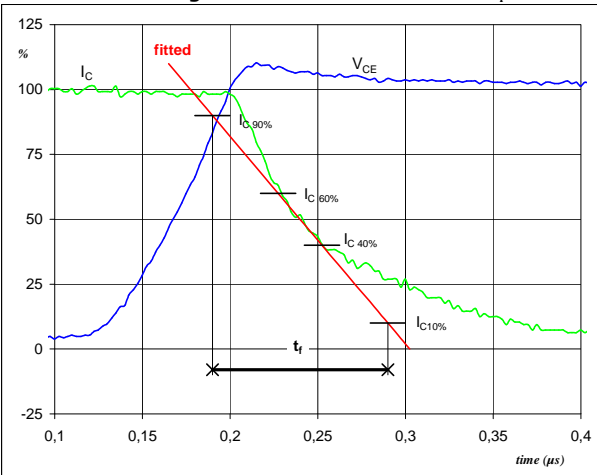
Turn-on Switching Waveforms & definition of t_{don} , t_{Eon}
 (t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	20	A
t_{don} =	0,01	μs
t_{Eon} =	0,18	μs

figure 3. IGBT

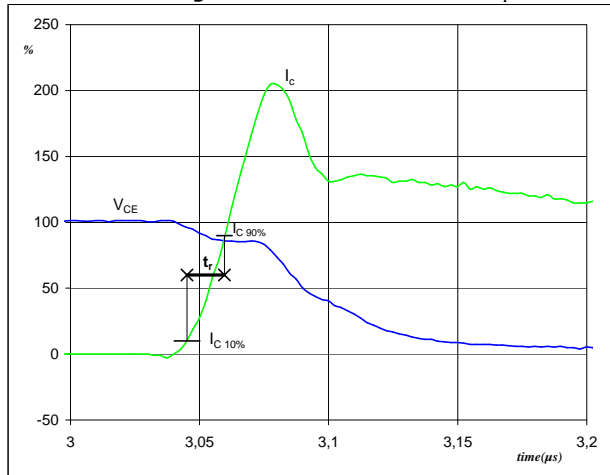
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	300	V
I_C (100%) =	20	A
t_f =	0,10	μs

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

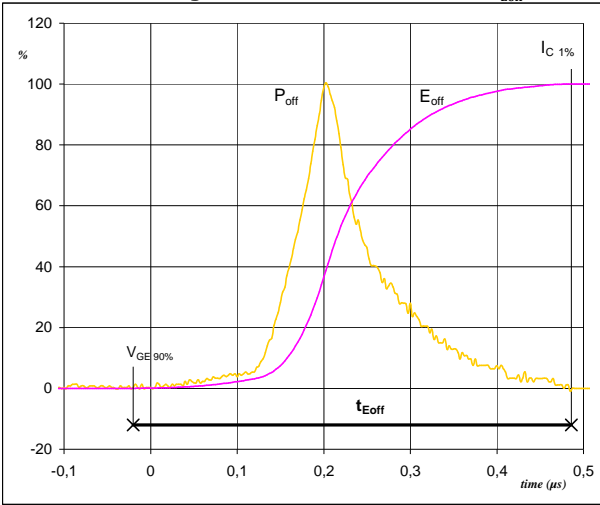


V_C (100%) =	300	V
I_C (100%) =	20	A
t_r =	0,02	μs



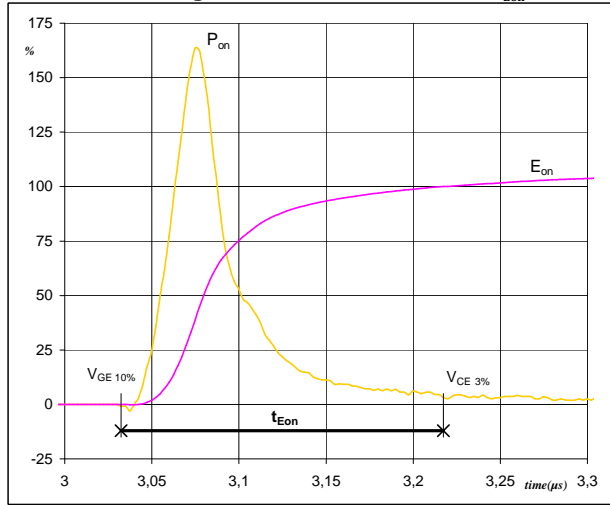
Switching Definitions Inverter

figure 5. IGBT
Turn-off Switching Waveforms & definition of t_{Eoff}



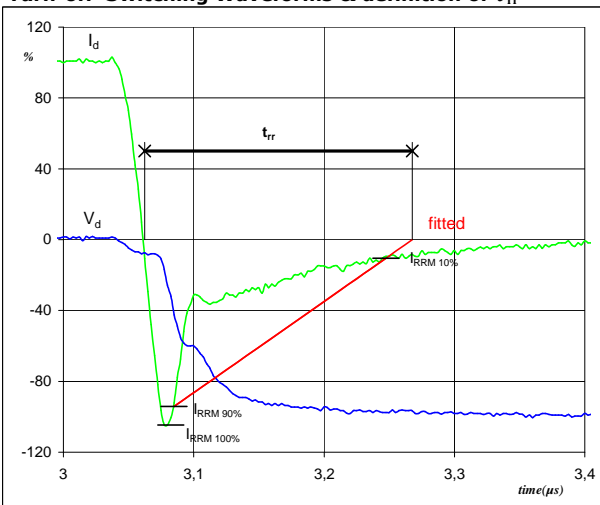
$P_{off} (100\%) = 5,99 \text{ kW}$
 $E_{off} (100\%) = 0,65 \text{ mJ}$
 $t_{Eoff} = 0,51 \text{ μs}$

figure 6. IGBT
Turn-on Switching Waveforms & definition of t_{Eon}



$P_{on} (100\%) = 5,99 \text{ kW}$
 $E_{on} (100\%) = 0,43 \text{ mJ}$
 $t_{Eon} = 0,18 \text{ μs}$

figure 7. FWD
Turn-off Switching Waveforms & definition of t_{rr}



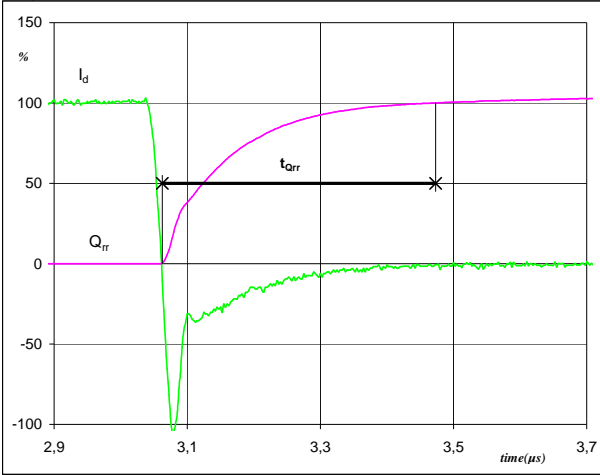
$V_d (100\%) = 300 \text{ V}$
 $I_d (100\%) = 20 \text{ A}$
 $I_{RRM} (100\%) = 21 \text{ A}$
 $t_{rr} = 0,19 \text{ μs}$



Switching Definitions Inverter

figure 8. IGBT

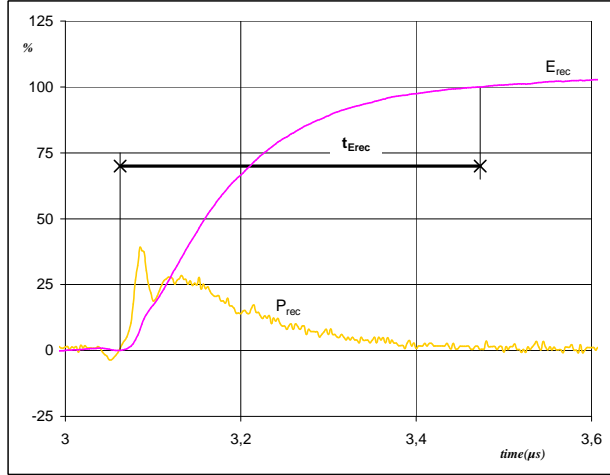
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	20	A
Q_{rr} (100%) =	1,35	μC
t_{Qrr} =	0,41	μs

figure 9. IGBT

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



P_{rec} (100%) =	5,99	kW
E_{rec} (100%) =	0,27	mJ
t_{Erec} =	0,41	μs



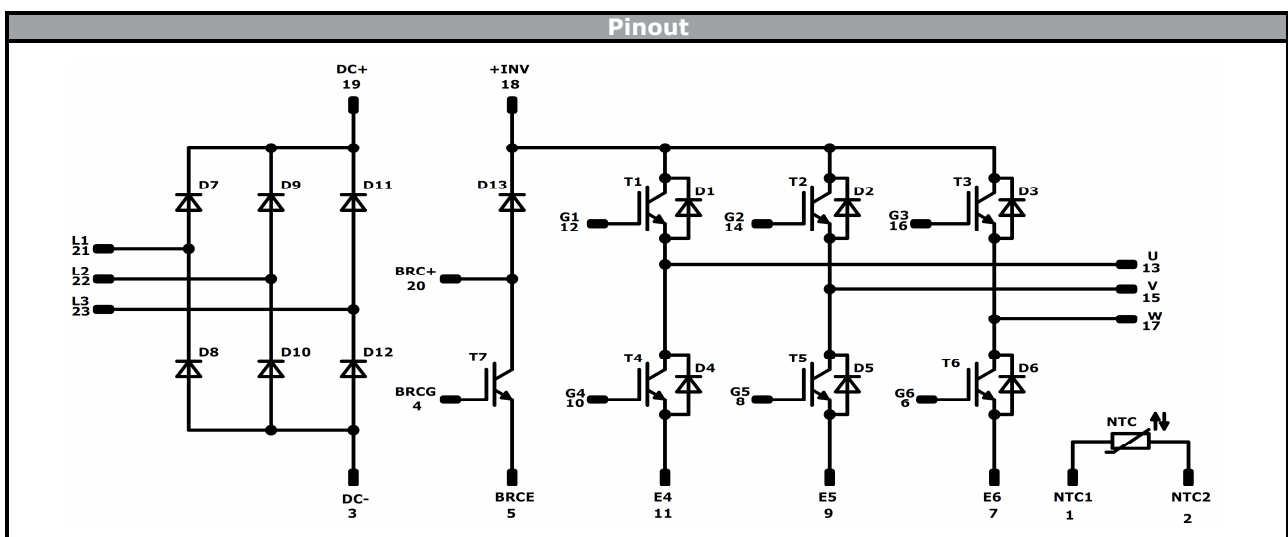
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking			
Version		Ordering Code	
without thermal paste 17mm housing with solder pins		V23990-P545-A20-PM	
	Text	VIN	Date code
		VIN	WYYY
Datamatrix	Name&Ver	UL	Lot
	Serial	SSSS	Serial
	Type&Ver	Date Code	
	TTTTTTTV	WYYY	

Outline

Pin 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

Tolerance of pinpositions $\pm 0.5\text{mm}$ 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	20 A	Inverter Switch	
D1-D6	FWD	600 V	20 A	Inverter Diode	
T7	IGBT	600 V	15 A	Brake Switch	
D13	FWD	600 V	15 A	Brake Diode	
D7-D12	Rectifier	1600 V	25 A	Rectifier Diode	
NTC	NTC			Thermistor	



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

Handling instruction
Handling instructions for <i>flow</i> 0 packages see vincotech.com website.

Package data
Package data for <i>flow</i> 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-P545-A20-D4-14	15 Apr. 2019	R_{thr} I_{max} P_{tot} clearance values corrected	All

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- 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.