Vincotech

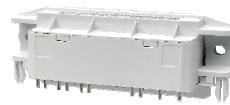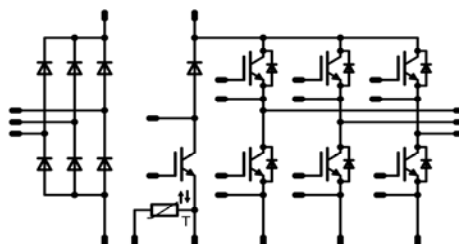| *flow* 90PIM 1	1200V/15A

Features

- Trench Fieldstop Technology IGBT4 for low saturation loss
- Supports design with 90° mounting angle between heatsink and PCB
- Clip-in PCB mounting
- Clip or screw on heatsink mounting

Target Applications

- Industrial drives

Types

- V23990-P630-A40-PM

flow 90PIM 1

Schematic

Maximum Ratings

T_j=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Input Rectifier Diode					
Repetitive peak reverse voltage	V_{RRM}			1600	V
DC forward current	I_{FAV}	T_j=$T_j$max	T_h=80℃ T_c=80℃	28 36	A
Surge forward current	I_{FSM}	t_p=10ms	T_j=25℃	200	A
I^2t-value	I^2t		T_j=150℃	200	A^2s
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	33 50	W
Maximum Junction Temperature	$T_j$max			150	℃
Inverter Transistor					
Collector-emitter break down voltage	V_{CE}			1200	V
DC collector current	I_C	T_j=$T_j$max	T_h=80℃ T_c=80℃	21 26	A
Repetitive peak collector current	I_{Cpulse}	t_p limited by $T_j$max		45	A
Turn off safe operating area		VCE ≤ 1200V, Tj ≤ Top max		45	A
Power dissipation per IGBT	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	62 95	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150℃ V_{GE}=15V		10 800	µs V
Maximum Junction Temperature	$T_j$max			175	℃

Maximum Ratings

T_j=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter FWD					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	T_j=$T_j$max	T_h=80℃ T_c=80℃	14 17	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		30	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	44 67	W
Maximum Junction Temperature	$T_j$max			175	℃
Brake Transistor					
Collector-emitter break down voltage	V_{CE}			1200	V
DC collector current	I_C	T_j=$T_j$max	T_h=80℃ T_c=80℃	13 15	A
Repetitive peak collector current	I_{Cpuls}	t_p limited by $T_j$max		24	A
Turn off safe operating area		VCE ≤ 1200V, Tj ≤ Top max		24	A
Power dissipation per IGBT	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	46 70	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150℃ V_{GE}=15V		10 800	μs V
Maximum Junction Temperature	$T_j$max			175	℃
Brake FWD					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	T_j=$T_j$max	T_h=80℃ T_c=80℃	14 19	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		15	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	31 48	W
Maximum Junction Temperature	$T_j$max			150	℃
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	℃
Operation temperature under switching condition	T_{op}			-40…+(Tjmax - 25)	℃
Insulation Properties					
Insulation voltage	V_{is}	t=2s 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	
Input Rectifier Diode									
Forward voltage	V_F			30	Tj=25℃ / Tj=125℃	1	1,26 / 1,24	1,8	V
Threshold voltage (for power loss calc. only)	V_{to}			30	Tj=25℃ / Tj=125℃		0,92 / 0,82		V
Slope resistance (for power loss calc. only)	r_t			30	Tj=25℃ / Tj=125℃		11 / 14		mΩ
Reverse current	I_r		1500		Tj=25℃ / Tj=125℃			0,2	mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK					2,10		K/W
Inverter Transistor									
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$		0,0005	Tj=25℃ / Tj=150℃	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	15		15	Tj=25℃ / Tj=150℃	1,6	1,86 / 2,22	2,1	V
Collector-emitter cut-off current incl. Diode	I_{CES}	0	1200		Tj=25℃ / Tj=150℃			0,0055	mA
Gate-emitter leakage current	I_{GES}	20	0		Tj=25℃ / Tj=150℃			120	nA
Integrated Gate resistor	R_{gint}						none		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=32 Ω Rgon=32 Ω	±15	600	15	Tj=25℃ / Tj=150℃	85 / 93		ns
Rise time	t_r					Tj=25℃ / Tj=150℃	30 / 32		
Turn-off delay time	$t_{d(off)}$					Tj=25℃ / Tj=150℃	214 / 285		
Fall time	t_f					Tj=25℃ / Tj=150℃	83 / 142		
Turn-on energy loss per pulse	E_{on}					Tj=25℃ / Tj=150℃	1,17 / 1,78		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ / Tj=150℃	0,89 / 1,53		
Input capacitance	C_{ies}	f=1MHz	0	25	Tj=25℃		900		pF
Output capacitance	C_{oss}						80		
Reverse transfer capacitance	C_{rss}						55		
Gate charge	Q_{Gate}	±15	960	15	Tj=25℃		85		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK					1,52		K/W
Inverter FWD									
Diode forward voltage	V_F			15	Tj=25℃ / Tj=150℃	1,2	1,80 / 1,72	2,2	V
Peak reverse recovery current	I_{RRM}	Rgon=32 Ω	±15	600	15	Tj=25℃ / Tj=150℃	10 / 13		A
Reverse recovery time	t_{rr}					Tj=25℃ / Tj=150℃	297 / 505		ns
Reverse recovered charge	Q_{rr}					Tj=25℃ / Tj=150℃	1,51 / 3,04		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25℃ / Tj=150℃	50 / 41		A/µs
Reverse recovered energy	Erec					Tj=25℃ / Tj=150℃	0,59 / 1,22		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK					2,15		K/W

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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	
Brake Transistor									
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$		0,0003	Tj=25℃ Tj=150℃	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	15		8	Tj=25℃ Tj=150℃	1,6	1,86 2,15	2,1	V
Collector-emitter cut-off incl diode	I_{CES}	0	1200		Tj=25℃ Tj=150℃			0,001	mA
Gate-emitter leakage current	I_{GES}	20	0		Tj=25℃ Tj=150℃			120	nA
Integrated Gate resistor	R_{gint}						none		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=32 Ω Rgon=32 Ω	±15	600	8	Tj=25℃ Tj=150℃	60 61		ns
Rise time	t_r					Tj=25℃ Tj=150℃	27 26		
Turn-off delay time	$t_{d(off)}$					Tj=25℃ Tj=150℃	179 247		
Fall time	t_f					Tj=25℃ Tj=150℃	68 137		
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=150℃	0,51 0,79		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=150℃	0,45 0,78		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25℃	490		pF
Output capacitance	C_{oss}						50		
Reverse transfer capacitance	C_{rss}						30		
Gate charge	Q_{Gate}		±15	960	8	Tj=25℃	53		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK					2,05		K/W
Brake FWD									
Diode forward voltage	V_F			8		Tj=25℃ Tj=125℃	1	1,76 1,69	2,3	V
Reverse leakage current	I_r		1200			Tj=25℃ Tj=125℃			250	µA
Peak reverse recovery current	I_{RRM}	Rgon=32 Ω	±15	600	8	Tj=25℃ Tj=125℃	6 8		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=125℃	374 637		ns
Reverse recovered charge	Q_{rr}					Tj=25℃ Tj=125℃	1,01 2,09		µC
Peak rate of fall of recovery current	di(rec)max/dt					Tj=25℃ Tj=125℃	39 34		A/µs
Reverse recovery energy	E_{rec}					Tj=25℃ Tj=125℃	0,46 0,96		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK					2,23		K/W
Thermistor									
Rated resistance	R				Tj=25℃		22000		Ω
Deviation of R100	ΔR/R	R100=1486 Ω			Tc=100℃	-5		5	%
Power dissipation	P				Tc=25℃		200		mW
Power dissipation constant					Tj=25℃		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%			Tj=25℃		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%			Tj=25℃		3996		K
Vincotech NTC Reference					Tj=25℃			B	

Output Inverter

Figure 1 Output inverter IGBT
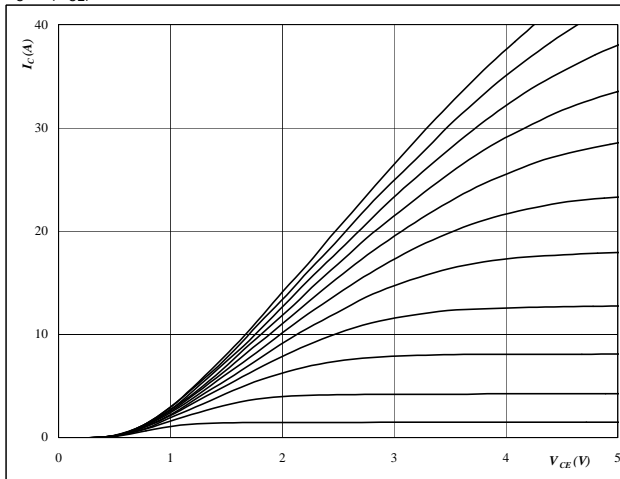
Typical output characteristics

$I_C = f(V_{CE})$

At
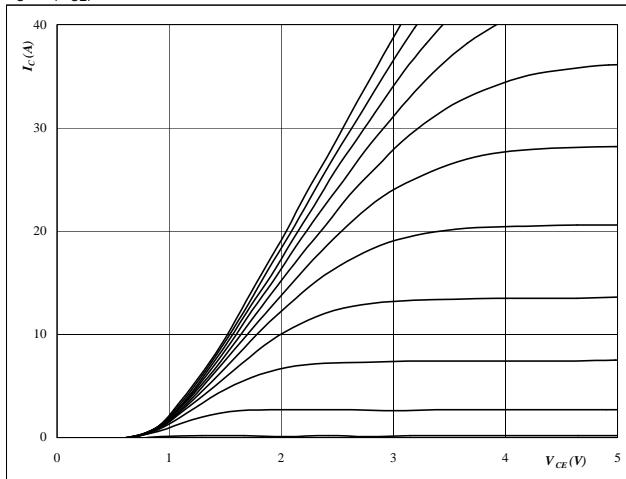
$t_p =$	250	μs
$T_j =$	25	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 2 Output inverter IGBT
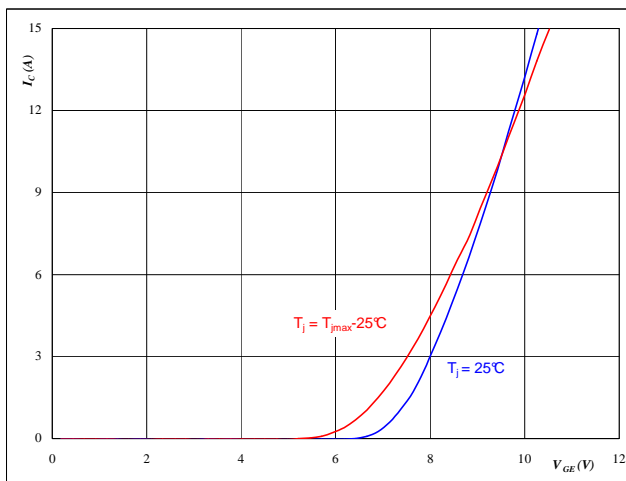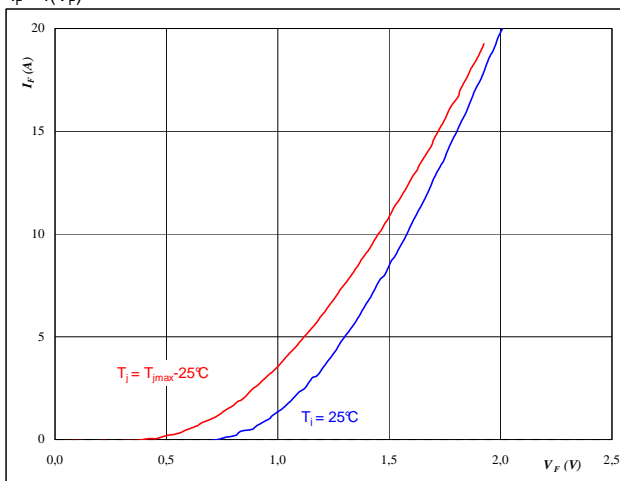
Typical output characteristics

$I_C = f(V_{CE})$

At

$t_p =$	250	μs
$T_j =$	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 3 Output inverter IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

$T_j = T_{jmax}\text{-}25°C$

$T_j = 25°C$

At

$t_p =$	250	μs
$V_{CE} =$	10	V

Figure 4 Output inverter FWD

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

$I_F = f(V_F)$

$T_j = T_{jmax}\text{-}25°C$

$T_j = 25°C$

At

$t_p =$	250	μs

Revision: 2

Output Inverter

Figure 5	Output inverter IGBT

Typical switching energy losses
as a function of collector current

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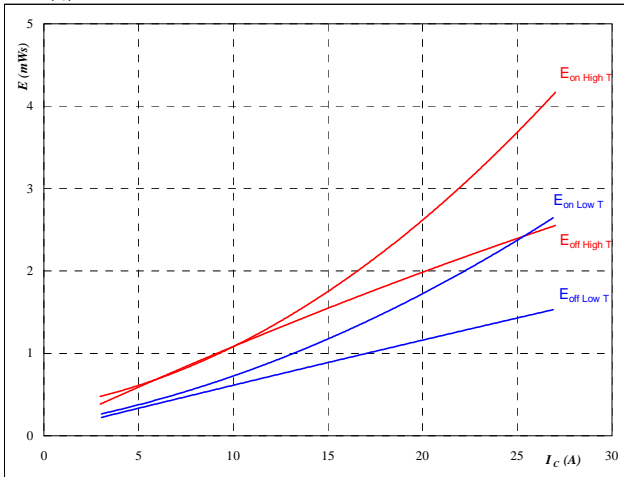
With an inductive load at

$T_j =$	25/150	℃
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	32	Ω
$R_{goff} =$	32	Ω

Figure 6	Output inverter IGBT

Typical switching energy losses
as a function of gate resistor

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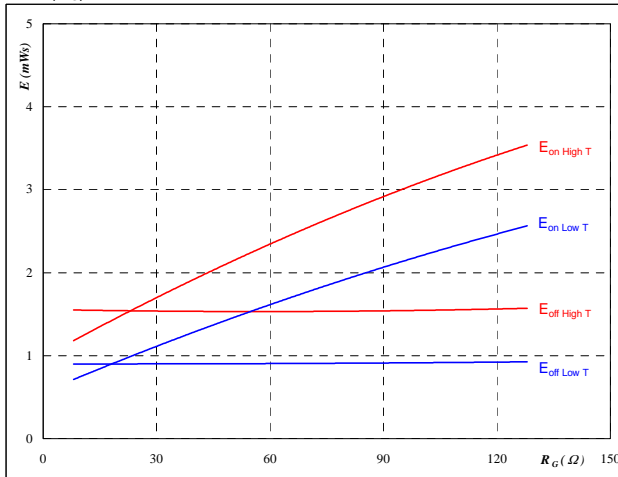
With an inductive load at

$T_j =$	25/150	℃
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$I_C =$	15	A

Figure 7	Output inverter FWD

Typical reverse recovery energy loss
as a function of collector current

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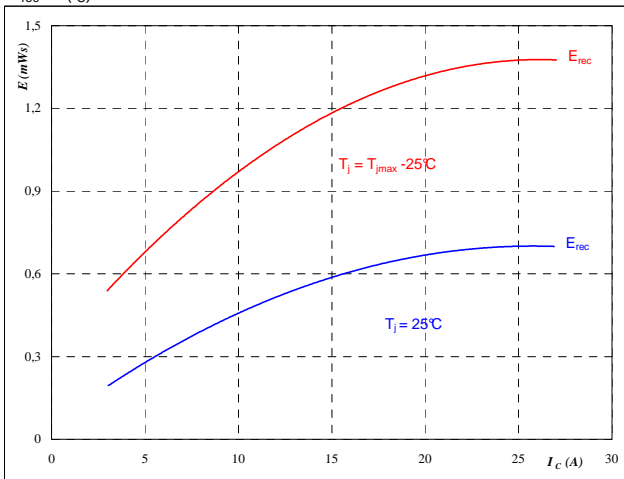
With an inductive load at

$T_j =$	25/150	℃
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	32	Ω

Figure 8	Output inverter FWD

Typical reverse recovery energy loss
as a function of gate resistor

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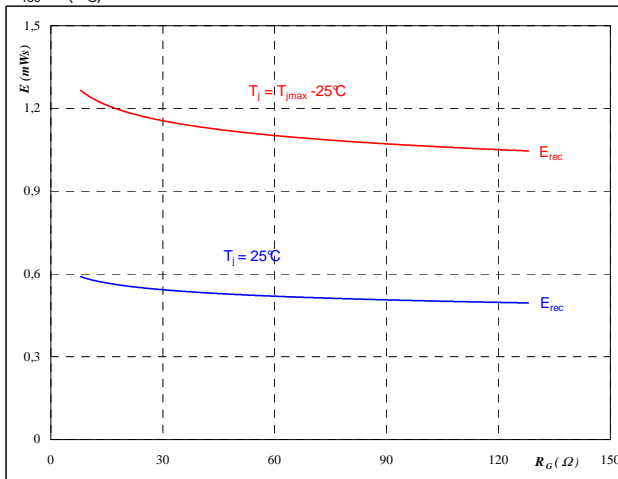
With an inductive load at

$T_j =$	25/150	℃
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$I_C =$	15	A

Output Inverter

Figure 9	Output inverter IGBT

Typical switching times as a function of collector current

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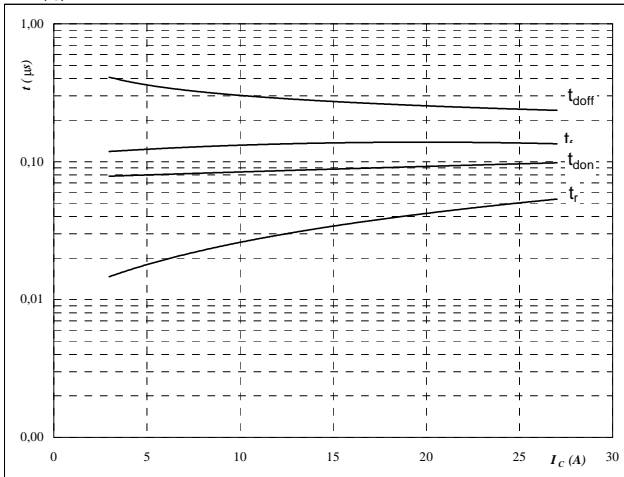
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	32	Ω
$R_{goff} =$	32	Ω

Figure 10	Output inverter IGBT

Typical switching times as a function of gate resistor

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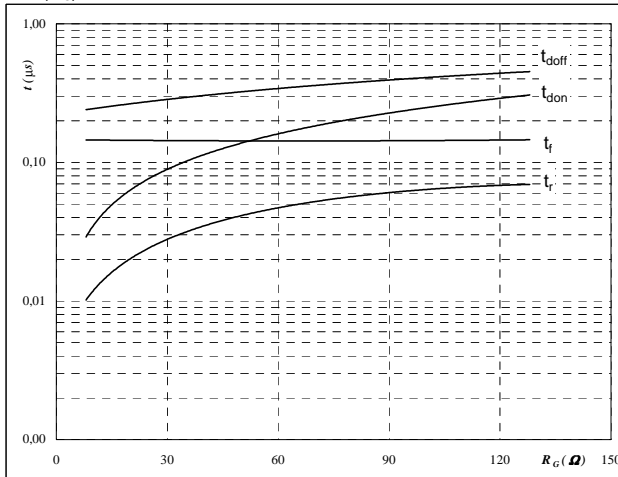
With an inductive load at

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

Figure 11	Output inverter FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

At
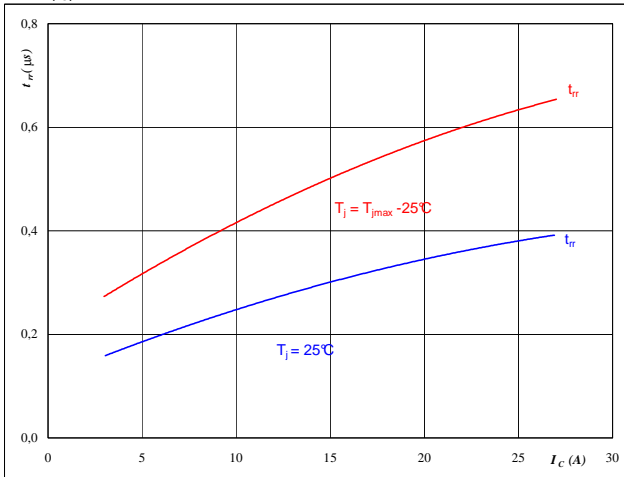
$T_j =$	25/150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	32	Ω

Figure 12	Output inverter FWD

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

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

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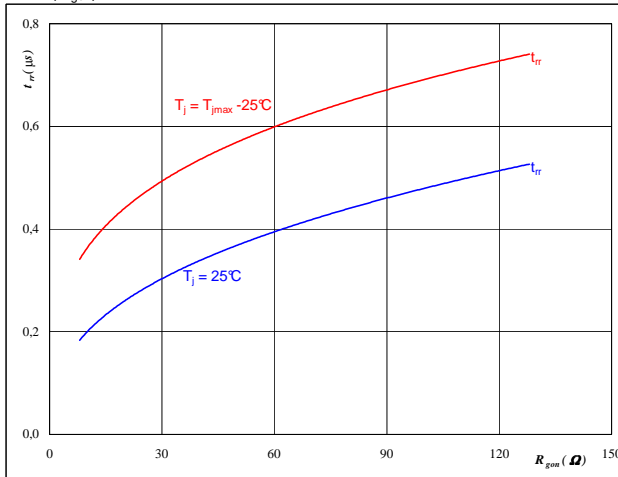
$T_j =$	25/150	°C
$V_R =$	600	V
$I_F =$	15	A
$V_{GE} =$	±15	V

Output Inverter

Figure 13 — Output inverter FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$

At
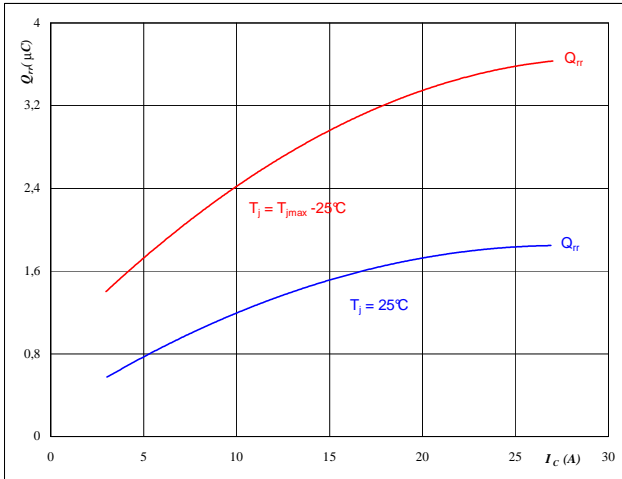
$T_j =$	25/150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	32	Ω

Figure 14 — Output inverter FWD

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

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

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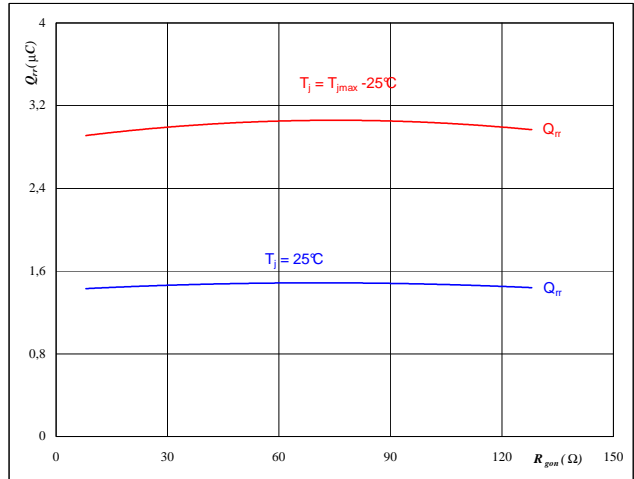
$T_j =$	25/150	°C
$V_R =$	600	V
$I_F =$	15	A
$V_{GE} =$	±15	V

Figure 15 — Output inverter FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$

At
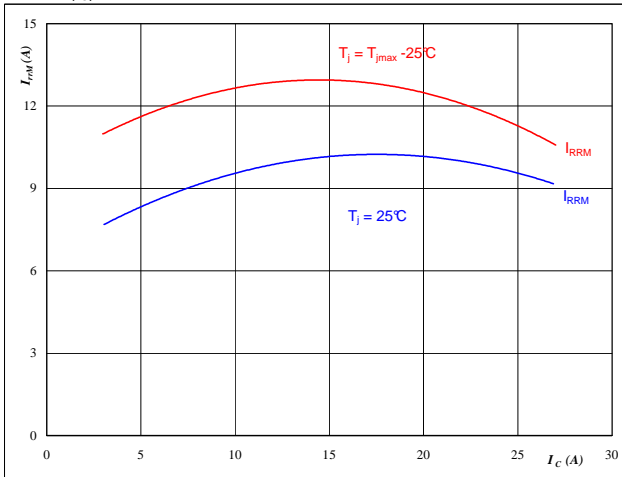
$T_j =$	25/150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	32	Ω

Figure 16 — Output inverter FWD

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

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

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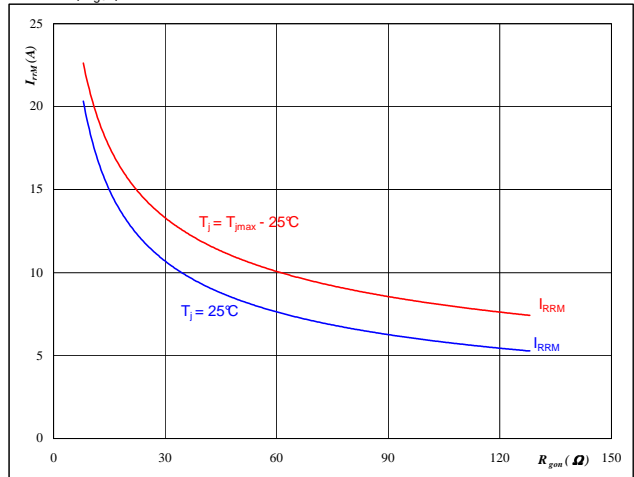
$T_j =$	25/150	°C
$V_R =$	600	V
$I_F =$	15	A
$V_{GE} =$	±15	V

Output Inverter

Figure 17	Output inverter FWD

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

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

At
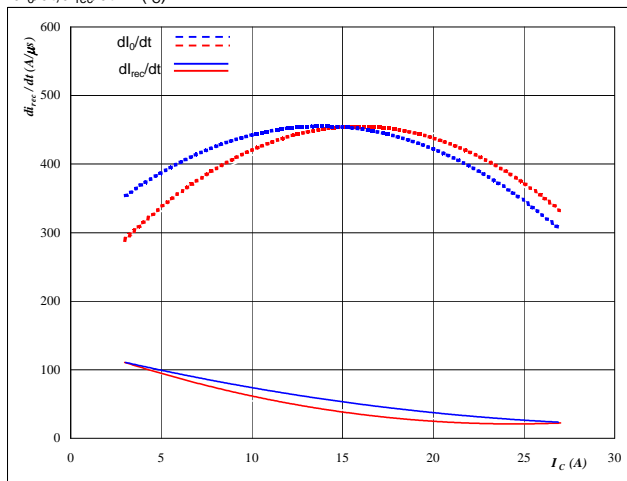
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

Figure 18	Output inverter FWD

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

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

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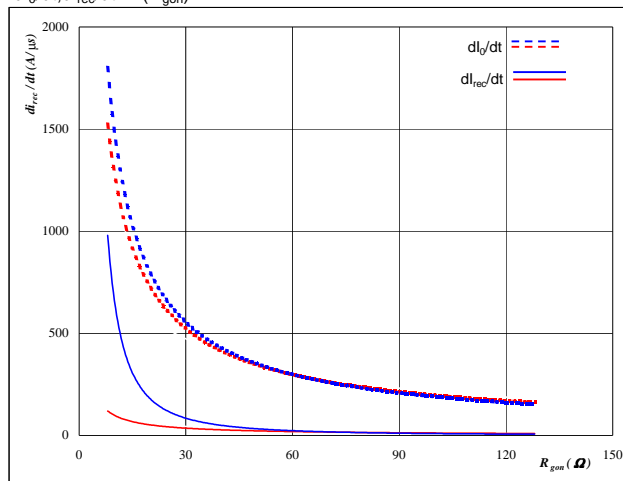
T_j =	25/150	°C
V_R =	600	V
I_F =	15	A
V_{GE} =	±15	V

Figure 19	Output inverter IGBT

IGBT transient thermal impedance as a function of pulse width

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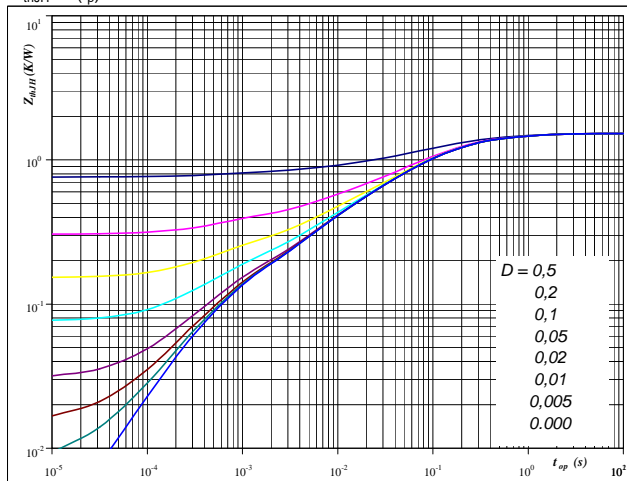
At

D =	t_p / T				
R_{thJH} =	1,52	K/W	R_{thJH} =	1,23	K/W

IGBT thermal model values

Thermal grease		Phase change material	
R (C/W)	Tau (s)	R (C/W)	Tau (s)
0,15	1,0E+00	0,12	8,2E-01
0,59	1,6E-01	0,48	1,3E-01
0,44	4,3E-02	0,36	3,5E-02
0,23	7,0E-03	0,19	5,7E-03
0,11	5,4E-04	0,09	4,4E-04

Figure 20	Output inverter FWD

FWD transient thermal impedance as a function of pulse width

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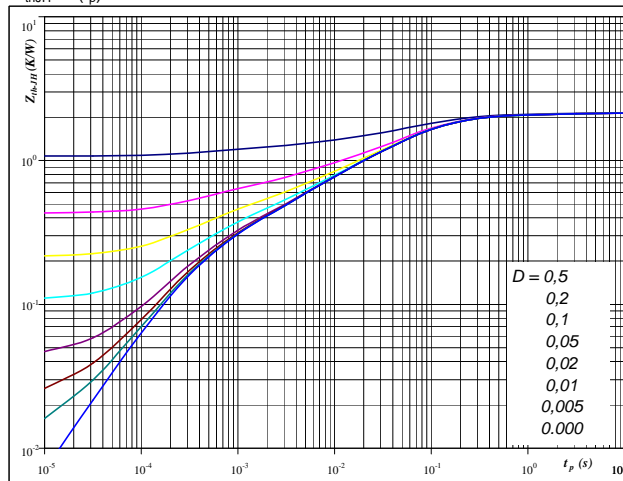
At

D =	t_p / T				
R_{thJH} =	2,15	K/W	R_{thJH} =	1,74	K/W

FWD thermal model values

| Thermal grease		Phase change material	
R (C/W)	Tau (s)	R (C/W)	Tau (s)
0,03	7,7E+00	0,03	6,3E+00
0,11	1,1E+00	0,09	8,8E-01
0,39	1,8E-01	0,32	1,4E-01
0,90	5,5E-02	0,73	4,5E-02
0,37	8,9E-03	0,30	7,2E-03
0,16	1,8E-03	0,13	1,5E-03

Output Inverter

Figure 21 — Output inverter IGBT

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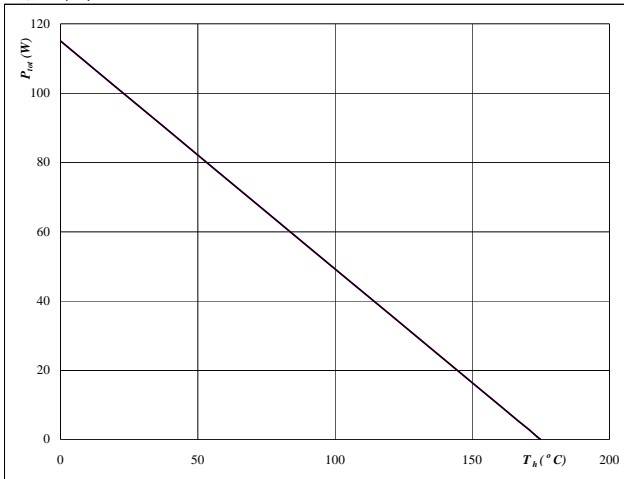
$P_{tot} = f(T_h)$

At

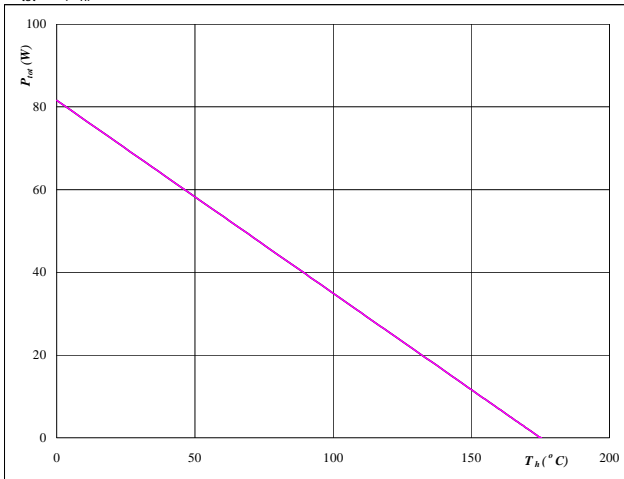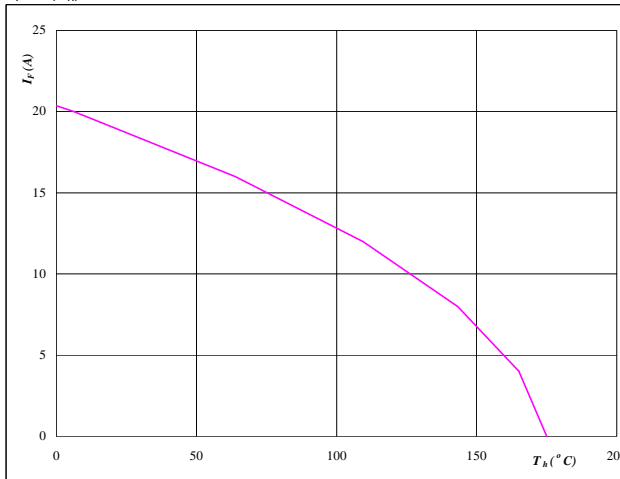$T_j =$ 175   °C

Figure 22 — Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$
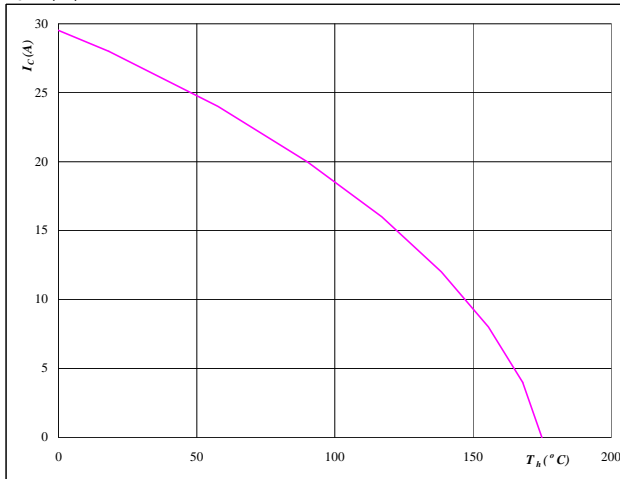
At

$T_j =$ 175   °C

$V_{GE} =$ 15   V

Figure 23 — Output inverter FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

At

$T_j =$ 175   °C

Figure 24 — Output inverter FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$

At

$T_j =$ 175   °C

Output Inverter

Figure 25 | Output inverter IGBT

Safe operating area as a function of collector-emitter voltage

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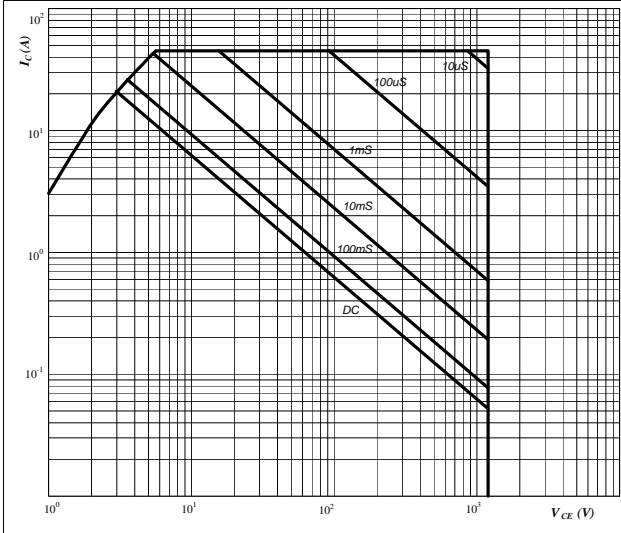
At

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

Figure 26 | Output inverter IGBT

Gate voltage vs Gate charge

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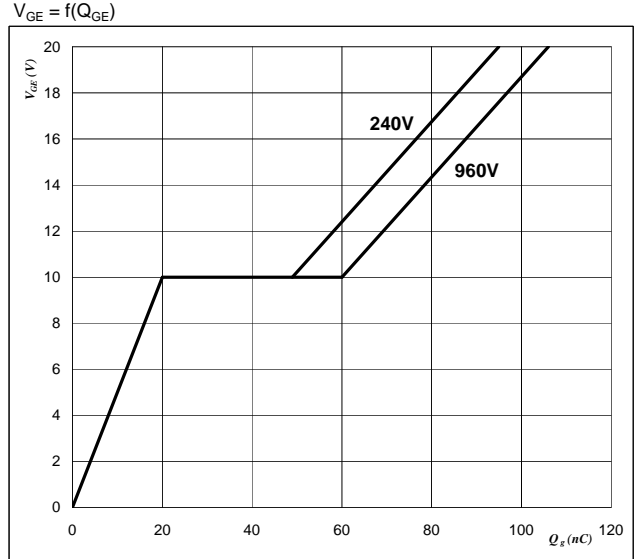
At

I_C =	15	A

Figure 27 | Output inverter IGBT

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

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

At
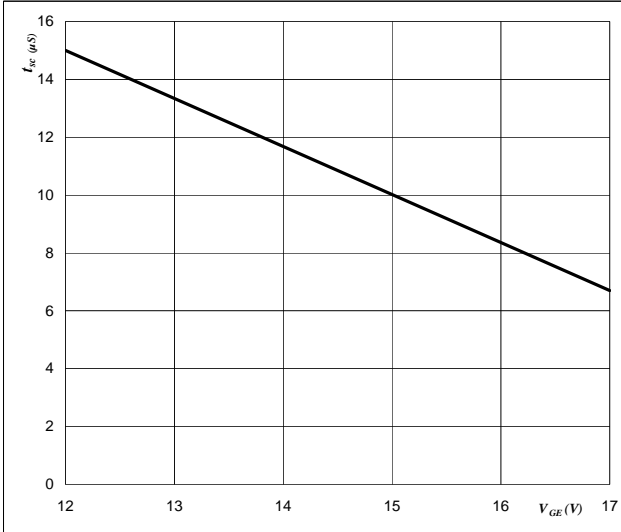
V_{CE} =	600	V
T_j ≤	25	ºC

Figure 28 | Output inverter IGBT

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

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

At
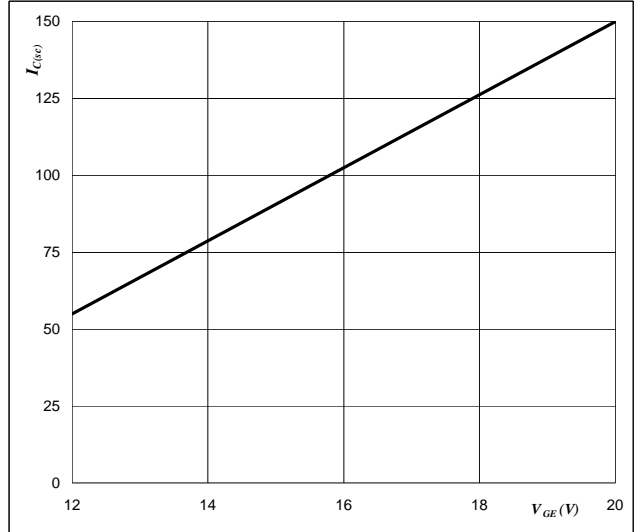
V_{CE} ≤	600	V
T_j =	150	ºC

Figure 29   IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$

At
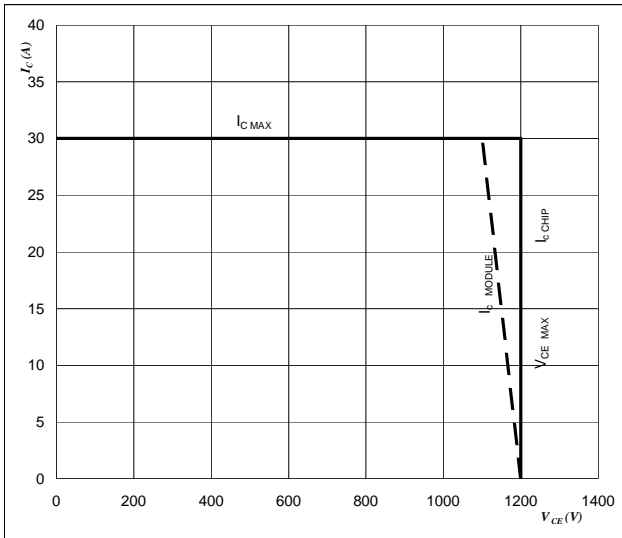
$T_j =$ T_{jmax}-25   ºC

Switching mode :   3phase SPWM

Brake

Figure 1	Brake IGBT

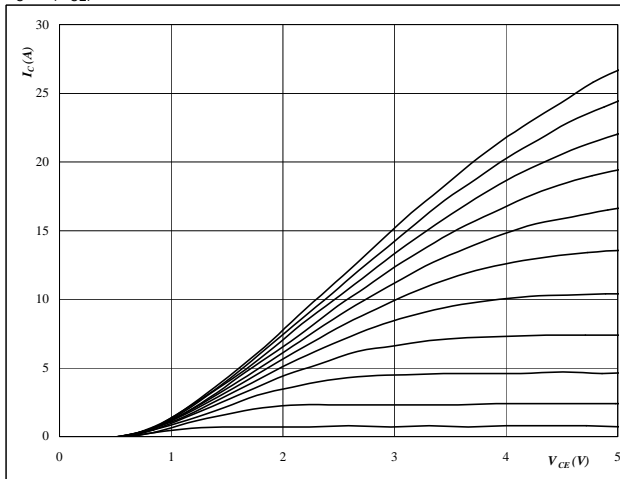**Typical output characteristics**

$I_C = f(V_{CE})$

At

t_p = 250 µs
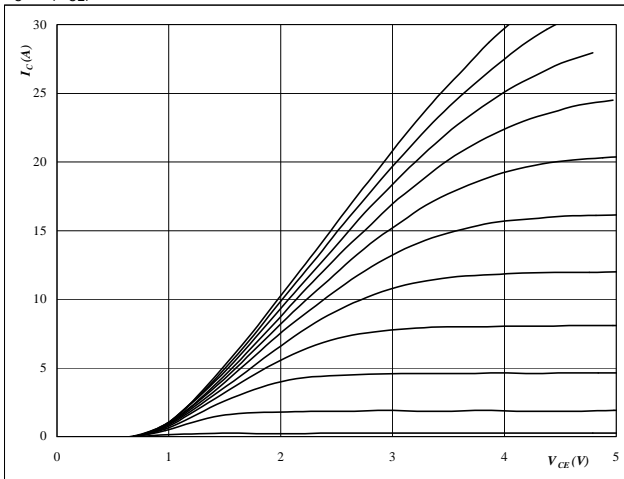
t_p = 250 µs
T_j = 25 °C
V_{GE} from 7 V to 17 V in steps of 1 V

Figure 2	Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$

At

t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

Figure 3	Brake IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

$T_j = T_{jmax}$-25°C $T_j = 25$°C

At
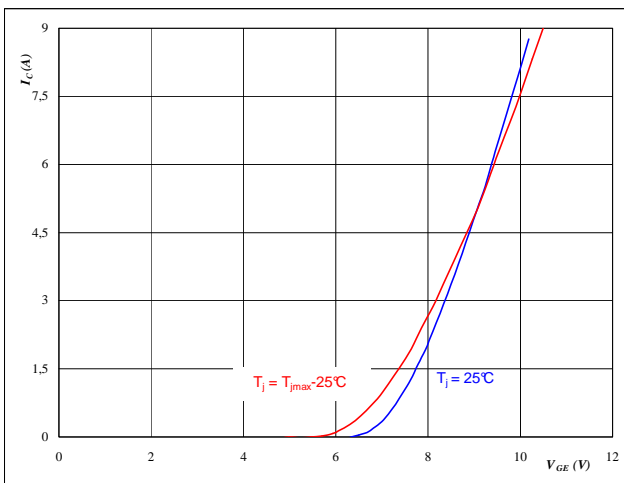
t_p = 250 µs
V_{CE} = 10 V

Figure 4	Brake FWD

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

$I_F = f(V_F)$

$T_j = T_{jmax}$-25°C $T_j = 25$°C

At
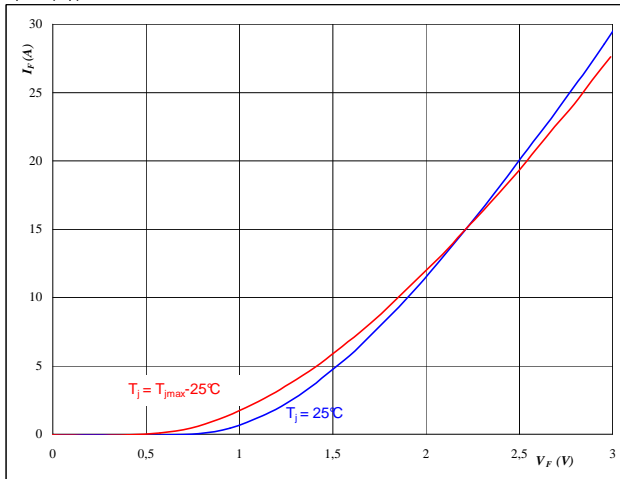
t_p = 250 µs

Brake

Figure 5	Brake IGBT

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

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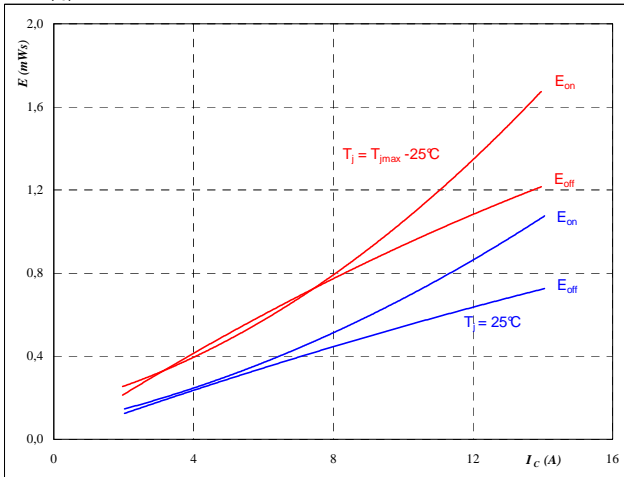
With an inductive load at

$T_j =$	25/150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	32	Ω
$R_{goff} =$	32	Ω

Figure 6	Brake IGBT

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

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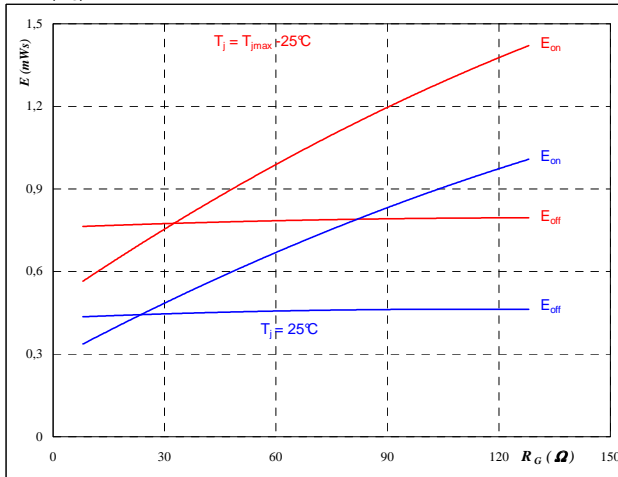
With an inductive load at

$T_j =$	25/150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$I_C =$	8	A

Figure 7	Brake FWD

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

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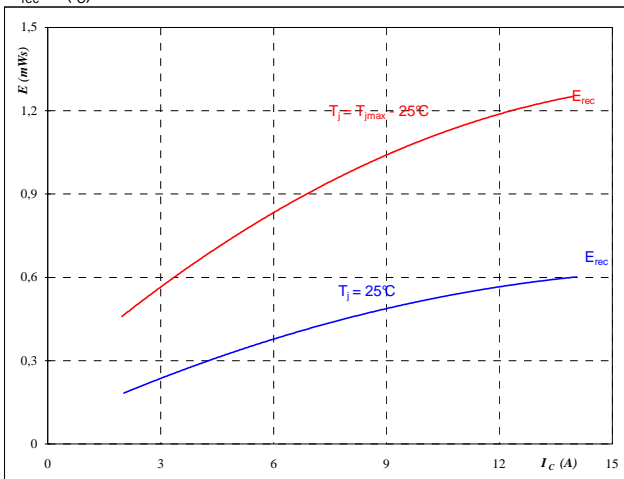
With an inductive load at

$T_j =$	25/150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	32	Ω

Figure 8	Brake FWD

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

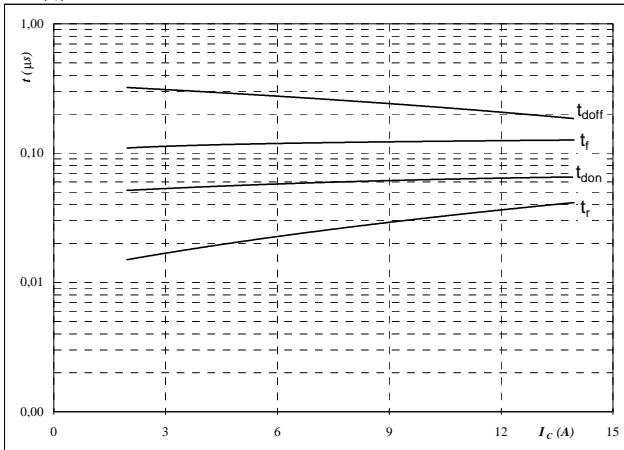$E_{rec} = f(R_G)$

With an inductive load at

$T_j =$	25/150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$I_C =$	8	A

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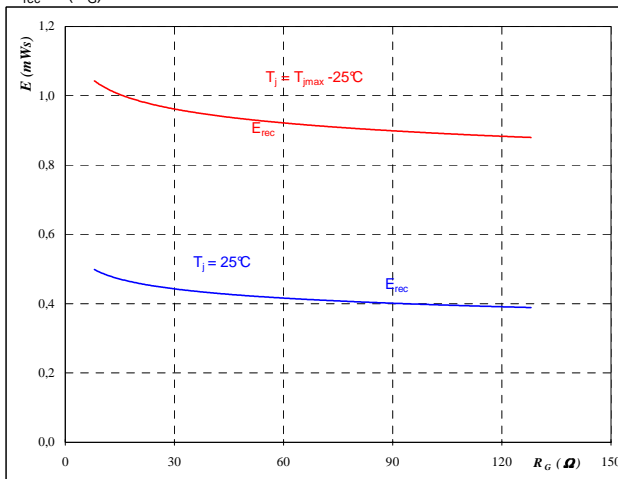
Brake

Figure 9	Brake IGBT

Typical switching times as a function of collector current

$t = f(I_C)$

With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

Figure 10	Brake IGBT

Typical switching times as a function of gate resistor

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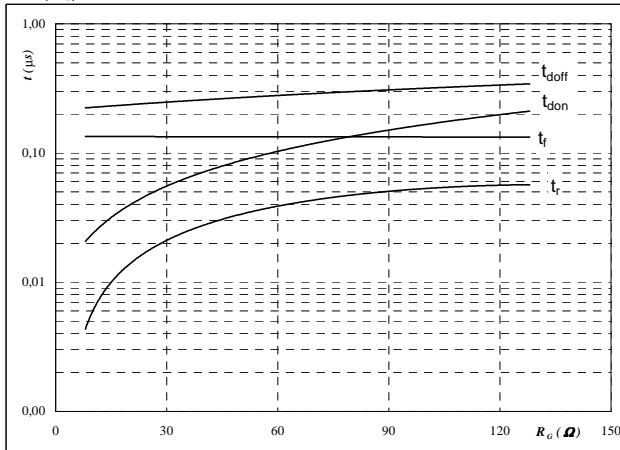
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	8	A

Figure 11	Brake IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$

D = 0,5
0,2
0,1
0,05
0,02
0,01
0,005
0.000
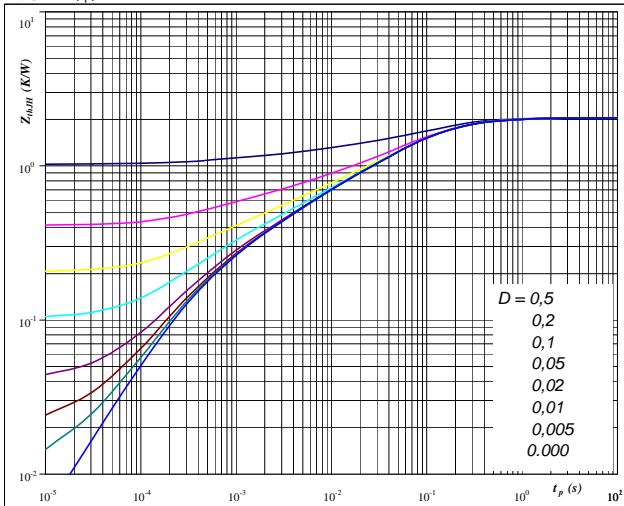
At		D =	tp / T
Thermal grease		Phase change material	
R_{thJH} =	2,05 K/W	R_{thJH} =	1,66 K/W

Figure 12	Brake FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$

D = 0,5
0,2
0,1
0,05
0,02
0,01
0,005
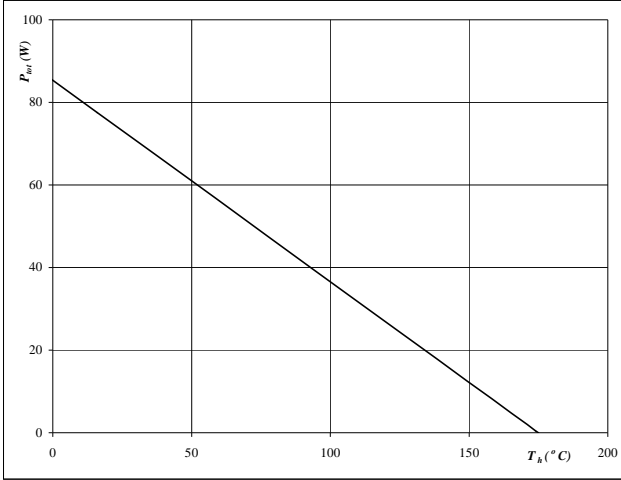0.000
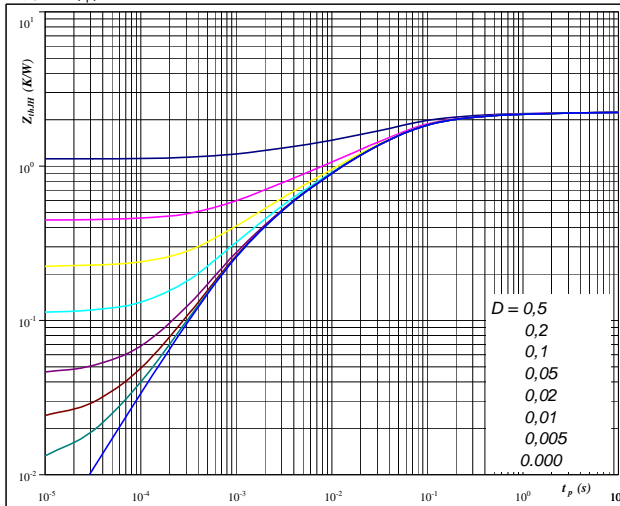
At		D =	tp / T
Thermal grease		Phase change material	
R_{thJH} =	2,23 K/W	R_{thJH} =	1,81 K/W

Brake

Figure 13 Brake IGBT

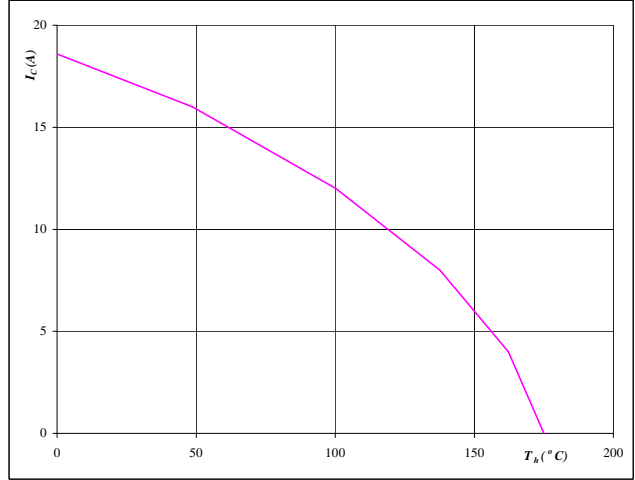**Power dissipation as a function of heatsink temperature**
$P_{tot} = f(T_h)$

At
$T_j =$ 175 ºC

Figure 14 Brake IGBT

Collector current as a function of heatsink temperature
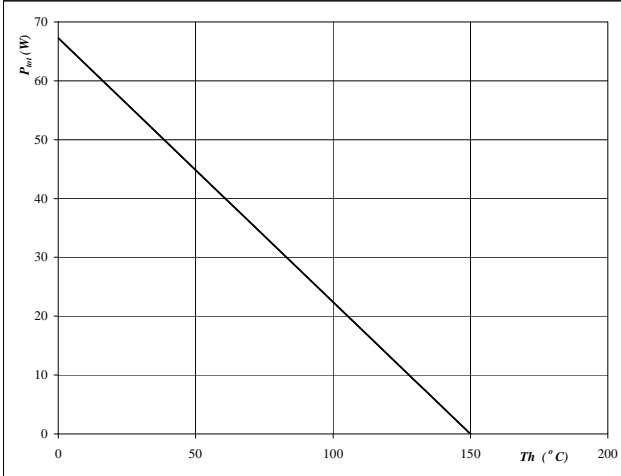$I_C = f(T_h)$

At
$T_j =$ 175 ºC
$V_{GE} =$ 15 V

Figure 15 Brake FWD

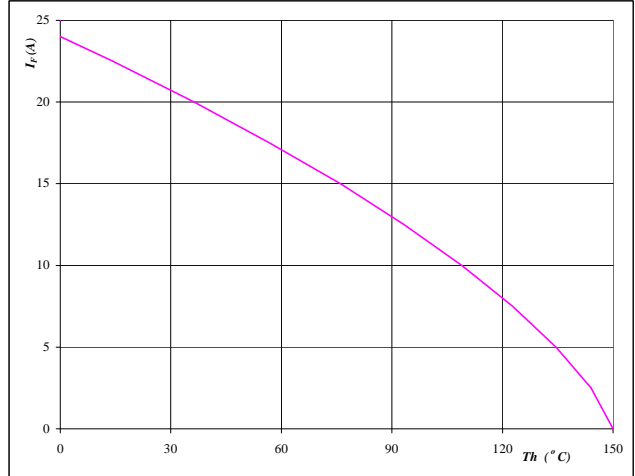**Power dissipation as a function of heatsink temperature**
$P_{tot} = f(T_h)$

At
$T_j =$ 150 ºC

Figure 16 Brake FWD

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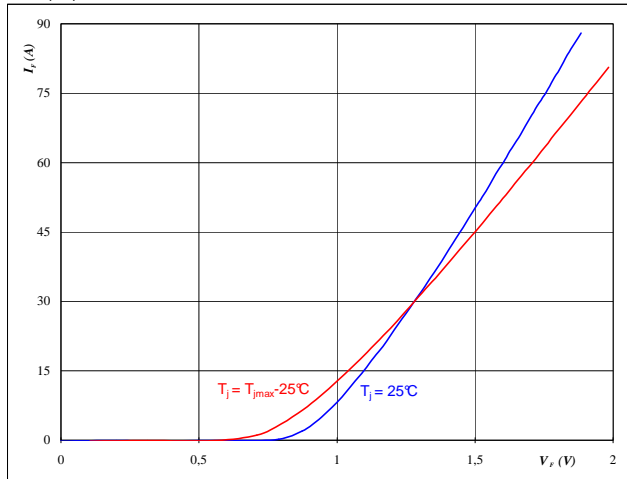$I_F = f(T_h)$

At
$T_j =$ 150 ºC

Input Rectifier Bridge

Figure 1	Rectifier diode

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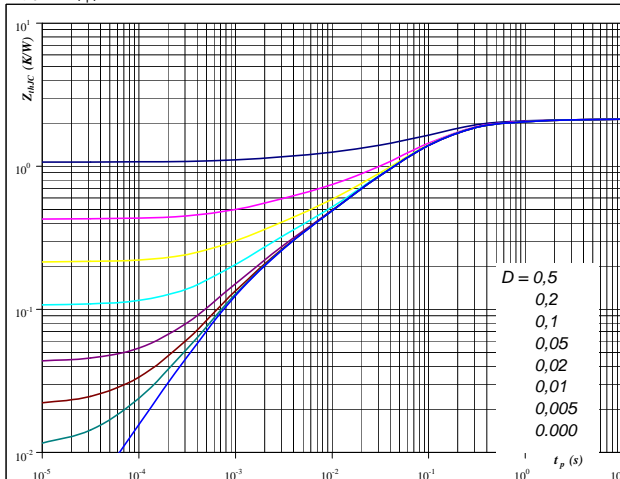
$I_F = f(V_F)$

At

$t_p =$ 250   µs

Figure 2	Rectifier diode

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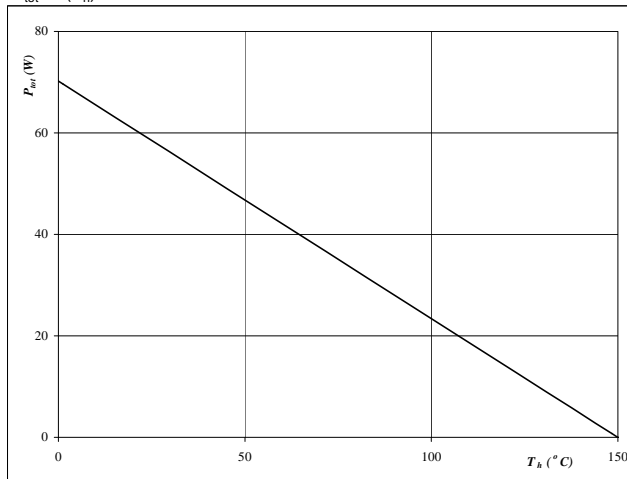
$Z_{thJH} = f(t_p)$

At

$D =$ t_p / T
$R_{thJH} =$ 2,10   K/W

Figure 3	Rectifier diode

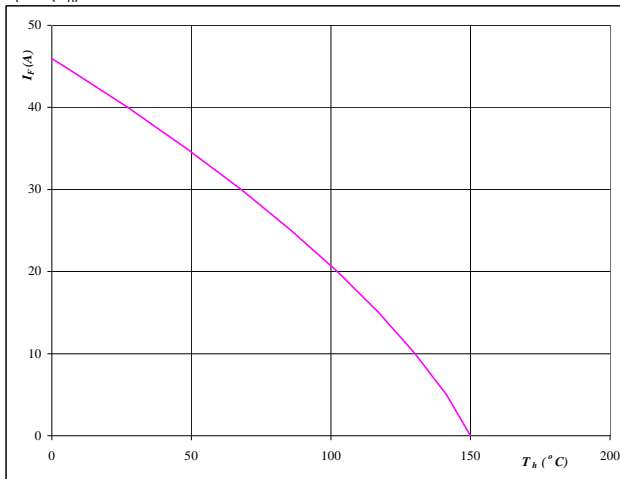**Power dissipation as a function of heatsink temperature**

$P_{tot} = f(T_h)$

At

$T_j =$ 150   ºC

Figure 4	Rectifier diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$

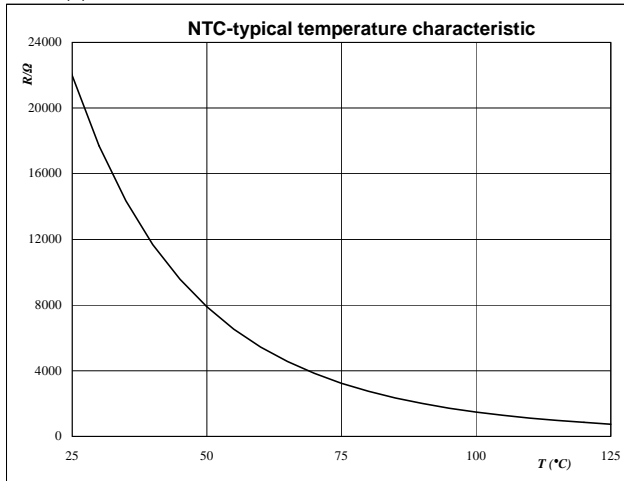**At**

$T_j =$ 150   ºC

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Thermistor

Figure 1   Thermistor

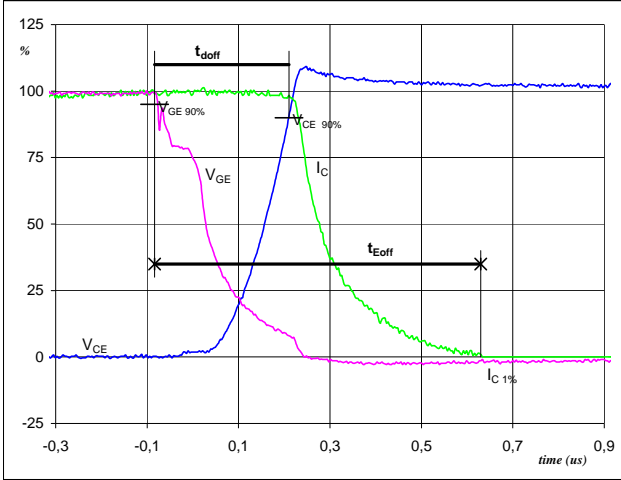**Typical NTC characteristic**
**as a function of temperature**
R_T = f(T)

NTC-typical temperature characteristic

Switching Definitions Output Inverter

General conditions

T_j	=	150 °C
R_{gon}	=	32 Ω
R_{goff}	=	32 Ω

Figure 1 — Output inverter IGBT

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

(t_{Eoff} = integrating time for E_{off})
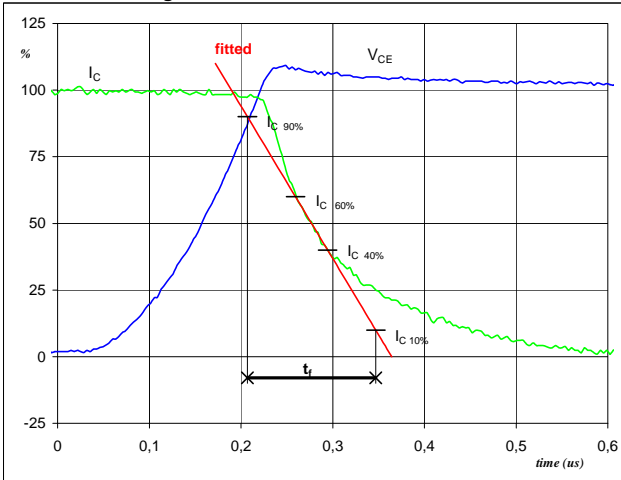

V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	15	A
t_{doff} =	0,29	µs
t_{Eoff} =	0,71	µs

Figure 2 — Output inverter IGBT

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

(t_{Eon} = integrating time for E_{on})
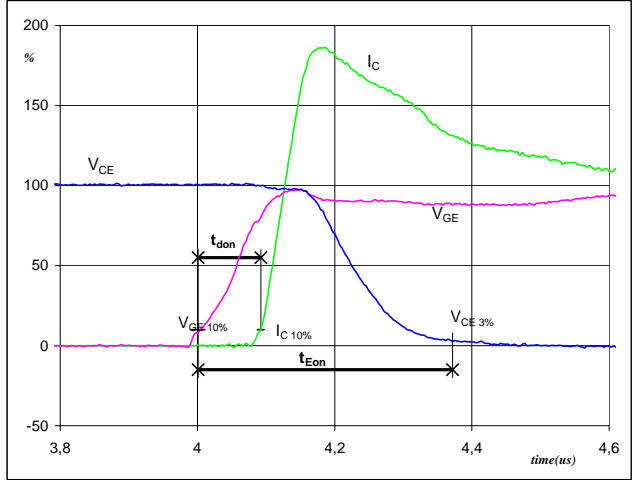
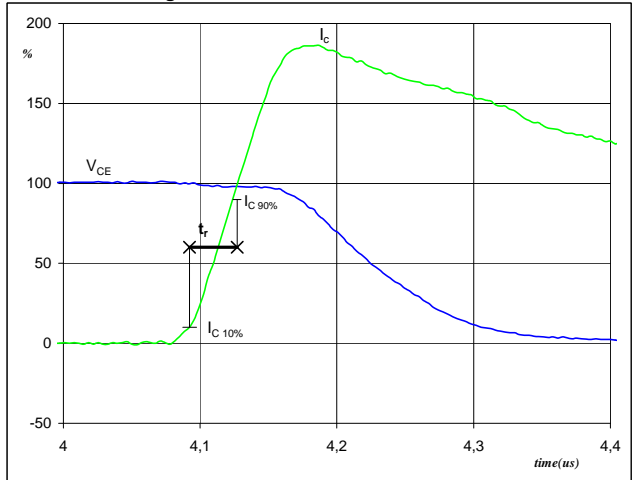|		
V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	15	A
t_{don} =	0,09	µs
t_{Eon} =	0,37	µs

Figure 3 — Output inverter IGBT

Turn-off Switching Waveforms & definition of t_f

V_C (100%) =	600	V
I_C (100%) =	15	A
t_f =	0,14	µs

Figure 4 — Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

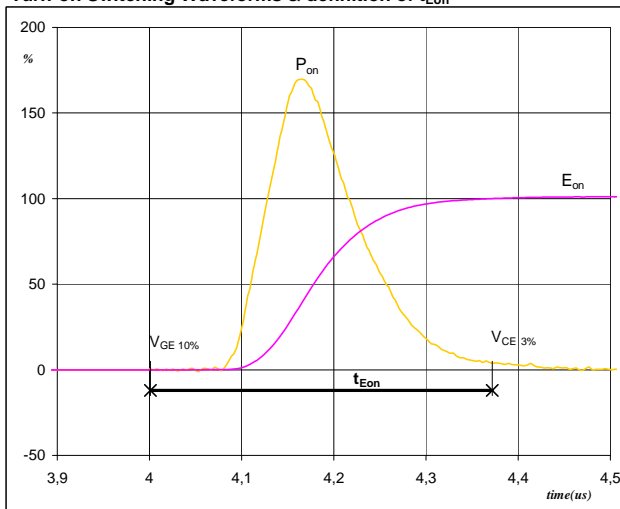|		
V_C (100%) =	600	V
I_C (100%) =	15	A
t_r =	0,03	µs

Switching Definitions Output Inverter

Figure 5   Output inverter IGBT

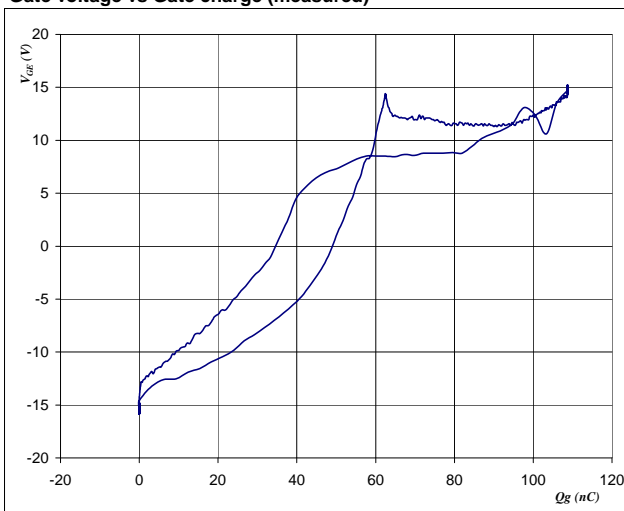**Turn-off Switching Waveforms & definition of t_{Eoff}**
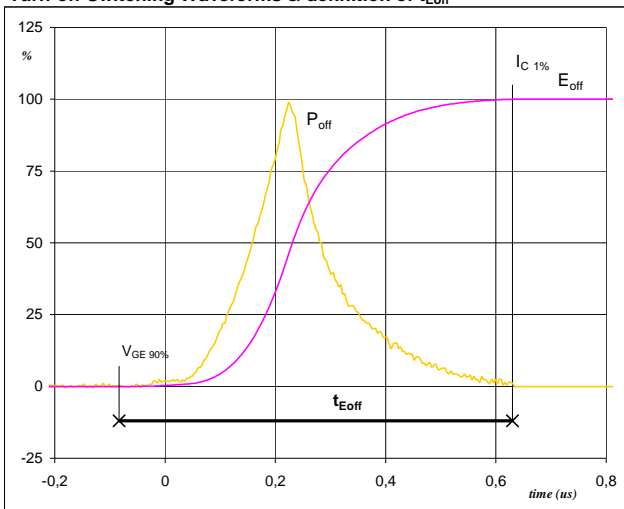
P_{off} (100%) =	9,02	kW
E_{off} (100%) =	1,53	mJ
t_{Eoff} =	0,71	µs

Figure 6   Output inverter IGBT

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

P_{on} (100%) =	9,02	kW
E_{on} (100%) =	1,78	mJ
t_{Eon} =	0,37	µs

Figure 7   Output inverter FWD

Gate voltage vs Gate charge (measured)

V_{GEoff} =	-15	V
V_{GEon} =	15	V
V_C (100%) =	600	V
I_C (100%) =	15	A
Q_g =	108,88	nC

Figure 8   Output inverter IGBT

Turn-off Switching Waveforms & definition of t_{rr}
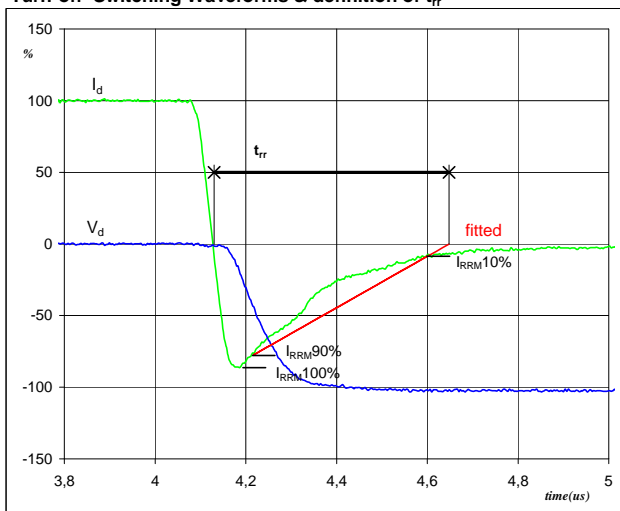
V_d (100%) =	600	V
I_d (100%) =	15	A
I_{RRM} (100%) =	-13	A
t_{rr} =	0,51	µs

Switching Definitions Output Inverter

Figure 9 — Output inverter FWD

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

(t_{Qrr} = integrating time for Q_{rr})
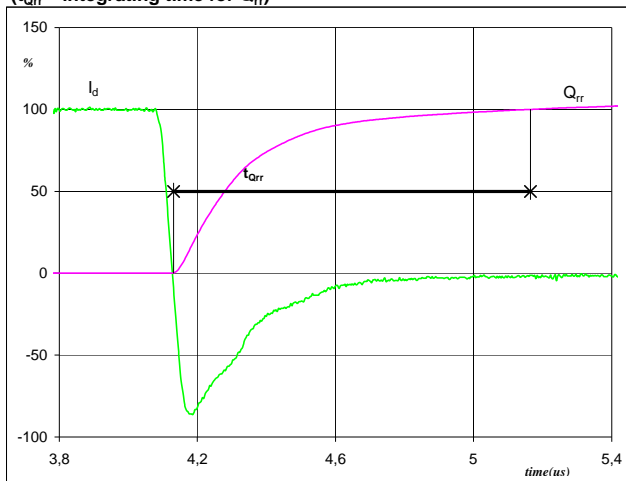
I_d (100%) =	15	A
Q_{rr} (100%) =	3,04	µC
t_{Qrr} =	1,03	µs

Figure 10 — Output inverter FWD

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

(t_{Erec} = integrating time for E_{rec})
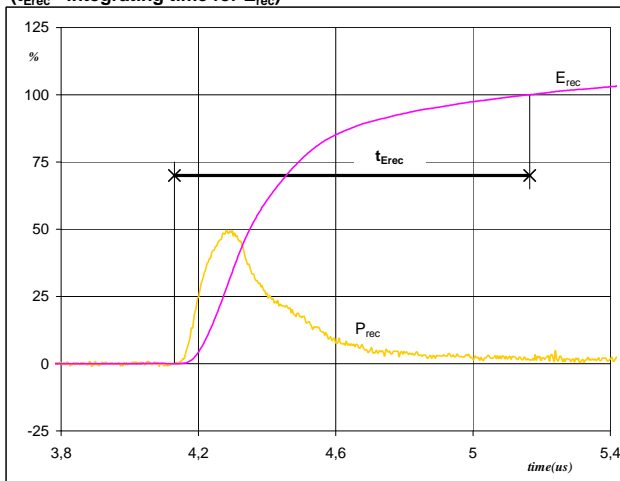
P_{rec} (100%) =	9,02	kW
E_{rec} (100%) =	1,22	mJ
t_{Erec} =	1,03	µs

Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste	V23990-P630-A40-PM	P630-A40	P630-A40

Outline

Pin table		
Pin	X	Y
1	53	0
2	46	0
3	39,5	0
4	32,5	0
5	28,1	0
6	18	0
7	15	0
8	12	0
9	9	0
10	3	0
11	0	0
12	0	7
13	3	7
14	8,5	7
15	11,5	7
16	17	7
17	20	7
18	33	7
19	36	7
20	39	7
21	46	7
22	53	7
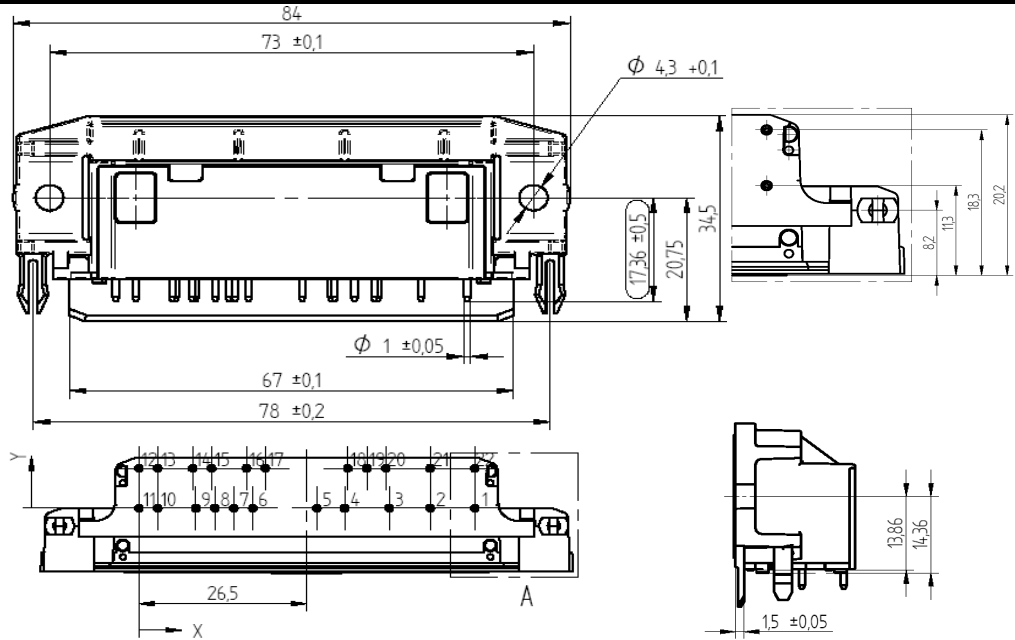
Pinout
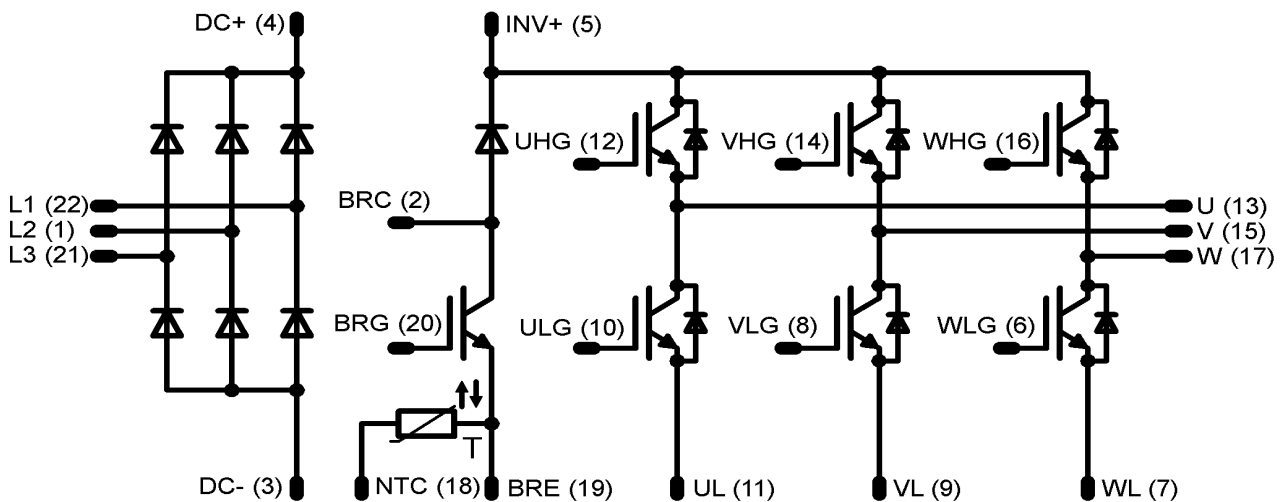
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