Vincotech

MiniSKiiP® 2 PIM	1200V / 25A

Features

- Solderless interconnection
- Trench Fieldstop IGBT4 technology
- Enhanced input rectifier

MiniSKiiP® 2 housing

Target Applications

- Industrial Drives

Schematic

Types

- V23990-K229-A41-PM

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℃	39	A
Surge forward current	I_{FSM}	t_p=10ms	T_j=150℃	450	A
I^2t-value	I^2t			1020	A^2s
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80℃	52	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℃	26	A
Repetitive peak collector current	I_{Cpulse}	t_p limited by $T_j$max		75	A
Power dissipation per IGBT	P_{tot}	T_j=$T_j$max	T_h=80℃	61	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	℃

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Maximum Ratings

T_j=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	T_j=$T_j$max	T_h=80℃	19	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		160	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80℃	43	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℃	26	A
Repetitive peak collector current	I_{Cpuls}	t_p limited by $T_j$max		75	A
Power dissipation per IGBT	P_{tot}	T_j=$T_j$max	T_h=80℃	59	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 Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	T_j=$T_j$max	T_h=80℃	20	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		160	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80℃	46	W
Maximum Junction Temperature	$T_j$max			175	℃
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

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			25	Tj=25℃ Tj=125℃	0,8	1,2 1,12	1,35	V
Threshold voltage (for power loss calc. only)	V_{to}				Tj=25℃ Tj=125℃		0,85 0,73		V
Slope resistance (for power loss calc. only)	r_t				Tj=25℃ Tj=125℃		14 15		mΩ
Reverse current	I_r		1500		Tj=25℃ Tj=125℃			0,1 1,1	mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50µm λ=1W/mK					1,34		K/W
Thermal resistance chip to case per chip	R_{thJC}						N/A		
Inverter Transistor									
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$		0,00085	Tj=25℃ Tj=150℃	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	15		25	Tj=25℃ Tj=150℃	1,35	1,88 2,2	2,15	V
Collector-emitter cut-off current incl. diode	I_{CES}	0	1200		Tj=25℃ Tj=150℃			0,05	mA
Gate-emitter leakage current	I_{GES}	20	0		Tj=25℃ Tj=150℃			300	nA
Integrated Gate resistor	R_{gint}						-		Ω
Turn-on delay time	$t_{d(on)}$				Tj=25℃ Tj=150℃		112 113		ns
Rise time	t_r				Tj=25℃ Tj=150℃		29,3 34,7		
Turn-off delay time	$t_{d(off)}$	Rgoff=32Ω Rgon=32Ω			Tj=25℃ Tj=150℃		231 303		
Fall time	t_f	±15	600	25	Tj=25℃ Tj=150℃		91 137		
Turn-on energy loss per pulse	E_{on}				Tj=25℃ Tj=150℃		1,87 2,77		mWs
Turn-off energy loss per pulse	E_{off}				Tj=25℃ Tj=150℃		1,49 2,43		
Input capacitance	C_{ies}						1430		pF
Output capacitance	C_{oss}	f=1MHz	0	25	Tj=25℃		115		
Reverse transfer capacitance	C_{rss}						85		
Gate charge	Q_{Gate}	Vcc=960V	15	40	Tj=25℃		120		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50µm λ=1W/mK					1,57		K/W
Thermal resistance chip to case per chip	R_{thJC}						N/A		
Inverter Diode									
Diode forward voltage	V_F			25	Tj=25℃ Tj=150℃	1,5	2,47 2,49	2,75	V
Peak reverse recovery current	I_{RRM}				Tj=25℃ Tj=150℃		13,5 18,3		A
Reverse recovery time	t_{rr}				Tj=25℃ Tj=150℃		319 544		ns
Reverse recovered charge	Q_{rr}	Rgon=32Ω	±15 600	25	Tj=25℃ Tj=150℃		1,48 3,69		µC
Peak rate of fall of recovery current	di(rec)max /dt				Tj=25℃ Tj=150℃		174 64		A/µs
Reverse recovered energy	Erec				Tj=25℃ Tj=150℃		0,52 1,44		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50µm λ=1W/mK					2,22		K/W
Thermal resistance chip to case per chip	R_{thJC}						N/A		

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	$V_{GE(th)}$	$V_{CE}=V_{GE}$		0,00085	Tj=25℃ Tj=150℃	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	15		25	Tj=25℃ Tj=150℃	1,35	1,88 2,2	2,15	V
Collector-emitter cut-off incl. diode	I_{CES}	0	1200		Tj=25℃ Tj=150℃			0,05	mA
Gate-emitter leakage current	I_{GES}	20	0		Tj=25℃ Tj=150℃			300	nA
Integrated Gate resistor	R_{gint}						-		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=32Ω Rgon=32Ω	±15	600	25	Tj=25℃ Tj=150℃	112 114		ns
Rise time	t_r					Tj=25℃ Tj=150℃	34 40		
Turn-off delay time	$t_{d(off)}$					Tj=25℃ Tj=150℃	217 289		
Fall time	t_f					Tj=25℃ Tj=150℃	91 143		
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=150℃	1,97 2,88		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=150℃	1,46 2,36		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25℃	1430		pF
Output capacitance	C_{oss}						115		
Reverse transfer capacitance	C_{rss}						85		
Gate charge	Q_{Gate}	Vcc=960V	15		40	Tj=25℃	120		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50µm λ=1W/mK					1,6		K/W
Thermal resistance chip to case per chip	R_{thJC}						N/A		
Brake Diode									
Diode forward voltage	V_F			25		Tj=25℃ Tj=150℃	1,5	2,46 2,49	2,75	V
Reverse leakage current	I_r		±15	600	25	Tj=25℃ Tj=150℃			60	µA
Peak reverse recovery current	I_{RRM}	Rgoff=32Ω Rgoff=32Ω	±15	600	25	Tj=25℃ Tj=150℃	11,3 15,6		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=150℃	327 562		ns
Reverse recovered charge	Q_{rr}					Tj=25℃ Tj=150℃	1,42 3,41		µC
Peak rate of fall of recovery current	di(rec)max/dt					Tj=25℃ Tj=150℃	111 42		A/µs
Reverse recovery energy	E_{rec}					Tj=25℃ Tj=150℃	0,51 1,32		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50µm λ=1W/mK					2,06		K/W
Thermal resistance chip to case per chip	R_{thJC}						N/A		
Thermistor									
Rated resistance	R					T=25℃		1000		Ω
Deviation of R100	ΔR/R	R100=1670 Ω				T=100℃	-3		3	%
R100	P					T=100℃		1670,313		Ω
Power dissipation constant						T=25℃				mW/K
A-value	B(25/50)	Tol. %				T=25℃		7,635*10-3		1/K
B-value	B(25/100)	Tol. %				T=25℃		1,731*10-5		1/K²
Vincotech NTC Reference								E	

Output Inverter

Figure 1   Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$

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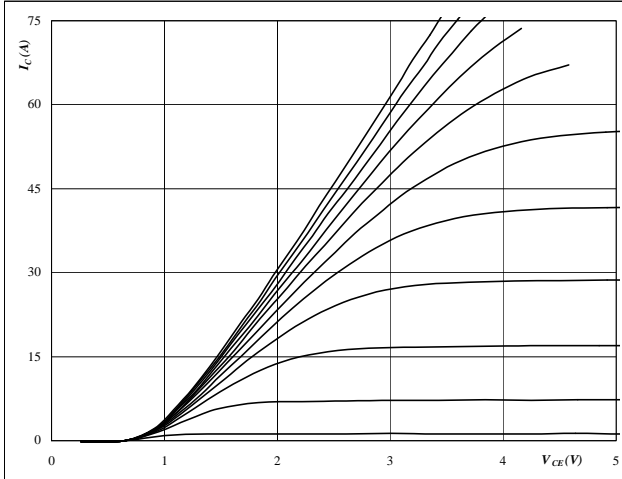
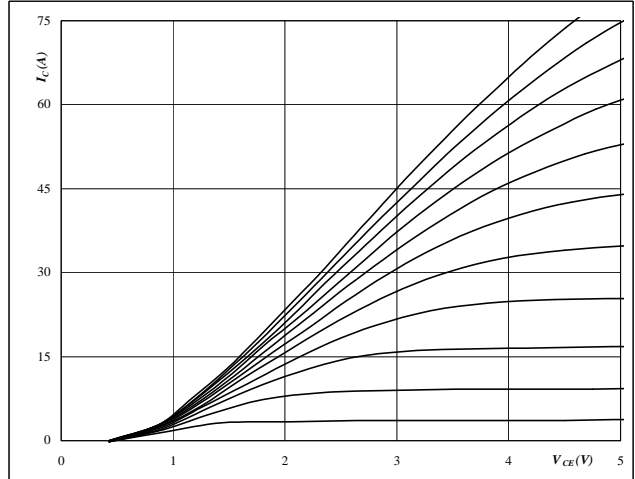$t_p =$ 250   µs
$T_j =$ 25   °C
V_{GE} from   7 V to 17 V in steps of 1 V

Figure 2   Output inverter IGBT

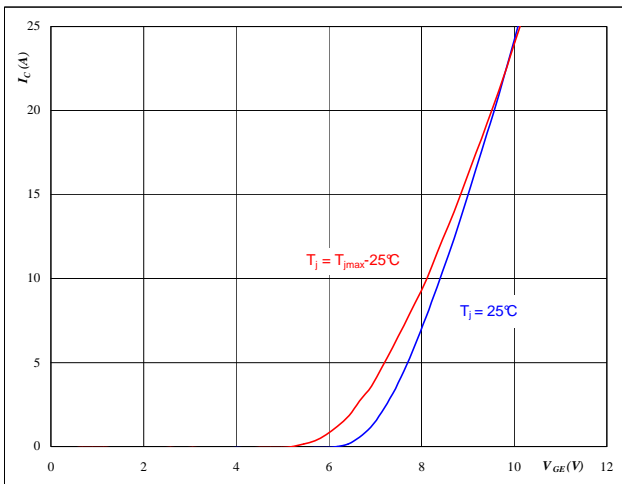**Typical output characteristics**

$I_C = f(V_{CE})$

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

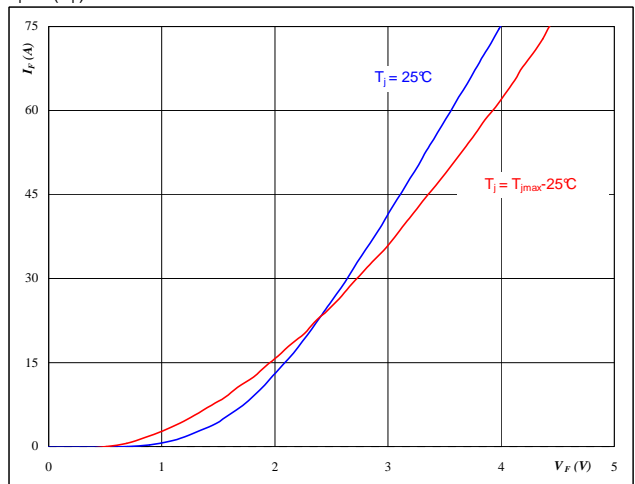**Typical transfer characteristics**

$I_C = f(V_{GE})$

$T_j = T_{jmax} - 25°C$

$T_j = 25°C$

At

$t_p =$ 250   µs
$V_{CE} =$ 10   V

Figure 4   Output inverter FRED

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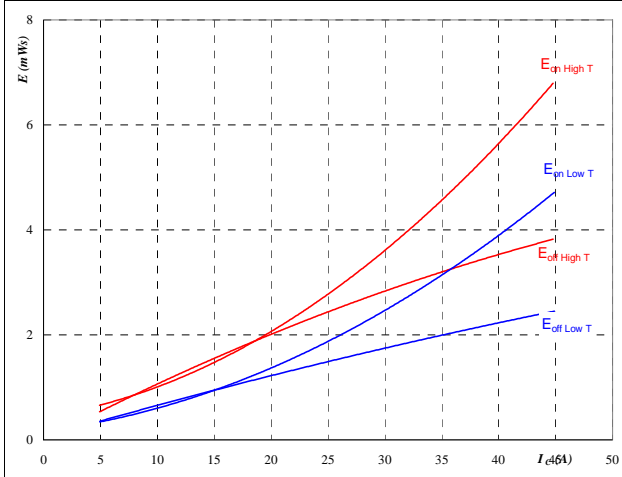a function of forward voltage**

$I_F = f(V_F)$

$T_j = 25°C$

$T_j = T_{jmax} - 25°C$

At

$t_p =$ 250   µs

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	°C
$V_{CE} =$	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
$E = f(R_G)$
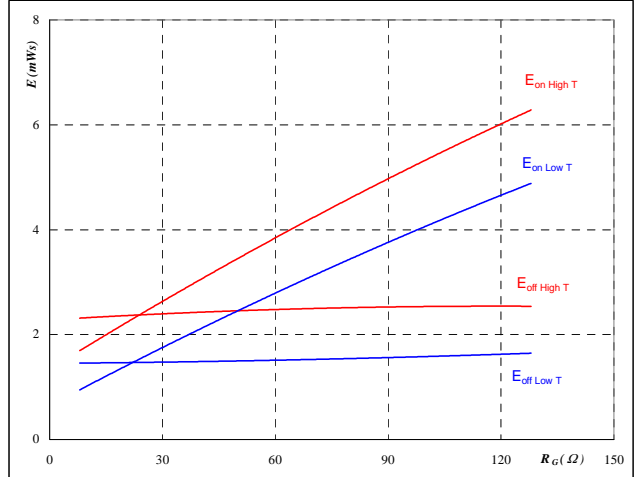
With an inductive load at

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

Figure 7	Output inverter IGBT

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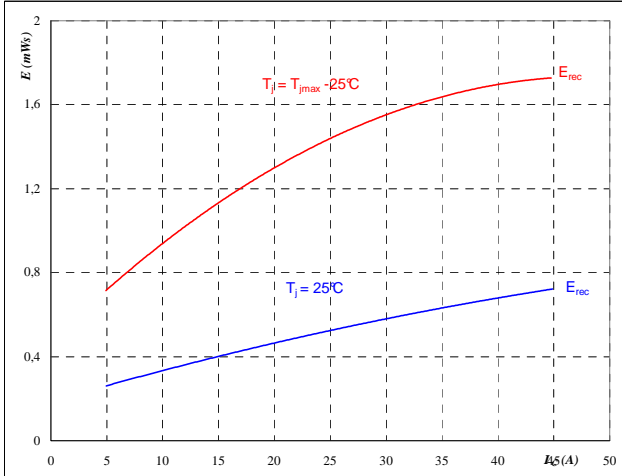
With an inductive load at

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

Figure 8	Output inverter IGBT

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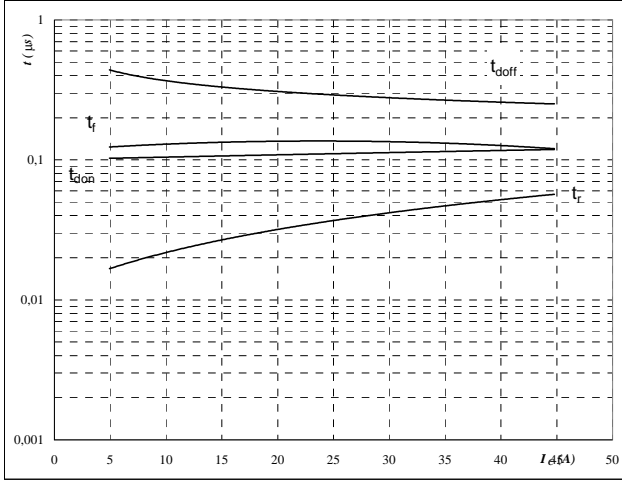$E_{rec} = f(R_G)$
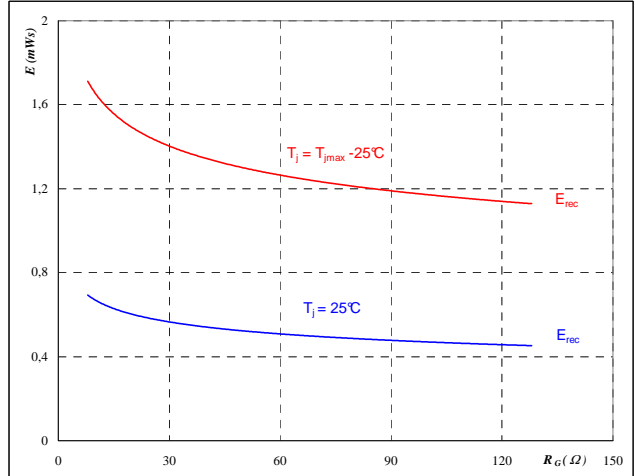
With an inductive load at

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

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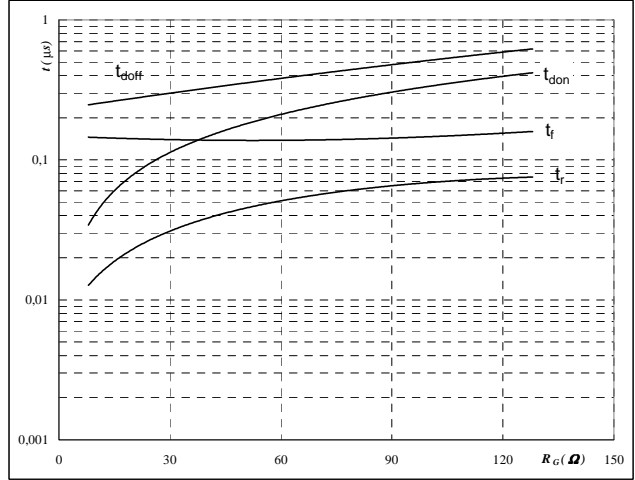
With an inductive load at

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

Figure 11	Output inverter FRED

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

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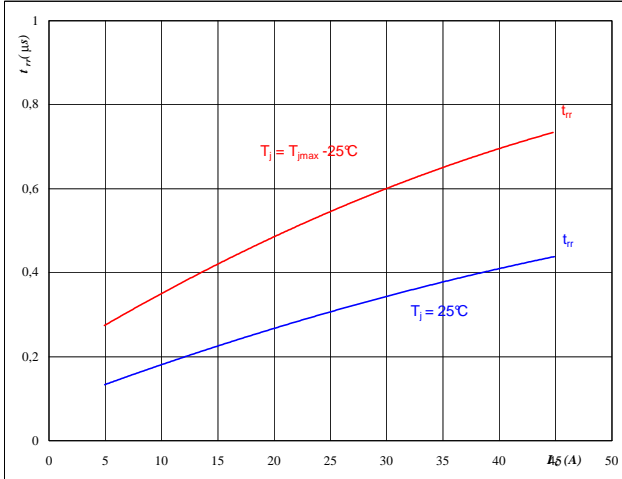
$T_j =$	25/150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	32	Ω

Figure 12	Output inverter FRED

Typical reverse recovery time as a function of IGBT turn on gate resistor
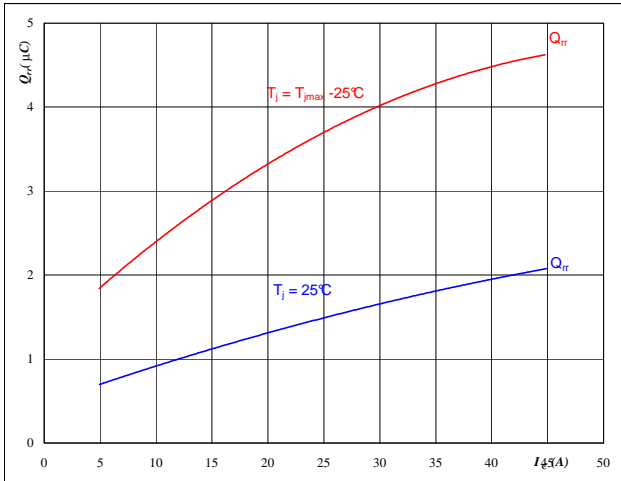
$t_{rr} = f(R_{gon})$

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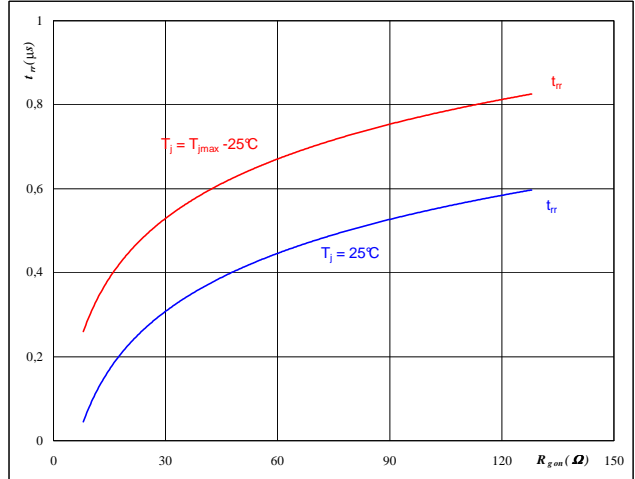
$T_j =$	25/150	°C
$V_R =$	600	V
$I_F =$	25	A
$V_{GE} =$	±15	V

Output Inverter

Figure 13 — Output inverter FRED

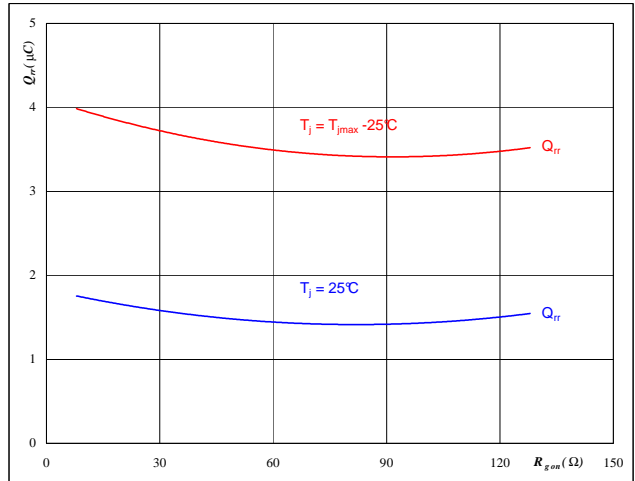**Typical reverse recovery charge as a function of collector current**

$Q_{rr} = f(I_C)$

At

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

Figure 14 — Output inverter FRED

Typical reverse recovery charge as a function of IGBT turn on gate resistor
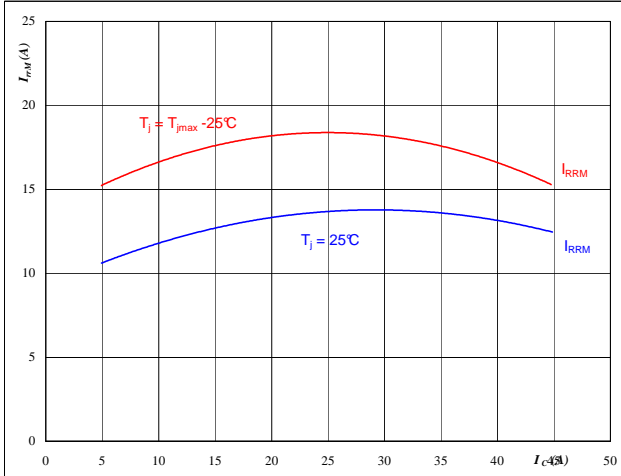
$Q_{rr} = f(R_{gon})$

At

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

Figure 15 — Output inverter FRED

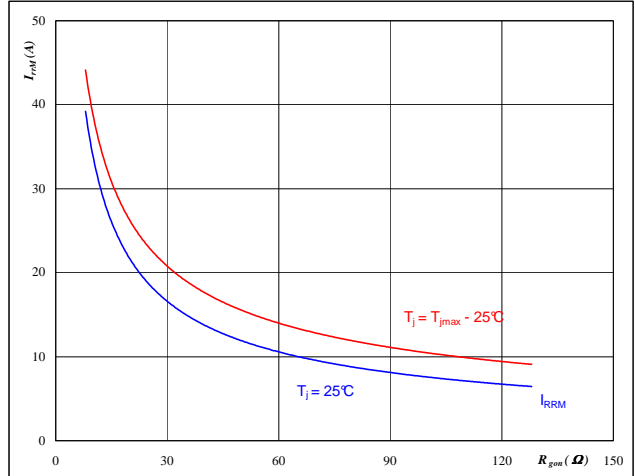**Typical reverse recovery current as a function of collector current**

$I_{RRM} = f(I_C)$

At

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

Figure 16 — Output inverter FRED

Typical reverse recovery current as a function of IGBT turn on gate resistor
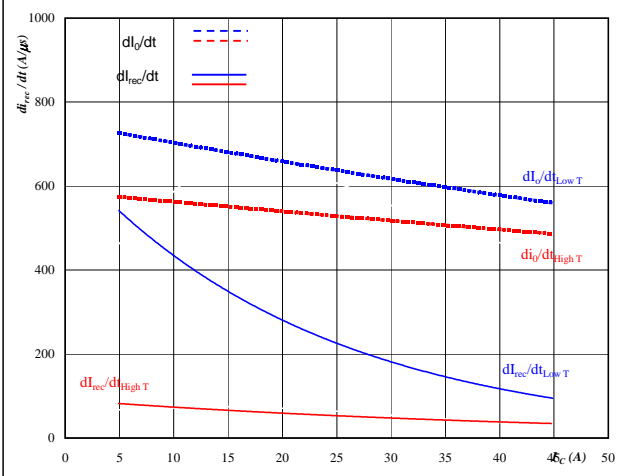
$I_{RRM} = f(R_{gon})$

At

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

Output Inverter

Figure 17	Output inverter FRED

Typical rate of fall of forward and reverse recovery current as a function of collector current
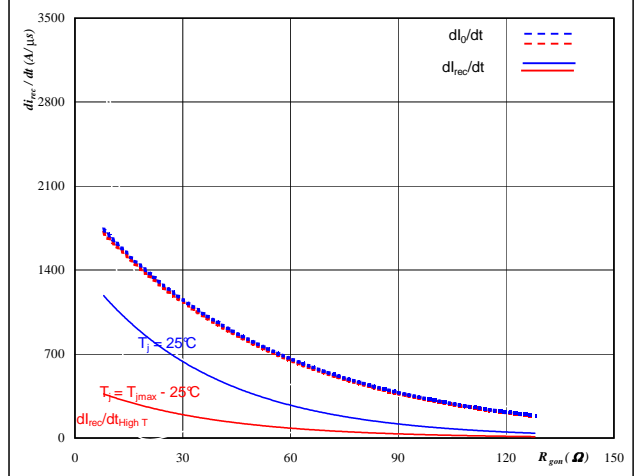
$dI_0/dt, dI_{rec}/dt = f(I_C)$

At

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

Figure 18	Output inverter FRED

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 =	25	A
V_{GE} =	±15	V

Figure 19	Output inverter IGBT

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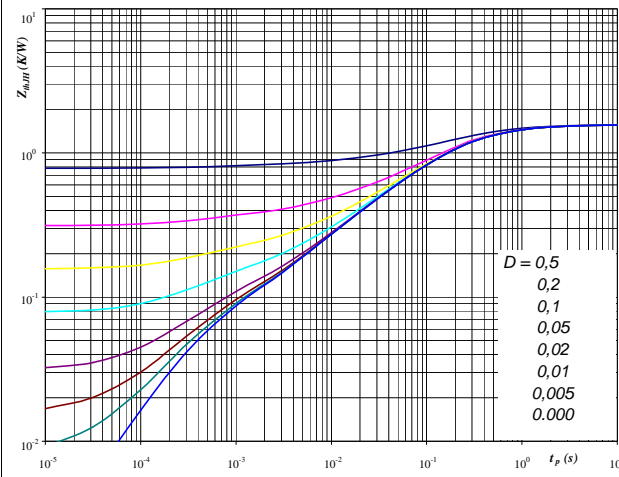
$Z_{thJH} = f(t_p)$

At

D =	t_p / T	
R_{thJH} =	1,57	K/W

IGBT thermal model values

R (C/W)	Tau (s)
0,07	3,7E+00
0,34	6,1E-01
0,73	1,5E-01
0,28	2,9E-02
0,09	4,4E-03
0,06	4,1E-04

Figure 20	Output inverter FRED

FRED transient thermal impedance as a function of pulse width

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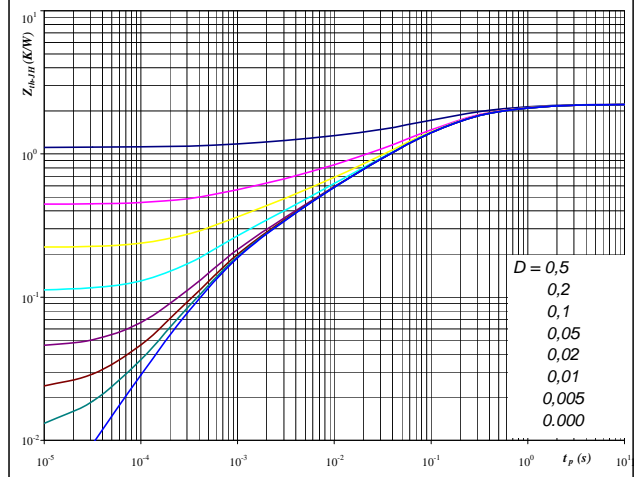
At

D =	t_p / T	
R_{thJH} =	2,22	K/W

FRED thermal model values

R (C/W)	Tau (s)
0,04	9,3E+00
0,33	7,6E-01
0,92	1,5E-01
0,53	3,0E-02
0,25	4,4E-03
0,14	6,5E-04

Output Inverter

Figure 21	Output inverter IGBT

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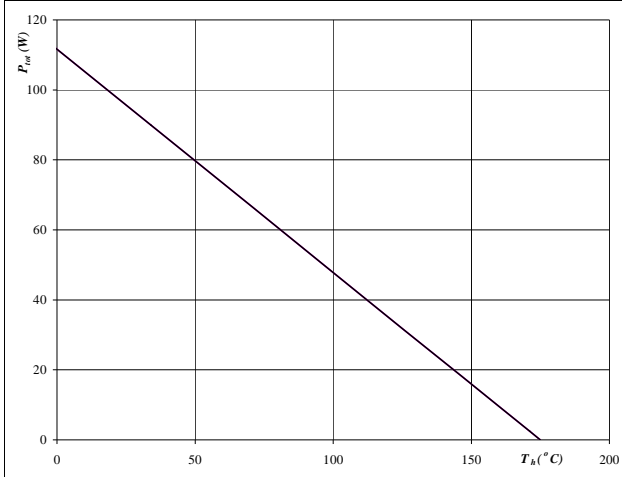
$P_{tot} = f(T_h)$

At

T_j = 175 °C

Figure 22	Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$
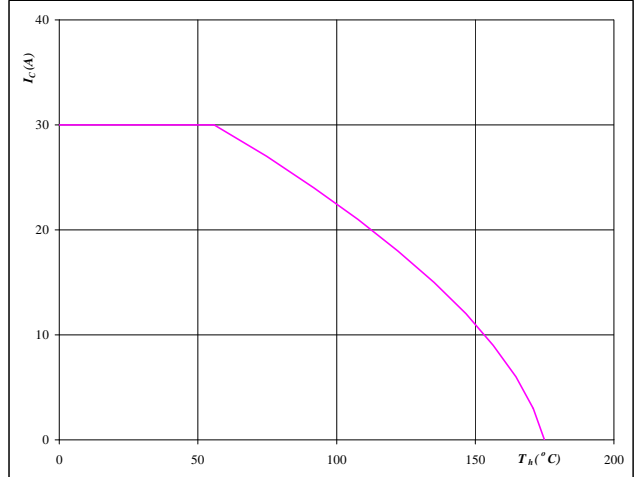
At

T_j = 175 °C
V_{GE} = 15 V

Figure 23	Output inverter FRED

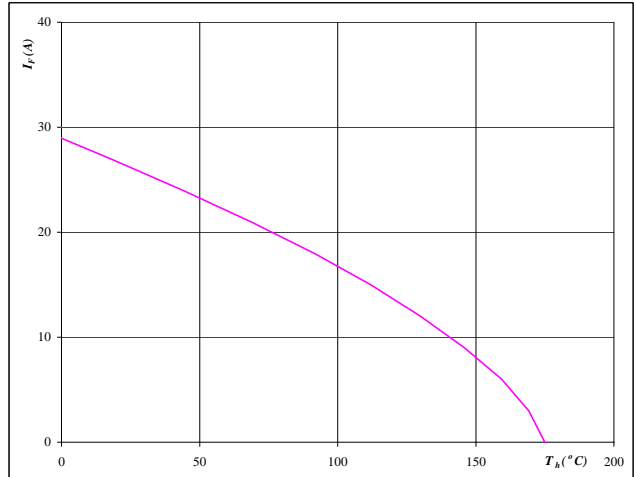**Power dissipation as a function of heatsink temperature**

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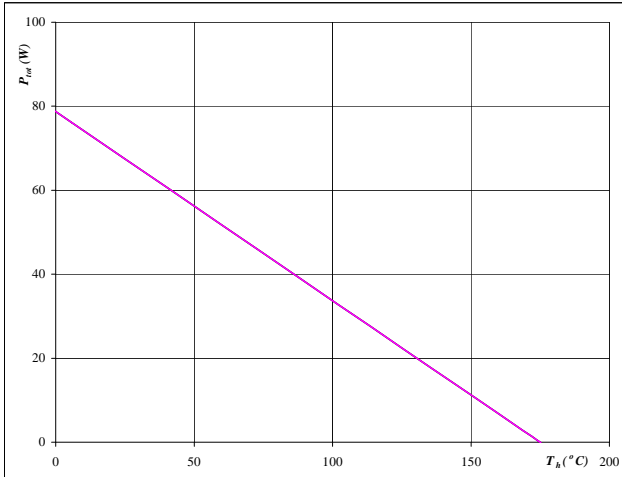
At

T_j = 175 °C

Figure 24	Output inverter FRED

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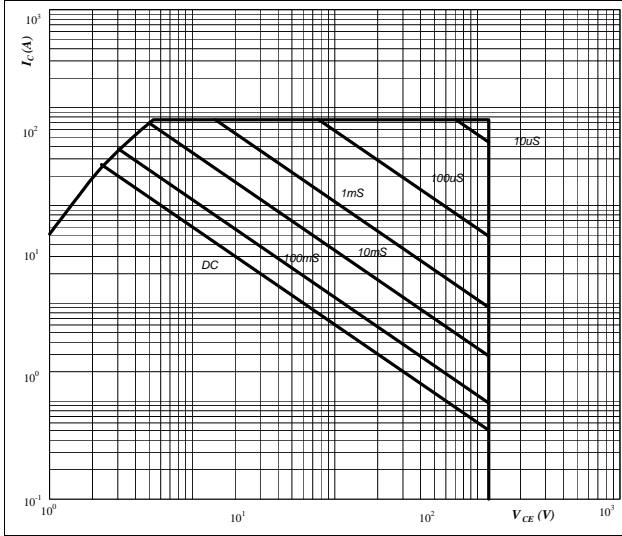
$I_F = f(T_h)$

At

T_j = 175 °C

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Output Inverter

Output inverter IGBT

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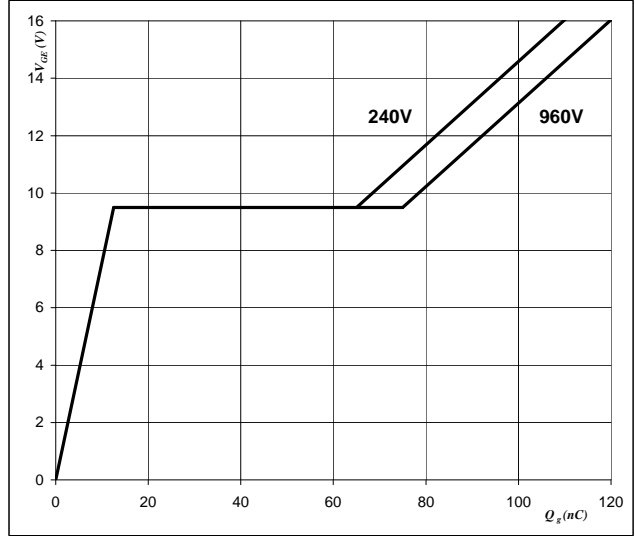of collector-emitter voltage**
$I_C = f(V_{CE})$

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 =	25	A

Brake

Figure 1 — Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$

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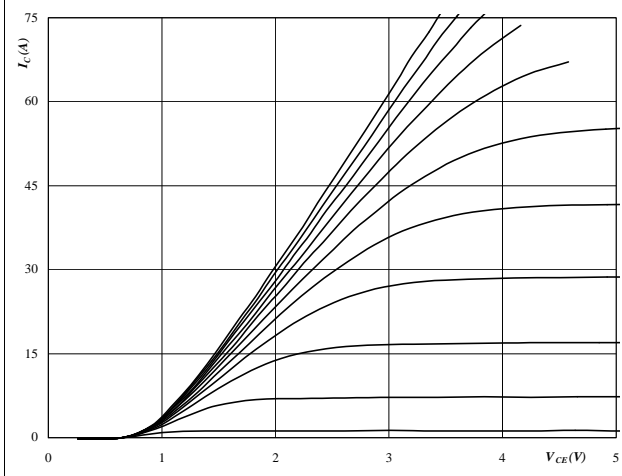
$t_p =$	250	µs
$T_j =$	25	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 2 — Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$

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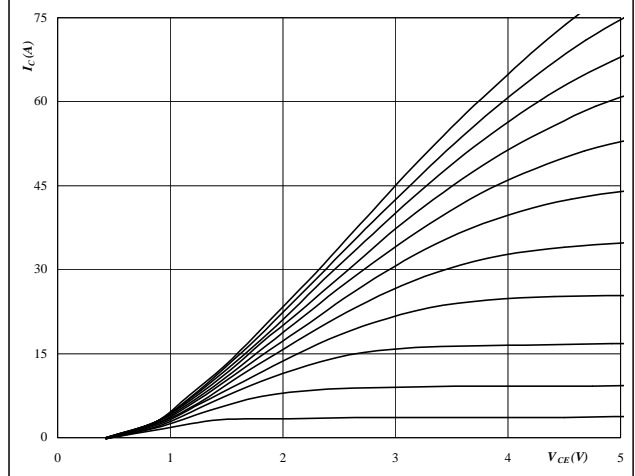
$t_p =$	250	µs
$T_j =$	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 3 — Brake IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

At
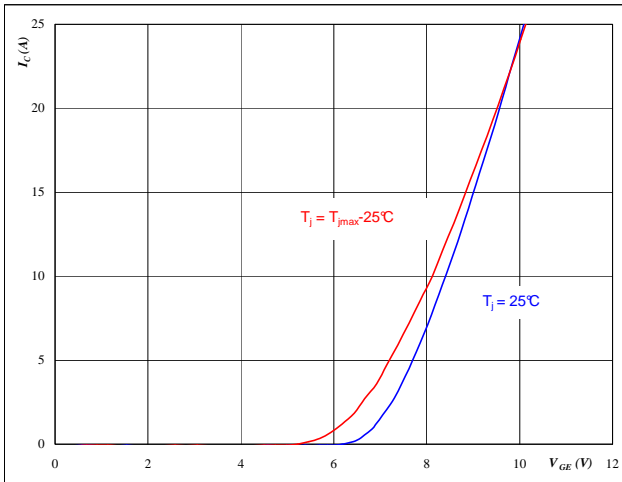
$t_p =$	250	µs
$V_{CE} =$	10	V

Figure 4 — Brake FRED

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$

At
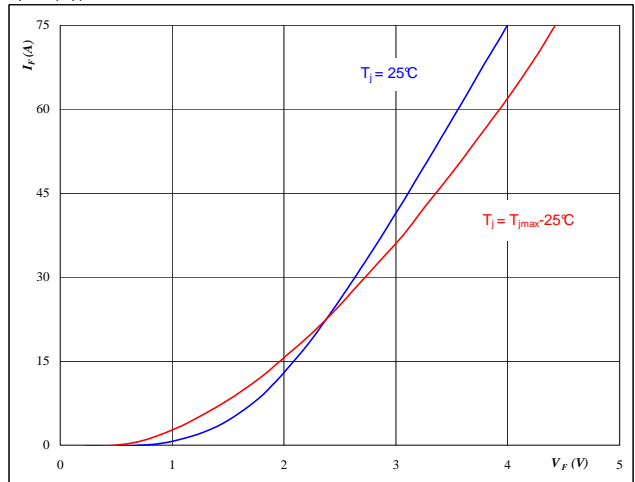
$t_p =$	250	µs

Brake

Figure 5	Brake IGBT

Typical switching energy losses
as a function of collector current

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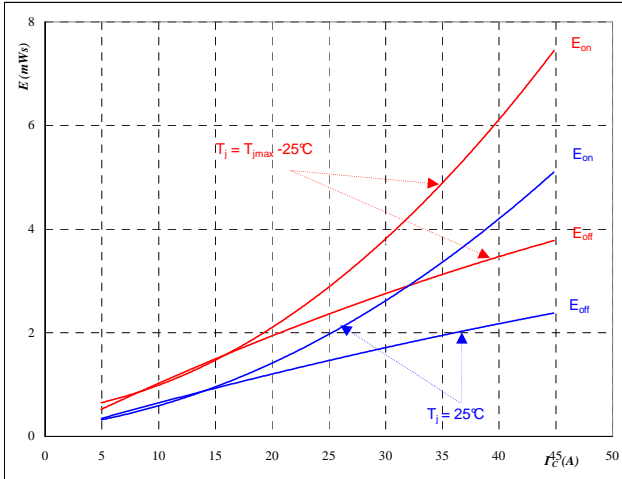
With an inductive load at

T_j =	25/150	℃
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

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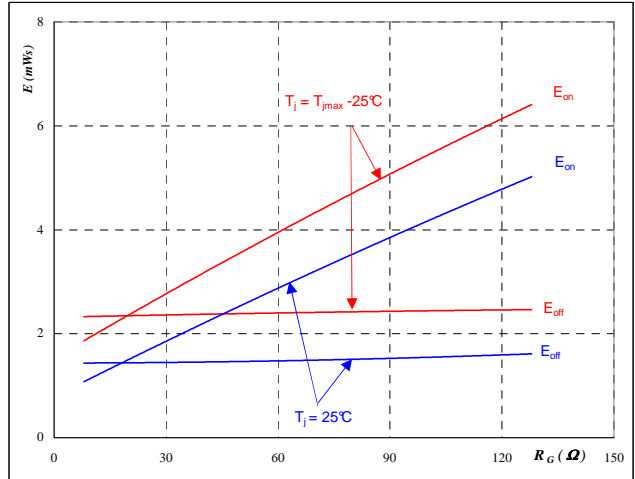
With an inductive load at

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

Figure 7	Brake IGBT

Typical reverse recovery energy loss
as a function of collector current

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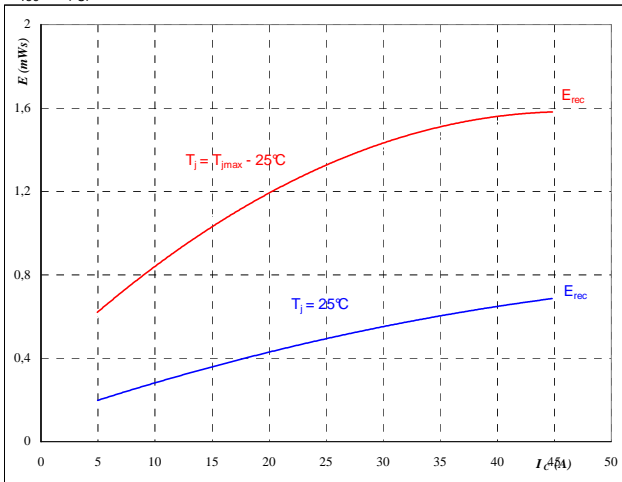
With an inductive load at

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

Figure 8	Brake IGBT

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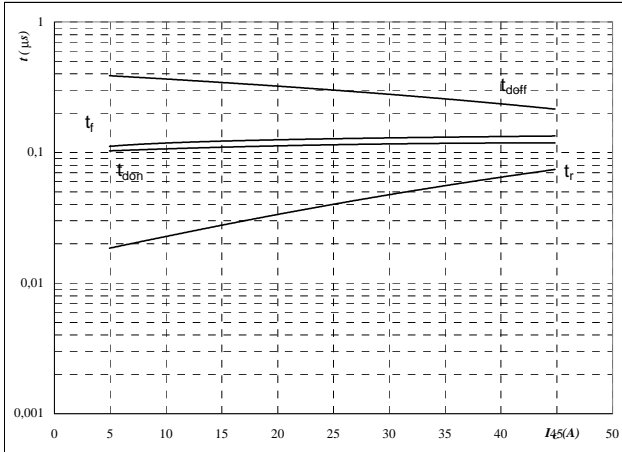
$E_{rec} = f(R_G)$
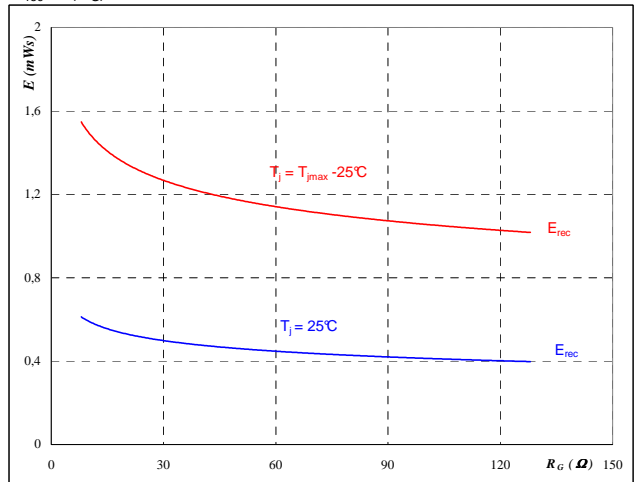
With an inductive load at

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

Brake

Figure 9	Brake IGBT

**Typical switching times as a
function of collector current**

$t = f(I_C)$

With an inductive load at

T_j =	25/150	°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**

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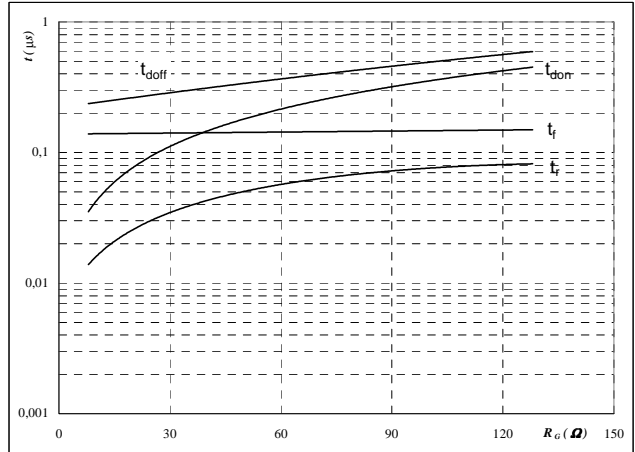
With an inductive load at

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

Figure 11	Brake IGBT

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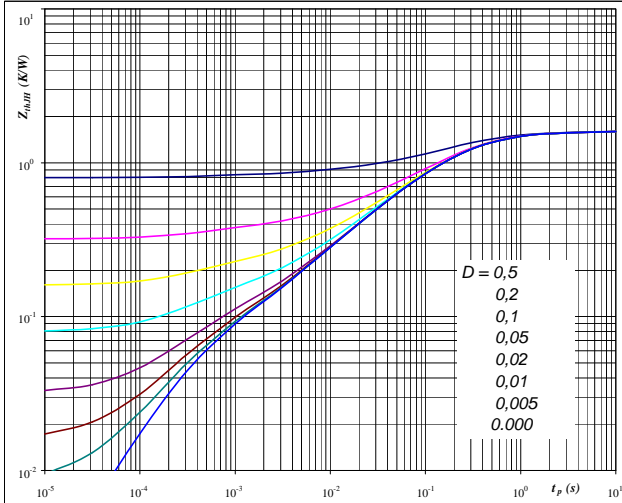
$Z_{thJH} = f(t_p)$

At

D =	tp / T	
R_{thJH} =	1,60	K/W

Figure 12	Brake FRED

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

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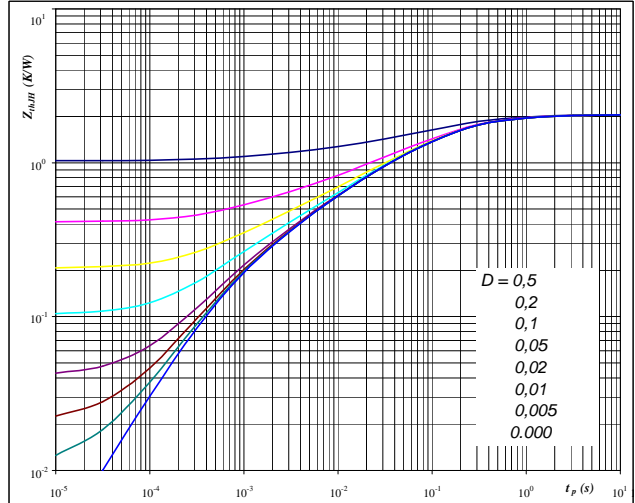
At

D =	tp / T	
R_{thJH} =	2,06	K/W

Brake

Figure 13	Brake IGBT

Power dissipation as a
function of heatsink temperature

$P_{tot} = f(T_h)$

At
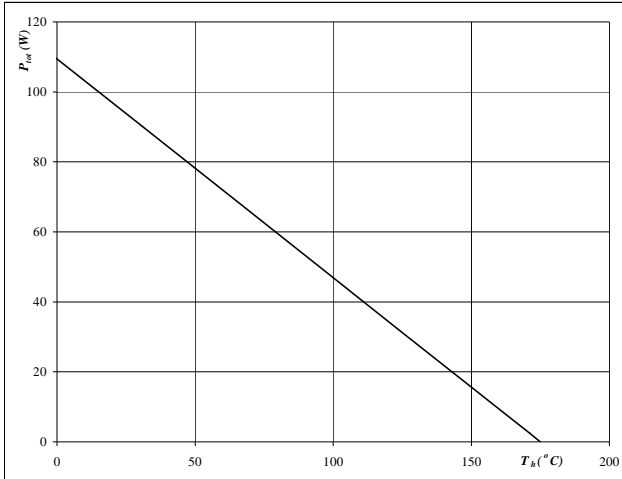
$T_j =$ 175   ºC

Figure 14	Brake IGBT

Collector current as a
function of heatsink temperature

$I_C = f(T_h)$

At
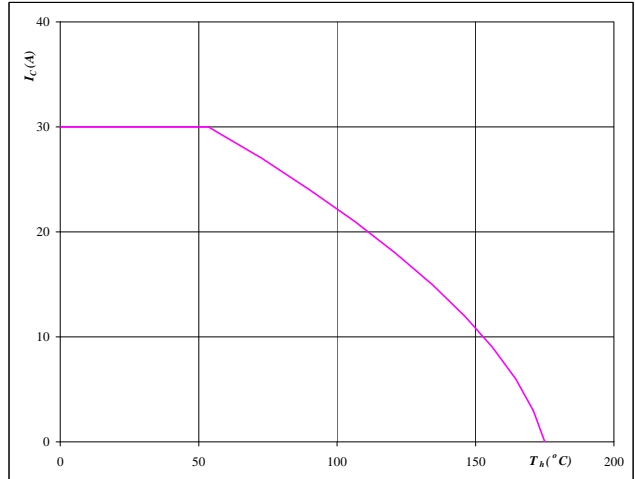
$T_j =$ 175   ºC
$V_{GE} =$ 15   V

Figure 15	Brake FRED

Power dissipation as a
function of heatsink temperature

$P_{tot} = f(T_h)$

At
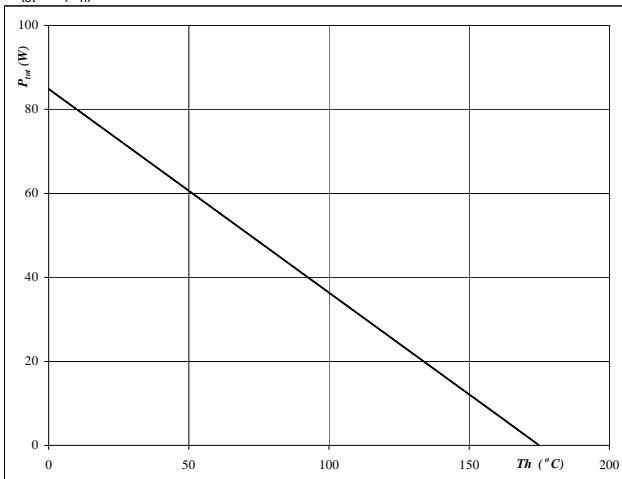
$T_j =$ 175   ºC

Figure 16	Brake FRED

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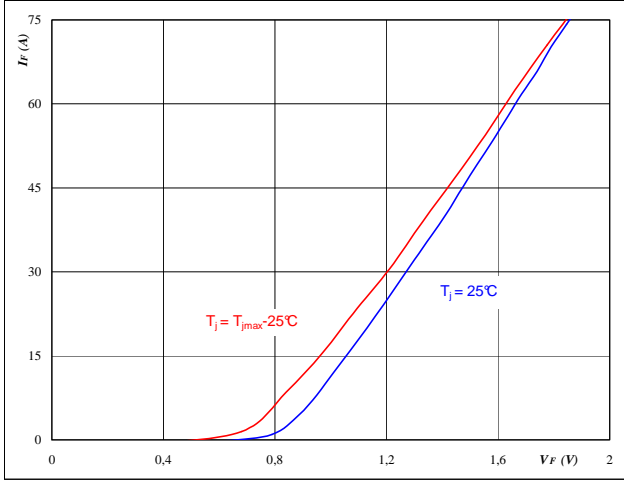
$I_F = f(T_h)$

At
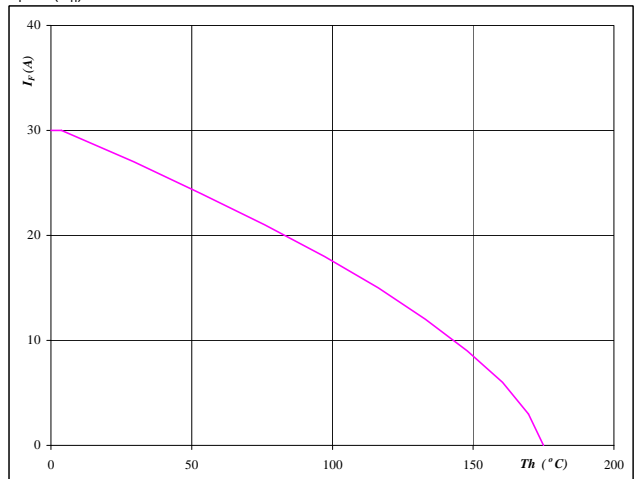
$T_j =$ 175   ºC

Input Rectifier Bridge

Figure 1 | Rectifier diode

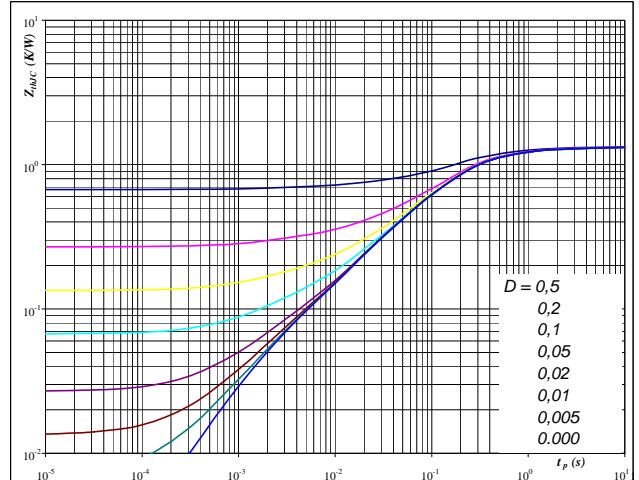**Typical diode forward current as a function of forward voltage**

$I_F = f(V_F)$

At

$t_p =$ 250 µs

Figure 2 | Rectifier diode

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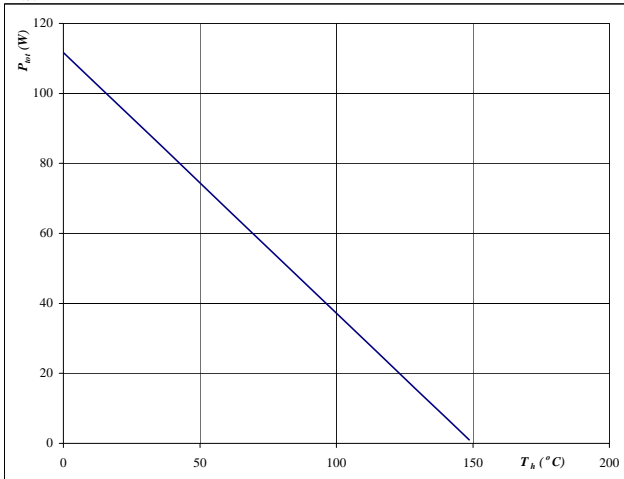
$Z_{thJH} = f(t_p)$

At

$D =$ t_p / T

$R_{thJH} =$ 1,343 K/W

Figure 3 | Rectifier diode

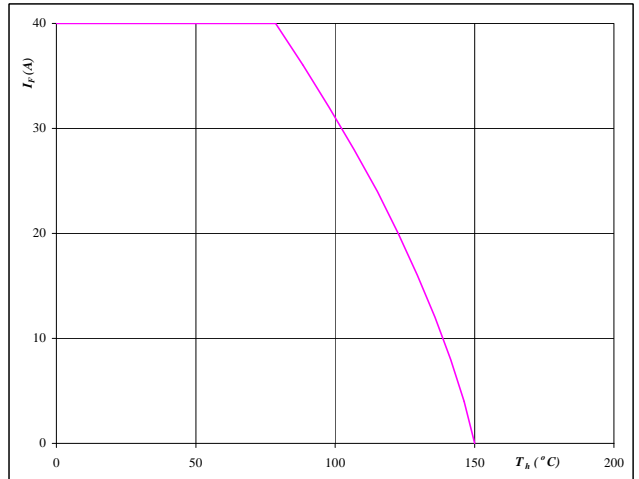**Power dissipation as a function of heatsink temperature**

$P_{tot} = f(T_h)$

At

$T_j =$ 150 ºC

Figure 4 | Rectifier diode

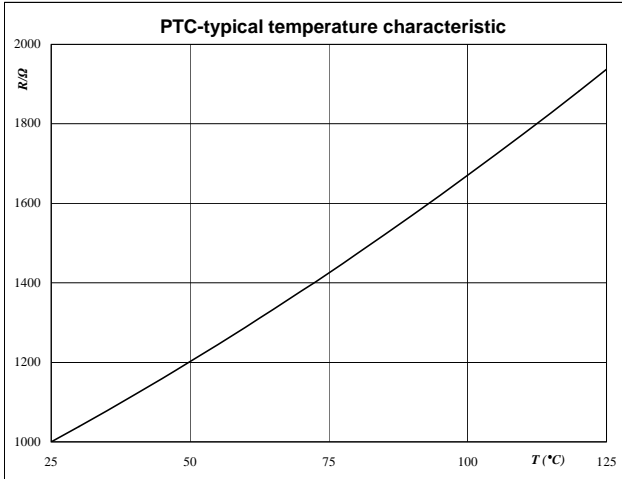**Forward current as a function of heatsink temperature**

$I_F = f(T_h)$

At

$T_j =$ 150 ºC

Thermistor

Figure 1	Thermistor

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

$R_T = f(T)$

PTC-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}
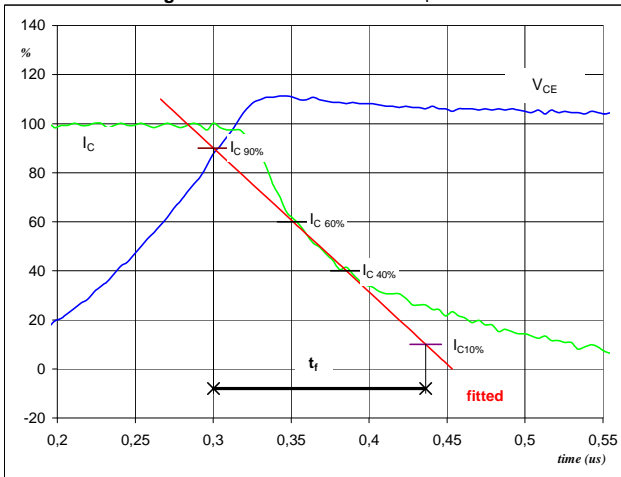**(t_{Eoff} = integrating time for E_{off})**
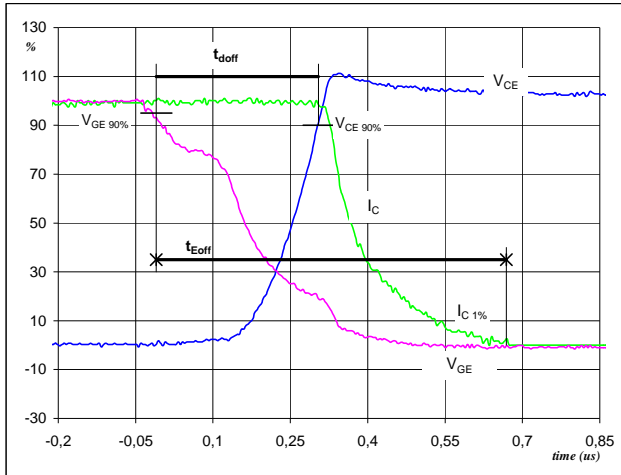
V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	25	A
t_{doff} =	0,30	µs
t_{Eoff} =	0,68	µs

Figure 2 — Output inverter IGBT

Turn-on Switching Waveforms & definition of tdon, t_{Eon}
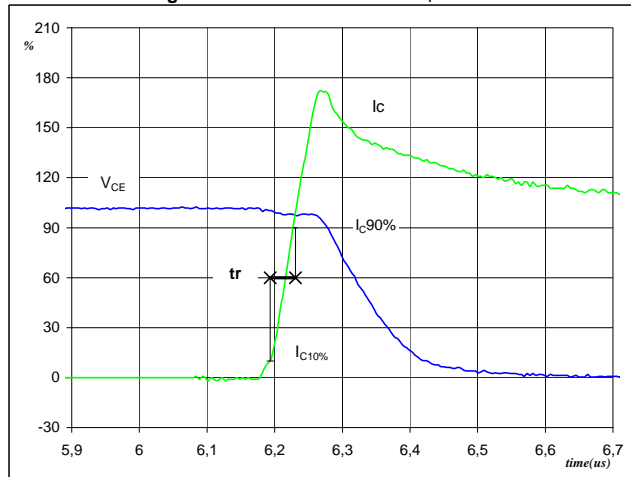**(t_{Eon} = integrating time for E_{on})**
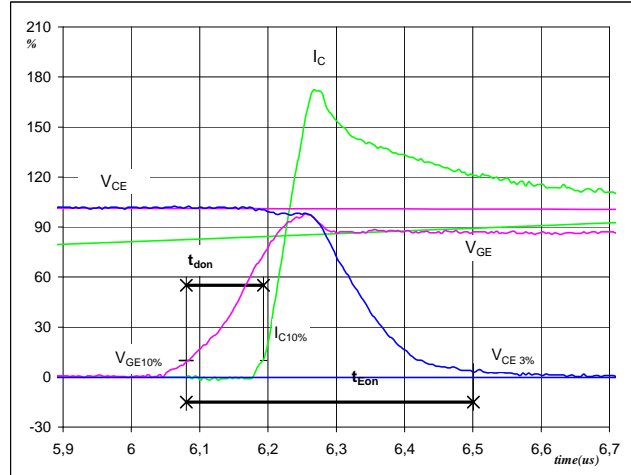
V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	25	A
t_{don} =	0,11	µs
t_{Eon} =	0,42	µs

Figure 3 — Output inverter IGBT

Turn-off Switching Waveforms & definition of t_f

V_C (100%) =	600	V
I_C (100%) =	25	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%) =	25	A
t_r =	0,03	µs

Switching Definitions Output Inverter

Figure 5	Output inverter IGBT

Turn-off Switching Waveforms & definition of t_Eoff
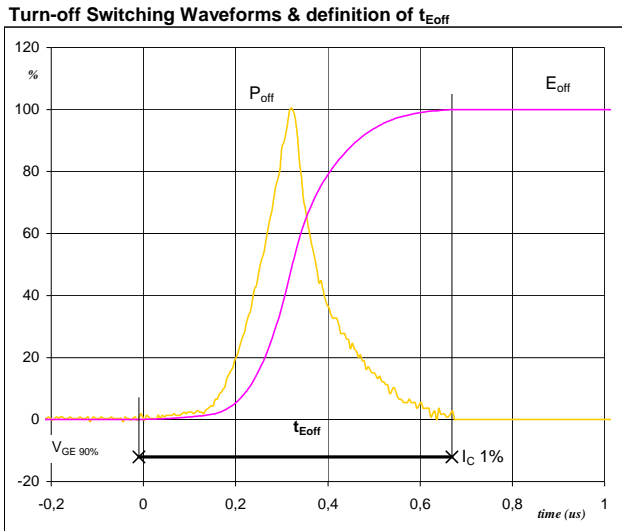
P_{off} (100%) =	14,95	kW
E_{off} (100%) =	2,43	mJ
t_{Eoff} =	0,68	µs

Figure 6	Output inverter IGBT

Turn-on Switching Waveforms & definition of t_Eon
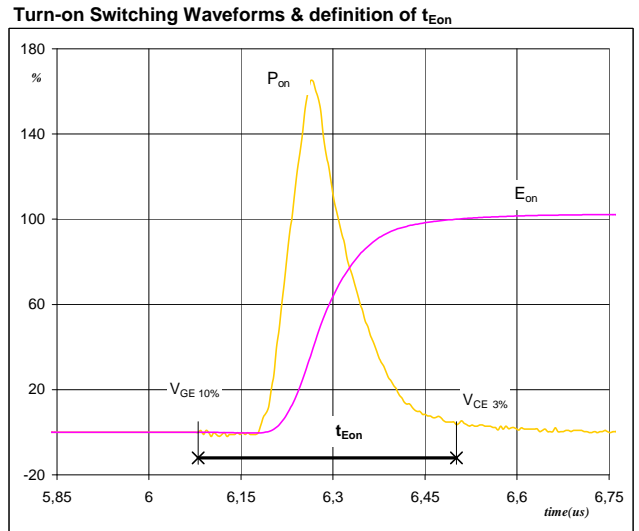
P_{on} (100%) =	14,95	kW
E_{on} (100%) =	2,77	mJ
t_{Eon} =	0,42	µs

Figure 7	Output inverter IGBT

Turn-off Switching Waveforms & definition of t_rr
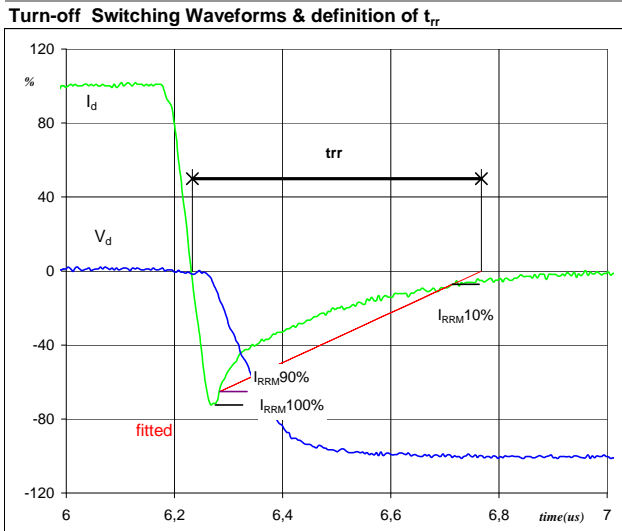
V_d (100%) =	600	V
I_d (100%) =	25	A
I_{RRM} (100%) =	18	A
t_{rr} =	0,54	µs

Switching Definitions Output Inverter

| Figure 8 | Output inverter FRED |

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

(t_{Qrr} = integrating time for Q_{rr})
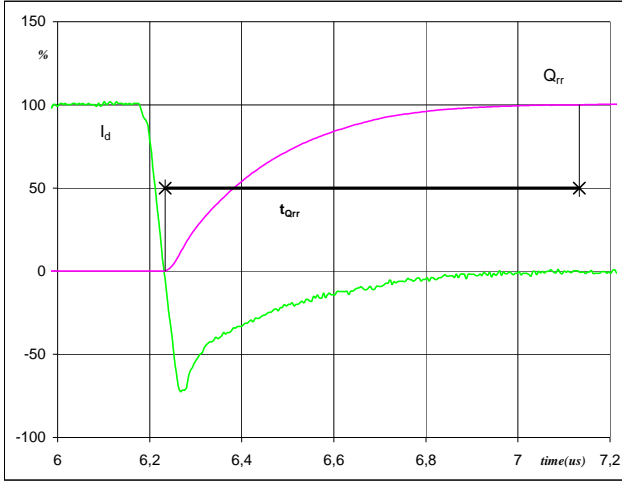
I_d (100%) =	25	A
Q_{rr} (100%) =	3,69	µC
t_{Qrr} =	0,90	µs

| Figure 9 | Output inverter FRED |

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

(t_{Erec}= integrating time for E_{rec})
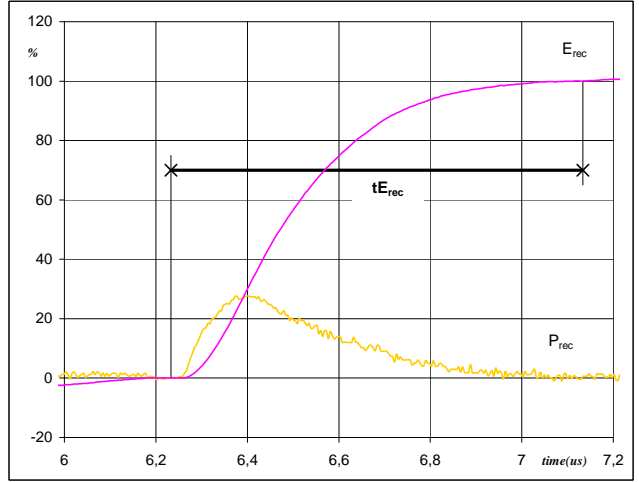
P_{rec} (100%) =	14,95	kW
E_{rec} (100%) =	1,44	mJ
t_{Erec} =	0,90	µs

Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
with std lid (black V23990-K12-T-PM)	V23990-K229-A41-/0A/-PM	K229A41	K229A41-/0A/
with std lid (black V23990-K12-T-PM) and P12	V23990-K229-A41-/1A/-PM	K229A41	K229A41-/1A/
with thin lid (white V23990-K13-T-PM)	V23990-K229-A41-/0B/-PM	K229A41	K229A41-/0B/
with thin lid (white V23990-K13-T-PM) and P12	V23990-K229-A41-/1B/-PM	K229A41	K229A41-/1B/

Outline

X = assembled pin position
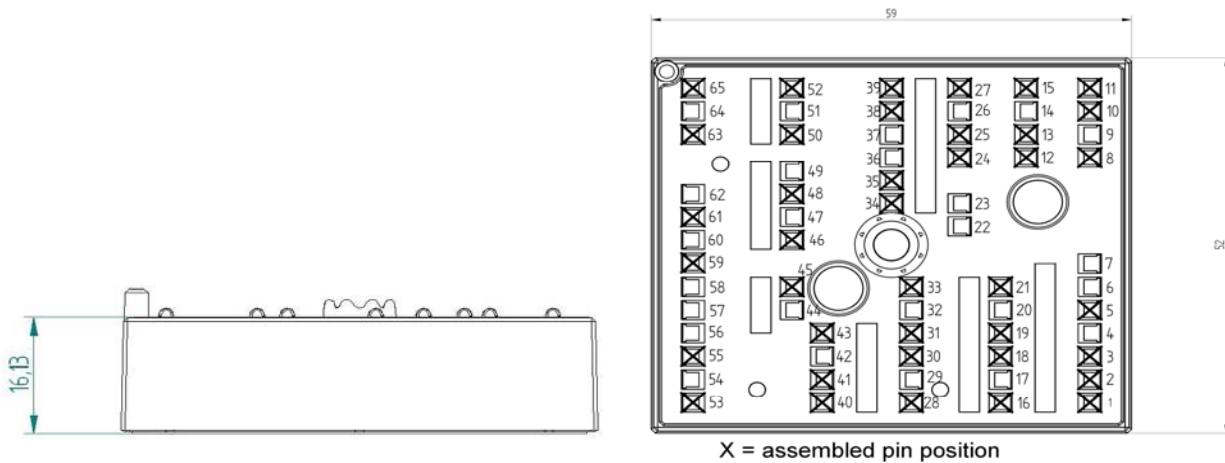
Pinout
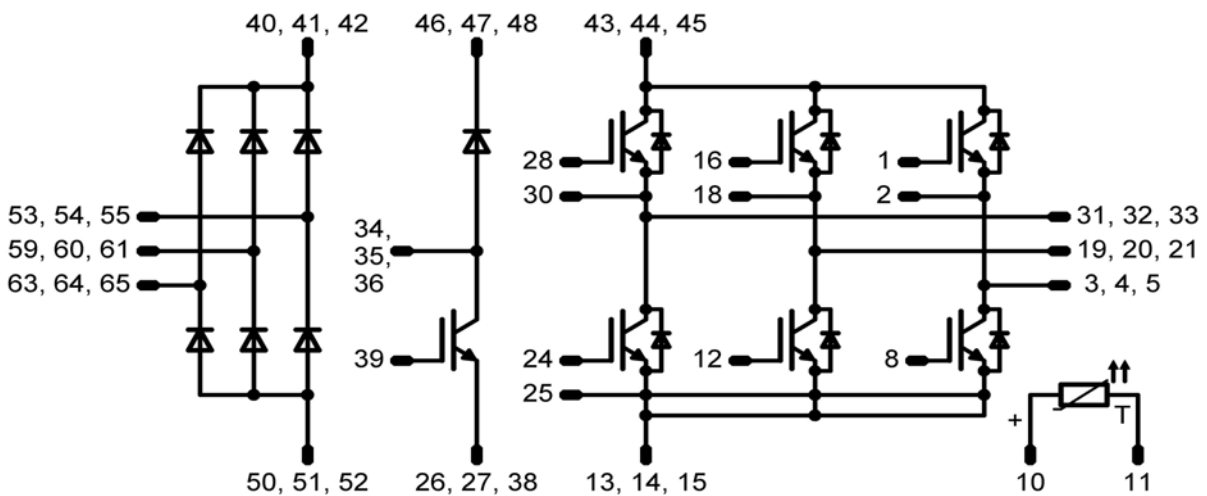
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