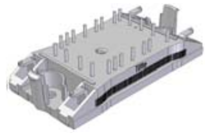
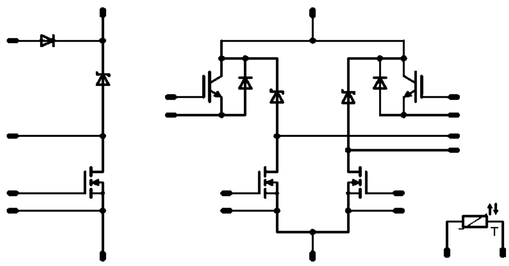
flowSOL BI — 600V/35A

Features
- High efficiency
- Ultra fast switching frequency
- Low inductive design
- Open emitter
- SiC in boost and H bridge

flow0 housing


Target Applications
- Transformerless solar inverters

Schematic


Types
- FZ06BIA045FH02

Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Bypass Diode					
Repetitive peak reverse voltage	V_{RRM}			600	V
Forward current per diode	I_{FAV}	DC current	T_h=80°C T_c=80°C	36 49	A
Surge forward current	I_{FSM}	t_p=10ms	T_j=25°C	370	A
I2t-value	I^2t			360	A^2s
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	42 63	W
Maximum Junction Temperature	$T_j$max			150	°C
Input Boost MOSFET					
Drain to source breakdown voltage	V_{DS}			600	V
DC drain current	I_D	T_j=$T_j$max	T_h=80°C T_c=80°C	30 37	A
Pulsed drain current	I_{Dpulse}	t_p limited by $T_j$max		230	A
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	92 139	W
Gate-source peak voltage	V_{GS}			±20	V
Maximum Junction Temperature	$T_j$max			150	°C

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Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Input Boost Diode					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25°C		600	V
DC forward current	I_F	$T_j=T_j$max	T_h=80°C T_c=80°C	20 24	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		70	A
Power dissipation	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	41 62	W
Maximum Junction Temperature	$T_j$max			175	°C
Buck Diode					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25°C		600	V
DC forward current	I_F	$T_j=T_j$max	T_h=80°C T_c=80°C	13 16	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max	T_c=100°C	35	A
Power dissipation per Diode	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	29 44	W
Maximum Junction Temperature	$T_j$max			175	°C
Buck MOSFET					
Drain to source breakdown voltage	V_{DS}			600	V
DC drain current	I_D	$T_j=T_j$max	T_h=80°C T_c=80°C	30 37	A
Pulsed drain current	I_{Dpulse}	t_p limited by $T_j$max	Tc=25°C	230	A
Power dissipation	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	94 142	W
Gate-source peak voltage	Vgs			±20	V
Maximum Junction Temperature	$T_j$max			150	°C
Boost IGBT					
Collector-emitter break down voltage	V_{CE}			600	V
DC collector current	I_C	$T_j=T_j$max	T_h=80°C T_c=80°C	40 40	A
Repetitive peak collector current	I_{Cpuls}	t_p limited by $T_j$max		150	A
Power dissipation per IGBT	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	86 131	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150°C V_{GE}=15V		6 360	μs V
Maximum Junction Temperature	$T_j$max			175	°C

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Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost Inverse Diode					
Peak Repetitive Reverse Voltage	V_{RRM}	T_c=25°C		600	V
DC forward current	I_F	T_j=$T_j$max	T_h=80°C T_c=80°C	16 20	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		20	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	32 49	W
Maximum Junction Temperature	$T_j$max			175	°C
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(Tjmax - 25)	°C
Insulation Properties					
Insulation voltage	V_{is}	t=2s	DC voltage	4000	V
Creepage distance				min 12,7	mm
Clearance				min 12,7	mm

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Characteristic Values

Parameter	Symbol	Conditions	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	Unit
Bypass Diode										
Forward voltage	solar inverte				15	Tj=25°C Tj=125°C	0,7	1,01 0,93	1,3	V
Threshold voltage (for power loss calc. only)	V_{to}					Tj=25°C Tj=125°C		0,86 0,75		V
Slope resistance (for power loss calc. only)	r_t					Tj=25°C Tj=125°C		0,01 0,01		Ω
Reverse current	I_r			1200		Tj=25°C Tj=125°C			0,05	mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal foil thickness=76um Kunze foil KU-ALF5						1,68		K/W
Input Boost MOSFET										
Static drain to source ON resistance	$R_{DS(on)}$		10		44	Tj=25°C Tj=125°C		0,04 0,09		Ω
Gate threshold voltage	$V_{(GS)th}$	VGS=VDS			0,003	Tj=25°C Tj=125°C	2,1	3	3,9	V
Gate to Source Leakage Current	I_{gss}		20	0		Tj=25°C Tj=125°C			200	nA
Zero Gate Voltage Drain Current	I_{dss}		0	600		Tj=25°C Tj=125°C			25000	nA
Turn On Delay Time	$t_{d(ON)}$	Rgoff=4 Ω Rgon=4 Ω	10	400	15	Tj=25°C Tj=125°C		28 27		ns
Rise Time	t_r					Tj=25°C Tj=125°C		5 6		
Turn off delay time	$t_{d(OFF)}$					Tj=25°C Tj=125°C		154 167		
Fall time	t_f					Tj=25°C Tj=125°C		10 9		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		0,063 0,072		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		0,025 0,025		
Total gate charge	Q_g	Rgon=4 Ω	10	400	44	Tj=25°C Tj=125°C		150	190	nC
Gate to source charge	Q_{gs}					Tj=25°C Tj=125°C		34		
Gate to drain charge	Q_{gd}					Tj=25°C Tj=125°C		51		
Input capacitance	C_{iss}	f=1MHz	0	100		Tj=25°C		6800		pF
Output capacitance	C_{oss}							320		
Reverse transfer capacitance	C_{rss}							48		
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,76		K/W
Input Boost Diode										
Forward voltage	V_F				16	Tj=25°C Tj=150°C	1	1,54 1,71	1,8	V
Reverse leakage current	I_{rm}		10	400	15	Tj=25°C Tj=150°C			400	μA
Peak recovery current	I_{RRM}	Rgon=4 Ω	10	400	15	Tj=25°C Tj=150°C		16,63 14,68		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		9,3 10,4		ns
Reverse recovery charge	Q_{rr}					Tj=25°C Tj=150°C		0,058 0,064		μC
Reverse recovered energy	E_{rec}					Tj=25°C Tj=150°C		0,005 0,006		mWs
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=150°C		4244 2752		A/μs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,34		K/W

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Characteristic Values

Parameter	Symbol	Conditions	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	Value Min	Value Typ	Value Max	Unit
Buck Diode										
Diode forward voltage	V_F				8	Tj=25°C Tj=125°C	1	1,52 1,64	1,8	V
Peak reverse recovery current	I_{RRM}	Rgon=4 Ω	10	400	15	Tj=25°C Tj=125°C		14 12		A
Reverse recovery time	t_{rr}	Rgon=4 Ω	10	400	15	Tj=25°C Tj=125°C		7,8 8,8		ns
Reverse recovered charge	Q_{rr}	Rgon=4 Ω	10	400	15	Tj=25°C Tj=125°C		0,05 0,05		μC
Peak rate of fall of recovery current	di(rec)max /dt	Rgon=4 Ω	10	400	15	Tj=25°C Tj=125°C		4078 3373		A/μs
Reverse recovered energy	Erec	Rgon=4 Ω	10	400	15	Tj=25°C Tj=125°C		0,008 0,007		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						3,28		K/W
Buck MOSFET										
Static drain to source ON resistance	$R_{ds(on)}$		10		44	Tj=25°C Tj=125°C		45 90		mΩ
Gate threshold voltage	$V_{(GS)th}$			$V_{DS}=V_{GS}$	0,003	Tj=25°C Tj=125°C	2,1	3	3,9	V
Gate to Source Leakage Current	I_{gss}		20	0		Tj=25°C Tj=125°C			200	nA
Zero Gate Voltage Drain Current	I_{dss}		0	600		Tj=25°C Tj=125°C			25000	nA
Turn On Delay Time	$t_{d(ON)}$	Rgoff=4 Ω Rgon=4 Ω	10	400	15	Tj=25°C Tj=125°C		31 30		ns
Rise Time	t_r	Rgoff=4 Ω Rgon=4 Ω	10	400	15	Tj=25°C Tj=125°C		5,4 6		ns
Turn off delay time	$t_{d(OFF)}$	Rgoff=4 Ω Rgon=4 Ω	10	400	15	Tj=25°C Tj=125°C		147 158		ns
Fall time	t_f	Rgoff=4 Ω Rgon=4 Ω	10	400	15	Tj=25°C Tj=125°C		13,7 10,3		ns
Turn-on energy loss per pulse	E_{on}	Rgoff=4 Ω Rgon=4 Ω	10	400	15	Tj=25°C Tj=125°C		0,063 0,067		mWs
Turn-off energy loss per pulse	E_{off}	Rgoff=4 Ω Rgon=4 Ω	10	400	15	Tj=25°C Tj=125°C		0,02 0,03		mWs
Total gate charge	Q_g		10	400	44	Tj=25°C		150	190	nC
Gate to source charge	Q_{gs}		10	400	44	Tj=25°C		34		nC
Gate to drain charge	Q_{gd}		10	400	44	Tj=25°C		51		nC
Input capacitance	C_{iss}	f=1MHz	0	100		Tj=25°C		6800		pF
Output capacitance	C_{oss}	f=1MHz	0	100		Tj=25°C		320		pF
Reverse transfer capacitance	C_{rss}	f=1MHz	0	100		Tj=25°C		48		pF
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,75		K/W

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Characteristic Values

Parameter	Symbol	Conditions	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	Unit
Boost IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	V_{CE}=V_{GE}			0,0008	Tj=25°C Tj=125°C	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		50	Tj=25°C Tj=125°C		1,18 1,21		V
Collector-emitter cut-off incl diode	I_{CES}		0	600		Tj=25°C Tj=125°C			0,03	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=125°C			650	nA
Integrated Gate resistor	R_{gint}							none		Ω
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		3140		pF
Output capacitance	C_{oss}							200		
Reverse transfer capacitance	C_{rss}							93		
Gate charge	Q_{Gate}		15	480	50	Tj=25°C		310		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,1		K/W

Note: For the **Boost IGBT** only LF switching allowed

Parameter	Symbol	Conditions	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	Unit
Boost Inverse Diode										
Diode forward voltage	V_F				10	Tj=25°C Tj=125°C		1,68 1,63		V
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,949		K/W
Thermistor										
Rated resistance*	R_{25}					Tj=25°C	17,5	22	29,0	kΩ
	R_{100}	Tol. ±5%						1486		Ω
Power dissipation	P					Tj=25°C		210		mW
B-value	$B_{(25/100)}$	Tol. ±3%				Tj=25°C		4000		K

* see details on **Thermistor** charts on **Figure 2.**

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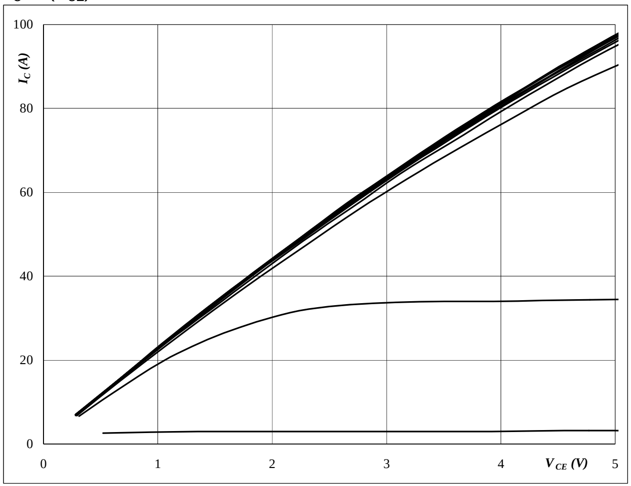
Figure 1 MOSFET

Typical output characteristics

$I_C = f(V_{CE})$



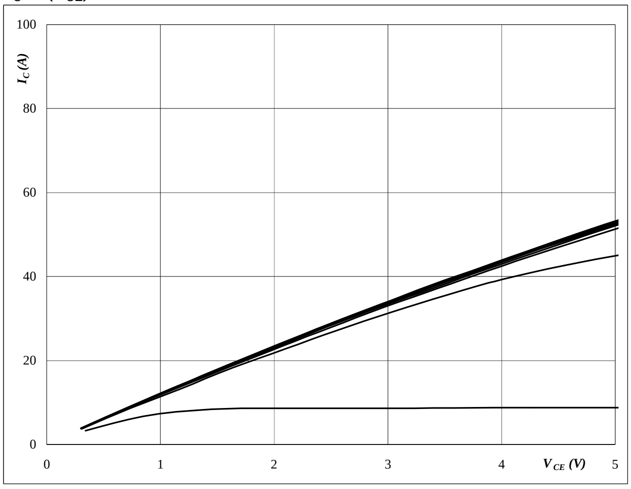
At

t_p =	250	μs
T_j =	25	°C
V_{GE} from	4 V to 14 V in steps of 1 V	

Figure 2 MOSFET

Typical output characteristics

$I_C = f(V_{CE})$



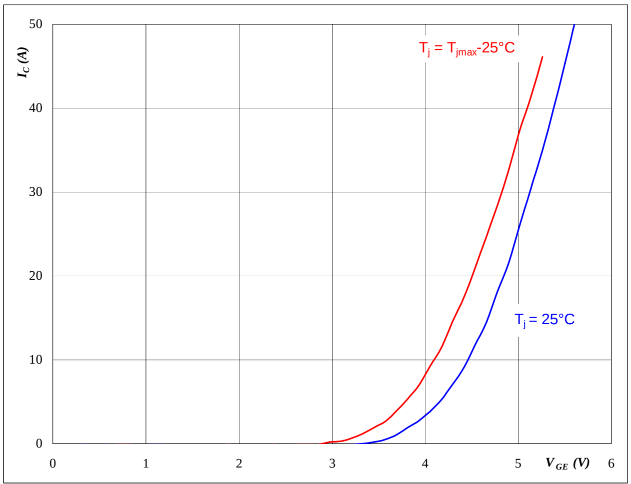
At

t_p =	250	μs
T_j =	125	°C
V_{GE} from	4 V to 14 V in steps of 1 V	

Figure 3 MOSFET

Typical transfer characteristics

$I_C = f(V_{GE})$



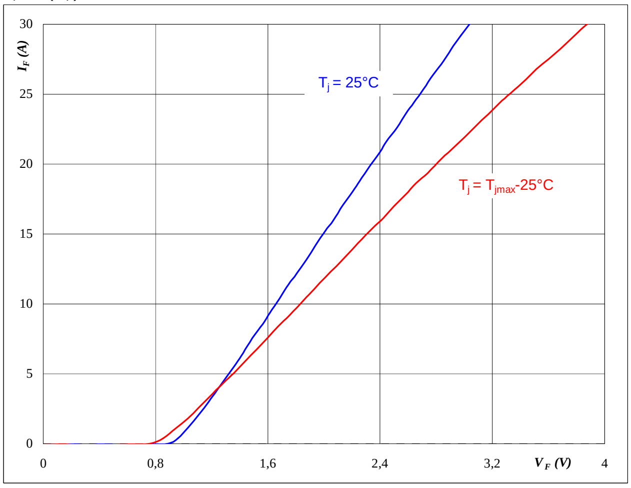
At

t_p =	250	μs
V_{CE} =	10	V

Figure 4 FRED

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

t_p =	250	μs

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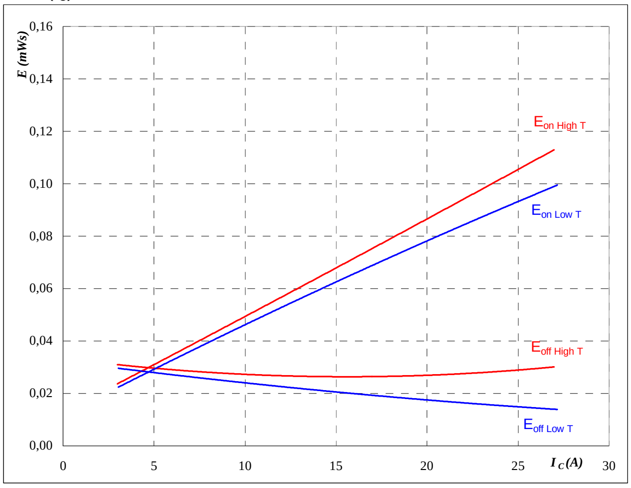
Figure 5 MOSFET

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



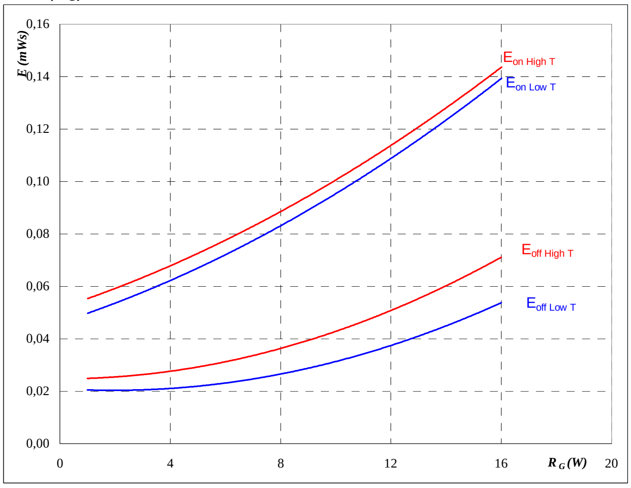
With an inductive load at

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 6 MOSFET

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



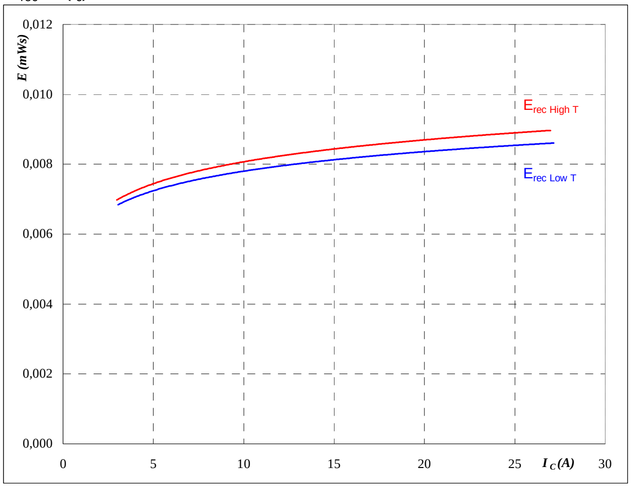
With an inductive load at

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
I_C =	15	A

Figure 7 FRED

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_c)$



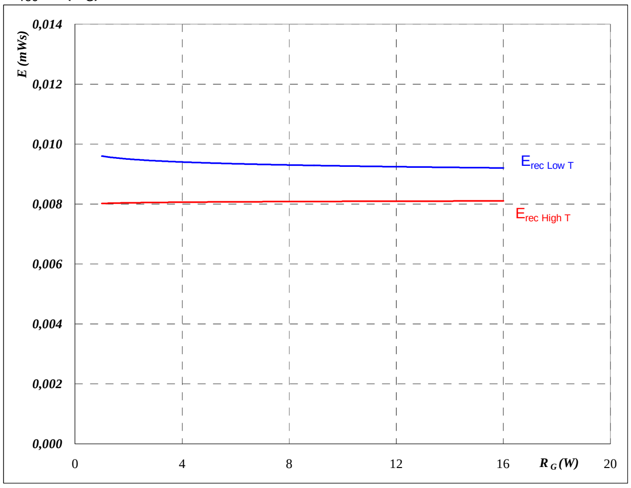
With an inductive load at

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω

Figure 8 FRED

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} =	400	V
V_{GE} =	10	V
I_C =	15	A

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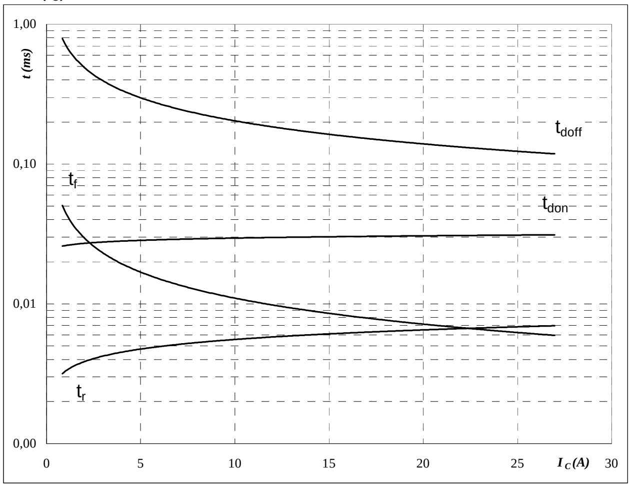
Figure 9 MOSFET

Typical switching times as a function of collector current

t = f(I_C)



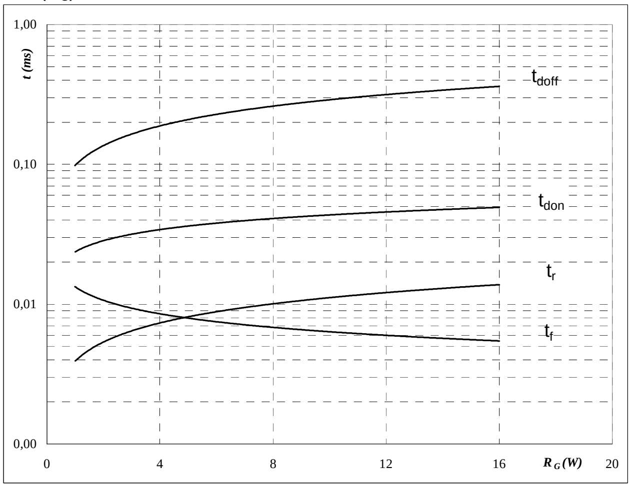
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10 MOSFET

Typical switching times as a function of gate resistor

t = f(R_G)



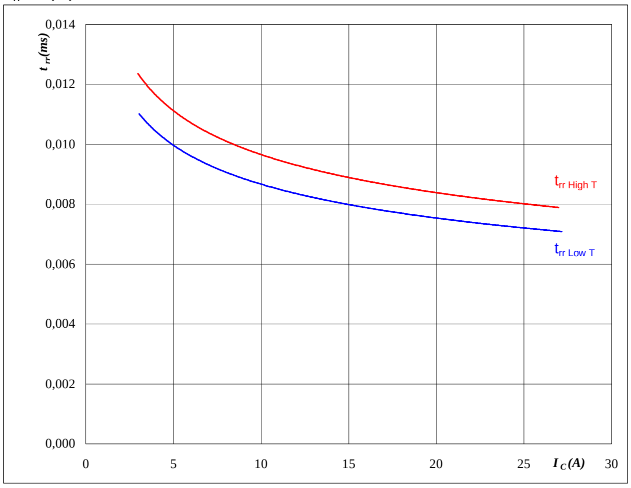
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	10	V
I_C =	15	A

Figure 11 FRED

Typical reverse recovery time as a function of collector current

t_{rr} = f(Ic)



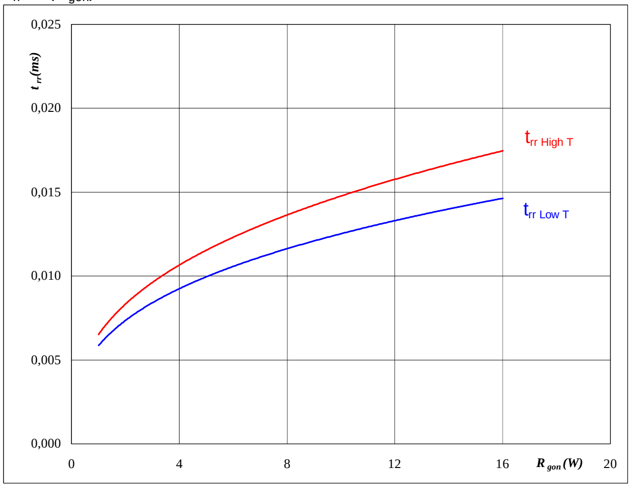
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω

Figure 12 FRED

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

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



At

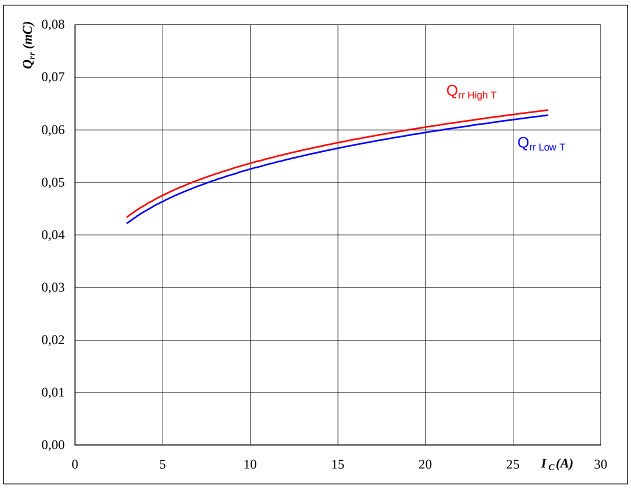
T_j =	25/125	°C
V_R =	400	V
I_F =	15	A
V_{GE} =	10	V

Buck

Figure 13 FRED

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



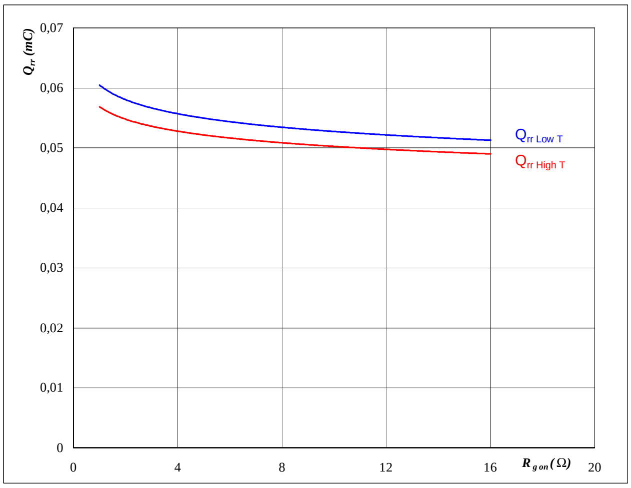
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω

Figure 14 FRED

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

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



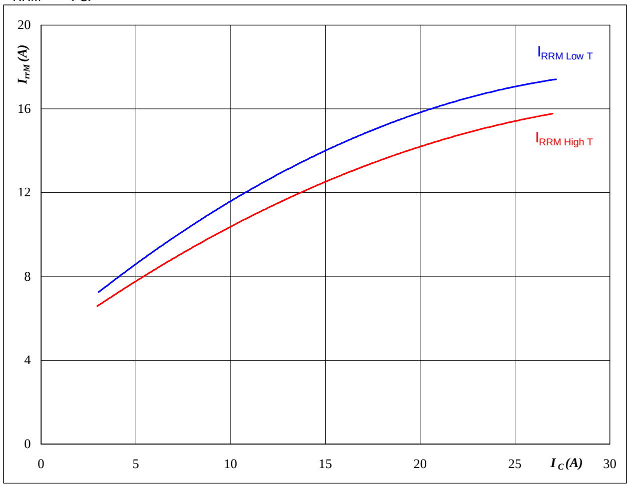
At

T_j =	25/125	°C
V_R =	400	V
I_F =	15	A
V_{GE} =	10	V

Figure 15 FRED

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



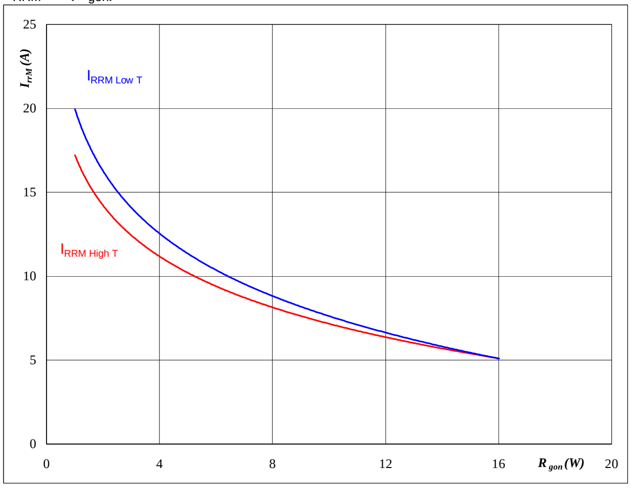
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω

Figure 16 FRED

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

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



At

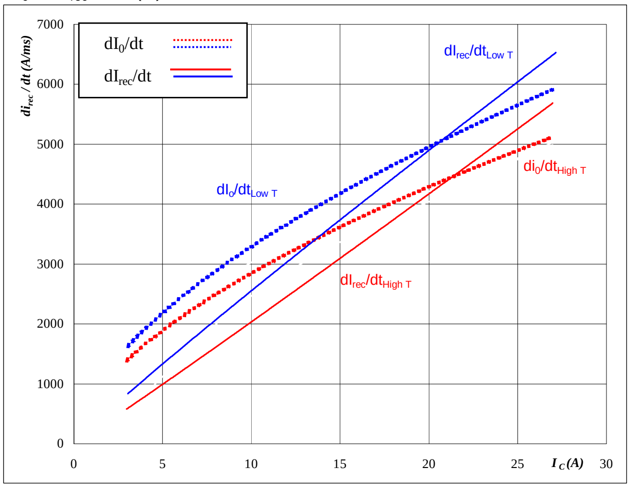
T_j =	25/125	°C
V_R =	400	V
I_F =	15	A
V_{GE} =	10	V

Buck

Figure 17 FRED

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

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



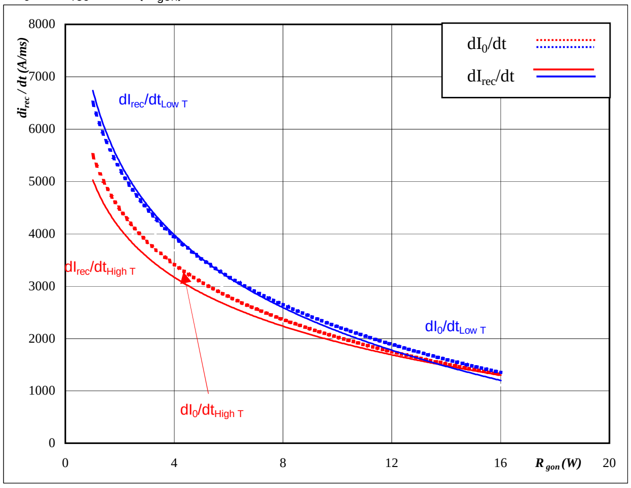
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω

Figure 18 FRED

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

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



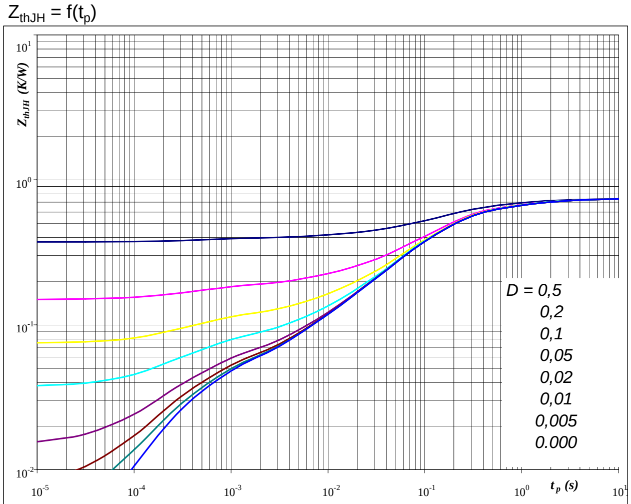
At

T_j =	25/125	°C
V_R =	400	V
I_F =	15	A
V_{GE} =	10	V

Figure 19 MOSFET

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	0,75	K/W

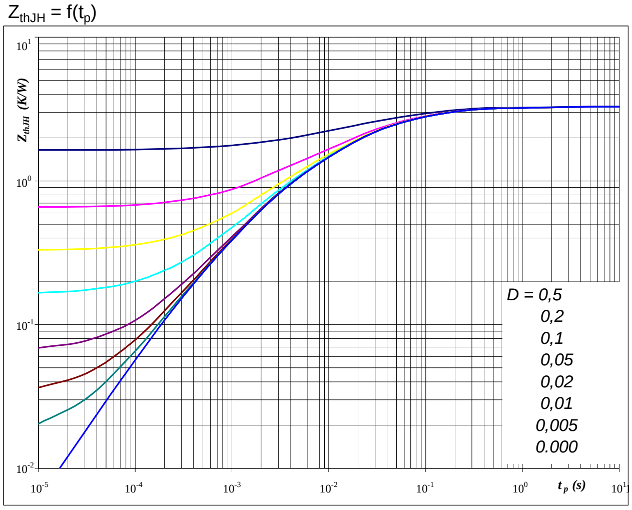
IGBT thermal model values

R (C/W)	Tau (s)
0,03	9,3E+00
0,12	1,2E+00
0,41	1,6E-01
0,11	3,8E-02
0,03	5,2E-03
0,04	3,7E-04

Figure 20 FRED

FRED transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	3,28	K/W

FRED thermal model values

R (C/W)	Tau (s)
0,17	9,7E-01
1,04	8,5E-02
1,34	1,6E-02
0,65	2,5E-03
0,08	3,2E-04

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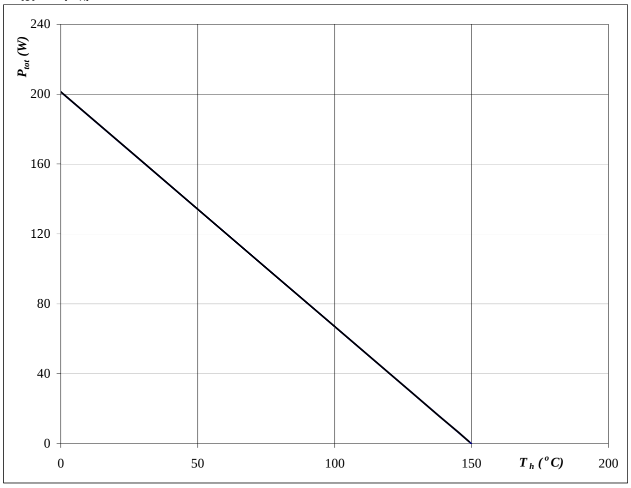
Buck

Figure 21 MOSFET

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



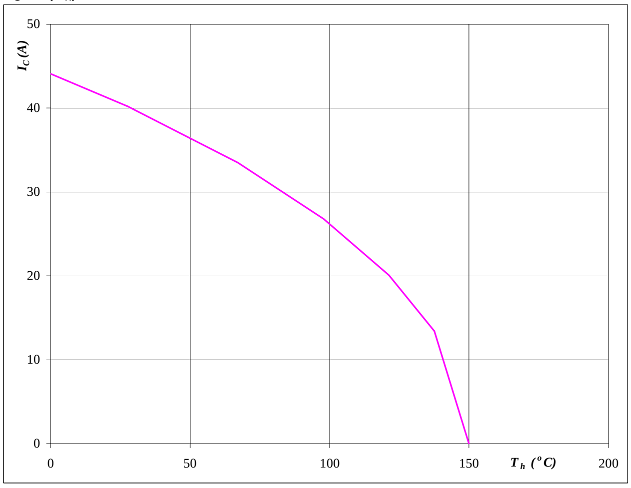
At

T_j = 150 °C

Figure 22 MOSFET

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

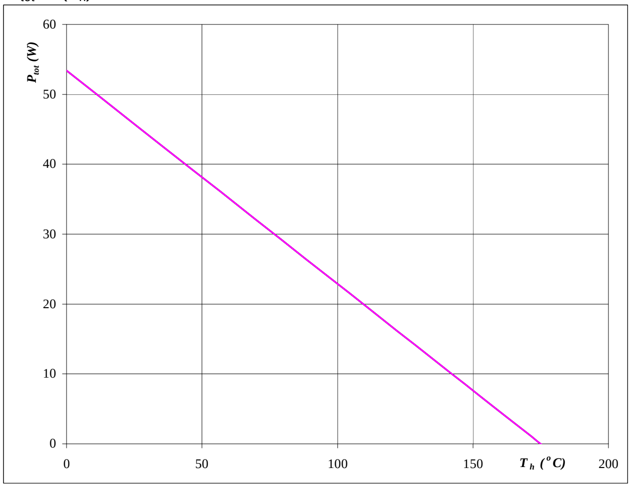
T_j = 150 °C

V_{GE} = 15 V

Figure 23 FRED

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



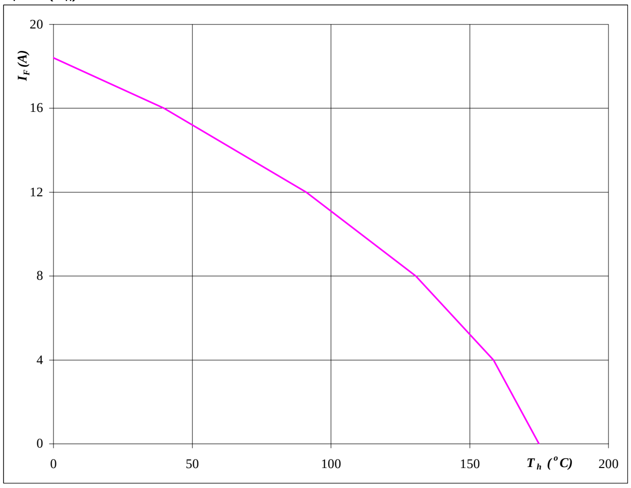
At

T_j = 175 °C

Figure 24 FRED

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

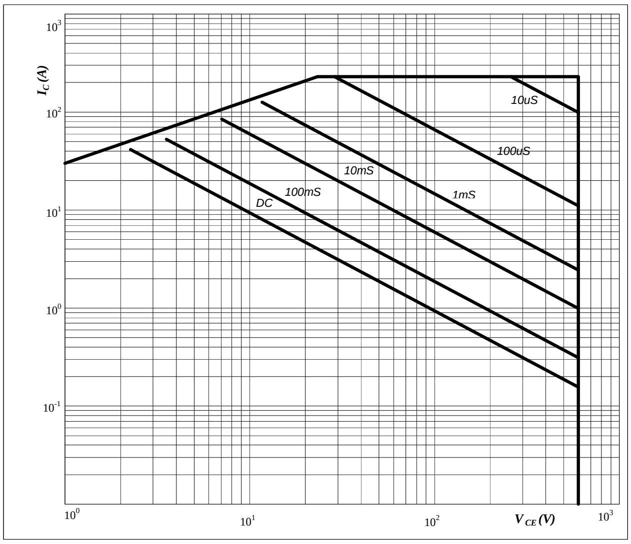
T_j = 175 °C

Buck

Figure 25	MOSFET

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



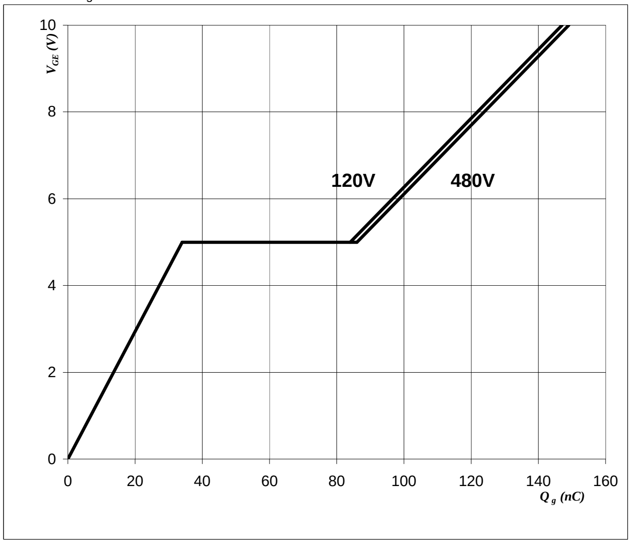
At

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

Figure 26	MOSFET

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



At

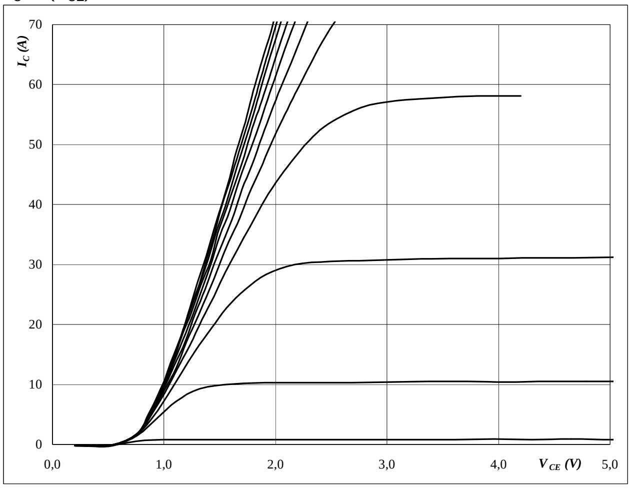
I_C =	44	A

Boost

Figure 1 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



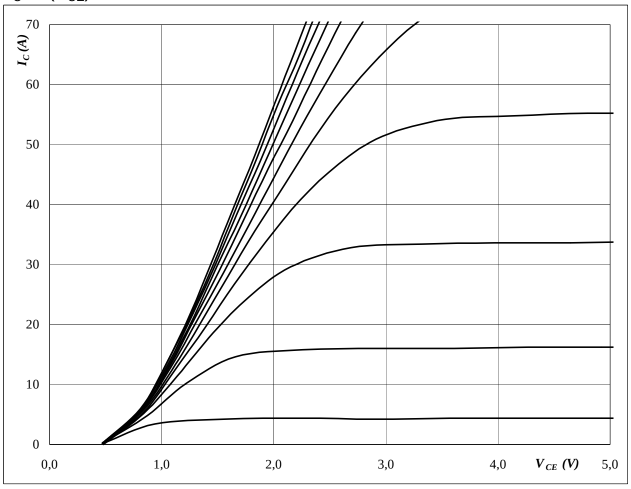
At

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

Figure 2 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



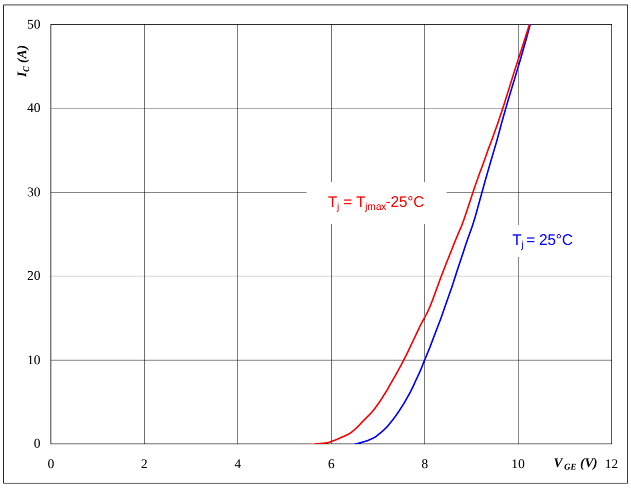
At

t_p =	250	μs
T_j =	125	°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

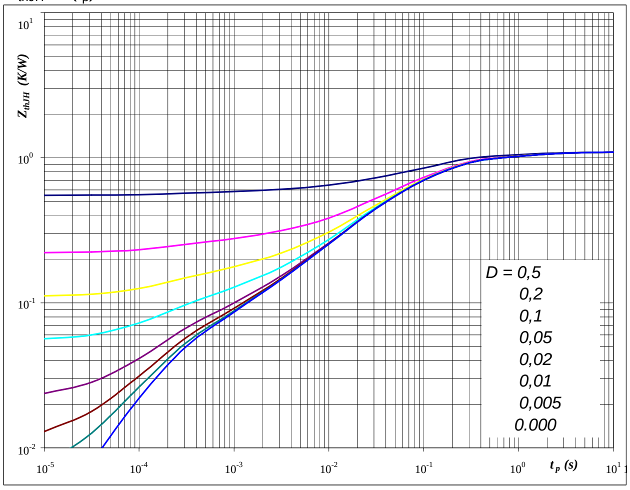
t_p =	250	μs
V_{CE} =	10	V

Figure 4 IGBT

IGBT transient thermal impedance

as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	tp / T	
R_{thJH} =	1,10	K/W

IGBT thermal model values

0,04	6,3E+00
0,17	6,9E-01
0,58	1,0E-01
0,22	1,6E-02
0,05	1,7E-03

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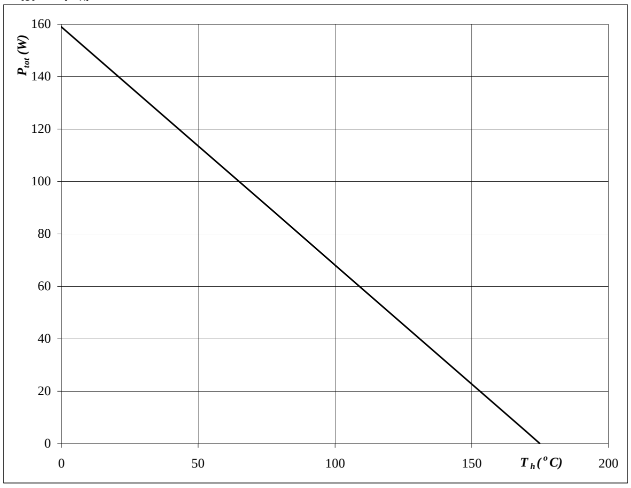
Boost

Figure 5 IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



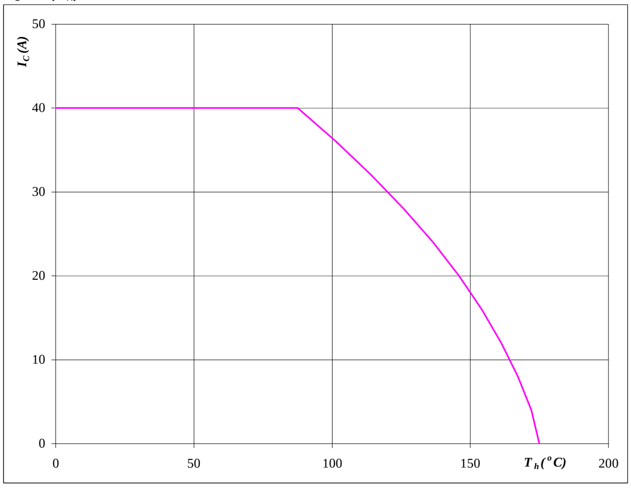
At

T_j = 175 ºC

Figure 6 IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

T_j = 175 ºC

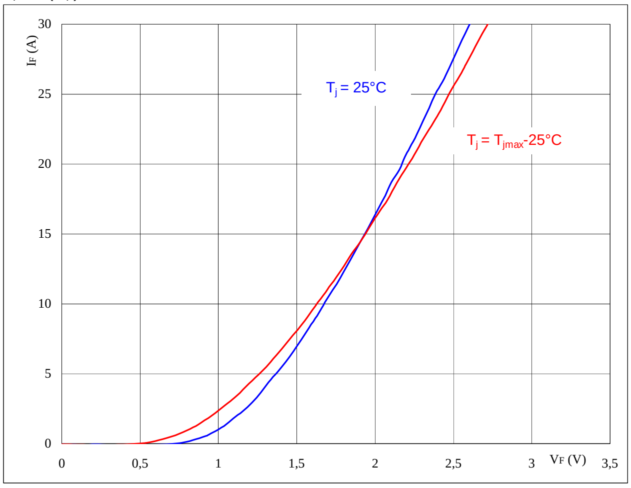
V_{GE} = 15 V

Boost

Figure 7 Boost Inverse Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



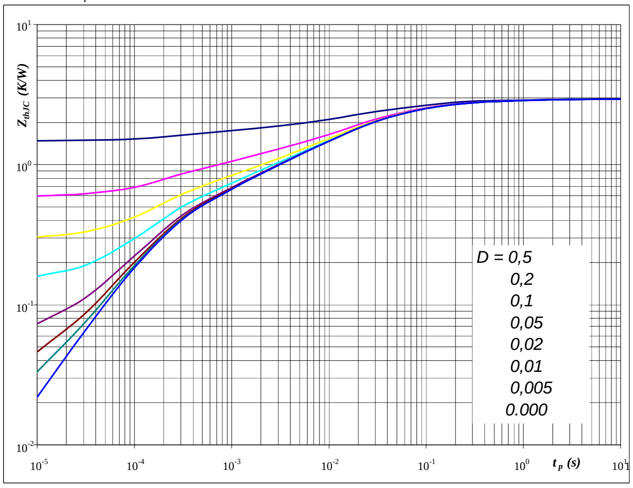
At

t_p =	250	μs

Figure 8 Boost Inverse Diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



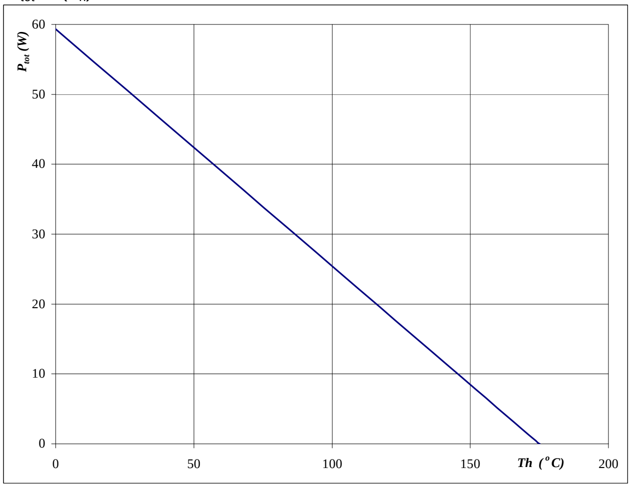
At

D =	tp / T	
R_{thJH} =	2,95	K/W

Figure 9 Boost Inverse Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



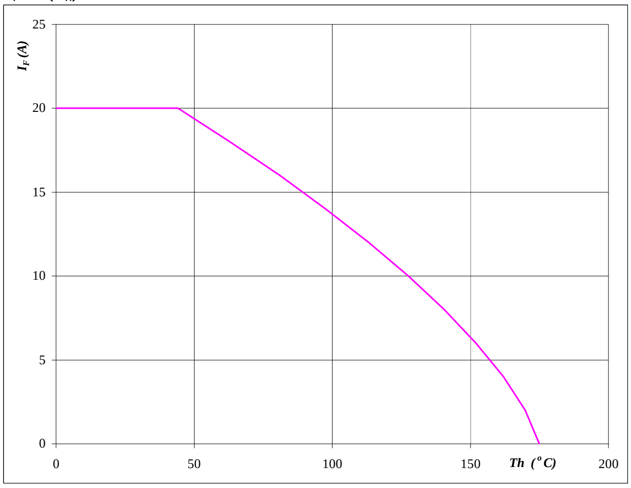
At

T_j =	175	ºC

Figure 10 Boost Inverse Diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

T_j =	175	ºC

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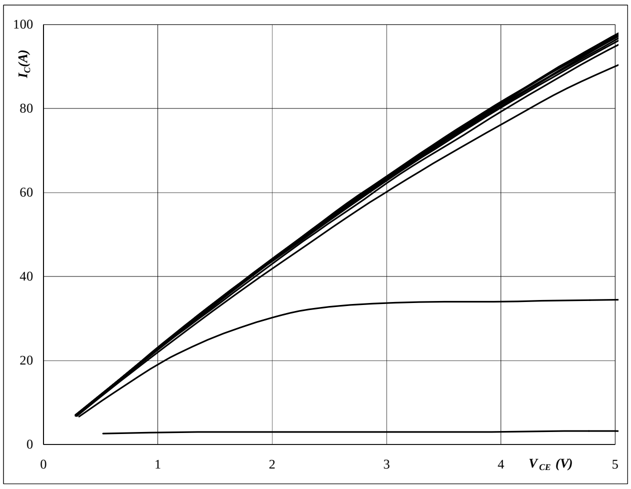
INPUT BOOST

Figure 1 BOOST MOSFET

Typical output characteristics

$I_D = f(V_{DS})$



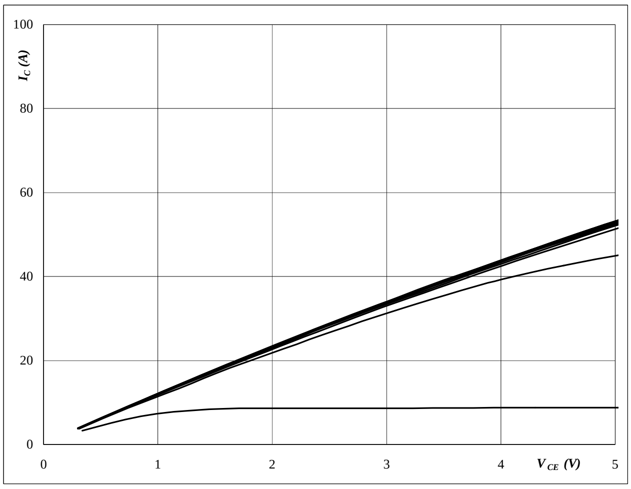
At

t_p =	250	μs
T_j =	25	°C
V_{GS} from	4 V to 14 V in steps of 1 V	

Figure 2 BOOST MOSFET

Typical output characteristics

$I_D = f(V_{DS})$



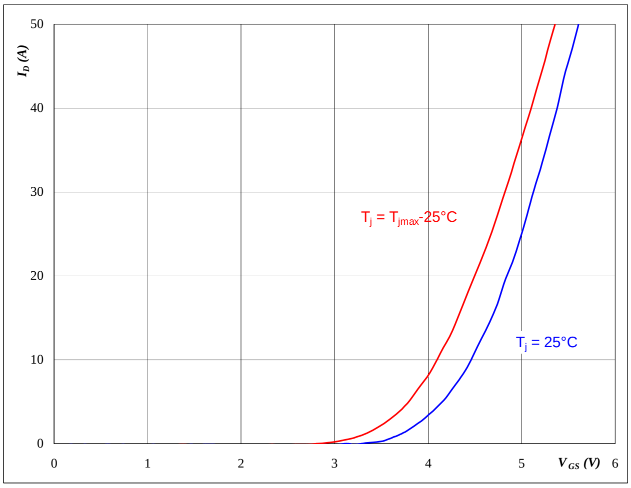
At

t_p =	250	μs
T_j =	126	°C
V_{GS} from	4 V to 14 V in steps of 1 V	

Figure 3 BOOST MOSFET

Typical transfer characteristics

$I_D = f(V_{DS})$



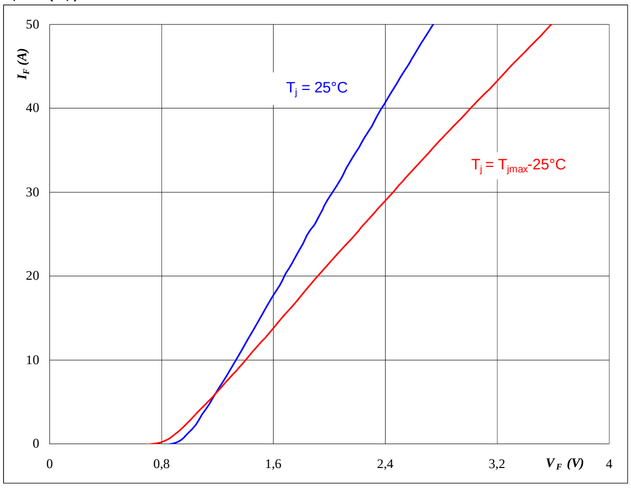
At

t_p =	250	μs
V_{DS} =	10	V

Figure 4 BOOST FRED

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

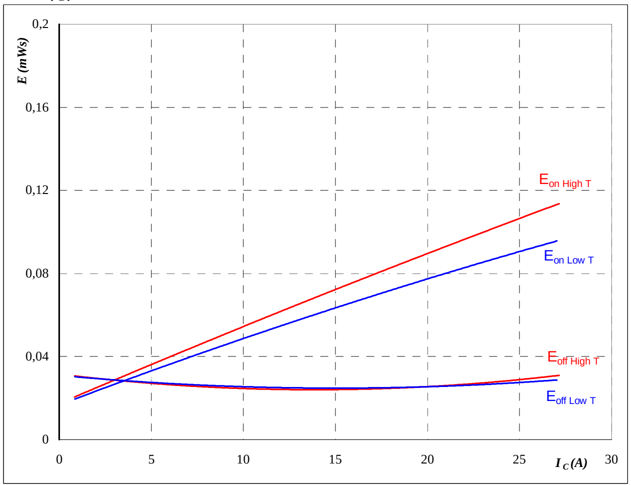
t_p =	250	μs

INPUT BOOST

Figure 5 BOOST MOSFET

Typical switching energy losses as a function of collector current

$E = f(I_D)$



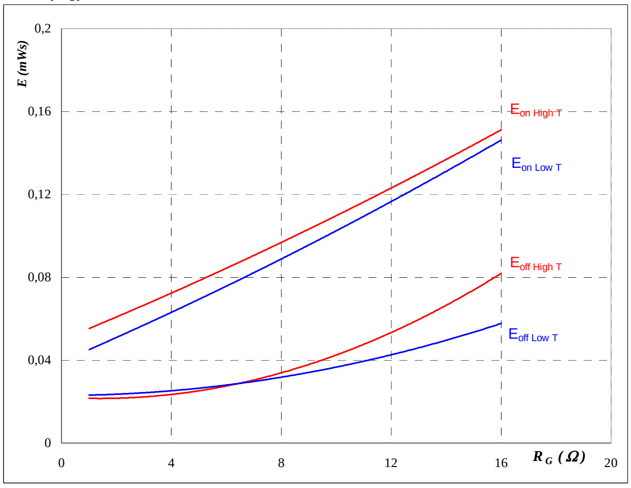
With an inductive load at

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	10	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 6 BOOST MOSFET

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



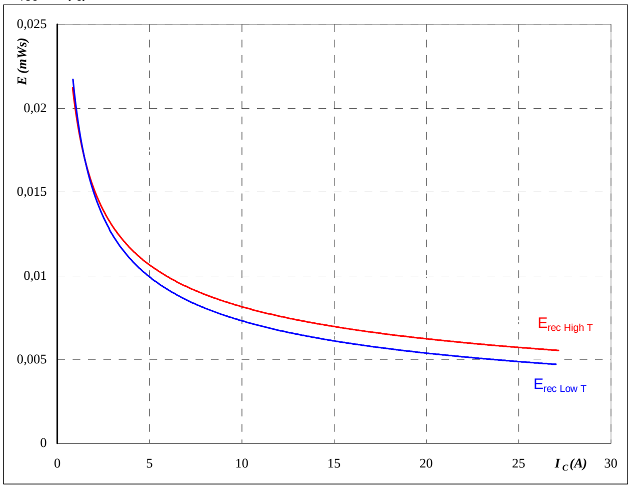
With an inductive load at

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	10	V
I_D =	15	A

Figure 7 BOOST FRED

Typical reverse recovery energy loss as a function of collector (drain) current

$E_{rec} = f(I_c)$



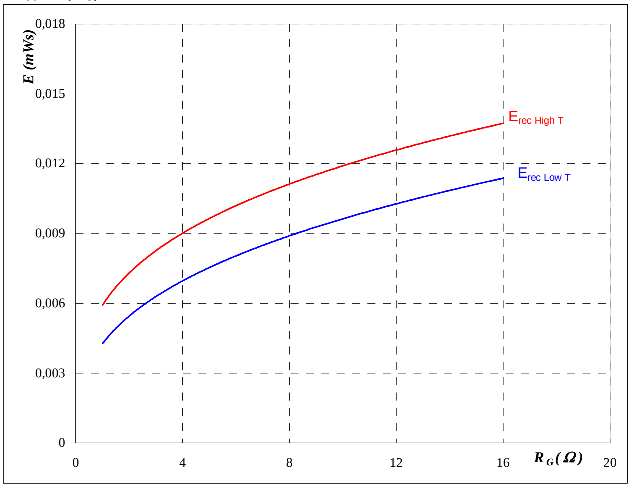
With an inductive load at

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	10	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 8 BOOST FRED

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_{DS} =	400	V
V_{GS} =	10	V
I_D =	15	A

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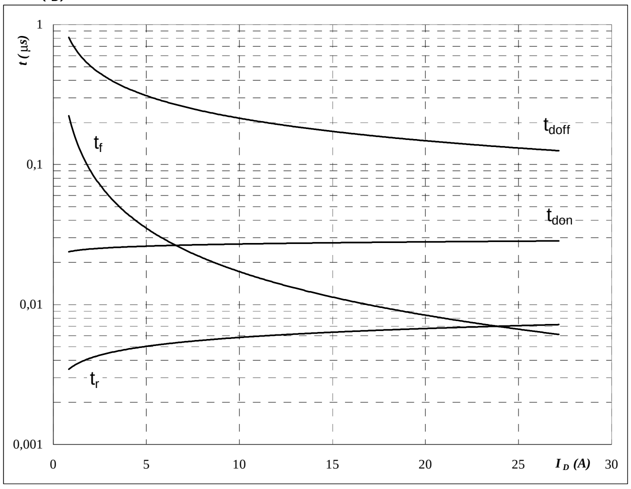
INPUT BOOST

Figure 9 BOOST MOSFET

Typical switching times as a function of collector current

$t = f(I_D)$



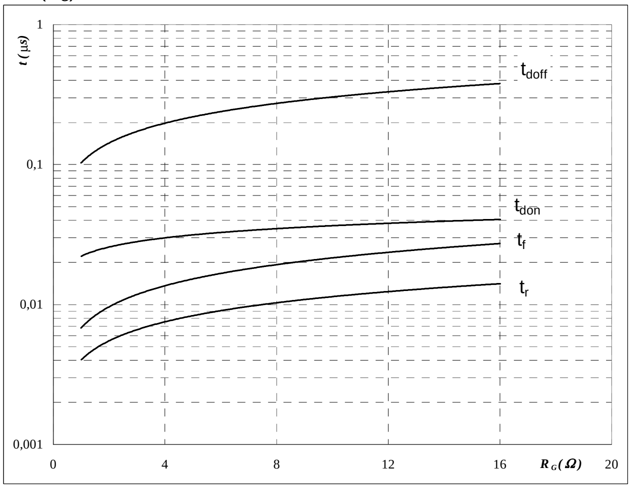
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	10	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10 BOOST MOSFET

Typical switching times as a function of gate resistor

$t = f(R_G)$



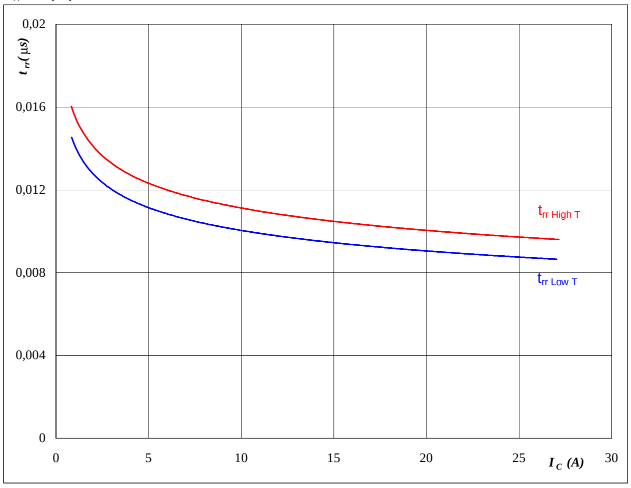
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	10	V
I_C =	15	A

Figure 11 BOOST FRED

Typical reverse recovery time as a function of collector current

$t_{rr} = f(Ic)$



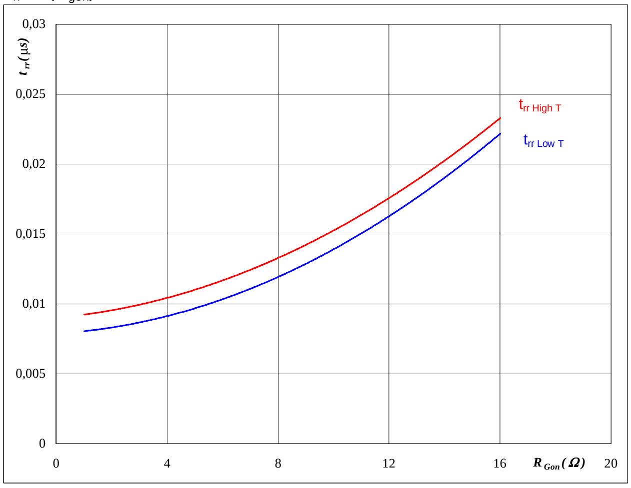
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω

Figure 12 BOOST FRED

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

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



At

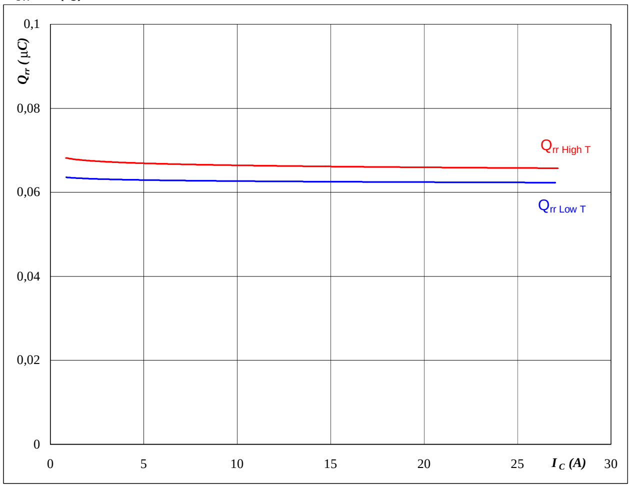
T_j =	25/125	°C
V_R =	400	V
I_F =	15	A
V_{GS} =	10	V

INPUT BOOST

Figure 13 BOOST FRED

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



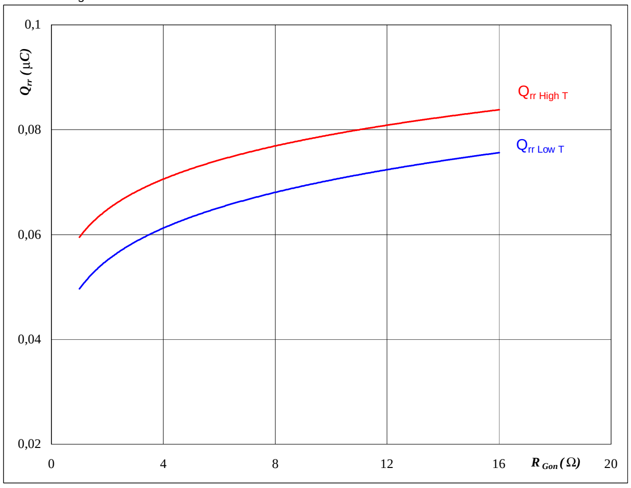
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω

Figure 14 BOOST FRED

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

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



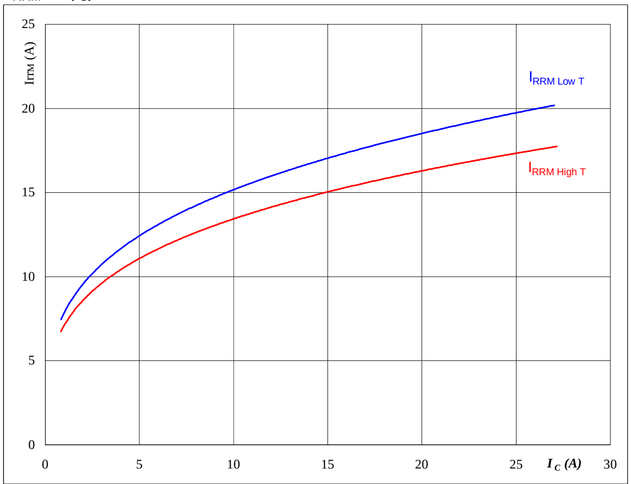
At

T_j =	25/125	°C
V_R =	400	V
I_F =	15	A
V_{GS} =	10	V

Figure 15 BOOST FRED

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



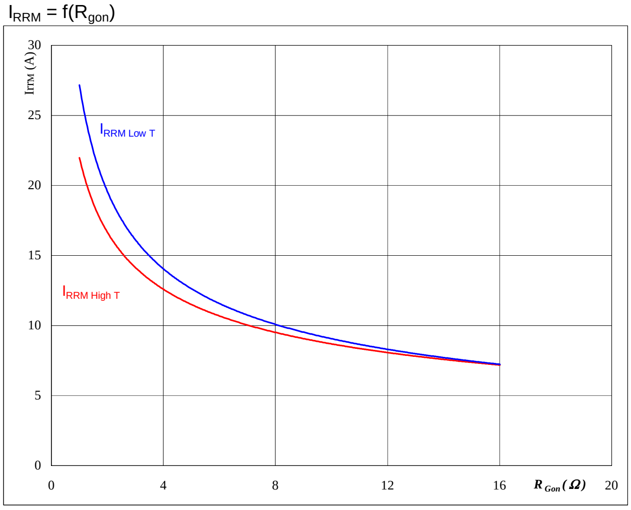
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω

Figure 16 BOOST FRED

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

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



At

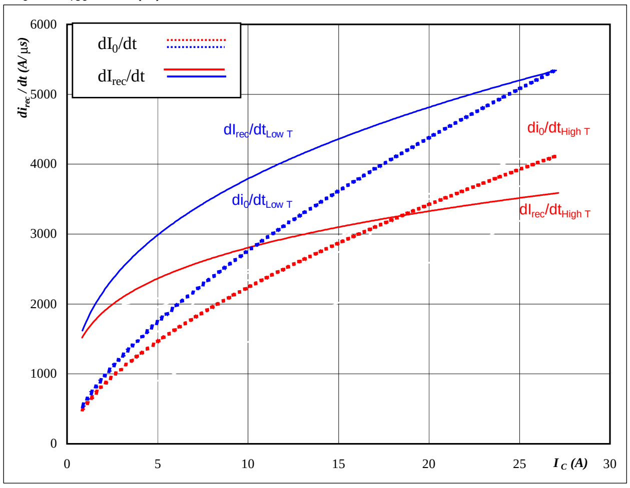
T_j =	25/125	°C
V_R =	400	V
I_F =	15	A
V_{GS} =	10	V

INPUT BOOST

Figure 17 BOOST FRED

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

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



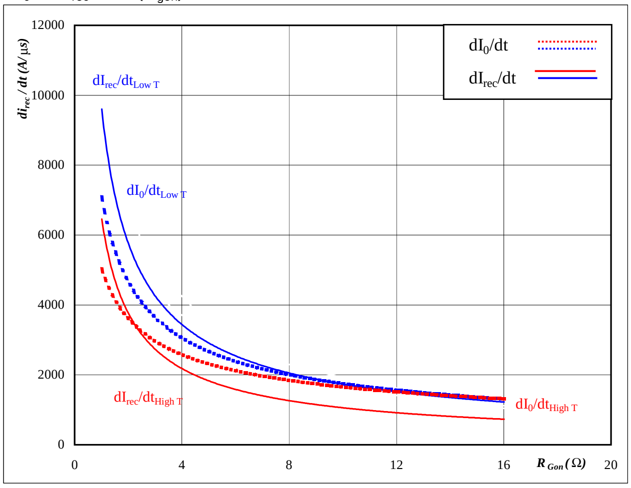
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	10	V
R_{gon} =	4	Ω

Figure 18 BOOST FRED

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

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



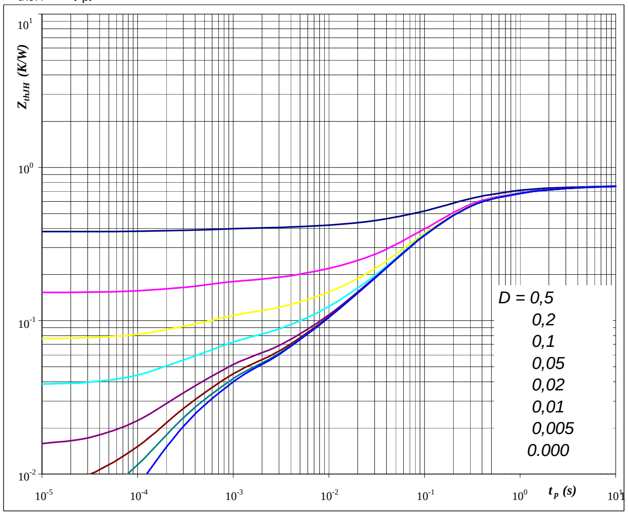
At

Tj =	25/125	°C
VR =	400	V
IF =	15	A
VGS =	10	V

Figure 19 BOOST MOSFET

IGBT/MOSFET transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



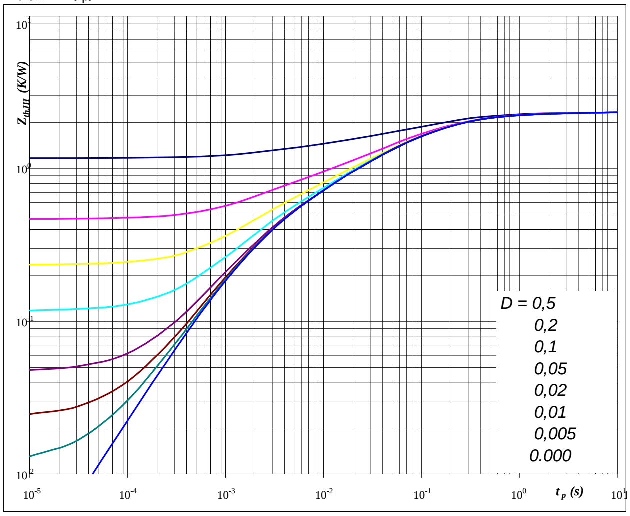
At

D =	t_p / T	
R_{thJH} =	0,76	K/W

Figure 20 BOOST FRED

FRED transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	2,34	K/W

IGBT thermal model values

R (C/W)	Tau (s)
3,25E-02	9,97E+00
1,22E-01	1,22E+00
4,26E-01	1,80E-01
1,17E-01	4,70E-02
3,10E-02	5,89E-03
3,30E-02	4,04E-04

FRED thermal model values

R (C/W)	Tau (s)
1,02E-01	2,89E+00
4,95E-01	3,44E-01
9,89E-01	7,04E-02
4,87E-01	1,00E-02
2,67E-01	1,61E-03

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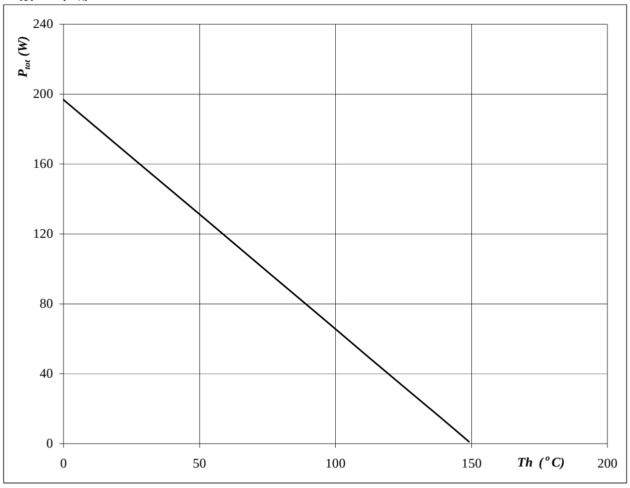
INPUT BOOST

Figure 21 BOOST MOSFET

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



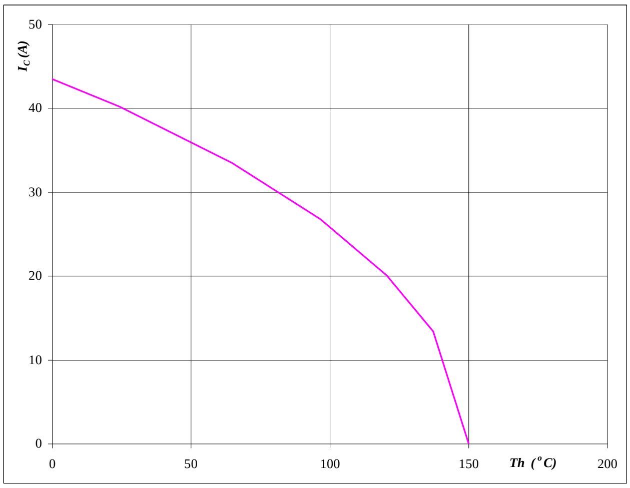
At

T_j = 150 ºC

Figure 22 BOOST MOSFET

Collector/Drain current as a function of heatsink temperature

$I_C = f(T_h)$



At

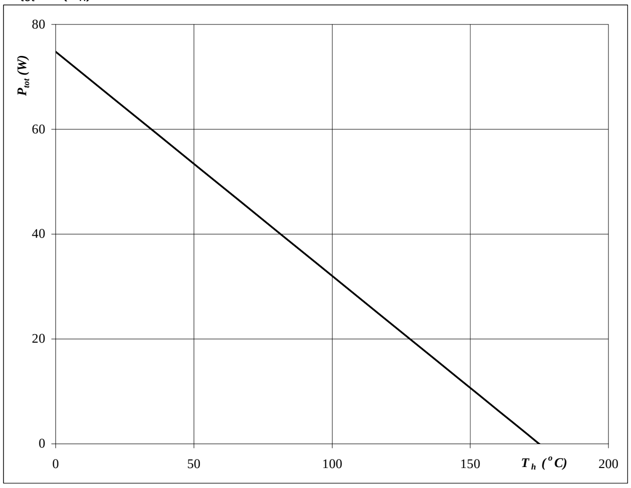
T_j = 150 ºC

V_{GS} = 10 V

Figure 23 BOOST FRED

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



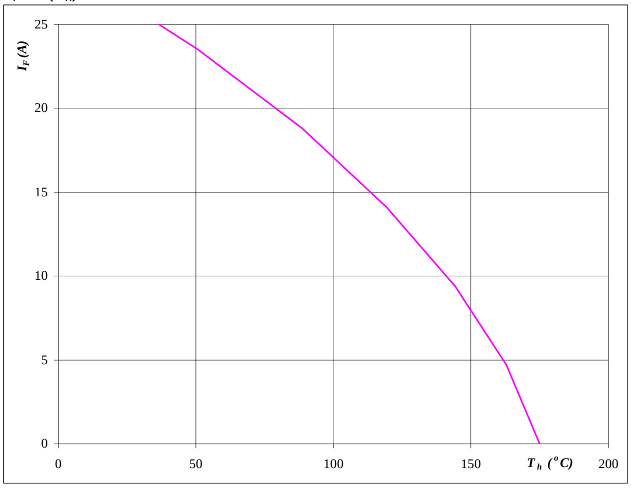
At

T_j = 175 ºC

Figure 24 BOOST FRED

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

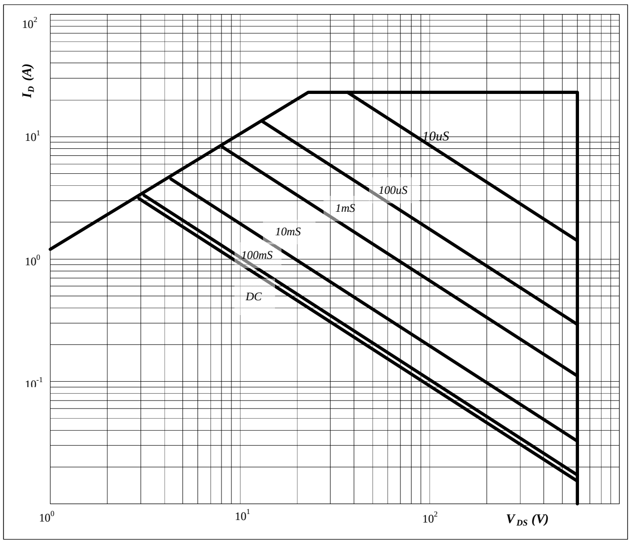
T_j = 175 ºC

INPUT BOOST

Figure 25	BOOST MOSFET

Safe operating area as a function of drain-source voltage

$I_D = f(V_{DS})$



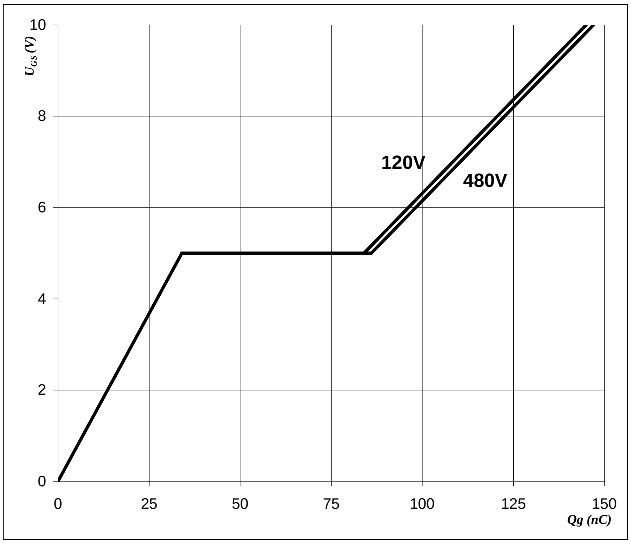
At

D =	single pulse	
T_h =	80	ºC
V_{GS} =	10	V
T_j =	T_{jmax}	ºC

Figure 26	BOOST MOSFET

Gate voltage vs Gate charge

$V_{GS} = f(Qg)$



At

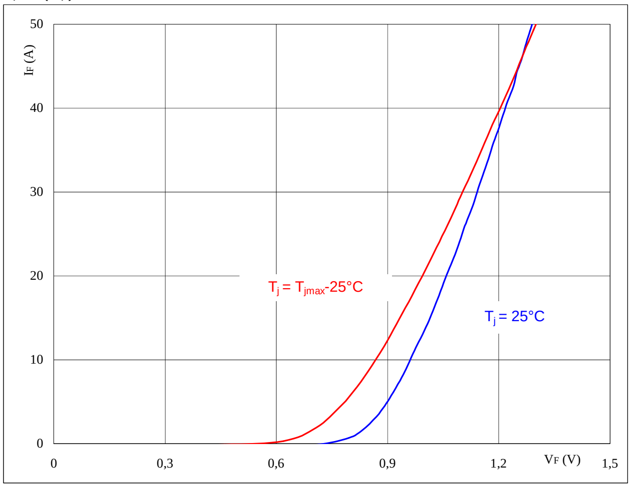
I_D =	44	A

Bypass Diode

Figure 1 Bypass diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



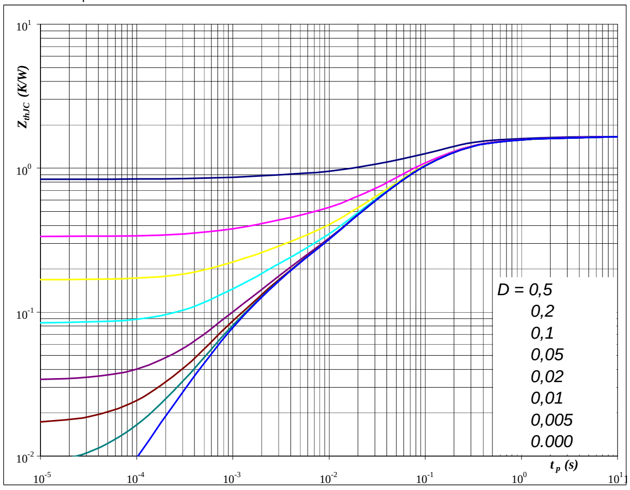
At

t_p = 250 µs

Figure 2 Bypass diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

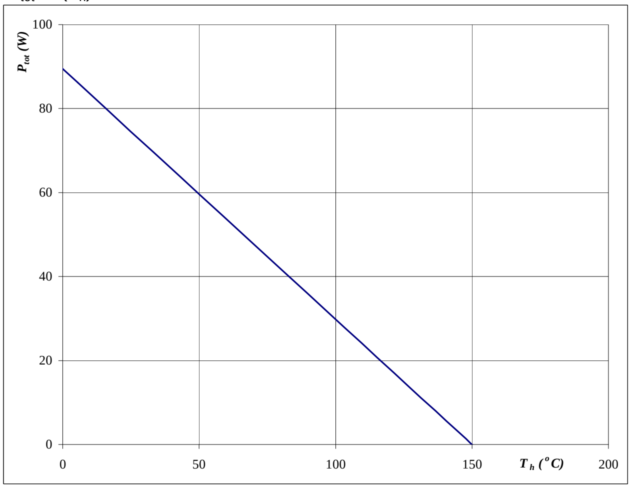
D = t_p / T

R_{thJH} = 1,677 K/W

Figure 3 Bypass diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



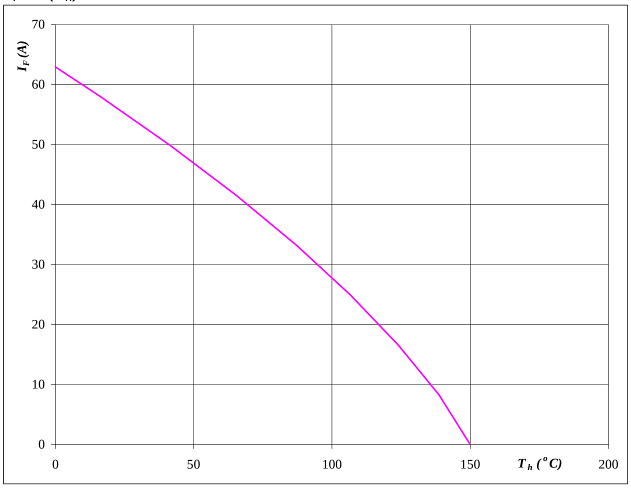
At

T_j = 150 ºC

Figure 4 Bypass diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

T_j = 150 ºC

Thermistor

Figure 1 Thermistor

Typical NTC characteristic as a function of temperature

$R_T = f(T)$

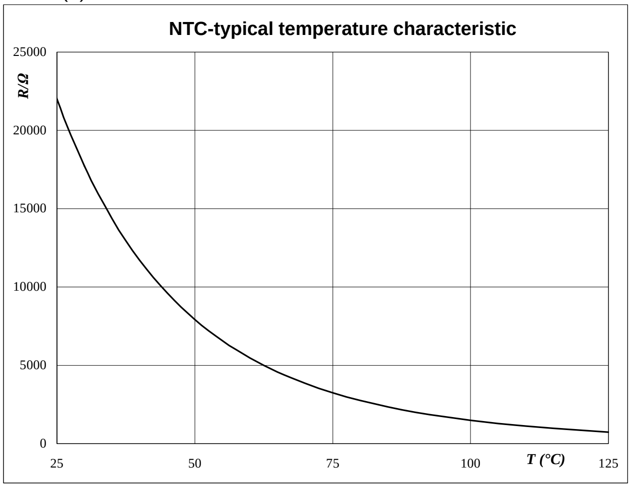


Figure 2 Thermistor

Typical NTC resistance values

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

T [°C]	R_{nom} [Ω]	R_{min} [Ω]	R_{max} [Ω]	△R/R [±%]
-55	2089434,5	1506495,4	2672373,6	27,9
0	71804,2	59724,4	83884	16,8
10	43780,4	37094,4	50466,5	15,3
20	27484,6	23684,6	31284,7	13,8
25	22000	19109,3	24890,7	13,1
30	17723,3	15512,2	19934,4	12,5
60	5467,9	4980,6	5955,1	8,9
70	3848,6	3546	4151,1	7,9
80	2757,7	2568,2	2947,1	6,9
90	2008,9	1889,7	2128,2	5,9
100	**1486,1**	**1411,8**	**1560,4**	**5**
150	400,2	364,8	435,7	8,8

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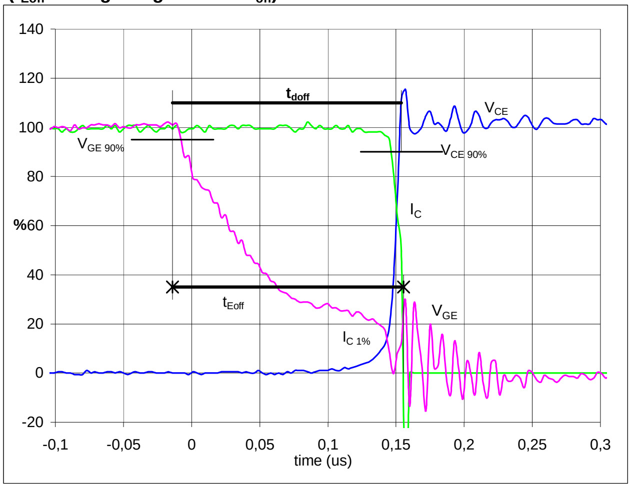
Switching Definitions BUCK MOSFET

General conditions

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

Figure 1 Output inverter IGBT

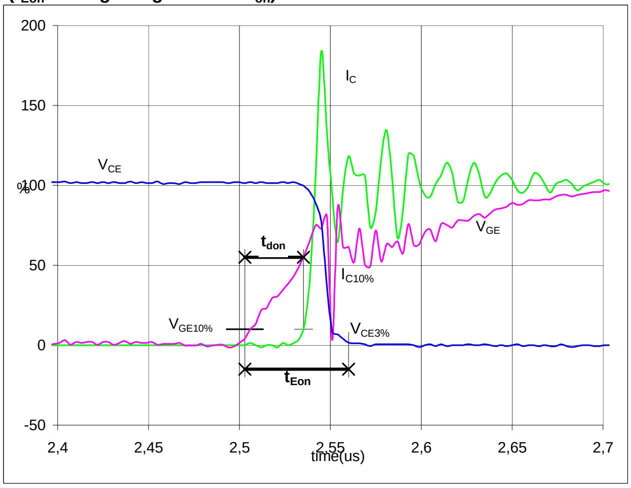
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	10	V
V_C (100%) =	400	V
I_C (100%) =	15	A
t_{doff} =	0,16	µs
t_{Eoff} =	0,17	µs

Figure 2 Output inverter IGBT

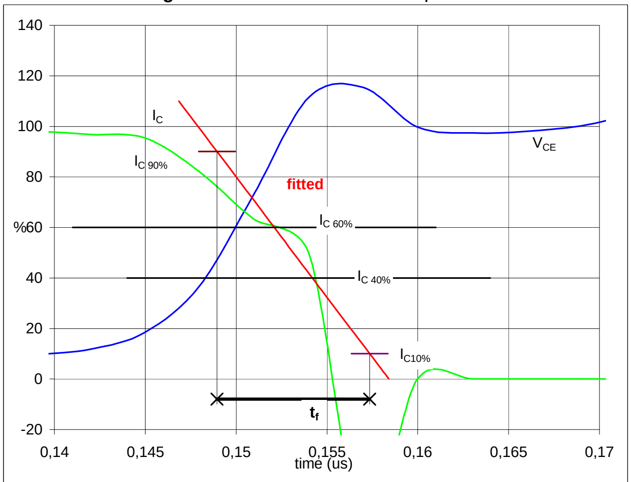
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	10	V
V_C (100%) =	400	V
I_C (100%) =	15	A
t_{don} =	0,03	µs
t_{Eon} =	0,06	µs

Figure 3 Output inverter IGBT

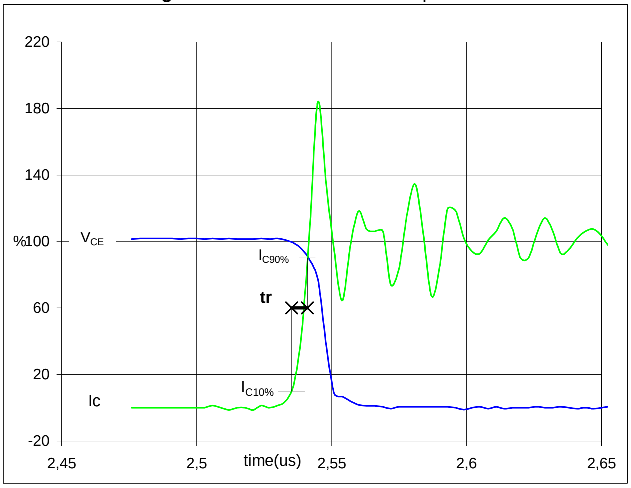
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	400	V
I_C (100%) =	15	A
t_f =	0,01	µs

Figure 4 Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

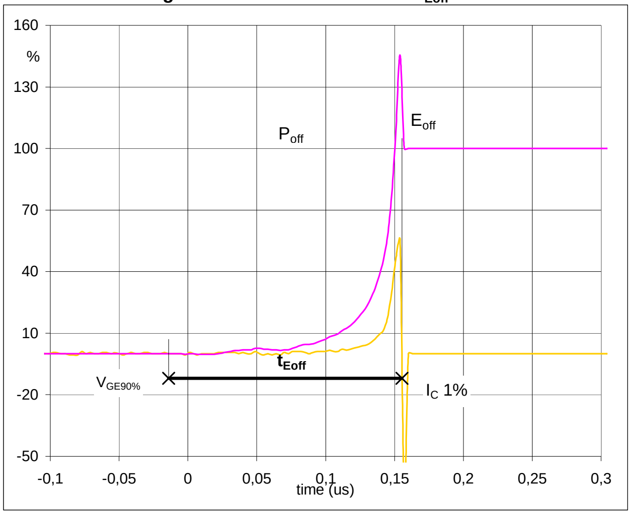


V_C (100%) =	400	V
I_C (100%) =	15	A
t_r =	0,01	µs

Switching Definitions BUCK MOSFET

Figure 5 Output inverter IGBT

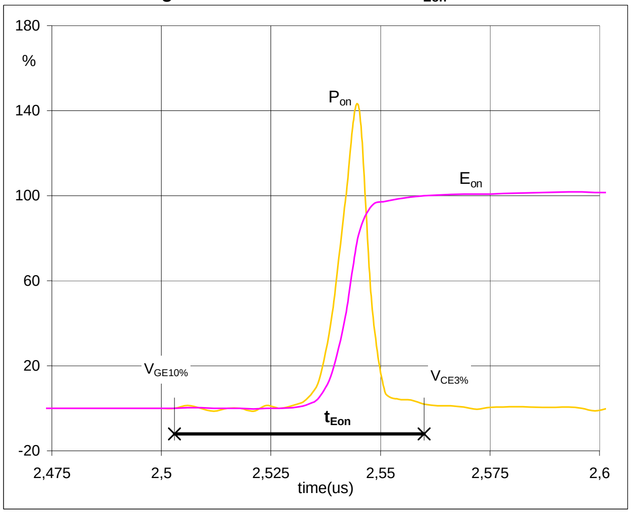
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	6,01	kW
E_{off} (100%) =	0,02	mJ
t_{Eoff} =	0,17	μs

Figure 6 Output inverter IGBT

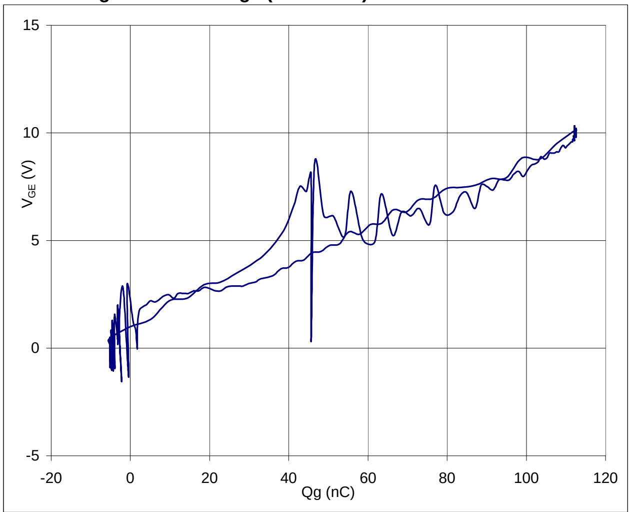
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	6,01	kW
E_{on} (100%) =	0,07	mJ
t_{Eon} =	0,06	μs

Figure 7 Output inverter FRED

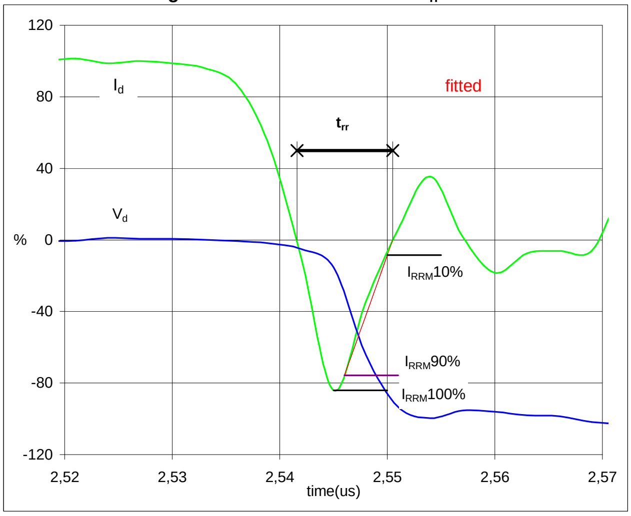
Gate voltage vs Gate charge (measured)



V_{GEoff} =	0	V
V_{GEon} =	10	V
V_C (100%) =	400	V
I_C (100%) =	15	A
Q_g =	112,54	nC

Figure 8 Output inverter IGBT

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



V_d (100%) =	400	V
I_d (100%) =	15	A
I_{RRM} (100%) =	-6	A
t_{rr} =	0,01	μs

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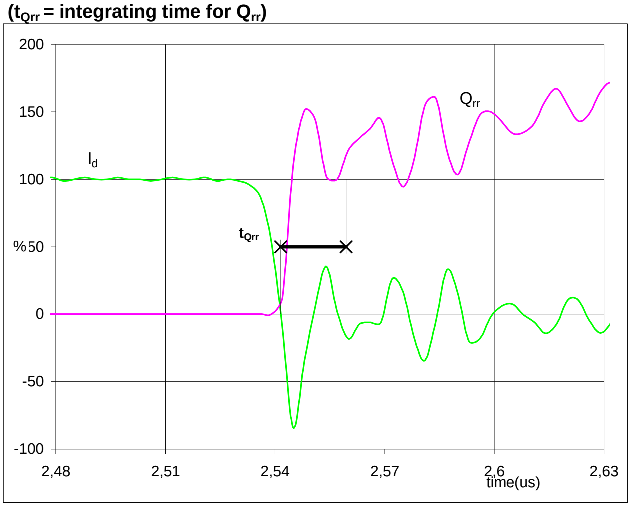
Switching Definitions BUCK MOSFET

Figure 9	Output inverter FRED

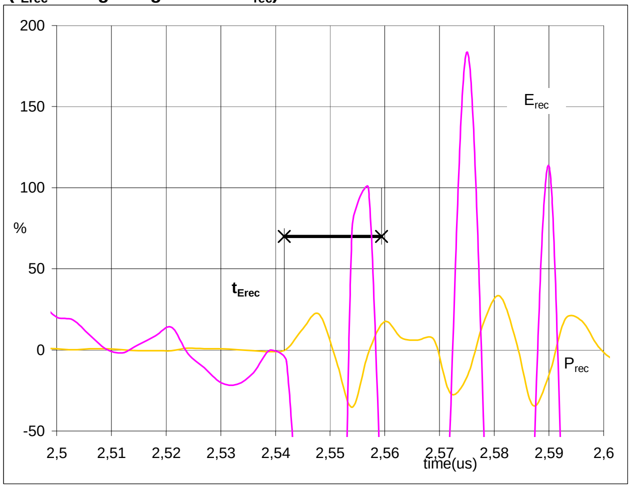
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	15	A
Q_{rr} (100%) =	0,03	μC
t_{Qrr} =	0,02	μs

Figure 10	Output inverter FRED

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

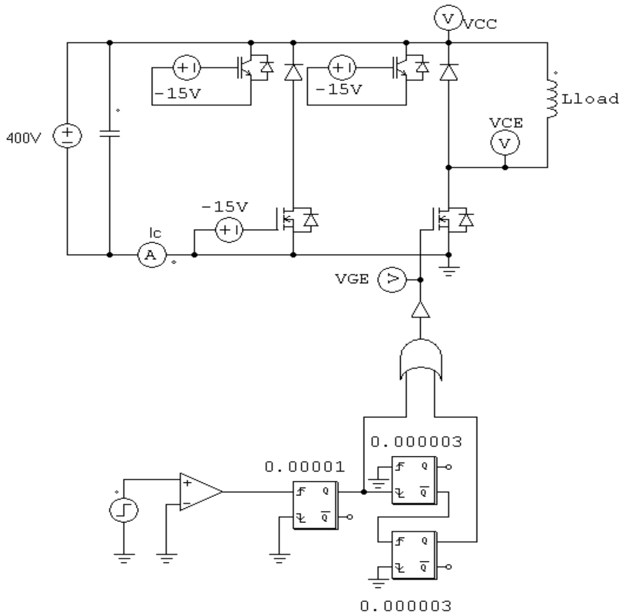


P_{rec} (100%) =	6,01	kW
E_{rec} (100%) =	0,01	mJ
t_{Erec} =	0,02	μs

Measurement circuits

Figure 11

BUCK stage switching measurement circuit



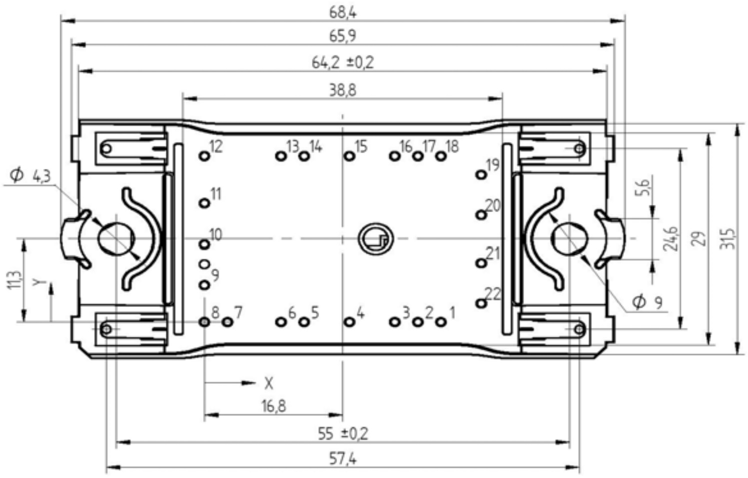
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

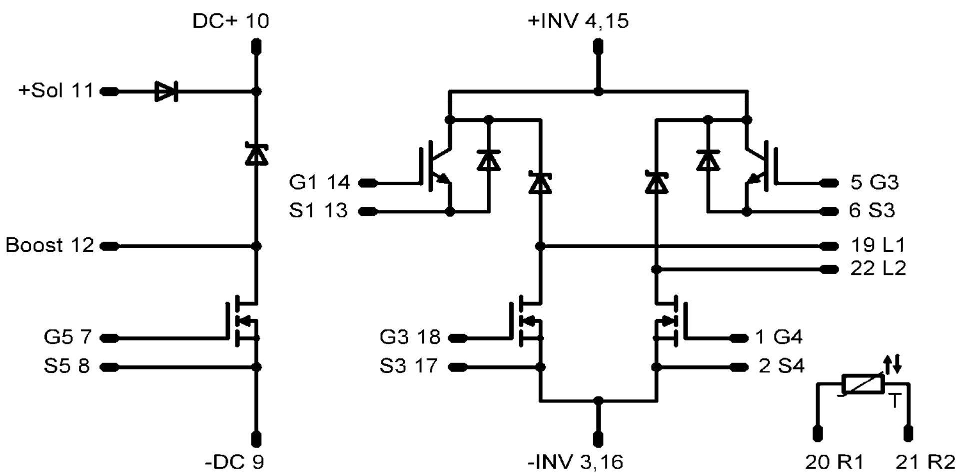
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	10-FZ06BIA045FH02-P897D	P897D	P897D

Outline

Pin table		
Pin	X	Y
1	28,7	0
2	25,9	0
3	23,1	0
4	17,6	0
5	12,1	0
6	9,3	0
7	2,8	0
8	0	0
9	0	5,05
10	0	10,55
11	0	16,15
12	0	22,6
13	9,3	22,6
14	12,1	22,6
15	17,6	22,6
16	23,1	22,6
17	25,9	22,6
18	28,7	22,6
19	33,6	20,05
20	33,6	14,55
21	33,6	8,05
22	33,6	2,55



Pinout



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