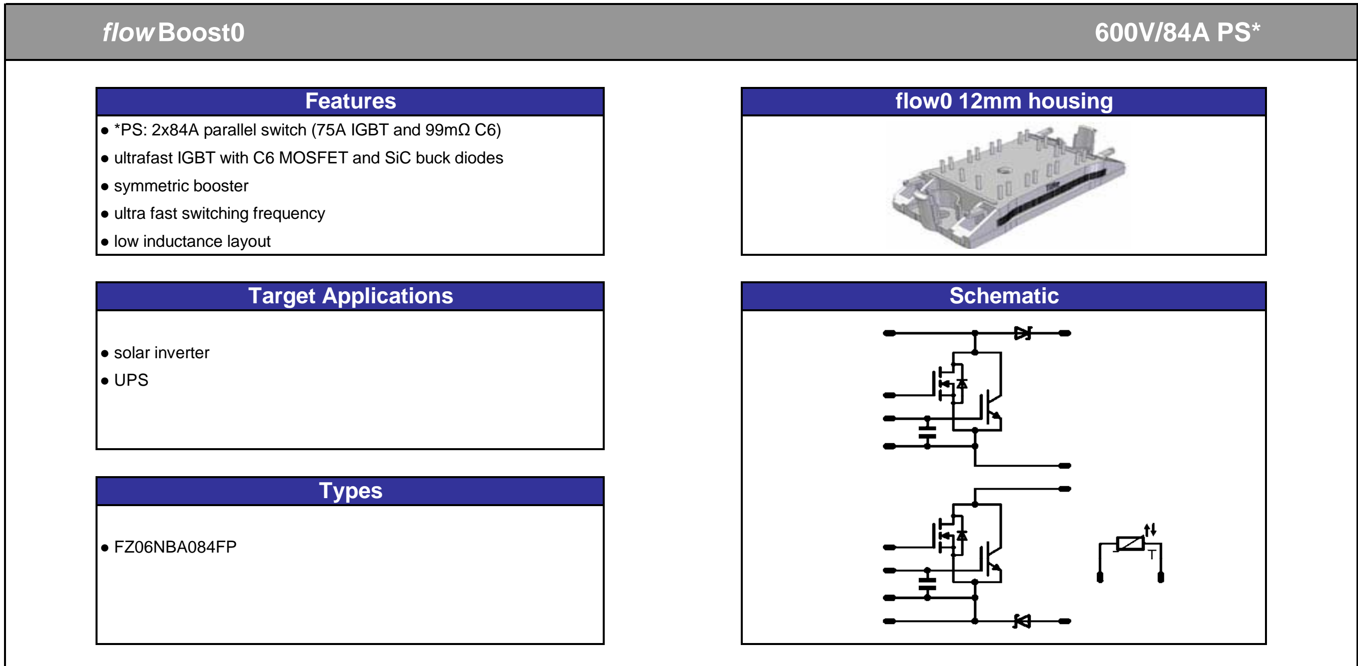

flow*Boost0** — **600V/84A PS

Features

- *PS: 2x84A parallel switch (75A IGBT and 99mΩ C6)
- ultrafast IGBT with C6 MOSFET and SiC buck diodes
- symmetric booster
- ultra fast switching frequency
- low inductance layout

flow0 12mm housing

Target Applications

- solar inverter
- UPS

Schematic

Types

- FZ06NBA084FP

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Input 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	58 76	A
Repetitive peak collector current	I_{Cpulse}	t_p limited by $T_j$max		225	A
Power dissipation per IGBT	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	111 169	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤125°C V_{GE}=15V		10 480	μs V
Maximum Junction Temperature	$T_j$max			175	°C
Input Boost FWD					
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	49 63	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		210	A
Power dissipation per Diode	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	88 133	W
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
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	17 19	A
Pulsed drain current	I_{Dpulse}	t_p limited by $T_j$max	Tc=25°C	112	A
Power dissipation	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	111 169	W
Gate-source peak voltage	Vgs			±20	V
Maximum Junction Temperature	$T_j$max			150	°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					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 Boost IGBT *										
Gate emitter threshold voltage	$V_{GE(th)}$	VCE=VGE			0,00025	Tj=25°C Tj=150°C	3,5	4,5	6	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		75	Tj=25°C Tj=150°C		2,12 2,24	2,72	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		Tj=25°C Tj=150°C			250	uA
Gate-emitter leakage current	I_{GES}		±20	0		Tj=25°C Tj=150°C			400	nA
Integrated Gate resistor	R_{gint}							none		Ω
Input capacitance	C_{ies}	f=1MHz	0	30		Tj=25°C		4000		pF
Output capacitance	C_{oss}							400		pF
Reverse transfer capacitance	C_{rss}							115		
Gate charge	Q_{Gate}		15	400	75	Tj=25°C		94		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,85		K/W

* see dynamic characteristic at **MosFET**

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
Input Boost FWD										
Diode forward voltage	V_F				48	Tj=25°C Tj=125°C		1,55 1,69	1,75	V
Peak reverse recovery current	I_{RRM}	Rgon=4 Ω **	15	350	77	Tj=25°C Tj=125°C		52 43		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		11 12		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=125°C		0,47 0,60		μC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=125°C		12292 9335		A/μs
Reverse recovered energy	Erec					Tj=25°C Tj=125°C		0,078 0,128		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,10		K/W
Input Boost MOSFET										
Static drain to source ON resistance	$R_{ds(on)}$		10		15	Tj=25°C Tj=125°C		97 193		mΩ
Gate threshold voltage	$V_{(GS)th}$		V_{DS}=V_{GS}		0,00121	Tj=25°C Tj=125°C	2,5	3	3,5	V
Gate to Source Leakage Current	I_{gss}		20	0		Tj=25°C Tj=125°C			100	nA
Zero Gate Voltage Drain Current	I_{dss}		0	600		Tj=25°C Tj=125°C			5	uA
Turn On Delay Time	$t_{d(ON)}$	Rgon=4 Ω ** Rgoff=4 Ω **	15	350	77	Tj=25°C Tj=125°C		17 16		ns
Rise Time	t_r					Tj=25°C Tj=125°C		6 7		
Turn off delay time	$t_{d(OFF)}$					Tj=25°C Tj=125°C		105 124		
Fall time	t_f					Tj=25°C Tj=125°C		6 7		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		0,15 0,29		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		0,40 0,84		
Total gate charge	Q_g		0-10	480	18,1	Tj=25°C		119		nC
Gate to source charge	Q_{gs}							14		
Gate to drain charge	Q_{gd}							61		
Input capacitance	C_{iss}	f=1MHz	0	100		Tj=25°C		2660		pF
Output capacitance	C_{oss}							154		
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,05		K/W

** see gate drive conditions at characteristic figures

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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	
IGBT gate capacitor										
C value	C							4,7		nF
Thermistor										
Rated resistance*	R_{25}	Tol. ±13%				Tj=25°C	19,1	22	24,9	kΩ
	R_{100}	Tol. ±5%				Tj=100°C	1411	1486	1560	Ω
Power dissipation	P					Tj=25°C		210		mW
B-value	$B_{(25/100)}$	Tol. ±3%				Tj=25°C		4000		K

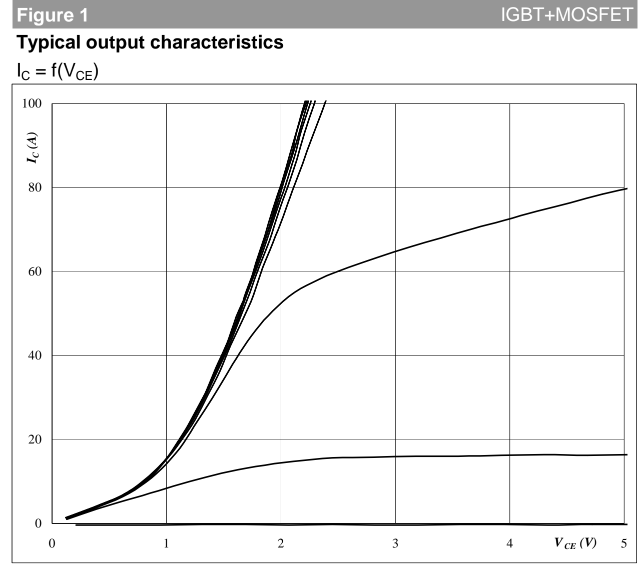
* see details on **Thermistor** charts on ***Figure 2.***

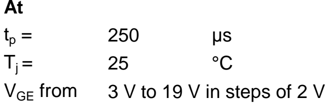
Input Boost

Figure 1 IGBT+MOSFET

Typical output characteristics

$I_C = f(V_{CE})$





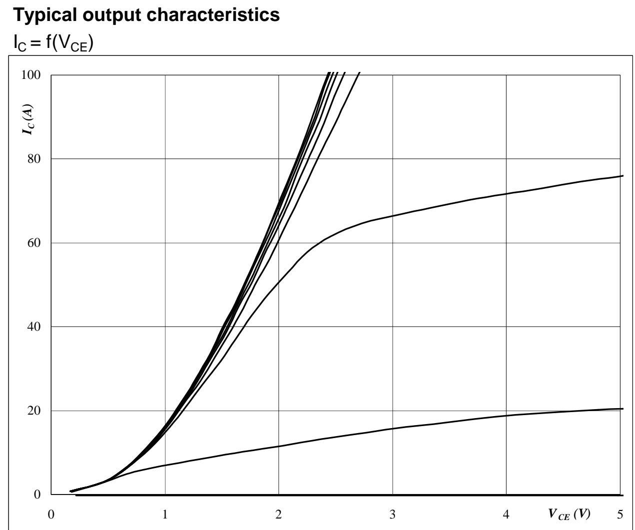
At

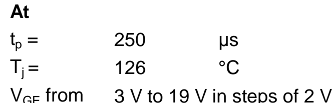
t_p =	250	µs
T_j =	25	°C
V_{GE} from	3 V to 19 V in steps of 2 V	

Figure 2 IGBT+MOSFET

Typical output characteristics

$I_C = f(V_{CE})$





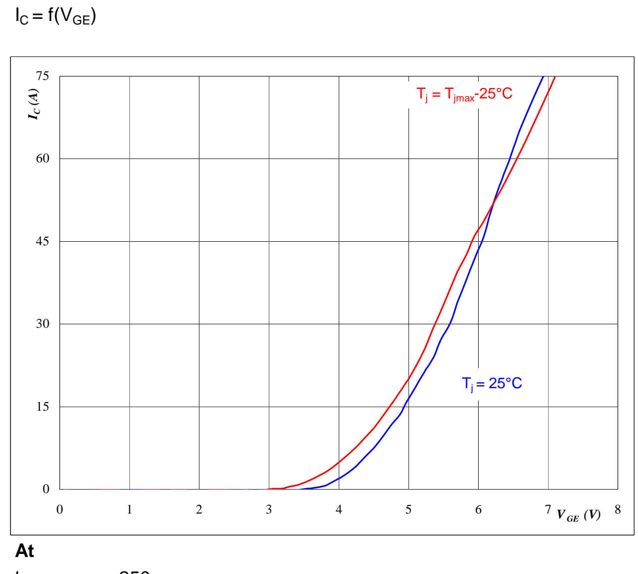
At

t_p =	250	µs
T_j =	126	°C
V_{GE} from	3 V to 19 V in steps of 2 V	

Figure 3 IGBT+MOSFET

Typical transfer characteristics

$I_C = f(V_{GE})$



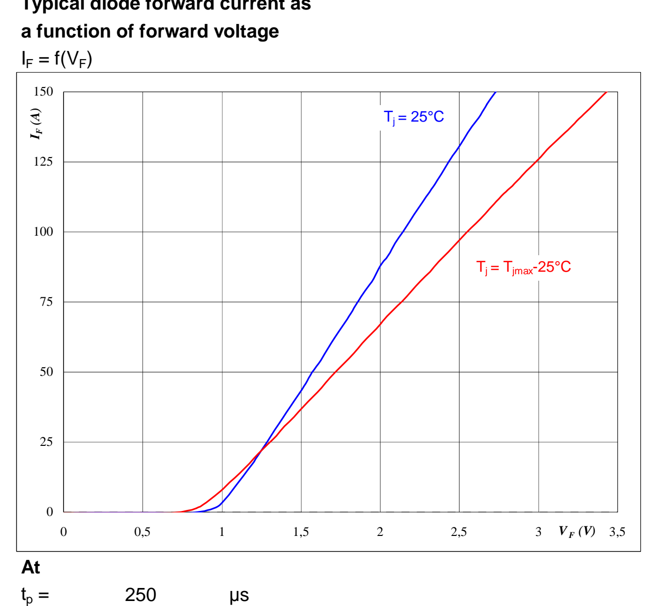
At

t_p =	250	µs
V_{CE} =	10	V

Figure 4 FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

t_p =	250	µs

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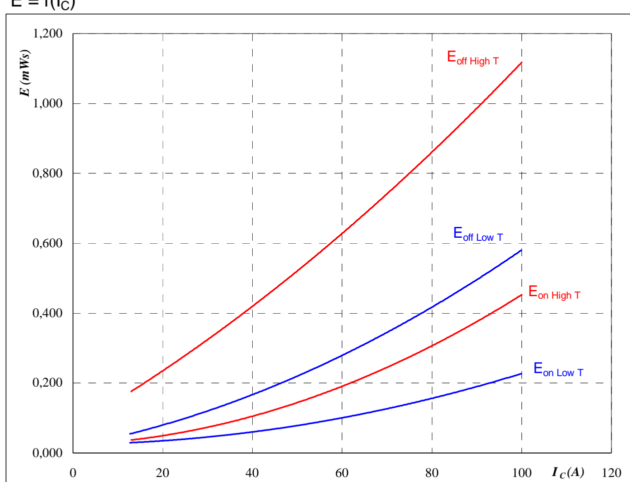
Input Boost

Figure 5 IGBT+MOSFET

Typical switching energy losses

as a function of collector current

$E = f(I_C)$



With an inductive load at

T_j =	25/126	°C
V_{CE} =	350	V
V_{GE} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

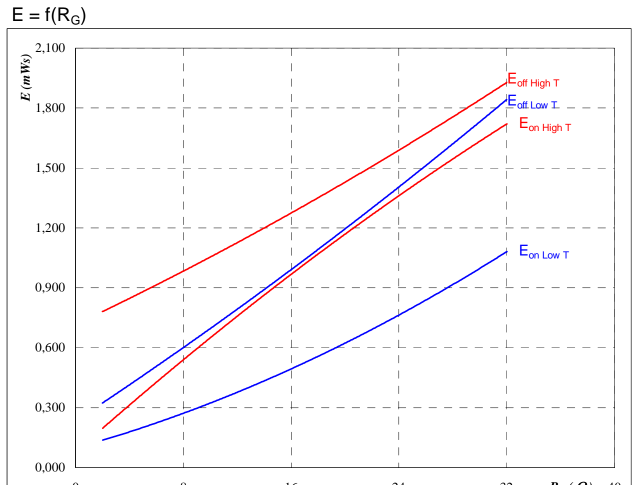
MOSFET turn off delayed by 100ns

Figure 6 IGBT+MOSFET

Typical switching energy losses

as a function of gate resistor

$E = f(R_G)$



With an inductive load at

T_j =	25/126	°C
V_{CE} =	350	V
V_{GE} =	15	V
I_C =	78	A

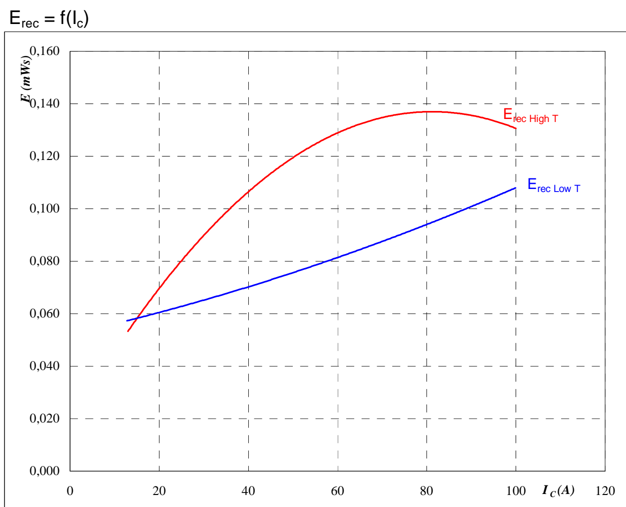
MOSFET turn off delayed by 100ns

Figure 7 FWD

Typical reverse recovery energy loss

as a function of collector current

$E_{rec} = f(I_c)$



With an inductive load at

T_j =	25/126	°C
V_{CE} =	350	V
V_{GE} =	15	V
R_{gon} =	4	Ω

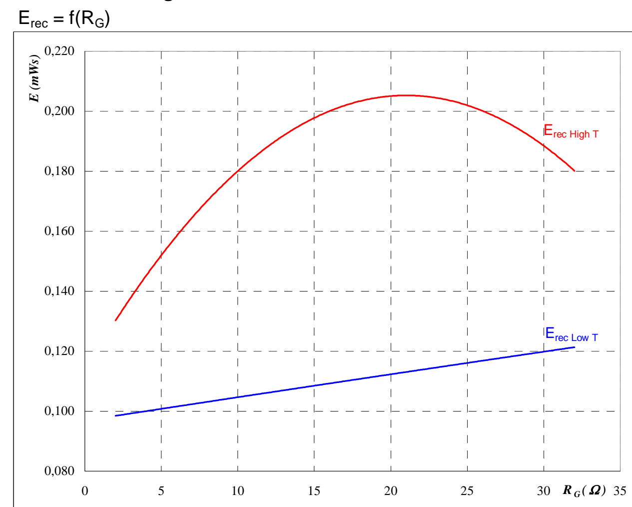
MOSFET turn off delayed by 100ns

Figure 8 FWD

Typical reverse recovery energy loss

as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

T_j =	25/126	°C
V_{CE} =	350	V
V_{GE} =	15	V
I_C =	78	A

MOSFET turn off delayed by 100ns

Copyright by Vincotech

Input Boost

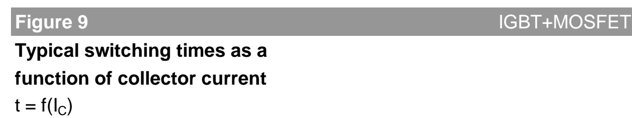
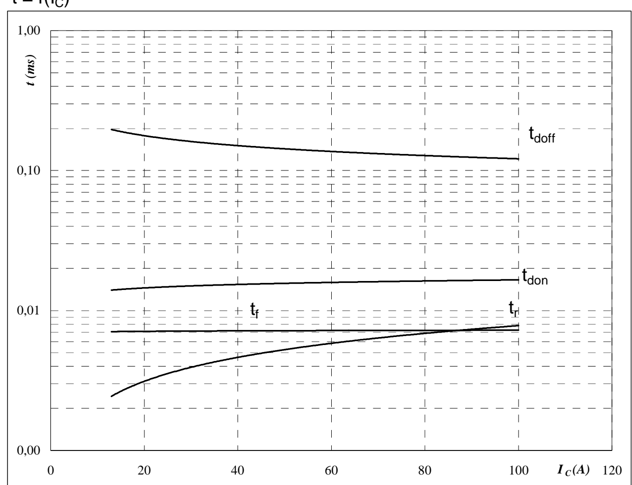


Figure 9 IGBT+MOSFET

Typical switching times as a function of collector current

$t = f(I_C)$



With an inductive load at

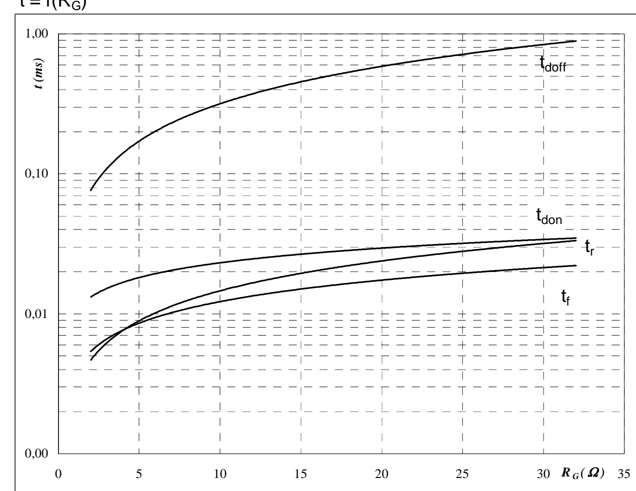
T_j =	126	°C
V_{CE} =	350	V
V_{GE} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

MOSFET turn off delayed by 100ns

Figure 10 IGBT+MOSFET

Typical switching times as a function of gate resistor

$t = f(R_G)$



With an inductive load at

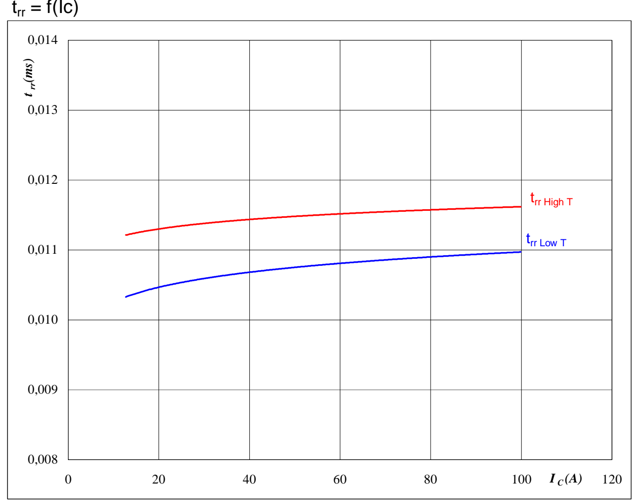
T_j =	126	°C
V_{CE} =	350	V
V_{GE} =	15	V
I_C =	78	A

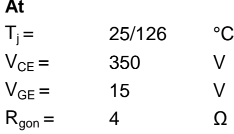
MOSFET turn off delayed by 100ns

Figure 11 FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(Ic)$





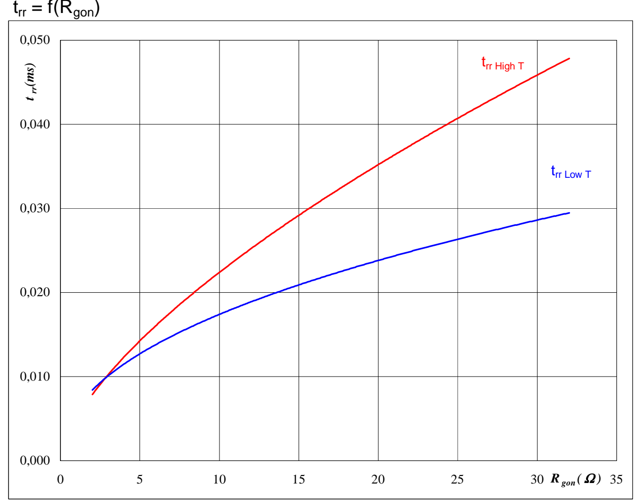
At

T_j =	25/126	°C
V_{CE} =	350	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 12 FWD

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

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



At

T_j =	25/126	°C
V_R =	350	V
I_F =	78	A
V_{GE} =	15	V

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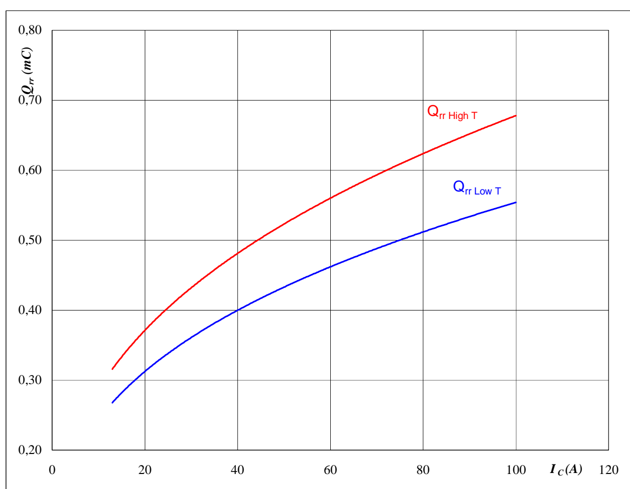
Input Boost

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



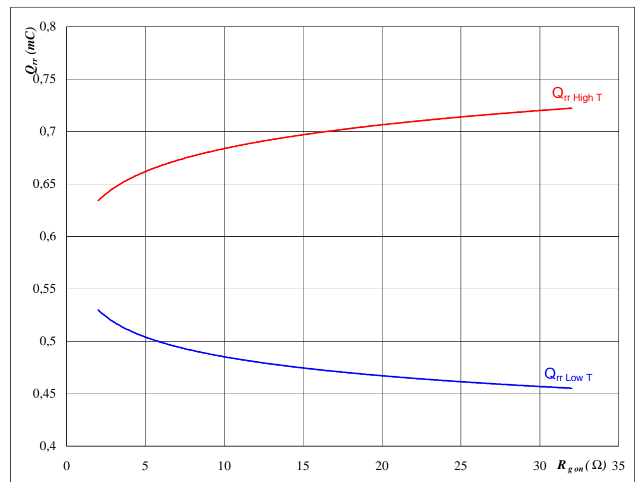
At

T_j =	25/126	°C
V_{CE} =	350	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 14 FWD

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

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



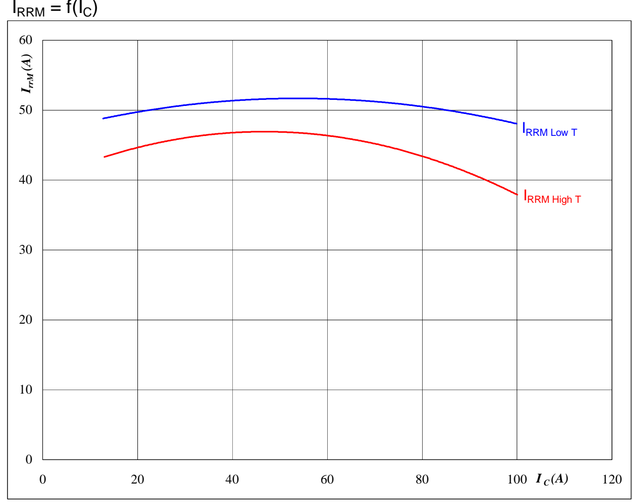
At

T_j =	25/126	°C
V_R =	350	V
I_F =	78	A
V_{GE} =	15	V

Figure 15 FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



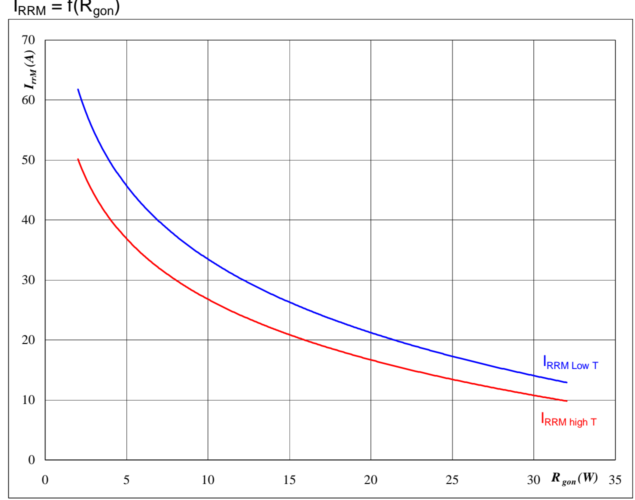
At

T_j =	25/126	°C
V_{CE} =	350	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 16 FWD

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

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



At

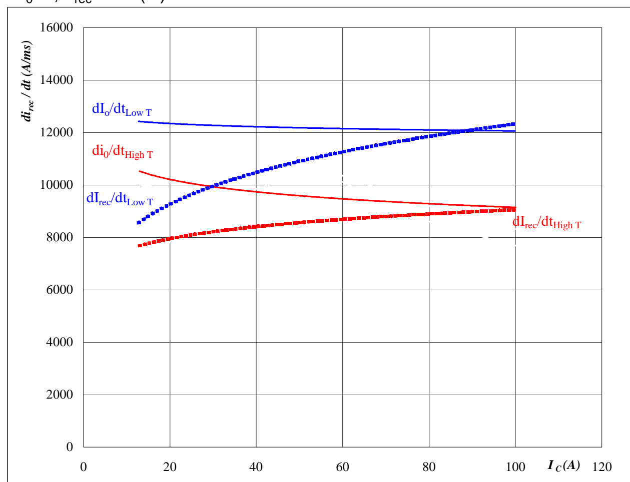
T_j =	25/126	°C
V_R =	350	V
I_F =	78	A
V_{GE} =	15	V

Input Boost

Figure 17	FWD

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

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



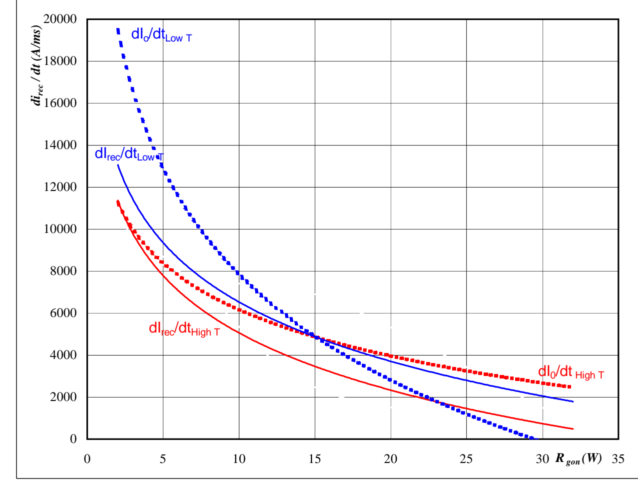
At

T_j =	25/126	°C
V_{CE} =	350	V
V_{GE} =	15	V
R_{gon} =	4	Ω

Figure 18	FWD

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

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



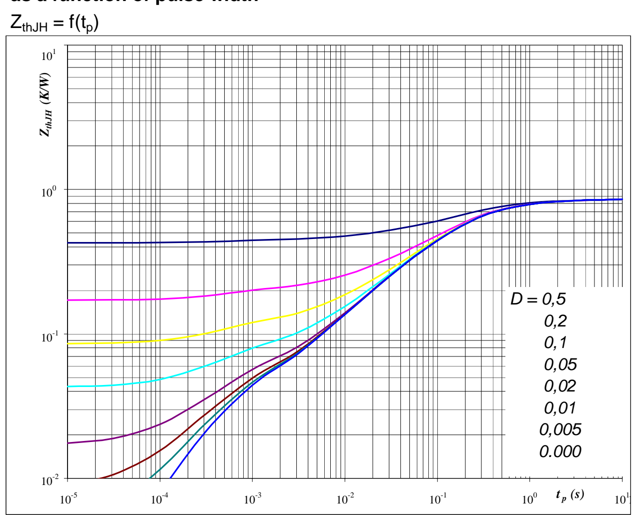
At

T_j =	25/126	°C
V_R =	350	V
I_F =	78	A
V_{GE} =	15	V

Figure 19	IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	0,85	K/W

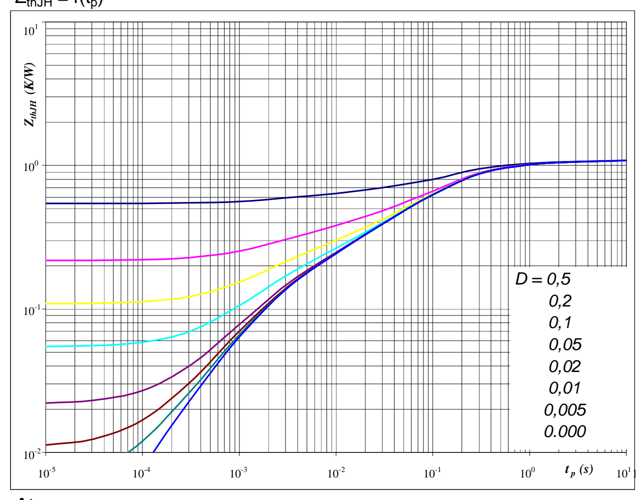
IGBT thermal model values

R (C/W)	Tau (s)
0,10	1,8E+00
0,32	2,8E-01
0,30	8,4E-02
0,09	1,2E-02
0,04	5,0E-04

Figure 20	FWD

FRED transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	1,09	K/W

FRED thermal model values

R (C/W)	Tau (s)
0,06	4,1E+00
0,22	5,0E-01
0,55	1,1E-01
0,16	1,1E-02
0,10	1,6E-03

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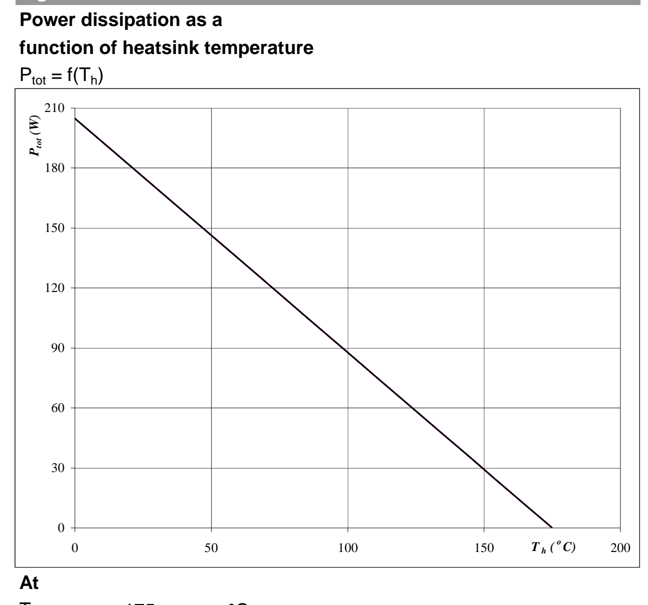
Input Boost

Figure 21 IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



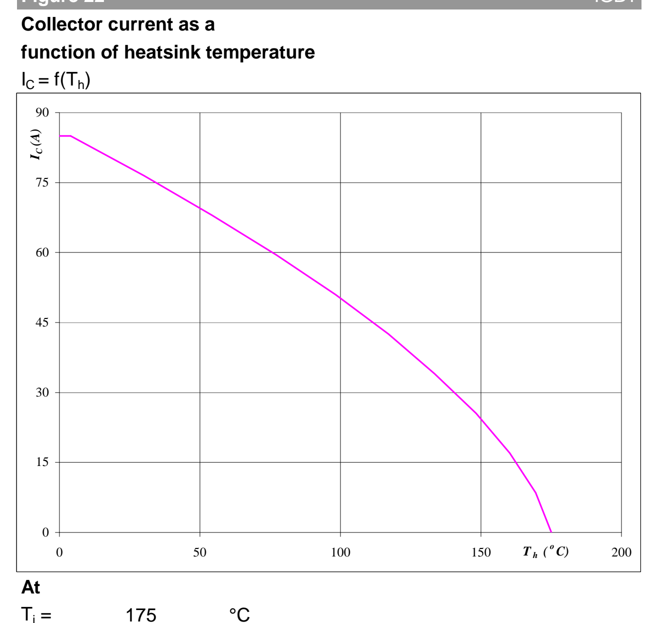
At

T_j = 175 °C

Figure 22 IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

T_j = 175 °C

V_{GE} = 15 V

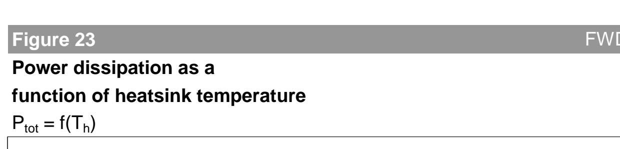
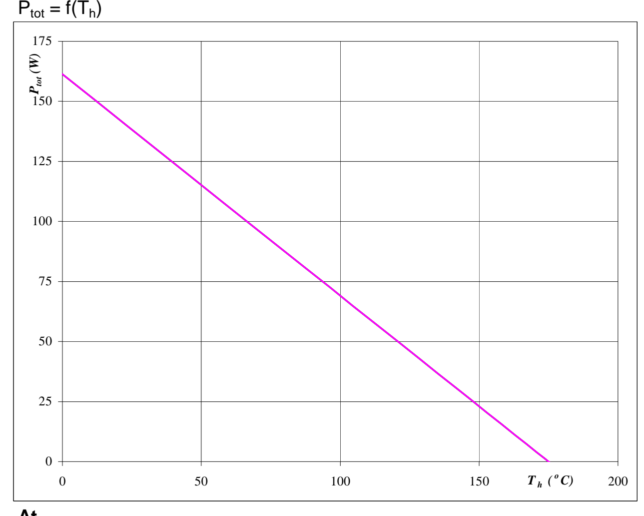


Figure 23 FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



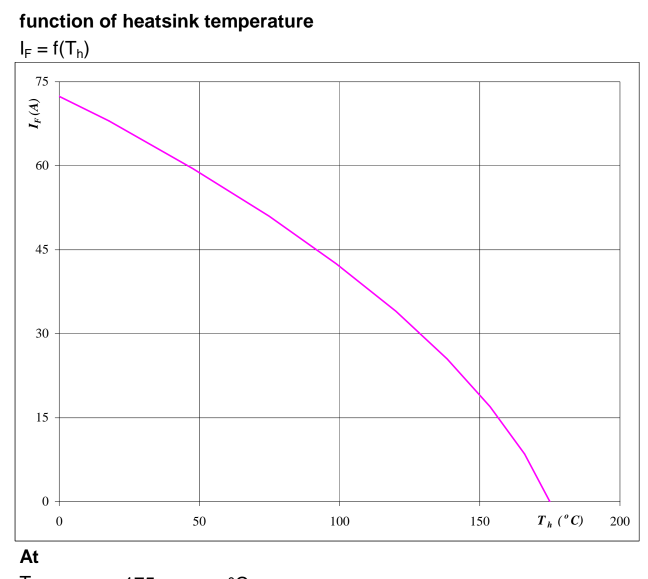
At

T_j = 175 °C

Figure 24 FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

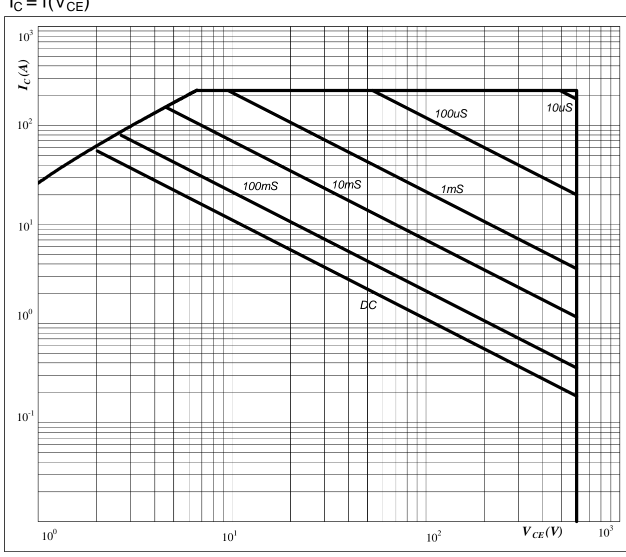
T_j = 175 °C

Input Boost

Figure 25 IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



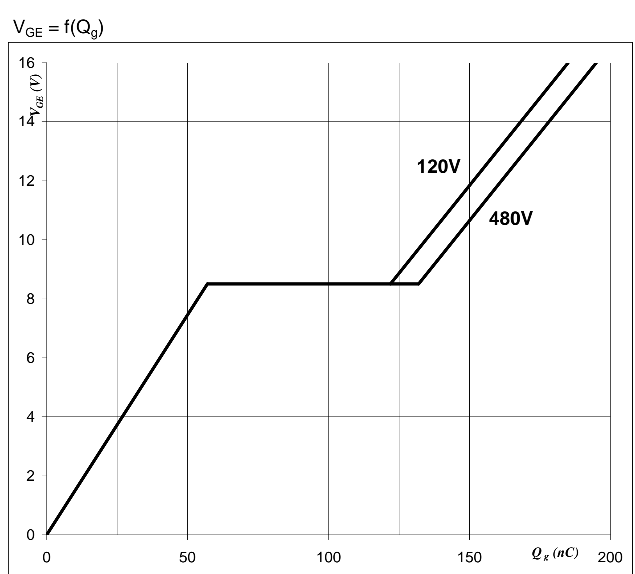
At

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

Figure 26 IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



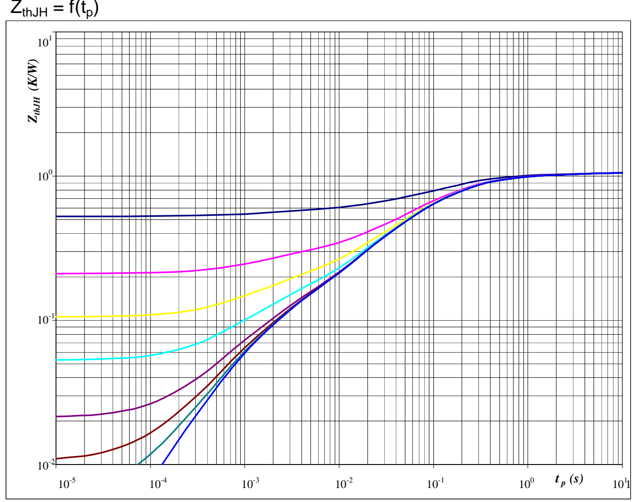
At

$I_{G(REF)}$=1mA, R_L=15Ω

Figure 27 MOSFET

MOSFET transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	1,05	K/W

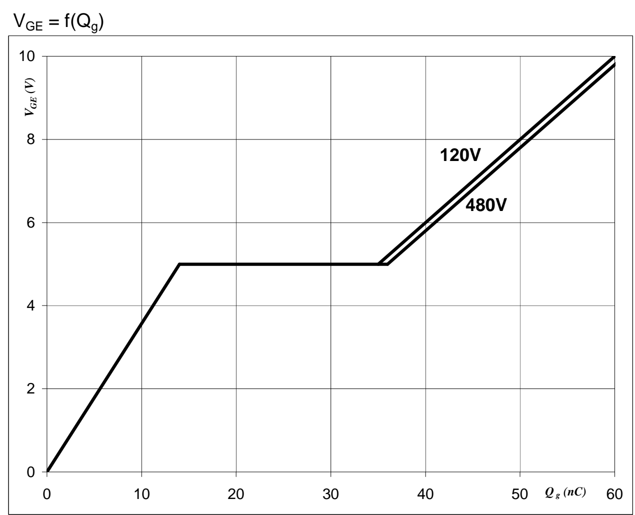
MOSFET thermal model values

R (C/W)	Tau (s)
0,06	3,4E+00
0,23	4,0E-01
0,53	8,8E-02
0,15	1,5E-02
0,08	1,3E-03
0,05	4,7E-04

Figure 28 MOSFET

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



At

I_C =	18	A

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Thermistor

Figure 1 Thermistor

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

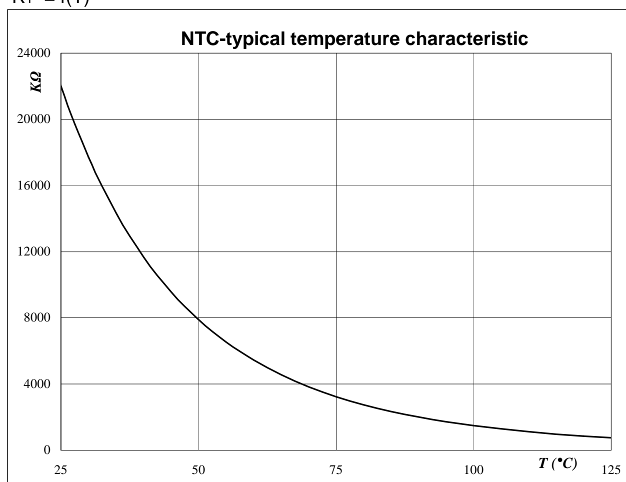


Figure 2 Thermistor

Typical NTC resistance values

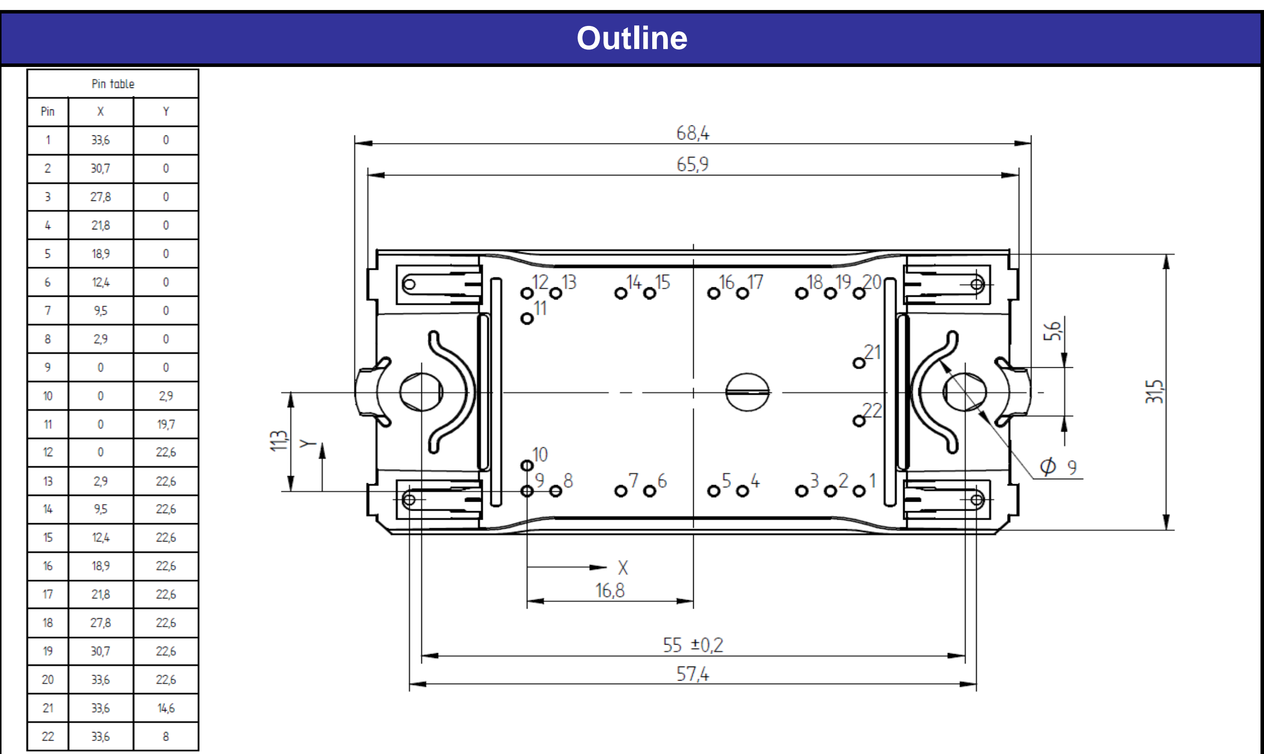
$$R(T) = R_{25} \cdot e^{\left(B_{25/100} \cdot \left(\frac{1}{T} - \frac{1}{T_{25}}\right)\right)} \quad [\Omega]$$

Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

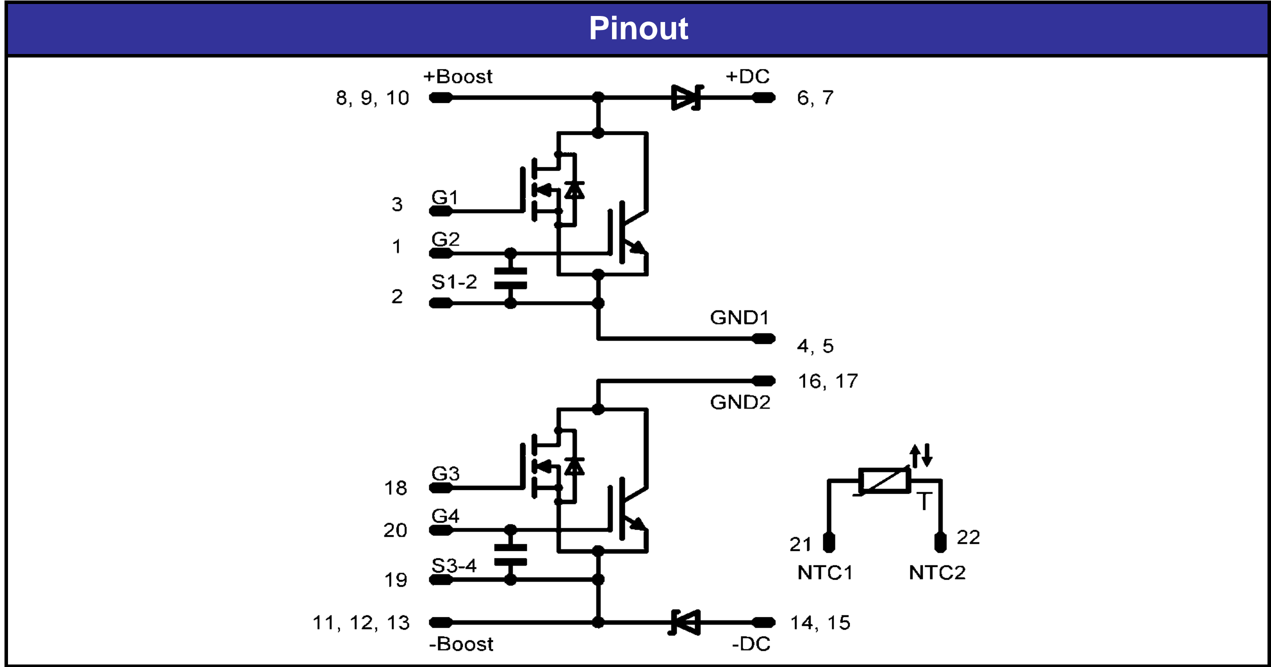
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	10-FZ06NBA084FP-M306L48	M306L48	M306L48

Outline



Pin table		
Pin	X	Y
1	33,6	0
2	30,7	0
3	27,8	0
4	21,8	0
5	18,9	0
6	12,4	0
7	9,5	0
8	2,9	0
9	0	0
10	0	2,9
11	0	19,7
12	0	22,6
13	2,9	22,6
14	9,5	22,6
15	12,4	22,6
16	18,9	22,6
17	21,8	22,6
18	27,8	22,6
19	30,7	22,6
20	33,6	22,6
21	33,6	14,6
22	33,6	8

Pinout



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