

flowBOOST0
600V/41mΩ
Features

- High efficiency symmetric boost
- Ultra fast switching with MOSFET and SiC diodes
- Low Inductance Layout
- Tandem to NPC and MNPC modules

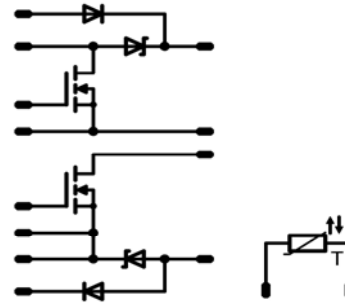
Target Applications

- Neutral point solar inverters
- Solar inverters
- UPS

Types

- 10-PZ06NBA041FS-P915L68Y

flow0 12mm housing

Schematic


Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
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Bypass Diode

Repetitive peak reverse voltage	V _{RRM}		1600	V
Forward current per diode	I _{FAV}	DC current T _h =80°C T _c =80°C	42 57	A
Surge forward current	I _{FSM}	t _p =10ms T _j =25°C	370	A
I ² t-value	I ² t		T _j =150°C	370
Power dissipation per Diode	P _{tot}	T _j =T _j max T _h =80°C T _c =80°C	49 75	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 _{jmax}	T _h =80°C T _c =80°C	32 39	A
Pulsed drain current	I _{Dpulse}	t _p limited by T _{jmax}		272	A
Power dissipation	P _{tot}	T _j =T _{jmax}	T _h =80°C T _c =80°C	97 147	W
Gate-source peak voltage	V _{GS}			±20	V
Maximum Junction Temperature	T _{jmax}			150	°C

Maximum Ratings

 $T_j=25^{\circ}\text{C}$, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
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Input Boost Diode

Peak Repetitive Reverse Voltage	V_{RRM}	$T_j=25^{\circ}\text{C}$	600	V
DC forward current	I_F	$T_j=T_{jmax}$ $T_h=80^{\circ}\text{C}$ $T_c=80^{\circ}\text{C}$	20 24	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	114	A
Power dissipation	P_{tot}	$T_j=T_{jmax}$ $T_h=80^{\circ}\text{C}$ $T_c=80^{\circ}\text{C}$	41 63	W
Maximum Junction Temperature	T_{jmax}		150	$^{\circ}\text{C}$

Thermal Properties

Storage temperature	T_{slg}		-40...+125	$^{\circ}\text{C}$
Operation temperature under switching condition	T_{op}		-40...+($T_{jmax} - 25$)	$^{\circ}\text{C}$

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 $V_{GS}[V]$	$V_i[V]$ or $V_{CE}[V]$ or $V_{DS}[V]$	$I_C[A]$ or $I_F[A]$ or $I_D[A]$	T_j	Min	Typ	Max	

Bypass Diode

Forward voltage	V_F				35	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	0,8	1,14 1,09	1,3	V
Threshold voltage (for power loss calc. only)	V_{th}				35	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		0,92 0,81		V
Slope resistance (for power loss calc. only)	r_t				35	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		0,006 0,008		Ω
Reverse current	I_r			1600		$T_j=25^{\circ}C$ $T_j=125^{\circ}C$			0,1	mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness $\leq 50\mu m$ $\lambda = 1$ W/mK						1,42		K/W

Input Boost MOSFET

Static drain to source ON resistance	$R_{DS(on)}$		10		44,4	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		0,04 0,08		Ω
Gate threshold voltage	$V_{(GS)th}$	VGS=VDS			0,00296	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	2,4	3	3,6	V
Gate to Source Leakage Current	I_{gss}		0	600		$T_j=25^{\circ}C$ $T_j=125^{\circ}C$			100	nA
Zero Gate Voltage Drain Current	I_{dss}		20	0		$T_j=25^{\circ}C$ $T_j=125^{\circ}C$			5	μA
Turn On Delay Time	$t_{d(ON)}$	Rgoff=8 Ω Rgon=8 Ω	10/0	400	15	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		33 30		ns
Rise Time	t_r					$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		9 10		
Turn off delay time	$t_{d(OFF)}$					$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		290 317		
Fall time	t_f					$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		14 5		
Turn-on energy loss per pulse	E_{on}	Rgon=8 Ω	10/0	480	44	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		0,13 0,14		mWs
Turn-off energy loss per pulse	E_{off}					$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		0,06 0,07		
Total gate charge	Q_g					$T_j=25^{\circ}C$		290		
Gate to source charge	Q_{gs}					$T_j=25^{\circ}C$		36		
Gate to drain charge	Q_{gd}					$T_j=25^{\circ}C$		150		nC
Input capacitance	C_{iss}	f=1MHz	0	100		$T_j=25^{\circ}C$		6530		pF
Output capacitance	C_{oss}							360		
Reverse transfer capacitance	C_{rss}							tbd.		
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness $\leq 50\mu m$ $\lambda = 1$ W/mK						0,72		K/W

Input Boost Diode

Forward voltage	V_F				15	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	0,9	1,50 1,76	1,9	V
Reverse leakage current	I_{rm}		10/0	400		$T_j=25^{\circ}C$ $T_j=125^{\circ}C$			100	μA
Peak recovery current	I_{RRM}	Rgon=8 Ω	10/0	400	15	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		8 7		A
Reverse recovery time	t_{rr}					$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		9 10		ns
Reverse recovery charge	Q_{rr}					$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		0,11 0,14		μC
Reverse recovered energy	E_{rec}					$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		0,03 0,04		mWs
Peak rate of fall of recovery current	$di(rec)_{max}/dt$					$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		2512 1984		A/ μs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness $\leq 50\mu m$ $\lambda = 1$ W/mK						1,69		K/W

Thermistor

Rated resistance*	R_{25}	Tol. $\pm 5\%$				$T_j=25^{\circ}C$	20,9	22	23,1	k Ω
	R_{100}							1486		Ω
Power dissipation	P					$T_j=25^{\circ}C$		200		mW
B-value	$B_{(25/100)}$	Tol. $\pm 3\%$				$T_j=25^{\circ}C$		3950		K

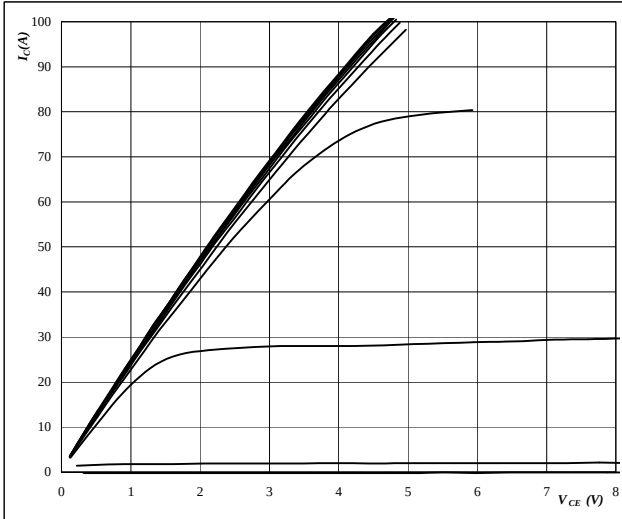
* see details on **Thermistor** charts on **Figure 2**.

INPUT BOOST

Figure 1 BOOST MOSFET

Typical output characteristics

$$I_D = f(V_{DS})$$

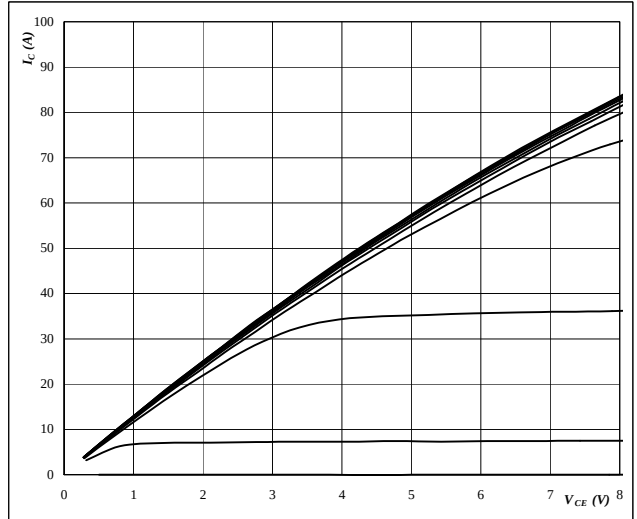


$t_p = 250 \mu s$
 $T_j = 25^\circ C$
 V_{DS} from 3 V to 13 V in steps of 1 V

Figure 2 BOOST MOSFET

Typical output characteristics

$$I_D = f(V_{DS})$$

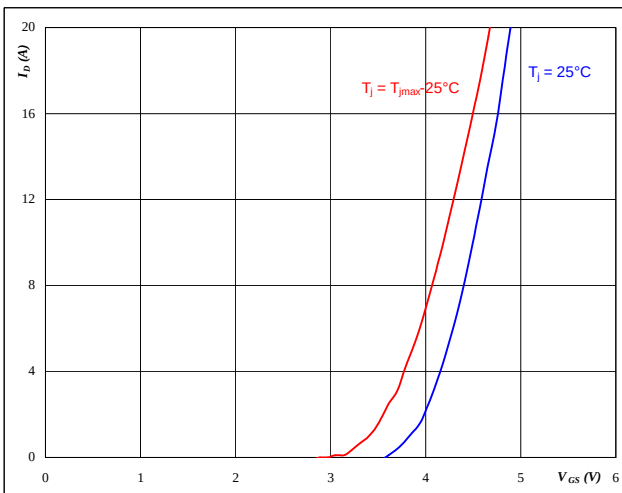


$t_p = 250 \mu s$
 $T_j = 125^\circ C$
 V_{DS} from 3 V to 13 V in steps of 1 V

Figure 3 BOOST MOSFET

Typical transfer characteristics

$$I_D = f(V_{GS})$$

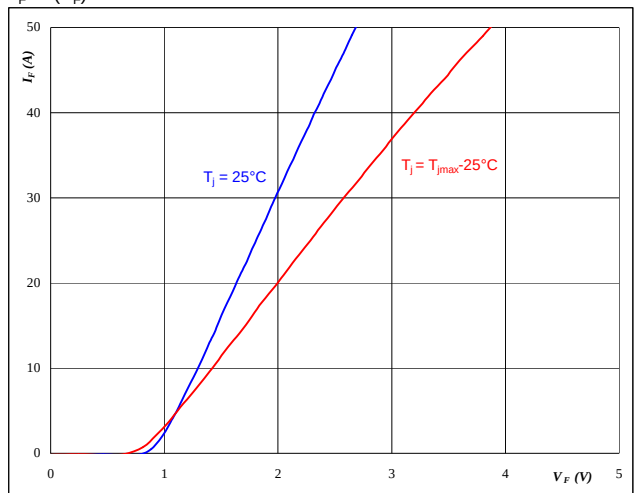


At
 $t_p = 250 \mu s$
 $V_{DS} = 10 V$

Figure 4 BOOST FWD

Typical diode forward current as a function of forward voltage

$$I_F = f(V_F)$$



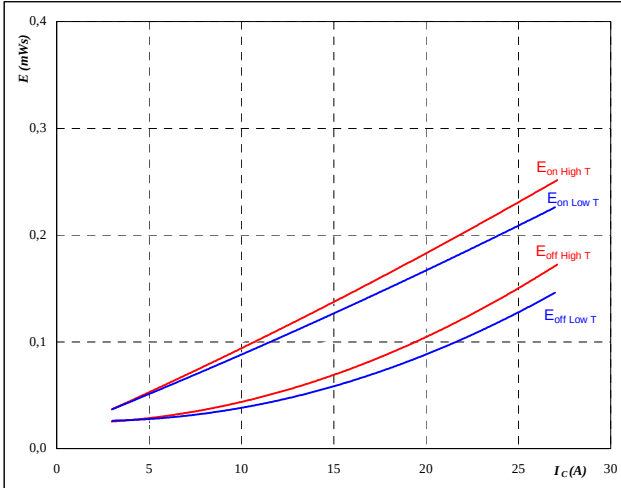
At
 $t_p = 250 \mu s$

INPUT BOOST

Figure 5 BOOST MOSFET

Typical switching energy losses
as a function of collector current

$$E = f(I_D)$$



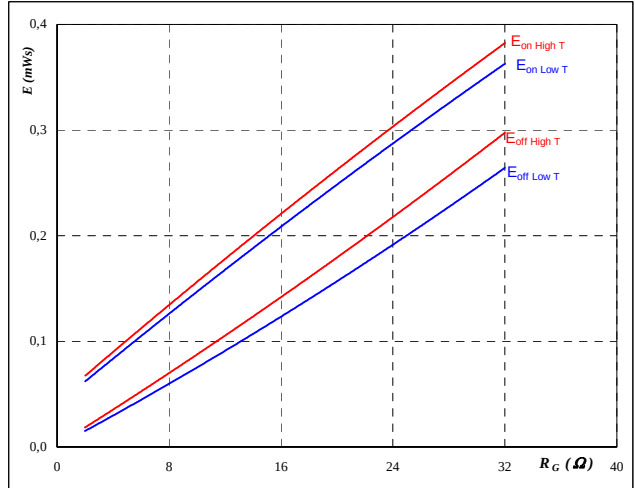
With an inductive load at

$T_J =$	25/125	°C
$V_{DS} =$	400	V
$V_{GS} =$	+10/0	V
$R_{gon} =$	8	Ω
$R_{goff} =$	8	Ω

Figure 6 BOOST MOSFET

Typical switching energy losses
as a function of gate resistor

$$E = f(R_G)$$



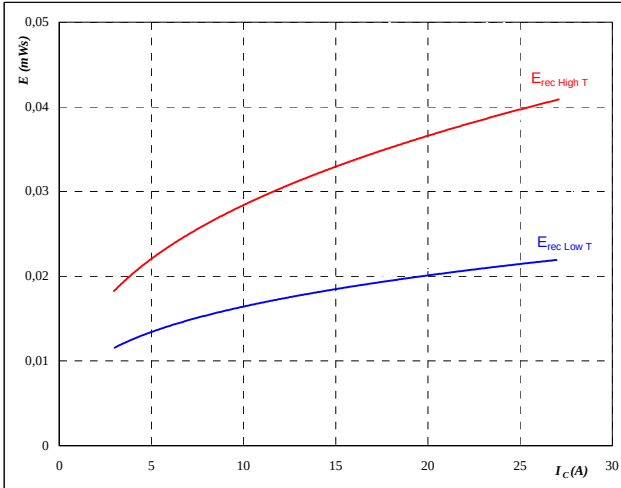
With an inductive load at

$T_J =$	25/125	°C
$V_{DS} =$	400	V
$V_{GS} =$	+10/0	V
$I_D =$	15	A

Figure 7 BOOST MOSFET

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

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



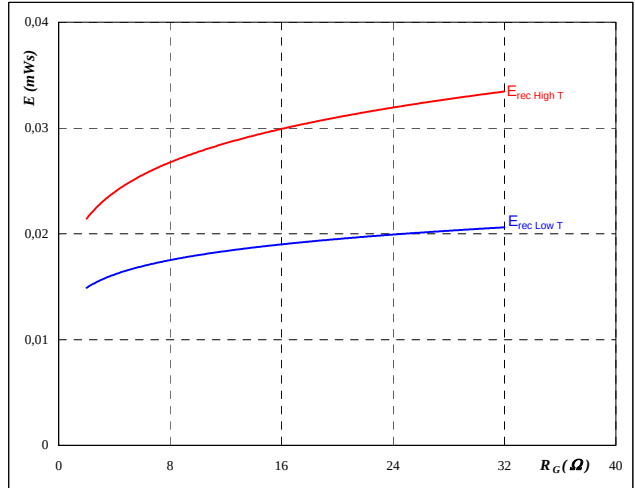
With an inductive load at

$T_J =$	25/125	°C
$V_{DS} =$	400	V
$V_{GS} =$	+10/0	V
$R_{gon} =$	8	Ω
$R_{goff} =$	8	Ω

Figure 8 BOOST MOSFET

Typical reverse recovery energy loss
as a function of gate resistor

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



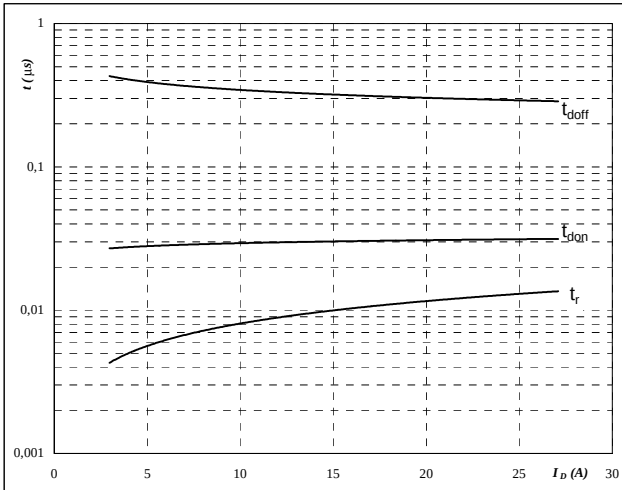
With an inductive load at

$T_J =$	25/125	°C
$V_{DS} =$	400	V
$V_{GS} =$	+10/0	V
$I_D =$	15	A

INPUT BOOST

Figure 9 BOOST MOSFET

Typical switching times as a
function of collector current
 $t = f(I_D)$

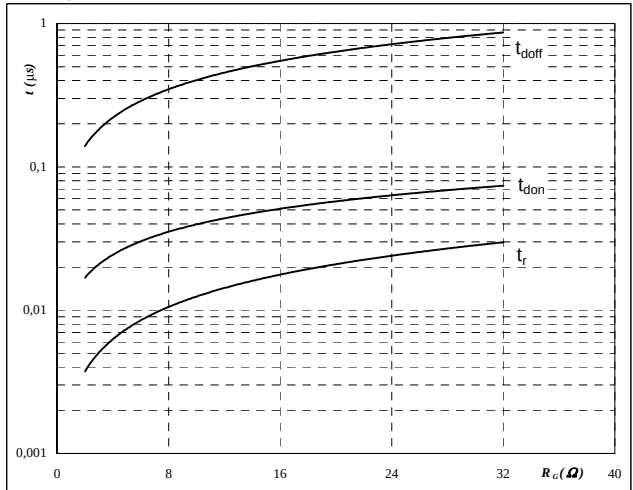


With an inductive load at

$T_J =$	125	°C
$V_{DS} =$	400	V
$V_{GS} =$	+10/0	V
$R_{gon} =$	8	Ω
$R_{goff} =$	8	Ω

Figure 10 BOOST MOSFET

Typical switching times as a
function of gate resistor
 $t = f(R_G)$

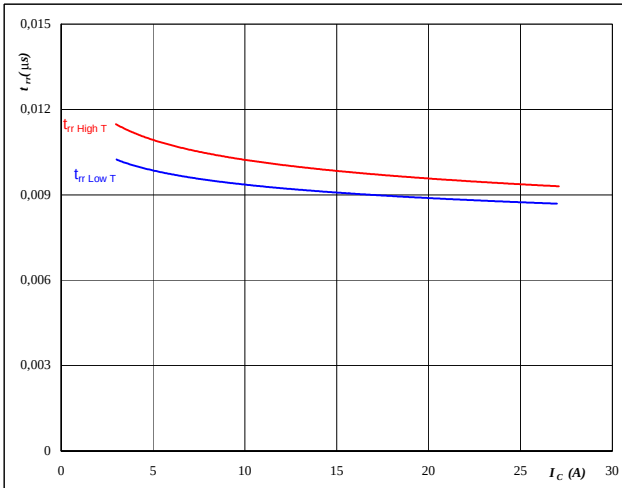


With an inductive load at

$T_J =$	125	°C
$V_{DS} =$	400	V
$V_{GS} =$	+10/0	V
$I_C =$	15	A

Figure 11 BOOST FWD

Typical reverse recovery time as a
function of collector current
 $t_{rr} = f(I_C)$

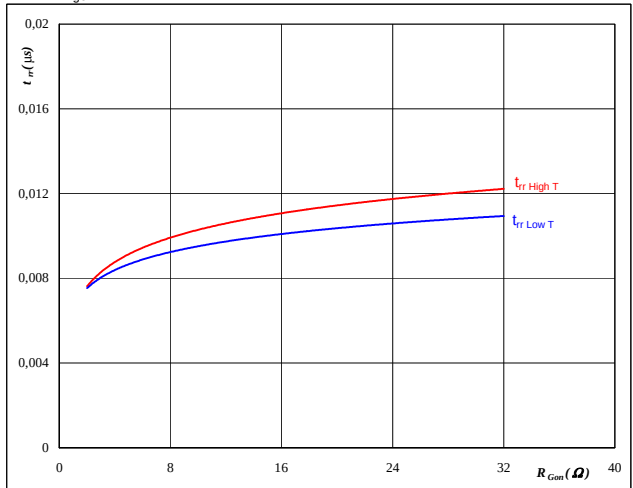


At

$T_J =$	25/125	°C
$V_{DS} =$	400	V
$V_{GS} =$	+10/0	V
$R_{gon} =$	8	Ω

Figure 12 BOOST FWD

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



At

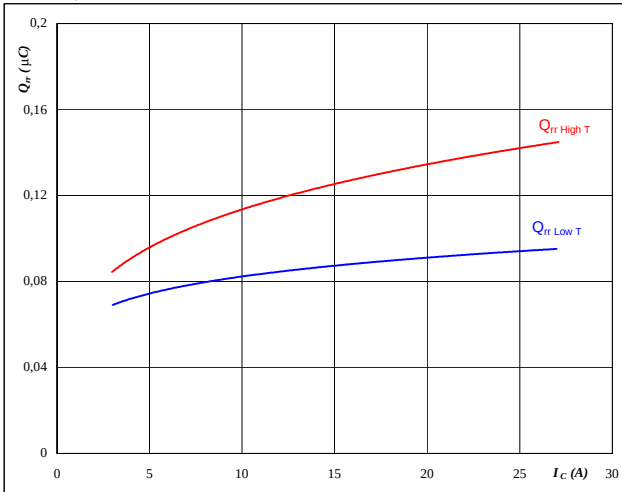
$T_J =$	25/125	°C
$V_R =$	400	V
$I_F =$	15	A
$V_{GS} =$	+10/0	V

INPUT BOOST

Figure 13 BOOST FWD

Typical reverse recovery charge as a function of collector current

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



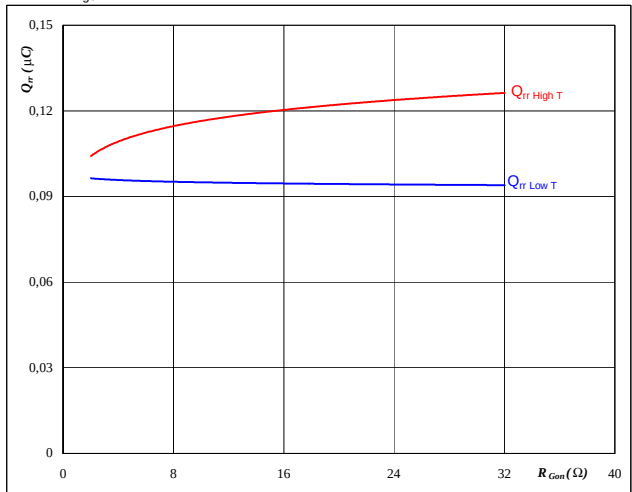
At

$T_j =$	25/125	°C
$V_{DS} =$	400	V
$V_{GS} =$	+10/0	V
$R_{gon} =$	8	Ω

Figure 14 BOOST FWD

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

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



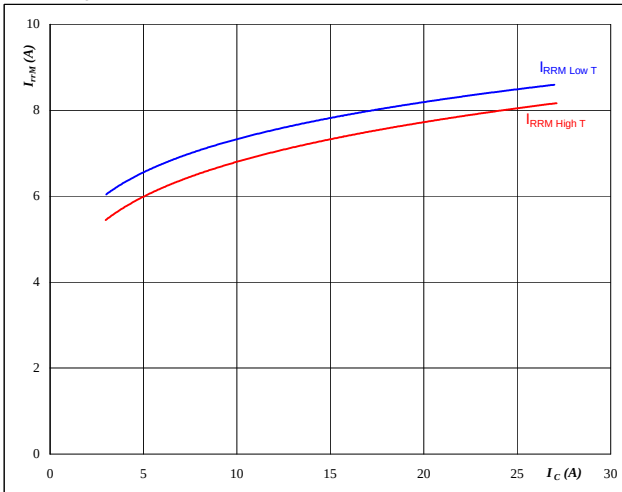
At

$T_j =$	25/125	°C
$V_R =$	400	V
$I_F =$	15	A
$V_{GS} =$	+10/0	V

Figure 15 BOOST FWD

Typical reverse recovery current as a function of collector current

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



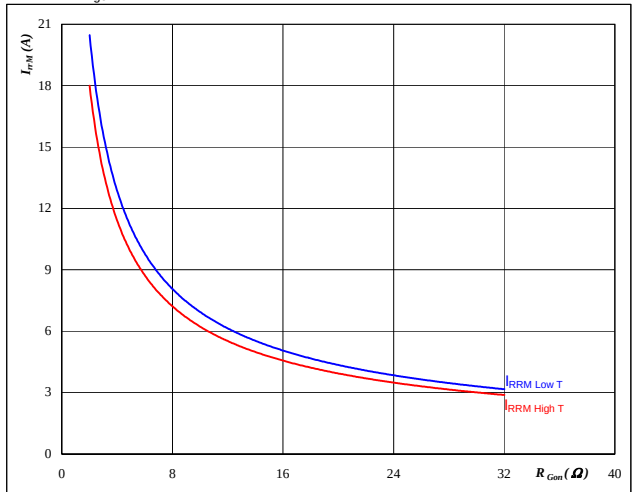
At

$T_j =$	25/125	°C
$V_{DS} =$	400	V
$V_{GS} =$	+10/0	V
$R_{gon} =$	8	Ω

Figure 16 BOOST FWD

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

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



At

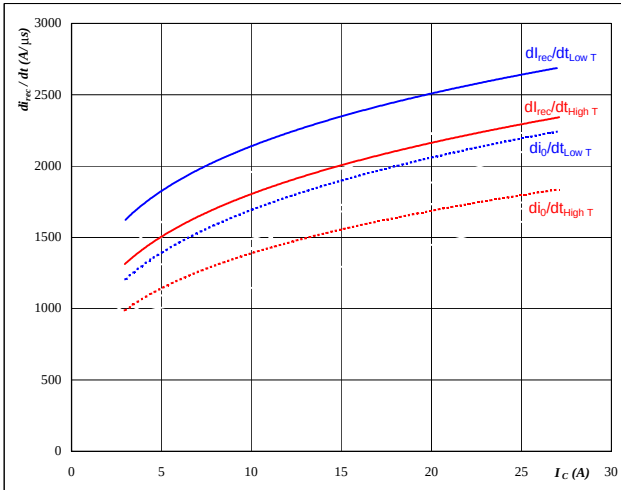
$T_j =$	25/125	°C
$V_R =$	400	V
$I_F =$	15	A
$V_{GS} =$	+10/0	V

INPUT BOOST

Figure 17 BOOST FWD

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

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



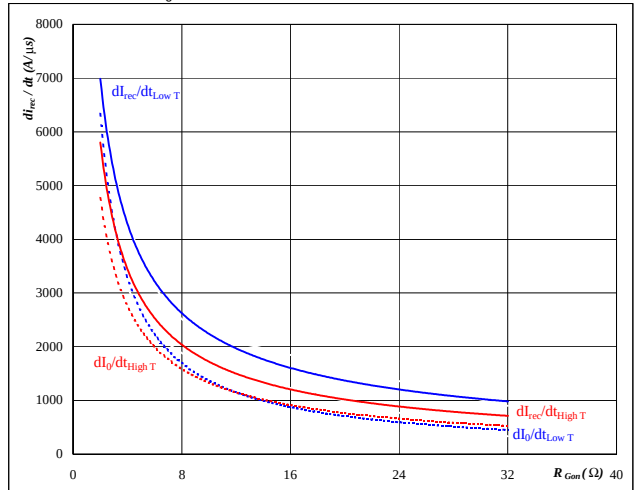
At
T_J = 25/125 °C
V_{CE} = 400 V
V_{GE} = +10/0 V
R_{gon} = 8 Ω

dI_G/dt
dI_{rec}/dt

Figure 18 BOOST FWD

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

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



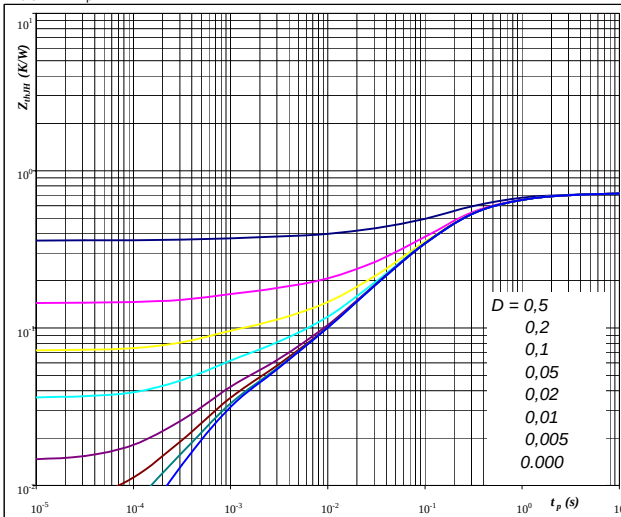
At
T_J = 25/125 °C
V_{CE} = 400 V
I_F = 15 A
V_{GS} = +10/0 V

dI_G/dt
dI_{rec}/dt

Figure 19 BOOST MOSFET

MOSFET transient thermal impedance as a function of pulse width

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



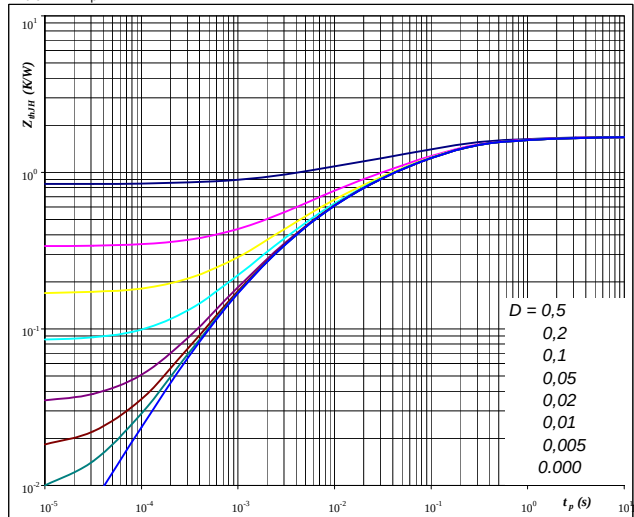
At
D = t_p / T
R_{thJH} = 0,72 K/W MOSFET thermal model values

R (C/W)	Tau (s)
0,019	8,77E+00
0,106	1,31E+00
0,352	2,19E-01
0,164	6,50E-02
0,049	1,06E-02
0,031	7,41E-04

Figure 20 BOOST FWD

FWD transient thermal impedance as a function of pulse width

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



At
D = t_p / T
R_{thJH} = 1,69 K/W FWD thermal model values

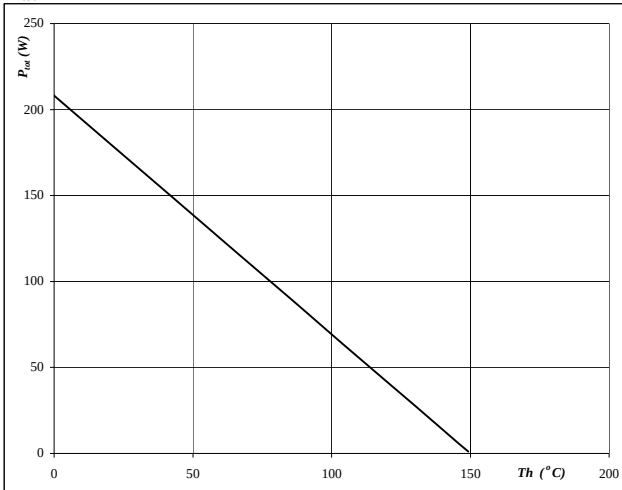
R (C/W)	Tau (s)
0,05	5,64E+00
0,17	6,62E-01
0,59	1,18E-01
0,47	2,15E-02
0,33	3,58E-03
0,07	5,72E-04

INPUT BOOST

Figure 21 BOOST MOSFET

Power dissipation as a function of heatsink temperature

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

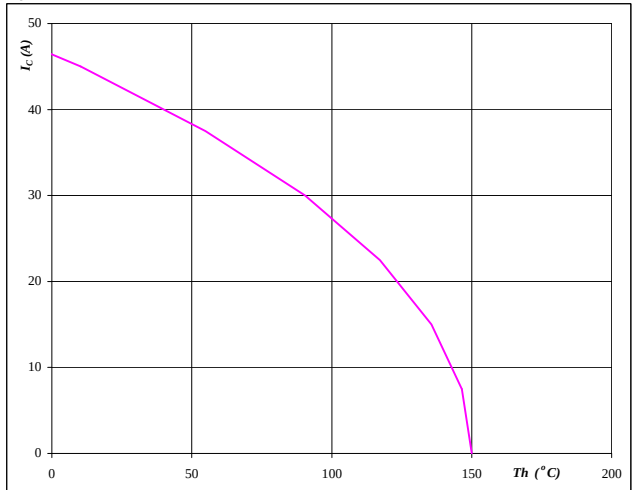


At
 $T_J = 150$ °C

Figure 22 BOOST MOSFET

Collector/Drain current as a function of heatsink temperature

$$I_C = f(T_h)$$

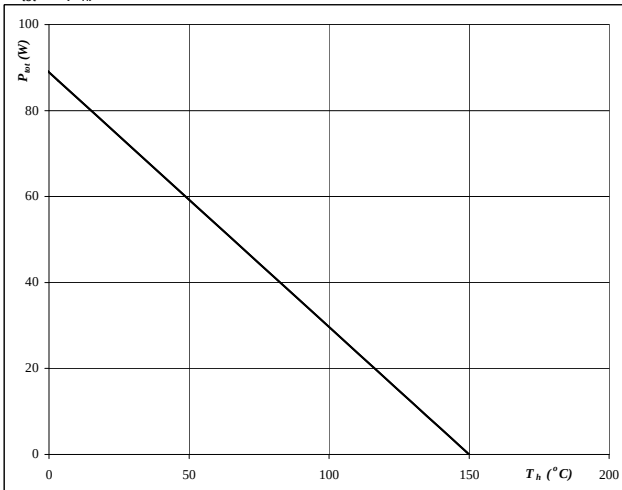


At
 $T_J = 150$ °C
 $V_{GS} = 10$ V

Figure 23 BOOST FWD

Power dissipation as a function of heatsink temperature

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

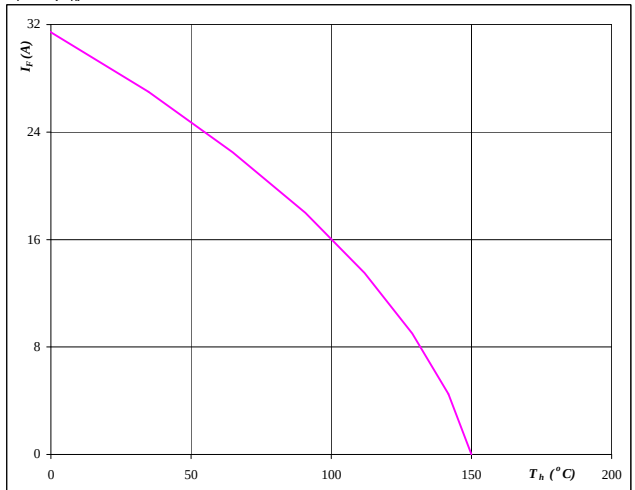


At
 $T_J = 150$ °C

Figure 24 BOOST FWD

Forward current as a function of heatsink temperature

$$I_F = f(T_h)$$



At
 $T_J = 150$ °C

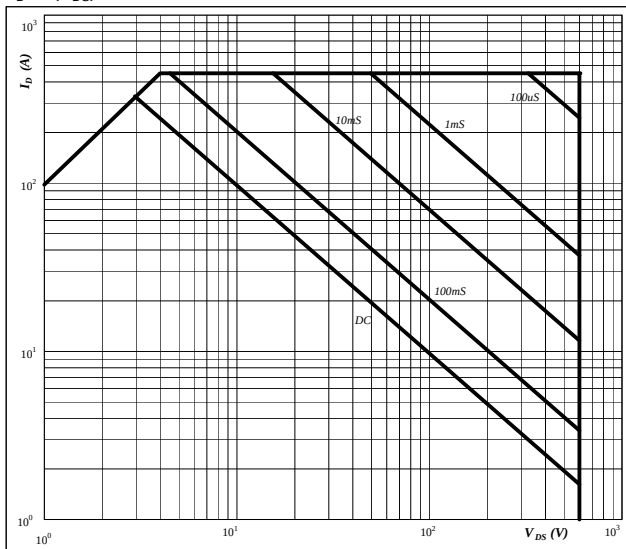
INPUT BOOST

Figure 25

BOOST MOSFET

Safe operating area as a function
of drain-source voltage

$$I_D = f(V_{DS})$$



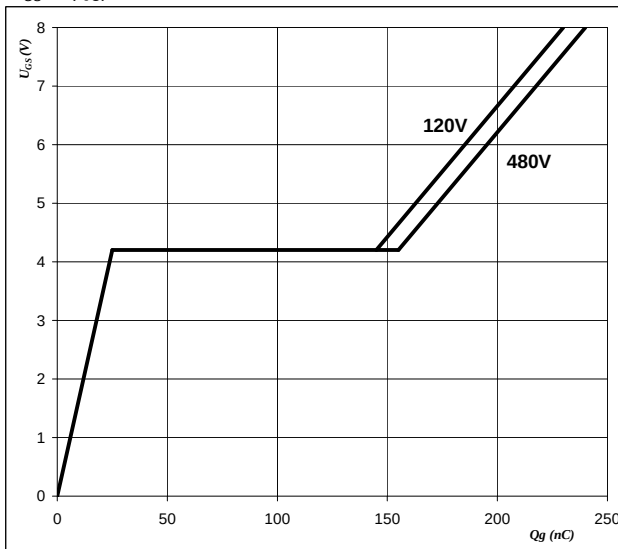
At
D = single pulse
T_h = 80 °C
V_{GS} = +10/0 V
T_J = T_{Jmax} °C

Figure 26

BOOST MOSFET

Gate voltage vs Gate charge

$$V_{GS} = f(Q_g)$$



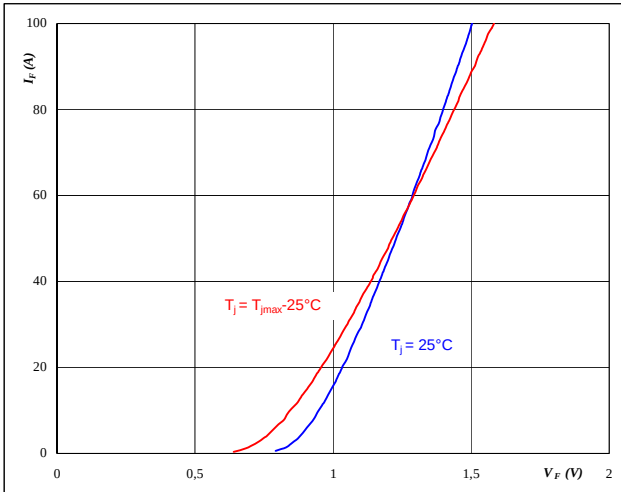
At
I_D = 15 A

Bypass Diode

Figure 1 Bypass diode

Typical diode forward current as a function of forward voltage

$$I_F = f(V_F)$$

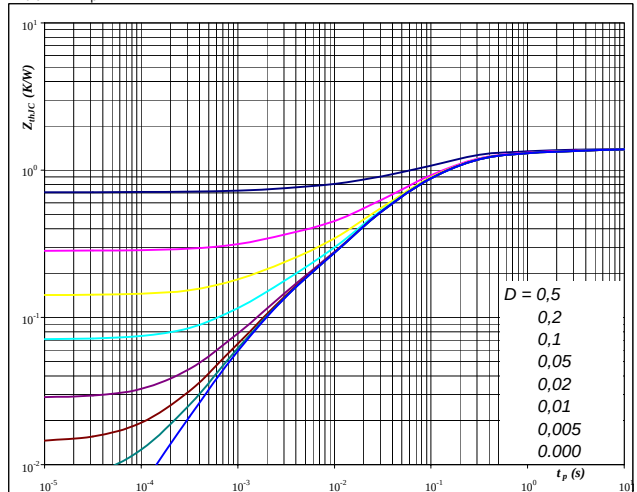


At
 $t_p = 250 \mu s$

Figure 2 Bypass diode

Diode transient thermal impedance as a function of pulse width

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

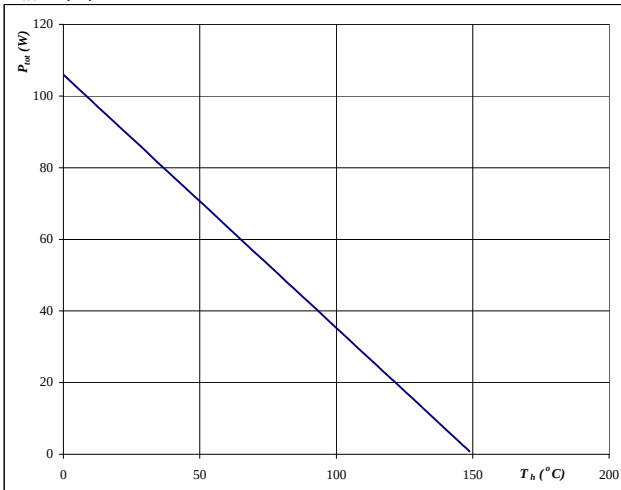


At
 $D = t_p / T$
 $R_{thJH} = 1,42 \text{ K/W}$

Figure 3 Bypass diode

Power dissipation as a function of heatsink temperature

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

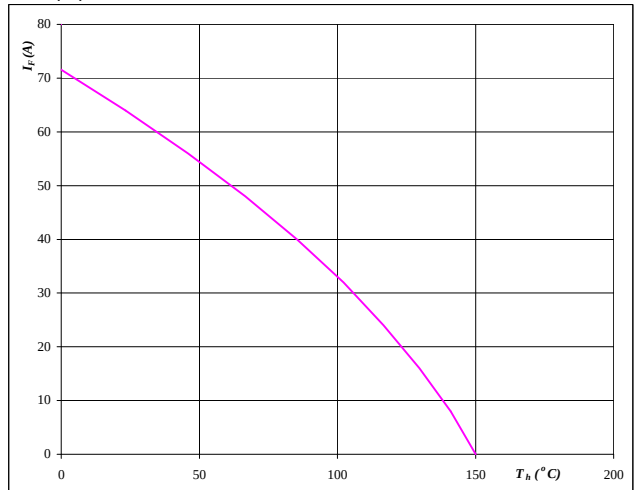


At
 $T_j = 150 \text{ } ^\circ\text{C}$

Figure 4 Bypass diode

Forward current as a function of heatsink temperature

$$I_F = f(T_h)$$



At
 $T_j = 150 \text{ } ^\circ\text{C}$

Thermistor

Figure 1 Thermistor

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$

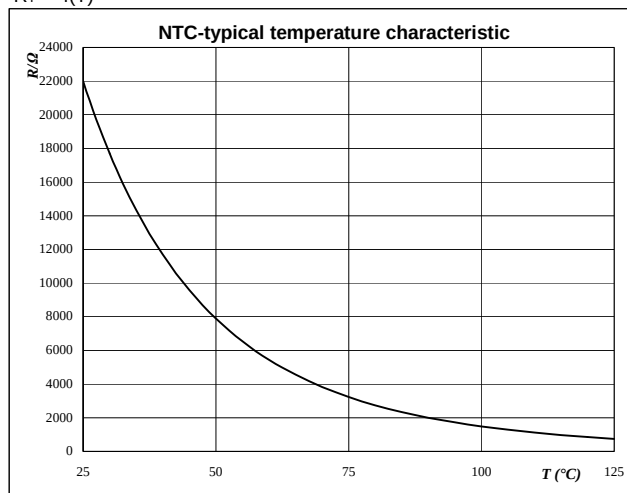


Figure 2 Thermistor

Typical NTC resistance values

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

Switching Definitions Boost MOSFET

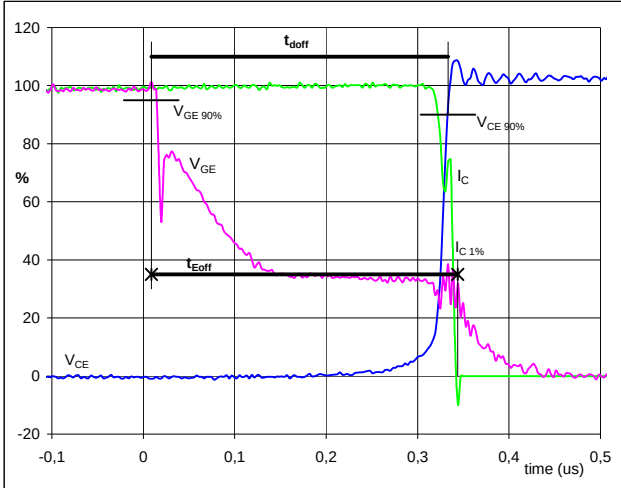
General conditions

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

Figure 1 BOOST MOSFET

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

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

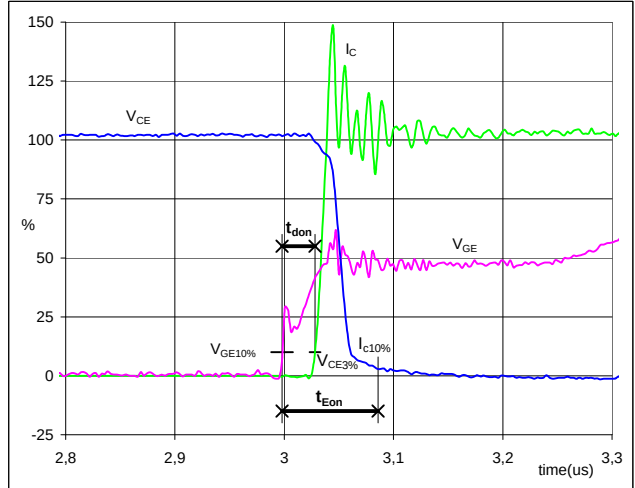


$V_{GE}(0\%) =$	0	V
$V_{GE}(100\%) =$	10	V
$V_C(100\%) =$	400	V
$I_C(100\%) =$	15	A
$t_{doff} =$	0,32	μ S
$t_{Eoff} =$	0,33	μ S

Figure 2 BOOST MOSFET

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

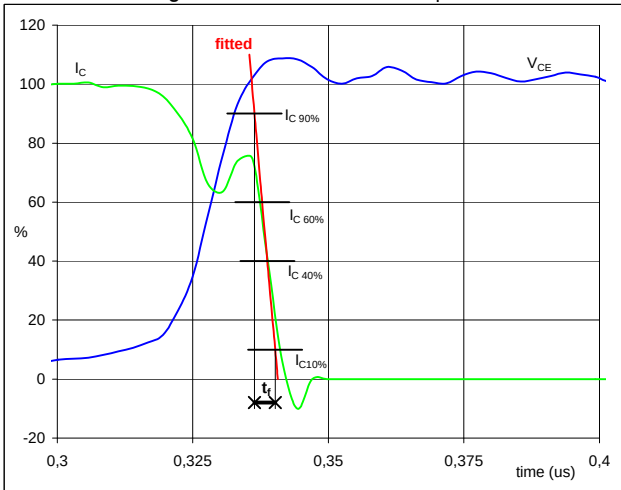
(t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%) =$	0	V
$V_{GE}(100\%) =$	10	V
$V_C(100\%) =$	400	V
$I_C(100\%) =$	15	A
$t_{don} =$	0,03	μ S
$t_{Eon} =$	0,09	μ S

Figure 3 BOOST MOSFET

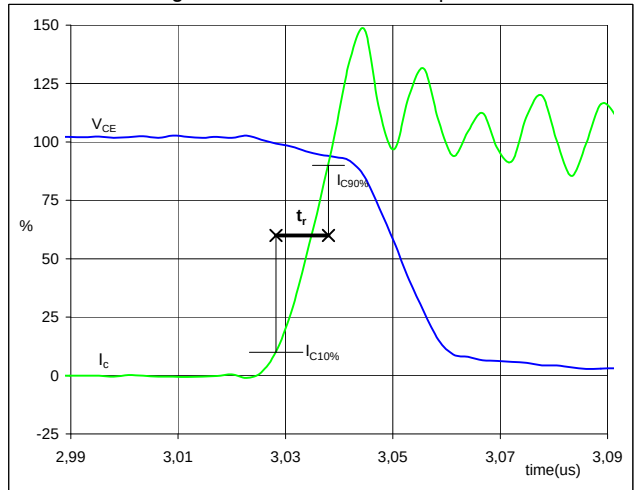
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%) =$	400	V
$I_C(100\%) =$	15	A
$t_f =$	0,0050	μ S

Figure 4 BOOST MOSFET

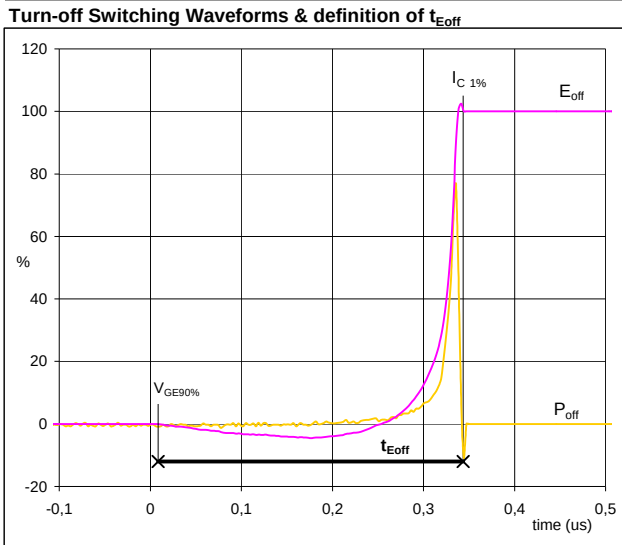
Turn-on Switching Waveforms & definition of t_r



$V_C(100\%) =$	400	V
$I_C(100\%) =$	15	A
$t_r =$	0,01	μ S

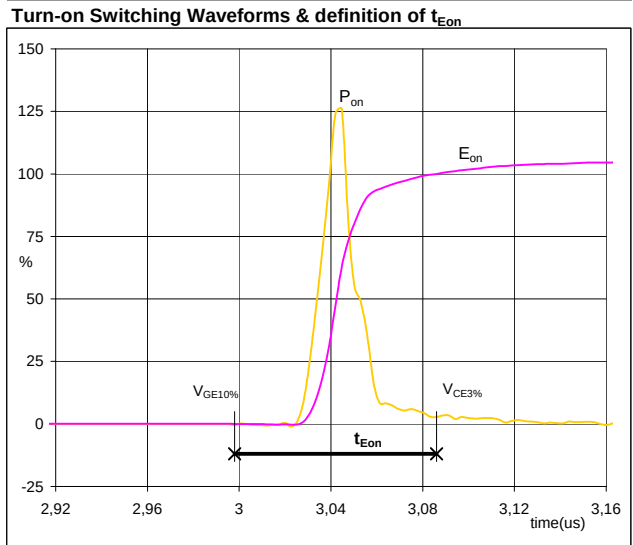
Switching Definitions Boost MOSFET

Figure 5 BOOST MOSFET



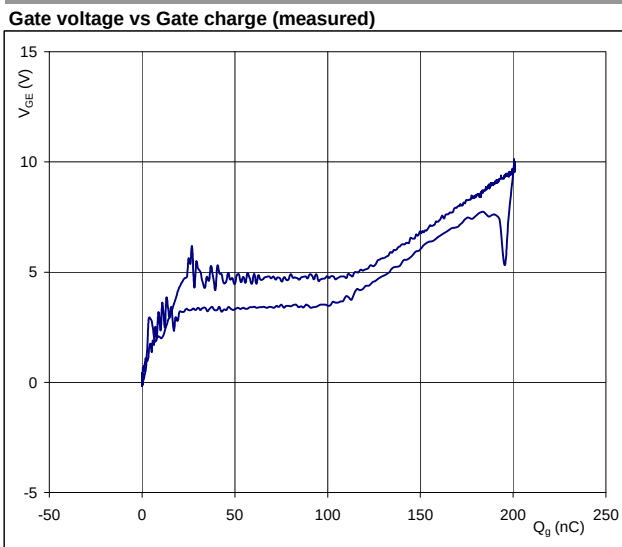
$P_{off}(100\%) = 6,01 \text{ kW}$
 $E_{off}(100\%) = 0,07 \text{ mJ}$
 $t_{Eoff} = 0,33 \text{ }\mu\text{s}$

Figure 6 BOOST MOSFET



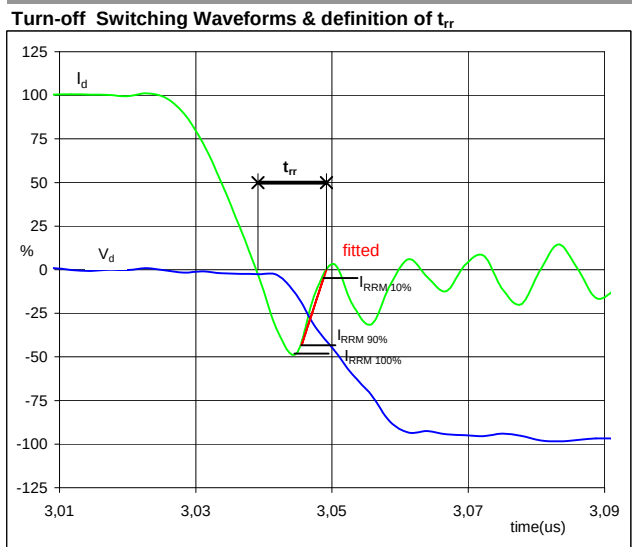
$P_{on}(100\%) = 6,01 \text{ kW}$
 $E_{on}(100\%) = 0,14 \text{ mJ}$
 $t_{Eon} = 0,09 \text{ }\mu\text{s}$

Figure 7 BOOST MOSFET



$V_{GEoff} = 0 \text{ V}$
 $V_{GEon} = 10 \text{ V}$
 $V_C(100\%) = 400 \text{ V}$
 $I_C(100\%) = 15 \text{ A}$
 $Q_g = 200,78 \text{ nC}$

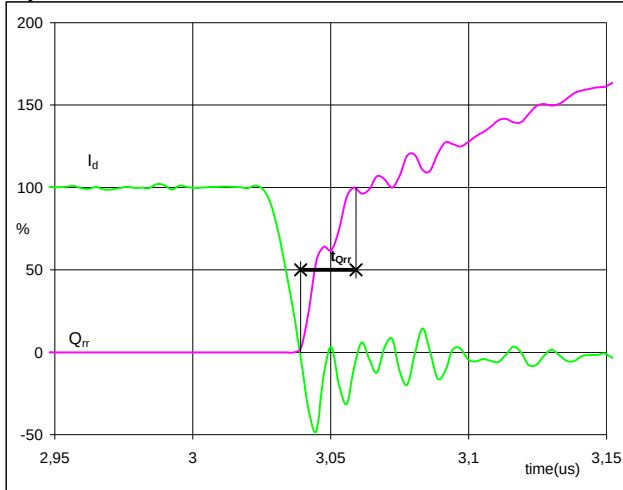
Figure 8 BOOST FWD



$V_d(100\%) = 400 \text{ V}$
 $I_d(100\%) = 15 \text{ A}$
 $I_{RRM}(100\%) = -7 \text{ A}$
 $t_{rr} = 0,01 \text{ }\mu\text{s}$

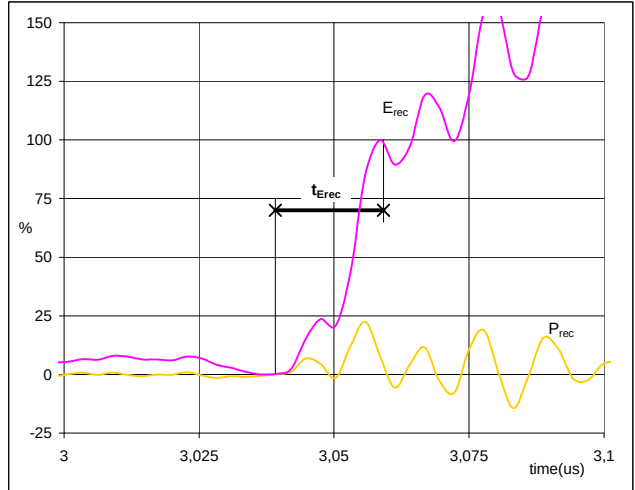
Switching Definitions Boost MOSFET

Figure 9 BOOST FWD

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


I_d (100%) = 15 A
 Q_{rr} (100%) = 0,14 μ C
 t_{Qrr} = 0,02 μ s

Figure 10 BOOST FWD

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


P_{rec} (100%) = 6,01 kW
 E_{rec} (100%) = 0,04 mJ
 t_{Erec} = 0,02 μ s

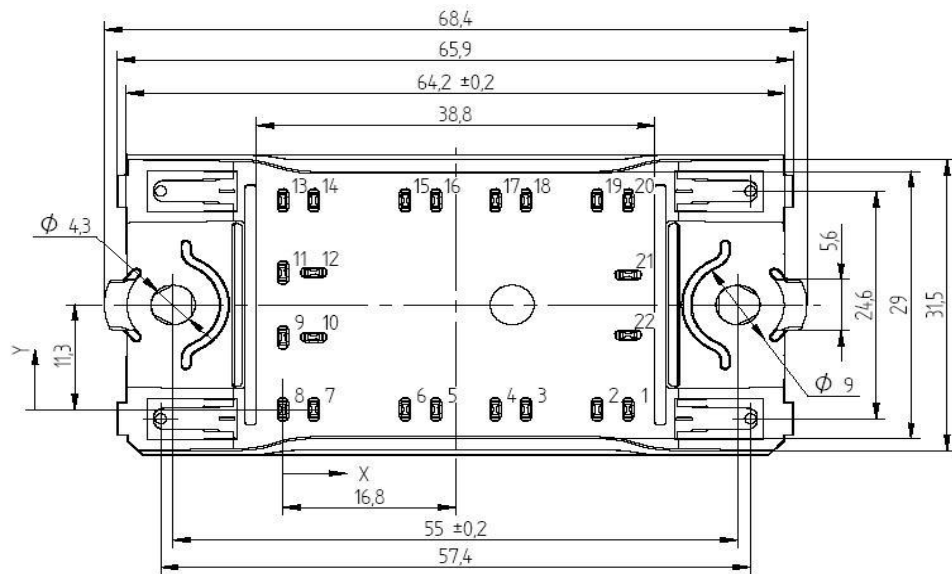
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

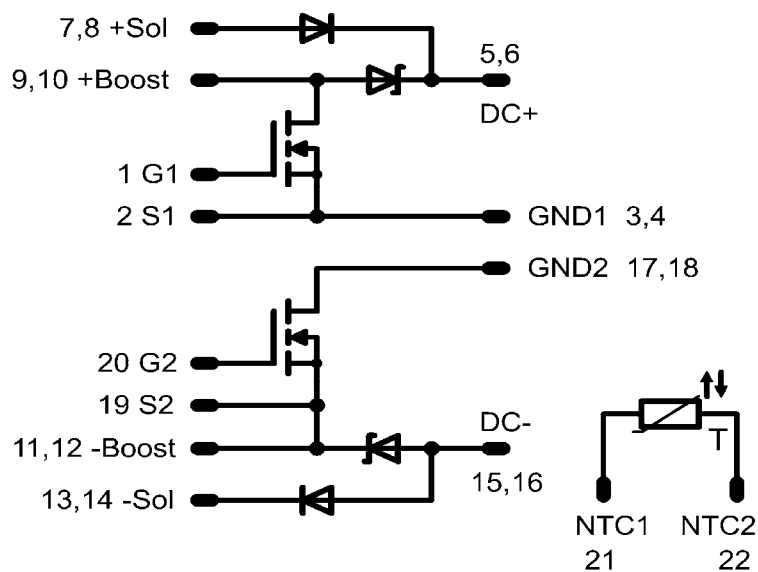
Version	Ordering Code	in DataMatrix as	in packaging barcode as
Standard in flow0 12mm housing	10-PZ06NBA041FS-P915L68Y	P915-L68Y	P915-L68Y

Outline

Pin table		
Pin	X	Y
1	33,6	0
2	30,6	0
3	23,65	0
4	20,65	0
5	14,9	0
6	11,9	0
7	3	0
8	0	0
9	0	7,8
10	3	7,8
11	0	14,8
12	3	14,8
13	0	22,6
14	3	22,6
15	11,9	22,6
16	14,9	22,6
17	20,65	22,6
18	23,65	22,6
19	30,6	22,6
20	33,6	22,6
21	33,6	14,55
22	33,6	8,05



Pinout



PRODUCT STATUS DEFINITIONS

Datasheet Status	Product Status	Definition
Target	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice. The data contained is exclusively intended for technically trained staff.
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