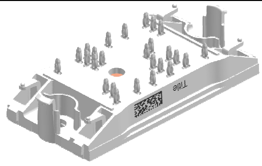
flow 3xBOOST0-SiC — 1200V/80mΩ

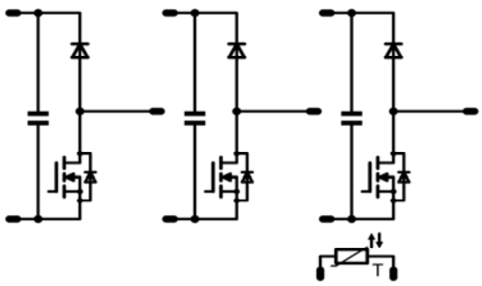
Features
- SiC-Power MOSFET´s and Schottky Diodes
- 3 channel boost topology
- Ultra Low Inductance with integrated DC-capacitors
- Switching frequency >100kHz
- Temperature sensor

flow 0 12mm housing



Target Applications
- solar inverter
- Power Supply

Schematic



Types
- 10-PZ123BA080ME-M909L18Y

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
T1, T2, T3, T4, T5, T6				
Drain to source breakdown voltage	V_{DS}		1200	V
DC drain current	I_D	$T_j=T_j$max; T_h=80°C T_c=80°C	17 21	A
Pulsed drain current	I_{Dpulse}	t_p limited by $T_j$max	60	A
Power dissipation	P_{tot}	$T_j=T_j$max; T_h=80°C T_c=80°C	41 62	W
Gate-source peak voltage	V_{GS}		-10/25	V
Maximum Junction Temperature	$T_j$max		150	°C
D1, D2, D3, D4, D5, D6				
Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
Forward average current	I_{FAV}	$T_j=T_j$max; T_h=80°C T_c=80°C	17 21	A
Non-Repetitive Peak Forward Surge Current	I_{FSM}	t_p=10ms; T_j=25°C	92	A
Repetitive Peak Forward Surge Current	I_{FRM}	t_p limited by $T_j$max	52	A
Power dissipation per Diode	P_{tot}	$T_j=T_j$max; T_h=80°C T_c=80°C	50 76	W
Maximum Junction Temperature	$T_j$max		175	°C

Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
C1, C2, C3				
Max.DC voltage	V_{MAX}	Tc=25°C	1000	V
Thermal Properties				
Storage temperature	T_{stg}		-40…+125	°C
Operation temperature under switching condition	T_{op}		-40…+(Tjmax - 25)	°C
Insulation Properties				
Insulation voltage		t=2s DC voltage	4000	V
Creepage distance			min 12,7	mm
Clearance			min 9,9	mm

Characteristic Values

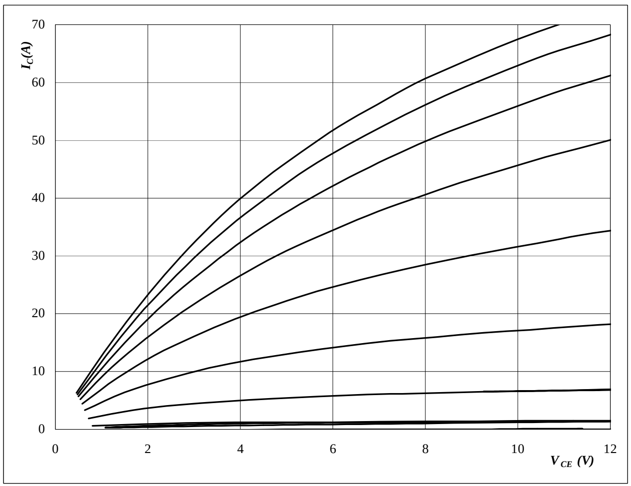
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
T1, T2, T3, T4, T5, T6										
Static drain to source ON resistance	$R_{DS(on)}$		20		20	Tj=25°C Tj=125°C		0,08 0,14		Ω
Gate threshold voltage	$V_{(GS)th}$	$V_{DS} = V_{GS}$		10	0,001	Tj=25°C Tj=125°C	1,7	2,2		V
Gate to Source Leakage Current	I_{gss}		20	0		Tj=25°C Tj=125°C			250	nA
Zero Gate Voltage Drain Current	I_{dss}		0	1200		Tj=25°C Tj=125°C			100	µA
Internal Gate Resistance	R_G	f=1MHz; V_{AC}=25mV						4,6		Ω
Turn On Delay Time	$t_{d(ON)}$					Tj=25°C Tj=125°C		12 10		
Rise Time	t_r					Tj=25°C Tj=125°C		5 5		ns
Turn off delay time	$t_{d(OFF)}$	Rgoff=4 Ω Rgon=4 Ω	16	700	16	Tj=25°C Tj=125°C		36 39		
Fall time	t_f					Tj=25°C Tj=125°C		16 18		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		0,126 0,108		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		0,051 0,050		
Total gate charge	Q_g							49,2		
Gate to source charge	Q_{gs}		0/20	800	20			10,8		nC
Gate to drain charge	Q_{gd}							18		
Input capacitance	C_{iss}					Tj=25°C		950		
Output capacitance	C_{oss}	f=1MHz	0	1000				80		pF
Reverse transfer capacitance	C_{rss}							6,5		
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						1,72		K/W
D1, D2, D3, D4, D5, D6										
Forward voltage	V_F				10	Tj=25°C Tj=125°C		1,46 1,80	1,8	V
Reverse leakage current	I_{rm}			1200		Tj=25°C Tj=125°C			300	µA
Peak recovery current	I_{RRM}					Tj=25°C Tj=125°C		17 18		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		10 11		ns
Reverse recovery charge	Q_{rr}	Rgon=4 Ω	16	700	16	Tj=25°C Tj=125°C		0,102 0,103		µC
Reverse recovered energy	E_{rec}					Tj=25°C Tj=125°C		0,028 0,031		mWs
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=125°C		3666 3626		A/µs
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						1,88		K/W
C1, C2, C3										
C value	C							47		nF
Thermistor										
Rated resistance	R					T=25°C		22000		Ω
Deviation of R25	ΔR/R	R100=1486 Ω				T=25°C	-5		5	%
Power dissipation	P					T=25°C		200		mW
Power dissipation constant						T=25°C		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				T=25°C		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				T=25°C		3996		K
Vincotech NTC Reference									B	

T1, T2, T3, T4, T5, T6 / D1, D2, D3, D4, D5, D6

Figure 1 T1, T2, T3, T4, T5, T6 MOSFET

Typical output characteristics

$I_D = f(V_{DS})$



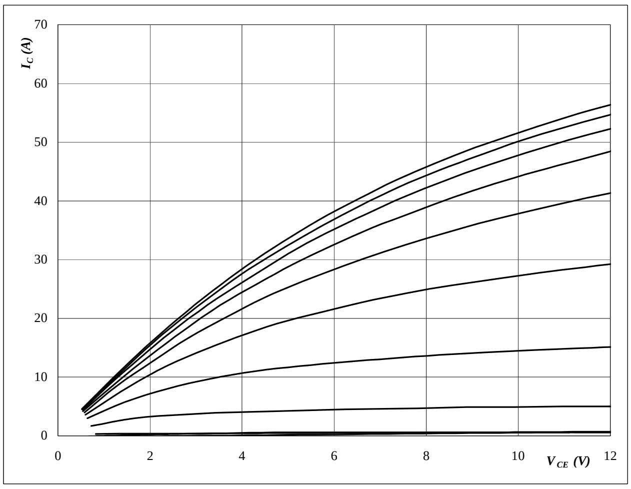
At

t_p =	250	μs
T_j =	25	°C
V_{GS} from	0 V to 20 V in steps of 2 V	

Figure 2 T1, T2, T3, T4, T5, T6 MOSFET

Typical output characteristics

$I_D = f(V_{DS})$



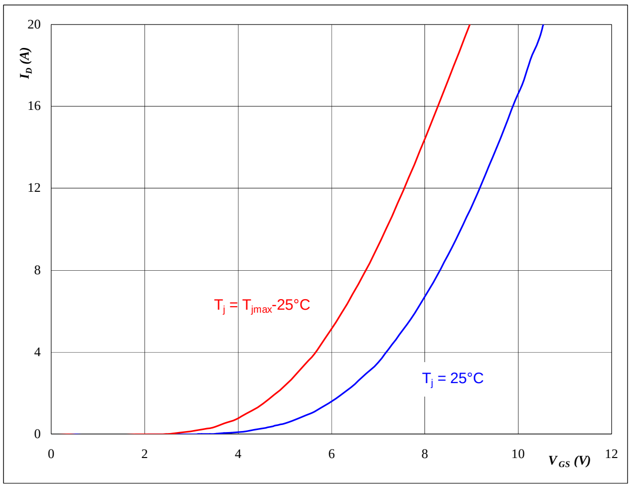
At

t_p =	250	μs
T_j =	126	°C
V_{GS} from	0 V to 20 V in steps of 2 V	

Figure 3 T1, T2, T3, T4, T5, T6 MOSFET

Typical transfer characteristics

$I_D = f(V_{GS})$



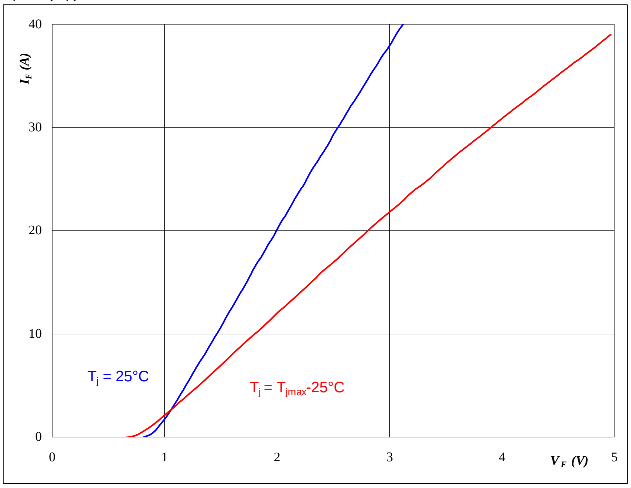
At

t_p =	250	μs
V_{DS} =	10	V

Figure 4 D1, D2, D3, D4, D5, D6 FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

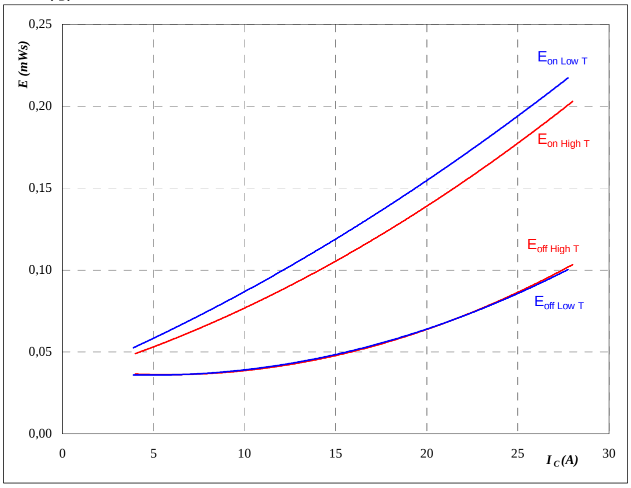
t_p =	250	μs

T1, T2, T3, T4, T5, T6 / D1, D2, D3, D4, D5, D6

Figure 5 T1, T2, T3, T4, T5, T6 MOSFET

Typical switching energy losses as a function of collector current

$E = f(I_D)$



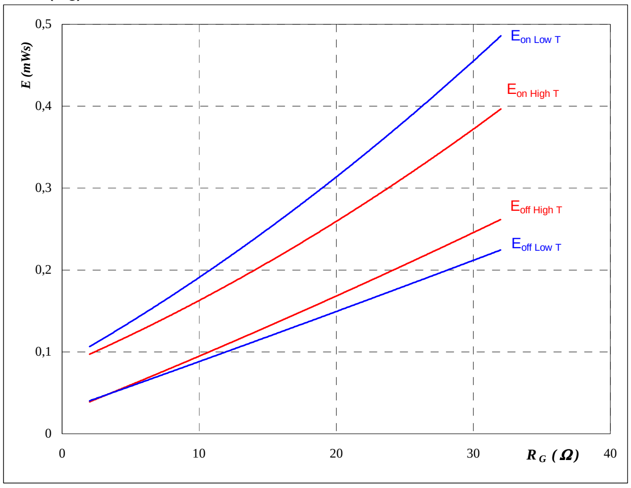
With an inductive load at

T_j =	25/125	°C
V_{DS} =	700	V
V_{GS} =	16	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 6 T1, T2, T3, T4, T5, T6 MOSFET

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



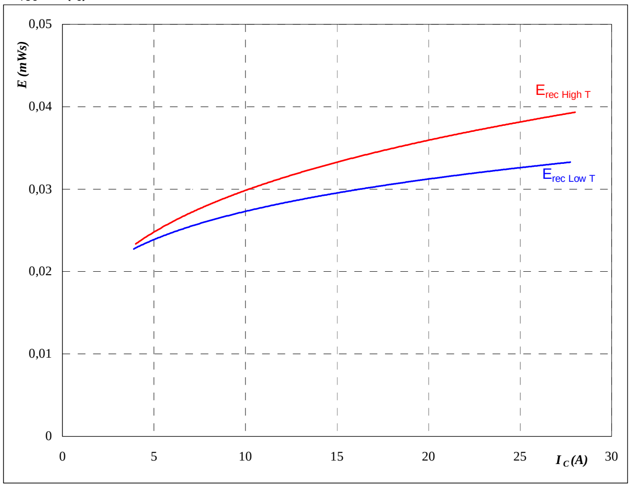
With an inductive load at

T_j =	25/125	°C
V_{DS} =	700	V
V_{GS} =	16	V
I_D =	16	A

Figure 7 D1, D2, D3, D4, D5, D6 FWD

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

$E_{rec} = f(I_c)$



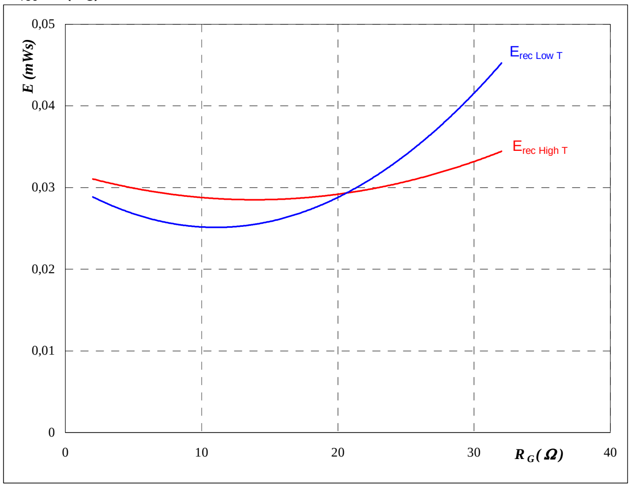
With an inductive load at

T_j =	25/125	°C
V_{DS} =	700	V
V_{GS} =	16	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 8 D1, D2, D3, D4, D5, D6 FWD

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

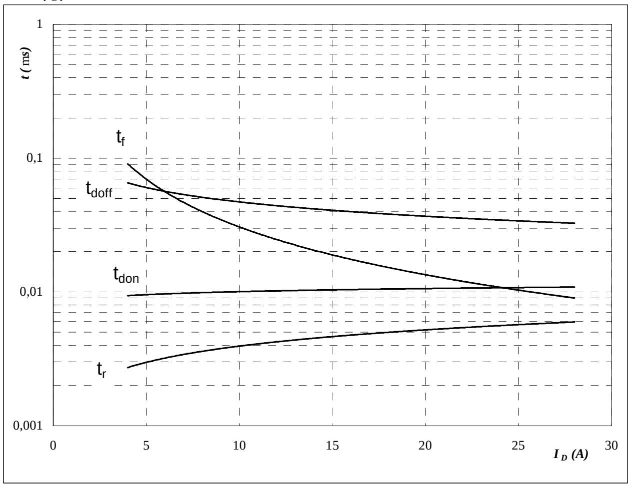
T_j =	25/125	°C
V_{DS} =	700	V
V_{GS} =	16	V
I_D =	16	A

T1, T2, T3, T4, T5, T6 / D1, D2, D3, D4, D5, D6

Figure 9 T1, T2, T3, T4, T5, T6 MOSFET

Typical switching times as a function of collector current

$t = f(I_D)$



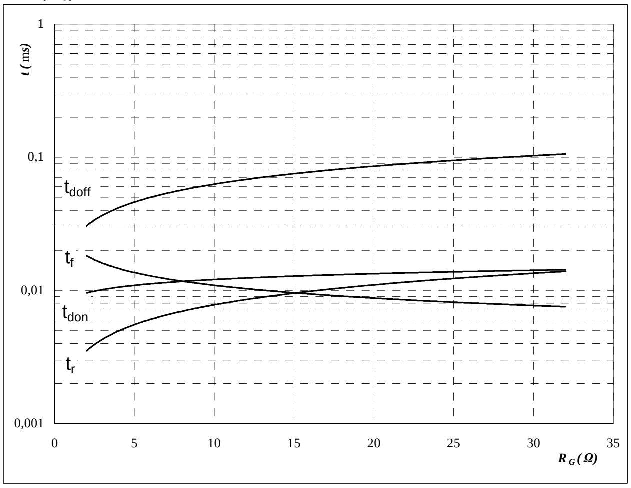
With an inductive load at

T_j =	125	°C
V_{DS} =	700	V
V_{GS} =	16	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10 T1, T2, T3, T4, T5, T6 MOSFET

Typical switching times as a function of gate resistor

$t = f(R_G)$



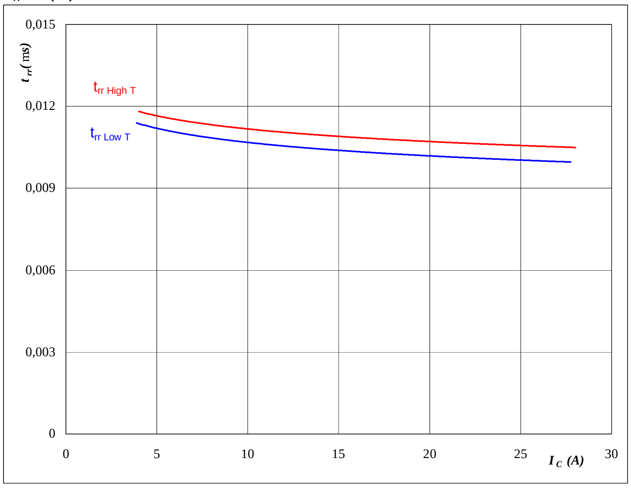
With an inductive load at

T_j =	125	°C
V_{DS} =	700	V
V_{GS} =	16	V
I_C =	16	A

Figure 11 D1, D2, D3, D4, D5, D6 FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(Ic)$



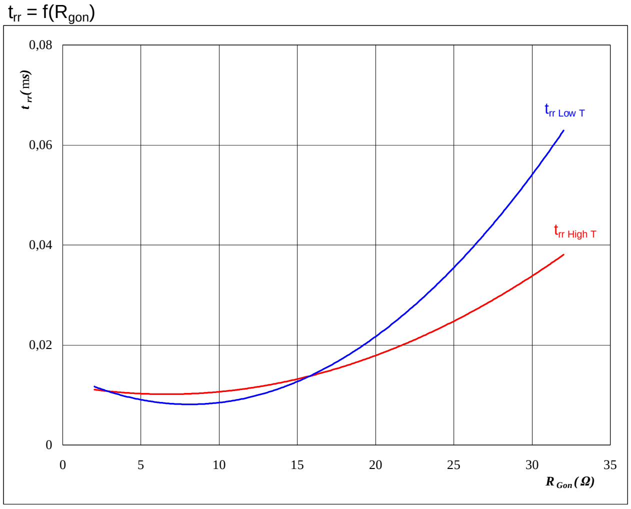
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	16	V
R_{gon} =	4	Ω

Figure 12 D1, D2, D3, D4, D5, D6 FWD

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

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



At

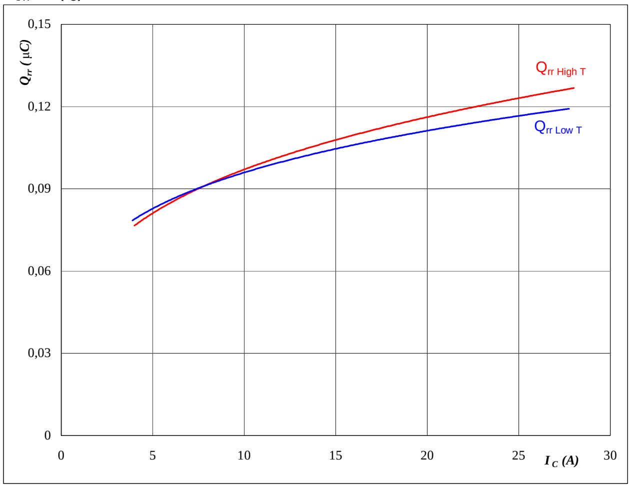
T_j =	25/125	°C
V_R =	700	V
I_F =	16	A
V_{GS} =	16	V

T1, T2, T3, T4, T5, T6 / D1, D2, D3, D4, D5, D6

Figure 13 D1, D2, D3, D4, D5, D6 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



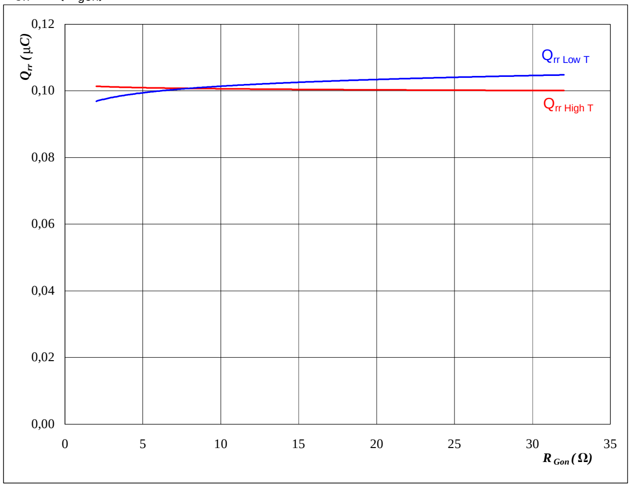
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	16	V
R_{gon} =	4	Ω

Figure 14 D1, D2, D3, D4, D5, D6 FWD

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

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



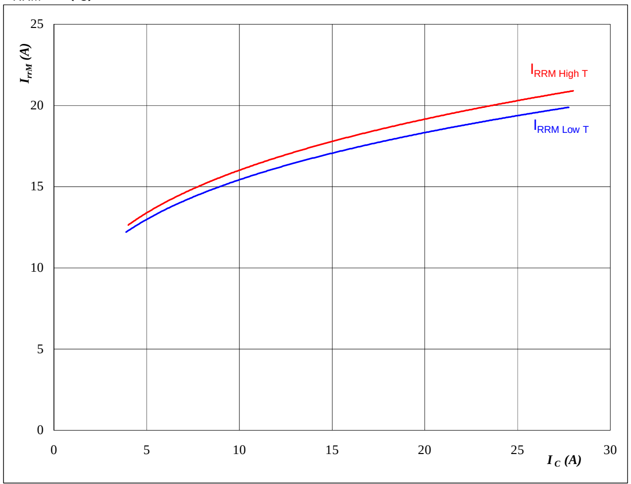
At

Tj =	25/125	°C
VR =	700	V
IF =	16	A
VGS =	16	V

Figure 15 D1, D2, D3, D4, D5, D6 FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



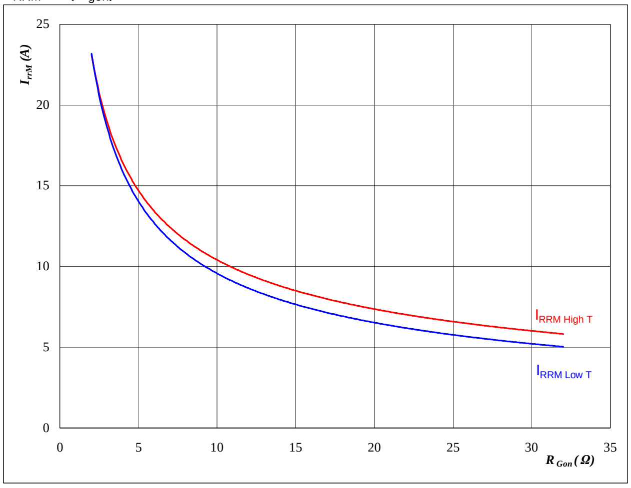
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	16	V
R_{gon} =	4	Ω

Figure 16 D1, D2, D3, D4, D5, D6 FWD

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

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



At

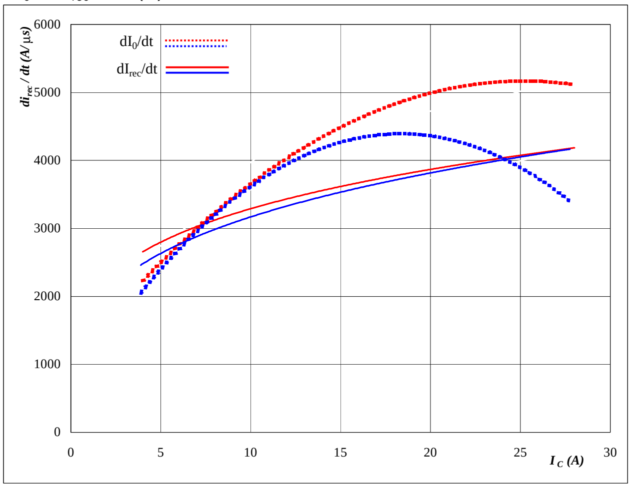
T_j =	25/125	°C
V_R =	700	V
I_F =	16	A
V_{GS} =	16	V

T1, T2, T3, T4, T5, T6 / D1, D2, D3, D4, D5, D6

Figure 17 D1, D2, D3, D4, D5, D6 FWD

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

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



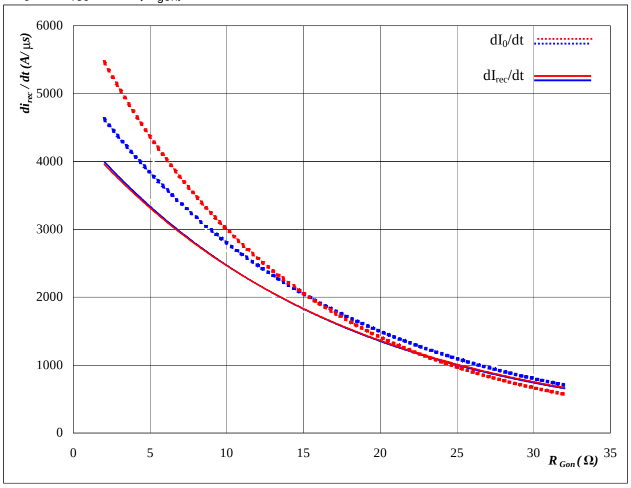
At

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	16	V
R_{gon} =	4	Ω

Figure 18 D1, D2, D3, D4, D5, D6 FWD

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

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



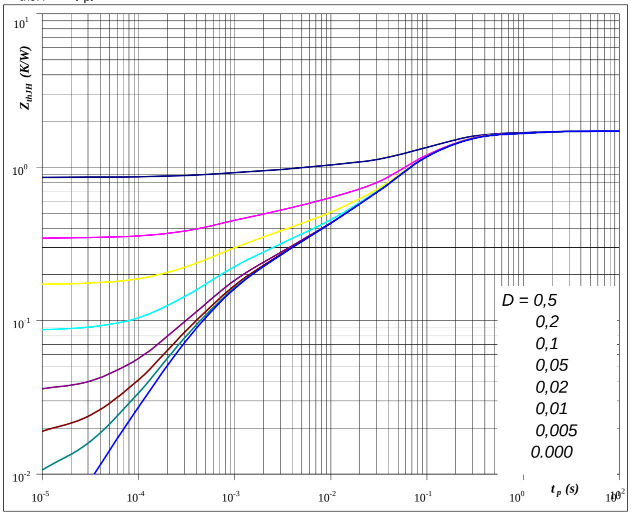
At

Tj =	25/125	°C
VR =	700	V
IF =	16	A
VGS =	16	V

Figure 19 T1, T2, T3, T4, T5, T6 MOSFET

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

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	1,72	K/W

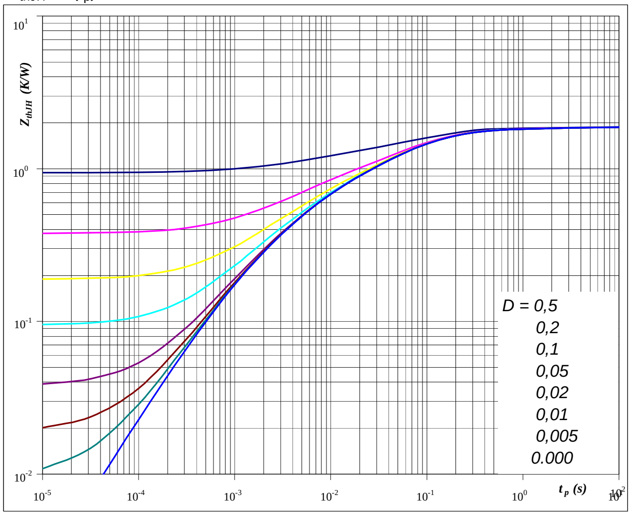
IGBT thermal model values

R (C/W)	Tau (s)
1,42E-01	1,02E+00
7,14E-01	1,29E-01
5,71E-01	5,47E-02
1,68E-01	3,53E-03
1,23E-01	5,32E-04

Figure 20 D1, D2, D3, D4, D5, D6 FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	1,88	K/W

FWD thermal model values

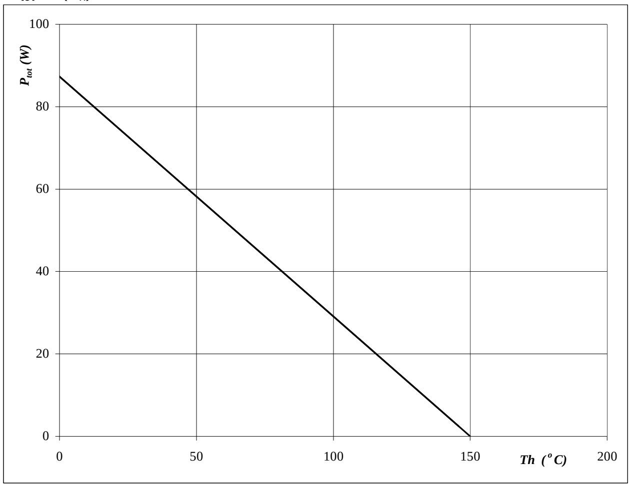
R (C/W)	Tau (s)
5,58E-02	6,96E+00
1,47E-01	5,43E-01
8,94E-01	7,92E-02
4,33E-01	1,33E-02
2,94E-01	3,03E-03
5,99E-02	6,32E-04

T1, T2, T3, T4, T5, T6 / D1, D2, D3, D4, D5, D6

Figure 21 T1, T2, T3, T4, T5, T6 MOSFET

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



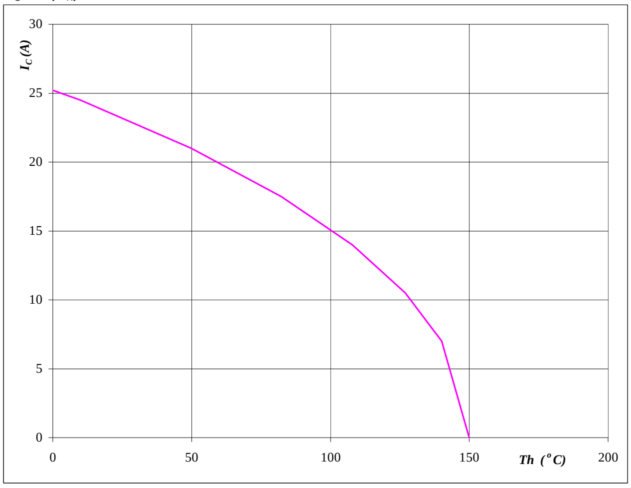
At

T_j = 150 ºC

Figure 22 T1, T2, T3, T4, T5, T6 MOSFET

Collector/Drain current as a function of heatsink temperature

$I_C = f(T_h)$



At

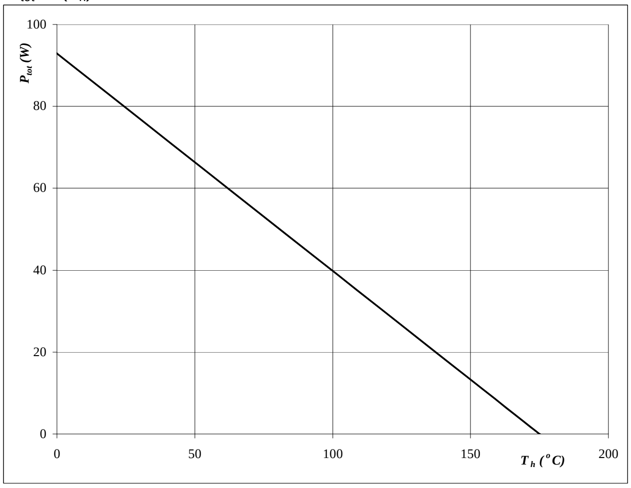
T_j = 150 ºC

V_{GS} = 20 V

Figure 23 D1, D2, D3, D4, D5, D6 FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



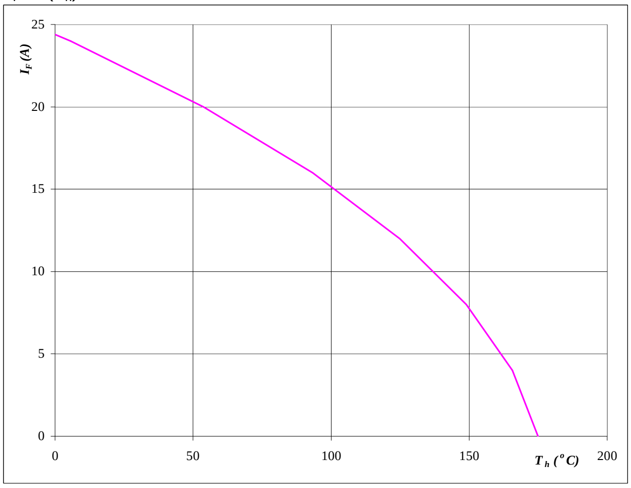
At

T_j = 175 ºC

Figure 24 D1, D2, D3, D4, D5, D6 FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

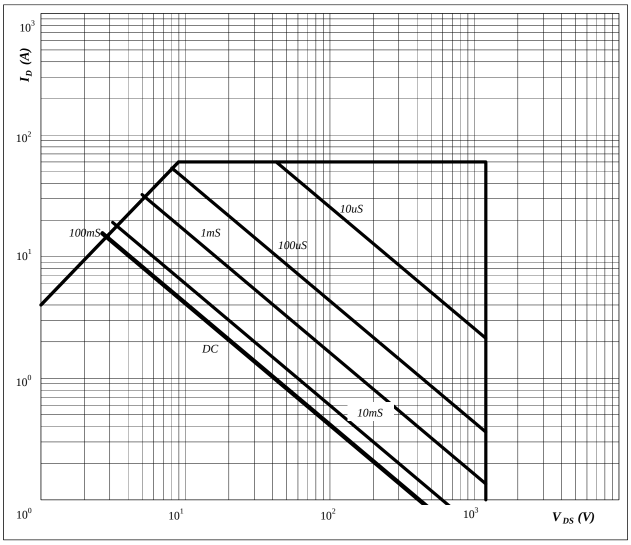
T_j = 175 ºC

T1, T2, T3, T4, T5, T6 / D1, D2, D3, D4, D5, D6

Figure 25 T1, T2, T3, T4, T5, T6 MOSFET

Safe operating area as a function of drain-source voltage

$I_D = f(V_{DS})$



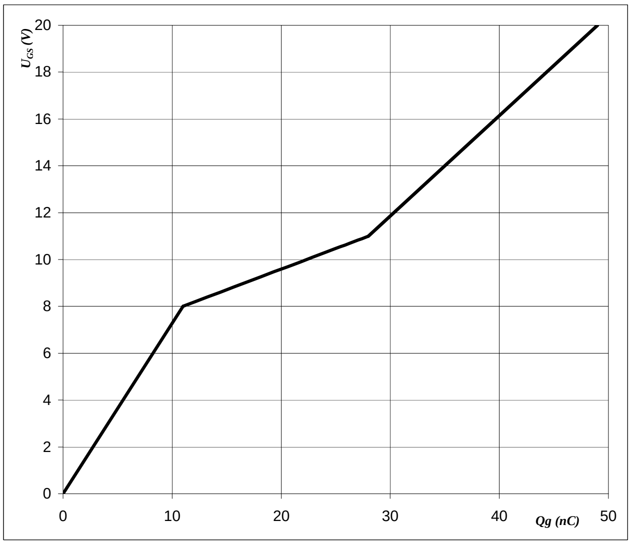
At

D =	single pulse	
T_h =	80	ºC
V_{GS} =	16	V
T_j =	T_{jmax}	ºC

Figure 26 T1, T2, T3, T4, T5, T6 MOSFET

Gate voltage vs Gate charge

$V_{GS} = f(Qg)$



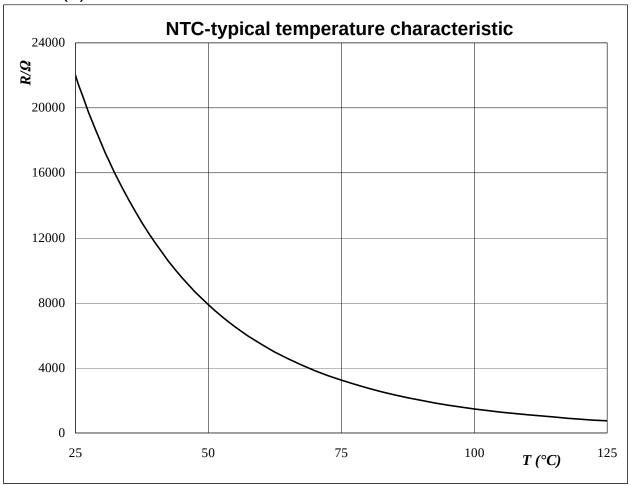
At

I_{DS} =	20	A
V_{DS}=	800	V
I_{GS}=	10	mA
T_j =	25	ºC

Thermistor

Figure 1 Thermistor

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



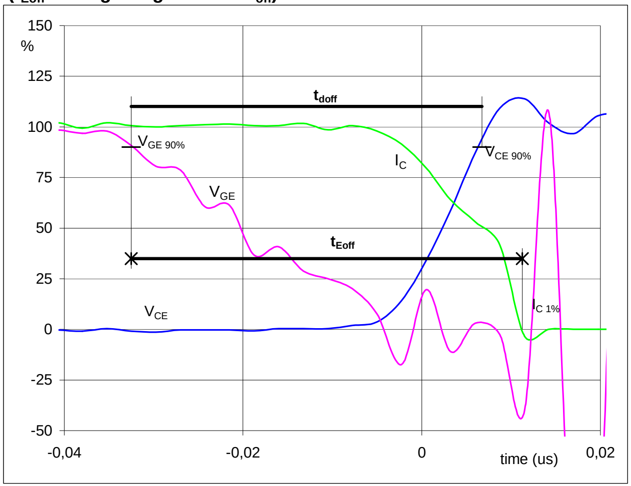
Switching Definitions BOOST

General conditions

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

Figure 1 T1, T2, T3, T4, T5, T6 MOSFET

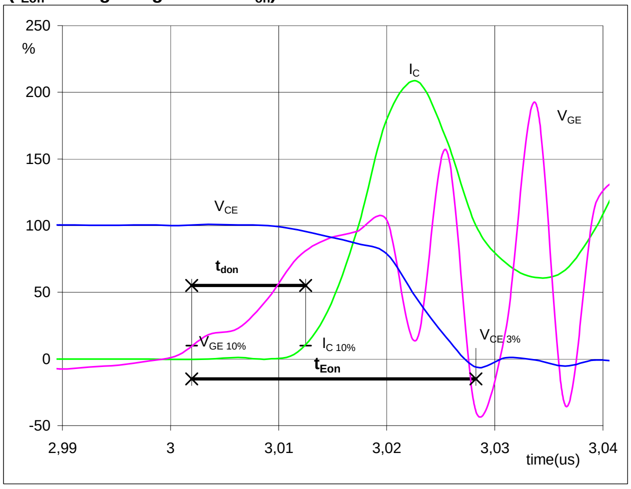
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	16	V
V_C (100%) =	700	V
I_C (100%) =	16	A
t_{doff} =	0,04	μs
t_{Eoff} =	0,04	μs

Figure 2 T1, T2, T3, T4, T5, T6 MOSFET

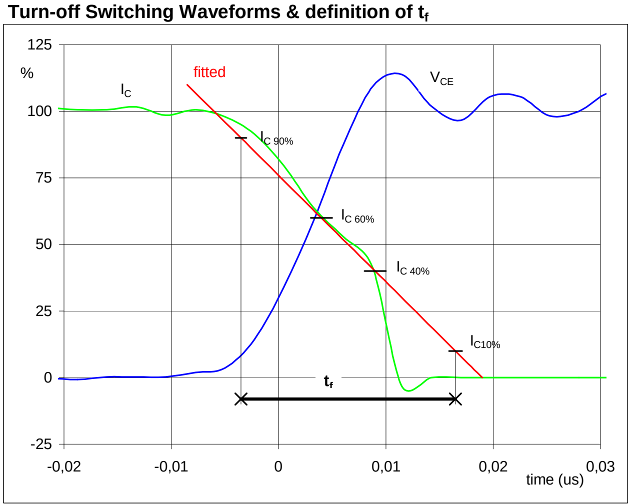
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	16	V
V_C (100%) =	700	V
I_C (100%) =	16	A
t_{don} =	0,01	μs
t_{Eon} =	0,03	μs

Figure 3 T1, T2, T3, T4, T5, T6 MOSFET

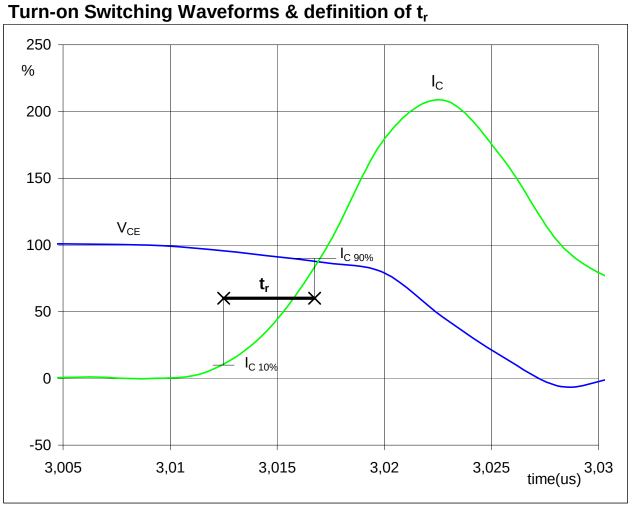
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	700	V
I_C (100%) =	16	A
t_f =	0,02	μs

Figure 4 T1, T2, T3, T4, T5, T6 MOSFET

Turn-on Switching Waveforms & definition of t_r

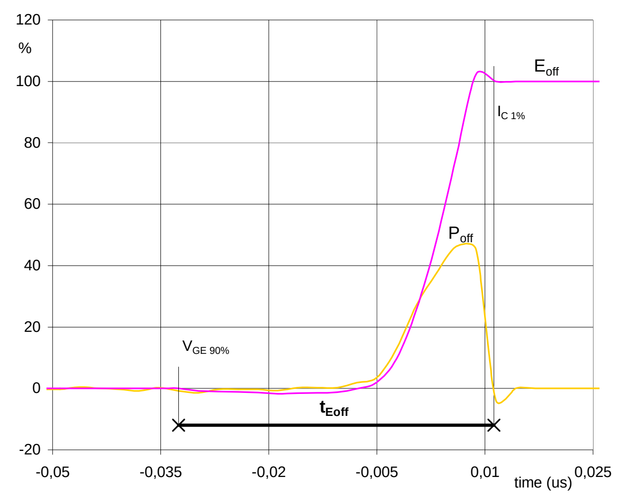


V_C (100%) =	700	V
I_C (100%) =	16	A
t_r =	0,01	μs

Switching Definitions BOOST

Figure 5 T1, T2, T3, T4, T5, T6 MOSFET

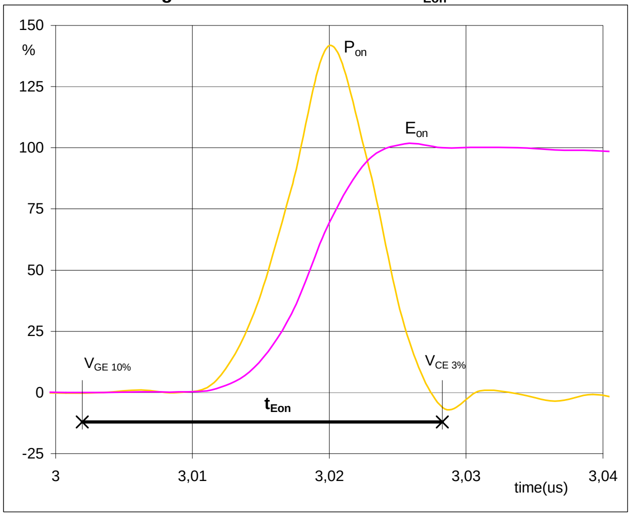
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	11,12	kW
E_{off} (100%) =	0,05	mJ
t_{Eoff} =	0,04	μs

Figure 6 T1, T2, T3, T4, T5, T6 MOSFET

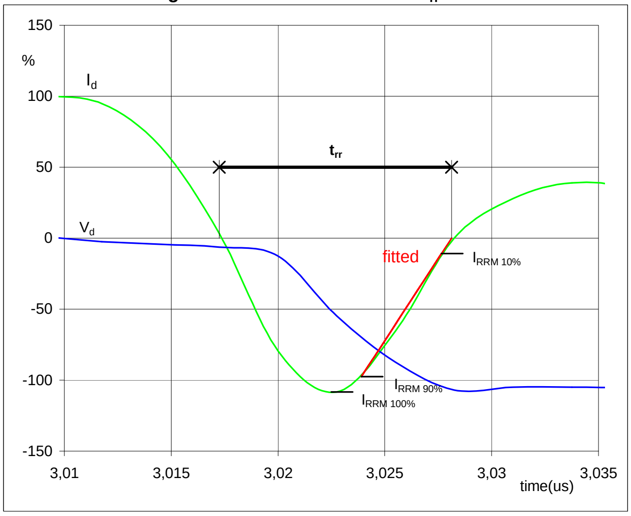
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	11,12	kW
E_{on} (100%) =	0,11	mJ
t_{Eon} =	0,03	μs

Figure 7 D1, D2, D3, D4, D5, D6 FWD

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

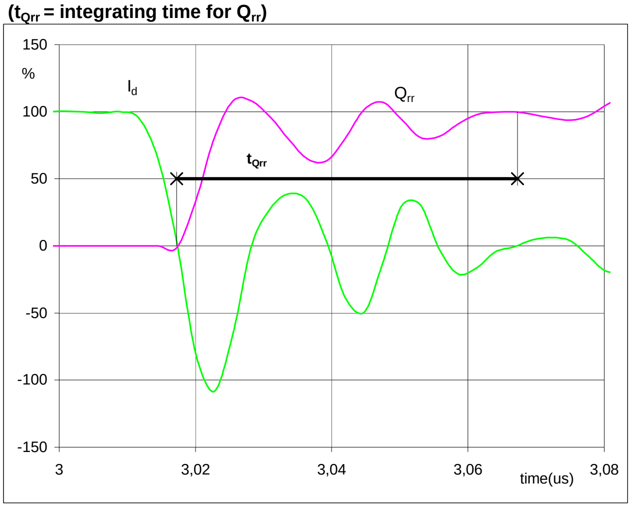


V_d (100%) =	700	V
I_d (100%) =	16	A
I_{RRM} (100%) =	-18	A
t_{rr} =	0,01	μs

Switching Definitions BOOST

Figure 8 D1, D2, D3, D4, D5, D6 FWD

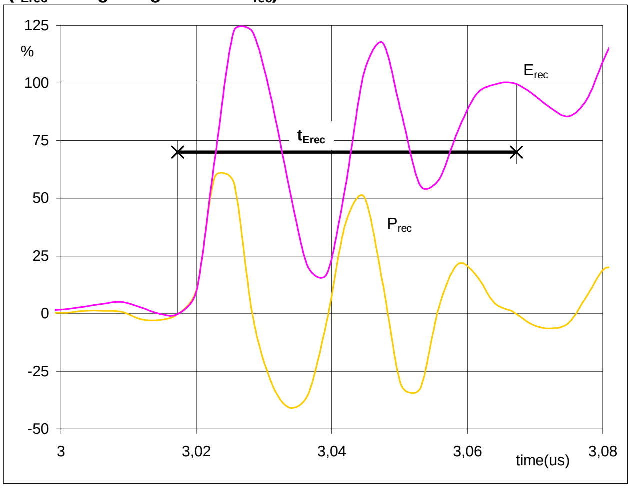
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	16	A
Q_{rr} (100%) =	0,10	μC
t_{Qrr} =	0,05	μs

Figure 10 D1, D2, D3, D4, D5, D6 FWD

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

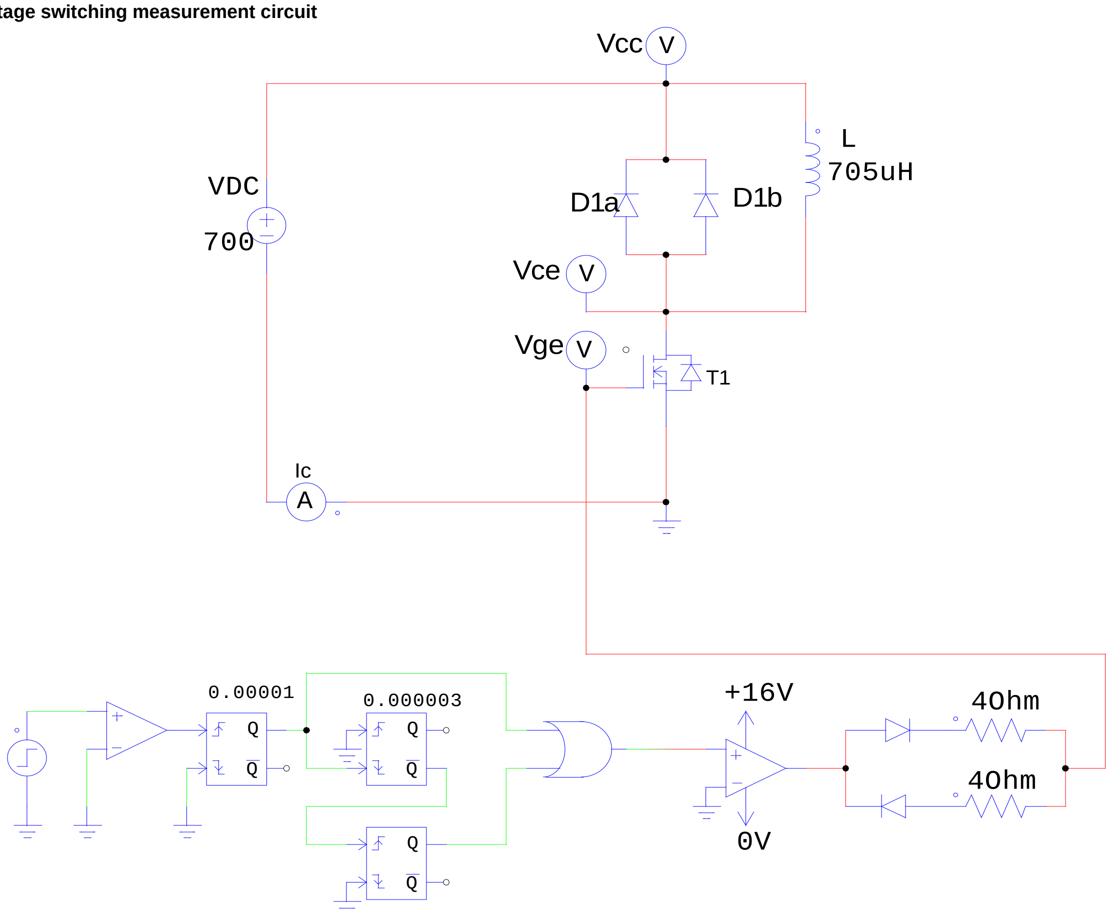


P_{rec} (100%) =	11,12	kW
E_{rec} (100%) =	0,03	mJ
t_{Erec} =	0,05	μs

Measurement circuit

Figure 11

BOOST stage switching measurement circuit



Ordering Code and Marking - Outline - Pinout

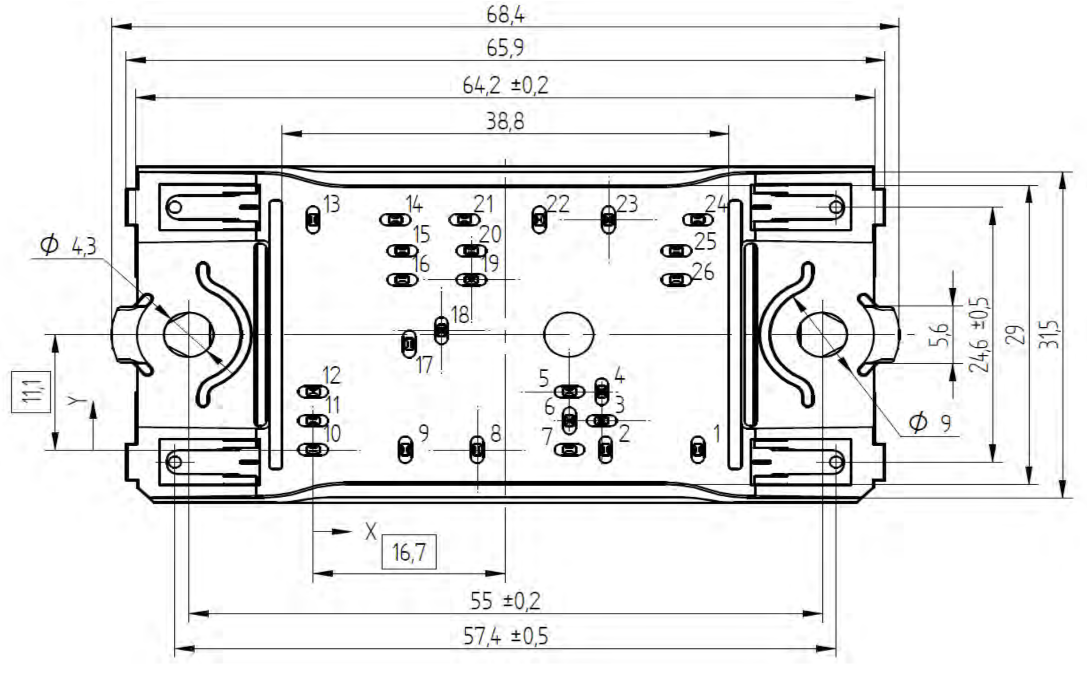
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
w/o thermal paste 12mm housing Press-fit pin	10-PZ123BA080ME-M909L18Y	M909L18Y	M909L18Y

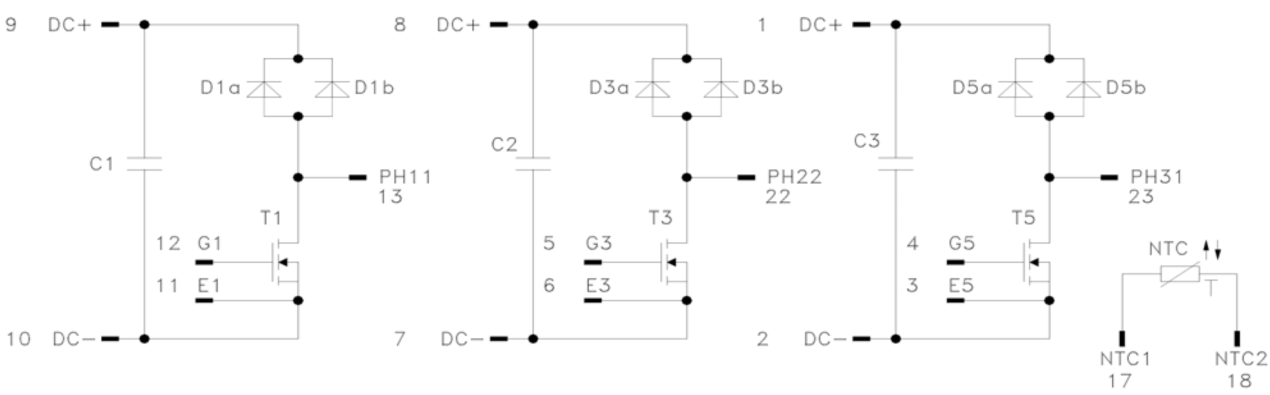
Outline

Pin table

Pin	X	Y
1	33,4	0
2	25,4	0
3	25,05	2,8
4	25,05	5,6
5	22,25	5,6
6	22,25	2,8
7	22,25	0
8	14,25	0
9	8	0
10	0	0
11	0	2,8
12	0	5,6
13	0	22,2
14	7,15	22,2
15	7,75	19,2
16	7,75	16,4
17	8,35	10,2
18	11,15	11,5
19	13,75	16,4
20	13,75	19,2
21	13,15	22,2
22	19,65	22,2
23	25,65	22,2
24	33,4	22,2
25	31,55	19,2
26	31,55	16,4



Pinout



Pin 15, 16, 19, 20, 25, 26 not connented

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.