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

Target Applications

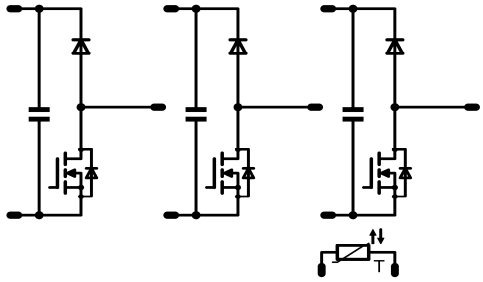
- solar inverter
- Power Supply

Types

- 10-PZ123BA080ME-M909L18Y

flow 0 12mm housing

Schematic



Maximum Ratings

Tj=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

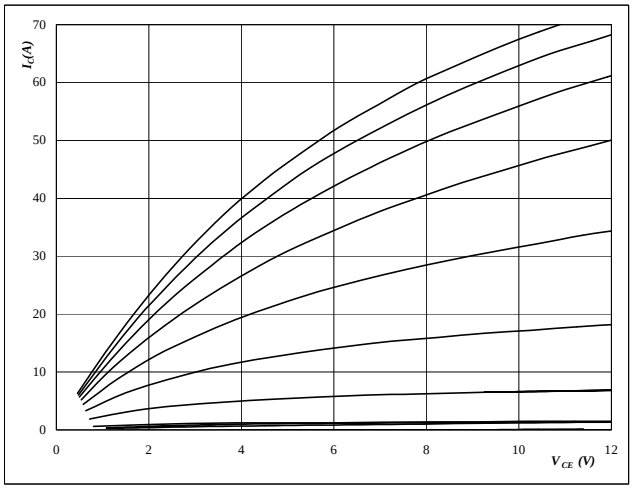
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
T1, T2, T3, T4, T5, T6										
Static drain to source ON resistance	$R_{DS(on)}$		20		20	Tj=25°C Tj=125°C		0,08 0,14		Ω
Gate threshold voltage	$V_{(GS)th}$	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	$t_{d(ON)}$	Rgoff=4 Ω Rgon=4 Ω	16	700	16	Tj=25°C Tj=125°C		12 10		ns
Rise Time	t_r					Tj=25°C Tj=125°C		5 5		
Turn off delay time	$t_{d(OFF)}$					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		0/20	800	20	Tj=25°C		49,2		nC
Gate to source charge	Q_{gs}							10,8		
Gate to drain charge	Q_{gd}							18		
Input capacitance	C_{iss}	f=1MHz	0	1000				950		pF
Output capacitance	C_{oss}							80		
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}	Rgon=4 Ω	16	700	16	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}					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

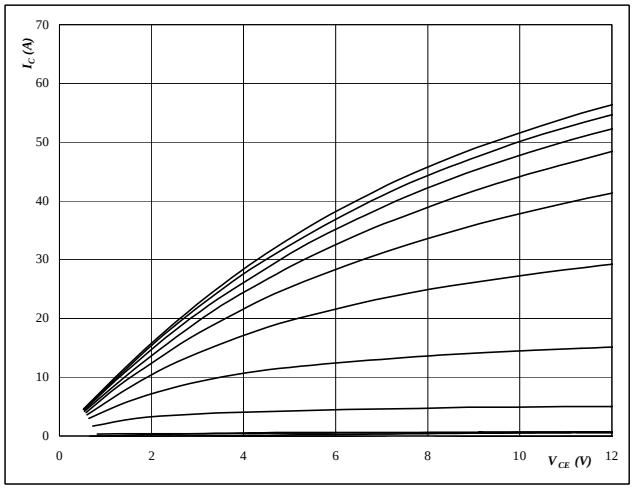
T_j = 25 °C

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

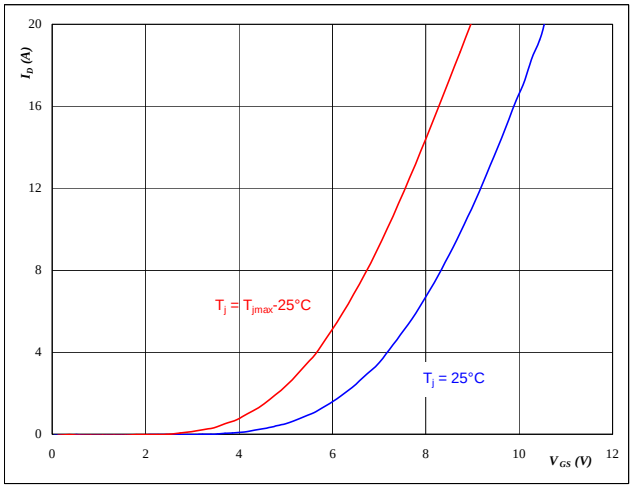
T_j = 126 °C

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

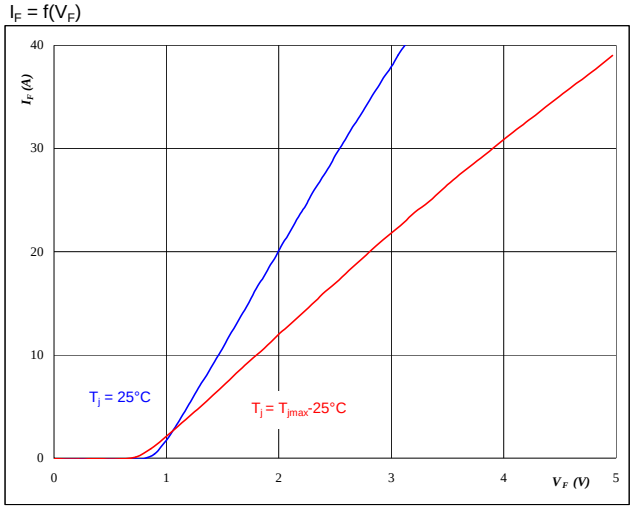
t_p = 250 µs

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

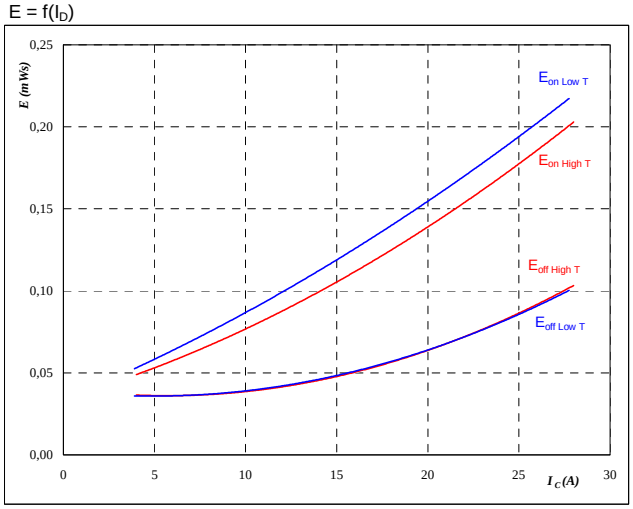
t_p = 250 µs

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

$E = f(I_D)$



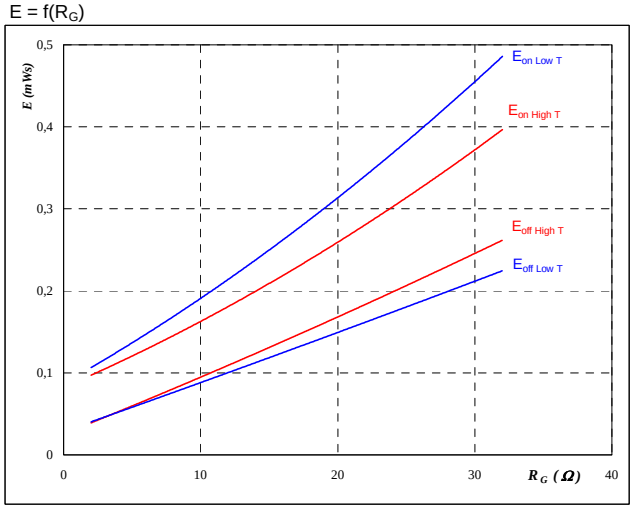
With an inductive load at

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

$E = f(R_G)$



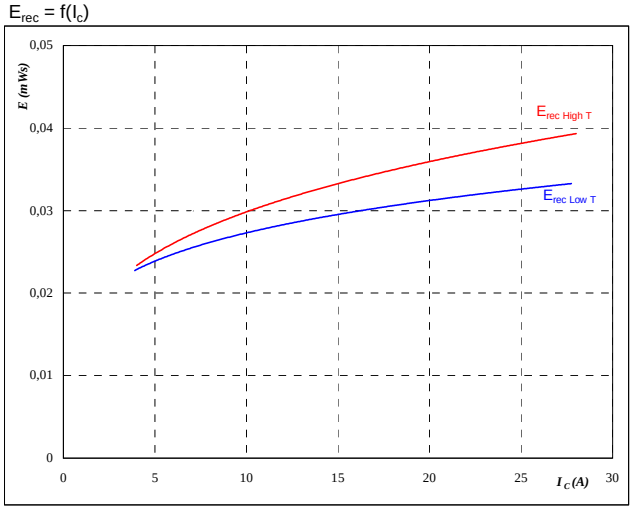
With an inductive load at

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

$E_{rec} = f(I_c)$



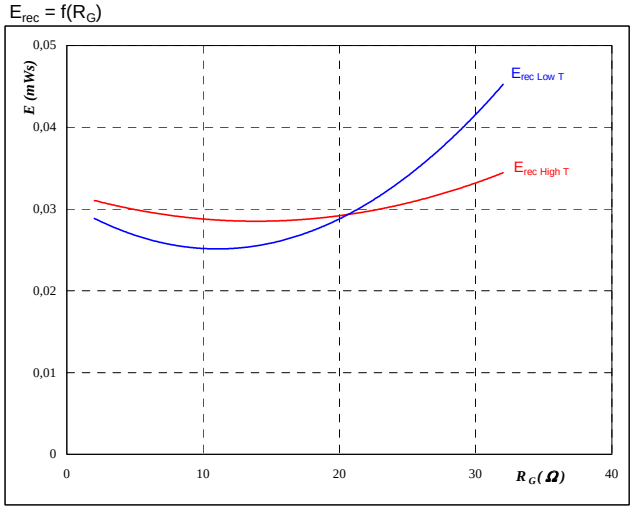
With an inductive load at

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

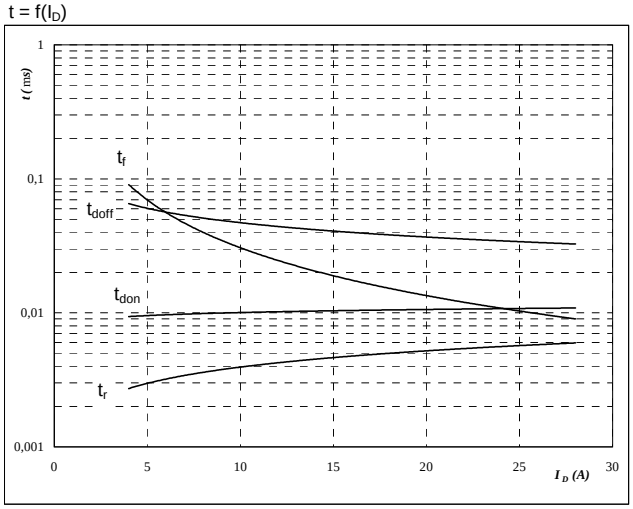
T_j =	25/125	°C
V_{DS} =	700	V
V_{GS} =	16	V
I_D =	16	A

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)



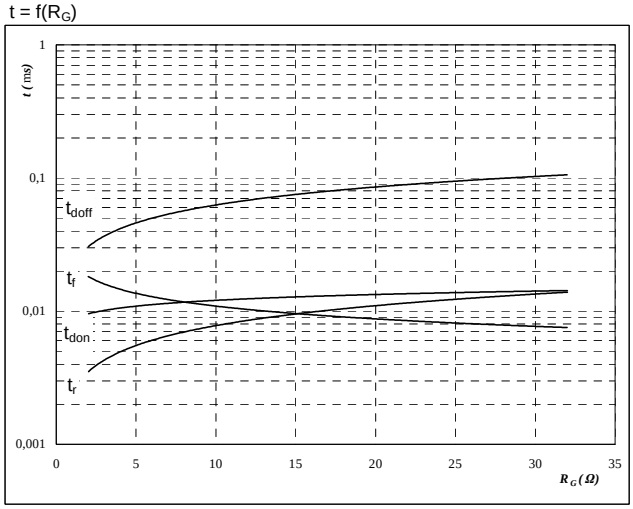
With an inductive load at

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)



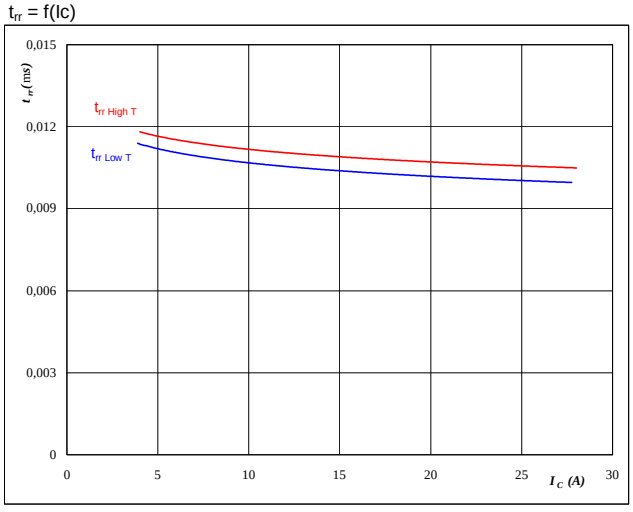
With an inductive load at

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)



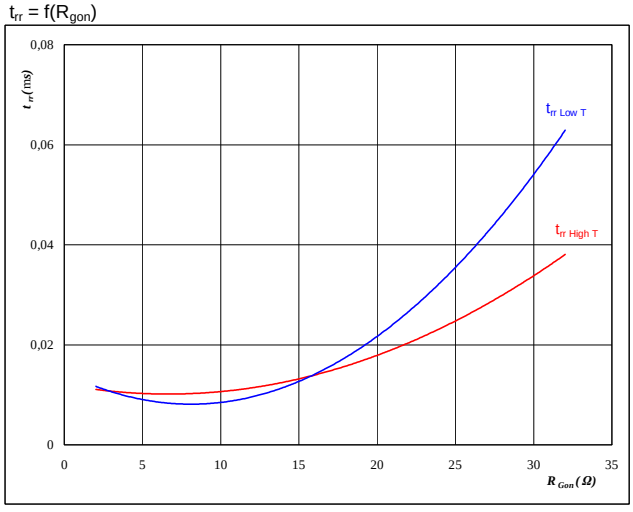
At

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

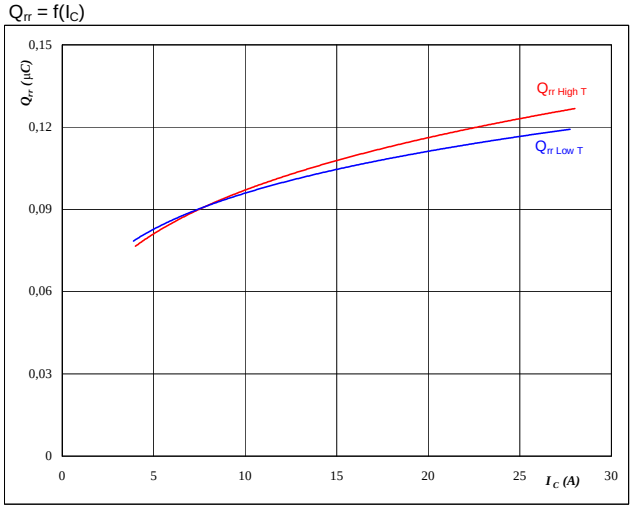
T_j =	25/125	°C
V_R =	700	V
I_F =	16	A
V_{GS} =	16	V

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

$Q_{rr} = f(I_C)$



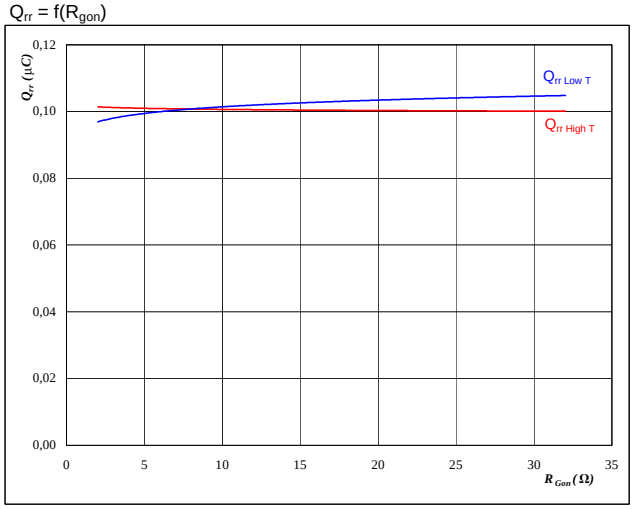
At

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

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



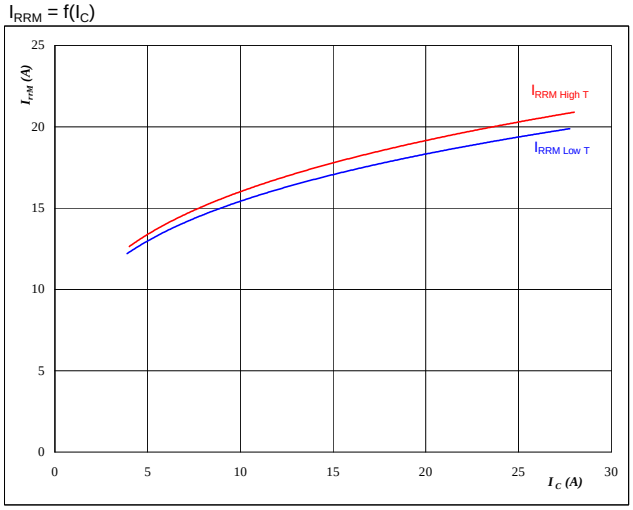
At

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

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

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



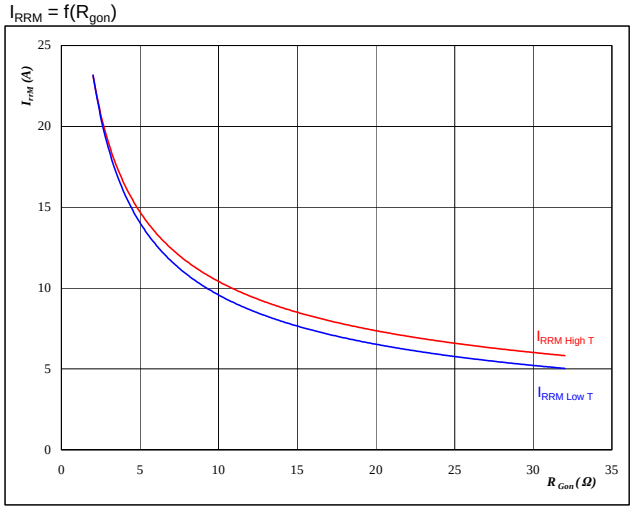
At

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

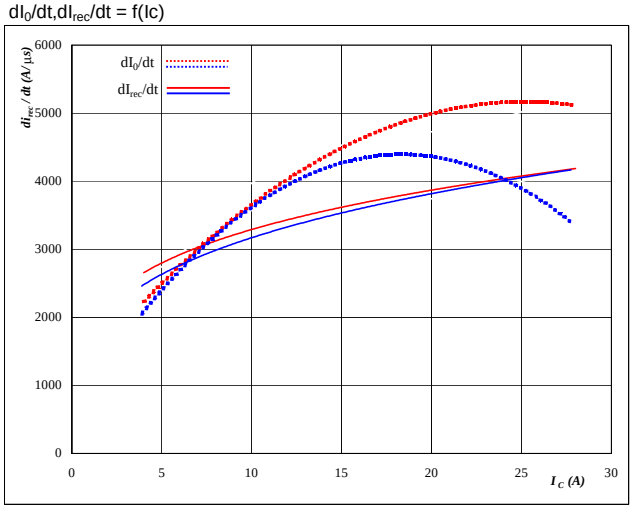
T_j =	25/125	°C
V_R =	700	V
I_F =	16	A
V_{GS} =	16	V

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

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



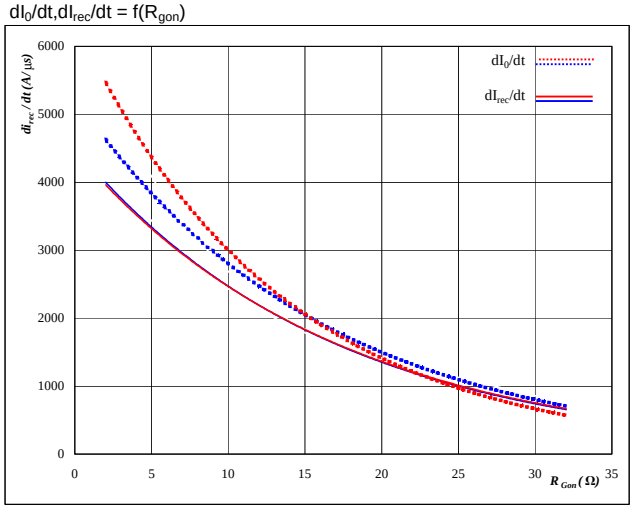
At

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

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



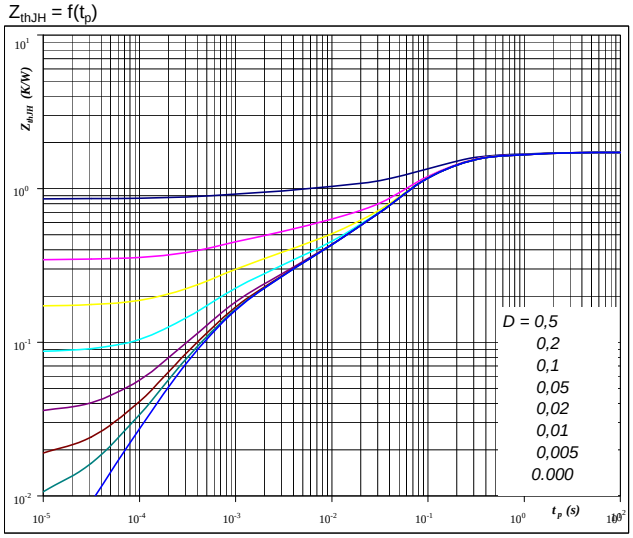
At

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

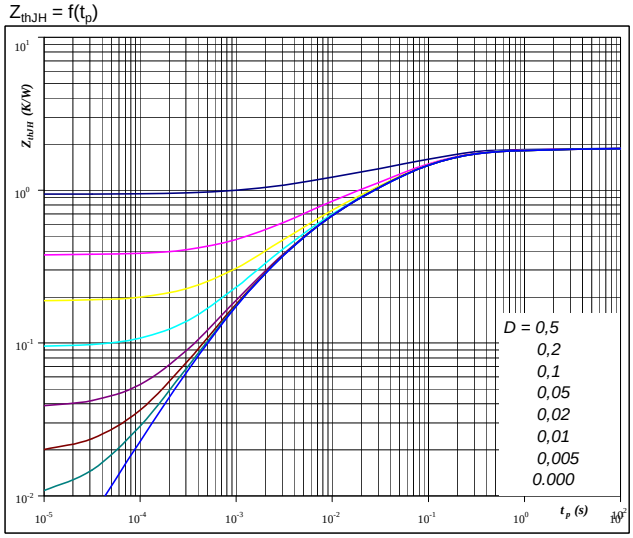
IGBT thermal model values

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

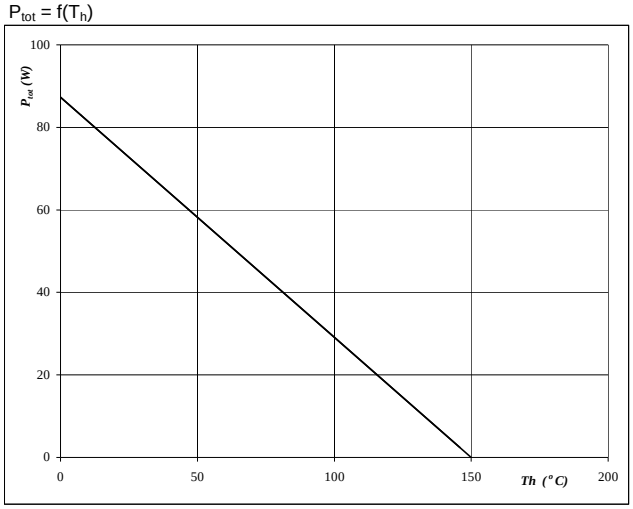
R (C/W)	Tau (s)
5,58E-02	6,96E+00
1,47E-01	5,43E-01
8,94E-01	7,92E-02
4,33E-01	1,33E-02
2,94E-01	3,03E-03
5,99E-02	6,32E-04

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

$P_{tot} = f(T_h)$



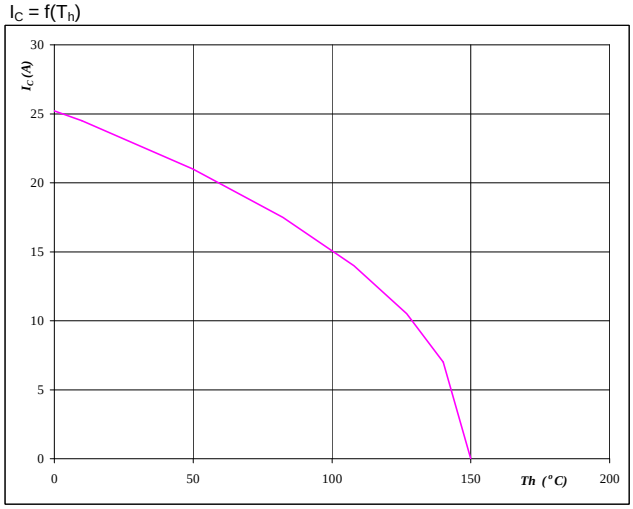
At

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

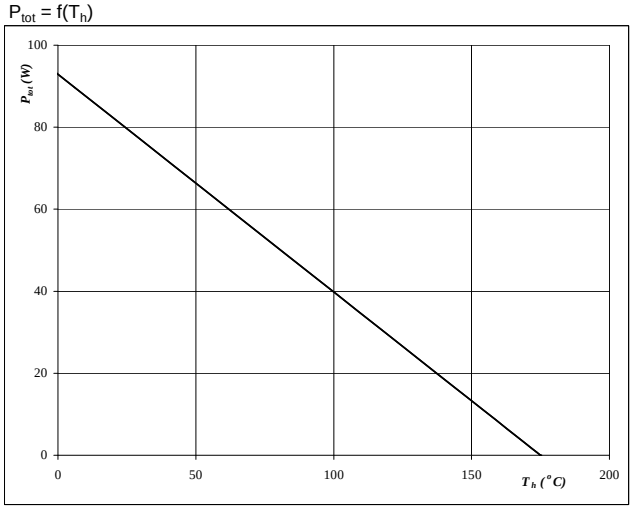
T_j = 150 ºC

V_{GS} = 20 V

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

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



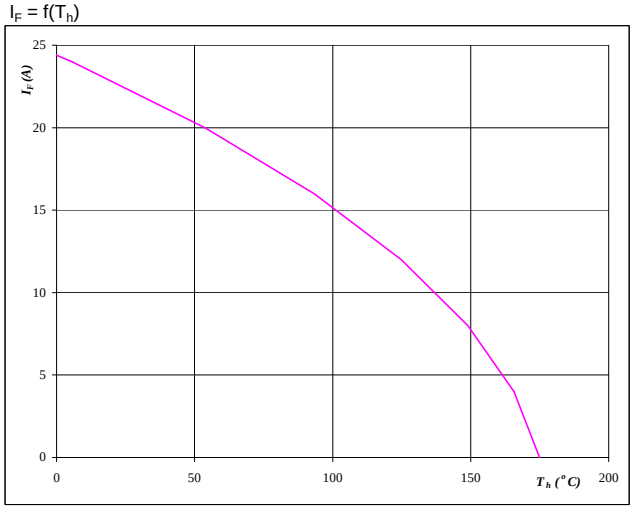
At

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

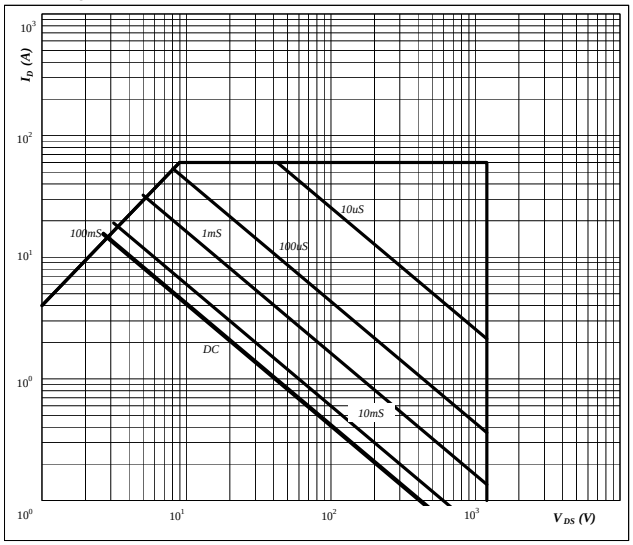
T_j = 175 ºC

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

$I_D = f(V_{DS})$



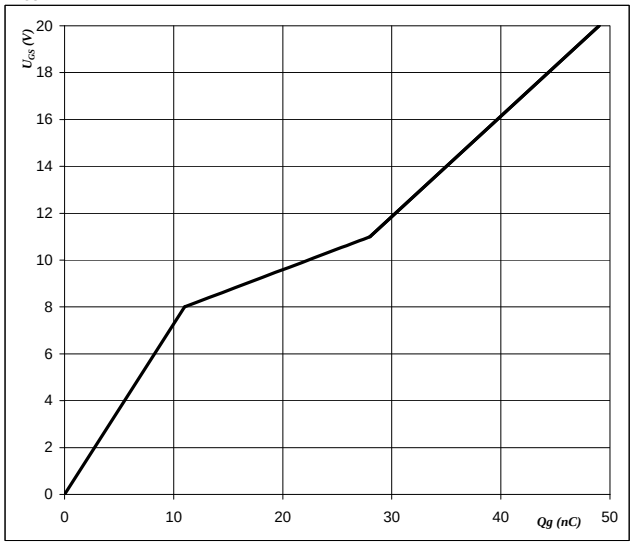
At

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

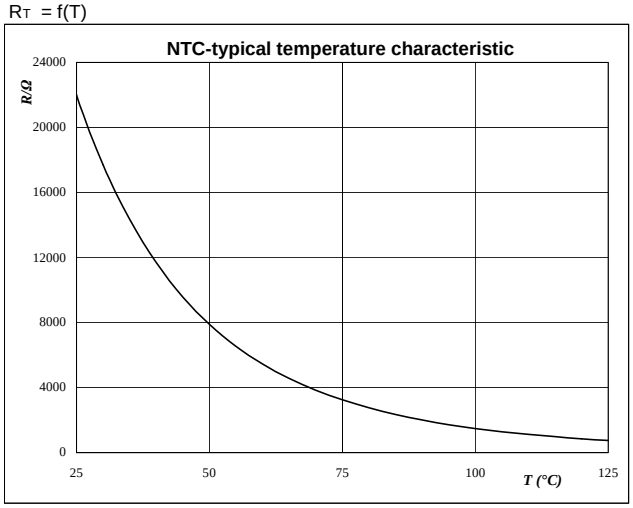
I_{DS} =	20	A
V_{DS}=	800	V
I_{GS}=	10	mA
T_j =	25	ºC

Thermistor

Figure 1 Thermistor

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$



Switching Definitions BOOST

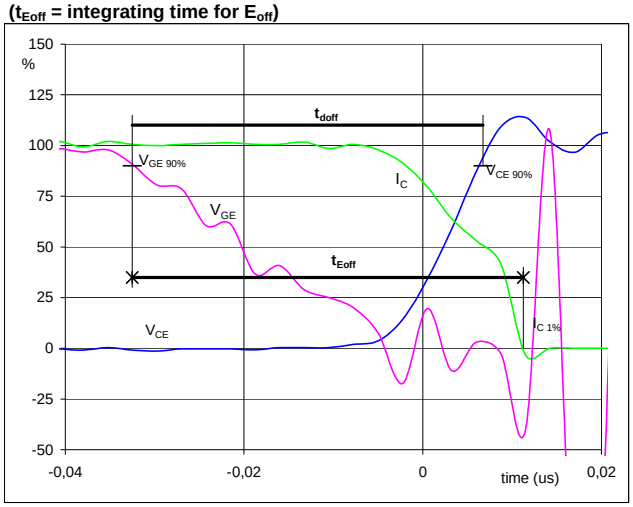
General conditions

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})

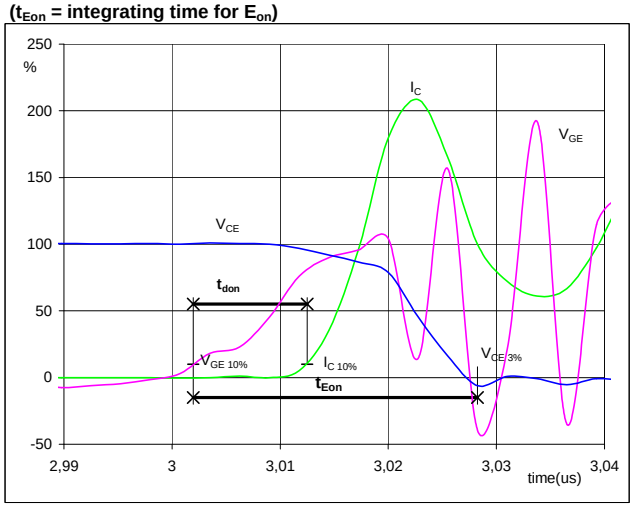


V_{GE} (0%) =	0	V
V_{GE} (100%) =	16	V
V_C (100%) =	700	V
I_C (100%) =	16	A
t_{doff} =	0,04	µs
t_{Eoff} =	0,04	µs

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

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

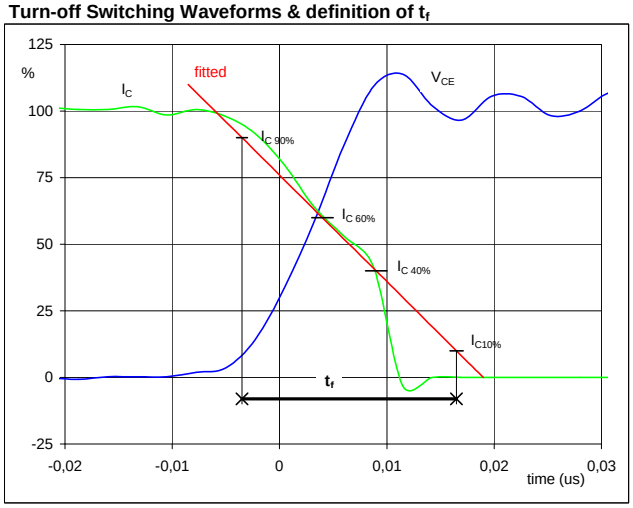
(t_{Eon} = integrating time for E_{on})



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

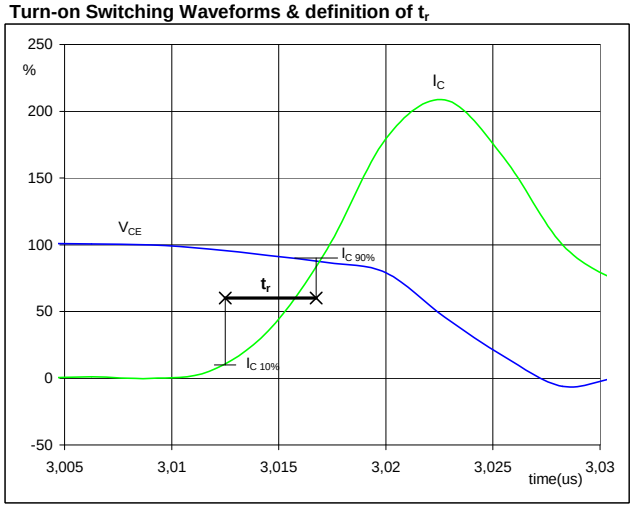
Turn-off Switching Waveforms & definition of t_f



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

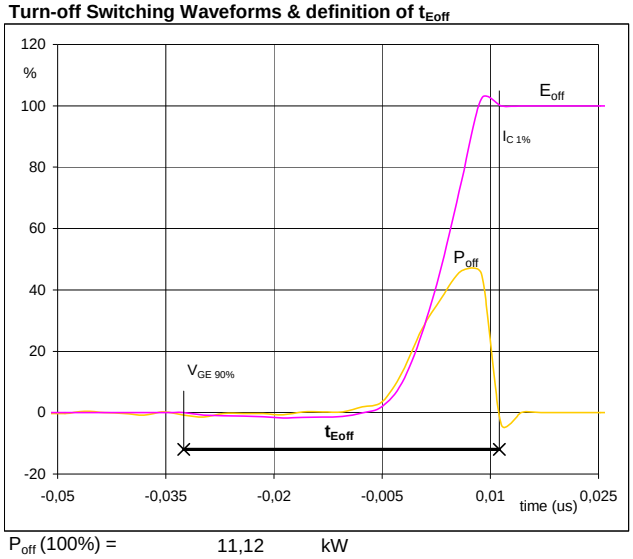


V_C (100%) =	700	V
I_C (100%) =	16	A
t_r =	0,01	µs

Switching Definitions BOOST

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

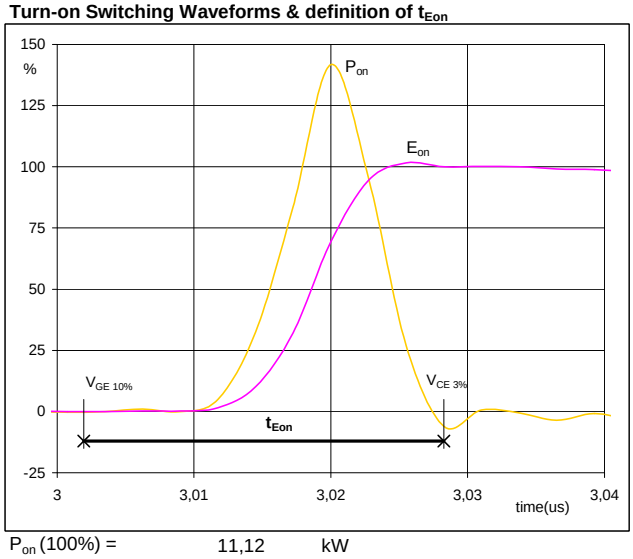
Turn-off Switching Waveforms & definition of t_{Eoff}



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

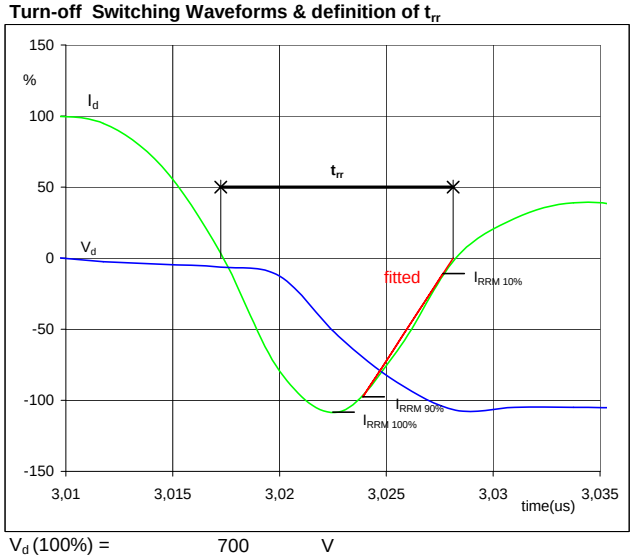
Turn-on Switching Waveforms & definition of t_{Eon}



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}



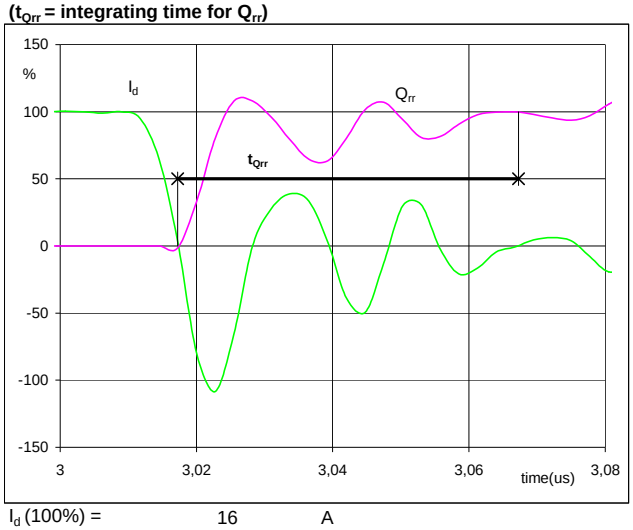
V_d (100%) =	700	V
I_d (100%) =	16	A
I_{RRM} (100%) =	-18	A
t_{rr} =	0,01	µs

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})

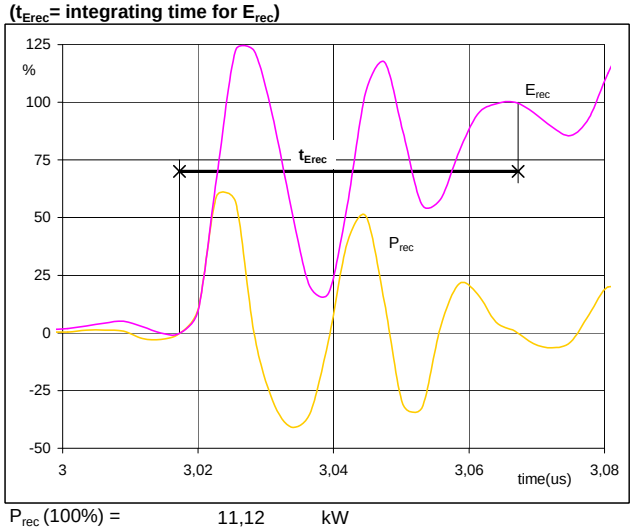


I_d (100%) =	16	A
Q_{rr} (100%) =	0,10	µC
t_{Qrr} =	0,05	µs

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

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

(t_{Erec}= integrating time for E_{rec})

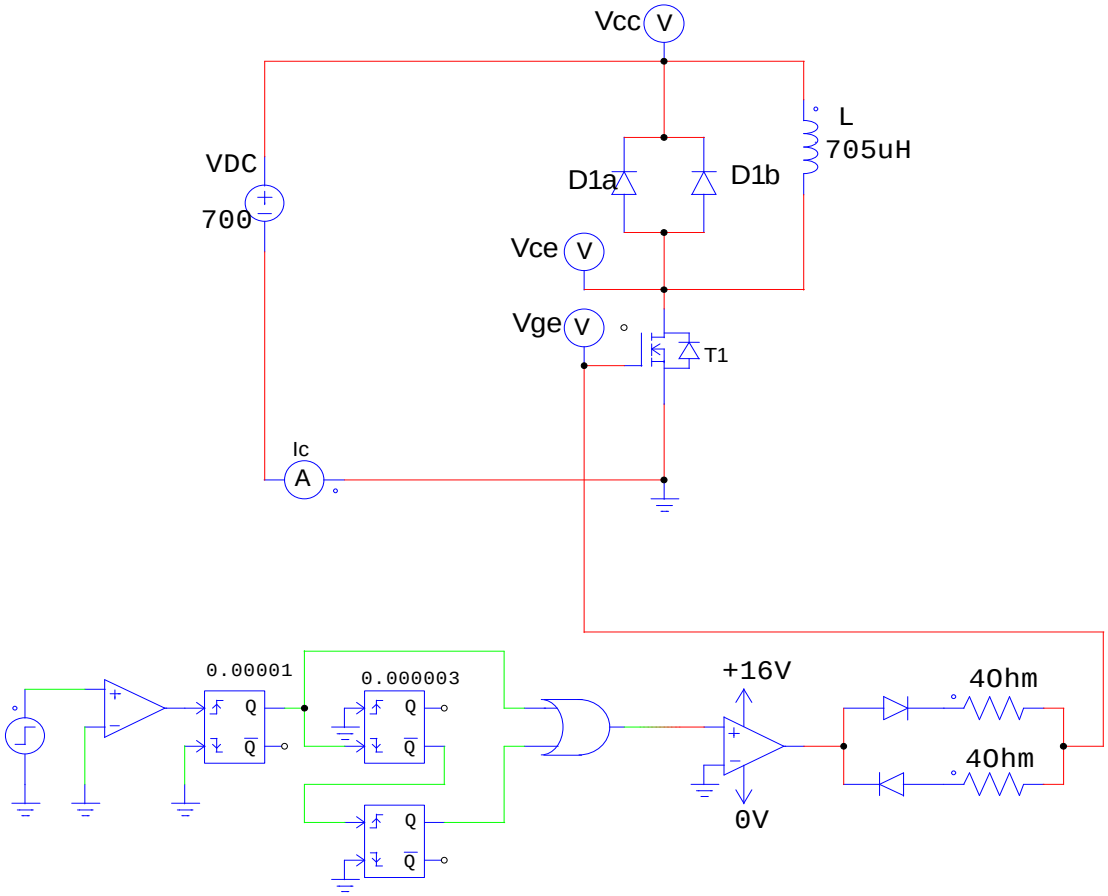


P_{rec} (100%) =	11,12	kW
E_{rec} (100%) =	0,03	mJ
t_{Erec} =	0,05	µs

Measurement circuit

Figure 11

BOOST stage switching measurement circuit



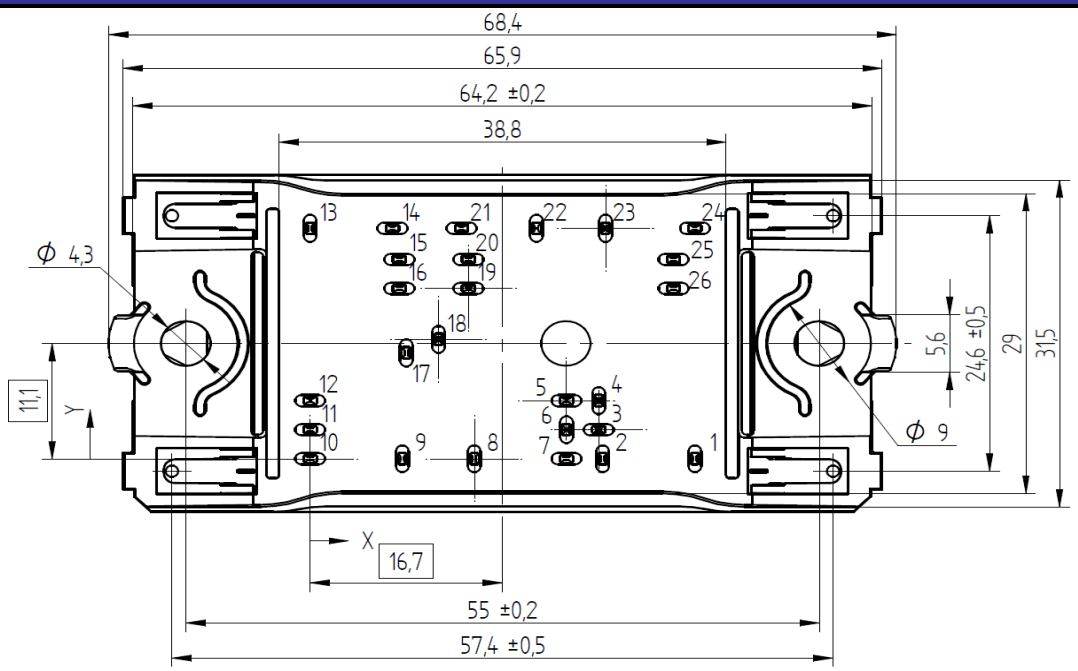
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

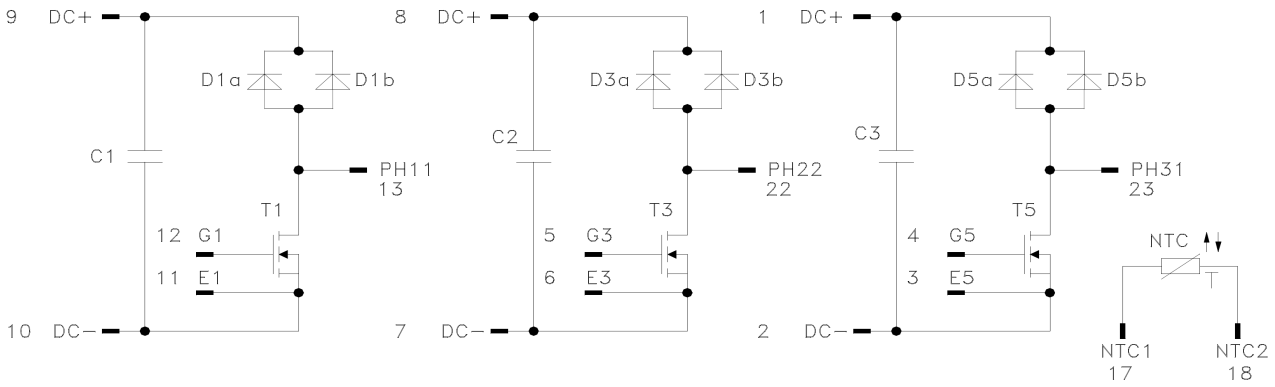
Version	Ordering Code	in DataMatrix as	in packaging barcode as
w/o thermal paste 12mm housing Press-fit pin	10-PZ123BA080ME-M909L18Y	M909L18Y	M909L18Y

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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