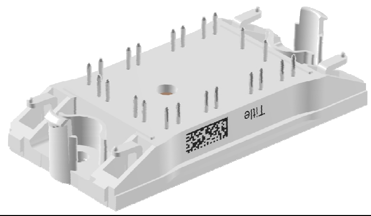
flow BOOST 0 — 1200V/50A

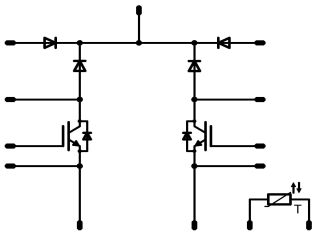
Features
- High efficiency dual boost
- Ultra fast switching frequency
- Low Inductance Layout
- 1200V IGBT and 1200V SiC diode
- Antiparallel IGBT protection diode with high current

flow 0 12mm housing



Target Applications
- solar inverter

Schematic



Types
- V23990-P629-L63

Maximum Ratings

Tj=25℃, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
D7-D10				
Repetitive peak reverse voltage	V_{RRM}		1600	V
Forward average current	I_{FAV}	$T_j=T_j$max; T_h=80℃ / T_c=80℃	38 45	A
Surge forward current	I_{FSM}	t_p=10ms; T_j=25℃	220	A
I2t-value	I^2t	t_p=10ms; T_j=25℃	200	A^2s
Power dissipation per Diode	P_{tot}	$T_j=T_j$max; T_h=80℃ / T_c=80℃	47 71	W
Maximum Junction Temperature	$T_j$max		150	℃
T1,T2				
Collector-emitter break down voltage	V_{CES}		1200	V
DC collector current	I_C	$T_j=T_j$max; T_h=80℃ / T_c=80℃	43 57	A
Pulsed collector current	I_{Cpulse}	t_p limited by $T_j$max	160	A
Power dissipation per IGBT	P_{tot}	$T_j=T_j$max; T_h=80℃ / T_c=80℃	145 220	W
Gate-emitter peak voltage	V_{GE}		±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150℃ V_{GE}=15V	10 600	µs V
Maximum Junction Temperature	$T_j$max		175	℃

Maximum Ratings

Tj=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
D1,D2,D3,D4,D5,D6 *					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
Forward average current	I_{FAV}	$T_j=T_jmax$	T_h=80℃ T_c=80℃	28 34	A
Surge forward current	I_{FSM}	t_p=10ms	T_j=25℃	138	A
I2t-value	I^2t	t_p=10ms	T_j=25℃	95	A^2s
Repetitive peak forward current	I_{FRM}	t_p limited by T_jmax		78	A
Power dissipation per Diode	P_{tot}	$T_j=T_jmax$	T_h=80℃ T_c=80℃	81 123	W
Maximum Junction Temperature	T_jmax			175	℃

Thermal Properties

Parameter	Symbol	Condition	Value	Unit
Storage temperature	T_{stg}		-40…+125	℃
Operation temperature under switching condition	T_{op}		-40…+(Tjmax - 25)	℃

Insulation Properties

Parameter	Symbol	Condition		Value	Unit
Insulation voltage		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_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	
D7-D10										
Forward voltage	V_F				25	Tj=25℃ Tj=125℃	0,8	1,14 1,10	1,9	V
Threshold voltage (for power loss calc. only)	V_{to}				25	Tj=25℃ Tj=125℃		0,92 0,80		V
Slope resistance (for power loss calc. only)	r_t				25	Tj=25℃ Tj=125℃		0,009 0,012		Ω
Reverse current	I_r			1500		Tj=25℃ Tj=125℃			0,05	mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						1,49		K/W
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease tickness≤ 50um λ= 1 W/K						1,73		K/W
T1,T2										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}$			0,00025	Tj=25℃ Tj=125℃	3,5	5,5	7,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		50	Tj=25℃ Tj=125℃	1,5	3,16 3,42	2,5	V
Collector-emitter cut-off	I_{CES}		0	1200		Tj=25℃ Tj=125℃			1	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25℃ Tj=125℃	250		250	nA
Integrated Gate resistor	R_{gint}							4		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=4 Ω Rgon=4 Ω	15	700	40	Tj=25℃ Tj=125℃		24 23		ns
Rise time	t_r					Tj=25℃ Tj=125℃		9 11		
Turn-off delay time	$t_{d(off)}$					Tj=25℃ Tj=125℃		178 208		
Fall time	t_f					Tj=25℃ Tj=125℃		11 39		
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=125℃		0,467 0,550		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=125℃		0,934 1,760		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25℃		3200		pF
Output capacitance	C_{oss}							370		
Reverse transfer capacitance	C_{rss}							125		
Gate charge	Q_{Gate}		15	600	40	Tj=25℃		220	330	nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						0,65		K/W
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease tickness≤ 50um λ= 1 W/K						0,43		K/W
D1,D2,D3,D4,D5,D6 *										
Forward voltage	V_F				15	Tj=25℃ Tj=125℃		1,43 1,69	2	V
Reverse leakage current	I_{rm}			1200		Tj=25℃ Tj=125℃			150	µA
Peak recovery current	I_{RRM}	Rgon=4 Ω	15	700	40	Tj=25℃ Tj=125℃		17 15		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=125℃		9 9		ns
Reverse recovery charge	Q_{rr}					Tj=25℃ Tj=125℃		0,24 0,21		µC
Reverse recovered energy	E_{rec}					Tj=25℃ Tj=125℃		0,093 0,074		mWs
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25℃ Tj=125℃		6570 5559		A/µs
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						1,17		K/W
Thermal resistance chip to case per chip	R_{thJH}	Thermal grease tickness≤ 50um λ= 1 W/K						1,36		K/W

Characteristic Values

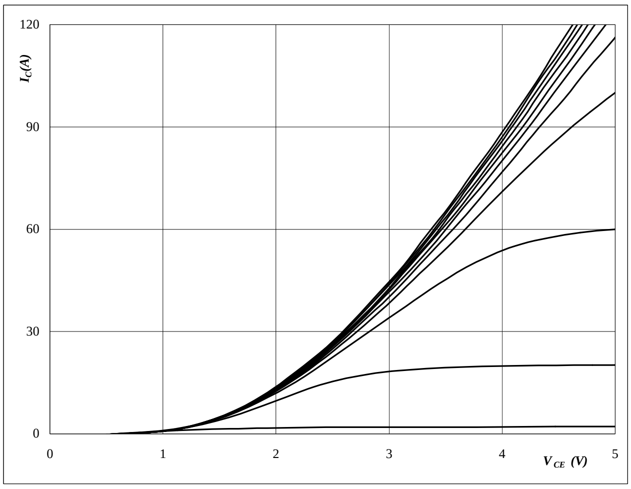
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Thermistor										
Rated resistance	R					T=25℃		21511		Ω
Deviation of R100	ΔR/R	R100=1486 Ω				T=25℃	-4,5		+4,5	%
Power dissipation	P					T=25℃		210		mW
Power dissipation constant						T=25℃		3,5		mW/K
B-value	B(25/50)	Tol. ±3%				T=25℃		3884		K
B-value	B(25/100)	Tol. ±3%				T=25℃		3964		K
Vincotech NTC Reference									F	

T1, T2

Figure 1 T1, T2

Typical output characteristics

$I_D = f(V_{DS})$



At

t_p = 250 µs

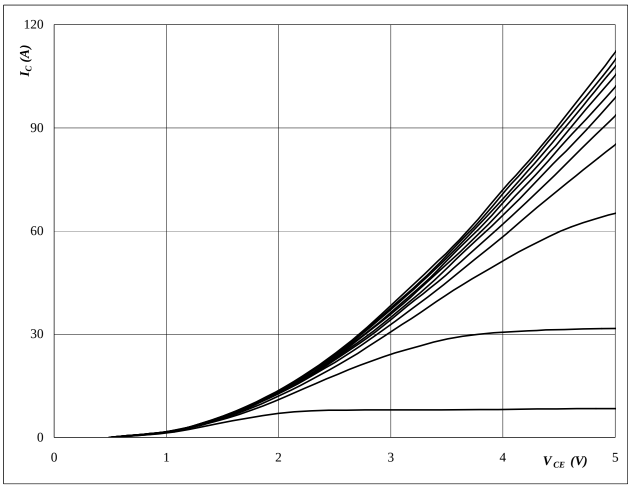
T_j = 25 °C

V_{GS} from 7 V to 17 V in steps of 1 V

Figure 2 T1, T2

Typical output characteristics

$I_D = f(V_{DS})$



At

t_p = 250 µs

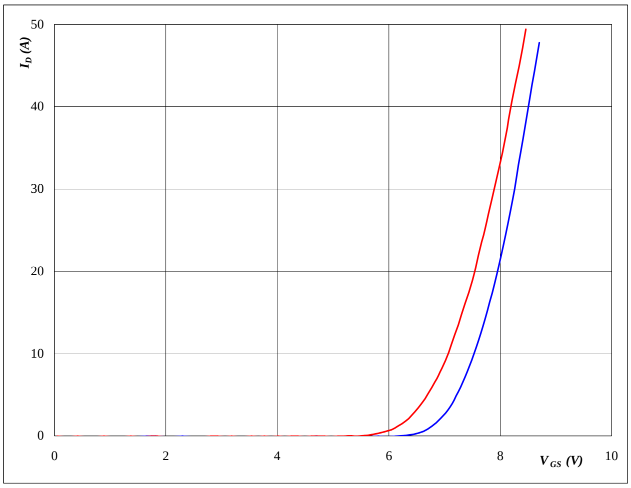
T_j = 126 °C

V_{GS} from 7 V to 17 V in steps of 1 V

Figure 3 T1, T2

Typical transfer characteristics

$I_D = f(V_{GS})$



At

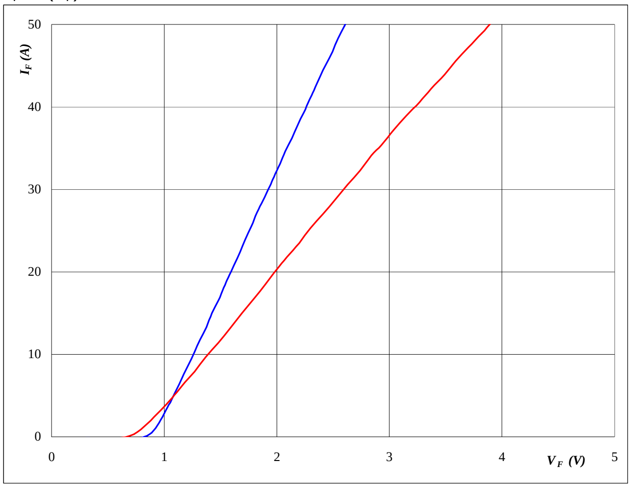
t_p = 100 µs T_j = 25/125 °C

V_{DS} = 10 V

Figure 4 T1, T2

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

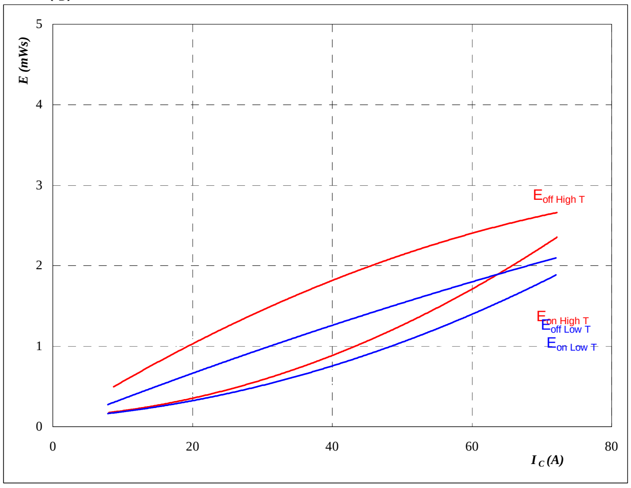
t_p = 250 µs T_j = 25/125 °C

T1, T2

Figure 5 T1, T2

Typical switching energy losses as a function of collector current

$E = f(I_D)$



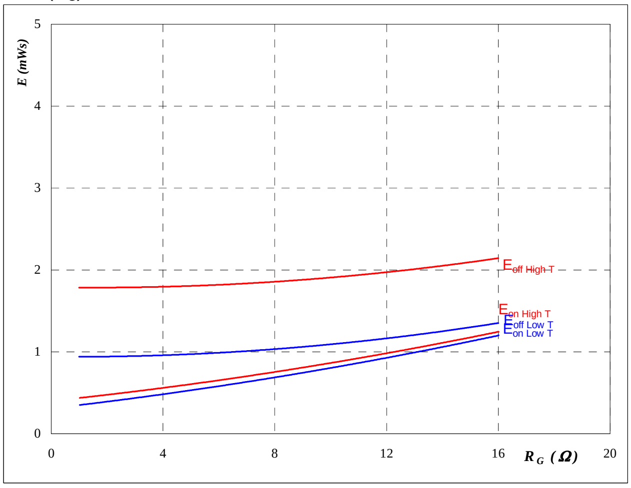
With an inductive load at

T_j =	25/125	°C
V_{DS} =	700	V
V_{GS} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 6 T1, T2

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



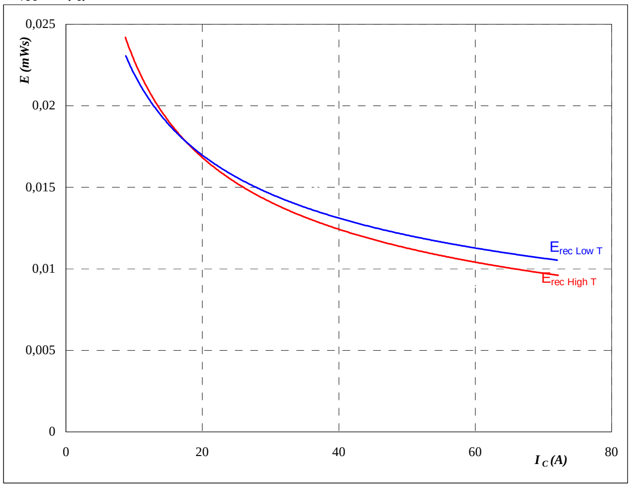
With an inductive load at

T_j =	25/125	°C
V_{DS} =	700	V
V_{GS} =	15	V
I_D =	40	A

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

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

$E_{rec} = f(I_c)$



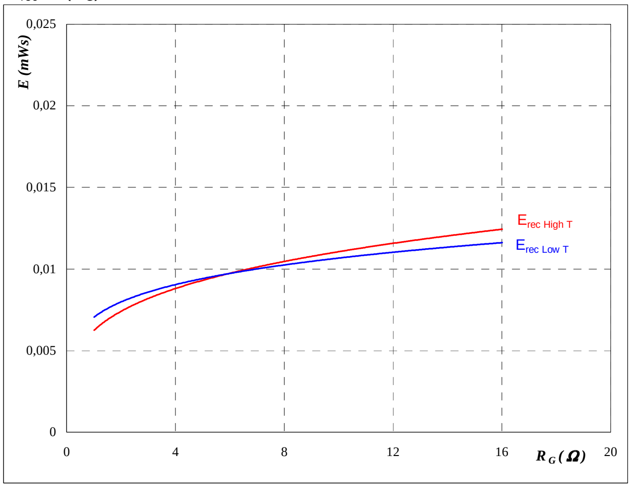
With an inductive load at

T_j =	25/125	°C
V_{DS} =	700	V
V_{GS} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

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

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

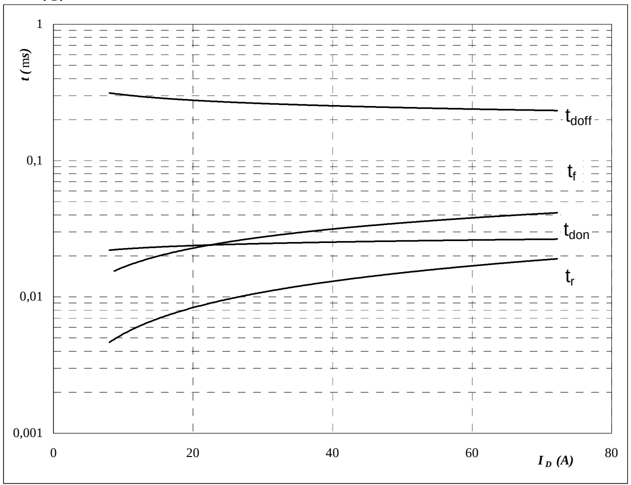
T_j =	25/125	°C
V_{DS} =	700	V
V_{GS} =	15	V
I_D =	40	A

T1, T2

Figure 9 T1, T2

Typical switching times as a function of collector current

$t = f(I_D)$



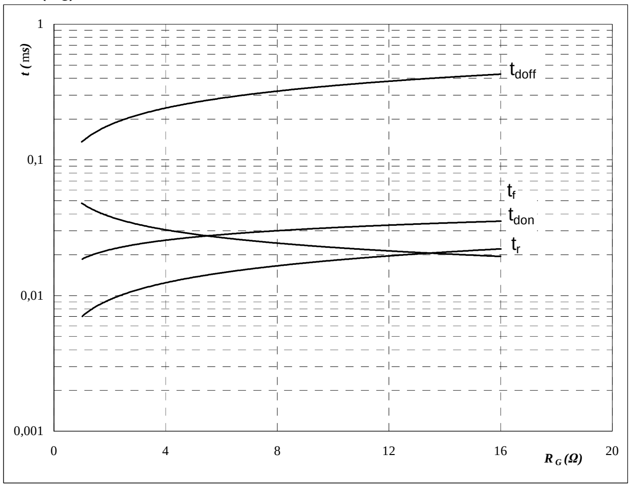
With an inductive load at

T_j =	125	℃
V_{DS} =	700	V
V_{GS} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10 T1, T2

Typical switching times as a function of gate resistor

$t = f(R_G)$



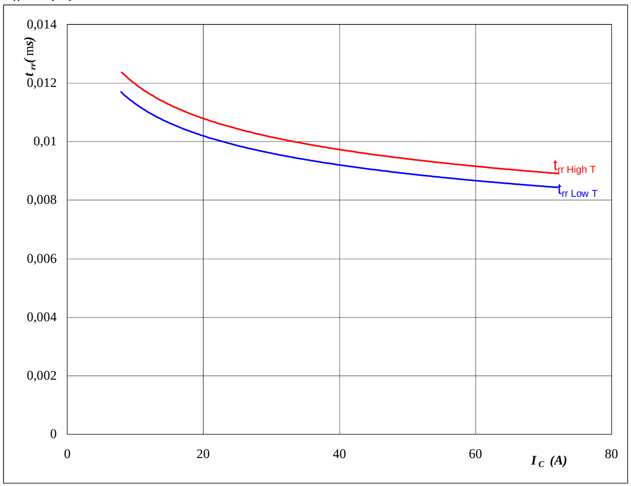
With an inductive load at

T_j =	125	℃
V_{DS} =	700	V
V_{GS} =	15	V
I_C =	40	A

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

Typical reverse recovery time as a function of collector current

$t_{rr} = f(Ic)$



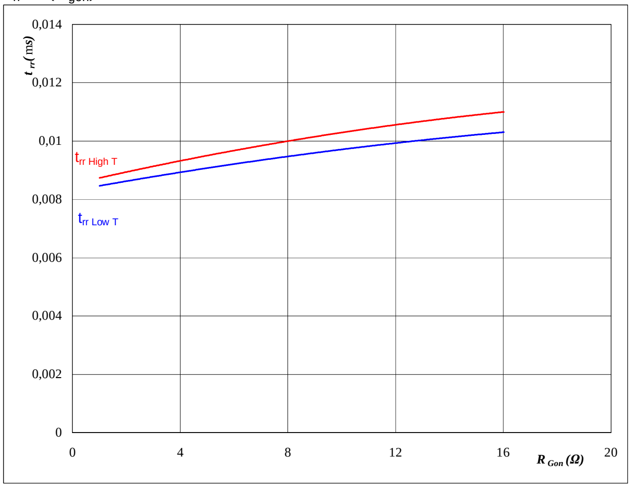
At

T_j =	25/125	℃
V_{CE} =	700	V
V_{GE} =	15	V
R_{gon} =	4	Ω

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

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

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



At

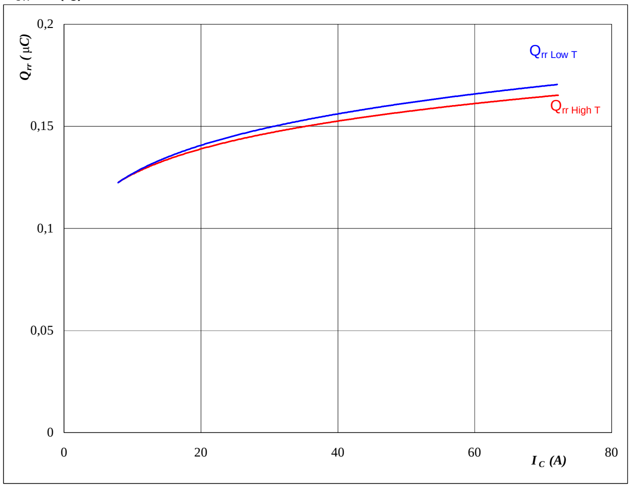
T_j =	25/125	℃
V_R =	700	V
I_F =	40	A
V_{GS} =	15	V

T1, T2

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

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$

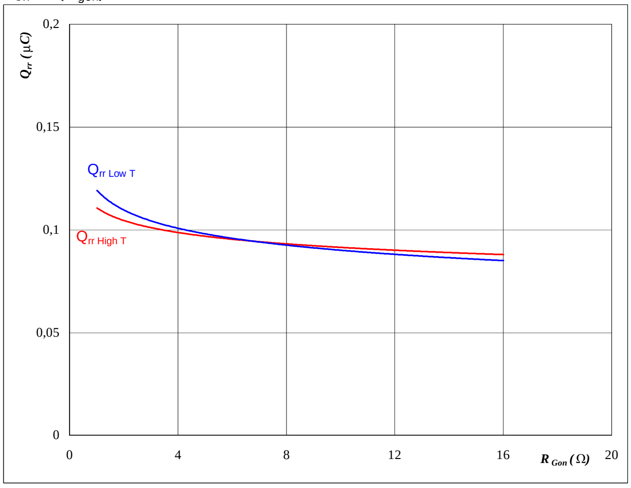


At		
T_j =	25/125	℃
V_{CE} =	700	V
V_{GE} =	15	V
R_{gon} =	4	Ω

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

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

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

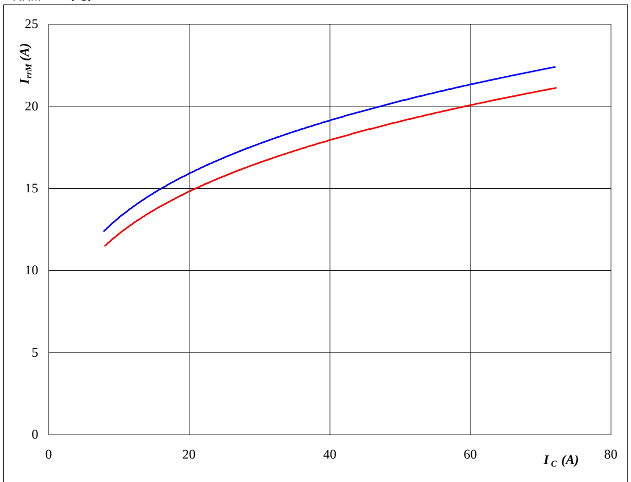


At		
Tj =	25/125	℃
VR =	700	V
IF =	40	A
VGS =	15	V

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

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$

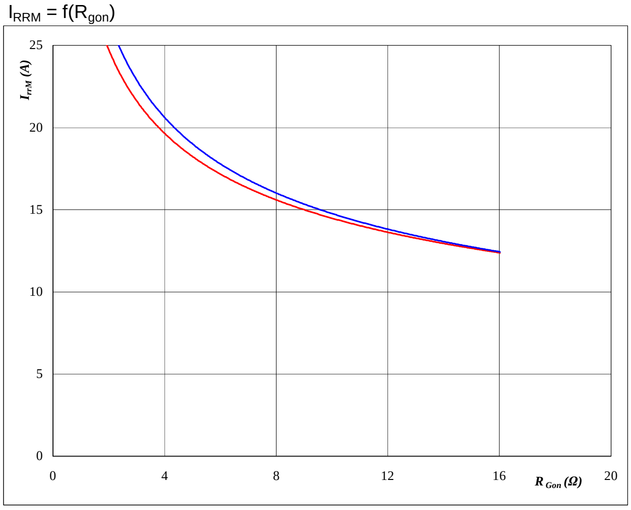


At		
T_j =	25/125	℃
V_{CE} =	700	V
V_{GE} =	15	V
R_{gon} =	4	Ω

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

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

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



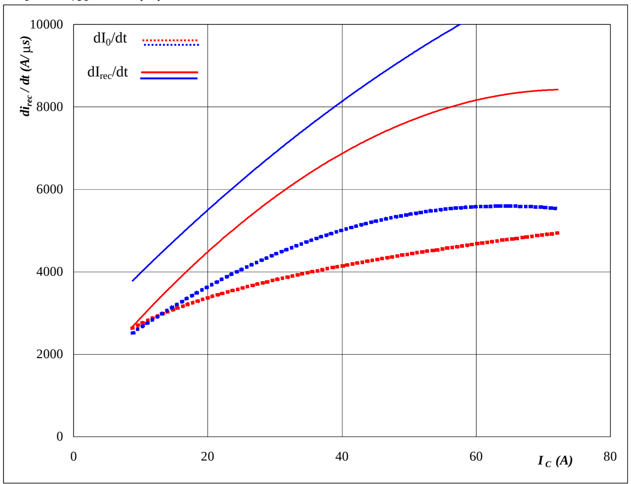
At		
T_j =	25/125	℃
V_R =	700	V
I_F =	40	A
V_{GS} =	15	V

T1, T2

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

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

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



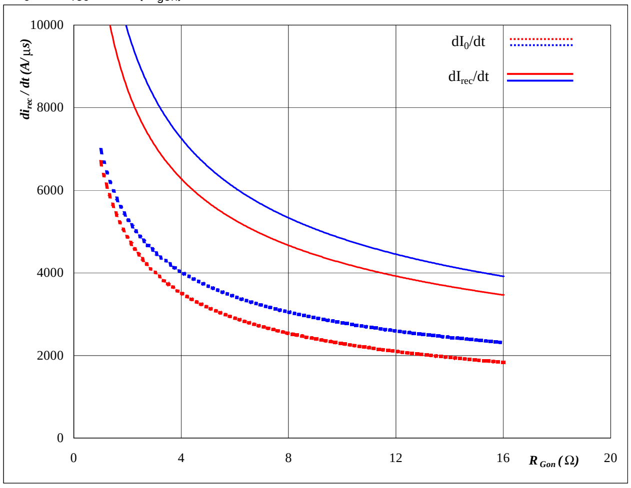
At

T_j =	25/125	℃
V_{CE} =	700	V
V_{GE} =	15	V
R_{gon} =	4	Ω

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

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

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



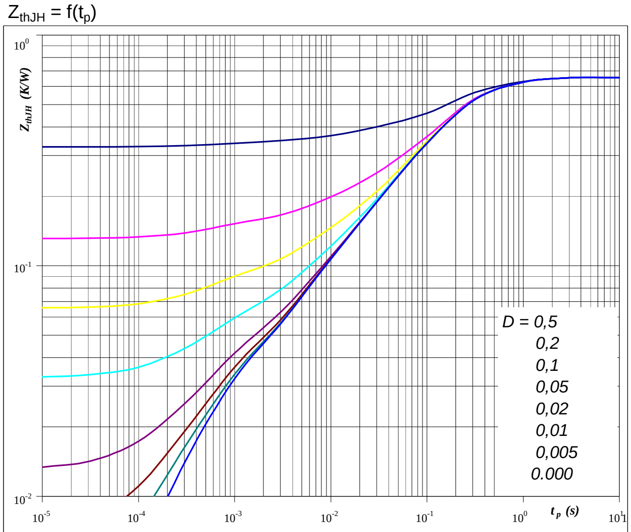
At

Tj =	25/125	℃
VR =	700	V
IF =	40	A
VGS =	15	V

Figure 19 T1, T2

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

$Z_{thJH} = f(t_p)$



At

D = t_p / T

	Phase-Change Material			Thermal grease	
R_{thJH} =	0,65	K/W	R_{thJH} =	0,79	K/W

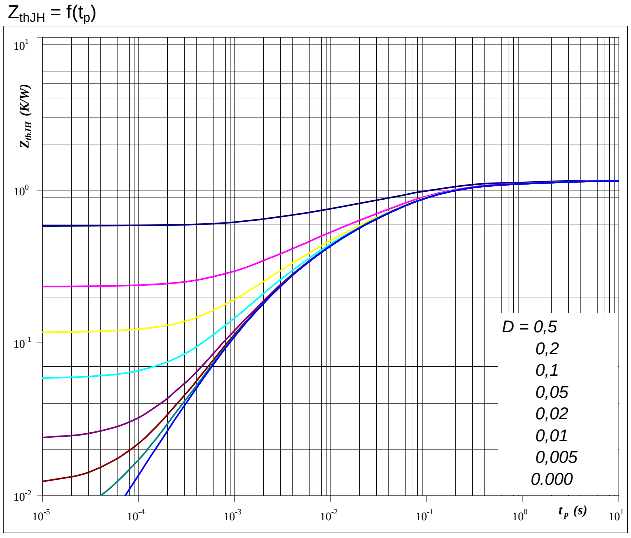
IGBT thermal model values

Phase-Change Material		Thermal grease	
R (C/W)	Tau (s)	R (C/W)	Tau (s)
0,173	0,561	0,208	0,561
0,381	0,125	0,459	0,125
0,078	0,010	0,094	0,010
-0,003	0,048	-0,004	0,048
0,026	0,001	0,032	0,001

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

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D = t_p / T

	Phase-Change Material			Thermal grease	
R_{thJH} =	1,17	K/W	R_{thJH} =	1,36	K/W

FWD thermal model values

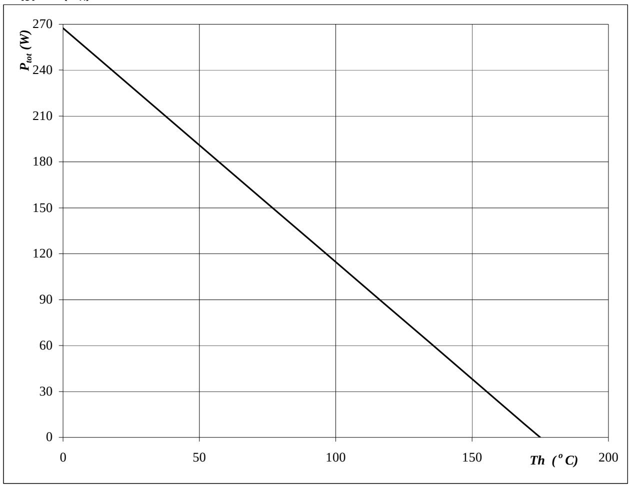
Phase-Change Material		Thermal grease	
R (C/W)	Tau (s)	R (C/W)	Tau (s)
0,043	9,803	0,050	9,80
0,101	0,815	0,118	0,82
0,383	0,098	0,445	0,10
0,308	0,026	0,358	0,03
0,233	0,005	0,271	0,01
0,098	0,001	0,114	0,00

T1, T2

Figure 21 T1, T2

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



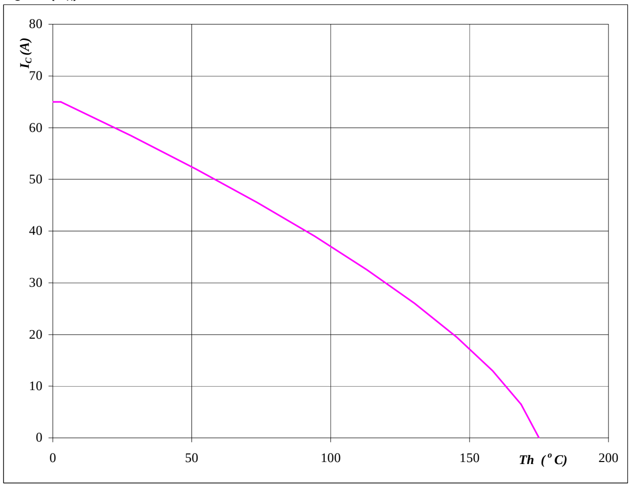
At

T_j = 175 ºC

Figure 22 T1, T2

Collector/Drain current as a function of heatsink temperature

$I_C = f(T_h)$



At

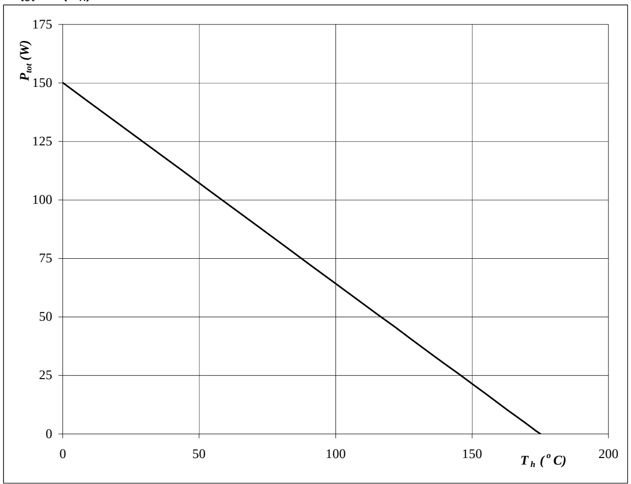
T_j = 175 ºC

V_{GS} = 15 V

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

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



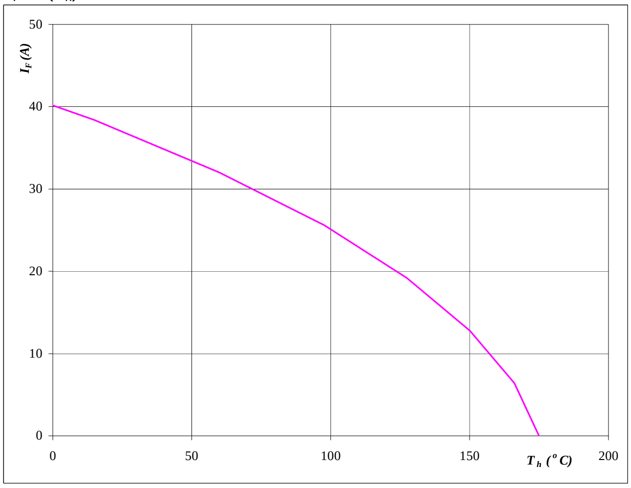
At

T_j = 175 ºC

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

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

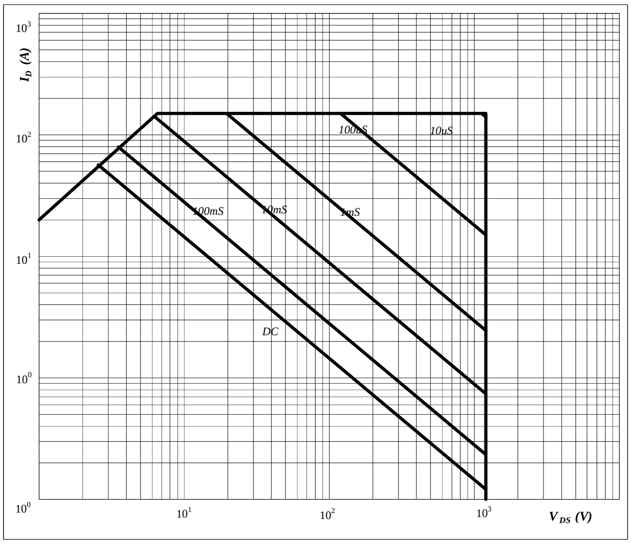
T_j = 175 ºC

T1, T2

Figure 25 T1, T2

Safe operating area as a function of drain-source voltage

$I_D = f(V_{DS})$



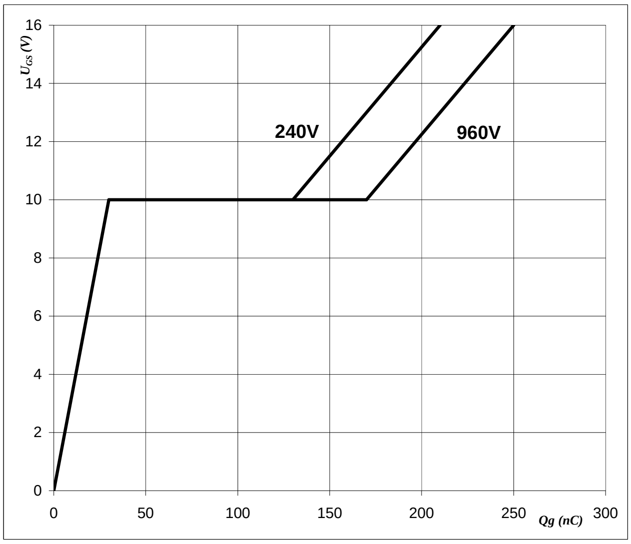
At

D =	single pulse	
T_h =	80	ºC
V_{GS} =	15	V
T_j =	T_{jmax}	ºC

Figure 26 T1, T2

Gate voltage vs Gate charge

$V_{GS} = f(Qg)$



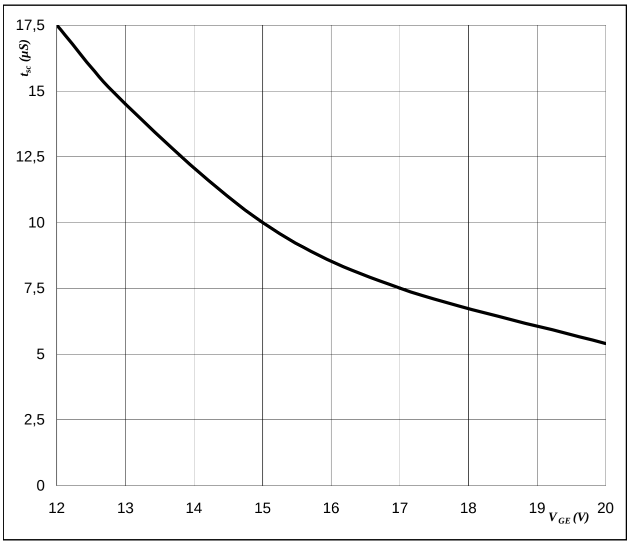
At

I_D =	50	A

Figure 27 T1, T2

Short circuit withstand time as a function of gate-emitter voltage

$t_{sc} = f(V_{GE})$



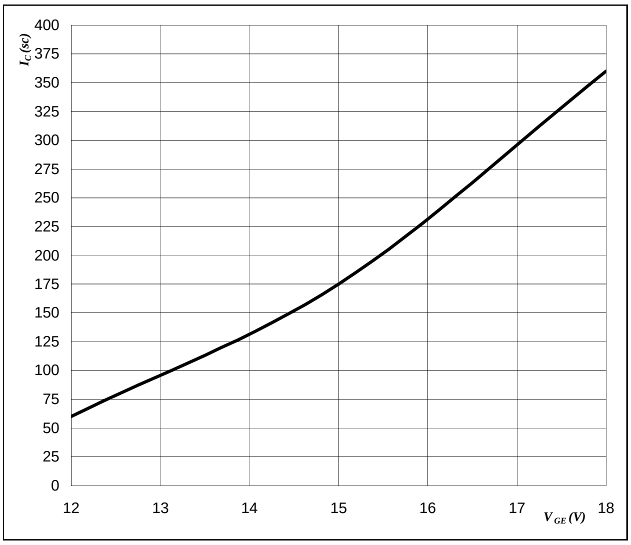
At

V_{CE} =	600	V
T_j ≤	150	ºC

Figure 28 T1, T2

Typical short circuit collector current as a function of gate-emitter voltage

$V_{GE} = f(Q_{GE})$



At

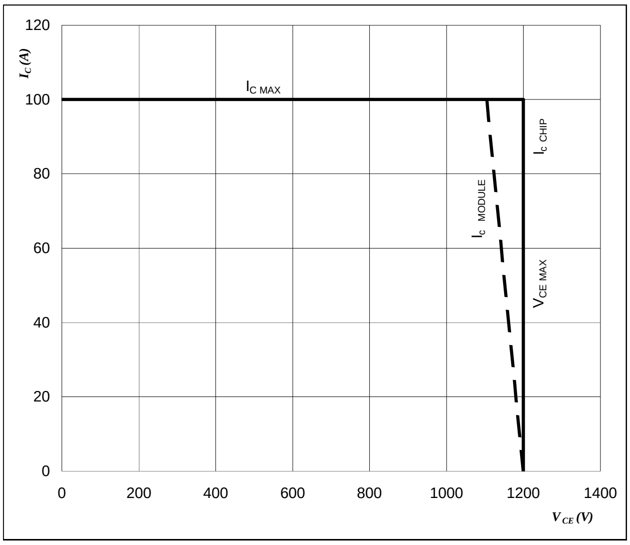
V_{CE} ≤	600	V
T_j =	25	ºC

T1, T2

Figure 29 T1, T2

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

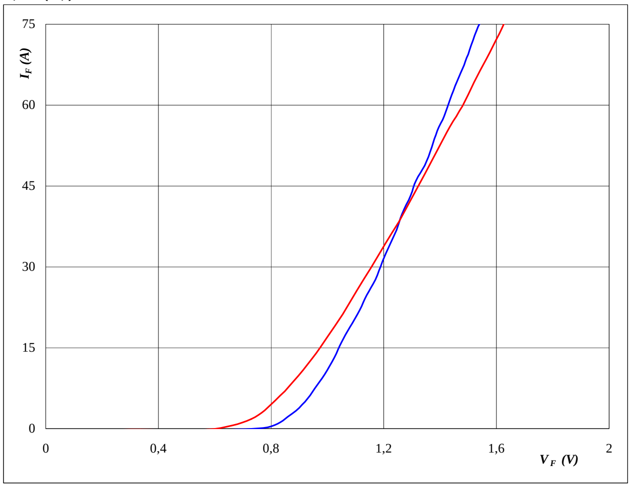
T_{vj} ≤	150	ºC
$I_{C\ MAX}$=	100	A
$U_{CE\ MAX}$=	1200	V

D7-D10

Figure 1 D7-D10

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



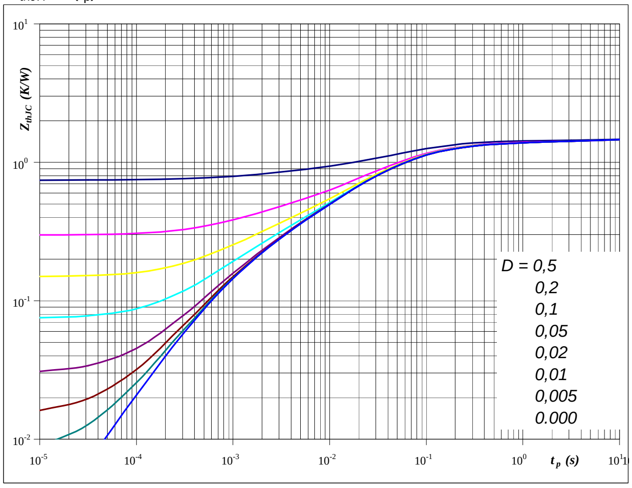
At

T_j =	25/125	°C
t_p =	250	µs

Figure 2 D7-D10

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

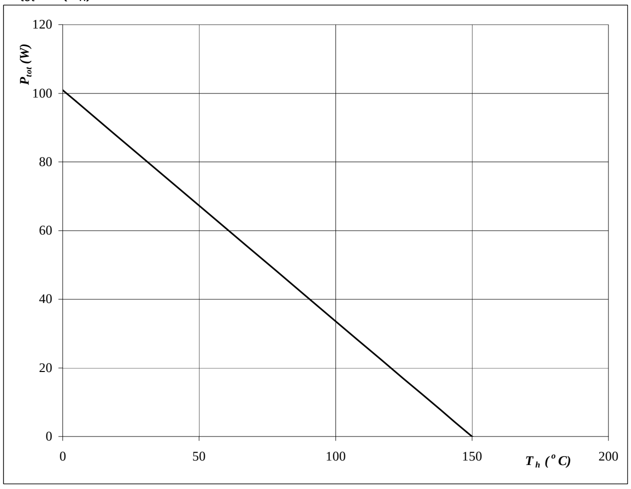
D = t_p / T

	Phase-Change Material			Thermal grease	
R_{thJH} =	1,49	K/W	R_{thJH} =	1,73	K/W

Figure 3 D7-D10

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



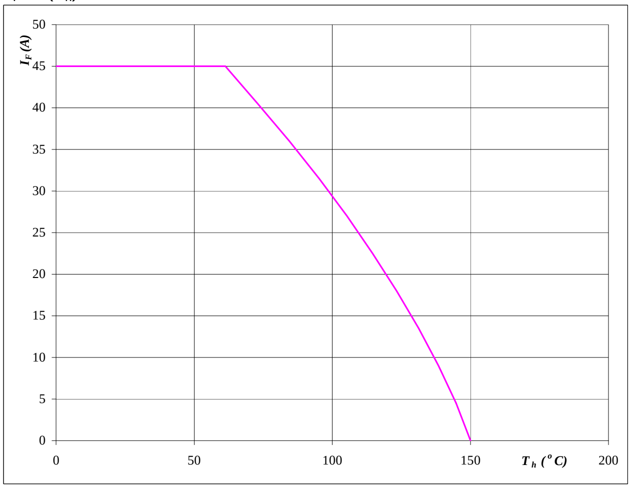
At

T_j = 150 ºC

Figure 4 D7-D10

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

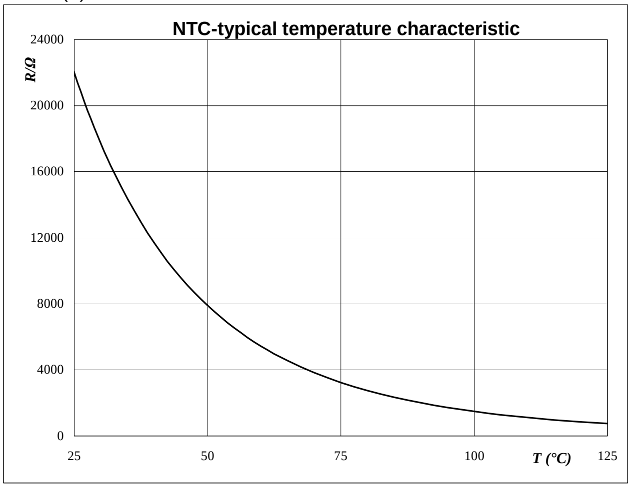
T_j = 150 ºC

Thermistor

Figure 1	Thermistor

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$



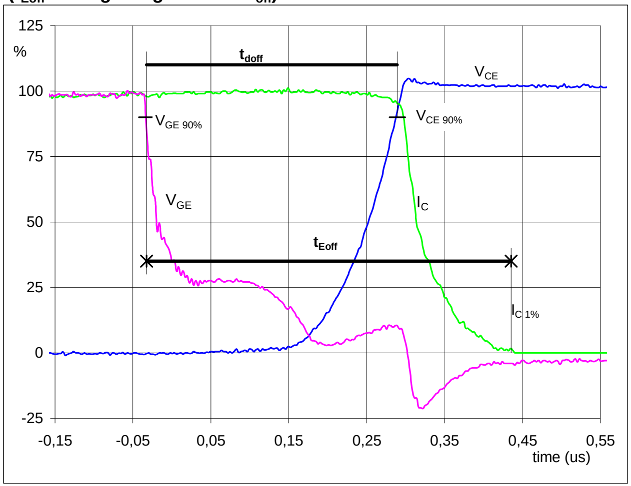
Switching Definitions Boost

General conditions

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

Figure 1 T1, T2

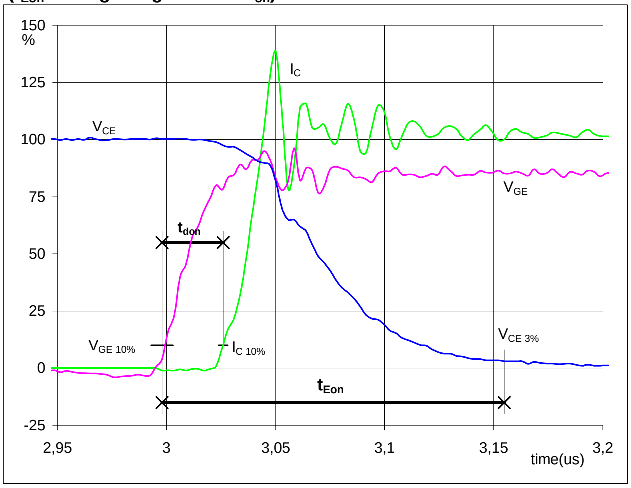
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	40	A
t_{doff} =	0,320	µs
t_{Eoff} =	0,468	µs

Figure 2 T1, T2

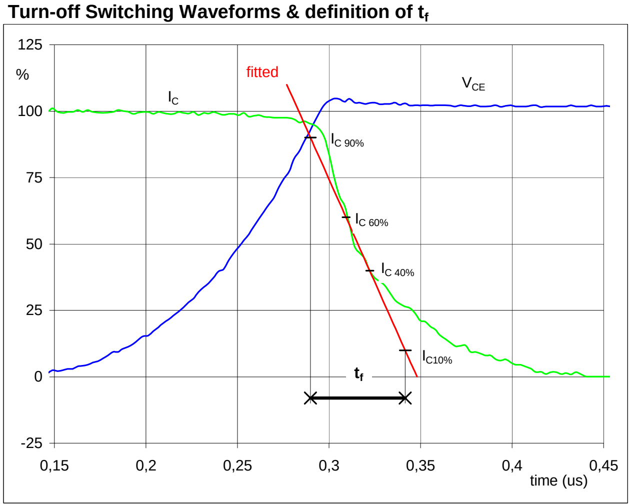
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	40	A
t_{don} =	0,027	µs
t_{Eon} =	0,157	µs

Figure 3 T1, T2

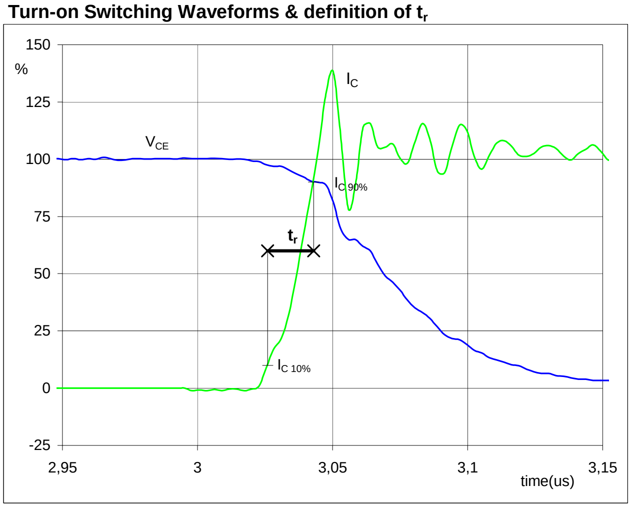
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	700	V
I_C (100%) =	40	A
t_f =	0,057	µs

Figure 4 T1, T2

Turn-on Switching Waveforms & definition of t_r

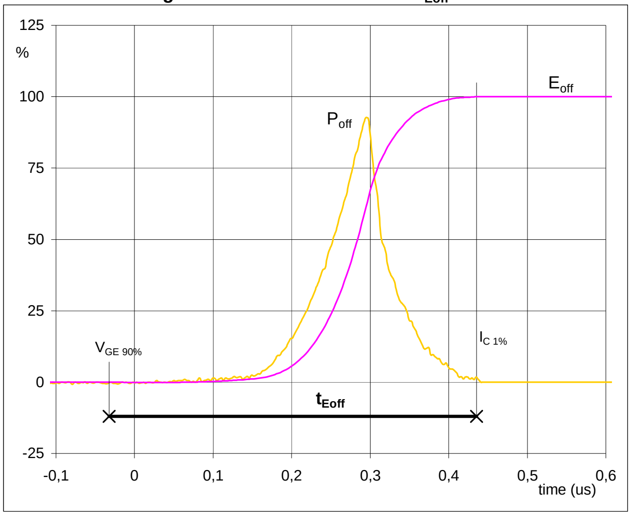


V_C (100%) =	700	V
I_C (100%) =	40	A
t_r =	0,017	µs

Switching Definitions Boost

Figure 5 T1, T2

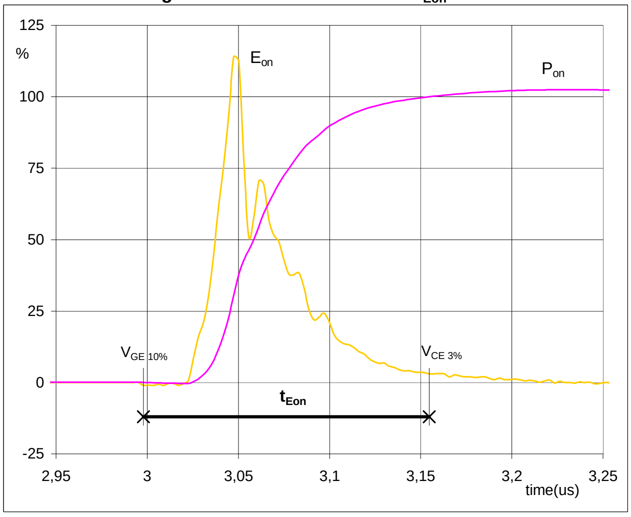
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	28,02	kW
E_{off} (100%) =	2,43	mJ
t_{Eoff} =	0,468	μs

Figure 6 T1, T2

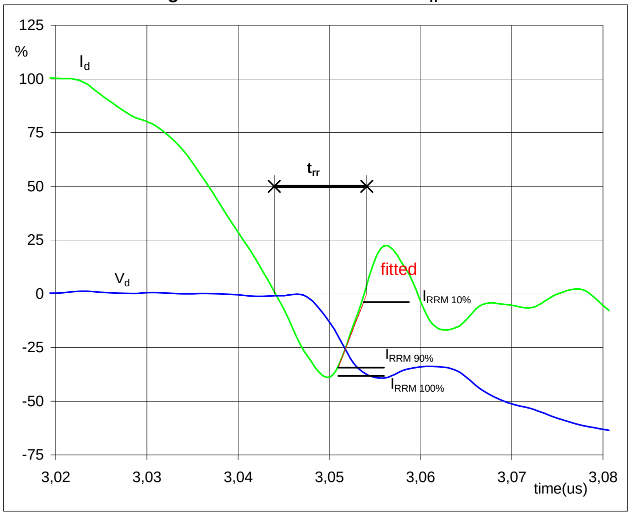
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	28,02	kW
E_{on} (100%) =	1,22	mJ
t_{Eon} =	0,1567	μs

Figure 7 T1, T2

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

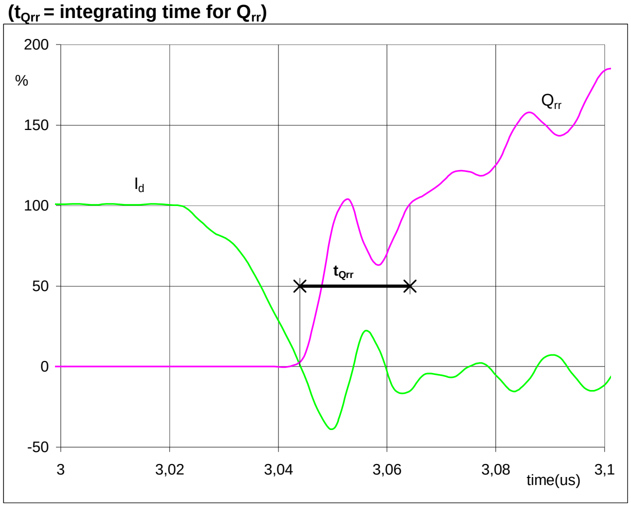


V_d (100%) =	700	V
I_d (100%) =	40	A
I_{RRM} (100%) =	-15	A
t_{rr} =	0,009	μs

Switching Definitions Boost

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

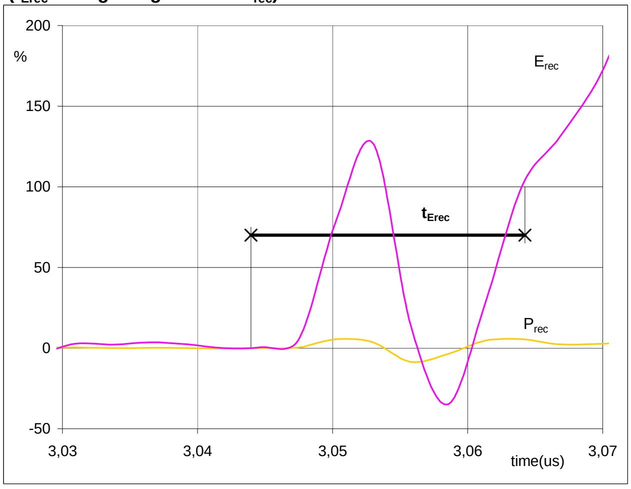
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	40	A
Q_{rr} (100%) =	0,21	μC
t_{Qrr} =	0,02	μs

Figure 9	D1, D2, D3, D4, D5, D6

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



P_{rec} (100%) =	28,02	kW
E_{rec} (100%) =	0,07	mJ
t_{Erec} =	0,02	μs

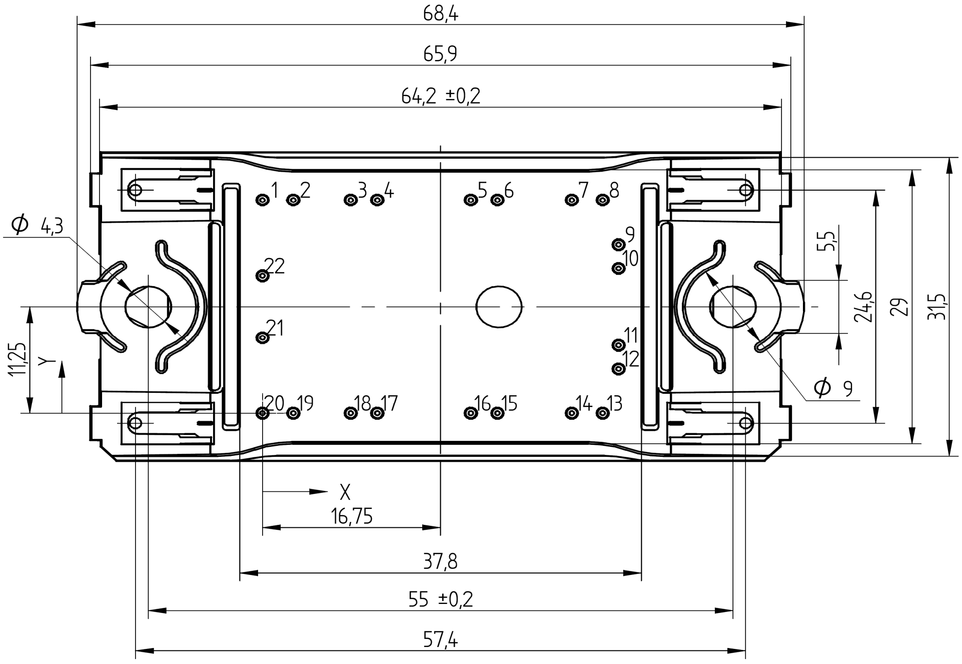
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

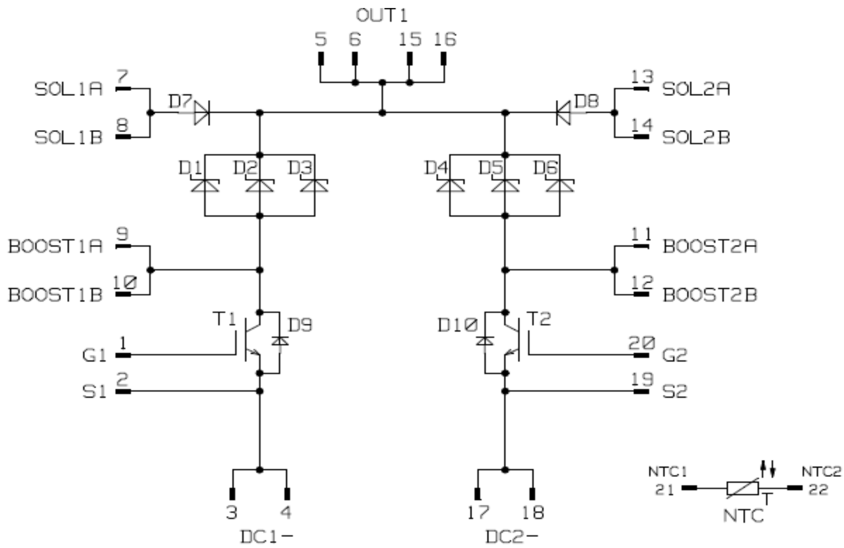
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	V23990-P629-L63	P629L63	P629L63

Outline

Pin Table		
Pin	X	Y
1	0	22,5
2	2,9	22,5
3	8,3	22,5
4	10,8	22,5
5	19,6	22,5
6	22,1	22,5
7	29,1	22,5
8	32	22,5
9	33,5	17,8
10	33,5	15,3
11	33,5	7,2
12	33,5	4,7
13	32	0
14	29,1	0
15	22,1	0
16	19,6	0
17	10,8	0
18	8,3	0
19	2,9	0
20	0	0
21	0	8
22	0	14,5



Pinout



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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.