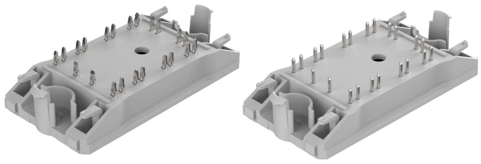
flow BOOST 0 — 1200 V / 50 A

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

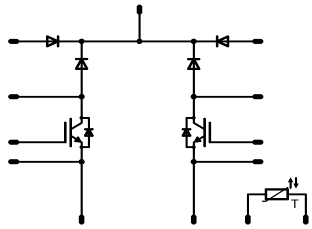


Press-fit pins — solder pins

Target Applications

- solar inverter

Schematic



Types

- V23990-P629-L43-PM
- V23990-P629-L43Y-PM

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Bypass Diode D5, D6 / Boost Sw. Protection Diode D1, D2				
Repetitive peak reverse voltage	V_{RRM}		1600	V
Mean forward current	I_{FAV}	$T_j=T_{jmax}$ T_s = 80°C T_c=80°C	38 45	A
Surge (non-repetitive) forward current	I_{FSM}	t_p=10ms T_j=25°C	220	A
I^2t-value	I^2t		200	A^2s
Power dissipation	P_{tot}	$T_j=T_{jmax}$ T_s = 80°C T_c=80°C	47 71	W
Maximum Junction Temperature	T_{jmax}		150	°C
Boost Switch (T1,T2)				
Collector-emitter break down voltage	V_{CES}		1200	V
DC collector current	I_C	$T_j=T_{jmax}$ T_s = 80°C T_c=80°C	51 65	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	150	A
Turn off safe operating area		T_j≤150°C V_{CE}<=V_{CES}	100	A
Power dissipation	P_{tot}	$T_j=T_{jmax}$ T_s = 80°C T_c=80°C	144 210	W
Gate-emitter peak voltage	V_{GE}		±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150°C V_{GE}=15V	10 800	μs V
Maximum Junction Temperature	T_{jmax}		175	°C

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost Diode (D3,D4)					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
Mean forward current	I_{FAV}	T_j=T_{jmax}	T_s = 80°C T_c=80°C	28 34	A
Surge (non-repetitive) forward current	I_{FSM}	t_p=10ms	T_j=25°C	138	A
I^2t-value	I^2t	t_p=10ms	T_j=25°C	95	A^2s
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		78	A
Power dissipation	P_{tot}	T_j=T_{jmax}	T_s = 80°C T_c=80°C	81 123	W
Maximum Junction Temperature	T_{jmax}			175	°C
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(T_{jmax} - 25)	°C
Insulation Properties					
Insulation voltage		t=2s	DC voltage	4000	V
Creepage distance				min 12,7	mm
Clearance		solder pins / Press-fit pins		9,55 / 9,57	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 [°C]	Min	Typ	Max	
Bypass Diode D5, D6 / Boost Sw. Protection Diode D1, D2										
Forward voltage	V_F				25	25 125	0,8	1,14 1,10	1,9	V
Threshold voltage (for power loss calc. only)	V_{to}				25	25 125		0,92 0,80		V
Slope resistance (for power loss calc. only)	r_t				25	25 125		0,009 0,012		Ω
Reverse current	I_r			1500		25 125			0,05	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ=3,4W/mK						1,49		K/W
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease tickness≤ 50um λ= 1 W/K						1,73		K/W
Boost Switch (T1,T2)										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}$			0,0017	25 125	5,2	5,8	6,4	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	25 125	1,5	2,13 2,58	2,5	V
Collector-emitter cut-off	I_{CES}		0	1200		25 125			0,05	mA
Gate-emitter leakage current	I_{GES}		20	0		25 125			600	nA
Integrated Gate resistor	R_{gint}							4		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff}=4 Ω R_{gon}=4 Ω	15	700	40	25 125		27 27		ns
Rise time	t_r					25 125		14 17		
Turn-off delay time	$t_{d(off)}$					25 125		256 320		
Fall time	t_f					25 125		47 57		
Turn-on energy loss	E_{on}					25 125		1,051 1,224		mWs
Turn-off energy loss	E_{off}					25 125		1,540 2,430		
Input capacitance	C_{ies}	f=1MHz	0	25		25		2770		pF
Output capacitance	C_{oss}							240		
Reverse transfer capacitance	C_{rss}							160		
Gate charge	Q_G		15	960	50	25		230		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ=3,4W/mK						0,66		K/W
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease tickness≤ 50um λ= 1 W/K						0,80		K/W
Boost Diode (D3, D4)										
Forward voltage	V_F				15	25 125		1,43 1,69	2	V
Reverse leakage current	I_{rm}			1200		25 125			150	μA
Peak recovery current	I_{RRM}	R_{gon}=4 Ω	15	700	40	25 125		17 15		A
Reverse recovery time	t_{rr}					25 125		9 9		ns
Reverse recovery charge	Q_{rr}					25 125		0,24 0,21		μC
Reverse recovered energy	E_{rec}					25 125		0,093 0,074		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		6570 5559		A/μs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ=3,4W/mK						1,17		K/W
Thermal resistance junction to case	$R_{th(j-s)}$	Thermal grease tickness≤ 50um λ= 1 W/K						1,36		K/W

Characteristic Values

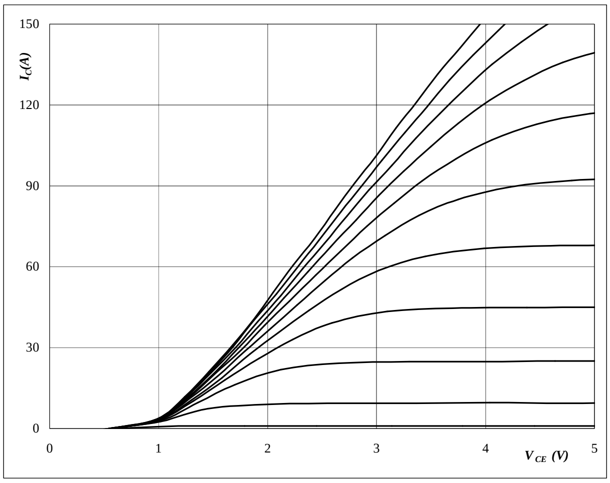
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j [°C]	Min	Typ	Max	
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R100	$\Delta_{R/R}$	R_{100}=1486 Ω				100	-12		12	%
Power dissipation	P					25		200		mW
Power dissipation constant						25		2		mW/K
B-value	$B_{(25/50)}$	Tol.±3%				25		3950		K
B-value	$B_{(25/100)}$	Tol.±3%				25		3998		K
Vincotech NTC Reference									B	

Boost Switch T1,T2 / Boost Diode D3,D4

Figure 1 T1, T2

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

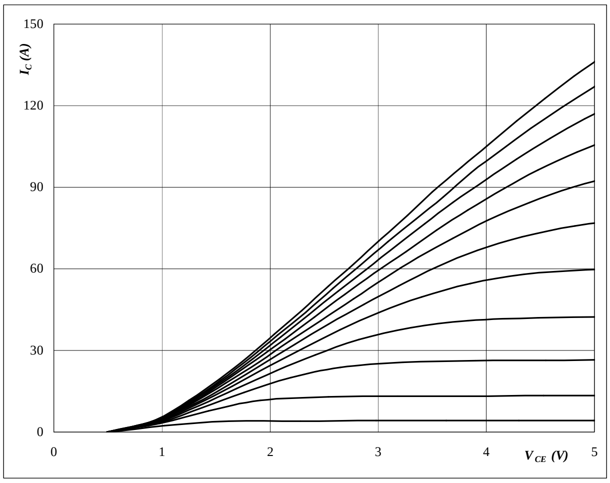
T_j = 25 °C

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

Figure 2 T1, T2

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

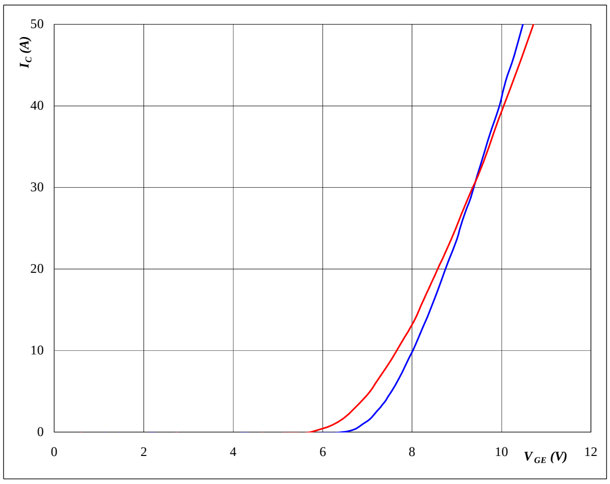
T_j = 125 °C

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

Figure 3 T1, T2

Typical transfer characteristics

$I_C = f(V_{GE})$



At

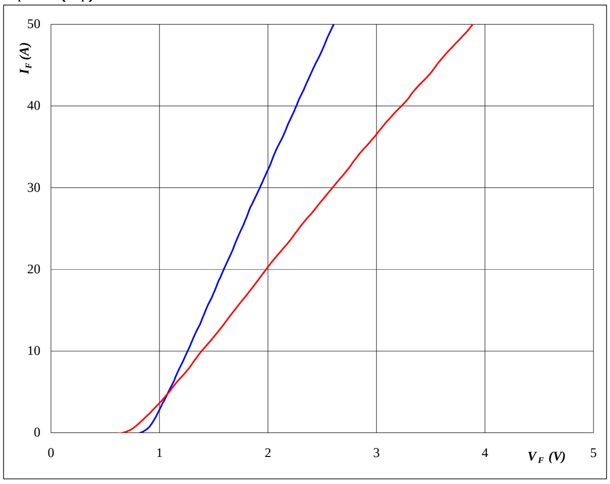
t_p = 100 µs T_j = 25/125 °C

V_{CE} = 10 V

Figure 4 D3,D4

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

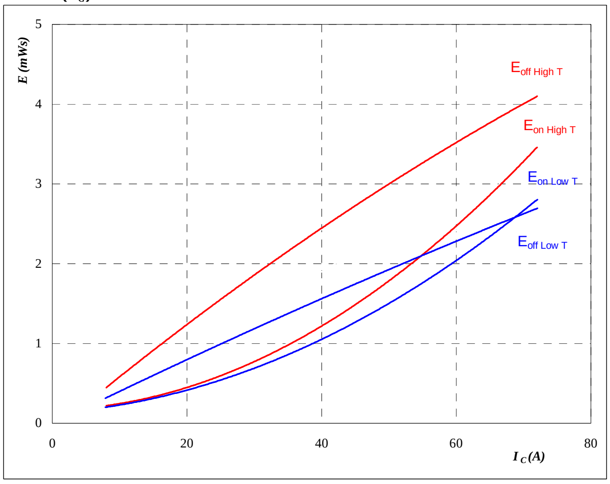
t_p = 250 µs T_j = 25/125 °C

Boost Switch T1,T2 / Boost Diode D3,D4

Figure 5 T1, T2

Typical switching energy losses as a function of collector current

$E = f(I_C)$



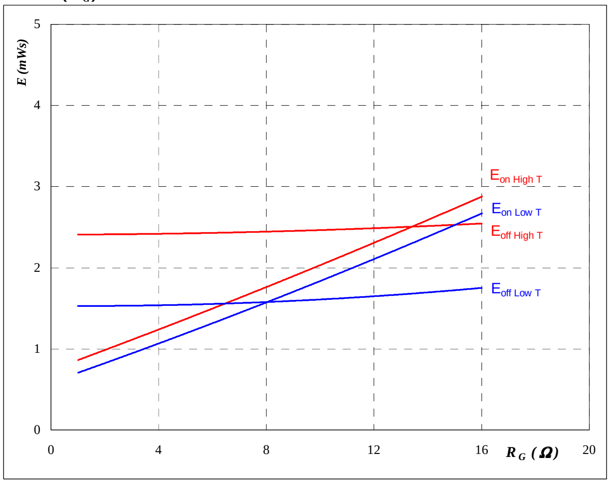
With an inductive load at

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

Figure 6 T1, T2

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



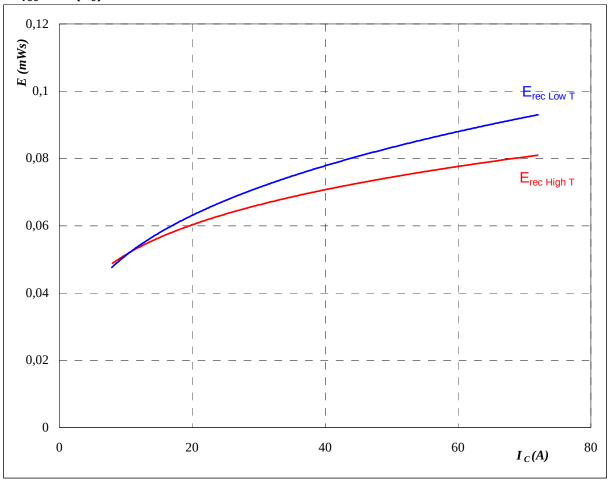
With an inductive load at

T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	15	V
I_C =	40	A

Figure 7 D3,D4

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_c)$



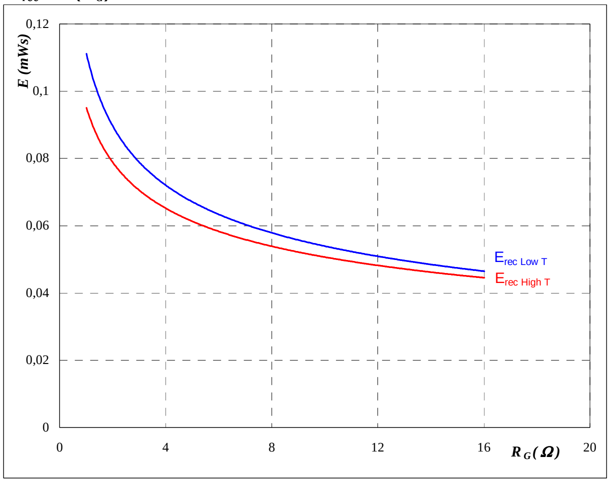
With an inductive load at

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

Figure 8 D3,D4

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

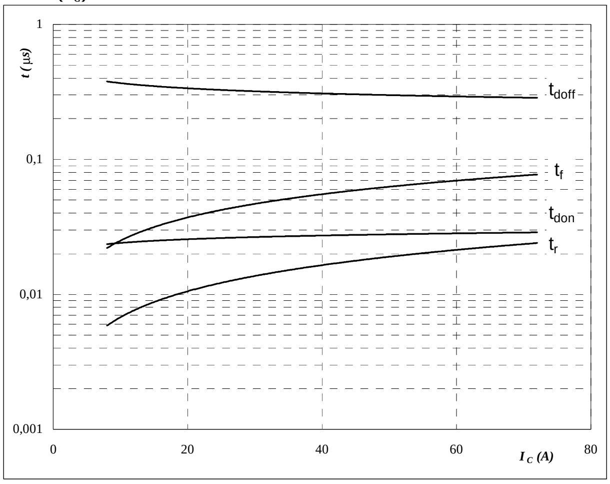
T_j =	25/125	°C
V_{CE} =	700	V
V_{GE} =	15	V
I_C =	40	A

Boost Switch T1,T2 / Boost Diode D3,D4

Figure 9 T1, T2

Typical switching times as a function of collector current

$t = f(I_C)$



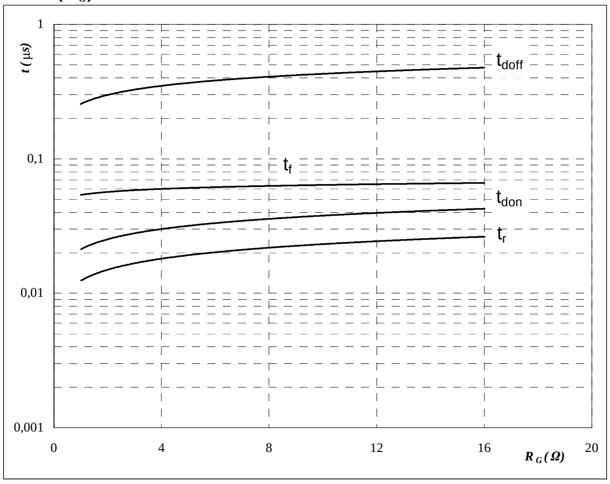
With an inductive load at

T_j =	126	°C
V_{CE} =	700	V
V_{GE} =	15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10 T1, T2

Typical switching times as a function of gate resistor

$t = f(R_G)$



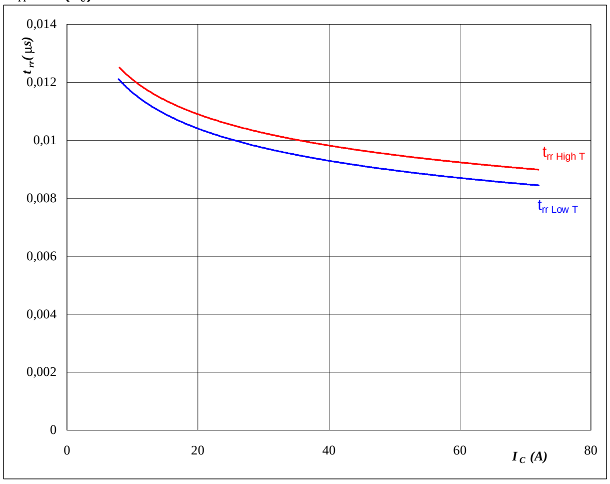
With an inductive load at

T_j =	126	°C
V_{CE} =	700	V
V_{GE} =	15	V
I_C =	40	A

Figure 11 D3,D4

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



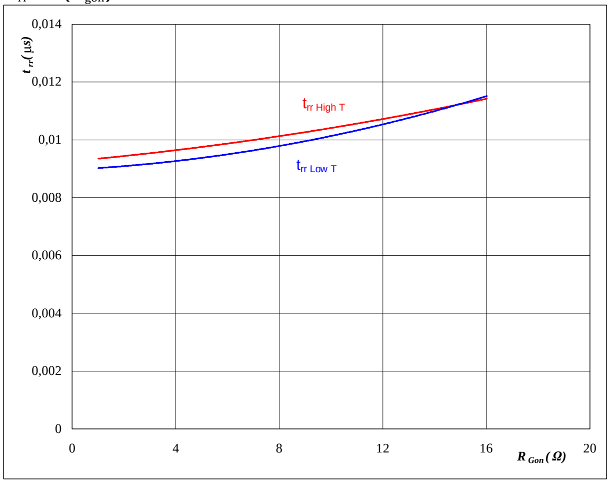
At

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

Figure 12 D3,D4

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

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



At

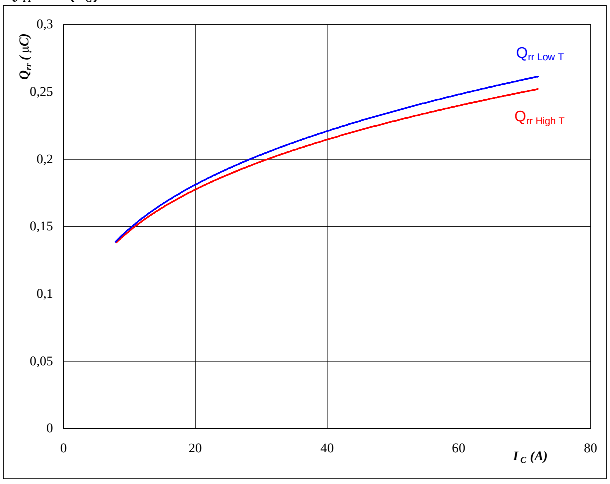
T_j =	25/125	°C
V_R =	700	V
I_F =	40	A
V_{GE} =	15	V

Boost Switch T1,T2 / Boost Diode D3,D4

Figure 13 D3,D4

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



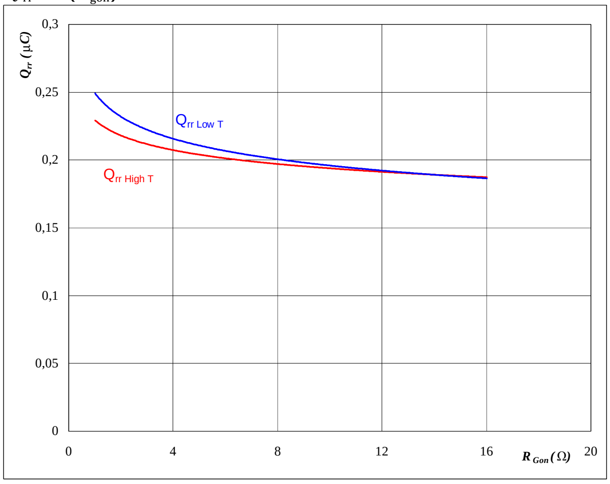
At

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

Figure 14 D3,D4

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

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



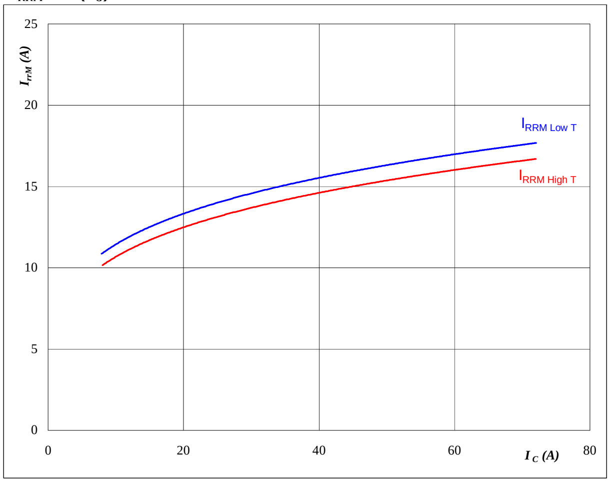
At

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

Figure 15 D3,D4

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



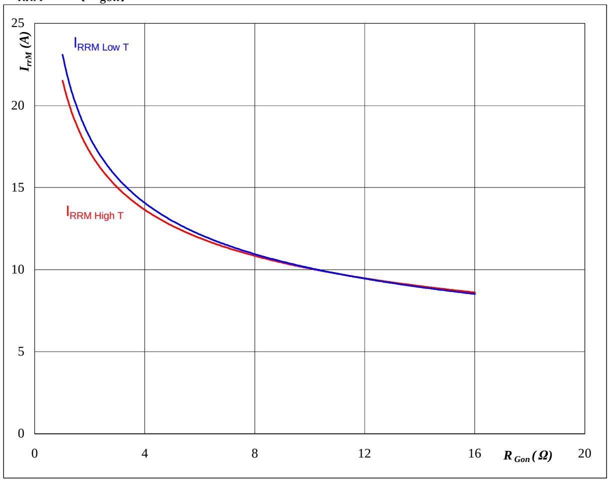
At

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

Figure 16 D3,D4

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

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



At

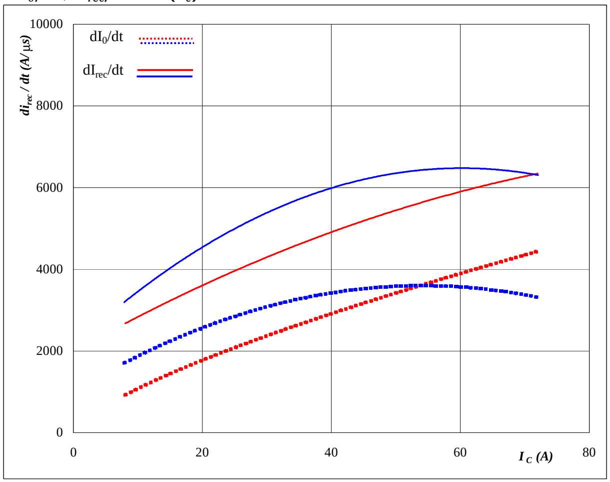
T_j =	25/125	°C
V_R =	700	V
I_F =	40	A
V_{GE} =	15	V

Boost Switch T1,T2 / Boost Diode D3,D4

Figure 17 D3,D4

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

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



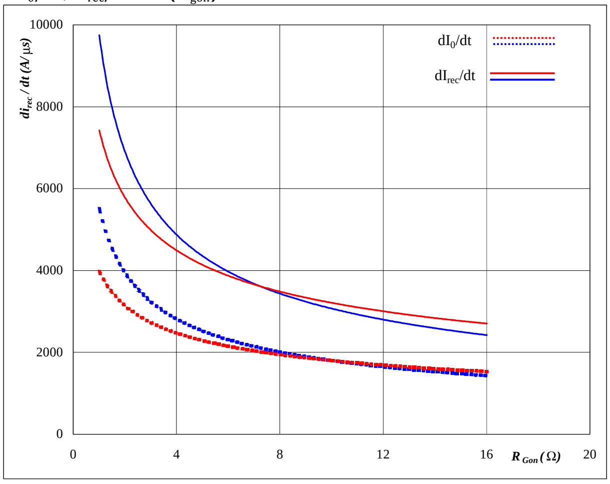
At

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

Figure 18 D3,D4

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

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



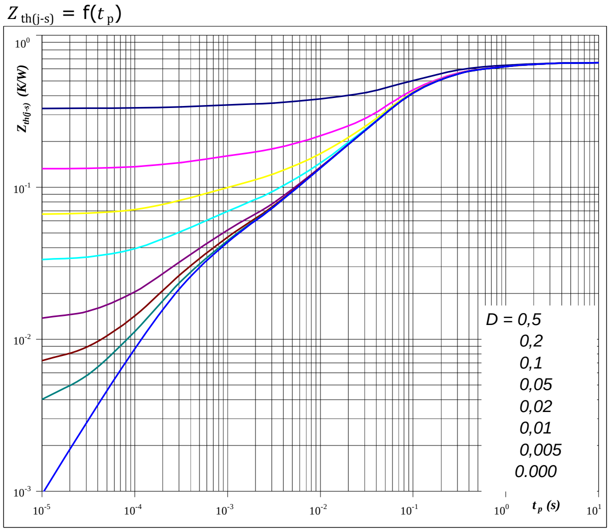
At

T_j =	25/125	°C
V_R =	700	V
I_F =	40	A
V_{GE} =	15	V

Figure 19 T1, T2

IGBT transient thermal impedance as a function of pulse width

$Z_{th(j\text{-}s)} = f(t_p)$



At

$D = t_p / T$

	phase-change material			Thermal grease	
$R_{th(j\text{-}s)}$ =	0,66	K/W	$R_{th(j\text{-}s)}$ =	0,80	K/W

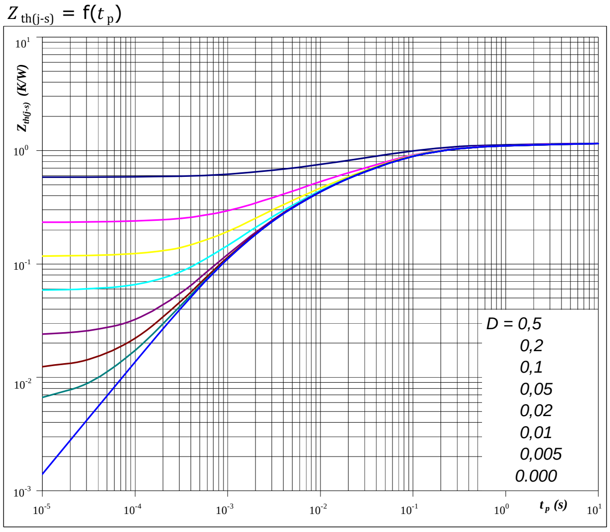
IGBT thermal model values

phase-change material		Thermal grease	
R (K/W)	Tau (s)	R (K/W)	Tau (s)
0,085	1,272	0,103	1,272
0,179	0,186	0,216	0,186
0,314	0,060	0,378	0,060
0,053	0,005	0,064	0,005
0,029	0,000	0,035	0,000

Figure 20 D3,D4

FWD transient thermal impedance as a function of pulse width

$Z_{th(j\text{-}s)} = f(t_p)$



At

$D = t_p / T$

	phase-change material			Thermal grease	
$R_{th(j\text{-}s)}$ =	1,17	K/W	$R_{th(j\text{-}s)}$ =	1,36	K/W

FWD thermal model values

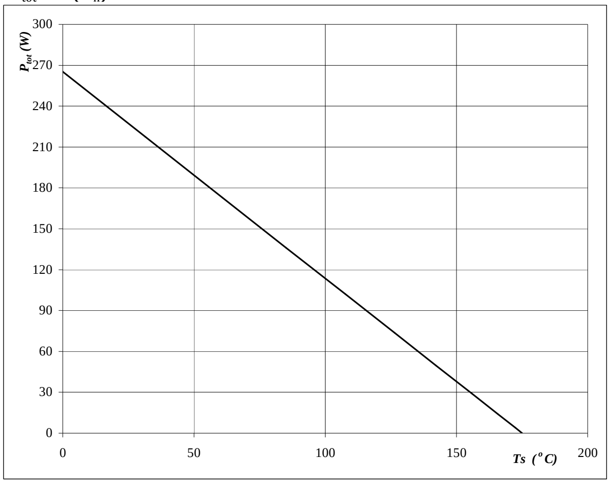
phase-change material		Thermal grease	
R (K/W)	Tau (s)	R (K/W)	Tau (s)
0,043	9,803	0,050	9,80
0,101	0,815	0,118	0,82
0,383	0,098	0,445	0,10
0,308	0,026	0,358	0,03
0,233	0,005	0,271	0,01
0,098	0,001	0,114	0,00

Boost Switch T1,T2 / Boost Diode D3,D4

Figure 21 T1, T2

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



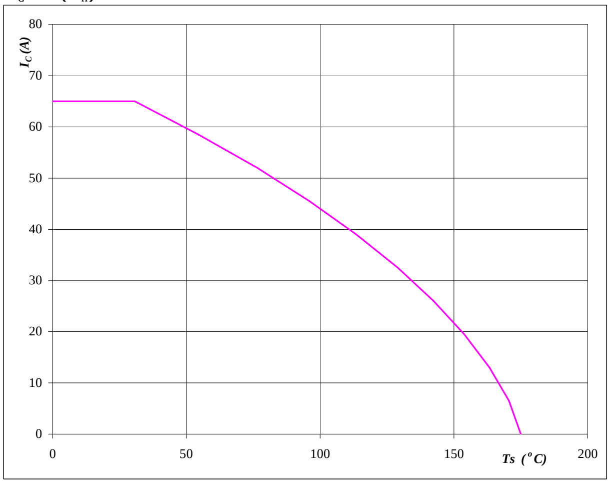
At

T_j =	175	ºC

Figure 22 T1, T2

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



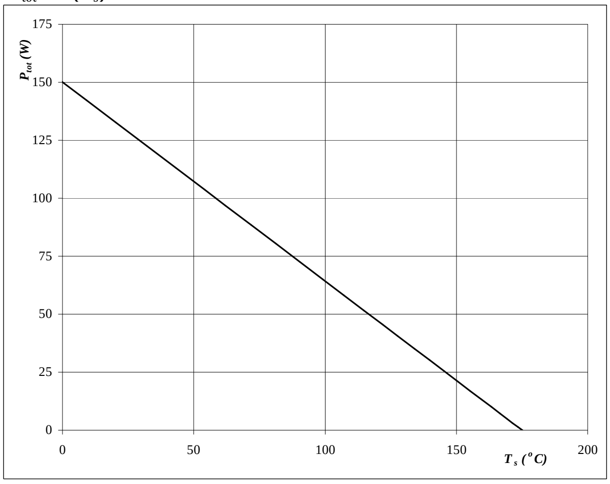
At

T_j =	175	ºC
V_{GE} =	15	V

Figure 23 D3,D4

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



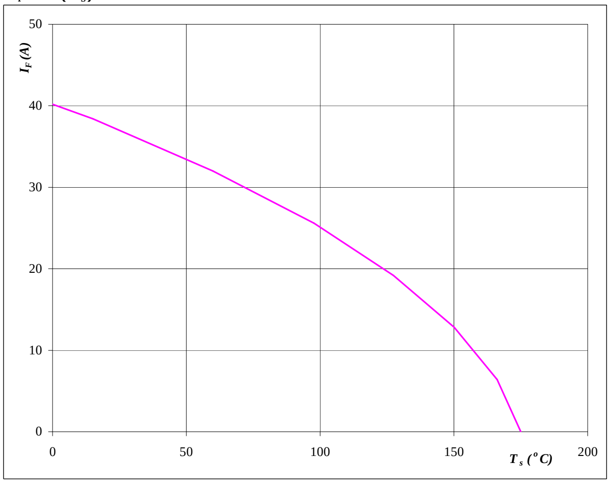
At

T_j =	175	ºC

Figure 24 D3,D4

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

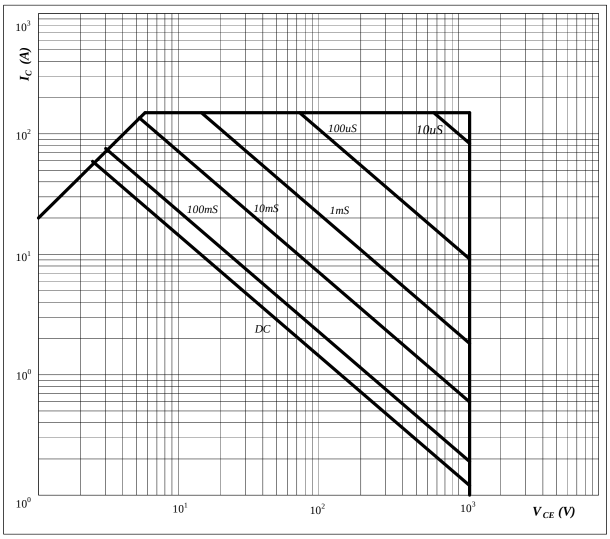
T_j =	175	ºC

Boost Switch T1,T2 / Boost Diode D3,D4

Figure 25 T1, T2

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



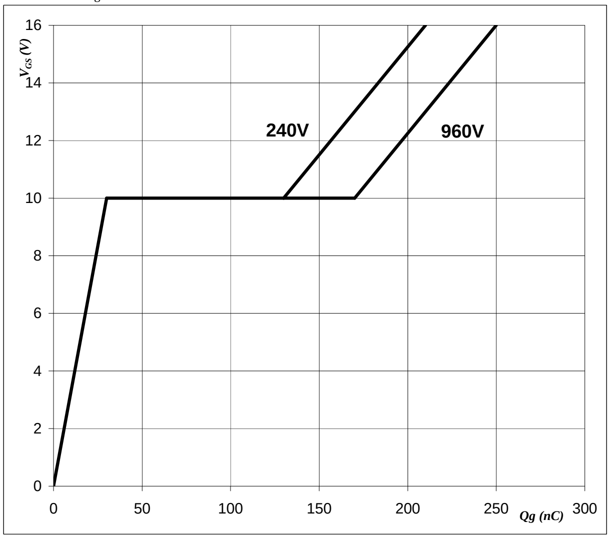
At

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

Figure 26 T1, T2

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



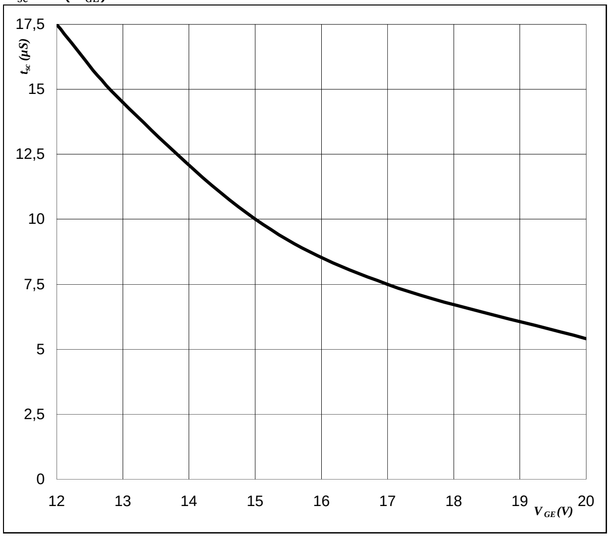
At

I_C =	50	A

Figure 27 T1, T2

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

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



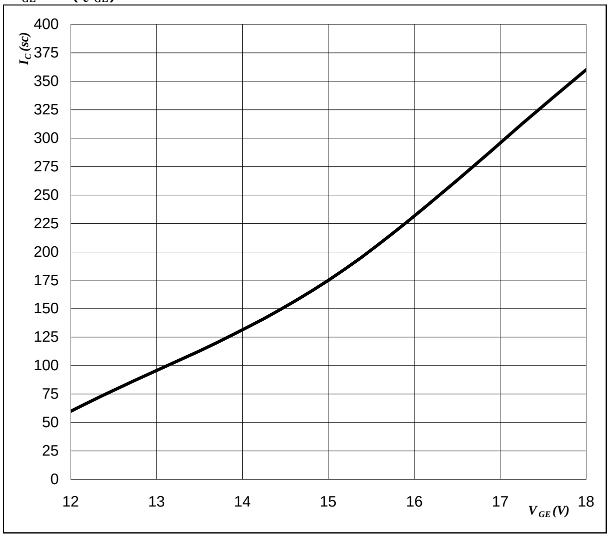
At

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

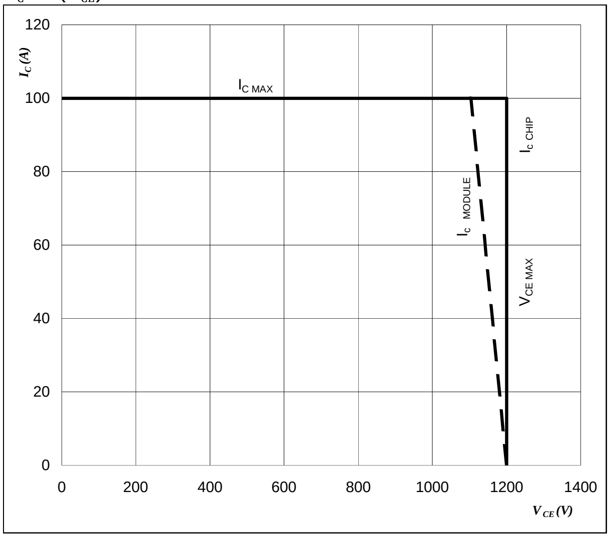
V_{CE} ≤	600	V
T_j =	25	ºC

Boost Switch T1,T2 / Boost Diode D3,D4

Figure 29	T1, T2

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

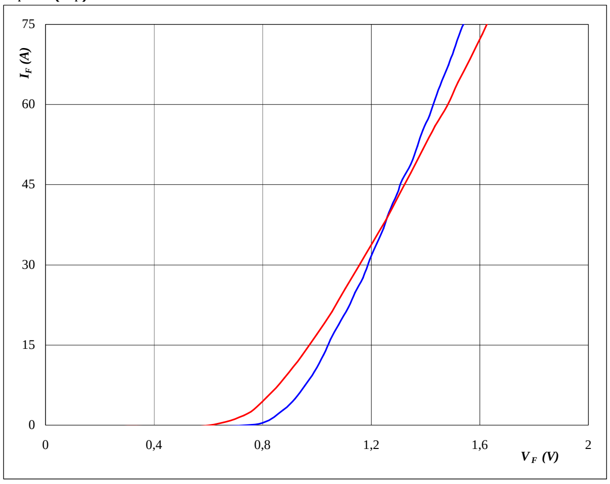
T_{vj} ≤	150	ºC
$I_{C\,MAX}$=	100	A
V_{CE} MAX=	1200	V

Bypass Diode D5,D6 / Boost Sw. Protection Diode D1,D2

Figure 1 D1,D2,D5,D6

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

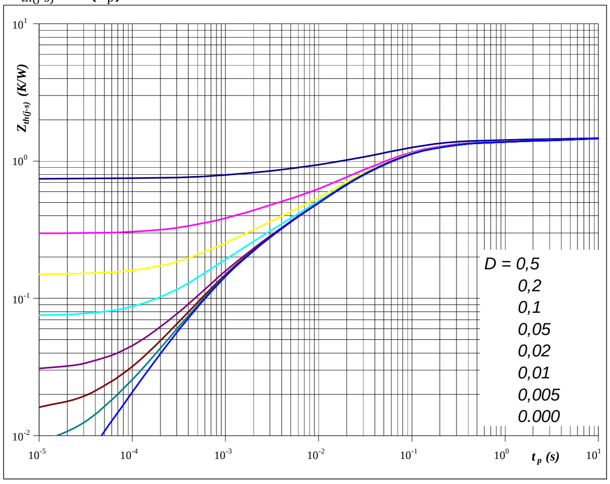
T_j = 25/125 °C

t_p = 250 µs

Figure 2 D1,D2,D5,D6

Diode transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



At

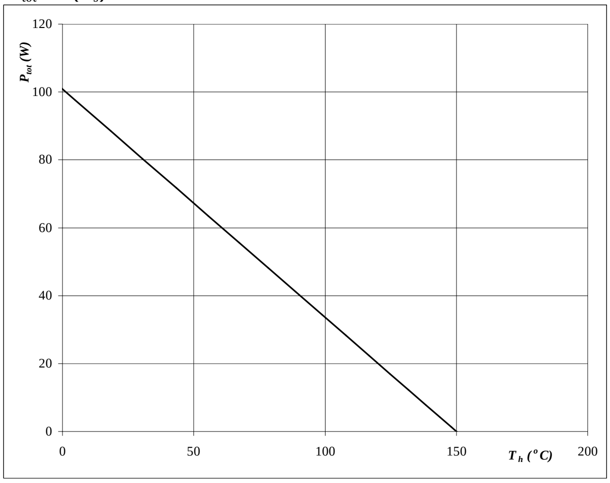
$D = t_p / T$

	phase-change material			Thermal grease	
$R_{th(j-s)}$ =	1,49	K/W	$R_{th(j-s)}$ =	1,73	K/W

Figure 3 D1,D2,D5,D6

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



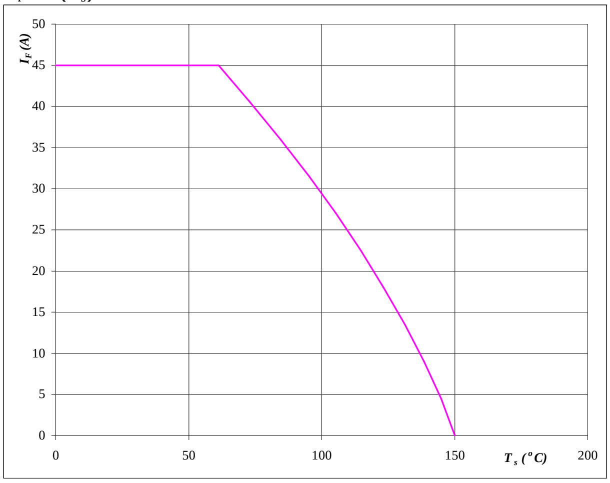
At

T_j = 150 ºC

Figure 4 D1,D2,D5,D6

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

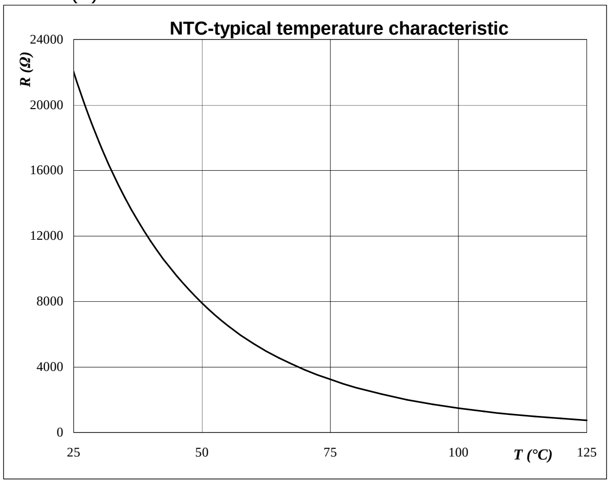
T_j = 150 ºC

Thermistor

Figure 1	Thermistor

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$



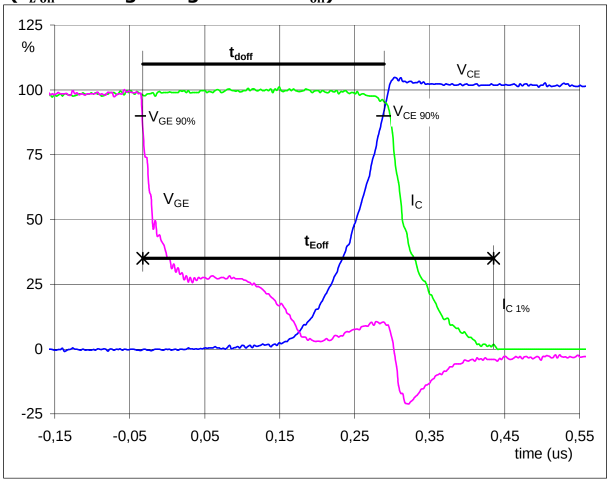
Switching Definitions Boost

General conditions

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

Figure 1 T1, T2

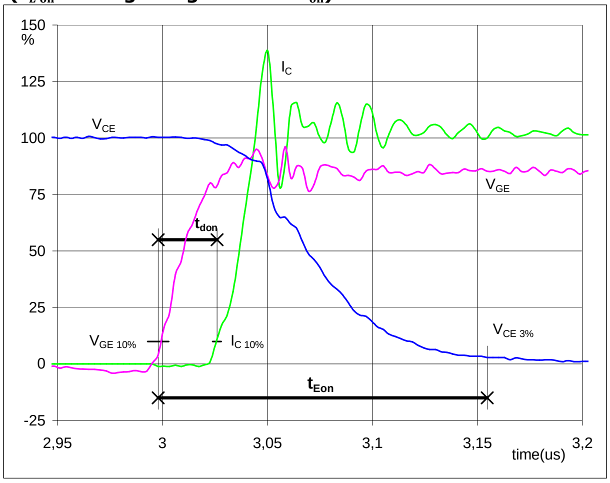
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



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
$t_{E\,off}$ =	0,468	µs

Figure 2 T1, T2

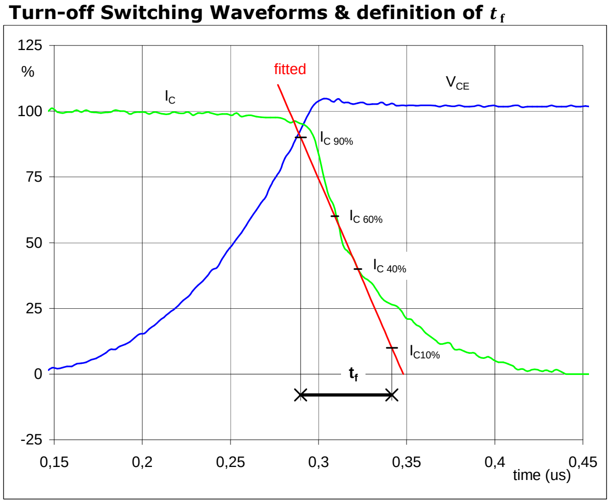
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



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
$t_{E\,on}$ =	0,157	µs

Figure 3 T1, T2

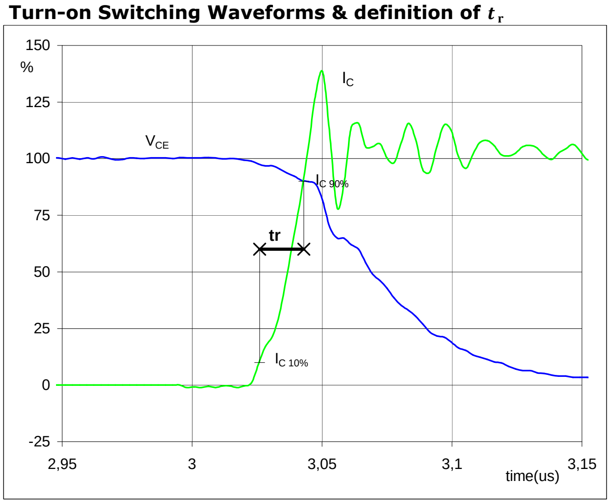
Turn-off Switching Waveforms & definition of t_f



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

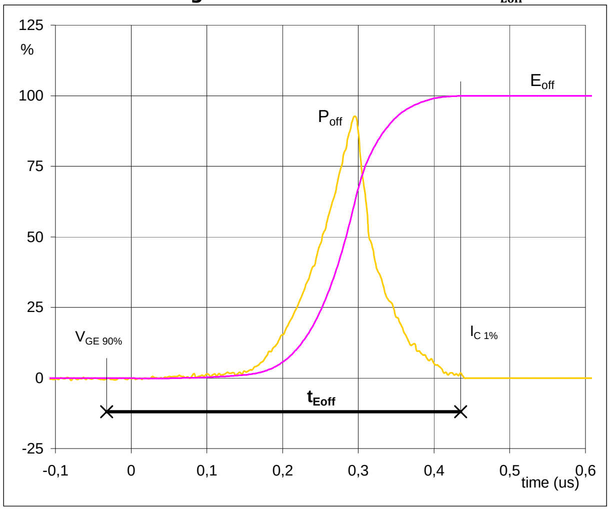


V_C (100%) =	700	V
I_C (100%) =	40	A
t_r =	0,017	µs

Switching Definitions Boost

Figure 5 T1, T2

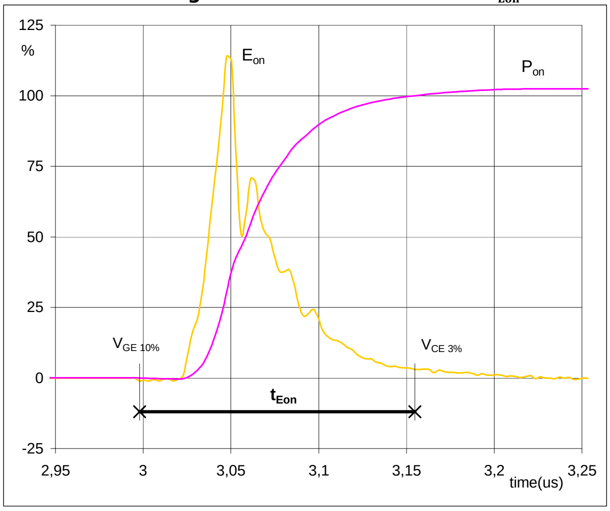
Turn-off Switching Waveforms & definition of t_{Eoff}



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

Figure 6 T1, T2

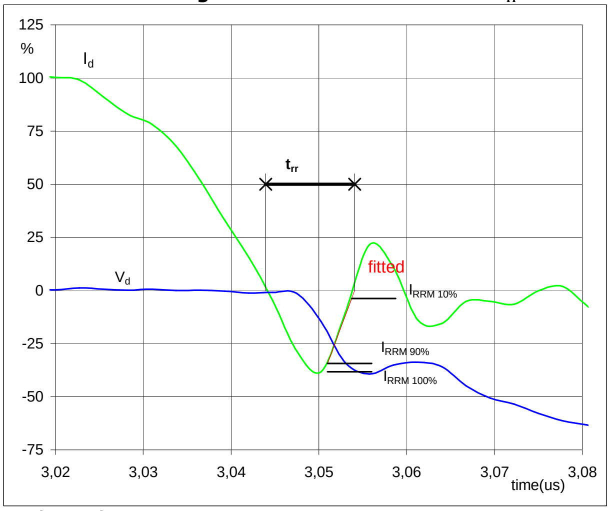
Turn-on Switching Waveforms & definition of t_{Eon}



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

Figure 7 T1, T2

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

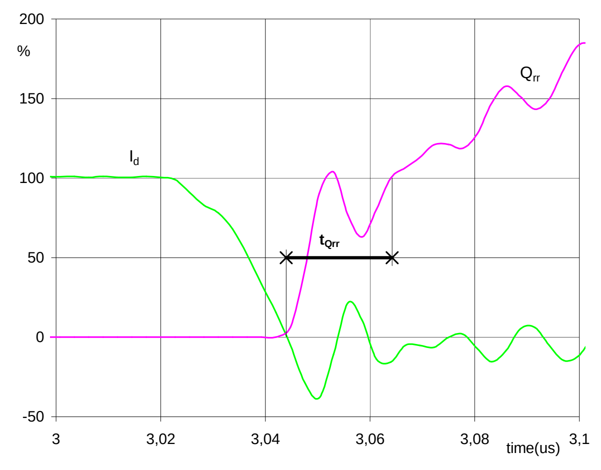


V_d (100%) =	700	V
I_d (100%) =	40	A
I_{RRM} (100%) =	-15	A
t_{rr} =	0,009	μs

Switching Definitions Boost

Figure 8 D3, D4

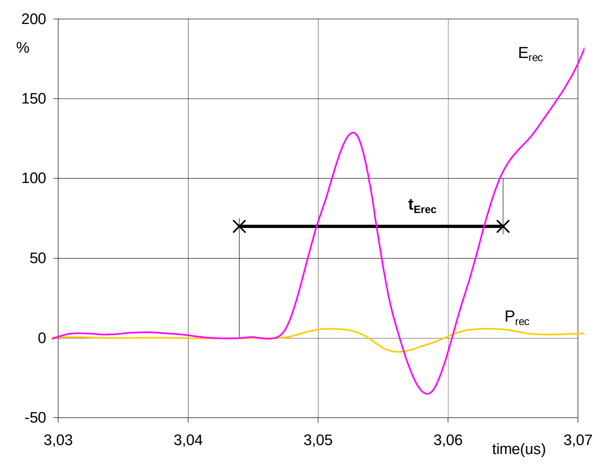
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



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

Figure 9 D3, D4

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

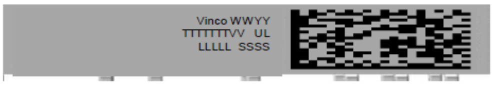


P_{rec} (100%) =	28,02	kW
E_{rec} (100%) =	0,07	mJ
$t_{E\,rec}$ =	0,02	μs

Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

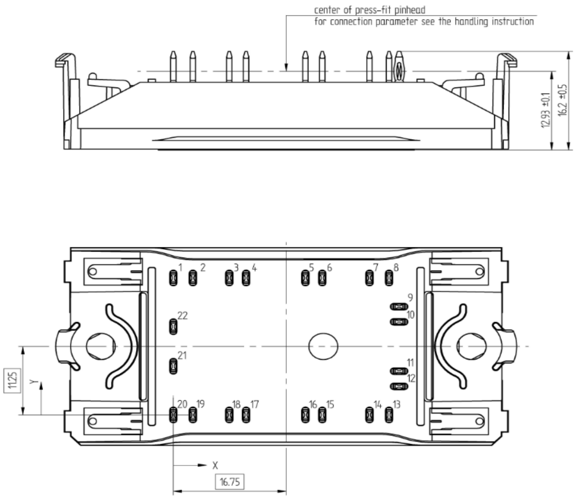
Version	Ordering Code
without thermal paste 12mm housing solder pins	V23990-P629-L43-PM
with thermal paste 12mm housing solder pins	V23990-P629-L43-/3/-PM
without thermal paste 12mm housing Press-fit pins	V23990-P629-L43Y-PM



Text	Vinco	Date code	Name & Ver	UL	Lot	Serial
	Vinco	WWYY	TTTTTTTVV	UL	LLLLL	SSSS
Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

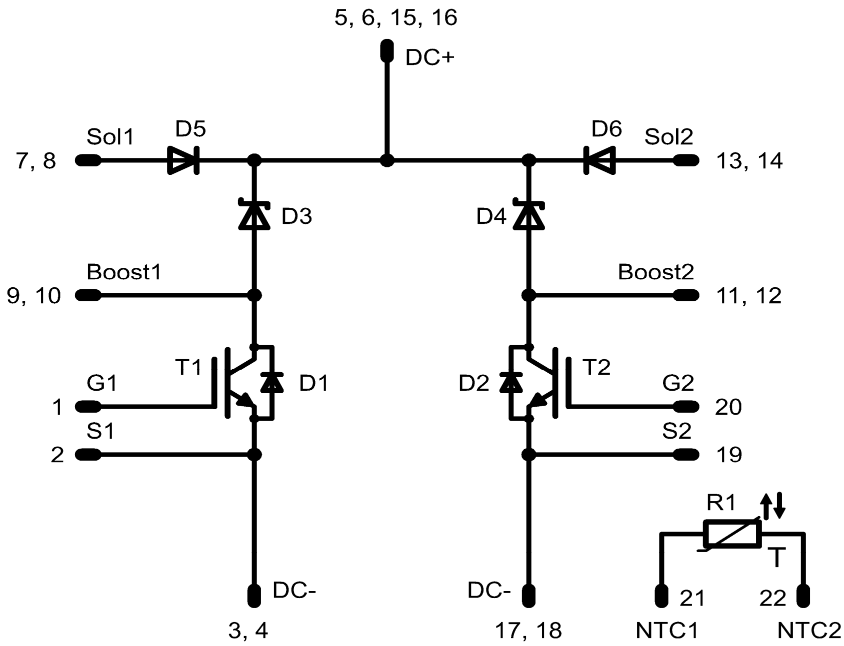
Outline

Pin	X	Y	Function	Pin	X	Y	Function
1	0	22,5	G1	20	0	0	G2
2	2,9	22,5	S1	21	0	8	NTC1
3	8,3	22,5	DC-	22	0	14,5	NTC2
4	10,8	22,5	DC-				
5	19,6	22,5	DC+				
6	22,1	22,5	DC+				
7	29,1	22,5	Sol1				
8	32	22,5	Sol1				
9	33,5	17,8	Boost1				
10	33,5	15,3	Boost1				
11	33,5	7,2	Boost2				
12	33,5	4,7	Boost2				
13	32	0	Sol2				
14	29,1	0	Sol2				
15	22,1	0	DC+				
16	19,6	0	DC+				
17	10,8	0	DC-				
18	8,3	0	DC-				
19	2,9	0	S2				



Tolerance of pinpositions: ±0,5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1,T2	IGBT	1200 V	50 A	Boost Switch	
D3,D4	FWD	1200 V	15 A	Boost Diode	
D1,D2	FWD	1600 V	25 A	Boost Sw. Protection Diode	
D5,D6	FWD	1600 V	25 A	Bypass Diode	
R1	NTC			Thermistor	

Packaging instruction					
Standard packaging quantity (SPQ)	**135**	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 0 packages see vincotech.com website.

Package data
Package data for *flow* 0 packages see vincotech.com website.

Document No.:	Date:	Modification:	Pages
V23990-P629-L43x-D5-14	01 Dec. 2015	Added Press-fit version	