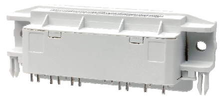
flow 90PIM 1	1200 V / 15 A

Features

- Trench Fieldstop Technology IGBT4 for low saturation loss
- Supports design with 90° mounting angle between heatsink and PCB
- Clip-in PCB mounting
- Clip or screw on heatsink mounting

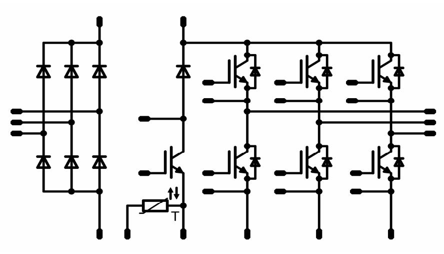
flow 90PIM 1



Target Applications

- Industrial drives

Schematic



Types

- V23990-P630-A40-PM

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Input Rectifier Diode					
Repetitive peak reverse voltage	V_{RRM}			1600	V
DC forward current	I_{FAV}	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80°C	28 36	A
Surge (non-repetitive) forward current	I_{FSM}	t_p = 10 ms	T_j = 25°C	200	A
I²t-value	I^2t		T_j = 150°C	200	A^2s
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80°C	33 50	W
Maximum Junction Temperature	T_{jmax}			150	°C
Inverter Transistor					
Collector-emitter breakdown voltage	V_{CE}			1200	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80°C	21 26	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		45	A
Turn off safe operating area		V_{CE} ≤ 1200V, $T_j \le T_{op}$ max		45	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80°C	62 95	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V		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
Inverter FWD					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80°C	14 17	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		30	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80°C	44 67	W
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Transistor					
Collector-emitter breakdown voltage	V_{CE}			1200	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80°C	13 15	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		24	A
Turn off safe operating area		V_{CE} ≤ 1200V, T_j ≤ T_{op} max		24	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80°C	46 70	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V		10 800	μs V
Maximum Junction Temperature	T_{jmax}			175	°C
Brake FWD					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80°C	14 19	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		15	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C T_c = 80°C	31 48	W
Maximum Junction Temperature	T_{jmax}			150	°C
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{is}	t = 2 s	DC Test Voltage	4000	V
Creepage distance				min 12,7	mm
Clearance				11,84	mm
Comparative tracking index	CTI			>200	

Characteristic Values

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	Unit
Input Rectifier Diode										
Forward voltage	V_F				30	25 125	1	1,26 1,24	1,8	V
Threshold voltage (for power loss calc. only)	V_{to}				30	25 125		0,92 0,82		V
Slope resistance (for power loss calc. only)	r_t				30	25 125		11 14		mΩ
Reverse current	I_r			1500		25			0,2	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 0,8 W/mK (P12)						2,10		K/W
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,70		K/W
Inverter Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0005	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		15	25 150	1,6	1,86 2,22	2,1	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	1200		25			0,0055	mA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$					25 150		85 93		
Rise time	t_r					25 150		30 32		ns
Turn-off delay time	$t_{d(off)}$	R_{goff} = 32 Ω R_{gon} = 32 Ω	±15	600	15	25 150		214 285		
Fall time	t_f					25 150		83 142		
Turn-on energy loss	E_{on}					25 150		1,17 1,78		mWs
Turn-off energy loss	E_{off}					25 150		0,89 1,53		
Input capacitance	C_{ies}							900		
Output capacitance	C_{oss}	f = 1 MHz	0	25		25		80		pF
Reverse transfer capacitance	C_{rss}							55		
Gate charge	Q_G		±15	960	15	25		85		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 0,8 W/mK (P12)						1,52		K/W
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,23		K/W
Inverter FWD										
Diode forward voltage	V_F				15	25 150	1,2	1,80 1,72	2,2	V
Peak reverse recovery current	I_{RRM}					25 150		10 13		A
Reverse recovery time	t_{rr}					25 150		297 505		ns
Reverse recovered charge	Q_{rr}	R_{gon} = 32 Ω	±15	600	15	25 150		1,51 3,04		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		50 41		A/μs
Reverse recovered energy	E_{rec}					25 150		0,59 1,22		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 0,8 W/mK (P12)						2,15		K/W
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,74		K/W

Characteristic Values

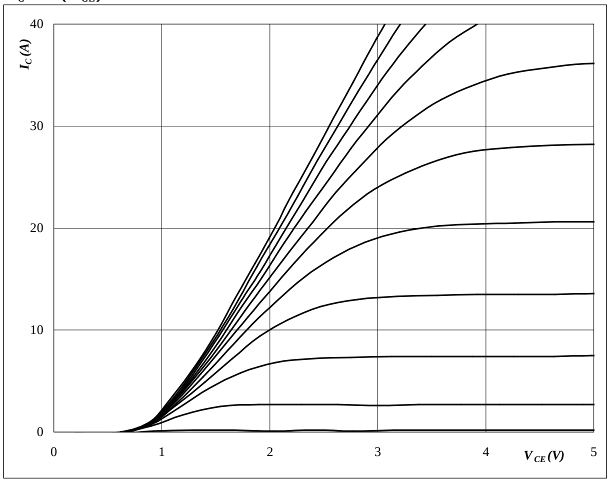
Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	Unit
Brake Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0003	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		8	25 150	1,6	1,86 2,15	2,1	V
Collector-emitter cut-off incl diode	I_{CES}		0	1200		25			0,001	mA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 32 Ω R_{gon} = 32 Ω	±15	600	8	25 150		60 61		ns
Rise time	t_r					25 150		27 26		ns
Turn-off delay time	$t_{d(off)}$					25 150		179 247		ns
Fall time	t_f					25 150		68 137		ns
Turn-on energy loss	E_{on}					25 150		0,51 0,79		mWs
Turn-off energy loss	E_{off}					25 150		0,45 0,78		mWs
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		490		pF
Output capacitance	C_{oss}							50		pF
Reverse transfer capacitance	C_{rss}							30		pF
Gate charge	Q_G		±15	960	8	25		53		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 0,8 W/mK (P12)						2,05		K/W
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,66		K/W
Brake FWD										
Diode forward voltage	V_F				8	25 125	1	1,76 1,69	2,3	V
Reverse leakage current	I_r			1200		25			250	μA
Peak reverse recovery current	I_{RRM}	R_{gon} = 32 Ω	±15	600	8	25 125		6 8		A
Reverse recovery time	t_{rr}					25 125		374 637		ns
Reverse recovered charge	Q_{rr}					25 125		1,01 2,09		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		39 34		A/μs
Reverse recovery energy	E_{rec}					25 125		0,46 0,96		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 0,8 W/mK (P12)						2,23		K/W
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,81		K/W
Thermistor										
Rated resistance	R					25		22000		Ω
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 Ω				Tj = 100	-5		5	%
Power dissipation	P					Tc=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		3996		K
Vincotech NTC Reference						25			B	

Output Inverter

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



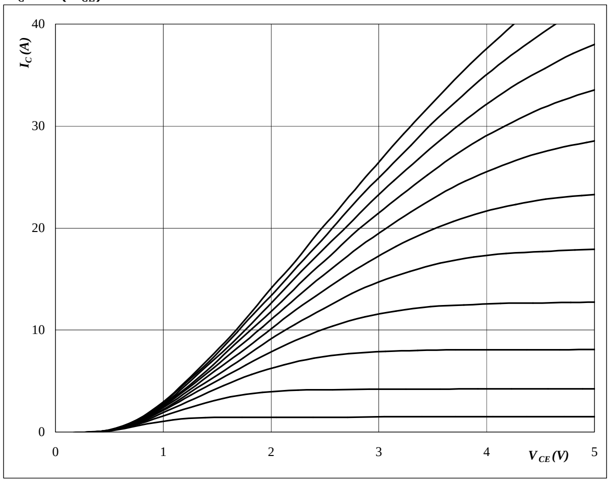
At

t_p =	250	μs
T_j =	25	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



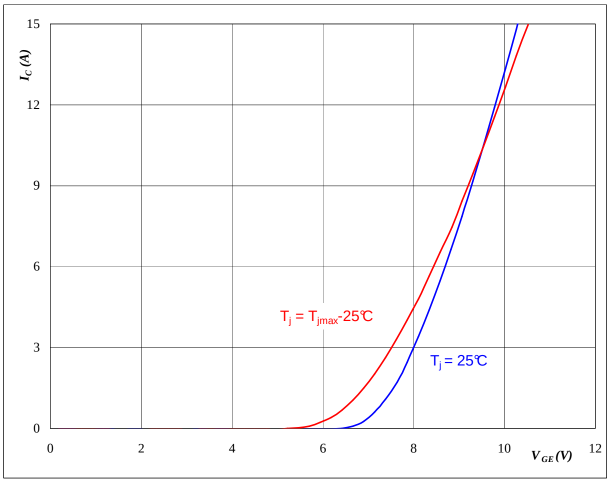
At

t_p =	250	μs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$



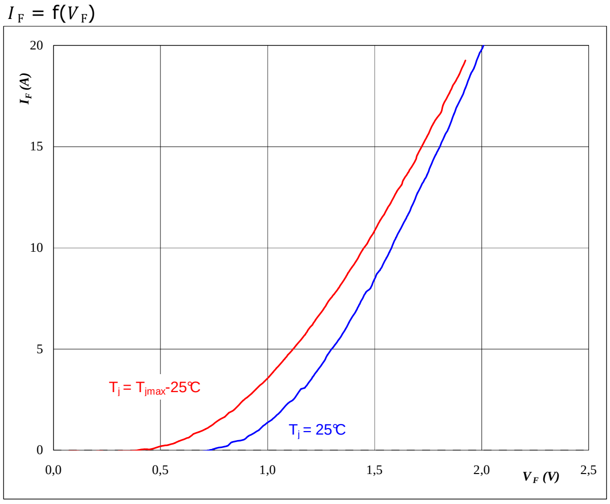
At

t_p =	250	μs
V_{CE} =	10	V

figure 4. **FWD**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

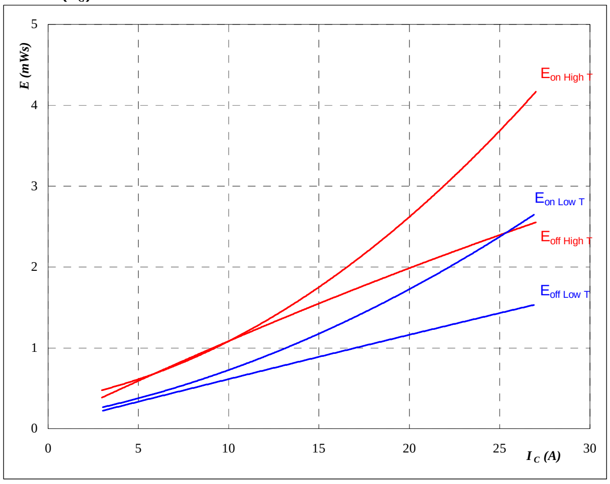
t_p =	250	μs

Output Inverter

figure 5. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



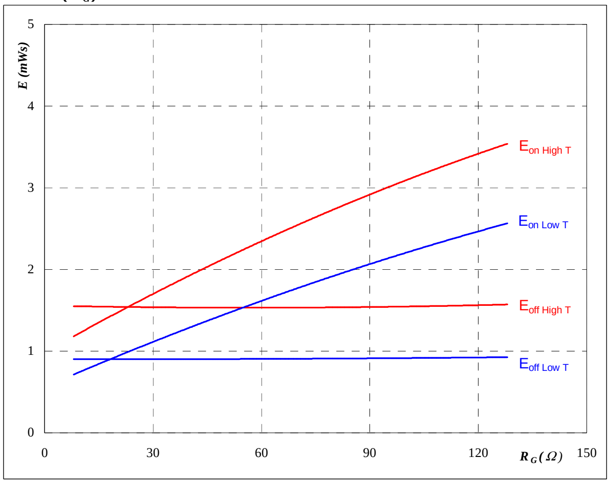
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

figure 6. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



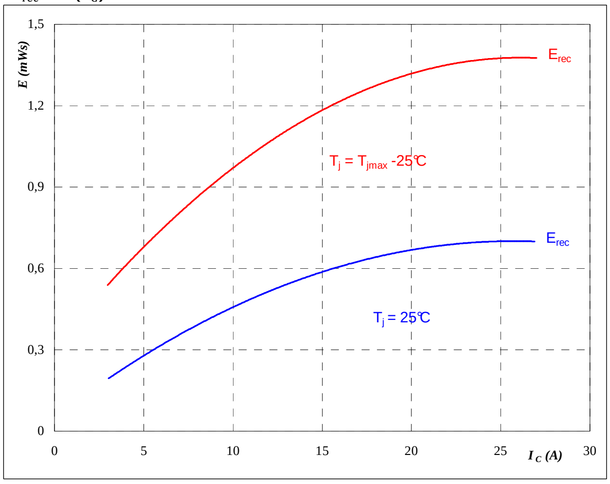
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	15	A

figure 7. **FWD**

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



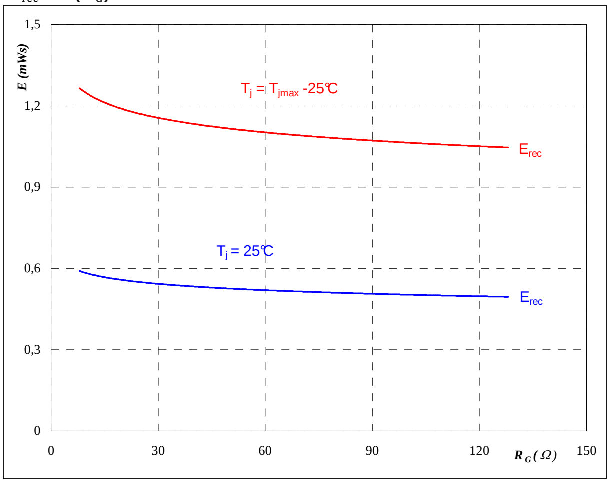
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

figure 8. **FWD**

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

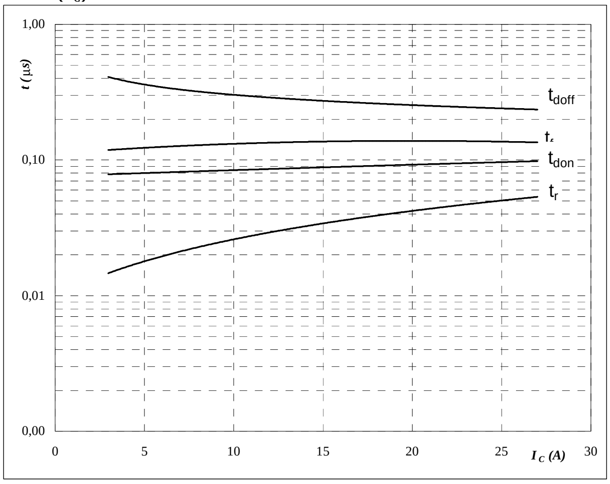
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	15	A

Output Inverter

figure 9. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



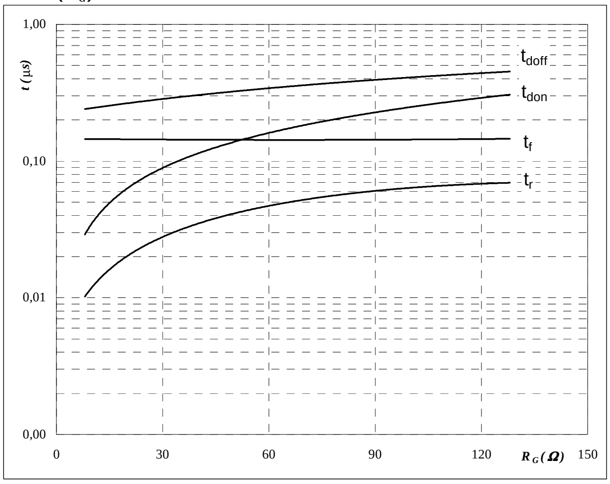
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

figure 10. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_G)$



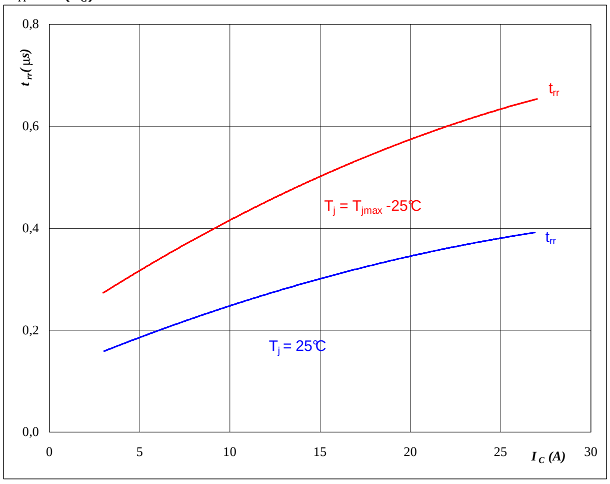
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	15	A

figure 11. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



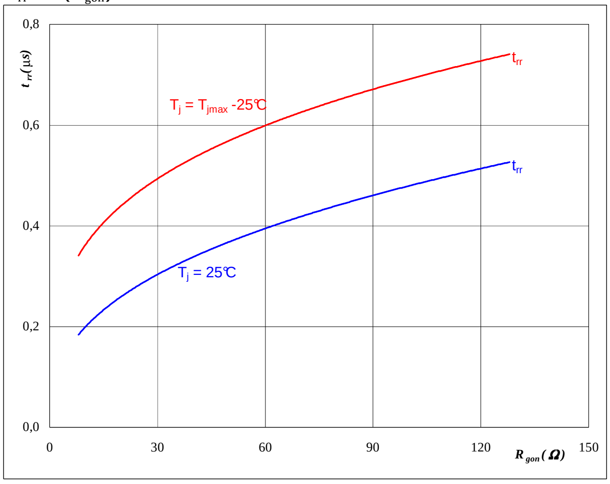
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

figure 12. **FWD**

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

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



At

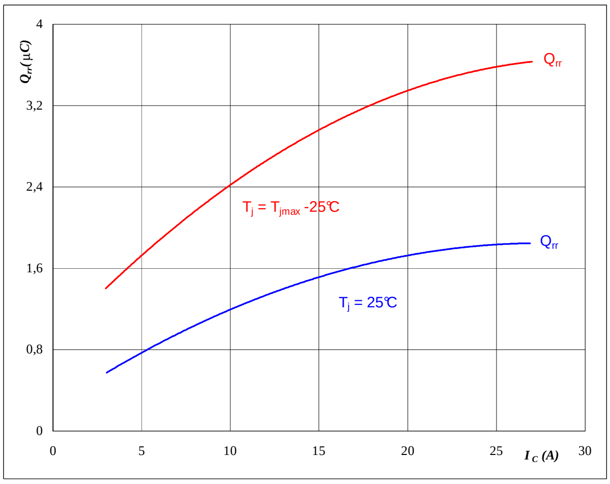
T_j =	25/150	°C
V_R =	600	V
I_F =	15	A
V_{GE} =	±15	V

Output Inverter

figure 13. **FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



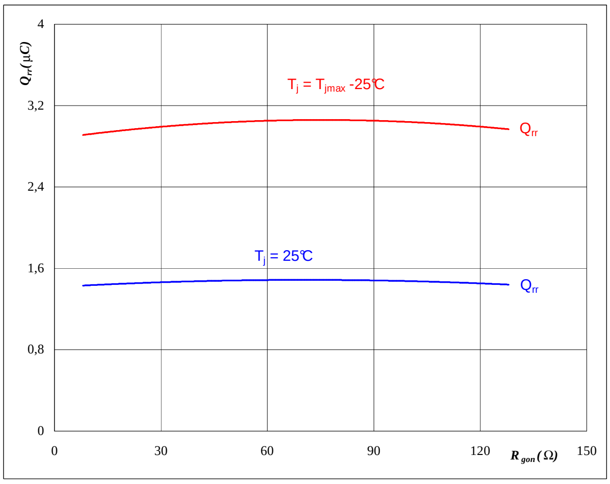
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

figure 14. **FWD**

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

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



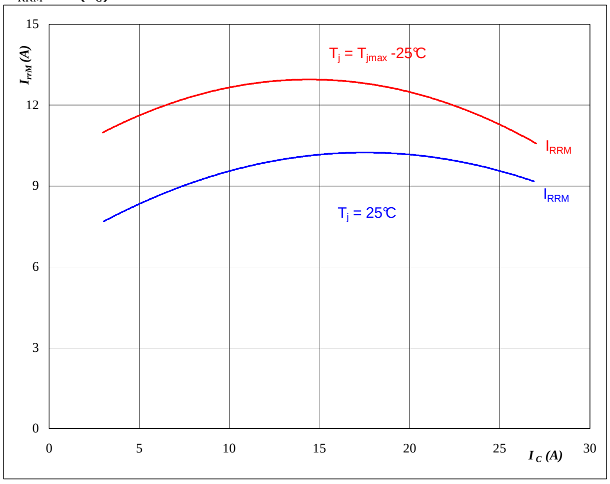
At

T_j =	25/150	°C
V_R =	600	V
I_F =	15	A
V_{GE} =	±15	V

figure 15. **FWD**

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



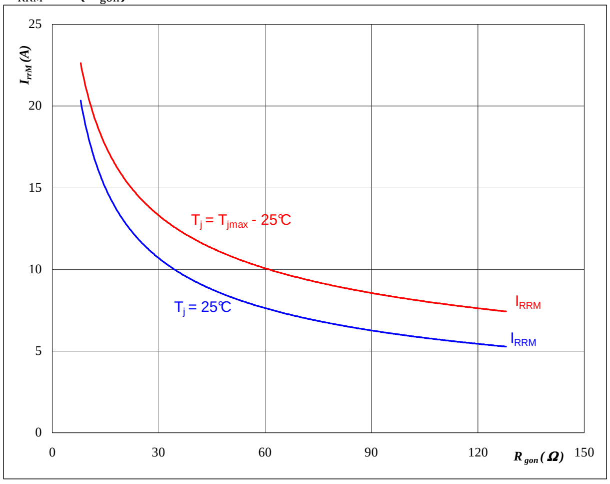
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

figure 16. **FWD**

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

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



At

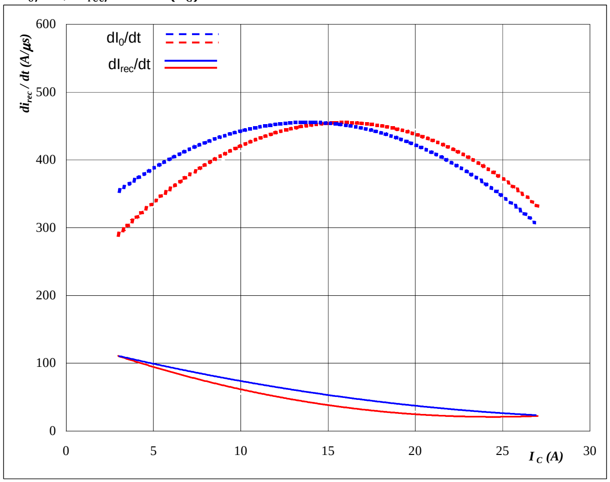
T_j =	25/150	°C
V_R =	600	V
I_F =	15	A
V_{GE} =	±15	V

Output Inverter

figure 17. **FWD**

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

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



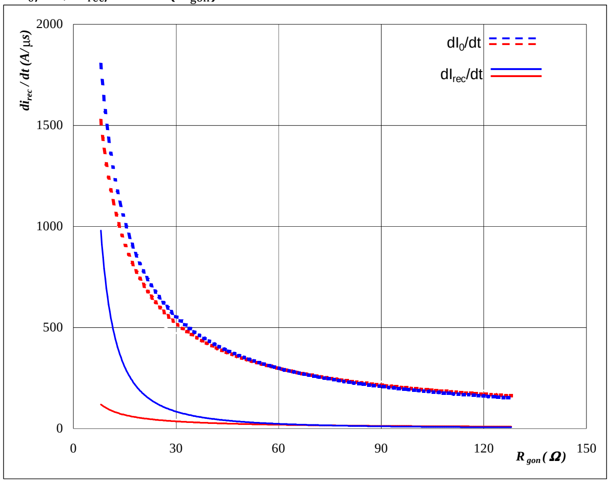
At

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

figure 18. **FWD**

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

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



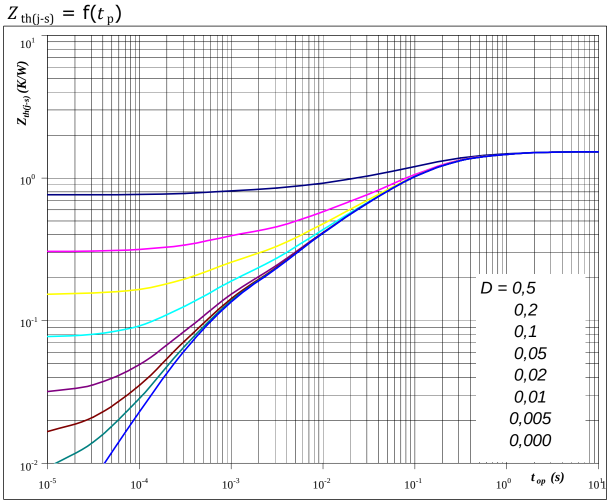
At

T_j =	25/150	°C
V_R =	600	V
I_F =	15	A
V_{GE} =	±15	V

figure 19. **IGBT**

IGBT transient thermal impedance as a function of pulse width

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



At

D = t_p / T

$R_{th(j-s)}$ = 1,52 K/W $R_{th(j-s)}$ = 1,23 K/W

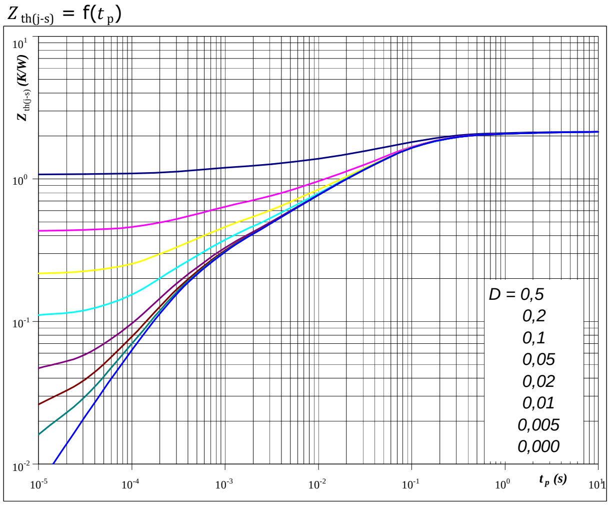
IGBT thermal model values

		phase-change material	
R (K/W)	Tau (s)	R (K/W)	Tau (s)
1,48E-01	1,01E+00	1,20E-01	8,22E-01
5,93E-01	1,63E-01	4,80E-01	1,32E-01
4,44E-01	4,34E-02	3,60E-01	3,52E-02
2,31E-01	6,97E-03	1,87E-01	5,65E-03
1,08E-01	5,38E-04	8,72E-02	4,37E-04

figure 20. **FWD**

FWD transient thermal impedance as a function of pulse width

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



At

D = t_p / T

$R_{th(j-s)}$ = 2,15 K/W $R_{th(j-s)}$ = 1,74 K/W

FWD thermal model values

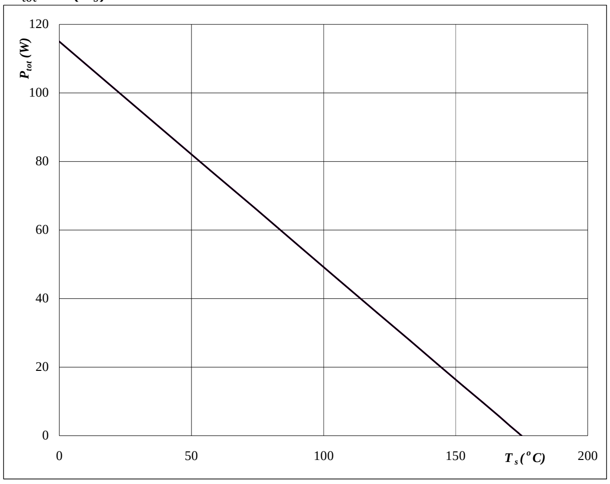
		phase-change material	
R (K/W)	Tau (s)	R (K/W)	Tau (s)
3,10E-02	7,71E+00	2,51E-02	6,25E+00
1,09E-01	1,08E+00	8,81E-02	8,77E-01
3,89E-01	1,75E-01	3,15E-01	1,42E-01
8,97E-01	5,51E-02	7,27E-01	4,47E-02
3,66E-01	8,94E-03	2,97E-01	7,25E-03
1,58E-01	1,84E-03	1,28E-01	1,49E-03
1,96E-01	3,48E-04	1,59E-01	2,82E-04

Output Inverter

figure 21.	IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



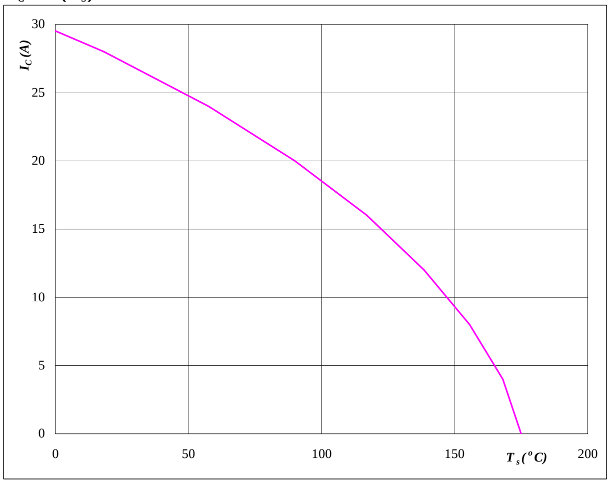
At

$T_j =$ 175 °C

figure 22.	IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

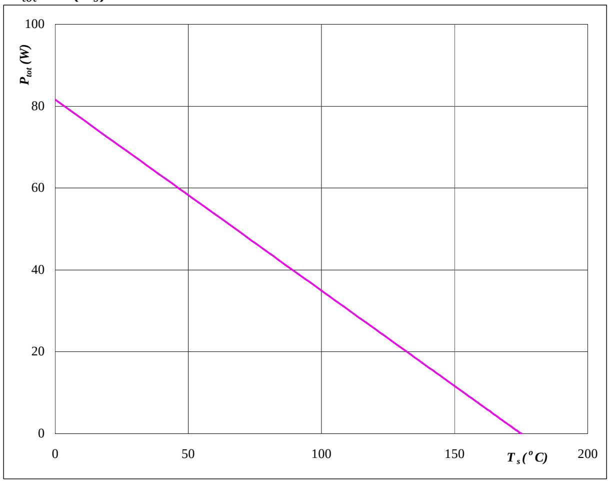
$T_j =$ 175 °C

$V_{GE} =$ 15 V

figure 23.	FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



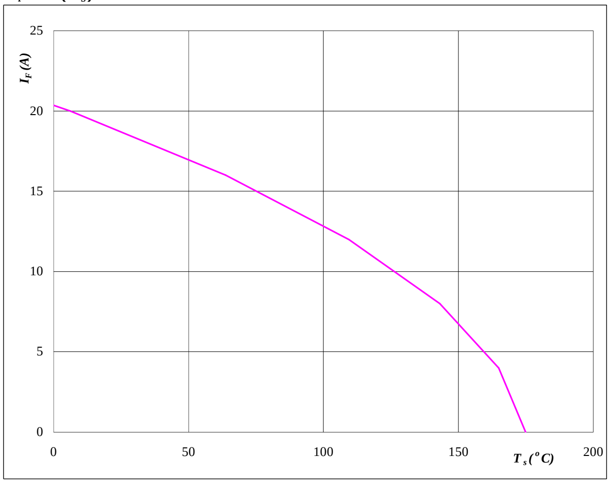
At

$T_j =$ 175 °C

figure 24.	FWD

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

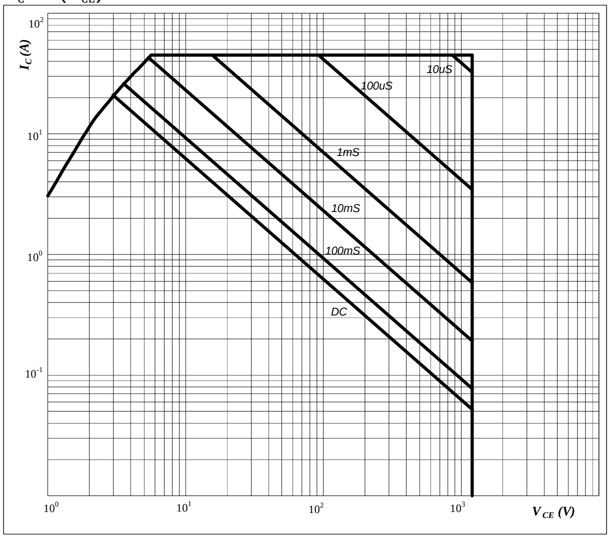
$T_j =$ 175 °C

Output Inverter

figure 25. **IGBT**

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



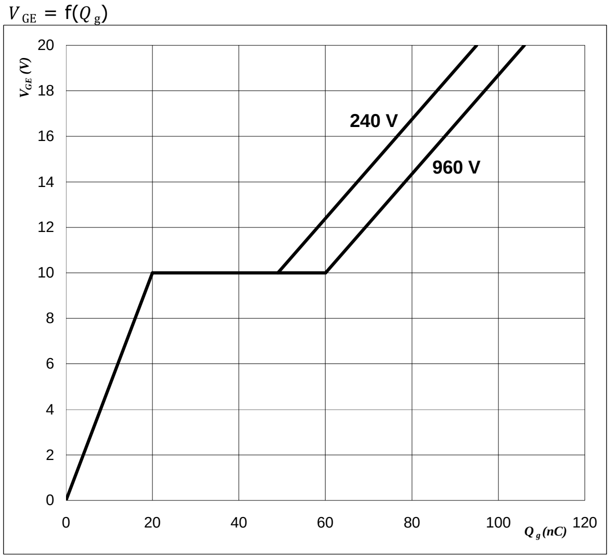
At

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

figure 26. **IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



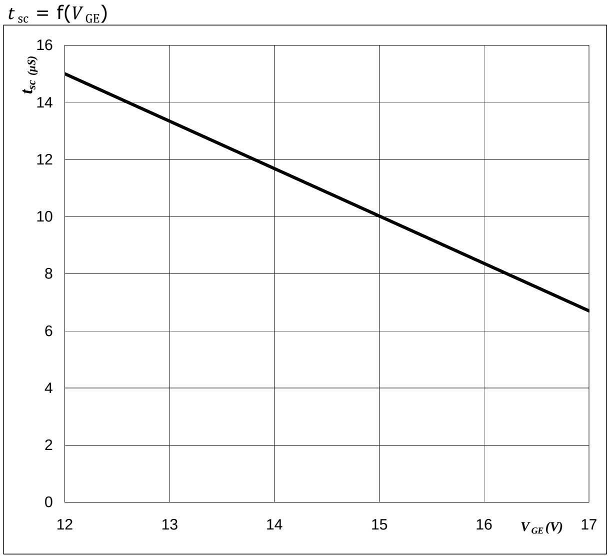
At

I_C = 15 A

figure 27. **IGBT**

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

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



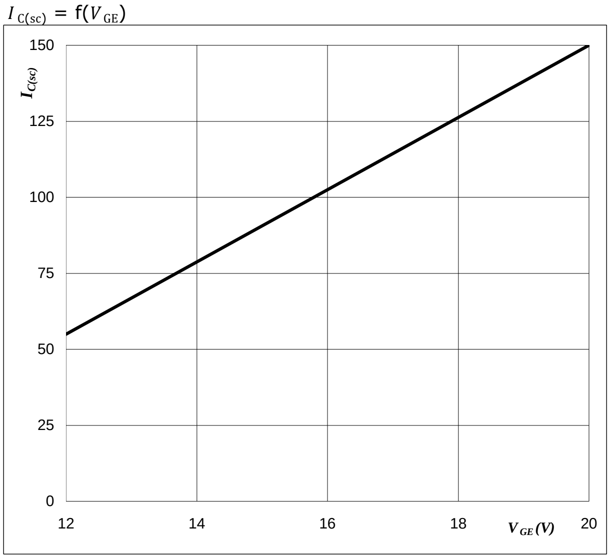
At

V_{CE} = 600 V
T_j ≤ 25 ºC

figure 28. **IGBT**

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

$I_{C(sc)} = f(V_{GE})$



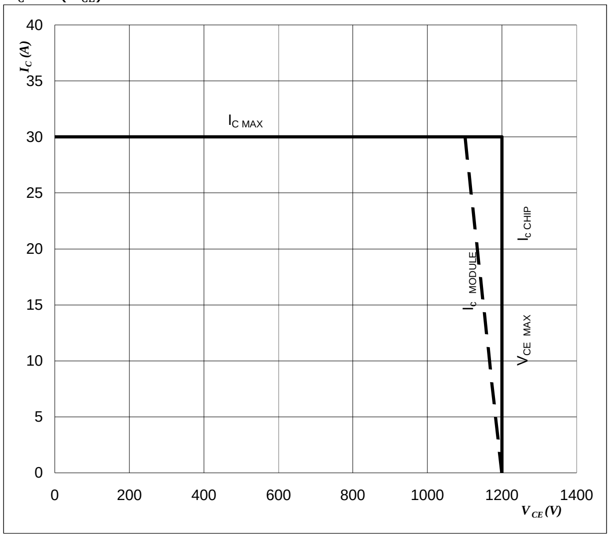
At

V_{CE} ≤ 600 V
T_j = 150 ºC

figure 29.	IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

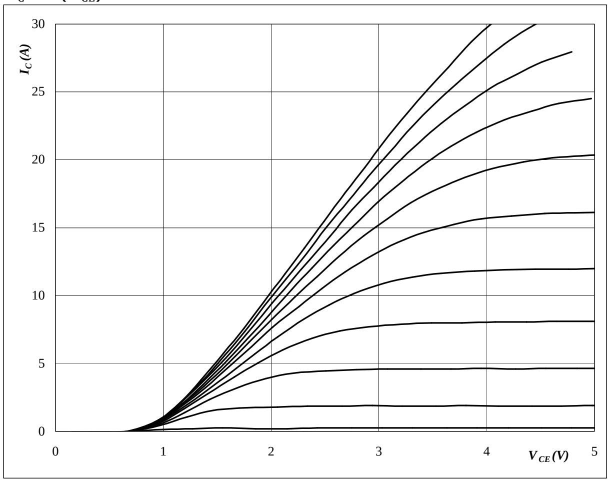
T_j = T_{jmax}-25 ºC

Brake

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 μs

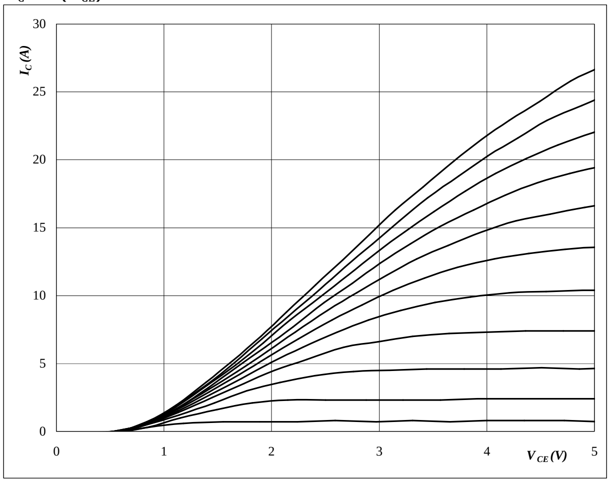
T_j = 25 °C

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

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 μs

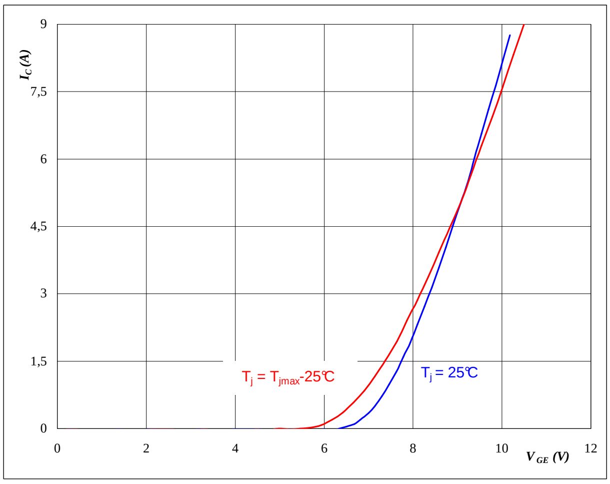
T_j = 150 °C

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

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$



At

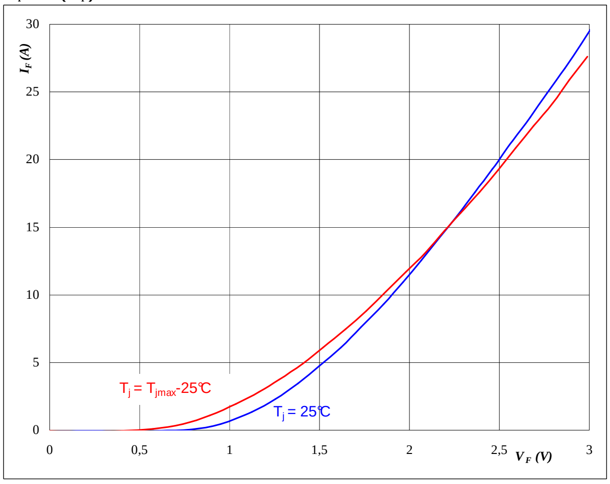
t_p = 250 μs

V_{CE} = 10 V

figure 4. **FWD**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

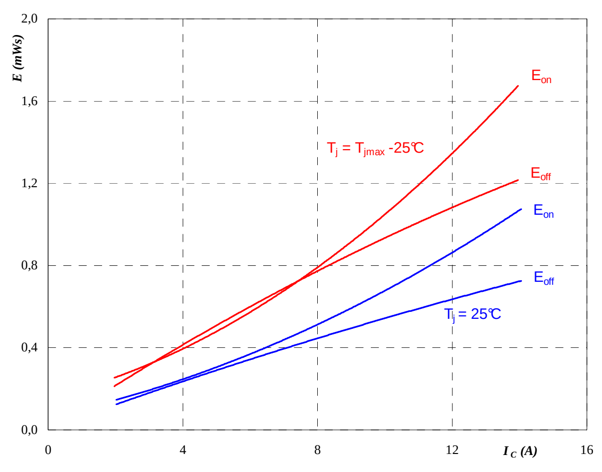
t_p = 250 μs

Brake

figure 5. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



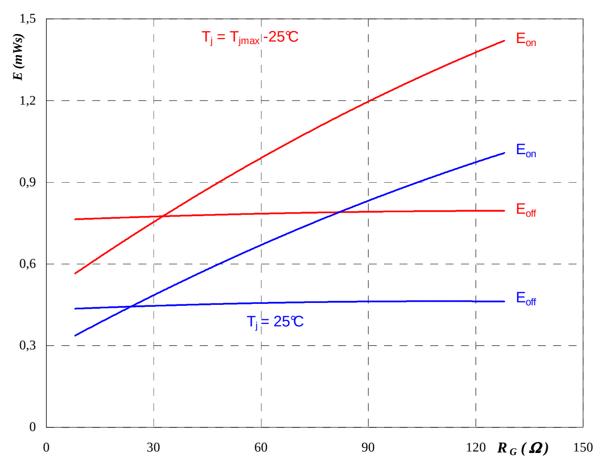
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

figure 6. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



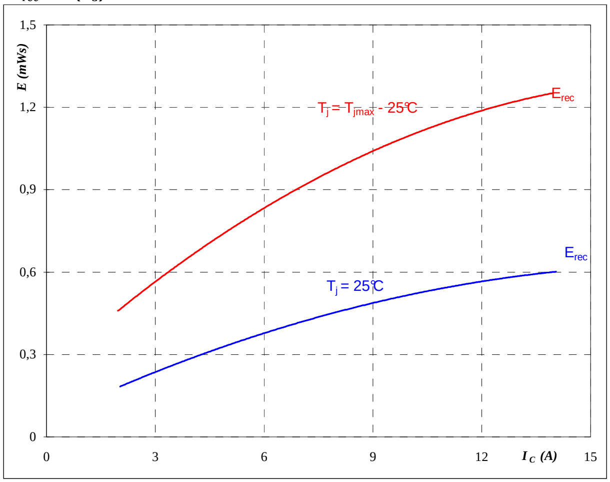
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	8	A

figure 7. **FWD**

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



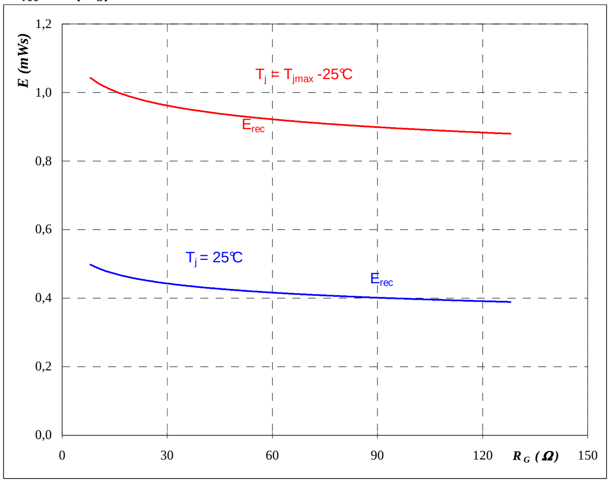
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

figure 8. **FWD**

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

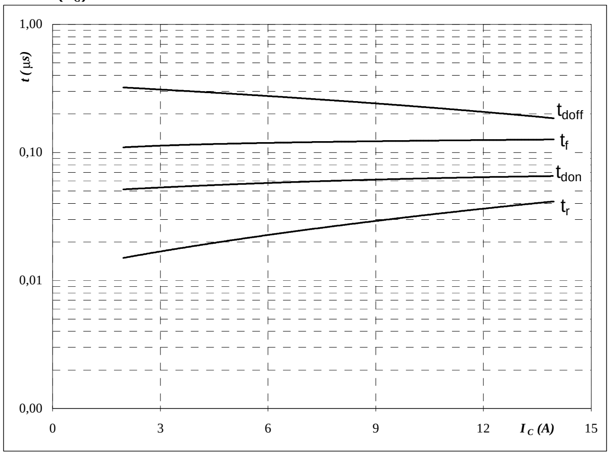
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	8	A

Brake

figure 9. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



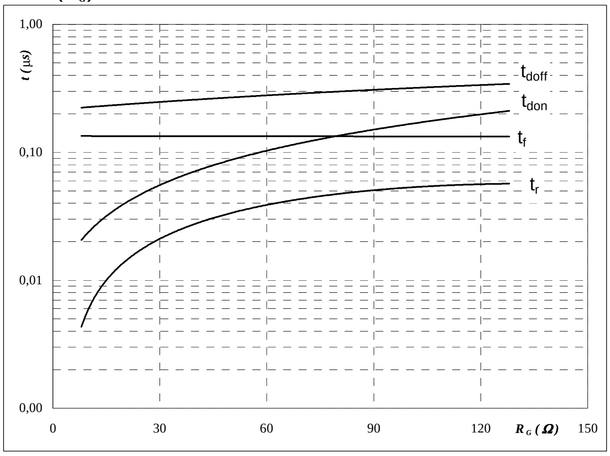
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

figure 10. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_G)$



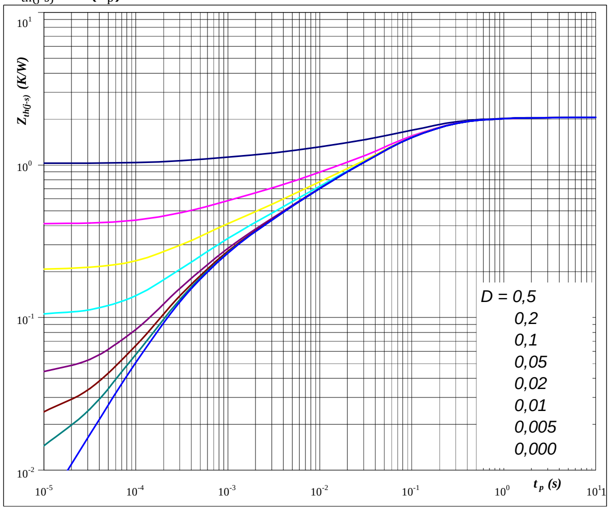
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	8	A

figure 11. **IGBT**

IGBT transient thermal impedance as a function of pulse width

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



At $D = t_p / T$

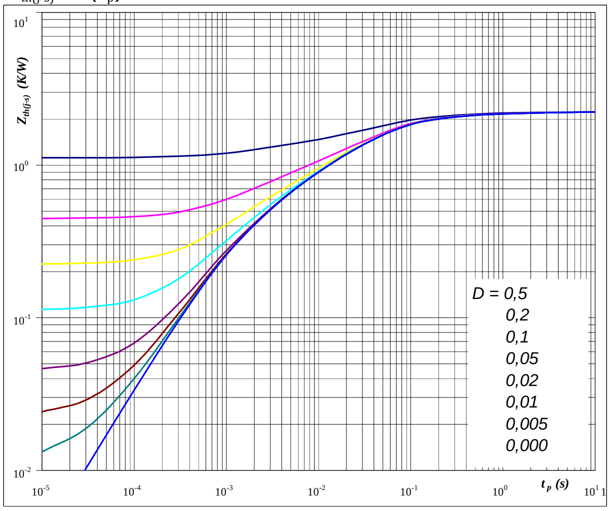
phase-change material

$R_{th(j-s)}$ = 2,05 K/W $R_{th(j-s)}$ = 1,66 K/W

figure 12. **FWD**

FWD transient thermal impedance as a function of pulse width

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



At $D = t_p / T$

phase-change material

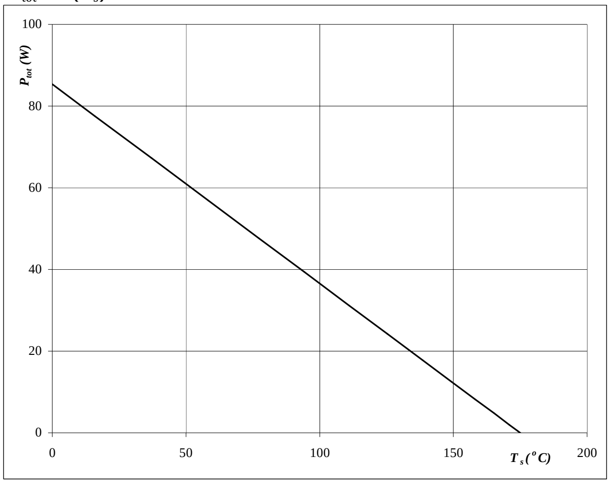
$R_{th(j-s)}$ = 2,23 K/W $R_{th(j-s)}$ = 1,81 K/W

Brake

figure 13. **IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



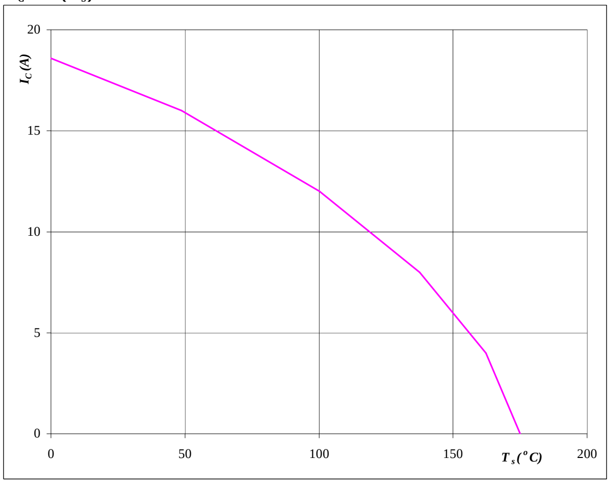
At

T_j = 175 ºC

figure 14. **IGBT**

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

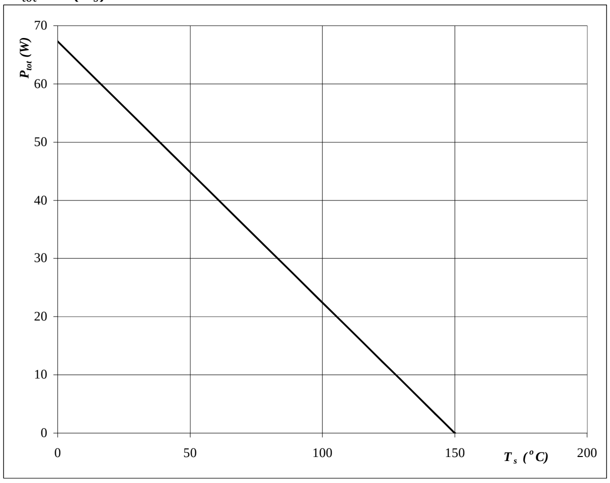
T_j = 175 ºC

V_{GE} = 15 V

figure 15. **FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



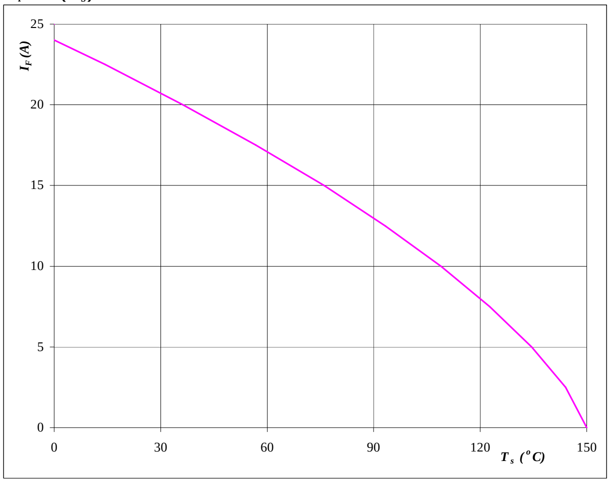
At

T_j = 150 ºC

figure 16. **FWD**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

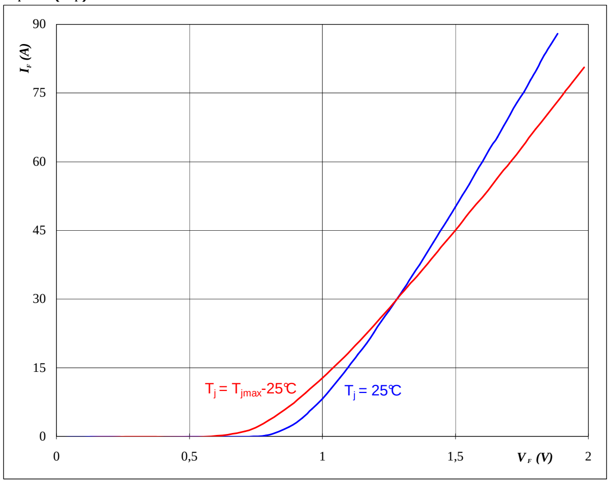
T_j = 150 ºC

Input Rectifier Bridge

figure 1. **Rectifier Diode**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



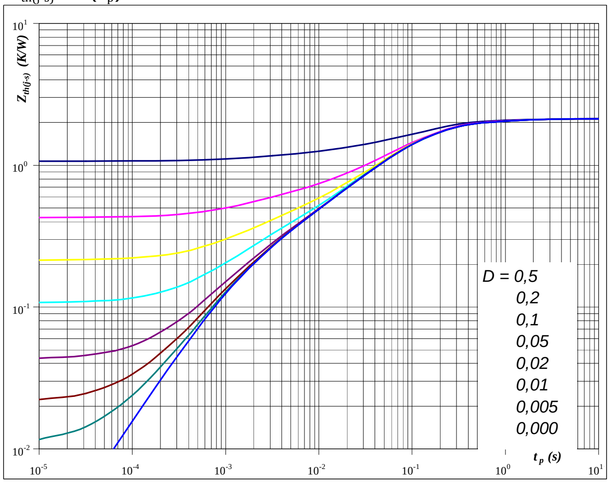
At

t_p = 250 µs

figure 2. **Rectifier Diode**

Diode transient thermal impedance as a function of pulse width

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



At

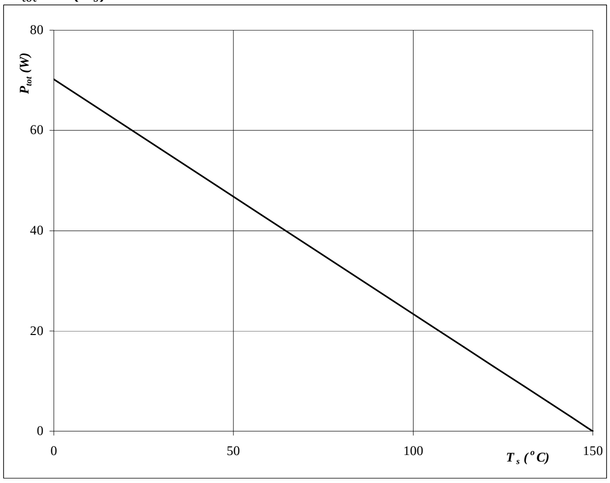
$D = t_p / T$

$R_{th(j-s)}$ = 2,10 K/W $R_{th(j-s)}$ = 1,70 K/W

figure 3. **Rectifier Diode**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



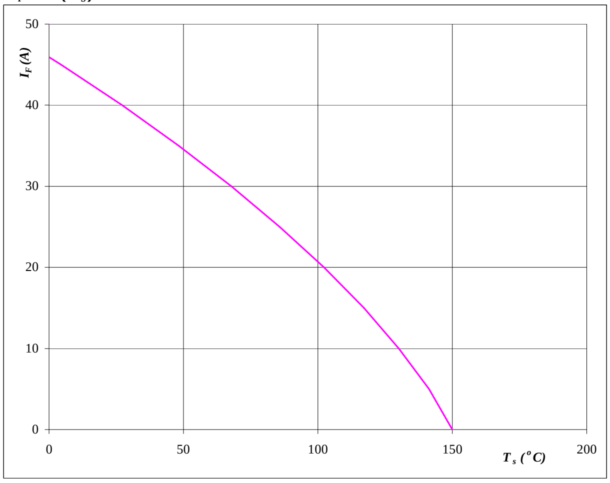
At

T_j = 150 ºC

figure 4. **Rectifier Diode**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



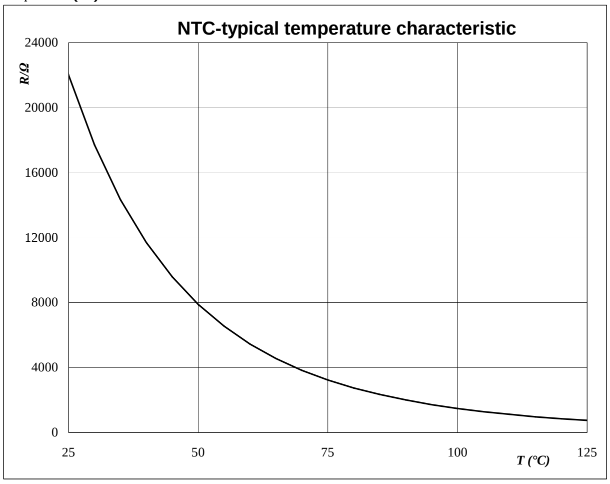
At

T_j = 150 ºC

Thermistor

figure 1.	Thermistor

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



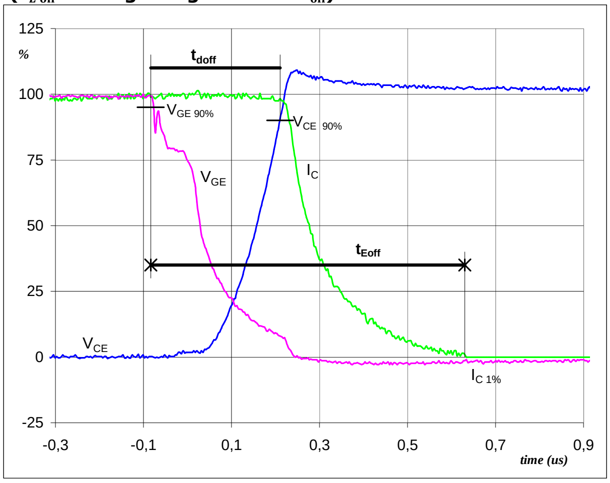
Switching Definitions Output Inverter

General conditions

T_j	=	150 °C
R_{gon}	=	32 Ω
R_{goff}	=	32 Ω

figure 1. **IGBT**

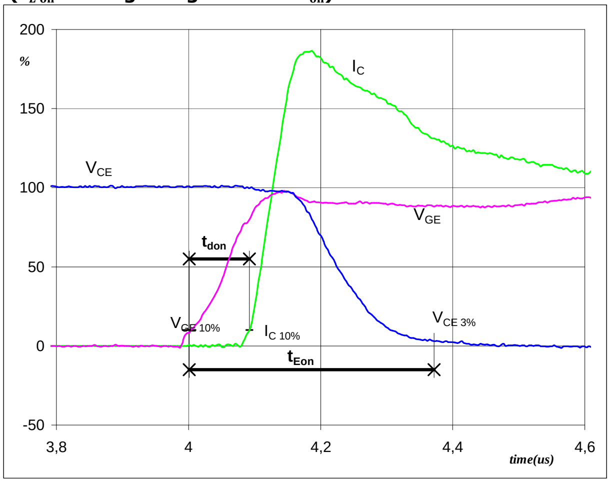
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	15	A
t_{doff} =	0,29	μs
t_{Eoff} =	0,71	μs

figure 2. **IGBT**

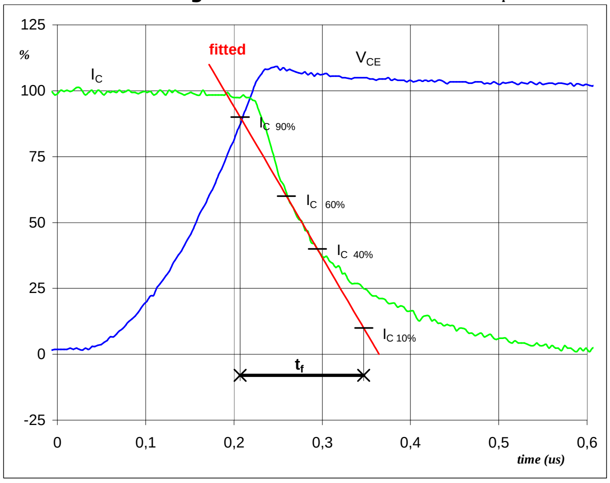
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	15	A
t_{don} =	0,09	μs
t_{Eon} =	0,37	μs

figure 3. **IGBT**

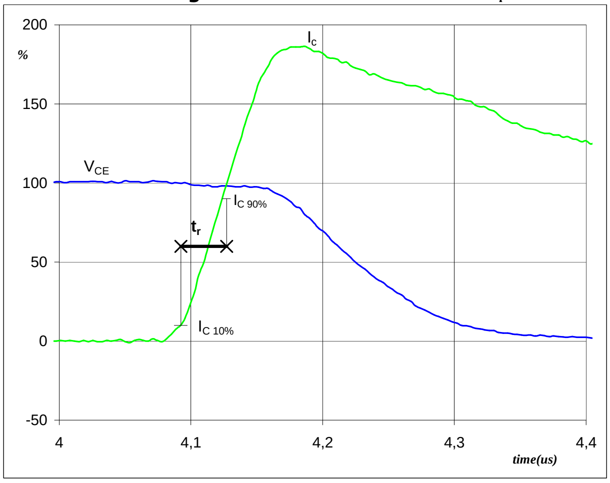
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	15	A
t_f =	0,14	μs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

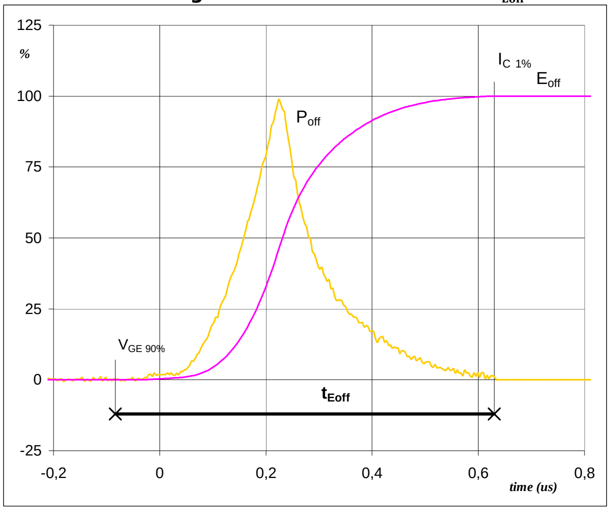


V_C (100%) =	600	V
I_C (100%) =	15	A
t_r =	0,03	μs

Switching Definitions Output Inverter

figure 5. **IGBT**

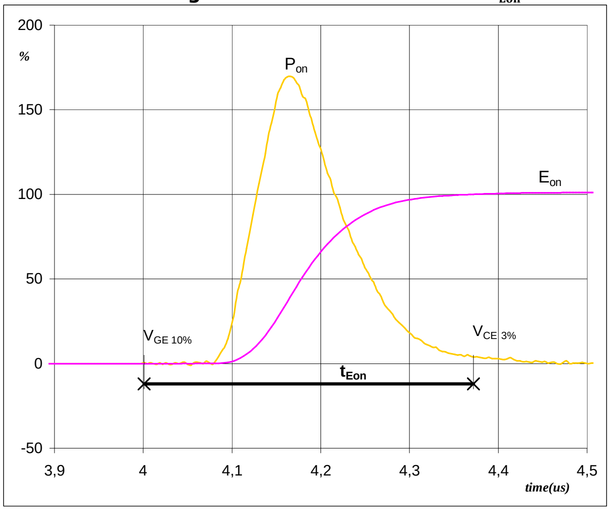
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	9,02	kW
E_{off} (100%) =	1,53	mJ
$t_{E\,off}$ =	0,71	μs

figure 6. **IGBT**

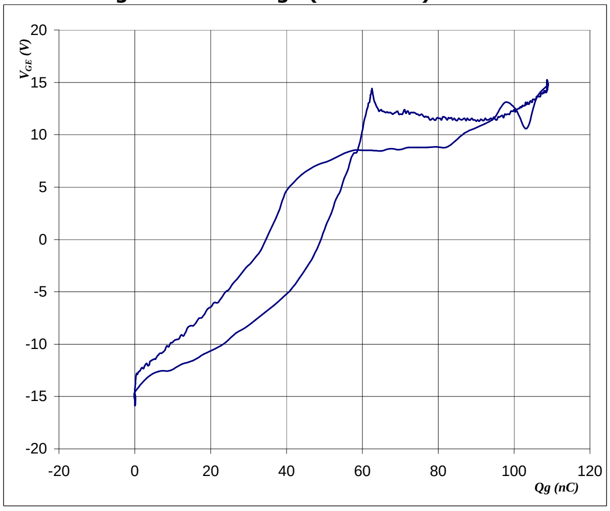
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	9,02	kW
E_{on} (100%) =	1,78	mJ
$t_{E\,on}$ =	0,37	μs

figure 7. **FWD**

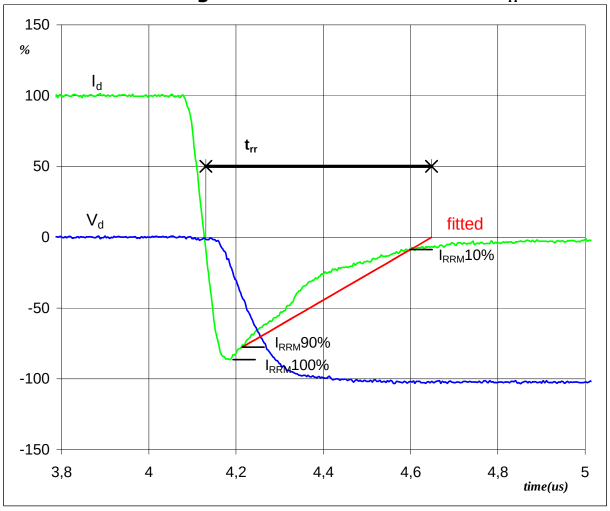
Gate voltage vs Gate charge (measured)



$V_{GE\,off}$ =	-15	V
$V_{GE\,on}$ =	15	V
V_C (100%) =	600	V
I_C (100%) =	15	A
Q_g =	108,88	nC

figure 8. **IGBT**

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

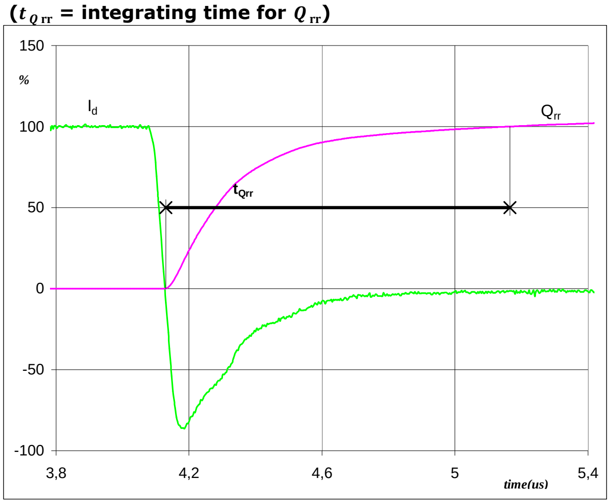


V_d (100%) =	600	V
I_d (100%) =	15	A
I_{RRM} (100%) =	-13	A
t_{rr} =	0,51	μs

Switching Definitions Output Inverter

figure 9.	FWD

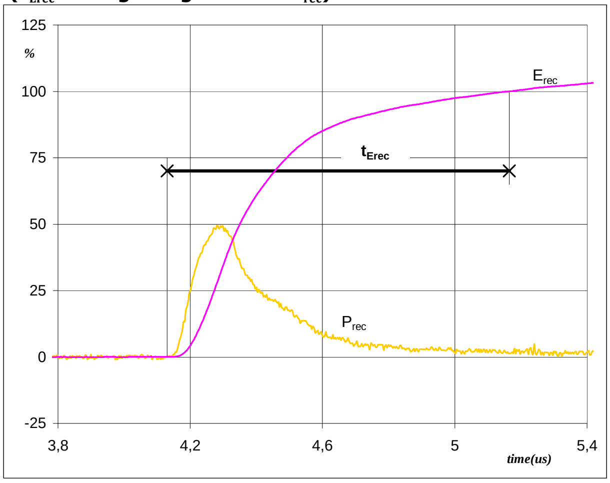
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q rr}$ = integrating time for Q_{rr})



I_d (100%) =	15	A
Q_{rr} (100%) =	3,04	µC
$t_{Q rr}$ =	1,03	µs

figure 10.	FWD

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

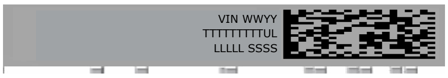


P_{rec} (100%) =	9,02	kW
E_{rec} (100%) =	1,22	mJ
$t_{E rec}$ =	1,03	µs

Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste	V23990-P630-A40-PM	P630-A40	P630-A40



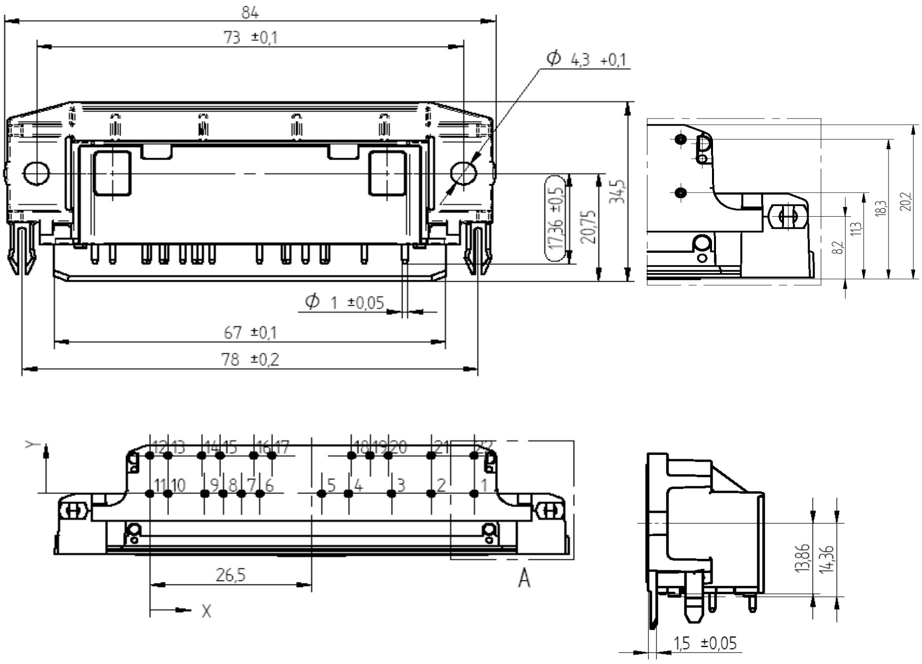
	Vinco	Date code	Type	UL	Lot number	Serial
Text	VIN	WWYY	TTTTTTTTT	UL	LLLLL	SSSS

	Type	Lot number	Serial	Date code		
Datamatrix	TTTTTTTTT	LLLLL	SSSS	WWYY		

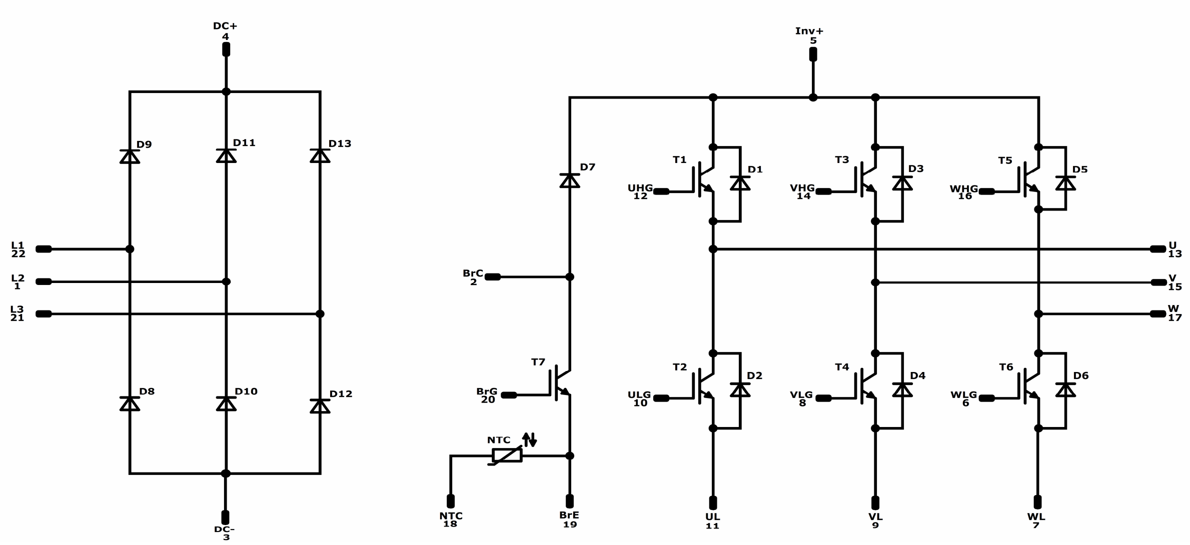
Outline

Pin table

Pin	X	Y	Function
1	53	0	L2
2	46	0	BrC
3	39,5	0	DC-
4	32,5	0	DC+
5	28,1	0	Inv+
6	18	0	WLG
7	15	0	WL
8	12	0	VLG
9	9	0	VL
10	3	0	ULG
11	0	0	UL
12	0	7	UHG
13	3	7	U
14	8,5	7	VHG
15	11,5	7	V
16	17	7	WHG
17	20	7	W
18	33	7	NTC
19	36	7	BrE
20	39	7	BrG
21	46	7	L3
22	53	7	L1



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1 - T6	IGBT	1200 V	15 A	Inverter Switch	
D1 - D6	FWD	1200 V	15 A	Inverter Diode	
T7	IGBT	1200 V	8 A	Brake Switch	
D7	FWD	1200 V	7,5 A	Brake Diode	
D8 - D13	Rectifier	1600 V	25 A	Rectifier Diode	
NTC	NTC			Thermistor	

Packaging instruction			
Standard packaging quantity (SPQ)	**80**	>SPQ Standard	<SPQ Sample

Handling instruction
Handling instructions for *flow* 90 0 packages see vincotech.com website.

Package data
Package data for *flow* 90 0 packages see vincotech.com website.

UL recognition and file number
This device is certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
V23990-P630-A40-D3-14	23 Nov. 2017		