



flowANPC 2

950 V / 200 A

Topology features

- Temperature sensor
- Advanced Neutral Point Clamped topology

Component features

- Low collector emitter saturation voltage
- High speed and smooth switching

Housing features

- Base isolation: Al₂O₃
- Convex shaped baseplate for superior thermal contact
- Cu baseplate
- Thermo-mechanical push-and-pull force relief
- Solder pin

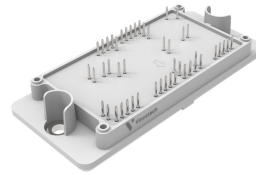
Target applications

- Energy Storage Systems
- Solar Inverters

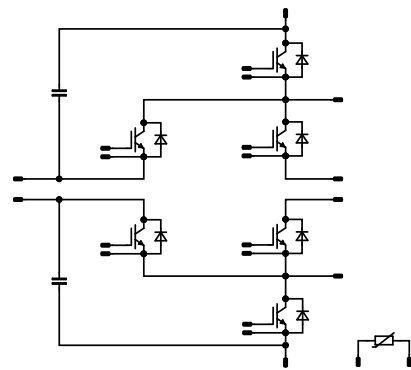
Types

- 30-FT10NAA200S701-PE59F08

flow 2 13 mm housing



Schematic





Vincotech

30-FT10NAA200S701-PE59F08
datasheet

Maximum Ratings

$T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
AC Switch				
Collector-emitter voltage	V_{CES}		950	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	203	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	400	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	256	W
Gate-emitter voltage	V_{GES}		± 20	V
Maximum junction temperature	T_{jmax}		175	°C

AC Diode

Peak repetitive reverse voltage	V_{RRM}		950	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	108	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	400	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	192	W
Maximum junction temperature	T_{jmax}		175	°C

Neutral Point Switch

Collector-emitter voltage	V_{CES}		950	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	153	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	400	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	300	W
Gate-emitter voltage	V_{GES}		± 20	V
Maximum junction temperature	T_{jmax}		175	°C



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Maximum Ratings

$T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
DC-Link Diode				
Peak repetitive reverse voltage	V_{RRM}		950	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	108	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	400	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	192	W
Maximum junction temperature	T_{jmax}		175	°C

DC-Link Switch

Collector-emitter voltage	V_{CES}		950	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	153	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	400	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	300	W
Gate-emitter voltage	V_{GES}		±20	V
Maximum junction temperature	T_{jmax}		175	°C

Neutral Point Diode

Peak repetitive reverse voltage	V_{RRM}		950	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	108	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	400	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	192	W
Maximum junction temperature	T_{jmax}		175	°C

Capacitor (DC)

Maximum DC voltage	V_{MAX}		750	V
		$T_j = 125\text{ °C}$	1000	
		$T_j = 150\text{ °C}$	750	
Operation Temperature	T_{op}		-55 ... 150	°C



Vincotech

30-FT10NAA200S701-PE59F08
datasheet

Maximum Ratings

$T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
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Module Properties

Thermal Properties

Storage temperature	T_{stg}		-40...+125	°C
Operation temperature under switching condition	T_{jop}		-40...+($T_{jmax} - 25$)	°C

Isolation Properties

Isolation voltage	V_{isol}	DC Test Voltage* $t_p = 2\text{ s}$	6000	V
Creepage distance			>12,7	mm
Clearance			10,76	mm
Comparative Tracking Index	CTI		≥ 600	

*100 % tested in production



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Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
		V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	I_D [A]	T_j [°C]	Min	Typ	Max	

AC Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00325	25	4,15	4,85	5,65	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		200	25 125 150		1,22 1,25 1,26	1,4 ⁽¹⁾	V
Collector-emitter cut-off current	I_{CES}		0	950		25			4	μA
Gate-emitter leakage current	I_{GES}		20	0		25			100	nA
Internal gate resistance	r_g							1,5		Ω
Input capacitance	C_{ies}							24600		pF
Output capacitance	C_{oes}	$f = 100$ kHz	0	25		25		265		pF
Reverse transfer capacitance	C_{res}							110		pF
Gate charge	Q_g		±15		0	25		2050		nC

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,37		K/W
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AC Diode

Static

Forward voltage	V_F				200	25 125 150	2,1	2,64 2,44 2,36	2,8 ⁽¹⁾	V
Reverse leakage current	I_R	$V_r = 950$ V				25			8	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,5		K/W
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Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
		V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	I_D [A]	T_j [°C]	Min	Typ	Max	

Neutral Point Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00334	25	4,35	5,1	5,85	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		200	25 125 150		1,83 2,06 2,11	2,35 ⁽¹⁾	V
Collector-emitter cut-off current	I_{CES}		0	950		25			4	μA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Internal gate resistance	r_g							0,75		Ω
Input capacitance	C_{ies}							13000		pF
Output capacitance	C_{oes}	$f = 100$ kHz	0	25		25		278		pF
Reverse transfer capacitance	C_{res}							40		pF
Gate charge	Q_g		±15		0	25		460		nC

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,32		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		85,83 88,21 89,19		ns
Rise time	t_r	$R_{gon} = 2$ Ω $R_{goff} = 2$ Ω				25 125 150		13,34 15,07 15,31		ns
Turn-off delay time	$t_{d(off)}$		±15	750	170	25 125 150		101,78 131,72 139,97		ns
Fall time	t_f					25 125 150		19,65 41,02 50,59		ns
Turn-on energy (per pulse)	E_{on}	$Q_{tFWD} = 4,95$ μC $Q_{tFWD} = 11,2$ μC $Q_{tFWD} = 13,4$ μC				25 125 150		7,2 9,86 10,58		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		5,22 9,58 10,81		mWs



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Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
		V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max		
DC-Link Diode										
Static										
Forward voltage	V_F			200	25 125 150	2,1	2,64 2,44 2,36	2,8 ⁽¹⁾		V
Reverse leakage current	I_R	$V_r = 950$ V			25			8		μA
Thermal										
Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)					0,5			K/W
Dynamic										
Peak recovery current	I_{RM}				25 125 150		104,12 156,48 171,85			A
Reverse recovery time	t_{rr}				25 125 150		110,17 150,99 166,05			ns
Recovered charge	Q_r	$di/dt=6941$ A/μs $di/dt=7416$ A/μs $di/dt=7571$ A/μs	±15	750	170	25 125 150	4,95 11,2 13,4			μC
Reverse recovered energy	E_{rec}				25 125 150		1,88 4,69 5,74			mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$				25 125 150		2387,68 1344,81 1455,48			A/μs



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Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
		V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	I_D [A]	T_j [°C]	Min	Typ	Max	

DC-Link Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00334	25	4,35	5,1	5,85	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		200	25 125 150		1,83 2,06 2,11	2,35 ⁽¹⁾	V
Collector-emitter cut-off current	I_{CES}		0	950		25			4	μA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Internal gate resistance	r_g							0,75		Ω
Input capacitance	C_{ies}							13000		pF
Output capacitance	C_{oes}	$f = 100$ kHz	0	25		25		278		pF
Reverse transfer capacitance	C_{res}							40		pF
Gate charge	Q_g		±15		0	25		460		nC

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,32		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		260,37 258,01 257,36		ns
Rise time	t_r	$R_{gon} = 8$ Ω $R_{goff} = 8$ Ω				25 125 150		38,04 40,64 41,29		ns
Turn-off delay time	$t_{d(off)}$		±15	750	170	25 125 150		189,81 221,15 229,97		ns
Fall time	t_f					25 125 150		20,63 41,58 49,96		ns
Turn-on energy (per pulse)	E_{on}	$Q_{tFWD} = 4,32$ μC $Q_{tFWD} = 10,47$ μC $Q_{tFWD} = 12,58$ μC				25 125 150		12,71 15,81 16,54		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		5,16 8,57 9,48		mWs



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Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
		V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max		
Neutral Point Diode										
Static										
Forward voltage	V_F				200	25 125 150	2,1	2,64 2,44 2,36	2,8 ⁽¹⁾	V
Reverse leakage current	I_R	$V_T = 950$ V				25			8	μA
Thermal										
Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,5		K/W
Dynamic										
Peak recovery current	I_{RM}					25 125 150		81,59 123,07 133,99		A
Reverse recovery time	t_{rr}					25 125 150		127,76 182,08 197,89		ns
Recovered charge	Q_r	$di/dt=3481$ A/μs $di/dt=3450$ A/μs $di/dt=3656$ A/μs	±15	750	170	25 125 150		4,32 10,47 12,58		μC
Reverse recovered energy	E_{rec}					25 125 150		1,35 3,66 4,58		mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$					25 125 150		1504,45 1171,27 1258,98		A/μs



Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
		V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max		

Capacitor (DC)

Static

Capacitance	C	DC bias voltage = 0 V				25		750		V
Tolerance							-5		5	%
Dissipation factor		$f = 1$ kHz				25		0,1		%

Thermistor

Static

Rated resistance	R					25		22		k Ω
Deviation of R_{100}	$A_{R/R}$	$R_{100} = 1484 \Omega$				100	-5		5	%
Power dissipation	P					25		130		mW
Power dissipation constant	d					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ± 1 %						3962		K
B-value	$B_{(25/100)}$	Tol. ± 1 %						4000		K
Vincotech Thermistor Reference									I	

(1) Value at chip level

(2) Only valid with pre-applied Vincotech thermal interface material.

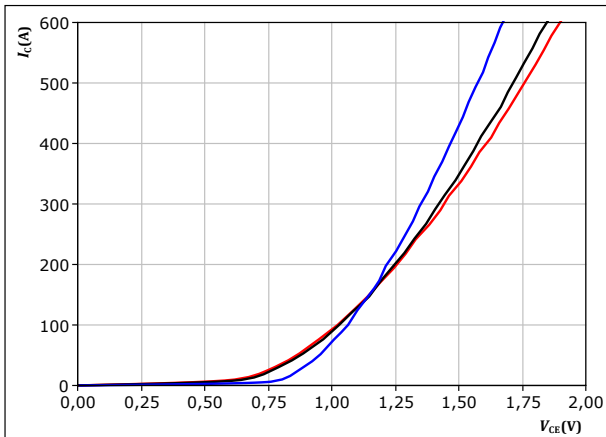


AC Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

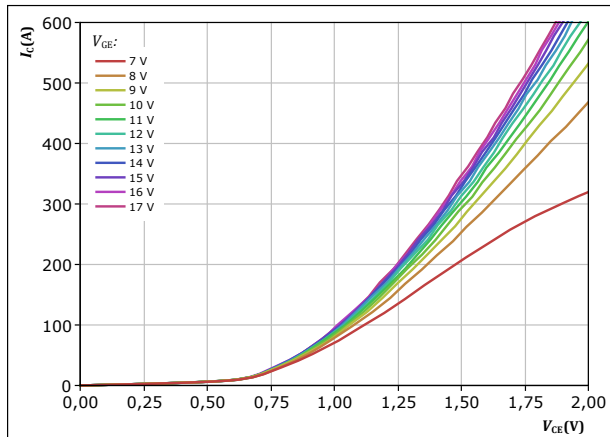


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j:$ 25 °C, 125 °C, 150 °C

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

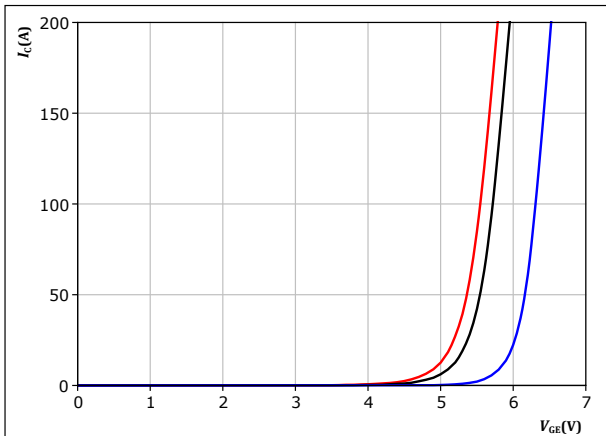


$t_p = 250 \mu s$
 $T_j = 150 \text{ °C}$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

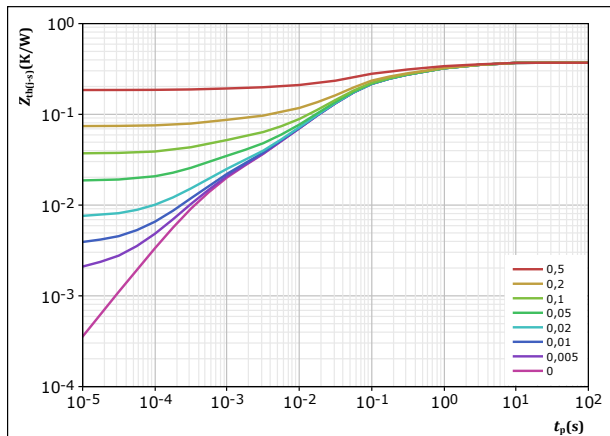


$t_p = 250 \mu s$
 $V_{CE} = 59 V$
 $T_j:$ 25 °C, 125 °C, 150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 0,371 \text{ K/W}$
 IGBT thermal model values

R (K/W)	τ (s)
6,29E-02	2,66E+00
9,87E-02	3,54E-01
1,71E-01	4,59E-02
2,32E-02	6,22E-03
1,51E-02	5,38E-04

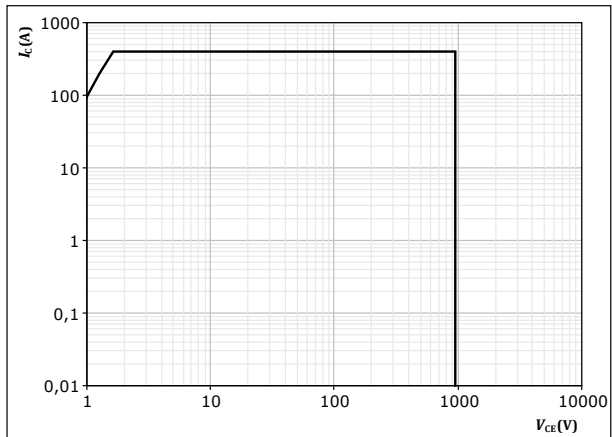


AC Switch Characteristics

figure 5. IGBT

Safe operating area

$$I_C = f(V_{CE})$$



$D =$ single pulse

$T_s = 80$ °C

$V_{GE} = 15$ V

$T_j = T_{jmax}$



AC Diode Characteristics

figure 6. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

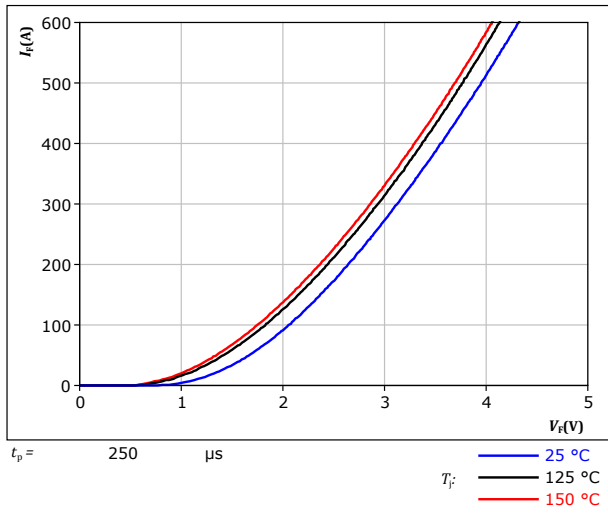
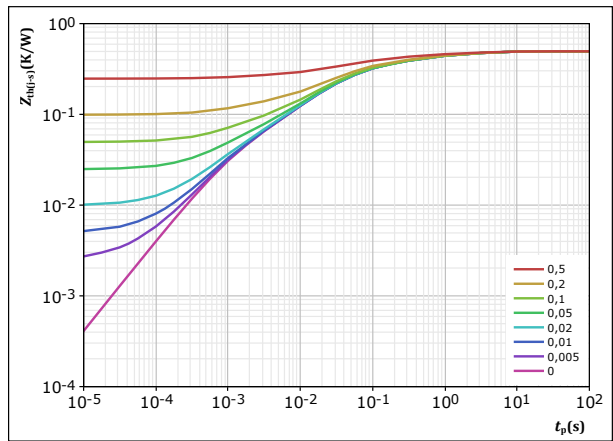


figure 7. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 0,495 \text{ K/W}$
 FWD thermal model values

R (K/W)	τ (s)
5,54E-02	3,24E+00
1,07E-01	4,54E-01
1,95E-01	5,74E-02
1,05E-01	1,25E-02
3,26E-02	1,12E-03

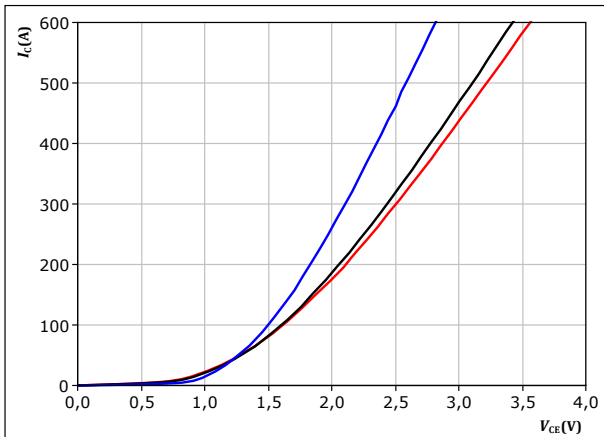


Neutral Point Switch Characteristics

figure 8. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$



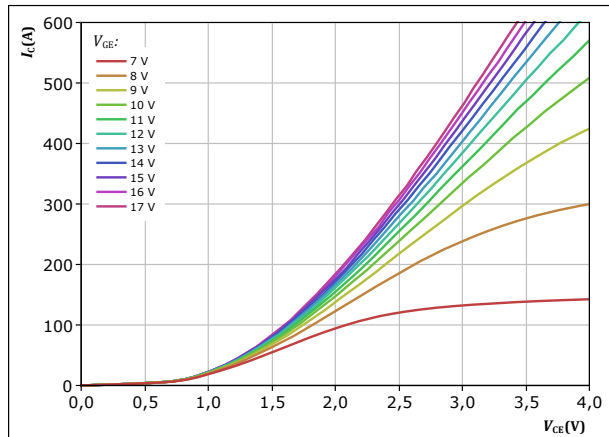
$t_p = 250 \mu s$
 $V_{GE} = 15 V$

T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 9. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$



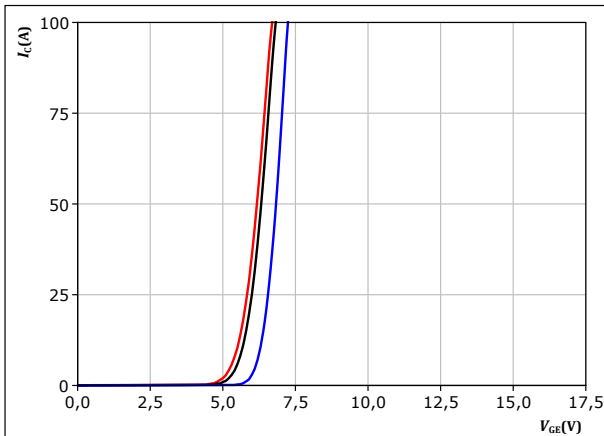
$t_p = 250 \mu s$
 $T_j = 150 \text{ } ^\circ C$

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

figure 10. IGBT

Typical transfer characteristics

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



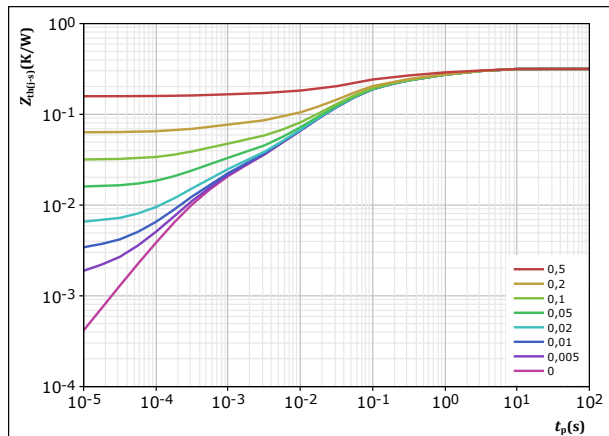
$t_p = 250 \mu s$
 $V_{CE} = 8 V$

T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 11. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)} = 0,316 \text{ K/W}$

IGBT thermal model values

R (K/W)	τ (s)
6,47E-02	2,21E+00
8,02E-02	2,58E-01
1,36E-01	3,99E-02
2,02E-02	4,97E-03
1,51E-02	4,41E-04

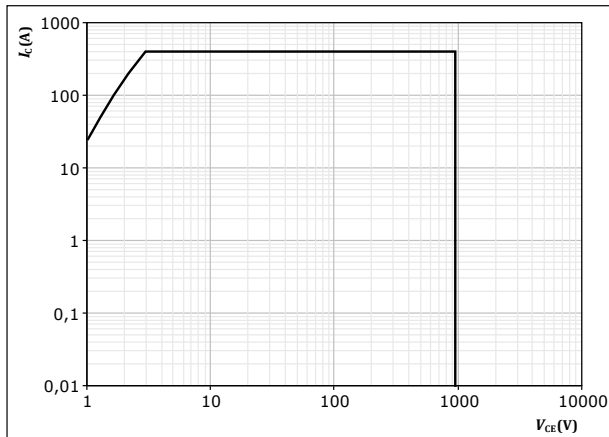


Neutral Point Switch Characteristics

figure 12. IGBT

Safe operating area

$$I_C = f(V_{CE})$$



D = single pulse
T_s = 80 °C
V_{CE} = 15 V
T_j = T_{jmax}



DC-Link Diode Characteristics

figure 13. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

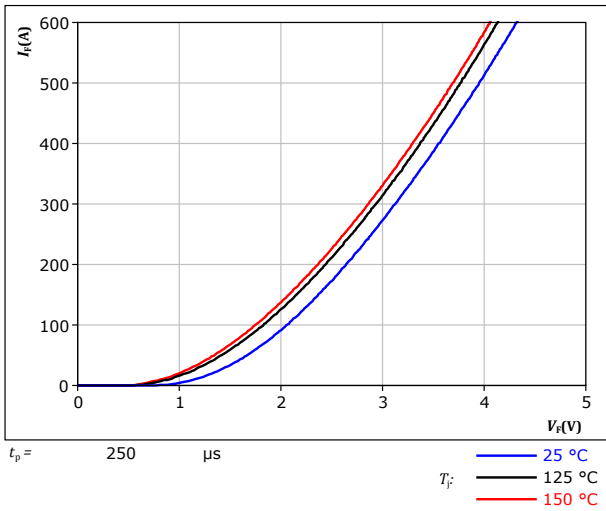
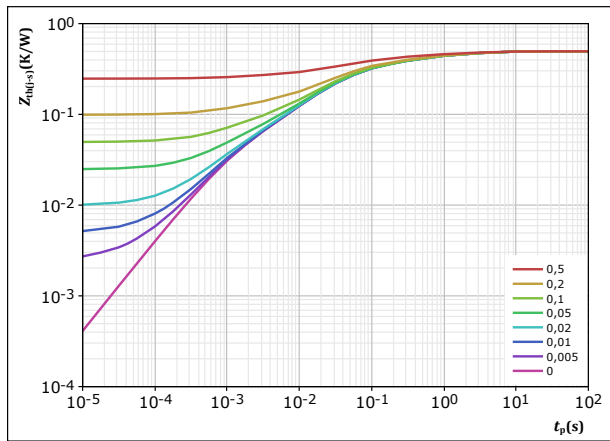


figure 14. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 0,495$ K/W
 FWD thermal model values

R (K/W)	τ (s)
5,54E-02	3,24E+00
1,07E-01	4,54E-01
1,95E-01	5,74E-02
1,05E-01	1,25E-02
3,26E-02	1,12E-03

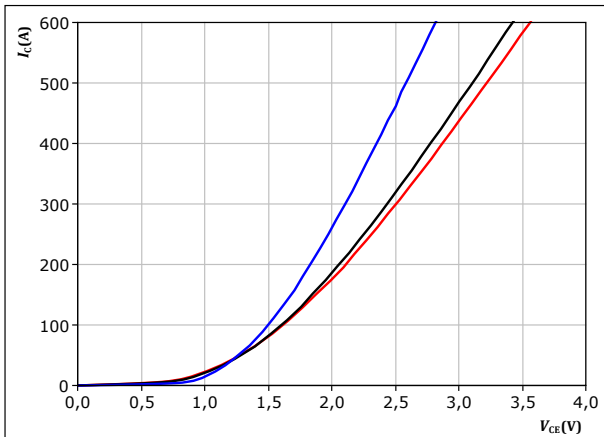


DC-Link Switch Characteristics

figure 15. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$



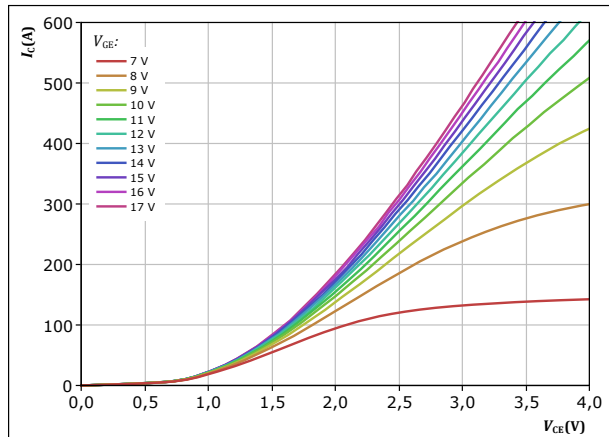
$t_p = 250 \mu\text{s}$
 $V_{GE} = 15 \text{ V}$

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 16. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

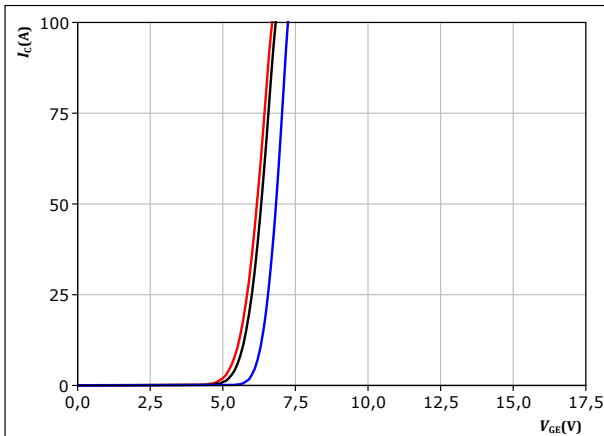


$t_p = 250 \mu\text{s}$
 $T_j = 150 \text{ °C}$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 17. IGBT

Typical transfer characteristics

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



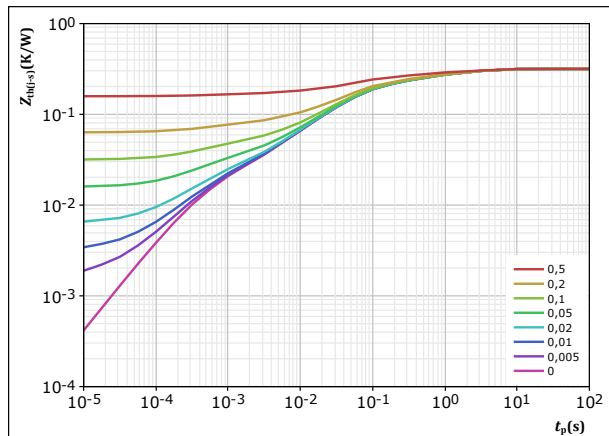
$t_p = 250 \mu\text{s}$
 $V_{CE} = 8 \text{ V}$

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 18. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 0,316 \text{ K/W}$

IGBT thermal model values

R (K/W)	τ (s)
6,47E-02	2,21E+00
8,02E-02	2,58E-01
1,36E-01	3,99E-02
2,02E-02	4,97E-03
1,51E-02	4,41E-04

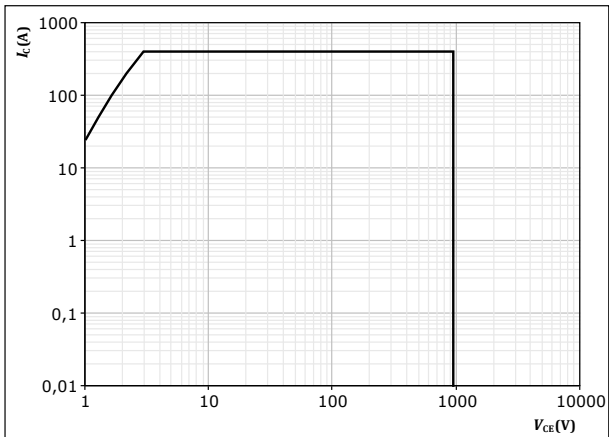


DC-Link Switch Characteristics

figure 19. IGBT

Safe operating area

$$I_C = f(V_{CE})$$



$D =$ single pulse
 $T_s = 80$ °C
 $V_{CE} = 15$ V
 $T_j = T_{jmax}$



Neutral Point Diode Characteristics

figure 20. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

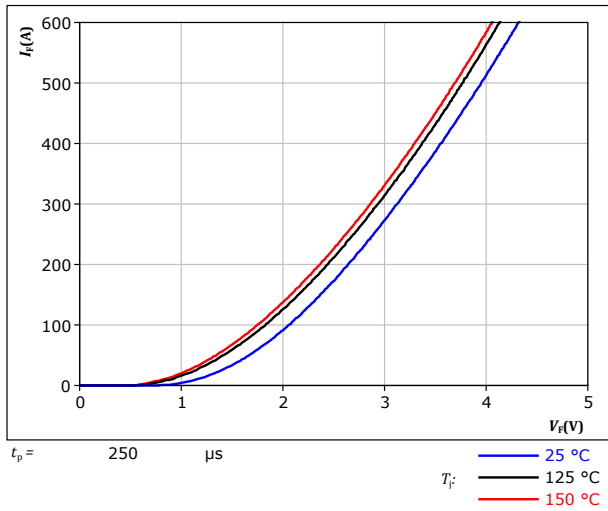
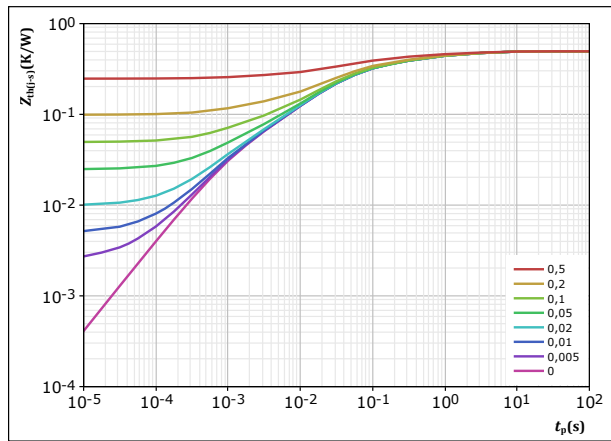


figure 21. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 0,495 \text{ K/W}$
 FWD thermal model values

R (K/W)	τ (s)
5,54E-02	3,24E+00
1,07E-01	4,54E-01
1,95E-01	5,74E-02
1,05E-01	1,25E-02
3,26E-02	1,12E-03

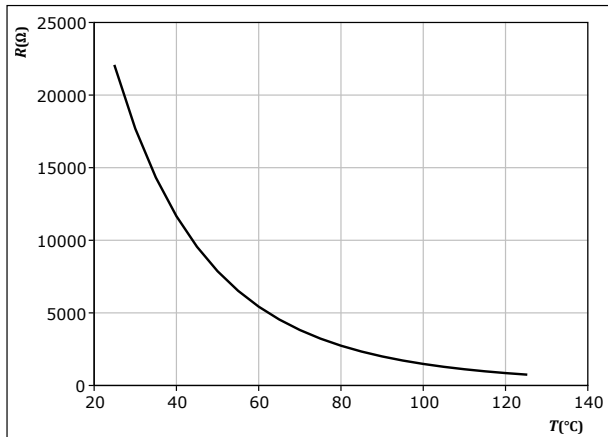


Thermistor Characteristics

figure 22. Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$

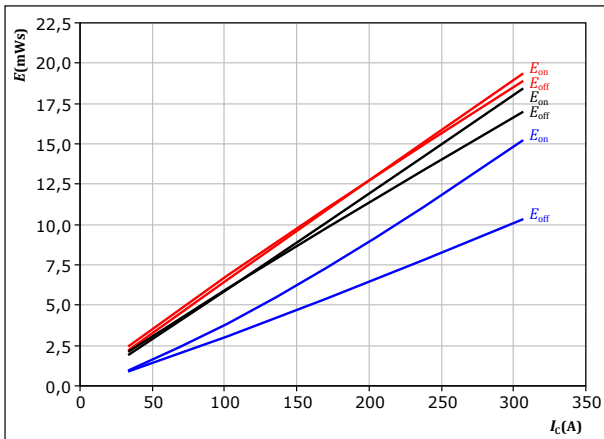




Neutral Point Switching Characteristics

figure 23. IGBT

Typical switching energy losses as a function of collector current
 $E = f(I_c)$



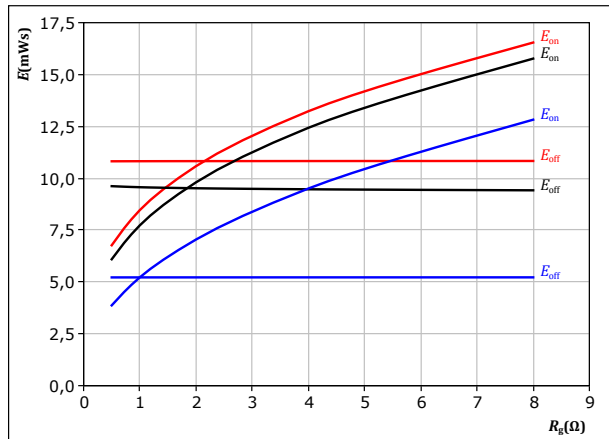
With an inductive load at

$V_{CE} = 750 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 2 \text{ } \Omega$
 $R_{goff} = 2 \text{ } \Omega$

T_j : — 25 °C
— 125 °C
— 150 °C

figure 24. IGBT

Typical switching energy losses as a function of IGBT turn on gate resistor
 $E = f(R_g)$



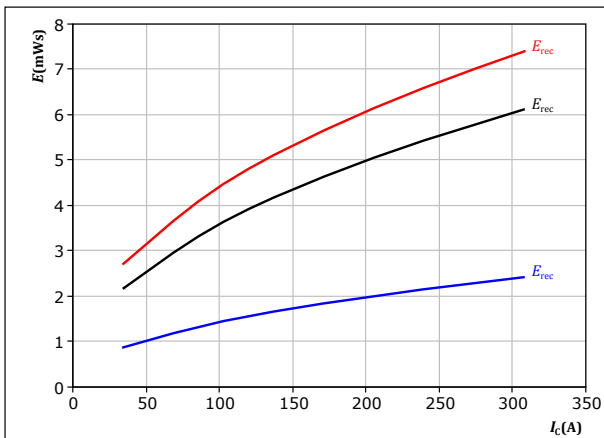
With an inductive load at

$V_{CE} = 750 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 170 \text{ A}$

T_j : — 25 °C
— 125 °C
— 150 °C

figure 25. FWD

Typical reverse recovered energy loss as a function of collector current
 $E_{rec} = f(I_c)$



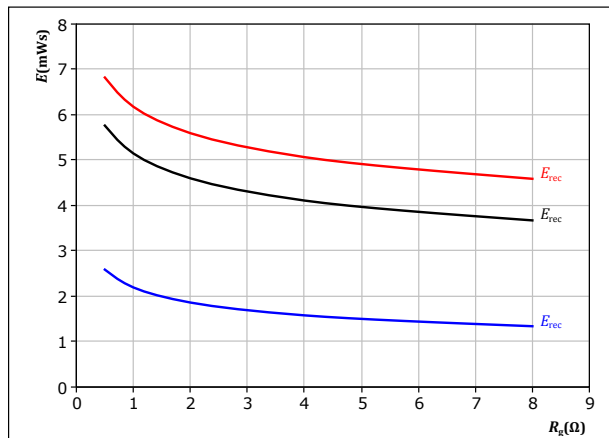
With an inductive load at

$V_{CE} = 750 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 2 \text{ } \Omega$

T_j : — 25 °C
— 125 °C
— 150 °C

figure 26. FWD

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor
 $E_{rec} = f(R_g)$



With an inductive load at

$V_{CE} = 750 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 170 \text{ A}$

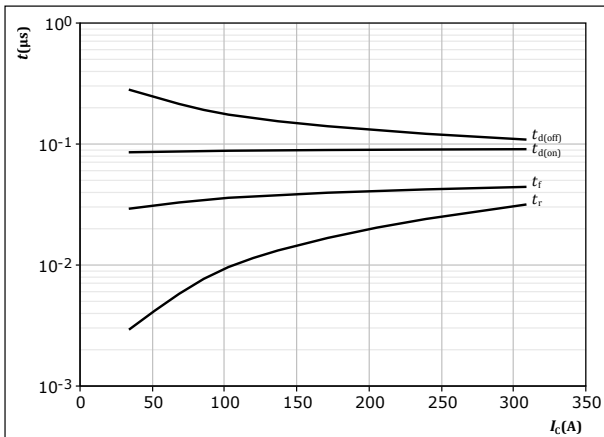
T_j : — 25 °C
— 125 °C
— 150 °C



Neutral Point Switching Characteristics

figure 27. IGBT

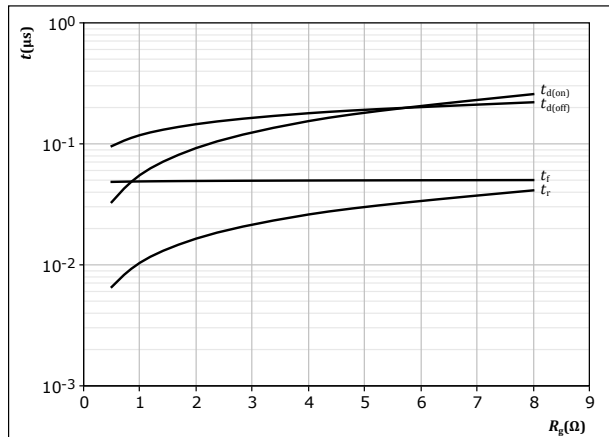
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 150$ °C
 $V_{CE} = 750$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 2$ Ω
 $R_{goff} = 2$ Ω

figure 28. IGBT

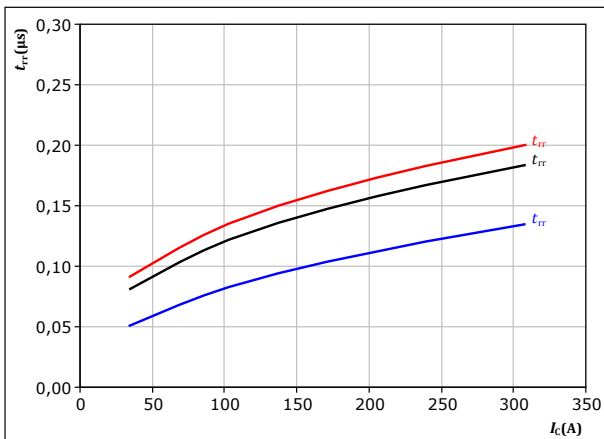
Typical switching times as a function of IGBT turn on gate resistor
 $t = f(R_g)$



With an inductive load at
 $T_j = 150$ °C
 $V_{CE} = 750$ V
 $V_{GE} = \pm 15$ V
 $I_c = 170$ A

figure 29. FWD

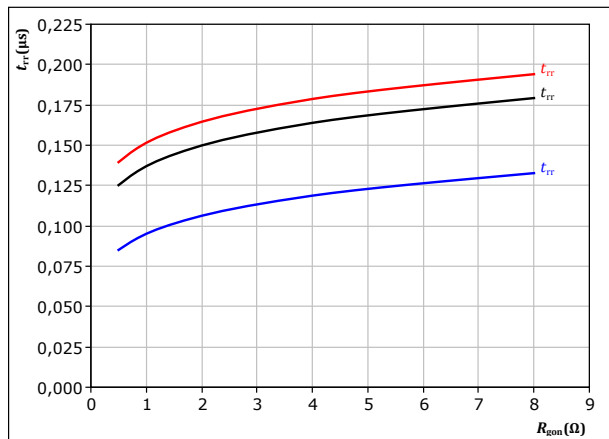
Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at
 $V_{CE} = 750$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 2$ Ω
 $T_j:$ — 25 °C
 — 125 °C
 — 150 °C

figure 30. FWD

Typical reverse recovery time as a function of IGBT turn on gate resistor
 $t_{rr} = f(R_{gon})$



With an inductive load at
 $V_{CE} = 750$ V
 $V_{GE} = \pm 15$ V
 $I_c = 170$ A
 $T_j:$ — 25 °C
 — 125 °C
 — 150 °C

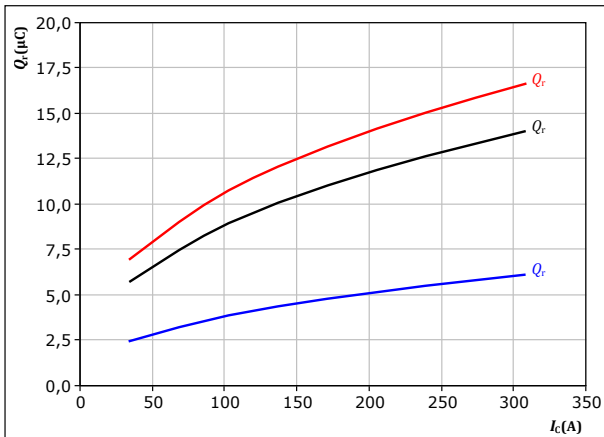


Neutral Point Switching Characteristics

figure 31. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

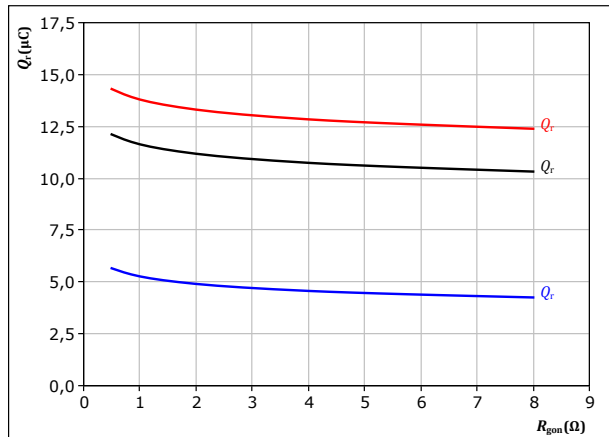
$V_{CE} = 750 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 2 \ \Omega$

T_j :
 — 25 °C
 — 125 °C
 — 150 °C

figure 32. FWD

Typical recovered charge as a function of IGBT turn on gate resistor

$$Q_r = f(R_{gon})$$



With an inductive load at

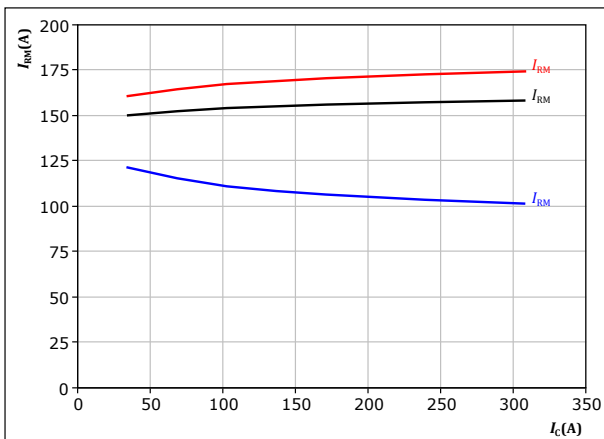
$V_{CE} = 750 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 170 \text{ A}$

T_j :
 — 25 °C
 — 125 °C
 — 150 °C

figure 33. FWD

Typical peak reverse recovery current as a function of collector current

$$I_{RM} = f(I_c)$$



With an inductive load at

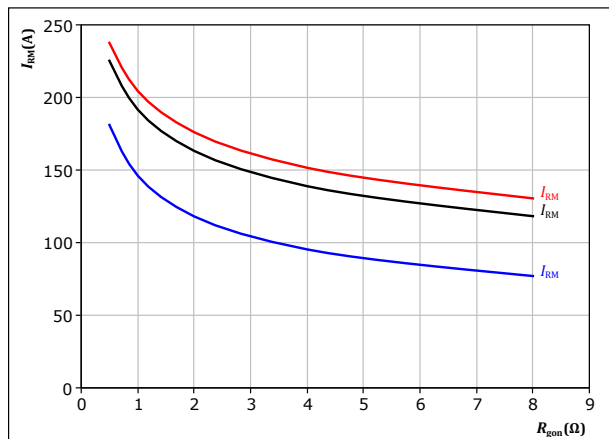
$V_{CE} = 750 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 2 \ \Omega$

T_j :
 — 25 °C
 — 125 °C
 — 150 °C

figure 34. FWD

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

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



With an inductive load at

$V_{CE} = 750 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 170 \text{ A}$

T_j :
 — 25 °C
 — 125 °C
 — 150 °C

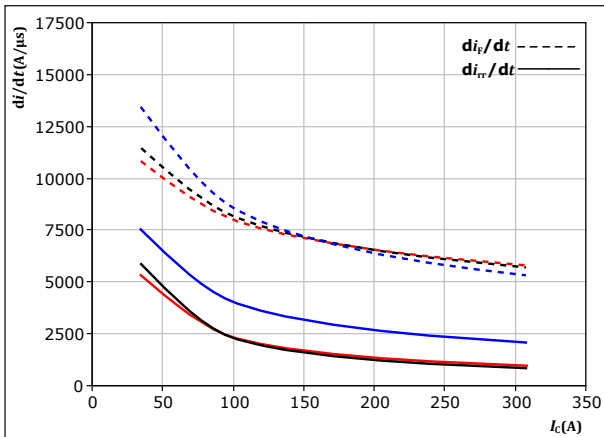


Vincotech

Neutral Point Switching Characteristics

figure 35. FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_r/dt = f(I_C)$



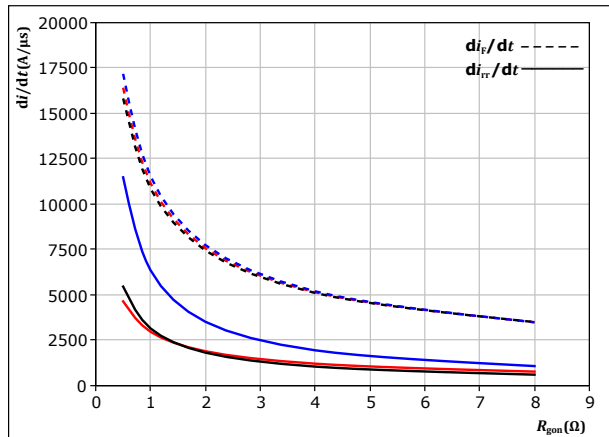
With an inductive load at

$V_{CE} = 750 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 2 \ \Omega$

$T_j = 25 \text{ }^\circ\text{C}$
 $125 \text{ }^\circ\text{C}$
 $150 \text{ }^\circ\text{C}$

figure 36. FWD

Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor
 $di_f/dt, di_r/dt = f(R_{gon})$



With an inductive load at

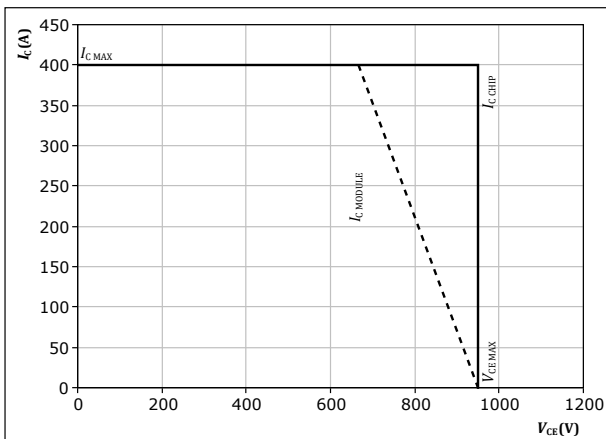
$V_{CE} = 750 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_C = 170 \text{ A}$

$T_j = 25 \text{ }^\circ\text{C}$
 $125 \text{ }^\circ\text{C}$
 $150 \text{ }^\circ\text{C}$

figure 37. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



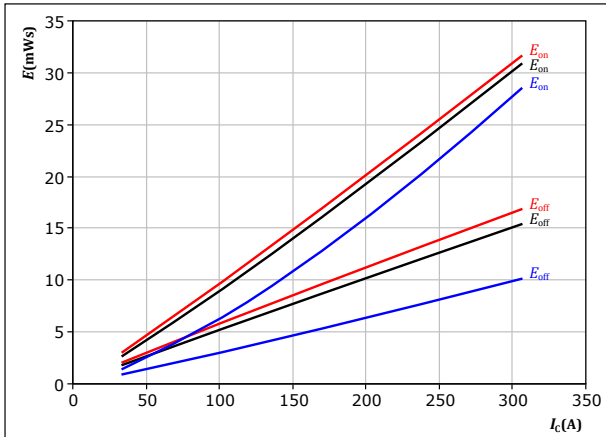
At $T_j = 150 \text{ }^\circ\text{C}$
 $R_{gon} = 2 \ \Omega$
 $R_{goff} = 2 \ \Omega$



DC-Link Switching Characteristics

figure 38. IGBT

Typical switching energy losses as a function of collector current
 $E = f(I_c)$

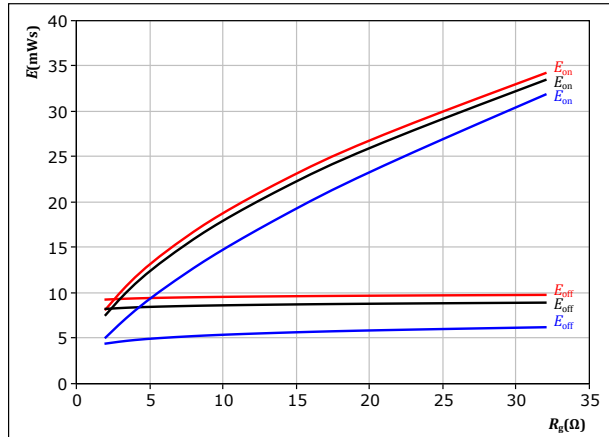


With an inductive load at

$V_{CE} = 750$ V	$T_j:$ 25 °C
$V_{GE} = \pm 15$ V	125 °C
$R_{g(on)} = 8$ Ω	150 °C
$R_{g(off)} = 8$ Ω	

figure 39. IGBT

Typical switching energy losses as a function of IGBT turn on gate resistor
 $E = f(R_g)$

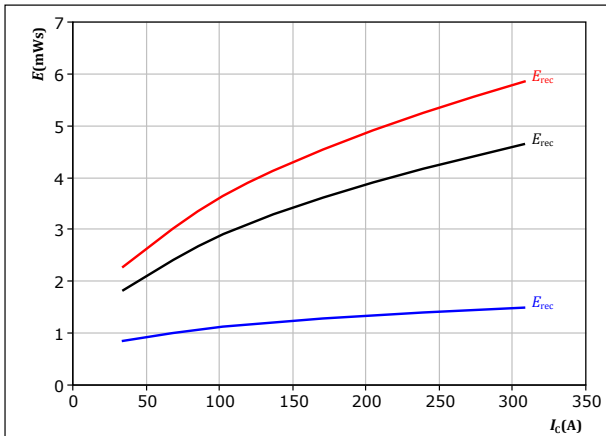


With an inductive load at

$V_{CE} = 750$ V	$T_j:$ 25 °C
$V_{GE} = \pm 15$ V	125 °C
$I_c = 170$ A	150 °C

figure 40. FWD

Typical reverse recovered energy loss as a function of collector current
 $E_{rec} = f(I_c)$

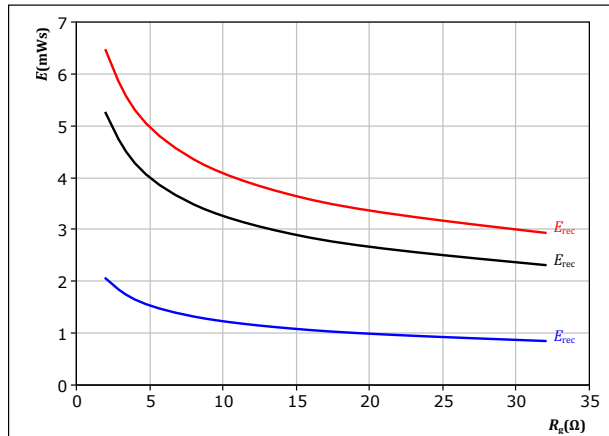


With an inductive load at

$V_{CE} = 750$ V	$T_j:$ 25 °C
$V_{GE} = \pm 15$ V	125 °C
$R_{g(on)} = 8$ Ω	150 °C

figure 41. FWD

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor
 $E_{rec} = f(R_g)$



With an inductive load at

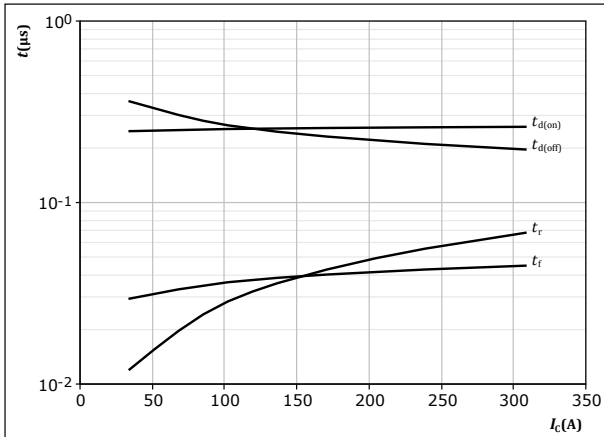
$V_{CE} = 750$ V	$T_j:$ 25 °C
$V_{GE} = \pm 15$ V	125 °C
$I_c = 170$ A	150 °C



DC-Link Switching Characteristics

figure 42. IGBT

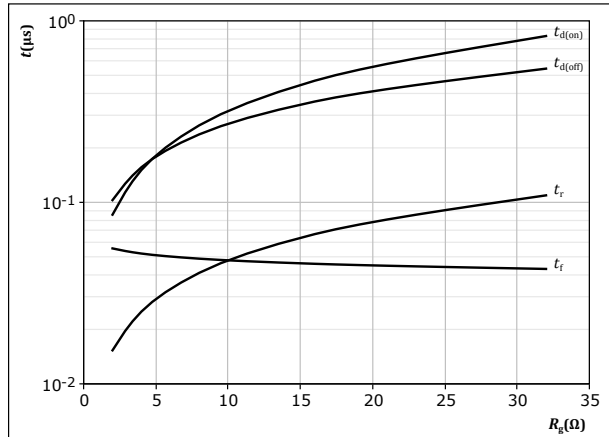
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 150$ °C
 $V_{CE} = 750$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 8$ Ω
 $R_{goff} = 8$ Ω

figure 43. IGBT

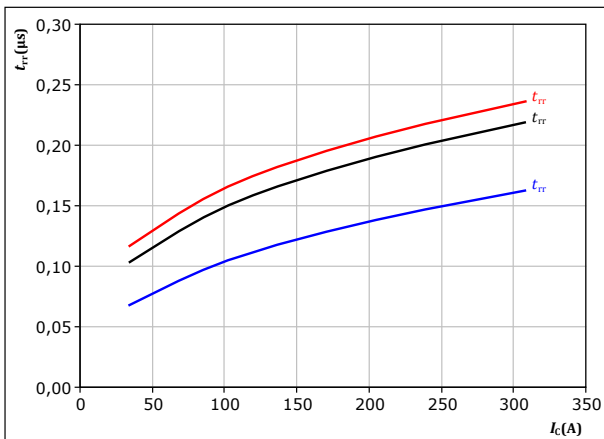
Typical switching times as a function of IGBT turn on gate resistor
 $t = f(R_g)$



With an inductive load at
 $T_j = 150$ °C
 $V_{CE} = 750$ V
 $V_{GE} = \pm 15$ V
 $I_c = 170$ A

figure 44. FWD

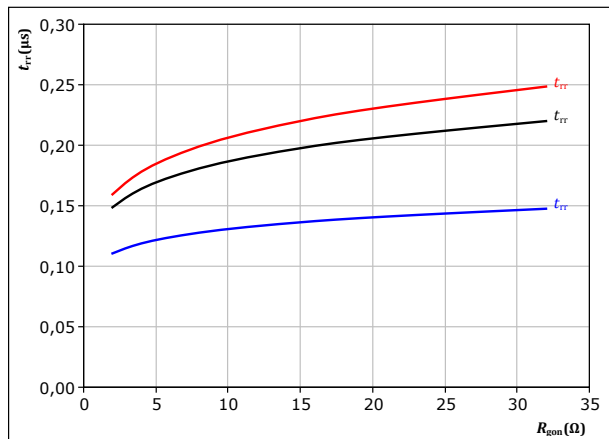
Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at
 $V_{CE} = 750$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 8$ Ω
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 45. FWD

Typical reverse recovery time as a function of IGBT turn on gate resistor
 $t_{rr} = f(R_{gon})$



With an inductive load at
 $V_{CE} = 750$ V
 $V_{GE} = \pm 15$ V
 $I_c = 170$ A
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

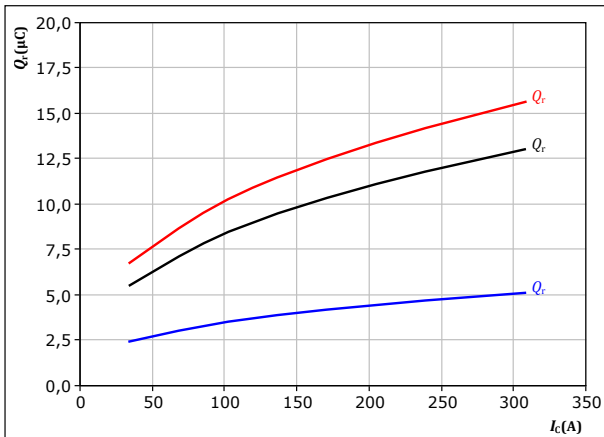


DC-Link Switching Characteristics

figure 46. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



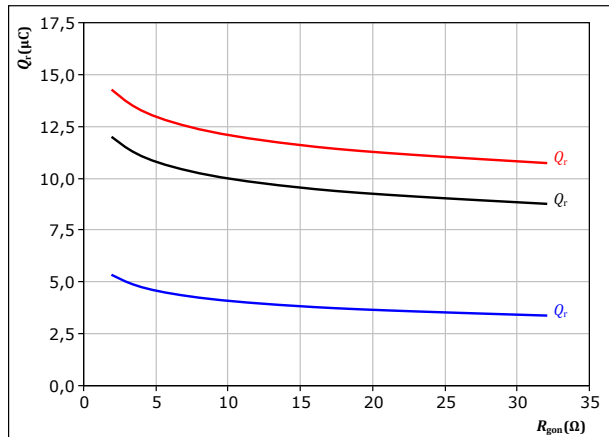
With an inductive load at

$V_{CE} = 750$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 8$ Ω
 $T_j:$ 25 °C (blue), 125 °C (black), 150 °C (red)

figure 47. FWD

Typical recovered charge as a function of IGBT turn on gate resistor

$$Q_r = f(R_{gon})$$



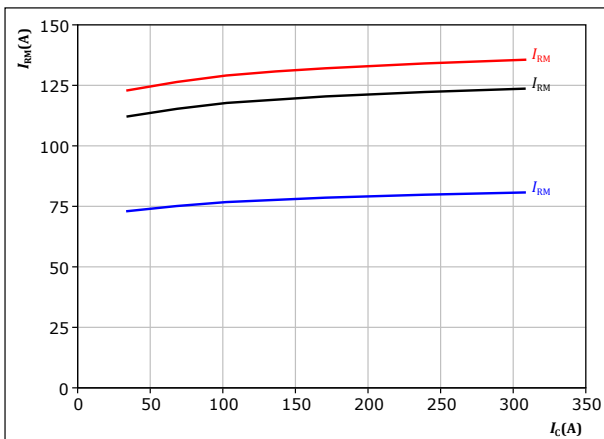
With an inductive load at

$V_{CE} = 750$ V
 $V_{GE} = \pm 15$ V
 $I_c = 170$ A
 $T_j:$ 25 °C (blue), 125 °C (black), 150 °C (red)

figure 48. FWD

Typical peak reverse recovery current as a function of collector current

$$I_{RM} = f(I_c)$$



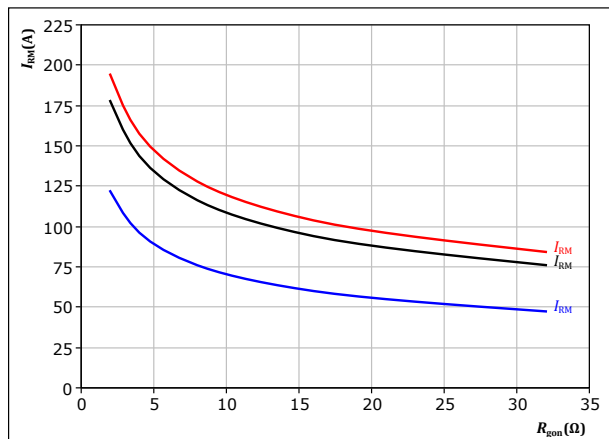
With an inductive load at

$V_{CE} = 750$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 8$ Ω
 $T_j:$ 25 °C (blue), 125 °C (black), 150 °C (red)

figure 49. FWD

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

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



With an inductive load at

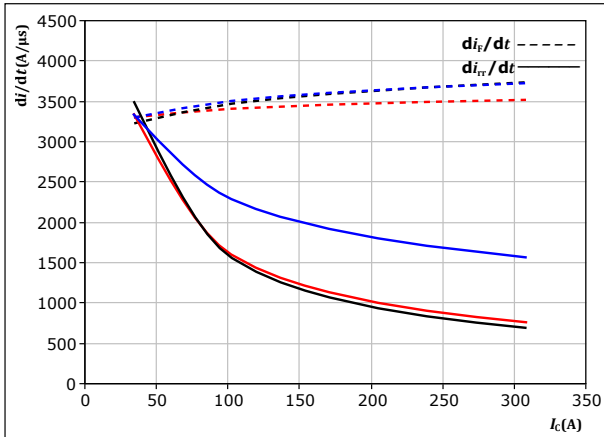
$V_{CE} = 750$ V
 $V_{GE} = \pm 15$ V
 $I_c = 170$ A
 $T_j:$ 25 °C (blue), 125 °C (black), 150 °C (red)



DC-Link Switching Characteristics

figure 50. FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_r/dt = f(I_C)$



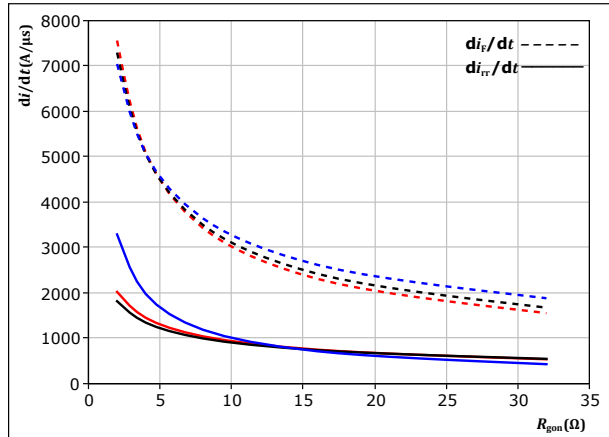
With an inductive load at

$V_{CE} = 750 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 8 \ \Omega$

$T_f:$
— 25 °C
— 125 °C
— 150 °C

figure 51. FWD

Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor
 $di_f/dt, di_r/dt = f(R_{gon})$



With an inductive load at

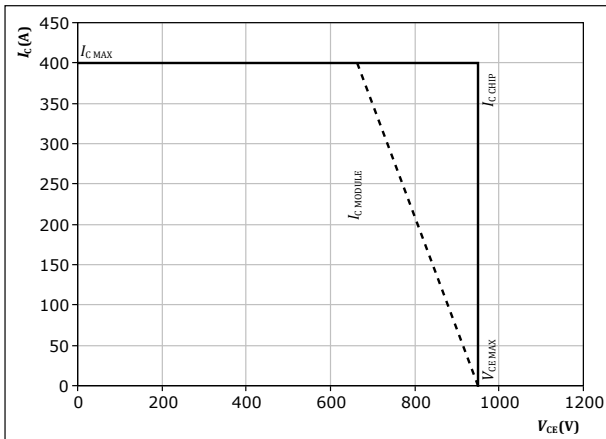
$V_{CE} = 750 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_C = 170 \text{ A}$

$T_f:$
— 25 °C
— 125 °C
— 150 °C

figure 52. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At $T_f = 150 \text{ °C}$
 $R_{gon} = 8 \ \Omega$
 $R_{goff} = 8 \ \Omega$



Switching Definitions

figure 53. IGBT

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

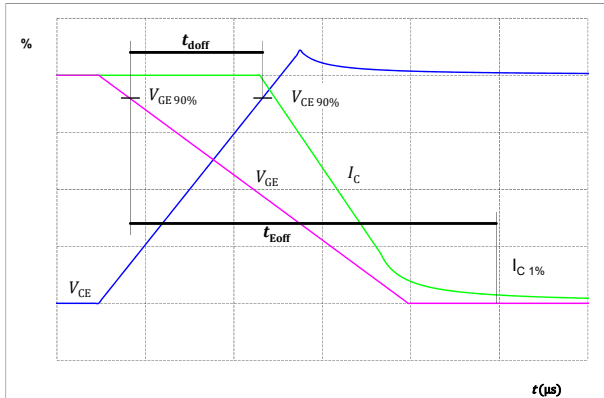


figure 54. IGBT

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

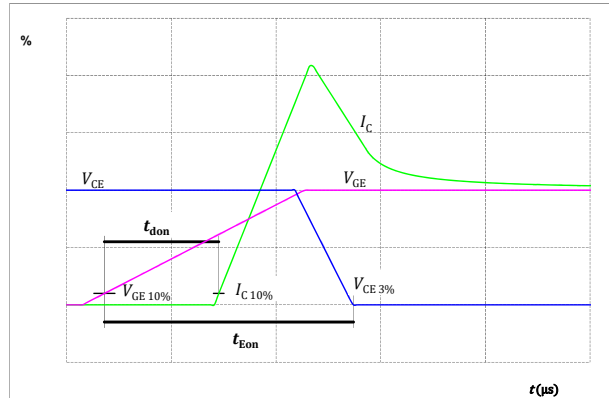


figure 55. IGBT

Turn-off Switching Waveforms & definition of t_f

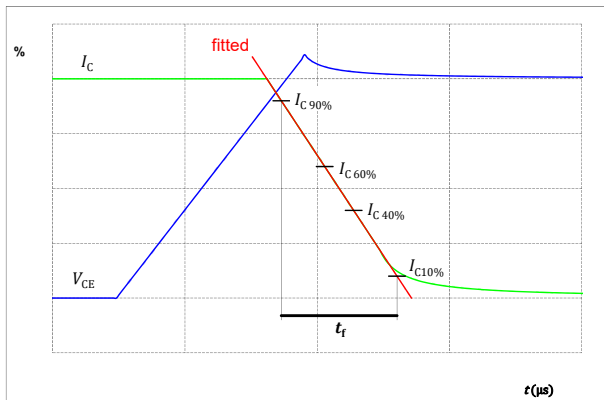
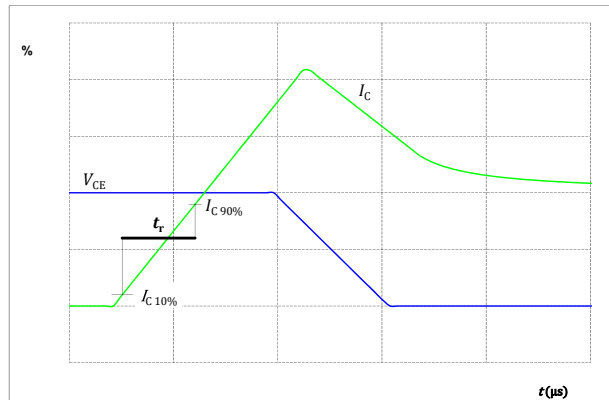


figure 56. IGBT

Turn-on Switching Waveforms & definition of t_r





Switching Definitions

figure 57. FWD

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

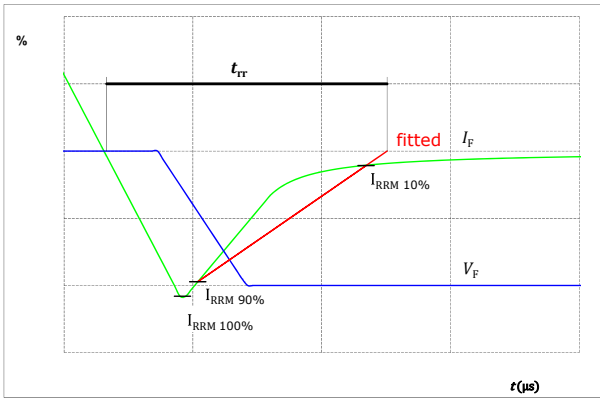
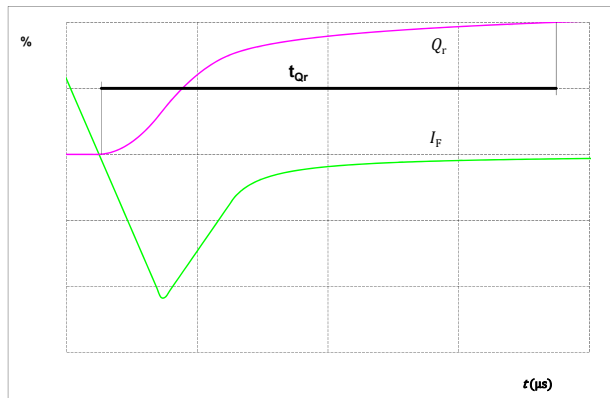


figure 58. FWD

Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)






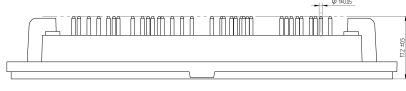
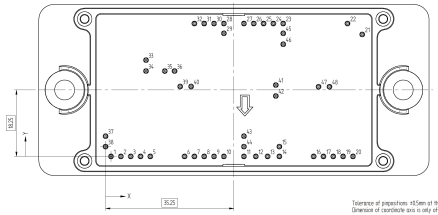
Vincotech

30-FT10NAA200S701-PE59F08
datasheet

Ordering Code	
Version	Ordering Code
Without thermal paste	30-FT10NAA200S701-PE59F08
With thermal paste (3,4 W/mK, PSX-P7)	30-FT10NAA200S701-PE59F08-/3/

Marking						
	Text	Name NN-NNNNNNNNNNNNNN- TTTTTVV	Date code WWYY	UL & VIN UL VIN	Lot LLLLL	Serial SSSS
	Datamatrix	Type&Ver TTTTTTTVV	Lot number LLLLL	Serial SSSS	Date code WWYY	

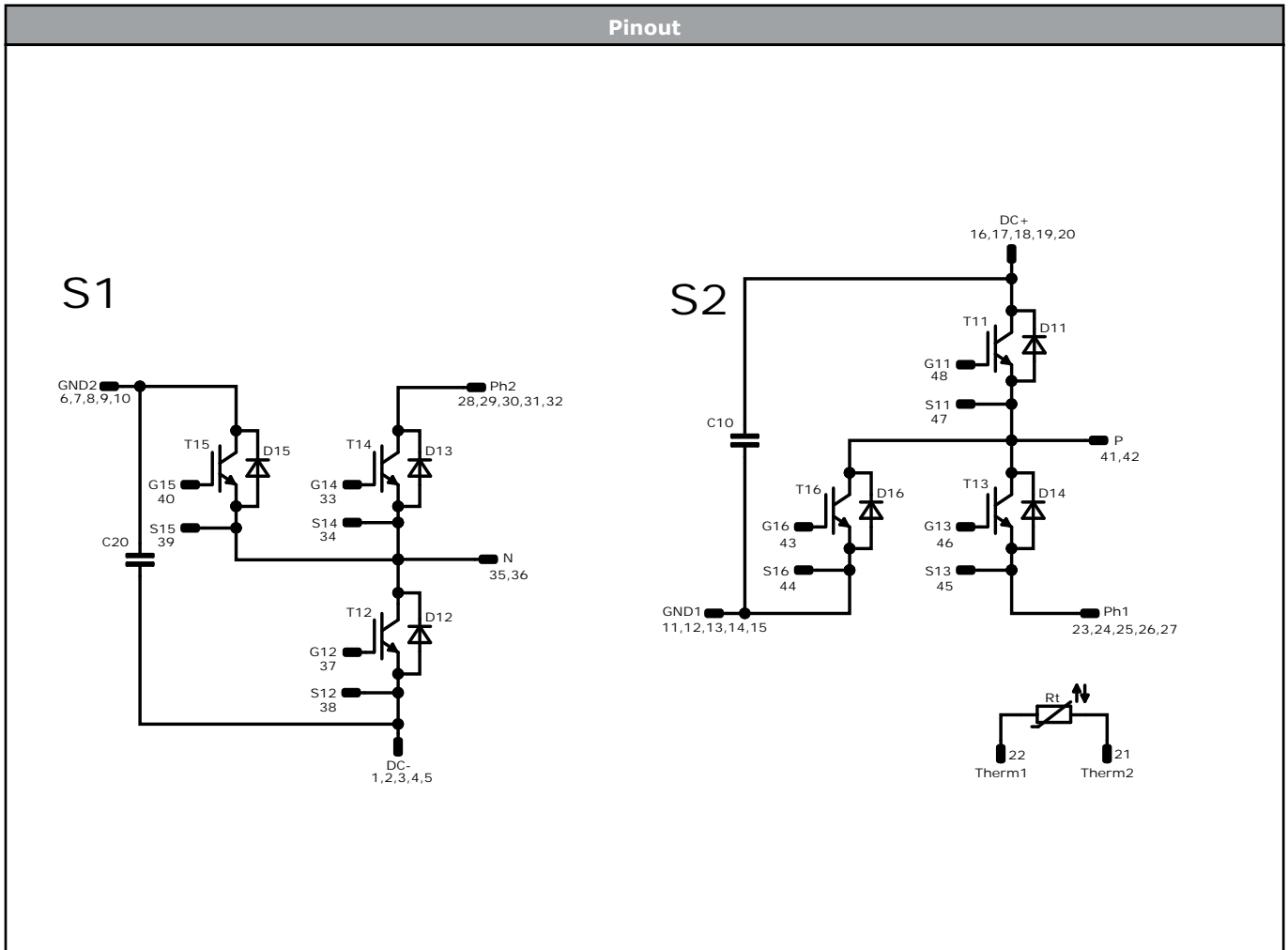
Outline							
Pin table [mm]							
Pin	X	Y	Function	25	43,4	36,5	Ph1
1	1,5	0	DC-	26	40,7	36,5	Ph1
2	4,2	0	DC-	27	38	36,5	Ph1
3	6,9	0	DC-	28	32,5	36,5	Ph2
4	9,6	0	DC-	29	32,5	33,8	Ph2
5	12,3	0	DC-	30	29,8	36,5	Ph2
6	21,7	0	GND2	31	27,1	36,5	Ph2
7	24,4	0	GND2	32	24,4	36,5	Ph2
8	27,1	0	GND2	33	11,1	26,45	G14
9	29,8	0	GND2	34	11,1	23,45	S14
10	32,5	0	GND2	35	16,25	23,45	N
11	38	0	GND1	36	18,95	23,45	N
12	41,25	0	GND1	37	0	5,55	G12
13	44,5	0	GND1	38	0	2,7	S12
14	47,75	0	GND1	39	20,5	19,2	S15
15	47,75	2,7	GND1	40	23,5	19,2	G15
16	57,15	0	DC+	41	46,75	19,6	P
17	59,85	0	DC+	42	46,75	16,6	P
18	62,55	0	DC+	43	38	5,55	G16
19	65,25	0	DC+	44	38	2,7	S16
20	67,95	0	DC+	45	48,8	33,8	S13
21	70,5	33,5	Therm2	46	48,8	30,8	G13
22	66,45	36,5	Therm1	47	58,5	19,15	S11
23	48,8	36,5	Ph1	48	61,5	19,15	G11
24	46,1	36,5	Ph1				

Dimension of package pins is only valid without separator



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Identification					
ID	Component	Voltage	Current	Function	Comment
T13, T14	IGBT	950 V	200 A	AC Switch	
D13, D14	FWD	950 V	200 A	AC Diode	
T15, T16	IGBT	950 V	200 A	Neutral Point Switch	
D12, D11	FWD	950 V	200 A	DC-Link Diode	
T11, T12	IGBT	950 V	200 A	DC-Link Switch	
D16, D15	FWD	950 V	200 A	Neutral Point Diode	
C10, C20	Capacitor	1000 V		Capacitor (DC)	
Rt	Thermistor			Thermistor	




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Packaging instruction				
Standard packaging quantity (SPQ) 36	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for <i>flow 2</i> packages see vincotech.com website.

Package data
Package data for <i>flow 2</i> packages see vincotech.com website.

Vincotech thermistor reference
See Vincotech thermistor reference table at 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
30-FT10NAA200S701-PE59F08-D1-14	23 Aug. 2022		

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1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.
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.