



flow3xANPFC 0

650 V / 30 A

Topology features

- 3ph Advanced Neutral PFC

Component features

- High efficiency in hard switching and resonant topologies
- High speed switching
- Low gate charge

Housing features

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

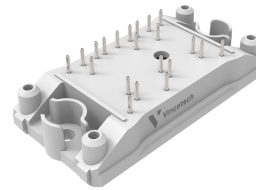
Target applications

- Embedded Drives
- Heat Pumps
- HVAC
- Industrial Drives

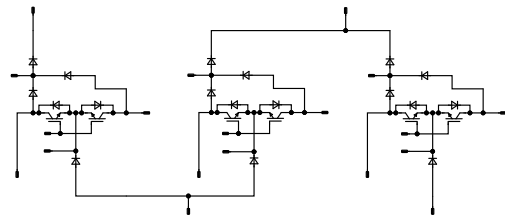
Types

- 10-FU073AA030SM-PF04H06

flow 0 12 mm housing



Schematic





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Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
Negative Neutral Point Switch				
Collector-emitter voltage	V_{CES}		650	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	27	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	90	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	48	W
Gate-emitter voltage	V_{GES}		± 20	V
Maximum junction temperature	T_{jmax}		175	°C
Positive Neutral Point Switch				
Collector-emitter voltage	V_{CES}		650	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	27	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	90	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	48	W
Gate-emitter voltage	V_{GES}		± 20	V
Maximum junction temperature	T_{jmax}		175	°C
Negative Boost Diode				
Peak repetitive reverse voltage	V_{RRM}		600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	38	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	60	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 25\text{ °C}$	330	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	45	W
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
Positive Boost Diode				
Peak repetitive reverse voltage	V_{RRM}		600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	38	A
Repetitive peak forward current	I_{FRM}	i_p limited by T_{jmax}	60	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 25\text{ °C}$	330	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	45	W
Maximum junction temperature	T_{jmax}		175	°C
Negative Neutral Point Diode				
Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	31	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	200	A
Surge current capability	I^2t		200	A ² s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	37	W
Maximum junction temperature	T_{jmax}		150	°C
Positive Neutral Point Diode				
Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	31	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	200	A
Surge current capability	I^2t		200	A ² s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	37	W
Maximum junction temperature	T_{jmax}		150	°C



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Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
Positive Boost Diode Protection Diode				
Peak repetitive reverse voltage	V_{RRM}		650	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	17	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	33	W
Maximum junction temperature	T_{jmax}		175	°C

Positive Boost Blocking Diode

Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	31	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	200	A
Surge current capability	I^2t		200	A ² s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	37	W
Maximum junction temperature	T_{jmax}		150	°C

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
Isolation voltage	V_{isol}	AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			>12,7	mm
Clearance			10,32	mm
Comparative Tracking Index	CTI		≥ 200	

*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_C [A]	T_j [°C]	Min	Typ	Max	

Negative Neutral Point Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0003	25	3,3	4	4,7	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		30	25 125 150		1,67 1,8 1,84	2,22 ⁽¹⁾	V
Collector-emitter cut-off current	I_{CES}		0	650		25			40	μA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}							1800		pF
Output capacitance	C_{oes}	$f = 1$ Mhz	0	25		25		45		pF
Reverse transfer capacitance	C_{res}							7		pF
Gate charge	Q_g	$V_{CC} = 520$ V	15		30	25		70		nC

Thermal

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

Turn-on delay time	$t_{d(on)}$					25 125 150		33,78 31,81 31,19		ns
Rise time	t_r					25 125 150		27,26 28,63 28,69		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		204,32 224,39 228,78		ns
Fall time	t_f					25 125 150		8,89 8,68 8,6		ns
Turn-on energy (per pulse)	E_{on}	$Q_{tFWD} = 0,542$ μC $Q_{tFWD} = 1,52$ μC $Q_{tFWD} = 1,87$ μC				25 125 150		0,686 1,07 1,18		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,255 0,317 0,347		mWs



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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	

Positive Neutral Point Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0003	25	3,3	4	4,7	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		30	25 125 150		1,67 1,8 1,84	2,22 ⁽¹⁾	V
Collector-emitter cut-off current	I_{CES}		0	650		25			40	μA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}							1800		pF
Output capacitance	C_{oes}	$f = 1$ Mhz	0	25		25		45		pF
Reverse transfer capacitance	C_{res}							7		pF
Gate charge	Q_g	$V_{CC} = 520$ V	15		30	25		70		nC

Thermal

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

Turn-on delay time	$t_{d(on)}$					25 125 150		34 31,12 30,91		ns
Rise time	t_r					25 125 150		34,57 35,51 35,19		ns
Turn-off delay time	$t_{d(off)}$		0/15	400	30	25 125 150		646,93 699,36 712,09		ns
Fall time	t_f					25 125 150		85,64 92,53 95,4		ns
Turn-on energy (per pulse)	E_{on}	$Q_{tFWD} = 0,516$ μC $Q_{tFWD} = 1,39$ μC $Q_{tFWD} = 1,7$ μC				25 125 150		0,701 1,06 1,18		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		1,18 1,2 1,24		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		
Negative Boost Diode										
Static										
Forward voltage	V_F				30	25 125 150		1,39 1,2 1,14	2 ⁽¹⁾	V
Reverse leakage current	I_R	$V_T = 600$ V				25			20	μA
Thermal										
Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						2,12		K/W
Dynamic										
Peak recovery current	I_{RM}					25 125 150		22,37 34,7 39,77		A
Reverse recovery time	t_{rr}					25 125 150		45,85 70,4 77,69		ns
Recovered charge	Q_r	$di/dt=1616$ A/μs $di/dt=1406$ A/μs $di/dt=1370$ A/μs	0/15	400	30	25 125 150		0,542 1,52 1,87		μC
Reverse recovered energy	E_{rec}					25 125 150		0,069 0,234 0,298		mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$					25 125 150		620,75 1316,54 1333,69		A/μs



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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		
Positive Boost Diode										
Static										
Forward voltage	V_F				30	25 125 150		1,39 1,2 1,14	2 ⁽¹⁾	V
Reverse leakage current	I_R	$V_i = 600$ V				25			20	μA
Thermal										
Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						2,12		K/W
Dynamic										
Peak recovery current	I_{RM}					25 125 150		20,13 32,83 37,54		A
Reverse recovery time	t_{rr}					25 125 150		44,55 67,28 74,54		ns
Recovered charge	Q_r	$di/dt=1226$ A/μs $di/dt=1138$ A/μs $di/dt=1163$ A/μs	0/15	400	30	25 125 150		0,516 1,39 1,7		μC
Reverse recovered energy	E_{rec}					25 125 150		0,068 0,21 0,264		mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$					25 125 150		702,76 1591,16 1552,43		A/μs



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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		

Negative Neutral Point Diode

Static

Forward voltage	V_F				18	25 125 150		1,11 1,03 1,02	1,5 ⁽¹⁾	V
Reverse leakage current	I_R	$V_r = 1600$ V				25 150			100 1000	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,87		K/W
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Positive Neutral Point Diode

Static

Forward voltage	V_F				18	25 125 150		1,11 1,03 1,02	1,5 ⁽¹⁾	V
Reverse leakage current	I_R	$V_r = 1600$ V				25 150			100 1000	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,87		K/W
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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		

Positive Boost Diode Protection Diode

Static

Forward voltage	V_F				10	25 125	1,23	1,67 1,56	1,87 ⁽¹⁾	V
Reverse leakage current	I_R	$V_r = 650$ V				25			0,14	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						2,87		K/W
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Positive Boost Blocking Diode

Static

Forward voltage	V_F				18	25 125 150		1,11 1,03 1,02	1,5 ⁽¹⁾	V
Reverse leakage current	I_R	$V_r = 1600$ V				25 150			100 1000	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,87		K/W
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⁽¹⁾ Value at chip level

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

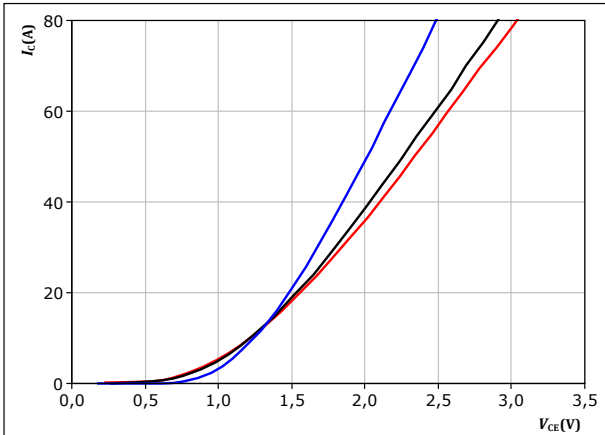


Negative Neutral Point Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

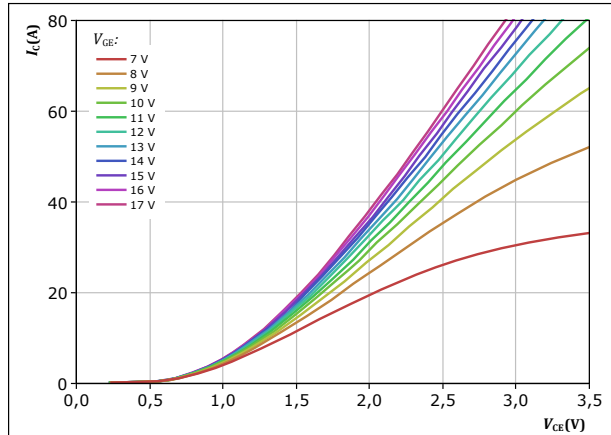


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j:$ — 25 °C
— 125 °C
— 150 °C

figure 2. IGBT

Typical output characteristics

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

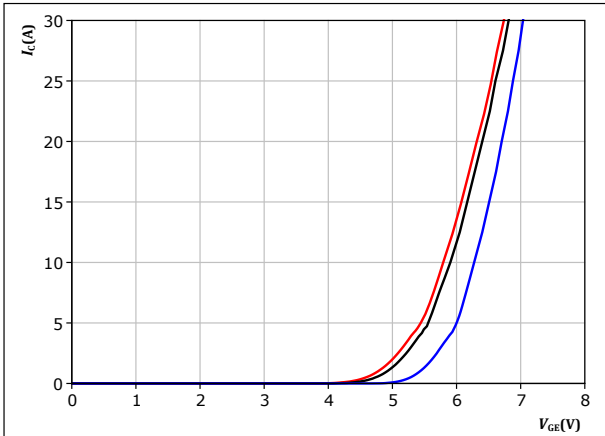


$t_p = 250 \mu s$
 $T_j = 150 \text{ °C}$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

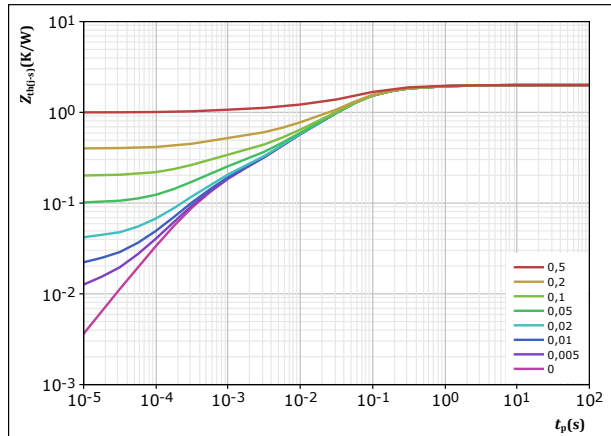


$t_p = 250 \mu s$
 $V_{CE} = 10 V$
 $T_j:$ — 25 °C
— 125 °C
— 150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,997 \text{ K/W}$
IGBT thermal model values

R (K/W)	τ (s)
1,14E-01	1,42E+00
3,93E-01	1,82E-01
1,10E+00	4,78E-02
2,59E-01	5,78E-03
1,35E-01	4,53E-04

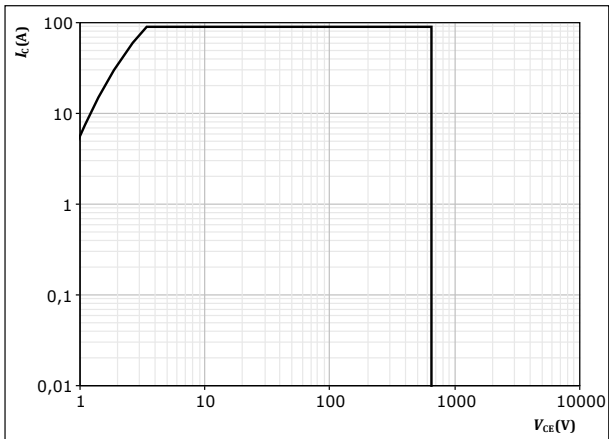


Negative Neutral Point Switch Characteristics

figure 5. IGBT

Safe operating area

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

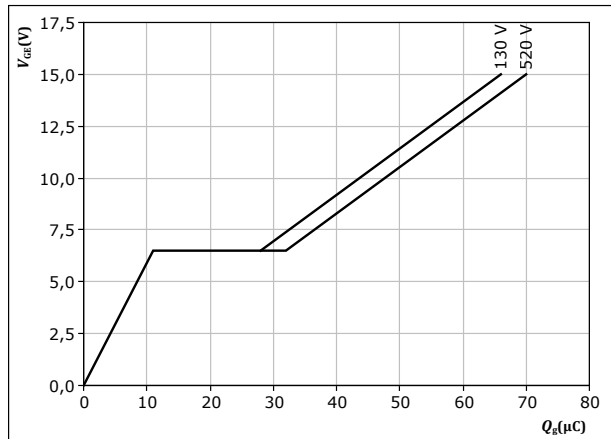


$D =$ single pulse
 $T_s = 80$ °C
 $V_{GE} = 15$ V
 $T_j = T_{jmax}$

figure 6. IGBT

Gate voltage vs gate charge

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



$I_C = 30$ A
 $T_j = 25$ °C

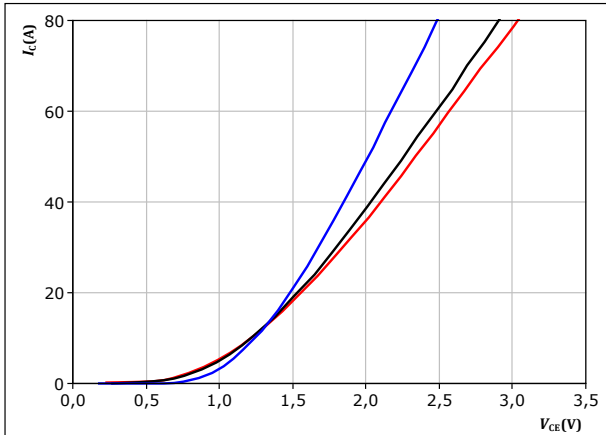


Positive Neutral Point Switch Characteristics

figure 7. IGBT

Typical output characteristics

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



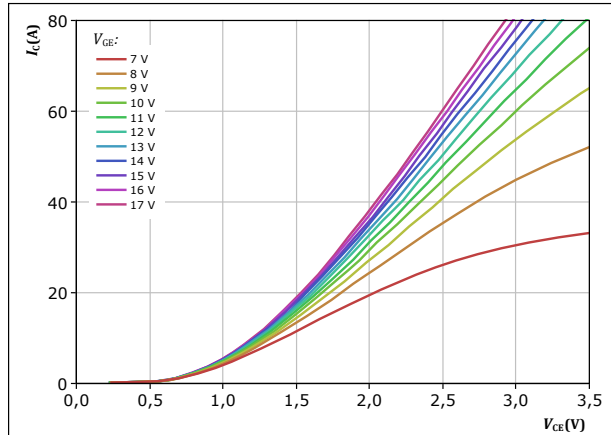
$t_p = 250 \mu s$
 $V_{GE} = 15 V$

T_j : 25 °C
125 °C
150 °C

figure 8. IGBT

Typical output characteristics

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

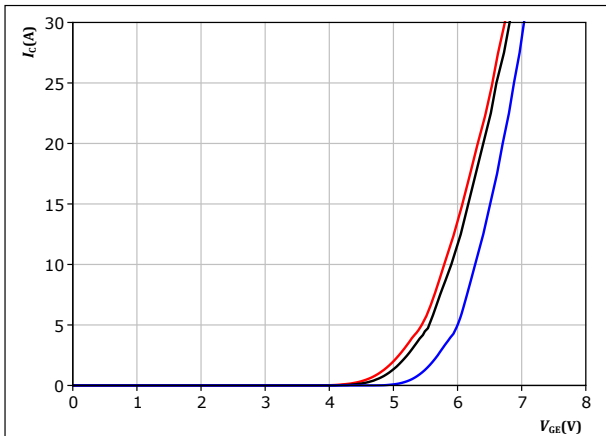


$t_p = 250 \mu s$
 $T_j = 150 \text{ °C}$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 9. IGBT

Typical transfer characteristics

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



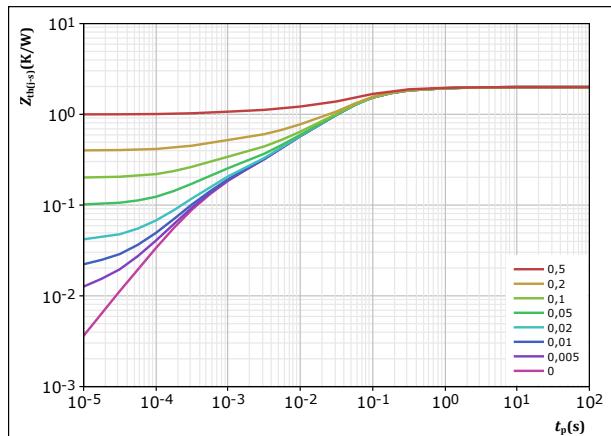
$t_p = 250 \mu s$
 $V_{CE} = 10 V$

T_j : 25 °C
125 °C
150 °C

figure 10. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,997 \text{ K/W}$

IGBT thermal model values

R (K/W)	τ (s)
1,14E-01	1,42E+00
3,93E-01	1,82E-01
1,10E+00	4,78E-02
2,59E-01	5,78E-03
1,35E-01	4,53E-04

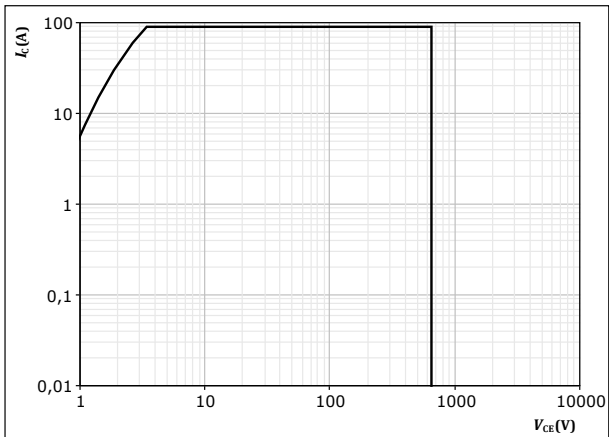


Positive Neutral Point Switch Characteristics

figure 11. IGBT

Safe operating area

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

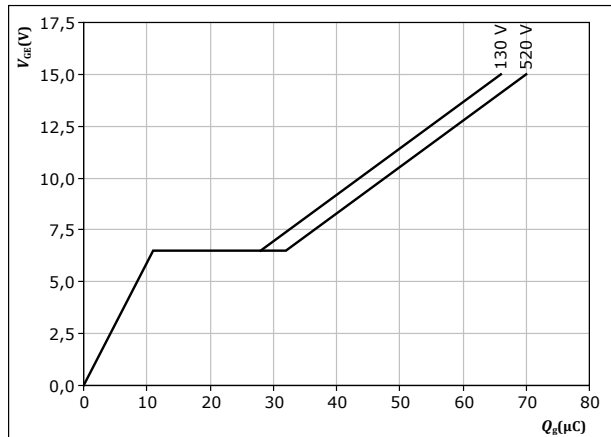


$D =$ single pulse
 $T_s = 80$ °C
 $V_{GE} = 15$ V
 $T_j = T_{jmax}$

figure 12. IGBT

Gate voltage vs gate charge

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



$I_C = 30$ A
 $T_j = 25$ °C



Negative Boost Diode Characteristics

figure 13. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

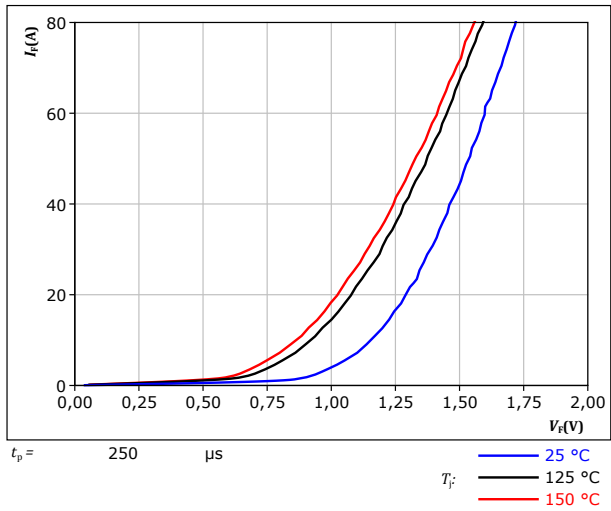
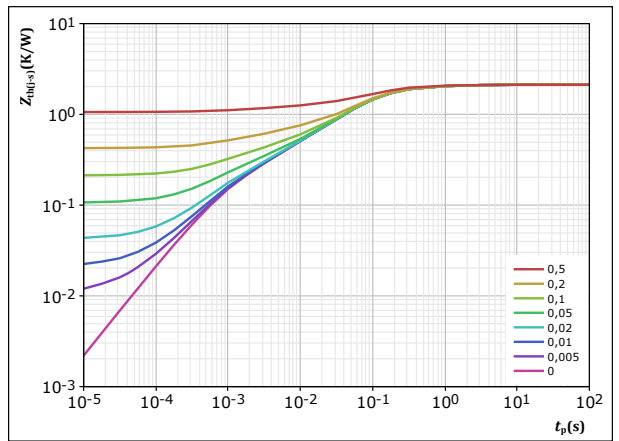


figure 14. FWD

Transient thermal impedance as a function of pulse width

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



$D =$	t_p / T	
$R_{th(j-s)} =$	2,12	K/W
FWD thermal model values		
R (K/W)	τ (s)	
1,00E-01	1,94E+00	
3,45E-01	3,11E-01	
1,29E+00	7,10E-02	
2,38E-01	7,05E-03	
1,48E-01	8,81E-04	



Positive Boost Diode Characteristics

figure 15. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

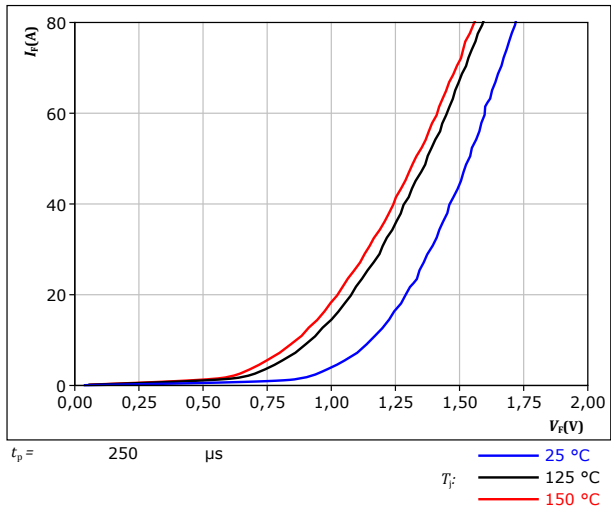
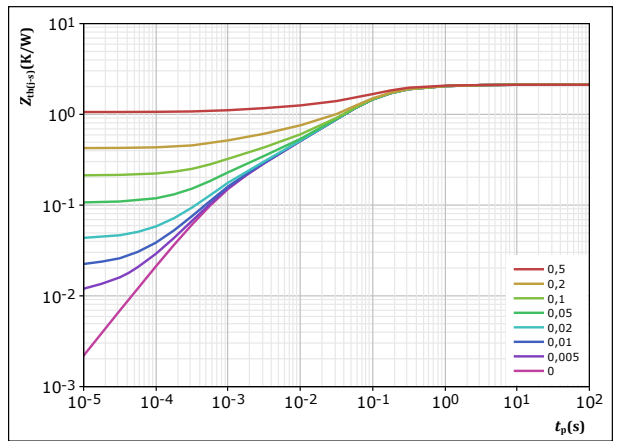


figure 16. FWD

Transient thermal impedance as a function of pulse width

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



$D = \frac{t_p}{T}$
 $R_{th(j-s)} = 2,12 \text{ K/W}$
 FWD thermal model values

R (K/W)	τ (s)
1,00E-01	1,94E+00
3,45E-01	3,11E-01
1,29E+00	7,10E-02
2,38E-01	7,05E-03
1,48E-01	8,81E-04



Negative Neutral Point Diode Characteristics

figure 17. Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

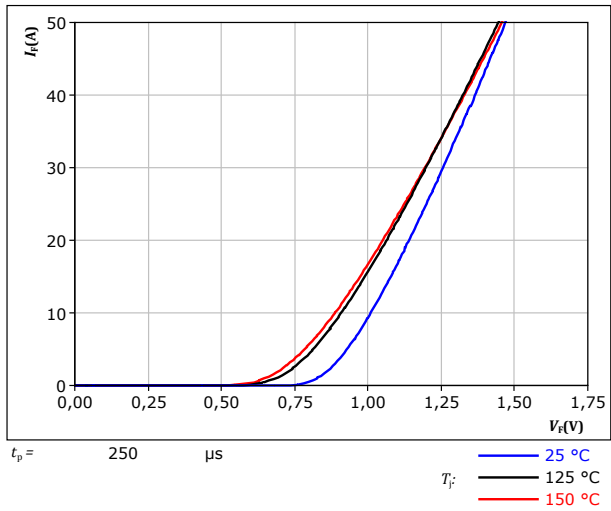
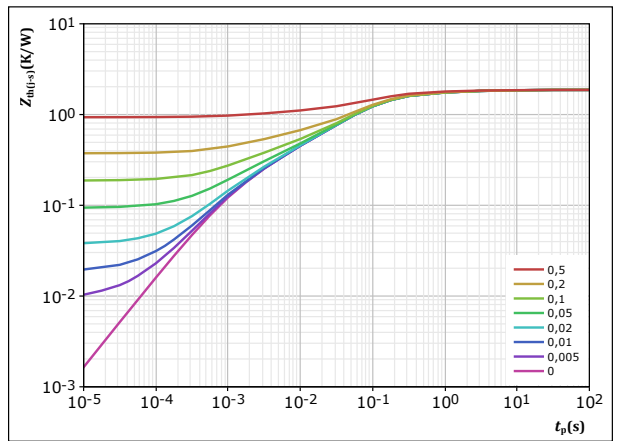


figure 18. Rectifier

Transient thermal impedance as a function of pulse width

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



$D = \frac{t_p}{T}$
 $R_{th(j-s)} = 1,869$ K/W
 Rectifier thermal model values

R (K/W)	τ (s)
5,65E-02	8,90E+00
1,70E-01	1,08E+00
6,15E-01	1,58E-01
6,94E-01	5,21E-02
2,16E-01	6,16E-03
1,19E-01	1,06E-03



Positive Neutral Point Diode Characteristics

figure 19. Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

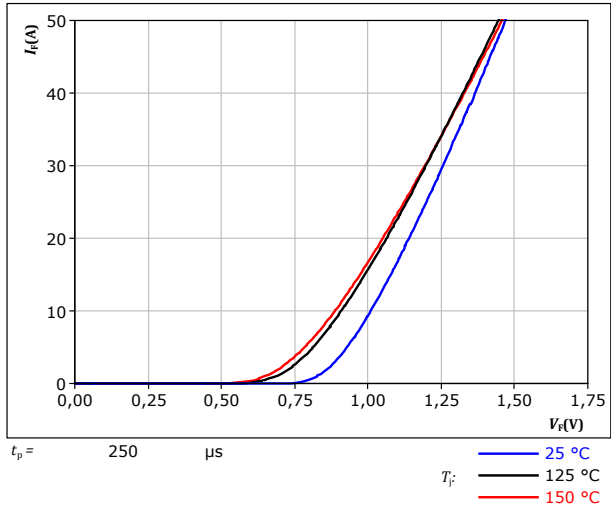
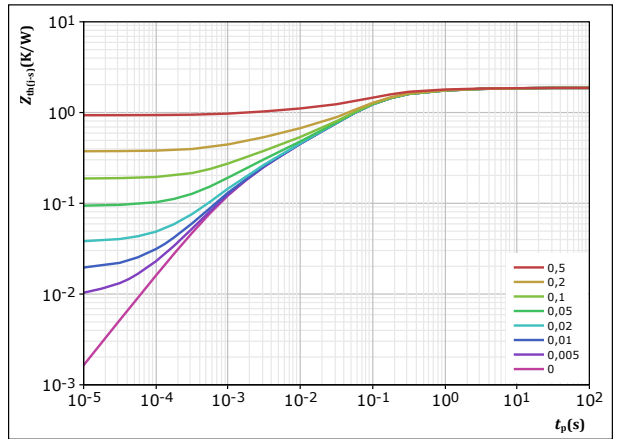


figure 20. Rectifier

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,869$ K/W
 Rectifier thermal model values

R (K/W)	τ (s)
5,65E-02	8,90E+00
1,70E-01	1,08E+00
6,15E-01	1,58E-01
6,94E-01	5,21E-02
2,16E-01	6,16E-03
1,19E-01	1,06E-03

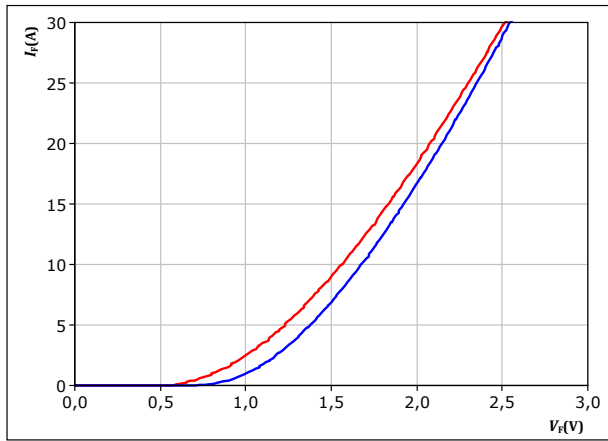


Positive Boost Diode Protection Diode Characteristics

figure 21. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

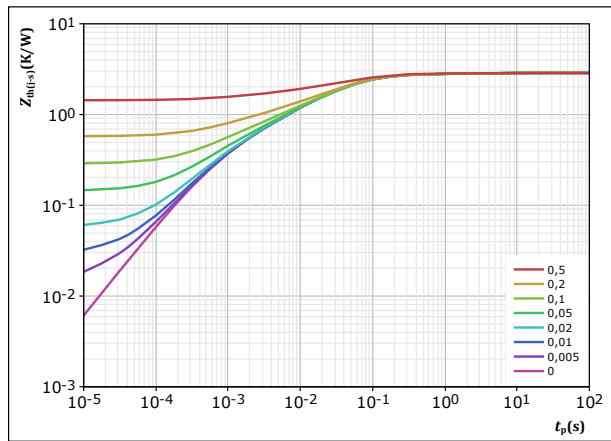


$t_p = 250 \mu s$
 $T_j: 25 \text{ }^\circ\text{C}$ (blue), $125 \text{ }^\circ\text{C}$ (red)

figure 22. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 2,873 \text{ K/W}$
FWD thermal model values

R (K/W)	τ (s)
6,53E-02	3,94E+00
1,48E-01	4,48E-01
1,31E+00	5,96E-02
7,32E-01	1,36E-02
4,04E-01	2,79E-03
2,11E-01	5,37E-04



Positive Boost Blocking Diode Characteristics

figure 23. Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

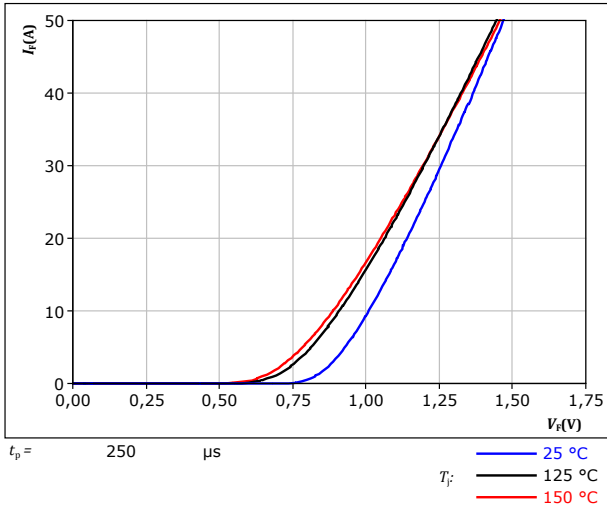
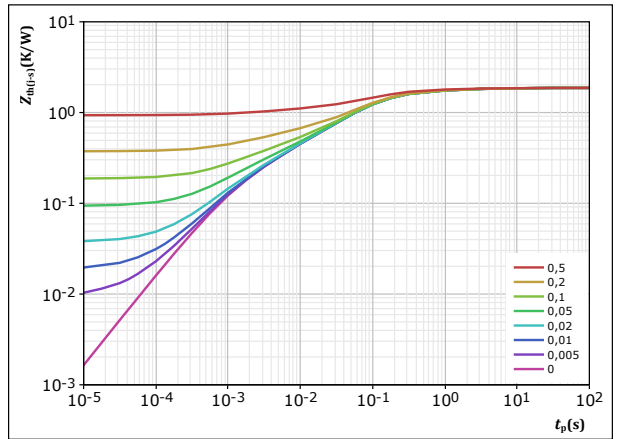


figure 24. Rectifier

Transient thermal impedance as a function of pulse width

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



$D = \frac{t_p}{T}$
 $R_{th(j-s)} = 1,869 \text{ K/W}$
 Rectifier thermal model values

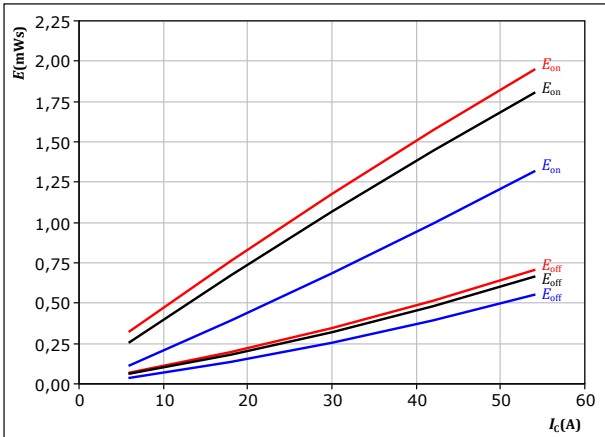
R (K/W)	τ (s)
5,65E-02	8,90E+00
1,70E-01	1,08E+00
6,15E-01	1,58E-01
6,94E-01	5,21E-02
2,16E-01	6,16E-03
1,19E-01	1,06E-03



Negative Neutral Point Switching Characteristics

figure 25. IGBT

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

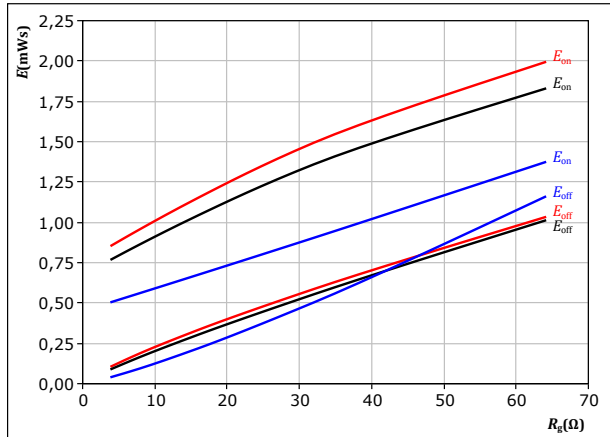


With an inductive load at
 $V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 16$ Ω
 $R_{goff} = 16$ Ω

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 26. IGBT

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

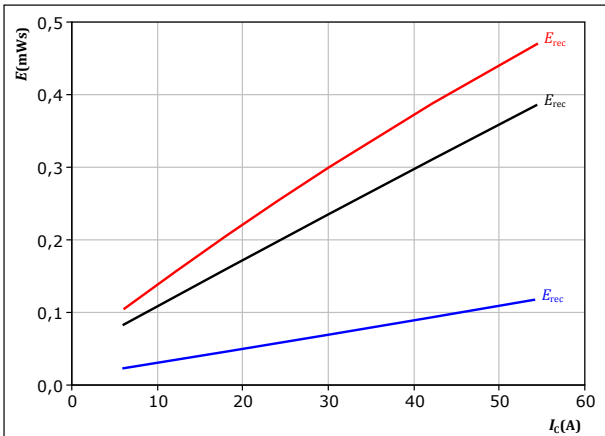


With an inductive load at
 $V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $I_c = 30$ A

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 27. FWD

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

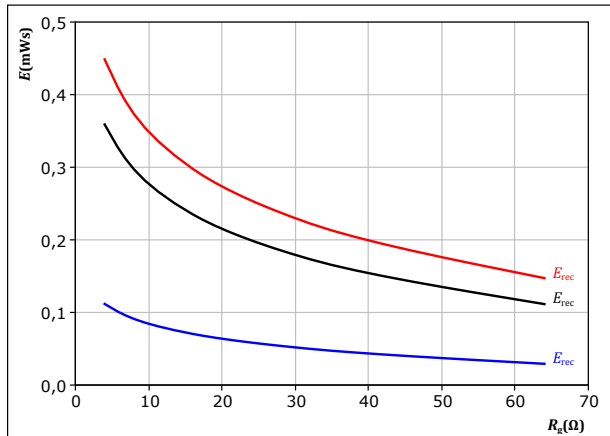


With an inductive load at
 $V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 16$ Ω

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 28. 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
 $V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $I_c = 30$ A

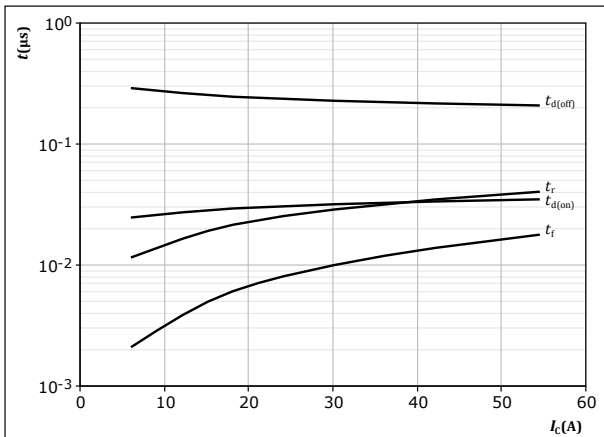
T_j :
— 25 °C
— 125 °C
— 150 °C



Negative Neutral Point Switching Characteristics

figure 29. IGBT

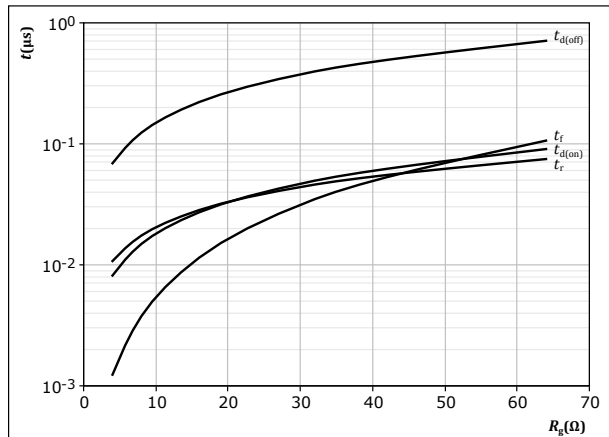
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 150 \text{ }^\circ\text{C}$
 $V_{CE} = 400 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $R_{gon} = 16 \text{ } \Omega$
 $R_{goff} = 16 \text{ } \Omega$

figure 30. IGBT

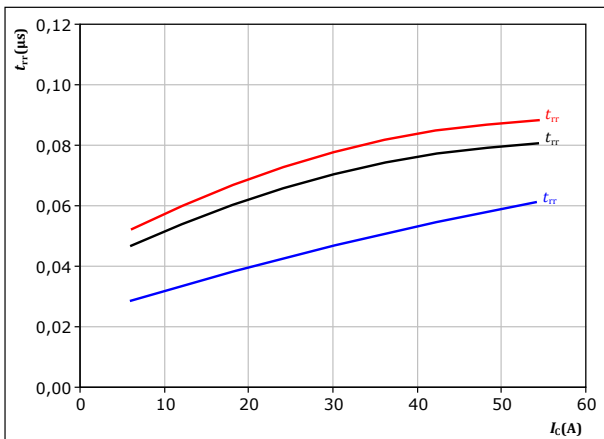
Typical switching times as a function of IGBT turn on gate resistor
 $t = f(R_g)$



With an inductive load at
 $T_j = 150 \text{ }^\circ\text{C}$
 $V_{CE} = 400 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $I_c = 30 \text{ A}$

figure 31. FWD

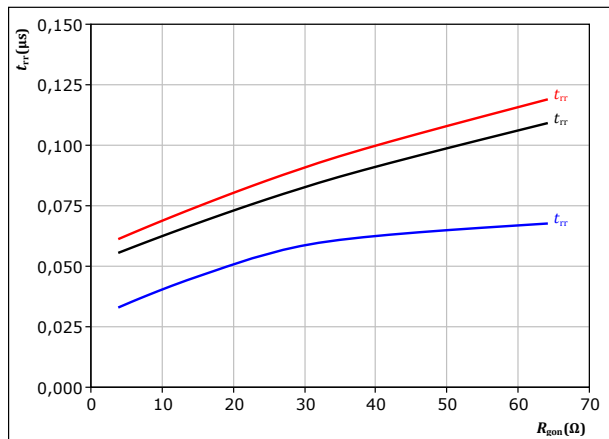
Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at
 $V_{CE} = 400 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $R_{gon} = 16 \text{ } \Omega$
 $T_j:$ — 25 °C
 — 125 °C
 — 150 °C

figure 32. FWD

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



With an inductive load at
 $V_{CE} = 400 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $I_c = 30 \text{ A}$
 $T_j:$ — 25 °C
 — 125 °C
 — 150 °C

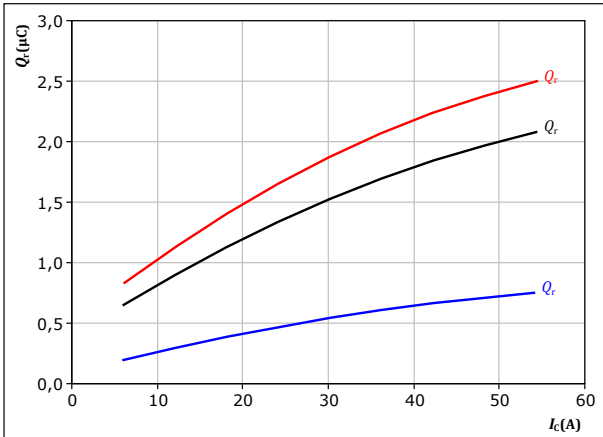


Negative Neutral Point Switching Characteristics

figure 33. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



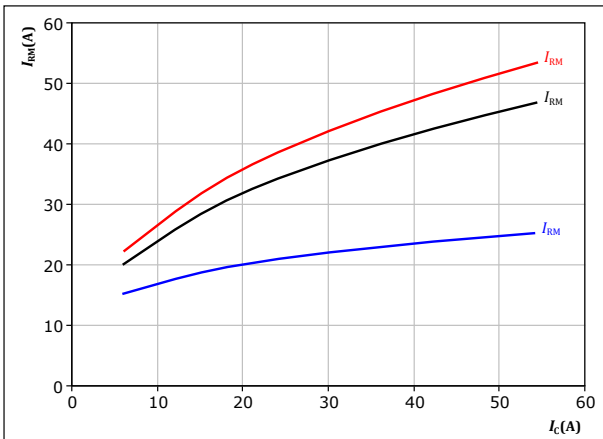
With an inductive load at

$V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 16$ Ω
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 35. FWD

Typical peak reverse recovery current as a function of collector current

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



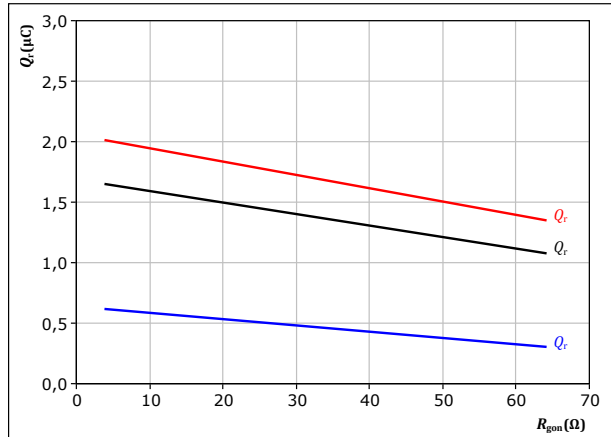
With an inductive load at

$V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 16$ Ω
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 34. FWD

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

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



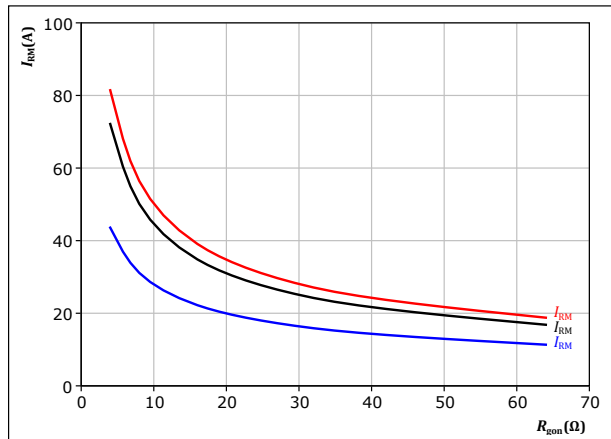
With an inductive load at

$V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $I_c = 30$ A
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 36. 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

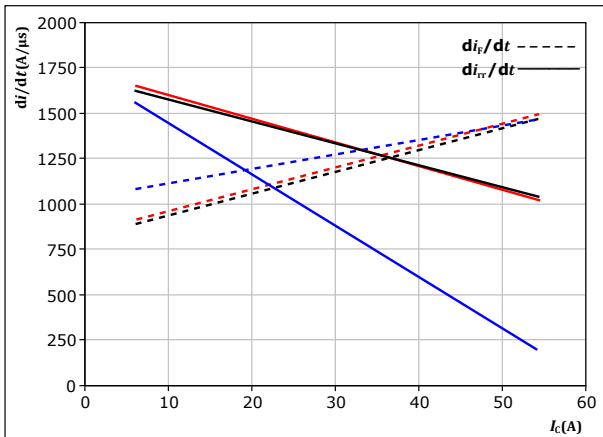
$V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $I_c = 30$ A
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)



Negative Neutral Point Switching Characteristics

figure 37. FWD

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

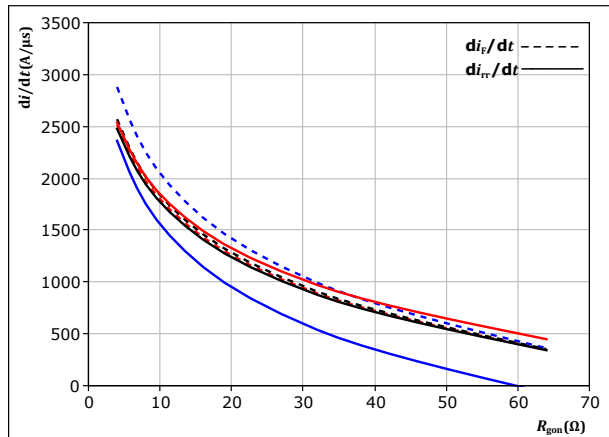


With an inductive load at
 $V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 16$ Ω

T_j : — 25 °C
 — 125 °C
 — 150 °C

figure 38. FWD

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

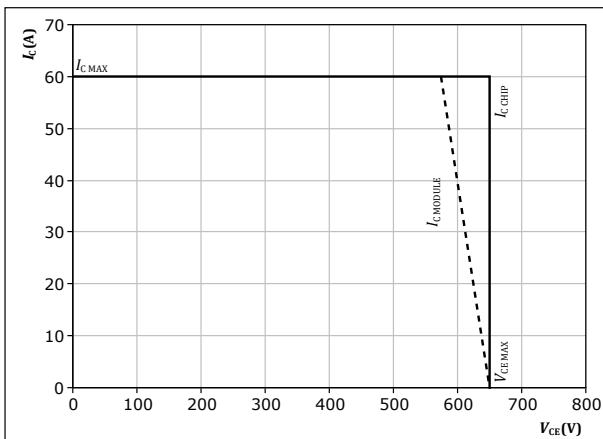


With an inductive load at
 $V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $I_c = 30$ A

T_j : — 25 °C
 — 125 °C
 — 150 °C

figure 39. IGBT

Reverse bias safe operating area
 $I_c = f(V_{CE})$



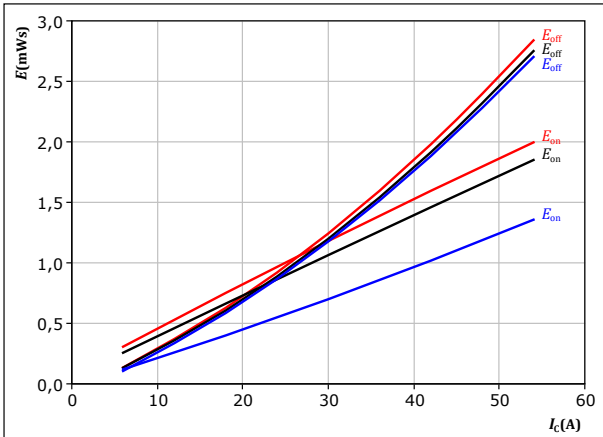
At $T_j = 150$ °C
 $R_{gon} = 16$ Ω
 $R_{goff} = 16$ Ω



Positive Neutral Point Switching Characteristics

figure 40. IGBT

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

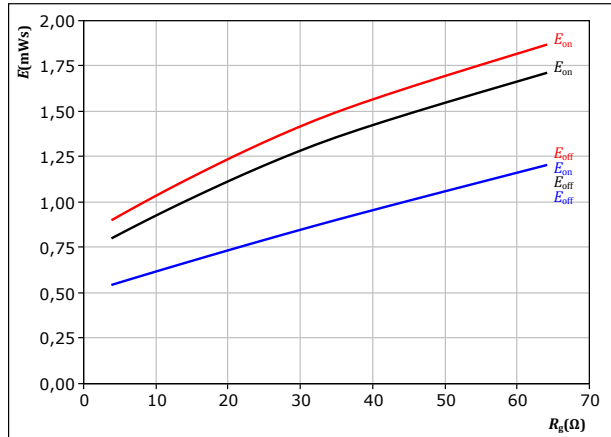


With an inductive load at
 $V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $R_{g(on)} = 16$ Ω
 $R_{g(off)} = 64$ Ω

T_j : — 25 °C
— 125 °C
— 150 °C

figure 41. IGBT

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

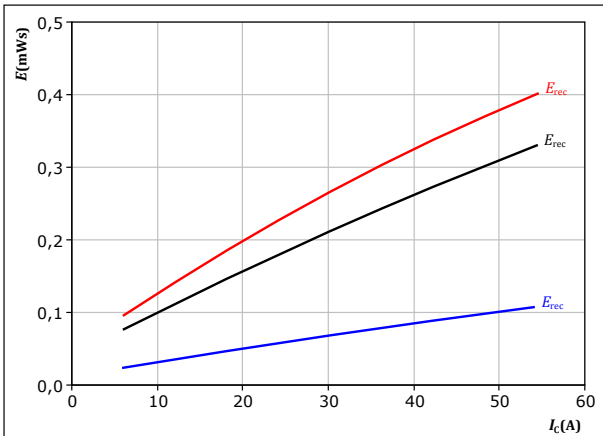


With an inductive load at
 $V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $I_c = 30$ A

T_j : — 25 °C
— 125 °C
— 150 °C

figure 42. FWD

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

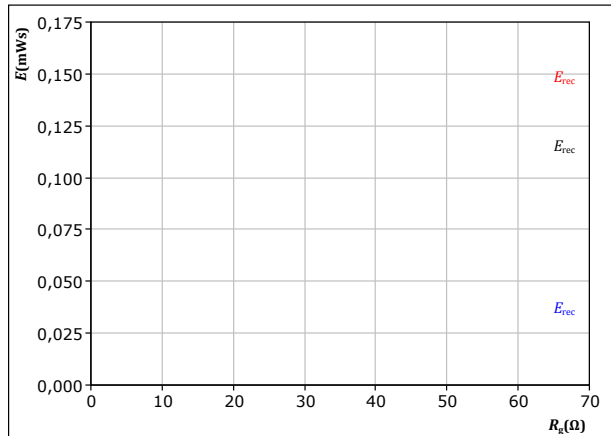


With an inductive load at
 $V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $R_{g(on)} = 16$ Ω

T_j : — 25 °C
— 125 °C
— 150 °C

figure 43. 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
 $V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $I_c = 30$ A

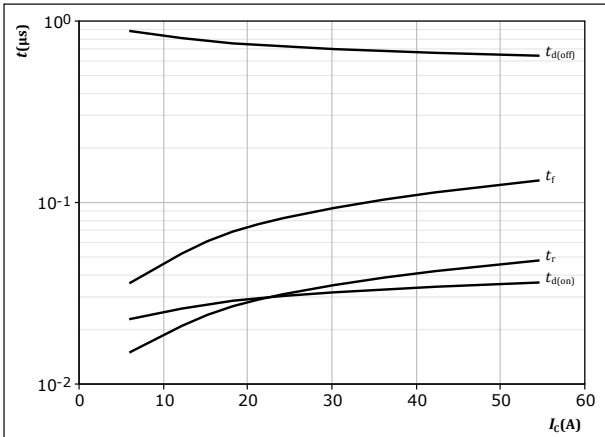
T_j : — 25 °C
— 125 °C
— 150 °C



Positive Neutral Point Switching Characteristics

figure 44. IGBT

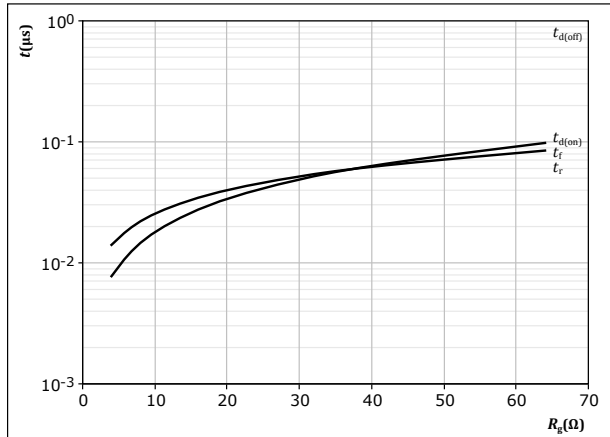
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 150 \text{ }^\circ\text{C}$
 $V_{CE} = 400 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $R_{gon} = 16 \text{ } \Omega$
 $R_{goff} = 64 \text{ } \Omega$

figure 45. IGBT

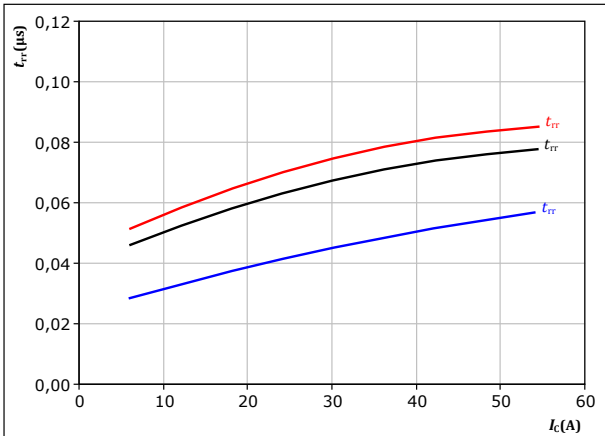
Typical switching times as a function of IGBT turn on gate resistor
 $t = f(R_g)$



With an inductive load at
 $T_j = 150 \text{ }^\circ\text{C}$
 $V_{CE} = 400 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $I_c = 30 \text{ A}$

figure 46. FWD

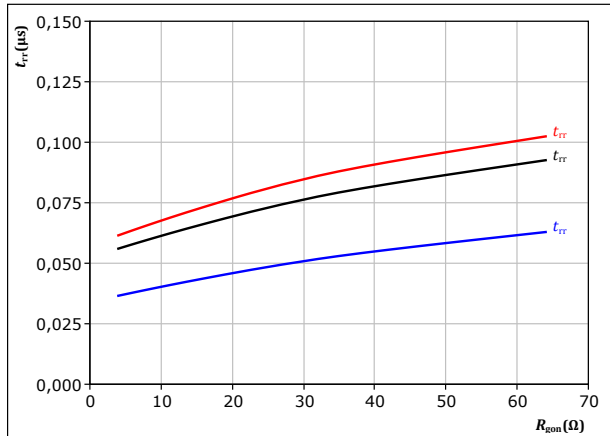
Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at
 $V_{CE} = 400 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $R_{gon} = 16 \text{ } \Omega$
 $T_j:$ — 25 °C
— 125 °C
— 150 °C

figure 47. FWD

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



With an inductive load at
 $V_{CE} = 400 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $I_c = 30 \text{ A}$
 $T_j:$ — 25 °C
— 125 °C
— 150 °C

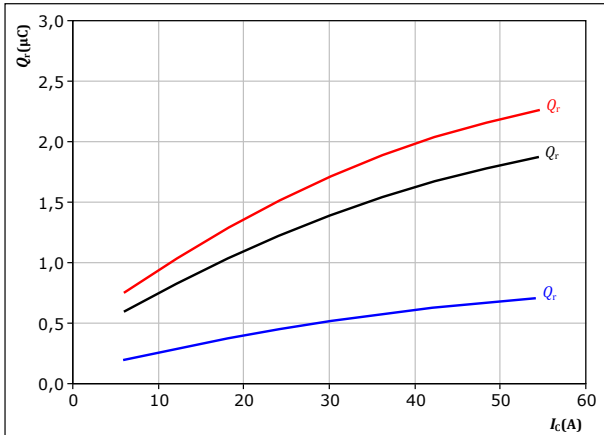


Positive Neutral Point Switching Characteristics

figure 48. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



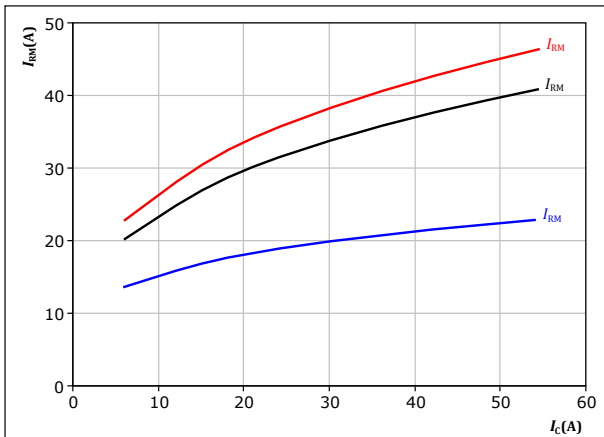
With an inductive load at

$V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 16$ Ω
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 50. FWD

Typical peak reverse recovery current as a function of collector current

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



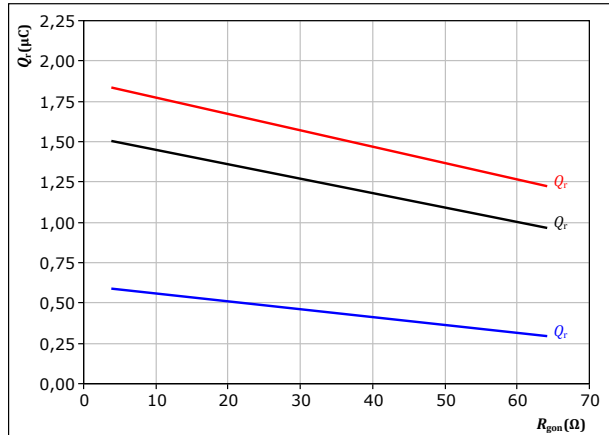
With an inductive load at

$V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 16$ Ω
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 49. FWD

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

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



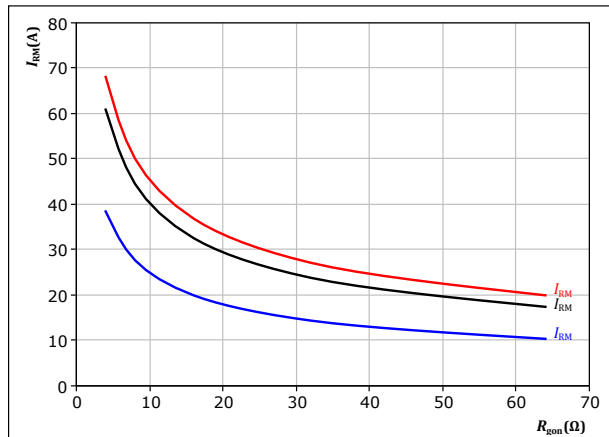
With an inductive load at

$V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $I_c = 30$ A
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 51. 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

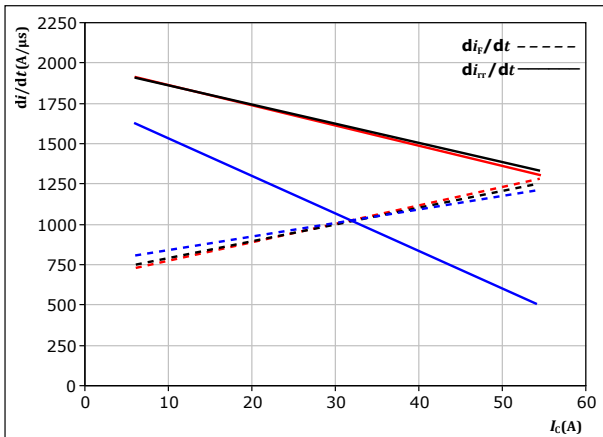
$V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $I_c = 30$ A
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)



Positive Neutral Point Switching Characteristics

figure 52. FWD

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

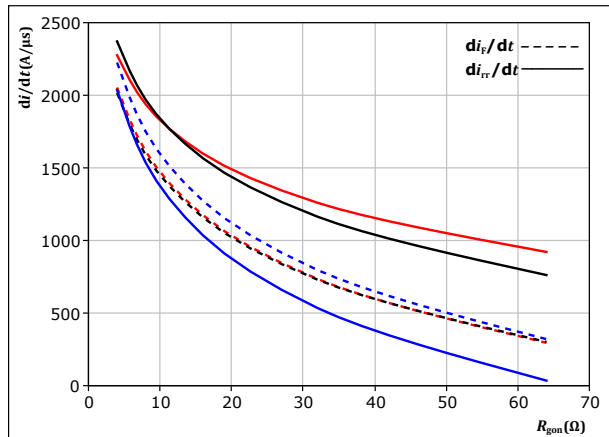


With an inductive load at
 $V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 16$ Ω

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 53. FWD

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

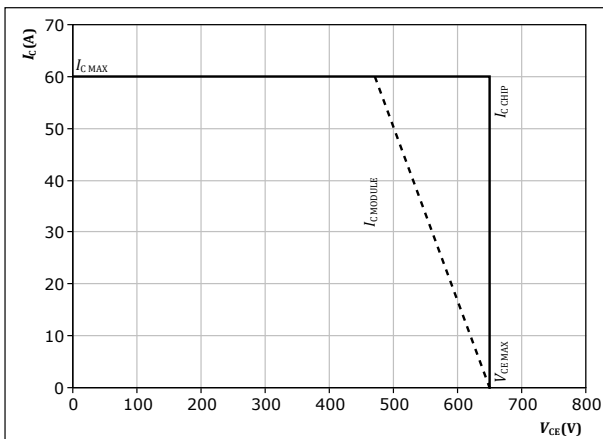


With an inductive load at
 $V_{CE} = 400$ V
 $V_{GE} = 0/15$ V
 $I_C = 30$ A

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 54. IGBT

Reverse bias safe operating area
 $I_C = f(V_{CE})$



At $T_j = 150$ °C
 $R_{gon} = 16$ Ω
 $R_{goff} = 64$ Ω



Switching Definitions

figure 55. IGBT

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

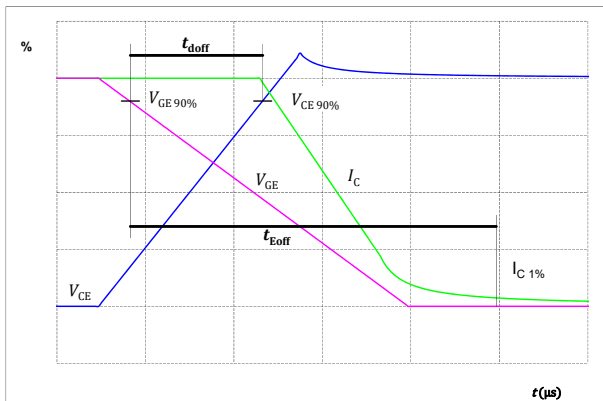


figure 56. IGBT

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

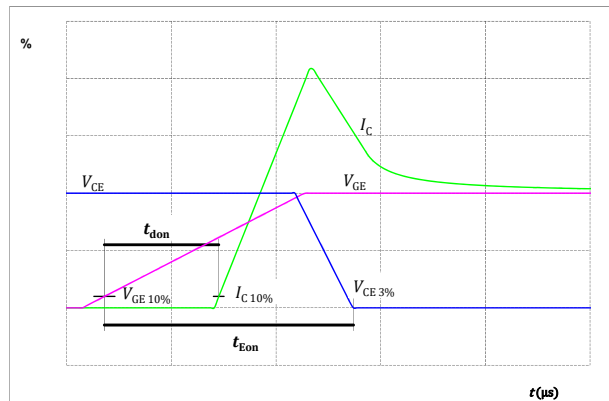


figure 57. IGBT

Turn-off Switching Waveforms & definition of t_f

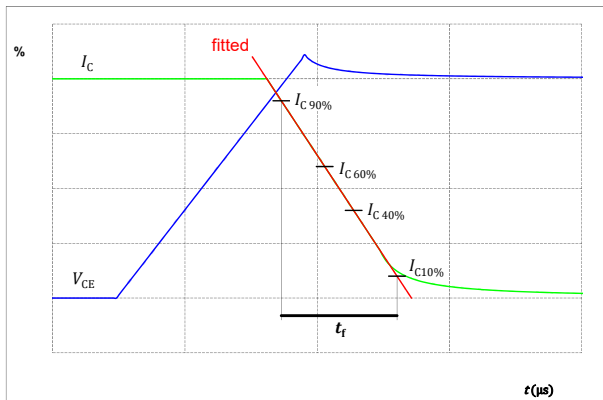
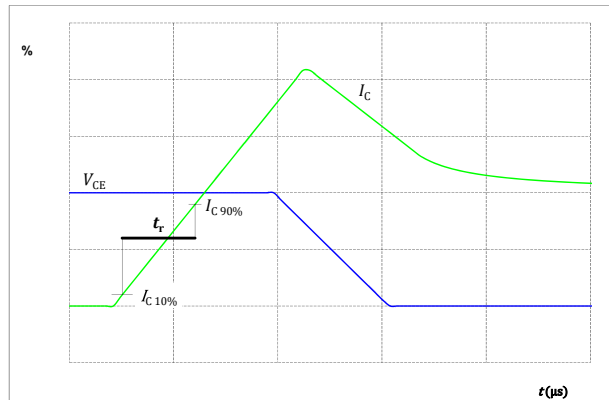


figure 58. IGBT

Turn-on Switching Waveforms & definition of t_r





Switching Definitions

figure 59. FWD

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

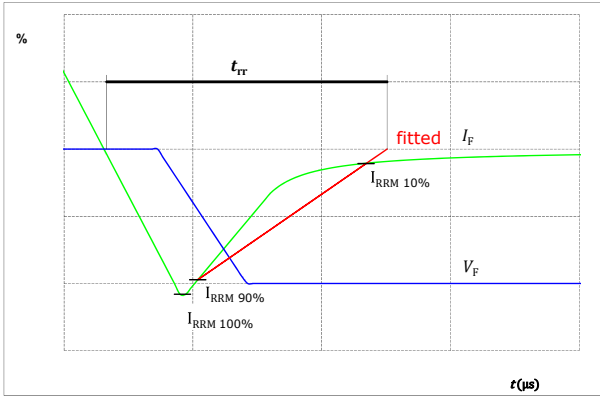
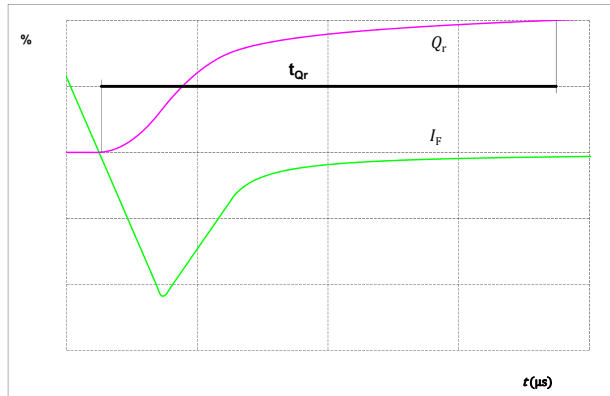


figure 60. FWD

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

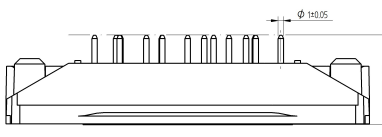
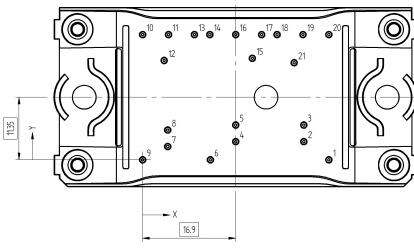




Ordering Code	
Version	Ordering Code
Without thermal paste	10-FU073AA030SM-PF04H06
With thermal paste (5,2 W/mK, PTM6000HV)	10-FU073AA030SM-PF04H06-/7/
With thermal paste (3,4 W/mK, PSX-P7)	10-FU073AA030SM-PF04H06-/3/

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

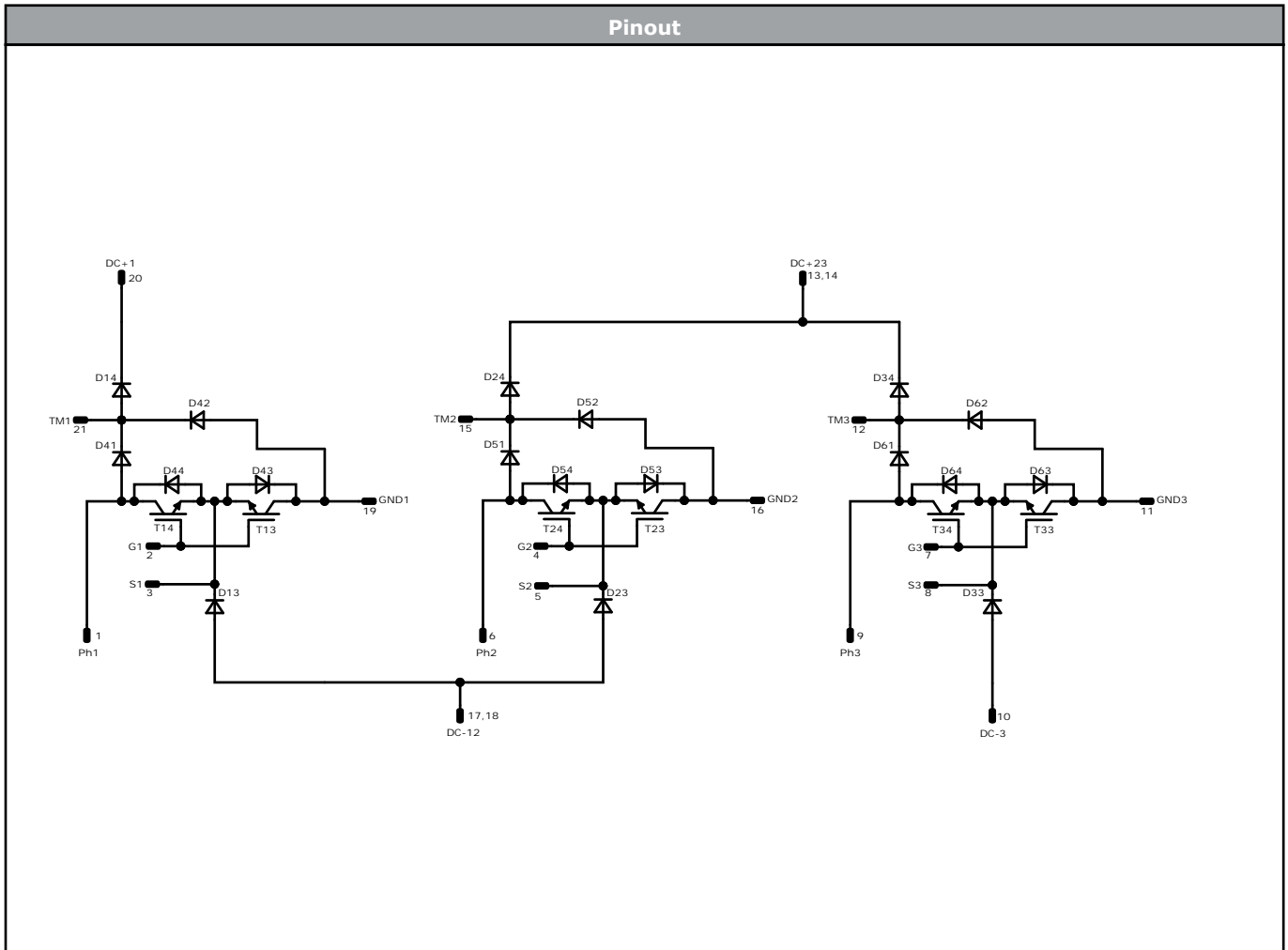
Outline			
Pin table [mm]			
Pin	X	Y	Function
1	33,8	0	Ph1
2	29,25	3,3	G1
3	29,25	6,3	S1
4	16,9	3,3	G2
5	16,9	6,3	S2
6	12,3	0	Ph2
7	4,55	2,4	G3
8	4,55	5,4	S3
9	0	0	Ph3
10	0	22,7	DC-3
11	4,7	22,7	GND3
12	3,9	18	TM3
13	9,4	22,7	DC+23
14	12,2	22,7	DC+23
15	19,9	18,4	TM2
16	16,9	22,7	GND2
17	21,6	22,7	DC-12
18	24,4	22,7	DC-12
19	29,1	22,7	GND1
20	33,8	22,7	DC+1
21	27,5	17,6	TM1

Tolerance of pinpositions: ±0.5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance



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Identification					
ID	Component	Voltage	Current	Function	Comment
T13, T23, T33	IGBT	650 V	30 A	Negative Neutral Point Switch	
T14, T24, T34	IGBT	650 V	30 A	Positive Neutral Point Switch	
D13, D23, D33	FWD	600 V	30 A	Negative Boost Diode	
D14, D24, D34	FWD	600 V	30 A	Positive Boost Diode	
D43, D53, D63	Rectifier	1600 V	18 A	Negative Neutral Point Diode	
D44, D54, D64	Rectifier	1600 V	18 A	Positive Neutral Point Diode	
D42, D52, D62	FWD	650 V	10 A	Positive Boost Diode Protection Diode	
D41, D51, D61	Rectifier	1600 V	18 A	Positive Boost Blocking Diode	




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

Handling instruction
Handling instructions for <i>flow 0</i> packages see vincotech.com website.

Package data
Package data for <i>flow 0</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
10-FU073AA030SM-PF04H06-D1-14	11 Jul. 2022		

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.