



flowPIM E1

1200 V / 15 A

Topology features

- Common brake+Inverter DC+
- Converter+Brake+Inverter
- Open Emitter configuration
- Tandem diode
- Temperature sensor

Component features

- Easy paralleling
- Low turn-off losses
- Low collector emitter saturation voltage
- Positive temperature coefficient
- Short tail current
- Switching optimized for EMC

Housing features

- Base isolation: Al₂O₃
- Convex shaped substrate for superior thermal contact
- Compact housing
- CTI600 housing material
- Thermo-mechanical push-and-pull force relief
- Solder pin

Target applications

- Embedded Drives
- Industrial Drives

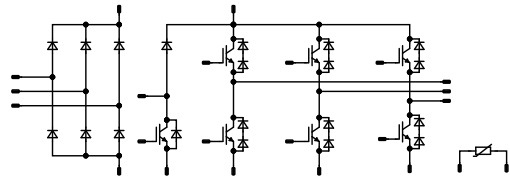
Types

- 10-E112PMA015M701-L928A73Z

flow E1 12 mm housing



Schematic





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Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s \leq 80\text{ °C}$	30 ⁽¹⁾	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	64	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$, $V_{CC} = 800\text{ V}$ $T_j = 150\text{ °C}$	9,5	μs
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

⁽¹⁾ limited by I_{CRM}

Inverter Diode

Peak repetitive reverse voltage	V_{RRM}		1300	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s \leq 80\text{ °C}$	30 ⁽²⁾	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	97	W
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

⁽²⁾ limited by I_{FRM}

Brake Switch

Collector-emitter voltage	V_{CES}		1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s \leq 80\text{ °C}$	30 ⁽³⁾	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	64	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$, $V_{CC} = 800\text{ V}$ $T_j = 150\text{ °C}$	9,5	μs
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

⁽³⁾ limited by I_{CRM}



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Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
Brake Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s \leq 80\text{ °C}$	20 ⁽⁴⁾	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	43	W
Maximum junction temperature	T_{jmax}		175	°C

⁽⁴⁾ limited by I_{FRM}

Brake Sw. Protection Diode

Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s \leq 80\text{ °C}$	10 ⁽⁵⁾	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	10	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	30	W
Maximum junction temperature	T_{jmax}		175	°C

⁽⁵⁾ limited by I_{FRM}

Rectifier Diode

Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	47	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	270	A
Surge current capability	I^2t		370	A ² s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	58	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
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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
Isolation voltage	V_{isol}	AC Voltage $t_p = 1\text{ min}$	3500	V
Creepage distance			>12,7	mm
Clearance			>12,7	mm
Comparative Tracking Index	CTI		≥ 600	

*100 % tested in production



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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		

Inverter Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,0015	25	5,4	6	6,6	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		15	25 125 150		1,7 1,95 2,01	2,1 ⁽⁶⁾	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			60	μA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}							2900		pF
Output capacitance	C_{oes}		0	10		25		120		pF
Reverse transfer capacitance	C_{res}							34		pF
Gate charge	Q_g	$V_{CC} = 600$ V	0/15		15	25		110		nC

Thermal

Thermal resistance junction to sink ⁽⁷⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,48		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		13,32 12,31 12,07		ns
Rise time	t_r					25 125 150		9,03 8,62 8,63		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		71,65 80,68 83,38		ns
Fall time	t_f					25 125 150		19,52 19,27 19,5		ns
Turn-on energy (per pulse)	E_{on}	$Q_{tFWD} = 0,268$ μC $Q_{tFWD} = 0,301$ μC $Q_{tFWD} = 0,308$ μC				25 125 150		0,491 0,455 0,448		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,278 0,297 0,308		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		
Inverter Diode										
Static										
Forward voltage	V_F			15	25 125 150		2,91 2,7 2,63	3,84 ⁽⁶⁾		V
Reverse leakage current	I_R	$V_r = 1300$ V			25			0,94		μA
Thermal										
Thermal resistance junction to sink ⁽⁷⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)					0,97			K/W
Dynamic										
Peak recovery current	I_{RM}				25 125 150		27,89 30,52 31,27			A
Reverse recovery time	t_{rr}				25 125 150		16,79 17,39 17,35			ns
Recovered charge	Q_r	$di/dt=4550$ A/μs $di/dt=4765$ A/μs $di/dt=4850$ A/μs	0/15	700	40	25 125 150	0,268 0,301 0,308			μC
Reverse recovered energy	E_{rec}				25 125 150		0,076 0,097 0,101			mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$				25 125 150		4464,75 4549,86 4392,02			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		

Brake Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,0015	25	5,4	6	6,6	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		15	25 125 150		1,7 1,95 2,01	2,1 ⁽⁶⁾	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			60	μA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}							2900		pF
Output capacitance	C_{oes}		0	10		25		120		pF
Reverse transfer capacitance	C_{res}							34		pF
Gate charge	Q_g	$V_{CC} = 600$ V	0/15		15	25		110		nC

Thermal

Thermal resistance junction to sink ⁽⁷⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,48		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		299,8 261,6 252,6		ns
Rise time	t_r					25 125 150		193,8 204,6 209,2		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		387,8 427,8 438,2		ns
Fall time	t_f					25 125 150		66,52 86,69 88,96		ns
Turn-on energy (per pulse)	E_{on}	$Q_{tFWD} = 1,11$ μC $Q_{tFWD} = 1,78$ μC $Q_{tFWD} = 2,04$ μC				25 125 150		2,5 3 3,19		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		1,12 1,44 1,54		mWs



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datasheet

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		
Brake Diode										
Static										
Forward voltage	V_F				10	25 125 150		1,61 1,69 1,7	1,9 ⁽⁶⁾	V
Reverse leakage current	I_R	$V_r = 1200$ V				25			25	μA
Thermal										
Thermal resistance junction to sink ⁽⁷⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						2,19		K/W
Dynamic										
Peak recovery current	I_{RM}	$di/dt=74$ A/μs $di/dt=65$ A/μs $di/dt=62$ A/μs	0/15	600	15	25 125 150		5,91 6,68 6,84		A
Reverse recovery time	t_{rr}					25 125 150		317,36 472,66 542,16		ns
Recovered charge	Q_r					25 125 150		1,11 1,78 2,04		μC
Reverse recovered energy	E_{rec}					25 125 150		0,368 0,644 0,753		mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$					25 125 150		40,15 27,59 23,82		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	

Brake Sw. Protection Diode

Static

Forward voltage	V_F				5	25 125 150		1,57 1,66 1,65	2,1 ⁽⁶⁾	V
Reverse leakage current	I_R	$V_r = 1200$ V				25			20	μA

Thermal

Thermal resistance junction to sink ⁽⁷⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						3,19		K/W
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Rectifier Diode

Static

Forward voltage	V_F				13	25 125		0,988 0,899	1,21 ⁽⁶⁾ 1,1 ⁽⁶⁾	V
Reverse leakage current	I_R	$V_r = 1600$ V				25			50	μA

Thermal

Thermal resistance junction to sink ⁽⁷⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,2		K/W
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Thermistor

Static

Rated resistance	R					25		5		kΩ
Deviation of R100	$A_{R/R}$	$R_{100} = 499$ Ω				100	3,2		3,3	%
Power dissipation	P					25		130		mW
Power dissipation constant	d					25		1,3		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %						3380		K
Vincotech Thermistor Reference									V	

⁽⁶⁾ Value at chip level

⁽⁷⁾ Only valid with pre-applied Vincotech thermal interface material.

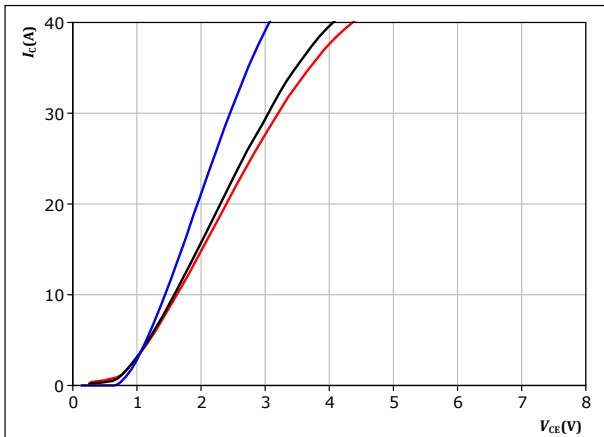


Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

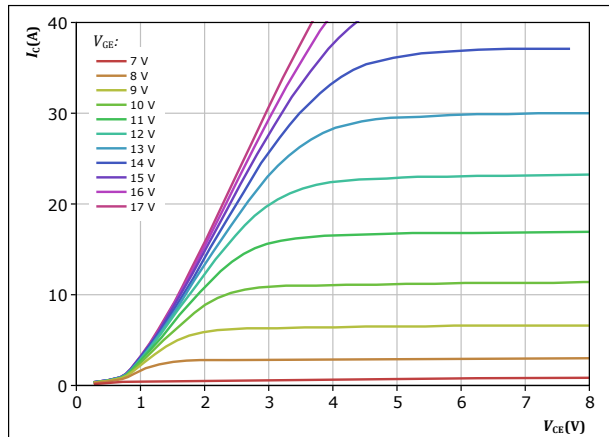


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 T_j : 25 °C, 125 °C, 150 °C

figure 2. IGBT

Typical output characteristics

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

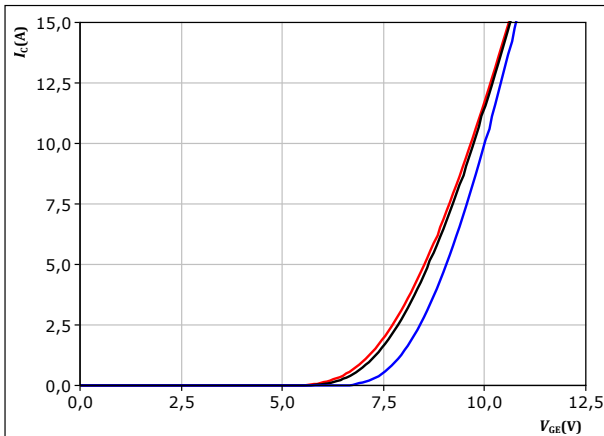


$t_p = 250 \mu s$
 $T_j = 150 \text{ °C}$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

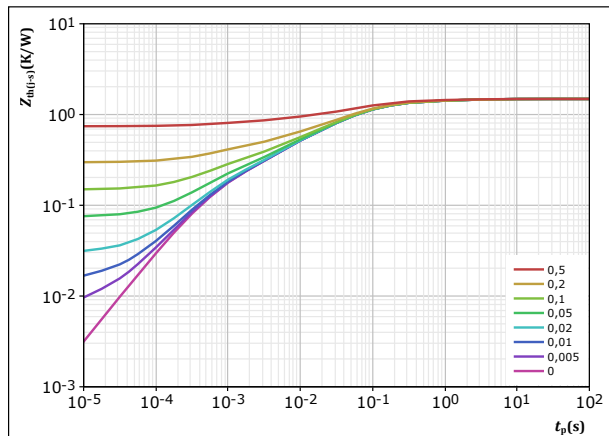


$t_p = 250 \mu s$
 $V_{CE} = 10 V$
 T_j : 25 °C, 125 °C, 150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,485 \text{ K/W}$
IGBT thermal model values

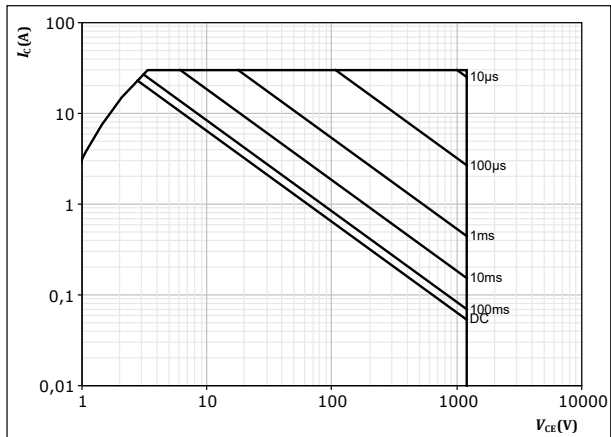
R (K/W)	τ (s)
4,90E-02	3,61E+00
1,10E-01	6,54E-01
4,70E-01	1,09E-01
4,98E-01	2,97E-02
2,21E-01	4,73E-03
1,37E-01	5,51E-04



Inverter Switch Characteristics

figure 5. IGBT

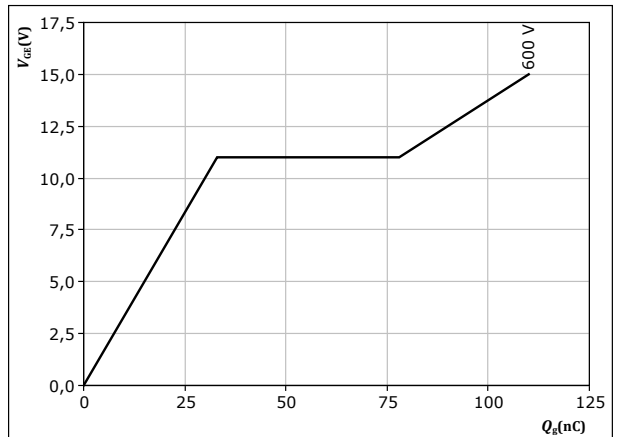
Safe operating area
 $I_C = f(V_{CE})$



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

figure 6. IGBT

Gate voltage vs gate charge
 $V_{GE} = f(Q_g)$



$I_C = 15$ A
 $T_j = 25$ °C



Inverter Diode Characteristics

figure 7. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

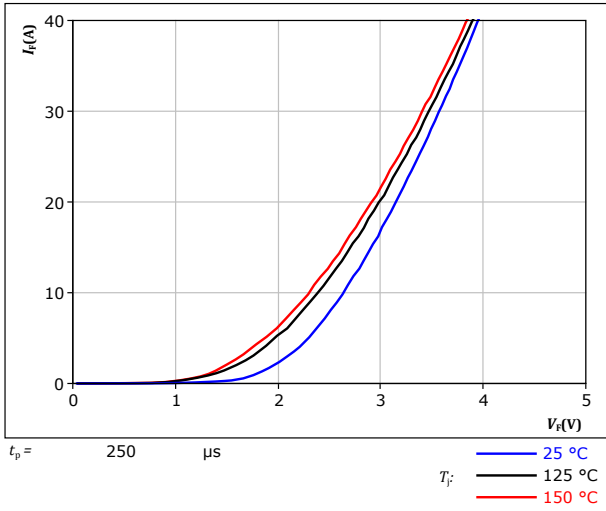
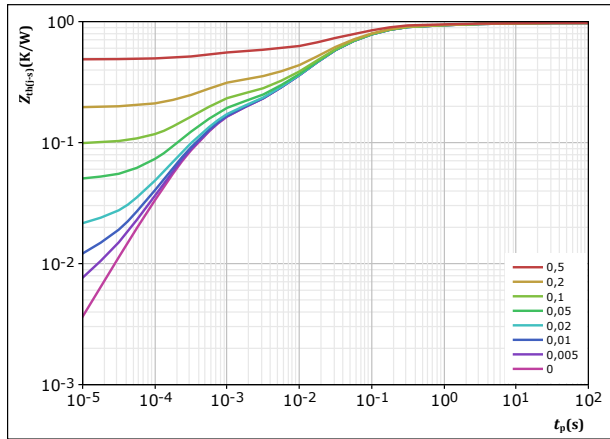


figure 8. FWD

Transient thermal impedance as a function of pulse width

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



$D =$	t_p / T	
$R_{th(j-s)} =$	0,974	K/W
FWD thermal model values		
R (K/W)	τ (s)	
2,25E-02	9,54E+00	
6,00E-02	9,21E-01	
3,80E-01	8,25E-02	
3,56E-01	1,67E-02	
1,56E-01	4,56E-04	

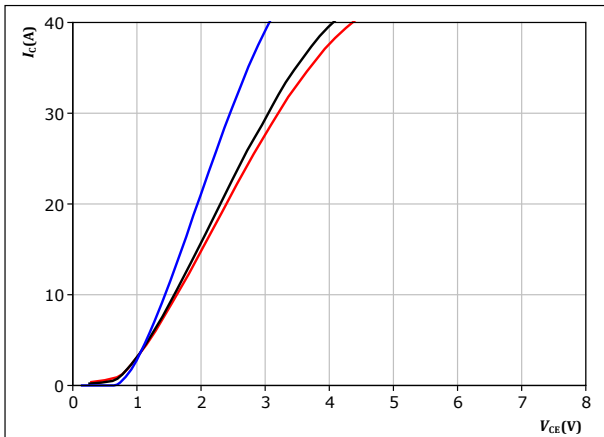


Brake Switch Characteristics

figure 9. IGBT

Typical output characteristics

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

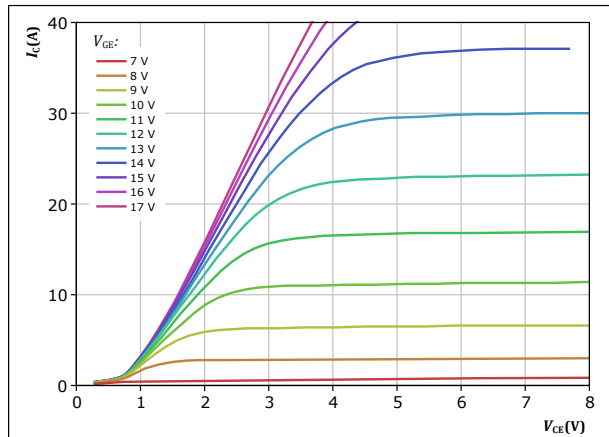


$t_p = 250\ \mu\text{s}$
 $V_{GE} = 15\ \text{V}$
 $T_j:$ 25 °C
 125 °C
 150 °C

figure 10. IGBT

Typical output characteristics

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

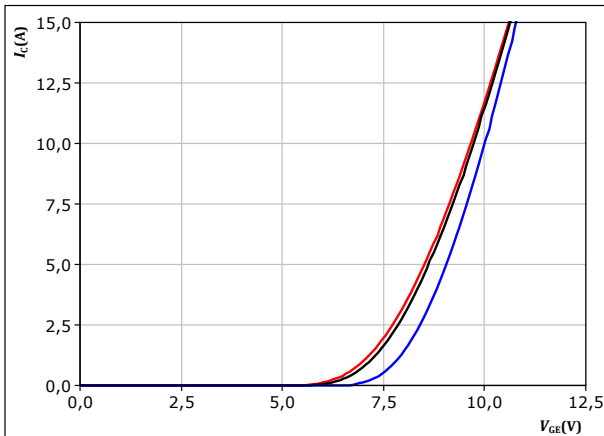


$t_p = 250\ \mu\text{s}$
 $T_j = 150\text{ °C}$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 11. IGBT

Typical transfer characteristics

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

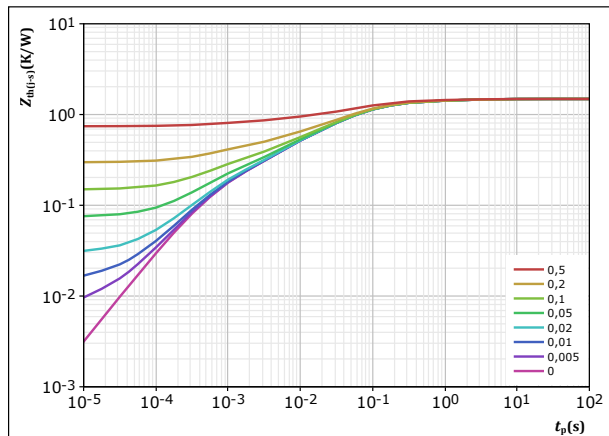


$t_p = 250\ \mu\text{s}$
 $V_{CE} = 10\ \text{V}$
 $T_j:$ 25 °C
 125 °C
 150 °C

figure 12. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,485\ \text{K/W}$
IGBT thermal model values

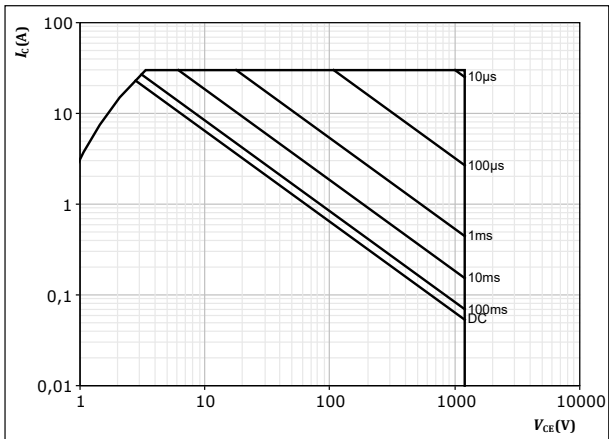
R (K/W)	τ (s)
4,90E-02	3,61E+00
1,10E-01	6,54E-01
4,70E-01	1,09E-01
4,98E-01	2,97E-02
2,21E-01	4,73E-03
1,37E-01	5,51E-04



Brake Switch Characteristics

figure 13. IGBT

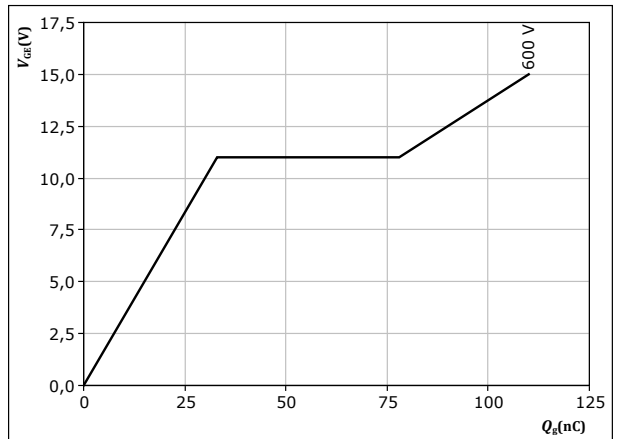
Safe operating area
 $I_C = f(V_{CE})$



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

figure 14. IGBT

Gate voltage vs gate charge
 $V_{GE} = f(Q_g)$



$I_C = 15$ A
 $T_j = 25$ °C



Brake Diode Characteristics

figure 15. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

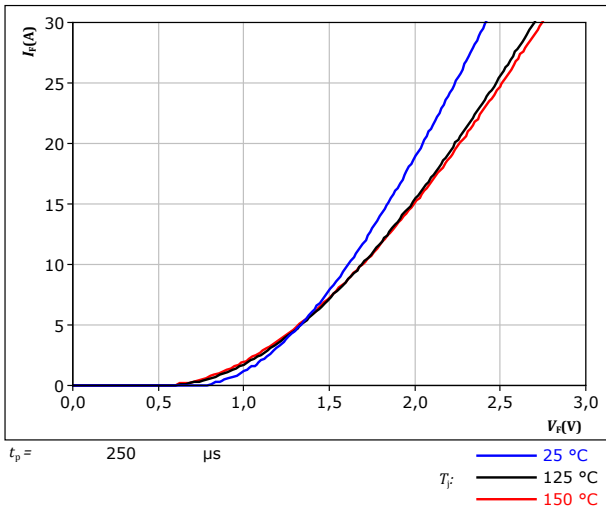
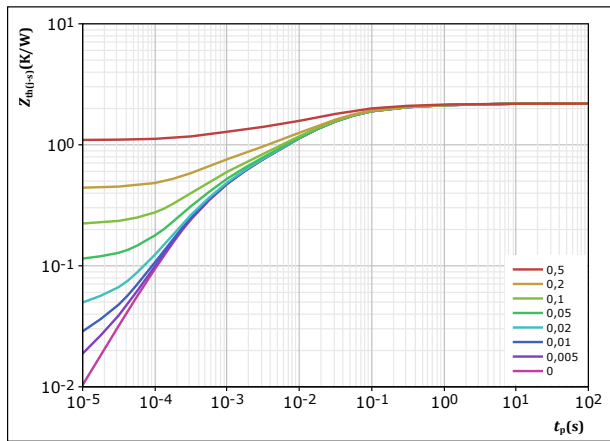


figure 16. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 2,189 \text{ K/W}$
 FWD thermal model values

R (K/W)	τ (s)
8,09E-02	3,20E+00
2,08E-01	2,82E-01
6,85E-01	4,41E-02
5,92E-01	1,02E-02
3,27E-01	2,02E-03
2,95E-01	3,64E-04



Brake Sw. Protection Diode Characteristics

figure 17. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

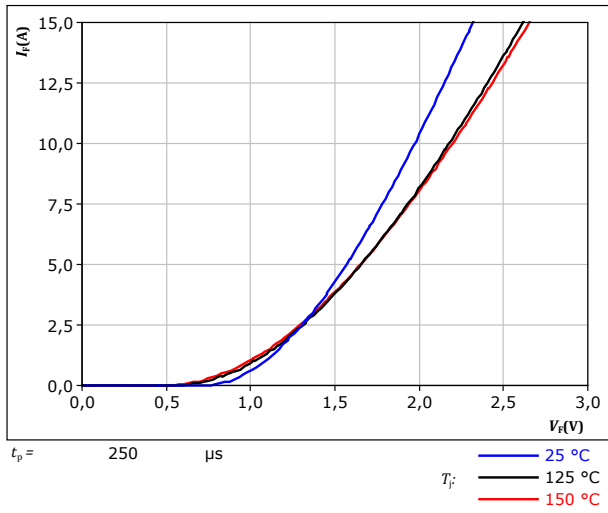
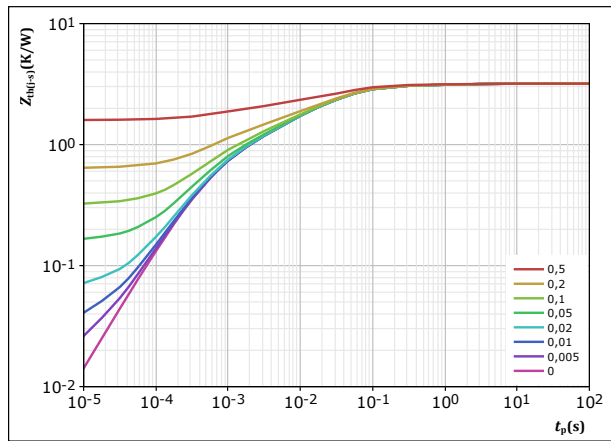


figure 18. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 3,189$ K/W
 FWD thermal model values

R (K/W)	τ (s)
1,13E-01	1,88E+00
4,09E-01	1,23E-01
1,37E+00	2,62E-02
7,40E-01	3,25E-03
5,56E-01	4,86E-04



Rectifier Diode Characteristics

figure 19. Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

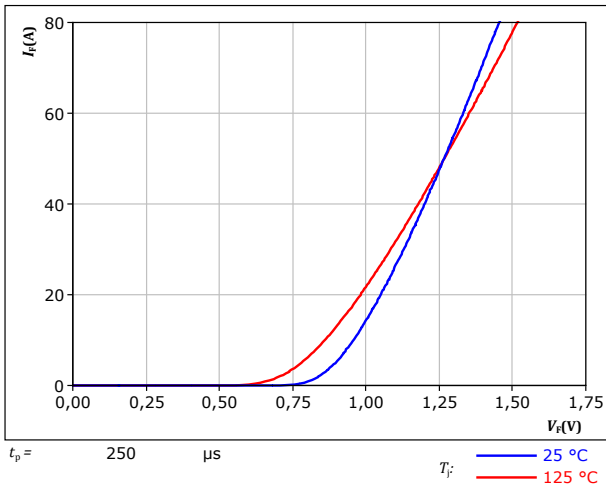
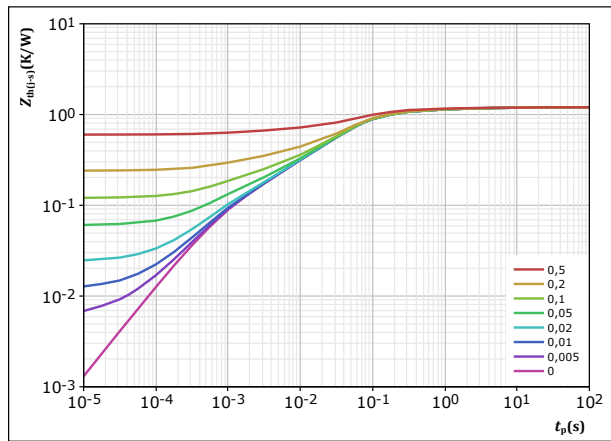


figure 20. Rectifier

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)} = 1,202 \text{ K/W}$

Rectifier thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
3,54E-02	9,31E+00
8,09E-02	9,99E-01
2,12E-01	1,71E-01
6,76E-01	4,85E-02
1,19E-01	5,88E-03
7,98E-02	8,33E-04

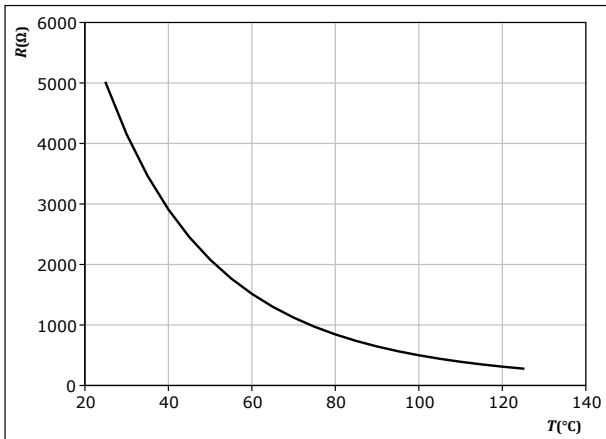


Thermistor Characteristics

figure 21. Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$

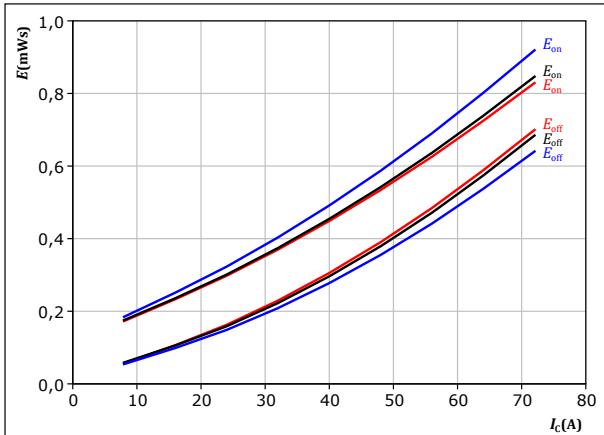




Inverter Switching Characteristics

figure 22. IGBT

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

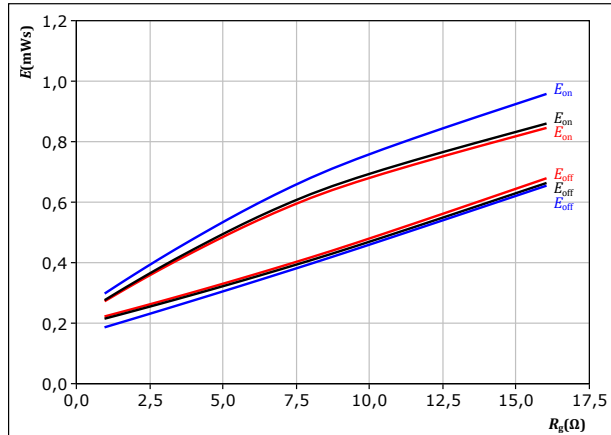


With an inductive load at

$V_{CE} = 700$ V	$T_j = 25$ °C
$V_{GE} = 0/15$ V	$T_j = 125$ °C
$R_{g(on)} = 4$ Ω	$T_j = 150$ °C
$R_{g(off)} = 4$ Ω	

figure 23. IGBT

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

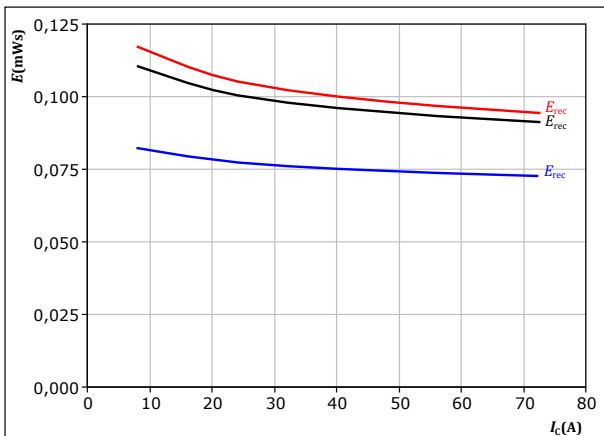


With an inductive load at

$V_{CE} = 700$ V	$T_j = 25$ °C
$V_{GE} = 0/15$ V	$T_j = 125$ °C
$I_c = 40$ A	$T_j = 150$ °C

figure 24. FWD

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

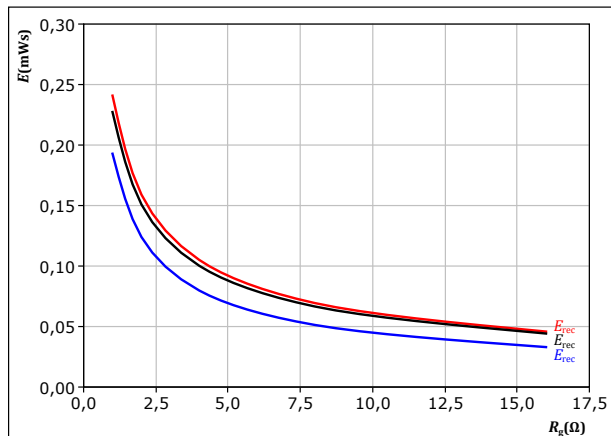


With an inductive load at

$V_{CE} = 700$ V	$T_j = 25$ °C
$V_{GE} = 0/15$ V	$T_j = 125$ °C
$R_{g(on)} = 4$ Ω	$T_j = 150$ °C

figure 25. 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

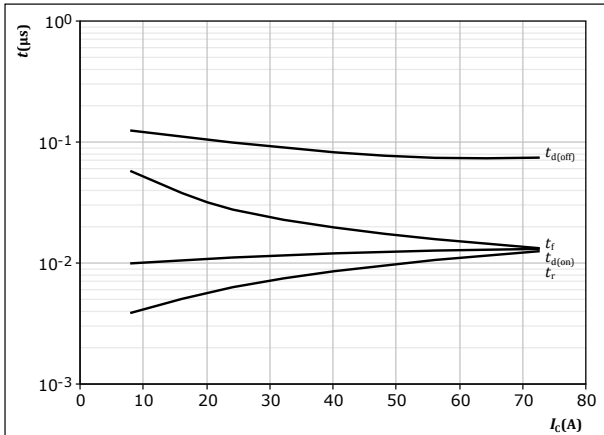
$V_{CE} = 700$ V	$T_j = 25$ °C
$V_{GE} = 0/15$ V	$T_j = 125$ °C
$I_c = 40$ A	$T_j = 150$ °C



Inverter Switching Characteristics

figure 26. IGBT

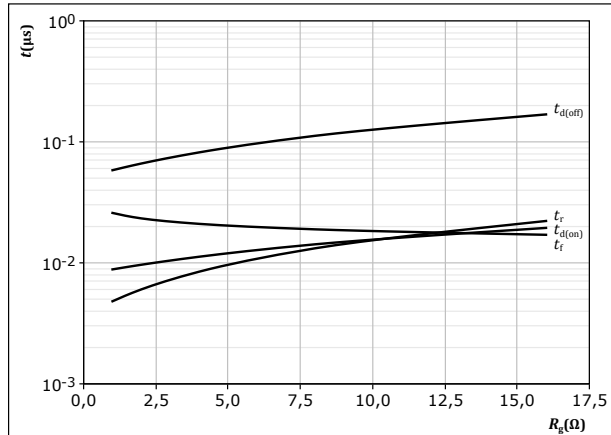
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 150 \text{ }^\circ\text{C}$
 $V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $R_{gon} = 4 \text{ } \Omega$
 $R_{goff} = 4 \text{ } \Omega$

figure 27. IGBT

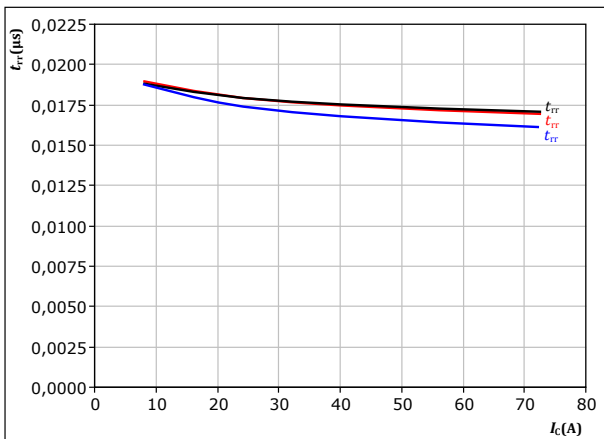
Typical switching times as a function of IGBT turn on gate resistor
 $t = f(R_g)$



With an inductive load at
 $T_j = 150 \text{ }^\circ\text{C}$
 $V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $I_c = 40 \text{ A}$

figure 28. FWD

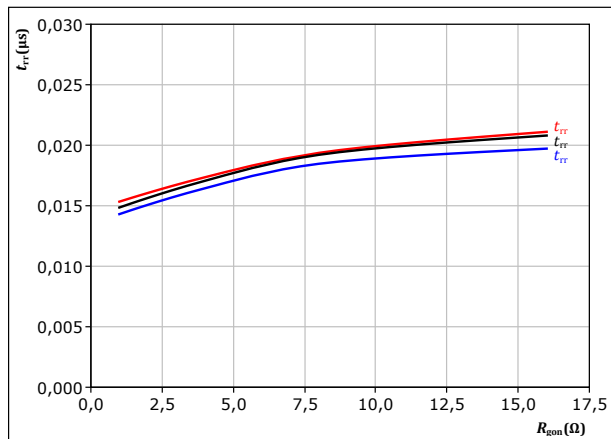
Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at
 $V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $R_{gon} = 4 \text{ } \Omega$
 $T_j: \text{ — } 25 \text{ }^\circ\text{C}$
 $\text{ — } 125 \text{ }^\circ\text{C}$
 $\text{ — } 150 \text{ }^\circ\text{C}$

figure 29. FWD

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



With an inductive load at
 $V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $I_c = 40 \text{ A}$
 $T_j: \text{ — } 25 \text{ }^\circ\text{C}$
 $\text{ — } 125 \text{ }^\circ\text{C}$
 $\text{ — } 150 \text{ }^\circ\text{C}$

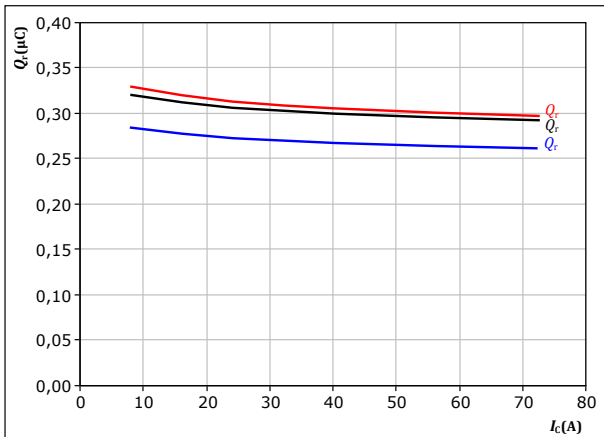


Inverter Switching Characteristics

figure 30. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

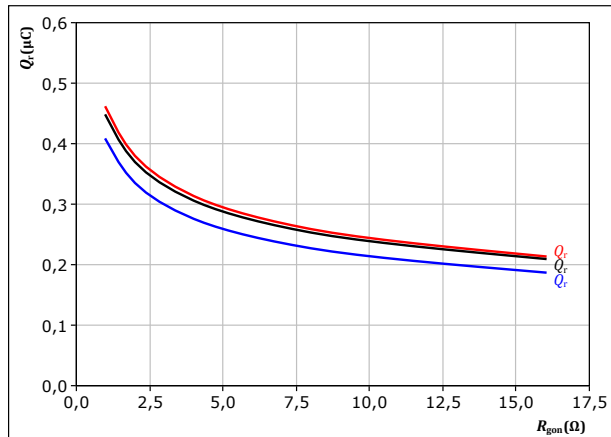
$V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $R_{gon} = 4 \text{ } \Omega$

T_j : — 25 °C
— 125 °C
— 150 °C

figure 31. FWD

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

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



With an inductive load at

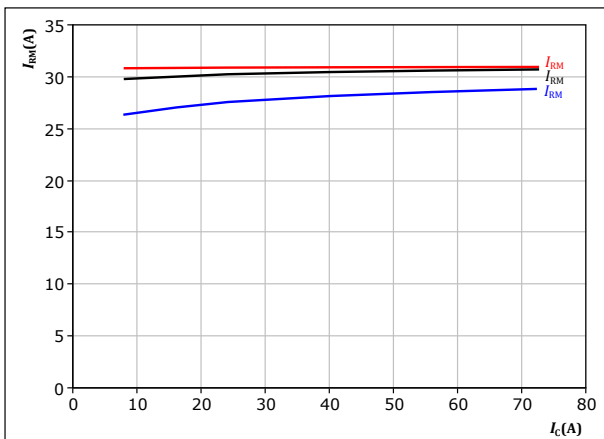
$V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $I_c = 40 \text{ A}$

T_j : — 25 °C
— 125 °C
— 150 °C

figure 32. FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

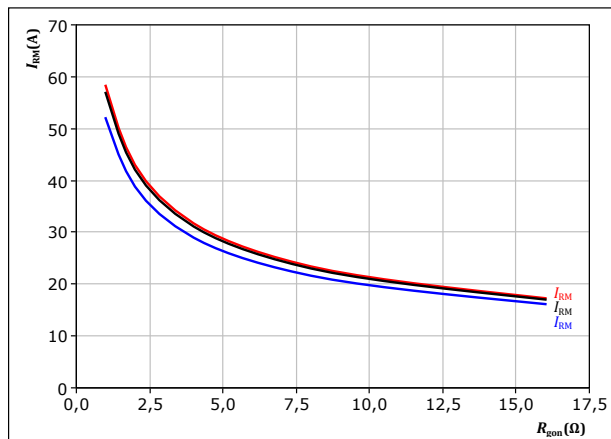
$V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $R_{gon} = 4 \text{ } \Omega$

T_j : — 25 °C
— 125 °C
— 150 °C

figure 33. 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

$V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $I_c = 40 \text{ A}$

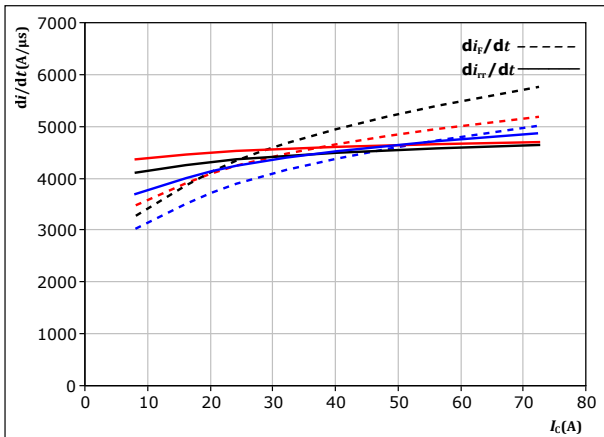
T_j : — 25 °C
— 125 °C
— 150 °C



Inverter Switching Characteristics

figure 34. FWD

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

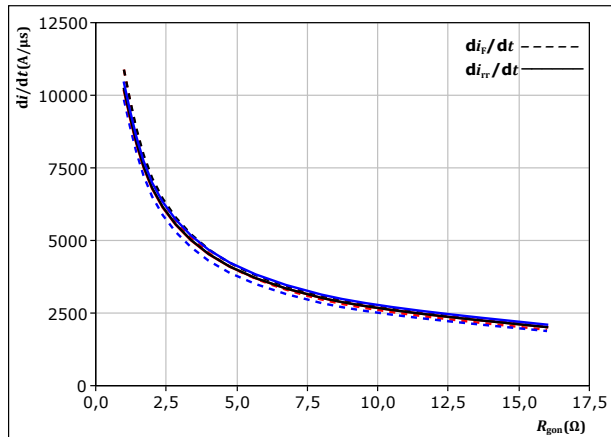


With an inductive load at

$V_{CE} = 700 \text{ V}$	$T_j = 25 \text{ }^\circ\text{C}$
$V_{GE} = 0/15 \text{ V}$	$T_j = 125 \text{ }^\circ\text{C}$
$R_{gon} = 4 \text{ } \Omega$	$T_j = 150 \text{ }^\circ\text{C}$

figure 35. FWD

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

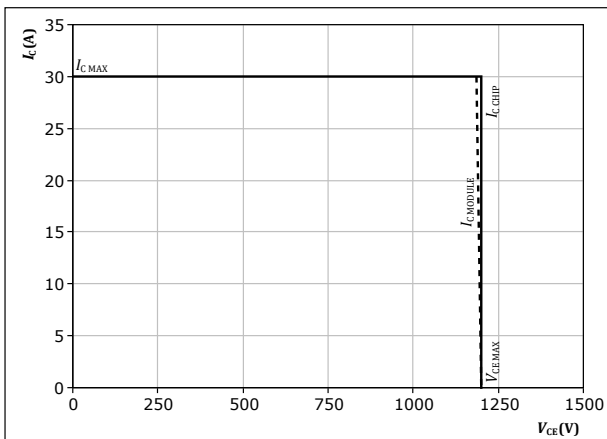


With an inductive load at

$V_{CE} = 700 \text{ V}$	$T_j = 25 \text{ }^\circ\text{C}$
$V_{GE} = 0/15 \text{ V}$	$T_j = 125 \text{ }^\circ\text{C}$
$I_C = 40 \text{ A}$	$T_j = 150 \text{ }^\circ\text{C}$

figure 36. IGBT

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



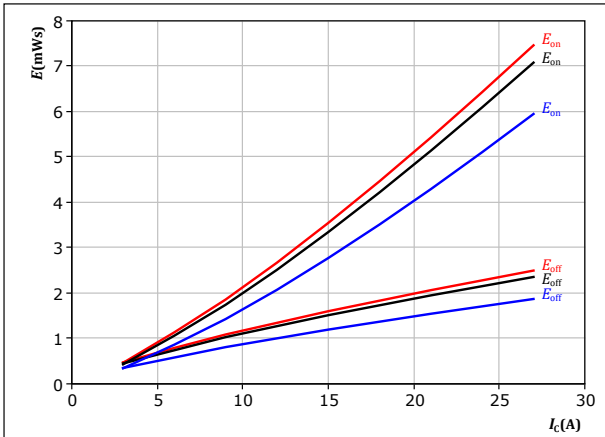
At $T_j = 150 \text{ }^\circ\text{C}$
 $R_{gon} = 4 \text{ } \Omega$
 $R_{goff} = 4 \text{ } \Omega$



Brake Switching Characteristics

figure 37. IGBT

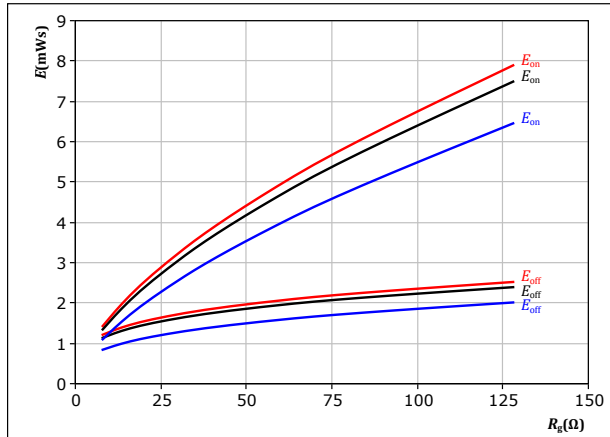
Typical switching energy losses as a function of collector current
 $E = f(I_c)$



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 32$ Ω
 $R_{goff} = 32$ Ω
 T_j : — 25 °C
— 125 °C
— 150 °C

figure 38. IGBT

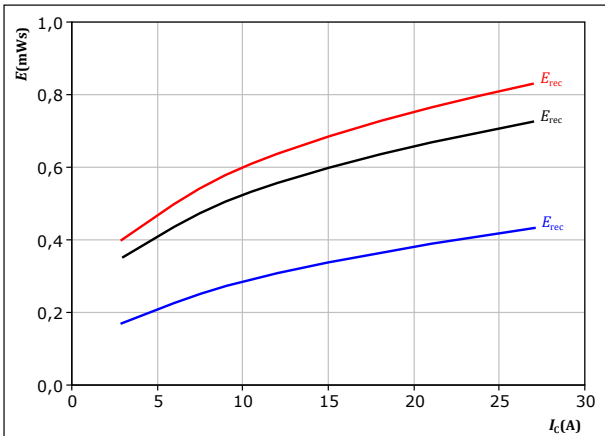
Typical switching energy losses as a function of IGBT turn on gate resistor
 $E = f(R_g)$



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = 0/15$ V
 $I_c = 15$ A
 T_j : — 25 °C
— 125 °C
— 150 °C

figure 39. FWD

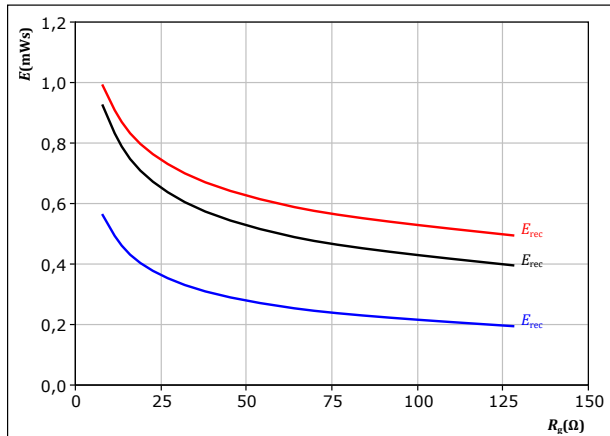
Typical reverse recovered energy loss as a function of collector current
 $E_{rec} = f(I_c)$



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 32$ Ω
 T_j : — 25 °C
— 125 °C
— 150 °C

figure 40. FWD

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



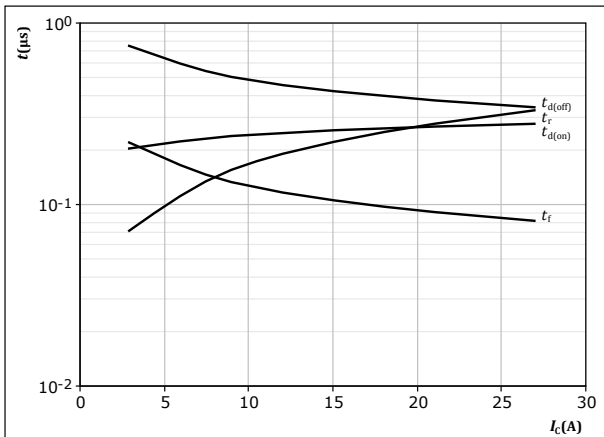
With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = 0/15$ V
 $I_c = 15$ A
 T_j : — 25 °C
— 125 °C
— 150 °C



Brake Switching Characteristics

figure 41. IGBT

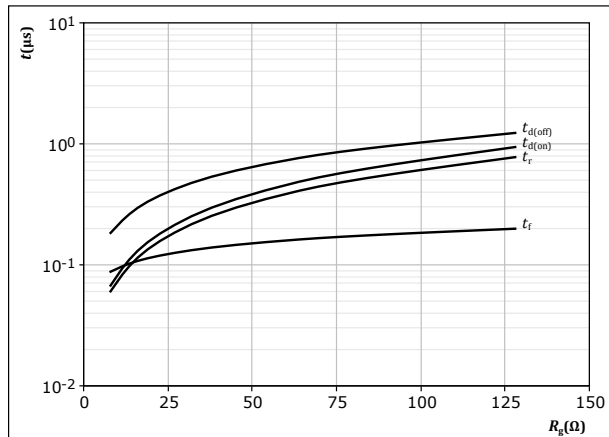
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 150$ °C
 $V_{CE} = 600$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 32$ Ω
 $R_{goff} = 32$ Ω

figure 42. IGBT

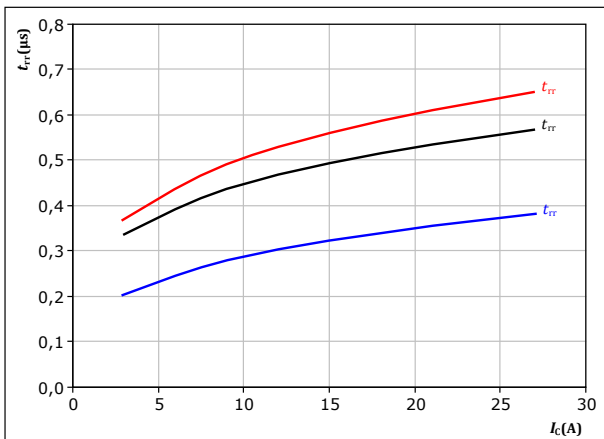
Typical switching times as a function of IGBT turn on gate resistor
 $t = f(R_g)$



With an inductive load at
 $T_j = 150$ °C
 $V_{CE} = 600$ V
 $V_{GE} = 0/15$ V
 $I_c = 15$ A

figure 43. FWD

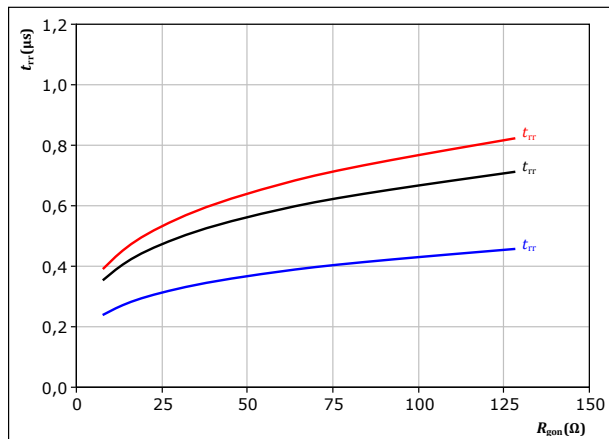
Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 32$ Ω
 $T_j:$ — 25 °C
— 125 °C
— 150 °C

figure 44. FWD

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



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = 0/15$ V
 $I_c = 15$ A
 $T_j:$ — 25 °C
— 125 °C
— 150 °C

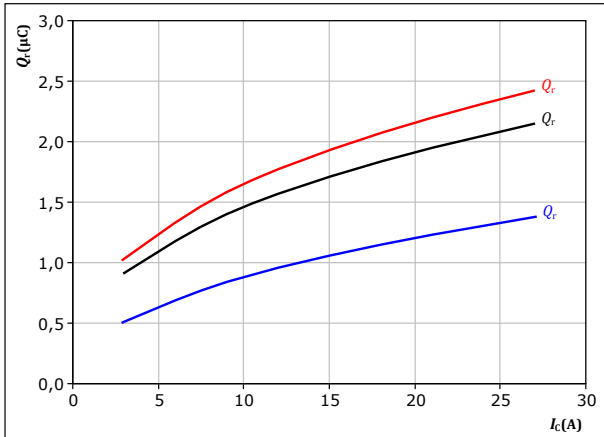


Brake Switching Characteristics

figure 45. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



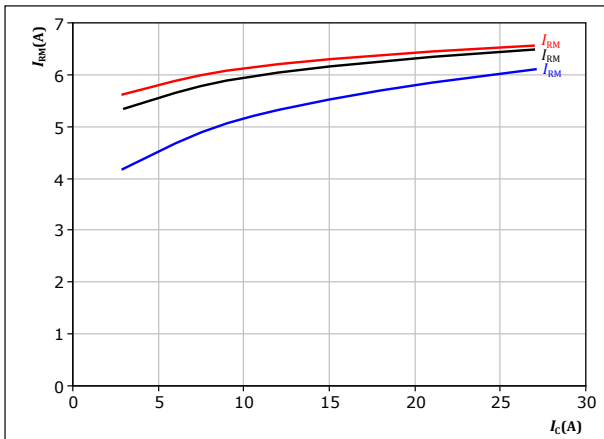
With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 32$ Ω
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 47. FWD

Typical peak reverse recovery current as a function of collector current

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



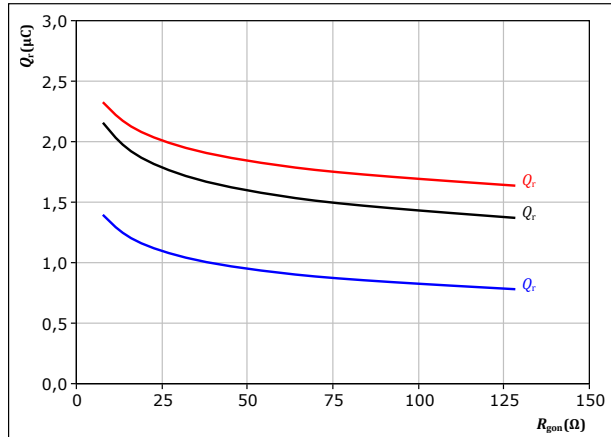
With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 32$ Ω
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 46. FWD

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

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



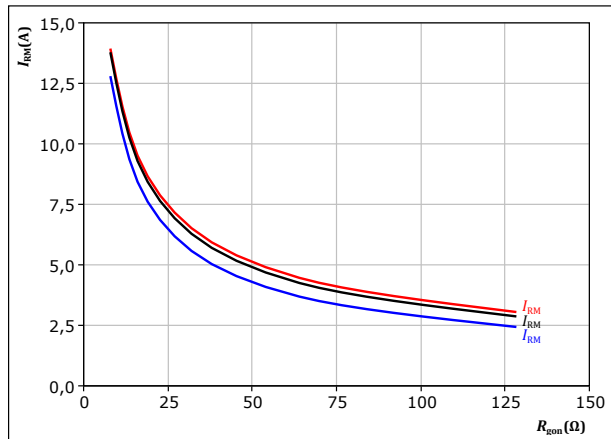
With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = 0/15$ V
 $I_c = 15$ A
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 48. 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

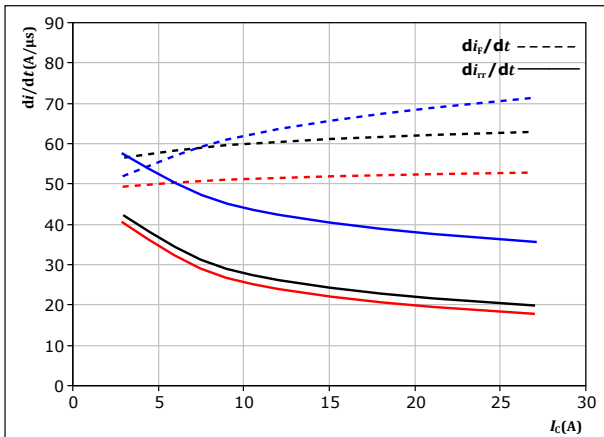
$V_{CE} = 600$ V
 $V_{GE} = 0/15$ V
 $I_c = 15$ A
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)



Brake Switching Characteristics

figure 49. FWD

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



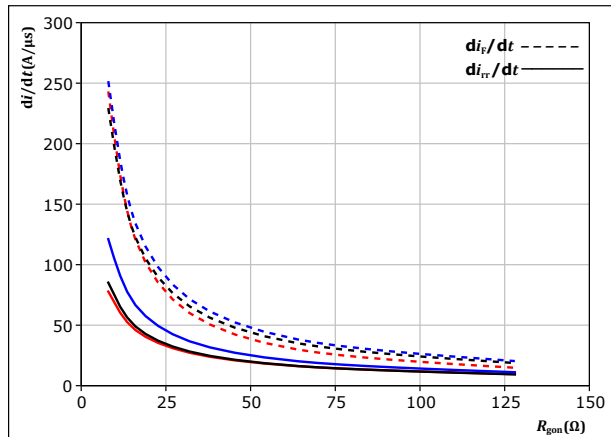
With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 32$ Ω

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 50. 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

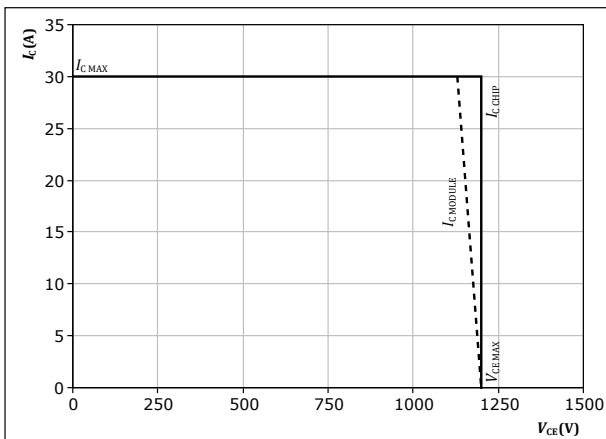
$V_{CE} = 600$ V
 $V_{GE} = 0/15$ V
 $I_c = 15$ A

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 51. IGBT

Reverse bias safe operating area

$I_c = f(V_{CE})$



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



Switching Definitions

figure 52. IGBT

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

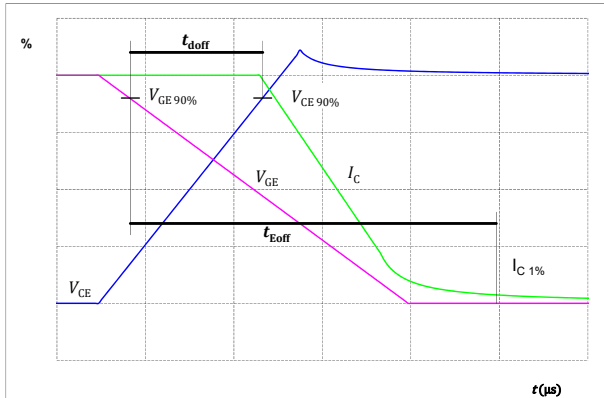


figure 53. IGBT

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

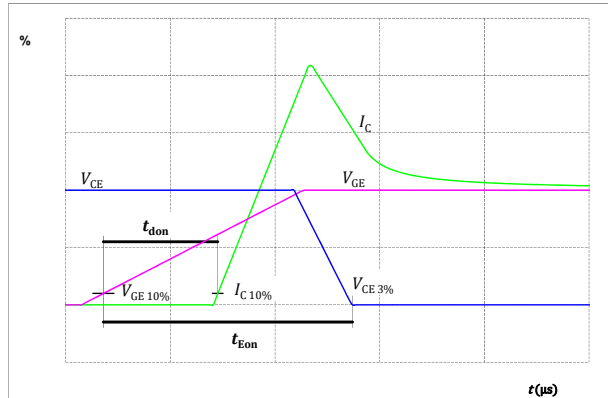


figure 54. IGBT

Turn-off Switching Waveforms & definition of t_f

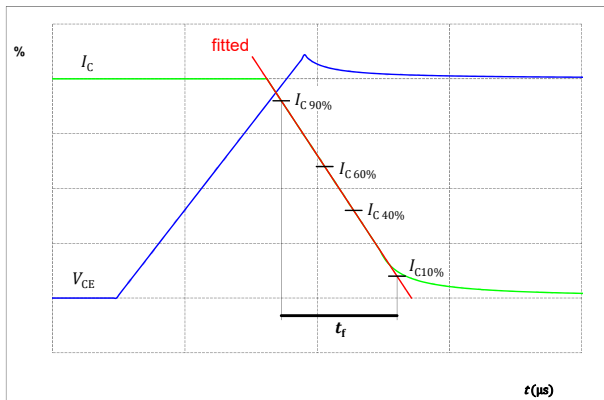
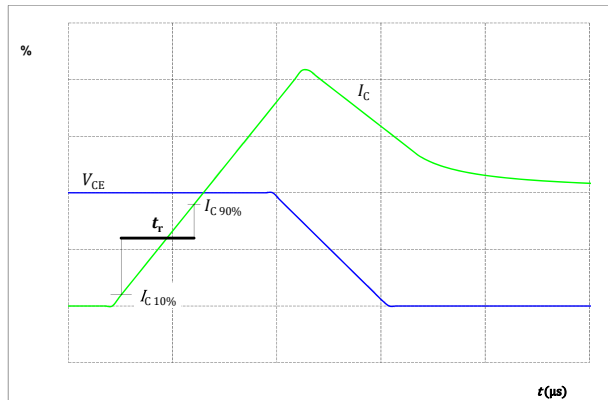


figure 55. IGBT

Turn-on Switching Waveforms & definition of t_r





Switching Definitions

figure 56. FWD

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

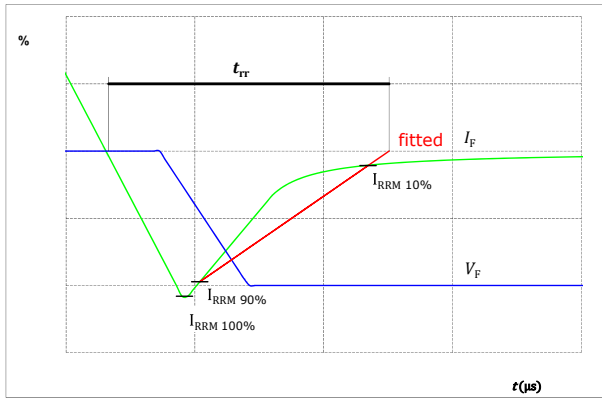
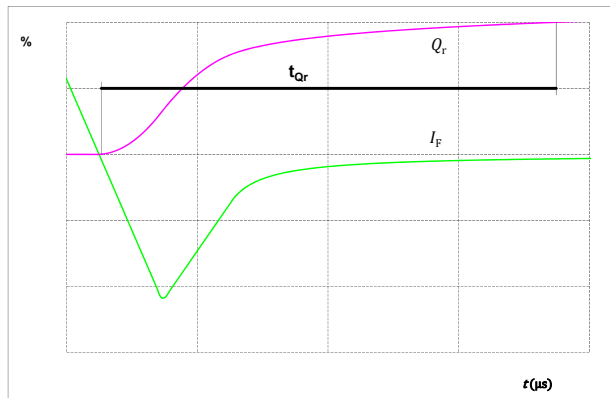


figure 57. FWD

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






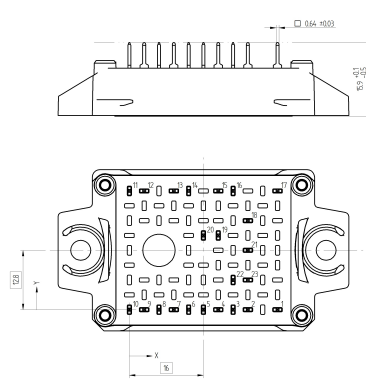
Vincotech

10-E112PMA015M701-L928A73Z
datasheet

Ordering Code	
Version	Ordering Code
Without thermal paste	10-E112PMA015M701-L928A73Z
With thermal paste (3,4 W/mK, PSX-P7)	10-E112PMA015M701-L928A73Z-/3/

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

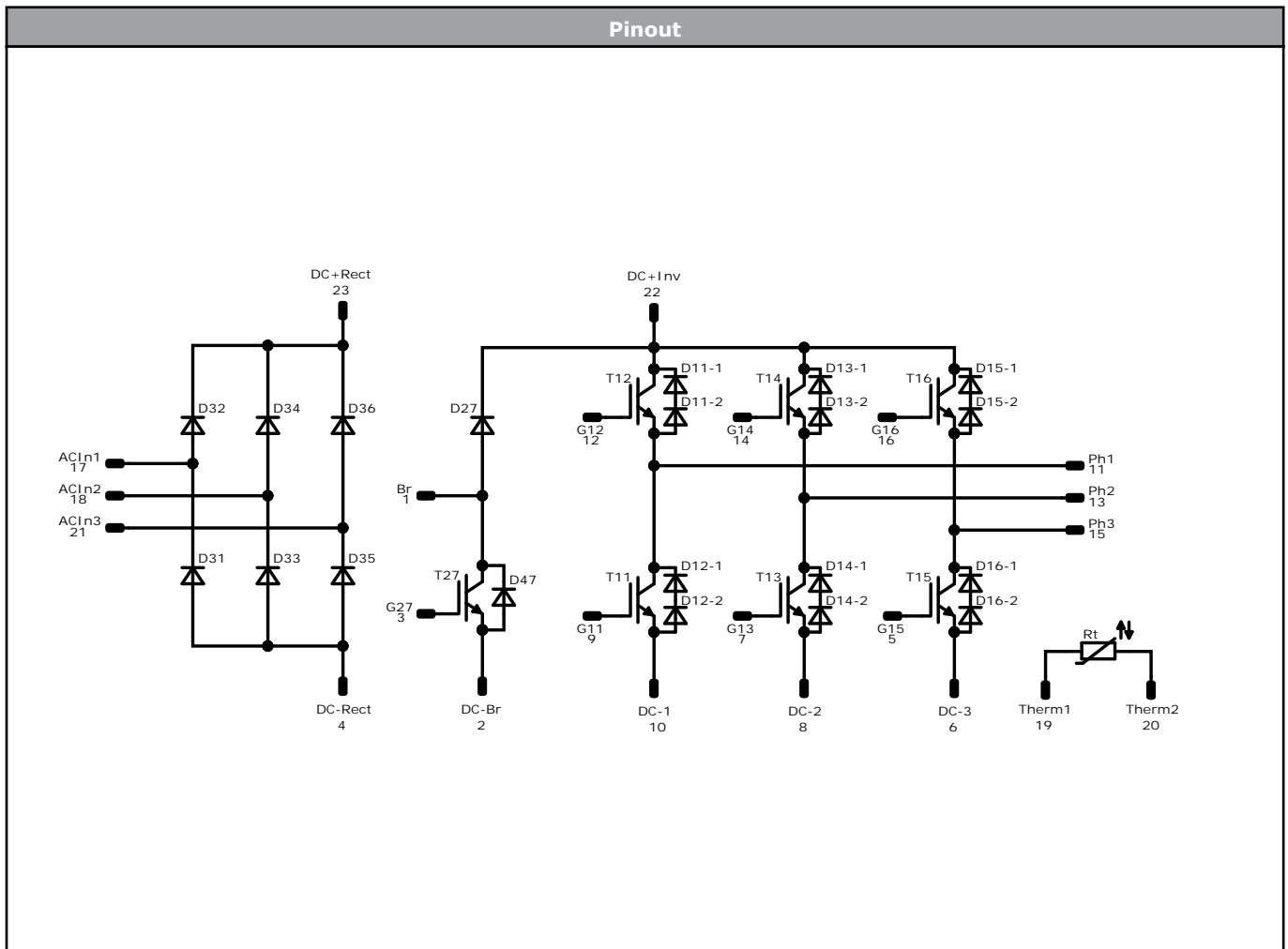
Outline				
Pin table [mm]				
Pin	X	Y	Function	
1	32	0	Br	
2	25,6	0	DC-Br	
3	22,4	0	G27	
4	19,2	0	DC-Rect	
5	16	0	G15	
6	12,8	0	DC-3	
7	9,6	0	G13	
8	6,4	0	DC-2	
9	3,2	0	G11	
10	0	0	DC-1	
11	0	25,6	Ph1	
12	3,2	25,6	G12	
13	9,6	25,6	Ph2	
14	12,8	25,6	G14	
15	19,2	25,6	Ph3	
16	22,4	25,6	G16	
17	32	25,6	ACIn1	
18	25,6	19,2	ACIn2	
19	19,2	16	Therm1	
20	16	16	Therm2	
21	25,6	12,8	ACIn3	
22	22,4	6,4	DC+Inv	
23	25,6	6,4	DC+Rect	



Tolerance of pinposition: ±0,05mm at the end of pins
Dimension of coordinate axis to axis of facet without tolerance



Vincotech



Identification					
ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	15 A	Inverter Switch	
D11-1, D11-2, D12-1, D12-2, D13-1, D13-2, D14-1, D14-2, D15-1, D15-2, D16-1, D16-2	FWD	1300 V	15 A	Inverter Diode	
T27	IGBT	1200 V	15 A	Brake Switch	
D27	FWD	1200 V	10 A	Brake Diode	
D47	FWD	1200 V	5 A	Brake Sw. Protection Diode	
D31, D32, D33, D34, D35, D36	Rectifier	1600 V	35 A	Rectifier Diode	
Rt	Thermistor			Thermistor	




Vincotech

Packaging instruction				
Standard packaging quantity (SPQ) 100	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for <i>flow</i> E1 packages see vincotech.com website.

Package data
Package data for <i>flow</i> E1 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-E112PMA015M701-L928A73Z-D1-14	16 Aug. 2023		

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Vincotech products are not authorised for use as critical components in life support devices or systems without the express written approval of Vincotech.

As used herein:

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.