



Vincotech

# 10-F112PMA050M7-P580A79

datasheet

flowPIM 1

1200 V / 50 A

## Topology features

- Kelvin Emitter for improved switching performance
- Open Emitter configuration
- Temperature sensor
- Converter+Brake+Inverter

## 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:  $\text{Al}_2\text{O}_3$
- Convex shaped substrate for superior thermal contact
- Thermo-mechanical push-and-pull force relief
- Solder pin

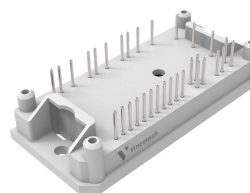
## Target applications

- Industrial Drives

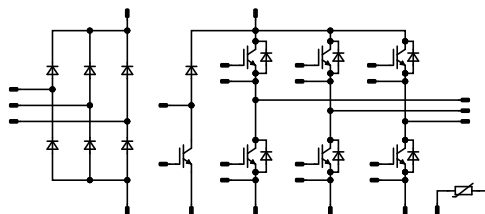
## Types

- 10-F112PMA050M7-P580A79

## flow 1 17 mm housing



## Schematic





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## Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
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### Inverter Switch

Collector-emitter voltage	$V_{CES}$		1200	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	57	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	100	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	115	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Short circuit ratings	$t_{SC}$	$V_{GE} = 15\text{ V}$ , $V_{CC} = 800\text{ V}$ $T_j = 150\text{ °C}$	9,5	$\mu s$
Maximum junction temperature	$T_{jmax}$		175	$^{\circ}\text{C}$

### Inverter Diode

Peak repetitive reverse voltage	$V_{RRM}$		1200	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	45	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	100	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	78	W
Maximum junction temperature	$T_{jmax}$		175	$^{\circ}\text{C}$

### Brake Switch

Collector-emitter voltage	$V_{CES}$		1200	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	51	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	70	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	107	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Short circuit ratings	$t_{SC}$	$V_{GE} = 15\text{ V}$ , $V_{CC} = 800\text{ V}$ $T_j = 150\text{ °C}$	9,5	$\mu s$
Maximum junction temperature	$T_{jmax}$		175	$^{\circ}\text{C}$



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## Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
<b>Brake Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		1200	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	33	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	50	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	62	W
Maximum junction temperature	$T_{jmax}$		175	°C

## Rectifier Diode

Peak repetitive reverse voltage	$V_{RRM}$		1600	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	54	A
Surge (non-repetitive) forward current	$I_{FSM}$	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	350	A
Surge current capability	$I^2t$		610	A²s
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	65	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			>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	0,005	25	5,4	6	6,6	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		50	25 125 150		1,55 1,77 1,83	1,9 <sup>(1)</sup>	V
Collector-emitter cut-off current	$I_{CES}$		0	1200		25			0,09	mA
Gate-emitter leakage current	$I_{GES}$		20	0		25			0,5	μA
Internal gate resistance	$r_g$							None		Ω
Input capacitance	$C_{ies}$	0	10	25				10000		pF
Output capacitance	$C_{oes}$							350		pF
Reverse transfer capacitance	$C_{res}$							130		pF
Gate charge	$Q_g$	$V_{CC} = 600$ V	0/15		50	25		380		nC

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,82		K/W
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#### Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 8 \Omega$ $R_{goff} = 8 \Omega$	$\pm 15$	600	50	25 125 150		176 176 190		ns
Rise time	$t_r$					25 125 150		52 58 60		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		206 229 241		ns
Fall time	$t_f$					25 125 150		92,14 124,72 122,14		ns
Turn-on energy (per pulse)	$E_{on}$	$Q_{tFWD}=4,93 \mu C$ $Q_{tFWD}=7,08 \mu C$ $Q_{tFWD}=8,04 \mu C$				25 125 150		4,82 6,38 6,25		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		2,98 4,25 5,03		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	$V_F$				50	25 125 150		1,66 1,78 1,79	2,1 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_i = 1200$ V				25			40	µA

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,22		K/W
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#### Dynamic

Peak recovery current	$I_{RM}$	$di/dt=338$ A/µs $di/dt=450$ A/µs $di/dt=498$ A/µs	$\pm 15$	600	50	25 125 150		28,72 32,83 32,97		A
Reverse recovery time	$t_{rr}$					25 125 150		339,05 434,87 511,31		ns
Recovered charge	$Q_r$					25 125 150		4,93 7,08 8,04		µC
Reverse recovered energy	$E_{rec}$					25 125 150		1,79 2,59 3,33		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		194,94 128,35 114,47		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	0,0035	25	5,4	6	6,6	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		35	25 125 150		1,47 1,64 1,68	1,85 <sup>(1)</sup>	V
Collector-emitter cut-off current	$I_{CES}$		0	1200		25			80	µA
Gate-emitter leakage current	$I_{GES}$		20	0		25			200	nA
Internal gate resistance	$r_g$							None		Ω
Input capacitance	$C_{ies}$	0	10		25			7900		pF
Output capacitance	$C_{oes}$							270		pF
Reverse transfer capacitance	$C_{res}$							97		pF
Gate charge	$Q_g$	$V_{CC} = 600$ V	0/15		35	25		260		nC

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,89		K/W
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#### Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 16$ Ω $R_{goff} = 16$ Ω	0/15	700	35	25 125 150		199,4 172,4 167		ns
Rise time	$t_r$					25 125 150		111,2 109,2 110,4		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		437,6 485,4 497,2		ns
Fall time	$t_f$					25 125 150		64,65 99,99 107,31		ns
Turn-on energy (per pulse)	$E_{on}$					25 125 150		4,87 5,85 6,1		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		3 3,88 4,1		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	

### Brake Diode

#### Static

Forward voltage	$V_F$				25	25 125 150		1,63 1,7 1,69	2,1 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_i = 1200$ V				25			35	µA

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,54		K/W
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#### Dynamic

Peak recovery current	$I_{RM}$	$di/dt=310$ A/µs $di/dt=311$ A/µs $di/dt=260$ A/µs	0/15	700	35	25 125 150		17,92 19,64 20,47		A
Reverse recovery time	$t_{rr}$					25 125 150		269,22 397,4 448,88		ns
Recovered charge	$Q_r$					25 125 150		2,81 4,53 5,09		µC
Reverse recovered energy	$E_{rec}$					25 125 150		1,12 1,92 2,21		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		132,1 79,89 77,49		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	

### Rectifier Diode

#### Static

Forward voltage	$V_F$				18	25 125 150		0,99 0,912 0,908	1,21 <sup>(1)</sup> 1,1 <sup>(1)</sup>		V
Reverse leakage current	$I_R$	$V_i = 1600$ V				25				50	µA

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,08			K/W
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### Thermistor

#### Static

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

<sup>(1)</sup> Value at chip level

<sup>(2)</sup> Only valid with pre-applied Vincotech thermal interface material.



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## Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

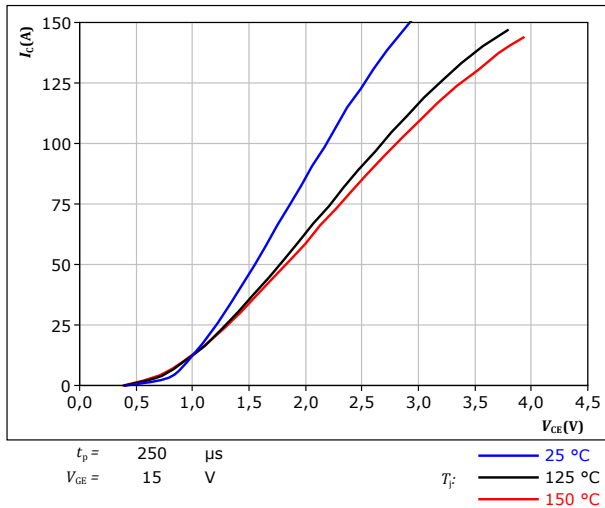


figure 2. IGBT

Typical output characteristics

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

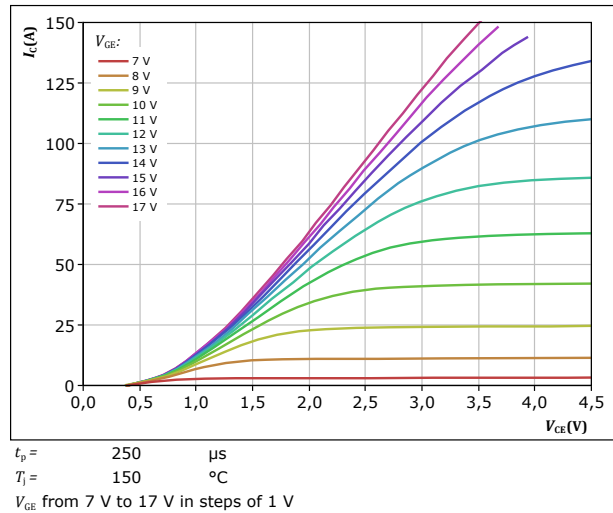


figure 3. IGBT

Typical transfer characteristics

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

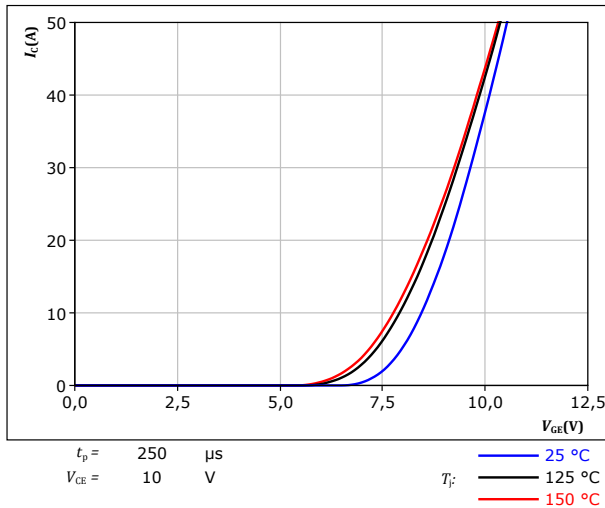
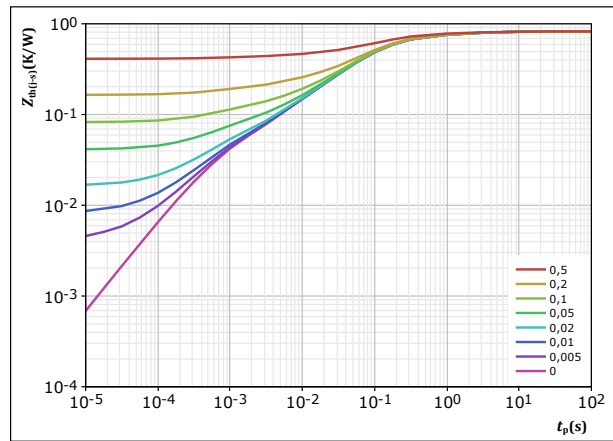


figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



IGBT thermal model values	
$R$ (K/W)	$\tau$ (s)
4,05E-02	5,17E+00
8,54E-02	1,03E+00
3,18E-01	1,67E-01
2,80E-01	5,49E-02
6,47E-02	7,32E-03
3,43E-02	6,46E-04



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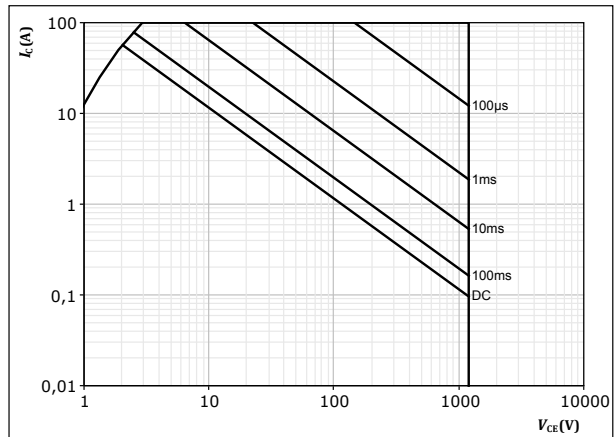
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## Inverter Switch Characteristics

figure 5. IGBT

Safe operating area

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

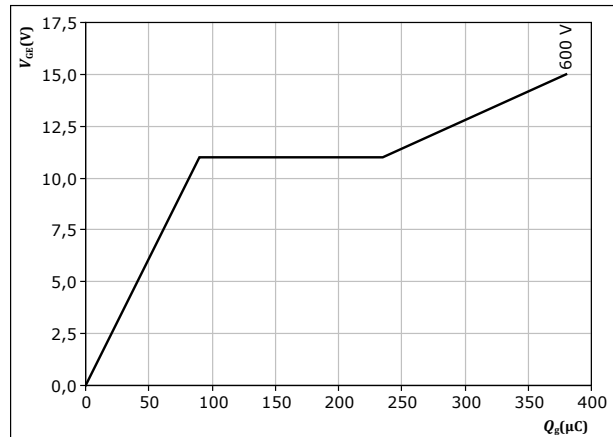


$D = \text{single pulse}$   
 $T_s = 80 \text{ } ^\circ\text{C}$   
 $V_{GE} = 15 \text{ V}$   
 $T_j = T_{jmax}$

figure 6. IGBT

Gate voltage vs gate charge

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



$I_C = 50 \text{ A}$   
 $T_j = 25 \text{ } ^\circ\text{C}$



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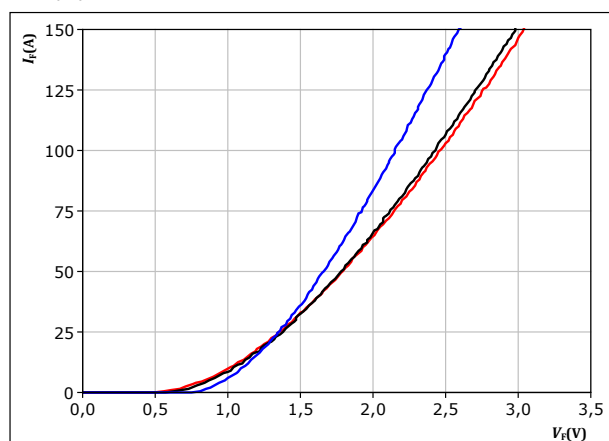
## Inverter Diode Characteristics

figure 7.

FWD

Typical forward characteristics

$$I_F = f(V_F)$$



$t_p = 250 \mu s$

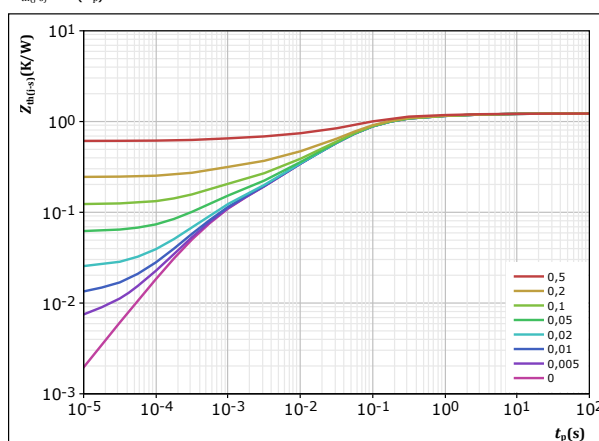
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 8.

FWD

Transient thermal impedance as a function of pulse width

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



$D =$	$t_p / T$	
$R_{th(j-s)} =$	1,224	K/W
FWD thermal model values		
$R$ (K/W)	$\tau$ (s)	
3,84E-02	6,82E+00	
9,89E-02	9,92E-01	
3,93E-01	1,28E-01	
4,67E-01	3,75E-02	
1,41E-01	5,65E-03	
8,52E-02	5,44E-04	



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## Brake Switch Characteristics

figure 9. IGBT

Typical output characteristics

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

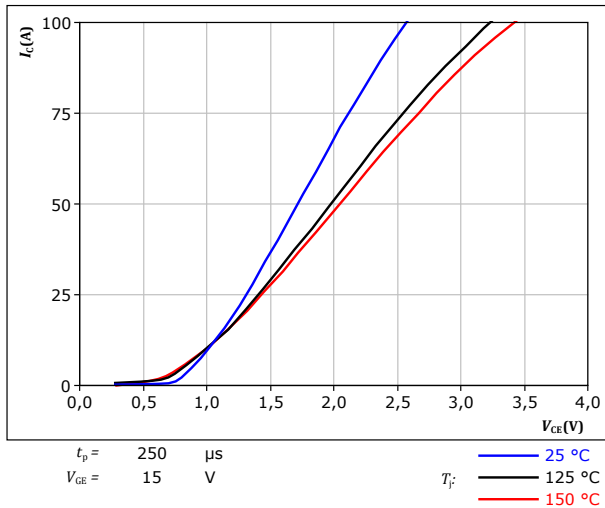


figure 10. IGBT

Typical output characteristics

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

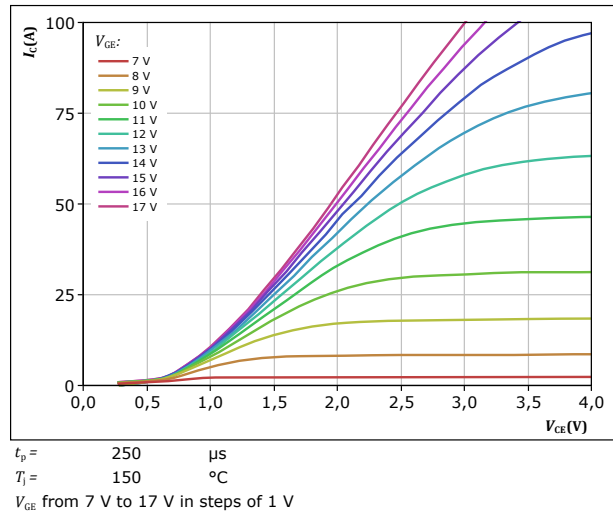


figure 11. IGBT

Typical transfer characteristics

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

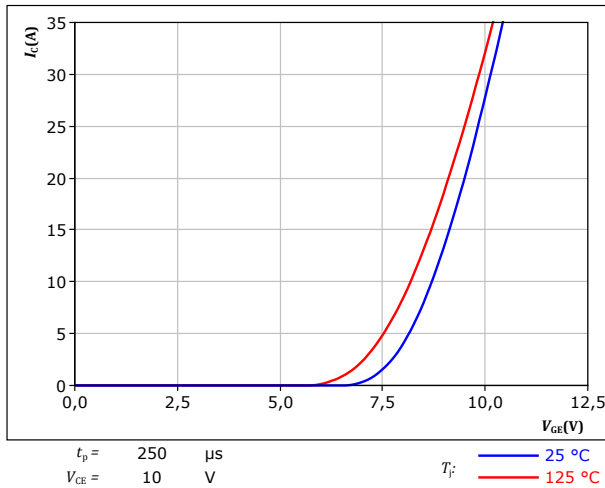
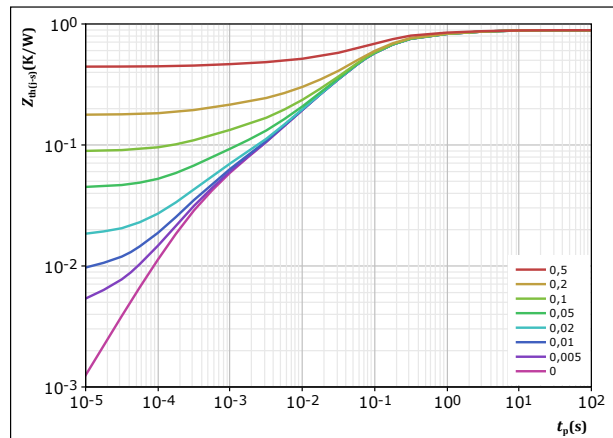


figure 12. IGBT

Transient thermal impedance as a function of pulse width

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



IGBT thermal model values	
$R$ (K/W)	$\tau$ (s)
4,56E-02	3,89E+00
8,84E-02	7,65E-01
3,30E-01	1,35E-01
2,86E-01	4,71E-02
8,94E-02	7,49E-03
3,24E-02	8,15E-04
1,67E-02	2,52E-04



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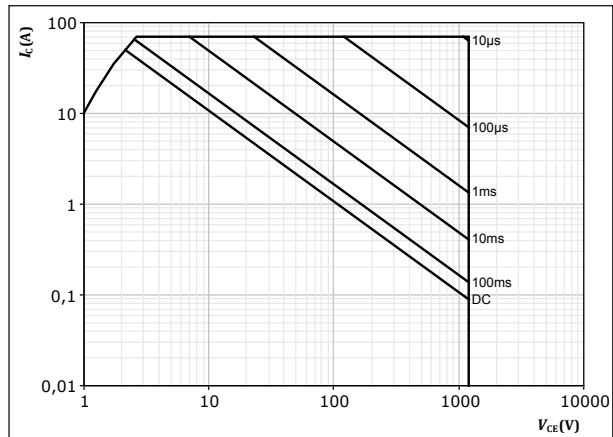
## Brake Switch Characteristics

figure 13.

IGBT

Safe operating area

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



$D =$  single pulse

$T_s = 80$  °C

$V_{GE} = 15$  V

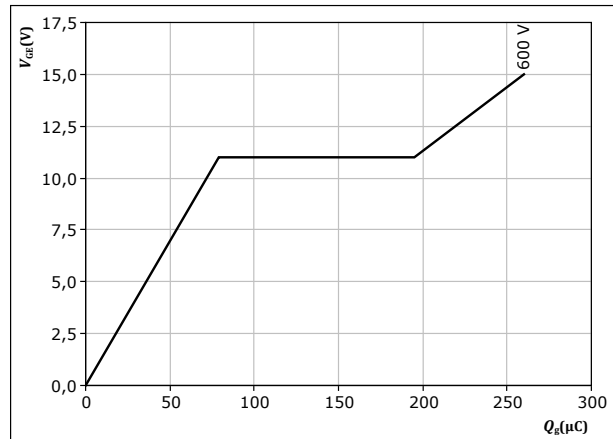
$T_j = T_{jmax}$

figure 14.

IGBT

Gate voltage vs gate charge

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



$I_C = 35$  A

$T_j = 25$  °C



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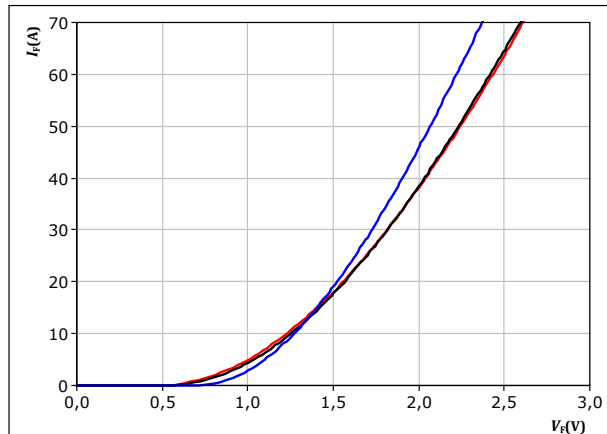
## Brake Diode Characteristics

figure 15.

FWD

Typical forward characteristics

$$I_F = f(V_F)$$



$t_p = 250 \mu s$

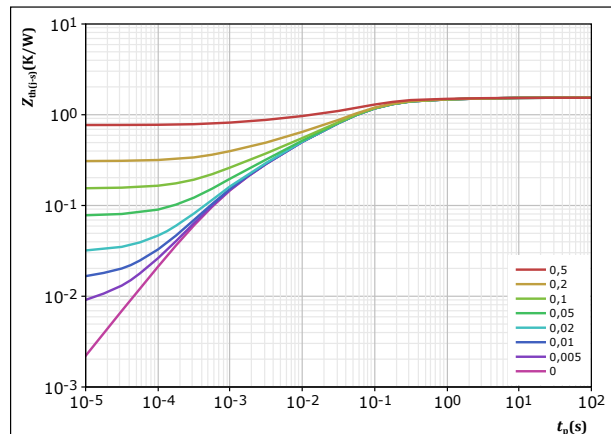
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 16.

FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 1,539 \text{ K/W}$

FWD thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
4,69E-02	5,05E+00
1,06E-01	7,09E-01
5,57E-01	1,01E-01
4,68E-01	3,22E-02
2,35E-01	5,52E-03
8,77E-02	1,01E-03
4,01E-02	5,52E-04



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## Rectifier Diode Characteristics

figure 17.

Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

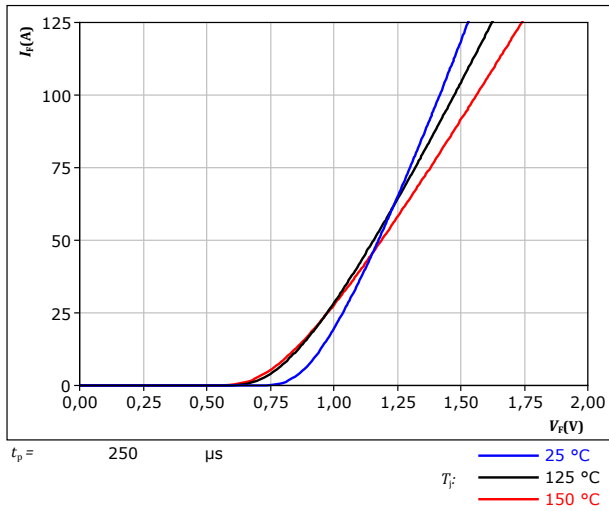
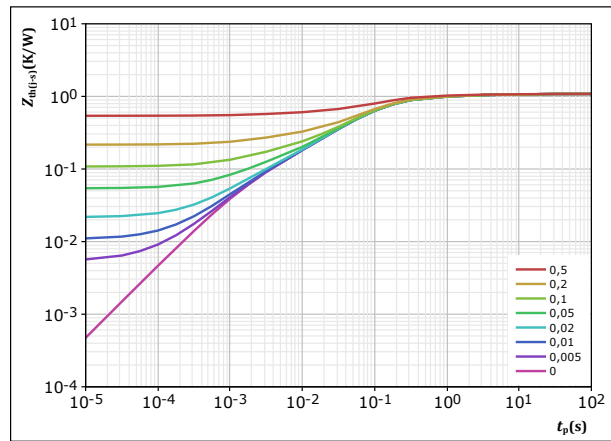


figure 18.

Rectifier

Transient thermal impedance as a function of pulse width

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





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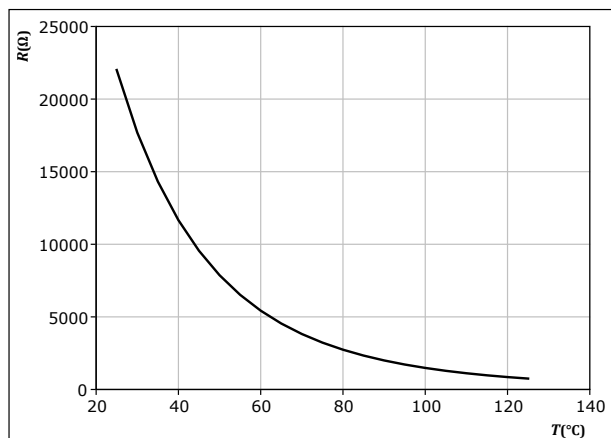
## Thermistor Characteristics

figure 19.

Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$





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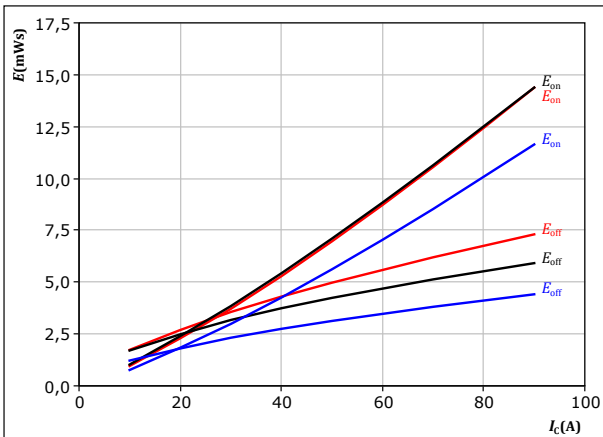
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## Inverter Switching Characteristics

figure 20. IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_c)$$



With an inductive load at

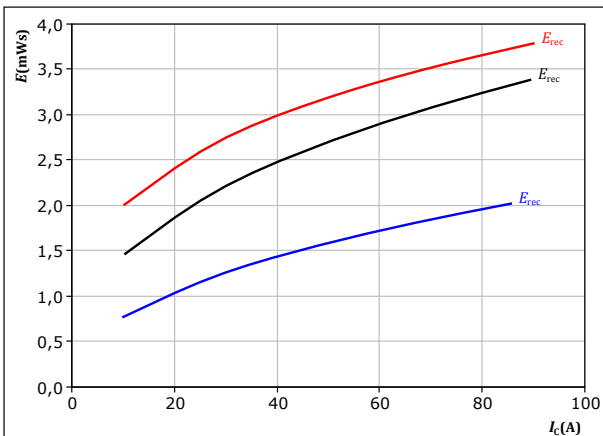
$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$   $\Omega$   
 $R_{goff} = 8$   $\Omega$

$T_j$ : 25 °C  
125 °C  
150 °C

figure 22. FWD

Typical reverse recovered energy loss as a function of collector current

$$E_{rec} = f(I_c)$$



With an inductive load at

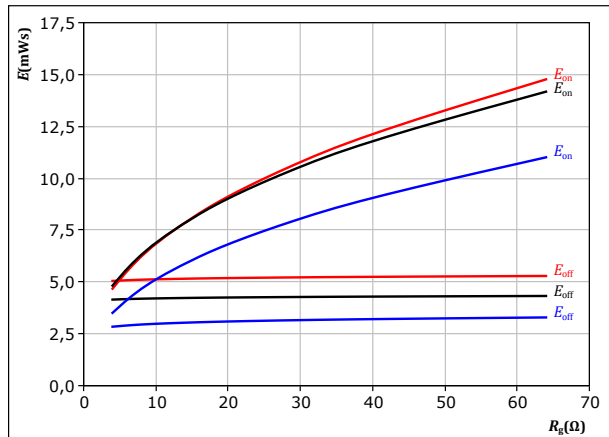
$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$   $\Omega$

$T_j$ : 25 °C  
125 °C  
150 °C

figure 21. IGBT

Typical switching energy losses as a function of IGBT turn on gate resistor

$$E = f(R_g)$$



With an inductive load at

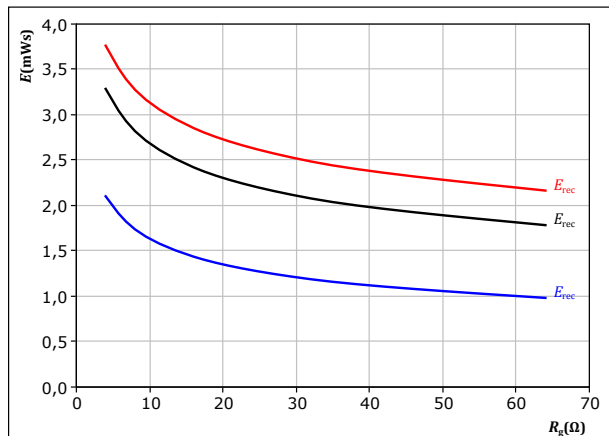
$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 50$  A

$T_j$ : 25 °C  
125 °C  
150 °C

figure 23. 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  
 $V_{GE} = \pm 15$  V  
 $I_c = 50$  A

$T_j$ : 25 °C  
125 °C  
150 °C



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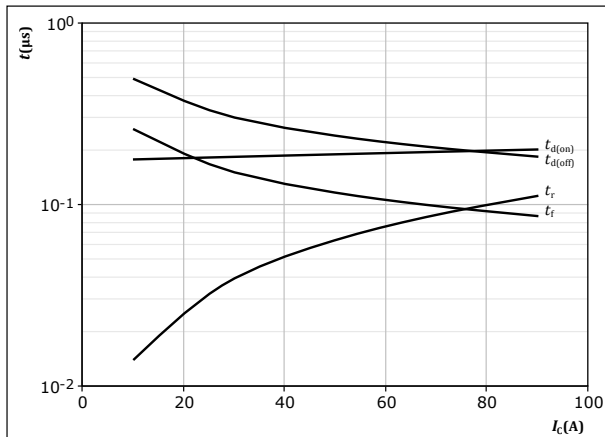
## Inverter Switching Characteristics

figure 24.

IGBT

Typical switching times as a function of collector current

$$t = f(I_c)$$



With an inductive load at

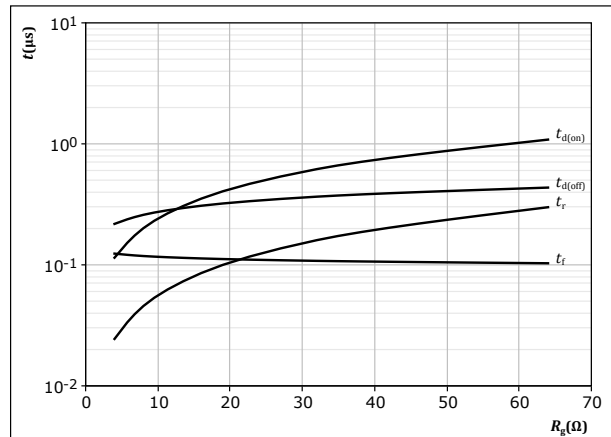
$T_j = 150$  °C  
 $V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$  Ω  
 $R_{goff} = 8$  Ω

figure 25.

IGBT

Typical switching times as a function of IGBT turn on gate resistor

$$t = f(R_g)$$



With an inductive load at

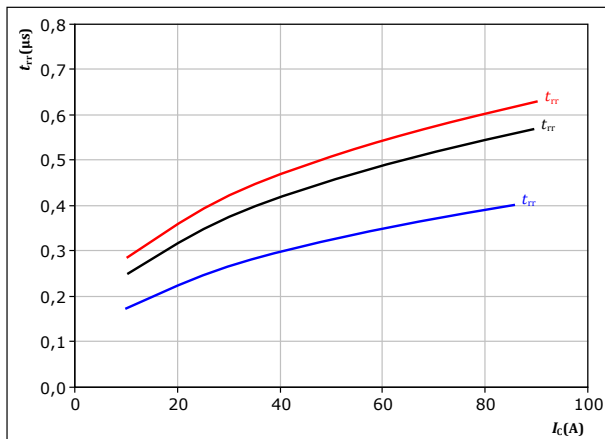
$T_j = 150$  °C  
 $V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 50$  A

figure 26.

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  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$  Ω

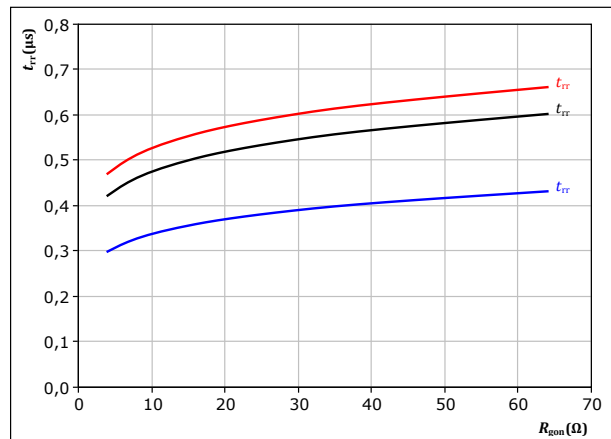
$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

figure 27.

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  
 $V_{GE} = \pm 15$  V  
 $I_c = 50$  A

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C



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datasheet

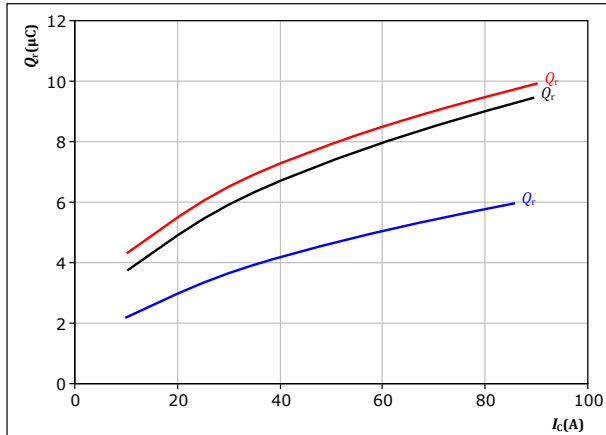
## Inverter Switching Characteristics

figure 28.

FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$   $\Omega$

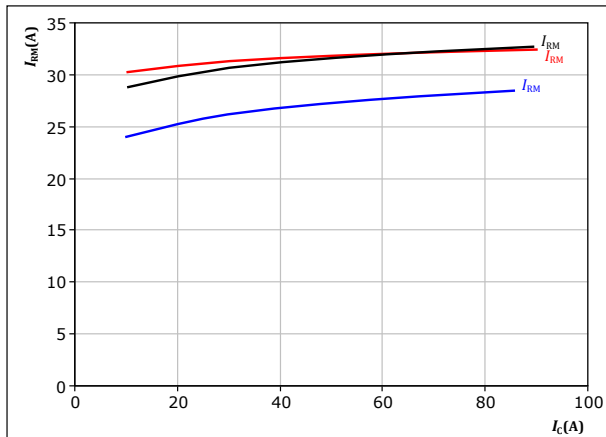
$T_j$ : 25 °C  
125 °C  
150 °C

figure 30.

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

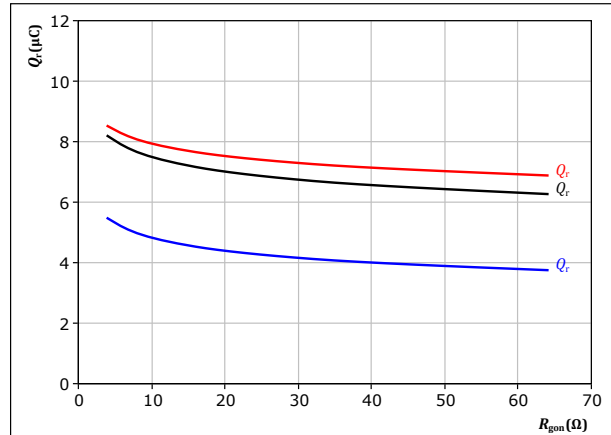
$T_j$ : 25 °C  
125 °C  
150 °C

figure 29.

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  
 $V_{GE} = \pm 15$  V  
 $I_c = 50$  A

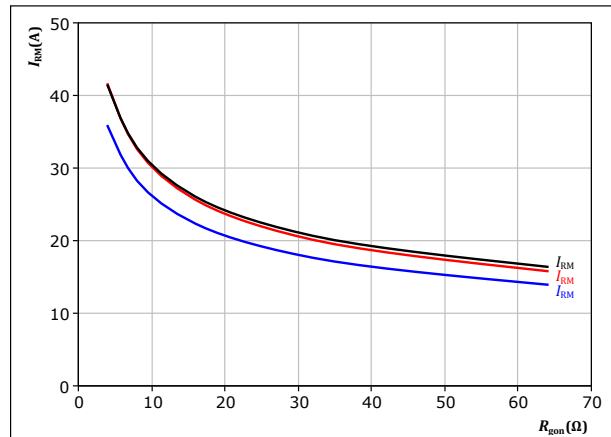
$T_j$ : 25 °C  
125 °C  
150 °C

figure 31.

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  
 $V_{GE} = \pm 15$  V  
 $I_c = 50$  A

$T_j$ : 25 °C  
125 °C  
150 °C



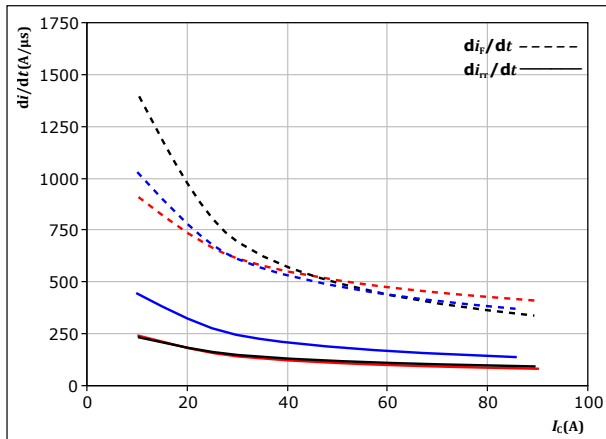
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datasheet

## Inverter Switching Characteristics

figure 32. FWD

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



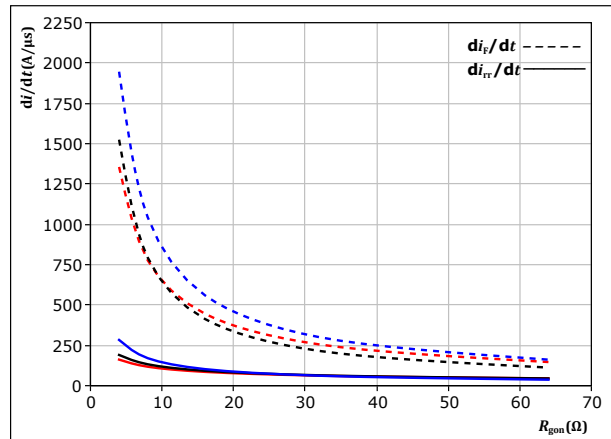
With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 8$   $\Omega$

$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 33. 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

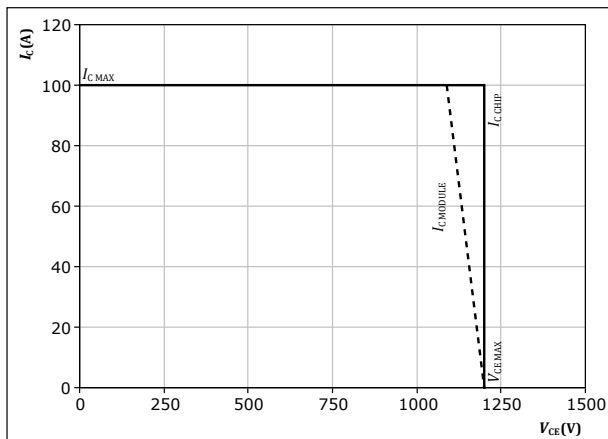
$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_C = 50$  A

$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 34. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



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



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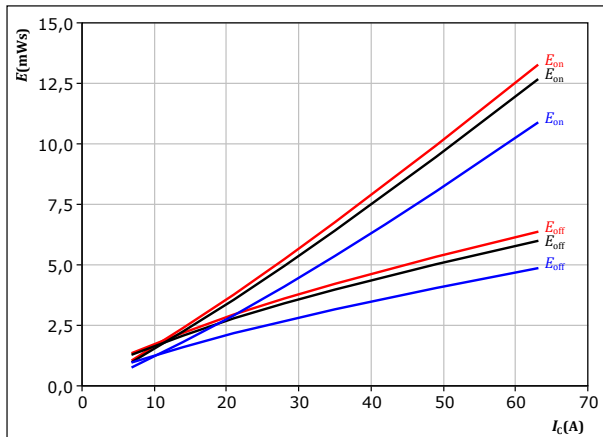
## Brake Switching Characteristics

figure 35.

IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_c)$$



With an inductive load at

$V_{CE} = 700 \text{ V}$   
 $V_{GE} = 0/15 \text{ V}$   
 $R_{gon} = 16 \text{ } \Omega$   
 $R_{goff} = 16 \text{ } \Omega$

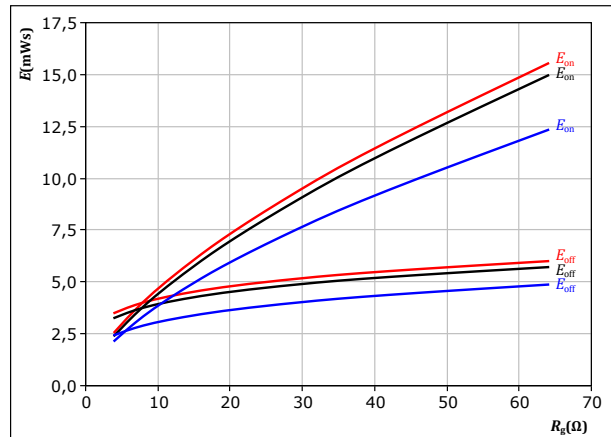
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 36.

IGBT

Typical switching energy losses as a function of IGBT turn on gate resistor

$$E = f(R_g)$$



With an inductive load at

$V_{CE} = 700 \text{ V}$   
 $V_{GE} = 0/15 \text{ V}$   
 $I_c = 35 \text{ A}$

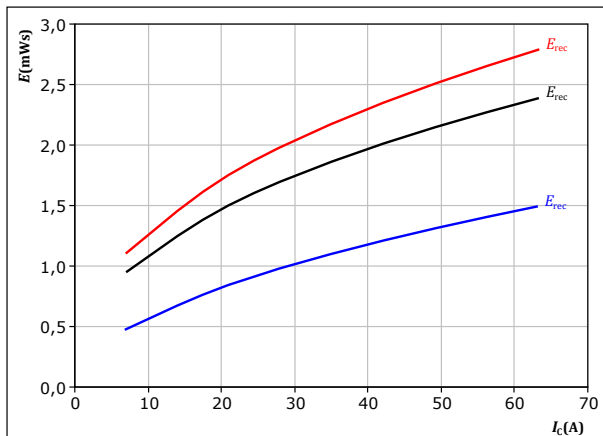
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 37.

FWD

Typical reverse recovered energy loss as a function of collector current

$$E_{rec} = f(I_c)$$



With an inductive load at

$V_{CE} = 700 \text{ V}$   
 $V_{GE} = 0/15 \text{ V}$   
 $R_{gon} = 16 \text{ } \Omega$

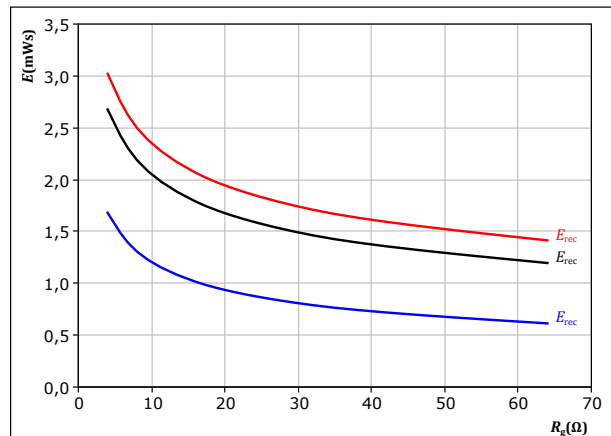
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 38.

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

$V_{CE} = 700 \text{ V}$   
 $V_{GE} = 0/15 \text{ V}$   
 $I_c = 35 \text{ A}$

$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C



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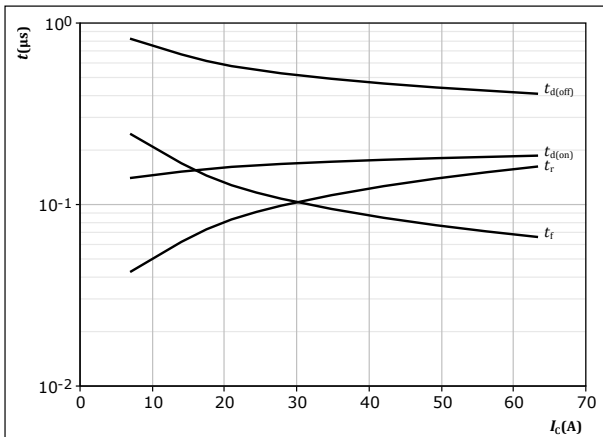
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datasheet

## Brake Switching Characteristics

figure 39.

IGBT

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



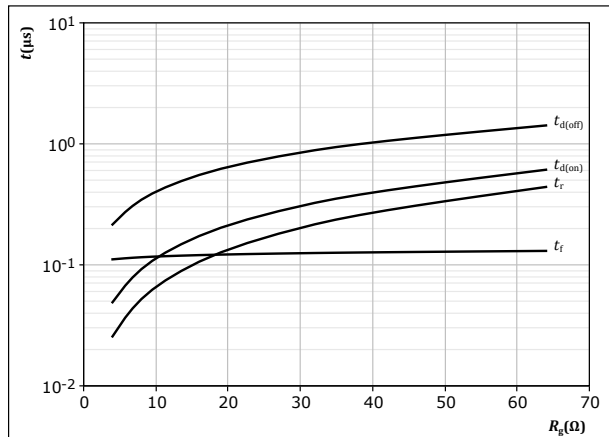
With an inductive load at

$T_j = 150$  °C  
 $V_{CE} = 700$  V  
 $V_{GE} = 0/15$  V  
 $R_{gon} = 16$   $\Omega$   
 $R_{goff} = 16$   $\Omega$

figure 40.

IGBT

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



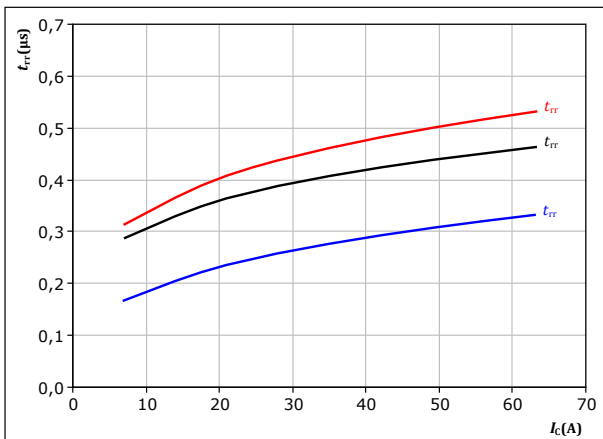
With an inductive load at

$T_j = 150$  °C  
 $V_{CE} = 700$  V  
 $V_{GE} = 0/15$  V  
 $I_C = 35$  A

figure 41.

FWD

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



With an inductive load at

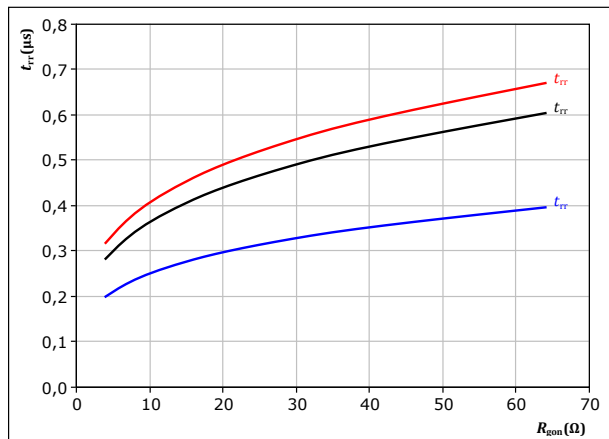
$V_{CE} = 700$  V  
 $V_{GE} = 0/15$  V  
 $R_{gon} = 16$   $\Omega$

$T_j$ : 25 °C  
125 °C  
150 °C

figure 42.

FWD

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



With an inductive load at

$V_{CE} = 700$  V  
 $V_{GE} = 0/15$  V  
 $I_C = 35$  A

$T_j$ : 25 °C  
125 °C  
150 °C



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datasheet

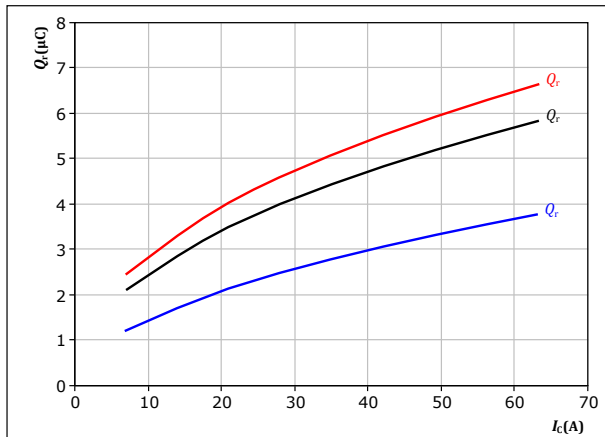
## Brake Switching Characteristics

figure 43.

FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

$V_{CE} = 700$  V  
 $V_{GE} = 0/15$  V  
 $R_{gon} = 16$  Ω

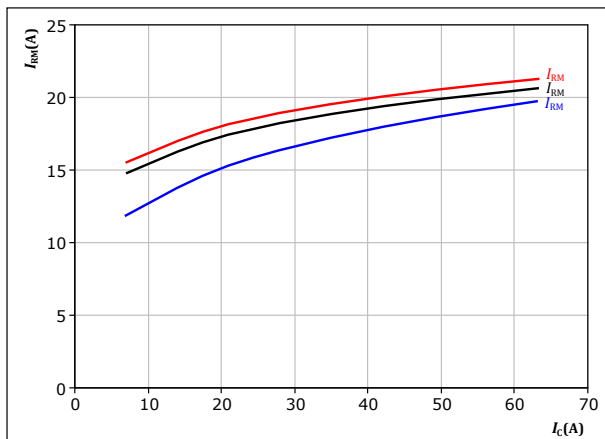
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 45.

FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

$V_{CE} = 700$  V  
 $V_{GE} = 0/15$  V  
 $R_{gon} = 16$  Ω

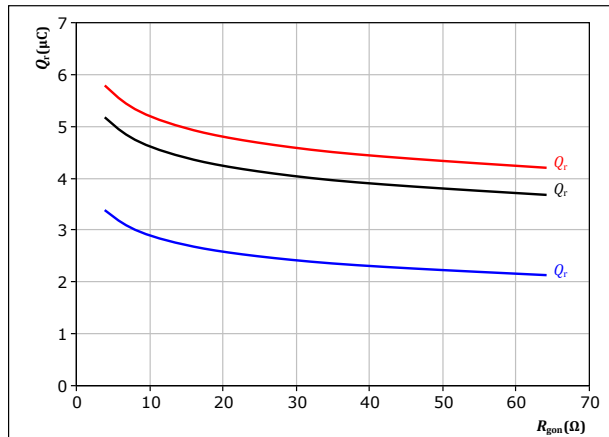
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 44.

FWD

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

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



With an inductive load at

$V_{CE} = 700$  V  
 $V_{GE} = 0/15$  V  
 $I_c = 35$  A

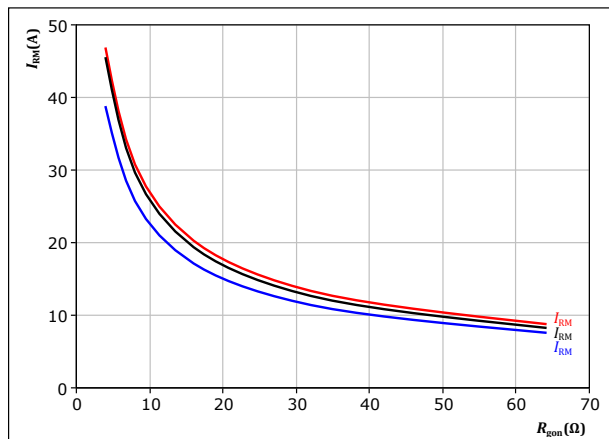
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 46.

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

$V_{CE} = 700$  V  
 $V_{GE} = 0/15$  V  
 $I_c = 35$  A

$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C



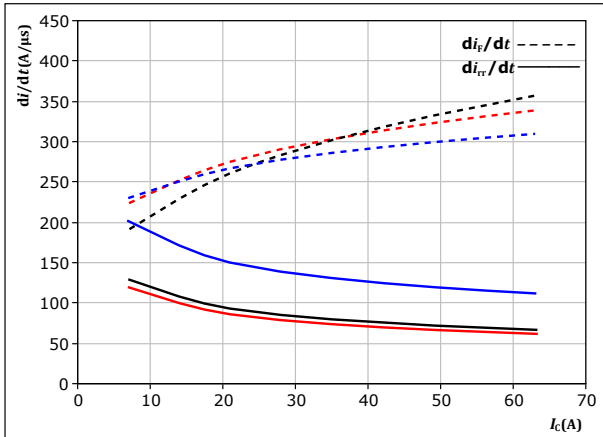
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datasheet

## Brake Switching Characteristics

figure 47. FWD

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

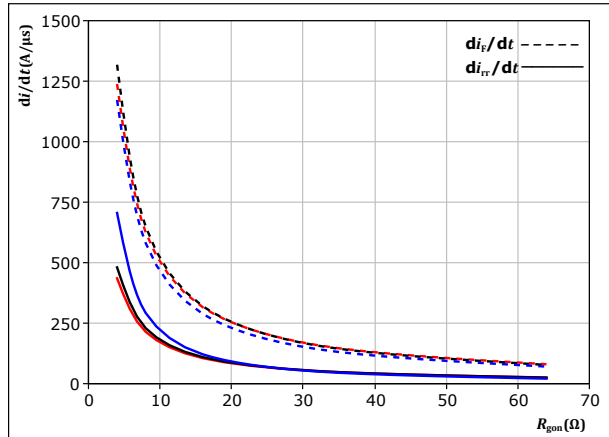


With an inductive load at

$V_{CE} = 700$  V  
 $V_{GE} = 0/15$  V  
 $R_{gon} = 16$   $\Omega$   
 $T_j: 25$  °C  
 $125$  °C  
 $150$  °C

figure 48. FWD

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



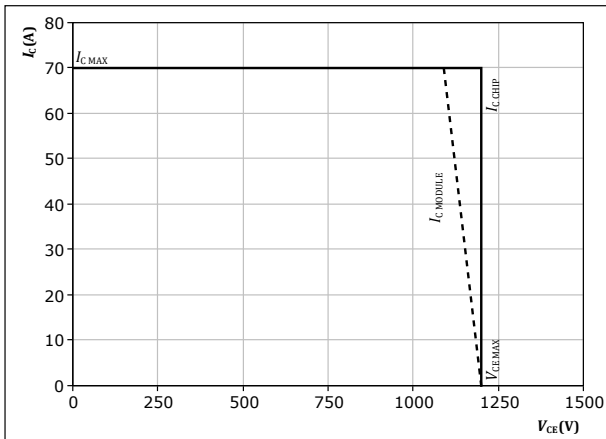
With an inductive load at

$V_{CE} = 700$  V  
 $V_{GE} = 0/15$  V  
 $I_c = 35$  A  
 $T_j: 25$  °C  
 $125$  °C  
 $150$  °C

figure 49. IGBT

Reverse bias safe operating area

$I_c = f(V_{CE})$



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



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## Switching Definitions

figure 50.

IGBT

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

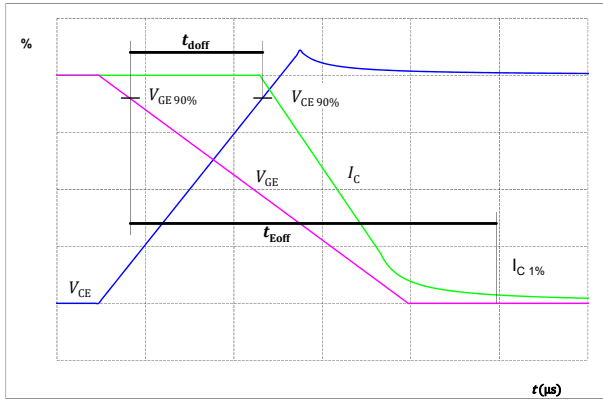


figure 51.

IGBT

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

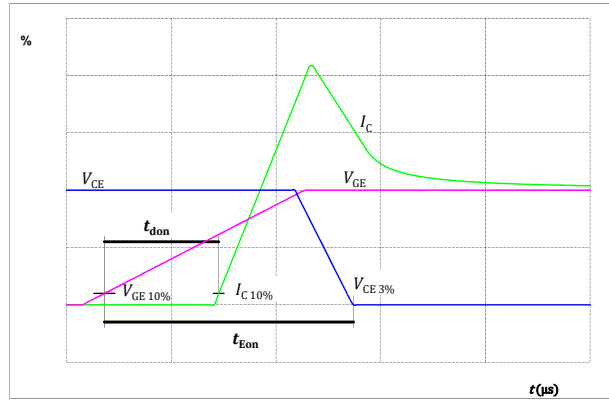


figure 52.

IGBT

Turn-off Switching Waveforms & definition of  $t_f$

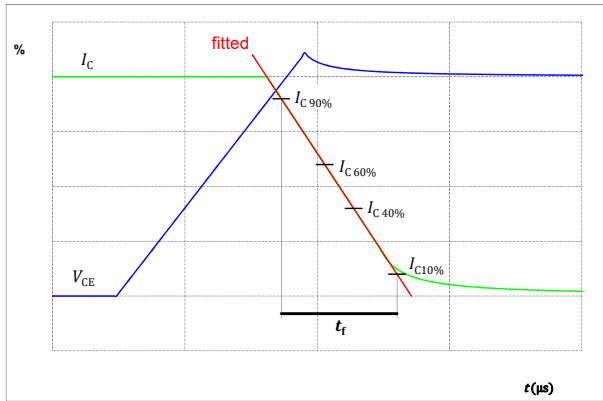
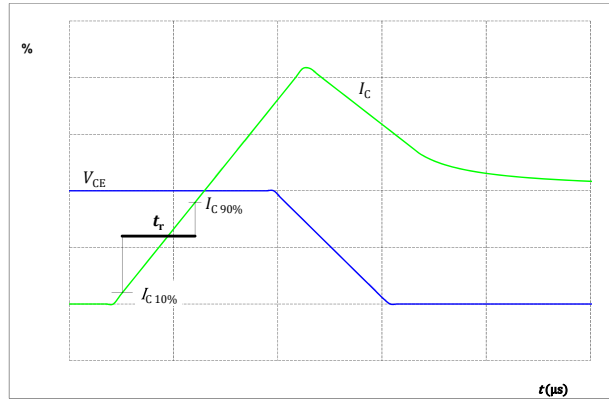


figure 53.

IGBT

Turn-on Switching Waveforms & definition of  $t_r$





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## Switching Definitions

figure 54.

FWD

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

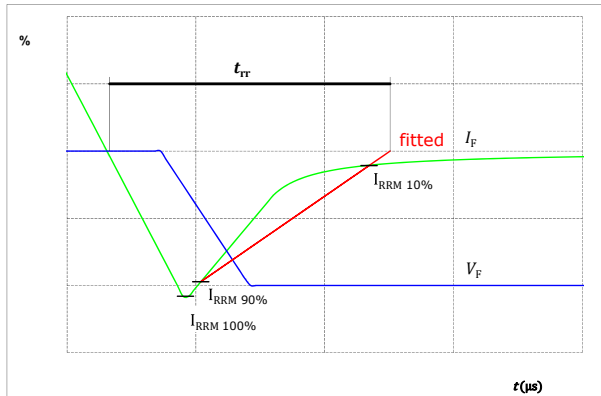
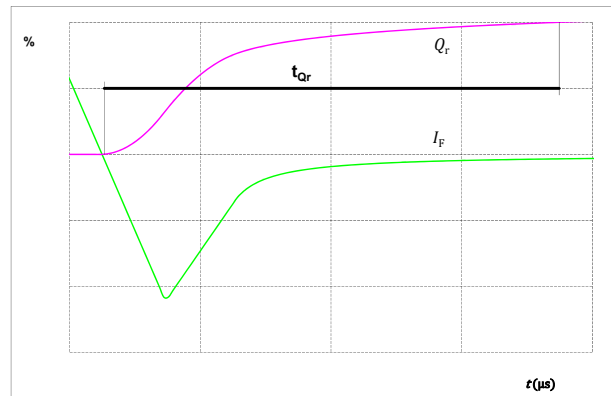


figure 55.

FWD

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









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# 10-F112PMA050M7-P580A79

datasheet

Ordering Code	
Version	Ordering Code
Without thermal paste	10-F112PMA050M7-P580A79
With thermal paste (5,2 W/mK, PTM6000HV)	10-F112PMA050M7-P580A79-/7/
With thermal paste (3,4 W/mK, PSX-P7)	10-F112PMA050M7-P580A79-/3/

Marking							
<div><div>NN-NNNNNNNNNNNNNN TTTTTVVWWYY UL VIN LLLL SSSS</div><div></div><div></div></div>	Text	Name		Date code	UL & VIN	Lot	Serial
		NN-NNNNNNNNNNNNNN- TTTTTVV		WWYY	UL VIN	LLLLL	SSSS
	<div><div></div><div></div><div></div></div>	Datamatrix	Type&Ver	Lot number	Serial	Date code	
		TTTTTVV	LLLLL	SSSS	WWYY		

Outline			
Pin table [mm]			
Pin	X	Y	Function
1	52,55	0	G27
2	47,7	0	DC-Rect
3	44,8	0	DC-Rect
4	37,8	0	DC+Rect
5	37,8	2,8	DC+Rect
6	35	0	DC+Inv
7	35	2,8	DC+Inv
8	28	0	Therm1
9	25,2	0	Therm2
10	22,4	0	DC-3
11	19,6	0	G15
12	16,8	0	S15
13	14	0	DC-2
14	11,2	0	G13
15	8,4	0	S13
16	5,6	0	DC-1
17	2,8	0	G11
18	0	0	S11
19	0	28,5	Ph1
20	2,8	28,5	G12
21	7,5	28,5	S12
22	14,5	28,5	Ph2
23	17,3	28,5	G14
24	22	28,5	S14
25	29	28,5	Ph3
26	31,8	28,5	G16
27	36,5	28,5	S16
28	43,5	28,5	ACIn1
29	52,55	25	ACIn2
30	52,55	16,9	ACIn3
31	52,55	8,6	Br
32	52,55	2,8	DC-Br

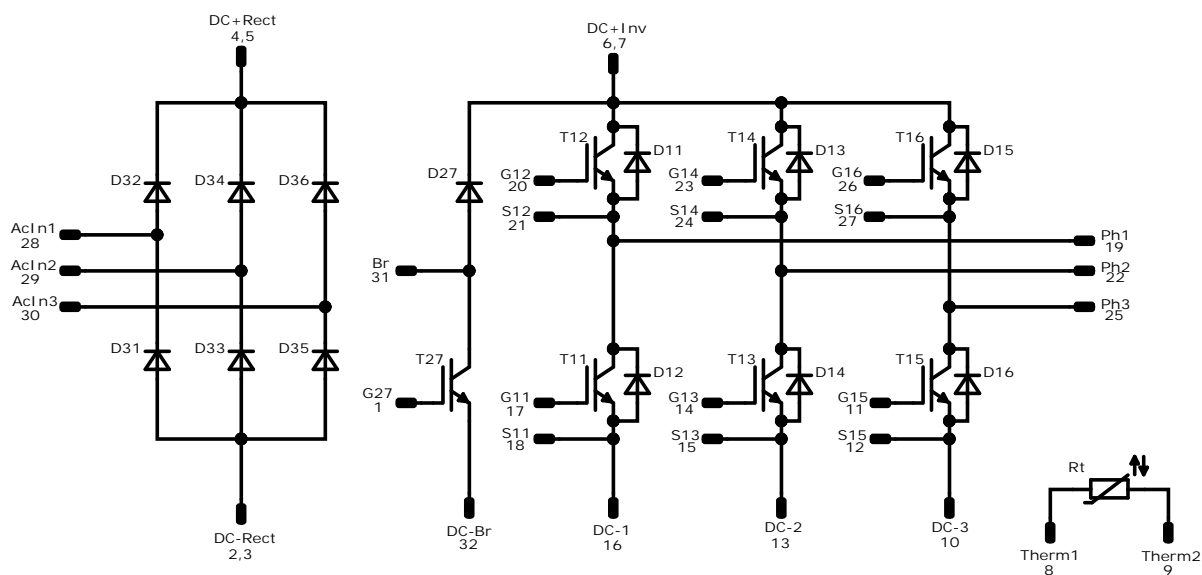
Tolerance of pinposition:  $\pm 0,5\text{mm}$  at the end of pins  
Dimension of coordinate axis is only offset without tolerance



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**10-F112PMA050M7-P580A79**  
datasheet

**Pinout**




**Identification**

ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	50 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	50 A	Inverter Diode	
T27	IGBT	1200 V	35 A	Brake Switch	
D27	FWD	1200 V	25 A	Brake Diode	
D31, D32, D33, D34, D35, D36	Rectifier	1600 V	45 A	Rectifier Diode	
Rt	NTC			Thermistor	



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**10-F112PMA050M7-P580A79**  
datasheet

Packaging instruction				
Standard packaging quantity (SPQ) 100	>SPQ	Standard	<SPQ	Sample
Handling instruction				
Handling instructions for <i>flow 1</i> packages see vincotech.com website.				
Package data				
Package data for <i>flow 1</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-F112PMA050M7-P580A79-D4-14	9 Jun. 2022	New Datasheet format, module is unchanged Separate datasheet Corrected collector current and continuous forward current Conditions of maximum collector current and continuous forward current added	

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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.