



Vincotech

# 10-E212PMA050M7-L189A78Z

datasheet

flowPIM E2

1200 V / 50 A

## Features

- IGBT M7 with low VCEsat and improved EMC behavior
- Standard industrial housing
- Optimized Rth(j-s) with Phase Change Material
- Built-in NTC

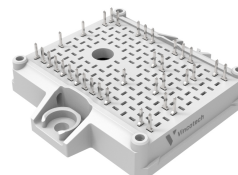
## Target applications

- Industrial Drives

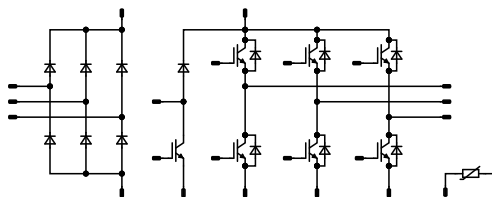
## Types

- 10-E212PMA050M7-L189A78Z

## flow E2 12 mm housing



## Schematic





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## Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
<b>Inverter Switch</b>				
Collector-emitter voltage	$V_{CES}$		1200	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	60	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	100	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	124	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)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	48	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	100	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	87	W
Maximum junction temperature	$T_{jmax}$		175	$^{\circ}\text{C}$

## Brake Switch

Collector-emitter voltage	$V_{CES}$		1200	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	60	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	100	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	124	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)	$I_F$	$T_j = T_{jmax}$ $T_a = 80\text{ °C}$	19	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_a = 80\text{ °C}$	43	W
Maximum junction temperature	$T_{jmax}$		175	°C

## Rectifier Diode

Peak repetitive reverse voltage	$V_{RRM}$		1600	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_a = 80\text{ °C}$	58	A
Surge (non-repetitive) forward current	$I_{FSM}$	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	400	A
Surge current capability	$I^2t$		800	A <sup>2</sup> s
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_a = 80\text{ °C}$	68	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			8,83	mm
Comparative Tracking Index	CTI		≥ 600	

\*100 % tested in production

\*\* $T_{jmax} > T_j > T_{jop}$  is allowed only for maximum 60 sec overload not exceeding 1/5 duty ratio of each loading cycle for selected semiconductor component under switching conditions.



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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	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)						0,77		K/W
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#### Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 16$ Ω $R_{goff} = 16$ Ω	±15	600	50	25 125 150		343 337 349		ns
Rise time	$t_r$					25 125 150		84 94 96		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		274 297 308		ns
Fall time	$t_f$					25 125 150		96,5 106,46 114,83		ns
Turn-on energy (per pulse)	$E_{on}$					25 125 150		5,83 7,88 7,98		mWs
Turn-off energy (per pulse)	$E_{off}$	$Q_{tFWD}=4,51$ µC $Q_{tFWD}=7,96$ µC $Q_{tFWD}=8,1$ µC				25 125 150		2,97 4,12 5,04		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)						1,09		K/W
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#### Dynamic

Peak recovery current	$I_{RRM}$	$di/dt=488$ A/µs $di/dt=364$ A/µs $di/dt=416$ A/µs	$\pm 15$	600	50	25 125 150		23,22 28,4 27,65		A
Reverse recovery time	$t_{rr}$					25 125 150		319,72 502,45 543,17		ns
Recovered charge	$Q_r$					25 125 150		4,51 7,96 8,1		µC
Reverse recovered energy	$E_{rec}$					25 125 150		1,48 2,9 3,16		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		150,38 120,86 82,76		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	0,005	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	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)						0,77		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	16,5	25 125 150		128,8 117,2 114		ns
Rise time	$t_r$					25 125 150		25,2 30 30,4		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		619,4 700,4 721		ns
Fall time	$t_f$					25 125 150		118,12 159,87 169,1		ns
Turn-on energy (per pulse)	$E_{on}$					25 125 150		1,13 1,33 1,38		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		1,93 2,61 2,79		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	$V_F$				10	25 125 150		1,61 1,69 1,7	2,1 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_i = 1200$ V				25			25	µA

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						2,19		K/W
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#### Dynamic

Peak recovery current	$I_{RRM}$	$di/dt=662$ A/µs $di/dt=627$ A/µs $di/dt=544$ A/µs	0/15	700	16,5	25 125 150		14,73 15,4 15,6		A
Reverse recovery time	$t_{rr}$					25 125 150		225,94 322,11 356,51		ns
Recovered charge	$Q_r$					25 125 150		1,53 2,19 2,43		µC
Reverse recovered energy	$E_{rec}$					25 125 150		0,682 1,05 1,19		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		70,55 84,31 99,59		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	$V_F$				35	25 125 150		1,09 1,02 1,02	1,5 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_i = 1600$ V				25 150			100 2000	μA

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,03		K/W
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### Thermistor

#### Static

Rated resistance	$R$					25		5		kΩ
Deviation of $R_{100}$	$\Delta_{R/R}$	$R_{100} = 493$ Ω				100	-5		5	%
Power dissipation	$P$							245		mW
Power dissipation constant	$d$					25		1,4		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 2$ %						3375		K
B-value	$B_{(25/100)}$	Tol. $\pm 2$ %						3437		K
Vincotech Thermistor Reference									K	

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

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



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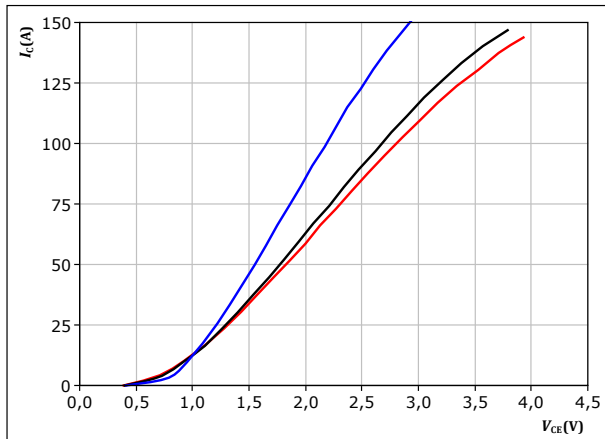
# 10-E212PMA050M7-L189A78Z datasheet

## Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

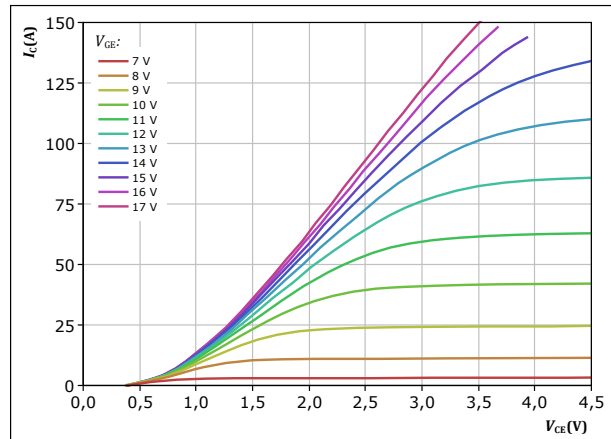


$t_p = 250 \mu s$   
 $V_{GE} = 15 V$   
 $T_j: 25 ^\circ C, 125 ^\circ C, 150 ^\circ C$

figure 2. IGBT

Typical output characteristics

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

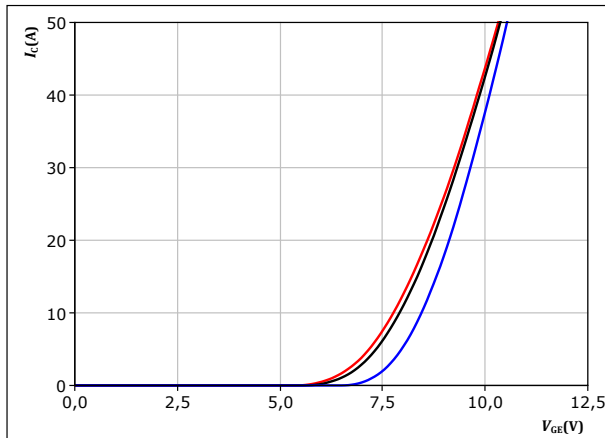


$t_p = 250 \mu s$   
 $T_j = 150 ^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

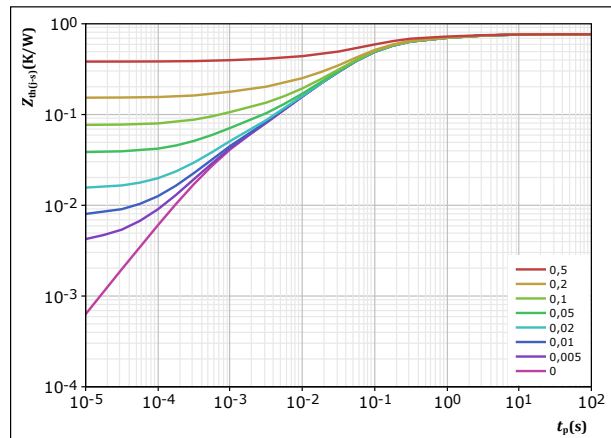


$t_p = 250 \mu s$   
 $V_{CE} = 10 V$   
 $T_j: 25 ^\circ C, 125 ^\circ C, 150 ^\circ C$

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,766 K/W$   
IGBT thermal model values  

$R (K/W)$	$\tau (s)$
4,42E-02	4,45E+00
9,11E-02	9,15E-01
2,73E-01	1,28E-01
2,59E-01	4,34E-02
6,73E-02	6,94E-03
3,15E-02	6,91E-04



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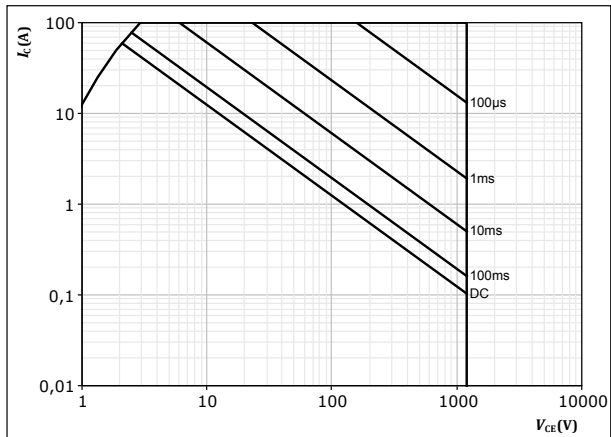
## Inverter Switch Characteristics

figure 5.

IGBT

Safe operating area

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



$D =$  single pulse

$T_s = 80$  °C

$V_{GE} = 15$  V

$T_j = T_{jmax}$



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datasheet

## Inverter Diode Characteristics

figure 6. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

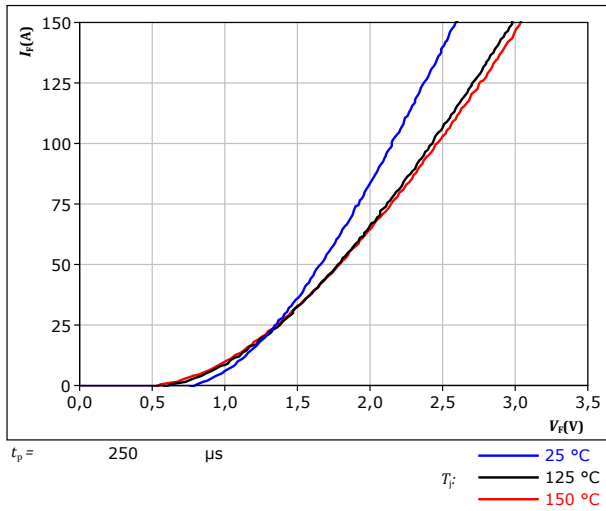
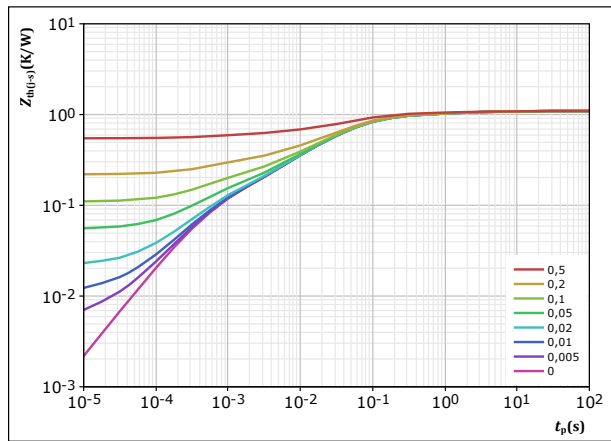


figure 7. FWD

Transient thermal impedance as a function of pulse width

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



$D =$	$t_p / T$
$R_{th(j-s)} =$	1,094 K/W
FWD thermal model values	
$R$ (K/W)	$\tau$ (s)
4,05E-02	7,09E+00
8,82E-02	9,93E-01
2,80E-01	1,18E-01
4,48E-01	3,26E-02
1,45E-01	5,44E-03
9,23E-02	5,22E-04



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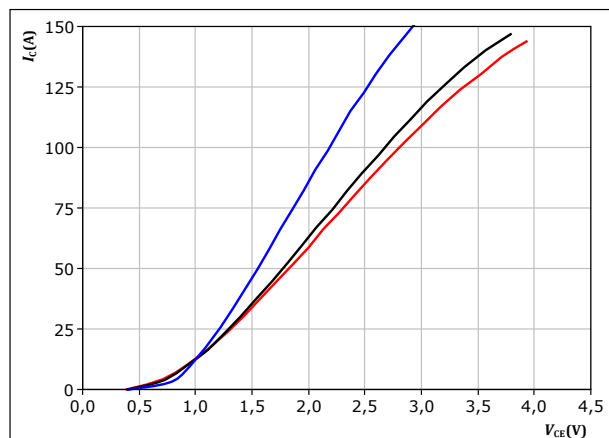
## Brake Switch Characteristics

figure 8.

IGBT

Typical output characteristics

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



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

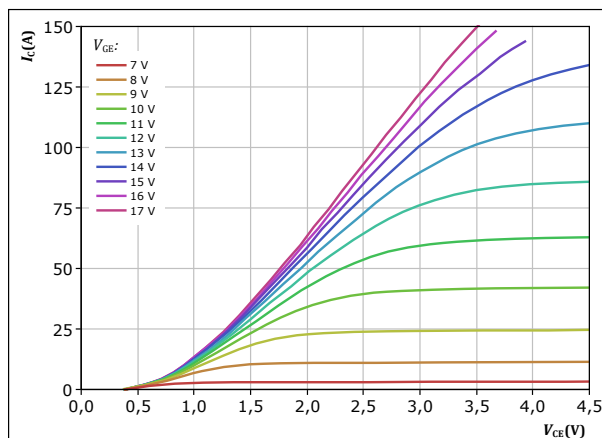
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 9.

IGBT

Typical output characteristics

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



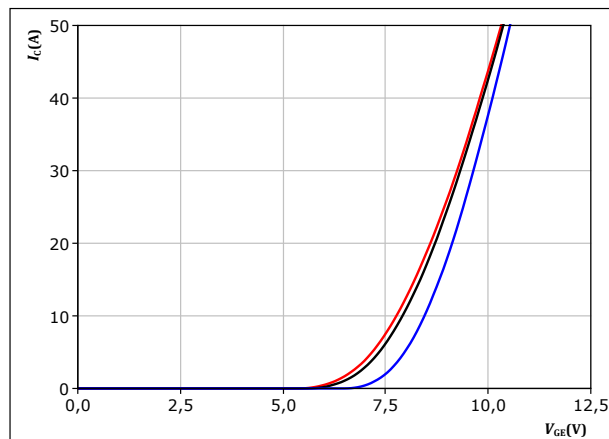
$t_p = 250 \mu s$   
 $T_j = 150 \text{ °C}$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

figure 10.

IGBT

Typical transfer characteristics

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



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

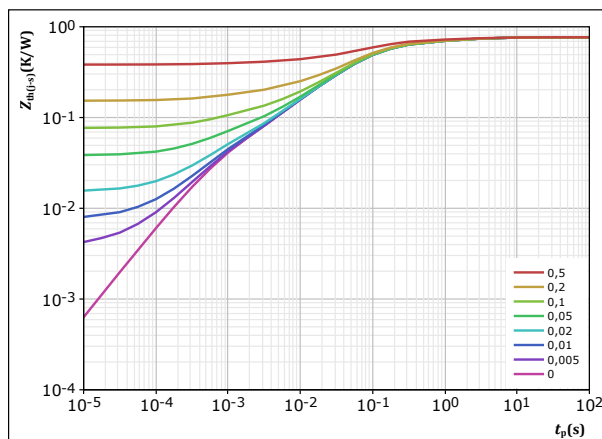
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 11.

IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T = 0.766 \text{ K/W}$   
IGBT thermal model values  

$R$ (K/W)	$\tau$ (s)
4,42E-02	4,45E+00
9,11E-02	9,15E-01
2,73E-01	1,28E-01
2,59E-01	4,34E-02
6,73E-02	6,94E-03
3,15E-02	6,91E-04





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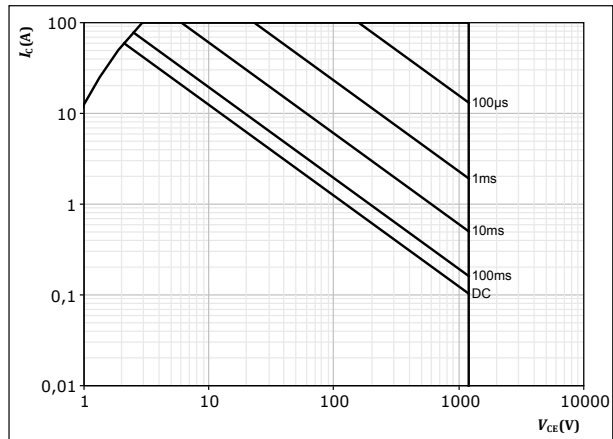
## Brake Switch Characteristics

figure 12.

IGBT

Safe operating area

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



$D =$  single pulse

$T_s = 80$  °C

$V_{GE} = 15$  V

$T_j = T_{jmax}$



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datasheet

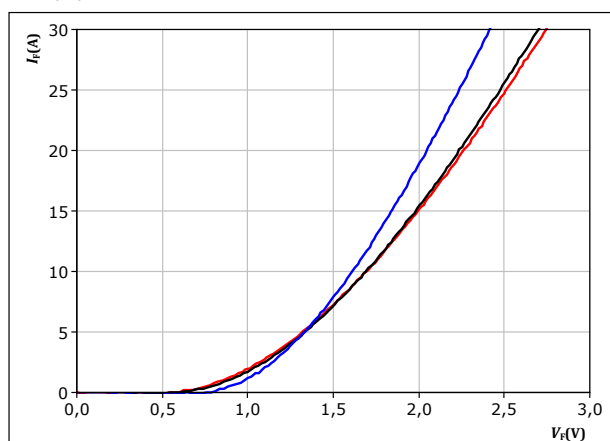
## Brake Diode Characteristics

figure 13.

FWD

Typical forward characteristics

$$I_F = f(V_F)$$



$t_p = 250 \mu s$

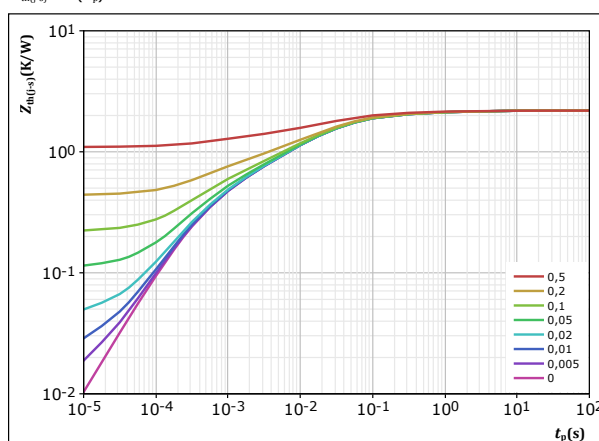
$T_j:$   
— 25 °C  
— 125 °C  
— 150 °C

figure 14.

FWD

Transient thermal impedance as a function of pulse width

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



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



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## Rectifier Diode Characteristics

figure 15.

Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

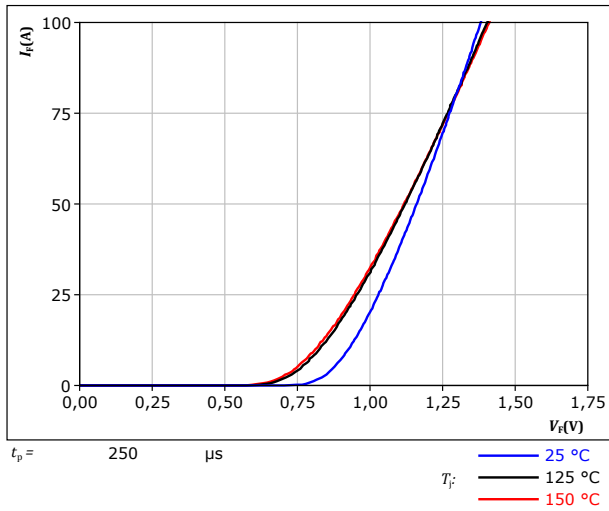
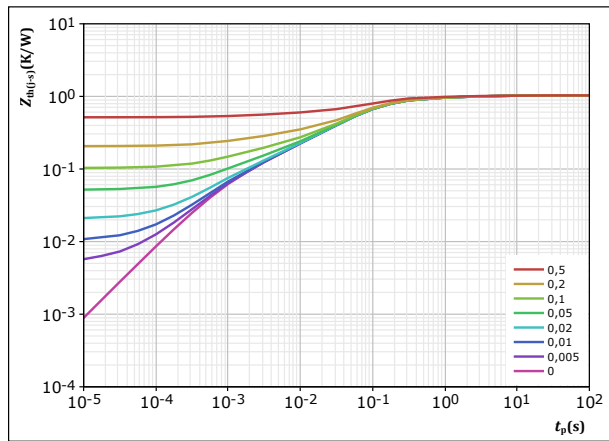


figure 16.

Rectifier

Transient thermal impedance as a function of pulse width

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





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datasheet

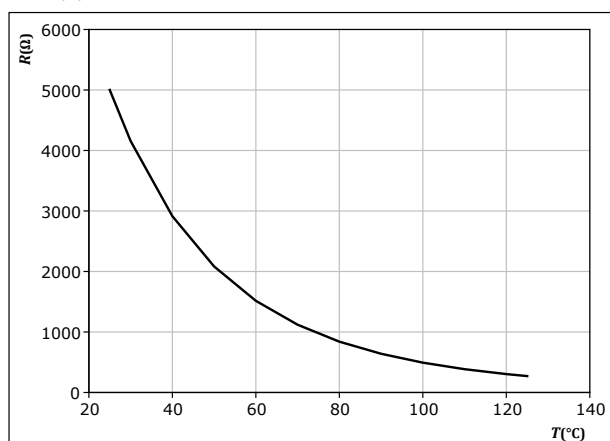
## Thermistor Characteristics

figure 17.

Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$





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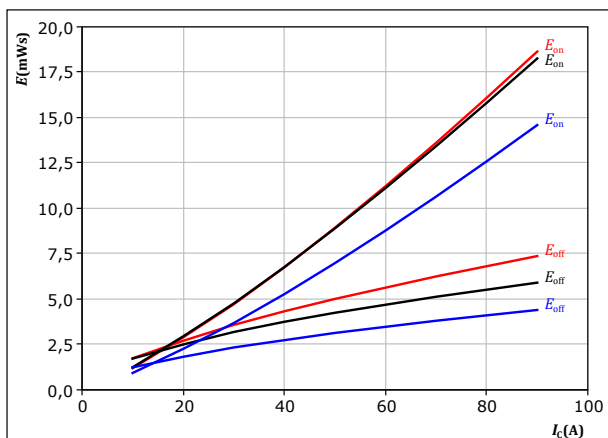
## Inverter Switching Characteristics

figure 18.

IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 16 \text{ } \Omega$   
 $R_{goff} = 16 \text{ } \Omega$

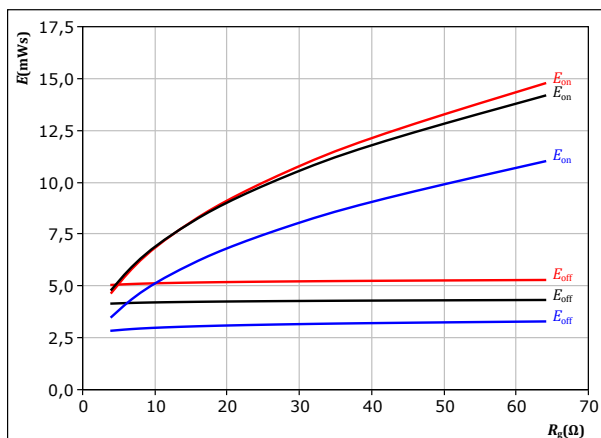
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 19.

IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$



With an inductive load at

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

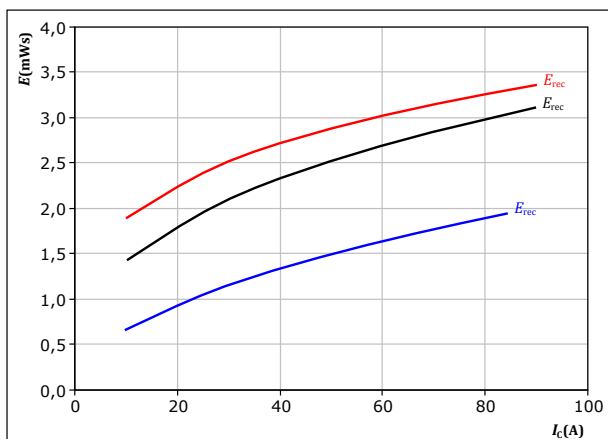
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 20.

FWD

Typical reverse recovered energy loss as a function of collector current

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



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 16 \text{ } \Omega$

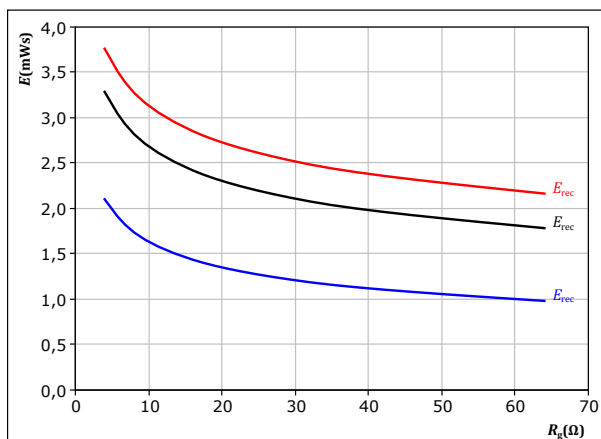
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 21.

FWD

Typical reverse recovered energy loss as a function of gate resistor

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



With an inductive load at

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

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



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datasheet

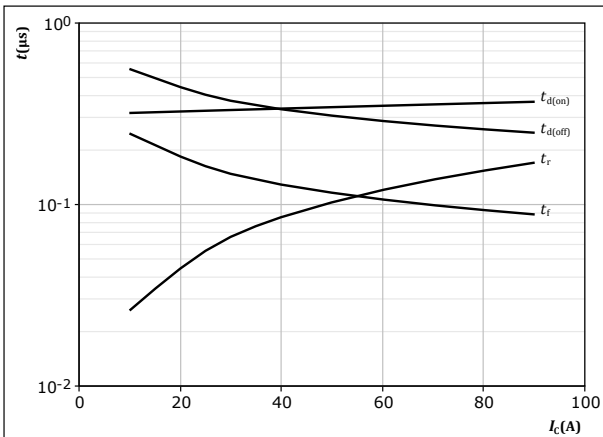
## Inverter Switching Characteristics

figure 22.

IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



With an inductive load at

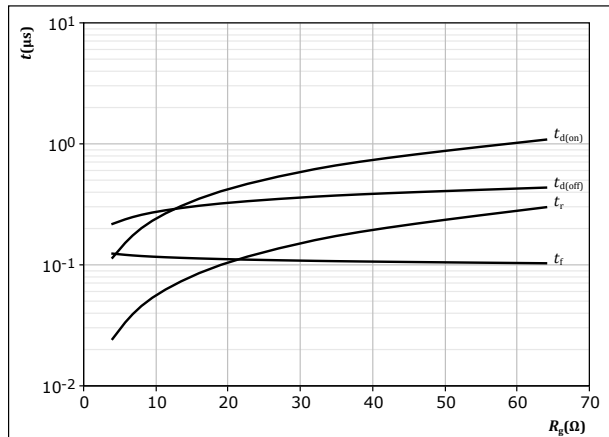
$T_j = 150 \text{ } ^\circ\text{C}$   
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 16 \text{ } \Omega$   
 $R_{goff} = 16 \text{ } \Omega$

figure 23.

IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



With an inductive load at

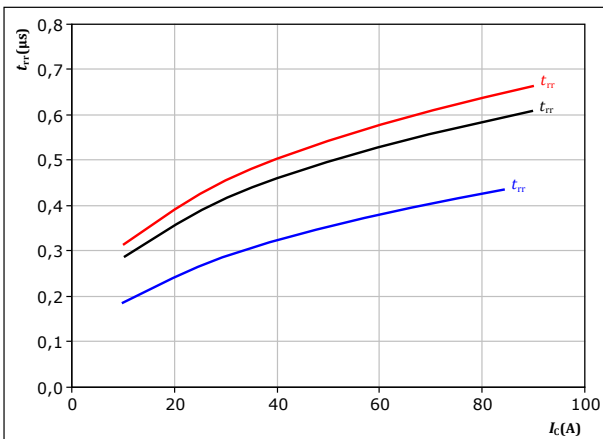
$T_j = 150 \text{ } ^\circ\text{C}$   
 $V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_C = 50 \text{ A}$

figure 24.

FWD

Typical reverse recovery time as a function of collector current

$$t_{rr} = f(I_C)$$



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 16 \text{ } \Omega$

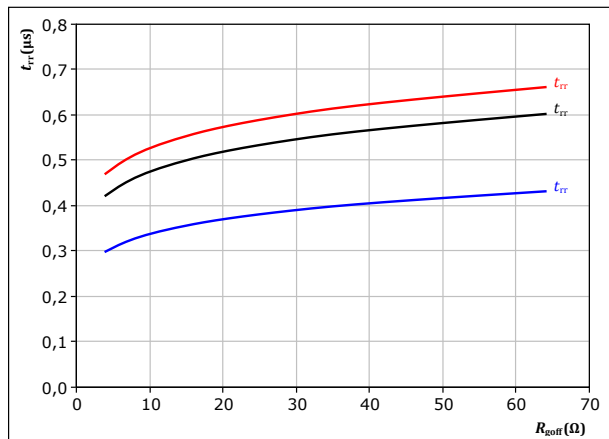
$T_j$ : — 25 °C  
 — 125 °C  
 — 150 °C

figure 25.

FWD

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

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



With an inductive load at

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

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



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datasheet

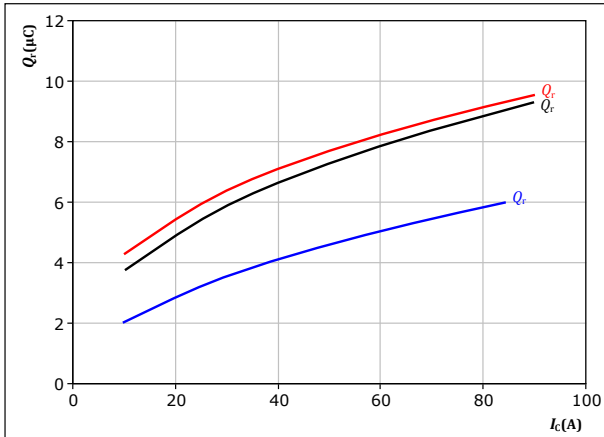
## Inverter Switching Characteristics

figure 26.

FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 16 \text{ } \Omega$

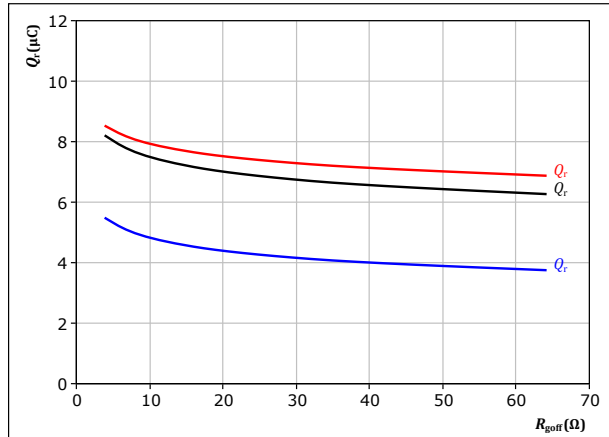
$T_j$ :  $25 \text{ } ^\circ\text{C}$   
 $125 \text{ } ^\circ\text{C}$   
 $150 \text{ } ^\circ\text{C}$

figure 27.

FWD

Typical recovered charge as a function of turn off gate resistor

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



With an inductive load at

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

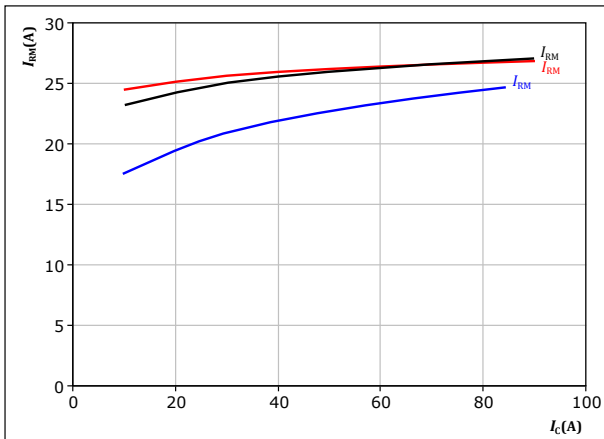
$T_j$ :  $25 \text{ } ^\circ\text{C}$   
 $125 \text{ } ^\circ\text{C}$   
 $150 \text{ } ^\circ\text{C}$

figure 28.

FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 16 \text{ } \Omega$

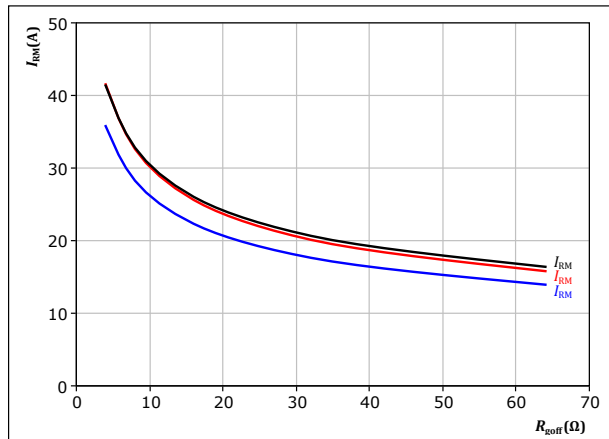
$T_j$ :  $25 \text{ } ^\circ\text{C}$   
 $125 \text{ } ^\circ\text{C}$   
 $150 \text{ } ^\circ\text{C}$

figure 29.

FWD

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

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



With an inductive load at

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

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



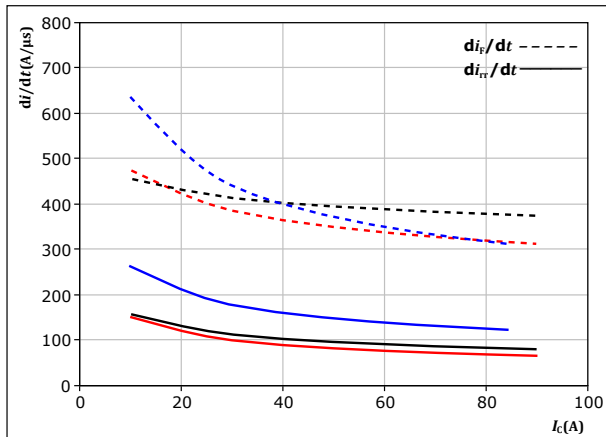
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datasheet

## Inverter Switching Characteristics

figure 30. FWD

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



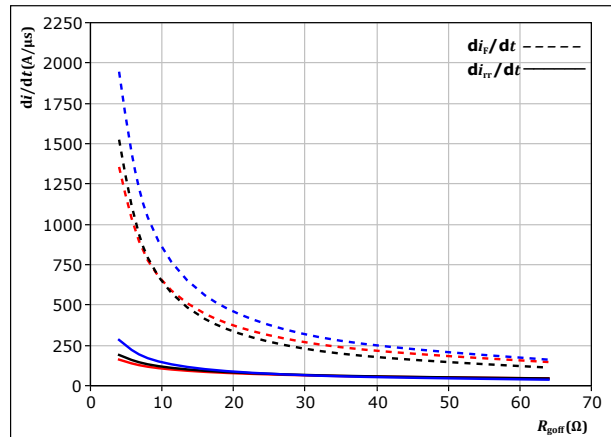
With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{goff} = 16 \text{ } \Omega$

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

figure 31. FWD

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



With an inductive load at

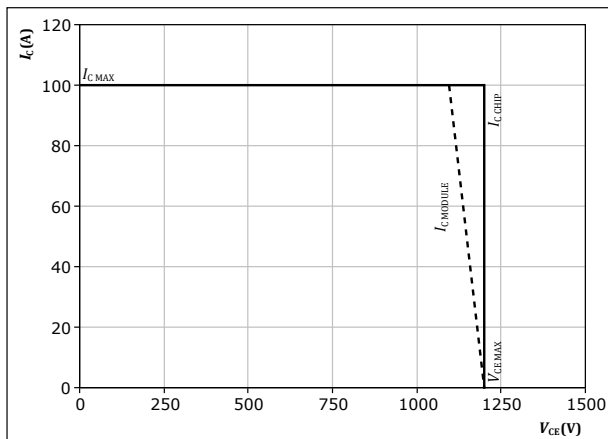
$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_C = 50 \text{ A}$

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

figure 32. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At  $T_j = 150 \text{ } ^\circ\text{C}$   
 $R_{goff} = 16 \text{ } \Omega$   
 $R_{goff} = 16 \text{ } \Omega$





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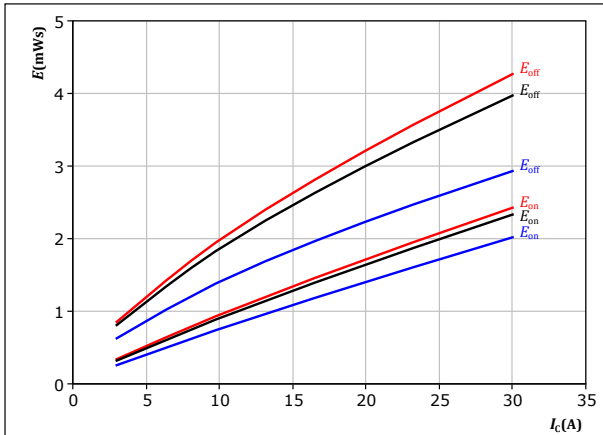
## Brake Switching Characteristics

figure 33.

IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_c)$$



With an inductive load at

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

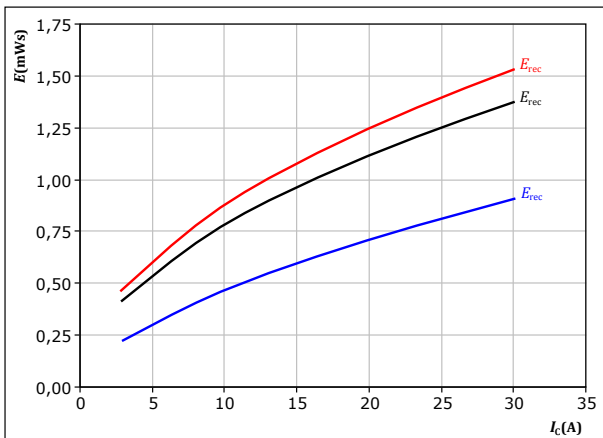
$T_j$ : 25 °C  
125 °C  
150 °C

figure 35.

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

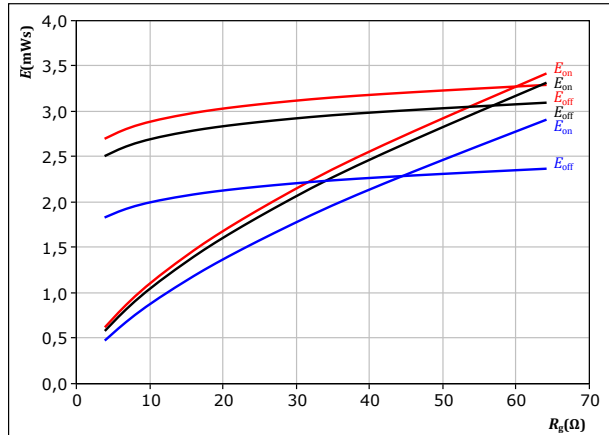
$T_j$ : 25 °C  
125 °C  
150 °C

figure 34.

IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$



With an inductive load at

$V_{CE} = 700$  V  
 $V_{GE} = 0/15$  V  
 $I_c = 16,5$  A

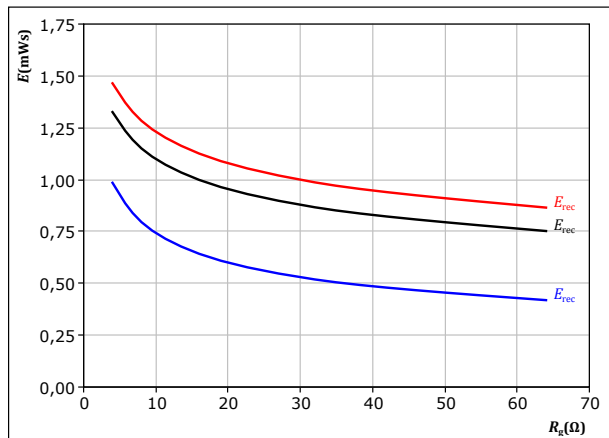
$T_j$ : 25 °C  
125 °C  
150 °C

figure 36.

FWD

Typical reverse recovered energy loss as a function of gate resistor

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



With an inductive load at

$V_{CE} = 700$  V  
 $V_{GE} = 0/15$  V  
 $I_c = 16,5$  A

$T_j$ : 25 °C  
125 °C  
150 °C



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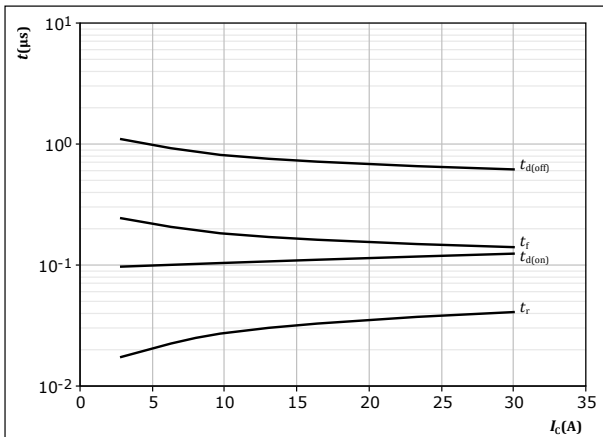
10-E212PMA050M7-L189A78Z  
datasheet

## Brake Switching Characteristics

figure 37.

IGBT

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



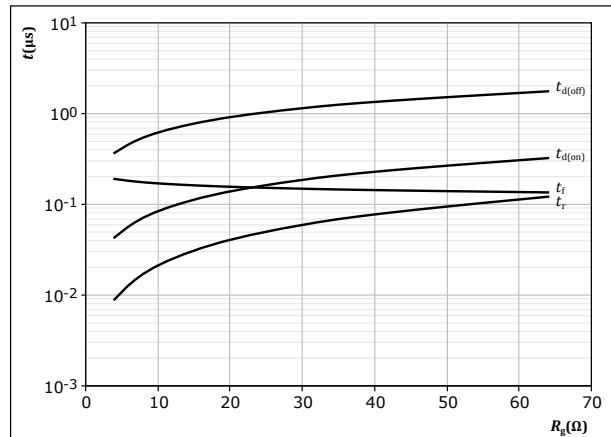
With an inductive load at

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

figure 38.

IGBT

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



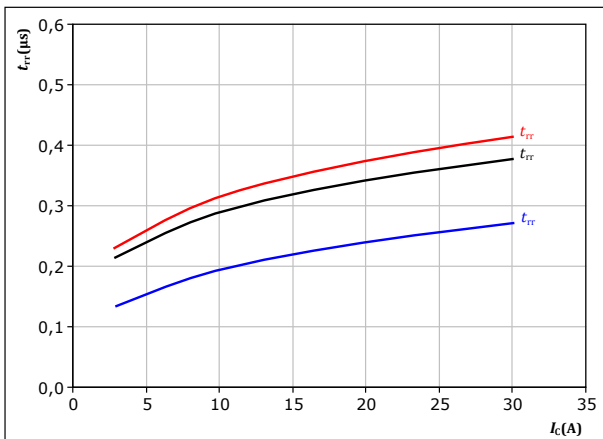
With an inductive load at

$T_j = 150$  °C  
 $V_{CE} = 700$  V  
 $V_{GE} = 0/15$  V  
 $I_c = 16,5$  A

figure 39.

FWD

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



With an inductive load at

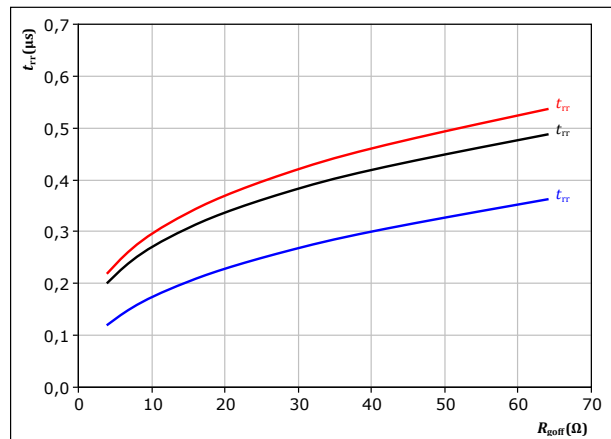
$V_{CE} = 700$  V  
 $V_{GE} = 0/15$  V  
 $R_{gon} = 16$   $\Omega$

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

figure 40.

FWD

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



With an inductive load at

$V_{CE} = 700$  V  
 $V_{GE} = 0/15$  V  
 $I_c = 16,5$  A

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



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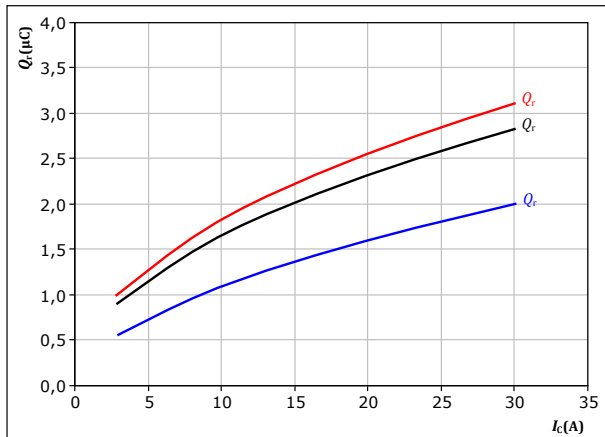
## Brake Switching Characteristics

figure 41.

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

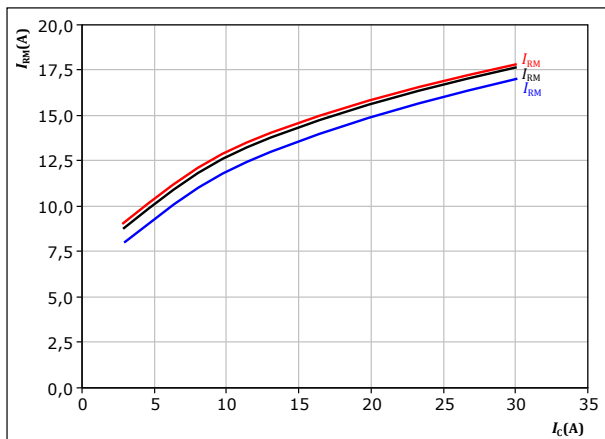
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 43.

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

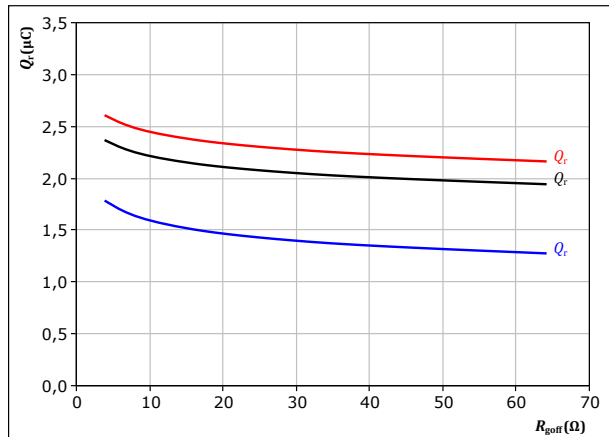
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 42.

FWD

Typical recovered charge as a function of turn off gate resistor

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



With an inductive load at

$V_{CE} = 700$  V  
 $V_{GE} = 0/15$  V  
 $I_c = 16,5$  A

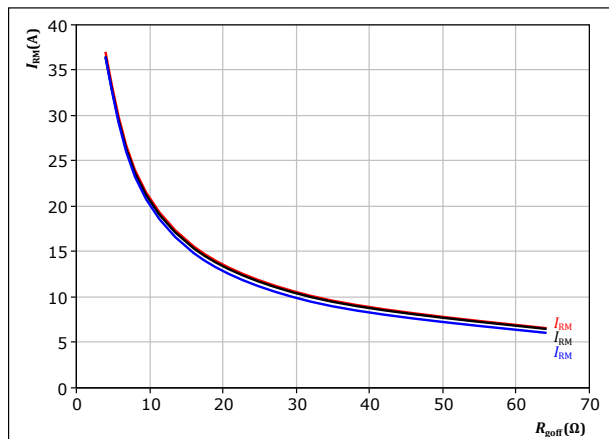
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 44.

FWD

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

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



With an inductive load at

$V_{CE} = 700$  V  
 $V_{GE} = 0/15$  V  
 $I_c = 16,5$  A

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



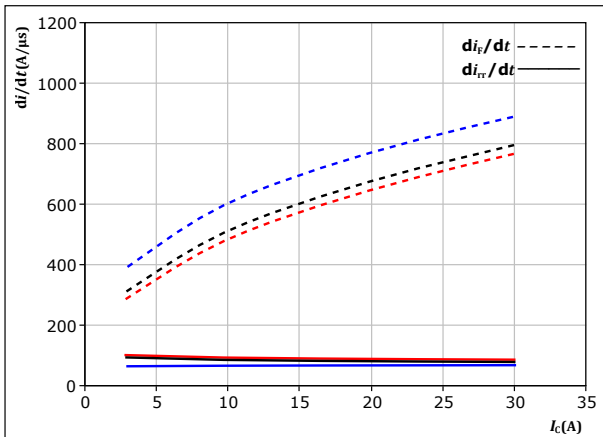
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datasheet

## Brake Switching Characteristics

figure 45. FWD

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



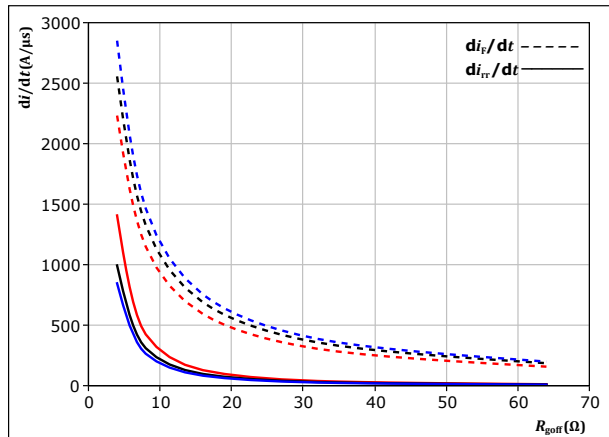
With an inductive load at

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

$T_j$ : 25 °C  
125 °C  
150 °C

figure 46. FWD

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



With an inductive load at

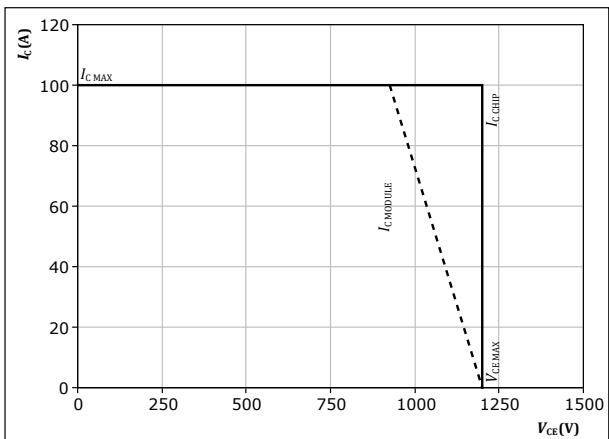
$V_{CE} = 700$  V  
 $V_{GE} = 0/15$  V  
 $I_C = 16,5$  A

$T_j$ : 25 °C  
125 °C  
150 °C

figure 47. 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 48. IGBT

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

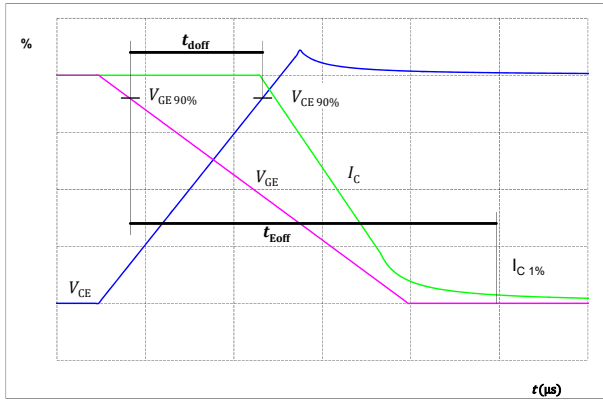


figure 49. IGBT

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

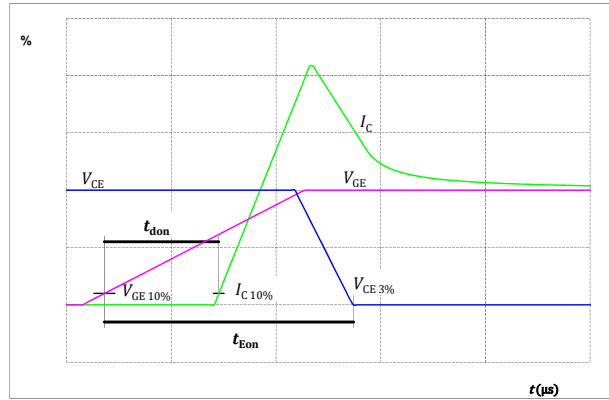


figure 50. IGBT

Turn-off Switching Waveforms & definition of  $t_f$

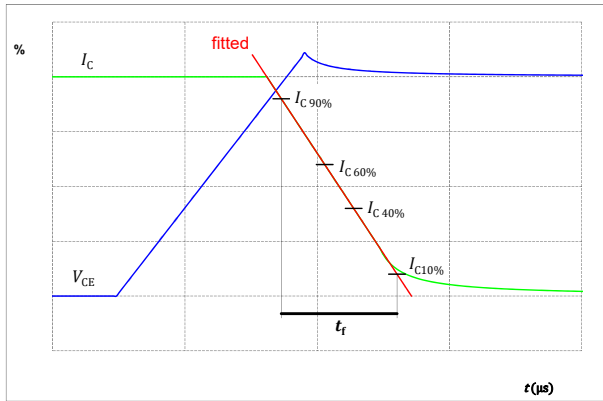
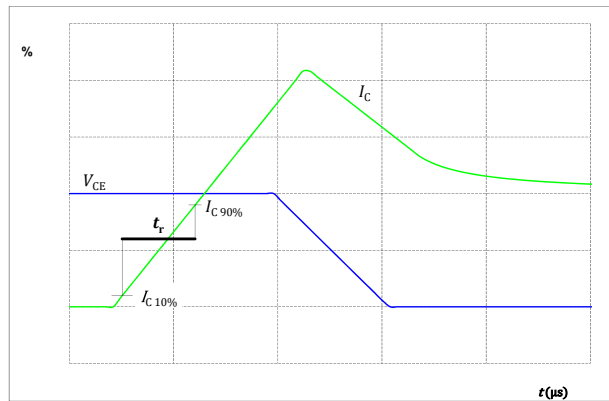


figure 51. IGBT

Turn-on Switching Waveforms & definition of  $t_r$





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## Switching Definitions

figure 52.

FWD

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

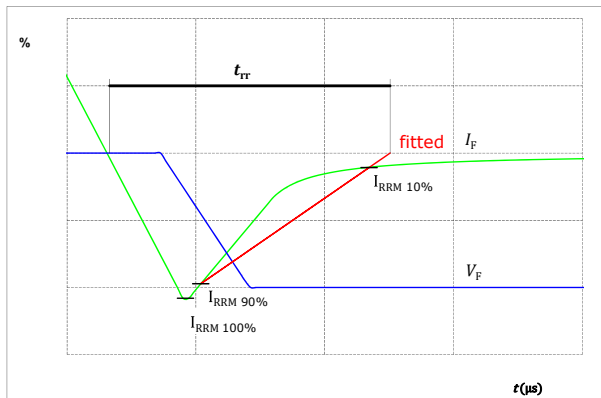
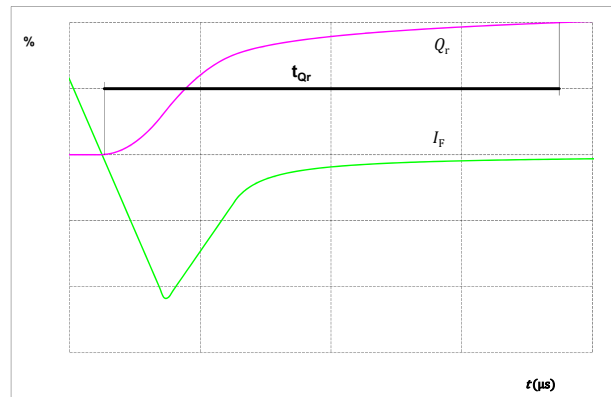


figure 53.

FWD



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





datasheet

Ordering Code	
Version	Ordering Code
Without thermal paste	10-E212PMA050M7-L189A78Z
With thermal paste	10-E212PMA050M7-L189A78Z-/3/

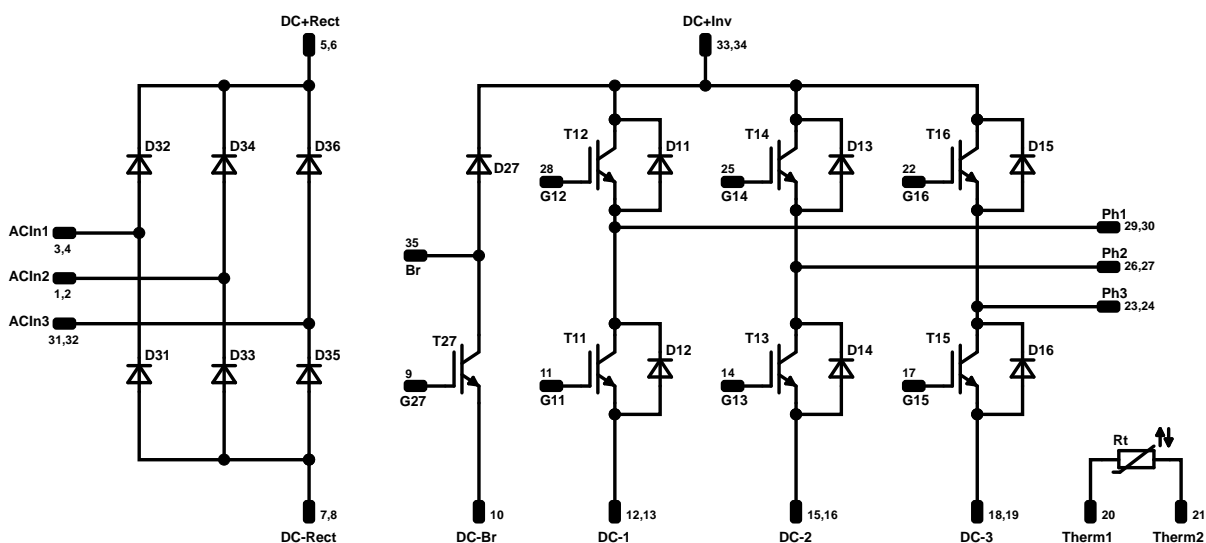
Marking							
<div><div>NN-NNNNNNNNNNNNN TTTTTWWYY UL VIN LLLL SSSS</div><div></div><div></div></div>	Text	Name		Date code	UL & VIN	Lot	Serial
		NN-NNNNNNNNNNNNN- TTTTTVV		WWYY	UL VIN	LLLLL	SSSS
	Datamatrix	Type&Ver	Lot number	Serial	Date code		
		TTTTTTVV	LLLLL	SSSS	WWYY		

Pin table [mm]			
Pin	X	Y	Function
1	25,6	6,4	ACIn2
2	22,4	6,4	ACIn2
3	16	9,6	ACIn1
4	12,8	9,6	ACIn1
5	9,6	0	DC+Rect
6	9,6	3,2	DC+Rect
7	0	0	DC-Rect
8	0	3,2	DC-Rect
9	0	16	G27
10	0	19,2	DC-Br
11	0	22,4	G11
12	0	25,6	DC-1
13	0	28,8	DC-1
14	0	32	G13
15	0	35,2	DC-2
16	0	38,4	DC-2
17	0	41,6	G15
18	0	44,8	DC-3
19	0	48	DC-3
20	9,6	48	Therm1
21	19,2	48	Therm2
22	28,8	48	G16
23	32	48	Ph3
24	32	44,8	Ph3
25	32	35,2	G14
26	32	32	Ph2
27	32	28,8	Ph2
28	32	19,2	G12
29	32	16	Ph1
30	32	12,8	Ph1
31	32	3,2	ACIn3
32	32	0	ACIn3
33	22,4	19,2	DC+Inv
34	22,4	16	DC+Inv
35	9,6	19,2	Br



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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	50 A	Brake Switch	
D27	FWD	1200 V	10 A	Brake Diode	
D31, D32, D33, D34, D35, D36	Rectifier	1600 V	35 A	Rectifier Diode	
Rt	NTC			Thermistor	





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Packaging instruction				
Standard packaging quantity (SPQ) 100	>SPQ	Standard	<SPQ	Sample
Handling instruction				
Handling instructions for <i>flow</i> E2 packages see vincotech.com website.				
Package data				
Package data for <i>flow</i> E2 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. I @fYVt[ b]hcb'j U'X'Zcf HWUgYO %&) \$7'UbX'Ha Ul O % \$ \$7"				

Document No.:	Date:	Modification:	Pages
10-E212PMA050M7-L189A78Z-D3-14	17 May. 2021	New datasheet format, separate solder and pressfit pin variant Update characteristics of rectifier diode, leakage current max value from 50 -> 100 uA	

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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.