



Vincotech

flow PIM E1

1200 V / 10 A

Features

- Trench IGBT4 technology
- Standard industrial housing
- Optimized $R_{th(j-s)}$ with Phase Change Material
- Built-in NTC

Target applications

- Industrial Drives

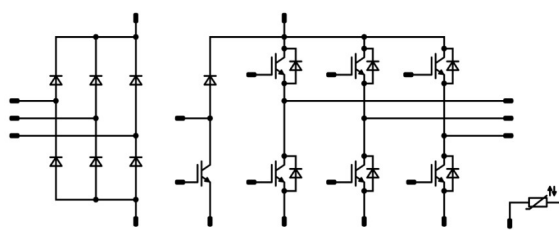
Types

- 10-EZ12PMA010SC-L927A08T

flow E1 12 mm housing



Schematic



Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
Rectifier Diode				
Peak repetitive reverse voltage	V_{RRM}		1600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	47	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave $T_j = 150\text{ °C}$	270	A
Surge current capability	I^2t	$t_p = 10\text{ ms}$	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	Condition	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	14	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	59	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$ $V_{CE} = 800\text{ V}$ $T_j = 150\text{ °C}$	10	μs
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

Inverter Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	14	A
Repetitive peak forward current	I_{FRM}		20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	50	W
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

Brake Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	14	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	59	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$ $V_{CE} = 800\text{ V}$ $T_j = 150\text{ °C}$	10	μs
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	Condition	Value	Unit
Brake Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	14	A
Repetitive peak forward current	I_{FRM}		20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	50	W
Maximum junction temperature	T_{jmax}		175	°C

Module Properties

General Properties

Stray inductance	L_P		30	nH
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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
		AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			min. 12,7	mm
Clearance			min. 12,7	mm
Comparative Tracking Index	CTI		≥ 600	

*100 % tested in production



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10-EZ12PMA010SC-L927A08T

datasheet

Characteristic Values

Parameter	Symbol	Conditions					Value			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		1,17 1,13		V
Reverse leakage current	I_R			1600		25			50	µA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						1,20		K/W
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Characteristic Values

Parameter	Symbol	Conditions					Value			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	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,00035	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		10	25 125 150	1,58	1,78 2,06 2,10	2,07	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			1,2	μA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	$f = 1 \text{ Mhz}$	0	25		25		625		pF
Reverse transfer capacitance	C_{res}							40		

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						1,60		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 32 \Omega$ $R_{goft} = 32 \Omega$	± 15	600	10	25 125 150		62 61 60		ns
Rise time	t_r					25 125 150		24 24 26		
Turn-off delay time	$t_{d(off)}$					25 125 150		186 243 259		
Fall time	t_f					25 125 150		97 155 162		
Turn-on energy (per pulse)*	E_{on}	$Q_{tFWD} = 0,9 \mu C$ $Q_{tFWD} = 1,7 \mu C$ $Q_{tFWD} = 1,9 \mu C$	± 15	600	10	25 125 150		0,591 0,848 0,931		mWs
Turn-off energy (per pulse)*	E_{off}					25 125 150		0,637 0,979 1,11		

* $L_S = 14 \text{ nH}$



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Characteristic Values

Parameter	Symbol	Conditions					Value			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				10	25 150		1,77 1,68	2,05	V
Reverse leakage current	I_R			1200		25			2,7	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						1,91		K/W
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Dynamic

Peak recovery current	I_{RRM}	$di/dt = 425 \text{ A/}\mu\text{s}$ $di/dt = 421 \text{ A/}\mu\text{s}$ $di/dt = 405 \text{ A/}\mu\text{s}$	± 15	600	10	25 125 150		8 10 11		A
Reverse recovery time	t_{rr}					25 125 150		261 403 436		ns
Recovered charge	Q_r					25 125 150		0,908 1,69 1,92		μC
Reverse recovered energy	E_{rec}					25 125 150		0,358 0,684 0,782		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		64 62 55		A/μs



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Characteristic Values

Parameter	Symbol	Conditions					Value			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	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,00035	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		10	25 125 150	1,58	1,78 2,06 2,10	2,07	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			1,2	µA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	$f = 1 \text{ Mhz}$	0	25		25		625		pF
Reverse transfer capacitance	C_{res}							40		

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						1,60		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 32 \Omega$ $R_{goft} = 32 \Omega$	0 / 15	600	10	25 125 150		19 17 16		ns
Rise time	t_r					25 125 150		30 31 32		
Turn-off delay time	$t_{d(off)}$					25 125 150		243 301 319		
Fall time	t_f					25 125 150		107 165 172		
Turn-on energy (per pulse)	E_{on}	$Q_{tFWD} = 0,9 \mu C$ $Q_{tFWD} = 1,6 \mu C$ $Q_{tFWD} = 1,9 \mu C$				25 125 150		0,616 0,900 0,945		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,656 1,02 1,11		



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Characteristic Values

Parameter	Symbol	Conditions					Value			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	25 150		1,77 1,68	2,05	V
Reverse leakage current	I_R			1200		25			2,7	µA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						1,91		K/W
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Dynamic

Peak recovery current	I_{RRM}	$di/dt = 436 \text{ A/}\mu\text{s}$ $di/dt = 332 \text{ A/}\mu\text{s}$ $di/dt = 363 \text{ A/}\mu\text{s}$	0 / 15	600	10	25 125 150		7 9 10		A
Reverse recovery time	t_{rr}					25 125 150		262 413 445		ns
Recovered charge	Q_r					25 125 150		0,872 1,64 1,85		µC
Reverse recovered energy	E_{rec}					25 125 150		0,342 0,666 0,750		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		57 50 51		A/µs

Thermistor

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



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10-EZ12PMA010SC-L927A08T datasheet

Rectifier Diode Characteristics

figure 1. Rectifier Diode

Typical forward characteristics

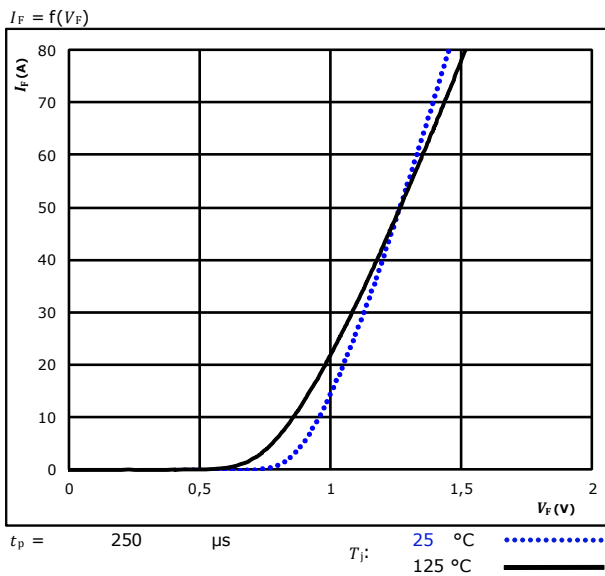
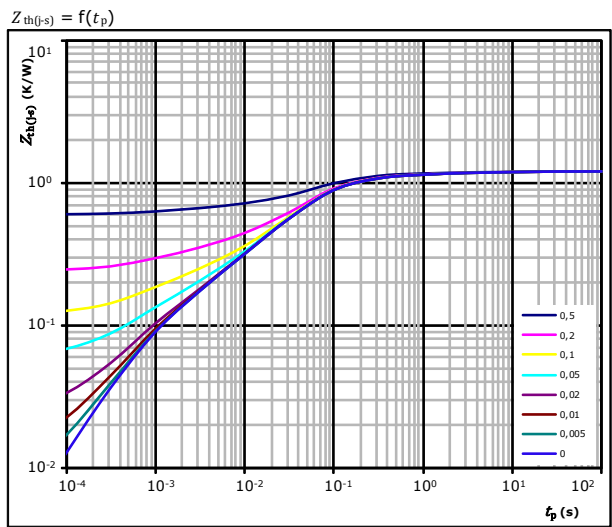


figure 2. Rectifier Diode

Transient thermal impedance as a function of pulse width



Diode 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



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10-EZ12PMA010SC-L927A08T datasheet

Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

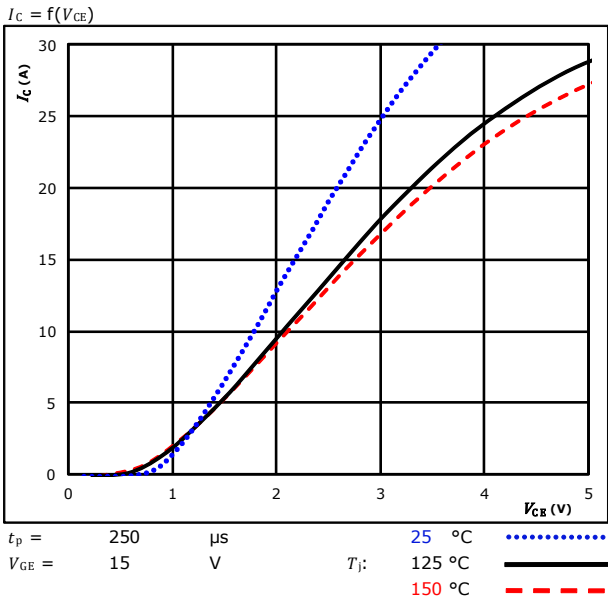


figure 2. IGBT

Typical output characteristics

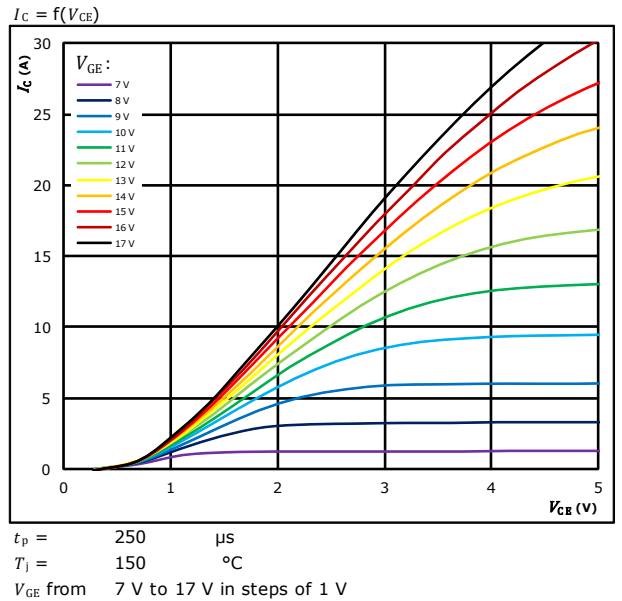


figure 3. IGBT

Typical transfer characteristics

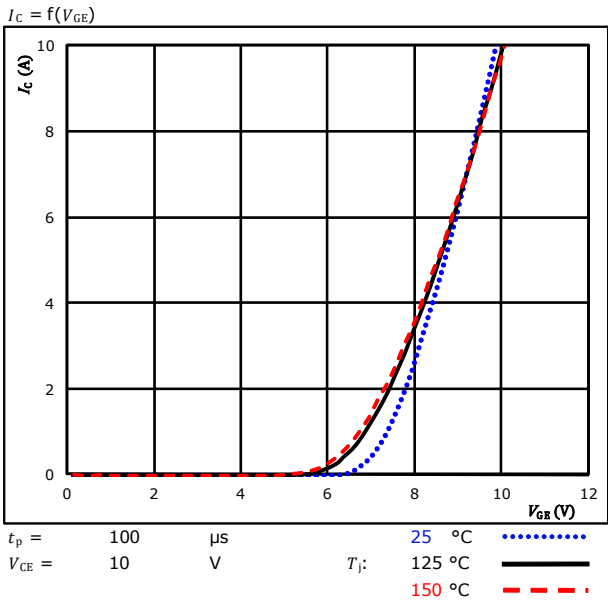
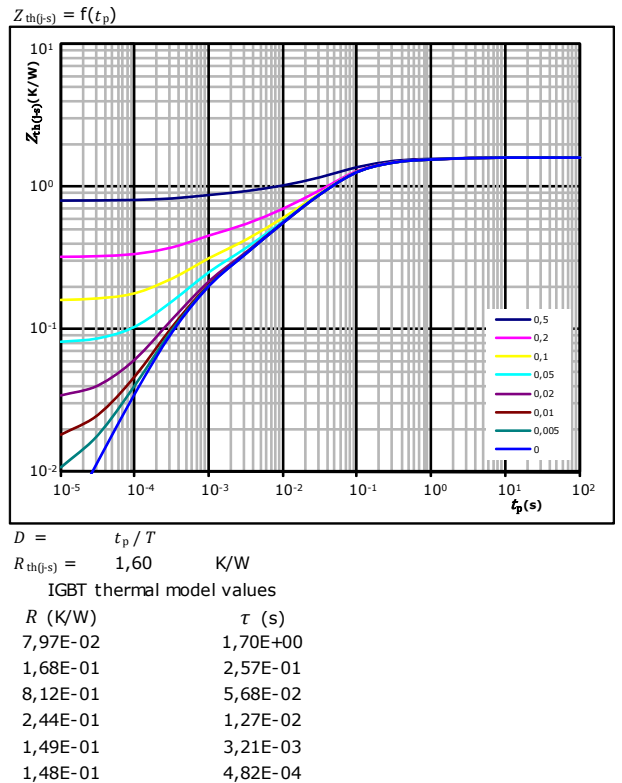


figure 4. IGBT

Transient thermal impedance as function of pulse duration



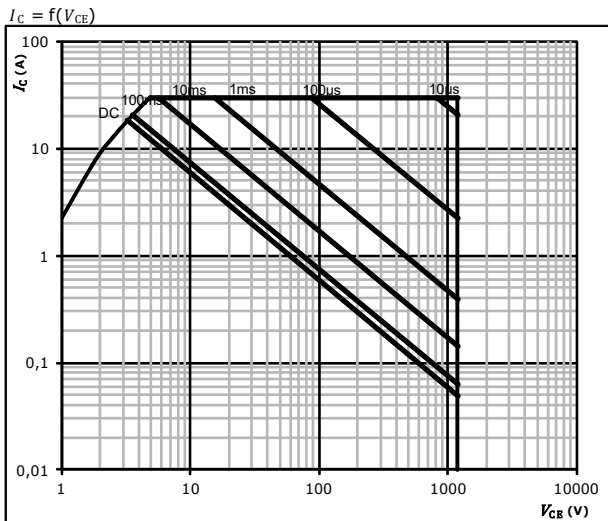


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Inverter Switch Characteristics

figure 5. IGBT

Safe operating area



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



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Inverter Diode Characteristics

figure 1. FWD

Typical forward characteristics

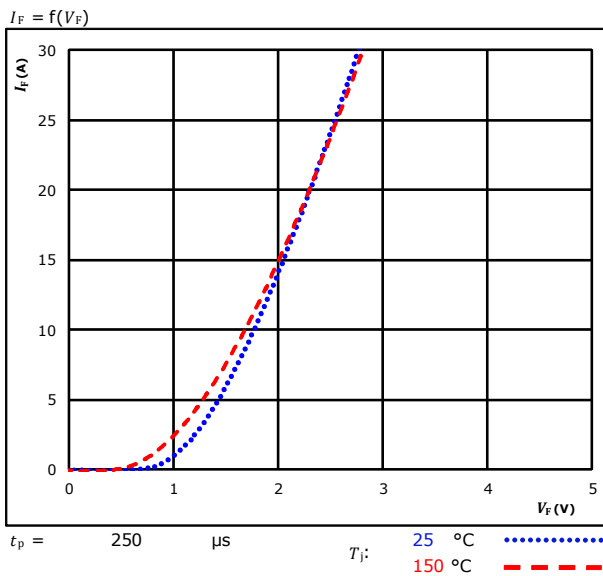
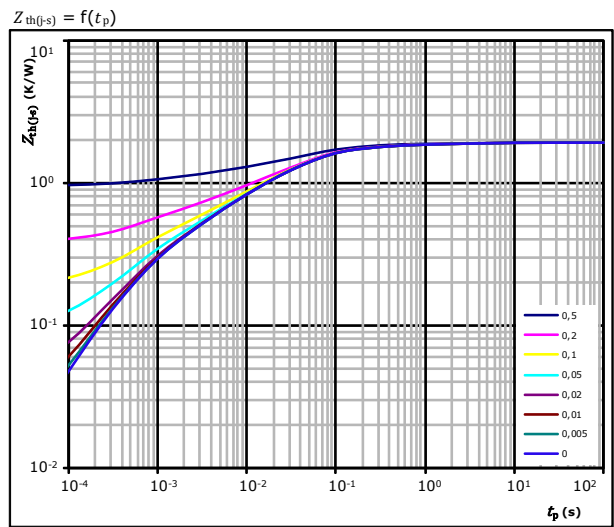


figure 2. FWD

Transient thermal impedance as a function of pulse width



FWD thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
6,90E-02	3,61E+00
1,74E-01	3,07E-01
8,07E-01	4,87E-02
3,70E-01	1,36E-02
2,79E-01	3,22E-03
2,10E-01	5,68E-04



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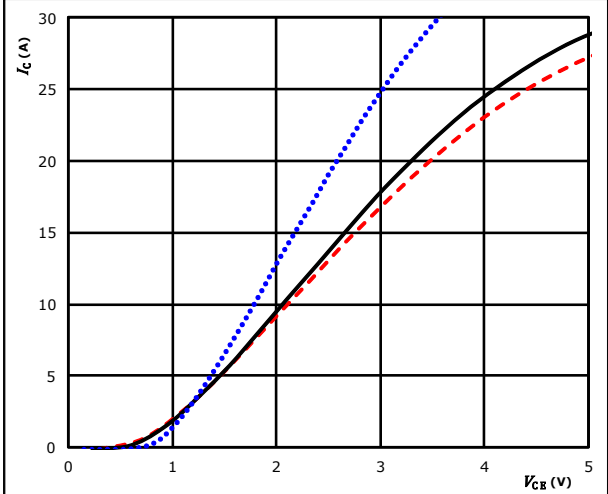
10-EZ12PMA010SC-L927A08T datasheet

Brake Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

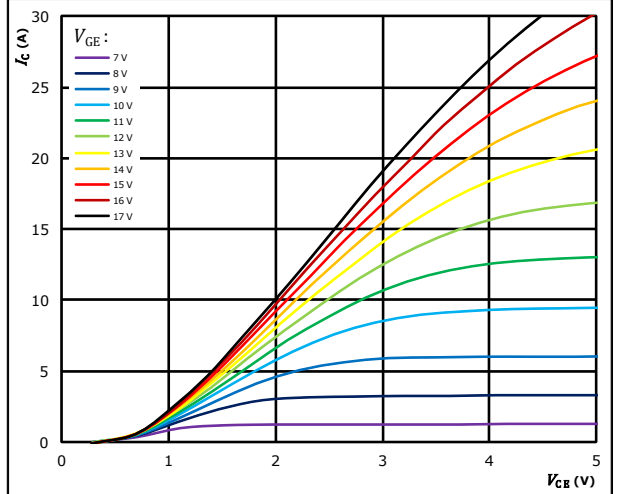


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_J: 25 \text{ } ^\circ C$ (dotted blue)
 $125 \text{ } ^\circ C$ (solid black)
 $150 \text{ } ^\circ C$ (dashed red)

figure 2. IGBT

Typical output characteristics

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

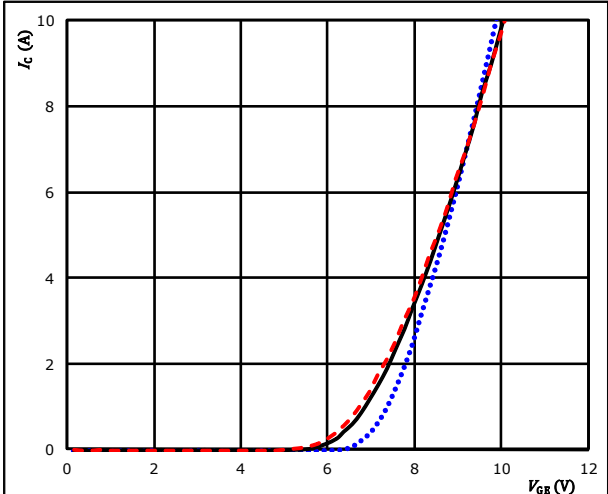


$t_p = 250 \mu s$
 $T_J = 150 \text{ } ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

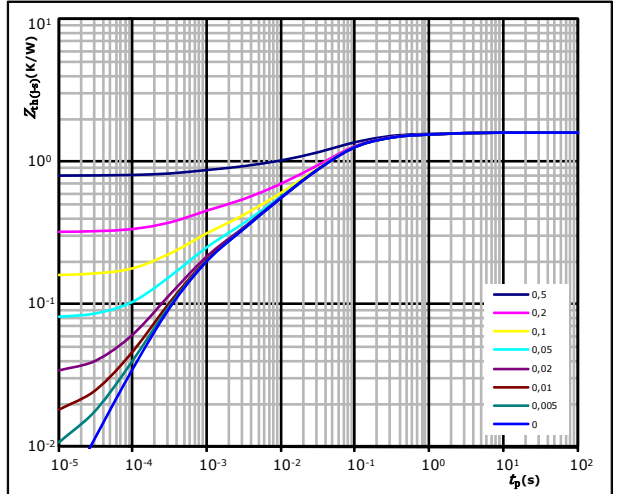


$t_p = 100 \mu s$
 $V_{CE} = 10 V$
 $T_J: 25 \text{ } ^\circ C$ (dotted blue)
 $125 \text{ } ^\circ C$ (solid black)
 $150 \text{ } ^\circ C$ (dashed red)

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$
 $R_{th(j-s)} = 1,60 \text{ K/W}$

IGBT thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
7,97E-02	1,70E+00
1,68E-01	2,57E-01
8,12E-01	5,68E-02
2,44E-01	1,27E-02
1,49E-01	3,21E-03
1,48E-01	4,82E-04

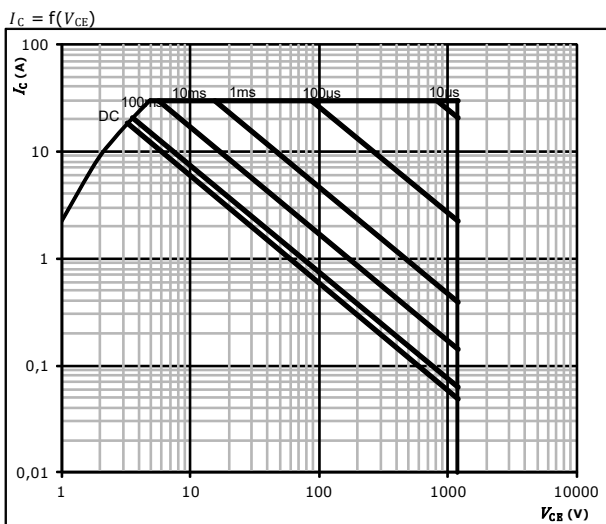


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Brake Switch Characteristics

figure 5. IGBT

Safe operating area



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



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Brake Diode Characteristics

figure 1. FWD

Typical forward characteristics

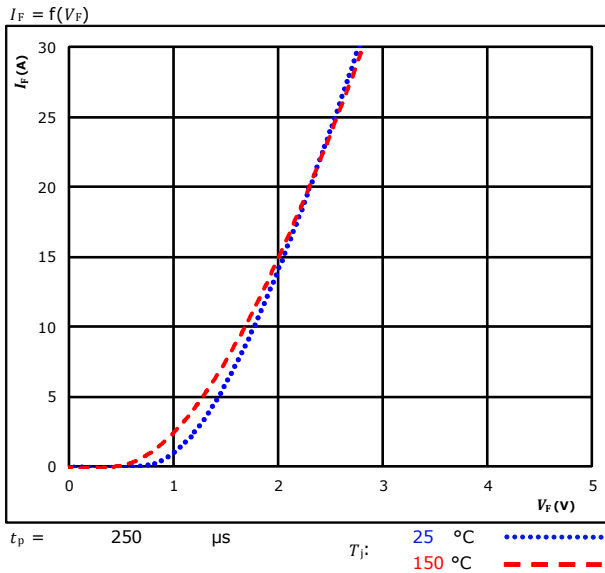
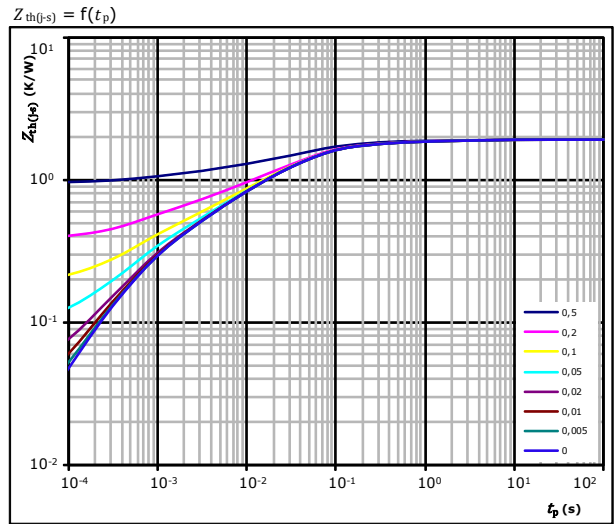


figure 2. FWD

Transient thermal impedance as a function of pulse width



$$D = \frac{t_p}{T}$$

$$R_{th(j-s)} = 1,91 \text{ K/W}$$

FWD thermal model values

R (K/W)	τ (s)
6,90E-02	3,61E+00
1,74E-01	3,07E-01
8,07E-01	4,87E-02
3,70E-01	1,36E-02
2,79E-01	3,22E-03
2,10E-01	5,68E-04



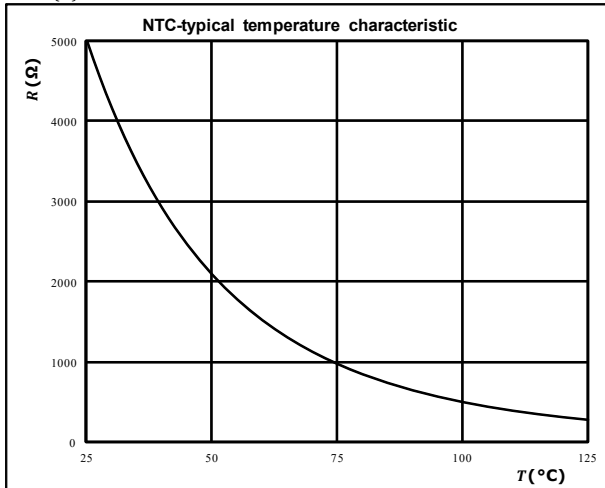
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Thermistor Characteristics

figure 1. Thermistor

**Typical NTC characteristic
as a function of temperature**

$$R = f(T)$$



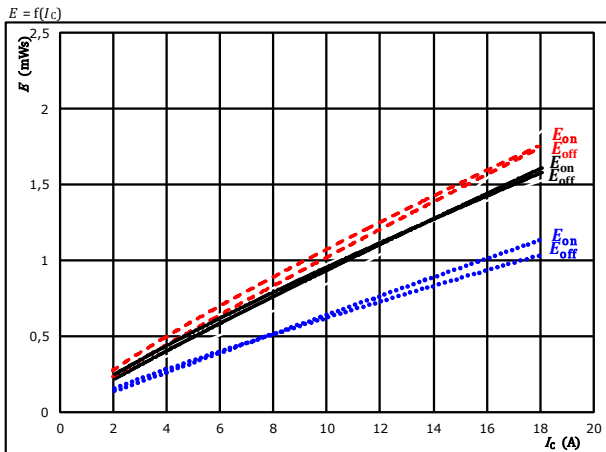


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Inverter Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current

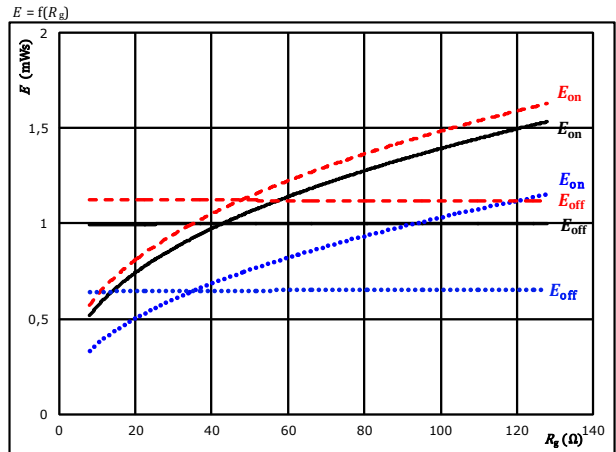


With an inductive load at

$V_{CE} =$	600	V	$T_j:$	25 °C	
$V_{GE} =$	±15	V		125 °C	————
$R_{gon} =$	32	Ω		150 °C	----
$R_{goff} =$	32	Ω			

figure 2. IGBT

Typical switching energy losses as a function of gate resistor

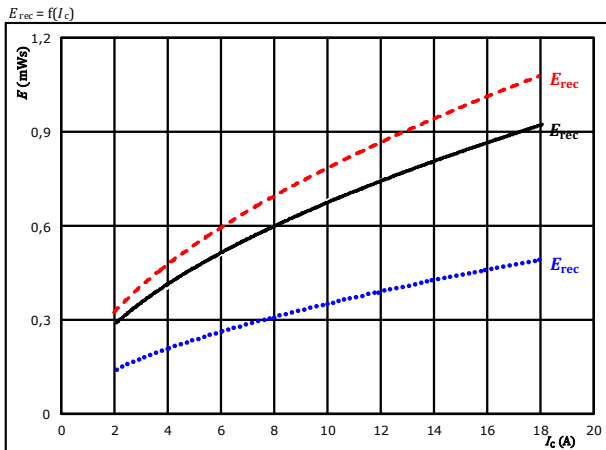


With an inductive load at

$V_{CE} =$	600	V	$T_j:$	25 °C	
$V_{GE} =$	±15	V		125 °C	————
$I_C =$	10	A		150 °C	----

figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

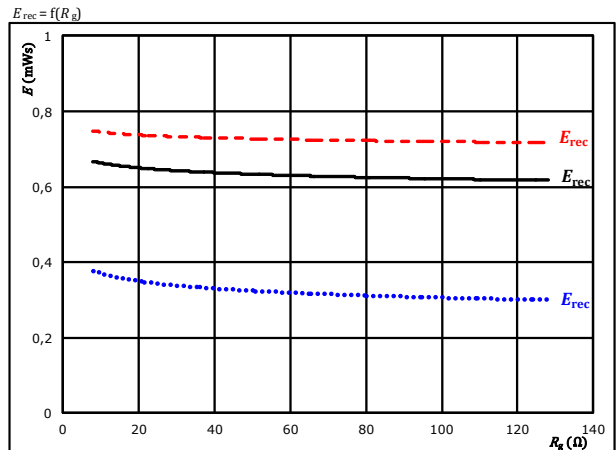


With an inductive load at

$V_{CE} =$	600	V	$T_j:$	25 °C	
$V_{GE} =$	±15	V		125 °C	————
$R_{gon} =$	32	Ω		150 °C	----

figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor



With an inductive load at

$V_{CE} =$	600	V	$T_j:$	25 °C	
$V_{GE} =$	±15	V		125 °C	————
$I_C =$	10	A		150 °C	----



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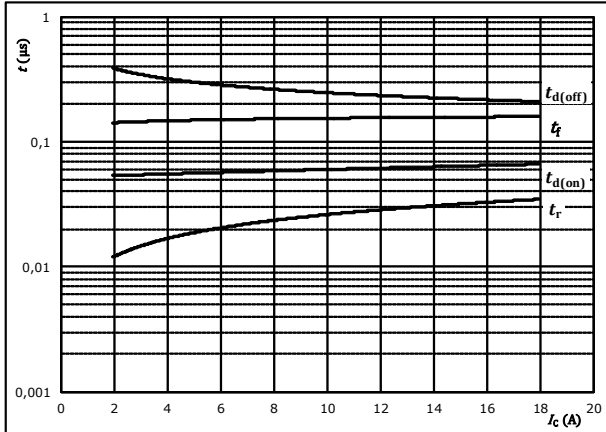
datasheet

Inverter Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



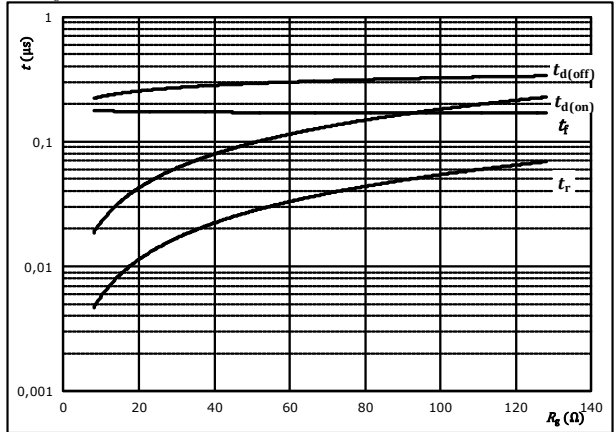
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	32	Ω
$R_{goff} =$	32	Ω

figure 6. IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



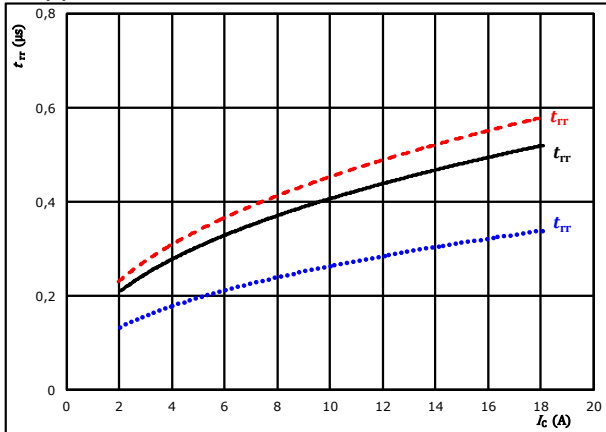
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$I_C =$	10	A

figure 7. FWD

Typical reverse recovery time as a function of collector current

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

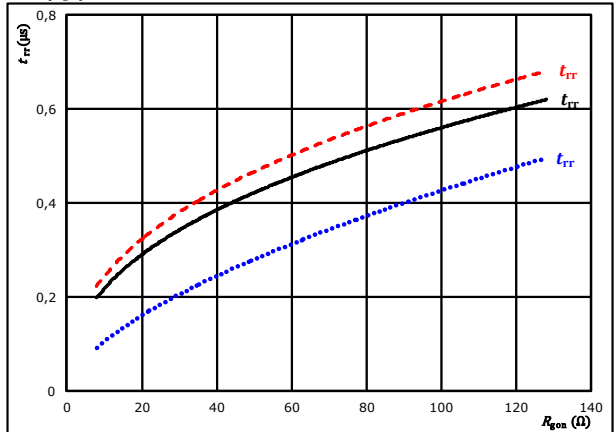


At	$V_{CE} =$	600	V	$T_j =$	25 °C	
	$V_{GE} =$	±15	V		125 °C	————
	$R_{gon} =$	32	Ω		150 °C	-----

figure 8. FWD

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

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



At	$V_{CE} =$	600	V	$T_j =$	25 °C	
	$V_{GE} =$	±15	V		125 °C	————
	$I_C =$	10	A		150 °C	-----



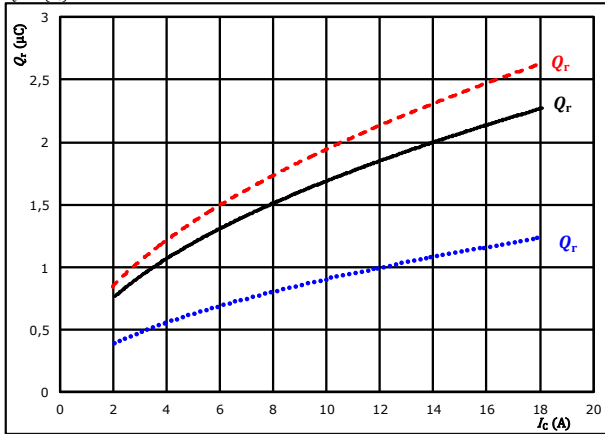
Vincotech

Inverter Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_C)$$

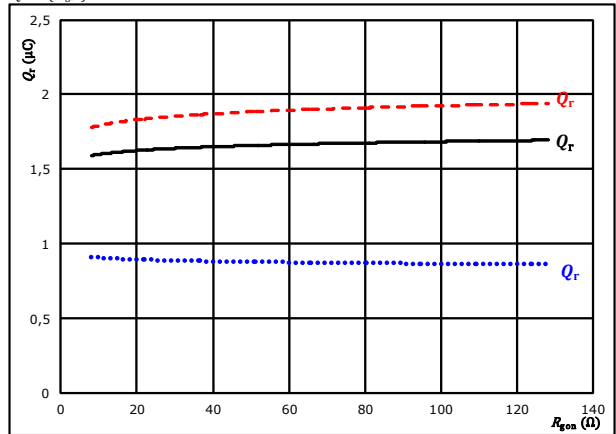


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω
 $T_j = 25$ °C
 125 °C
 150 °C

figure 10. FWD

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

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

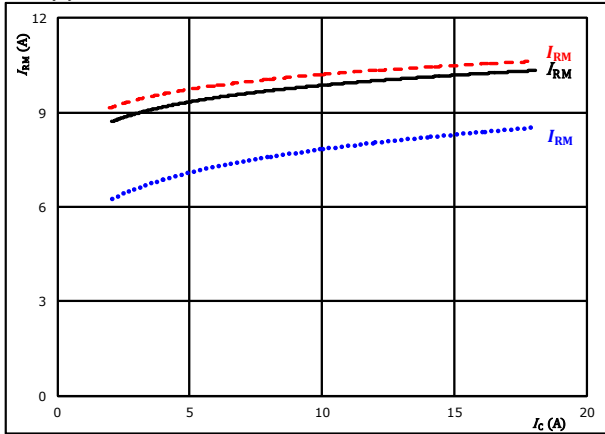


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 10$ A
 $T_j = 25$ °C
 125 °C
 150 °C

figure 11. FWD

Typical peak reverse recovery current as a function of collector current

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

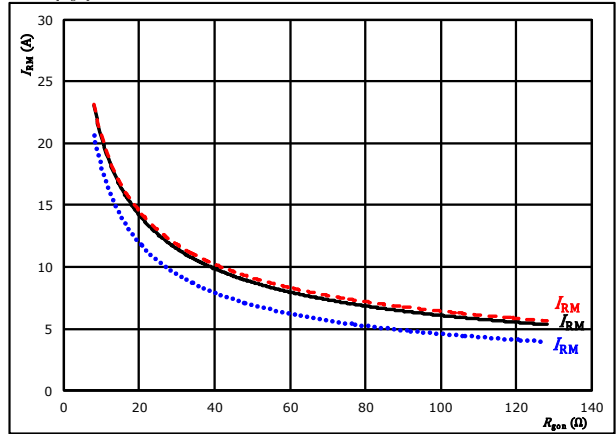


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω
 $T_j = 25$ °C
 125 °C
 150 °C

figure 12. FWD

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

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



At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 10$ A
 $T_j = 25$ °C
 125 °C
 150 °C



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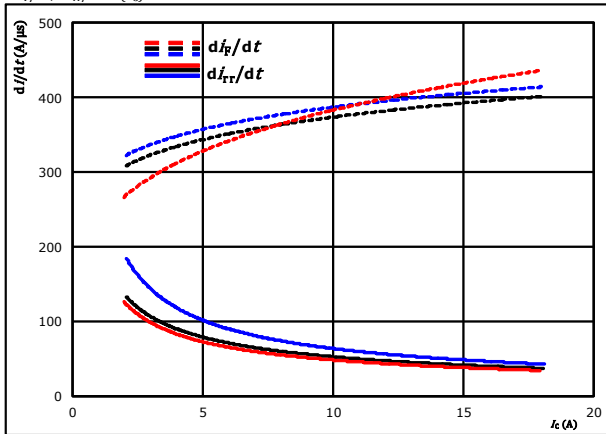
10-EZ12PMA010SC-L927A08T

datasheet

Inverter Switching Characteristics

figure 13. FWD

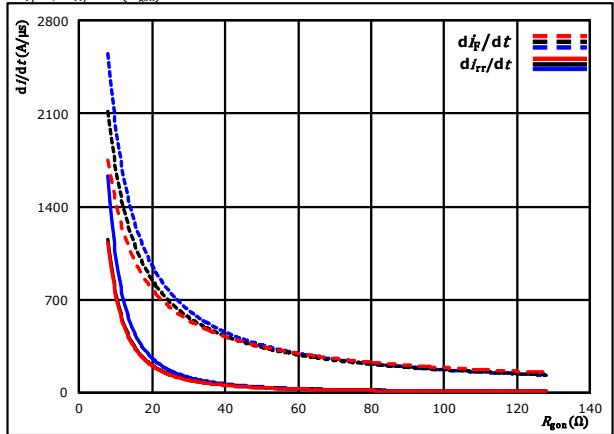
Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_F/dt, di_{rr}/dt = f(I_C)$



At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{g0n} = 32$ Ω
 $T_j = 25$ °C
 125 °C
 150 °C

figure 14. FWD

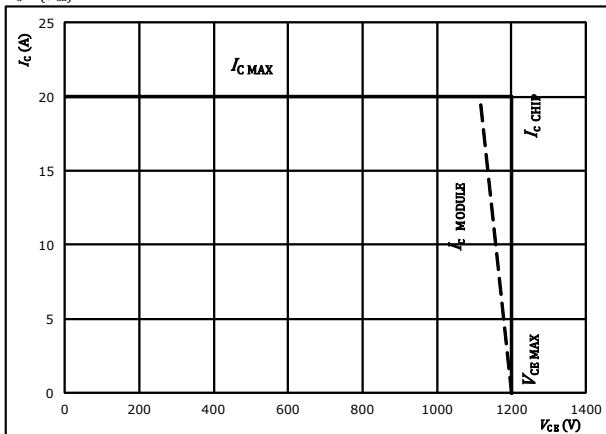
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
 $di_F/dt, di_{rr}/dt = f(R_{g0n})$



At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 10$ A
 $T_j = 25$ °C
 125 °C
 150 °C

figure 15. IGBT

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



At $T_j = 125$ °C
 $R_{g0n} = 32$ Ω
 $R_{g0ff} = 32$ Ω



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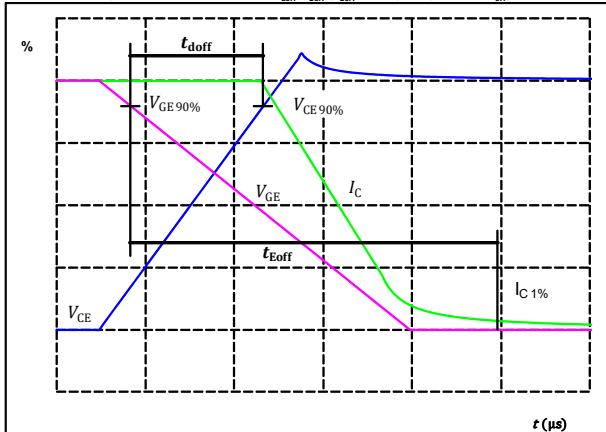
Inverter Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	32 Ω
R_{goff}	=	32 Ω

figure 1. IGBT

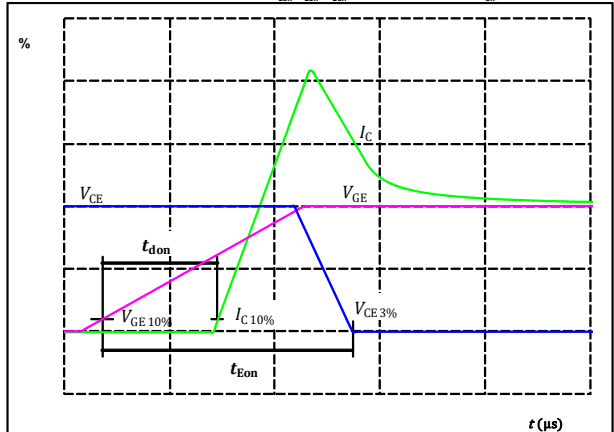
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	600	V
$I_C(100\%) =$	10	A
$t_{doff} =$	243	ns

figure 2. IGBT

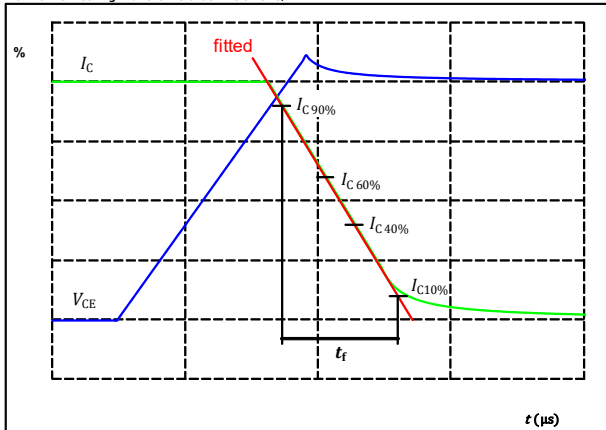
Turn-on Switching Waveforms & definition of t_{don} , t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	600	V
$I_C(100\%) =$	10	A
$t_{don} =$	61	ns

figure 3. IGBT

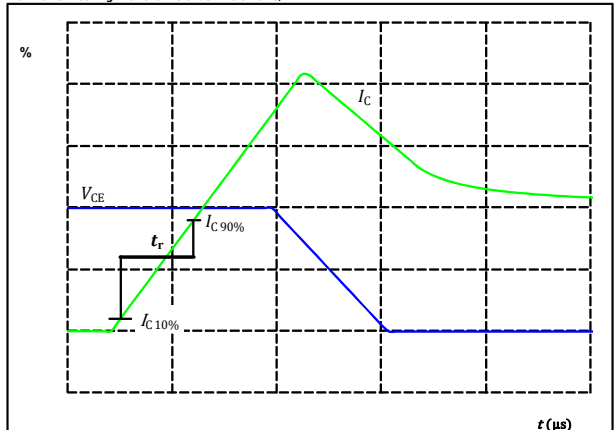
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%) =$	600	V
$I_C(100\%) =$	10	A
$t_f =$	155	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r



$V_C(100\%) =$	600	V
$I_C(100\%) =$	10	A
$t_r =$	24	ns

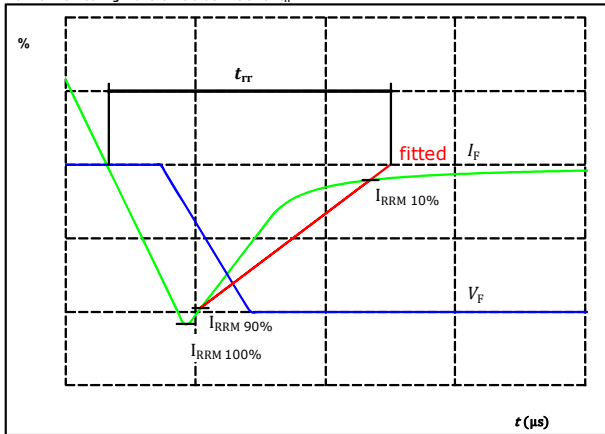


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Inverter Switching Characteristics

figure 5. FWD

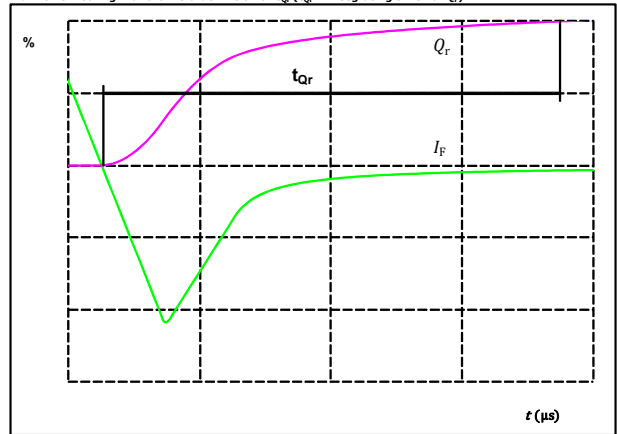
Turn-off Switching Waveforms & definition of t_{rr}



$V_F(100\%) =$	600	V
$I_F(100\%) =$	10	A
$I_{RRM}(100\%) =$	10	A
$t_{rr} =$	403	ns

figure 6. FWD

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



$I_F(100\%) =$	10	A
$Q_r(100\%) =$	1,69	μC

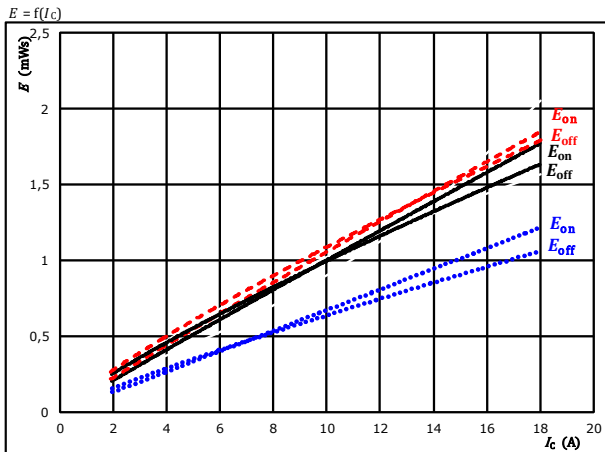


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Brake Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current

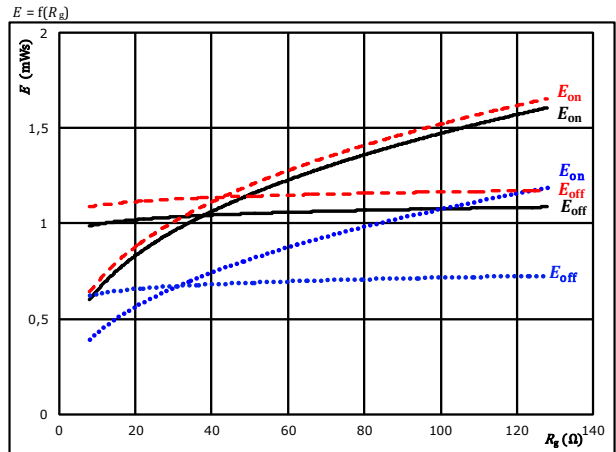


With an inductive load at

$V_{CE} = 600$ V	$T_j = 25$ °C	
$V_{GE} = 0 / 15$ V	$T_j = 125$ °C	————
$R_{gon} = 32$ Ω	$T_j = 150$ °C	-----
$R_{goff} = 32$ Ω		

figure 2. IGBT

Typical switching energy losses as a function of gate resistor

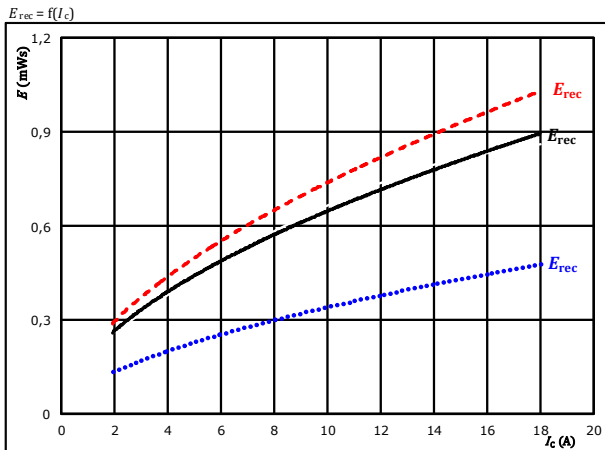


With an inductive load at

$V_{CE} = 600$ V	$T_j = 25$ °C	
$V_{GE} = 0 / 15$ V	$T_j = 125$ °C	————
$I_C = 10$ A	$T_j = 150$ °C	-----

figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

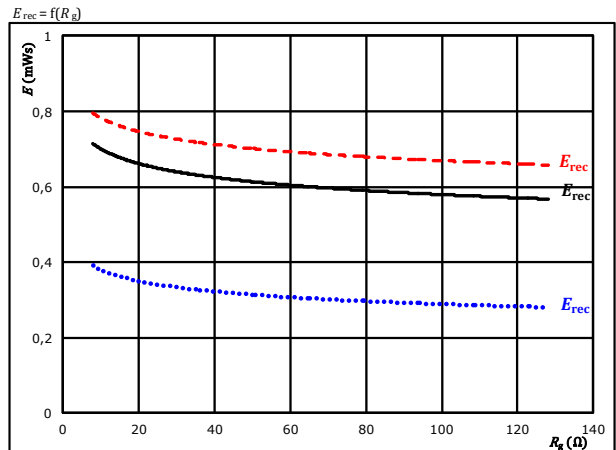


With an inductive load at

$V_{CE} = 600$ V	$T_j = 25$ °C	
$V_{GE} = 0 / 15$ V	$T_j = 125$ °C	————
$R_{gon} = 32$ Ω	$T_j = 150$ °C	-----

figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor



With an inductive load at

$V_{CE} = 600$ V	$T_j = 25$ °C	
$V_{GE} = 0 / 15$ V	$T_j = 125$ °C	————
$I_C = 10$ A	$T_j = 150$ °C	-----



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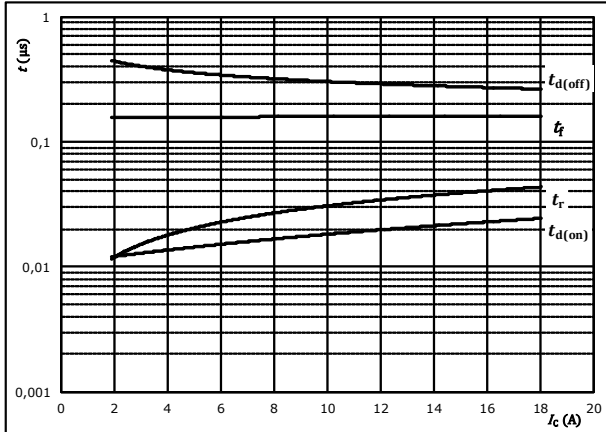
datasheet

Brake Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



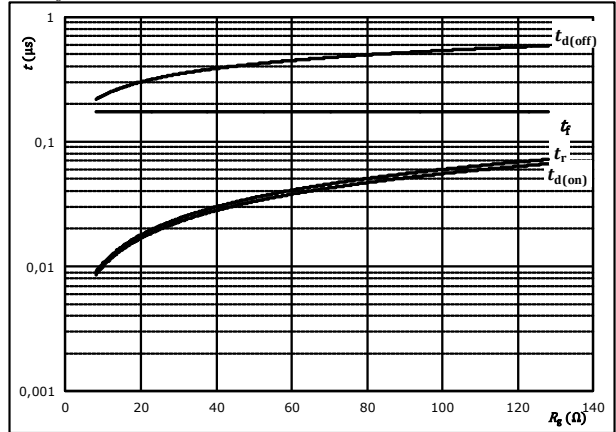
With an inductive load at

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

figure 6. IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



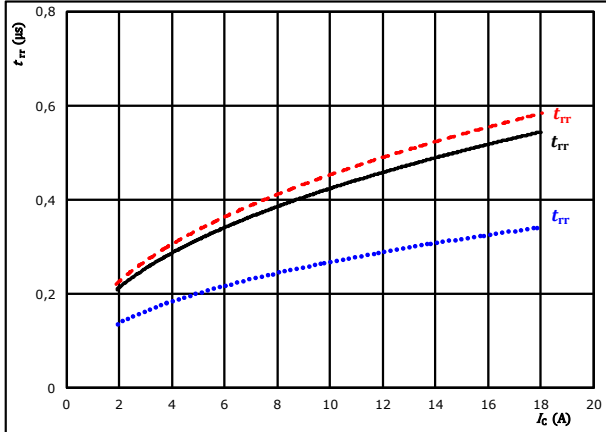
With an inductive load at

$T_j = 150$ °C
 $V_{CE} = 600$ V
 $V_{GE} = 0 / 15$ V
 $I_C = 10$ A

figure 7. FWD

Typical reverse recovery time as a function of collector current

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

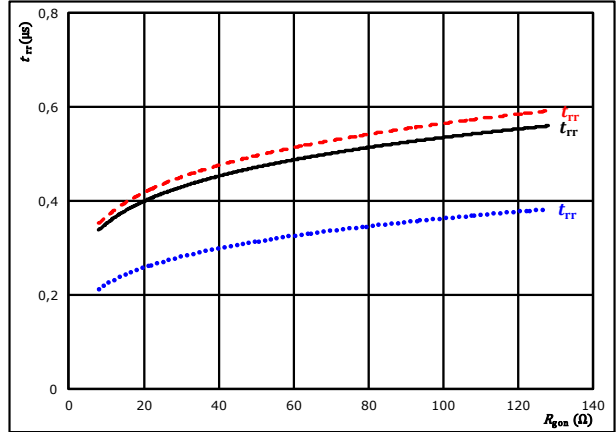


At $V_{CE} = 600$ V
 $V_{GE} = 0 / 15$ V
 $R_{gon} = 32$ Ω
 $T_j: 25$ °C (dotted blue)
 125 °C (solid black)
 150 °C (dashed red)

figure 8. FWD

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

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



At $V_{CE} = 600$ V
 $V_{GE} = 0 / 15$ V
 $I_C = 10$ A
 $T_j: 25$ °C (dotted blue)
 125 °C (solid black)
 150 °C (dashed red)



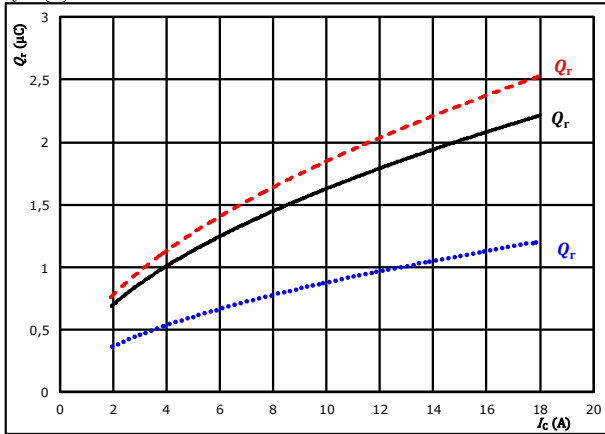
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Brake Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_C)$$

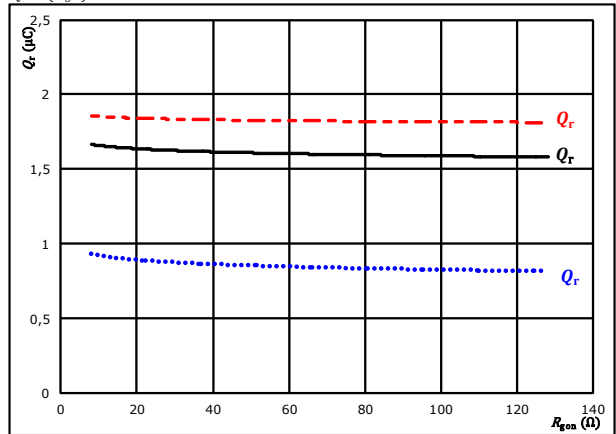


At $V_{CE} = 600$ V
 $V_{GE} = 0 / 15$ V
 $R_{gon} = 32$ Ω
 $T_j = 25$ °C (dotted blue)
 $T_j = 125$ °C (solid black)
 $T_j = 150$ °C (dashed red)

figure 10. FWD

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

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

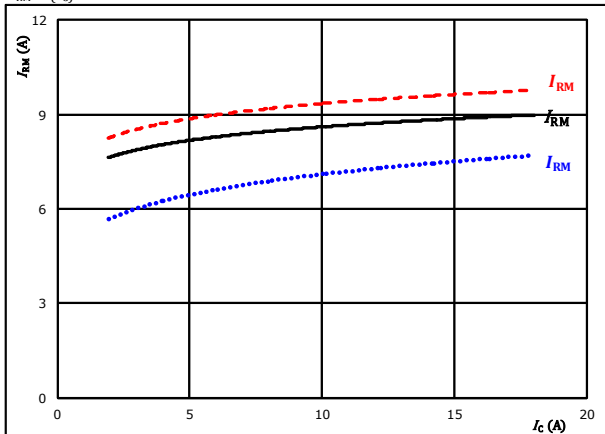


At $V_{CE} = 600$ V
 $V_{GE} = 0 / 15$ V
 $I_C = 10$ A
 $T_j = 25$ °C (dotted blue)
 $T_j = 125$ °C (solid black)
 $T_j = 150$ °C (dashed red)

figure 11. FWD

Typical peak reverse recovery current as a function of collector current

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

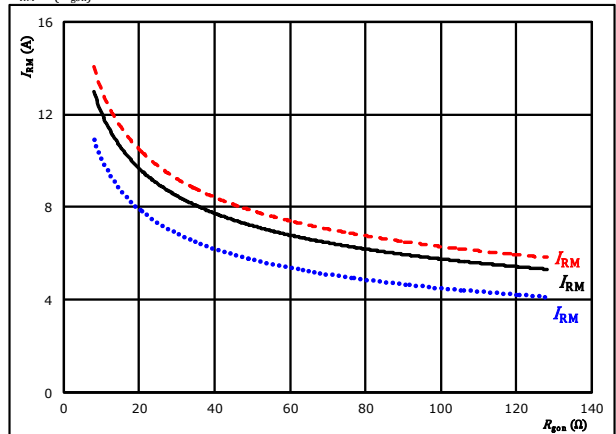


At $V_{CE} = 600$ V
 $V_{GE} = 0 / 15$ V
 $R_{gon} = 32$ Ω
 $T_j = 25$ °C (dotted blue)
 $T_j = 125$ °C (solid black)
 $T_j = 150$ °C (dashed red)

figure 12. FWD

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

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



At $V_{CE} = 600$ V
 $V_{GE} = 0 / 15$ V
 $I_C = 10$ A
 $T_j = 25$ °C (dotted blue)
 $T_j = 125$ °C (solid black)
 $T_j = 150$ °C (dashed red)



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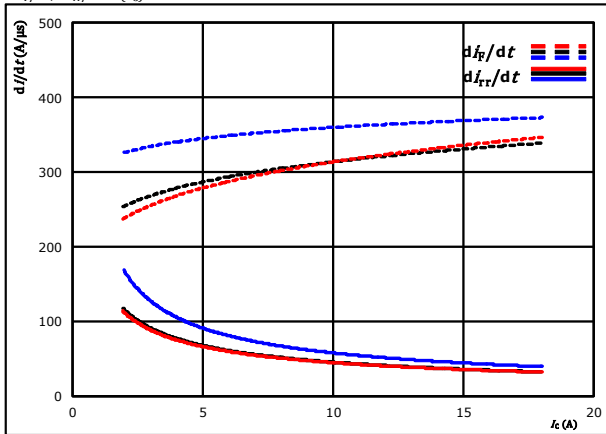
10-EZ12PMA010SC-L927A08T

datasheet

Brake Switching Characteristics

figure 13. FWD

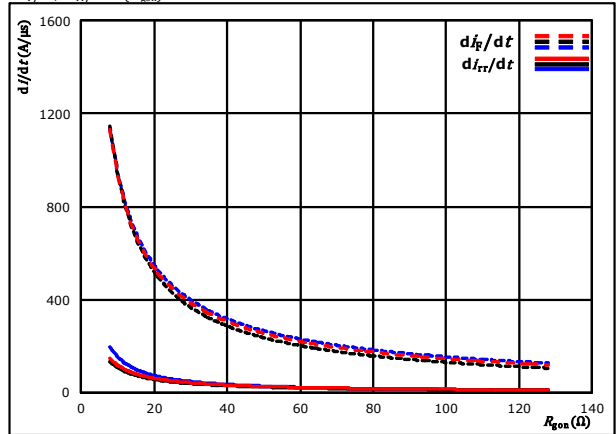
Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_F/dt, di_{rr}/dt = f(I_C)$



At $V_{CE} = 600$ V
 $V_{GE} = 0 / 15$ V
 $R_{g0n} = 32$ Ω
 $T_j = 25$ °C
 125 °C
 150 °C

figure 14. FWD

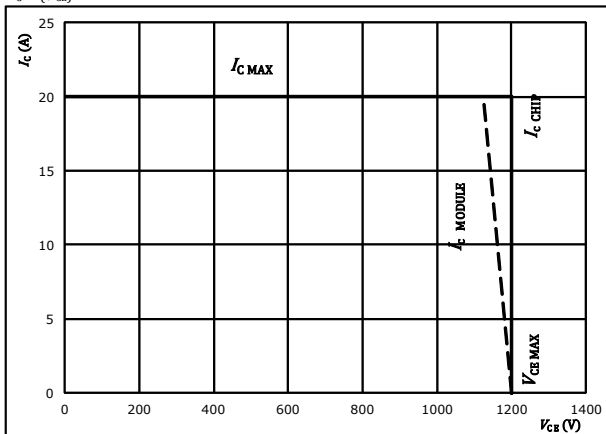
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
 $di_F/dt, di_{rr}/dt = f(R_{g0n})$



At $V_{CE} = 600$ V
 $V_{GE} = 0 / 15$ V
 $I_C = 10$ A
 $T_j = 25$ °C
 125 °C
 150 °C

figure 15. IGBT

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



At $T_j = 125$ °C
 $R_{g0n} = 32$ Ω
 $R_{g0ff} = 32$ Ω



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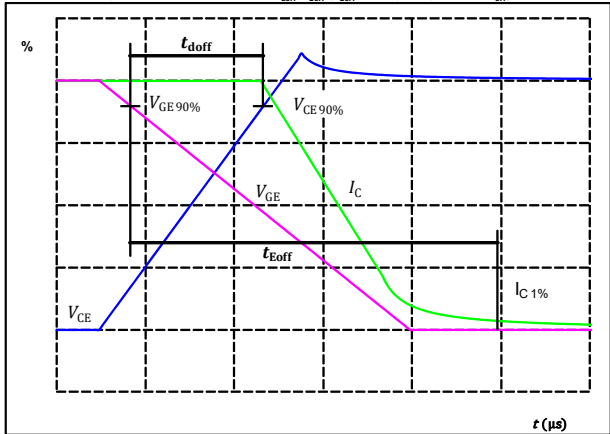
Brake Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	32 Ω
R_{goff}	=	32 Ω

figure 1. IGBT

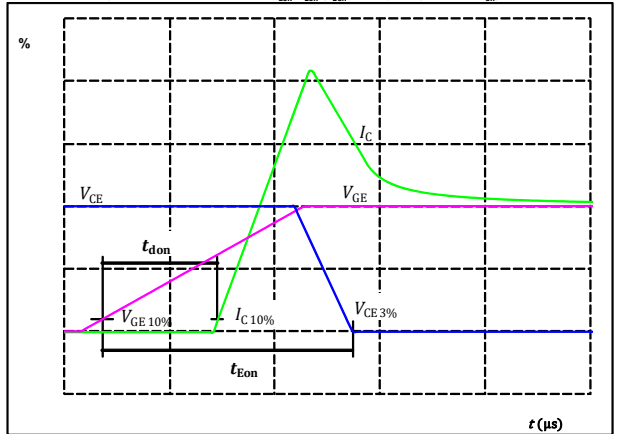
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%) =$	0	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	600	V
$I_C(100\%) =$	10	A
$t_{doff} =$	301	ns

figure 2. IGBT

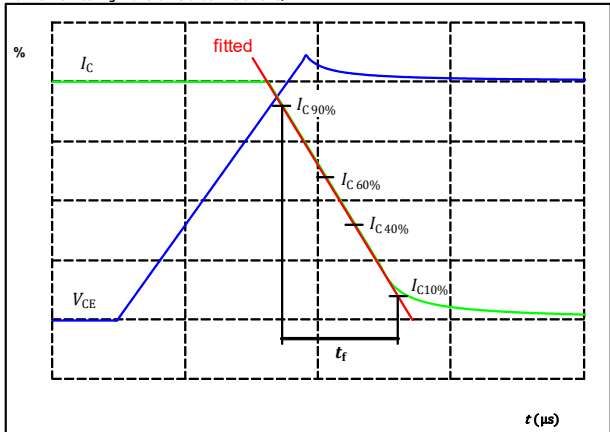
Turn-on Switching Waveforms & definition of t_{don} , t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%) =$	0	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	600	V
$I_C(100\%) =$	10	A
$t_{don} =$	17	ns

figure 3. IGBT

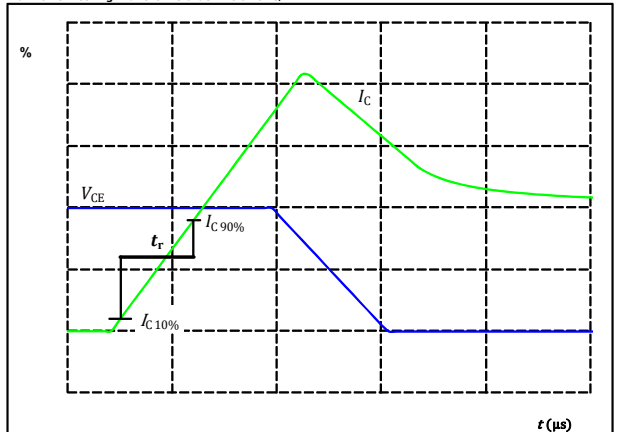
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%) =$	600	V
$I_C(100\%) =$	10	A
$t_f =$	165	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r



$V_C(100\%) =$	600	V
$I_C(100\%) =$	10	A
$t_r =$	31	ns

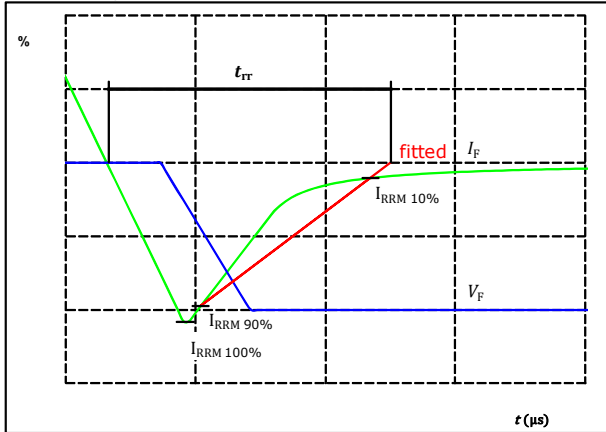


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Brake Switching Characteristics

figure 5. FWD

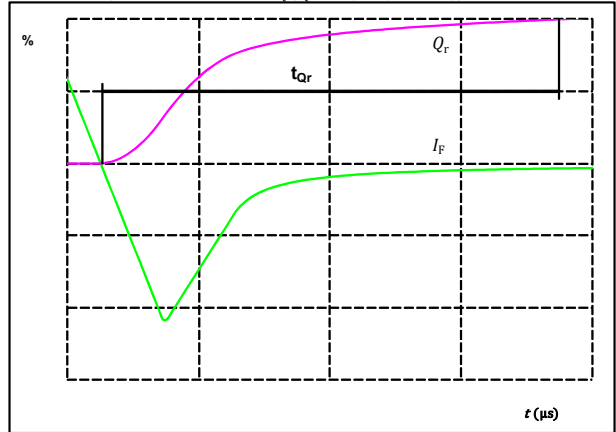
Turn-off Switching Waveforms & definition of t_{rr}



$V_F(100\%) =$	600	V
$I_F(100\%) =$	10	A
$I_{RRM}(100\%) =$	9	A
$t_{rr} =$	413	ns

figure 6. FWD

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



$I_F(100\%) =$	10	A
$Q_r(100\%) =$	1,64	μC



10-EZ12PMA010SC-L927A08T

datasheet

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Ordering Code & Marking								
Version				Ordering Code				
without thermal paste 12 mm housing with press-fit pins				10-EZ12PMA010SC-L927A08T				
with thermal paste 12 mm housing with press-fit pins				10-EZ12PMA010SC-L927A08T-/3/				
NN-NNNNNNNNNNNNNN TTTTTUV WWYY UL VIN LLLLL SSSS  		Text	Name		Date code	UL & VIN	Lot	Serial
			NN-NNNNNNNNNNNNNN-TTTTTUV		WWYY	UL VIN	LLLLL	SSSS
		Datamatrix	Type&Ver	Lot number	Serial	Date code		
TTTTTUV	LLLLL		SSSS	WWYY				

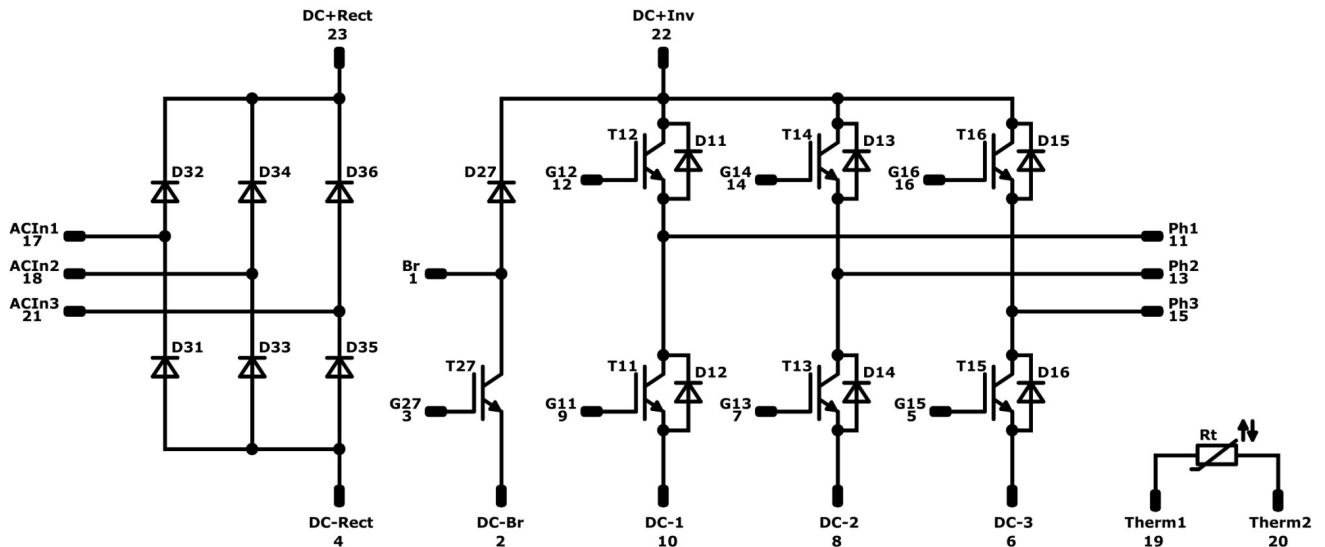
Pin table				Outline	
Pin	X	Y	Function		
1	32	0	Br		
2	25,6	0	DC-Br		
3	22,4	0	G27		
4	19,2	0	DC-Rect		
5	16	0	G15		
6	12,8	0	DC-3		
7	9,6	0	G13		
8	6,4	0	DC-2		
9	3,2	0	G11		
10	0	0	DC-1		
11	0	25,6	Ph1		
12	3,2	25,6	G12		
13	9,6	25,6	Ph2		
14	12,8	25,6	G14		
15	19,2	25,6	Ph3		
16	22,4	25,6	G16		
17	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 pinpositions: ±0.4mm at the end of pins
Dimension of coordinate axis is only offset without tolerance



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Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
D31-D36	Rectifier	1600 V	35 A	Rectifier Diode	
T11-T16	IGBT	1200 V	10 A	Inverter Switch	
D11-D16	FWD	1200 V	10 A	Inverter Diode	
T27	IGBT	1200 V	10 A	Brake Switch	
D27	FWD	1200 V	10 A	Brake Diode	
Rt	NTC			Thermistor	



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10-EZ12PMA010SC-L927A08T
datasheet

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

Handling instruction
Handling instructions for <i>flowE</i> 1 packages see vincotech.com website.

Package data
Package data for <i>flowE</i> 1 packages see 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-EZ12PMA010SC-L927A08T-D3-14	27 Feb. 2019	Correction of I_c/I_f	1,2,3

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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.