10-EZ12PMA010M7-L927A78T
10-E112PMA010M7-L927A78Z
datasheet

Vincotech

***flow*PIM E1** — **1200 V / 10 A**

Features

- IGBT M7 with low V_{CEsat} and improved EMC behavior
- Standard industrial housing
- Optimized $R_{th(j-s)}$ with Phase Change Material
- Built-in NTC

flow E1 12 mm housing

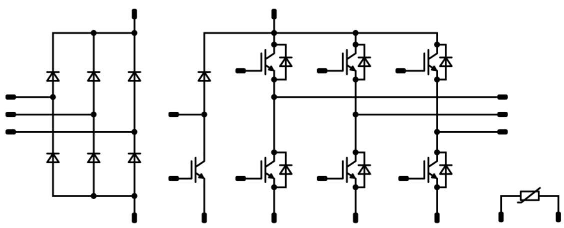

Press-fit pin


Solder pin

Target applications

- Industrial Drives

Schematic



Types

- 10-EZ12PMA010M7-L927A78T
- 10-E112PMA010M7-L927A78Z

Maximum Ratings

T_j = 25 °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 °C	14	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	56	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	14	A
Repetitive peak forward current	I_{FRM}	T_j limited by T_{jmax}		20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	43	W
Maximum junction temperature	T_{jmax}			175	°C
Brake Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	14	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	56	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C
Brake Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	14	A
Repetitive peak forward current	I_{FRM}	T_j limited by T_{jmax}		20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	43	W
Maximum junction temperature	T_{jmax}			175	°C
Rectifier Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	47	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms	T_j = 150 °C	270	A
Surge current capability	I^2t			370	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	58	W
Maximum junction temperature	T_{jmax}			150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
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 s	6000	V
		AC Voltage	t_p = 1 min	2500	V
Creepage distance				min. 12,7	mm
Clearance				min. 12,7	mm
Comparative Tracking Index	CTI			≥ 600	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions	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	Unit
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,001	25	5,4	6,0	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		10	25 125 150		1,66 1,90 1,96	2,15	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			35	µA
Gate-emitter leakage current	I_{GES}		20	0		25			500	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}		0	10		25		2000		pF
Output capacitance	C_{oes}							86		
Reverse transfer capacitance	C_{res}							23		
Gate charge	Q_g		15	600	10	25		80		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,69		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 32 Ω R_{goff} = 32 Ω	±15	600	10	25 125 150		128 126 123		ns
Rise time	t_r					25 125 150		29 32 34		
Turn-off delay time	$t_{d(off)}$					25 125 150		145 179 182		
Fall time	t_f					25 125 150		98 108 117		
Turn-on energy (per pulse)*	E_{on}	Q_{rFWD} = 1,1 µC Q_{rFWD} = 1,7 µC Q_{rFWD} = 1,8 µC				25 125 150		0,883 1,13 1,19		mWs
Turn-off energy (per pulse)*	E_{off}					25 125 150		0,656 0,860 0,908		

* Ls = 14 nH

Characteristic Values

Parameter	Symbol	Conditions	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	Unit
Inverter Diode										
Static										
Forward voltage	V_F				10	25 125 150		1,61 1,69 1,69	2,1	V
Reverse leakage current	I_R			1200		25			25	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,19		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 278 A/µs di/dt = 270 A/µs di/dt = 272 A/µs	±15	600	10	25 125 150		9 9 9		A
Reverse recovery time	t_{rr}					25 125 150		254 373 409		ns
Recovered charge	Q_r					25 125 150		1,09 1,66 1,81		µC
Reverse recovered energy	E_{rec}					25 125 150		0,374 0,620 0,680		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		85 54 49		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	$V_{GE(th)}$			10	0,001	25	5,4	6,0	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		10	25 125 150		1,66 1,90 1,96	2,15	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			35	µA
Gate-emitter leakage current	I_{GES}		20	0		25			500	nA
Internal gate resistance	r_{g}							none		Ω
Input capacitance	C_{ies}		0	10		25		2000		pF
Output capacitance	C_{oes}							86		
Reverse transfer capacitance	C_{res}							23		
Gate charge	Q_{g}		15	600	10	25		80		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,69		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 32 Ω R_{goff} = 32 Ω	0 / 15	600	10	25 125 150		72 68 68		ns
Rise time	t_{r}					25 125 150		46 50 50		
Turn-off delay time	$t_{d(off)}$					25 125 150		225 251 257		
Fall time	t_{f}					25 125 150		93 111 113		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 1 µC Q_{rFWD} = 1,6 µC Q_{rFWD} = 1,8 µC				25 125 150		0,973 1,25 1,33		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,647 0,863 0,915		

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	25 125 150		1,61 1,69 1,69	2,1	V
Reverse leakage current	I_R			1200		25			25	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,19		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 165 A/µs di/dt = 148 A/µs di/dt = 153 A/µs	0 / 15	600	10	25 125 150		7 8 8		A
Reverse recovery time	t_{rr}					25 125 150		2647 3964 4475		ns
Recovered charge	Q_r					25 125 150		0,989 1,57 1,77		µC
Reverse recovered energy	E_{rec}					25 125 150		0,337 0,577 0,666		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		6 4 4		A/µs
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	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,20		K/W

Characteristic Values

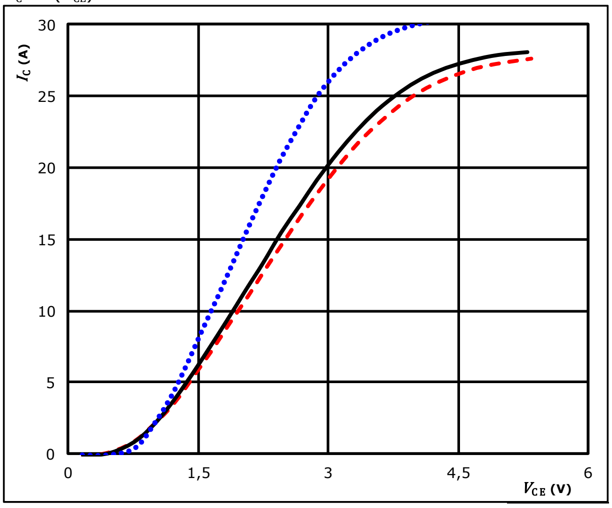
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Thermistor										
Rated resistance	R					25		5		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 493 Ω				100	-5		+5	%
Power dissipation	P					25		245		mW
Power dissipation constant						25		1,4		mW/K
B-value	$B_{(25/50)}$	Tol. ±2 %				25		3375		K
B-value	$B_{(25/100)}$	Tol. ±2 %				25		3437		K
Vincotech NTC Reference									K	

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

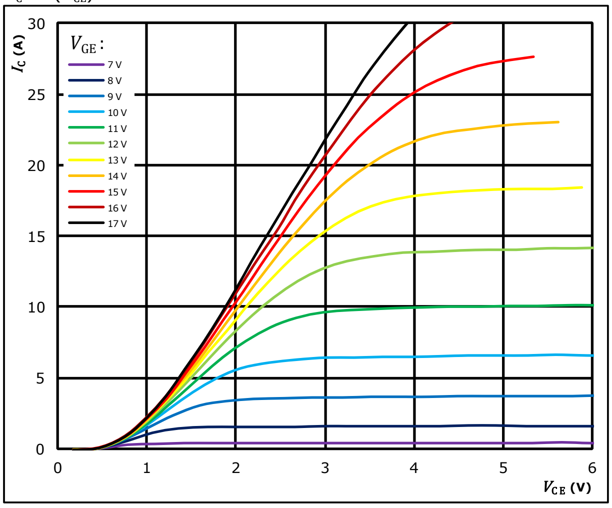


t_p =	250	μs		25	°C
V_{GE} =	15	V	T_j:	125	°C
				150	°C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



t_p = 250 μs

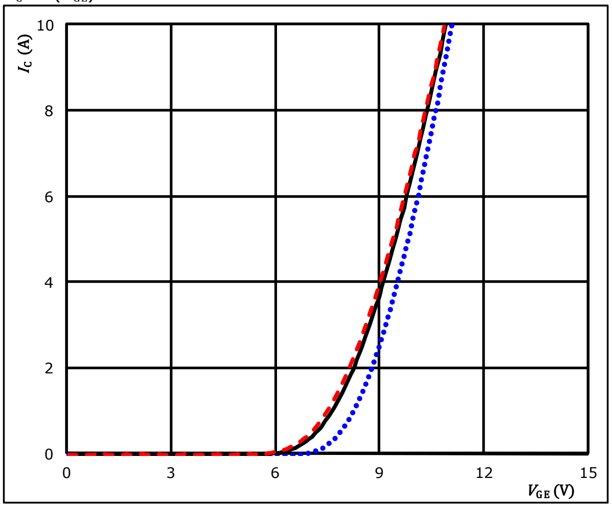
T_j = 150 °C

V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

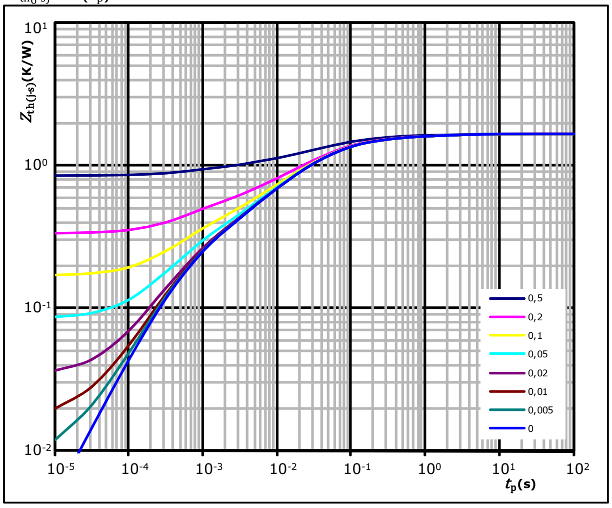


t_p =	100	μs		25	°C
V_{CE} =	10	V	T_j:	125	°C
				150	°C

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T

$R_{th(j-s)}$ = 1,69 K/W

IGBT thermal model values

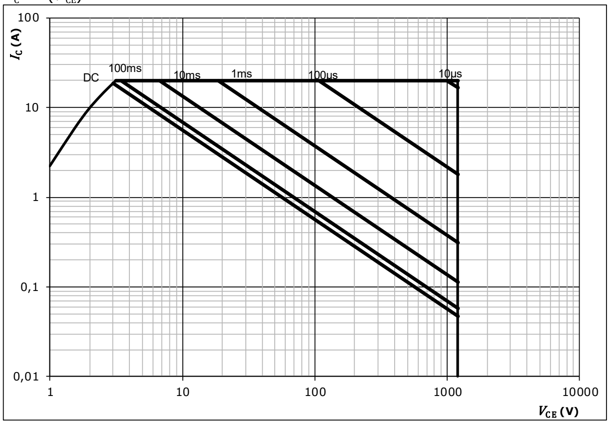
R (K/W)	τ (s)
8,19E-02	2,69E+00
1,67E-01	3,26E-01
5,87E-01	5,94E-02
4,55E-01	1,53E-02
2,18E-01	3,12E-03
1,79E-01	4,83E-04

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



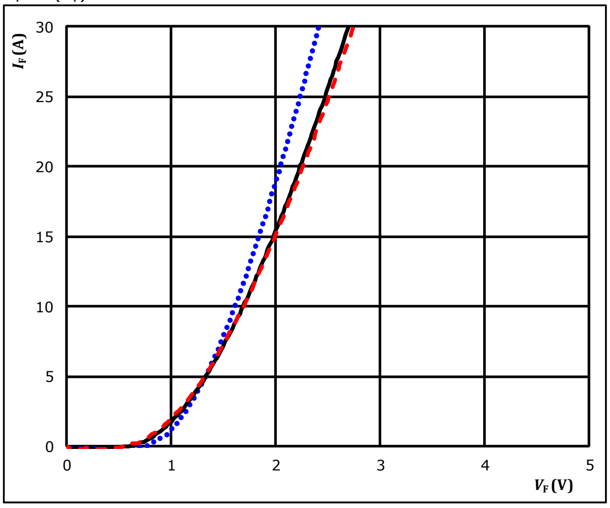
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Inverter Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



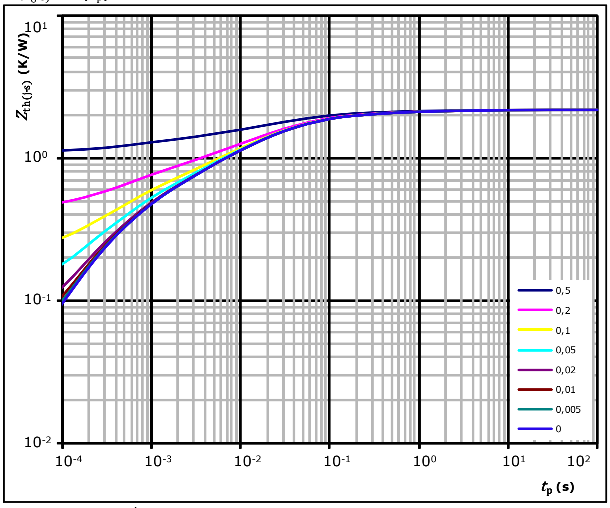
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 2,19 K/W

FWD thermal model values

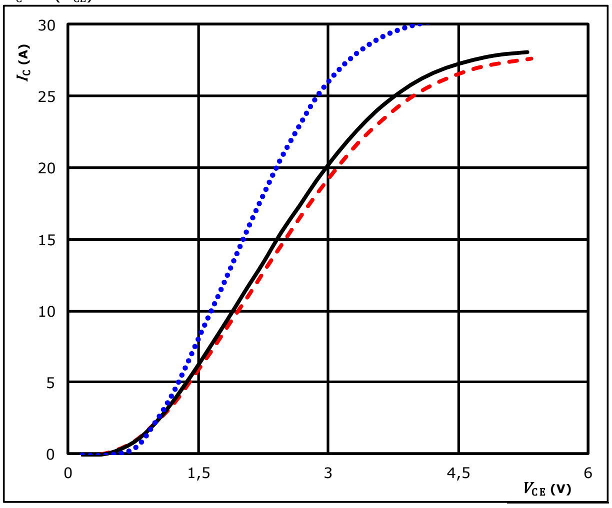
R (K/W)	τ (s)
8,09E-02	3,20E+00
2,08E-01	2,82E-01
6,85E-01	4,41E-02
5,92E-01	1,02E-02
3,27E-01	2,02E-03
2,95E-01	3,64E-04

Brake Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

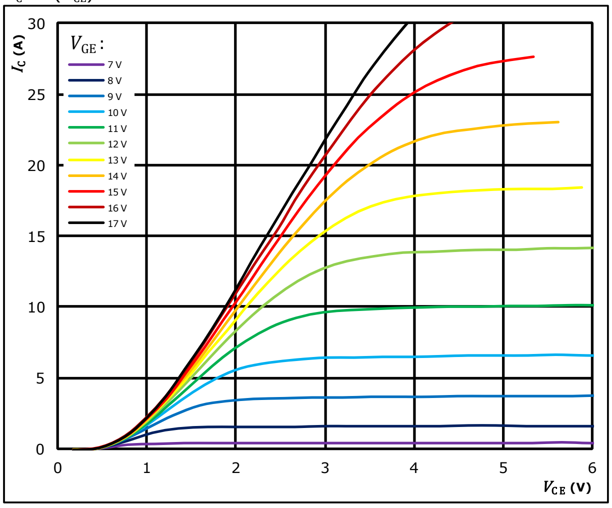


t_p =	250	µs		25	°C
V_{GE} =	15	V	T_j:	125	°C
				150	°C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

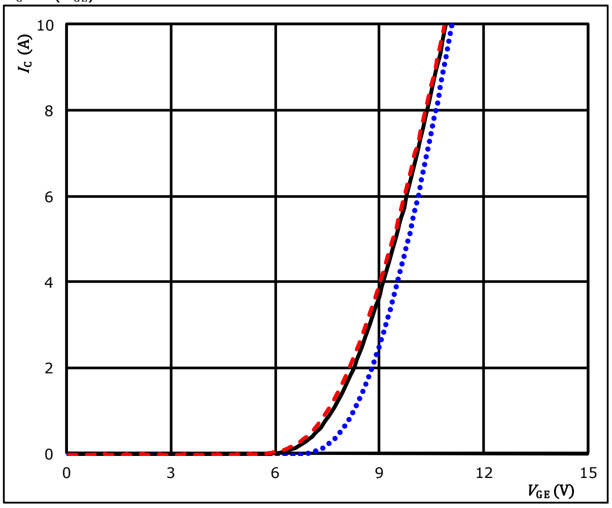


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

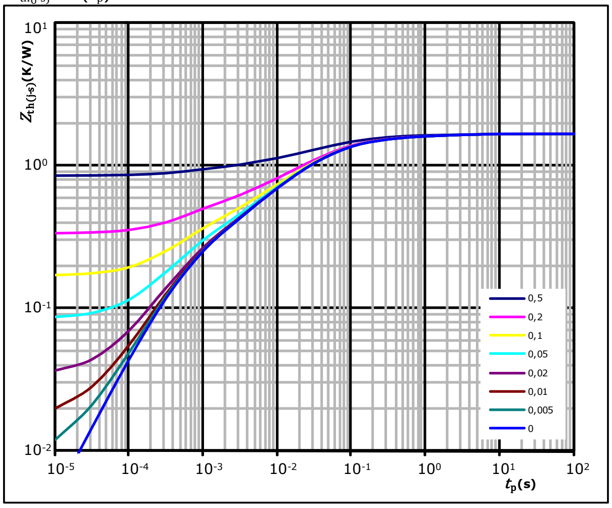


t_p =	100	µs		25	°C
V_{CE} =	10	V	T_j:	125	°C
				150	°C

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T

$R_{th(j-s)}$ = 1,69 K/W

IGBT thermal model values

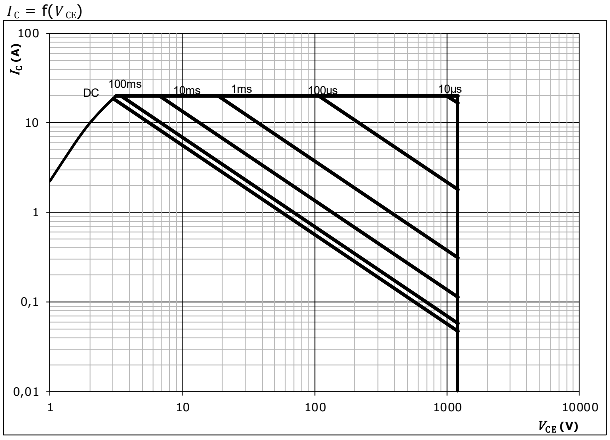
R (K/W)	τ (s)
8,19E-02	2,69E+00
1,67E-01	3,26E-01
5,87E-01	5,94E-02
4,55E-01	1,53E-02
2,18E-01	3,12E-03
1,79E-01	4,83E-04

Brake Switch Characteristics

figure 5.	IGBT

Safe operating area

$I_C = f(V_{CE})$



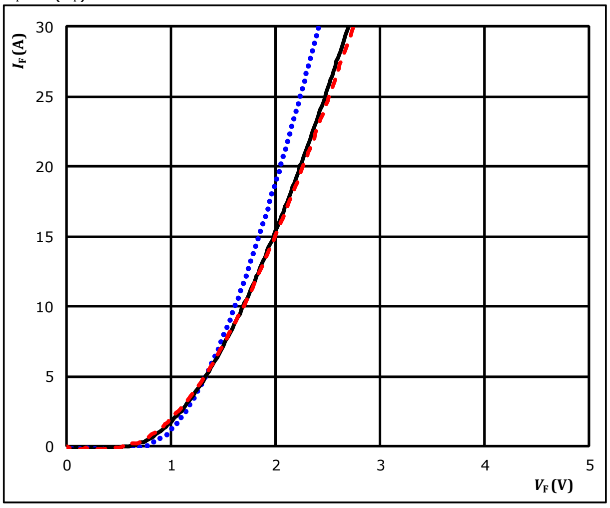
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Brake Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$

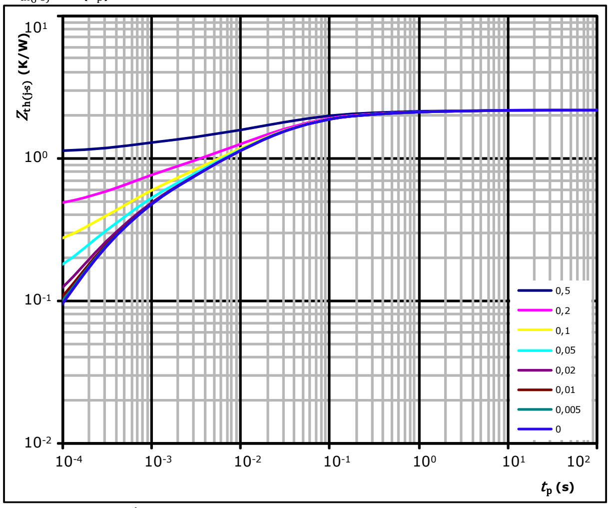


t_p =	250	µs	T_j:	25 °C
				125 °C
				150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 2,19 K/W

FWD thermal model values

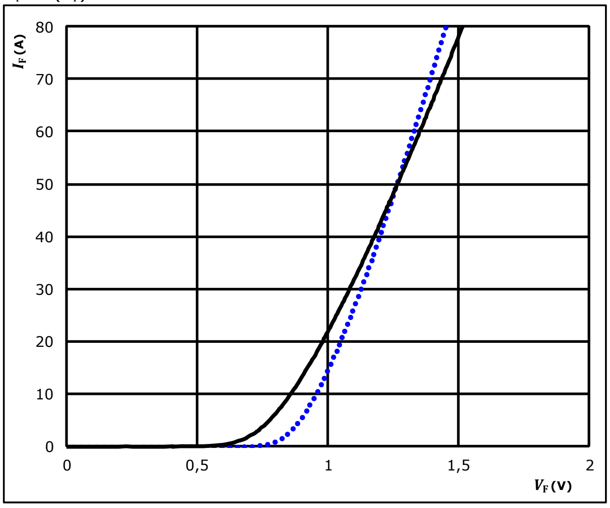
R (K/W)	τ (s)
8,09E-02	3,20E+00
2,08E-01	2,82E-01
6,85E-01	4,41E-02
5,92E-01	1,02E-02
3,27E-01	2,02E-03
2,95E-01	3,64E-04

Rectifier Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



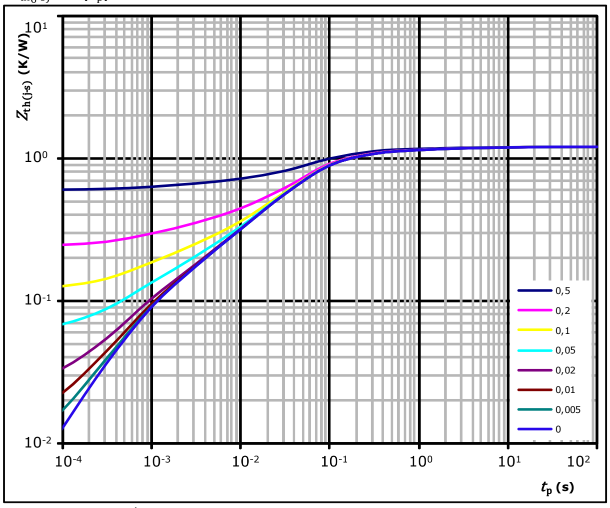
t_p = 250 µs

T_j: 25 °C / 125 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)} =$ 1,20 K/W

FWD thermal model values

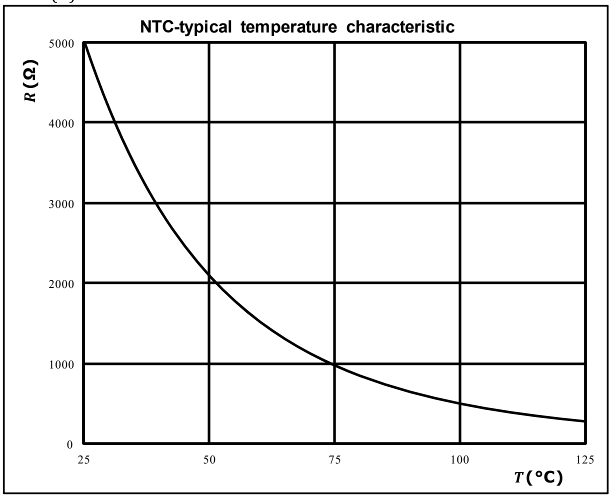
R (K/W)	τ (s)
3,54E-02	9,31E+00
8,09E-02	9,99E-01
2,12E-01	1,71E-01
6,76E-01	4,85E-02
1,19E-01	5,88E-03
7,98E-02	8,33E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic as a function of temperature

$R = f(T)$

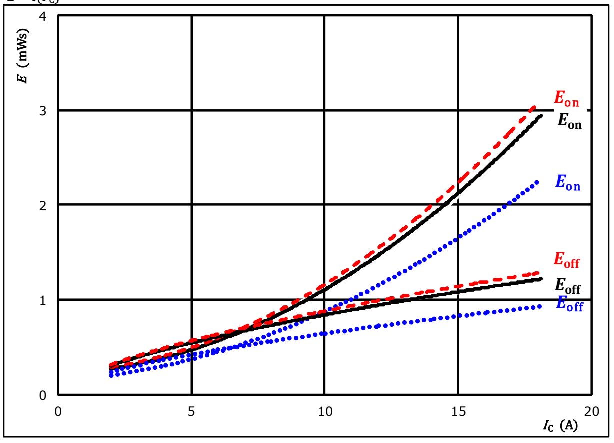


Inverter Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



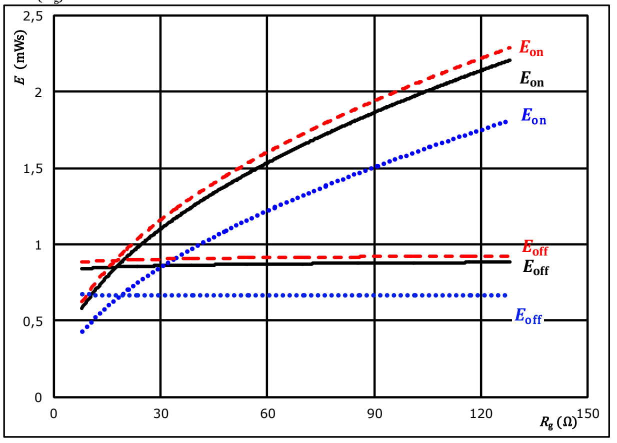
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	32	Ω		150 °C	dashed
R_{goff} =	32	Ω			

figure 2. IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



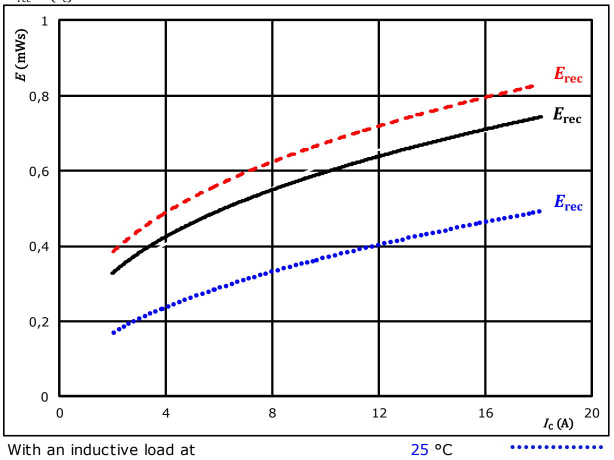
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C =	10	A		150 °C	dashed

figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_c)$



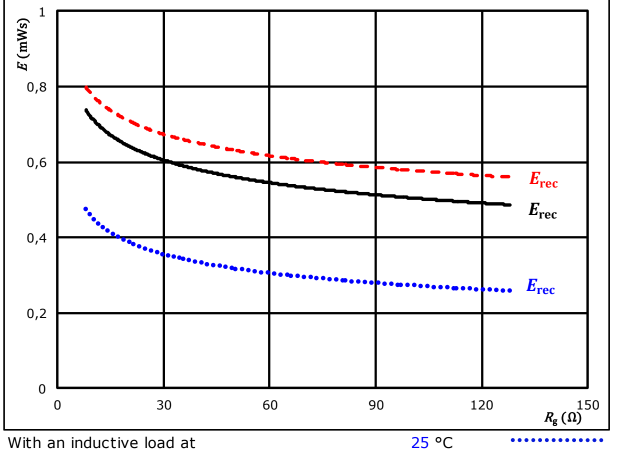
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	32	Ω		150 °C	dashed

figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

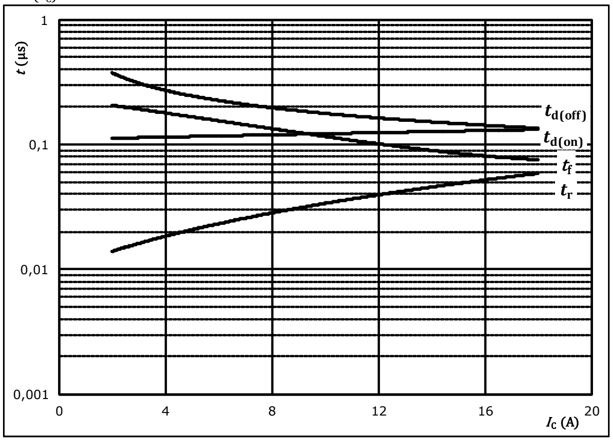
V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C =	10	A		150 °C	dashed

Inverter Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



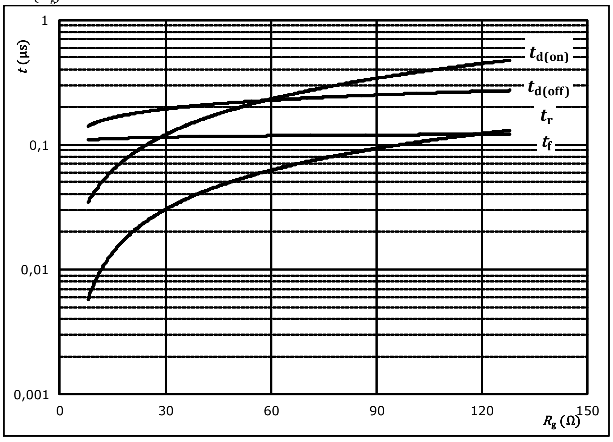
With an inductive load at

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

$t = f(R_g)$



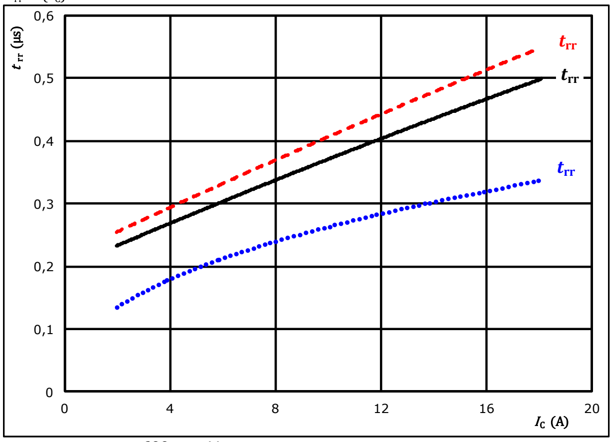
With an inductive load at

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

$t_{rr} = f(I_C)$

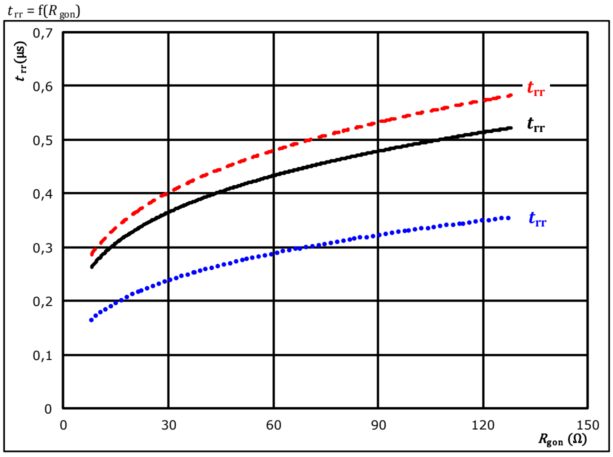


At				T_j:		
	V_{CE} =	600	V		25 °C	dotted blue
	V_{GE} =	±15	V		125 °C	solid black
	R_{gon} =	32	Ω		150 °C	dashed red

figure 8. **FWD**

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

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



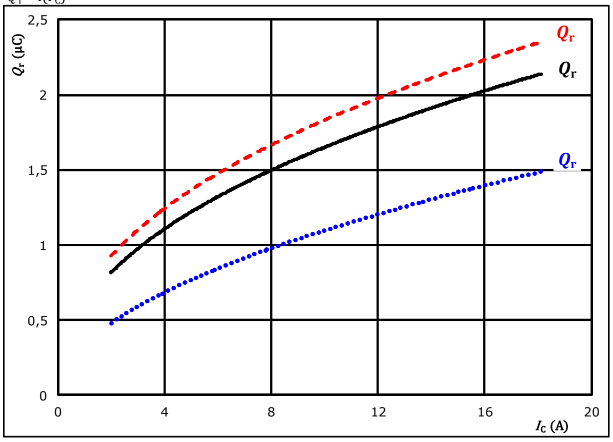
At				T_j:		
	V_{CE} =	600	V		25 °C	dotted blue
	V_{GE} =	±15	V		125 °C	solid black
	I_C =	10	A		150 °C	dashed red

Inverter Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

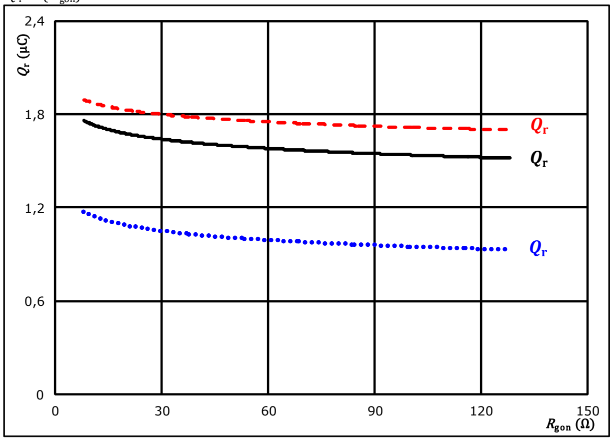


At					
V_{CE} =	600	V	T_j:	25 °C	
V_{GE} =	±15	V		125 °C	
R_{gon} =	32	Ω		150 °C	

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

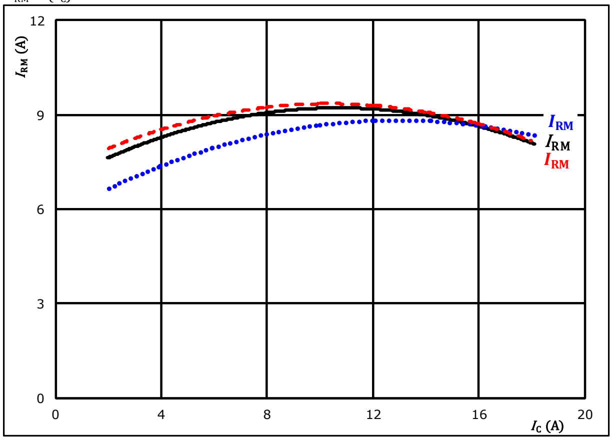


At					
V_{CE} =	600	V	T_j:	25 °C	
V_{GE} =	±15	V		125 °C	
I_C =	10	A		150 °C	

figure 11. **FWD**

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

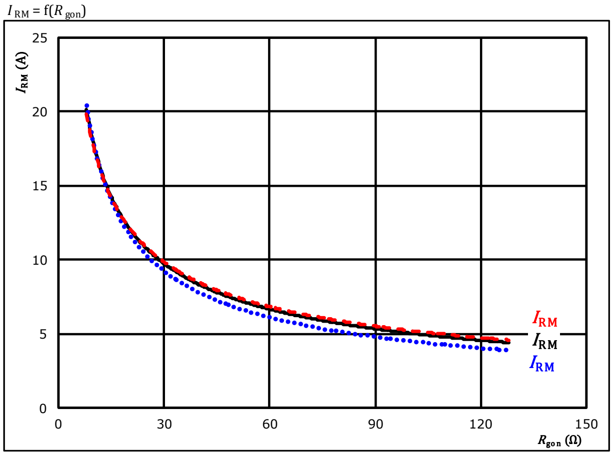


At					
V_{CE} :	600	V	T_j:	25 °C	
V_{GE} =	±15	V		125 °C	
R_{gon} =	32	Ω		150 °C	

figure 12. **FWD**

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

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



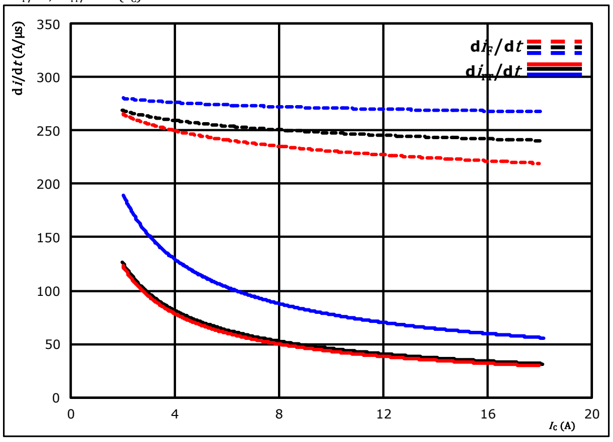
At					
V_{CE} =	600	V	T_j:	25 °C	
V_{GE} =	±15	V		125 °C	
I_C =	10	A		150 °C	

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, $di_{rr}/dt = f(I_C)$

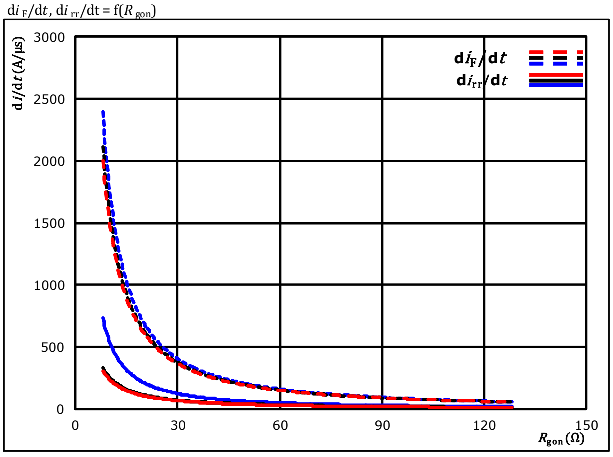


At						
	V_{CE} =	600	V		25	°C
	V_{GE} =	±15	V	T_j:	125	°C
	R_{gon} =	32	Ω		150	°C

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, $di_{rr}/dt = f(R_{gon})$

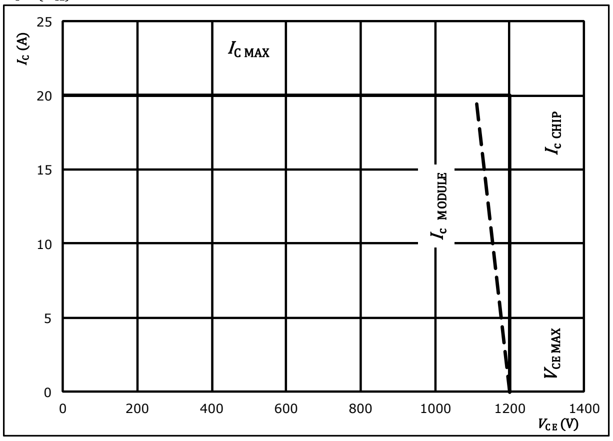


At						
	V_{CE} =	600	V		25	°C
	V_{GE} =	±15	V	T_j:	125	°C
	I_C =	10	A		150	°C

figure 15. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



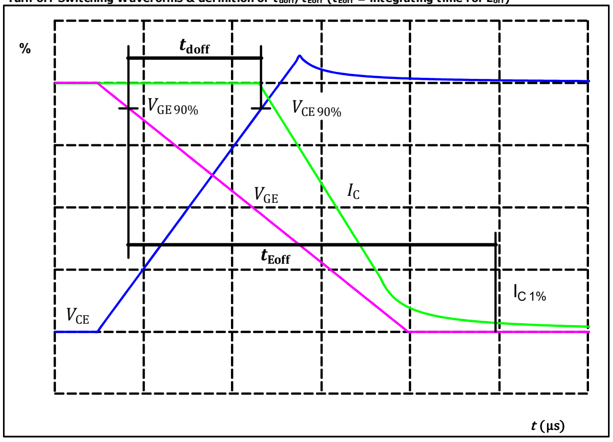
At			
	T_j =	175	°C
	R_{gon} =	32	Ω
	R_{goff} =	32	Ω

Inverter Switching Definitions

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

figure 1. IGBT

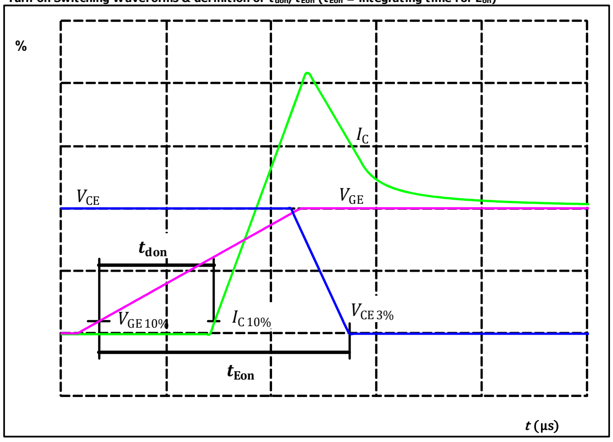
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	10	A
t_{doff} =	179	ns

figure 2. IGBT

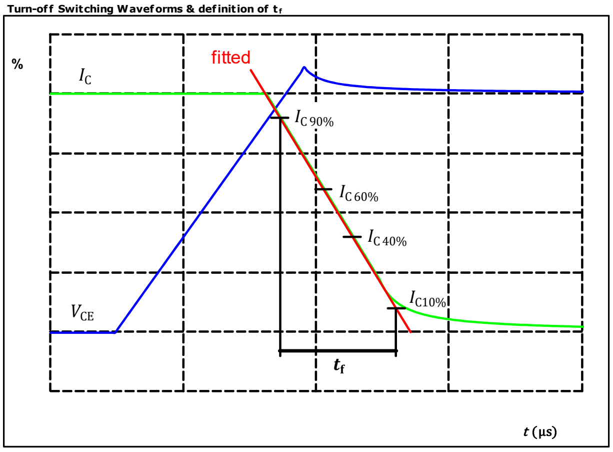
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	10	A
t_{don} =	126	ns

figure 3. IGBT

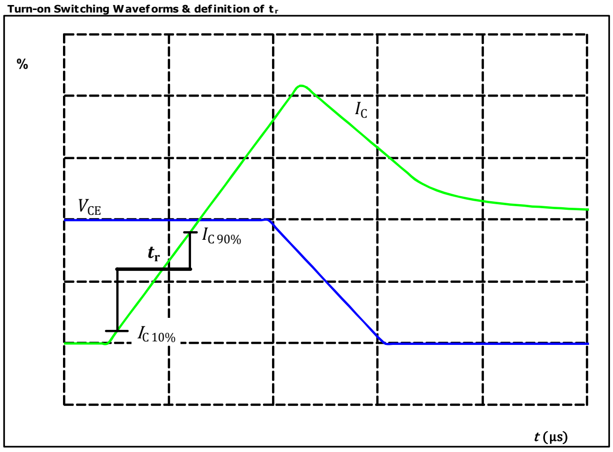
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	10	A
t_f =	108	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

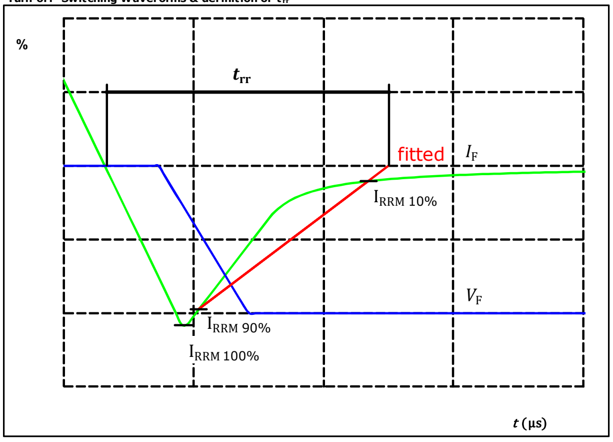


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	10	A
t_r =	32	ns

Inverter Switching Characteristics

figure 5. **FWD**

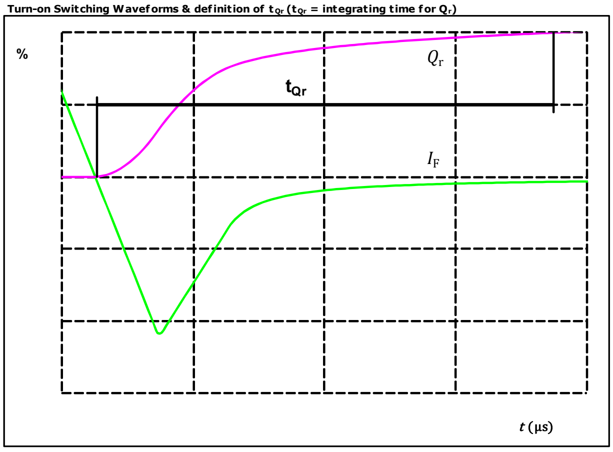
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	600	V
I_F (100%) =	10	A
I_{RRM} (100%) =	9	A
t_{rr} =	373	ns

figure 6. **FWD**

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



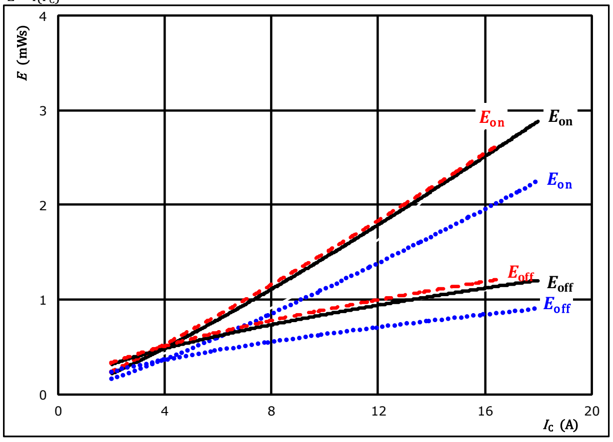
I_F (100%) =	10	A
Q_r (100%) =	1,66	µC

Brake Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



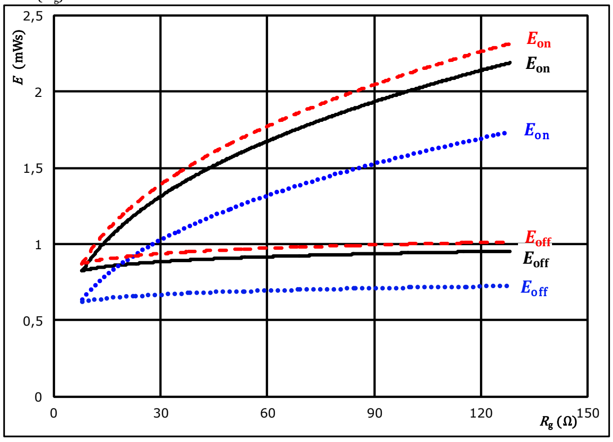
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	············
V_{GE} =	0 / 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

$E = f(R_g)$



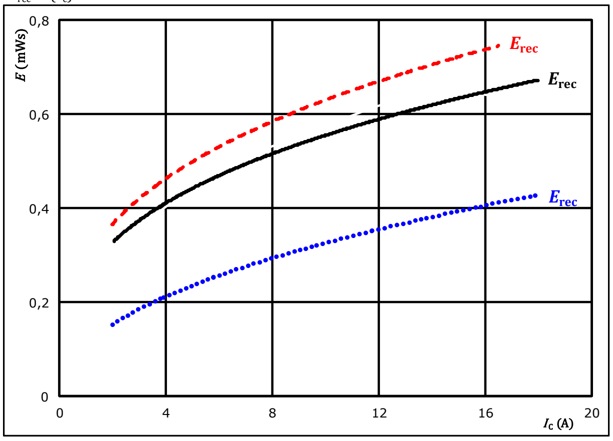
With an inductive load at

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

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



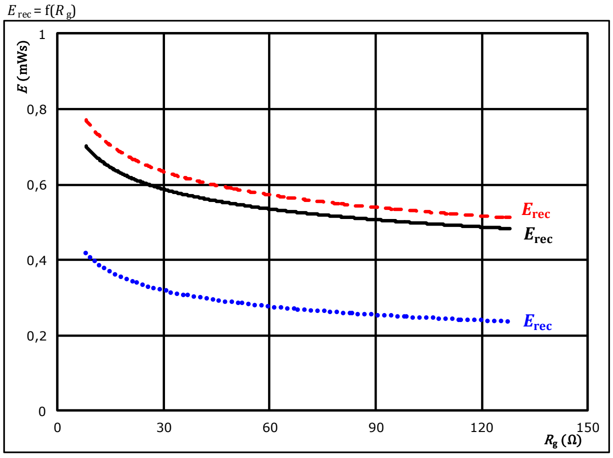
With an inductive load at

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

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

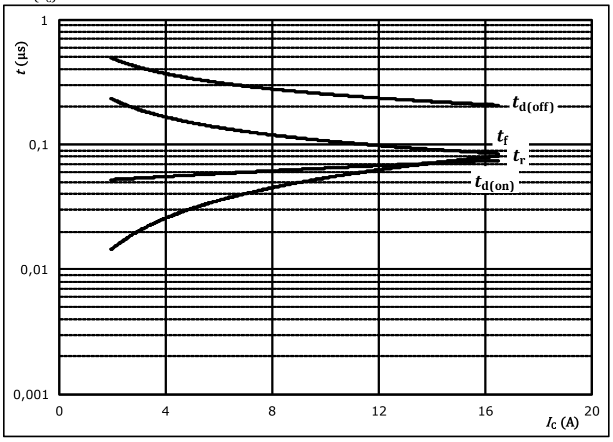
V_{CE} =	600	V	T_j:	25 °C	············
V_{GE} =	0 / 15	V		125 °C	———
I_C =	10	A		150 °C	– – –

Brake Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



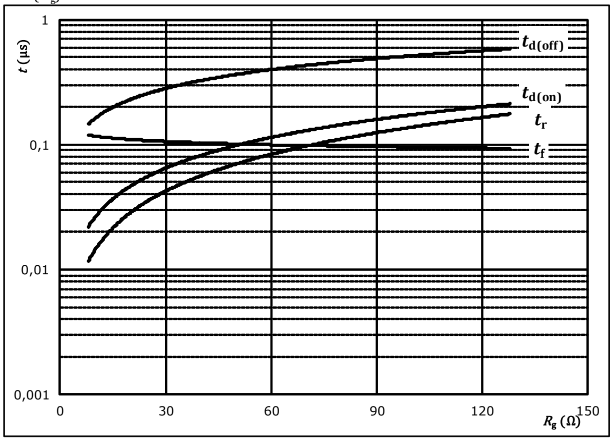
With an inductive load at

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

$t = f(R_g)$



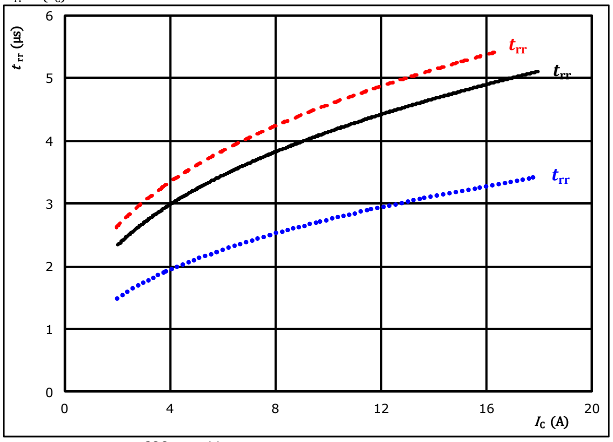
With an inductive load at

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

$t_{rr} = f(I_C)$

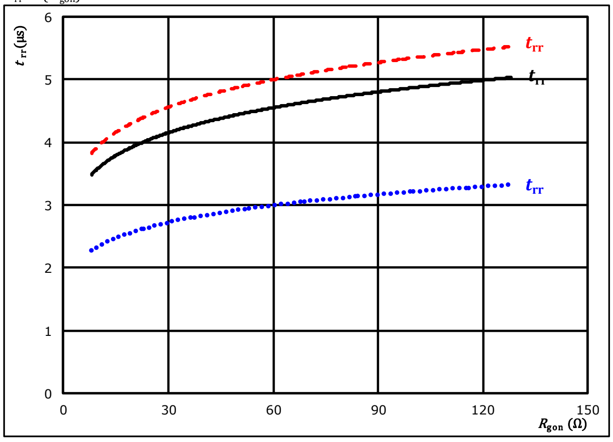


At					
V_{CE} =	600	V		25 °C	dotted
V_{GE} =	0 / 15	V	T_j:	125 °C	solid
R_{gon} =	32	Ω		150 °C	dashed

figure 8. **FWD**

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

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



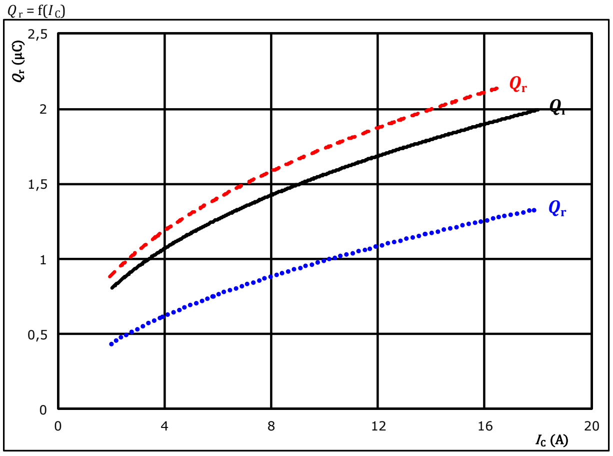
At					
V_{CE} =	600	V		25 °C	dotted
V_{GE} =	0 / 15	V	T_j:	125 °C	solid
I_C =	10	A		150 °C	dashed

Brake Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

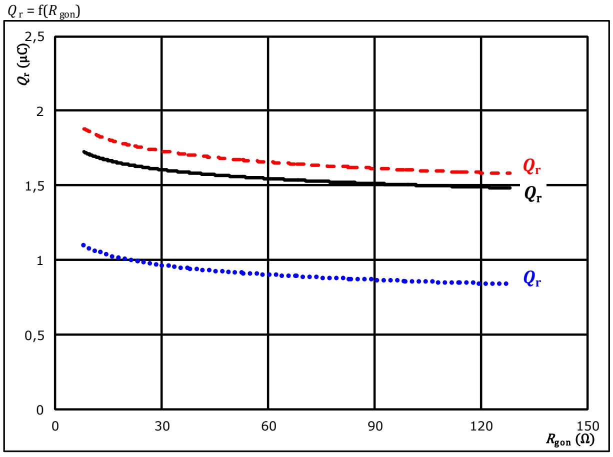


At					
V_{CE} =	600	V		25 °C	···········
V_{GE} =	0 / 15	V	T_j:	125 °C	———
R_{gon} =	32	Ω		150 °C	– – –

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

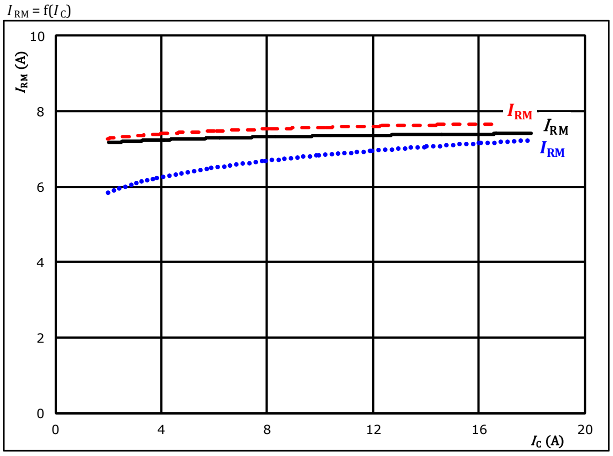


At					
V_{CE} =	600	V		25 °C	···········
V_{GE} =	0 / 15	V	T_j:	125 °C	———
I_C =	10	A		150 °C	– – –

figure 11. **FWD**

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

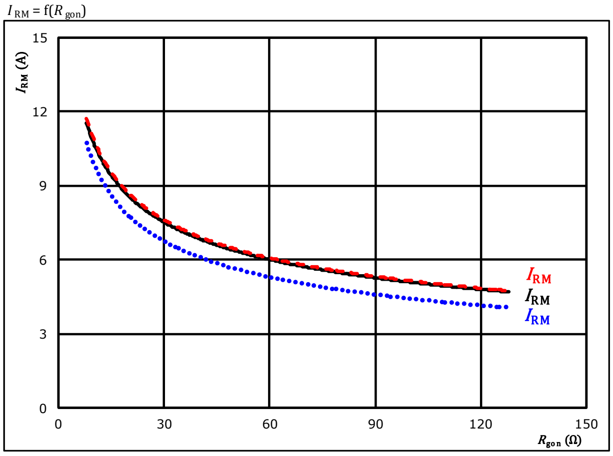


At					
V_{CE} =	600	V		25 °C	···········
V_{GE} =	0 / 15	V	T_j:	125 °C	———
R_{gon} =	32	Ω		150 °C	– – –

figure 12. **FWD**

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

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



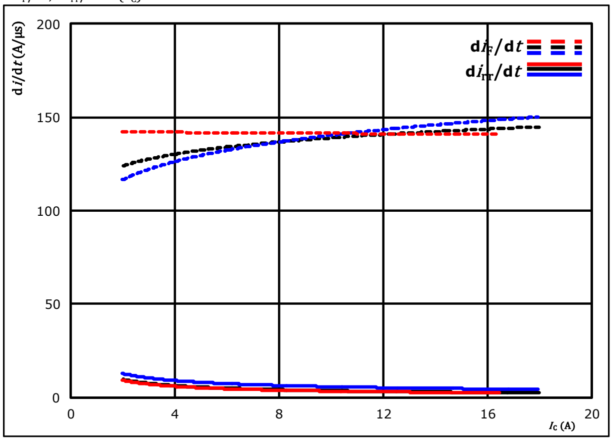
At					
V_{CE} =	600	V		25 °C	···········
V_{GE} =	0 / 15	V	T_j:	125 °C	———
I_C =	10	A		150 °C	– – –

Brake Switching Characteristics

figure 13. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of collector current

$di_F/dt,\ di_{rr}/dt = f(I_C)$

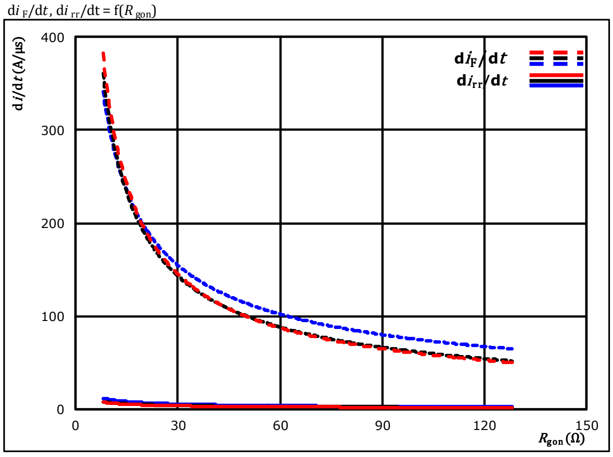


At					
V_{CE} =	600	V		25	°C
V_{GE} =	0 / 15	V	T_j:	125	°C
R_{gon} =	32	Ω		150	°C

figure 14. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor

$di_F/dt,\ di_{rr}/dt = f(R_{gon})$

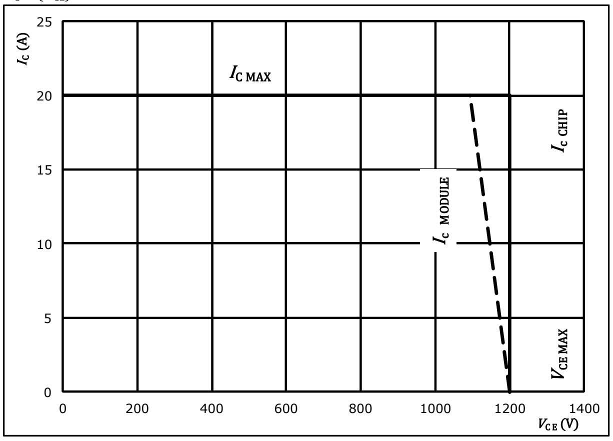


At					
V_{CE} =	600	V		25	°C
V_{GE} =	0 / 15	V	T_j:	125	°C
I_C=	10	A		150	°C

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



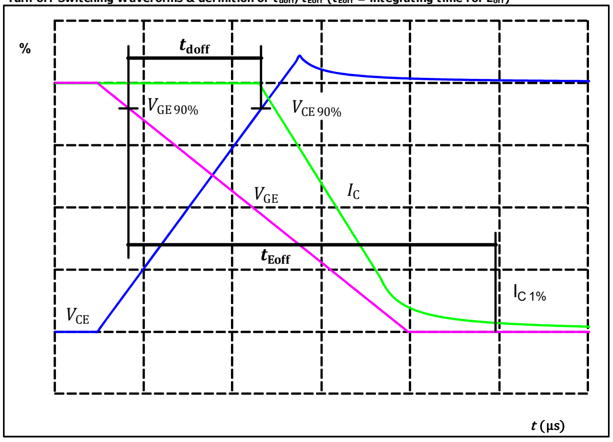
At		
T_j =	175	°C
R_{gon} =	32	Ω
R_{goff} =	32	Ω

Brake Switching Definitions

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

figure 1. IGBT

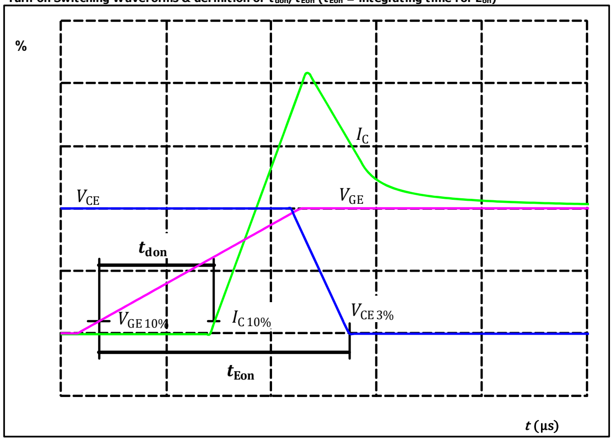
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



V_{GE}(0%) =	0	V
V_{GE}(100%) =	15	V
V_C(100%) =	600	V
I_C(100%) =	10	A
t_{doff} =	251	ns

figure 2. IGBT

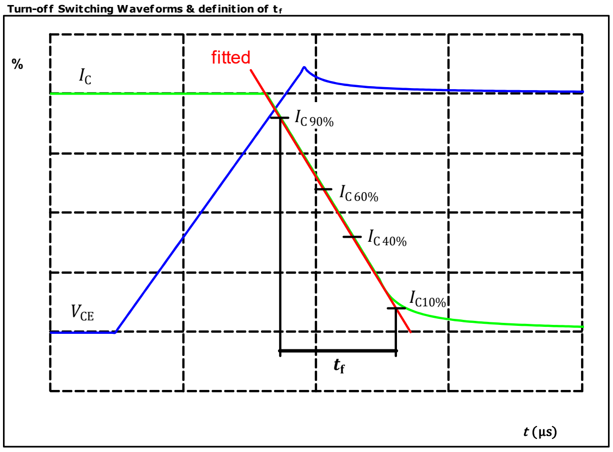
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



V_{GE}(0%) =	0	V
V_{GE}(100%) =	15	V
V_C(100%) =	600	V
I_C(100%) =	10	A
t_{don} =	68	ns

figure 3. IGBT

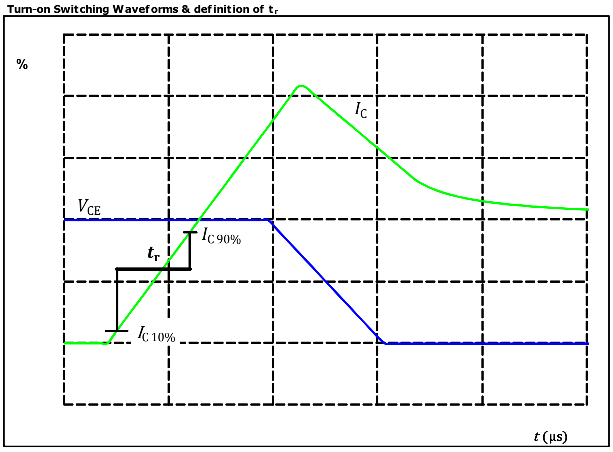
Turn-off Switching Waveforms & definition of t_f



V_C(100%) =	600	V
I_C(100%) =	10	A
t_f =	111	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

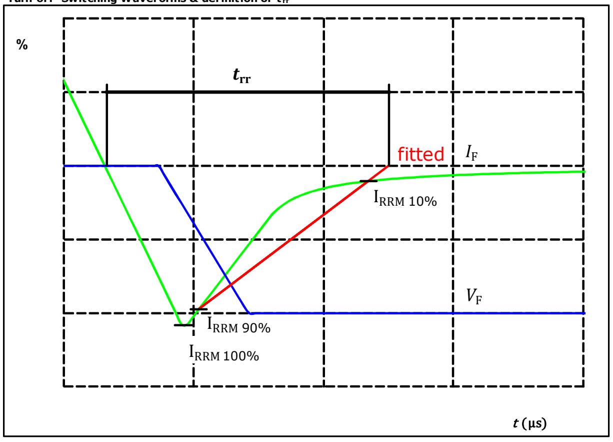


V_C(100%) =	600	V
I_C(100%) =	10	A
t_r =	50	ns

Brake Switching Characteristics

figure 5.	FWD

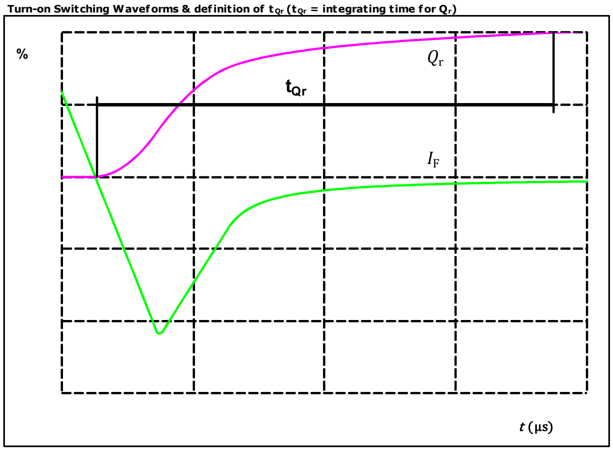
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	600	V
I_F (100%) =	10	A
I_{RRM} (100%) =	8	A
t_{rr} =	3964	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%) =	1,57	µC

10-EZ12PMA010M7-L927A78T
10-E112PMA010M7-L927A78Z
datasheet

Vincotech

Ordering Code & Marking

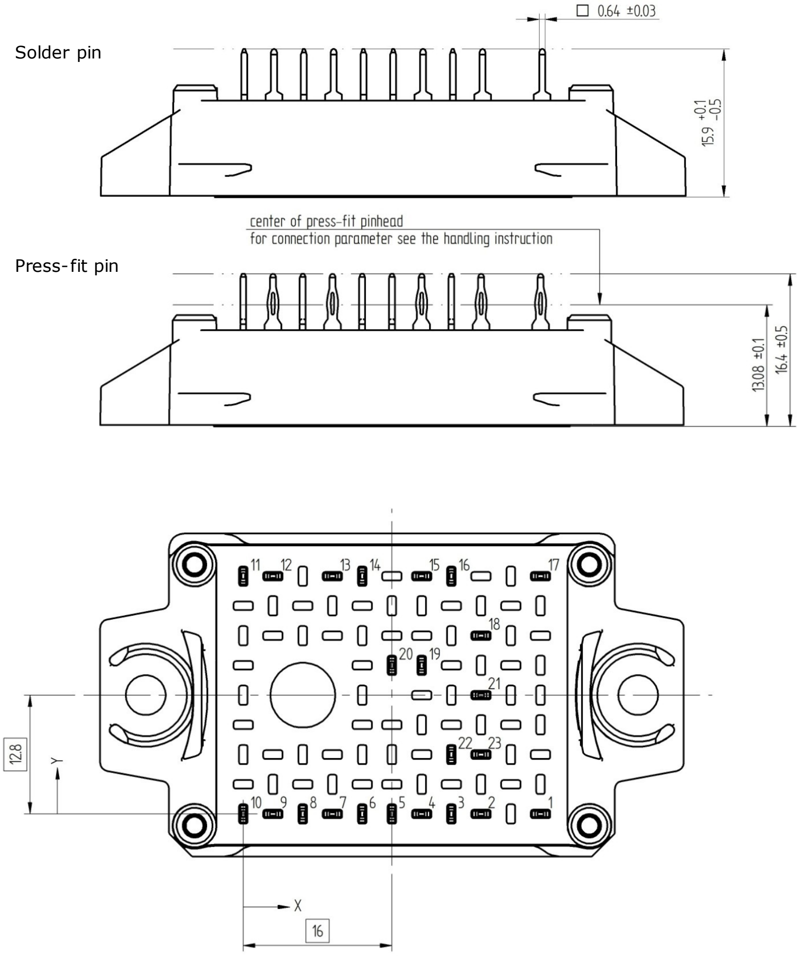
Version	Ordering Code
without thermal paste 12 mm housing with Press-fit pins	10-EZ12PMA010M7-L927A78T
with thermal paste 12 mm housing with Press-fit pins	10-EZ12PMA010M7-L927A78T-/3/
without thermal paste 12 mm housing with solder pins	10-E112PMA010M7-L927A78Z
with thermal paste 12 mm housing with solder pins	10-E112PMA010M7-L927A78Z-/3/

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

Outline

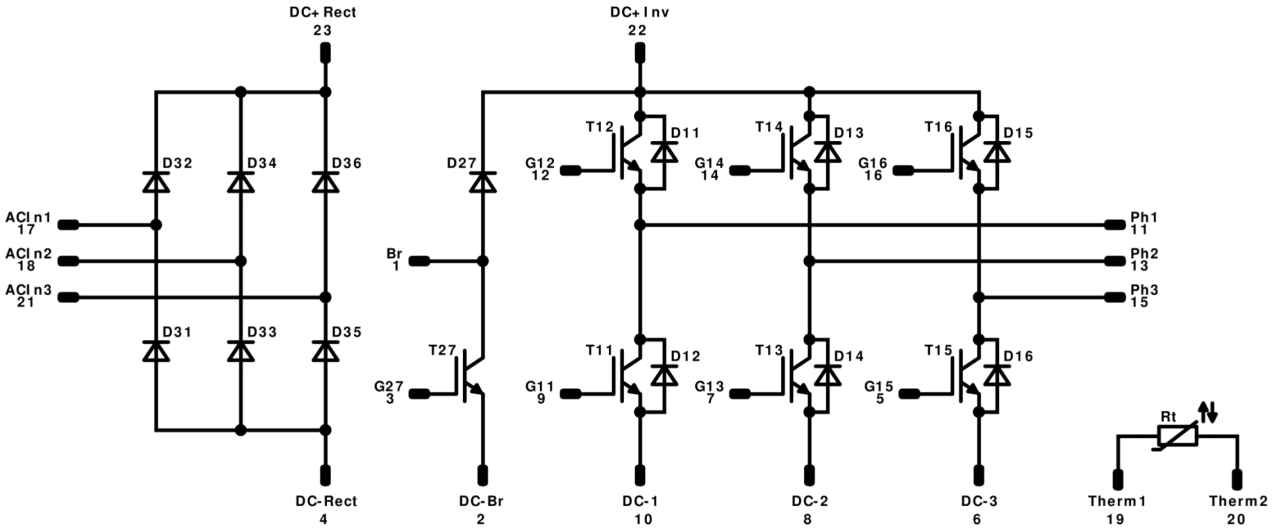
Pin table

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

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	10 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	10 A	Inverter Diode	
T27	IGBT	1200 V	10 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	

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

Handling instruction
Handling instructions for *flow* E1 packages see vincotech.com website.

Package data
Package data for *flow* E1 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-Ex12PMA010M7-L927A78x-D4-14	30 May. 2019	Correction of I_c/I_f values Outline updated	1, 2 28