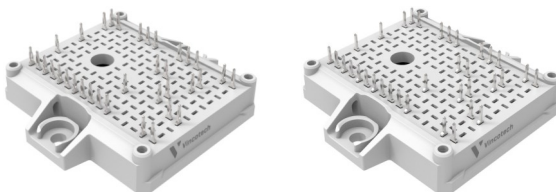
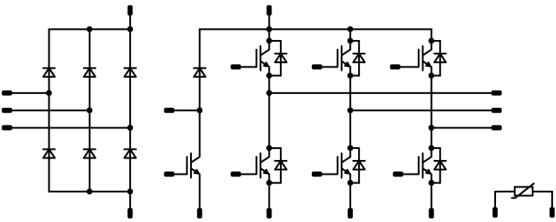




Vincotech

10-EY12PMA035M7-L188A78T 10-E212PMA035M7-L188A78Z

datasheet

flowPIM E2		1200 V / 35 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 E2 12 mm housing  Press-fit pin Solder pin
Target applications Industrial Drives		Schematic 
Types 10-EY12PMA035M7-L188A78T 10-E212PMA035M7-L188A78Z		

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	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	49	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	70	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	108	W
Gate-emitter voltage	V_{GES}		± 20	V
Maximum junction temperature	T_{jmax}		175	°C



Vincotech

10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
 datasheet

Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
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Inverter Diode

Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	41	A
Repetitive peak forward current	I_{FRM}		70	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	78	W
Maximum junction temperature	T_{jmax}		175	°C

Brake Switch

Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	49	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	70	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	108	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	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	14	A
Repetitive peak forward current	I_{FRM}	T_j limited by T_{jmax}	20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	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	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	51	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	350	A
Surge current capability	I^2t		610	A ² s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	60	W
Maximum junction temperature	T_{jmax}		150	°C



Vincotech

10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
datasheet

Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
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Module Properties

Thermal Properties

Storage temperature	T_{stg}		-40...+125	°C
Operation temperature under switching condition	T_{top}		-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		Press-fit pin / Solder pin	8,83 / 8,85	mm
Comparative Tracking Index	CTI		≥ 600	

*100 % tested in production



Vincotech

10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
 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	

Inverter Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,0035	25	5,4	6,0	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		35	25 125 150		1,48 1,64 1,68	1,85	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			80	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			7900		pF
Output capacitance	C_{oes}							270		
Reverse transfer capacitance	C_{res}							97		
Gate charge	Q_g		15	600	35	25		260		nC

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						0,88		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 16 \Omega$ $R_{goff} = 16 \Omega$	± 15	600	35	25 125 150		223 240 233		ns
Rise time	t_r					25 125 150		28 34 35		
Turn-off delay time	$t_{d(off)}$					25 125 150		227 252 259		
Fall time	t_f					25 125 150		97 114 123		
Turn-on energy (per pulse)*	E_{on}					25 125 150		2,45 3,23 3,44		mWs
Turn-off energy (per pulse)*	E_{off}					25 125 150		2,46 3,24 3,46		

* $L_s = 10 \text{ nH}$



Vincotech

10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
 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	

Inverter Diode

Static

Forward voltage	V_F				35	25 125 150		1,66 1,76 1,75	2,1	V
Reverse leakage current	I_R			1200		25			40	μA

Thermal

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

Peak recovery current	I_{RRM}	$di/dt = 1364$ A/μs $di/dt = 1192$ A/μs $di/dt = 1157$ A/μs	± 15	600	35	25 125 150		41 40 41		A
Reverse recovery time	t_{rr}					25 125 150		267 425 450		ns
Recovered charge	Q_r					25 125 150		3,80 5,84 6,39		μC
Reverse recovered energy	E_{rec}					25 125 150		1,48 2,39 2,60		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		485 353 343		A/μs



Vincotech

10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
 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	

Brake Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,0035	25	5,4	6,0	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		35	25 125 150		1,48 1,64 1,68	1,85	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			80	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			7900		pF
Output capacitance	C_{oes}							270		
Reverse transfer capacitance	C_{res}							97		
Gate charge	Q_g		15	600	35	25		260		nC

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						0,88		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 32 \Omega$ $R_{goff} = 32 \Omega$	± 15	600	35	25 125 150		577 552 546		ns
Rise time	t_r					25 125 150		135 145 147		
Turn-off delay time	$t_{d(off)}$					25 125 150		301 332 338		
Fall time	t_f					25 125 150		70 88 95		
Turn-on energy (per pulse)	E_{on}					25 125 150		4,53 5,19 5,37		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		2,45 3,26 3,48		



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10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
 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	

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	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK (PSX)}$						2,19		K/W
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Dynamic

Peak recovery current	I_{RRM}	$di/dt = 224 \text{ A/}\mu\text{s}$ $di/dt = 207 \text{ A/}\mu\text{s}$ $di/dt = 207 \text{ A/}\mu\text{s}$	± 15	600	35	25 125 150		10 11 11		A
Reverse recovery time	t_{rr}					25 125 150		340 472 521		ns
Recovered charge	Q_r					25 125 150		1,88 2,74 2,97		μC
Reverse recovered energy	E_{rec}					25 125 150		0,652 1,03 1,13		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		40 37 38		A/μs

Rectifier Diode

Static

Forward voltage	V_F				45	25 125		1,15 1,12		V
Reverse leakage current	I_R			1600		25			50	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK (PSX)}$						1,17		K/W
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Vincotech

10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
 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	

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	



Vincotech

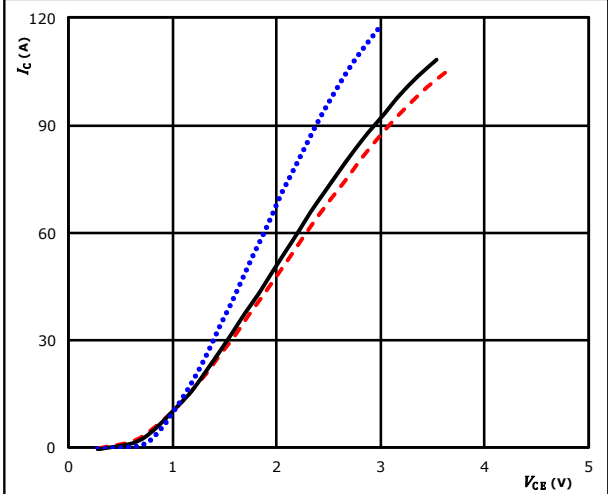
10-EY12PMA035M7-L188A78T 10-E212PMA035M7-L188A78Z datasheet

Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

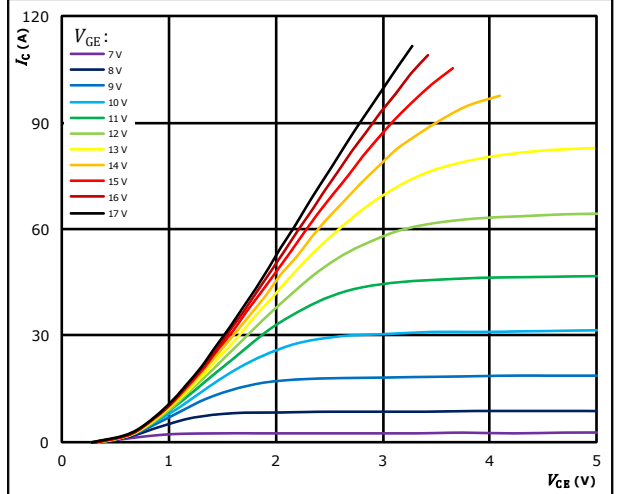


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j: 25 \text{ } ^\circ C$ (blue dotted line)
 $125 \text{ } ^\circ C$ (black solid line)
 $150 \text{ } ^\circ C$ (red dashed line)

figure 2. IGBT

Typical output characteristics

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

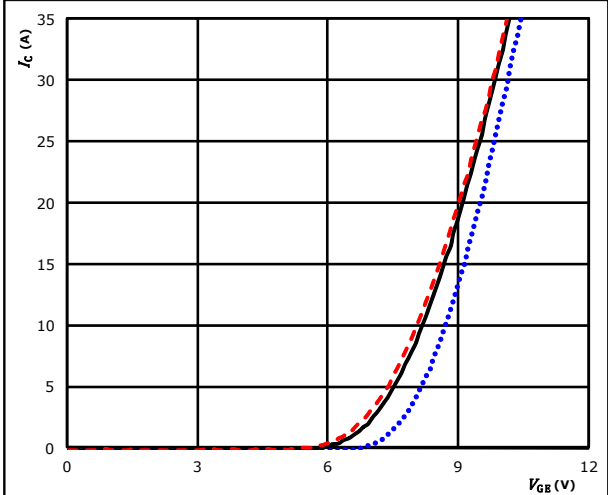


$t_p = 250 \mu s$
 $T_j = 150 \text{ } ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

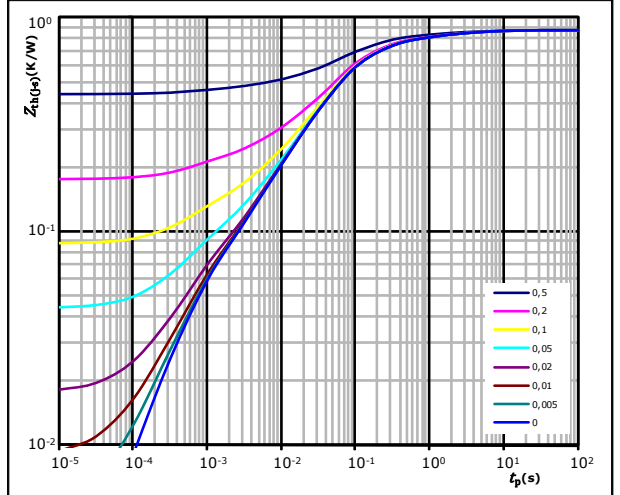


$t_p = 100 \mu s$
 $V_{CE} = 10 V$
 $T_j: 25 \text{ } ^\circ C$ (blue dotted line)
 $125 \text{ } ^\circ C$ (black solid line)
 $150 \text{ } ^\circ C$ (red dashed line)

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$
 $R_{th(j-s)} = 0,88 \text{ K/W}$

IGBT thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
4,21E-02	5,44E+00
8,81E-02	8,75E-01
2,30E-01	1,59E-01
3,79E-01	4,61E-02
9,10E-02	6,73E-03
4,73E-02	6,45E-04



Vincotech

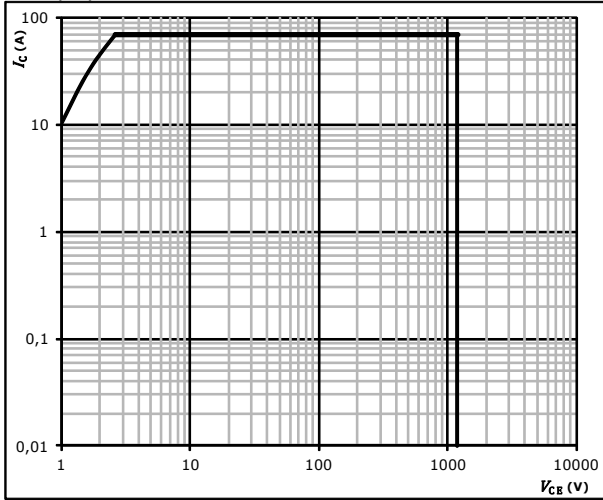
10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
datasheet

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}



Vincotech

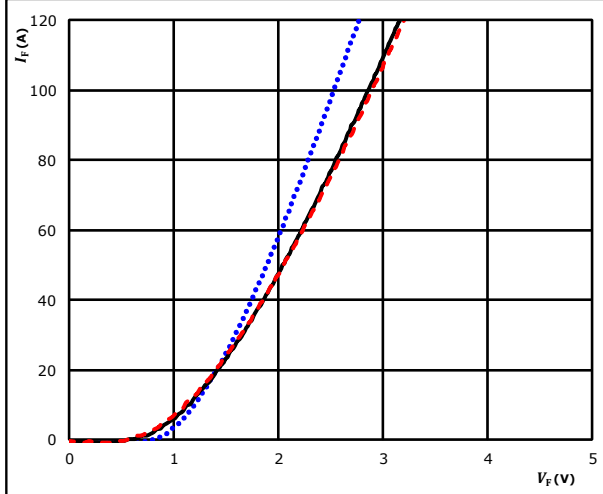
10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
 datasheet

Inverter Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

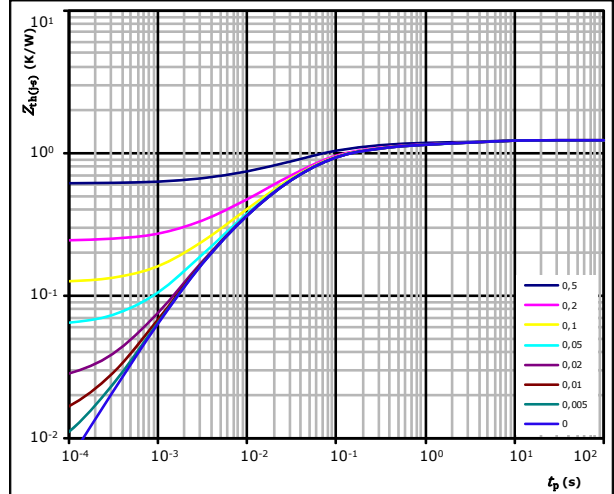


$t_p =$ 250 μ s
 T_j : 25 °C
 125 °C ———
 150 °C - - - -

figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,22$ K/W
 FWD thermal model values

R (K/W)	τ (s)
1,07E-01	3,56E+00
1,60E-01	2,77E-01
5,76E-01	5,00E-02
2,75E-01	1,24E-02
1,01E-01	2,87E-03



Vincotech

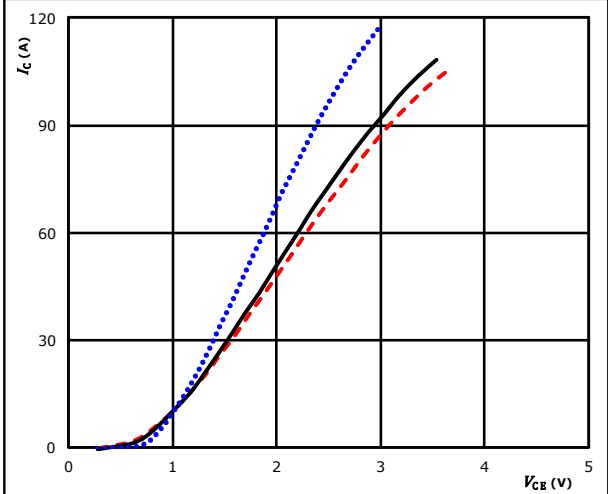
10-EY12PMA035M7-L188A78T 10-E212PMA035M7-L188A78Z datasheet

Brake Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

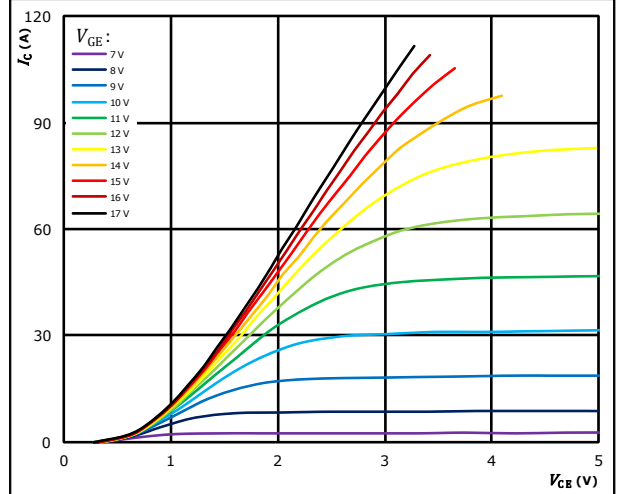


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j: 25 \text{ } ^\circ C$ (blue dotted line)
 $125 \text{ } ^\circ C$ (black solid line)
 $150 \text{ } ^\circ C$ (red dashed line)

figure 2. IGBT

Typical output characteristics

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

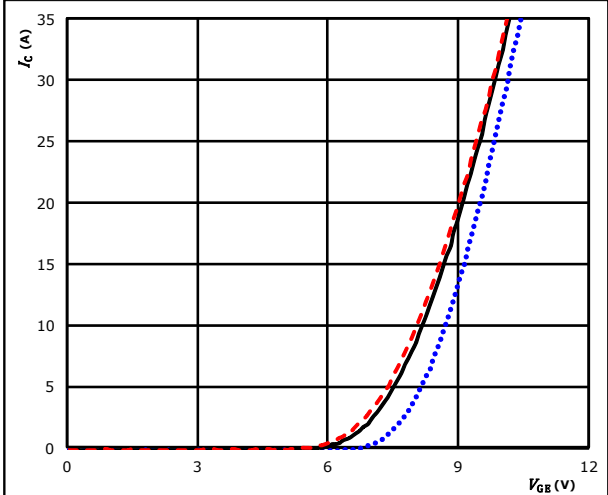


$t_p = 250 \mu s$
 $T_j = 150 \text{ } ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

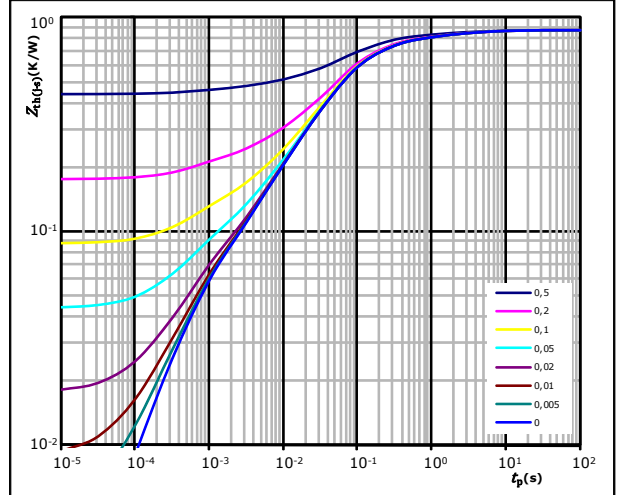


$t_p = 100 \mu s$
 $V_{CE} = 10 V$
 $T_j: 25 \text{ } ^\circ C$ (blue dotted line)
 $125 \text{ } ^\circ C$ (black solid line)
 $150 \text{ } ^\circ C$ (red dashed line)

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$
 $R_{th(j-s)} = 0,88 \text{ K/W}$
IGBT thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
4,21E-02	5,44E+00
8,81E-02	8,75E-01
2,30E-01	1,59E-01
3,79E-01	4,61E-02
9,10E-02	6,73E-03
4,73E-02	6,45E-04



Vincotech

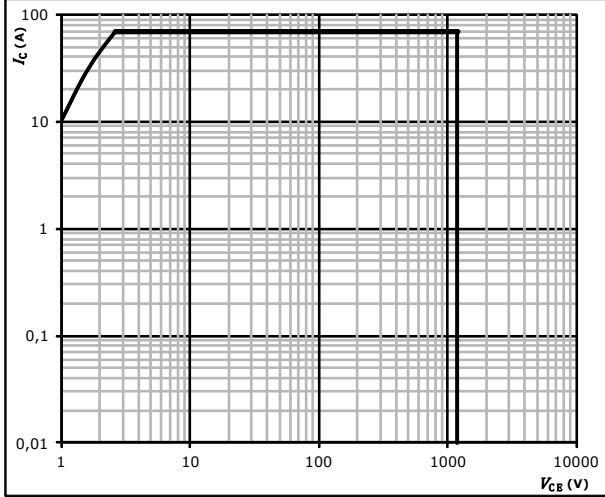
10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
datasheet

Brake 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}



Vincotech

10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
datasheet

Brake Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

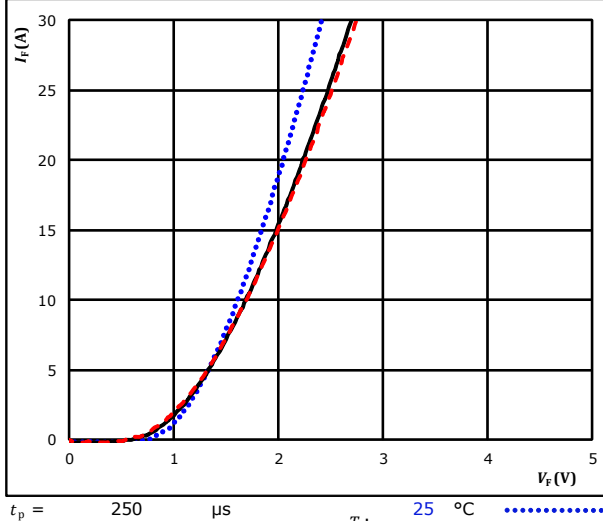
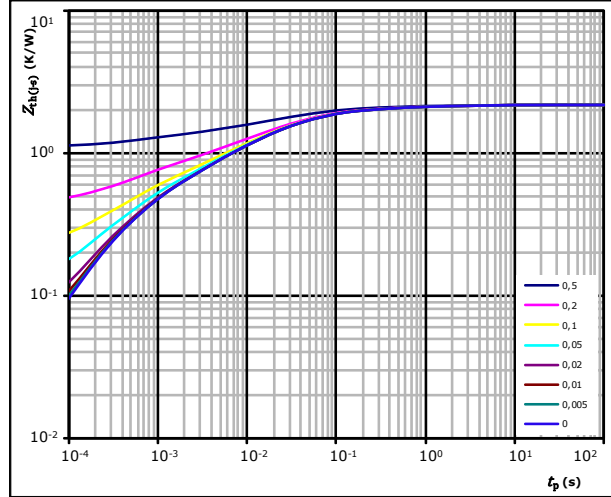


figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$$D = \frac{t_p}{T}$$
$$R_{th(j-s)} = 2,19 \text{ K/W}$$

FWD thermal model values

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



Vincotech

10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
datasheet

Rectifier Diode Characteristics

figure 1. Rectifier Diode

Typical forward characteristics

$$I_F = f(V_F)$$

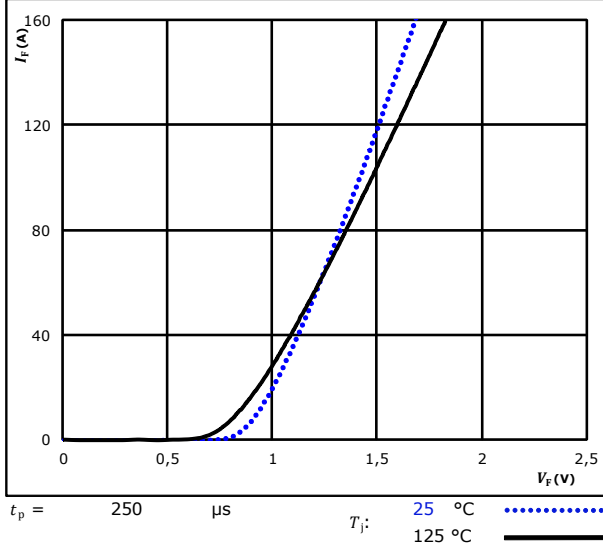
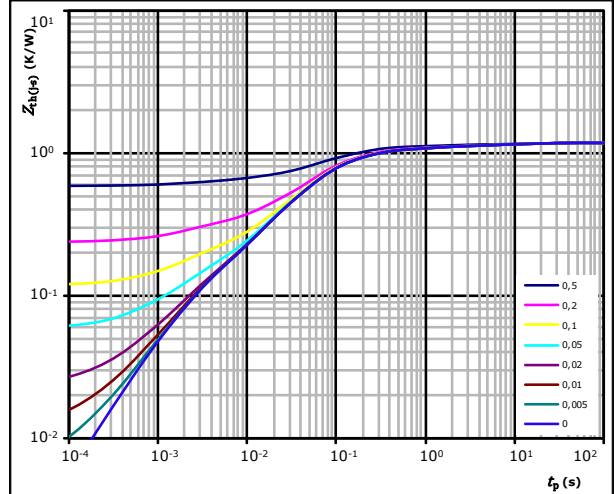


figure 2. Rectifier Diode

Transient thermal impedance as a function of pulse width

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



$$D = t_p / T$$

$$R_{th(j-s)} = 1,17 \text{ K/W}$$

Diode thermal model values

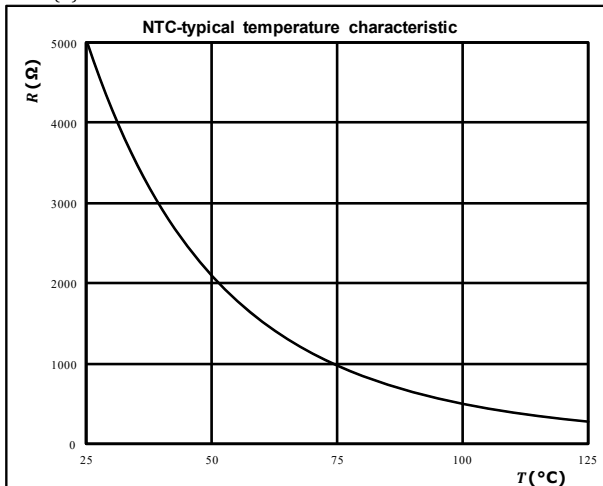
$R \text{ (K/W)}$	$\tau \text{ (s)}$
7,71E-02	9,00E+00
1,19E-01	7,09E-01
4,99E-01	1,03E-01
3,97E-01	3,61E-02
8,19E-02	2,07E-03

Thermistor Characteristics

figure 1. Thermistor

Typical NTC characteristic
as a function of temperature

$$R = f(T)$$





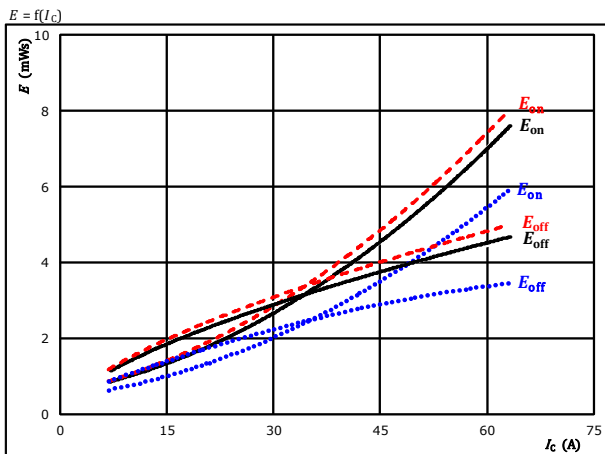
Vincotech

10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
 datasheet

Inverter Switching Characteristics

figure 1. IGBT

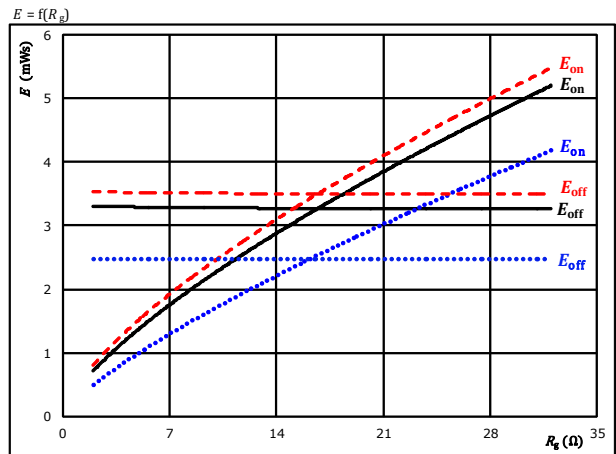
Typical switching energy losses as a function of collector current



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{g\text{on}} = 16$ Ω
 $R_{g\text{off}} = 16$ Ω
 $T_j: 25$ °C (dotted blue line)
 125 °C (solid black line)
 150 °C (dashed red line)

figure 2. IGBT

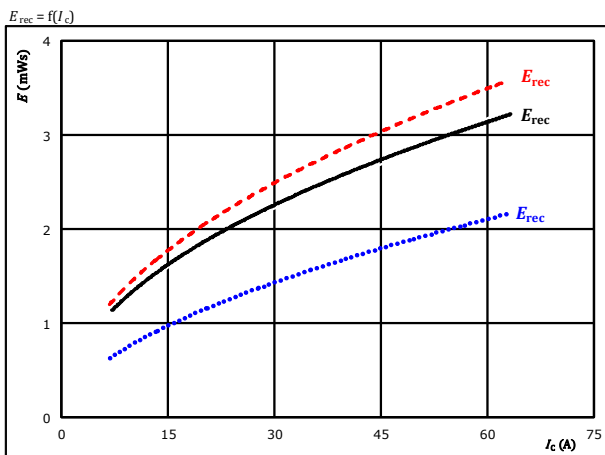
Typical switching energy losses as a function of gate resistor



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 35$ A
 $T_j: 25$ °C (dotted blue line)
 125 °C (solid black line)
 150 °C (dashed red line)

figure 3. FWD

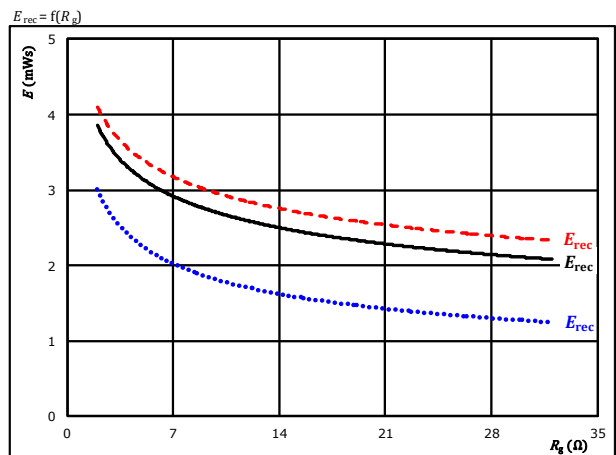
Typical reverse recovered energy loss as a function of collector current



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{g\text{on}} = 16$ Ω
 $T_j: 25$ °C (dotted blue line)
 125 °C (solid black line)
 150 °C (dashed red line)

figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 35$ A
 $T_j: 25$ °C (dotted blue line)
 125 °C (solid black line)
 150 °C (dashed red line)



Vincotech

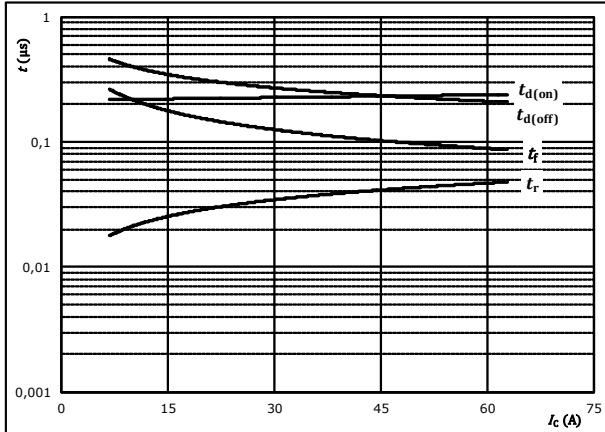
10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
datasheet

Inverter Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



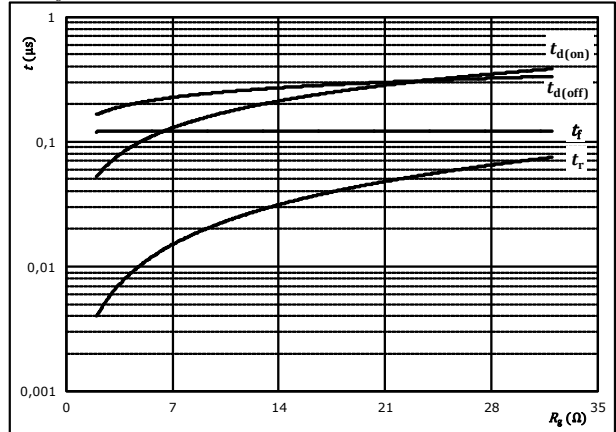
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	16	Ω
$R_{goff} =$	16	Ω

figure 6. IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



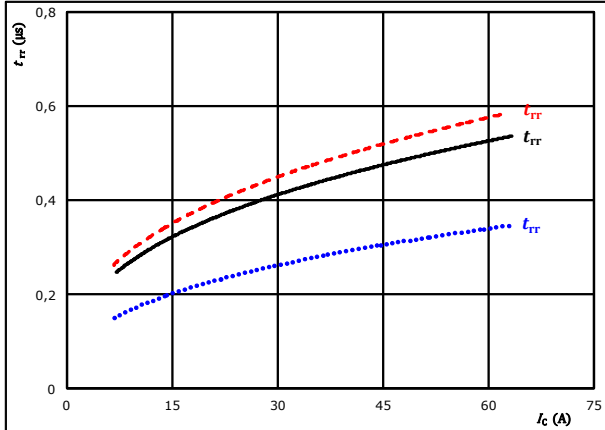
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$I_C =$	35	A

figure 7. FWD

Typical reverse recovery time as a function of collector current

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

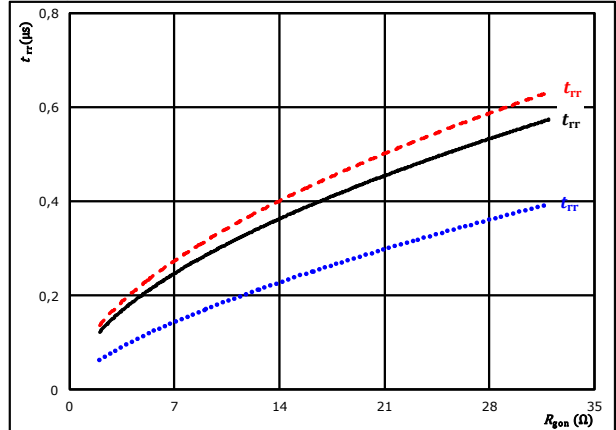


At	$V_{CE} =$	600	V	$T_j:$	25 °C	
	$V_{GE} =$	±15	V		125 °C	————
	$R_{gon} =$	16	Ω		150 °C	-----

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	————
	$I_C =$	35	A		150 °C	-----



Vincotech

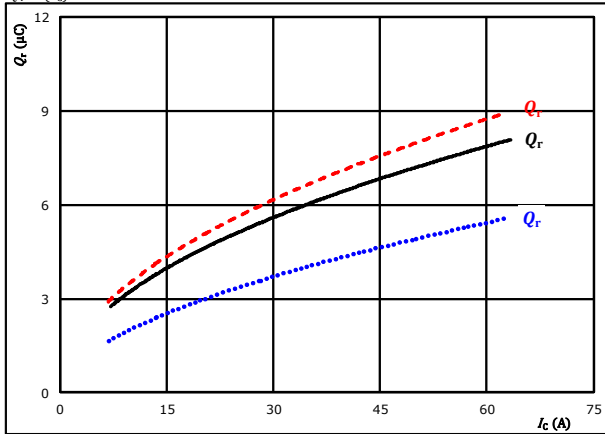
10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
datasheet

Inverter Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_C)$$

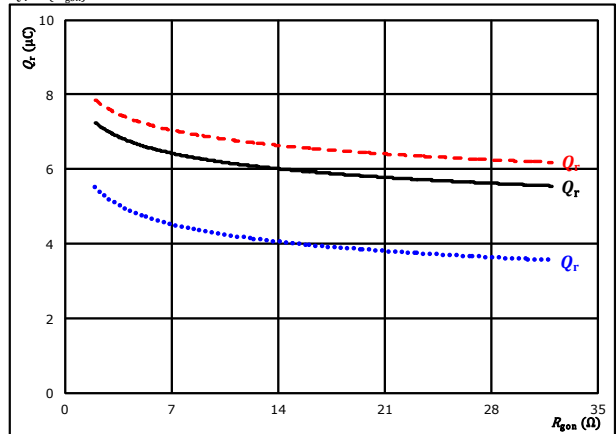


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω
 $T_j = 25$ °C (dotted blue)
 $T_j = 125$ °C (solid black)
 $T_j = 150$ °C (dashed red)

figure 10. FWD

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

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

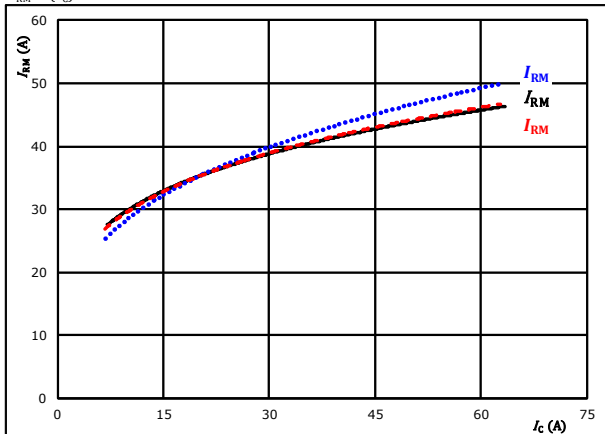


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 35$ A
 $T_j = 25$ °C (dotted blue)
 $T_j = 125$ °C (solid black)
 $T_j = 150$ °C (dashed red)

figure 11. FWD

Typical peak reverse recovery current as a function of collector current

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

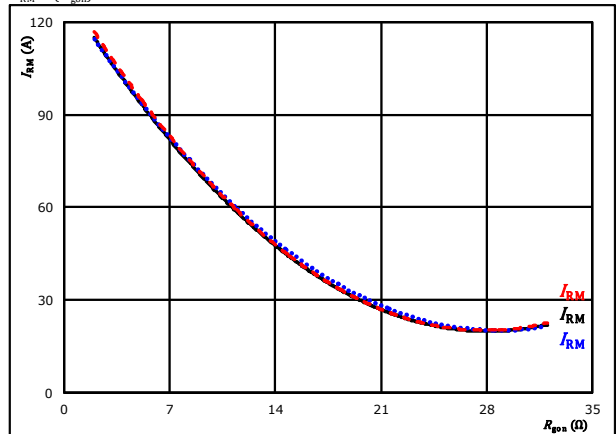


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω
 $T_j = 25$ °C (dotted blue)
 $T_j = 125$ °C (solid black)
 $T_j = 150$ °C (dashed red)

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
 $V_{GE} = \pm 15$ V
 $I_C = 35$ A
 $T_j = 25$ °C (dotted blue)
 $T_j = 125$ °C (solid black)
 $T_j = 150$ °C (dashed red)



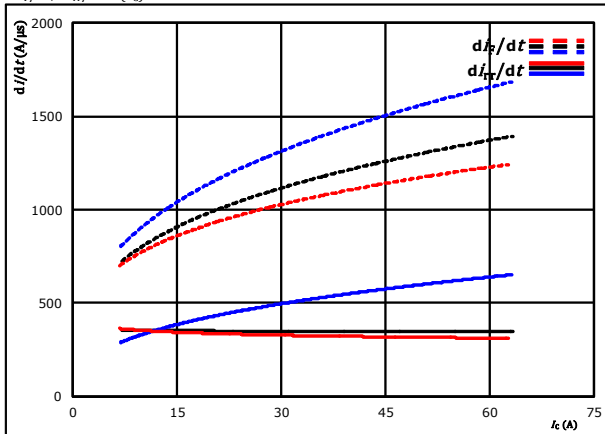
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10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
 datasheet

Inverter Switching Characteristics

figure 13. FWD

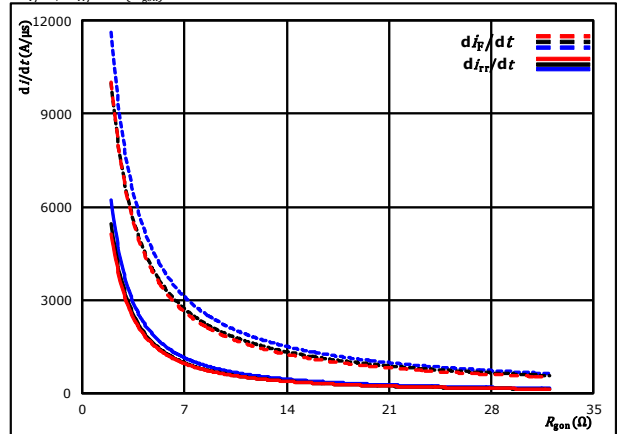
Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_F/dt, di_{rr}/dt = f(I_C)$



At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ 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
 $di_F/dt, di_{rr}/dt = f(R_{gon})$

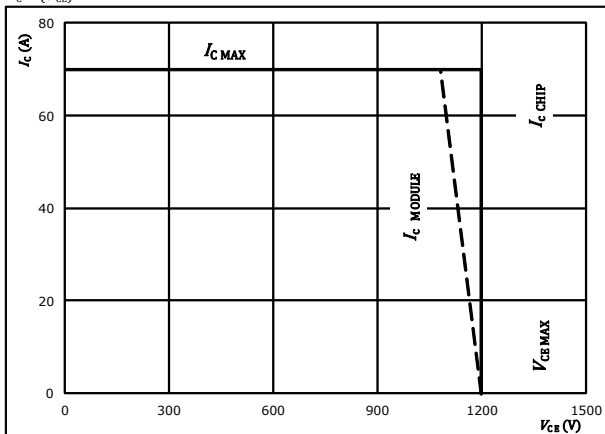


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 35$ A
 $T_j = 25$ °C
 125 °C
 150 °C

figure 15. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At $T_j = 175$ °C
 $R_{gon} = 16$ Ω
 $R_{goff} = 16$ Ω



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10-E212PMA035M7-L188A78Z
 datasheet

Inverter Switching Definitions

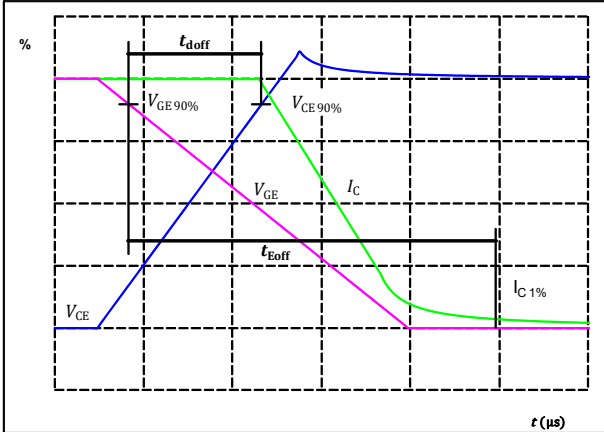
General conditions

T_j	=	125 °C
R_{gon}	=	16 Ω
R_{goff}	=	16 Ω

figure 1.

IGBT

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

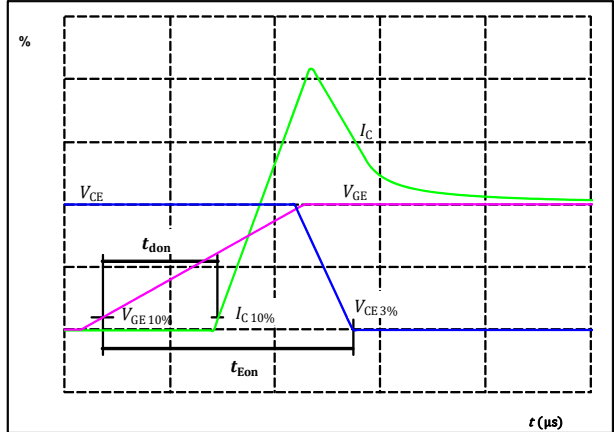


$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	600	V
$I_C(100\%) =$	35	A
$t_{doff} =$	252	ns

figure 2.

IGBT

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

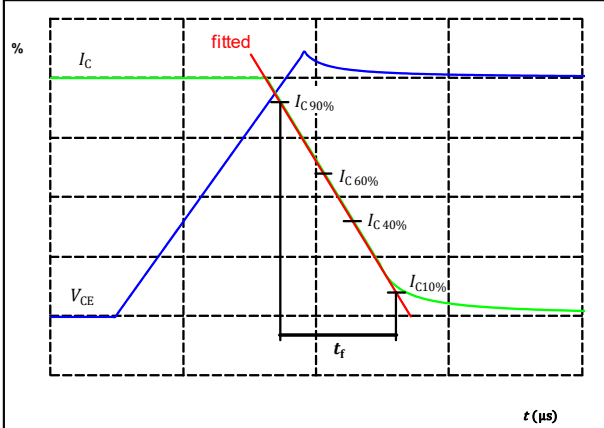


$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	600	V
$I_C(100\%) =$	35	A
$t_{don} =$	240	ns

figure 3.

IGBT

Turn-off Switching Waveforms & definition of t_f

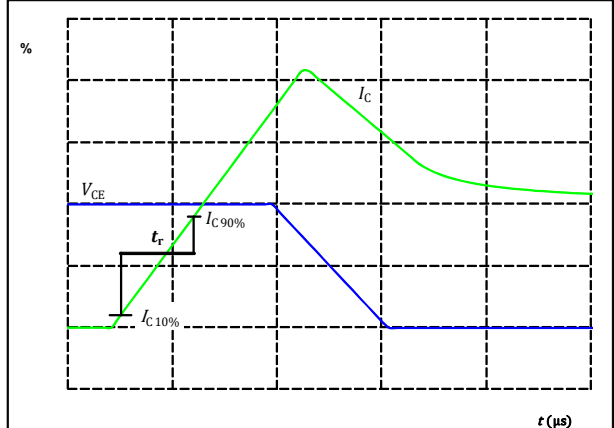


$V_C(100\%) =$	600	V
$I_C(100\%) =$	35	A
$t_f =$	114	ns

figure 4.

IGBT

Turn-on Switching Waveforms & definition of t_r



$V_C(100\%) =$	600	V
$I_C(100\%) =$	35	A
$t_r =$	34	ns

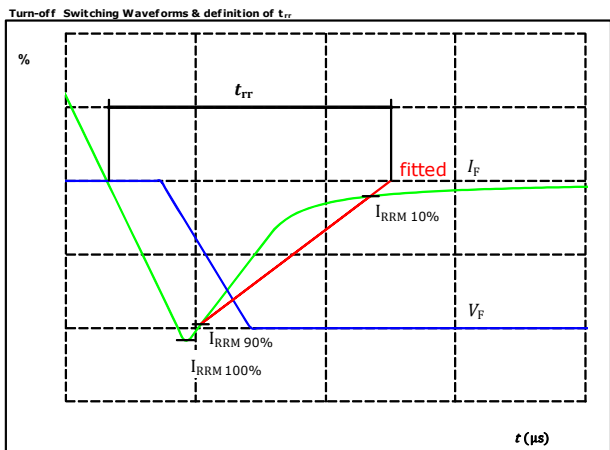


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 datasheet

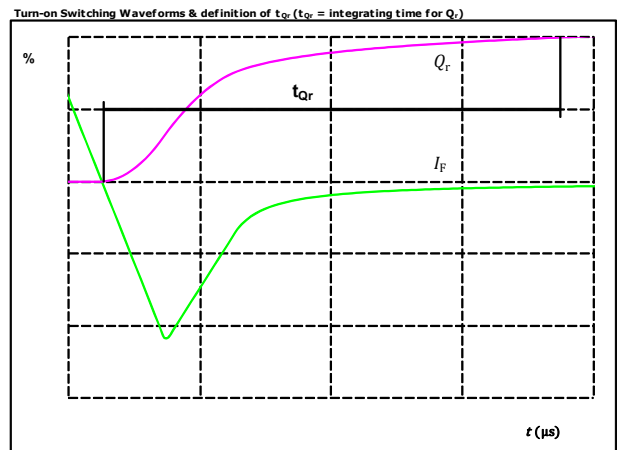
Inverter Switching Characteristics

figure 5. FWD



$V_F(100\%) =$	600	V
$I_F(100\%) =$	35	A
$I_{RRM}(100\%) =$	40	A
$t_{rr} =$	425	ns

figure 6. FWD



$I_F(100\%) =$	35	A
$Q_r(100\%) =$	5,84	μC



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10-E212PMA035M7-L188A78Z
 datasheet

Brake Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current

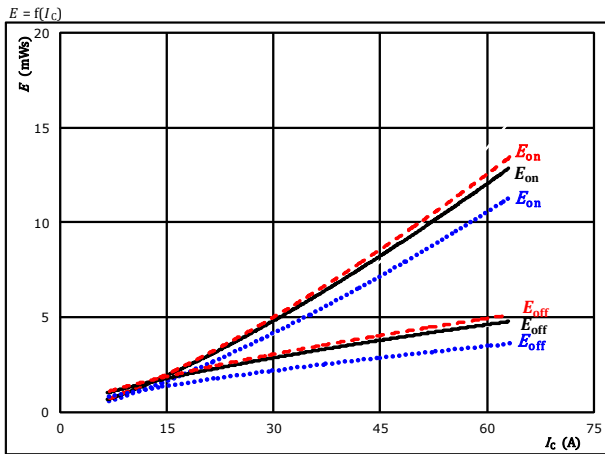


figure 2. IGBT

Typical switching energy losses as a function of gate resistor

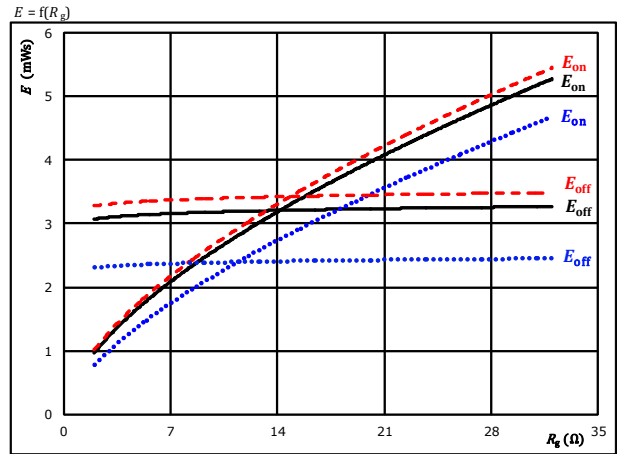


figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

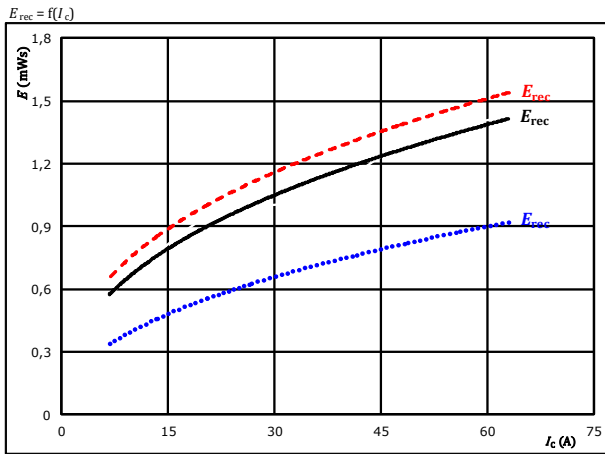
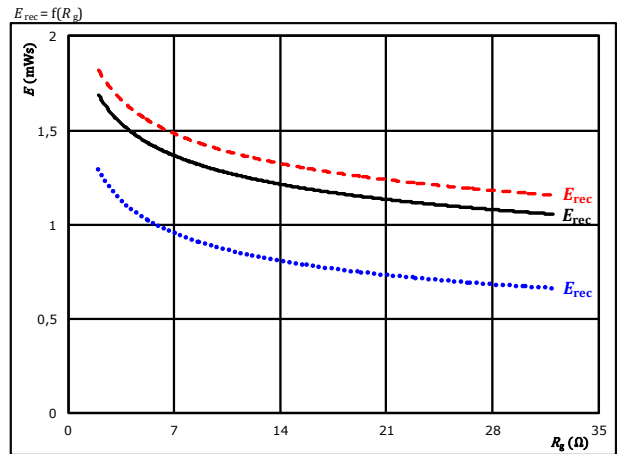


figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor





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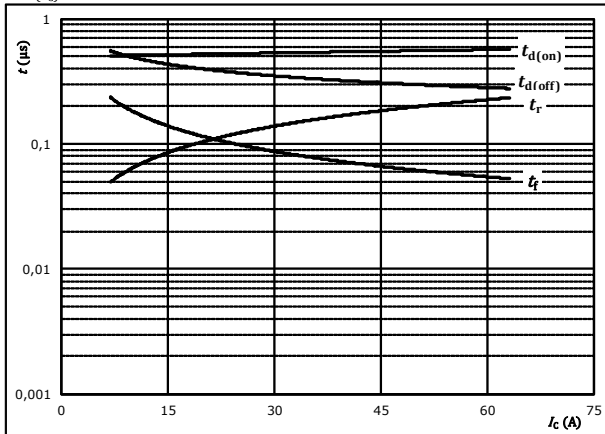
10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
 datasheet

Brake Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



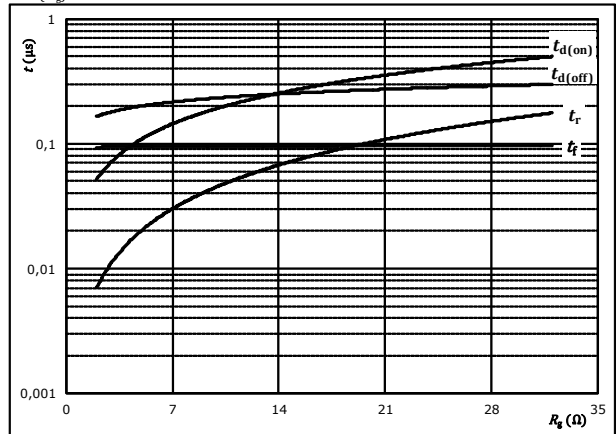
With an inductive load at

$T_j = 150$ °C
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{g(on)} = 32$ Ω
 $R_{g(off)} = 32$ Ω

figure 6. IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



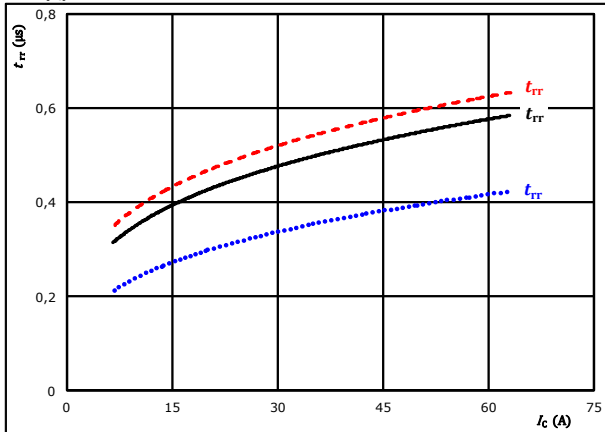
With an inductive load at

$T_j = 150$ °C
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 35$ A

figure 7. FWD

Typical reverse recovery time as a function of collector current

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

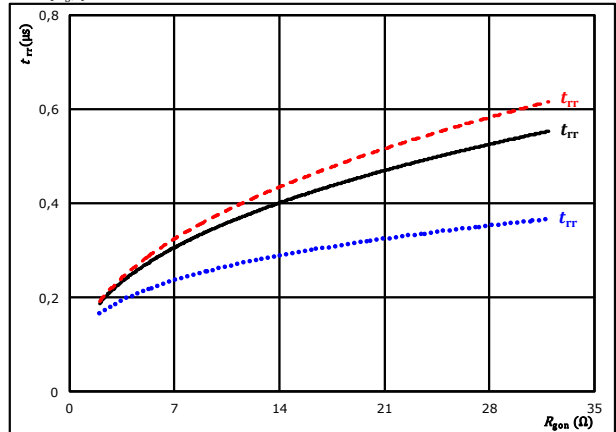


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{g(on)} = 32$ Ω
 $T_j: 25$ °C (dotted blue)
 125 °C (solid black)
 150 °C (dashed red)

figure 8. FWD

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

$$t_{rr} = f(R_{g(on)})$$



At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 35$ A
 $T_j: 25$ °C (dotted blue)
 125 °C (solid black)
 150 °C (dashed red)



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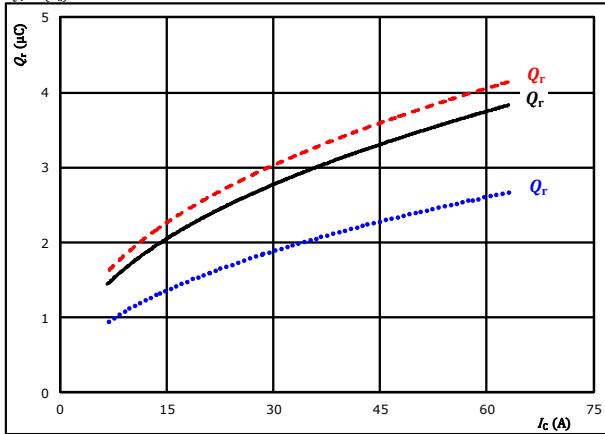
10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
 datasheet

Brake Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_C)$$

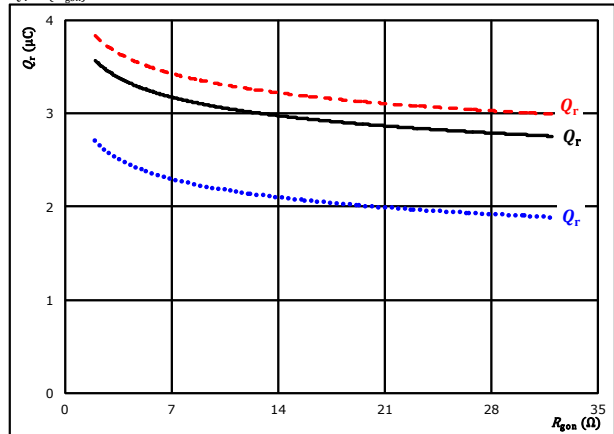


At $V_{CE} = 600$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C
 $R_{gon} = 32$ Ω $T_j = 150$ °C -----

figure 10. FWD

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

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

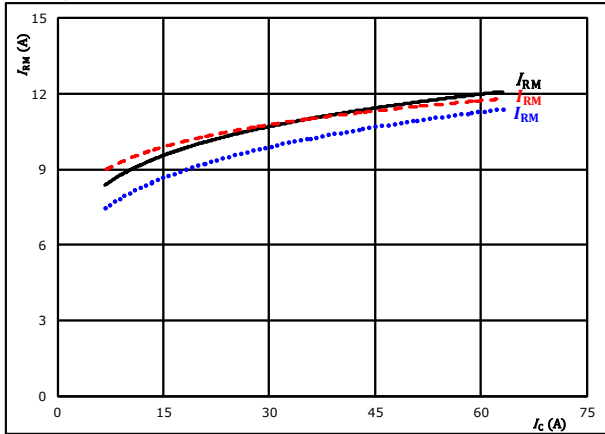


At $V_{CE} = 600$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C
 $I_C = 35$ A $T_j = 150$ °C -----

figure 11. FWD

Typical peak reverse recovery current as a function of collector current

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

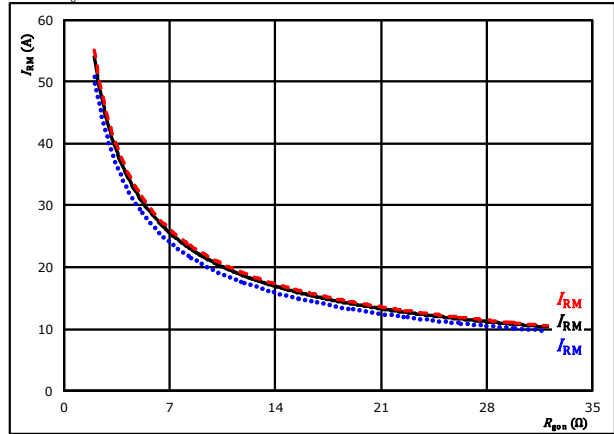


At $V_{CE} = 600$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C
 $R_{gon} = 32$ Ω $T_j = 150$ °C -----

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
 $V_{GE} = \pm 15$ V $T_j = 125$ °C
 $I_C = 35$ A $T_j = 150$ °C -----



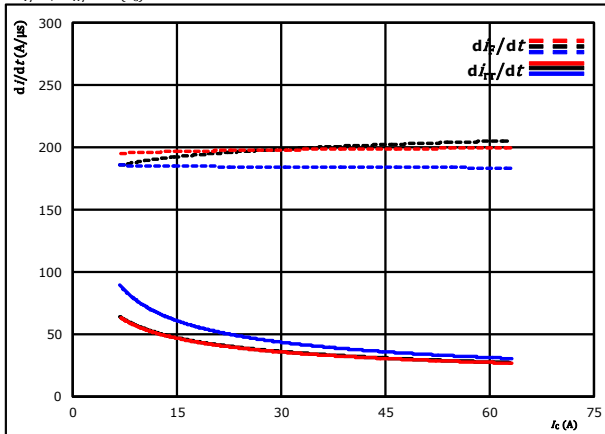
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10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
 datasheet

Brake Switching Characteristics

figure 13. FWD

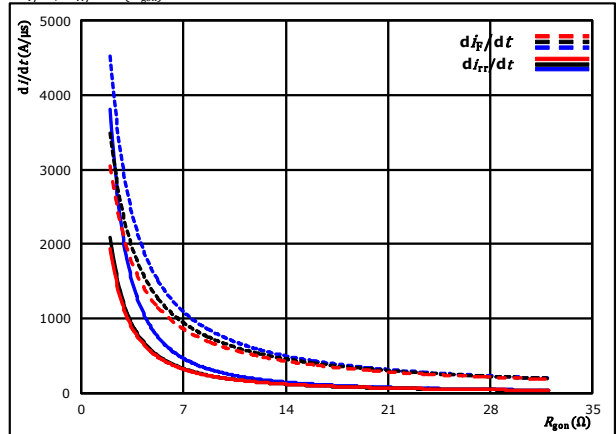
Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_F/dt, di_{rr}/dt = f(I_C)$



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

figure 14. FWD

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

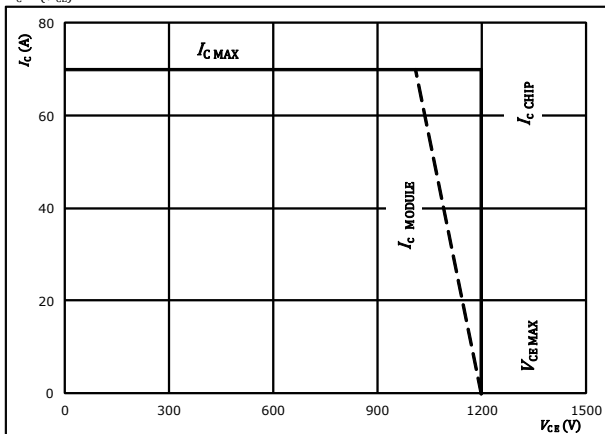


At $V_{CE} = 600$ V $T_J = 25$ °C
 $V_{GE} = \pm 15$ V $T_J = 125$ °C
 $I_C = 35$ A $T_J = 150$ °C

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



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10-E212PMA035M7-L188A78Z
 datasheet

Brake Switching Definitions

General conditions

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

figure 1. IGBT

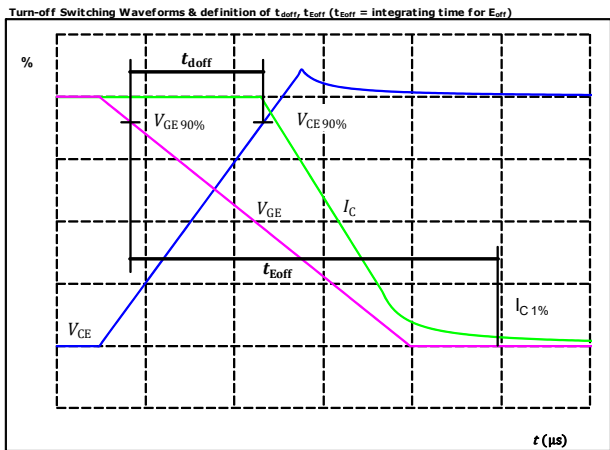


figure 2. IGBT

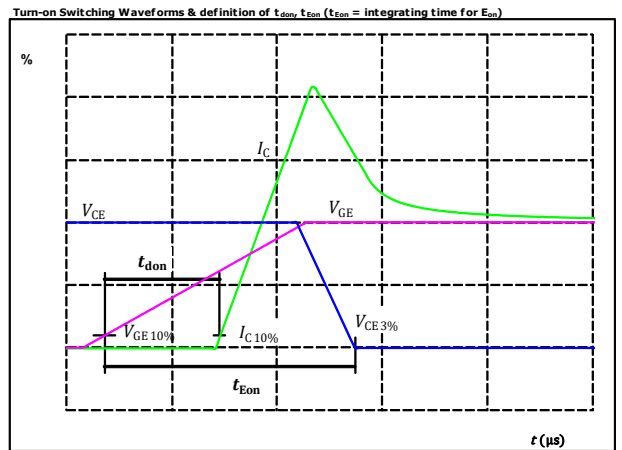


figure 3. IGBT

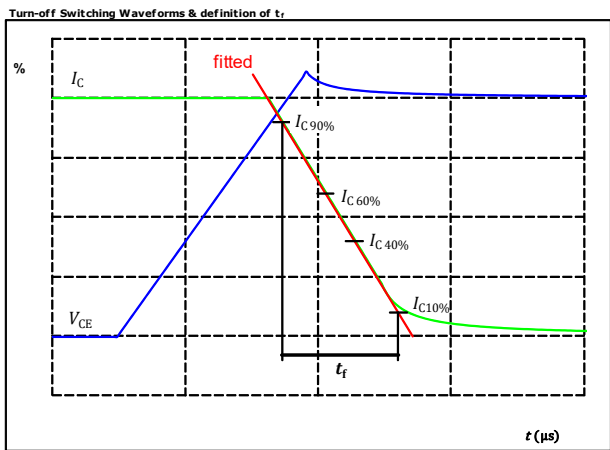
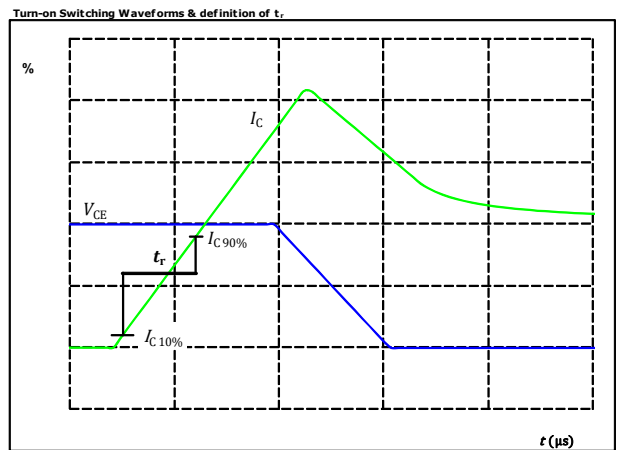


figure 4. IGBT



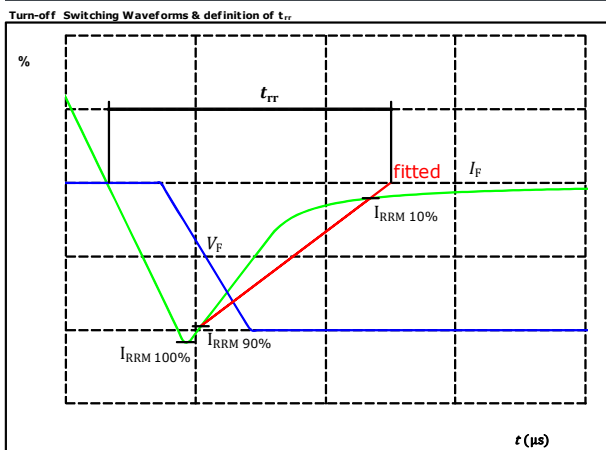


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10-E212PMA035M7-L188A78Z
 datasheet

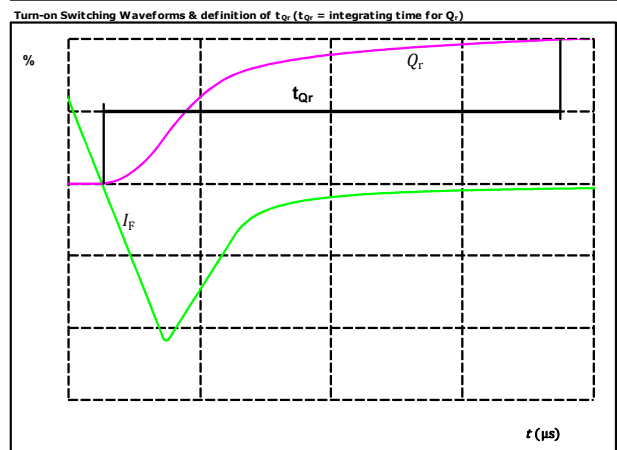
Brake Switching Characteristics

figure 5. FWD



V_F (100%) =	600	V
I_F (100%) =	35	A
I_{RRM} (100%) =	11	A
t_{rr} =	472	ns

figure 6. FWD



I_F (100%) =	35	A
Q_r (100%) =	2,74	μC



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10-EY12PMA035M7-L188A78T
10-E212PMA035M7-L188A78Z
datasheet

Ordering Code & Marking							
Version				Ordering Code			
without thermal paste 12 mm housing with Press-fit pins				10-EY12PMA035M7-L188A78T			
with thermal paste 12 mm housing with Press-fit pins				10-EY12PMA035M7-L188A78T-/3/			
without thermal paste 12 mm housing with Solder pins				10-E212PMA035M7-L188A78Z			
with thermal paste 12 mm housing with Solder pins				10-E212PMA035M7-L188A78Z-/3/			
		Text	Name	Date code	UL & VIN	Lot	Serial
			NN-NNNNNNNNNNNNNNNN-TTTTUVV	WWYY	UL VIN	LLLLL	SSSS
		Datamatrix	Type&Ver	Lot number	Serial	Date code	
			TTTTTUVV	LLLLL	SSSS	WWYY	

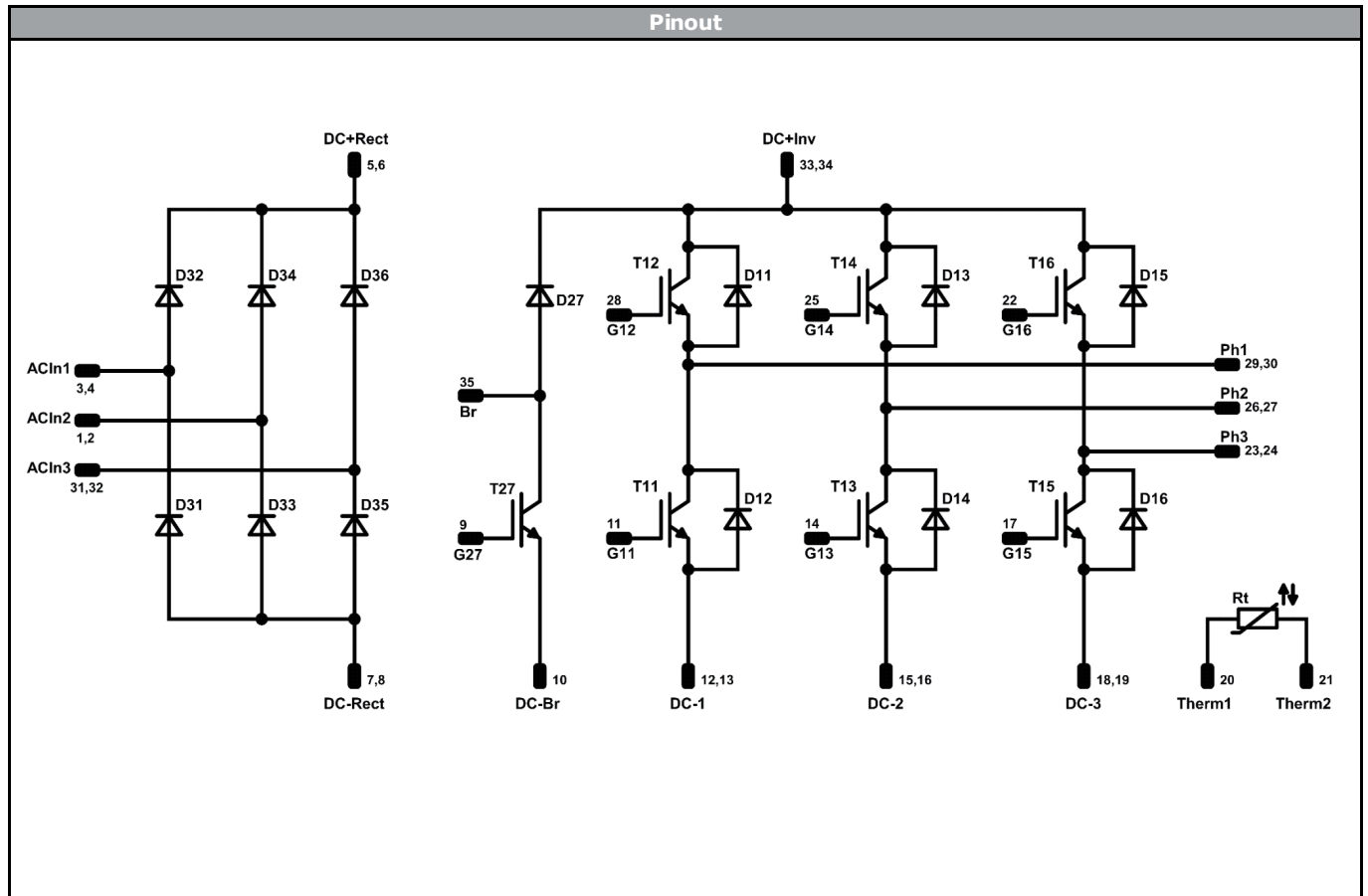
Pin table				Outline	
Pin	X	Y	Function		
1	25,6	6,4	ACIn2		Solder pin
2	22,4	6,4	ACIn2		
3	16	9,6	ACIn1		
4	12,8	9,6	ACIn1		
5	9,6	0	DC+Rect		
6	9,6	3,2	DC+Rect		
7	0	0	DC-Rect		
8	0	3,2	DC-Rect		
9	0	16	G27		
10	0	19,2	DC-Br		Press-fit pin
11	0	22,4	G11		
12	0	25,6	DC-1		
13	0	28,8	DC-1		
14	0	32	G13		
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		

Tolerance of pinpositions: ±0.4mm at the end of pins
Dimension of coordinate axis is only offset without tolerance



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10-E212PMA035M7-L188A78Z
datasheet



Identification					
ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	35 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	35 A	Inverter Diode	
T27	IGBT	1200 V	35 A	Brake Switch	
D27	FWD	1200 V	10 A	Brake Diode	
D31, D32, D33, D34, D35, D36	Rectifier	1600 V	45 A	Rectifier Diode	
Rt	NTC			Thermistor	



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10-E212PMA035M7-L188A78Z
datasheet

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.

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-Ex12PMA035M7-L188A78x-D3-14	30 May. 2019	Correction of I_G/I_f values Outline updated	1,2 28

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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.