



Vincotech

10-FY12PMA035M703-P589A73

datasheet

flowPIM 1

1200 V / 35 A

Topology features

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

Component features

- Easy paralleling
- Low turn-off losses
- Low collector emitter saturation voltage
- Positive temperature coefficient
- Short tail current
- Switching optimized for EMC

Housing features

- Base isolation: Al_2O_3
- Convex shaped substrate for superior thermal contact
- Thermo-mechanical push-and-pull force relief
- Solder pin

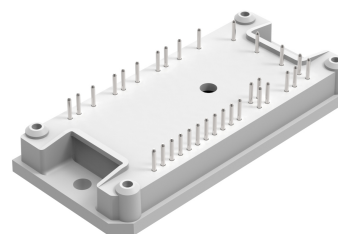
Target applications

- Embedded Drives
- Industrial Drives

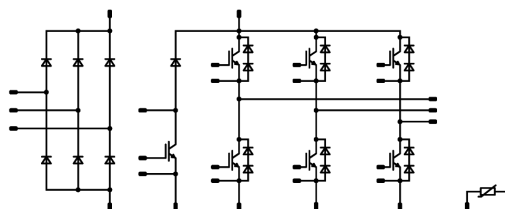
Types

- 10-FY12PMA035M703-P589A73

flow 1 12 mm housing



Schematic





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Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	48	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	70	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	99	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$, $V_{CC} = 800\text{ V}$ $T_j = 150\text{ °C}$	9,5	μs
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

Inverter Diode

Peak repetitive reverse voltage	V_{RRM}		1300	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	31	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	89	W
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

Brake Switch

Collector-emitter voltage	V_{CES}		1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	32	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	50	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	72	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$, $V_{CC} = 800\text{ V}$ $T_j = 150\text{ °C}$	9,5	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	Conditions	Value	Unit
Brake Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	21	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	42	W
Maximum junction temperature	T_{jmax}		175	°C

Rectifier Diode

Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	47	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	350	A
Surge current capability	I^2t		610	A ² s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	53	W
Maximum junction temperature	T_{jmax}		150	°C

Module Properties

Thermal Properties

Storage temperature	T_{stg}		-40...+125	°C
Operation temperature under switching condition	T_{jop}		-40...+($T_{jmax} - 25$)	°C

Isolation Properties

Isolation voltage	V_{isol}	DC Test Voltage* $t_p = 2\text{ s}$	6000	V
Creepage distance			>12,7	mm
Clearance			7,91	mm
Comparative Tracking Index	CTI		≥ 200	

*100 % tested in production



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Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	

Inverter Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,0035	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		35	25 125 150		1,47 1,64 1,68	1,85 ⁽¹⁾	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			80	µA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	0	10		25			7900		pF
Output capacitance	C_{oes}							270		pF
Reverse transfer capacitance	C_{res}							97		pF
Gate charge	Q_g	$V_{CC} = 600$ V	0/15		35	25		260		nC

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)						0,96		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 4$ Ω $R_{goff} = 4$ Ω	±15	600	35	25 125 150		73,42 73,71 73,27		ns
Rise time	t_r					25 125 150		10,01 10,85 11,72		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		151,83 172,63 181,28		ns
Fall time	t_f					25 125 150		97,02 120,23 126,56		ns
Turn-on energy (per pulse)	E_{on}					25 125 150		0,646 1,06 1,17		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		2,49 3,32 3,47		mWs



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Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
		V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]		Min	Typ	Max	
Inverter Diode										
Static										
Forward voltage	V_F			30	25 125 150			3,19 3,01 2,93	3,84 ⁽¹⁾	V
Reverse leakage current	I_R	$V_i = 1300$ V			25				1,6	µA
Thermal										
Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)						1,07		K/W
Dynamic										
Peak recovery current	I_{RM}	$di/dt=5362$ A/µs $di/dt=4088$ A/µs $di/dt=4424$ A/µs	± 15	600	35	25 125 150		53,4 57,55 58,7		A
Reverse recovery time	t_{rr}					25 125 150		19,21 134,98 149,98		ns
Recovered charge	Q_r					25 125 150		0,578 1,8 2,03		µC
Reverse recovered energy	E_{rec}					25 125 150		0,154 0,695 0,789		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		7177,28 4480,86 3819,39		A/µs



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Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	

Brake Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,0025	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		25	25 125 150		1,64 1,89 1,95	2,1 ⁽¹⁾	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			70	µA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	0	10	25				4800		pF
Output capacitance	C_{oes}							170		pF
Reverse transfer capacitance	C_{res}							57		pF
Gate charge	Q_g	$V_{CC} = 600$ V	0/15		25	25		180		nC

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)						1,31		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 16$ Ω $R_{goff} = 16$ Ω	0/15	700	25	25 125 150		70,6 66,6 65		ns
Rise time	t_r					25 125 150		47,6 50,4 51,4		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		262,2 290 296		ns
Fall time	t_f					25 125 150		101,1 117,29 119,12		ns
Turn-on energy (per pulse)	E_{on}					25 125 150		2,6 3,11 3,24		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		2,03 2,65 2,81		mWs



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Characteristic Values

Parameter	Symbol	Conditions						Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]		Min	Typ	Max	

Brake Diode

Static

Forward voltage	V_F				15	25 125 150		1,63 1,74 1,73	1,9 ⁽¹⁾		V
Reverse leakage current	I_R	$V_r = 1200$ V				25			30		µA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)						2,25			K/W
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Dynamic

Peak recovery current	I_{RM}	$di/dt=394$ A/µs $di/dt=319$ A/µs $di/dt=403$ A/µs	0/15	700	25	25 125 150		13,75 15,17 15,47			A
Reverse recovery time	t_{rr}					25 125 150		263,52 374,58 413,14			ns
Recovered charge	Q_r					25 125 150		1,92 2,9 3,15			µC
Reverse recovered energy	E_{rec}					25 125 150		0,778 1,28 1,41			mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		111,02 85 72,04			A/µs



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Characteristic Values

Parameter	Symbol	Conditions						Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]		Min	Typ	Max	

Rectifier Diode

Static

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

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)						1,31			K/W
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Thermistor

Static

Rated resistance	R					25		22			kΩ
Deviation of R100	$\Delta_{R/R}$	$R_{100} = 1484$ Ω				100	-5		5		%
Power dissipation	P					25		130			mW
Power dissipation constant	d					25		1,5			mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %						3962			K
B-value	$B_{(25/100)}$	Tol. ±1 %						4000			K
Vincotech Thermistor Reference									I		

⁽¹⁾ Value at chip level

⁽²⁾ Only valid with pre-applied Vincotech thermal interface material.



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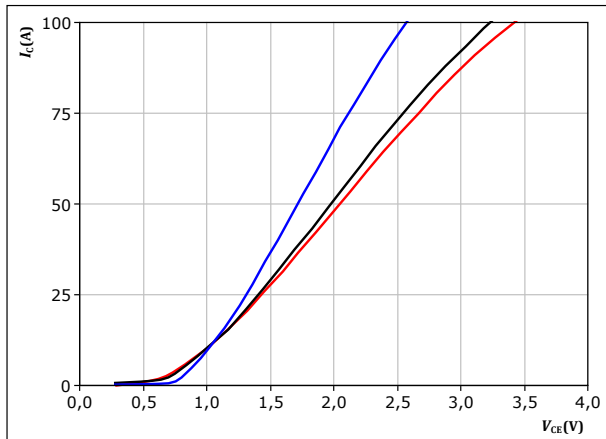
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Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

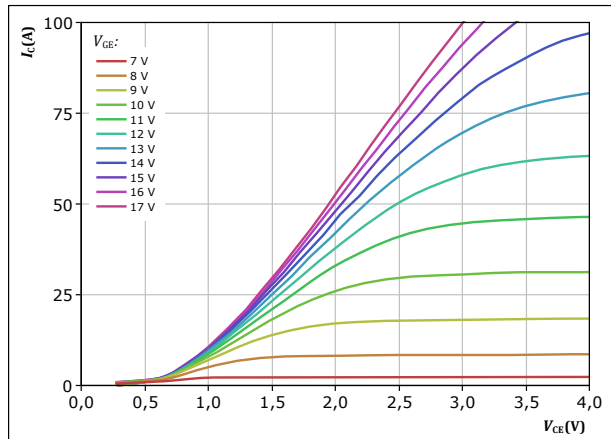


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j: 25 ^\circ C$
 $125 ^\circ C$
 $150 ^\circ C$

figure 2. IGBT

Typical output characteristics

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

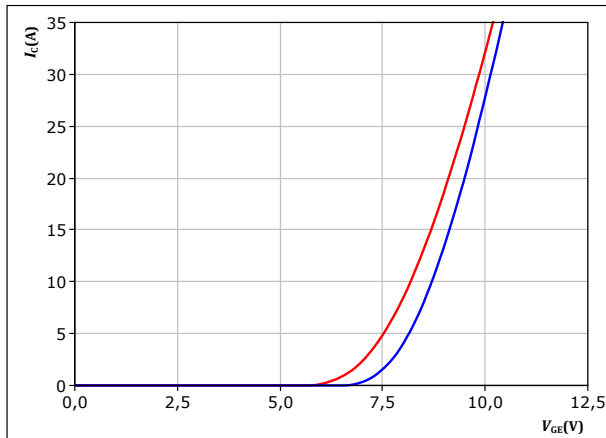


$t_p = 250 \mu s$
 $T_j = 150 ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

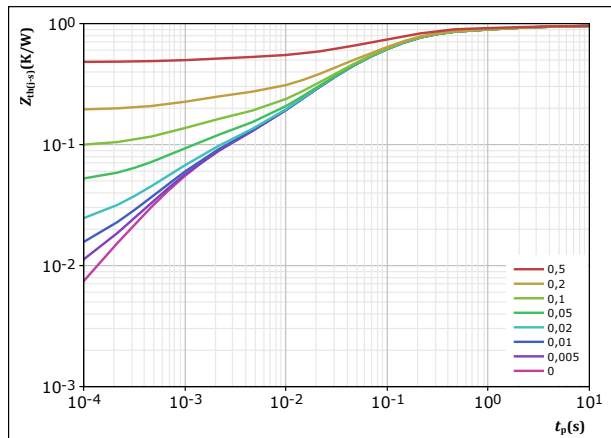


$t_p = 250 \mu s$
 $V_{CE} = 10 V$
 $T_j: 25 ^\circ C$
 $125 ^\circ C$

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 0,957 K/W$
IGBT thermal model values

$R (K/W)$	$\tau (s)$
3,36E-02	5,53E+00
1,00E-01	1,06E+00
5,28E-01	1,14E-01
2,33E-01	2,36E-02
6,69E-02	1,07E-03



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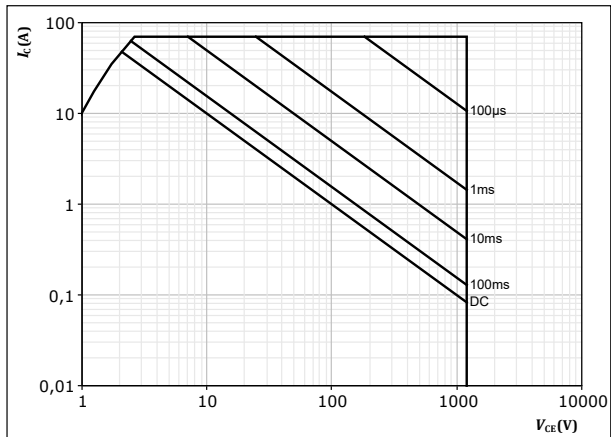
Inverter Switch Characteristics

figure 5.

IGBT

Safe operating area

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



$D = \text{single pulse}$

$T_s = 80 \text{ } ^\circ\text{C}$

$V_{GE} = 15 \text{ V}$

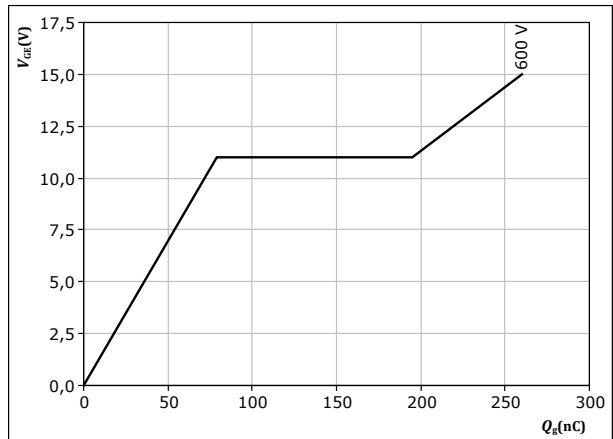
$T_j = T_{jmax}$

figure 6.

IGBT

Gate voltage vs gate charge

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



$I_C = 35 \text{ A}$

$T_j = 25 \text{ } ^\circ\text{C}$



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Inverter Diode Characteristics

figure 7.

FWD

Typical forward characteristics

$$I_F = f(V_F)$$

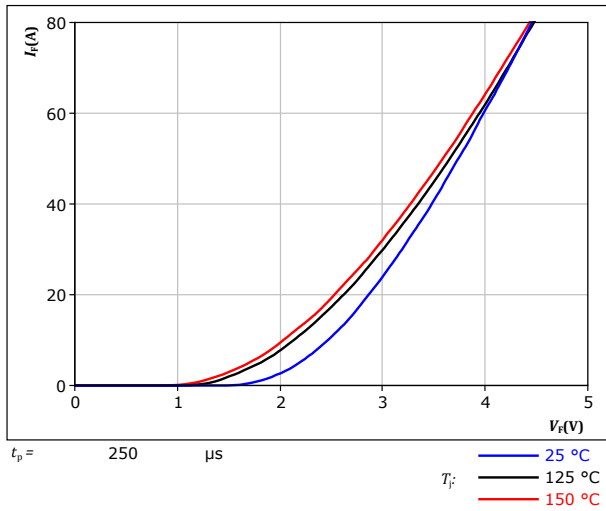
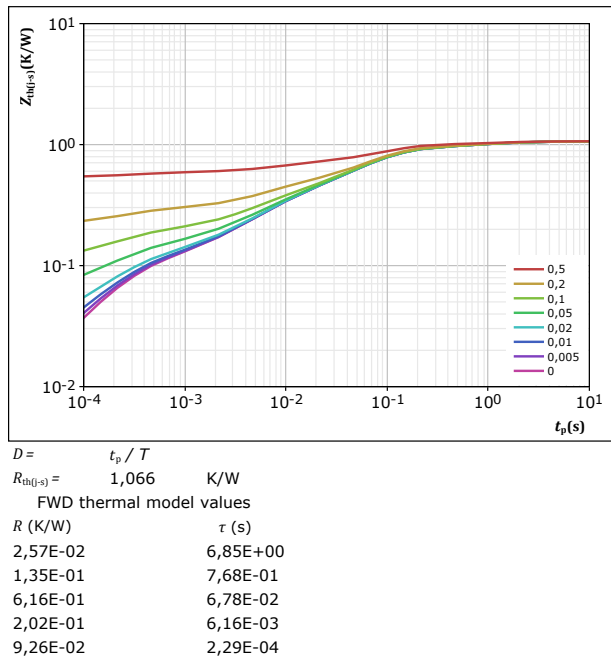


figure 8.

FWD

Transient thermal impedance as a function of pulse width

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





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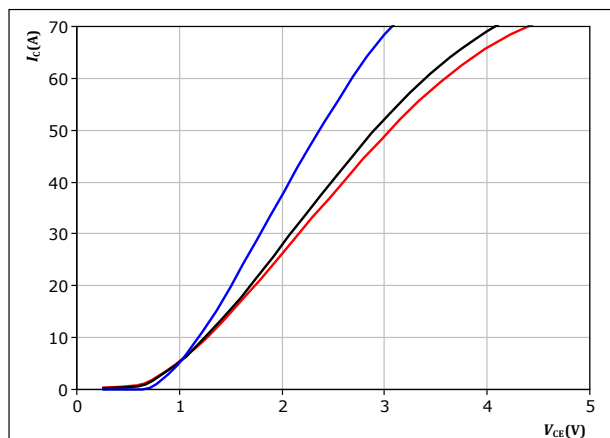
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Brake Switch Characteristics

figure 9. IGBT

Typical output characteristics

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

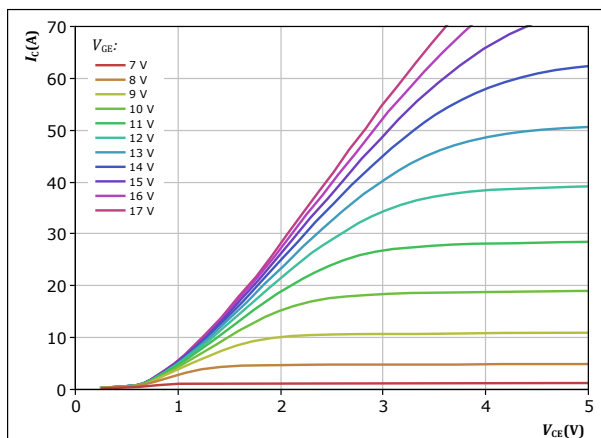


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j:$ 25 °C, 125 °C, 150 °C

figure 10. IGBT

Typical output characteristics

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

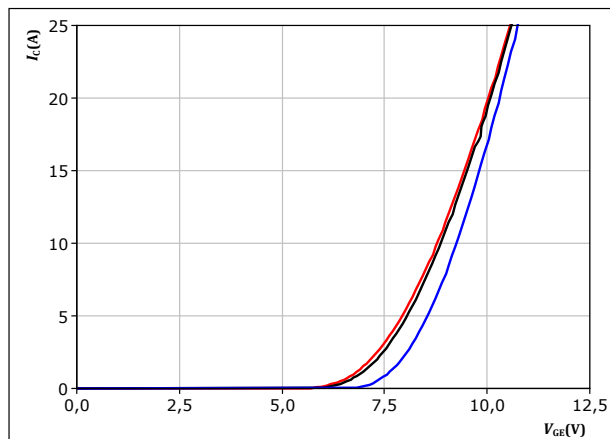


$t_p = 250 \mu s$
 $T_j = 150 \text{ } ^\circ\text{C}$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 11. IGBT

Typical transfer characteristics

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

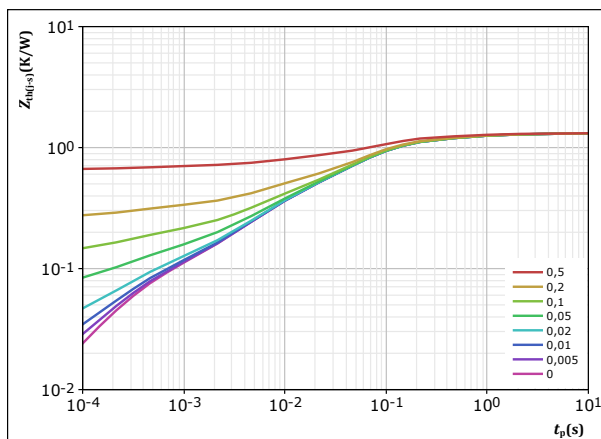


$t_p = 250 \mu s$
 $V_{CE} = 10 V$
 $T_j:$ 25 °C, 125 °C, 150 °C

figure 12. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,314 \text{ K/W}$
IGBT thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
4,80E-02	4,95E+00
2,14E-01	4,62E-01
7,66E-01	6,41E-02
2,24E-01	6,11E-03
6,85E-02	3,04E-04



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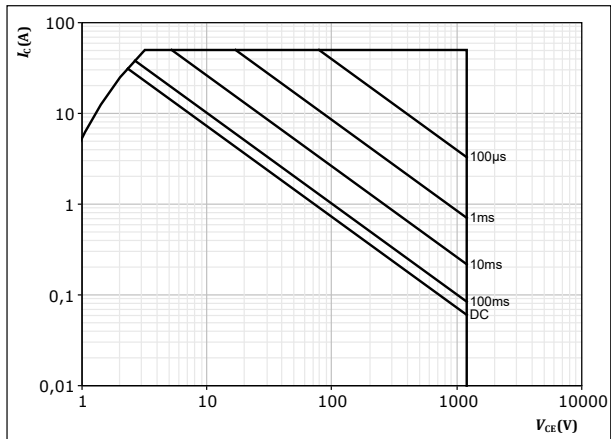
Brake Switch Characteristics

figure 13.

IGBT

Safe operating area

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



$D =$ single pulse

$T_s = 80$ °C

$V_{GE} = 15$ V

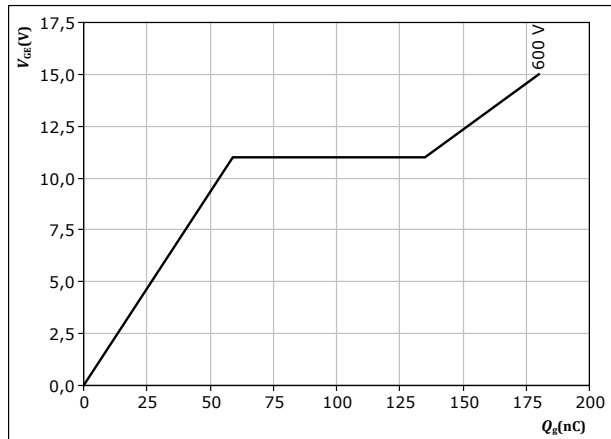
$T_j = T_{jmax}$

figure 14.

IGBT

Gate voltage vs gate charge

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



$I_C = 25$ A

$T_j = 25$ °C



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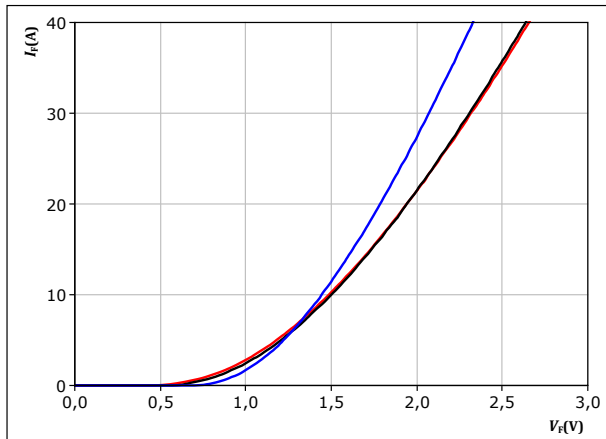
Brake Diode Characteristics

figure 15.

FWD

Typical forward characteristics

$$I_F = f(V_F)$$



$t_p = 250 \mu s$

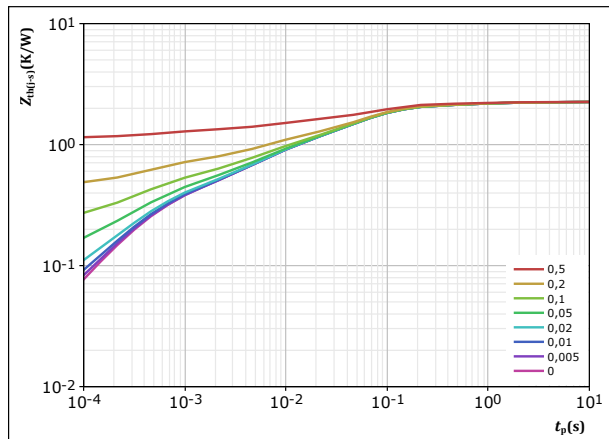
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 16.

FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 2,253 \text{ K/W}$

FWD thermal model values

R (K/W)	τ (s)
4,18E-02	6,42E+00
1,99E-01	5,83E-01
1,22E+00	5,90E-02
4,91E-01	5,62E-03
3,08E-01	4,15E-04



Rectifier Diode Characteristics

figure 17. Rectifier

Typical forward characteristics
 $I_F = f(V_F)$

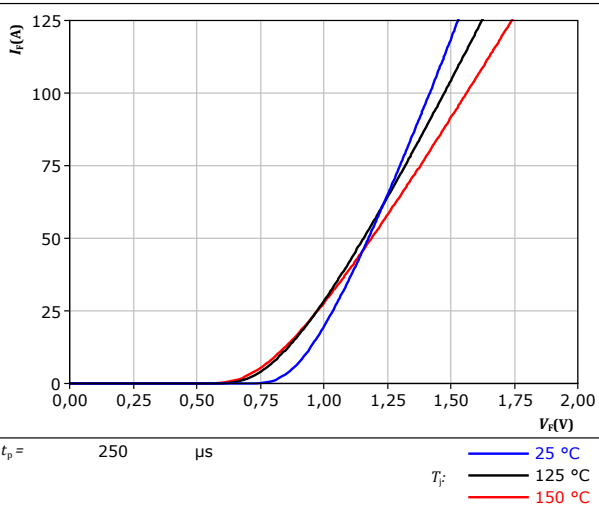
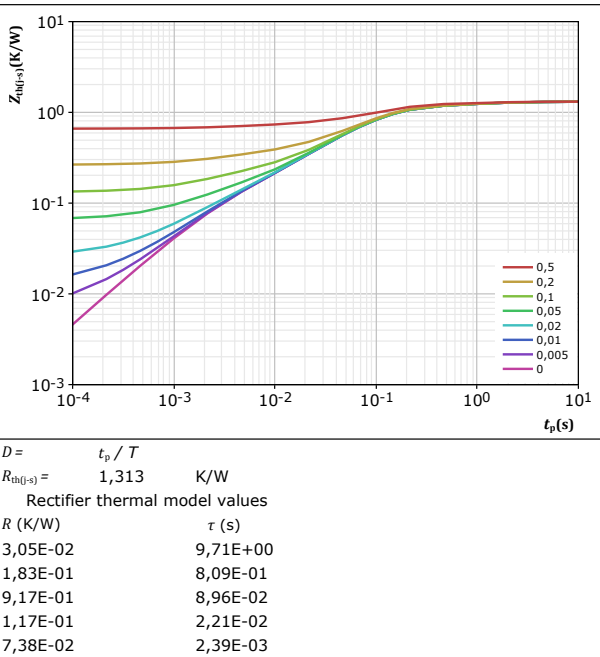


figure 18. Rectifier

Transient thermal impedance as a function of pulse width
 $Z_{th(j-s)} = f(t_p)$





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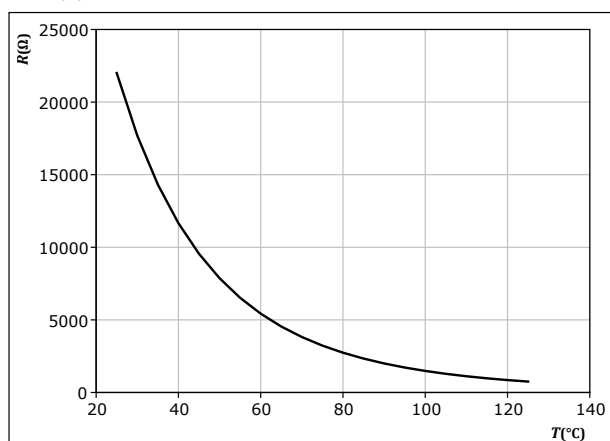
Thermistor Characteristics

figure 19.

Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$





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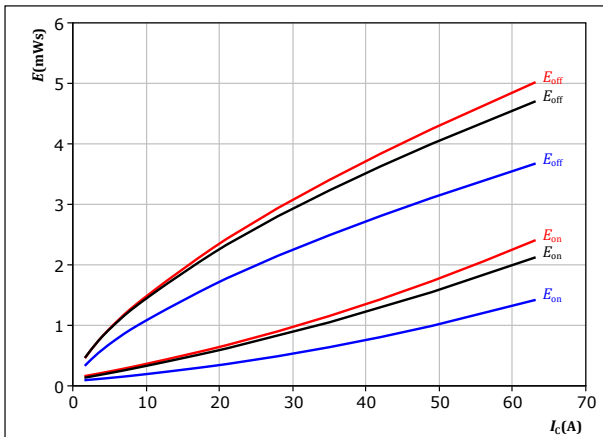
Inverter Switching Characteristics

figure 20.

IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$



With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω
 $R_{goff} = 4$ Ω

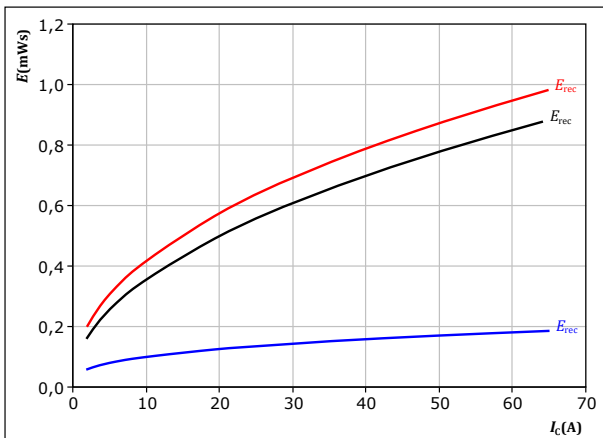
T_j : 25 °C (blue)
125 °C (black)
150 °C (red)

figure 22.

FWD

Typical reverse recovered energy loss as a function of collector current

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



With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω

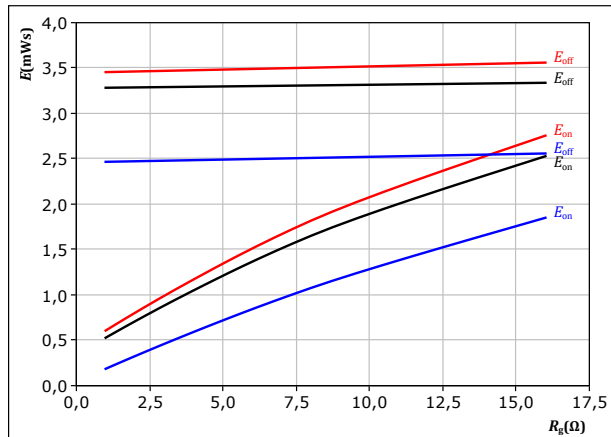
T_j : 25 °C (blue)
125 °C (black)
150 °C (red)

figure 21.

IGBT

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

$$E = f(R_g)$$



With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 35$ A

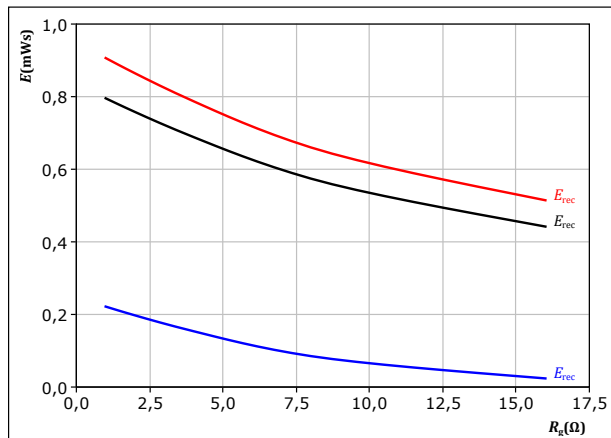
T_j : 25 °C (blue)
125 °C (black)
150 °C (red)

figure 23.

FWD

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor

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



With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 35$ A

T_j : 25 °C (blue)
125 °C (black)
150 °C (red)



Vincotech

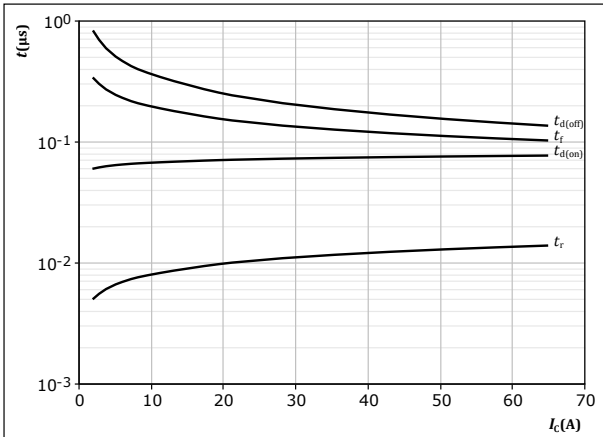
10-FY12PMA035M703-P589A73
datasheet

Inverter Switching Characteristics

figure 24.

IGBT

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



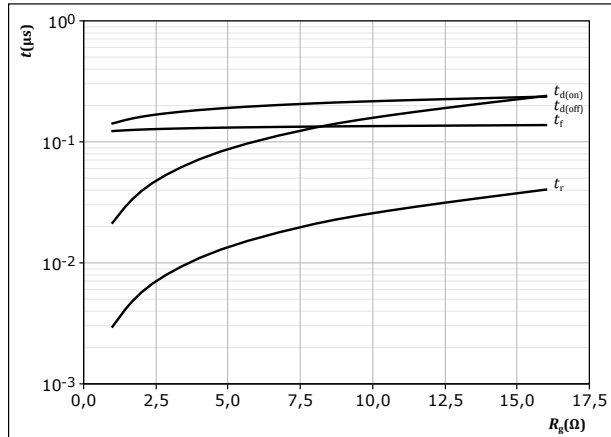
With an inductive load at

$T_j = 150$ °C
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω
 $R_{goff} = 4$ Ω

figure 25.

IGBT

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



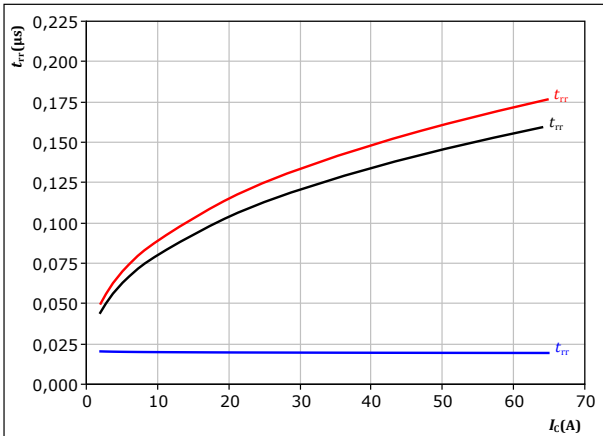
With an inductive load at

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

figure 26.

FWD

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



With an inductive load at

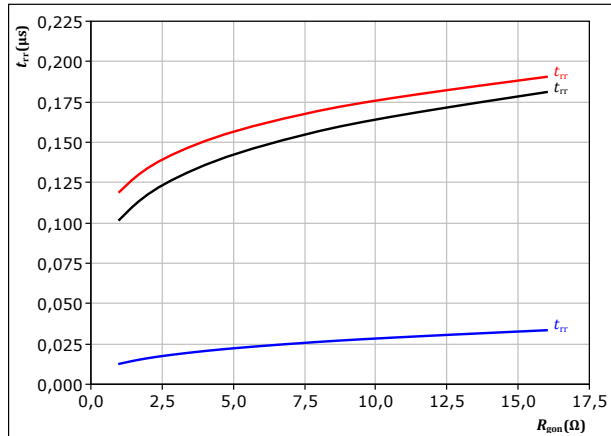
$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω

T_j : 25 °C (blue)
125 °C (black)
150 °C (red)

figure 27.

FWD

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



With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 35$ A

T_j : 25 °C (blue)
125 °C (black)
150 °C (red)



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10-FY12PMA035M703-P589A73
datasheet

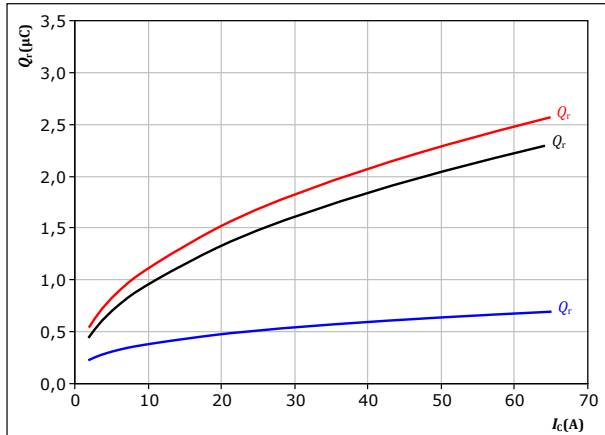
Inverter Switching Characteristics

figure 28.

FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω

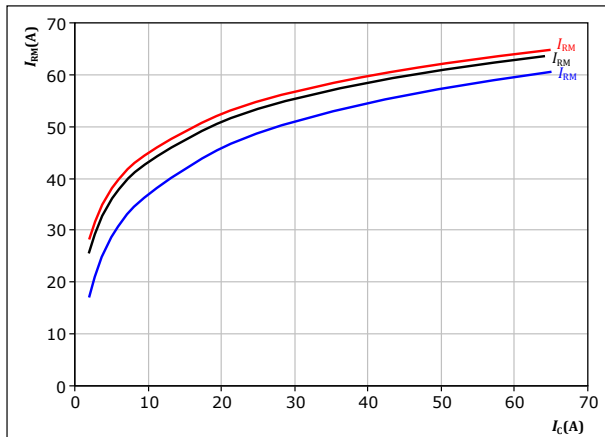
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 30.

FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω

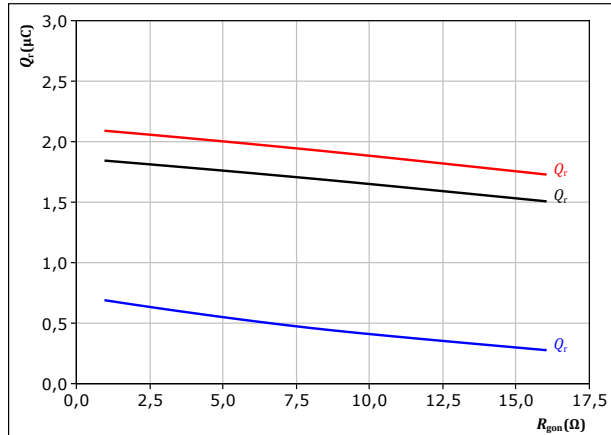
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 29.

FWD

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

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



With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 35$ A

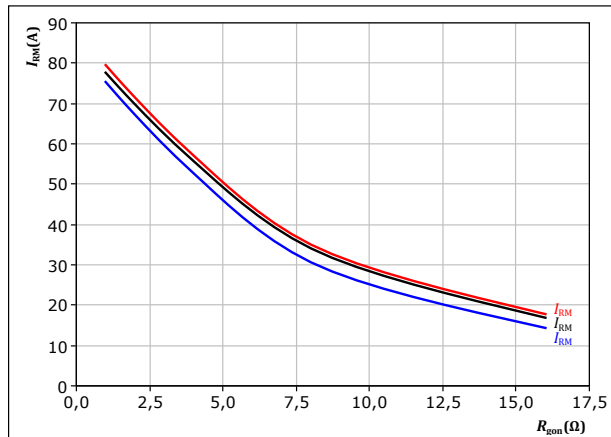
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 31.

FWD

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

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



With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 35$ A

T_j :
— 25 °C
— 125 °C
— 150 °C



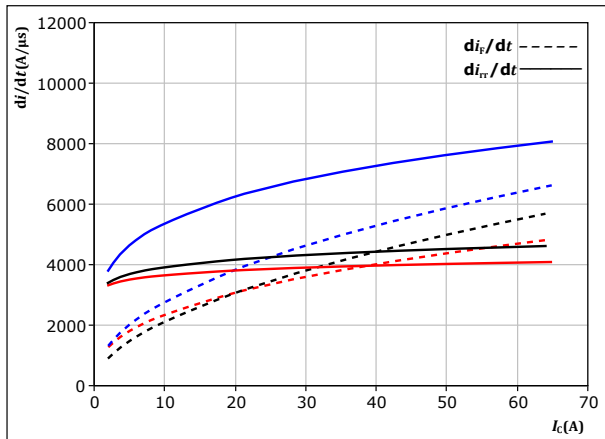
Vincotech

10-FY12PMA035M703-P589A73
datasheet

Inverter Switching Characteristics

figure 32. FWD

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

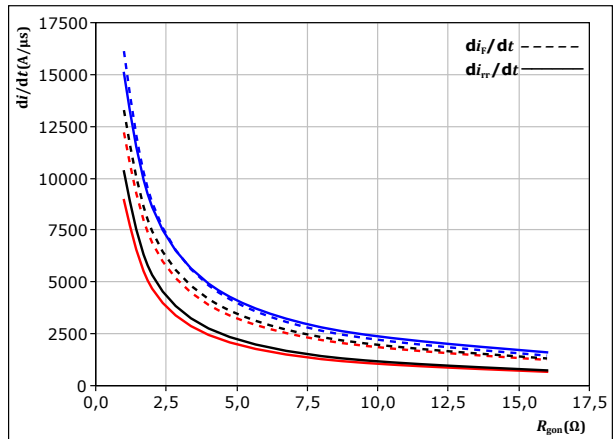


With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω
 $T_j = 25^\circ\text{C}$
 $T_j = 125^\circ\text{C}$
 $T_j = 150^\circ\text{C}$

figure 33. FWD

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



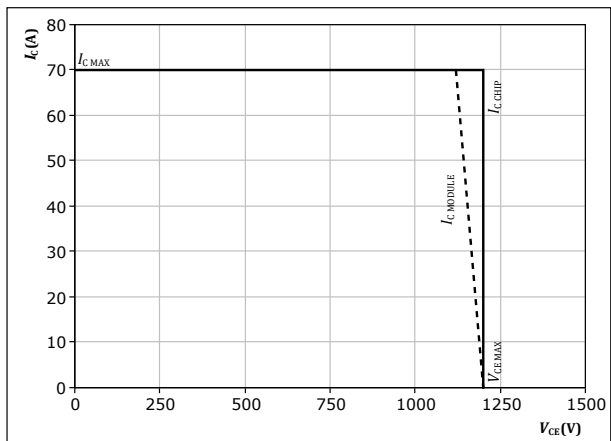
With an inductive load at

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

figure 34. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At $T_j = 150^\circ\text{C}$
 $R_{gon} = 4$ Ω
 $R_{goff} = 4$ Ω



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10-FY12PMA035M703-P589A73
datasheet

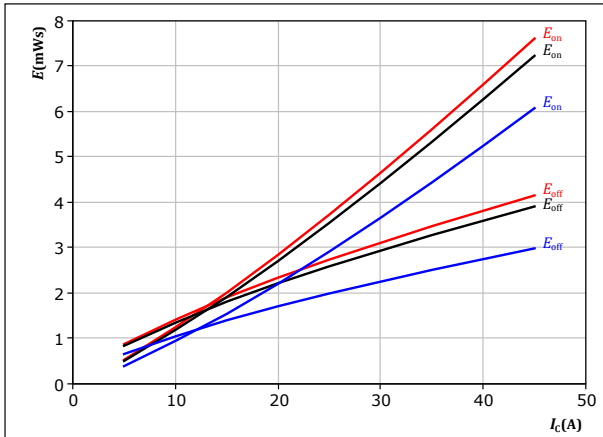
Brake Switching Characteristics

figure 35.

IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$



With an inductive load at

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

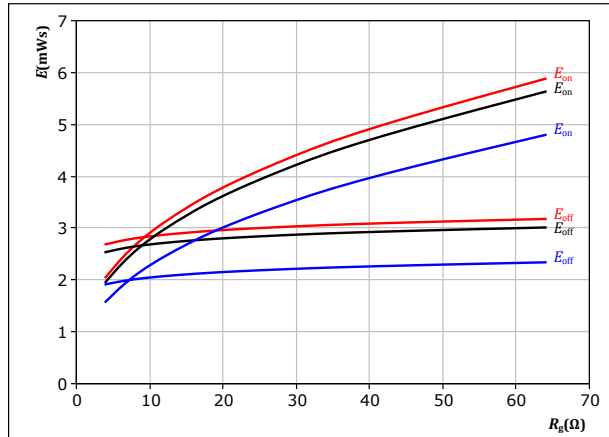
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 36.

IGBT

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

$$E = f(R_g)$$



With an inductive load at

$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_C = 25$ A

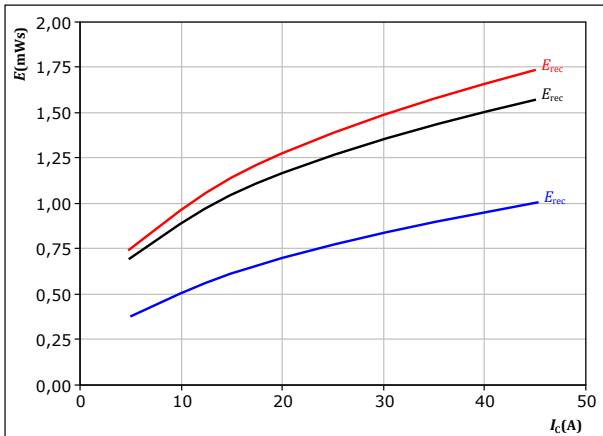
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 37.

FWD

Typical reverse recovered energy loss as a function of collector current

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



With an inductive load at

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

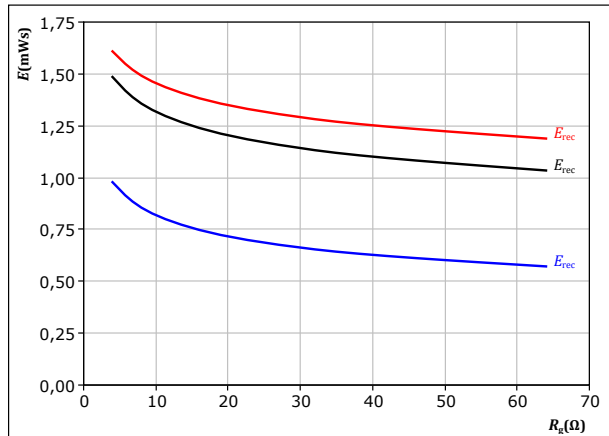
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 38.

FWD

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor

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



With an inductive load at

$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_C = 25$ A

T_j :
— 25 °C
— 125 °C
— 150 °C



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10-FY12PMA035M703-P589A73
datasheet

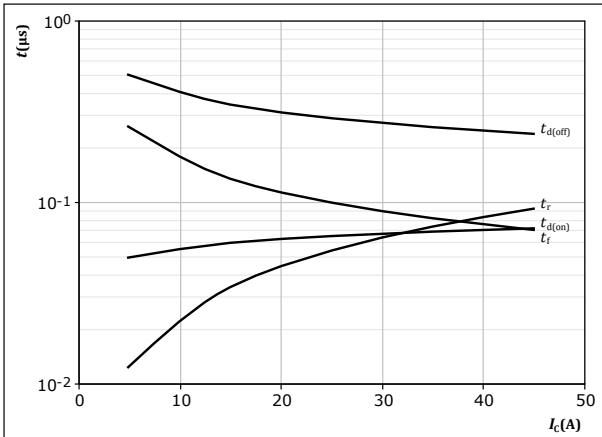
Brake Switching Characteristics

figure 39.

IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



With an inductive load at

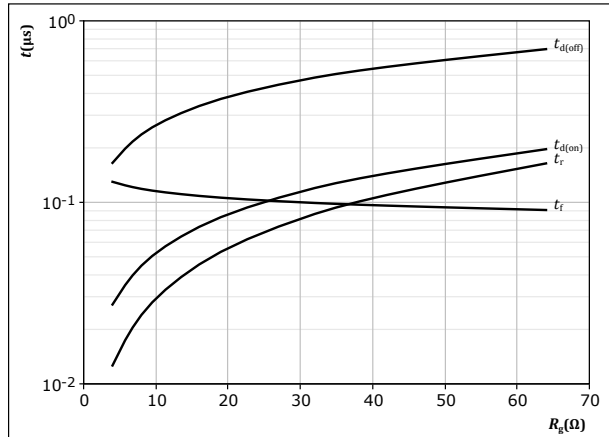
$T_j = 150$ °C
 $V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 16$ Ω
 $R_{goff} = 16$ Ω

figure 40.

IGBT

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

$$t = f(R_g)$$



With an inductive load at

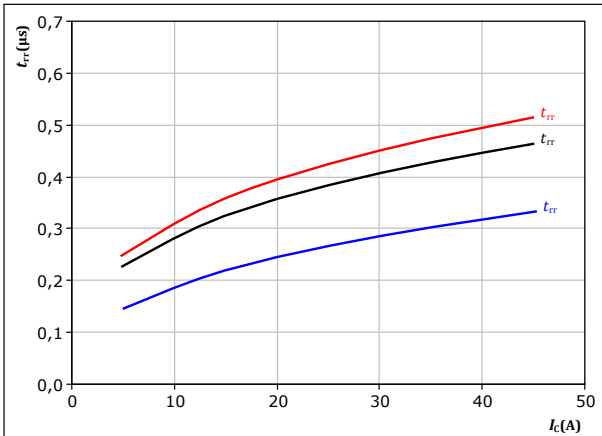
$T_j = 150$ °C
 $V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_C = 25$ A

figure 41.

FWD

Typical reverse recovery time as a function of collector current

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



With an inductive load at

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

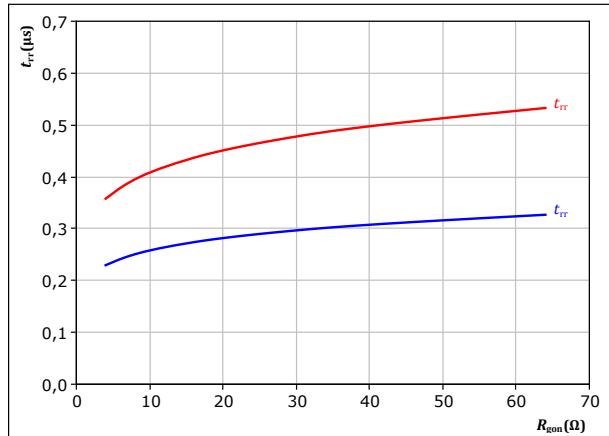
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 42.

FWD

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

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



With an inductive load at

$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_C = 25$ A

T_j :
— 25 °C
— 150 °C



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datasheet

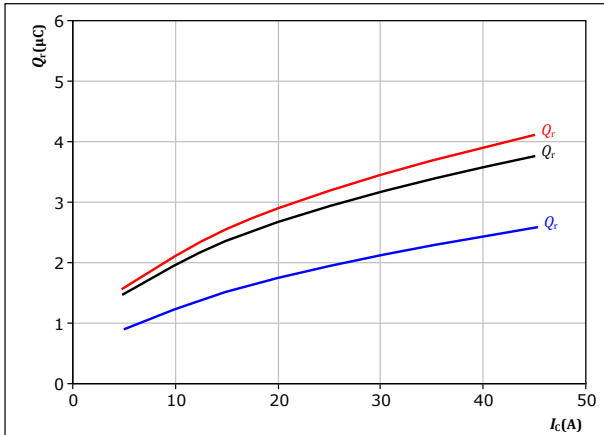
Brake Switching Characteristics

figure 43.

FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

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

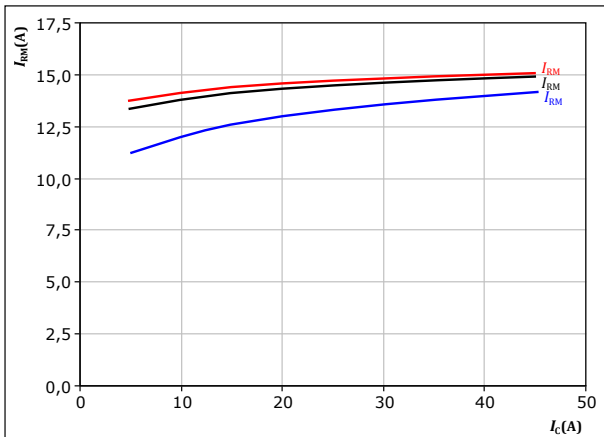
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 45.

FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

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

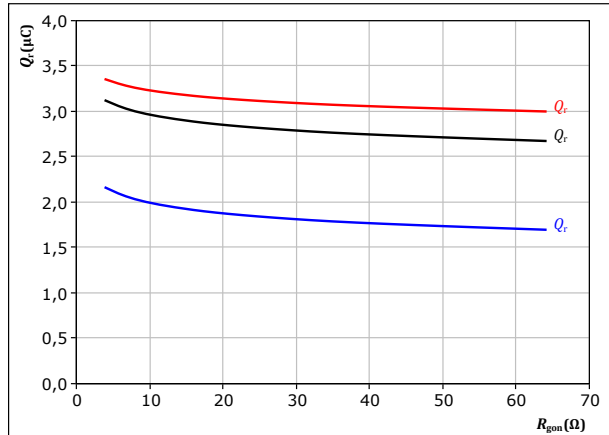
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 44.

FWD

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

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



With an inductive load at

$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_c = 25$ A

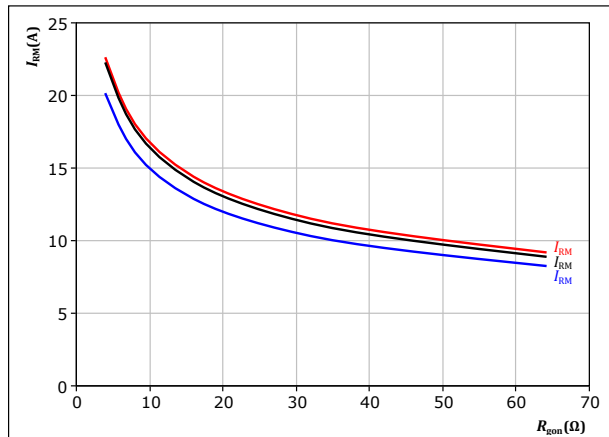
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 46.

FWD

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

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



With an inductive load at

$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_c = 25$ A

T_j :
— 25 °C
— 125 °C
— 150 °C



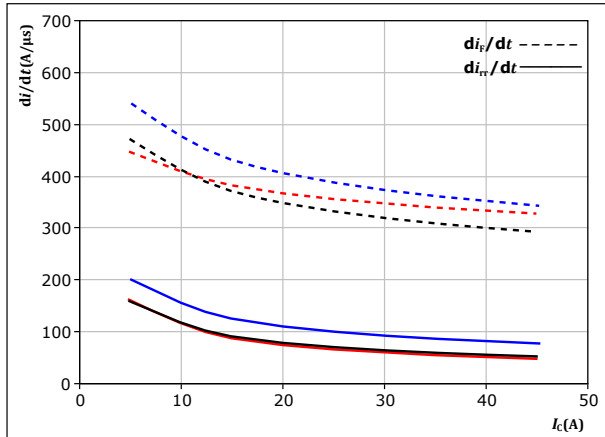
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10-FY12PMA035M703-P589A73
datasheet

Brake Switching Characteristics

figure 47. FWD

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



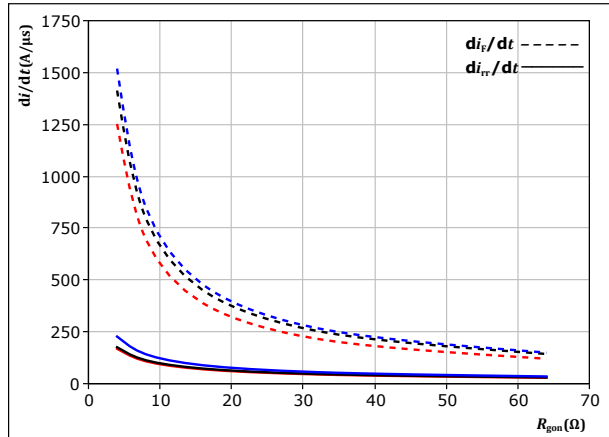
With an inductive load at

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

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 48. FWD

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



With an inductive load at

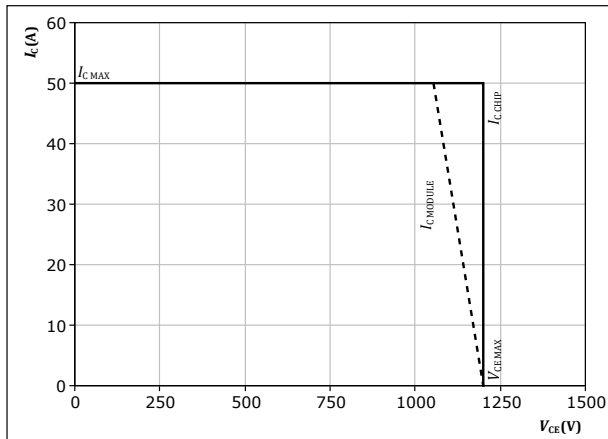
$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_C = 25$ A

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 49. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



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



Vincotech

Switching Definitions

figure 50. IGBT

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

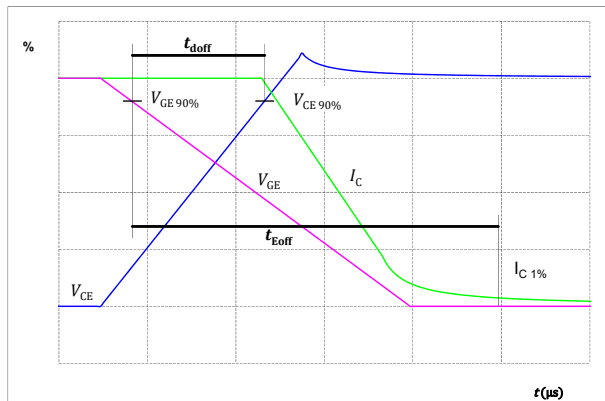


figure 51. IGBT

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

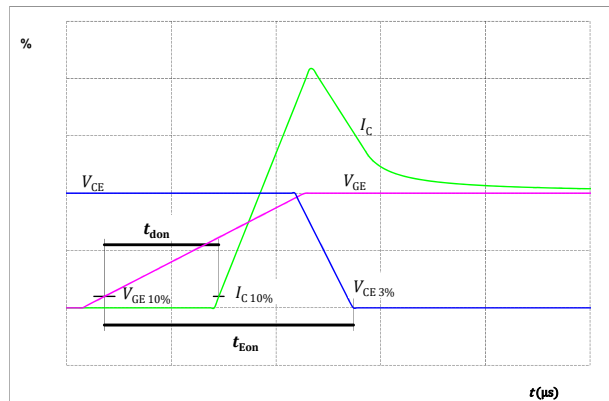


figure 52. IGBT

Turn-off Switching Waveforms & definition of t_f

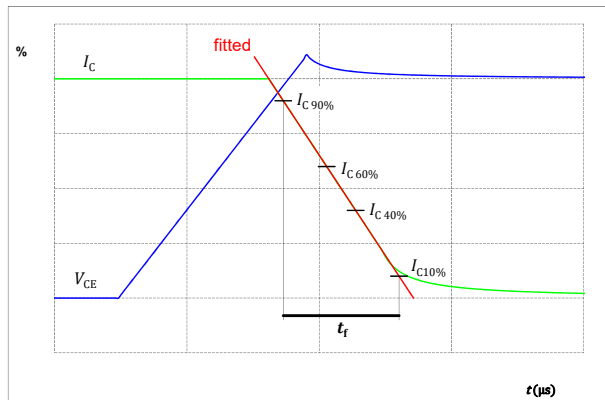
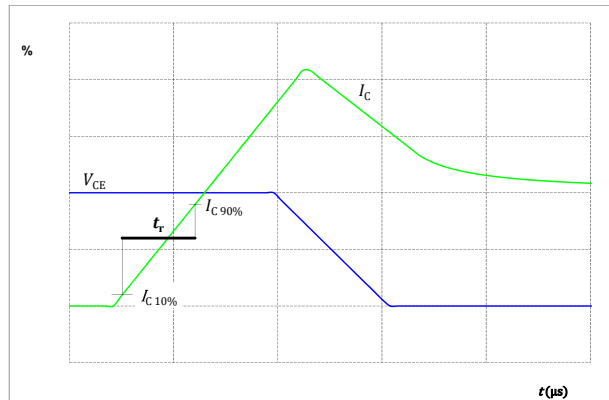


figure 53. IGBT

Turn-on Switching Waveforms & definition of t_r





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Switching Definitions

figure 54.

FWD

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

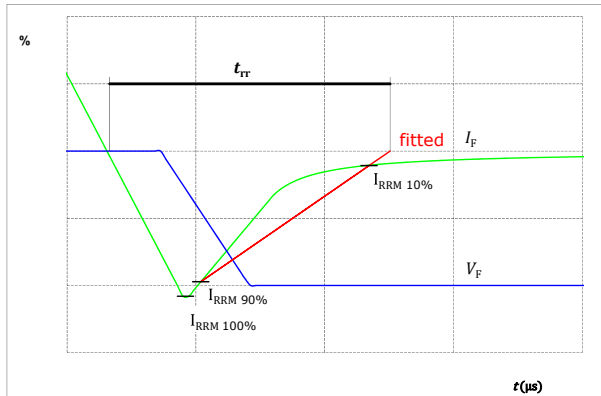
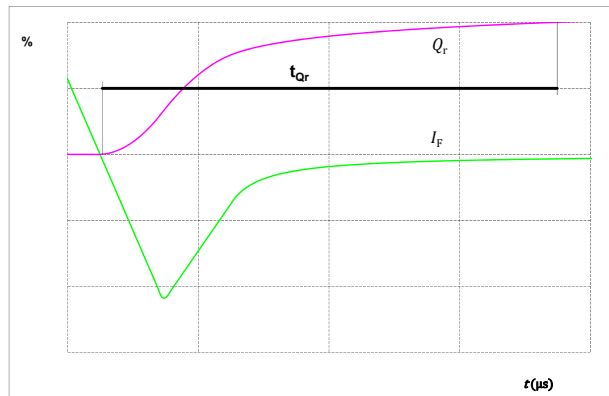


figure 55.

FWD

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





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10-FY12PMA035M703-P589A73

datasheet

Ordering Code	
Version	Ordering Code
Without thermal paste	10-FY12PMA035M703-P589A73
With thermal paste (5,2 W/mK, PTM6000HV)	10-FY12PMA035M703-P589A73-/7/

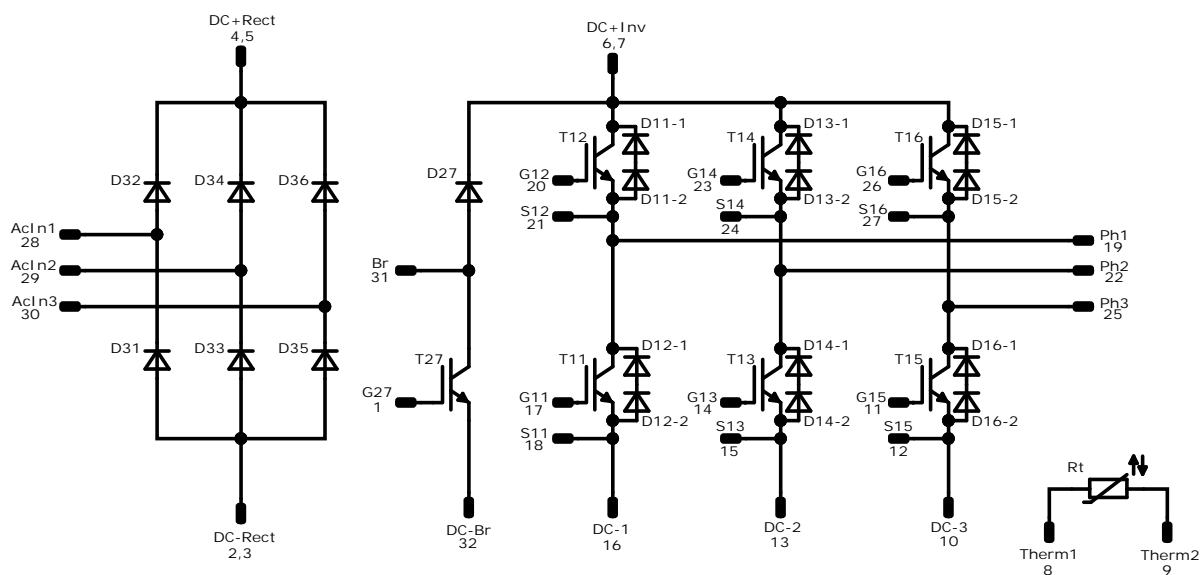
Marking					
	Text	Name NN-NNNNNNNNNNNNNNNN- TTTTTUVV	Date code WWYY	UL & VIN UL VIN	Lot LLLLL
	Datamatrix	Type&Ver TTTTTUVV	Lot number LLLLL	Serial SSSS	Date code WWYY

Outline																																																																																																																																							
<p>Pin table [mm]</p> <table><thead><tr><th>Pin</th><th>X</th><th>Y</th><th>Function</th></tr></thead><tbody><tr><td>1</td><td>52,55</td><td>0</td><td>G27</td></tr><tr><td>2</td><td>47,7</td><td>0</td><td>DC-Rect</td></tr><tr><td>3</td><td>44,8</td><td>0</td><td>DC-Rect</td></tr><tr><td>4</td><td>37,8</td><td>0</td><td>DC+Rect</td></tr><tr><td>5</td><td>37,8</td><td>2,8</td><td>DC+Rect</td></tr><tr><td>6</td><td>35</td><td>0</td><td>DC+Inv</td></tr><tr><td>7</td><td>35</td><td>2,8</td><td>DC+Inv</td></tr><tr><td>8</td><td>28</td><td>0</td><td>Therm1</td></tr><tr><td>9</td><td>25,2</td><td>0</td><td>Therm2</td></tr><tr><td>10</td><td>22,4</td><td>0</td><td>DC-3</td></tr><tr><td>11</td><td>19,6</td><td>0</td><td>G15</td></tr><tr><td>12</td><td>16,8</td><td>0</td><td>S15</td></tr><tr><td>13</td><td>14</td><td>0</td><td>DC-2</td></tr><tr><td>14</td><td>11,2</td><td>0</td><td>G13</td></tr><tr><td>15</td><td>8,4</td><td>0</td><td>S13</td></tr><tr><td>16</td><td>5,6</td><td>0</td><td>DC-1</td></tr><tr><td>17</td><td>2,8</td><td>0</td><td>G11</td></tr><tr><td>18</td><td>0</td><td>0</td><td>S11</td></tr><tr><td>19</td><td>0</td><td>28,5</td><td>Ph1</td></tr><tr><td>20</td><td>2,8</td><td>28,5</td><td>G12</td></tr><tr><td>21</td><td>7,5</td><td>28,5</td><td>S12</td></tr><tr><td>22</td><td>14,5</td><td>28,5</td><td>Ph2</td></tr><tr><td>23</td><td>17,3</td><td>28,5</td><td>G14</td></tr><tr><td>24</td><td>22</td><td>28,5</td><td>S14</td></tr><tr><td>25</td><td>29</td><td>28,5</td><td>Ph3</td></tr><tr><td>26</td><td>31,8</td><td>28,5</td><td>G16</td></tr><tr><td>27</td><td>36,5</td><td>28,5</td><td>S16</td></tr><tr><td>28</td><td>43,5</td><td>28,5</td><td>ACIn1</td></tr><tr><td>29</td><td>52,55</td><td>25</td><td>ACIn2</td></tr><tr><td>30</td><td>52,55</td><td>16,9</td><td>ACIn3</td></tr><tr><td>31</td><td>52,55</td><td>8,6</td><td>Br</td></tr><tr><td>32</td><td>52,55</td><td>2,8</td><td>DC-Br</td></tr></tbody></table>				Pin	X	Y	Function	1	52,55	0	G27	2	47,7	0	DC-Rect	3	44,8	0	DC-Rect	4	37,8	0	DC+Rect	5	37,8	2,8	DC+Rect	6	35	0	DC+Inv	7	35	2,8	DC+Inv	8	28	0	Therm1	9	25,2	0	Therm2	10	22,4	0	DC-3	11	19,6	0	G15	12	16,8	0	S15	13	14	0	DC-2	14	11,2	0	G13	15	8,4	0	S13	16	5,6	0	DC-1	17	2,8	0	G11	18	0	0	S11	19	0	28,5	Ph1	20	2,8	28,5	G12	21	7,5	28,5	S12	22	14,5	28,5	Ph2	23	17,3	28,5	G14	24	22	28,5	S14	25	29	28,5	Ph3	26	31,8	28,5	G16	27	36,5	28,5	S16	28	43,5	28,5	ACIn1	29	52,55	25	ACIn2	30	52,55	16,9	ACIn3	31	52,55	8,6	Br	32	52,55	2,8	DC-Br
Pin	X	Y	Function																																																																																																																																				
1	52,55	0	G27																																																																																																																																				
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20	2,8	28,5	G12																																																																																																																																				
21	7,5	28,5	S12																																																																																																																																				
22	14,5	28,5	Ph2																																																																																																																																				
23	17,3	28,5	G14																																																																																																																																				
24	22	28,5	S14																																																																																																																																				
25	29	28,5	Ph3																																																																																																																																				
26	31,8	28,5	G16																																																																																																																																				
27	36,5	28,5	S16																																																																																																																																				
28	43,5	28,5	ACIn1																																																																																																																																				
29	52,55	25	ACIn2																																																																																																																																				
30	52,55	16,9	ACIn3																																																																																																																																				
31	52,55	8,6	Br																																																																																																																																				
32	52,55	2,8	DC-Br																																																																																																																																				
<p>Tolerance of pinpositions: +0.5mm at the end of pins Dimension of coordinate axis is only offset without tolerance.</p>																																																																																																																																							



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Pinout




Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	35 A	Inverter Switch	
D11-1, D11-2, D12-1, D12-2, D13-1, D13-2, D14-1, D14-2, D15-1, D15-2, D16-1, D16-2	FWD	1300 V	30 A	Inverter Diode	
T27	IGBT	1200 V	25 A	Brake Switch	
D27	FWD	1200 V	15 A	Brake Diode	
D31, D32, D33, D34, D35, D36	Rectifier	1600 V	45 A	Rectifier Diode	
Rt	Thermistor			Thermistor	



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10-FY12PMA035M703-P589A73
datasheet

Packaging instruction				
Standard packaging quantity (SPQ) 100	>SPQ	Standard	<SPQ	Sample
Handling instruction				
Handling instructions for <i>flow</i> 1 packages see vincotech.com website.				
Package data				
Package data for <i>flow</i> 1 packages see vincotech.com website.				
Vincotech thermistor reference				
See Vincotech thermistor reference table at vincotech.com website.				
UL recognition and file number				
This device is UL 1557 recognized under E192116 up to a junction temperature under switching condition $T_{j,sp}=175^{\circ}\text{C}$ and up to 3500VAC/1min isolation voltage. For more information see vincotech.com website.				

Document No.:	Date:	Modification:	Pages
10-FY12PMA035M703-P589A73-D1-14	5 Mar. 2026	Initial Release	

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