



Vincotech

V23990-P544-A27Y-PM

datasheet

flowPIM 0

600 V / 15 A

Topology features

- Open Emitter configuration
- Temperature sensor
- Converter+Brake+Inverter

Component features

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

Housing features

- Base isolation: Al_2O_3
- Convex shaped substrate for superior thermal contact
- Thermo-mechanical push-and-pull force relief
- Press-fit pin
- Reliable cold welding connection

Extra features

- full configuration

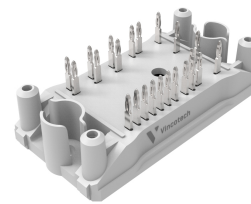
Target applications

- Industrial Drives
- Embedded Drives

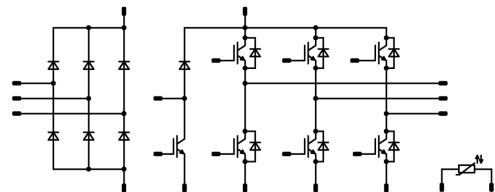
Types

- V23990-P544-A27Y-PM

flow 0 17 mm housing



Schematic





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Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
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Inverter Switch

Collector-emitter voltage	V_{CES}		600	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	22	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	45	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	52	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$, $V_{CC} = 360\text{ V}$ $T_j = 150\text{ °C}$	6	μs
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

Inverter Diode

Peak repetitive reverse voltage	V_{RRM}		600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	20	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	38	W
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

Brake Switch

Collector-emitter voltage	V_{CES}		600	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	16	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	44	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$, $V_{CC} = 360\text{ V}$ $T_j = 150\text{ °C}$	6	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}		600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	16	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	32	W
Maximum junction temperature	T_{jmax}		175	°C

Rectifier Diode

Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	34	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	200	A
Surge current capability	I^2t		200	A²s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	44	W
Maximum junction temperature	T_{jmax}		150	°C

Module Properties

Thermal Properties

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

Isolation Properties

Isolation voltage	V_{isol}	DC Test Voltage* $t_p = 2\text{ s}$	6000	V
Isolation voltage	V_{isol}	AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			>12,7	mm
Clearance			>12,7	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	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00021	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		15	25 125	1,1	1,61 1,81	1,9 ⁽¹⁾	V
Collector-emitter cut-off current	I_{CES}		0	600		25			0,85	µA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	$f = 1 \text{ Mhz}$	0	25	25			800		pF
Output capacitance	C_{oes}							55		pF
Reverse transfer capacitance	C_{res}							24		pF
Gate charge	Q_g		0/15		0	25		87		nC

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						1,83		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 16 \Omega$ $R_{goff} = 8 \Omega$	± 15	300	15	25 125 150		65,92 65,76 65,6		ns
Rise time	t_r					25 125 150		25,92 27,36 28,16		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		82,08 97,28 99,84		ns
Fall time	t_f					25 125 150		70,77 77,18 77,64		ns
Turn-on energy (per pulse)	E_{on}					25 125 150		0,21 0,298 0,329		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,282 0,376 0,402		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				15	25 125		1,25	1,79 1,67	1,95 ⁽¹⁾	V
Reverse leakage current	I_R	$V_r = 600$ V				25				27	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)							2,51		K/W
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Dynamic

Peak recovery current	I_{RRM}	$di/dt=553$ A/μs $di/dt=520$ A/μs $di/dt=524$ A/μs	± 15	300	15	25 125 150		6,34 8,78 9,51			A
Reverse recovery time	t_{rr}					25 125 150		214,72 282,23 311,18			ns
Recovered charge	Q_r					25 125 150		0,497 1 1,17			μC
Reverse recovered energy	E_{rec}					25 125 150		0,115 0,23 0,268			mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		52,38 63,68 63,26			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	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00015	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		10	25 125	1,1	1,66 1,87	1,9 ⁽¹⁾	V
Collector-emitter cut-off current	I_{CES}		0	600		25			0,6	µA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	$f = 1 \text{ Mhz}$	0	25		25		551		pF
Output capacitance	C_{oes}							40		pF
Reverse transfer capacitance	C_{res}							17		pF

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						2,15		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 32 \text{ } \Omega$ $R_{goff} = 16 \text{ } \Omega$	0/15	300	10	25 125 150		34,08 31,68 31,04		ns
Rise time	t_r					25 125 150		28,64 31,2 32		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		133,28 150,08 153,76		ns
Fall time	t_f					25 125 150		96,72 97,35 100,84		ns
Turn-on energy (per pulse)	E_{on}					25 125 150		0,169 0,236 0,254		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,23 0,298 0,316		mWs



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Characteristic Values

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

Brake Diode

Static

Forward voltage	V_F				10	25 125	1,25	1,68 1,61	1,95 ⁽¹⁾	V
Reverse leakage current	I_R	$V_r = 600$ V				25			27	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						2,99		K/W
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Dynamic

Peak recovery current	I_{RRM}	$di/dt=316$ A/μs $di/dt=289$ A/μs $di/dt=298$ A/μs	0/15	300	10	25 125 150		3,82 5,68 6,14		A
Reverse recovery time	t_{rr}					25 125 150		222,64 283,44 313,89		ns
Recovered charge	Q_r					25 125 150		0,344 0,678 0,788		μC
Reverse recovered energy	E_{rec}					25 125 150		0,078 0,151 0,176		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		26,24 42,8 40,68		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				8	25 125		0,983 0,889	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⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,59		K/W
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Thermistor

Static

Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	$R_{100} = 1484$ 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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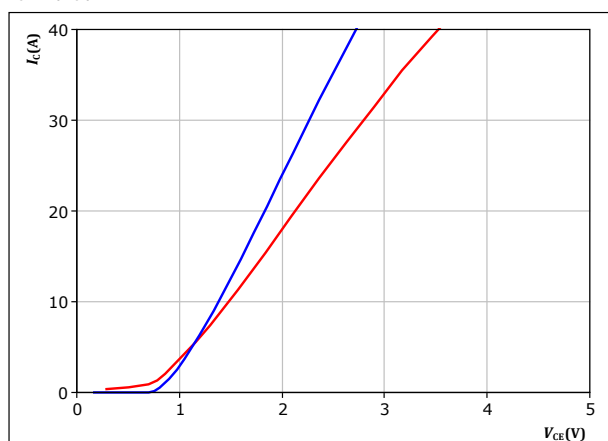
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Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

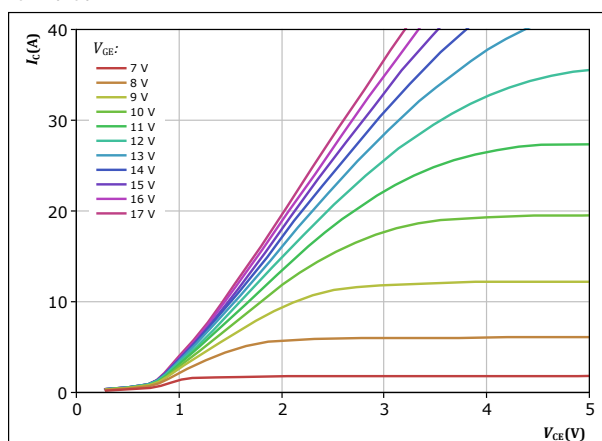


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_J: 25 ^\circ C$ (blue line)
 $125 ^\circ C$ (red line)

figure 2. IGBT

Typical output characteristics

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

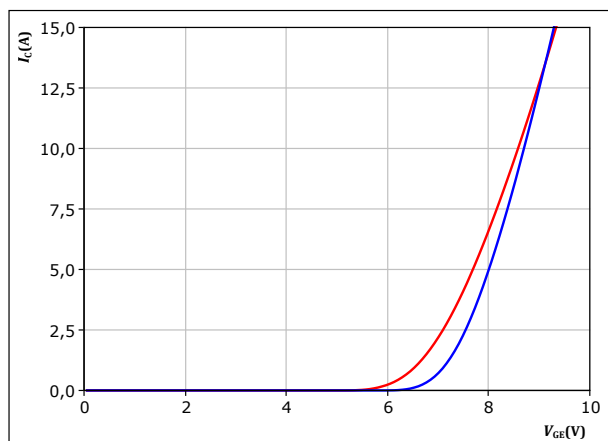


$t_p = 250 \mu s$
 $T_J = 125 ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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



$t_p = 250 \mu s$
 $V_{CE} = 10 V$
 $T_J: 25 ^\circ C$ (blue line)
 $125 ^\circ C$ (red line)

figure 4. IGBT

Short circuit withstand time as a function of V_{GE}

$$t_{sc} = f(V_{GE})$$



At $V_{CE} = 600 V$
 $T_J \leq 25 ^\circ C$



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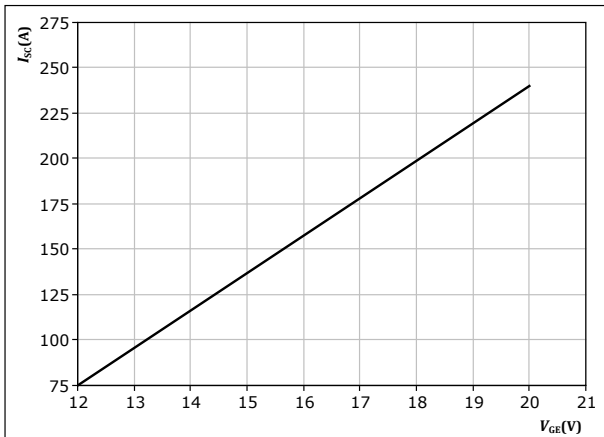
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Inverter Switch Characteristics

figure 5.

IGBT

Typical short circuit current as a function of V_{GE}
 $I_{SC} = f(V_{GE})$

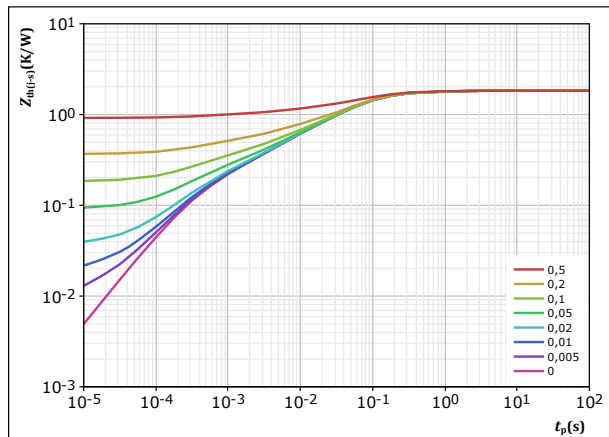


At $V_{CE} = 400$ V
 $T_j \leq 150$ °C

figure 6.

IGBT

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



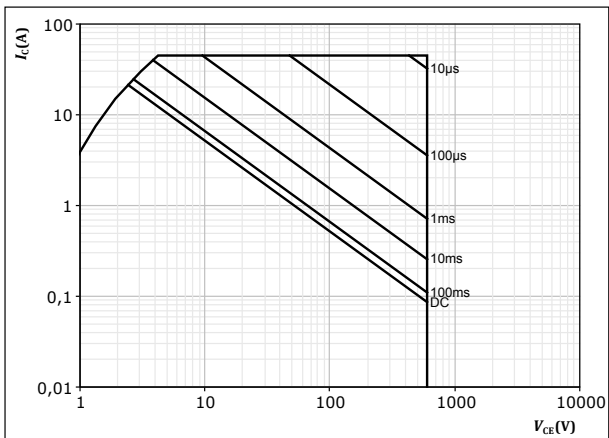
$D = t_p / T$
 $R_{th(j-s)} = 1,834$ K/W
IGBT thermal model values

R (K/W)	τ (s)
8,30E-02	1,29E+00
3,76E-01	1,56E-01
8,46E-01	5,15E-02
2,81E-01	8,16E-03
1,16E-01	2,04E-03
1,32E-01	3,43E-04

figure 7.

IGBT

Safe operating area
 $I_C = f(V_{CE})$

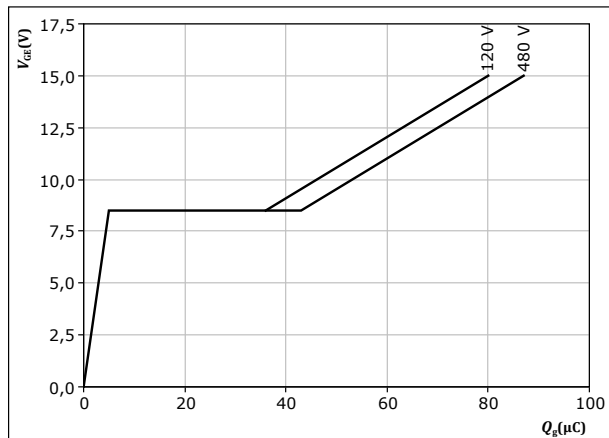


$D = \text{single pulse}$
 $T_s = 80$ °C
 $V_{GE} = 15$ V
 $T_j = T_{jmax}$

figure 8.

IGBT

Gate voltage vs gate charge
 $V_{GE} = f(Q_g)$



$I_C = 15$ A
 $T_j = 25$ °C



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Inverter Diode Characteristics

figure 9.

FWD

Typical forward characteristics

$$I_F = f(V_F)$$

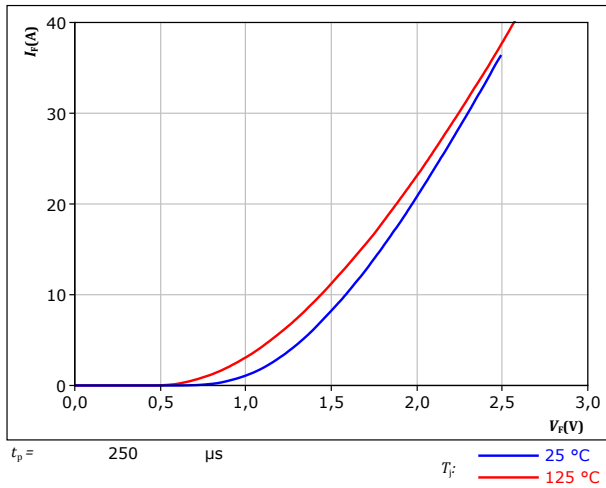
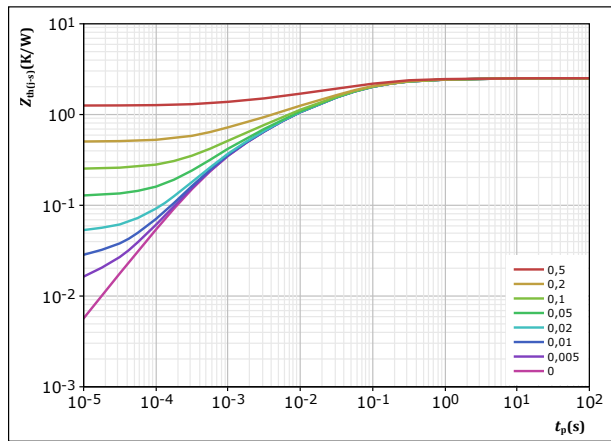


figure 10.

FWD

Transient thermal impedance as a function of pulse width

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





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Brake Switch Characteristics

figure 11. IGBT

Typical output characteristics

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

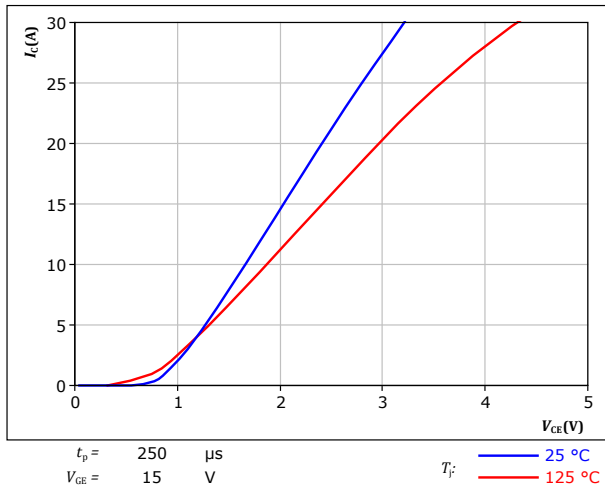


figure 12. IGBT

Typical output characteristics

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

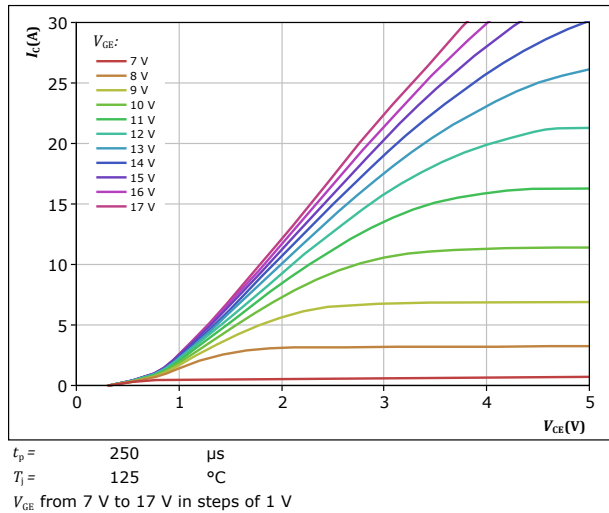


figure 13. IGBT

Typical transfer characteristics

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

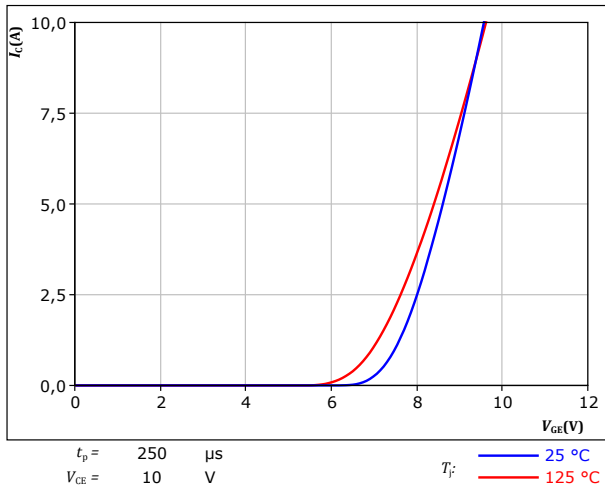
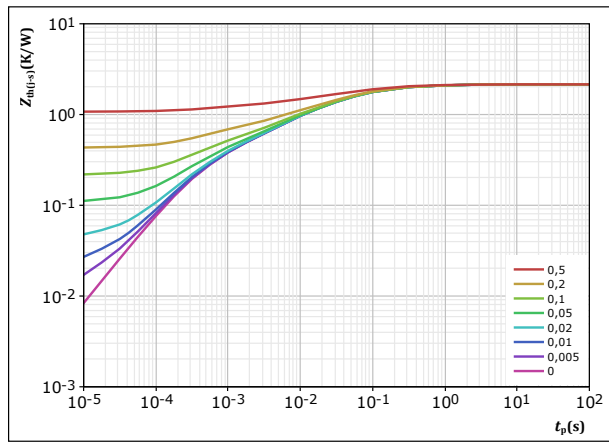


figure 14. IGBT

Transient thermal impedance as a function of pulse width

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





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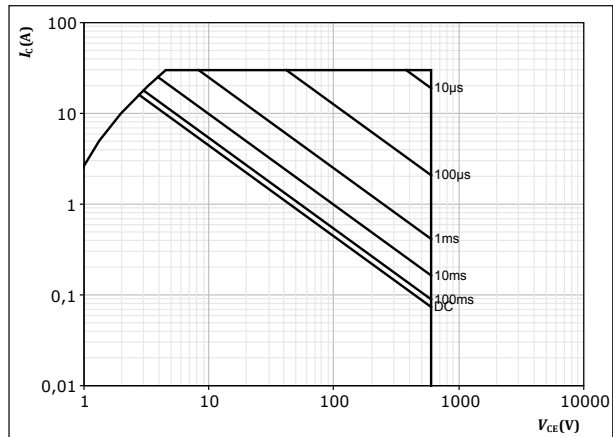
Brake Switch Characteristics

figure 15.

IGBT

Safe operating area

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



$D =$ single pulse

$T_s = 80$ °C

$V_{GE} = 15$ V

$T_j = T_{jmax}$



Brake Diode Characteristics

figure 16.

FWD

Typical forward characteristics

$$I_F = f(V_F)$$

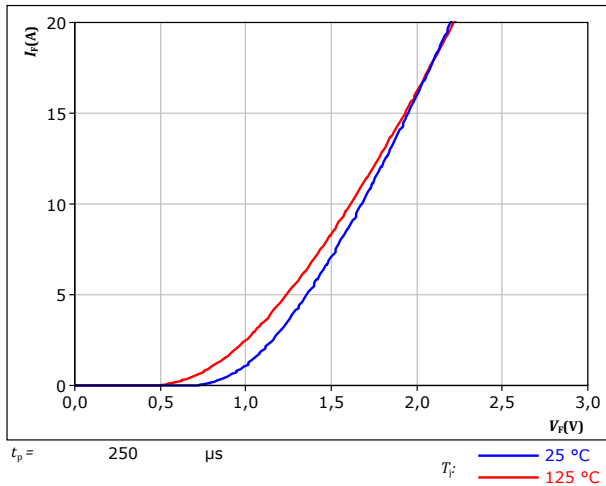
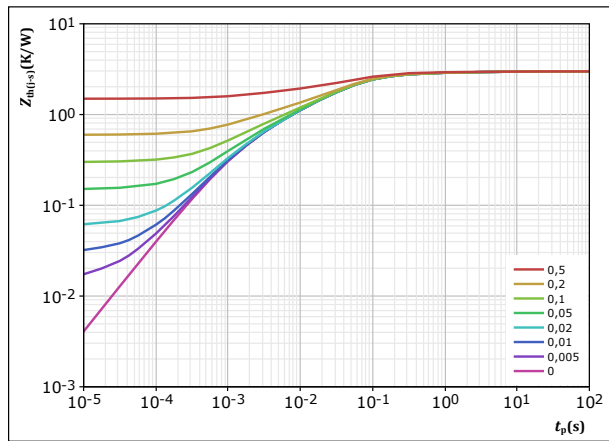


figure 17.

FWD

Transient thermal impedance as a function of pulse width

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



$D =$	t_p / T	
$R_{th(j-s)} =$	2,988	K/W
FWD thermal model values		
R (K/W)	τ (s)	
8,74E-02	5,59E+00	
2,41E-01	4,60E-01	
1,22E+00	6,53E-02	
6,89E-01	2,20E-02	
4,52E-01	5,14E-03	
2,99E-01	1,11E-03	



Rectifier Diode Characteristics

figure 18.

Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

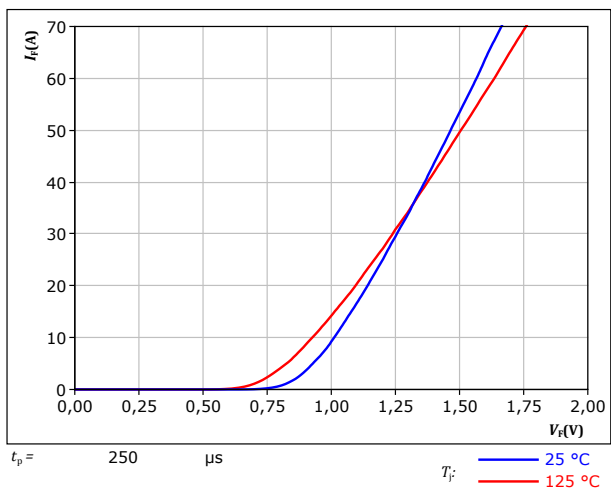
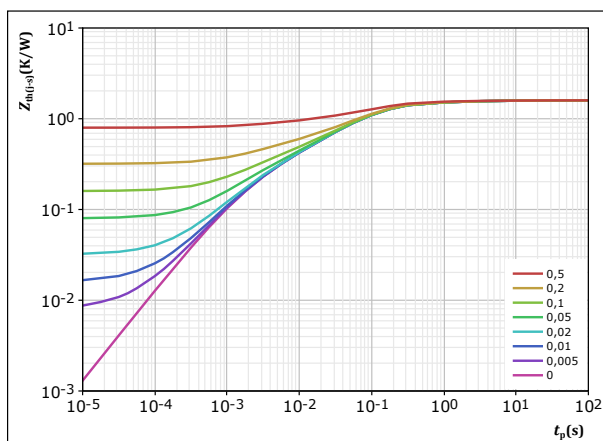


figure 19.

Rectifier

Transient thermal impedance as a function of pulse width

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



$D =$	t_p / T	
$R_{th(j-s)} =$	1,594	K/W
Rectifier thermal model values		
R (K/W)	τ (s)	
3,44E-02	9,66E+00	
1,12E-01	1,22E+00	
5,81E-01	1,45E-01	
4,89E-01	5,05E-02	
2,38E-01	9,26E-03	
1,22E-01	1,79E-03	
1,81E-02	7,88E-04	



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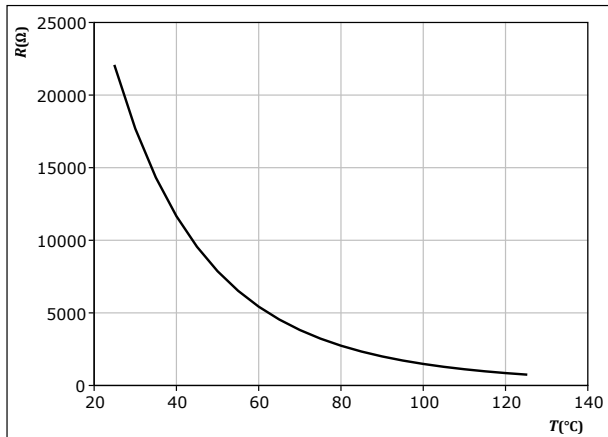
Thermistor Characteristics

figure 20.

Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$





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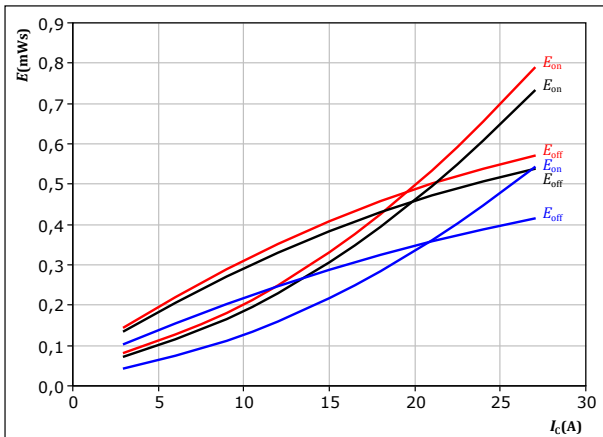
Inverter Switching Characteristics

figure 21.

IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_c)$$



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω
 $R_{goff} = 8$ Ω

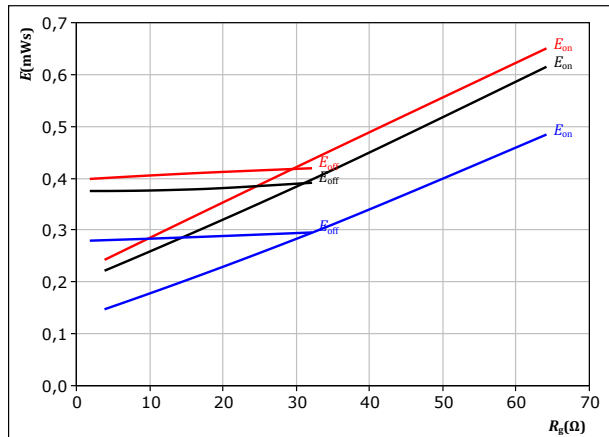
T_j : 25 °C
125 °C
150 °C

figure 22.

IGBT

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

$$E = f(R_g)$$



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_c = 15$ A

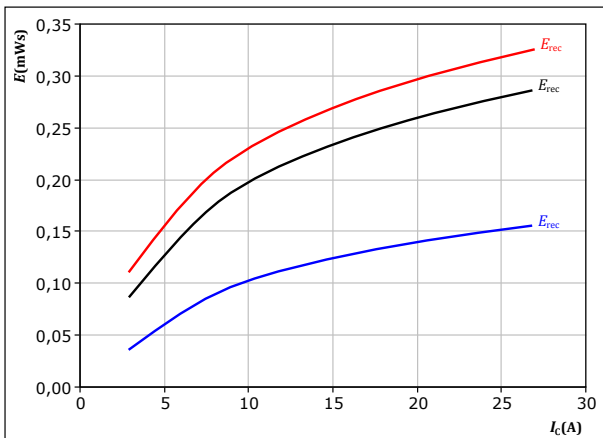
T_j : 25 °C
125 °C
150 °C

figure 23.

FWD

Typical reverse recovered energy loss as a function of collector current

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



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

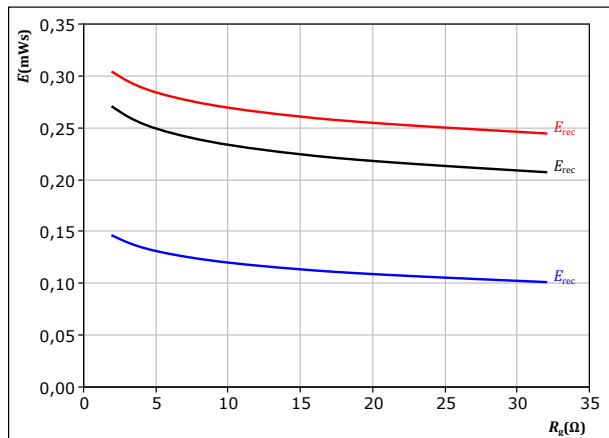
T_j : 25 °C
125 °C
150 °C

figure 24.

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

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_c = 15$ A

T_j : 25 °C
125 °C
150 °C



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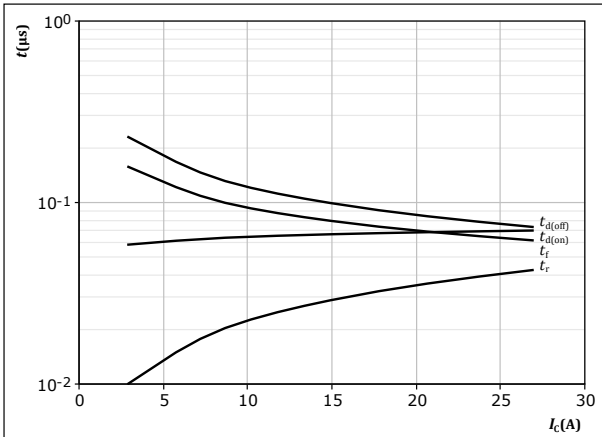
Inverter Switching Characteristics

figure 25.

IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



With an inductive load at

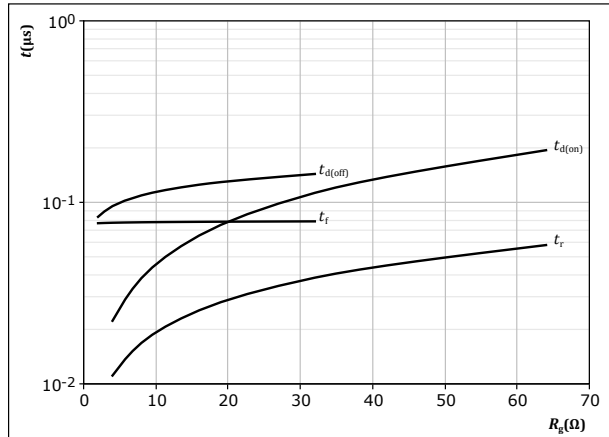
$T_j = 150$ °C
 $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω
 $R_{goff} = 8$ Ω

figure 26.

IGBT

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

$$t = f(R_g)$$



With an inductive load at

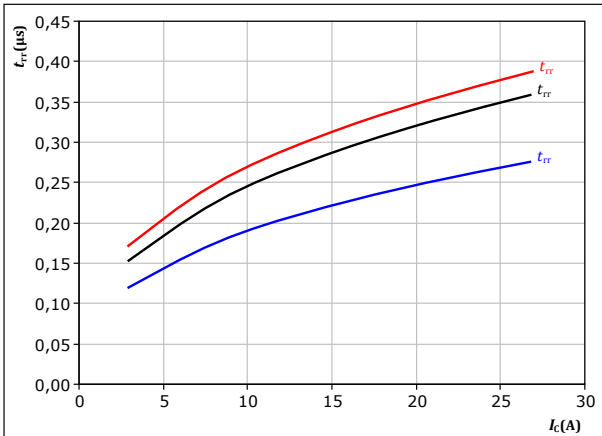
$T_j = 150$ °C
 $V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_C = 15$ A

figure 27.

FWD

Typical reverse recovery time as a function of collector current

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



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

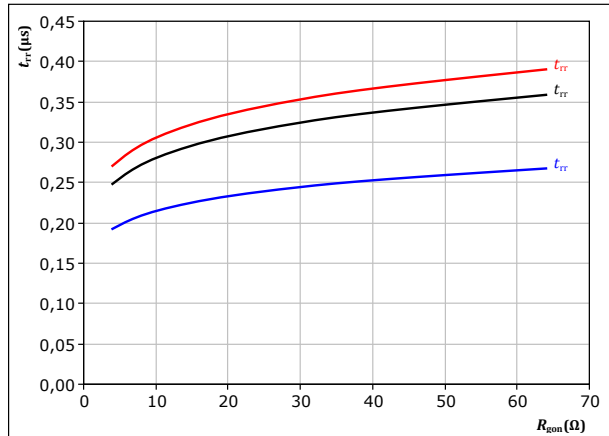
T_j : — 25 °C
— 125 °C
— 150 °C

figure 28.

FWD

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

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



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_C = 15$ A

T_j : — 25 °C
— 125 °C
— 150 °C



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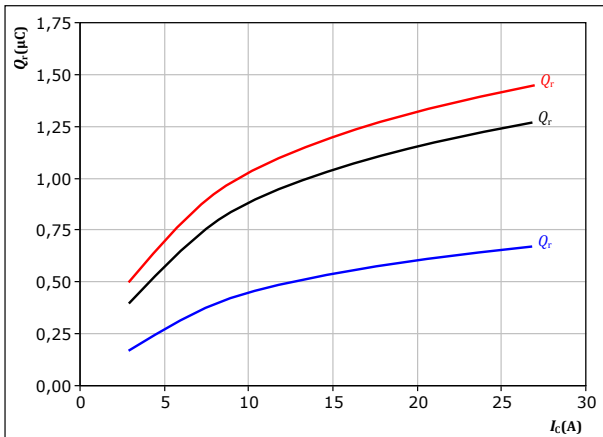
Inverter Switching Characteristics

figure 29.

FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

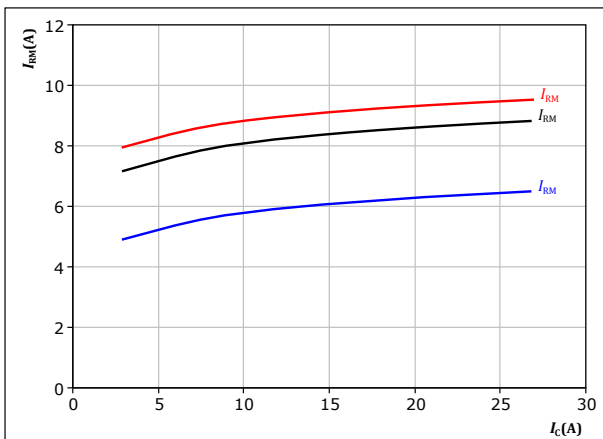
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 31.

FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

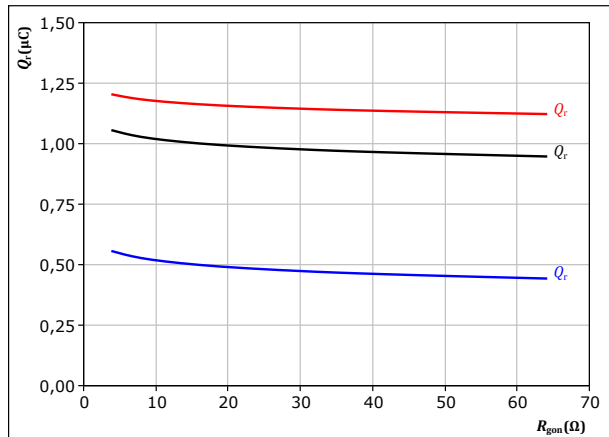
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 30.

FWD

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

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



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_c = 15$ A

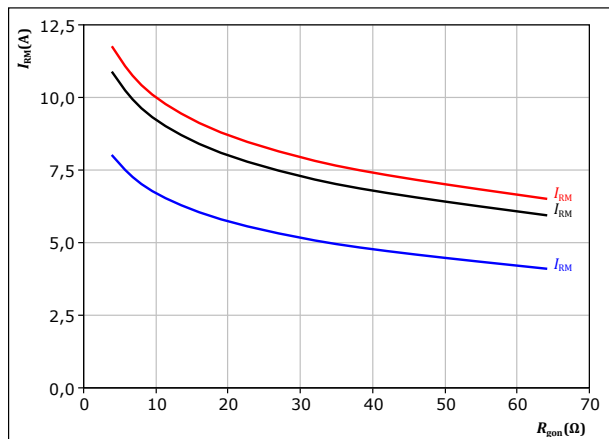
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 32.

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

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_c = 15$ A

T_j :
— 25 °C
— 125 °C
— 150 °C



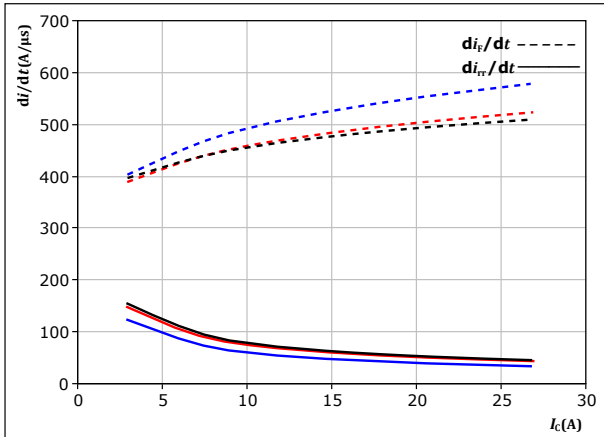
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datasheet

Inverter Switching Characteristics

figure 33. FWD

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



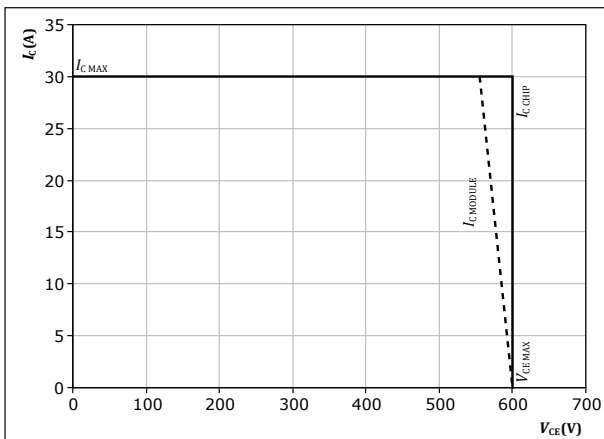
With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω
 $T_j: 25$ °C
125 °C
150 °C

figure 35. IGBT

Reverse bias safe operating area

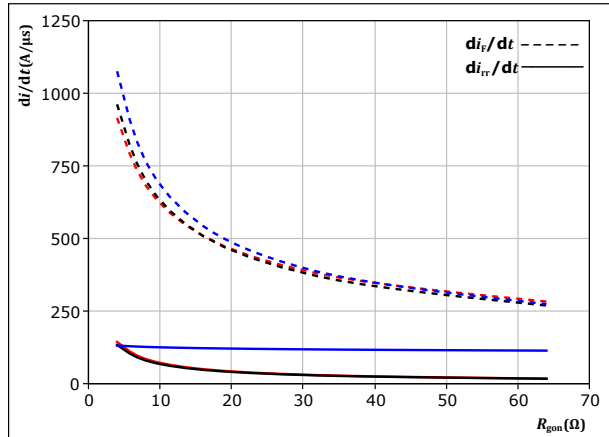
$I_C = f(V_{CE})$



At $T_j = 150$ °C
 $R_{gon} = 16$ Ω
 $R_{goff} = 8$ Ω

figure 34. 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

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_C = 15$ A
 $T_j: 25$ °C
125 °C
150 °C



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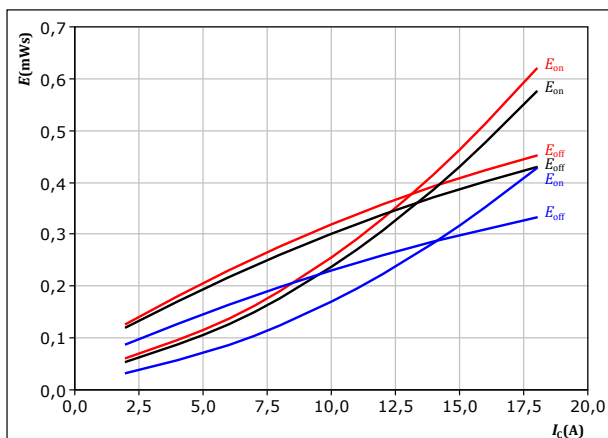
Brake Switching Characteristics

figure 36.

IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_c)$$



With an inductive load at

$V_{CE} = 300 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $R_{gon} = 32 \text{ } \Omega$
 $R_{goff} = 16 \text{ } \Omega$

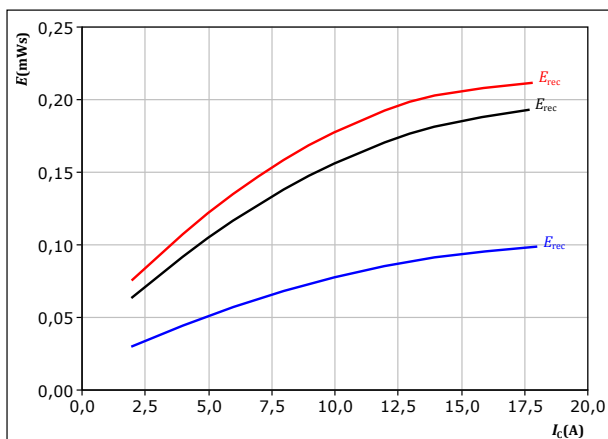
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 38.

FWD

Typical reverse recovered energy loss as a function of collector current

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



With an inductive load at

$V_{CE} = 300 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $R_{gon} = 32 \text{ } \Omega$

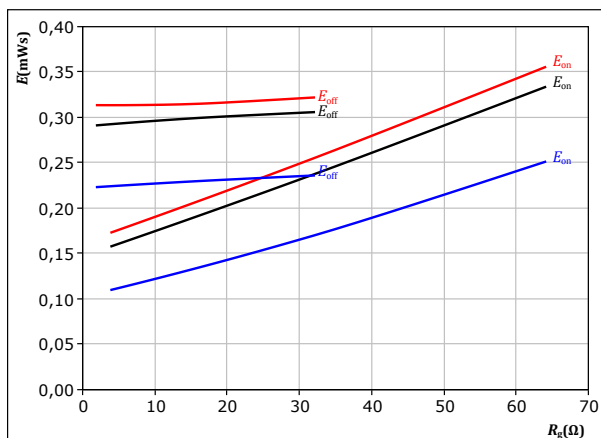
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 37.

IGBT

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

$$E = f(R_g)$$



With an inductive load at

$V_{CE} = 300 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $I_c = 10 \text{ A}$

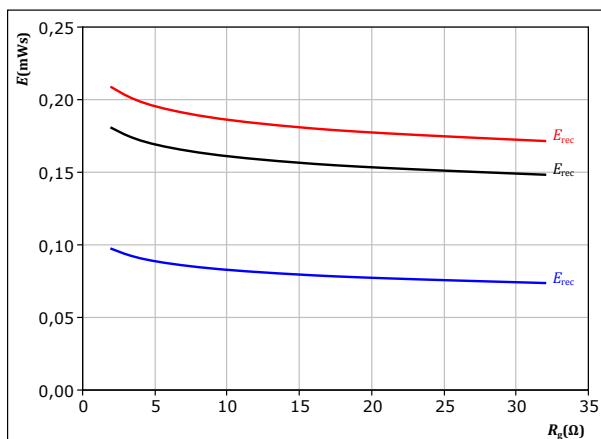
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 39.

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

$V_{CE} = 300 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $I_c = 10 \text{ A}$

T_j :
— 25 °C
— 125 °C
— 150 °C



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datasheet

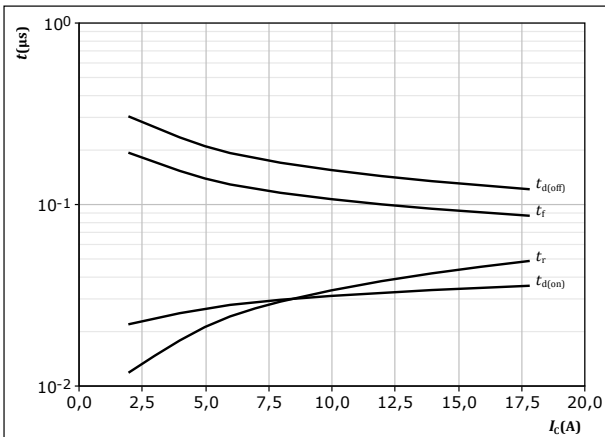
Brake Switching Characteristics

figure 40.

IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



With an inductive load at

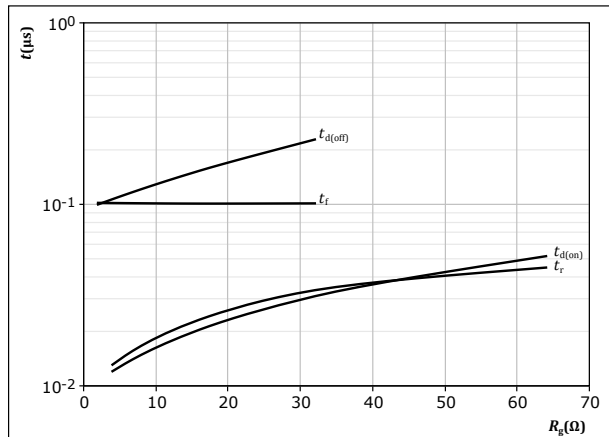
$T_j = 150$ °C
 $V_{CE} = 300$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 32$ Ω
 $R_{goff} = 16$ Ω

figure 41.

IGBT

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

$$t = f(R_g)$$



With an inductive load at

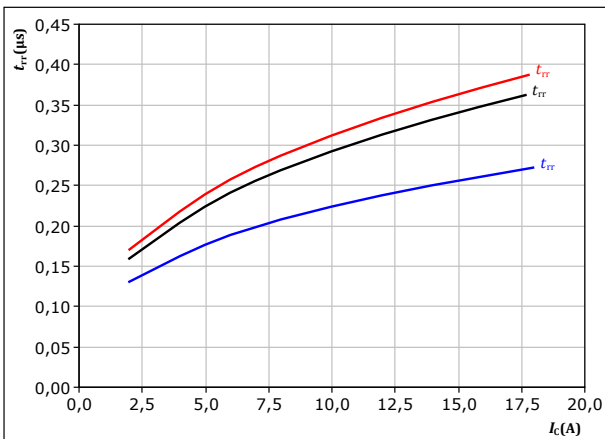
$T_j = 150$ °C
 $V_{CE} = 300$ V
 $V_{GE} = 0/15$ V
 $I_C = 10$ A

figure 42.

FWD

Typical reverse recovery time as a function of collector current

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



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 32$ Ω

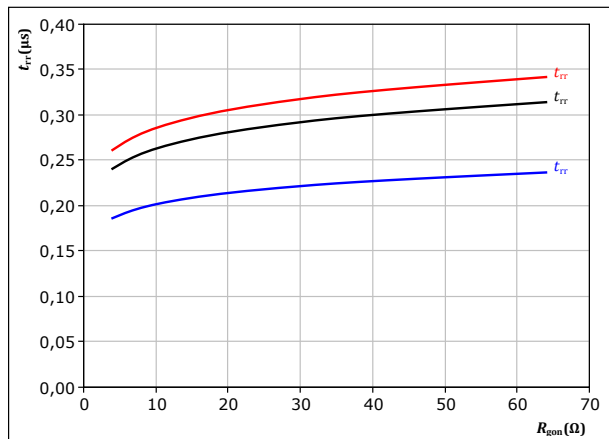
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 43.

FWD

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

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



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = 0/15$ V
 $I_C = 10$ A

T_j :
— 25 °C
— 125 °C
— 150 °C



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datasheet

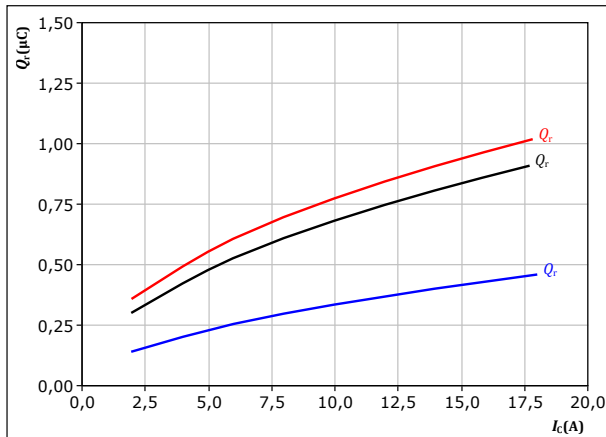
Brake Switching Characteristics

figure 44.

FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 32$ Ω

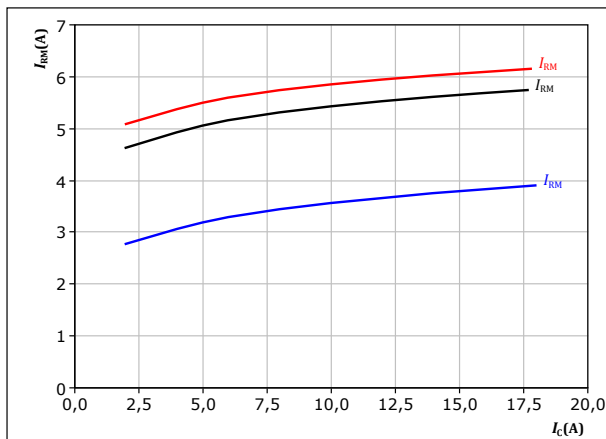
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 46.

FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 32$ Ω

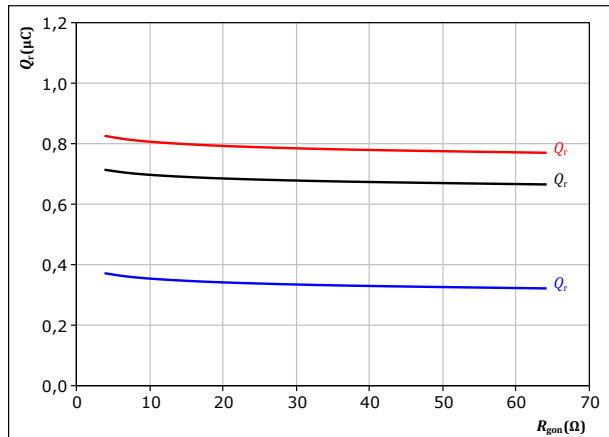
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 45.

FWD

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

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



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = 0/15$ V
 $I_c = 10$ A

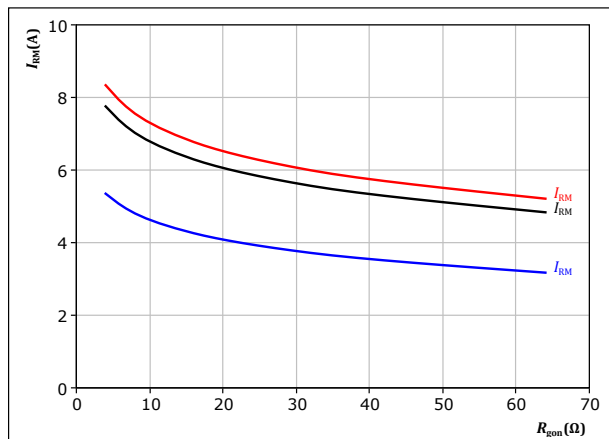
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 47.

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

$V_{CE} = 300$ V
 $V_{GE} = 0/15$ V
 $I_c = 10$ A

T_j :
— 25 °C
— 125 °C
— 150 °C



Brake Switching Characteristics

figure 48. FWD

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

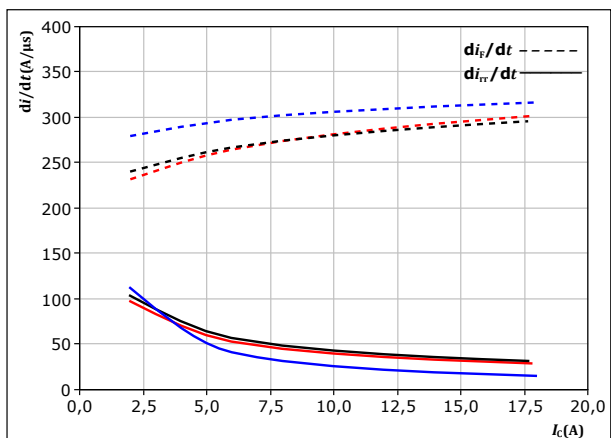


figure 49. FWD

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

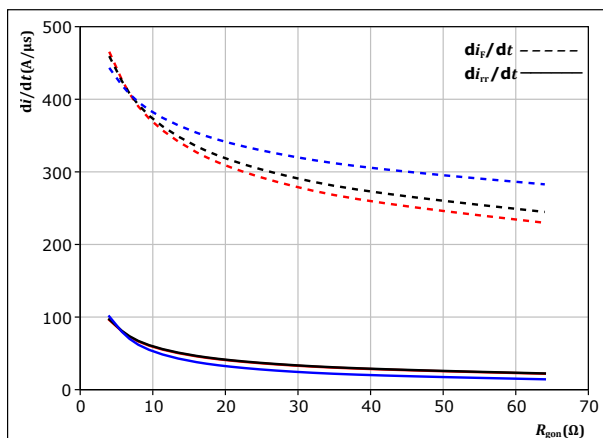
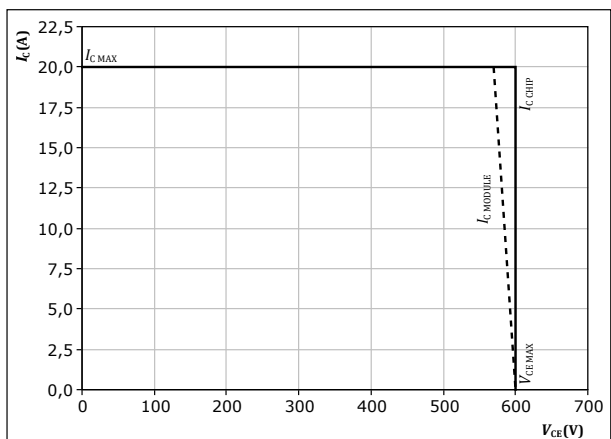


figure 50. IGBT

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





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Switching Definitions

figure 51.

IGBT

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

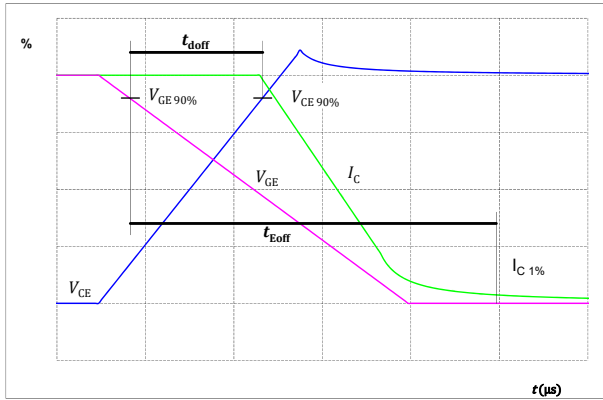


figure 52.

IGBT

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

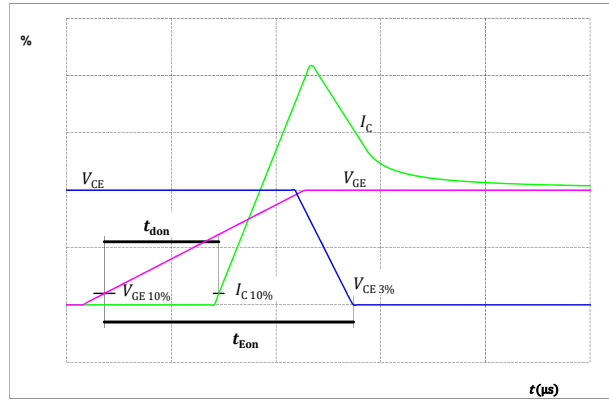


figure 53.

IGBT

Turn-off Switching Waveforms & definition of t_f

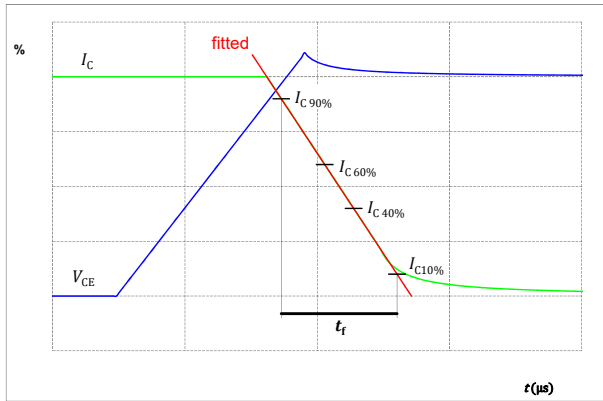
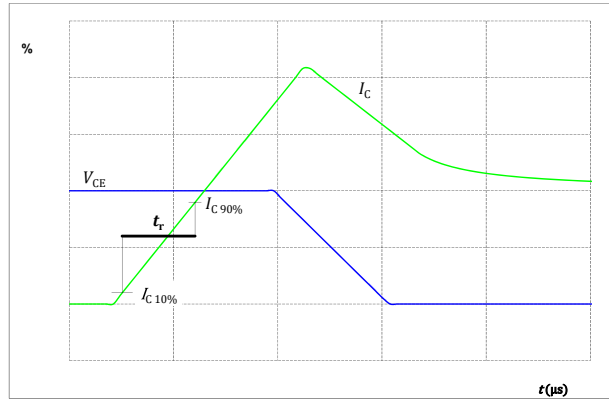


figure 54.

IGBT

Turn-on Switching Waveforms & definition of t_r





Switching Definitions

figure 55.

FWD

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



figure 56.

FWD

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





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V23990-P544-A27Y-PM

datasheet

Ordering Code	
Version	Ordering Code
Without thermal paste	V23990-P544-A27Y-PM
With thermal paste (5,2 W/mK, PTM6000HV)	V23990-P544-A27Y-/7/-PM
With thermal paste (3,4 W/mK, PSX-P7)	V23990-P544-A27Y-/3/-PM

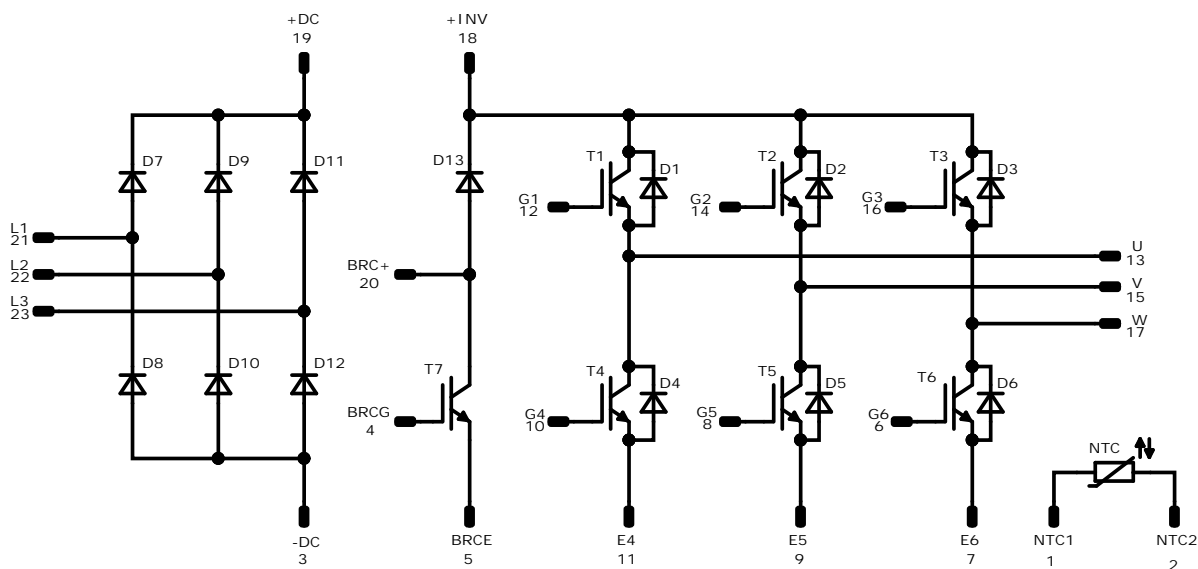
Marking							
	Text	VIN	Date code	Type&Ver	UL	Lot	Serial
		VIN	WWYY	TTTTTTVV	UL	LLLL	SSSS
	Datamatrix	Type&Ver	Lot number	Serial	Date code		
		TTTTTTVV	LLLL	SSSS	WWYY		

Outline			
Pin table [mm]			
Pin	X	Y	Function
1	25,5	2,7	NTC1
2	25,5	0	NTC2
3	22,8	0	-DC
4	20,1	0	BRCG
5	16,2	0	BRCE
6	13,5	0	G6
7	10,8	0	E6
8	8,1	0	G5
9	5,4	0	E5
10	2,7	0	G4
11	0	0	E4
12	0	19,8	G1
13	0	22,5	U
14	7,5	19,8	G2
15	7,5	22,5	V
16	15	19,8	G3
17	15	22,5	W
18	22,8	22,5	+INV
19	25,5	22,5	+DC
20	33,5	22,5	BRC+
21	33,5	15	L1
22	33,5	7,5	L2
23	33,5	0	L3

Tolerance of positions: $\pm 0,05$ mm at the end of pins
Dimension of coordinate axis is only offset without tolerance



Pinout




Identification

ID	Component	Voltage	Current	Function	Comment
T4, T1, T5, T2, T6, T3	IGBT	600 V	15 A	Inverter Switch	
D1, D4, D2, D5, D3, D6	FWD	600 V	15 A	Inverter Diode	
T7	IGBT	600 V	10 A	Brake Switch	
D13	FWD	600 V	10 A	Brake Diode	
D8, D7, D10, D9, D12, D11	Rectifier	1600 V	25 A	Rectifier Diode	
NTC	Thermistor			Thermistor	



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V23990-P544-A27Y-PM
datasheet

Packaging instruction				
Standard packaging quantity (SPQ) 135	>SPQ	Standard	<SPQ	Sample
Handling instruction				
Handling instructions for <i>flow 0</i> packages see vincotech.com website.				
Package data				
Package data for <i>flow 0</i> packages see vincotech.com website.				
Vincotech thermistor reference				
See Vincotech thermistor reference table at vincotech.com website.				
UL recognition and file number				
This device is certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.				

Document No.:	Date:	Modification:	Pages
V23990-P544-A27Y-PM-D2-14	6 May. 2022	New Datasheet format, module is unchanged	

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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.