



flow90PIM 1

600 V / 20 A

Features

- Trench Fieldstop Technology IGBT3 for low saturation loss
- Supports design with 90° mounting angle between heatsink and PCB
- Clip-in PCB mounting
- Clip or screw on heatsink mounting

Target applications

- Industrial drives

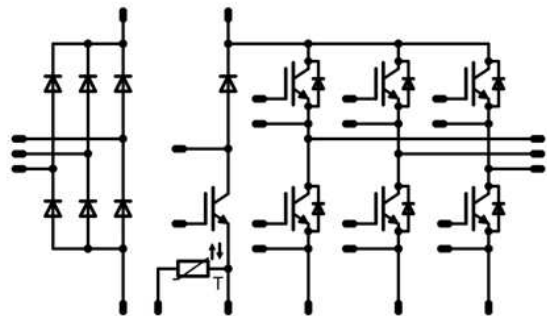
Types

- V23990-P634-A-PM

flow 90 housing



Schematic



Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
Inverter switch				
Collector-emitter voltage	V_{CES}		600	V
Collector current	I_{C}	$T_j=T_{j\text{max}}$ $T_s=80^{\circ}\text{C}$	24	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{j\text{max}}$	60	A
Total power dissipation	P_{tot}	$T_j=T_{j\text{max}}$ $T_s=80^{\circ}\text{C}$	53	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$T_j \leq 150^{\circ}\text{C}$	6	μs
	V_{CC}	$V_{\text{CE}} = 15\text{V}$	360	V
Maximum Junction Temperature	$T_{j\text{max}}$		175	$^{\circ}\text{C}$



Parameter	Symbol	Conditions	Value	Unit
Inverter Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_h = 80^\circ\text{C}$	24	A
Repetitive peak forward current	I_{FRM}		40	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_h = 80^\circ\text{C}$	40	W
Maximum Junction Temperature	T_{jmax}		175	$^\circ\text{C}$

Parameter	Symbol	Condition	Value	Unit
Brake switch				
Collector-emitter voltage	V_{CES}		600	V
Collector current	I_C	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	20	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	45	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	47	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$T_j \leq 150^\circ\text{C}$	6	μs
	V_{CC}	$V_{GE} = 15\text{V}$	360	V
Maximum Junction Temperature	T_{jmax}		175	$^\circ\text{C}$

Parameter	Symbol	Conditions	Value	Unit
Brake Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_h = 80^\circ\text{C}$	17	A
Repetitive peak forward current	I_{FRM}		20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_h = 80^\circ\text{C}$	34	W
Maximum Junction Temperature	T_{jmax}		175	$^\circ\text{C}$



Parameter	Symbol	Conditions	Value	Unit
Rectifier Diode				
Repetitive peak reverse voltage	V_{RRM}		1600	V
Mean forward current	I_{FAV}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	33	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave	200	A
Surge current capability	I^2_t	$t_p = 10\text{ ms}$ 50 Hz sine $T_j = 150\text{ °C}$	200	A ² s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	43	W
Maximum Junction Temperature	T_{jmax}		150	°C

Parameter	Symbol	Conditions	Value	Unit
Module Properties				
Thermal Properties				
Storage temperature	T_{stg}		-40...+125	°C
Operation Junction Temperature	T_{jop}		-40...+($T_{jmax} - 25$)	°C

Isolation Properties					
Isolation voltage	V_{isol}	DC voltage	$t_p=2s$	4000	V
Creepage distance				min 12,7	mm
Clearance				min 11,84	mm
Comparative Tracking Index	CTI			>200	



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datasheet

Characteristic Values

Inverter Switch

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{CE}$			0,00029	25 125	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		20	25 125 150	1,1	1,52 -	1,9	V
Collector-emitter cut-off current	I_{CES}		0	600		25 125			1,1	μA
Gate-emitter leakage current	I_{GES}		20	0		25 125			300	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f=1 MHz	0	25	25			1100		pF
Output capacitance	C_{oes}							71		
Reverse transfer capacitance	C_{res}							32		
Gate charge	Q_g		15	480	20	25		120		nC

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	Phase-Change Material $\lambda=3,4\text{W/mK}$						1,81		K/W
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IGBT Switching

Turn-on delay time	$t_{d(on)}$	$R_{goff} = 16 \Omega$ $R_{gon} = 16 \Omega$	±15	300	20	25 150		71 70		ns
Rise time	t_r					25 150		11 16		
Turn-off delay time	$t_{d(off)}$					25 150		122 143		
Fall time	t_f					25 150		91 111		
Turn-on energy (per pulse)	E_{on}	$Q_{rFWD} = 0,8 \mu\text{C}$ $Q_{rFWD} = 1,7 \mu\text{C}$				25 150		0,259 0,380		mWs
Turn-off energy (per pulse)	E_{off}					25 150		0,448 0,613		



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Inverter Diode

Parameter	Symbol	Conditions					Value			Unit
				V_r [V]	I_F [A]	T_j [°C]	Min	Typ	Max	

Static

Forward voltage	V_F				20	25 125 150		1,70 1,58 -	1,95	V
Reverse leakage current	I_r			600		25 150			27 -	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	Phase-Change Material $\lambda=3,4\text{W/mK}$						2,37		K/W
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FWD Switching

Peak recovery current	I_{RRM}	$di/dt = 2072 \text{ A/}\mu\text{s}$ $di/dt = 1922 \text{ A/}\mu\text{s}$	± 15	300	20	25 150		22 26		A
Reverse recovery time	t_{rr}					25 150		125 204		ns
Recovered charge	Q_r					25 150		0,809 1,713		μC
Reverse recovered energy	E_{rec}					25 150		0,171 0,373		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 150		2050 741		A/μs



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Brake Switch

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}$			0,00021	25 125	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		15	25 125 150	1,1	1,59 -	1,9	V
Collector-emitter cut-off current	I_{CES}		0	600		25 125			0,85	µA
Gate-emitter leakage current	I_{GES}		20	0		25 125			300	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f=1 MHz	0	25	25			860		pF
Output capacitance	C_{oes}							55		
Reverse transfer capacitance	C_{res}							24		
Gate charge	Q_g		15	480	15	25		87		nC

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	Phase-Change Material $\lambda=3,4W/mK$						2,03		K/W
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IGBT Switching

Turn-on delay time	$t_{d(on)}$	$R_{goff} = 16 \Omega$ $R_{gon} = 32 \Omega$	15/0	300	15	25 125		19 21		ns
Rise time	t_r					25 125		16 20		
Turn-off delay time	$t_{d(off)}$					25 125		186 202		
Fall time	t_f					25 125		89 94		
Turn-on energy (per pulse)	E_{on}	$Q_{rFWD} = 0,5 \mu C$ $Q_{rFWD} = 0 \mu C$				25 125		0,334 0,408		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,318 0,402		



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Brake Diode

Parameter	Symbol	Conditions					Value			Unit
				V_r [V]	I_F [A]	T_j [°C]	Min	Typ	Max	

Static

Forward voltage	V_F				10	25 150		1,60 1,56	1,95	V
Reverse leakage current	I_r			600		25 150			27 -	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	Phase-Change Material $\lambda=3,4\text{W/mK}$						2,79		K/W
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FWD Switching

Peak recovery current	I_{RRM}	$di/dt = 670\text{ A/}\mu\text{s}$ $di/dt = 0\text{ A/}\mu\text{s}$	15/0	300	15	25 125		8 9		A
Reverse recovery time	t_{rr}					25 125		198 276		ns
Recovered charge	Q_r					25 125		0,514 0,935		μC
Reverse recovered energy	E_{rec}					25 125		0,094 0,187		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125		411 78		A/μs



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Rectifier Diode

Parameter	Symbol	Conditions					Value			Unit
				V_F [V]	I_F [A]	T_j	Min	Typ	Max	

Static

Forward voltage	V_F				25	25°C 125°C 150°C		1,22 1,21 -	1,9	V
Reverse leakage current	I_R			1600		25°C 150°C			50 1100	μA

Thermal

Thermal resistance junction to case	$R_{th(j-c)}$	Phase-Change Material $\lambda=3,4\text{W/mK}$						1,61		K/W
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Thermistor

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	

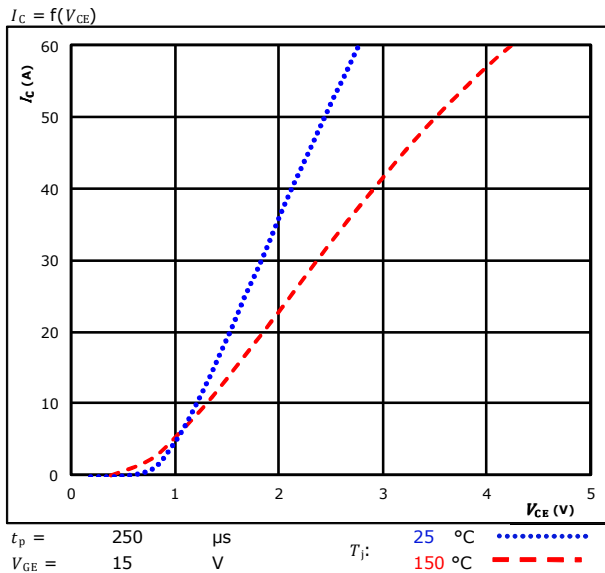
Rated resistance	R					25		22		kΩ
Deviation of R100	$\Delta_{R/R}$	R100=1486 Ω				100	-12		+12	%
Power dissipation	P					25		200		mW
Power dissipation constant						25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				25		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				25		3998		K
Vincotech NTC Reference									B	



Inverter Switch Characteristics

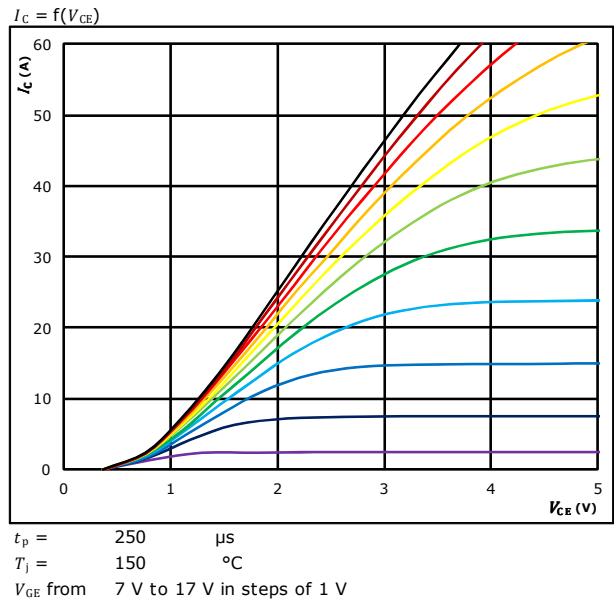
Typical output characteristics

IGBT



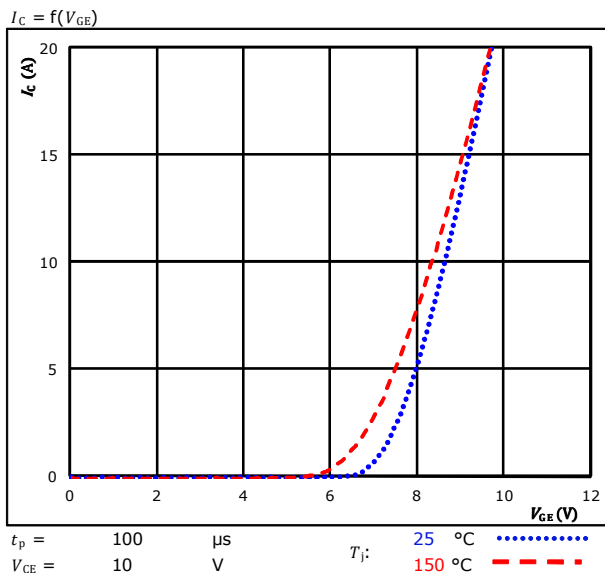
Typical output characteristics

IGBT



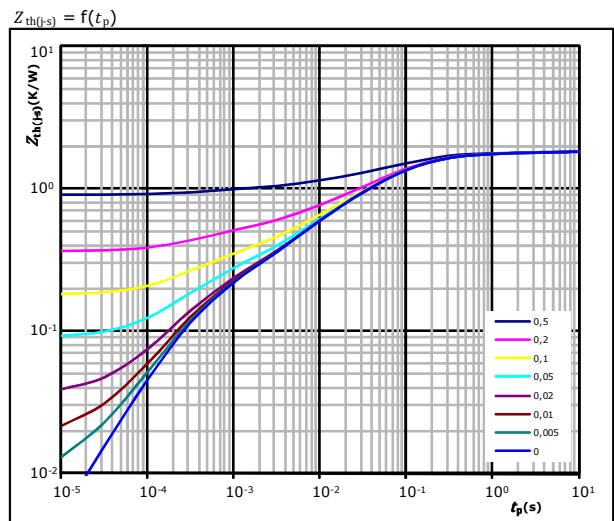
Typical transfer characteristics

IGBT



Transient Thermal Impedance as function of Pulse duration

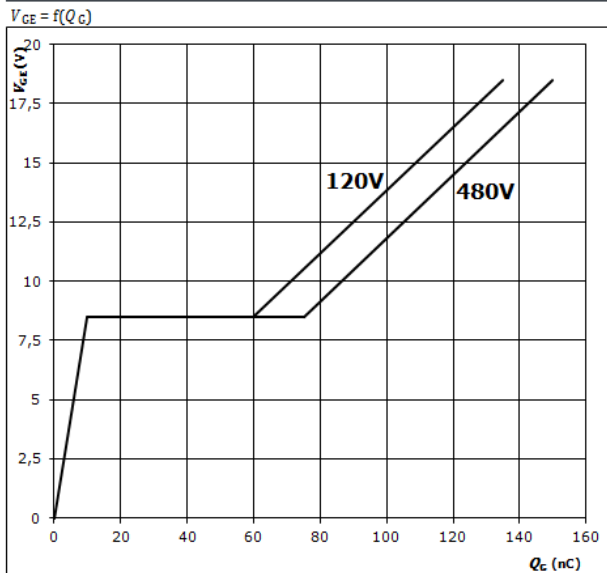
IGBT





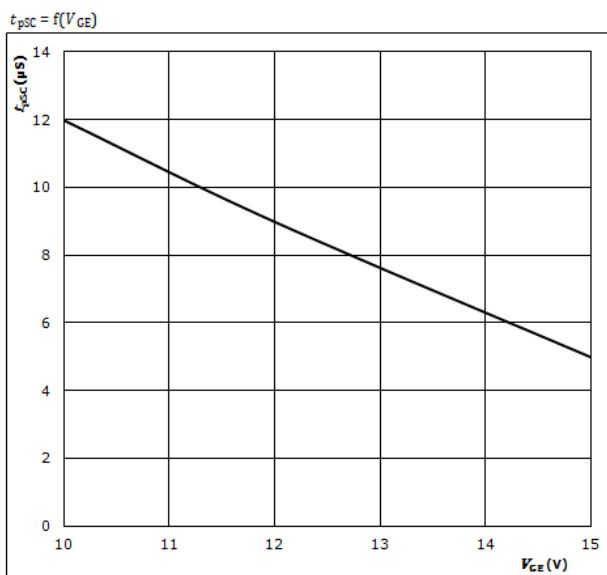
Inverter Switch Characteristics

Gate voltage vs Gate charge IGBT



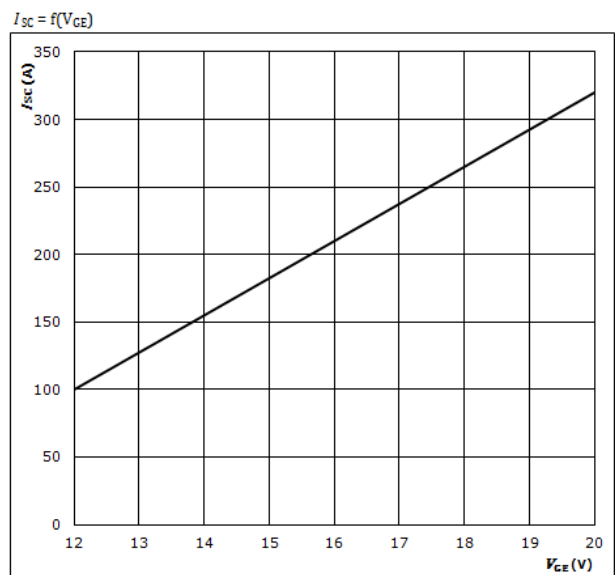
At
 $I_C = 20$ A

Short circuit duration as a function of V_{CE} IGBT



At
 $V_{CE} = 600$ V
 $T_j \leq 175$ °C

Typical short circuit current as a function of V_{CE} IGBT



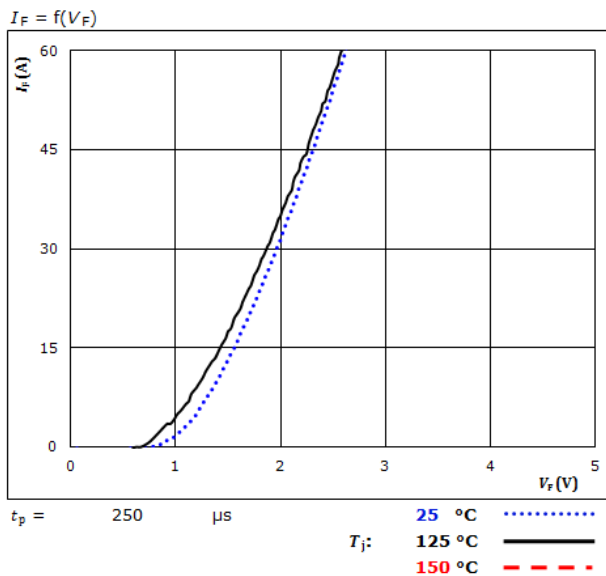
At
 $V_{CE} \leq 600$ V
 $T_j \leq 175$ °C



Inverter Diode Characteristics

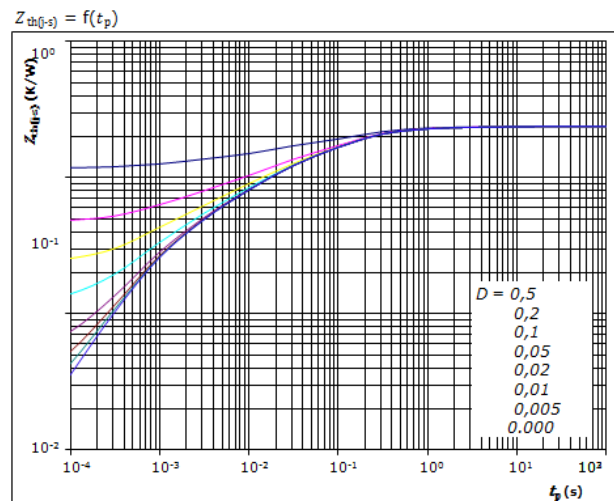
Typical forward characteristics

FWD



Transient thermal impedance as a function of pulse width

FWD



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

$$R_{th(j-s)} = 2,37 \text{ K/W}$$

FWD thermal model values

R (K/W)	τ (s)
4,62E-02	8,95E+00
1,39E-01	1,10E+00
6,93E-01	1,96E-01
5,75E-01	6,44E-02
6,19E-01	9,95E-03
2,95E-01	1,01E-03



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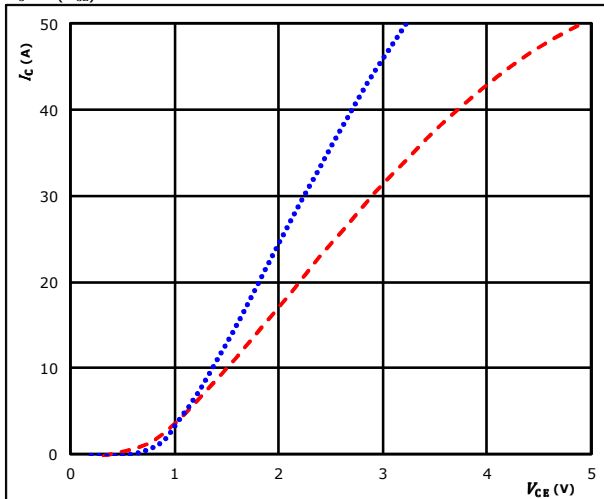
datasheet

Brake Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

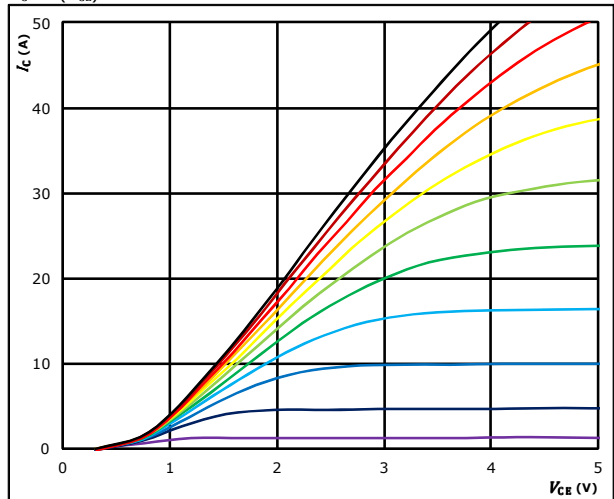


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j: 25 \text{ } ^\circ C$ (blue dotted line)
 $150 \text{ } ^\circ C$ (red dashed line)

figure 2. IGBT

Typical output characteristics

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

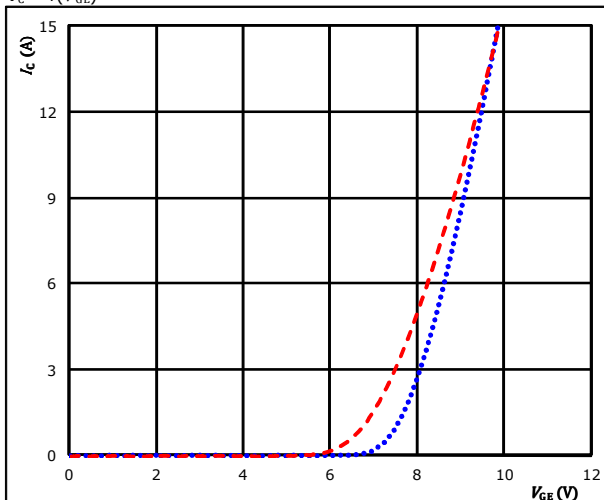


$t_p = 250 \mu s$
 $T_j = 150 \text{ } ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

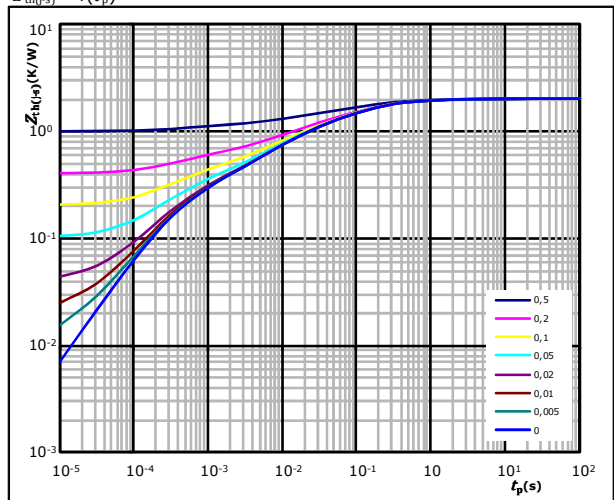


$t_p = 100 \mu s$
 $V_{CE} = 10 V$
 $T_j: 25 \text{ } ^\circ C$ (blue dotted line)
 $150 \text{ } ^\circ C$ (red dashed line)

figure 4. IGBT

Transient Thermal Impedance as function of Pulse duration

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



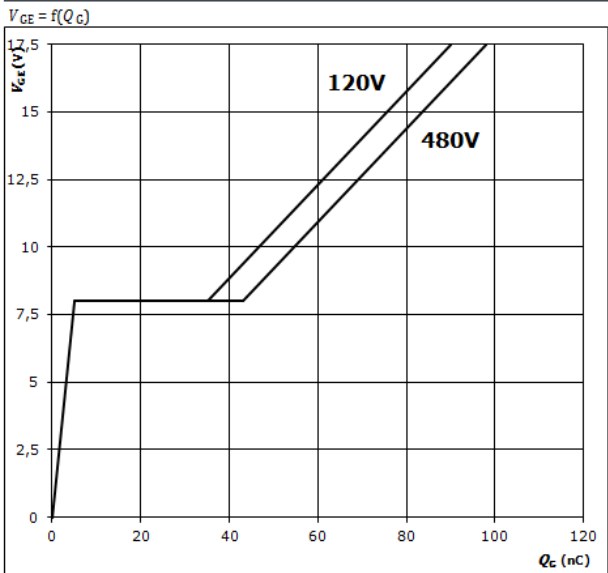
$D = t_p / T$
 $R_{th(j-s)} = 2,03 \text{ K/W}$
 IGBT thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
3,94E-02	6,65E+00
2,08E-01	7,06E-01
7,57E-01	1,14E-01
5,53E-01	1,86E-02
2,62E-01	3,35E-03
2,07E-01	3,46E-04



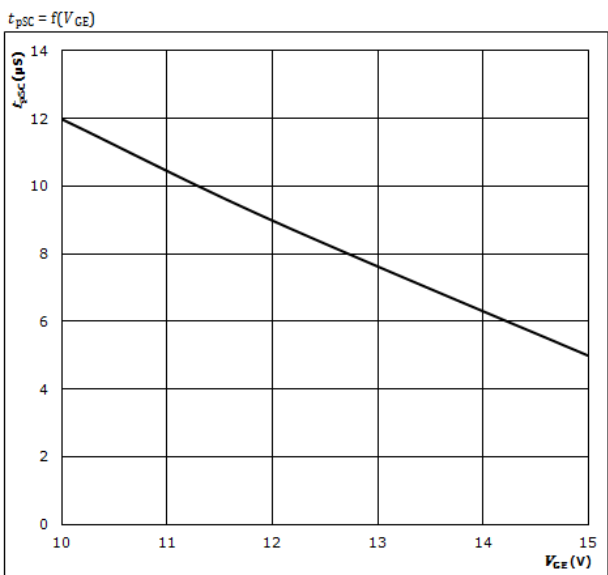
Brake Switch Characteristics

Gate voltage vs Gate charge IGBT



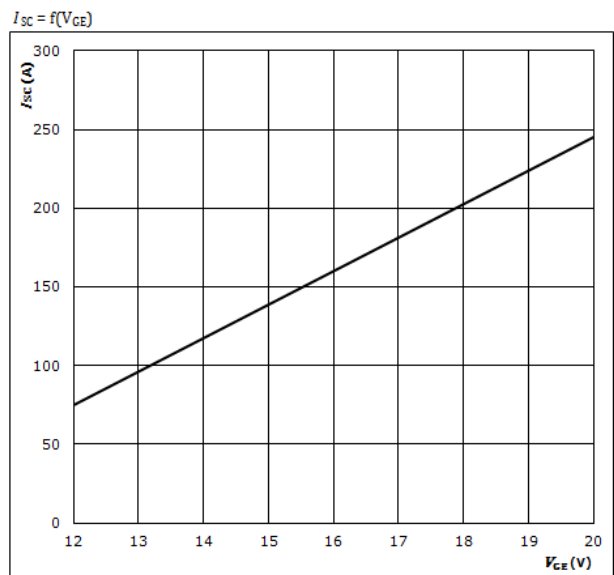
At
 $I_C = 15$ A

Short circuit duration as a function of V_{CE} IGBT



At
 $V_{CE} = 600$ V
 $T_j \leq 175$ °C

Typical short circuit current as a function of V_{CE} IGBT

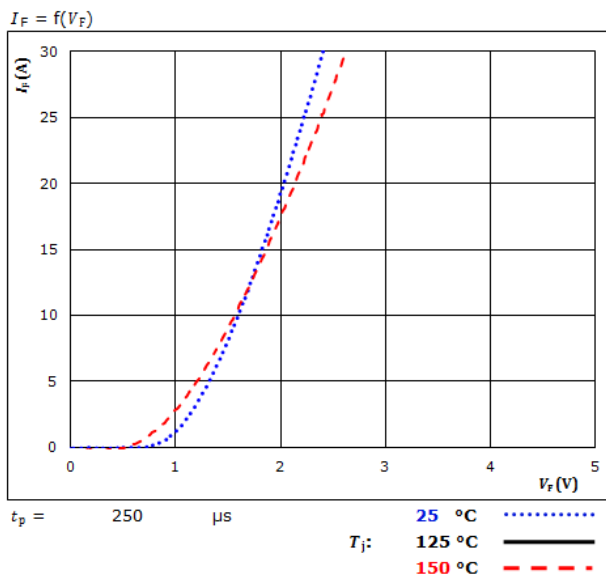


At
 $V_{CE} \leq 600$ V
 $T_j \leq 175$ °C

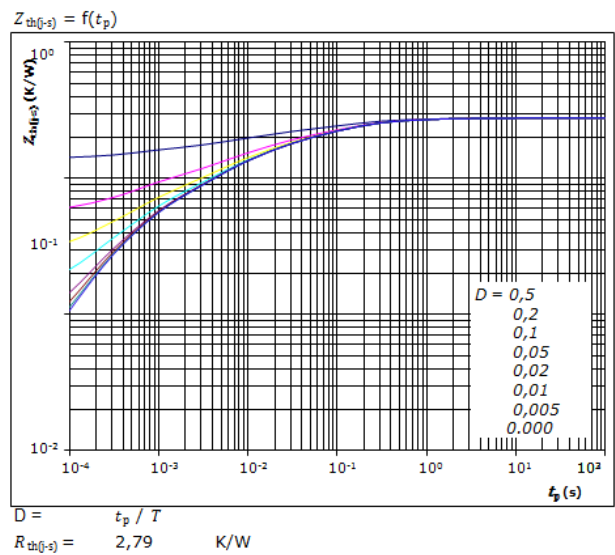


Brake Diode Characteristics

Typical forward characteristics FWD



Transient thermal impedance as a function of pulse width FWD



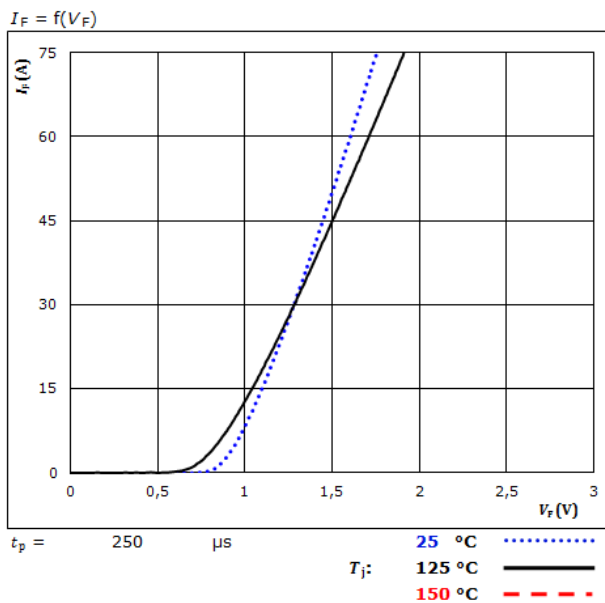
FWD thermal model values

R (K/W)	τ (s)
3,61E-02	8,54E+00
2,58E-01	5,80E-01
8,01E-01	1,03E-01
7,36E-01	1,63E-02
5,56E-01	3,27E-03
3,99E-01	4,24E-04

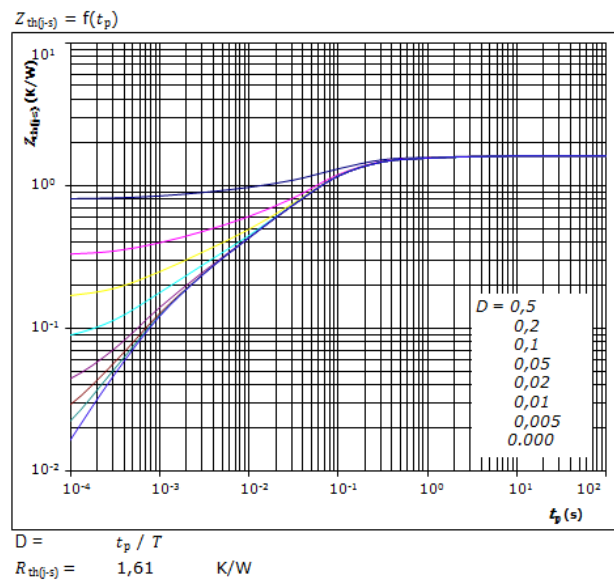


Rectifier Diode Characteristics

Typical forward characteristics Rectifier Diode



Transient thermal impedance as a function of pulse width Rectifier Diode



Diode thermal model values

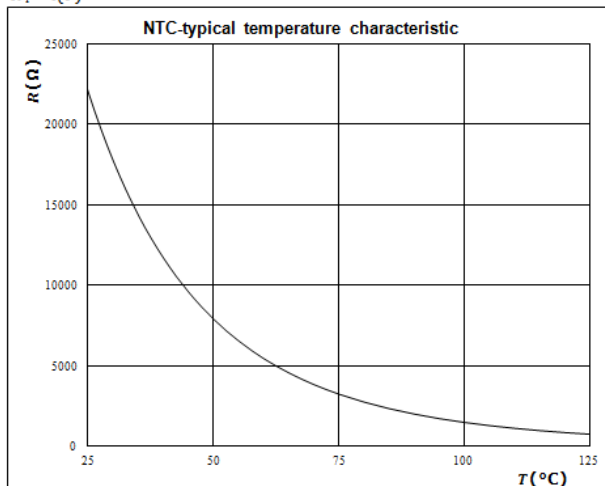
R (K/W)	τ (s)
6,72E-02	2,72E+00
1,48E-01	4,14E-01
8,68E-01	8,33E-02
2,53E-01	2,89E-02
1,69E-01	5,15E-03
1,06E-01	9,10E-04

Thermistor Characteristics

Thermistor typical temperature characteristic

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$





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Inverter Switching Characteristics

Figure 1. IGBT

Typical switching energy losses as a function of collector current

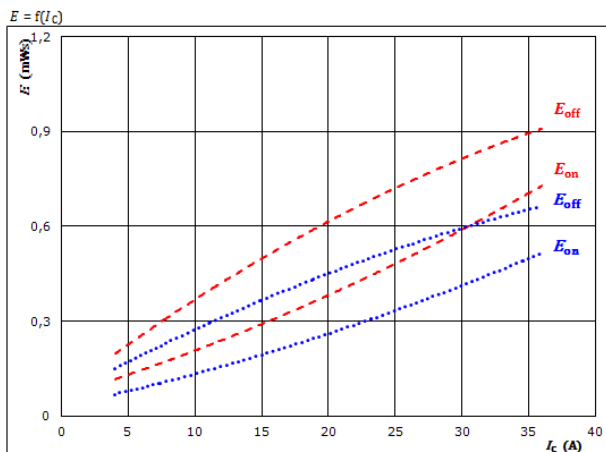


Figure 2. IGBT

Typical switching energy losses as a function of gate resistor

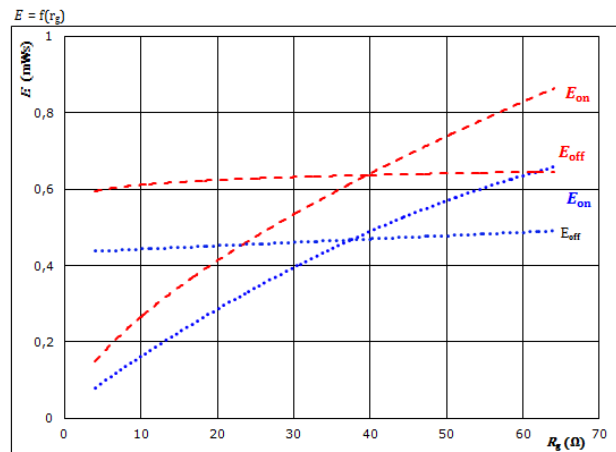


Figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

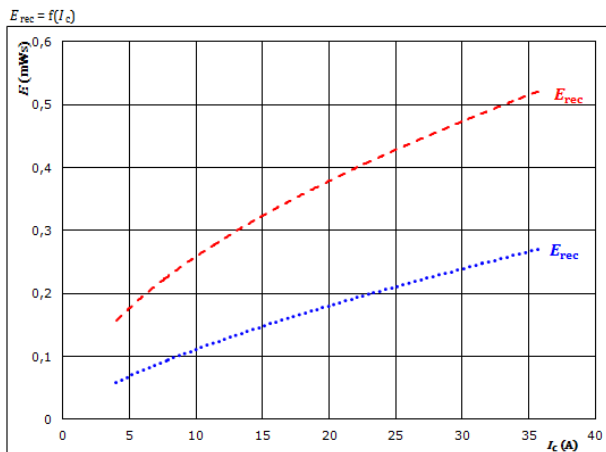
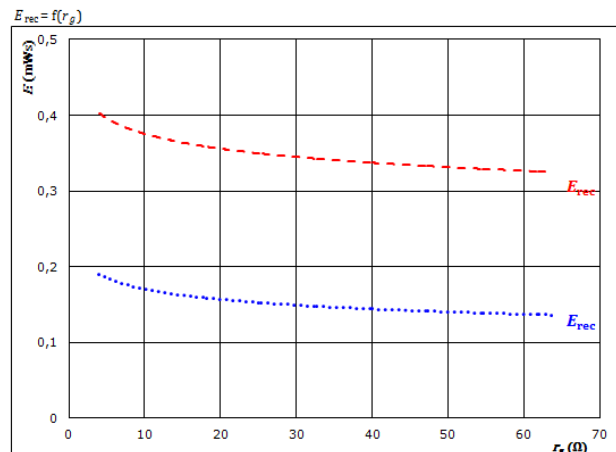


Figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor





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Inverter Switching Characteristics

Figure 5. IGBT

Typical switching times as a function of collector current

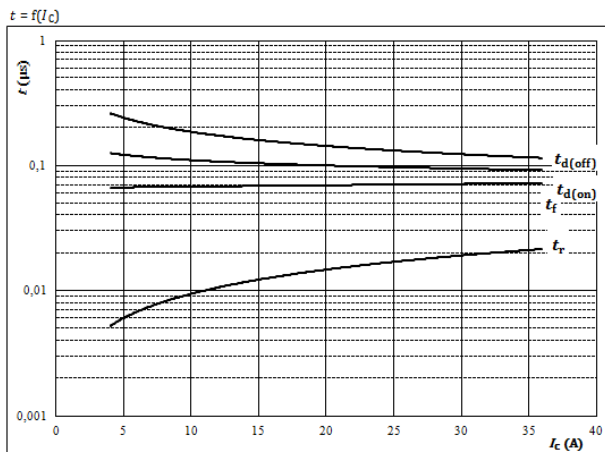


Figure 6. IGBT

Typical switching times as a function of gate resistor

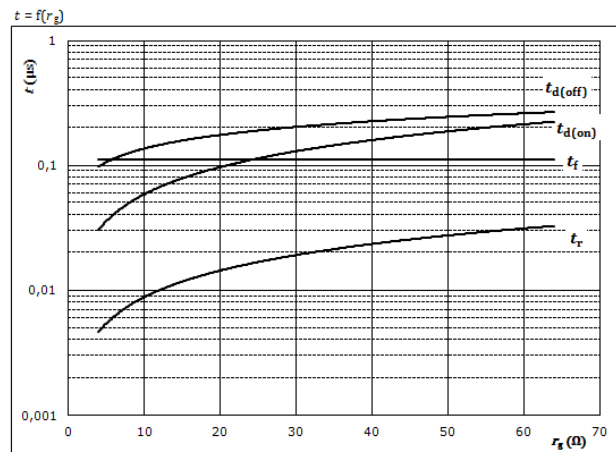


Figure 7. FWD

Typical reverse recovery time as a function of collector current

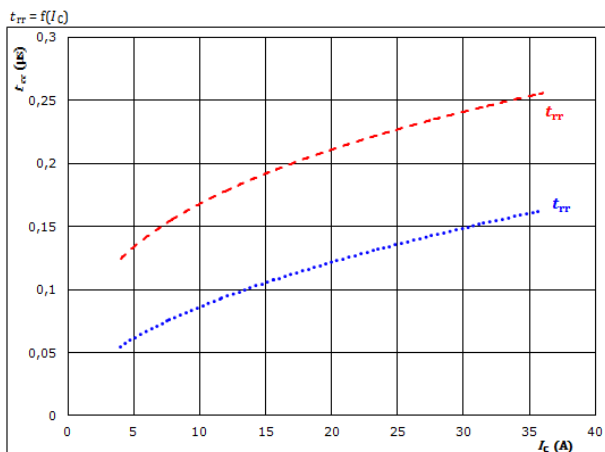
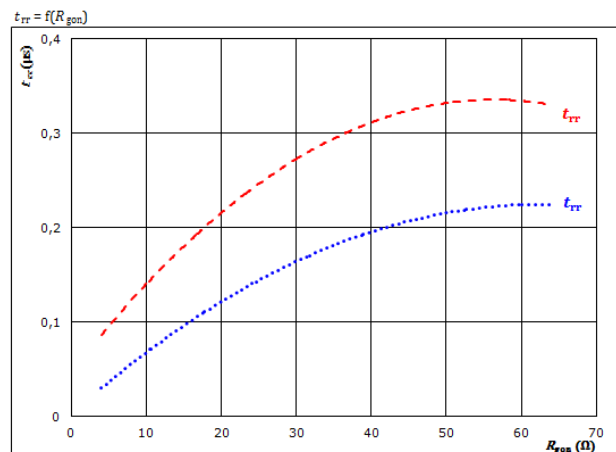


Figure 8. FWD

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





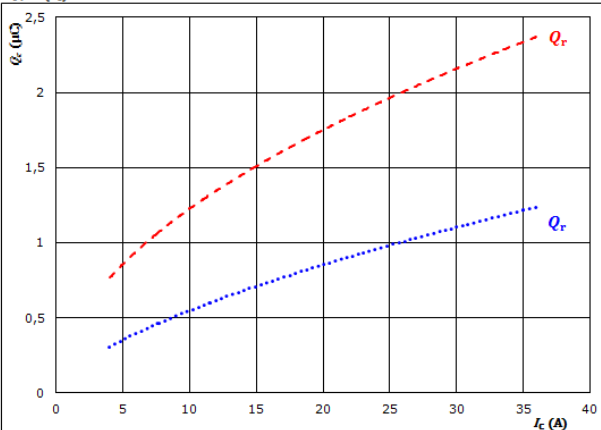
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Inverter Switching Characteristics

Figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_C)$$

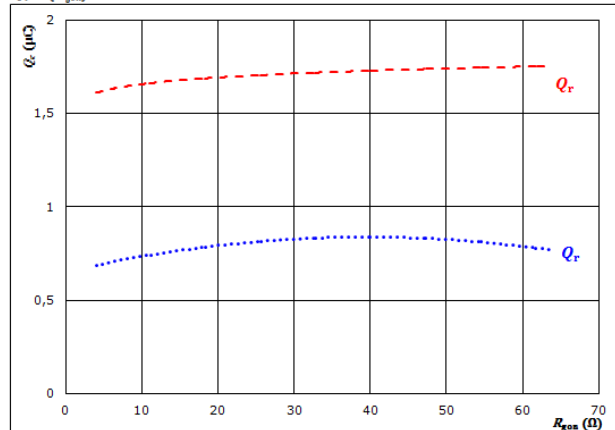


At $V_{CE} = 300$ V
 $V_{CE} = \pm 15$ V
 $R_{gon} = 16$ Ω
 T_j : 25 °C
 125 °C ———
 150 °C - - - - -

Figure 10. FWD

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

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

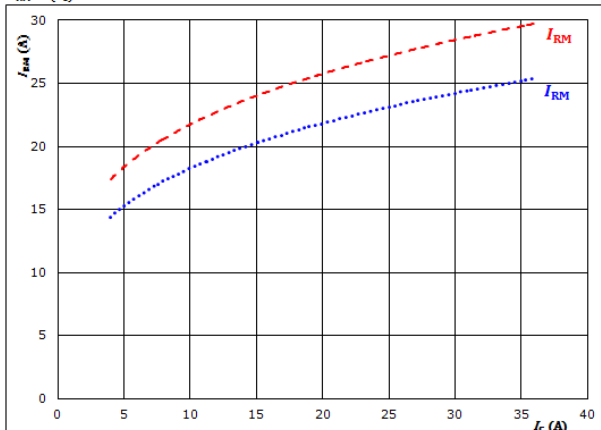


At $V_{CE} = 300$ V
 $V_{CE} = \pm 15$ V
 $I_C = 20$ A
 T_j : 25 °C
 125 °C ———
 150 °C - - - - -

Figure 11. FWD

Typical peak reverse recovery current as a function of collector current

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

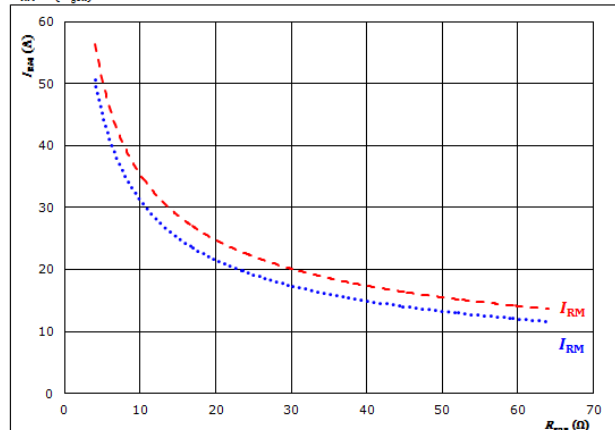


At $V_{CE} = 300$ V
 $V_{CE} = \pm 15$ V
 $R_{gon} = 16$ Ω
 T_j : 25 °C
 125 °C ———
 150 °C - - - - -

Figure 12. FWD

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

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



At $V_{CE} = 300$ V
 $V_{CE} = \pm 15$ V
 $I_C = 20$ A
 T_j : 25 °C
 125 °C ———
 150 °C - - - - -



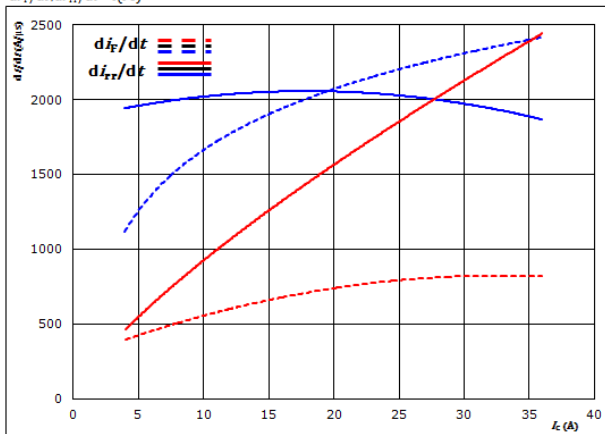
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Inverter Switching Characteristics

Figure 13. FWD

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

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

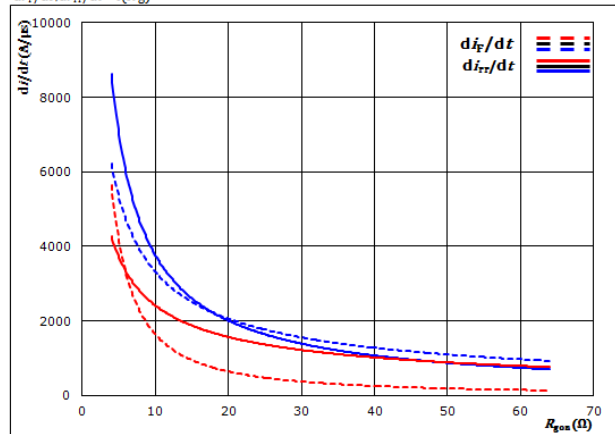


At $V_{CE} = 300$ V
 $V_{CE} = \pm 15$ V
 $R_{gon} = 16$ Ω
 $T_J: 25$ °C
 125 °C
 150 °C

Figure 14. FWD

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

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

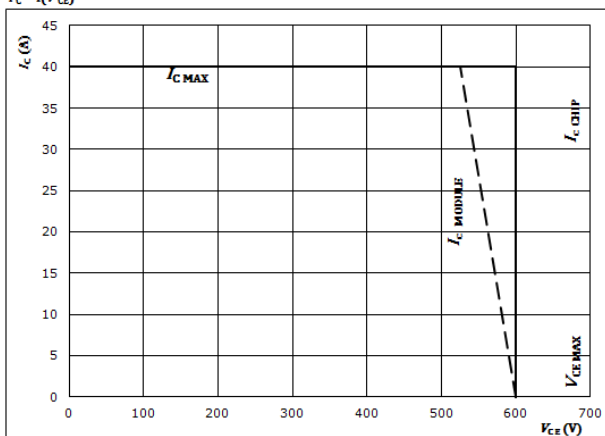


At $V_{CE} = 300$ V
 $V_{CE} = \pm 15$ V
 $I_C = 20$ A
 $T_J: 25$ °C
 125 °C
 150 °C

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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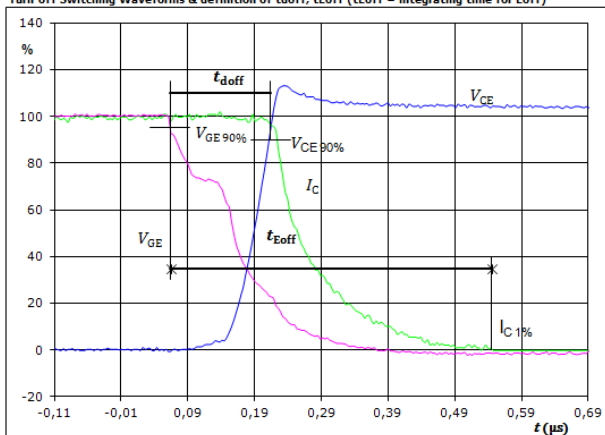
Inverter Switching Characteristics

General conditions

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

Figure 1. IGBT

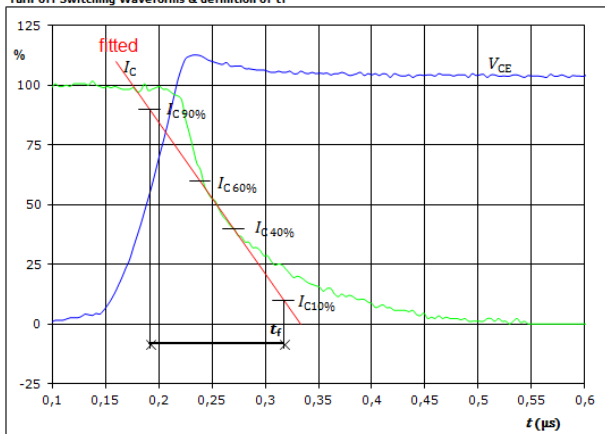
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{CE}(0\%)$	=	-15	V
$V_{GE}(100\%)$	=	15	V
$V_C(100\%)$	=	300	V
$I_C(100\%)$	=	20	A
t_{doff}	=	0,143	μs
t_{Eoff}	=	0,482	μs

Figure 3. IGBT

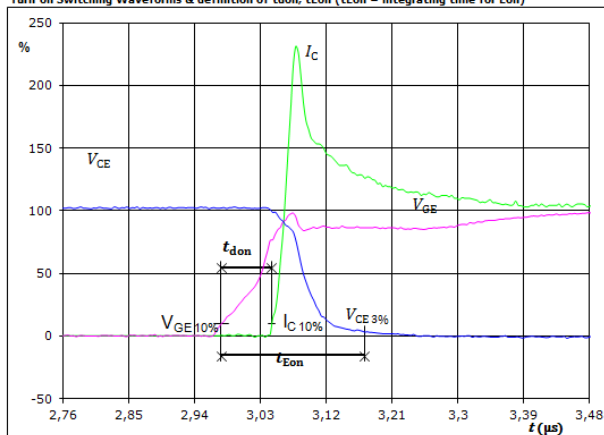
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$	=	300	V
$I_C(100\%)$	=	20	A
t_f	=	0,110	μs

Figure 2. IGBT

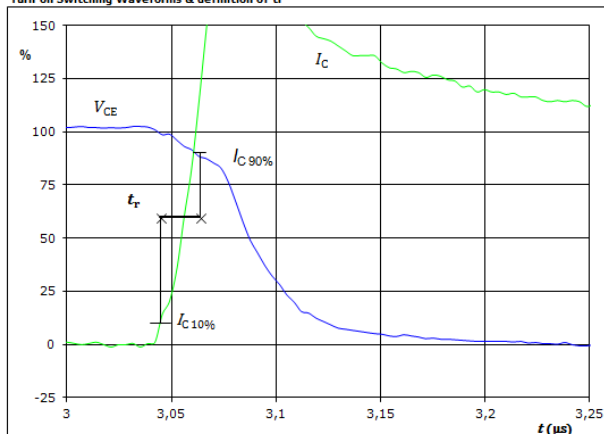
Turn-on Switching Waveforms & definition of t_{don} , t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{CE}(0\%)$	=	-15	V
$V_{GE}(100\%)$	=	15	V
$V_C(100\%)$	=	300	V
$I_C(100\%)$	=	20	A
t_{don}	=	0,070	μs
t_{Eon}	=	0,196	μs

Figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r



$V_C(100\%)$	=	300	V
$I_C(100\%)$	=	20	A
t_r	=	0,016	μs



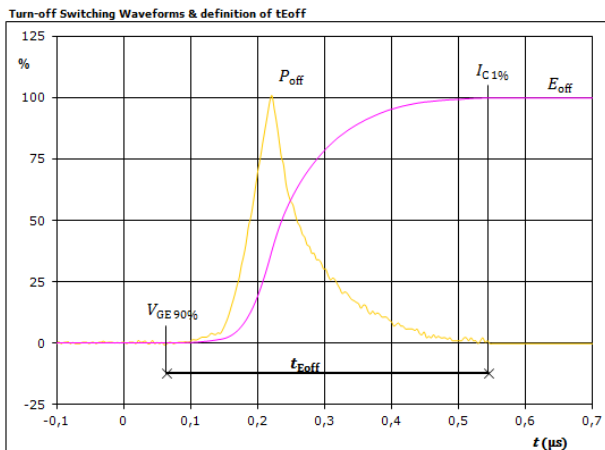
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datasheet

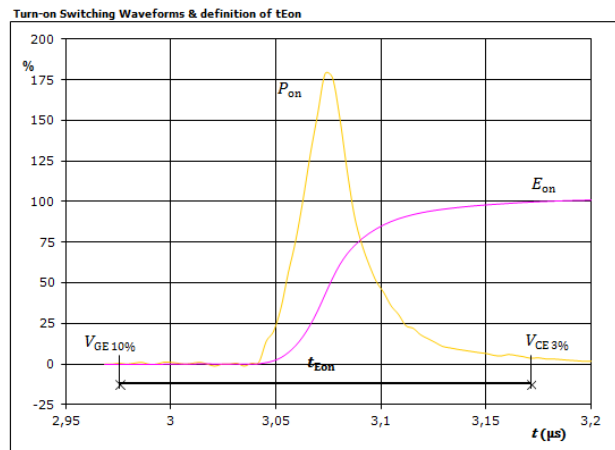
Inverter Switching Characteristics

Figure 5. IGBT



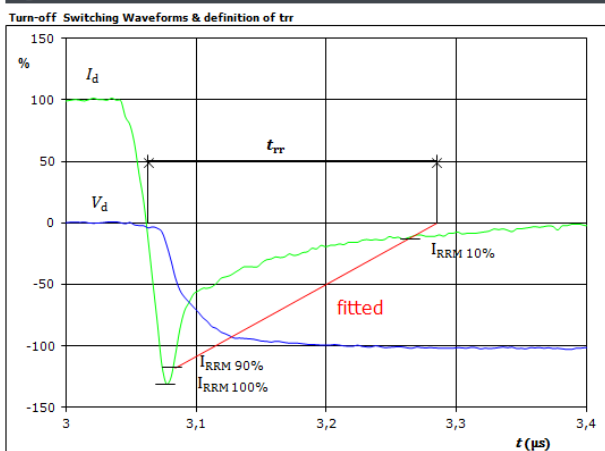
$P_{\text{off}}(100\%) =$	5,98	kW
$E_{\text{off}}(100\%) =$	0,61	mJ
$t_{\text{Eoff}} =$	0,48	μs

Figure 6. IGBT



$P_{\text{on}}(100\%) =$	5,98	kW
$E_{\text{on}}(100\%) =$	0,38	mJ
$t_{\text{Eon}} =$	0,20	μs

Figure 7. FWD



$V_{\text{d}}(100\%) =$	300	V
$I_{\text{d}}(100\%) =$	20	A
$I_{\text{RRM}}(100\%) =$	-26	A
$t_{\text{rr}} =$	0,204	μs

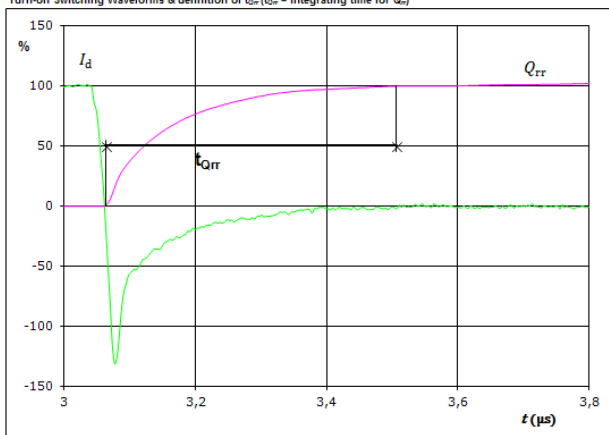


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Inverter Switching Characteristics

Figure 8. FWD

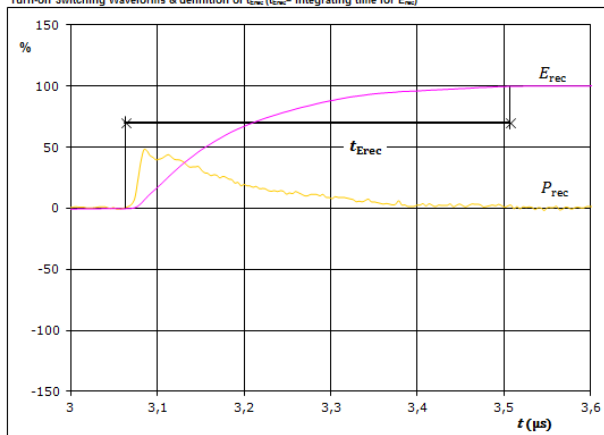
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



$I_d(100\%) = 20$ A
 $Q_{rr}(100\%) = 1,71$ μC
 $t_{Qrr} = 0,44$ μs

Figure 9. FWD

Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec} = integrating time for E_{rec})



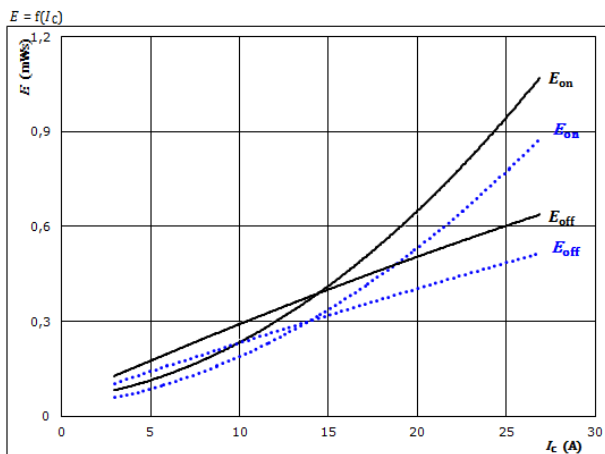
$P_{rec}(100\%) = 5,98$ kW
 $E_{rec}(100\%) = 0,37$ mJ
 $t_{Erec} = 0,44$ μs



Brake Switching Characteristics

Figure 1. IGBT

Typical switching energy losses as a function of collector current



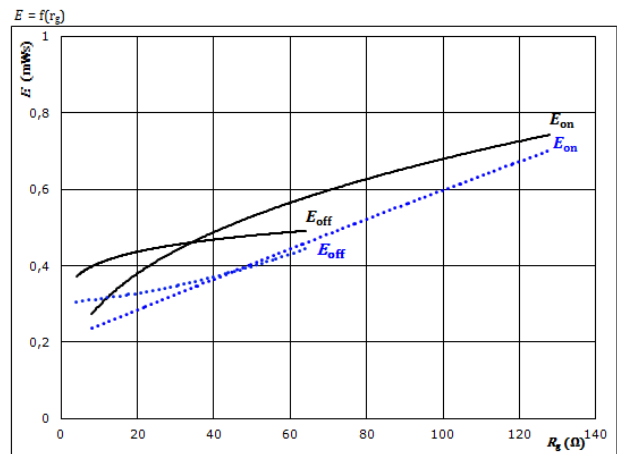
With an inductive load at

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

T_j : 25 °C
125 °C ———
150 °C - - - -

Figure 2. IGBT

Typical switching energy losses as a function of gate resistor



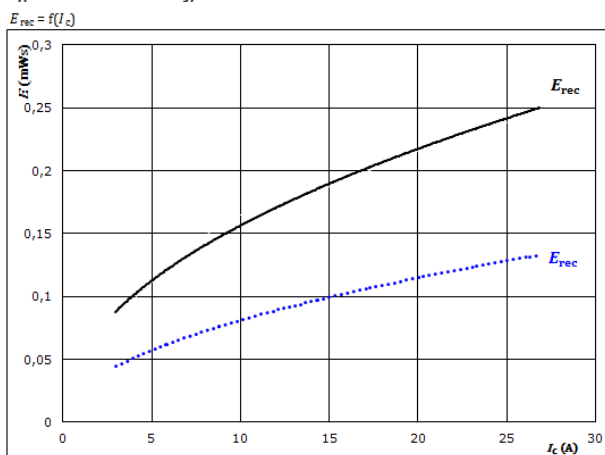
With an inductive load at

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

T_j : 25 °C
125 °C ———
150 °C - - - -

Figure 3. FWD

Typical reverse recovered energy loss as a function of collector current



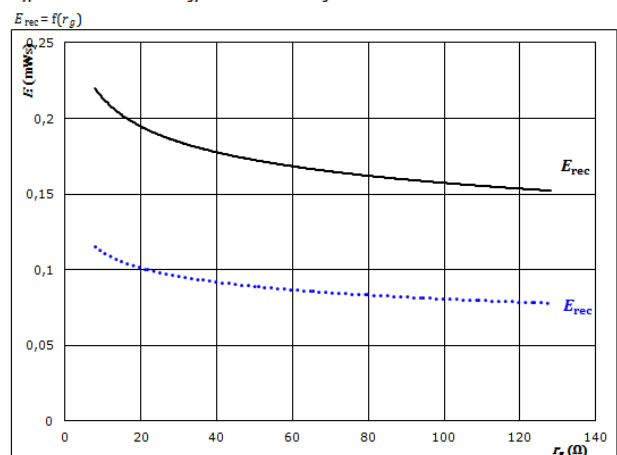
With an inductive load at

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

T_j : 25 °C
125 °C ———
150 °C - - - -

Figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor



With an inductive load at

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

T_j : 25 °C
125 °C ———
150 °C - - - -

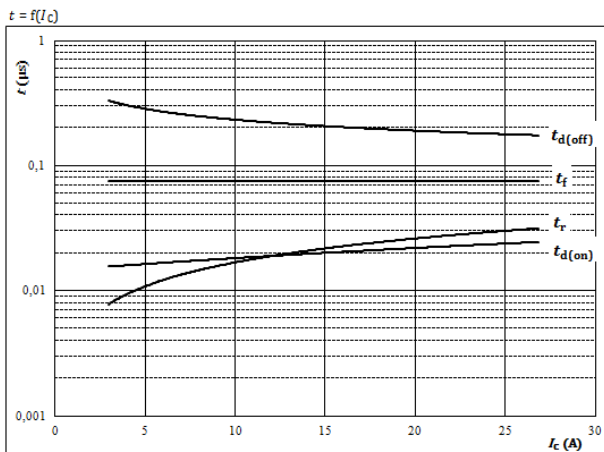


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Brake Switching Characteristics

Figure 5. IGBT

Typical switching times as a function of collector current

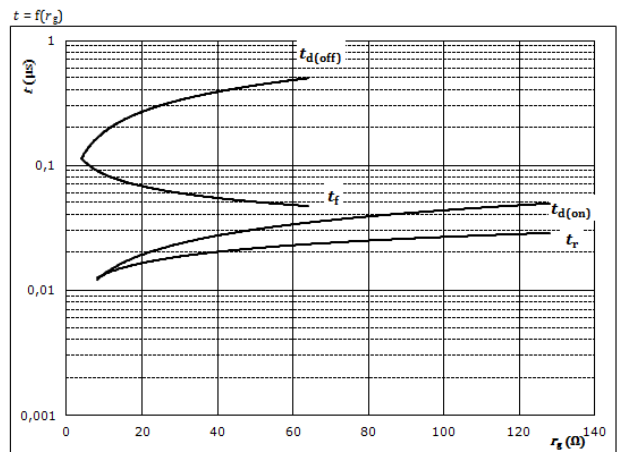


With an inductive load at

$T_J =$	125	°C
$V_{CE} =$	300	V
$V_{GE} =$	15/0	V
$R_{gon} =$	32	Ω
$R_{goff} =$	16	Ω

Figure 6. IGBT

Typical switching times as a function of gate resistor

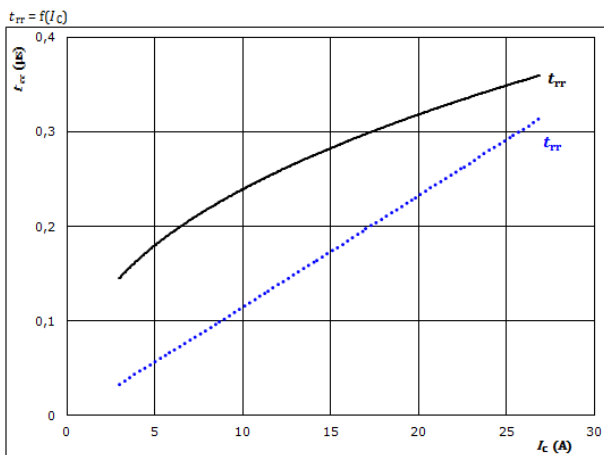


With an inductive load at

$T_J =$	125	°C
$V_{CE} =$	300	V
$V_{GE} =$	15/0	V
$I_C =$	15	A

Figure 7. FWD

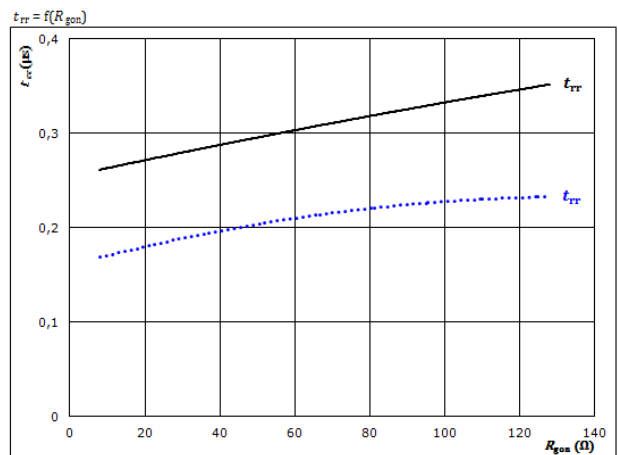
Typical reverse recovery time as a function of collector current



At	$V_{CE} =$	300	V	$T_J:$	25 °C	
	$V_{GE} =$	15/0	V		125 °C	——
	$R_{gon} =$	32	Ω		150 °C	---

Figure 8. FWD

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



At	$V_{CE} =$	300	V	$T_J:$	25 °C	
	$V_{GE} =$	15/0	V		125 °C	——
	$I_C =$	15	A		150 °C	---

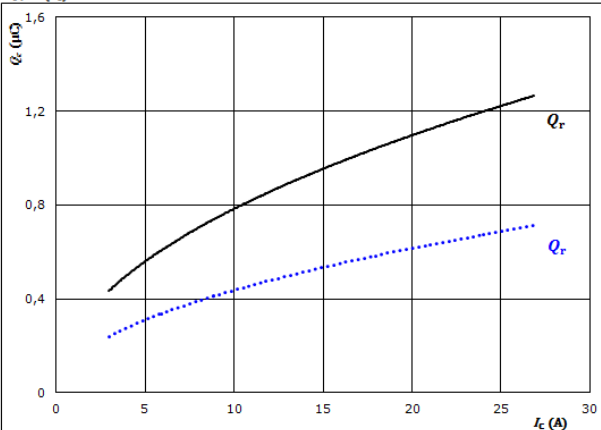


Brake Switching Characteristics

Figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

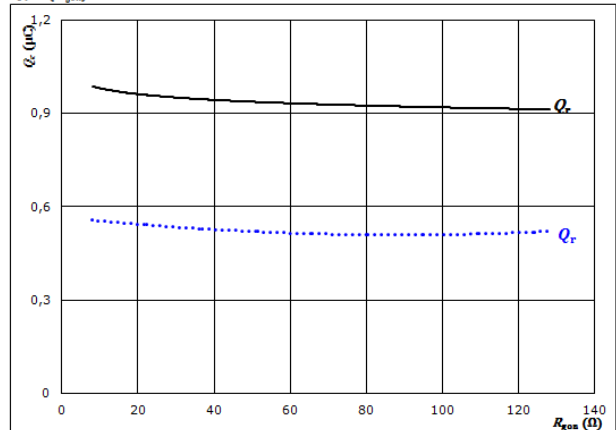


At $V_{CE} = 300$ V
 $V_{CE} = 15/0$ V
 $R_{gon} = 32$ Ω
 T_j : 25 °C (dotted blue line)
 125 °C (solid black line)
 150 °C (dashed red line)

Figure 10. FWD

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

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

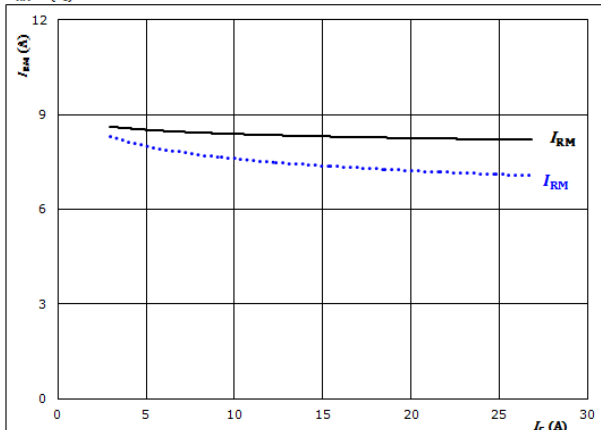


At $V_{CE} = 300$ V
 $V_{CE} = 15/0$ V
 $I_c = 15$ A
 T_j : 25 °C (dotted blue line)
 125 °C (solid black line)
 150 °C (dashed red line)

Figure 11. FWD

Typical peak reverse recovery current as a function of collector current

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

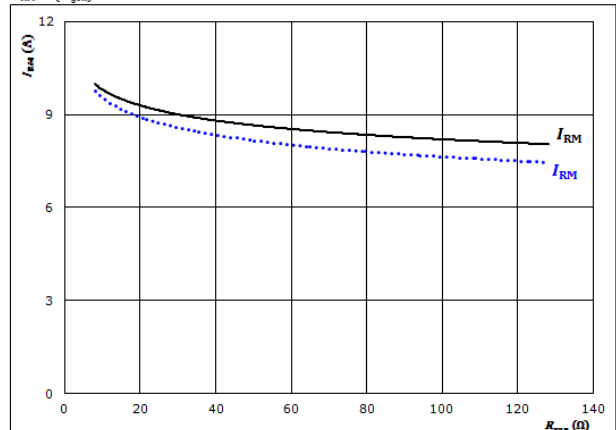


At $V_{CE} = 300$ V
 $V_{CE} = 15/0$ V
 $R_{gon} = 32$ Ω
 T_j : 25 °C (dotted blue line)
 125 °C (solid black line)
 150 °C (dashed red line)

Figure 12. FWD

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

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



At $V_{CE} = 300$ V
 $V_{CE} = 15/0$ V
 $I_c = 15$ A
 T_j : 25 °C (dotted blue line)
 125 °C (solid black line)
 150 °C (dashed red line)

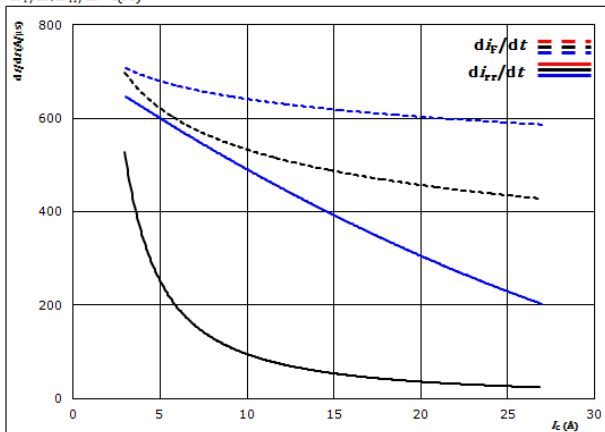


Brake Switching Characteristics

Figure 13. FWD

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

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

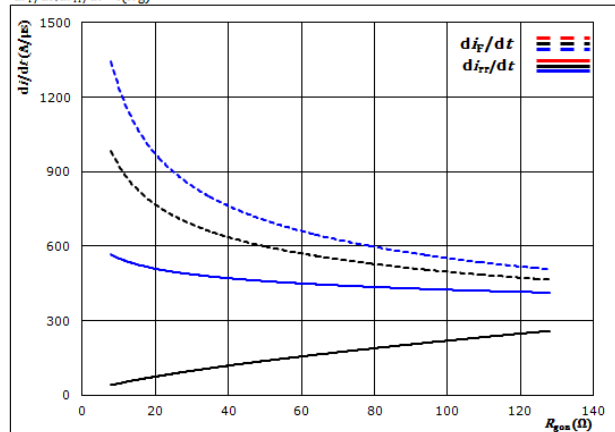


At $V_{CE} = 300$ V
 $V_{CE} = 15/0$ V
 $R_{gon} = 32$ Ω
 T_J : 25 °C (dotted blue)
 125 °C (solid black)
 150 °C (dashed red)

Figure 14. FWD

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

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

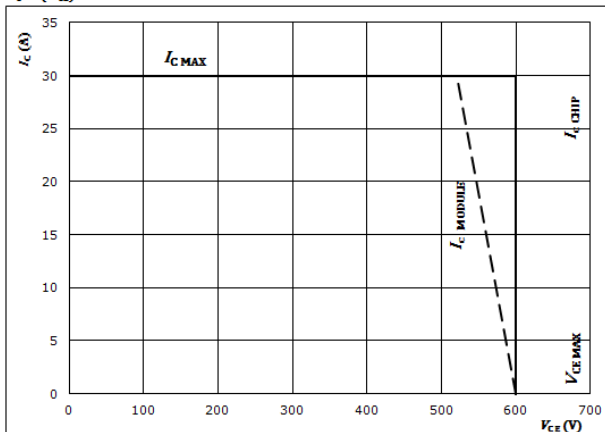


At $V_{CE} = 300$ V
 $V_{CE} = 15/0$ V
 $I_C = 15$ A

Figure 15. IGBT

Reverse bias safe operating area

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



At $T_J = 175$ °C
 $R_{gon} = 32$ Ω
 $R_{goff} = 16$ Ω



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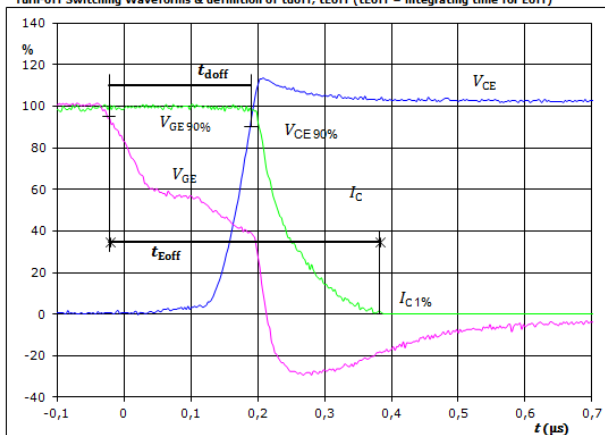
Brake Switching Characteristics

General conditions

T_j	=	125 °C
R_{gon}	=	32 Ω
R_{goff}	=	16 Ω

Figure 1. IGBT

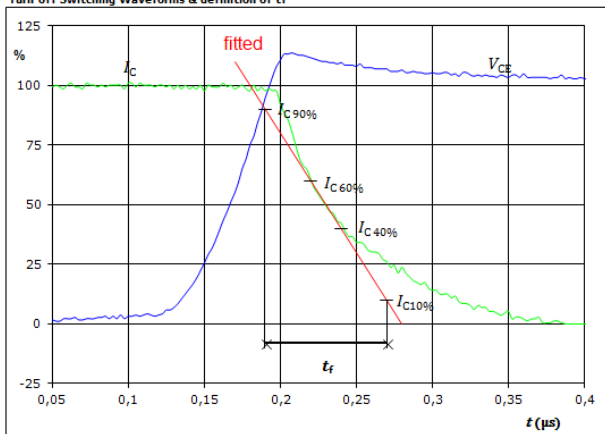
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{CE}(0\%) =$	0	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	300	V
$I_C(100\%) =$	15	A
$t_{doff} =$	0,203	μs
$t_{Eoff} =$	0,405	μs

Figure 3. IGBT

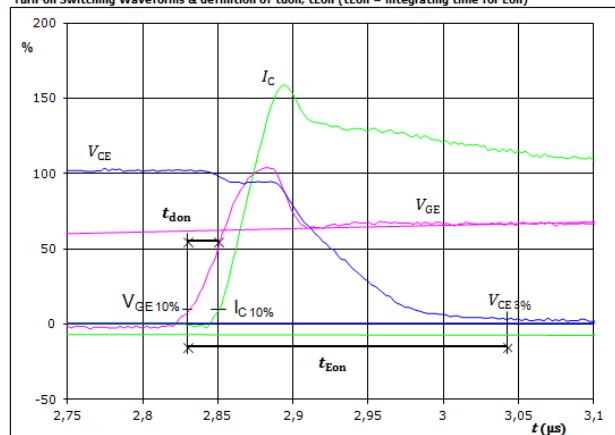
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%) =$	300	V
$I_C(100\%) =$	15	A
$t_f =$	0,091	μs

Figure 2. IGBT

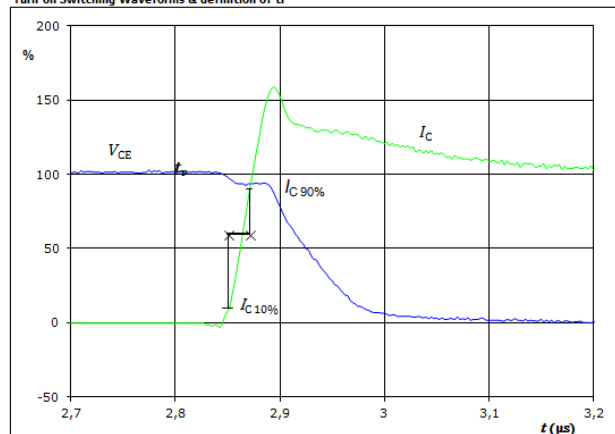
Turn-on Switching Waveforms & definition of t_{don} , t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{CE}(0\%) =$	0	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	300	V
$I_C(100\%) =$	15	A
$t_{don} =$	0,020	μs
$t_{Eon} =$	0,213	μs

Figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r



$V_C(100\%) =$	300	V
$I_C(100\%) =$	15	A
$t_r =$	0,021	μs



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Brake Switching Characteristics

Figure 5. IGBT

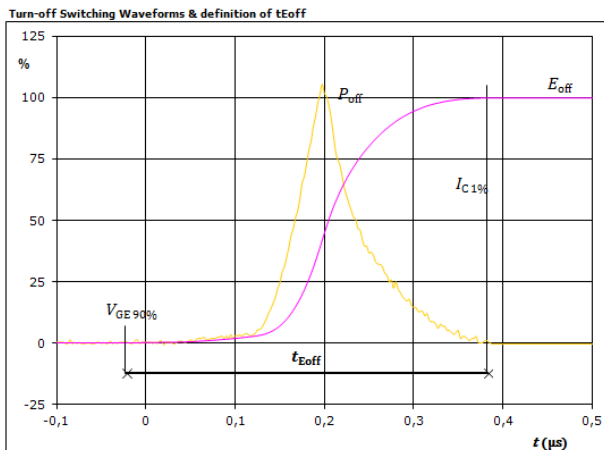


Figure 6. IGBT

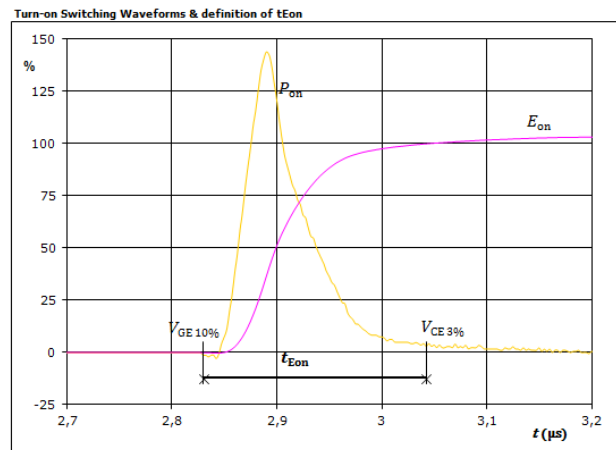
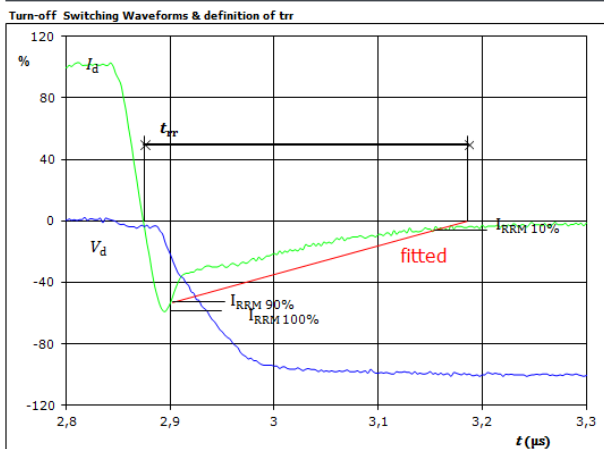


Figure 7. FWD



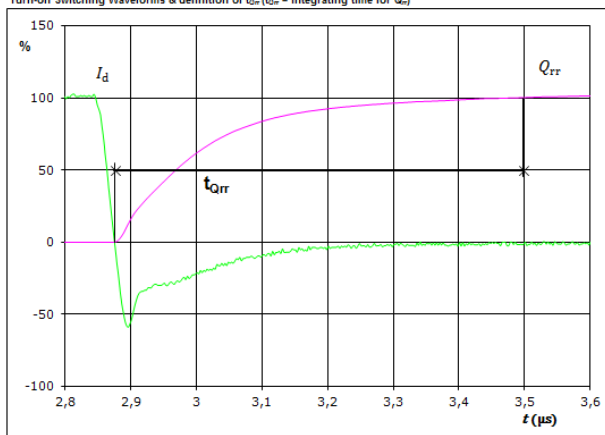


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Brake Switching Characteristics

Figure 8. FWD

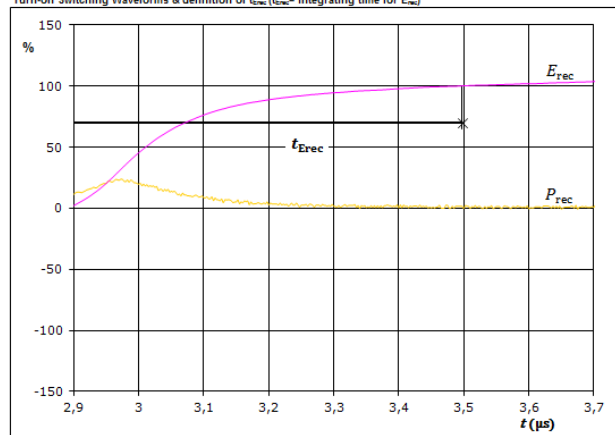
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



$I_d(100\%) = 15$ A
 $Q_{rr}(100\%) = 0,96$ μ C
 $t_{Qrr} = 0,62$ μ s

Figure 9. FWD

Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec} = integrating time for E_{rec})



$P_{rec}(100\%) = 4,49$ kW
 $E_{rec}(100\%) = 0,20$ mJ
 $t_{Erec} = 0,62$ μ s

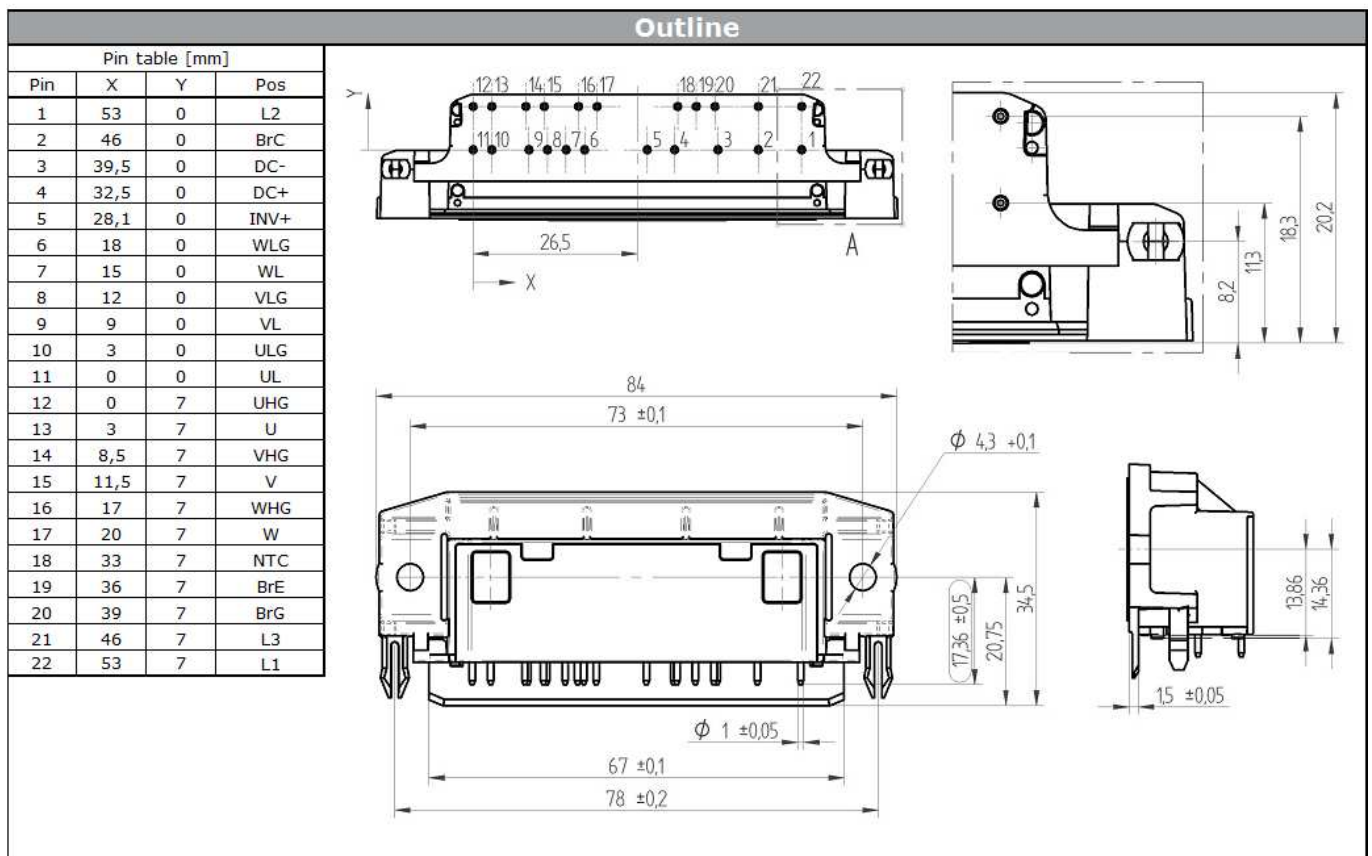


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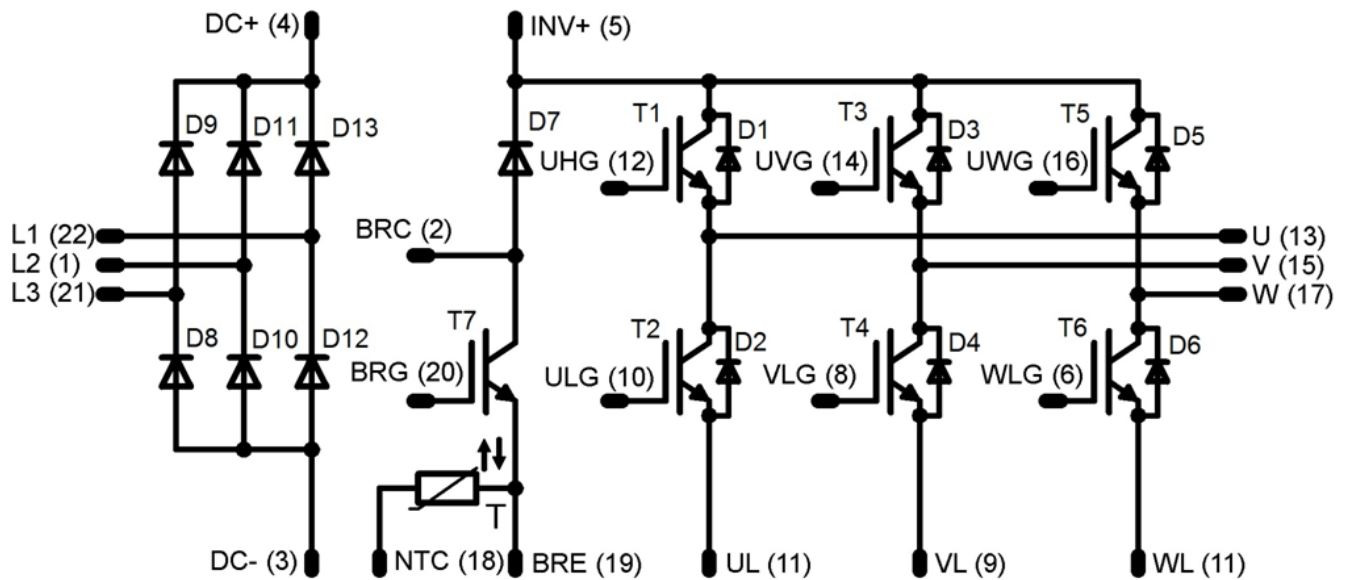
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Ordering Code & Marking							
Version	Ordering Code			in DataMatrix as		in packaging barcode as	
without thermal paste with solder pins	V23990-P634-A-PM			P634-A		P634-A	
with thermal paste with solder pins	V23990-P634-A-/3/-PM			P634-A		P634-A-/3/	
 Vinco WWYY TTTTTTTTTUL LLLLL SSSS	Text	Vinco	Date code	Type	UL	Lot number	Serial
		Vinco	WWYY	TTTTTTTT	UL	LLLLL	SSSS
	Datamatrix	Type	Lot number	Serial	Date code		
		TTTTTTTT	LLLLL	SSSS	WWYY		





Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1,T2,T3,T4,T5,T6	IGBT	600V	20A	Inverter switch	
D1,D2,D3,D4,D5,D6	FWD	600V	20A	Inverter Diode	
T7	IGBT	600V	15A	Brake switch	
D7	FWD	600V	10A	Brake Diode	
D8,D9,D10, D11,D12,D13	Diode	1600V	18A	Rectifier	
T	NTC			Thermistor	



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Packaging instruction			
Standard packaging quantity (SPQ)	80	>SPQ	Standard <SPQ Sample
Handling instruction			
Handling instructions for <i>flow</i> 90 1 packages see vincotech.com website.			

Document No.:	Date:	Modification:	Pages
V23990-P634-A-D5-14	15 Nov. 2017		

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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.