



Vincotech

MiniSKiiP® PIM 3		1200 V / 150 A
Features		MiniSkiip® 3 housing
<ul style="list-style-type: none">IGBT M7 with low V_{CEsat} and improved EMC behaviorKelvin Emitter for improved switching performanceSolder-free spring contact technologyBuilt-in PTC		
Target applications		Schematic
<ul style="list-style-type: none">Industrial Drives		
Types		
<ul style="list-style-type: none">80-M312PMA150M7-K420A80		

Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
Rectifier Diode				
Peak repetitive reverse voltage	V_{RRM}		1600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	85	A
Surge (non-repetitive) forward current	I_{FSM}	$50\text{ Hz Single Half Sine Wave}$ $t_p = 10\text{ ms}$	890	A
Surge current capability	I^2t	$T_j = 150^\circ\text{C}$	3960	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	119	W
Maximum junction temperature	T_{jmax}		150	$^\circ\text{C}$



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Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	159	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	317	W
Gate-emitter voltage	V_{GES}		± 20	V
Maximum junction temperature	T_{jmax}		175	$^\circ\text{C}$
Inverter Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	115	A
Repetitive peak forward current	I_{FRM}		300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	194	W
Maximum junction temperature	T_{jmax}		175	$^\circ\text{C}$
Brake Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	159	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	317	W
Gate-emitter voltage	V_{GES}		± 20	V
Maximum junction temperature	T_{jmax}		175	$^\circ\text{C}$
Brake Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	83	A
Repetitive peak forward current	I_{FRM}		200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^\circ\text{C}$	149	W
Maximum junction temperature	T_{jmax}		175	$^\circ\text{C}$



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Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
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Module Properties

Thermal Properties

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

Isolation Properties

Isolation voltage	V_{isol}	DC Test Voltage* $t_p = 2 \text{ s}$	5500	V
		AC Voltage $t_p = 1 \text{ min}$	2500	V
Creepage distance		With std lid For more informations see handling instructions	6,3	mm
Clearance		With std lid For more informations see handling instructions	6,3	mm
Comparative Tracking Index	CTI		> 200	

*100 % tested in production



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Characteristic Values

Parameter	Symbol	Conditions						Value			Unit
			V_{GE} [V]	V_{CE} [V]	I_c [A]	I_D [A]	T_1 [°C]	Min	Typ	Max	
			V_{GS} [V]	V_{DS} [V]	I_F [A]	I_F [A]					

Rectifier Diode

Static

Forward voltage	V_F				60	25 125		1,04 0,97	1,5	V
Reverse leakage current	I_R			1600		25 150			100 2000	µA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 2,5 \text{ W/mK}$ (HPTP)						0,59		K/W
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Characteristic Values

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

Inverter Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,015	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CESat}		15		150	25 125 150		1,57 1,80 1,86	1,85	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			100	µA
Gate-emitter leakage current	I_{GES}		20	0		25			500	nA
Internal gate resistance	r_g							3		Ω
Input capacitance	C_{ies}							30000		pF
Output capacitance	C_{oes}		0	10		25		880		
Reverse transfer capacitance	C_{res}							320		
Gate charge	Q_g		15	600	150	25		1000		nC

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 2,5 \text{ W/mK}$ (HPTP)						0,30		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 4 \Omega$ $R_{goff} = 4 \Omega$	± 15	600	150	25		416		ns
Rise time	t_r					125		431		
Turn-off delay time	$t_{d(off)}$					150		433		
Fall time	t_f	$Q_{rFWD} = 14,7 \mu\text{C}$ $Q_{rFWD} = 22,6 \mu\text{C}$ $Q_{rFWD} = 25,6 \mu\text{C}$	± 15	600	150	25		95		mWs
Turn-on energy (per pulse)	E_{on}					125		110		
Turn-off energy (per pulse)	E_{off}					150		114		
						25		300		
						125		340		
						150		346		
						25		79		
						125		90		
						150		96		
						25		21,132		
						125		27,106		
						150		28,881		
						25		9,810		
						125		13,007		
						150		14,016		



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Characteristic Values

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

Inverter Diode

Static

Forward voltage	V_F				150	25 125 150		1,80 1,90 1,90	2,1	V
Reverse leakage current	I_R			1200		25			40	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 2,5 \text{ W/mK}$ (HPTP)						0,49		K/W
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Dynamic

Peak recovery current	I_{RRM}	$di/dt = 1573 \text{ A}/\mu\text{s}$ $di/dt = 980 \text{ A}/\mu\text{s}$ $di/dt = 1114 \text{ A}/\mu\text{s}$	± 15	600	150	25		63		A
Reverse recovery time	t_{rr}					125		72		
Recovered charge	Q_r					150		74		
Reverse recovered energy	E_{rec}					25		409		ns
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					125		553		



80-M312PMA150M7-K420A80

datasheet

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Characteristic Values

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

Brake Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,015	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CESat}		15		150	25 125 150		1,57 1,80 1,86	1,85	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			100	µA
Gate-emitter leakage current	I_{GES}		20	0		25			500	nA
Internal gate resistance	r_g							3		Ω
Input capacitance	C_{ies}						30000			pF
Output capacitance	C_{oes}		0	10		25		880		
Reverse transfer capacitance	C_{res}							320		
Gate charge	Q_g		15	600	150	25		1000		nC

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 2,5 \text{ W/mK}$ (HPTP)						0,30		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 2 \Omega$ $R_{goff} = 2 \Omega$	0 / 15	700	147	25		159		ns
Rise time	t_r					125		161		
						150		161		
Turn-off delay time	$t_{d(off)}$					25		86		
Fall time	t_f					125		96		
						150		96		
Turn-on energy (per pulse)	E_{on}	$Q_{fwd} = 12,3 \mu\text{C}$ $Q_{fwd} = 18,2 \mu\text{C}$ $Q_{fwd} = 20,2 \mu\text{C}$				25		487		
						125		542		
						150		562		
Turn-off energy (per pulse)	E_{off}					25		64		
						125		84		
						150		83		
						25		22,714		
						125		27,831		
						150		28,847		
						25		11,106		
						125		14,536		
						150		15,138		



80-M312PMA150M7-K420A80

datasheet

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Characteristic Values

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

Brake Diode

Static

Forward voltage	V_F				100	25 125 150		1,82 1,96 1,97	2,1	V
Reverse leakage current	I_R			1200		25			40	µA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 2,5 \text{ W/mK}$ (HPTP)						0,64		K/W
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Dynamic

Peak recovery current	I_{RRM}	$di/dt = 856 \text{ A/}\mu\text{s}$ $di/dt = 844 \text{ A/}\mu\text{s}$ $di/dt = 827 \text{ A/}\mu\text{s}$	0 / 15	700	147	25		53		A
Reverse recovery time	t_{rr}					125		61		
Recovered charge	Q_r					150		65		
Reverse recovered energy	E_{rec}					25		363		ns
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					125		486		

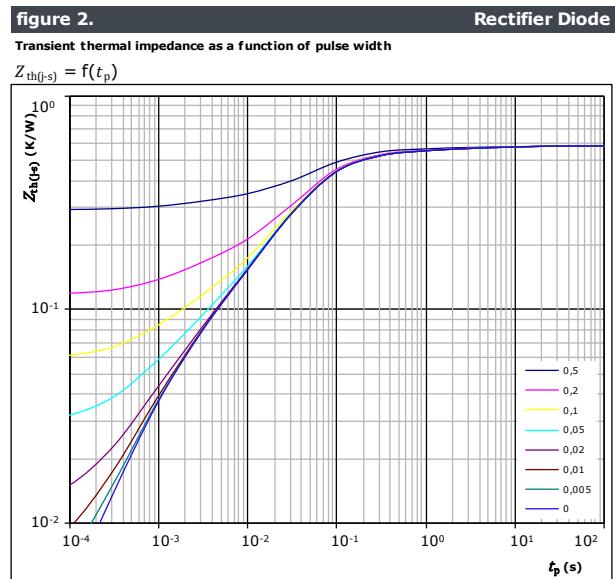
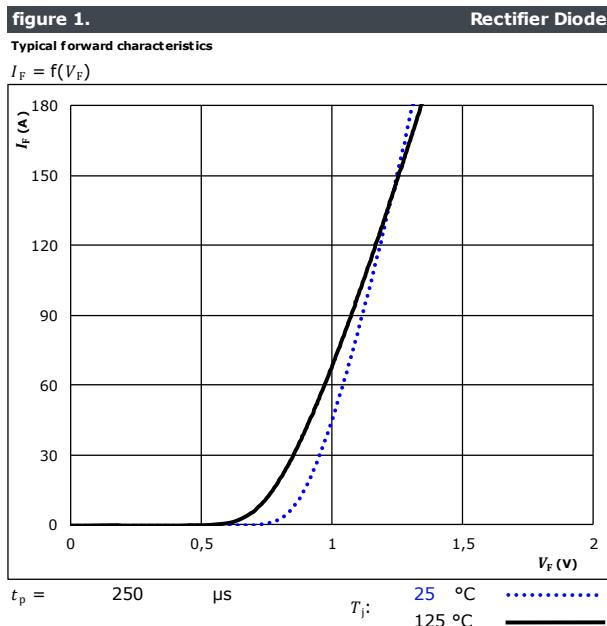
Thermistor

Rated resistance	R					25		1		$k\Omega$
Deviation of R_{100}	$\Delta_{R/R}$	$R_{100} = 1670 \Omega$				100	-2		+2	%
R_{100}	R					100		1670		Ω
Power dissipation constant						25		0,76		mW/K
A-value	$A_{(25/50)}$					25		$7,635 \cdot 10^{-3}$		$1/K$
B-value	$B_{(25/100)}$					25		$1,731 \cdot 10^{-5}$		$1/K^2$
Vincotech PTC Reference									E	



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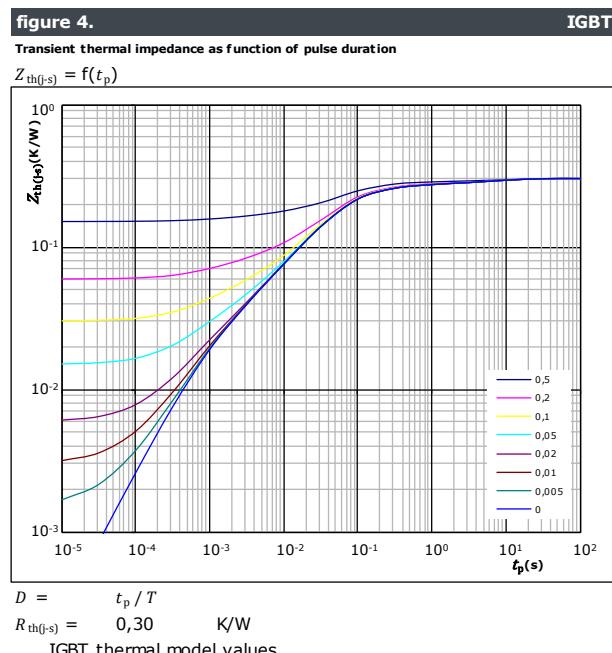
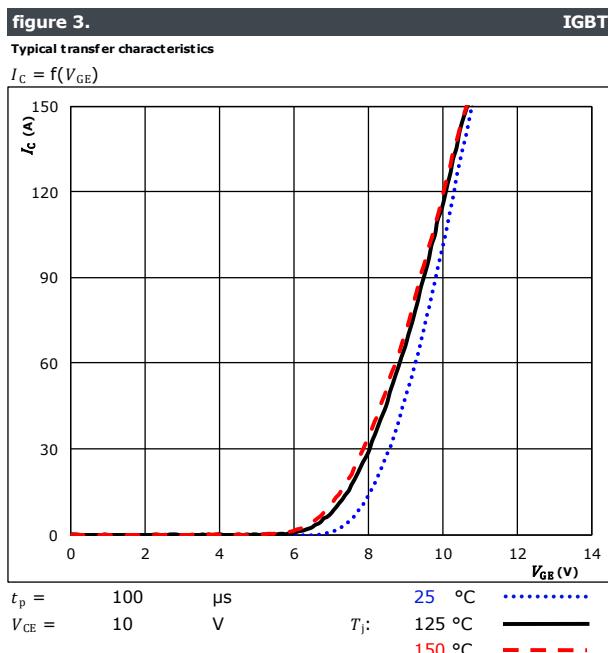
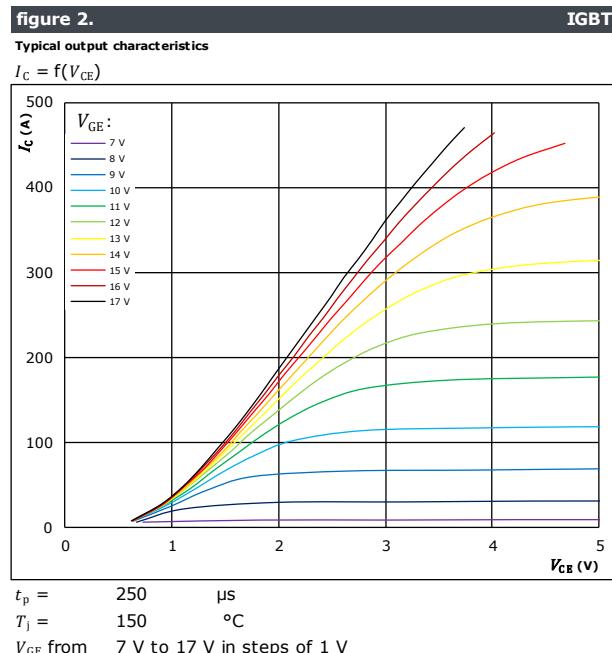
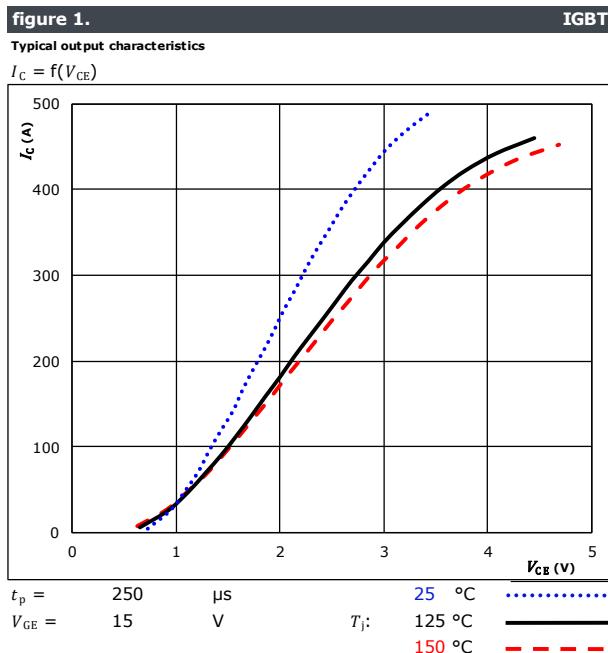
Rectifier Diode Characteristics





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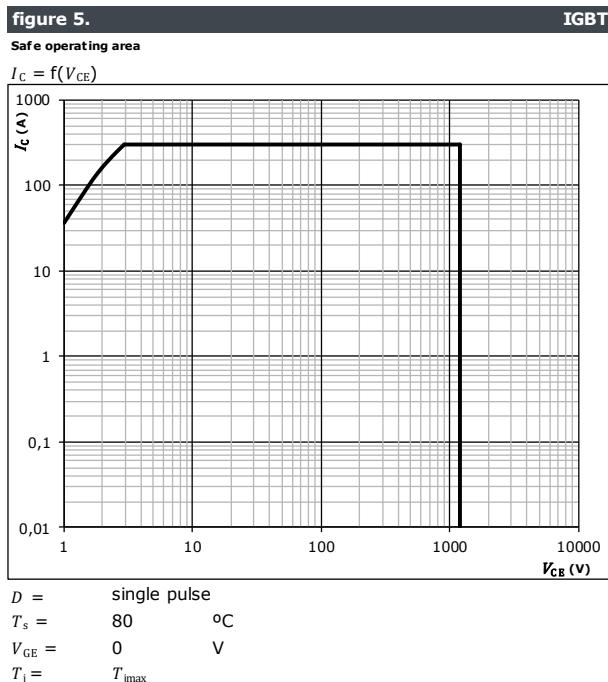
Inverter Switch Characteristics





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Inverter Switch Characteristics





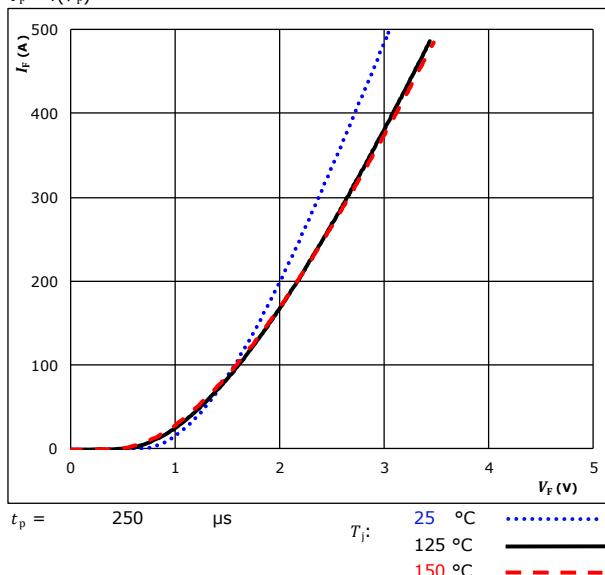
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Inverter Diode Characteristics

figure 1.

Typical forward characteristics

$$I_F = f(V_F)$$

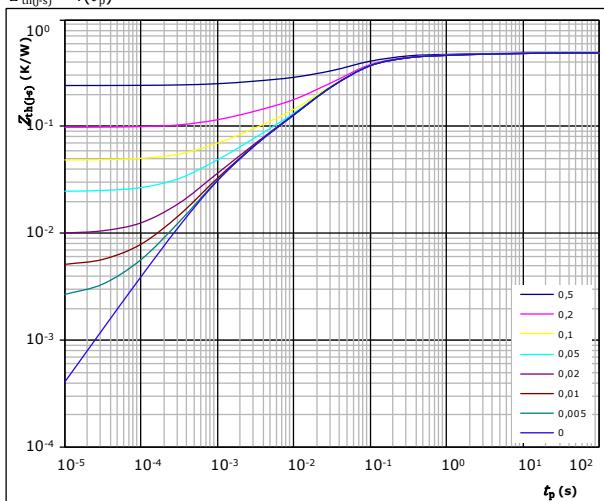


FWD

figure 2.

Transient thermal impedance as a function of pulse width

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



FWD

$$D = t_p / T$$

$$R_{th(t-s)} = 0,49 \text{ K/W}$$

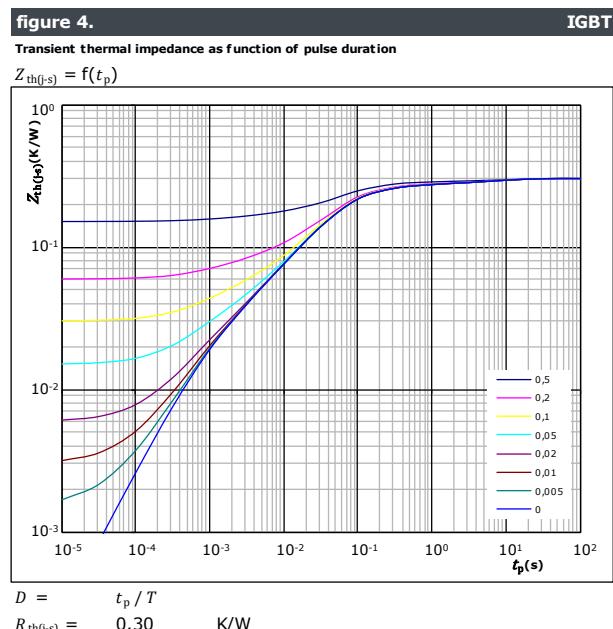
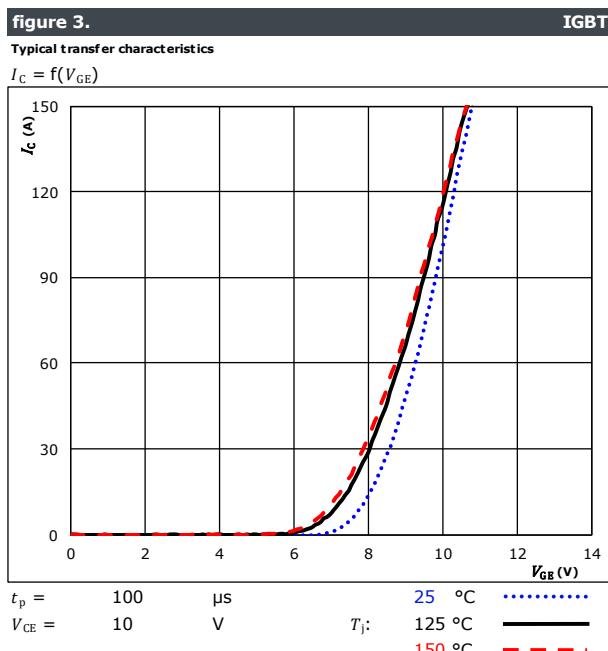
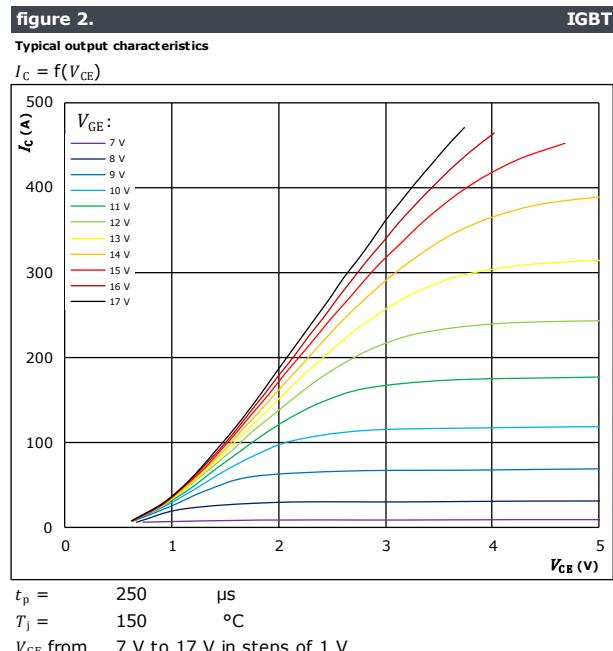
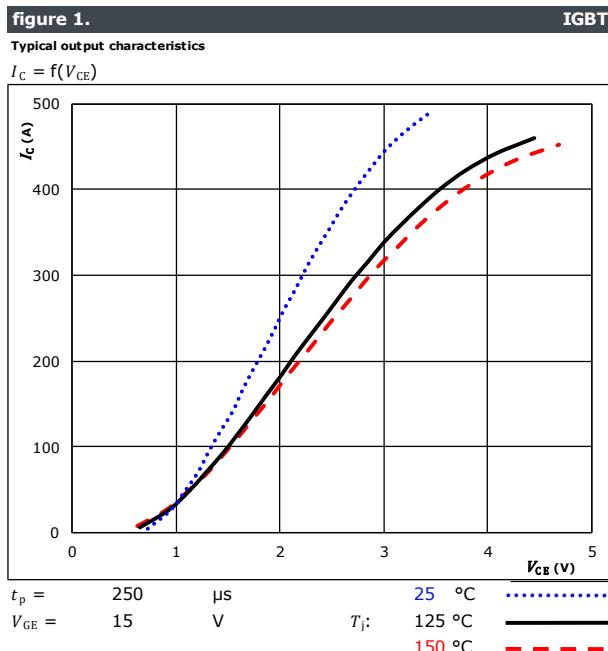
FWD thermal model values

R (K/W)	τ (s)
1,82E-02	3,65E+00
3,42E-02	3,11E-01
9,07E-02	5,55E-02
2,63E-01	1,86E-02
4,90E-02	3,61E-03
3,29E-02	5,54E-04
2,27E-03	2,68E-04



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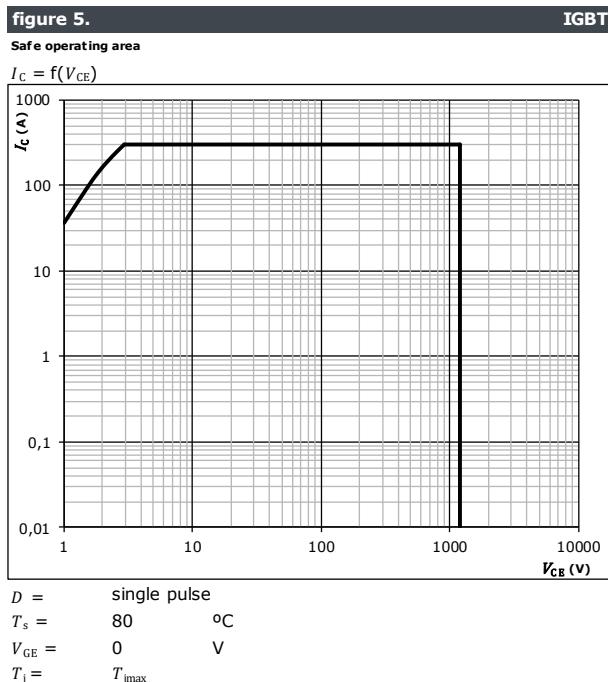
Brake Switch Characteristics





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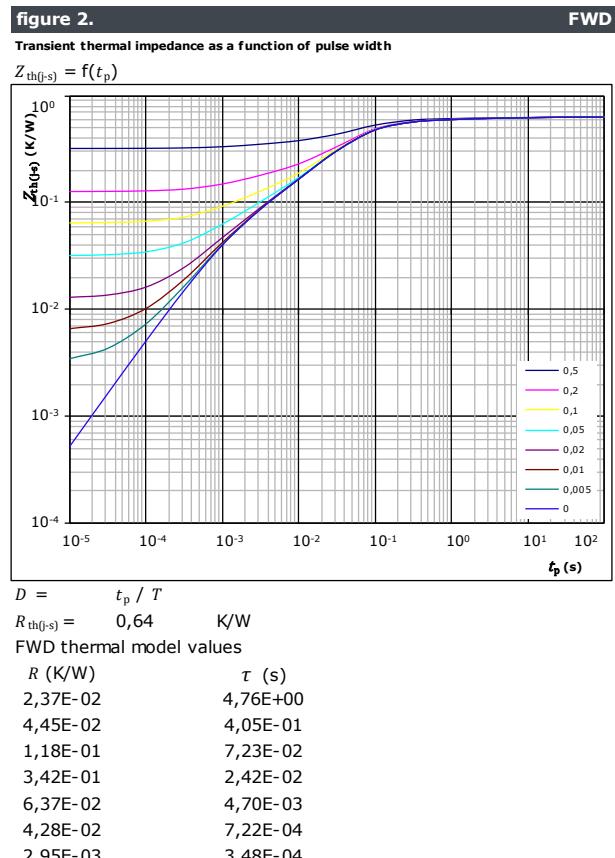
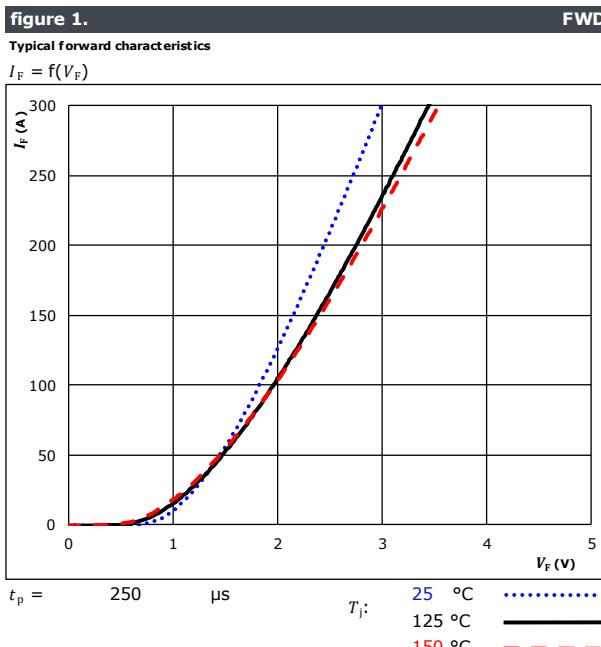
Brake Switch Characteristics



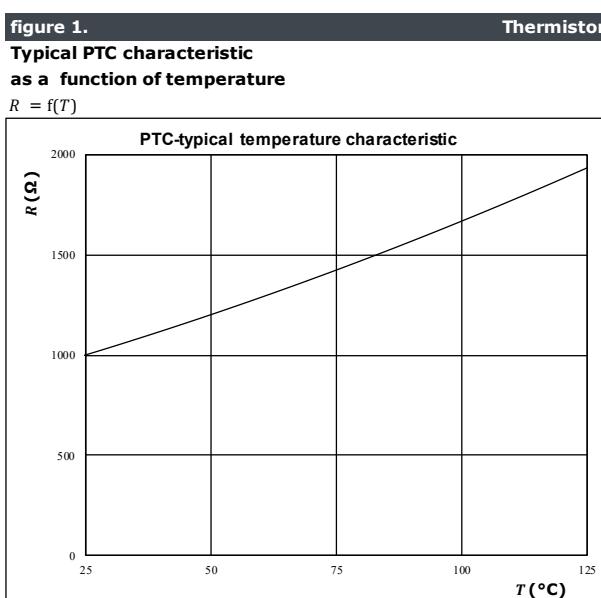


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Brake Diode Characteristics



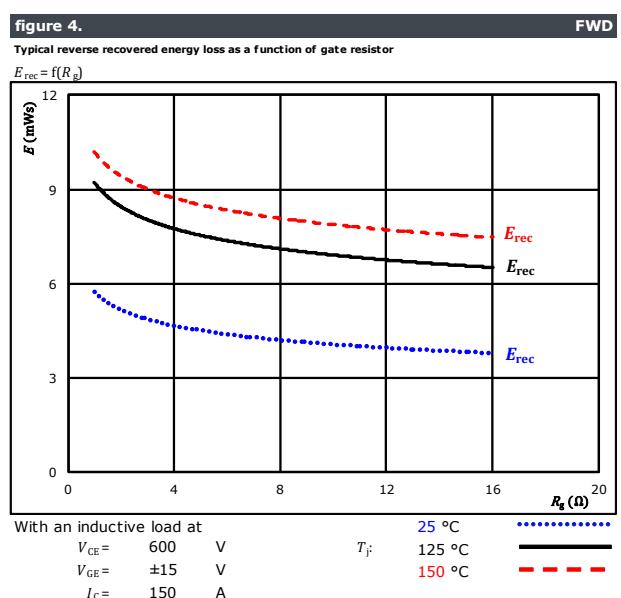
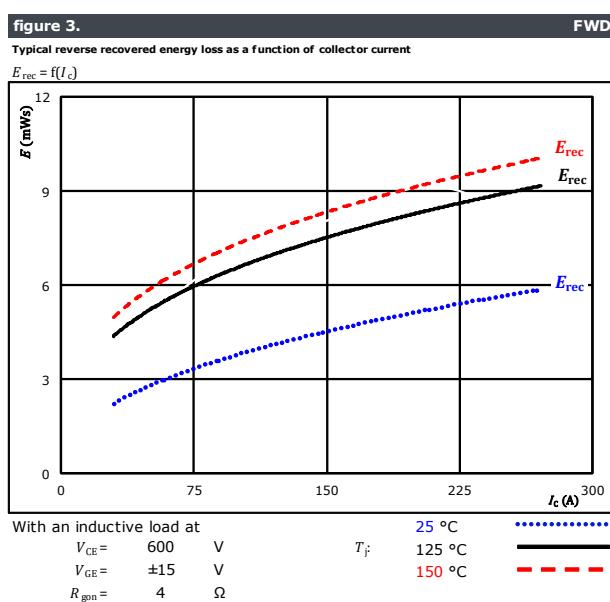
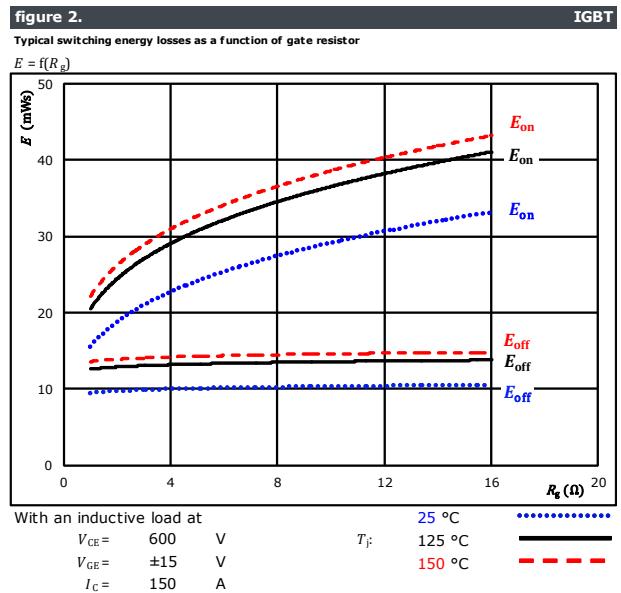
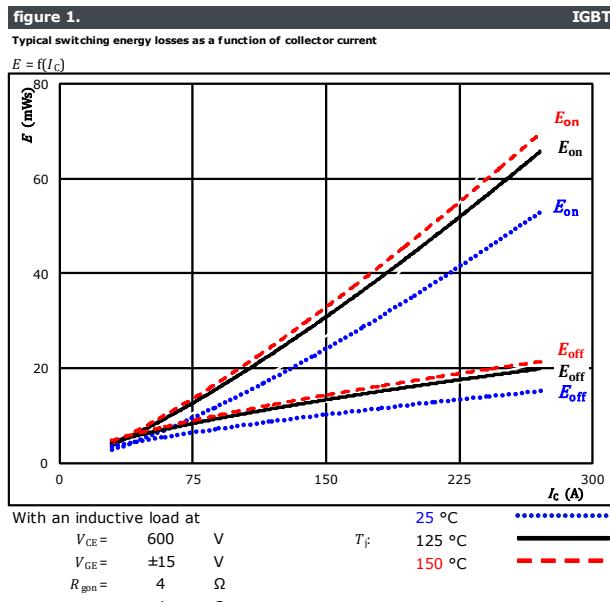
Thermistor Characteristics





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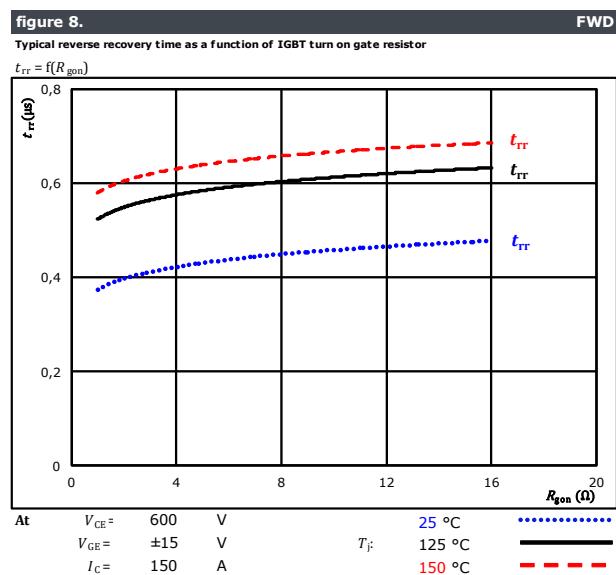
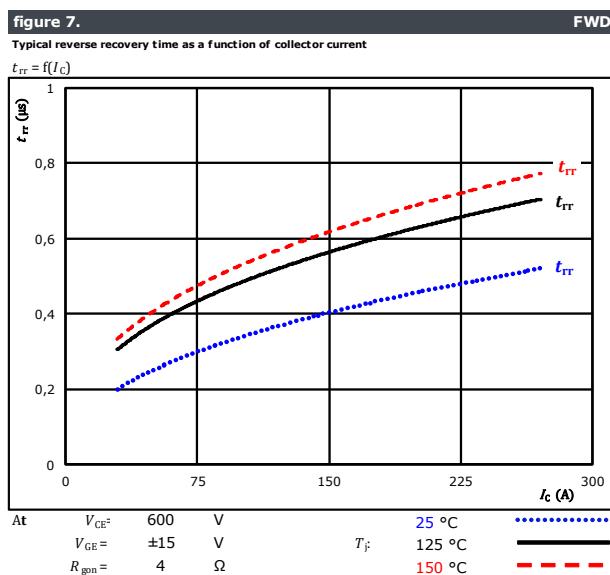
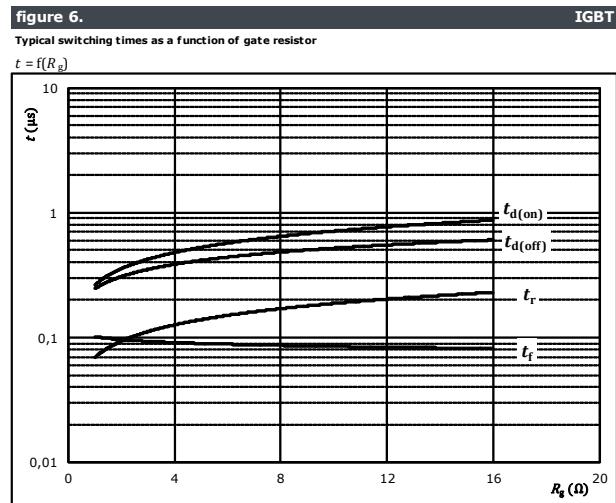
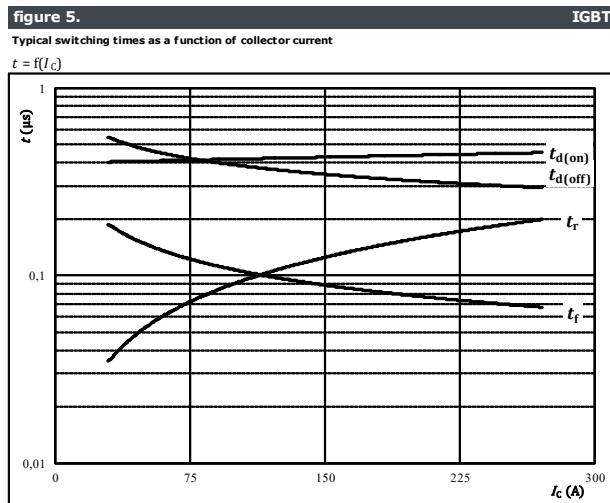
Inverter Switching Characteristics





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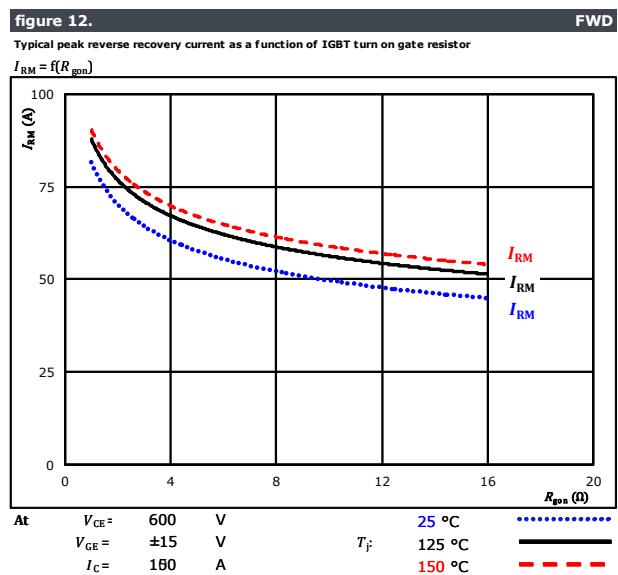
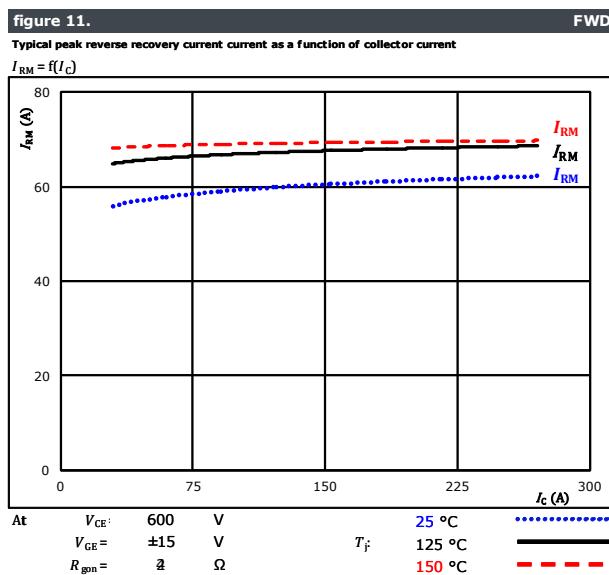
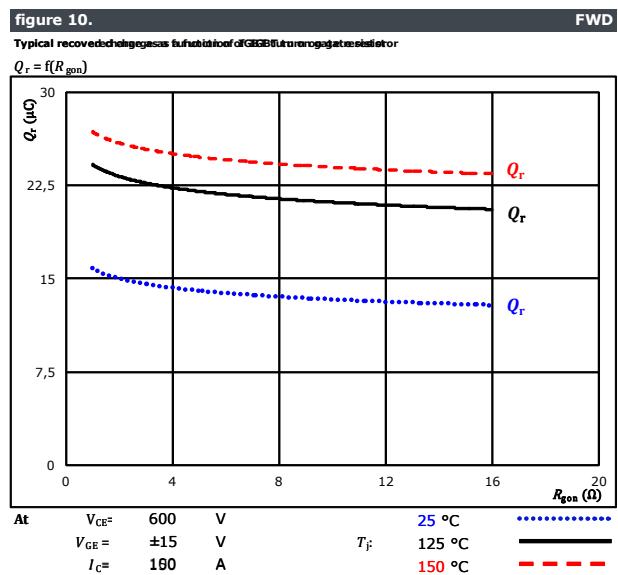
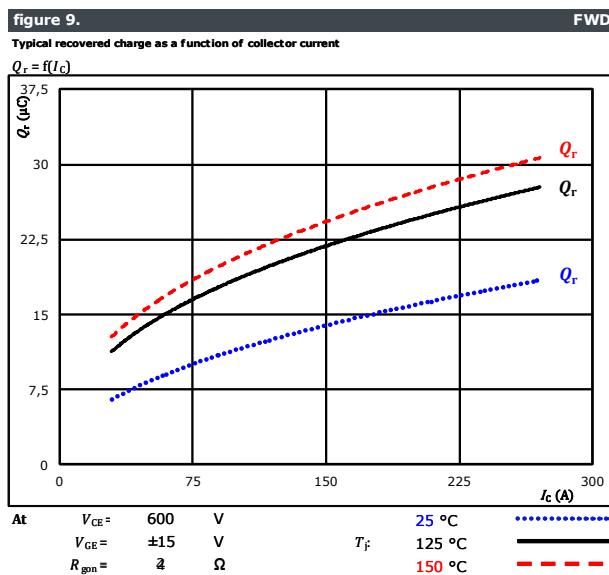
Inverter Switching Characteristics





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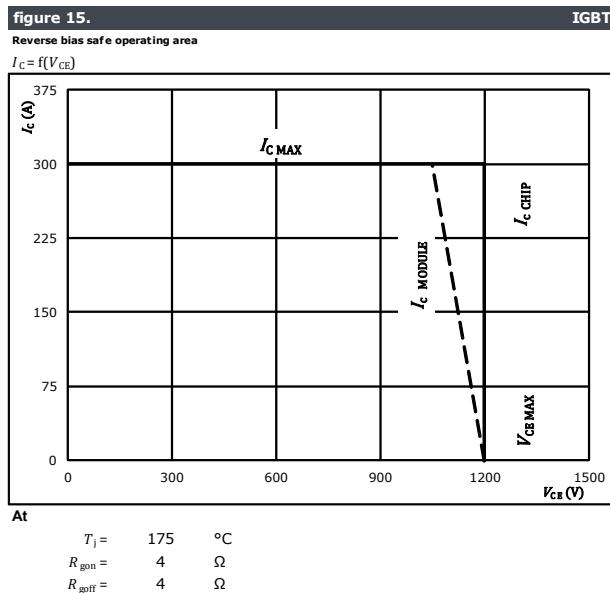
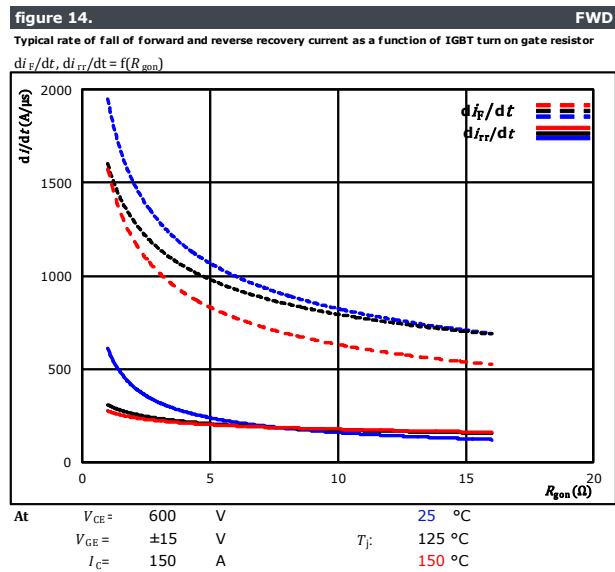
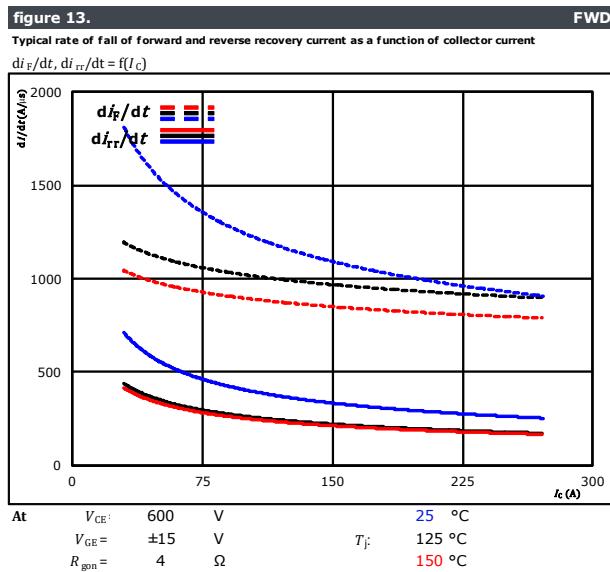
Inverter Switching Characteristics





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Inverter Switching Characteristics





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Inverter Switching Definitions

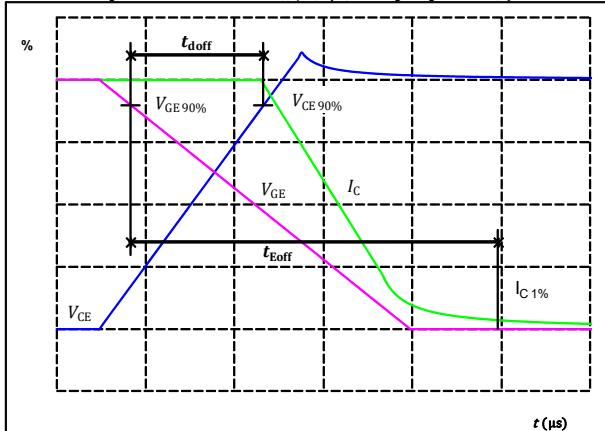
General conditions

T_J	=	125 °C
R_{gon}	=	1 Ω
R_{goff}	=	1 Ω

figure 1.

IGBT

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

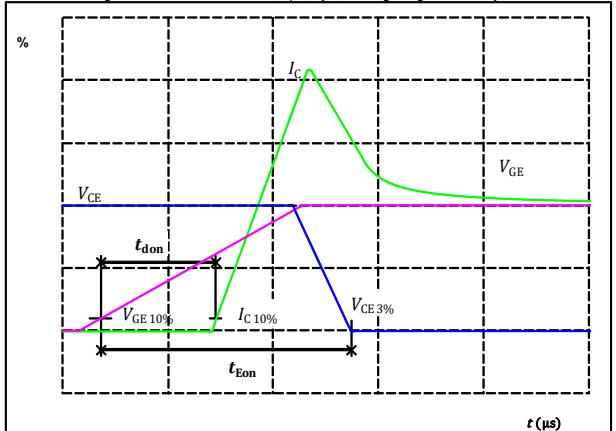


$V_{GE}(0\%) = -15 \text{ V}$
 $V_{GE}(100\%) = 15 \text{ V}$
 $V_C(100\%) = 600 \text{ V}$
 $I_C(100\%) = 150 \text{ A}$
 $t_{doff} = 267 \text{ ns}$

figure 2.

IGBT

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

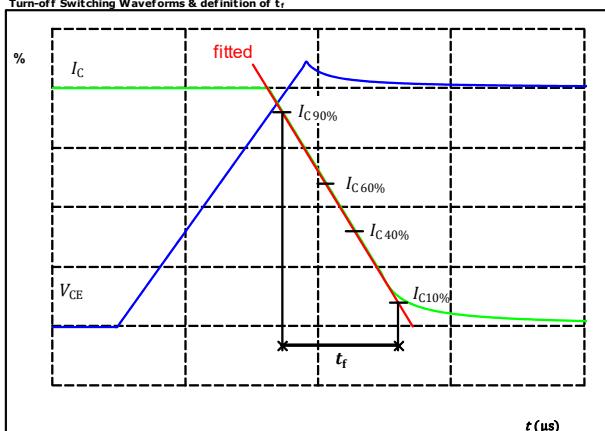


$V_{GE}(0\%) = -15 \text{ V}$
 $V_{GE}(100\%) = 15 \text{ V}$
 $V_C(100\%) = 600 \text{ V}$
 $I_C(100\%) = 150 \text{ A}$
 $t_{don} = 290 \text{ ns}$

figure 3.

IGBT

Turn-off Switching Waveforms & definition of t_f

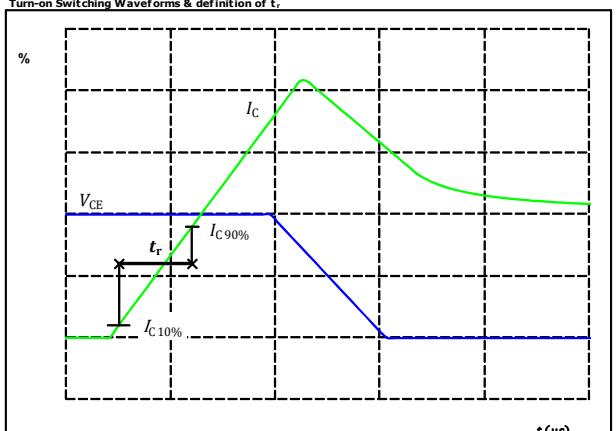


$V_C(100\%) = 600 \text{ V}$
 $I_C(100\%) = 150 \text{ A}$
 $t_f = 90 \text{ ns}$

figure 4.

IGBT

Turn-on Switching Waveforms & definition of t_r



$V_C(100\%) = 600 \text{ V}$
 $I_C(100\%) = 150 \text{ A}$
 $t_r = 73 \text{ ns}$



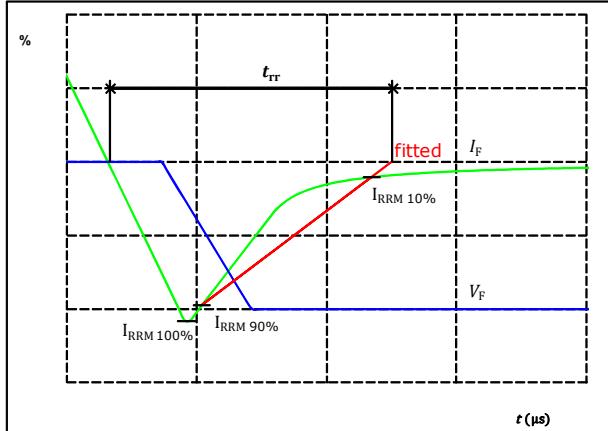
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Inverter Switching Characteristics

figure 5.

FWD

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

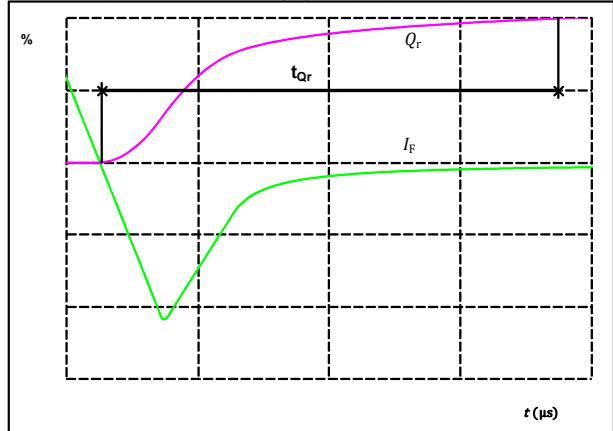


$I_F(100\%) =$ 600 V
 $I_F(100\%) =$ 150 A
 $I_{RRM}(100\%) =$ 72 A
 $t_{rr} =$ 553 ns

figure 6.

FWD

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

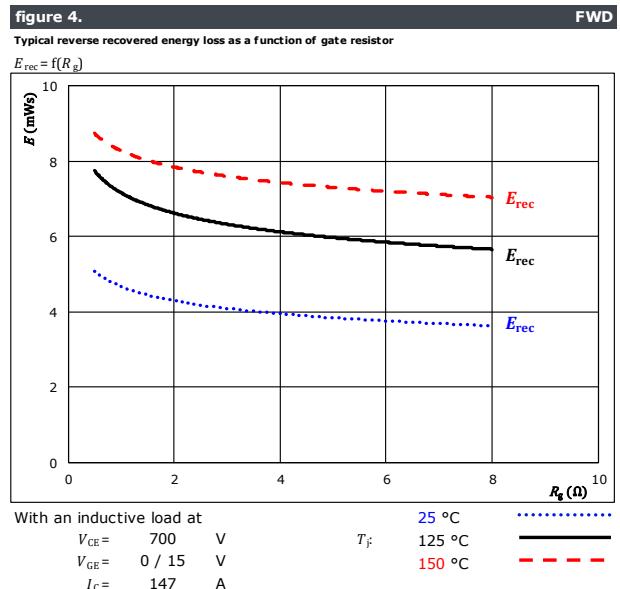
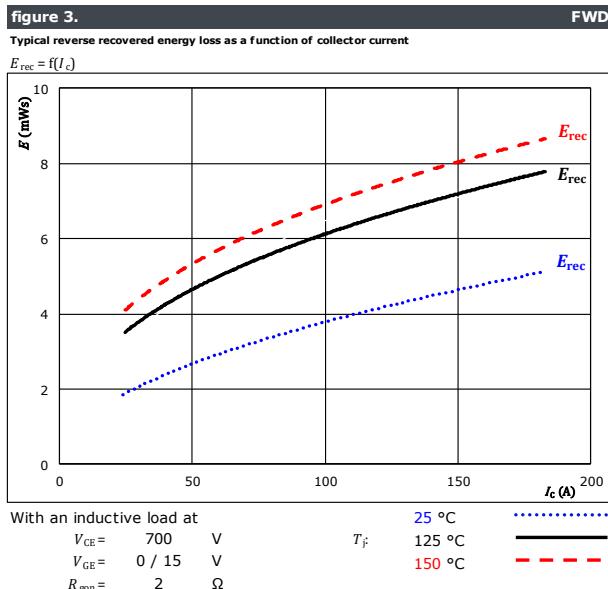
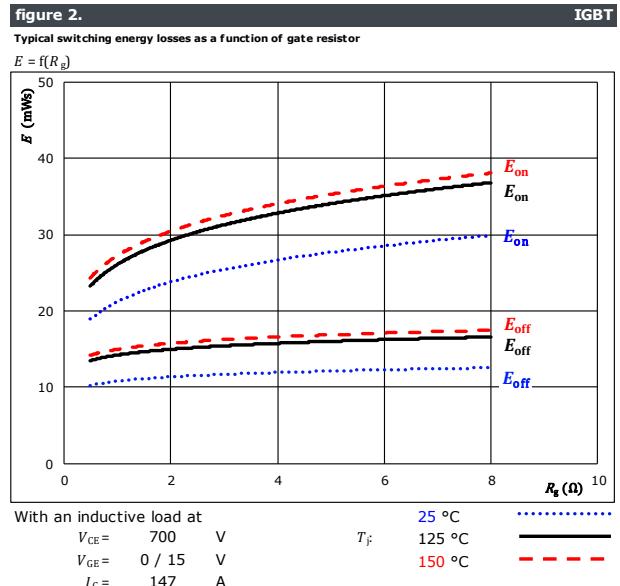
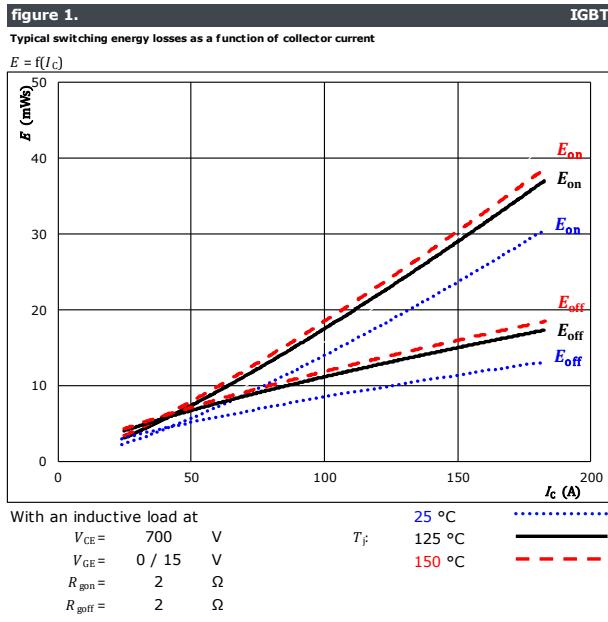


$I_F(100\%) =$ 150 A
 $Q_r(100\%) =$ 22,63 μC



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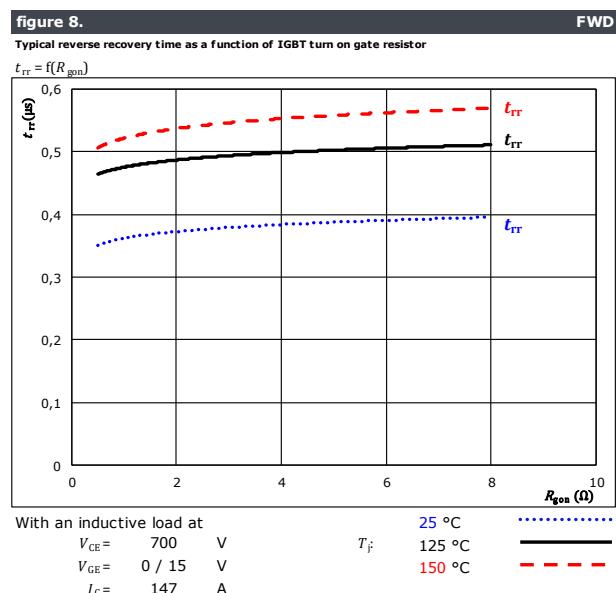
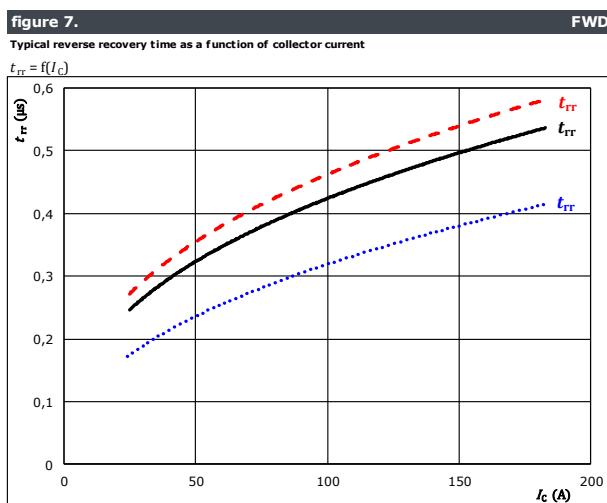
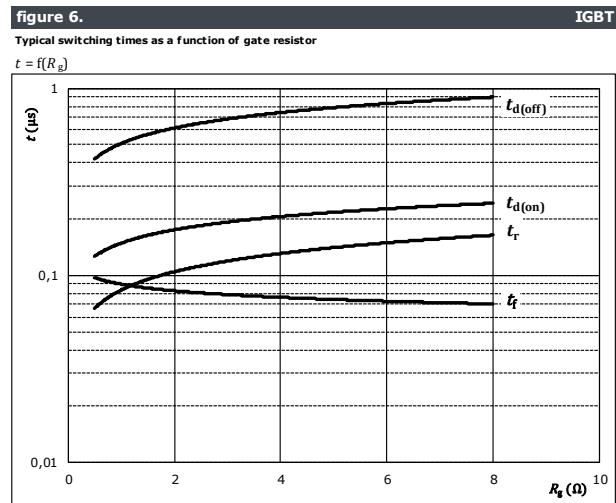
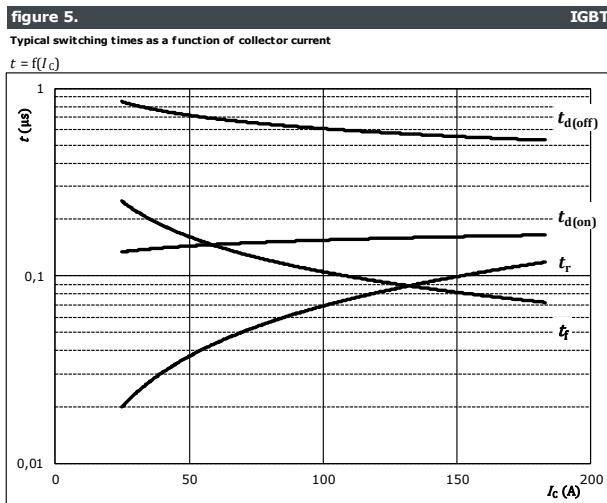
Brake Switching Characteristics





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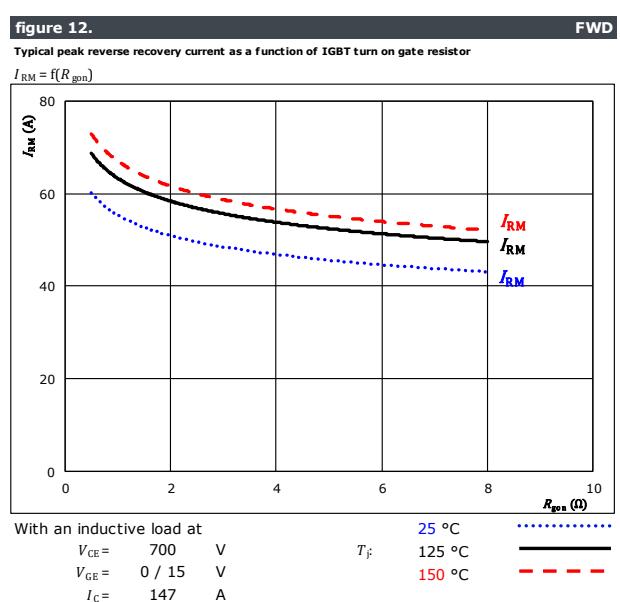
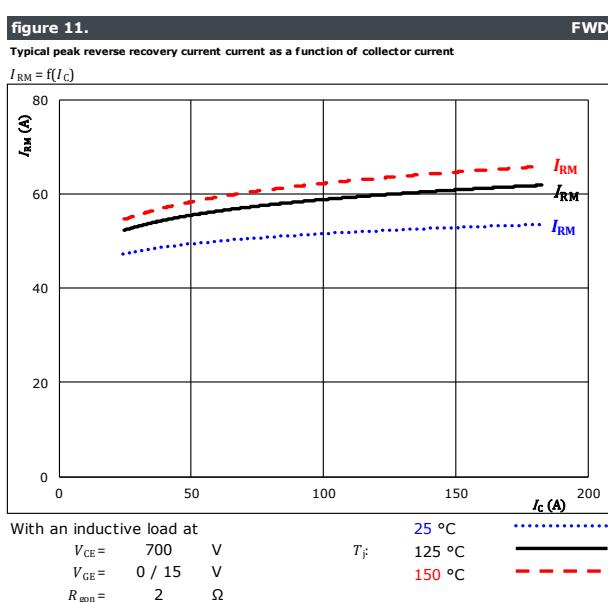
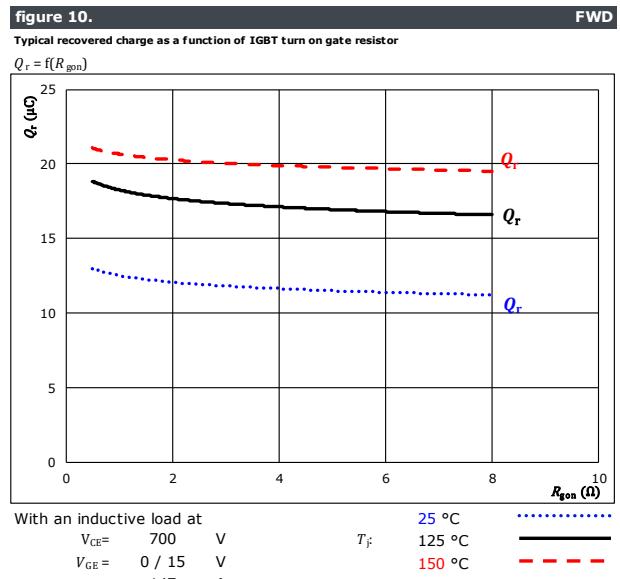
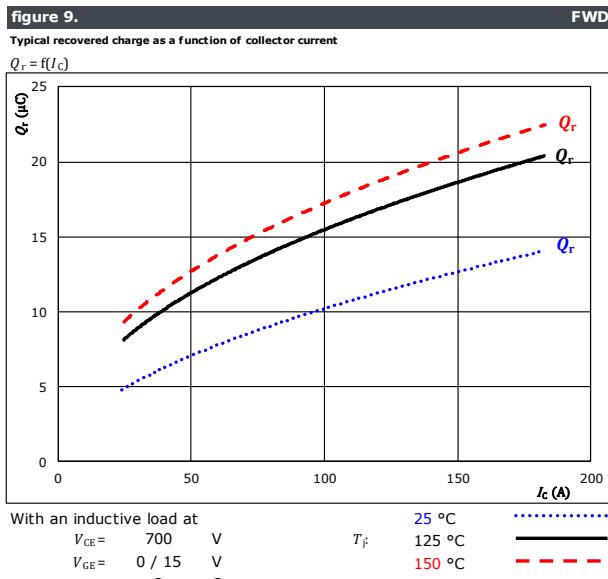
Brake Switching Characteristics





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Brake Switching Characteristics

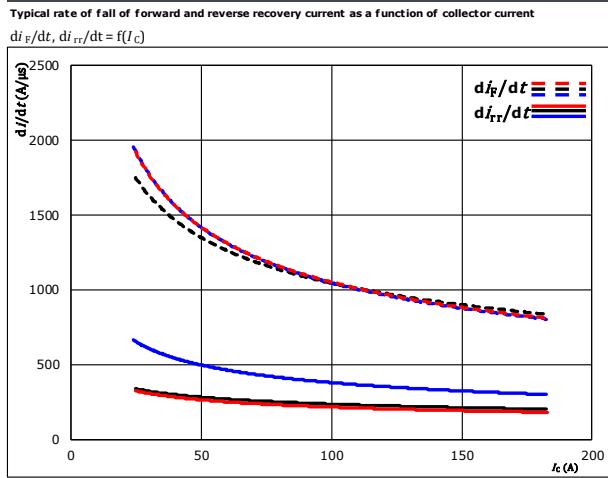




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Brake Switching Characteristics

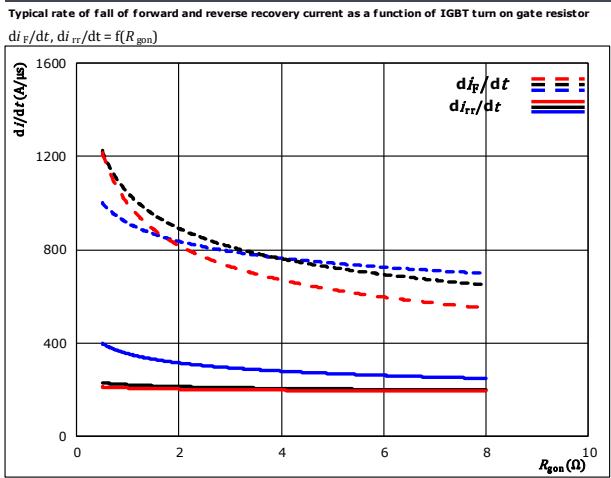
figure 13.



With an inductive load at

$V_{CE} = 700$ V $T_f = 25^\circ\text{C}$
 $V_{GE} = 0 / 15$ V $T_f = 125^\circ\text{C}$
 $R_{gon} = 2$ Ω $T_f = 150^\circ\text{C}$

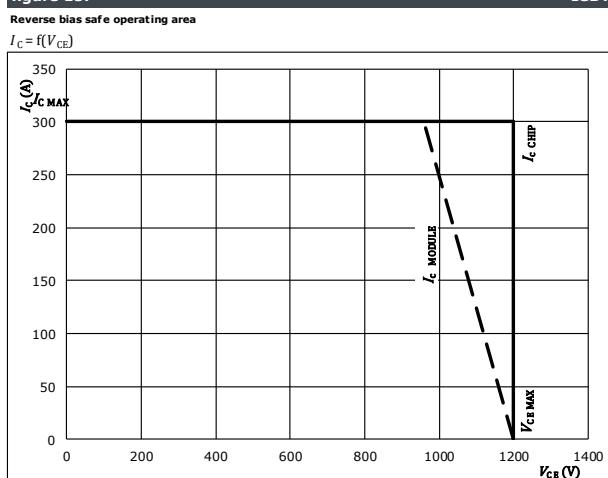
figure 14.



With an inductive load at

$V_{CE} = 700$ V $T_f = 25^\circ\text{C}$
 $V_{GE} = 0 / 15$ V $T_f = 125^\circ\text{C}$
 $I_C = 147$ A $T_f = 150^\circ\text{C}$

figure 15.



At

$T_f = 150^\circ\text{C}$
 $R_{gon} = 2$ Ω
 $R_{goff} = 2$ Ω



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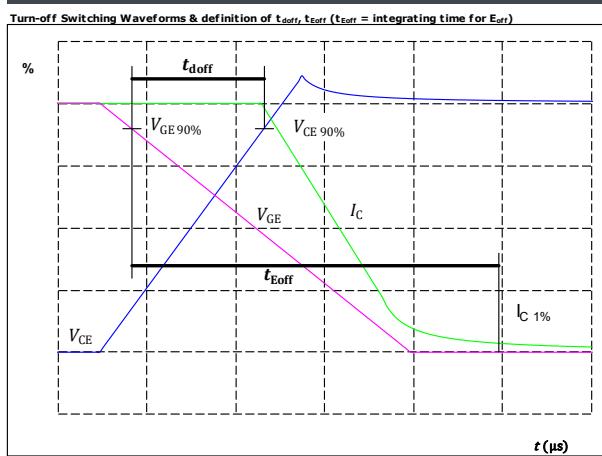
Brake Switching Definitions

General conditions

T_j	=	150 °C
R_{gon}	=	2 Ω
R_{goff}	=	2 Ω

figure 1.

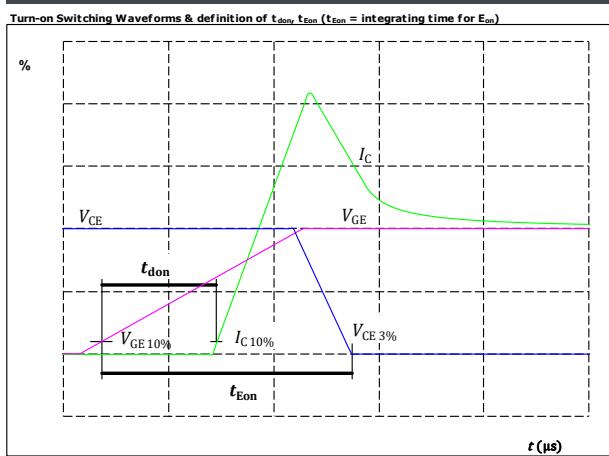
IGBT



$V_{GE\ (0\%)} =$	0	V
$V_{GE\ (100\%)} =$	15	V
$V_C\ (100\%) =$	700	V
$I_C\ (100\%) =$	147	A
$t_{doff} =$	562	ns

figure 2.

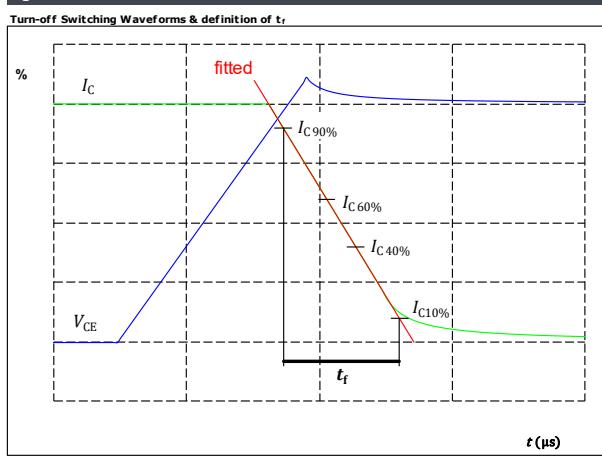
IGBT



$V_{GE\ (0\%)} =$	0	V
$V_{GE\ (100\%)} =$	15	V
$V_C\ (100\%) =$	700	V
$I_C\ (100\%) =$	147	A
$t_{don} =$	161	ns

figure 3.

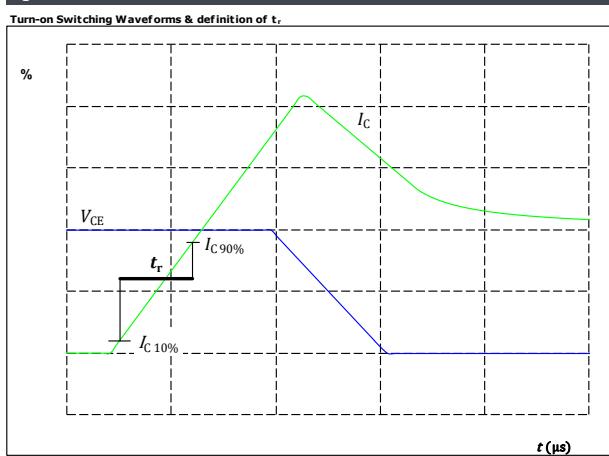
IGBT



$V_C\ (100\%) =$	700	V
$I_C\ (100\%) =$	147	A
$t_f =$	83	ns

figure 4.

IGBT

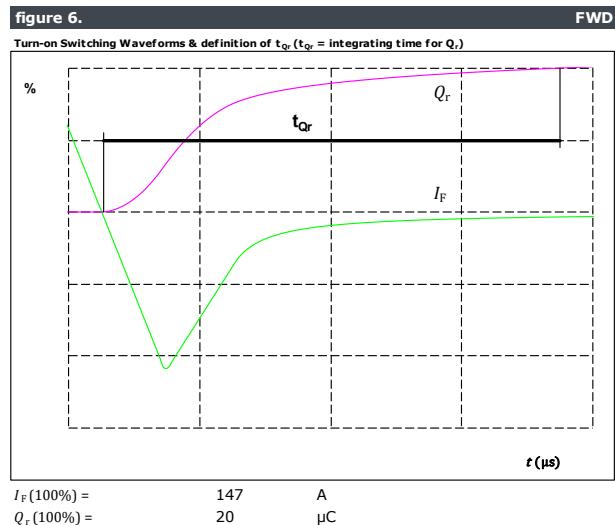
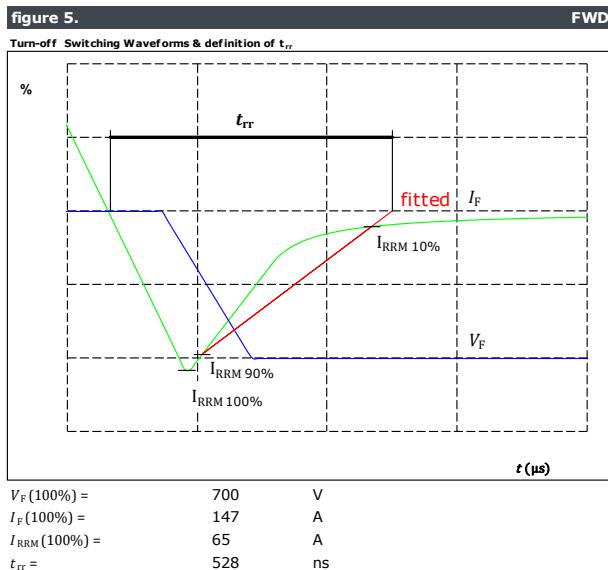


$V_C\ (100\%) =$	700	V
$I_C\ (100\%) =$	147	A
$t_r =$	96	ns



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Brake Switching Characteristics





80-M312PMA150M7-K420A80

datasheet

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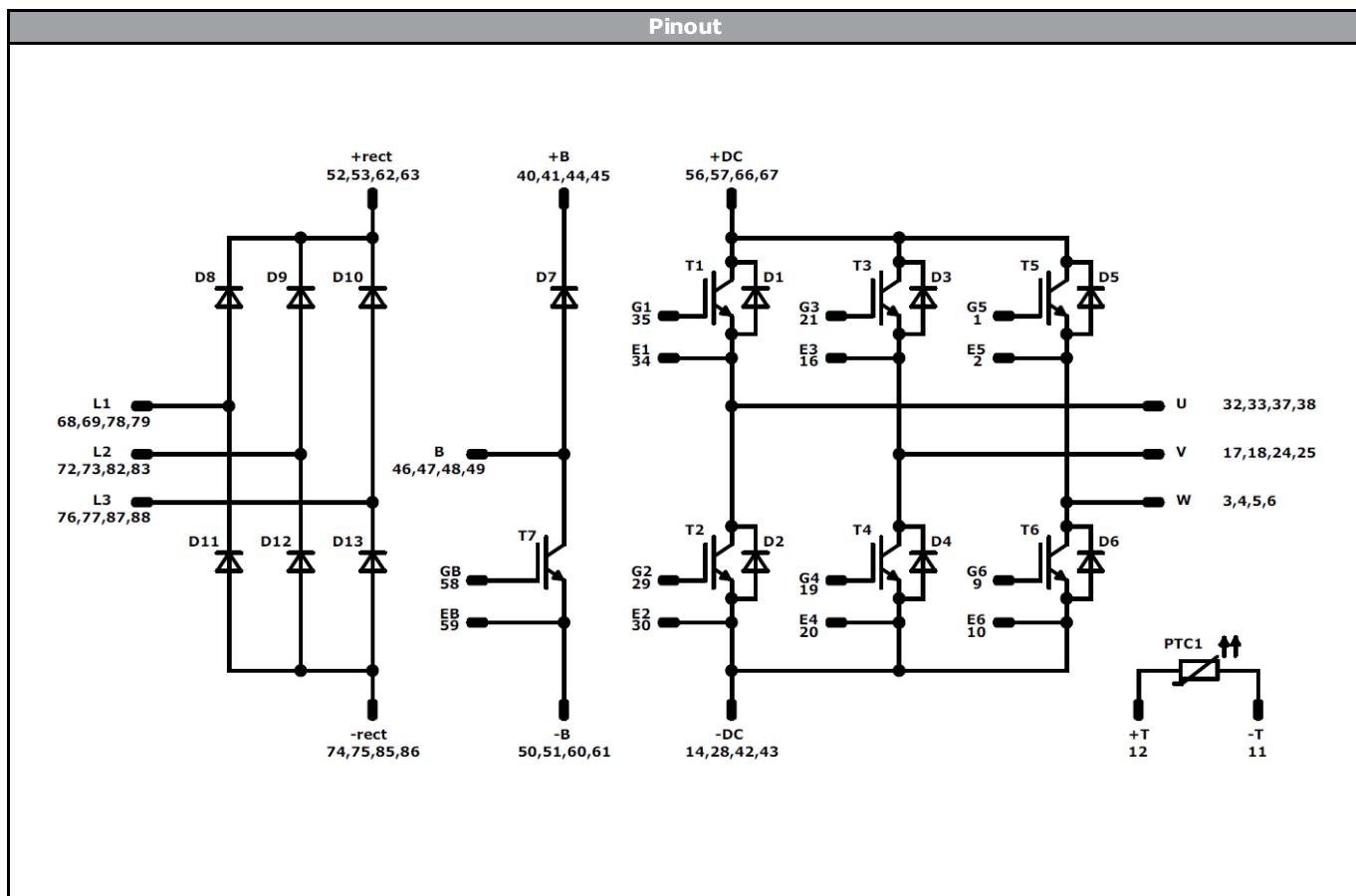
Ordering Code & Marking					
Version			Ordering Code		
With std lid (6.5mm height) + no thermal grease			80-M312PMA150M7-K420A80-/0A/		
With thin lid (2.8mm height) + no thermal grease			80-M312PMA150M7-K420A80-/0B/		
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)			80-M312PMA150M7-K420A80-/1A/		
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)			80-M312PMA150M7-K420A80-/1B/		
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)			80-M312PMA150M7-K420A80-/4A/		
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)			80-M312PMA150M7-K420A80-/4B/		
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)			80-M312PMA150M7-K420A80-/5A/		
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)			80-M312PMA150M7-K420A80-/5B/		
Text			Name	Date code	UL & VIN
NN-NNNNNNNNNNNNNN TTTTTTVV WWYY UL VIN LLLL SSSS			NN-NNNNNNNNNNNNNN-TTTTTVW	WWYY	UL VIN
Datamatrix			Type&Ver	Lot number	Serial
TTTTTTVV			LLLLL	SSSS	WWYY

Outline						
PCB pad table			PCB pad table			
Pin	X	Y	Function	Pin	X	
1	15,83	-25,3	G5	48	-32,82	
2	15,83	-6,4	E5	49	-32,82	
3	15,83	-3,2	W	50	4,32	
4	15,83	0	W	51	4,32	
5	15,83	3,2	W	52	3,42	
6	15,83	6,4	W	53	3,42	
7	Not assembled		54	Not assembled		
8	Not assembled		55	Not assembled		
9	15,83	22,1	G6	56	3,42	
10	15,83	25,3	E6	57	3,42	
11	8,13	-25,3	-T	58	-39,32	
12	8,13	-22,1	+T	59	-39,32	
13	Not assembled		60	-39,32		
14	8,13	25,3	-DC	61	-39,32	
15	Not assembled		62	-25,3		
16	41,82	-12,18	E3	63	-40,22	
17	41,82	-8,98	V	64	Not assembled	
18	41,82	-5,79	V	65	Not assembled	
19	0,43	22,1	G4	66	-40,22	
20	0,43	25,3	E4	67	-40,22	
21	-1,07	-25,3	G3	68	-10,18	
22	Not assembled		69	-25,3		
23	Not assembled		70	-22,1		
24	-1,82	-8,98	V	71	L1	
25	-1,82	-5,79	V	72	-10,18	
26	Not assembled		73	-9,5		
27	Not assembled		74	-6,3		
28	-7,27	25,3	-DC	75	-10,18	
29	-14,97	22,1	G2	76	-10,18	
30	-14,97	25,3	E2	77	-10,18	
31	Not assembled		78	25,3		
32	23,95	-11,82	U	79	-53,82	
33	23,95	-8,63	U	80	Not assembled	
34	23,95	-5,42	E1	81	Not assembled	
35	-19,22	-25,3	G1	82	-53,82	
36	Not assembled		83	-9,5		
37	-19,7	-11,82	U	84	-rect	
38	-19,7	-8,62	U	85	-53,82	
39	Not assembled		86	6,3		
40	17,74	-1	+B	87	-53,82	
41	17,74	2,2	+B	88	-53,82	
42	-22,67	22,1	-DC			
43	-22,67	25,3	-DC			
44	-25,9	-1	+B			
45	-25,9	2,2	+B			
46	10,82	8,74	B			
47	10,82	11,94	B			

Pad positions refers to center point. For more informations on pad design please see package data



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Identification

ID	Component	Voltage	Current	Function	Comment
D11, D8, D12, D9, D13, D10	Rectifier	1600 V	60 A	Rectifier Diode	
T2, T1, T4, T3, T6, T5	IGBT	1200 V	150 A	Inverter Switch	
D1, D2, D3, D4, D5, D6	FWD	1200 V	150 A	Inverter Diode	
T7	IGBT	1200 V	150 A	Brake Switch	
D7	FWD	1200 V	100 A	Brake Diode	
PTC1	PTC			Thermistor	



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Packaging instruction			
Standard packaging quantity (SPQ) 48	>SPQ	Standard	<SPQ Sample

Handling instruction			
Handling instructions for MiniSkiip® 3 packages see vincotech.com website.			

Package data			
Package data for MiniSkiip® 3 packages see vincotech.com website.			

UL recognition and file number			
This device is certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.			

Document No.:	Date:	Modification:	Pages
80-M312PMA150M7-K420A80-D2-14	08 Jul. 2019	Schematic correction	1

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