



flowPIM E2

1200 V / 25 A

Features

- Trench IGBT4 technology
- Standard industrial housing
- Optimized $R_{th(j-s)}$ with Phase Change Material
- Built-in NTC

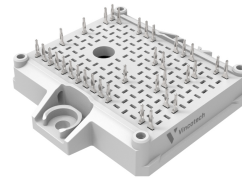
Target applications

- Industrial Drives

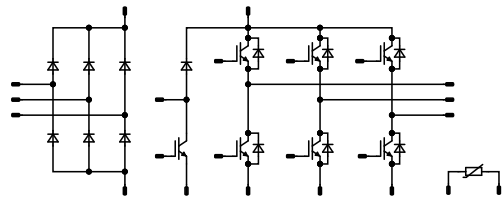
Types

- 10-EY12PMA025SC-L187A48T

flow E2 12 mm housing



Schematic





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10-EY12PMA025SC-L187A48T
datasheet

Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	32	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	75	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	86	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$, $V_{CC} = 800\text{ V}$ $T_j = 150\text{ °C}$	10	μs
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

Inverter Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	31	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	50	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	66	W
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

Brake Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	32	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	75	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	86	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$, $V_{CC} = 800\text{ V}$ $T_j = 150\text{ °C}$	10	μs
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$



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Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
Brake Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	20	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	50	W
Maximum junction temperature	T_{jmax}		175	°C

Rectifier Diode

Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	58	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	400	A
Surge current capability	I^2t		800	A ² s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	68	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			8,83	mm
Comparative Tracking Index	CTI		≥ 600	

*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	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00085	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		25	25 125 150	1,58	1,83 2,12	2,07 ⁽¹⁾ 2,18	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			2,4	μA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	$f = 1 \text{ Mhz}$	0	25		25		1450		pF
Reverse transfer capacitance	C_{res}							50		pF
Gate charge	Q_g		-15		0	25		200		nC

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						1,11		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 16 \Omega$ $R_{goff} = 16 \Omega$	±15	600	27	25		62,6		ns
Rise time	t_r					125		62,4		
						150		62,8		
						25		32,4		
Turn-off delay time	$t_{d(off)}$					125		34,2		
						150		34,2		
		25		180,6						
Fall time	t_f	125		236						
		150		255,6						
		25		84,28						
Turn-on energy (per pulse)	E_{on}	$Q_{tFWD} = 2,2 \mu\text{C}$ $Q_{tFWD} = 4,12 \mu\text{C}$ $Q_{tFWD} = 4,77 \mu\text{C}$				25		1,99		mWs
						125		2,79		
						150		3,02		
Turn-off energy (per pulse)	E_{off}					25		1,52		
						125		2,4		
						150		2,74		



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datasheet

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				25	25 125 150	1,35	1,9 1,9 1,88	2,05 ⁽¹⁾	V
Reverse leakage current	I_R	$V_r = 1200$ V				25			5,2	μA
Thermal										
Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,44		K/W
Dynamic										
Peak recovery current	I_{RRM}					25 125 150		15,66 19,3 20,2		A
Reverse recovery time	t_{rr}					25 125 150		278,92 444,27 504,3		ns
Recovered charge	Q_r	$di/dt=707$ A/μs $di/dt=565$ A/μs $di/dt=683$ A/μs	±15	600	27	25 125 150		2,2 4,12 4,77		μC
Reverse recovered energy	E_{rec}					25 125 150		0,806 1,59 1,87		mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$					25 125 150		99,04 96,55 84,72		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	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00085	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		25	25 125 150	1,58	1,83 2,12	2,07 ⁽¹⁾ 2,18	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			2,4	μA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	$f = 1 \text{ Mhz}$	0	25		25		1450		pF
Reverse transfer capacitance	C_{res}							50		pF
Gate charge	Q_g		-15		0	25		200		nC

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						1,11		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 64 \Omega$ $R_{goff} = 64 \Omega$	-5/15	600	27	25		87,4		ns
Rise time	t_r					125		120,2	ns	
						150		118		
						25		76,8		
Turn-off delay time	$t_{d(off)}$					125		78,2	ns	
						150		77		
		25		622,2						
Fall time	t_f	125		483,4	ns					
		150		515						
		25		24,64						
Turn-on energy (per pulse)	E_{on}	$Q_{tFWD} = 1,27 \mu\text{C}$ $Q_{tFWD} = 2,47 \mu\text{C}$ $Q_{tFWD} = 2,78 \mu\text{C}$				25		3,87	mWs	
						125		4,85		
						150		4,78		
Turn-off energy (per pulse)	E_{off}					25		1,98		mWs
						125		2,62		
						150		3		



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datasheet

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	25 125 150	1,35	1,79 1,77 1,73	2,05 ⁽¹⁾		V
Reverse leakage current	I_R	$V_r = 1200$ V			25			2,7		μA
Thermal										
Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)					1,91			K/W
Dynamic										
Peak recovery current	I_{RRM}				25 125 150		5,86 7,34 8,13			A
Reverse recovery time	t_{rr}				25 125 150		453,81 685,44 731,88			ns
Recovered charge	Q_r	$di/dt=258$ A/μs $di/dt=229$ A/μs $di/dt=235$ A/μs	-5/15	600	27	25 125 150	1,27 2,47 2,78			μC
Reverse recovered energy	E_{rec}				25 125 150		0,409 0,866 0,999			mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$				25 125 150		12,62 7,34 8,63			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				35	25 125 150		1,09 1,02 1,02	1,5 ⁽¹⁾	V
Reverse leakage current	I_R	$V_T = 1600$ V				25 150			100 2000	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,03		K/W
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Thermistor

Static

Rated resistance	R					25		5		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	$R_{100} = 493$ Ω				100	-5		5	%
Power dissipation	P							245		mW
Power dissipation constant	d					25		1,4		mW/K
B-value	$B_{(25/50)}$	Tol. ±2 %						3375		K
B-value	$B_{(25/100)}$	Tol. ±2 %						3437		K
Vincotech Thermistor Reference									K	

⁽¹⁾ Value at chip level

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

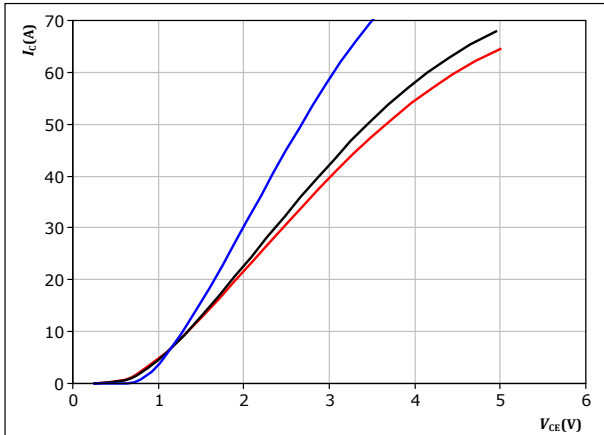


Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

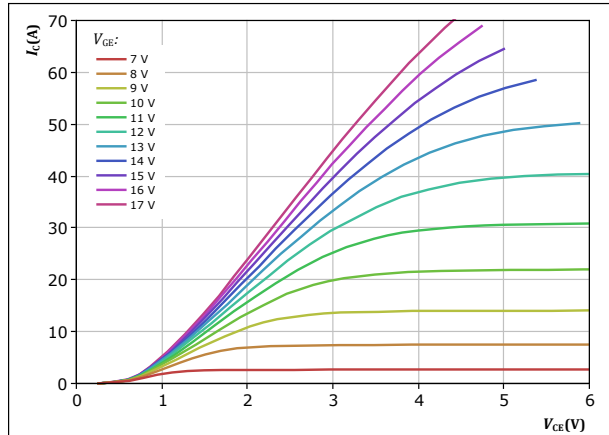


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j:$ — 25 °C
— 125 °C
— 150 °C

figure 2. IGBT

Typical output characteristics

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

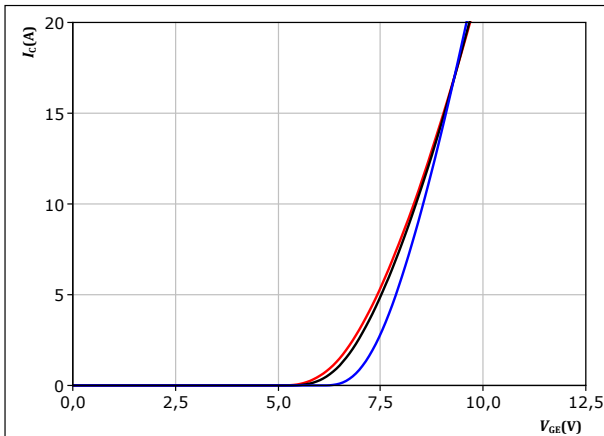


$t_p = 250 \mu s$
 $T_j = 150 \text{ °C}$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

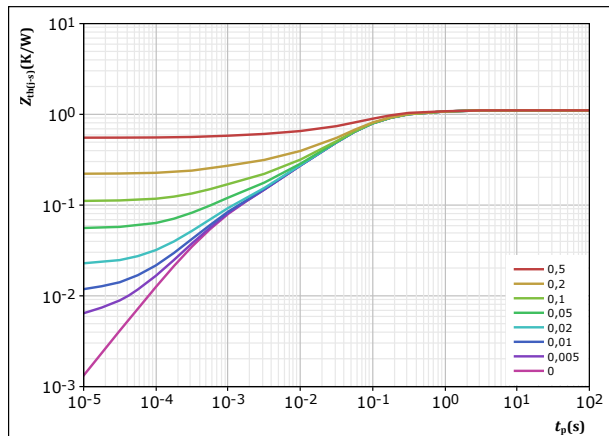


$t_p = 250 \mu s$
 $V_{CE} = 10 V$
 $T_j:$ — 25 °C
— 125 °C
— 150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,106 \text{ K/W}$
IGBT thermal model values

R (K/W)	τ (s)
1,48E-01	6,22E-01
6,17E-01	8,14E-02
1,91E-01	2,57E-02
8,97E-02	5,16E-03
6,06E-02	6,02E-04



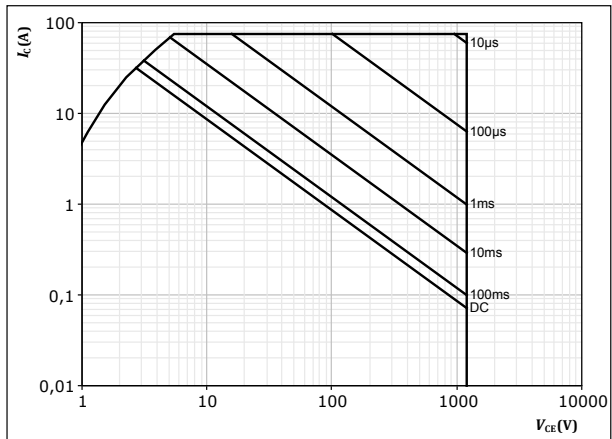
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Inverter Switch Characteristics

figure 5. IGBT

Safe operating area

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



$D =$ single pulse

$T_s = 80$ °C

$V_{GE} = 15$ V

$T_j = T_{jmax}$



Inverter Diode Characteristics

figure 6. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

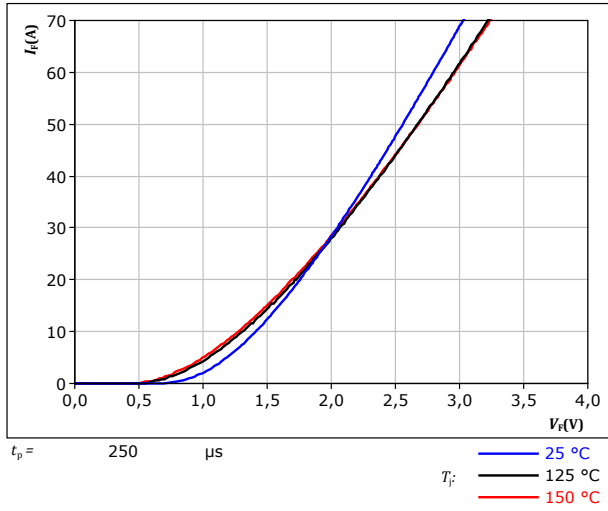
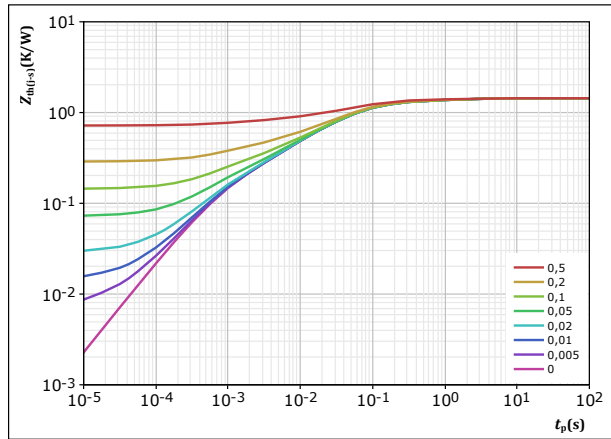


figure 7. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,439 \text{ K/W}$
 FWD thermal model values

R (K/W)	τ (s)
9,20E-02	2,28E+00
1,26E-01	3,18E-01
5,59E-01	6,71E-02
3,61E-01	2,27E-02
1,79E-01	5,09E-03
1,23E-01	7,30E-04



Brake Switch Characteristics

figure 8. IGBT

Typical output characteristics
 $I_C = f(V_{CE})$

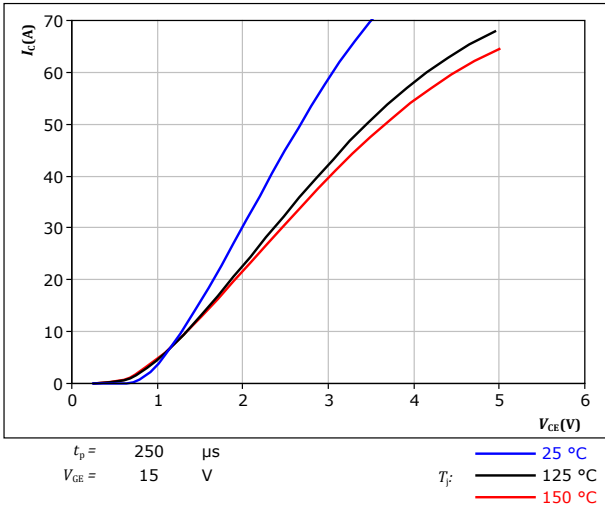


figure 9. IGBT

Typical output characteristics
 $I_C = f(V_{CE})$

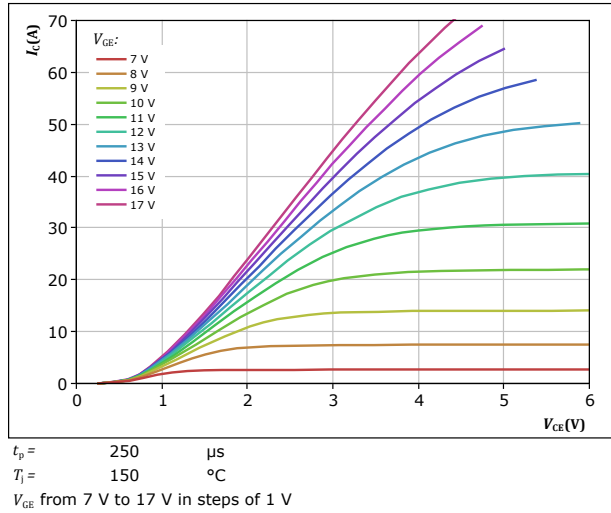


figure 10. IGBT

Typical transfer characteristics
 $I_C = f(V_{GE})$

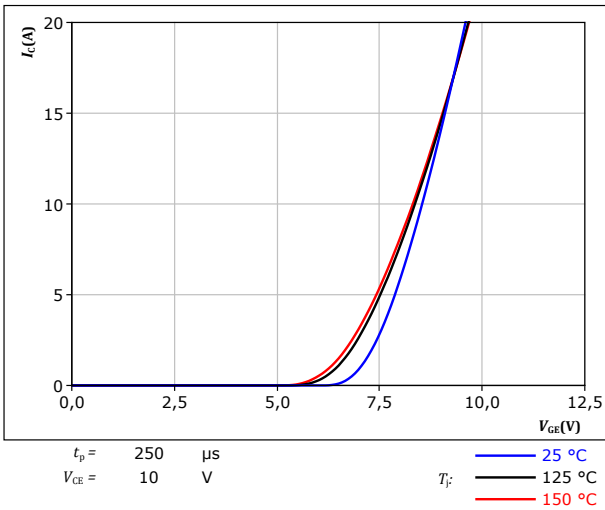
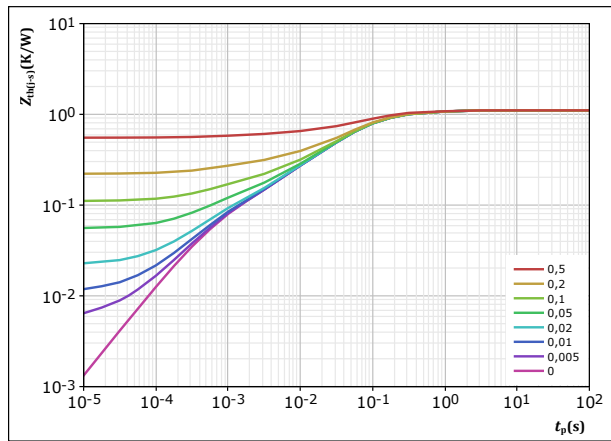


figure 11. IGBT

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



IGBT thermal model values

R (K/W)	τ (s)
1,48E-01	6,22E-01
6,17E-01	8,14E-02
1,91E-01	2,57E-02
8,97E-02	5,16E-03
6,06E-02	6,02E-04

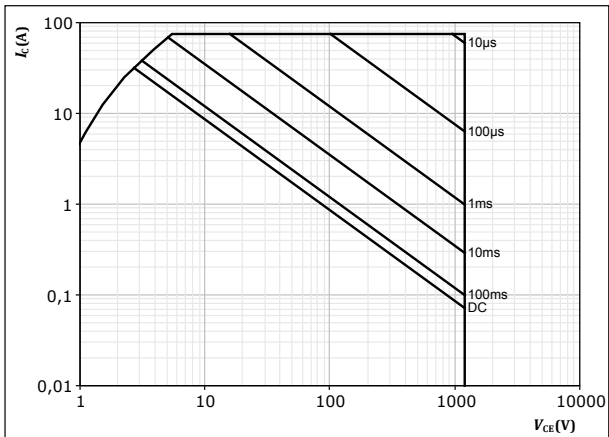


Brake Switch Characteristics

figure 12. IGBT

Safe operating area

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



$D =$ single pulse
 $T_s = 80 \text{ } ^\circ\text{C}$
 $V_{CE} = 15 \text{ V}$
 $T_j = T_{jmax}$



Brake Diode Characteristics

figure 13. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

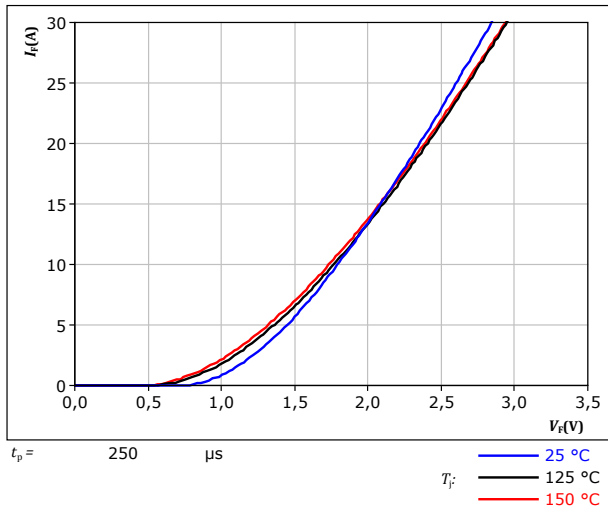
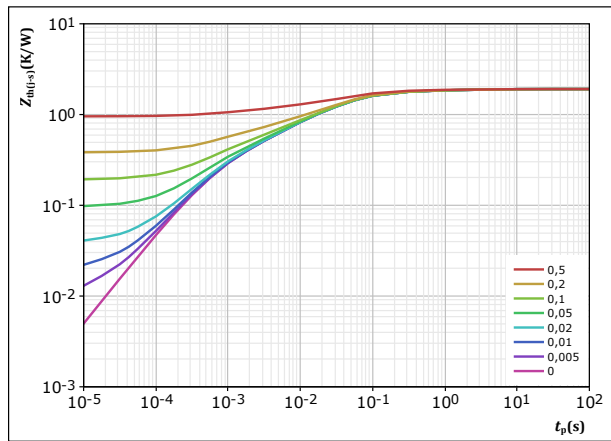


figure 14. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,909 \text{ K/W}$
 FWD thermal model values

R (K/W)	τ (s)
6,90E-02	3,61E+00
1,74E-01	3,07E-01
8,07E-01	4,87E-02
3,70E-01	1,36E-02
2,79E-01	3,22E-03
2,10E-01	5,68E-04



Rectifier Diode Characteristics

figure 15. Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

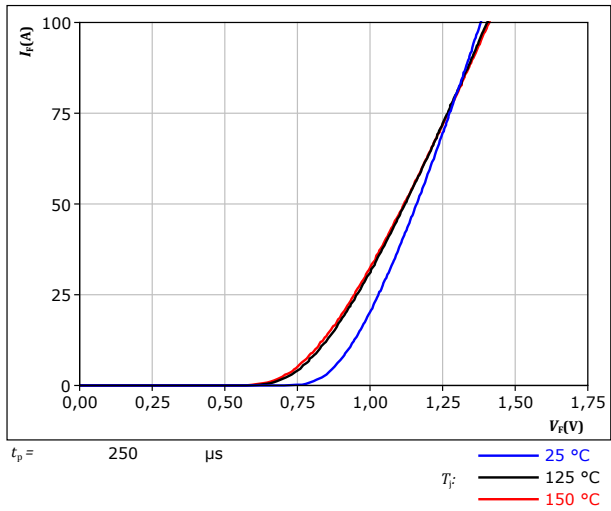
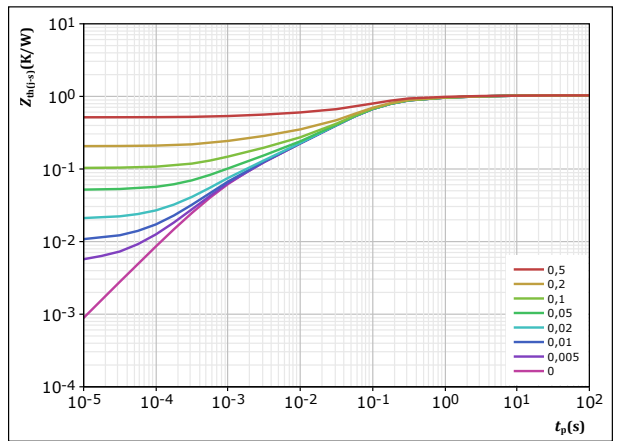


figure 16. Rectifier

Transient thermal impedance as a function of pulse width

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



$D = \frac{t_p}{T}$
 $R_{th(j-s)} = 1,032 \text{ K/W}$
 Rectifier thermal model values

R (K/W)	τ (s)
4,86E-02	5,67E+00
1,31E-01	6,68E-01
5,24E-01	9,95E-02
1,97E-01	3,35E-02
8,14E-02	4,54E-03
4,98E-02	8,29E-04

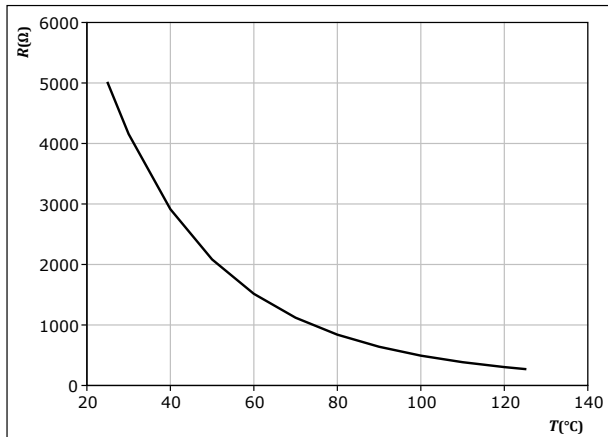


Thermistor Characteristics

figure 17. Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$

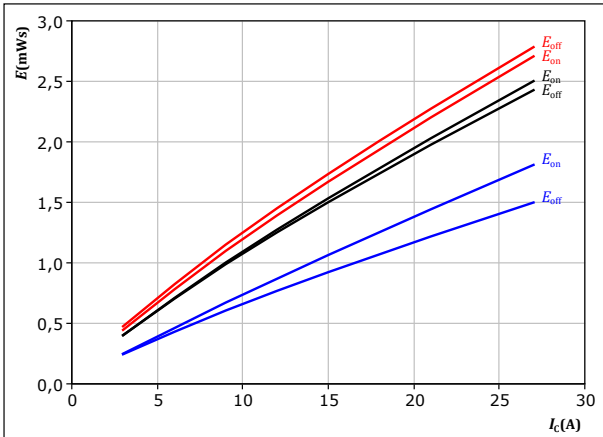




Inverter Switching Characteristics

figure 18. IGBT

Typical switching energy losses as a function of collector current
 $E = f(I_c)$

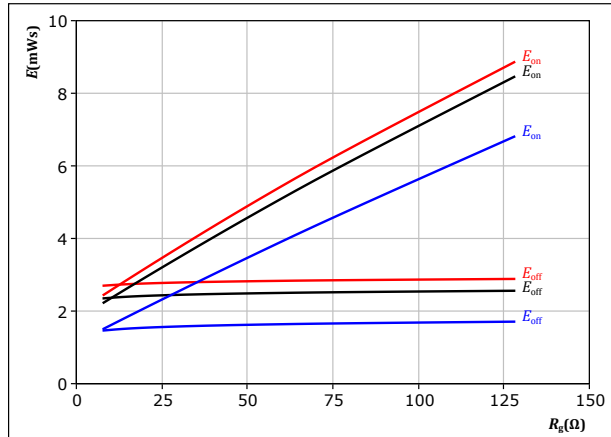


With an inductive load at

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

figure 19. IGBT

Typical switching energy losses as a function of gate resistor
 $E = f(R_g)$

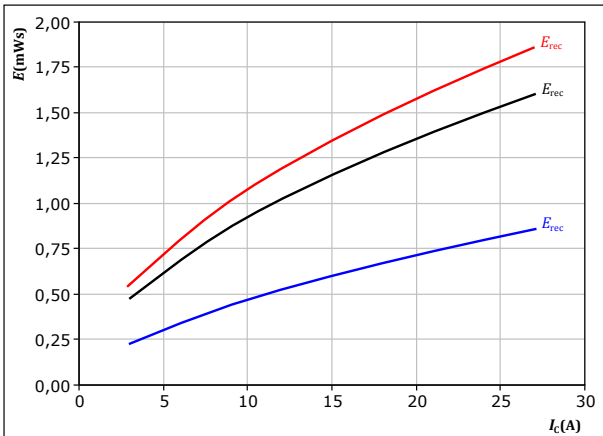


With an inductive load at

$V_{CE} =$	600	V	$T_f:$	—	25 °C
$V_{GE} =$	±15	V		—	125 °C
$I_c =$	27	A		—	150 °C

figure 20. FWD

Typical reverse recovered energy loss as a function of collector current
 $E_{rec} = f(I_c)$

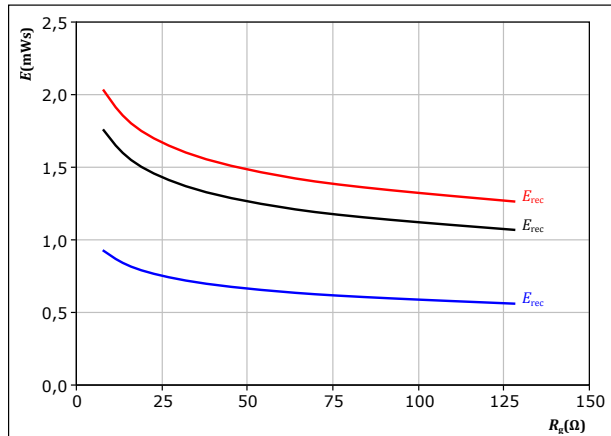


With an inductive load at

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

figure 21. FWD

Typical reverse recovered energy loss as a function of gate resistor
 $E_{rec} = f(R_g)$



With an inductive load at

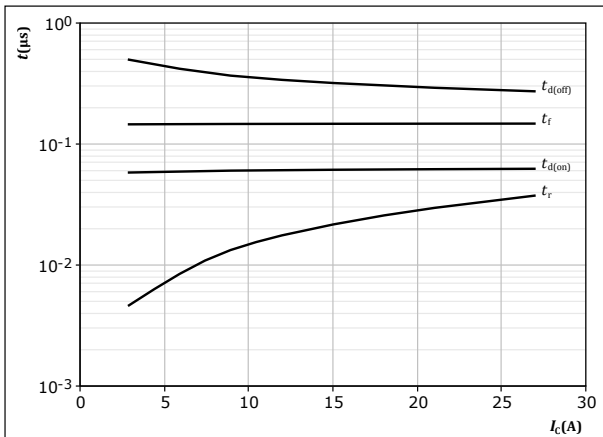
$V_{CE} =$	600	V	$T_f:$	—	25 °C
$V_{GE} =$	±15	V		—	125 °C
$I_c =$	27	A		—	150 °C



Inverter Switching Characteristics

figure 22. IGBT

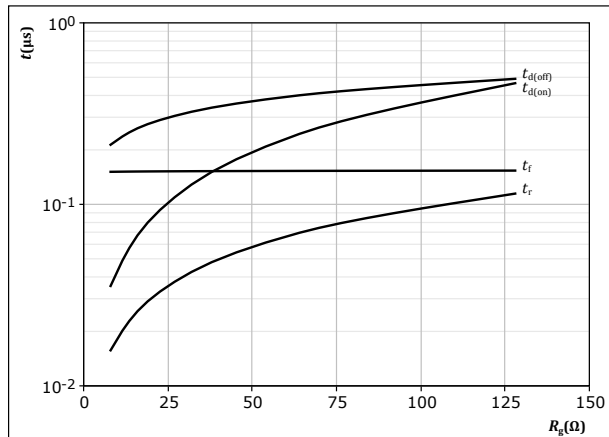
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 150 \text{ } ^\circ\text{C}$
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{g(on)} = 16 \text{ } \Omega$
 $R_{g(off)} = 16 \text{ } \Omega$

figure 23. IGBT

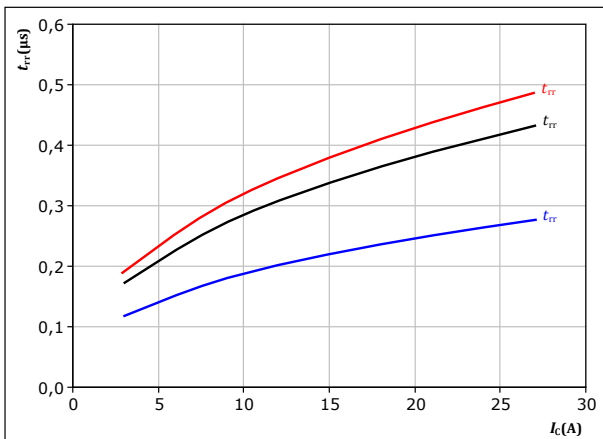
Typical switching times as a function of gate resistor
 $t = f(R_g)$



With an inductive load at
 $T_j = 150 \text{ } ^\circ\text{C}$
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 27 \text{ A}$

figure 24. FWD

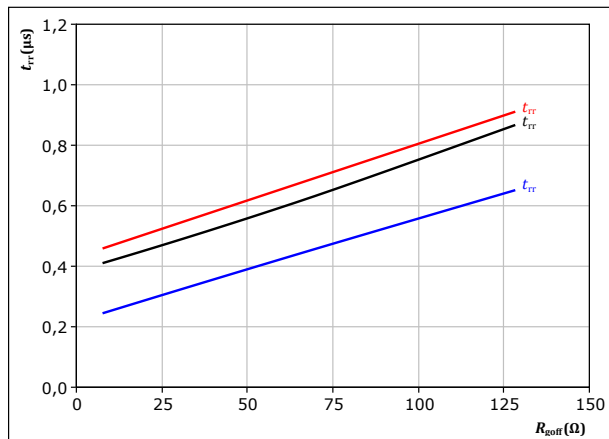
Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{g(on)} = 16 \text{ } \Omega$
 $T_j:$ — 25 °C
— 125 °C
— 150 °C

figure 25. FWD

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



With an inductive load at
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 27 \text{ A}$
 $T_j:$ — 25 °C
— 125 °C
— 150 °C

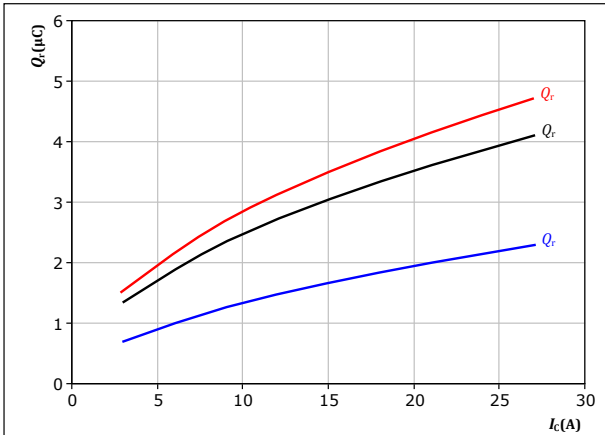


Inverter Switching Characteristics

figure 26. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



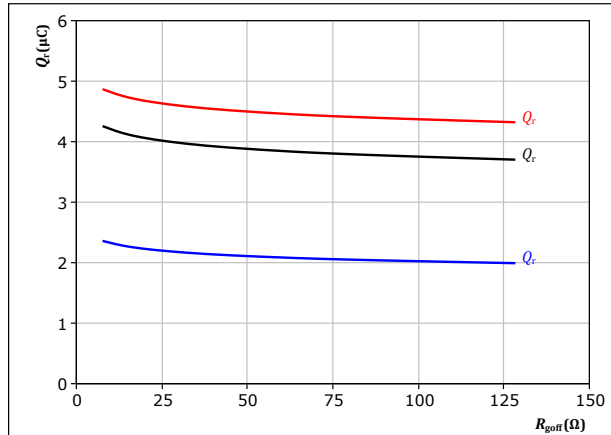
With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{goff} = 16$ Ω
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 27. FWD

Typical recovered charge as a function of turn off gate resistor

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



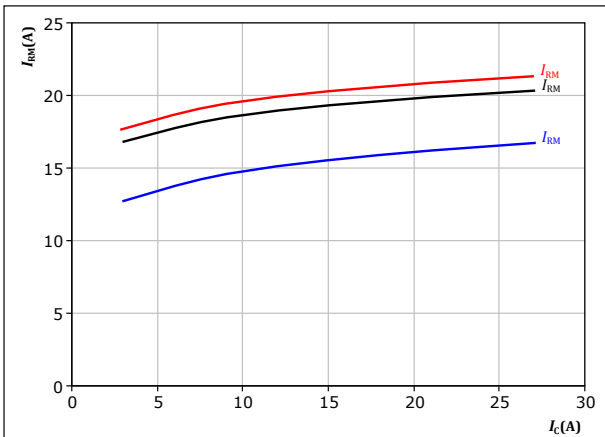
With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 27$ A
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 28. FWD

Typical peak reverse recovery current as a function of collector current

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



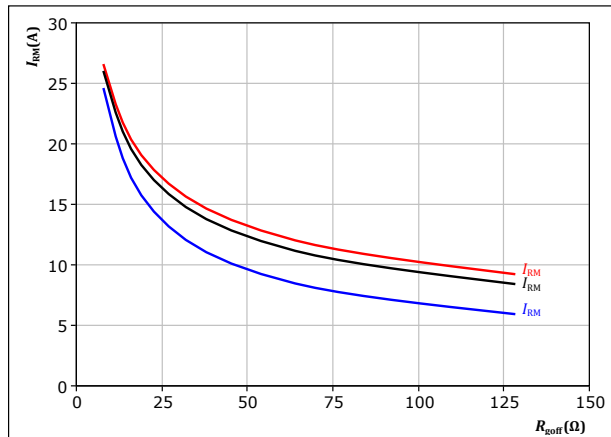
With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{goff} = 16$ Ω
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 29. FWD

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

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



With an inductive load at

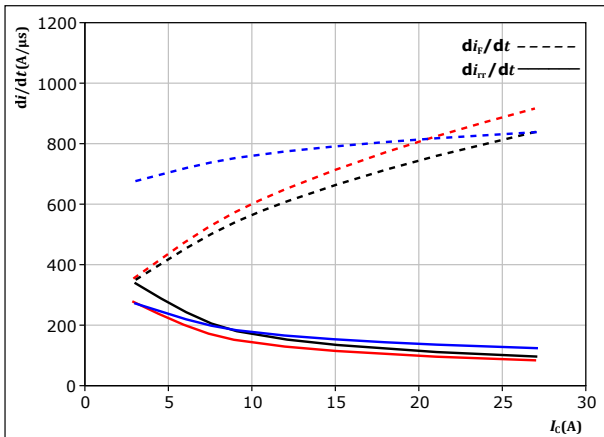
$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 27$ A
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)



Inverter Switching Characteristics

figure 30. FWD

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

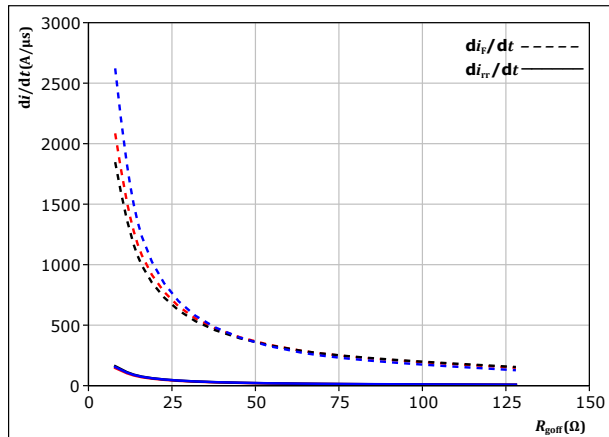


With an inductive load at

$V_{CE} = 600$ V	$T_j = 25$ °C
$V_{GE} = \pm 15$ V	$T_j = 125$ °C
$R_{goff} = 16$ Ω	$T_j = 150$ °C

figure 31. FWD

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

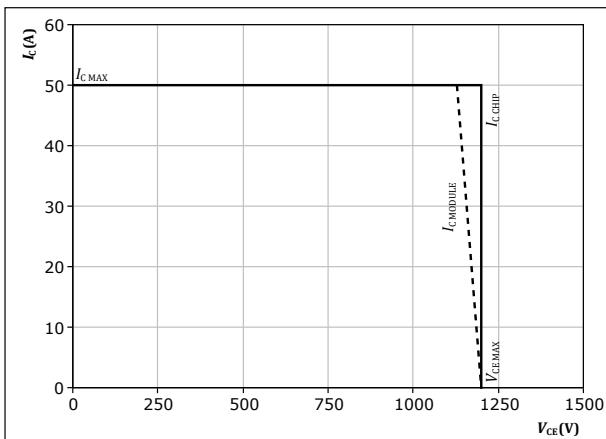


With an inductive load at

$V_{CE} = 600$ V	$T_j = 25$ °C
$V_{GE} = \pm 15$ V	$T_j = 125$ °C
$I_c = 27$ A	$T_j = 150$ °C

figure 32. IGBT

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



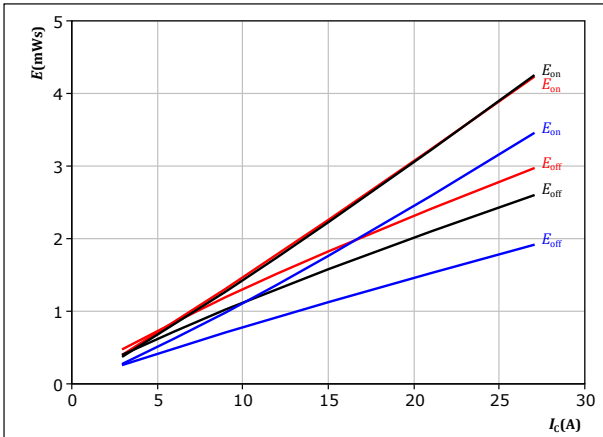
At $T_j = 150$ °C
 $R_{goff} = 16$ Ω
 $R_{goff} = 16$ Ω



Brake Switching Characteristics

figure 33. IGBT

Typical switching energy losses as a function of collector current
 $E = f(I_c)$



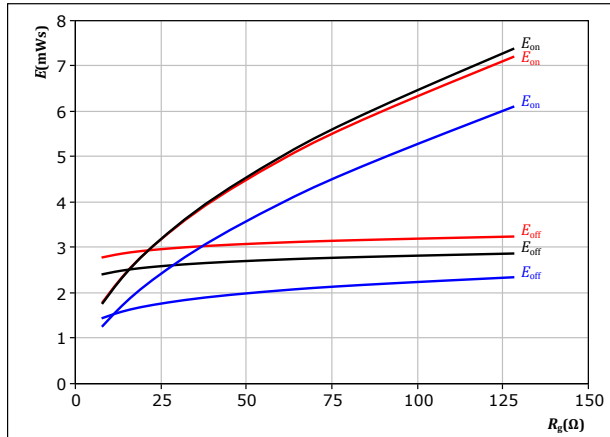
With an inductive load at

$V_{CE} = 600 \text{ V}$
 $V_{GE} = -5/15 \text{ V}$
 $R_{gon} = 64 \ \Omega$
 $R_{goff} = 64 \ \Omega$

T_j : — 25 °C
— 125 °C
— 150 °C

figure 34. IGBT

Typical switching energy losses as a function of gate resistor
 $E = f(R_g)$



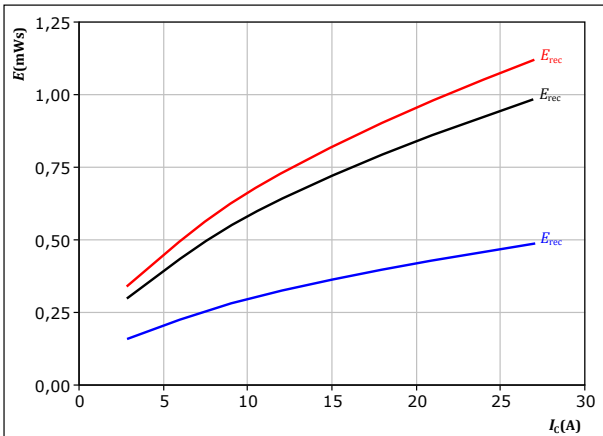
With an inductive load at

$V_{CE} = 600 \text{ V}$
 $V_{GE} = -5/15 \text{ V}$
 $I_c = 27 \text{ A}$

T_j : — 25 °C
— 125 °C
— 150 °C

figure 35. FWD

Typical reverse recovered energy loss as a function of collector current
 $E_{rec} = f(I_c)$



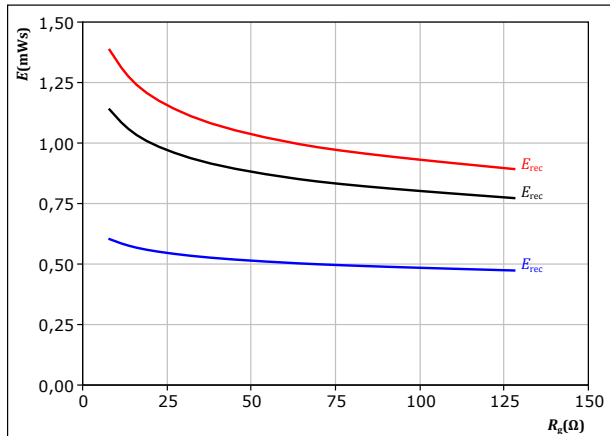
With an inductive load at

$V_{CE} = 600 \text{ V}$
 $V_{GE} = -5/15 \text{ V}$
 $R_{gon} = 64 \ \Omega$

T_j : — 25 °C
— 125 °C
— 150 °C

figure 36. FWD

Typical reverse recovered energy loss as a function of gate resistor
 $E_{rec} = f(R_g)$



With an inductive load at

$V_{CE} = 600 \text{ V}$
 $V_{GE} = -5/15 \text{ V}$
 $I_c = 27 \text{ A}$

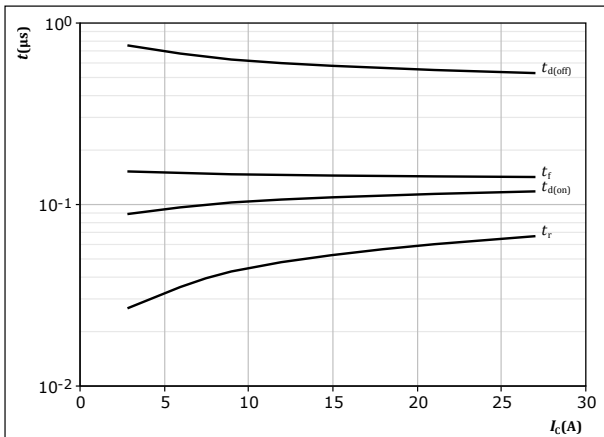
T_j : — 25 °C
— 125 °C
— 150 °C



Brake Switching Characteristics

figure 37. IGBT

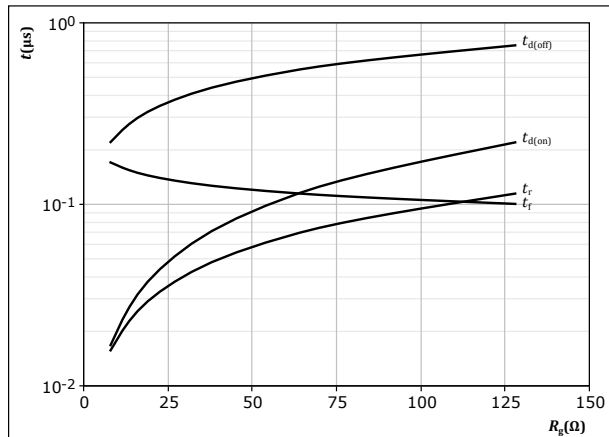
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 150 \text{ }^\circ\text{C}$
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = -5/15 \text{ V}$
 $R_{g(on)} = 64 \text{ } \Omega$
 $R_{g(off)} = 64 \text{ } \Omega$

figure 38. IGBT

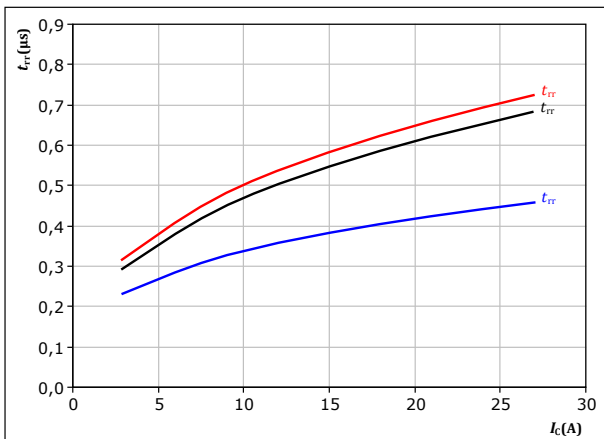
Typical switching times as a function of gate resistor
 $t = f(R_g)$



With an inductive load at
 $T_j = 150 \text{ }^\circ\text{C}$
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = -5/15 \text{ V}$
 $I_c = 27 \text{ A}$

figure 39. FWD

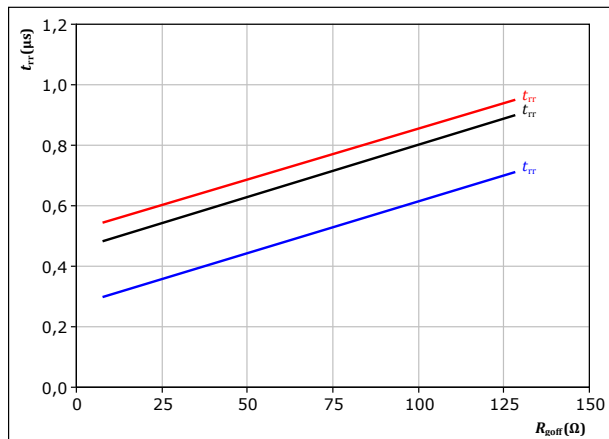
Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = -5/15 \text{ V}$
 $R_{g(on)} = 64 \text{ } \Omega$
 $T_j:$ — 25 °C
 — 125 °C
 — 150 °C

figure 40. FWD

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



With an inductive load at
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = -5/15 \text{ V}$
 $I_c = 27 \text{ A}$
 $T_j:$ — 25 °C
 — 125 °C
 — 150 °C

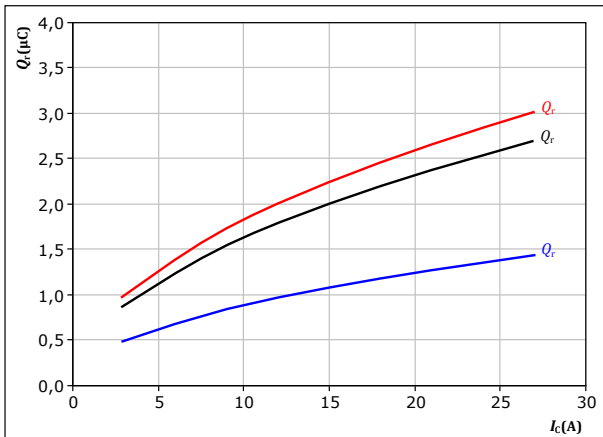


Brake Switching Characteristics

figure 41. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



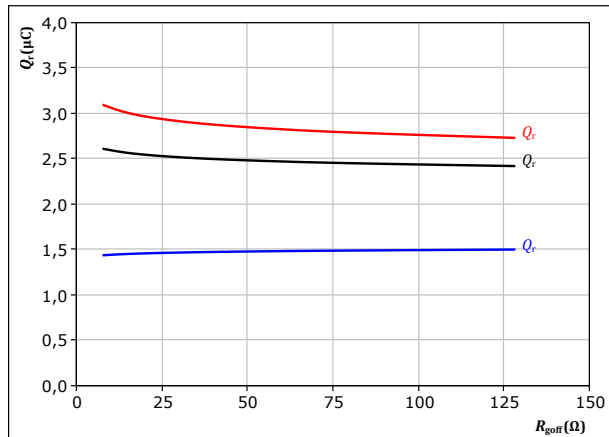
With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = -5/15$ V
 $R_{goff} = 64$ Ω
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 42. FWD

Typical recovered charge as a function of turn off gate resistor

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



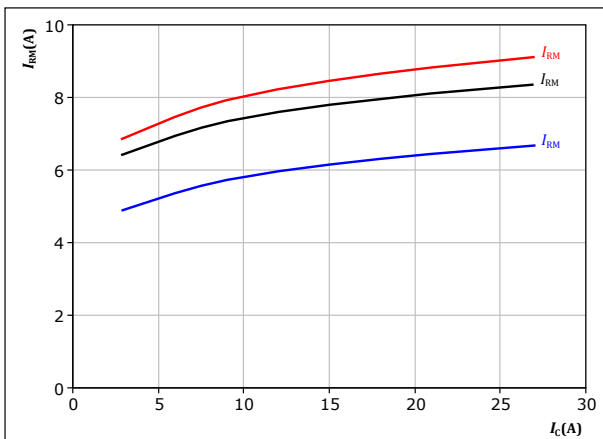
With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = -5/15$ V
 $I_c = 27$ A
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 43. FWD

Typical peak reverse recovery current as a function of collector current

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



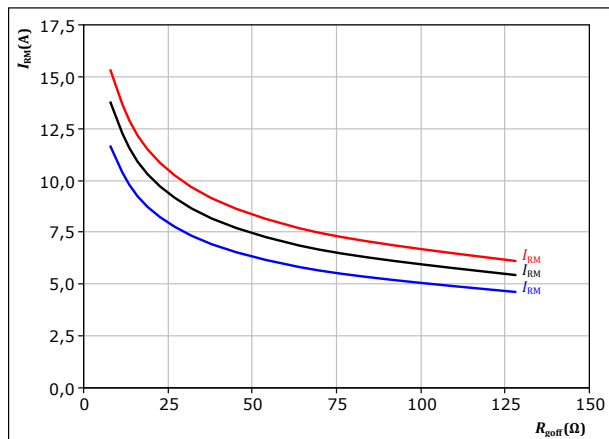
With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = -5/15$ V
 $R_{goff} = 64$ Ω
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 44. FWD

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

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



With an inductive load at

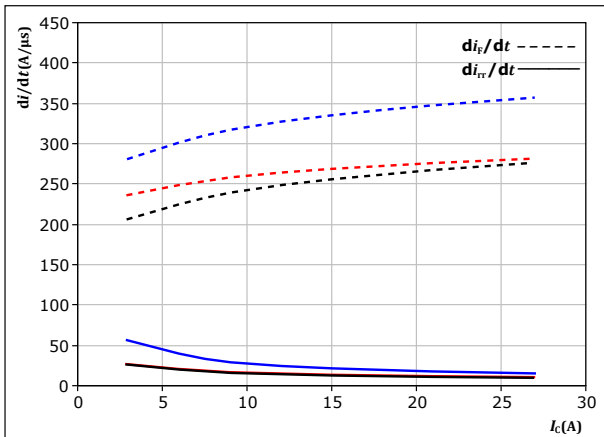
$V_{CE} = 600$ V
 $V_{GE} = -5/15$ V
 $I_c = 27$ A
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)



Brake Switching Characteristics

figure 45. FWD

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



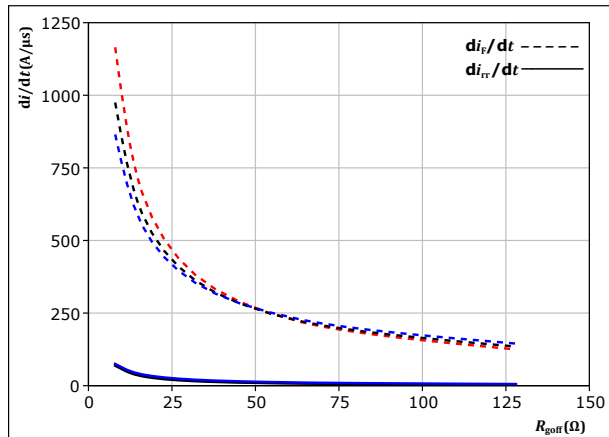
With an inductive load at

$V_{CE} = 600 \text{ V}$
 $V_{GE} = -5/15 \text{ V}$
 $R_{goff} = 64 \text{ } \Omega$

— 25 °C
 — 125 °C
 — 150 °C

figure 46. FWD

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



With an inductive load at

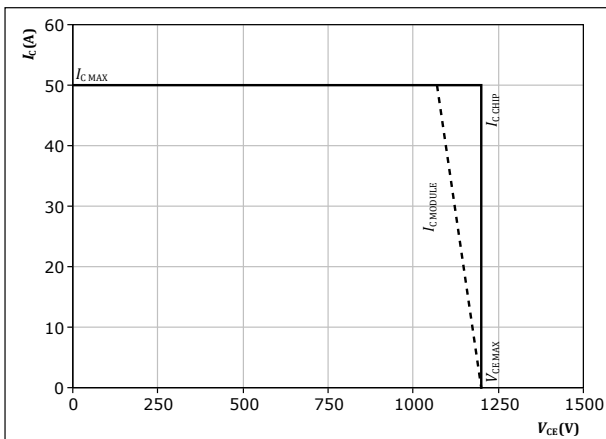
$V_{CE} = 600 \text{ V}$
 $V_{GE} = -5/15 \text{ V}$
 $I_c = 27 \text{ A}$

— 25 °C
 — 125 °C
 — 150 °C

figure 47. IGBT

Reverse bias safe operating area

$I_c = f(V_{CE})$



At $T_j = 150 \text{ } ^\circ\text{C}$
 $R_{goff} = 64 \text{ } \Omega$
 $R_{goff} = 64 \text{ } \Omega$



Switching Definitions

figure 48. IGBT

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

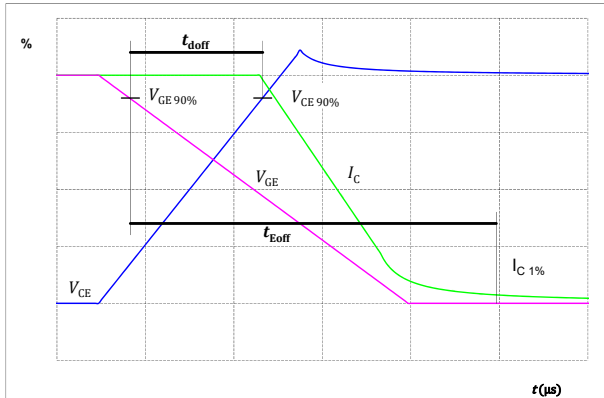


figure 49. IGBT

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

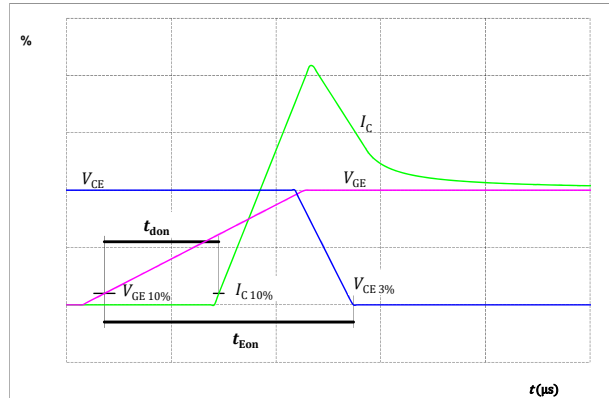


figure 50. IGBT

Turn-off Switching Waveforms & definition of t_f

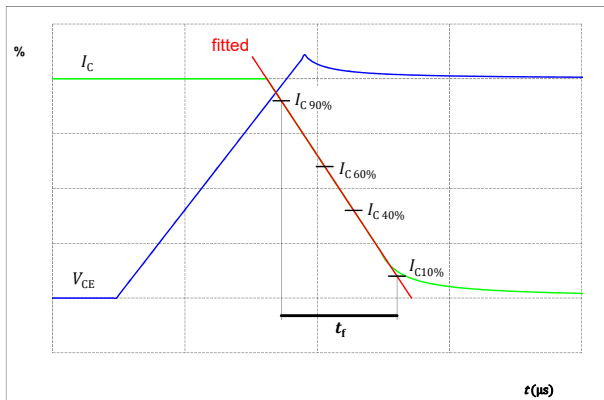
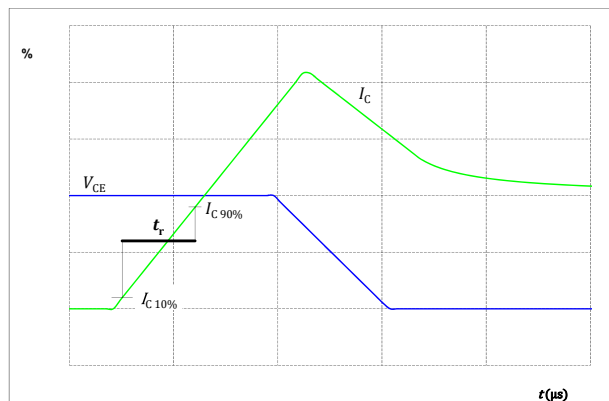


figure 51. IGBT

Turn-on Switching Waveforms & definition of t_r





Switching Definitions

figure 52. FWD

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

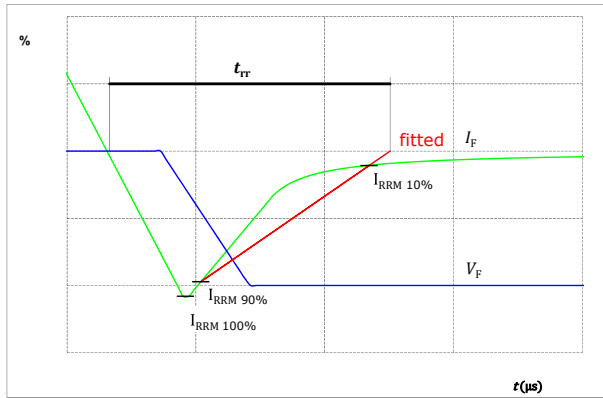
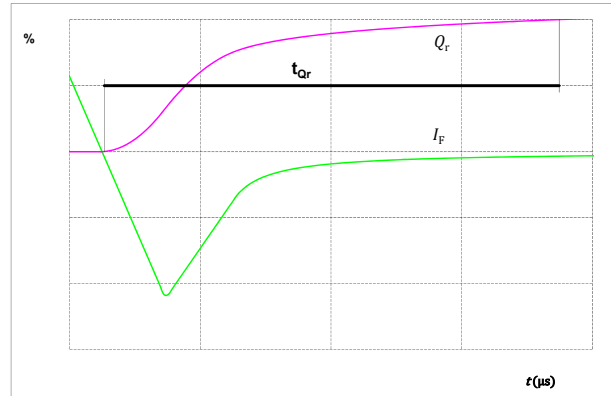


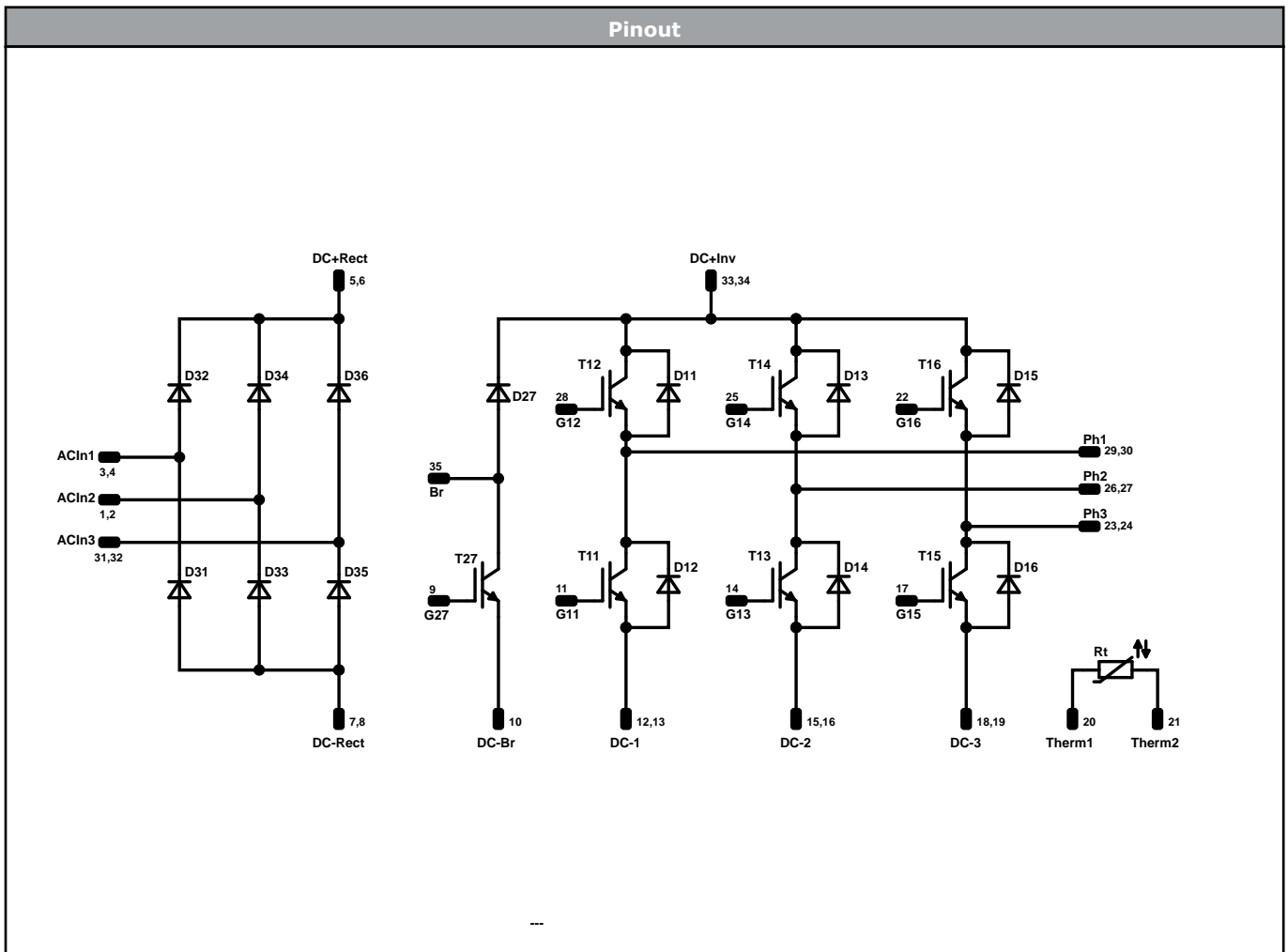
figure 53. FWD

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





Vincotech



Identification					
ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	25 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	25 A	Inverter Diode	
T27	IGBT	1200 V	25 A	Brake Switch	
D27	FWD	1200 V	10 A	Brake Diode	
D31, D32, D33, D34, D35, D36	Rectifier	1600 V	35 A	Rectifier Diode	
Rt	NTC			Thermistor	




Packaging instruction				
Standard packaging quantity (SPQ) 100	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for <i>flow</i> E2 packages see vincotech.com website.

Package data
Package data for <i>flow</i> E2 packages see vincotech.com website.

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
10-EY12PMA025SC-L187A48T-D5-14	16 Apr. 2021	Update characteristics of rectifier diode, leakage current max value from 50 -> 100 uA	

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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.