B0-SP12NAA008ME01-LR88F78T
datasheet

***flow*ANPC S3** **1200 V / 8 mΩ**

Features

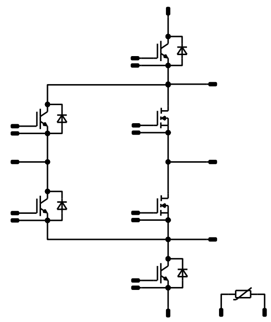
- Active NPC topology
- Ultra-high switching frequency with SiC MOSFETs
- Optimized for 1500Vdc applications
- Low inductive mid-power package
- Supports interleaved operation

flow S3 12 mm housing

Target applications

- Solar Inverters

Schematic



Types

- B0-SP12NAA008ME01-LR88F78T

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
AC Switch					
Drain-source voltage	V_{DSS}			1200	V
Drain current (DC current)	I_D	$T_j = T_{jmax}$	T_s = 80 °C	148	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}		480	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	262	W
Gate-source voltage	V_{GSS}			-4 / 15	V
		dynamic		-8 / 19	
Maximum Junction Temperature	T_{jmax}			175	°C
Neutral Point Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	128	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 °C	226	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 800 V	T_j = 150 °C	9,5	µs
Maximum junction temperature	T_{jmax}			175	°C
DC-Link Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	104	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	172	W
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
DC-Link Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	128	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 °C	226	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 800 V	T_j = 150 °C	9,5	µs
Maximum junction temperature	T_{jmax}			175	°C
Neutral Point Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	104	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	172	W
Maximum junction temperature	T_{jmax}			175	°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 s	6000	V
Creepage distance				9,53	mm
Clearance				8,19	mm
Comparative Tracking Index	CTI			≥ 600	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions	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]	Values Min	Values Typ	Values Max	Unit
AC Switch										
Static										
Drain-source on-state resistance	$r_{DS(on)}$		15		160	25 125 150	5,6	9 11 12	10,4(1)	mΩ
Gate-source threshold voltage	$V_{GS(th)}$		0		0,046	25	1,8	2,5	3,6	V
Gate to Source Leakage Current	I_{GSS}		15	0		25		40	1000	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	1200		25		4	76	μA
Internal gate resistance	r_g							0,425		Ω
Gate charge	Q_g		-4/15	800	160	25		472		nC
Short-circuit input capacitance	C_{iss}	f = 100 kHz	0	1000	0	25		13428		pF
Short-circuit output capacitance	C_{oss}							516		
Reverse transfer capacitance	C_{rss}							32		
Diode forward voltage	V_{SD}		0		80	25		4,6		V
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,36		K/W

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	
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	0/15	600	40	25 125 150		34,24 30,4 29,76		ns
Rise time	t_r					25 125 150		14,4 12,8 12,16		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		154,88 177,28 183,36		ns
Fall time	t_f					25 125 150		41,56 43,02 42,14		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=1,16 µC Q_{rFWD}=1,37 µC Q_{rFWD}=1,46 µC				25 125 150		0,973 0,818 0,801		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,431 0,464 0,482		mWs
Peak recovery current	I_{RRM}	d*i*/d*t*=3489 A/µs d*i*/d*t*=4139 A/µs d*i*/d*t*=4327 A/µs				25 125 150		57,38 66,88 70,09		A
Reverse recovery time	t_{rr}					25 125 150		35,15 35,4 35,88		ns
Recovered charge	Q_r					25 125 150		1,16 1,37 1,46		µC
Reverse recovered energy	E_{rec}					25 125 150		0,357 0,571 0,635		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		4007 4266 4436		A/µs

Characteristic Values

Parameter	Symbol	Conditions	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	Unit
Neutral Point Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,015	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		150	25 125 150		1,58 1,8 1,86	1,85(1)	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}		0	10		25		30000		pF
Output capacitance	C_{oes}							880		pF
Reverse transfer capacitance	C_{res}							320		pF
Gate charge	Q_g	V_{CC} = 600 V	15		150	25		1000		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,42		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	135	25 125 150		319,36 334,72 338,56		ns
Rise time	t_r					25 125 150		62,08 74,24 77,76		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		247,36 287,04 296,64		ns
Fall time	t_f					25 125 150		77,11 104,65 111,69		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=11,82 µC Q_{rFWD}=19,01 µC Q_{rFWD}=21,51 µC				25 125 150		13,91 18,53 20,08		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		10,68 14,39 15,49		mWs

Characteristic Values

Parameter	Symbol	Conditions	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	Unit
DC-Link Diode										
Static										
Forward voltage	V_F				150	25 125 150		1,79 1,9 1,9	2,1[(1)]	V
Reverse leakage current	I_R	V_r = 1200 V				25			40	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,55		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=1925 A/µs d*i*/d*t*=1659 A/µs d*i*/d*t*=1643 A/µs	±15	600	135	25 125 150		82,45 86,04 88,02		A
Reverse recovery time	t_{rr}					25 125 150		325,48 489,27 540,31		ns
Recovered charge	Q_r					25 125 150		11,82 19,01 21,51		µC
Reverse recovered energy	E_{rec}					25 125 150		3,99 6,77 7,72		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		433,38 360,37 331,11		A/µs

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	
DC-Link Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,015	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		150	25 125 150		1,58 1,8 1,86	1,85(1)	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}		0	10		25		30000		pF
Output capacitance	C_{oes}							880		pF
Reverse transfer capacitance	C_{res}							320		pF
Gate charge	Q_g	V_{CC} = 600 V	15		150	25		1000		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,42		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	125	25 125 150		304,32 318,72 322,56		ns
Rise time	t_r					25 125 150		46,72 56,64 60,48		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		256,96 298,88 308,16		ns
Fall time	t_f					25 125 150		79,44 113,41 120,75		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=12,64 µC Q_{rFWD}=20,51 µC Q_{rFWD}=23,29 µC				25 125 150		8,8 12,8 14,42		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		9,87 13,56 14,96		mWs

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	
Neutral Point Diode										
Static										
Forward voltage	V_F				150	25 125 150		1,79 1,9 1,9	2,1 (1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			40	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,55		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=2704 A/µs d*i*/d*t*=2202 A/µs d*i*/d*t*=2119 A/µs	±15	600	125	25 125 150		118,78 118,84 120,44		A
Reverse recovery time	t_{rr}					25 125 150		257,69 416,79 467,22		ns
Recovered charge	Q_r					25 125 150		12,64 20,51 23,29		µC
Reverse recovered energy	E_{rec}					25 125 150		4,91 8,12 9,22		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		1287 694,05 634,74		A/µs

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	
Thermistor										
Static										
Rated resistance	R					25		4,7		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 401 Ω				100	-5		5	%
Power dissipation	P							5		mW
Power dissipation constant	d					25		1,3		mW/K
B-value	$B_{(25/50)}$	Tol. ±3 %						3612		K
B-value	$B_{(25/100)}$	Tol. ±3 %						3650		K

(1) Value at chip level

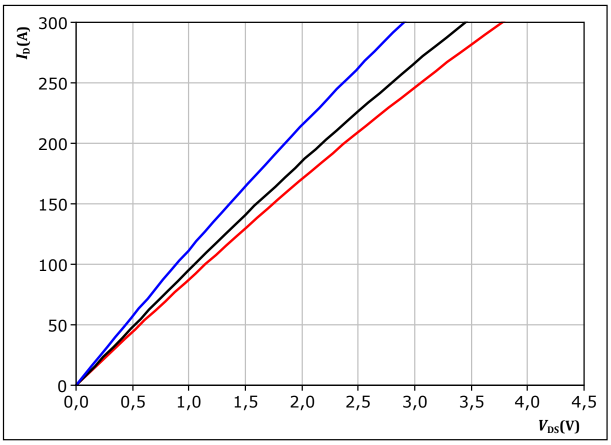
(2) Only valid with pre-applied Vincotech thermal interface material.

AC Switch Characteristics

figure 1. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

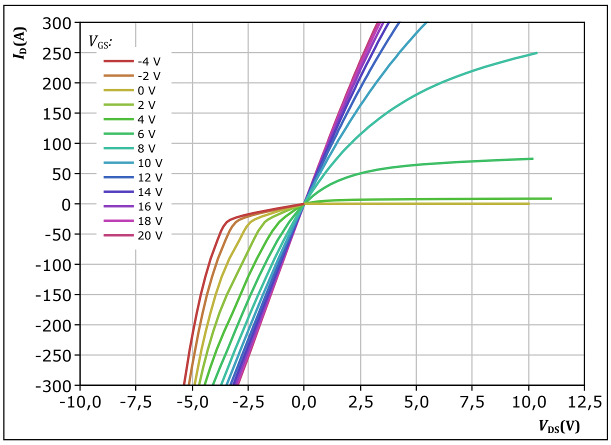


t_p = 250 µs
V_{GS} = 14 V
T_j: 25 °C, 125 °C, 150 °C

figure 2. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

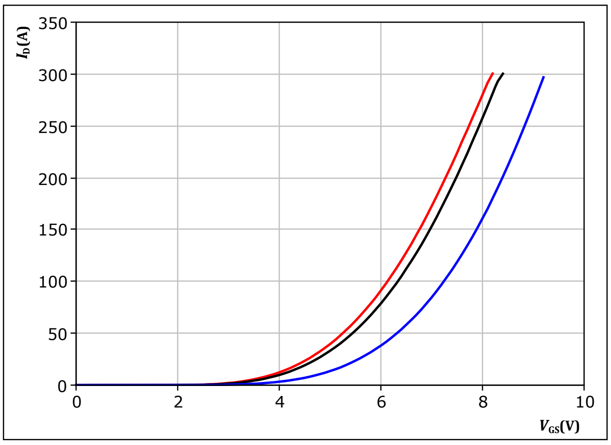


t_p = 250 µs
T_j = 150 °C
V_{GS} from -4 V to 20 V in steps of 2 V

figure 3. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$

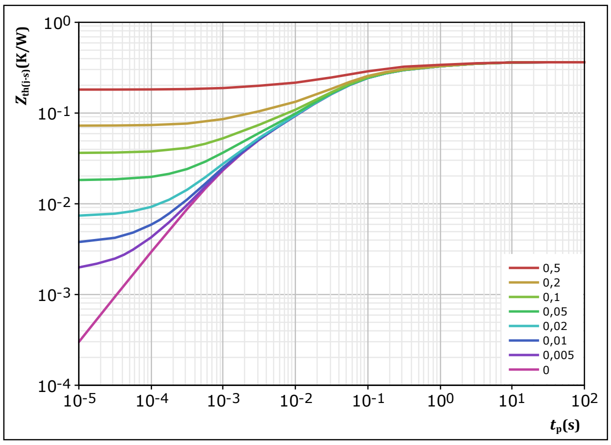


t_p = 250 µs
V_{DS} = 10 V
T_j: 25 °C, 125 °C, 150 °C

figure 4. **MOSFET**

Transient thermal impedance as a function of pulse width

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



D = t_p / T
$R_{th(j-s)}$ = 0,363 K/W

MOSFET thermal model values

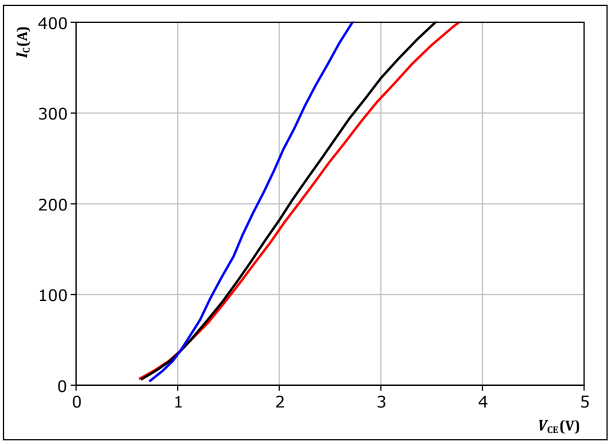
R (K/W)	τ (s)
3,12E-02	3,34E+00
5,80E-02	6,26E-01
1,74E-01	6,78E-02
6,98E-02	1,25E-02
3,03E-02	1,39E-03

Neutral Point Switch Characteristics

figure 5. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

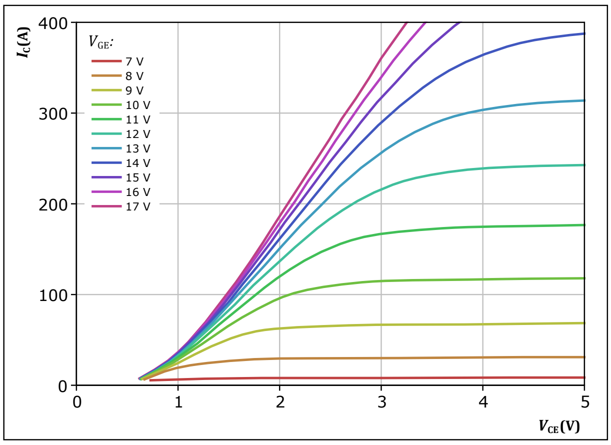


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 6. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



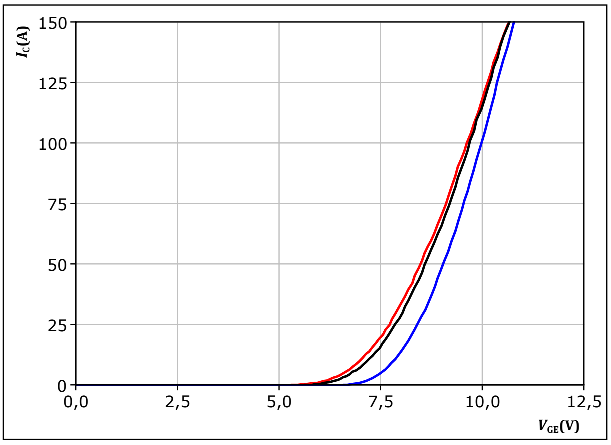
t_p =	250	µs
T_j =	150	°C

V_{GE} from 7 V to 17 V in steps of 1 V

figure 7. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})

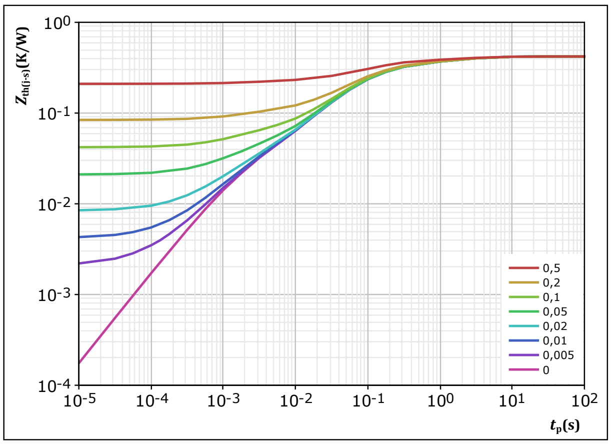


t_p =	250	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 8. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,42	K/W

IGBT thermal model values

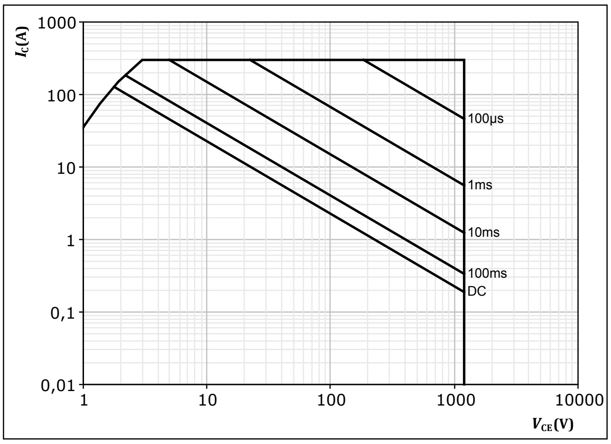
R (K/W)	τ (s)
5,01E-02	3,17E+00
7,90E-02	5,66E-01
2,16E-01	8,74E-02
5,52E-02	2,28E-02
1,93E-02	1,55E-03

Neutral Point Switch Characteristics

figure 9.	IGBT

Safe operating area

$I_C = f(V_{CE})$



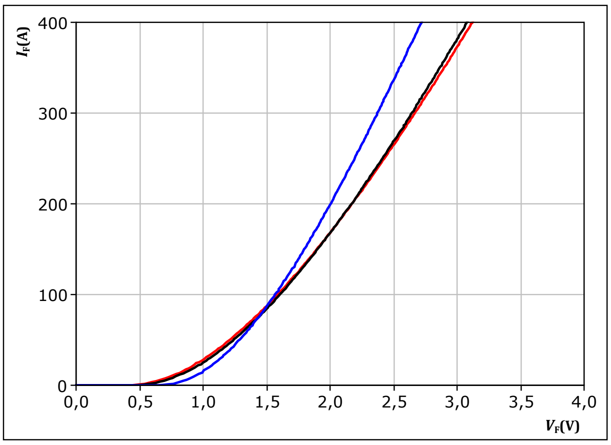
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

DC-Link Diode Characteristics

figure 10. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



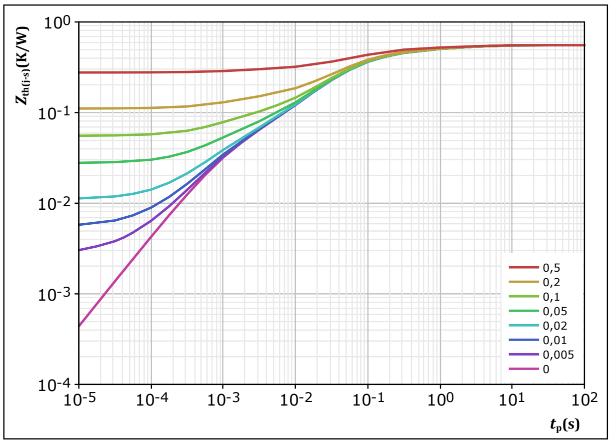
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 11. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,554 K/W

FWD thermal model values

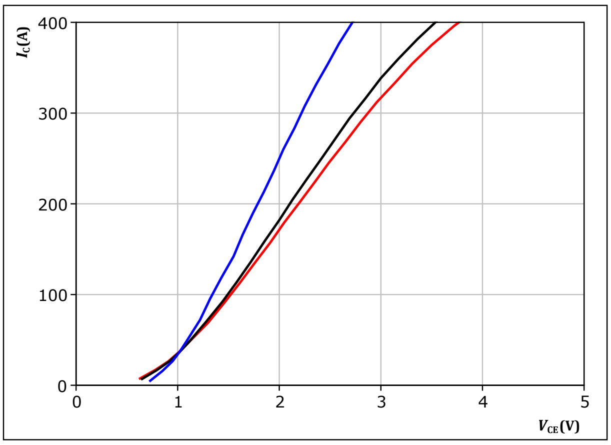
R (K/W)	τ (s)
5,67E-02	2,72E+00
9,06E-02	4,39E-01
2,74E-01	6,77E-02
9,64E-02	1,56E-02
3,58E-02	1,06E-03

DC-Link Switch Characteristics

figure 12. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

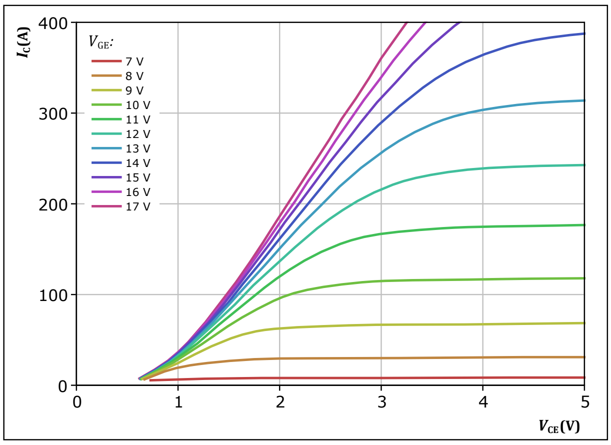


t_p = 250 µs
V_{GE} = 15 V
T_j: 25 °C, 125 °C, 150 °C

figure 13. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

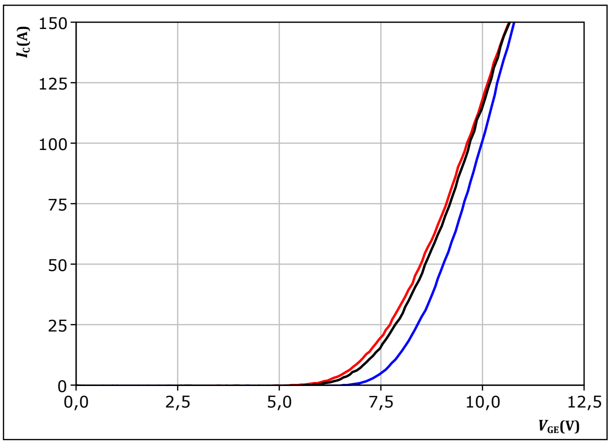


t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 14. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

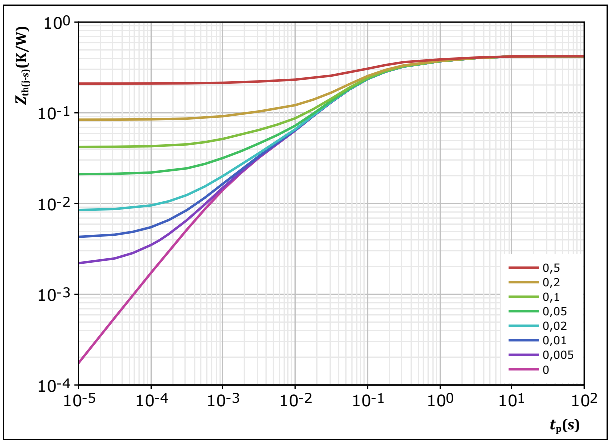


t_p = 250 µs
V_{CE} = 10 V
T_j: 25 °C, 125 °C, 150 °C

figure 15. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
$R_{th(j-s)}$ = 0,42 K/W

IGBT thermal model values

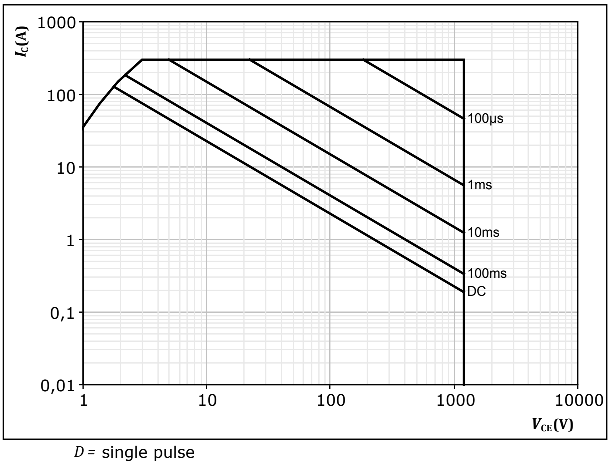
R (K/W)	τ (s)
5,01E-02	3,17E+00
7,90E-02	5,66E-01
2,16E-01	8,74E-02
5,52E-02	2,28E-02
1,93E-02	1,55E-03

DC-Link Switch Characteristics

figure 16.	IGBT

Safe operating area

I_C = f(V_{CE})



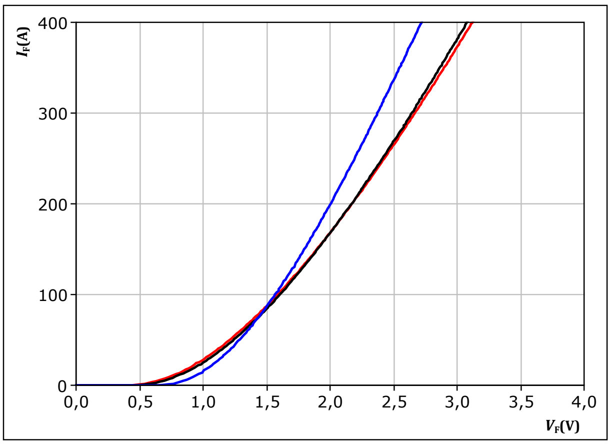
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Neutral Point Diode Characteristics

figure 17. FWD

Typical forward characteristics

$I_F = f(V_F)$



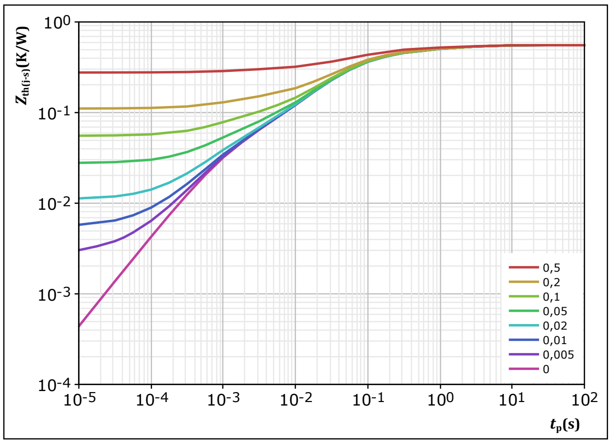
t_p = 250 μs

T_j: 25 °C, 125 °C, 150 °C

figure 18. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,554 K/W

FWD thermal model values

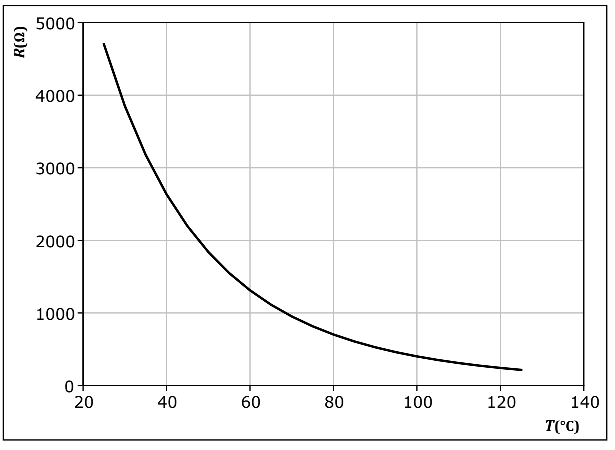
R (K/W)	τ (s)
5,67E-02	2,72E+00
9,06E-02	4,39E-01
2,74E-01	6,77E-02
9,64E-02	1,56E-02
3,58E-02	1,06E-03

Thermistor Characteristics

figure 19.	Thermistor

Typical NTC characteristic as function of temperature

R_T = f(T)

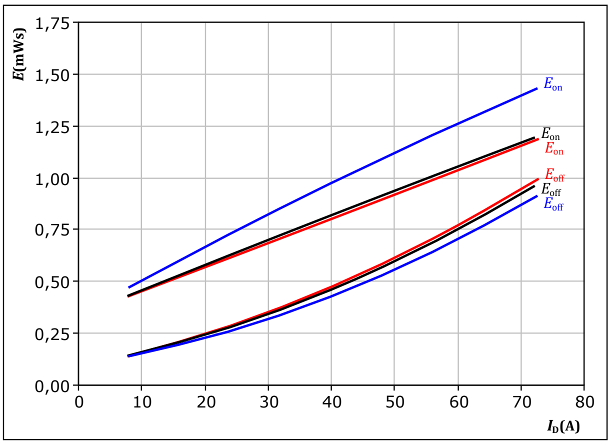


AC Switching Characteristics

figure 20. **MOSFET**

Typical switching energy losses as a function of drain current

E = f(I_D)



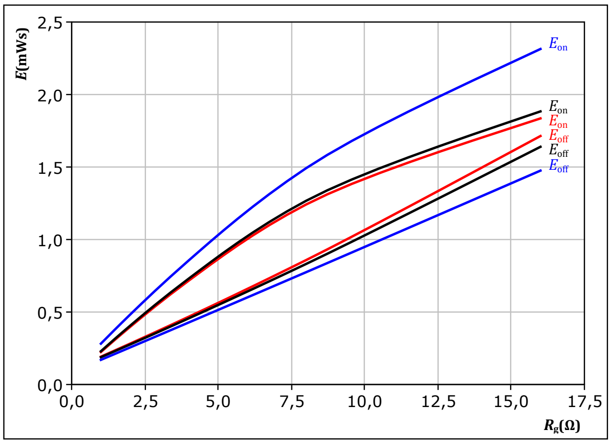
With an inductive load at

V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	0/15	V		125 °C
R_{gon} =	4	Ω		150 °C
R_{goff} =	4	Ω		

figure 21. **MOSFET**

Typical switching energy losses as a function of gate resistor

E = f(R_g)



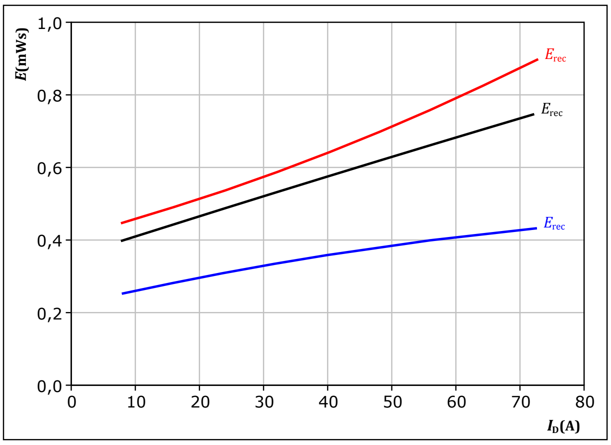
With an inductive load at

V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	0/15	V		125 °C
I_D =	40	A		150 °C

figure 22. **MOSFET**

Typical reverse recovered energy loss as a function of drain current

E_{rec} = f(I_D)



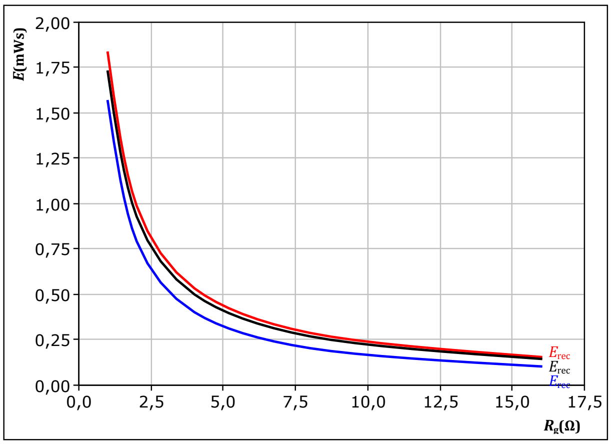
With an inductive load at

V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	0/15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 23. **MOSFET**

Typical reverse recovered energy loss as a function of gate resistor

E_{rec} = f(R_g)



With an inductive load at

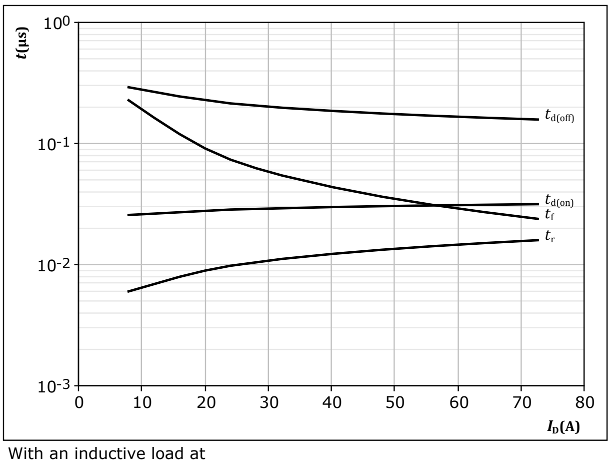
V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	0/15	V		125 °C
I_D =	40	A		150 °C

AC Switching Characteristics

figure 24. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



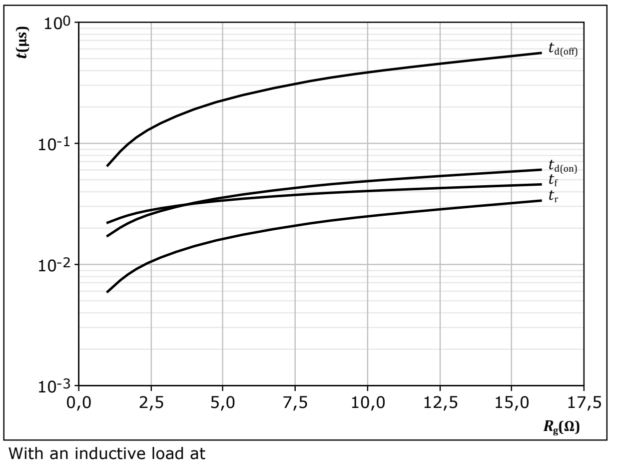
With an inductive load at

T_j =	150	°C
V_{DS} =	600	V
V_{GS} =	0/15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 25. **MOSFET**

Typical switching times as a function of gate resistor

$t = f(R_g)$



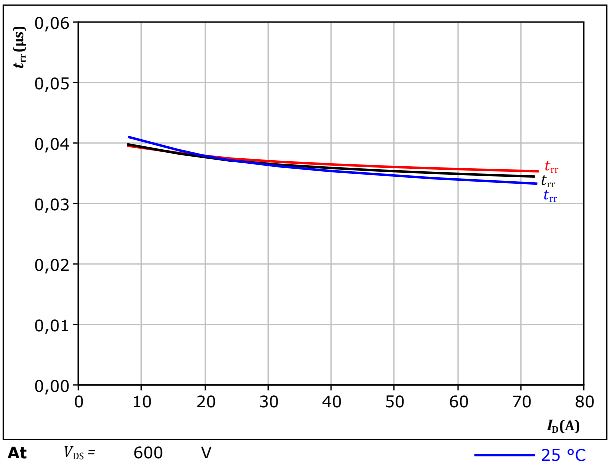
With an inductive load at

T_j =	150	°C
V_{DS} =	600	V
V_{GS} =	0/15	V
I_D =	40	A

figure 26. **MOSFET**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$

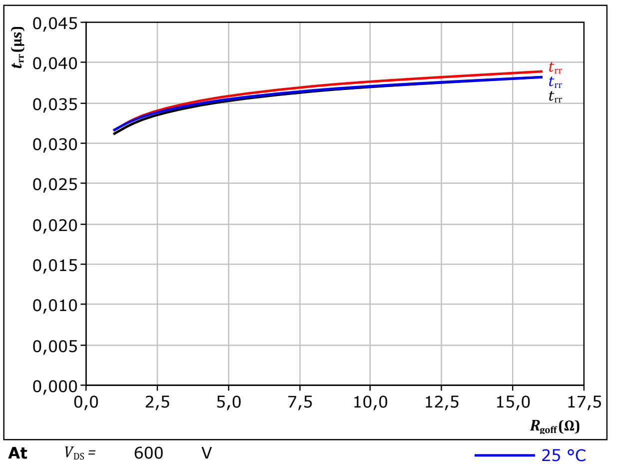


At			
	V_{DS} =	600	V
	V_{GS} =	0/15	V
	R_{gon} =	4	Ω

figure 27. **MOSFET**

Typical reverse recovery time as a function of turn off gate resistor

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



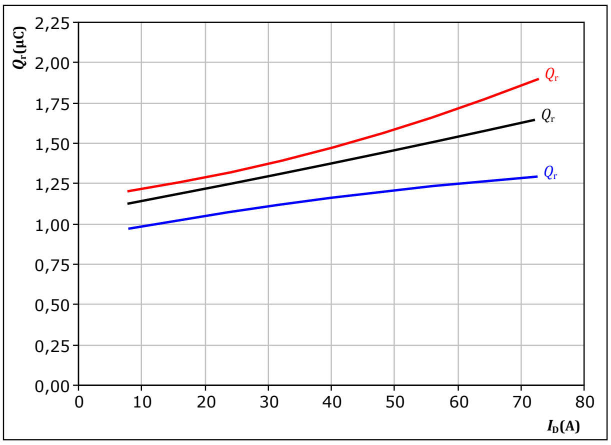
At			
	V_{DS} =	600	V
	V_{GS} =	0/15	V
	I_D =	40	A

AC Switching Characteristics

figure 28. **MOSFET**

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

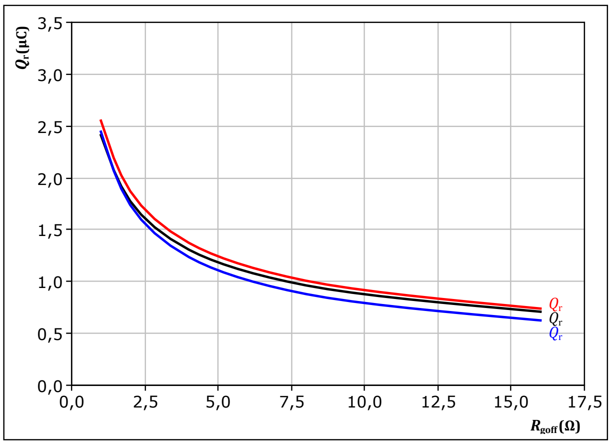


At				
V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	0/15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 29. **MOSFET**

Typical recovered charge as a function of turn off gate resistor

$Q_r = f(R_{goff})$

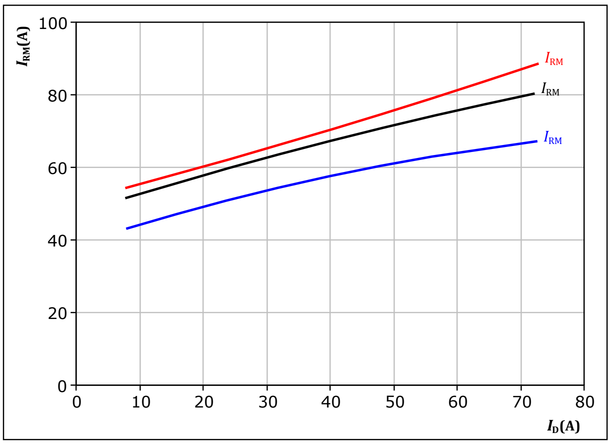


At				
V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	0/15	V		125 °C
I_D =	40	A		150 °C

figure 30. **MOSFET**

Typical peak reverse recovery current as a function of drain current

$I_{RM} = f(I_D)$

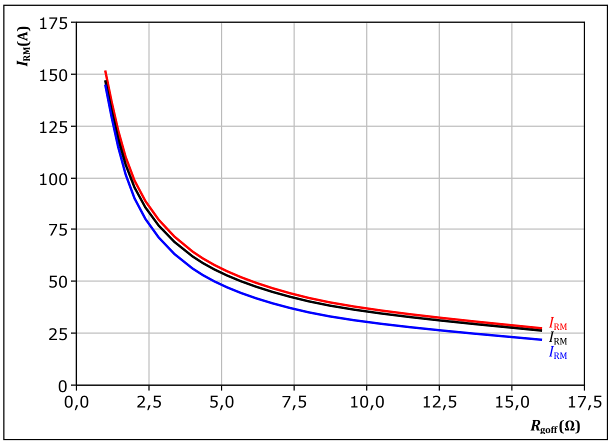


At				
V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	0/15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 31. **MOSFET**

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

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



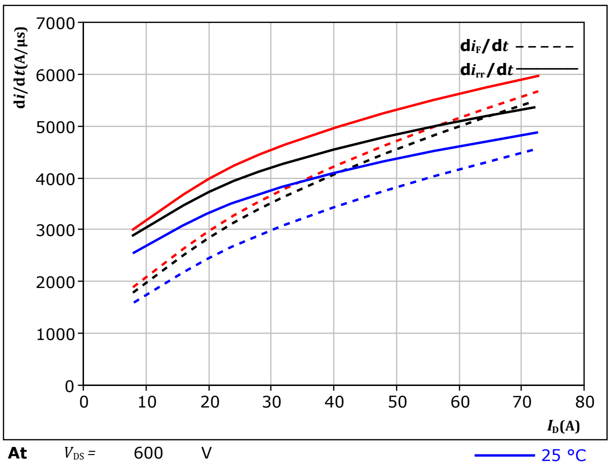
At				
V_{DS} =	600	V	T_j:	25 °C
V_{GS} =	0/15	V		125 °C
I_D =	40	A		150 °C

AC Switching Characteristics

figure 32. **MOSFET**

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

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

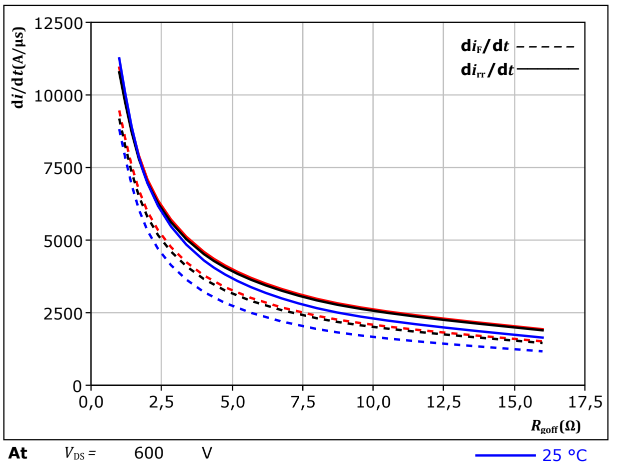


At				
	V_{DS} =	600	V	
	V_{GS} =	0/15	V	T_j: 25 °C / 125 °C / 150 °C
	R_{gon} =	4	Ω	

figure 33. **MOSFET**

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})

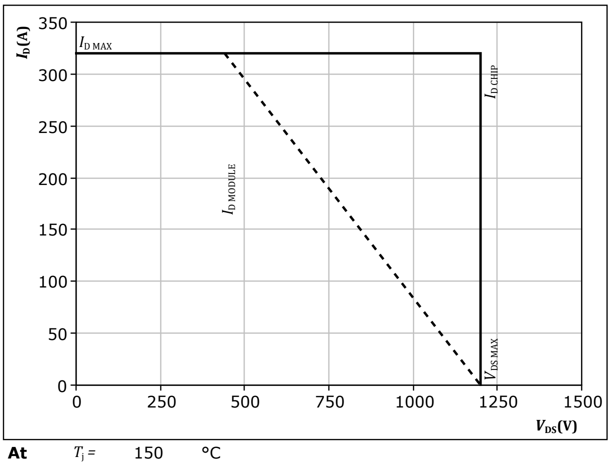


At				
	V_{DS} =	600	V	
	V_{GS} =	0/15	V	T_j: 25 °C / 125 °C / 150 °C
	I_D =	40	A	

figure 34. **MOSFET**

Reverse bias safe operating area

I_D = f(V_{DS})



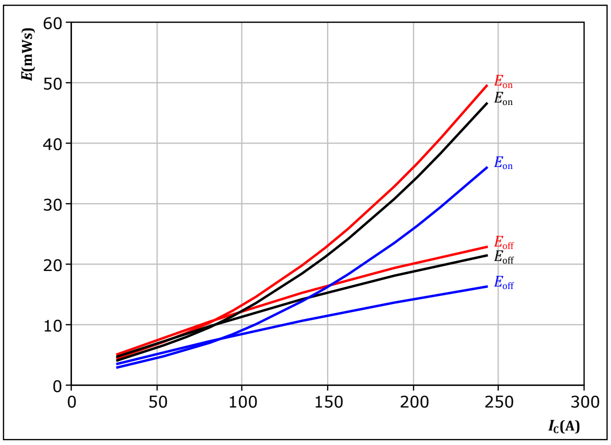
At			
	T_j =	150	°C
	R_{gon} =	4	Ω
	R_{goff} =	4	Ω

Neutral Point Switching Characteristics

figure 35. **IGBT**

Typical switching energy losses as a function of collector current

E = f(I_C)



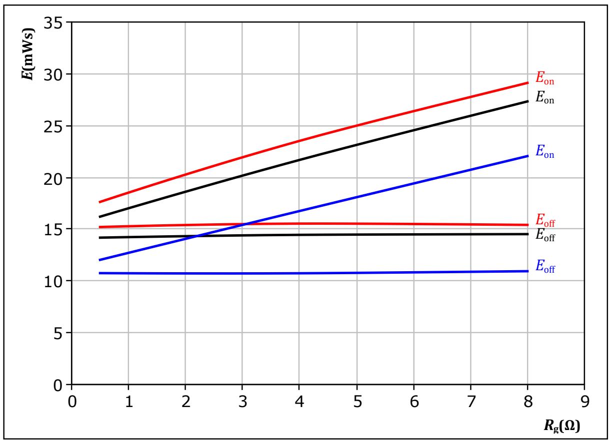
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		150 °C
R_{goff} =	2	Ω		

figure 36. **IGBT**

Typical switching energy losses as a function of gate resistor

E = f(R_g)



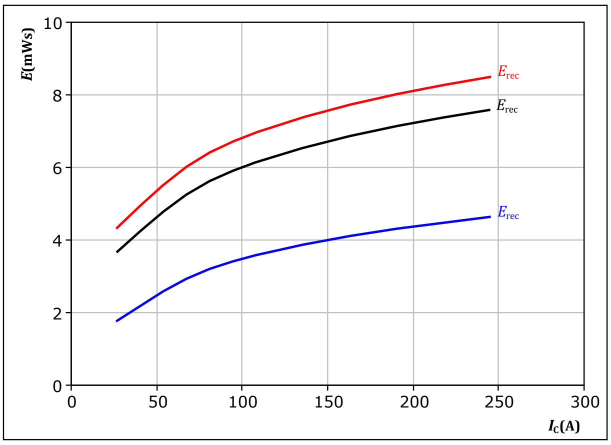
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	135	A		150 °C

figure 37. **FWD**

Typical reverse recovered energy loss as a function of collector current

E_{rec} = f(I_C)



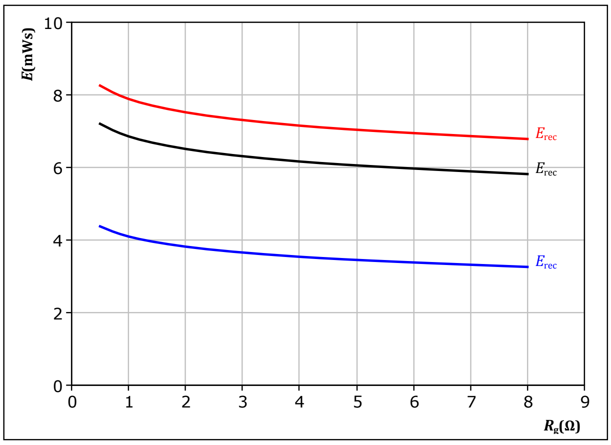
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 38. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

E_{rec} = f(R_g)



With an inductive load at

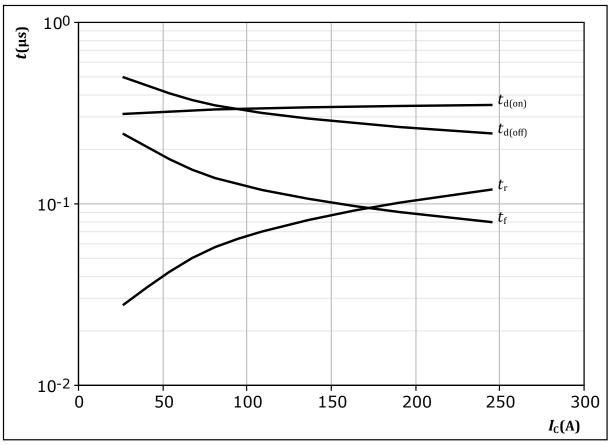
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	135	A		150 °C

Neutral Point Switching Characteristics

figure 39. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



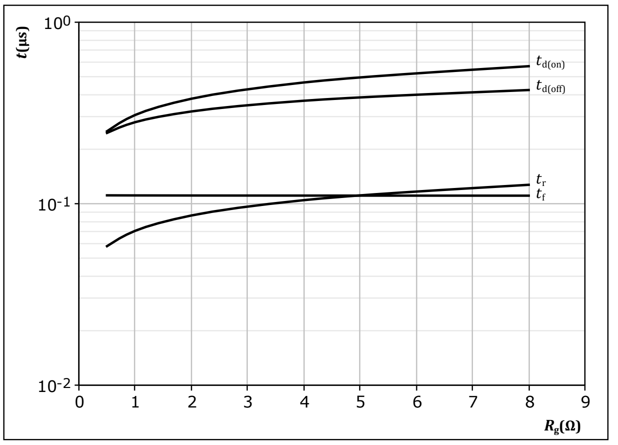
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 40. **IGBT**

Typical switching times as a function of gate resistor

t = f(R_g)



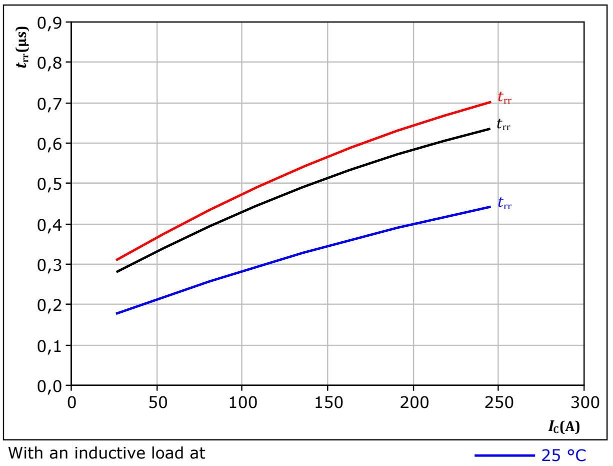
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	135	A

figure 41. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

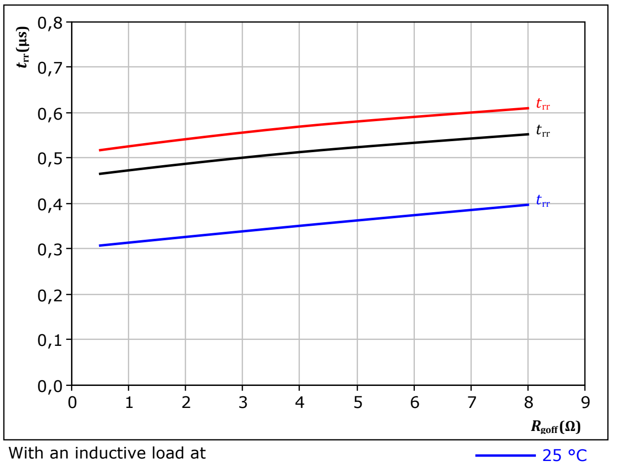
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 42. **FWD**

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

t_{rr} = f(R_{goff})



With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	135	A

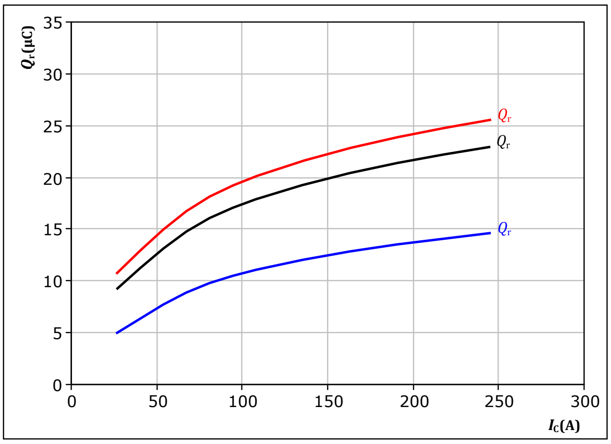
T_j: 25 °C, 125 °C, 150 °C

Neutral Point Switching Characteristics

figure 43. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



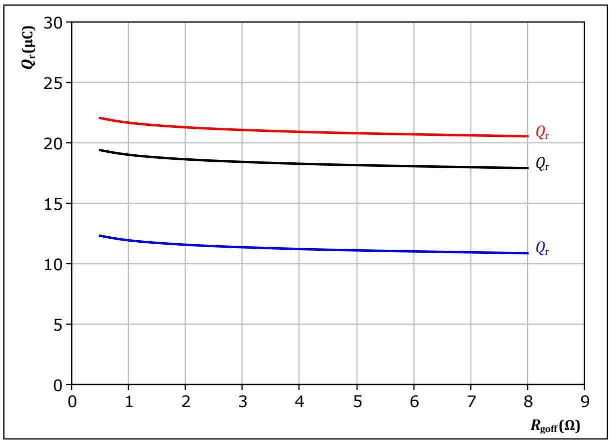
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 44. **FWD**

Typical recovered charge as a function of turn off gate resistor

Q_r = f(R_{goff})



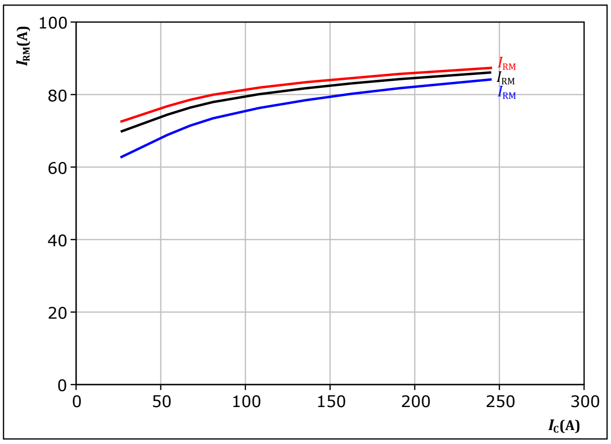
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	135	A		150 °C

figure 45. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



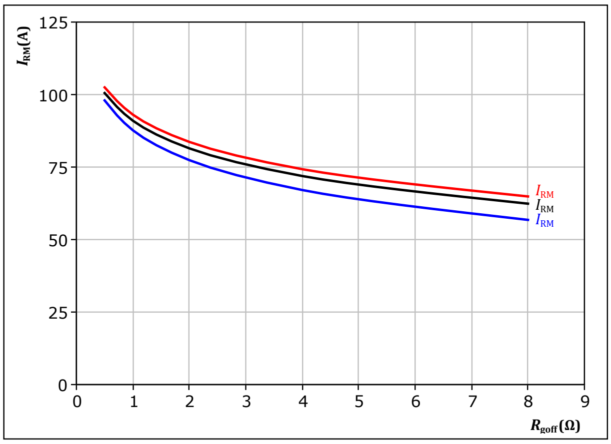
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 46. **FWD**

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

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



With an inductive load at

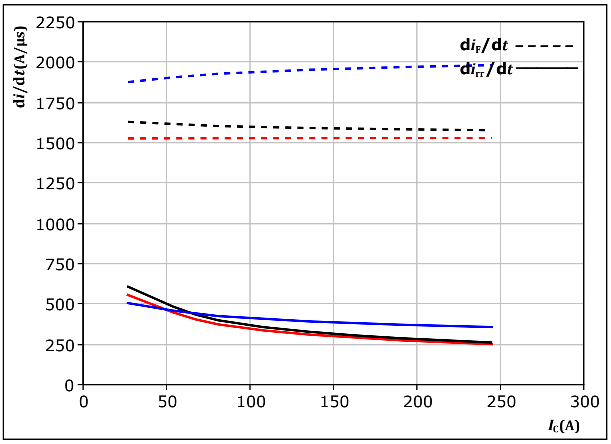
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	135	A		150 °C

Neutral Point Switching Characteristics

figure 47. **FWD**

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

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



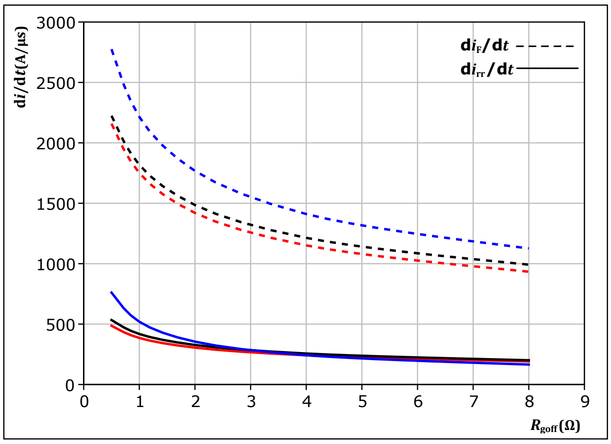
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 48. **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})



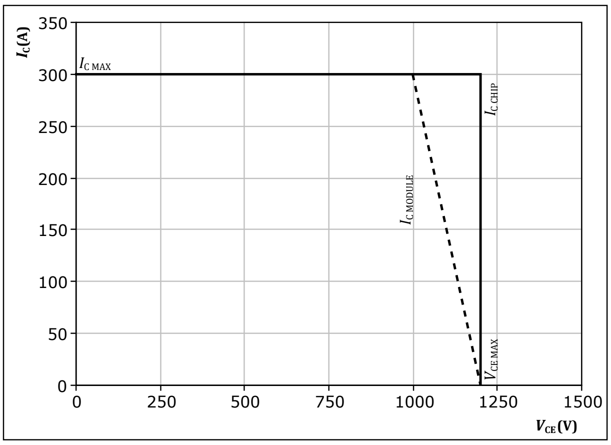
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	135	A		150 °C

figure 49. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



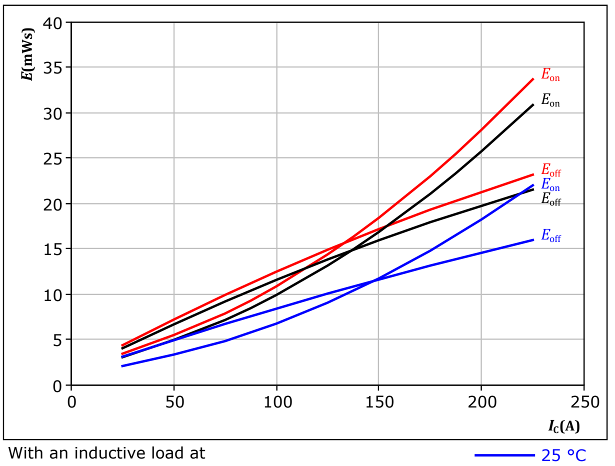
At	T_j =	150	°C
	R_{gon} =	2	Ω
	R_{goff} =	2	Ω

DC-Link Switching Characteristics

figure 50. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



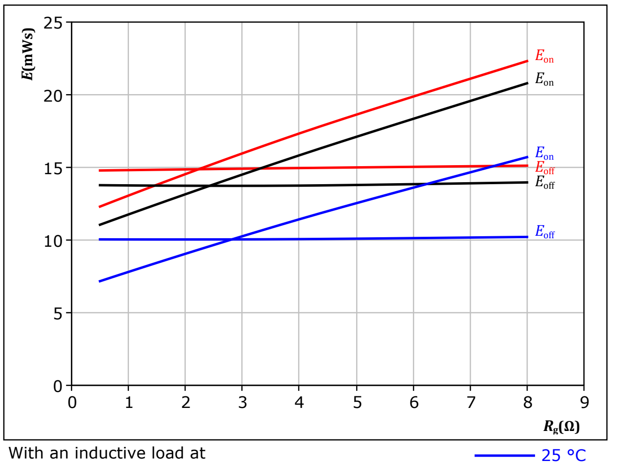
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		150 °C
R_{goff} =	2	Ω		

figure 51. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



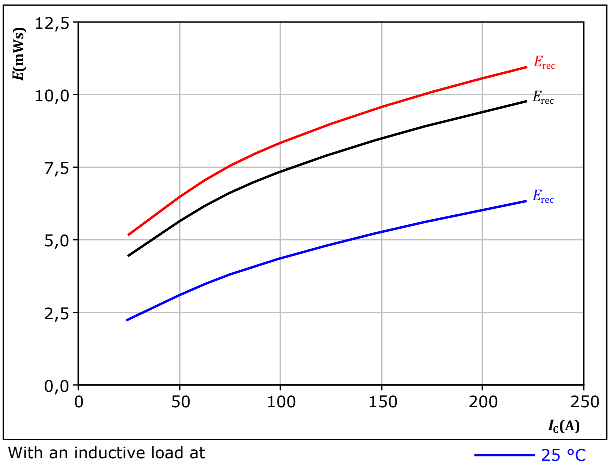
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	125	A		150 °C

figure 52. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



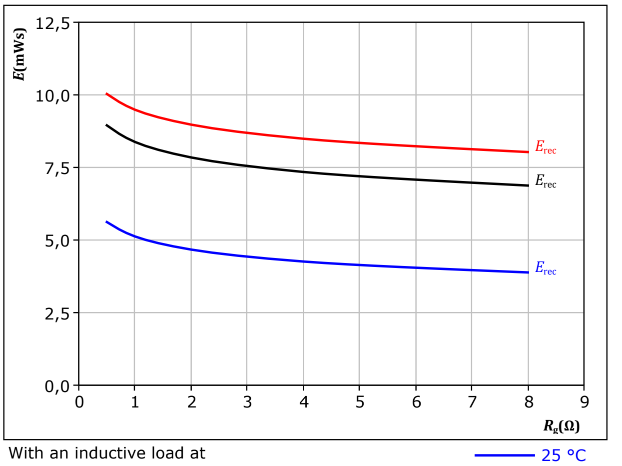
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 53. **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_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	125	A		150 °C

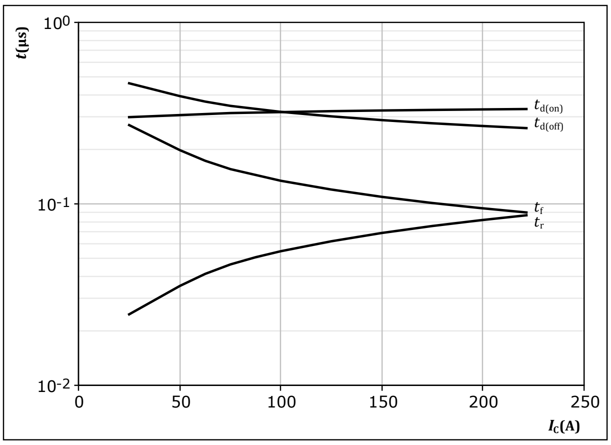
Copyright Vincotech

DC-Link Switching Characteristics

figure 54. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



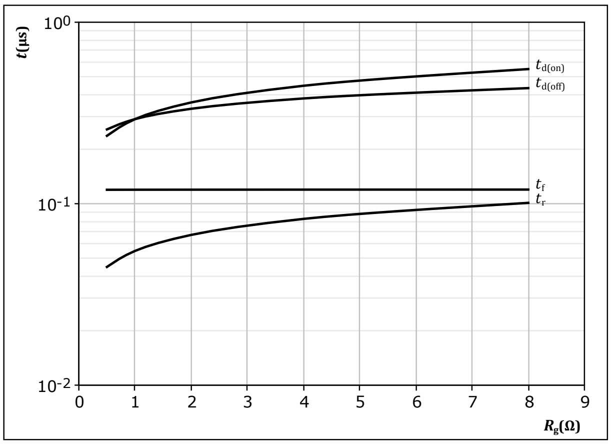
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 55. **IGBT**

Typical switching times as a function of gate resistor

t = f(R_g)



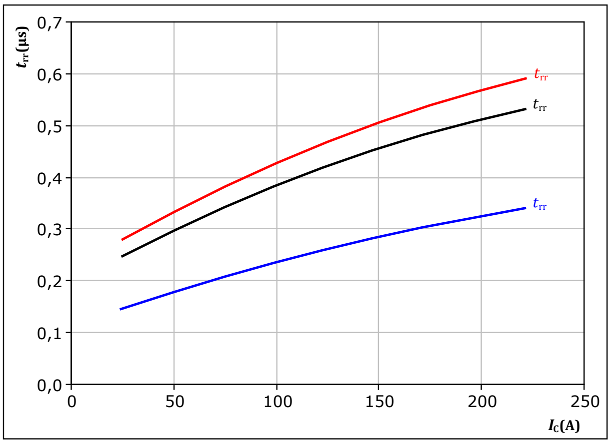
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	125	A

figure 56. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

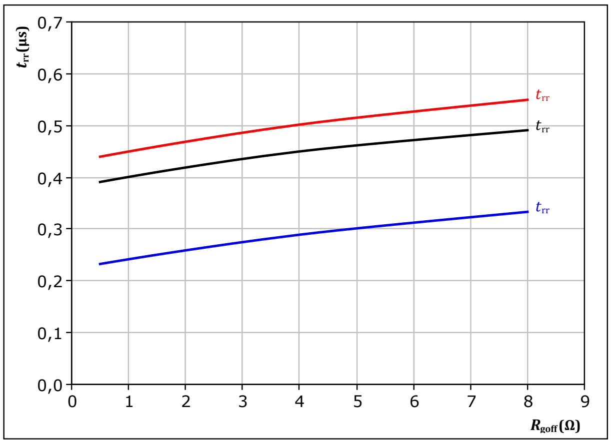
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 57. **FWD**

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

t_{rr} = f(R_{goff})



With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	125	A

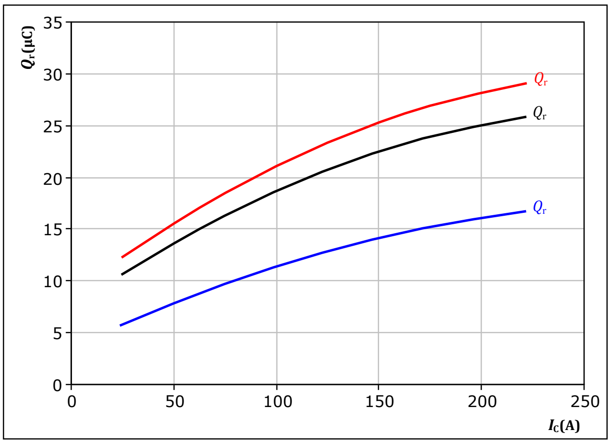
T_j: 25 °C, 125 °C, 150 °C

DC-Link Switching Characteristics

figure 58. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



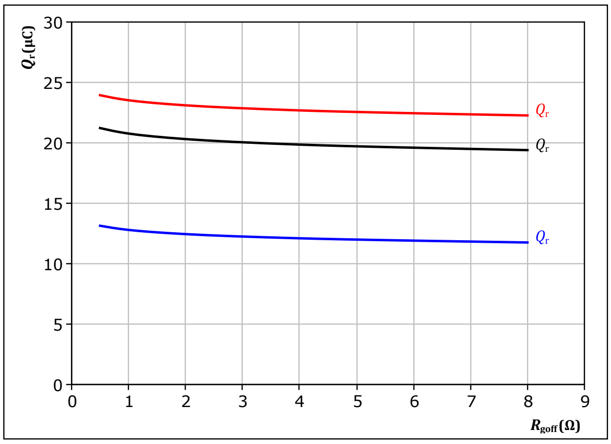
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 59. **FWD**

Typical recovered charge as a function of turn off gate resistor

Q_r = f(R_{goff})



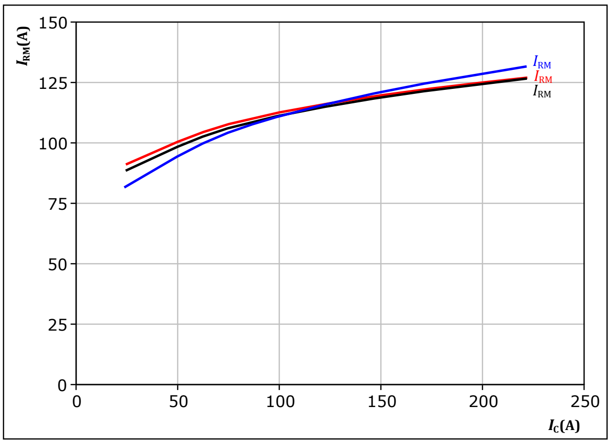
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	125	A		150 °C

figure 60. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



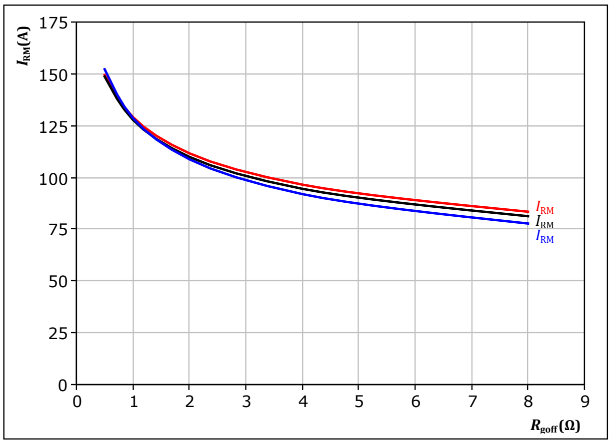
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 61. **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	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	125	A		150 °C

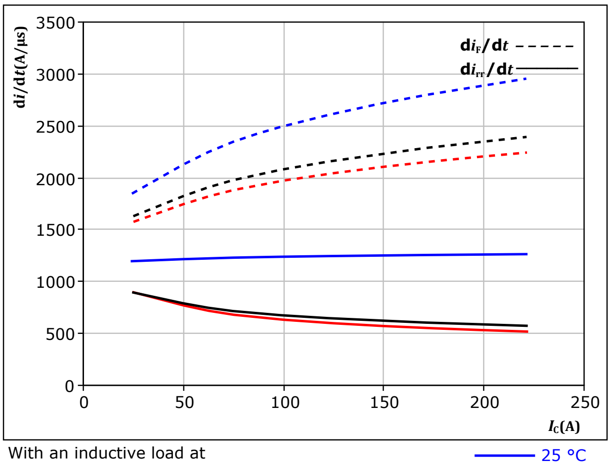
Copyright Vincotech

DC-Link Switching Characteristics

figure 62. **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)



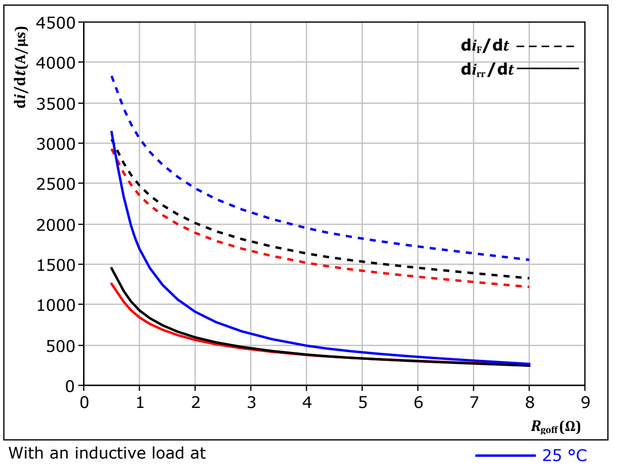
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 63. **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})



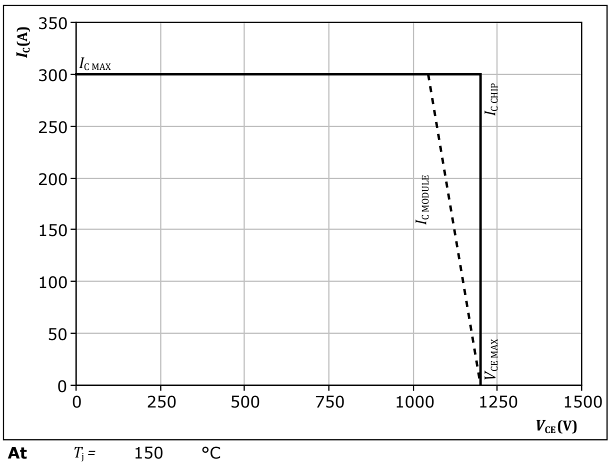
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	125	A		150 °C

figure 64. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



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

Switching Definitions

figure 65. **IGBT**

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

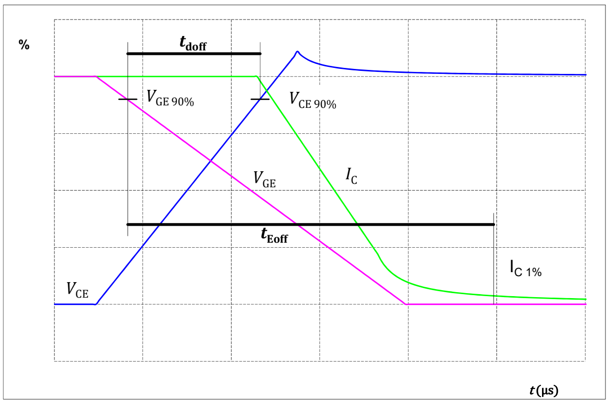


figure 66. **IGBT**

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

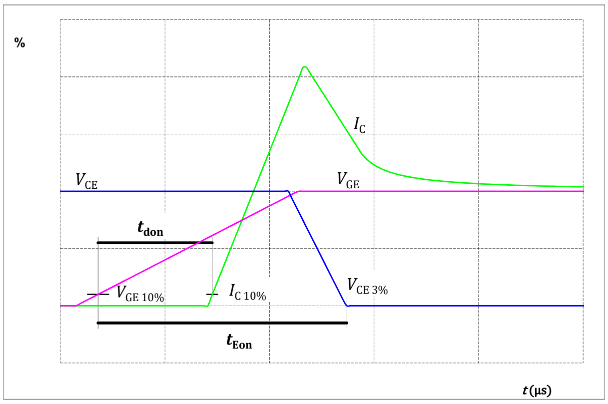


figure 67. **IGBT**

Turn-off Switching Waveforms & definition of t_f

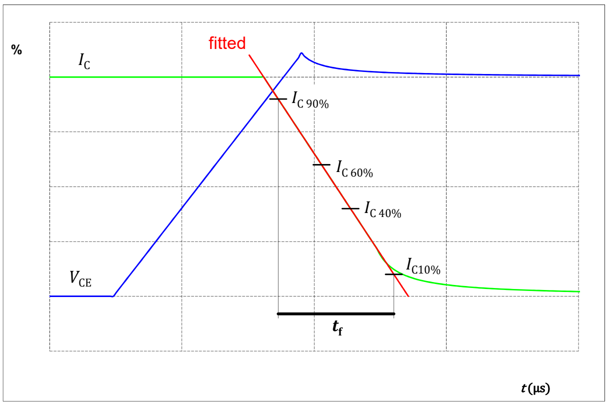
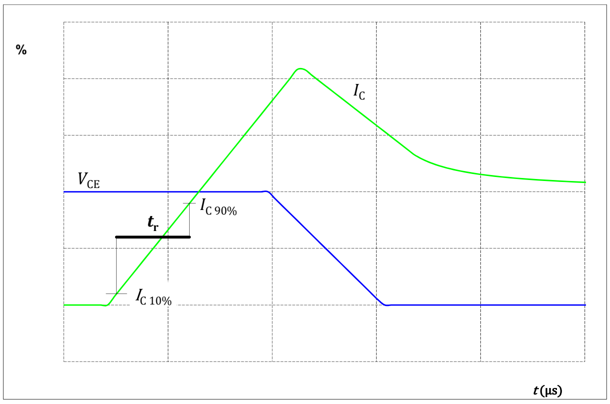


figure 68. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Switching Definitions

figure 69.	FWD

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

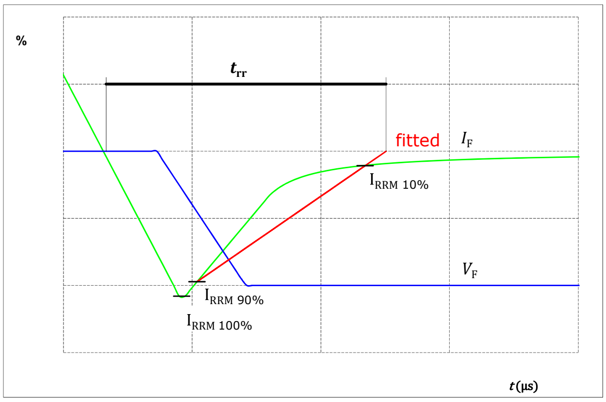
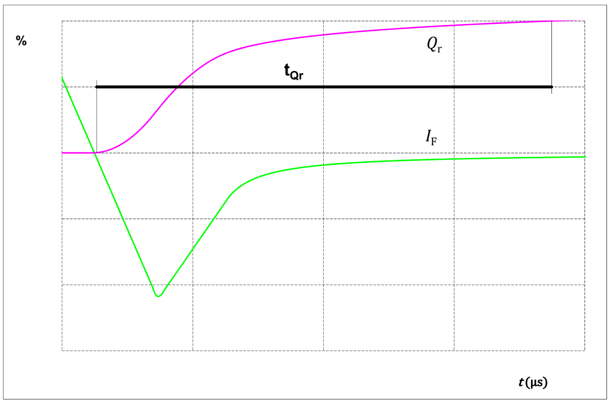


figure 70.	FWD

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



AC Switching Definitions

figure 65. **MOSFET**

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

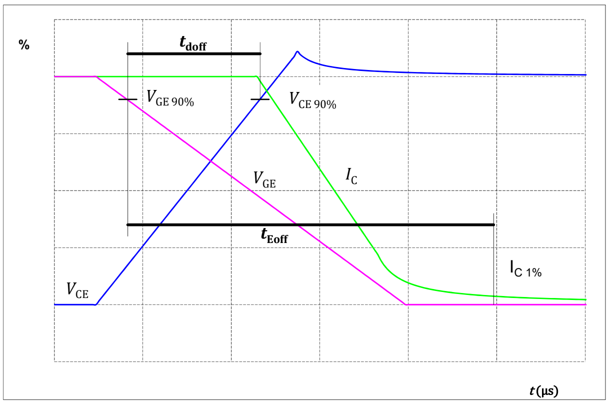


figure 66. **MOSFET**

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

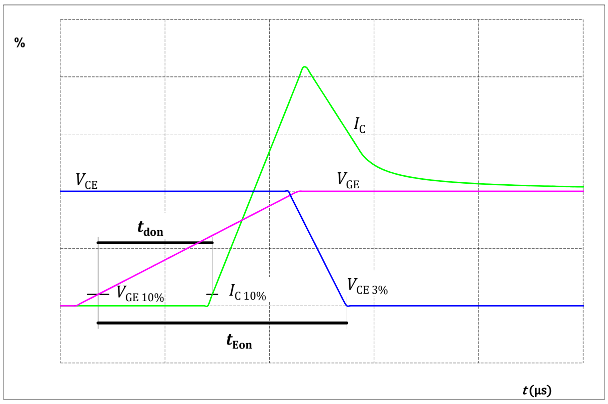


figure 67. **MOSFET**

Turn-off Switching Waveforms & definition of t_f

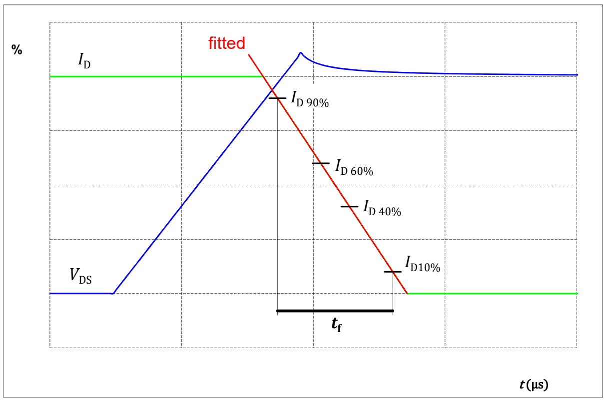
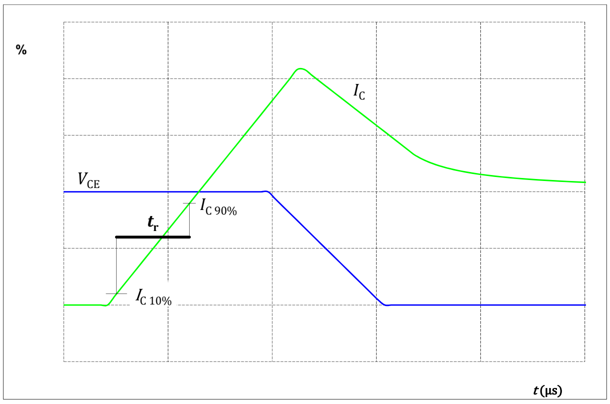


figure 68. **MOSFET**

Turn-on Switching Waveforms & definition of t_r



AC Switching Definitions

figure 69. **FWD**

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

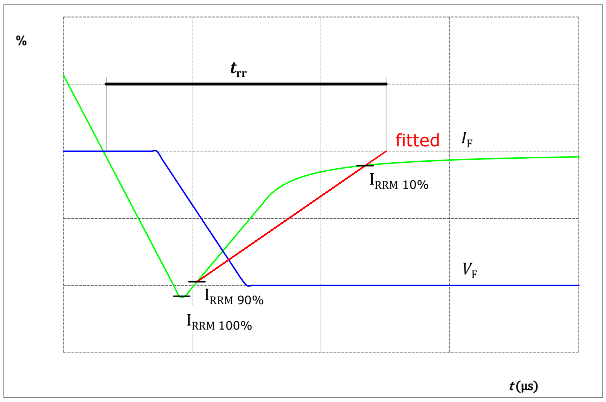


figure 70. **FWD**

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

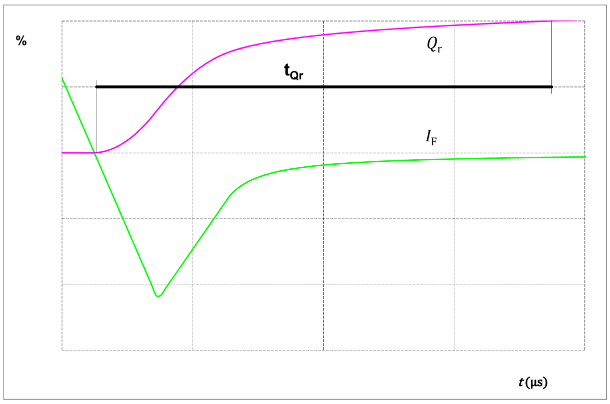
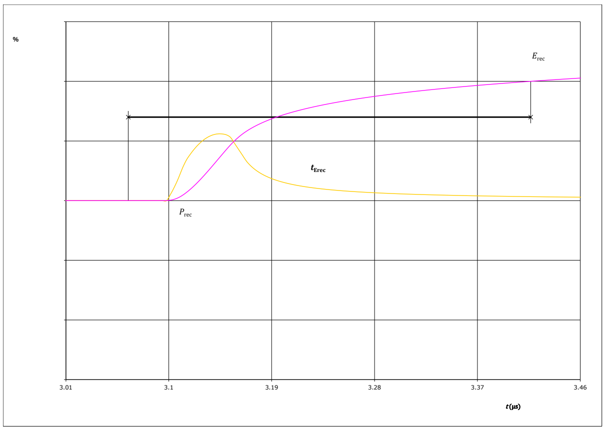


figure 71. **FWD**

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



Ordering Code

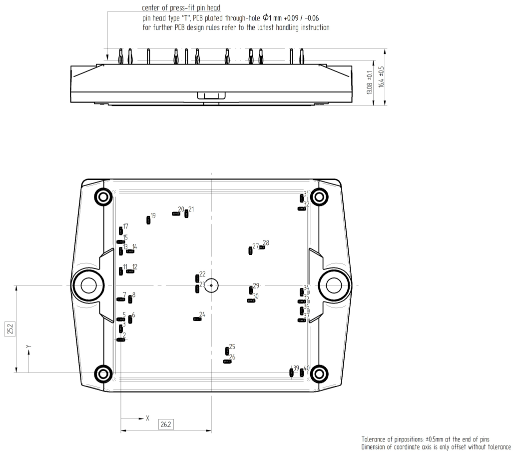
Version	Ordering Code
With thermal paste (4,4 W/mK, PTM6000)	B0-SP12NAA008ME01-LR88F78T-/7/

Marking

Text	**Name**		**Date code**	**UL & VIN**	**Lot**	**Serial**
	NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

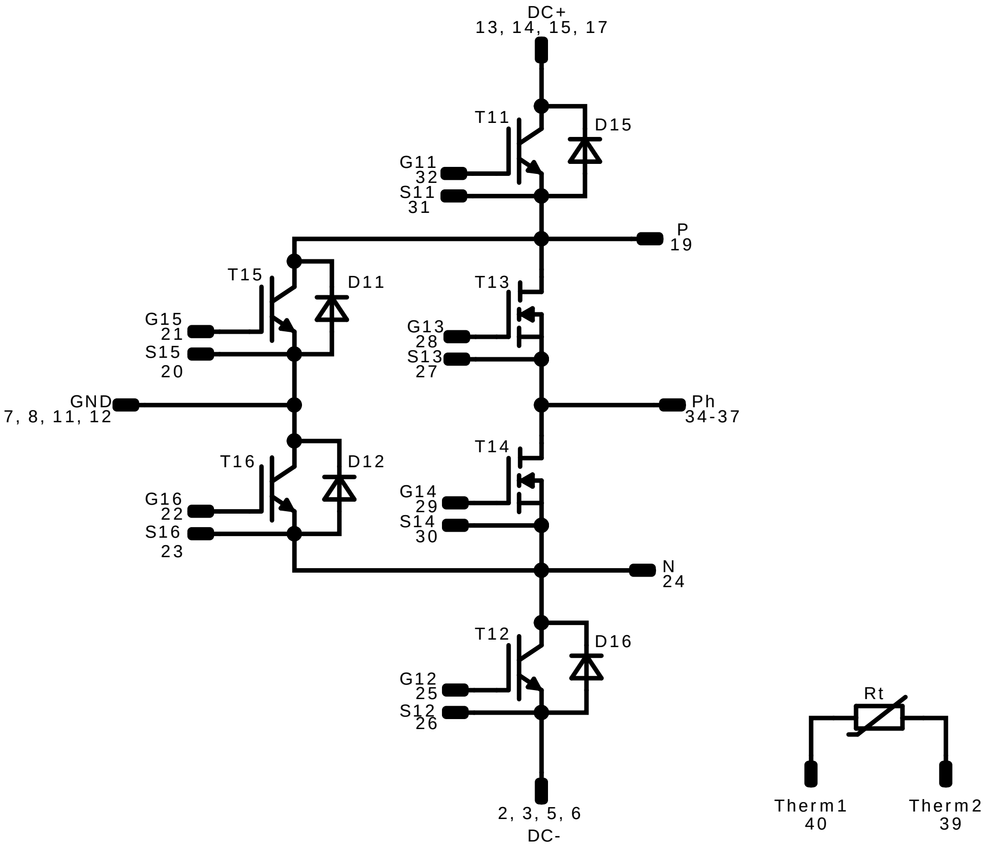
Outline

Pin table [mm]			
Pin	X	Y	Function
1	not assembled		
2	0	9,5	DC-
3	0	12,7	DC-
4	not assembled		
5	0	15,4	DC-
6	2,7	15,4	DC-
7	0	21,2	GND
8	2,7	21,2	GND
9	not assembled		
10	not assembled		
11	0	29,3	GND
12	2,7	29,3	GND
13	0	35,1	DC+
14	2,7	35,1	DC+
15	0	37,8	DC+
16	not assembled		
17	0	41	DC+
18	not assembled		
19	8	44,1	P
20	16	45,95	S15
21	19	45,95	G15
22	22,15	27,2	G16
23	22,15	24,2	S16
24	22,15	15,5	N
25	30,8	6,2	G12
26	30,8	3,2	S12
27	37,55	35,25	S13
28	40,55	36,25	G13
29	37,7	23,8	G14
30	37,7	20,8	S14
31	52,4	50,4	S11
32	52,4	47,4	G11
33	not assembled		
34	52,4	23,25	Ph
35	52,4	20,55	Ph
36	52,4	17,85	Ph
37	52,4	15,15	Ph
38	not assembled		
39	49,4	0	Therm2
40	52,4	0	Therm1



Copyright Vincotech

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
D11, D12	FWD	1200 V	150 A	Neutral Point Diode	
T13, T14	MOSFET	1200 V	8 mΩ	AC Switch	
T15, T16	IGBT	1200 V	150 A	Neutral Point Switch	
D15, D16	FWD	1200 V	150 A	DC-Link Diode	
T11, T12	IGBT	1200 V	150 A	DC-Link Switch	
Rt	Thermistor			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 45	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* S3 packages see vincotech.com website.

Package data
Package data for *flow* S3 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
B0-SP12NAA008ME01-LR88F78T-D1-14	26 Feb. 2021		
B0-SP12NAA008ME01-LR88F78T-D2-14	7 Jul. 2021	Module marking is updated with UL logo, product is unchanged	

DISCLAIMER
The information, specifications, procedures, methods and recommendations herein (together "information") are presented by Vincotech to reader in good faith, are believed to be accurate and reliable, but may well be incomplete and/or not applicable to all conditions or situations that may exist or occur. Vincotech reserves the right to make any changes without further notice to any products to improve reliability, function or design. No representation, guarantee or warranty is made to reader as to the accuracy, reliability or completeness of said information or that the application or use of any of the same will avoid hazards, accidents, losses, damages or injury of any kind to persons or property or that the same will not infringe third parties rights or give desired results. It is reader's sole responsibility to test and determine the suitability of the information and the product for reader's intended use.

LIFE SUPPORT POLICY
Vincotech products are not authorised for use as critical components in life support devices or systems without the express written approval of Vincotech.
As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.
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.