Vincotech

B0-SP12NAA008ME01-LR88F78T
datasheet

_flow_ANPC S3 **1200 V / 8 mΩ**

Topology features

- Kelvin Emitter for improved switching performance
- Temperature sensor
- Advanced Neutral Point Clamped topology
- MOSFET
- IGBT

Component features

- High Blocking Voltage with low drain source on state resistance
- High speed SiC-MOSFET technology
- Resistant to Latch-up

Housing features

- Base isolation: Al_2O_3
- CTI600 housing material
- Compact, baseplate-less housing
- VINcoPress Technology
- Thermo-mechanical push-and-pull force relief
- Press-fit pin
- Reliable cold welding connection

Target applications

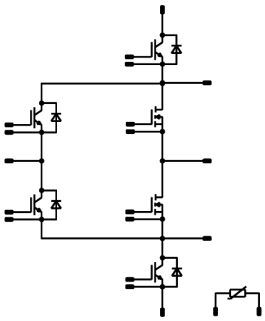
- Solar Inverters

Types

- B0-SP12NAA008ME01-LR88F78T

flow S3 12 mm housing

Schematic



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	141	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}	static	-4 / 15	V
		dynamic	-8 / 19	V
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
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
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					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	
AC Switch										
Static										
Drain-source on-state resistance	$r_{DS(on)}$		15		160	25 125 150	5,6	8,65 11,3 12,6	10,4[1]	mΩ
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$			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} = 5,2 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	-4/15	600	160	25 125 150		46,26 42 41,79		ns
Rise time	t_r					25 125 150		23,6 20,69 19,61		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		105,43 115,33 117,72		ns
Fall time	t_f					25 125 150		14,19 15,21 15,87		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=1,2 µC Q_{rFWD}=2,86 µC Q_{rFWD}=3,45 µC				25 125 150		2,62 2,69 2,75		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		1,9 1,96 2,02		mWs
Peak recovery current	I_{RRM}	di/dt=7832 A/µs di/dt=9083 A/µs di/dt=9821 A/µs				25 125 150		88,53 148,12 168,08		A
Reverse recovery time	t_{rr}					25 125 150		22,29 30,36 32,42		ns
Recovered charge	Q_r					25 125 150		1,2 2,86 3,45		µC
Reverse recovered energy	E_{rec}					25 125 150		0,349 0,994 1,22		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		10704,04 23592,29 29089,35		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	
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	0/15		150	25		1000		nC
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 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					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 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} = 5,2 W/mK (PTM)						0,55		K/W
Dynamic										
Peak recovery current	I_{RM}	di/dt=1925 A/µs di/dt=1659 A/µs di/dt=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	0/15		150	25		1000		nC
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 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} = 5,2 W/mK (PTM)						0,55		K/W
Dynamic										
Peak recovery current	I_{RM}	di/dt=2704 A/µs di/dt=2202 A/µs di/dt=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 R100	$\Delta_{R/R}$	R_{100} = 401 Ω				100	-12		13,1	%
Power dissipation	P					25		130		mW
Power dissipation constant	d					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±3 %						3612		K
B-value	$B_{(25/100)}$	Tol. ±3 %						3650		K
Vincotech Thermistor Reference									U	

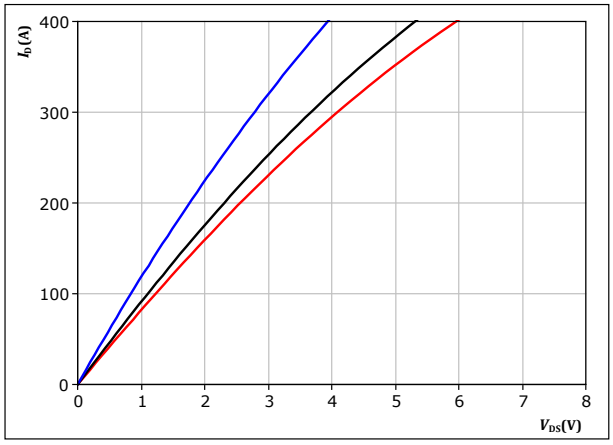
(1) Value at chip level
(2) Only valid with pre-applied Vincotech thermal interface material.

AC Switch Characteristics

figure 1. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

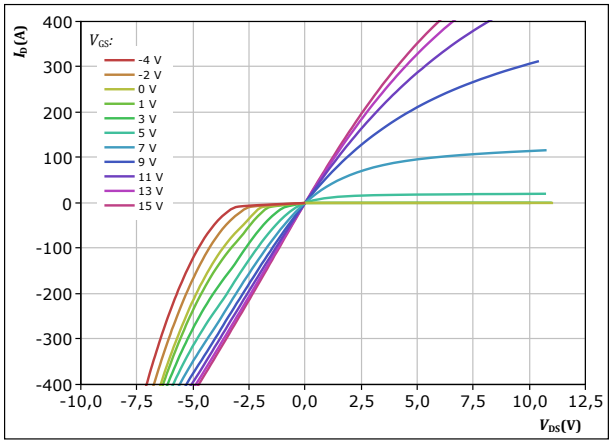


t_p =	250	µs		
V_{GS} =	15	V	T_j:	25 °C
				125 °C
				150 °C

figure 2. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$



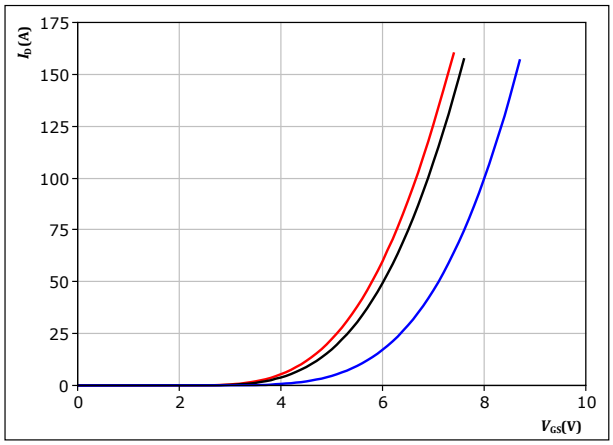
t_p =	250	µs
T_j =	150	°C

V_{GS} from -4 V to 15 V in steps of 2 V

figure 3. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$

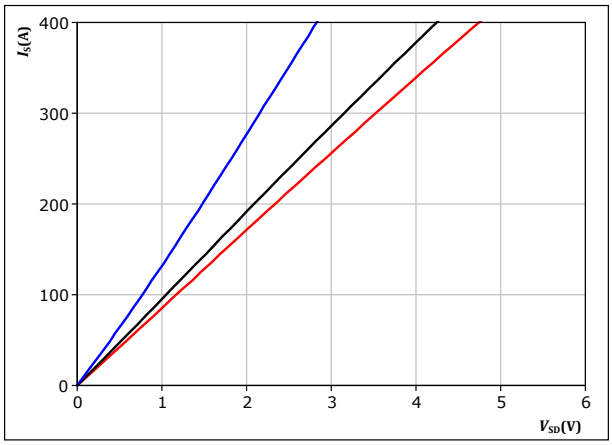


t_p =	250	µs		
V_{DS} =	10	V	T_j:	25 °C
				125 °C
				150 °C

figure 4. **MOSFET**

Typical reverse drain current characteristics

$I_{SD} = f(V_{SD})$



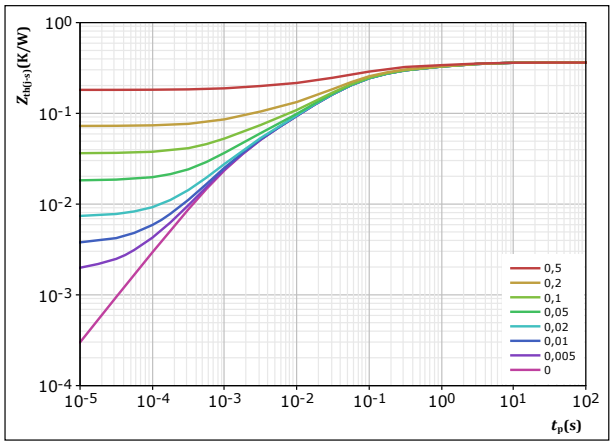
t_p =	250	µs		
V_{GS} =	15	V	T_j:	25 °C
				125 °C
				150 °C

AC Switch Characteristics

figure 5. **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

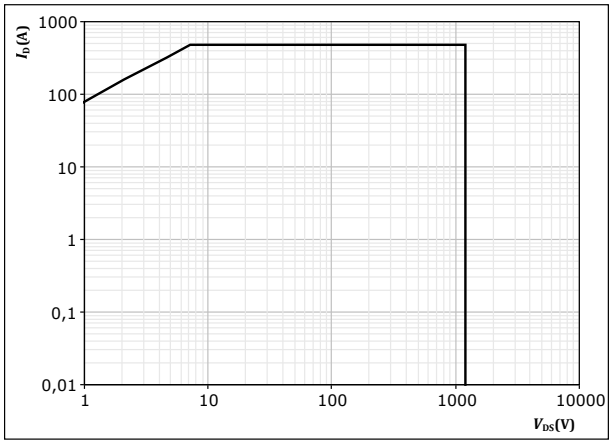
MOSFET thermal model values

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

figure 6. **MOSFET**

Safe operating area

$I_D = f(V_{DS})$



$D =$ single pulse

$T_s =$ 80 °C

$V_{GS} =$ 15 V

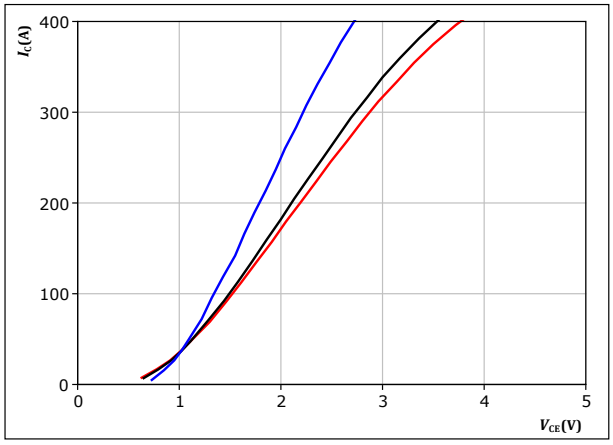
$T_j =$ T_{jmax}

Neutral Point Switch Characteristics

figure 7. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

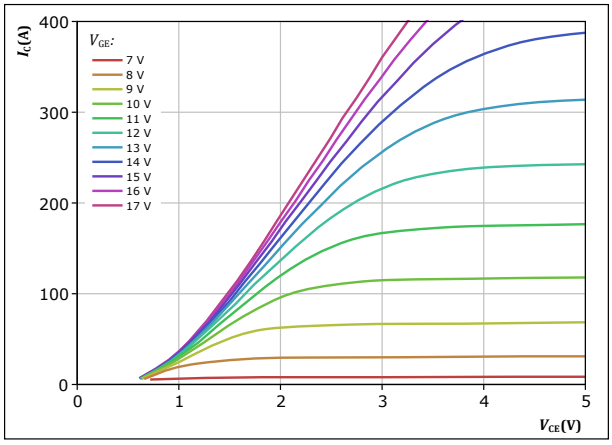


t_p =	250	µs		
V_{GE} =	15	V	T_j:	25 °C
				125 °C
				150 °C

figure 8. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



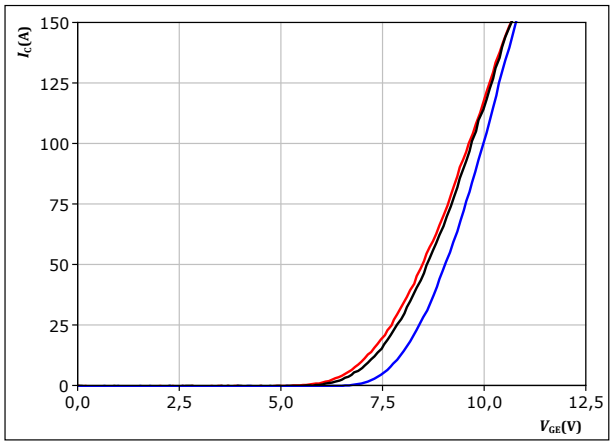
t_p =	250	µs
T_j =	150	°C

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

figure 9. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

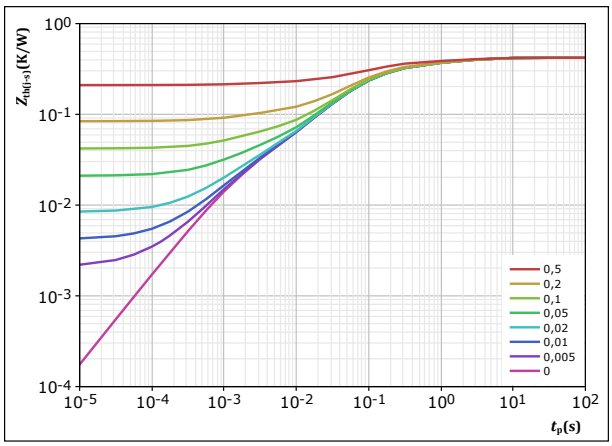


t_p =	250	µs		
V_{CE} =	10	V	T_j:	25 °C
				125 °C
				150 °C

figure 10. **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

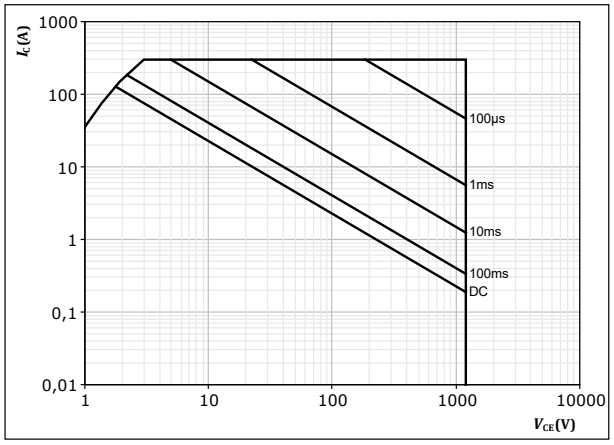
R (K/W)	τ (s)
5,01E-02	3,17E+00
7,90E-02	5,66E-01
2,16E-01	8,74E-02
5,52E-02	2,28E-02
1,93E-02	1,55E-03

Neutral Point Switch Characteristics

figure 11. **IGBT**

Safe operating area

$I_C = f(V_{CE})$

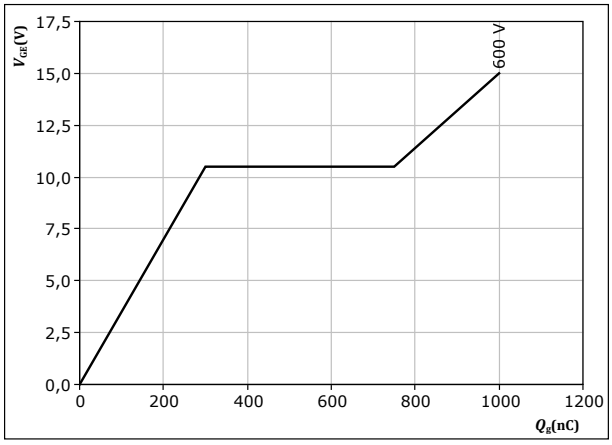


D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

figure 12. **IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_g)$



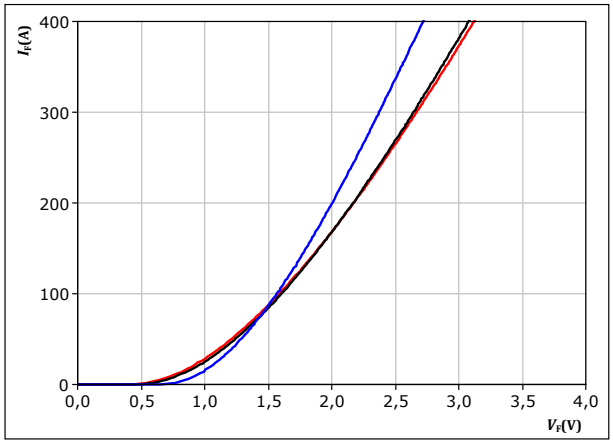
I_C =	150	A
T_j =	25	°C

DC-Link Diode Characteristics

figure 13. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



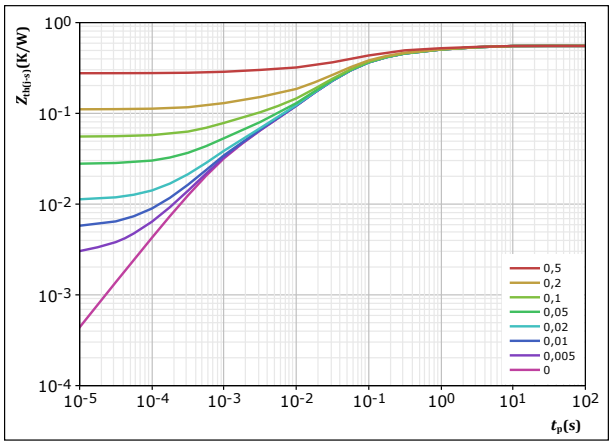
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 14. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

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

FWD thermal model values

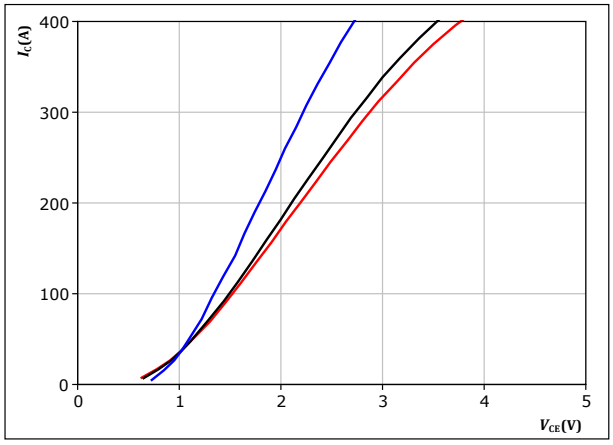
R (K/W)	τ (s)
5,67E-02	2,72E+00
9,06E-02	4,39E-01
2,74E-01	6,77E-02
9,64E-02	1,56E-02
3,58E-02	1,06E-03

DC-Link Switch Characteristics

figure 15. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

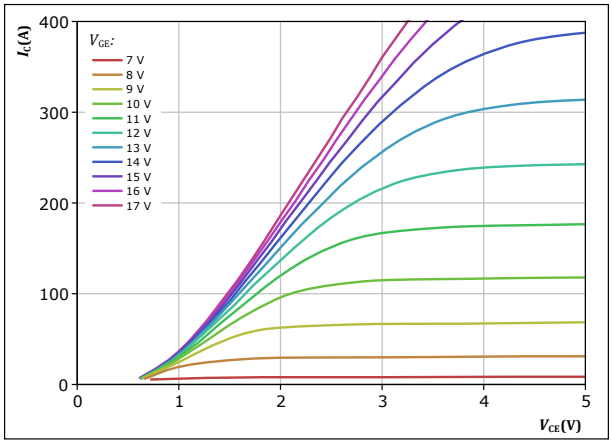


t_p =	250	µs		
V_{GE} =	15	V	T_j:	25 °C
				125 °C
				150 °C

figure 16. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



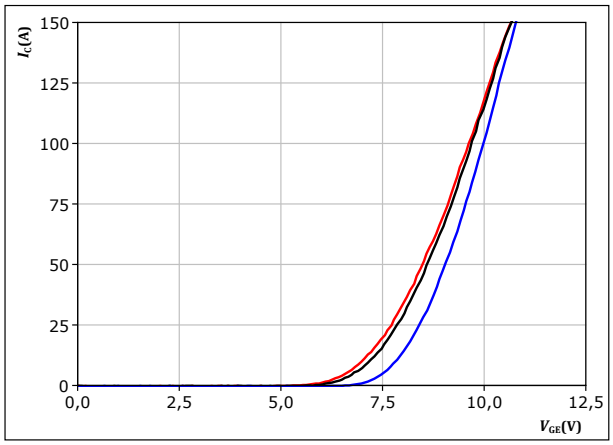
t_p =	250	µs
T_j =	150	°C

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

figure 17. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

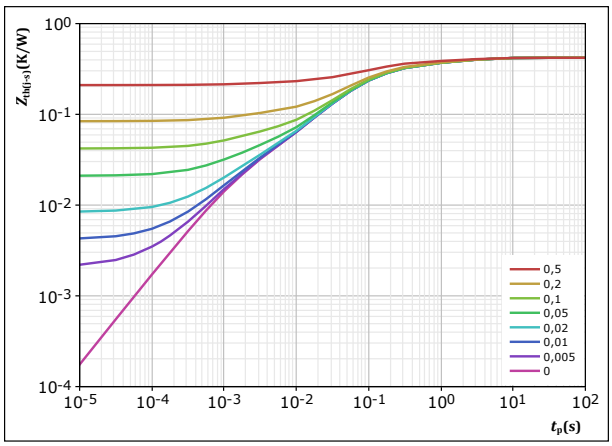


t_p =	250	µs		
V_{CE} =	10	V	T_j:	25 °C
				125 °C
				150 °C

figure 18. **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

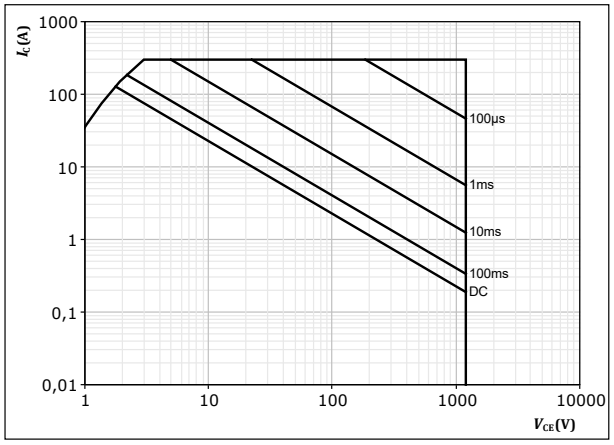
R (K/W)	τ (s)
5,01E-02	3,17E+00
7,90E-02	5,66E-01
2,16E-01	8,74E-02
5,52E-02	2,28E-02
1,93E-02	1,55E-03

DC-Link Switch Characteristics

figure 19. **IGBT**

Safe operating area

$I_C = f(V_{CE})$

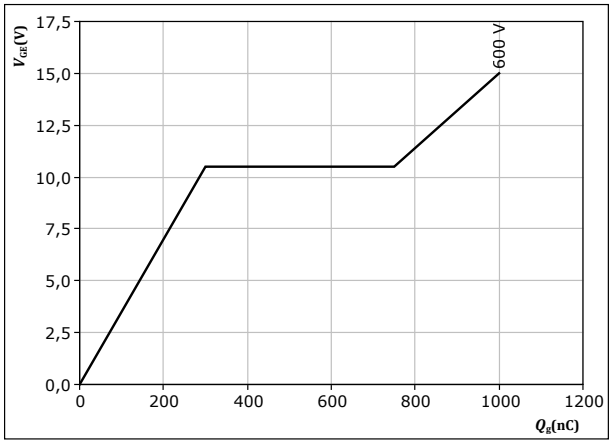


D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

figure 20. **IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_g)$



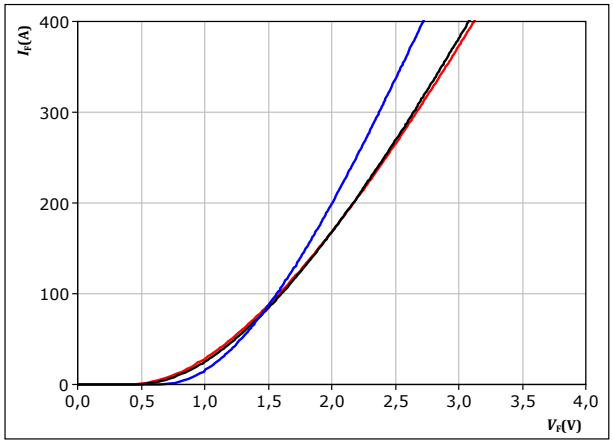
I_C =	150	A
T_j =	25	°C

Neutral Point Diode Characteristics

figure 21. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



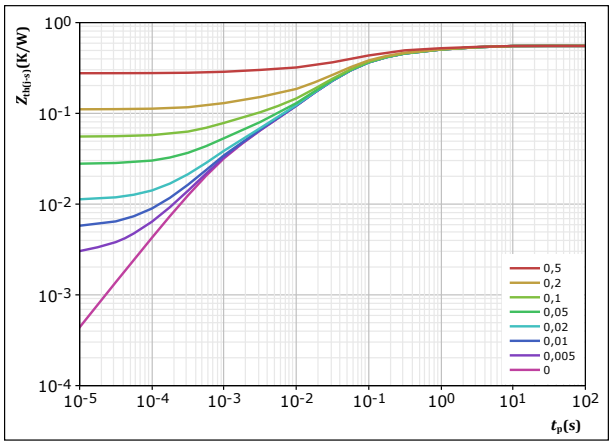
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 22. **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

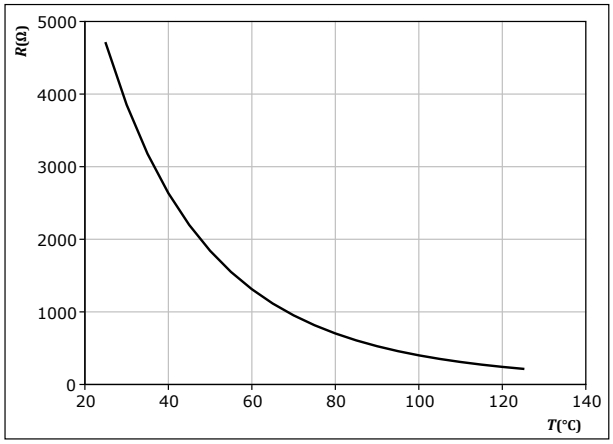
R (K/W)	τ (s)
5,67E-02	2,72E+00
9,06E-02	4,39E-01
2,74E-01	6,77E-02
9,64E-02	1,56E-02
3,58E-02	1,06E-03

Thermistor Characteristics

figure 23. **Thermistor**

Typical NTC characteristic as function of temperature

$R_T = f(T)$

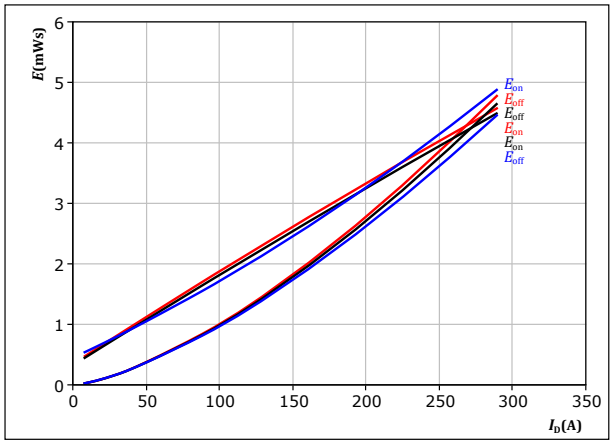


AC Switching Characteristics

figure 24. MOSFET

Typical switching energy losses as a function of drain current

$E = f(I_D)$



With an inductive load at

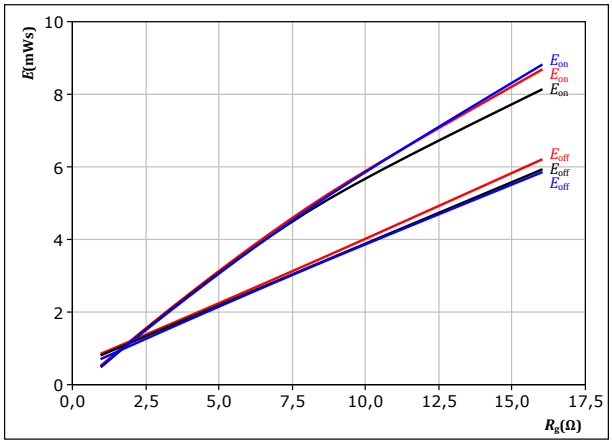
V_{DS} =	600	V
V_{GS} =	-4/15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 25. MOSFET

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

$E = f(R_g)$



With an inductive load at

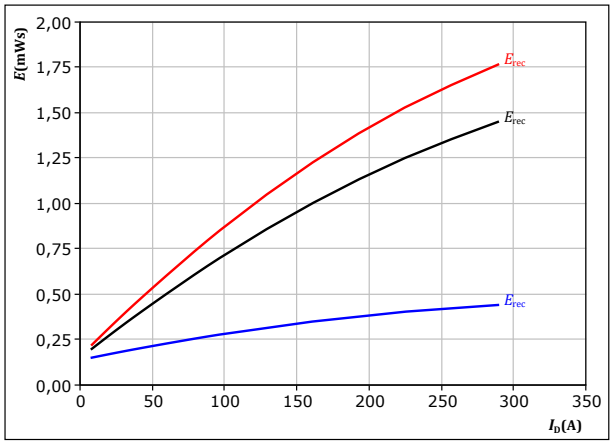
V_{DS} =	600	V
V_{GS} =	-4/15	V
I_D =	160	A

T_j: 25 °C, 125 °C, 150 °C

figure 26. MOSFET

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



With an inductive load at

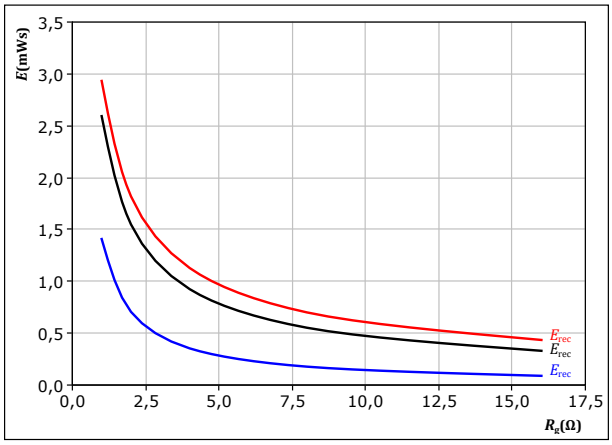
V_{DS} =	600	V
V_{GS} =	-4/15	V
R_{gon} =	4	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 27. MOSFET

Typical reverse recovered energy loss as a function of MOSFET turn on gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

V_{DS} =	600	V
V_{GS} =	-4/15	V
I_D =	160	A

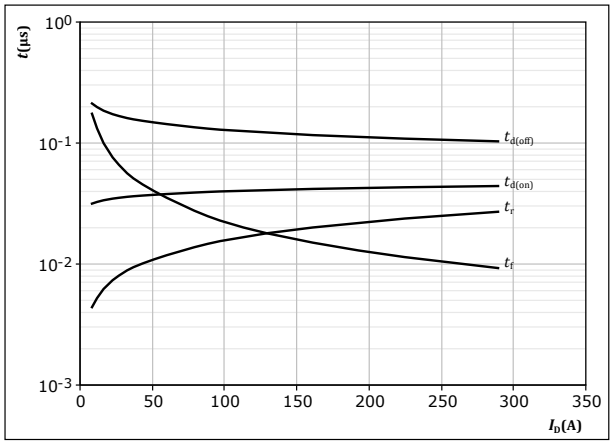
T_j: 25 °C, 125 °C, 150 °C

AC Switching Characteristics

figure 28. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



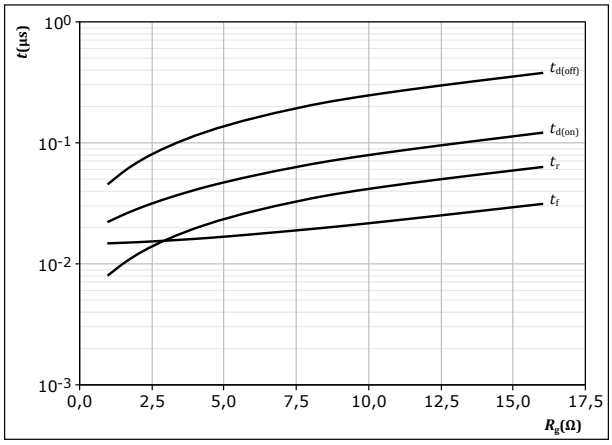
With an inductive load at

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

figure 29. **MOSFET**

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

$t = f(R_g)$



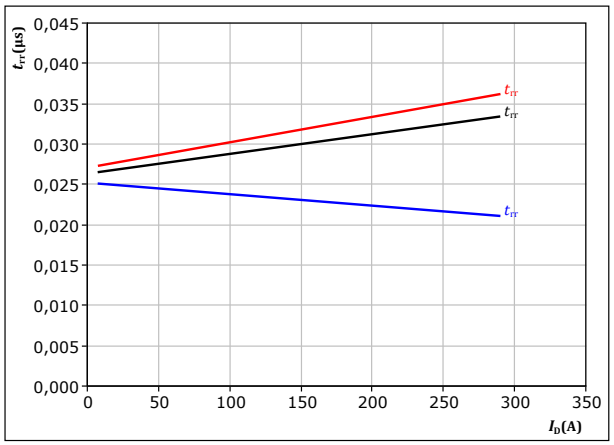
With an inductive load at

T_j =	150	°C
V_{DS} =	600	V
V_{GS} =	-4/15	V
I_D =	160	A

figure 30. **MOSFET**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$



At

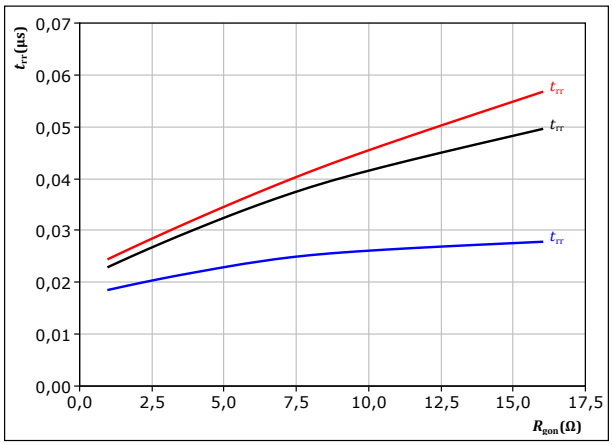
V_{DS} =	600	V
V_{GS} =	-4/15	V
R_{gon} =	4	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 31. **MOSFET**

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

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



At

V_{DS} =	600	V
V_{GS} =	-4/15	V
I_D =	160	A

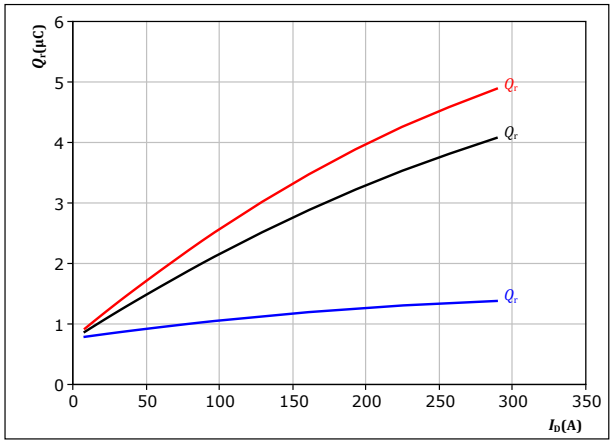
T_j: 25 °C, 125 °C, 150 °C

AC Switching Characteristics

figure 32. **MOSFET**

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

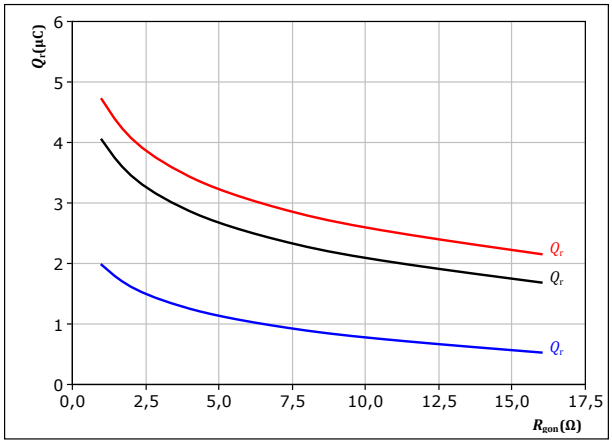


At				T_j:	
	V_{DS} =	600	V		25 °C
	V_{GS} =	-4/15	V		125 °C
	R_{gon} =	4	Ω		150 °C

figure 33. **MOSFET**

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

$Q_r = f(R_{gon})$

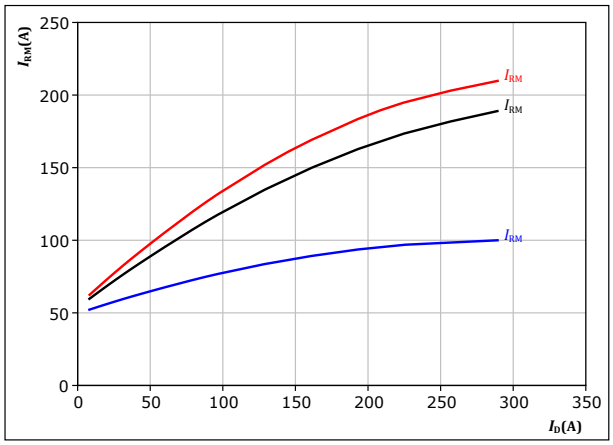


At				T_j:	
	V_{DS} =	600	V		25 °C
	V_{GS} =	-4/15	V		125 °C
	I_D =	160	A		150 °C

figure 34. **MOSFET**

Typical peak reverse recovery current as a function of drain current

$I_{RM} = f(I_D)$

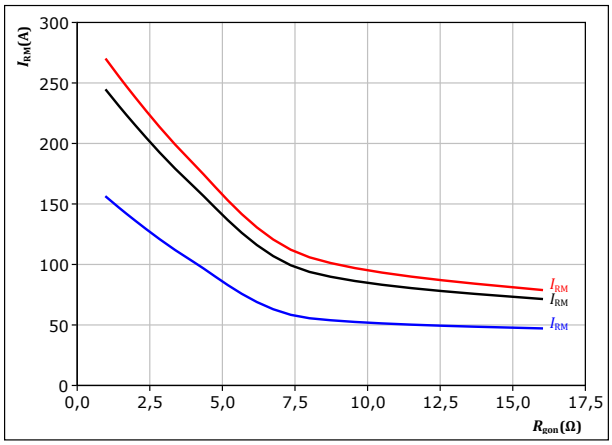


At				T_j:	
	V_{DS} =	600	V		25 °C
	V_{GS} =	-4/15	V		125 °C
	R_{gon} =	4	Ω		150 °C

figure 35. **MOSFET**

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

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



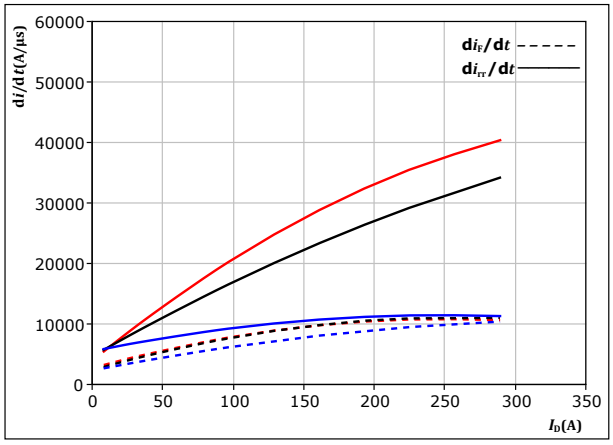
At				T_j:	
	V_{DS} =	600	V		25 °C
	V_{GS} =	-4/15	V		125 °C
	I_D =	160	A		150 °C

AC Switching Characteristics

figure 36. **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)

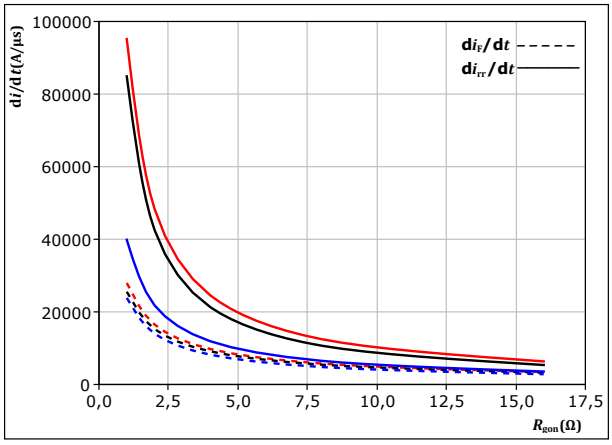


At	V_{DS} =	600	V		
	V_{GS} =	-4/15	V	T_j:	25 °C
	R_{gon} =	4	Ω		125 °C
					150 °C

figure 37. **MOSFET**

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

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

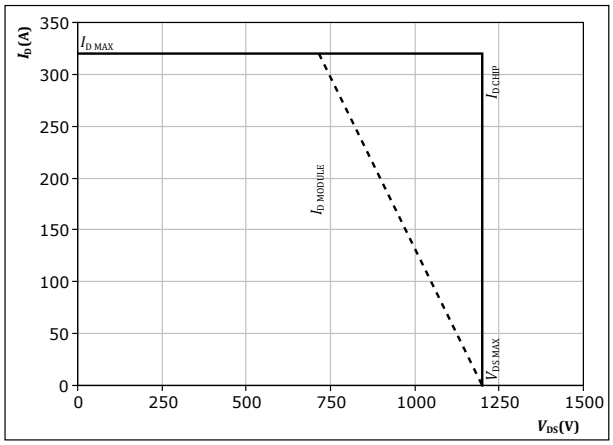


At	V_{DS} =	600	V		
	V_{GS} =	-4/15	V	T_j:	25 °C
	I_D =	160	A		125 °C
					150 °C

figure 38. **MOSFET**

Reverse bias safe operating area

I_D = f(V_{DS})



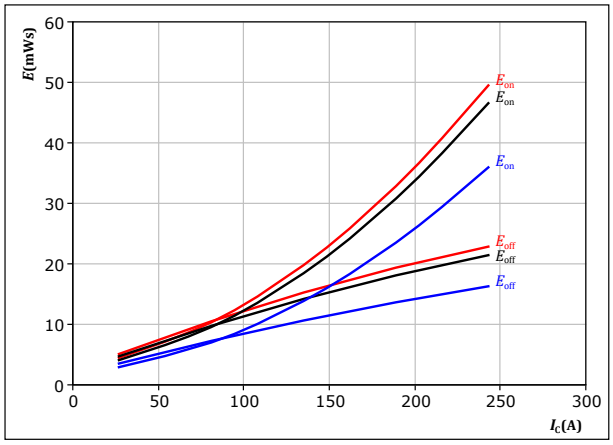
At	T_j =	150	°C
	R_{gon} =	4	Ω
	R_{goff} =	4	Ω

Neutral Point Switching Characteristics

figure 39. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



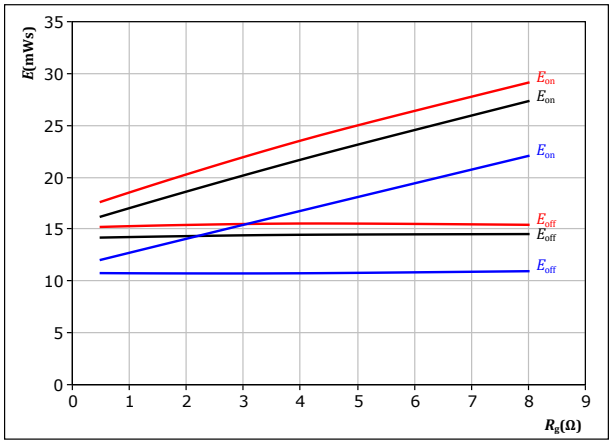
With an inductive load at

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

figure 40. **IGBT**

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

$E = f(R_g)$



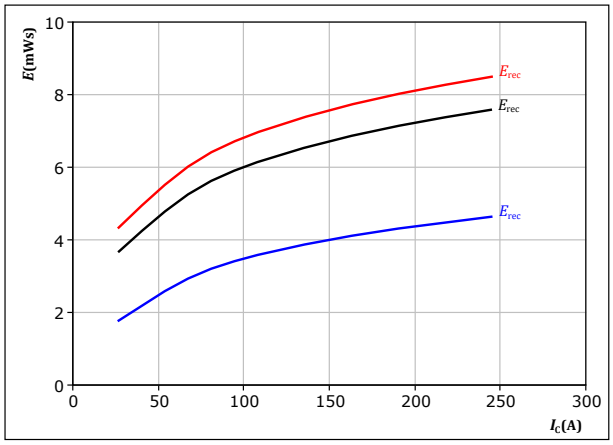
With an inductive load at

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

figure 41. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



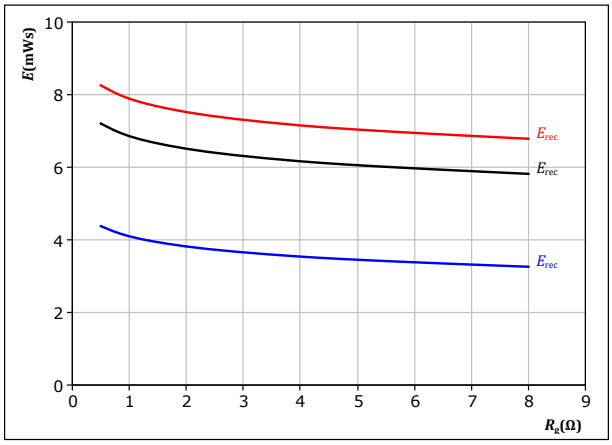
With an inductive load at

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

figure 42. **FWD**

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

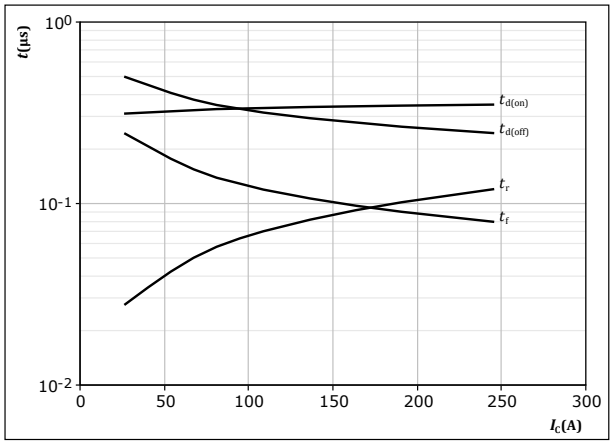
			T_j:	
V_{CE} =	600	V		25 °C
V_{GE} =	±15	V		125 °C
I_C =	135	A		150 °C

Neutral Point Switching Characteristics

figure 43. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



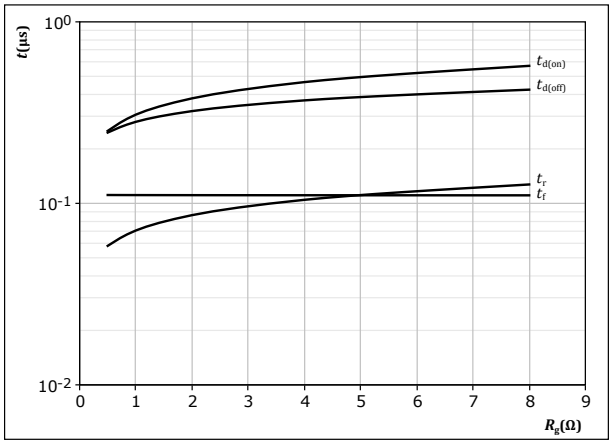
With an inductive load at

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

figure 44. **IGBT**

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

$t = f(R_g)$



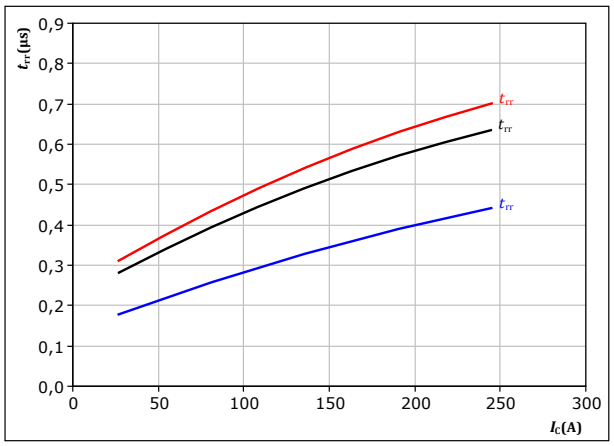
With an inductive load at

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

figure 45. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



With an inductive load at

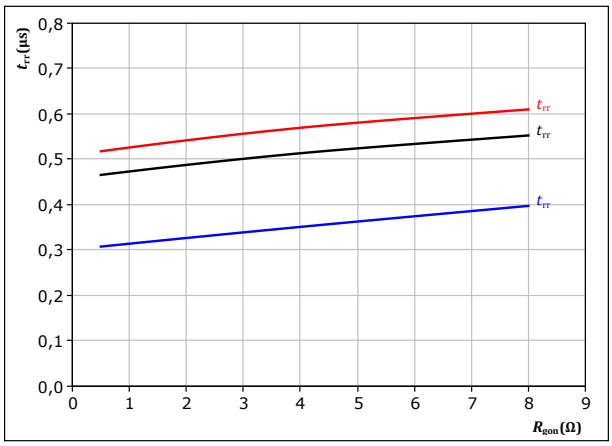
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 46. **FWD**

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

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



With an inductive load at

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

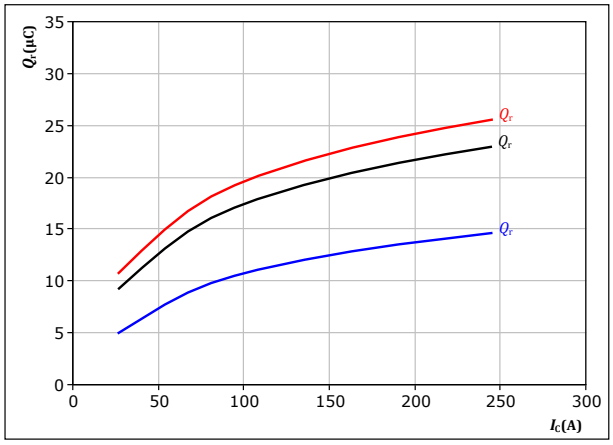
T_j: 25 °C, 125 °C, 150 °C

Neutral Point Switching Characteristics

figure 47. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



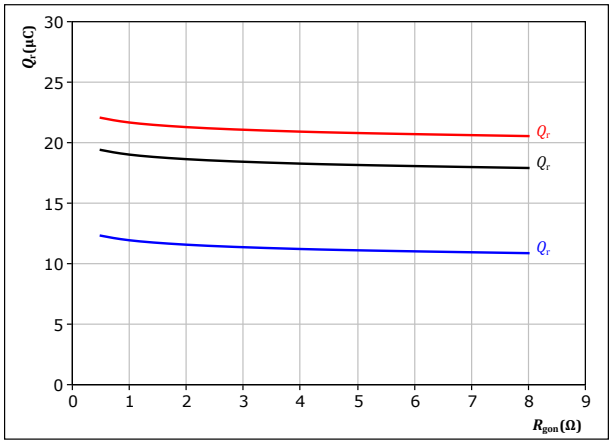
With an inductive load at

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

figure 48. **FWD**

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

$Q_r = f(R_{gon})$



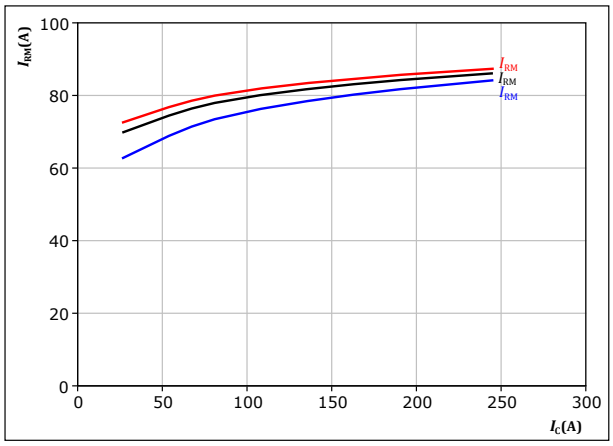
With an inductive load at

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

figure 49. **FWD**

Typical peak reverse recovery current as a function of collector current

$I_{RM} = f(I_C)$



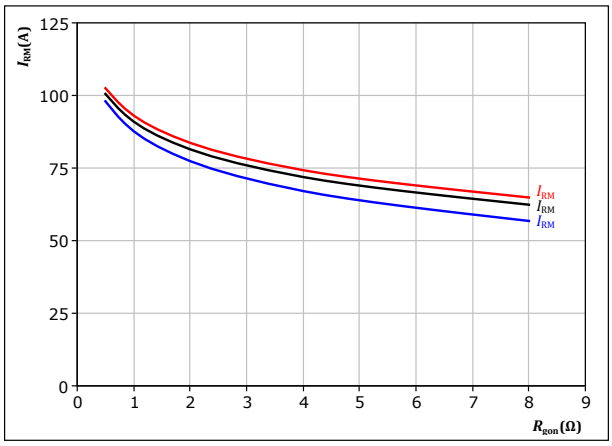
With an inductive load at

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

figure 50. **FWD**

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

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



With an inductive load at

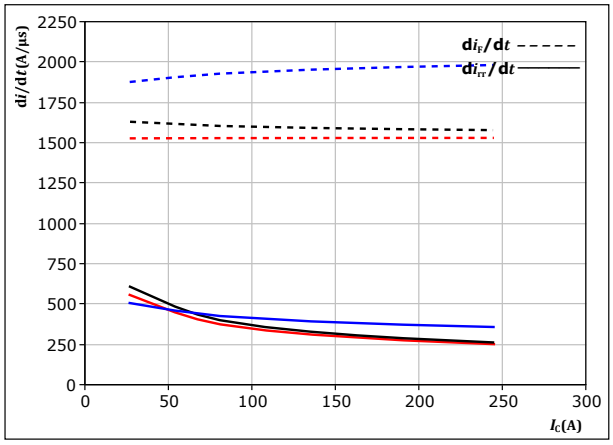
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	135	A		150 °C

Neutral Point Switching Characteristics

figure 51. **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)



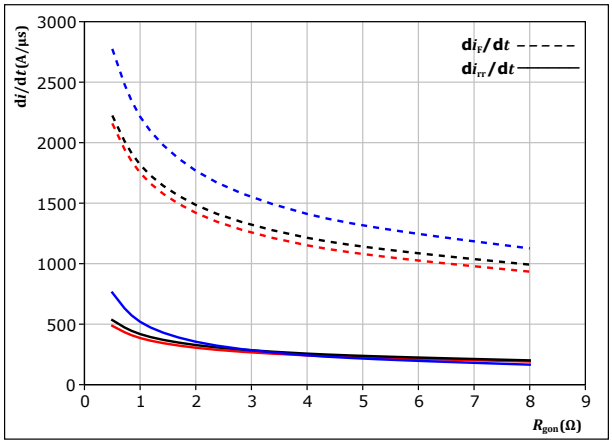
With an inductive load at

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

figure 52. **FWD**

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

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



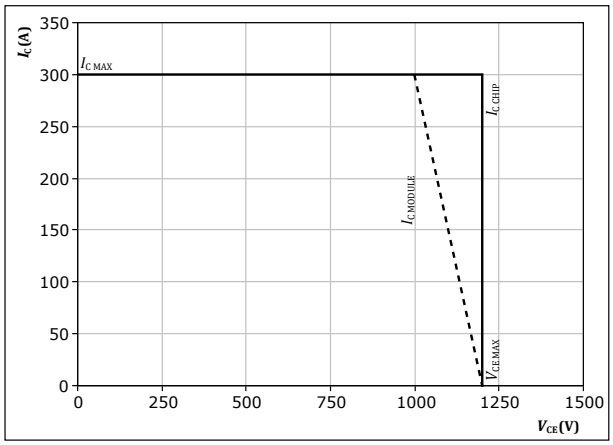
With an inductive load at

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

figure 53. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At

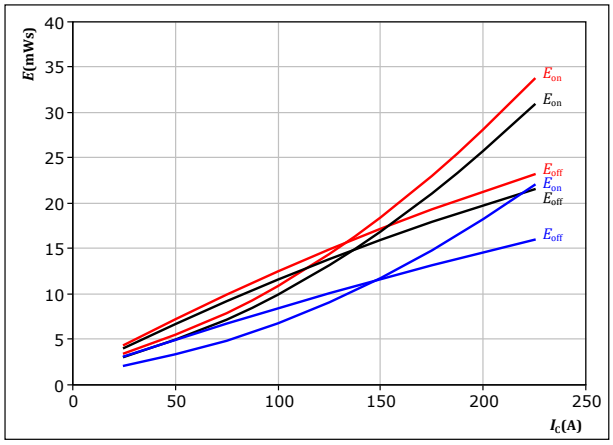
T_j =	150	°C	
R_{gon} =	2	Ω	
R_{goff} =	2	Ω	

DC-Link Switching Characteristics

figure 54. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



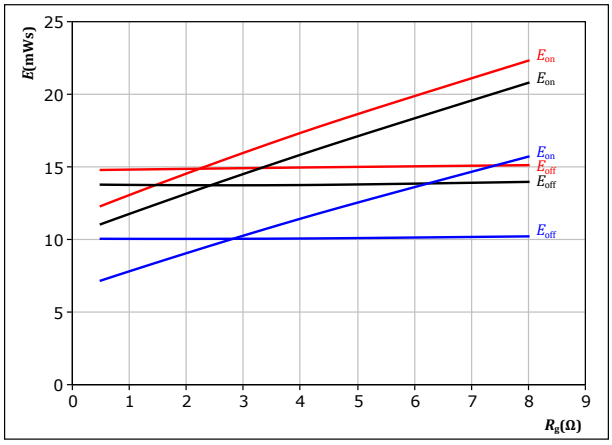
With an inductive load at

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 55. **IGBT**

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

$E = f(R_g)$



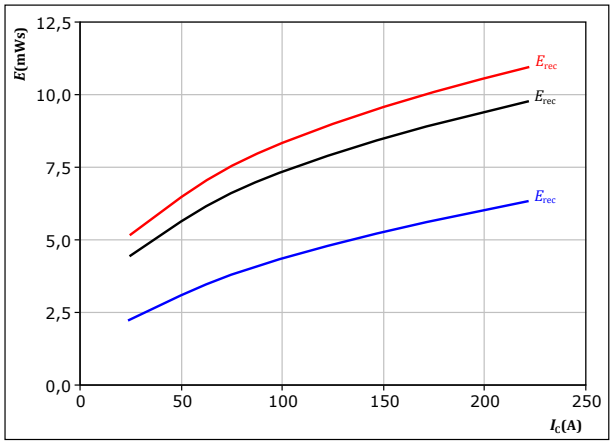
With an inductive load at

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

figure 56. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



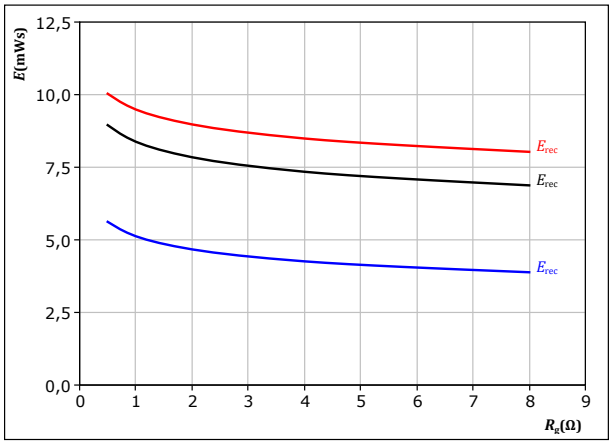
With an inductive load at

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

figure 57. **FWD**

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

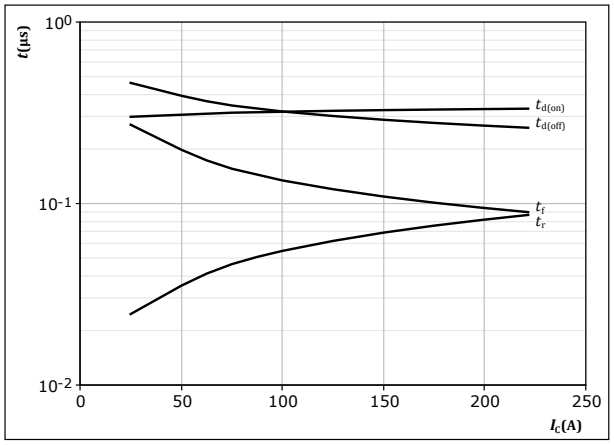
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	125	A		150 °C

DC-Link Switching Characteristics

figure 58. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



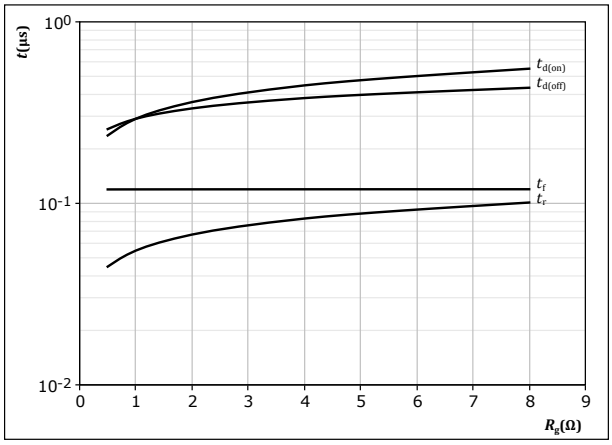
With an inductive load at

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

figure 59. **IGBT**

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

t = f(R_g)



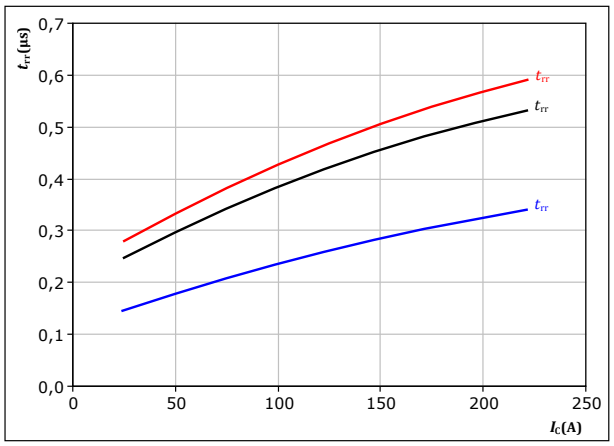
With an inductive load at

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

figure 60. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

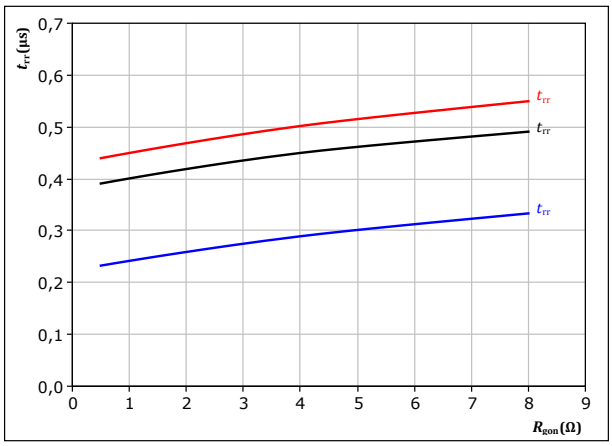
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 61. **FWD**

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

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



With an inductive load at

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

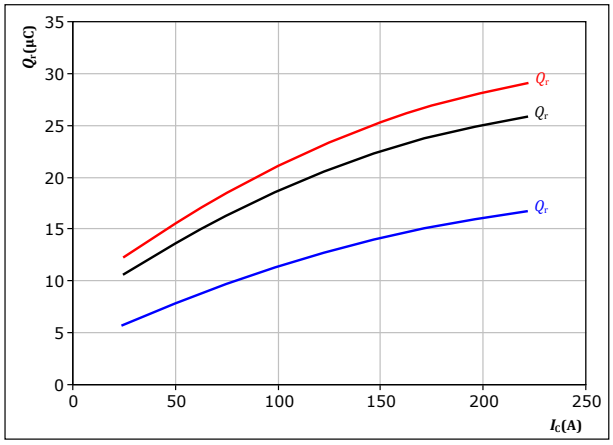
T_j: 25 °C, 125 °C, 150 °C

DC-Link Switching Characteristics

figure 62. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



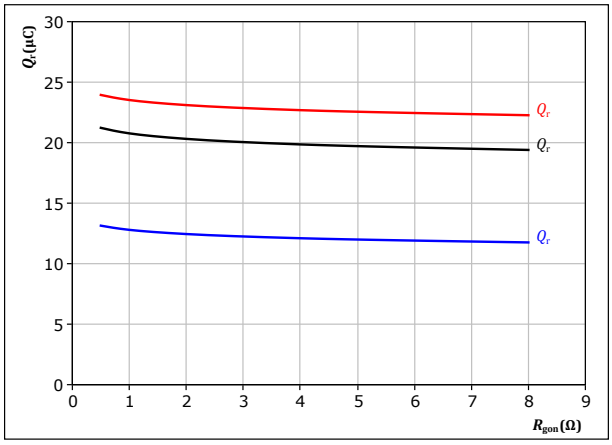
With an inductive load at

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

figure 63. **FWD**

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

$Q_r = f(R_{gon})$



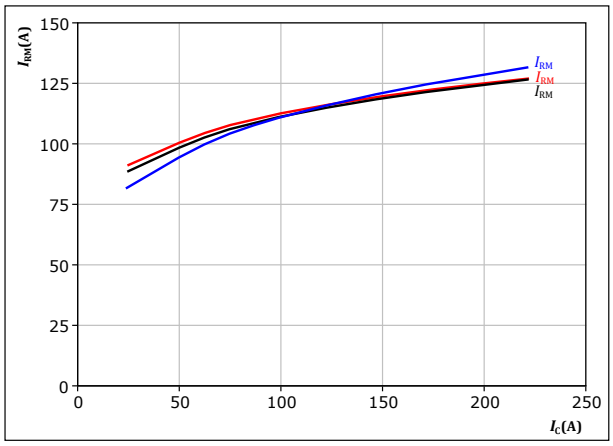
With an inductive load at

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

figure 64. **FWD**

Typical peak reverse recovery current as a function of collector current

$I_{RM} = f(I_C)$



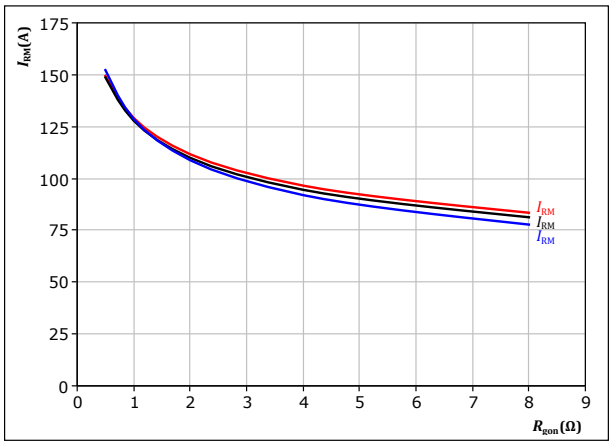
With an inductive load at

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

figure 65. **FWD**

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

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



With an inductive load at

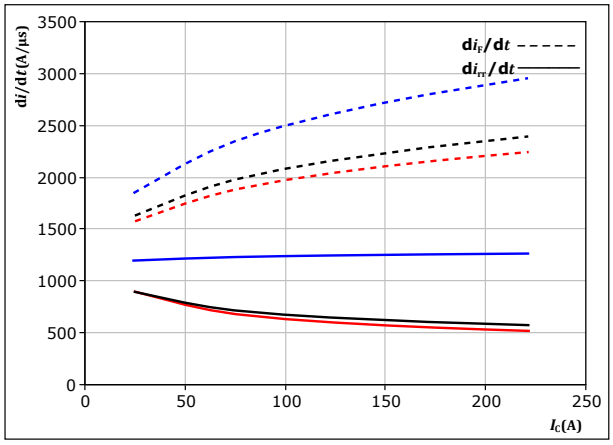
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	125	A		150 °C

DC-Link Switching Characteristics

figure 66. **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)



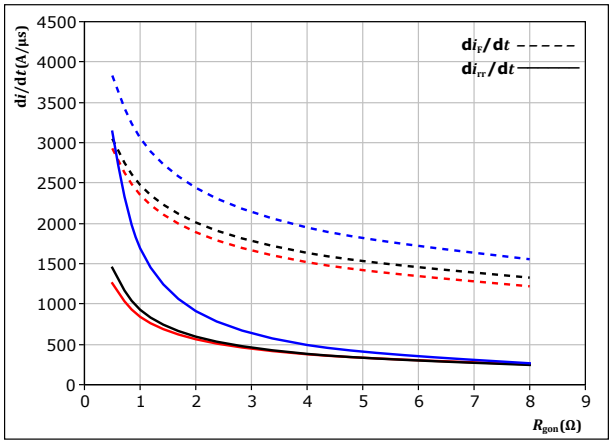
With an inductive load at

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

figure 67. **FWD**

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

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



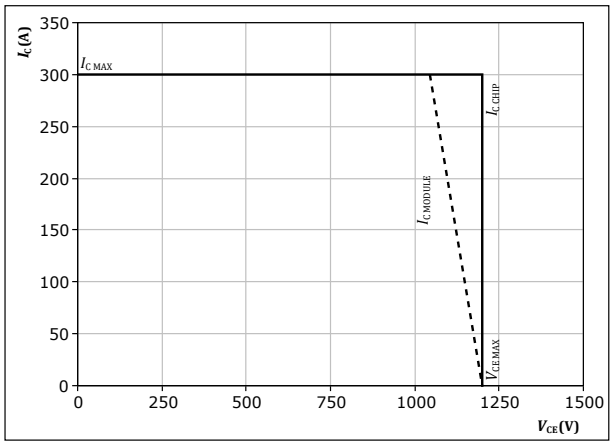
With an inductive load at

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

figure 68. **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 69. **IGBT**

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

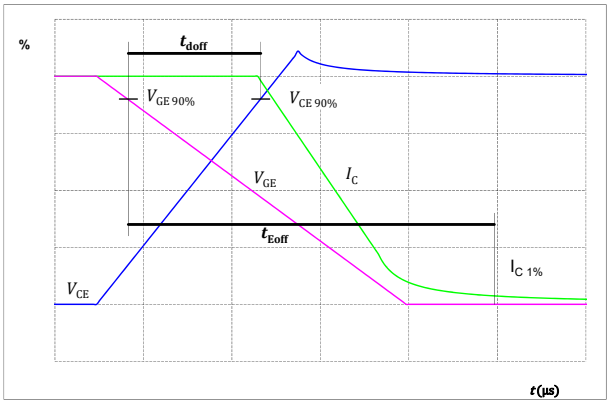


figure 70. **IGBT**

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

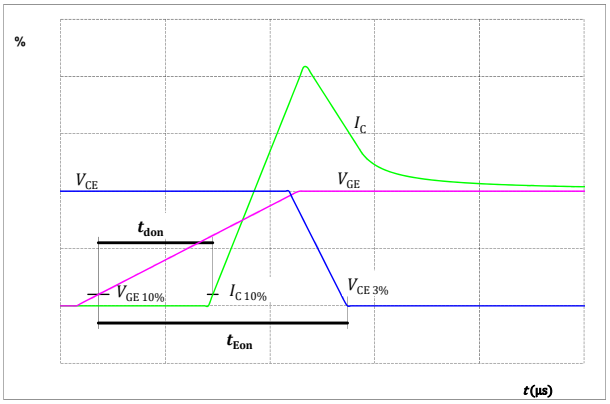


figure 71. **IGBT**

Turn-off Switching Waveforms & definition of t_f

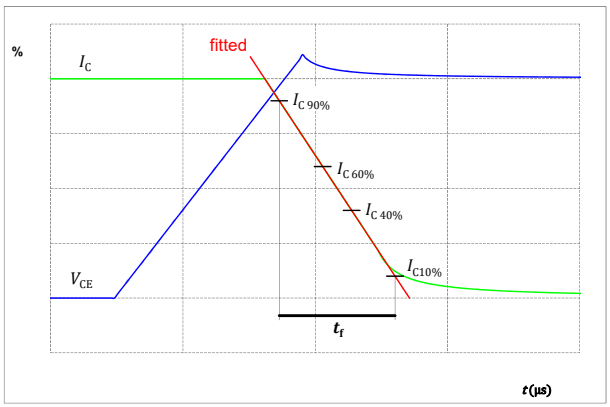
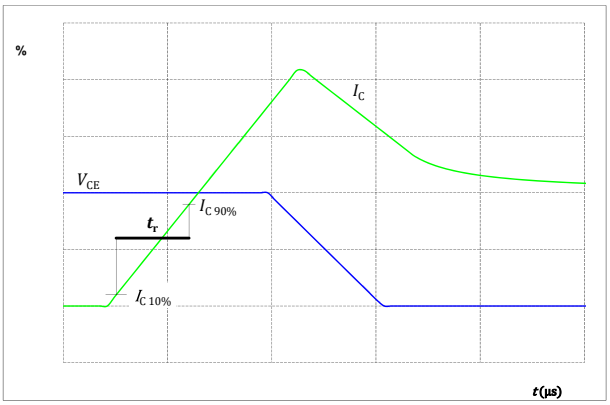


figure 72. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Switching Definitions

figure 73. **FWD**

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

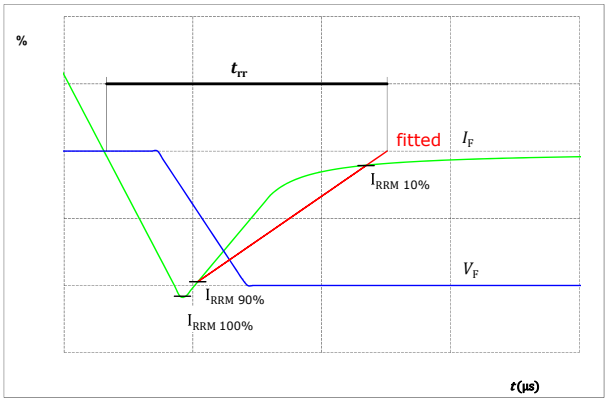
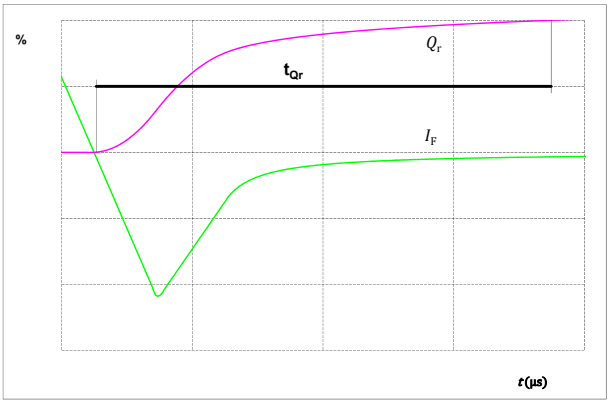


figure 74. **FWD**

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



AC Switching Definitions

figure 69. MOSFET

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

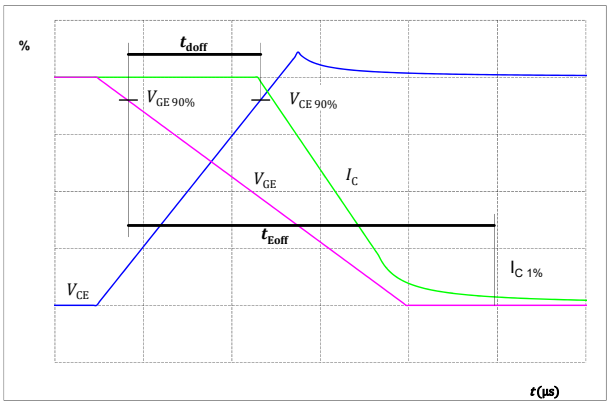


figure 70. MOSFET

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

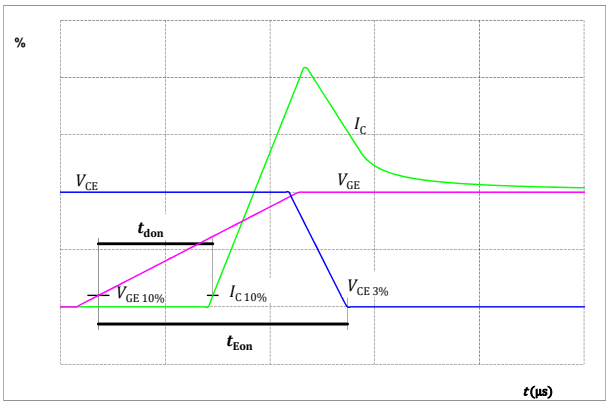


figure 71. MOSFET

Turn-off Switching Waveforms & definition of t_f

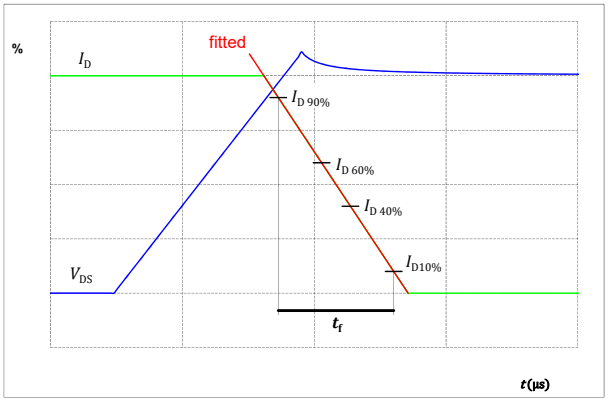
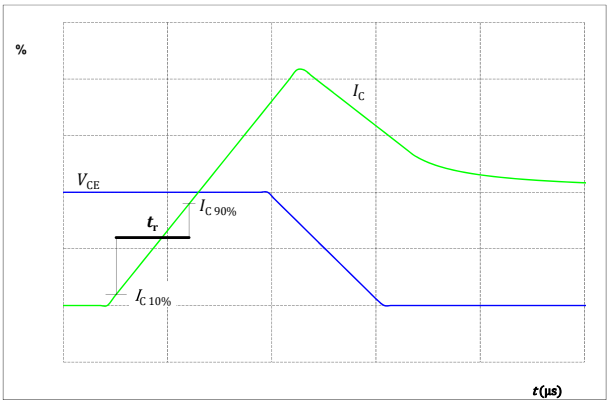


figure 72. MOSFET

Turn-on Switching Waveforms & definition of t_r



AC Switching Definitions

figure 73. **FWD**

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

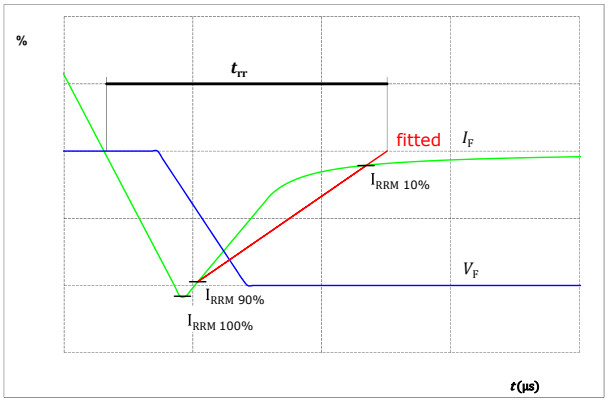


figure 74. **FWD**

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

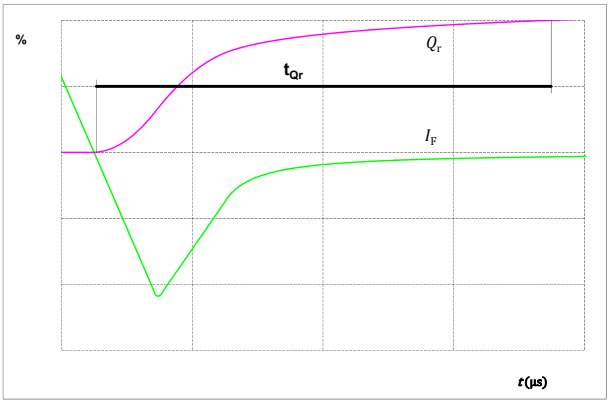
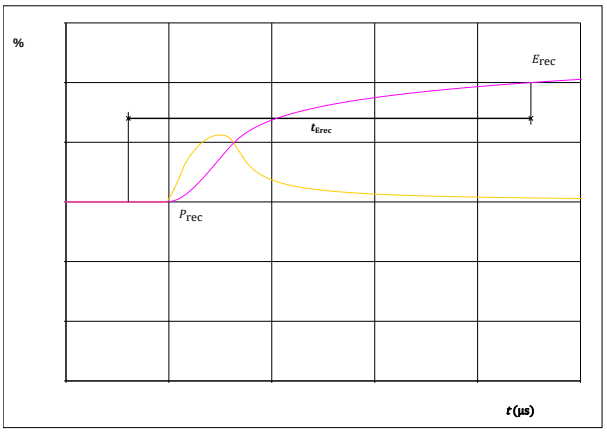


figure 75. **FWD**

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



Ordering Code

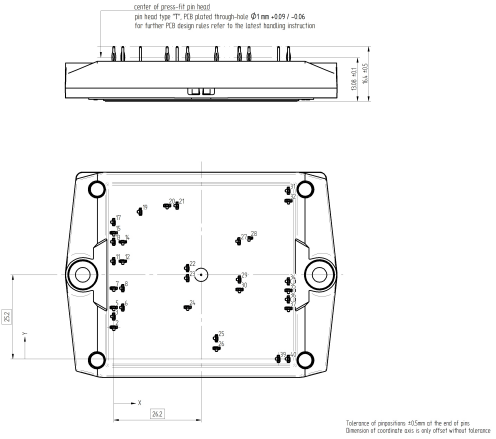
Version	Ordering Code
Without thermal paste	B0-SP12NAA008ME01-LR88F78T
With thermal paste (5,2 W/mK, PTM6000HV)	B0-SP12NAA008ME01-LR88F78T-/7/
With thermal paste (5,2 W/mK, PTM6000HV) and Protection Foil	B0-SP12NAA008ME01-LR88F78T-/7F/

Marking

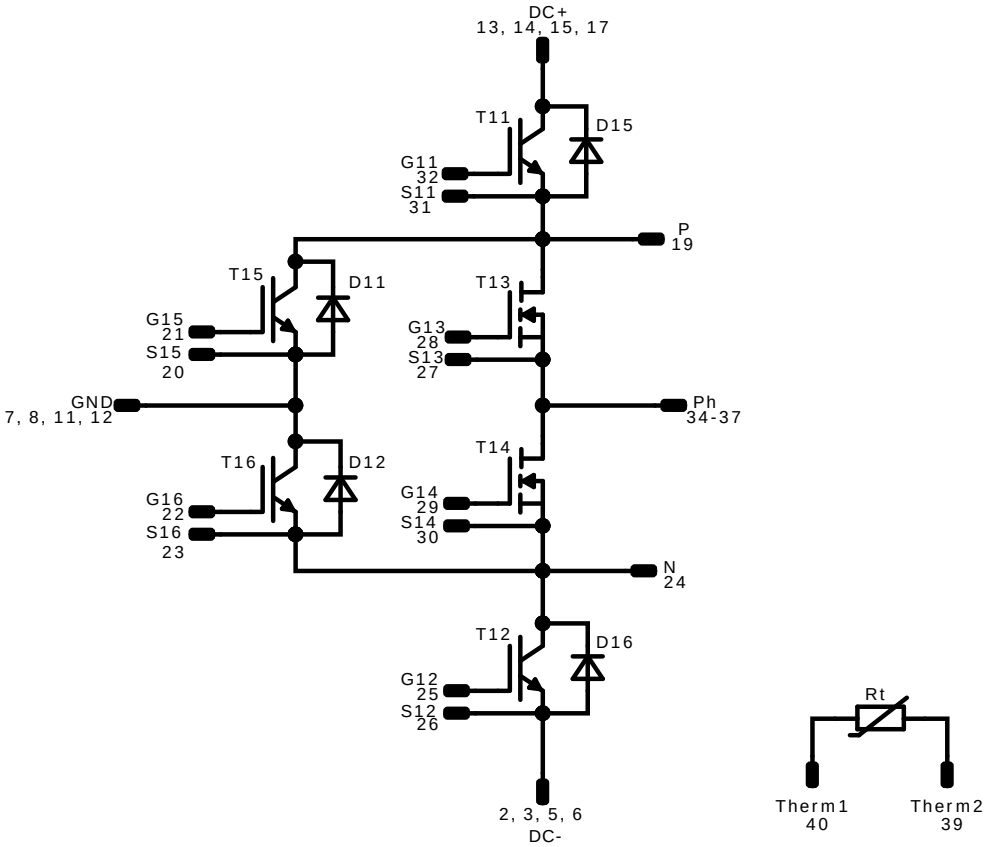
	Name		Date code	UL & VIN	Lot	Serial
Text	NN-NNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

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	S13
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



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
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	
D11, D12	FWD	1200 V	150 A	Neutral Point Diode	
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 UL 1557 recognized under E192116 up to a junction temperature under switching condition $T_{j,op}$=150°C and up to 4000VAC/1min isolation voltage. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
B0-SP12NAA008ME01-LR88F78T-D3-14	7 May. 2025	PCN-2024-006 Update AC Switch	