Vincotech

B0-SP10FSA600S7-LM69F98T
B0-SP10FSB600S7-LM79F98T

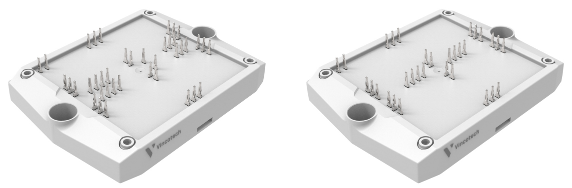
datasheet

***flow*FC S3 split** — **950 V / 600 A**

Features

- Low inductive mid-power package
- High efficient Flying Capacitor topology
- Optimized for 1500 V applications
- Integrated DC capacitors

flow S3 12 mm housing



LM69F98T — LM79F98T

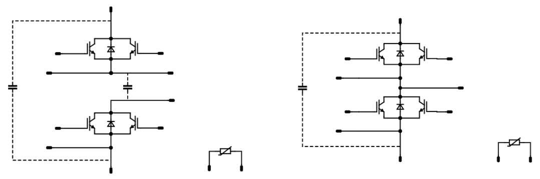
Target applications

- Solar Inverters

Types

- B0-SP10FSA600S7-LM69F98T
- B0-SP10FSB600S7-LM79F98T

Schematic



LM69F98T — LM79F98T

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
AC 1 Switch L					
Collector-emitter voltage	V_{CES}			950	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	357	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		1200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	636	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C
AC 1 Diode L					
Peak repetitive reverse voltage	V_{RRM}			950	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	295	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	506	W
Maximum junction temperature	T_{jmax}			175	°C
AC 1 Switch H					
Collector-emitter voltage	V_{CES}			950	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	357	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		1200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	636	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C
AC 1 Diode H					
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Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
AC 2 Switch L					
Collector-emitter voltage	V_{CES}			950	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	357	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		1200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	636	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C
AC 2 Diode L					
Peak repetitive reverse voltage	V_{RRM}			950	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	295	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	506	W
Maximum junction temperature	T_{jmax}			175	°C
AC 2 Switch H					
Collector-emitter voltage	V_{CES}			950	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	357	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		1200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	636	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C
AC 2 Diode H					
Peak repetitive reverse voltage	V_{RRM}			950	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	295	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	506	W
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Flying Capacitor					
Maximum DC voltage	V_{MAX}			1000	V
Operation Temperature	T_{op}			-55 ... 125	°C
Capacitor (DC)					
Maximum DC voltage	V_{MAX}			1500	V
Operation Temperature	T_{op}			-55 ... 125	°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
Isolation voltage	V_{isol}	AC Voltage	t_p = 1 min	2500	V
Creepage distance		LM69F98T LM79F98T		9,77 9,6	mm
Clearance		LM69F98T LM79F98T		8,72 8,22	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	Typ	Max	Unit
AC 1 Switch L										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,01002	25	4,35	5,1	5,85	V
Collector-emitter saturation voltage	V_{CEsat}		15		600	25 125 150		1,79 2,05 2,09	2,35(1)	V
Collector-emitter cut-off current	I_{CES}		0	950		25			12	µA
Gate-emitter leakage current	I_{GES}		20	0		25			600	nA
Internal gate resistance	r_g							0,25		Ω
Input capacitance	C_{ies}	f = 100 kHz	0	25		25		39000		pF
Output capacitance	C_{oes}							834		pF
Reverse transfer capacitance	C_{res}							120		pF
Gate charge	Q_g		15		0	25		1380		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,15		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	600	25 125 150		197,76 198,72 199,36		ns
Rise time	t_r					25 125 150		25,92 28,16 28,48		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		148,16 170,88 176,64		ns
Fall time	t_f					25 125 150		23,26 41,21 46,35		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=17,07 µC Q_{rFWD}=36,66 µC Q_{rFWD}=42 µC				25 125 150		29,9 33,52 33,7		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		15,19 23,63 25,62		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	
AC 1 Diode L										
Static										
Forward voltage	V_F				600	25 125 150	2,1	2,58 2,41 2,35	2,8(1)	V
Reverse leakage current	I_R	V_r = 950 V				25			24	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,19		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt=19055 A/µs di/dt=19448 A/µs di/dt=19304 A/µs	±15	600	600	25 125 150		361,81 540,11 587,56		A
Reverse recovery time	t_{rr}					25 125 150		142,07 173,11 182,02		ns
Recovered charge	Q_r					25 125 150		17,07 36,66 42		µC
Reverse recovered energy	E_{rec}					25 125 150		4,8 12,05 14,24		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		15319 13469 14003		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]	Values Min	Typ	Max	Unit
AC 1 Switch H										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,01002	25	4,35	5,1	5,85	V
Collector-emitter saturation voltage	V_{CEsat}		15		600	25 125 150		1,79 2,05 2,09	2,35[1]	V
Collector-emitter cut-off current	I_{CES}		0	950		25			12	µA
Gate-emitter leakage current	I_{GES}		20	0		25			600	nA
Internal gate resistance	r_g							0,25		Ω
Input capacitance	C_{ies}	f = 100 kHz	0	25		25		39000		pF
Output capacitance	C_{oes}							834		pF
Reverse transfer capacitance	C_{res}							120		pF
Gate charge	Q_g		15		0	25		1380		nC
Thermal										
Thermal resistance junction to sink [2]	$R_{th(j-s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,15		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	600	25 125 150		197,76 198,72 199,36		ns
Rise time	t_r					25 125 150		25,92 28,16 28,48		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		148,16 170,88 176,64		ns
Fall time	t_f					25 125 150		23,26 41,21 46,35		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=17,07 µC Q_{rFWD}=36,66 µC Q_{rFWD}=42 µC				25 125 150		29,9 33,52 33,7		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		15,19 23,63 25,62		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	
AC 1 Diode H										
Static										
Forward voltage	V_F				600	25 125 150	2,1	2,58 2,41 2,35	2,8(1)	V
Reverse leakage current	I_R	V_r = 950 V				25			24	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,19		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt=19055 A/µs di/dt=19448 A/µs di/dt=19304 A/µs	±15	600	600	25 125 150		361,81 540,11 587,56		A
Reverse recovery time	t_{rr}					25 125 150		142,07 173,11 182,02		ns
Recovered charge	Q_r					25 125 150		17,07 36,66 42		µC
Reverse recovered energy	E_{rec}					25 125 150		4,8 12,05 14,24		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		15319 13469 14003		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
AC 2 Switch L										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,01002	25	4,35	5,1	5,85	V
Collector-emitter saturation voltage	V_{CEsat}		15		600	25 125 150		1,79 2,05 2,09	2,35(1)	V
Collector-emitter cut-off current	I_{CES}		0	950		25			12	µA
Gate-emitter leakage current	I_{GES}		20	0		25			600	nA
Internal gate resistance	r_g							0,25		Ω
Input capacitance	C_{ies}	f = 100 kHz	0	25		25		39000		pF
Output capacitance	C_{oes}							834		pF
Reverse transfer capacitance	C_{res}							120		pF
Gate charge	Q_g		15		0	25		1380		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,15		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	600	25 125 150		199,04 200,32 200,64		ns
Rise time	t_r					25 125 150		24,32 26,56 27,52		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		151,04 175,36 181,76		ns
Fall time	t_f					25 125 150		22,91 42,32 49,49		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=17,05 µC Q_{rFWD}=38,32 µC Q_{rFWD}=44,72 µC				25 125 150		29,33 33,29 34,4		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		15,06 23,9 26,74		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	
AC 2 Diode L										
Static										
Forward voltage	V_F				600	25 125 150	2,1	2,58 2,41 2,35	2,8(1)	V
Reverse leakage current	I_R	V_r = 950 V				25			24	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,19		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=20877 A/µs d*i*/d*t*=20334 A/µs d*i*/d*t*=20767 A/µs	±15	600	600	25 125 150		377,72 572,15 625,39		A
Reverse recovery time	t_{rr}					25 125 150		138,55 173,65 187,29		ns
Recovered charge	Q_r					25 125 150		17,05 38,32 44,72		µC
Reverse recovered energy	E_{rec}					25 125 150		4,65 12,41 15,01		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		16716 15210 15877		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
AC 2 Switch H										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,01002	25	4,35	5,1	5,85	V
Collector-emitter saturation voltage	V_{CEsat}		15		600	25 125 150		1,79 2,05 2,09	2,35(1)	V
Collector-emitter cut-off current	I_{CES}		0	950		25			12	µA
Gate-emitter leakage current	I_{GES}		20	0		25			600	nA
Internal gate resistance	r_g							0,25		Ω
Input capacitance	C_{ies}	f = 100 kHz	0	25		25		39000		pF
Output capacitance	C_{oes}							834		pF
Reverse transfer capacitance	C_{res}							120		pF
Gate charge	Q_g		15		0	25		1380		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,15		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 2 Ω R_{goff} = 2 Ω	±15	600	600	25 125 150		199,04 200,32 200,64		ns
Rise time	t_r					25 125 150		24,32 26,56 27,52		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		151,04 175,36 181,76		ns
Fall time	t_f					25 125 150		22,91 42,32 49,49		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=17,05 µC Q_{rFWD}=38,32 µC Q_{rFWD}=44,72 µC				25 125 150		29,33 33,29 34,4		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		15,06 23,9 26,74		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
AC 2 Diode H										
Static										
Forward voltage	V_F				600	25 125 150	2,1	2,58 2,41 2,35	2,8[1]	V
Reverse leakage current	I_R	V_r = 950 V				25			24	µA
Thermal										
Thermal resistance junction to sink [2]	$R_{th(j\text{-}s)}$	λ_{paste} = 4,4 W/mK (PTM)						0,19		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=20877 A/µs d*i*/d*t*=20334 A/µs d*i*/d*t*=20767 A/µs	±15	600	600	25 125 150		377,72 572,15 625,39		A
Reverse recovery time	t_{rr}					25 125 150		138,55 173,65 187,29		ns
Recovered charge	Q_r					25 125 150		17,05 38,32 44,72		µC
Reverse recovered energy	E_{rec}					25 125 150		4,65 12,41 15,01		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		16716 15210 15877		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	
Flying Capacitor										
Static										
Capacitance	C	DC bias voltage = 0 V				25		400		nF
Tolerance							-10		10	%
Dissipation factor		f = 1 kHz				25		2,5		%
Capacitor (DC)										
Static										
Capacitance	C	DC bias voltage = 0 V				25		112		nF
Tolerance							-10		10	%
Dissipation factor		f = 1 kHz				25		2,5		%
Thermistor										
Static										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P							5		mW
Power dissipation constant	d					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %						3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %						4000		K
Vincotech Thermistor Reference									I	

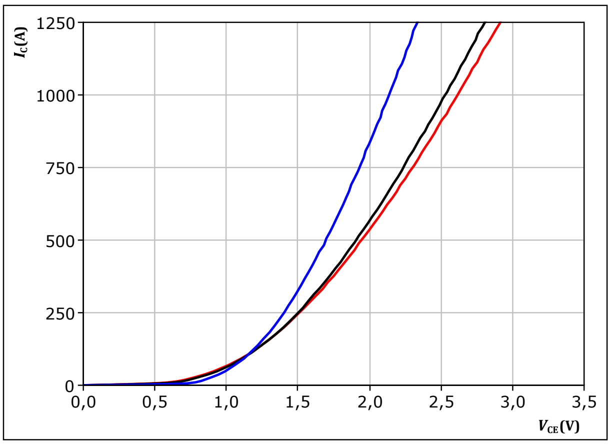
(1) Value at chip level
(2) Only valid with pre-applied Vincotech thermal interface material.

AC 1, AC 2 Switch L Characteristics

figure 1. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

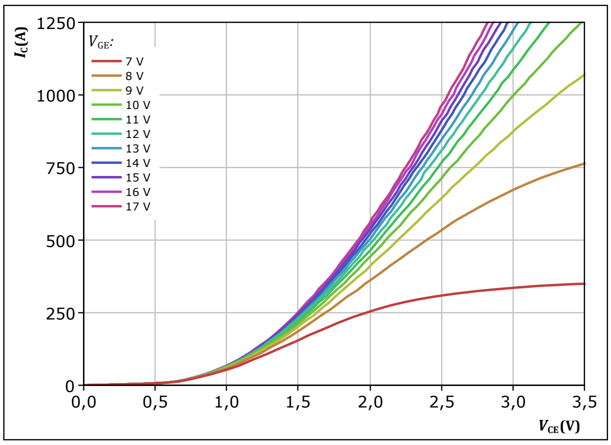


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



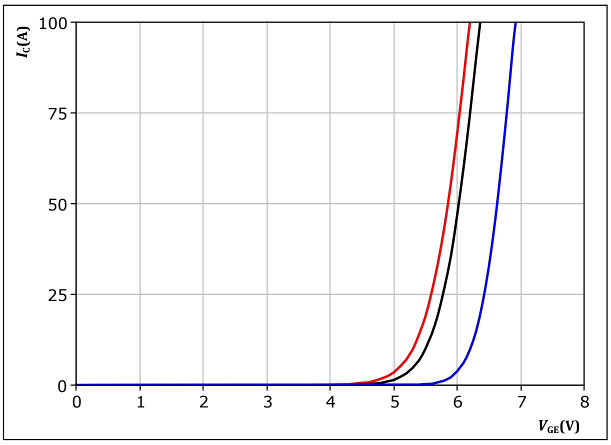
t_p =	250	µs
T_j =	150	°C

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

figure 3. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})

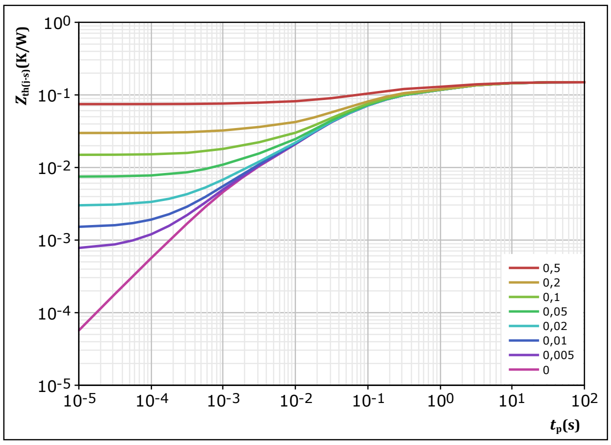


t_p =	250	µs		25 °C
V_{CE} =	14	V	T_j:	125 °C
				150 °C

figure 4. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,149	K/W

IGBT thermal model values

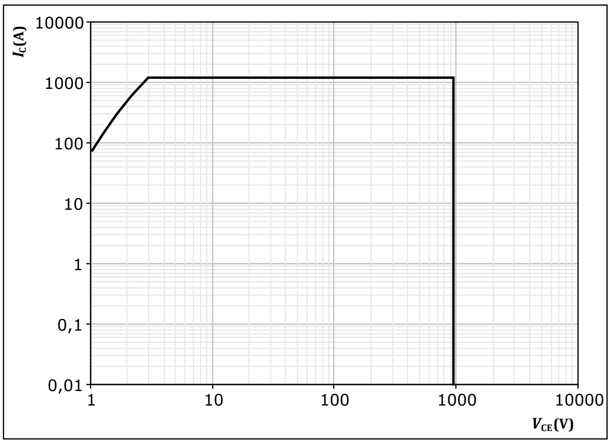
R (K/W)	τ (s)
1,26E-02	8,85E+00
4,17E-02	1,44E+00
6,06E-02	1,19E-01
2,86E-02	2,31E-02
5,81E-03	1,46E-03

AC 1, AC 2 Switch L Characteristics

figure 5. **IGBT**

Safe operating area

I_C = f(V_{CE})



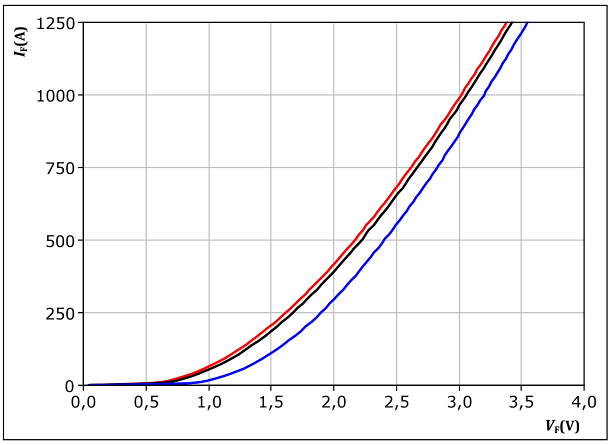
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

AC 1, AC 2 Diode L Characteristics

figure 6. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



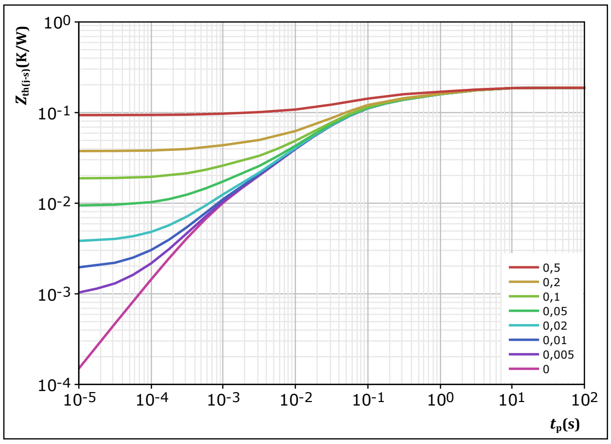
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 7. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,188 K/W

FWD thermal model values

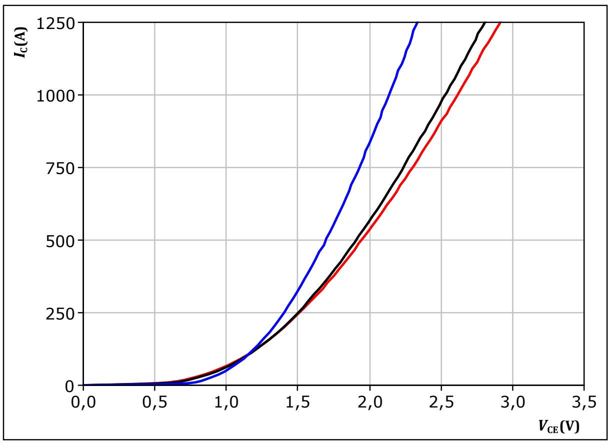
R (K/W)	τ (s)
2,89E-02	3,31E+00
3,81E-02	5,82E-01
8,22E-02	6,14E-02
3,00E-02	1,08E-02
8,47E-03	7,78E-04

AC 1, AC 2 Switch H Characteristics

figure 8. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

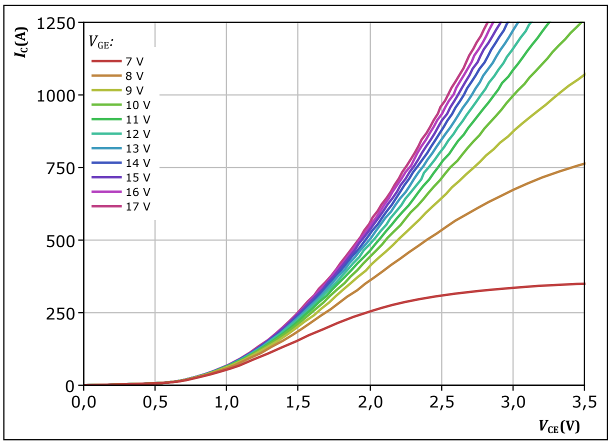


t_p = 250 µs
V_{GE} = 15 V
T_j: 25 °C, 125 °C, 150 °C

figure 9. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

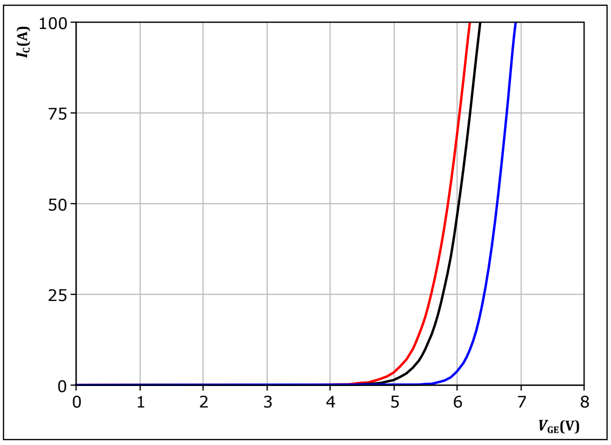


t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 10. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})

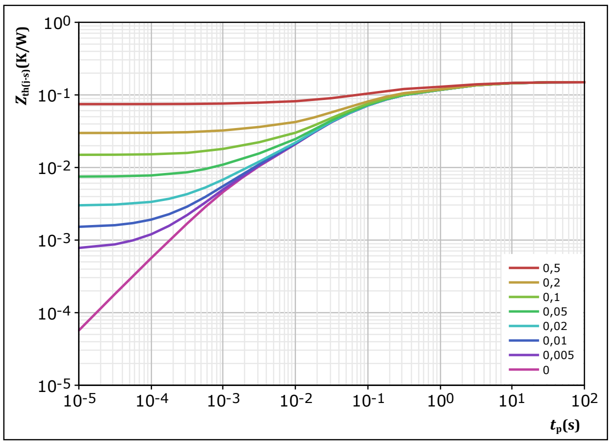


t_p = 250 µs
V_{CE} = 14 V
T_j: 25 °C, 125 °C, 150 °C

figure 11. **IGBT**

Transient thermal impedance as a function of pulse width

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



D = t_p / T
$R_{th(j-s)}$ = 0,149 K/W

IGBT thermal model values

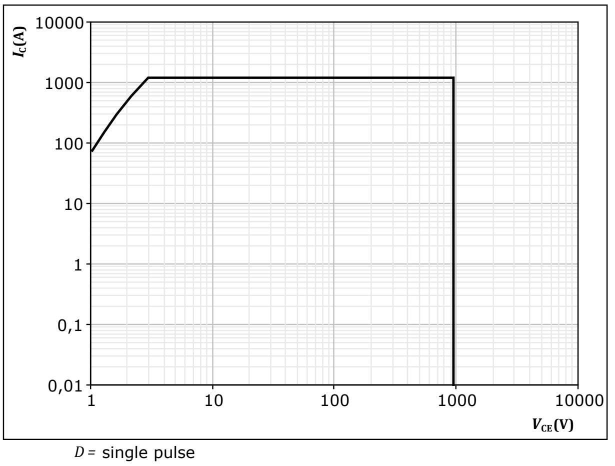
R (K/W)	τ (s)
1,26E-02	8,85E+00
4,17E-02	1,44E+00
6,06E-02	1,19E-01
2,86E-02	2,31E-02
5,81E-03	1,46E-03

AC 1, AC 2 Switch H Characteristics

figure 12. **IGBT**

Safe operating area

I_C = f(V_{CE})



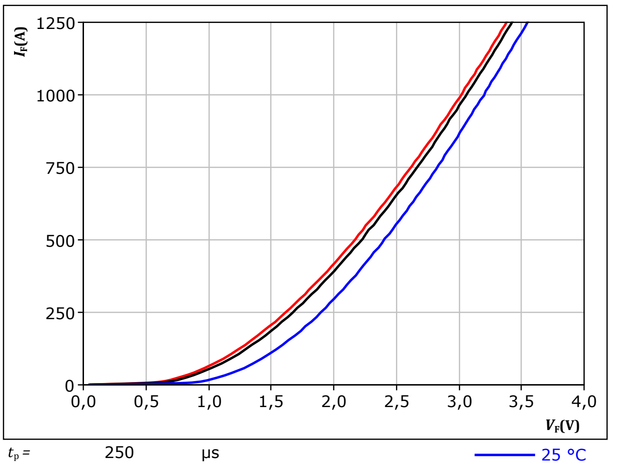
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

AC 1, AC 2 Diode H Characteristics

figure 13. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



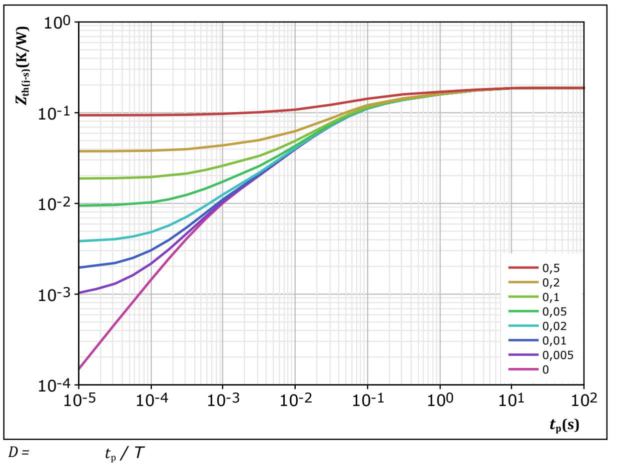
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 14. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,188 K/W

FWD thermal model values

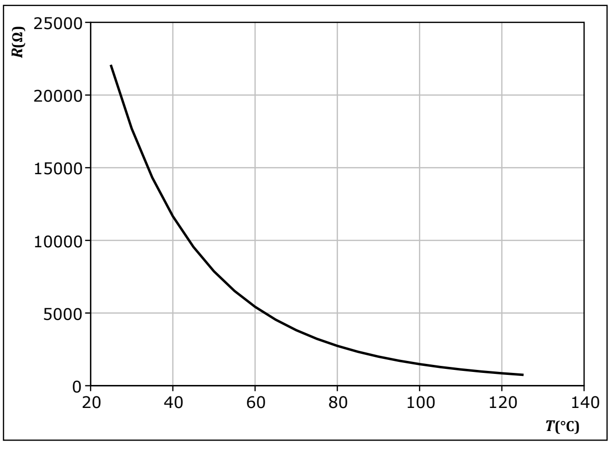
R (K/W)	τ (s)
2,89E-02	3,31E+00
3,81E-02	5,82E-01
8,22E-02	6,14E-02
3,00E-02	1,08E-02
8,47E-03	7,78E-04

Thermistor Characteristics

figure 15. Thermistor

Typical NTC characteristic as function of temperature

R_T = f(T)

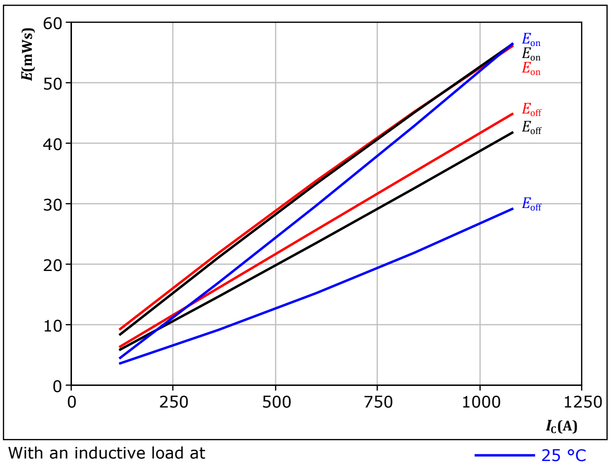


AC 1 Switching Characteristics L

figure 16. IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



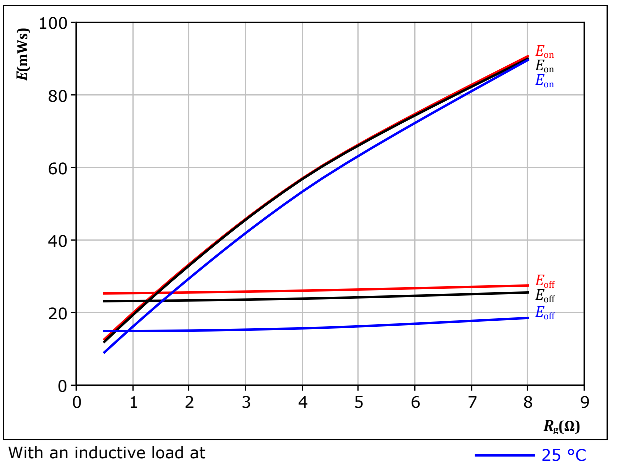
With an inductive load at

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 17. IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



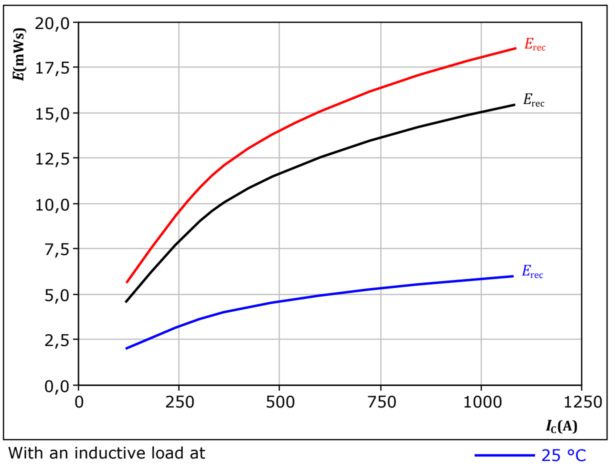
With an inductive load at

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

figure 18. FWD

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



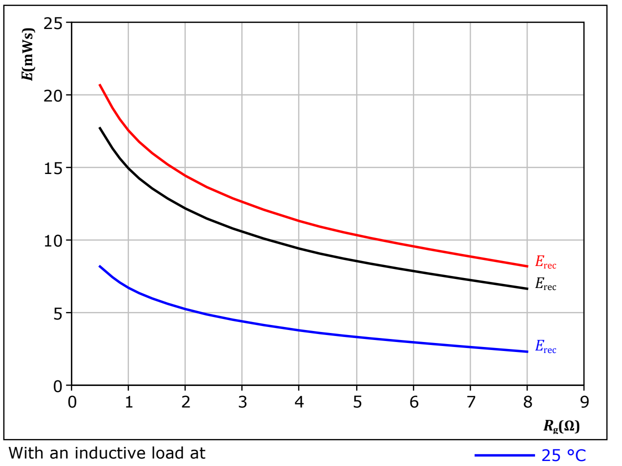
With an inductive load at

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

figure 19. FWD

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

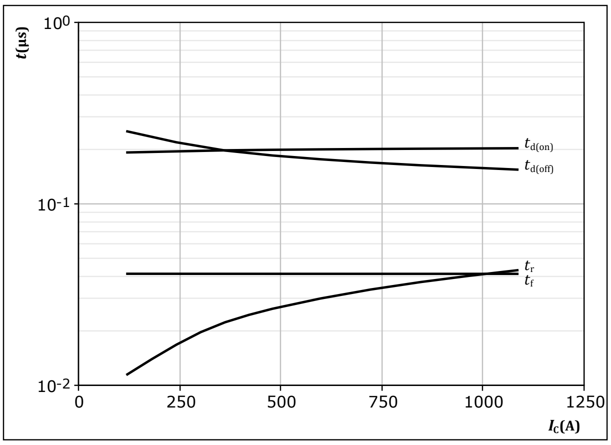
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	600	A		150 °C

AC 1 Switching Characteristics L

figure 20. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



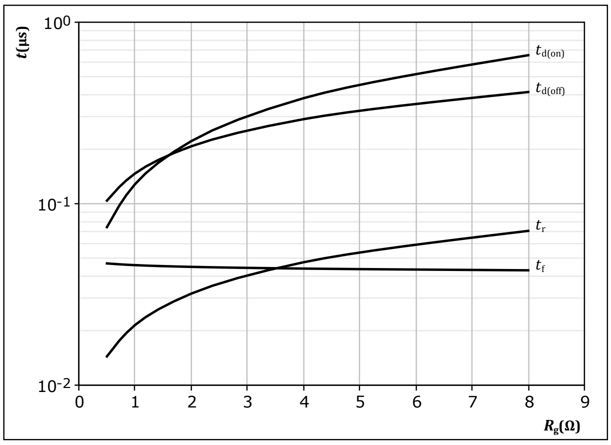
With an inductive load at

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

figure 21. **IGBT**

Typical switching times as a function of gate resistor

t = f(R_g)



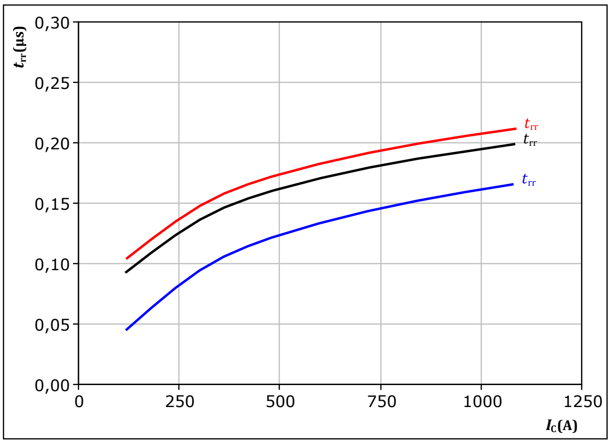
With an inductive load at

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

figure 22. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

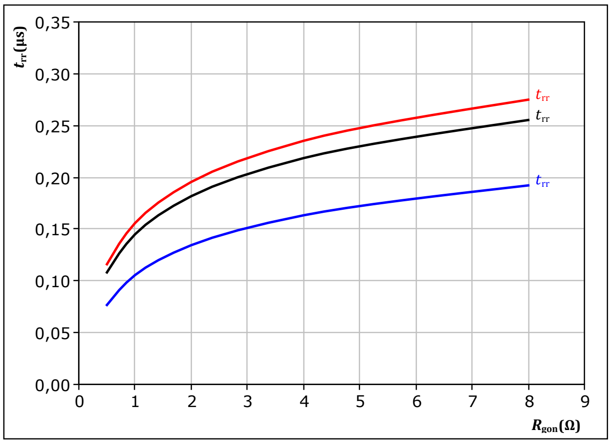
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 23. **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 =	600	A

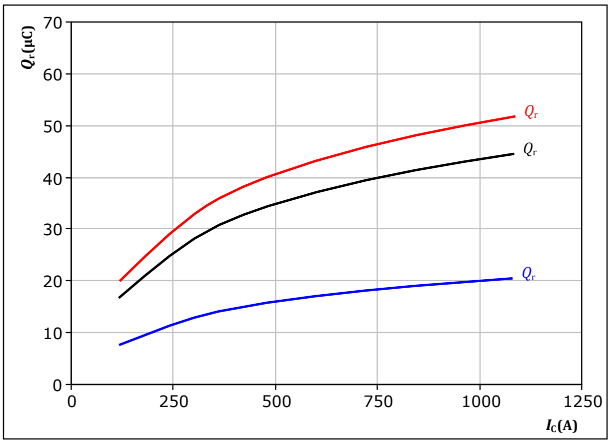
T_j: 25 °C, 125 °C, 150 °C

AC 1 Switching Characteristics L

figure 24. FWD

Typical recovered charge as a function of collector current

Q_r = f(I_C)



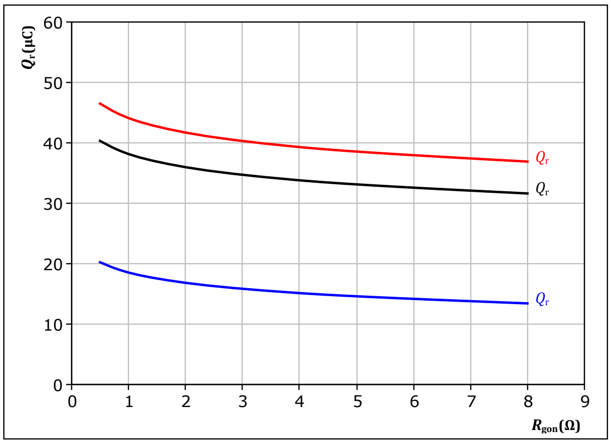
With an inductive load at

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

figure 25. FWD

Typical recovered charge as a function of turn on gate resistor

Q_r = f(R_{gon})



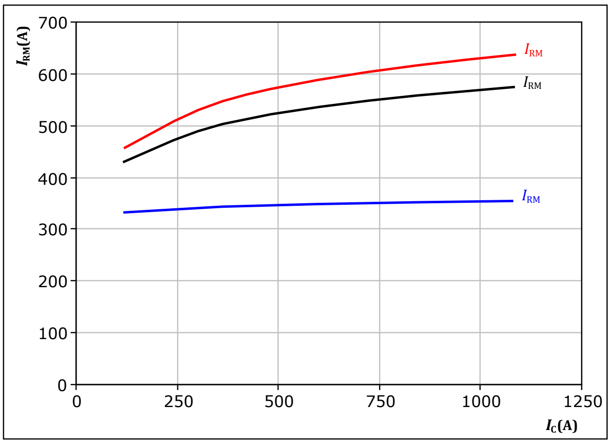
With an inductive load at

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

figure 26. FWD

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



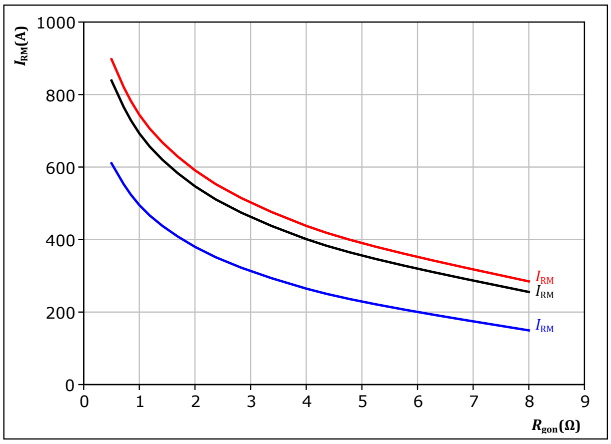
With an inductive load at

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

figure 27. FWD

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

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



With an inductive load at

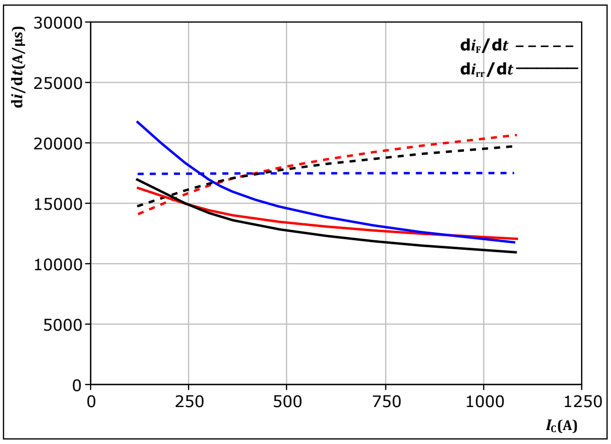
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	600	A		150 °C

AC 1 Switching Characteristics L

figure 28. **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)



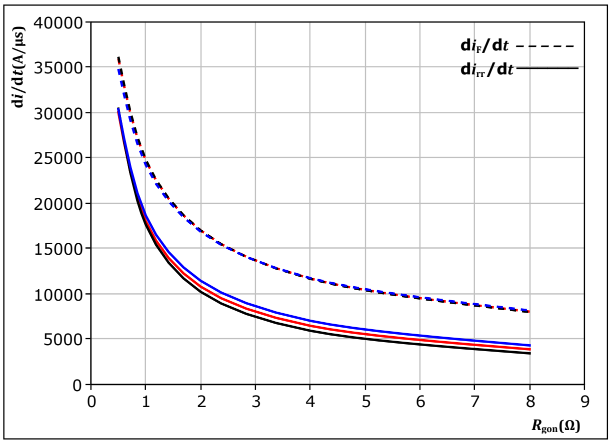
With an inductive load at

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

figure 29. **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})



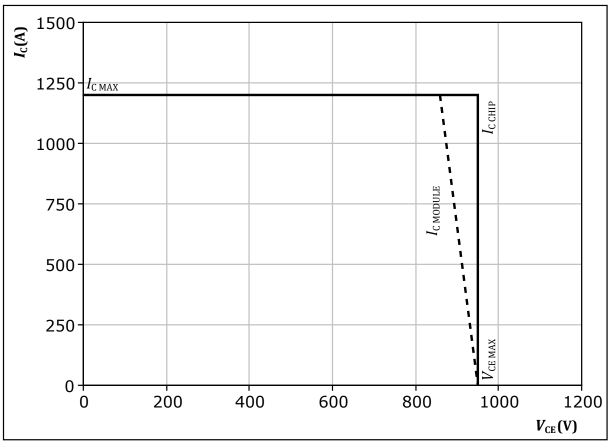
With an inductive load at

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

figure 30. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



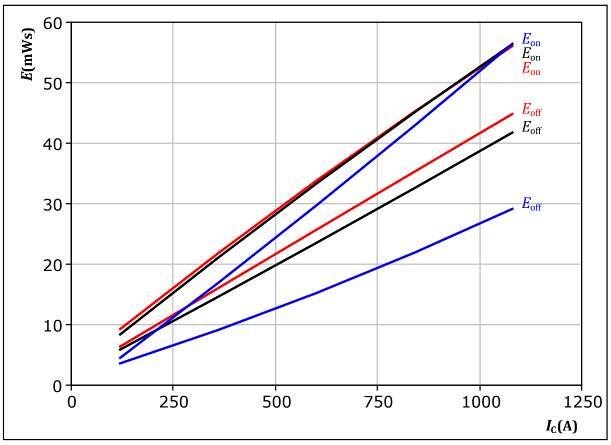
At	T_j =	150	°C
	R_{gon} =	2	Ω
	R_{goff} =	2	Ω

AC 1 Switching Characteristics H

figure 31. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



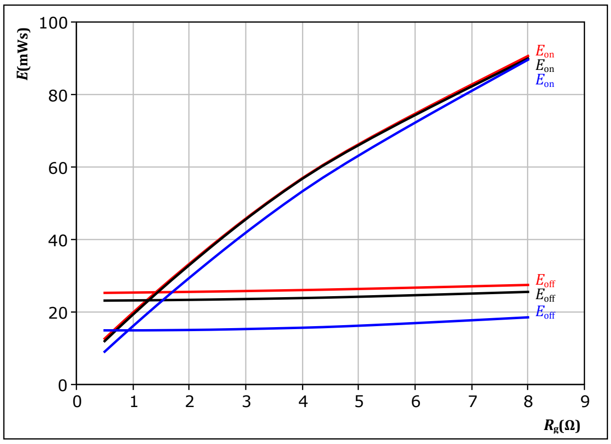
With an inductive load at

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 32. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



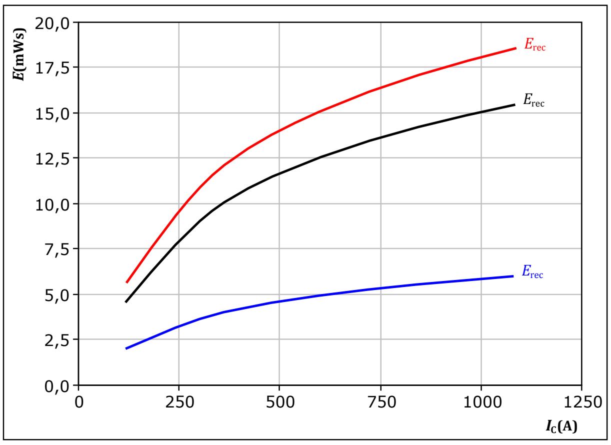
With an inductive load at

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

figure 33. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



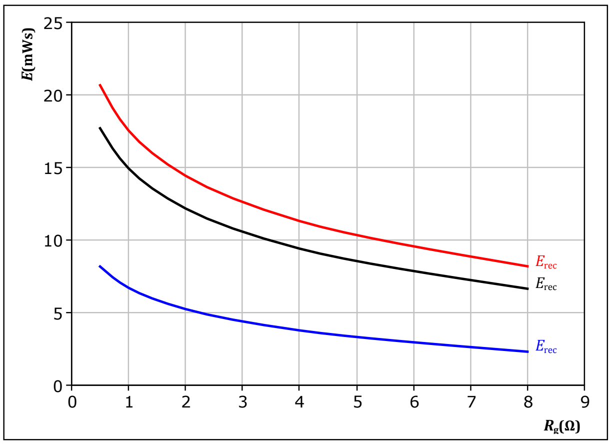
With an inductive load at

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

figure 34. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

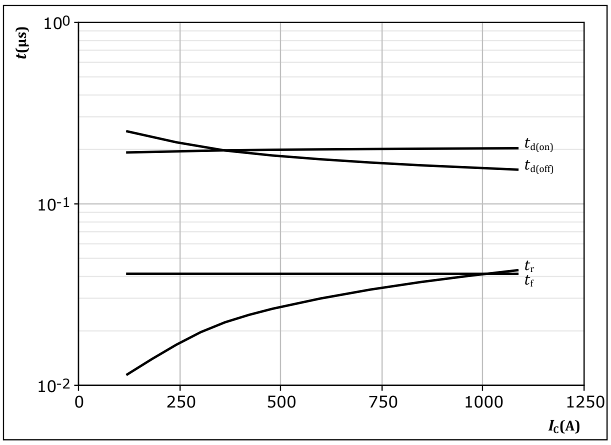
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	600	A		150 °C

AC 1 Switching Characteristics H

figure 35. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



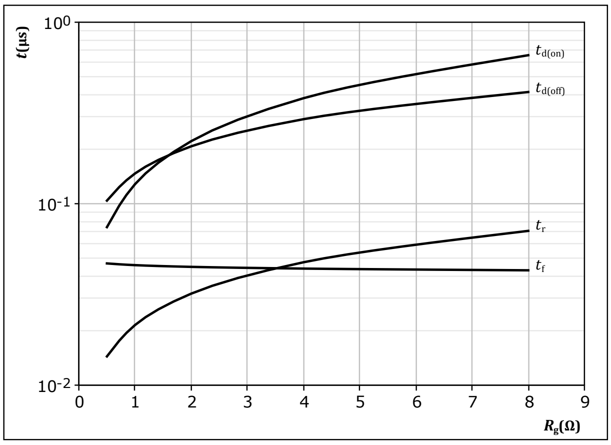
With an inductive load at

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

figure 36. **IGBT**

Typical switching times as a function of gate resistor

t = f(R_g)



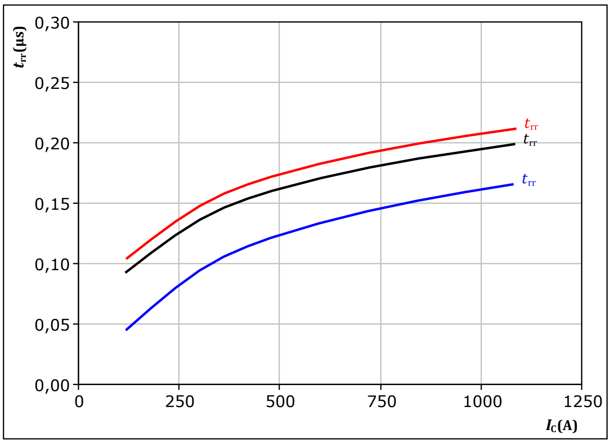
With an inductive load at

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

figure 37. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

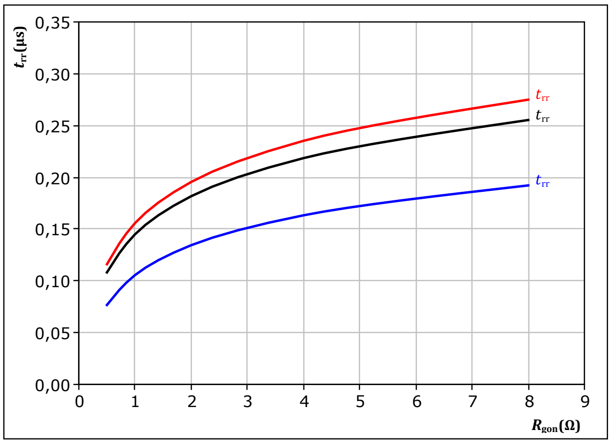
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 38. **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 =	600	A

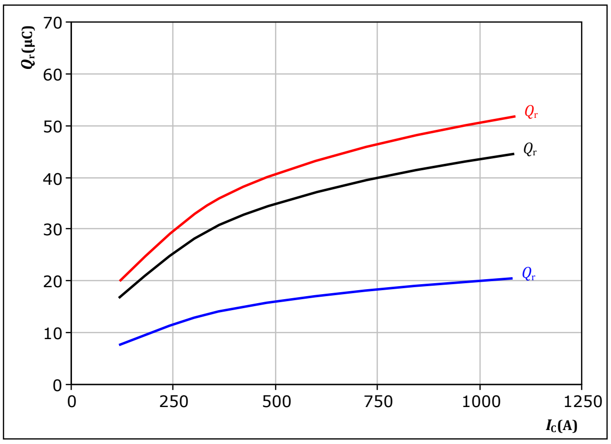
T_j: 25 °C, 125 °C, 150 °C

AC 1 Switching Characteristics H

figure 39. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



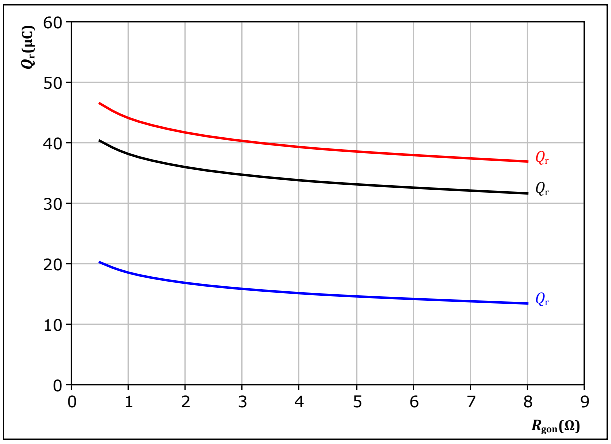
With an inductive load at

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

figure 40. **FWD**

Typical recovered charge as a function of turn on gate resistor

Q_r = f(R_{gon})



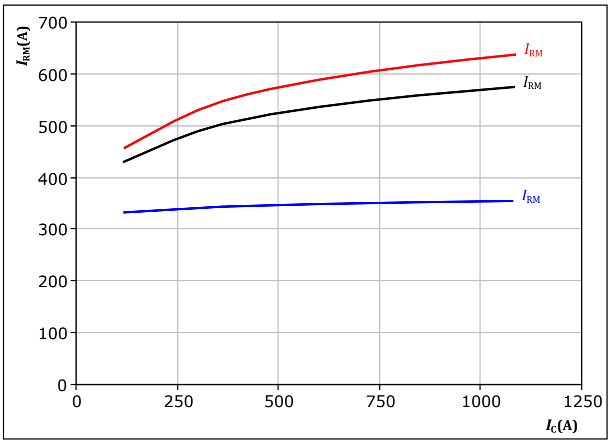
With an inductive load at

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

figure 41. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



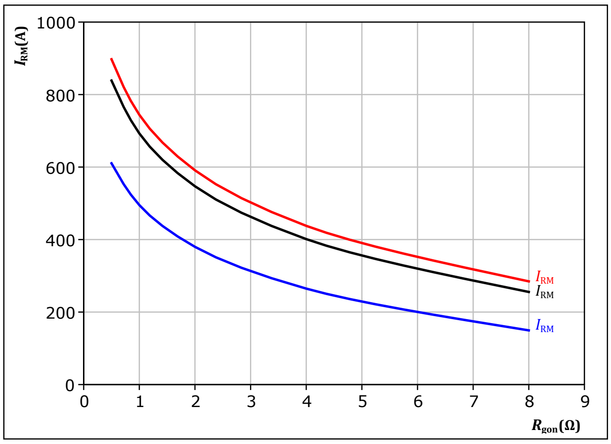
With an inductive load at

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

figure 42. **FWD**

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

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



With an inductive load at

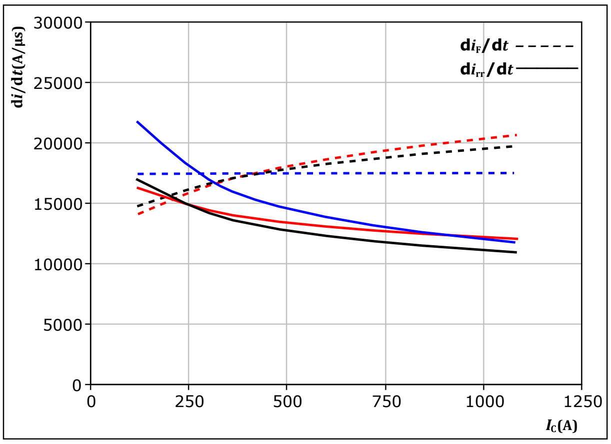
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	600	A		150 °C

AC 1 Switching Characteristics H

figure 43. **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)



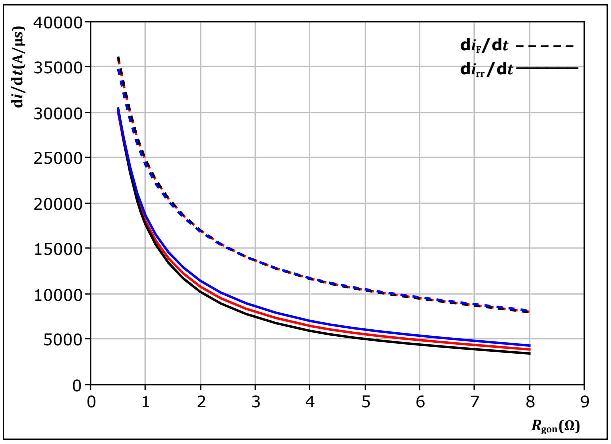
With an inductive load at

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

figure 44. **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})



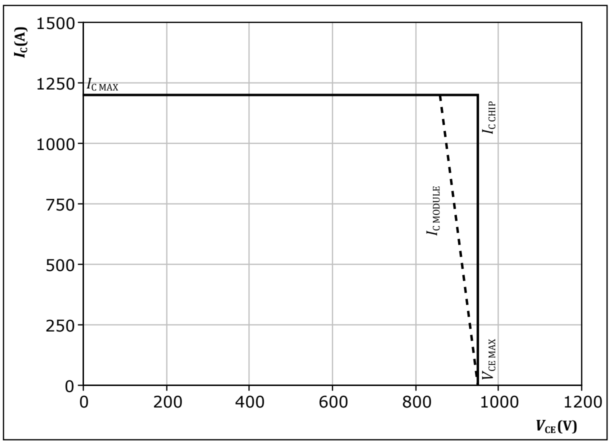
With an inductive load at

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

figure 45. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



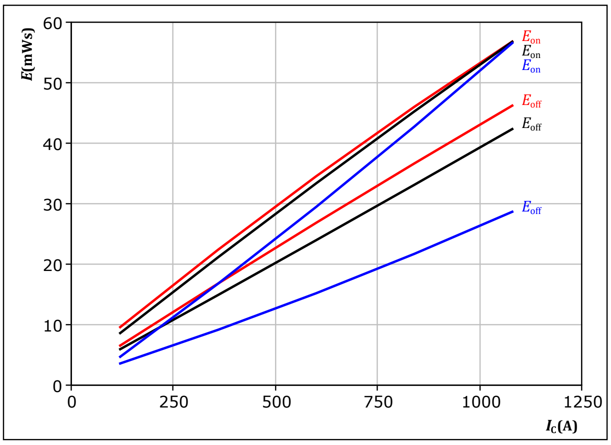
At			
	T_j =	150	°C
	R_{gon} =	2	Ω
	R_{goff} =	2	Ω

AC 2 Switching Characteristics L

figure 16. IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



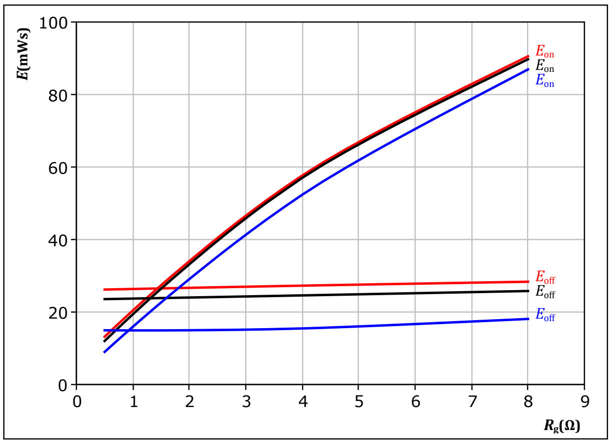
With an inductive load at

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 17. IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



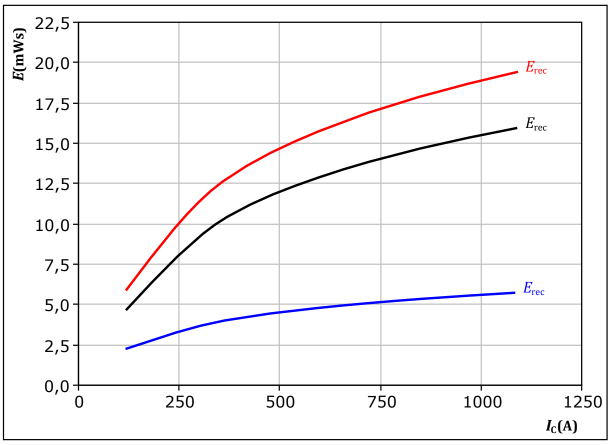
With an inductive load at

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

figure 18. FWD

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



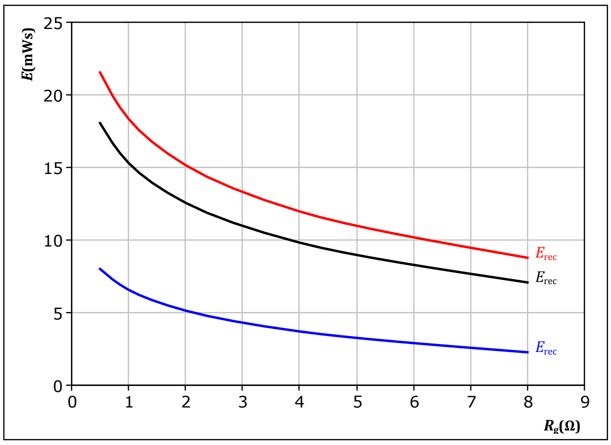
With an inductive load at

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

figure 19. FWD

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

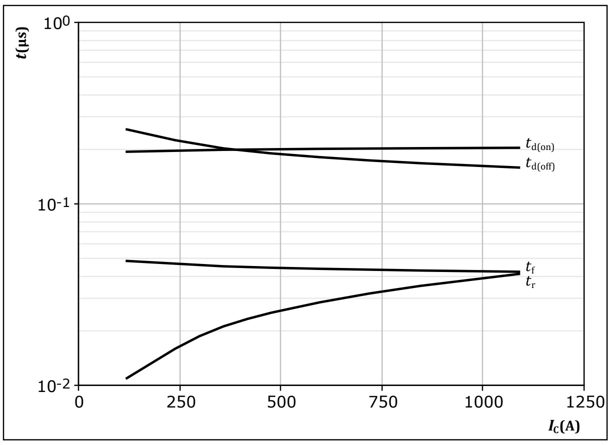
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	600	A		150 °C

AC 2 Switching Characteristics L

figure 20. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



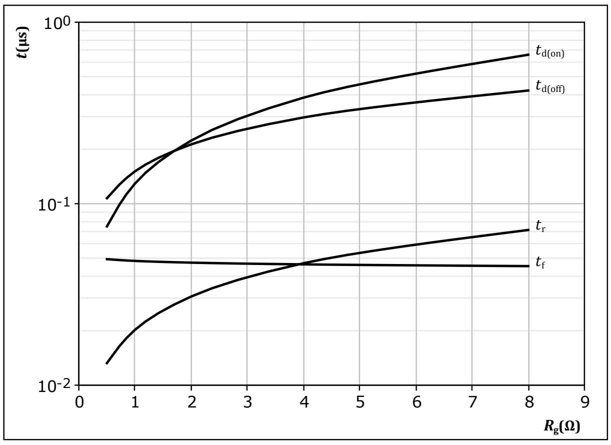
With an inductive load at

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

figure 21. **IGBT**

Typical switching times as a function of gate resistor

t = f(R_g)



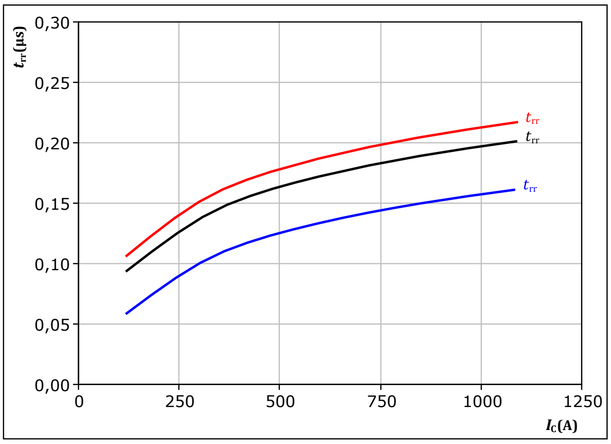
With an inductive load at

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

figure 22. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

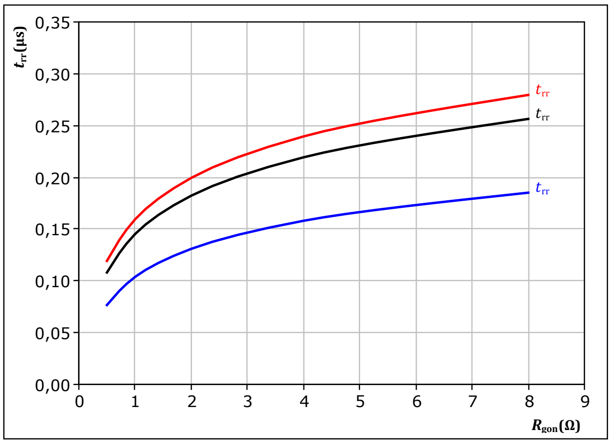
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 23. **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 =	600	A

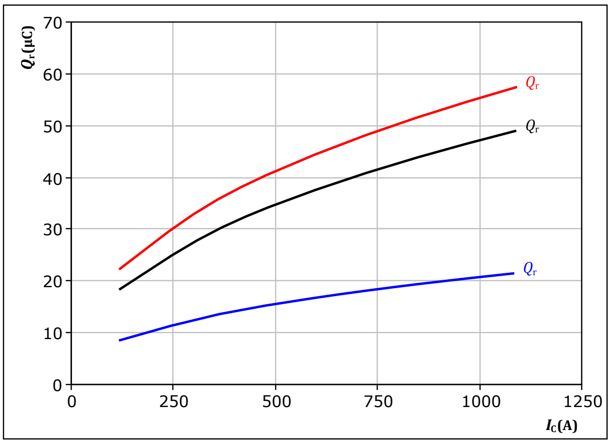
T_j: 25 °C, 125 °C, 150 °C

AC 2 Switching Characteristics L

figure 24. FWD

Typical recovered charge as a function of collector current

Q_r = f(I_C)



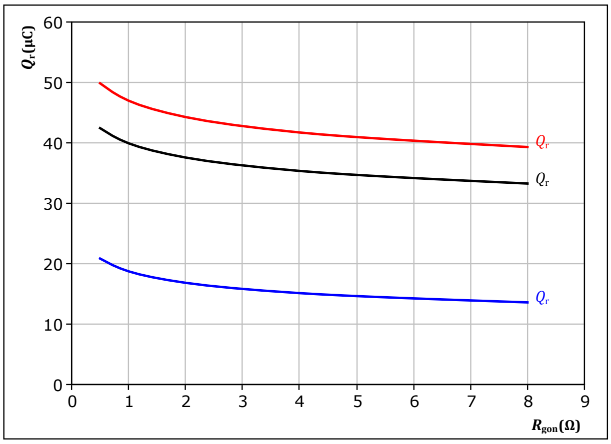
With an inductive load at

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

figure 25. FWD

Typical recovered charge as a function of turn on gate resistor

Q_r = f(R_{gon})



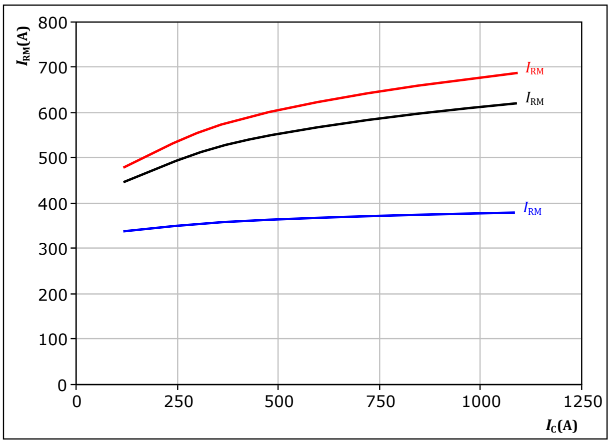
With an inductive load at

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

figure 26. FWD

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



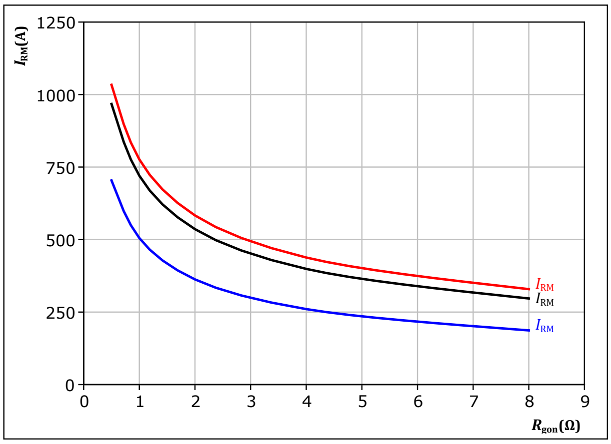
With an inductive load at

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

figure 27. FWD

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

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



With an inductive load at

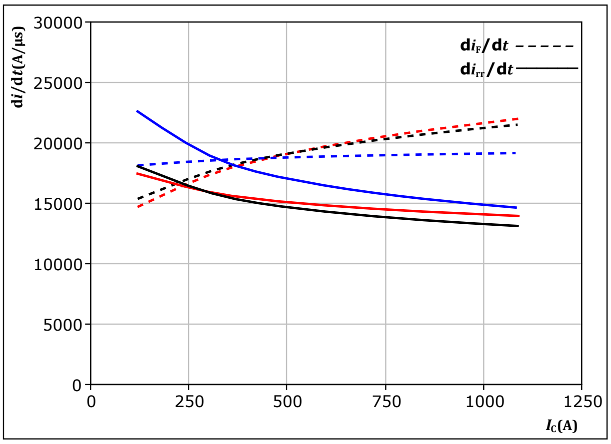
V_{CE} =	600	V	T_j:	25 °C / 125 °C / 150 °C
V_{GE} =	±15	V		
I_C =	600	A		

AC 2 Switching Characteristics L

figure 28. **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)



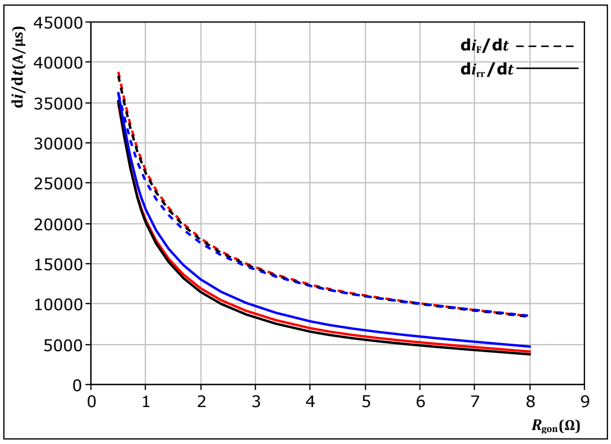
With an inductive load at

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

figure 29. **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})



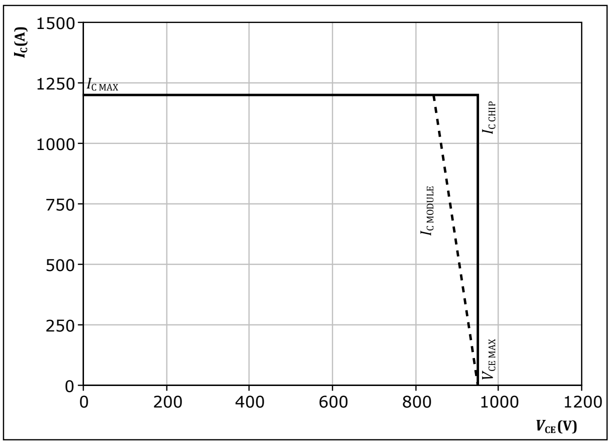
With an inductive load at

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

figure 30. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



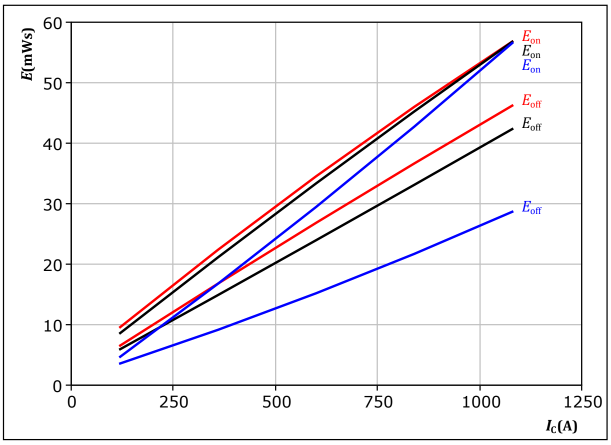
At	T_j =	150	°C
	R_{gon} =	2	Ω
	R_{goff} =	2	Ω

AC 2 Switching Characteristics H

figure 31. IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



With an inductive load at

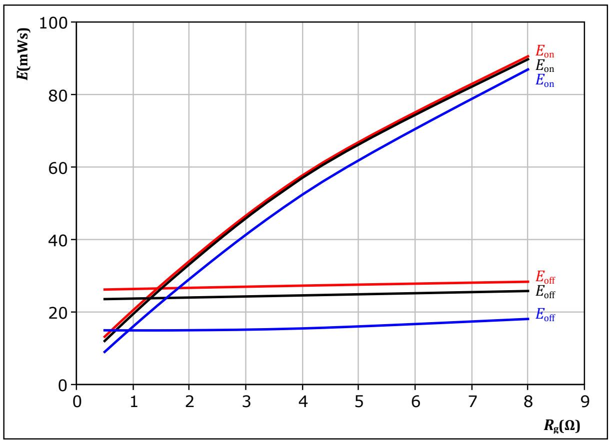
V_{CE} = 600 V
V_{GE} = ±15 V
R_{gon} = 2 Ω
R_{goff} = 2 Ω

T_j: 25 °C, 125 °C, 150 °C

figure 32. IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



With an inductive load at

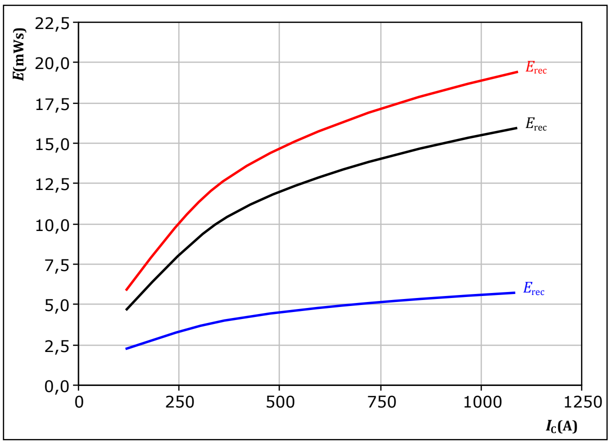
V_{CE} = 600 V
V_{GE} = ±15 V
I_C = 600 A

T_j: 25 °C, 125 °C, 150 °C

figure 33. FWD

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



With an inductive load at

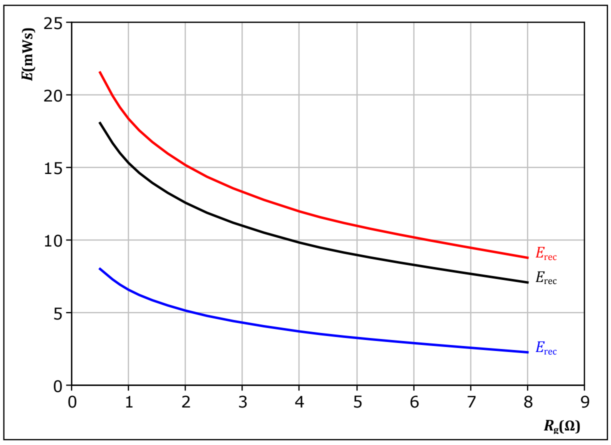
V_{CE} = 600 V
V_{GE} = ±15 V
R_{gon} = 2 Ω

T_j: 25 °C, 125 °C, 150 °C

figure 34. 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
V_{GE} = ±15 V
I_C = 600 A

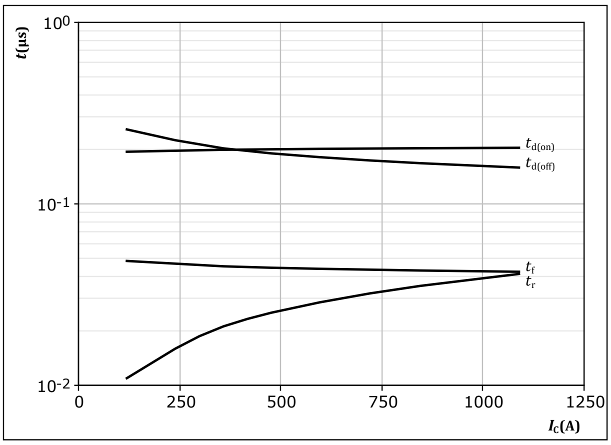
T_j: 25 °C, 125 °C, 150 °C

AC 2 Switching Characteristics H

figure 35. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



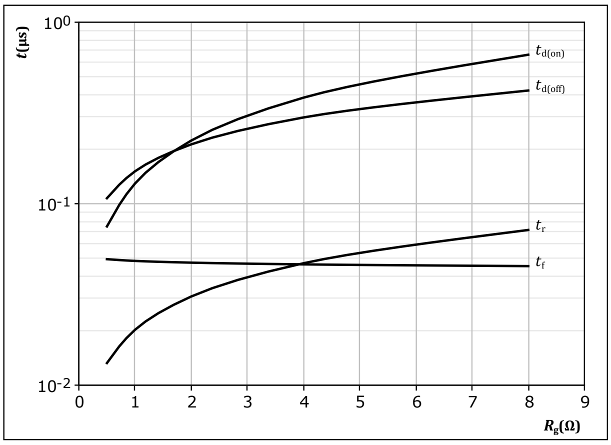
With an inductive load at

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

figure 36. **IGBT**

Typical switching times as a function of gate resistor

t = f(R_g)



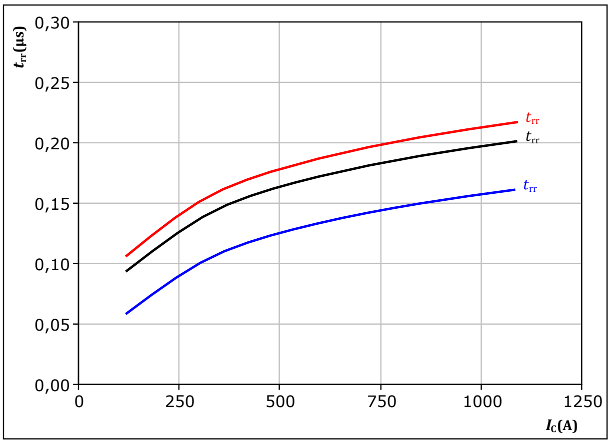
With an inductive load at

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

figure 37. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

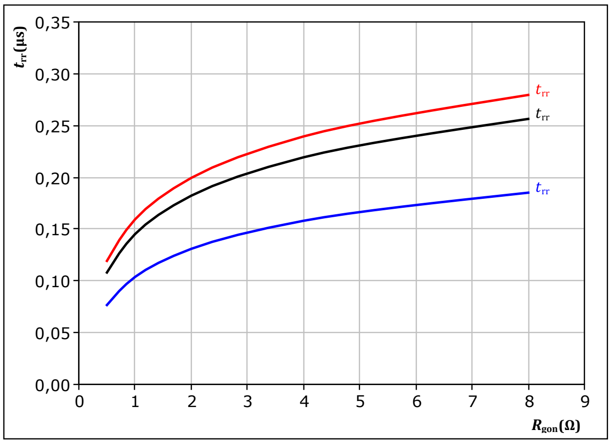
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 38. **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 =	600	A

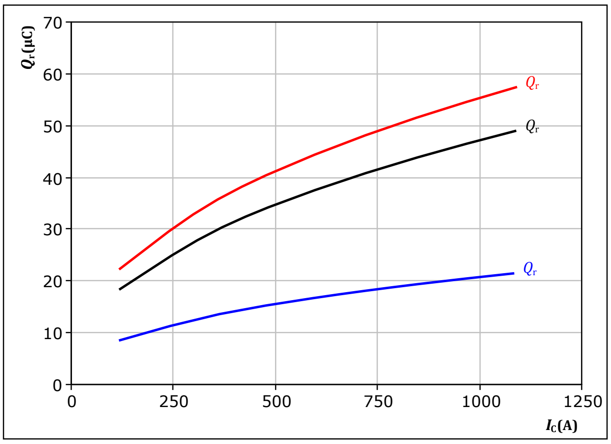
T_j: 25 °C, 125 °C, 150 °C

AC 2 Switching Characteristics H

figure 39. FWD

Typical recovered charge as a function of collector current

Q_r = f(I_C)



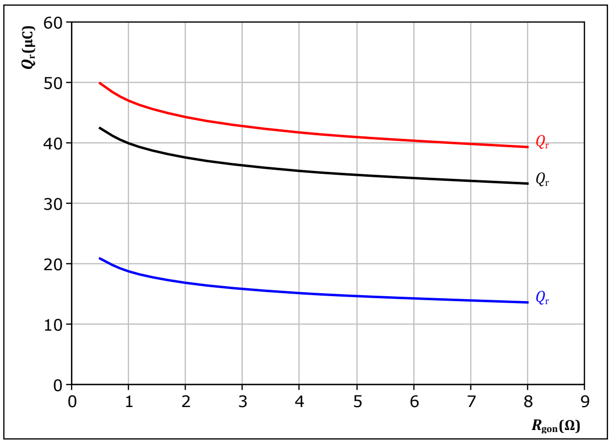
With an inductive load at

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

figure 40. FWD

Typical recovered charge as a function of turn on gate resistor

Q_r = f(R_{gon})



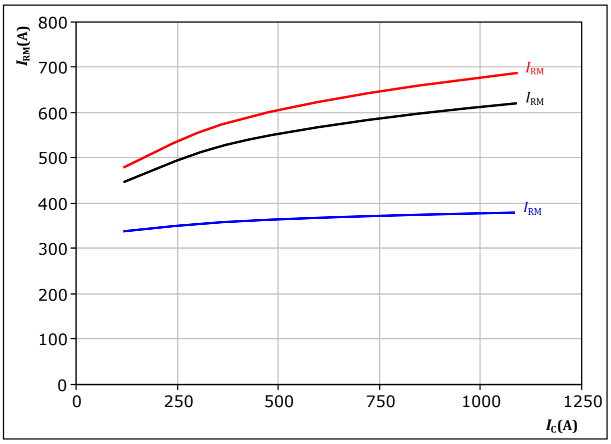
With an inductive load at

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

figure 41. FWD

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



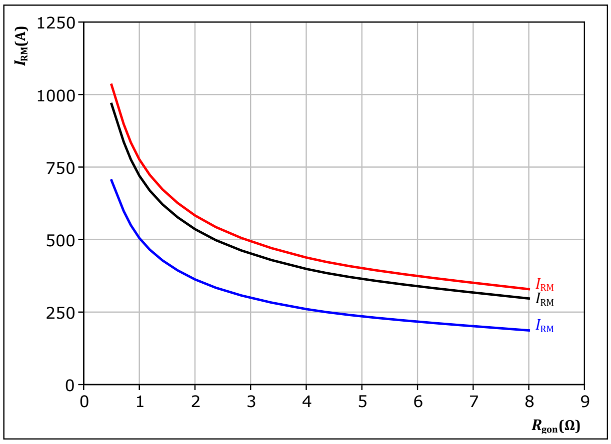
With an inductive load at

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

figure 42. FWD

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

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



With an inductive load at

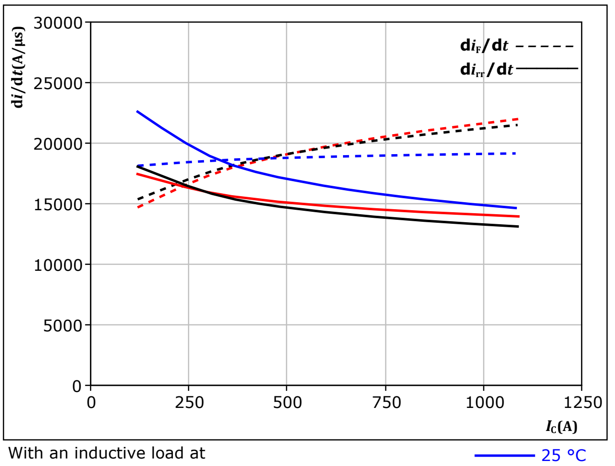
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	600	A		150 °C

AC 2 Switching Characteristics H

figure 43. **FWD**

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

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



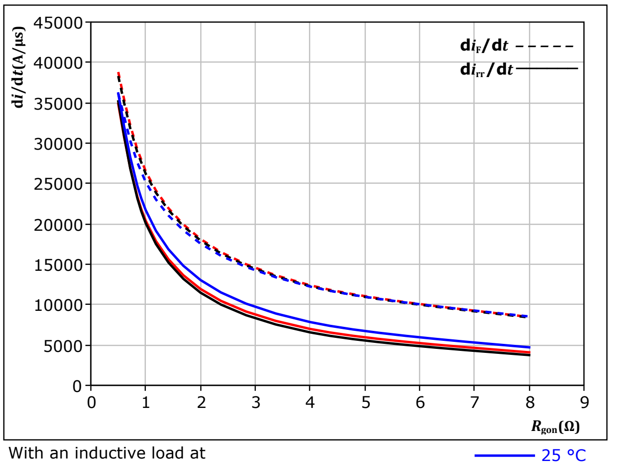
With an inductive load at

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

figure 44. **FWD**

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

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



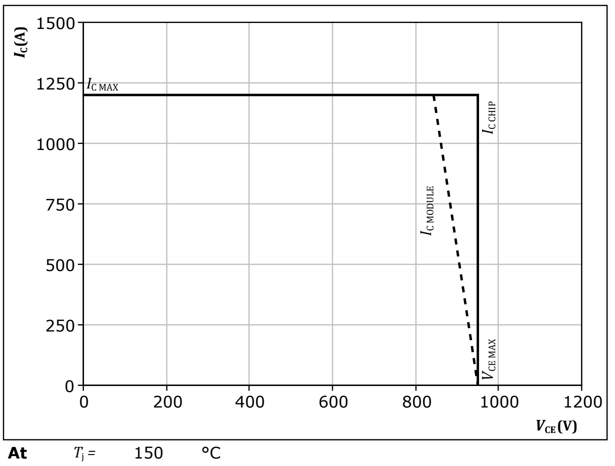
With an inductive load at

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

figure 45. **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 46. **IGBT**

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

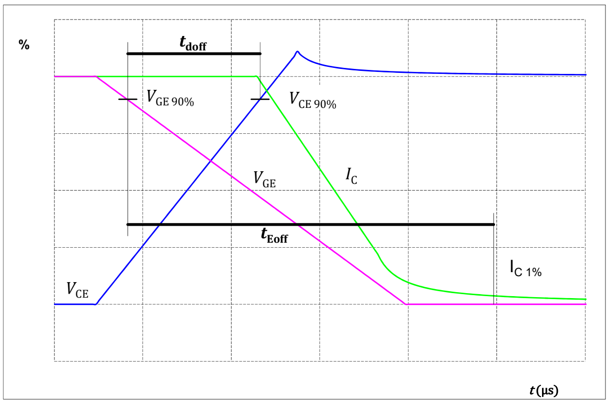


figure 47. **IGBT**

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

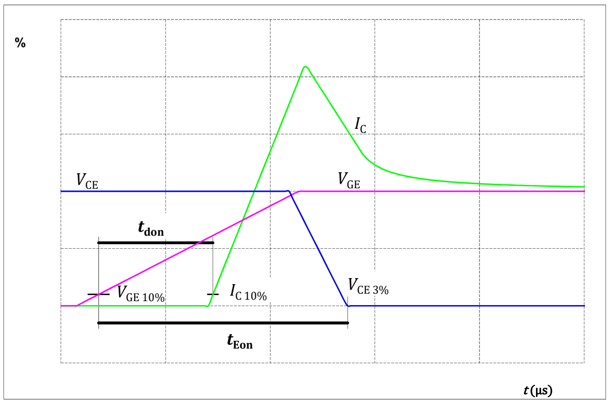


figure 48. **IGBT**

Turn-off Switching Waveforms & definition of t_f

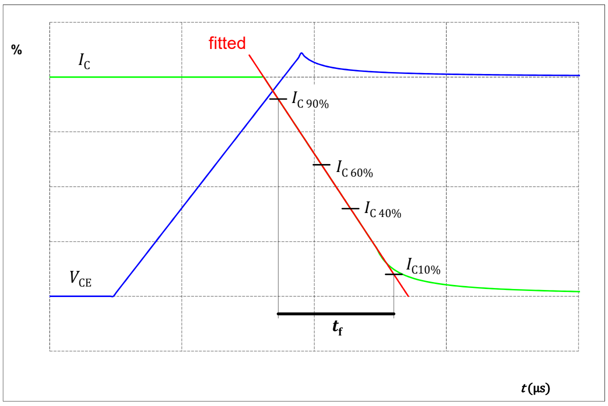
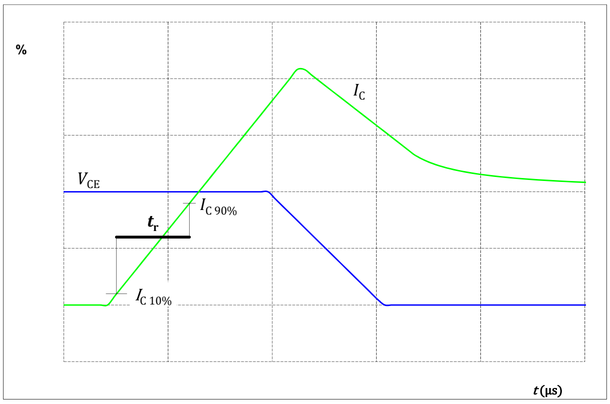


figure 49. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Switching Definitions

figure 50. **FWD**

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

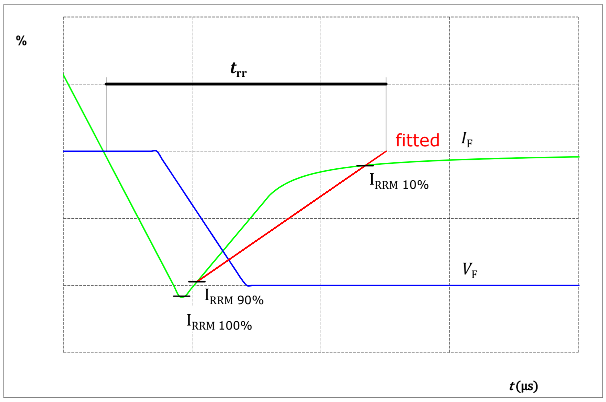
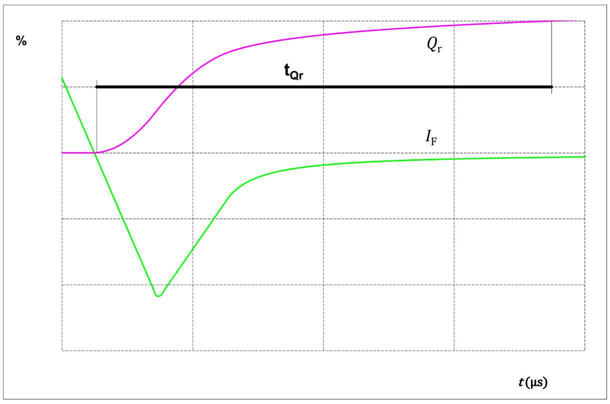


figure 51. **FWD**

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



Ordering Code

Version	Ordering Code
With thermal paste	B0-SP10FSA600S7-LM69F98T-/7/

Marking

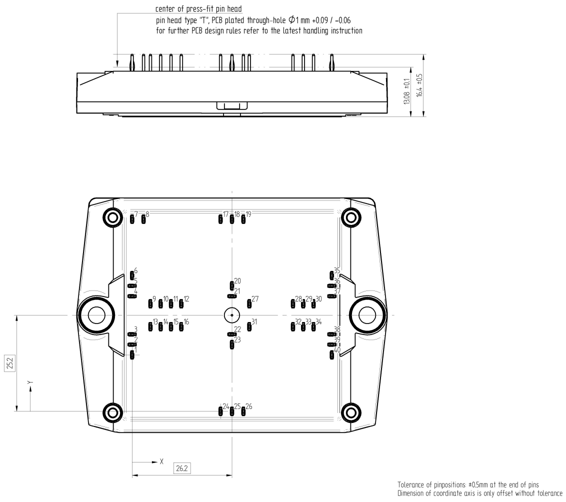
		Name		Date code	Logo	Lot	Serial
	**Text**	NN-NNNNNNNNNNNNNN-TTTTTTTVV		WWYY	VIN	LLLLL	SSSS
	Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
		TTTTTTTVV	LLLLL	SSSS	WWYY		

B0-SP10FSA600S7-LM69F98T

Outline

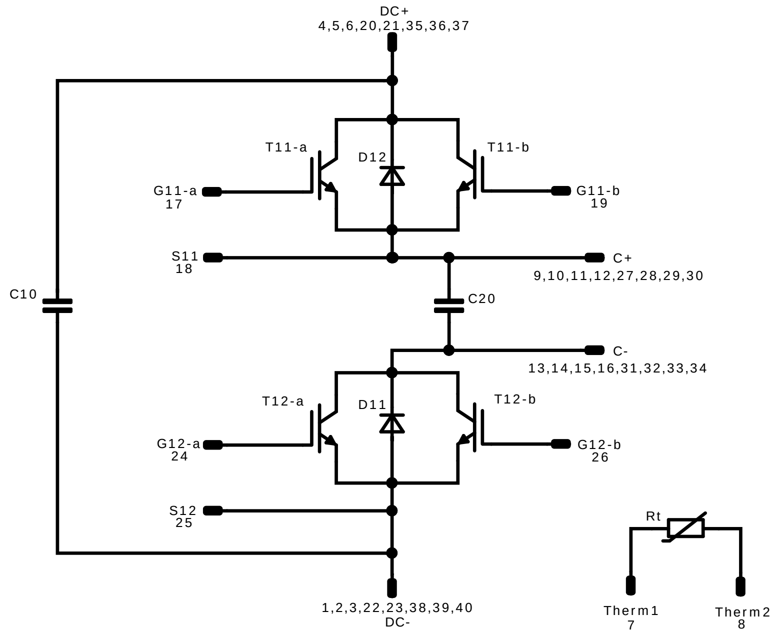
Pin table [mm]

Pin	X	Y	Function
1	0	14,8	DC-
2	0	17,5	DC-
3	0	20,2	DC-
4	0	30,2	DC+
5	0	32,9	DC+
6	0	35,6	DC+
7	0	50,4	Therm1
8	3	50,4	Therm2
9	4,8	28,2	C+
10	7,5	28,2	C+
11	10,2	28,2	C+
12	12,9	28,2	C+
13	4,8	22,2	C-
14	7,5	22,2	C-
15	10,2	22,2	C-
16	12,9	22,2	C-
17	23,2	50,4	G11-a
18	26,2	50,4	S11
19	29,2	50,4	G11-b
20	26,2	32,9	DC+
21	26,2	30,2	DC+
22	26,2	20,2	DC-
23	26,2	17,5	DC-
24	23,2	0	G12-a
25	26,2	0	S12
26	29,2	0	G12-b
27	30,75	28,2	C+
28	42,2	28,2	C+
29	44,9	28,2	C+
30	47,6	28,2	C+
31	30,75	22,2	C-
32	42,2	22,2	C-
33	44,9	22,2	C-
34	47,6	22,2	C-
35	52,4	35,6	DC+
36	52,4	32,9	DC+
37	52,4	30,2	DC+
38	52,4	20,2	DC-
39	52,4	17,5	DC-
40	52,4	14,8	DC-



B0-SP10FSA600S7-LM69F98T

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T12	IGBT	950 V	600 A	AC 1 Switch L	Parallel devices with separate control. Values apply to complete device.
D11	FWD	950 V	600 A	AC 1 Diode L	
T11	IGBT	950 V	600 A	AC 1 Switch H	Parallel devices with separate control. Values apply to complete device.
D12	FWD	950 V	600 A	AC 1 Diode H	
C20	Capacitor	1000 V		Flying Capacitor	
C10	Capacitor	1500 V		Capacitor (DC)	
Rt	Thermistor			Thermistor	

Ordering Code	
Version	**Ordering Code**
With thermal paste	B0-SP10FSB600S7-LM79F98T-/7/

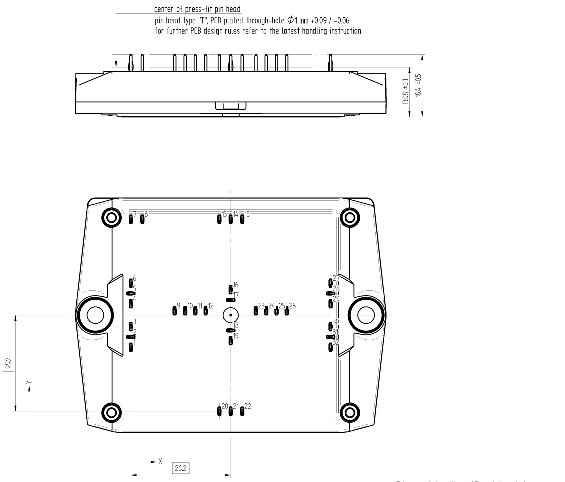
Marking

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

B0-SP10FSB600S7-LM79F98T

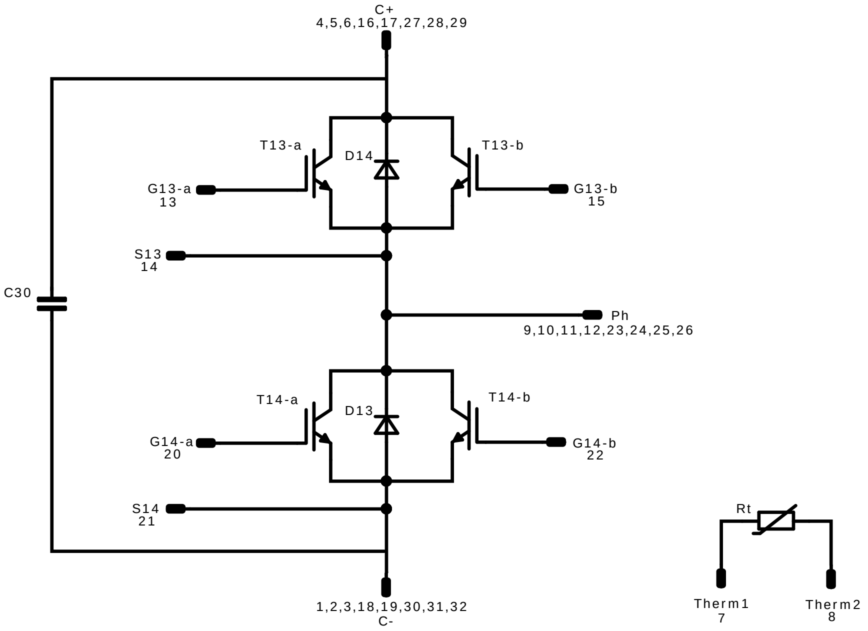
Outline

Pin table [mm]			
Pin	X	Y	Function
1	0	16,8	C-
2	0	19,5	C-
3	0	22,2	C-
4	0	28,2	C+
5	0	30,9	C+
6	0	33,6	C+
7	0	50,4	Therm1
8	3	50,4	Therm2
9	11,5	26,35	Ph
10	14,22	26,35	Ph
11	16,9	26,35	Ph
12	19,62	26,35	Ph
13	23,2	50,4	G13-a
14	26,2	50,4	S13
15	29,2	50,4	G13-b
16	26,2	31,9	C+
17	26,2	29,2	C+
18	26,2	21,2	C-
19	26,2	18,5	C-
20	23,2	0	G14-a
21	26,2	0	S14
22	29,2	0	G14-b
23	32,8	26,35	Ph
24	35,5	26,35	Ph
25	38,2	26,35	Ph
26	40,9	26,35	Ph
27	52,4	33,6	C+
28	52,4	30,9	C+
29	52,4	28,2	C+
30	52,4	22,2	C-
31	52,4	19,5	C-
32	52,4	16,8	C-



B0-SP10FSB600S7-LM79F98T

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T16	IGBT	950 V	600 A	AC 2 Switch L	Parallel devices with separate control. Values apply to complete device.
D13	FWD	950 V	600 A	AC 2 Diode L	
T13	IGBT	950 V	600 A	AC 2 Switch H	Parallel devices with separate control. Values apply to complete device.
D14	FWD	950 V	600 A	AC 2 Diode H	
C30	Capacitor	1000 V		Flying Capacitor	
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
Certification pending. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
B0-SP10FSx600S7-LMx9F98T-D1-14	29 Jan. 2021		