Vincotech

10-FY12NMA160SH09-M820F98

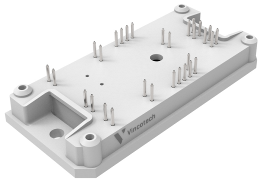
datasheet

***flow*MNPC 1** **1200 V / 160 A**

Features

- High reactive power capability
- Low inductance layout
- Split output
- Enhanced LVRT capability

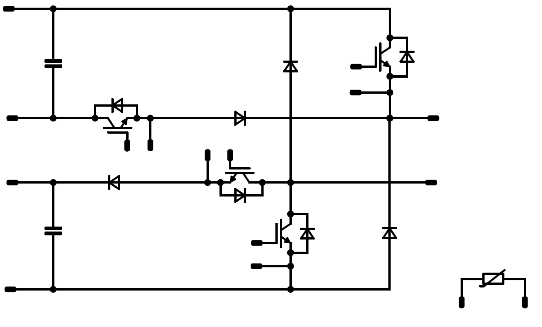
flow 1 12 mm housing



Target applications

- Solar Inverters

Schematic



Types

- 10-FY12NMA160SH09-M820F98

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Buck Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	137	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		480	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	302	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	10	µs
Maximum junction temperature	T_{jmax}			175	°C
Buck Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	82	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		640	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	105	W
Maximum junction temperature	T_{jmax}			175	°C
Buck Sw. Protection Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	19	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	46	W
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Boost Switch					
Collector-emitter voltage	V_{CES}			650	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	93	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		640	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	132	W
Gate-emitter voltage	V_{GES}			±30	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 360 V	T_j = 25 °C	2	μs
Maximum junction temperature	T_{jmax}			175	°C
Boost Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	50	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	340	A
Surge current capability	I^2t			580	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	104	W
Maximum junction temperature	T_{jmax}			175	°C
Boost Sw. Protection Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	21	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	40	W
Maximum junction temperature	T_{jmax}			175	°C
Capacitor (DC)					
Maximum DC voltage	V_{MAX}			630	V
Operation Temperature	T_{op}			-55 … 125	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
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				>12,7	mm
Clearance				7.48	mm
Comparative Tracking Index	CTI			≥ 200	

*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	
Buck Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,006	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		160	25 125 150	1,78	1,94 2,23 2,32	2,42(1)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			20	µA
Gate-emitter leakage current	I_{GES}		20	0		25			480	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		9320		pF
Output capacitance	C_{oes}							600		pF
Reverse transfer capacitance	C_{res}							520		pF
Gate charge	Q_g	V_{CC} = 960 V	15		160	25		740		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,31		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	±15	350	160	25 125 150		136 139 138		ns
Rise time	t_r					25 125 150		32 34 36		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		211 250 260		ns
Fall time	t_f					25 125 150		40,78 60,42 67,19		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=4,77 µC Q_{rFWD}=7,65 µC Q_{rFWD}=8,72 µC				25 125 150		3,85 4,58 5,32		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		4,06 5,76 6,39		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	
Buck Diode										
Static										
Forward voltage	V_F				160	25 125 150		1,55 1,62 1,61	1,9(1)	V
Reverse leakage current	I_R	V_r = 650 V				25			20	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,91		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=5150 A/µs d*i*/d*t*=4397 A/µs d*i*/d*t*=4035 A/µs	±15	350	160	25 125 150		117,08 126,42 129,78		A
Reverse recovery time	t_{rr}					25 125 150		72,65 134,9 151,31		ns
Recovered charge	Q_r					25 125 150		4,77 7,65 8,72		µC
Reverse recovered energy	E_{rec}					25 125 150		0,86 1,45 1,68		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		4481 3055 2711		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	
Buck Sw. Protection Diode										
Static										
Forward voltage	V_F				10	25 125 150	1,35	1,79 1,77 1,73	2,05(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			2,7	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,07		K/W

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
Boost Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$			5	0,1142	25	5	6	7	V
Collector-emitter saturation voltage	V_{CEsat}		15		160	25 125 150		1,64 1,69 1,75	1,9(1)	V
Collector-emitter cut-off current	I_{CES}		0	650		25			20	μA
Gate-emitter leakage current	I_{GES}		30	0		25			400	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	30		25		9620		pF
Output capacitance	C_{oes}							368		pF
Reverse transfer capacitance	C_{res}							158		pF
Gate charge	Q_g		15	400	160	25		342		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,72		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	350	160	25 125 150		147 146 146		ns
Rise time	t_r					25 125 150		27 29 29		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		124 132 134		ns
Fall time	t_f					25 125 150		29,4 40,54 44,97		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=4,56 μC Q_{rFWD}=10,26 μC Q_{rFWD}=11,6 μC				25 125 150		1,8 2,3 2,39		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		2,33 3,24 3,44		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	
Boost Diode										
Static										
Forward voltage	V_F				70	25 125 150		2,28 2,41 2,37	2,62(1) 2,62(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25 150		 5400	120 11000	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,92		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=6393 A/µs d*i*/d*t*=5363 A/µs	±15	350	160	25 125 150		134,46 151,57 159,08		A
Reverse recovery time	t_{rr}					25 125 150		54,76 92,75 153,6		ns
Recovered charge	Q_r					25 125 150		4,56 10,26 11,6		µC
Reverse recovered energy	E_{rec}					25 125 150		0,898 2,55 2,89		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		7853 5712 5545		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
Boost Sw. Protection Diode										
Static										
Forward voltage	V_F				15	25 125	1,23	1,79 1,67	1,87(1)	V
Reverse leakage current	I_R	V_r = 650 V				25			0,18	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,36		K/W
Capacitor (DC)										
Static										
Capacitance	C	DC bias voltage = 0 V				25		100		nF
Tolerance							-10		10	%
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

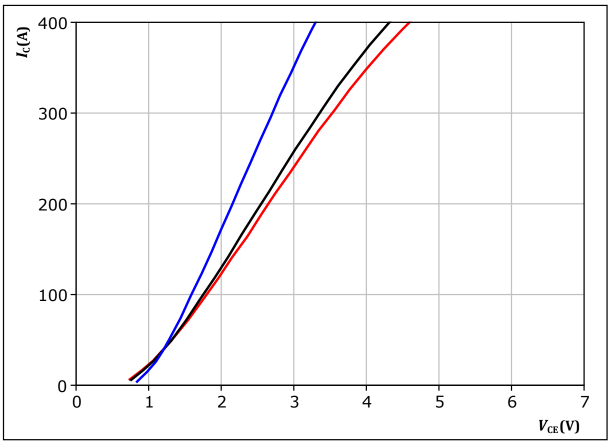
(2) Only valid with pre-applied Vincotech thermal interface material.

Buck Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

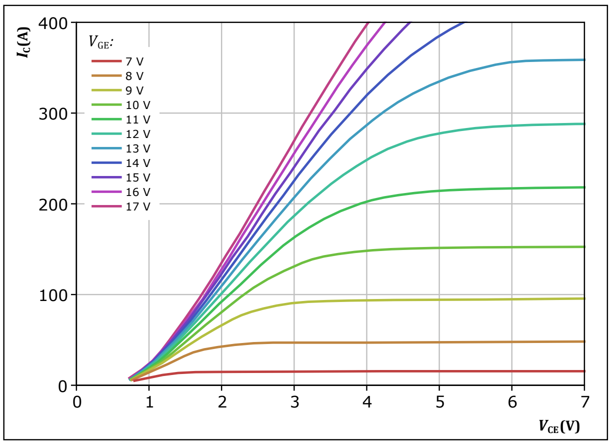


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$



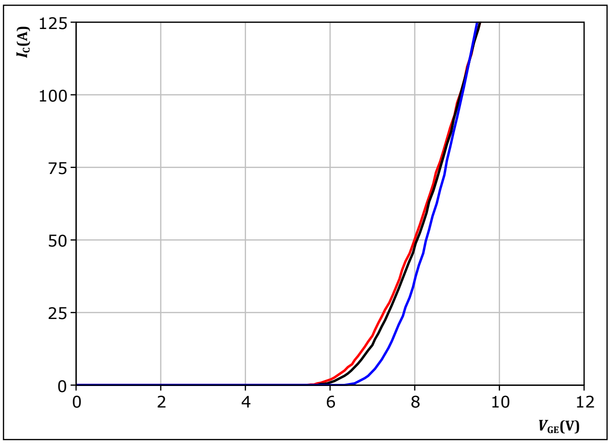
t_p =	250	µs
T_j =	150	°C

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

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

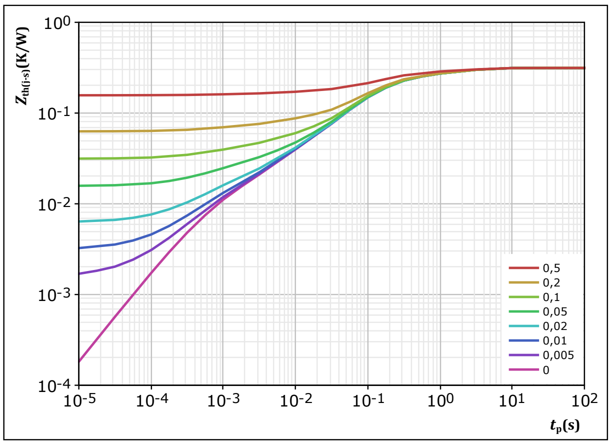


t_p =	250	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,314	K/W

IGBT thermal model values

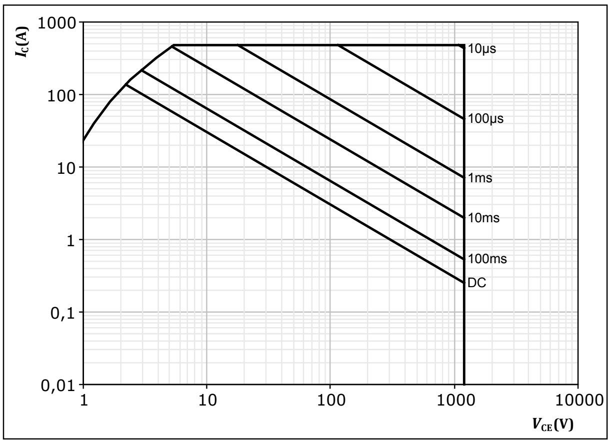
R (K/W)	τ (s)
5,90E-02	2,20E+00
7,71E-02	3,38E-01
1,55E-01	9,10E-02
1,55E-02	5,12E-03
7,89E-03	5,92E-04

Buck Switch Characteristics

figure 5.	**IGBT**

Safe operating area

$I_C = f(V_{CE})$



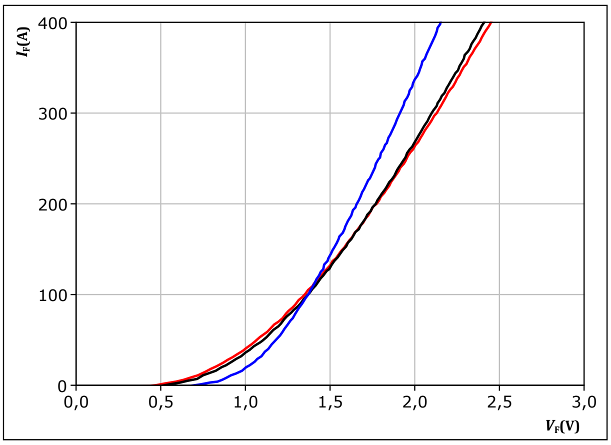
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Buck Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

I_F = f(V_F)



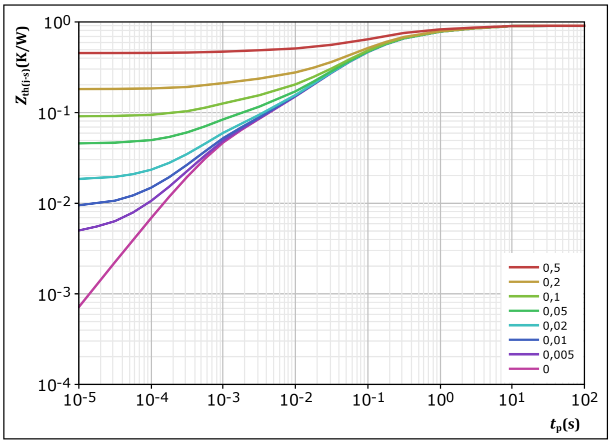
t_p = 250 µs

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

$R_{th(j-s)}$ = 0,908 K/W

FWD thermal model values

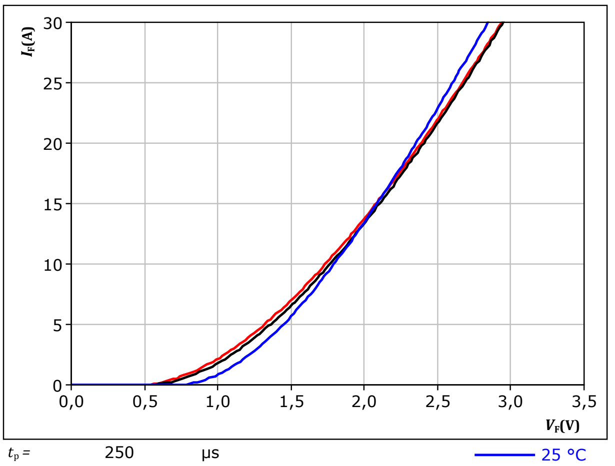
R (K/W)	τ (s)
1,44E-01	3,21E+00
2,39E-01	4,06E-01
3,84E-01	8,31E-02
9,23E-02	1,18E-02
4,87E-02	8,28E-04

Buck Sw. Protection Diode Characteristics

figure 8. **FWD**

Typical forward characteristics

I_F = f(V_F)



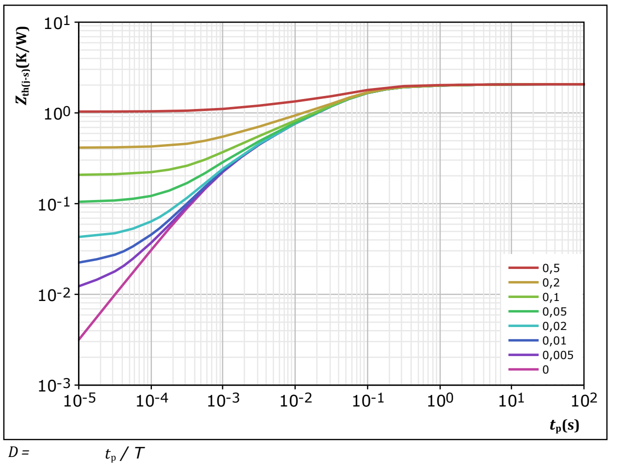
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 9. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 2,066 K/W

FWD thermal model values

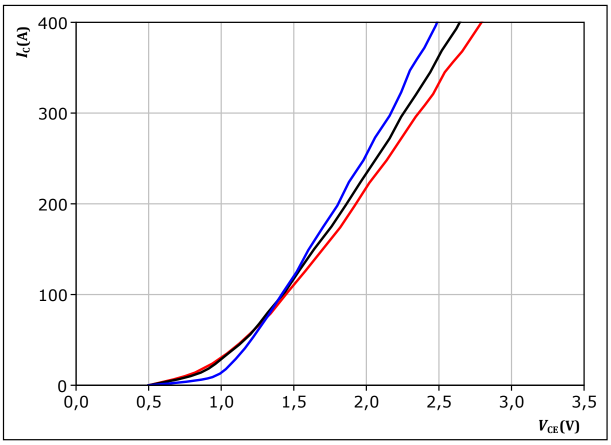
R (K/W)	τ (s)
5,09E-02	4,26E+00
1,55E-01	5,03E-01
7,75E-01	7,89E-02
5,33E-01	2,68E-02
3,54E-01	5,03E-03
1,97E-01	9,09E-04

Boost Switch Characteristics

figure 10. IGBT

Typical output characteristics

I_C = f(V_{CE})



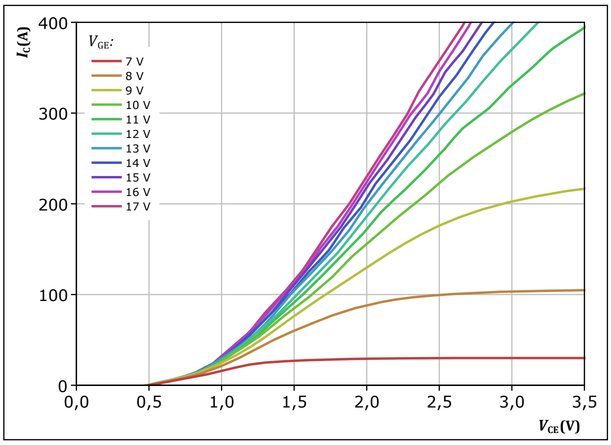
t_p =	250	µs
V_{GE} =	15	V

T_j: 25 °C, 125 °C, 150 °C

figure 11. IGBT

Typical output characteristics

I_C = f(V_{CE})



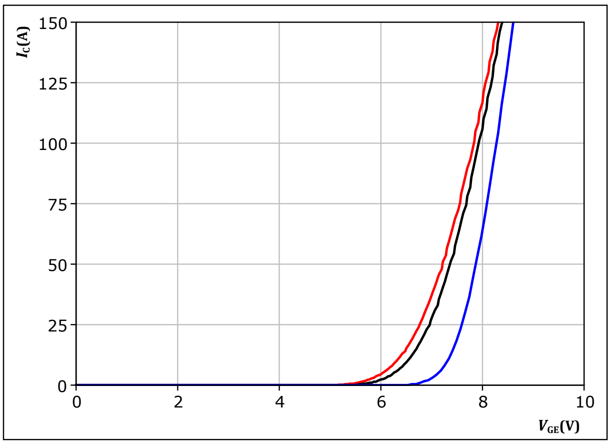
t_p =	250	µs
T_j =	150	°C

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

figure 12. IGBT

Typical transfer characteristics

I_C = f(V_{GE})



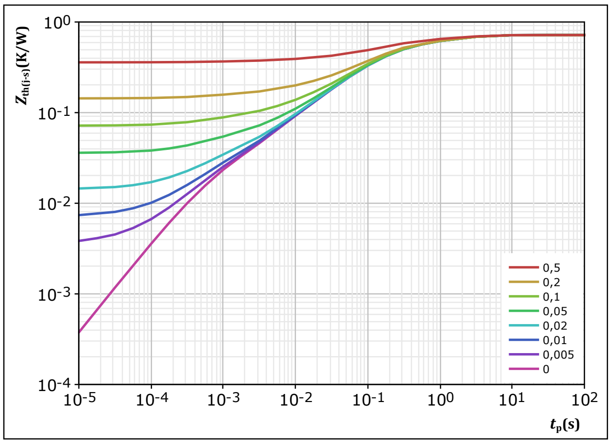
t_p =	250	µs
V_{CE} =	10	V

T_j: 25 °C, 125 °C, 150 °C

figure 13. IGBT

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,718	K/W

IGBT thermal model values

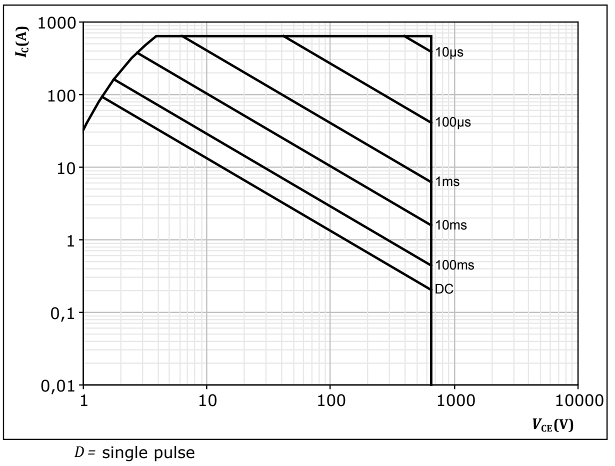
R (K/W)	τ (s)
1,06E-01	2,45E+00
1,53E-01	6,14E-01
3,11E-01	1,37E-01
9,72E-02	3,49E-02
3,40E-02	6,36E-03
1,64E-02	6,05E-04

Boost Switch Characteristics

figure 14.	IGBT

Safe operating area

$I_C = f(V_{CE})$



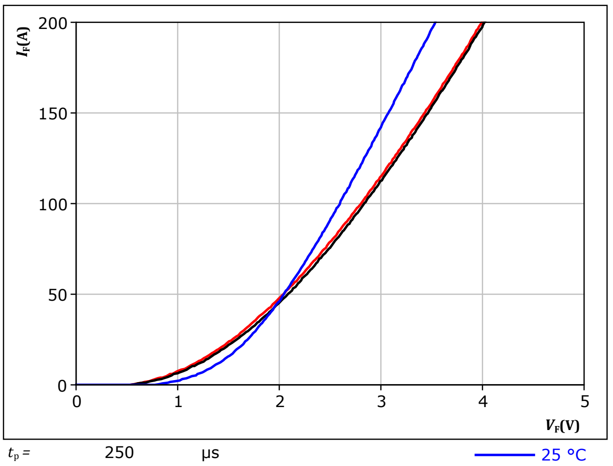
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Boost Diode Characteristics

figure 15. **FWD**

Typical forward characteristics

I_F = f(V_F)



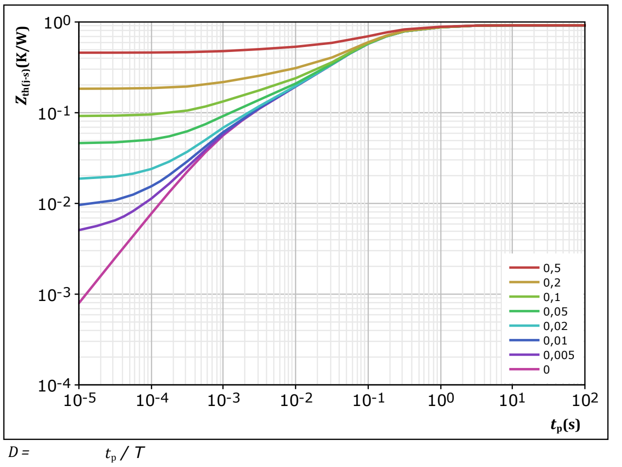
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 16. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,917 K/W

FWD thermal model values

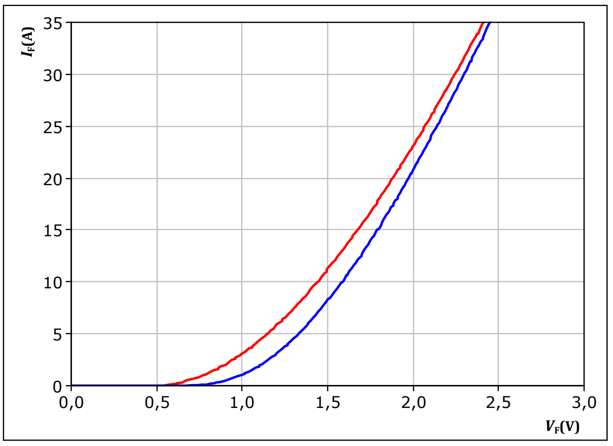
R (K/W)	τ (s)
1,15E-01	1,01E+00
3,98E-01	1,45E-01
2,68E-01	5,21E-02
7,83E-02	6,35E-03
5,82E-02	9,74E-04

Boost Sw. Protection Diode Characteristics

figure 17. **FWD**

Typical forward characteristics

I_F = f(V_F)



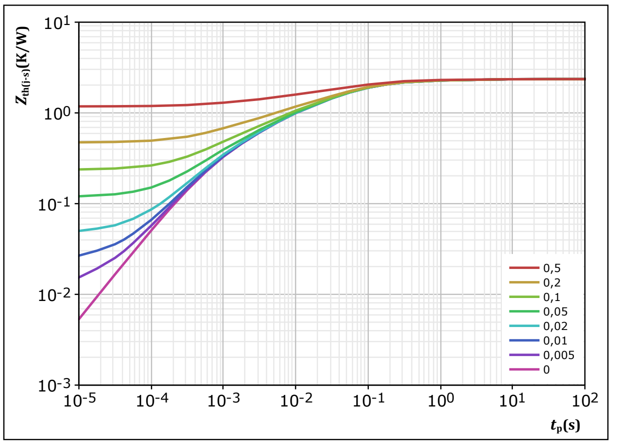
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 18. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 2,358 K/W

FWD thermal model values

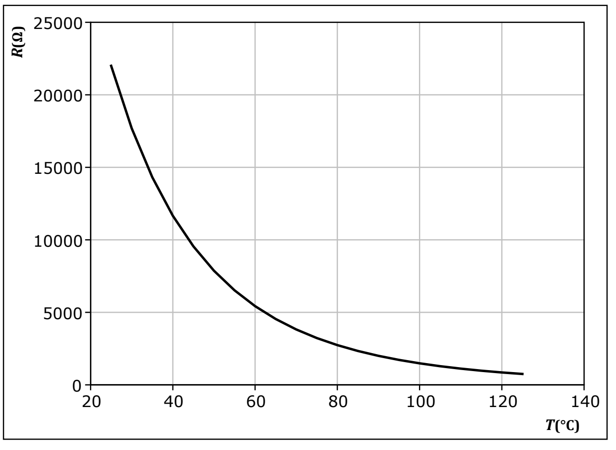
R (K/W)	τ (s)
9,10E-02	3,90E+00
2,66E-01	3,08E-01
8,25E-01	6,57E-02
5,40E-01	1,54E-02
4,23E-01	3,41E-03
2,13E-01	5,87E-04

Thermistor Characteristics

figure 19. **Thermistor**

Typical NTC characteristic as function of temperature

R_T = f(T)

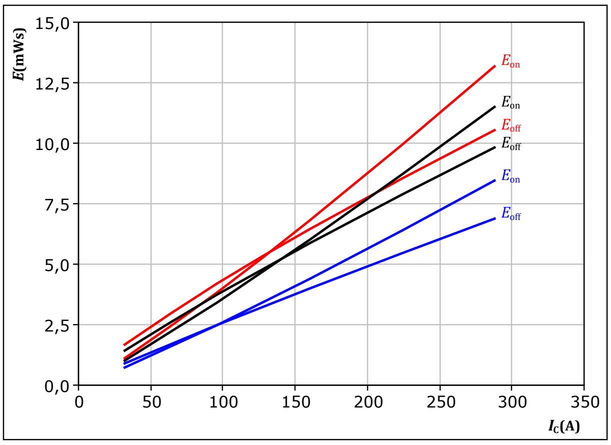


Buck Switching Characteristics

figure 20. **IGBT**

Typical switching energy losses as a function of collector current

E = f(I_C)



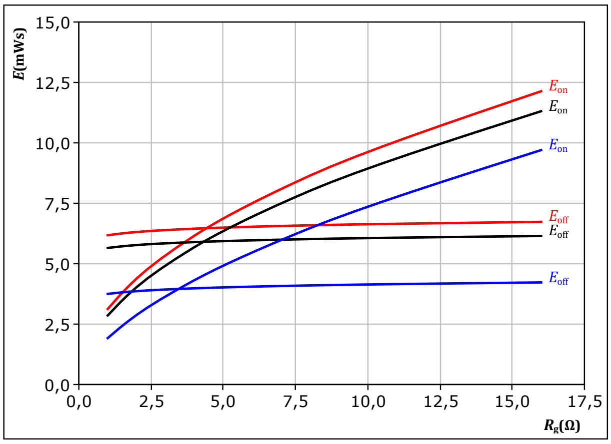
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	4	Ω		150 °C
R_{goff} =	4	Ω		

figure 21. **IGBT**

Typical switching energy losses as a function of gate resistor

E = f(R_g)



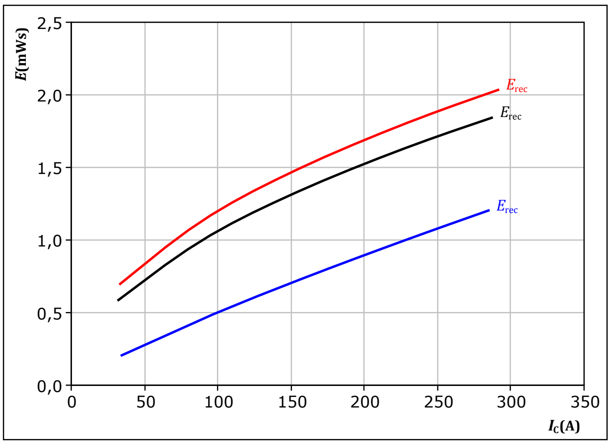
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	160	A		150 °C

figure 22. **FWD**

Typical reverse recovered energy loss as a function of collector current

E_{rec} = f(I_C)



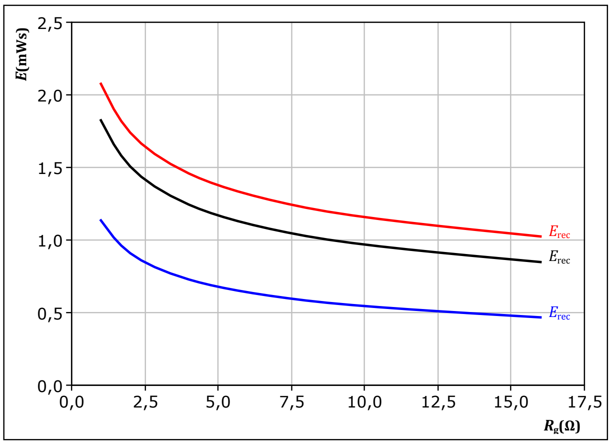
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 23. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

E_{rec} = f(R_g)



With an inductive load at

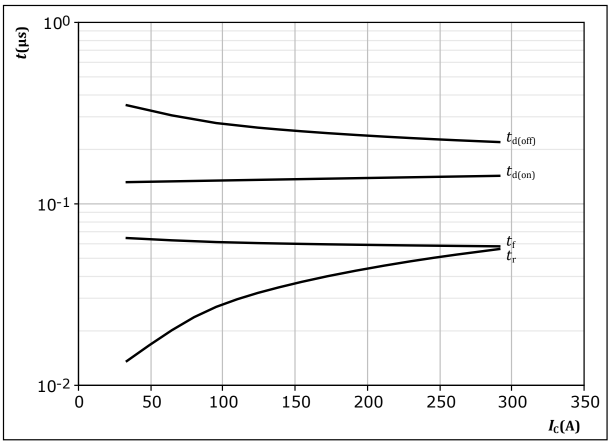
V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	160	A		150 °C

Buck Switching Characteristics

figure 24. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



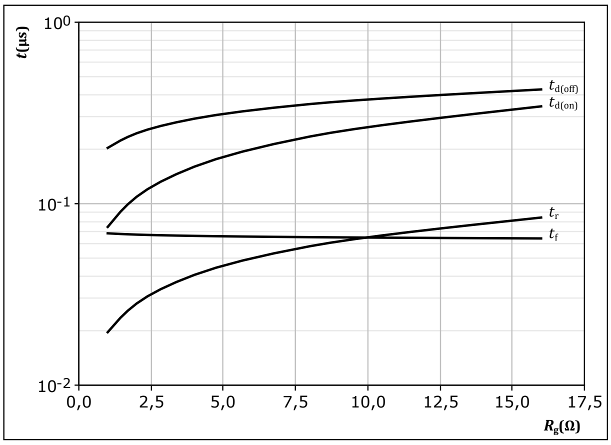
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 25. **IGBT**

Typical switching times as a function of gate resistor

t = f(R_g)



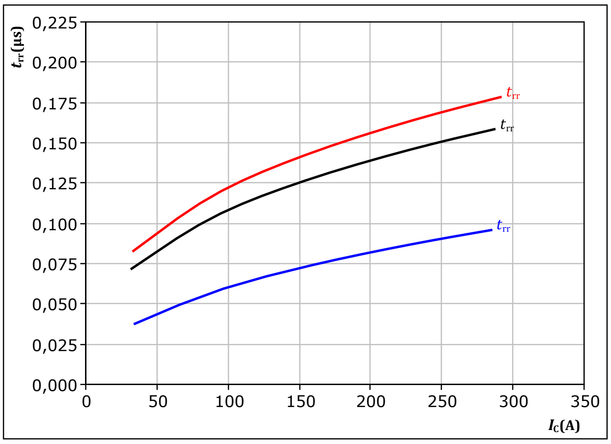
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	160	A

figure 26. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

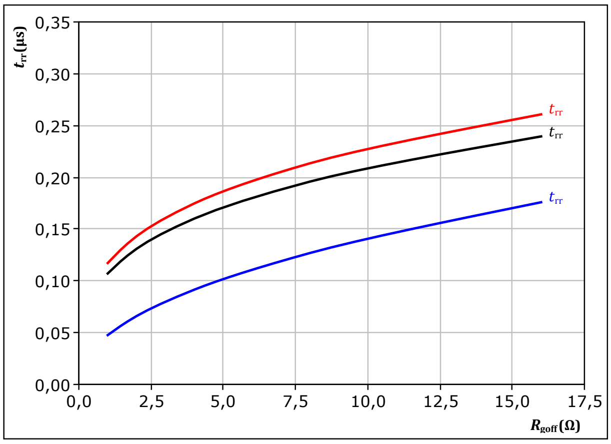
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 27. **FWD**

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

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



With an inductive load at

V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	160	A

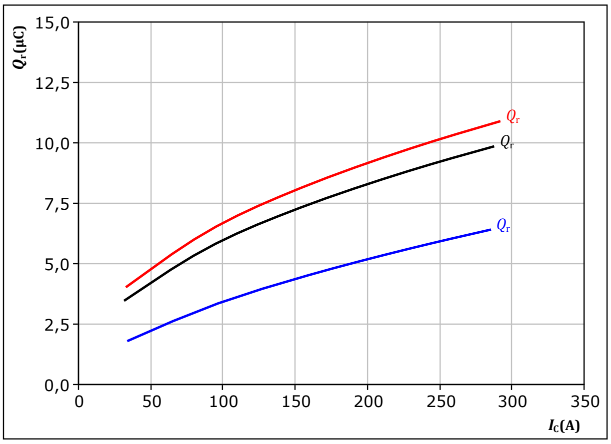
T_j: 25 °C, 125 °C, 150 °C

Buck Switching Characteristics

figure 28. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



With an inductive load at

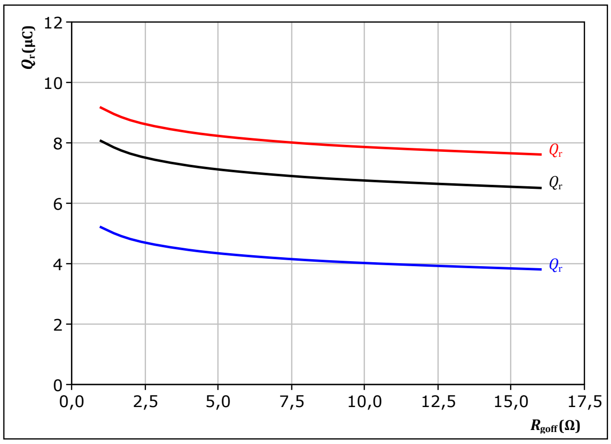
V_{CE} = 350 V
V_{GE} = ±15 V
R_{gon} = 4 Ω

T_j: 25 °C, 125 °C, 150 °C

figure 29. **FWD**

Typical recovered charge as a function of turn off gate resistor

$Q_r = f(R_{goff})$



With an inductive load at

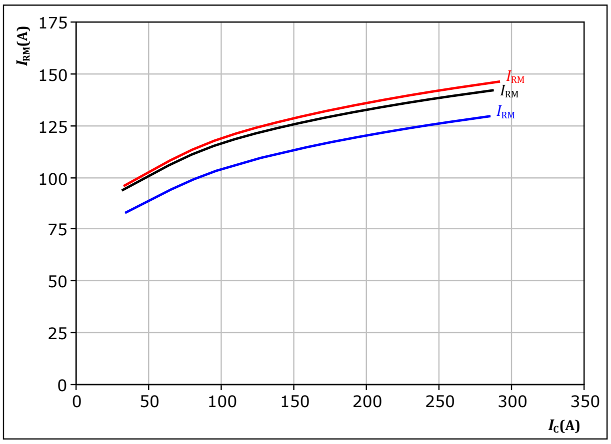
V_{CE} = 350 V
V_{GE} = ±15 V
I_C = 160 A

T_j: 25 °C, 125 °C, 150 °C

figure 30. **FWD**

Typical peak reverse recovery current as a function of collector current

$I_{RM} = f(I_C)$



With an inductive load at

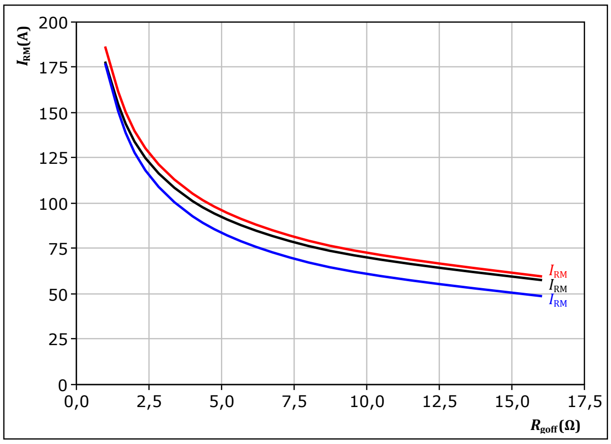
V_{CE} = 350 V
V_{GE} = ±15 V
R_{gon} = 4 Ω

T_j: 25 °C, 125 °C, 150 °C

figure 31. **FWD**

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

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



With an inductive load at

V_{CE} = 350 V
V_{GE} = ±15 V
I_C = 160 A

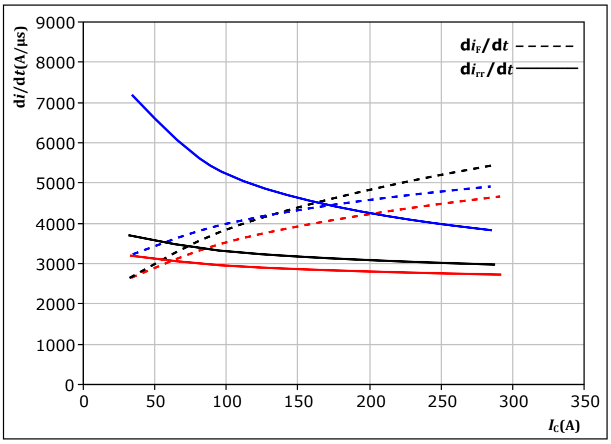
T_j: 25 °C, 125 °C, 150 °C

Buck Switching Characteristics

figure 32. **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)



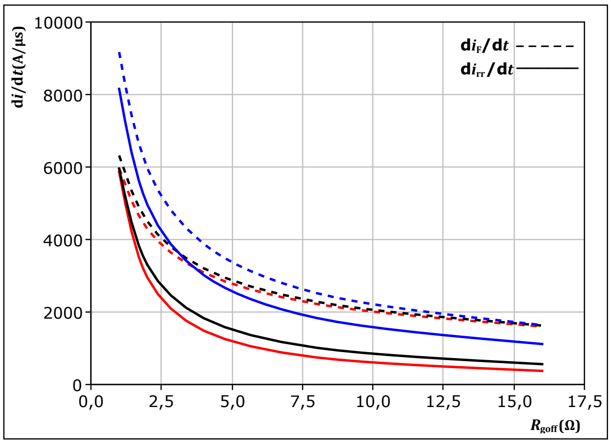
With an inductive load at

V_{CE} =	350	V	T_j: 25 °C / 125 °C / 150 °C
V_{GE} =	±15	V	
R_{gon} =	4	Ω	

figure 33. **FWD**

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

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



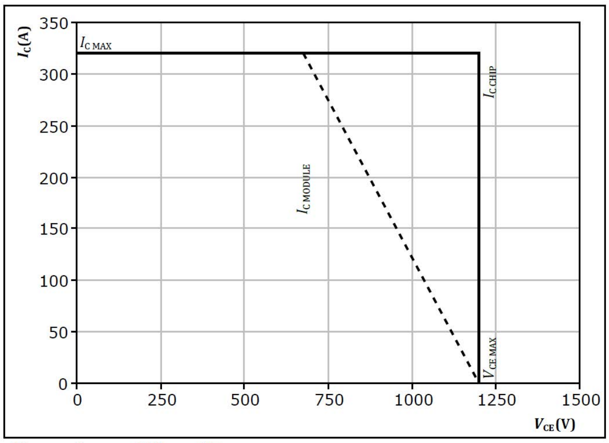
With an inductive load at

V_{CE} =	350	V	T_j: 25 °C / 125 °C / 150 °C
V_{GE} =	±15	V	
I_C =	160	A	

figure 34. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



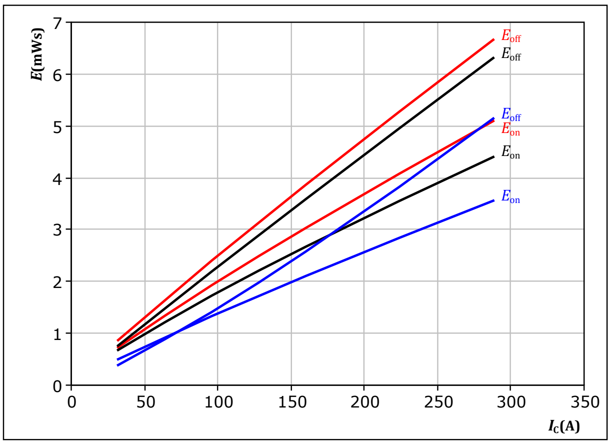
At	T_j =	150	°C
	R_{gon} =	4	Ω
	R_{goff} =	4	Ω

Boost Switching Characteristics

figure 35. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



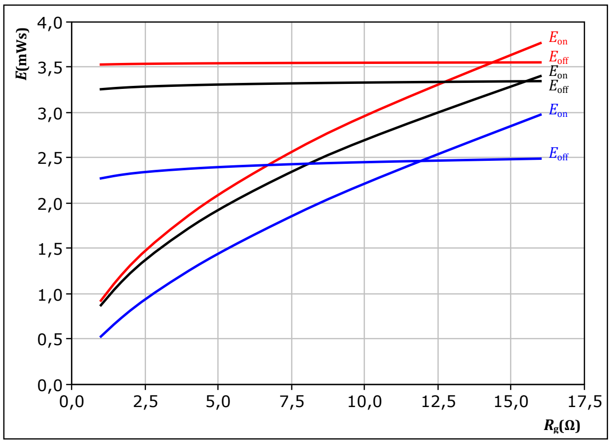
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C
R_{goff} =	8	Ω		

figure 36. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



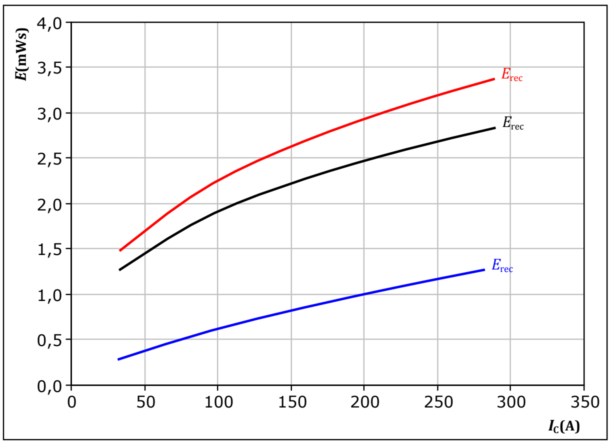
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	160	A		150 °C

figure 37. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



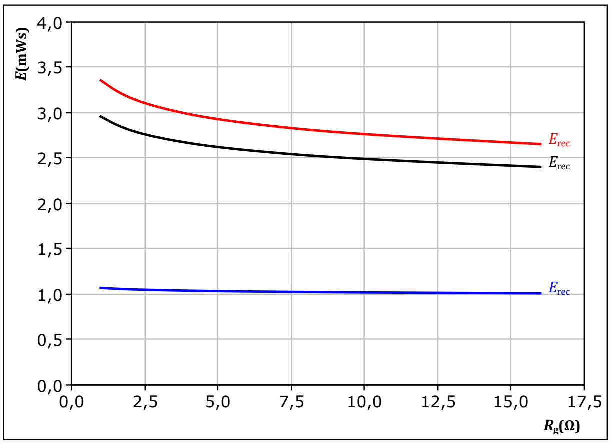
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 38. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

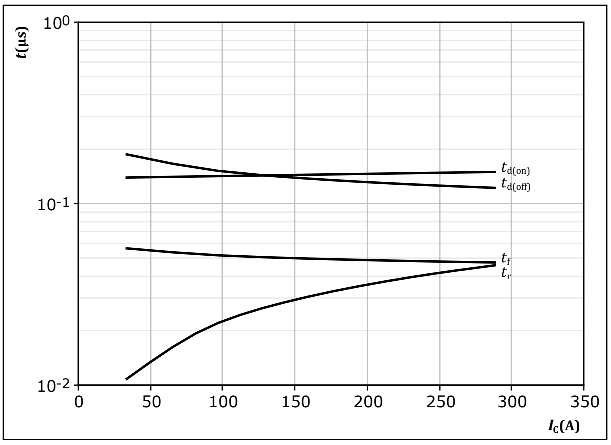
V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	160	A		150 °C

Boost Switching Characteristics

figure 39. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



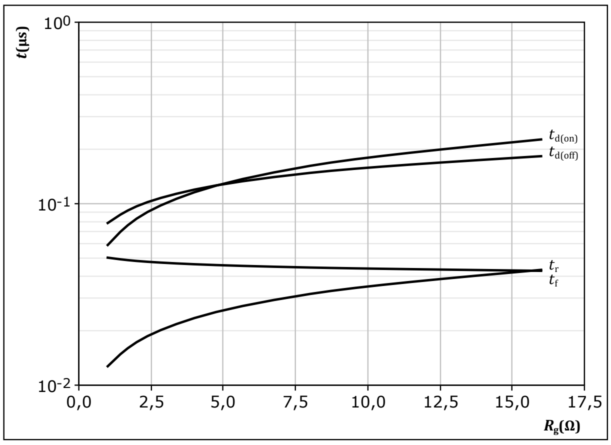
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

figure 40. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



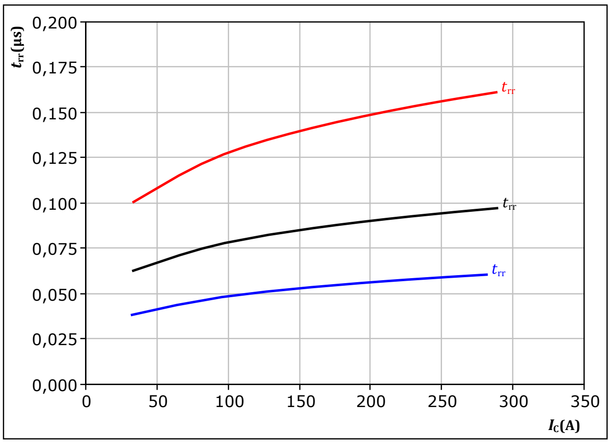
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	160	A

figure 41. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



With an inductive load at

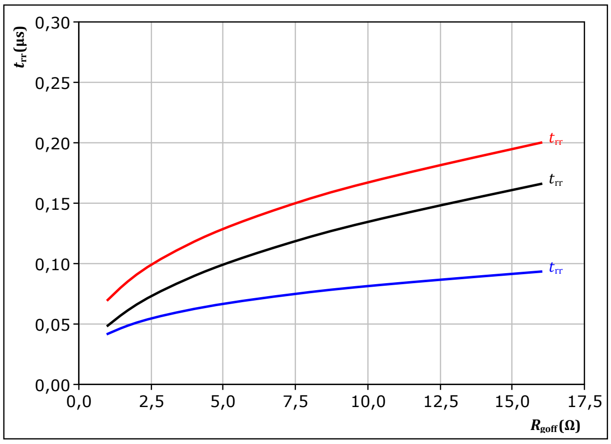
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

T_j: 25 °C (blue), 125 °C (black), 150 °C (red)

figure 42. **FWD**

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

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



With an inductive load at

V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	160	A

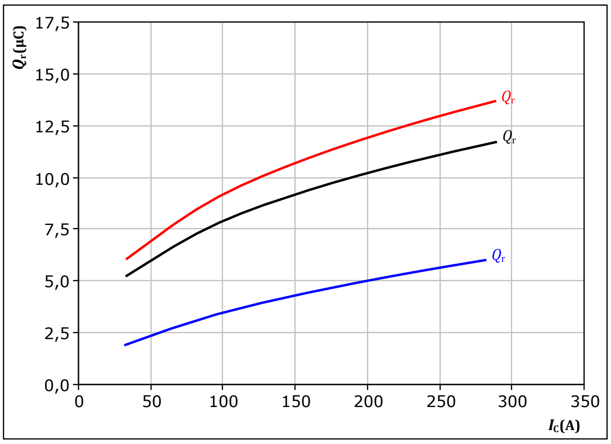
T_j: 25 °C (blue), 125 °C (black), 150 °C (red)

Boost Switching Characteristics

figure 43. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



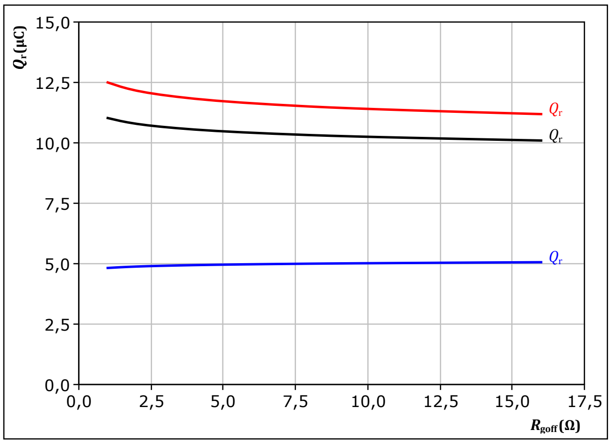
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 44. **FWD**

Typical recovered charge as a function of turn off gate resistor

Q_r = f(R_{goff})



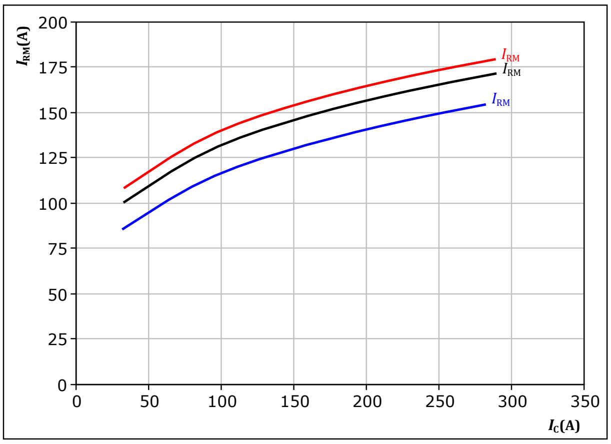
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	160	A		150 °C

figure 45. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



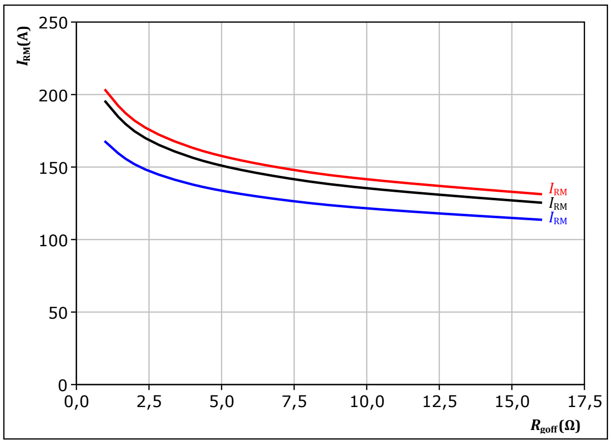
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 46. **FWD**

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

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



With an inductive load at

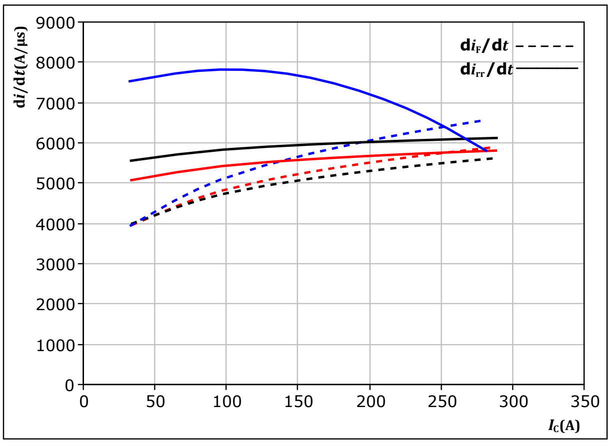
V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	160	A		150 °C

Boost Switching Characteristics

figure 47. **FWD**

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

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



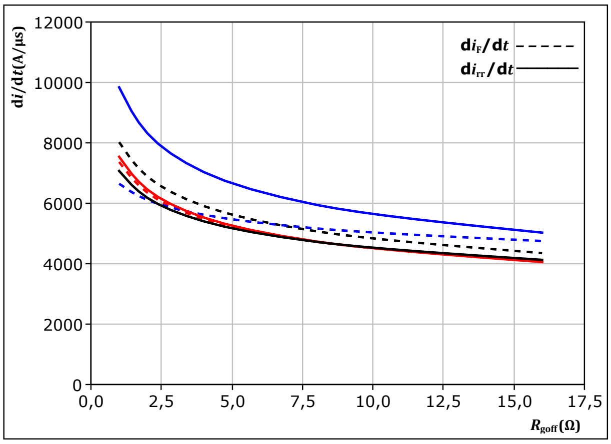
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 48. **FWD**

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

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



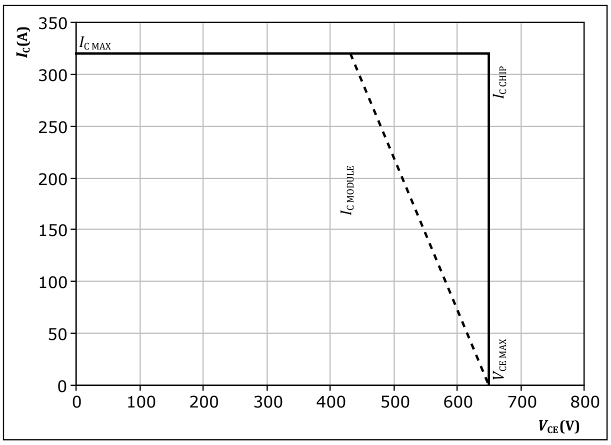
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	160	A		150 °C

figure 49. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At	T_j =	150	°C
	R_{gon} =	8	Ω
	R_{goff} =	8	Ω

Switching Definitions

figure 50. **IGBT**

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

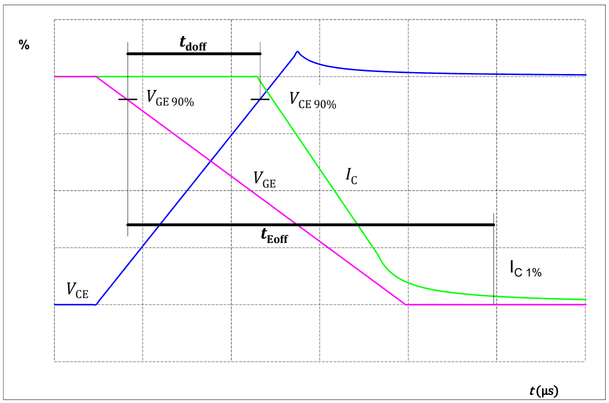


figure 51. **IGBT**

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

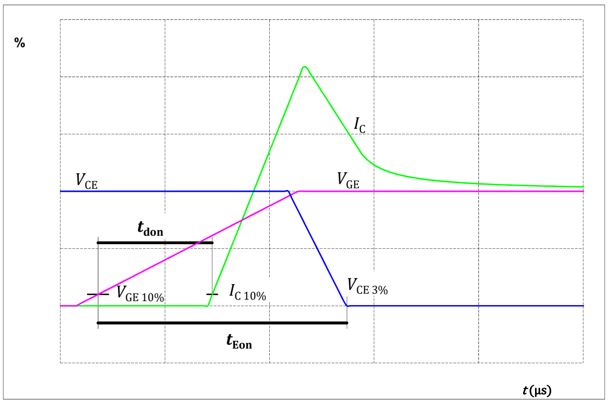


figure 52. **IGBT**

Turn-off Switching Waveforms & definition of t_f

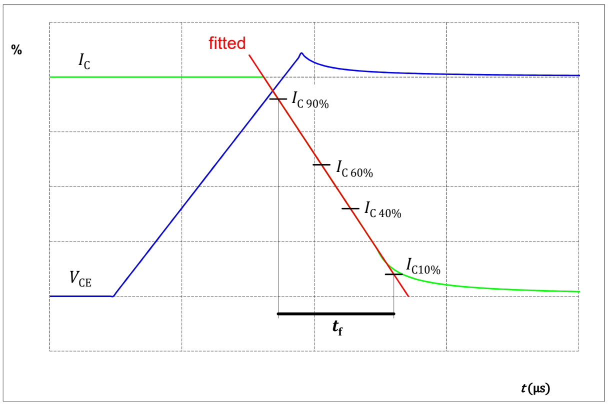
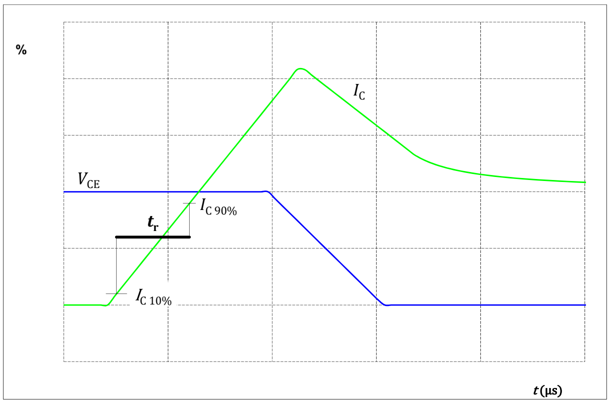


figure 53. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Switching Definitions

figure 54. **FWD**

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

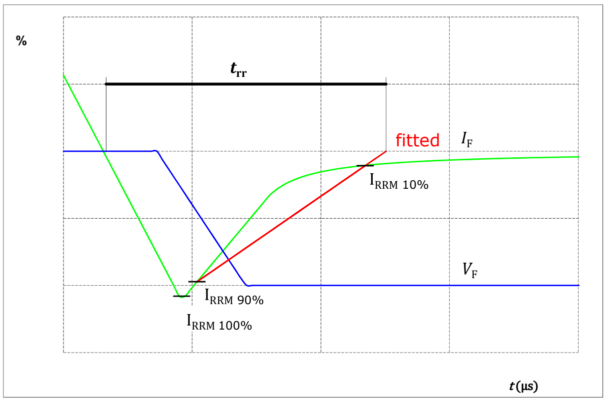
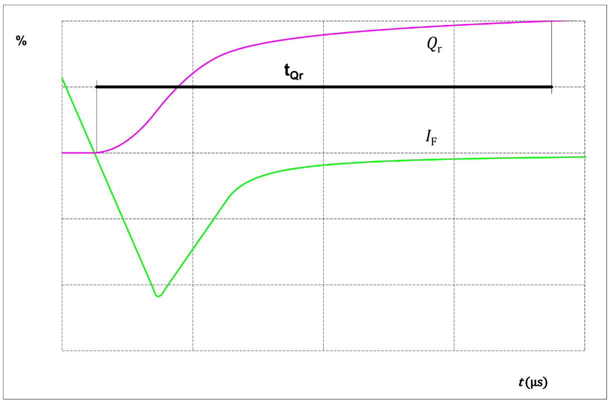


figure 55. **FWD**

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



10-FY12NMA160SH09-M820F98
datasheet

Ordering Code

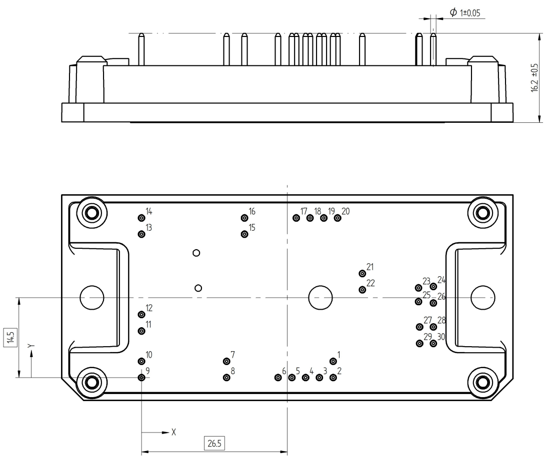
Version	Ordering Code
Without thermal paste	10-FY12NMA160SH09-M820F98
With thermal paste	10-FY12NMA160SH09-M820F98-/3/

Marking

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

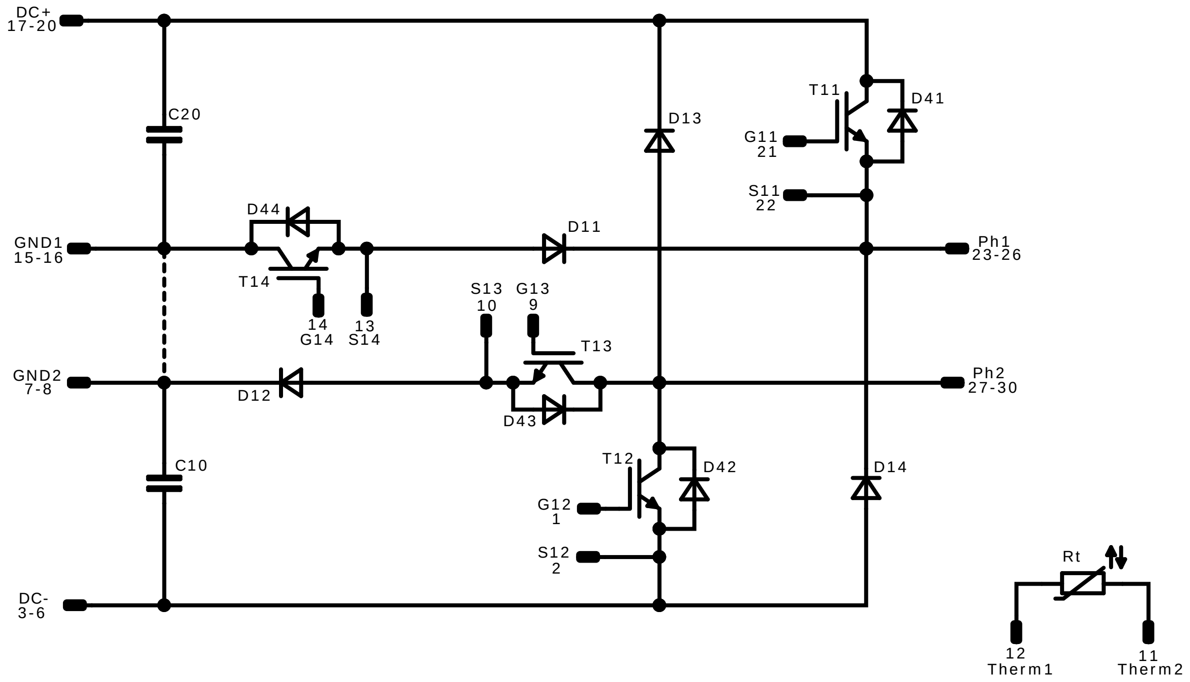
Outline

Pin table [mm]			
Pin	X	Y	Function
1	34,8	2,95	G12
2	34,8	0	S12
3	32,3	0	DC-
4	29,8	0	DC-
5	27,3	0	DC-
6	24,8	0	DC-
7	15,45	2,95	GND2
8	15,45	0	GND2
9	0	0	G13
10	0	2,95	S13
11	0	8,45	Therm2
12	0	11,45	Therm1
13	0	26,05	S14
14	0	29	G14
15	18,7	26,05	GND1
16	18,7	29	GND1
17	28,1	29	DC+
18	30,6	29	DC+
19	33,1	29	DC+
20	35,6	29	DC+
21	40,1	18,9	G11
22	40,1	15,95	S11
23	50,3	16,3	Ph1
24	53	16,55	Ph1
25	50,3	13,8	Ph1
26	53	13,55	Ph1
27	50,5	9,2	Ph2
28	53	9,2	Ph2
29	50,5	6,2	Ph2
30	53	6,2	Ph2



Tolerance of pinpositions: ±0.5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12	IGBT	1200 V	160 A	Buck Switch	
D11, D12	FWD	650 V	160 A	Buck Diode	
D41, D42	FWD	1200 V	10 A	Buck Sw. Protection Diode	
T13, T14	IGBT	650 V	160 A	Boost Switch	
D13, D14	FWD	1200 V	70 A	Boost Diode	
D43, D44	FWD	650 V	15 A	Boost Sw. Protection Diode	
C10, C20	Capacitor	630 V		Capacitor (DC)	
Rt	NTC			Thermistor	

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

Handling instruction
Handling instructions for *flow* 1 packages see vincotech.com website.

Package data
Package data for *flow* 1 packages see vincotech.com website.

Vincotech thermistor reference
See Vincotech thermistor reference table at vincotech.com website.

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

Document No.:	Date:	Modification:	Pages
10-FY12NMA160SH09-M820F98-D3-14	19 Jun. 2020	Datasheet format update: Generalized format to Type-specific format NTC change	
10-FY12NMA160SH09-M820F98-D4-14	13 May. 2021	Buck switching conditions corrected to Vce=350V	