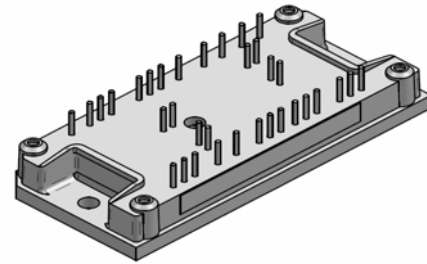


flowSOL 1 BI

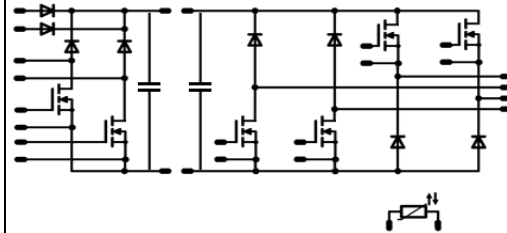
650 V/41 mOhm

Features

- Low inductive 12mm flow1 package
- Booster:
 - Dual boost topology
 - MOSFET 650V/37mOhm + SiC diode
 - Bypass rectifier
- Inverter:
 - Pseudo H-bridge topology
 - MOSFET 650V/41mOhm CFD + SiC diode
- Integrated DC-capacitors
- Temperature sensor

flow1 12mm housing

Target Applications

- Solar Inverter:
- High efficient transformer-less solar inverter with bipolar modulation

Schematic

Types

10-FY07BIA041MC-M528E58

Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
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Bypass Diode

Repetitive peak reverse voltage	V_{RRM}		1600	V	
Forward current per diode	I_{FAV}	DC current	$T_h=80^\circ\text{C}$	41	A
			$T_c=80^\circ\text{C}$	55	
Surge forward current	I_{FSM}	$t_p=10\text{ms}$	$T_j=25^\circ\text{C}$	370	A
I2t-value	I^2t			370	A ² s
Power dissipation per Diode	P_{tot}	$T_j=T_{jmax}$	$T_h=80^\circ\text{C}$	50	W
			$T_c=80^\circ\text{C}$	76	
Maximum Junction Temperature	T_{jmax}		150	$^\circ\text{C}$	

Input Boost MOSFET

Drain to source breakdown voltage	V_{DS}		650	V	
DC drain current	I_D	$T_j=T_{jmax}$	$T_h=80^\circ\text{C}$	35	A
			$T_c=80^\circ\text{C}$	43	
Pulsed drain current	I_{Dpulse}	$T_j=25^\circ\text{C}$	297	A	
Power dissipation	P_{tot}	$T_j=T_{jmax}$	$T_h=80^\circ\text{C}$	105	W
			$T_c=80^\circ\text{C}$	159	
Gate-source peak voltage	V_{GS}		± 20	V	
Maximum Junction Temperature	T_{jmax}		150	$^\circ\text{C}$	

Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
-----------	--------	-----------	-------	------

Input Boost Diode

Peak Repetitive Reverse Voltage	V_{RRM}	$T_j=25^{\circ}\text{C}$	650	V	
DC forward current	I_F	$T_j=T_{jmax}$	$T_h=80^{\circ}\text{C}$	22	A
			$T_c=80^{\circ}\text{C}$	28	
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	134	A	
Power dissipation	P_{tot}	$T_j=T_{jmax}$	$T_h=80^{\circ}\text{C}$	48	W
			$T_c=80^{\circ}\text{C}$	73	
Maximum Junction Temperature	T_{jmax}		175	$^{\circ}\text{C}$	

Pseudo H-Bridge MOSFET

Drain to source breakdown voltage	V_{DS}		650	V	
DC drain current	I_D	$T_j=T_{jmax}$	$T_h=80^{\circ}\text{C}$	34	A
			$T_c=80^{\circ}\text{C}$	42	
Pulsed drain current	I_{Dpulse}	t_p limited by T_{jmax}	$T_c=25^{\circ}\text{C}$	255	A
Power dissipation	P_{tot}	$T_j=T_{jmax}$	$T_h=80^{\circ}\text{C}$	111	W
			$T_c=80^{\circ}\text{C}$	168	
Gate-source peak voltage	V_{gs}		± 20	V	
Maximum Junction Temperature	T_{jmax}		150	$^{\circ}\text{C}$	

Pseudo H-Bridge Diode

Peak Repetitive Reverse Voltage	V_{RRM}	$T_j=25^{\circ}\text{C}$	650	V	
DC forward current	I_F	$T_j=T_{jmax}$	$T_h=80^{\circ}\text{C}$	22	A
			$T_c=80^{\circ}\text{C}$	29	
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	134	A	
Power dissipation per Diode	P_{tot}	$T_j=T_{jmax}$	$T_h=80^{\circ}\text{C}$	48	W
			$T_c=80^{\circ}\text{C}$	73	
Maximum Junction Temperature	T_{jmax}		175	$^{\circ}\text{C}$	

DC link Capacitor

Max.DC voltage	V_{MAX}	$T_c=25^{\circ}\text{C}$	630	V
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Thermal Properties

Storage temperature	T_{stg}		-40...+125	$^{\circ}\text{C}$
Operation temperature under switching condition	T_{op}		-40...+($T_{jmax} - 25$)	$^{\circ}\text{C}$

Insulation Properties

Insulation voltage	V_{is}	$t=2s$ DC voltage	4000	V
Creepage distance			min 12,7	mm
Clearance			min 12,7	mm

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
		$V_{GE}[V]$ or $V_{GS}[V]$	$V_r[V]$ or $V_{CE}[V]$ or $V_{DS}[V]$	$I_c[A]$ or $I_F[A]$ or $I_D[A]$	T_j	Min	Typ	Max		
Bypass Diode										
Forward voltage	solar invert				35	$T_j=25^\circ C$ $T_j=125^\circ C$	1.18 1.17	1.21		V
Threshold voltage (for power loss calc. only)	V_{th}				35	$T_j=25^\circ C$ $T_j=125^\circ C$	0.91 0.80			V
Slope resistance (for power loss calc. only)	r_t				35	$T_j=25^\circ C$ $T_j=125^\circ C$	0.01 0.01			Ω
Reverse current	I_r			1600		$T_j=25^\circ C$ $T_j=125^\circ C$		0.05		mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness $\leq 50\mu m$					1.40			K/W
Thermal resistance chip to case per chip	R_{thJC}	$\lambda = 1 W/mK$					0.92			
Input Boost MOSFET										
Static drain to source ON resistance	$R_{DS(on)}$		10		50	$T_j=25^\circ C$ $T_j=125^\circ C$	38 78			m Ω
Gate threshold voltage	$V_{(GS)th}$				0.0033	$T_j=25^\circ C$ $T_j=125^\circ C$	2.5	3	3.5	V
Gate to Source Leakage Current	I_{gss}		20	0		$T_j=25^\circ C$ $T_j=125^\circ C$		100		nA
Zero Gate Voltage Drain Current	I_{dss}		0	650		$T_j=25^\circ C$ $T_j=125^\circ C$		2000		nA
Turn On Delay Time	$t_{d(ON)}$	Rgoff=2 Ω Rgon=2 Ω	10	400	30	$T_j=25^\circ C$ $T_j=125^\circ C$	30 29			ns
Rise Time	t_r					$T_j=25^\circ C$ $T_j=125^\circ C$	6 7			
Turn off delay time	$t_{d(OFF)}$					$T_j=25^\circ C$ $T_j=125^\circ C$	173 186			
Fall time	t_f					$T_j=25^\circ C$ $T_j=125^\circ C$	6 7			
Turn-on energy loss per pulse	E_{on}					$T_j=25^\circ C$ $T_j=125^\circ C$	0.11 0.12			
Turn-off energy loss per pulse	E_{off}	$T_j=25^\circ C$ $T_j=125^\circ C$	0.04 0.06							
Total gate charge	Q_g	Rgon=2 Ω	10	480	49.6	$T_j=25^\circ C$ $T_j=125^\circ C$	330			nC
Gate to source charge	Q_{gs}					$T_j=25^\circ C$ $T_j=125^\circ C$	40			
Gate to drain charge	Q_{gd}					$T_j=25^\circ C$ $T_j=125^\circ C$	170			
Input capacitance	C_{iss}	f=1MHz	0	100		$T_j=25^\circ C$	7240			pF
Output capacitance	C_{oss}						380			
Reverse transfer capacitance	C_{rss}						tbd.			
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness $\leq 50\mu m$					0.67			K/W
Thermal resistance chip to case per chip	R_{thJC}	$\lambda = 1 W/mK$					0.44			
Input Boost Diode										
Forward voltage	V_F				20	$T_j=25^\circ C$ $T_j=125^\circ C$	1.61 1.86	1.8		V
Reverse leakage current	I_{rm}		10	400	30	$T_j=25^\circ C$ $T_j=125^\circ C$		60		μA
Peak recovery current	I_{RRM}	Rgon=2 Ω	10	400	30	$T_j=25^\circ C$ $T_j=125^\circ C$	25 23			A
Reverse recovery time	t_{rr}					$T_j=25^\circ C$ $T_j=125^\circ C$	9 11			
Reverse recovery charge	Q_{rr}					$T_j=25^\circ C$ $T_j=125^\circ C$	0.19 0.26			
Reverse recovered energy	E_{rec}					$T_j=25^\circ C$ $T_j=125^\circ C$	0.05 0.07			
Peak rate of fall of recovery current	$di(rec)max/dt$					$T_j=25^\circ C$ $T_j=125^\circ C$	6521 4908			
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness $\leq 50\mu m$					1.98			
Thermal resistance chip to case per chip	R_{thJC}	$\lambda = 1 W/mK$					1.31			

Characteristic Values

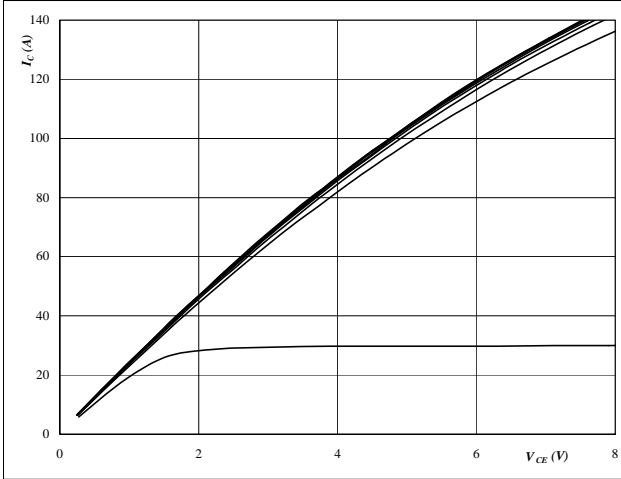
Parameter	Symbol	Conditions					Value			Unit
		$V_{GE}[V]$ or $V_{GS}[V]$	$V_r[V]$ or $V_{CE}[V]$ or $V_{DS}[V]$	$I_c[A]$ or $I_F[A]$ or $I_D[A]$	T_j	Min	Typ	Max		
Pseudo H-Bridge MOSFET										
Static drain to source ON resistance	$R_{ds(on)}$		10		50	$T_j=25^\circ C$ $T_j=125^\circ C$		43 80		m Ω
Gate threshold voltage	$V_{(GS)th}$			$V_{DS}=V_{GS}$	0.0033	$T_j=25^\circ C$ $T_j=125^\circ C$	3.5	4	4.5	V
Gate to Source Leakage Current	I_{gss}		20	0		$T_j=25^\circ C$ $T_j=125^\circ C$			100	nA
Zero Gate Voltage Drain Current	I_{dss}		0	650		$T_j=25^\circ C$ $T_j=125^\circ C$			3500	nA
Turn On Delay Time	$t_{d(ON)}$	Rgoff=2 Ω Rgon=2 Ω	10	400	30	$T_j=25^\circ C$ $T_j=125^\circ C$		37 36		ns
Rise Time	t_r					$T_j=25^\circ C$ $T_j=125^\circ C$		6 7		
Turn off delay time	$t_{d(OFF)}$					$T_j=25^\circ C$ $T_j=125^\circ C$		146 154		
Fall time	t_f					$T_j=25^\circ C$ $T_j=125^\circ C$		7 4		
Turn-on energy loss per pulse	E_{on}					$T_j=25^\circ C$ $T_j=125^\circ C$		0.12 0.14	mWs	
Turn-off energy loss per pulse	E_{off}					$T_j=25^\circ C$ $T_j=125^\circ C$		0.03 0.04		
Total gate charge	Q_g									
Gate to source charge	Q_{gs}		10	480	49.6	$T_j=25^\circ C$		54		
Gate to drain charge	Q_{gd}							165		
Input capacitance	C_{iss}							8400		pF
Output capacitance	C_{oss}	f=1MHz	0	100		$T_j=25^\circ C$		400		
Reverse transfer capacitance	C_{rss}							tb.		
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness \leq 50um						0.63		K/W
Thermal resistance chip to case per chip	R_{thJC}	$\lambda = 1$ W/mK						0.42		
Pseudo H-Bridge Diode										
Diode forward voltage	V_F				50	$T_j=25^\circ C$ $T_j=125^\circ C$		1.61 1.85	1.8	V
Peak reverse recovery current	I_{RRM}					$T_j=25^\circ C$ $T_j=125^\circ C$		27 24		A
Reverse recovery time	t_{rr}					$T_j=25^\circ C$ $T_j=125^\circ C$		10 10		ns
Reverse recovered charge	Q_{rr}	Rgon=2 Ω	15	400	60	$T_j=25^\circ C$ $T_j=125^\circ C$		0.19 0.20		μ C
Peak rate of fall of recovery current	$di(rec)max/dt$					$T_j=25^\circ C$ $T_j=125^\circ C$		7041 5575		A/ μ s
Reverse recovery energy	E_{rec}					$T_j=25^\circ C$ $T_j=125^\circ C$		0.04 0.05		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness \leq 50um						1.98		K/W
Thermal resistance chip to case per chip	R_{thJC}	$\lambda = 1$ W/mK						1.31		
DC link Capacitor										
C value	C							47		nF
Thermistor										
Rated resistance	R					$T_j=25^\circ C$		22000		Ω
Deviation of R25	$\Delta R/R$	R100=1486 Ω				$T_c=100^\circ C$	-5		+5	%
Power dissipation	P					$T_c=100^\circ C$		200		mW
Power dissipation constant						$T_j=25^\circ C$		2		mW/K
B-value	$B_{(25/50)}$	Tol. \pm 3%				$T_j=25^\circ C$		3950		K
B-value	$B_{(25/100)}$	Tol. \pm 3%				$T_j=25^\circ C$		3996		K
Vincotech NTC Reference						$T_j=25^\circ C$			B	

Pseudo H-Bridge

Figure 1 MOSFET

Typical output characteristics

$I_C = f(V_{CE})$

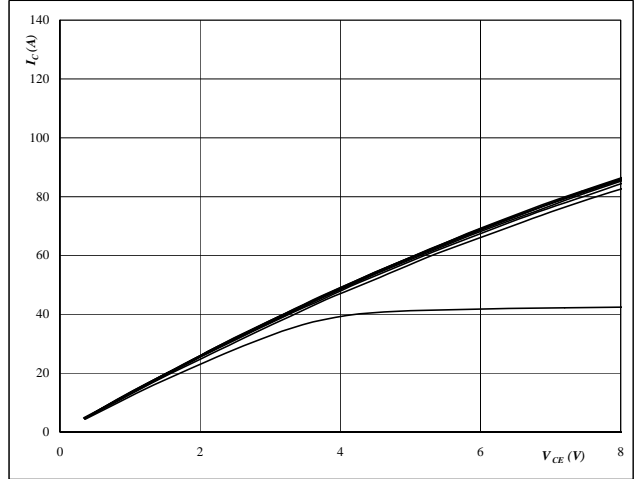


At
 $t_p = 250 \mu s$
 $T_j = 25 \text{ } ^\circ C$
 V_{GE} from 0 V to 20 V in steps of 2 V

Figure 2 MOSFET

Typical output characteristics

$I_C = f(V_{CE})$

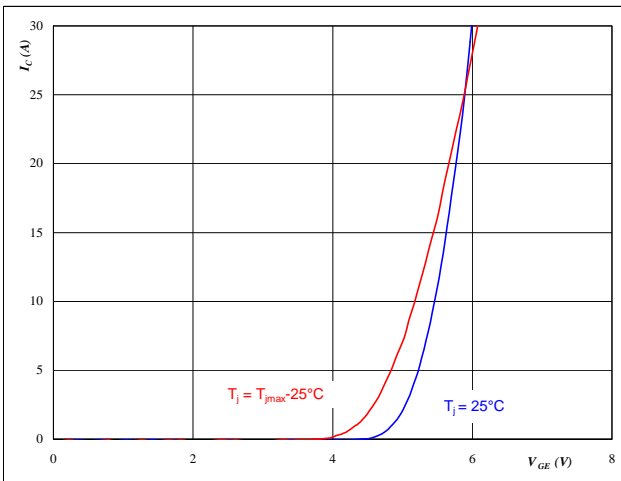


At
 $t_p = 250 \mu s$
 $T_j = 125 \text{ } ^\circ C$
 V_{GE} from 0 V to 20 V in steps of 2 V

Figure 3 MOSFET

Typical transfer characteristics

$I_C = f(V_{GE})$

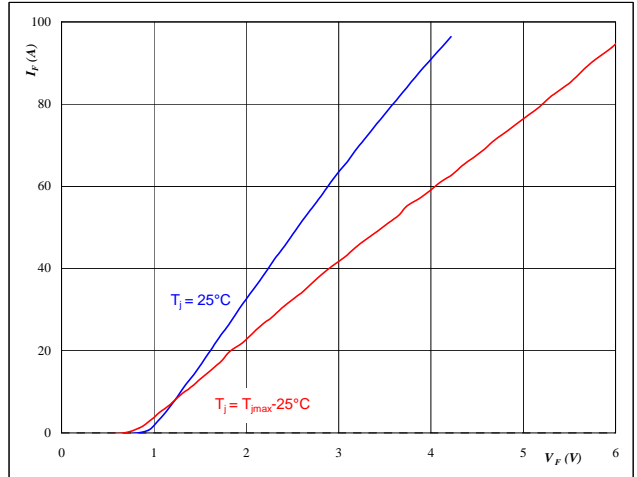


At
 $t_p = 250 \mu s$
 $V_{CE} = 10 V$

Figure 4 FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



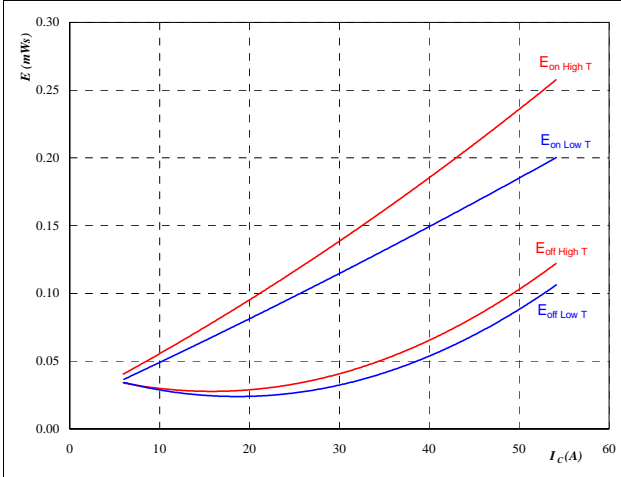
At
 $t_p = 250 \mu s$

Pseudo H-Bridge

Figure 5 MOSFET

**Typical switching energy losses
as a function of collector current**

$$E = f(I_C)$$



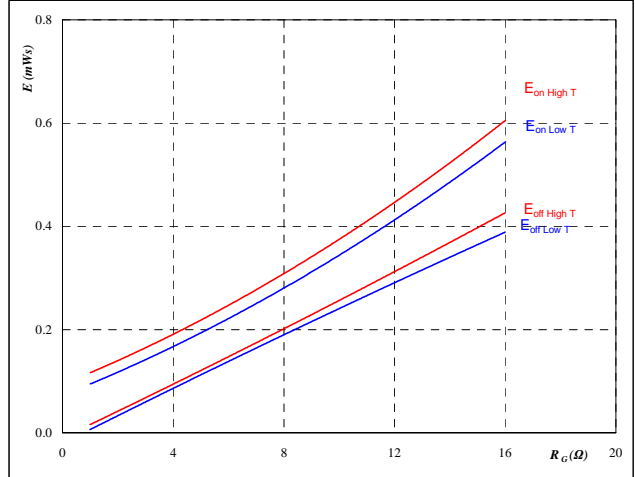
With an inductive load at

$T_J =$	25/125	°C
$V_{CE} =$	400	V
$V_{GE} =$	10	V
$R_{gon} =$	2	Ω
$R_{goff} =$	2	Ω

Figure 6 MOSFET

**Typical switching energy losses
as a function of gate resistor**

$$E = f(R_G)$$



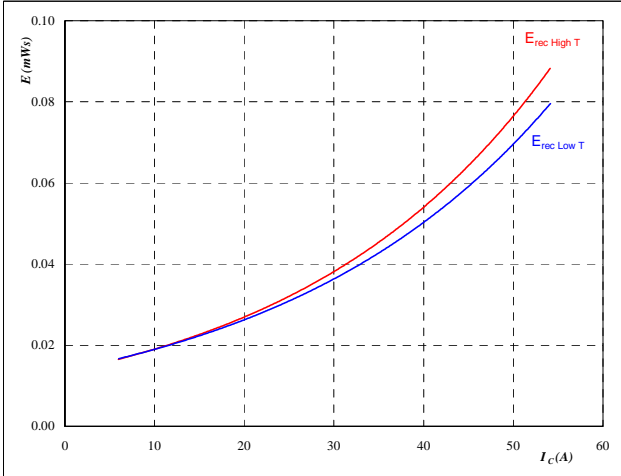
With an inductive load at

$T_J =$	25/125	°C
$V_{CE} =$	400	V
$V_{GE} =$	10	V
$I_C =$	30	A

Figure 7 FWD

**Typical reverse recovery energy loss
as a function of collector current**

$$E_{rec} = f(I_C)$$



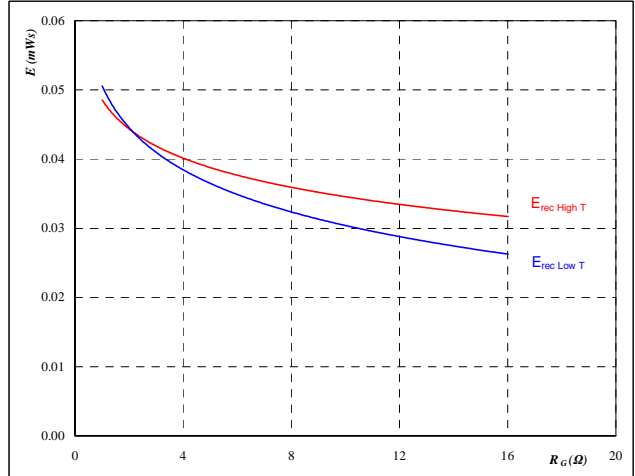
With an inductive load at

$T_J =$	25/125	°C
$V_{CE} =$	400	V
$V_{GE} =$	10	V
$R_{gon} =$	2	Ω

Figure 8 FWD

**Typical reverse recovery energy loss
as a function of gate resistor**

$$E_{rec} = f(R_G)$$



With an inductive load at

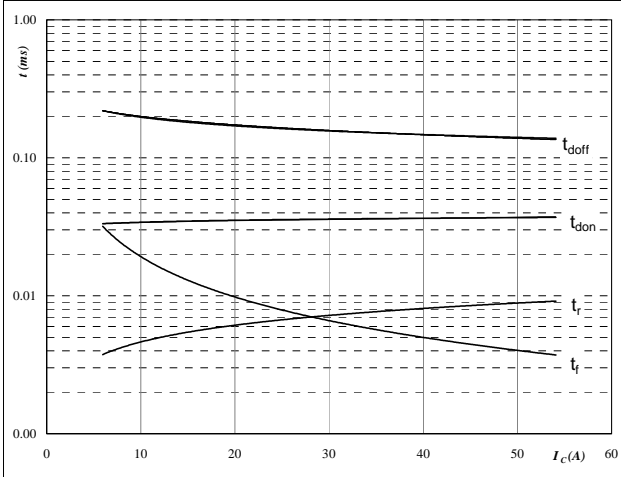
$T_J =$	25/125	°C
$V_{CE} =$	400	V
$V_{GE} =$	10	V
$I_C =$	30	A

Pseudo H-Bridge

Figure 9 MOSFET

Typical switching times as a function of collector current

$$t = f(I_C)$$



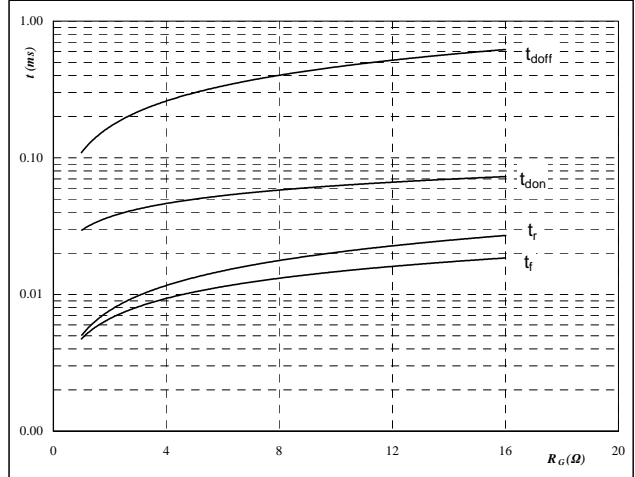
With an inductive load at

$T_J =$	125	°C
$V_{CE} =$	400	V
$V_{GE} =$	10	V
$R_{gon} =$	2	Ω
$R_{goff} =$	2	Ω

Figure 10 MOSFET

Typical switching times as a function of gate resistor

$$t = f(R_G)$$



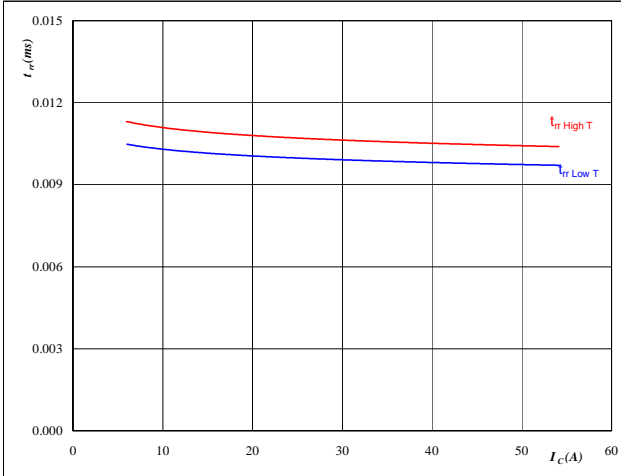
With an inductive load at

$T_J =$	125	°C
$V_{CE} =$	400	V
$V_{GE} =$	10	V
$I_C =$	30	A

Figure 11 FWD

Typical reverse recovery time as a function of collector current

$$t_{rr} = f(I_C)$$



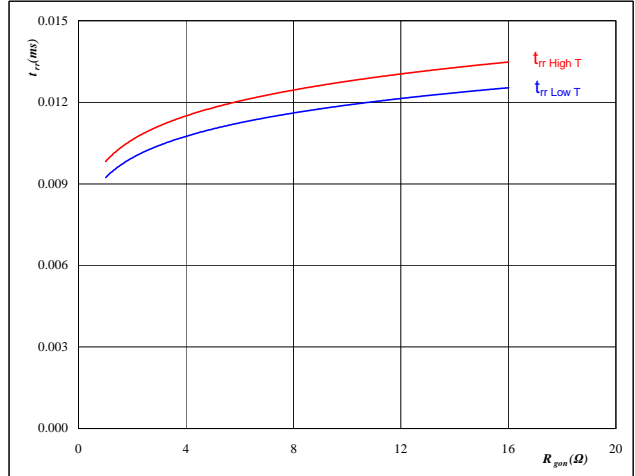
At

$T_J =$	25/125	°C
$V_{CE} =$	400	V
$V_{GE} =$	10	V
$R_{gon} =$	2	Ω

Figure 12 FWD

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

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



At

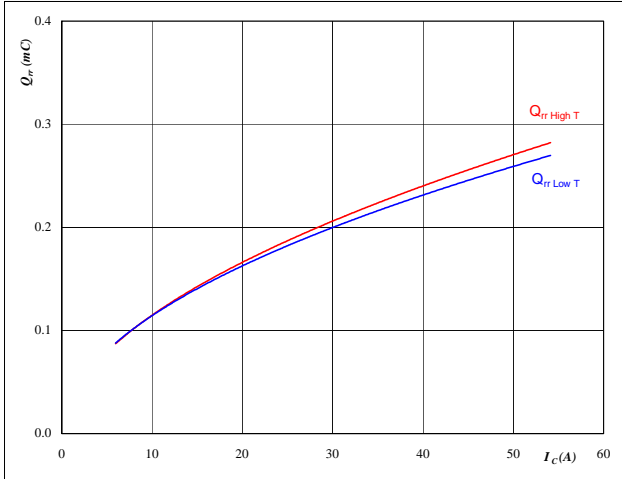
$T_J =$	25/125	°C
$V_R =$	400	V
$I_F =$	30	A
$V_{GE} =$	10	V

Pseudo H-Bridge

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$$Q_{rr} = f(I_C)$$

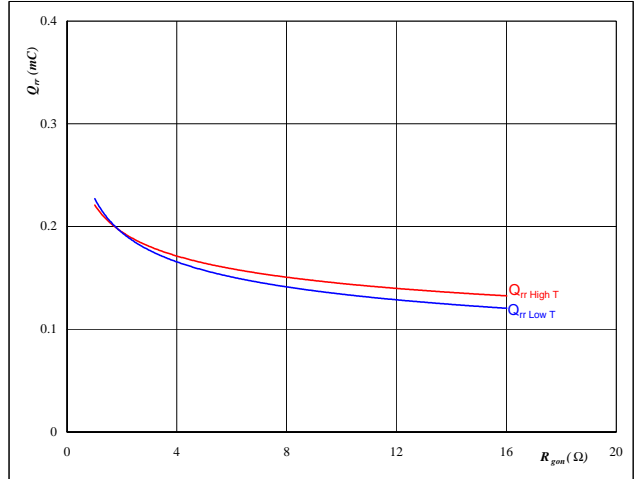


At
 $T_j = 25/125$ °C
 $V_{CE} = 400$ V
 $V_{GE} = 10$ V
 $R_{gon} = 2$ Ω

Figure 14 FWD

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

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

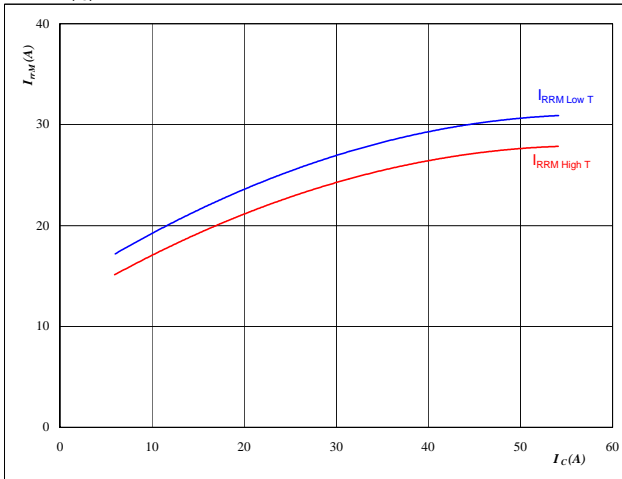


At
 $T_j = 25/125$ °C
 $V_R = 400$ V
 $I_F = 30$ A
 $V_{GE} = 10$ V

Figure 15 FWD

Typical reverse recovery current as a function of collector current

$$I_{RRM} = f(I_C)$$

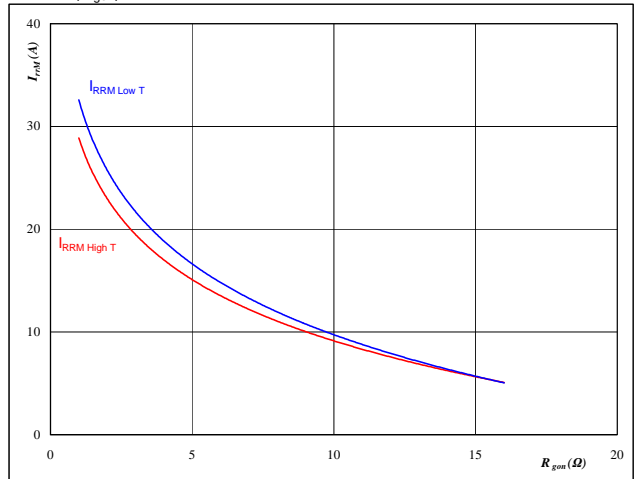


At
 $T_j = 25/125$ °C
 $V_{CE} = 400$ V
 $V_{GE} = 10$ V
 $R_{gon} = 2$ Ω

Figure 16 FWD

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

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



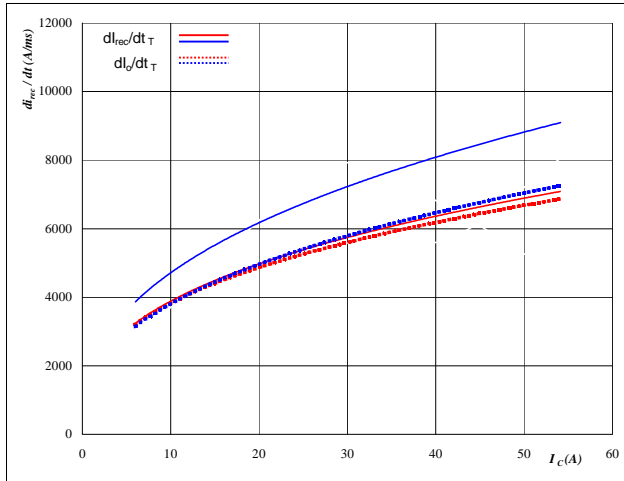
At
 $T_j = 25/125$ °C
 $V_R = 400$ V
 $I_F = 30$ A
 $V_{GE} = 10$ V

Pseudo H-Bridge

Figure 17 FWD

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

$$dI_F/dt, dI_{rec}/dt = f(I_C)$$

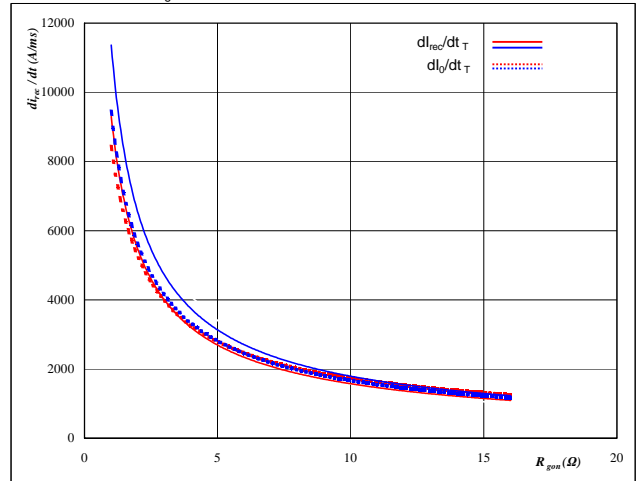


At
 $T_j = 25/125 \text{ } ^\circ\text{C}$
 $V_{CE} = 400 \text{ V}$
 $V_{GE} = 10 \text{ V}$
 $R_{gon} = 2 \text{ } \Omega$

Figure 18 FWD

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

$$dI_F/dt, dI_{rec}/dt = f(R_{gon})$$

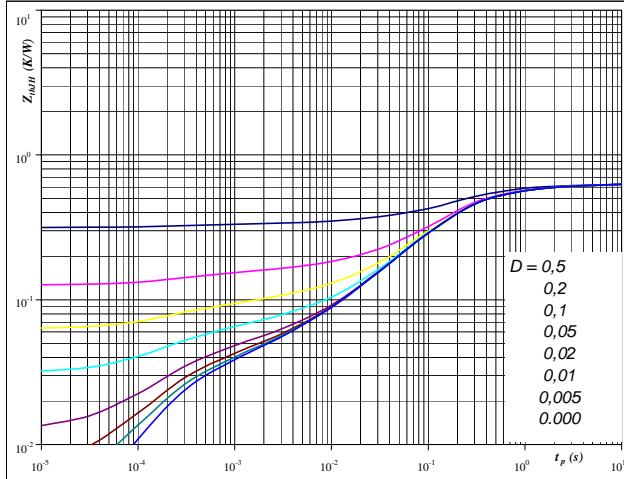


At
 $T_j = 25/125 \text{ } ^\circ\text{C}$
 $V_R = 400 \text{ V}$
 $I_F = 30 \text{ A}$
 $V_{GE} = 10 \text{ V}$

Figure 19 MOSFET

IGBT transient thermal impedance as a function of pulse width

$$Z_{thJH} = f(t_p)$$



At
 $D = t_p / T$
 $R_{thJH} = 0.63 \text{ K/W}$

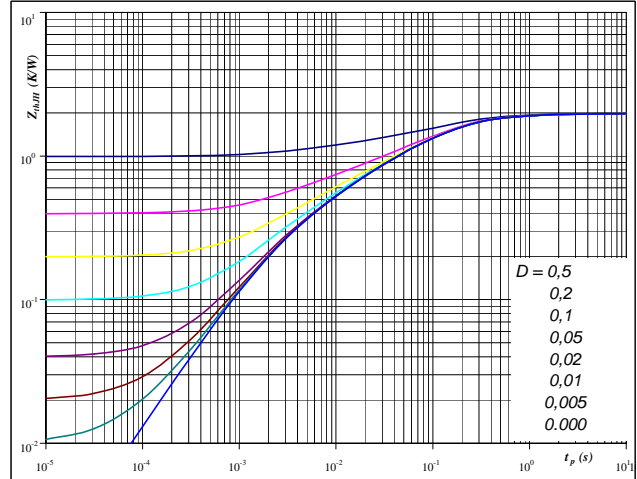
IGBT thermal model values

R (C/W)	Tau (s)
0.04	5.1E+00
0.08	1.0E+00
0.30	2.1E-01
0.14	8.6E-02
0.03	1.3E-02
0.02	1.4E-03

Figure 20 FWD

FWD transient thermal impedance as a function of pulse width

$$Z_{thJH} = f(t_p)$$



At
 $D = t_p / T$
 $R_{thJH} = 1.98 \text{ K/W}$

FWD thermal model values

R (C/W)	Tau (s)
0.06	3.9E+00
0.15	7.0E-01
0.84	1.5E-01
0.44	4.4E-02
0.33	9.5E-03
0.17	2.0E-03

Pseudo H-Bridge

Figure 21 MOSFET

Power dissipation as a function of heatsink temperature

$$P_{tot} = f(T_h)$$

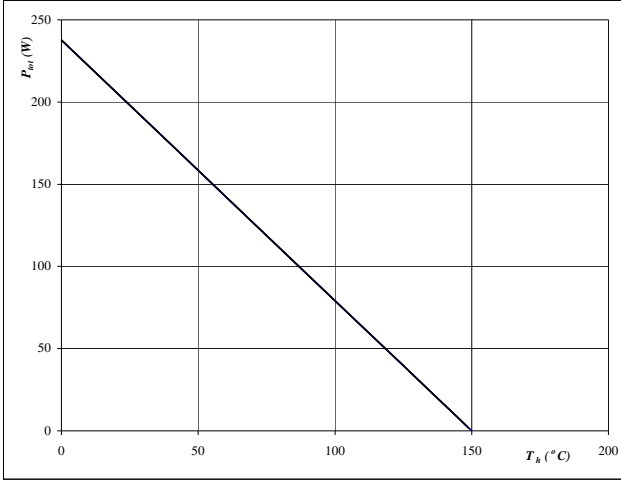

At
 $T_j = 150$ °C

Figure 22 MOSFET

Collector current as a function of heatsink temperature

$$I_C = f(T_h)$$

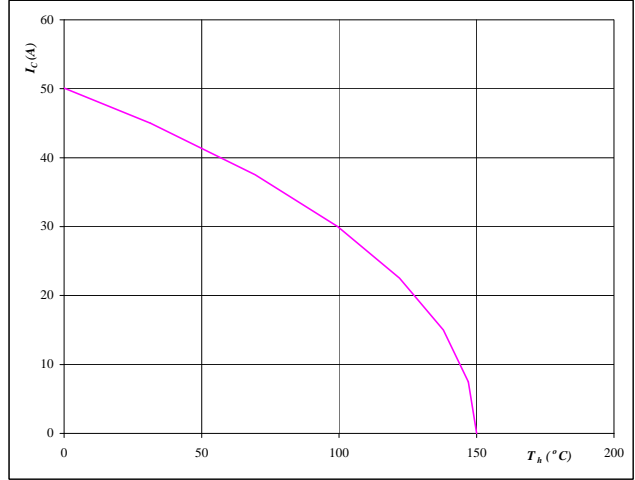

At
 $T_j = 150$ °C
 $V_{GE} = 15$ V

Figure 23 FWD

Power dissipation as a function of heatsink temperature

$$P_{tot} = f(T_h)$$

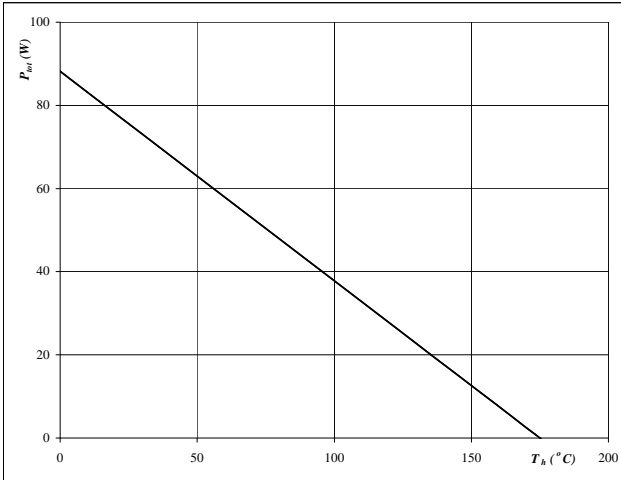
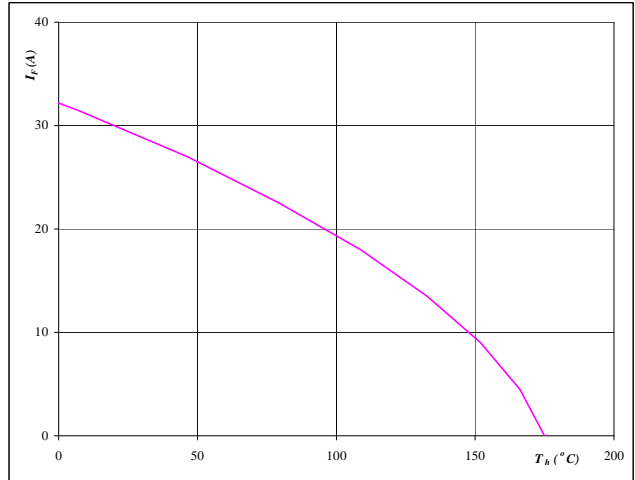

At
 $T_j = 175$ °C

Figure 24 FWD

Forward current as a function of heatsink temperature

$$I_F = f(T_h)$$

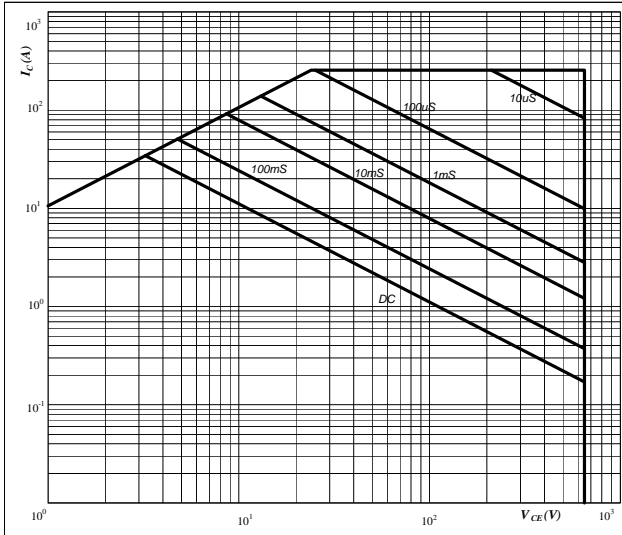

At
 $T_j = 175$ °C

Pseudo H-Bridge

Figure 25 MOSFET

Safe operating area as a function of collector-emitter voltage

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

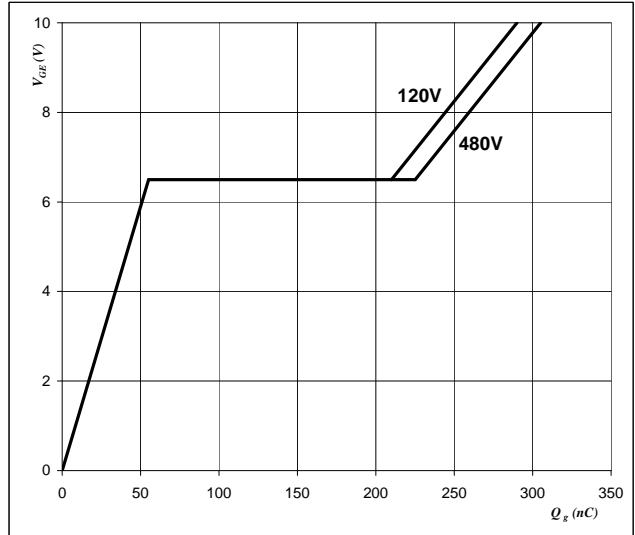


At
 D = single pulse
 Th = 80 °C
 V_{GE} = 15 V
 T_j = T_{jmax} °C

Figure 26 MOSFET

Gate voltage vs Gate charge

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

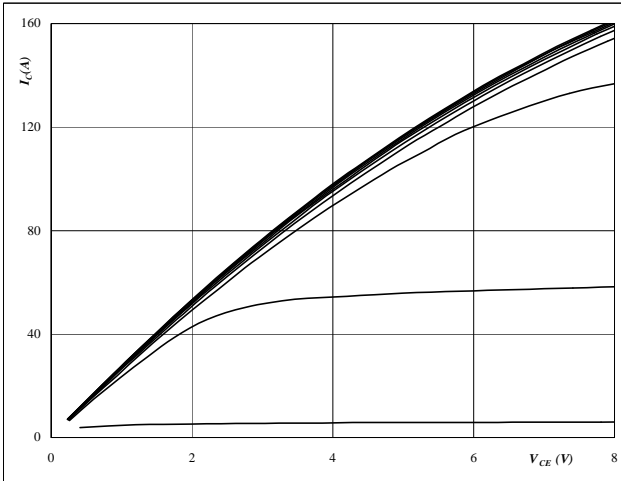


At
 I_C = 50 A

INPUT BOOST

Figure 1 BOOST MOSFET
Typical output characteristics

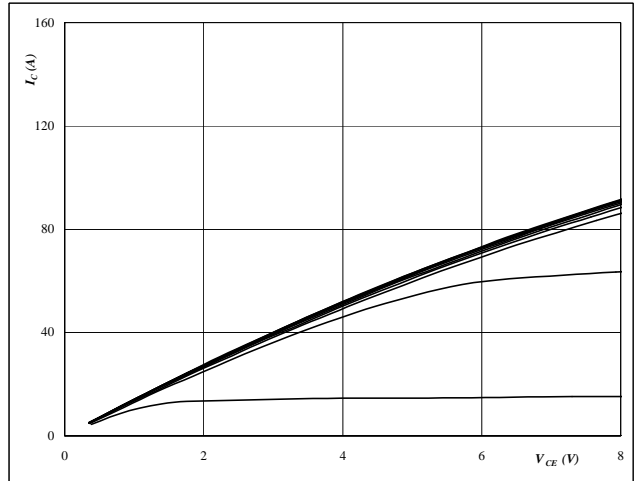
$I_D = f(V_{DS})$



At
 $t_p = 250 \mu s$
 $T_j = 25 \text{ } ^\circ C$
 V_{GS} from 3 V to 13 V in steps of 1 V

Figure 2 BOOST MOSFET
Typical output characteristics

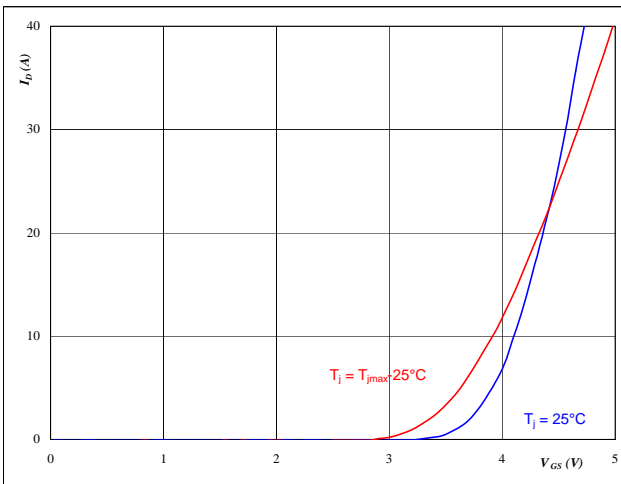
$I_D = f(V_{DS})$



At
 $t_p = 250 \mu s$
 $T_j = 125 \text{ } ^\circ C$
 V_{GS} from 3 V to 13 V in steps of 1 V

Figure 3 BOOST MOSFET
Typical transfer characteristics

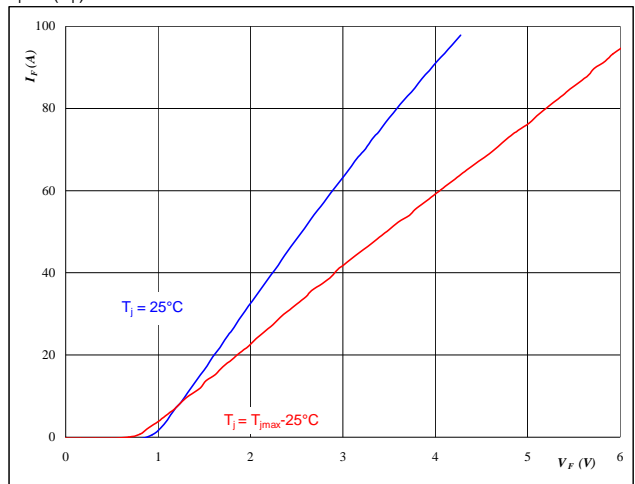
$I_D = f(V_{GS})$



At
 $t_p = 250 \mu s$
 $V_{DS} = 10 V$

Figure 4 BOOST FWD
Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



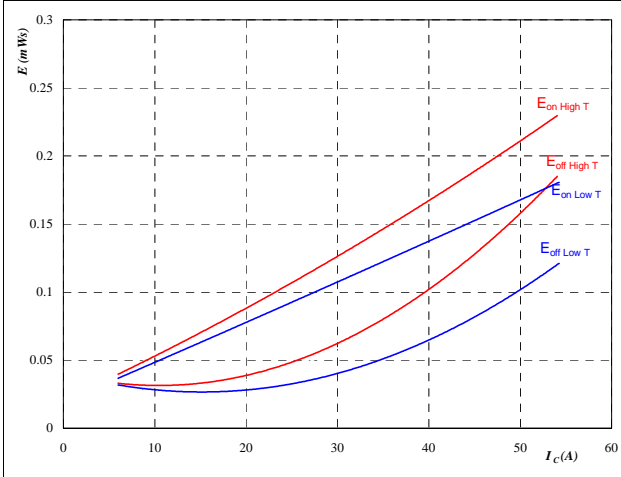
At
 $t_p = 250 \mu s$

INPUT BOOST

Figure 5 BOOST MOSFET

**Typical switching energy losses
as a function of collector current**

$$E = f(I_D)$$



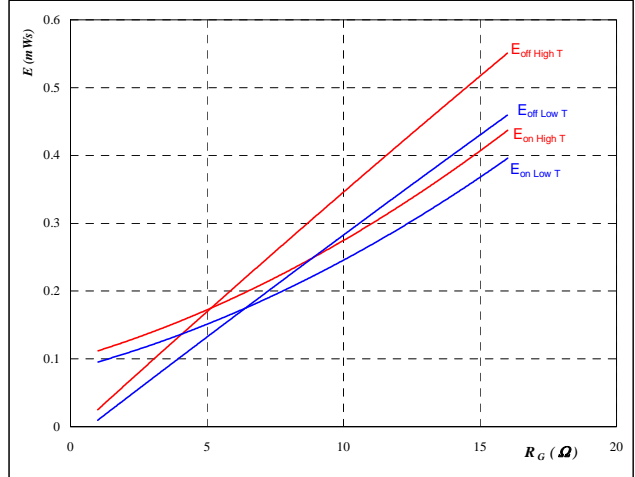
With an inductive load at

$T_J =$	25/125	°C
$V_{DS} =$	400	V
$V_{GS} =$	10	V
$R_{gon} =$	2	Ω
$R_{goff} =$	2	Ω

Figure 6 BOOST MOSFET

**Typical switching energy losses
as a function of gate resistor**

$$E = f(R_G)$$



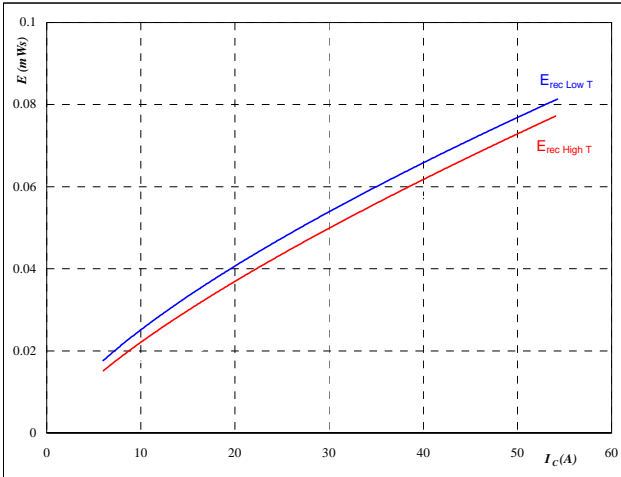
With an inductive load at

$T_J =$	25/125	°C
$V_{DS} =$	400	V
$V_{GS} =$	10	V
$I_D =$	30	A

Figure 7 BOOST FWD

**Typical reverse recovery energy loss
as a function of collector (drain) current**

$$E_{rec} = f(I_c)$$



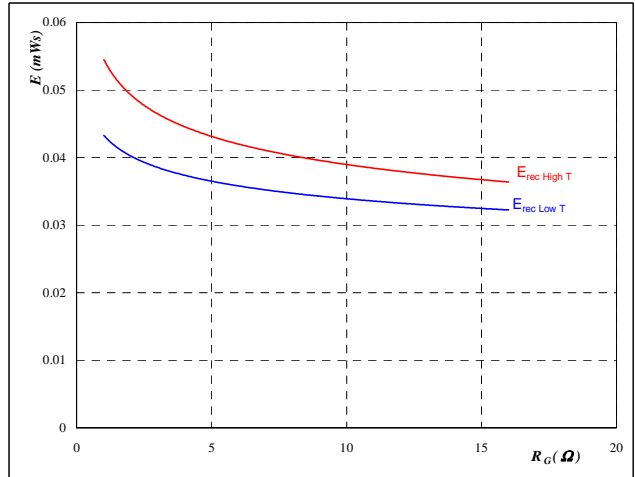
With an inductive load at

$T_J =$	25/125	°C
$V_{DS} =$	400	V
$V_{GS} =$	10	V
$R_{gon} =$	2	Ω
$R_{goff} =$	2	Ω

Figure 8 BOOST FWD

**Typical reverse recovery energy loss
as a function of gate resistor**

$$E_{rec} = f(R_G)$$



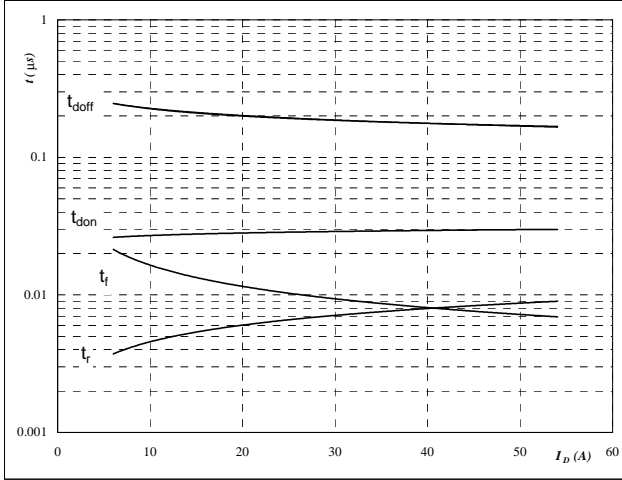
With an inductive load at

$T_J =$	25/125	°C
$V_{DS} =$	400	V
$V_{GS} =$	10	V
$I_D =$	30	A

INPUT BOOST

Figure 9 BOOST MOSFET
Typical switching times as a function of collector current

$$t = f(I_C)$$

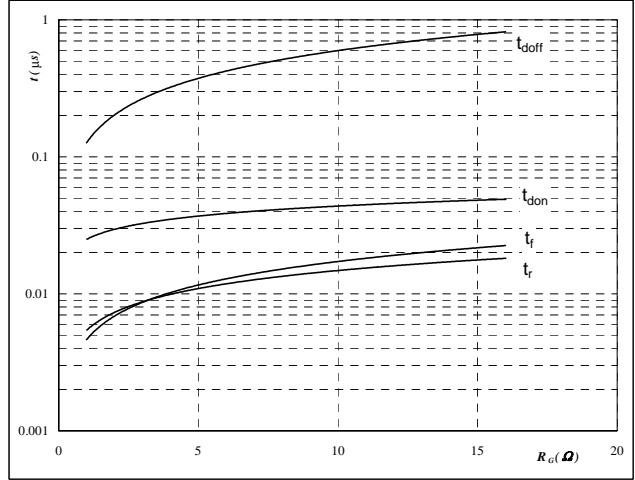


With an inductive load at

$T_j =$	125	°C
$V_{DS} =$	400	V
$V_{GS} =$	10	V
$R_{gon} =$	2	Ω
$R_{goff} =$	2	Ω

Figure 10 BOOST MOSFET
Typical switching times as a function of gate resistor

$$t = f(R_G)$$

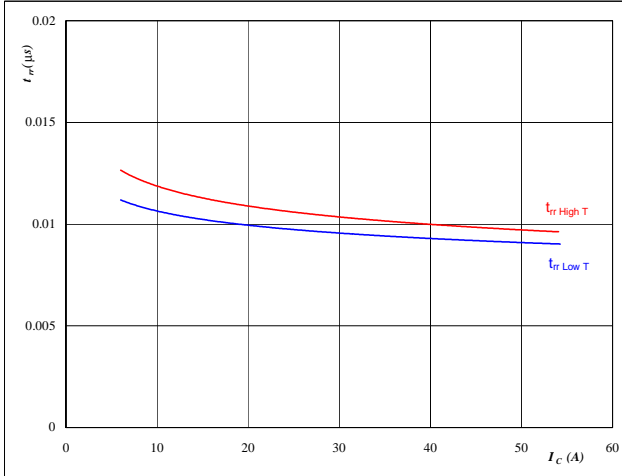


With an inductive load at

$T_j =$	125	°C
$V_{DS} =$	400	V
$V_{GS} =$	10	V
$I_C =$	30	A

Figure 11 BOOST FWD
Typical reverse recovery time as a function of collector current

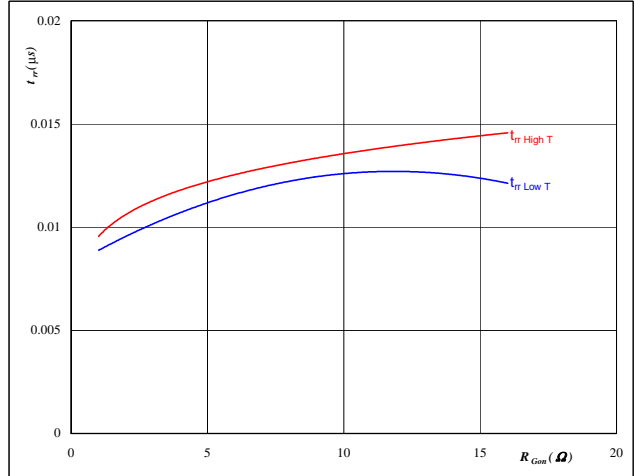
$$t_{rr} = f(I_C)$$


At

$T_j =$	25/125	°C
$V_{CE} =$	400	V
$V_{GE} =$	10	V
$R_{gon} =$	2	Ω

Figure 12 BOOST FWD
Typical reverse recovery time as a function of IGBT turn on gate resistor

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

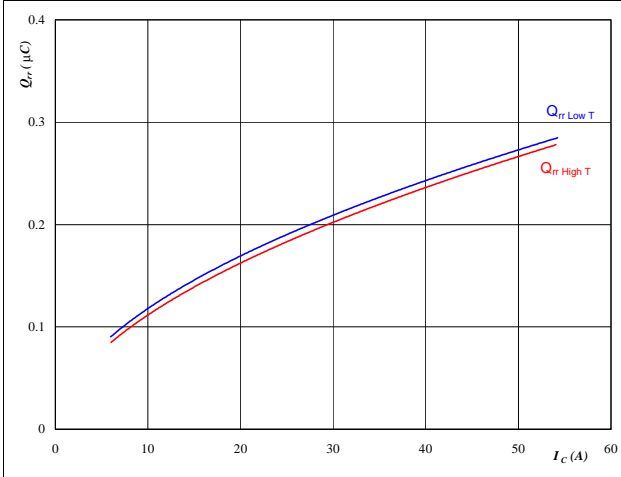

At

$T_j =$	25/125	°C
$V_R =$	400	V
$I_F =$	30	A
$V_{GS} =$	10	V

INPUT BOOST

Figure 13 BOOST FWD
Typical reverse recovery charge as a function of collector current

$$Q_{rr} = f(I_C)$$

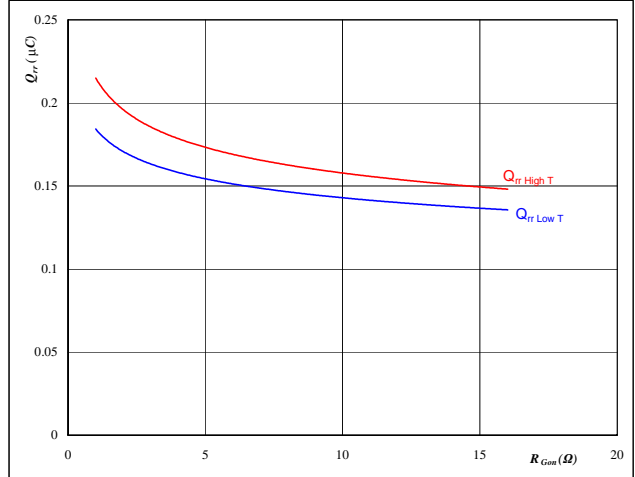


At

$T_j =$	25/125	°C
$V_{CE} =$	400	V
$V_{GE} =$	10	V
$R_{gon} =$	2	Ω

Figure 14 BOOST FWD
Typical reverse recovery charge as a function of IGBT turn on gate resistor

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

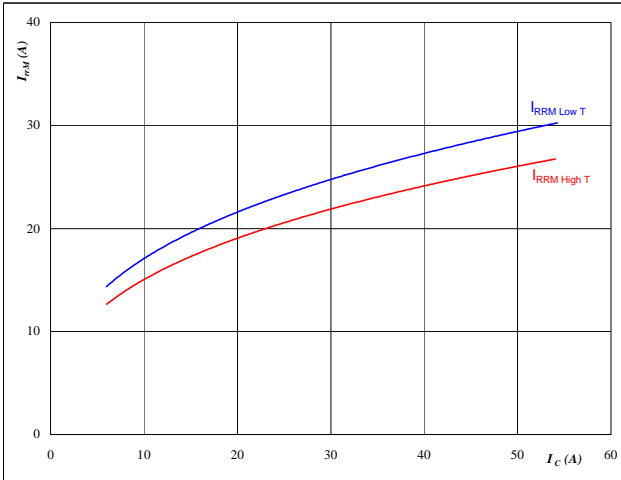


At

$T_j =$	25/125	°C
$V_R =$	400	V
$I_F =$	30	A
$V_{GS} =$	10	V

Figure 15 BOOST FWD
Typical reverse recovery current as a function of collector current

$$I_{RRM} = f(I_C)$$

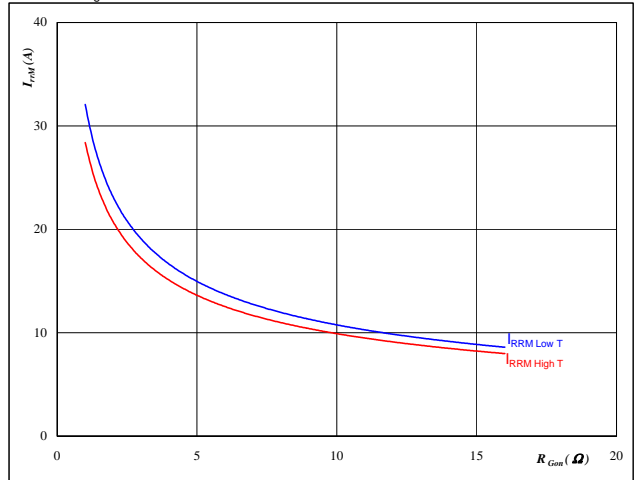


At

$T_j =$	25/125	°C
$V_{CE} =$	400	V
$V_{GE} =$	10	V
$R_{gon} =$	2	Ω

Figure 16 BOOST FWD
Typical reverse recovery current as a function of IGBT turn on gate resistor

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



At

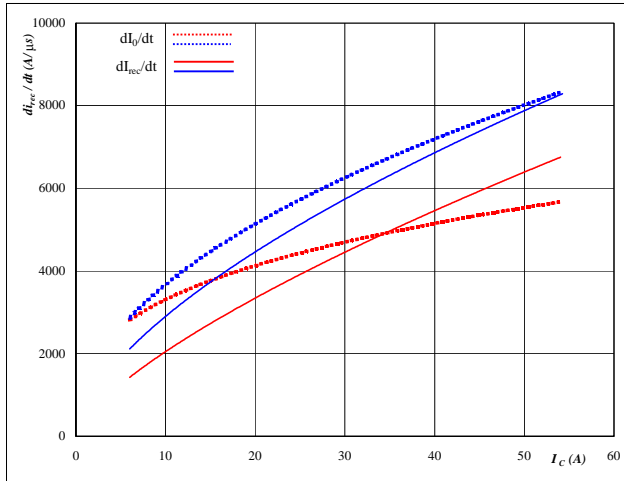
$T_j =$	25/125	°C
$V_R =$	400	V
$I_F =$	30	A
$V_{GS} =$	10	V

INPUT BOOST

Figure 17 BOOST FWD

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

$$dI_f/dt, dI_{rec}/dt = f(I_c)$$

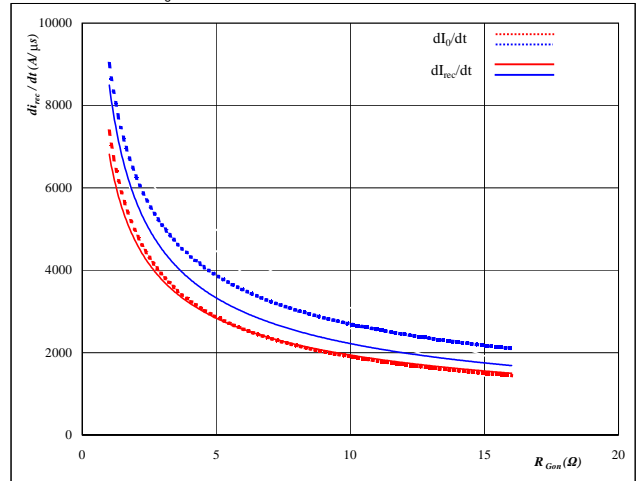


At
 $T_j = 25/125 \text{ } ^\circ\text{C}$
 $V_{CE} = 400 \text{ V}$
 $V_{GE} = 10 \text{ V}$
 $R_{gon} = 2 \text{ } \Omega$

Figure 18 BOOST FWD

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

$$dI_f/dt, dI_{rec}/dt = f(R_{gon})$$

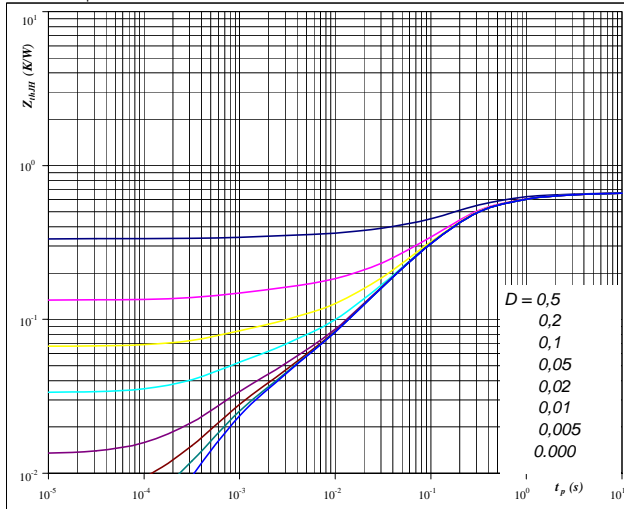


At
 $T_j = 25/125 \text{ } ^\circ\text{C}$
 $V_R = 400 \text{ V}$
 $I_f = 30 \text{ A}$
 $V_{GS} = 10 \text{ V}$

Figure 19 BOOST MOSFET

IGBT/MOSFET transient thermal impedance as a function of pulse width

$$Z_{thJH} = f(t_p)$$



At
 $D = t_p / T$
 $R_{thJH} = 0.67 \text{ K/W}$

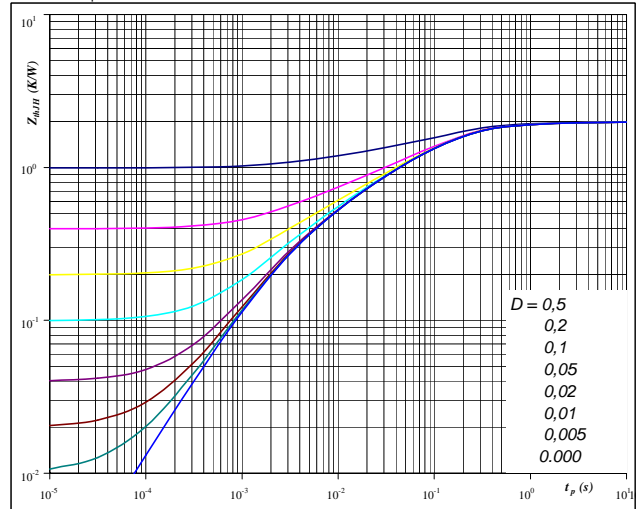
IGBT thermal model values

R (C/W)	Tau (s)
3.56E-02	5.26E+00
8.98E-02	9.94E-01
3.76E-01	1.88E-01
1.04E-01	6.08E-02
3.74E-02	1.20E-02
2.56E-02	9.33E-04

Figure 20 BOOST FWD

FWD transient thermal impedance as a function of pulse width

$$Z_{thJH} = f(t_p)$$



At
 $D = t_p / T$
 $R_{thJH} = 1.98 \text{ K/W}$

FWD thermal model values

R (C/W)	Tau (s)
5.95E-02	3.91E+00
1.47E-01	7.03E-01
8.44E-01	1.45E-01
4.42E-01	4.35E-02
3.26E-01	9.54E-03
1.67E-01	2.01E-03

INPUT BOOST

Figure 21 BOOST MOSFET

Power dissipation as a function of heatsink temperature

$$P_{tot} = f(T_h)$$

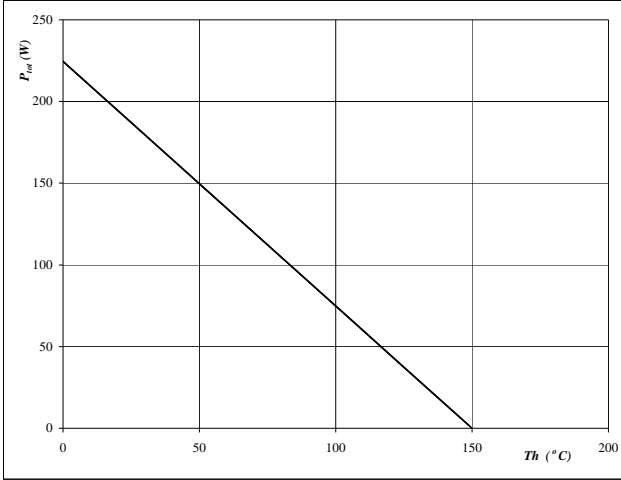

At
 T_j = 150 °C

Figure 22 BOOST MOSFET

Collector/Drain current as a function of heatsink temperature

$$I_C = f(T_h)$$

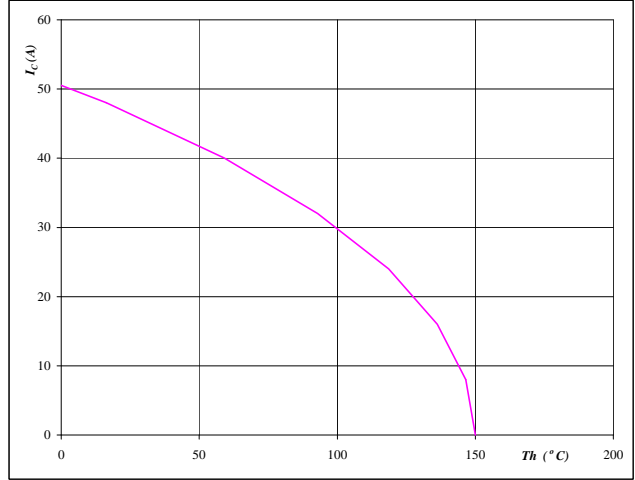

At
 T_j = 150 °C
 V_{GS} = 10 V

Figure 23 BOOST FWD

Power dissipation as a function of heatsink temperature

$$P_{tot} = f(T_h)$$

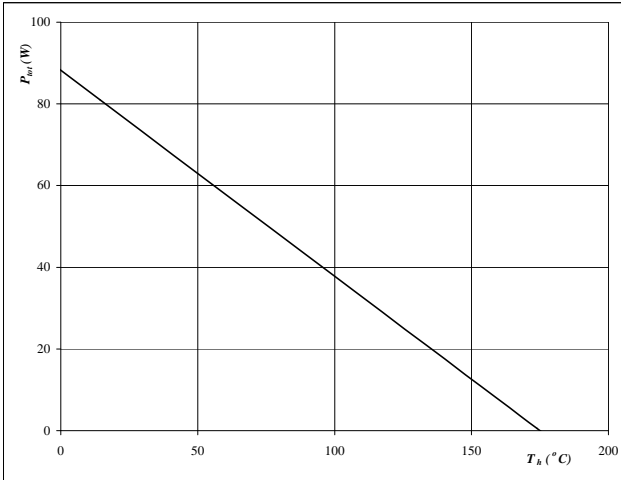
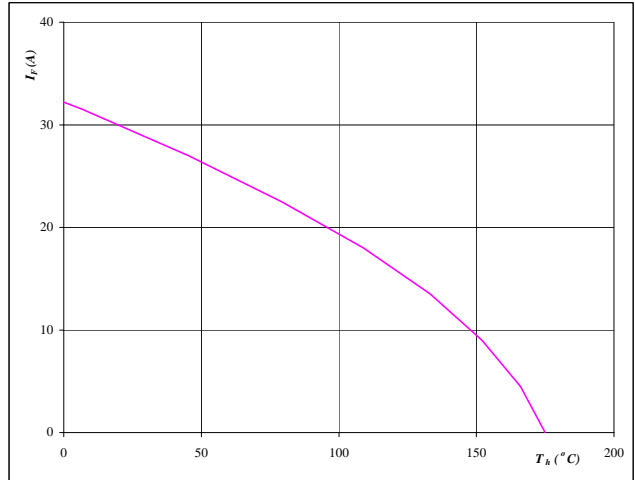

At
 T_j = 175 °C

Figure 24 BOOST FWD

Forward current as a function of heatsink temperature

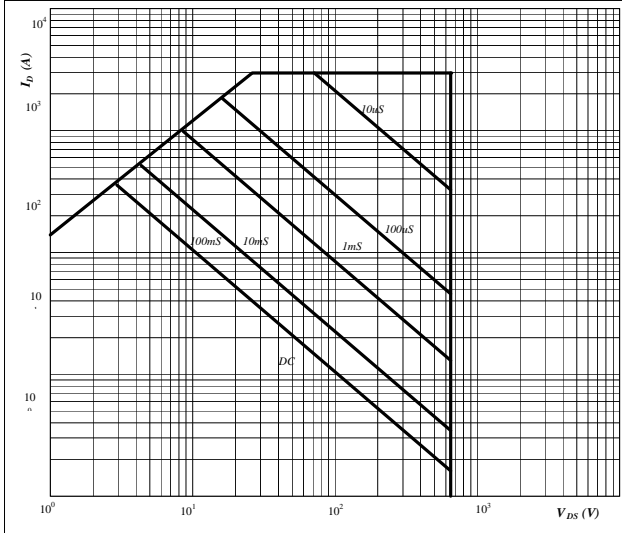
$$I_F = f(T_h)$$


At
 T_j = 175 °C

INPUT BOOST

Figure 25 BOOST MOSFET
Safe operating area as a function of drain-source voltage

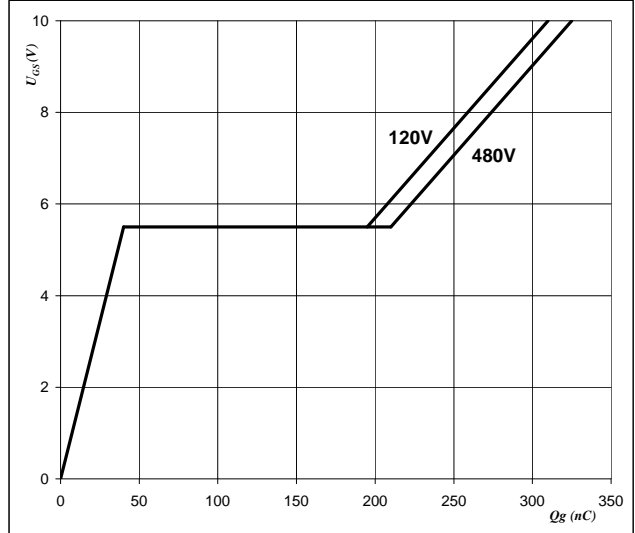
$$I_D = f(V_{DS})$$



At
 D = single pulse
 $T_n = 80 \text{ } ^\circ\text{C}$
 $V_{GS} = 10 \text{ V}$
 $T_j = T_{jmax} \text{ } ^\circ\text{C}$

Figure 26 BOOST MOSFET
Gate voltage vs Gate charge

$$V_{GS} = f(Q_g)$$



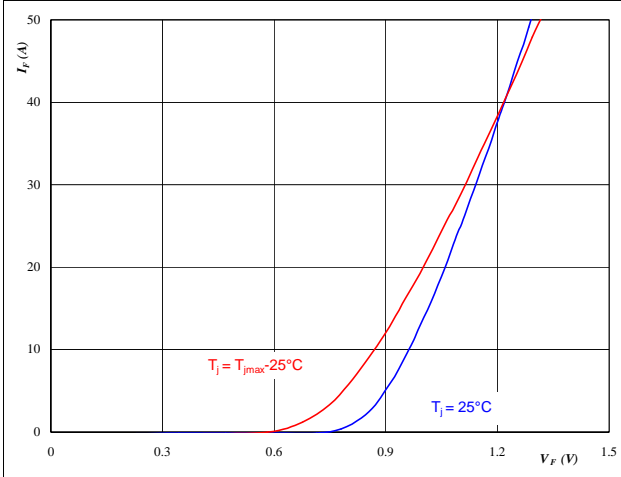
At
 $I_D = 50 \text{ A}$

Bypass Diode

Figure 1 Bypass diode

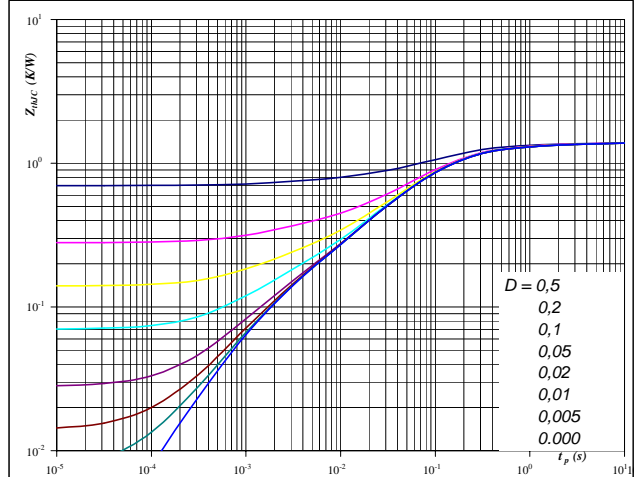
Typical diode forward current as a function of forward voltage

$$I_F = f(V_F)$$


At
 $t_p = 250 \mu s$
Figure 2 Bypass diode

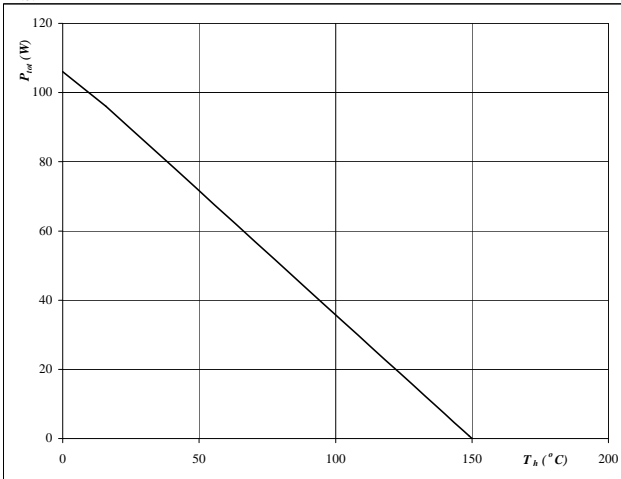
Diode transient thermal impedance as a function of pulse width

$$Z_{thJH} = f(t_p)$$


At
 $D = t_p / T$
 $R_{thJH} = 1.397 \text{ K/W}$
Figure 3 Bypass diode

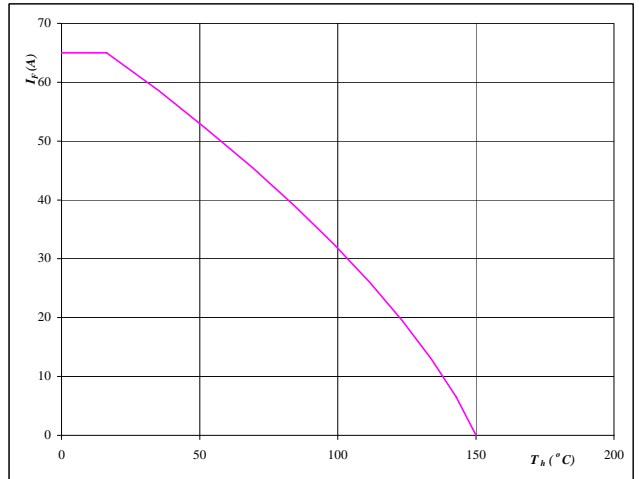
Power dissipation as a function of heatsink temperature

$$P_{tot} = f(T_h)$$


At
 $T_j = 150 \text{ °C}$
Figure 4 Bypass diode

Forward current as a function of heatsink temperature

$$I_F = f(T_h)$$

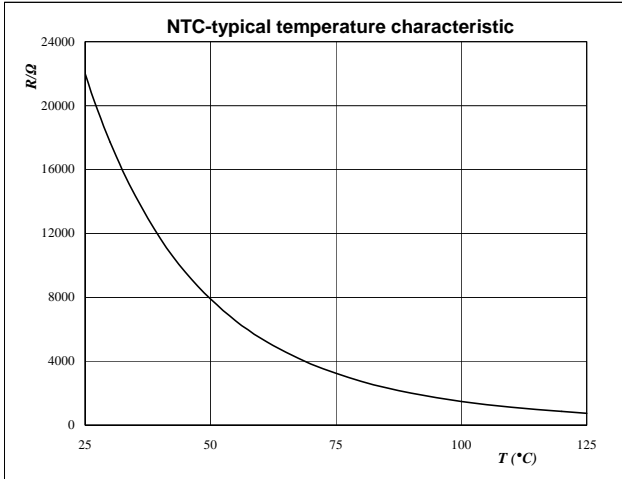

At
 $T_j = 150 \text{ °C}$

Thermistor

Figure 1 Thermistor

Typical NTC characteristic
as a function of temperature

$$R_T = f(T)$$

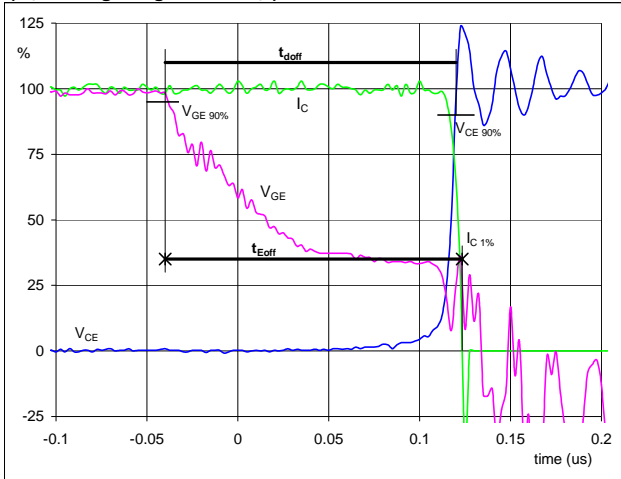


Switching Definitions H-Bridge MOSFET

General conditions

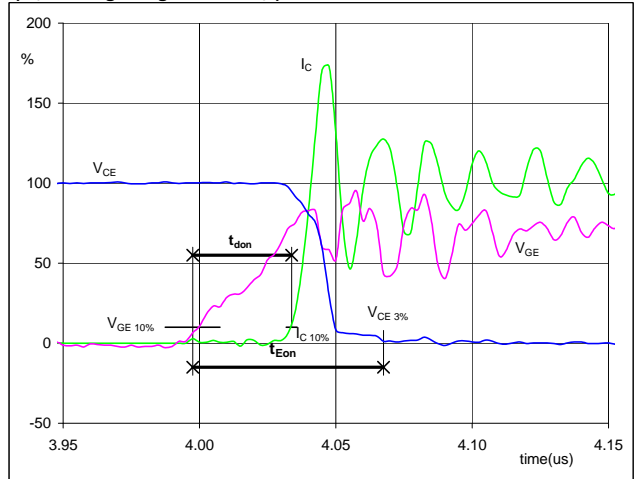
T_j	=	125 °C
R_{gon}	=	2 Ω
R_{goff}	=	2 Ω

Figure 1 H-Bridge MOSFET

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


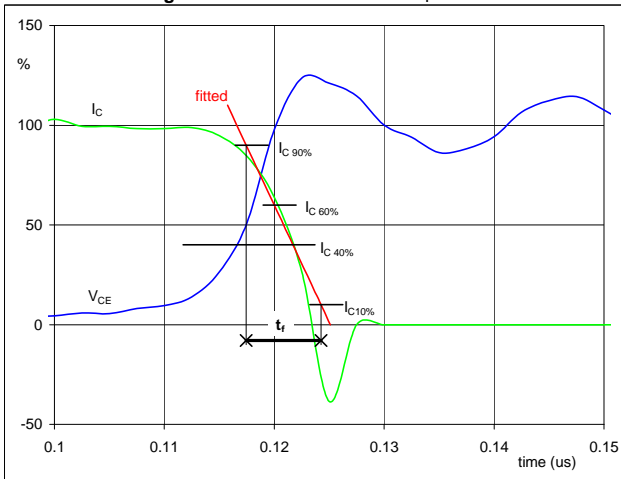
V_{GE} (0%) =	0	V
V_{GE} (100%) =	10	V
V_C (100%) =	400	V
I_C (100%) =	30	A
t_{doff} =	0.15	μ s
t_{Eoff} =	0.16	μ s

Figure 2 H-Bridge MOSFET

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


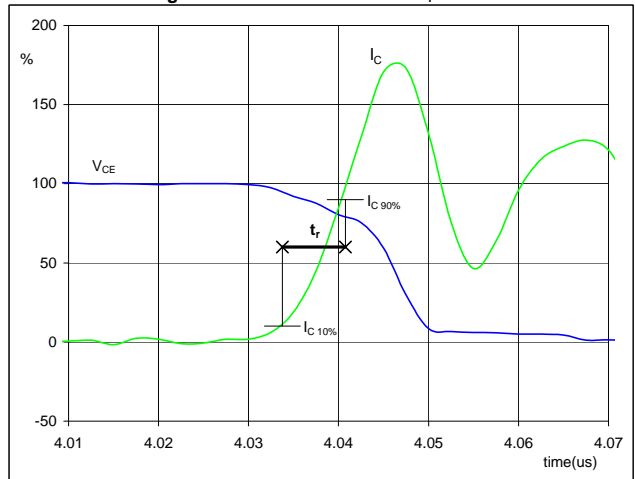
V_{GE} (0%) =	0	V
V_{GE} (100%) =	10	V
V_C (100%) =	400	V
I_C (100%) =	30	A
t_{don} =	0.04	μ s
t_{Eon} =	0.07	μ s

Figure 3 H-Bridge MOSFET

Turn-off Switching Waveforms & definition of t_f


V_C (100%) =	400	V
I_C (100%) =	30	A
t_f =	0.01	μ s

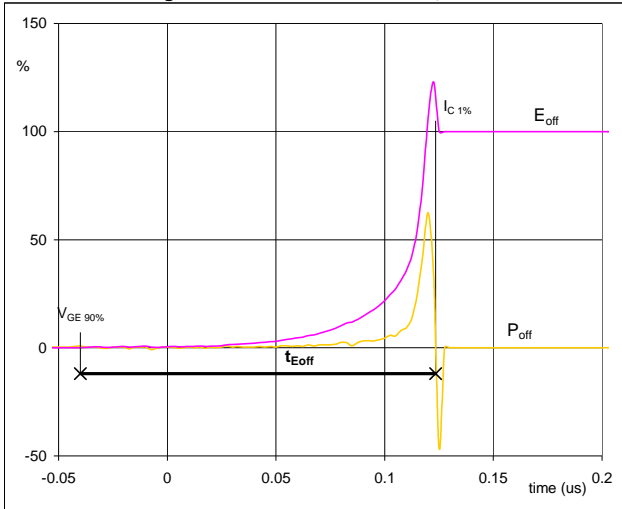
Figure 4 H-Bridge MOSFET

Turn-on Switching Waveforms & definition of t_r


V_C (100%) =	400	V
I_C (100%) =	30	A
t_r =	0.01	μ s

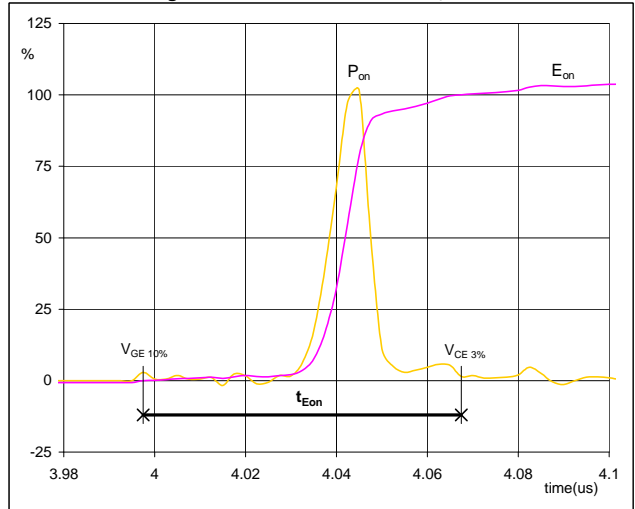
Switching Definitions H-Bridge MOSFET

Figure 5 H-Bridge MOSFET

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


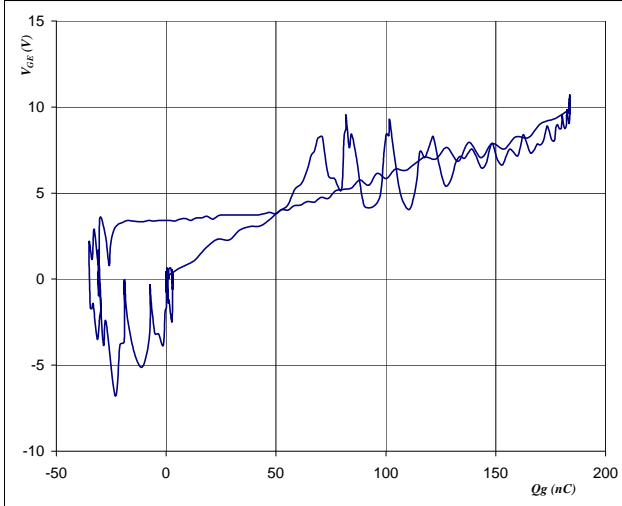
$P_{off} (100\%) = 12.04 \text{ kW}$
 $E_{off} (100\%) = 0.03 \text{ mJ}$
 $t_{Eoff} = 0.16 \text{ } \mu\text{s}$

Figure 6 H-Bridge MOSFET

Turn-on Switching Waveforms & definition of t_{Eon}


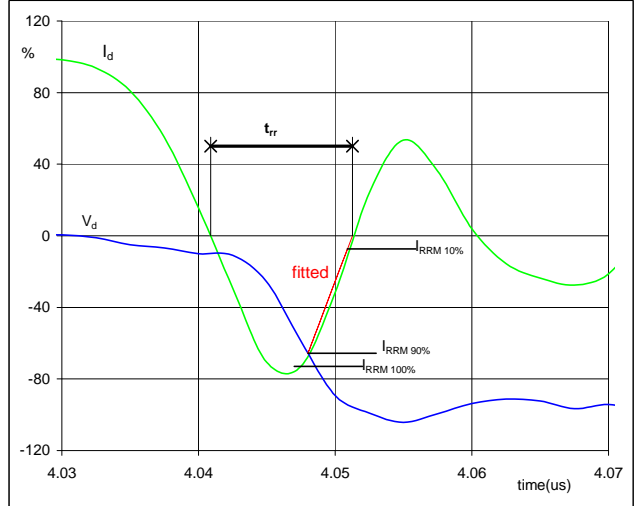
$P_{on} (100\%) = 12.04 \text{ kW}$
 $E_{on} (100\%) = 0.14 \text{ mJ}$
 $t_{Eon} = 0.07 \text{ } \mu\text{s}$

Figure 7 H-Bridge MOSFET

Gate voltage vs Gate charge (measured)


$V_{GEoff} = 0 \text{ V}$
 $V_{GEon} = 10 \text{ V}$
 $V_C (100\%) = 400 \text{ V}$
 $I_C (100\%) = 30 \text{ A}$
 $Q_g = 183.73 \text{ nC}$

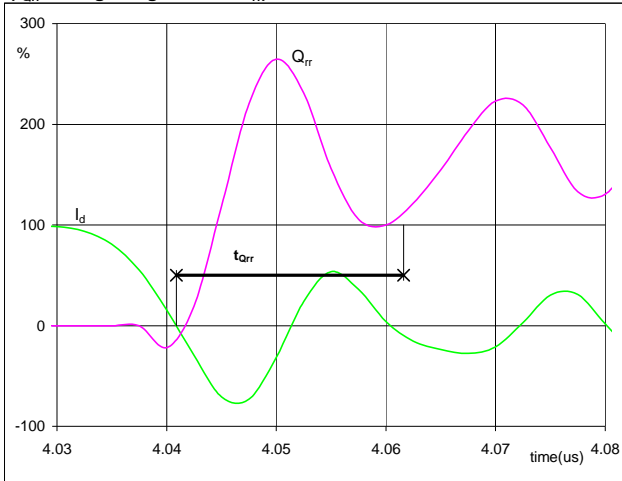
Figure 8 H-Bridge FWD

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


$V_d (100\%) = 400 \text{ V}$
 $I_d (100\%) = 30 \text{ A}$
 $I_{RRM} (100\%) = -24 \text{ A}$
 $t_{rr} = 0.01 \text{ } \mu\text{s}$

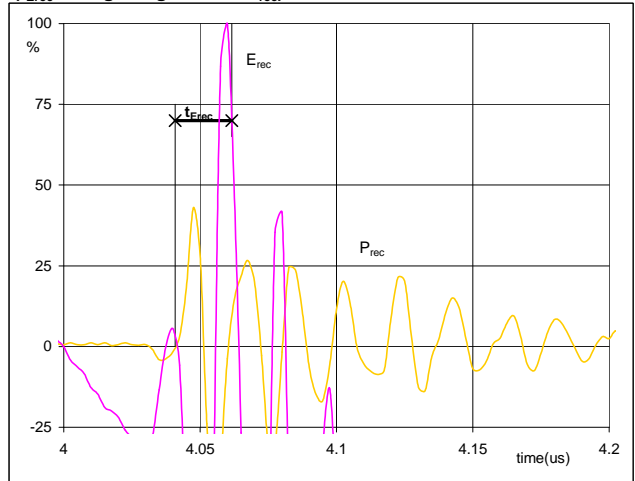
Switching Definitions H-Bridge MOSFET

Figure 9 H-Bridge FWD

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


I_d (100%) =	30	A
Q_{rr} (100%) =	0.12	μC
t_{Qrr} =	0.02	μs

Figure 10 H-Bridge FWD

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


P_{rec} (100%) =	12.04	kW
E_{rec} (100%) =	0.02	mJ
t_{Erec} =	0.02	μs

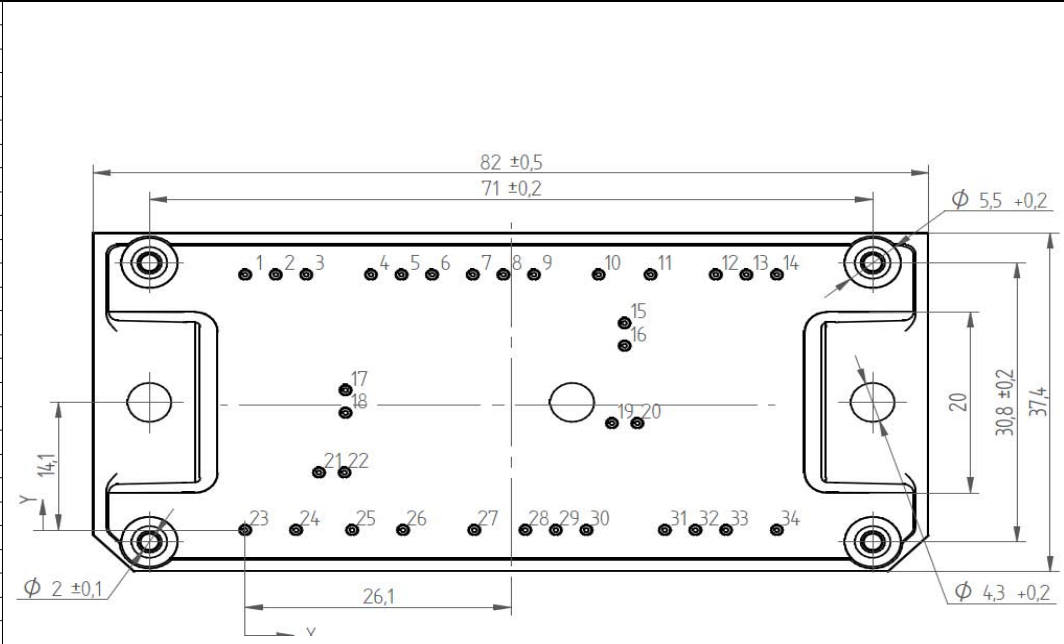
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	10-FY07BIA041MC-M528E58	M528E58	M528E58

Outline

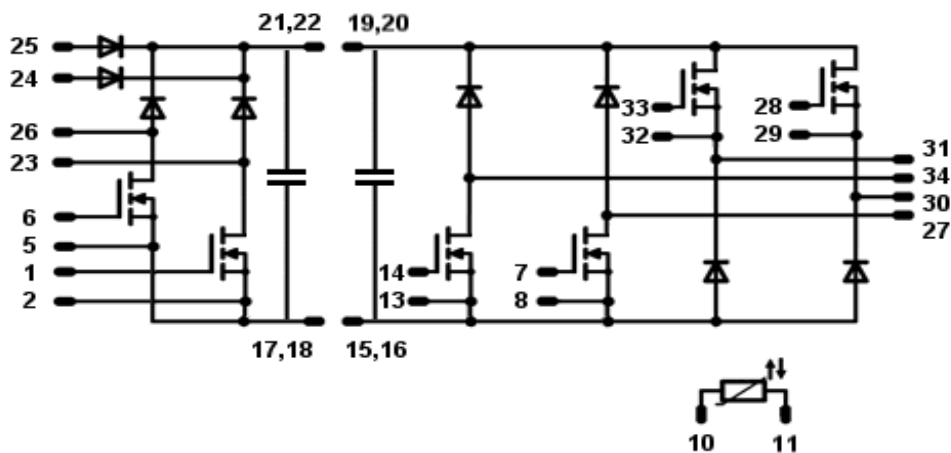
Pin table		
Pin	X	Y
1	0	28.2
2	3	28.2
3	6	28.2
4	12.35	28.2
5	15.35	28.2
6	18.35	28.2
7	22.35	28.2
8	25.35	28.2
9	28.35	28.2
10	34.7	28.2
11	39.8	28.2
12	44.2	28.2
13	49.2	28.2
14	52.2	28.2
15	37.25	22.85
16	37.25	20.35
17	9.85	15.45
18	9.85	12.95
19	36	11.8
20	38.5	11.8
21	7.25	6.35
22	9.75	6.35
23	0	0
24	5	0
25	10.5	0
26	15.5	0
27	22.5	0
28	27.5	0
29	30.5	0
30	33.5	0



Pin table		
Pin	X	Y
31	41.2	0
32	44.2	0
33	47.2	0
34	52.2	0

Tolerance of pinpositions: $\pm 0.5\text{mm}$ at the end of pins
Dimension of coordinate axis is only offset without tolerance
PCB cutouts and holes see in handling instructions document

Pinout



Pins 3,4,9,12 are not connected.

PRODUCT STATUS DEFINITIONS

Datasheet Status	Product Status	Definition
Target	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice. The data contained is exclusively intended for technically trained staff.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data may be published at a later date. Vincotech reserves the right to make changes at any time without notice in order to improve design. The data contained is exclusively intended for technically trained staff.
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