

### Description

The DFS36FB14EYQ1 is a 3 Phase SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips designed for the applications such as DC/DC Converter, Motor converter, UPS, High Frequency Switching application.



### Features

- Blocking voltage:1400V
- $R_{ds(on)}=36m\Omega$
- Low Switching Losses
- 175°C maximum junction temperature
- Thermistor inside

### Applications

- DC/DC converter
- Motor converter
- Uninterruptible Power Supplier
- High Frequency Switching application

### Circuit diagram

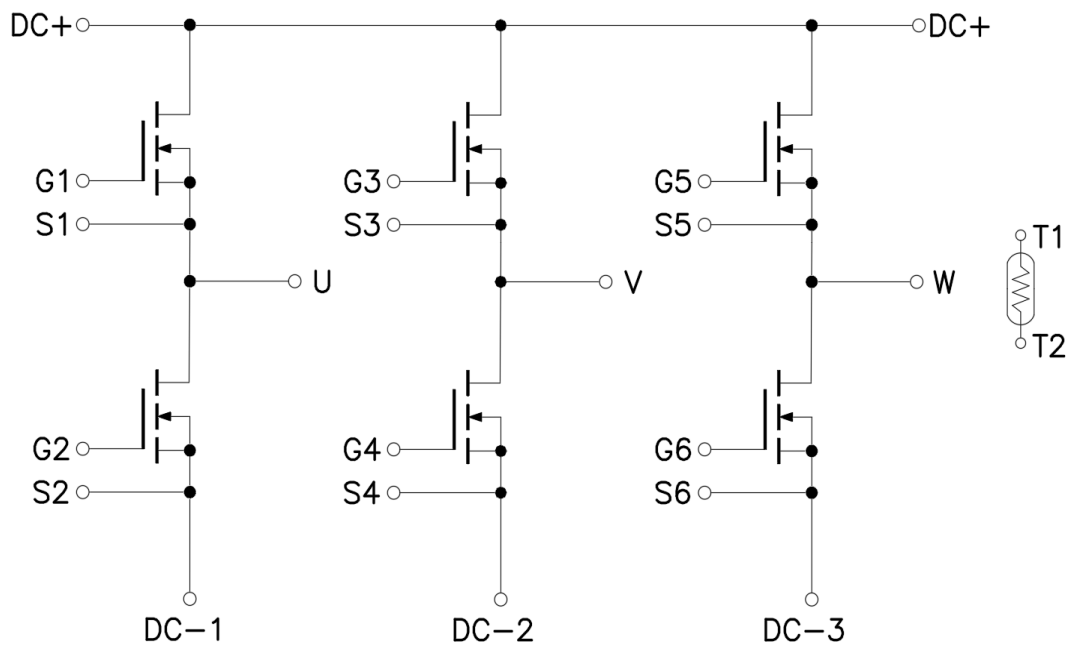


Figure 1. Out drawing & circuit diagram for DFS36FB14EYQ1

## Pin Configuration and Marking Information

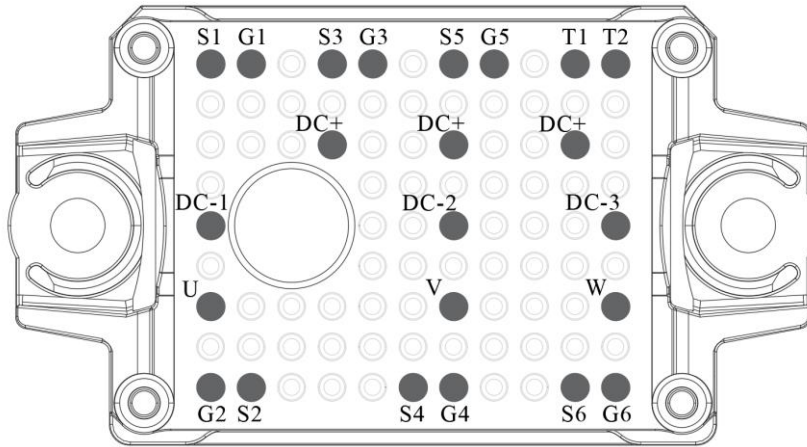


Figure 2. Pin configuration

Symbol	Description
U, V, W	Output terminal of 3 Phase
S2, S4, S6	Low side source signal terminal
G2, G4, G6	Low side gate signal terminal
DC+ (3Pin)	DC+ Bus connection
DC- 1, 2, 3	DC- Bus connection
S1, S3, S5	High side source signal terminal
G1, G3, G5	High side gate signal terminal
T1	Thermistor connection 1
T2	Thermistor connection 2

## Module

Parameter	Conditions	Value	Unit
Isolation Voltage	RMS, f =50Hz, t =1min	3.4	kV
Clearance	Terminal to Terminal	5	mm
	Terminal to Heatsink	10	mm
Creepage distance	Terminal to Terminal	6.3	mm
	Terminal to Heatsink	12.7	mm
Comparative Tracking Index	-	400	-
Weight	-	24	g

### Maximum Ratings (T<sub>j</sub>=25°C unless otherwise specified)

Symbol	Parameter	Condition	Ratings	Unit
V <sub>DSS</sub>	Drain-Source Voltage	G-S Short	1400	V
V <sub>DS nom</sub>	Continuous Operating DC Voltage	Not include surge voltage	1100	V
V <sub>GSS</sub>	Gate-Source Voltage(+)	D-S Short	20	V
V <sub>GSS</sub>	Gate-Source Voltage(-)	D-S Short	-5	V
V <sub>GSSsurge</sub>	G-S Voltage(t <sub>surge</sub> <300nsec)	D-S Short, Note1	-10 to 25	V
I <sub>DS</sub>	DC Continuous Drain Current	T <sub>f</sub> =145°C, Note2	25	A
I <sub>SD</sub>	Source (Body Diode) Current	T <sub>f</sub> =145°C, with ON signal	25	A
I <sub>DP</sub>	Drain Pulse Current, Peak	Less than 1ms, Note3	50	A
T <sub>j</sub>	junction temperature	-	-40 to 175	°C
T <sub>stg</sub>	Storage temperature	-	-40 to 125	°C

Note1: Recommended Operating Value, +20V/-5V;+18V/-4V;+15V/-4V

Note2: Case temperature(T<sub>c</sub>) is defined on the surface of AMB substrate bottom just under the chips

Note3: Pulse width limited by maximum junction temperature

### NTC characteristics

Symbol	Parameter	Condition	Value			Unit
			Min.	Typ.	Max.	
R <sub>25</sub>	Resistance	T <sub>c</sub> =25°C	-	5	-	kΩ
ΔR/R	Deviation of R <sub>100</sub>	T <sub>c</sub> =100°C, R <sub>100</sub> =493Ω	-5	-	5	%
P <sub>25</sub>	Power dissipation	T <sub>c</sub> =25°C	-	-	20	mW
B <sub>25/50</sub>	B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15 K))]$	-	3375	-	K
B <sub>25/80</sub>	B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15 K))]$	-	3411	-	K
B <sub>25/100</sub>	B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15 K))]$	-	3433	-	K

### MOSFET Electrical characteristics ( $T_j=25^\circ\text{C}$ unless otherwise specified, chip)

Symbol	Item	Condition	Value			Unit	
			Min.	Typ.	Max		
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=1mA$	1400	-	-	V	
$I_{DSS}$	Zero gate voltage drain Current	$V_{DS}=1400V, V_{GS}=0V$	-	-	300	$\mu A$	
$V_{GS(th)}$	Gate-Source threshold Voltage	$I_D=20mA, V_{DS}=V_{GS}$	2.0	2.5	4.0	V	
$I_{GSS+}$	Gate-Source Leakage Current	$V_{GS}=20V, V_{DS}=0V, T_j=25^\circ C$	-	-	200	nA	
$I_{GSS-}$		$V_{GS}=-5V, V_{DS}=0V, T_j=25^\circ C$	-200	-	-	nA	
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	$I_D=25A, V_{GS}=20V$	$T_j=25^\circ C$	-	36	45	mΩ
			$T_j=175^\circ C$	-	70	-	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	$I_D=25A, V_{GS}=20V$	$T_j=25^\circ C$	-	0.9	1.13	V
			$T_j=175^\circ C$	-	1.75	-	V
$C_{iss}$	Input Vapacitance	$V_{DS}=1000V, V_{GS}=0V, f=200kHz$	-	3192	-	pF	
$C_{oss}$	Output Vapacitance		-	132	-	pF	
$C_{rss}$	Reverse transfer Capacitance		-	7	-	pF	
$Q_G$	Total gate charge	$V_{DD}=800V, I_D=40A, V_{GS}=+20/-5V$	-	118	-	nC	
$R_{Gint}$	Internal Gate Resistance	$T_j=25^\circ C$	-	1.9	-	Ω	
$t_{d(on)}$	Turn-on delay time	$V_{DD}=800V$ $I_D=25A$ $V_{GS}=+18/-4V$ $R_G=5.1\Omega$ Inductive load switching operation	$T_j=25^\circ C$	-	19	-	ns
			$T_j=150^\circ C$	-	20	-	
$t_r$	Rise time		$T_j=25^\circ C$	-	9	-	ns
			$T_j=150^\circ C$	-	8	-	
$t_{d(off)}$	Turn-off delay time		$T_j=25^\circ C$	-	26	-	ns
			$T_j=150^\circ C$	-	33	-	
$t_f$	Fall time		$T_j=25^\circ C$	-	13	-	ns
			$T_j=150^\circ C$	-	13	-	
$E_{on}$	Turn-on power dissipation		$T_j=25^\circ C$	-	225	-	$\mu J$
			$T_j=150^\circ C$	-	313	-	
$E_{off}$	Turn-off power dissipation	$T_j=25^\circ C$	-	312	-	$\mu J$	
		$T_j=150^\circ C$	-	20	-		
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case/MOSFET	-	0.52	-	K/W	
$R_{th(c-f)}$	Contact thermal resistance	With thermal conductive grease /MOSFET	-	0.15	-	K/W	

Assumes Thermal Conductivity of grease is 2.8 W/m · K and thickness is 50um.

### Body Diode Electrical characteristics (T<sub>j</sub>=25°C unless otherwise specified, chip: Target)

Symbol	Item	Condition	Value			Unit	
			Min.	Typ.	Max.		
V <sub>SD</sub>	Body Diode Forward Voltage	V <sub>GS</sub> = -5V I <sub>SD</sub> = 25A	T <sub>j</sub> = 25°C	-	3.9	-	V
			T <sub>j</sub> = 175°C	-	3.4	-	
T <sub>rr</sub>	Reverse recovery time	V <sub>DD</sub> = 800V I <sub>D</sub> = 25A	T <sub>j</sub> = 25°C	-	27	-	ns
			T <sub>j</sub> = 150°C	-	28	-	
Q <sub>rr</sub>	Reverse recovery charge	V <sub>GS</sub> = +18/-4V R <sub>G</sub> = 5.1Ω	T <sub>j</sub> = 25°C	-	0.66	-	μC
			T <sub>j</sub> = 150°C	-	1.77	-	
E <sub>rr</sub>	Diode switching power dissipation	Inductive load switching operation	T <sub>j</sub> = 25°C	-	380	-	μJ
			T <sub>j</sub> = 150°C	-	848	-	

### Test Conditions

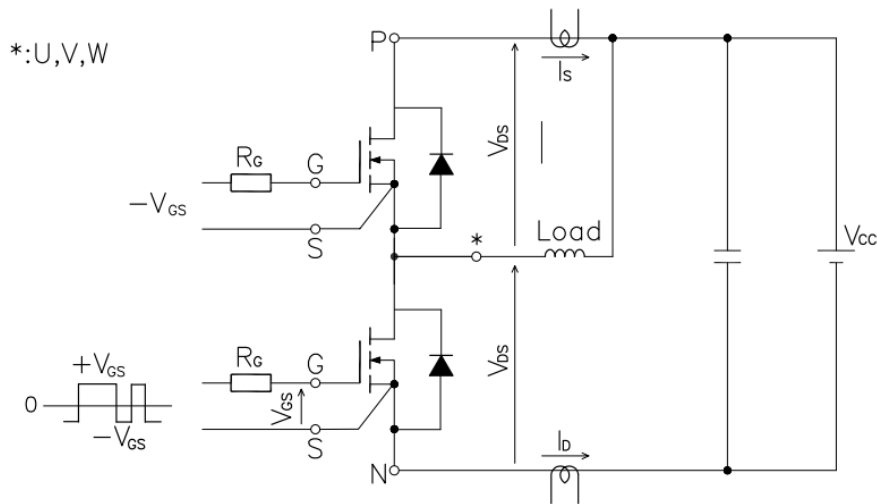


Figure 3. Switching time measure circuit

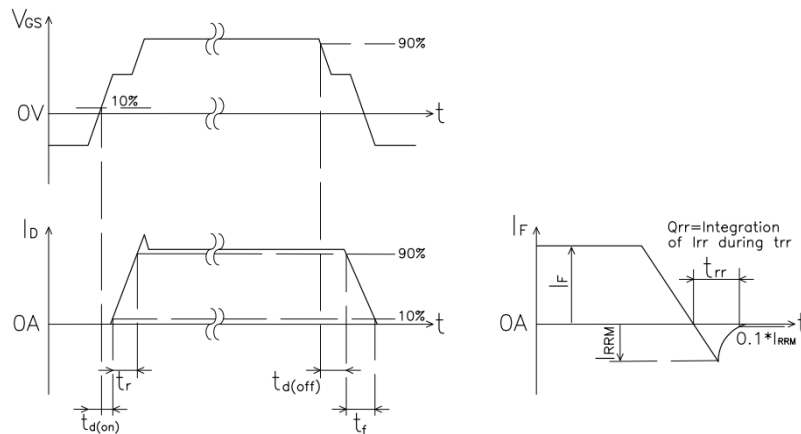


Figure 4. Switching time definition

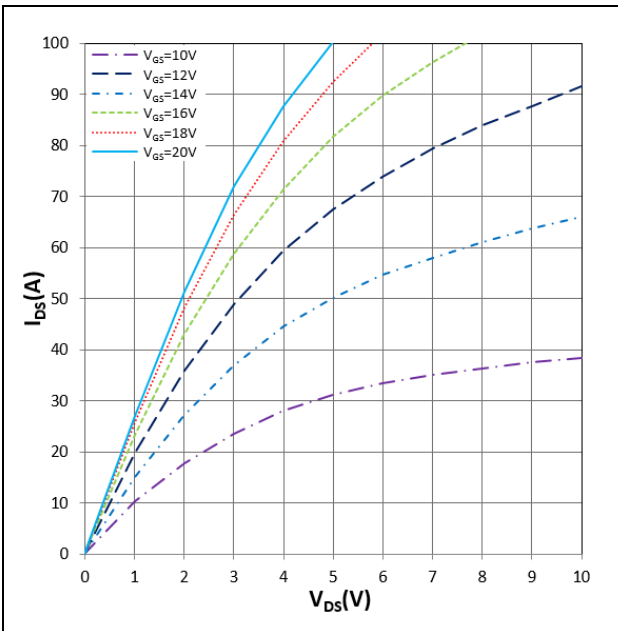


Figure 5.  $I_{D_S}$  vs  $V_{D_S}$   
 $T_j = 25^\circ\text{C}$ ,  $V_{G_S}$  parameter

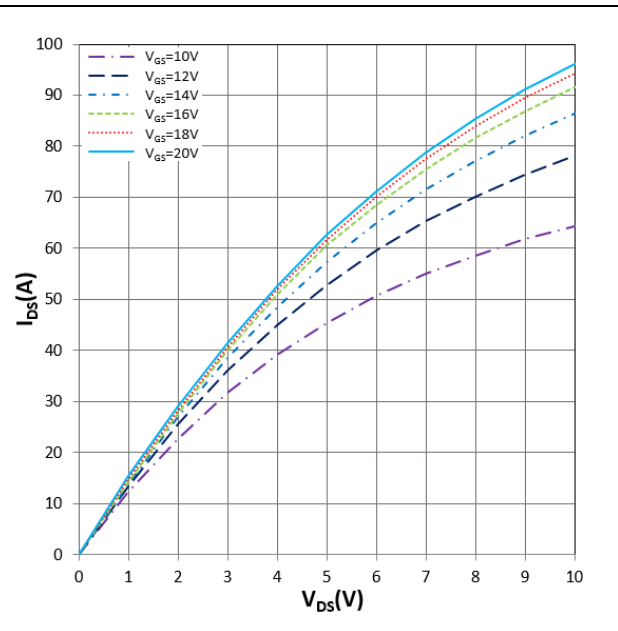


Figure 6.  $I_{D_S}$  vs  $V_{D_S}$   
 $T_j = 175^\circ\text{C}$ ,  $V_{G_S}$  parameter

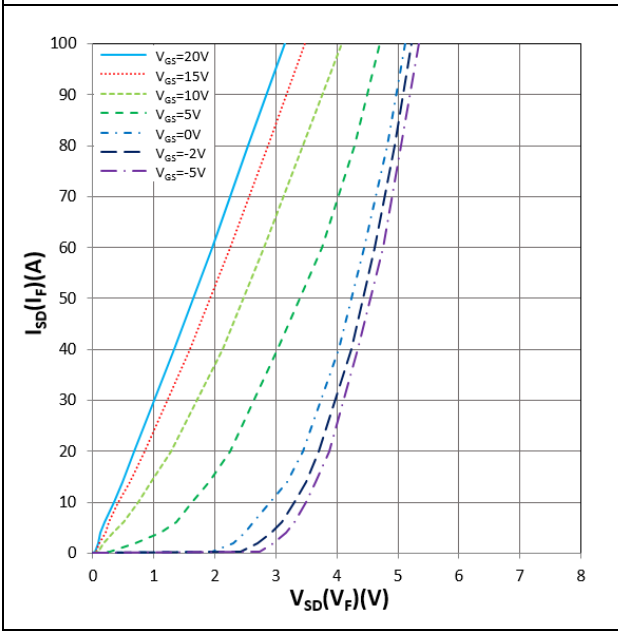


Figure 7.  $I_{S_D}(I_F)$  vs  $V_{S_D}(V_F)$   
 $T_j = 25^\circ\text{C}$ ,  $V_{G_S}$  parameter

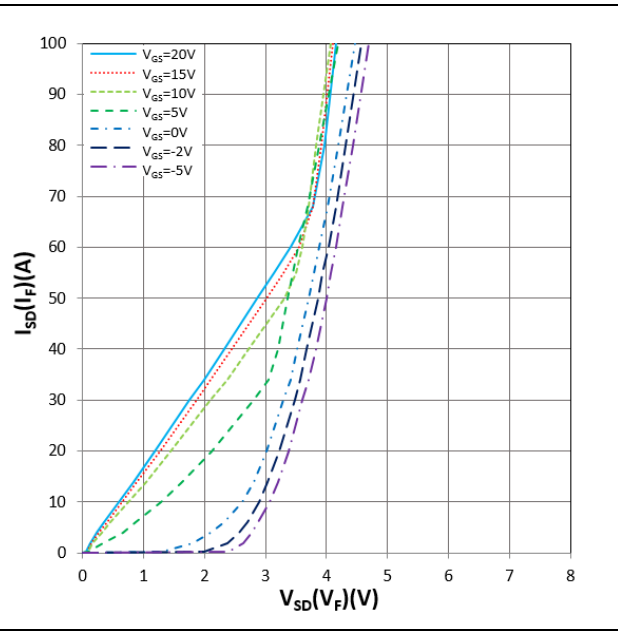


Figure 8.  $I_{S_D}(I_F)$  vs  $V_{S_D}(V_F)$   
 $T_j = 175^\circ\text{C}$ ,  $V_{G_S}$  parameter

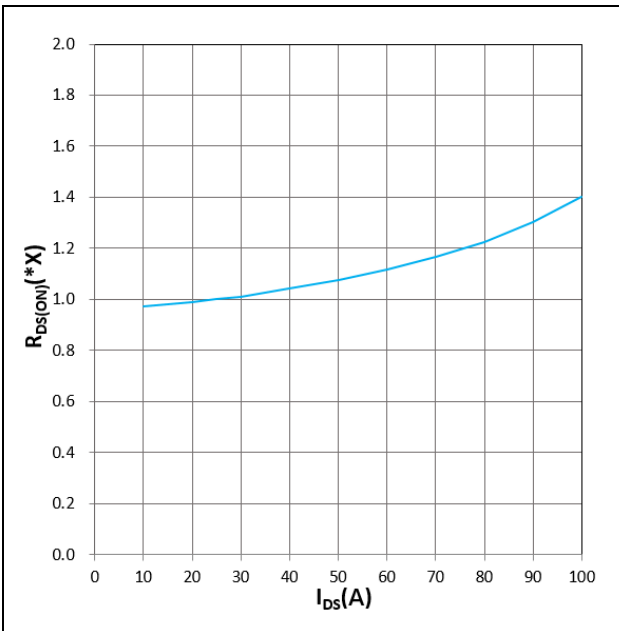


Figure 9.  $R_{DS(ON)}$  vs  $I_{DS}$   
 $V_{GS} = 20V$ ,  $1.0X = 36m\Omega$

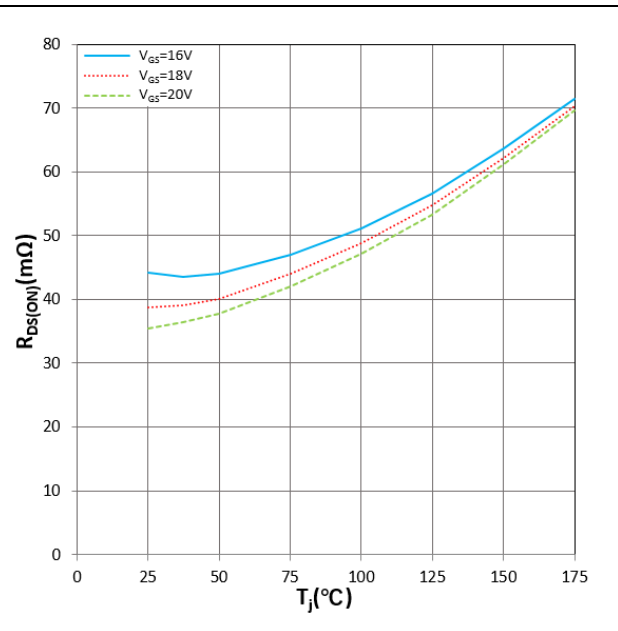


Figure 10.  $R_{DS(ON)}$  vs  $T_j$   
 $I_D = 25A$

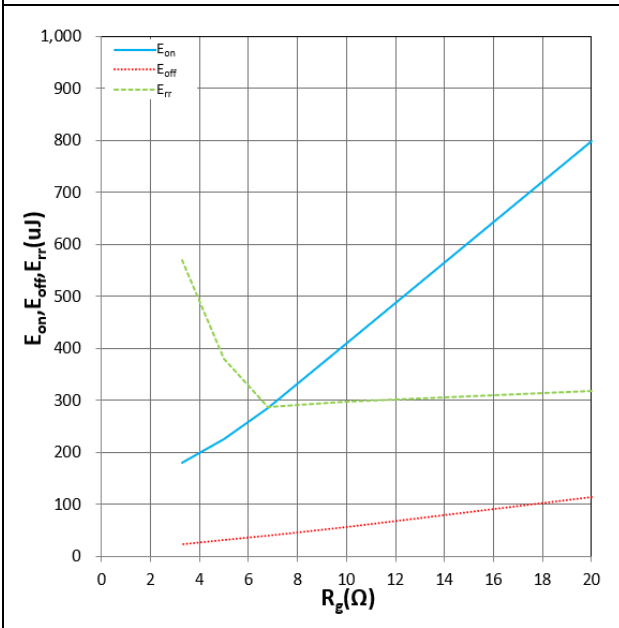


Figure 11.  $E_{on}$ ,  $E_{off}$ ,  $E_{rr}$  vs  $R_G$   
 $T_j = 25^\circ C$ ,  $V_{DD} = 800V$ ,  $I_D = 25A$ ,  $V_{GS} = +18/-4V$

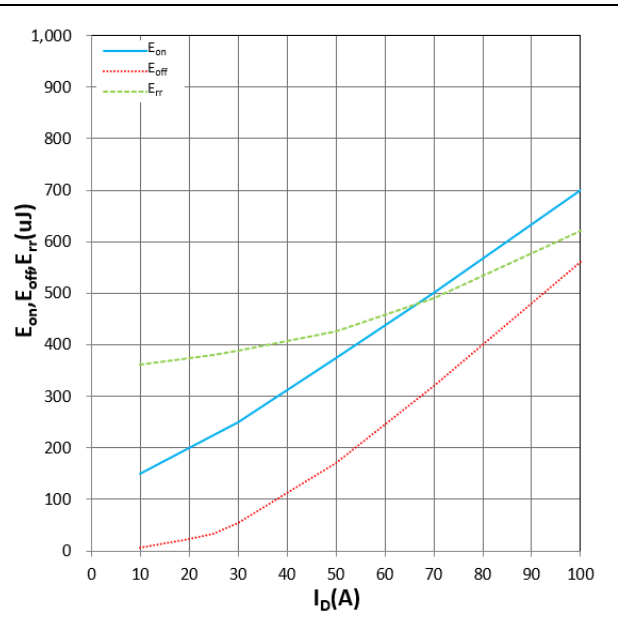


Figure 12.  $E_{on}$ ,  $E_{off}$ ,  $E_{rr}$  vs  $I_D$   
 $T_j = 25^\circ C$ ,  $V_{DD} = 800V$ ,  $R_G = 5.1\Omega$ ,  $V_{GS} = +18/-4V$

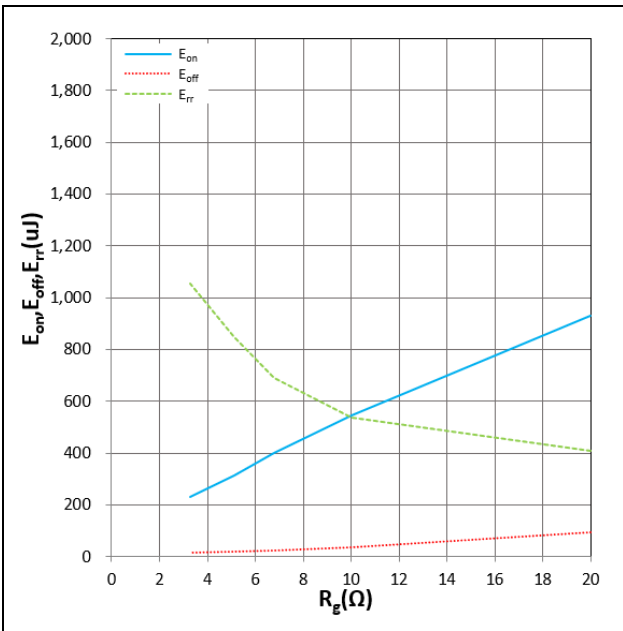


Figure 13.  $E_{on}$ ,  $E_{off}$ ,  $E_{rr}$  vs  $R_g$   
 $T_j = 150^\circ C$ ,  $V_{DD} = 800V$ ,  $I_D = 25A$ ,  $V_{GS} = +18/-4V$

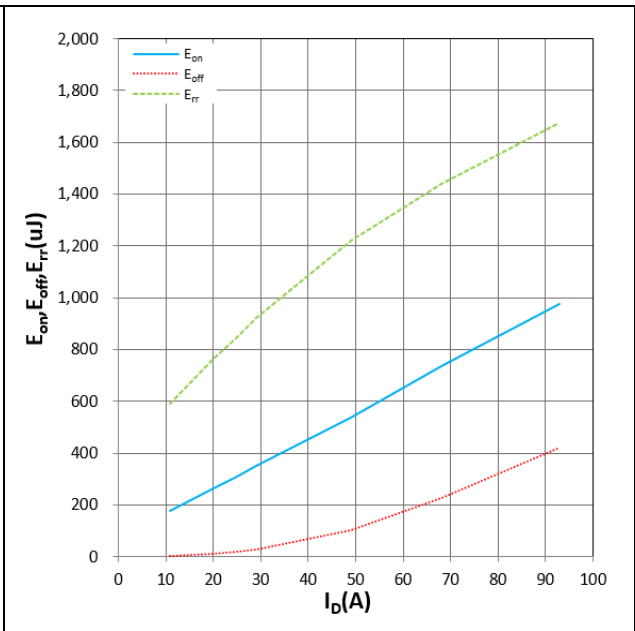


Figure 14.  $E_{on}$ ,  $E_{off}$ ,  $E_{rr}$  vs  $I_D$   
 $T_j = 150^\circ C$ ,  $V_{DD} = 800V$ ,  $R_g = 5.1\Omega$ ,  $V_{GS} = +18/-4V$

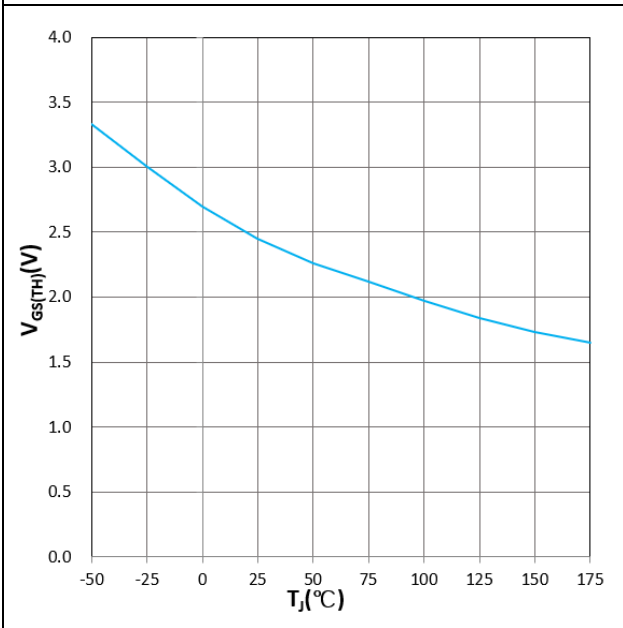


Figure 15.  $V_{GS(TH)}$  vs  $T_j$   
 $V_{DS} = V_{GS}$ ,  $I_{DS} = 20mA$

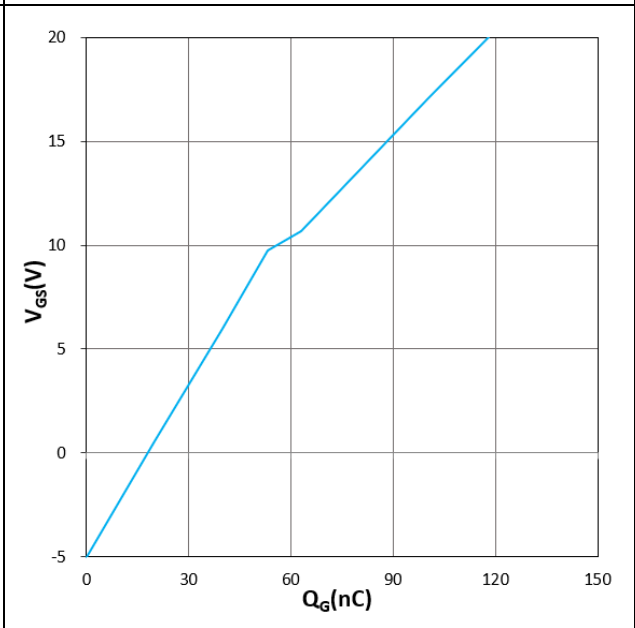


Figure 16.  $V_{GS}$  vs  $Q_g$   
 $V_{DD} = 800V$ ,  $I_D = 40A$



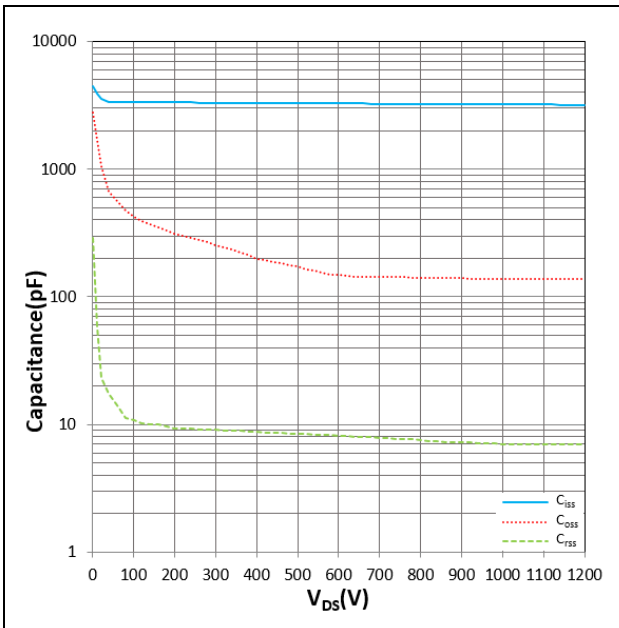


Figure 17.  $C_{iss}$ ,  $C_{oss}$ ,  $C_{rss}$  vs  $V_{DS}$   
 $T_j = 25^\circ\text{C}$

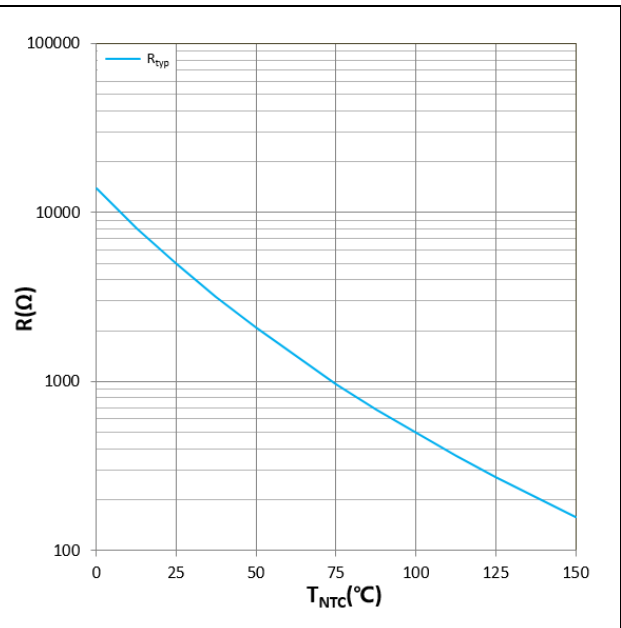
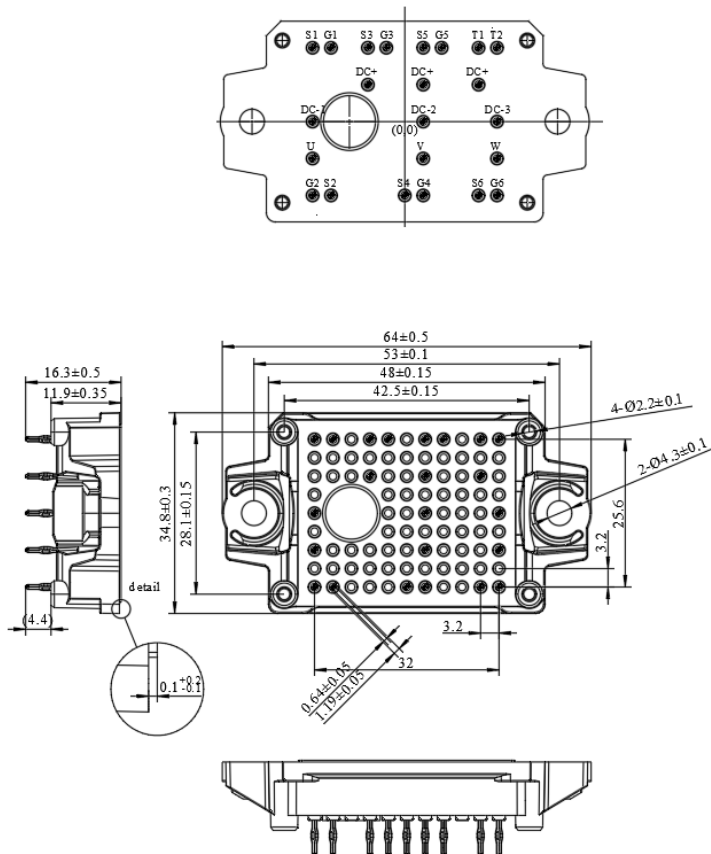


Figure 18.  $R$  vs  $T_{NTC}$

## Package dimensions



Pin table

Pin	X	Y
T2	16	12.8
T1	12.8	12.8
G5	6.4	12.8
S5	3.2	12.8
G3	-3.2	12.8
S3	-6.4	12.8
G1	-12.8	12.8
S1	-16	12.8
DC+	12.8	6.4
DC+	3.2	6.4
DC+	-6.4	6.4
DC-3	16	0
DC-2	3.2	0
DC-1	-16	0
W	16	-6.4
V	3.2	-6.4
U	-16	-6.4
G6	16	-12.8
S6	12.8	-12.8
G4	3.2	-12.8
S4	0	-12.8
S2	-12.8	-12.8
G2	-16	-12.8

### IMPORTANT NOTICE:

This product data sheet describes the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively under the terms and conditions of the supply agreement. There will be no guarantee or of any kind for the product and its characteristics.

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