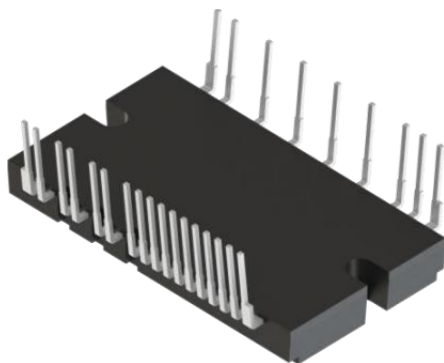


Description

The DFS80FB12M6C1 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:1200V
- 80m Ω $R_{DS(on)}$ @ $T_j = 25^{\circ}\text{C}$
- 149m Ω $R_{DS(on)}$ @ $T_j = 175^{\circ}\text{C}$
- Low Switching Losses
- 175 $^{\circ}\text{C}$ maximum junction temperature
- Si₃N₄ AMB
- Thermistor inside

Applications

- Automotive high voltage auxiliary motors:
Compressor motor control for air conditioner
Oil/water pumps
Super/turbo chargers
- DC/DC converter
- Motor converter
- Uninterruptible Power Supplier
- High Frequency Switching application

Circuit diagram

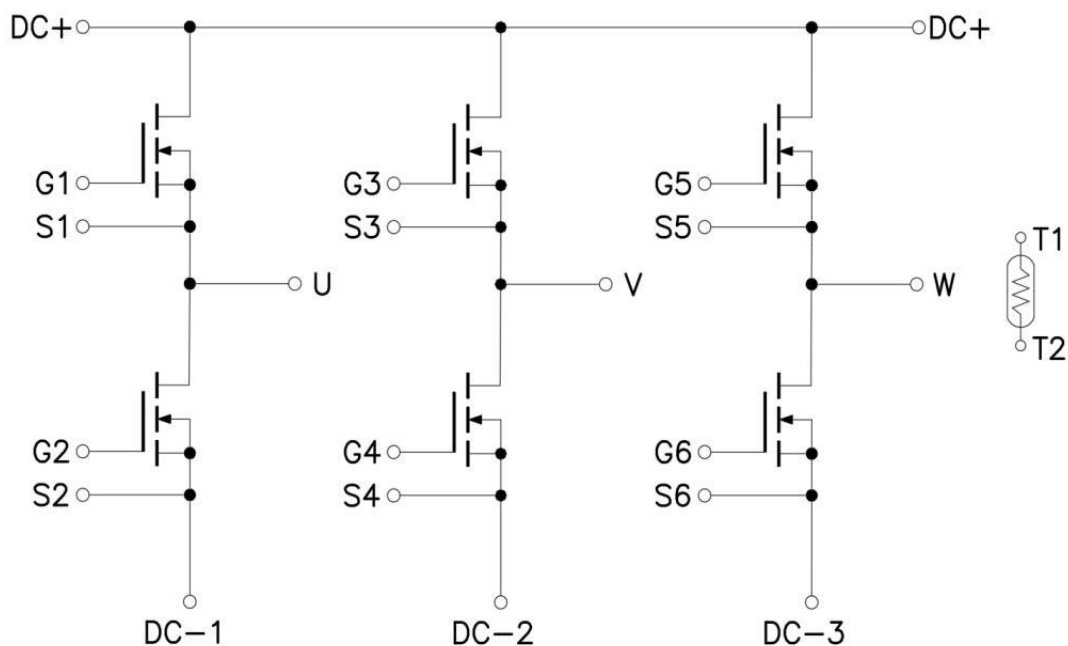


Figure 1. Out drawing & circuit diagram for DFS80FB12M6Q1

Pin Configuration and Marking Information

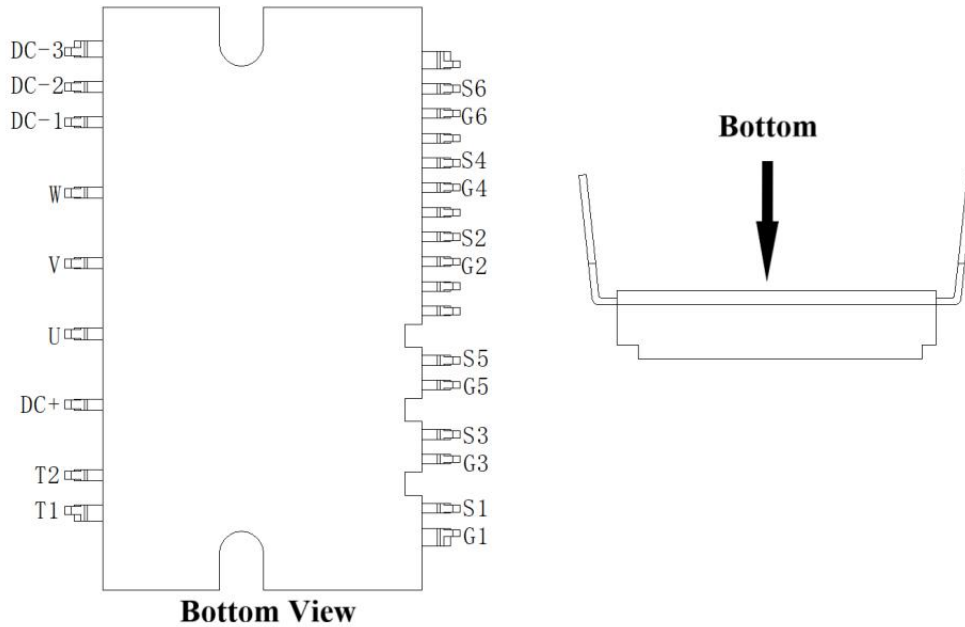


Figure 2. Pin configuration

Symbol	Description
U, V, W	Output terminal of 3 Phase
DC-1, 2, 3	DC- Bus connection
DC+	DC+ Bus connection
G1, G3, G5	High side gate signal terminal
S1, S3, S5	High side source signal terminal
G2, G4, G6	Low side gate signal terminal
S2, S4, S6	Low side source 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	4.3	mm
	Terminal to Heatsink	3.9	mm

Creepage distance	Terminal to Terminal	4.3	mm
	Terminal to Heatsink	5.5	mm

Parameter	Condition	Value			Unit
		Min.	Typ.	Max.	
Mounting torque	Mounting screw: M3	0.6	0.7	0.8	N · m

Maximum Ratings (T_j=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V _{DSS}	Drain-Source Voltage	G-S Short	1200	V
V _{GSSsurge}	G-S Voltage(t _{surge} <200nsec)	D-S Short, Note1	-10 to 25	V
I _{DS}	DC Continuous Drain Current	T _f =25°C, V _{GS} = -5/+20V, Note2	34	A
I _{DS}	DC Continuous Drain Current	T _f =100°C, V _{GS} = -5/+20V	25	A
I _{SD}	Source (Body Diode) Current	T _f =100°C, with ON signal	25	A
I _{DP}	Drain Pulse Current, Peak	Less than 1ms, Note3	80	A
T _j	junction temperature	-	-40 to 175	°C
T _{stg}	Storage temperature	-	-40 to 125	°C

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

Note2: Case temperature(T_f) is defined on the surface ofAMB 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 ₂₅	Resistance	T _C =25°C	-	10	-	kΩ
ΔR/R	Deviation of R ₁₀₀	T _C =100°C, R ₁₀₀ =854Ω	-3	-	3	%
P ₂₅	Power dissipation	T _C =25°C	-	-	326	W
B _{25/50}	B-value	R ₂ = R ₂₅ exp [B _{25/50} (1/T ₂ - 1/(298,15 K))]	-	3590	-	K
B _{25/85}	B-value	R ₂ = R ₂₅ exp [B _{25/85} (1/T ₂ - 1/(298,15 K))]	-	3635	-	K
B _{25/100}	B-value	R ₂ = R ₂₅ exp [B _{25/100} (1/T ₂ - 1/(298,15 K))]	-	3650	-	K

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MOSFET Electrical characteristics (T_j=25°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		1200	-	-	V	
I _{DSS}	Zero gate voltage drain Current	V _{DS} =1200V, V _{GS} =0V		-	3	-	μA	
V _{GS(th)}	Gate-Source threshold Voltage	I _D =10mA, V _{DS} =V _{GS}		2	2.8	4	V	
I _{GSS+}	Gate-Source Leakage Current	V _{GS} =20V, V _{DS} =0V, T _j =25°C		-	-	100	nA	
I _{GSS-}		V _{GS} =-5V, V _{DS} =0V, T _j =25°C		-100	-	-	nA	
R _{DS(on)} (Chip)	Static drain-source	I _D =40A	T _j =25°C	-	80	100	mΩ	
	On-state resistance	V _{GS} =+20V	T _j =175°C	-	149	-	mΩ	
C _{iss}	Input Capacitance	V _{DS} =1000V, V _{GS} =0V, f =200kHz, V _{AC} =25mV		-	146	-	pF	
C _{oss}	Output Capacitance			-	62	-	pF	
C _{rss}	Reverse transfer Capacitance			-	3	-	pF	
Q _G	Total gate charge	V _{DD} =800V, I _D =20A, V _{GS} =-5/+20V		-	58	-	nC	
R _{Gint}	Internal Gate Resistance	T _j =25°C		-	3	-	Ω	
t _{d(on)}	Turn-on delay time	V _{DD} =800V I _D =20A, R _G =2.5Ω V _{GS} =-5/+20V Inductive load switching operation	T _j =25°C	-	10	-	ns	
			T _j =150°C	-	-	-		
t _r	Rise time		T _j =25°C	-	7	-	ns	
			T _j =150°C	-	-	-		
t _{d(off)}	Turn-off delay time		T _j =25°C	-	17	-	ns	
			T _j =150°C	-	-	-		
t _f	Fall time		T _j =25°C	-	14	-	ns	
			T _j =150°C	-	-	-		
E _{on}	Turn-on power dissipation		T _j =25°C	-	410	-	μJ	
			T _j =150°C	-	530	-		
E _{off}	Turn-off power dissipation		T _j =25°C	-	18	-	μJ	
			T _j =150°C	-	61	-		
R _{th(j-c)}	FET Thermal Resistance	Junction to Case/MOSFET		-	0.72	-	K/W	

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Body Diode Electrical characteristics ($T_j=25^\circ\text{C}$ unless otherwise specified, chip: Target)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_{SD}	Body Diode Forward Voltage	$V_{GS} = -5\text{V}$ $I_{SD} = 20\text{A}$	$T_j = 25^\circ\text{C}$	-	4.4	-	V
			$T_j = 175^\circ\text{C}$	-	3.86	-	
T_{rr}	Reverse recovery time	$V_{DD} = 800\text{V}$ $I_D = 20\text{A}$, $R_G = 2.5\Omega$ $V_{GS} = -5/+15\text{V}$	$T_j = 25^\circ\text{C}$	-	20	-	ns
			$T_j = 150^\circ\text{C}$	-	-	-	
Q_{rr}	Reverse recovery charge	Inductive load switching operation	$T_j = 25^\circ\text{C}$	-	128	-	nC
			$T_j = 150^\circ\text{C}$	-	-	-	

Test Conditions

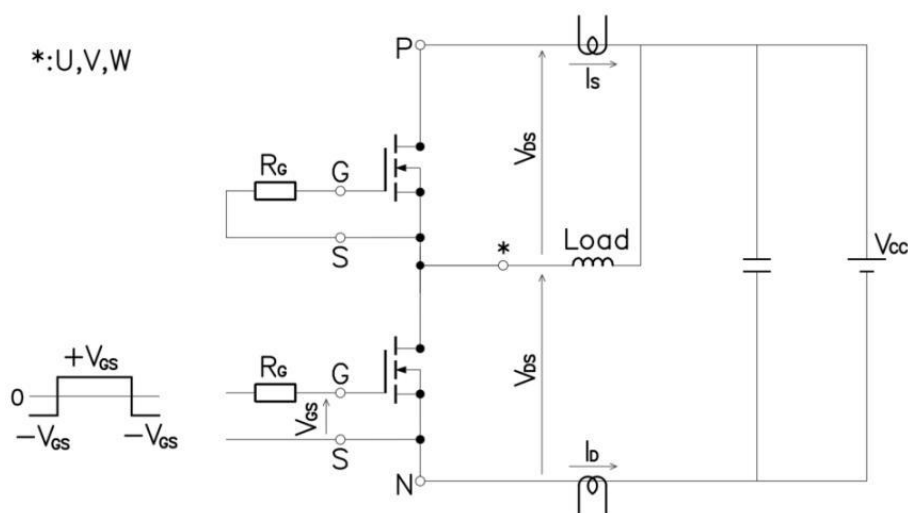


Figure 3. Switching time measure circuit

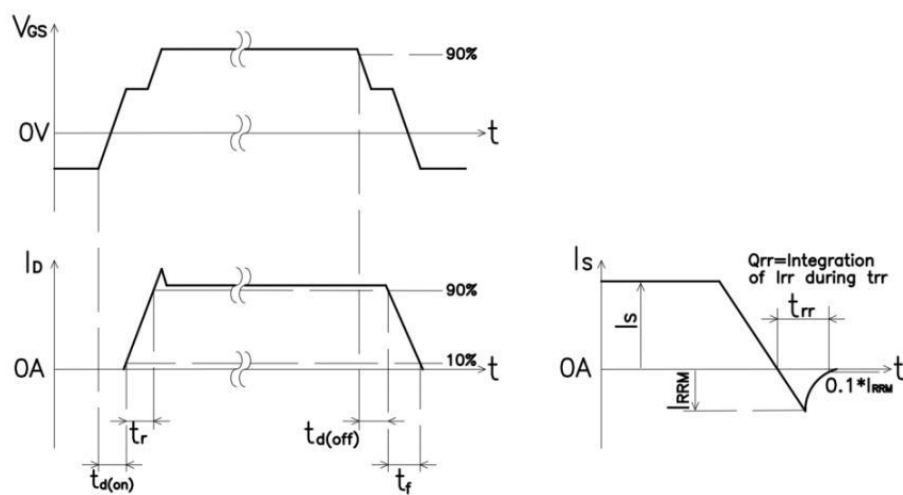


Figure 4. Switching time definition

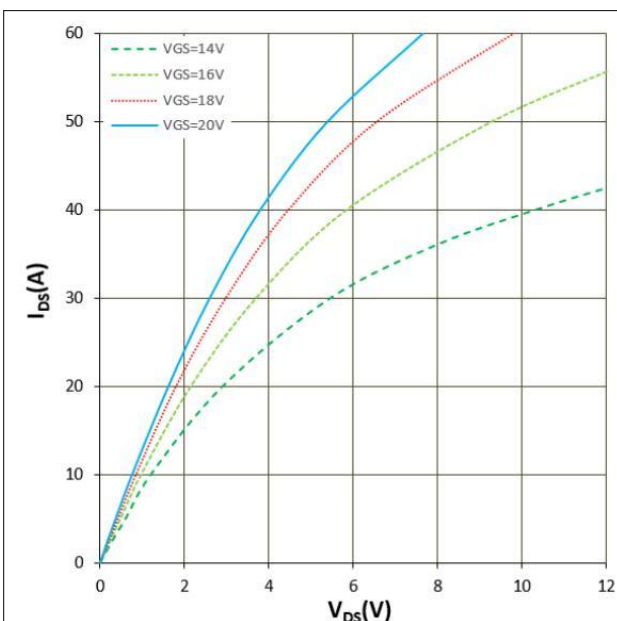


Figure 5. I_{DS} vs V_{DS}
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

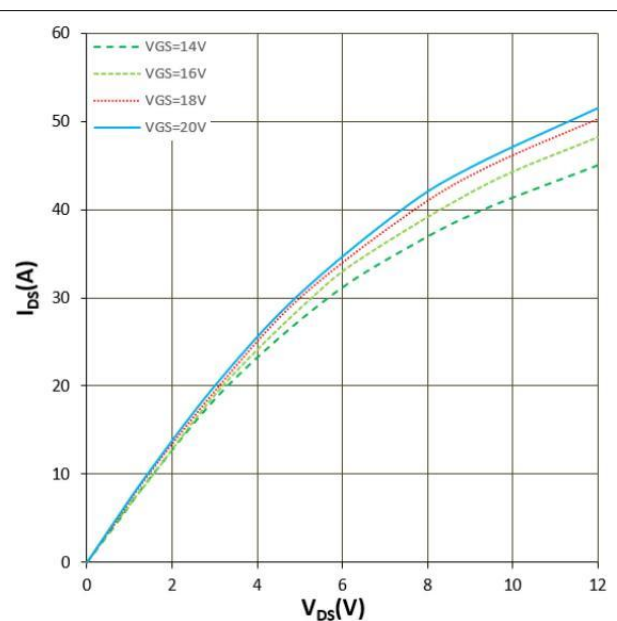


Figure 6. I_{DS} vs V_{DS}
 $T_j = 175^\circ\text{C}$, V_{GS} parameter

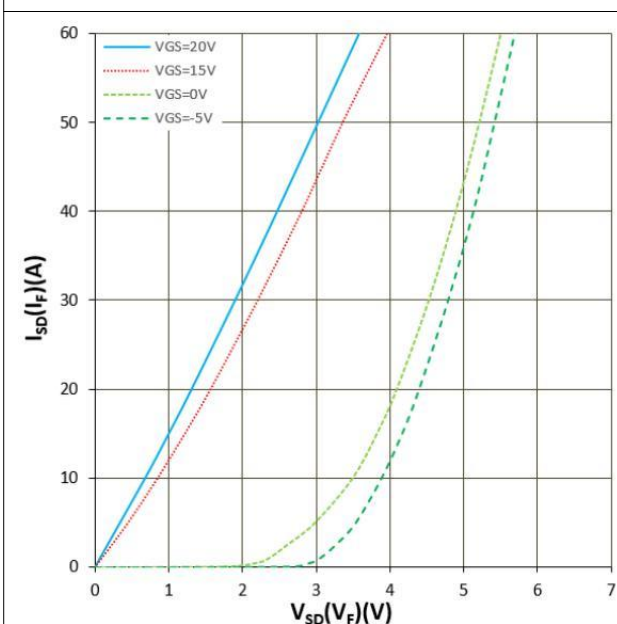


Figure 7. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

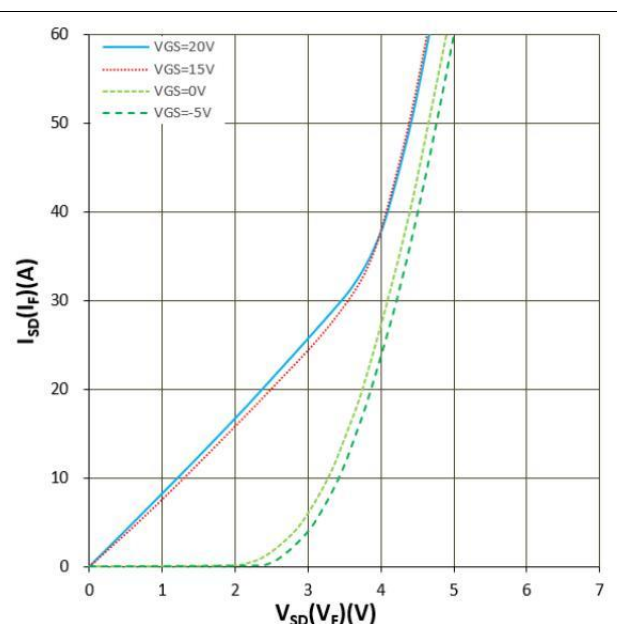


Figure 8. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 175^\circ\text{C}$, V_{GS} parameter

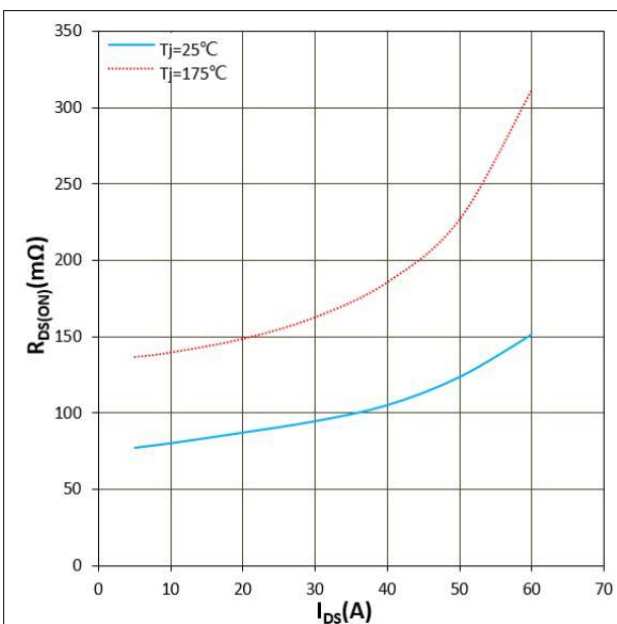


Figure 9. $R_{DS(on)}$ vs I_{DS}
 $V_{GS} = 20V$

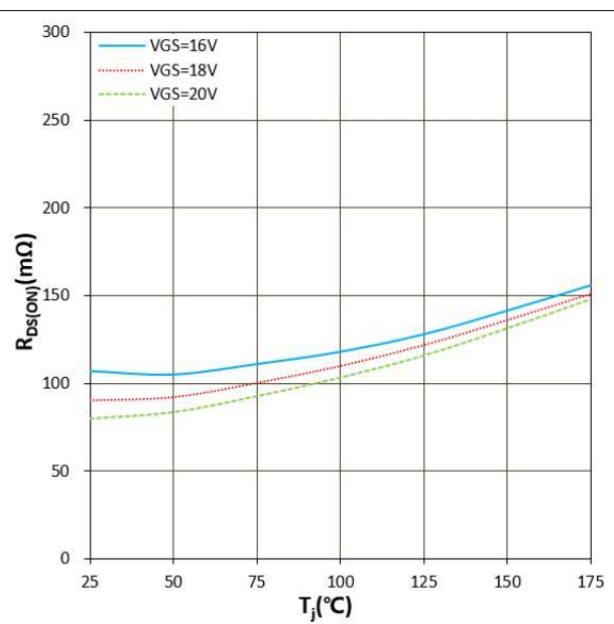


Figure 10. $R_{DS(on)}$ vs T_j
 $T_j = 25^\circ C$, $I_D = 20A$

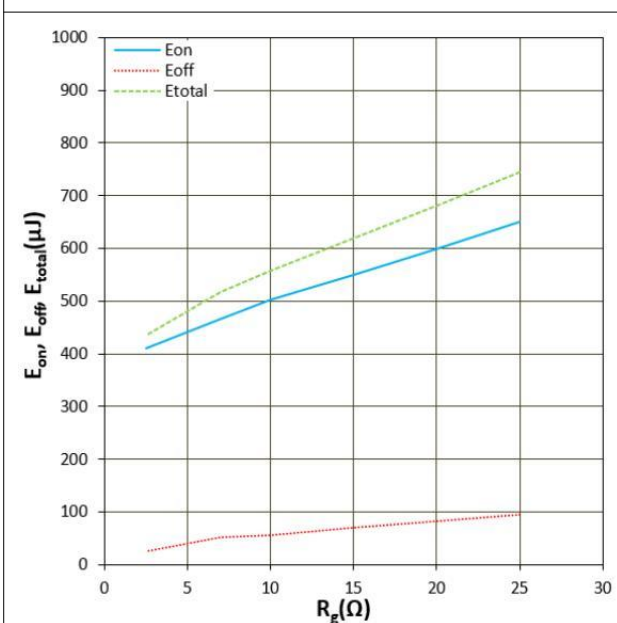


Figure 11. E_{on} , E_{off} , E_{total} vs R_G
 $T_j = 25^\circ C$, $I_D = 20A$, $V_{GS} = -5/+20V$

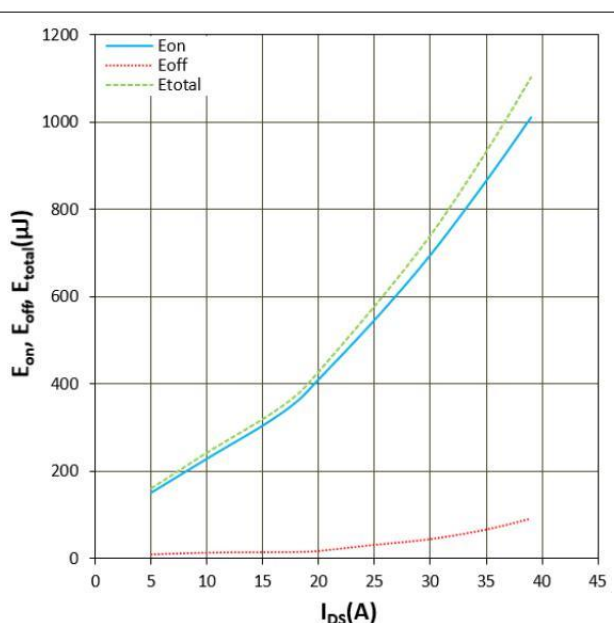


Figure 12. E_{on} , E_{off} , E_{total} vs I_D
 $T_j = 25^\circ C$, $R_G = 2.5\Omega$, $V_{GS} = -5/+20V$

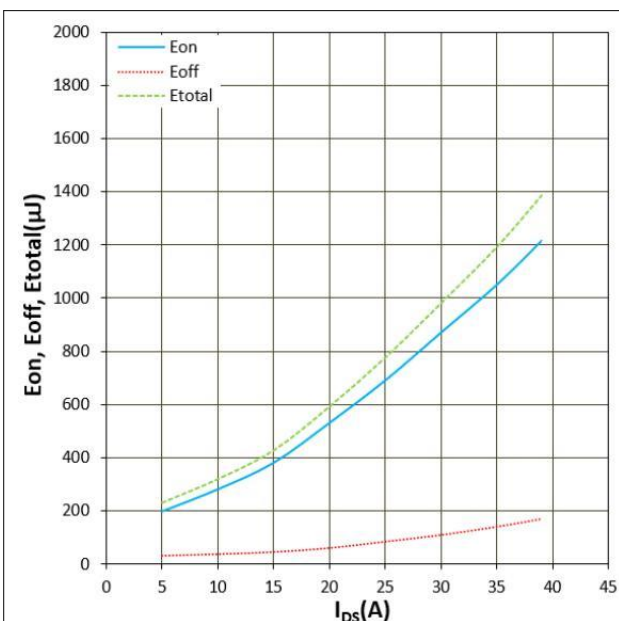


Figure 13. E_{on} , E_{off} , E_{total} vs I_D
 $T_j = 150^\circ C$, $R_G = 2.5\Omega$, $V_{GS} = -5/+20V$

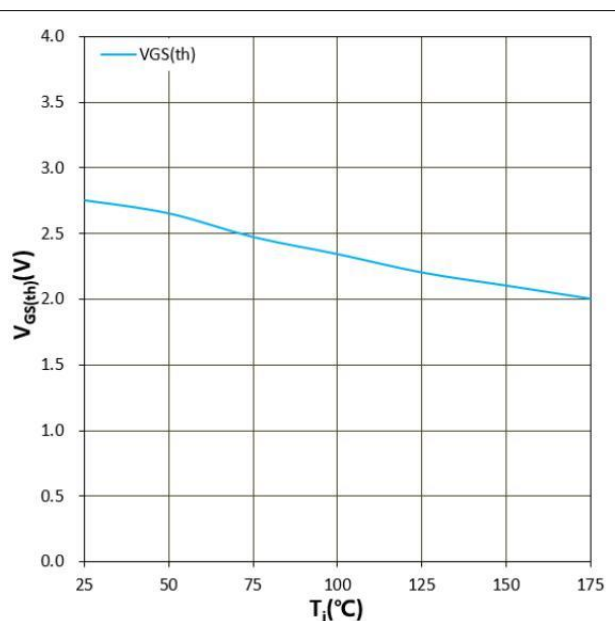


Figure 14. $V_{GS(th)}$ vs T_j
 $V_{DS} = V_{GS}$, $I_{DS} = 10mA$

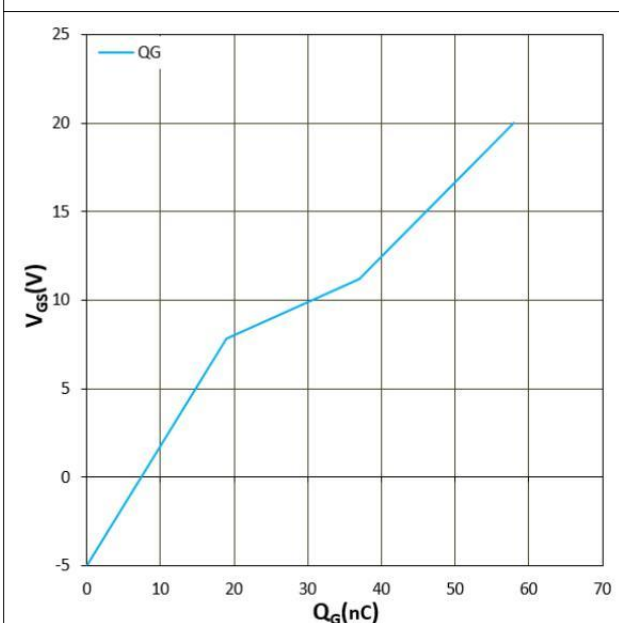


Figure 15. V_{GS} vs Q_G
 $T_j = 25^\circ C$, $V_{DD} = 800V$, $I_D = 20A$

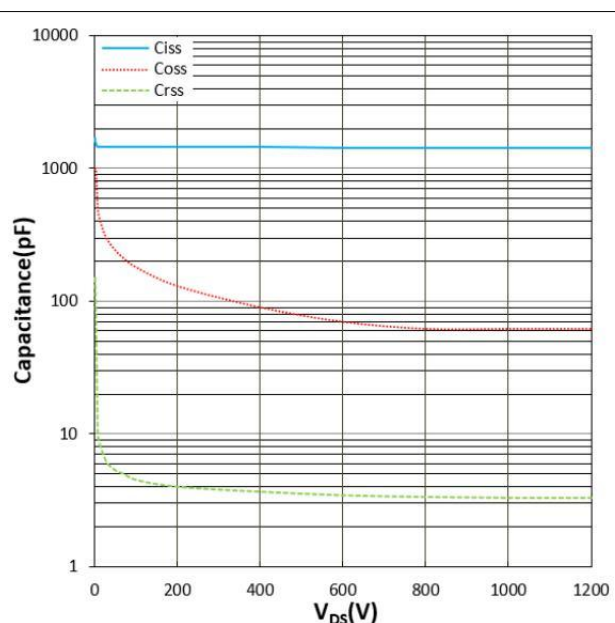
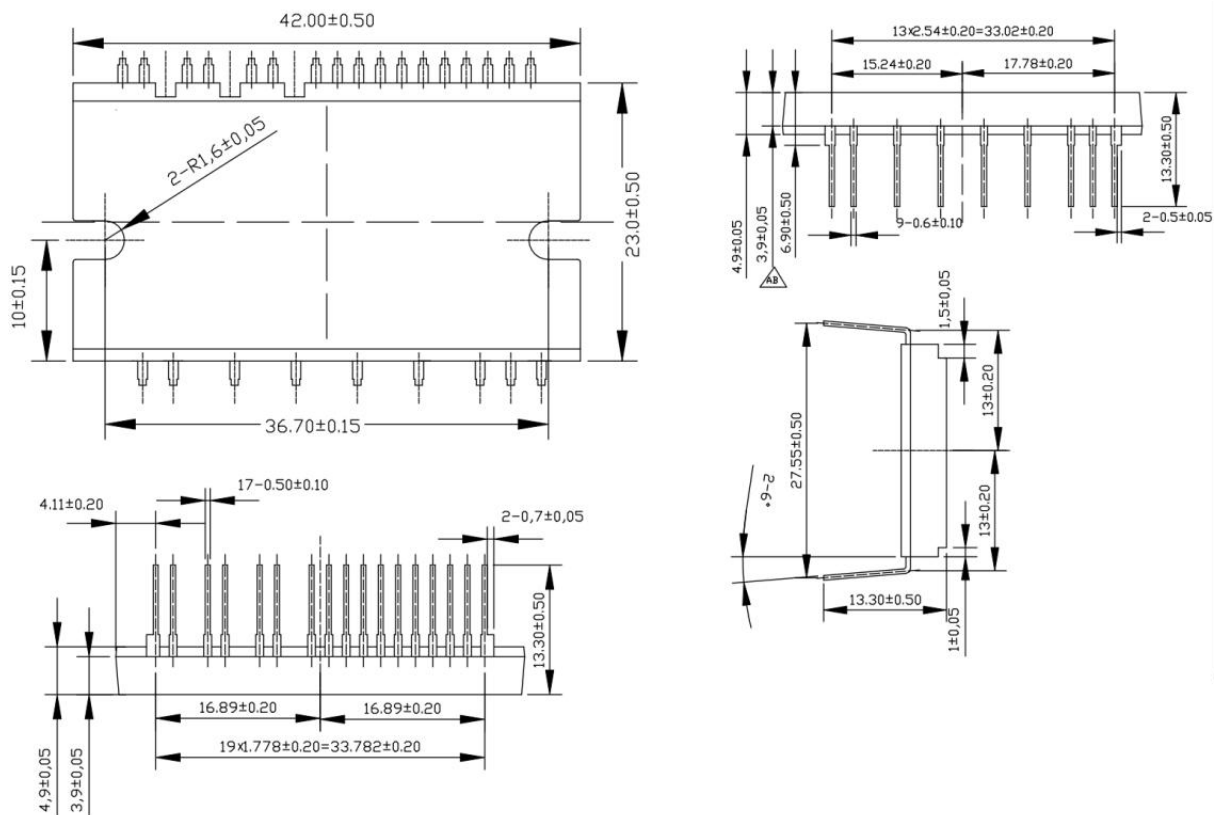


Figure 16. C_{iss} , C_{oss} , C_{rss} vs V_{DS}
 $T_j = 25^\circ C$

Package dimensions



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