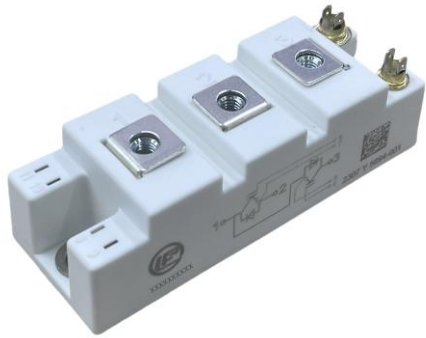


Description

The DFS15HF12DEA1 is 34mm package SiC power module. It offers lower losses and higher energy for applications such as motor drives, inverter, UPS and welding applications.



Features

- 1200V/15mΩ
- High Frequency Operation
- Si₃N₄ AMB substrate
- Fast intrinsic diode with low reverse recovery

Applications

- Motor drives
- Inverter
- UPS
- Welding application

Circuit diagram

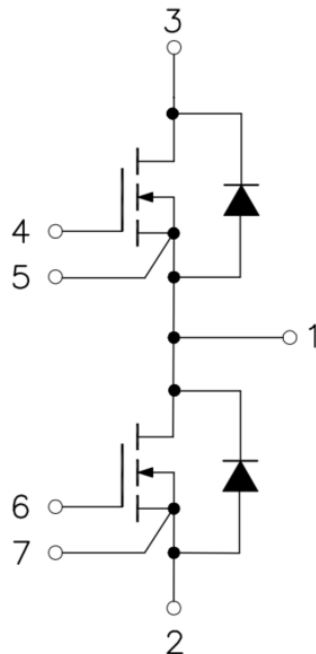


Figure 1. Out drawing & circuit diagram for DFS15HF12DEA1

Pin Configuration and Marking Information

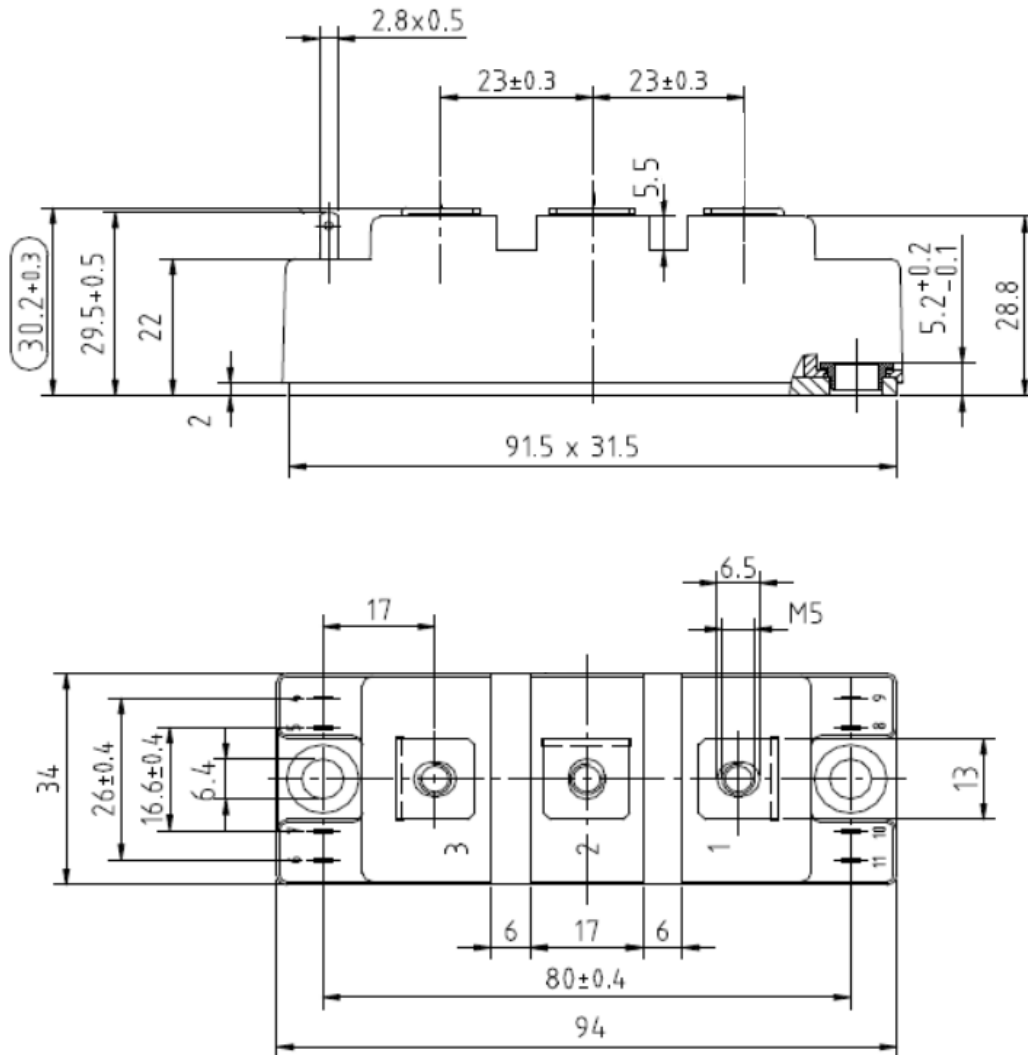


Figure 2. Pin configuration

Module

Parameter	Conditions	Value	Unit
Isolation Voltage	RMS, f = 50Hz, t = 1min	2.5	kV
Material of module baseplate	-	Cu	-
Creepage distance	terminal to heatsink terminal to terminal	26 21	mm
Clearance	terminal to heatsink terminal to terminal	23.6 10	mm
CTI	-	>200	-
Module lead resistance, terminals – chip	T _c = 25°C	0.8	mΩ
Mounting torque for module mounting	M5, M6	3 to 6	Nm
Weight	-	160	g

Maximum Ratings (SiC MOSFET, $T_j=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{DSS}	Drain-Source Voltage	G-S Short	1200	V
V_{GSS}	Gate-Source Voltage	D-S Short, AC frequency $\geq 1\text{Hz}$, Note1	-10 to 23	V
I_{DS}	DC Continuous Drain Current	$T_C=25^\circ\text{C}$, $V_{GS}=18\text{V}$	126	A
		$T_C=100^\circ\text{C}$, $V_{GS}=18\text{V}$	90	A
I_{SD}	Source-Drain Current(diode)	$T_C=25^\circ\text{C}$, with ON signal	126	A
		$T_C=100^\circ\text{C}$, with ON signal	90	A
I_{DSM}	Pulse Drain Current	$T_C=25^\circ\text{C}$, Pulse width =1ms, $V_{GS}=18\text{V}$, Note2	340	A
P_{tot}	Total Power Dissipation	$T_C=25^\circ\text{C}$	893	W
T_{jmax}	Max Junction Temperature	-	175	$^\circ\text{C}$
T_{stg}	Storage Temperature	-	-55 to 175	$^\circ\text{C}$

Note1: Recommended Operating Value, +18V/-4V

Note2: Pulse width limited by maximum junction temperature

SiC 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	$V_{GS}=0\text{V}$, $I_D=100\mu\text{A}$	1200	-	-	V	
$V_{GS(th)}$	Gate-source threshold Voltage	$I_D=27\text{mA}$, $V_{DS}=V_{GS}$	$T_j=25^\circ\text{C}$	2.0	2.8	3.7	V
			$T_j=150^\circ\text{C}$	-	2.1	-	
			$T_j=175^\circ\text{C}$	-	2.0	-	
I_{DSS}	Zero gate voltage drain Current	$V_{DS}=1200\text{V}$, $V_{GS}=0\text{V}$	$T_j=25^\circ\text{C}$	0	1	50	μA
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=18\text{V}$, $V_{DS}=0\text{V}$	$T_j=25^\circ\text{C}$	0	1	200	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	$I_D=80\text{A}$ $V_{GS}=+18\text{V}$	$T_j=25^\circ\text{C}$	-	15	18	mΩ
			$T_j=150^\circ\text{C}$	-	25	-	
			$T_j=175^\circ\text{C}$	-	28	-	
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	$I_D=80\text{A}$ $V_{GS}=+18\text{V}$	$T_j=25^\circ\text{C}$	-	1.89	-	V
			$T_j=150^\circ\text{C}$	-	3.15	-	
			$T_j=175^\circ\text{C}$	-	3.53	-	
C_{iss}	Input Capacitance	$V_D=1000\text{V}$, $V_{GS}=0\text{V}$ $f=1\text{MHz}$, $V_{AC}=25\text{mV}$	-	4.3	-	nF	
C_{oss}	Output Capacitance		-	0.214	-		
C_{rss}	Reverse transfer Capacitance		-	0.019	-		
R_{Gint}	Internal gate resistor	$f=1\text{MHz}$, $I_D=0\text{V}$	-	1.4	-	Ω	
Q_g	Total gate charge	$V_{DD}=800\text{V}$, $I_D=80\text{A}$, $V_{GS}=+18/-4\text{V}$	-	222	-	nC	
Q_{gs}	Gate-source charge		-	55	-		
Q_{gd}	Gate-drain charge		-	88	-		
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case, Note1	-	0.168	-	$^\circ\text{C}/\text{W}$	

Note1: Assumes Thermal Conductivity of grease is 2.8 W/m · K and thickness is 50um.

Body Diode Electrical characteristics (T_j=25°C unless otherwise specified, chip: Target)

Symbol	Item	Condition	Value			Unit	
			Min.	Typ.	Max.		
V _{SD}	Body Diode Forward Voltage	V _{GS} = -4V, I _{SD} = 40A	T _j = 25°C	-	4.1	-	V
			T _j = 150°C	-	3.7	-	
			T _j = 175°C	-	3.6	-	
I _S	Continuous Diode Forward Current	V _{GS} = -4V	T _j = 25°C	-	-	97	A
T _{rr}	Reverse recovery time	V _{DD} = 800V, I _D = 80A V _{GS} = +18/-4V, R _g = 1Ω Inductive load switching operation	T _j = 25°C	-	21	-	ns
Q _{rr}	Reverse recovery charge		T _j = 25°C	-	470	-	nC
I _{rr}	Diode switching power dissipation		T _j = 25°C	-	40	-	A

Test Conditions

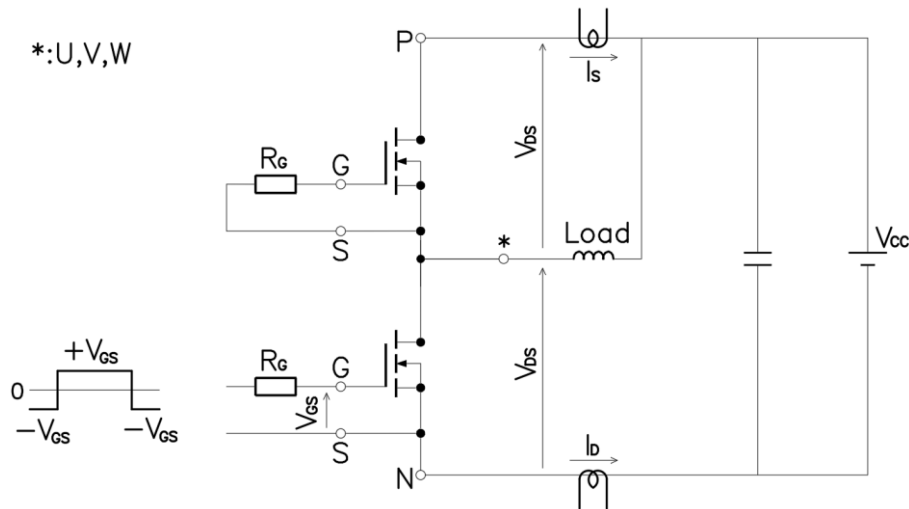


Figure 3. Switching time measure circuit

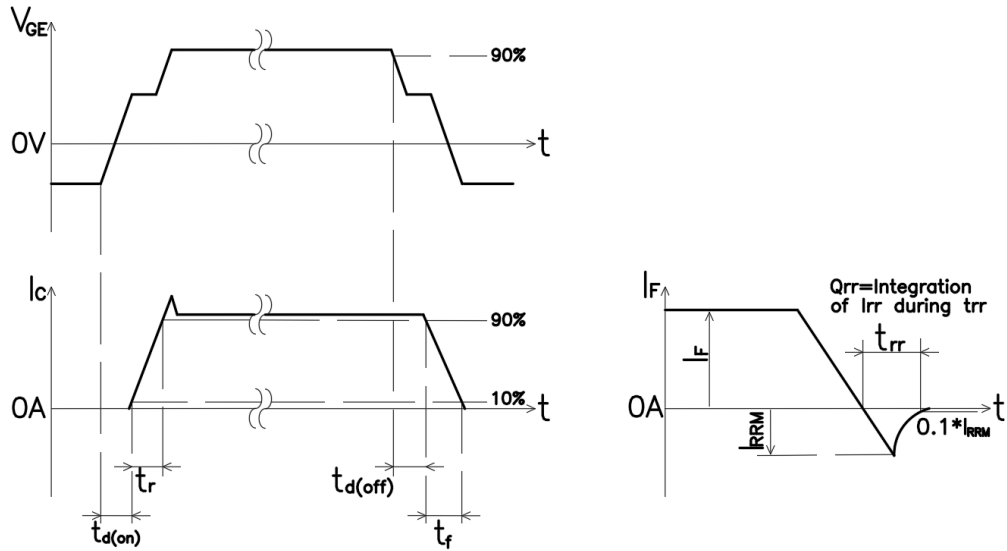
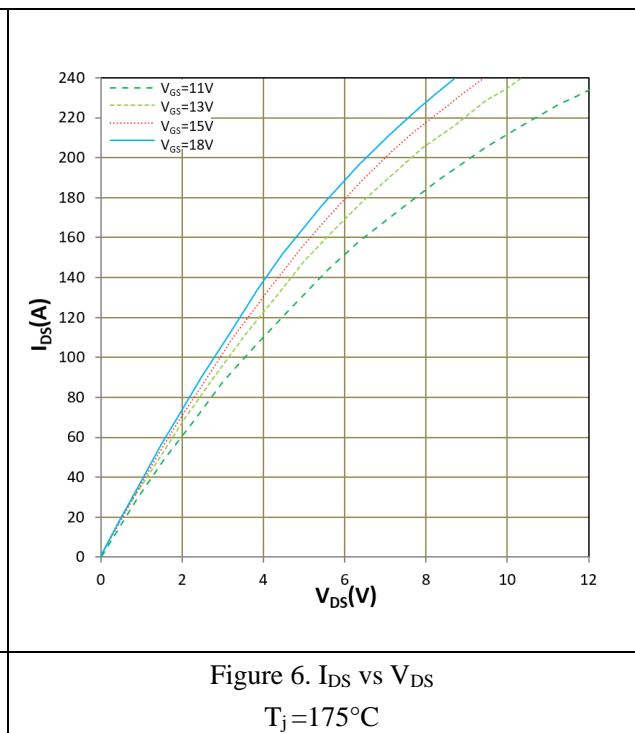
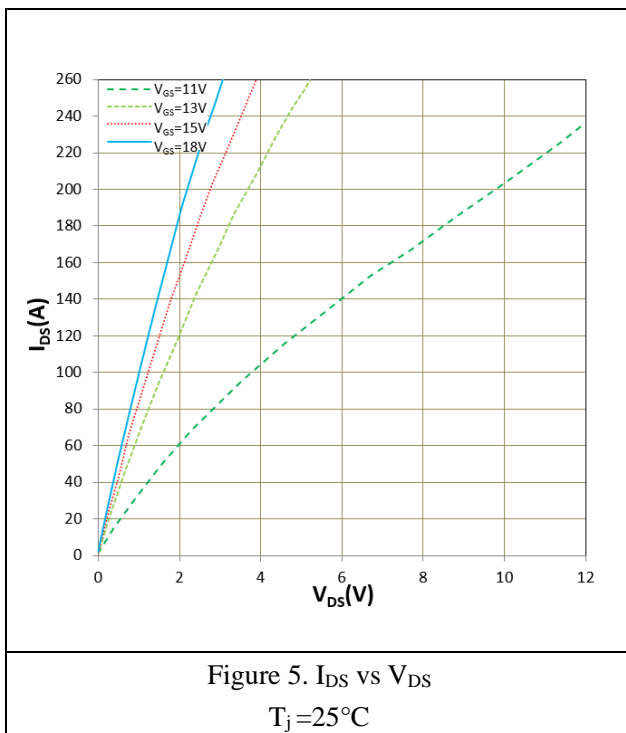


Figure 4. Switching time definition



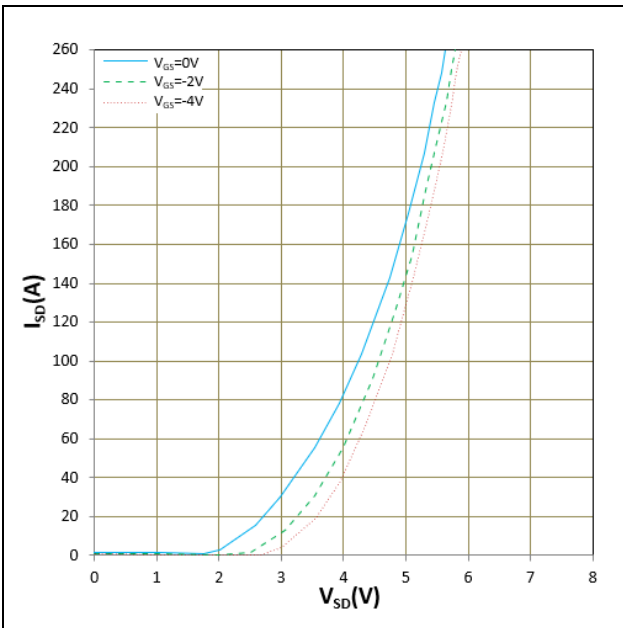


Figure 7. I_{SD} vs V_{SD}
 $T_j = 25^\circ\text{C}$

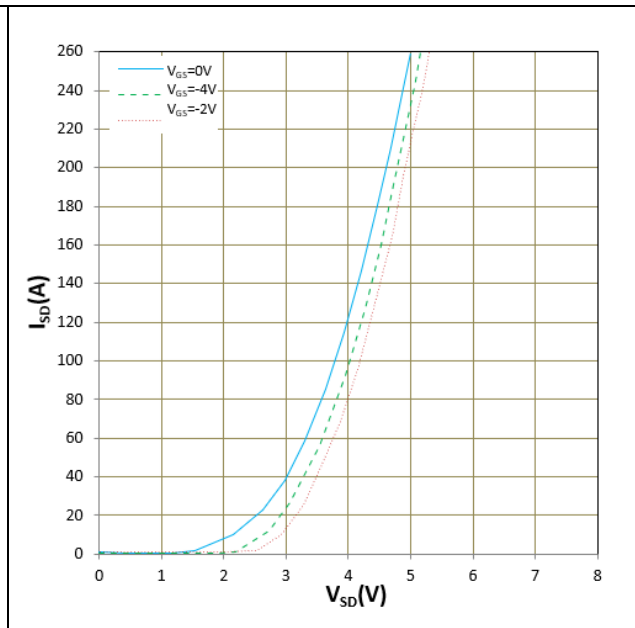


Figure 8. I_{SD} vs V_{SD}
 $T_j = 175^\circ\text{C}$

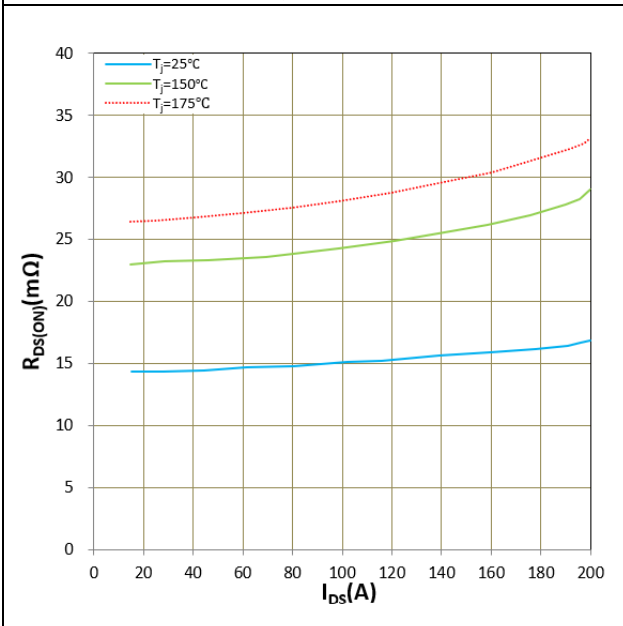


Figure 9. $R_{DS(ON)}$ vs I_{DS}

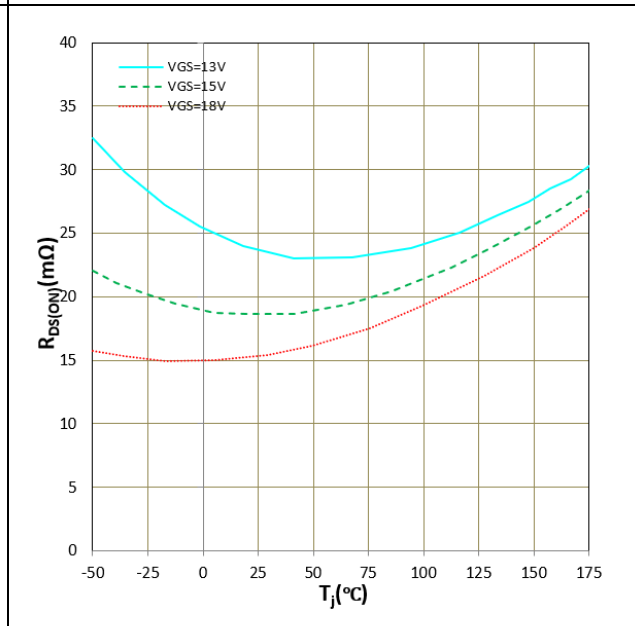


Figure 10. $R_{DS(ON)}$ vs T_j
 $I_{DS} = 80\text{A}$

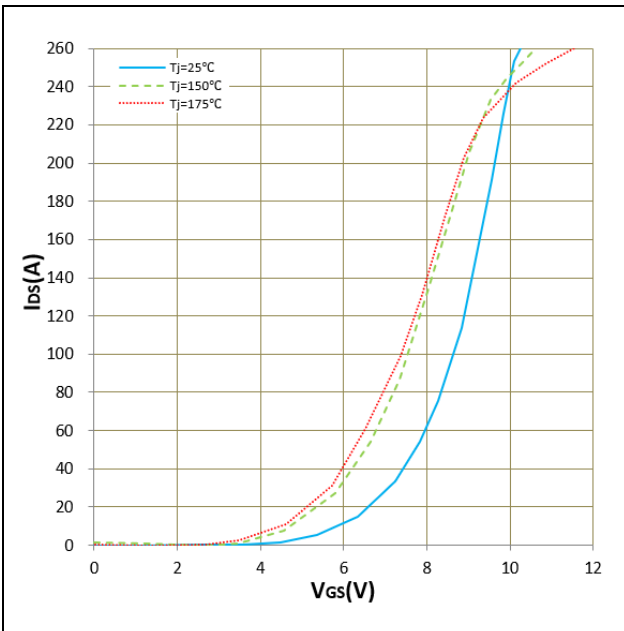


Figure 11. I_{DS} vs V_{GS}
 $V_{DS} = 20\text{V}$

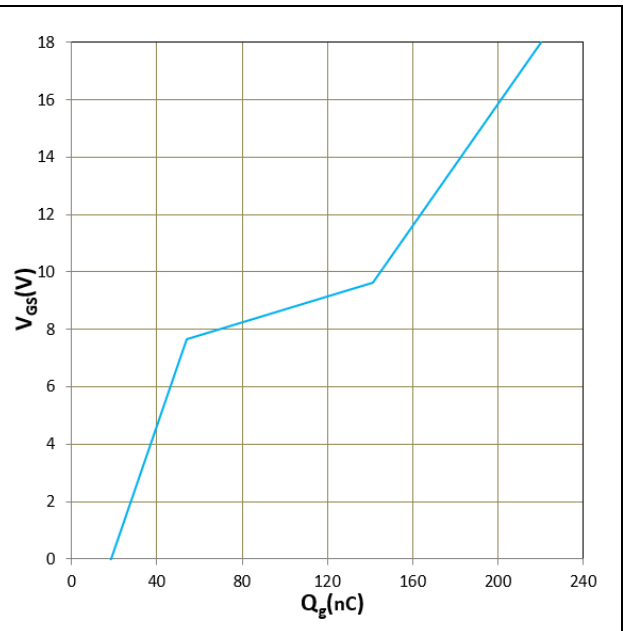


Figure 12. Gate charge
 $V_{DS} = 800\text{V}$, $I_{DS} = 80\text{A}$, $I_{GS} = 1\text{mA}$, $T_j = 25^\circ\text{C}$

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