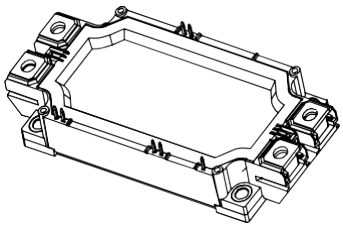
Silicon Carbide (SiC)
1200V 1.6mohm Half-Bridge MOSFET Module ED3

EDSC600X12K



PIM11, 152.00 x 62.15 x 20.80
CASE 180HT

The EDSC600X12K is a power module containing 1.6 mΩ /1200V SiC MOSFET half−bridge with SBD and a thermistor with Si_3N_4 AMB in an ED3 package.

Features
- 1.6 mΩ / 1200 V SiC MOSFET Half−Bridge
- Si_3N_4 AMB
- NTC Thermistor
- Low Inductive Layout
- Solderable Pins
- Isolated Base Plate
- SwiftSiC™

Typical Applications
- Motor Drives
- Servo Drives
- Solar Drives
- Uninterruptible Power Supply Systems (UPS)

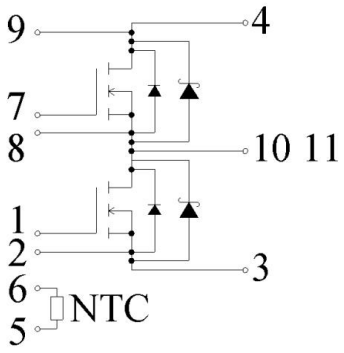
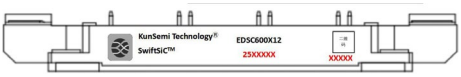


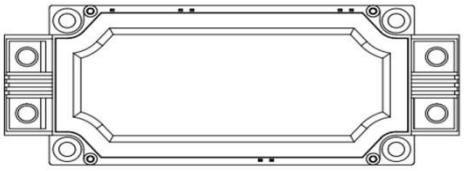
Figure 1. Schematic

MARKING DIAGRAM



EDSC600X12K = Device Code
25XXXX = Year and Week Code

PIN ASSIGNMENTS



ORDERING INFORMATION

Device	Package
EDSC600X12K	ED3

PIN DESCRIPTION

Pin	Name	Description
1	G2	T2 Gate
2	S2	T2 Source
3	DC-	DC Negative Bus Connection
4	DC+	DC Positive Bus Connection
5	TH2	Thermistor Connection 2
6	TH1	Thermistor Connection 1
7	G1	T1 Gate
8	S1	T1 Source
9	DS1	T1 Drain Sensing
10	OUT	Center Point of Half Bridge
11	OUT	Center Point of Half Bridge

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
SiC MOSFET			
Drain−Source Voltage	V_{DSS}	1200	V
Gate−Source Voltage	V_{GS}	−10/+20	V
Continuous Drain Current @ T_c = 80°C (T_J = 175°C)	I_{DS}	600	A
Pulsed Drain Current (T_J = 175°C)	I_{DPulse}	1200	A
Maximum Power Dissipation @ T_c = 80°C (T_J = 175°C)	Ptot	4700	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
SiC MOSFET CHARACTERISTICS						
Zero Gate Voltage Drain Current	V_{GS} = 0V, V_{DS} = 1200V	I_{DSS}	-	-	200	nA
Drain−Source On Resistance	V_{GS} = 18V, I_{DS} = 600A, T_J = 25°C	$R_{DS(ON)}$	-	1.59	1.80	mΩ
	V_{GS} = 18V, I_{DS} = 600A, T_J = 125°C		-	2.35	-	
	V_{GS} = 18V, I_{DS} = 600A, T_J = 175°C		-	3.14	-	
Gate−Source Threshold Voltage	V_{GS} = V_{DS}, I_{DS} = 100mA	$V_{GS(TH)}$	1.5	2.1	3.0	V
Gate Resistance	V_{GS} = 0V, f = 1MHz	R_g	-	0.85	-	Ω
Gate Leakage Current	V_{GS} = −10V / 20V, V_{DS} = 0V	I_{GSS}	-800	-	+800	nA
Input Capacitance	V_{DS} = 800V, V_{GS} = 0V, f = 100kHz	C_{ISS}	-	39.9	-	nF
Reverse Transfer Capacitance		C_{RSS}	-	122	-	pF
Output Capacitance		C_{OSS}	-	2.33	-	nF

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted) (continued)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
SiC MOSFET CHARACTERISTICS						
Total Gate Charge	V_{DS} = 800V, V_{GS} = −5V / 18V, I_D = 600A	$Q_{G(TOTAL)}$	-	1840	-	nC
Gate−Source Charge		Q_{GS}	-	440	-	nC
Gate−Drain Charge		Q_{GD}	-	970	-	nC
Turn−on Delay Time	V_{DS} = 600V, I_{DS} = 600A V_{GS} = −5V / 18V, R_G = 6.8Ω Ls = 2uH, T_J = 25°C	$T_{d(on)}$	-	127.0	-	ns
Rise Time		t_r	-	228.2	-	ns
Turn−off Delay Time		$T_{d(off)}$	-	405.1	-	ns
Fall Time		t_f	-	93.4	-	ns
Turn−on Switching Loss per Pulse		E_{ON}	-	24.03	-	mJ
Turn−off Switching Loss per Pulse		E_{OFF}	-	52.45	-	mJ
Turn−on Delay Time	V_{DS} = 600V, I_{DS} = 600A V_{GS} = −5V / 18V, R_G = 6.8Ω Ls = 2uH, T_J = 125°C	$T_{d(on)}$	-	97.0	-	ns
Rise Time		t_r	-	188.2	-	ns
Turn−off Delay Time		$T_{d(off)}$	-	455.4	-	ns
Fall Time		t_f	-	96.0	-	ns
Turn−on Switching Loss per Pulse		E_{ON}	-	20.49	-	mJ
Turn−off Switching Loss per Pulse		E_{OFF}	-	54.90	-	mJ
Turn−on Delay Time	V_{DS} = 600V, I_{DS} = 600A V_{GS} = −5V / 18V, R_G = 6.8Ω Ls = 2uH, T_J = 175°C	$T_{d(on)}$	-	79.7	-	ns
Rise Time		t_r	-	179.5	-	ns
Turn−off Delay Time		$T_{d(off)}$	-	496.3	-	ns
Fall Time		t_f	-	99.8	-	ns
Turn−on Switching Loss per Pulse		E_{ON}	-	18.76	-	mJ
Turn−off Switching Loss per Pulse		E_{OFF}	-	54.34	-	mJ
Thermal Resistance, Junction to Case (MOSFET)		R_{thJC}		0.0319		°C/W

ELECTRICAL CHARACTERISTICS (T_J = 25℃ unless otherwise noted) (continued)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
SiC MOSFET CHARACTERISTICS						
Diode Forward Voltage	I_{SD} = 600A, T_J = 25℃	V_{SD}	-	2.32	2.5	V
	I_{SD} = 600A, T_J = 125℃		-	2.65		
	I_{SD} = 600A, T_J = 175℃		-	2.74		
Diode Reverse Recovery Charge	V_R = 600V, I_{SD} = 600A V_{GS} = −5V, R_G = 6.8Ω Ls = 2uH,-di/dt = 4410A/us,T_J = 25℃	Q_r	-	3.81		uC
Peak Reverse Recovery Current		I_{rrm}	-	144.6		A
Reverse Recovery Energy		E_{rr}	-	1.87		mJ
Diode Reverse Recovery Charge	V_R = 600V, I_{SD} = 600A V_{GS} = −5V, R_G = 6.8Ω Ls = 2uH,-di/dt = 4790A/us,T_J = 125℃	Q_r	-	6.74		uC
Peak Reverse Recovery Current		I_{rrm}	-	188.0		A
Reverse Recovery Energy		E_{rr}	-	3.70		mJ
Diode Reverse Recovery Charge	V_R = 600V, I_{SD} = 600A V_{GS} = −5V, R_G = 6.8Ω Ls = 2uH,-di/dt = 5050A/us,T_J = 175℃	Q_r	-	9.44		uC
Peak Reverse Recovery Current		I_{rrm}	-	231.4		A
Reverse Recovery Energy		E_{rr}	-	5.72		mJ
THERMISTOR CHARACTERISTICS						
Rated Resistance		R_{25}	-	5.0	-	K Ω
Deviation of R_{100}	T_C = 100℃, R_{100} = 493.3Ω	ΔR/R	-5	-	5	%
Power Dissipation		P_{25}	-	-	20.0	mW
B-value	$R_2 = R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$	$B_{25/50}$	-	3375	-	K
B-value	$R_2 = R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$	$B_{25/80}$	-	3411	-	K

MODULE

Storage Temperature Range	T_{stg}	−40 to 150	℃
Module Operating Junction Temperature	T_J	−40 to 150	℃
Isolation Test Voltage, t = 1 s, 50 Hz	Viso	2500	V
Mounting torque to main terminals(M6 screw)	M_T	6.0	N.m
Mounting torque to main terminals(M5 screw)	M_H	6.0	N.m
Stray Inductance	L_{DS}	20	nH
Weight of Module	G	350	g

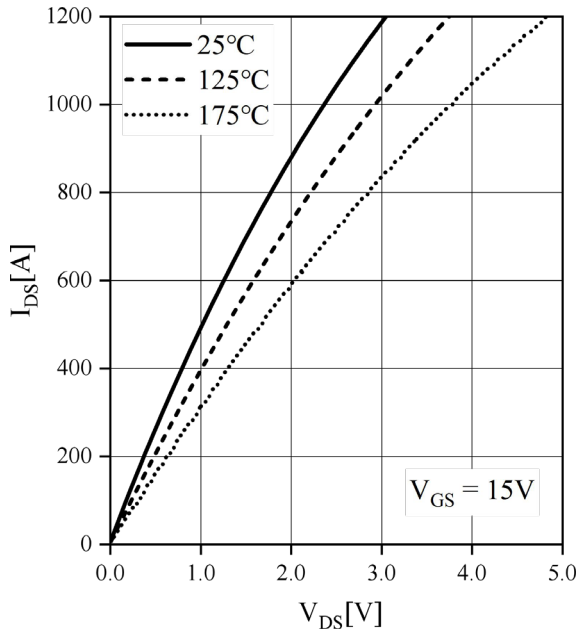


Figure 2. MOSFET Typical Output Characteristic

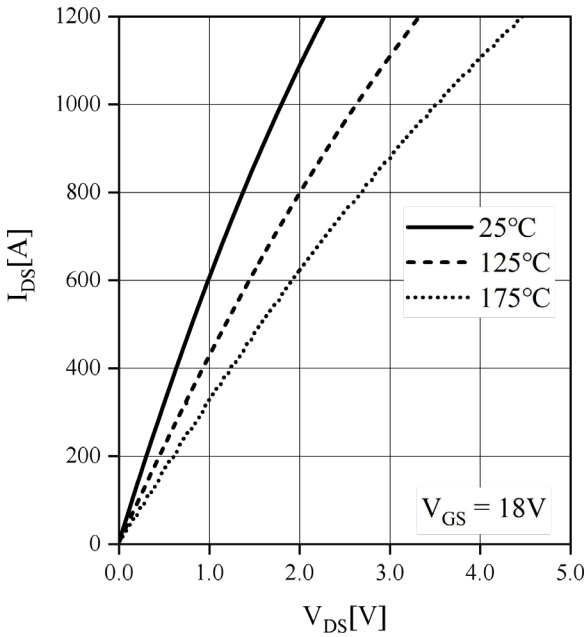


Figure 3. MOSFET Typical Output Characteristic

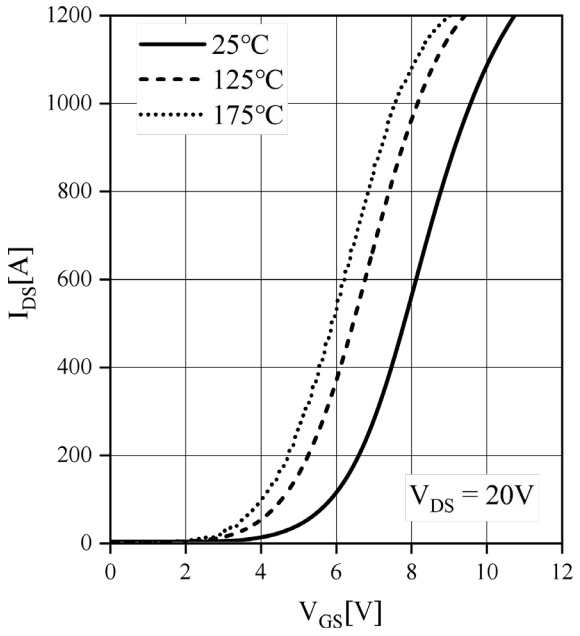


Figure 4. MOSFET Typical Transfer Characteristic

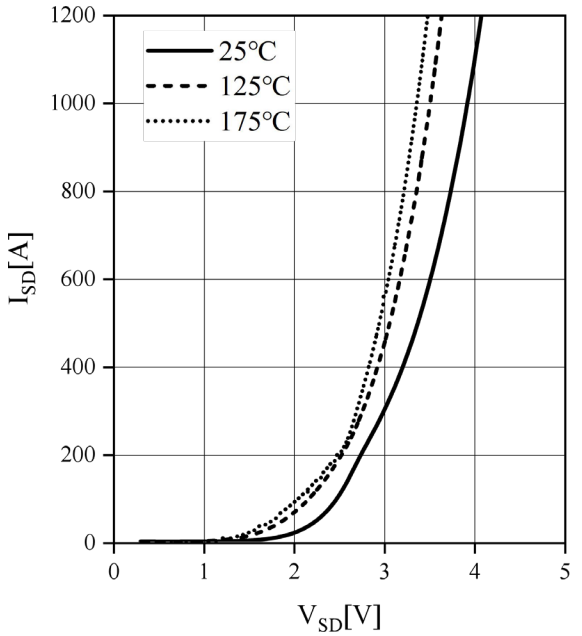


Figure 5. Diode Forward Characteristic

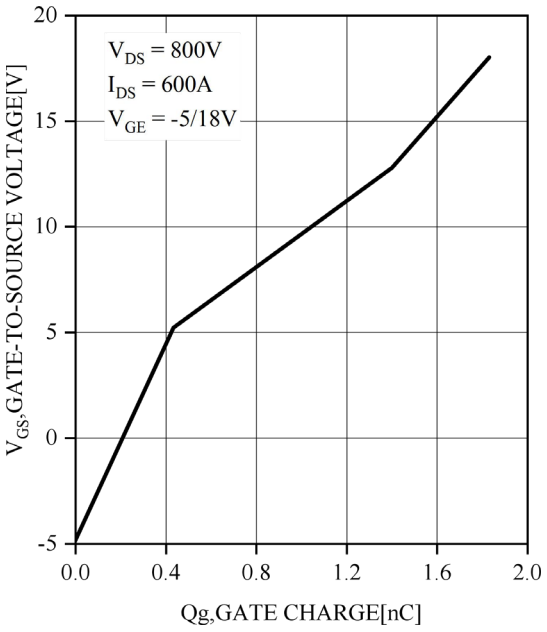


Figure 6. Gate−to−Source Voltage vs. Total Charge

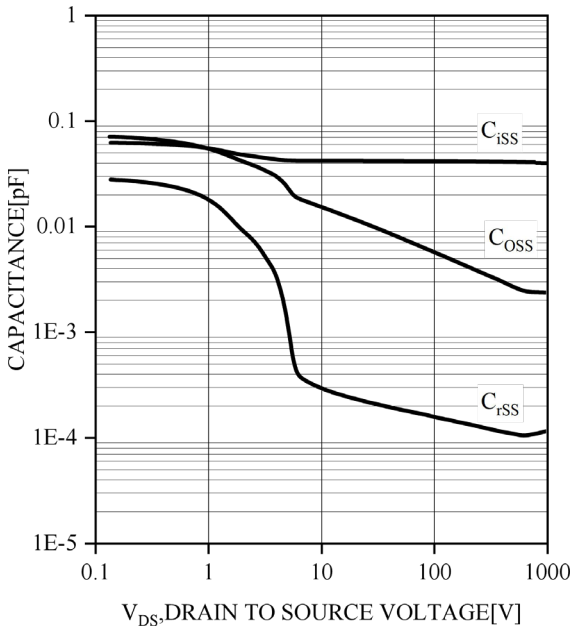


Figure 7. Capacitance vs. Drain−to−Source Voltage

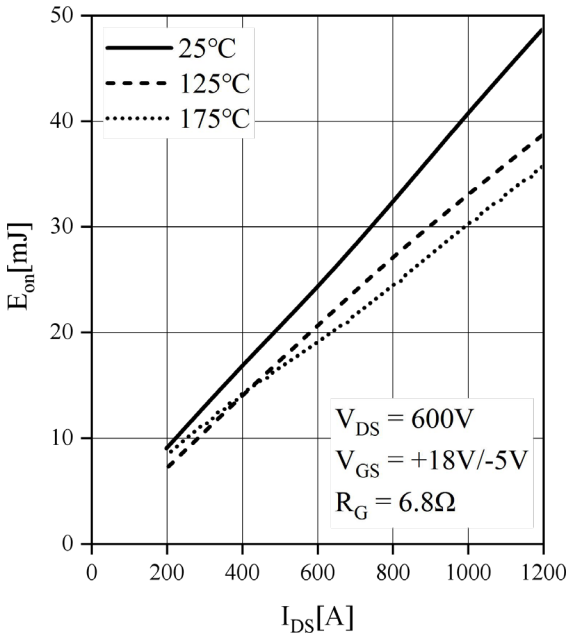


Figure 8. Typical Switching Loss E_{on} vs. I_{DS}

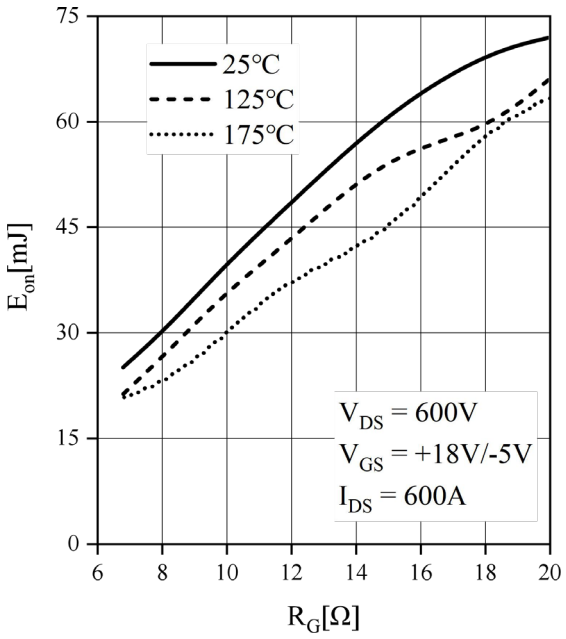


Figure 9. Typical Switching Loss E_{on} vs. R_G

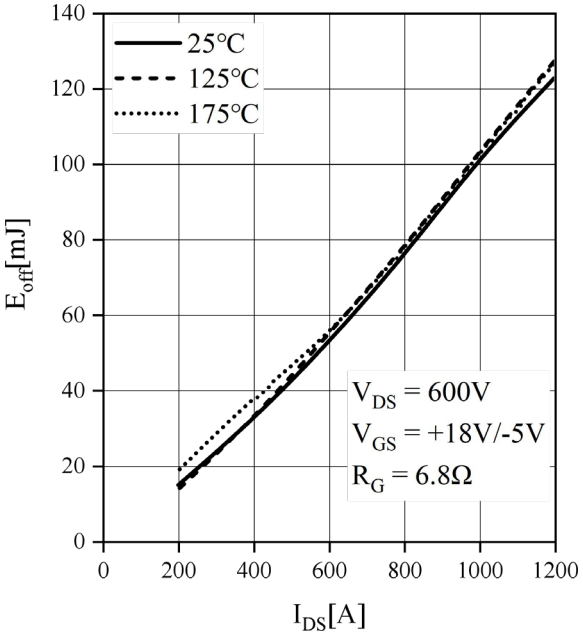


Figure 10. Typical Switching Loss E_{off} vs. I_{DS}

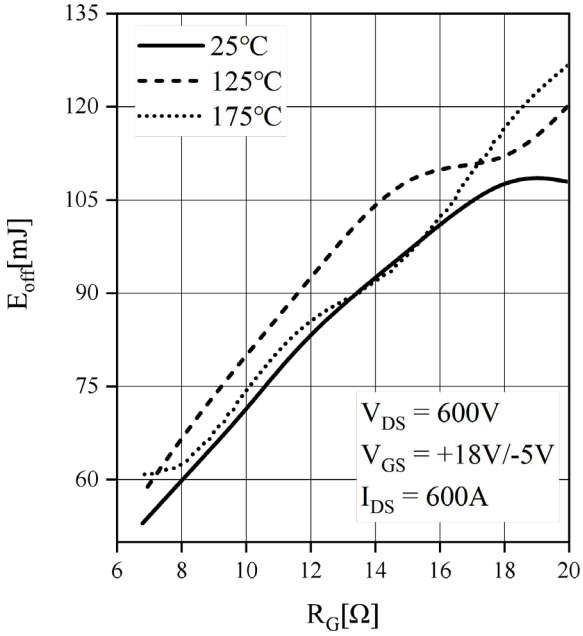


Figure 11. Typical Switching Loss E_{off} vs. R_G

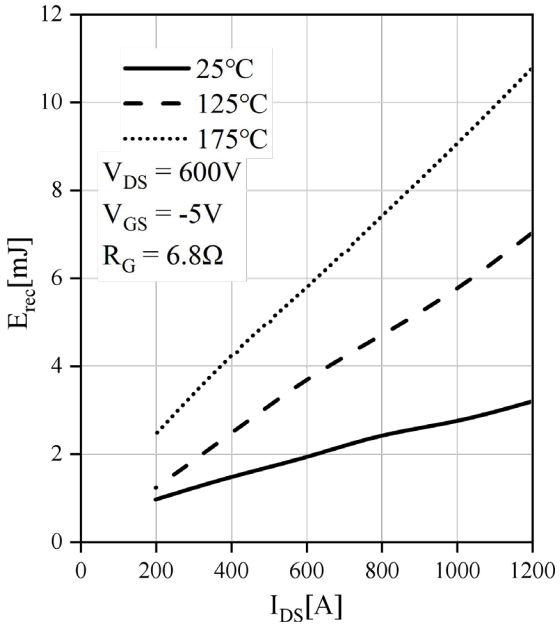


Figure 12. Typical Switching Loss E_{rec} vs. I_{DS}

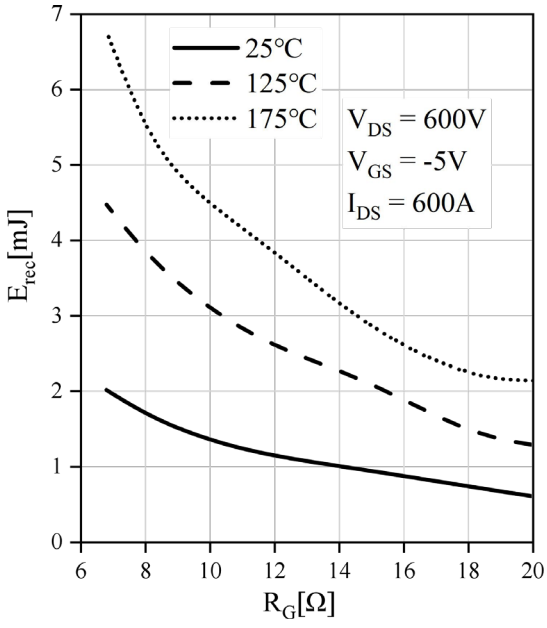


Figure 13. Typical Switching Loss E_{rec} vs. R_G

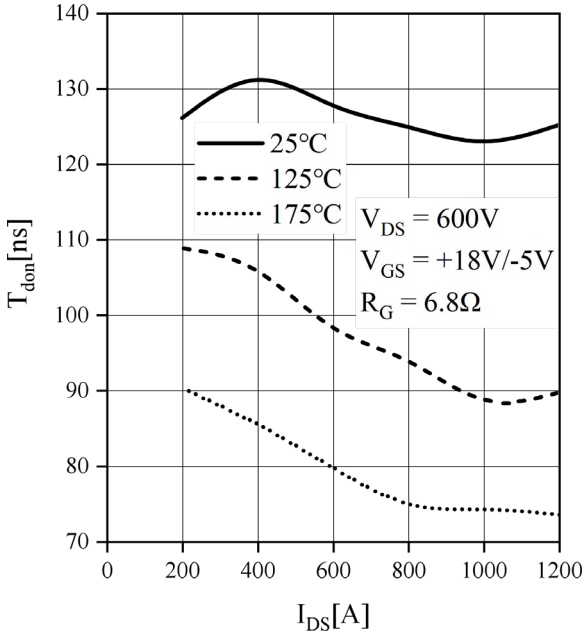


Figure 14. Typical Switching Loss $T_{d(on)}$ vs. I_{DS}

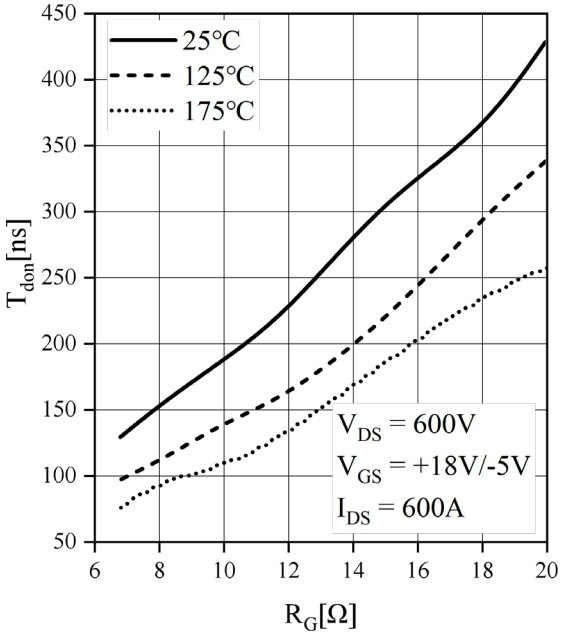


Figure 15. Typical Switching Loss $T_{d(on)}$ vs. R_G

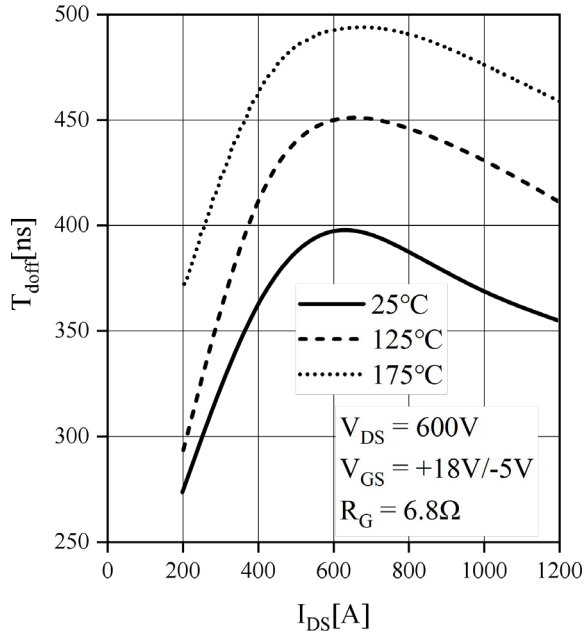


Figure 16. Typical Switching Loss $T_{d(off)}$ vs. I_{DS}

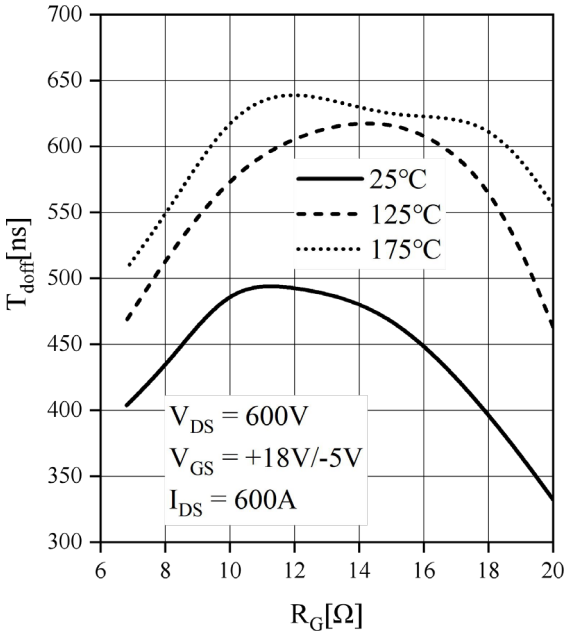


Figure 17. Typical Switching Loss $T_{d(off)}$ vs. R_G

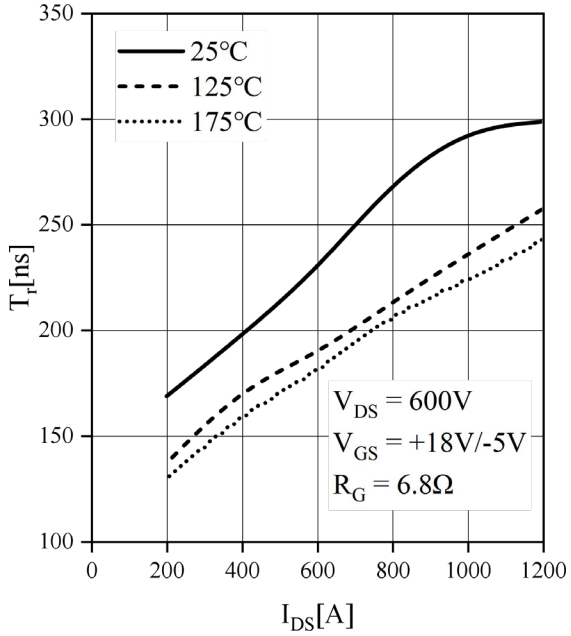


Figure 18. Typical Switching Loss T_r vs. I_{DS}

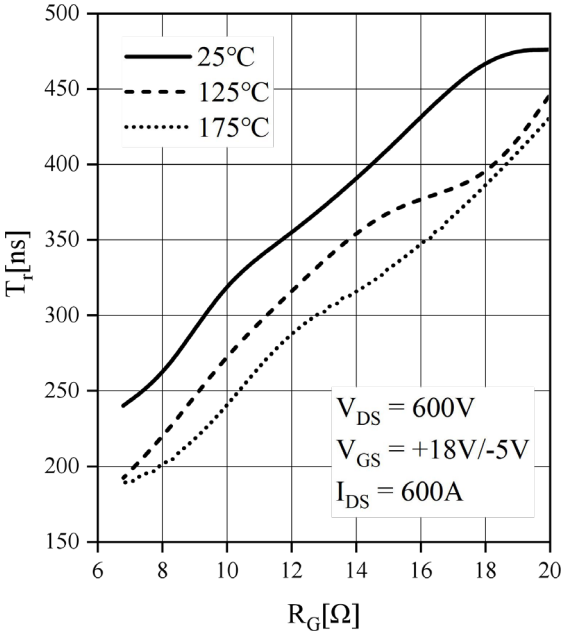


Figure 19. Typical Switching Loss T_r vs. R_G

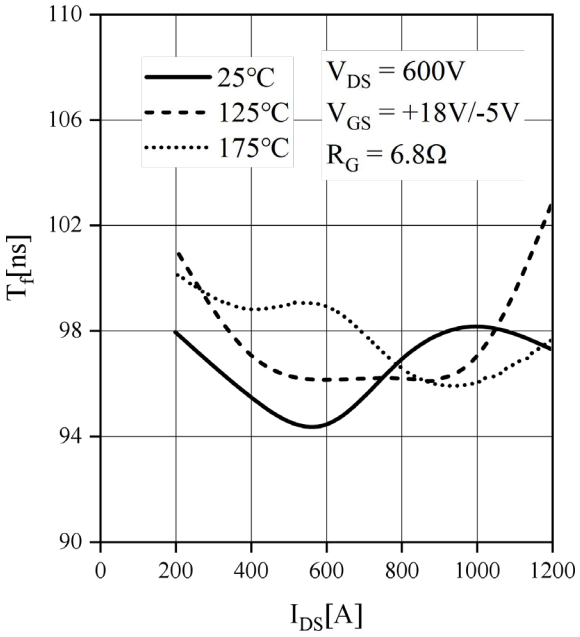


Figure 20. Typical Switching Loss T_f vs. I_{DS}

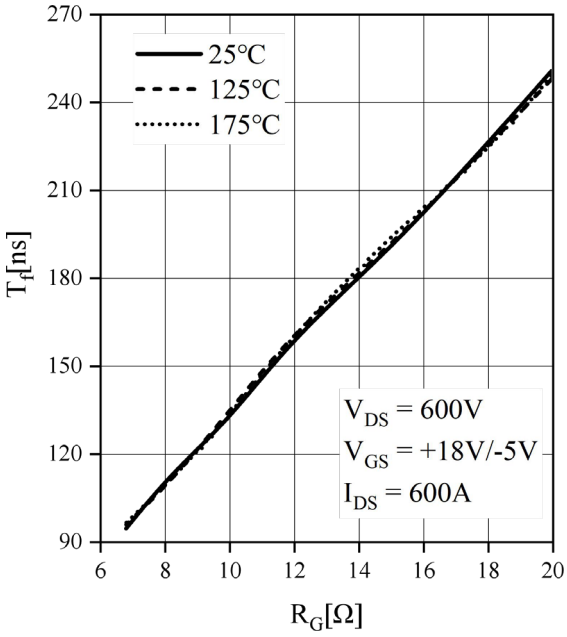


Figure 21. Typical Switching Loss T_f vs. R_G

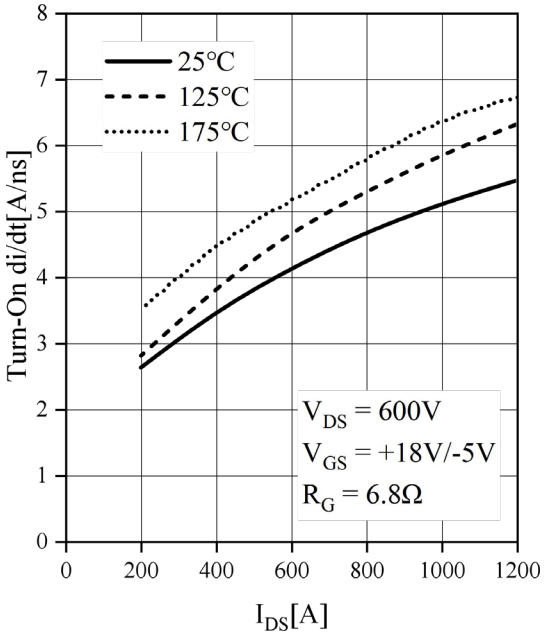


Figure 22. di/dt ON vs. I_{DS}

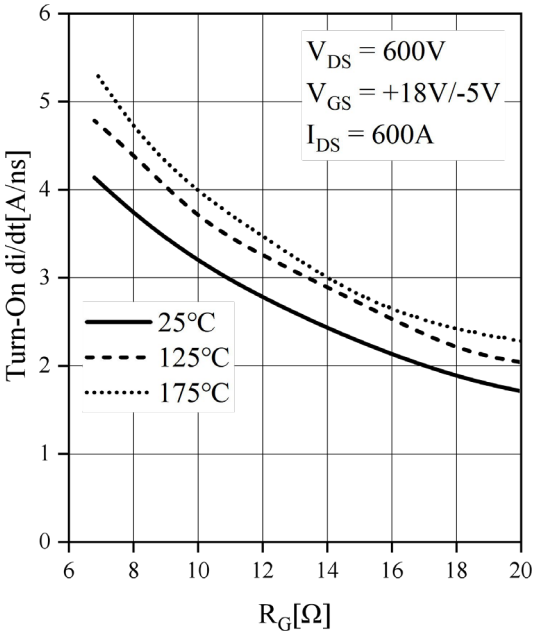


Figure 23. di/dt ON vs. R_G

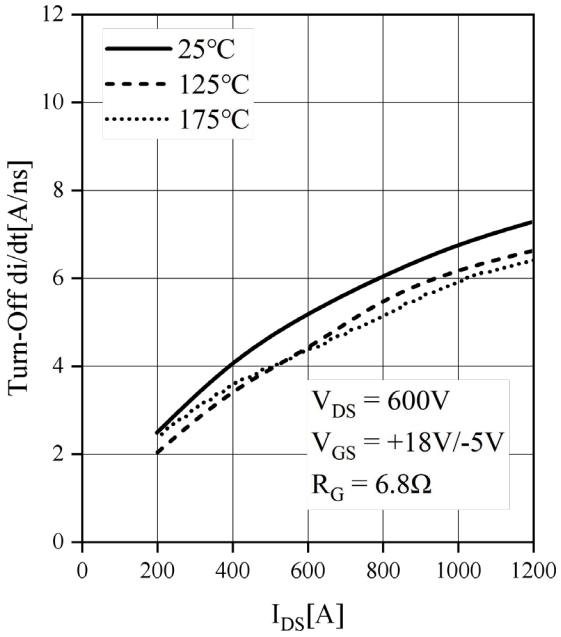


Figure 24. di/dt OFF vs. I_{DS}

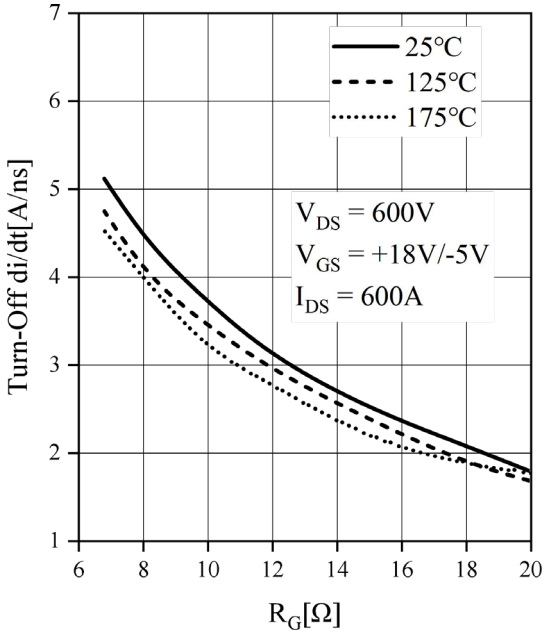


Figure 25. di/dt OFF vs. R_G

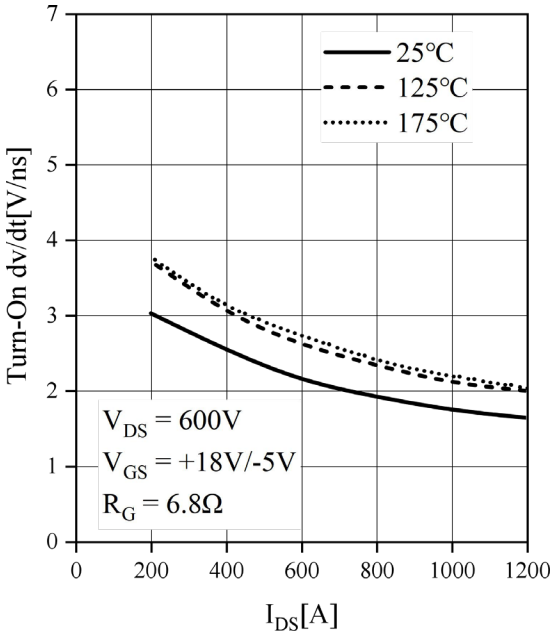


Figure 26. dV/dt ON vs. I_{DS}

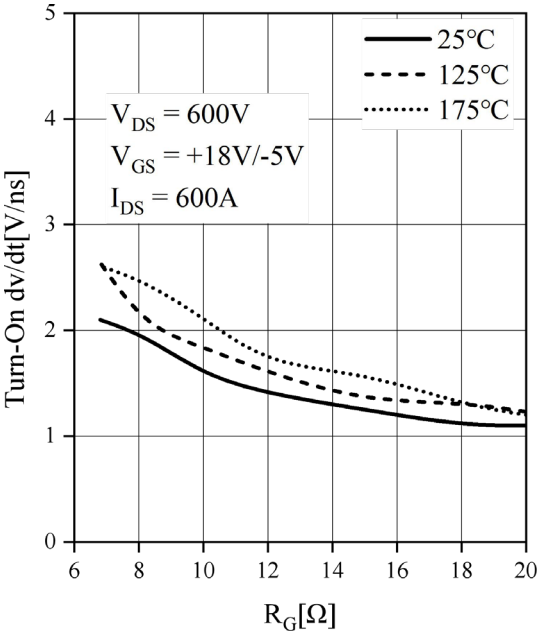


Figure 27. dV/dt ON vs. R_G

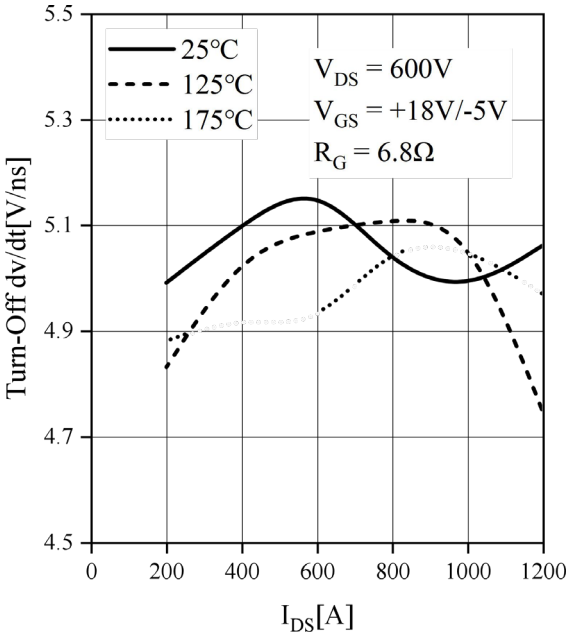


Figure 28. dV/dt OFF vs. I_{DS}

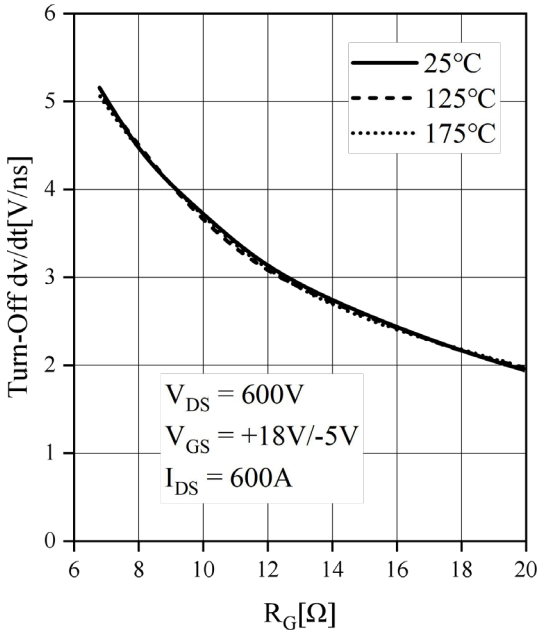


Figure 29. dV/dt OFF vs. R_G

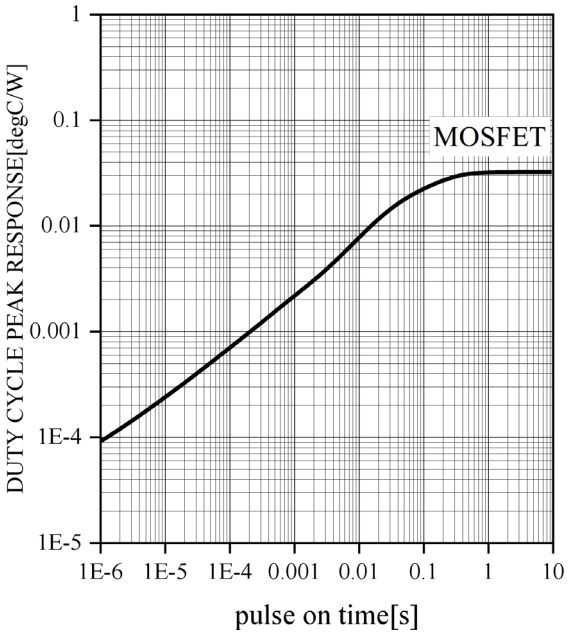
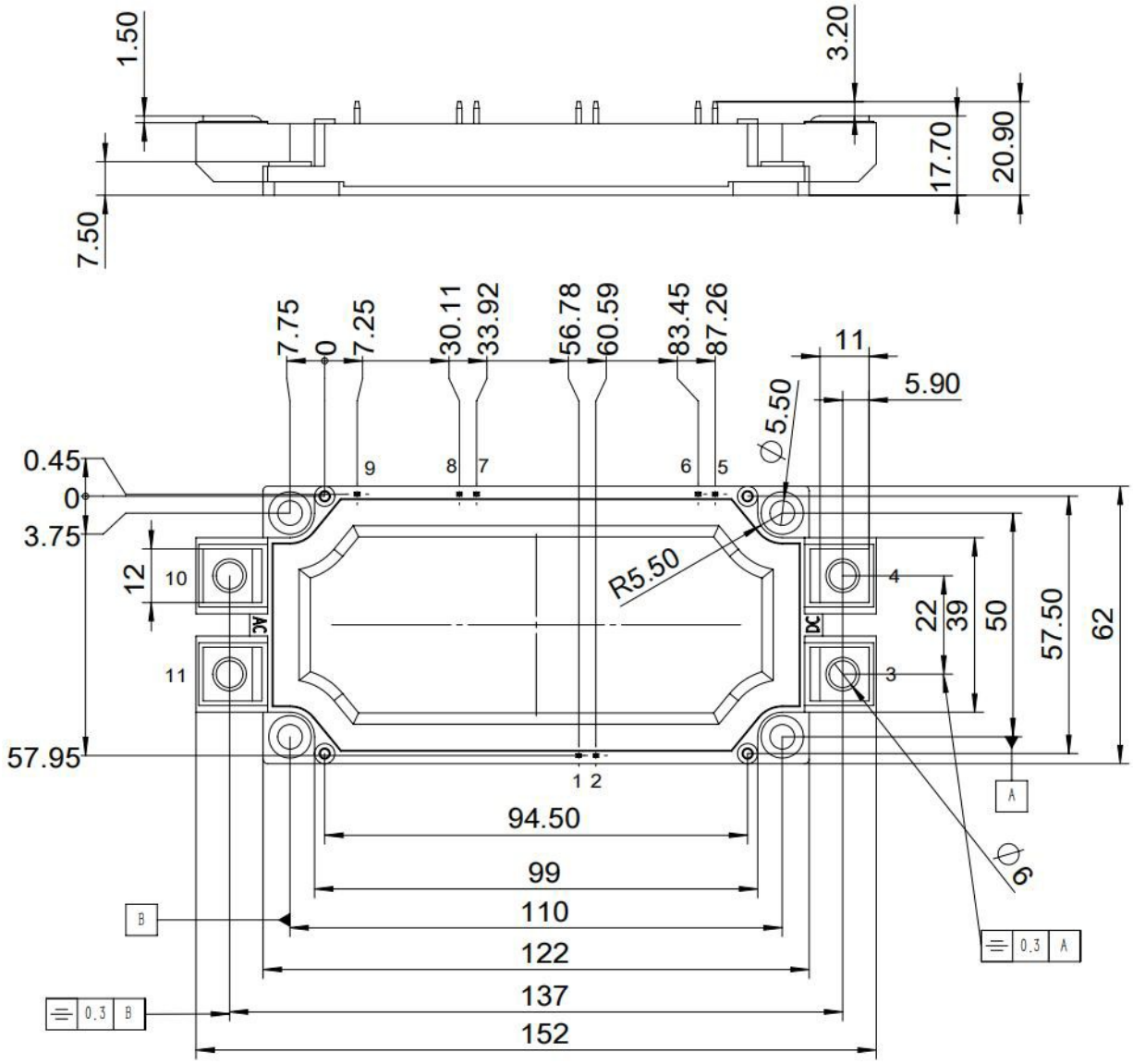


Figure 30. MOSFET Junction−to−Case Transient Thermal Impedance

Package Drawing



UNIT:mm