Silicon Carbide (SiC)
1200V 3.7mohm
Brake-Chopper
MOSFET Module
62mm
SC300SL12C1KR

The SC300SL12C1KR is a power module containing 3.7mΩ / 1200V SiC MOSFET Brake-Chopper and a thermistor with Si_3N_4 AMB in an 62mm package.

Features

- 3.7mΩ /1200V SiC MOSFET
- Si_3N_4 AMB
- NTC Thermistor
- Low Inductive Layout
- Solderable Pins
- Isolated Base Plate

Typical Applications

- 3-level applications
- Chopper applications
- Motor drives

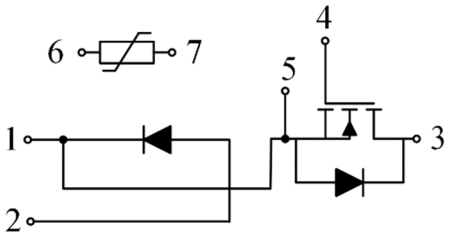
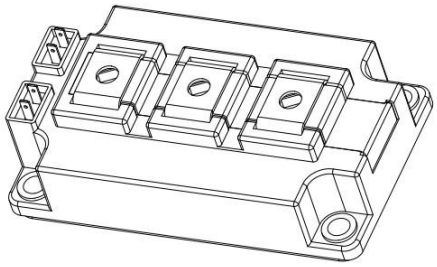
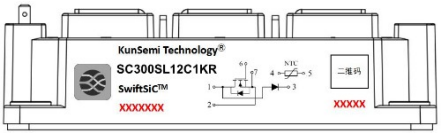


Figure 1. Schematic



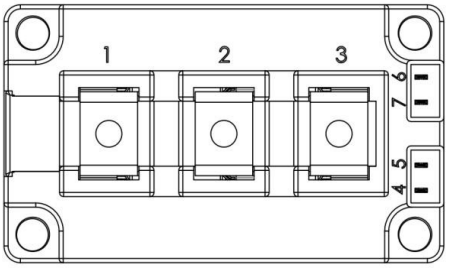
PIM7, 106.10 × 61.00 × 30.85

MARKING DIAGRAM



SC300SL12C1KR = Device Code
XXXXXXX = Year, week and batch Code
XXXXX = Flow code

PIN ASSIGNMENTS



ORDERING INFORMATION

Device	Package
SC300SL12C1KR	62mm

PIN DESCRIPTION

Pin	Name	Description
1	OUT	Center Point of Switching Node
2	DC-	DC Negative Bus Connection
3	DC+	DC Positive Bus Connection
4	G1	T1 Gate
5	S1	T1 Source
6, 7	NTC	NTC

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
SiC MOSFET, Brake-Chopper			
Drain−Source Voltage	V_{DSS}	1200	V
Gate−Source Voltage	V_{GS}	+ 22 /- 10	V
Continuous Drain Current @ T_C = 80 °C (T_J = 175 °C)	I_{DS}	300	A
Pulsed Drain Current (T_J = 175°C)	I_{Dpluse}	600	A
Maximum Power Dissipation @ T_C = 80°C (T_J = 175 °C)	P_{tol}	2500	W
Minimum Operating Junction Temperature	T_{JMIN}	- 40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C

ELECTRICAL CHARACTERISTICS (T_J = 25 ℃ unless otherwise noted)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
SiC MOSFET CHARACTERISTICS						
Zero Gate Voltage Drain Current	V_{GS} = 0 V, V_{DS} = 1200 V	I_{DSS}	-	-	1	mA
Drain−Source On Resistance	V_{GS} = 18 V, I_{DS} = 300 A, T_J = 25°C	$R_{DS(ON)}$	-	3.65	-	mΩ
	V_{GS} = 18 V, I_{DS} = 300 A, T_J = 125°C		-	4.85	-	
	V_{GS} = 18 V, I_{DS} = 300 A, T_J = 175°C		-	6.33	-	
Gate−Source Threshold Voltage	V_{GS} = V_{DS}, I_{DS} = 40 mA, T_J = 25°C	$V_{GS(TH)}$	1.80	2.80	4.00	V
Gate Resistance	V_{GS} = 0V, f = 1 MHz	R_g	-	1.7	-	Ω
Gate Leakage Current	V_{GS} = 22 V,V_{DS} = 0 V	I_{GSS}	-	-	200	nA
Input Capacitance	V_{DS} = 800 V, V_{GS} = 0 V, f = 100 kHz	C_{ISS}	-	20.3	-	nF
Reverse Transfer Capacitance		C_{RSS}	-	93.1	-	pF
Output Capacitance		C_{OSS}	-	1.8	-	nF
Total Gate Charge	V_{DS} = 800 V, V_{GS} = -5 / 18 V, I_D = 300 A	$Q_{G(TOTAL)}$	-	970	-	nC
Gate-Source Charge		Q_{GS}		468		
Gate-Drain Charge		Q_{GD}		335		
Turn−on Delay Time	V_{DS} = 600 V, I_{DS} = 300 A V_{GS} = -5 / 18 V, R_G = 4.7 Ω L_S = 7 uH, T_J = 25 °C	$T_{d(on)}$	-	87.1	-	ns
Rise Time		t_r	-	129.0	-	ns
Turn−off Delay Time		$T_{d(off)}$	-	284.0	-	ns
Fall Time		t_f	-	68.5	-	ns
Turn−on Switching Loss per Pulse		E_{ON}	-	3.2	-	mJ
Turn−off Switching Loss per Pulse		E_{OFF}	-	7.6	-	mJ
Turn−on Delay Time	V_{DS} = 600 V, I_{DS} = 300 A V_{GS} = -5 / 18 V, R_G = 4.7 Ω L_S = 7 uH, T_J = 125 °C	$T_{d(on)}$	-	66.0	-	ns
Rise Time		t_r	-	99.0	-	ns
Turn−off Delay Time		$T_{d(off)}$	-	336.0	-	ns
Fall Time		t_f	-	73.2	-	ns
Turn−on Switching Loss per Pulse		E_{ON}	-	2.7	-	mJ
Turn−off Switching Loss per Pulse		E_{OFF}	-	8.3	-	mJ
Turn−on Delay Time	V_{DS} = 600 V, I_{DS} = 300 A V_{GS} = -5 / 18 V, R_G = 4.7 Ω L_S = 7 uH, T_J = 175 °C	$T_{d(on)}$		66.0		ns
Rise Time		t_r		99.2		ns
Turn−off Delay Time		$T_{d(off)}$		358.0		ns
Fall Time		t_f		75.0		ns
Turn−on Switching Loss per Pulse		E_{ON}		2.8		mJ
Turn−off Switching Loss per Pulse		E_{OFF}		8.63		mJ
Thermal Resistance, Junction to Case (MOSFET)		R_{thJC}	-	0.06	-	°C/W

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
DIODE , Brake-Chopper CHARACTERISTICS						
Diode Forward Voltage	I_{SD} = 300 A, T_J = 25 ℃	V_{SD}	-	2.28	-	V
	I_{SD} = 300 A, T_J = 125 ℃		-	2.59	-	
	I_{SD} = 300 A, T_J = 175 ℃		-	2.73	-	
Diode Reverse Recovery Charge	V_R = 600 V, I_{SD} = 300 A V_{GS} = -5 V, R_G = 4.7 Ω L_S = 7 uH, T_J = 25 ℃	Q_r	-	1.8	-	uC
Peak Reverse Recovery Current		I_{rrm}	-	89.2	-	A
Reverse Recovery Time		t_{rr}		34.1		ns
Reverse Recovery Energy		E_{rr}	-	0.9	-	mJ
Diode Reverse Recovery Charge	V_R = 600 V, I_{SD} = 300 A V_{GS} = -5 V, R_G = 4.7 Ω L_S = 7 uH, T_J = 125 ℃	Q_r	-	2.2	-	uC
Peak Reverse Recovery Current		I_{rrm}	-	104.1	-	A
Reverse Recovery Time		t_{rr}		35.9		ns
Reverse Recovery Energy		E_{rr}	-	1.2	-	mJ
Diode Reverse Recovery Charge	V_R = 600 V, I_{SD} = 300 A V_{GS} = -5 V, R_G = 4.7 Ω L_S = 7 uH, T_J = 175 ℃	Q_r		2.5		uC
Peak Reverse Recovery Current		I_{rrm}		107.8		A
Reverse Recovery Time		t_{rr}		37.2		ns
Reverse Recovery Energy		E_{rr}		1.4		mJ
Thermal Resistance, Junction to Case (Diode)		R_{thJC}	-	0.18	-	℃/W

Diode, Reverse CHARACTERISTICS

Diode Forward Voltage	I_{SD} = 240 A, T_J = 25 ℃	V_{SD}	-	1.52	-	V
	I_{SD} = 240 A, T_J = 125 ℃		-	2.10	-	
	I_{SD} = 240 A, T_J = 175 ℃		-	2.23	-	
Thermal Resistance, Junction to Case (Diode)		R_{thJC}	-	0.15	-	℃/W

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	V_{iso}	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}	13.5	nH
Weight of Module	G	320	g

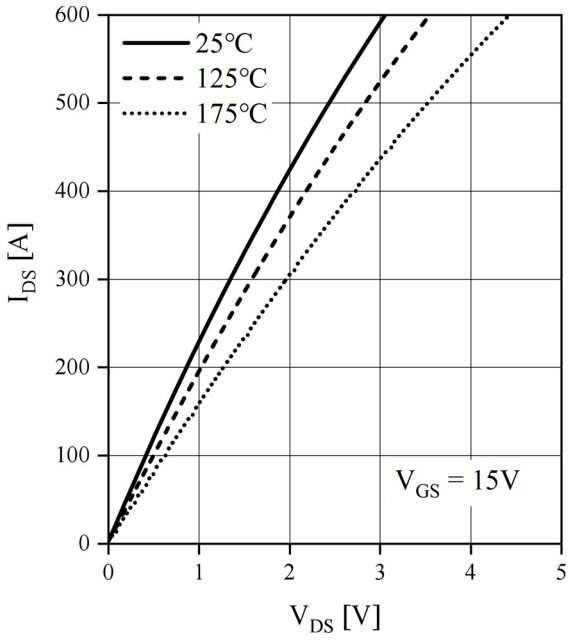


Figure 2. MOSFET Typical Output Characteristic(Brake-Chopper)

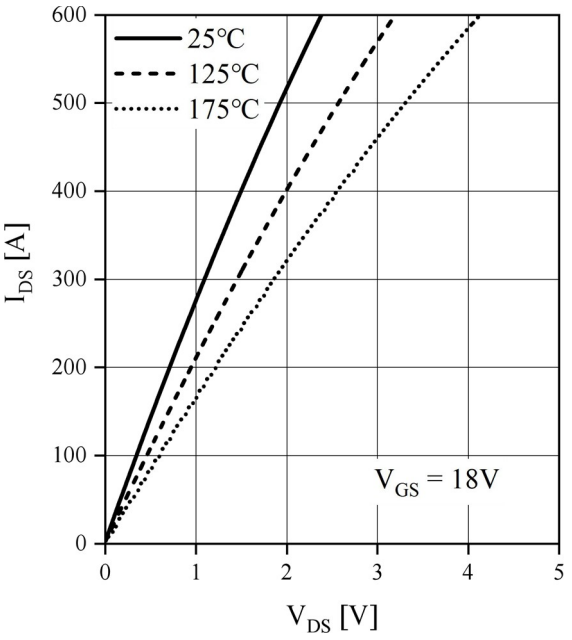


Figure 3. MOSFET Typical Output Characteristic(Brake-Chopper)

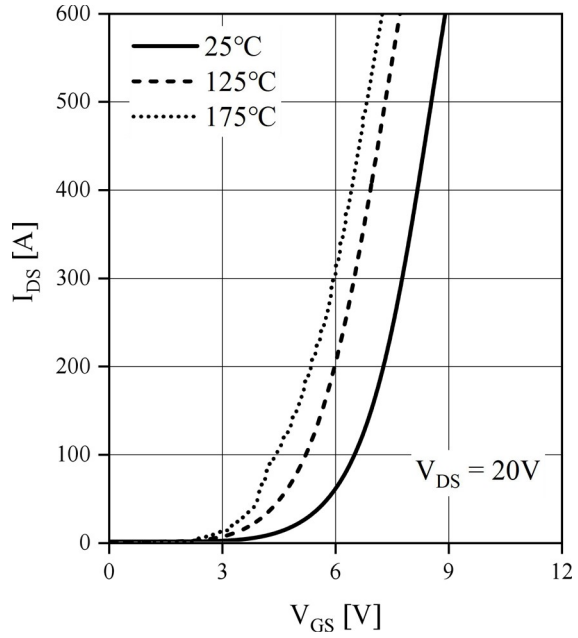


Figure 4. MOSFET Typical Transfer Characteristic(Brake-Chopper)

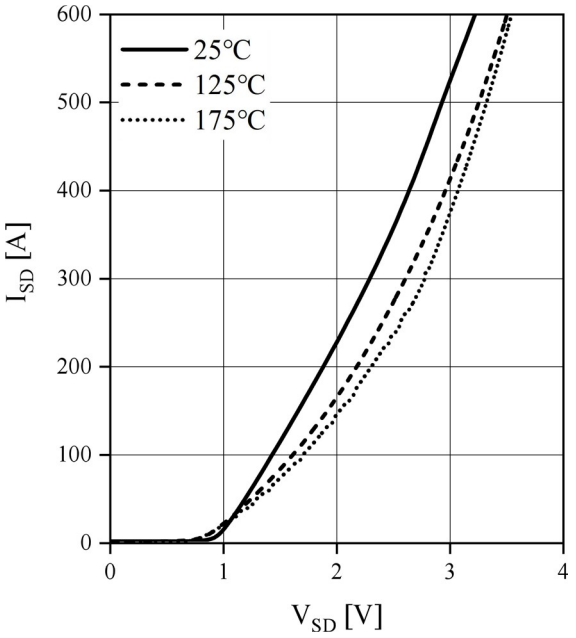


Figure 5. Body Diode Forward Characteristic(Brake-Chopper)

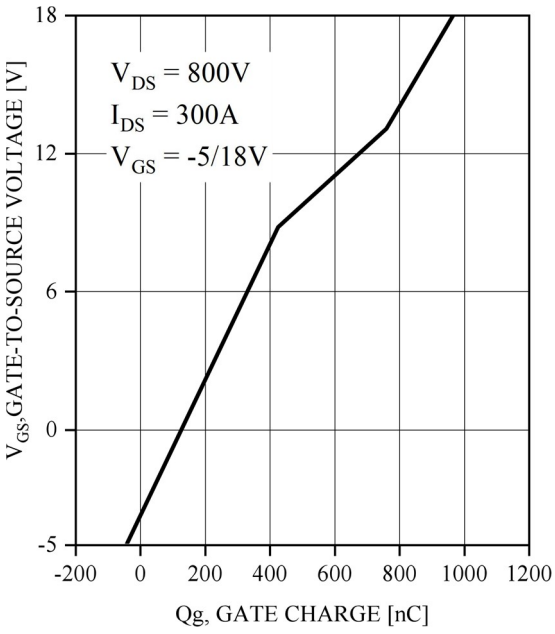


Figure 6. Gate−to−Source Voltage vs. Total Charge(Brake-Chopper)

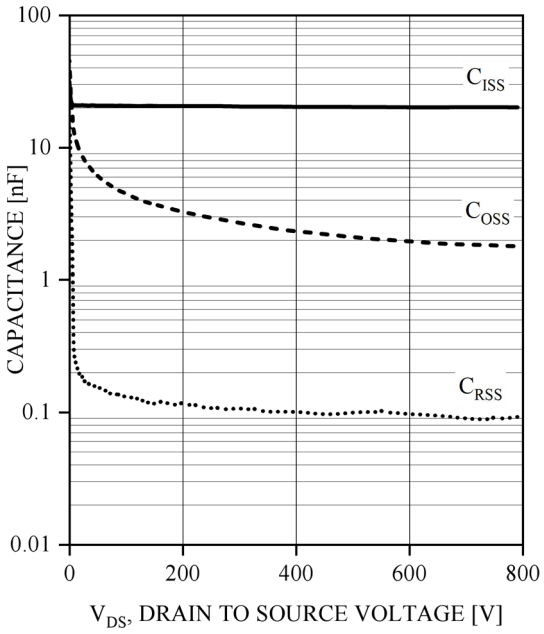


Figure 7. Capacitance vs. Drain−to−Source Voltage(Brake-Chopper)

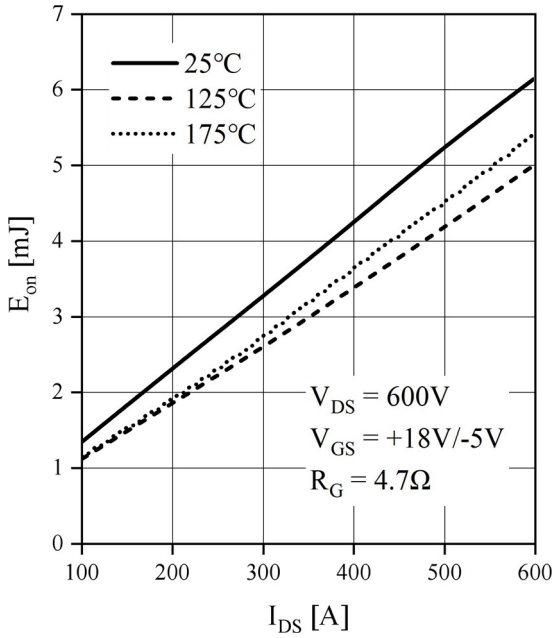


Figure 8. Typical Switching Loss E_{on} vs. I_{DS}(Brake-Chopper)

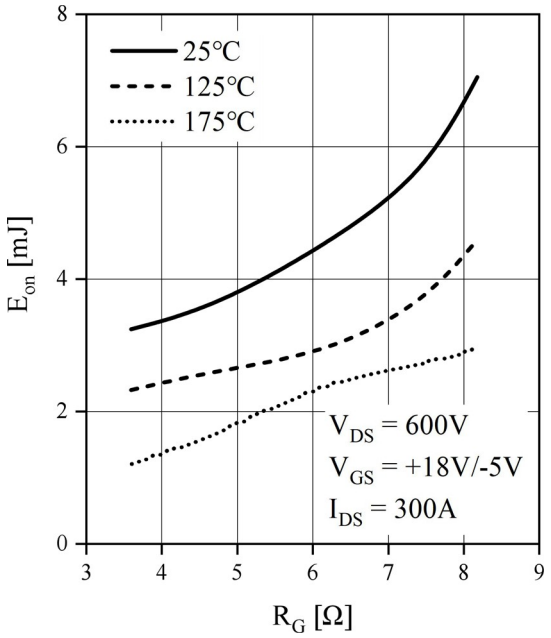


Figure 9. Typical Switching Loss E_{on} vs. R_G(Brake-Chopper)

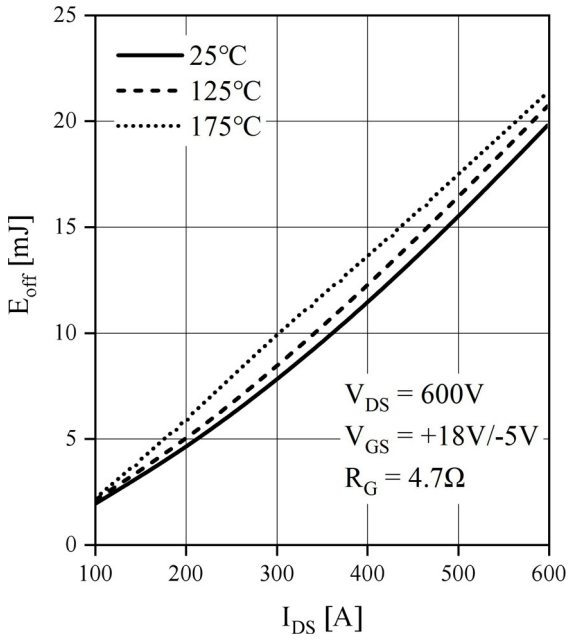


Figure 10. Typical Switching Loss E_{off} vs. I_{DS}(Brake-Chopper)

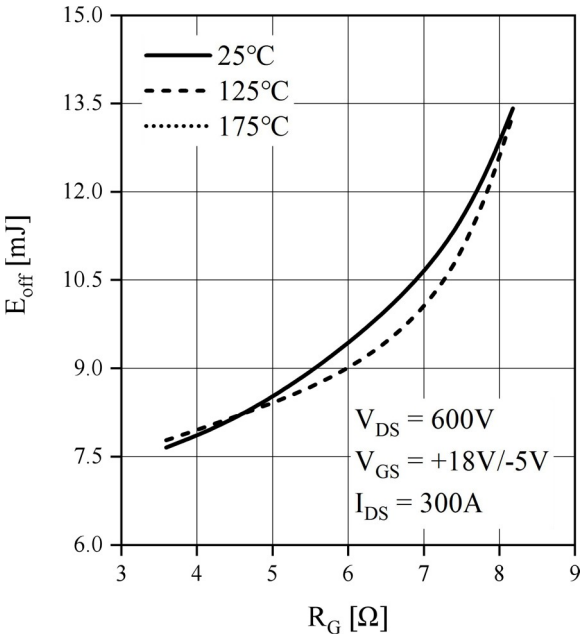


Figure 11.Typical Switching Loss E_{off} vs. R_G(Brake-Chopper)

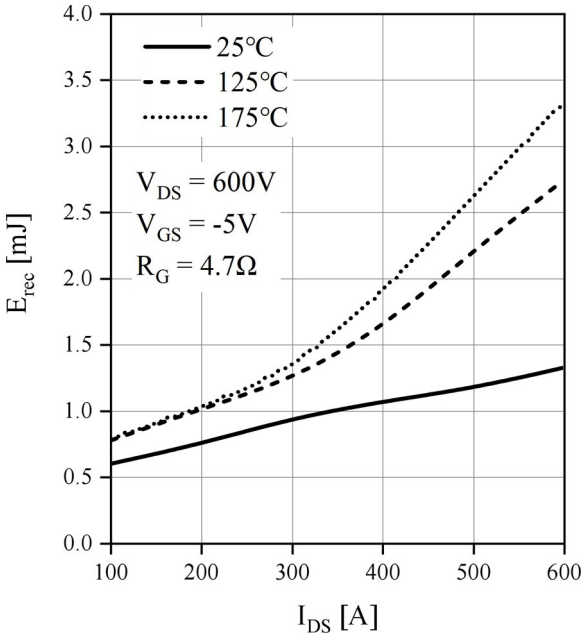


Figure 12. Typical Switching Loss E_{rec} vs. I_{DS}(Brake-Chopper)

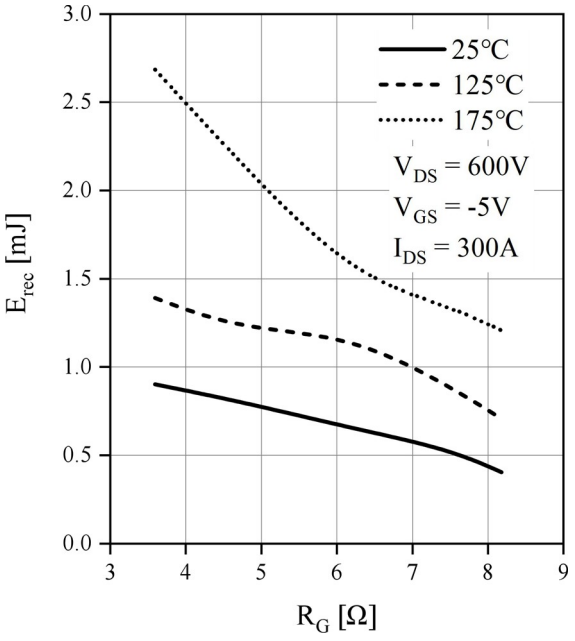


Figure 13. Typical Switching Loss E_{rec} vs. R_G(Brake-Chopper)

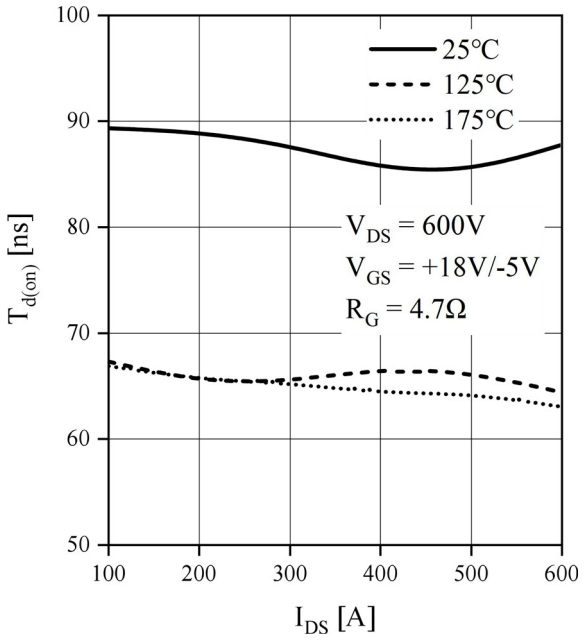


Figure 14. Typical Switching Loss $T_{d(on)}$ vs. I_{DS}(Brake-Chopper)

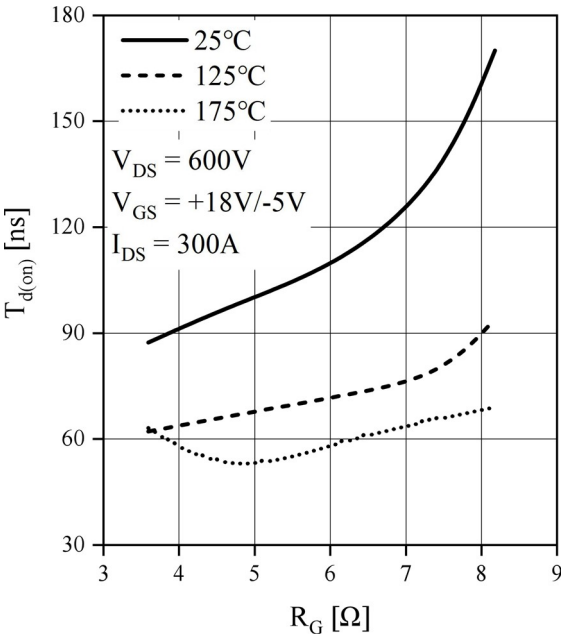


Figure 15. Typical Switching Loss $T_{d(on)}$ vs. R_G(Brake-Chopper)

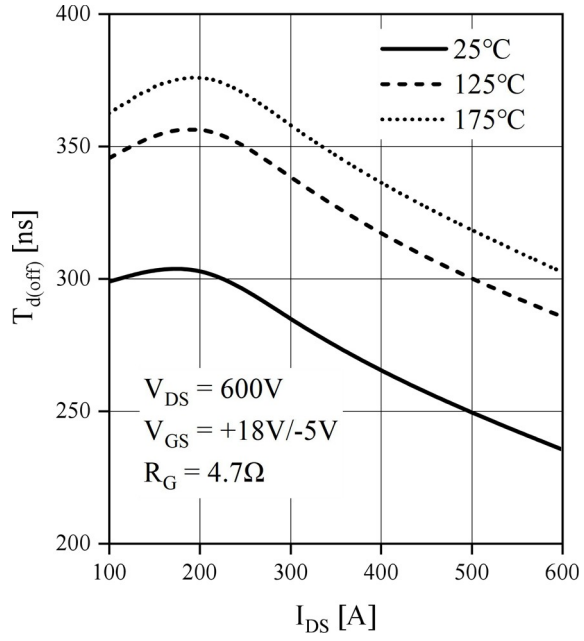


Figure 16. Typical Switching Loss $T_{d(off)}$ vs. I_{DS}(Brake-Chopper)

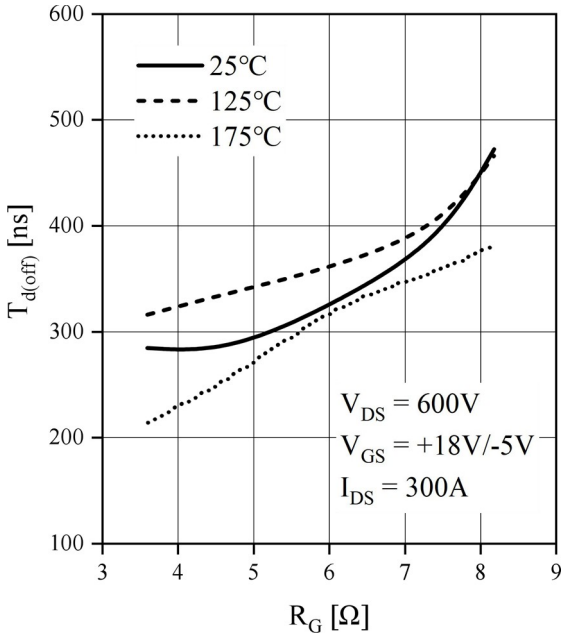


Figure 17. Typical Switching Loss $T_{d(off)}$ vs. R_G(Brake-Chopper)

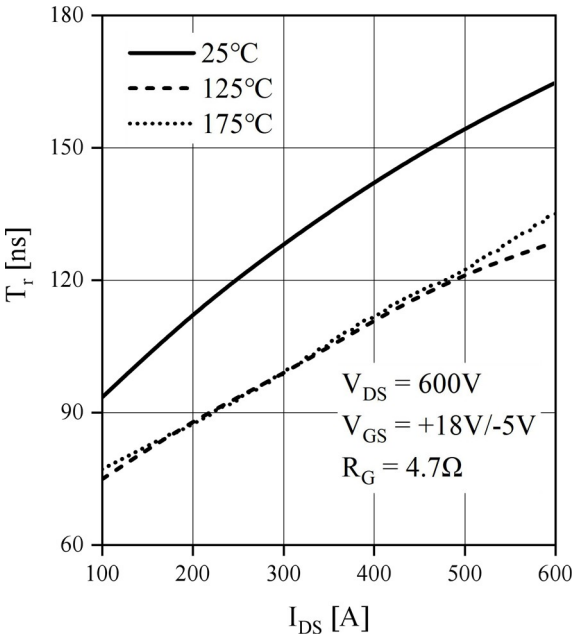


Figure 18. Typical Switching Loss T_r vs. I_{DS}(Brake-Chopper)

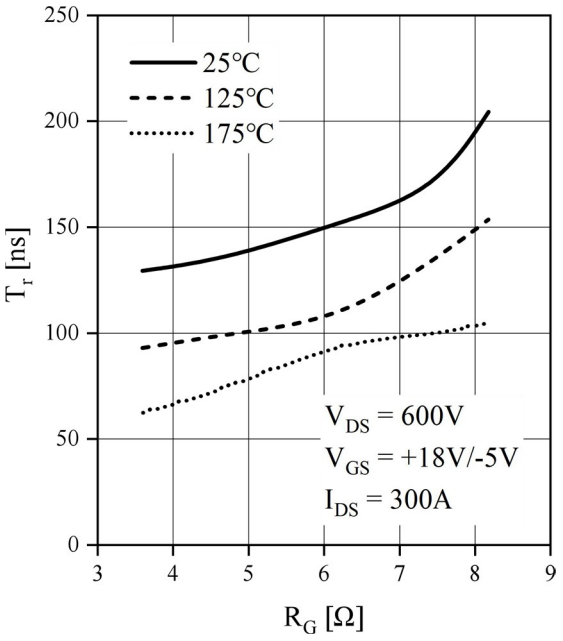


Figure 19. Typical Switching Loss T_r vs. R_G(Brake-Chopper)

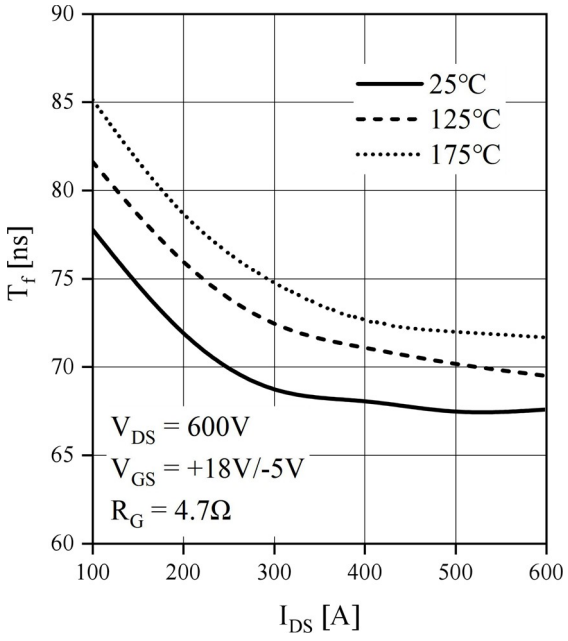


Figure 20. Typical Switching Loss T_f vs. I_{DS}(Brake-Chopper)

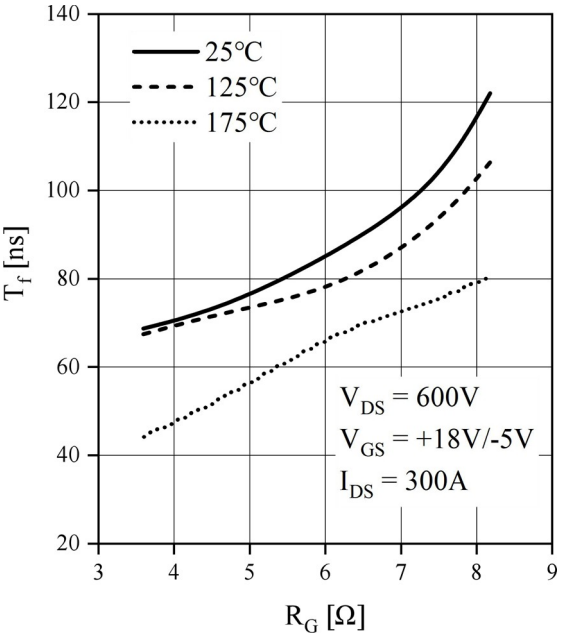


Figure 21. Typical Switching Loss T_f vs. R_G(Brake-Chopper)

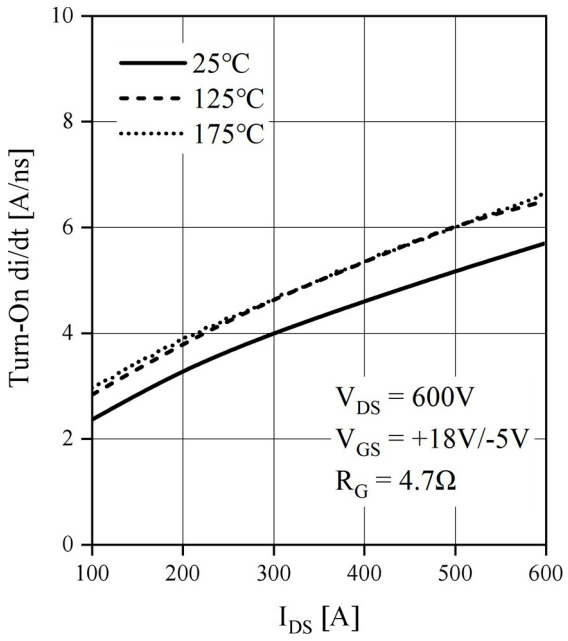


Figure 22. di/dt ON vs. I_{DS}(Brake-Chopper)

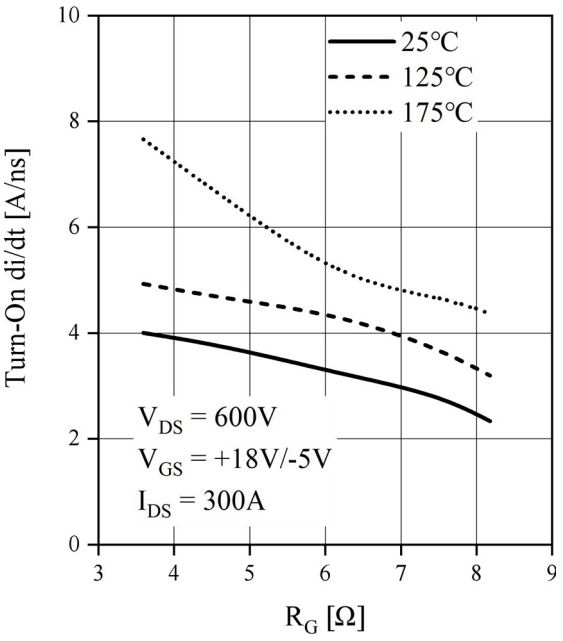


Figure 23. di/dt ON vs. R_G(Brake-Chopper)

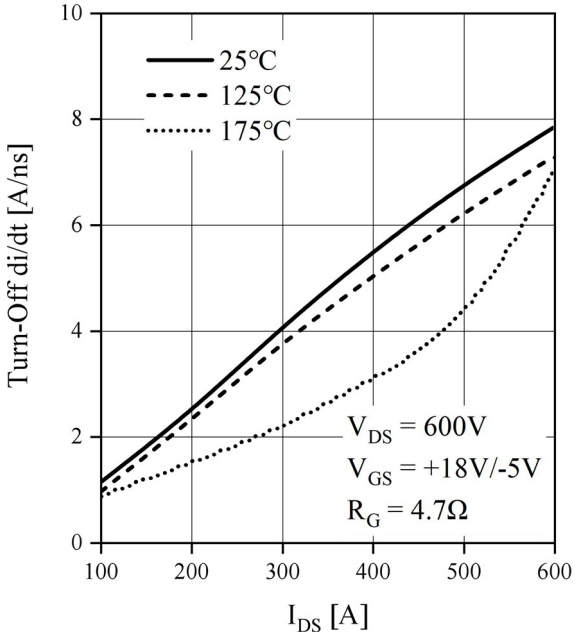


Figure 24. di/dt OFF vs. I_{DS}(Brake-Chopper)

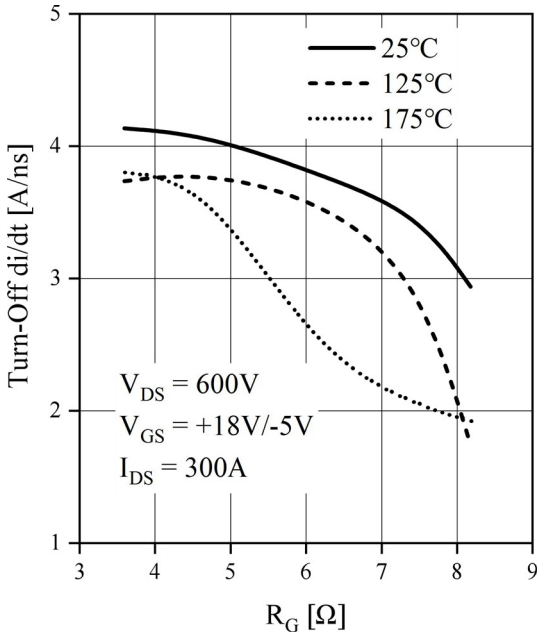


Figure 25. di/dt OFF vs. R_G(Brake-Chopper)

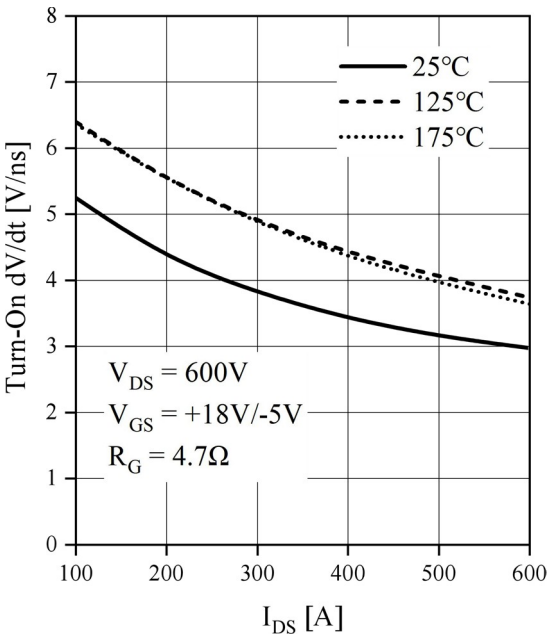


Figure 26. dV/dt ON vs. I_{DS}(Brake-Chopper)

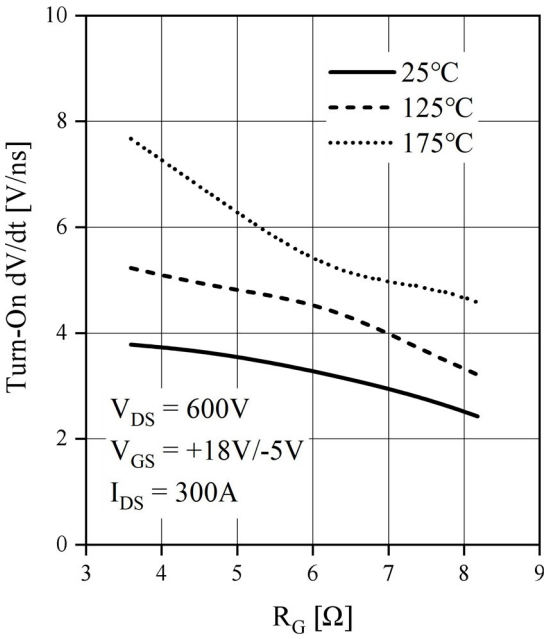


Figure 27. dV/dt ON vs. R_G(Brake-Chopper)

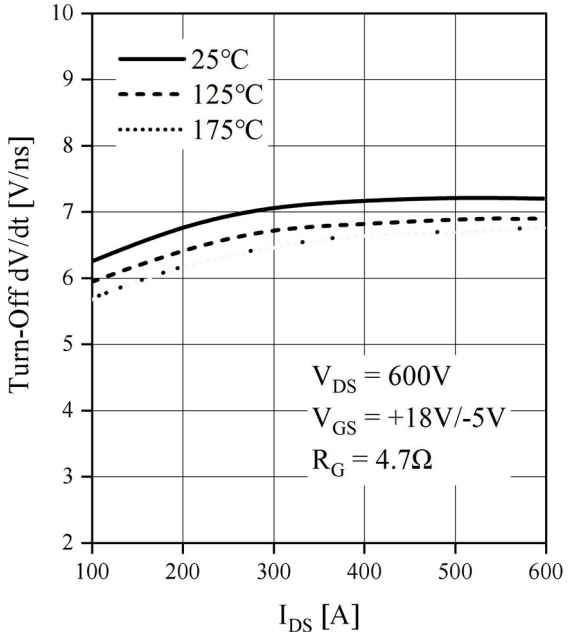


Figure 28. dV/dt OFF vs. I_{DS}(Brake-Chopper)

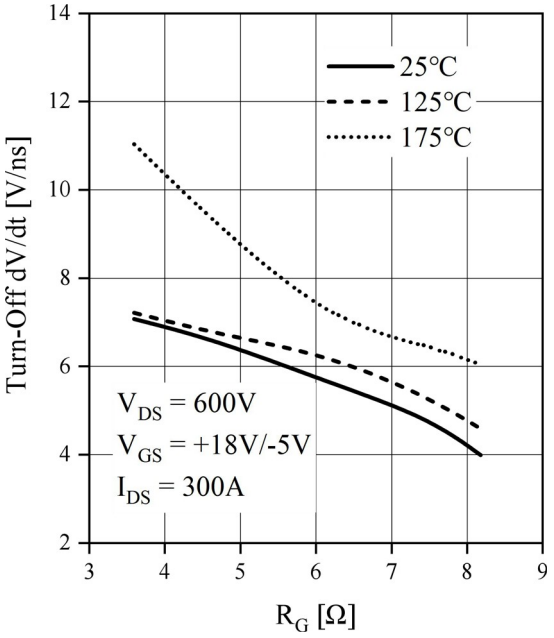


Figure 29. dV/dt OFF vs. R_G(Brake-Chopper)

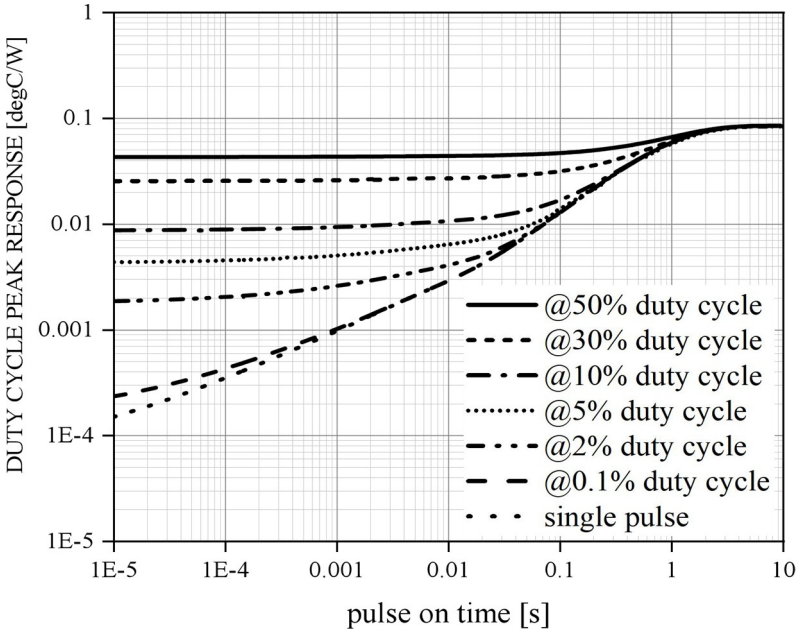


Figure 30. MOSFET Junction−to−Case Transient Thermal Impedance(Brake-Chopper)

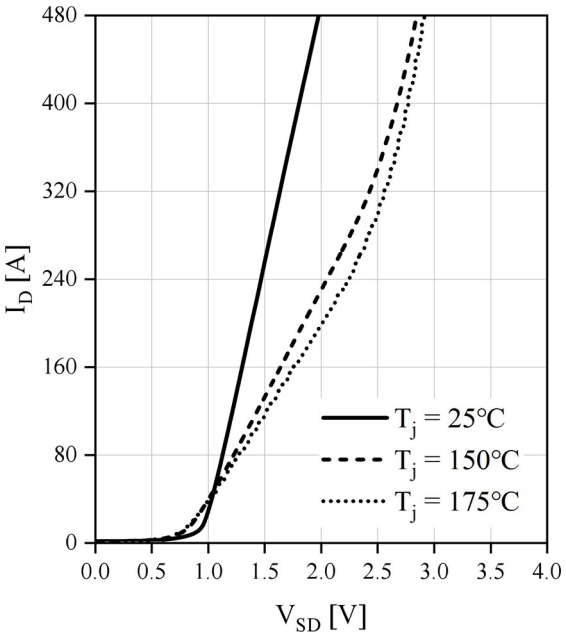


Figure 31. Diode Forward Characteristic(Reverse)

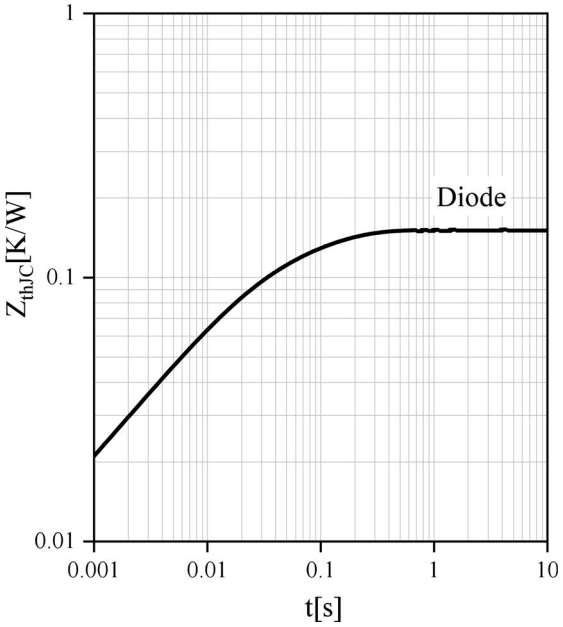
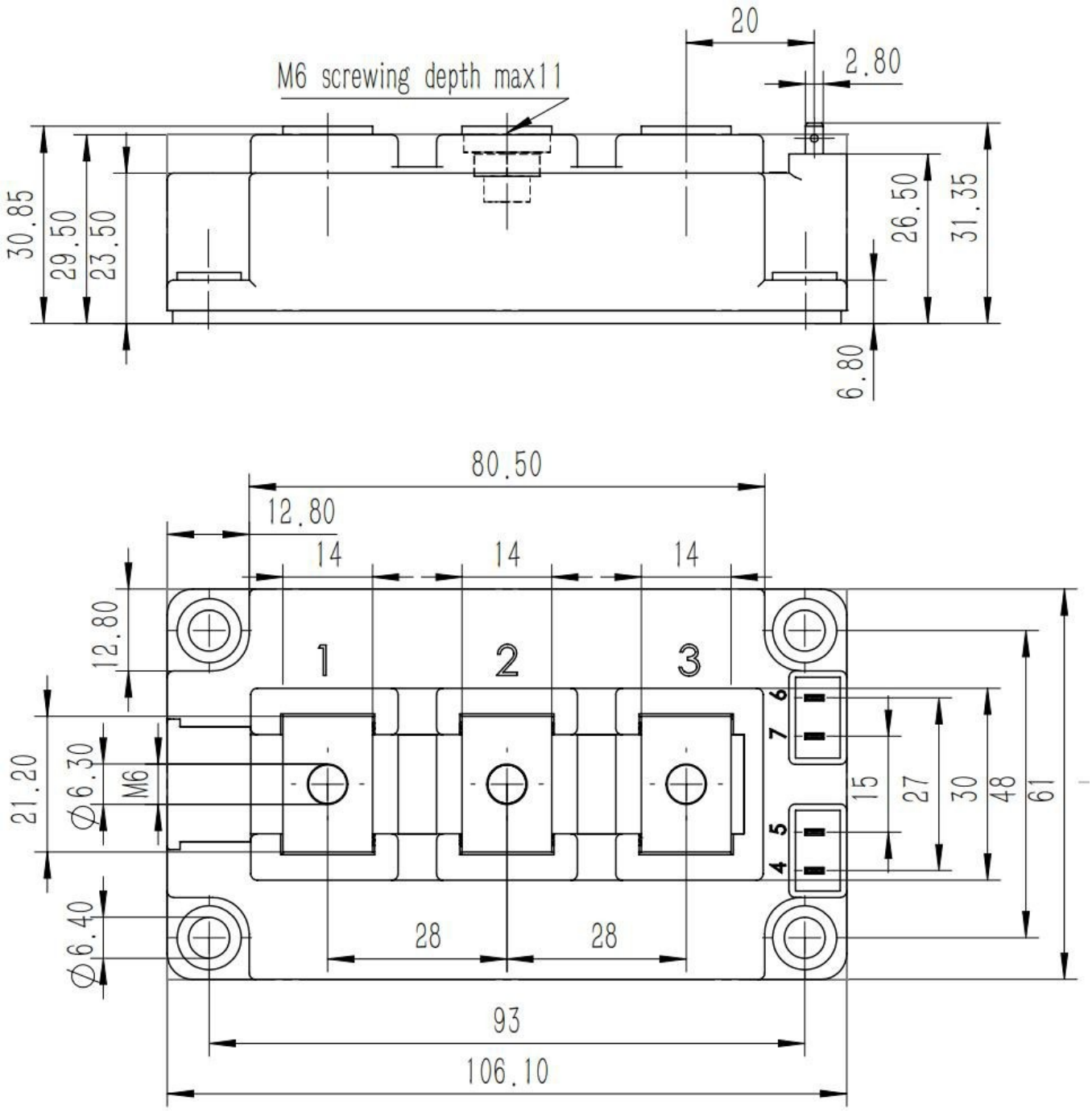


Figure 32. Junction−to−Case Transient Thermal Impedance(Reverse)

Package Drawing



UNIT:mm