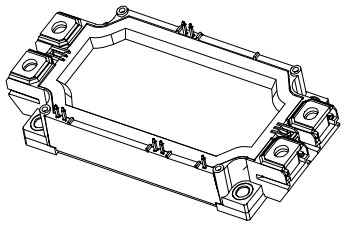
Silicon Carbide (SiC)

1200V 2.5 mohm Half-Bridge MOSFET Module Edual3

EDSC450X12



PIM11, 152.00 x 62.15 x 20.80
CASE 180HT

The EDSC450X12 is a power module containing 2.5 mΩ /1200 V SiC MOSFET half−bridge and a thermistor with Si_3N_4 AMB in an ED3 package.

Features

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

Typical Applications

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

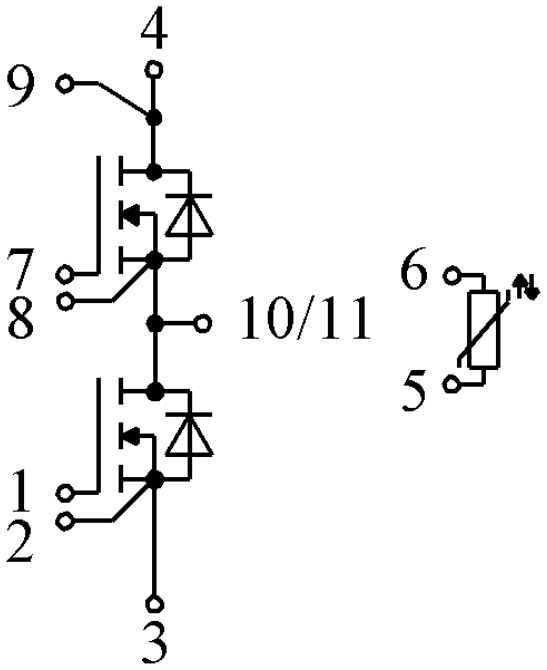
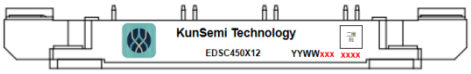


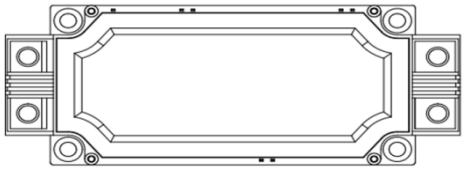
Figure 1. Schematic

MARKING DIAGRAM



EDSC450X12 = Device Code
YYWW = Year and Work WeeK Code

PIN ASSIGNMENTS



ORDERING INFORMATION

Device	Package
EDSC450X12	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}	+22/−10	V
Continuous Drain Current @ T_c = 80°C (T_J = 175°C)	I_{DS}	450	A
Pulsed Drain Current (T_J = 175°C)	I_{DPulse}	900	A
Maximum Power Dissipation @ T_c = 80°C (T_J = 175°C)	Ptot	1260	W
Minimum Operating Junction Temperature	TJMIN	−40	°C
Maximum Operating Junction Temperature	TJMAX	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}	-	-	38.6	nA
Drain−Source On Resistance	V_{GS} = 20V, I_{DS} = 300A, T_J = 25°C	$R_{DS(ON)}$	-	2.45	3.43	mΩ
	V_{GS} = 20V, I_{DS} = 300A, T_J = 125°C		-	3.6	-	
	V_{GS} = 20V, I_{DS} = 300A, T_J = 150°C		-	4.09	-	
Gate−Source Threshold Voltage	V_{GS} = V_{DS}, I_{DS} = 222mA	$V_{GS(TH)}$	-	2.27	3.16	V
Gate Resistance	V_{GS} = 0V, f = 1MHz	R_g	-	2.45	-	ohm
Gate Leakage Current	V_{GS} = −10V / 20V, V_{DS} = 0 V	I_{GSS}	-800	-	+800	nA
Input Capacitance	V_{DS} = 800V, V_{GS} = 0V, f = 1MHz	C_{ISS}	-	43.4	-	pF
Reverse Transfer Capacitance		C_{RSS}	-	1.67	-	nF
Output Capacitance		C_{OSS}	-	1.4	-	pF

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
SiC MOSFET CHARACTERISTICS						
Total Gate Charge	VDS = 800V, VGS = −5/20V, ID = 300A	$Q_{G(TOTAL)}$	-	1.33	-	uC
Gate−Source Charge		Q_{GS}	-	879.1	-	nC
Gate−Drain Charge		Q_{GD}	-	95.4	-	nC
Turn−on Delay Time	V_{DS} = 600V, I_{DS} = 300A, V_{GS} = −5V / 18V, R_G = 4.7Ω, Ls = 16uH, T_J = 25°C	$T_{d(on)}$	-	74.9	-	ns
Rise Time		t_r	-	114.2	-	ns
Turn−off Delay Time		$T_{d(off)}$	-	241.3	-	ns
Fall Time		t_f	-	54.4	-	ns
Turn−on Switching Loss per Pulse		E_{ON}	-	9.4	-	mJ
Turn−off Switching Loss per Pulse		E_{OFF}	-	7.2	-	mJ
Turn−on Delay Time	V_{DS} = 600V, I_{DS} = 300A, V_{GS} = −5V / 18V, R_G = 4.7Ω, Ls = 16uH, T_J = 125°C	$T_{d(on)}$	-	58.2	-	ns
Rise Time		t_r	-	106.9	-	ns
Turn−off Delay Time		$T_{d(off)}$	-	280.6	-	ns
Fall Time		t_f	-	54.4	-	ns
Turn−on Switching Loss per Pulse		E_{ON}	-	8.7	-	mJ
Turn−off Switching Loss per Pulse		E_{OFF}	-	7.6	-	mJ
Turn−on Delay Time	V_{DS} = 600V, I_{DS} = 300A, V_{GS} = −5V / 18V, R_G = 4.7Ω, Ls = 16uH, T_J = 150°C	$T_{d(on)}$	-	54.1	-	ns
Rise Time		t_r	-	104.6	-	ns
Turn−off Delay Time		$T_{d(off)}$	-	307.8	-	ns
Fall Time		t_f	-	56.3	-	ns
Turn−on Switching Loss per Pulse		E_{ON}	-	8.4	-	mJ
Turn−off Switching Loss per Pulse		E_{OFF}	-	8.2	-	mJ

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} = 300A, T_J = 25℃	V_{SD}	-	3.38	4.27	V
	I_{SD} = 300A, T_J = 125℃		-	3.04	-	
	I_{SD} = 300A, T_J = 150℃		-	2.97	-	
Diode Reverse Recovery Charge	V_R = 600V, I_{SD} = 300A V_{GS} = −5V, R_G = 4.7Ω Ls = 16uH,-di/dt = A/us,T_J = 25℃	Q_r	-	2.5	-	uC
Peak Reverse Recovery Current		I_{rrm}	-	111.4	-	A
Reverse Recovery Energy		E_{rr}	-	0.54	-	mJ
Diode Reverse Recovery Charge	V_R = 600 V, I_{SD} = 300 A V_{GS} = −5 V, R_G = 4.7Ω Ls = 16uH,-di/dt = A/us,T_J = 125℃	Q_r	-	4.2	-	uC
Peak Reverse Recovery Current		I_{rrm}	-	156.4	-	A
Reverse Recovery Energy		E_{rr}	-	1.09	-	mJ
Diode Reverse Recovery Charge	V_R = 600V, I_{SD} = 300A V_{GS} = −5V, R_G = 4.7Ω Ls = 16uH,-di/dt = A/us,T_J = 150℃	Q_r	-	5.4	-	uC
Peak Reverse Recovery Current		I_{rrm}	-	184.2	-	A
Reverse Recovery Energy		E_{rr}	-	1.52	-	mJ
Thermal Resistance − Chip−to−Case	M1, M2	R_{thJC}	-	0.071	-	℃/W
Thermal Resistance − Chip−to−Heatsink	Thermal grease, Thickness = 2 Mil +2%, A = 2.8 W/mK	R_{thJH}	-	0.083	-	℃/W
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_{RMS}
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

TYPICAL CHARACTERISTIC

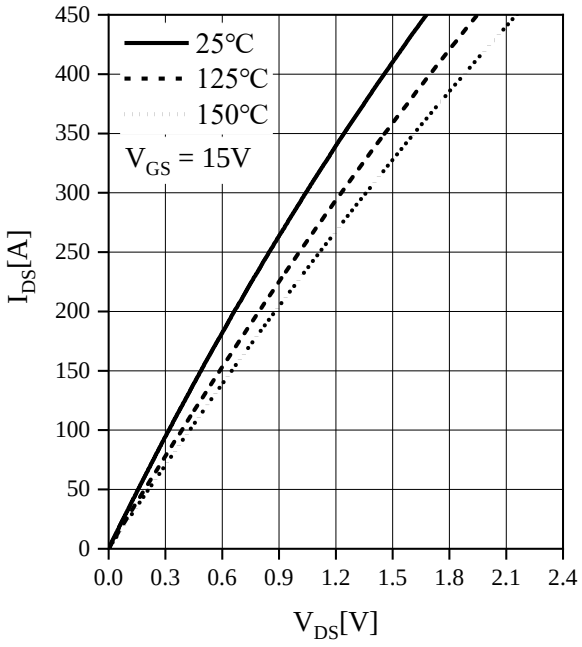


Figure 2. MOSFET Typical Output Characteristic

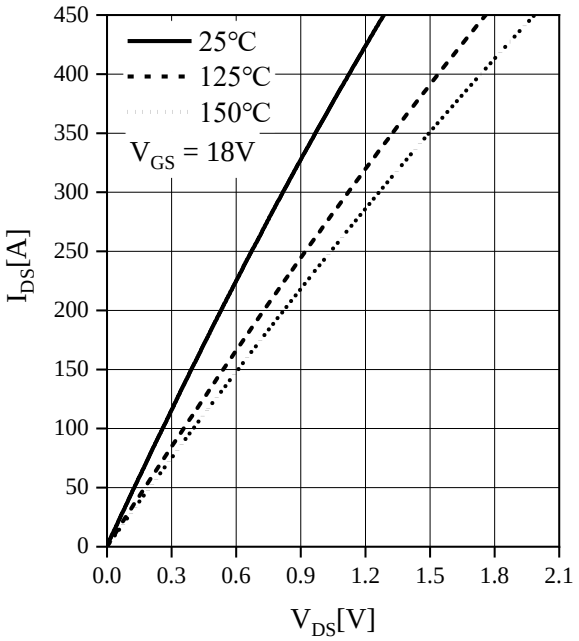


Figure 3. MOSFET Typical Output Characteristic

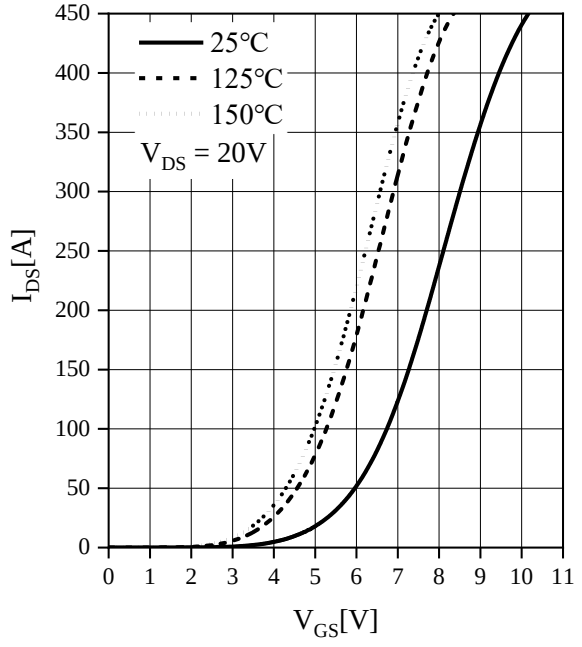


Figure 4. MOSFET Typical Transfer Characteristic

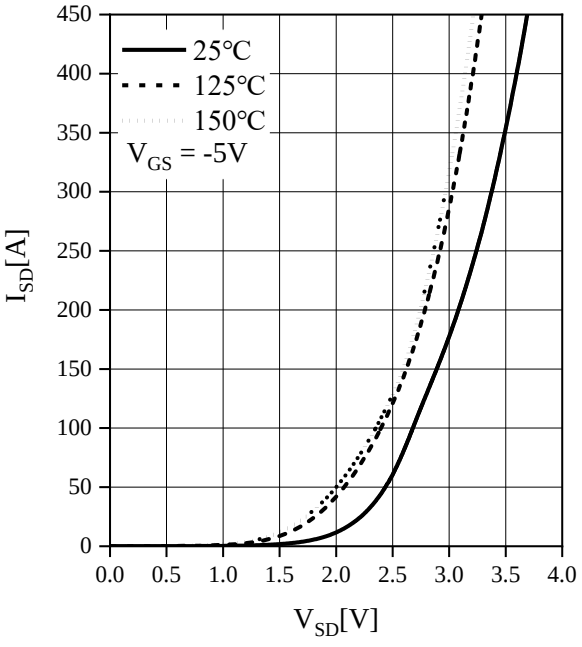


Figure 5. Body Diode Forward Characteristic

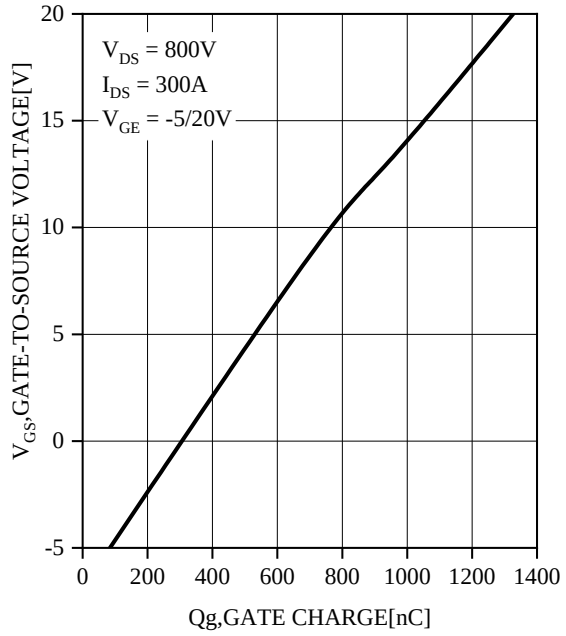


Figure 6. Gate−to−Source Voltage vs. Total Charge

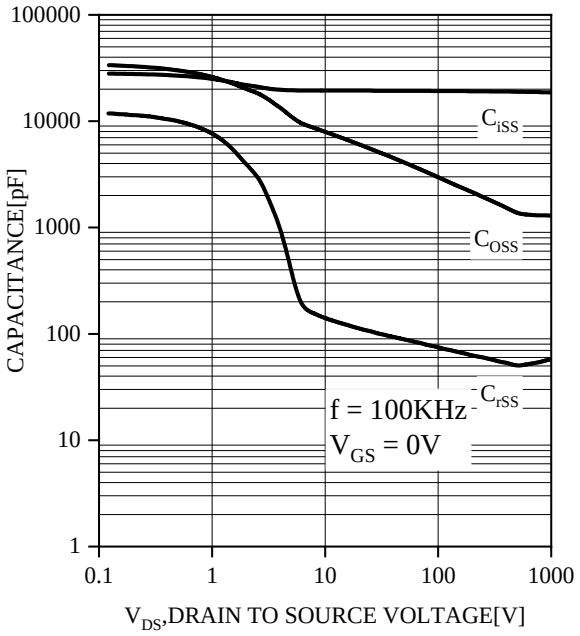


Figure 7. Capacitance vs. Drain−to−Source Voltage

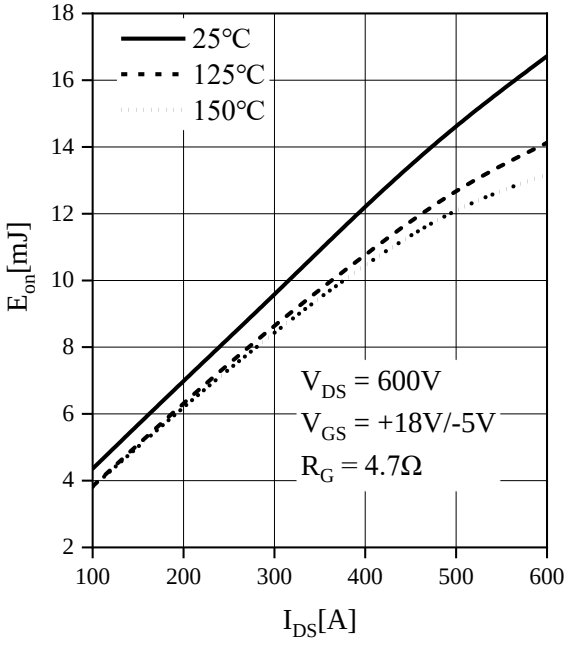


Figure 8. Typical Switching Loss Eon vs. ID

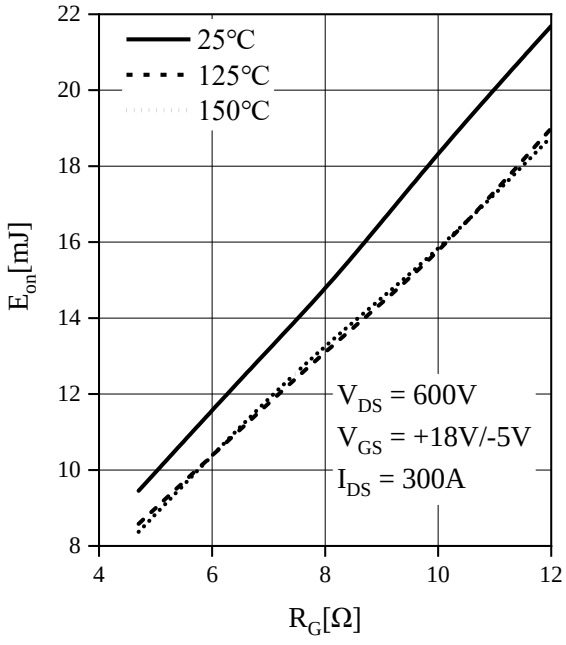


Figure 9. Typical Switching Loss Eon vs. Rg

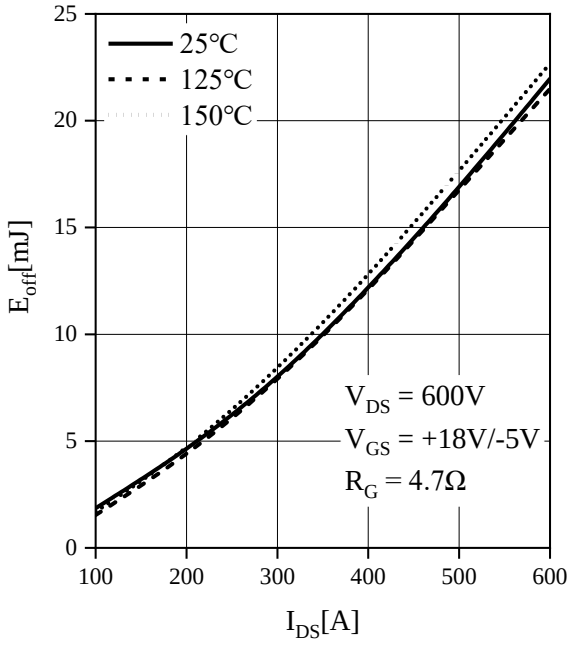


Figure 10. Typical Switching Loss Eoff vs. ID

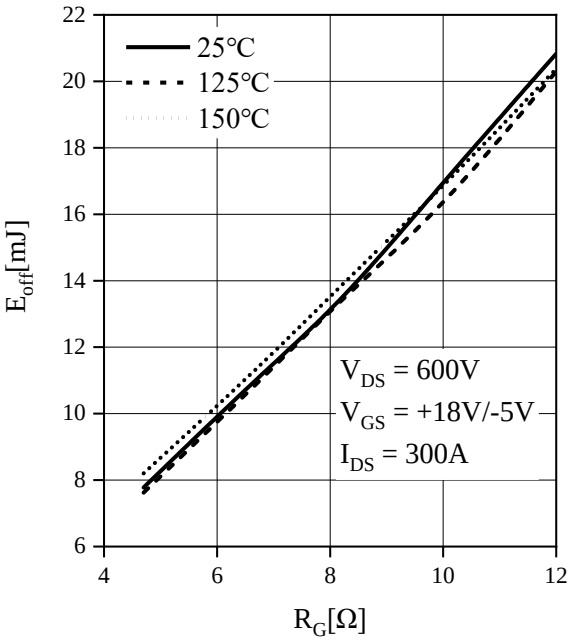


Figure 11. Typical Switching Loss Eoff vs. Rg

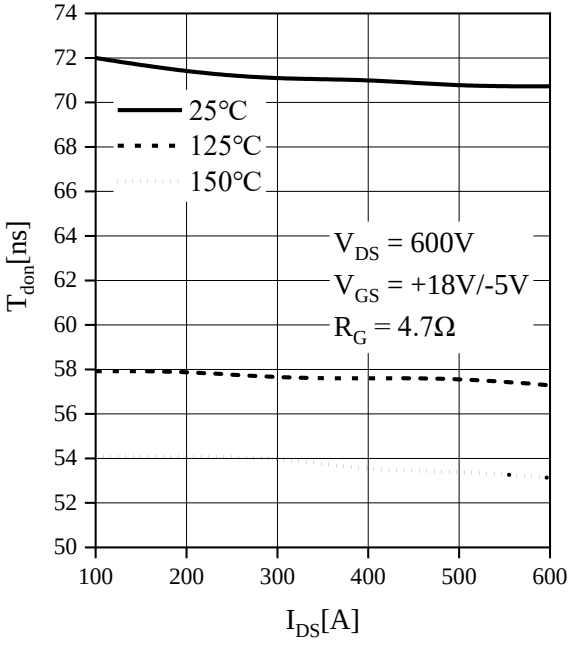


Figure 12. Typical Switching Loss Tdon vs. ID

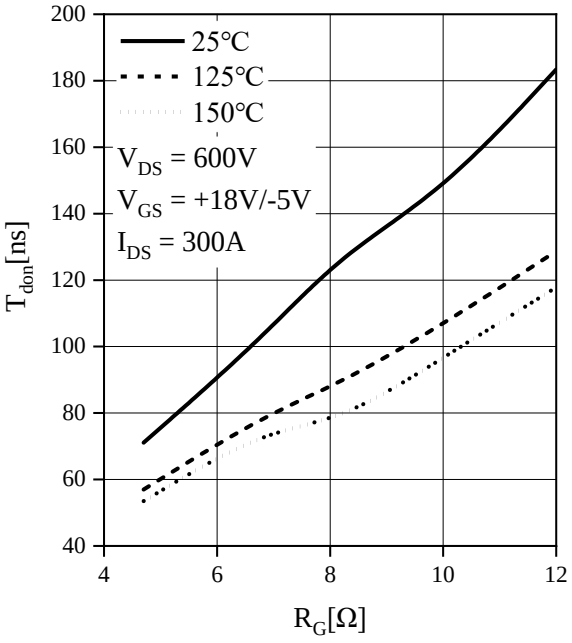


Figure 13. Typical Switching Loss Tdon vs. Rg

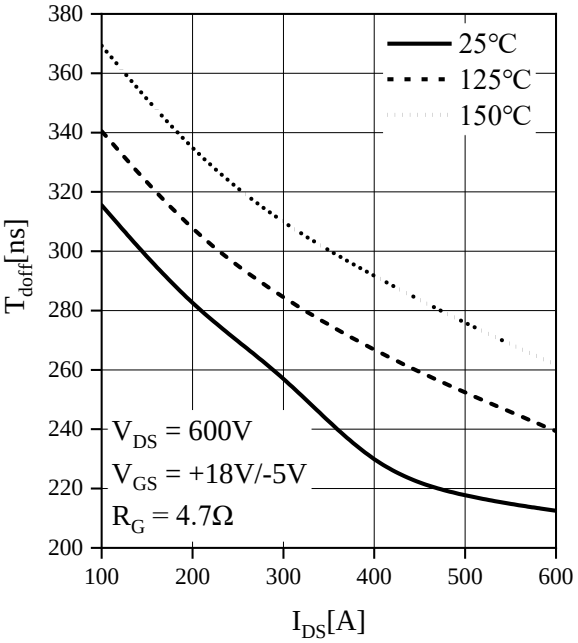


Figure 14. Typical Switching Loss Tdoff vs. ID

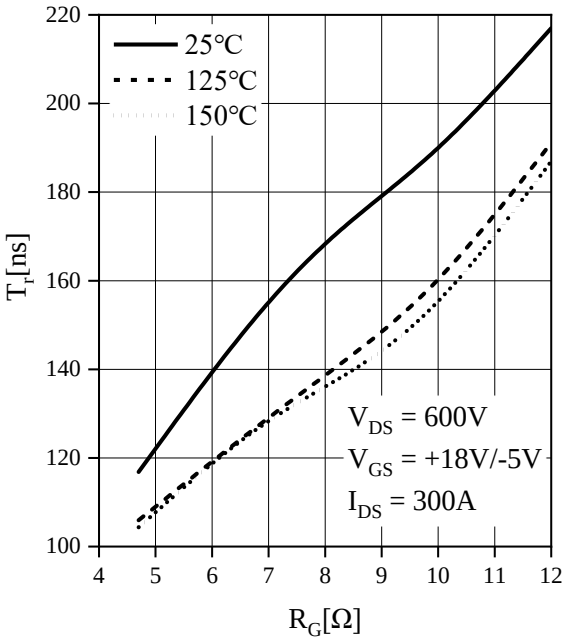


Figure 15. Typical Switching Loss Tdoff vs. Rg

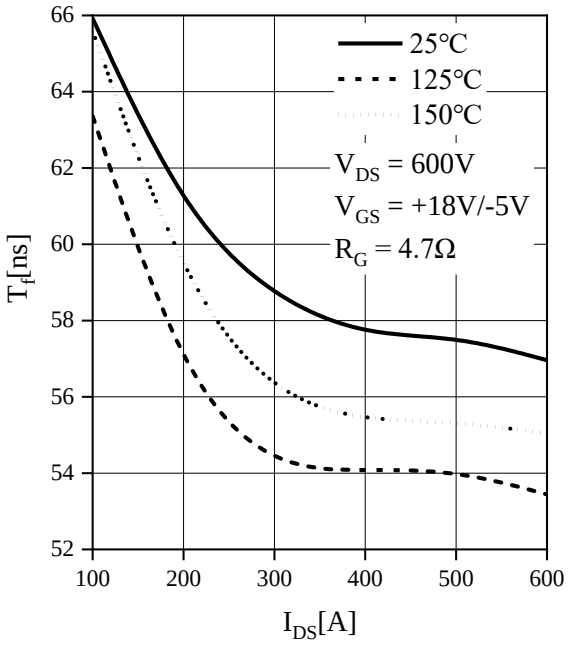


Figure 16. Typical Switching Loss Tr vs. ID

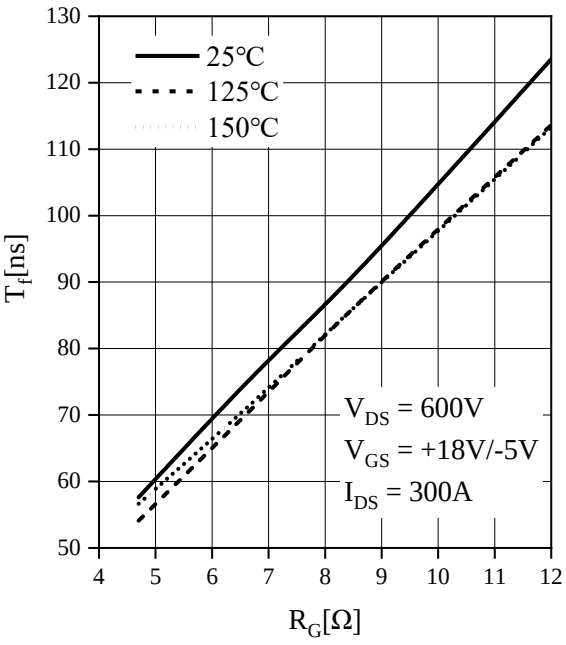


Figure 17. Typical Switching Loss Tr vs. Rg

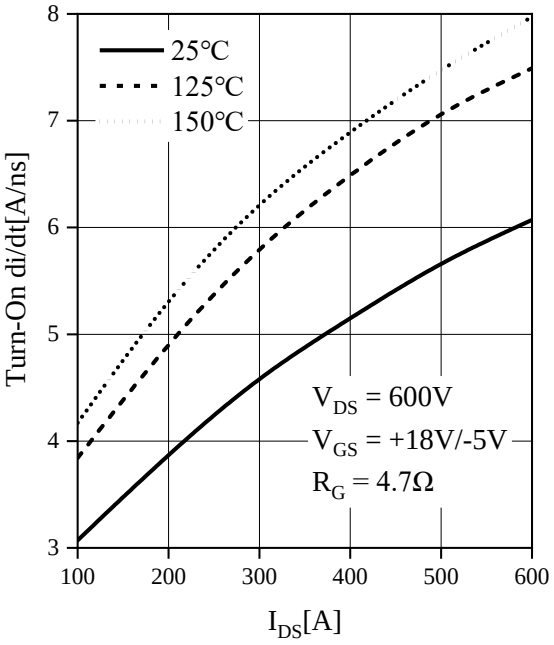


Figure 18. Typical Switching Loss Tf vs. ID

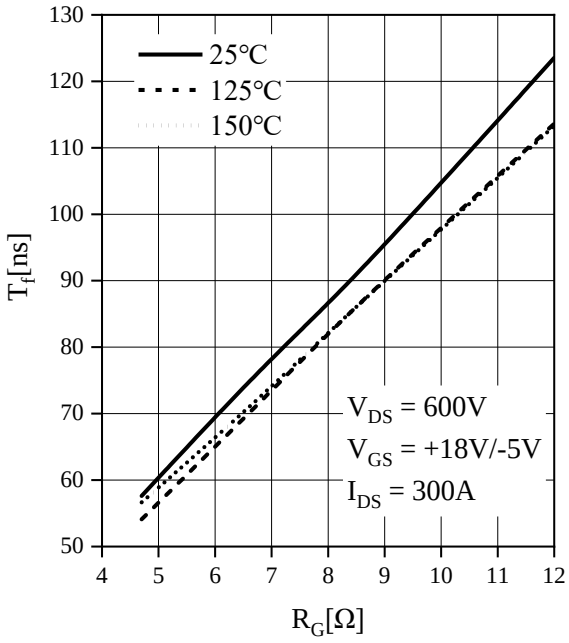


Figure 19. Typical Switching Loss Tf vs. Rg

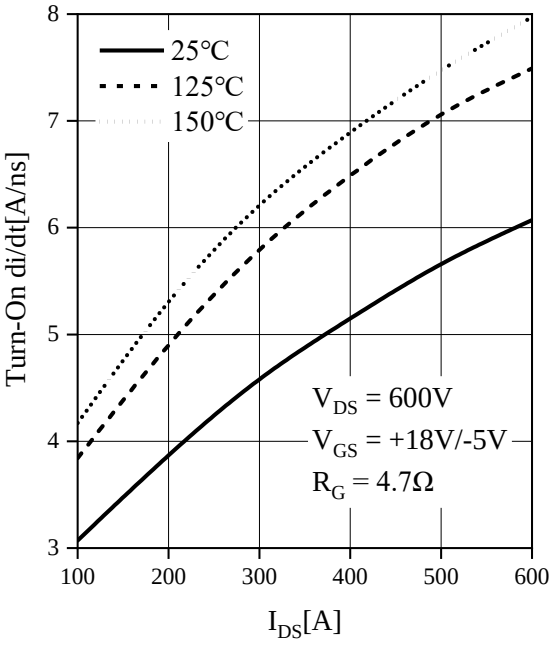


Figure 20. di/dt ON vs. ID

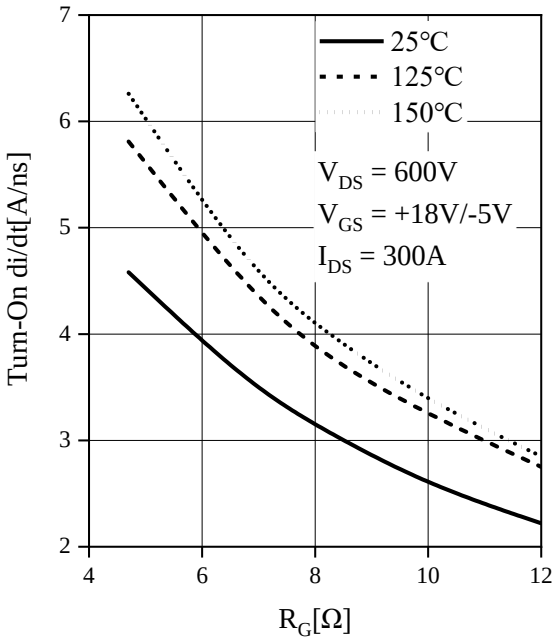


Figure 21. di/dt ON vs. RG

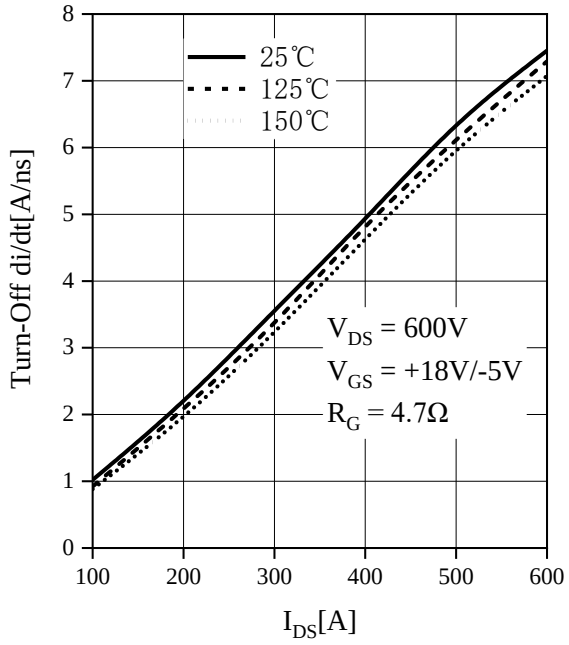


Figure 22. di/dt OFF vs. ID

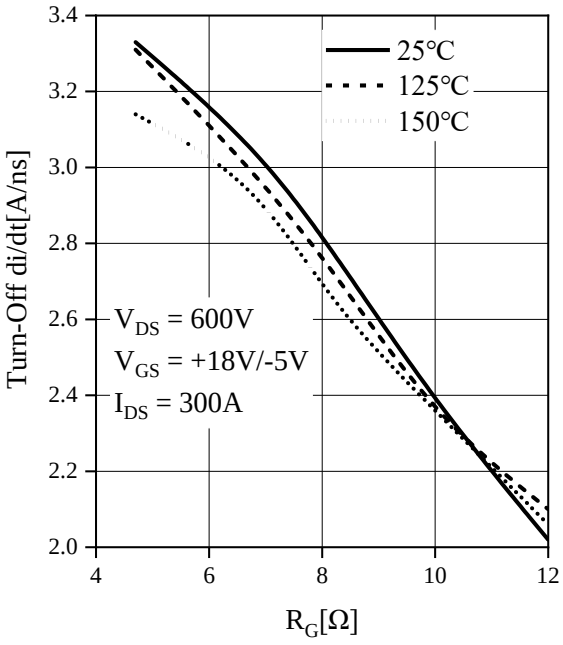


Figure 23. di/dt OFF vs. RG

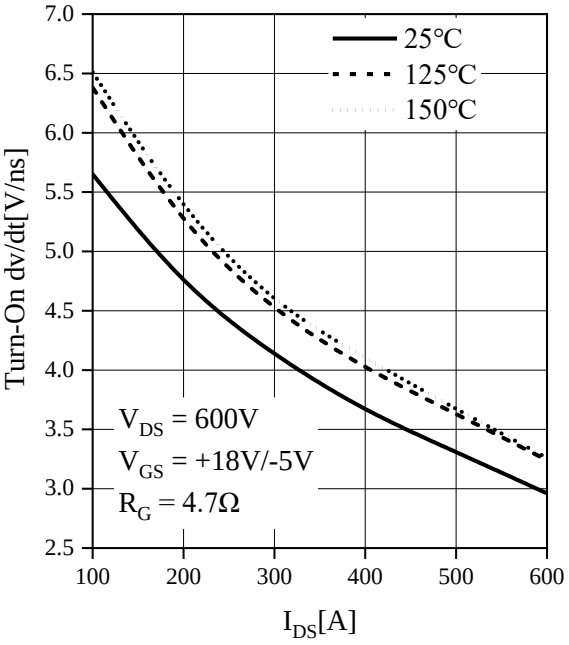


Figure 24. dv/dt ON vs. ID

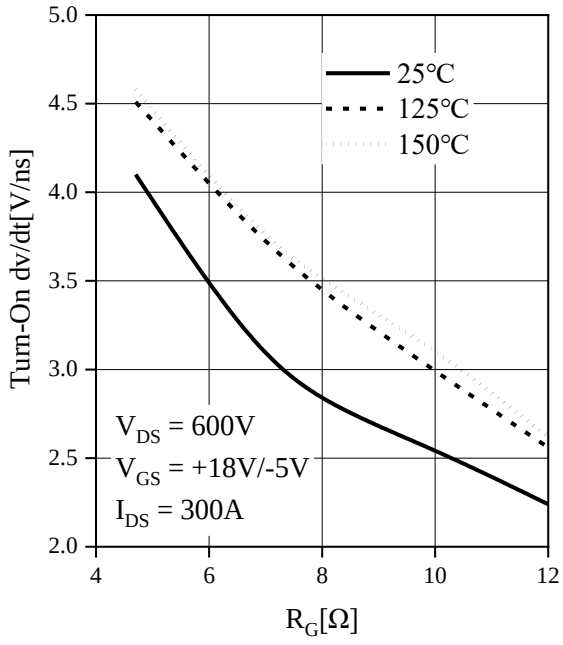


Figure 25. dv/dt ON vs. RG

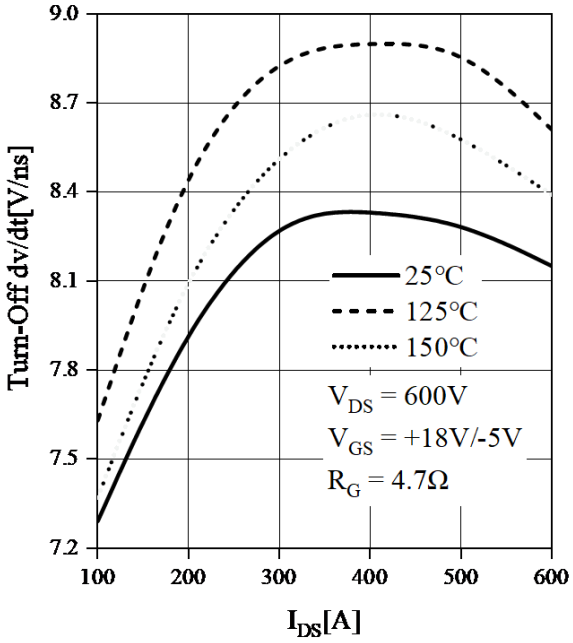


Figure 26. dv/dt OFF vs. ID

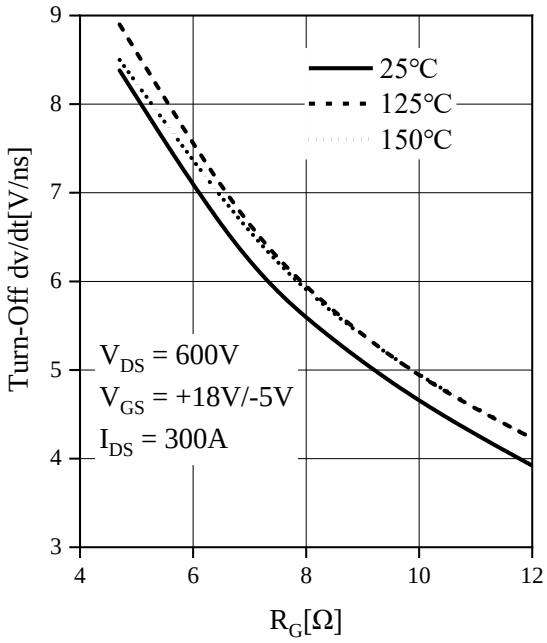


Figure 27. dv/dt OFF vs. RG

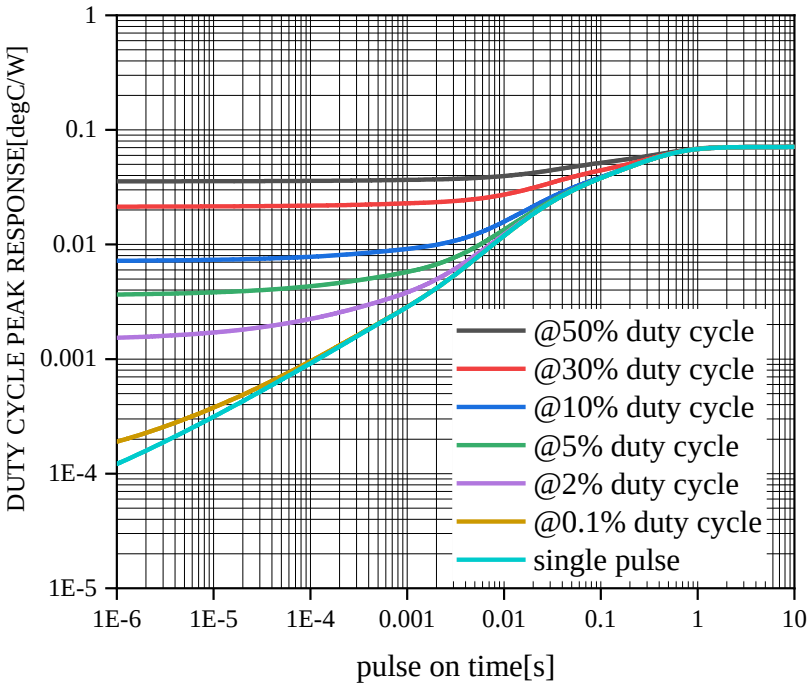
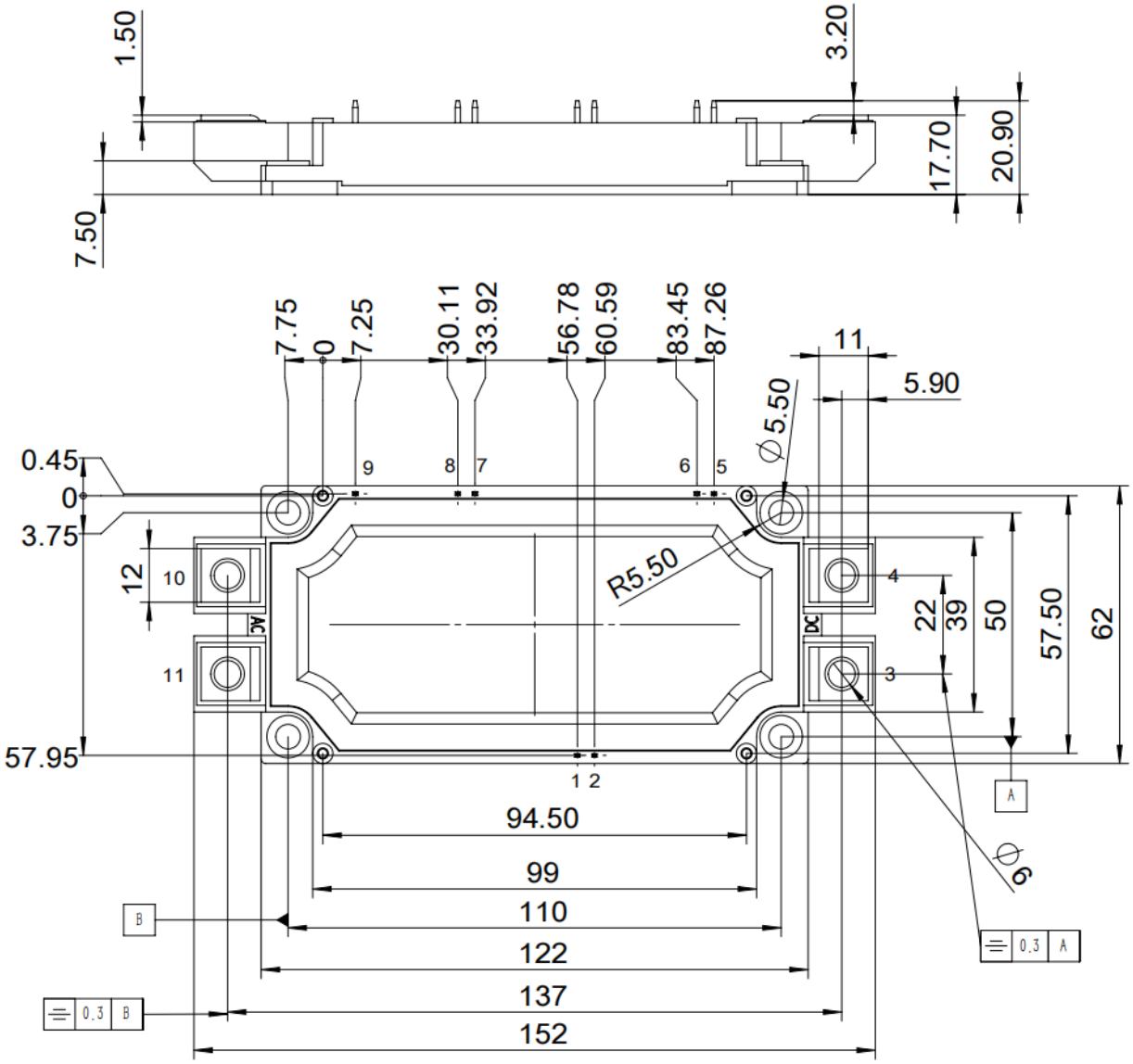


Figure 28. MOSFET Junction−to−Case Transient Thermal Impedance

Package Drawing



UNIT:mm