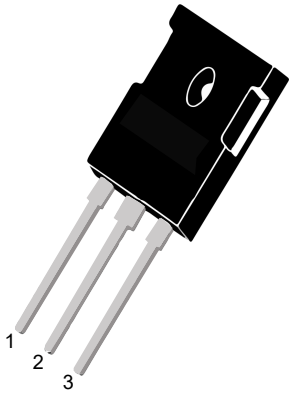
1200V, 60 mΩ N-Channel mSiC™ MOSFET

MSC060SMB120B

Product Overview

1200V, 60 mΩ typical at V_{GS} = 18V, 74 mΩ typical at V_{GS} = 15V, Silicon Carbide (SiC) N-Channel MOSFET, TO-247.



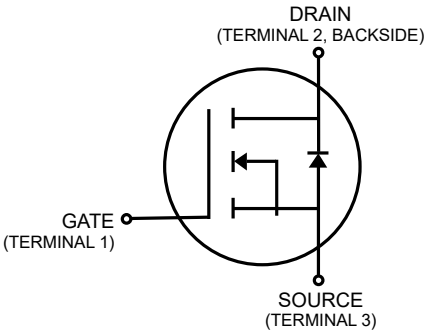


Table 1. Ordering Information

Catalog Part Number (CPN)	Package	Packing Media (Qty.)	Qualification
MSC060SMB120B	TO-247	Tube (30)	Industrial
MSC060SMB120BVAO	TO-247	Tube (30)	AEC-Q101

Features

- Low capacitances and low gate charge
- Fast switching speed due to low internal gate resistance (ESR)
- Stable operation at high junction temperature, $T_{J(max)}$ = 175 °C
- Fast and reliable body diode
- Superior avalanche ruggedness (100% UIS production tested)
- Creepage distance (Typ. > 2.55 mm)
- RoHS compliant

Applications

- Photovoltaic (PV) inverter, converter, and industrial motor drives
- Smart grid transmission and distribution
- Induction heating and welding
- Hybrid Electric Vehicle (HEV) powertrain and Electric Vehicle (EV) charger
- Power supply and distribution

Benefits

- High efficiency to enable lighter and more compact system
- Simple to drive and easy to parallel
- Improved thermal capabilities and lower switching losses
- Eliminates the need for external freewheeling diode
- Lower system cost of ownership

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1. Device Specifications

This section shows the specifications of this device.

1.1. Absolute Maximum Ratings

The following table shows the absolute maximum ratings of this device.

Table 1-1. Absolute Maximum Ratings

Symbol	Parameter	Ratings	Unit
V_{DSS}	Drain source voltage	1200	V
I_D	Continuous drain current at T_C = 25 °C	38	A
	Continuous drain current at T_C = 100 °C	27	
I_{DM}	Pulsed drain current[1]	84	
V_{GS}	Gate-source voltage	21/–10	V
	Transient gate-source voltage	23/–12	
	Recommended turn-on gate-source voltage	15 to 18	
	Recommended turn-off gate-source voltage	–5	
P_D	Total power dissipation at T_C = 25 °C	192	W
	Linear derating factor	1.3	W/°C

Note:

1. Repetitive rating: Pulse width and case temperature are limited by the maximum junction temperature.

1.2. Thermal and Mechanical Characteristics

The following table shows the thermal and mechanical characteristics of this device.

Table 1-2. Thermal and Mechanical Characteristics

Symbol	Characteristic/Test Conditions	Min.	Typ.	Max.	Unit
$R_{\theta JC}$	Junction-to-case thermal resistance	—	0.6	0.78	°C/W
T_J	Operating junction temperature	–55	—	175	°C
T_{STG}	Storage temperature	–55	—	175	
T_L	Lead temperature for 10 seconds	—	—	300	°C
τ_M	Mounting torque, M3 screw for heat sink attachment (requires 1, not included)	—	0.8	—	N·m
Wt	Package weight	—	6.2	—	g

ESD practices should comply with JESD-625.

1.3. Electrical Performance

The following table shows the static characteristics of this device at T_J = 25 °C unless otherwise specified.

Table 1-3. Static Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0V, I_D = 100 µA	1200	—	—	V
$R_{DS(on)}$	Drain-source on resistance[1]	V_{GS} = 18V, I_D = 8A	—	60	80	mΩ
		V_{GS} = 15V, I_D = 8A	—	74	—	
		V_{GS} = 18V, I_D = 8A, T_J = 175 °C	—	99	—	

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Table 1-3. Static Characteristics (continued)

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate-source threshold voltage	V_{GS} = V_{DS}, I_D = 1.0 mA	1.9	3.0	5.0	V
		V_{DS} = 960V, I_D = 1.0 mA	1.5	—	—	
I_{DSS}	Zero gate voltage drain current	V_{DS} = 1200V, V_{GS} = 0V	—	0.02	3.80	µA
		V_{DS} = 1200V, V_{GS} = 0V, T_J = 175 °C	—	0.36	—	
I_{GSS}	Gate-source leakage current	V_{GS} = 21V/–10V	—	—	±100	nA

Note:

1. Pulse test: pulse width < 380 µs, duty cycle < 2%.

The following table shows the dynamic characteristics of the device at T_J = 25 °C unless otherwise specified.

Table 1-4. Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{GS} = 0V, V_{DD} = 1000V, V_{AC} = 25 mV, f = 100 kHz	—	1143	—	pF
C_{rss}	Reverse transfer capacitance		—	4.0	—	
C_{oss}	Output capacitance		—	53	—	
Q_G	Total gate charge	V_{GS} = 18V/–5V, V_{DD} = 800V, I_D = 8A	—	45	—	nC
Q_{GS}	Gate-source charge		—	13	—	
Q_{GD}	Gate-drain charge		—	8.0	—	
$t_{d(on)}$	Turn-on delay time	V_{DD} = 820V, V_{GS} = 18V/–5V, I_D = 30A, R_G = 8Ω, Freewheeling diode = MSC060SMB120B (V_{GS} = –5V); reference Figure 1-19	—	35	—	ns
t_r	Rise time		—	12	—	
$t_{d(off)}$	Turn-off delay time		—	17	—	
t_f	Fall time		—	7	—	
E_{on}	Turn-on switching energy		—	687	—	µJ
E_{off}	Turn-off switching energy		—	123	—	
ESR	Gate equivalent series resistance	f = 1 MHz, 25 mV, drain-to-source short	—	2.25	—	Ω
SCWT	Short circuit withstand time	V_{DS} = 960, V_{GS} = 18V/0V, R_G = 20Ω	—	2	—	µs
E_{AS}	Avalanche energy, single pulse	I_D = 2.3A, 100% UIS production tested	420	—	—	mJ
$E_{AS\ CHAR}$		I_D = 10A, last typical pass	—	1020	—	

The following table shows the body diode characteristics of the device at T_J = 25 °C unless otherwise specified.

Table 1-5. Body Diode Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
V_{SD}	Diode forward voltage	I_{SD} = 8A, V_{GS} = 0V	—	3.5	—	V
		I_{SD} = 8A, V_{GS} = –5V	—	3.9	5.0	
t_{rr}	Reverse recovery time	I_{SD} = 30A, V_{GS} = –5V, Drive R_G = 8Ω, V_{DD} = 820V, dI/dt = –1600 A/µs	—	25	—	ns
Q_{rr}	Reverse recovery charge		—	117	—	nC
I_{RRM}	Reverse recovery current		—	8	—	A

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1.4. Typical Performance Curves

Figure 1-1. Drain Current vs. V_{DS} at T_J

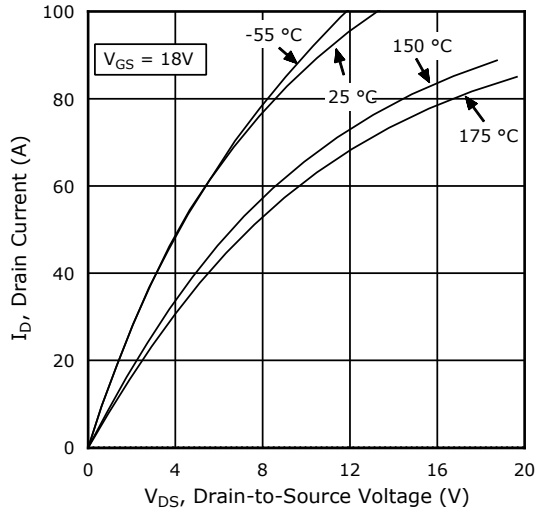


Figure 1-2. Drain Current vs. V_{DS} at V_{GS}

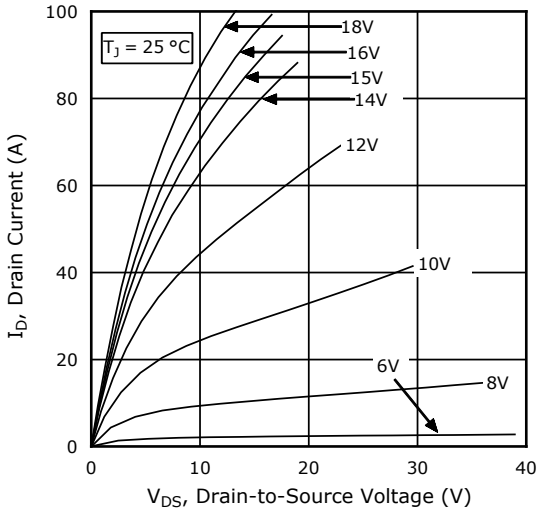


Figure 1-3. Drain Current vs. V_{DS} at V_{GS}

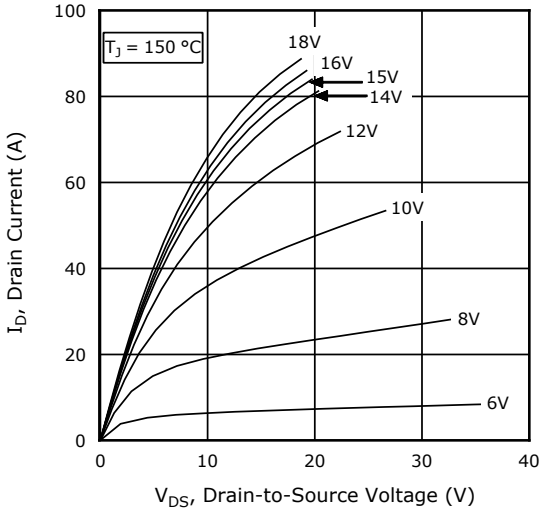
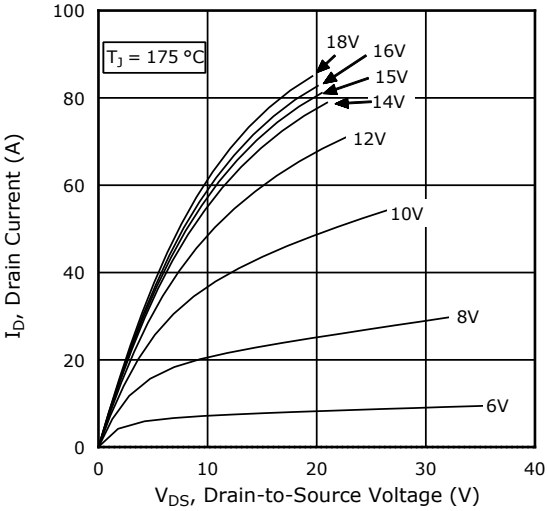


Figure 1-4. Drain Current vs. V_{DS} at V_{GS}



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Figure 1-5. I_D vs. V_{DS} 3rd Quadrant Conduction

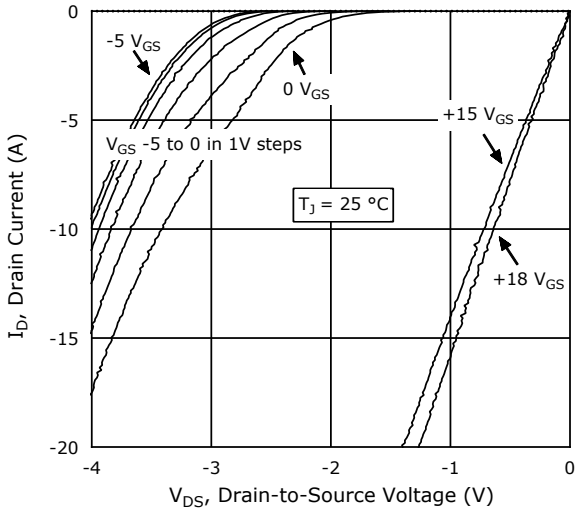


Figure 1-6. I_D vs. V_{DS} 3rd Quadrant Conduction

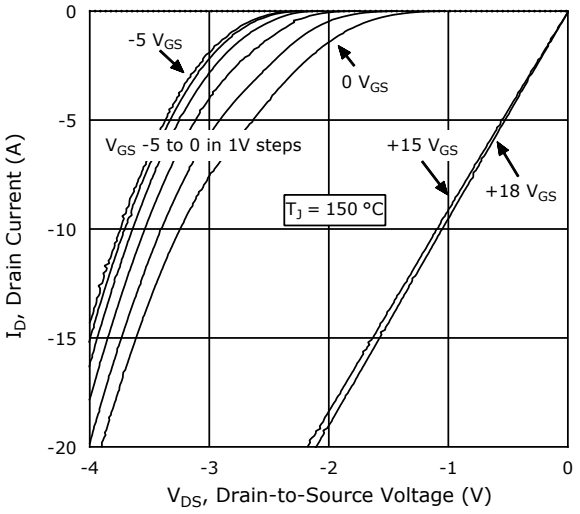


Figure 1-7. $R_{DS(on)}$ vs. Junction Temperature

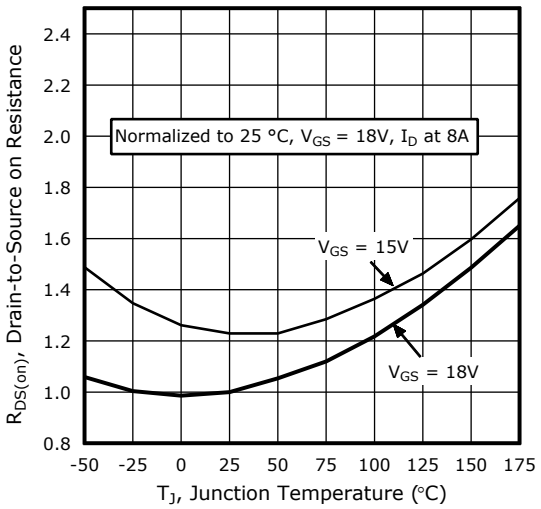
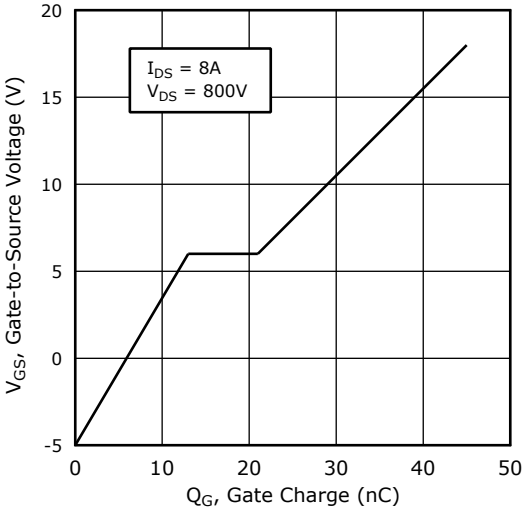


Figure 1-8. Gate Charge Characteristics



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Figure 1-9. Capacitance vs. Drain-to-Source Voltage

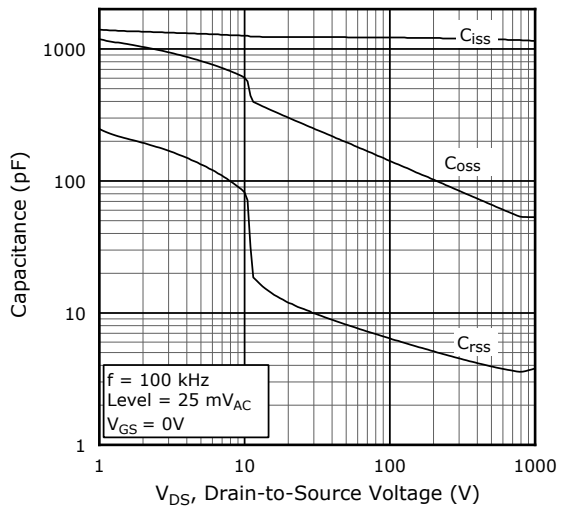


Figure 1-10. Q_{oss} vs. Drain-to-Source Voltage

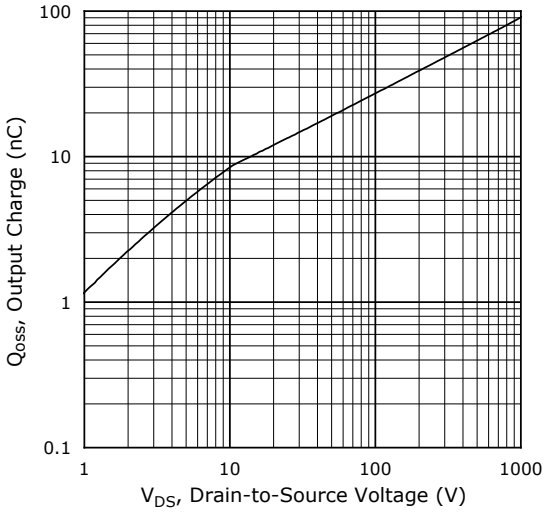


Figure 1-11. E_{oss} vs. Drain-to-Source Voltage

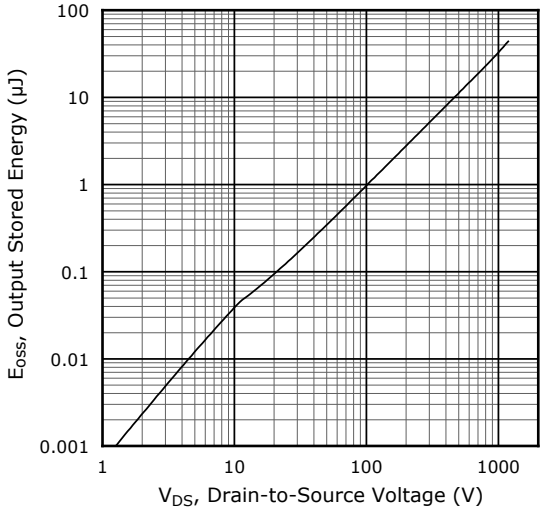
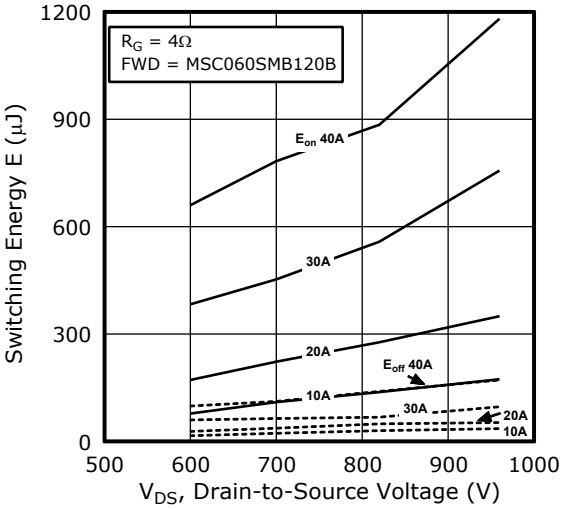


Figure 1-12. Switching Energy vs. V_{DS} & I_D



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Figure 1-13. Switching Energy vs. V_{DS} & I_D

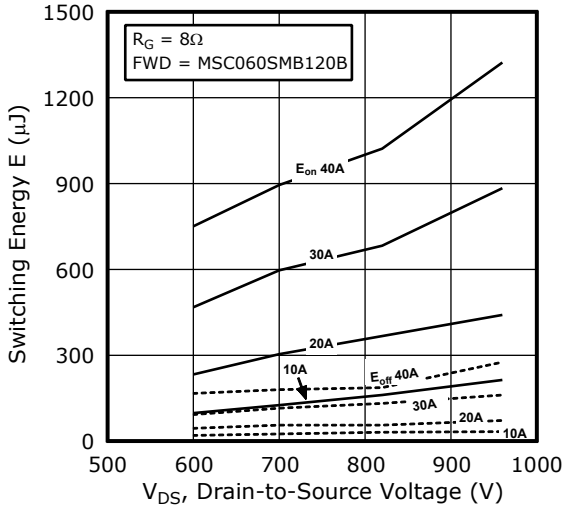


Figure 1-14. Switching Energy vs. V_{DS} & I_D

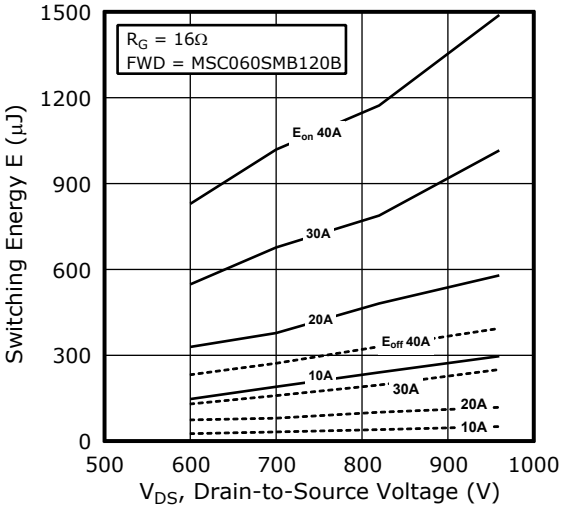


Figure 1-15. Switching Energy vs. Junction Temperature

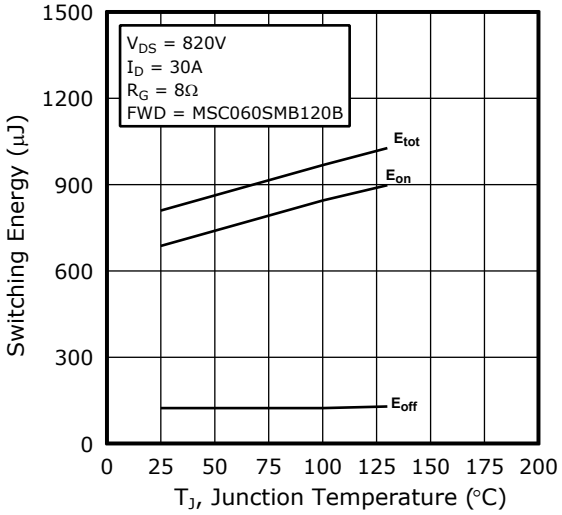
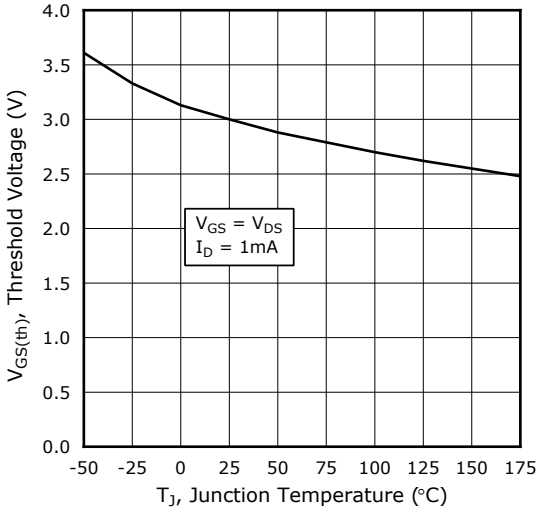


Figure 1-16. Threshold Voltage vs. Junction Temperature



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Figure 1-17. Forward Safe Operating Area

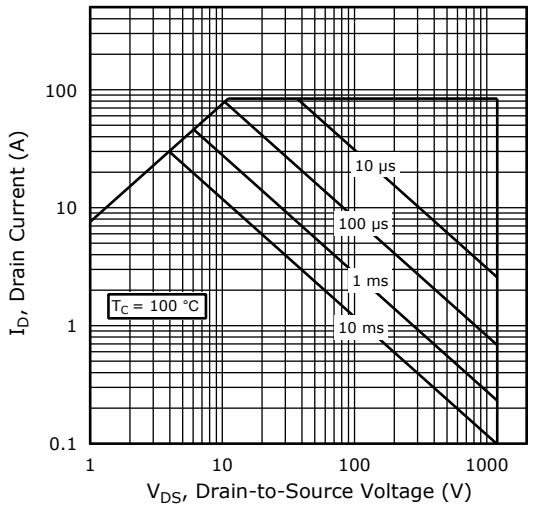
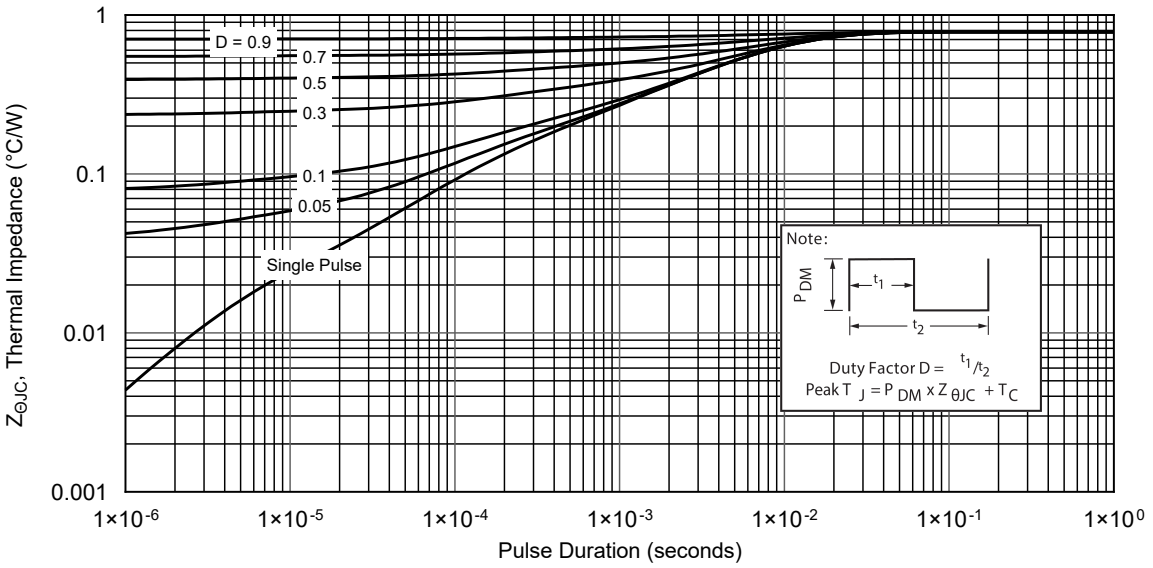
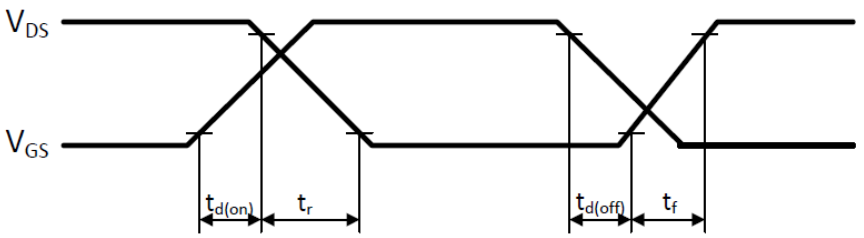


Figure 1-18. Maximum Transient Thermal Impedance



The following figure shows the switching waveform diagram of this device.

Figure 1-19. Switching Waveform



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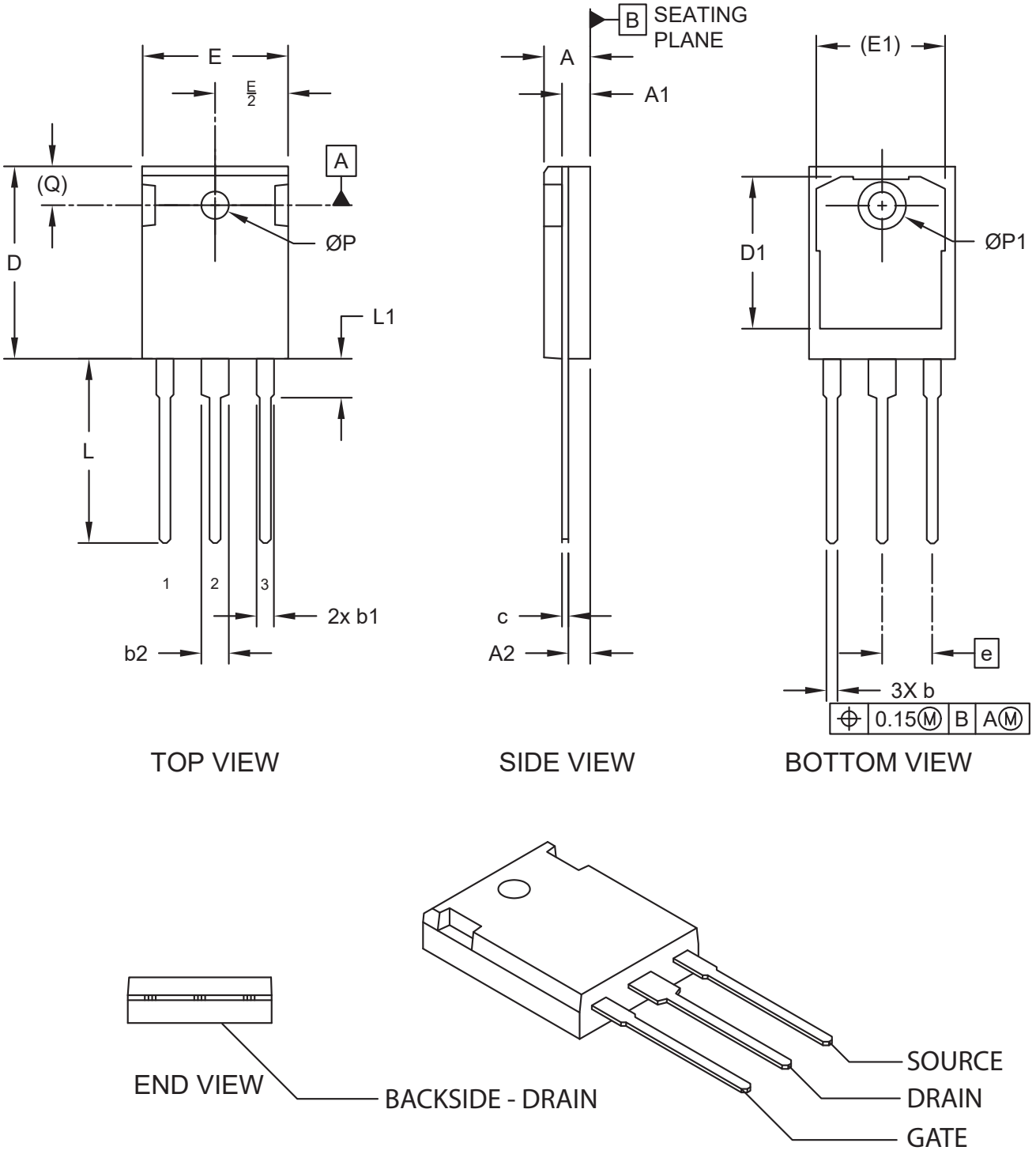
2. Package Specification

This section shows the package specification of this device.

2.1. Package Outline Drawing

The following figure illustrates the TO-247 package outline of this device.

Figure 2-1. Package Outline Drawing



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The following table shows the TO-247 dimensions and should be used in conjunction with the package outline drawing.

Table 2-1. TO-247 Dimensions

Symbol	Description	Min. (mm)	Max. (mm)
N	Number of leads	3	
e	Pitch	5.44 BSC	
A	Overall height	4.70	5.31
A1	Tab height	1.50	2.49
A2	Seating plane to lead	2.21	2.59
b	Lead width	1.02	1.40
b1	Lead shoulder width (X2)	1.65	2.41
b2	Lead shoulder width	2.87	3.38
c	Lead thickness	0.41	0.79
L	Lead length	19.81	20.32
L1	Lead shoulder length	3.99	4.50
D	Molded body length	20.80	21.46
D1	Thermal pad length	16.25	17.65
E	Total width	15.49	16.26
E1	Thermal pad width	13.10	14.50
Q	Hole center to tab edge	6.15 REF	
∅P	Hole diameter	3.51	3.81
∅P1	Thermal pad hole diameter	7.18 REF	

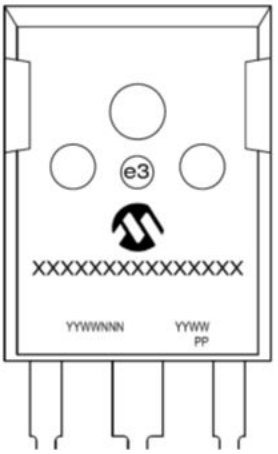
Notes:
Dimensioning and tolerancing per ASME Y14.5M.

- BSC: Basic dimension. Theoretically exact value shown without tolerances.
- REF: Reference dimension, usually without tolerance, for information purposes only.

2.2. Product Marking Information

The following figure shows the product marking information of this device.

Figure 2-2. Product Marking Information



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Marking	Marking Identifier	Description
XXXXXXXXXX	Catalog Part Number (CPN)	This is the unique catalog number for the finished device. **Note:** For automotive-grade device, the VAO identifier is not shown.
YYWWNNN	Traceability code	A unique identifier assigned by Microchip to track and verify the manufacturing history of the device.
YYWW	Date code	A four-digit number which reflects the year and work week of manufacturing. It is the first four digits of the traceability code.
PP	Country of origin	Two-character code per ISO 3166-1-Alpha-2, indicating the manufacturing country.
e3	ROHS category (Lead finish code)	This code specifies the type of finish applied to the device's leads. **Note:** e3 indicates a 100% Matte Tin (Sn) finish.

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3. Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

Table 3-1. Revision History

Revision	Date	Description
A	12/2025	Initial revision

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