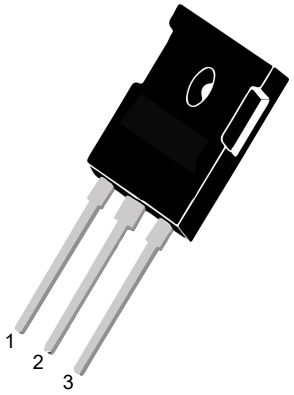
600 V, 40 A Superjunction MOSFET

APT40N60BC7

Product Overview

600 V, 49 mΩ at V_{GS} = 10 V Superjunction MOSFET, TO-247.



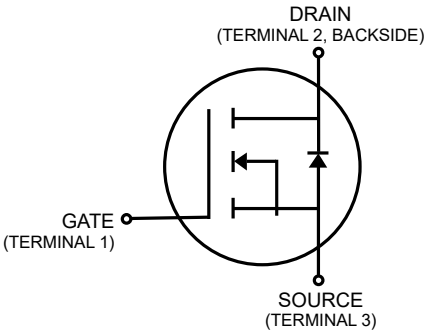


Table 1. Ordering Information

Catalog Part Number (CPN)	Package	Packing Media (Qty.)	Qualification
APT40N60BC7	TO-247	Tube (30)	Industrial

Features

- Lower on-resistance at the same voltage
- Ultra-fast reverse recovery
- Low gate charge and output capacitance
- Avalanche rated
- RoHS compliant

Benefits

- Lower conduction losses
- Lower switching losses in both hard and soft switching topologies
- Reliable operation at high switching frequencies
- Superior hard commutation ruggedness
- High power density for lower system cost

Applications

- Switch-mode power supplies (SMPS)
- DC-DC converters
- Zero-voltage switching (ZVS)
- Resonant LLC converters
- Power factor correction (PFC)
- Solar inverters (photovoltaic)
- Industrial power systems

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	600	V
I_D	Continuous drain current at T_C = 25 °C	40	A
	Continuous drain current at T_C = 100 °C	25	
I_{DM}	Pulsed drain current[1]	153	
V_{GS}	Gate-source voltage	20/–20	V
	Transient gate-source voltage	30/–30	
P_D	Total power dissipation at T_C = 25 °C	179	W
	Linear derating factor	1.43	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			0.70	°C/W
T_J	Operating junction temperature	–55		150	°C
T_{STG}	Storage temperature	–55		150	
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} = 0 V, I_D = 1.0 mA	600			V
$R_{DS(on)}$	Drain-source on resistance[1]	V_{GS} = 10 V, I_D = 18 A		49	55	mΩ
		V_{GS} = 10 V, I_D = 18 A, T_J = 150 °C		105		
$V_{GS(th)}$	Gate-source threshold voltage	V_{GS} = V_{DS}, I_D = 0.9 mA	3.5	4.0	4.5	V
I_{DSS}	Zero gate voltage drain current	V_{DS} = 600 V, V_{GS} = 0 V			1.0	µA
		V_{DS} = 600 V, V_{GS} = 0 V, T_J = 150 °C		20	75	
I_{GSS}	Gate-source leakage current	V_{GS} = 20 V			±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} = 0 V, V_{DD} = 400 V, ƒ = 100 kHz		3525		pF
C_{rss}	Reverse transfer capacitance			11		
C_{oss}	Output capacitance			59		
Q_G	Total gate charge	V_{GS} = 15 V, V_{DD} = 480 V, I_D = 40 A		76		nC
Q_{GS}	Gate-source charge			20		
Q_{GD}	Gate-drain charge			30		
$t_{d(on)}$	Turn-on delay time	V_{DD} = 40 V, V_{GS} = 10 V, I_D = 40 A, R_G = 5 Ω		29		ns
t_r	Rise time			64		
$t_{d(off)}$	Turn-off delay time			97		
t_f	Fall time			67		
E_{on}	Turn-on switching energy			1020		µJ
E_{off}	Turn-off switching energy			489		
ESR	Gate equivalent series resistance	f = 1 MHz, 25 mV, drain-to-source short		1.0		Ω
E_{AS}	Avalanche energy, single pulse	I_D = 6.7 A, 100% UIS production tested	180			mJ

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} = 18 A, V_{GS} = 0 V		1.0		V
t_{rr}	Reverse recovery time	I_{SD} = 40 A, V_{GS} = 0 V, V_{DD} = 400 V, dI/dt = –100 A/µs		138		ns
Q_{rr}	Reverse recovery charge			838		nC
I_{RRM}	Reverse recovery current			10.7		A

1.4. Typical Performance Curves

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

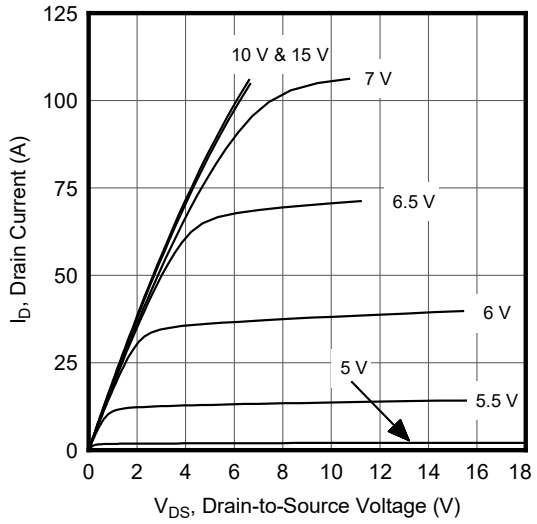


Figure 1-2. Drain Current vs. V_{GS}

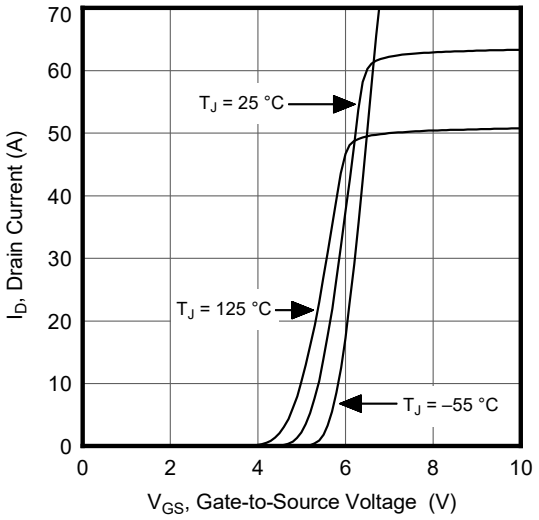


Figure 1-3. Reverse Drain Current vs. Drain Current

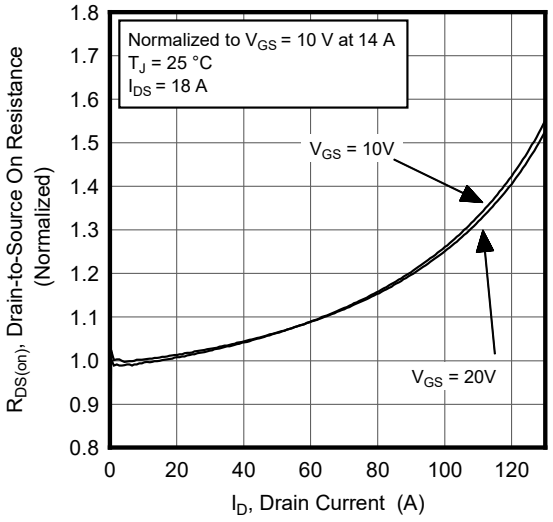


Figure 1-4. Maximum Drain Current vs. Case Temperature

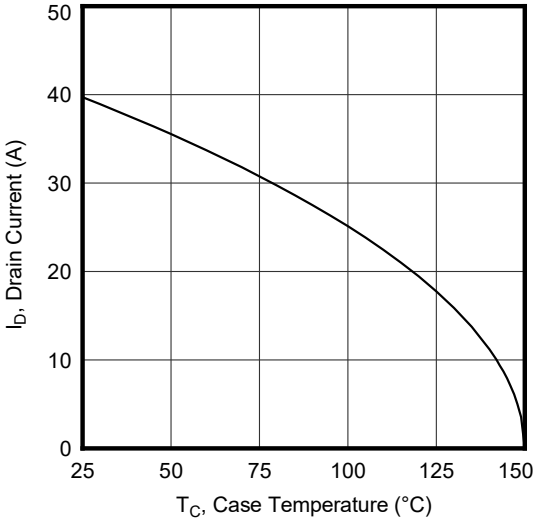


Figure 1-5. BV_{DSS} vs. Junction Temperature

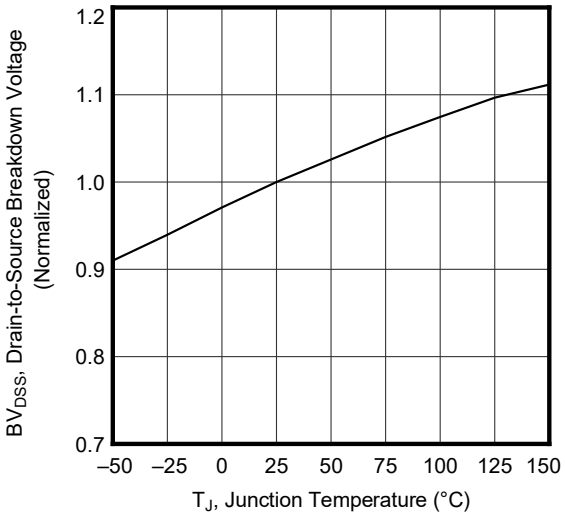


Figure 1-6. $R_{DS(on)}$ vs. Junction Temperature

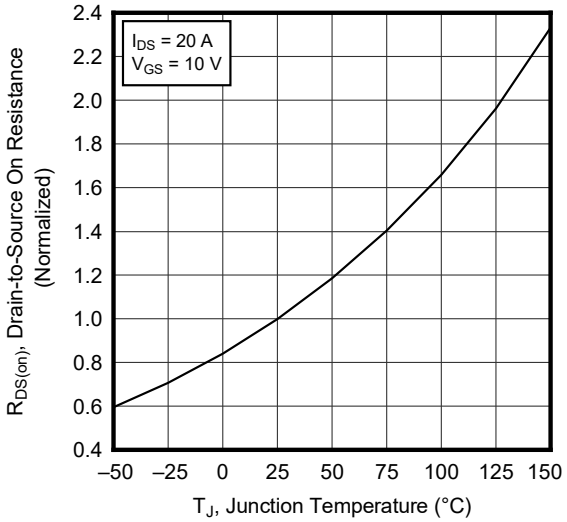


Figure 1-7. Threshold Voltage vs. Case Temperature

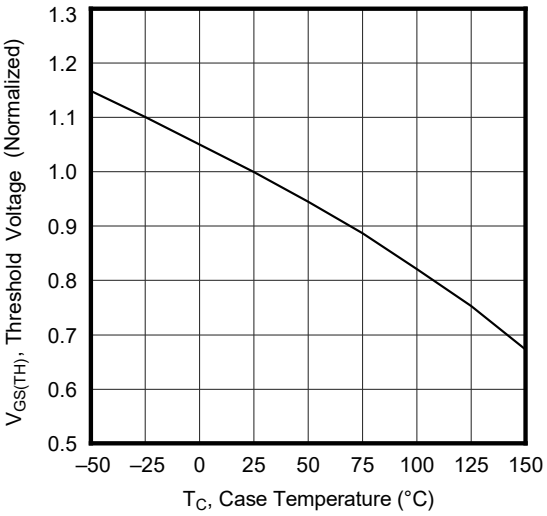


Figure 1-8. Capacitance vs. Drain-to-Source Voltage

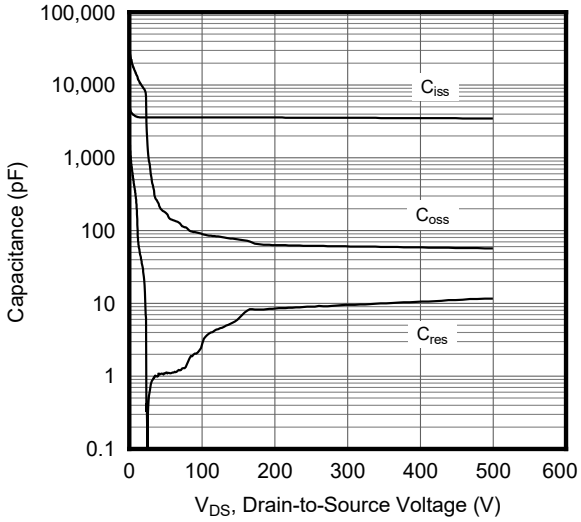


Figure 1-9. Gate-to-Source Voltage vs. Gate Charge

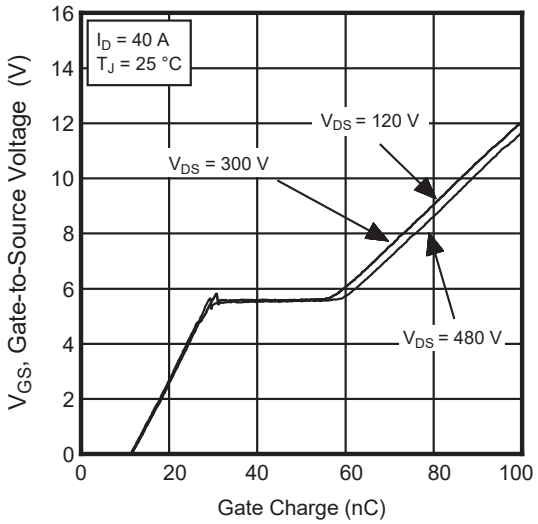


Figure 1-10. Reverse Drain Current vs. Source-to-Drain Voltage

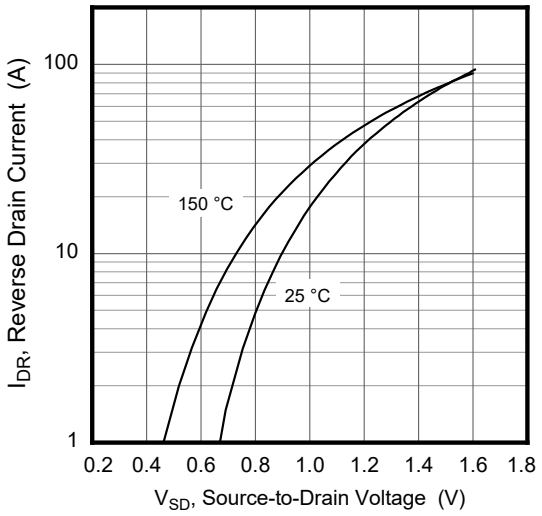


Figure 1-11. Forward Safe Operating Area

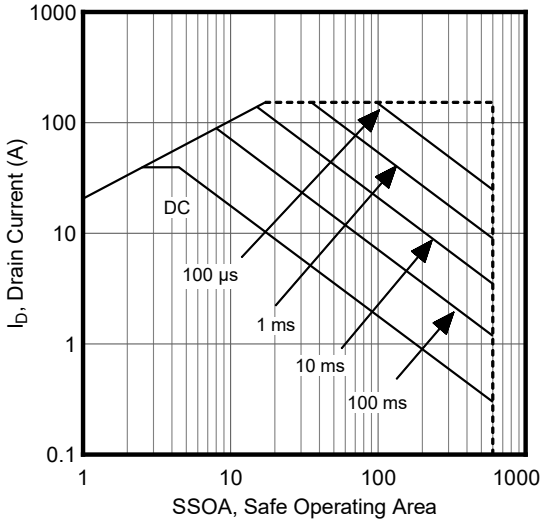


Figure 1-12. Delay Time vs. Drain Current

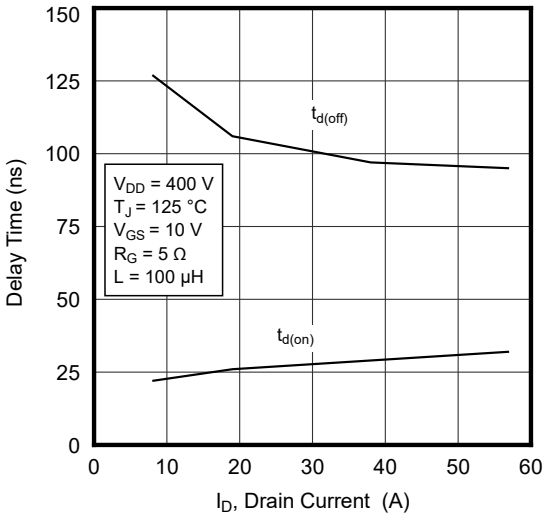


Figure 1-13. Rise/Fall Time vs. Drain Current

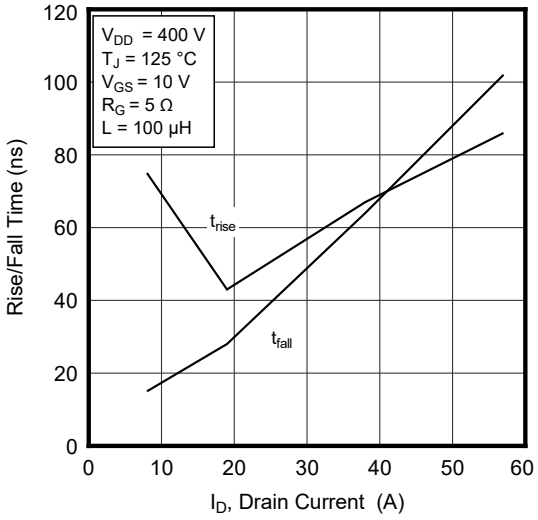


Figure 1-14. Eon/Eoff Energy vs. Drain Current

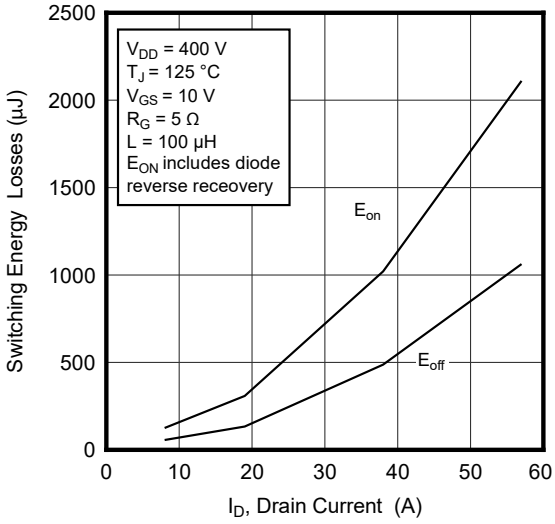


Figure 1-15. Maximum Transient Thermal Impedance

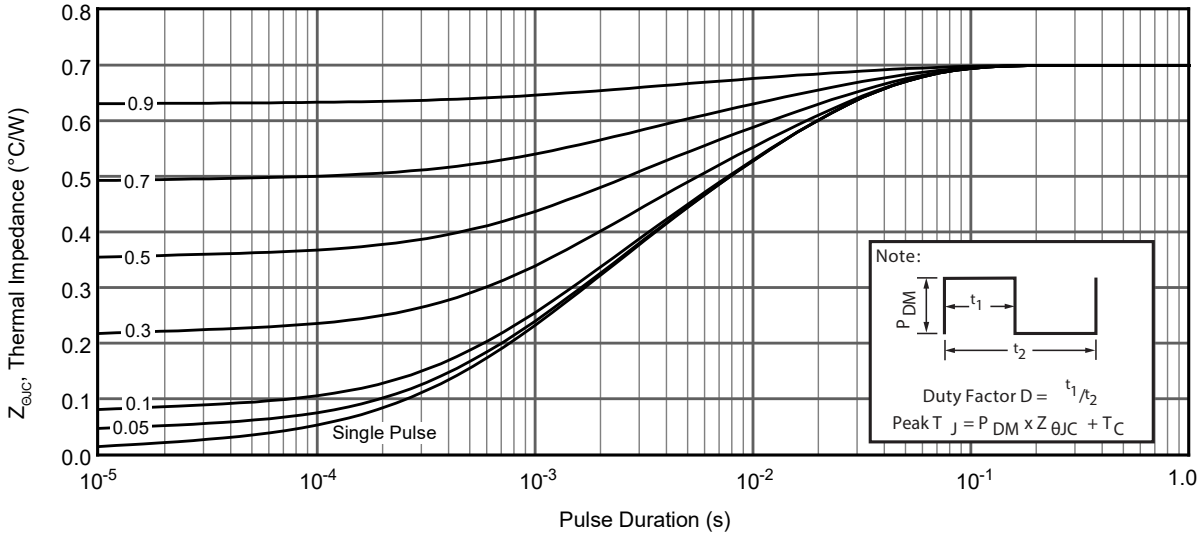


Figure 1-16. Turn-on Switching Waveform and Definitions

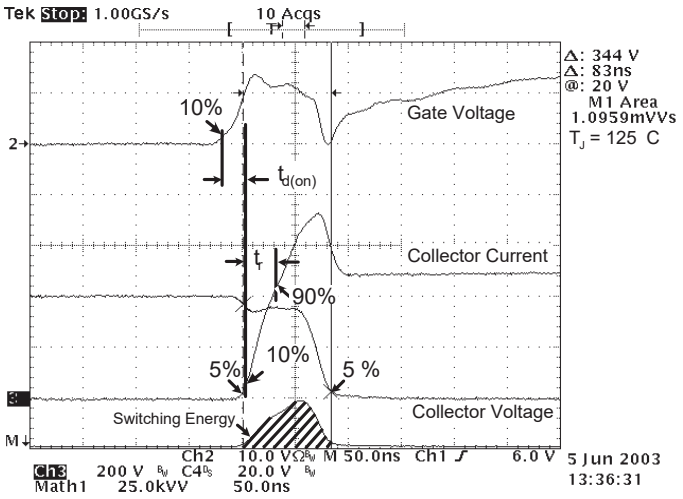


Figure 1-17. Turn-off Switching Waveform and Definitions

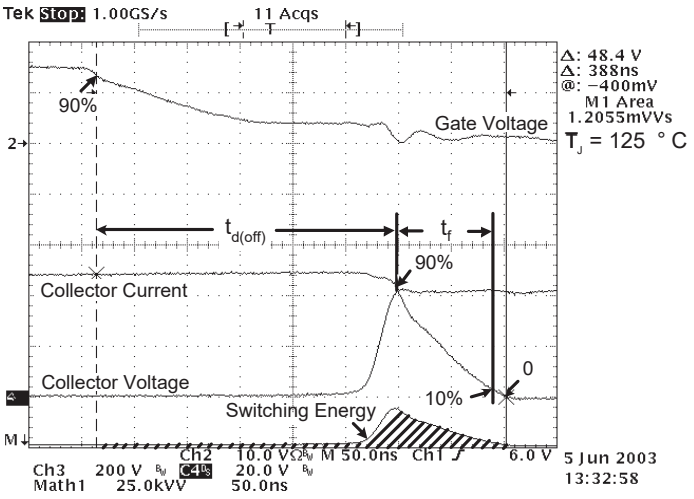
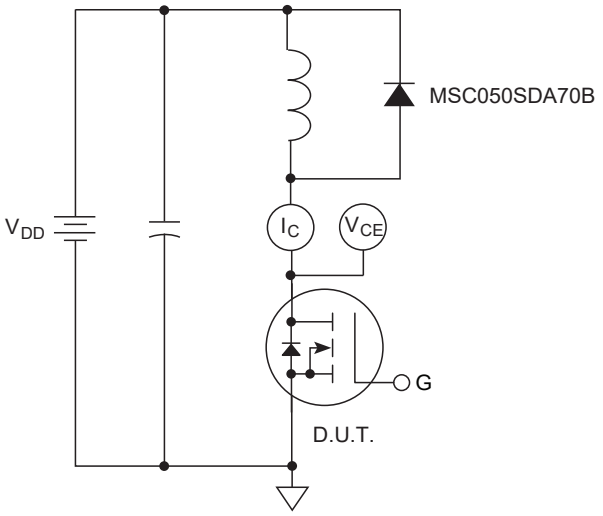


Figure 1-18. Inductive Switching Test Circuit



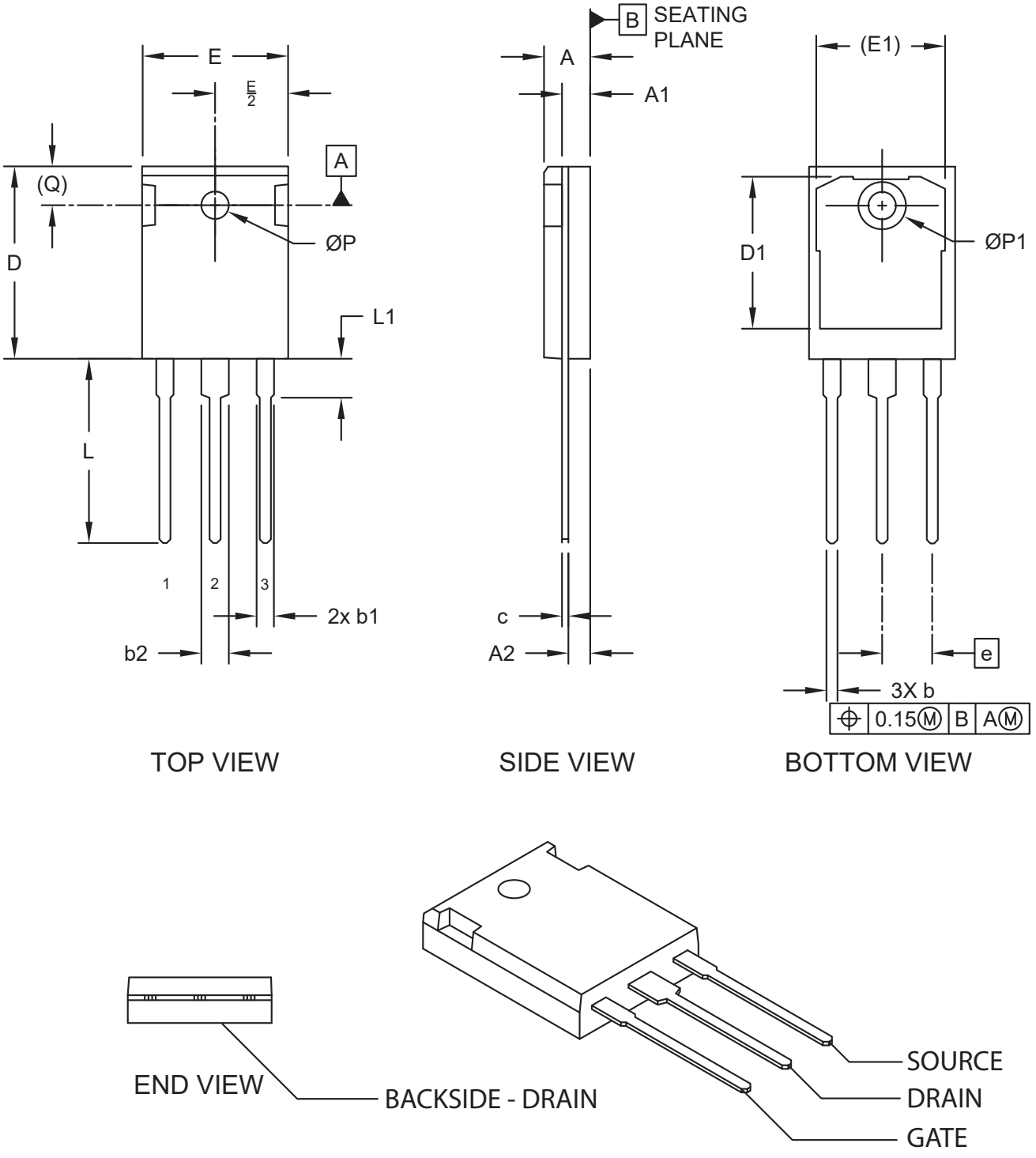
2. Package Specification

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



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.

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	03/2026	Document created.

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