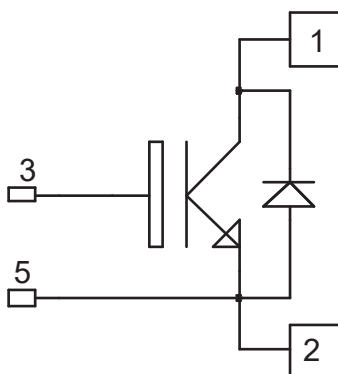


## Product Overview

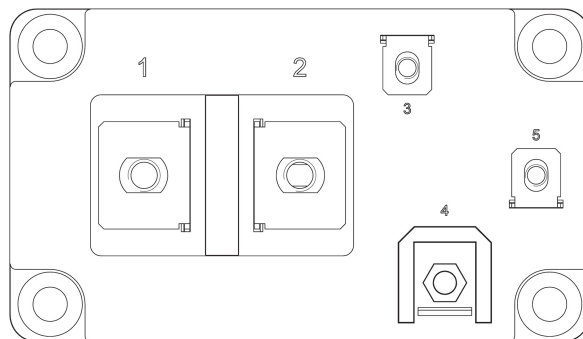
The APTGX900U170D4G device is a single switch 1700V, 900A Insulated-Gate Bipolar Transistor (IGBT) 7 power module.

The following figures show the electrical diagram and pinout location of the device.

**Figure 1.** Electrical Diagram



**Figure 2.** Pinout Location



### Note:

- All ratings are at  $T_j = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified.



These devices are sensitive to electrostatic discharge. Proper handling procedures must be followed.

## Features

The APTGX900U170D4G device has the following key features:

- IGBT 7
  - Low-voltage drop
  - Low-leakage current
- Very low-stray inductance
- Kelvin emitter for easy drive
- M6 power connectors
- M4 connectors for signal
- Al<sub>2</sub>O<sub>3</sub> substrate and copper base plate

## Benefits

The APTGX900U170D4G device has the following benefits:

- High efficiency converter
- Direct mounting to heatsink (isolated package)
- Low junction-to-case thermal resistance
- Low profile
- RoHS compliant

## Potential Applications

The APTGX900U170D4G device has the following potential applications:

- Welding converters
- Switched-mode power supplies
- Uninterruptible power supplies
- Electric Vehicle (EV) motor and traction drive

# 1. Electrical Specifications

The following sections show the electrical specifications of the APTGX900U170D4G device.

## 1.1 IGBT Characteristics (Per IGBT)

The following table lists the absolute maximum ratings (per IGBT) of the APTGX900U170D4G device.

**Table 1-1.** Absolute Maximum Ratings

Symbol	Parameter	Maximum Ratings	Unit
$V_{CES}$	Collector-emitter voltage	1700	V
$I_C$	Continuous collector current	$T_C = 25\text{ }^{\circ}\text{C}$ 1060	A
		$T_C = 60\text{ }^{\circ}\text{C}$ 900	
$I_{CM}$	Pulsed collector current, $t_p$ limited by $T_{J(max)}$	1800	
$V_{GE}$	Gate-emitter voltage	$\pm 20$	V
$P_D$	Power dissipation	$T_C = 25\text{ }^{\circ}\text{C}$ 2800	W

The following table lists the electrical characteristics (per IGBT) of the APTGX900U170D4G device.

**Table 1-2.** Electrical Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
$I_{CES}$	Zero gate voltage collector current	$V_{GE} = 0V$ ; $V_{CE} = 1700V$	—	—	75	$\mu A$
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15V$ $I_C = 900A$ $T_J = 25\text{ }^{\circ}\text{C}$	—	1.7	2	V
		$T_J = 125\text{ }^{\circ}\text{C}$	—	1.95	—	
		$T_J = 175\text{ }^{\circ}\text{C}$	—	2.1	—	
$V_{GE(th)}$	Gate threshold voltage	$V_{GE} = V_{CE}$ ; $I_C = 19\text{ mA}$	5.15	5.8	6.45	
$I_{GES}$	Gate-emitter leakage current	$V_{GE} = 20V$ ; $V_{CE} = 0V$	—	—	300	nA

The following table lists the dynamic characteristics (per IGBT) of the APTGX900U170D4G device.

**Table 1-3.** Dynamic Characteristics

Symbol	Characteristic	Test Conditions		Min.	Typ.	Max.	Unit
C <sub>ies</sub>	Input capacitance	V <sub>GE</sub> = 0V V <sub>CE</sub> = 25V f = 100 kHz		—	94	—	nF
C <sub>oes</sub>	Output capacitance			—	1.5	—	
C <sub>res</sub>	Reverse transfer capacitance			—	0.33	—	
Q <sub>G</sub>	Gate charge	V <sub>GE</sub> = ±15V V <sub>CE</sub> = 900V I <sub>C</sub> = 900A		—	8.4	—	μC
T <sub>d(on)</sub>	Turn-on delay time	V <sub>GE</sub> = ±15V V <sub>Bus</sub> = 900V I <sub>C</sub> = 900A R <sub>G</sub> = 0.75Ω	T <sub>J</sub> = 25 °C	—	172	—	ns
			T <sub>J</sub> = 125 °C	—	186	—	
			T <sub>J</sub> = 175 °C	—	192	—	
T <sub>r</sub>	Rise time		T <sub>J</sub> = 25 °C	—	41	—	
			T <sub>J</sub> = 125 °C	—	67	—	
			T <sub>J</sub> = 175 °C	—	73	—	
T <sub>d(off)</sub>	Turn-off delay time		T <sub>J</sub> = 25 °C	—	441	—	
			T <sub>J</sub> = 125 °C	—	538	—	
			T <sub>J</sub> = 175 °C	—	583	—	
T <sub>f</sub>	Fall time		T <sub>J</sub> = 25 °C	—	270	—	
			T <sub>J</sub> = 125 °C	—	429	—	
			T <sub>J</sub> = 175 °C	—	556	—	
E <sub>on</sub>	Turn-on energy	V <sub>GE</sub> = ±15V V <sub>Bus</sub> = 900V I <sub>C</sub> = 900A R <sub>G</sub> = 0.75Ω di/dt = 18 kA/μs dv/dt = 6.1 kV/μs	T <sub>J</sub> = 25 °C	—	106	—	mJ
			T <sub>J</sub> = 125 °C	—	165	—	
			T <sub>J</sub> = 175 °C	—	205	—	
E <sub>off</sub>	Turn-off energy		T <sub>J</sub> = 25 °C	—	142	—	
			T <sub>J</sub> = 125 °C	—	200	—	
			T <sub>J</sub> = 175 °C	—	240	—	
R <sub>Gint</sub>	Internal gate resistance			—	0.22	—	Ω
I <sub>sc</sub>	Short circuit data	V <sub>GE</sub> ≤ 15V V <sub>Bus</sub> = 1000V t <sub>p</sub> ≤ 8 μs	T <sub>J</sub> = 150 °C	—	2950	—	A
		V <sub>GE</sub> ≤ 15V V <sub>Bus</sub> = 800V t <sub>p</sub> ≤ 7 μs	T <sub>J</sub> = 175 °C	—	2850	—	
R <sub>thJC</sub>	Junction-to-case thermal resistance			—	—	0.053	°C/W

## 1.2 Diode Characteristics (Per Diode)

The following table lists the diode characteristics (per diode) of the APTGX900U170D4G device.

**Table 1-4.** Diode Characteristics

Symbol	Characteristic	Test Conditions		Min.	Typ.	Max.	Unit	
V <sub>RRM</sub>	Peak repetitive reverse voltage			—	—	1700	V	
I <sub>RM</sub>	Reverse leakage current	V <sub>R</sub> = 1700V		—	—	75	μA	
I <sub>FRM</sub>	Repetitive forward current, t <sub>p</sub> limited by T <sub>J(max)</sub>			—	1800	—	A	
I <sup>2</sup> t	I <sup>2</sup> t value	t <sub>p</sub> = 10 ms V <sub>R</sub> = 0V	T <sub>J</sub> = 125 °C T <sub>J</sub> = 175 °C	— —	40200 27000	— —	A <sup>2</sup> s	
I <sub>F</sub>	DC forward current			—	900	—	A	
V <sub>F</sub>	Diode forward voltage	I <sub>F</sub> = 900A V <sub>GE</sub> = 0V	T <sub>J</sub> = 25 °C T <sub>J</sub> = 125 °C T <sub>J</sub> = 175 °C	— — —	2.35 2.25 2.1	2.7 — —	V	
I <sub>RRM</sub>	Reverse recovery current	V <sub>GE</sub> = -15V I <sub>F</sub> = 900A V <sub>R</sub> = 900V di/dt = 18 kA/μs	T <sub>J</sub> = 25 °C T <sub>J</sub> = 125 °C T <sub>J</sub> = 175 °C	— — —	960 1110 1170	— — —	A	
Q <sub>rr</sub>	Reverse recovery charge		T <sub>J</sub> = 25 °C T <sub>J</sub> = 125 °C T <sub>J</sub> = 175 °C	— — —	93 210 261	— — —	μC	
E <sub>rr</sub>	Reverse recovery energy		T <sub>J</sub> = 25 °C T <sub>J</sub> = 125 °C T <sub>J</sub> = 175 °C	— — —	57 119 175	— — —	mJ	
R <sub>thJC</sub>	Junction-to-case thermal resistance				—	—	0.1	°C/W

## 1.3 Thermal and Package Characteristics

The following table lists the thermal and package characteristics of the APTGX900U170D4G device.

**Table 1-5.** Thermal and Package Characteristics

Symbol	Characteristic		Min.	Typ.	Max.	Unit
$V_{ISOL}$	RMS isolation voltage, any terminal-to-case $t = 1$ min, 50/60 Hz		4000	—	—	V
$L_{stray}$	Stray inductance module		—	15	—	nH
$d_{creep}$	Creepage distance terminal-to-terminal		—	19.9	—	mm
	Creepage distance terminal-to-heatsink		—	28.7	—	
$d_{clear}$	Clearance distance terminal-to-terminal		—	12.2	—	
	Clearance distance terminal-to-heatsink		—	28.6	—	
$R_{CE}$	Lead resistance terminal-to-chip	$T_C = 25$ °C, per switch	—	0.5	—	mΩ
$T_J$	Operating junction temperature range		-40	—	175	°C
$T_{STG}$	Storage temperature range		-40	—	125	
$T_C$	Operating case temperature		-40	—	125	
$\tau_M$	Mounting torque	M6	3	—	5	N.m
		M4	1	—	2	
Wt	Package weight		—	335	—	g

## 1.4 Typical IGBT Performance Curve

The following figures show the IGBT performance curves of the APTGX900U170D4G device.

Figure 1-1. Maximum Thermal Impedance

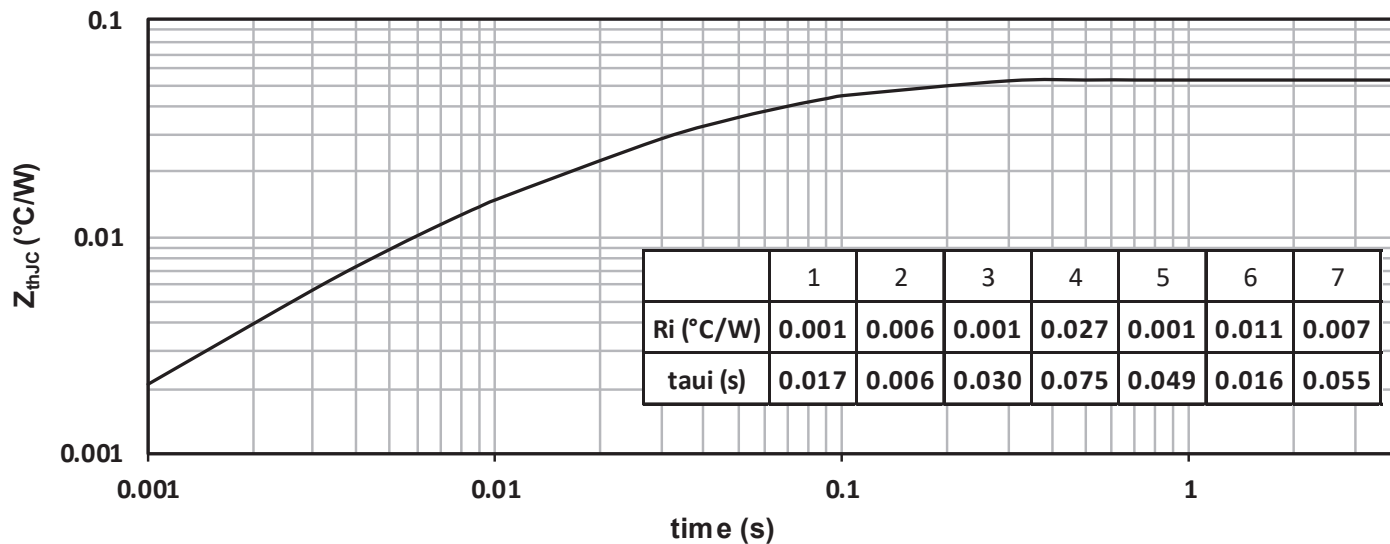


Figure 1-2. Output Characteristics,  $V_{GE} = 15V$

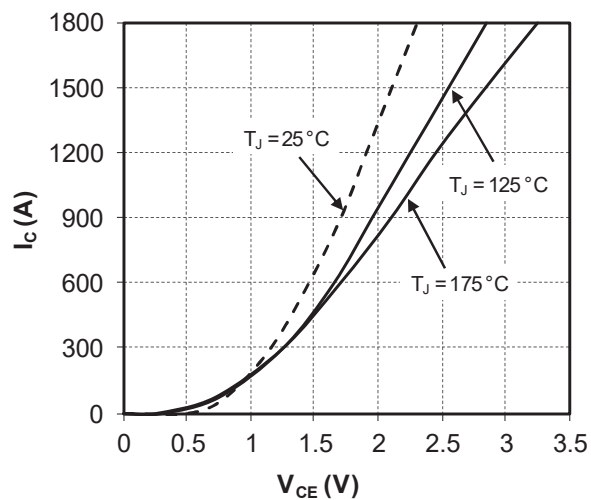


Figure 1-3. Output Characteristics,  $T_J = 175^\circ C$

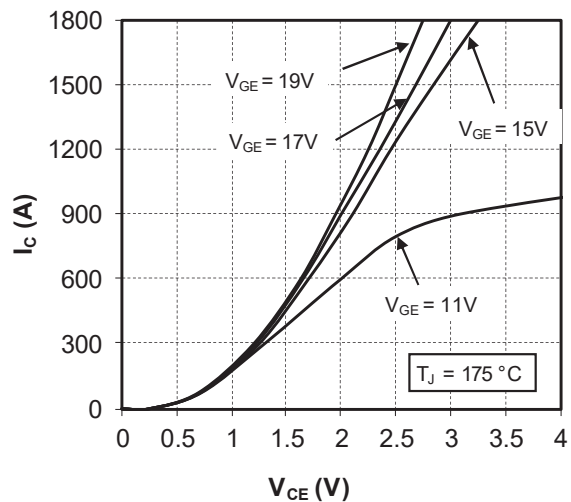


Figure 1-4. Switching Losses vs. Gate Resistance

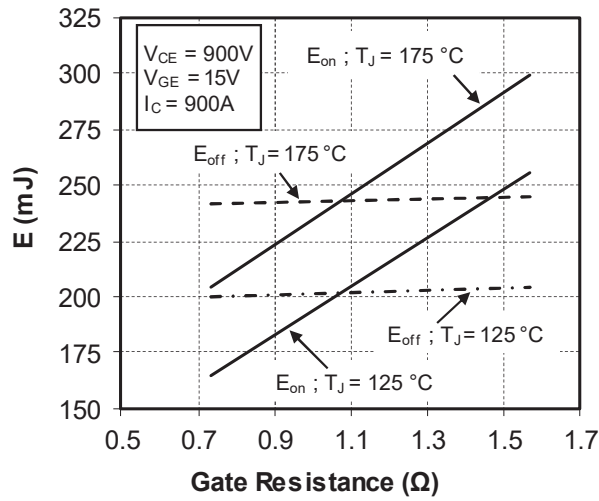


Figure 1-5. Switching Losses vs. Collector Current

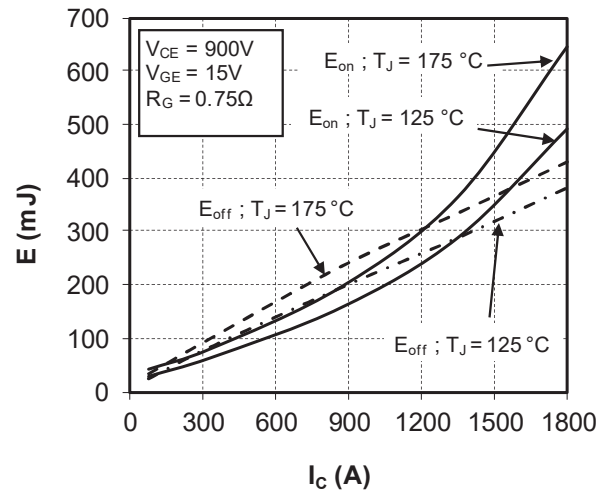


Figure 1-6. Operating Frequency vs. Collector Current

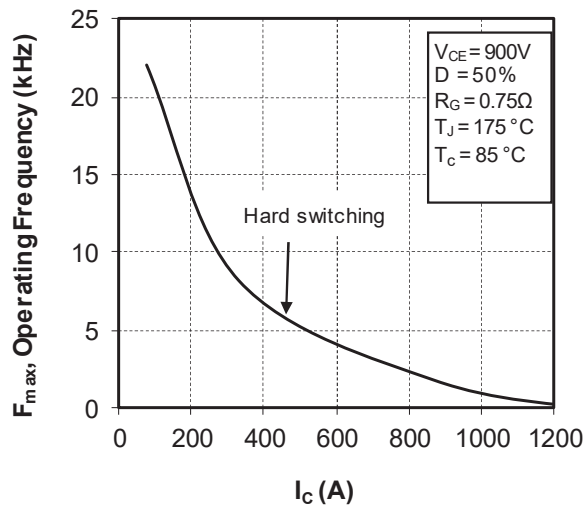
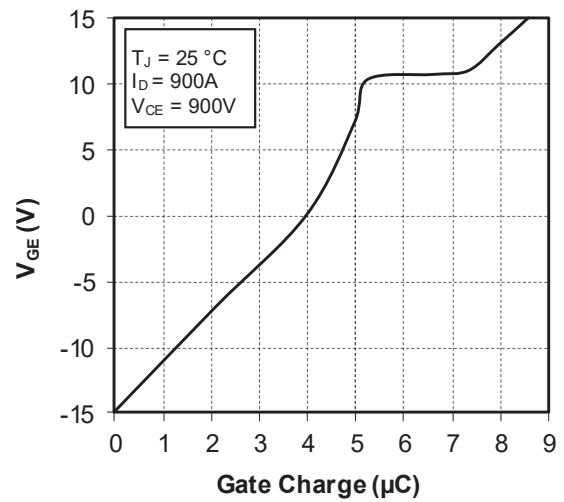
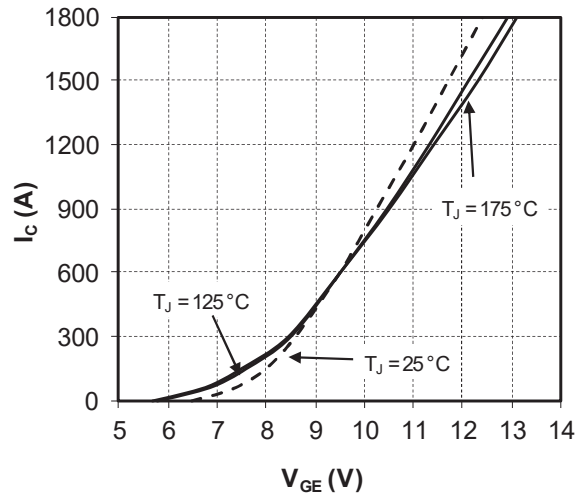


Figure 1-7. Gate Charge Characteristics

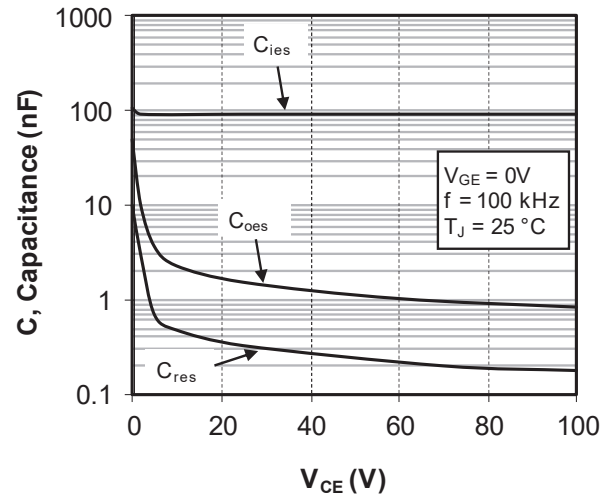




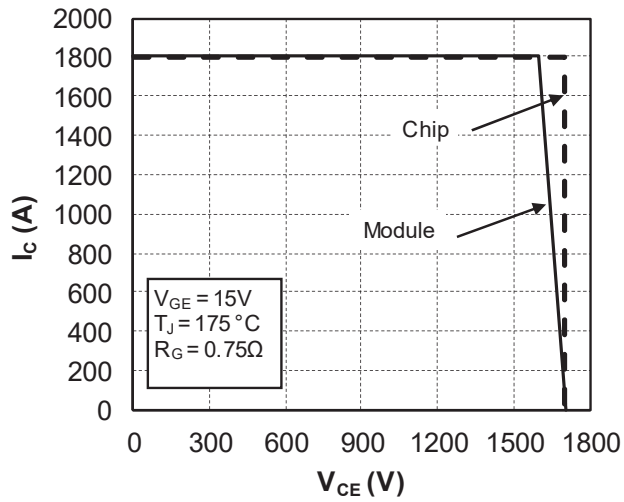
**Figure 1-8. Transfer Characteristics**



**Figure 1-9. Capacity Characteristics**



**Figure 1-10. Reverse Bias Safe Operating Area**



## 1.5 Typical Diode Performance Curve

The following figures show the diode performance curves of the APTGX900U170D4G device.

Figure 1-11. Maximum Thermal Impedance

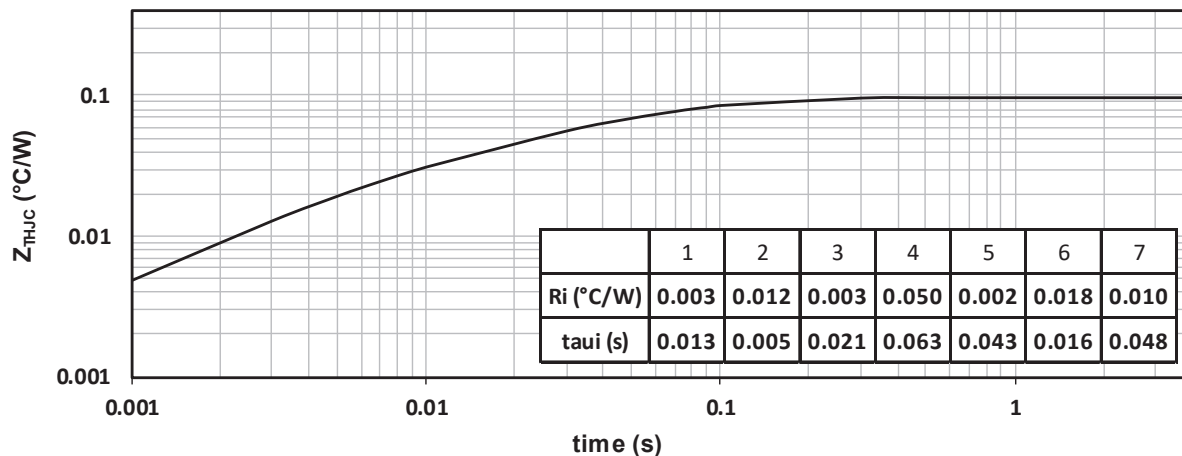


Figure 1-12. Forward Characteristics

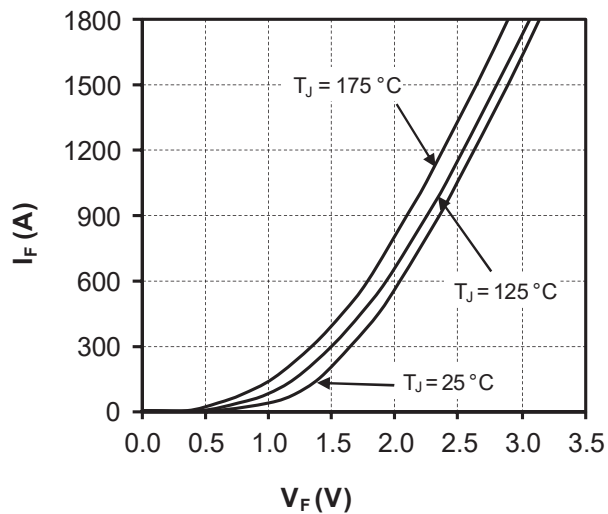


Figure 1-13. Switching Losses vs. Gate Resistance

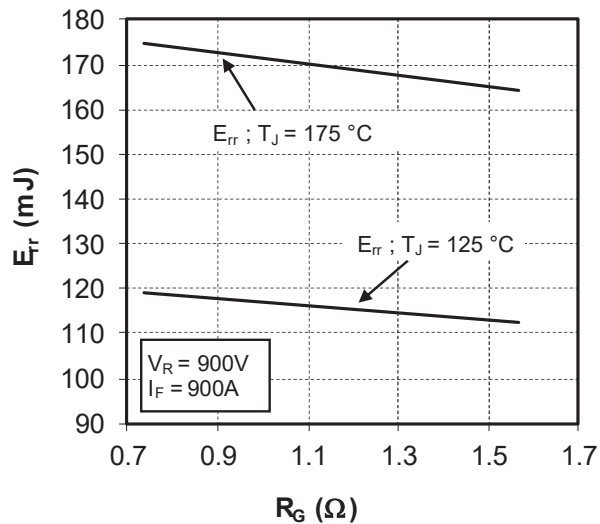
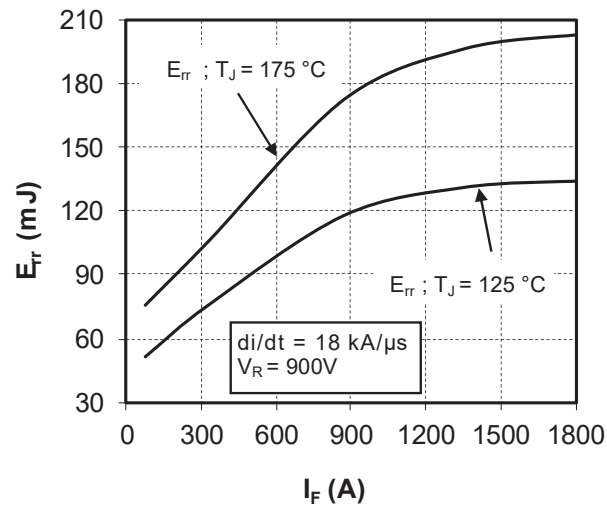


Figure 1-14. Switching Losses vs. Forward Current



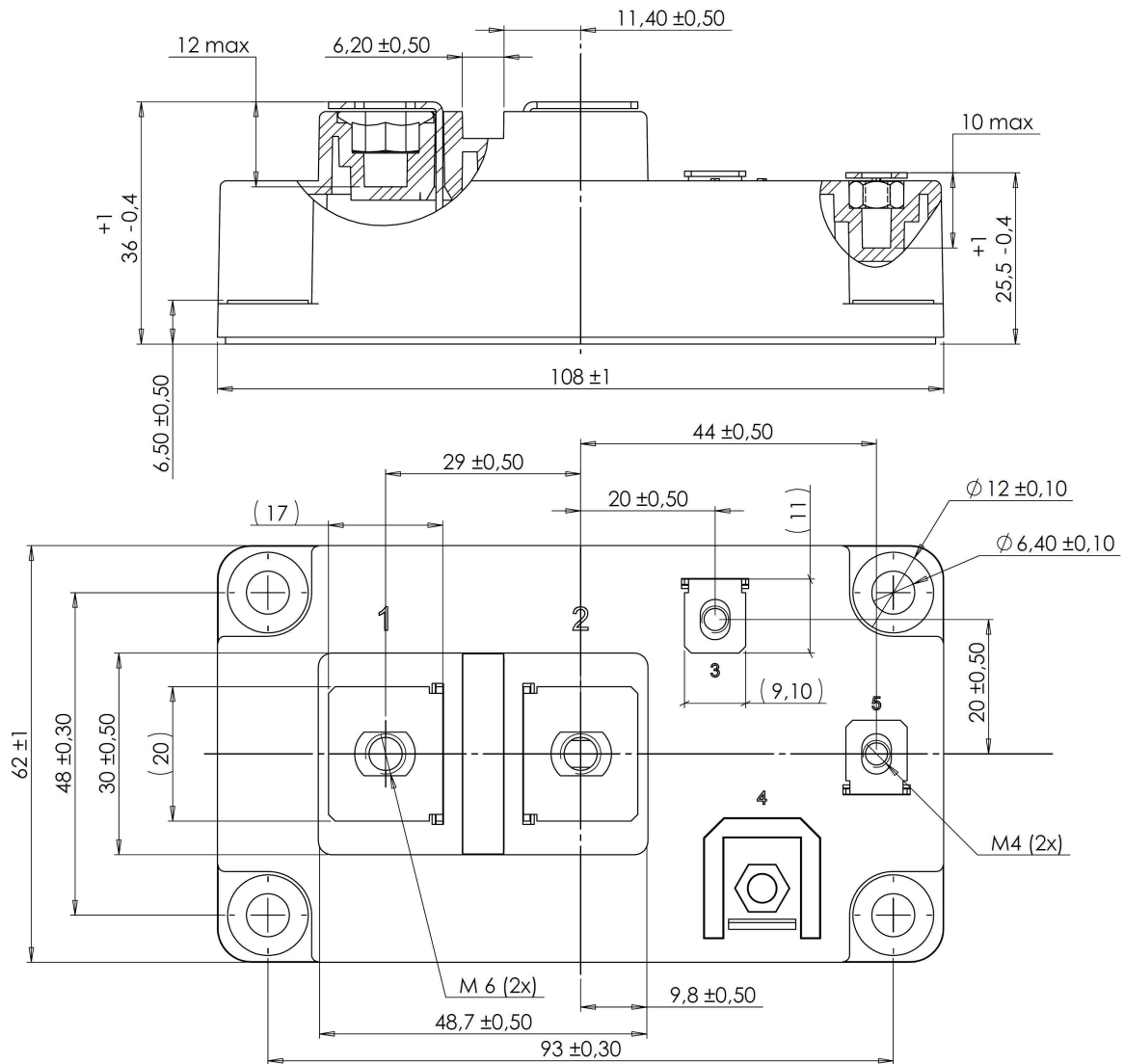
## 2. Package Specifications

The following section shows the package specification of the APTGX900U170D4G device.

## 2.1 Package Outline

The following figure shows the package outline drawing of the APTGX900U170D4G device. The dimensions in the following figure are in millimeters.

### Figure 2-1. Package Outline Drawing



**Note:** For more information, see [AN1908-Mounting Instructions for D3 & D4 Power Modules](#).

### 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.

Revision	Date	Description
A	11/2024	Initial revision

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