

Product Overview

The APTGX900A170TDP3EG device is a phase leg 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

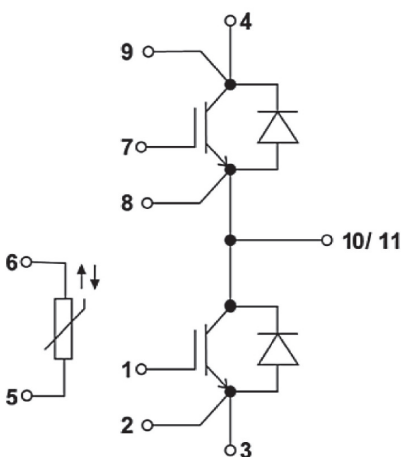
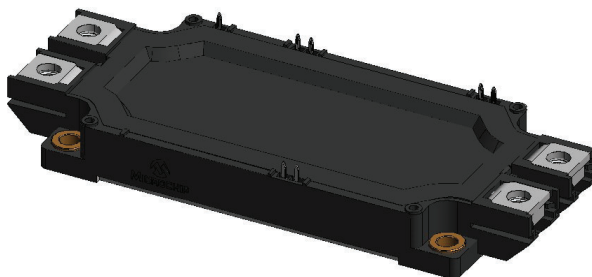
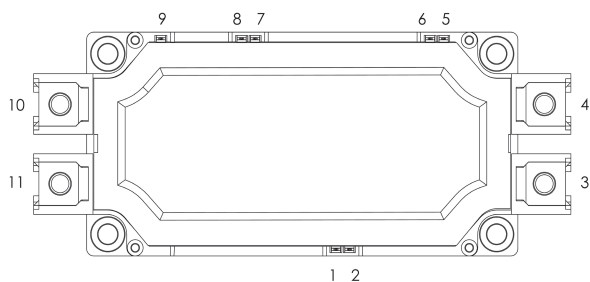


Figure 2. Pinout Location



Notes:

- Pins 10/11 must be shorted together.
- All ratings are at $T_J = 25^\circ\text{C}$, unless otherwise specified.



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

Features

The APTGX900A170TDP3EG device has the following key features:

- IGBT 7
 - Low-voltage drop
 - Low-leakage current
- Kelvin emitter for easy drive
- M6 power connectors
- Internal thermistor for temperature monitoring
- Al₂O₃ substrate and copper base plate
- Press-fit terminals for easy assembly
- V_{CEsat} with positive temperature coefficient

Benefits

The APTGX900A170TDP3EG 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 APTGX900A170TDP3EG 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 APTGX900A170TDP3EG device.

1.1. IGBT Characteristics (Per IGBT)

The following table lists the absolute maximum ratings (per IGBT) of the APTGX900A170TDP3EG device.

Table 1-1. Absolute Maximum Ratings

Symbol	Parameter	Maximum Ratings	Unit
V_{CES}	Collector-emitter voltage	1700	V
I_C	Continuous collector current	$T_C = 80\text{ }^{\circ}\text{C}$	900
I_{RMS}	RMS 3 & 4 DC power terminals current	$T_{\text{terminal}} = 90\text{ }^{\circ}\text{C}; T_C = 90\text{ }^{\circ}\text{C}$	580
I_{CM}	Pulsed collector current, t_p limited by $T_{J(\text{max})}$	1800	A
V_{GE}	Gate-emitter voltage	± 20	V
P_D	Power dissipation	$T_C = 25\text{ }^{\circ}\text{C}$	3260
			W

The following table lists the electrical characteristics (per IGBT) of the APTGX900A170TDP3EG device.

Table 1-2. Electrical Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
I_{CES}	Zero gate voltage collector current	$V_{GE} = 0V; V_{CE} = 1700V$	—	—	200	μA
$V_{CE(\text{sat})}$	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	—	
$V_{GE(\text{th})}$	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 APTGX900A170TDP3EG device.

Table 1-3. Dynamic Characteristics

Symbol	Characteristic	Test Conditions		Min.	Typ.	Max.	Unit
C _{ies}	Input capacitance	V _{GE} = 0V		—	94	—	nF
C _{oes}	Output capacitance	V _{CE} = 25V		—	1.5	—	
C _{res}	Reverse transfer capacitance	f = 100 kHz		—	0.33	—	
Q _G	Gate charge	V _{GE} = ±15V V _{CE} = 900V I _C = 900A		—	8.4	—	μC
T _{d(on)}	Turn-on delay time	V _{GE} = -5/15V V _{Bus} = 900V I _C = 900A R _{GON} = 0.33Ω R _{GOFF} = 2.7Ω	T _J = 25 °C	—	152	—	ns
			T _J = 125 °C	—	153	—	
			T _J = 175 °C	—	167	—	
T _r	Rise time		T _J = 25 °C	—	65	—	
			T _J = 125 °C	—	70	—	
			T _J = 175 °C	—	74	—	
T _{d(off)}	Turn-off delay time		T _J = 25 °C	—	776	—	
			T _J = 125 °C	—	856	—	
			T _J = 175 °C	—	901	—	
T _f	Fall time		T _J = 25 °C	—	157	—	
			T _J = 125 °C	—	297	—	
			T _J = 175 °C	—	400	—	
E _{on}	Turn-on energy	V _{GE} = -5/15V V _{Bus} = 900V I _C = 900A	T _J = 25 °C	—	46	—	mJ
		T _J = 125 °C	—	70	—		
		T _J = 175 °C	—	89	—		
E _{off}	Turn-off energy	R _{GON} = 0.33Ω R _{GOFF} = 2.7Ω di/dt = 11400 A/μs dv/dt = 6000 V/μs	T _J = 25 °C	—	149	—	
		T _J = 125 °C	—	214	—		
		T _J = 175 °C	—	251	—		
R _{Gint}	Internal gate resistance			—	0.22	—	Ω
I _{sc}	Short circuit data	V _{GE} = 15V V _{Bus} = 1000V t _p ≤ 8 μs	T _J = 150 °C	—	2950	—	A
		V _{GE} = 15V V _{Bus} = 1000V t _p ≤ 6 μs	T _J = 175 °C	—	2850	—	
R _{thJC}	Junction-to-case thermal resistance			—	—	0.046	°C/W
R _{thCH}	Case-to-heatsink thermal resistance		λ = 1 W/mK	—	0.027	—	

1.2. Diode Characteristics (Per Diode)

The following table lists the diode characteristics (per diode) of the APTGX900A170TDP3EG device.

Table 1-4. Diode Characteristics

Symbol	Characteristic	Test Conditions		Min.	Typ.	Max.	Unit
V _{RRM}	Peak repetitive reverse voltage			—	—	1700	V
I _{RM}	Reverse leakage current	V _R = 1700V		—	—	200	μA
I _{FRM}	Repetitive forward current, t _p limited by T _{J(max)}			—	1800	—	A
I ² t	I ² t value	t _p = 10 ms	T _J = 125 °C	—	40200	—	A²s
		V _R = 0V	T _J = 175 °C	—	27000	—	
I _F	DC forward current			—	900	—	A
V _F	Diode forward voltage	I _F = 900A V _{GE} = 0V	T _J = 25 °C	—	2.35	2.7	V
			T _J = 125 °C	—	2.25	—	
			T _J = 175 °C	—	2.1	—	
I _{RRM}	Reverse recovery current	V _{GE} = -5V I _F = 900A V _R = 900V di/dt = 11400 A/μs	T _J = 25 °C	—	993	—	A
			T _J = 125 °C	—	1255	—	
			T _J = 175 °C	—	1360	—	
Q _{rr}	Reverse recovery charge		T _J = 25 °C	—	100	—	μC
			T _J = 125 °C	—	189	—	
			T _J = 175 °C	—	242	—	
E _{rr}	Reverse recovery energy		T _J = 25 °C	—	91	—	mJ
			T _J = 125 °C	—	172	—	
			T _J = 175 °C	—	225	—	
R _{thJC}	Junction-to-case thermal resistance			—	—	0.089	°C/W
R _{thCH}	Case-to-heatsink thermal resistance		λ = 1 W/mK	—	0.037	—	

1.3. Thermal and Package Characteristics

The following table lists the thermal and package characteristics of the APTGX900A170TDP3EG 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			3400	—	—	V
CTI	Comparative tracking index			600	—	—	
L _{stray}	Stray inductance module			—	20	—	nH
d _{creep}	Creepage distance terminal-to-terminal			—	17.6	—	mm
	Creepage distance terminal-to-heatsink			—	20.1	—	
d _{clear}	Clearance distance terminal-to-terminal			—	10	—	
	Clearance distance terminal-to-heatsink			—	14.8	—	
R _{CE}	Lead resistance terminal to chip	T _C = 25 °C, per switch		—	0.8	—	mΩ
T _J	Operating junction temperature range			−40	—	175	°C
T _{STG}	Storage temperature range			−40	—	125	
T _C	Operating case temperature			−40	—	125	
τ _M	Mounting torque	To heatsink	M5	3	—	5	N.m
		To terminals	M6	3	—	5	
Wt	Package weight			—	350	—	g

Note: T_J exceeding 150 °C is permitted only under overload operating conditions.

The following table lists the temperature sensor NTC of the APTGX900A170TDP3EG device.

Table 1-6. Temperature Sensor NTC

Symbol	Characteristic	Min.	Typ.	Max.	Unit
R ₂₅	Resistance at 25 °C	—	5	—	kΩ
ΔR ₂₅ /R ₂₅	—	—	5	—	%
B _{25/50}	T ₂₅ = 298.15K	—	3380	—	K
ΔB/B	—	—	2	—	%

$$R_T = \frac{R_{25}}{\exp \left[B_{25/85} \left(\frac{1}{T_{25}} - \frac{1}{T} \right) \right]}$$

T: Thermistor temperature
R_T: Thermistor value at T

Note: For more information, see the latest document on using NTC temperature sensor integrated into power module, available on the Microchip website.

1.4. Typical IGBT Performance Curve

The following figures show the IGBT performance curves of the APTGX900A170TDP3EG device.

Figure 1-1. Maximum Thermal Impedance

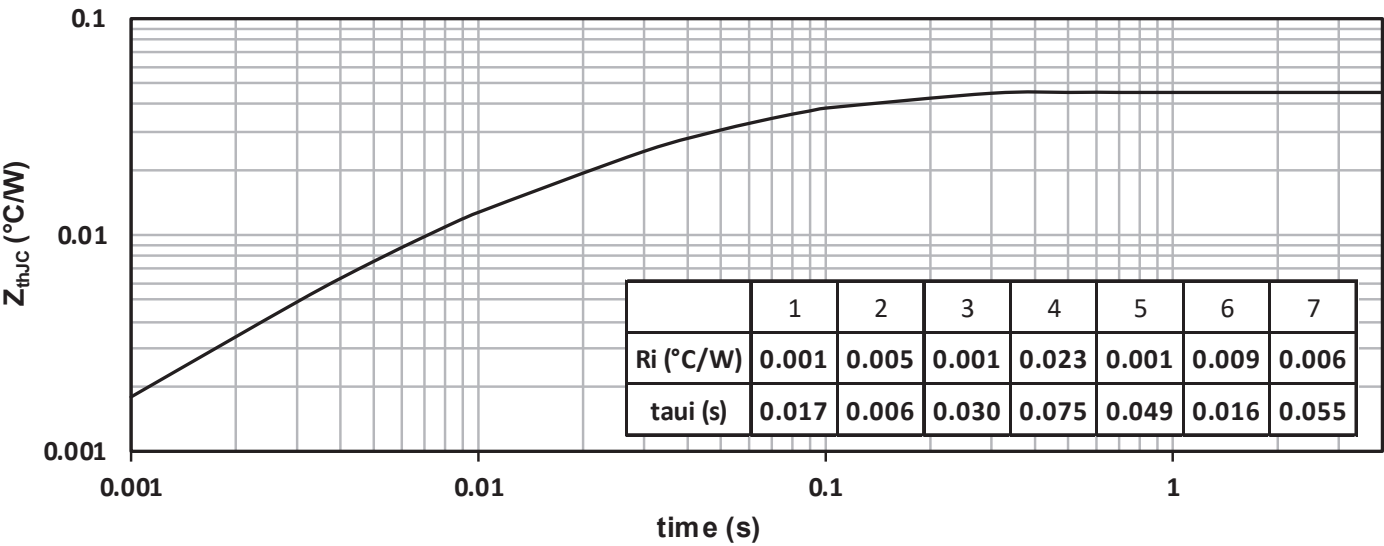


Figure 1-2. Output Characteristics, $V_{GE} = 15V$

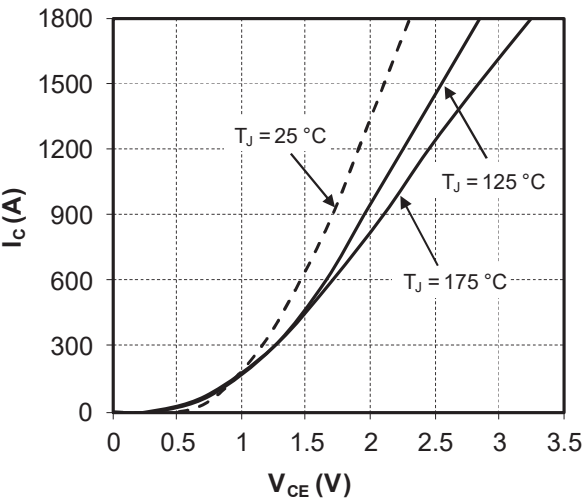


Figure 1-3. Output Characteristics, $T_J = 175^\circ C$

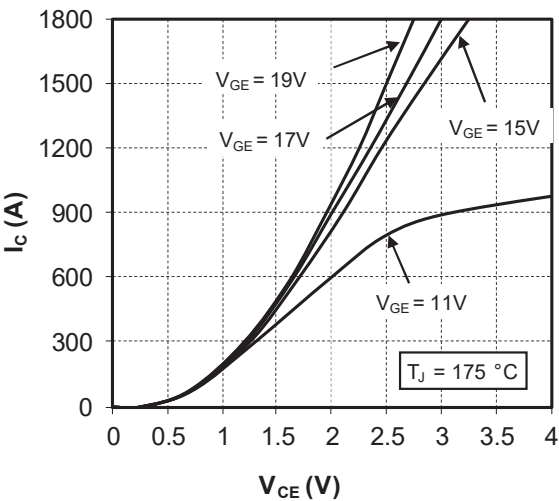


Figure 1-4. E_{on} vs. Gate Resistance

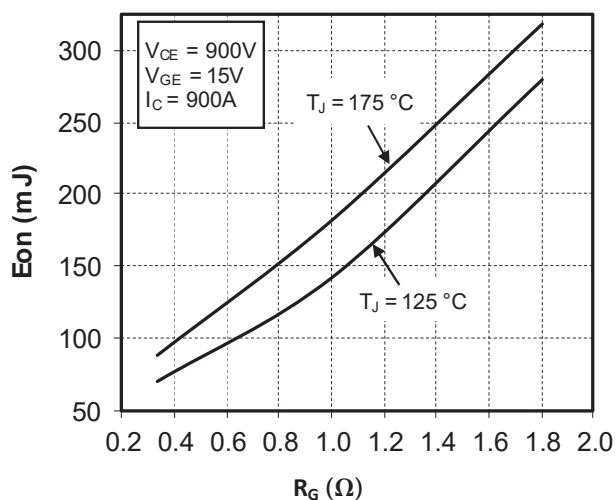


Figure 1-5. E_{off} vs. Gate Resistance

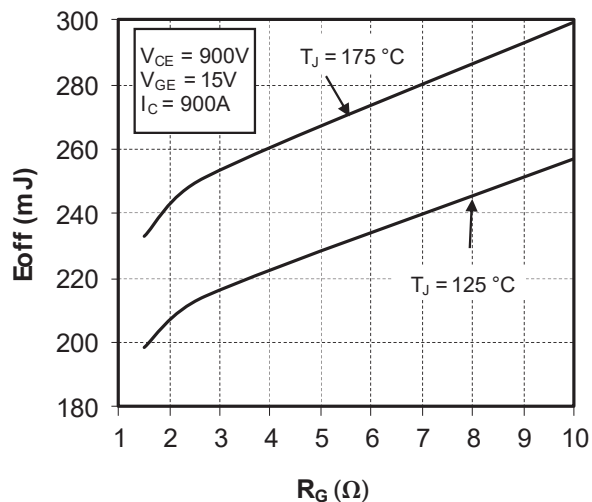


Figure 1-6. Switching Losses vs. Collector Current

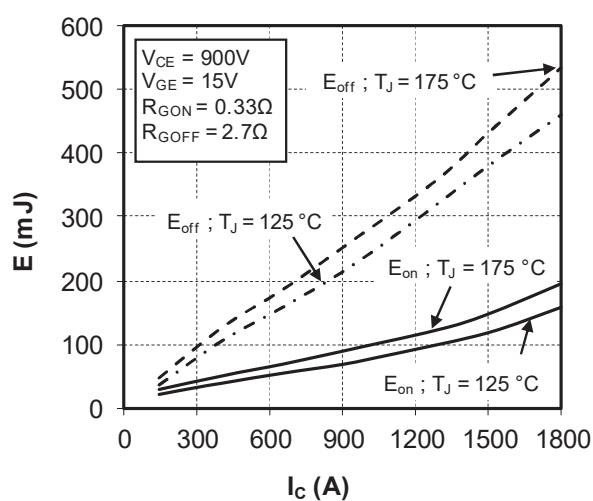


Figure 1-7. Switching Time vs. Collector Current

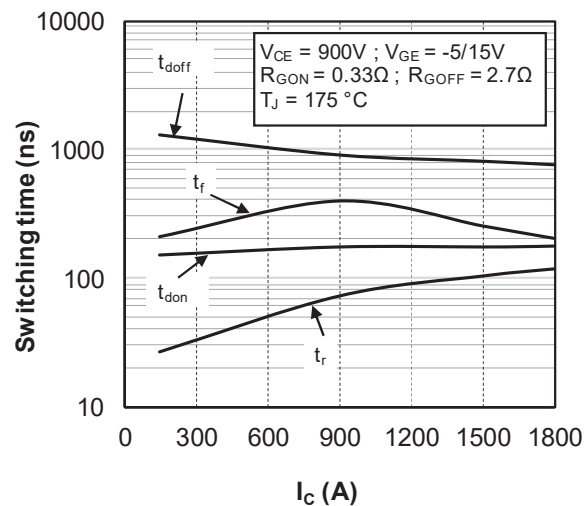


Figure 1-8. Switching Time vs. Gate Resistance

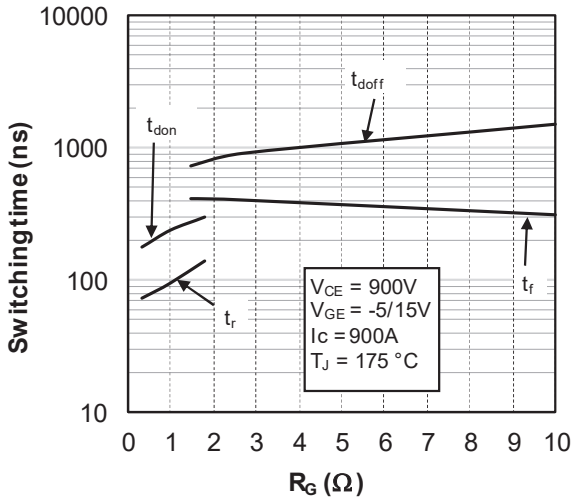


Figure 1-9. Operating Frequency vs. Collector Current

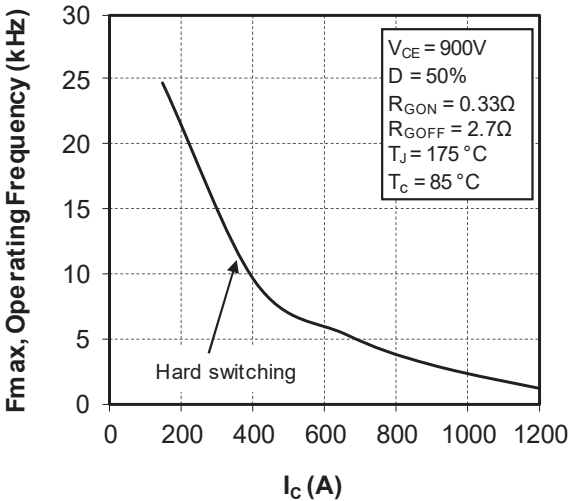


Figure 1-10. Gate Charge Characteristics

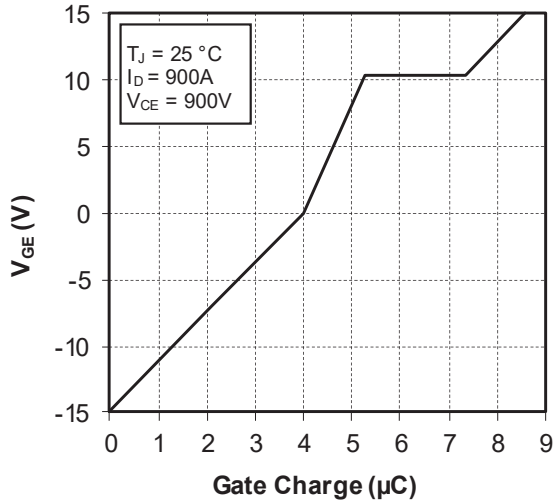


Figure 1-11. Transfer Characteristics

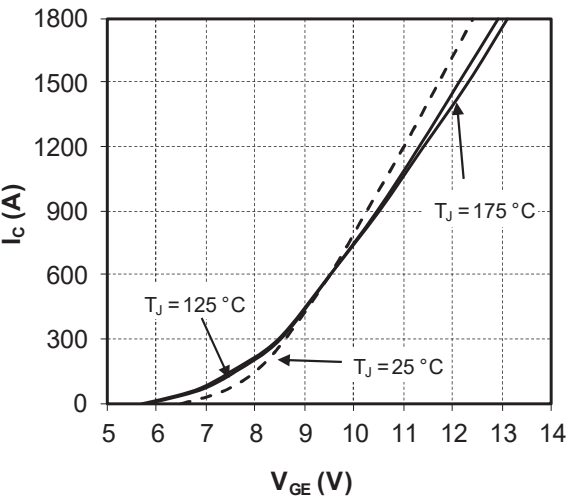


Figure 1-12. Capacity Characteristics

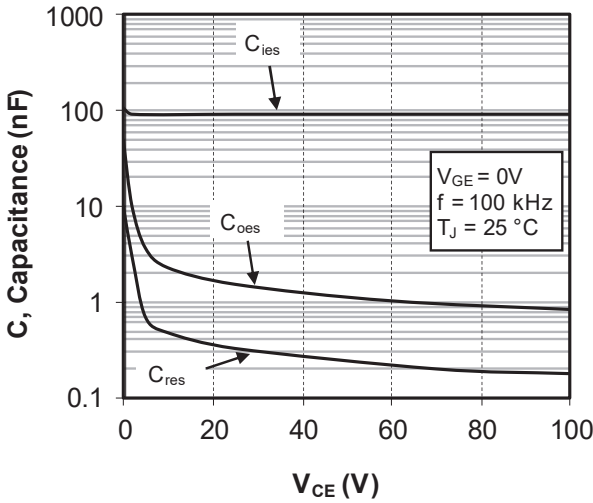
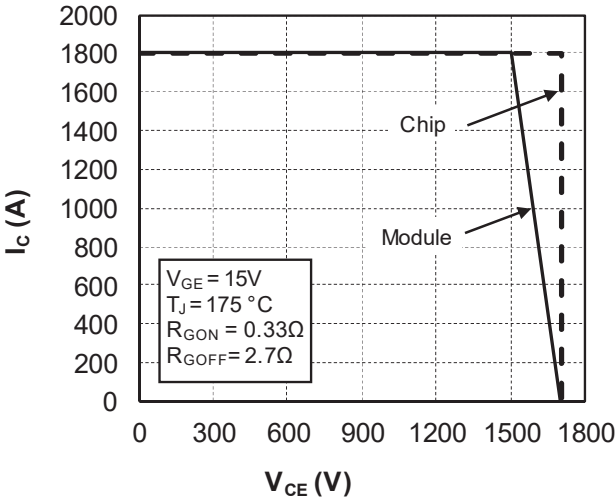


Figure 1-13. Reverse Bias Safe Operating Area



1.5. Typical Diode Performance Curve

The following figures show the diode performance curves of the APTGX900A170TDP3EG device.

Figure 1-14. Maximum Thermal Impedance

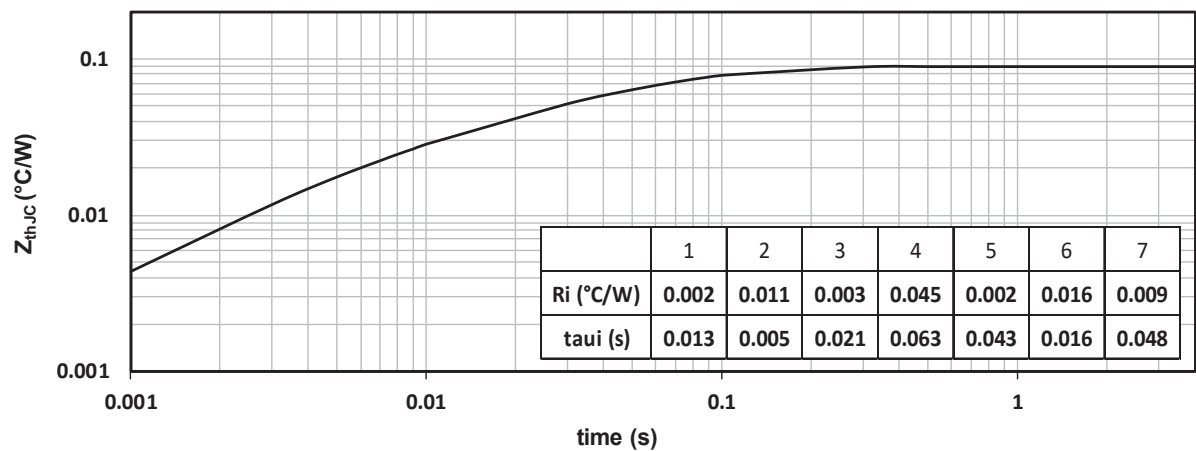


Figure 1-15. Forward Characteristics

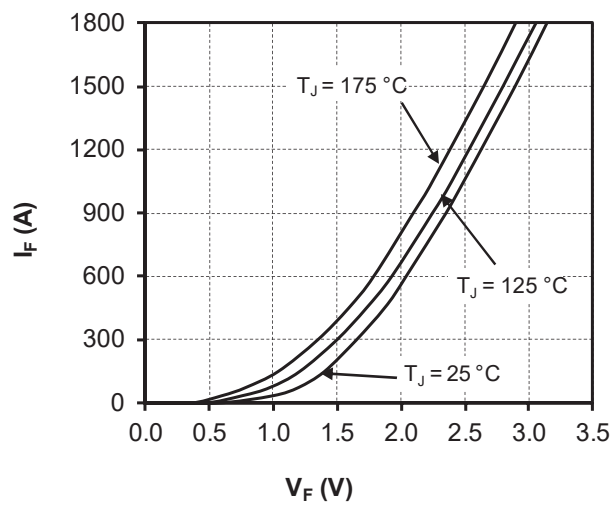


Figure 1-16. Switching Losses vs. Gate Resistance

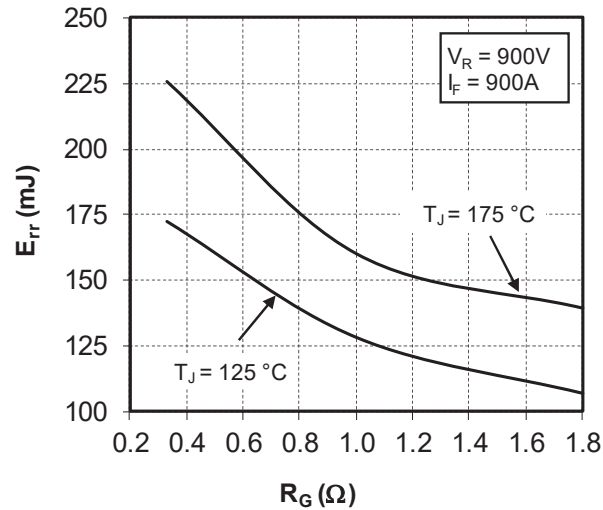
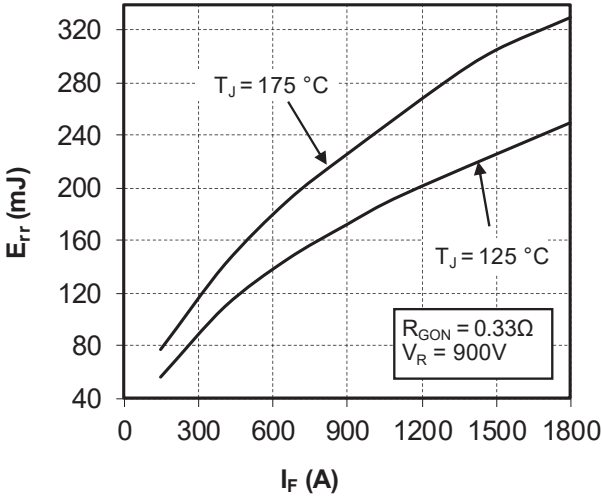


Figure 1-17. Switching Losses vs. Forward Current



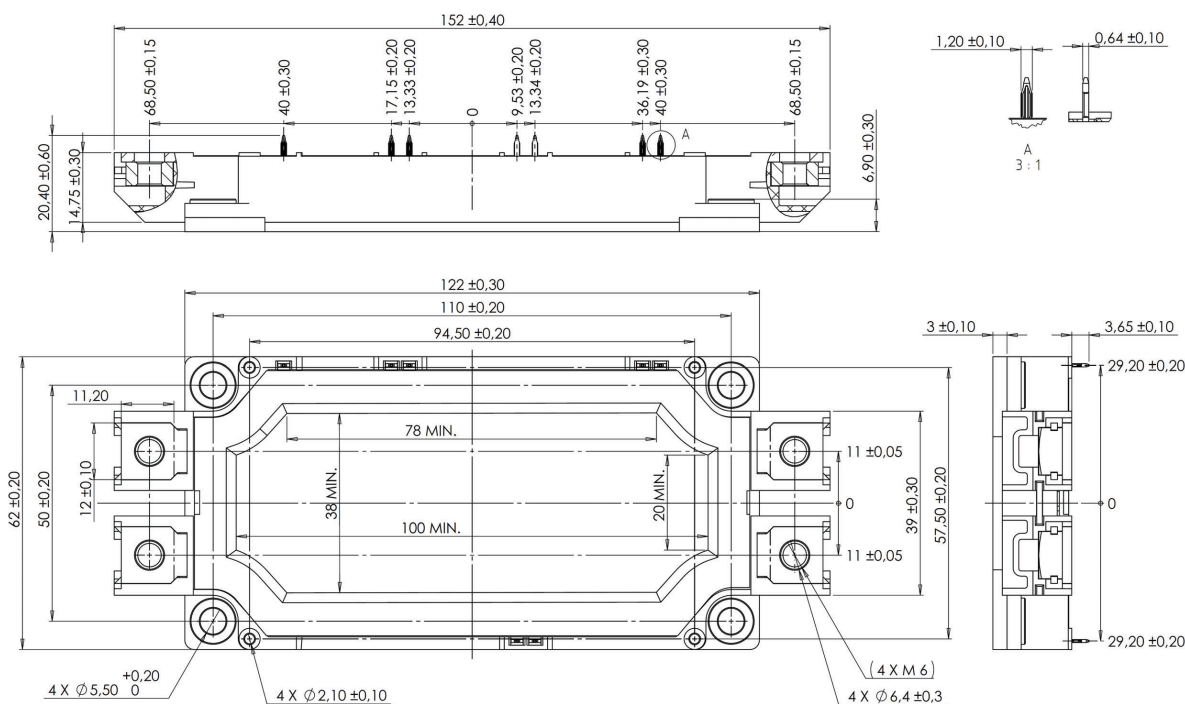
2. Package Specifications

The following section shows the package specification of the APTGX900A170TDP3EG device.

2.1. Package Outline

The following figure shows the package outline drawing of the APTGX900A170TDP3EG device. The dimensions in the following figure are in millimeters.

Figure 2-1. Package Outline Drawing



Note: For more information, see the latest application note on mounting instruction for DP3 power module, available on the Microchip website.

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	09/2025	Initial revision

Microchip Information

Trademarks

The “Microchip” name and logo, the “M” logo, and other names, logos, and brands are registered and unregistered trademarks of Microchip Technology Incorporated or its affiliates and/or subsidiaries in the United States and/or other countries (“Microchip Trademarks”). Information regarding Microchip Trademarks can be found at <https://www.microchip.com/en-us/about/legal-information/microchip-trademarks>.

ISBN: 979-8-3371-1909-0

Legal Notice

This publication and the information herein may be used only with Microchip products, including to design, test, and integrate Microchip products with your application. Use of this information in any other manner violates these terms. Information regarding device applications is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. Contact your local Microchip sales office for additional support or, obtain additional support at www.microchip.com/en-us/support/design-help/client-support-services.

THIS INFORMATION IS PROVIDED BY MICROCHIP “AS IS”. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTIES RELATED TO ITS CONDITION, QUALITY, OR PERFORMANCE.

IN NO EVENT WILL MICROCHIP BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL, OR CONSEQUENTIAL LOSS, DAMAGE, COST, OR EXPENSE OF ANY KIND WHATSOEVER RELATED TO THE INFORMATION OR ITS USE, HOWEVER CAUSED, EVEN IF MICROCHIP HAS BEEN ADVISED OF THE POSSIBILITY OR THE DAMAGES ARE FORESEEABLE. TO THE FULLEST EXTENT ALLOWED BY LAW, MICROCHIP’S TOTAL LIABILITY ON ALL CLAIMS IN ANY WAY RELATED TO THE INFORMATION OR ITS USE WILL NOT EXCEED THE AMOUNT OF FEES, IF ANY, THAT YOU HAVE PAID DIRECTLY TO MICROCHIP FOR THE INFORMATION.

Use of Microchip devices in life support and/or safety applications is entirely at the buyer’s risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

Microchip Devices Code Protection Feature

Note the following details of the code protection feature on Microchip products:

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is secure when used in the intended manner, within operating specifications, and under normal conditions.
- Microchip values and aggressively protects its intellectual property rights. Attempts to breach the code protection features of Microchip products are strictly prohibited and may violate the Digital Millennium Copyright Act.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is “unbreakable”. Code protection is constantly evolving. Microchip is committed to continuously improving the code protection features of our products.