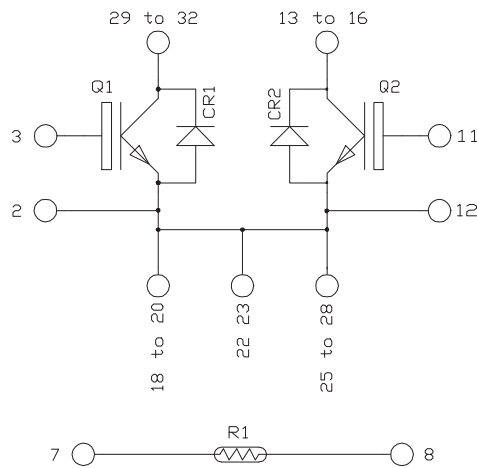


## Product Overview

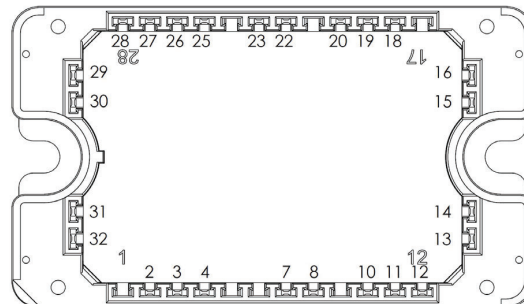
The APTGX150DU120T3AG device is a dual common emitter 1200V, 150A Insulated-Gate Bipolar Transistor (IGBT) 7 power module.

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

**Figure 1.** Electrical Diagram



**Figure 2.** Pinout Location



### Notes:

- All multiple inputs and outputs must be shorted together: 13/14/15/16, 18/19/20/22/23/25/26/27/28, and 29/30/31/32.
- 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 APTGX150DU120T3AG device has the following key features:

- IGBT 7
  - Low-voltage drop
  - Low-leakage current
- Very low-stray inductance
- Kelvin emitter for easy drive
- Internal thermistor for temperature monitoring
- AlN substrate for improved thermal performance
- Copper baseplate

## Benefits

The APTGX150DU120T3AG device has the following benefits:

- Direct mounting to heatsink (isolated package)
- Low junction-to-case thermal resistance
- Solderable terminals both for power and signal for easy PCB mounting
- Low profile
- RoHS compliant

## Potential Applications

The APTGX150DU120T3AG device has the following potential applications:

- AC switches

## 1. Electrical Specifications

The following sections show the electrical specifications of the APTGX150DU120T3AG device.

### 1.1 IGBT Characteristics (Per IGBT)

The following table lists the absolute maximum ratings (per IGBT) of the APTGX150DU120T3AG device.

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

Symbol	Parameter	Maximum Ratings	Unit
$V_{CES}$	Collector-emitter voltage	1200	V
$I_C$	Continuous collector current	$T_C = 25\text{ }^\circ\text{C}$	260
		$T_C = 115\text{ }^\circ\text{C}$	150
$I_{CM}$	Pulsed collector current, $t_p$ limited by $T_{J(max)}$	300	A
$V_{GE}$	Gate-emitter voltage	$\pm 20$	V
	Transient gate-emitter voltage	$\pm 25$	
$P_D$	Power dissipation	$T_C = 25\text{ }^\circ\text{C}$	777
			W

The following table lists the electrical characteristics (per IGBT) of the APTGX150DU120T3AG device.

**Table 1-2.** Electrical Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit	
$I_{CES}$	Zero gate voltage collector current	$V_{GE} = 0V; V_{CE} = 1200V$	—	—	12	$\mu\text{A}$	
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15V$ $I_C = 150A$	$T_J = 25\text{ }^\circ\text{C}$	—	1.55	1.8	V
			$T_J = 125\text{ }^\circ\text{C}$	—	1.7	—	
			$T_J = 175\text{ }^\circ\text{C}$	—	1.77	—	
$V_{GE(th)}$	Gate threshold voltage	$V_{GE} = V_{CE}; I_C = 3.5\text{ mA}$	5.15	5.8	6.45		
$I_{GES}$	Gate-emitter leakage current	$V_{GE} = 20V; V_{CE} = 0V$	—	—	150	nA	

The following table lists the dynamic characteristics (per IGBT) of the APTGX150DU120T3AG device.

**Table 1-3.** Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit	
$C_{ies}$	Input capacitance	$V_{GE} = 0V$ $V_{CE} = 25V$ $f = 100 \text{ kHz}$	—	30	—	nF	
$C_{oes}$	Output capacitance		—	0.38	—		
$C_{res}$	Reverse transfer capacitance		—	0.11	—		
$Q_G$	Gate charge	$V_{GE} = \pm 15V$ $V_{CE} = 600V$ $I_C = 150A$	—	2.5	—	$\mu C$	
$T_{d(on)}$	Turn-on delay time	$V_{GE} = \pm 15V$ $V_{BUS} = 600V$ $I_C = 150A$ $R_G = 3.3\Omega$	$T_J = 25 \text{ }^\circ C$	—	172	—	ns
			$T_J = 125 \text{ }^\circ C$	—	183	—	
			$T_J = 175 \text{ }^\circ C$	—	189	—	
$T_r$	Rise time		$T_J = 25 \text{ }^\circ C$	—	72	—	
			$T_J = 125 \text{ }^\circ C$	—	77	—	
			$T_J = 175 \text{ }^\circ C$	—	80	—	
$T_{d(off)}$	Turn-off delay time		$T_J = 25 \text{ }^\circ C$	—	331	—	
			$T_J = 125 \text{ }^\circ C$	—	414	—	
			$T_J = 175 \text{ }^\circ C$	—	433	—	
$T_f$	Fall time	$T_J = 25 \text{ }^\circ C$	—	103	—		
		$T_J = 125 \text{ }^\circ C$	—	198	—		
		$T_J = 175 \text{ }^\circ C$	—	262	—		
$E_{on}$	Turn-on energy	$V_{GE} = \pm 15V$ $V_{BUS} = 600V$ $I_C = 150A$ $R_G = 3.3\Omega$ $di/dt = 1700 \text{ A}/\mu s$ $dv/dt = 3200 \text{ V}/\mu s$	$T_J = 25 \text{ }^\circ C$	—	16.6	—	mj
			$T_J = 125 \text{ }^\circ C$	—	24.9	—	
			$T_J = 175 \text{ }^\circ C$	—	29.6	—	
$E_{off}$	Turn-off energy		$T_J = 25 \text{ }^\circ C$	—	10.4	—	
			$T_J = 125 \text{ }^\circ C$	—	15.9	—	
			$T_J = 175 \text{ }^\circ C$	—	19.9	—	
$R_{Gint}$	Internal gate resistance		—	1	—	$\Omega$	
$I_{sc}$	Short circuit data	$V_{GE} \leq 15V$ $V_{BUS} = 800V$ $t_p \leq 8 \mu s$	$T_J = 150 \text{ }^\circ C$	—	520	—	A
		$V_{GE} \leq 15V$ $V_{BUS} = 800V$ $t_p \leq 7 \mu s$	$T_J = 175 \text{ }^\circ C$	—	490	—	
$R_{thJC}$	Junction-to-case thermal resistance		—	—	0.193	$^\circ C/W$	

## 1.2 Diode Characteristics (Per Diode)

The following table lists the diode characteristics (per diode) of the APTGX150DU120T3AG device.

**Table 1-4.** Diode Characteristics

Symbol	Characteristic	Test Conditions		Min.	Typ.	Max.	Unit
$V_{RRM}$	Peak repetitive reverse voltage			—	—	1200	V
$I_{RM}$	Reverse leakage current	$V_R = 1200V$		—	—	8	$\mu A$
$I_{FRM}$	Repetitive forward current, $t_p$ limited by $T_{J(max)}$			—	—	300	A
$I^2t$	$I^2t$ value	$t_p = 10\text{ ms}$ $V_R = 0V$	$T_J = 125\text{ }^\circ C$	—	—	2700	$A^2s$
			$T_J = 175\text{ }^\circ C$	—	—	2250	
$I_F$	DC forward current	$T_C = 90\text{ }^\circ C$					
$V_F$	Diode forward voltage	$I_F = 150A$ $V_{GE} = 0V$	$T_J = 175\text{ }^\circ C$	—	150	—	A
			$T_J = 25\text{ }^\circ C$	—	1.75	2	V
			$T_J = 125\text{ }^\circ C$	—	1.6	—	
$I_{RRM}$	Reverse recovery current	$V_{GE} = -15V$ $I_F = 150A$ $V_R = 600V$ $di/dt = 1700\text{ A}/\mu s$	$T_J = 175\text{ }^\circ C$	—	1.52	—	A
			$T_J = 25\text{ }^\circ C$	—	65	—	
			$T_J = 125\text{ }^\circ C$	—	92	—	
$Q_{rr}$	Reverse recovery charge	$V_{GE} = -15V$ $I_F = 150A$ $V_R = 600V$ $di/dt = 1700\text{ A}/\mu s$	$T_J = 175\text{ }^\circ C$	—	107	—	$\mu C$
			$T_J = 25\text{ }^\circ C$	—	10.3	—	
$E_{rr}$	Reverse recovery energy	$V_{GE} = -15V$ $I_F = 150A$ $V_R = 600V$ $di/dt = 1700\text{ A}/\mu s$	$T_J = 175\text{ }^\circ C$	—	21.7	—	mJ
			$T_J = 125\text{ }^\circ C$	—	28.6	—	
			$T_J = 25\text{ }^\circ C$	—	3.3	—	
$R_{thJC}$	Junction-to-case thermal resistance			—	—	0.318	$^\circ C/W$

### 1.3 Thermal and Package Characteristics

The following table lists the thermal and package characteristics of the APTGX150DU120T3AG device.

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

Symbol	Characteristic	Min.	Typ.	Max.	Unit		
V <sub>ISOL</sub>	RMS isolation voltage, any terminal-to-case t = 1 min, 50/60 Hz	4000	—	—	V		
d <sub>creep</sub>	Creepage distance terminal-to-heatsink	—	12.2	—	mm		
d <sub>clear</sub>	Clearance distance terminal-to-heatsink	—	11.7	—			
R <sub>CCE</sub>	Lead resistance terminal-to-chip	T <sub>C</sub> = 25 °C, per switch		—	0.8	mΩ	
T <sub>J</sub>	Operating junction temperature range	-40	—	175	°C		
T <sub>STG</sub>	Storage temperature range	-40	—	125			
T <sub>C</sub>	Operating case temperature	-40	—	125			
τ <sub>M</sub>	Mounting torque	To heatsink	M4	2	—	3	N.m
Wt	Package weight	—	98	—	g		

The following table lists the temperature sensor NTC of the APTGX150DU120T3AG device.

**Table 1-6.** Temperature Sensor NTC

Symbol	Characteristic	Min.	Typ.	Max.	Unit		
R <sub>25</sub>	Resistance at 25 °C	—	50	—	kΩ		
ΔR <sub>25</sub> /R <sub>25</sub>	—	—	5	—	%		
B <sub>25/85</sub>	T <sub>25</sub> = 298.15K	—	3952	—	K		
ΔB/B	—	T <sub>C</sub> = 100 °C		—	4	—	%

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

T: Thermistor temperature  
R<sub>T</sub>: Thermistor value at T

**Note:** For more information, see [APT0406—Using NTC Temperature Sensor Integrated into Power Module](#).

## 1.4 Typical IGBT Performance Curve

The following figures show the IGBT performance curves of the APTGX150DU120T3AG device.

Figure 1-1. Maximum Thermal Impedance

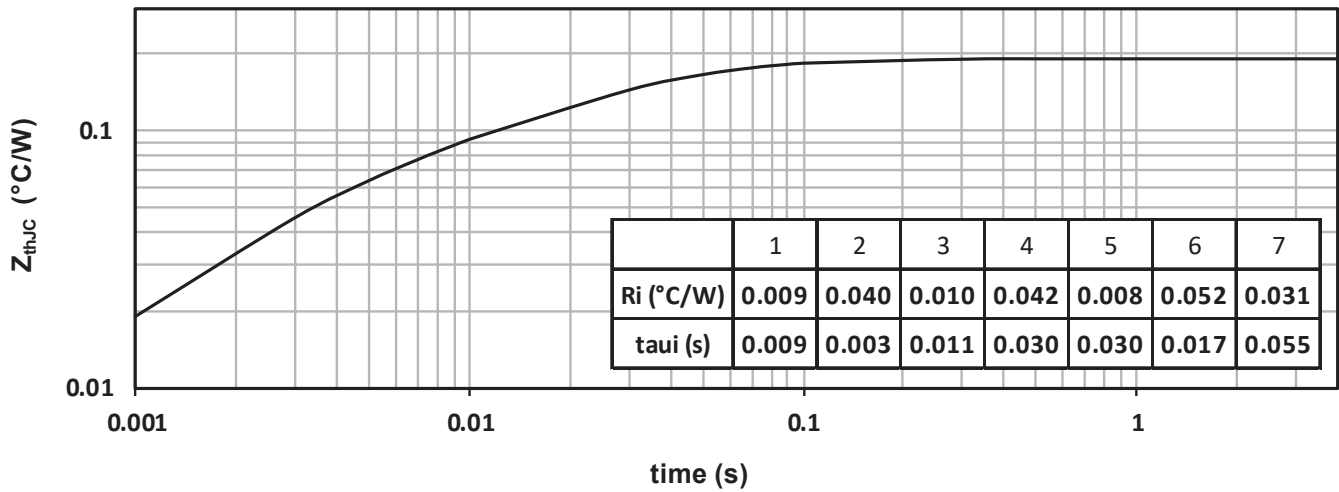


Figure 1-2. Output Characteristics,  $V_{GE} = 15V$

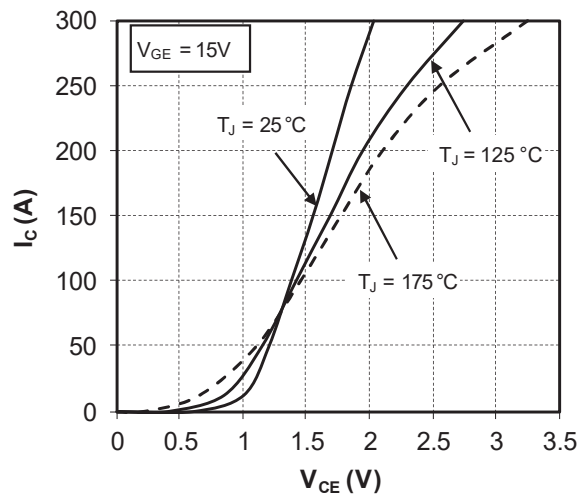


Figure 1-3. Output Characteristics,  $T_J = 175^\circ C$

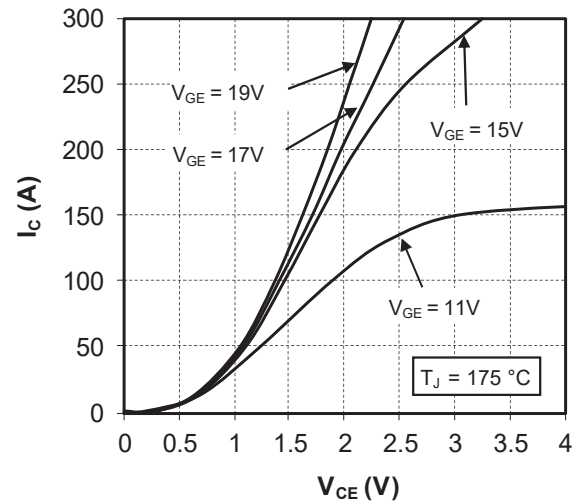


Figure 1-4. Switching Losses vs. Gate Resistance

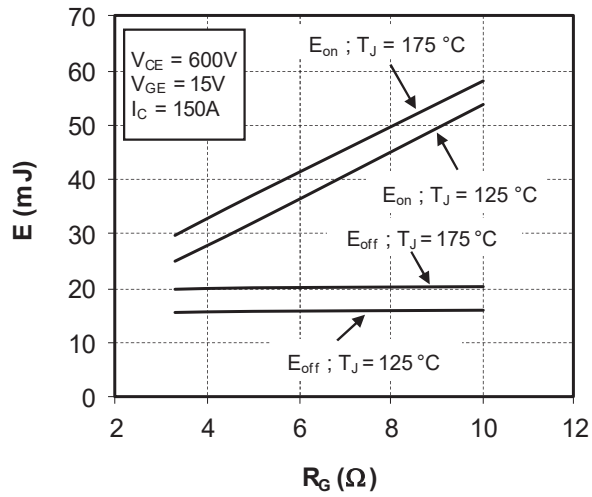


Figure 1-5. Switching Losses vs. Collector Current

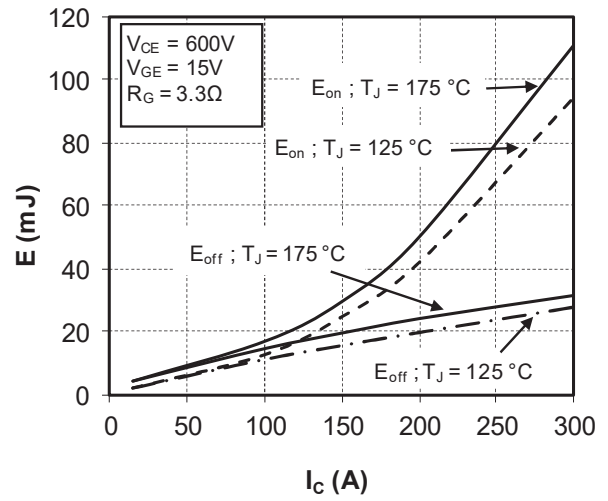


Figure 1-6. Operating Frequency vs. Collector Current

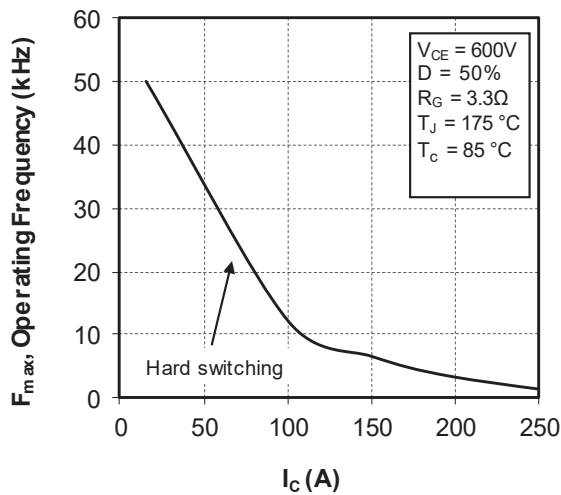


Figure 1-7. Gate Charge Characteristics

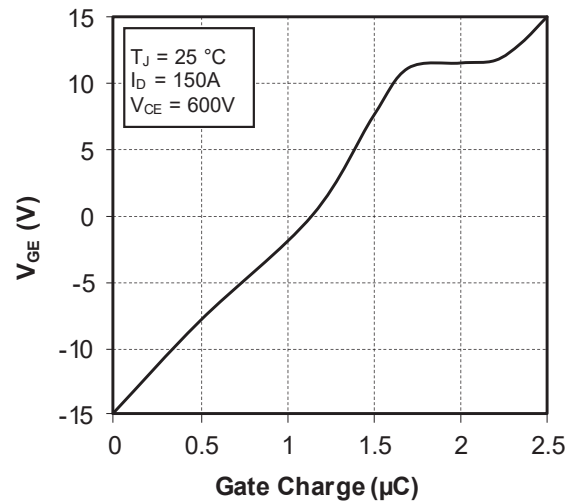


Figure 1-8. Transfer Characteristics

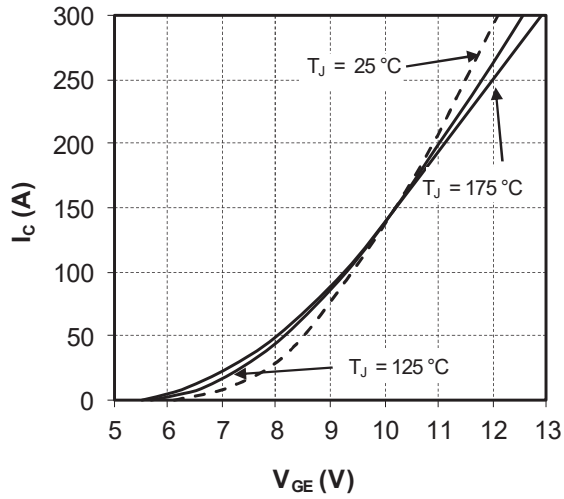


Figure 1-9. Capacity Characteristics

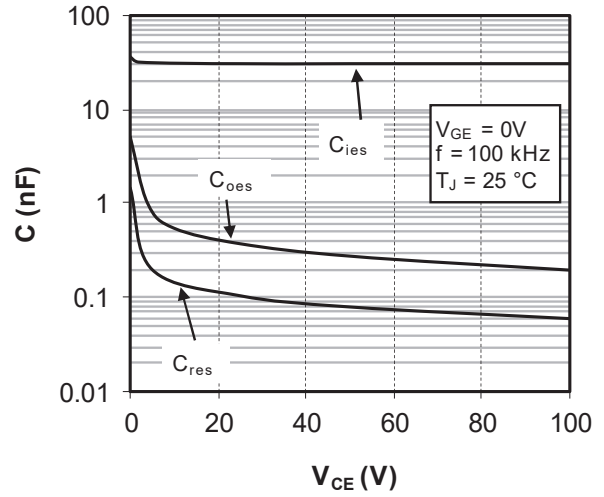
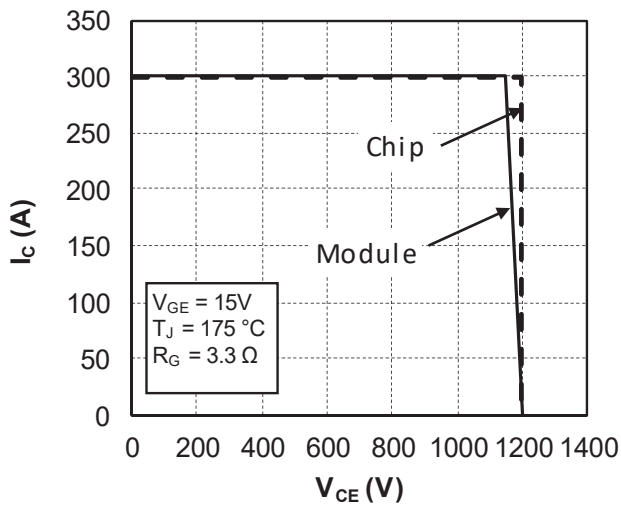


Figure 1-10. Reverse Bias Safe Operating Area



## 1.5 Typical Diode Performance Curve

The following figures show the diode performance curves of the APTGX150DU120T3AG device.

Figure 1-11. Maximum Thermal Impedance

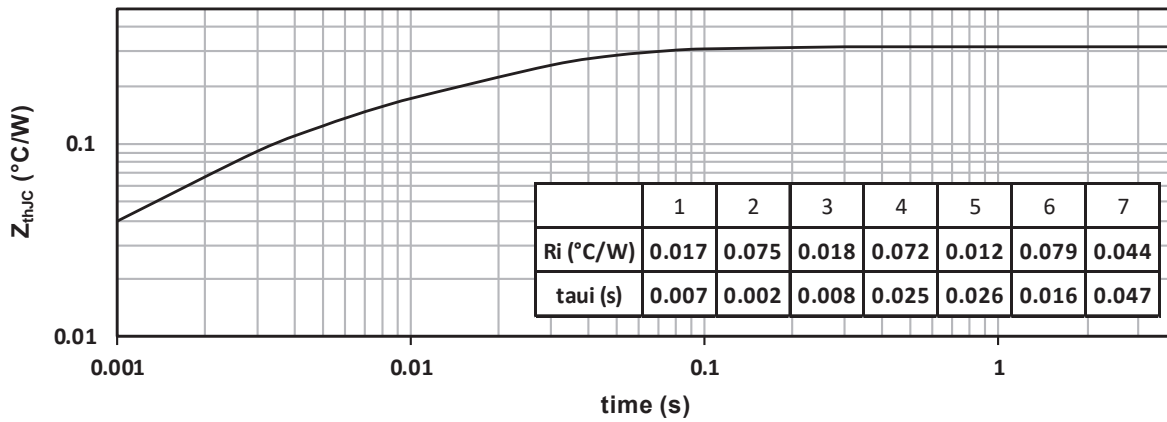


Figure 1-12. Forward Characteristics

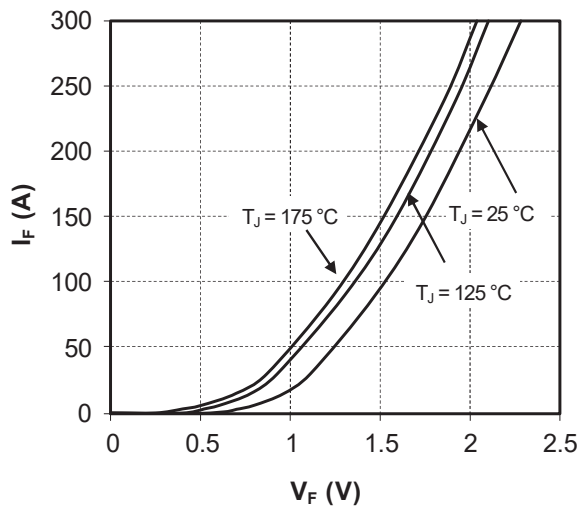


Figure 1-13. Switching Losses vs. Gate Resistance

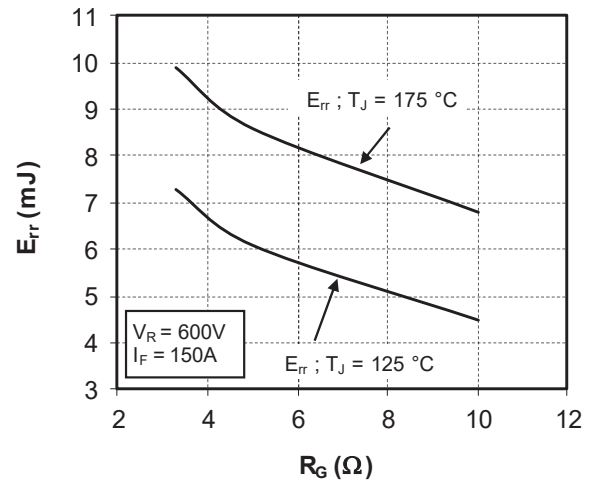
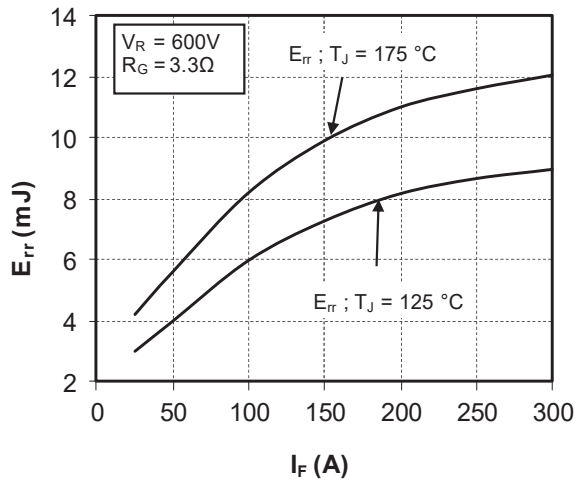


Figure 1-14. Switching Losses vs. Forward Current



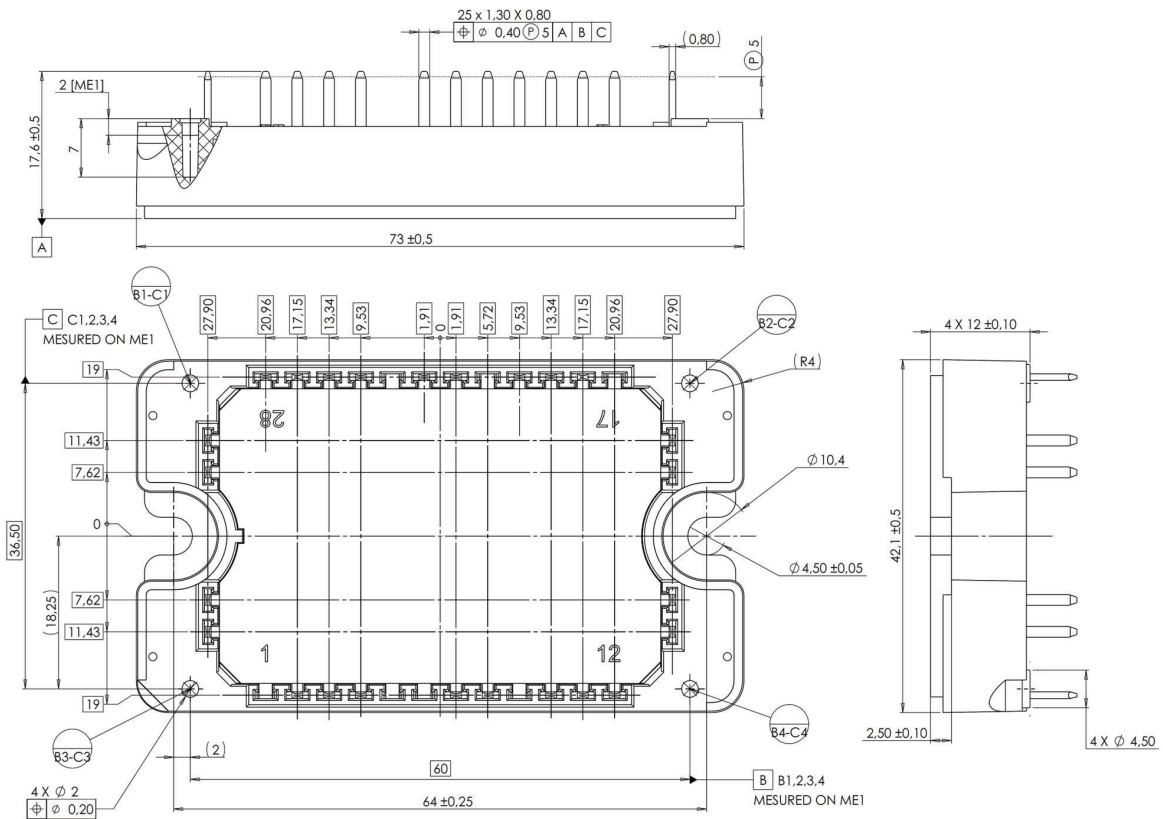
## 2. Package Specifications

The following section shows the package specification of the APTGX150DU120T3AG device.

### 2.1 Package Outline

The following figure shows the package outline drawing of the APTGX150DU120T3AG device. The dimensions in the following figure are in millimeters.

**Figure 2-1.** Package Outline Drawing



**Note:** For more information, see [AN3500A - Mounting instructions for SP1F and SP3F 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	09/2024	Initial revision

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