

# ART150PE; ART150PEG

Power LDMOS transistor

Rev. 1 — 13 January 2023

AMPLEON

Product data sheet

## 1. Product profile

### 1.1 General description

Based on Advanced Rugged Technology (ART), this 150 W LDMOS RF transistor has been designed to cover a wide range of applications for ISM, broadcast and communications. The unmatched transistor has a frequency range of 1 MHz to 650 MHz.

Table 1. Application information

Test signal	f (MHz)	V <sub>DS</sub> (V)	P <sub>L</sub> (W)	G <sub>p</sub> (dB)	η <sub>D</sub> (%)
CW [1]	6.78	63	150	-	86.5
CW	41	60	150	29.2	85.6
CW	41	65	150	31.7	80
CW [2]	108	65	150	31.0	81.7
CW pulsed [2][3]	108	65	150	31.5	81.4

[1] Class EF2 generator.

[2] Test circuit.

[3]  $t_p = 100 \mu\text{s}$ ;  $\delta = 10 \%$ .

### 1.2 Features and benefits

- High breakdown voltage enables class E operation up to  $V_{DS} = 53 \text{ V}$
- Qualified up to a maximum of  $V_{DS} = 65 \text{ V}$
- Characterized from 30 V to 65 V to support a wide range of applications
- Integrated dual sided ESD protection enables class C operation and complete switch off of the transistor
- Excellent ruggedness with no device degradation
- High efficiency
- Excellent thermal stability
- Designed for broadband operation
- For RoHS compliance see the product details on the Ampleon website

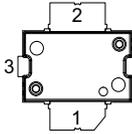
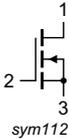
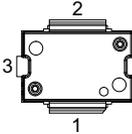
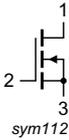
### 1.3 Applications

- Industrial, scientific and medical applications
  - ◆ Plasma generators
  - ◆ MRI systems
  - ◆ Particle accelerators
  - ◆ Defrosting
- Broadcast
  - ◆ FM radio
  - ◆ VHF TV

- Radar
  - ◆ Non cellular communications
  - ◆ UHF radar

## 2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
<b>ART150PE (TO-270-2F-1)</b>			
1	drain		 sym112
2	gate		
3	source <sup>[1]</sup>		
<b>ART150PEG (TO-270-2G-1)</b>			
1	drain		 sym112
2	gate		
3	source <sup>[1]</sup>		

[1] Connected to flange.

## 3. Ordering information

Table 3. Ordering information

Package name	Orderable part number	12NC	Packing description	Min. orderable quantity (pieces)
TO-270-2F-1	ART150PEXY	9349 604 91538	TR7; 100-fold; 24 mm; dry pack	100
	ART150PEZ	9349 604 91515	TR13; 500-fold; 24 mm; dry pack	500
TO-270-2G-1	ART150PEGXY	9349 604 92538	TR7; 100-fold; 24 mm; dry pack	100
	ART150PEGZ	9349 604 92515	TR13; 500-fold; 24 mm; dry pack	500

## 4. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	[1]	-	200	V
$V_{GS}$	gate-source voltage		-9	+13	V
$T_{stg}$	storage temperature		-65	+150	°C
$T_j$	junction temperature	[2]	-	225	°C

[1] Specified over lifetime at maximum operating temperature.

[2] Continuous use at maximum temperature will affect the reliability.

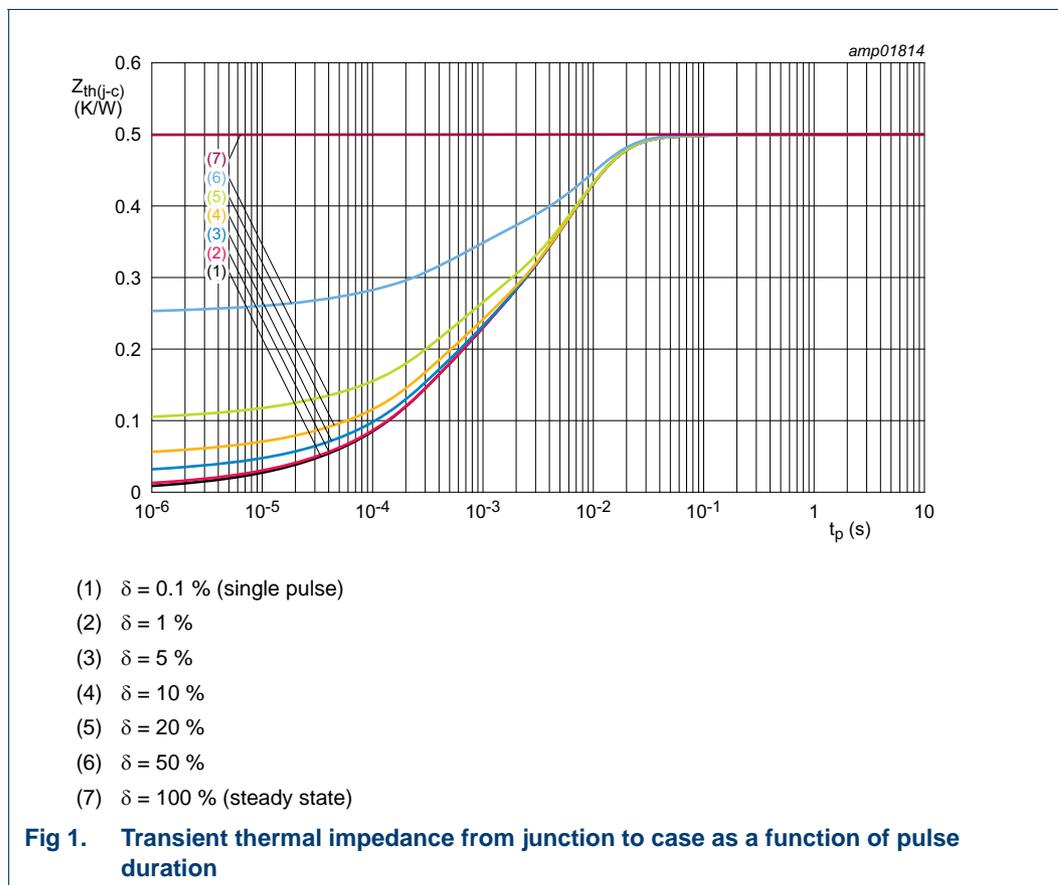
## 5. Thermal characteristics

**Table 5. Thermal characteristics**  
According to standard MIL-STD-883E.

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	$T_j = 57\text{ }^\circ\text{C}$ , measured under RF condition	[1][2] 0.50	K/W

[1] Refer to application note AN221014 on the Ampleon website.

[2] See [Figure 1](#).



## 6. Characteristics

**Table 6. DC characteristics**

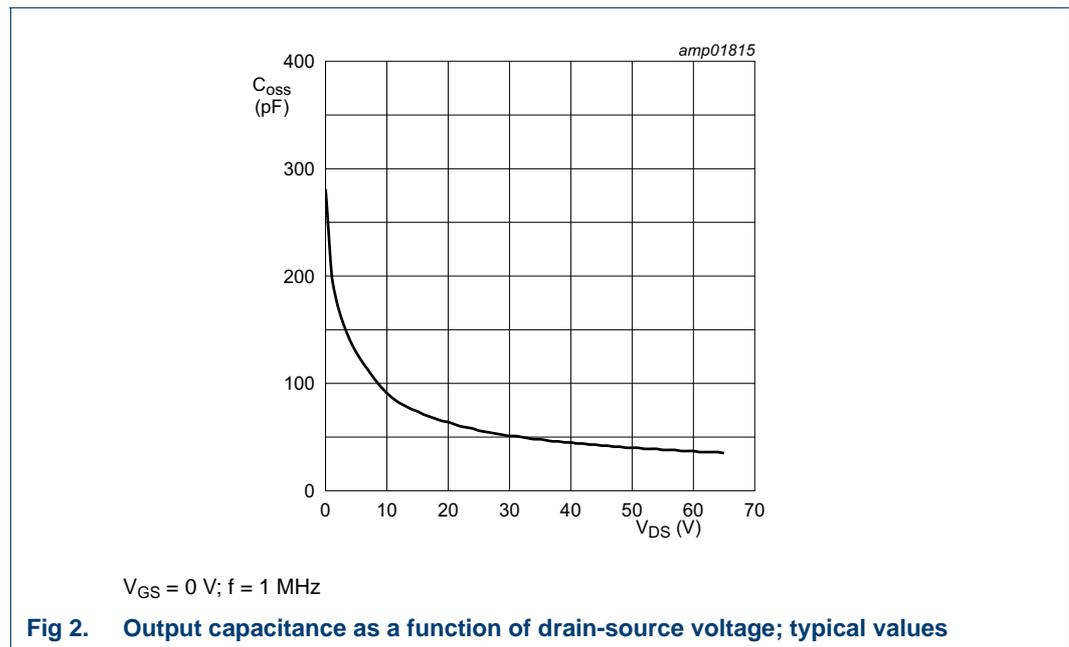
$T_j = 25\text{ }^\circ\text{C}$ ; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0\text{ V}$ ; $I_D = 1.11\text{ mA}$	203	208	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 20\text{ V}$ ; $I_D = 111\text{ mA}$	1.5	2.1	2.5	V
$I_{DSS}$	drain leakage current	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 65\text{ V}$	-	-	1.4	$\mu\text{A}$
$I_{DSX}$	drain cut-off current	$V_{GS} = V_{GS(th)} + 3.75\text{ V}$ ; $V_{DS} = 20\text{ V}$	-	15.1	-	A
$I_{GSS}$	gate leakage current	$V_{GS} = 11\text{ V}$ ; $V_{DS} = 0\text{ V}$	-	-	140	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 3.75\text{ V}$ ; $I_D = 3.885\text{ A}$	-	0.497	-	$\Omega$

**Table 7. AC characteristics**

$T_j = 25\text{ }^\circ\text{C}$ ; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$C_{rs}$	feedback capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 65\text{ V}$ ; $f = 1\text{ MHz}$	-	0.88	-	pF
$C_{iss}$	input capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 65\text{ V}$ ; $f = 1\text{ MHz}$	-	116	-	pF
$C_{oss}$	output capacitance	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 65\text{ V}$ ; $f = 1\text{ MHz}$	-	35	-	pF



**Table 8. RF characteristics**

Test signal: CW pulsed;  $t_p = 100\text{ }\mu\text{s}$ ;  $\delta = 10\%$ ;  $f = 108\text{ MHz}$ ; RF performance at  $V_{DS} = 65\text{ V}$ ;  $I_{Dq} = 20\text{ mA}$ ;  $T_{case} = 25\text{ }^\circ\text{C}$ ; unless otherwise specified; in a class-AB production test circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$G_p$	power gain	$P_L = 150\text{ W}$	29	31.2	-	dB
$RL_{in}$	input return loss	$P_L = 150\text{ W}$	-	-24	-9	dB
$\eta_D$	drain efficiency	$P_L = 150\text{ W}$	70	75.3	-	%

## 7. Test information

### 7.1 Ruggedness in class-AB operation

The ART150PE and ART150PEG are capable of withstanding a load mismatch corresponding to  $V_{SWR} \geq 65 : 1$  through all phases under the following conditions:  $V_{DS} = 65 \text{ V}$ ;  $I_{Dq} = 20 \text{ mA}$ ;  $P_L = 150 \text{ W}$ ;  $f = 108 \text{ MHz}$ ; CW and CW pulsed ( $t_p = 100 \text{ }\mu\text{s}$ ;  $\delta = 10 \%$ ).

### 7.2 Impedance information

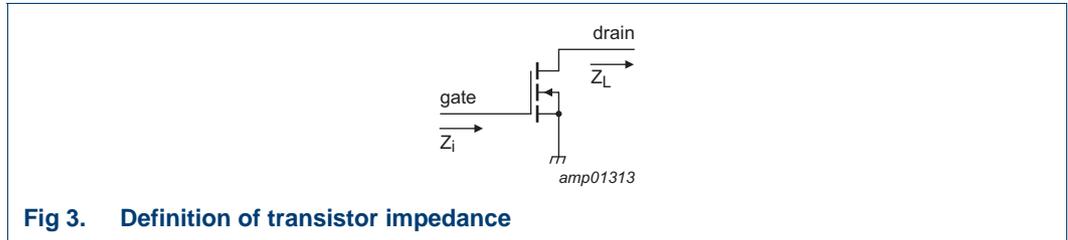


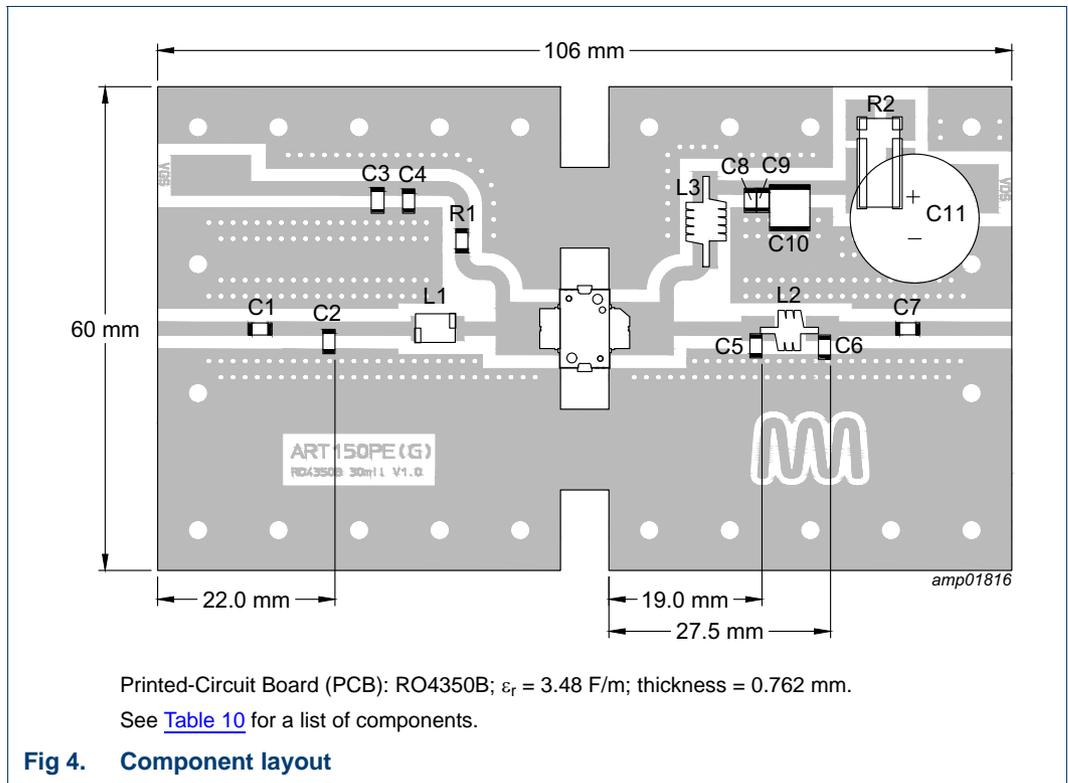
Fig 3. Definition of transistor impedance

Table 9. Typical impedance

Simulated  $Z_i$  and  $Z_L$  device impedance; impedance info at  $V_{DS} = 65 \text{ V}$  and  $P_L = 150 \text{ W}$ .

f (MHz)	$Z_i$ ( $\Omega$ )	$Z_L$ ( $\Omega$ )
108	$5.2 - j22.6$	$12.1 + j4.7$

7.3 Test circuit



**Table 10. List of components**

For test circuit see [Figure 4](#).

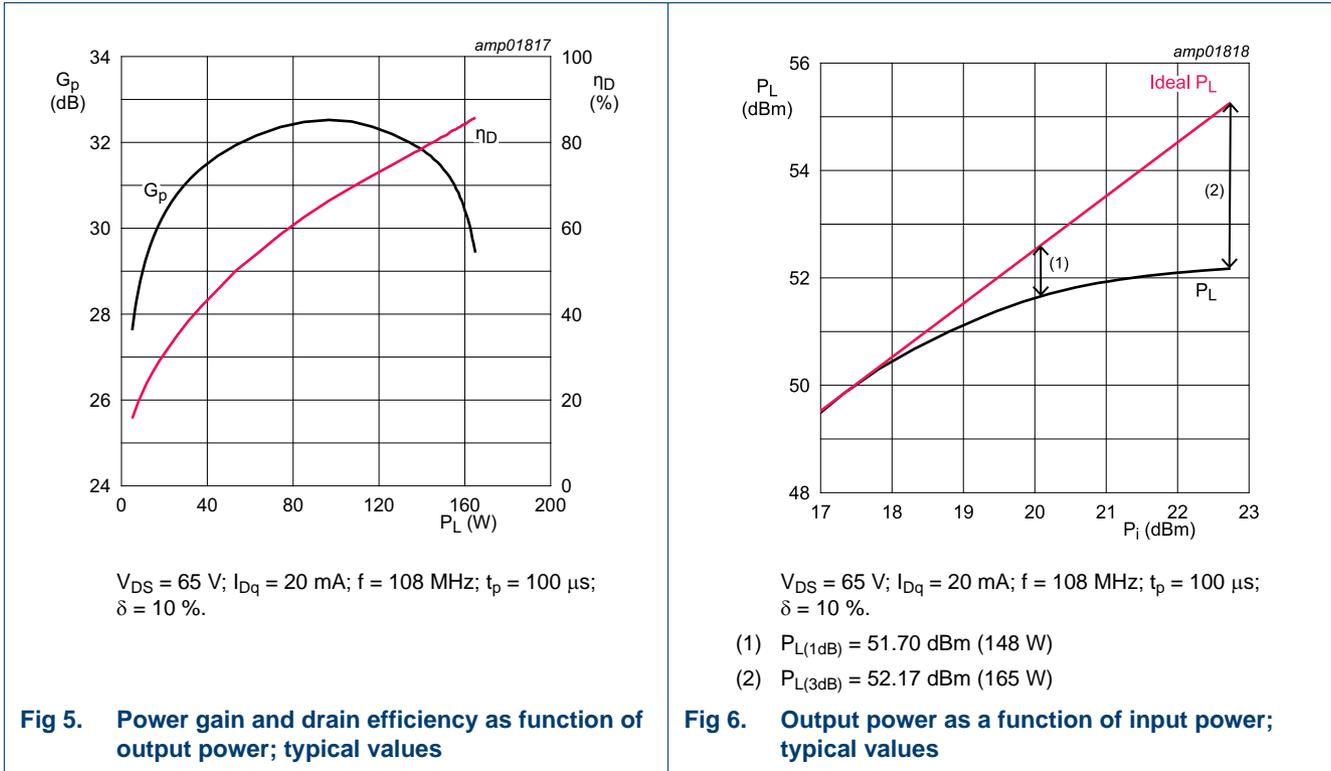
Component	Description	Value	Remarks
C1, C4, C7	multilayer ceramic chip capacitor	1 nF	[1][2]
C2	multilayer ceramic chip capacitor	110 pF	[1][2]
C3	multilayer ceramic chip capacitor	4.7 $\mu$ F, 100 V	Murata: GRM31CC72A475KE11L
C5	multilayer ceramic chip capacitor	20 pF	[1][2]
C6	multilayer ceramic chip capacitor	62 pF	[1][2]
C8, C9	multilayer ceramic chip capacitor	620 pF	[1][2]
C10	multilayer ceramic chip capacitor	4.7 $\mu$ F, 100 V	TDK: CGA9N2X7R2A465K230
C11	electrolytic capacitor	470 $\mu$ F, 100 V	
L1	midi spring air core inductor	39 nH	Coilcraft: 1812SMS-39N
L2	air inductor	3 turns, D = 5 mm	1 mm copper wire (39 nH)
L3	air inductor	5 turns, D = 5 mm	1 mm copper wire (82 nH)
R1	chip resistor	5.1 k $\Omega$	SMD 1206
R2	chip resistor	0.01 $\Omega$	FC4L110R010FER

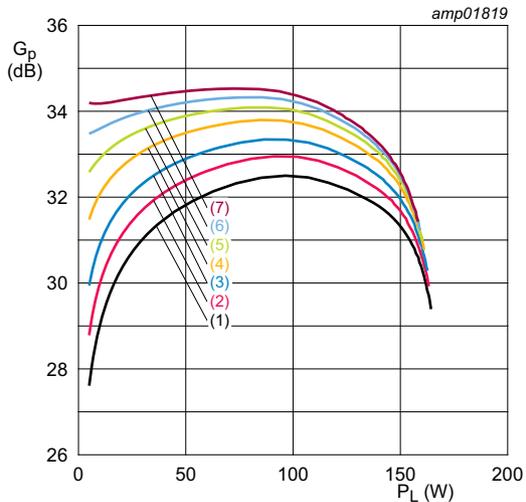
[1] American Technical Ceramics type 800B or capacitor of same quality.

[2] Vertical mounted

7.4 Graphical data

7.4.1 1-Tone CW pulsed

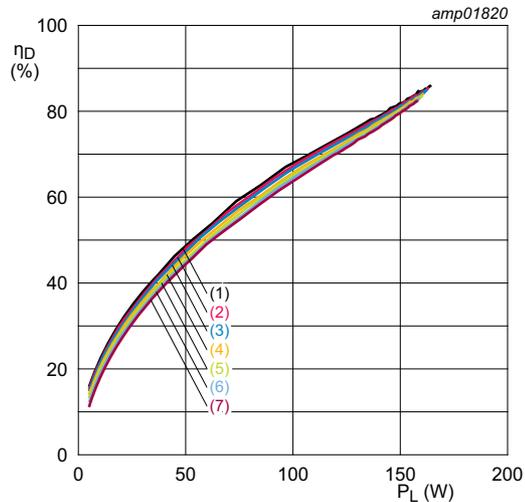




$V_{DS} = 65 \text{ V}; f = 108 \text{ MHz}; t_p = 100 \text{ }\mu\text{s}; \delta = 10 \text{ \%}$ .

- (1)  $I_{Dq} = 20 \text{ mA}$
- (2)  $I_{Dq} = 50 \text{ mA}$
- (3)  $I_{Dq} = 100 \text{ mA}$
- (4)  $I_{Dq} = 200 \text{ mA}$
- (5)  $I_{Dq} = 300 \text{ mA}$
- (6)  $I_{Dq} = 400 \text{ mA}$
- (7)  $I_{Dq} = 500 \text{ mA}$

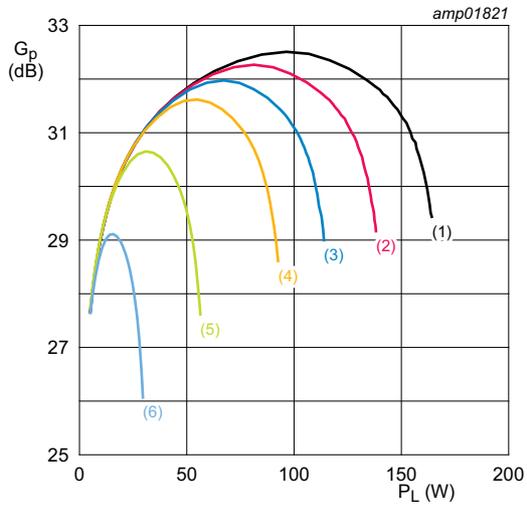
**Fig 7. Power gain as a function of output power; typical values**



$V_{DS} = 65 \text{ V}; f = 108 \text{ MHz}; t_p = 100 \text{ }\mu\text{s}; \delta = 10 \text{ \%}$ .

- (1)  $I_{Dq} = 20 \text{ mA}$
- (2)  $I_{Dq} = 50 \text{ mA}$
- (3)  $I_{Dq} = 100 \text{ mA}$
- (4)  $I_{Dq} = 200 \text{ mA}$
- (5)  $I_{Dq} = 300 \text{ mA}$
- (6)  $I_{Dq} = 400 \text{ mA}$
- (7)  $I_{Dq} = 500 \text{ mA}$

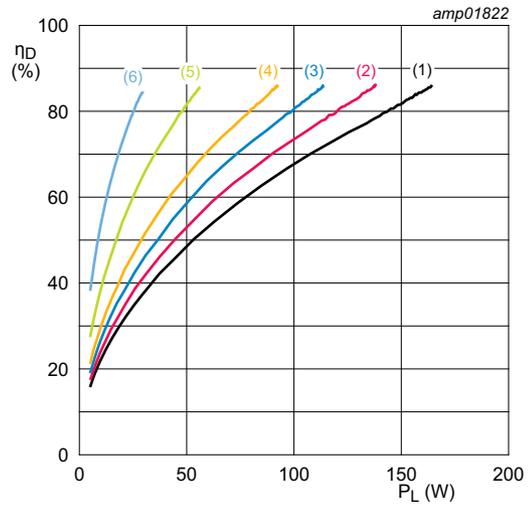
**Fig 8. Drain efficiency as a function of output power; typical values**



$I_{Dq} = 20 \text{ mA}; f = 108 \text{ MHz}; t_p = 100 \text{ }\mu\text{s}; \delta = 10 \text{ }\%$ .

- (1)  $V_{DS} = 65 \text{ V}$
- (2)  $V_{DS} = 60 \text{ V}$
- (3)  $V_{DS} = 55 \text{ V}$
- (4)  $V_{DS} = 50 \text{ V}$
- (5)  $V_{DS} = 40 \text{ V}$
- (6)  $V_{DS} = 30 \text{ V}$

**Fig 9. Power gain as a function of output power; typical values**

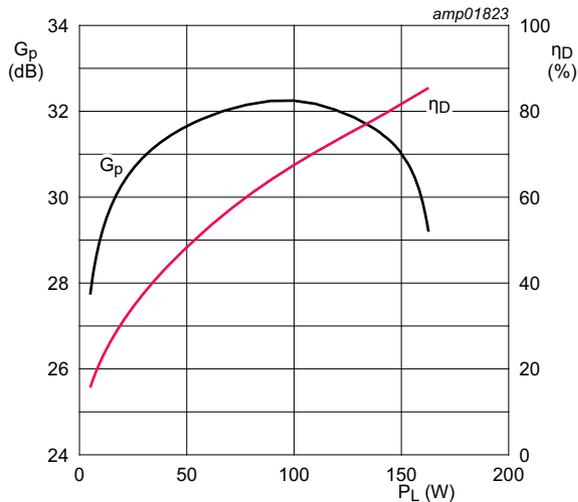


$I_{Dq} = 20 \text{ mA}; f = 108 \text{ MHz}; t_p = 100 \text{ }\mu\text{s}; \delta = 10 \text{ }\%$ .

- (1)  $V_{DS} = 65 \text{ V}$
- (2)  $V_{DS} = 60 \text{ V}$
- (3)  $V_{DS} = 55 \text{ V}$
- (4)  $V_{DS} = 50 \text{ V}$
- (5)  $V_{DS} = 40 \text{ V}$
- (6)  $V_{DS} = 30 \text{ V}$

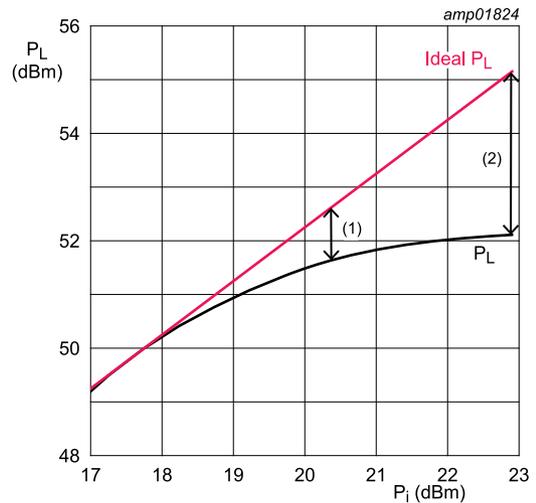
**Fig 10. Drain efficiency as a function of output power; typical values**

7.4.2 1-Tone CW



$V_{DS} = 65\text{ V}$ ;  $I_{Dq} = 20\text{ mA}$ ;  $f = 108\text{ MHz}$ .

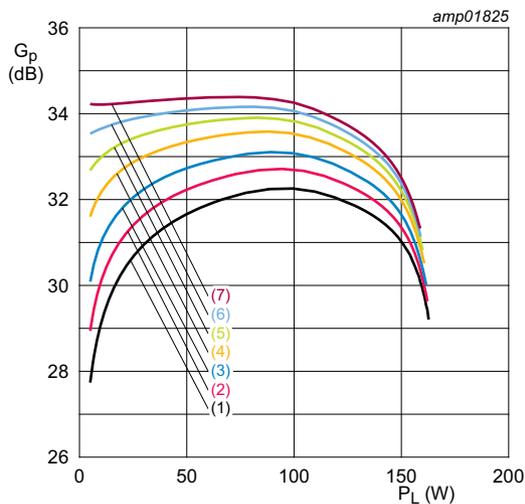
Fig 11. Power gain and drain efficiency as function of output power; typical values



$V_{DS} = 65\text{ V}$ ;  $I_{Dq} = 20\text{ mA}$ ;  $f = 108\text{ MHz}$ .

- (1)  $P_{L(1dB)} = 51.66\text{ dBm}$  (147 W)
- (2)  $P_{L(3dB)} = 52.11\text{ dBm}$  (163 W)

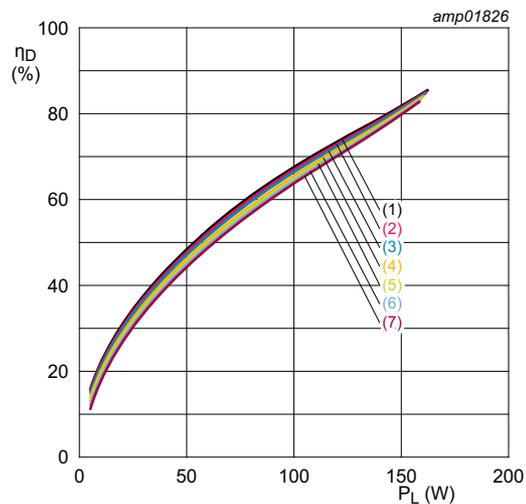
Fig 12. Output power as a function of input power; typical values



$V_{DS} = 65\text{ V}$ ;  $f = 108\text{ MHz}$ .

- (1)  $I_{Dq} = 20\text{ mA}$
- (2)  $I_{Dq} = 50\text{ mA}$
- (3)  $I_{Dq} = 100\text{ mA}$
- (4)  $I_{Dq} = 200\text{ mA}$
- (5)  $I_{Dq} = 300\text{ mA}$
- (6)  $I_{Dq} = 400\text{ mA}$
- (7)  $I_{Dq} = 500\text{ mA}$

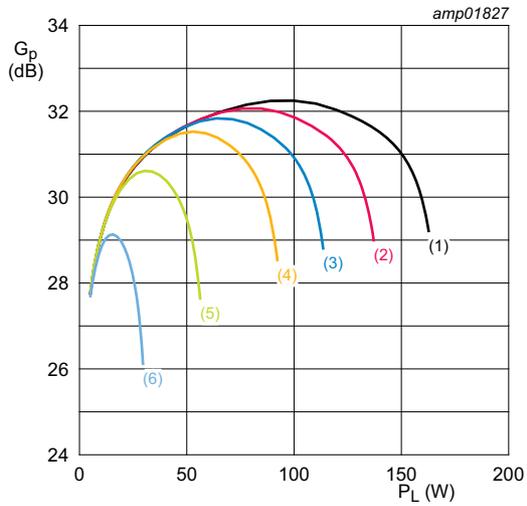
Fig 13. Power gain as a function of output power; typical values



$V_{DS} = 65\text{ V}$ ;  $f = 108\text{ MHz}$ .

- (1)  $I_{Dq} = 20\text{ mA}$
- (2)  $I_{Dq} = 50\text{ mA}$
- (3)  $I_{Dq} = 100\text{ mA}$
- (4)  $I_{Dq} = 200\text{ mA}$
- (5)  $I_{Dq} = 300\text{ mA}$
- (6)  $I_{Dq} = 400\text{ mA}$
- (7)  $I_{Dq} = 500\text{ mA}$

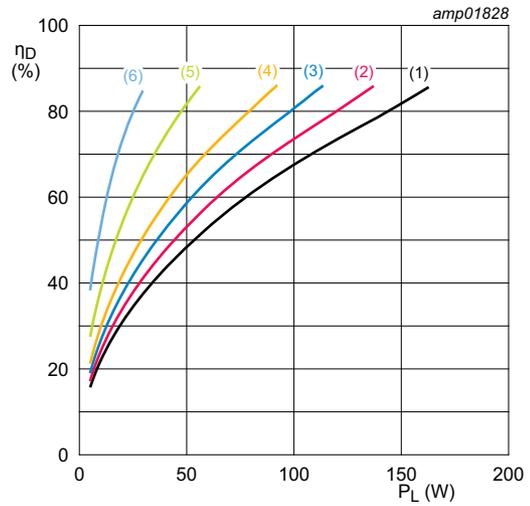
Fig 14. Drain efficiency as a function of output power; typical values



$I_{Dq} = 20 \text{ mA}; f = 108 \text{ MHz.}$

- (1)  $V_{DS} = 65 \text{ V}$
- (2)  $V_{DS} = 60 \text{ V}$
- (3)  $V_{DS} = 55 \text{ V}$
- (4)  $V_{DS} = 50 \text{ V}$
- (5)  $V_{DS} = 40 \text{ V}$
- (6)  $V_{DS} = 30 \text{ V}$

**Fig 15. Power gain as a function of output power; typical values**



$I_{Dq} = 20 \text{ mA}; f = 108 \text{ MHz.}$

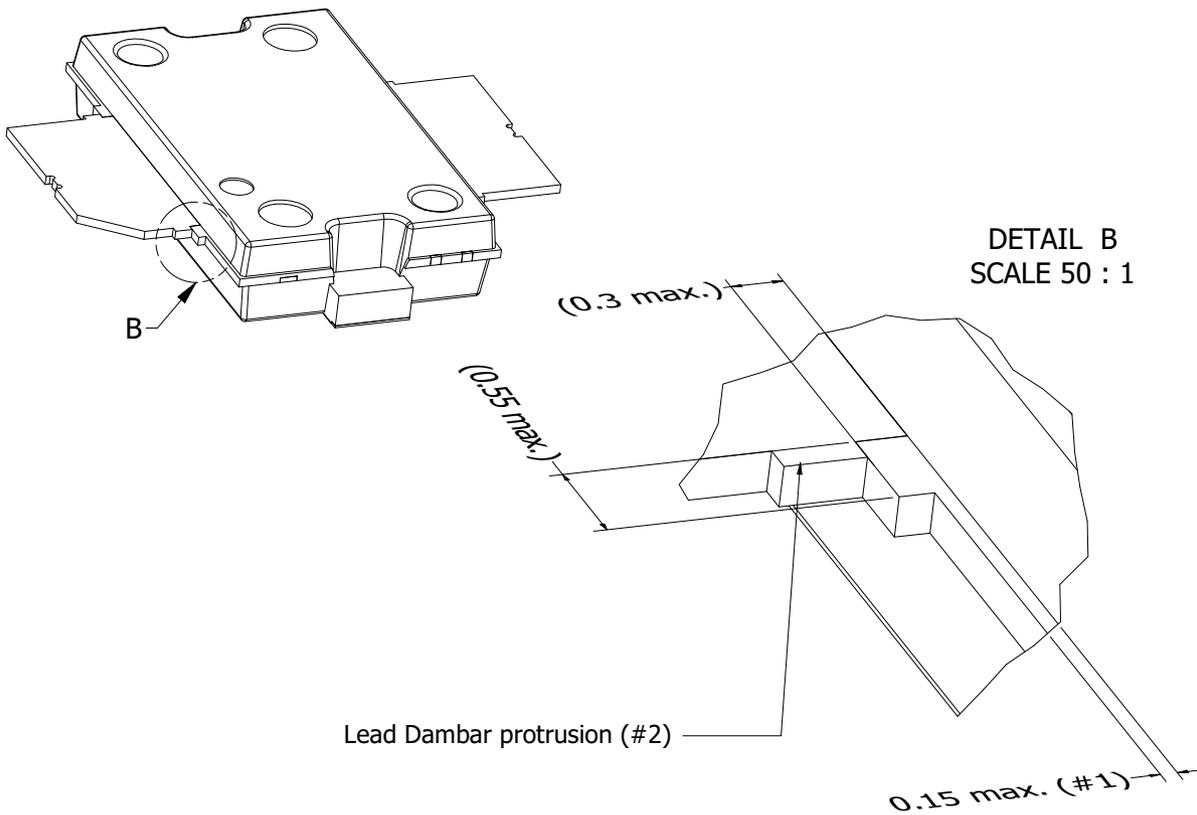
- (1)  $V_{DS} = 65 \text{ V}$
- (2)  $V_{DS} = 60 \text{ V}$
- (3)  $V_{DS} = 55 \text{ V}$
- (4)  $V_{DS} = 50 \text{ V}$
- (5)  $V_{DS} = 40 \text{ V}$
- (6)  $V_{DS} = 30 \text{ V}$

**Fig 16. Drain efficiency as a function of output power; typical values**



TO-270-2F-1

Drawing Notes	
Items	Description
(1)	Dimensions are excluding mold protrusion. The mold protrusion is maximum 0.15 mm per side. See also detail B. In the dambar area max. protrusion is 0.55 mm. max. in length and 0.3 mm. max. in width (4x). See also detail B.
(2)	The lead dambar (metal) protrusions are not included. Add 0.14 mm max to the total lead dimension at the dambar location.
(3)	The leads and exposed heatsink are plated with matte Tin (Sn).
(4)	Dimensions (Heatsink ears) 10,67 and 1,78 do not include mouldprotrusion. Overall Max. dimensions incl. mould protrusions is 10.92 mm. (max.) and 2.03 mm. (max.).
(5)	Lead coplanarity over the leads is 0,1 mm. maximum.
(6)	Surfaces may remain unplated (not solderable surfaces).



Package outline drawing:	units in mm.	Tolerances unless otherwise stated: Dimension: $\pm 0.05$ Angle: $\pm 1^\circ$	Revision: 0 Revision date: 11/7/2022
TO-270-2F-1		 Third angle projection	Sheet 2 of 2

Fig 18. Package outline TO-270-2F-1 (sheet 2 of 2)

TO-270-2G-1

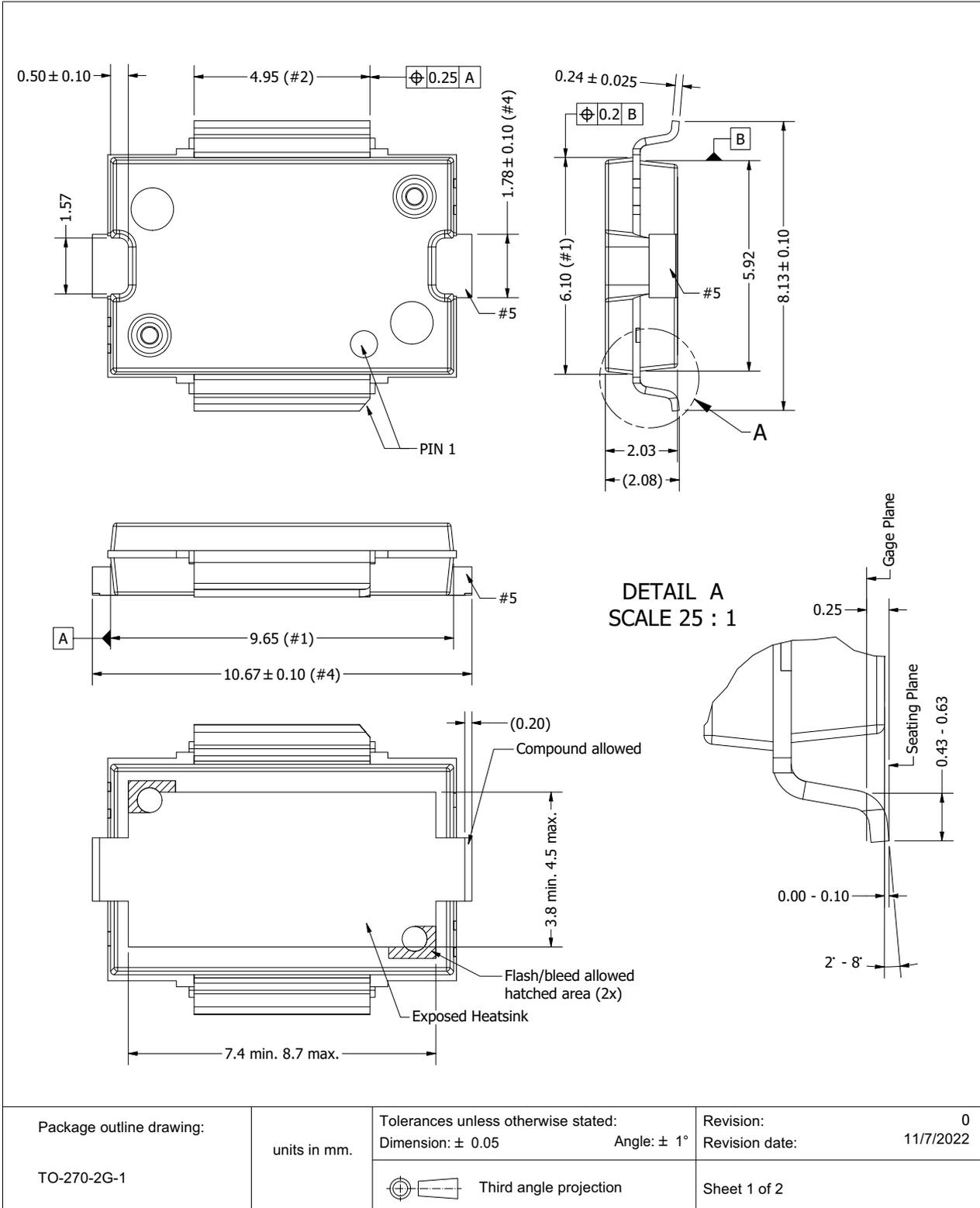
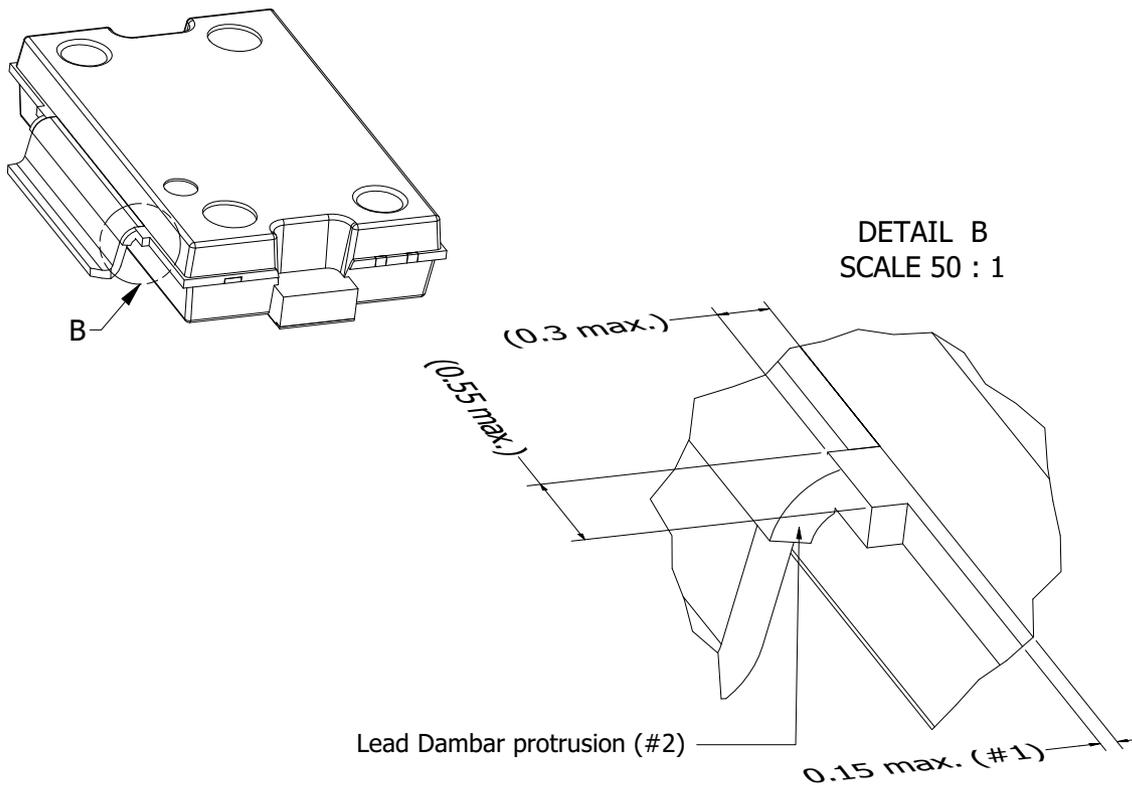


Fig 19. Package outline TO-270-2G-1 (sheet 1 of 2)

TO-270-2G-1

Drawing Notes	
Items	Description
(1)	Dimensions are excluding mold protrusion. The mold protrusion is maximum 0.15 mm per side. See also detail B. In the dambar area max. protrusion is 0.55mm max. in length and 0.3 mm max. in width (4x) See also detail B.
(2)	The lead dambar (metal) protrusions are not included. Add 0.14 mm max to the total lead dimension at the dambar location.
(3)	The leads and exposed heatsink are plated with matte Tin (Sn).
(4)	Dimensions (Heatsink ears) 10,67 and 1,78 do not include mouldprotrusion. Overall Max. dimensions incl. mould protrusions is 10,92 mm. (max.) and 2,03 mm. (max.).
(5)	Surfaces may remain unplated (not solderable surfaces).



Package outline drawing:	units in mm.	Tolerances unless otherwise stated:	Revision: 0
TO-270-2G-1		Dimension: $\pm 0.05$	Angle: $\pm 1^\circ$
		Third angle projection	Revision date: 11/7/2022
			Sheet 2 of 2

Fig 20. Package outline TO-270-2G-1 (sheet 2 of 2)

## 9. Handling information

**CAUTION**



This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices.

Such precautions are described in the *ANSI/ESD S20.20*, *IEC/ST 61340-5*, *JESD625-A* or equivalent standards.

**Table 11. ESD sensitivity**

ESD model	Class
Charged Device Model (CDM); According to ANSI/ESDA/JEDEC standard JS-002	C2A <a href="#">[1]</a>
Human Body Model (HBM); According to ANSI/ESDA/JEDEC standard JS-001	2 <a href="#">[2]</a>

[1] CDM classification C2A is granted to any part that passes after exposure to an ESD pulse of 500 V.

[2] HBM classification 2 is granted to any part that passes after exposure to an ESD pulse of 2000 V.

## 10. Abbreviations

**Table 12. Abbreviations**

Acronym	Description
CW	Continuous Wave
ESD	ElectroStatic Discharge
FM	Frequency Modulation
ISM	Industrial, Scientific and Medical
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
MRI	Magnetic Resonance Imaging
SMD	Surface Mounted Device
RoHS	Restriction of Hazardous Substances
UHF	Ultra High Frequency
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio

## 11. Revision history

**Table 13. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
ART150PE_ART150PEG v.1	20230113	Product data sheet	-	-

## 12. Legal information

### 12.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.ampleon.com>.

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