XTR2N0307

High Temperature 30V P-Channel Small Signal MOSFET

Rev 3 – August 2021 (DS-00449-13)

Data Sheet

PRODUCTION

CDFP8
XTR2N0307

TO18-3
XTR2N0307

FEATURES

- Minimum BVDSS = -30V.
- Allowed VGS range –5.5V to +5.5V.
- Operational beyond the -60°C to +230°C temperature range.
- Low RDS(on)
  - XTR2N0307: 6.7Ω @ 230°C
- Maximum ID:
  - XTR2N0307: -1A @ 230°C
- On-time (td(on)+tr):
  - XTR2N0307: 15nsec @ 230°C
- Off-time (td(off)+tf):
  - XTR2N0307: 24nsec @ 230°C
- Available in ruggedized SMT and thru-hole packages.
- Parts are also available as bare dies.

APPLICATIONS

- Reliability-critical, Automotive, Aeronautics & Aerospace, Down-hole.
- Shunt and series regulators, switching applications, sensor driving, level shifting.

DESCRIPTION

XTR2N0307 is a P-channel small signal MOSFET designed to reliably operate over a wide range of temperatures. Full functionality is guaranteed from -60°C to +230°C, though operation well below and above this temperature range is achieved.

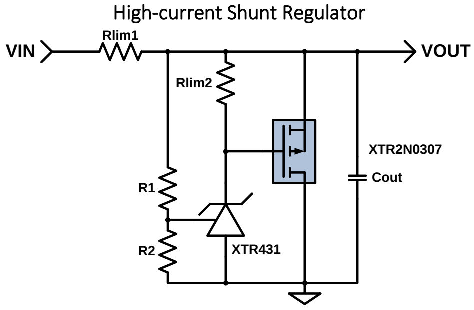
Fabricated on a Silicon-on-Insulator (SOI) process, XTR2N0307 parts offer reduced leakage currents while providing high drain currents and low RDS (on). These features allow the XTR2N0307 to be ideally suited for low power switching and continuous conduction applications.

XTR2N0307 parts have been designed to reduce system cost and ease adoption by reducing the learning curve and providing smart and easy to use features.

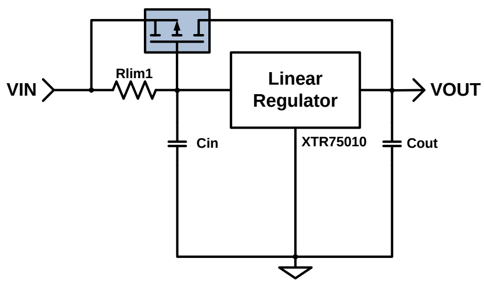
XTR2N0307 parts are available in ruggedized SMT and thru-hole packages. Parts are also available as bare dies.

PRODUCT HIGHLIGHT

High-current Shunt Regulator



Current-improved Series Regulator



ORDERING INFORMATION

X	TR	2N	0307
Source : X = X-REL Semi	Process: TR = HiTemp, HiRel	Part family	Part number

Product Reference	Temperature Range	Package	Pin Count	Marking
XTR2N0307-TD	-60°C to +230°C	Tested bare die		
XTR2N0307-FE	-60°C to +230°C	Gull-wing flat pack with ePad	8	XTR2N0307
XTR2N0307-T	-60°C to +230°C	TO-18 metal can	3	XTR2N0307

Other packages and packaging configurations possible upon request. For some packages or packaging configurations, MOQ may apply.

ABSOLUTE MAXIMUM RATINGS

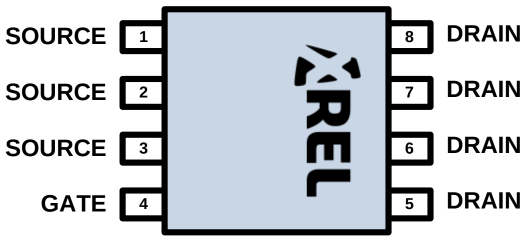
Drain-source voltage	-30V to 2V
Gate-source voltage	±6.0V
Storage temperature range	-70°C to +230°C
Operating junction temperature range	-70°C to +300°C
ESD classification	1kV HBM MIL-STD-750

Caution: *Stresses beyond those listed in "ABSOLUTE MAXIMUM RATINGS" may cause permanent damage to the device. These are stress ratings only and functionality of the device at these or any other condition beyond those indicated in the operational sections of the specifications is not implied. Exposure to "ABSOLUTE MAXIMUM RATINGS" conditions for extended periods may permanently affect device reliability.*

PRODUCT VARIANTS

CDFP8 with ePad
XTR2N0307-FE

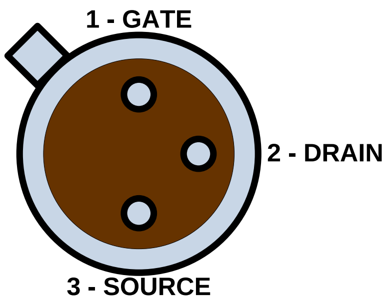
Top view



ePAD (bottom of package) connected to SOURCE

TO-18
XTR2N0307-T

Bottom view



Package case connected to SOURCE

THERMAL CHARACTERISTICS

Parameter	Condition	Min	Typ	Max	Units
XTR2N0307-T (TO-18)					
Thermal Resistance: J-C $R_{Th\_J\text{-}C}$			55		°C/W
Thermal Resistance: J-A $R_{Th\_J\text{-}A}$			300		°C/W
XTR2N0307-FE (DFP8 with exposed pad)					
Thermal Resistance: J-C $R_{Th\_J\text{-}C}$	Resistance to exposed pad.		15		°C/W
Thermal Resistance: J-A $R_{Th\_J\text{-}A}$			85		°C/W

RECOMMENDED OPERATING CONDITIONS

Parameter	Min	Typ	Max	Units
Drain-source voltage V_{DS}	-30		1.5	V
Gate-source voltage V_{GS}	-5.5		+5.5	V
Junction Temperature[1] T_j	-60		230	°C

[1] *Operation beyond the specified temperature range is achieved. The -60°C to +230°C range for the case temperature is considered for the case where $I_D \le I_{D(DC)}$ for a given case temperature.*

ELECTRICAL SPECIFICATIONS

Unless otherwise stated, specification applies for -60°C<T_j<230°C.

Parameter	Condition	Min	Typ	Max	Units
DC Characteristics					
Drain-source breakdown voltage BV_{DSS}	V_{GS}=0V, I_{DS}=-100µA, T_C=25°C	-30			V
Static drain-source on-state resistance $R_{DS(on)}$	V_{GS}=-5V, I_{DS}=-100mA T_C=-60°C T_C=85°C T_C=230°C		 3.15 4.60 6.65	 4.1 6.0 8.7	⍰
Continuous drain current $I_{D(DC)}$	V_{GS}=-5V for TO-18 T_C=-60°C T_C=85°C T_C=230°C	 -290 -220 -180	 -410 -310 -250		mA
Gate threshold voltage $V_{GS(th)}$	V_{DS}=V_{GS}, I_{DS}=-1mA T_C=-60°C T_C=85°C T_C=230°		 -1.36 -1.09 -0.76		V
Temperature drift of gate threshold voltage $\Delta V_{GS(th)}/\Delta T_j$	V_{DS}=V_{GS}, I_{DS}=-1mA		2.07		mV/°C
Off-state drain current I_{DSS}	V_{DS}=-30V, V_{GS}=0V T_C=85°C T_C=230°C		 -0.03 -9.0	 -2 -40	µA
Gate Leakage current I_{GSS}	V_{GS}=±5V, V_{DS}=0V T_C=85°C T_C=230°C		 ±0.3 ±120	 ±5 ±1000	nA
AC Characteristics					
Input capacitance C_{iss}	V_{DS}=-24V, V_{GS}=0V, f=1MHz		39		pF
Output capacitance C_{oss}			12		pF
Transfer capacitance C_{rss}			5		pF
Switching Characteristics					
Pulsed drain current I_{DM}	V_{DS}=-15V, $V_{GS\ sweep}$=0 to +5V, d=0.2%, ⍰=1ms T_C=-60°C T_C=85°C T_C=230°C	 -1.15 -0.85 -0.70	 -1.65 -1.24 -1.00		A
Total gate charge Q_g	V_{DS}=-15V, $V_{GS\ sweep}$=0 to -5V		1.3		nC
Turn-on delay time $t_{d(on)}$	V_{DS}=-15V, $V_{GS\ sweep}$=0 to -5V, R_D=100Ω, d=0.2%, ⍰=1ms		7		ns
Rise time t_r	V_{DS}=-15V, $V_{GS\ sweep}$=0 to -5V, R_D=100Ω, d=0.2%, ⍰=1ms		6		
Turn-off delay time $t_{d(off)}$	V_{DS}=-15V, $V_{GS\ sweep}$=0 to -5V, R_D=100Ω, d=0.2%, ⍰=1ms		11		
Fall time t_f	V_{DS}=-15V, $V_{GS\ sweep}$=0 to -5V, R_D=100Ω, d=0.2%, ⍰=1ms		13		
Drain-Source Diode Characteristics					
Forward diode voltage V_{SD}	V_{GS}=0V, I_{DS}=100mA T_C=-60°C T_C=85°C T_C=230°C		 -1.12 -0.96 -0.82		V
Maximum continuous current I_{SD_Max}	V_{GS}=0V, V_{SD}=2V T_C=-60°C T_C=85°C T_C=230°C		 -795 -716 -653		mA

TYPICAL PERFORMANCE

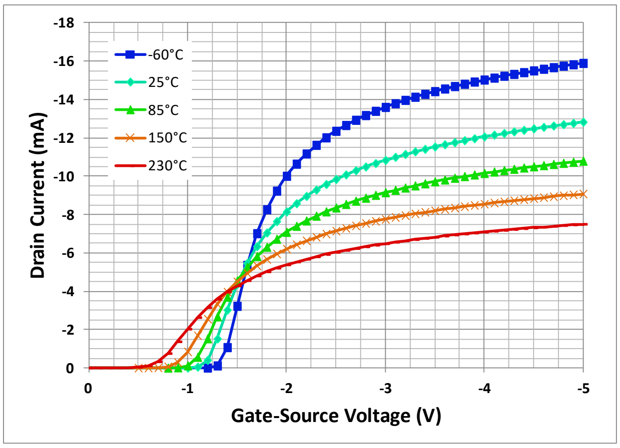


Figure 1. Drain Current (I_{DS}) vs Gate-Source Voltage for several case temperatures. V_{DS}=-50mV.

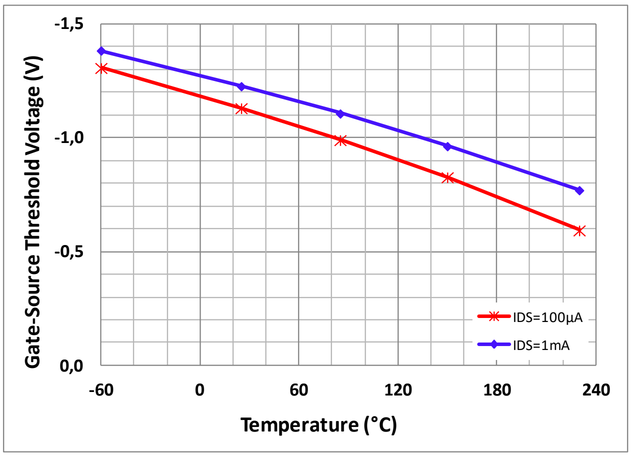


Figure 2. Gate-Source Threshold Voltage ($V_{GS(th)}$) vs Case Temperature. V_{GS}= V_{DS}.

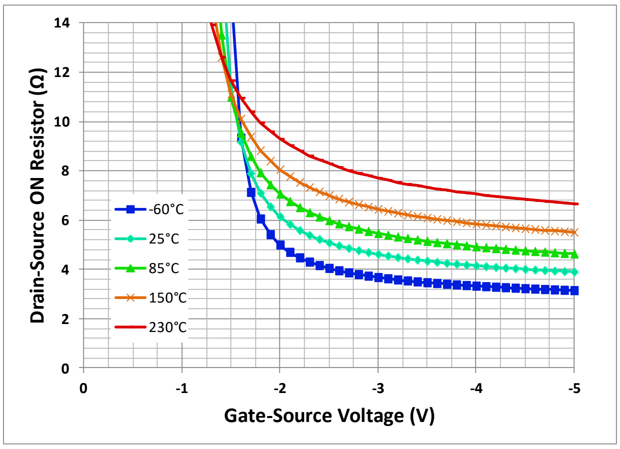


Figure 3. Drain-Source ON Resistance ($R_{DS(on)}$) vs Gate-Source Voltage for several case temperatures. V_{DS}=-50mV.

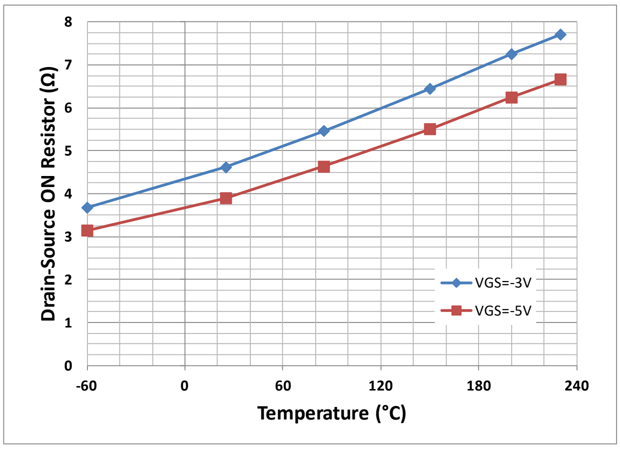


Figure 4. Drain-Source ON Resistance ($R_{DS(on)}$) vs Case Temperature. V_{DS}=-50mV.

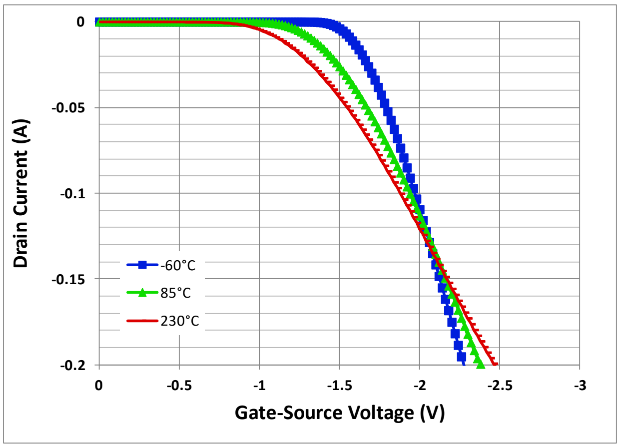


Figure 5. Drain Current (I_{DS}) vs Gate-Source Voltage for several case temperatures. V_{GS}=V_{DS}

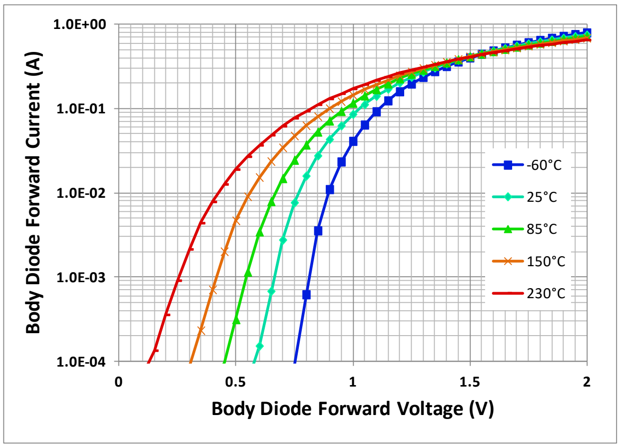


Figure 6. Body Diode Forward Current (I_{FD}) in logarithmic scale vs Forward Voltage for several case temperature. V_{GS}=0V.

TYPICAL PERFORMANCE (CONTINUED)

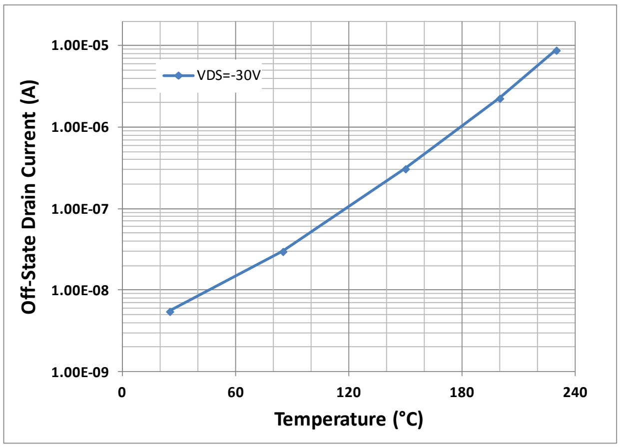


Figure 7. Off-State Drain Current (I_{DSS}) vs Case Temperature. V_{DS}=-30V, V_{GS}=0V.

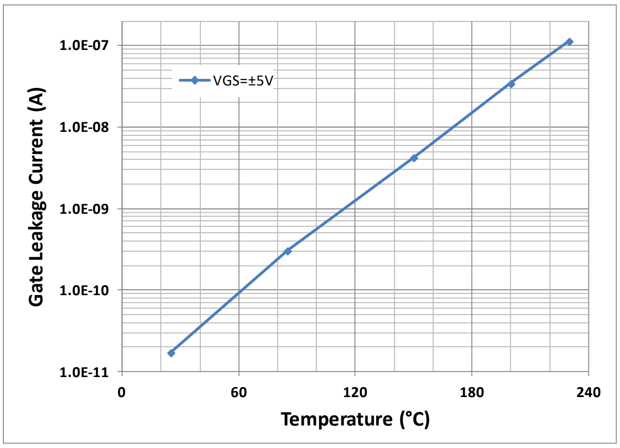


Figure 8. Gate Leakage Current (I_{GSS}) vs Case Temperature. V_{GS}=±5V, V_{DS}=0V.

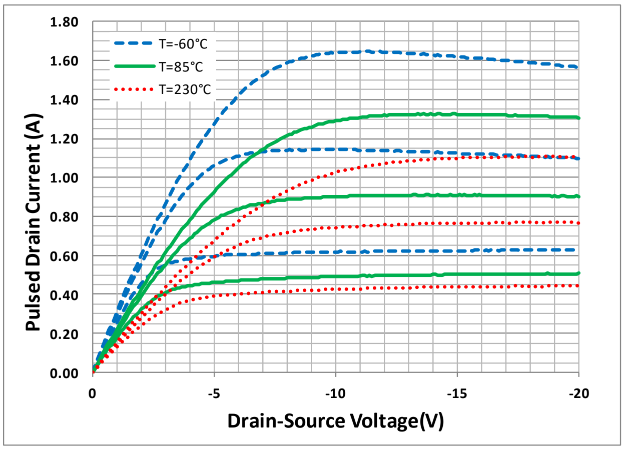


Figure 9. Pulsed Drain Current (I_{DM}) vs Drain-Source Voltage for several case temperatures. V_{GS}=-3V, -4V and -5V.

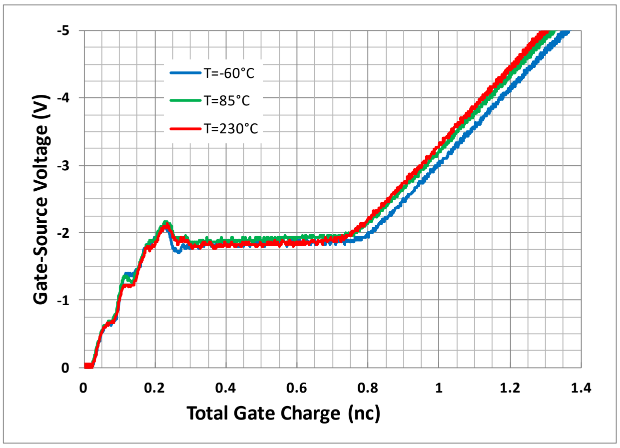


Figure 10. Total Gate Charge (Q_g) vs Gate-Source Voltage for several case temperatures. I_{DS}=-500mA.

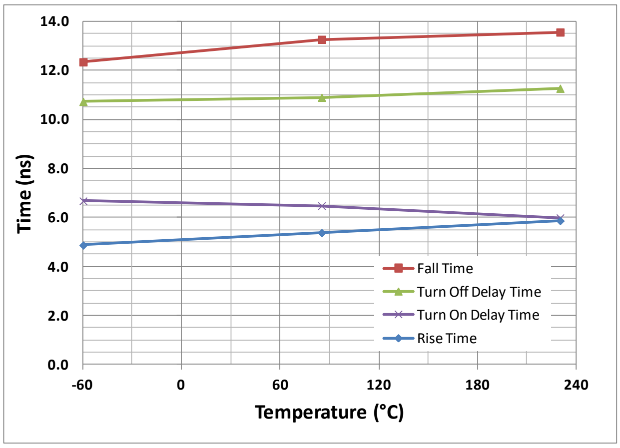


Figure 11. Timing Characteristics vs Case Temperature. V_{DS}=-15V, $V_{GS\ sweep}$= 0 to -5V.

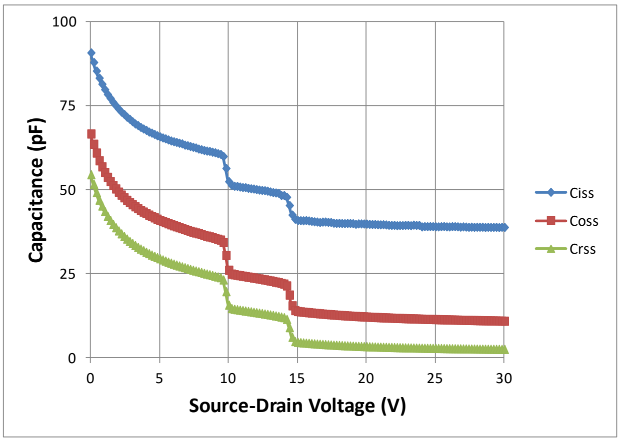


Figure 12. Capacitance vs Source-Drain Voltage at Tc=25°C.

TYPICAL PERFORMANCE (CONTINUED)

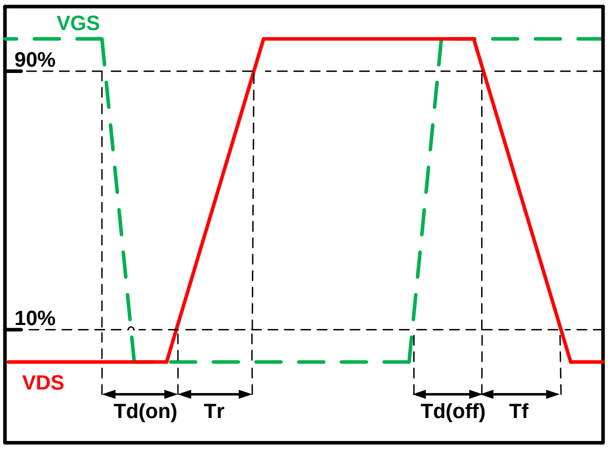
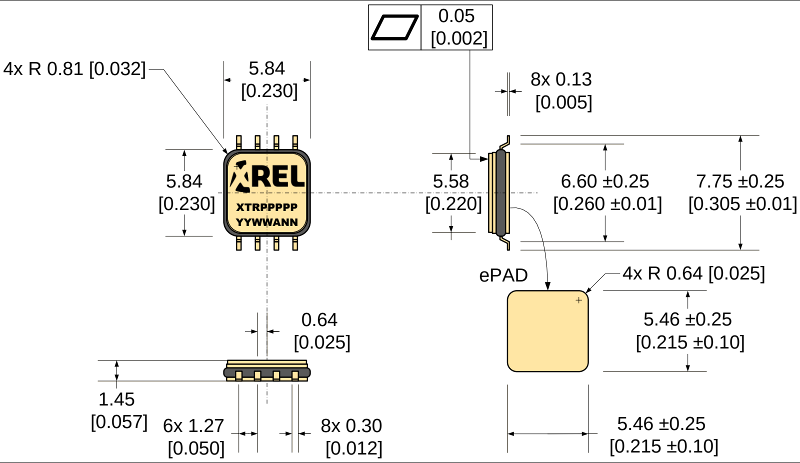


Figure 13. Timing diagram definition.

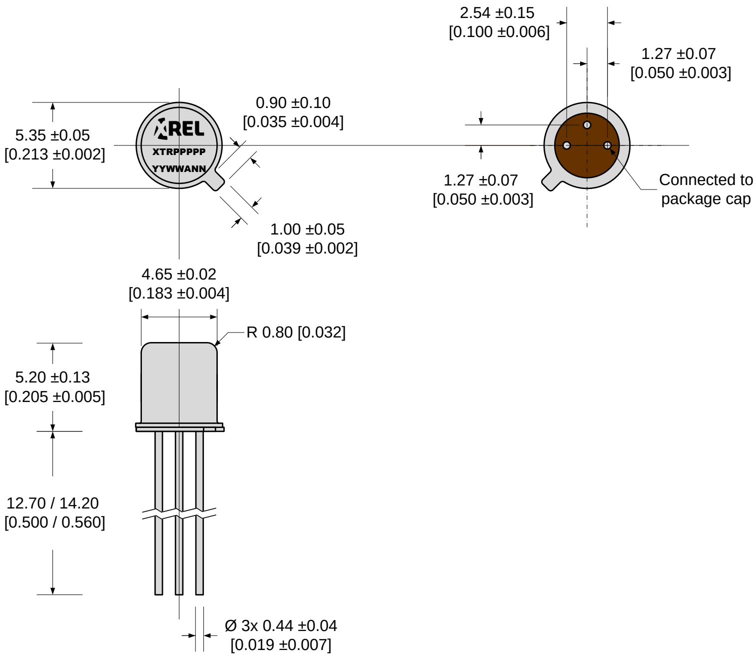
PACKAGE OUTLINES

Dimensions shown in mm [inches]. Tolerances ±0.13 mm [±0.005 in] unless otherwise stated.

Ceramic Gull-wing Flat Pack with ePad CDFP8



TO-18 Metal Can



Part Marking Convention	
Part Reference: XTRPPPPP	
XTR	X-REL Semiconductor, high-temperature, high-reliability product (XTRM Series).
PPPPP	Part number (0-9, A-Z).
Unique Lot Assembly Code: YYWWANN	
YY	Two last digits of assembly year (e.g. 11 = 2011).
WW	Assembly week (01 to 52).
A	Assembly location code.
NN	Assembly lot code (01 to 99).

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90, Avenue Leon Blum 38100 Grenoble -– France
✆ : +33 456 580 580
✉ : support.XREL@easii-ic.com

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