

### HIGH-TEMPERATURE, 30V P-CHANNEL SMALL SIGNAL MOSFET

#### FEATURES

- ▲ Minimum  $BV_{DSS} = -30V$ .
- ▲ Allowed  $V_{GS}$  range  $-5.5V$  to  $+5.5V$ .
- ▲ Operational beyond the  $-60^{\circ}C$  to  $+230^{\circ}C$  temperature range.
- ▲ Low  $R_{DS(on)}$ 
  - XTR2N0307:  $6.7\Omega$  @  $230^{\circ}C$
- ▲ Maximum  $I_D$ :
  - XTR2N0307:  $-1A$  @  $230^{\circ}C$
- ▲ On-time ( $t_{d(on)}+t_r$ ):
  - XTR2N0307:  $15nsec$  @  $230^{\circ}C$
- ▲ Off-time ( $t_{d(off)}+t_f$ ):
  - XTR2N0307:  $24nsec$  @  $230^{\circ}C$
- ▲ Available in ruggedized SMT and thru-hole packages.
- ▲ Parts are also available as bare dies.

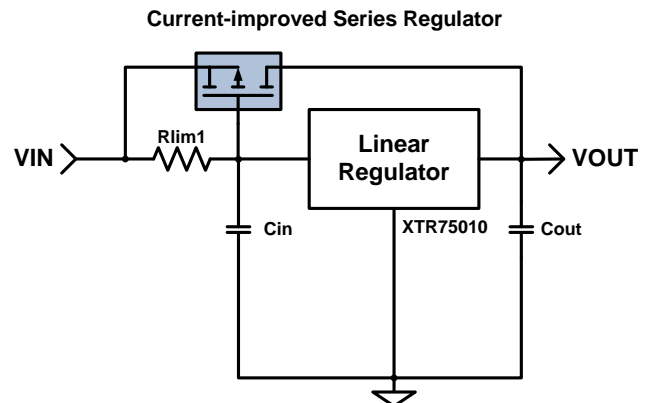
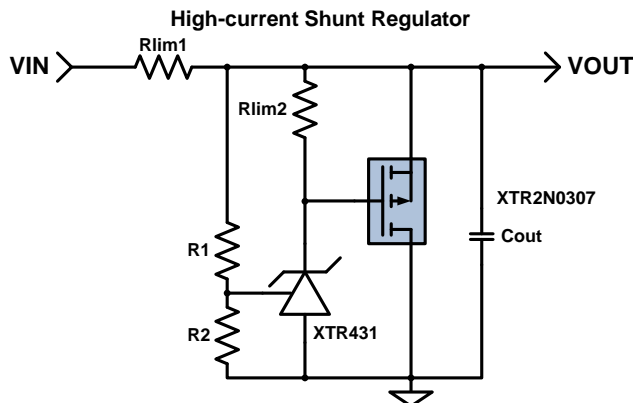
#### APPLICATIONS

- ▲ 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  $-60^{\circ}C$  to  $+230^{\circ}C$ , 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  $R_{DS(on)}$ . 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



#### ORDERING INFORMATION



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

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

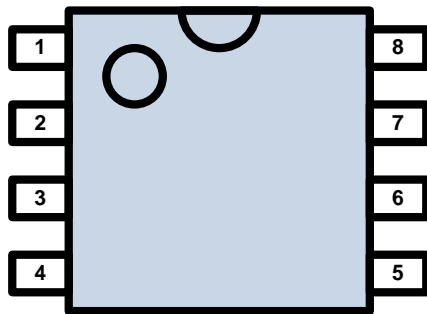
**ABSOLUTE MAXIMUM RATINGS**

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**

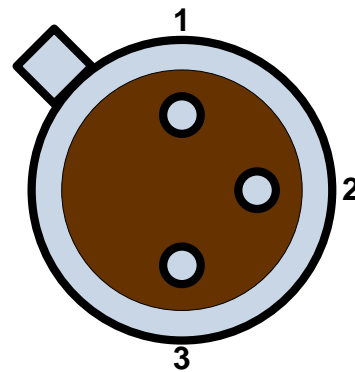
Top view



1, 2, 3 SOURCE  
 4 GATE  
 5, 6, 7, 8 DRAIN  
 ePAD of CDFP8 SOURCE

**TO-18**

Bottom view



1 GATE  
 2 DRAIN  
 3 SOURCE  
 Package case SOURCE

**THERMAL CHARACTERISTICS**

Parameter	Condition	Min	Typ	Max	Units
<b>XTR2N0307-T (TO-18)</b>					
Thermal Resistance: J-C $R_{Th\_J-C}$			55		°C/W
Thermal Resistance: J-A $R_{Th\_J-A}$			300		°C/W
<b>XTR2N0307-FE (DFP8 with exposed pad)</b>					
Thermal Resistance: J-C $R_{Th\_J-C}$	Resistance to exposed pad.		15		°C/W
Thermal Resistance: J-A $R_{Th\_J-A}$			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 <sup>1</sup> $T_j$	-60		230	°C

<sup>1</sup> 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  $I_D \leq I_D(DC)$  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
<b>DC Characteristics</b>					
Drain-source breakdown voltage $BV_{DSS}$	$V_{GS}=0V, I_{DS}=-100\mu A, T_C=25^\circ C$	-30			V
Static drain-source on-state resistance $R_{DS(on)}$	$V_{GS}=-5V, I_{DS}=-100mA$ $T_C=-60^\circ C$ $T_C=85^\circ C$ $T_C=230^\circ C$		3.15 4.60 6.65	4.1 6.0 8.7	$\Omega$
Continuous drain current $I_{D(DC)}$	$V_{GS}=-5V$ for TO-18 $T_C=-60^\circ C$ $T_C=85^\circ C$ $T_C=230^\circ C$	-290 -220 -180	-410 -310 -250		mA
Gate threshold voltage $V_{GS(th)}$	$V_{DS}=V_{GS}, I_{DS}=-1mA$ $T_C=-60^\circ C$ $T_C=85^\circ C$ $T_C=230^\circ$		-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 $I_{DSS}$	$V_{DS}=-30V, V_{GS}=0V$ $T_C=85^\circ C$ $T_C=230^\circ C$		-0.03 -9.0	-2 -40	$\mu A$
Gate Leakage current $I_{GSS}$	$V_{GS}=\pm 5V, V_{DS}=0V$ $T_C=85^\circ C$ $T_C=230^\circ C$		$\pm 0.3$ $\pm 120$	$\pm 5$ $\pm 1000$	nA
<b>AC Characteristics</b>					
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
<b>Switching Characteristics</b>					
Pulsed drain current $I_{DM}$	$V_{DS}=-15V, V_{GS\ sweep}=0$ to +5V, $d=0.2\%, \tau=1ms$ $T_C=-60^\circ C$ $T_C=85^\circ C$ $T_C=230^\circ C$	-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, $R_D=100\Omega, d=0.2\%, \tau=1ms$		7		ns
Rise time $t_r$	$V_{DS}=-15V, V_{GS\ sweep}=0$ to -5V, $R_D=100\Omega, d=0.2\%, \tau=1ms$		6		
Turn-off delay time $t_{d(off)}$	$V_{DS}=-15V, V_{GS\ sweep}=0$ to -5V, $R_D=100\Omega, d=0.2\%, \tau=1ms$		11		
Fall time $t_f$	$V_{DS}=-15V, V_{GS\ sweep}=0$ to -5V, $R_D=100\Omega, d=0.2\%, \tau=1ms$		13		
<b>Drain-Source Diode Characteristics</b>					
Forward diode voltage $V_{SD}$	$V_{GS}=0V, I_{DS}=100mA$ $T_C=-60^\circ C$ $T_C=85^\circ C$ $T_C=230^\circ C$		-1.12 -0.96 -0.82		V
Maximum continuous current $I_{SD\_Max}$	$V_{GS}=0V, V_{SD}=2V$ $T_C=-60^\circ C$ $T_C=85^\circ C$ $T_C=230^\circ C$		-795 -716 -653		mA

TYPICAL PERFORMANCE

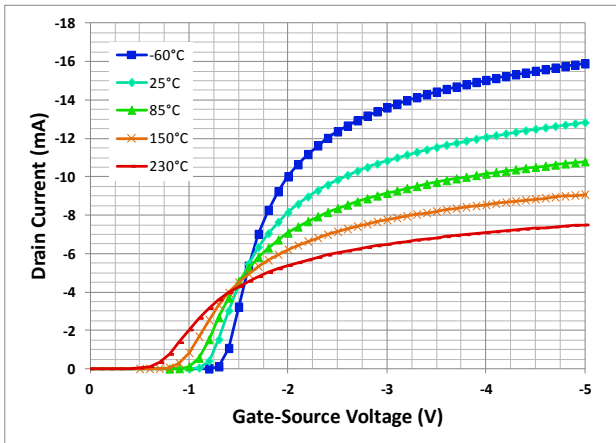


Figure 1. Drain Current ( $I_{DS}$ ) vs Gate-Source Voltage for several case temperatures.  $V_{DS} = -50mV$ .

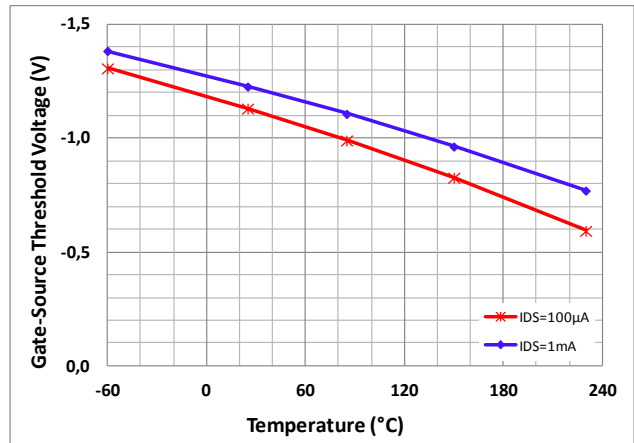


Figure 2. Gate-Source Threshold Voltage ( $V_{GS(th)}$ ) vs Case Temperature.  $V_{GS} = V_{DS}$ .

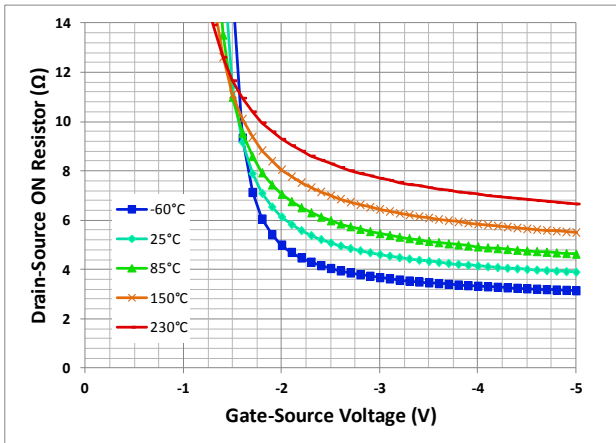


Figure 3. Drain-Source ON Resistance ( $R_{DS(on)}$ ) vs Gate-Source Voltage for several case temperatures.  $V_{DS} = -50mV$ .

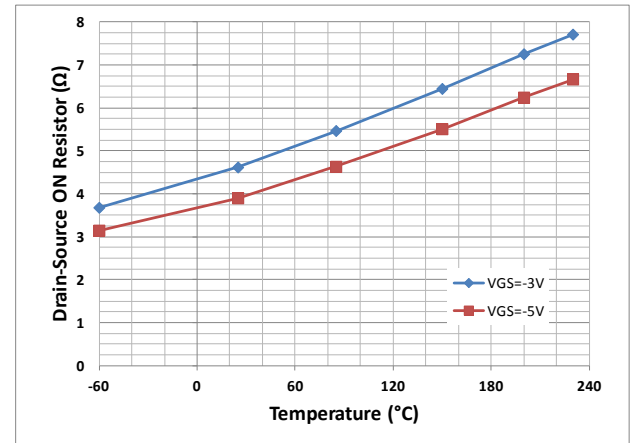


Figure 4. Drain-Source ON Resistance ( $R_{DS(on)}$ ) vs Case Temperature.  $V_{DS} = -50mV$ .

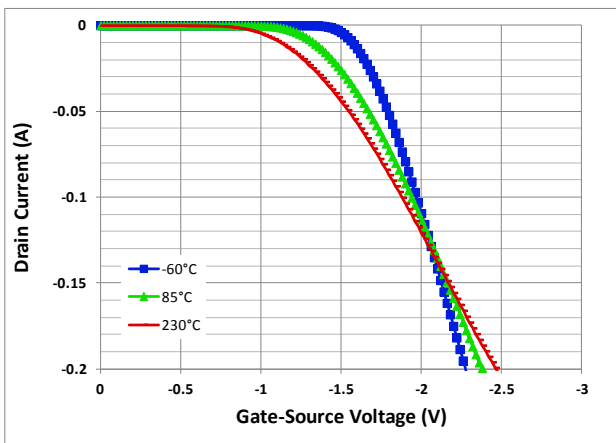


Figure 5. Drain Current ( $I_{DS}$ ) vs Gate-Source Voltage for several case temperatures.  $V_{GS} = V_{DS}$

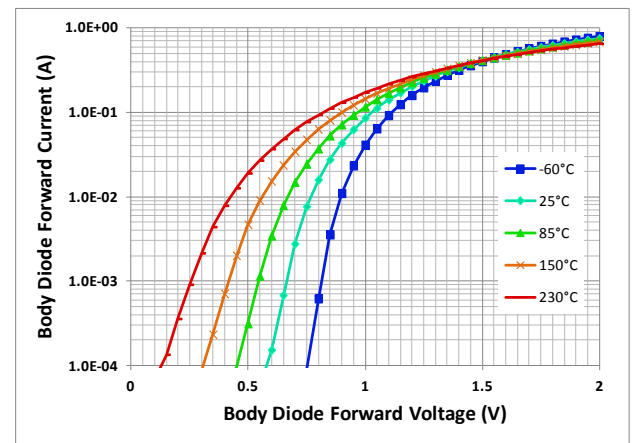


Figure 6. Body Diode Forward Current ( $I_{FD}$ ) in logarithmic scale vs Forward Voltage for several case temperature.  $V_{GS} = 0V$ .

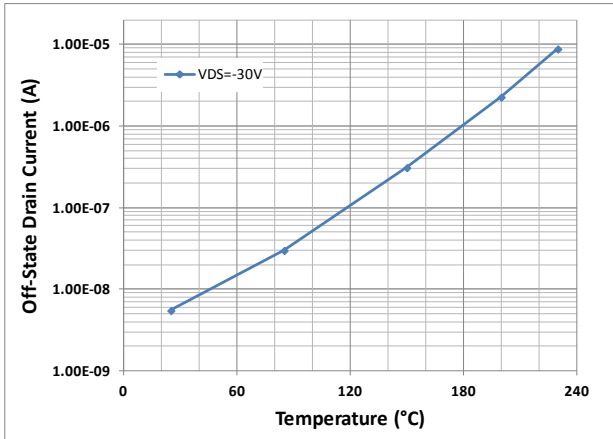


Figure 7. Off-State Drain Current ( $I_{DSS}$ ) vs Case Temperature.  $V_{DS}=-30V$ ,  $V_{GS}=0V$ .

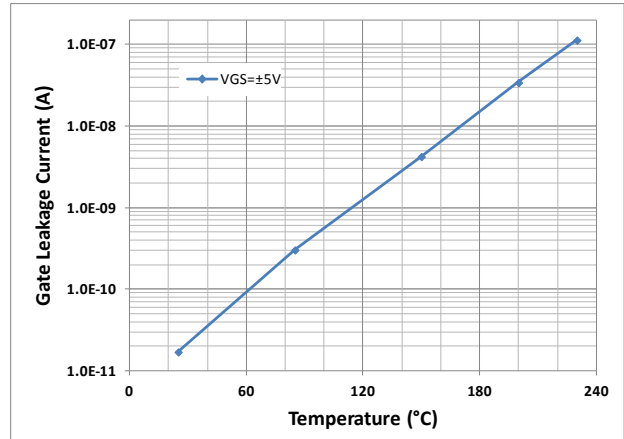


Figure 8. Gate Leakage Current ( $I_{GSS}$ ) vs Case Temperature.  $V_{GS}=\pm 5V$ ,  $V_{DS}=0V$ .

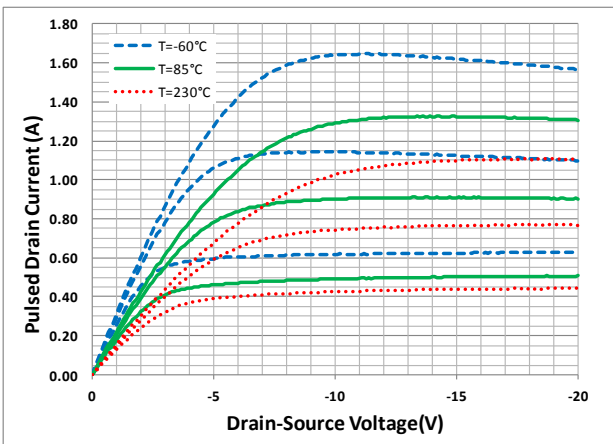


Figure 9. Pulsed Drain Current ( $I_{DM}$ ) vs Drain-Source Voltage for several case temperatures.  $V_{GS}=-3V$ ,  $-4V$  and  $-5V$ .

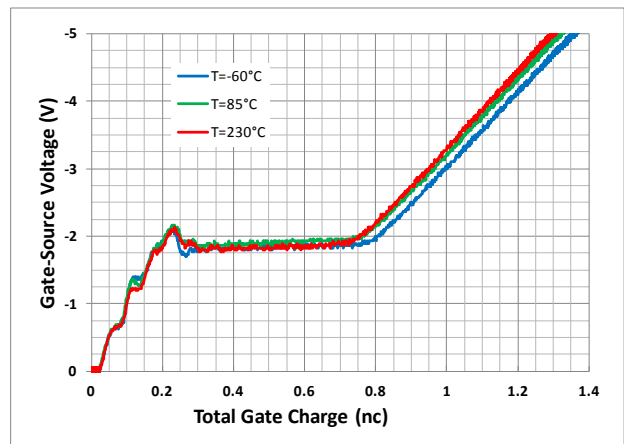


Figure 10. Total Gate Charge ( $Q_g$ ) vs Gate-Source Voltage for several case temperatures.  $I_D=-500mA$ .

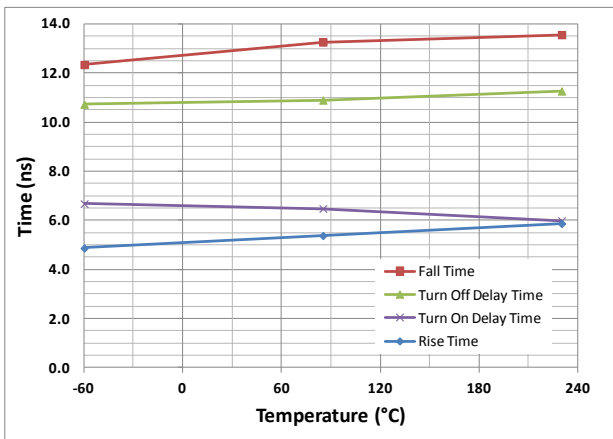


Figure 11. Timing Characteristics vs Case Temperature.  $V_{DS}=15V$ ,  $V_{GS}$  sweep= 0 to  $-5V$ .

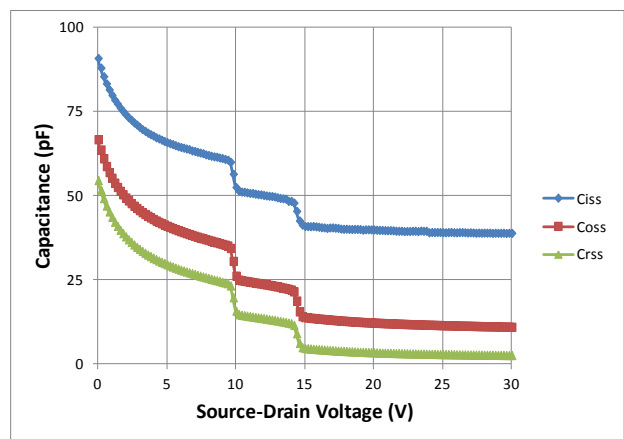


Figure 12. Capacitance vs Source-Drain Voltage at  $T_c=25^\circ C$ .

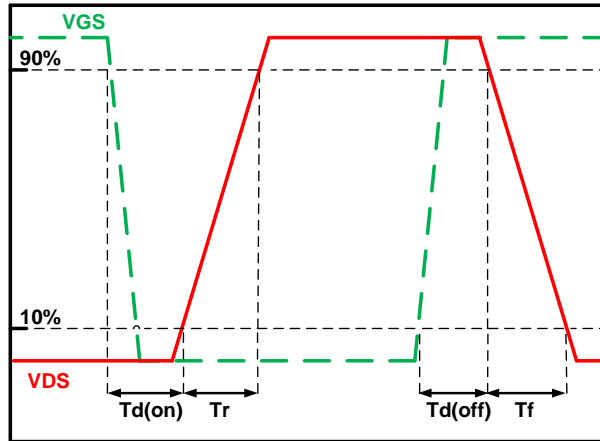
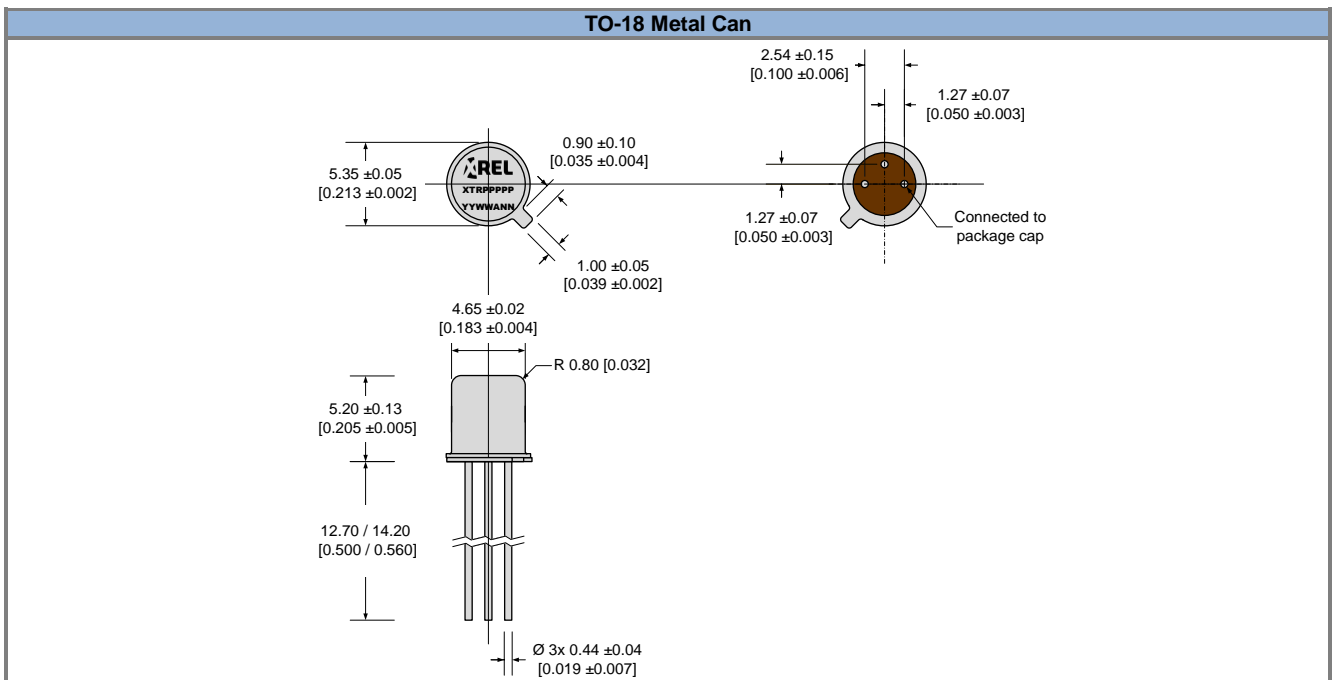
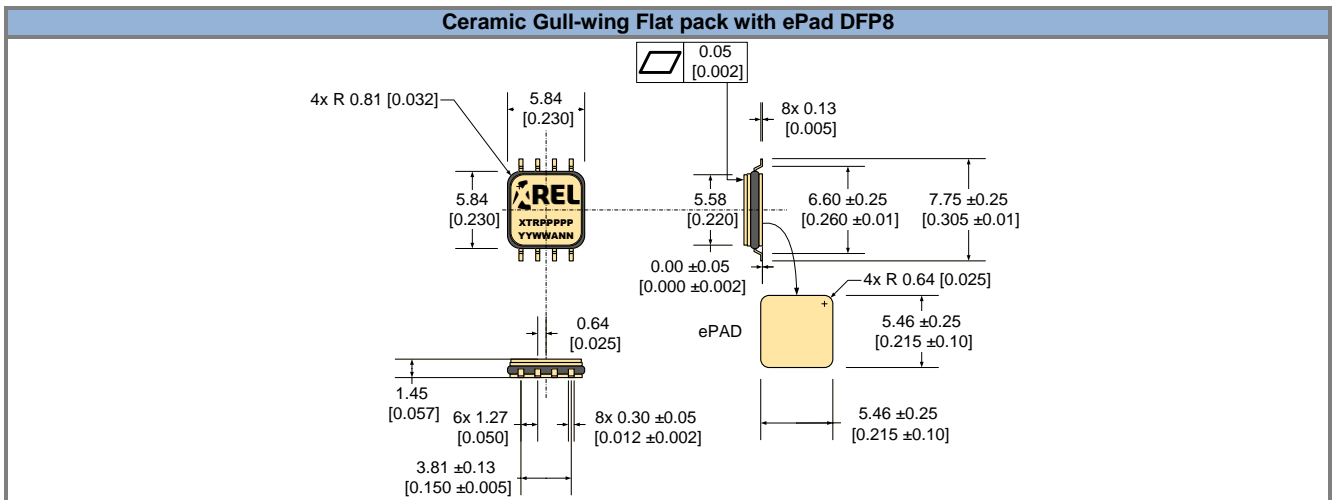


Figure 13. Timing diagram definition.

**PACKAGE OUTLINES**

Dimensions shown in mm [inches]. Tolerances  $\pm 0.13$  mm [ $\pm 0.005$  in] unless otherwise stated.



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

## IMPORTANT NOTICE & DISCLAIMER

Information in this document supersedes and replaces all information previously supplied. Information in this document is provided solely in connection with X-REL Semiconductor products.

The information contained herein is believed to be reliable. X-REL Semiconductor makes no warranties regarding the information contained herein. X-REL Semiconductor assumes no responsibility or liability whatsoever for any of the information contained herein. X-REL Semiconductor reserves the right to make changes, corrections, modifications or improvements, to this document and the information herein without notice. Customers should obtain and verify the latest relevant information before placing orders for X-REL Semiconductor products. The information contained herein or any use of such information does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other intellectual property rights, whether with regard to such information itself or anything described by such information.

Unless expressly approved in writing by an authorized representative of X-REL Semiconductor, X-REL Semiconductor products are not designed, authorized or warranted for use in military, aircraft, space, life saving, or life sustaining applications, nor in products or systems where failure or malfunction may result in personal injury, death, or property or environmental damage.

General Sales Terms & Conditions apply.

## CONTACT US

For more information on X-REL Semiconductor's products, technical support or ordering:

- ✓ Web: [www.x-relsemi.com/products](http://www.x-relsemi.com/products)
- ✓ Tel: +33 456 580 580
- ✓ Fax: +33 456 580 599
- ✓ Sales: [sales@x-relsemi.com](mailto:sales@x-relsemi.com)  
[www.x-relsemi.com/EN/Sales-Representatives](http://www.x-relsemi.com/EN/Sales-Representatives)
- ✓ Information: [info@x-relsemi.com](mailto:info@x-relsemi.com)
- ✓ Support: [support@x-relsemi.com](mailto:support@x-relsemi.com)

### X-REL Semiconductor

90, Avenue Léon Blum  
38100 Grenoble  
France