HIGH-TEMPERATURE, 50V P-CHANNEL POWER MOSFET FAMILY

FEATURES

- ▲ Minimum BV_{DSS} =-55V.
- ▲ Allowed V_{GS} range –5.5V to +5.5V.
- ▲ Operational beyond the -60°C to +230°C temperature range.
- ▲ Low $R_{DS(on)}$
    - o XTR2N0525: 2.6 Ω @ 230°C
    - o XTR2N0550: 1.2 Ω @ 230°C
- ▲ Maximum Peak I_D:
    - o XTR2N0525: 4.5A @ 230°C
    - o XTR2N0550: 10A @ 230°C
- ▲ On-time ($t_{d(on)}+t_r$):
    - o XTR2N0525: 77nsec @ 230°C
    - o XTR2N0550: 90nsec @ 230°C
- ▲ Off-time ($t_{d(off)}+t_f$):
    - o XTR2N0525: 64nsec @ 230°C
    - o XTR2N0550: 70nsec @ 230°C
- ▲ Ruggedized 3-lead TO257, 8-lead side brazed DIP, 8-lead SOIC with ePAD and SMD power packages.
- ▲ Also available as tested bare die.

APPLICATIONS

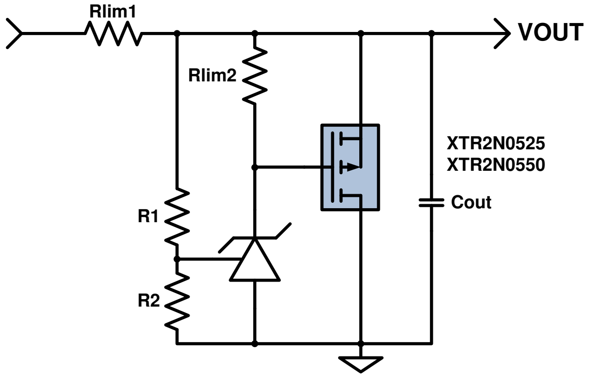
- ▲ Reliability-critical, Automotive, Aeronautics & Aerospace, Down-hole.
- ▲ DC/DC converters, power switching, motor control, power inverters, power linear regulators, power supply.

DESCRIPTION

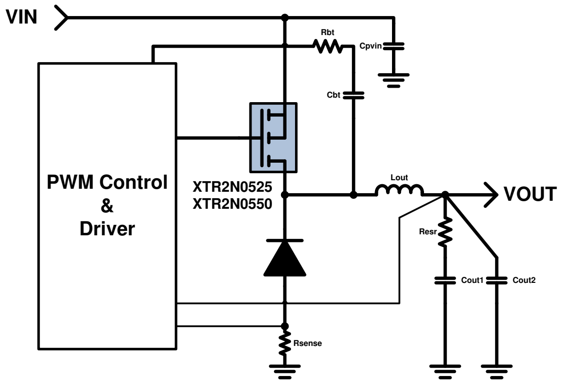
XTR2N0500 is a family of 50V P-channel power MOSFETs designed to reliably operate over a wide range of temperatures. Full functionality is guaranteed from -60°C to +230°C, though operation well below and above this temperature range is achieved.
Fabricated in a Silicon-on-Insulator (SOI) process, XTR2N0500 family parts offer reduced leakage currents while providing high drain currents and low $R_{DS(on)}$. These features allow XTR2N0500 parts to be ideally suited for switching and linear applications.
XTR2N0500 family parts have been designed to reduce system cost and ease adoption by reducing the learning curve and providing smart and easy to use features.
Parts from the XTR2N0500 family are available in ruggedized 3-lead TO257, 8-lead side brazed DIP, 8-lead SOIC with ePAD, as well as SMD power packages upon demand. Parts are also available as tested bare die.

PRODUCT HIGHLIGHT

High-current Shunt Regulator



DC-DC Converter



ORDERING INFORMATION

X	TR	2N	05xx
Source: X = X-REL Semi	Process: TR = HiTemp, HiRel	Part family	Part number

Product Reference	Temperature Range	Package	Pin Count	Marking
XTR2N0525-BD	-60°C to +230°C	Bare die		XTR2N0525
XTR2N0550-BD	-60°C to +230°C	Bare die		XTR2N0550
XTR2N0525-TD	-60°C to +230°C	Tested bare die		XTR2N0525
XTR2N0550-TD	-60°C to +230°C	Tested bare die		XTR2N0550
XTR2N0525-D	-60°C to +230°C	Ceramic side brazed DIP	8	XTR2N0525
XTR2N0525-FE	-60°C to +230°C	Gull-wing flat pack with ePad	8	XTR2N0525
XTR2N0525-T	-60°C to +230°C	TO-257AA	3	XTR2N0525
XTR2N0550-T	-60°C to +230°C	TO-257AA	3	XTR2N0550
XTR2N0525-M	-60°C to +230°C	SMD-0.5	3	XTR2N0525
XTR2N0550-M	-60°C to +230°C	SMD-1	3	XTR2N0550

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

© 2014 X-REL Semiconductor

ABSOLUTE MAXIMUM RATINGS

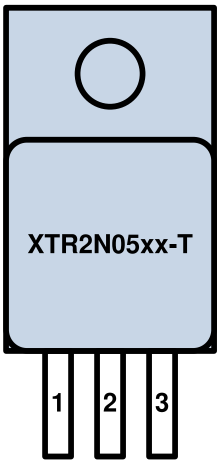
Drain-source voltage	-55V to +2V
Gate-source voltage	±6.0V
Storage temperature range	-70℃ to +230℃
Operating junction temperature range	-70℃ to +300℃
ESD classification	2kV HBM

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

TO-257

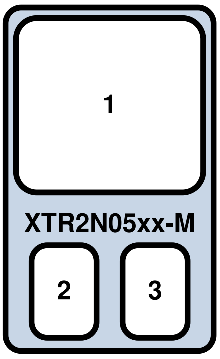
Front view



1	DRAIN
2	SOURCE
3	GATE

SMD-0.5 / SMD-1

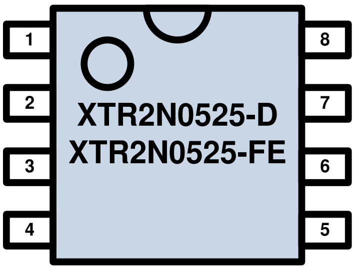
Bottom view



1	SOURCE
2	GATE
3	DRAIN

DIP8 / CDFP8

Top view



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

THERMAL CHARACTERISTICS

Parameter	Condition	Min	Typ	Max	Units
XTR2N05xx-T (TO257)					
Thermal Resistance: J-C R_{Th_J-C}			5		℃/W
Thermal Resistance: J-A R_{Th_J-A}	Still air.		50		℃/W
XTR2N05xx-M (SMD-0.5 / SMD-1)					
Thermal Resistance: J-C R_{Th_J-C}			2		℃/W
Thermal Resistance: J-A R_{Th_J-A}	Still air.		45		℃/W
XTR2N0525-D (DIL8)					
Thermal Resistance: J-C R_{Th_J-C}			20		℃/W
Thermal Resistance: J-A R_{Th_J-A}	Still air.		100		℃/W
XTR2N0525-FE (DFP8 with exposed pad)					
Thermal Resistance: J-C R_{Th_J-C}	Measured on ePAD.		7		℃/W
Thermal Resistance: J-A R_{Th_J-A}	ePAD thermally connected to 3cm² PCB copper		70		℃/W

RECOMMENDED OPERATING CONDITIONS

Parameter	Min	Typ	Max	Units
Drain-source voltage $\mathbf{V_{DS}}$	-50		1.5	V
Gate-source voltage $\mathbf{V_{GS}}$	-5.5		+5.5	V
Junction Temperature[1] $\mathbf{T_C}$	-60		230	℃

---

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

XTR2N0525 SPECIFICATIONS

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

Parameter	Condition	Min	Typ	Max	Units
DC Characteristics					
Drain-source breakdown voltage $\mathbf{BV_{DSS}}$	V_{GS}=0V, I_{DS}=-100µA	-55			V
Static drain-source on-state resistance $\mathbf{R_{DS(on)}}$	V_{GS}=-5V, I_{DS}=-100mA T_C=-60℃ T_C=85℃ T_C=230℃		1.1 1.8 2.6		Ω
Continuous drain current $\mathbf{I_{D(DC)}}$	V_{GS}=-5V T_C=-60℃ T_C=85℃ T_C=230℃		-1.8 -1.4 -1.1		A
Gate threshold voltage $\mathbf{V_{GS(th)}}$	V_{DS}=V_{GS}, I_{DS}=-1mA T_C=-60℃ T_C=85℃ T_C=230°		-1.31 -0.98 -0.66		V
Temperature drift of gate threshold voltage $\mathbf{\Delta V_{GS(TH)}/\Delta T_j}$	V_{DS}=V_{GS}, I_{DS}=-1mA		2.2		mV/℃
Off-state drain current $\mathbf{I_{DSS}}$	V_{DS}=-50V, V_{GS}=0V T_C=85℃ T_C=230℃		0.035 25		µA
Gate leakage current $\mathbf{I_{GSS}}$	V_{GS}=±5V, V_{DS}=0V T_C=85℃ T_C=230℃		±0.6 ±170		nA
AC Characteristics					
Input capacitance $\mathbf{C_{iss}}$	V_{DS}=-25V, V_{GS}=0V, f=1MHz		200		pF
Output capacitance $\mathbf{C_{oss}}$			60		pF
Reverse transfer capacitance $\mathbf{C_{rss}}$			12		pF
Switching Characteristics					
Pulsed drain current $\mathbf{I_{DM}}$	V_{DS}=-20V, $V_{GS\ sweep}$=0 to -5V, d=0.2%, τ=1ms T_C=-60℃ T_C=85℃ T_C=230℃		-7.1 -5.7 -4.5		A
Total gate charge $\mathbf{Q_g}$	V_{DS}=-25V, $V_{GS\ sweep}$=0 to -5V		TBD		nC
Turn-on delay time $\mathbf{t_{d(on)}}$	V_{DS}=-25V, $V_{GS\ sweep}$=0 to -5V, d=0.2%, τ=1ms		29		ns
Rise time $\mathbf{t_r}$	V_{DS}=-25V, $V_{GS\ sweep}$=0 to -5V, d=0.2%, τ=1ms		48		
Turn-off delay time $\mathbf{t_{d(off)}}$	V_{DS}=-25V, $V_{GS\ sweep}$=-5 to 0V, d=0.2%, τ=1ms		41		
Fall time $\mathbf{t_f}$	V_{DS}=-25V, $V_{GS\ sweep}$=-5 to 0V, d=0.2%, τ=1ms		23		

XTR2N0550 SPECIFICATIONS

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

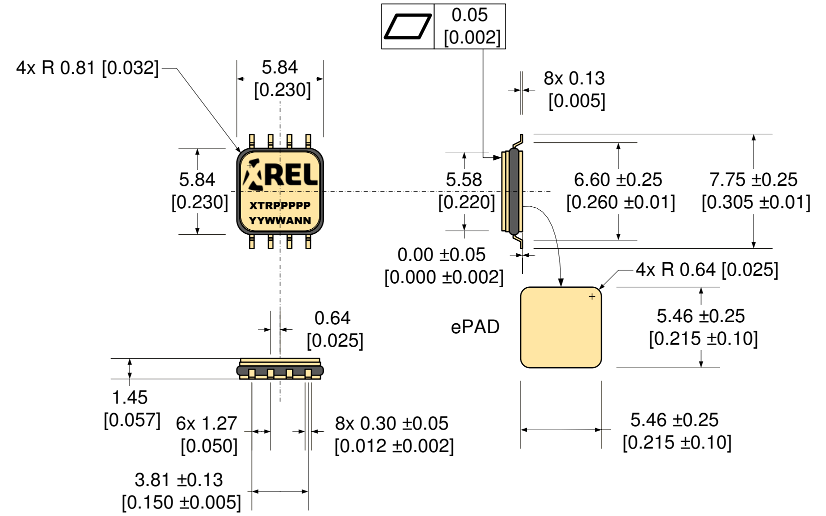
Parameter	Condition	Min	Typ	Max	Units
DC Characteristics					
Drain-source breakdown voltage **BV_{DSS}**	V_{GS}=0V, I_{DS}=-100µA	-60			V
Static drain-source on-state resistance **$R_{DS(on)}$**	V_{GS}=-5V, I_{DS}=-100mA T_C=-60℃ T_C=85℃ T_C=230℃		0.50 0.81 1.2		Ω
Continuous drain current **$I_{D(DC)}$**	V_{GS}=-5V T_C=-60℃ T_C=85℃ T_C=230℃		-3.9 -3.1 -2.4		A
Gate threshold voltage **$V_{GS(th)}$**	V_{DS}=V_{GS}, I_{DS}=-1mA T_C=-60℃ T_C=85℃ T_C=230°		-1.31 -0.98 -0.66		V
Temperature drift of gate threshold voltage **$\Delta V_{GS(TH)}/\Delta T_j$**	V_{DS}=V_{GS}, I_{DS}=-2.5mA		2.2		mV/℃
Off-state drain current **I_{DSS}**	V_{DS}=-50V, V_{GS}=0V T_C=85℃ T_C=230℃		0.08 60		µA
Gate leakage current **I_{GSS}**	V_{GS}=±5V, V_{DS}=0V T_C=85℃ T_C=230℃		±0.6 ±190		nA
AC Characteristics					
Input capacitance **C_{iss}**	V_{DS}=-25V, V_{GS}=0V, f=1MHz		460		pF
Output capacitance **C_{oss}**			140		pF
Reverse transfer capacitance **C_{rss}**			28		pF
Switching Characteristics					
Pulsed drain current **I_{DM}**	V_{DS}=-25V, $V_{GS\ sweep}$=0 to -5V, d=0.2%, τ=1ms T_C=-60℃ T_C=85℃ T_C=230℃		-15.6 -12.5 -10		A
Total gate charge **Q_g**	V_{DS}=-20V, $V_{GS\ sweep}$=0 to -5V		TBD		nC
Turn-on delay time **$t_{d(on)}$**	V_{DS}=-25V, $V_{GS\ sweep}$=0 to -5V, d=0.2%, τ=1ms		35		ns
Rise time **t_r**	V_{DS}=-25V, $V_{GS\ sweep}$=0 to -5V, d=0.2%, τ=1ms		55		
Turn-off delay time **$t_{d(off)}$**	V_{DS}=-25V, $V_{GS\ sweep}$=-5 to 0V, d=0.2%, τ=1ms		45		
Fall time **t_f**	V_{DS}=-25V, $V_{GS\ sweep}$=-5 to 0V, d=0.2%, τ=1ms		25		

© 2014 X-REL Semiconductor

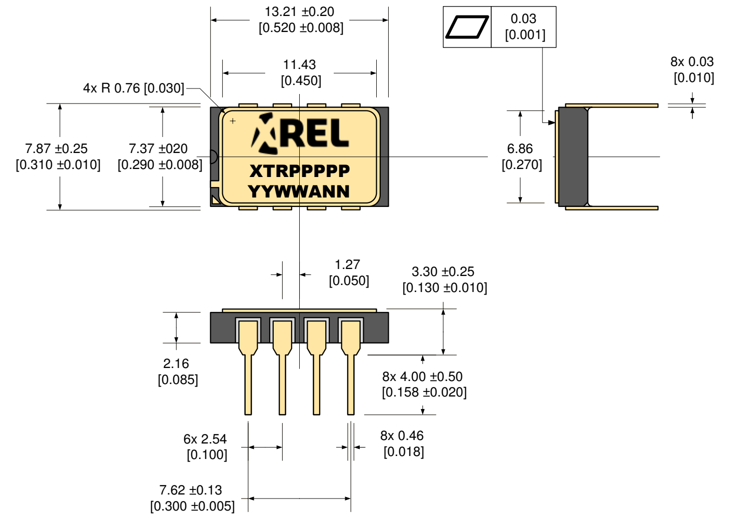
PACKAGE OUTLINES

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

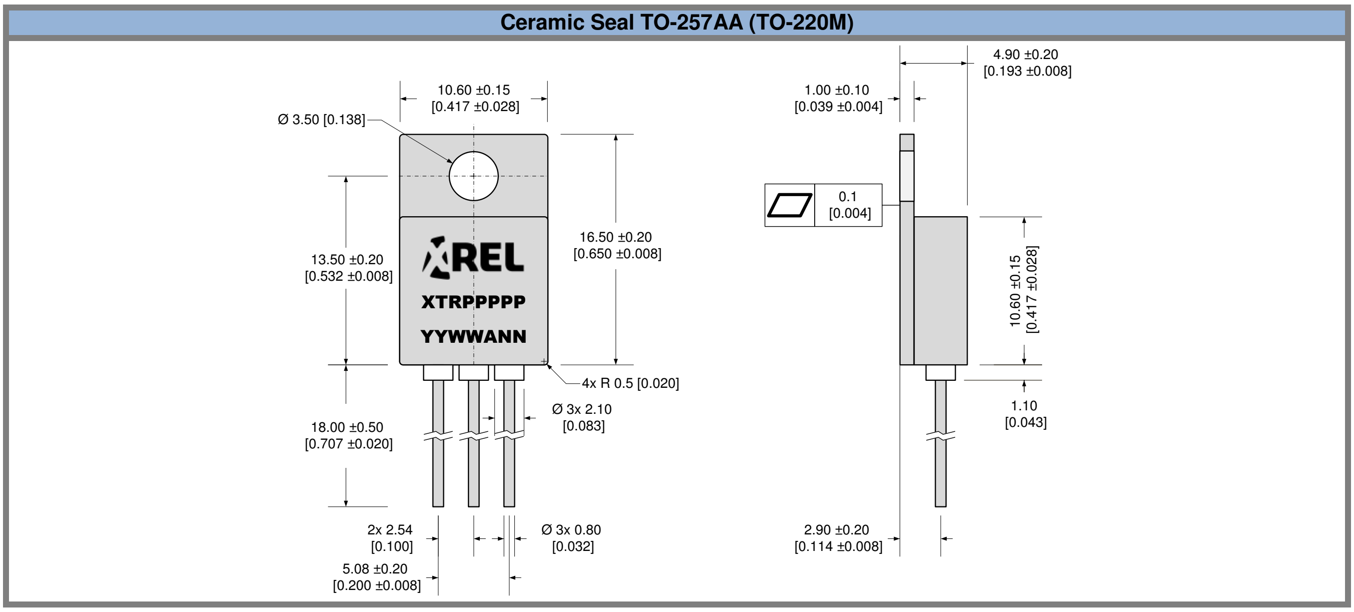
Ceramic Gull-wing Flat Pack with ePad CDFP8



Ceramic Side Brazed Dual In-line DIP8

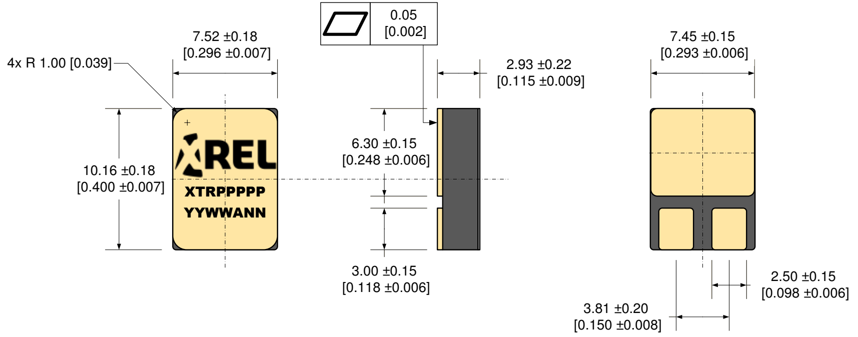


Ceramic Seal TO-257AA (TO-220M)

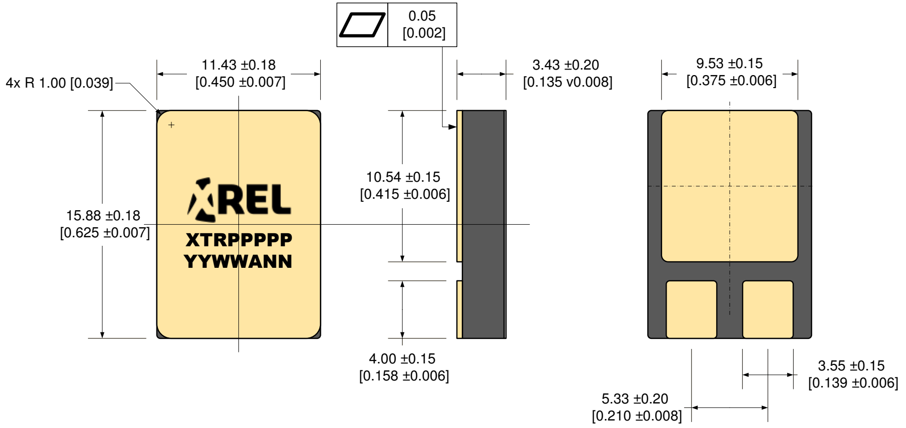


© 2014 X-REL Semiconductor

SMD-0.5 (TO-276AA)



SMD-1 (TO-276AB)



Part Marking Convention

Part Reference: XTRPPPPPP	
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. 12 = 2012).
WW	Assembly week (01 to 52).
A	Assembly location code.
NN	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 contain herein. X-REL Semiconductor assumes no responsibility or liability whatsoever for any of the information contained herein. X-REL Semiconductor assumes no responsibility or liability whatsoever for the use of the information contained herein. The information contained herein is provided "AS IS, WHERE IS" and with all faults, and the entire risk associated with such information is entirely with the user. 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
✓	Tel:	+33 456 580 580
✓	Fax:	+33 456 580 599
✓	Sales:	sales@x-relsemi.com www.x-relsemi.com/EN/Sales-Representatives
✓	Information:	info@x-relsemi.com
✓	Support:	support@x-relsemi.com

X-REL Semiconductor
90, Avenue Léon Blum
38100 Grenoble
France