



## UTD413

Power MOSFET

### P-CHANNEL ENHANCEMENT MODE

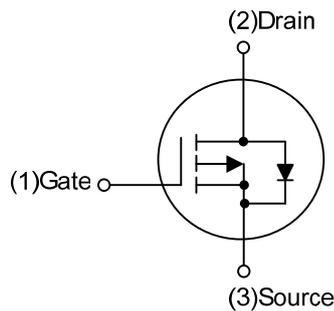
#### DESCRIPTION

The **UTD413** can provide excellent  $R_{DS(ON)}$  and low gate charge by using UTC's advanced trench technology. The **UTD413** is well suited for high current load applications with the excellent thermal resistance of the TO-252 package. Standard Product **UTD413** is Pb-free.

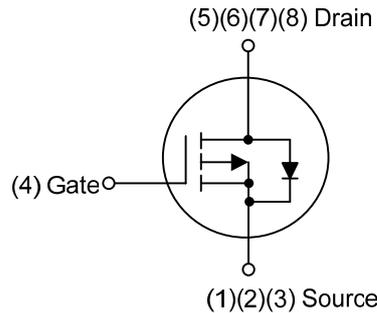
#### FEATURES

- \*  $R_{DS(ON)} \leq 45 \text{ m}\Omega$  @  $V_{GS} = -10\text{V}$ ,  $I_D = -12\text{A}$
- \*  $R_{DS(ON)} \leq 69 \text{ m}\Omega$  @  $V_{GS} = -4.5\text{V}$ ,  $I_D = -8.0\text{A}$
- \* Low capacitance
- \* Low gate charge
- \* Fast switching capability
- \* Avalanche energy specified

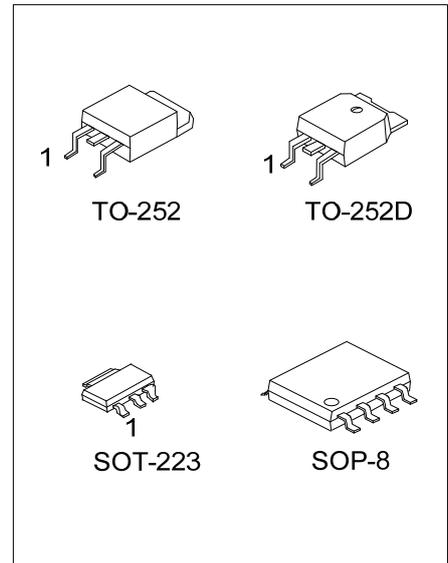
#### SYMBOL



SOT-223/TO-251/TO-252D



PDFN5x6



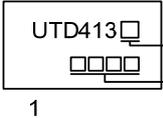
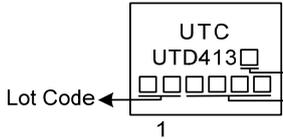
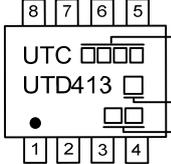
#### ORDERING INFORMATION

Ordering Number		Package	Pin Assignment								Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	
UTD413L-AA3-R	UTD413G-AA3-R	SOT-223	G	D	S	-	-	-	-	-	Tape Reel
UTD413L-TN3-R	UTD413G-TN3-R	TO-252	G	D	S	-	-	-	-	-	Tape Reel
UTD413L-TND-R	UTD413G-TND-R	TO-252D	G	D	S	-	-	-	-	-	Tape Reel
UTD413L-S08-R	UTD413G-S08-R	SOP-8	S	S	S	G	D	D	D	D	Tape Reel

Note: Pin Assignment: G: Gate D: Drain S: Source

<p>UTD413G-AA3-R</p> <p>(1)Packing Type</p> <p>(2)Package Type</p> <p>(3)Green Package</p>	<p>(1) R: Tape Reel</p> <p>(2) AA3: SOT-223, TN3: TO-252, TND: TO-252D</p> <p>S08: SOP-8</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p>
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MARKING

PACKAGE	MARKING
SOT-223	 <p>UTD413 □            □ □ □ □            1</p> <p>L: Lead Free            G: Halogen Free            Date Code</p>
TO-252 TO-252D	 <p>UTC            UTD413 □            □ □ □ □ □ □            1</p> <p>Lot Code ←            L: Lead Free            G: Halogen Free            Date Code</p>
SOP-8	 <p>8 7 6 5            UTC □ □ □ □            UTD413 □            • □ □ □            1 2 3 4</p> <p>Date Code            L: Lead Free            G: Halogen Free            Lot Code</p>

■ ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ , unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		$V_{DSS}$	-40	V
Gate-Source Voltage		$V_{GSS}$	$\pm 20$	V
Continuous Drain Current		$I_D$	-12	A
Pulsed Drain Current		$I_{DM}$	-30	A
Avalanche Energy		$E_{AS}$	37	mJ
Power Dissipation	SOT-223	$P_D$	2.4	W
	TO-252/TO-252D		46	W
	SOP-8		1.7	W
Junction Temperature		$T_J$	+175	$^\circ\text{C}$
Storage Temperature		$T_{STG}$	-55 ~ +175	$^\circ\text{C}$

- Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.  
 2. Repetitive Rating: Pulse width limited by maximum junction temperature  
 3.  $L = 0.1\text{mH}$ ,  $I_{AS} = -27\text{A}$ ,  $V_{DD} = -25\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-223	$\theta_{JA}$	140	$^\circ\text{C/W}$
	TO-252/TO-252D		50	$^\circ\text{C/W}$
	SOP-8		90	$^\circ\text{C/W}$
Junction to Case	SOT-223	$\theta_{JC}$	52	$^\circ\text{C/W}$
	TO-252/TO-252D		2.7	$^\circ\text{C/W}$
	SOP-8		73	$^\circ\text{C/W}$

Note: When surface mounted to an FR4 board using minimum recommended pad size. (Cu. Area 0.412 sq in), Steady State.

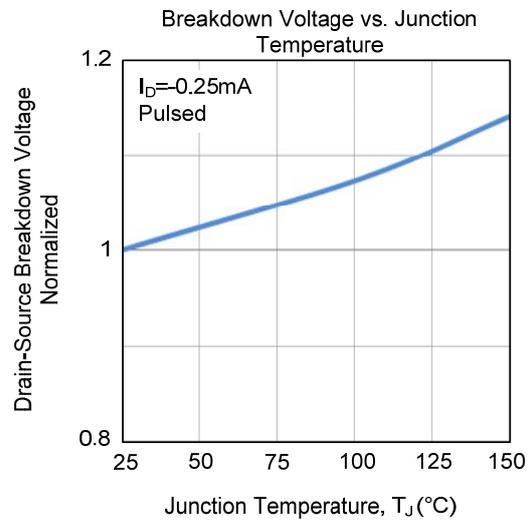
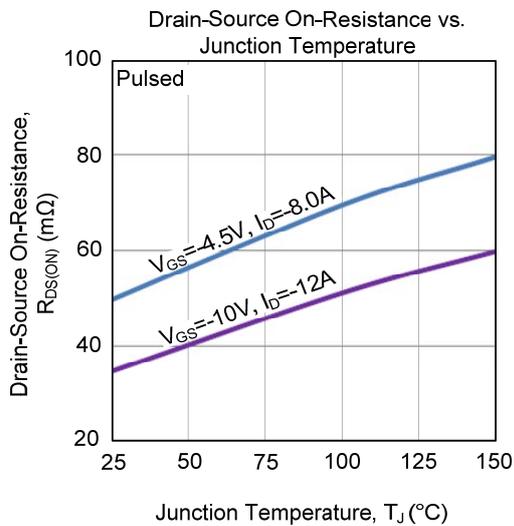
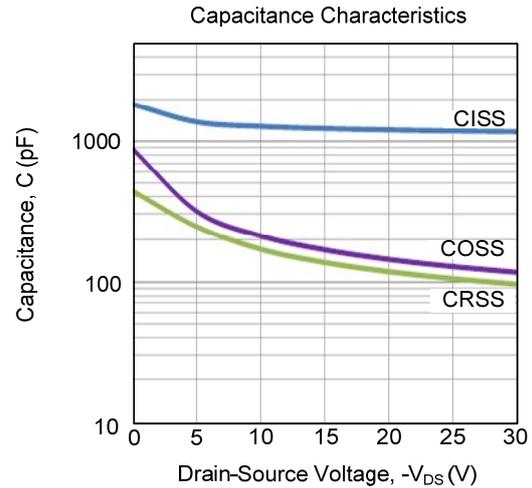
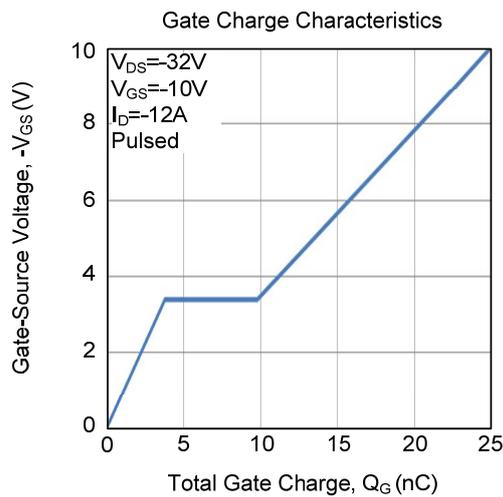
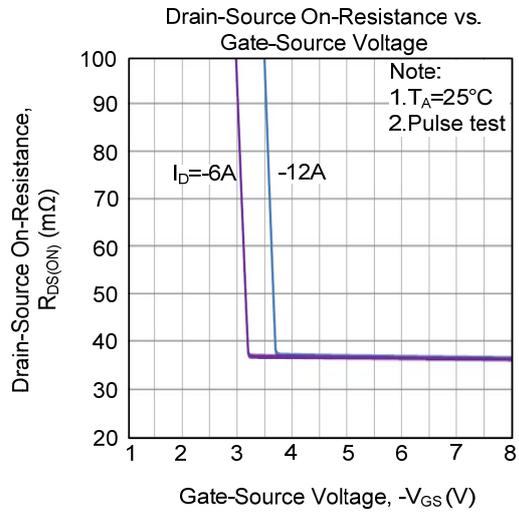
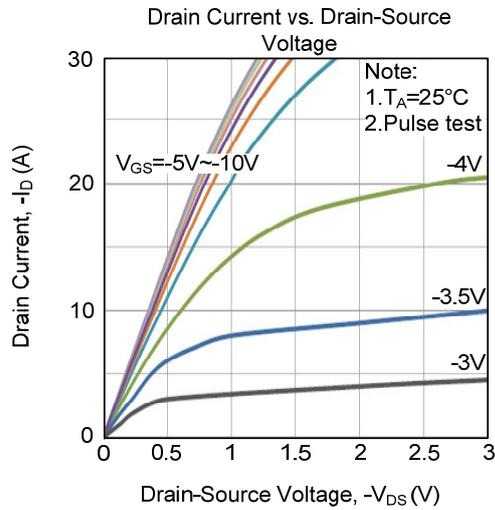
■ ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =-10mA	-40			V
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> =-32V, V <sub>GS</sub> =0V			-1	μA
Gate-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V			±100	nA
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	-1.0	-1.9	-3.0	V
On State Drain Current	I <sub>D(ON)</sub>	V <sub>DS</sub> =-5V, V <sub>GS</sub> =-10V	-30			A
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-12A		36	45	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-8.0A		51	69	mΩ
<b>DYNAMIC PARAMETERS</b>						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V, f=1MHz		1200		pF
Output Capacitance	C <sub>OSS</sub>			145		pF
Reverse Transfer Capacitance	C <sub>RSS</sub>			118		pF
<b>SWITCHING PARAMETERS</b>						
Total Gate Charge	Q <sub>G</sub>	V <sub>DS</sub> =-32V, V <sub>GS</sub> =-10V, I <sub>D</sub> =-12A		25		nC
Gate Source Charge	Q <sub>GS</sub>			3.8		nC
Gate Drain Charge	Q <sub>GD</sub>			6		nC
Turn-ON Delay Time	t <sub>D(ON)</sub>	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-20V, I <sub>D</sub> =-12A, R <sub>G</sub> =3.3Ω		7		ns
Turn-ON Rise Time	t <sub>R</sub>			18		ns
Turn-OFF Delay Time	t <sub>D(OFF)</sub>			43		ns
Turn-OFF Fall-Time	t <sub>F</sub>			24		ns
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Maximum Body-Diode Continuous Current	I <sub>S</sub>				-12	A
Diode Forward Voltage	V <sub>SD</sub>	I <sub>S</sub> =-12A, V <sub>GS</sub> =0V		-1	-1.2	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	I <sub>S</sub> =-12A, V <sub>GS</sub> =0V, di/dt=100A/μs		56		ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			48		nC

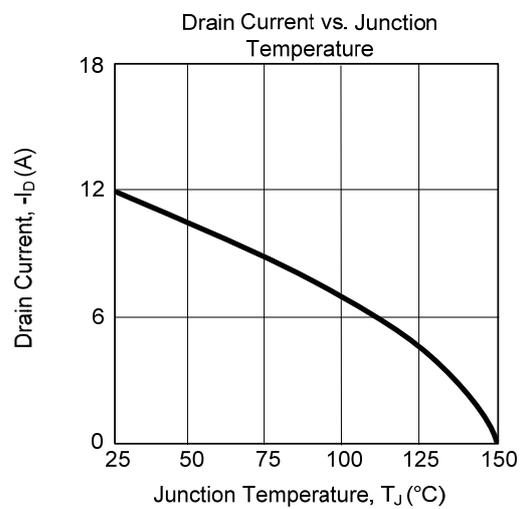
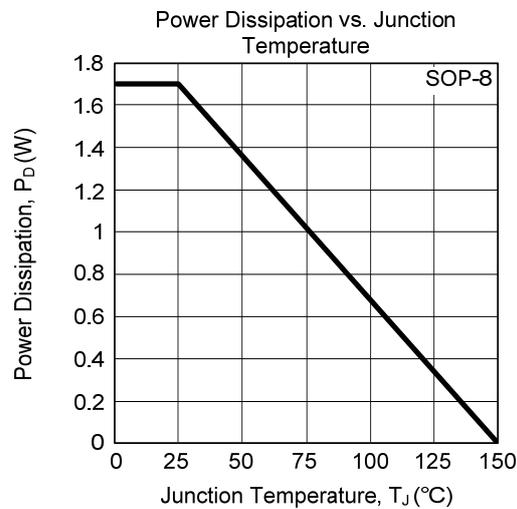
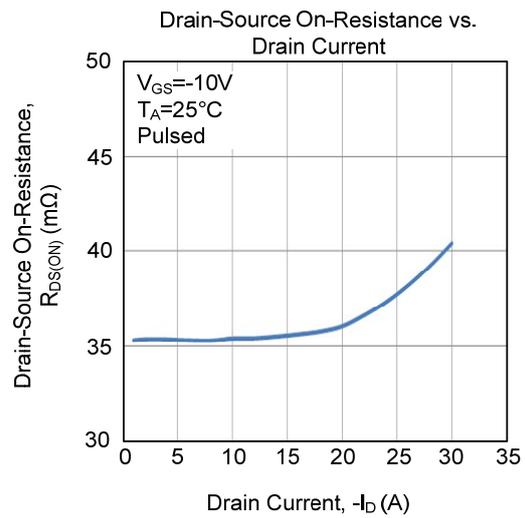
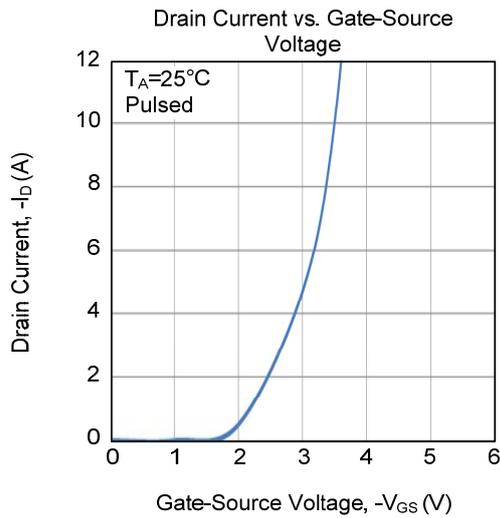
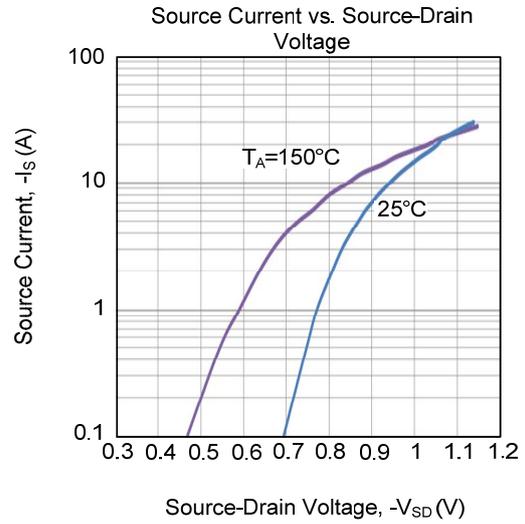
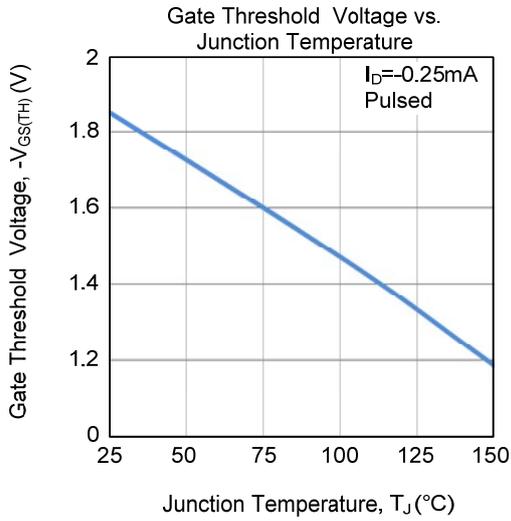
Notes: 1. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating temperature.

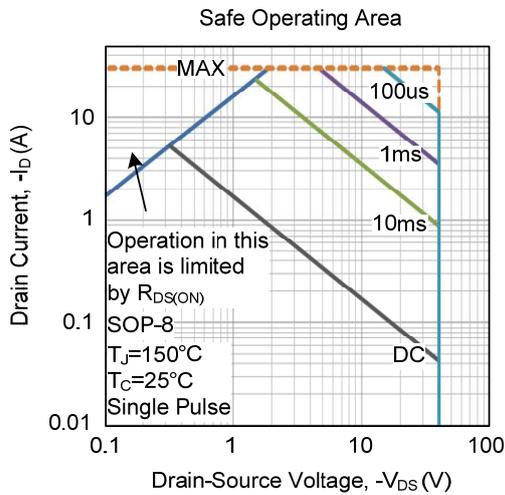
## TYPICAL CHARACTERISTICS



## TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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