

## **47A, 30V, 0.021 Ohm, N-Channel, Logic Level UltraFET Power MOSFETs**

These N-Channel power MOSFETs are manufactured using the innovative UltraFET™ process.

This advanced process technology achieves the lowest possible on-resistance per silicon area, resulting in outstanding performance. This device is capable of withstanding high energy in the avalanche mode and the diode exhibits very low reverse recovery time and stored charge. It was designed for use in applications where power efficiency is important, such as switching regulators, switching converters, motor drivers, relay drivers, low-voltage bus switches, and power management in portable and battery-operated products.

Formerly developmental type TA76121.

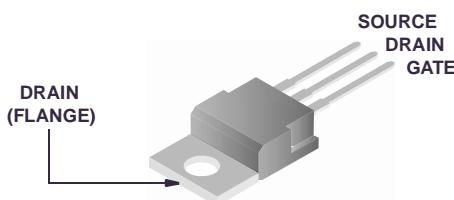
### **Ordering Information**

PART NUMBER	PACKAGE	BRAND
HUF76121P3	TO-220AB	76121P
HUF76121S3S	TO-263AB	76121S

NOTE: When ordering, use the entire part number. Add the suffix T to obtain the TO-263AB variant in tape and reel, e.g., HUF76121S3ST.

### **Packaging**

JEDEC TO-220AB



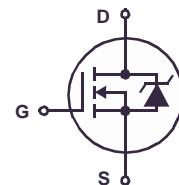
JEDEC TO-263AB



### **Features**

- Logic Level Gate Drive
- 47A, 30V
- Ultra Low On-Resistance,  $r_{DS(ON)} = 0.021\Omega$
- Temperature Compensating PSPICE® Model
- Temperature Compensating SABER® Model
- Thermal Impedance SPICE Model
- Thermal Impedance SABER Model
- Peak Current vs Pulse Width Curve
- UIS Rating Curve
- Related Literature
  - TB334, "Guidelines for Soldering Surface Mount Components to PC Boards"

### **Symbol**



# HUF76121P3, HUF76121S3S

## Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ , Unless Otherwise Specified

			UNITS
Drain to Source Voltage (Note 1) . . . . .	$V_{DSS}$	30	V
Drain to Gate Voltage ( $R_{GS} = 20\text{k}\Omega$ ) (Note 1) . . . . .	$V_{DGR}$	30	V
Gate to Source Voltage . . . . .	$V_{GS}$	$\pm 20$	V
Drain Current			
Continuous ( $T_C = 25^\circ\text{C}$ , $V_{GS} = 10\text{V}$ ) (Figure 2) . . . . .	$I_D$	47	A
Continuous ( $T_C = 100^\circ\text{C}$ , $V_{GS} = 5\text{V}$ ) . . . . .	$I_D$	25	A
Continuous ( $T_C = 100^\circ\text{C}$ , $V_{GS} = 4.5\text{V}$ ) (Figure 2) . . . . .	$I_D$	24	A
Pulsed Drain Current . . . . .	$I_{DM}$		Figure 4
Pulsed Avalanche Rating . . . . .	$E_{AS}$		Figures 6, 17, 18
Power Dissipation . . . . .	$P_D$	75	W
Derate Above $25^\circ\text{C}$ . . . . .		0.6	$\text{W}/^\circ\text{C}$
Operating and Storage Temperature . . . . .	$T_J, T_{STG}$	-40 to 150	$^\circ\text{C}$
Maximum Temperature for Soldering			
Leads at 0.063in (1.6mm) from Case for 10s. . . . .	$T_L$	300	$^\circ\text{C}$
Package Body for 10s, See Techbrief 334. . . . .	$T_{pkg}$	260	$^\circ\text{C}$

**CAUTION:** Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

### NOTE:

1.  $T_J = 25^\circ\text{C}$  to  $150^\circ\text{C}$ .

## Electrical Specifications $T_A = 25^\circ\text{C}$ , Unless Otherwise Specified

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
<b>OFF STATE SPECIFICATIONS</b>						
Drain to Source Breakdown Voltage	$BV_{DSS}$	$I_D = 250\mu\text{A}$ , $V_{GS} = 0\text{V}$ (Figure 12)	30	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 25\text{V}$ , $V_{GS} = 0\text{V}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 25\text{V}$ , $V_{GS} = 0\text{V}$ , $T_C = 150^\circ\text{C}$	-	-	250	$\mu\text{A}$
Gate to Source Leakage Current	$I_{GSS}$	$V_{GS} = \pm 20\text{V}$	-	-	$\pm 100$	nA
<b>ON STATE SPECIFICATIONS</b>						
Gate to Source Threshold Voltage	$V_{GS(\text{TH})}$	$V_{GS} = V_{DS}$ , $I_D = 250\mu\text{A}$ (Figure 11)	1	-	3	V
Drain to Source On Resistance	$r_{DS(\text{ON})}$	$I_D = 47\text{A}$ , $V_{GS} = 10\text{V}$ (Figures 9, 10)	-	0.015	0.021	$\Omega$
		$I_D = 25\text{A}$ , $V_{GS} = 5\text{V}$ (Figure 9)	-	0.019	0.028	$\Omega$
		$I_D = 24\text{A}$ , $V_{GS} = 4.5\text{V}$ (Figure 9)	-	0.021	0.031	$\Omega$
<b>THERMAL SPECIFICATIONS</b>						
Thermal Resistance Junction to Case	$R_{\theta\text{JC}}$	(Figure 3)	-	-	1.66	$^\circ\text{C}/\text{W}$
Thermal Resistance Junction to Ambient	$R_{\theta\text{JA}}$	TO-220 and TO-263	-	-	62	$^\circ\text{C}/\text{W}$
<b>SWITCHING SPECIFICATIONS</b> ( $V_{GS} = 4.5\text{V}$ )						
Turn-On Time	$t_{ON}$	$V_{DD} = 15\text{V}$ , $I_D \leq 24\text{A}$ , $R_L = 0.63\Omega$ , $V_{GS} = 4.5\text{V}$ , $R_{GS} = 10.0\Omega$ (Figures 15, 21, 22)	-	-	265	ns
Turn-On Delay Time	$t_{d(\text{ON})}$		-	15	-	ns
Rise Time	$t_r$		-	160	-	ns
Turn-Off Delay Time	$t_{d(\text{OFF})}$		-	14	-	ns
Fall Time	$t_f$		-	31	-	ns
Turn-Off Time	$t_{OFF}$		-	-	70	ns

# HUF76121P3, HUF76121S3S

## Electrical Specifications $T_A = 25^\circ\text{C}$ , Unless Otherwise Specified (Continued)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS	
<b>SWITCHING SPECIFICATIONS (<math>V_{GS} = 10\text{V}</math>)</b>							
Turn-On Time	$t_{ON}$	$V_{DD} = 15\text{V}, I_D \geq 47\text{A}, R_L = 0.32\Omega, V_{GS} = 10\text{V}, R_{GS} = 12.5\Omega$ (Figures 16, 21, 22)	-	-	80	ns	
Turn-On Delay Time	$t_{d(ON)}$		-	6	-	ns	
Rise Time	$t_r$		-	47	-	ns	
Turn-Off Delay Time	$t_{d(OFF)}$		-	47	-	ns	
Fall Time	$t_f$		-	42	-	ns	
Turn-Off Time	$t_{OFF}$		-	-	135	ns	
<b>GATE CHARGE SPECIFICATIONS</b>							
Total Gate Charge	$Q_g(\text{TOT})$	$V_{GS} = 0\text{V}$ to $10\text{V}$	$V_{DD} = 15\text{V}, I_D \geq 25\text{A}, R_L = 0.6\Omega, I_g(\text{REF}) = 1.0\text{mA}$ (Figures 14, 19, 20)	-	24	30	nC
Gate Charge at 5V	$Q_g(5)$	$V_{GS} = 0\text{V}$ to $5\text{V}$		-	13	16	nC
Threshold Gate Charge	$Q_g(\text{TH})$	$V_{GS} = 0\text{V}$ to $1\text{V}$		-	1.0	1.2	nC
Gate to Source Gate Charge	$Q_{gs}$	-		2.50	-	nC	
Gate to Drain "Miller" Charge	$Q_{gd}$	-		7.80	-	nC	
<b>CAPACITANCE SPECIFICATIONS</b>							
Input Capacitance	$C_{ISS}$	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$ (Figure 13)	-	850	-	pF	
Output Capacitance	$C_{OSS}$		-	465	-	pF	
Reverse Transfer Capacitance	$C_{RSS}$		-	100	-	pF	

## Source to Drain Diode Specifications

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Source to Drain Diode Voltage	$V_{SD}$	$I_{SD} = 25\text{A}$	-	-	1.25	V
Reverse Recovery Time	$t_{rr}$	$I_{SD} = 25\text{A}, dI_{SD}/dt = 100\text{A}/\mu\text{s}$	-	-	65	ns
Reverse Recovered Charge	$Q_{RR}$	$I_{SD} = 25\text{A}, dI_{SD}/dt = 100\text{A}/\mu\text{s}$	-	-	100	nC

## Typical Performance Curves

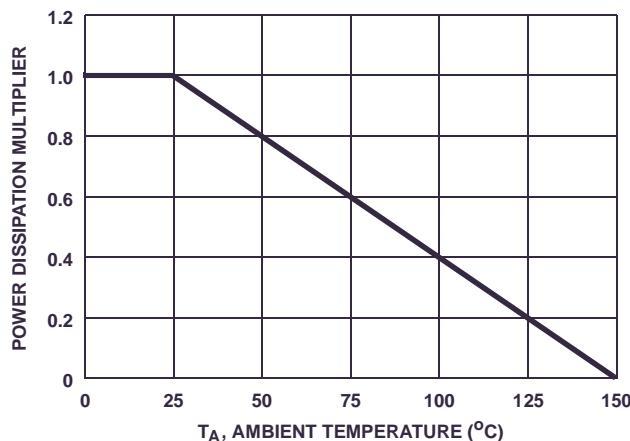


FIGURE 1. NORMALIZED POWER DISSIPATION vs CASE TEMPERATURE

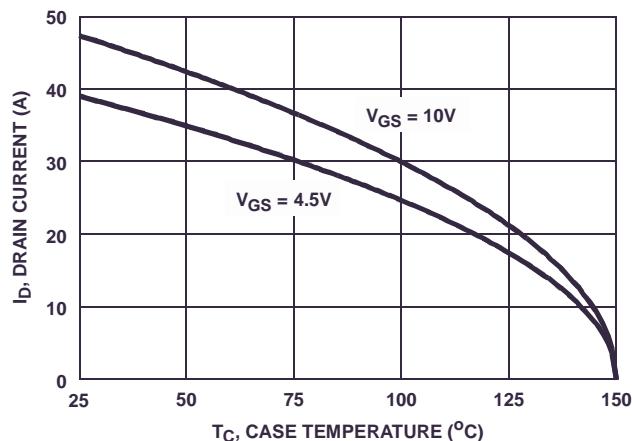


FIGURE 2. MAXIMUM CONTINUOUS DRAIN CURRENT vs CASE TEMPERATURE