

### SWITCHING

### P-CHANNEL POWER MOSFET

#### DESCRIPTION

The  $\mu$  PA2731UT1A is P-channel MOS Field Effect Transistor designed for power management applications of notebook computers and Li-ion battery protection circuit.

#### FEATURES

- Low on-state resistance  
 $R_{DS(on)1} = 3.3 \text{ m}\Omega \text{ MAX. (} V_{GS} = -10 \text{ V, } I_D = -22 \text{ A)}$   
 $R_{DS(on)2} = 6.4 \text{ m}\Omega \text{ MAX. (} V_{GS} = -4.5 \text{ V, } I_D = -22 \text{ A)}$
- Low  $C_{iss}$ :  $C_{iss} = 3620 \text{ pF TYP.}$
- Small and surface mount package (8pin HVSON)

#### ORDERING INFORMATION

PART NUMBER	PACKAGE
$\mu$ PA2731UT1A-E1-AZ <sup>Note</sup>	8pin HVSON
$\mu$ PA2731UT1A-E2-AZ <sup>Note</sup>	8pin HVSON

**Note** Pb-free (This product does not contain Pb in external electrode.)

#### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ , All terminals are connected.)

Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	-30	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 20$	V
Drain Current (DC)	$I_{D(DC)}$	$\pm 44$	A
Drain Current (pulse) <sup>Note1</sup>	$I_{D(pulse)}$	$\pm 180$	A
Total Power Dissipation <sup>Note2</sup>	$P_{T1}$	1.5	W
Total Power Dissipation ( $PW = 10 \text{ sec}$ ) <sup>Note2</sup>	$P_{T2}$	4.6	W
Channel Temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$
Single Avalanche Current <sup>Note3</sup>	$I_{AS}$	-22	A
Single Avalanche Energy <sup>Note3</sup>	$E_{AS}$	48	mJ

**Notes** 1.  $PW \leq 10 \mu\text{s}$ , Duty Cycle  $\leq 1\%$

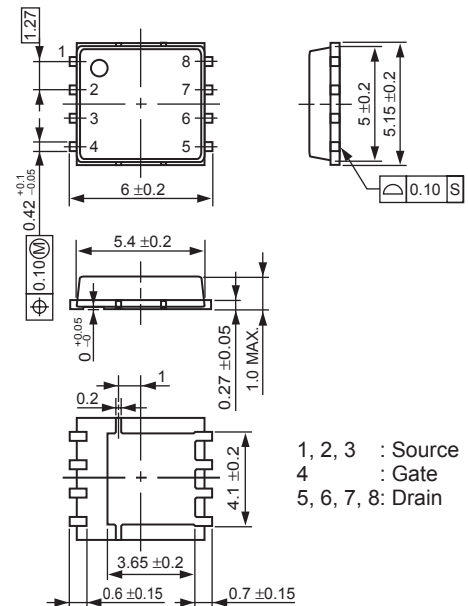
2. Mounted on a glass epoxy board (25.4 mm x 25.4 mm x 0.8 mm)

3. Starting  $T_{ch} = 25^\circ\text{C}$ ,  $V_{BD} = -15 \text{ V}$ ,  $R_G = 25 \Omega$ ,  $L = 100 \mu\text{H}$ ,  $V_{GS} = -20 \rightarrow 0 \text{ V}$

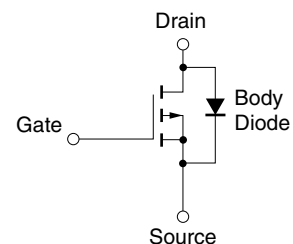
**Remark** Strong electric field, when exposed to this device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred.

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#### PACKAGE DRAWING (Unit: mm)



#### EQUIVALENT CIRCUIT

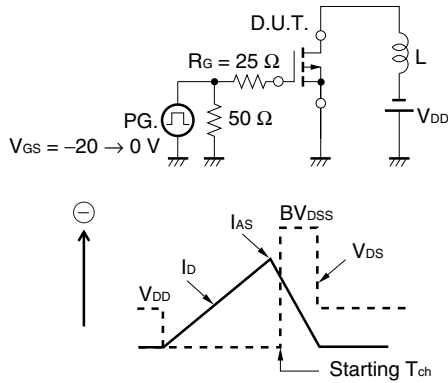


**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C, All terminals are connected.)**

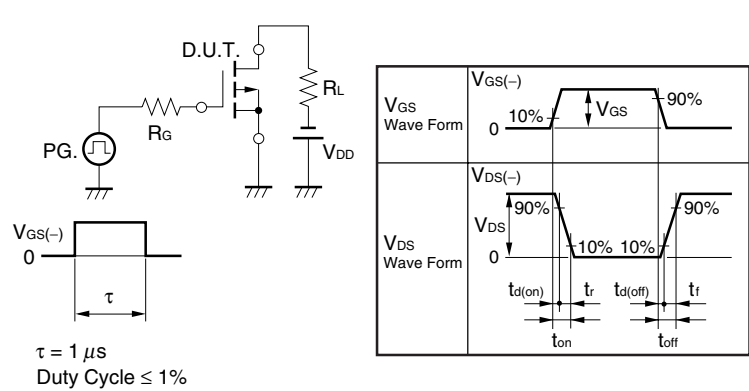
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = -30 V, V <sub>GS</sub> = 0 V			-1	μA
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V			±100	nA
Gate Cut-off Voltage	V <sub>GS(off)</sub>	V <sub>DS</sub> = -10 V, I <sub>D</sub> = -1 mA	-1.0		-2.5	V
Drain to Source On-state Resistance <b>Note</b>	R <sub>DS(on)1</sub>	V <sub>GS</sub> = -10 V, I <sub>D</sub> = -22 A		2.6	3.3	mΩ
	R <sub>bS(on)2</sub>	V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -22 A		4.2	6.4	mΩ
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = -10 V		3620		pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V		1540		pF
Reverse Transfer Capacitance	C <sub>rss</sub>	f = 1 MHz		630		pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = -15 V, I <sub>D</sub> = -22 A		15		ns
Rise Time	t <sub>r</sub>	V <sub>GS</sub> = -10 V		16		ns
Turn-off Delay Time	t <sub>d(off)</sub>	R <sub>G</sub> = 10 Ω		760		ns
Fall Time	t <sub>f</sub>			510		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = -24 V		149		nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>GS</sub> = -10 V		17		nC
Gate to Drain Charge	Q <sub>GD</sub>	I <sub>D</sub> = -44 A		48		nC
Body Diode Forward Voltage <b>Note</b>	V <sub>F(S-D)</sub>	I <sub>F</sub> = 44 A, V <sub>GS</sub> = 0 V		0.85		V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 44 A, V <sub>GS</sub> = 0 V		87		ns
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 50 A/μs		60		nC

**Note** Pulsed

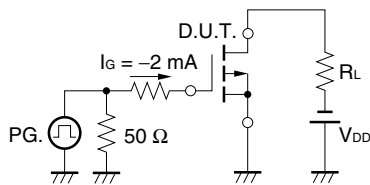
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



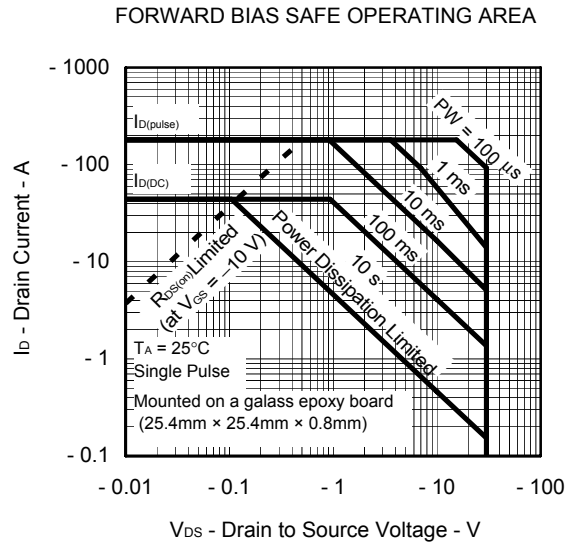
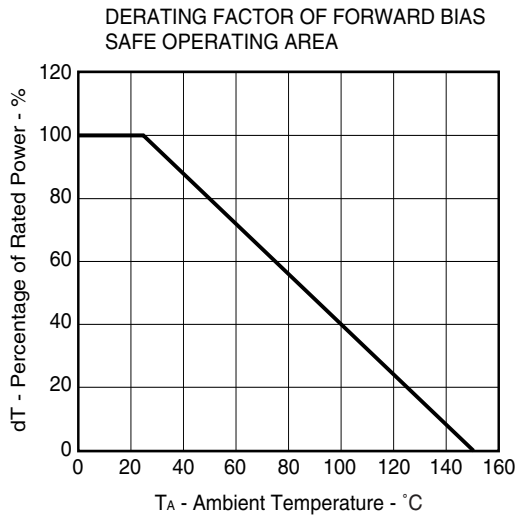
**TEST CIRCUIT 2 SWITCHING TIME**



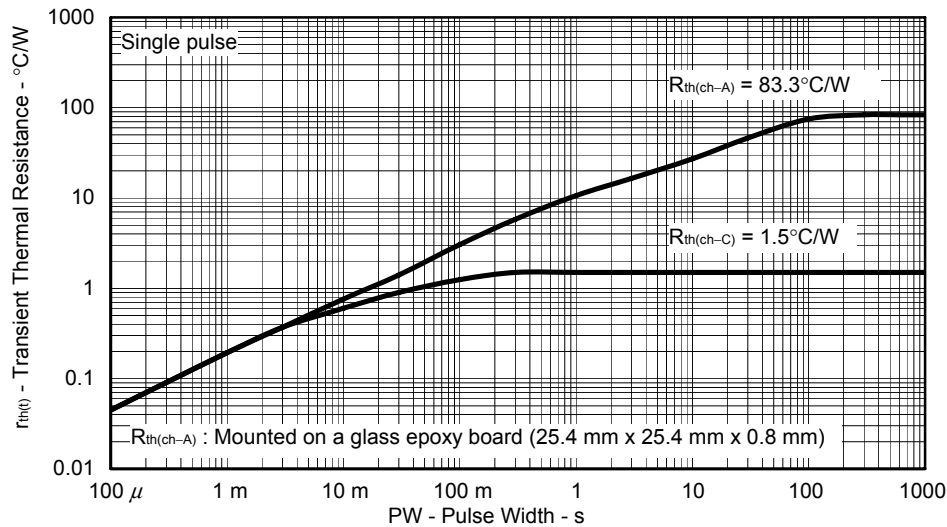
**TEST CIRCUIT 3 GATE CHARGE**



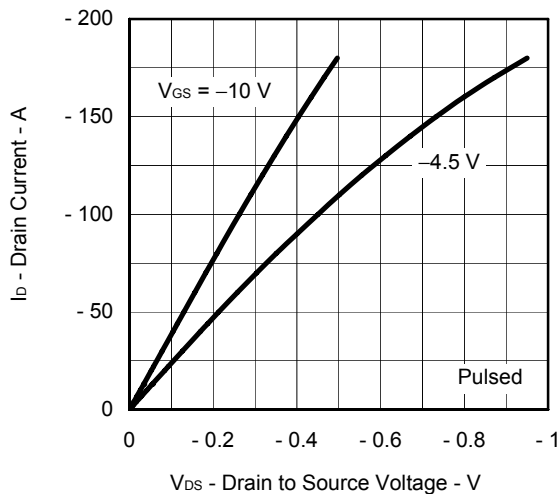
TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )



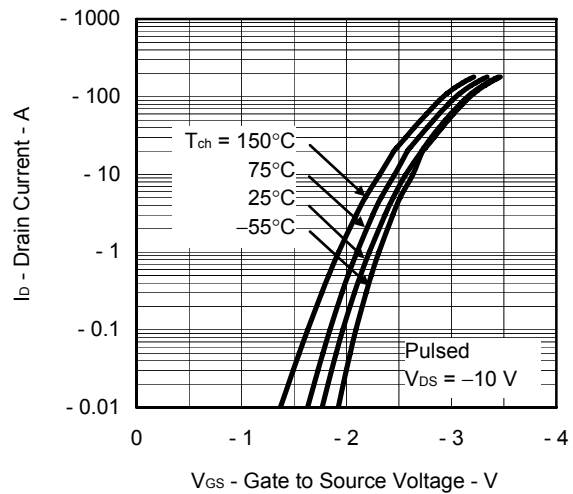
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



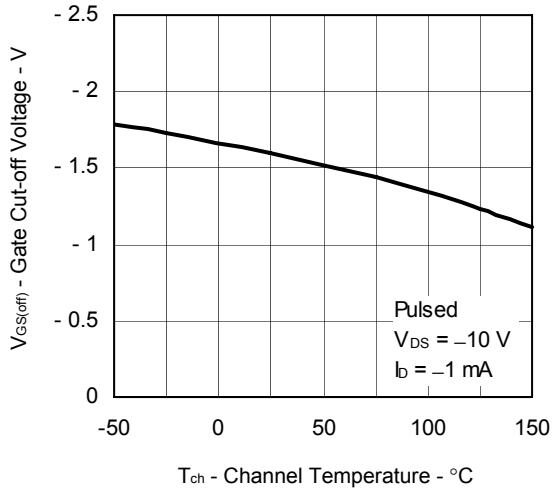
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



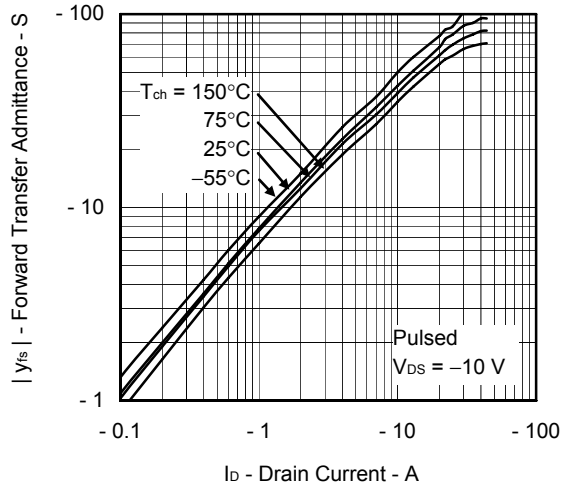
FORWARD TRANSFER CHARACTERISTICS



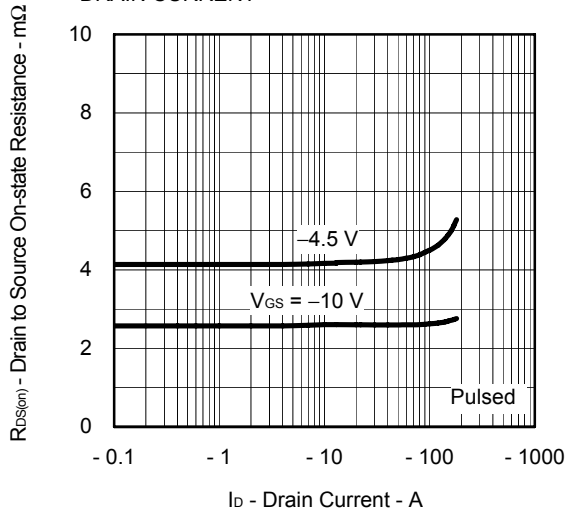
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



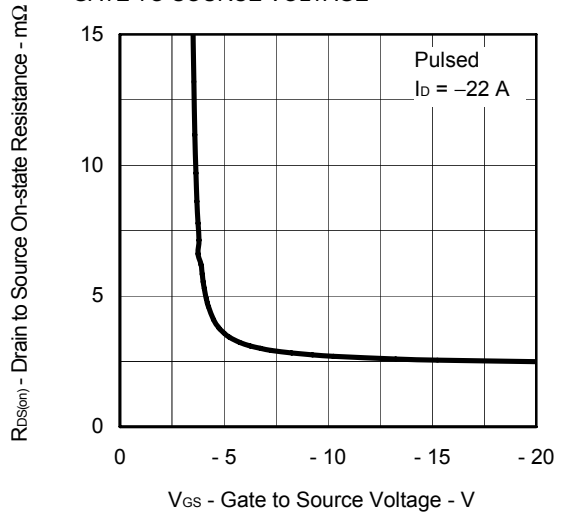
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



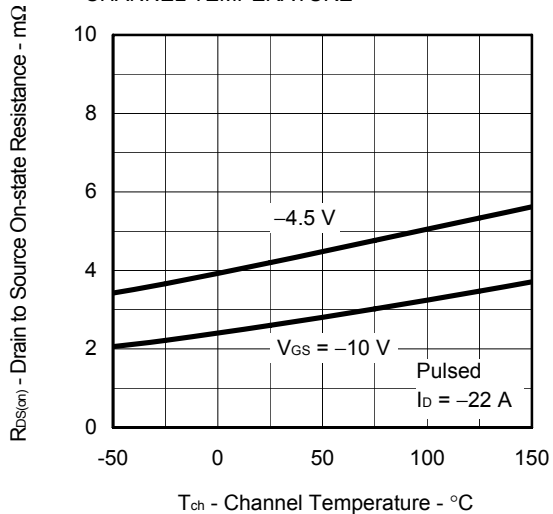
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



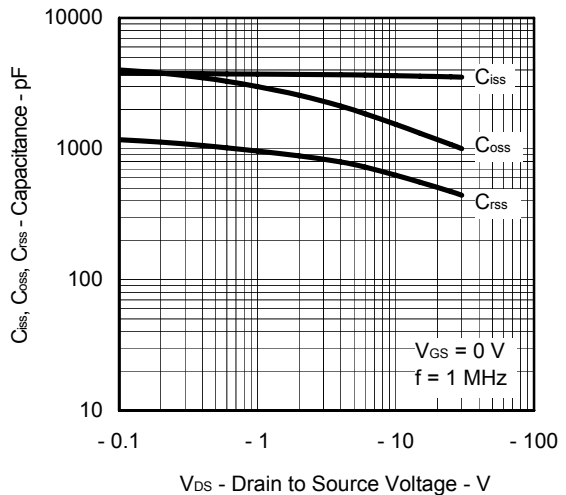
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



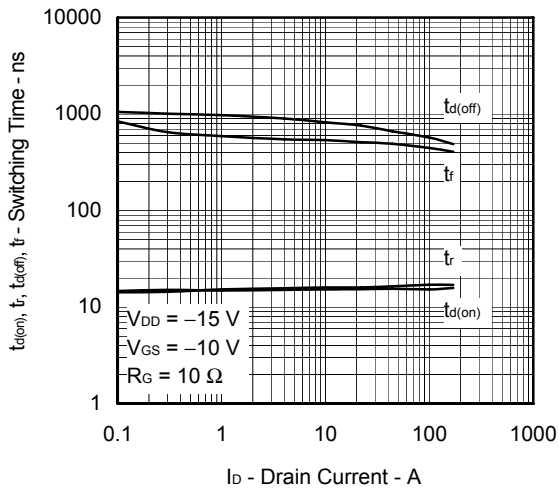
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



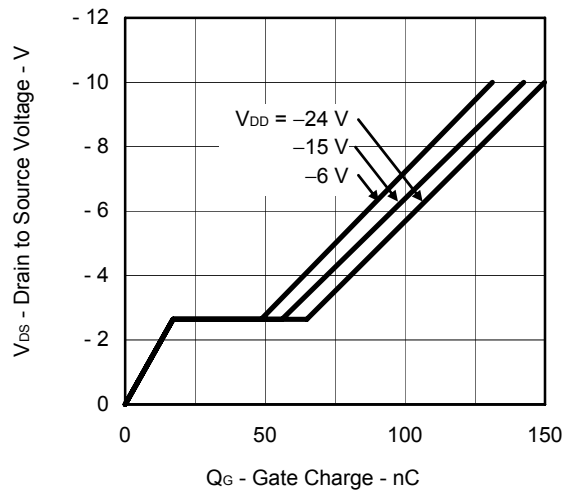
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



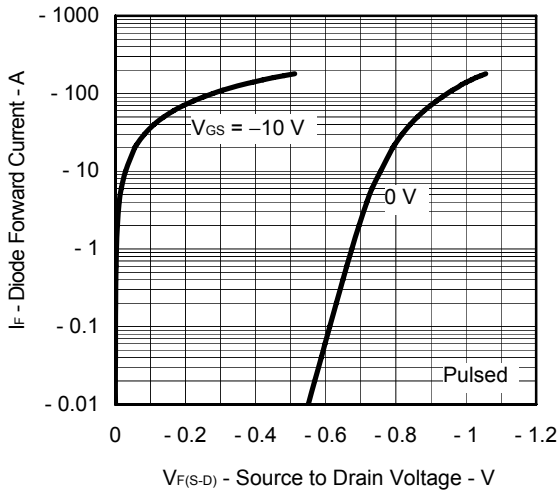
SWITCHING CHARACTERISTICS



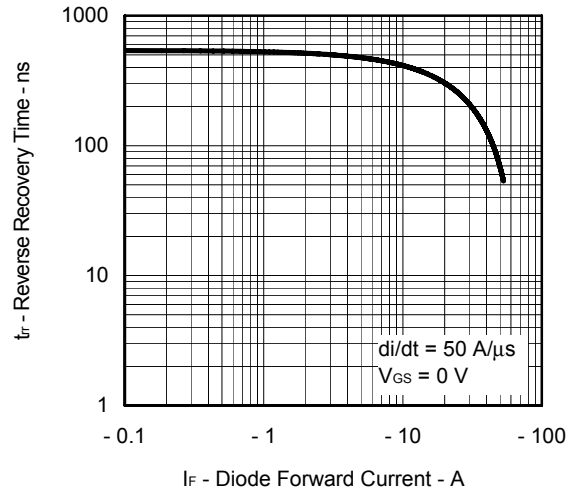
DYNAMIC INPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE



REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT



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