

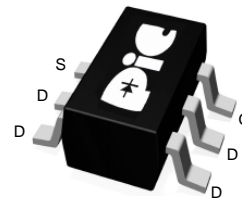
## ➤ General Description

This PAP2231H P-Channel enhancement mode power field effect transistor is the high density trench technology and this advanced technology can provide excellent  $R_{ds(On)}$  performance and efficiency for power switching and load switching application., this device also comply with the RoHS and Green Product requirement with full function reliability approved.

## ➤ Feature

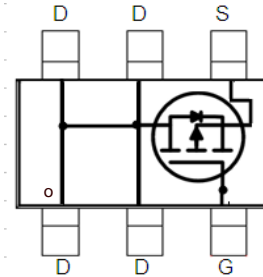
- Low Offset (Error) Voltage
- Low-Voltage Operation
- High-Speed Circuits
- Low Battery Voltage Operation
- SOT-363 package design

## ➤ SOT-363



## ➤ Application

- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories
- Battery Operated Systems
- Load/Power Switching Smart Phones, Pagers
- PA Switch
- Level Switch



## ➤ Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Drain-Source Voltage	$V_{DS}$	-20	V
Gate-Source Voltage	$V_{GS}$	$\pm 12$	V
Continuous Drain Current, $-V_{GS}$ @ $-4.5V^1$	$I_D @ T_A=25^\circ C$	-2.3	A
Continuous Drain Current, $-V_{GS}$ @ $-4.5V^1$	$I_D @ T_A=70^\circ C$	-1.8	A
Pulsed Drain Current <sup>2</sup>	$I_{DM}$	-10	A
Total Power Dissipation <sup>3</sup>	$P_D @ T_A=25^\circ C$	0.76	W
Total Power Dissipation <sup>3</sup>	$P_D @ T_A=70^\circ C$	0.48	W
Storage Temperature Range	$T_{STG}$	-55 to 150	$^\circ C$
Operating Junction Temperature Range	$T_J$	-55 to 150	$^\circ C$
Thermal Resistance Junction-Ambient <sup>1</sup>	$R_{\theta JA}$	165	$^\circ C/W$

## ➤ Electrical Characteristics ( $T_A=25^\circ C$ Unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V$ , $I_D=-250\mu A$	-20	---	---	V
Static Drain-Source On-Resistance <sup>2</sup>	$R_{DS(ON)}$	$V_{GS}=-4.5V$ , $I_D=-1.8A$	---	90	100	m $\Omega$
		$V_{GS}=-2.5V$ , $I_D=-1.5A$	---	130	155	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}$ , $I_D=-250\mu A$	-0.45	---	-1.0	V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=-16V$ , $V_{GS}=0V$ , $T_J=25^\circ C$	---	---	-1	uA
		$V_{DS}=-16V$ , $V_{GS}=0V$ , $T_J=85^\circ C$	---	---	-30	
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS}=\pm 12V$ , $V_{DS}=0V$	---	---	$\pm 100$	nA
Total Gate Charge	$Q_g$	$V_{DS}=-10V$ , $V_{GS}=-4.5V$ , $I_D=-1.8A$	---	3.8	---	nC
Gate-Source Charge	$Q_{gs}$		---	0.75	---	
Gate-Drain Charge	$Q_{gd}$		---	0.7	---	
Turn-On Delay Time	$T_{d(on)}$	$V_{DD}=-10V$ , $V_{GS}=-4.5$ , $R_G=1\Omega$ , $I_D=-1.8A$	---	3	---	ns
Rise Time	$T_r$		---	23.5	---	
Turn-Off Delay Time	$T_{d(off)}$		---	11	---	
Fall Time	$T_f$		---	20	---	
Input Capacitance	$C_{iss}$	$V_{DS}=-10V$ , $V_{GS}=0V$ , $f=1MHz$	---	312	---	pF
Output Capacitance	$C_{oss}$		---	51	---	
Reverse Transfer Capacitance	$C_{rss}$		---	47	---	

## ➤ Diode Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Continuous Source Current <sup>1,4</sup>	$I_S$	$V_G=V_D=0V$ , Force Current	---	---	-2.3	A
Diode Forward Voltage <sup>2</sup>	$V_{SD}$	$V_{GS}=0V$ , $I_S=-0.42A$ , $T_J=25^\circ C$	---	---	-1.2	V

Note :

- 1.Pulse width limited by maximum junction temperature.
- 2.The data tested by pulsed , pulse width  $\leq 300\mu s$  , duty cycle  $\leq 2\%$
- 3.Ensure that the channel temperature does not exceed  $150^\circ C$ .
- 4.The data is theoretically the same as  $I_D$  and  $I_{DM}$  , in real applications , should be limited by total power dissipation.

## ➤ Typical Characteristics

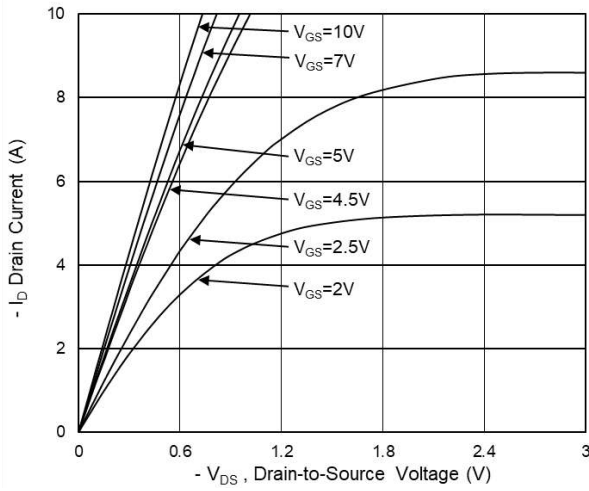


Fig.1 Typical Output Characteristics

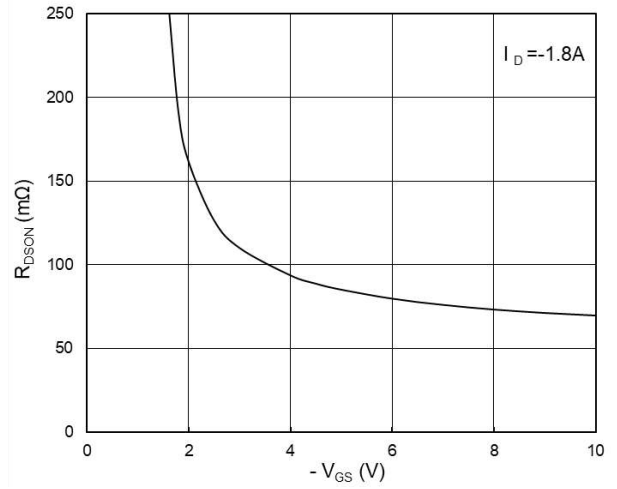


Fig.2 On-Resistance vs G-S Voltage

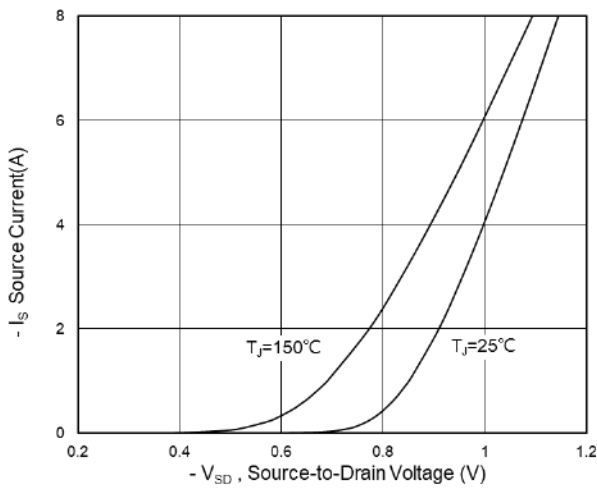


Fig.3 Source Drain Forward Characteristics

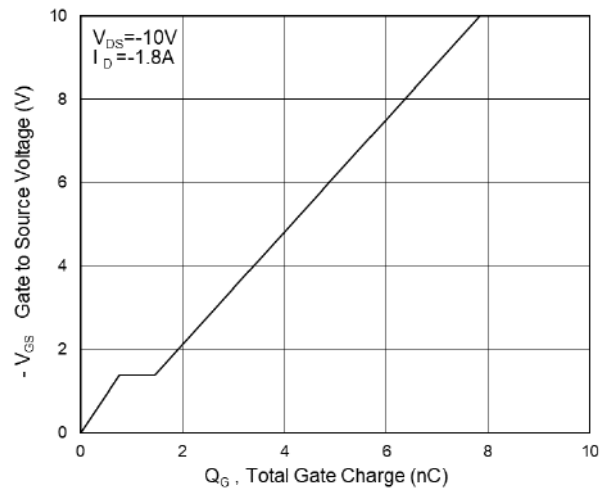


Fig.4 Gate-Charge Characteristics

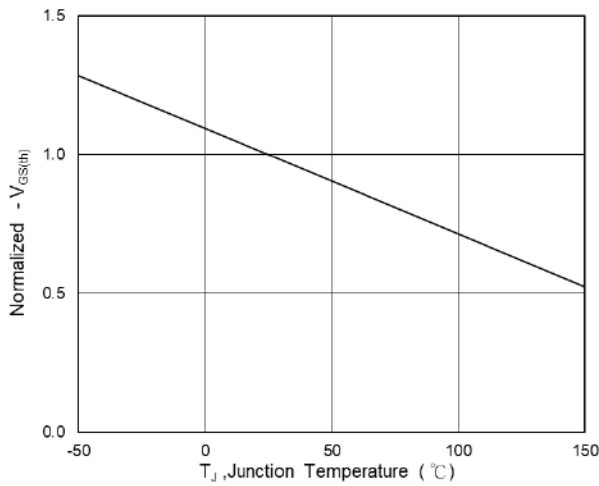


Fig.5 Normalized  $V_{GS(th)}$  vs  $T_J$

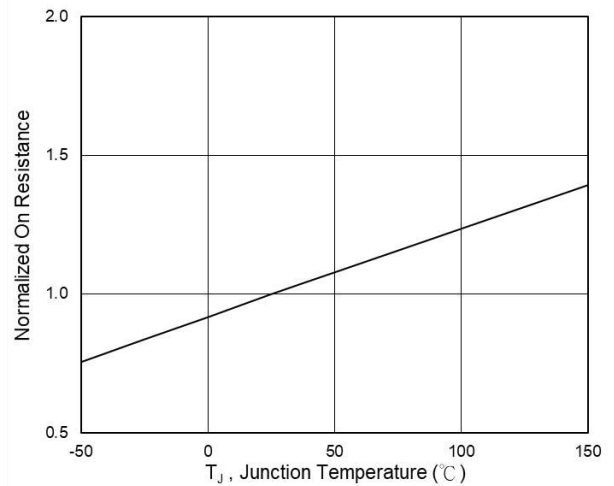
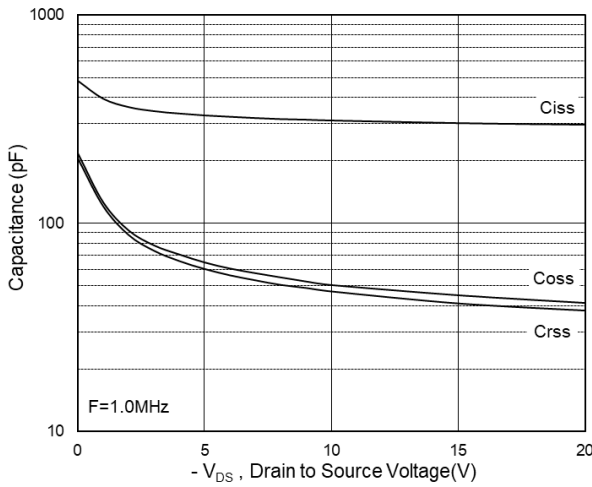
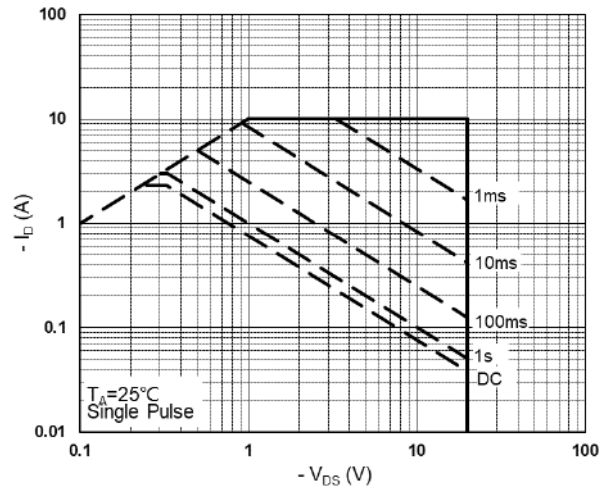


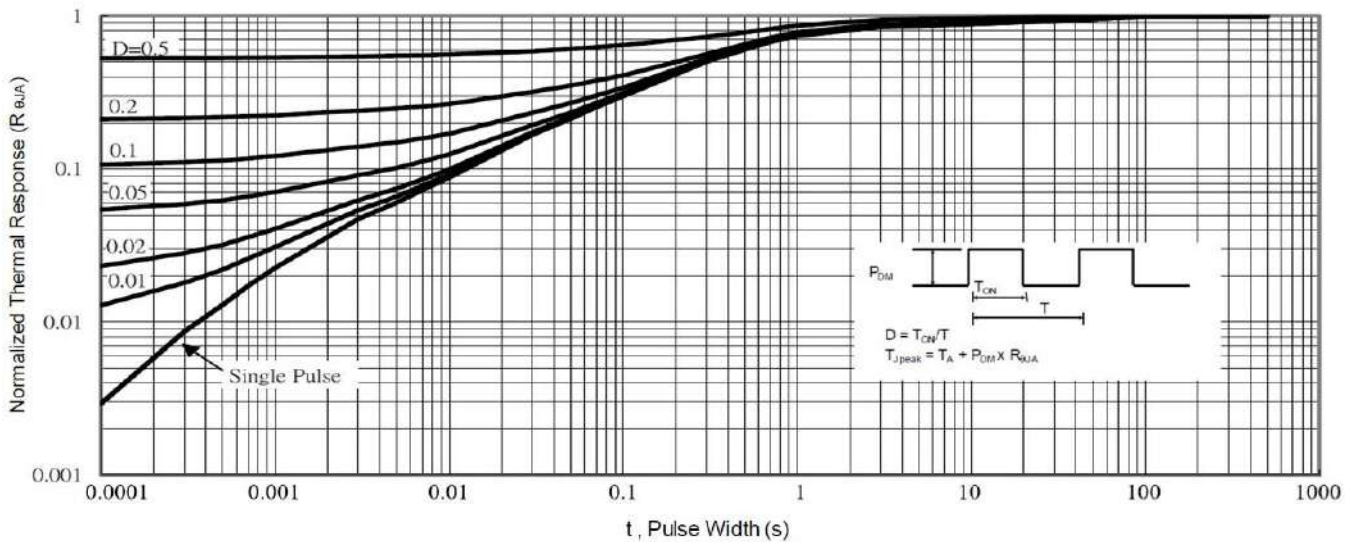
Fig.6 Normalized  $R_{DS(on)}$  vs  $T_J$



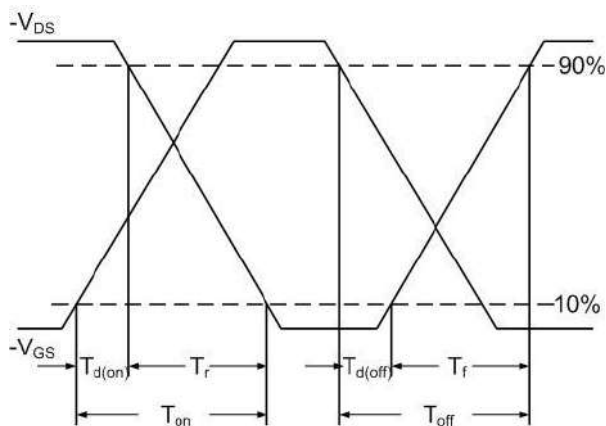
**Fig.7 Capacitance**



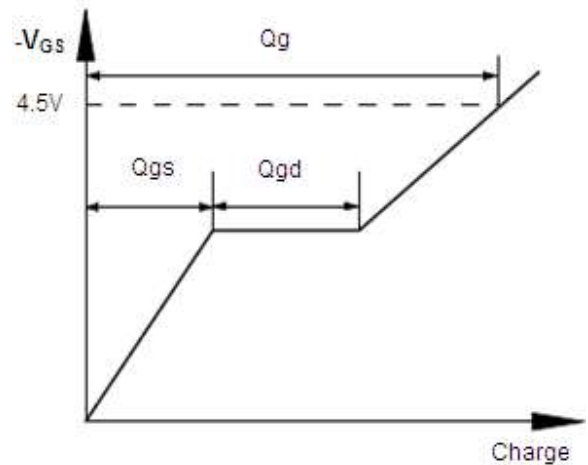
**Fig.8 Safe Operating Area**



**Fig.9 Normalized Maximum Transient Thermal Impedance**



**Fig.10 Switching Time Waveform**



**Fig.11 Gate Charge Waveform**

## ➤ Recommand IR Reflow Soldering Thermal Profile

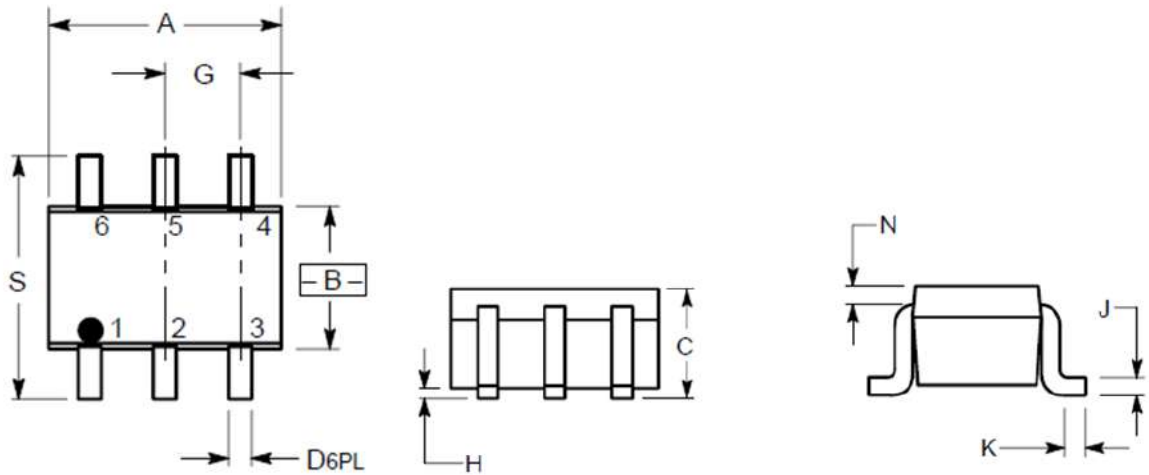


Profile Feature	Pb-Free Assembly Profile
Temperature Min. (T <sub>smin</sub> )	150°C
Temperature Max. (T <sub>smax</sub> )	200°C
Time (t <sub>s</sub> ) from (T <sub>smin</sub> to T <sub>smax</sub> )	60-120 seconds
Average Ramp-up Rate (t <sub>L</sub> to t <sub>P</sub> )	3°C/second max.
Liquidous Temperature (T <sub>L</sub> )	217°C
Time (t <sub>L</sub> ) Maintained Above (T <sub>L</sub> )	60 – 150 seconds
Peak Temperature	260°C +0°C / -5°C
Time (t <sub>P</sub> ) within 5°C of actual Peak Temperature	30 seconds
Ramp-down Rate (T <sub>P</sub> to T <sub>L</sub> )	6°C/second max
Time 25°C to Peak Temperature	8 minutes max.

## ➤ Ordering Information

Part Number	Description	Quantity
PAP2231H	SOT-363 Reel	3000 pcs

➤ Package Information ( SOT-363 )



$\oplus$	0.2 (0.008) $\text{\textcircled{M}}$	B $\text{\textcircled{M}}$
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DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	---	0.004	---	0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20 REF	
S	0.079	0.087	2.00	2.20

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